

Audi

Audi 100 1991 ➤

4-cylinder Engine (2-valve), Mechanical Components

Engine ID	AAD	AAE	ABB	ABK	ADA	ADW			
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Edition 12.1990

List of Workshop Manual Repair GroupsList of Workshop Manual
Repair GroupsList of Workshop Manual Repair Groups

Audi 100 1991 ➤

4-cylinder Engine (2-valve), Mechanical Components

Repair Group

00 - Technical data

10 - Removing and installing engine

13 - Crankshaft group

15 - Cylinder head, Valve gear

17 - Lubrication

19 - Cooling system

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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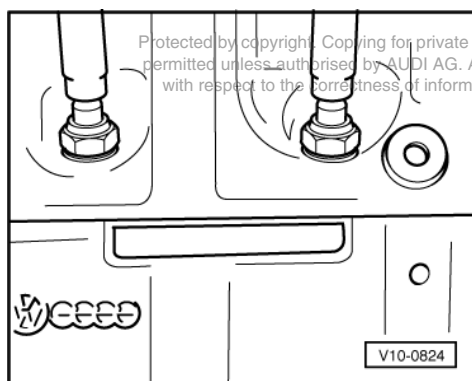
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00 - Technical data

1 - Technical data

1.1 - Technical data

1.2 - Engine number



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

There is also a label on the rear cylinder head cover indicating the "engine code" and "serial number".

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

1.3 - Engine data

Code		AAD	AAE	ABB	ABK	ADA	ADW
Capacity	l	2.0	2.0	1.6	2.0	1.6	2.0
Output	kW at rpm	85/5400	74/5500	75/6100	85/5400	74/6000	79/5300
Torque	Nm at rpm	168/3200	157/2750	127/3700	166/3200	130/3200	160/3200
Bore	ø in mm	82.5	82.5	81.0	82.5	81.0	82.5
Stroke	mm	92.8	92.8	77.4	92.8	77.4	92.8
Compression		10.4	9.0	10.0	10.5	10.5	9.0
RON	at least	95 1)	91	98 2)	95 1)	95 1)	91
Injection-/Ignition system		KE-Motronic	Mono-Motronic	K-Jetronic/TSZ-H	Digifant	Multi Point Injection	Digifant
Knock control		yes	no	no	yes	yes	yes
Self-diagnosis		yes	yes	no	yes	yes	yes
Lambda control		yes	yes	no	yes	yes	yes



Code	AAD	AAE	ABB	ABK	ADA	ADW
Catalytic converter	yes/-3)	yes	no	yes/-3)	yes/-3)	no

- 1) Regular unleaded petrol RON 91 can be used but will cause a slight loss of power.
- 2) When using Premium unleaded petrol 95 RON, adjust ignition timing to $3 \pm 1^\circ$ before TDC.
- 3) Optional in some countries.

Code	AAD	AAE	ABB	ABK	ADA	ADW
Valve timing at 1 mm valve lift and 0 mm valve clearance						
Inlet opens after TDC	6°	11°	6°	6°	6°	11°
Inlet closes after BDC	45°	50°	45°	45.0°	45°	50°
Exhaust opens before BDC	42°	37°	42°	42.0°	42°	37°
Exhaust closes before TDC	4°	2°	4°	4.0°	4°	2°



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10 - Removing and installing engine

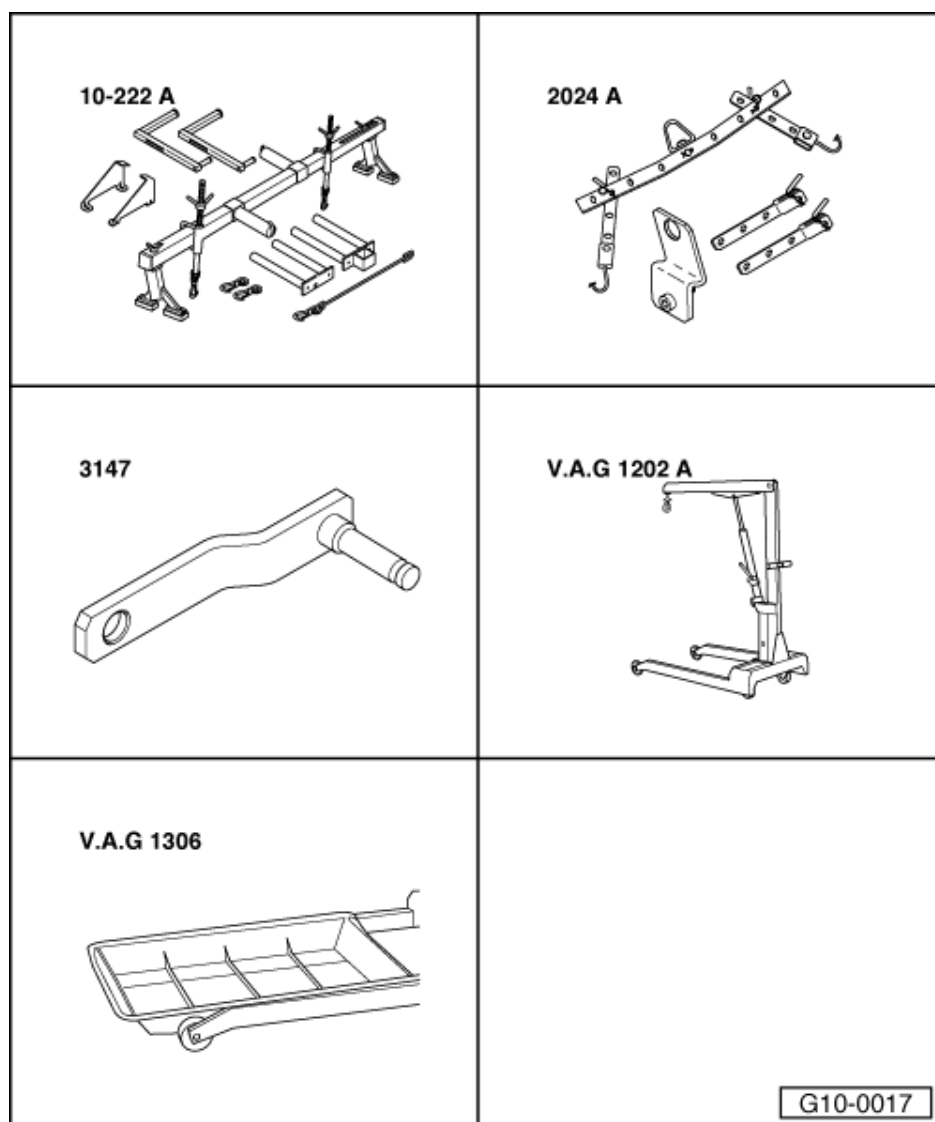
1 - Removing and installing engine

1.1 - Removing and installing engine

Notes:

- ◆ Renew all cut and defective cable ties. Refit cable ties in the same position when installing the engine.
- ◆ Remove engine upwards without gearbox.
- ◆ Collect drained coolant in a clean container for re-use or disposal.

1.2 - Removing engine -engine code AAE-





Special tools and workshop equipment required

- ♦ Support bar 10-222 A with 10-222 A/2
- ♦ Lifting tackle 2024 A
- ♦ Gearbox support 3147
- ♦ V.A.G 1202 A

or

- ♦ Workshop crane VAS 6100
- ♦ Drip tray V.A.G 1306

Procedure

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

Important

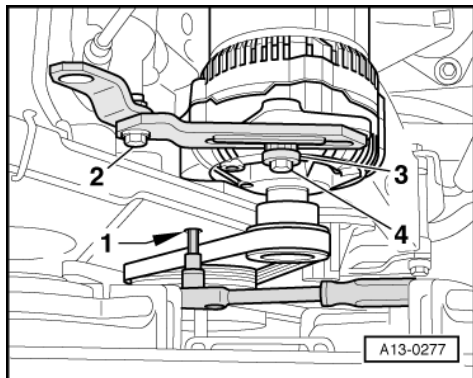
Hot steam or hot coolant can escape when opening expansion tank. Cover cap with a cloth and open carefully.

- Open the cover of the coolant expansion tank.

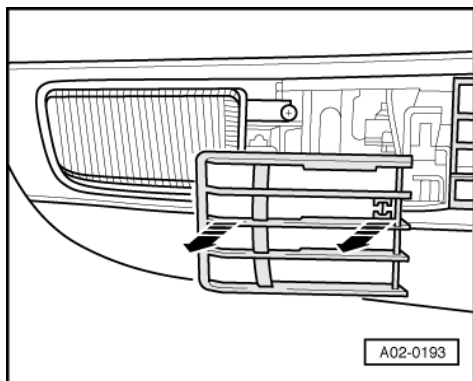
Vehicles with air conditioner:

Note:

Mark the ribbed belt running direction with chalk or a felt-tipped pen before removing the ribbed belt (on vehicles starting approx. 09.91). If the belt runs in the opposite direction when it is refitted, this can cause breakage.



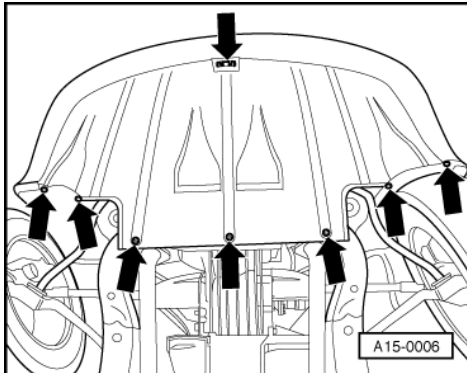
- -> Loosen bolts -1-, -2- and -4- at least one turn - bolt -1- can be reached from above via a hole in toothed belt guard.
- Release belt tension on V-belt or ribbed belt with tensioner nut -3-.
- Remove V-belt or ribbed belt from alternator belt pulley.



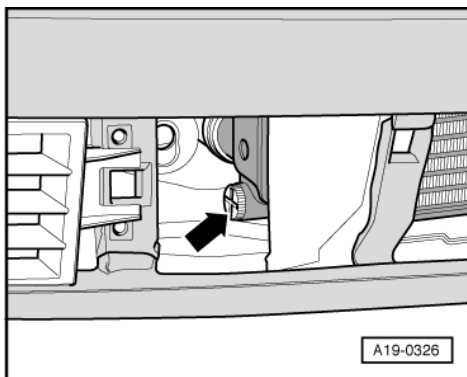
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All models:

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

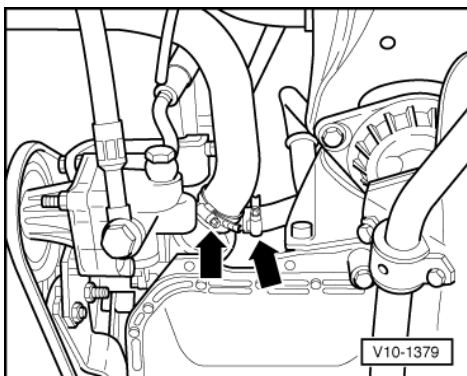


- -> Remove the noise insulation -arrows-.

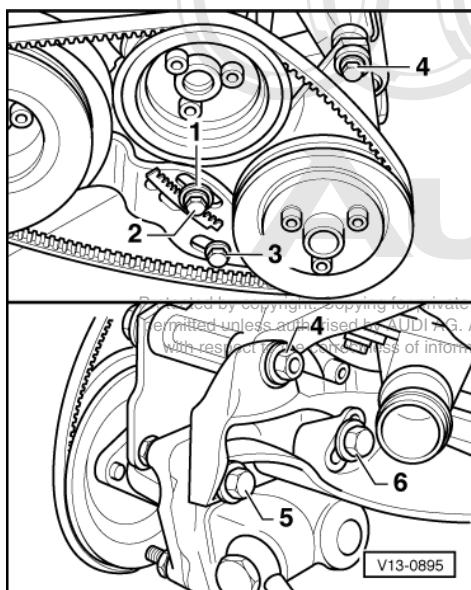


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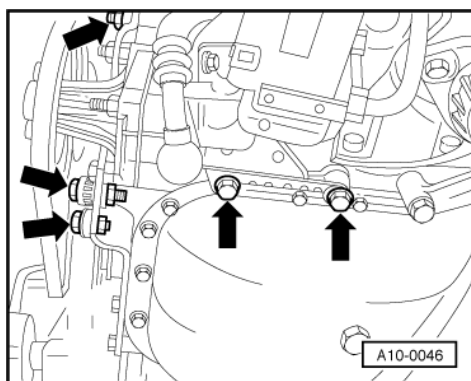
- Place drip tray V.A.G 1306 below engine.
- -> Turn drain plug -arrow- on radiator anti-clockwise. If necessary, fit drain hose on connection.



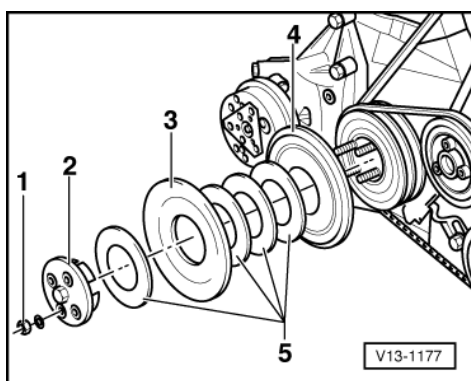
- -> Disconnect coolant hoses -arrows- to drain off remaining coolant.



- -> Loosen bolts 2...6.
- Release belt tension on V-belt with tensioner nut -1-.
- Remove V-belt for coolant pump and power assisted steering vane pump.



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



Vehicles with air conditioner:

- -> Unscrew the 4 nuts -1-.
- Detach hub -2- from belt pulley.

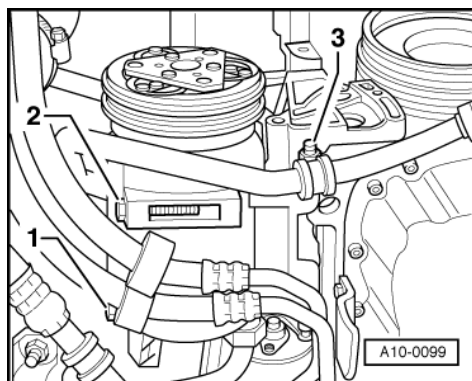
- Remove front half of belt pulley -3- and shims -5-.

Notes:

- ♦ Belt tension is adjusted by adding or taking out shims -5- between front section -3- and rear section -4- of belt pulley.
- ♦ Note the number of shims between the belt pulley halves for re-installation.
- Remove V-belt.
- Unbolt the vibration damper (with stud for belt pulley).

Note:

Otherwise the studs may cause damage when lifting out the engine.

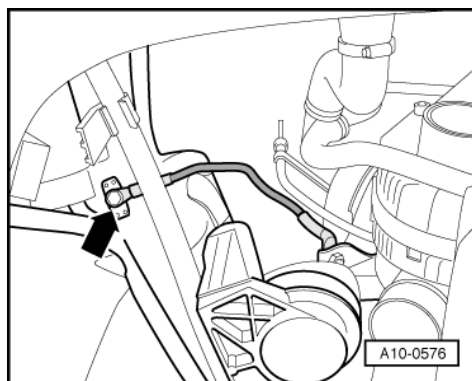


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Important

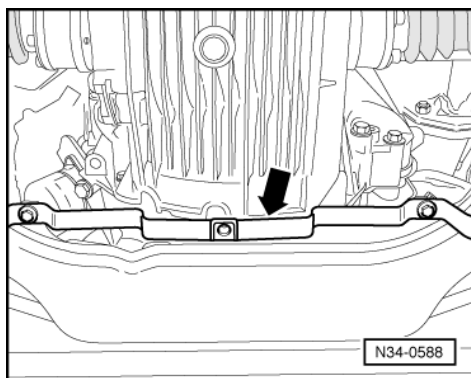
The air conditioner refrigerant circuit must not be opened.

- -> Unscrew the line bracket -3- for refrigerant line.
- Detach connector for solenoid clutch at air conditioner.
- Unscrew air conditioning compressor (4 bolts -Item 1- and -Item 2-) and suspend to the side together with the connected refrigerant hoses.

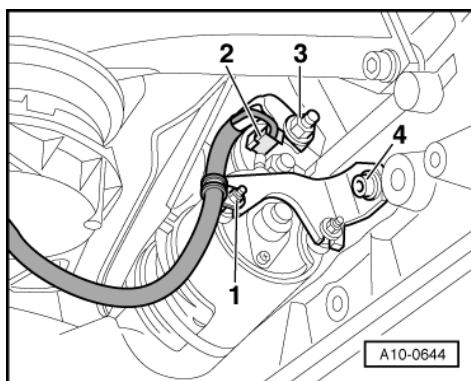


All models:

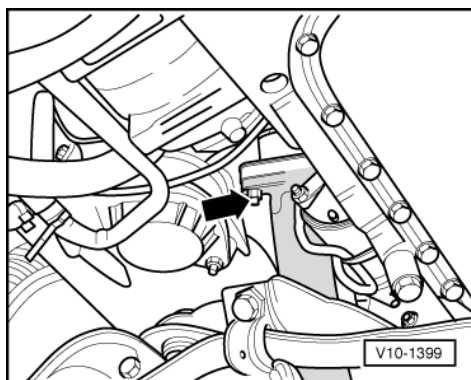
- -> Unscrew earthing strap from body -arrow-.



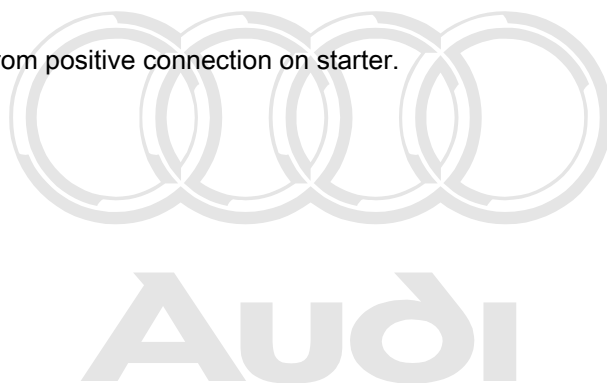
- -> Unbolt bracket for noise insulation -arrow-.



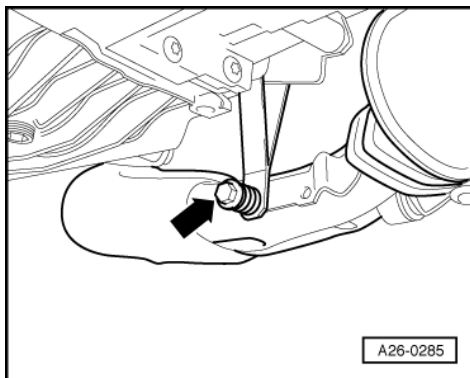
- -> Unbolt cable clamp -1-.
- Detach wires -2- and -3- from starter, remove insulator from positive connection on starter.
- Unbolt retainer on cylinder block -4-.
- If necessary, detach the heat shield clamp.
- Unbolt starter from gearbox and remove.



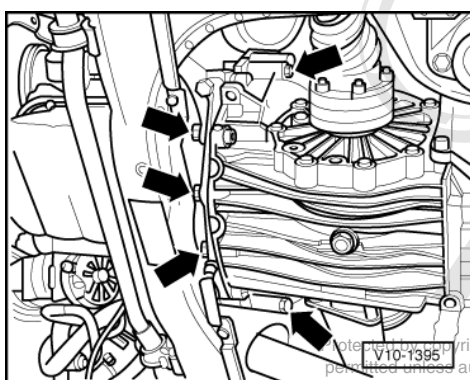
- -> Unscrew exhaust manifold/front exhaust pipe nuts -arrow-.



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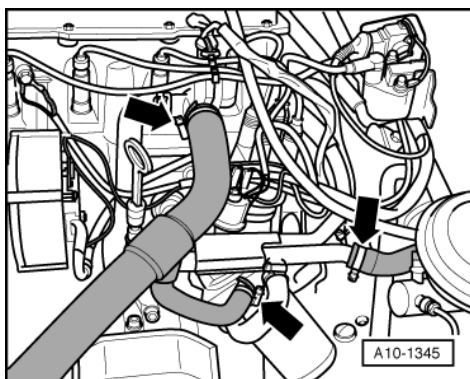
- -> Unbolt exhaust system at bracket -arrow-.
- Push exhaust system towards the rear so that studs on exhaust manifold are free.



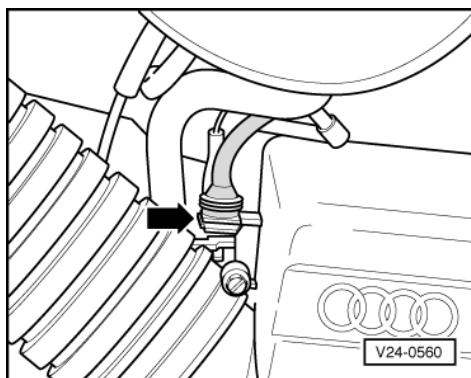
- -> Unscrew engine/gearbox connecting bolts accessible from below -arrows-.

Note:

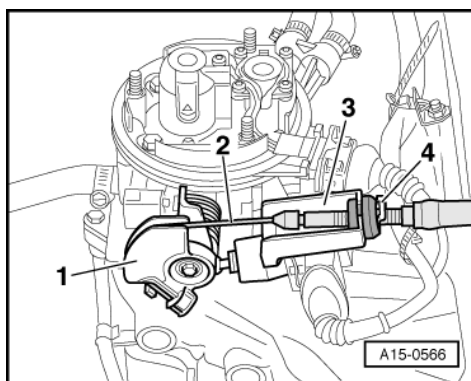
On removal, note the bolt lengths and assignment for re-installation.



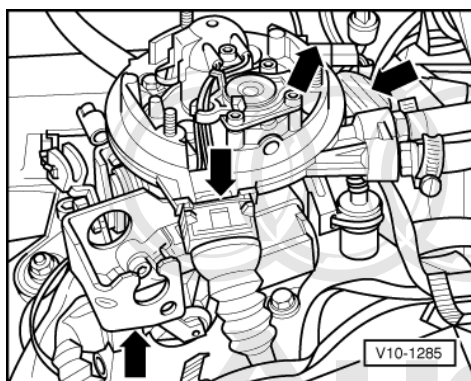
- -> Remove coolant hoses -arrows-.



- -> Detach connectors -arrow- to the lambda probe.

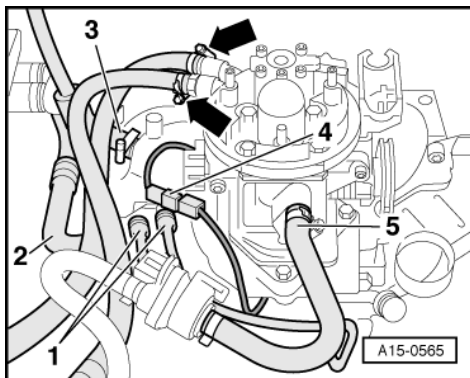


- Detach air intake cowl on the throttle body injection unit with air intake hose.
- -> Detach the throttle cable -2- from cable disc -1- and support bracket -3- (do not remove retainer -4-). Move throttle cable to the side.



- -> Unplug connectors at the throttle body injection unit -arrows-.
- Lay wiring harness aside.
- Detach hose of intake air preheater from warm air arrester plate on exhaust manifold.

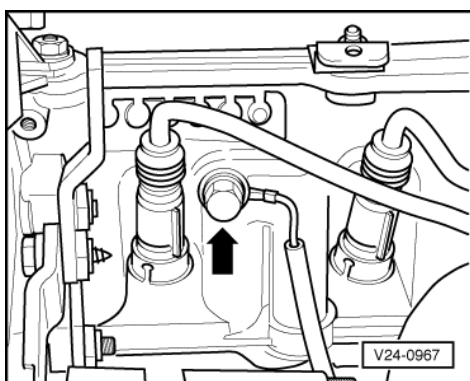
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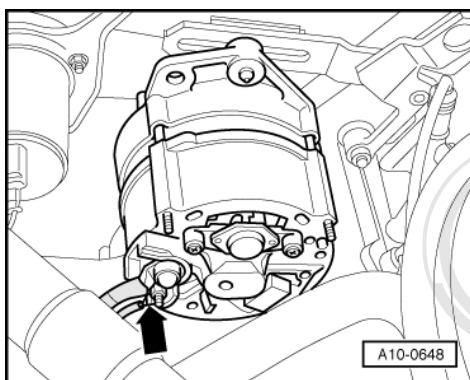
Important

The fuel system is pressurised. Before opening the system place a cloth around the connection point. Then release pressure by carefully loosening the connection.

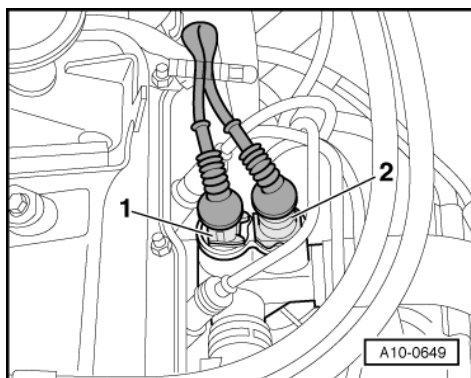
- -> Mark fuel feed pipe and fuel return pipe -arrows- and remove from the throttle body injection unit.
- Detach connector -4-.
- Lay wiring harness aside.
- Detach vacuum hose -5- to ACF valve.
- Detach the vacuum line -3- from the intake manifold.



- -> Unbolt the earth connection point on the left side of the cylinder head -arrow-.

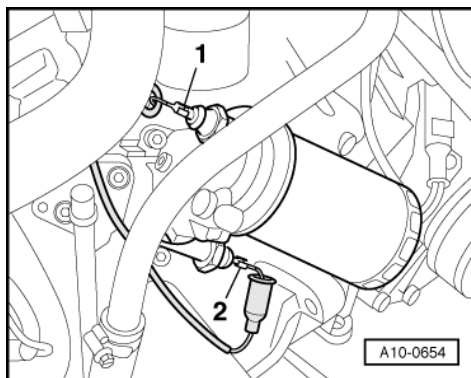


- -> Detach the D+ line -arrow- at alternator.



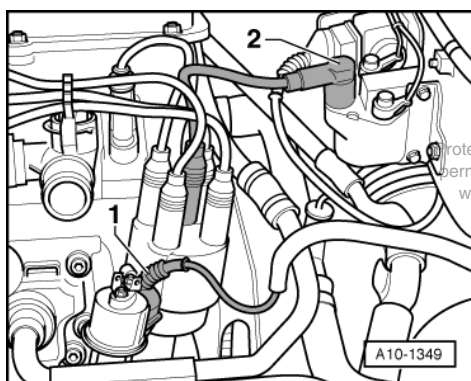
- -> Unplug the connectors at:

- 1 - Coolant temperature sensor -G62
- 2 - Sensor for coolant temperature display -G2, and coolant temperature switch (too hot) -F14



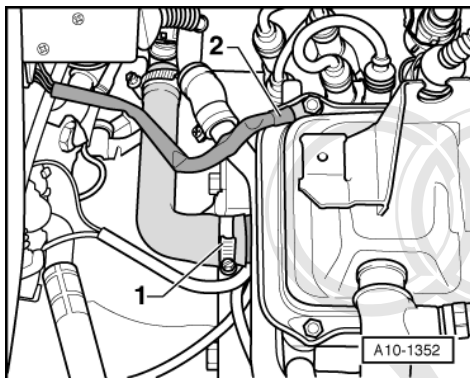
- -> Unplug the connectors at:

- 1 - Oil pressure switch -F22
- 2 - Oil pressure switch -F1

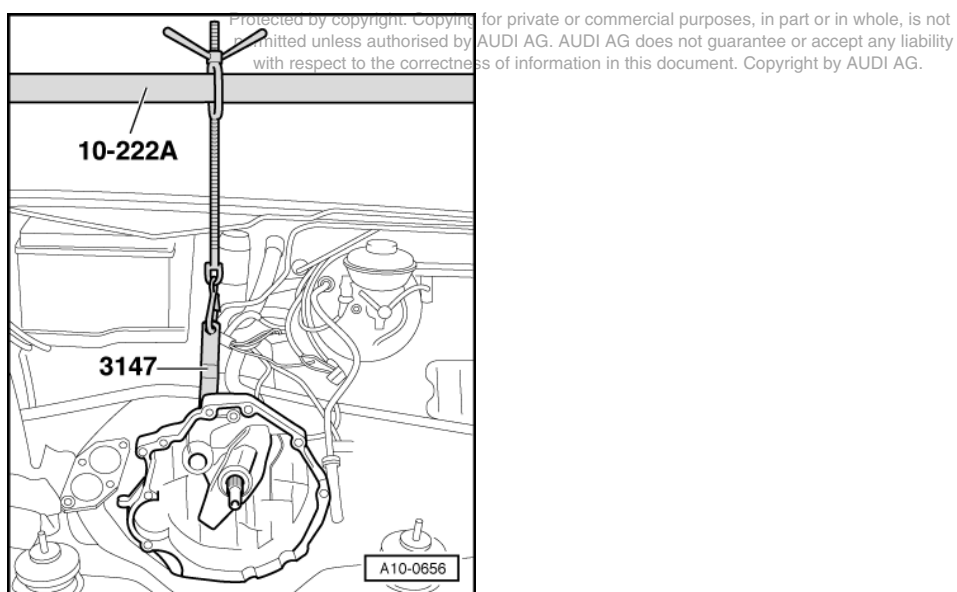


- -> Unplug the connector -1- on Hall sender -G40.
- Lay wiring aside.
- Detach main ignition wire -2- from ignition coil.

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- -> Detach coolant hose -1- from the connection at rear of cylinder head.
- Unscrew earth wire -2- at cylinder head cover.
- Unscrew upper engine/gearbox securing bolts. Leave one bolt in place (hand tight).



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

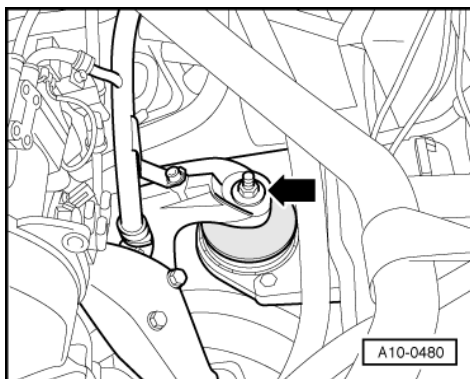
Note:

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

- Engage gearbox support 3147 in bolt hole in bell housing as shown in the illustration.
- Connect gearbox support 3147 and support bar 10-222 A.

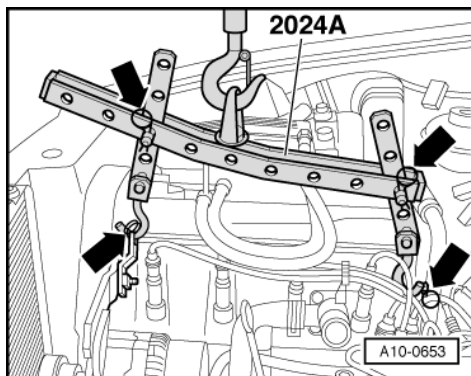
Note:

Shown in illustration with engine removed.





- Unbolt the left and right stop brackets above the engine mount.
- -> Unscrew nuts -arrow- at top right and left of engine mounts.



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

Note:

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

Important

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

Note:

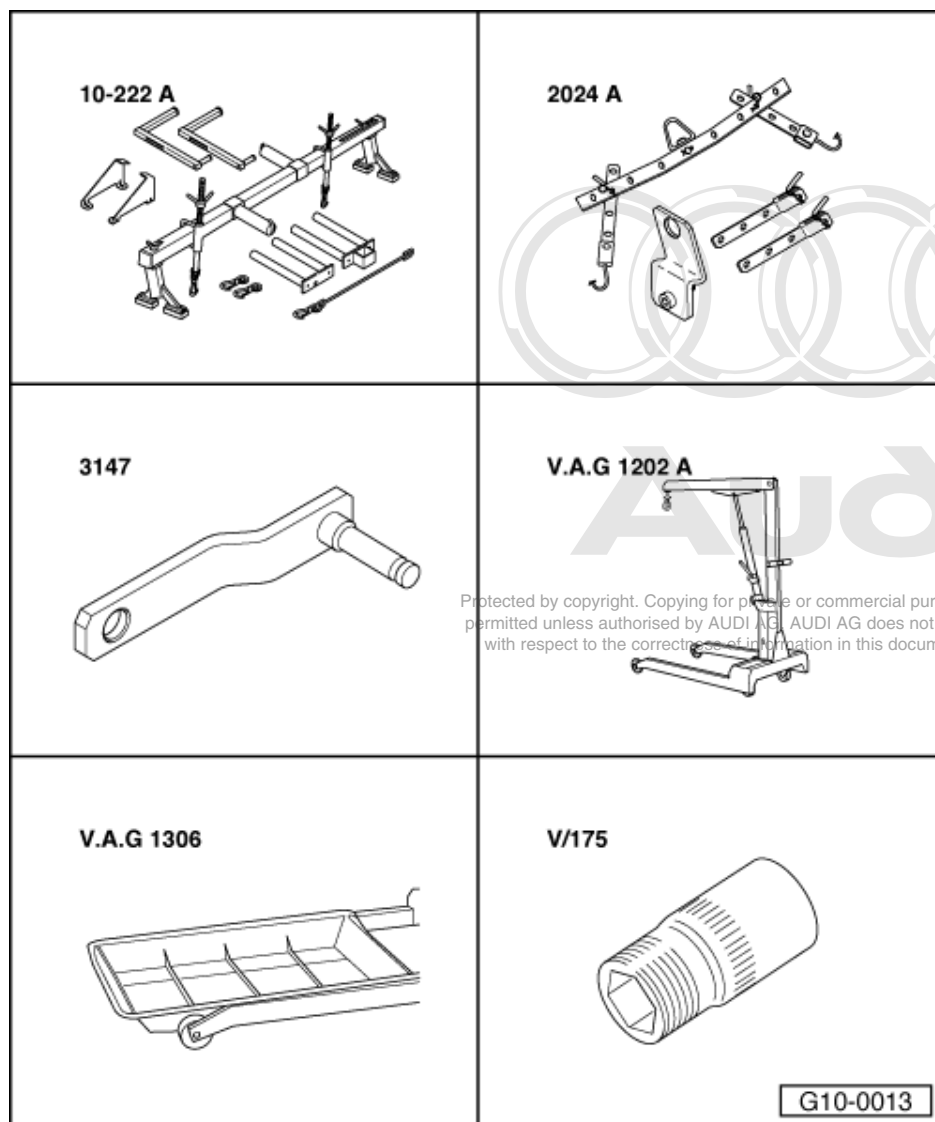
Check that all hoses and other connections between engine and body have been detached.

- Lift engine over studs of engine mounts.
- Tighten spindle of support bar 10-222 A.
- Remove the last securing bolt.
- Pull the engine from the gearbox.
- Guide the engine carefully while lifting it to avoid damaging bonnet, radiator and lock carrier.



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1.3 - Removing engine -engine codes AAD, ABB-



Special tools and workshop equipment required

- ◆ Support bar 10-222 A with 10-222 A/2
- ◆ Lifting tackle 2024 A
- ◆ Gearbox support 3147
- ◆ V.A.G 1202 A

or

- ◆ Workshop crane VAS 6100
- ◆ Drip tray V.A.G 1306
- ◆ 15 mm socket insert Matra V/175 (on vehicles with automatic gearbox)

Procedure

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



Important

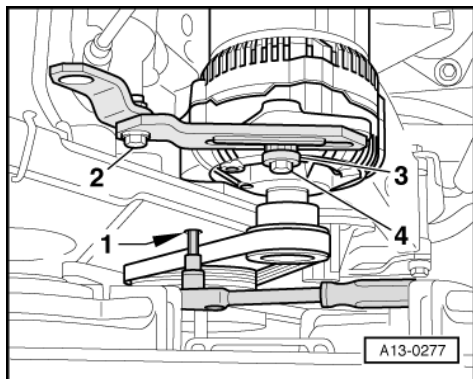
Hot steam or hot coolant can escape when opening expansion tank. Cover cap with a cloth and open carefully.

- Open the cover of the coolant expansion tank

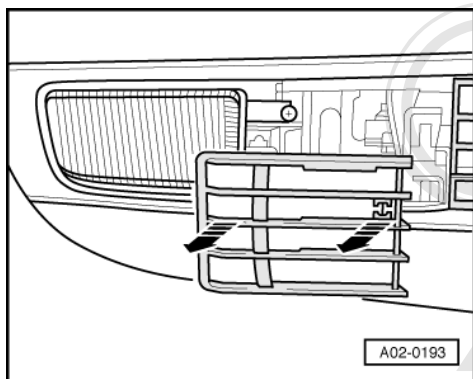
Vehicles with air conditioner:

Note:

Mark the ribbed belt running direction with chalk or a felt-tipped pen before removing the ribbed belt (on vehicles starting approx. 09.91). If the belt runs in the opposite direction when it is refitted, this can cause breakage.



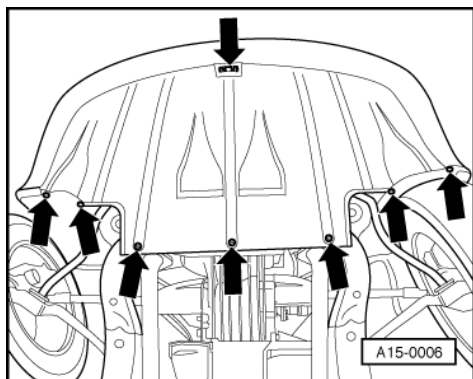
- -> Loosen bolts -1-, -2- and -4- at least one turn - bolt -1- can be reached from above via a hole in toothed belt guard.
- Release belt tension on V-belt or ribbed belt with tensioner nut -3-.
- Remove V-belt or ribbed belt from alternator belt pulley.



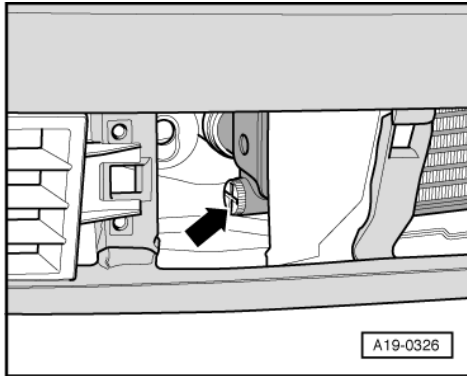
All models:

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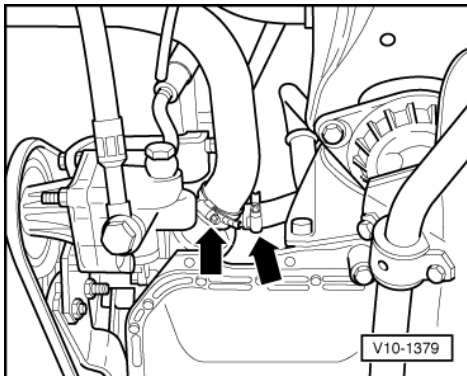
- -> Unclip the air intake grille to the lower right of the bumper -arrows-.



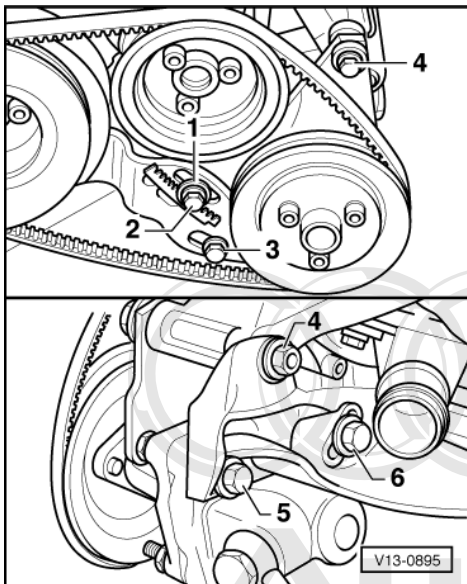
- -> Remove the noise insulation -arrows-.



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

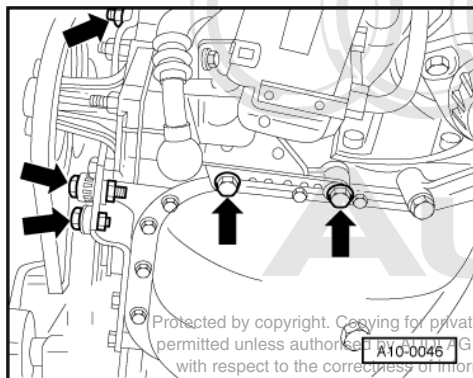


- -> Disconnect coolant hoses -arrows- to drain off remaining coolant.

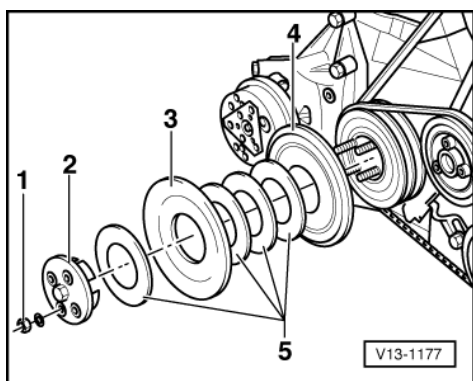


- -> Loosen bolts 2...6.
- Release belt tension on V-belt with tensioner nut -1-.
- Remove V-belt for coolant pump and power assisted steering vane pump.

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



Vehicles with air conditioner:

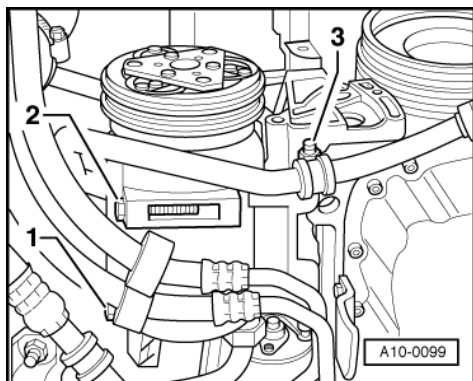
- -> Unscrew the 4 nuts -1-.
- Detach hub -2- from belt pulley.
- Remove front half of belt pulley -3- and shims -5-.

Notes:

- ♦ Belt tension is adjusted by adding or taking out shims -5- between front section -3- and rear section -4- of belt pulley.
- ♦ Note the number of shims between the belt pulley halves for re-installation.
- Remove V-belt.
- Unbolt the vibration damper (with stud for belt pulley).

Note:

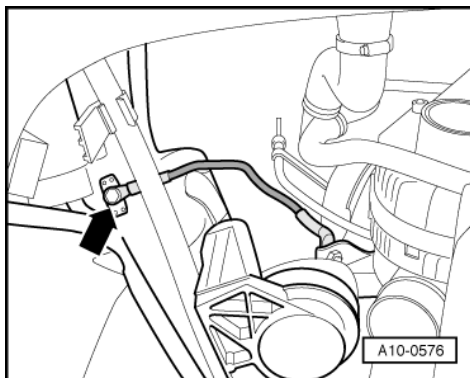
Otherwise the studs may cause damage when lifting out the engine.



Important

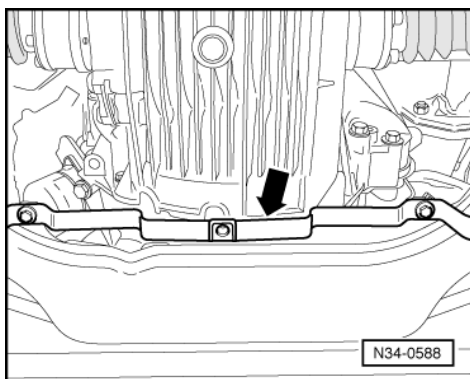
The air conditioner refrigerant circuit must not be opened.

- -> Unscrew the line bracket -3- for refrigerant line.
- Detach connector for solenoid clutch at air conditioner.
- Unscrew air conditioning compressor (4 bolts -Item 1- and -Item 2-) and suspend to the side together with the connected refrigerant hoses.

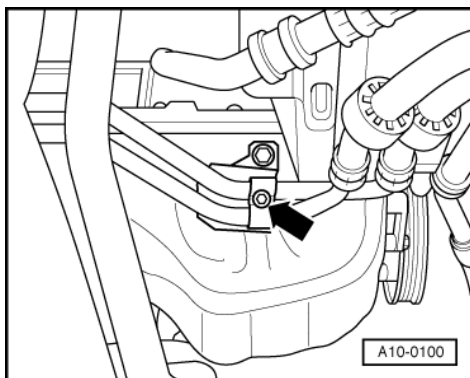


All models:

- -> Unscrew earthing strap from body -arrow-.



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

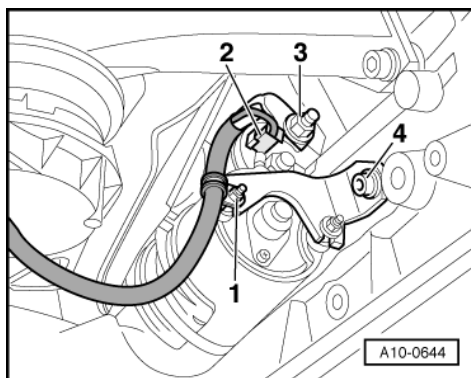


Vehicles with automatic gearbox:

- -> Unscrew bracket -arrow- for ATF line at engine oil sump.

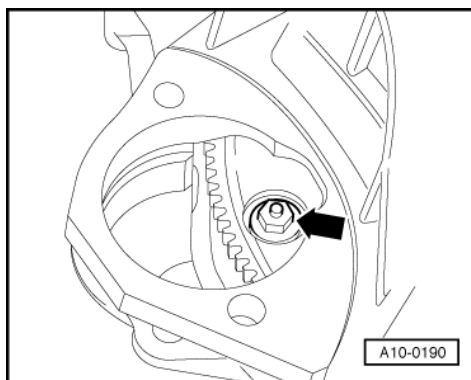


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All models:

- -> Unbolt cable clamp -1-.
- Detach wires -2- and -3- from starter, remove insulator from positive connection on starter.
- Unbolt retainer on cylinder block -4-.
- If necessary, detach the heat shield clamp.
- Unbolt starter from gearbox and remove.

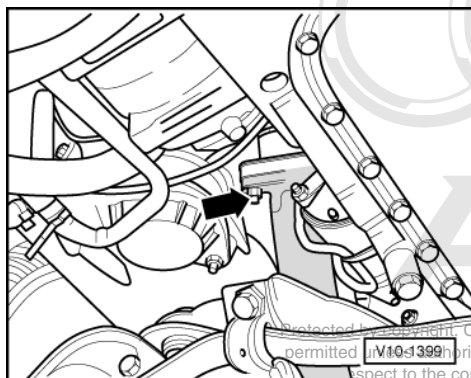


Vehicles with automatic gearbox:

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

Note:

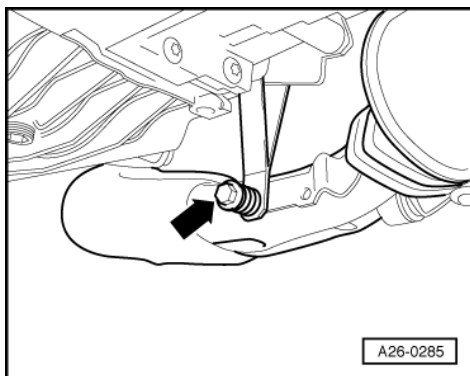
To prevent engine from turning when loosening torque converter nuts, counterhold central bolt on vibration damper.



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All models:

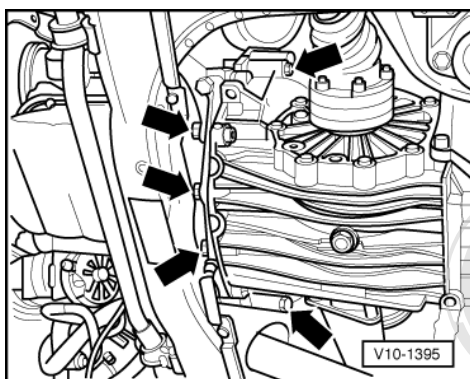
- -> Unscrew exhaust manifold/front exhaust pipe nuts -arrow-.



- -> Unbolt exhaust system at bracket -arrow-.
- Push exhaust system towards the rear so that studs on exhaust manifold are free.

Note:

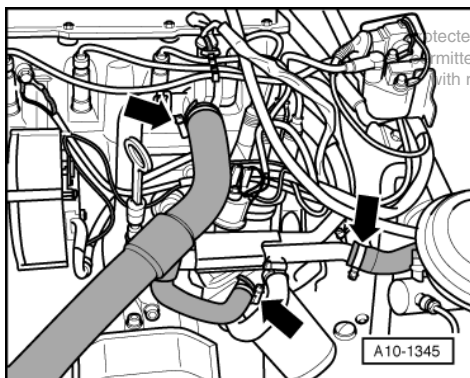
Note electrical wiring of lambda probe.



- -> Unscrew engine/gearbox connecting bolts accessible from below -arrows-.

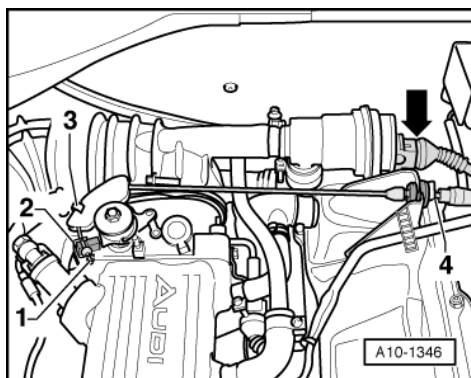
Note:

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

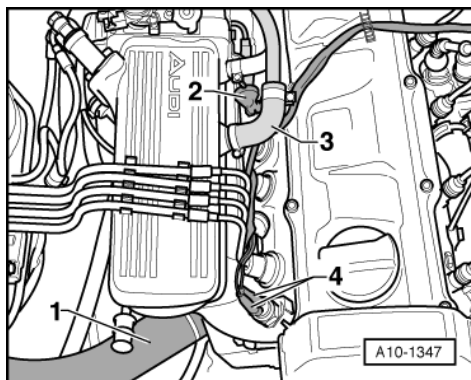


- -> Remove coolant hoses -arrows-.

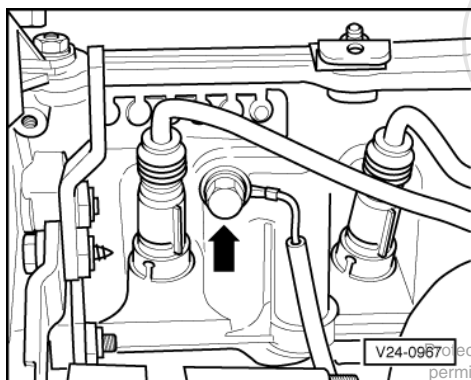
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- -> Remove securing clips -2- and -3-.
- Detach throttle cable -1- at throttle valve body and support bracket (do not remove throttle cable retainer -4-). Move throttle cable to the side.
- Detach connector -arrow- from idling stabilisation valve.

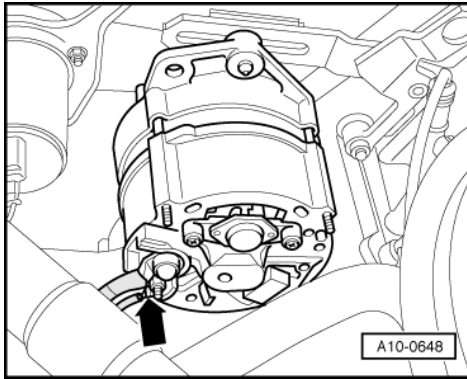


- -> Detach the vacuum pipe -3- to the brake servo.
- Unplug connectors at fan run-on thermoswitch -4-.
- Detach connector -2- from throttle switch.
- Lay wiring aside.
- Detach hose -1- of intake air preheater from warm air arrester plate on exhaust manifold.

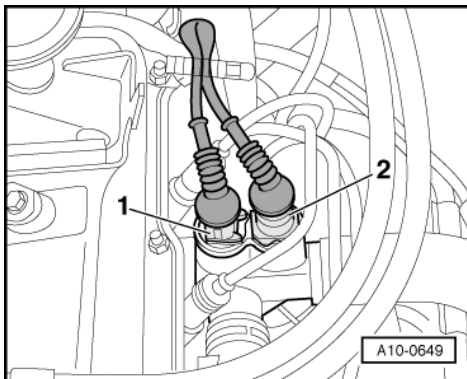


- -> Unbolt the earth connection point on the left side of the cylinder head -arrow-.

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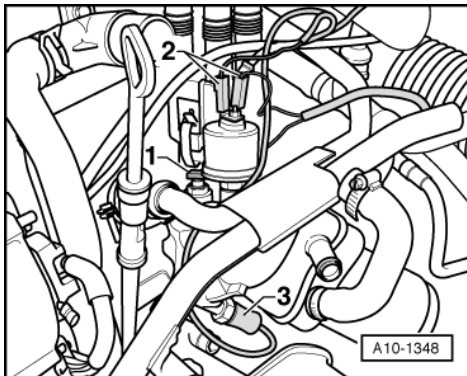


- -> Detach the D+ line -arrow- at alternator.



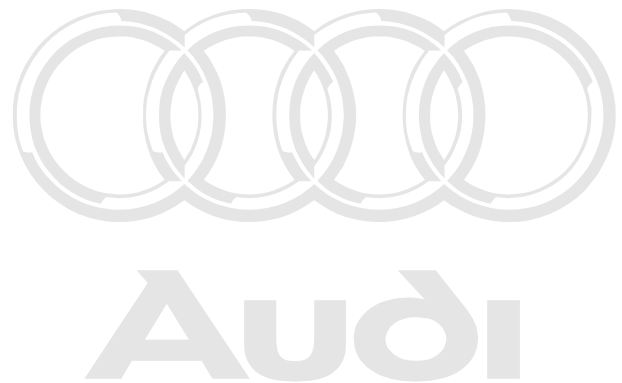
- -> Unplug the connectors at:

- 1 - Coolant temperature sensor -G62
- 2 - Sensor for coolant temperature display -G2, and coolant temperature switch (too hot) -F14

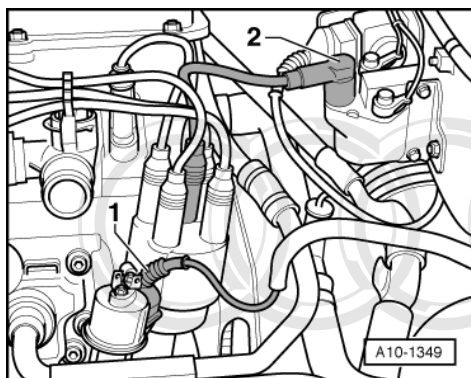


- -> Unplug the connectors at:

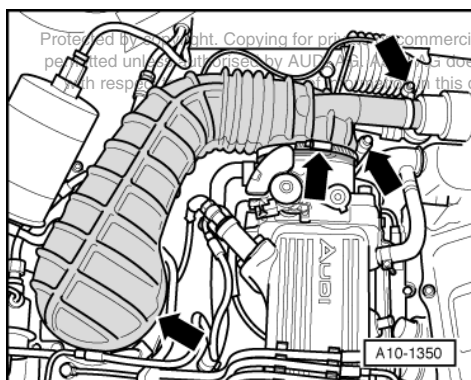
- 1 - Oil temperature sensor -G8
- 2 - Oil pressure sensor -G10
- 3 - Oil pressure switch -F1



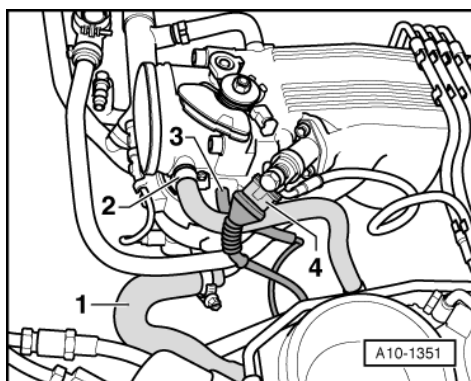
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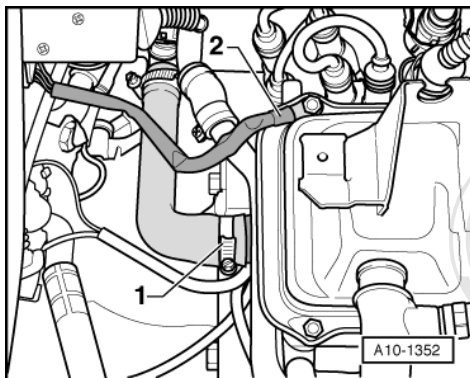
- -> Unplug the connector -1- on Hall sender -G40.
- Lay wiring aside.
- Detach main ignition wire -2- from ignition coil.



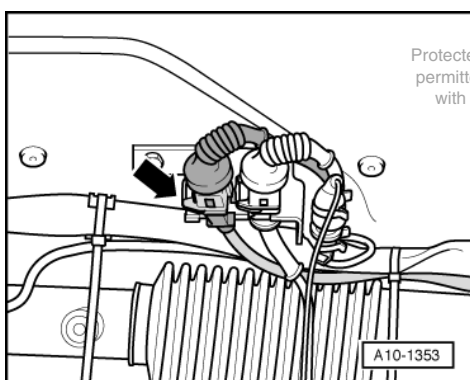
- -> Remove the air intake cowl -arrows-.



- -> Disconnect wires/unplug connectors:
 - 1 - Crankcase ventilation hose
 - 2 - Connection on throttle valve unit to activated carbon filter solenoid valve 1 -N80
 - 3 - Connection on throttle valve unit to intake air preheater
 - 4 - Cold start valve -N17
- Detach the cold start valve with the fuel line connected from the intake manifold.

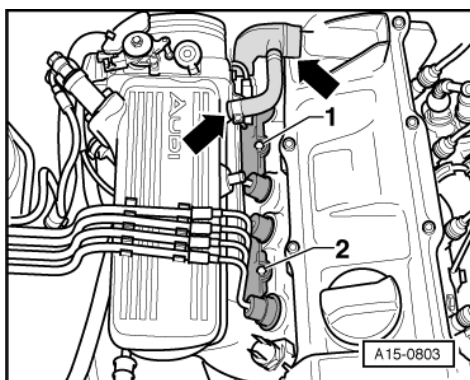


- -> Detach coolant hose -1- from the connection at rear of cylinder head.
- Unscrew earth wire -2- at cylinder head cover.



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- -> Detach the connector -arrow- for the knock sensor.
- Remove the connector from the bracket and lay the wiring aside.

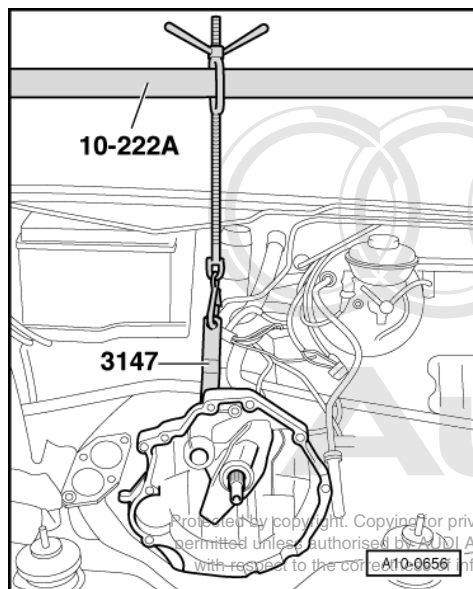


- -> Unbolt the injector retaining bar -1- and -2-.
- Remove the injectors with fuel lines connected from the intake manifold.

Note:

Ensure that the fuel lines are not kinked.

- Unscrew upper engine/gearbox securing bolts. Leave one bolt in place (hand tight).



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

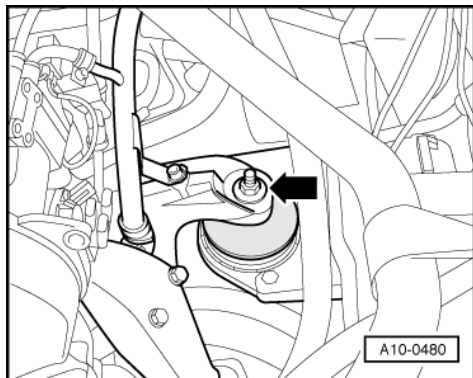
Note:

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

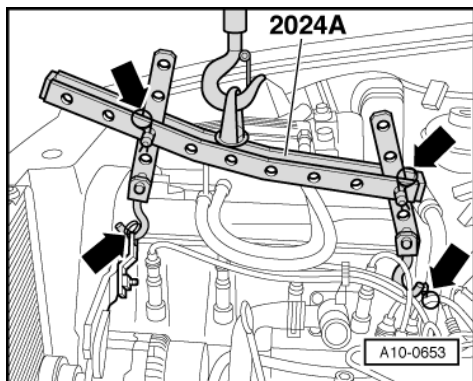
- Engage gearbox support 3147 in bolt hole in bell housing as shown in the illustration.
- Connect gearbox support 3147 and support bar 10-222 A.

Note:

Shown in illustration with engine removed.



- Unbolt the left and right stop brackets above the engine mount.
- -> Unscrew nuts -arrow- at top right and left of engine mounts.



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

Note:

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

Important

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

Note:

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

- Lift engine over studs of engine mounts.
- Tighten spindle of support bar 10-222 A.
- Remove the last securing bolt.
- Pull the engine from the gearbox.

Vehicles with automatic gearbox:

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

All models:

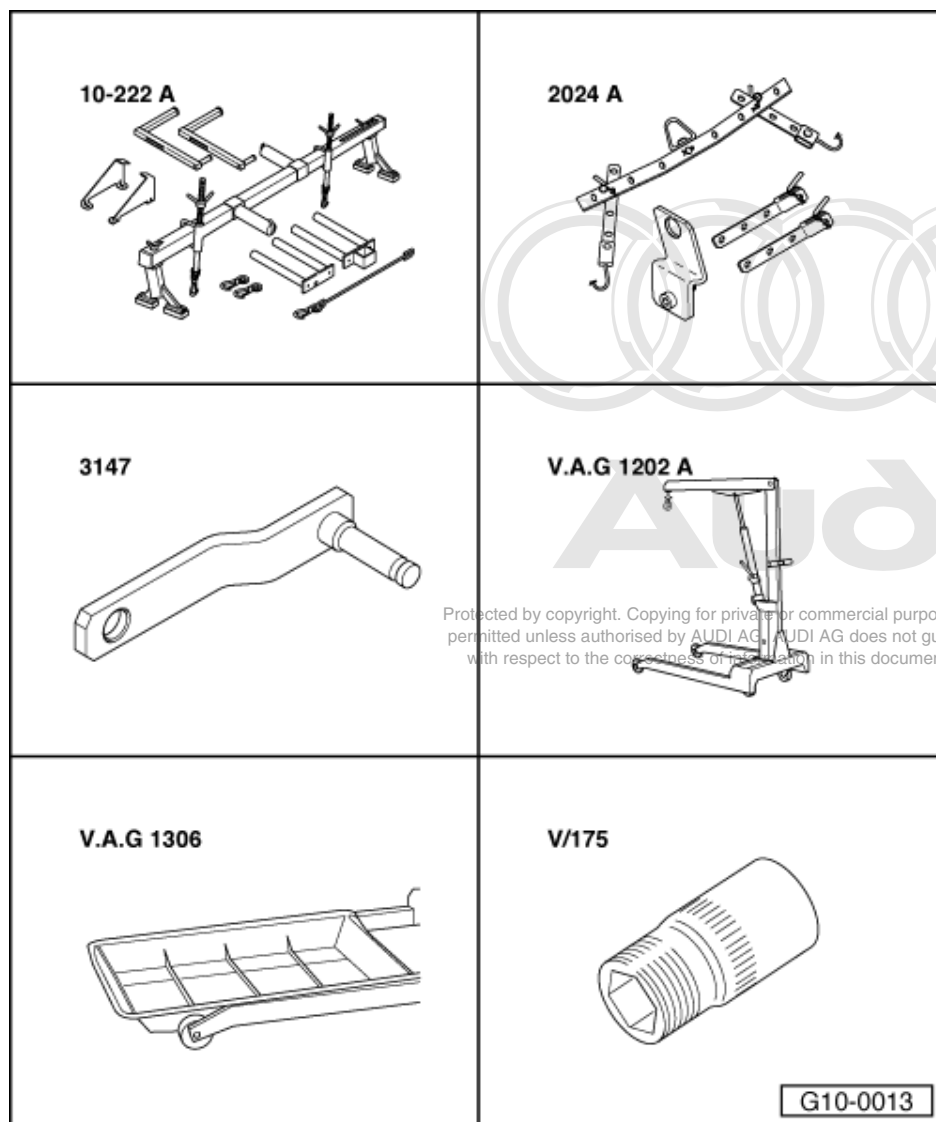
- Guide the engine carefully while lifting it to avoid damaging bonnet, radiator and lock carrier.



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1.4 - Removing engine -engine codes ABK, ADA, ADW-



Special tools and workshop equipment required

- ♦ Support bar 10-222 A with 10-222 A/2
- ♦ Lifting tackle 2024 A
- ♦ Gearbox support 3147
- ♦ V.A.G 1202 A

or

- ♦ Workshop crane VAS 6100
- ♦ Drip tray V.A.G 1306
- ♦ 15 mm socket insert Matra V/175 (on vehicles with automatic gearbox)

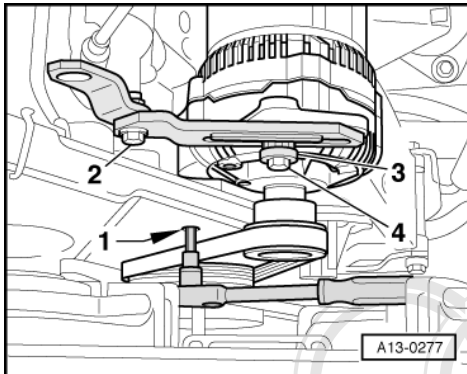
Procedure

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

Important

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

- Open the cover of the coolant expansion tank



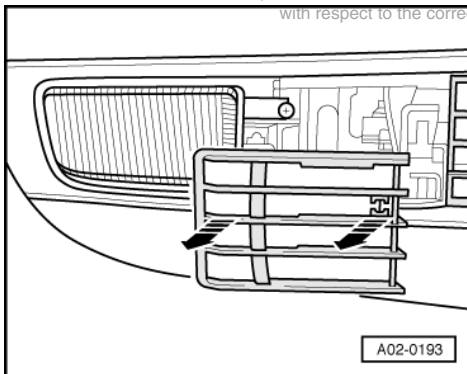
Vehicles with air conditioner:

Note:

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

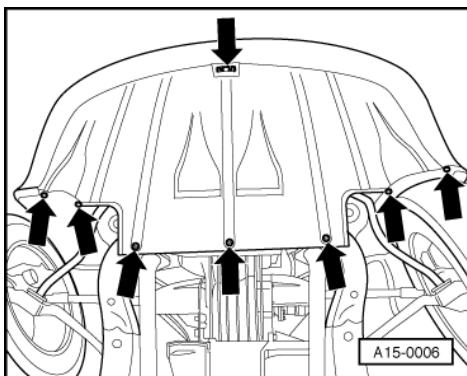
- -> Loosen bolts -1-, -2- and -4- at least one turn - bolt -1- can be reached from above via a hole in toothed belt guard.
- Release belt tension on ribbed belt with tensioner nut -3-.
- Detach ribbed belt from alternator belt pulley.

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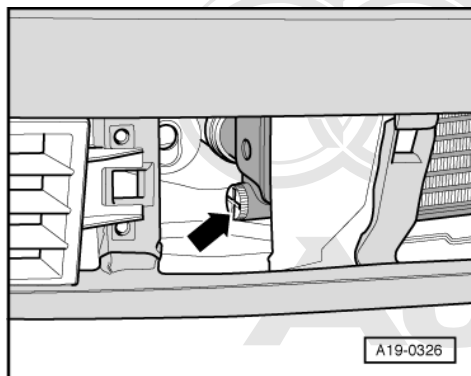
All models:

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

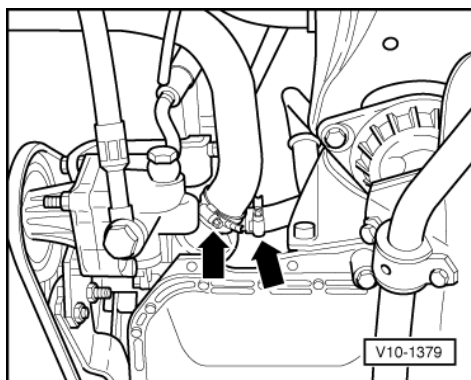




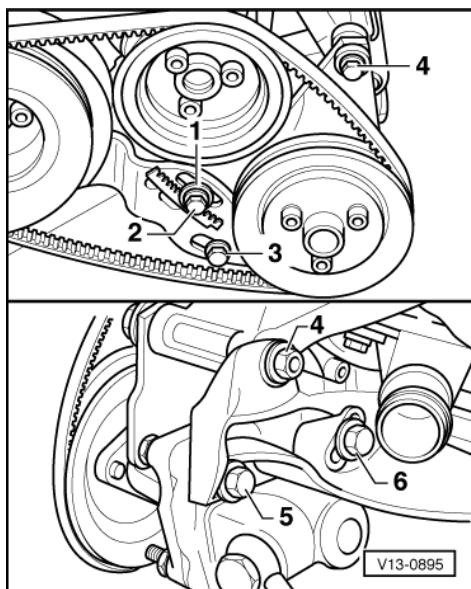
- -> Remove the noise insulation -arrows-.



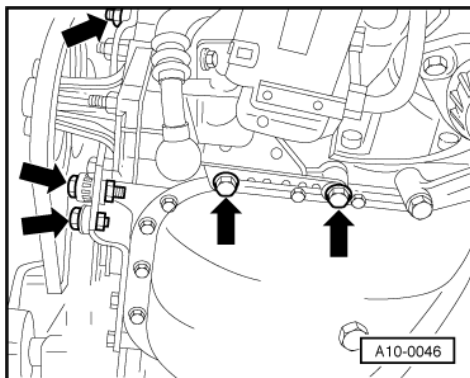
- Place drip tray V.A.G 1306 below engine.
- -> Turn drain plug arrow on radiator anti-clockwise. If necessary, fit drain hose on connection.



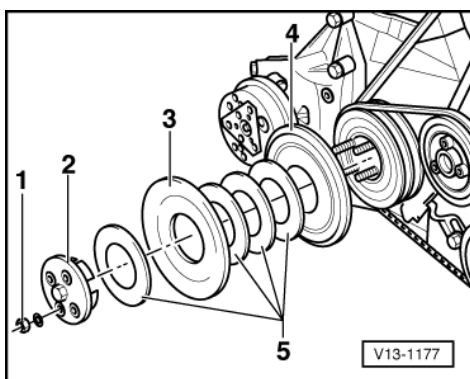
- -> Disconnect coolant hoses -arrows- to drain off remaining coolant.



- -> Loosen bolts 2...6.
- Release belt tension on V-belt with tensioner nut -1-.
- Remove V-belt for coolant pump and power assisted steering vane pump.



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



Vehicles with air conditioner:

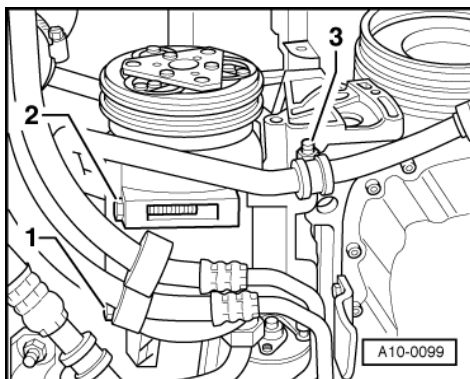
- -> Unscrew the 4 nuts -1-.
- Detach hub -2- from belt pulley.
- Remove front half of belt pulley -3- and shims -5-.

Notes:

- ◆ Belt tension is adjusted by adding or taking out shims -5- between front section -3- and rear section -4- of belt pulley.
- ◆ Note the number of shims between the belt pulley halves for re-installation.
- Remove V-belt.
- Unbolt the vibration damper (with stud for belt pulley).

Note:

Otherwise the studs may cause damage when lifting out the engine.

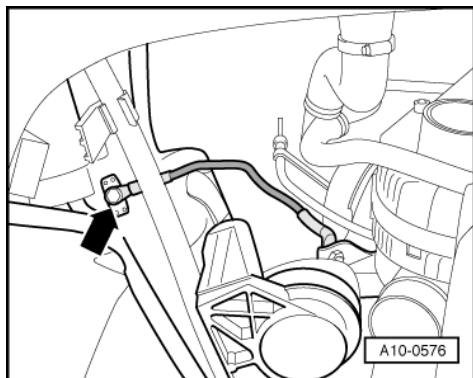




Important

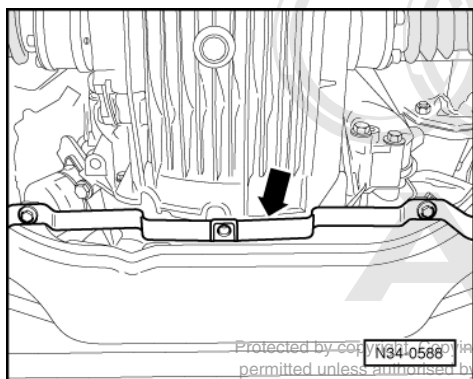
The air conditioner refrigerant circuit must not be opened.

- -> Unscrew the line bracket -3- for refrigerant line.
- Detach connector for solenoid clutch at air conditioner.
- Unscrew air conditioning compressor (4 bolts -Item 1- and -Item 2-) and suspend to the side together with the connected refrigerant hoses.



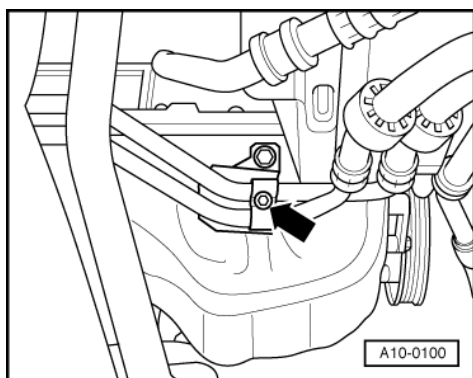
All models:

- -> Unscrew earthing strap from body -arrow-.



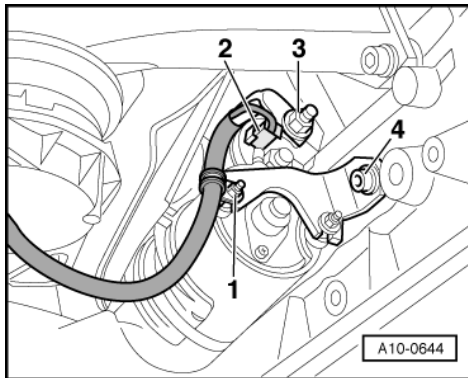
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- -> Unbolt bracket for noise insulation -arrow-.



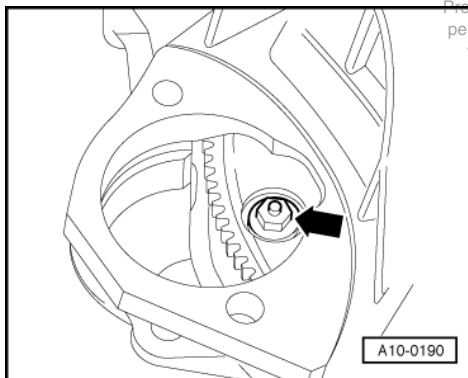
Vehicles with automatic gearbox:

- -> Unscrew bracket -arrow- for ATF line at engine oil sump.



All models:

- -> Unbolt cable clamp -1-.
- Detach wires -2- and -3- from starter, remove insulator from positive connection on starter.
- Unbolt retainer on cylinder block -4-.
- If necessary, detach the heat shield clamp.
- Unbolt starter from gearbox and remove.



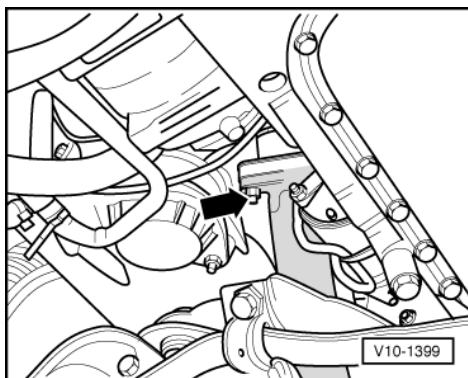
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Vehicles with automatic gearbox:

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

Note:

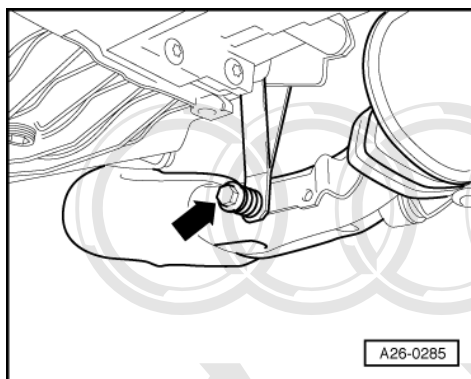
To prevent engine from turning when loosening torque converter nuts, counterhold central bolt on vibration damper.





All models:

- -> Unscrew exhaust manifold/front exhaust pipe nuts -arrow-.

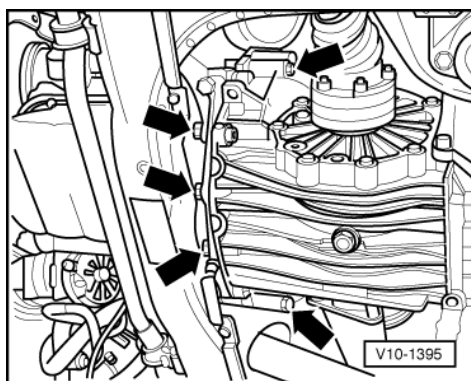


- -> Unbolt exhaust system at bracket -arrow-.
- Push exhaust system towards the rear so that studs on exhaust manifold are free.

Note:

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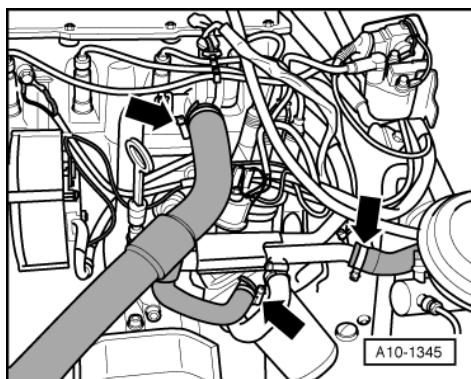
Note electrical wiring of lambda probe. Audi AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.



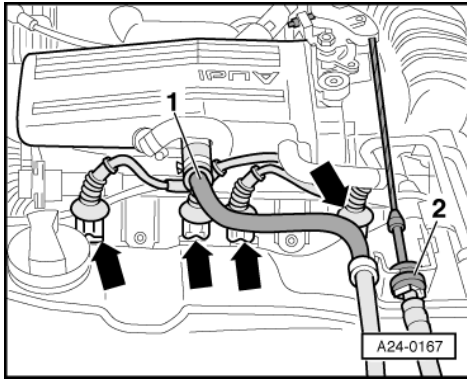
- -> Unscrew engine/gearbox connecting bolts accessible from below -arrows-.

Note:

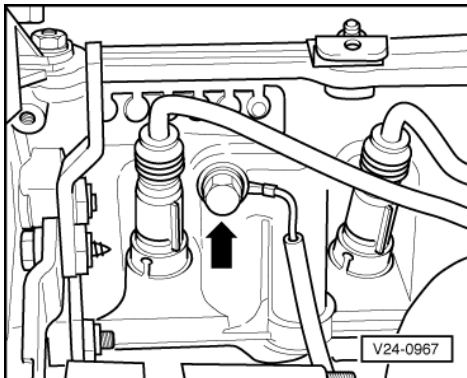
On removal, note the bolt lengths and assignment for re-installation.



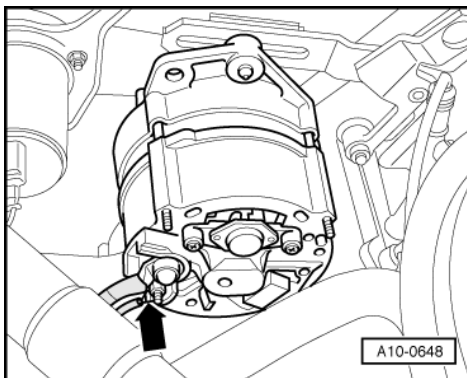
- -> Detach coolant hoses -arrows-.



- -> Detach throttle cable -2- at throttle valve connection and support bracket (do not remove retainer). Move throttle cable to the side.
- Detach the vacuum pipe -1- to the brake servo unit.
- Unplug connectors -arrows- at the injectors.
- Unplug connectors at fan run-on thermoswitch.
- Lay wiring aside.



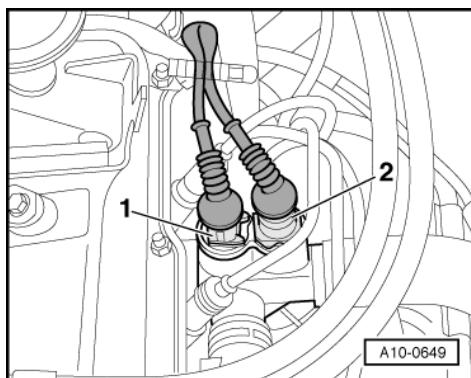
- -> Unbolt the earth connection point on the left side of the cylinder head -arrow-.



- -> Detach the D+ line -arrow- at alternator.

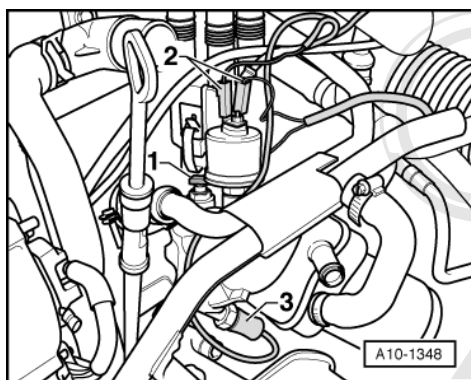


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- -> Unplug the connectors at:

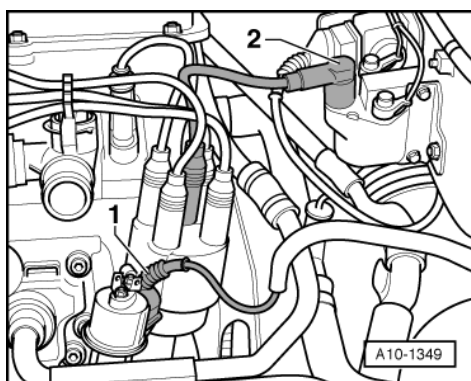
- 1 - Coolant temperature sensor -G62
- 2 - Sensor for coolant temperature display -G2, and coolant temperature switch (too hot) -F14



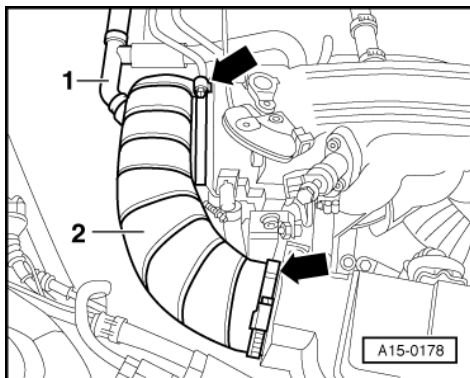
- -> Unplug the connectors at:

- 1 - Oil temperature sensor -G8
- 2 - Oil pressure sensor -G10
- 3 - Oil pressure switch -F1

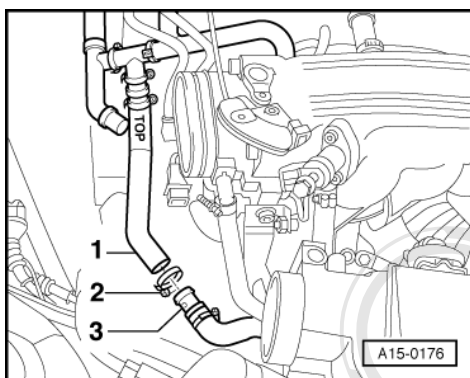
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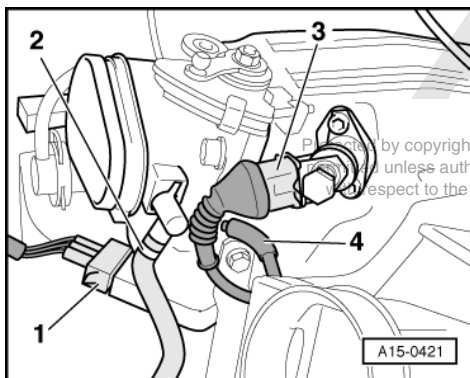
- -> Unplug the connector -1- on Hall sender -G40.
- Lay wiring aside.
- Detach main ignition wire -2- from ignition coil.



- -> Detach the air duct hose -2- from the throttle valve unit and the air flow meter, loosen hose clamps - arrows- for this purpose.
- Detach the elbow piece -1- from hose to cylinder head cover/intake manifold.

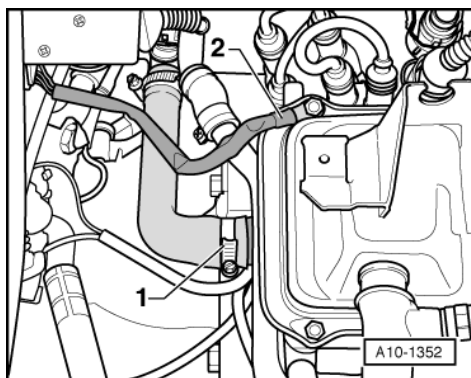


- -> Disconnect the air hoses -1- and -3- to the idling stabilisation valve, release hose clamp -2- for this purpose.
- Detach hose of intake air preheater from warm air arrester plate on exhaust manifold.

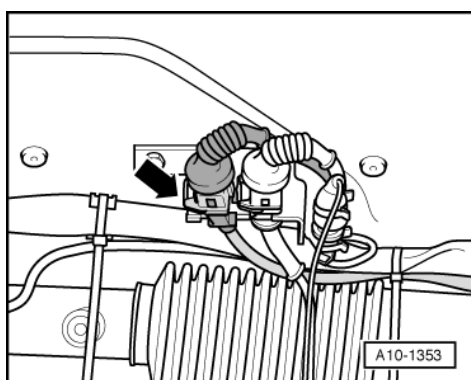


- -> Disconnect wires/unplug connectors:

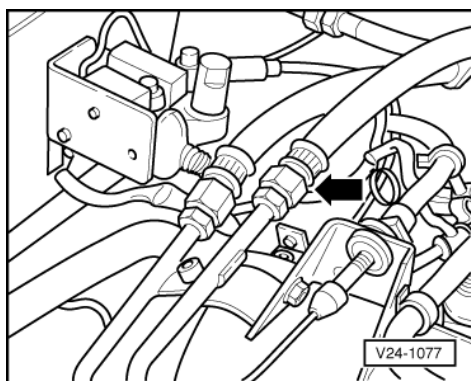
- 1 - Throttle valve potentiometer -G69
- 2 - Connection on throttle valve unit to activated carbon filter solenoid valve 1 -N80
- 3 - Cold start valve -N17
- 4 - Connection on throttle valve unit to intake air preheater
- Idling switch -F60



- -> Detach coolant hose -1- from the connection at rear of cylinder head.
- Unscrew earth wire -2- at cylinder head cover.



- -> Detach the connector -arrow- for the knock sensor.
- Remove the connector from the bracket and lay the wiring aside.

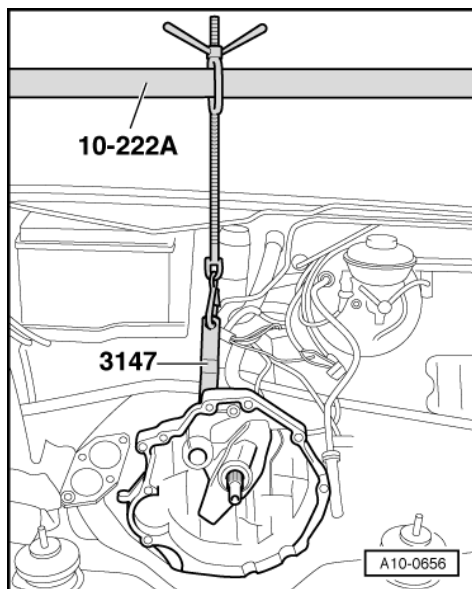


Important

The fuel system is pressurised. Before opening the system place a cloth around the connection point. Then release pressure by carefully loosening the connection.

- -> Disconnect fuel supply and return lines at the bolted connection -arrow-.
- Unscrew upper engine/gearbox securing bolts. Leave one bolt in place (hand tight).

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

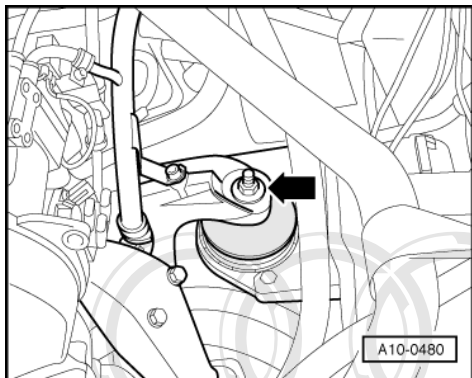
Note:

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

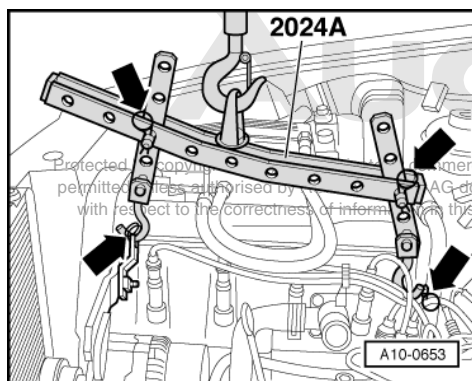
- Engage gearbox support 3147 in bolt hole in bell housing as shown in the illustration.
- Connect gearbox support 3147 and support bar 10-222 A.

Note:

Shown in illustration with engine removed.



- Unbolt the left and right stop brackets above the engine mount.
- -> Unscrew nuts -arrow- at top right and left of engine mounts.



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

Note:

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

Important

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

Note:

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

- Lift engine over studs of engine mounts.
- Tighten spindle of support bar 10-222 A.
- Remove the last securing bolt.
- Pull the engine from the gearbox.

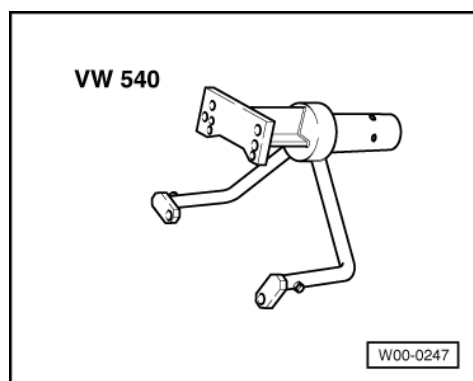
Vehicles with automatic gearbox:

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

All models:

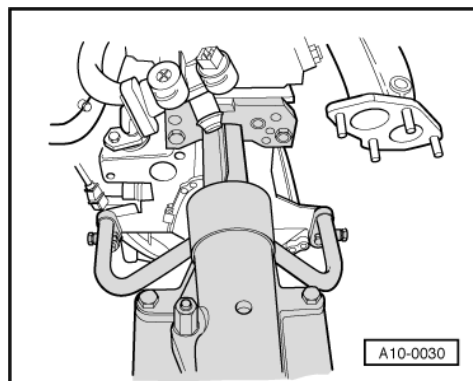
- Guide the engine carefully while lifting it to avoid damaging bonnet, radiator and lock carrier.

1.5 - Attaching engine to repair stand



Special tools and workshop equipment required

- ♦ Engine and gearbox support VW 540



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Procedure

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

1.6 - Installing

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

Notes:

- ◆ When performing installation procedures always replace self-locking nuts and bolts.
- ◆ Replace seals, gaskets, and bolts which have a specified tightening angle.
- ◆ Renew all cut and defective cable ties. Refit cable ties in the same position when installing the engine.
- ◆ Secure all hose connections with the correct hose clamps (same as original equipment):

=> Parts List

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

Vehicles with manual gearbox:

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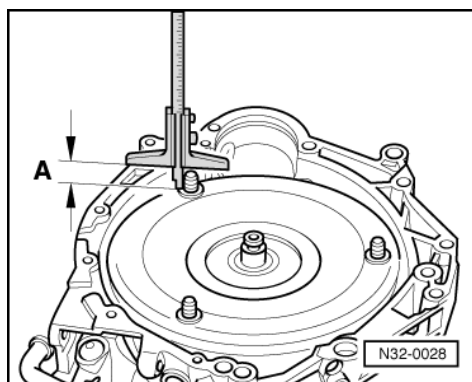
- Clean input shaft splines and (in the case of used clutch plates) the hub splines. Remove corrosion and apply only a very thin coating of grease G 000 100 to the splines. Do not grease guide sleeve.
- Check clutch release bearing for wear, renew if necessary.
- If necessary, check that clutch plate is properly centred.
- A needle bearing must be fitted in the crankshaft on vehicles with manual gearbox. Install needle bearing, if necessary => Page 91 .

Vehicles with automatic gearbox:

- In vehicles with automatic gearbox, no needle bearing must be fitted in the crankshaft. Remove needle bearing if necessary => Page 91 .
- To secure the torque converter on the drive plate only use the correct nuts as specified in the parts catalogue.

=> Parts List

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





Checking position of torque converter

-> If the torque converter is correctly installed, the distance -A- between the contact surfaces at the bottom of the studs on the torque converter and the contact surface of the torque converter bell housing is about 23 mm.

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

Important

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

- Check ATF level:

=> Automatic Gearbox 097; Repair group 37; Actuation, Housing; Checking ATF level and topping up ATF
Actuation, Housing Checking ATF level and topping up ATF

All models:

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Before installing engine, place rubber covers for engine mounting in installation position.
- Installing engine mounts free of stress. Ensure that engine mounts are free of stress by shaking engine to align it before tightening engine mounts.
- Install A/C compressor and power steering vane pump.
- Install V-belt/ribbed belt for alternator => Page 56 .
- Install V-belt for ancillaries => Page 60 .
- Top up coolant => Page 188 .

Notes:

- ♦ Drained coolant may only be used again if the original cylinder head and cylinder block are re installed.
 - ♦ Coolant must not be used again if it is dirty.
 - Check throttle cable setting
- => Fuel Supply - Petrol Engines; Repair group 20; Servicing throttle mechanism Servicing throttle mechanism
- Stress-free alignment of exhaust system => Page 225
 - Electrical connections and routing:
- => "Current Flow Diagrams, Electrical Fault-finding and Fitting Locations" binder

Important

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

Notes:

- ♦ When the battery is reconnected make sure that the vehicle equipment (radio, clock, electrical window lifter) is actuated according to the operating instructions.
- ♦ Further measures after reconnection of voltage supply:

=> Fuel Injection and Ignition System; Repair group 24

- To interrogate fault memory:

=> Fuel Injection and Ignition System; Repair group 01; Interrogating and erasing fault memory Interrogating and erasing fault memory

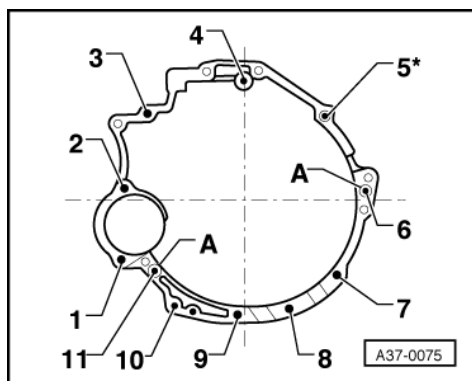
Note:

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

1.7 - Tightening torques

Notes:

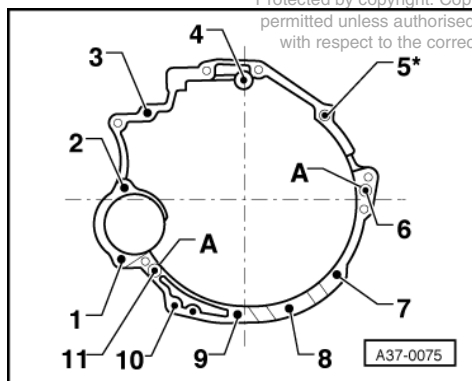
- ♦ The tightening torques listed on this page apply only to lightly greased, oiled, phosphated, or black finished nuts and bolts.
- ♦ Additional lubricant such as engine or gearbox oil may be used, but do not use graphite lubricant.
- ♦ Do not use degreased parts.
- ♦ Tightening torque tolerance $\pm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



-> Engine/gearbox mountings (manual gearbox)

Item	Bolt	Nm
1, 3, 4	M12 x 67	65
2	M12 x 80	65
5, 6	M12 x 90	65
7	M10 x 50	45
8	M8 x 32	25
9	M10 x 38	45
10	M10 x 45	45
11	M12 x 100	65

A: Centring sleeves



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-> Fastening engine to gearbox in vehicles with automatic gearbox

Item	Bolt	Nm
1, 2, 3, 4, 11	M12 x 67	65
5, 6	M12 x 90	65



Item	Bolt	Nm
7, 8, 9, 10	M10 x 45	45

A: Centring sleeves

Component	Nm
Bolts/nuts	M6 10
	M8 20
	M10 45
	M12 65
Except for the following:	
Engine support to engine mount	40
Drive plate to torque converter	85
A/C compressor to bracket	25
Vane pump to bracket	25

Component	Nm
Vibration damper to crankshaft	8.8 1) 25
	10.9 1) 40
Noise insulation bracket	10
Front exhaust pipe to exhaust manifold	30
Front exhaust pipe to mountings on gearbox	25
Earth wire to cylinder head	10
D+ wire to alternator	4
Brackets for ATF lines	10
Hose clamps	2

1) Bolt strength rating

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13 - Crankshaft group

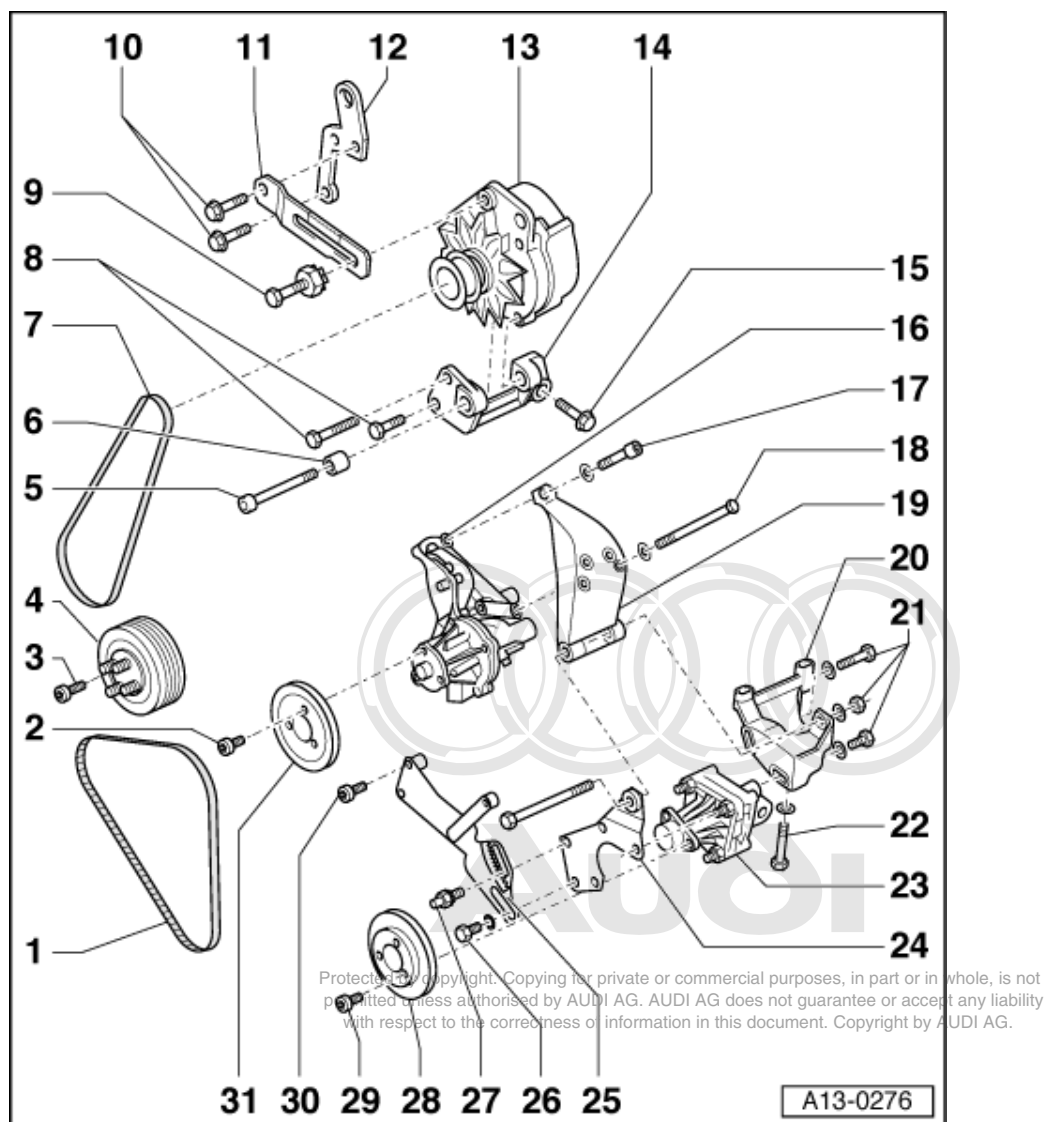
1 - Dismantling and assembling engine

1.1 - Dismantling and assembling engine

1.2 - Belt drive for alternator, coolant pump, and vane pump

Notes:

- ♦ The following illustration shows the belt drive on vehicles with ribbed belt and without air conditioner.
- ♦ Mark the direction of rotation before removing the ribbed belt. If the belt runs in the opposite direction when it is refitted, this can cause breakage. Ensure that the belt is properly seated in the pulleys when installing.



1 V-belt or ribbed belt

- ♦ For coolant pump
- ♦ For vane pump



- ♦ Different versions

=> Parts List

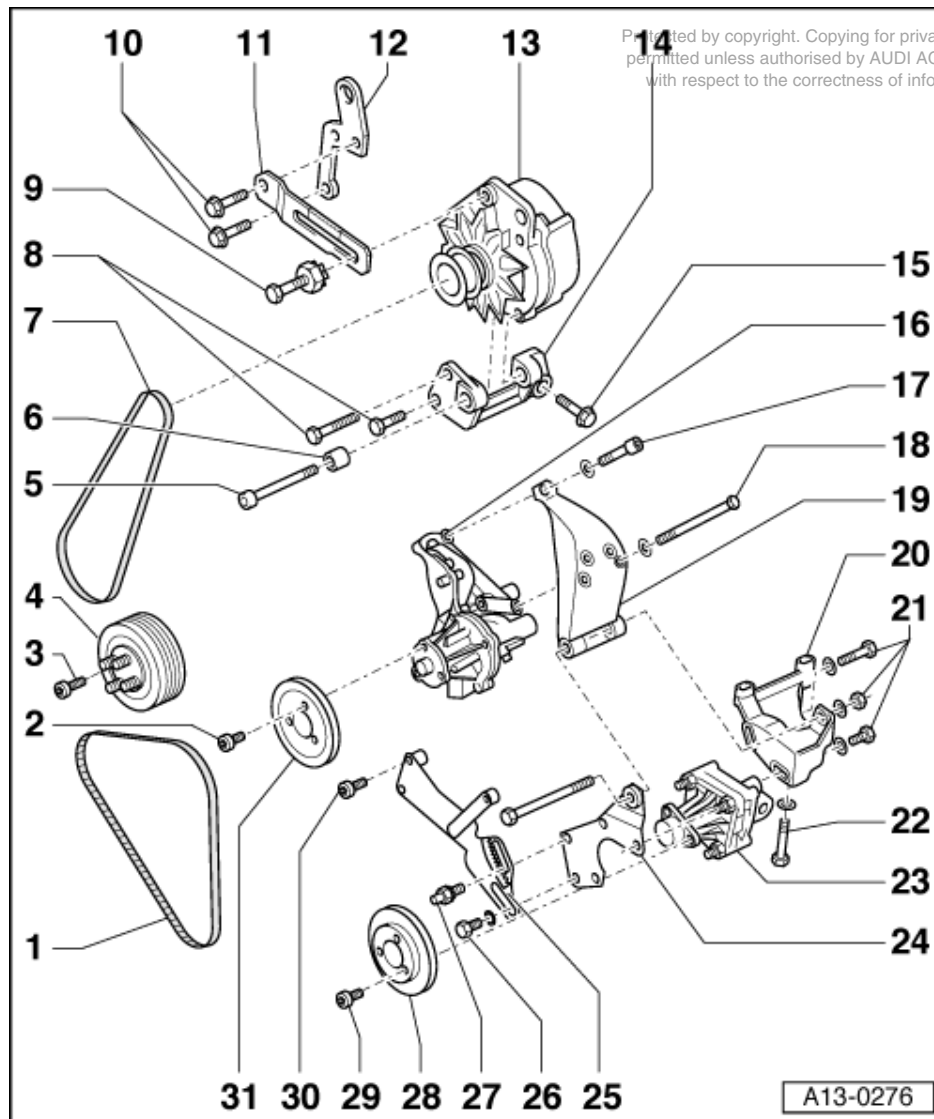
- ♦ Check for wear
- ♦ Removing and installing
=>Page 50

2 25 Nm

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

3 Hexagon socket-head bolt

- ♦ Bolt with strength rating 8.8: tighten to 25 Nm
- ♦ Bolt with strength rating 10.9: tighten to 40 Nm
- ♦ To release and tighten counterhold at vibration damper using oil filter strap wrench if necessary



4 Vibration damper

- ♦ On vehicles with air conditioner with 4 studs for belt pulley
- ♦ Can only be installed in one position. Holes are off set

5 Bolt (special type)

- ♦ Tighten to 35 Nm
- ♦ Use only correct bolts (same as original equipment); strength rating 10.9

=> Parts List

6 Socket

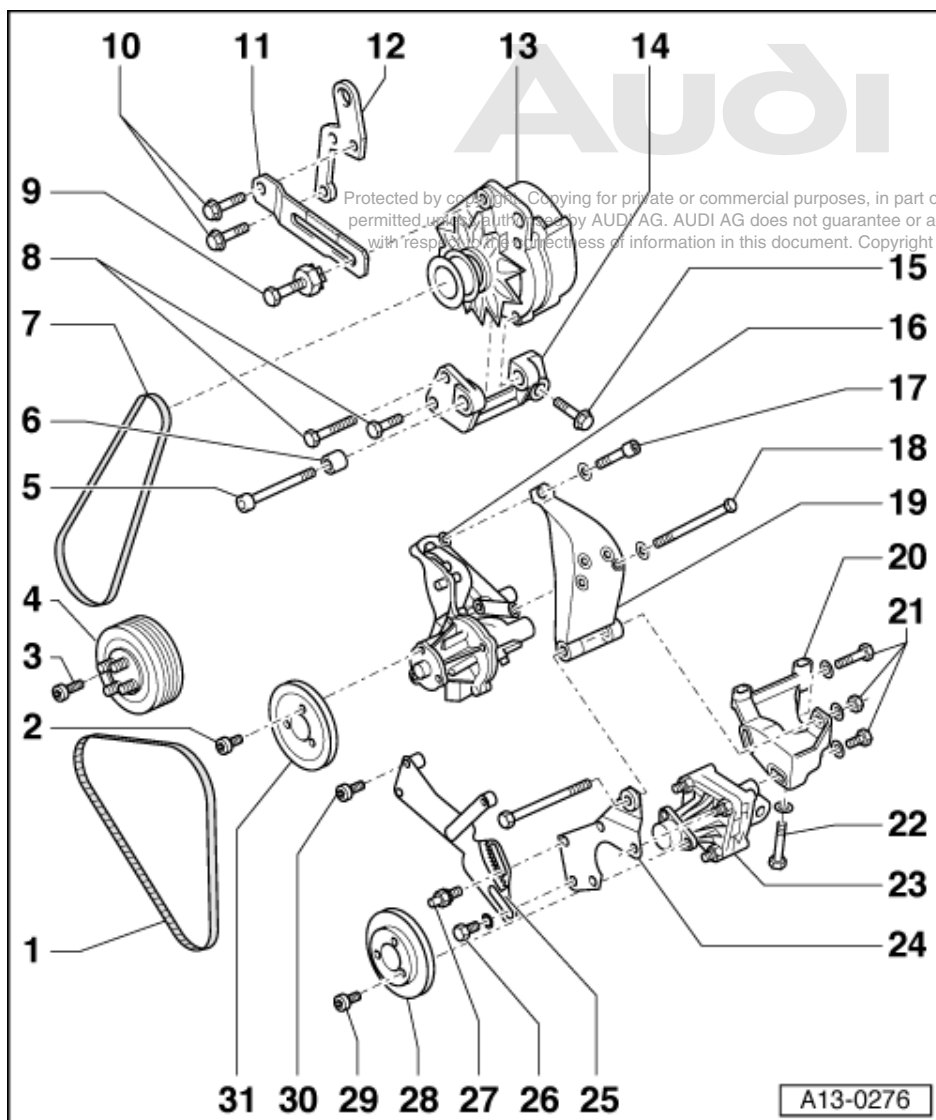
7 Ribbed belt

- ♦ For alternator
- ♦ Until 08.91 a V-belt was fitted instead of a ribbed belt

=> Parts List

- ♦ Check for wear
- ♦ Do not kink
- ♦ Removing and installing=> from Page 52 onwards

8 25 Nm



9 Bolt with tensioning nut

- ♦ Tighten bolt to 25 Nm

10 25 Nm

11 Retainer

- ♦ For alternator

12 Lifting eye

13 Alternator

14 Bracket



- ♦ For alternator

15 Bolt (special type)

- ♦ Tighten to 35 Nm
- ♦ Use only correct bolts (same as original equipment); strength rating 10.9

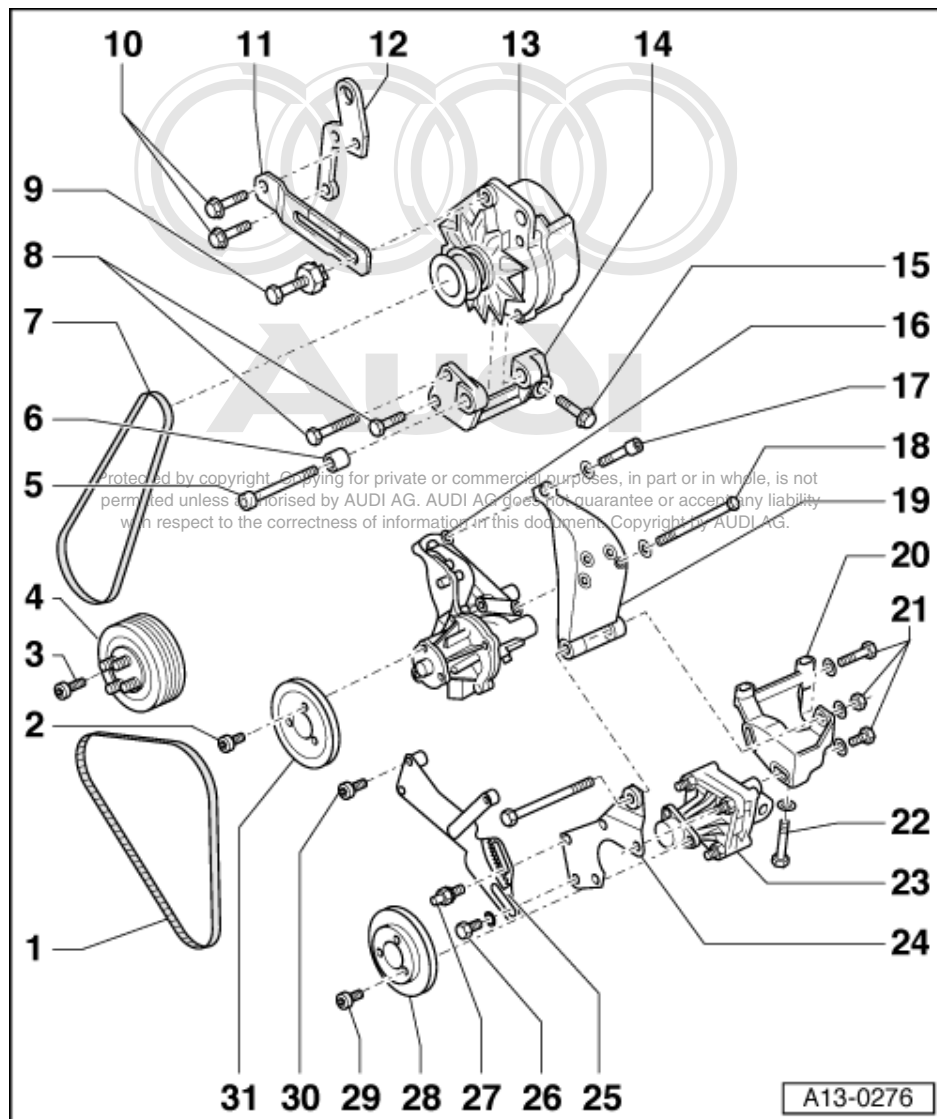
=> Parts List

16 Coolant pump

- ♦ Check for ease of movement
- ♦ Removing and installing

=>Page **192**

17 25 Nm



18 25 Nm

19 Bracket

- ♦ For vane pump

20 Rear holder

- ♦ For vane pump

21 25 Nm

22 25 Nm

23 Vane pump

- ♦ For power steering

- ♦ Removing and installing:

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

24 Front holder

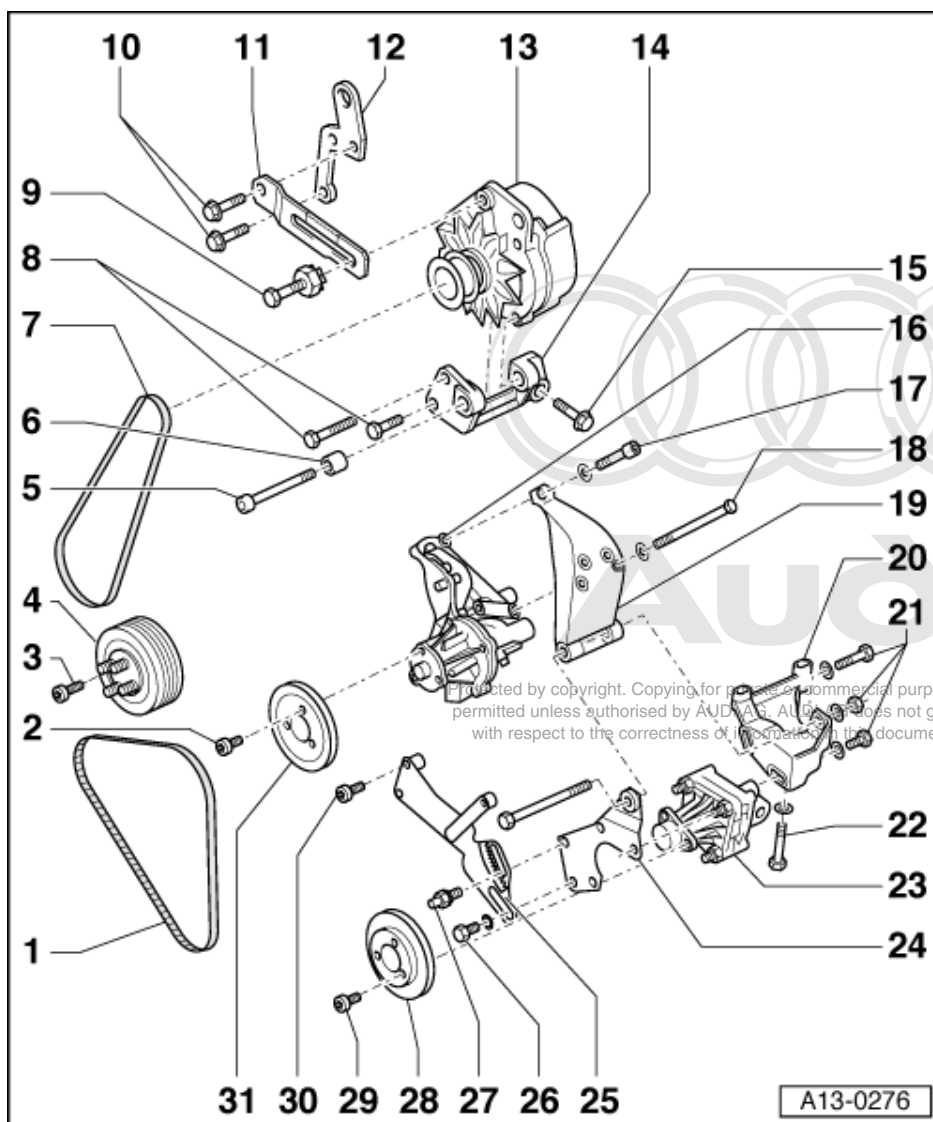
- ♦ For vane pump
- ♦ Different versions

=> Parts List

25 Retainer

- ♦ For vane pump
- ♦ Different versions

=> Parts List



26 25 Nm

- ♦ Different versions

=> Parts List

27 Bolt with tensioning nut

- ♦ Tighten bolt to 25 Nm

28 Belt pulley

- ◆ For vane pump
- ◆ Different versions

=> Parts List

29 25 Nm

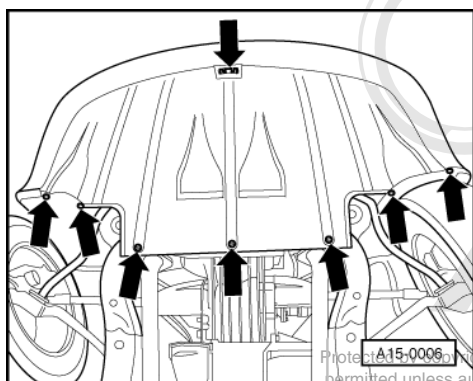
- ◆ To release and pick up pulley counterhold with oil filter strap wrench if necessary

30 25 Nm

31 Belt pulley

- ◆ For coolant pump

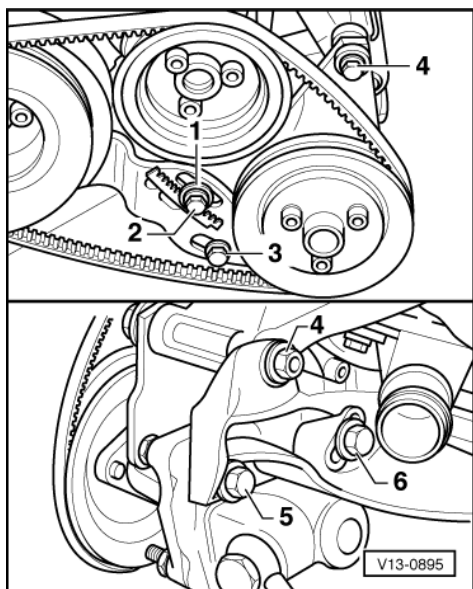
1.3 - Removing and installing V-belt for coolant pump and power assisted steering vane pump



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Removing

- V-belt for air conditioning compressor removed =>Page 60 .
- -> Remove the noise insulation -arrows-.



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

Installing

Installation is in reverse order.

- Check V-belt for correct fit.
- Tension V-belt =>Page 51 .

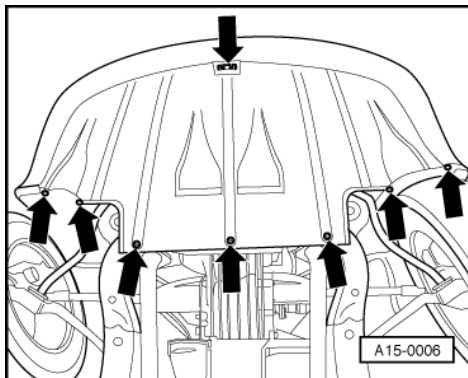
1.4 - Checking V-belt tension for coolant pump and power assisted steering vane pump, tensioning V-belt

Checking

- Press in the ribbed belt firmly with the thumb at a point half-way between the two pulleys which are farthest apart.

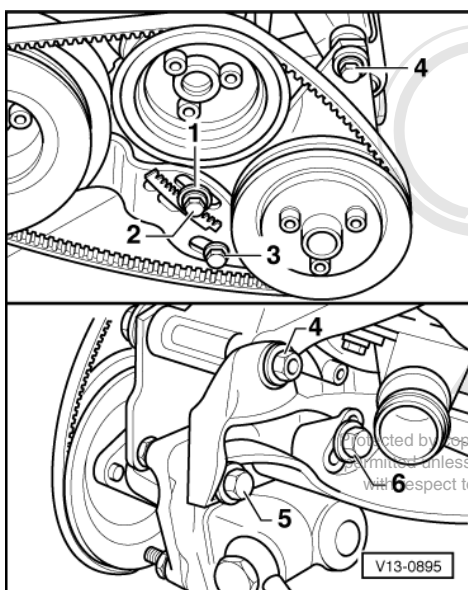
The amount of yield should be as follows:

- New and used V-belts: 10 mm



V-belts: tensioning

- -> Remove the noise insulation -arrows-.



- -> Loosen bolts 2...6.



- Adjust belt tension with tensioner nut -1-.

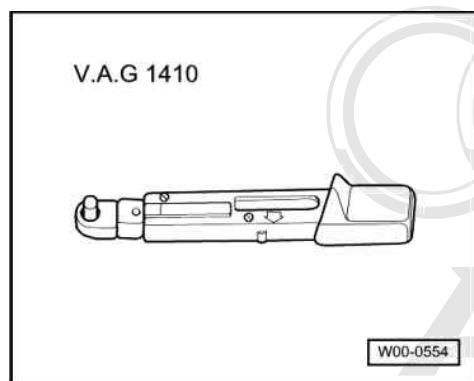
The amount of yield should be as follows:

- New and used V-belts: 10 mm
- Tighten securing bolts on vane pump.

Tightening torques

Component	Nm
Vane pump to bracket	25
Vane pump to tensioning bar	25
Clamping bolt for tensioner nut to tensioning bar	25

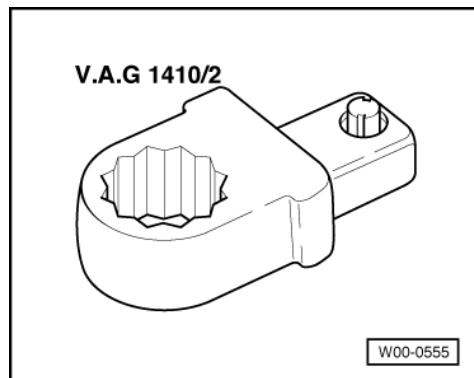
1.5 - Removing and installing V-belt for alternator > 08.91



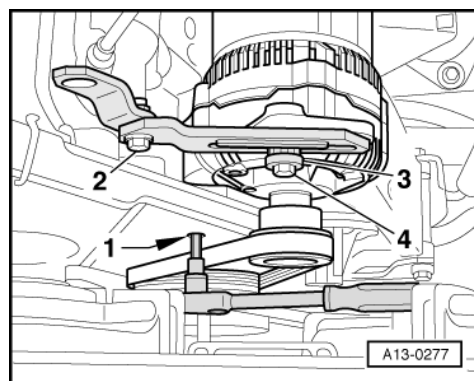
Special tools and workshop equipment required

- ♦ V.A.G 1410 Torque wrench

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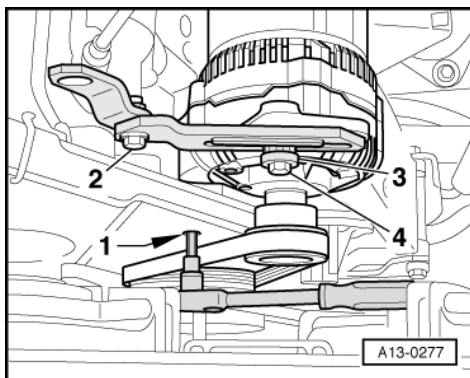


- ♦ Ring spanner attachment V.A.G 1410/2 (22 mm A/F)



Removing

- V-belt for air conditioning compressor removed =>Page 60 .
- V-belt for coolant pump and power assisted steering vane pump removed => Page 50 .
- -> Loosen bolts -1-, -2- and -4- at least one turn - bolt -1- can be reached from above via a hole in toothed belt guard.
- Release belt tension on V-belt with tensioner nut -3-.
- Remove V-belt.



Installing

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

- Fit V-belt.
- -> Using torque wrench V.A.G 1410 and ring spanner attachment V.A.G 1410/2 (22 mm A/F), tighten the tensioner nut -3-:

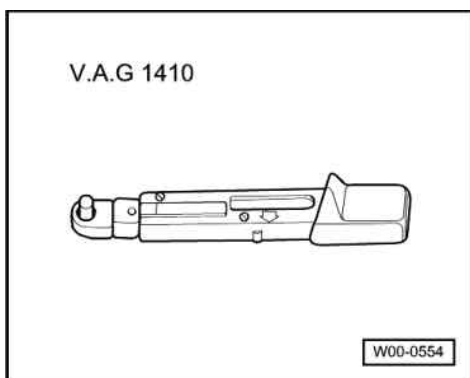
- Used V-belt:	4 Nm
- New V-belt:	8 Nm

- Maintain this torque on the tensioning nut, and tighten clamping bolt -4- to 25 Nm.

Tightening torques

Component	Nm
Clamping bolt for tensioner nut to tensioning bar	25
Alternator to bottom mounting	35
Tensioning bar to bracket	25

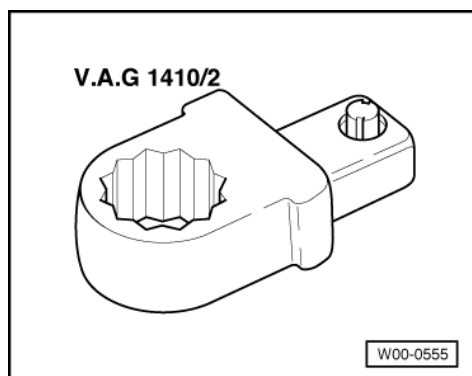
1.6 - Checking V-belt tension for alternator, tensioning V-belt





Special tools and workshop equipment required

- ♦ V.A.G 1410 Torque wrench



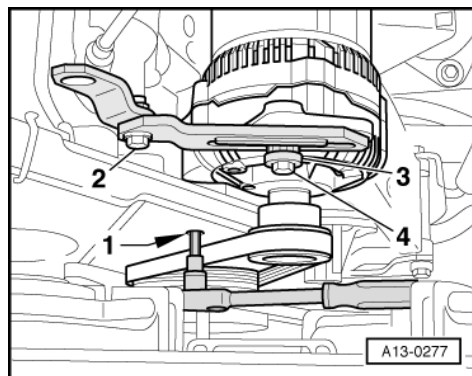
- ♦ Ring spanner attachment V.A.G 1410/2 (22 mm A/F)

Checking

- Press in the ribbed belt firmly with the thumb at a point half-way between the two pulleys which are farthest apart.

The amount of yield should be as follows:

- Used V-belt:	5 mm
- New V-belt:	2 mm



V-belts: tensioning

- -> Loosen bolts -1-, -2- and -4- at least one turn - bolt -1- can be reached from above via a hole in toothed belt guard.
- Using torque wrench V.A.G 1410 and ring spanner attachment V.A.G 1410/2 (22 mm A/F), tighten the tensioner nut -3-:

- Used V-belt:	4 Nm
- New V-belt:	8 Nm

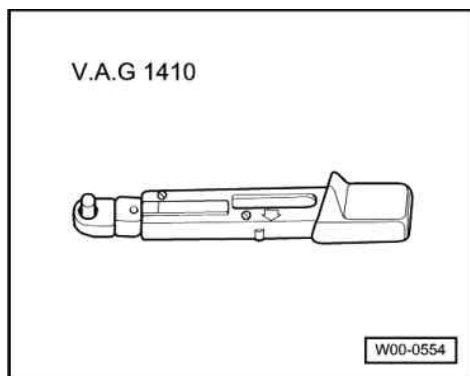
- Maintain this torque on the tensioning nut, and tighten clamping bolt -4- to 25 Nm.

Tightening torques

Component	Nm
Clamping bolt for tensioner nut to tensioning bar	25
Alternator to bottom mounting	35

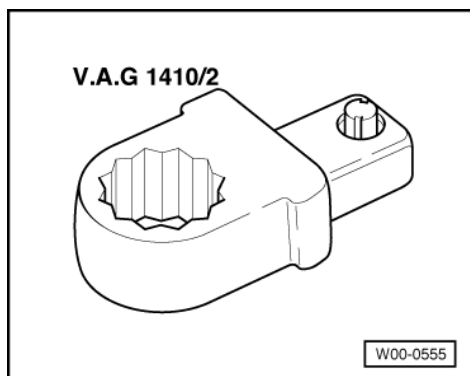
Component	Nm
Tensioning bar to bracket	25

1.7 - Removing and installing ribbed belt for alternator > 09.91

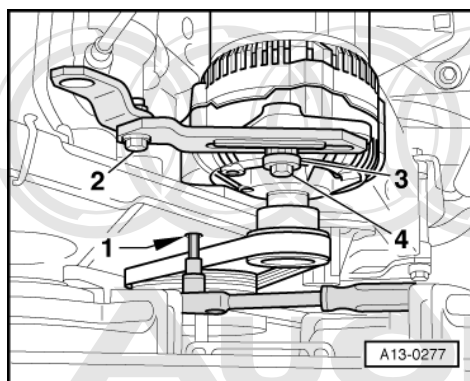


Special tools and workshop equipment required

- ♦ V.A.G 1410 Torque wrench



- ♦ Ring spanner attachment V.A.G 1410/2 (22 mm A/F)



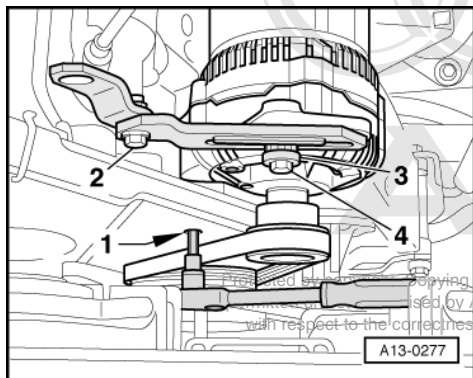
Removing

- V-belt for air conditioning compressor removed => Page 60 .
- V-belt for coolant pump and power assisted steering vane pump removed => Page 50 .

Note:

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

- -> Loosen bolts -1-, -2- and -4- at least one turn - bolt -1- can be reached from above via a hole in toothed belt guard.
- Release belt tension on ribbed belt with tensioner nut -3-.
- Remove ribbed belt.



Installing

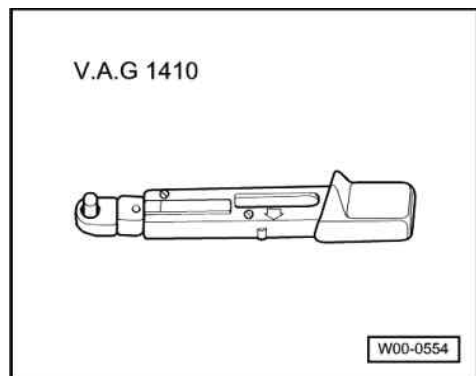
Installation is carried out in the reverse order; note the following:

- Fit ribbed belt.
- -> Using torque wrench V.A.G 1410 and ring spanner attachment V.A.G 1410/2 (22 mm A/F), apply a torque of 6 Nm to the tensioner nut-3-.
- Maintain this torque on the tensioning nut, and tighten clamping bolt -4- to 25 Nm.

Tightening torques

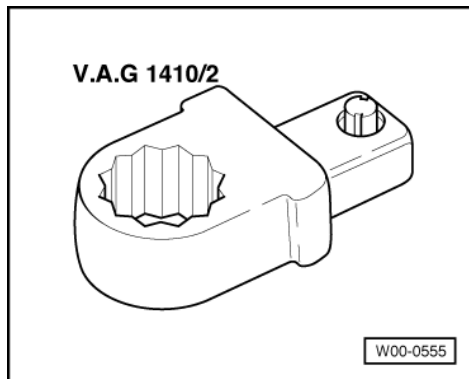
Component	Nm
Clamping bolt for tensioner nut to tensioning bar	25
Alternator to bottom mounting	35
Tensioning bar to bracket	25

1.8 - Checking ribbed belt tension for alternator, tensioning ribbed belt

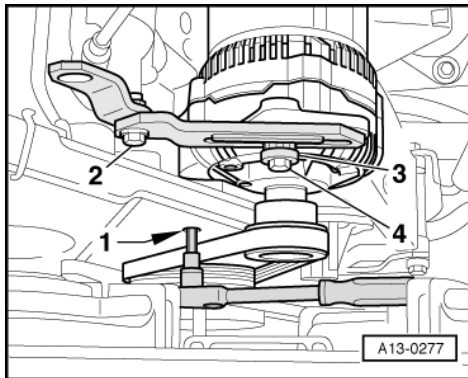


Special tools and workshop equipment required

- ♦ V.A.G 1410 Torque wrench



- ♦ Ring spanner attachment V.A.G 1410/2 (22 mm A/F)



Checking

- Press in the ribbed belt firmly with the thumb at a point half-way between the pulleys.
 - The belt should yield 5 mm

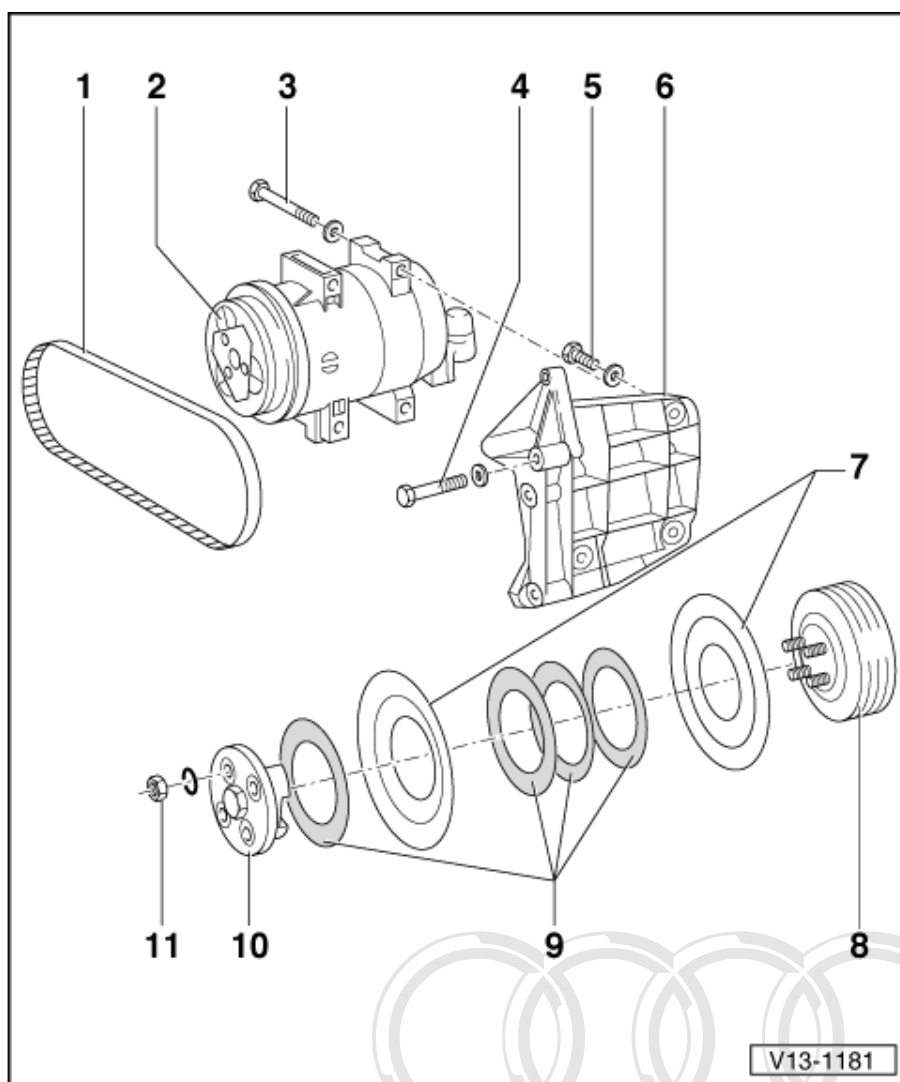
Tensioning ribbed belt

- -> Loosen bolts -1-, -2- and -4- at least one turn - bolt -1- can be reached from above via a hole in toothed belt guard.
- Using torque wrench V.A.G 1410 and ring spanner attachment V.A.G 1410/2 (22 mm A/F), apply a torque of 6 Nm to the tensioner nut -3-:
- Maintain this torque on the tensioning nut, and tighten clamping bolt -4- to 25 Nm.

Tightening torques

Component	Nm
Clamping bolt for tensioner nut to tensioning bar	25
Alternator to bottom mounting	35
Tensioning bar to bracket	25

1.9 - V-belt drive for air conditioning compressor



1 V-belts

- ♦ For A/C compressor
- ♦ Different versions

=> Parts List

- ♦ Check for wear
- ♦ Removing and installing
=>Page 60

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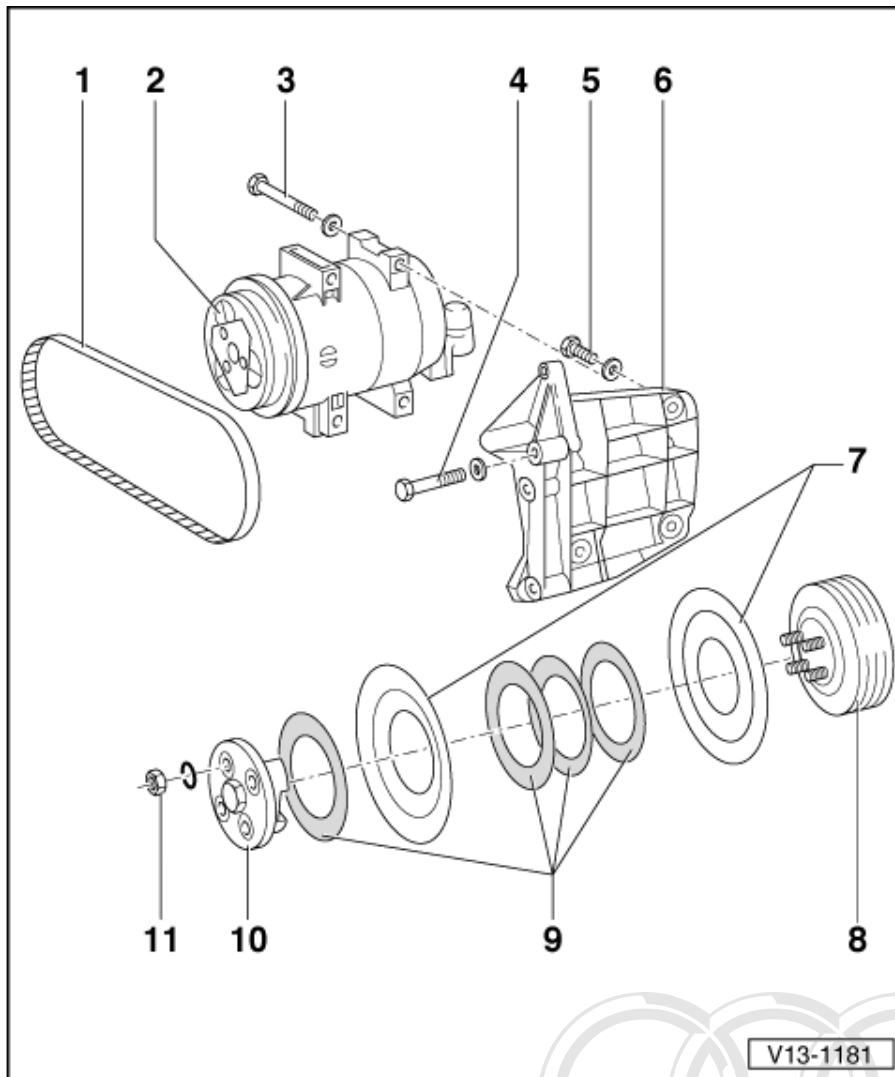
2 Air conditioner compressor

- ♦ After removing compressor from mountings, secure to chassis side member with wire or similar. Do not leave compressor suspended on refrigerant hoses
- ♦ Do not unscrew or disconnect refrigerant hoses or pipes

3 25 Nm

4 25 Nm

5 25 Nm



6 Bracket

- ♦ For A/C compressor
- ♦ Different versions

=> Parts List

7 Belt pulley halves

8 Vibration damper

- ♦ With 4 studs for air conditioning compressor V-belt pulley

9 Spacers

- ♦ To adjust V-belt tension => Page 60

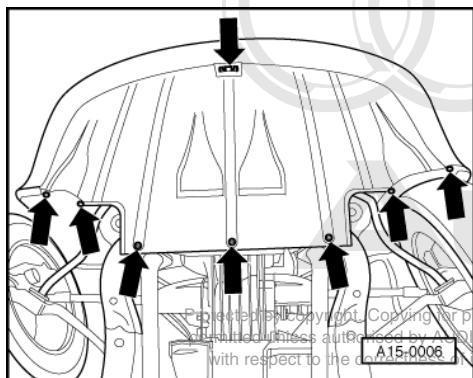
10 Hub

11 25 Nm

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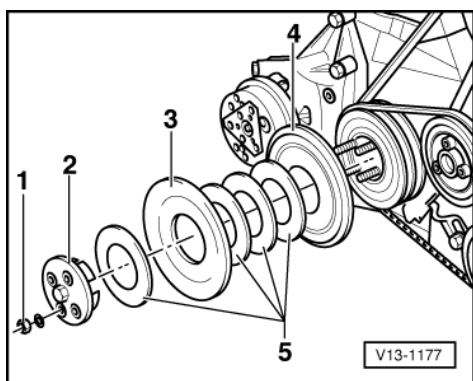


1.10 - Removing and installing V-belt for air conditioning compressor



Removing

- -> Remove the noise insulation -arrows-.



- -> Unscrew the 4 nuts -1-.
- Detach hub -2- from belt pulley.
- Remove front half of belt pulley -3- and shims -5-.
- Remove V-belt.

Installing

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

- Loosely bolt together the two sections of the belt pulley.
- Tension V-belt =>Page 60 .

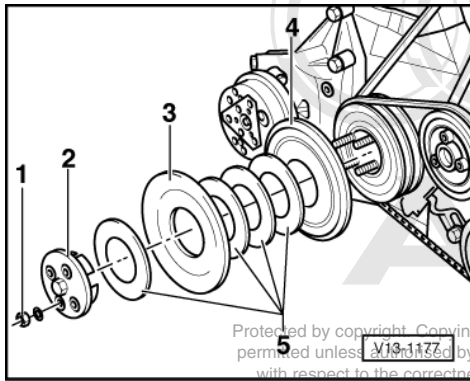
1.11 - Checking V-belt tension for alternator, tensioning V-belt

Checking

- Press in the V-belt firmly with the thumb at a point half-way between the pulleys.

The amount of yield should be as follows:

- Used V-belt:	5 mm
- New V-belt:	2 mm



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V-belts: tensioning

Notes:

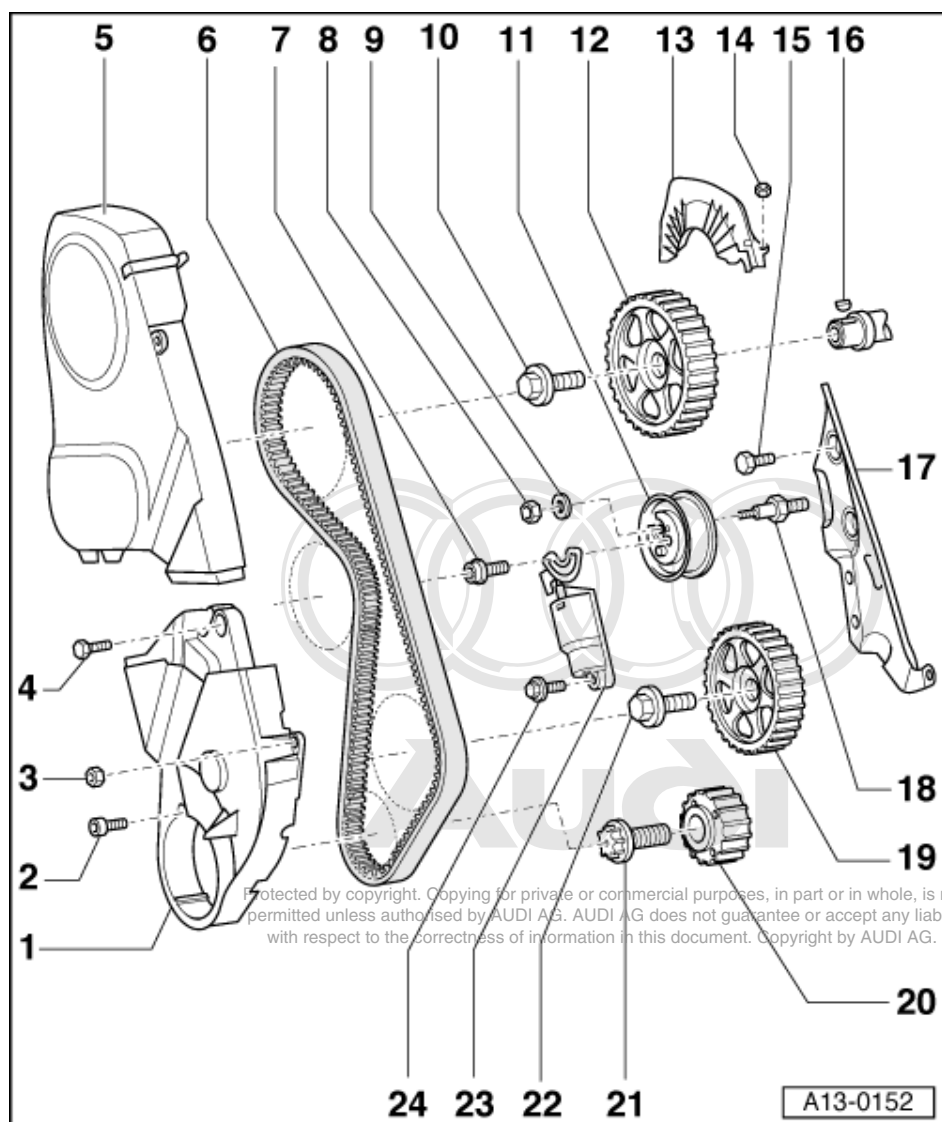
- ◆ -> Belt tension is adjusted by adding or removing shims -5- between front section -3- and rear section -4- of belt pulley.
- ◆ To reduce tension, add shims between two sections of belt pulley.
- ◆ To increase tension, remove shims between two sections of belt pulley.
- Place remaining shims between hub and front section of belt pulley.
- Tighten the bolts securing the two sections of the pulley in stages while turning the crankshaft.
 - As the bolts are tightened, the V-belt should gradually move outwards until seated on the contact surface.
- Tighten nuts to 25 Nm.

The amount of yield should be as follows:

- Used V-belt:	5 mm
- New V-belt:	2 mm

- Start engine and check belt running.
- Check the belt tension again and re-adjust if necessary.

1.12 - Toothed belt drive



Note:

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

1 Toothed belt guard - lower

- ♦ Different versions

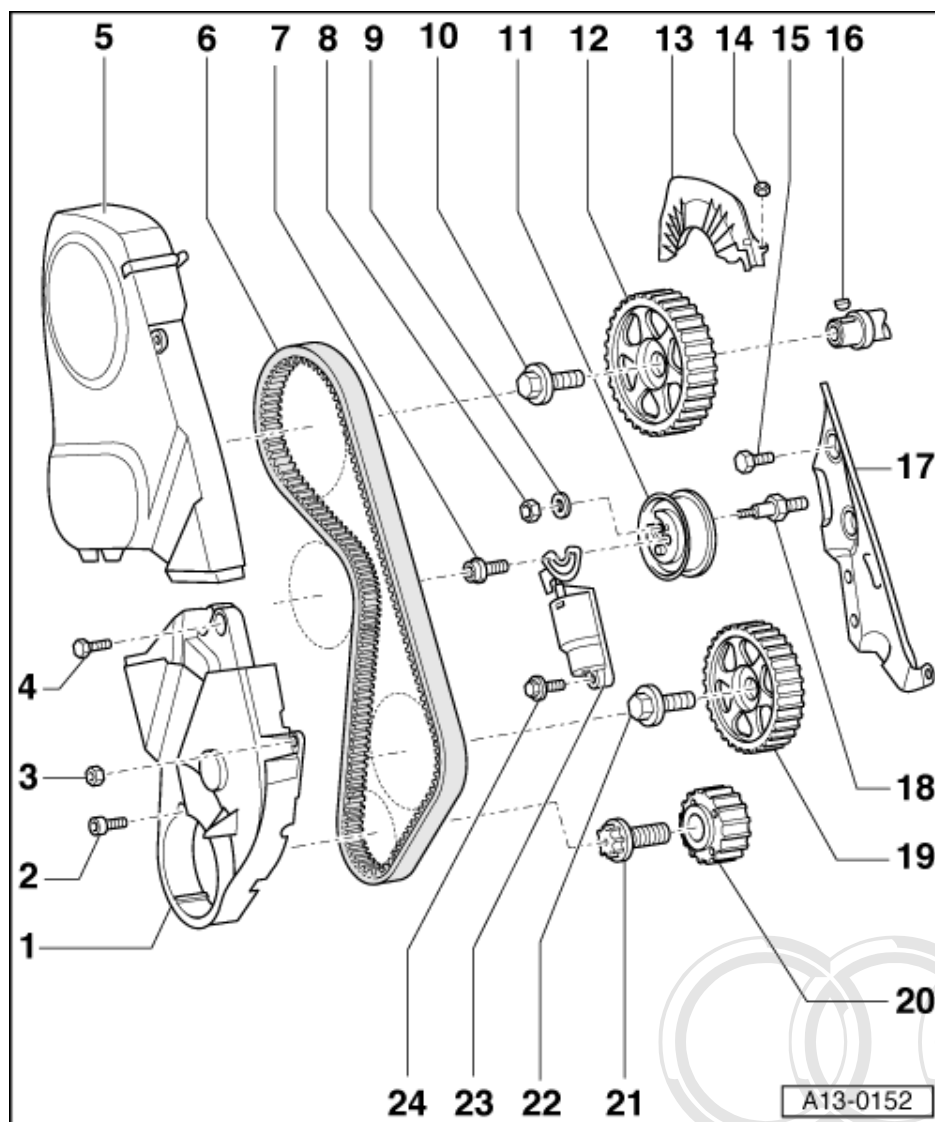
=> Parts List

- ♦ To remove, unbolt vibration damper

2 10 Nm

3 10 Nm

4 20 Nm



5 Toothed belt guard - top

- ◆ Different versions

=> Parts List

- ◆ When installing, engage carefully in lower toothed belt guard

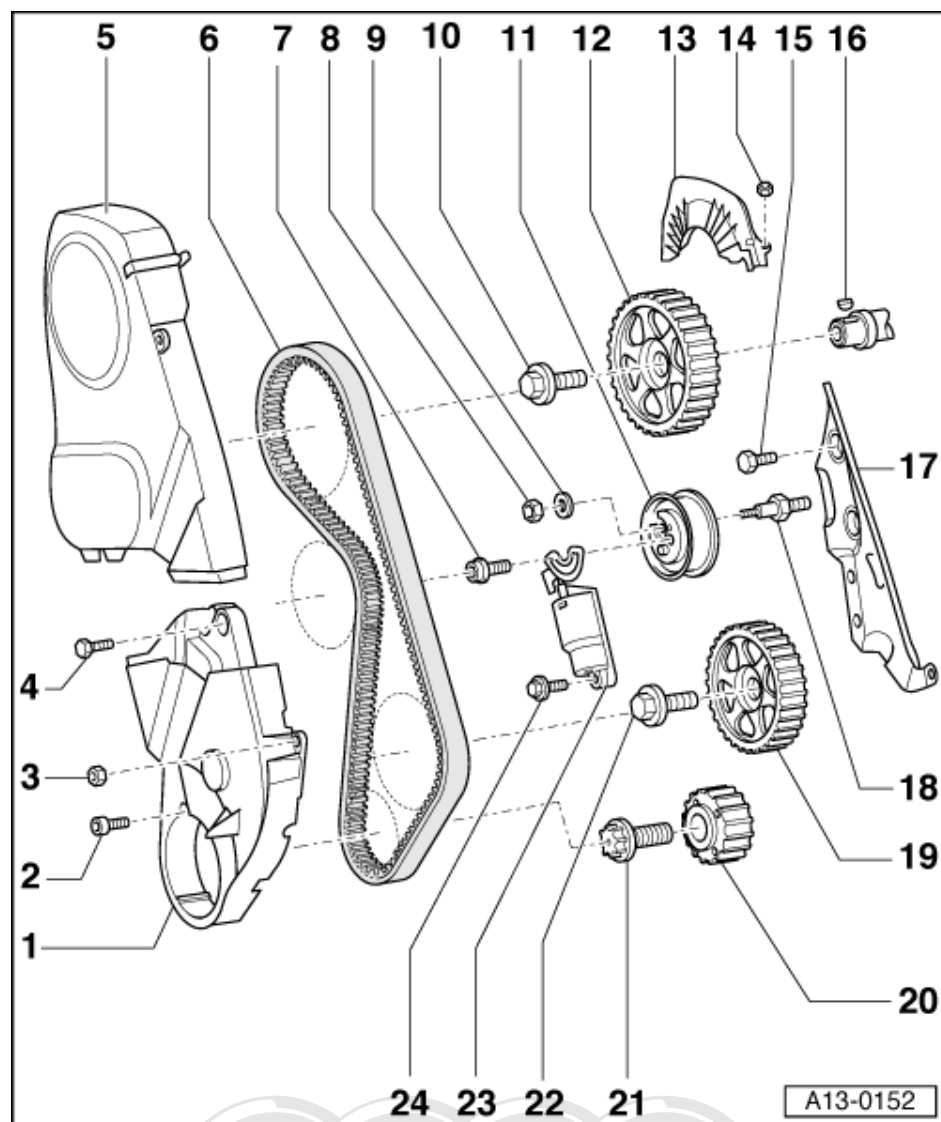
6 Toothed belts

- ◆ Different versions

=> Parts List

- ◆ Mark running direction with chalk or felt pen before removing
- ◆ Check for wear
- ◆ Removing => Page 68
- ◆ Installing (adjust valve timing) on vehicles > approx. 12.94 => Page 70
- ◆ Installing (adjust valve timing) on vehicles approx. 12.94 > => Page 73

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7 25 Nm

8 10 Nm

9 Washer

10 100 Nm

- ♦ Counterhold with 3036 to loosen and tighten

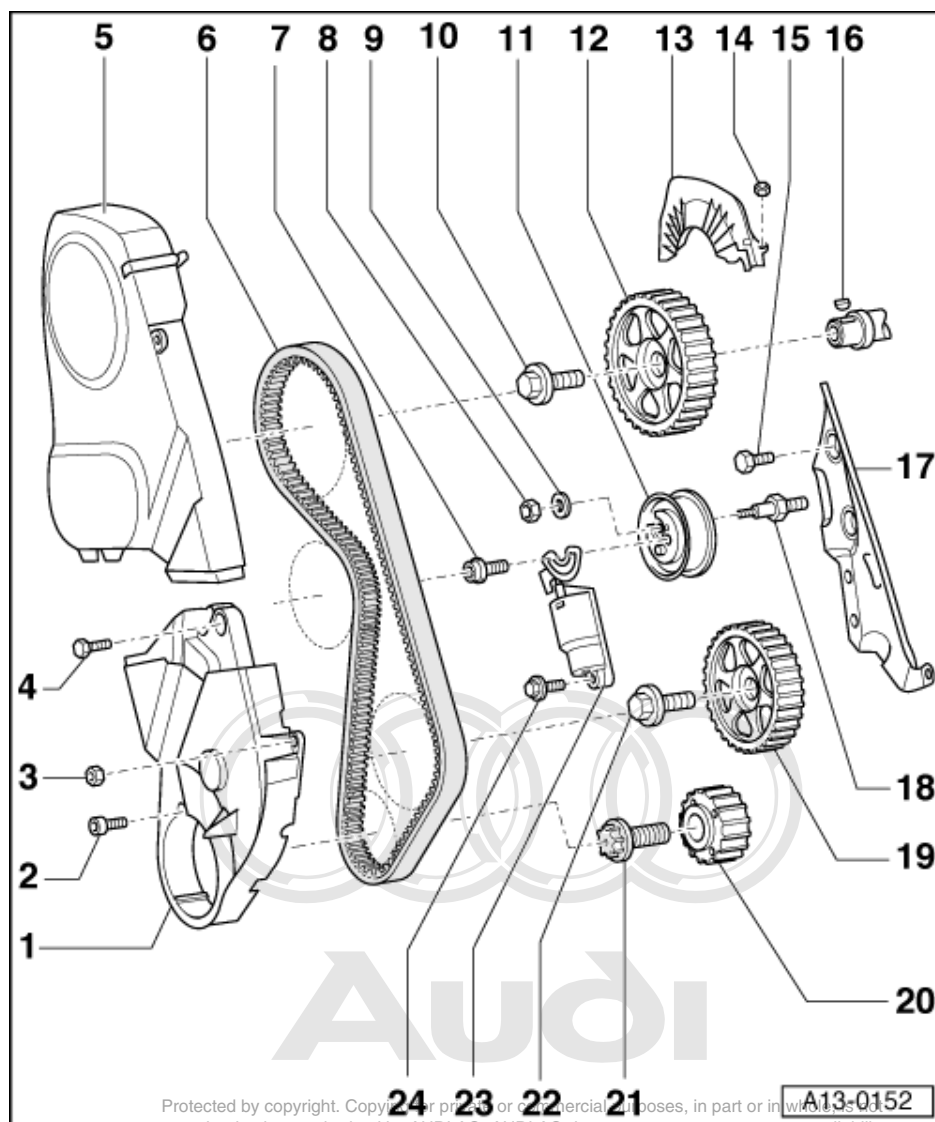
11 Tensioning roller

- ♦ Different versions

=> Parts List

12 Camshaft sprocket

- ♦ For removal and installation remove toothed belt => Page 68
- ♦ Installation position => Fig. 68. AUDI AG does not guarantee or accept any liability
- ♦ Installation position is fixed by Woodruff key - Item 16



13 Toothed belt guard

- ◆ Different versions

=> Parts List

14 10 Nm

15 20 Nm

16 Woodruff key

- ◆ Ensure tight fit

17 Toothed belt guard - rear

- ◆ Different versions

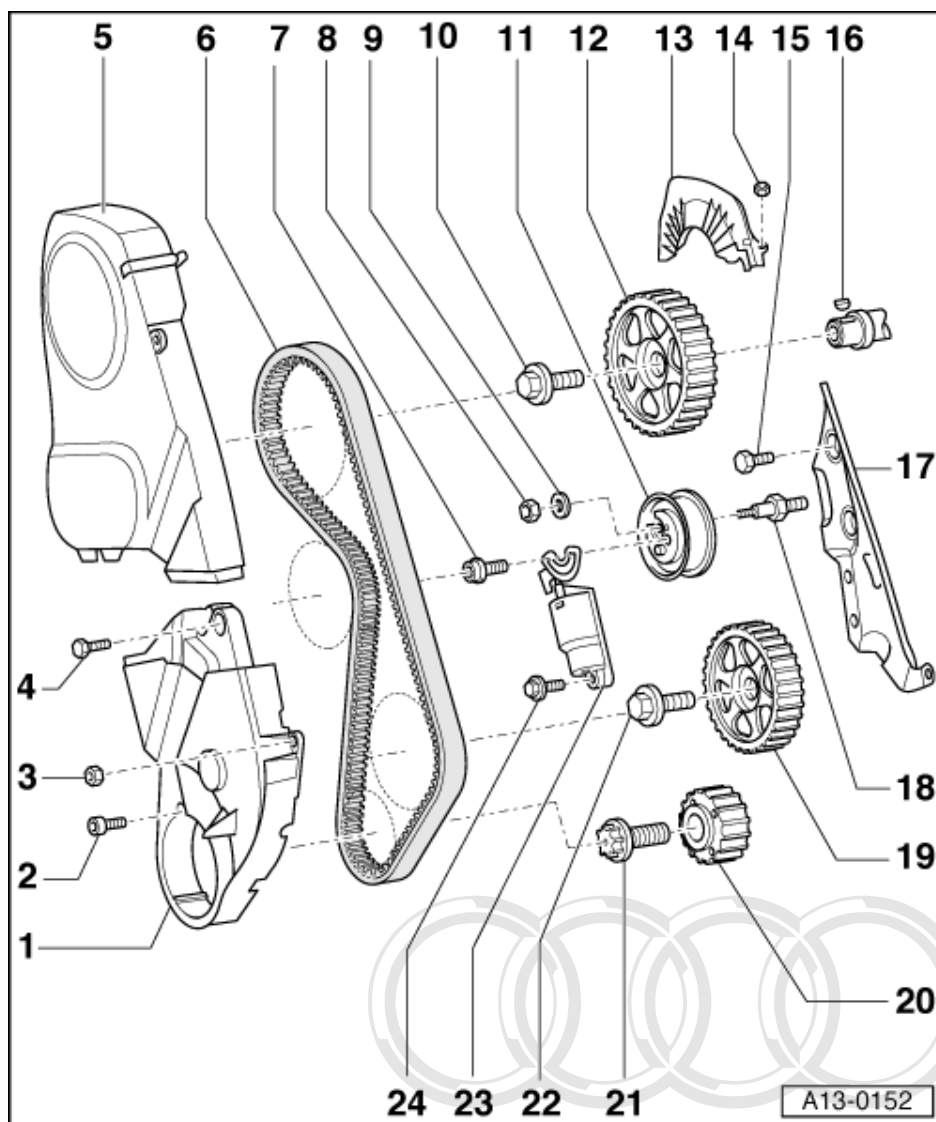
=> Parts List

18 Set bolt - 25 Nm

- ◆ For tensioning roller

19 Intermediate shaft sprocket

- ◆ Note correct installation position:
The small camshaft sprocket web faces forward and TDC mark for cylinder 1 is visible from the front
- ◆ Installation position when laying toothed belt in place =>Page 71



20 Crankshaft sprocket

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

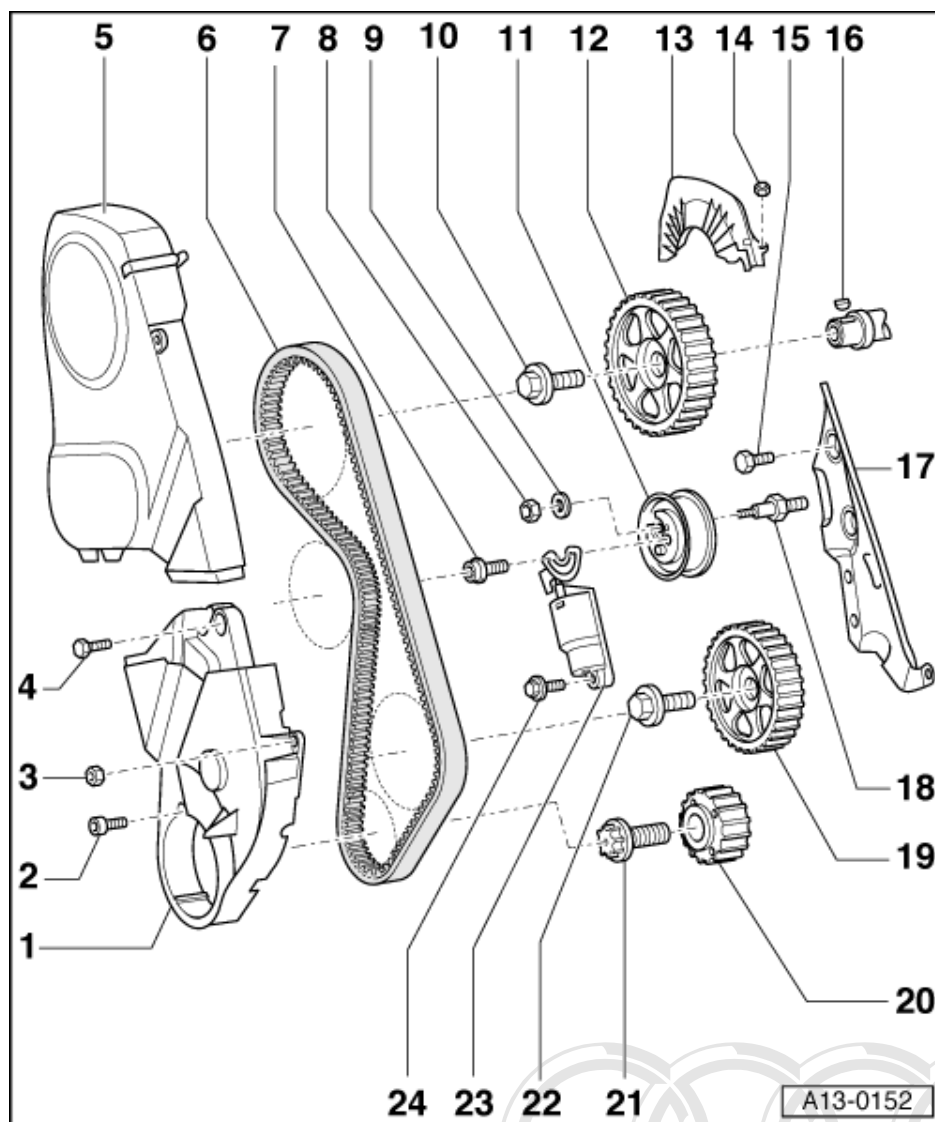
21 90 Nm + 1/4 turn (90°) further

- ◆ Replace
- ◆ Do not use oil
- ◆ Counterhold with 3099 to loosen and tighten
- ◆ Bolting on counterhold tool 3099 => Page 83

22 100 Nm

- ◆ Counterhold with 3036 to loosen and tighten

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23 Tensioner for toothed belt

- ♦ Different versions

=> Parts List

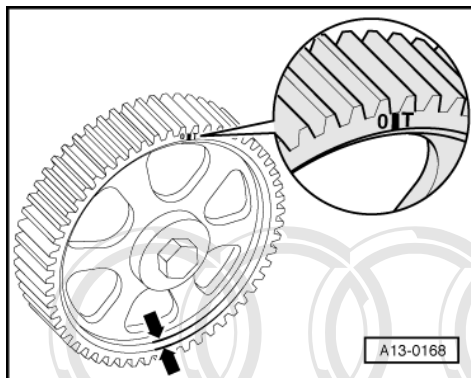
- ♦ Checking => Page 77

24 10 Nm

- ♦ Different versions

=> Parts List

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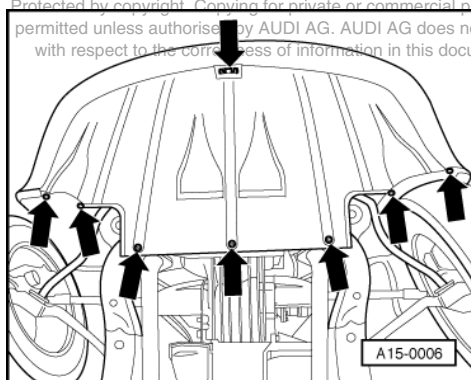


-> Fig. 1 Installation position of camshaft sprocket

- ♦ Narrow web on camshaft sprocket faces outwards -arrows- and marking for No. 1 cylinder TDC is visible.

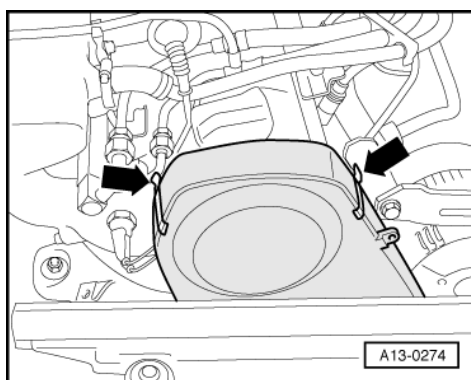
1.13 - Removing and installing toothed belt

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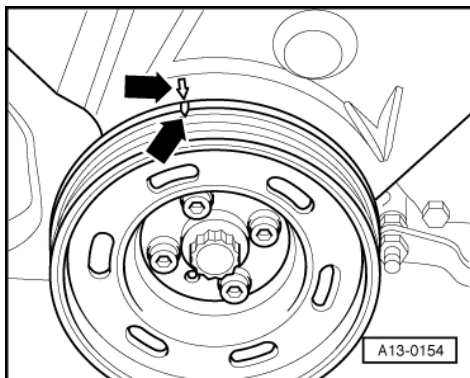


Removing

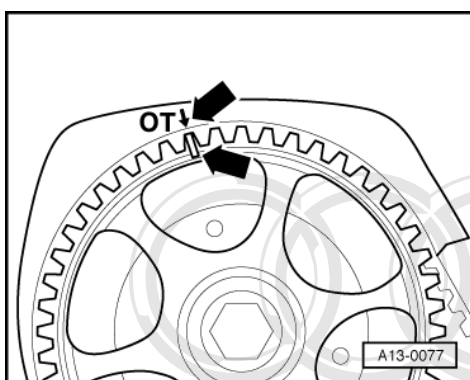
- -> Remove the noise insulation -arrows-.



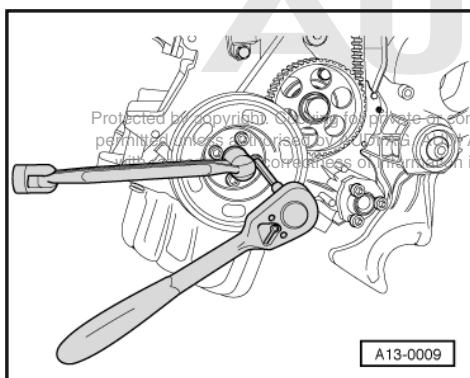
- Remove V-belt/ribbed belt for alternator => Page 55 .
- -> Remove the upper toothed belt guard -arrows-.



- Mark direction of rotation of toothed belt with chalk or felt pen.
- -> Set crankshaft to TDC mark for cylinder No. 1 -arrows- by turning central bolt on crankshaft toothed belt sprocket in direction of engine rotation...

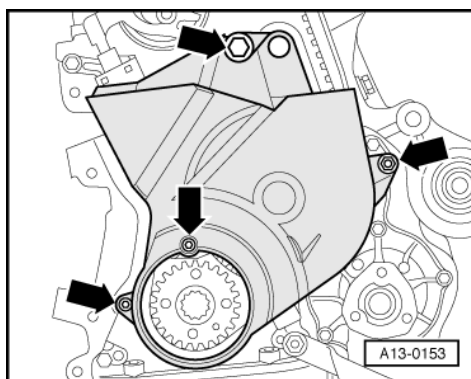


- -> ...at the same time the marking on front of the camshaft sprocket must align with the marking at the toothed belt guard -arrows-. If necessary, rotate crankshaft 1 additional turn.

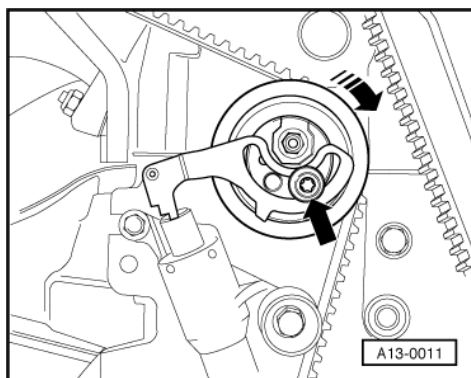


- -> Unbolt vibration damper.

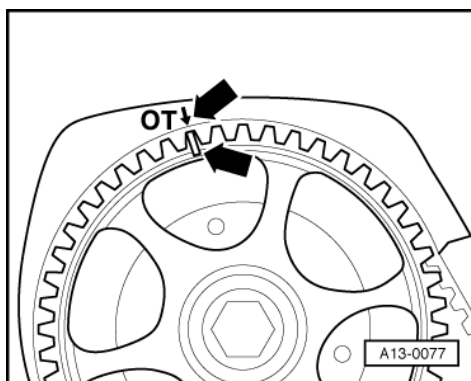
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- -> Unbolt toothed bottom belt guard -arrows-.



- -> Loosen toothed belt system with TORX key T45 -arrow below-.
- Press toothed belt tensioner downwards.
- Remove toothed belt.



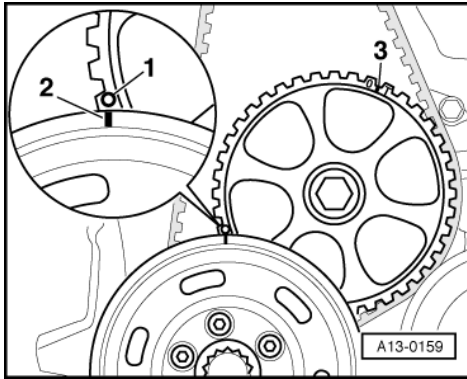
Installing (adjust valve timing) on vehicles > approx. 12.94

Notes:

- ♦ The position of the toothed belt must be set as described below, even after repairs in which the belt is only taken off the camshaft sprocket.
 - ♦ When turning the camshaft, the crankshaft must not be at TDC at any cylinder. Danger of damage to valves/ piston crown.
 - ♦ The setting can be performed with engine cold or engine warm.
- -> Bring mark on camshaft sprocket in line with the mark on toothed belt guard -arrows-.
 - Secure vibration damper/belt pulley with one bolt (note fixing arrangement).



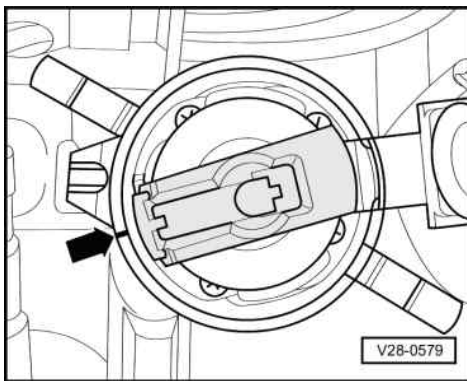
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- -> Align dot mark on intermediate shaft sprocket -1- with mark on vibration damper -2-.

Note:

The "TDC" mark -3- on the intermediate shaft sprocket is without significance and to be disregarded.

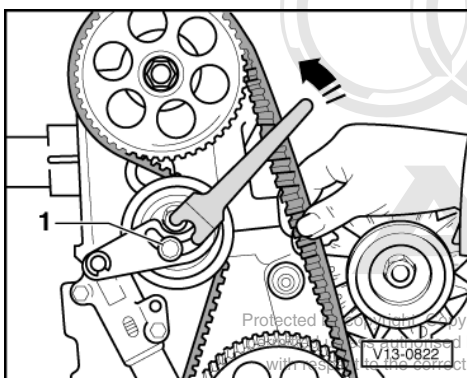


-> If the intermediate shaft sprocket is adjusted correctly, the distributor rotor must align with the mark - arrow- for cylinder 1 on the distributor housing.

- Check adjustment for the intermediate shaft sprocket as necessary.
- If this is OK, loosen and adjust the distributor or remove and re-install the distributor:

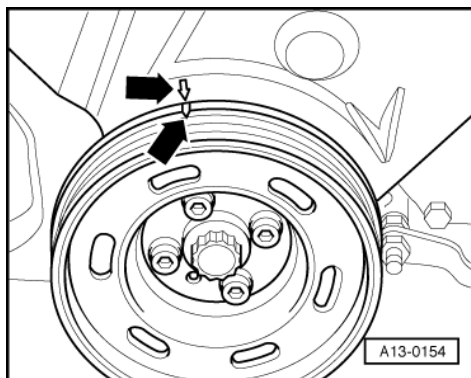
=> Fuel Injection and Ignition System; Repair group 28, Checking ignition system

- Remove the vibration damper again.
- Fit toothed belt (observe direction of rotation).

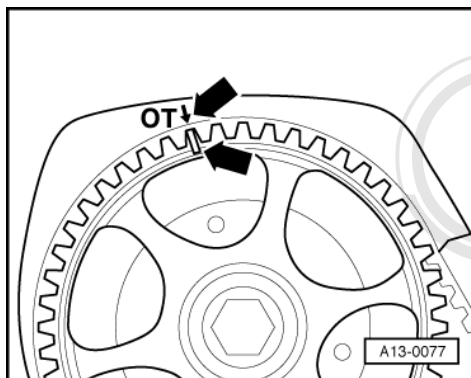


- -> Tension toothed belt. For this purpose, rotate tensioner in direction of arrow using 2-pronged spanner wrench for pin hole nut (e.g. Hazet 2587).
- Using thumb and index finger only, it must still be possible to twist the toothed belt by approx. 1/4 turn (90°) at a location mid-way between camshaft sprocket and intermediate shaft sprocket.
- Tighten bolt -1- to 25 Nm.
- Install toothed belt guard - lower part.

- Install vibration damper
- Rotate crankshaft two turns and check that camshaft and crankshaft markings are in line with their reference points.

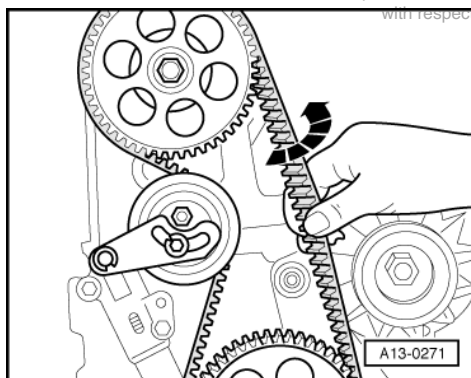


- -> The notch on the vibration damper must face the TDC mark for cylinder No. 1 on the toothed belt guard -arrows-...



- -> ...at the same time the marking on front of the camshaft sprocket must align with the marking on the toothed belt guard -arrows-.

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- -> Check the toothed belt tension again.
- Using thumb and index finger only, it must still be possible to twist the toothed belt by approx. 1/4 turn (90°) at a location mid-way between camshaft sprocket and intermediate shaft sprocket.
- Re-tension toothed belt as necessary.
- Install toothed belt guard (top section).
- Install V-belt/ribbed belt for alternator => Page 56 .
- Install V-belt for ancillaries => Page 60 .
- Checking and if necessary adjusting ignition point:

=> Fuel Injection and Ignition System; Repair group 28, Checking ignition system

Tightening torques

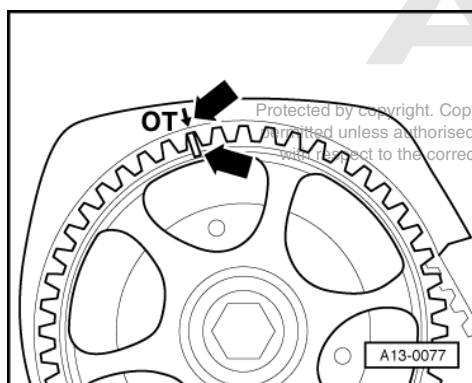
Component	Nm
Toothed belt tensioner to tensioning roller	25
Toothed belt guard - lower	M6 10
to cylinder block	M8 20
Vibration damper	25 1)
to crankshaft	40 2)

- 1) Bolt strength rating 8.8
- 2) Bolt strength rating 10.9

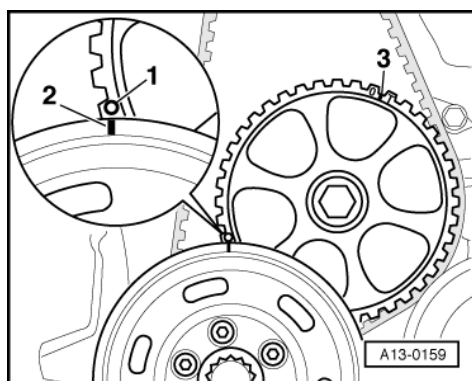
Installing (adjust valve timing) on vehicles approx. 12.94 >

Notes:

- ◆ The position of the toothed belt must be set as described below, even after repairs in which the belt is only taken off the camshaft sprocket.
- ◆ When turning the camshaft, the crankshaft must not be at TDC at any cylinder. Danger of damage to valves/piston crown.
- ◆ The setting can be performed with engine cold or engine warm.



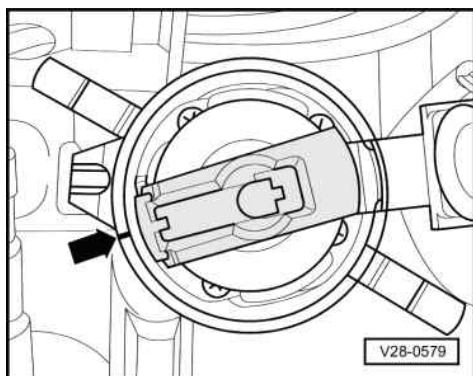
- -> Bring mark on camshaft sprocket in line with the mark on toothed belt guard -arrows-.
- Secure vibration damper/belt pulley with one bolt (note fixing arrangement).



- -> Align dot mark on intermediate shaft sprocket -1- with mark on vibration damper -2-.

Note:

The "TDC" mark -3- on the intermediate shaft sprocket is without significance and to be disregarded.

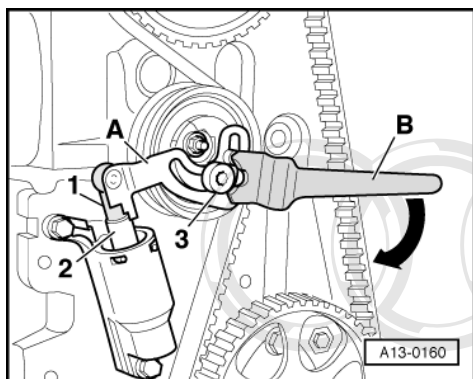


-> If the intermediate shaft sprocket is adjusted correctly then the distributor rotor must align with the mark -arrow- for cylinder 1 on the distributor housing.

- Check adjustment for the intermediate shaft sprocket as necessary.
- If this is OK, loosen and adjust the distributor or remove and re-install the distributor:

=> Fuel Injection and Ignition System; Repair group 28, Checking ignition system

- Remove the vibration damper again.
- Fit toothed belt (observe direction of rotation).



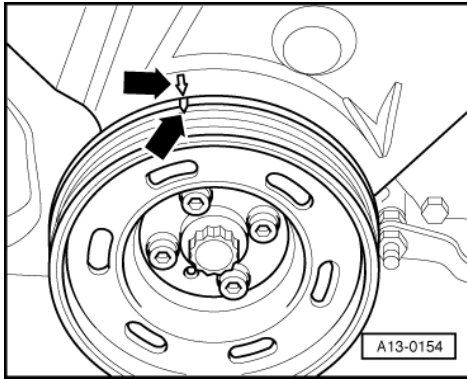
- -> Tension toothed belt. For this purpose, turn tensioner -A- to the right using a 2-pronged spanner wrench for pin hole nuts -B- (e.g. Hazet 2587) until the piston -1- is fully extended and the piston of the tensioner -2- is raised by approx. 1 mm.

Note:

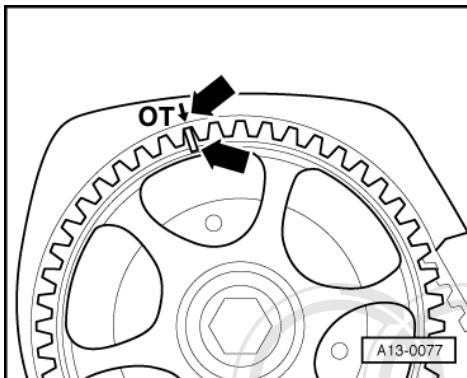
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If necessary, use a mirror to check.

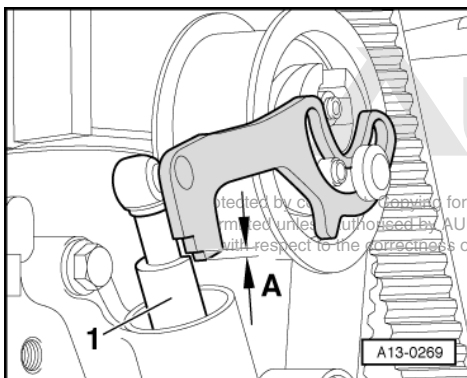
- Tighten securing bolt -3- hand-tight.
- Install toothed belt guard - lower part.
- Installing vibration damper
- Rotate crankshaft two turns and check that camshaft and crankshaft markings are in line with their reference points.



- -> The notch on the vibration damper must face the TDC mark for cylinder No. 1 on the toothed belt guard -arrows-...



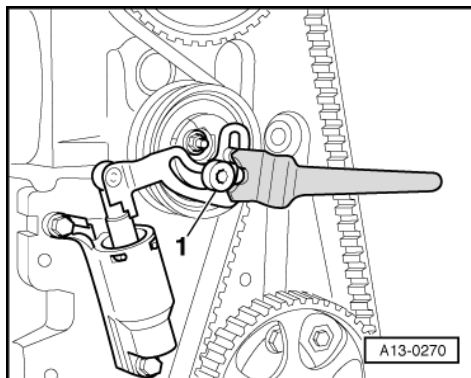
- -> ...at the same time the marking on the camshaft sprocket must align with the marking on the toothed belt guard -arrows-.



- -> Check toothed belt tension.
- The area -A- on the steps of the tensioner lever must align with the piston upper edge -1-.
- Re-tension toothed belt as necessary.

Note:

If necessary, use a mirror to check.



- ➔ Counterhold toothed belt tensioner using 2-pronged spanner wrench for pin hole nuts and tighten securing bolt -1- to 25 Nm.
- Install toothed belt guard (top section).
- Install V-belt/ribbed belt for alternator => Page 56 .
- Install V-belt for ancillaries => Page 60 .
- Checking and if necessary adjusting ignition point:

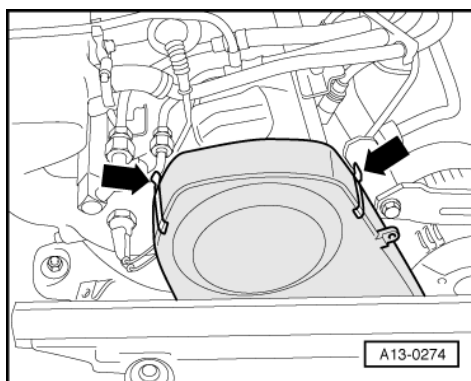
=> Fuel Injection and Ignition System; Repair group 28, Checking ignition system

Tightening torques

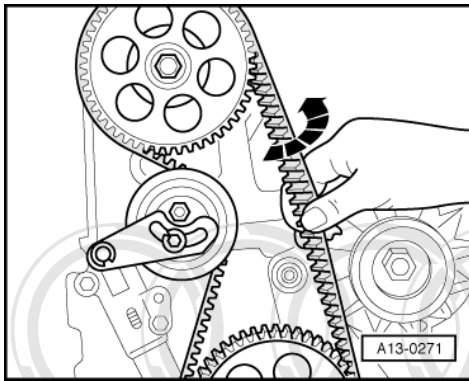
Component	Nm
Toothed belt tensioner to tensioning roller	25
Toothed belt guard - lower	10
to cylinder block	20
Vibration damper	25 1)
to crankshaft	40 2)

- 1) Bolt strength rating 8.8
- 2) Bolt strength rating 10.9

1.14 - Checking toothed belt tension and thermo tension roller - Vehicles > approx. 12.94

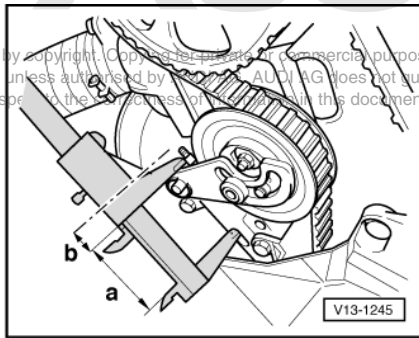


- ➔ Remove the upper toothed belt guard -arrows-.



Checking toothed belt tension

- -> Check toothed belt tension.
- Using thumb and index finger only, it must still be possible to twist the toothed belt by approx. 1/4 turn (90°) at a location mid-way between camshaft sprocket and intermediate shaft sprocket.



Checking thermo tension roller

Test requirements:

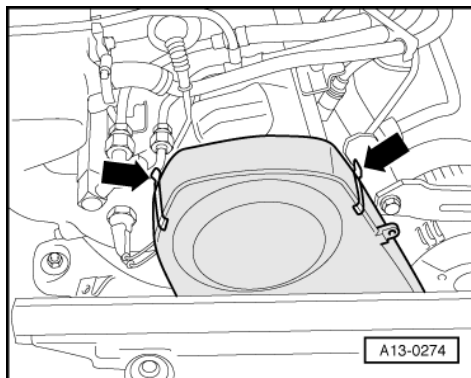
- Engine cold
- Toothed belt tension OK.
- -> Measure distance -a-.
 - Dimension a = approx. 49 mm
- Start the engine.
- Run engine until radiator fan cuts in.
- Repeat the measurement.
 - Specified value: Distance change b = 7.2...7.3 mm

If specified value is not attained:

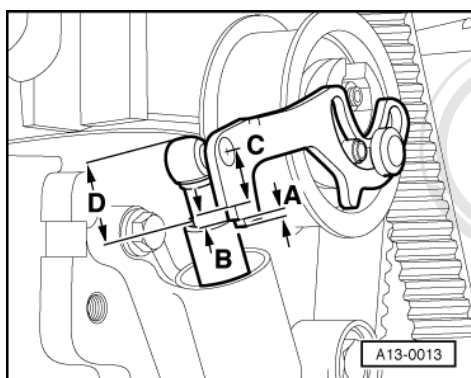
- Replace the thermo tension roller.
- Install toothed belt guard (top section).

1.15 - Checking tensioner - Vehicles approx. 12.94 >

- Engine warm or cold



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



- Check in which area on the edge of the piston the tensioner is positioned.

Note:

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If necessary, use a mirror to check.

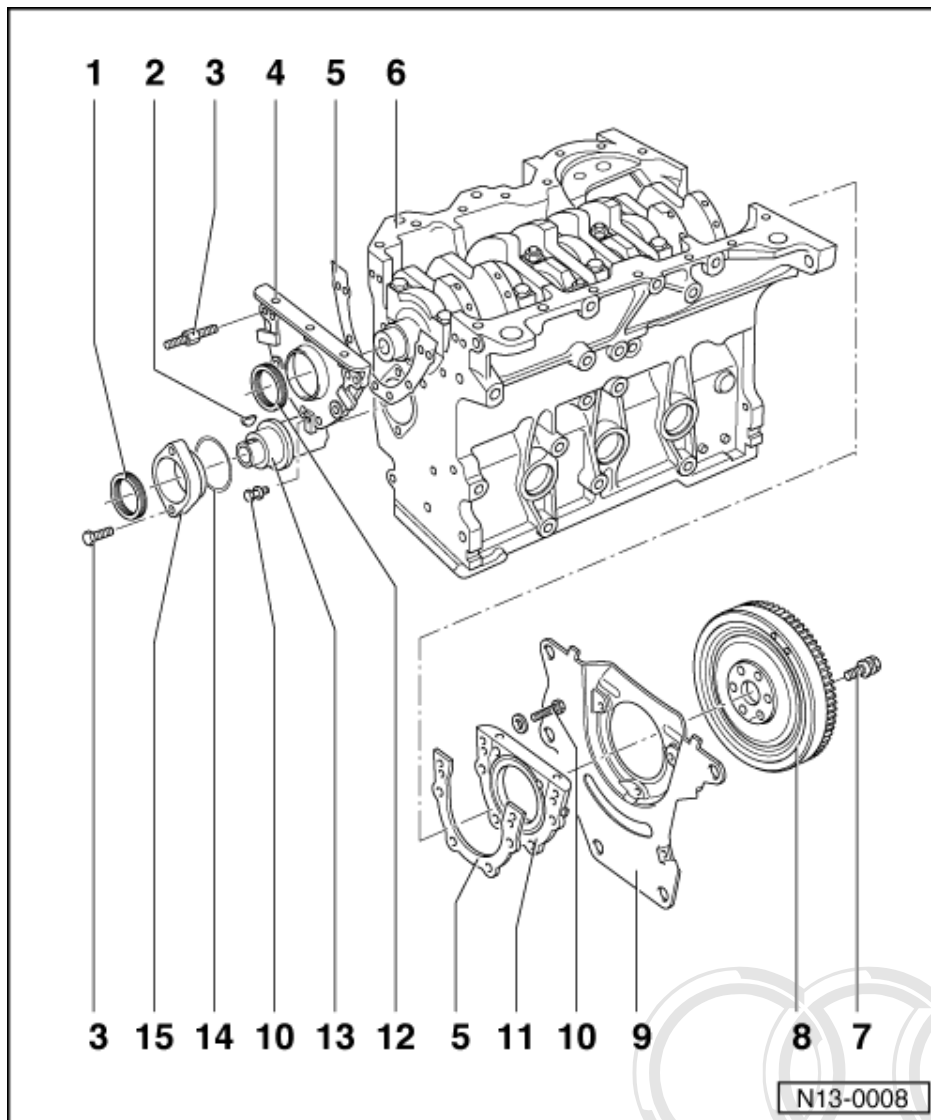
- -> Area -A-:
Adjustment OK
- Area -B-:
Wear range
- Area -C-:
Check readjustment or belt drive inclusive of tensioning roller for wear

Note:

If the end of the piston is in area -A-, this corresponds to a dimension -D- of 25...29 mm.

2 - Removing and installing sealing flange and flywheel

2.1 - Removing and installing sealing flange and flywheel



Notes:

- ♦ For repairs to the clutch:

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

=> 5-speed Manual Gearbox 01A, 4WD; Repair group 30; Servicing clutch Servicing clutch

1 Sealing ring

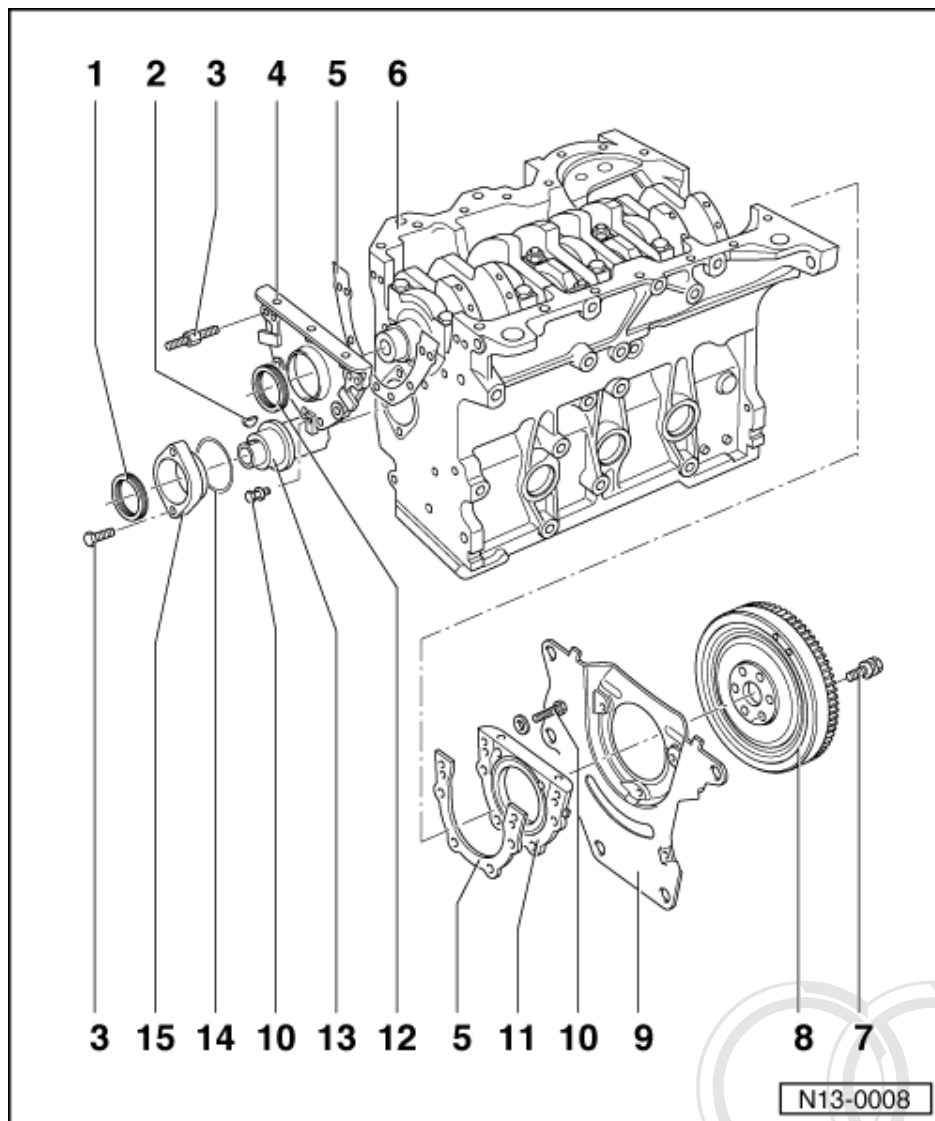
- ♦ To remove, remove sealing flange -Item 15 -
- ♦ Install with 10-203

2 Woodruff key

- ♦ Ensure tight fit

3 25 Nm

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4 Sealing flange - front

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

=> Parts List

5 Seal

- ◆ Replace

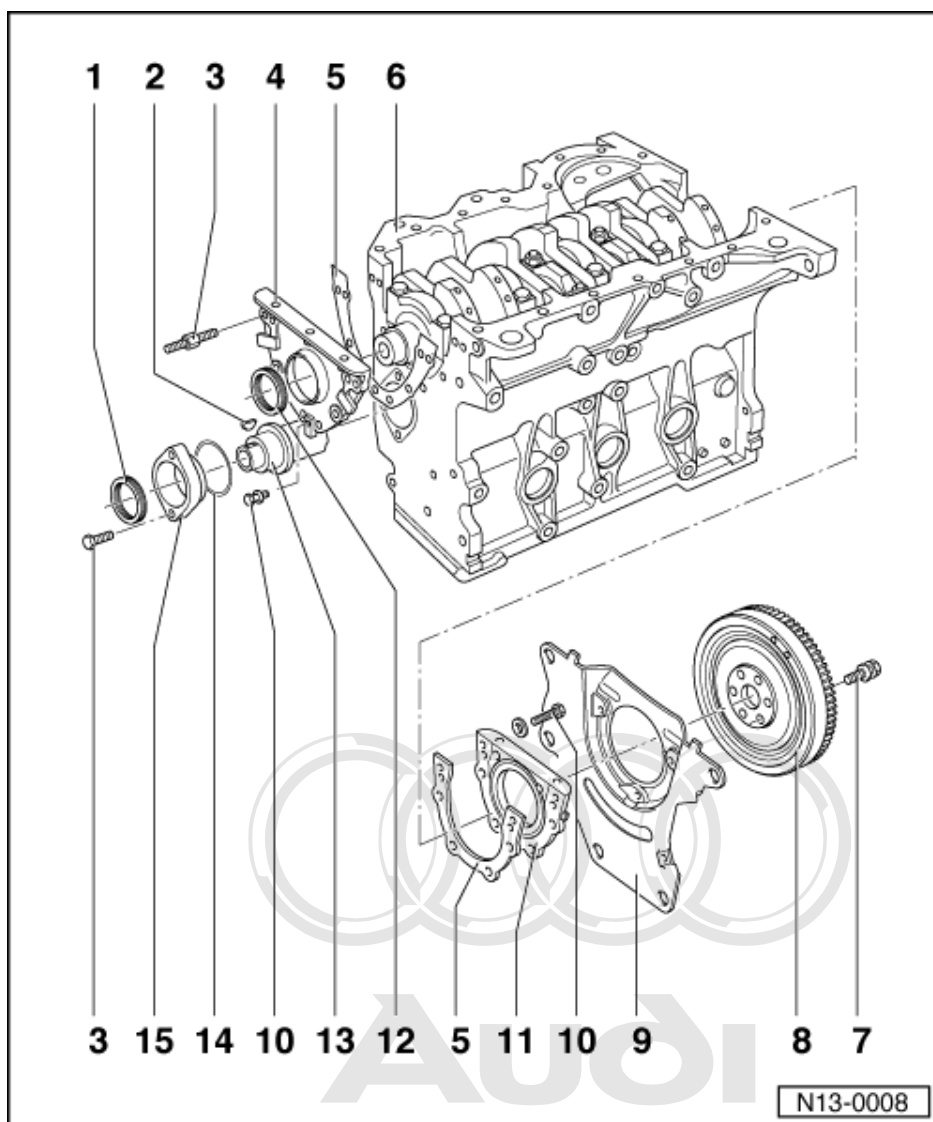
6 Cylinder block

- ◆ Removing and installing crankshaft=> Page 88
- ◆ Dismantling and assembling pistons and conrods => Page 93

7 60 Nm + 1/4 turn (90°) further

- ◆ Replace

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8 Flywheel or drive plate

- ♦ Removing and installing flywheel => Page 85
- ♦ Removing and installing drive plate => Page 86

9 Intermediate plate

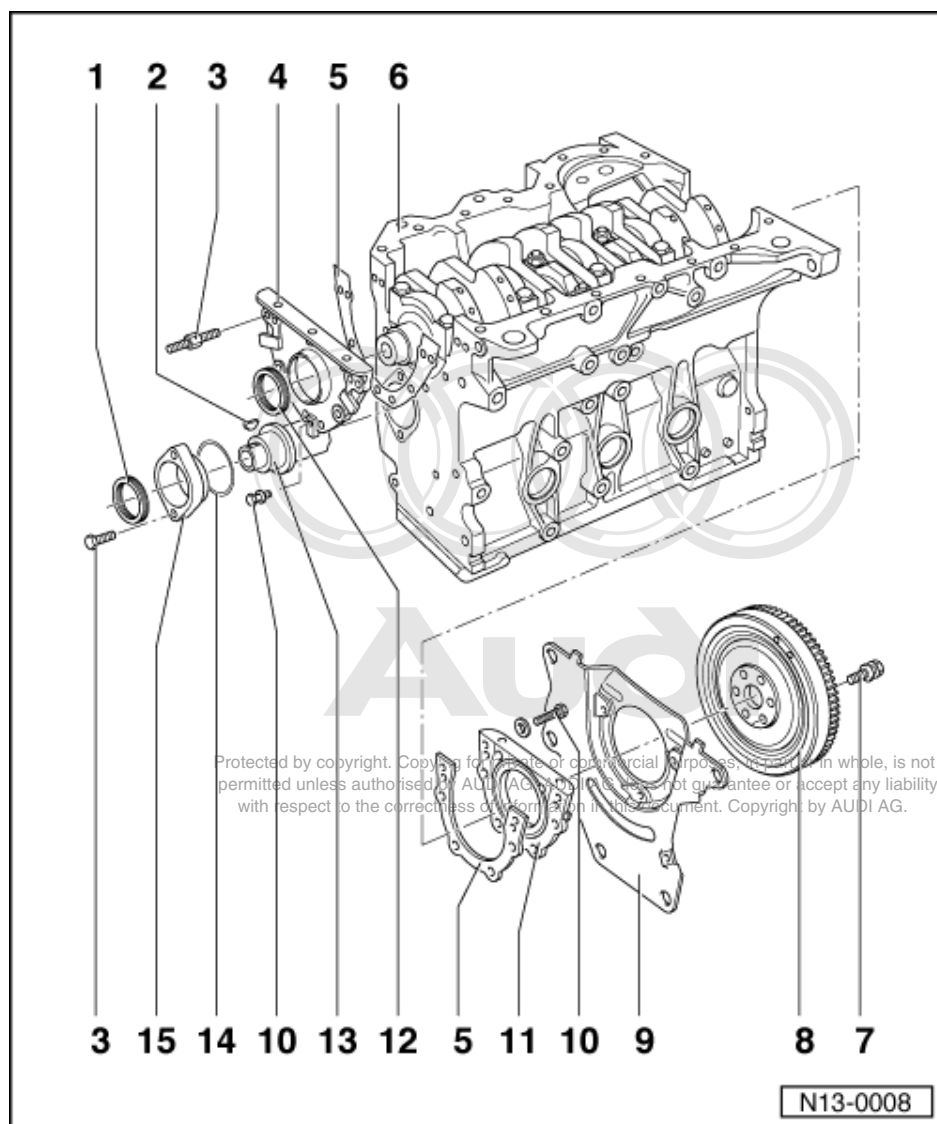
- ♦ Must be located on dowel sleeves
- ♦ Do not damage/bend when assembling

10 10 Nm

11 Rear sealing flange

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

=> Parts List



12 Sealing ring

- ♦ Replacing => Page 83 .

13 Intermediate shaft

- ♦ Axial play max. 0.25 mm
- ♦ Remove distributor to remove

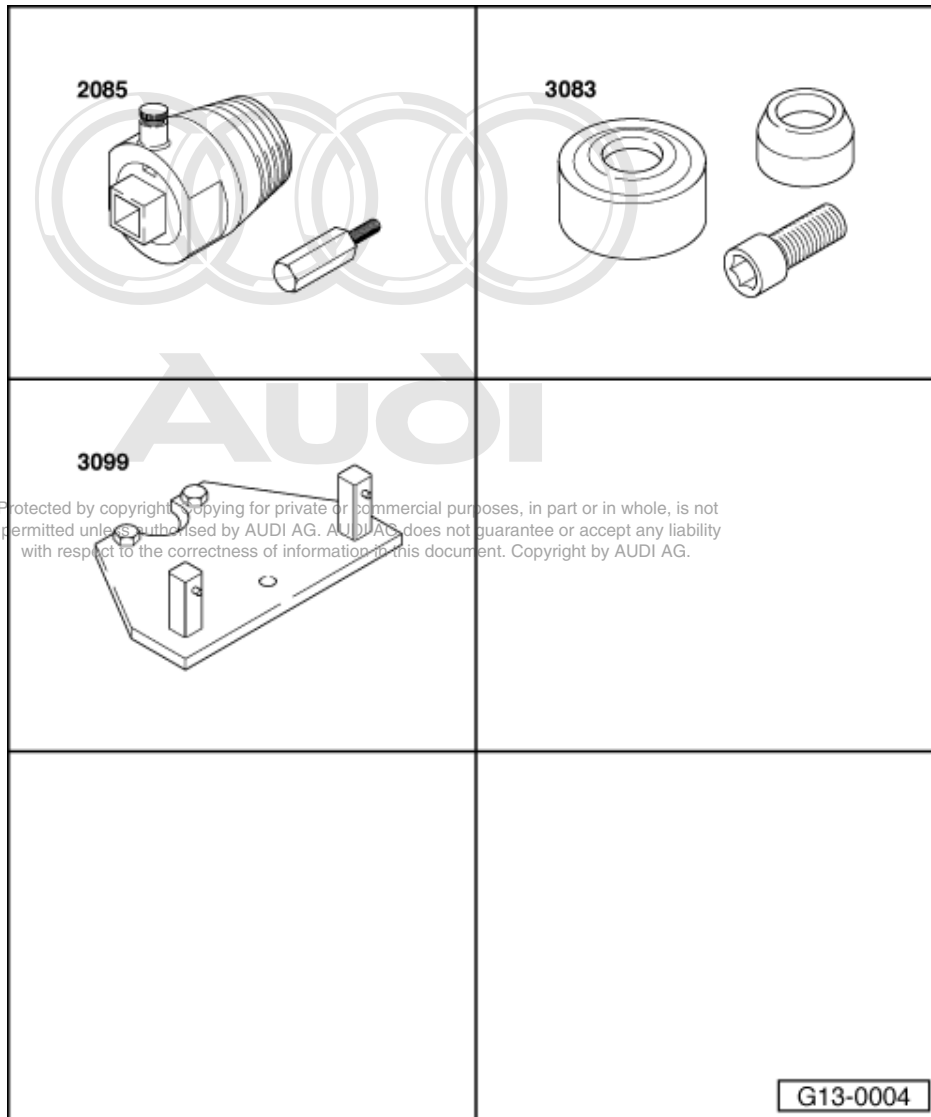
=> Fuel Injection and Ignition System; Repair group 28, Checking ignition system

14 O-ring

- ♦ Replace

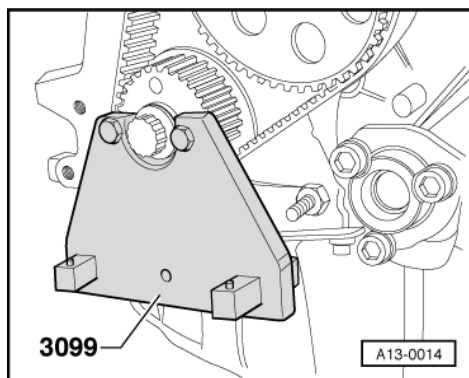
15 Sealing flange for intermediate shaft

2.2 - Replacing crankshaft oil seal on pulley end



Special tools and workshop equipment required

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



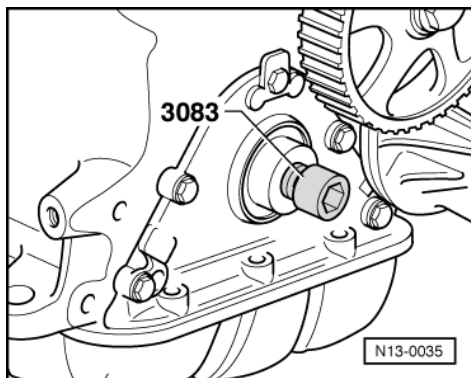


Removing

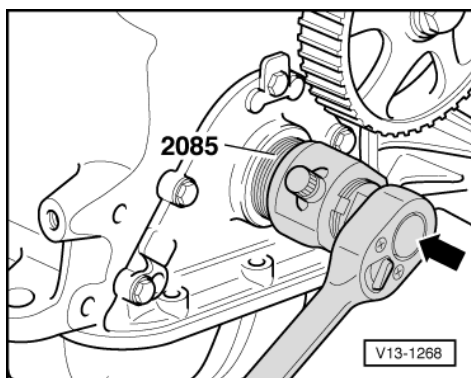
- Engine in vehicle
- Remove V-belt/ribbed belt for alternator => Page 55 .
- Remove toothed belt => Page 68 .
- -> Remove crankshaft toothed belt sprocket. Counterhold sprocket with 3099.

Note:

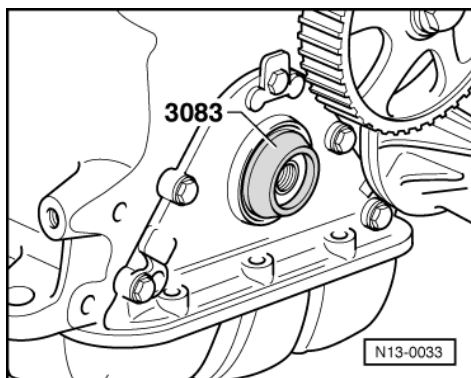
It is also possible to use special tool 3415. The tensioning bar may remain installed for this procedure.



- -> Before applying oil seal extractor, screw cheese-head bolt from 3083 into crankshaft as far as it will go.



- Adjust inner part of oil seal extractor 2085 two turns (ca. 3 mm) from the outer part and lock in position with the knurled screw.
- -> Lubricate threaded head of oil seal extractor, place it in position and exerting firm pressure, screw it into oil seal as far as possible.
- Loosen knurled screw and turn inner part against crankshaft until the sealing ring is pulled out.

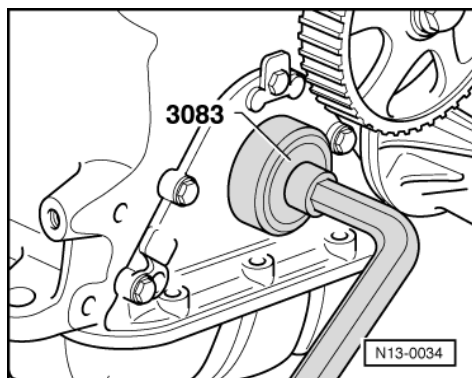


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Installing

- -> Place guide sleeve from 3083 onto crankshaft journal.
- Push oil seal over guide sleeve.



- -> Press sealing ring in until stop using press sleeve from 3083.
- Install crankshaft sprocket and lock in position with retainer 3099.

Notes:

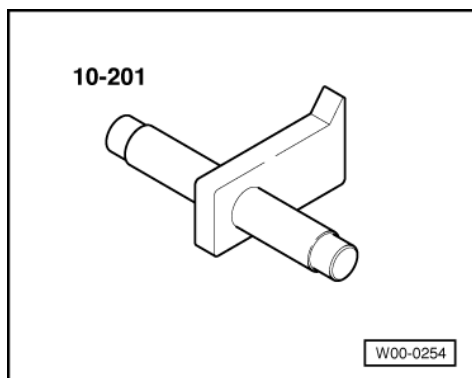
- ◆ Contact surface between sprocket and crankshaft must be free of oil.
- ◆ Do not oil bolt for crankshaft sprocket.
- Install toothed belt (adjust valve timing) => Page 73 .
- Install V-belt/ribbed belt for alternator => Page 56 .

Tightening torque

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

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

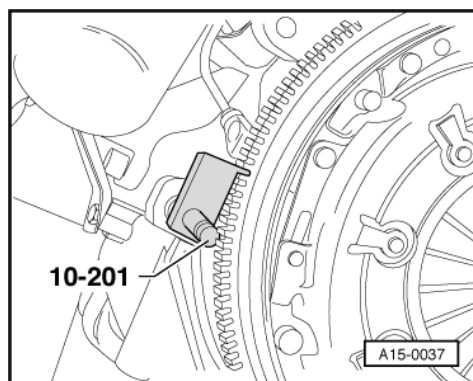
2.3 - Removing and installing flywheel/drive plate



Special tools and workshop equipment required

- ◆ Special tool 10-201

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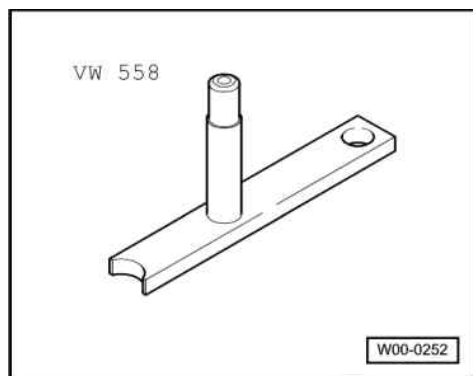
Flywheel

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

Tightening torque

Component	Nm
Flywheel to crankshaft	60 + 90°1)

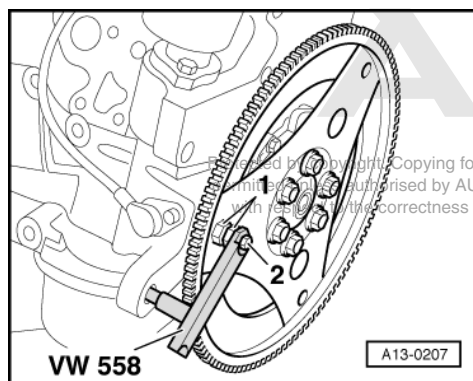
- 1) 90° corresponds to a quarter of a turn



Drive plate

Special tools and workshop equipment required

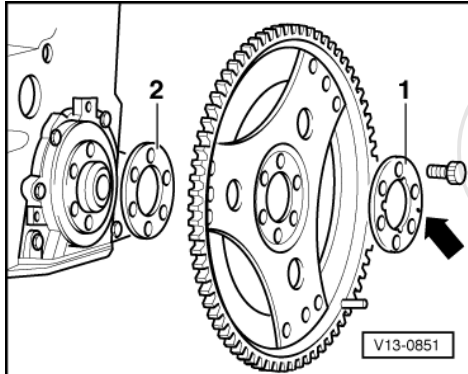
- ♦ Counterhold VW 558
- ♦ Hexagon bolt M8 x 45 and two M10 hexagon nuts
- ♦ Caliper gauge or depth gauge



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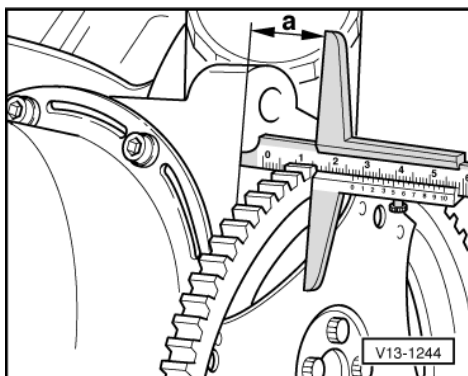
Removing

- -> Secure counterhold tool VW 558 to the drive plate with a hexagon bolt M8 x 45 -Item 2- Place two M10 hexagon nuts -1- between counterhold and drive plate.
- Mark position of drive plate relative to engine.
- Unbolt drive plate.

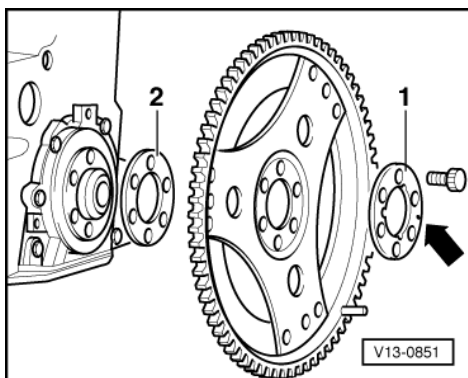


Installing

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



- -> Measure dimension -a- at three points and calculate average value.
- Specification for automatic gearbox 097: 26.3...27.9 mm



If nominal value is exceeded:

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



- Measure distance again.

If specified value is attained:

- Fit new bolts and tighten.

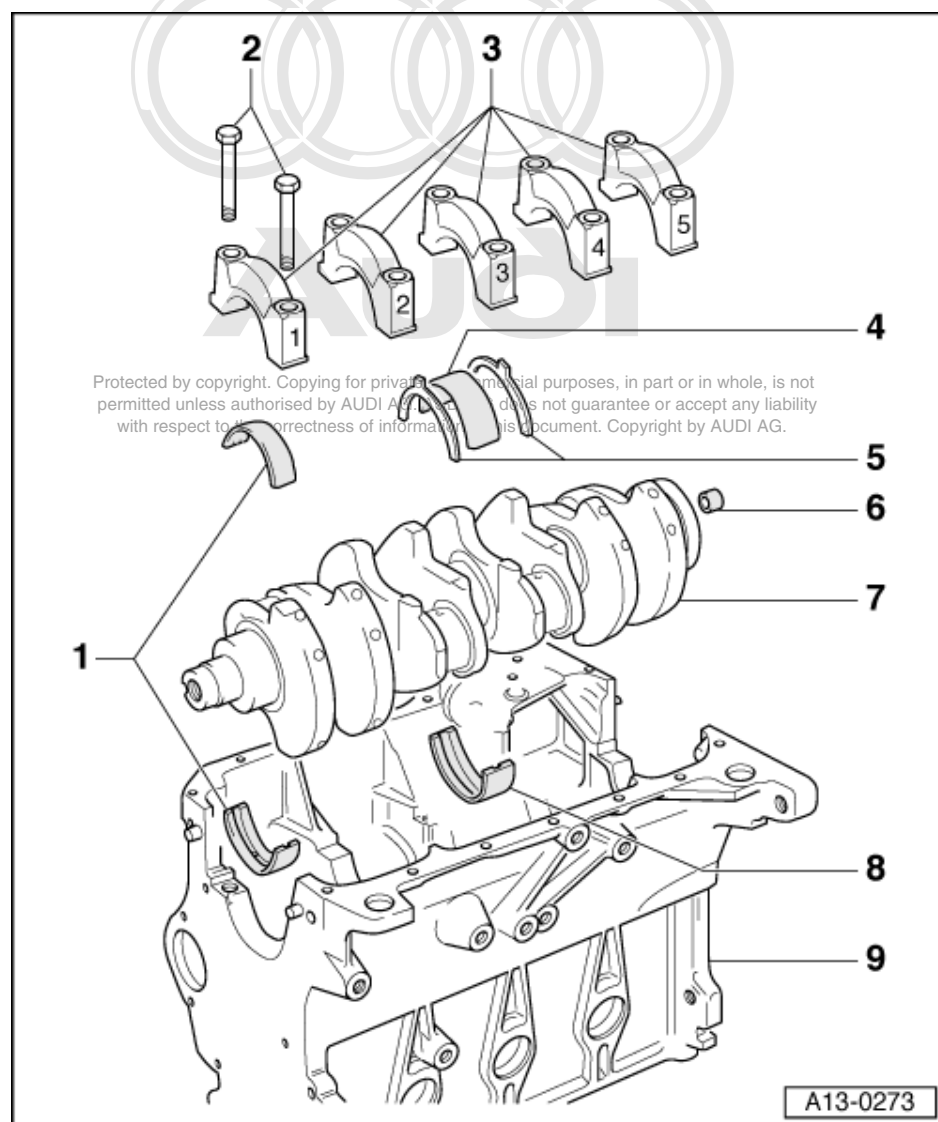
Tightening torque

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

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

3 - Removing and installing crankshaft

3.1 - Removing and installing crankshaft



Note:

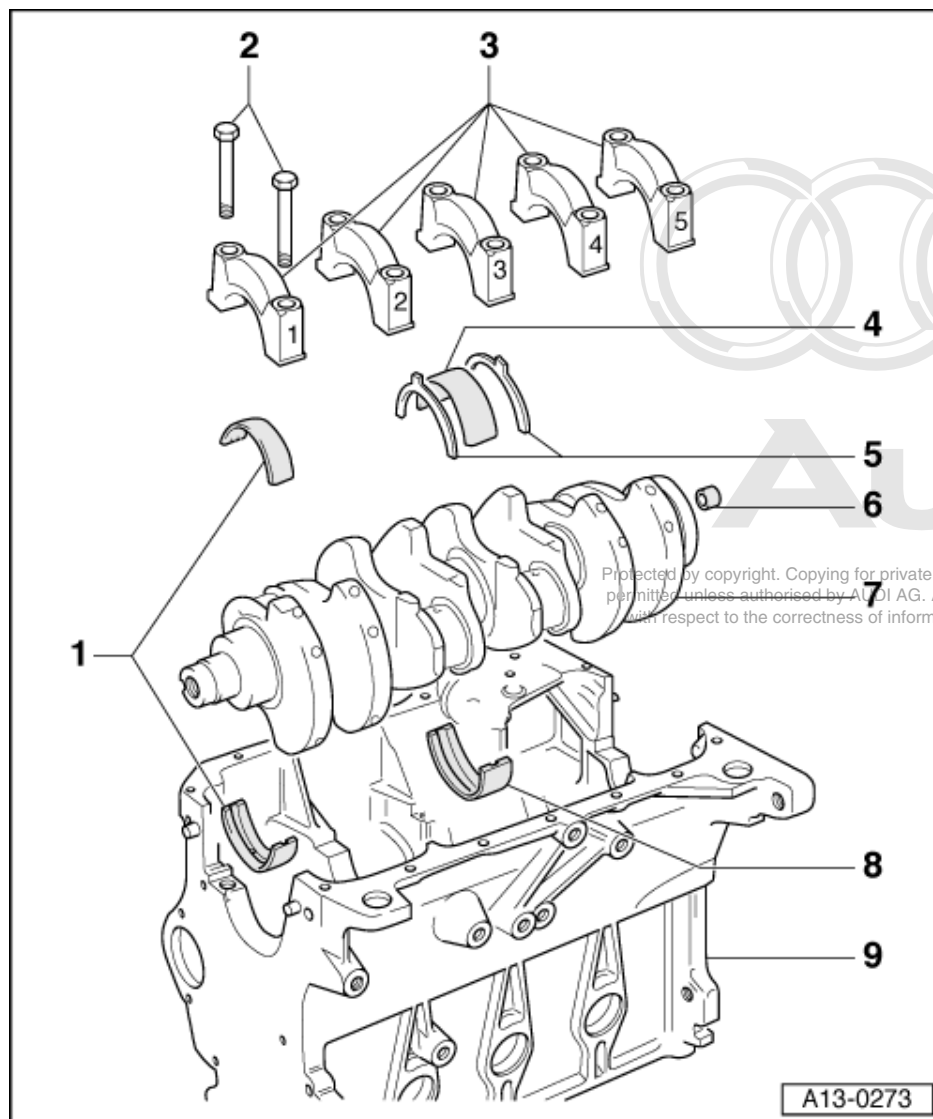
When working on the engine, it should be secured to the engine stand using the engine bracket VW 540 => Page 40.

1 Bearing caps 1, 2, 4 and 5

- ♦ Without oil groove for bearing caps 1, 2, and 5
- ♦ For bearing cap 4 and cylinder block with oil groove
- ♦ Do not interchange used bearing shells (mark)

2 65 Nm + 1/4 turn (90 °) further

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



3 Bearing cap

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

4 Bearing shell 3

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

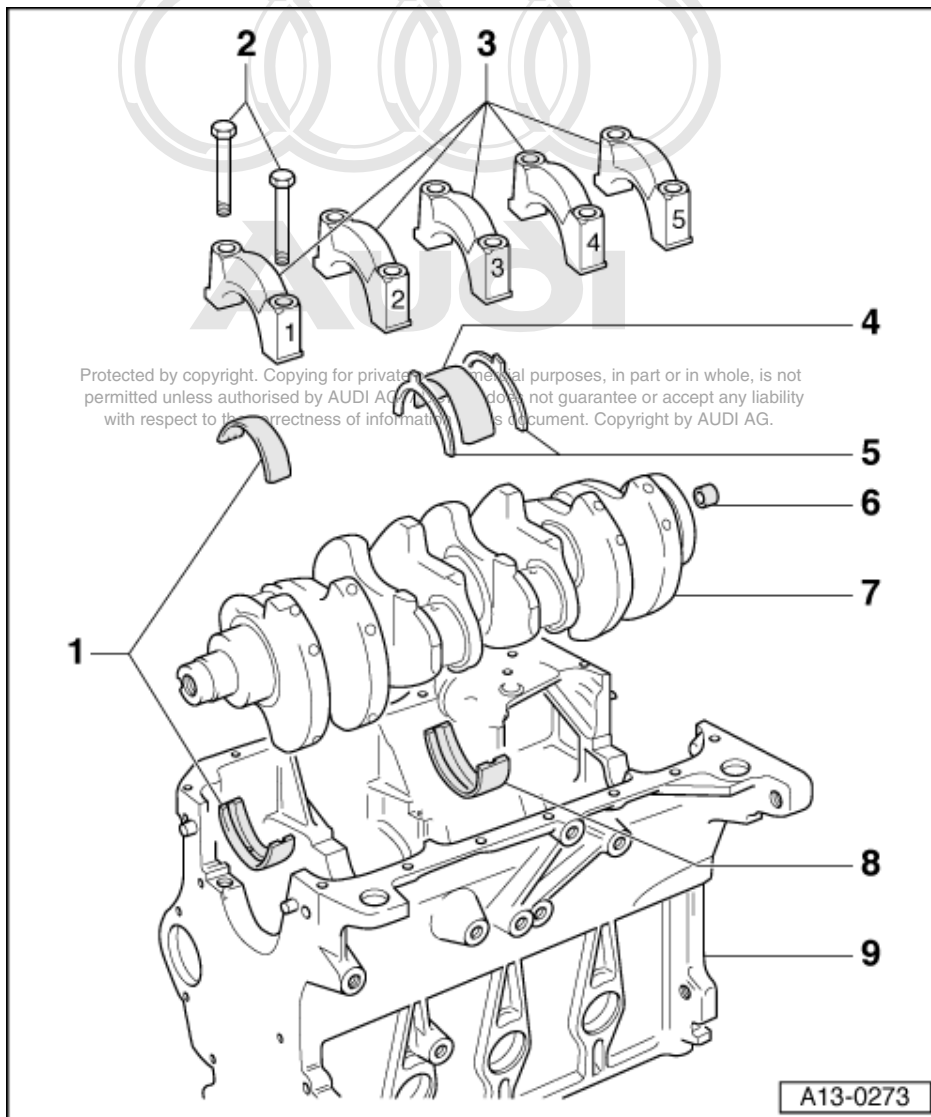
5 Thrust washers

- ♦ For bearing 3 bearing cap
- ♦ Note fixing arrangement

6 Needle bearing

- ♦ For vehicles with manual gearbox

- ♦ Pulling out and driving in =>Page 91



7 Crankshaft

- ♦ Axial play
New: 0.07...0.23 mm
Wear limit: 0.30 mm
- ♦ Check radial play with Plastigage
New: 0.02...0.04 mm
Wear limit: 0.15 mm
- ♦ Do not rotate the crankshaft when checking the radial play.
- ♦ Crankshaft dimensions=>Page 92

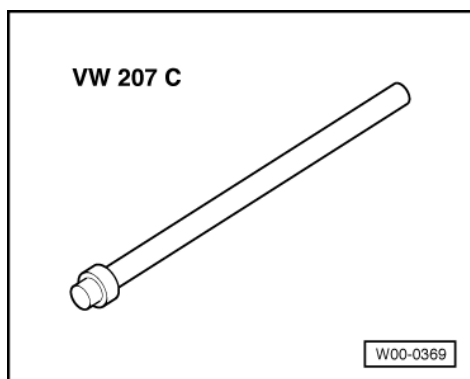
8 Bearing shell 3

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

9 Cylinder block

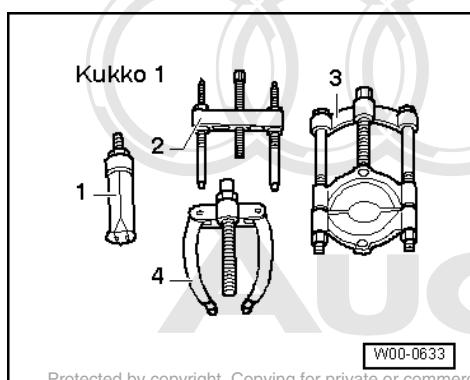
- ♦ Dismantling and assembling pistons and conrods => Page 93

3.2 - Removing and installing needle bearing in crankshaft

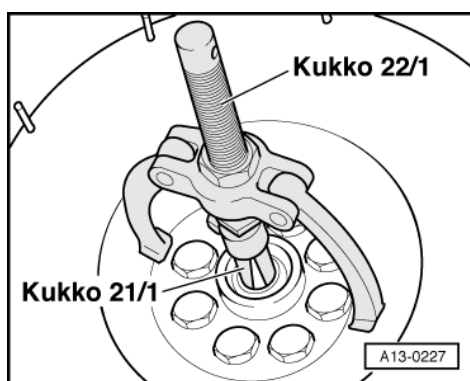


Special tools and workshop equipment required

- ♦ Drift VW 207 C



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

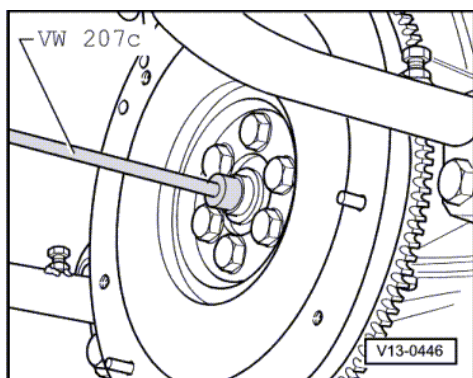


Notes:

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

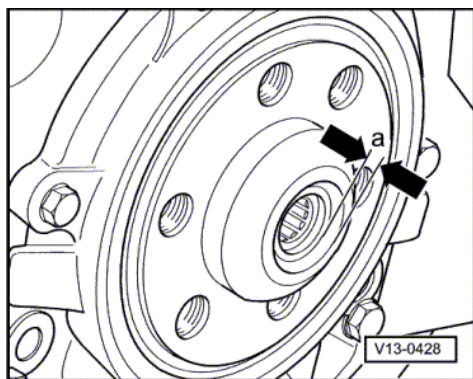
Removing

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



Installing

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



-> Installation depth of needle bearing

- ♦ Dimension a = 1.5 mm

3.3 - Crankshaft dimensions

(in mm)

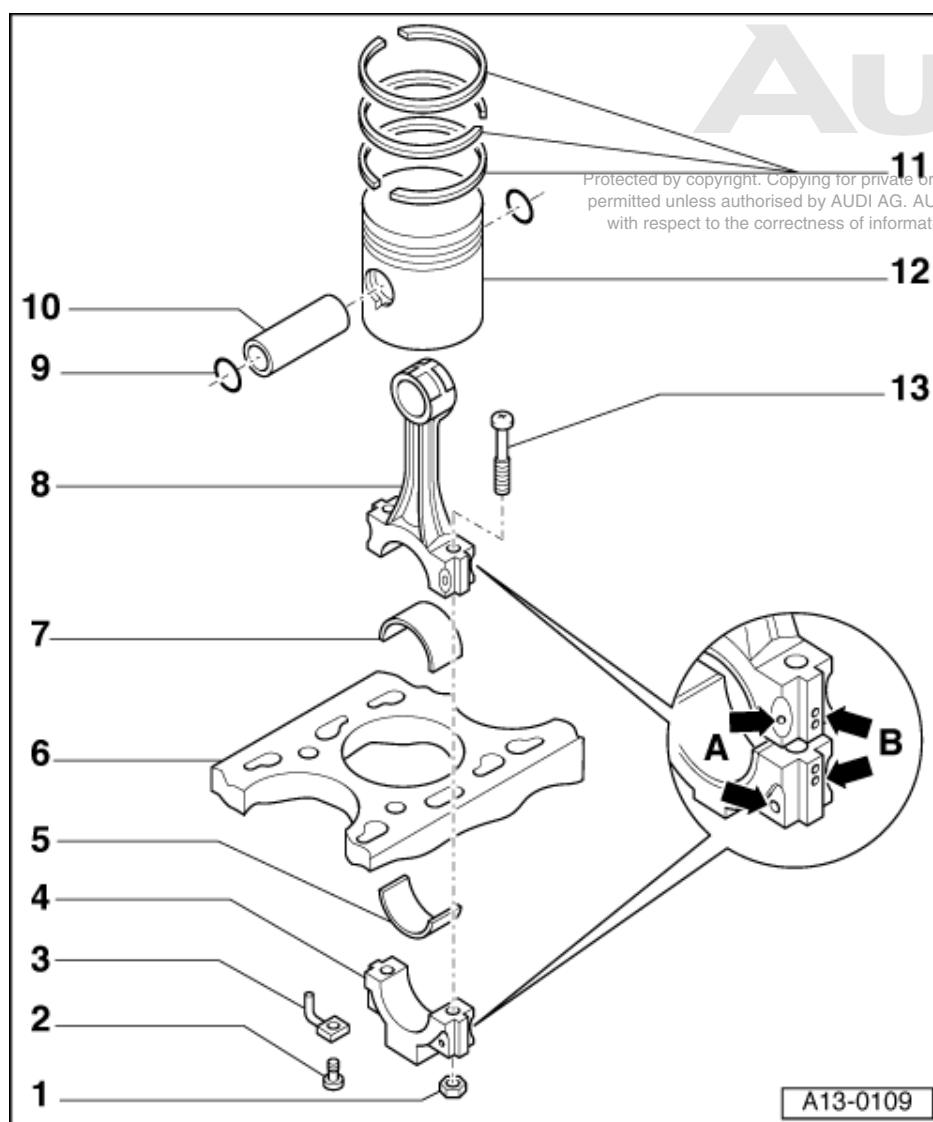
Honing dimension	Crankshaft bearing main journal $\varnothing$	Conrod bearing main journal $\varnothing$
Basic dimension	-0.022	-0.022
	54.00	47.80
	-0.042	-0.042
1st undersize	-0.022	-0.022
	53.75	47.55
	-0.042	-0.042
2nd undersize	-0.022	-0.022
	53.50	47.30
	-0.042	-0.042
3rd undersize	-0.022	-0.022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

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Honing dimension	Crankshaft bearing main journal $\varnothing$	Conrod bearing main journal $\varnothing$
	-0.042	-0.042

4 - Dismantling and assembling pistons and conrods

4.1 - Dismantling and assembling pistons and conrods



1 30 Nm + 1/4 turn (90°) further

- ◆ Replace conrod bolt -Item **13** -
- ◆ Oil threads and contact surface
- ◆ To measure radial play tighten to 30 Nm but not further

2 Relief valve - 27 Nm

- ◆ Opens at:
Excess pressure of 2.5...3.2 bar
- ◆ Dependent on construction

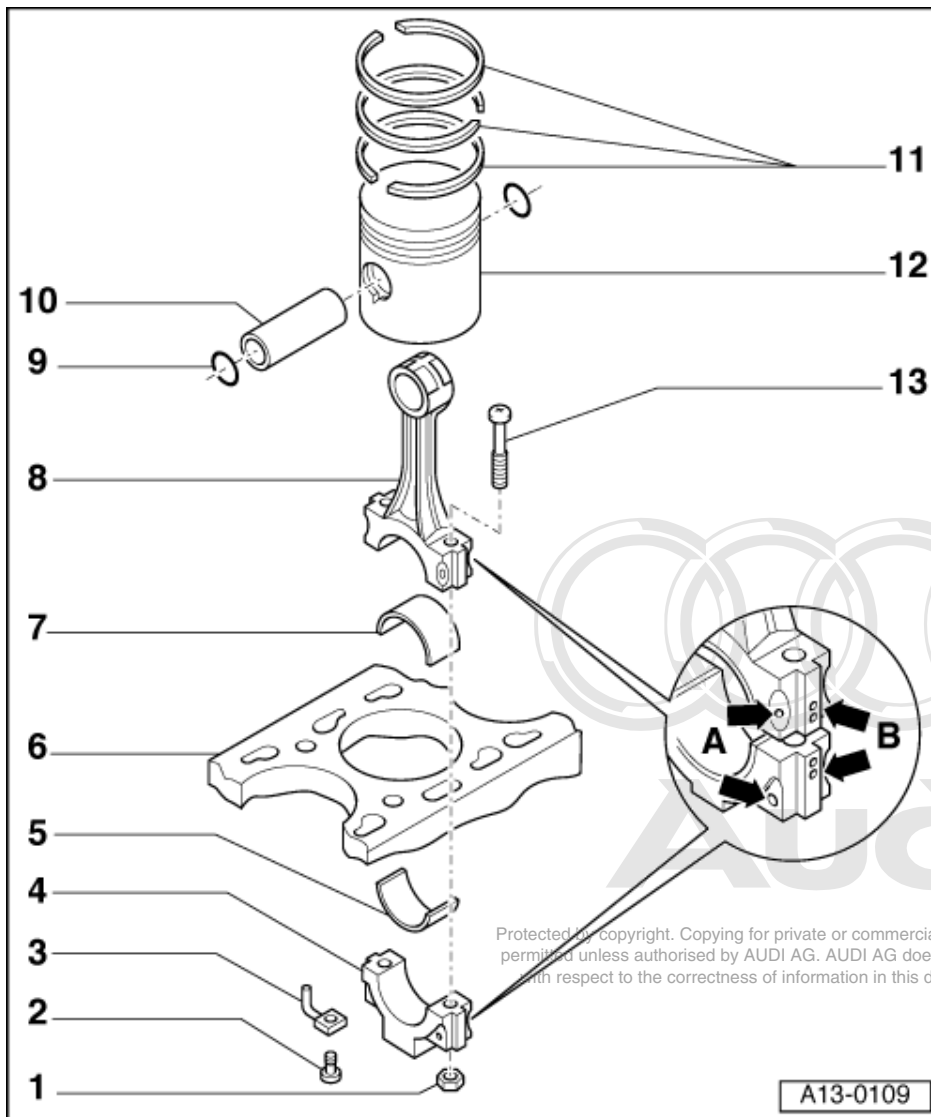
=> Parts List

3 Oil spray jet

- ◆ For piston cooling

- ◆ Dependent on construction

=> Parts List

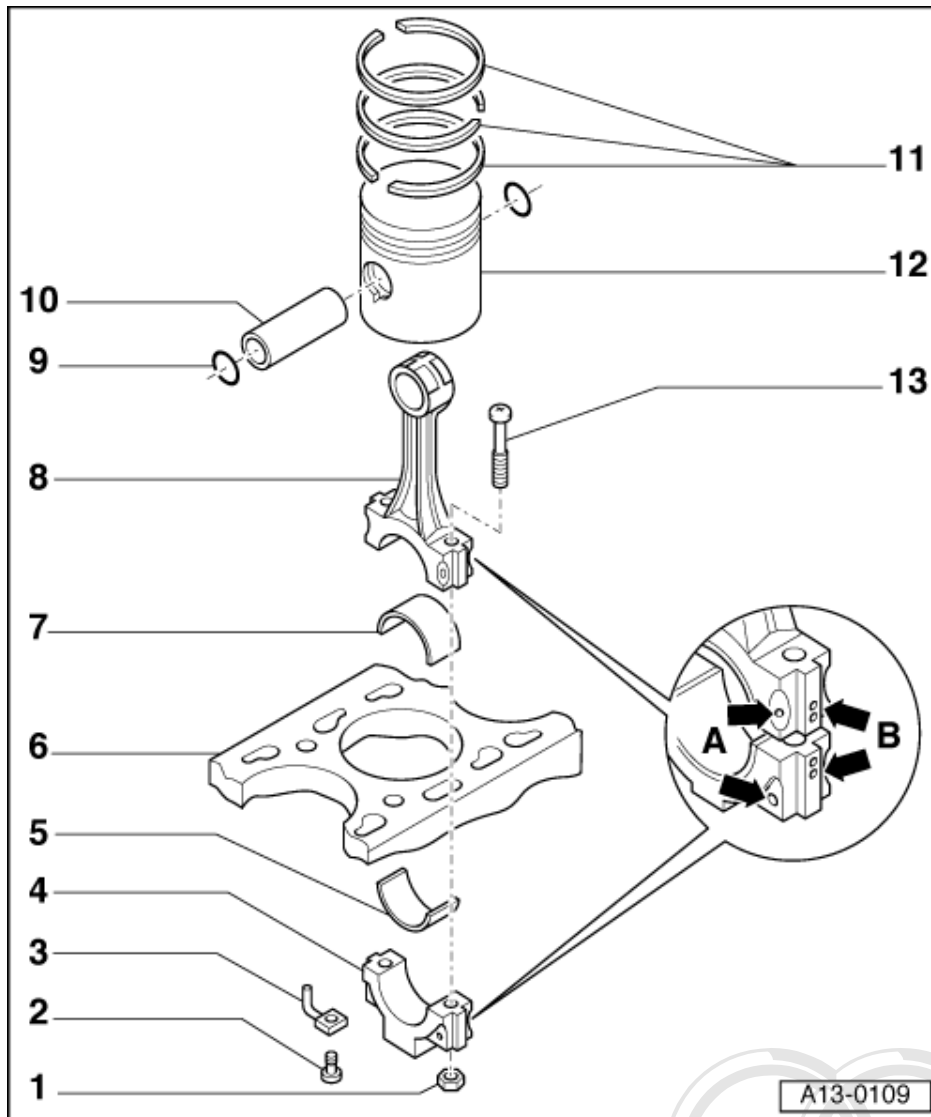


4 Conrod bearing cap

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

5 Lower bearing shell

- ◆ Note installation position
- ◆ Do not interchange used bearing shells (mark)
- ◆ Ensure retaining lugs fit tightly in recesses
- ◆ Axial play
New: 0.10...0.35 mm
Wear limit: 0.40 mm
- ◆ Check radial play with Plastigage
New: 0.01...0.05 mm
Wear limit: 0.12 mm
Do not rotate crankshaft when checking radial play
- ◆ To measure radial play, tighten nuts -Item 1 - to 30 Nm but do not turn further



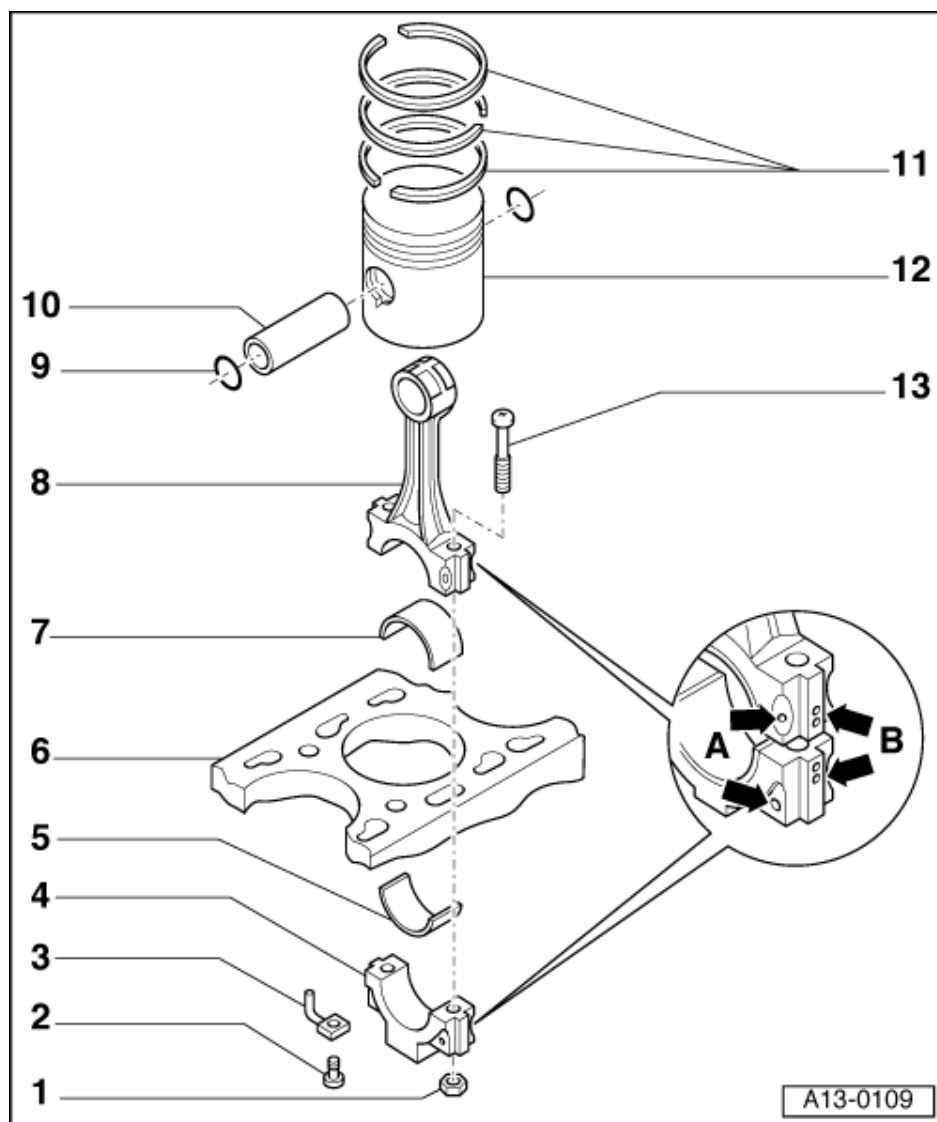
6 Cylinder block

- ♦ Checking cylinder bore
=> Fig. 99
- ♦ Piston and cylinder dimensions
=>Page 100

7 Upper bearing shell

- ♦ With oil bore for piston pin lubrication
- ♦ Note installation position
- ♦ Do not interchange used bearing shells (mark)
- ♦ Ensure retaining lugs fit tightly in recesses
- ♦ Axial play
New: 0.10...0.35 mm
Wear limit: 0.40 mm
- ♦ Check radial play with Plastigage
New: 0.01...0.05 mm
Wear limit: 0.12 mm
Do not rotate crankshaft when checking radial play
- ♦ To measure radial play, tighten nuts -Item 1 - to 30 Nm but do not turn further

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8 Conrod

- ◆ Only renew as a set
- ◆ Mark cylinder number -B-
- ◆ Installation position:
Markings -A- face towards pulley side
- ◆ With oil bore for piston pin lubrication
- ◆ Checking axial play=> Fig. 100
- ◆ Measuring radial play=>Page 100

9 Circlip

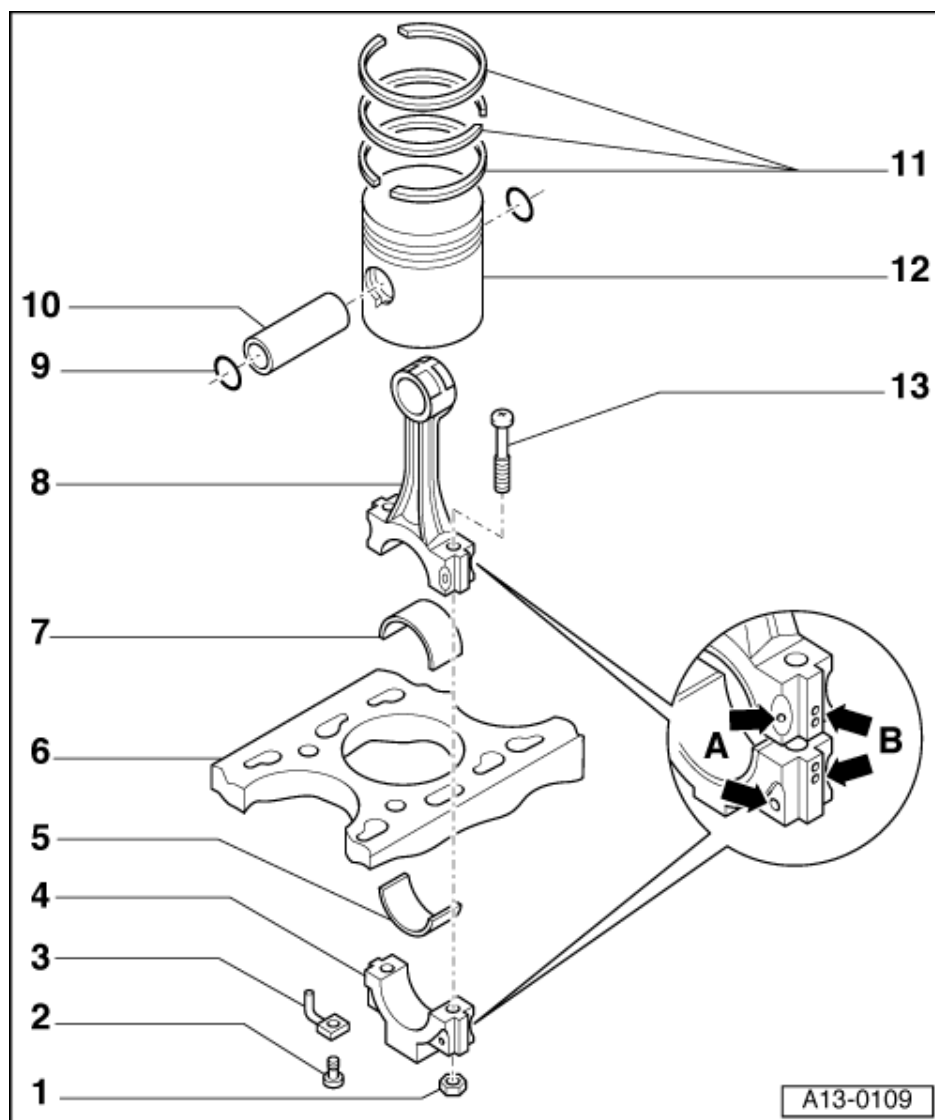
- ◆ Replace

10 Piston pin

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



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11 Piston rings

- ◆ Offset gaps by 120°
- ◆ Remove and install with piston ring pliers
- ◆ "TOP" marking must face piston crown
- ◆ Checking ring gap
=> Fig. 98
- ◆ Checking ring to groove play=> Fig. 98

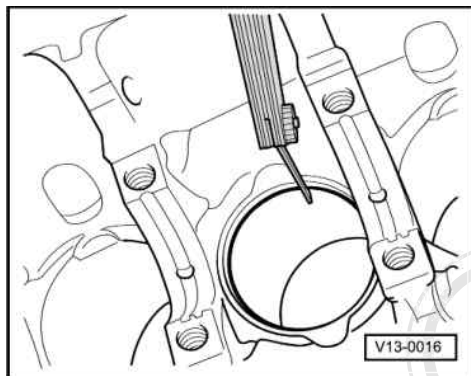
12 Piston

- ◆ Checking => Fig. 99
- ◆ Mark installation position and cylinder number
- ◆ Arrow on piston crown points to pulley end
- ◆ Use only pistons of the same weight class
- ◆ Install using piston ring clamp
- ◆ Piston and cylinder dimensions
=>Page 100

13 Conrod bolt

- ◆ Replace

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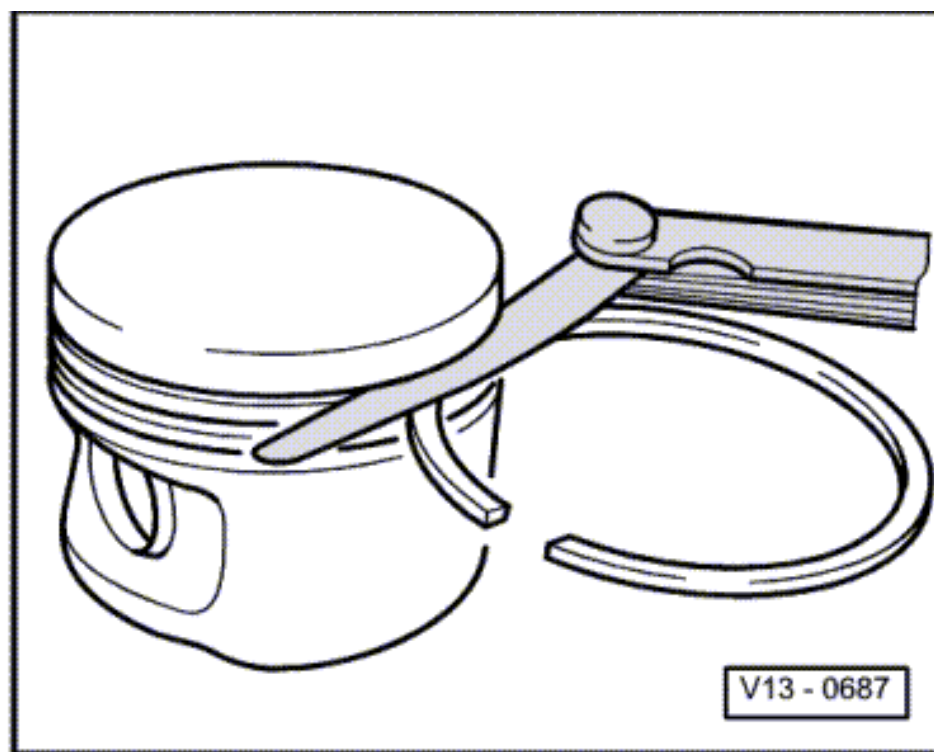


-> Fig. 1 Checking piston ring gap

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

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

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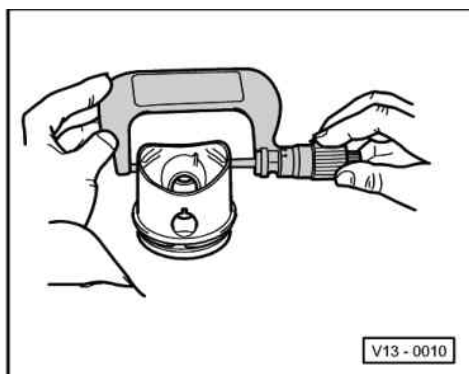


-> Fig. 2 Checking ring to groove play

- Clean groove before checking play.

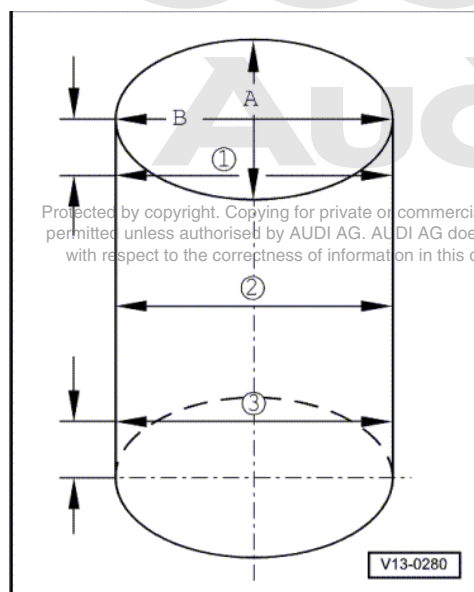
Piston ring Dimensions in mm	New	Wear limit
1st compression ring	0.06...0.09	0.20
2nd compression ring	0.05...0.08	0.20

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



→ Fig. 3 Checking piston

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

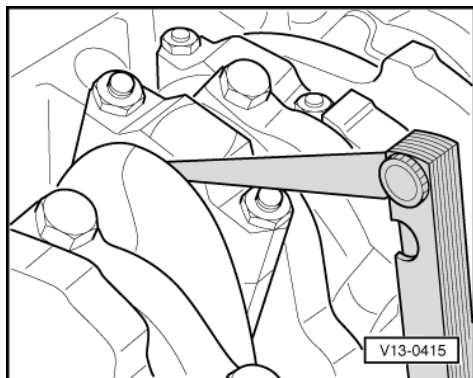


→ Fig. 4 Checking cylinder bores

Special tools and workshop equipment required

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

Nominal dimension => Page 100 ; Piston and cylinder dimensions



→ Fig.5 Checking axial play of conrods

- ♦ Wear limit: 0.40 mm

4.2 - Piston and cylinder dimensions

Engine codes ABB, ADA

Honing dimension		Piston-ø	Cylinder bore-ø
Basic dimension	mm	80.98	81.01
1st undersize	mm	81.23	81.26
2nd undersize	mm	81.48	81.51

Engine codes AAD, AAE, ABK, ADW

Honing dimension		Piston-ø	Cylinder bore-ø
Basic dimension	mm	82.48	82.51
1st undersize	mm	82.73	82.76
2nd undersize	mm	82.98	83.01

4.3 - Checking radial play of conrods

Notes:

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

Auxiliary equipment required

- ♦ Plastigage

Test sequence

- Remove conrod bearing cap. Clean bearing cap and bearing journal.
- Place a length of Plastigage of corresponding width on the bearing journal or in the bearing shells
- Fit conrod bearing cap and tighten to 30 Nm. Do not turn crankshaft.
- Remove conrod bearing cap again.

- Compare width of Plastigage with calibrated scale.

Play when new	Wear limit
0.010...0.056 mm	0.1 mm



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15 - Cylinder head, Valve gear

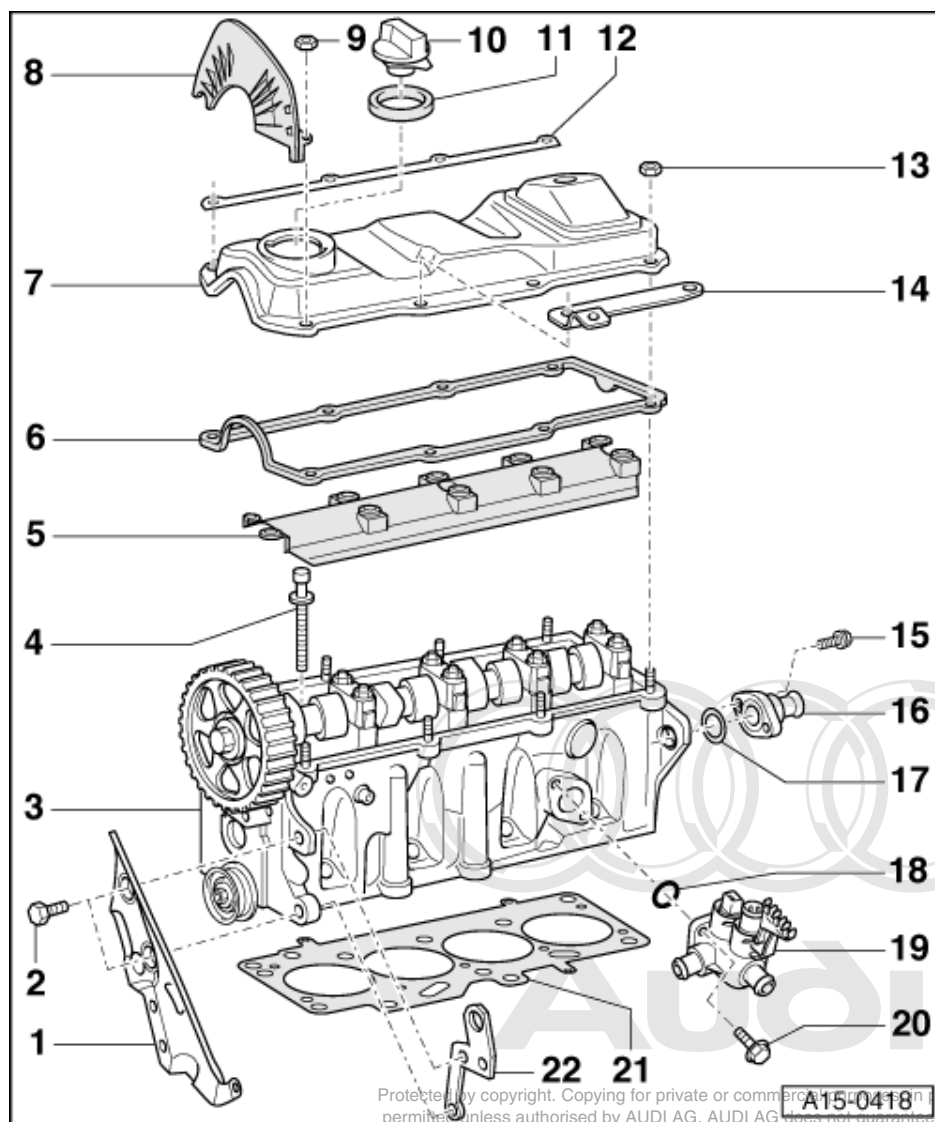
1 - Removing and installing cylinder head

1.1 - Removing and installing cylinder head

Notes:

- ♦ Replace the cylinder head bolts.
- ♦ When performing installation procedures always replace self-locking nuts and bolts.
- ♦ Replace seals, gaskets, and bolts which have a specified tightening angle.
- ♦ When installing an exchange cylinder head with fitted camshaft, the contact surfaces between tappets and cams must be oiled after installing the head.
- ♦ The plastic protectors fitted to protect the open valves must only be removed immediately before fitting the cylinder head.
- ♦ When fitting a new cylinder head or cylinder head gasket, drain off all the old coolant and re-fill with new coolant.
- ♦ Cylinder heads which have cracks between the valve seats or between valve seat inserts and the spark plug thread can be used further without reducing service life, provided the cracks do not exceed a maximum of 0.3 mm in width, or when no more than the first 4 turns of the spark plug threads are cracked.

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1 Toothed belt guard - rear

- ◆ Different versions

=> Parts List

2 20 Nm

3 Cylinder head

- ◆ Different versions

=> Parts List

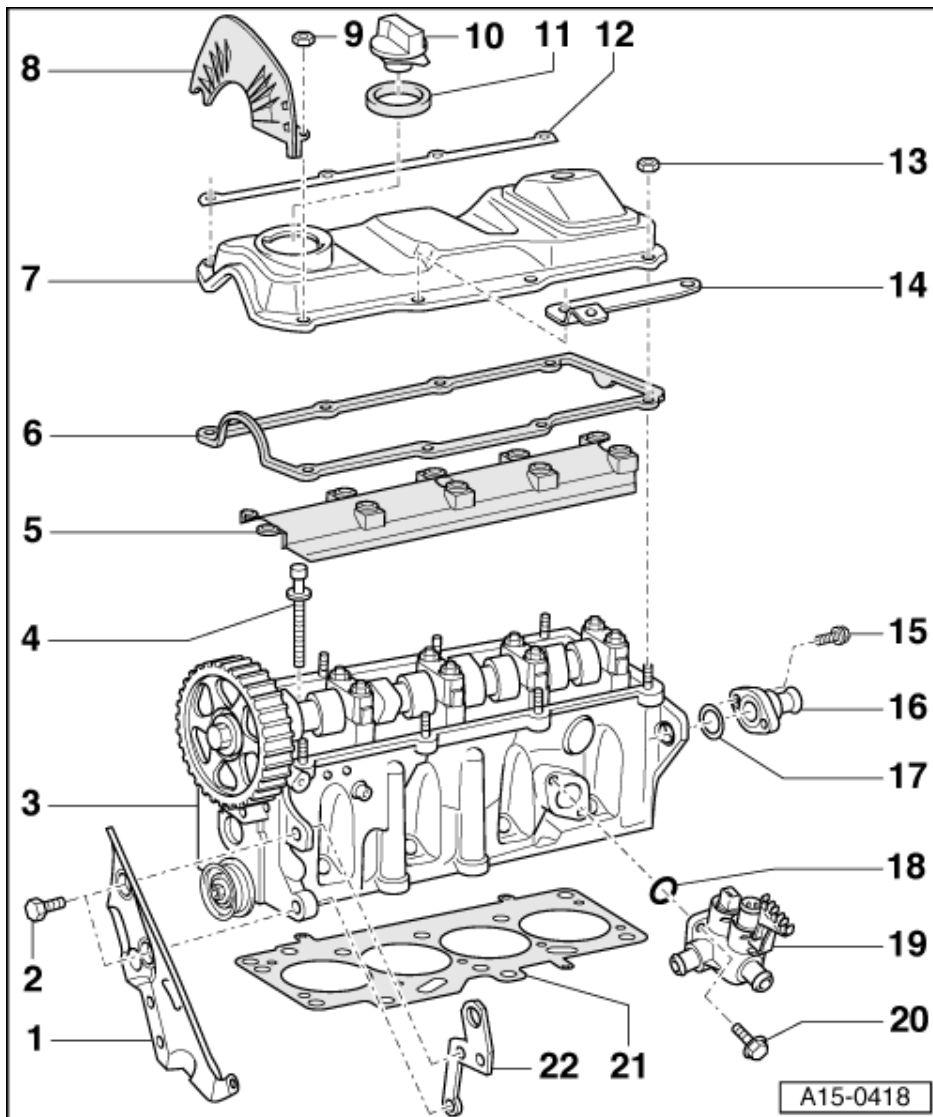
- ◆ Removing => from Page 118
- ◆ Checking for distortion => Fig. 107
- ◆ Reworking dimension => Fig. 107
- ◆ Installing => Page 134
- ◆ After replacing, fill with fresh coolant

4 Cylinder head bolt

- ◆ Different versions
- ◆ Allocation to cylinder head gasket
=> Fig. 108
- ◆ Note sequence when loosening => Page 123
- ◆ Replace



♦ Note sequence when tightening => Page 136



5 Oil deflector

6 Cylinder head cover gasket

- ♦ Renew if damaged or leaking
- ♦ New studs without collar must be installed when replacing cork gasket with rubber gasket.
- ♦ Before fitting gasket apply sealant at sealing points => Fig. 107

7 Cylinder head cover

- ♦ Different versions

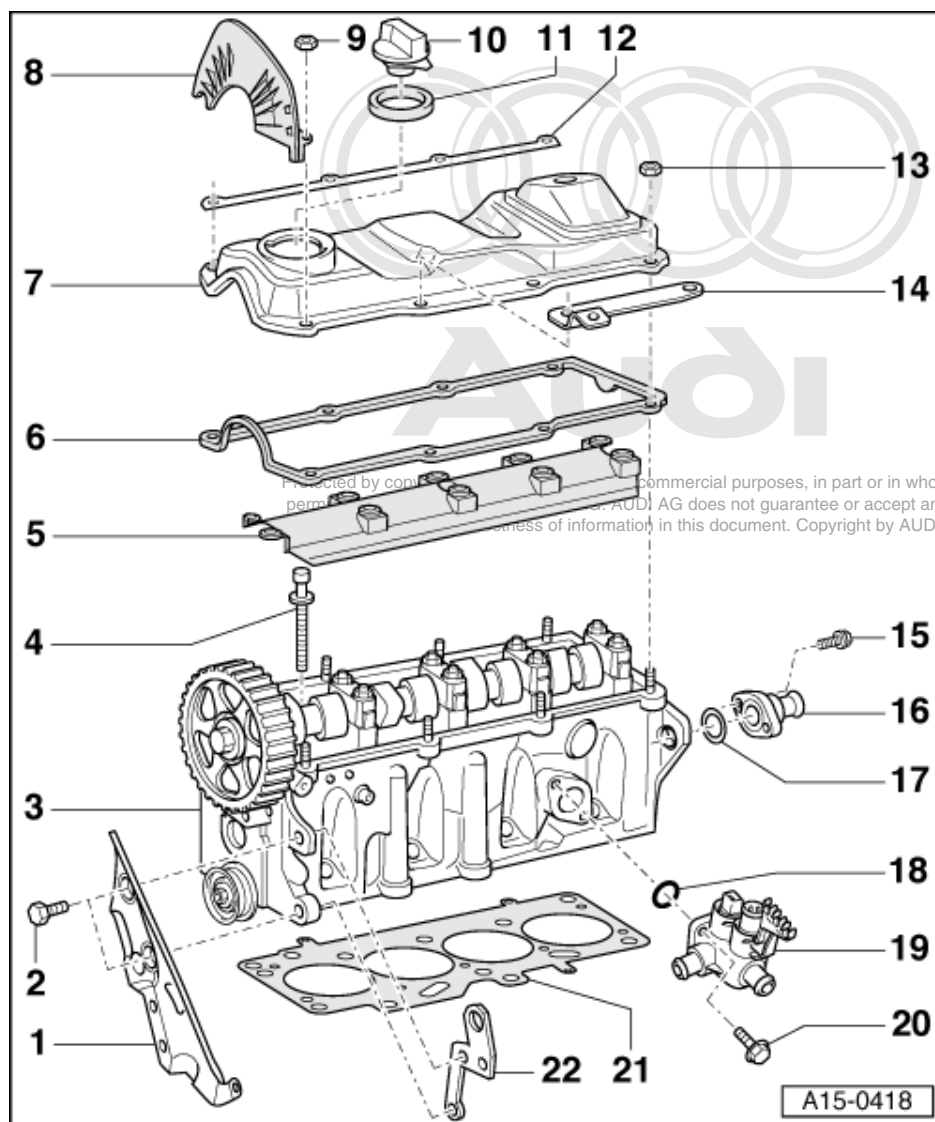
=> Parts List

- ♦ Removing and installing
=>Page 115

8 Toothed belt guard

- ♦ Different versions

=> Parts List



9 10 Nm

10 Cap

11 Seal

- ♦ Renew if damaged or leaking

12 Reinforcement strip

13 10 Nm

14 Not installed

15 10 Nm

16 Flange

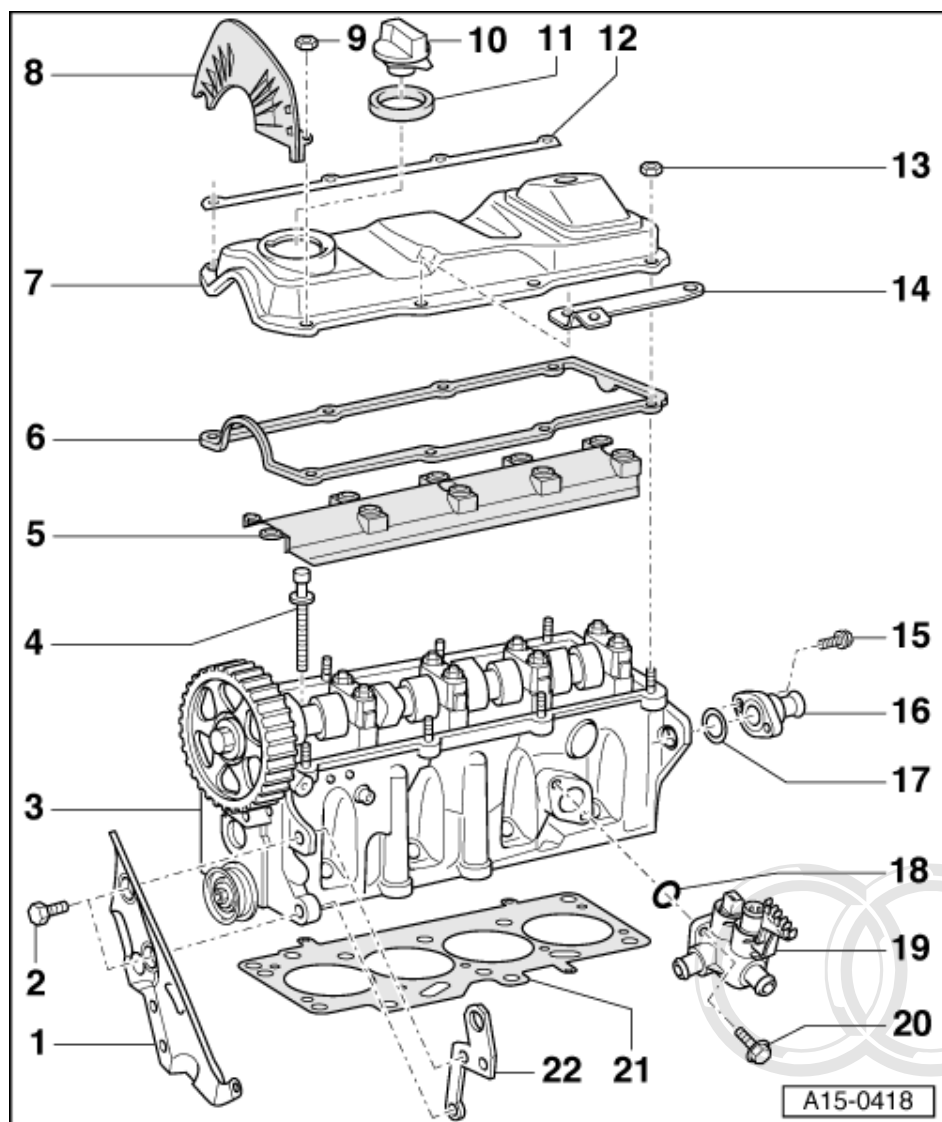
- ♦ For coolant pipe

17 O-ring

- ♦ Replace

18 O-ring

- ♦ Replace



19 Flange

- ◆ For coolant hoses
- ◆ With sensor for coolant temperature display -G2, and coolant temperature switch (too hot) -F14
- ◆ With coolant temperature sender -G62

20 10 Nm

21 Cylinder head gasket

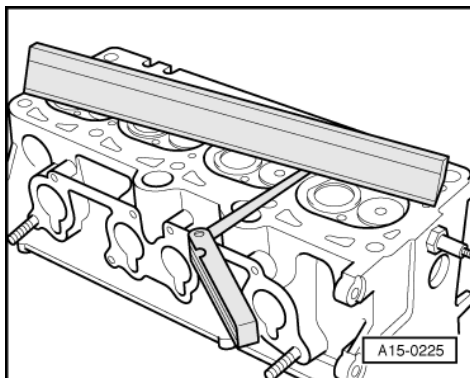
- ◆ Different versions

=> Parts List

- ◆ Allocation to cylinder head bolt
=> Fig. 108
- ◆ Replace => "Remove cylinder head", Page 118
- ◆ Installation position: Part No. to cylinder head
- ◆ After replacing, fill with fresh coolant

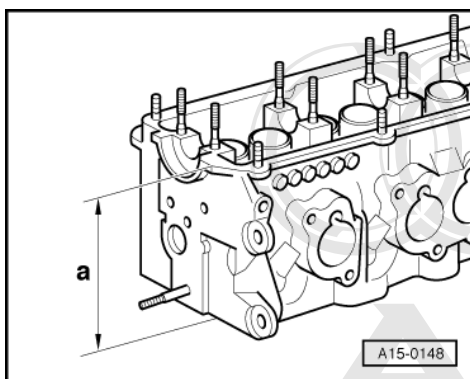
22 Lifting eye

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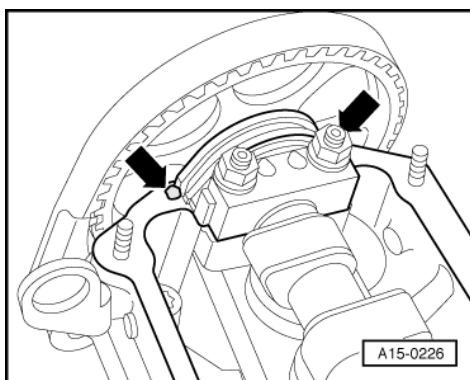
-> Fig.1 Checking cylinder head for distortion

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



-> Fig.2 Reworking dimension for cylinder head

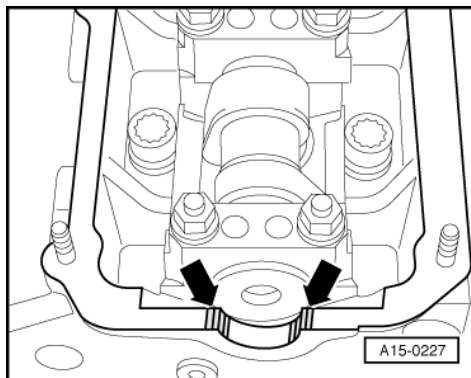
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- Reworking the cylinder head (grinding to level surface) is only permitted down to minimum dimension -a-.
 - Minimum dimension $a = 132.6 \text{ mm}$



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

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

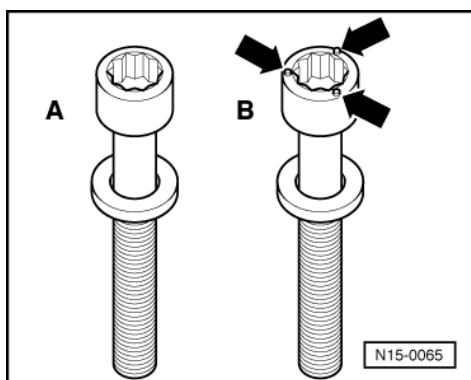
=> Parts List



-> Fig. 4 Applying sealant to sealing points

- Apply a small quantity of sealing compound to sealing points for half moon seal -arrows- on upper sealing surface of cylinder head.
- Sealing compound

=> Parts List



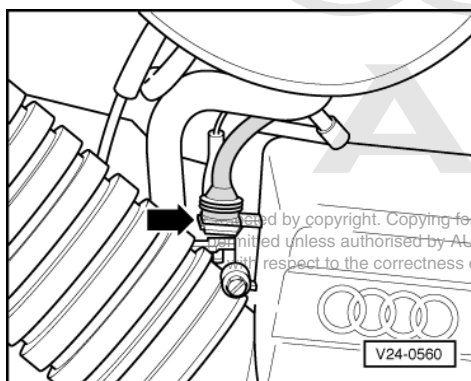
-> Fig.5 Allocation of cylinder head gasket/cylinder head bolts

- A - Bolt with smooth bolt head
- For previously used cylinder head gasket
- B - Bolt with embossed bolt head -arrows-
- For metal cylinder head gasket

Note:

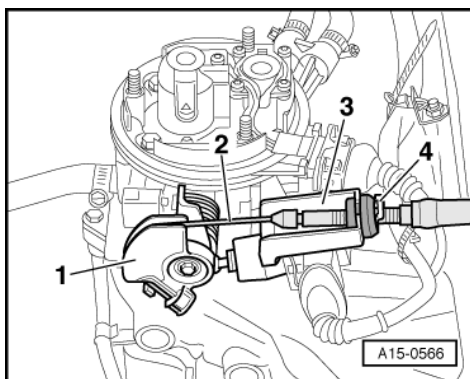
Use of metal cylinder head gasket starting from vehicle identification No. 4A_S_110 001.

1.2 - Removing and installing intake manifold -engine code AAE-

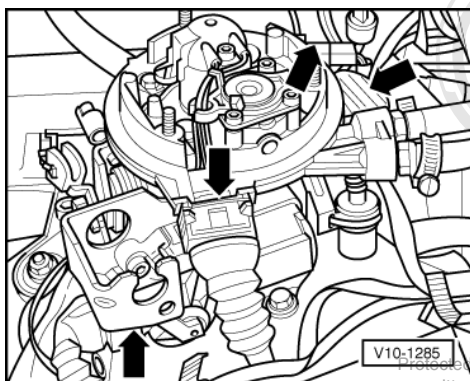


Removing

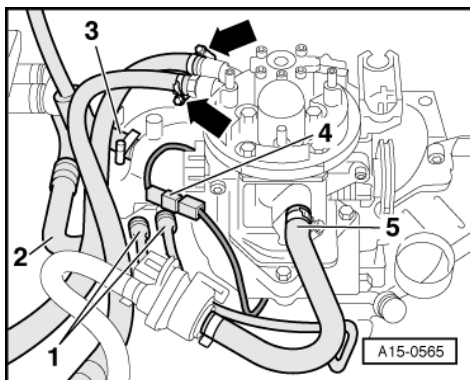
- -> Detach connectors -arrow- to the lambda probe.



- Detach air intake cowl on the throttle body injection unit with air intake hose.
- -> Detach the throttle cable -2- from cable disc -1- and support bracket -3- (do not remove retainer -4-). Move throttle cable to the side.



- -> Unplug connectors at the throttle body injection unit -arrows-.
- Lay wiring harness aside.



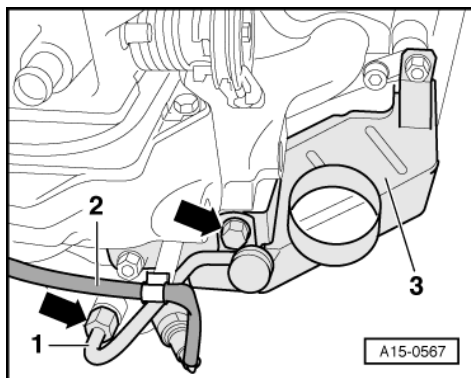
Important

The fuel system is pressurised. Before opening the system place a cloth around the connection point. Then release pressure by carefully loosening the connection.

- -> Mark fuel feed pipe and fuel return pipe -arrows- and remove it from the throttle body unit.
- Detach connector -4-.



- Lay wiring harness aside.
- Detach vacuum hose -5- to ACF valve.
- Detach the vacuum line -3- to the brake servo unit from the intake manifold.
- Disconnect the coolant hose -2- to the intake manifold.



- -> Unscrew the CO test pipe -1- from the exhaust manifold and the intake manifold -arrows-.
- Lay lambda probe wiring -2- aside.
- Unbolt the warm air arrester plate -3-.
- Unbolt the intake manifold support from the exhaust manifold and from the intake manifold.

Note:

Note spacer sleeve between support and exhaust manifold.

- Unscrew the intake manifold/cylinder head connection bolts.
- Remove intake manifold.

Note:

Plug intake ports on cylinder head with clean cloths.

Installing

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

Note:

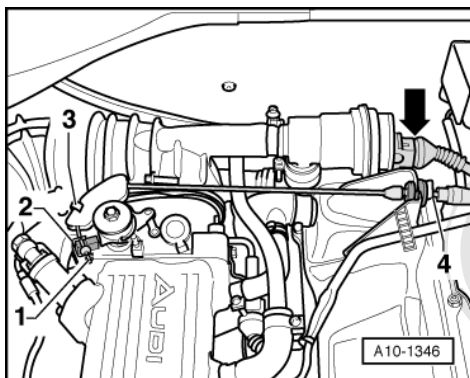
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Replace gaskets and seals.

Tightening torques

Component	Nm
Intake manifold to cylinder head	25
Support for intake pipe to intake pipe	20
Support for intake pipe to intake manifold	20
CO test pipe to exhaust manifold	20
CO test pipe to intake pipe	10
Warm air arrester plate to exhaust manifold	20
Hose clamps	2

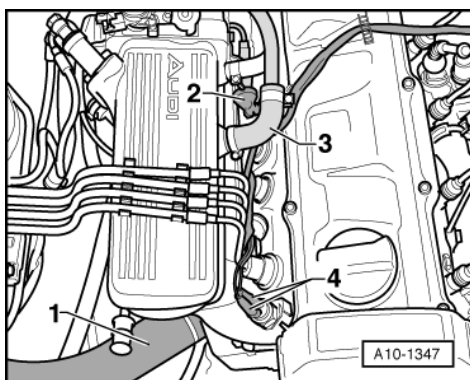
1.3 - Removing and installing intake manifold -engine codes AAD, ABB-



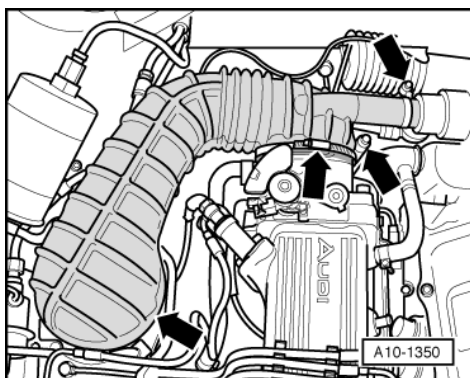
Removing

- -> Remove securing clips -2- and -3-.
- Detach throttle cable -1- at throttle valve body and support bracket (do not remove throttle cable retainer -4-). Move throttle cable to the side.
- Detach connector -arrow- from idling stabilisation valve.

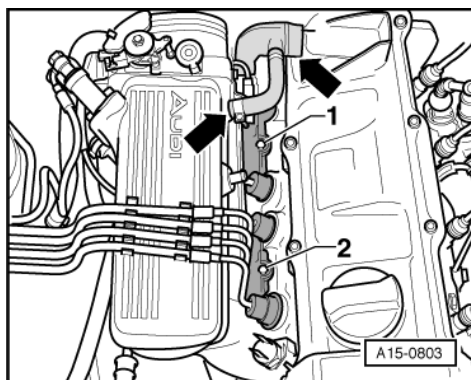
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- -> Detach the vacuum pipe -3- to the brake servo.
- Unplug connectors at fan run-on thermoswitch -4-.
- Detach connector -2- from throttle switch.
- Lay wiring aside.
- Detach hose -1- of intake air preheater from warm air arrester plate on exhaust manifold.



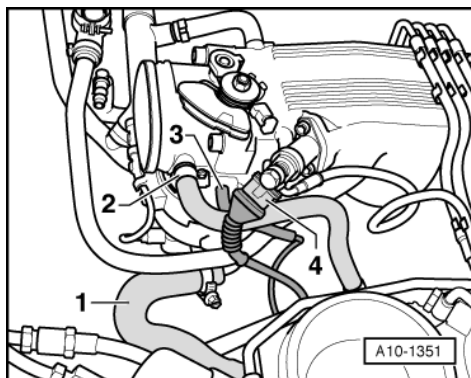
- -> Remove the air intake cowl -arrows-.



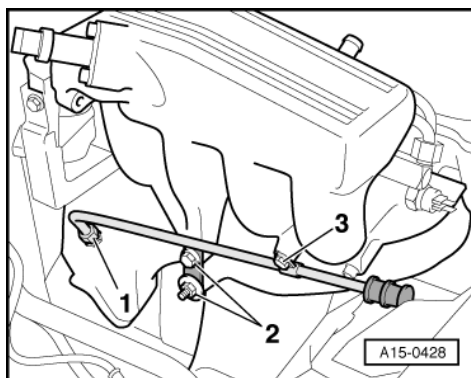
- -> Remove the crankcase breather hose -arrows-.
- Unbolt rear crankcase ventilation pipe from the cylinder head.
- Unbolt the injector retaining bar -1- and -2-.
- Remove the injectors with fuel lines connected from the intake manifold.

Note:

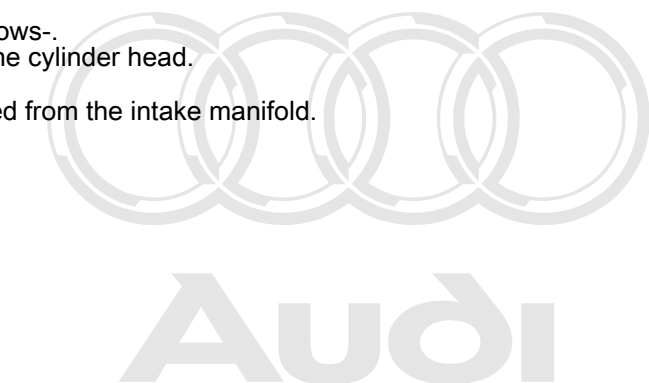
Ensure that the fuel lines are not kinked.



- -> Disconnect wires/unplug connectors:
 - 1 - Crankcase ventilation hose
 - 2 - Connection on throttle valve unit to activated carbon filter solenoid valve 1 -N80
 - 3 - Connection on throttle valve unit to intake air preheater
 - 4 - Cold start valve -N17
- Detach the cold start valve with the fuel line connected from the intake manifold.



- -> Unscrew the threaded connections -2- and remove intake manifold support.
- Unscrew bolt -3-.
- Unscrew CO test pipe from the exhaust manifold -1-.
- Unbolt the warm air arrester plate.



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- Unscrew nuts and bolts securing intake manifold to cylinder head.
- Remove intake manifold.

Note:

Plug intake ports on cylinder head with clean cloths.

Installing

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

Note:

Replace gaskets and seals.

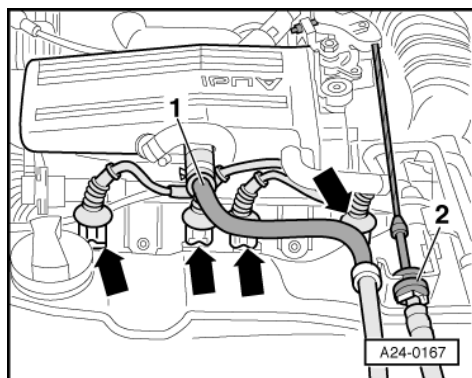
Tightening torques

Component		Nm
Intake manifold to cylinder head	M6	10
	M8	20
Support for intake pipe to intake pipe		20
Support for intake pipe to intake manifold		20
Warm air arrester plate to exhaust manifold		20
CO test pipe to exhaust manifold		20

Component	Nm
CO test pipe to intake pipe	10
Cold start valve to intake pipe	10
Injector retaining bars to intake pipe	10
Hose clamps	2

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1.4 - Removing and installing intake manifold -engine codes ABK, ADA, ADW-

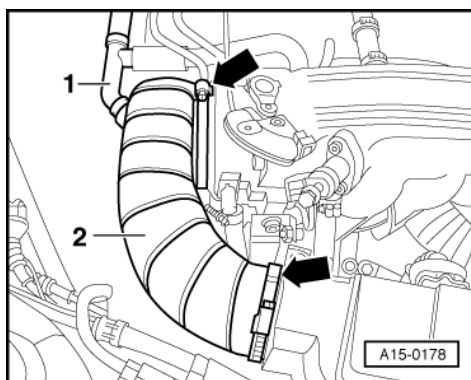


Removing

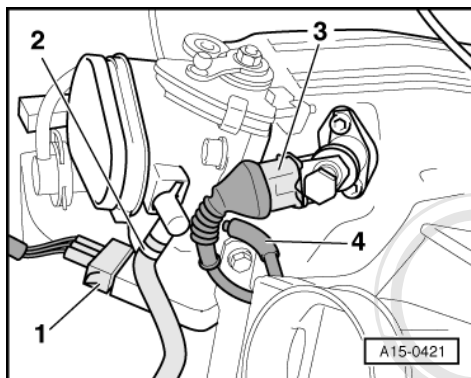
- -> Detach throttle cable -2- at throttle valve connection and support bracket (do not remove retainer). Move throttle cable to the side.
- Detach the vacuum pipe -1- to the brake servo unit.
- Unplug connectors -arrows- at the injectors.
- Unplug connectors at fan run-on thermoswitch.



- Detach crankcase breather hose.



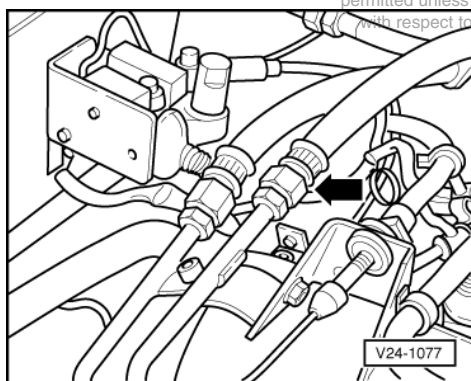
- -> Detach the air duct hose -2- from the throttle valve unit and the air flow meter, loosen hose clamps - arrows- for this purpose.
- Detach the elbow piece -1- from hose to cylinder head cover/intake manifold.
- Detach the heat shield for the throttle valve potentiometer at the side of the throttle valve body.



- -> Disconnect wires/unplug connectors:

- 1 - Throttle valve potentiometer -G69
- 2 - Connection on throttle valve unit to activated carbon filter solenoid valve 1 -N80
- 3 - Cold start valve -N17
- 4 - Connection on throttle valve unit to intake air preheater
- Idling switch -F60

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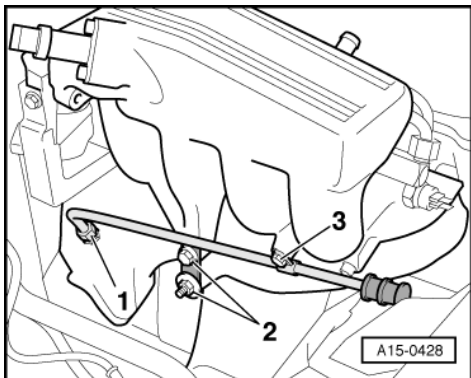


Important

The fuel system is pressurised. Before opening the system place a cloth around the connection point. Then release pressure by carefully loosening the connection.

- -> Disconnect fuel supply and return lines at the bolted connection -arrow-.

- Unscrew fuel supply and return lines from cylinder head cover.



- Detach hose of intake air preheater from warm air arrester plate on exhaust manifold.
- -> Unscrew the threaded connections -2- and remove intake manifold support.
- Unscrew bolt -3-.
- Unscrew CO test pipe from the exhaust manifold -1-.
- Unbolt the warm air arrester plate.
- Unscrew nuts and bolts securing intake manifold to cylinder head.
- Remove intake manifold.

Note:

Plug intake ports on cylinder head with clean cloths.

Installing

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

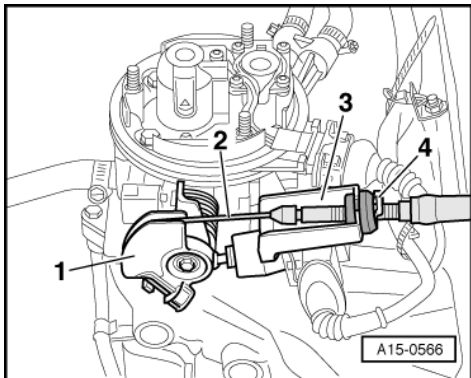
Note:

Replace gaskets and seals.

Tightening torques

Component		Nm
Intake manifold to	M6	10
cylinder head	M8	20
Support for intake pipe to intake pipe		20
Support for intake pipe to intake manifold		25
Warm air arrester plate to exhaust manifold		20
CO test pipe to exhaust manifold		20
CO test pipe to intake pipe		10
Heat shield to intake pipe		10
Fuel feed and return pipe to fuel manifold		25
Hose clamps		2

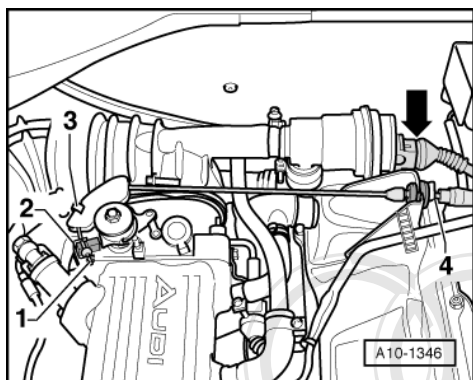
1.5 - Removing and installing cylinder head cover



Removing

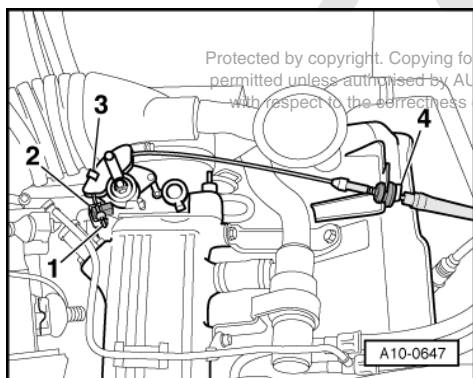
Vehicles with engine code AAE:

- -> Detach the throttle cable -2- from cable disc -1- and support bracket -3- (do not remove retainer -4-). Move throttle cable to the side.
- Loosen cable ties on the reinforcement bars and lay electrical wiring aside.



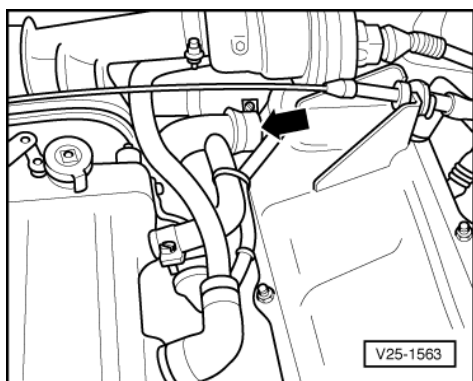
Vehicles with engine codes AAD, ABB:

- -> Detach the throttle cable at the support bracket (do not remove securing clip -4-). Move throttle cable to the side.
- Detach connector -arrow- from idling stabilisation valve.
- Remove idling stabilisation valve from cylinder head cover.
- Loosen cable tie and lay wiring aside.



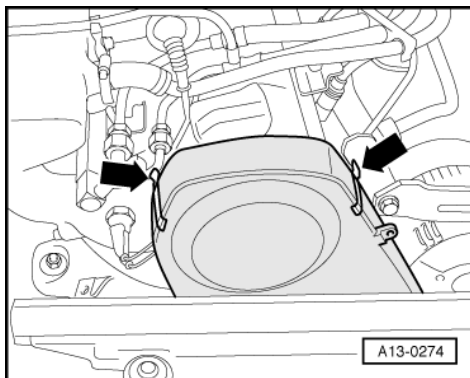
Vehicles with engine codes ABK, ADA, ADW:

- -> Detach the throttle cable at the support bracket (do not remove securing clip -4-). Move throttle cable to the side.
- Unscrew fuel supply and return lines from cylinder head cover.

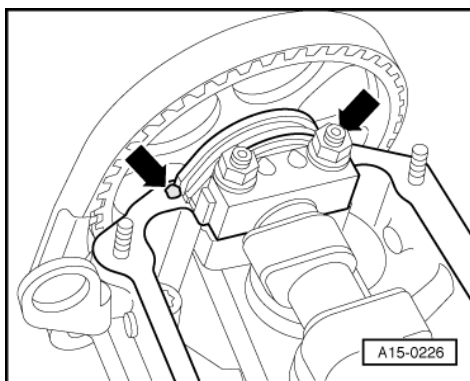


All models:

- -> Detach crankcase ventilation hose -arrow-.



- -> Remove the upper toothed belt guard -arrows-.
- Unscrew the nuts for the cylinder head cover.
- Remove reinforcement strips, bracket, toothed belt guard and cylinder head cover.



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Installing

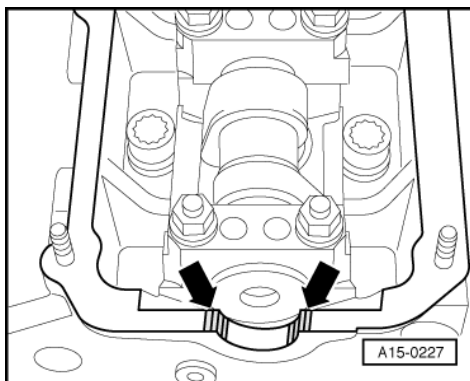
Installation is carried out in the reverse order; note the following:

Note:

Replace gaskets and seals.

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

=> Parts List





- -> Apply a small quantity of sealing compound to sealing points for half moon seal -arrows- on upper sealing surface of cylinder head.
- Sealing compound

=> Parts List

- Position cylinder head cover, reinforcement strips, toothed belt guard and bracket.
- Tighten nuts for cylinder head cover in diagonal sequence.

Tightening torques

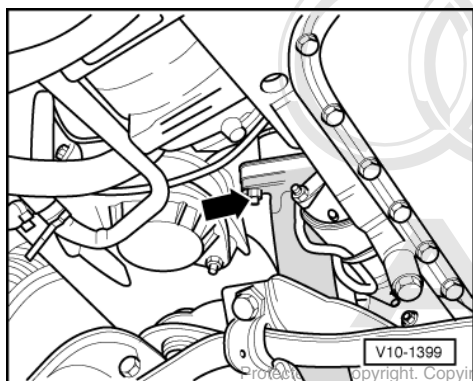
Component	Nm
Cylinder head cover to cylinder head	10
Fuel lines to cylinder head cover	10
Hose clamps	2

1.6 - Removing cylinder head -engine code AAE-

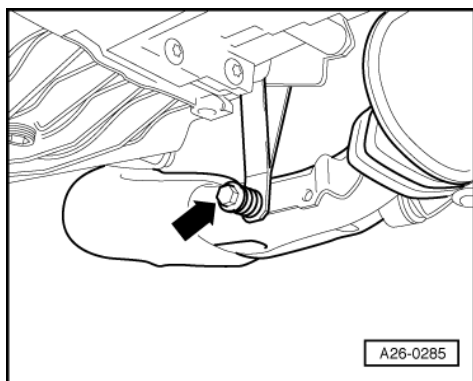
Note:

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

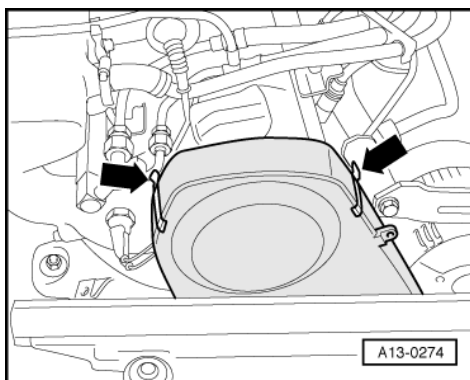
- Observe or obtain radio code on vehicles with coded radio.
- Disconnect earthing strap at battery with ignition switched off.
- Drain coolant => Page 187 .



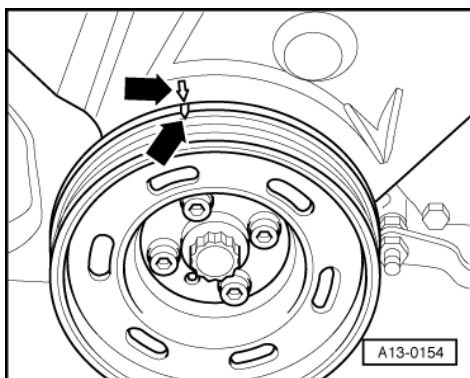
- -> Unscrew exhaust manifold/front exhaust pipe nuts -arrow-



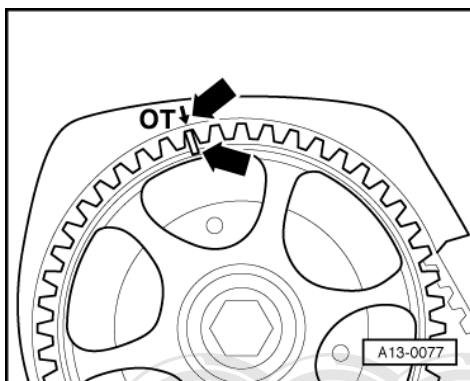
- -> Unbolt exhaust system at bracket -arrow-.
- Push exhaust system towards the rear so that studs on exhaust manifold are free.



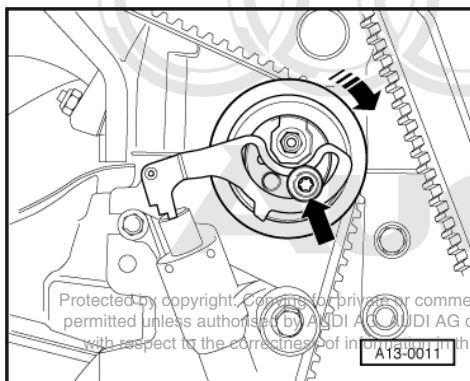
- -> Remove the upper toothed belt guard -arrows-.



- -> Set crankshaft to TDC mark for cylinder No. 1 -arrows- by turning central bolt on crankshaft toothed belt sprocket in direction of engine rotation...



- -> ...at the same time the marking on the camshaft sprocket must align with the marking at the toothed belt guard. If necessary, rotate crankshaft 1 additional turn.



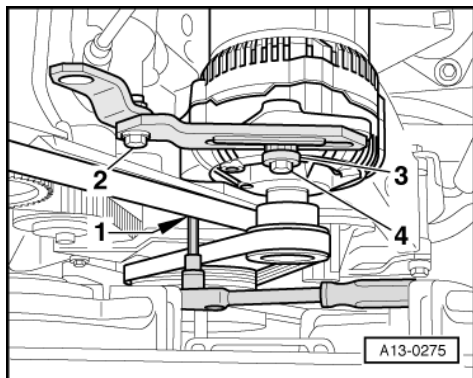
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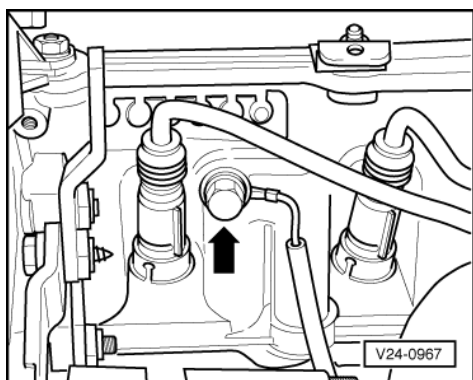
- -> Loosen toothed belt system with TORX key T45 -arrow below-.
- Press toothed belt tensioner downwards.
- Take toothed belt off camshaft sprocket.
- Unscrew Torx bolt and pivot tensioner plate forwards.

Note:

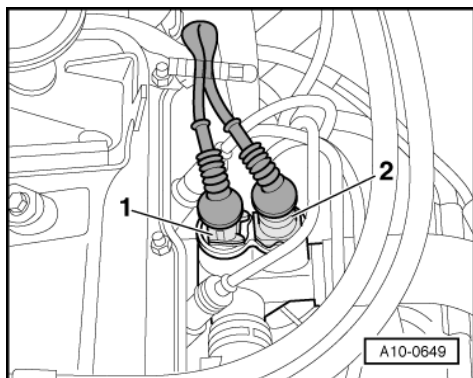
Mark the running direction with chalk or a felt-tipped pen before removing the ribbed belt. If the belt runs in the opposite direction when it is refitted, this can cause breakage.



- -> Loosen the bolts -1-, -2- and -4- by at least one turn.
- Release belt tension on V-belt or ribbed belt with tensioner nut -3-.
- Remove V-belt or ribbed belt from alternator belt pulley.
- Unscrew the bolt -2- and swing the alternator towards the left.
- Unscrew the 2 engine lifting eyelet bolts.



- -> Unbolt the earth connection point on the left side of the cylinder head -arrow-.

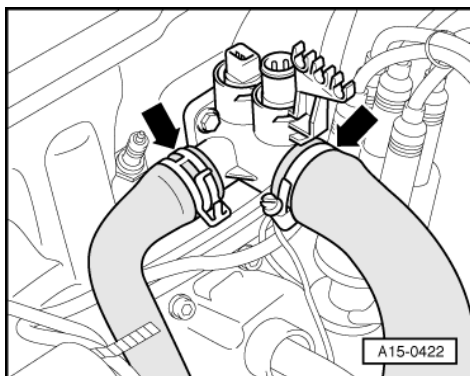


- -> Unplug the connectors at:
 - 1 - Coolant temperature sensor -G62

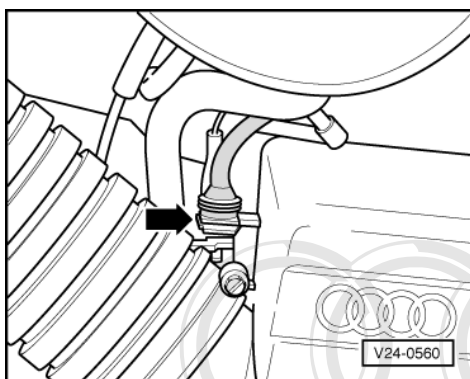


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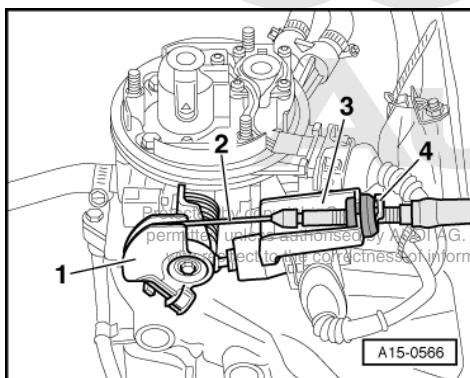
- 2 - Sensor for coolant temperature display -G2, and coolant temperature switch (too hot) -F14
- Unplug spark plug connectors and lay aside.



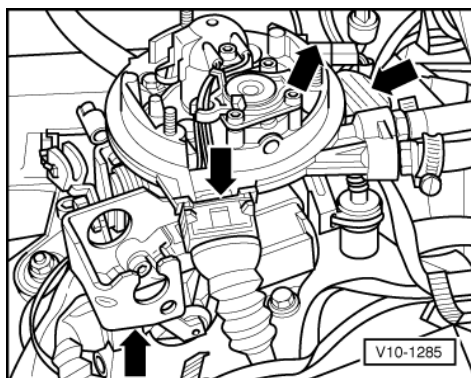
- -> Detach the coolant hoses on the left side of the cylinder head -arrows-.



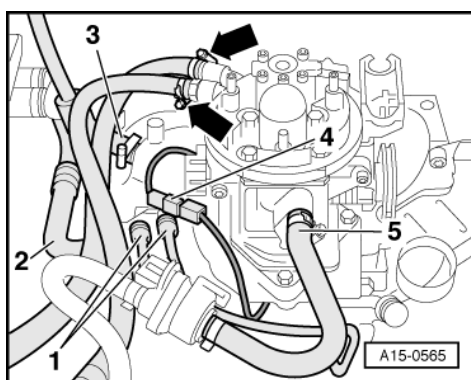
- -> Detach connectors -arrow- to the lambda probe.



- Detach air intake cowl on the throttle body injection unit with air intake hose.
- -> Detach the throttle cable -2- from cable disc -1- and support bracket -3- (do not remove retainer -4-). Move throttle cable to the side.



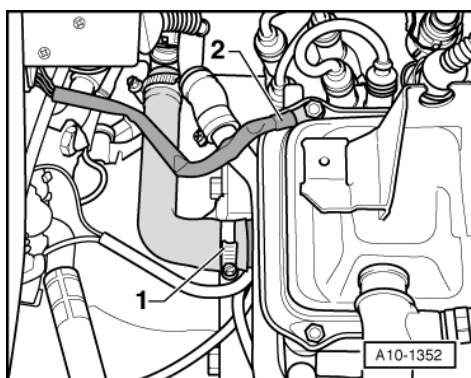
- -> Unplug connectors at the throttle body injection unit -arrows-.
- Lay wiring harness aside.



Important

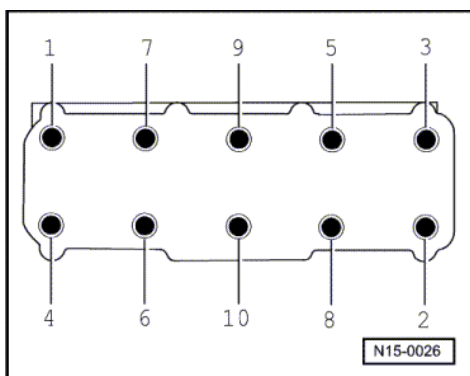
The fuel system is pressurised. Before opening the system place a cloth around the connection point. Then release pressure by carefully loosening the connection.

- -> Mark fuel feed pipe and fuel return pipe -arrows- and remove it from the throttle body unit.
- Detach connector -4-.
- Lay wiring harness aside.
- Detach vacuum hose -5- to ACF valve.
- Detach the vacuum line -3- to the brake servo unit from the intake manifold.
- Disconnect the coolant hose -2- to the intake manifold.



- -> Detach coolant hose -1- from the connection at rear of cylinder head.
- Unscrew earth wire -2- at cylinder head cover.
- Unbolt coolant pipe and rear crankcase ventilation pipe from cylinder head.

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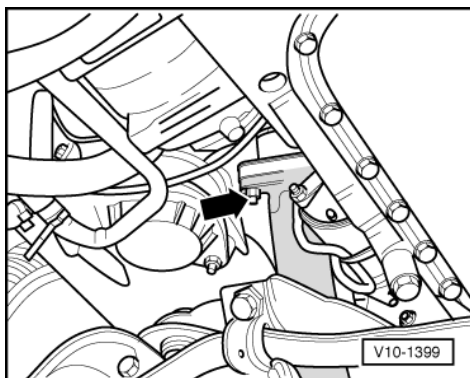
- Unscrew the nuts for the cylinder head cover.
- Remove reinforcement strips, bracket, toothed belt guard and cylinder head cover.
- -> Maintain sequence when loosening cylinder head bolts.
- Remove cylinder head.

1.7 - Removing cylinder head -engine codes AAD, ABB-

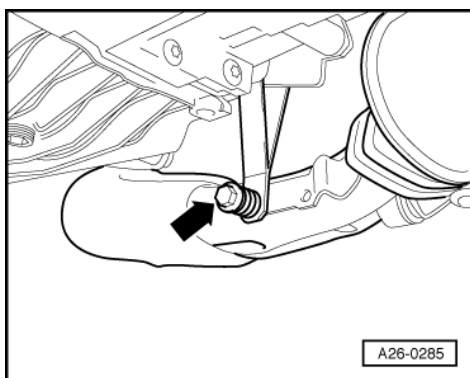
Note:

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

- Observe or obtain radio code on vehicles with coded radio.
- Disconnect earthing strap at battery with ignition switched off.
- Drain coolant => Page 187.



- -> Unscrew exhaust manifold/front exhaust pipe nuts -arrow-.



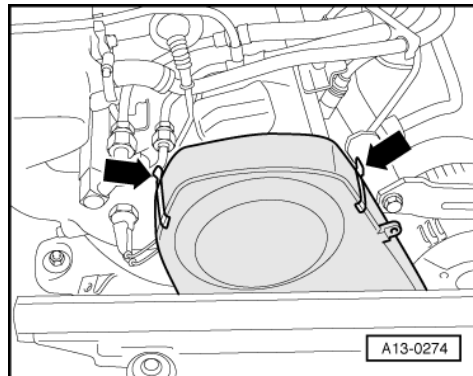
- -> Unbolt exhaust system at bracket -arrow-.



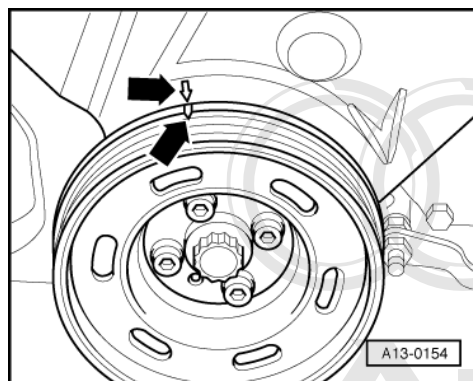
- Push exhaust system towards the rear so that studs on exhaust manifold are free.

Note:

Note electrical wiring of lambda probe.

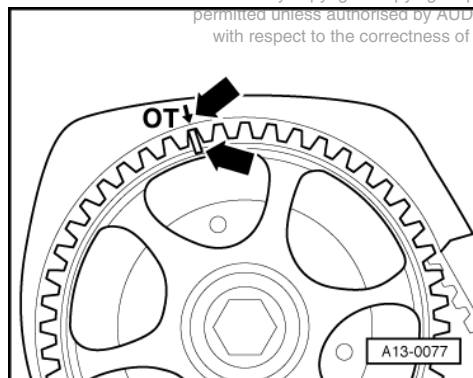


- -> Remove the upper toothed belt guard -arrows-.

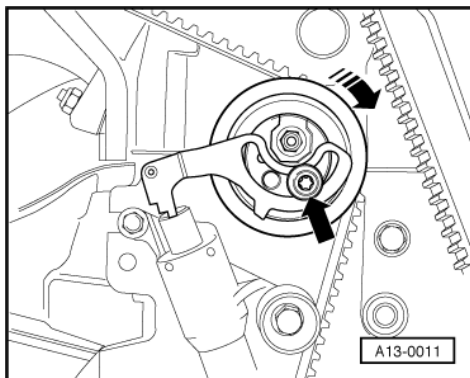


- -> Set crankshaft to TDC mark for cylinder No. 1 -arrows- by turning central bolt on crankshaft toothed belt sprocket in direction of engine rotation...

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- -> ...at the same time the marking on the camshaft sprocket must align with the marking on the toothed belt guard. If necessary, rotate crankshaft 1 additional turn.

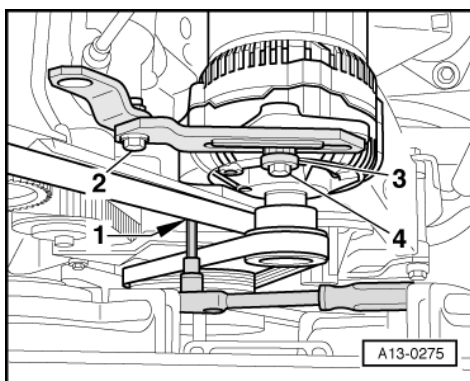


- -> Loosen toothed belt system with TORX key T45 -arrow below-.
- Press toothed belt tensioner downwards.
- Take toothed belt off camshaft sprocket.
- Unscrew Torx bolt and pivot tensioner plate forwards.

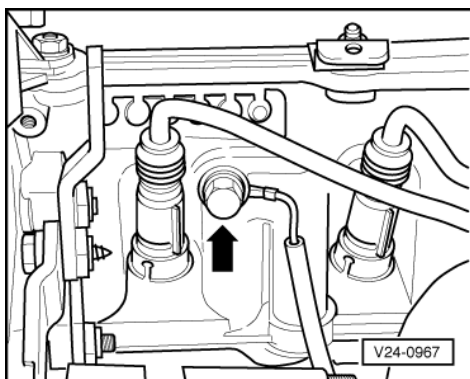
Note:

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

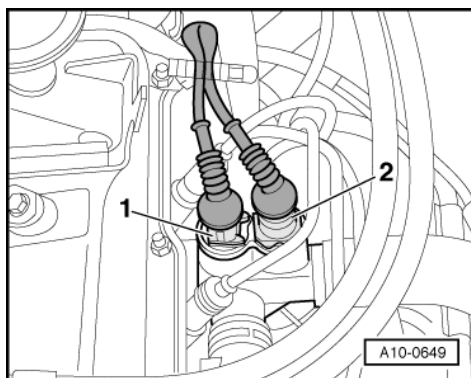
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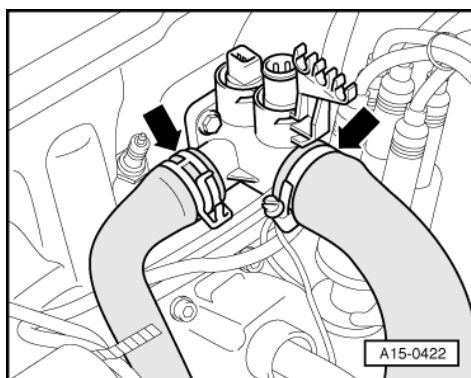
- -> Loosen the bolts -1-, -2- and -4- by at least one turn.
- Release belt tension on V-belt or ribbed belt with tensioner nut -3-.
- Remove V-belt or ribbed belt from alternator belt pulley.
- Unscrew the bolt -2- and swing the alternator towards the left.
- Unscrew the 2 engine lifting eyelet bolts.



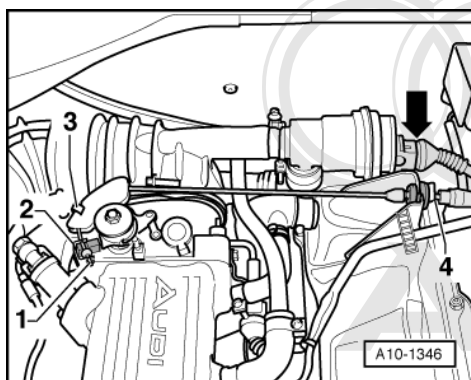
- -> Unbolt the earth connection point on the left side of the cylinder head -arrow-.



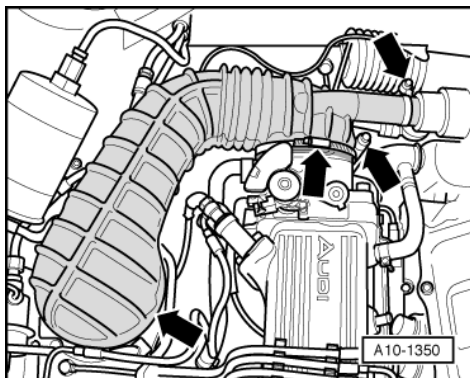
- -> Unplug the connectors at:
 - 1 - Coolant temperature sensor -G62
 - 2 - Sensor for coolant temperature display -G2, and coolant temperature switch (too hot) -F14
- Unplug spark plug connectors and lay aside.



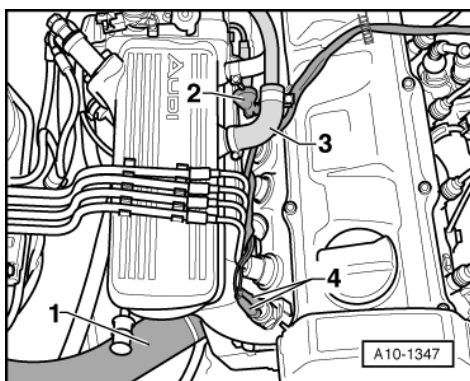
- -> Detach the coolant hoses on the left side of the cylinder head -arrows-.



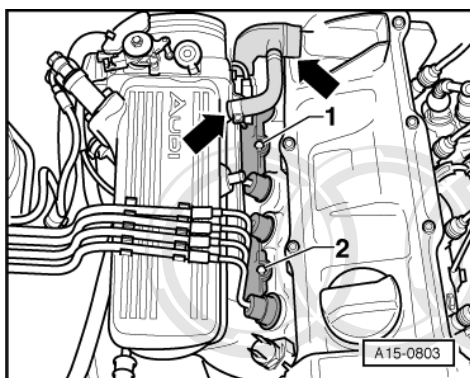
- -> Remove securing clips -2- and -3-.
- Detach throttle cable -1- at throttle valve body and support bracket (do not remove throttle cable retainer -4-). Move throttle cable to the side.
- Detach connector -arrow- from idling stabilisation valve.



- -> Remove the air intake cowl -arrows-.



- -> Detach the vacuum pipe -3- to the brake servo.
- Unplug connectors at fan run-on thermoswitch -4-.
- Detach connector -2- from throttle switch.
- Detach hose -1- of intake air preheater from warm air arrester plate on exhaust manifold.

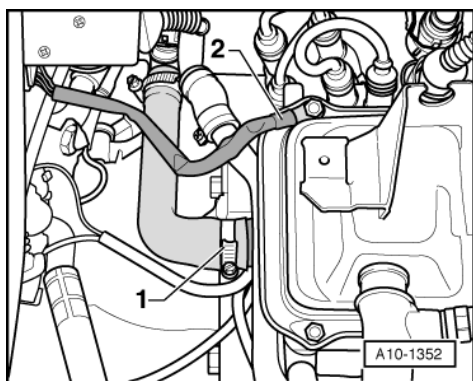


- -> Remove the crankcase breather hose -arrows-.
- Unbolt rear crankcase ventilation pipe from the cylinder head.
- Unbolt the injector retaining bar -1- and -2-.
- Remove the injectors with fuel lines connected from the intake manifold.

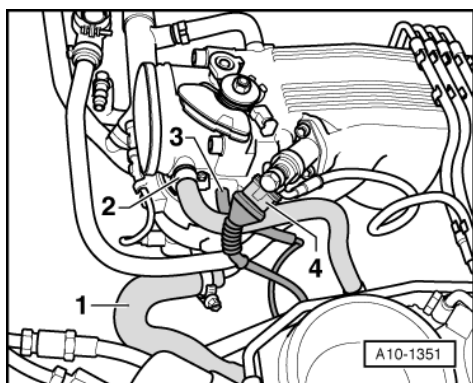
Note:

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Ensure that the fuel lines are not kinked.



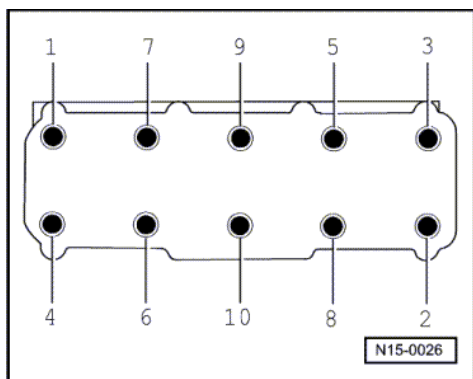
- -> Detach coolant hose -1- from the connection at rear of cylinder head.
- Unscrew earth wire -2- at cylinder head cover.
- Remove idling stabilisation valve from cylinder head cover.



- -> Disconnect wires/unplug connectors:

- 1 - Crankcase ventilation hose
- 2 - Connection on throttle valve unit to activated carbon filter solenoid valve 1 -N80
- 3 - Connection on throttle valve unit to intake air preheater
- 4 - Cold start valve -N17

- Detach the cold start valve with the fuel line connected from the intake manifold.



- Unscrew the nuts for the cylinder head cover.
- Remove reinforcement strips, bracket, toothed belt guard and cylinder head cover.
- -> Maintain sequence when loosening cylinder head bolts.
- Remove cylinder head.



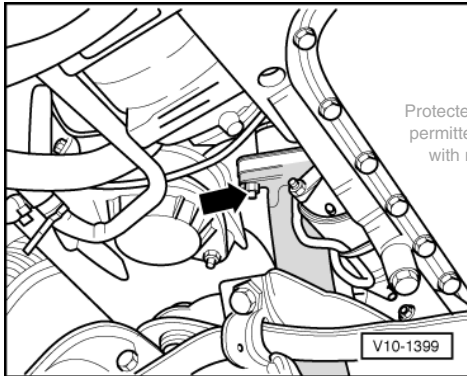
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1.8 - Removing cylinder head -engine codes ABK, ADA, ADW-

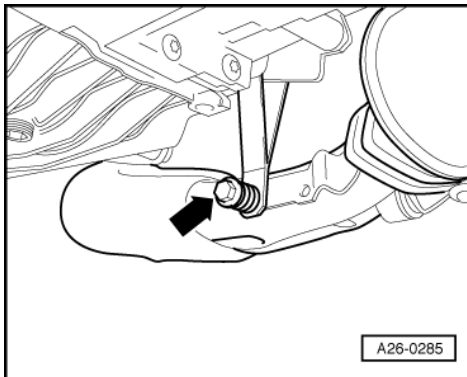
Note:

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

- Observe or obtain radio code on vehicles with coded radio.
- Disconnect earthing strap at battery with ignition switched off.
- Drain coolant => Page 187 .



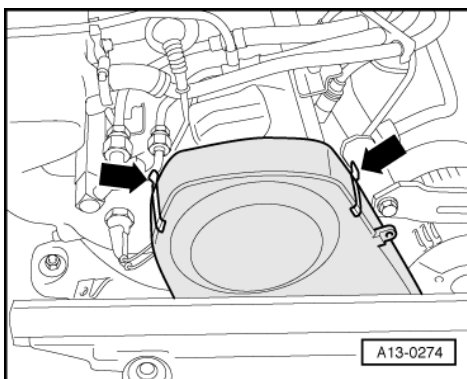
- -> Unscrew exhaust manifold/front exhaust pipe nuts -arrow-.



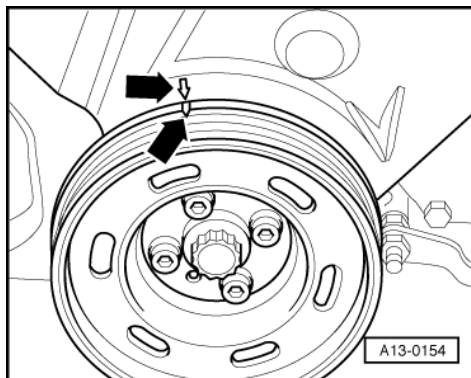
- -> Unbolt exhaust system at bracket -arrow-.
- Push exhaust system towards the rear so that studs on exhaust manifold are free.

Note:

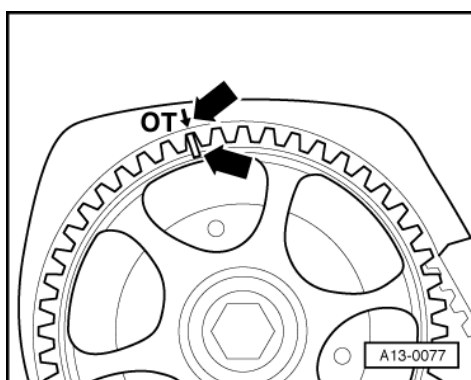
Note electrical wiring of lambda probe.



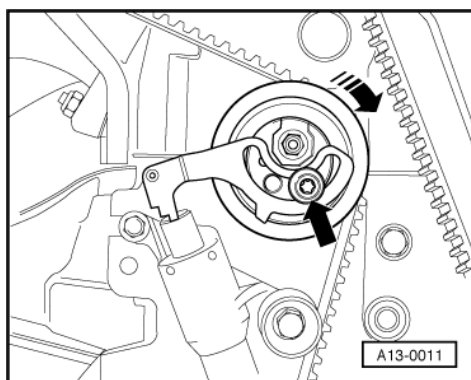
- -> Remove the upper toothed belt guard -arrows-.



- -> Set crankshaft to TDC mark for cylinder No. 1 -arrows- by turning central bolt on crankshaft toothed belt sprocket in direction of engine rotation...



- -> ...at the same time the marking on the camshaft sprocket must align with the marking on the toothed belt guard. If necessary, rotate crankshaft 1 additional turn.



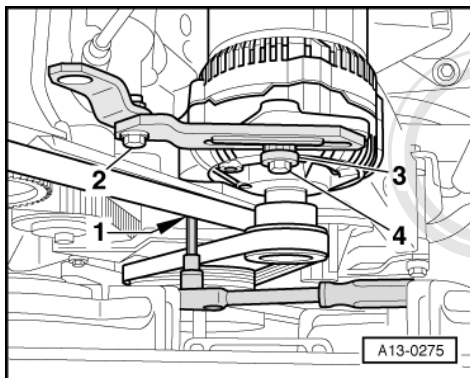
- -> Loosen toothed belt system with TORX key T45 -arrow below-.
- Press toothed belt tensioner downwards.
- Take toothed belt off camshaft sprocket.
- Unscrew Torx bolt and pivot tensioner plate forwards.

Note:

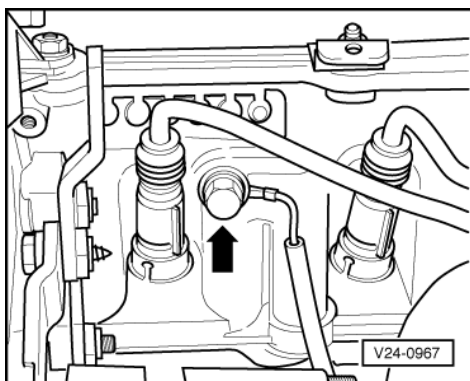
Mark the running direction with chalk or a felt-tipped pen before removing the ribbed belt. If the belt runs in the opposite direction when it is refitted, this can cause breakage.



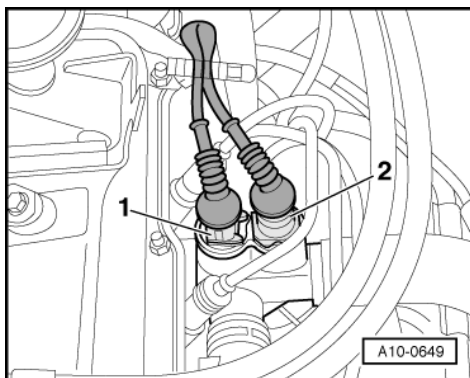
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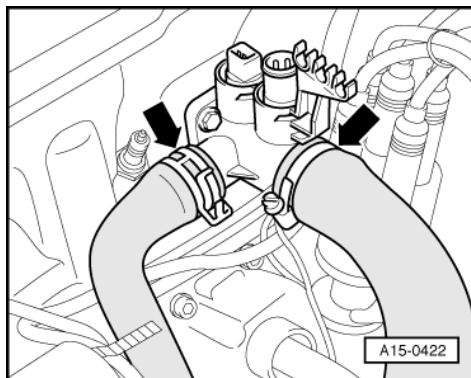
- -> Loosen the bolts -1-, -2- and -4- by at least one turn.
- Release belt tension on V-belt or ribbed belt with tensioner nut -3-.
- Remove V-belt or ribbed belt from alternator belt pulley.
- Unscrew the bolt -2- and swing the alternator towards the left.
- Unscrew the 2 engine lifting eyelet bolts.



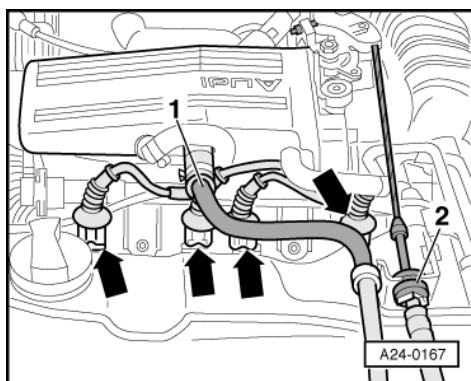
- -> Unbolt the earth connection point on the left side of the cylinder head -arrow-.



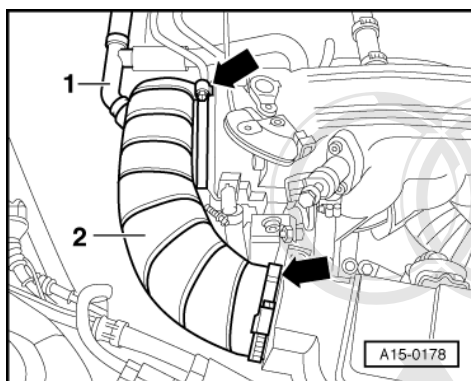
- -> Unplug the connectors at:
 - 1 - Coolant temperature sensor -G62
 - 2 - Sensor for coolant temperature display -G2, and coolant temperature switch (too hot) -F14
- Unplug spark plug connectors and lay aside.



- -> Detach the coolant hoses on the left side of the cylinder head -arrows-.

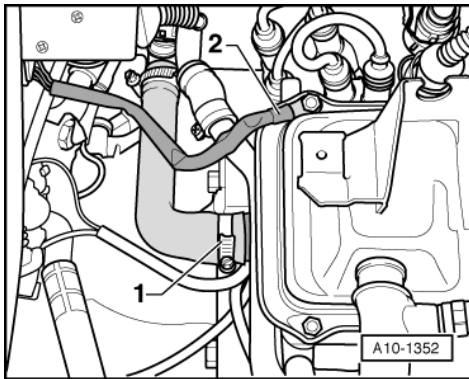


- -> Detach throttle cable -2- at throttle valve connection and support bracket (do not remove retainer). Move throttle cable to the side.
- Detach the vacuum pipe -1- to the brake servo unit.
- Unplug connectors -arrows- at the injectors.
- Unplug connectors at fan run-on thermoswitch.
- Lay wiring aside.
- Detach crankcase breather hose.

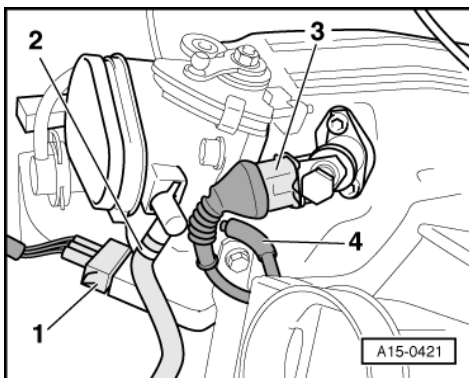


- -> Detach the air duct hose -2- from the throttle valve unit and the air flow meter, loosen hose clamps -arrows- for this purpose.
- Detach the elbow piece -1- from hose to cylinder head cover/intake manifold.
- Detach the heat shield for the throttle valve potentiometer at the side of the throttle valve body.

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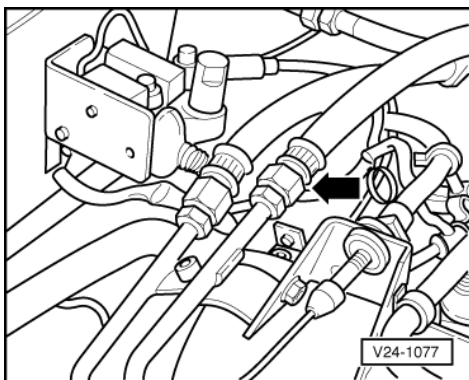


- -> Detach coolant hose -1- from the connection at rear of cylinder head.
- Unscrew earth wire -2- at cylinder head cover.
- Unbolt rear crankcase ventilation pipe from the cylinder head.



- -> Disconnect wires/unplug connectors:

- 1 - Throttle valve potentiometer -G69
- 2 - Connection on throttle valve unit to activated carbon filter solenoid valve 1 -N80
- 3 - Cold start valve -N17
- 4 - Connection on throttle valve unit to intake air preheater
- Idling switch -F60



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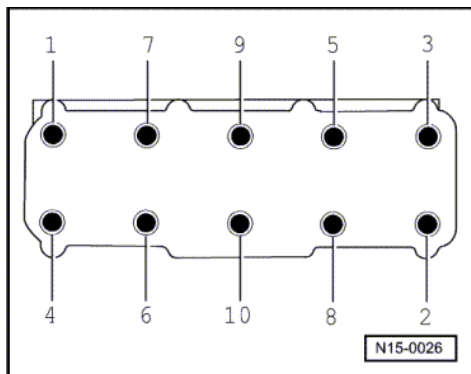
Important

The fuel system is pressurised. Before opening the system place a cloth around the connection point. Then release pressure by carefully loosening the connection.

- -> Disconnect fuel supply and return lines at the bolted connection -arrow-.



- Unscrew fuel supply and return lines from cylinder head cover.
- Detach hose of intake air preheater from warm air arrester plate on exhaust manifold.



- Unscrew the nuts for the cylinder head cover.
- Remove reinforcement strips, bracket, toothed belt guard and cylinder head cover.
- -> Maintain sequence when loosening cylinder head bolts.
- Remove cylinder head.

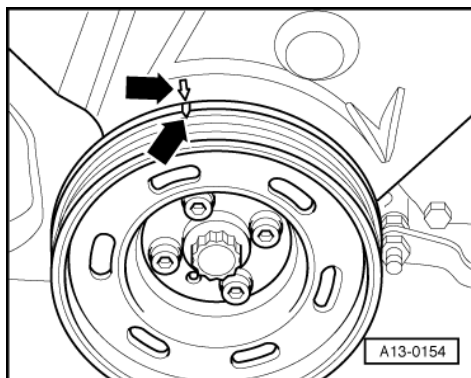
1.9 - Installing cylinder head

Notes:

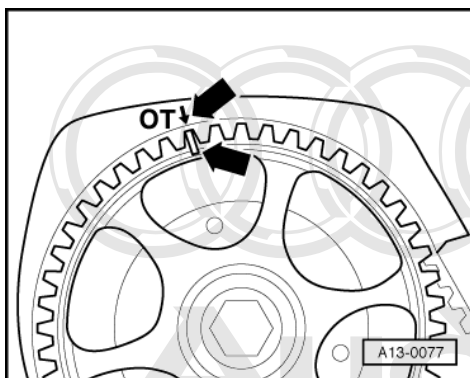
- ♦ Replace the cylinder head bolts.
- ♦ When performing installation procedures always replace self-locking nuts and bolts.
- ♦ Replace seals, gaskets, and bolts which have a specified tightening angle.
- ♦ Secure all hose connections with the correct hose clamps (same as original equipment).

=> Parts List

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

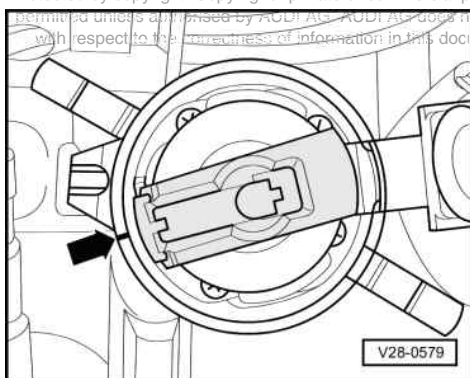


- Check that camshaft and crankshaft markings are in line with their reference points.
 - -> The notch on the vibration damper must face the TDC mark for cylinder No. 1 on the toothed belt guard -arrows-...



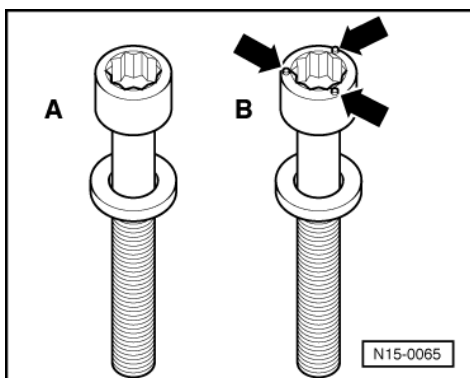
- -> ...at the same time the marking on the camshaft sprocket must align with the marking on the toothed belt guard -arrows-, set toothed belt guard in place on cylinder head for this purpose.

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- Check distributor rotor position:

-> If adjusted correctly, the distributor rotor must align with the mark -arrow- for cylinder No. 1 on the distributor housing.

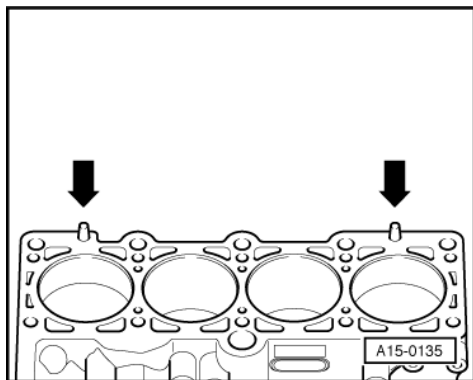


- -> Check allocation of cylinder head gasket/cylinder head bolts

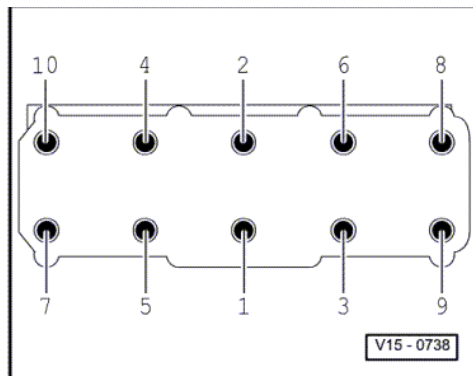
- A - Bolt with smooth bolt head
-For previously used cylinder head gasket
- B - Bolt with embossed bolt head -arrows-
-For metal cylinder head gasket

Note:

Use of metal cylinder head gasket starting from vehicle identification No. 4A_S_110 001.



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



- -> Tighten cylinder head in three stages in sequence shown, as follows:
 - 1st Stage: 40 Nm
 - 2nd Stage: 60 Nm
- Tighten with rigid wrench:
 - 3rd Stage: 180°(1/2 turn) further)

Notes:

- ♦ It is permissible to torque by 2 x 90°
- ♦ It is not necessary to re-tighten the cylinder head bolts

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

- Install cylinder head cover => Page 110 .
- Install toothed belt (adjust valve timing) => Page 73 .

Note:

Note all instructions on removing and installing the toothed belt

=>Page 68 .

- Install V-belt/ribbed belt for alternator => Page 56 .
- Check throttle cable setting

=> Fuel Supply - Petrol Engines; Repair group 20; Servicing throttle mechanism Servicing throttle mechanism

- Replace coolant => Page 188

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Notes:

- ♦ When the battery is reconnected make sure that the vehicle equipment (radio, clock, electrical window lifter) is activated according to the operating instructions.
- ♦ Further measures after reconnection of voltage supply:

=> Fuel Injection and Ignition System; Repair group 24

- To interrogate fault memory:

=> Fuel Injection and Ignition System; Repair group 01; Interrogating and erasing fault memory Interrogating and erasing fault memory

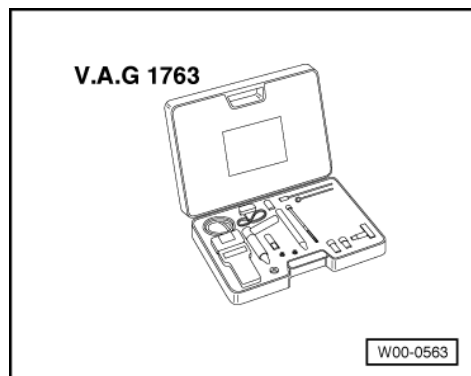
Note:

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

Tightening torques

Component	Nm
Lifting eyelet to cylinder head	20
Front exhaust pipe to exhaust manifold	30
Front exhaust pipe to mountings on gearbox	25
Earth wire to cylinder head	10

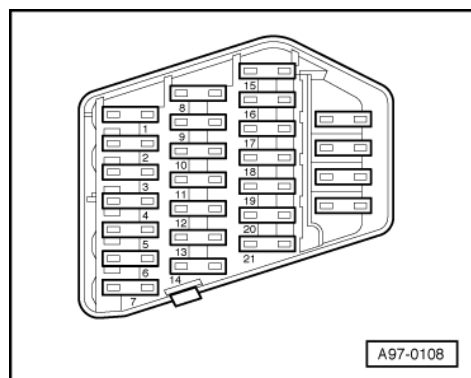
1.10 - Checking compression



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Special tools and workshop equipment required

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

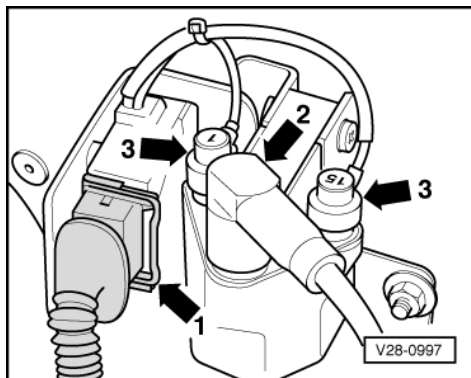




Test sequence

Test requirements:

- Engine oil temperature at least 30 °C
- Battery voltage at least 12.7 V
- Remove the cover of the left fuse holder.
- -> Remove fuse S17 from the fuse holder.



- -> Unplug the connector -arrow 1- of the power output stage from the ignition coil.
- Unplug spark plug connectors and lay aside.
- Remove spark plugs.
- Fully open throttle valve.
- Check compression with compression tester V.A.G 1381/V.A.G 1763.

Note:

Using the compression tester:

=> Operating Instructions

- Operate starter until tester shows no further pressure increase.

Compression values:

Engine code letters	New pressure in bar	Wear limit pressure in bar	Permissible difference between cylinders pressure in bar
AAD	10...13.0	7.5	max. 3.0
AAE	9...12.0	7.0	max. 3.0
ABB	10...13.0	7.5	max. 3.0
ABK	10...13.0	7.5	max. 3.0
ADA	10...13.0	7.5	max. 3.0
ADW	9...12.0	7.0	max. 3.0

- Install spark plugs.
- To interrogate fault memory:

=> Fuel Injection and Ignition System; Repair group 01; Interrogating and erasing fault memory Interrogating and erasing fault memory



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Note:

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

Tightening torque

Component	Nm
Spark plugs in cylinder head	30

2 - Servicing valve gear

2.1 - Servicing valve gear

2.2 - Different valve gear designs

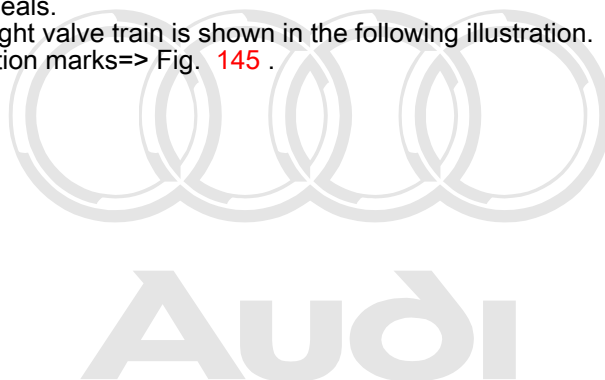
Since 09.94 the "light valve train" is installed instead of the "old valve train".

Important identification characteristics for the "light valve train":

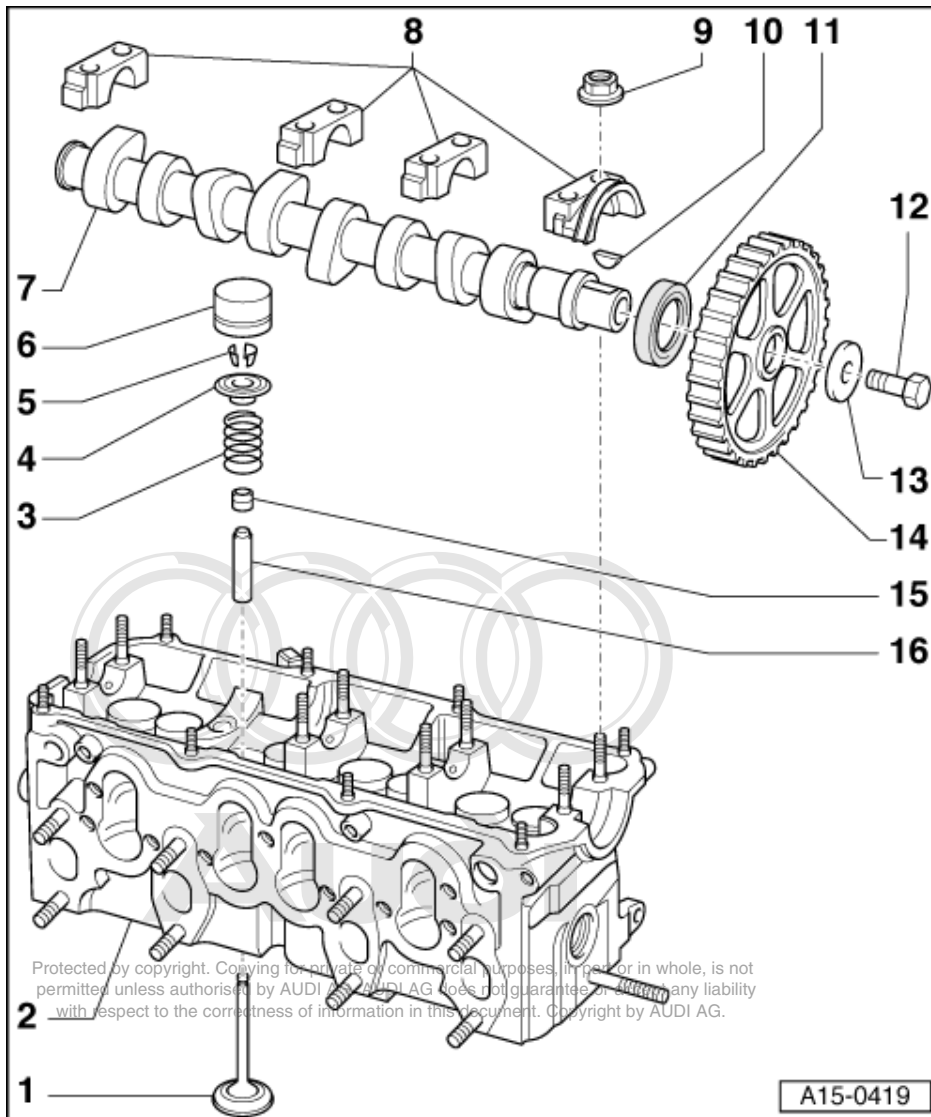
- ◆ One camshaft bearing has been discontinued
- ◆ Inner valve springs no longer used
- ◆ Lower valve plates no longer used
- ◆ The valve stem diameter was reduced
- ◆ Valve guide inside diameter reduced

Notes:

- ◆ Cylinder heads which have cracks between the valve seats or between valve seat inserts and the spark plug thread can be used further without reducing service life, provided the cracks do not exceed a maximum of 0.3 mm in width, or when no more than the first 4 turns of the spark plug threads are cracked.
- ◆ After installing the camshaft, wait for about 30 minutes before starting the engine. Hydraulic valve compensation elements have to settle (otherwise valves will strike pistons).
- ◆ After working on the valve gear, turn the engine carefully at least 2 rotations to ensure that none of the valves make contact when the starter is operated.
- ◆ Renew all gaskets and seals.
- ◆ The cylinder head with light valve train is shown in the following illustration.
- ◆ Old valve train identification marks=> Fig. 145.



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1 Valve

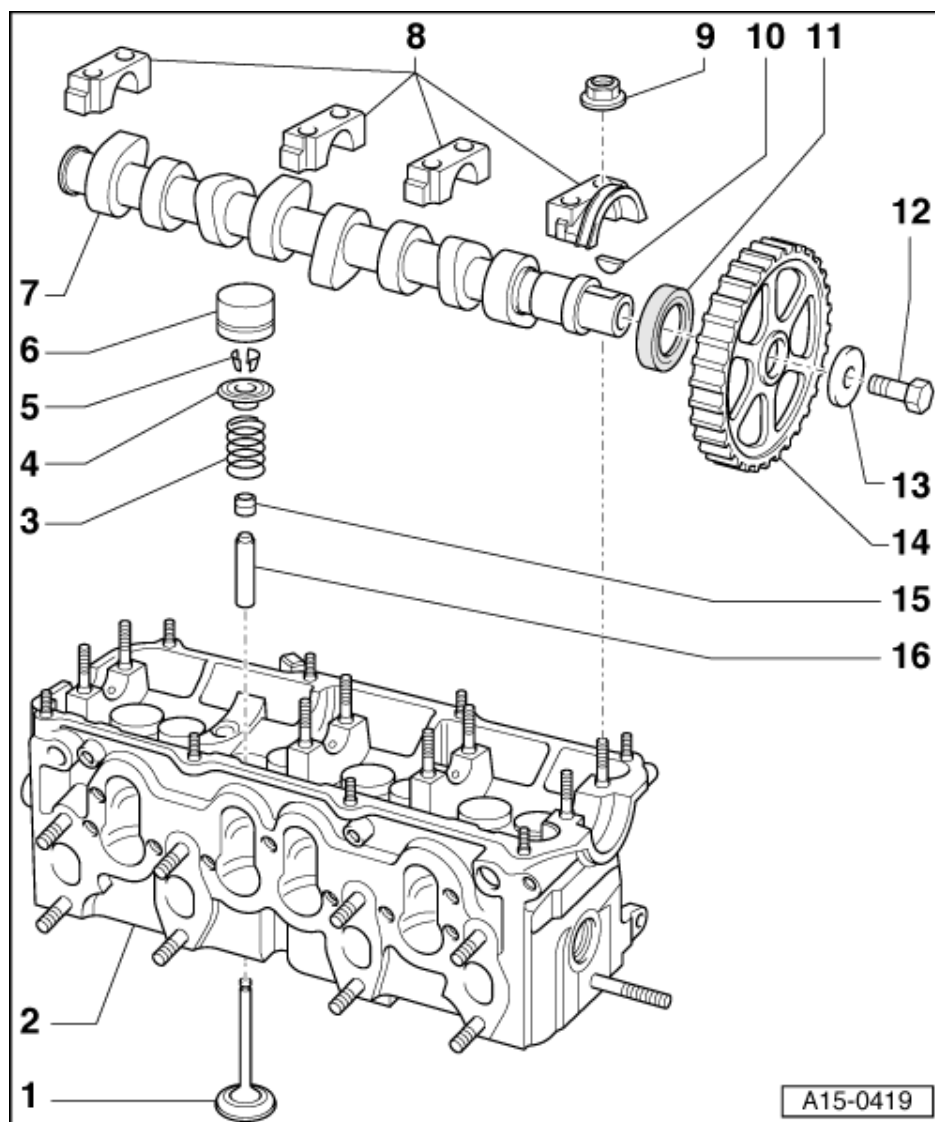
- ◆ Do not rework only grinding in is permitted
- ◆ Valve dimensions for old valve train
=> Fig. 146
- ◆ Valve dimensions for light valve train => Fig. 147

2 Cylinder head

- ◆ See note=>Page 139
- ◆ Checking valve guides=>Page 159
- ◆ Rework valve seats =>Page 163

3 Valve springs

- ◆ Only one valve spring per valve for light valve gear
- ◆ Valve springs for old valve gear
=> Fig. 145
- ◆ Removing and installing:
with cylinder head installed => Page 156
with cylinder head removed with 2037

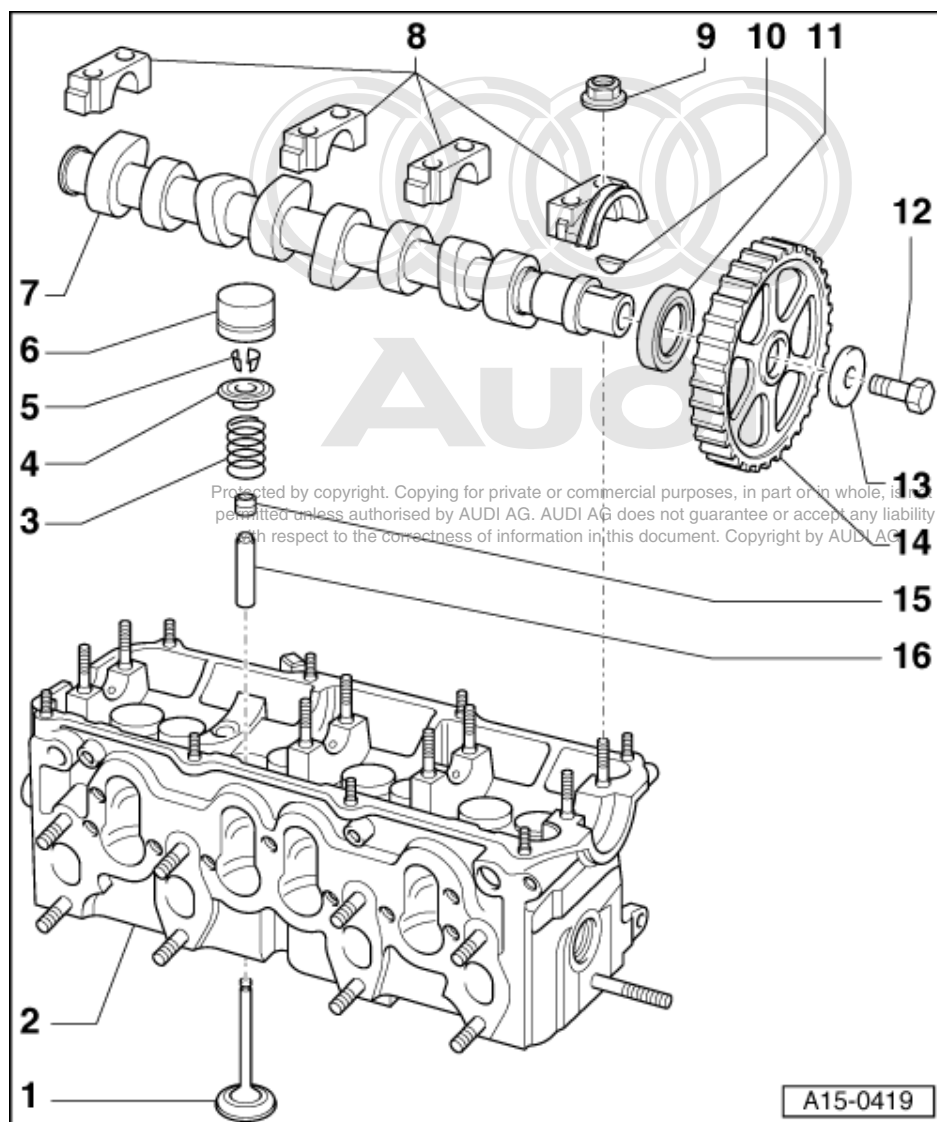
**4 Valve spring plate****5 Valve cotteners****6 Hydraulic bucket tappet**

- ◆ Checking => Page 155
- ◆ Removing and installing
=>Page 156
- ◆ Do not interchange
- ◆ Store with cam contact surface downwards
- ◆ Before installing check camshaft axial play=> Fig. 145
- ◆ Oil contact surface

7 Camshaft

- ◆ Checking axial play=> Fig. 145
- ◆ Removing and installing
=>Page 151
- ◆ Checking radial play with Plastigage Wear limit: 0.1 mm
- ◆ Run-out:
no more than 0.01 mm

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**8 Bearing cap**

- ◆ Installation position => Fig. 147
- ◆ Installation sequence=> Page 151 , Removing and installing camshaft
- ◆ Before installation, apply thin coating of housing sealing compound to contact surfaces of bearing cap No. 1
- ◆ Housing sealing compound

=> Parts List

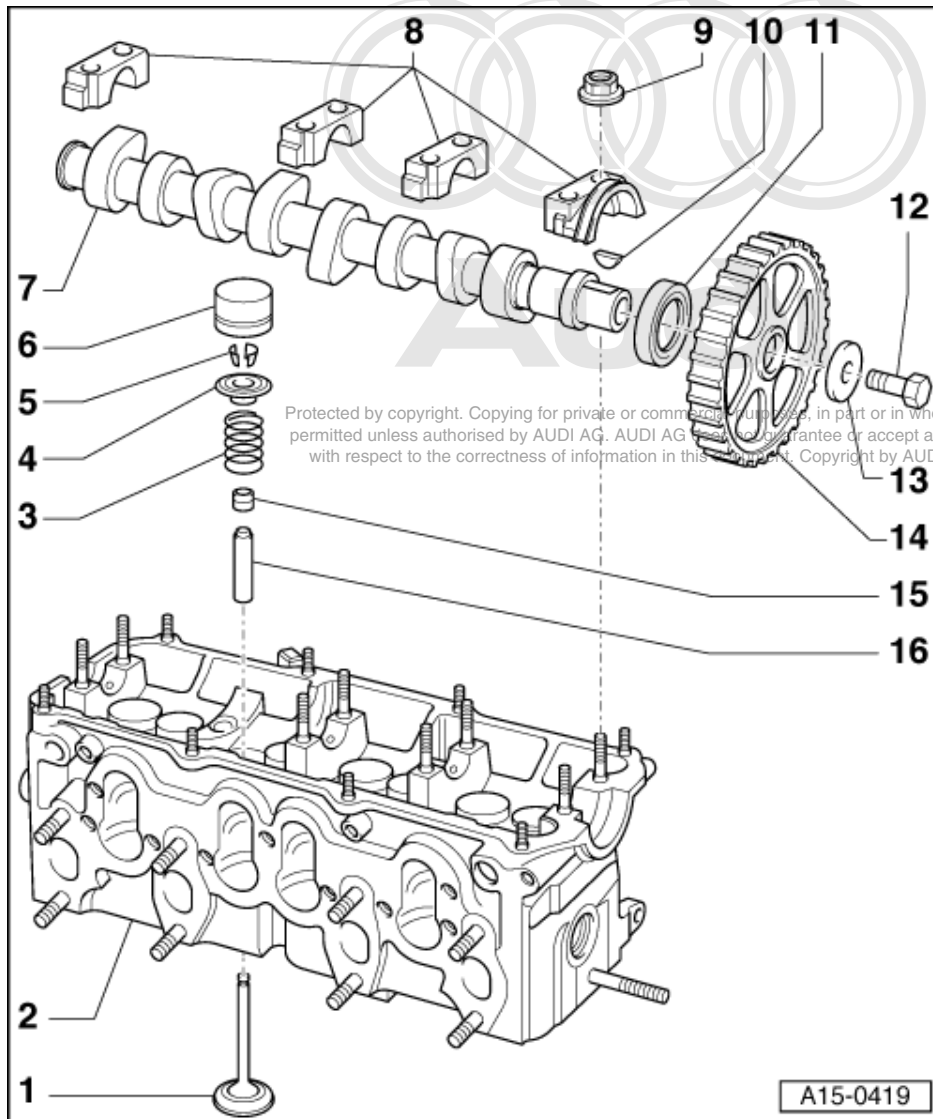
- ◆ Applying sealant to sealing points
=> Fig. 107

9 20 Nm**10 Woodruff key**

- ◆ Ensure tight fit

11 Sealing ring

- ◆ Replacing => Page 148



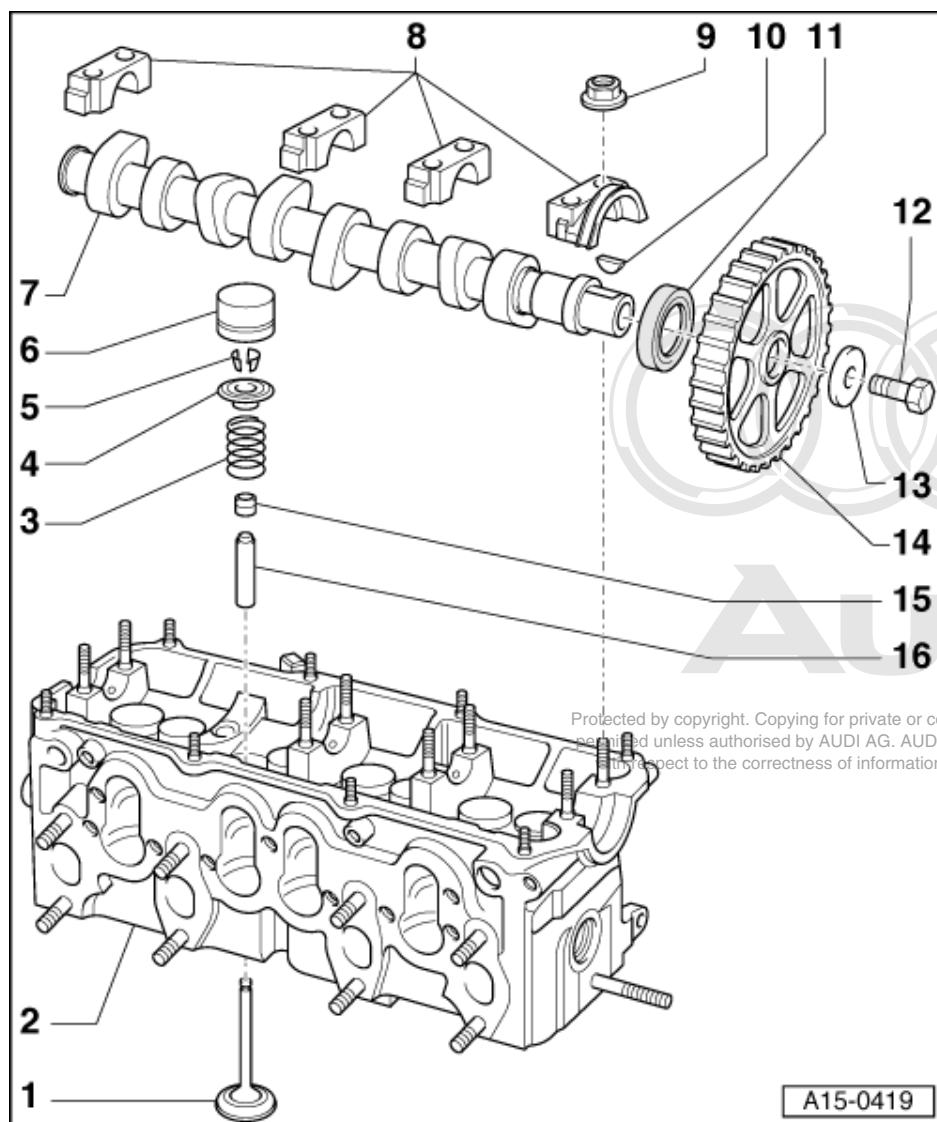
12 100 Nm

- ♦ Counterhold with 3036 to loosen and tighten

13 Washer

14 Camshaft sprocket

- ♦ For removal and installation remove toothed belt => Page 68
- ♦ Note correct installation position:
The small web on the camshaft gear faces forward and the TDC mark on cylinder 1 is visible from the front
=>Page 151
- ♦ Installation position is fixed by Woodruff key -Item 10 -



15 Valve stem seal

- ◆ Different valve stem seals for the old and light valve trains

=> Parts List

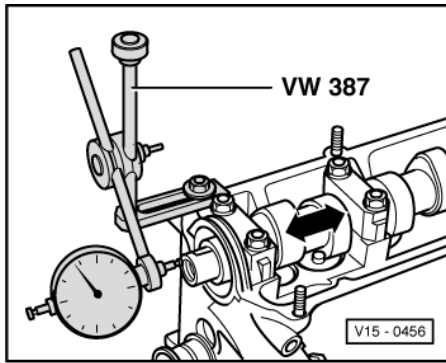
- ◆ Replacing => Page 156

16 Valve guide

- ◆ Different valve guides for the old and light valve trains

=> Parts List

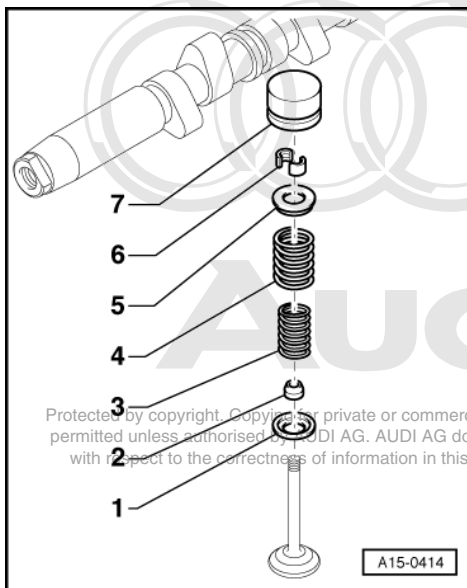
- ◆ Checking => Page 159
- ◆ Replacing => Page 161



-> Fig. 1 Camshaft, checking axial play

Wear limit:
no more than 0.15 mm

Measure with tappets removed and with first and last bearing caps fitted.



-> Fig.2 Old valve train

Engine codes AAD, ABB, ADA (all)

up to engine-No. AAE 032 209

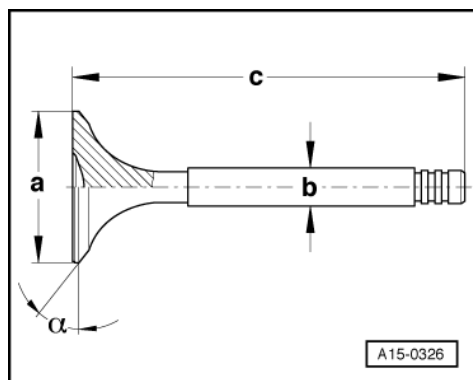
up to engine-No. ABK 243 926

up to engine-No. ADW 247 215

- 1 - Lower valve spring plate
- 2 - Valve stem seal
- 3 - Inner valve spring
- 4 - Outer valve spring
- 5 - Upper valve spring plate
- 6 - Valve cotter



7 - Hydraulic tappet



-> Fig. 3 Valve dimensions for old valve train

Engine codes AAD, ABB, ADA (all)

up to engine-No. AAE 032 209

up to engine-No. ABK 243 926

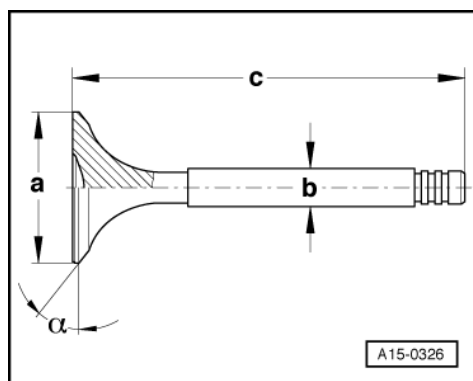
up to engine-No. ADW 247 215

Dim.	Inlet valve	Exhaust valve
øa mm	40.0	33.0
øb mm	7.97	7.95
c mm	91.9	91.2
α °	45	45

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Note:

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



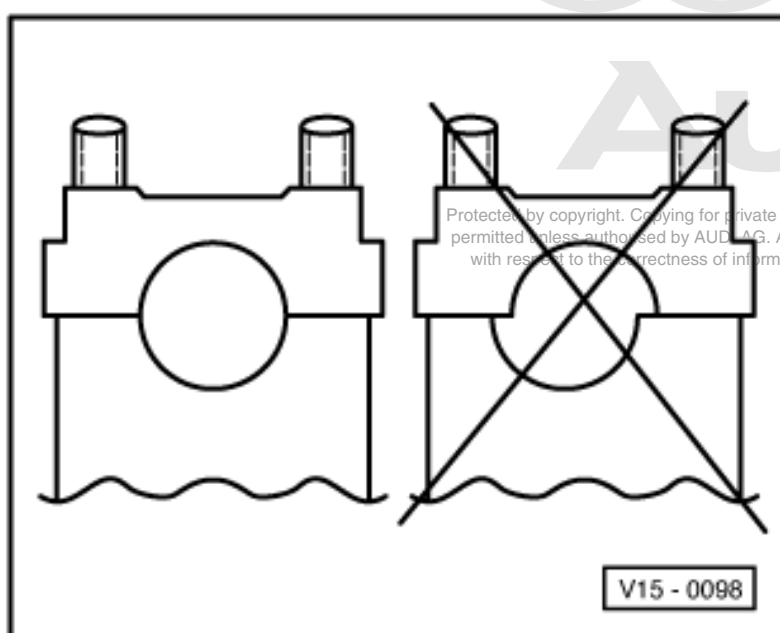
-> Fig. 4 Valve dimensions for light valve train

starting from engine-No. AAE 032 210

starting from engine-No. ABK 243.927

starting from engine-No. ADW 247.216

Dim.	Inlet valve	Exhaust valve
øa mm	39.5 ±0.15	32.9 ±0.15
øb mm	6.92 ±0.02	6.92 ±0.02
c mm	91.85	91.15
α °	45	45

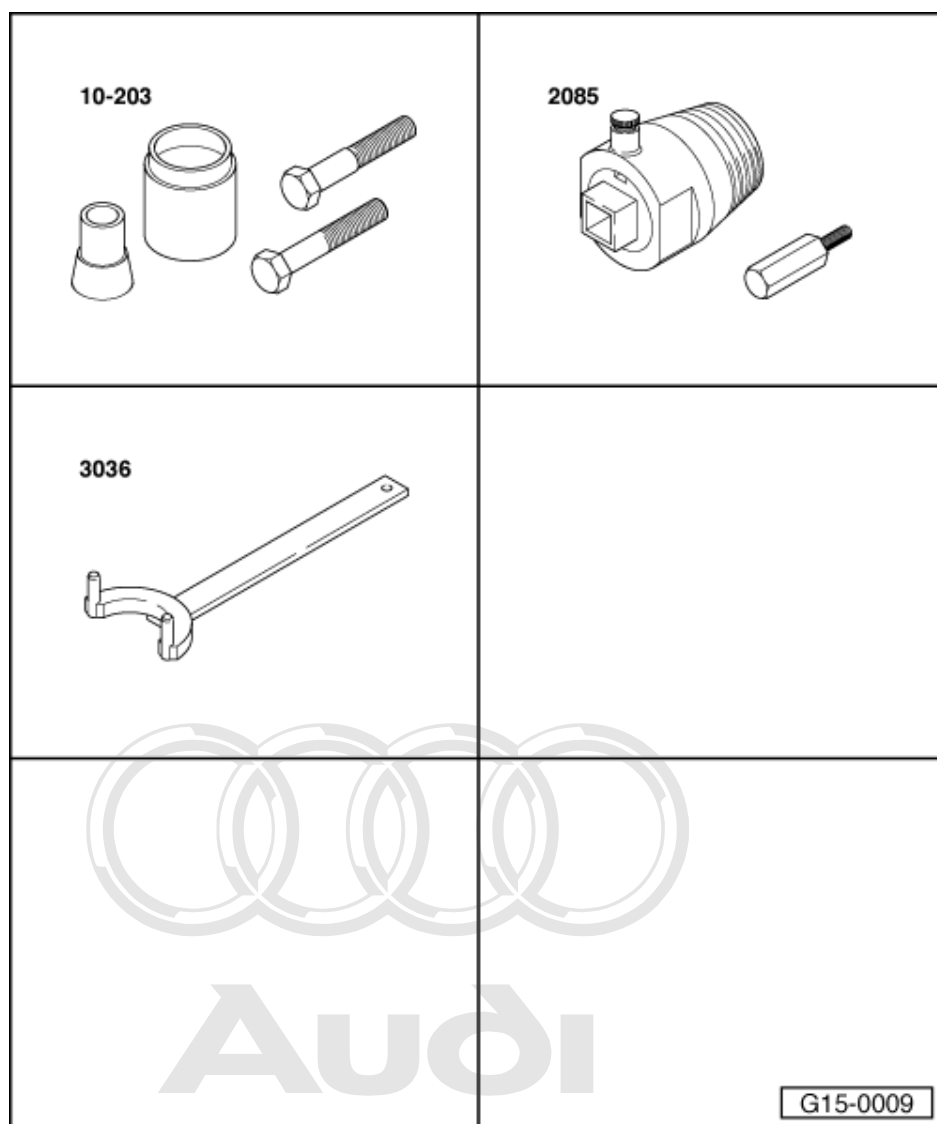


-> Fig. 5 Installation position of camshaft bearing caps

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



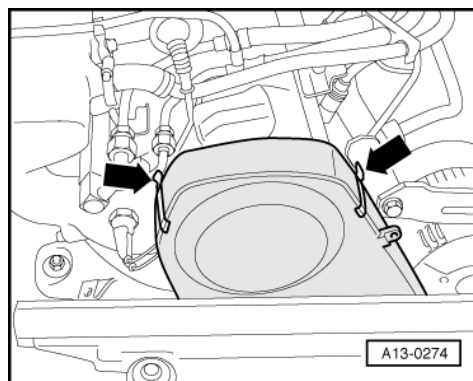
2.3 - Replacing camshaft oil seal



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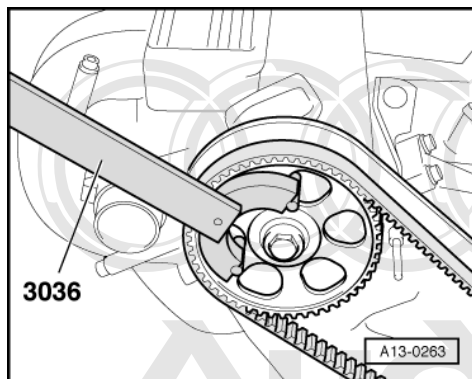
Special tools and workshop equipment required

- ♦ Installing tool 10-203
- ♦ Oil seal extractor 2085
- ♦ Counterhold 3036

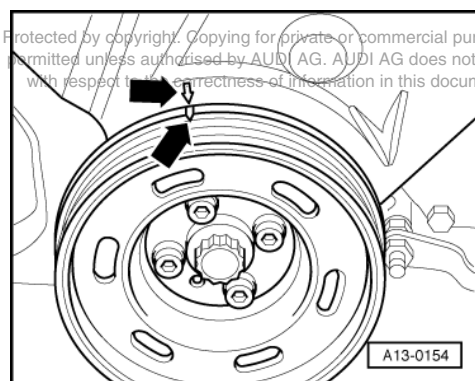


Removing

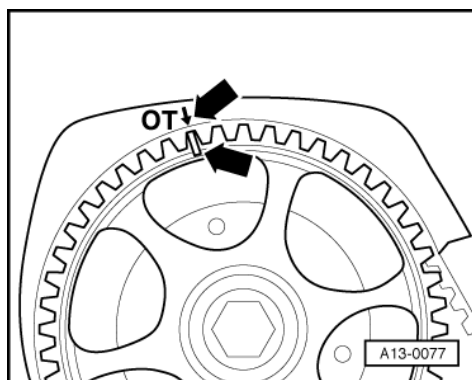
- Cylinder head installed
- -> Remove the upper toothed belt guard -arrows-.



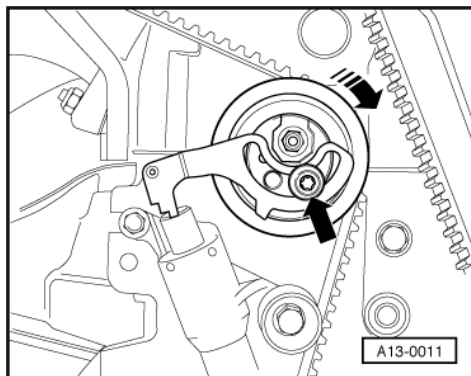
- -> Loosen bolt on camshaft sprocket using special tool 3036 to counterhold.



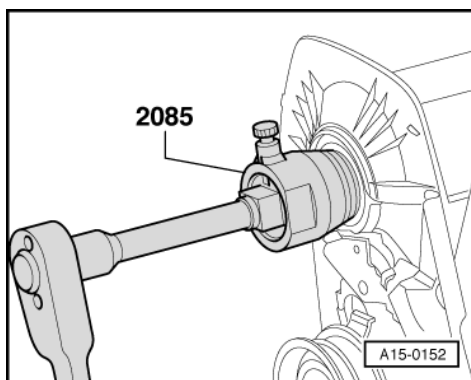
- -> Set crankshaft to TDC mark for cylinder No. 1 -arrows- by turning central bolt on crankshaft toothed belt sprocket in direction of engine rotation...



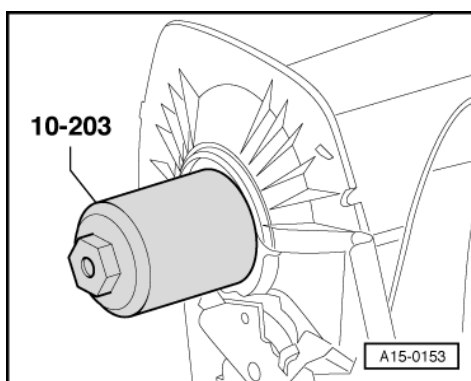
- -> ...at the same time the marking on the camshaft sprocket must align with the marking at the toothed belt guard -arrows-. If necessary, rotate crankshaft 1 additional turn.



- -> Loosen toothed belt system with TORX key T45 -arrow below-.
- Press toothed belt tensioner downwards.
- Take toothed belt off camshaft sprocket.
- Remove camshaft sprocket.
- Remove Woodruff key from camshaft.
- Screw camshaft sprocket securing bolt fully into camshaft.
- Adjust inner part of oil seal extractor 2085 until it is flush 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, screw it into oil seal as far as possible.
- Loosen knurled screw and turn inner part of extractor against camshaft until oil seal has been extracted.
- Clamp flats of oil seal extractor in vice. Remove oil seal with pliers.

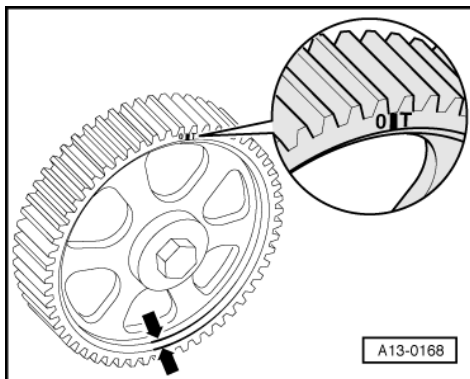


Installing

- -> Hold oil seal in position with guide sleeve from 10-203 and press in until flush using press sleeve 10-203.
- Insert Woodruff key.

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- -> Install camshaft sprocket.
- Note correct installation position:
Narrow web on camshaft sprocket faces outwards -arrows- and marking for No. 1 cylinder TDC is visible.
- Fit securing bolt for camshaft sprocket (use counterhold tool 3036).
- Install toothed belt (adjust valve timing) => Page 73 .

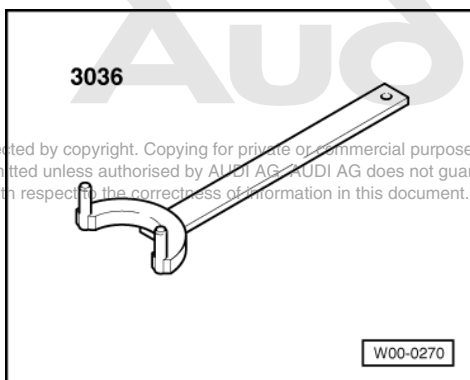
Note:

Note all instructions on removing and installing the toothed belt
=>Page 68 .

Tightening torque

Component	Nm
Camshaft sprocket to camshaft	100

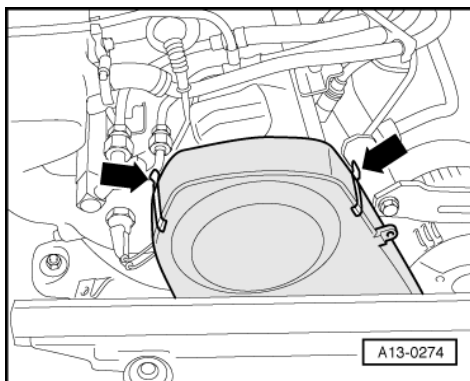
2.4 - Removing and installing camshaft



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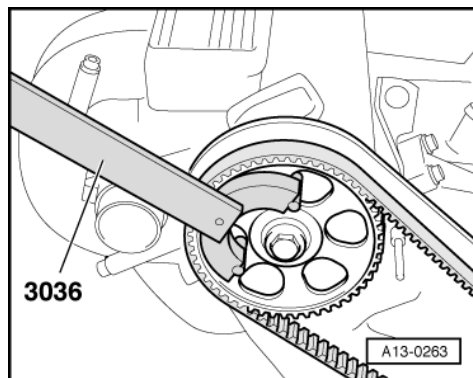
Special tools and workshop equipment required

- ♦ Counterhold 3036

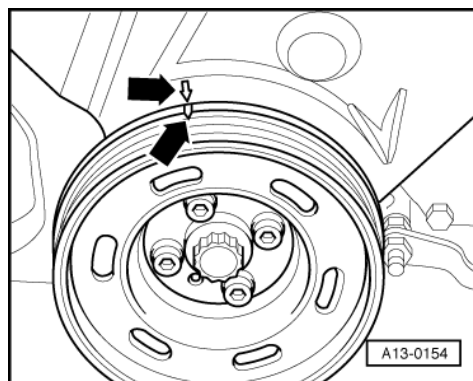


Removing

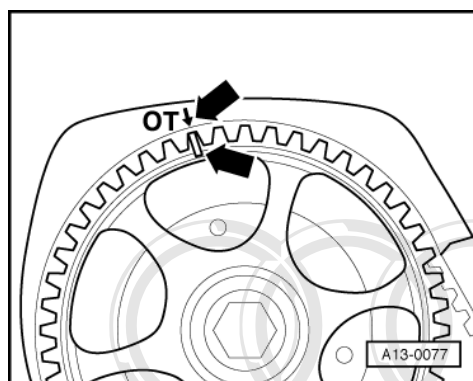
- Cylinder head installed
- -> Remove the upper toothed belt guard -arrows-.



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



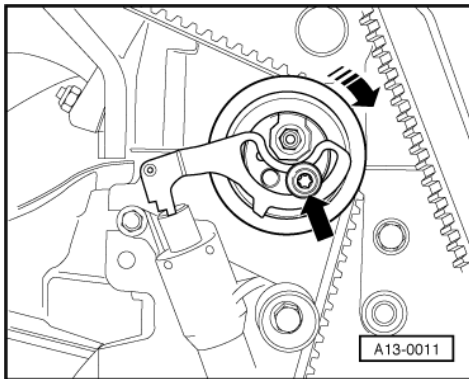
- -> Set crankshaft to TDC mark for cylinder No. 1 -arrows- by turning central bolt on crankshaft toothed belt sprocket in direction of engine rotation...



- -> ...at the same time the marking on the camshaft sprocket must align with the marking at the toothed belt guard -arrows-. If necessary, rotate crankshaft 1 additional turn.

Audi

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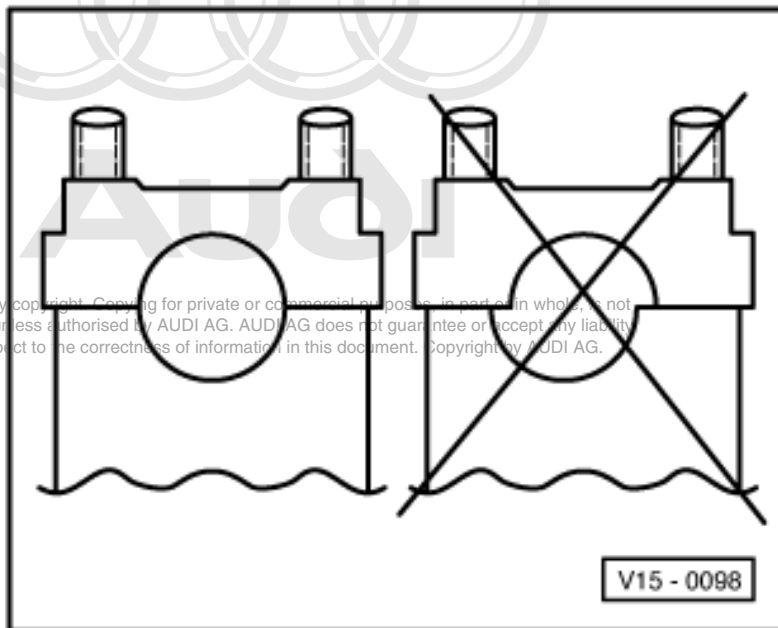


- -> Loosen toothed belt system with TORX key T45 -arrow below-.
- Press toothed belt tensioner downwards.
- Remove the toothed belt from the camshaft sprocket.
- Remove camshaft sprocket.
- Remove Woodruff key from camshaft.
- Remove cylinder head cover => Page 115 .
- Only remove bearing caps 1, 3 and 5. Loosen bearing caps 2 and 4 alternately and diagonally.

Note:

Bearing cap No. 5 is no longer used on the light valve train.

- Remove camshaft.



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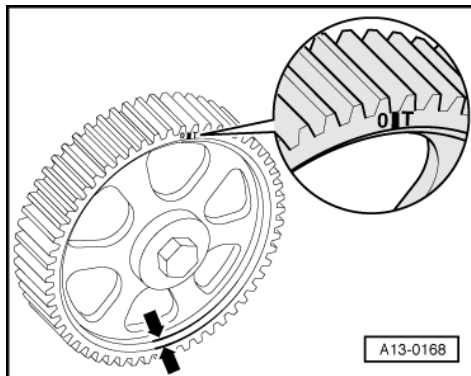
Installing

Notes:

- ◆ Renew camshaft oil seal.
- ◆ When installing the camshaft, No. 1 cylinder cams must point upwards.



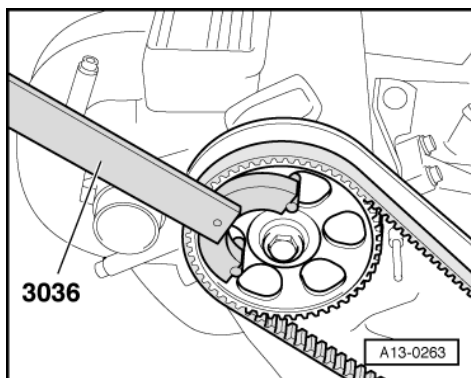
- ♦ -> Before installing bearing caps, note bore offset and determine installation position.
- Oil camshaft running surfaces.
- Insert camshaft.
- Tighten bearing caps 2 and 4 alternately and diagonally to 20 Nm.
- Install bearing caps 5, 1 and 3 and also tighten to 20 Nm.



Note:

Bearing cap No. 5 is no longer used on the light valve train.

- Insert Woodruff key in camshaft.
- -> Install camshaft sprocket.
 - Note correct installation position:
Narrow web on camshaft sprocket faces outwards -arrows- and marking for No. 1 cylinder TDC is visible.



- -> Install securing bolt of camshaft sprocket (use counterhold 3036).
- Install toothed belt (adjust valve timing) => Page 73 .

Notes:

- ♦ Note all instructions on removing and installing the toothed belt
=>Page 68 .
- ♦ After installing the camshaft, wait for about 30 minutes before starting the engine. Hydraulic valve compensation elements have to settle (otherwise valves will strike pistons).
- ♦ After working on the valve gear, turn the engine carefully at least 2 rotations to ensure that none of the valves make contact when the starter is operated.
- Install cylinder head cover => Page 117 .

Tightening torques

Component	Nm
Bearing cap to cylinder head	20

Component	Nm
Camshaft sprocket to camshaft	100

2.5 - Checking hydraulic bucket tappets

Special tools and workshop equipment required

- ♦ Feeler gauge
- ♦ Wood or plastic wedge

Notes:

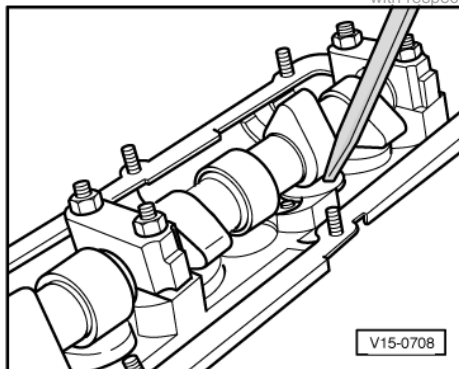
- ♦ Hydraulic tappets cannot be adjusted or repaired.
- ♦ Irregular valve noise during starting is normal.
- Start engine and leave it running until coolant temperature has reached approx. 80 °C.
- Increase engine speed to about 2500 rpm for 2 minutes (perform road test if necessary).

Note:

If the irregular valve noises stop but recur repeatedly during short journeys, a new oil retention valve must be fitted. Oil retention valve fitting location: In oil filter retainer => -Item 171.

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

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

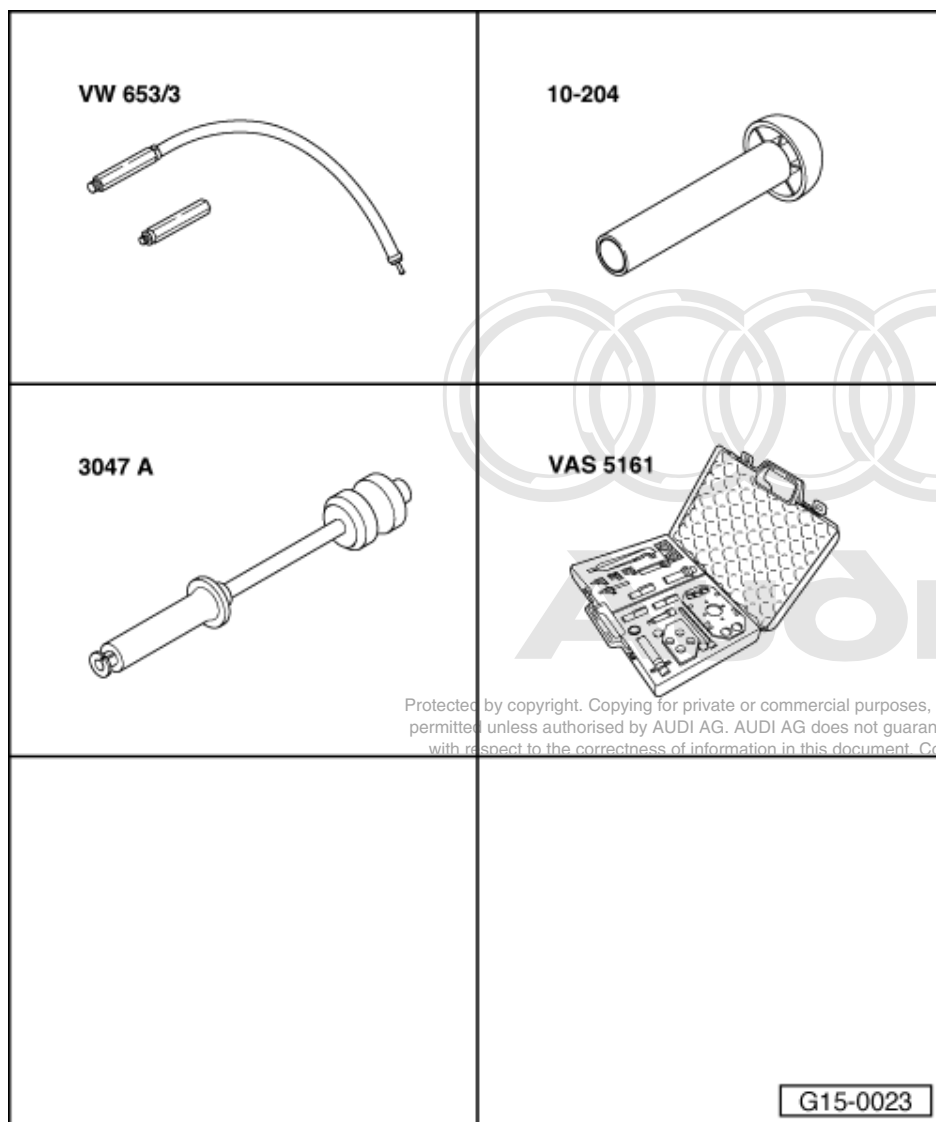


- -> Use a wooden or plastic wedge to push down bucket tappet. If an 0.20 mm feeler gauge can be inserted between camshaft and tappet, renew tappet.
- Replacing bucket tappet => Removing camshaft, Page 151.

Notes:

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

2.6 - Replacing valve stem seals



Special tools and workshop equipment required

- ♦ Pressure hose VW 653/3
- ♦ Press-on tool 10-204
- ♦ Puller 3047 A
- ♦ Disassembly and assembly tool VAS 5161

Removing

- Cylinder head installed

Note:

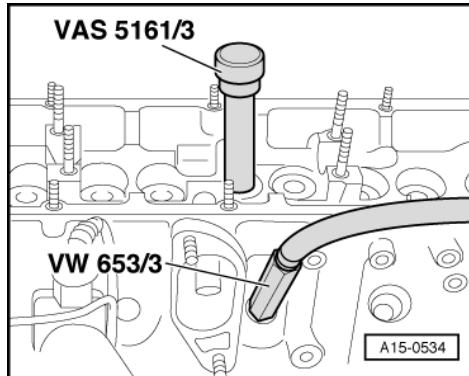
When cylinder head was removed the valve stem seals can be replaced when using special tool 2037.

- Removing camshaft => Page **151** .

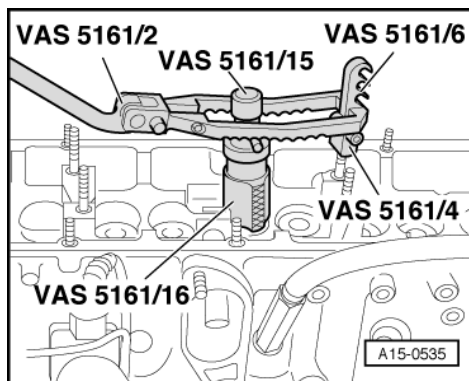
Notes:

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

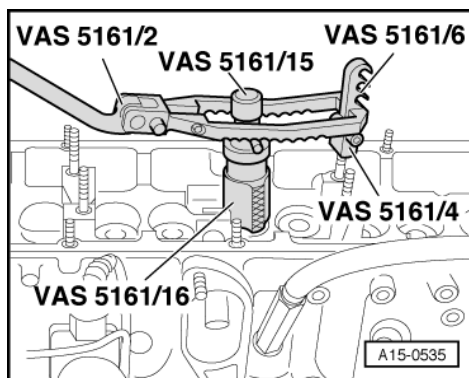
- ♦ Mark allocation of bucket tappets on rear with a waterproof felt-tip pen.
- Remove the bucket tappets from guides and put them down with the contact surface downwards.
- Remove spark plugs.
- Set piston of appropriate cylinder to "bottom dead centre".



- -> Screw in the pressure hose VW 653/3 into spark plug thread and put under constant pressure; at least 6 bar pressure.
- Install pin VAS 5161/3 into bucket tappet guide.
- Drive tightly fitting valve wedges of both valves loose using a plastic hammer.



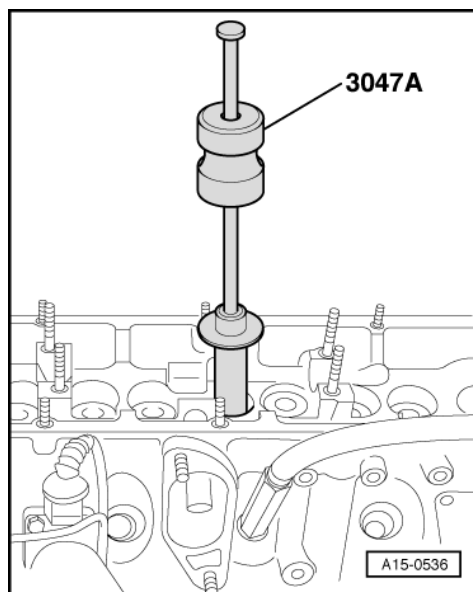
- -> Screw the catch part VAS 5161/6 with insertion fork VAS 5161/4 onto a stud on the cylinder head.
- Push guide bush VAS 5161/16 into bucket tappet guide of the valve to be removed until limit stop.
 - Installation position: Hatched areas face driving direction
- Push assembly cartridge VAS 5161/15 into guide bush.



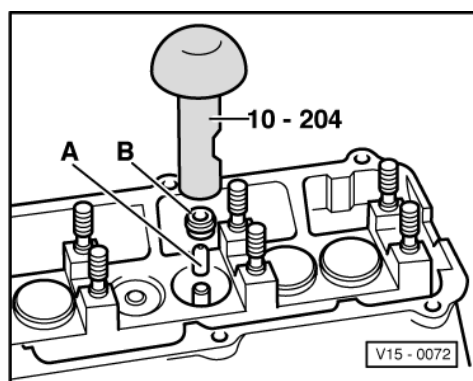
- -> Attach pressure fork VAS 5161/2 to catch part VAS 5161/6 and push assembly cartridge down.
- At the same time turn knurled screw of assembly cartridge towards the right until the tips of the valve wedges engage.
- Slightly move the knurled screw back and forth. This causes the valve wedges to be pressed apart and taken into the cartridge.
- Release the pressure fork.



- Remove assembly cartridge, guide bush, valve plate and valve springs.

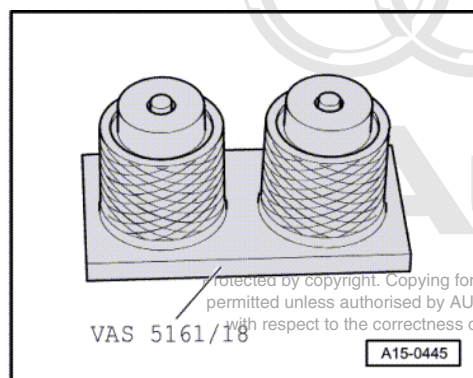


- -> Use 3047 A to remove valve stem seals.



Installing

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

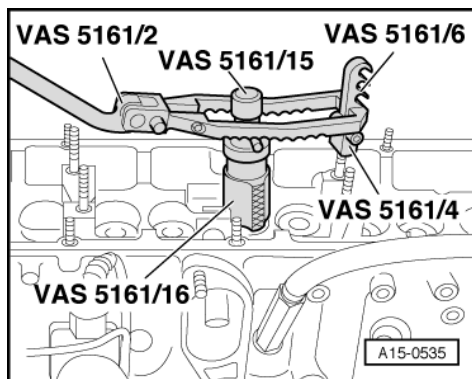


- -> If the valve wedges were taken out of the assembly cartridge they must first be inserted into the installing tool VAS 5161/18.

Note:

The large diameter of the valve wedges points upwards.

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



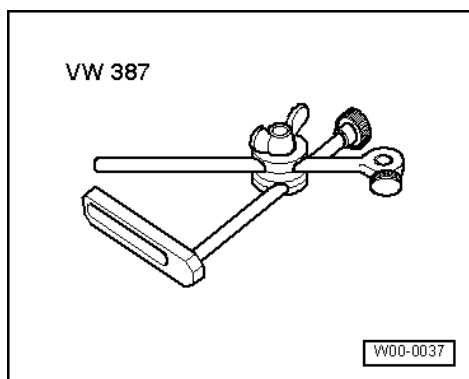
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- -> Reinstall the assembly cartridge VAS 5161/15 into guide bush VAS 5161/16.
- Push pressure fork down and pull knurled screw upwards by turning to left and right - thus the valve wedges are installed.
- Take load of the pressure fork when knurled screw is still tight.
- Insert bucket tappet.
- Installing camshaft =>Page 153 .

Notes:

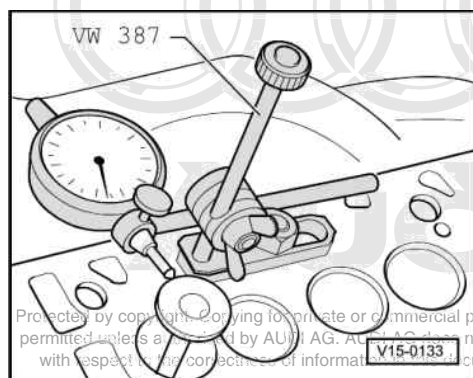
- ♦ After installing the camshaft, wait for about 30 minutes before starting the engine. Hydraulic valve compensation elements have to settle (otherwise valves will strike pistons).
- ♦ After working on the valve gear, turn the engine carefully at least 2 rotations to ensure that none of the valves make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

2.7 - Checking valve guides



Special tools and workshop equipment required

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



Procedure

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

Wear limit

Inlet valve guide	Exhaust valve guide
1.0 mm	1.3 mm

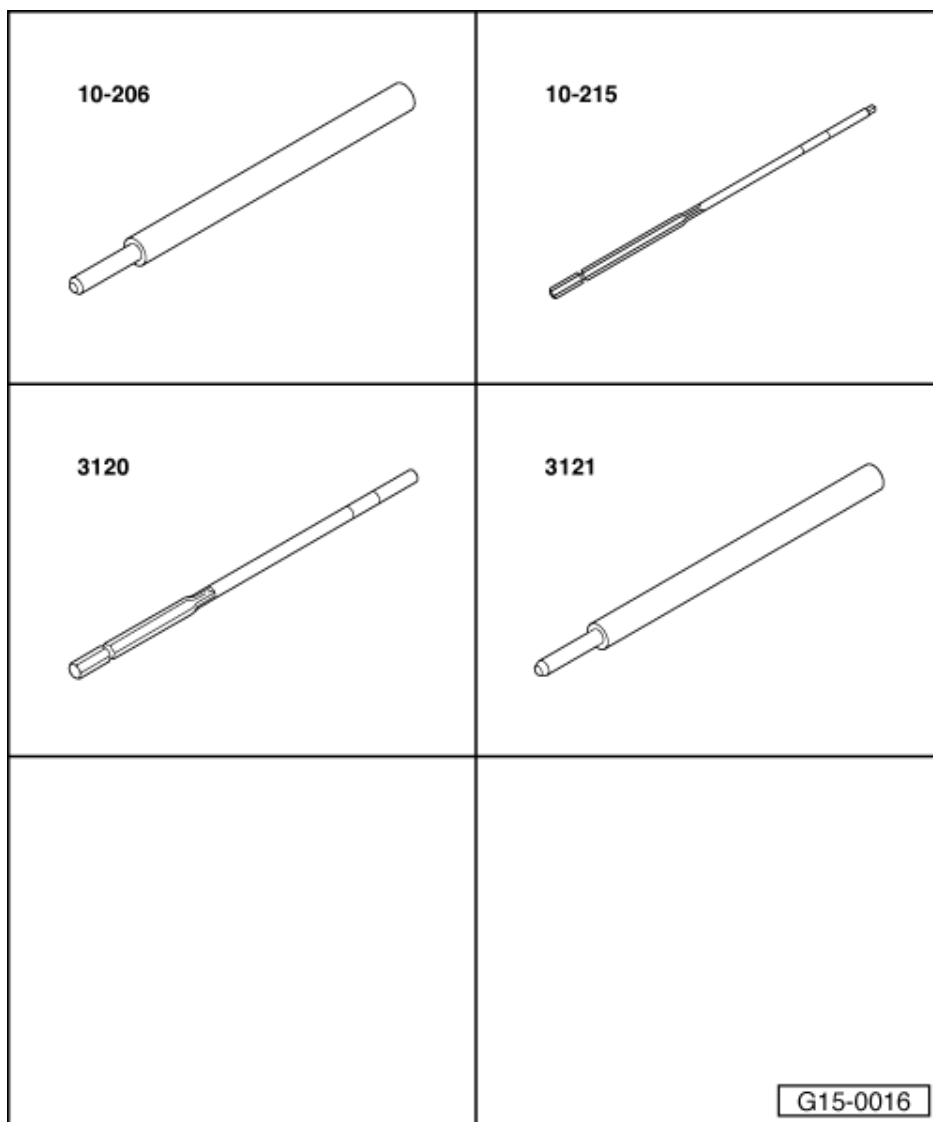
Notes:

- ♦ If the wear limit is exceeded, repeat the measurement with new valves. Replace valve guide if wear limit is still exceeded.
- ♦ If the valve must be renewed as part of a repair, use a new valve for the calculation.

2.8 - Checking valves

- Visually inspect stem and seat for scoring. Replace valves in the case of severe scoring.

2.9 - Replacing valve guides



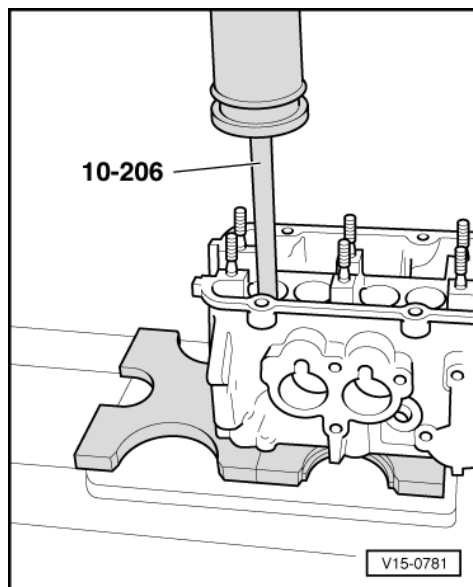
Special tools and workshop equipment required

- ◆ Driver 10-206
- ◆ Hand reamer 10-215
(for old valve train)
- ◆ Hand reamer 3120
(for light valve train)
- ◆ Drift 3121
- ◆ Cutting fluid

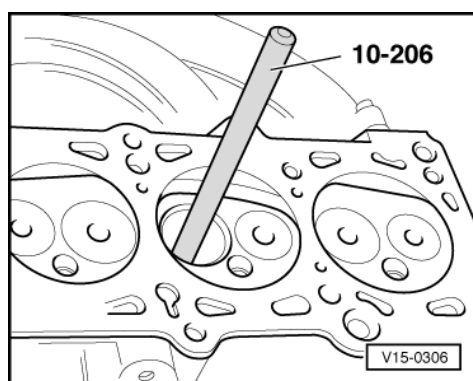
Removing

- Clean and check cylinder head. Cylinder heads in which the valve seats can no longer be reworked, or cylinder heads which have already been machined to the minimum dimension, should not have the valve guides replaced.

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- Press out worn valve guides using 10-206 or 3121 as follows:
 - -> Valve guides without collar:
from the camshaft end
 - Valve guides with collar (repair version):
from the combustion chamber end



Installing

- -> Lubricate new valve guides with oil and press in using 10-206 or 3121 from the camshaft end into cold cylinder head up to collar.

Note:

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

Old valve gear:

- Ream valve guide with hand reamer 10-215. Use plenty of cutting fluid.

Light valve train:

- Ream guides out with hand reamer 3120. Use plenty of cutting fluid.

All models:

- Reworking valve seats => Page 163

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- Renewing valve stem seals => Page 156 .

2.10 - Reworking valve seats

Note:

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

Special tools and workshop equipment required

- ◆ Depth gauge
- ◆ Valve seat machining tool

Notes:

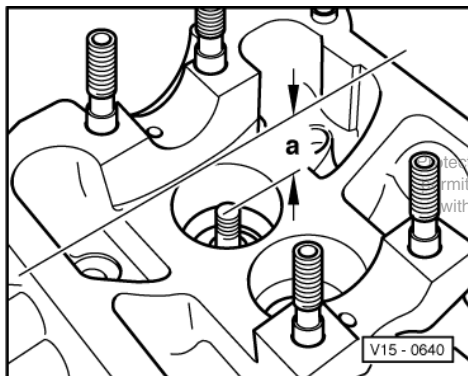
- ◆ When repairing engines with leaking valves, it is not sufficient to reface the valve seats and renew the valves. The valve guides must also be checked for wear. This is particularly important on high mileage engines => Page 159 .
- ◆ Only rework the valve seats as far as is necessary to ensure a good seating pattern.
- ◆ Before starting to rework the valve seats, calculate the maximum permissible reworking dimension.
- ◆ If the maximum reworking dimension is exceeded, the hydraulic tappets will not work properly and the cylinder head will have to be renewed.

Calculating maximum permissible reworking dimension

- Insert valve and press firmly against valve seat.

Note:

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



- -> Measure distance -a- between valve stem end and top edge of cylinder head.

Measured distance -a- in relation to minimum dimension.
= max. permissible reworking dimension.

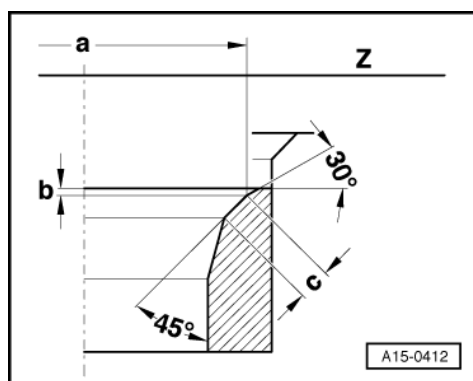
Minimum dimensions:
Inlet valve 33.8 mm
Exhaust valve 34.1 mm

Example:

- Measured distance -a-	35.1 mm
Minimum dimension	34.1 mm
= Max. permissible reworking dim.	1.0 mm

**Note:**

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

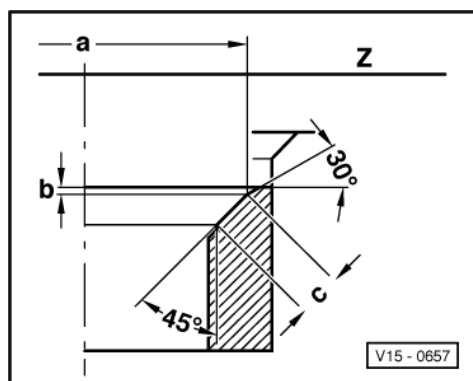
**-> Reworking inlet valve seat**

Inlet valve seat	
a	= $\varnothing 39.2$ mm
b	= max. permissible reworking dimension 1)
c	= approx. 2.0 mm
Z	= Lower surface of cylinder head
45°	= Valve seat angle
30°	= Upper correction angle



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- 1) Calculating maximum permissible reworking dimension => Page 163

**-> Reworking exhaust valve seat**

Exhaust valve seat	
a	= $\varnothing 32.4$ mm
b	= max. permissible reworking dimension 1)
c	= approx. 2.4 mm
Z	= Lower surface of cylinder head
45°	= Valve seat angle
30°	= Upper correction angle

- 1) Calculating maximum permissible reworking dimension => Page 163 .

Note:

Exhaust valve seat inserts also have an additional constriction. When reworking it is essential to ensure that the radius of the constriction is not damaged.



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17 - Lubrication

1 - Removing and installing parts of the lubrication system

1.1 - Removing and installing parts of the lubrication system

Notes:

- ♦ If upon performing engine repair larger quantities of metal shavings or particles are found in the engine oil, then the oil pump must be dismantled and checked, the oil passages must be cleaned carefully, and the oil cooler replaced in order to prevent further damage occurring later.
- ♦ The oil level must not be above max. mark on dipstick - danger of damage to catalytic converter.
- ♦ Oil spray jet and pressure relief valve => Fig. 175
- ♦ Refer to current information when using sealant.

=> Parts List

Viscosity grades and oil specifications:

=> Maintenance Manual

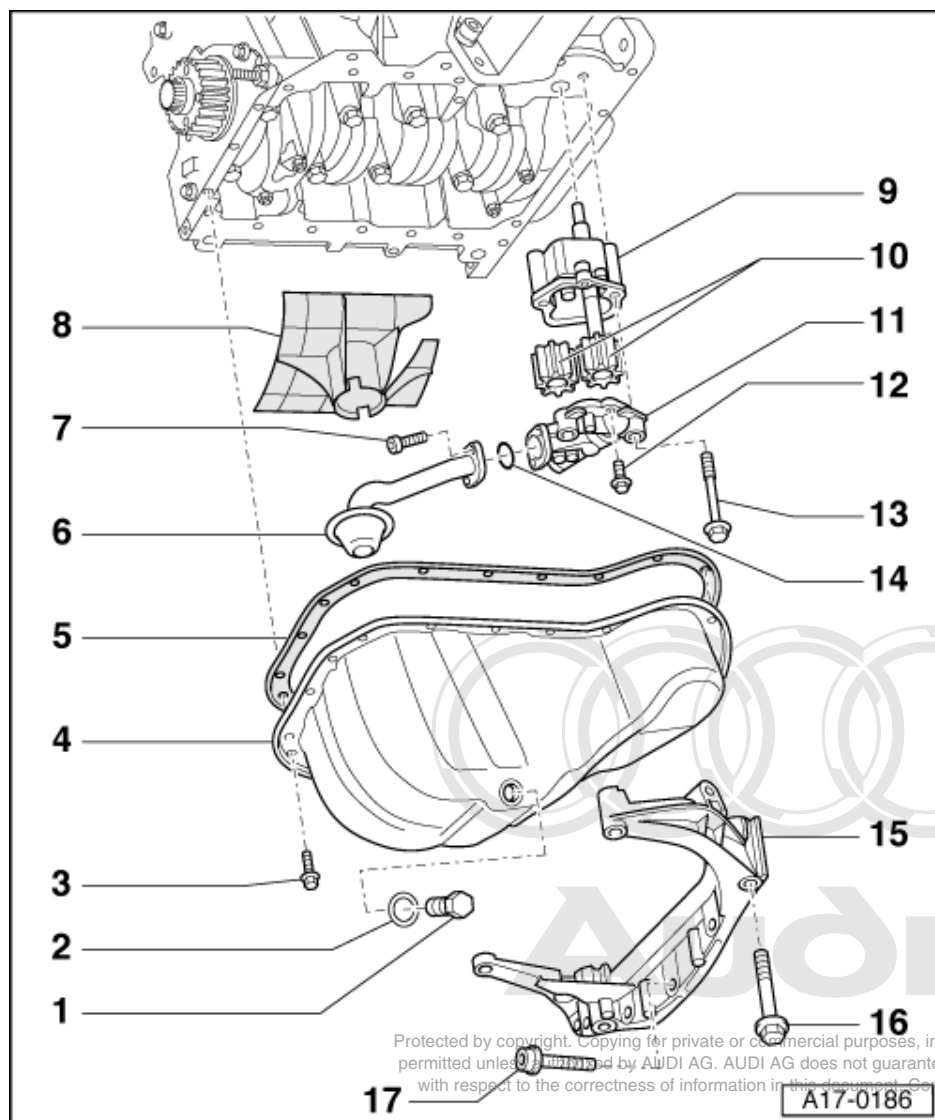
Oil system capacity:

=> "Exhaust Emission Test" binder



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1.2 - Part I



1 Oil drain plug - 30 Nm

2 Sealing ring

- ♦ Replace

3 Bolt (special type)

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

=> Parts List

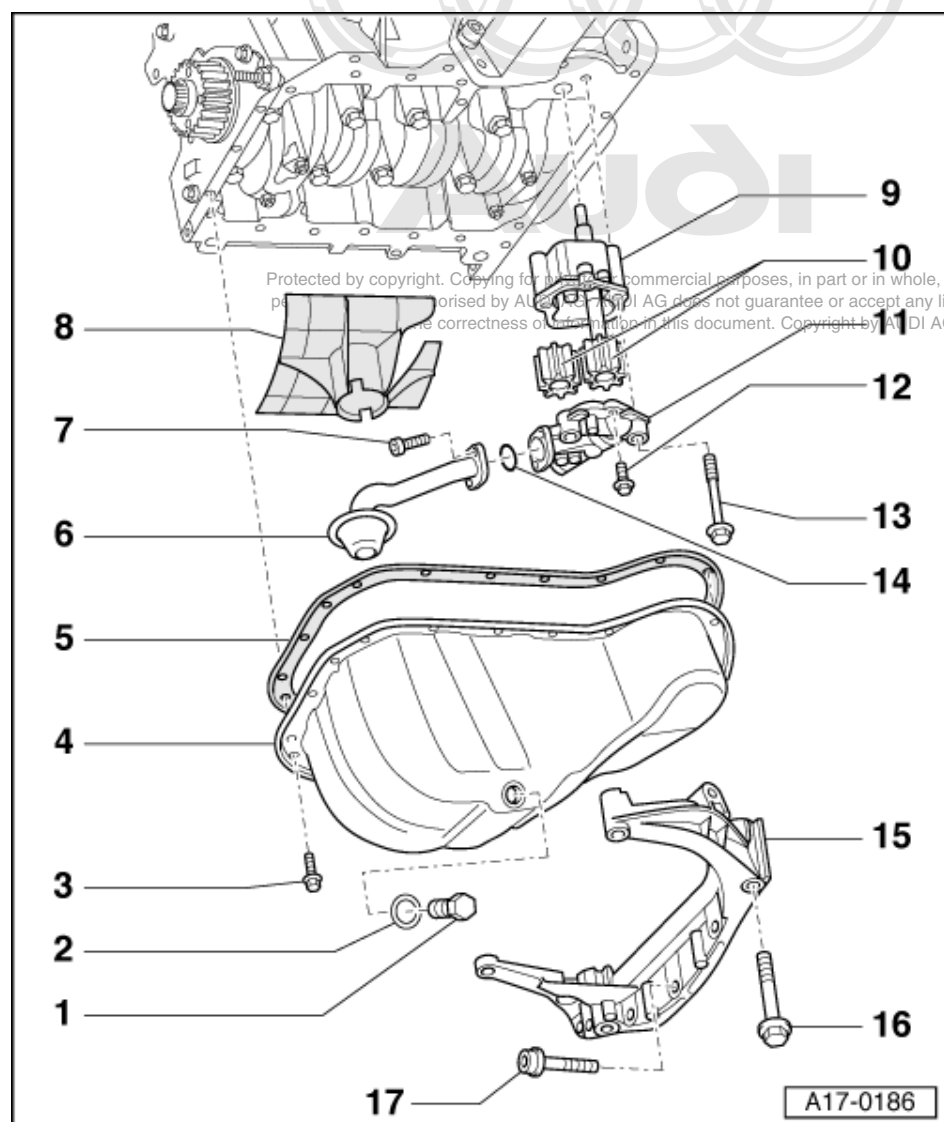
- ♦ Tighten to 20 Nm
- ♦ Tighten in stages and in diagonal sequence

4 Oil pan

- ♦ Removing and installing
=>Page 175.
- ♦ Clean sealing surface before installing
- ♦ Before fitting sump, apply a small amount of sealant to sealing points between sealing flange and cylinder block
- ♦ Sealants



=> Parts List



5 Seal

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

=> Parts List

6 Suction pipe

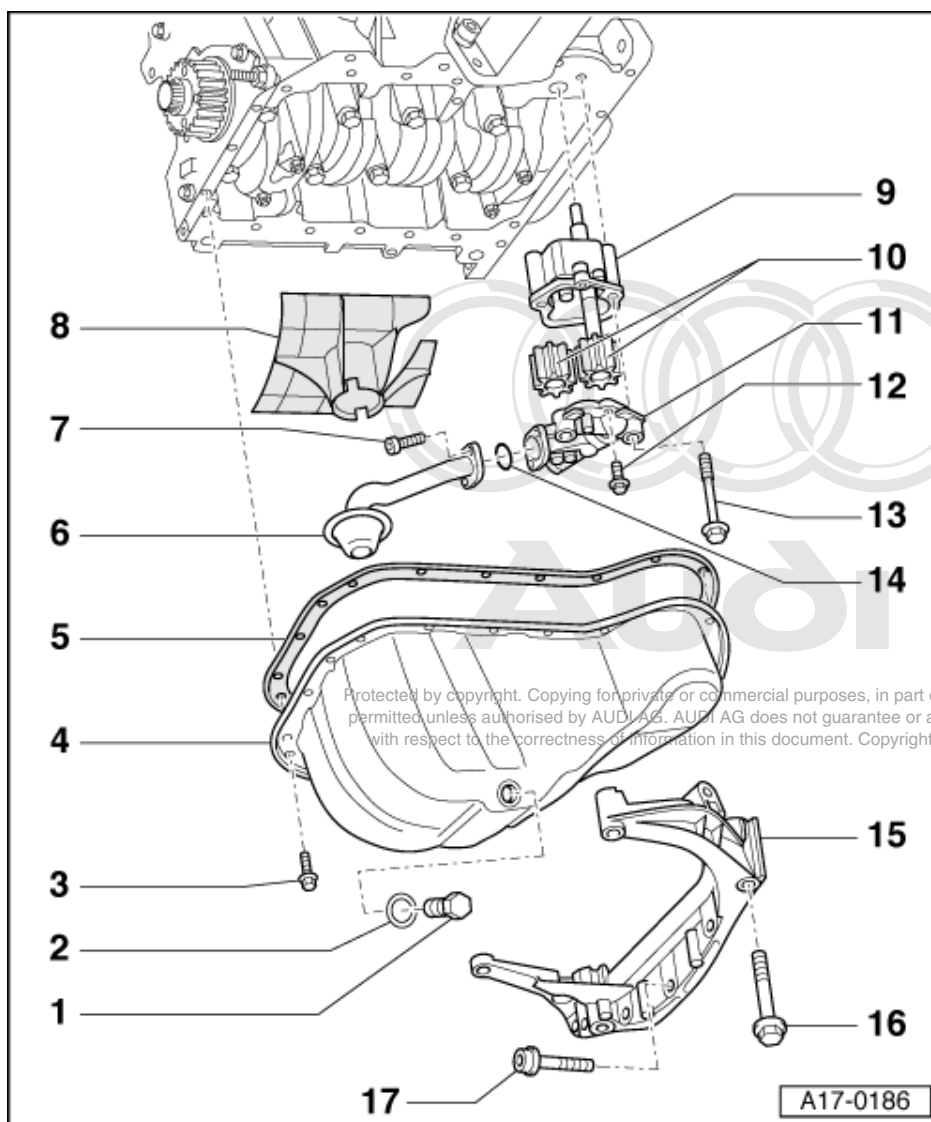
- ◆ Clean strainer if soiled

7 10 Nm

8 Baffle plate

- ◆ Clip onto suction line -Item 6 - check for secure fit

9 Oil pump housing



10 Gears

- ♦ Checking backlash
 => Fig. 174
- ♦ Checking axial play
 => Fig. 175

11 Oil pump cover with pressure relief valve

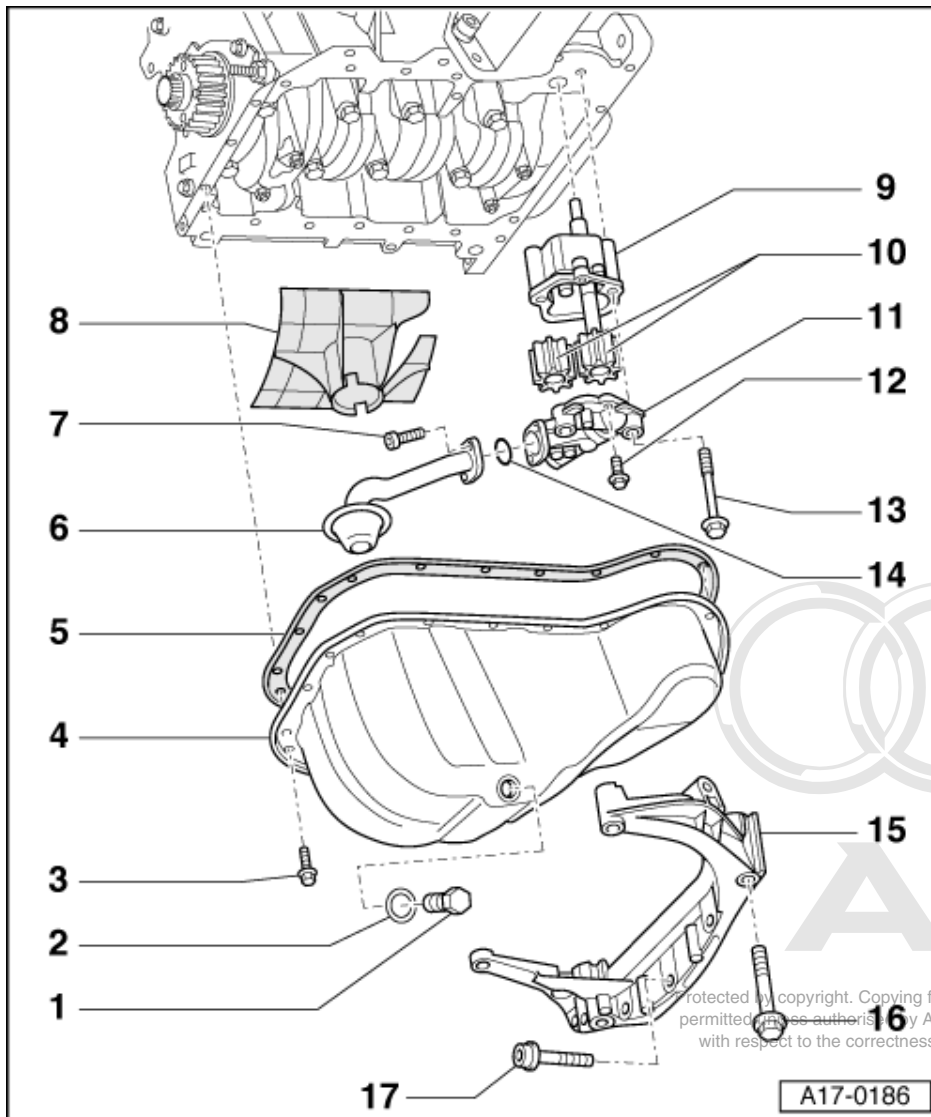
- ♦ Opening pressure: 5.7...6.7 bar

12 10 Nm

13 25 Nm

14 O-ring

- ♦ Replace



15 Engine/gearbox support

- ◆ Unbolt to remove the oil sump => Page **175**
- ◆ When installing sump on engine removed from vehicle, ensure that engine/gearbox support is positioned flush with intermediate plate at flywheel side, i.e. engine/gearbox support should protrude 0.8 mm from cylinder block

16 45 Nm

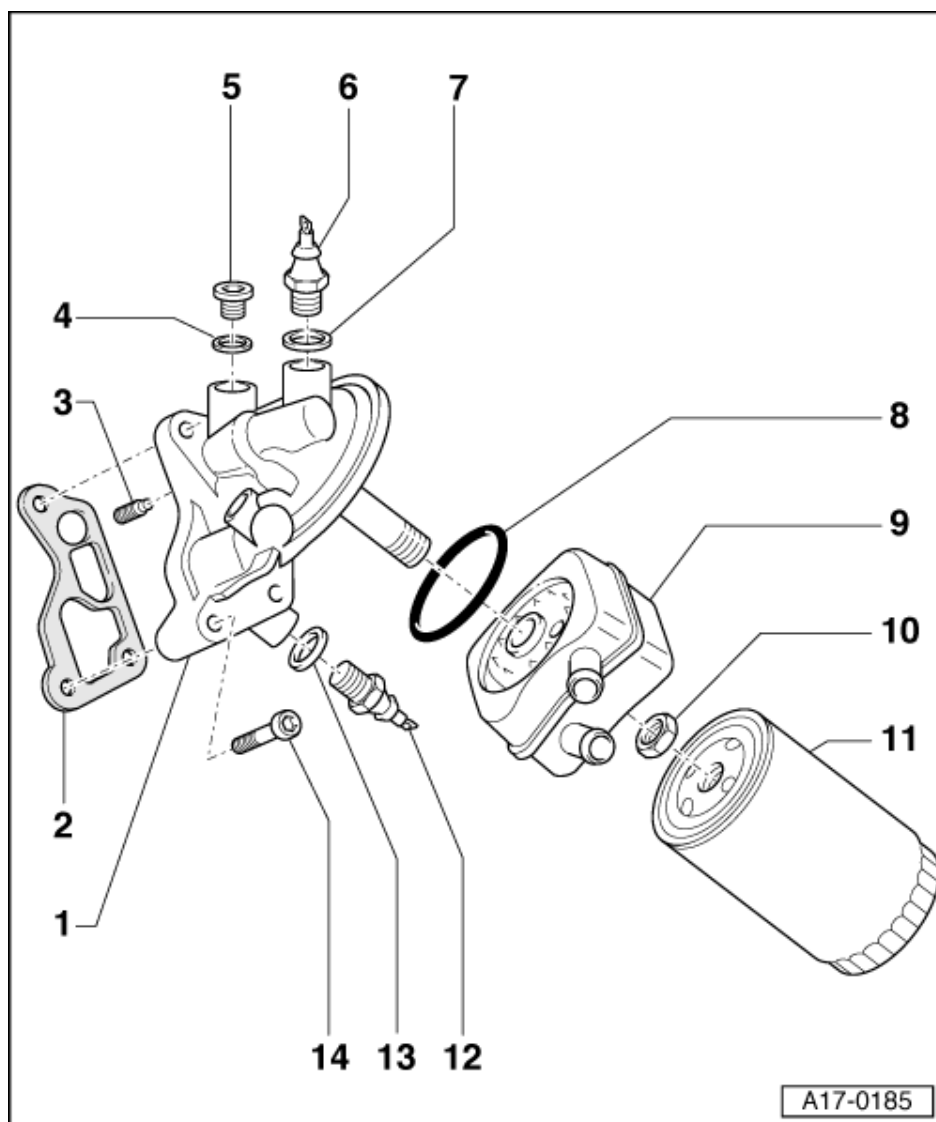
17 M8 - 25 Nm
M10 - 45 Nm

This diagram illustrates the exploded view of a carburetor assembly. The components are numbered as follows:

- 1: Main carburetor body
- 2: Air filter base plate
- 3: Air filter base gasket
- 4: Air filter base nut
- 5: Air filter base washer
- 6: Spark plug
- 7: Spark plug gasket
- 8: Air filter housing
- 9: Air filter housing gasket
- 10: Air filter housing nut
- 11: Air filter element
- 12: Spark plug
- 13: Spark plug gasket
- 14: Spark plug nut

- 4 Sealing ring**
 - ◆ If seal is leaking, cut open and renew.
- 5 Plug - 15 Nm**
 - ◆ For vehicles with additional instrumentation: Oil temperature sender -G8

1.3 - Part II 171



6 Oil pressure switch -F22 - 25 Nm

- ◆ 0.25 bar - blue or
0.3 bar - brown
- ◆ As a replacement for the 0.3 bar oil pressure switch (brown) a 0.25 bar oil pressure switch (blue) is supplied
- ◆ Checking => Page 180

7 Sealing ring

- ◆ Replace

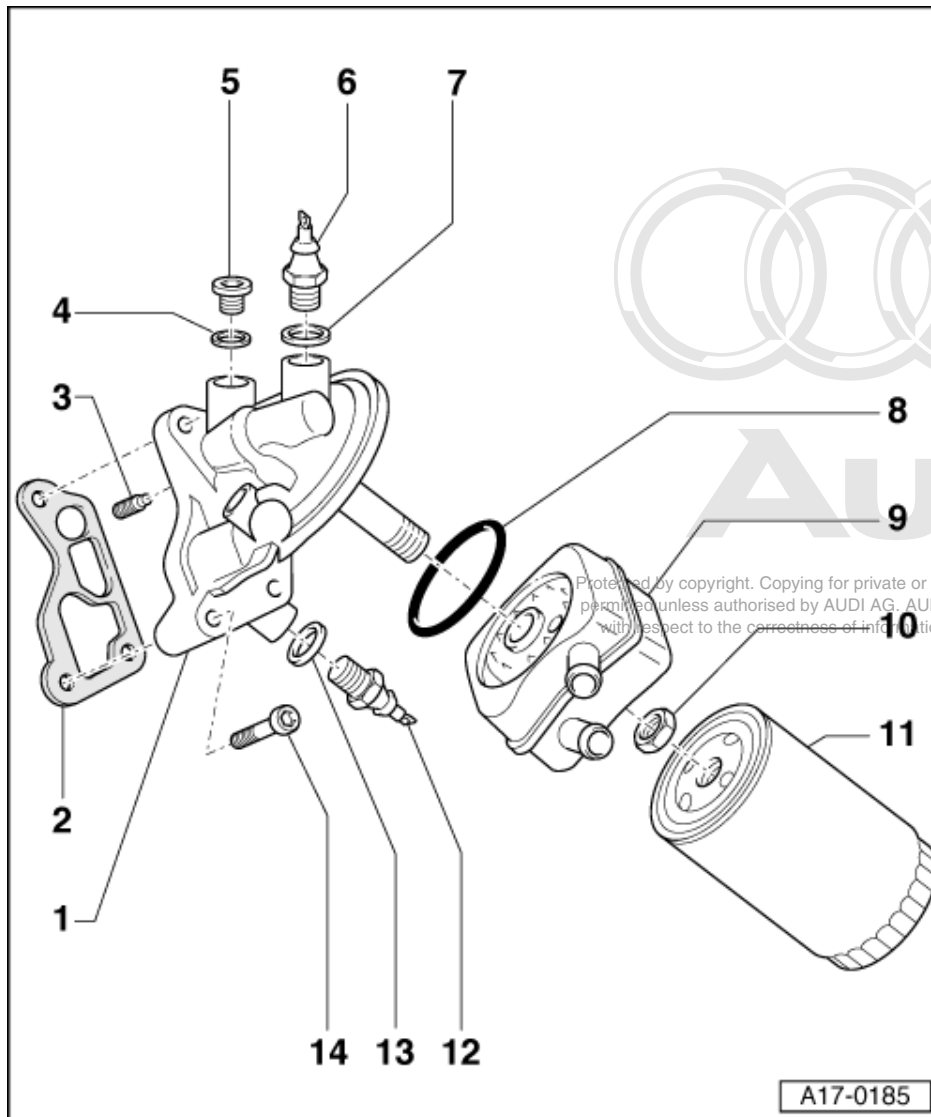
8 O-ring

- ◆ Not installed on vehicles with engine code AAE
- ◆ Replace
- ◆ Engage in projections on oil cooler

9 Oil cooler

- ◆ Not installed on vehicles with engine code AAE
- ◆ See note=>Page 166
- ◆ Coolant hose connection diagram
=> Page 185

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10 25 Nm

11 Oil filter

- ♦ Observe change intervals

=> Maintenance Manual

- ♦ Loosen with securing strap
- ♦ Observe installation instructions on oil filter

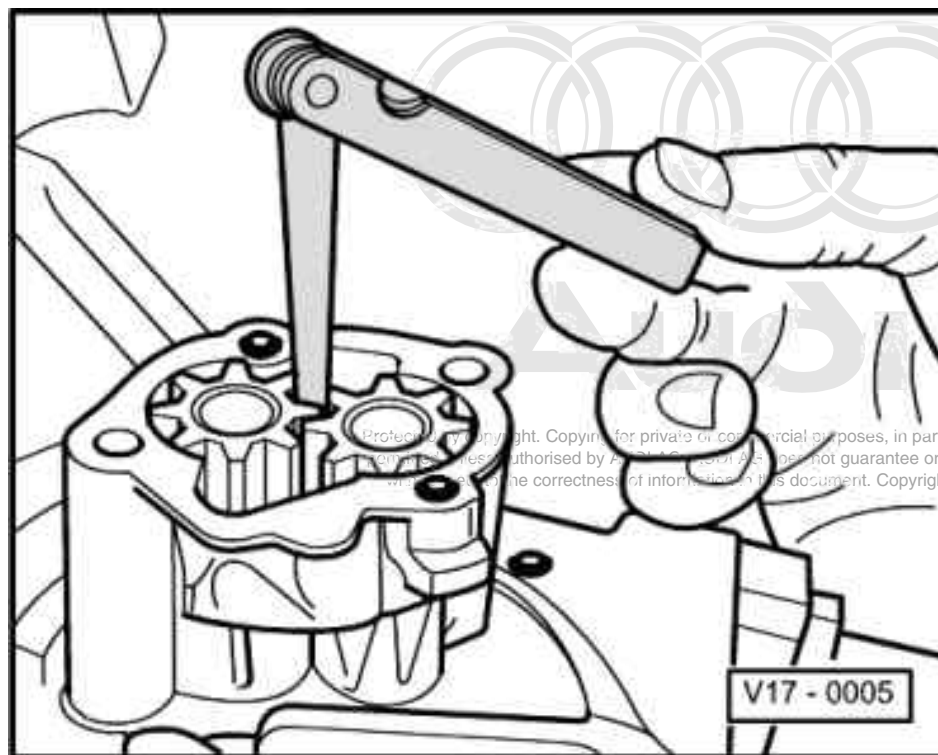
12 Oil pressure switch -F1 - 25 Nm

- ♦ 1.8 bar - white
- ♦ Checking => Page 182

13 Sealing ring

- ♦ Replace

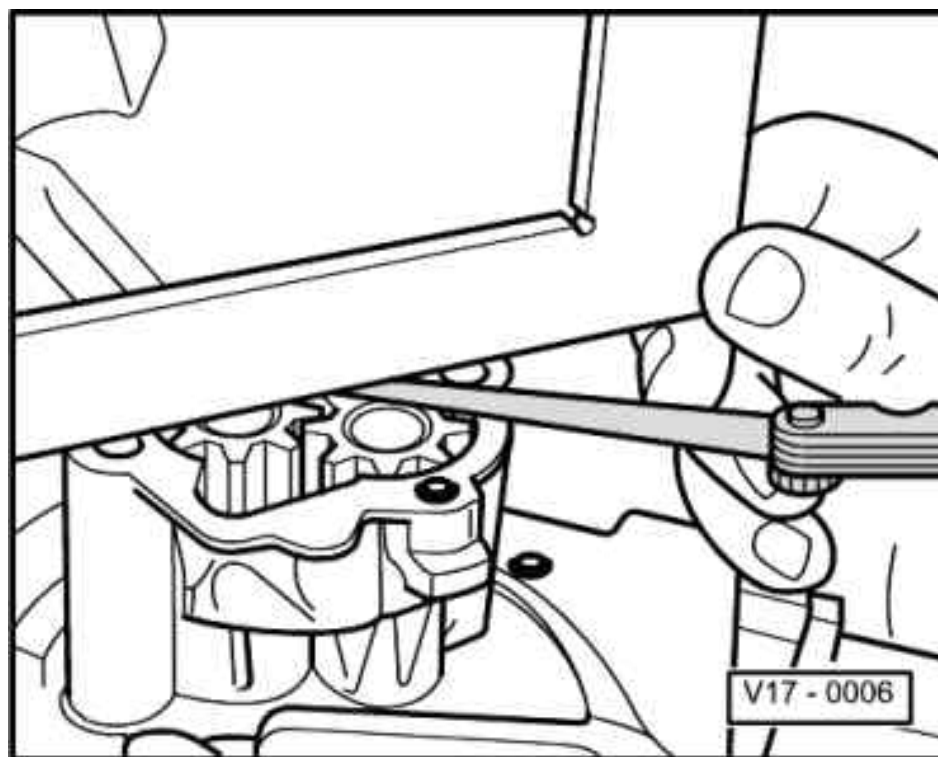
14 25 Nm



-> Fig. 1 Checking oil pump backlash

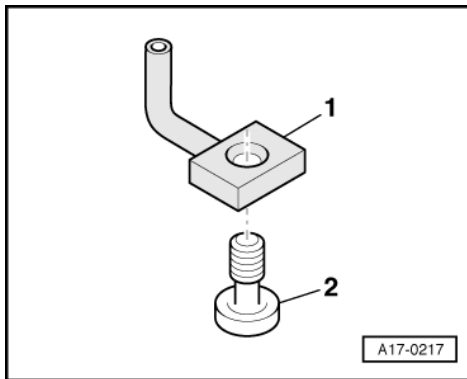
New: 0.05 mm

Wear limit: 0.20 mm



-> Fig. 2 Checking oil pump axial play

Wear limit: 0.15 mm



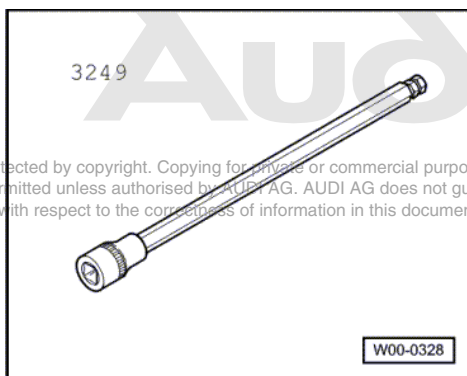
-> Fig.3 Oil spray jet and pressure relief valve

- 1 - Oil spray jet (for cooling of piston)
- Not fitted on all production versions

=> Parts List

- 2 - Bolt with pressure relief valve - 27 Nm
- Opening pressure 2.5...3.2 bar

1.4 - Removing and installing oil pan

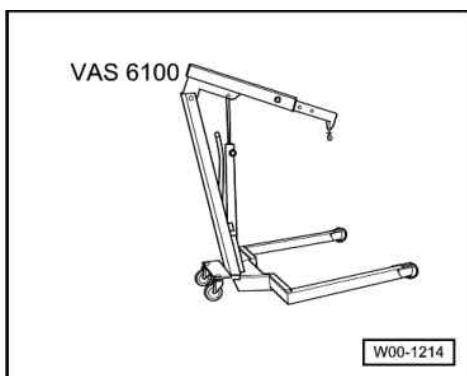


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Special tools and workshop equipment required

- ◆ Socket 3249
- ◆ Drip tray
- ◆ Sealants

=> Parts List

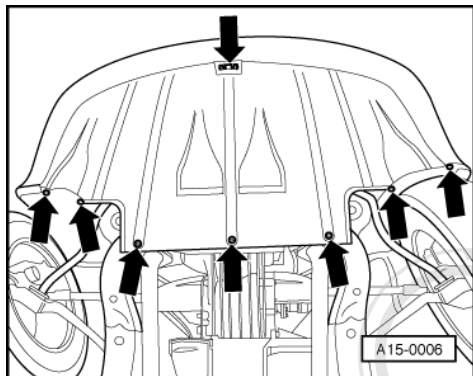




- ♦ Workshop crane VAS 6100

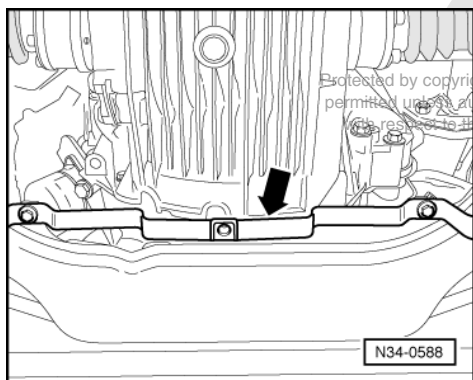
or

- ♦ Workshop crane V.A.G 1202 A

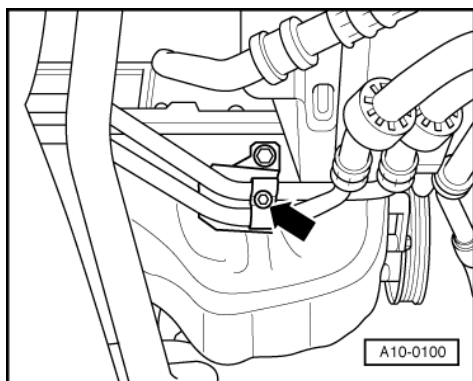


Removing

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

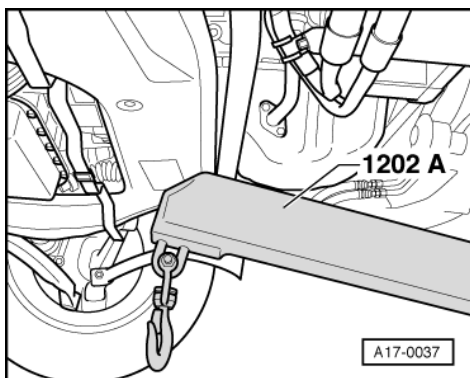


- -> Unbolt bracket for noise insulation -arrow-.



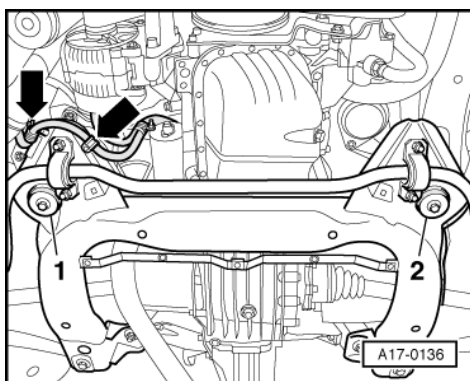
Vehicles with automatic gearbox:

- -> Unscrew bracket -arrow- for ATF line at oil pan.



All models:

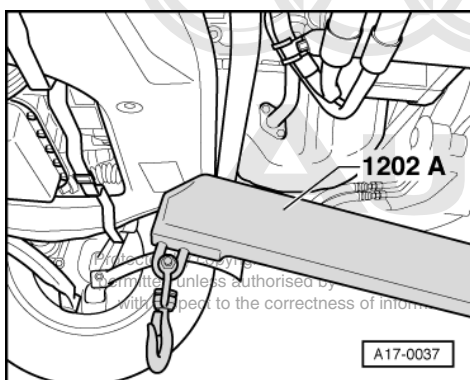
- -> Support subframe with workshop crane VAS 6100 or V.A.G 1202 A.



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

Note:

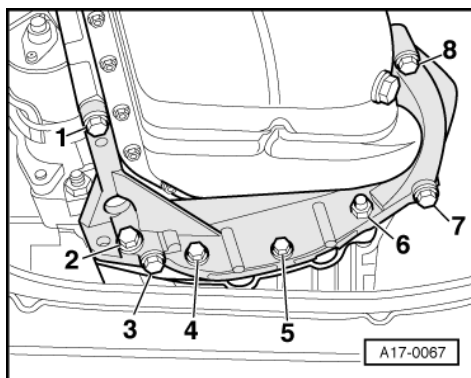
The subframe should be detached and lowered at the front only, otherwise it will be necessary to check wheel alignment.



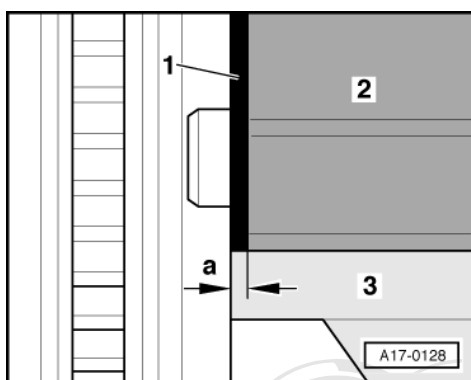
- -> Slowly lower subframe with workshop crane VAS 6100 or V.A.G 1202 A.

Important

The subframe is lowered by releasing the bolts approx. 100



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



Installing

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

Notes:

- ♦ Replace seals and gaskets.
- ♦ -> When installing engine/gearbox support with engine removed from vehicle, ensure that engine/gearbox support -3- is positioned flush with intermediate plate -1- at flywheel end, i.e. engine/gearbox support should protrude by dimension "a" = 0.8 mm from cylinder block -2-.
- Clean sealing surfaces before installing oil pan.
- Apply a thin coating of sealant to front and rear sealing flange/cylinder block sealing points at sealing surface to oil pan.
 - Sealants

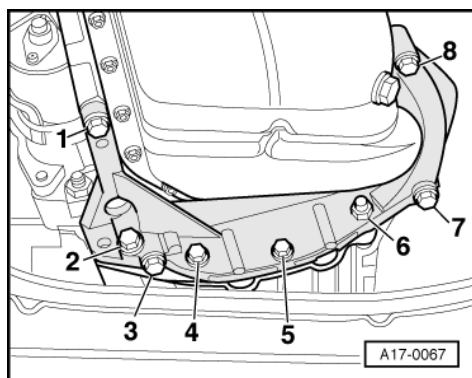
=> Parts List

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

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

- Fill up with engine oil and check oil level.

Tightening torques



-> Fastening engine/gearbox support

Item	Bolt	Nm
1, 4,	M10 x 45	45
2, 6	M8 x 32	25
3, 8	M10 x 95	45
5	M10 x 38	45
7	M10 x 60	45

Component	Nm
Oil pan to cylinder block	20, 1) 2)
Oil drain plug	30
Brackets for ATF lines	10

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- 1) Special bolts, use genuine replacement bolts only

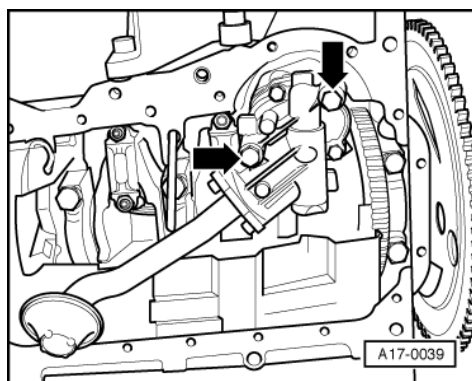
=> Parts List

- 2) Replace bolts

1.5 - Removing and installing oil pump

Removing

- Remove oil pan => Page 175.
- Disengage and remove baffle plate.





- -> Loosen bolts -arrows-.
- Detach oil pump downwards.

Installing

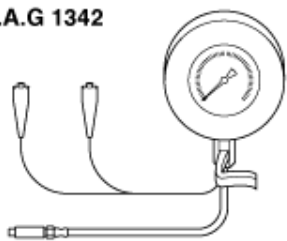
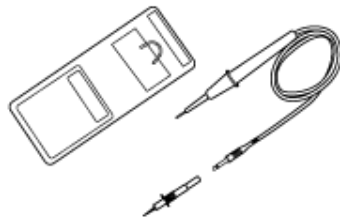
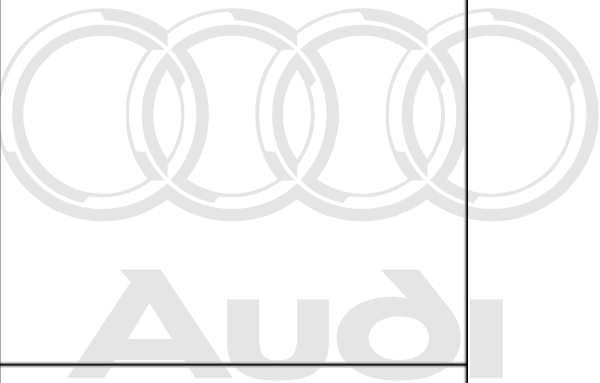
Installation is carried out in the reverse order; note the following:

- Installing oil pan => Page **178**

Tightening torque

Component	Nm
Oil pump to cylinder block	20

1.6 - Checking oil pressure and oil pressure switch

V.A.G 1342 	V.A.G 1527 B 
V.A.G 1594 A 	
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G17-0001	

Special tools and workshop equipment required

- ♦ V.A.G 1342
- ♦ V.A.G 1527 B

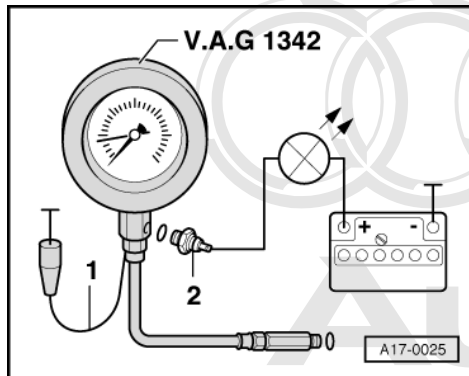
♦ V.A.G 1594 A

Test requirements:

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

Checking warning lamp

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



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

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

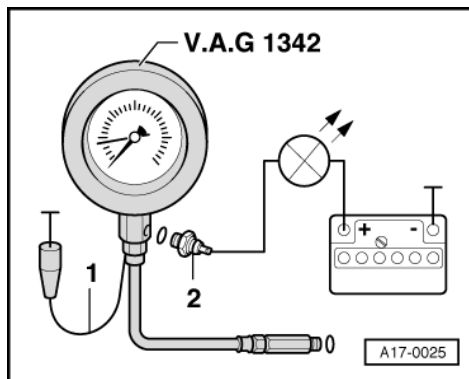
Note:

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

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

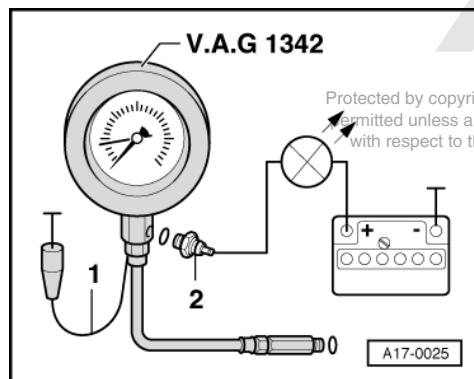
Note:

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



Checking 1.8 bar oil pressure switch (white)

- Disconnect wire from oil pressure switch.
- -> Unscrew oil pressure switch and screw in oil pressure tester V.A.G 1342.
- Screw oil pressure switch -2- into V.A.G 1342.
- Connect brown wire -1- of tester to earth (-).
- Connect voltage tester V.A.G 1527 B to oil pressure switch and positive side of battery (+) using test leads from V.A.G 1594 A.
 - LED should not illuminate.
- If the LED lights up, fit a new oil pressure switch.
- Start the engine.
 - at 1.6...2.0 bar.
- If the LED does not illuminate, fit a new oil pressure switch.



Checking oil pressure

- Disconnect wire from oil pressure switch.
- -> Unscrew oil pressure switch and screw in oil pressure tester V.A.G 1342.
- Screw oil pressure switch -2- into V.A.G 1342.
- Start engine (engine oil temperature approx. 80 °C).
 - Oil pressure at 2000 rpm: at least 2.0 bar
 - Oil pressure at higher engine speeds: max. 7.0 bar

If the specified values are not obtained:

- Pressure relief valve or oil pump defective, replace oil pump => Page **179**.

1.7 - Engine oil

Viscosity grades and oil specifications

=> Maintenance Manual

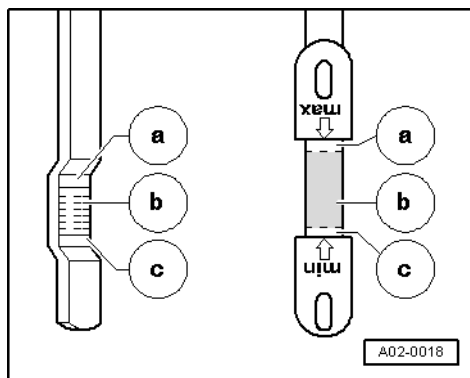
1.8 - Checking oil level

Test requirements:

- Engine oil temperature at least 60 °C
- Vehicle must be level (horizontal)
- Wait a few minutes after switching off the engine to allow the oil to flow back into the sump.

Test sequence

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



-> Markings on oil dipstick:

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

Note:

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

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19 - Cooling system

1 - Removing and installing parts of the cooling system

1.1 - Removing and installing parts of the cooling system

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

Notes:

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

=> Parts List

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



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1.2 - Parts of cooling system

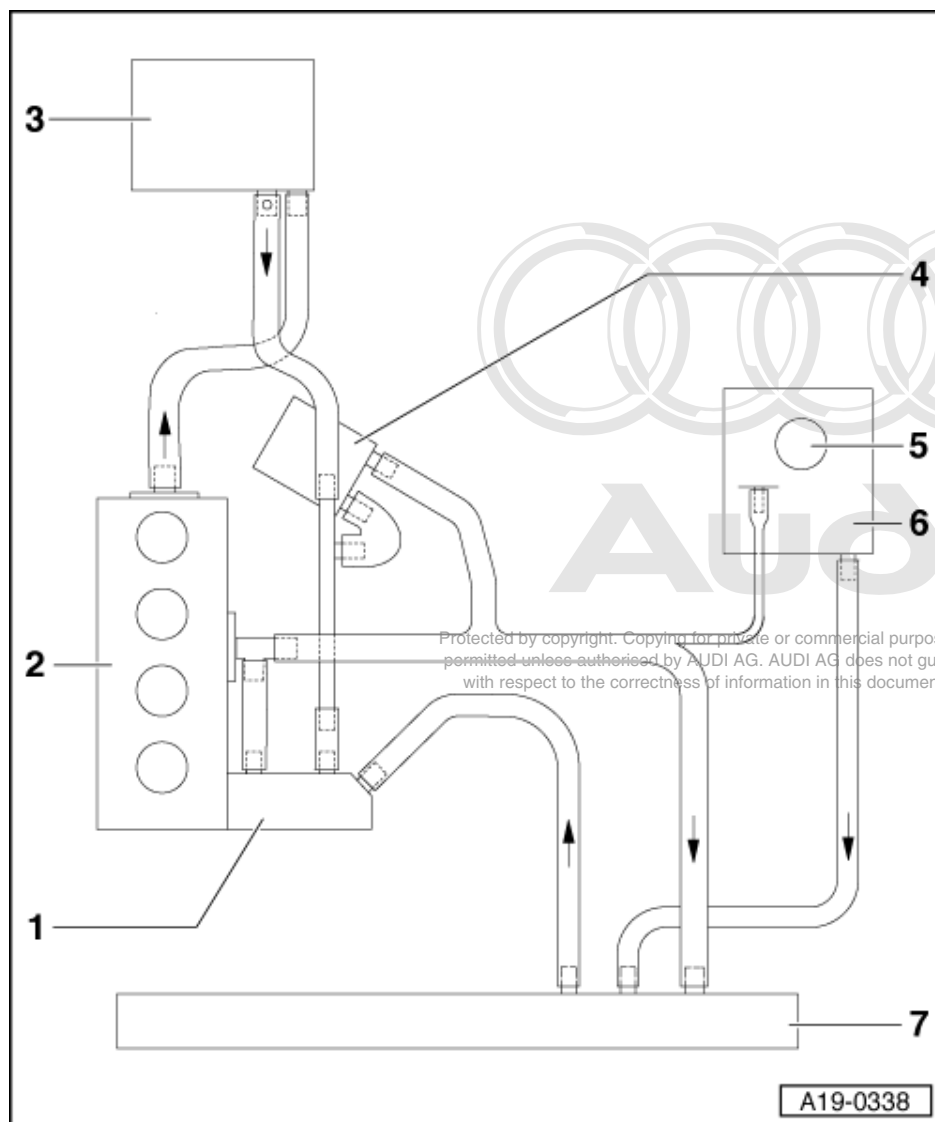


Diagram of coolant hose connections

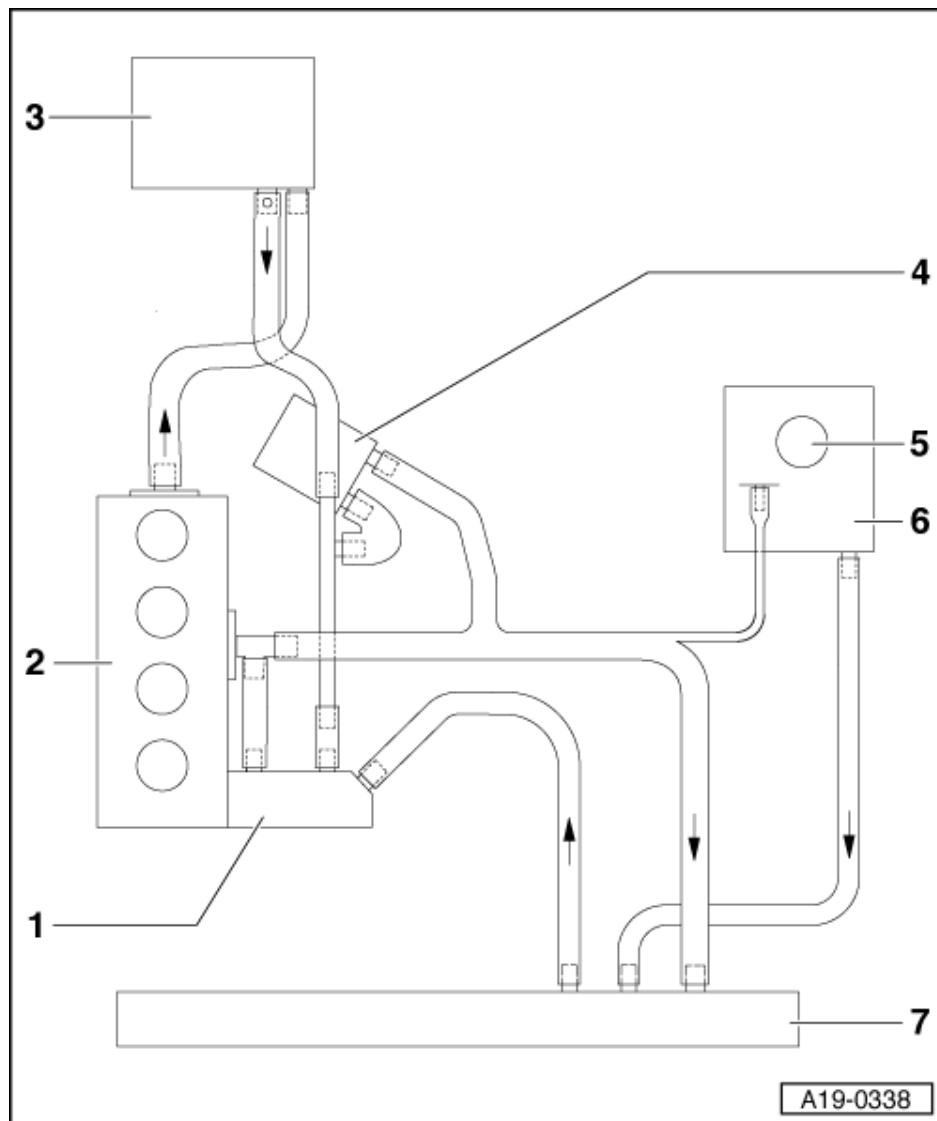
1 Coolant pump and coolant thermostat

- ◆ Installed in a common housing
- ◆ Removing and installing coolant pump => Page 192
- ◆ Check for ease of movement
- ◆ Removing and installing thermostat => Page 194
- ◆ Checking => Page 195

2 Cylinder block

3 Heating system heat exchanger

- ◆ After replacing, fill with fresh coolant



4 Fluid cooler

- ◆ Not installed on vehicles with engine code AAE
- ◆ Removing and installing => Item 172

5 Cap

- ◆ with pressure relief valve
- ◆ Checking pressure relief valve
=> Page 200

6 Expansion tank

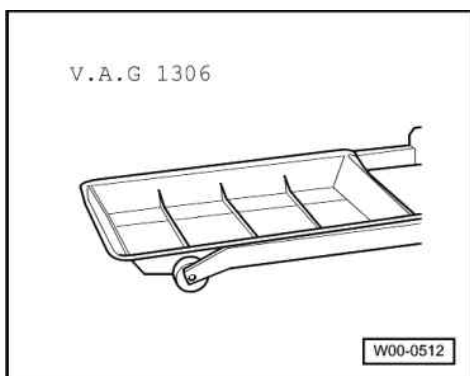
- ◆ With switch for low coolant level display -F66

7 Radiator

- ◆ Removing and installing
=>Page 195
- ◆ If replaced renew the complete coolant

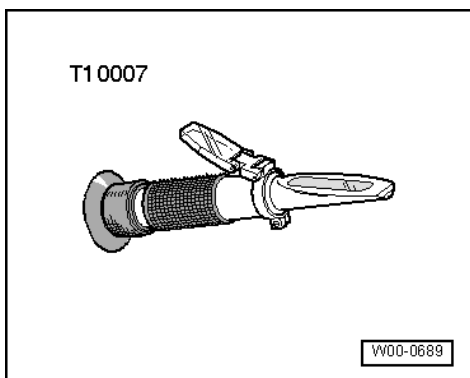
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1.3 - Draining and filling cooling system



Special tools and workshop equipment required

- ♦ Drip tray V.A.G 1306



- ♦ Special tool T10007

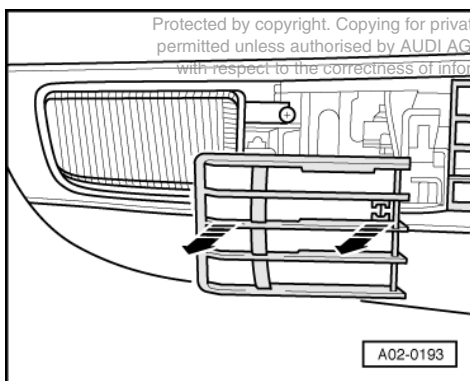
Draining

Note:

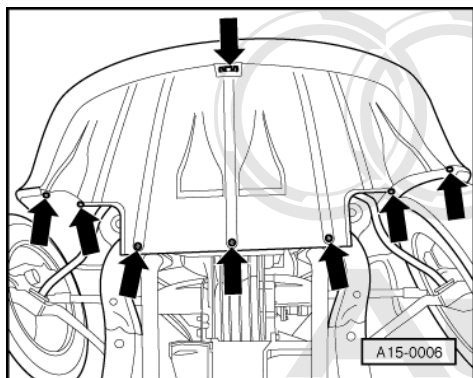
Collect drained coolant in a clean container for re use or disposal.

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

- Open the cover of the coolant expansion tank

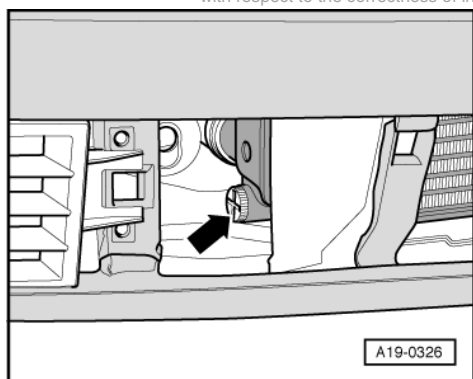


- -> Unclip the air intake grille to the lower right of the bumper -arrows-.

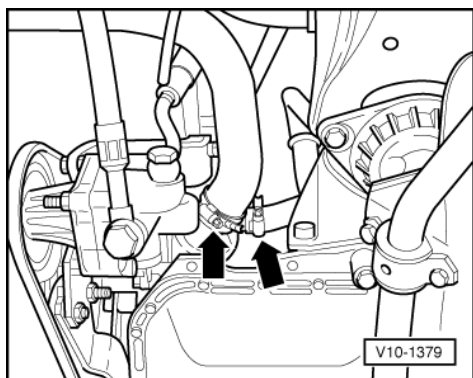


- -> Remove the noise insulation -arrows-.

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



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

Filling

Notes:

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

Important

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

- ◆ If the fluid in the expansion tank is brown, this means G 012 A8 D has been mixed with another type of coolant. In this case, flush out the cooling system and fill with fresh coolant. To flush the system, fill it with clean water and run the engine for about 2 minutes. This should remove as much of the old coolant as possible.
- ◆ G 011 A8 C and G 012 A8 D and coolant additives marked meeting specification TL VW 774 C or meeting specification TL VW 774 D prevent frost and corrosion damage, stop scaling and at the same time raise the boiling point of the coolant. For these reasons the cooling system must be filled all year round with the correct anti freeze and anti corrosion additive.
- ◆ Because of its high boiling point, the coolant improves engine reliability under heavy loads, particularly in countries with tropical climates.
- ◆ Protection against frost must be assured to about -25°C (in countries with an arctic climate to about -35°C).
- ◆ The coolant concentration must not be reduced by adding water even in warmer seasons and in warmer countries. The anti-freeze ratio must be at least 40 %.
- ◆ If greater frost protection is required in very cold climates, the amount of G 012 A8 D can be increased, but only up to 60 % (this gives frost protection to about -40°C), as otherwise frost protection is reduced again and cooling effectiveness is also reduced.
- ◆ Only use clean drinking water to mix the coolant.
- ◆ If radiator, heat exchanger, cylinder head or cylinder head gasket is replaced, do not reuse old coolant.
- ◆ Use special tool T10007 to check frost protection of coolant additive G 012 A8 D in cooling system.

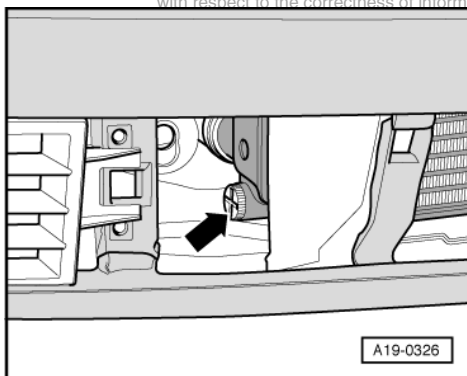
Recommended mixture ratios:

Frost protection to	Antifreeze concentration	G11/G12 1)	Water1)
-25 °C	40 %	2.8 l	4.2 l
-35 °C	50 %	3.5 l	3.5 l

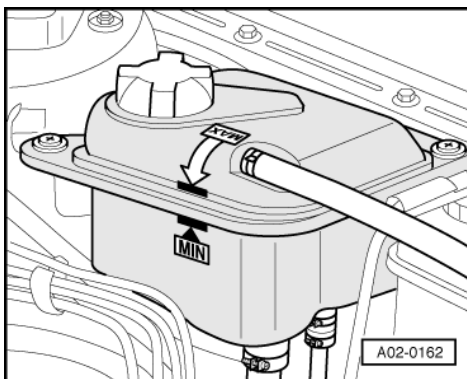
1) Coolant quantity: 7.0 litres (may vary depending upon the vehicle equipment)

- Installing and securing coolant hoses

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- -> Close drain plug -arrow- on radiator.



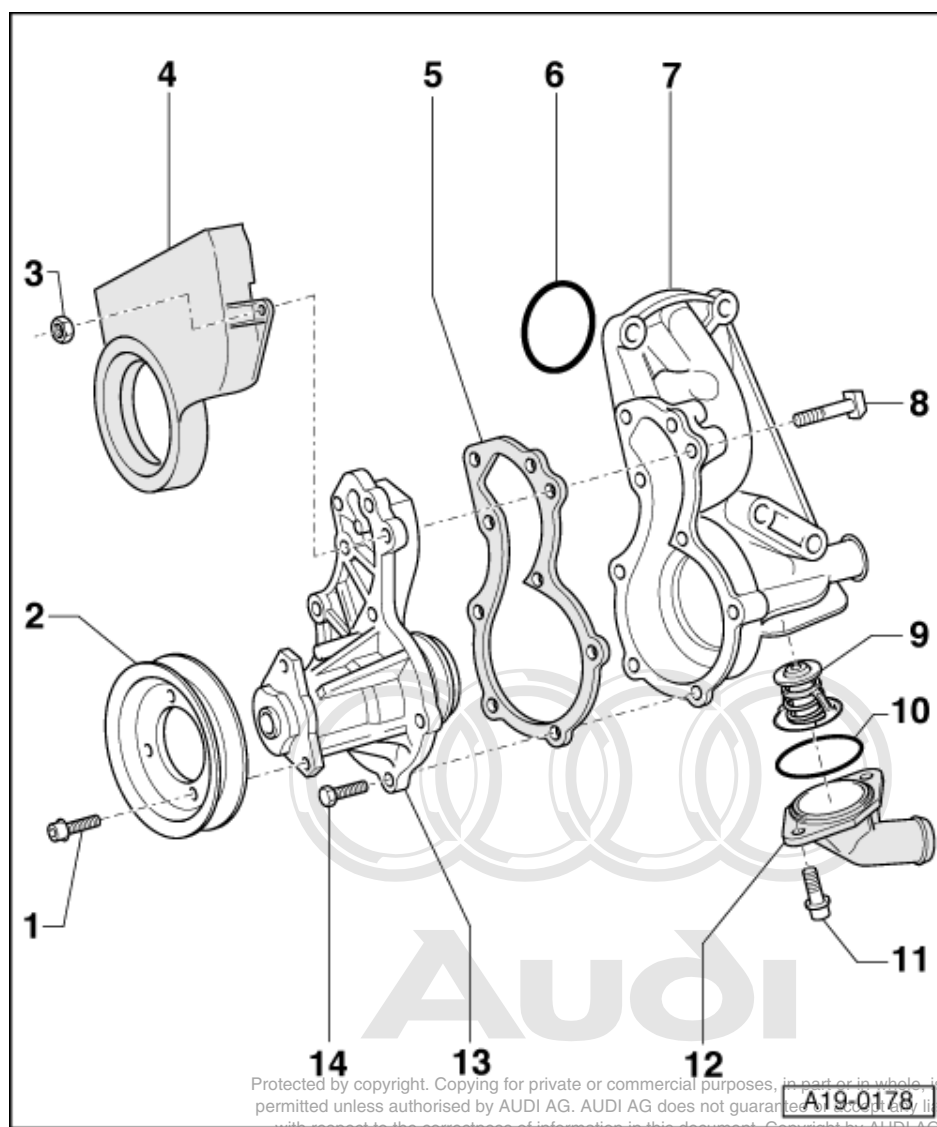
- -> Top up coolant to max. mark on expansion tank.
- Fit expansion tank cap.
- Start the engine.
- Run engine until radiator fan cuts in.

Important

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

- Check coolant level and top up if necessary.
 - If the engine is warm, the coolant level may be above the MAX mark
 - If the engine is cold, the coolant level must be between the MIN and MAX marks
- Stop engine.

1.4 - Coolant pump and coolant thermostat - Exploded view



1 25 Nm

2 Belt pulley

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

3 10 Nm

4 Toothed belt guard - lower

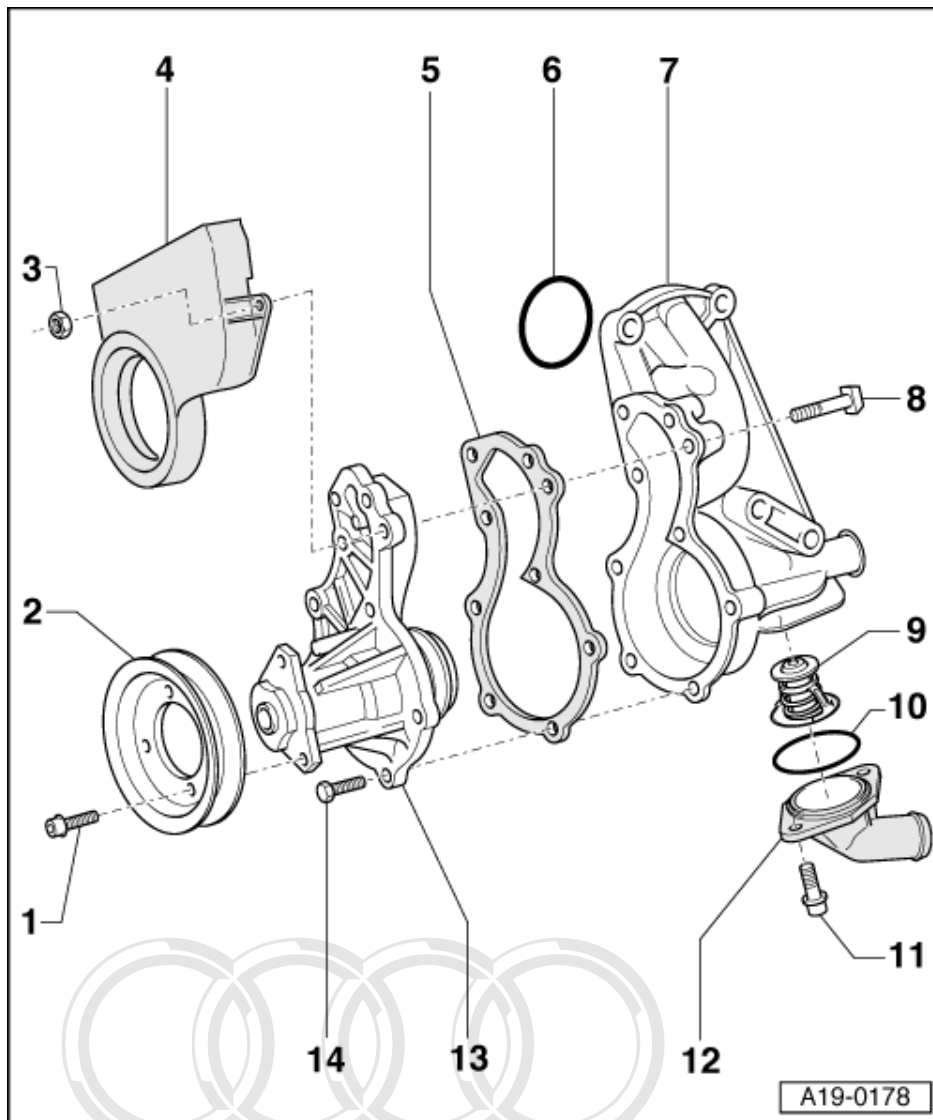
- ♦ Removing and installing => from Page 68 onwards

5 Seal

- ♦ Replace

6 O-ring

- ♦ Replace
- ♦ Lubricate with coolant



7 Housing for coolant pump and thermostat

8 Hammer head bolt

- ♦ Insert before installing

9 Thermostat

- ♦ Removing and installing
=>Page 194
- ♦ Checking => Page 195

10 O-ring

- ♦ Replace
- ♦ Lubricate with coolant

11 10 Nm

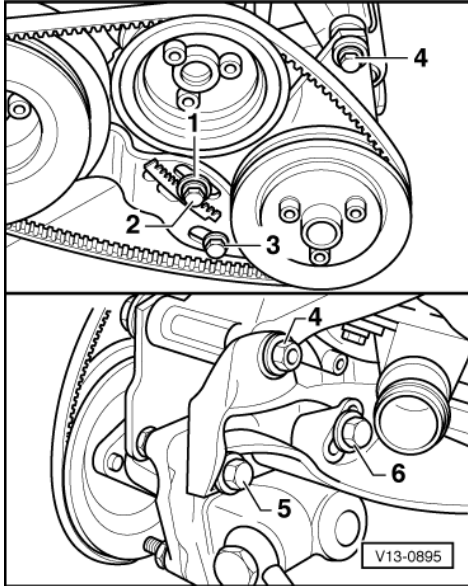
12 Pipe union

13 Coolant pump

- ♦ Removing and installing
=>Page 192
- ♦ Check for ease of movement

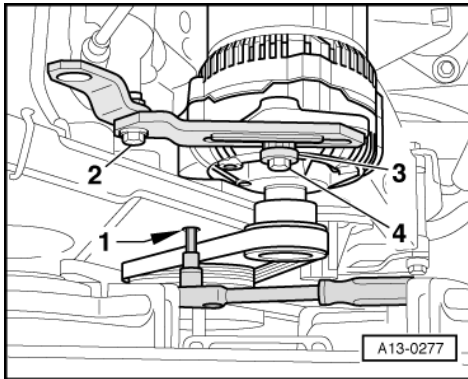
14 10 Nm

1.5 - Removing and installing coolant pump



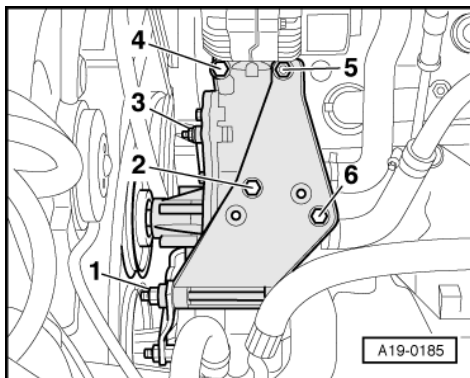
Removing

- Drain coolant => Page **187** .
- -> Loosen bolts 2...6.
- Release belt tension on V-belt with tensioner nut -1-.
- Remove V-belt.

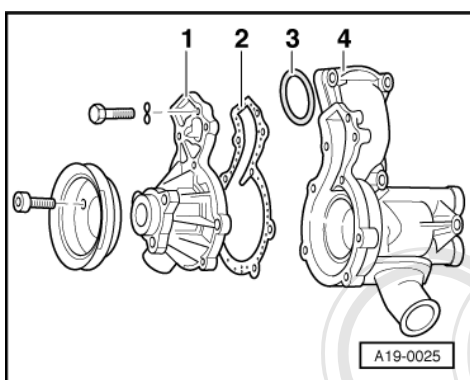


- -> Loosen bolts -1-, -2- and -4- at least one turn - bolt -1- can be reached from above via a hole in toothed belt guard.
- Release belt tension on V-belt or ribbed belt with tensioner nut -3-.
- Remove V-belt or ribbed belt from alternator belt pulley.
- Swing alternator towards cylinder head.

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- -> Unscrew bolts 1...6.
- Remove bracket for vane pump.
- Remove coolant pump.



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

Installing

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

Note:

Replace seals and gaskets.

- Clean sealing surfaces on both sections of housing.
- Insert hammer-head bolt in bore in coolant pump.
- Install V-belt/ribbed belt for alternator => Page 56 .
- Install V-belt for coolant pump => Page 50 .
- Top up coolant => Page 188 .

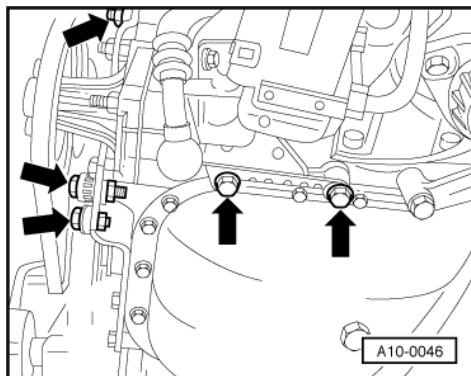
Tightening torques

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

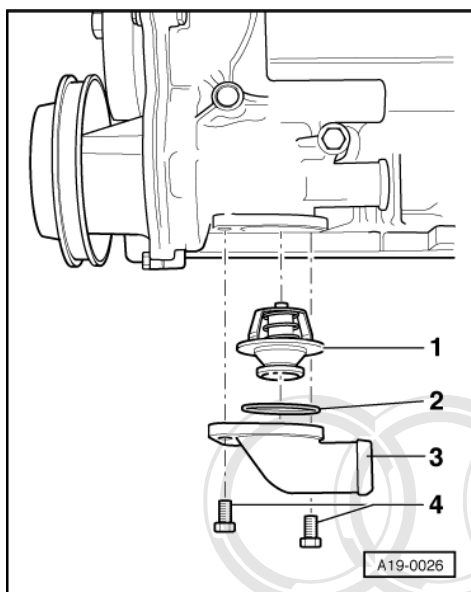
1.6 - Removing, installing and checking coolant thermostat

Removing

- Drain coolant => Page 187 .
- Remove V-belt for coolant pump and power assisted steering vane pump => Page 50 .



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



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

Installing

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

- Clean and smooth down sealing surface for O-ring as required.
- Insert coolant thermostat.
- Top up coolant => Page 188 .

Tightening torque

Component	Nm
Connection to pump housing	10

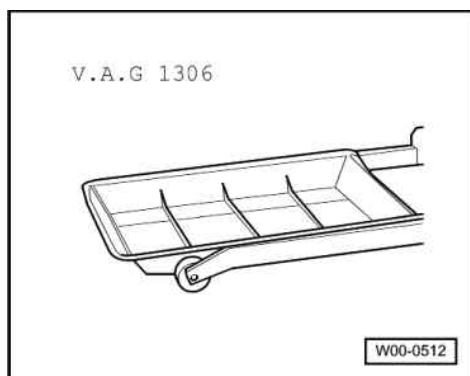
Checking coolant thermostat

- Heat thermostat in water bath.

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

- 1) Cannot be tested

1.7 - Removing and installing radiator



Special tools and workshop equipment required

- ♦ Drip tray V.A.G 1306

Removing

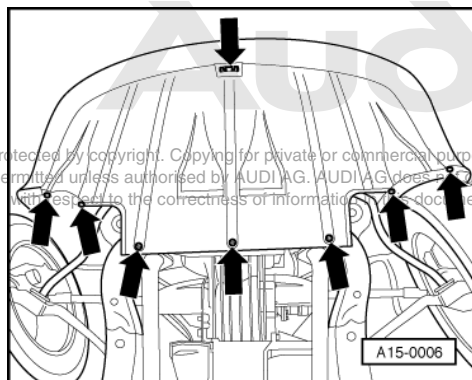
Note:

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

Important

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

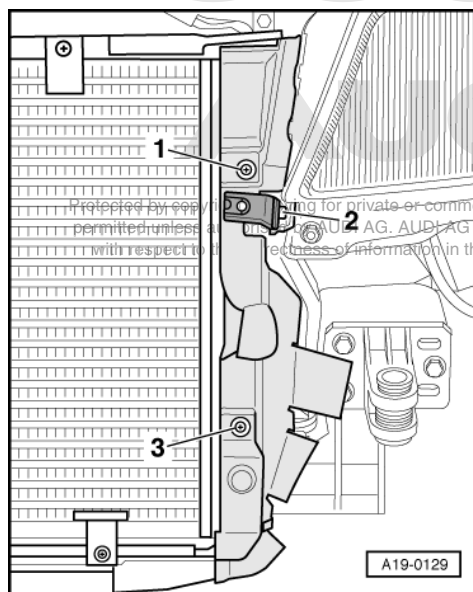
- Open the cover of the coolant expansion tank.



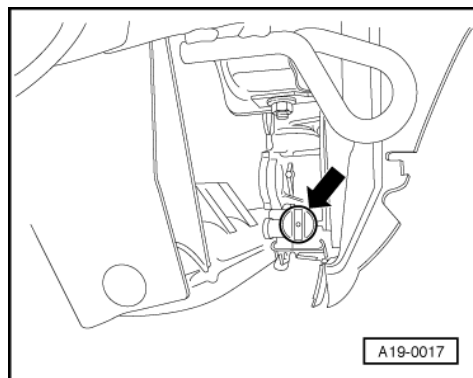
- -> Remove the noise insulation -arrows-.
- Remove the front bumper:



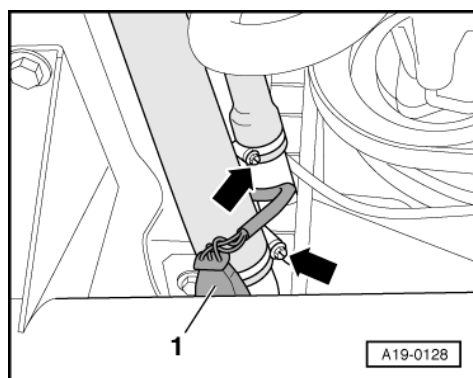
=> General Body Assembly; Repair group 63; Front bumper Front bumper



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



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



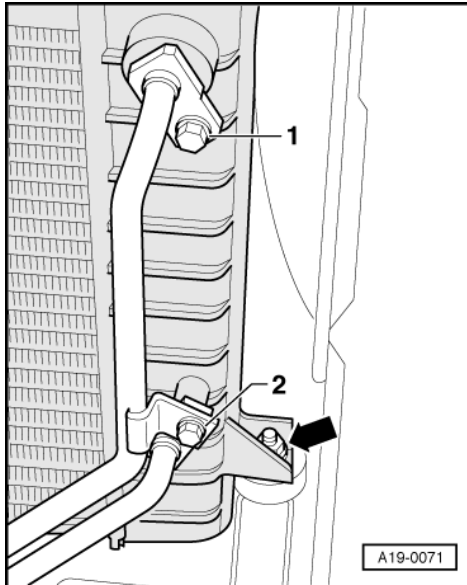
- -> Detach both coolant hoses at bottom of radiator -arrows-.
- Unplug connector -1- at the radiator fan thermoswitch.

Vehicles with air conditioner:

Important

The air conditioner refrigerant circuit must not be opened.

- Remove refrigerant pipe under radiator from brackets.



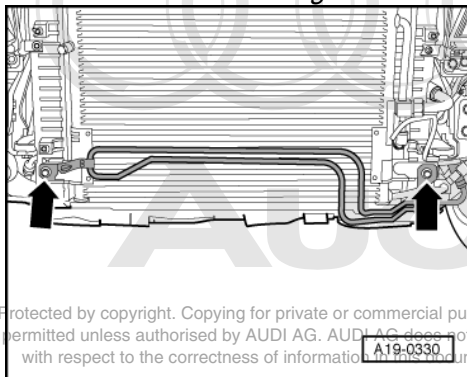
Vehicles with automatic gearbox:

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

=> Automatic Gearbox 097; Repair group 37

Note:

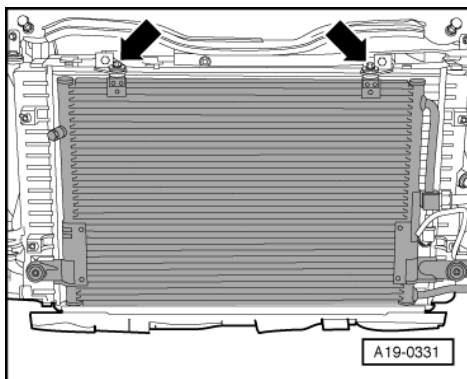
The nut -arrow- at lower right radiator fastening point must not be loosened.



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All models:

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





Vehicles with air conditioner:

Important

The air conditioner refrigerant circuit must not be opened.

- -> Remove the securing bolts for the condenser.

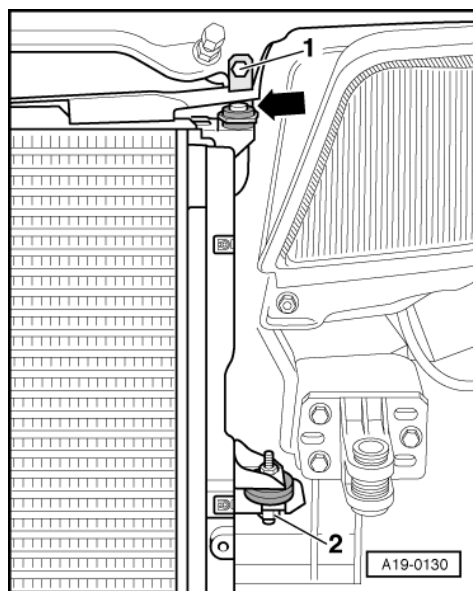
Note:

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

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

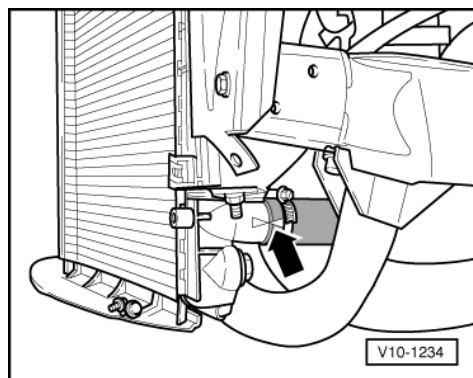
All models:

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



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



Installing

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

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

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

- Top up coolant => Page 188 .

Note:

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

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Vehicles with automatic gearbox:

- Attach ATF lines.

=> Automatic Gearbox 097; Repair group 37

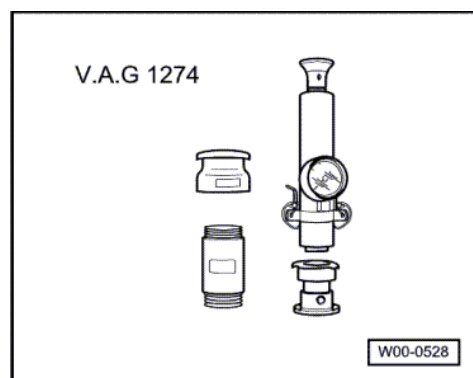
- Check ATF level:

=> Automatic Gearbox 097; Repair group 37

Tightening torques

Component		Nm
Radiator to lock carrier	M6	10
	M8	20
Radiator cowl to radiator		10
Condenser to radiator		10
Power steering cooling coil to radiator		10

1.8 - Checking cooling system for leaks

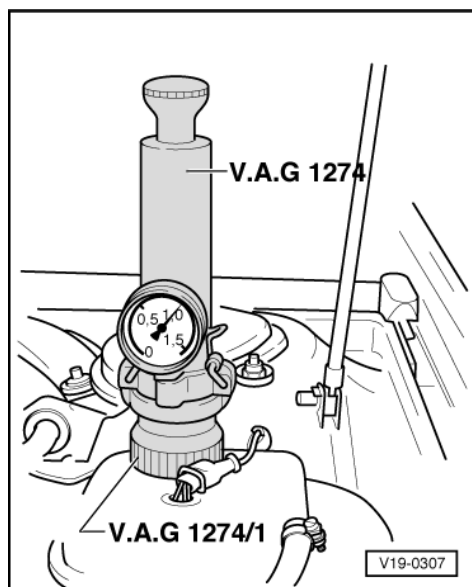


Special tools and workshop equipment required

- ♦ Cooling system tester V.A.G 1274
- ♦ Adapter 1274/1

Test requirements:

- Engine at operating temperature.

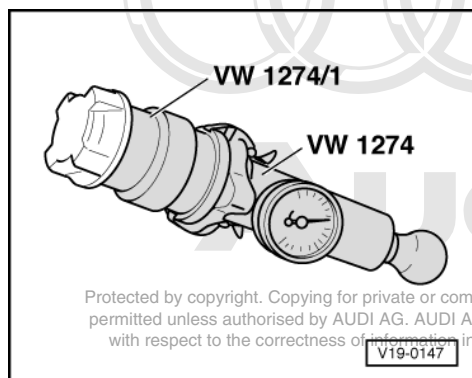


Test sequence

Important

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

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



Checking pressure relief valve in filler cap.

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

26 - Exhaust system

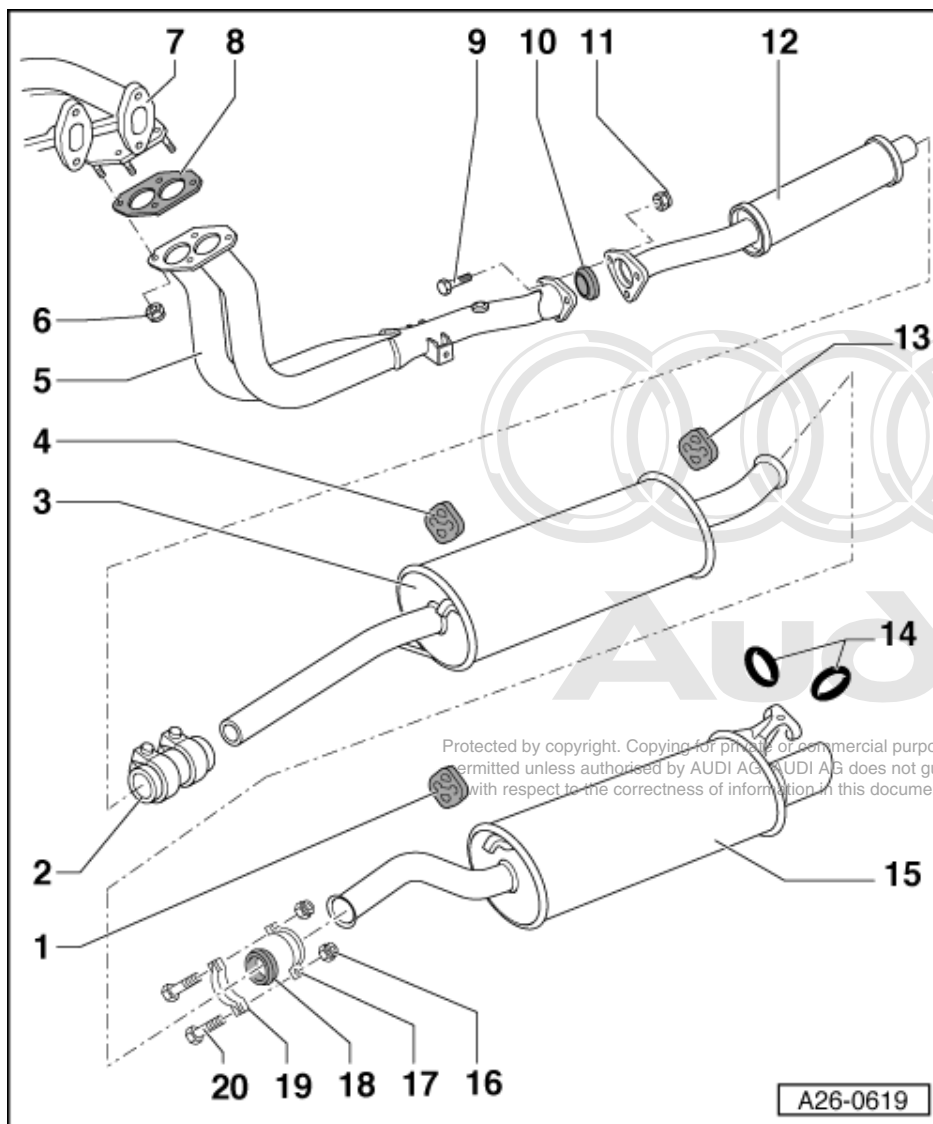
1 - Removing and installing parts of exhaust system

1.1 - Removing and installing parts of exhaust system

Notes:

- ◆ Always replace seals, gaskets and self-locking nuts
- ◆ After working on the exhaust system ensure that the system is not under stress, and that it has sufficient clearance from the body. If necessary, loosen clamp and align silencer and exhaust pipe so that sufficient clearance is maintained to the body at all points and the support rings are evenly loaded
- ◆ Removing and installing floor cross member => Fig. 218

1.2 - Vehicles with front-wheel drive without catalytic converter



- ◆ Replace if damaged
- ◆ Bending over securing tabs => Fig. 210

- ◆ Align exhaust system so it is free of stress before tightening clamp => Page 225
- ◆ Installation position => Fig. 210
- ◆ Tighten bolted connections evenly to 40 Nm

- ♦ Align exhaust system so it is free of stress before tightening clamp => Page 225



- ◆ Replace if damaged
- ◆ Bending over securing tabs => Fig. 210

◆ **Mounting components**
=> Fig. 211

- ◆ Replace

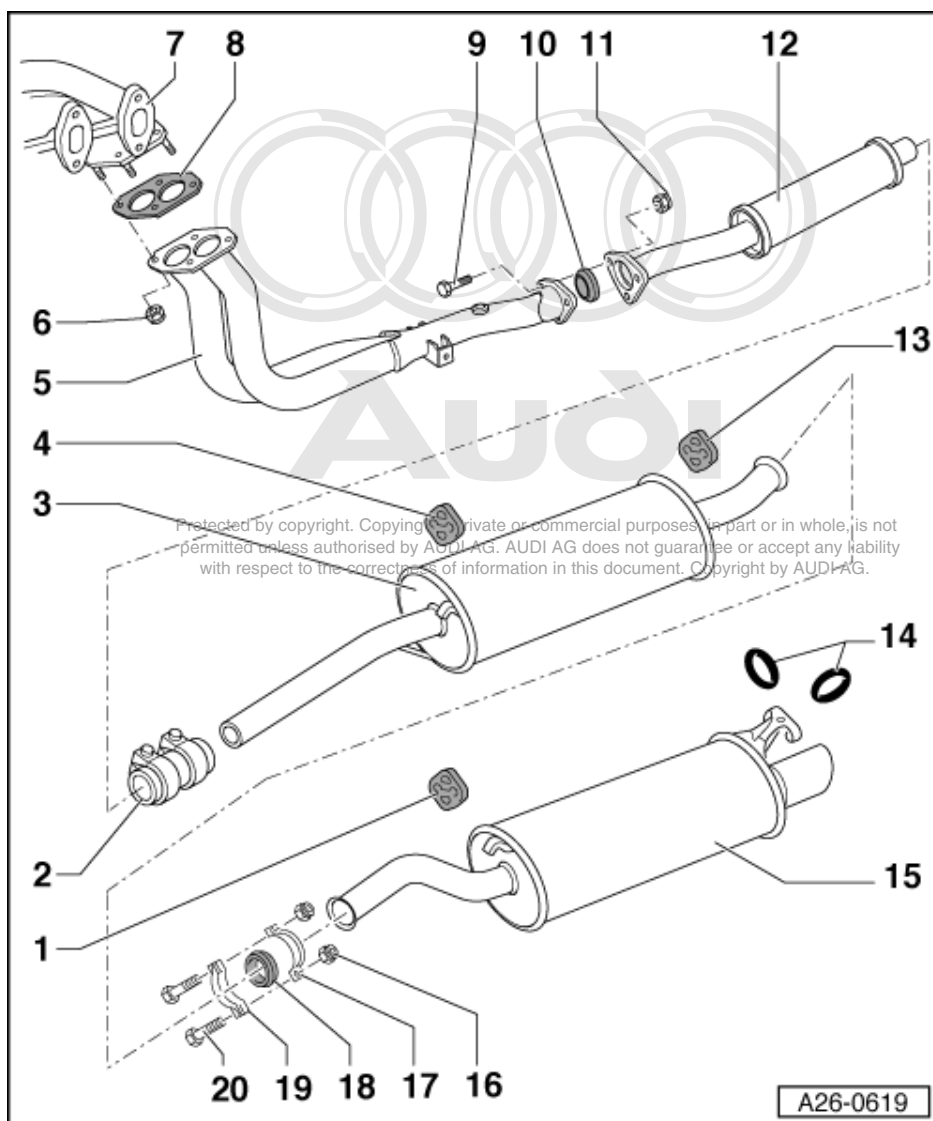
- ◆ Removing and installing
=>Page 222

- ◆ Replace

9 25 Nm

10 Sealing ring

- ♦ Sensitive to impact; take care not to drop



11 25 Nm

- ♦ Replace

12 Front silencer

13 Retainer

- ♦ Replace if damaged
- ♦ Bending over securing tabs => Fig. 210

14 Retaining rings

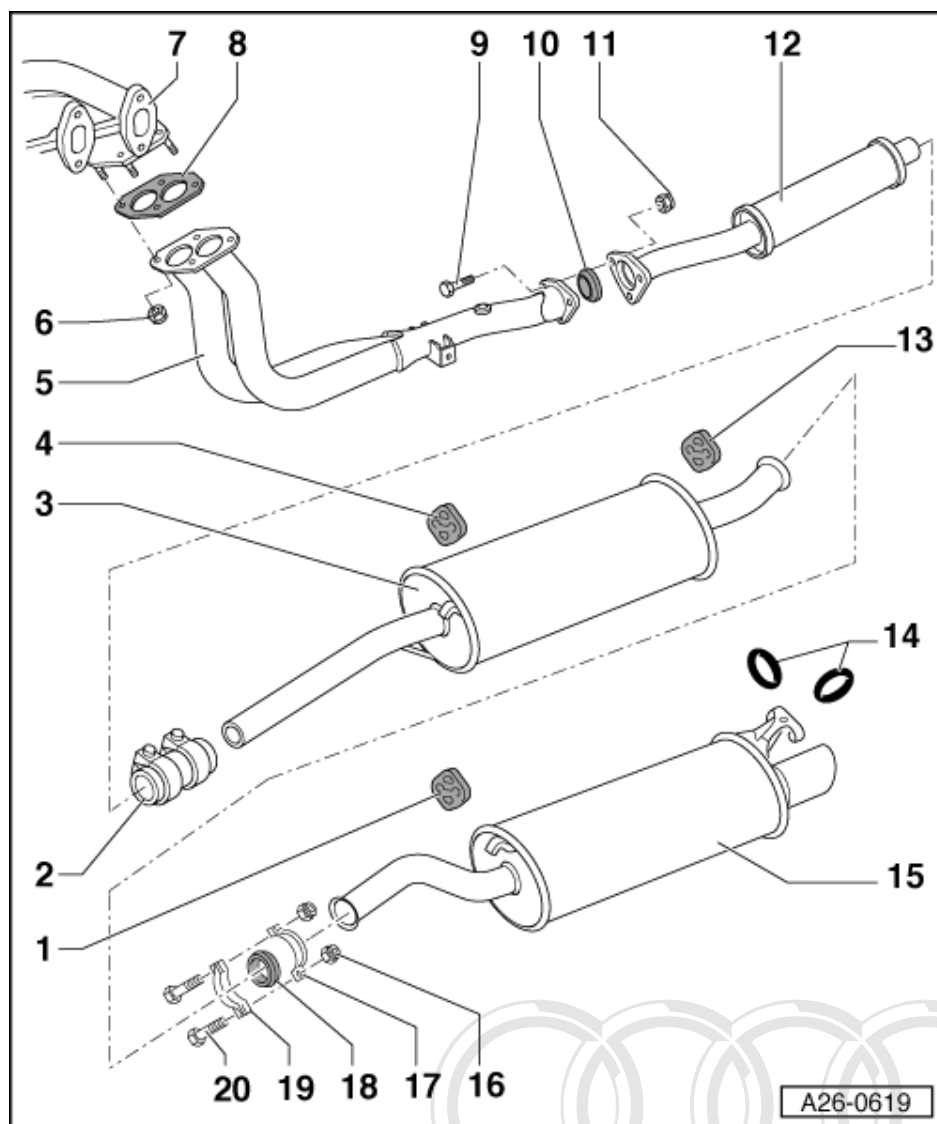
- ♦ Replace if damaged
- ♦ Bending over securing tabs => Fig. 211

15 Rear silencer

- ♦ Align exhaust system so it is free of stress before tightening clamp => Page 225

16 15 Nm

- ♦ Replace



17 Clip

- ♦ Installation position
=> Fig. 210

18 Sealing ring

- ♦ Sensitive to impact; take care not to drop

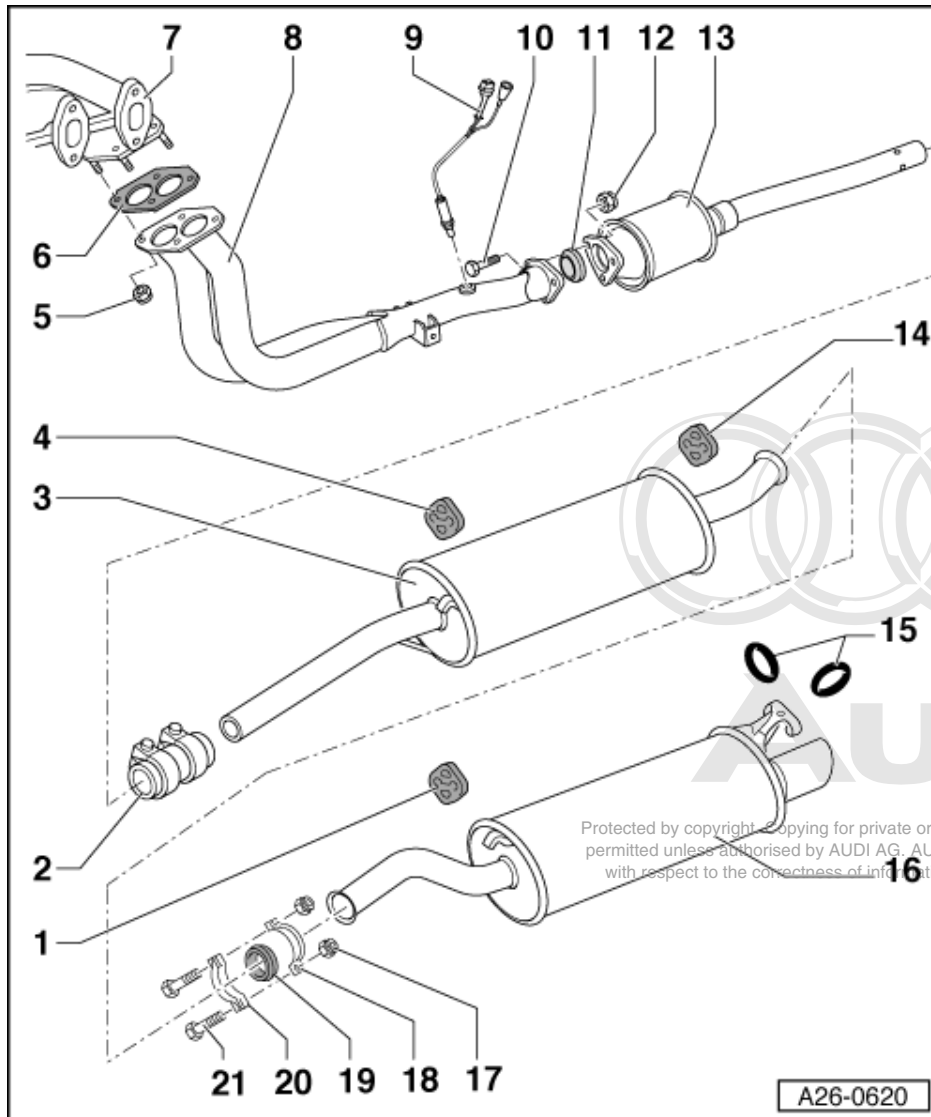
19 Clip

- ♦ Installation position
=> Fig. 210

20 Bolt

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1.3 - Vehicles with front-wheel drive with catalytic converter



1 Retainer

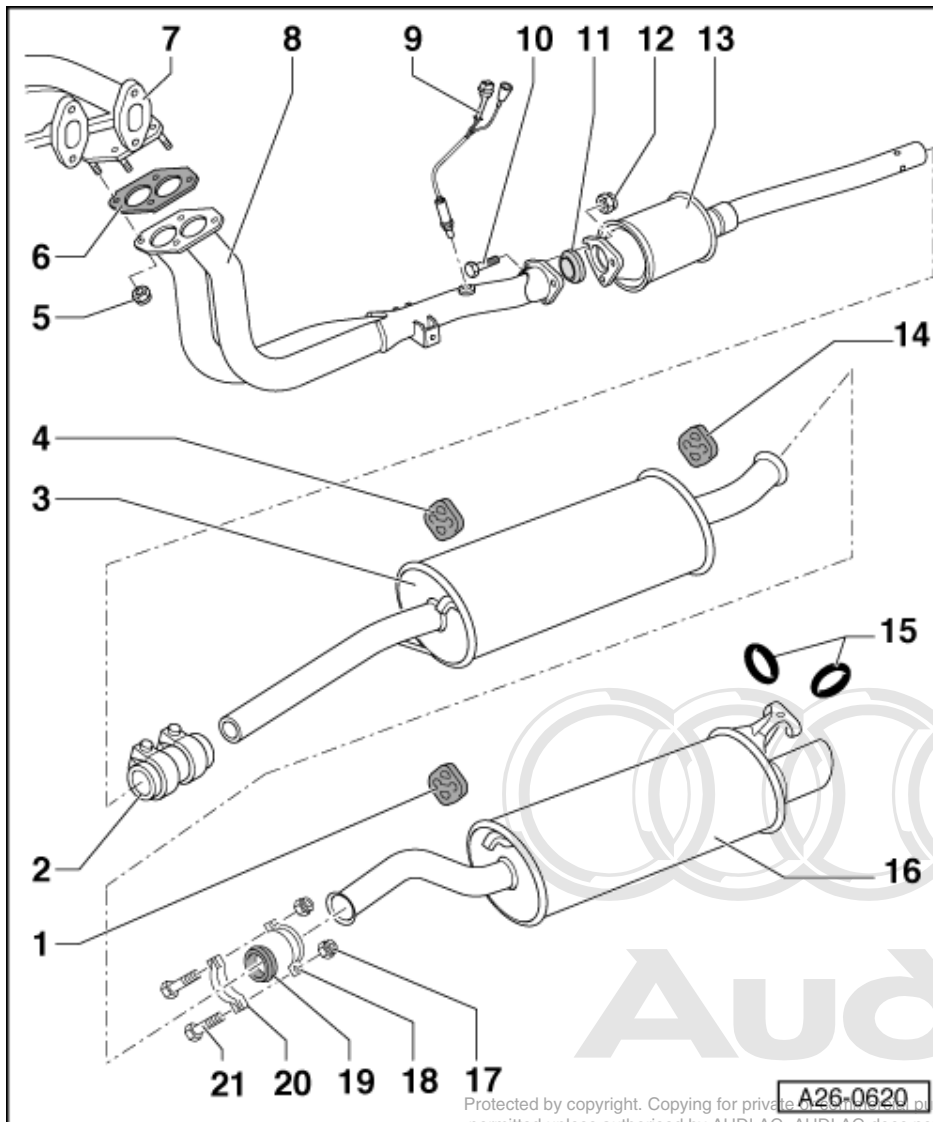
- ◆ Replace if damaged
- ◆ Bending over securing tabs => Fig. 210

2 Clamp

- ◆ Align exhaust system so it is free of stress before tightening clamp => Page 225
- ◆ Installation position
=> Fig. 210
- ◆ Tighten bolted connections evenly to 40 Nm

3 Centre silencer

- ◆ Align exhaust system so it is free of stress before tightening clamp => Page 225



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4 Retainer

- ♦ Replace if damaged
- ♦ Bending over securing tabs => Fig. 210

5 30 Nm

- ♦ Replace

6 Seal

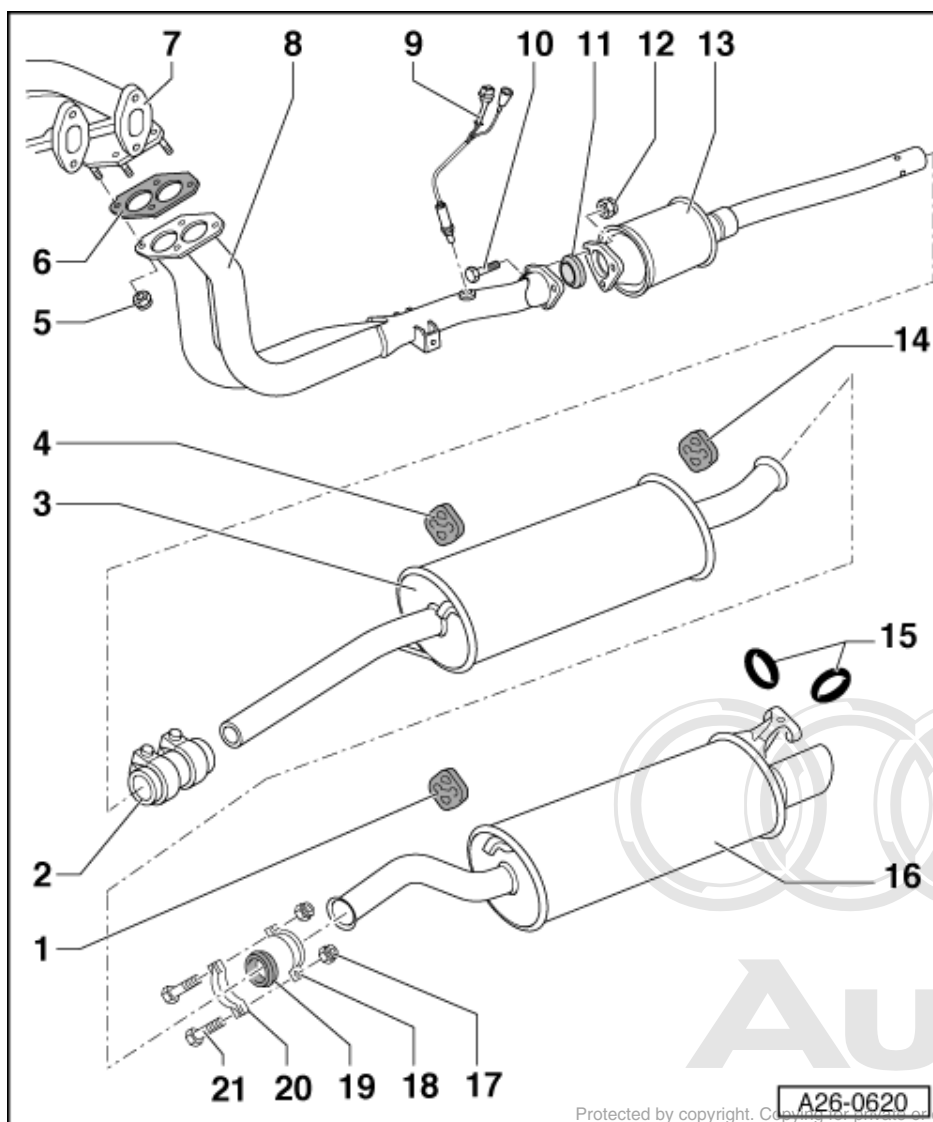
- ♦ Replace

7 Exhaust manifold

- ♦ Removing and installing
=>Page 222 .

8 Front exhaust pipe

- ♦ Mounting components
=> Fig. 211

**9 Lambda probe - 55 Nm**

- ♦ Different versions
- ♦ Allocation

=> Parts List

- ♦ Grease only the threads with high-temperature lubricant. The lubricant must not penetrate into the slots on the probe body.
- ♦ High-temperature lubricant

=> Parts List

- ♦ Checking:

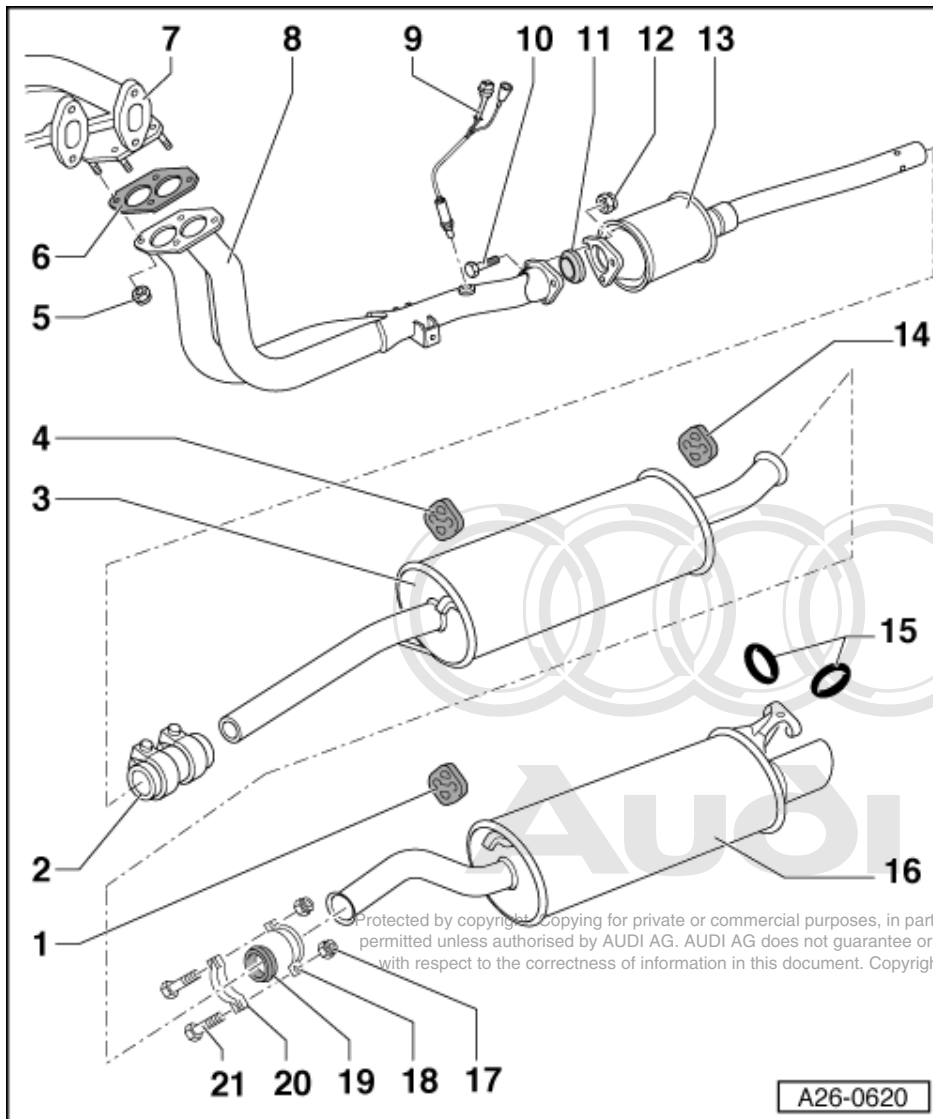
=> Fuel Injection and Ignition System; Repair group 24

=> Fuel Injection and Ignition System; Repair group 25

10 25 Nm**11 Sealing ring**

- ♦ Sensitive to impact; take care not to drop

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12 25 Nm

- ♦ Replace

13 Catalytic converter

- ♦ Protect from damage by knocks and impact

14 Retainer

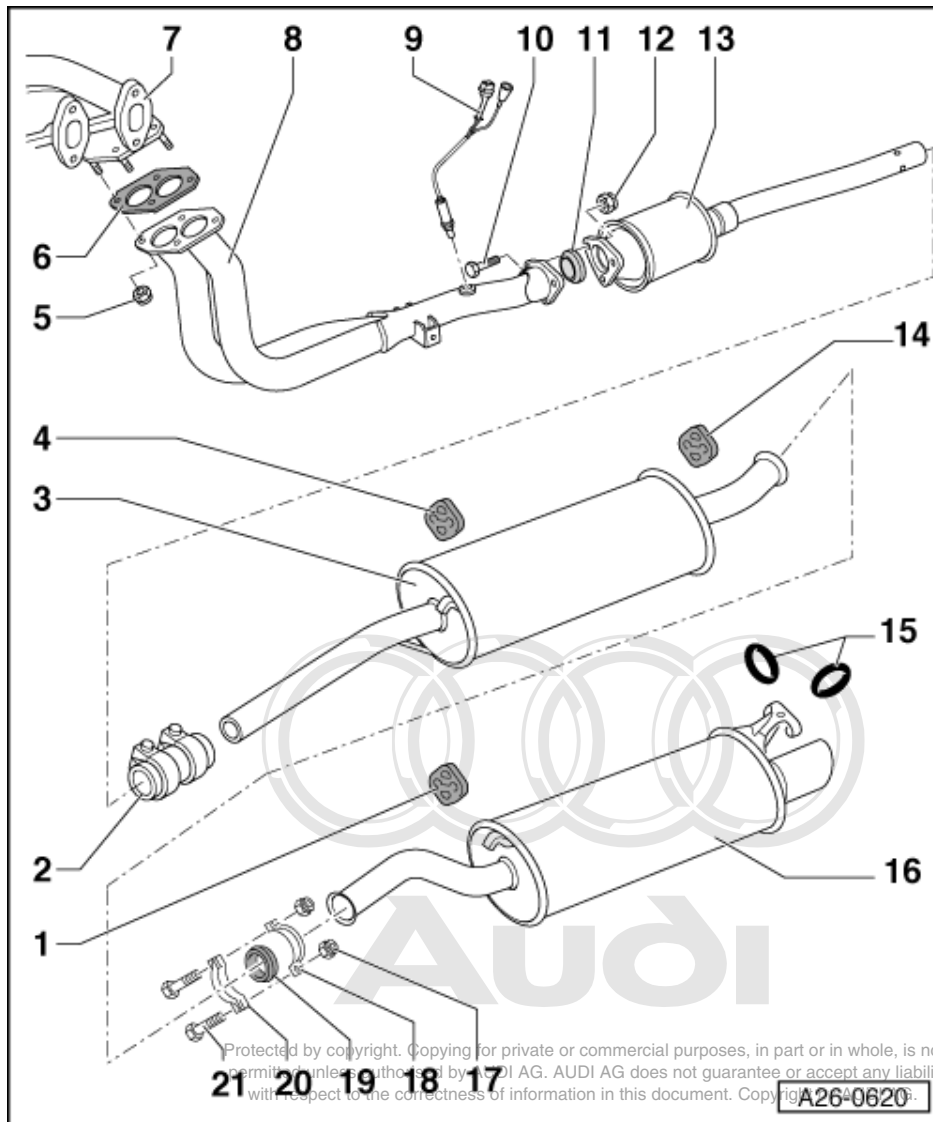
- ♦ Replace if damaged
- ♦ Bending over securing tabs => Fig. 210

15 Retaining rings

- ♦ Replace if damaged
- ♦ Bending over securing tabs => Fig. 211

16 Rear silencer

- ♦ Align exhaust system so it is free of stress before tightening clamp => Page 225



17 15 Nm

- ◆ Replace

18 Clip

- ◆ Installation position
=> Fig. 210

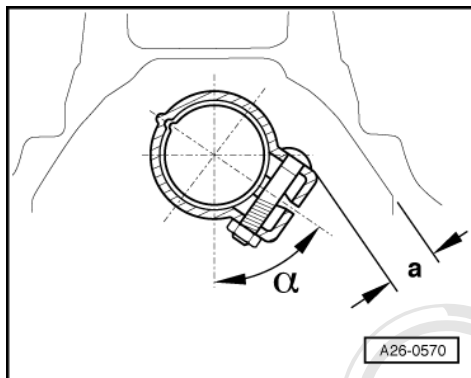
19 Sealing ring

- ◆ Sensitive to impact; take care not to drop

20 Clip

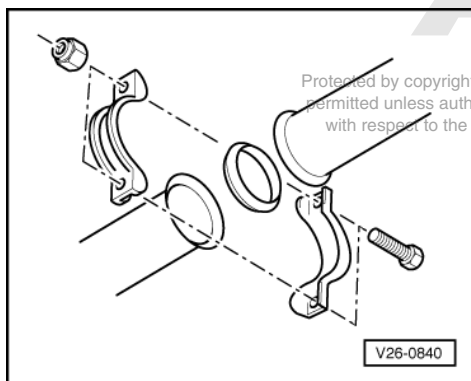
- ◆ Installation position
=> Fig. 210

21 15 Nm



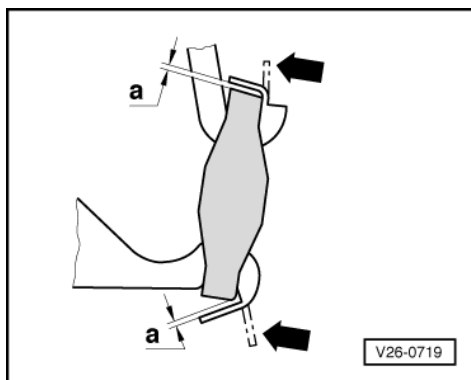
-> Fig.1 Installation position of the clamping sleeve

- Fit clamp in horizontal position.
- Bolted connections face to right
- $\alpha = 45^\circ$
- $a = 27 \dots 37 \text{ mm}$



-> Fig.2 Installation position of clamp

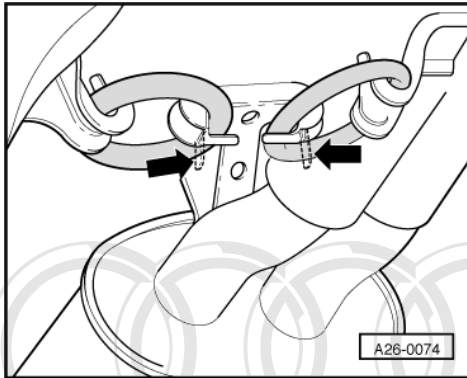
- Fit clamping sleeve vertically.
- Bolt head faces to right



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

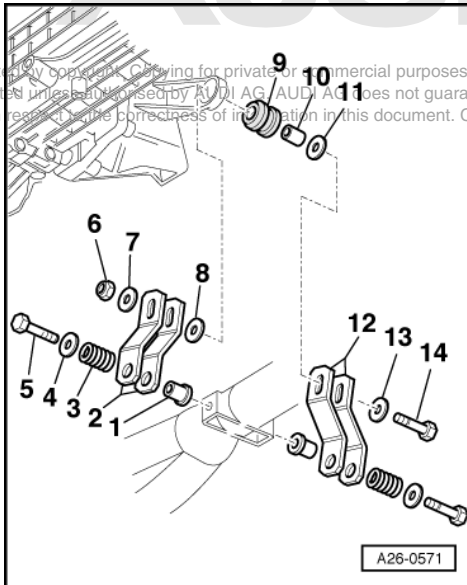
- Centre and rear silencers
- After installing the exhaust system, bend over the securing tabs -arrows- approx. 90° .
- Ensure that a distance corresponding to dimension -a- is maintained between retainer and securing tab.

- Dimension a = 2 mm



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

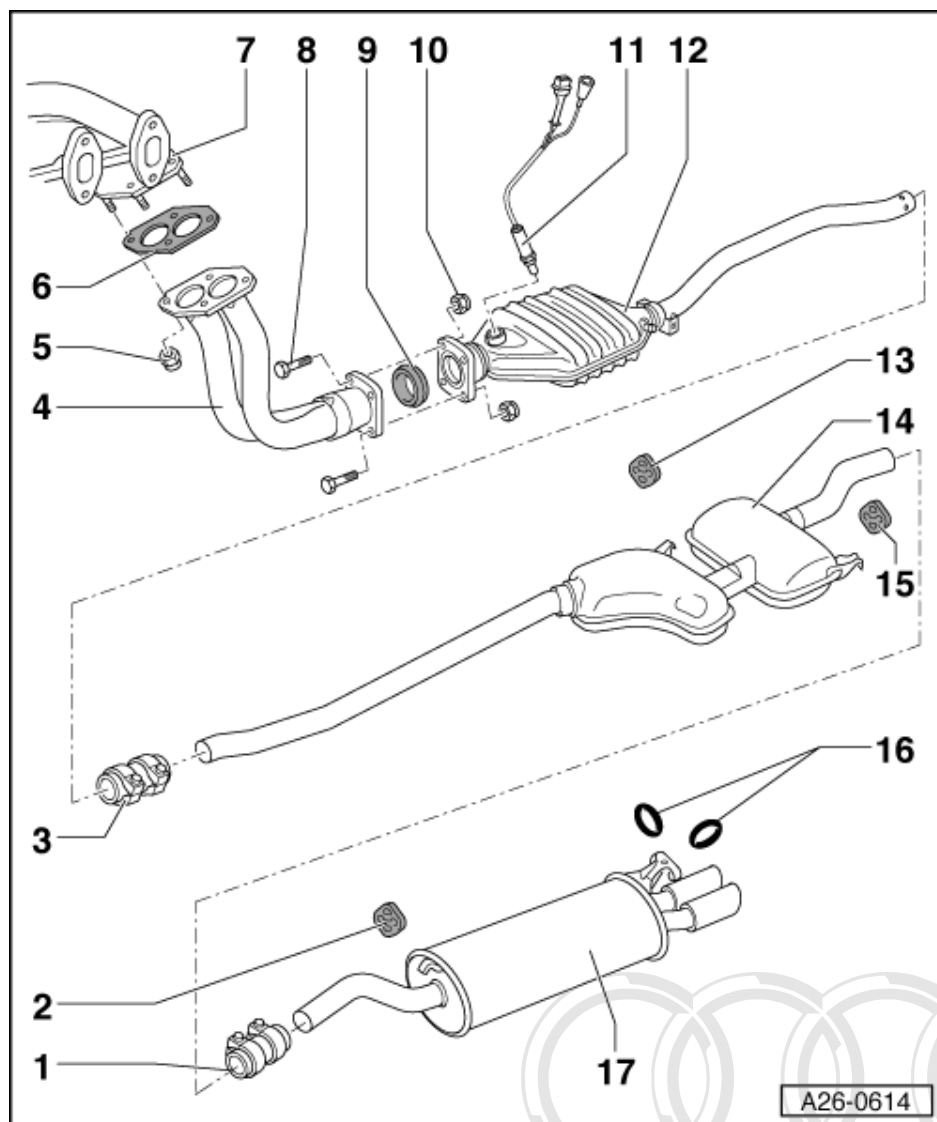
- Rear silencer
- After installing the exhaust system, bend over the securing tabs -arrows- approx. 90°.



-> Fig.5 Components of mounting

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

1.4 - Vehicles with four-wheel drive



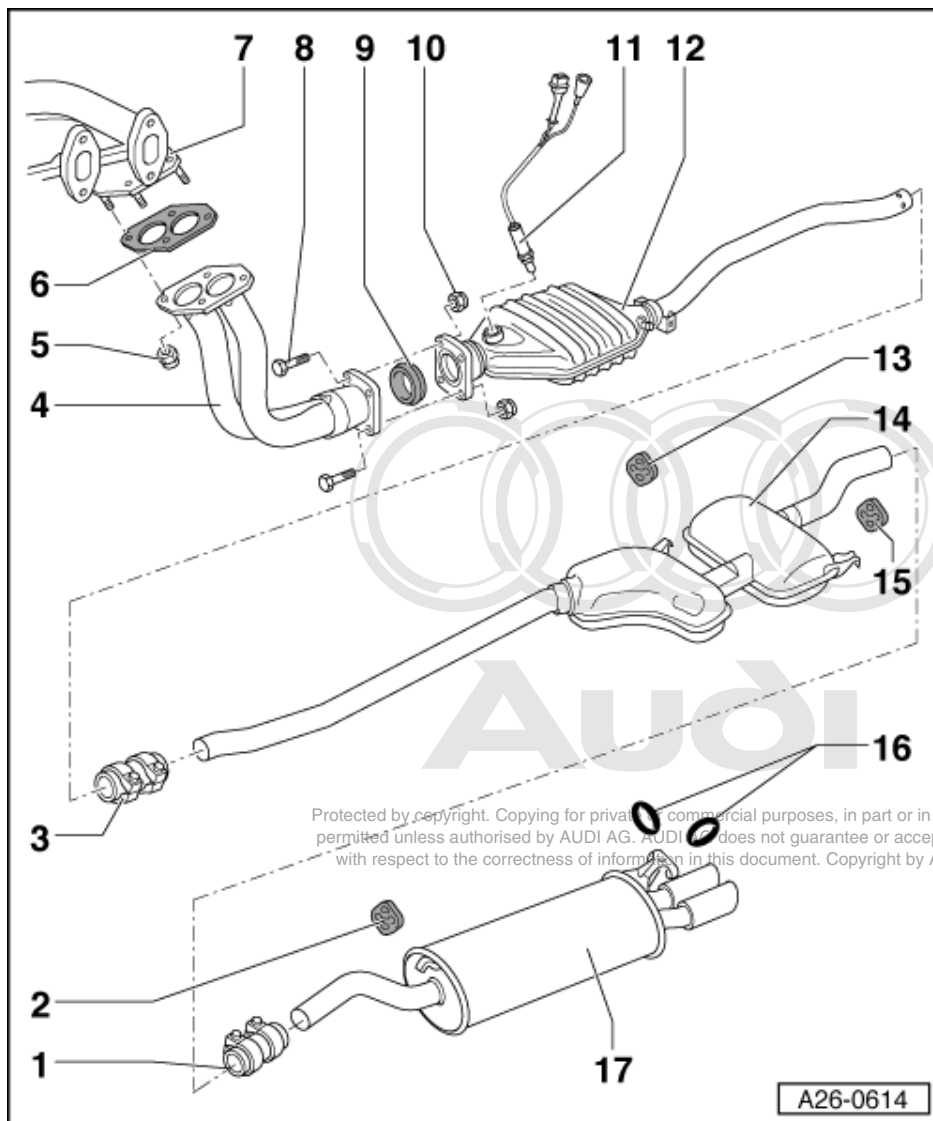
1 Rear clamping sleeve

- ◆ For separate replacement of centre and rear silencers
- ◆ Align exhaust system so it is free of stress before tightening clamp => Page 225
- ◆ Installation position
=> Fig. 217
- ◆ Tighten bolted connections evenly to 40 Nm

2 Retainer

- ◆ Replace if damaged
- ◆ Bending over securing tabs => Fig. 218

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3 Front clamping sleeve

- ♦ Align exhaust system so it is free of stress before tightening clamp => Page 225
- ♦ Installation position => Fig. 217
- ♦ Tighten bolted connections evenly to 40 Nm

4 Front exhaust pipe

5 30 Nm

- ♦ Replace

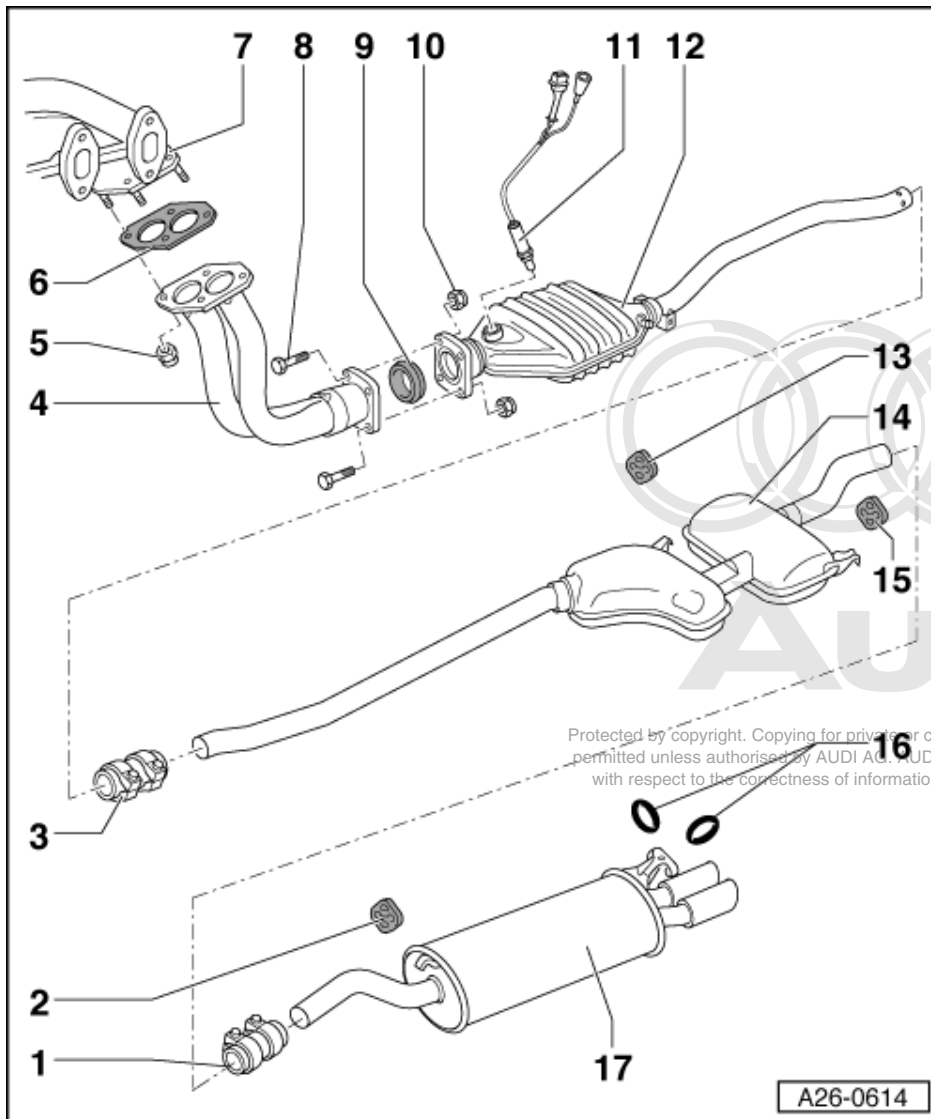
6 Seal

- ♦ Replace

7 Exhaust manifold

- ♦ Removing and installing
=>Page 222

8 Bolt

**9 Sealing ring**

- ♦ Sensitive to impact; take care not to drop

10 25 Nm

- ♦ Replace

11 Lambda probe - 55 Nm

- ♦ Different versions
- ♦ Allocation

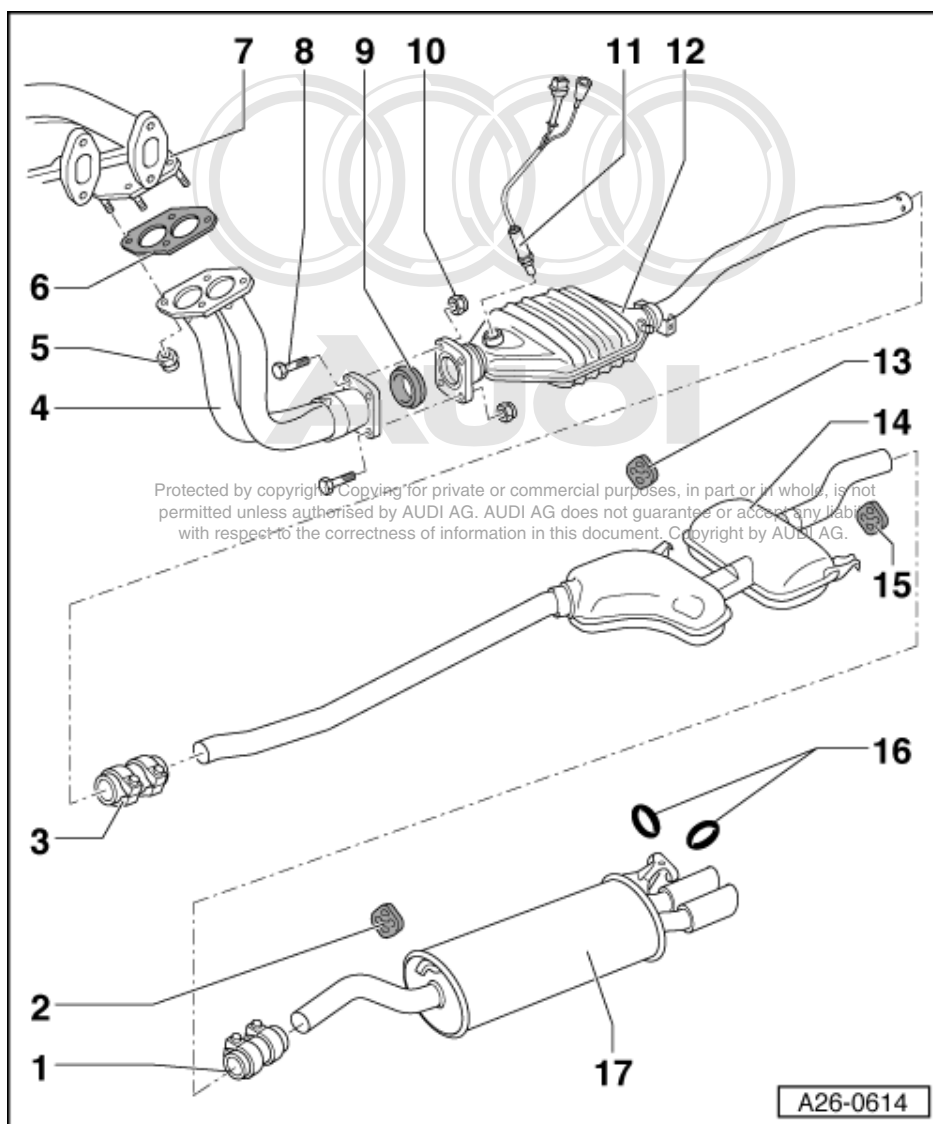
=> Parts List

- ♦ Grease only the threads with high-temperature lubricant. The lubricant must not penetrate into the slots on the probe body.
- ♦ High-temperature lubricant

=> Parts List

- ♦ Checking:

=> Fuel Injection and Ignition System; Repair group 25

**12 Catalytic converter**

- ◆ Protect from damage by knocks and impact
- ◆ Mounting components
=> Fig. 217

13 Retainer

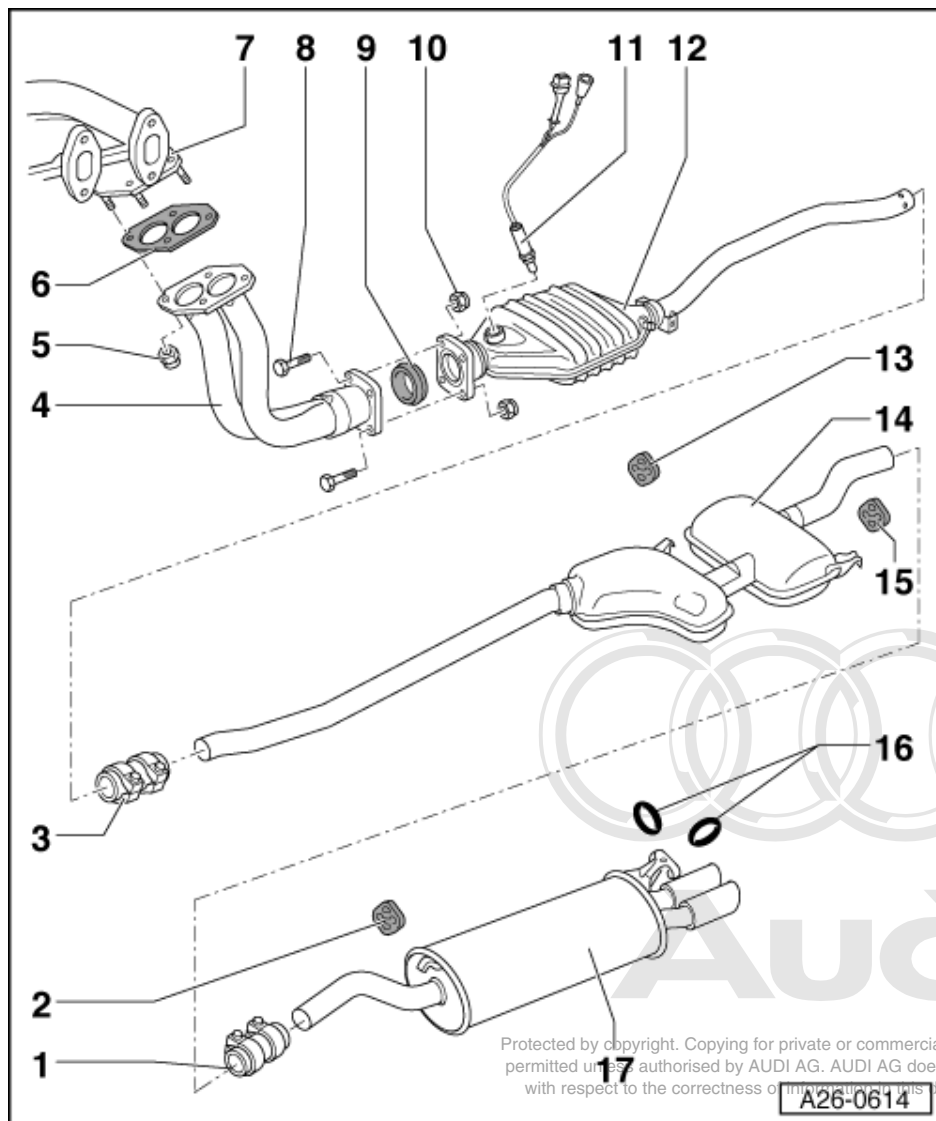
- ◆ Replace if damaged
- ◆ Bending over securing tabs => Fig. 218

14 Centre silencer

- ◆ Centre and rear silencers are one unit as original equipment. In cases of repair renew individually
- ◆ Cutting point => Page 219
- ◆ Align exhaust system so it is free of stress before tightening clamp => Page 225

15 Retainer

- ◆ Replace if damaged
- ◆ Bending over securing tabs => Fig. 218

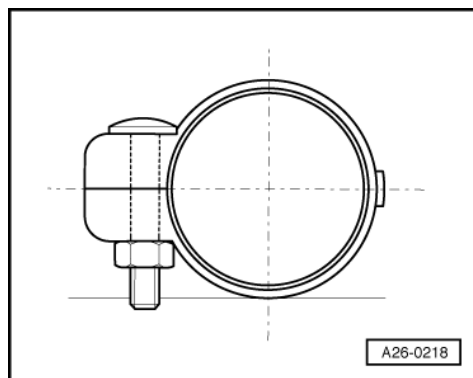


16 Retaining rings

- ◆ Replace if damaged
- ◆ Bending over securing tabs => Fig. 218

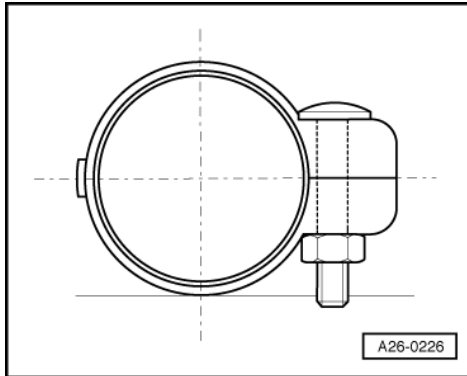
17 Rear silencer

- ◆ Rear and centre silencer are one unit as original equipment. In cases of repair renew individually
- ◆ Cutting point => Page 219
- ◆ Align exhaust system so it is free of stress before tightening clamp => Page 225



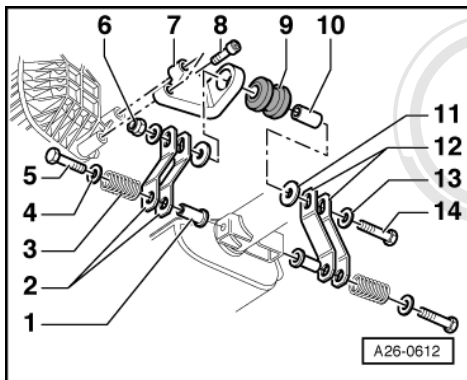
-> Fig.1 Installation position of front clamp

- Fit clamp in horizontal position.
- Bolted connection facing to the left



-> Fig.2 Installation position of rear clamp

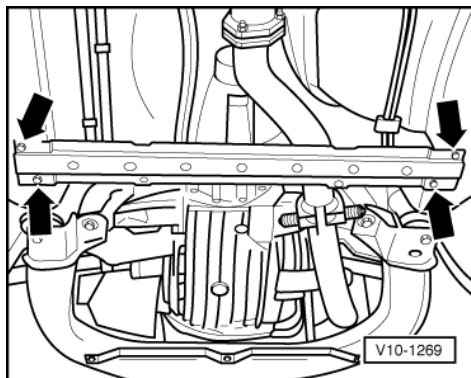
- Fit clamp in horizontal position.
- Bolted connection faces right



-> Fig.3 Components of mounting

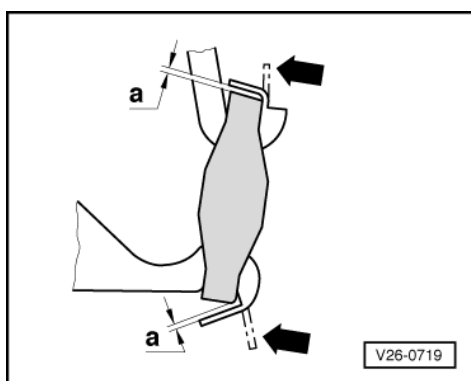
- 1 - Spacer
- 2 - Link
- 3 - Pressure spring
- 4 - Plate
- 5 - Bolt - 25 Nm
- 6 - Nut, self-locking - 25 Nm
- 7 - Console
- 8 - Torx socket head bolt - 25 Nm
- 9 - Buffer
- 10 - Spacer
- 11 - Plate
- 12 - Link
- 13 - Plate
- 14 - Bolt - 25 Nm

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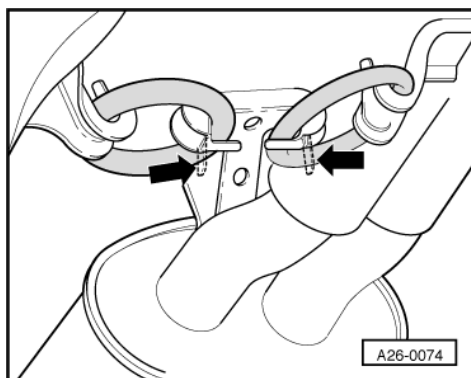
-> Fig.4 Removing and installing floor cross member

- ♦ Tightening torque: 20 Nm



-> Fig.5 Bending over securing tabs on brackets of front mounting

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



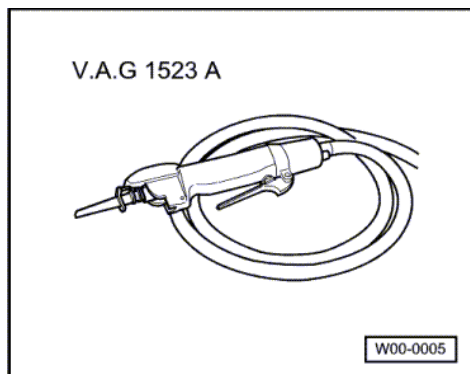
-> Fig.6 Bending over securing tabs on brackets of rear mounting

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

1.5 - Separating centre and rear silencers

Vehicles with four-wheel drive:

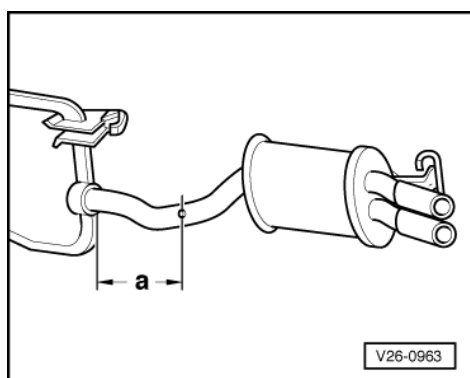
- ♦ The connecting pipe can be separated at the cutting point in order to replace the centre and rear silencers separately



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Special tools and workshop equipment required

- ♦ Body saw V.A.G 1523 A
- ♦ Protective goggles



Procedure

Important
Wear protective goggles.

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

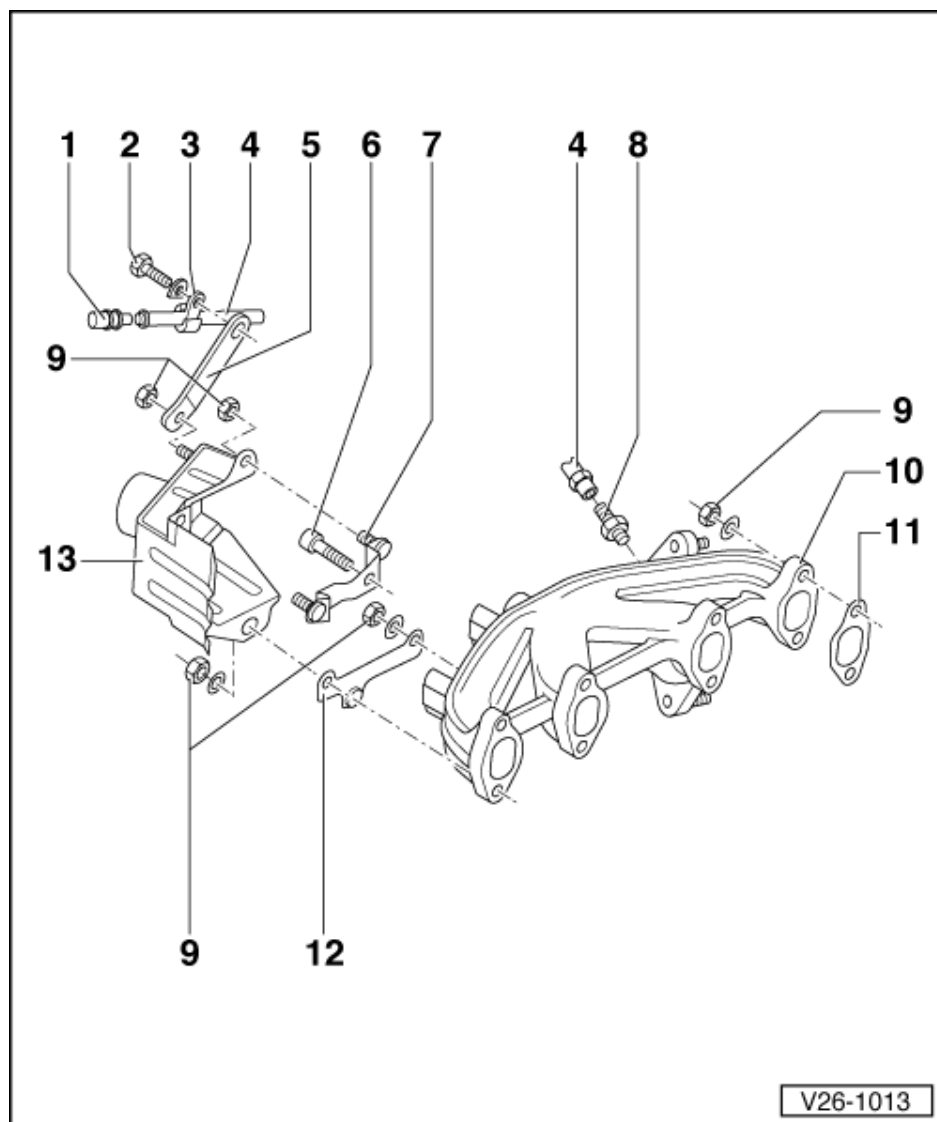
Note:

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

- When installing, position clamping sleeve centrally over saw cut.
 - Installation position of clamp => Fig. 217
- Stress-free alignment of exhaust system => Page 225
- Tighten bolted connections on clamp evenly to 40 Nm.



1.6 - Exhaust manifold - Overview



- 1 Cap
- 2 10 Nm
- 3 Clip
- 4 CO test pipe
 - ◆ Tighten to 20 Nm
 - ◆ Different versions

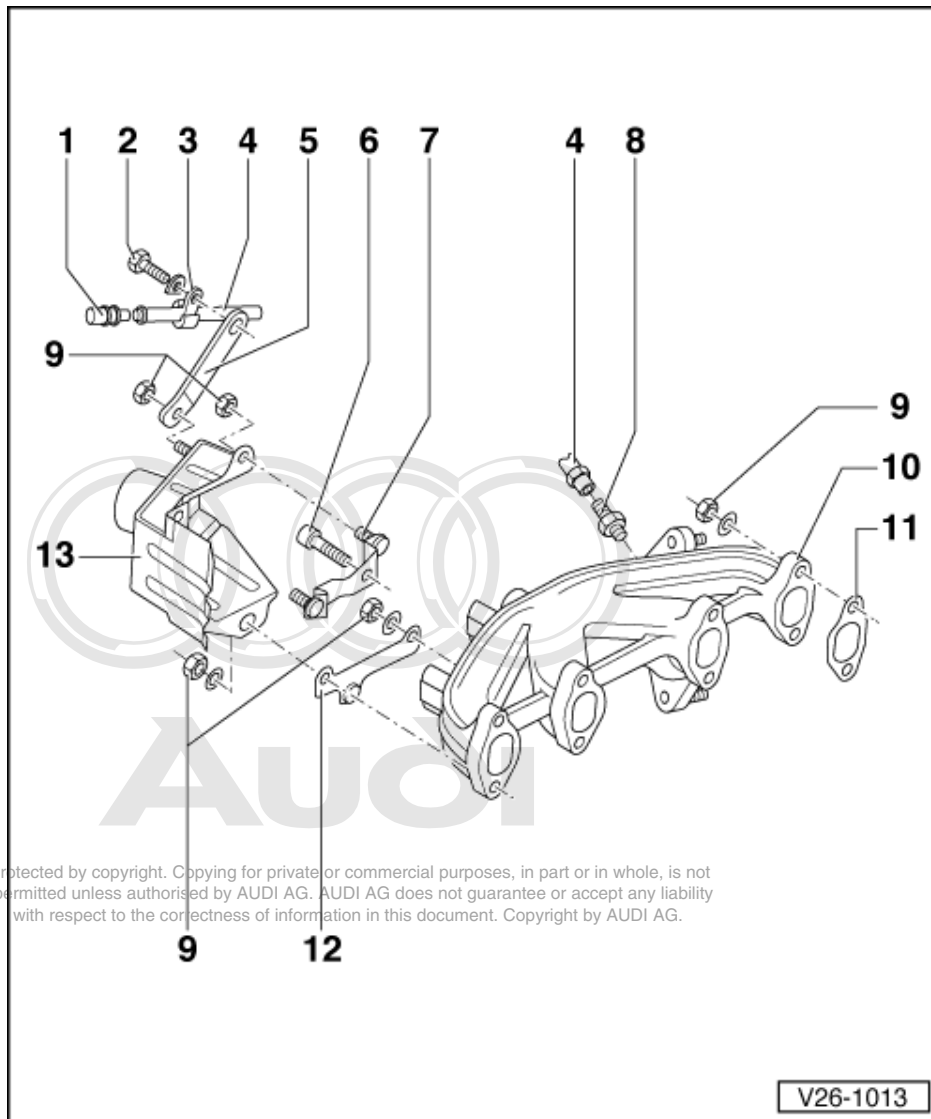
=> Parts List

- 5 Bracket
 - ◆ Different versions

=> Parts List

- 6 20 Nm
- 7 Bracket
- 8 Screw connection

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9 25 Nm

- ♦ Replace

10 Exhaust manifold

- ♦ Different versions

=> Parts List

- ♦ Removing and installing
=>Page [222](#)

11 Seal

- ♦ Replace

12 Bracket

- ♦ Different versions

=> Parts List

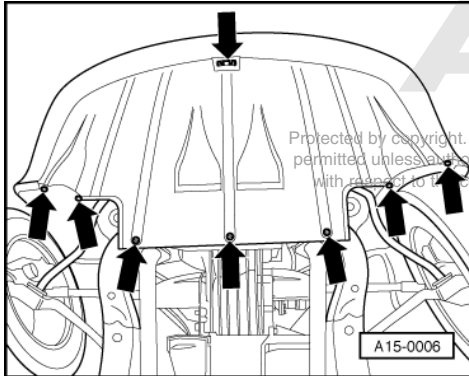
13 Warm air arrester plate

- ♦ For intake air preheater
- ♦ Different versions



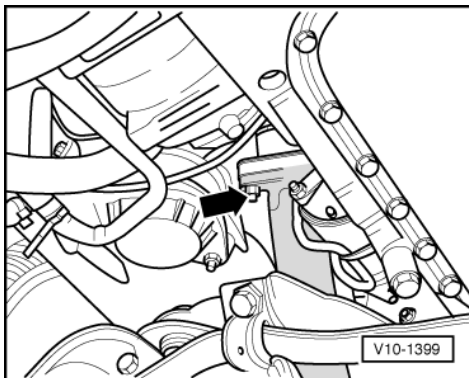
=> Parts List

1.7 - Removing and installing exhaust manifold

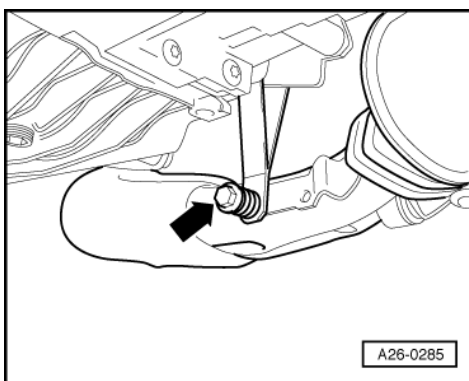


Removing

- -> Remove the noise insulation -arrows-.



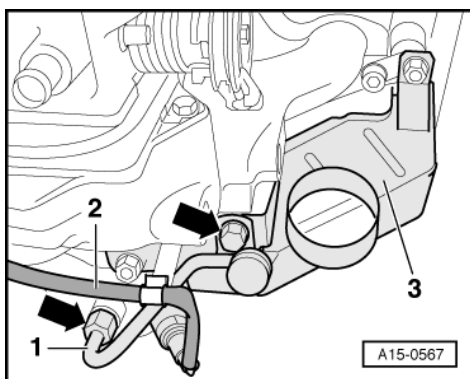
- -> Unscrew exhaust manifold/front exhaust pipe nuts -arrow-.



- -> Unbolt exhaust system at bracket -arrow-.
- Push exhaust system towards the rear so that studs on exhaust manifold are free.

Note:

Note electrical wiring of lambda probe.



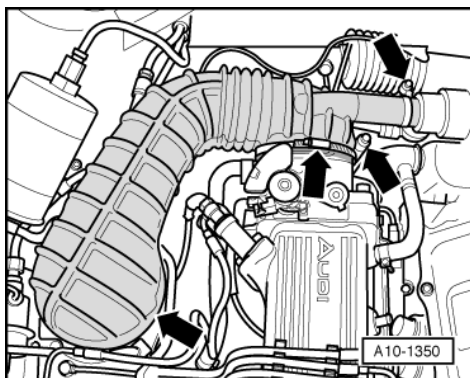
Vehicles with engine code AAE:

- Detach air intake cowl on the throttle body injection unit with air intake hose.
- -> Unscrew the CO test pipe -1- from the exhaust manifold and the intake manifold -arrows-.
- Unplug the lambda probe connectors.
- Lay lambda probe wiring -2- aside.
- Unbolt the warm air arrester plate -3-.
- Unbolt the intake manifold support from the exhaust manifold and from the intake manifold.

Note:

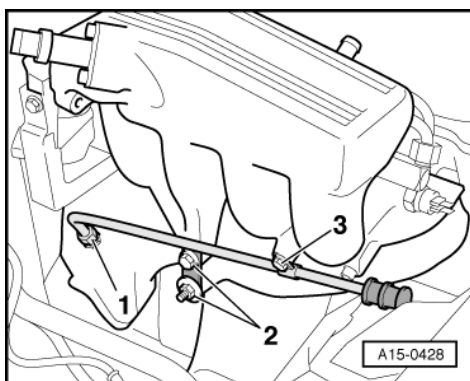
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Note spacer sleeve between support and exhaust manifold.



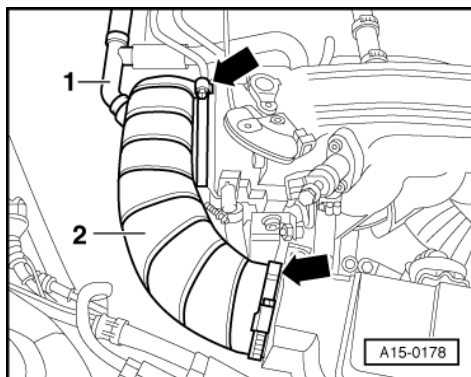
Vehicles with engine code AAD, ABB:

- -> Remove the air intake cowl -arrows-.
- Detach hose of intake air preheater from warm air arrester plate on exhaust manifold.



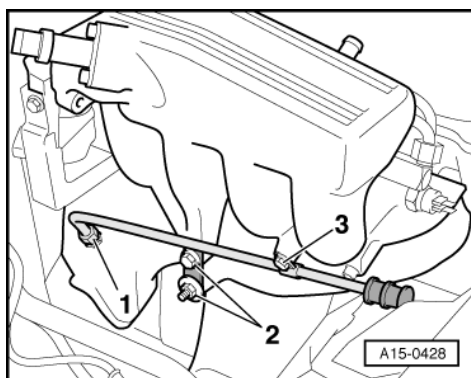


- -> Unscrew the threaded connections -2- and remove intake manifold support.
- Unscrew bolt -3-.
- Unscrew CO test pipe from the exhaust manifold -1-.
- Unbolt the warm air arrester plate.



Vehicles with engine codes ABK, ADA, ADW:

- -> Detach the air duct hose -2- from the throttle valve unit and the air flow meter, loosen hose clamps - arrows- for this purpose.
- Detach the elbow piece -1- from hose to cylinder head cover/intake manifold.
- Detach hose of intake air preheater from warm air arrester plate on exhaust manifold.



- -> Unscrew the threaded connections -2- and remove intake manifold support.
- Unscrew bolt -3-.
- Unscrew CO test pipe from the exhaust manifold -1-.
- Unbolt the warm air arrester plate.

All models:

- Unscrew all exhaust manifold nuts.
- Remove washers and exhaust manifold.

Installing

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

Note:

Replace gaskets and seals.

- Before installing engine support, place rubber covers for engine mounts in installation position.

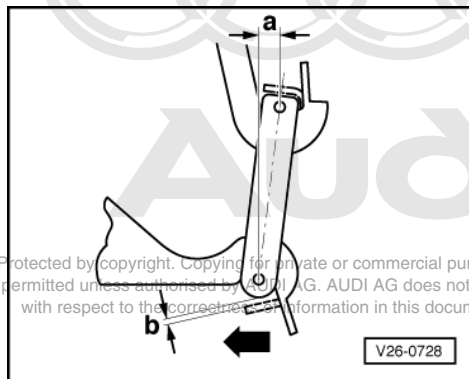
Tightening torques

Component	Nm
Exhaust manifold to cylinder head	25
Front exhaust pipe to exhaust manifold	30
Front exhaust pipe to mountings on gearbox	25
CO test pipe to exhaust manifold	20
CO test pipe to intake pipe	10
Support for intake pipe to intake pipe	20
Warm air arrester plate to exhaust manifold	20
Support for intake pipe to intake manifold	20

1.8 - Stress free alignment of exhaust system

Note:

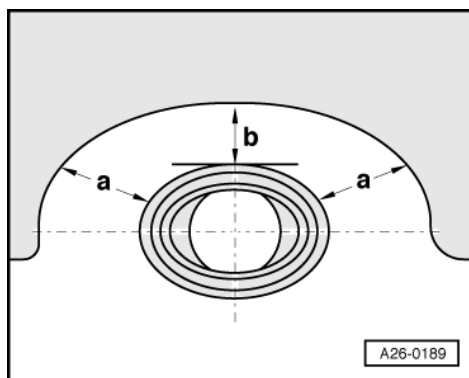
The exhaust system must be aligned when cold.



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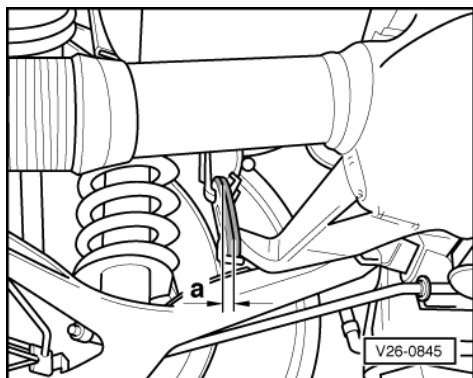
Vehicles with front-wheel drive:

- Loosen bolted connections on clamp -Item **202**
- -> Push exhaust system towards front of vehicle -arrow- until rear mounting on centre silencer is preloaded by $a = 7 \dots 10 \text{ mm}$.
- Tighten bolted connections on clamp evenly to 40 Nm.
- Note installation position of front clamp => Fig. **210**



Aligning tailpipe

- -> Align tailpipe so that distance -a- is the same on both sides.
- At the same time, distance -b- must be obtained between bumper cut-out and tailpipe:
 - Dimension b = approx. 30 mm



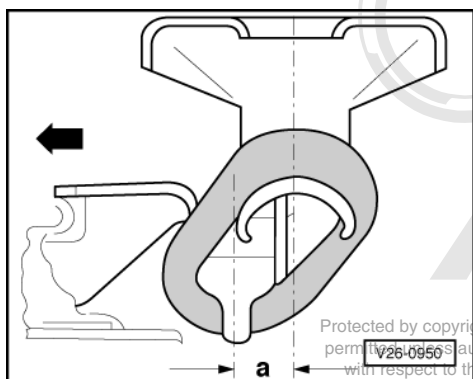
Vehicles with four-wheel drive:

- Vehicles with clamping sleeve between centre silencer and rear silencer

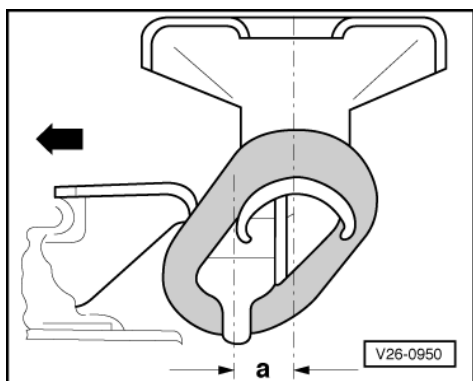
Note:

It is only necessary to additionally align the centre silencer on vehicles with clamp fitted between centre silencer and rear silencer.

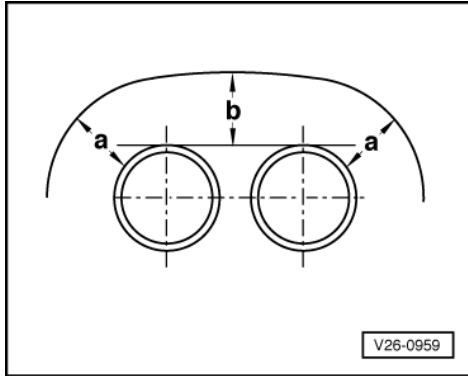
- Loosen bolted connections on clamp -Item 212 .
- -> Push exhaust system towards front of vehicle until rear mounting of centre silencer is preloaded by a = 7...10 mm.
- Tighten bolts on front clamping sleeve -Item 213 evenly to 40 Nm.
- Note installation position of front clamp=> Fig. 217 .



- -> Push rear silencer towards front of vehicle -arrow- until rear mounting on rear silencer is preloaded by a = 12...14 mm.
- Tighten bolts on rear clamp -Item 212 evenly to 40 Nm.
 - Note installation position of front clamp=> Fig. 217



- Vehicles without clamping sleeve between centre silencer and rear silencer
 - Slacken bolted connections on front clamping sleeve -Item 213 .
 - -> Push rear silencer towards front of vehicle -arrow- until rear mounting on rear silencer is preloaded by a = 12...14 mm.
 - Tighten bolts on front clamping sleeve -Item 213 evenly to 40 Nm.
 - Note installation position of front clamp=> Fig. 217



Aligning tailpipes

- -> Align tailpipes so that distance -a- is the same on both sides.
- At the same time, distance -b- must be obtained between bumper cut-out and tailpipe:
 - Dimension b = approx. 30 mm

1.9 - Checking exhaust system for leaks

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

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