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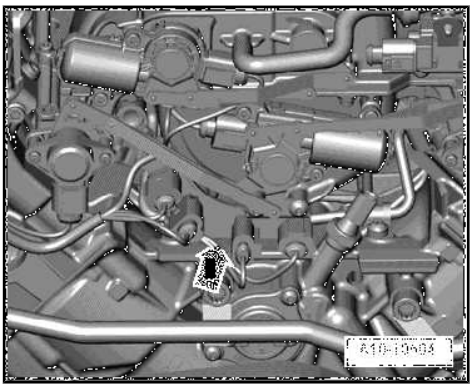
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00 – Technical data

1 Engine number

(ARL002997; Edition 08.2012)

- The engine number (“engine code” and “serial number”) can be found on top of the cylinder block at the front -arrow-.
- The engine code is also included on the vehicle data sticker.



Note

Pull off engine cover panel (front) to make the engine number visible.

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2 Engine data

Code letters		BVJ
Capacity	ltr.	4.163
Power output	kW at rpm	257/6800
Torque	Nm at rpm	440/3500
Bore	∅ mm	84.5
Stroke	mm	92.8
Compression ratio		12.5
RON		98 1)
Injection and ignition system		Bosch Motronic
Firing order		1-5-4-8-6-3-7-2
Turbocharging/supercharging		no
Lambda control		4 probes
Variable valve timing		yes
Intake manifold change-over		yes
Secondary air system		yes
Valves per cylinder		4

- 1) Unleaded premium RON 95 can also be used, but results in reduced power

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3 Safety precautions

⇒ “3.1 Working on the fuel supply system”, page 3

⇒ “3.2 Working on the cooling system”, page 4

⇒ “3.3 Using testers and measuring instruments during a road test”, page 4

⇒ “3.4 Working on the exhaust system”, page 4

3.1 Working on the fuel supply system

Please note the following warnings when working on the fuel supply system:

WARNING

The fuel system operates at extremely high pressure. This can cause injury.

- *The fuel pressure in the high-pressure section of the injection system must be reduced to a residual pressure prior to opening the system.*
- *Wrap a clean cloth around the connection and carefully loosen the connection to allow the residual pressure to dissipate.*

– Procedure before opening high-pressure section of injection system ⇒ Rep. gr. 24 .

Observe the following to prevent injuries to persons and damage to the injection and ignition system:

- Always switch off the ignition before connecting or disconnecting electrical wiring for the injection or ignition system or tester cables.
- Always switch off ignition before washing engine.
- Erase any entries in event memory resulting from testing or repairs ⇒ Vehicle diagnostic tester, `Guided Functions`, `Interrogate event memory`, then `Generate readiness code`.

Caution

To prevent irreparable damage to the electronic components when disconnecting the battery:

- *Observe notes on procedure for disconnecting the battery.*
- *Always switch off the ignition before disconnecting the battery.*

– Disconnect battery ⇒ Electrical system; Rep. gr. 27 .

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3.2 Working on the cooling system

When working on the cooling system note the following warnings:



WARNING

Hot steam/hot coolant can escape - risk of scalding.

- *The cooling system is under pressure when the engine is hot.*
- *To allow pressure to dissipate, cover filler cap on coolant expansion tank with cloth and open carefully.*

Risk of injury as the radiator fans may start up automatically.

- *Unplug electrical connectors before starting to work in the area of radiator cowl.*



Caution

Overheating can occur if the filler cap is not fitted properly.

- *The filler cap must engage positively and audibly when it is closed.*

3.3 Using testers and measuring instruments during a road test

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



WARNING

Accidents can be caused if the driver is distracted by test equipment while road-testing, or if test equipment is not properly secured.

Persons sitting in the front passenger's seat could be injured if the airbag is triggered in an accident.

- *The use of test equipment while driving causes distraction.*
- *There is an increased risk of injury if test equipment is not secured.*
- *Test equipment must always be secured on the rear seat with a strap and operated from the rear seat by a second person.*

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3.4 Working on the exhaust system

When working on the exhaust system please note the following:



Caution

Avoid damage to flexible joint.

- *Do not bend flexible joint more than 10°.*
- *Install flexible joint so that it is not under tension.*
- *Take care not to damage wire mesh on flexible joint.*

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4 Repair instructions

⇒ “4.1 Rules for cleanliness”, page 5

⇒ “4.2 Checking fuel system for leaks”, page 5

⇒ “4.3 Foreign particles in engine”, page 5

⇒ “4.4 Contact corrosion”, page 6

⇒ “4.5 Routing and attachment of pipes, hoses and wiring”, page 6

⇒ “4.6 Installing radiators and condensers”, page 6

4.1 Rules for cleanliness

Even small amounts of dirt can cause malfunctions. For this reason, please observe the following rules when working on the fuel supply system and injection system:

- Carefully clean connection points and the surrounding area with engine cleaner or brake cleaner and dry thoroughly before opening.
- Seal off open pipes/lines and connections immediately with clean plugs, e.g. from engine bung set -VAS 6122- .
- Place parts that have been removed on a clean surface and cover them over. Use only lint-free cloths.
- Carefully cover or seal open components if repairs cannot be carried out immediately.
- Only install clean components; replacement parts should only be unpacked immediately prior to installation. Do not use parts that have not been stored in their packing (e.g. in tool boxes etc.).
- When the system is open, do not work with compressed air and do not move the vehicle.
- Make sure that no fuel runs onto the fuel hoses. Should this occur, the fuel hoses must be cleaned again immediately.
- Protect unplugged electrical connectors against dirt and moisture and make sure connections are dry when attaching.

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4.2 Checking fuel system for leaks

– Allow engine to run for several minutes at moderate rpm.

– Switch off ignition.

– Check complete fuel system for leaks.

– If leaks are found although the connections have been tightened to the correct torque, the relevant component must be renewed.

– Road-test vehicle and accelerate with full throttle at least once.

– Then inspect high-pressure section of fuel system again for leaks.

4.3 Foreign particles in engine

- When working on the engine, all open inlet and exhaust ports must be sealed with suitable plugs (e.g. from engine bung set -VAS 6122-) to prevent foreign particles from entering the engine.
- In the event of mechanical damage to one of the cylinder banks, the intake and exhaust systems and combustion cham-

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bers of the opposite cylinder bank must always be examined for foreign particles to prevent further damage occurring later.

4.4 Contact corrosion

Contact corrosion can occur if unsuitable fasteners are used (e.g. bolts, nuts, washers, etc.).

For this reason, only fasteners with a special surface coating are used.

Additionally, all rubber and plastic parts and all adhesives are made of non-conductive materials.

Always install new parts if you are not sure whether used parts can be re-fitted ⇒ Electronic parts catalogue .

Note the following:

- We recommend using only genuine replacement parts; these have been tested and are compatible with aluminium.
- We recommend the use of Audi accessories.
- Damage caused by contact corrosion is not covered under warranty.

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4.5 Routing and attachment of pipes, hoses and wiring

- Mark fuel lines, hydraulic lines, vacuum lines, lines for activated charcoal filter and electrical wiring etc. before removal so they can be re-installed in the original positions and correctly connected. Make sketches or take photographs if necessary.
- To prevent damaging pipes, hoses and wiring, ensure sufficient clearance from all moving or hot components in engine compartment (little space in engine compartment).

4.6 Installing radiators and condensers

Even when the radiator and condenser are correctly installed, slight impressions may be visible on the fins of these components. This does not mean that the components are damaged. If the fins are only very slightly distorted, this does not justify renewal of the radiator or the condenser.

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10 – Removing and installing engine

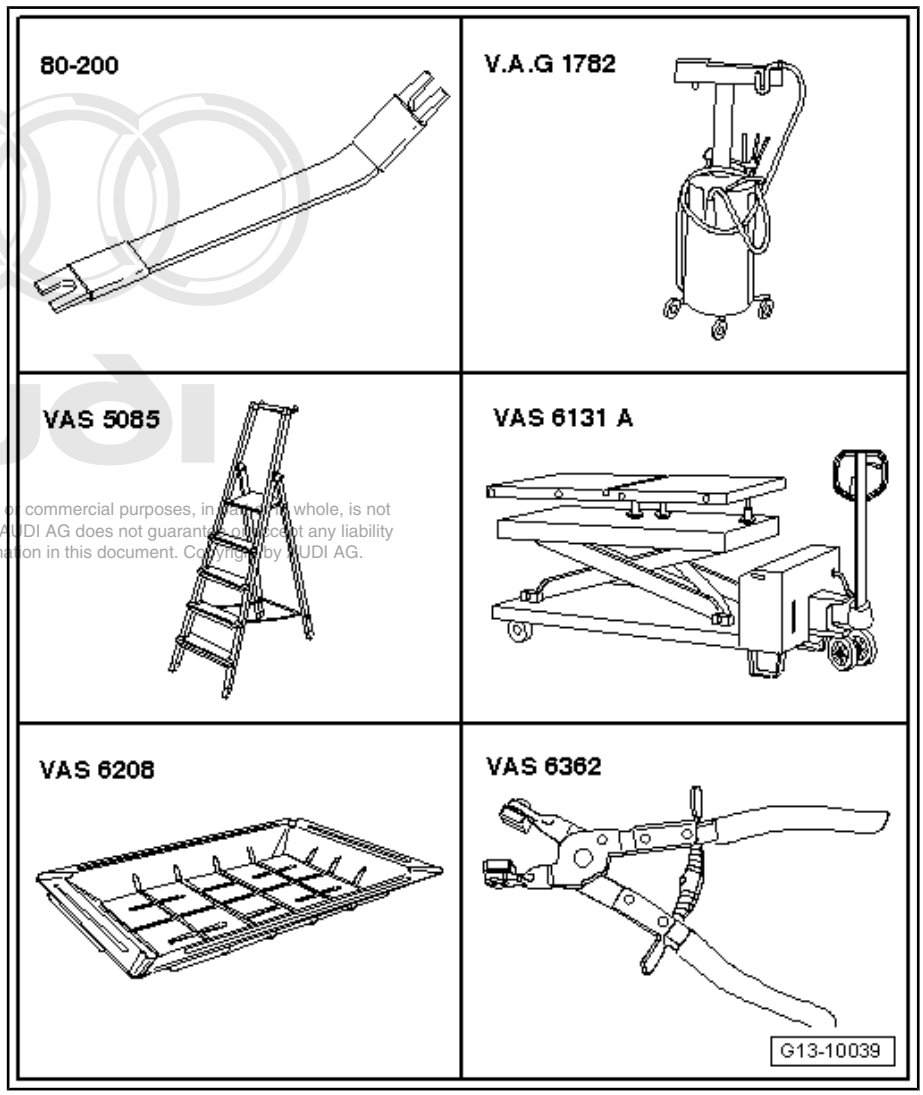
1 Removing engine

Note

- *The engine is removed from underneath together with the gearbox and subframe (with lock carrier installed).*
- *Collect drained coolant in a clean container for re-use or disposal.*
- *Fit all cable ties in the original positions when installing.*

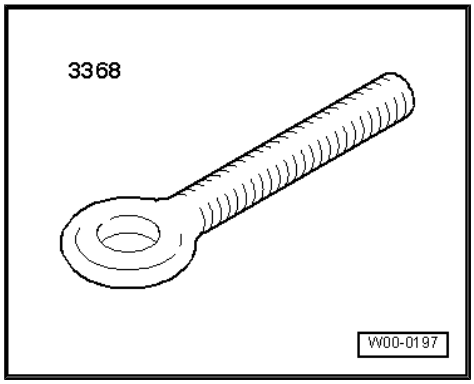
Special tools and workshop equipment required

- Removal lever -80 - 200-
- Used oil collection and extraction unit -V.A.G 1782-
- Stepladder -VAS 5085-
- Scissor-type assembly platform -VAS 6131 A- with support set for Audi - VAS 6131/10- and support set -VAS 6131/11- and -VAS 6131/12-
- Drip tray for workshop hoist -VAS 6208-
- Hose clip pliers -VAS 6362-

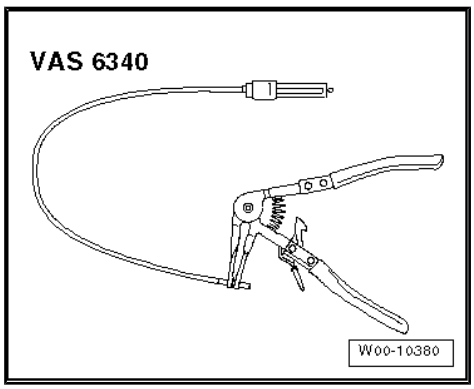


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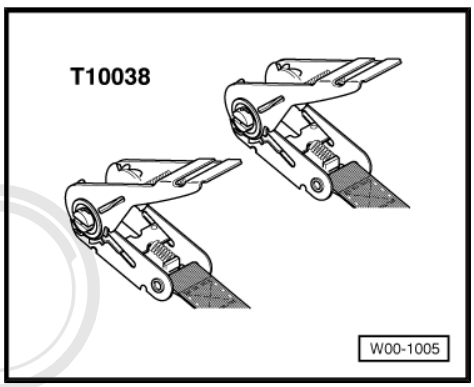
- Eye-head bolt -3368-



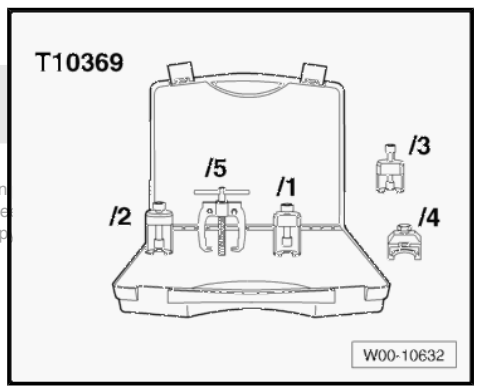
- Hose clip pliers -VAS 6340-



- Tensioning strap -T10038-



- Tool set for wiper arms -T10369-



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Procedure

WARNING

The fuel system operates at extremely high pressure. This can cause injury.

- *The fuel pressure in the high-pressure section of the injection system must be reduced to a residual pressure prior to opening the system.*

– Reduce fuel pressure in high-pressure section of injection system ⇒ Rep. gr. 24 .

– Discharge the refrigerant system ⇒ Air conditioner system - with refrigerant R134a .

– Extract hydraulic fluid for power steering from reservoir using used oil collection and extraction unit -V.A.G 1782- .

Caution

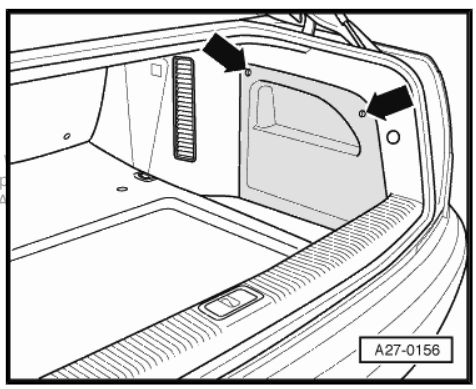
To prevent irreparable damage to the electronic components when disconnecting the battery:

- *Observe notes on procedure for disconnecting the battery.*

Note

- *To make sure you can still move the front wheels when the battery has been disconnected, only disconnect the battery with the ignition key inserted.*
- *The electronic parking brake must be released before disconnecting the battery, so that the propshaft can be turned during removal.*

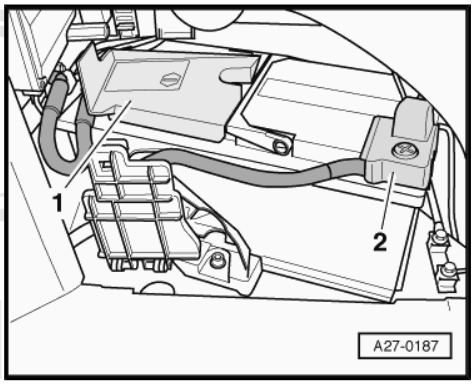
– Remove luggage compartment side trim cover (right-side) -arrows-.



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– Remove cover -1- over battery.

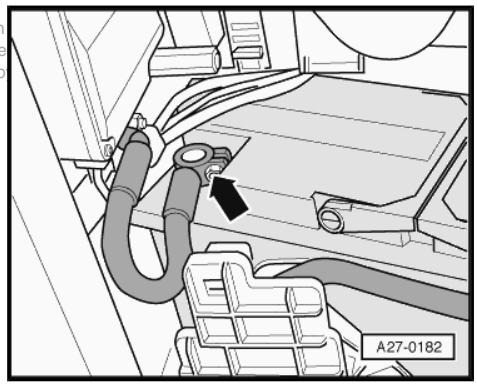


Note

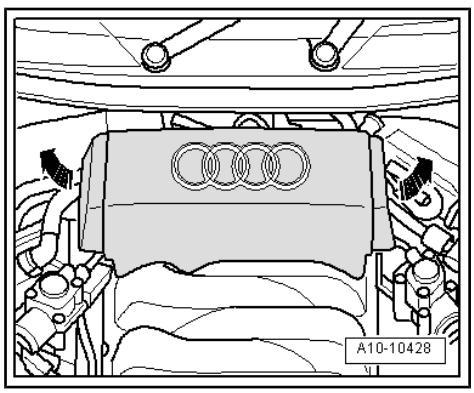
Disregard -item 2-.

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

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– Pull off engine cover panel (rear) -arrows-.

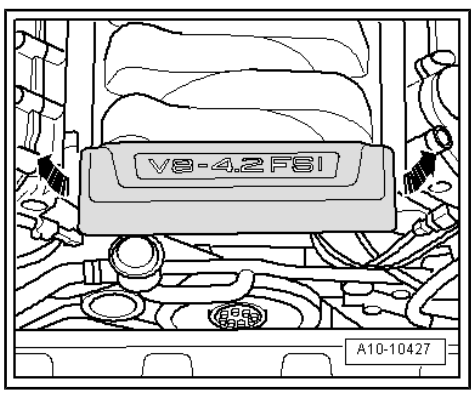


– Pull off engine cover panel (front) -arrows-.

WARNING

Hot steam/hot coolant can escape - risk of scalding.

- ***The cooling system is under pressure when the engine is hot.***
- ***To allow pressure to dissipate, cover filler cap on expansion tank with cloth and open carefully.***



– Open filler cap on coolant expansion tank.

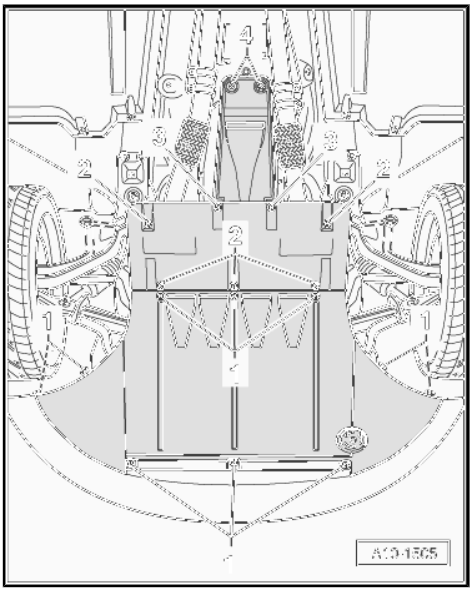
– Remove both front wheels.

– Remove front section of front left wheel housing liner ⇒ Rep. gr. 66 .

– Remove front and rear sections of front right wheel housing liner ⇒ Rep. gr. 66 .

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– Release fasteners -1, 2, 4- to remove noise insulation panels.

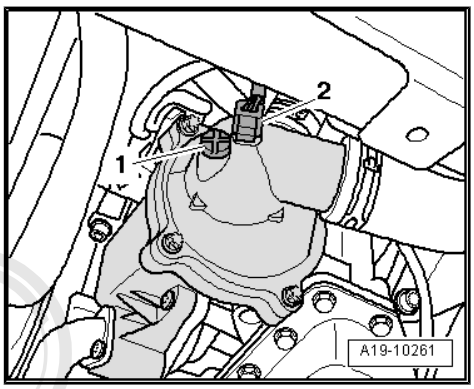


Note

Disregard -item 3-.

– Place drip tray for workshop hoist -VAS 6208- under engine.

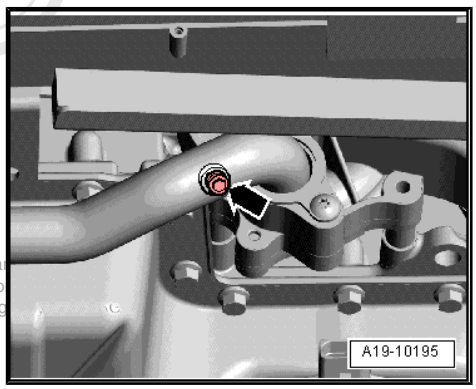
– Remove drain plug -1- at map-controlled engine cooling system thermostat -F265- and drain off coolant.



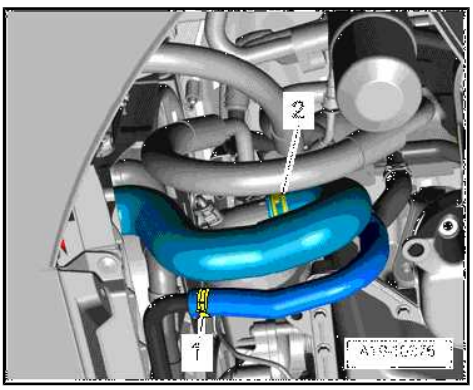
Note

Disregard -item 2-.

– Remove drain plug -arrow- at front coolant pipe and drain off coolant.

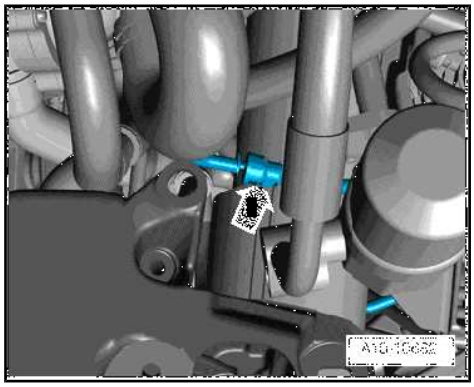


– Disconnect coolant hoses -1 and 2- and drain off coolant.



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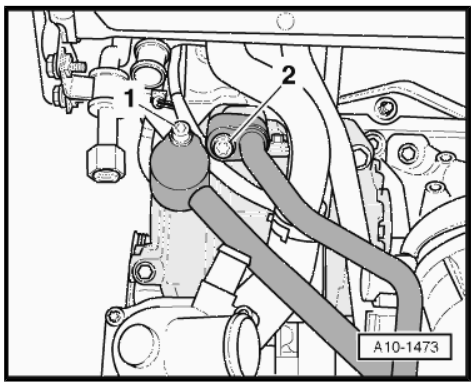
– Disconnect vacuum line -arrow-.



Caution

Danger of damage to refrigerant lines and hoses.

- *Do NOT stretch, kink or bend refrigerant lines and hoses.*

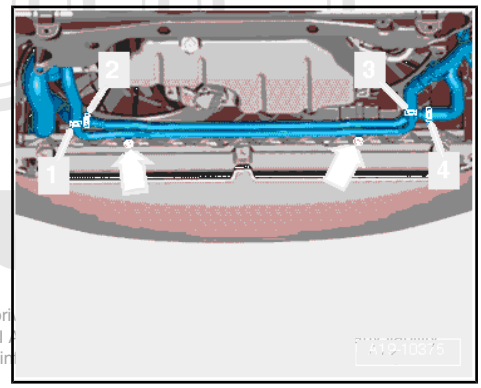


– Remove bolts -1 and 2-.
– Detach refrigerant lines from AC compressor.

Note

Seal off open pipes/lines and connections with clean plugs or protective caps to prevent dirt and moisture from entering.

– Remove bolts -arrows-.
– Disconnect coolant pipes going to ATF cooler from coolant hoses -2, 3, 4-.

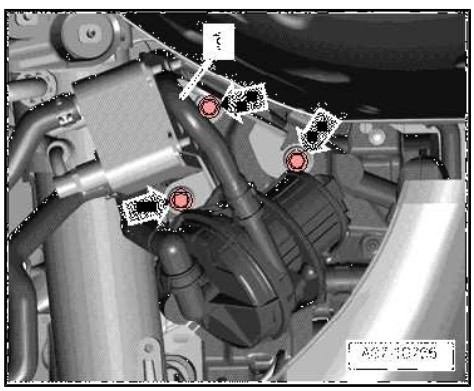


Note

Disregard -item 1-.

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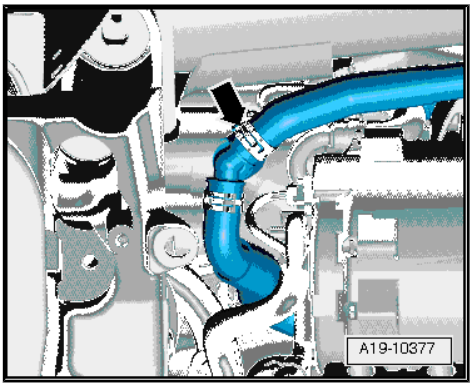
– Move clear air hose -1- for secondary air system at bracket for ATF cooler.
– Remove bolts -arrows-.
– Detach ATF cooler and tie up on engine cross member.



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– Place drip tray for workshop hoist -VAS 6208- under engine.

– Disconnect coolant hose (right-side) -arrow- and drain off coolant.



– Move clear fuel line and line going to activated charcoal filter at air pipe.

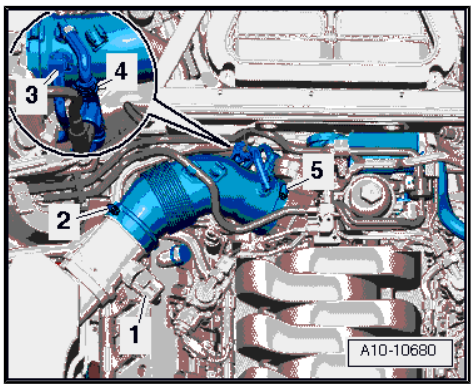
– Unplug electrical connector -1- at air mass meter -G70- .

– Detach vacuum line -4- leading to air intake hose from suction-jet pump.

Rest-of-world vehicles:

– Disconnect hose -3- for crankcase breather system from air hose by pressing release tabs.

– Release hose clips -2 and 5- and remove air hose.



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USA models:

Caution

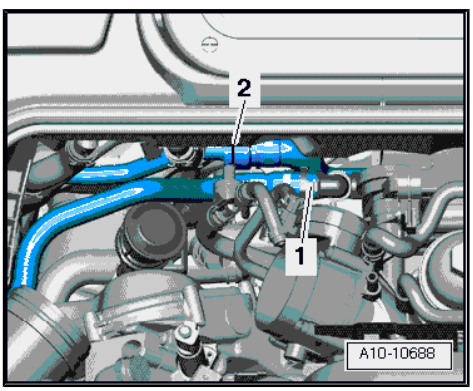
Risk of violating emission legislation applying to USA models.

- ***Do NOT open hose connection -3-.***

– Release hose clips -2 and 5- and move air hose clear to one side (crankcase breather hose -3- remains connected).

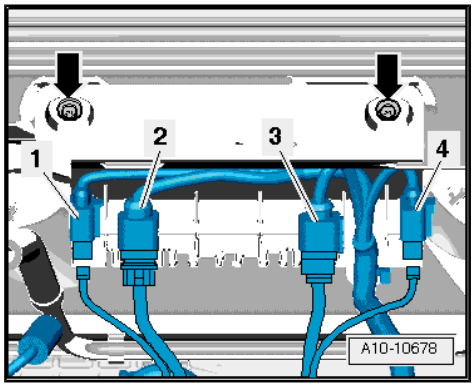
– Detach air hose -1- for secondary air system.

– Detach coolant hose -2-, to do so, pull out clip slightly.



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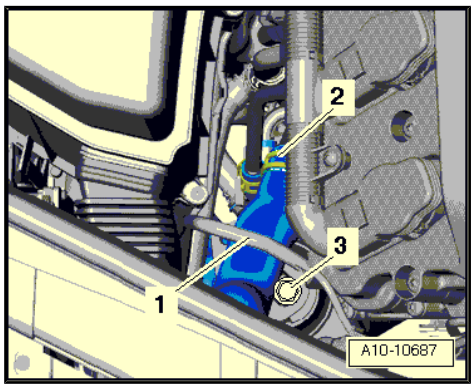
– Unscrew nuts -arrows- and detach bracket for electrical connectors from bulkhead.



Note

Disregard items marked -1 ... 4-.

– Unplug vacuum hose -1-.
– Detach coolant hose -2- from coolant pipe (right-side).
– Remove bolt -3- for torque reaction support.

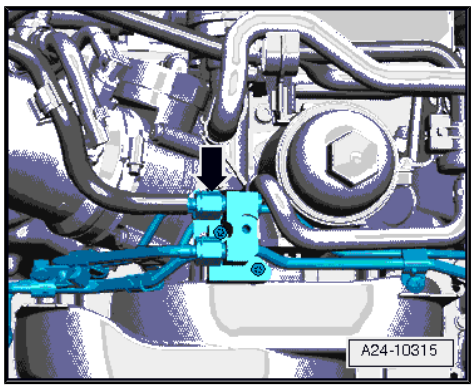


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WARNING

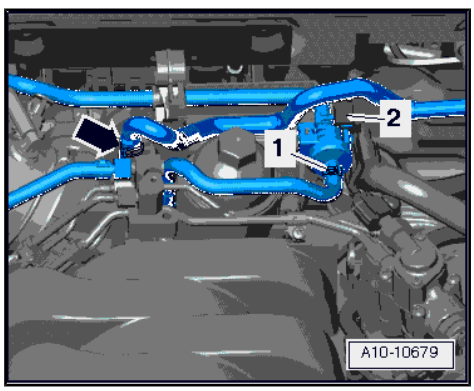
Risk of injury caused by fuel.

- ***To allow the fuel pressure to dissipate, wrap a clean cloth around the connection and carefully loosen the connection before opening the fuel system.***



– Disconnect fuel supply line -arrow- at connecting piece.

– Unplug electrical connector -2- at activated charcoal filter solenoid valve 1 -N80- and detach vacuum hose -1-.
– Detach activated charcoal filter solenoid valve 1 -N80- from bracket and move it clear to the side with hose still attached.
– Detach coolant hose -arrow- and move clear to one side.

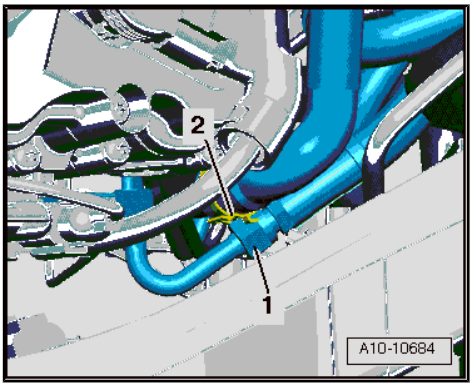


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Note

Lay a cloth under the separating point to catch escaping hydraulic fluid.

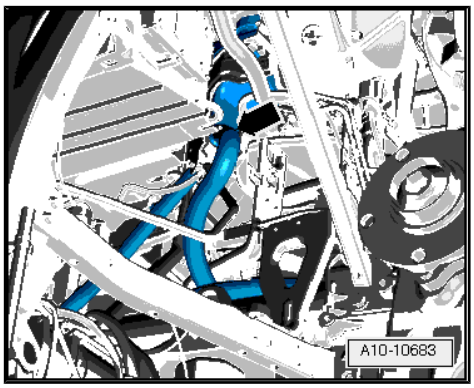
– Detach hydraulic pressure line -1- for power steering.
– Detach coolant hose -2- from coolant pipe (bottom left).



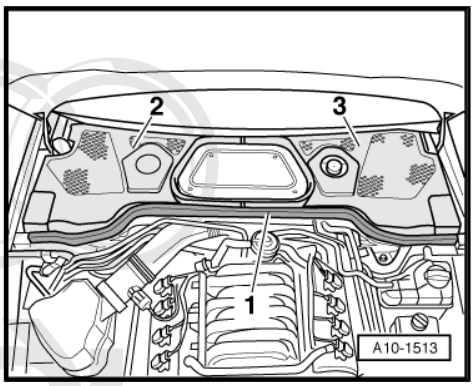
Note

Lay a cloth under the separating point to catch escaping hydraulic fluid.

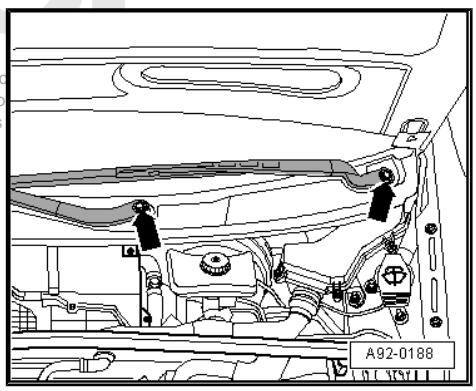
– Disconnect hydraulic hose -arrow- at bottom of hydraulic fluid reservoir.



– Pull off rubber seal -1- and remove plenum chamber covers -2 and 3-.



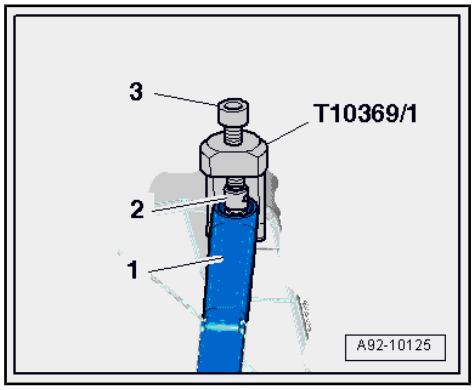
– Lever off caps on windscreen wiper arms with a screwdriver.
– Loosen nuts -arrows- several turns.



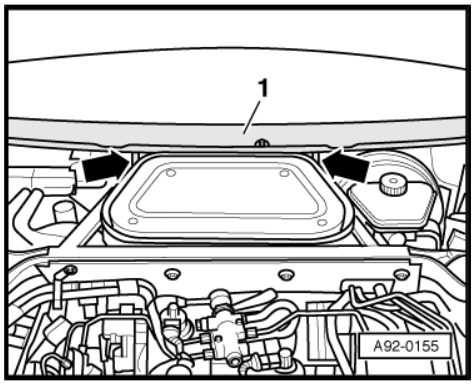
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– Apply puller -T10369/1- to wiper arm -1-, as shown in illustration.
– Apply thrust piece -2- onto wiper shaft.
– Turn bolt -3- in clockwise direction until wiper arm is pulled off wiper shaft.
– Remove nuts completely and take off wiper arms.



– Remove dust/pollen filter; to do so, open the four quick-release fasteners.



Note

Cover air duct at air conditioner housing with clean cloth to prevent anything falling in.

– Remove bolts -arrows- for cowl panel trim -1- on both sides.

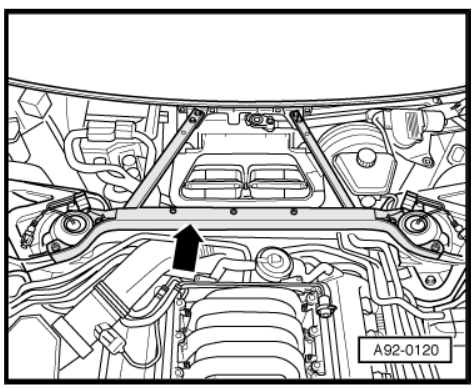
Caution

Risk of damage to cowl panel trim.

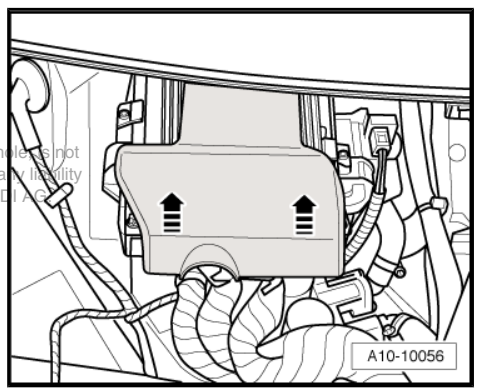
- ***Apply a small quantity of soap solution to transition between windscreen and cowl panel trim -1-. Then, starting at edge of windscreen, carefully pull cowl panel trim vertically upwards off retainer at windscreen.***

– Carefully pull cowl panel trim off retainer at windscreen.

– Unscrew body brace -arrow-.



– Detach cover above engine control unit -arrows-.

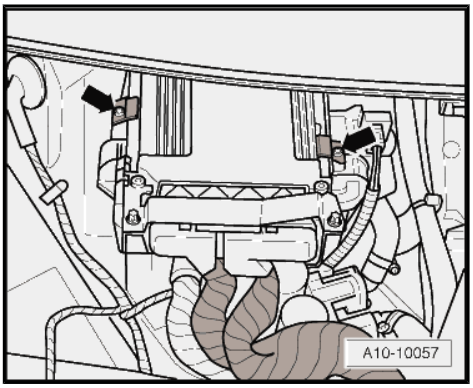


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– Remove bolts -arrows-.

– Detach retainers and engine control unit from electronics box (plenum chamber).



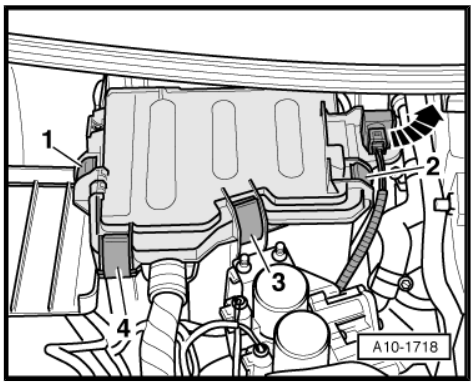
Note

The electrical wires remain connected.

– Turn air quality sensor -G238- approx. 90° anti-clockwise -arrow- and then remove from bracket.

– Release retaining clips -1 ... 4-.

– Open electronics box (plenum chamber) cover slightly and pull off to front.

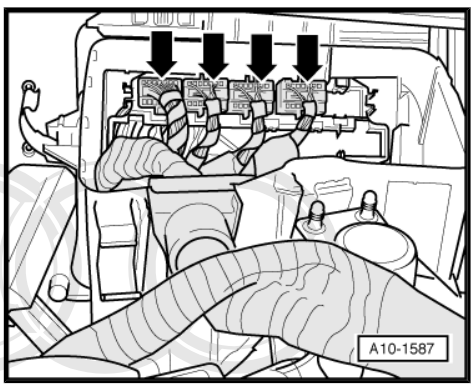


– Disconnect the electrical multi-pin connectors -arrows- using spark plug connector pliers -V.A.G 1922- .

– Detach wiring harness at electronics box and at bulkhead.

– Place engine control unit with wiring harness attached on top of engine.

– Secure the engine control unit to prevent it falling.



– Remove A-pillar trim (bottom right) ⇒ Rep. gr. 70 .

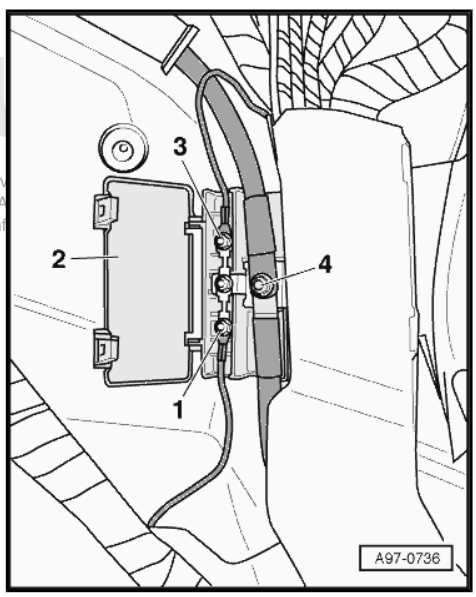
– Fold back floor carpet.

– Unbolt protective cover above main fuse holder.

– Fold cover -2- to side.

– Remove nut -4-.

– Detach terminal 30 wire to starter.



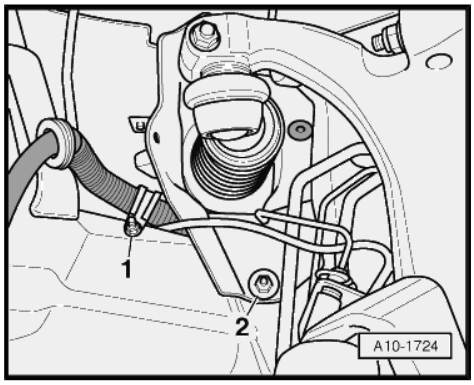
Note

Disregard -items 1 and 3-.

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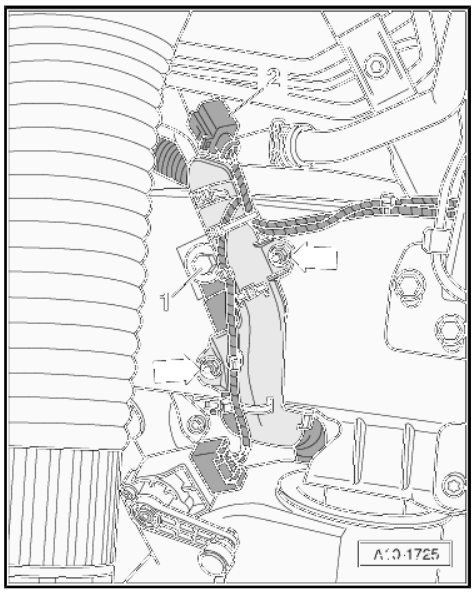
– Unscrew clamp -1-.



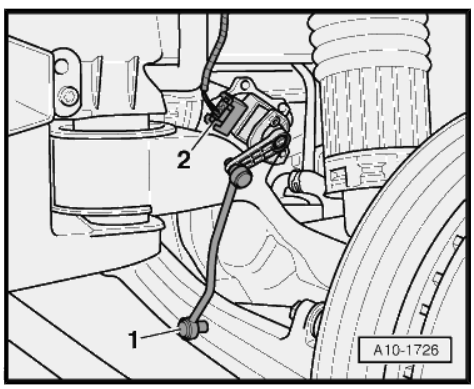
Note

Disregard -item 2-.

– Unplug electrical connector -2-.
– Unbolt earth cable -1- at longitudinal member.
– Unbolt bracket for wiring harness from longitudinal member -arrows-.
– Move electrical wiring harness clear.



– Unplug electrical connector -2- at vehicle level sender.
– Detach coupling rod -1- at track control link.
– Repeat procedure on other side of vehicle.



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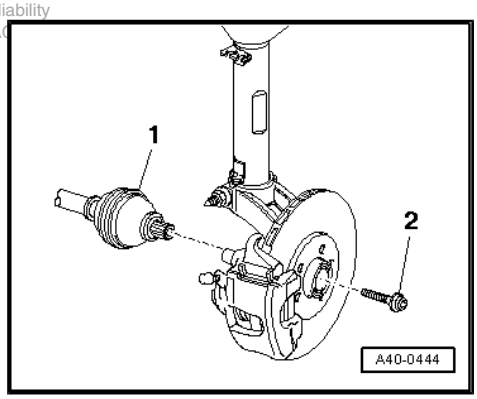
– Have a second mechanic press the brake pedal.

Caution

Danger of damage to wheel bearing.

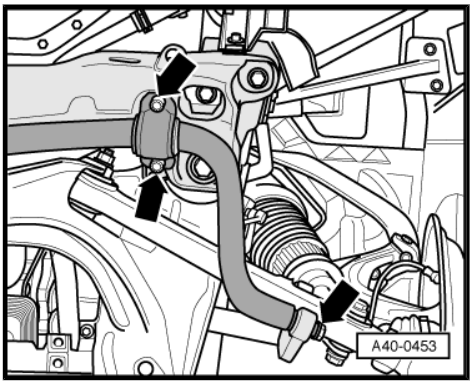
- ***When slackening the flange bolt securing the drive shaft, the vehicle must not be standing on its wheels.***

– Unscrew flange bolt -2- from drive shaft -1- (left and right).



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– Unscrew bolts (left and right) -arrows- evenly.
– Take out anti-roll bar.

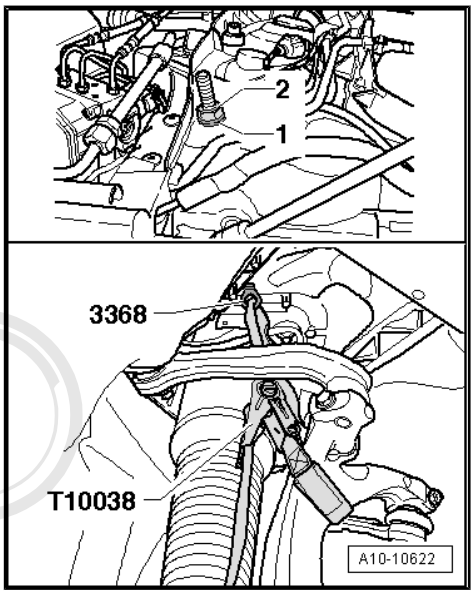


– Fit eye-head bolt -3368- from below in bore on suspension turret on both sides.
– Secure eye-head bolts -3368- with nut -2- and washer -1- (screw down nut several turns but not all the way down).

Caution

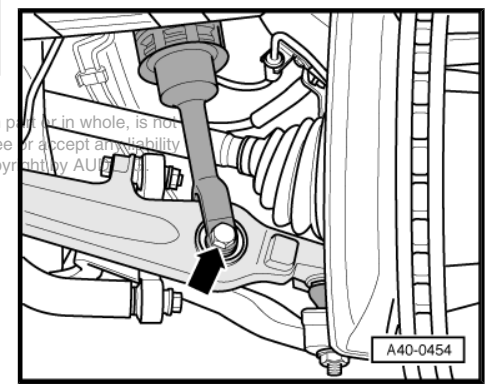
Danger of damage to the swivel joints of the upper links.

- ***Support wheel bearing housing.***

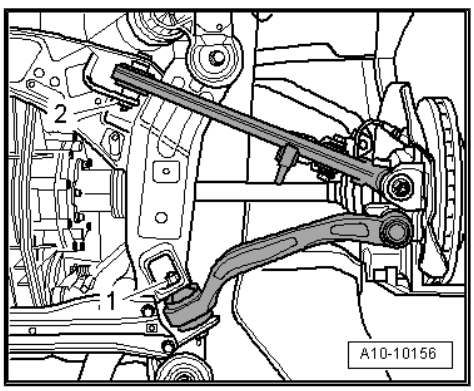


– Tie up wheel bearing housing on both sides using tensioning strap -T10038- as illustrated.

– Unbolt air spring strut from track control link -arrow-.



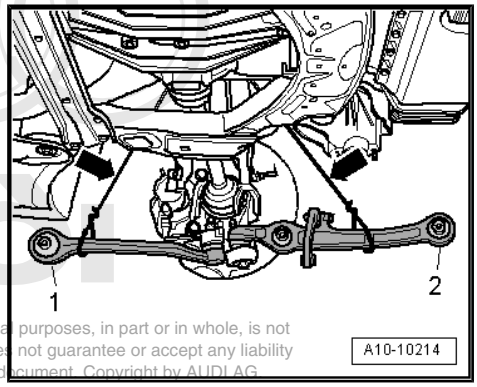
– Unbolt guide link -1- and track control link -2- at subframe.



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– Pivot guide link -1- and track control link -2- outwards.



Caution

Danger of damage to swivel joints of guide link and track control link.

- *Tie up guide link and track control link to wheel bearing housing -arrows-.*

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– Unbolt drive shaft from flange shaft on gearbox.

Caution

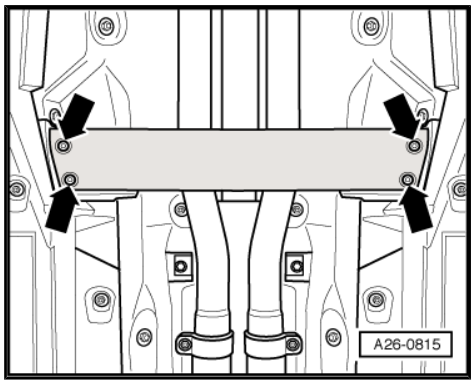
Danger of damage to brake hose.

- *Carefully pivot wheel bearing housing outwards.*

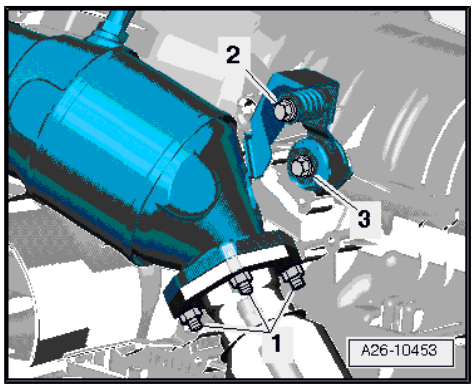
– Remove drive shaft.

– Repeat procedure on other side of vehicle.

– Unbolt cross piece (front) -arrows-.



– Unscrew nuts -1- for front silencer (left-side).

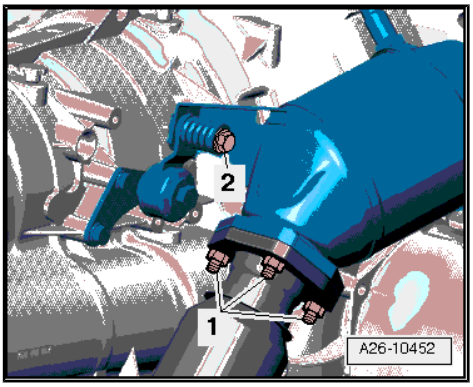


Note

Disregard -items 2 and 3-.

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– Unscrew nuts -1- for front silencer (right-side).



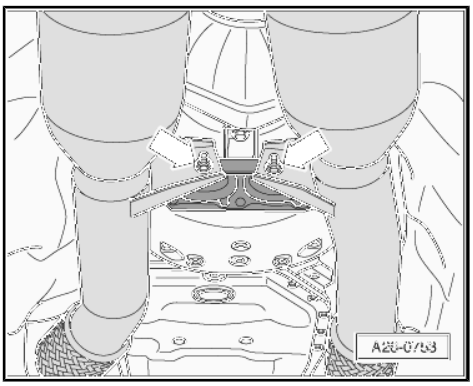
Note

Disregard -item 2-.

Caution

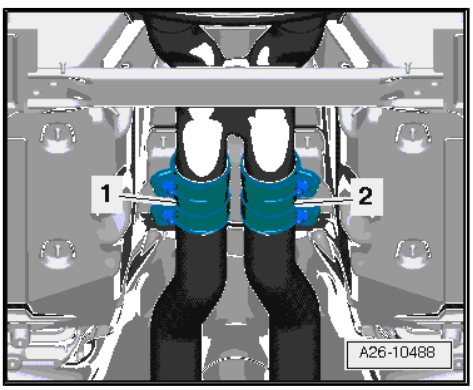
Risk of damage to flexible joints in front exhaust pipe.

- ***Do NOT bend flexible joints in front exhaust pipe more than 10°.***



– Unscrew nuts -arrows- on mounting brackets for front silencers.

– Disconnect exhaust system at clamps -1 and 2- and detach front silencers.

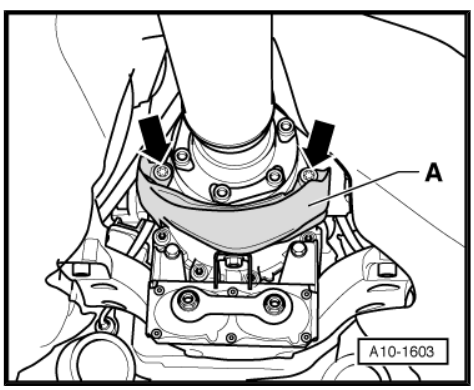


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– If fitted, unscrew heat shield -A- for propshaft -arrows-.

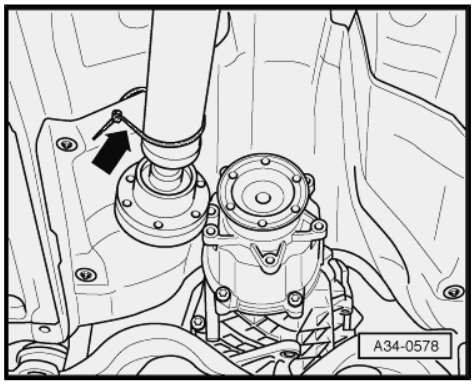
– Unscrew bolts securing propshaft to gearbox.

– Slide rear propshaft together towards rear final drive; the constant velocity joints can be moved axially.

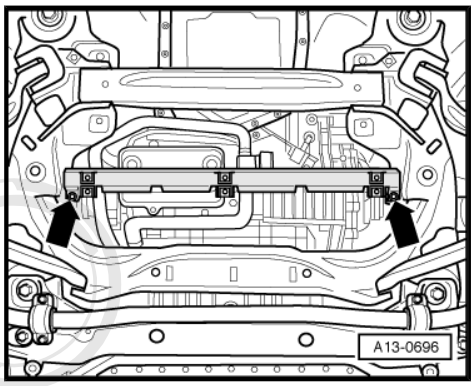


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– Tie propshaft up to side of heat shield -arrow-.

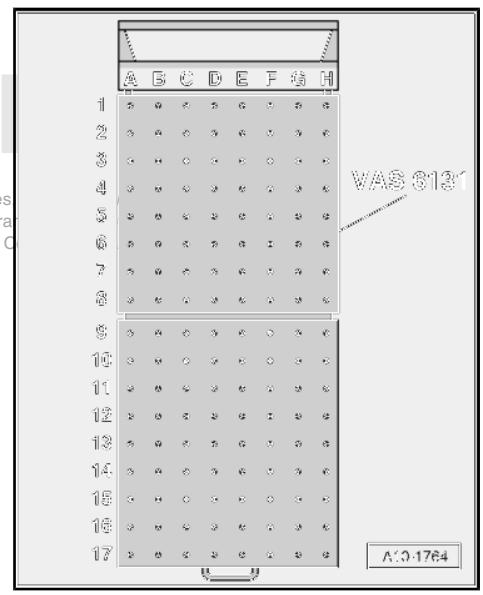


– Unbolt bracket for noise insulation -arrows-.



Set up the scissor-type assembly platform as follows:

– Set up scissor-type assembly platform -VAS 6131 A- with support set for Audi -VAS 6131/10- , support set -VAS 6131/11- and supplementary set -VAS 6131/12- as follows:



Platform coordinates	Parts of support set for Audi -VAS 6131/10- , support set -VAS 6131/11- and supplementary set -VAS 6131/12-			
B3	/10-1	/10-4	/10-5	/10-12
G3	/10-1	/10-4	/10-5	/10-11
B10	/10-1	/10-2	/10-5	/12-1
G10	/10-1	/10-2	/10-5	/11-3
C14	/10-1	/10-3	/10-5	/10-12
F14	/10-1	/10-3	/10-5	/10-12

– Initially tighten the support elements on the assembly platform only hand-tight.

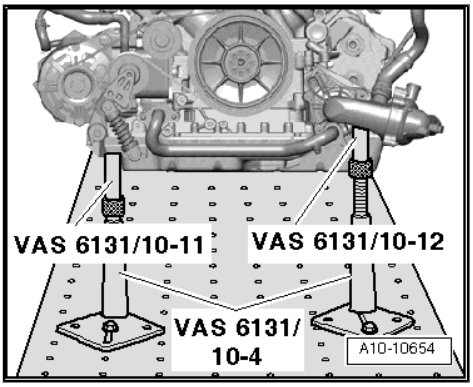
– Adjust the scissor-type assembly platform -VAS 6131 A- so that it is horizontal.

• Take note of spirit level (bubble gauge).

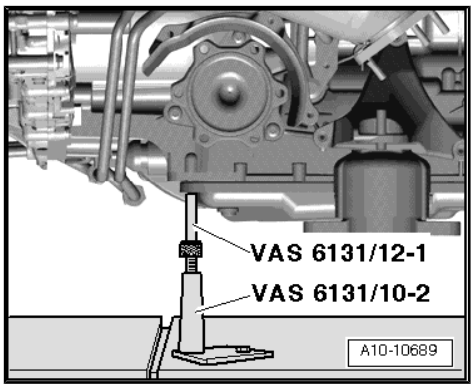
– Place scissor-type assembly platform -VAS 6131 A- under engine/gearbox assembly.

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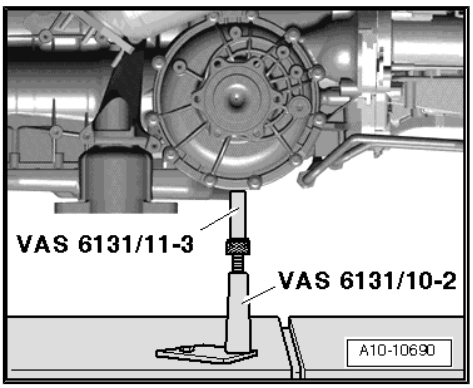
– Position support elements from -VAS 6131/10- at front of engine, as shown in illustration.
– Make sure that threaded spindle (right) at front of engine is screwed in completely.



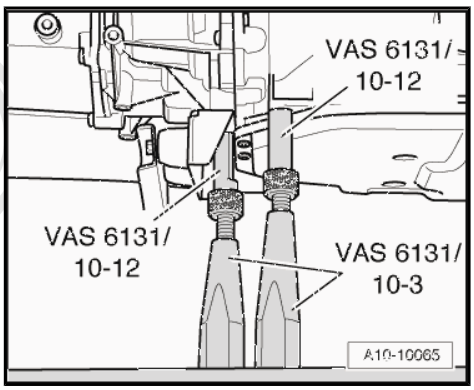
– Position support elements from -VAS 6131/12- at left side of gearbox, as shown in illustration.



– Position support elements from -VAS 6131/11- at right side of gearbox, as shown in illustration.



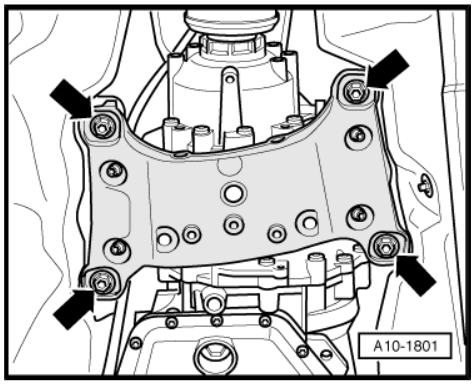
– Position support elements from -VAS 6131/10- at rear of gearbox, as shown in illustration.
– Turn all spindles for the support elements upwards until all locating lugs make contact with the mounting points.
– Tighten base plates for support elements to 20 Nm on scissor-type assembly platform -VAS 6131 A- .



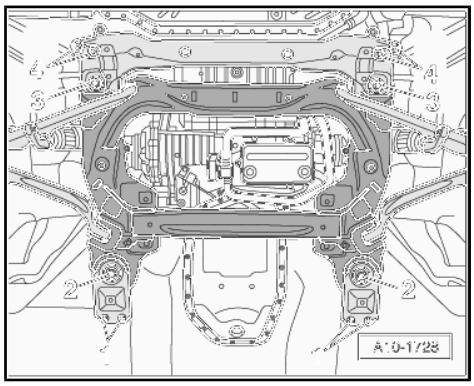
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– Remove bolts -arrows- at tunnel cross member.



– Mark the installation position of subframe with a felt-tip pen on longitudinal member.
– Remove bolts -1 and 4-.
– Unscrew bolts -2 and 3- in diagonal sequence and in stages.



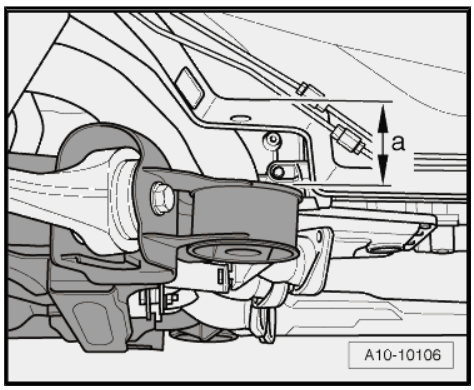
Caution

Danger of damage to hoses, pipes and wiring connections and to engine compartment.

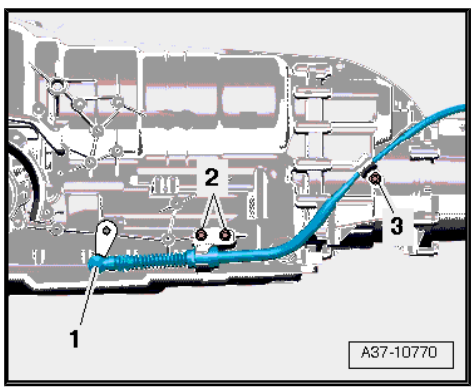
- ***Check that all connections between engine, gearbox, subframe and body have been detached.***
- ***Carefully guide out engine/gearbox assembly with subframe from engine compartment when lowering.***

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– Lower the engine/gearbox assembly using scissor-type assembly platform -VAS 6131 A- initially only as far as distance -a-.
• Dimension -a- = 120 mm (maximum).



– Mark installation position of support bracket for selector lever cable with felt-tip pen for re-installation.
– Pry ball socket -1- of selector lever cable off selector shaft lever using removal lever -80 - 200- .
– Unscrew bolts -2 … 3- and detach selector lever cable from gearbox.
– Lower engine/gearbox assembly.
– Pull out scissor-type assembly platform -VAS 6131 A- with engine/gearbox assembly from beneath vehicle.

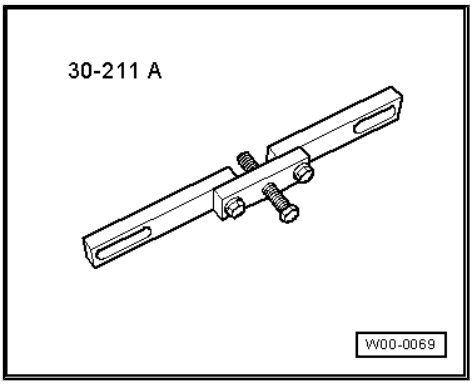


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2 Separating engine and gearbox

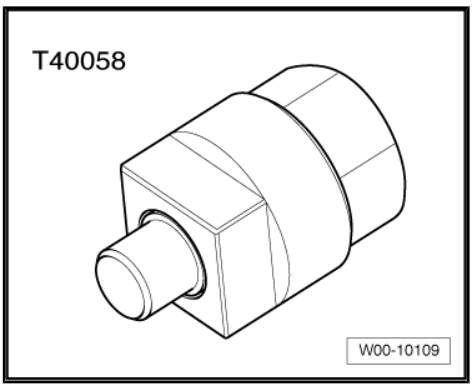
Special tools and workshop equipment required

- Support bridge -30 - 211 A-



- Adapter -VAS 6131/12-1- (2x)
- Adapter -T40058-

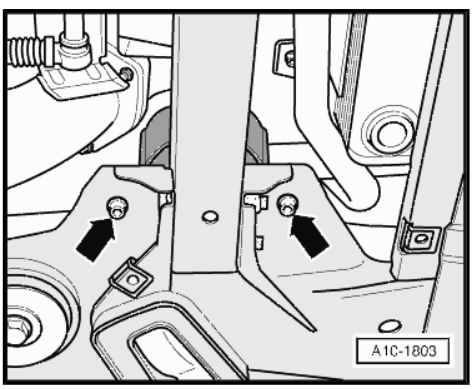
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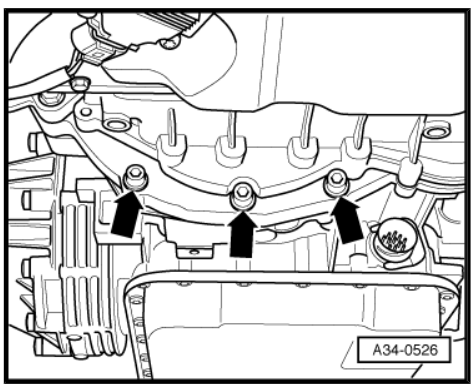
Procedure

- Engine/gearbox assembly removed and secured to scissor-type assembly platform -VAS 6131 A- .

– Remove bolts (left and right) -arrows- for front gearbox mounting and place subframe down on scissor-type assembly platform.



– Unscrew bottom bolts -arrows- securing engine to gearbox.

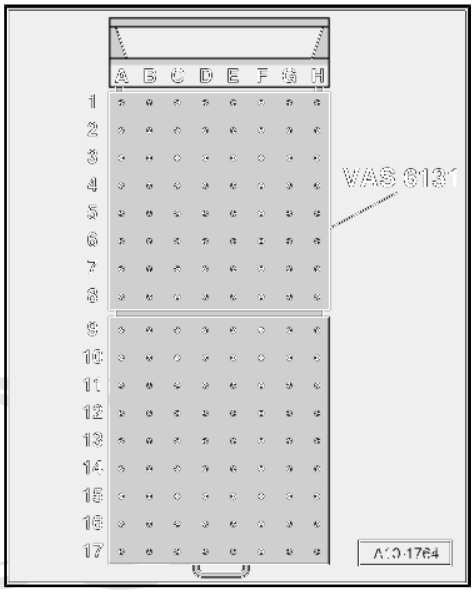


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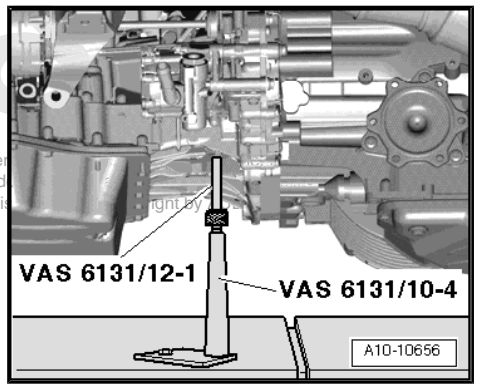
– Set up scissor-type assembly platform -VAS 6131 A- with support set for Audi -VAS 6131/10- and support set -VAS 6131/12- as follows:

Platform coordinates	Parts of support set for Audi -VAS 6131/10- , support set -VAS 6131/11- and supplementary set -VAS 6131/12-			
B3 1)	/10-1	/10-4	/10-5	/10-12
G3 1)	/10-1	/10-4	/10-5	/10-11
C6	/10-1	/10-4	/10-5	/12-1
F6	/10-1	/10-4	/10-5	/12-1
B10 1)	/10-1	/10-2	/10-5	/12-1
G10 1)	/10-1	/10-2	/10-5	/11-3
C14 1)	/10-1	/10-3	/10-5	/10-12
F14 1)	/10-1	/10-3	/10-5	/10-12

• 1) Support elements remain unchanged.

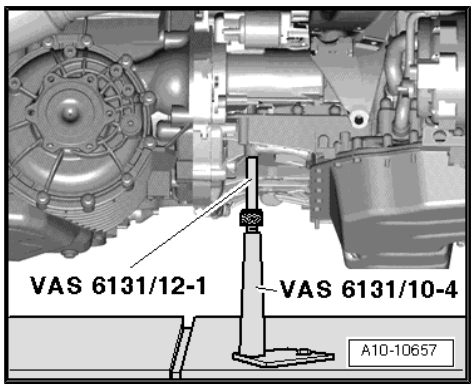


– Position support elements from -VAS 6131/10- and -VAS 6131/12- at left side of engine, as shown in illustration.

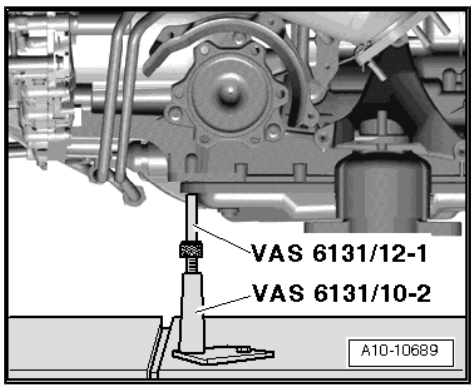


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– Position support elements from -VAS 6131/10- and -VAS 6131/12- at right side of engine, as shown in illustration.
– Turn spindles for the support elements upwards until all locating lugs make contact with the mounting points.
– Tighten base plates for support elements to 20 Nm on scissor-type assembly platform -VAS 6131 A- .



– Screw spindle for support element at left side of gearbox downwards as far as possible.
– Unscrew base plate for support element (left-side) from scissor-type assembly platform -VAS 6131 A- .

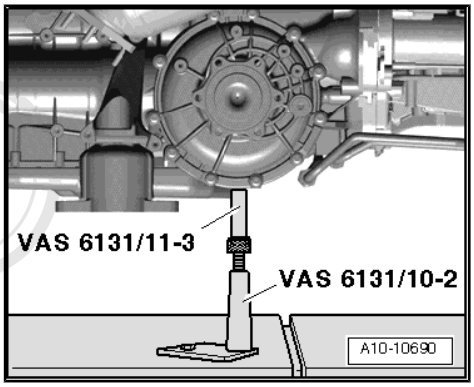


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– Screw spindle for support element at right side of gearbox downwards as far as possible.

– Unscrew base plate for support element (right-side) from scissor-type assembly platform -VAS 6131 A- .

– Remove subframe to the side.



WARNING

Accident risk from missing support.

- *If the subframe has been removed, set up the front gearbox support elements back in their original position.*

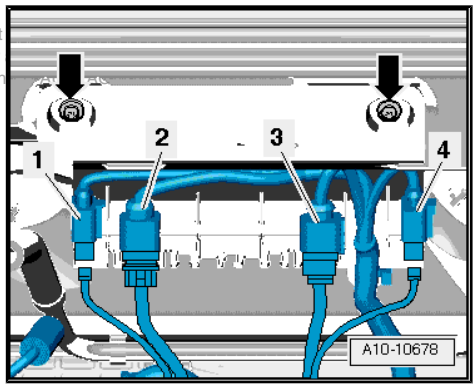
– Detach electrical connectors from bracket and unplug connectors:

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3 - For Lambda probe 2 -G108-

4 - For Lambda probe 2 -G131- (after catalytic converter)

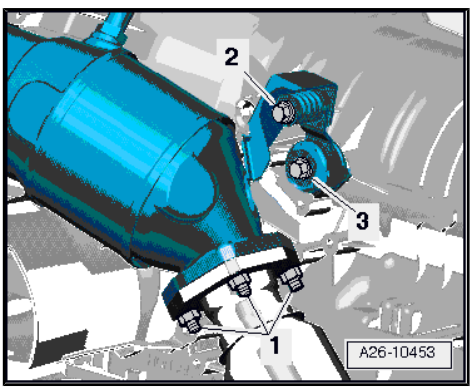
– Move electrical wiring to Lambda probes clear.



Note

- *Illustration shows electrical connectors in their installation position.*
- *Disregard -items 1, 2 and arrows-.*

– Remove bolt -2- on bracket for catalytic converter (left-side).



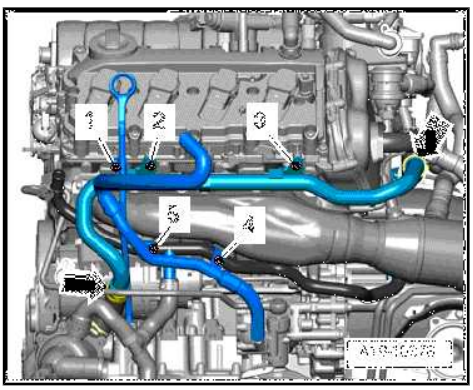
Note

Disregard -items 1 and 3-.

– Remove bolt -1- and lift out guide tube for oil dipstick.

– Unscrew bolts -4 and 5- and swivel hydraulic fluid pipe to one side.

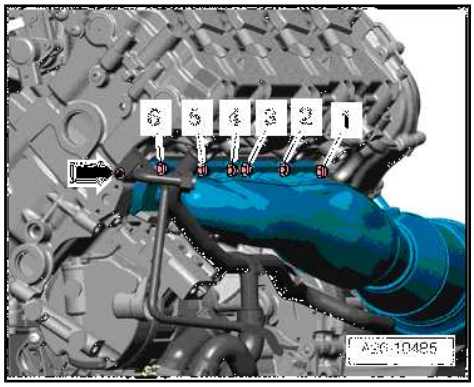
– Unscrew bolts -2 and 3- and detach coolant pipe (left-side) from coolant hoses -arrows-.



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– Unscrew bolt -arrow- and pull pressure pipe for hydraulic fluid slightly towards front.

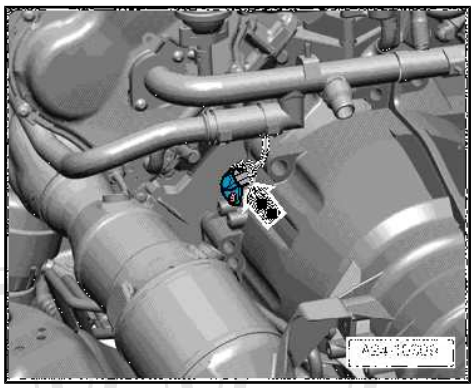
– Unscrew nuts -6 ... 1- and remove exhaust manifold (left-side) with catalytic converter.



Note

The two mounting strips (bottom) remain installed.

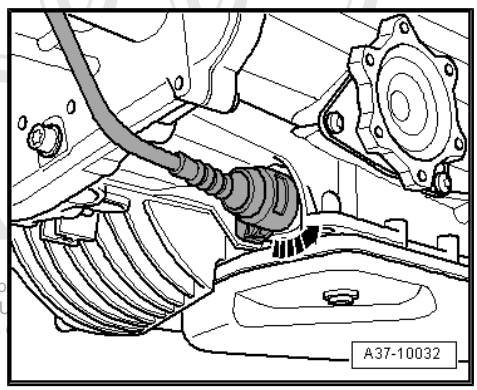
– Unplug electrical connector -arrow- at engine speed sender -G28- .



Caution

Risk of irreparable damage to gearbox control unit (mechatronic unit) because of static discharge.

- ***Do NOT touch connector contacts in gearbox connector with your hands.***



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– Touch gearbox housing with your hand (without wearing gloves) to eliminate static charge.

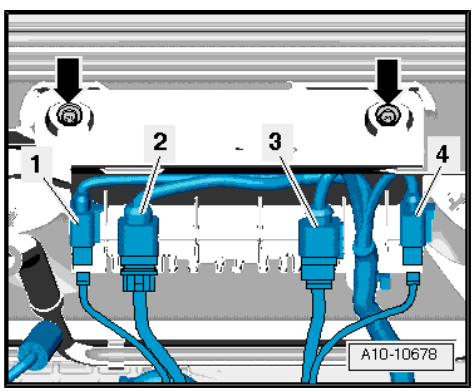
– Turn retainer catch anti-clockwise -arrow- and unplug electrical connector at gearbox.

– Detach electrical connectors from bracket and unplug connectors:

1 - For Lambda probe -G39-

2 - For Lambda probe after catalytic converter -G130-

– Move electrical wiring to Lambda probes clear.

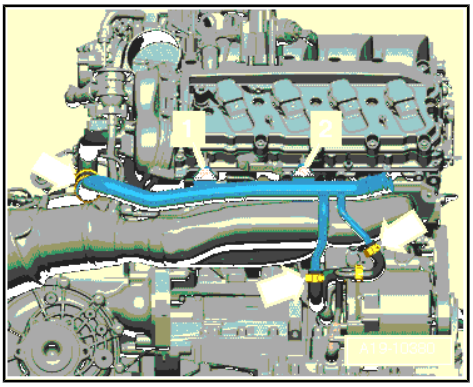


Note

- *Illustration shows electrical connectors in their installation position.*
- *Disregard -items 3, 4 and arrows-.*

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– Unscrew bolts -1 and 2- and detach coolant pipe (right-side) from coolant hoses -arrows-.



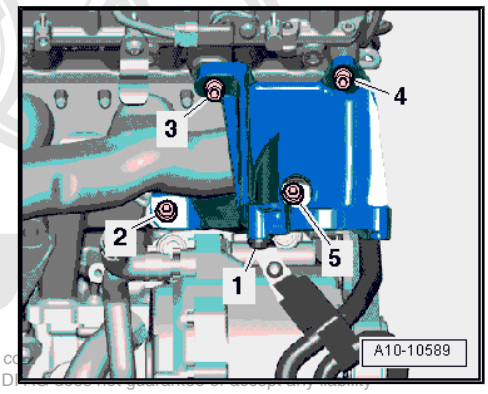
– Unscrew bolts -arrows- and remove mounting for torque reaction support.



– Unscrew bolts -2 … 5- and remove torque reaction support.

Note

Disregard -item 1-.

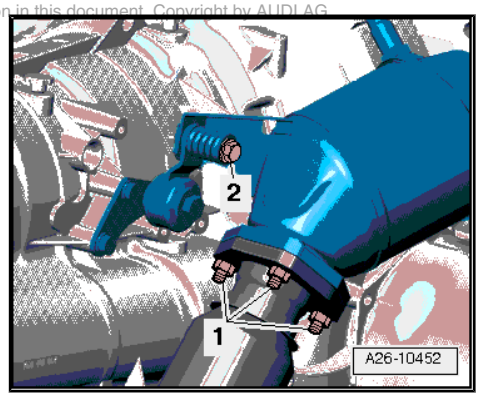


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– Remove bolt -2- on bracket for catalytic converter (right-side).

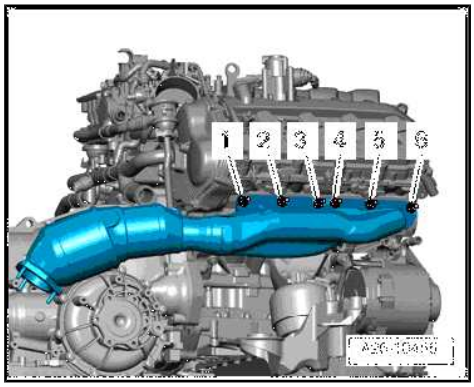
Note

Disregard -item 1-.



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– Unscrew nuts -6 ... 1- and remove exhaust manifold with catalytic converter (right-side).

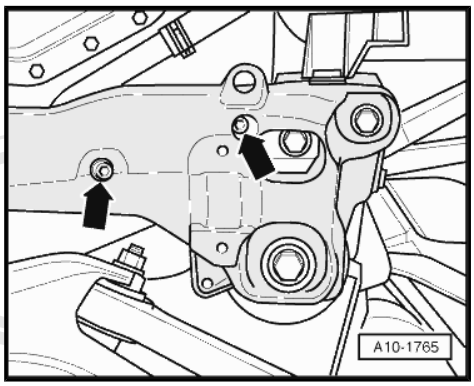


Note

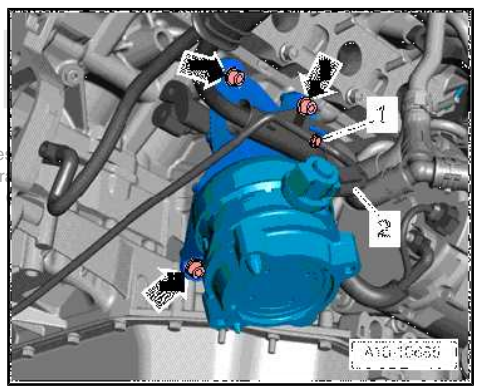
The two mounting strips (bottom) remain installed.

– Move clear ATF cooler at engine cross member and secure it to prevent it falling.

– Remove bolts for engine mountings -arrows- on both sides.
– Take out engine cross member.

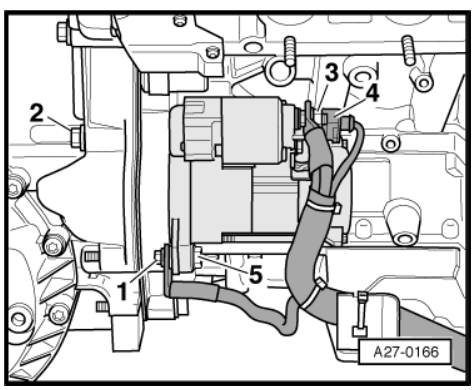


– Unplug electrical connector -2- at engine mounting (right-side).
– Unbolt bracket -1- for wiring from engine support (right-side).
– Remove bolts -arrows- and detach engine support with engine mounting.



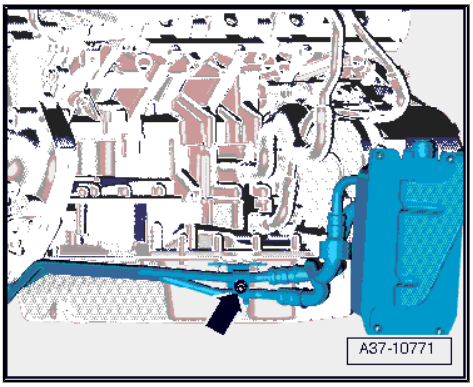
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– Disconnect earth cable -1-.
– Detach electrical wiring -3 and 4- at starter.
– Remove bolts -2 and 5- and detach starter.



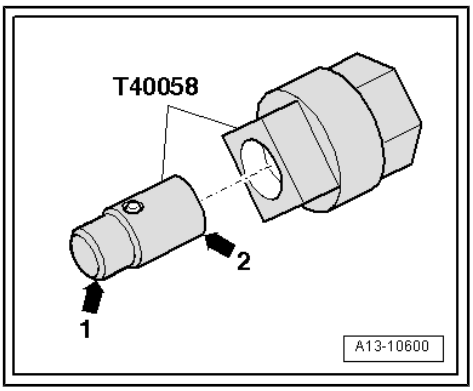
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– Unscrew nut -arrow- and remove ATF lines from bracket.



– Insert guide pin of adapter -T40058- as follows:

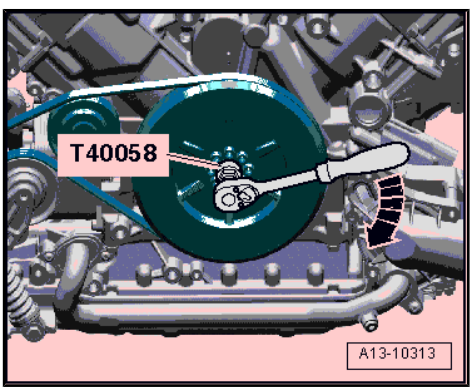
- The smaller-diameter section -arrow 1- faces the engine.
- The larger-diameter section -arrow 2- faces the adapter.



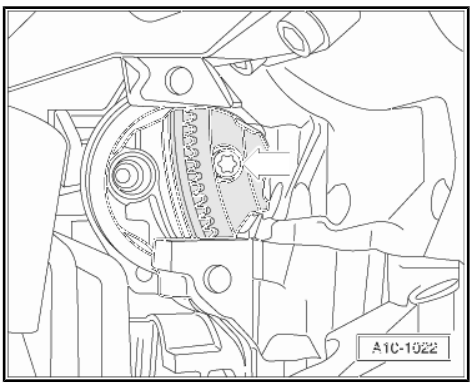
– When loosening torque converter bolts, counterhold crankshaft using adapter -T40058- .

Note

Disregard -arrow-.



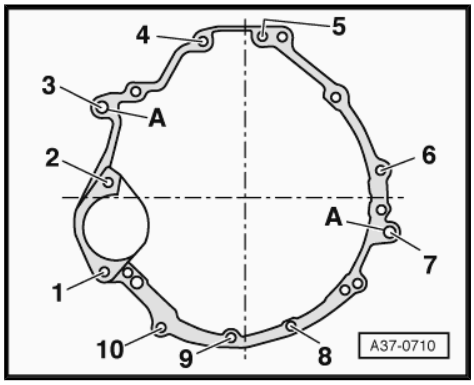
– Unscrew 3 bolts -arrow- for torque converter, working through opening of removed starter (turn crankshaft $^{1}/_{3}$ turn in direction of engine rotation each time).



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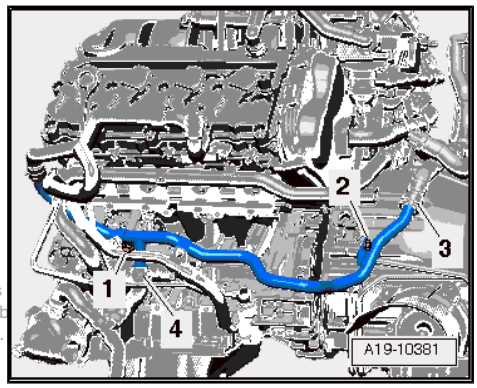
– Unscrew bolts -3 … 7- securing engine to gearbox.



Note

Disregard -item A-.

– Slacken bolt -1- and pivot coolant pipe (bottom left) upwards slightly.



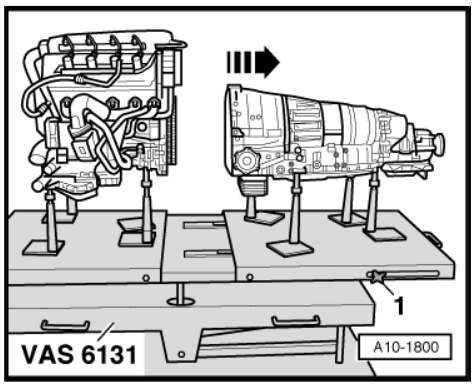
Note

Disregard -items 2, 3, 4-.

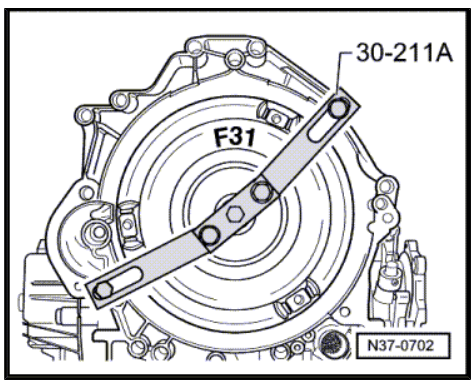
– Watch position of ATF cooler.

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– Loosen clamping bolts -1- on sides of scissor-type assembly platform -VAS 6131 A- and pull rear section of platform together with gearbox towards the rear -arrow-; simultaneously separate the torque converter from the drive plate working through the opening of removed starter.



– Secure the torque converter in the gearbox using support bridge -30 - 211 A- to prevent it falling out.

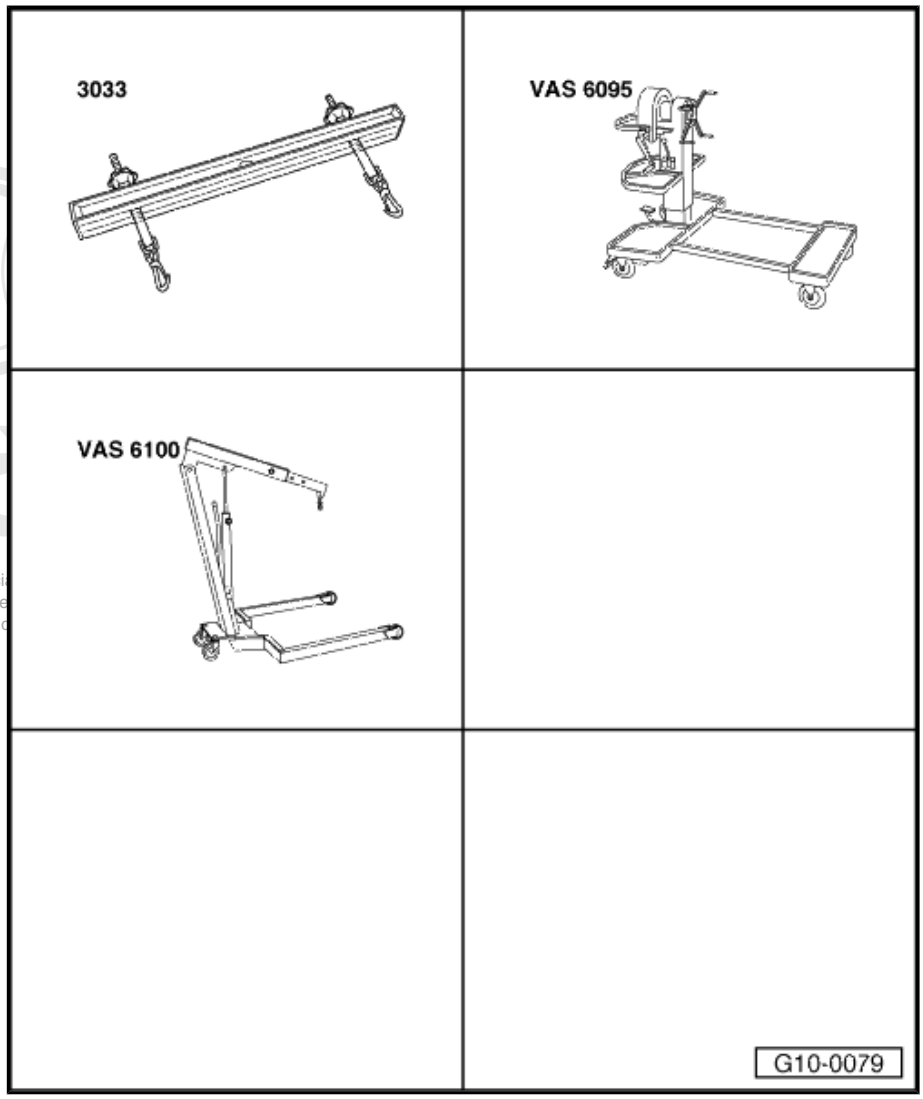


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3 Securing engine to engine and gearbox support

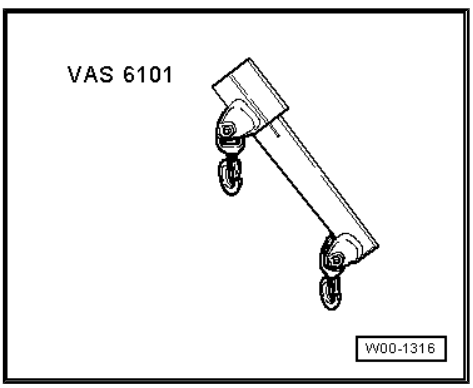
Special tools and workshop equipment required

- Lifting tackle -3033-
- Engine and gearbox support -VAS 6095- with bracket -VAS 6095/1-6A-
- Workshop hoist - VAS 6100-



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- Lift arm extension (workshop hoist) -VAS 6101-

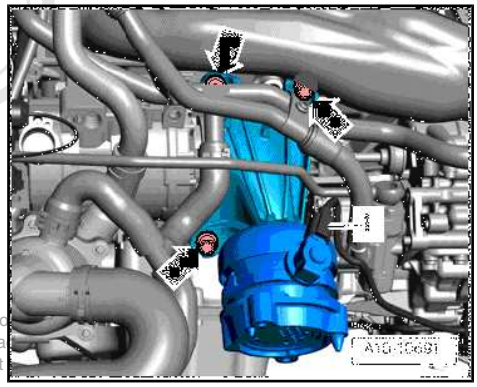


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Procedure

– Unplug electrical connector -1- at engine mounting (left-side).

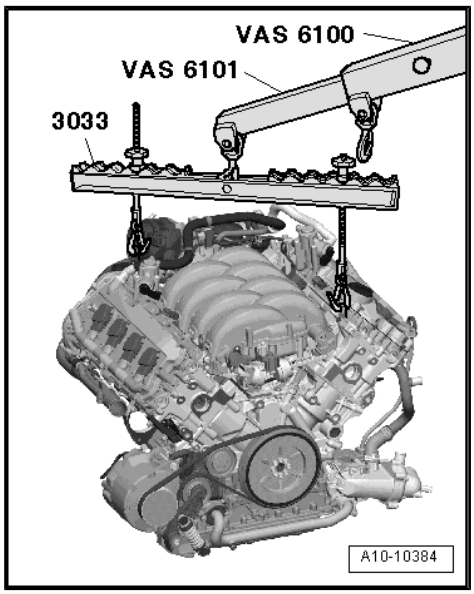
– Remove bolts -arrows- and detach engine support with engine mounting.



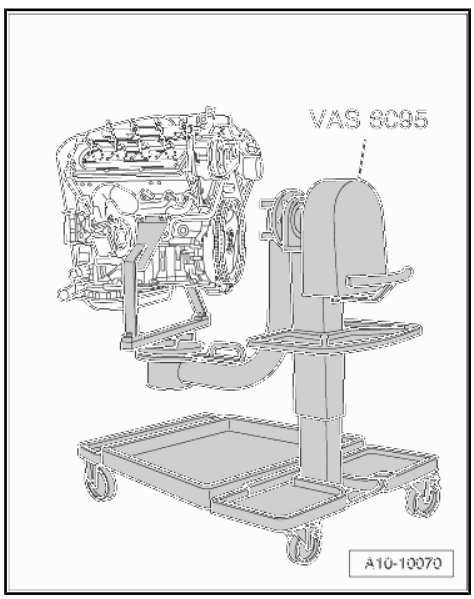
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– Attach the lifting tackle -3033- to engine lifting eyes and workshop hoist -VAS 6100- with lift arm extension (workshop hoist) -VAS 6101- as shown in the illustration.

– Lift engine off the support elements on scissor-type assembly platform -VAS 6131 A- .



– Using bracket -VAS 6095/1-6A- , secure engine to engine and gearbox support -VAS 6095- (tighten to 40 Nm) as shown in the illustration.



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4 Installing engine

Tightening torques



Note

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

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Tightening torques

- ⇒ “5.1 Assembly mountings - exploded view”, page 42
- ⇒ “3.1 Crankshaft - exploded view”, page 62

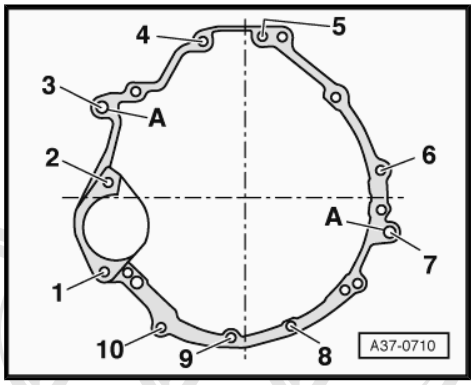
Component		Nm
Bolts/nuts	M6	9
	M8	20
	M10	40
	M12	65
Except for the following:		
Drive plate to torque converter		85 1)
High-pressure pipe		25
• 1) Renew bolts ⇒ Electronic parts catalogue .		

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Securing engine to gearbox

Item	Bolt	Nm
1	M10x80 1)	65
2	M12x90	65
3	M12x105	65
4, 5	M12x100	65
6	M12x125	65
7	M12x170	65
8, 9, 10	M10x80	45
A	Dowel sleeves for centralising	

• 1) Property class 10.9.



Procedure

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

Note

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- *Renew the bolts tightened with specified tightening angle.*
- *Renew self-locking nuts and bolts as well as seals, gaskets and O-rings.*
- *Replace bolts for torque converter only with new bolts of the correct type (same as original equipment) ⇒ Electronic parts catalogue .*
- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*
- *Fit all cable ties in the original positions when installing.*

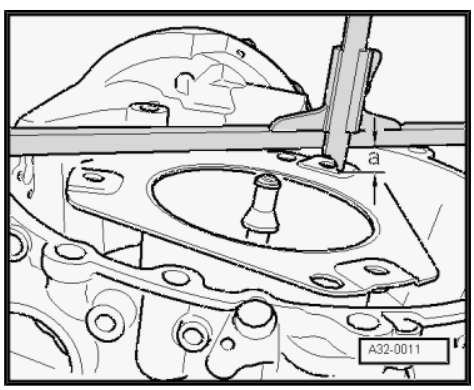
– Check whether dowel sleeves for centring the engine and the gearbox are fitted in the cylinder block; install missing dowel sleeves.

Caution

Risk of damage to drive lug of ATF pump if torque converter is installed incorrectly.

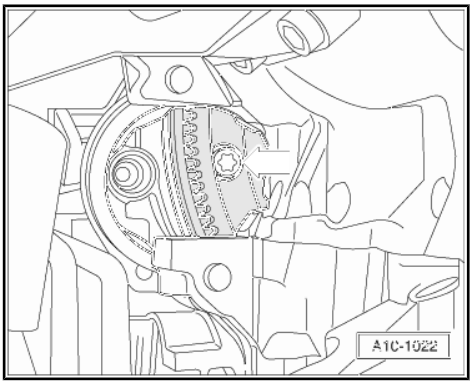
- ***Check installation depth of torque converter.***

If the torque converter has been correctly installed, the distance -a- between the contact surfaces at the threaded holes in the torque converter and the joint surface on the torque converter bell-housing for automatic gearbox 09L is at least 19 mm.



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– Before bringing engine and gearbox together, turn torque converter and drive plate on engine so that the holes and the threaded holes are in line with the opening for the removed starter -arrow-.



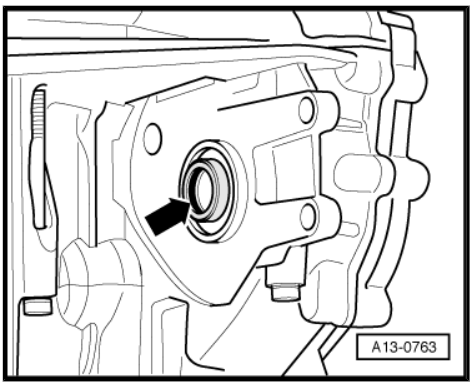
Caution

Risk of damage to automatic gearbox.

- *Before and during tightening of bolts securing engine to gearbox, continually check that the torque converter behind the drive plate can be turned. If the torque converter cannot be turned, it must be assumed that it has not been installed correctly.*
- *Use only new bolts of the correct type (same as original equipment) to secure torque converter on drive plate.*

– Install ATF lines ⇒ Rep. gr. 37 .

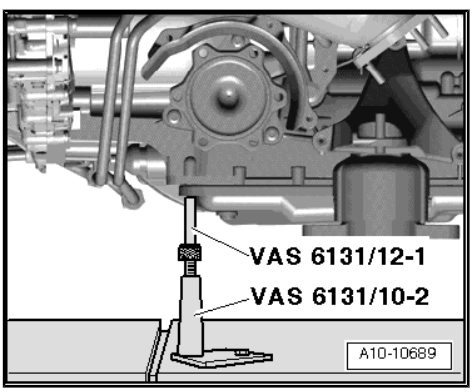
– Before installing an exchange engine, check whether the flat-section O-ring -arrow- is fitted in the drive shaft of the power steering pump.



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– Install starter ⇒ Electrical system; Rep. gr. 27 .
– Install engine supports ⇒ page 42 .
– Install torque reaction support and mounting for torque reaction support ⇒ page 42 .
– Install exhaust manifolds together with catalytic converters: left-side ⇒ page 236 , right-side ⇒ page 242 .
– Install coolant pipe (right-side) ⇒ page 214 .
– Install coolant pipe (left-side) ⇒ page 204 .
– Install coolant pipe (bottom left) ⇒ page 207 .
– Insert guide tube for oil dipstick with new O-ring into hole in top section of sump.
– The threaded holes in the flange shaft for the propshaft on the gearbox must be cleaned of remaining locking fluid with a thread tap before assembling.

– Screw spindle for support element at front left side of gearbox downwards.
– Unscrew base plate for support element (left-side) from scissor-type assembly platform -VAS 6131 A- .

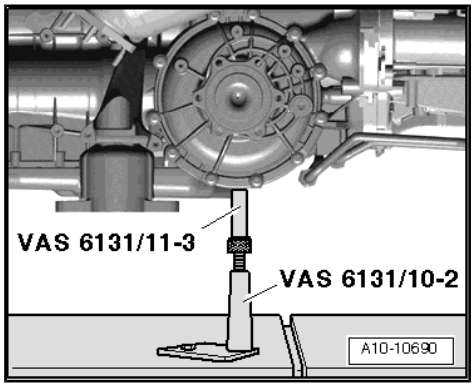


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– Screw spindle for support element at front right side of gearbox downwards.

– Unscrew base plate for support element (right-side) from scissor-type assembly platform -VAS 6131 A- .

– Place subframe onto scissor-type assembly platform -VAS 6131 A- .



WARNING

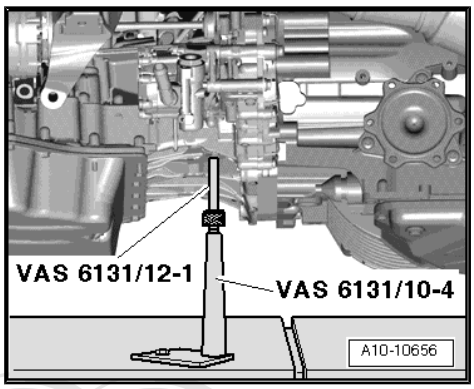
Accident risk from missing support.

- *After placing down the subframe, set up the front gearbox support elements back in their original position.*

– Re-position the front gearbox support elements.

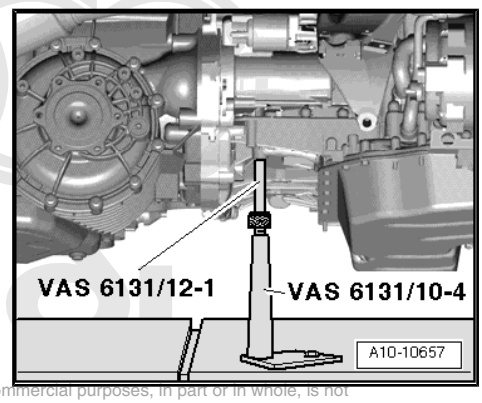
– Screw spindle for support element at rear left of engine downwards.

– Unscrew base plate for support element (left-side) from scissor-type assembly platform -VAS 6131 A- .



– Screw spindle for support element at rear right of engine downwards.

– Unscrew base plate for support element (right-side) from scissor-type assembly platform -VAS 6131 A- .

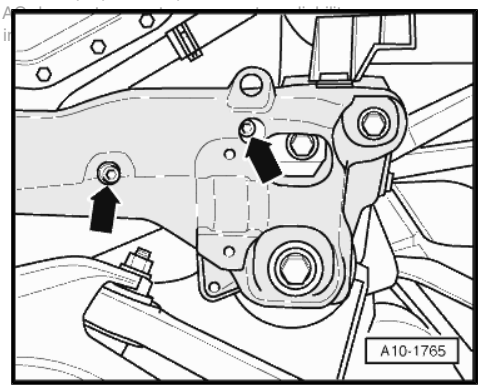


Note

The mounting points for engine (front) and gearbox remain unchanged.

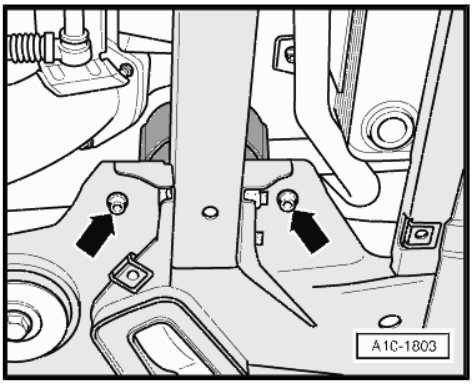
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– Install engine cross member -arrows-.



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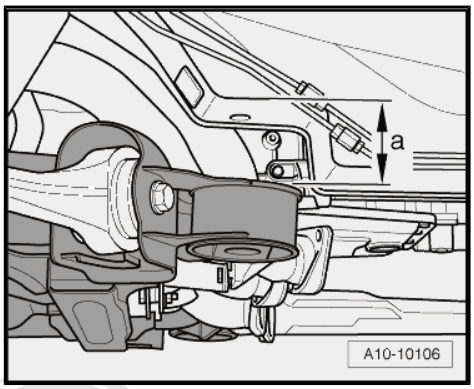
– Position subframe on engine cross member and tighten gearbox mountings (left and right) -arrows- ⇒ Rep. gr. 37 .



– Guide engine/gearbox assembly together with subframe and engine cross member into the body from below using scissor-type assembly platform -VAS 6131 A- .

– Raise the engine/gearbox assembly using scissor-type assembly platform -VAS 6131 A- until the distance -a- is reached.

• Dimension -a- = min. 120 mm.

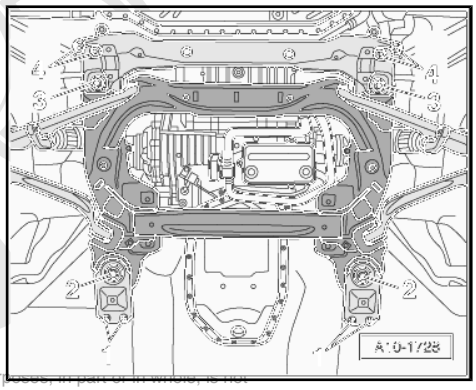


– Install selector lever cable and check adjustment ⇒ Rep. gr. 37 .

– Raise the engine/gearbox assembly further using scissor-type assembly platform -VAS 6131 A- .

– Adjust the subframe according to the markings previously made on the longitudinal members.

– Tighten bolts for subframe only to the specified torque (do not turn further); tighten bolts to final setting only after performing wheel alignment check ⇒ Rep. gr. 40 .



WARNING

Risk of accident because of loose bolt connections.

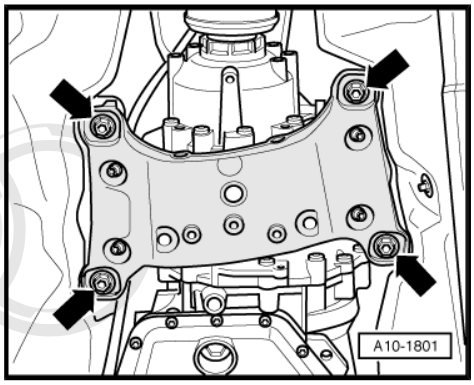
- ***Do NOT drive the vehicle unless the subframe bolts have been finally tightened.***

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– Tighten bolts -4- for engine cross member ⇒ page 42 .

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– Tighten bolts -arrows- at tunnel cross member ⇒ Rep. gr. 37 .



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

– Install propshaft ⇒ Rear final drive 01R; Rep. gr. 39 .
– Install front silencers: left-side ⇒ page 229 , right-side ⇒ page 231 .
– Align exhaust system so it is free of stress ⇒ page 232 .
– Install drive shafts ⇒ Rep. gr. 40 .
– Install guide links, track control links, anti-roll bar, coupling rods and cross piece (front) ⇒ Rep. gr. 40 .
– Install refrigerant lines ⇒ Rep. gr. 87 .
– Install ATF cooler ⇒ Rep. gr. 37 .
– Install body brace ⇒ Rep. gr. 40 .
– Install mounting for torque reaction support ⇒ page 47 .
– Electrical connections and routing ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.
– Observe notes on procedures required after connecting battery ⇒ Electrical system; Rep. gr. 27 .
– Install and adjust wiper arms ⇒ Electrical system; Rep. gr. 92 .

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Caution

Risk of irreparable damage to control units because of excessive voltage.

- ***Never use battery charging equipment for boost starting.***

– Before starting engine, top up hydraulic fluid in power steering reservoir ⇒ Rep. gr. 48 .

Note

The power steering pump must not be run when dry.

– Check oil level ⇒ page 176 .
– Fill cooling system ⇒ page 182 .

Note

- *Drained-off coolant may only be used again if the original cylinder head and cylinder block are re-installed.*
- *Contaminated or dirty coolant must not be used again.*

– Charge the refrigerant system ⇒ Air conditioner system - with refrigerant R134a .
– Perform wheel alignment check ⇒ Rep. gr. 44 .

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WARNING

Risk of accident because of loose bolt connections.

- *Tighten bolts for subframe to final setting after performing wheel alignment check.*

– Check ATF level ⇒ Rep. gr. 37 .

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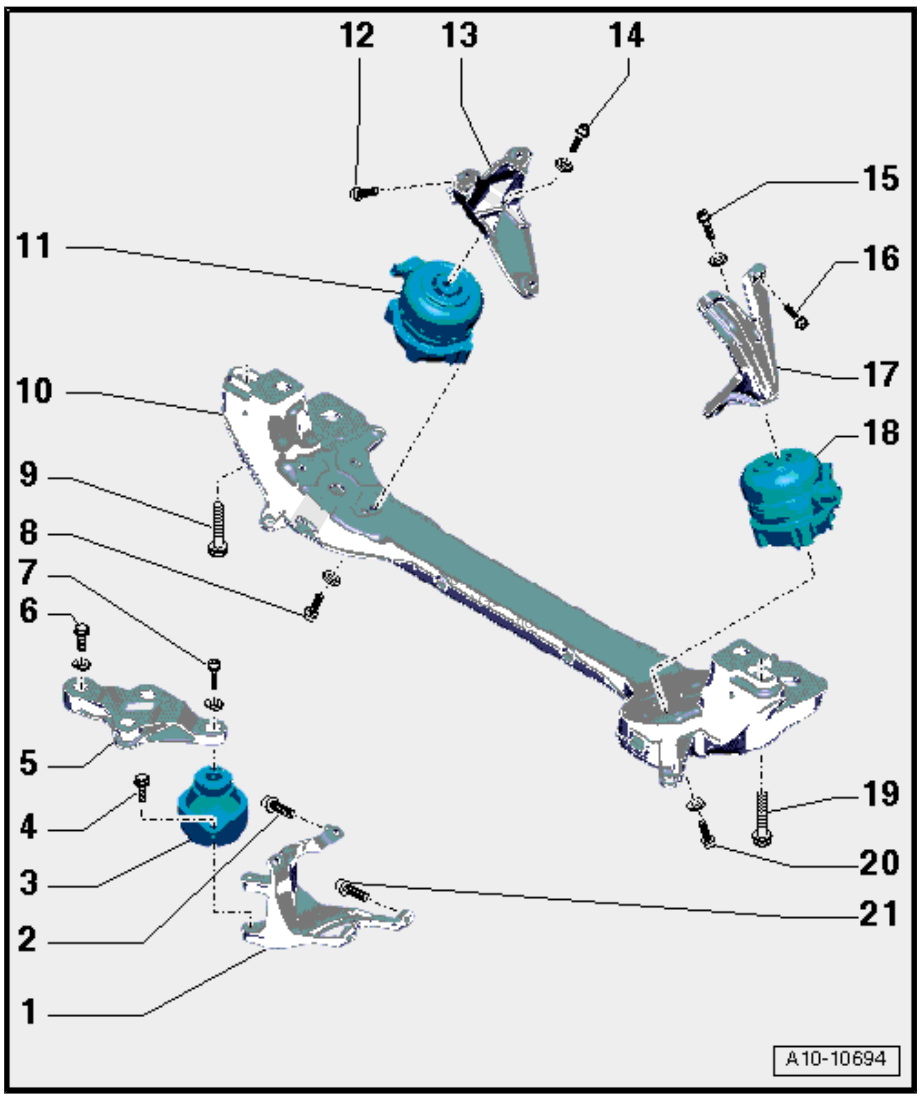
5 Assembly mountings

⇒ “5.1 Assembly mountings - exploded view”, page 42

⇒ “5.2 Removing and installing engine mounting (left and right)”, page 43

⇒ “5.3 Removing and installing mounting for torque reaction support”, page 47

5.1 Assembly mountings - exploded view



1 - Torque reaction support

2 - Bolt

- ❑ M8: 23 Nm
- ❑ M10: 40 Nm

3 - Mounting for torque reaction support

- ❑ Removing and installing ⇒ page 47

4 - Bolt

- ❑ 23 Nm

5 - Bracket for torque reaction support

6 - Bolt

- ❑ 40 Nm

7 - Bolt

- ❑ 40 Nm

8 - Bolt

- ❑ 23 Nm

9 - Bolt

- ❑ 68 Nm

10 - Engine cross member

11 - Engine mounting (right-side)

- ❑ Removing and installing ⇒ page 43

12 - Bolt

- ❑ 40 Nm

13 - Engine support (right-side)

- ❑ Removing and installing ⇒ page 43

14 - Bolt

- ❑ 40 Nm

15 - Bolt

- ❑ 40 Nm

16 - Bolt

- ❑ 40 Nm

17 - Engine support (left-side)

- ❑ Removing and installing ⇒ page 43

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18 - Engine mounting (left-side)

- ❑ Removing and installing ⇒ page 43

19 - Bolt

- ❑ 68 Nm

20 - Bolt

- ❑ 23 Nm

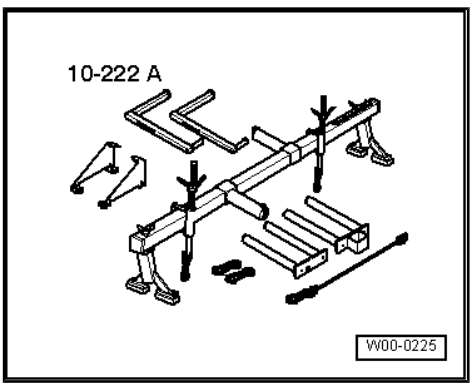
21 - Bolt

- ❑ M8: 23 Nm
- ❑ M10: 40 Nm

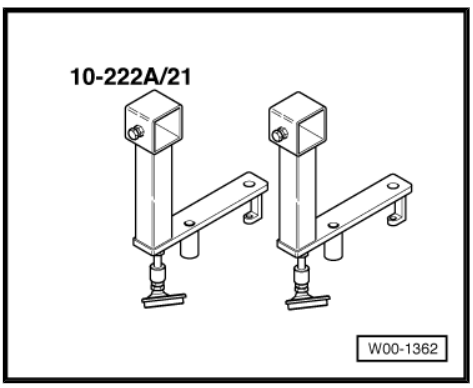
5.2 Removing and installing engine mounting (left and right)

Special tools and workshop equipment required

- ♦ Support bracket -10 - 222 A-



- ♦ Adapters -10 - 222 A /21-



- ♦ Engine support bracket (supplementary set) -T40093-

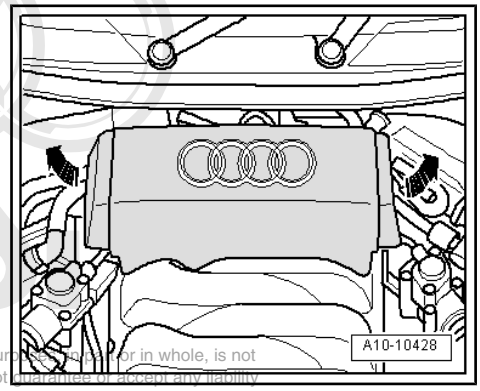


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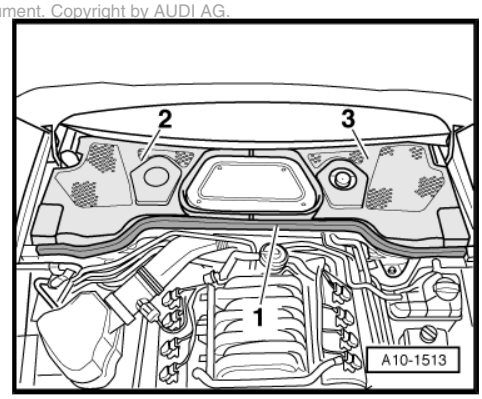
Removing

– Pull off engine cover panel (rear) -arrows-.



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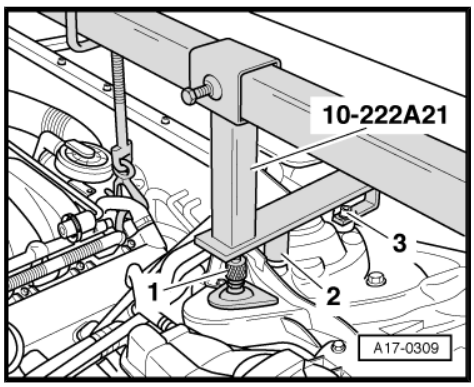
– Pull off rubber seal -1- and remove plenum chamber covers -2 and 3-.



– Unscrew rear bolts -3- for body brace.

– Attach adapters -10 - 222 A /21- without adapter -10 - 222 A /4- onto suspension turrets.

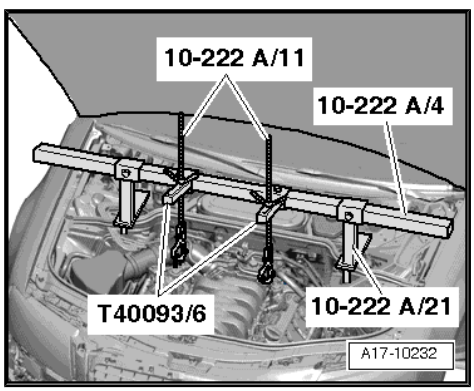
- Supports are marked for left and right side of vehicle.
- The centre resting point -2- of supports is positioned on front bolts for body brace.
- The adapters -10 - 222 A /21- are attached by means of the rear bolts -3- for the body brace.
- The knurled screw -1- must be screwed down until support plate rests on suspension turret.



– Attach adapter -10 - 222 A /4- using adapters -T40093/6- to adapters -10 - 222 A /21- .

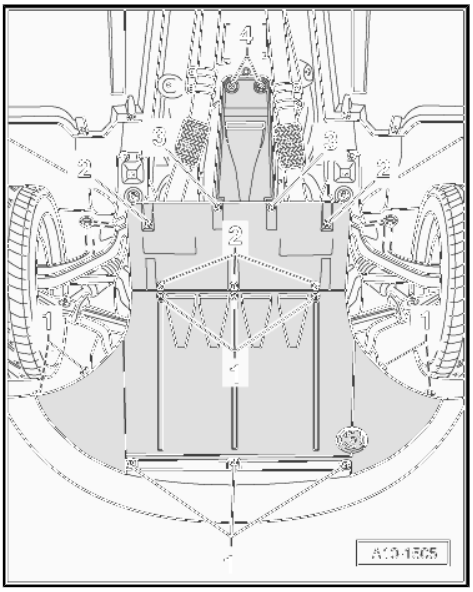
– Secure spindles -10 - 222 A /11- to engine lifting eyes.

– Take up weight of engine using spindles of support bracket.



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– Release fasteners -1- to remove front noise insulation.

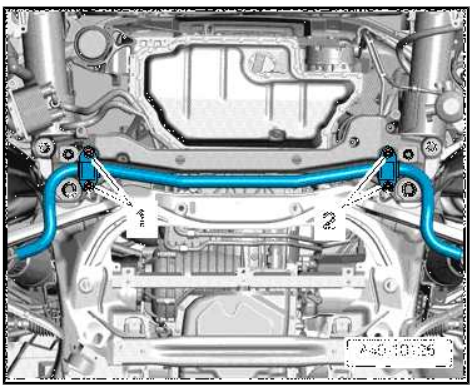


Note

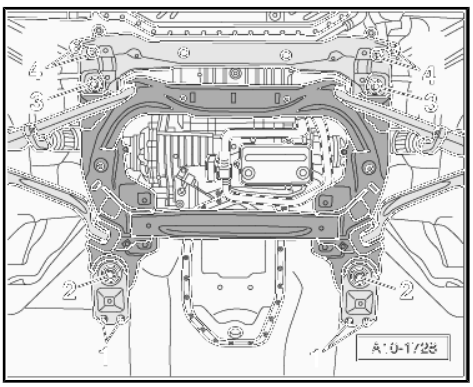
Disregard -items 2, 3, 4-.

– Remove bolts (left and right) -1 and 2- for anti-roll bar mountings.

– Lower anti-roll bar slightly.



– Remove bolts -3 and 4-.

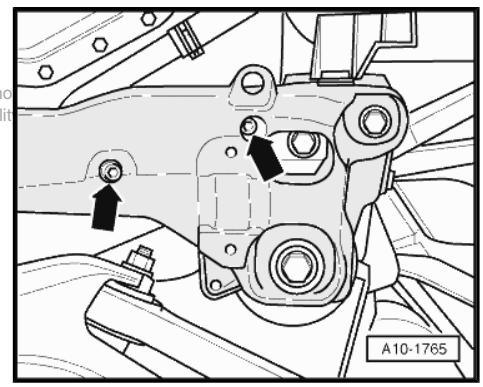


Note

Disregard -items 1 and 2-.

– Remove bolts for engine mountings -arrows- on both sides.

– Take out engine cross member.



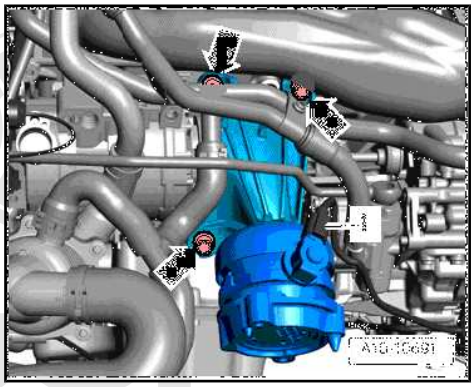
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Engine mounting (left-side):

– Unplug electrical connector -1- at engine mounting.

– Remove bolts -arrows- and detach engine support with engine mounting.



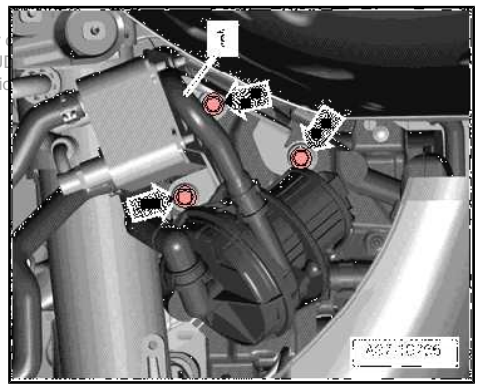
Engine mounting (right-side):

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– Move clear air hose -1- for secondary air system at bracket for ATF cooler.

– Unscrew bolts -arrows- and remove ATF cooler.

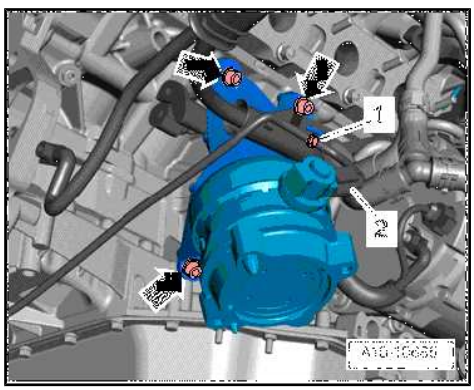
– Tie up ATF cooler (coolant hoses remain connected) on engine.



– Unplug electrical connector -2- at engine mounting (right-side).

– Unbolt bracket -1- for wiring from engine support (right-side).

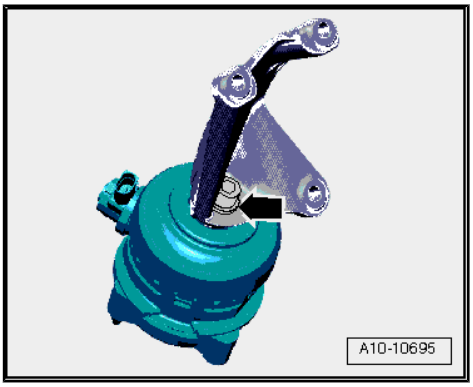
– Remove bolts -arrows- and detach engine support with engine mounting.



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Continuation for both sides:

– Unscrew bolt -arrow- and remove engine mounting from engine support.



Installing

- Tightening torques
  ⇒ “5.1 Assembly mountings - exploded view”, page 42

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

Note

♦ *Renew the bolts tightened with specified tightening angle.*

♦ *Fit all cable ties in the original positions when installing.*

– Install subframe ⇒ Rep. gr. 40 .

– Install anti-roll bar ⇒ Rep. gr. 40 .

– Install ATF cooler ⇒ Rep. gr. 37 .

– Install body brace ⇒ Rep. gr. 40 .

5.3 Removing and installing mounting for torque reaction support

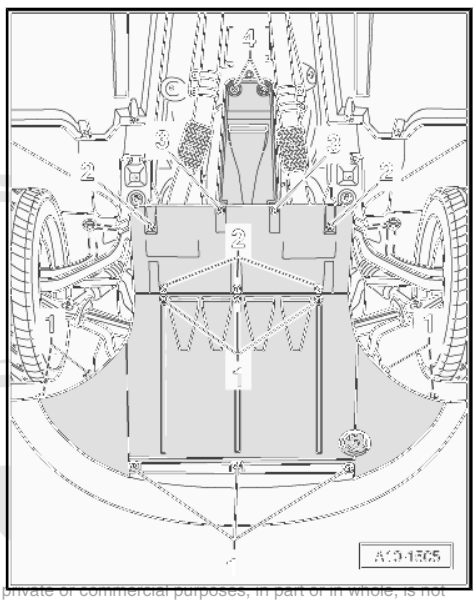
Special tools and workshop equipment required

♦ Electric drill

♦ Stepped centre bit (∅ 24 mm)

Removing

– Release fasteners -1- to remove front noise insulation.



Note

Disregard -items 2, 3, 4-.

– Remove both front wheels.

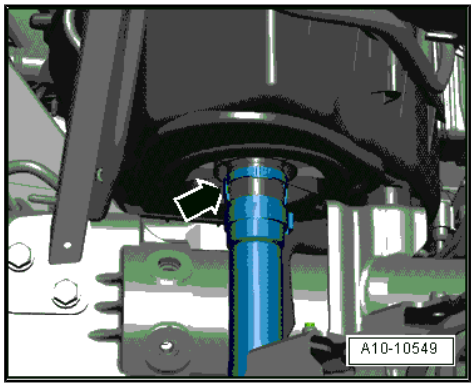
– Remove front sections of front wheel housing liners (left and right) ⇒ Rep. gr. 66 .

– Remove bumper cover (front) ⇒ Rep. gr. 63 .

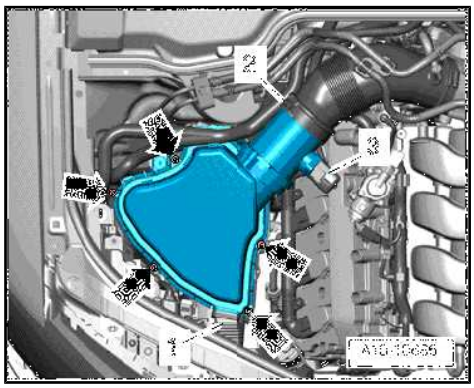
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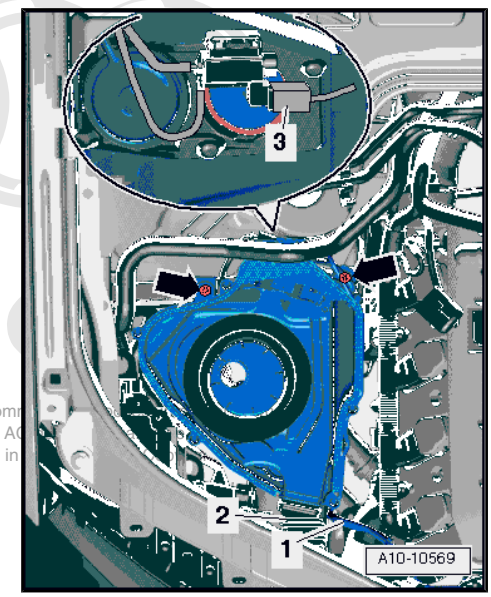
– Disconnect air hose (bottom) from air cleaner housing (bottom section) -arrow-.
– Remove right headlight ⇒ Rep. gr. 94 .



– Unplug electrical connector -3- at air mass meter -G70- .
– Disconnect air intake hose -2- from air pipe.
– Disconnect air duct -1- from air cleaner housing (top section).
– Unscrew bolts -arrows- and detach air cleaner housing (top section).

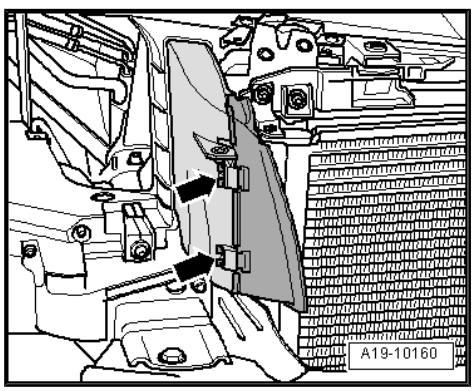


– Disconnect vacuum hose -1- and remove air duct -2-.
– Remove bolts -arrows-.
– Turn air cleaner housing (bottom section) and unplug electrical connector -3- at variable intake manifold change-over valve - N335- .
– Remove bottom section of air cleaner housing.



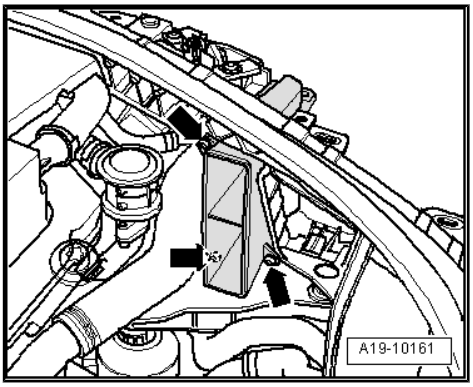
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– Compress retainer catches -arrows- and detach air duct from lock carrier (front right).

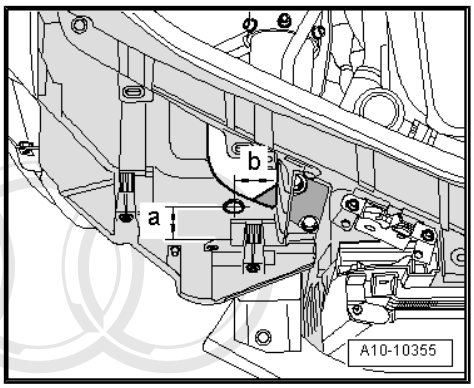


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– Remove bolts -arrows-.
– Detach air duct from lock carrier (rear right).



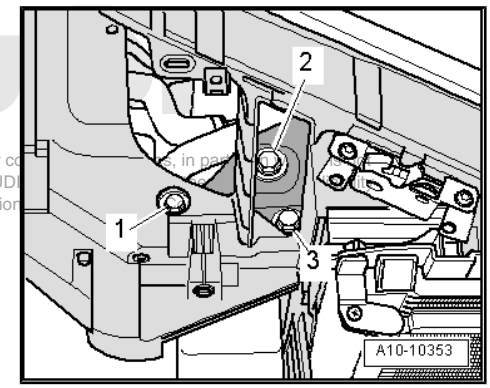
– Mark out drilling on lock carrier as illustrated according to dimensions -a and b-.
• Distance -a- = 40 mm
• Distance -b- = 55 mm.
– Drill a hole of 24 mm dia.



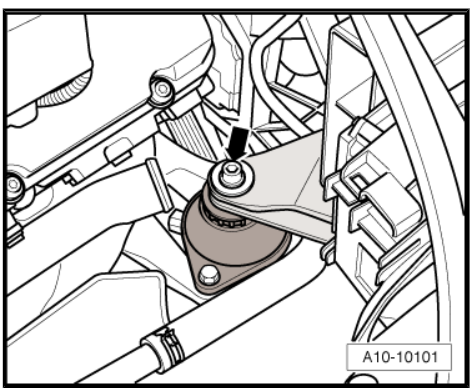
Note

Drill a pilot hole and then drill out to 24 mm dia using the stepped centre bit.

– Remove bolts -1 and 2- on bracket for torque reaction support.
– Slacken bolt -3- a few turns.

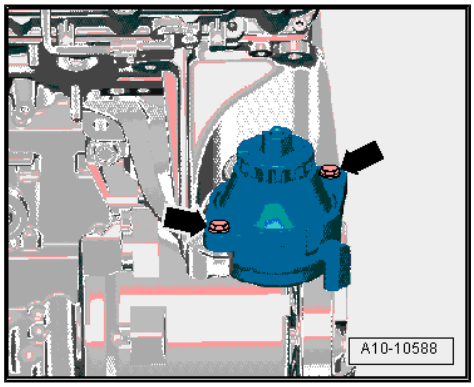


– Remove bolt -arrow- on mounting for torque reaction support.



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– Unscrew bolts -arrows- and remove mounting for torque reaction support.

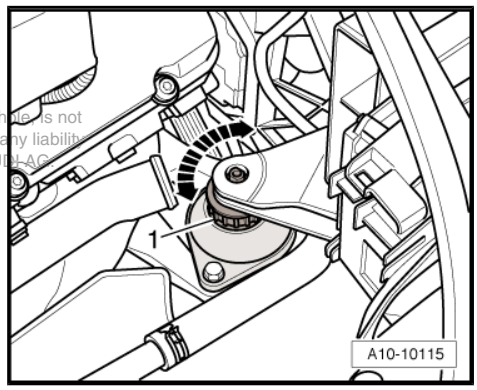


Installing

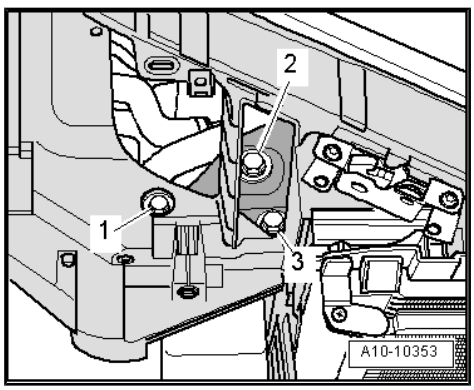
- Tightening torques
  ⇒ “5.1 Assembly mountings - exploded view”, page 42

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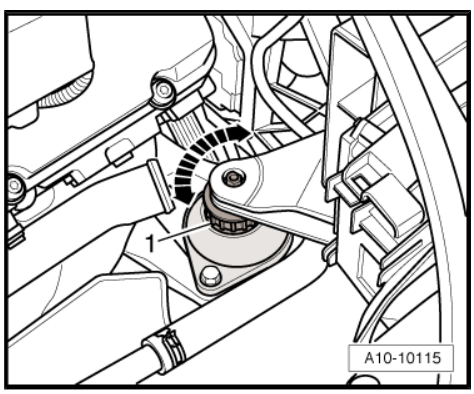
– Turn adjuster ring -1- on mounting for torque reaction support clockwise to stop.



– Tighten bolts -1 and 3- for bracket for torque reaction support.



– Turn adjuster ring -1- by hand anti-clockwise until it comes into contact with bracket for torque reaction support.
– Then turn adjuster ring one turn clockwise.

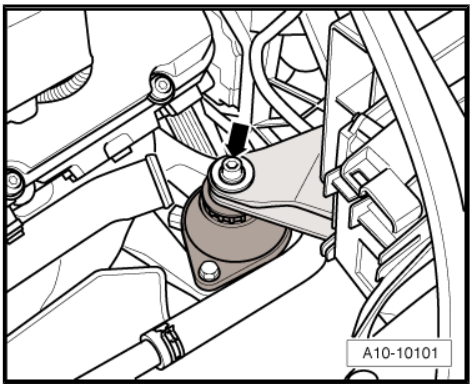


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– Tighten bolt -arrow- on mounting for torque reaction support.

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

– Install headlight ⇒ Rep. gr. 94 .
– Install bumper cover (front) ⇒ Rep. gr. 63 .
– Install air cleaner housing ⇒ Rep. gr. 24 .
– Check headlight adjustment ⇒ Maintenance ; Booklet 404 .



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13 – Crankshaft group

1 Cylinder block (pulley end)

⇒ “1.1 Poly V-belt drive - exploded view”, page 52

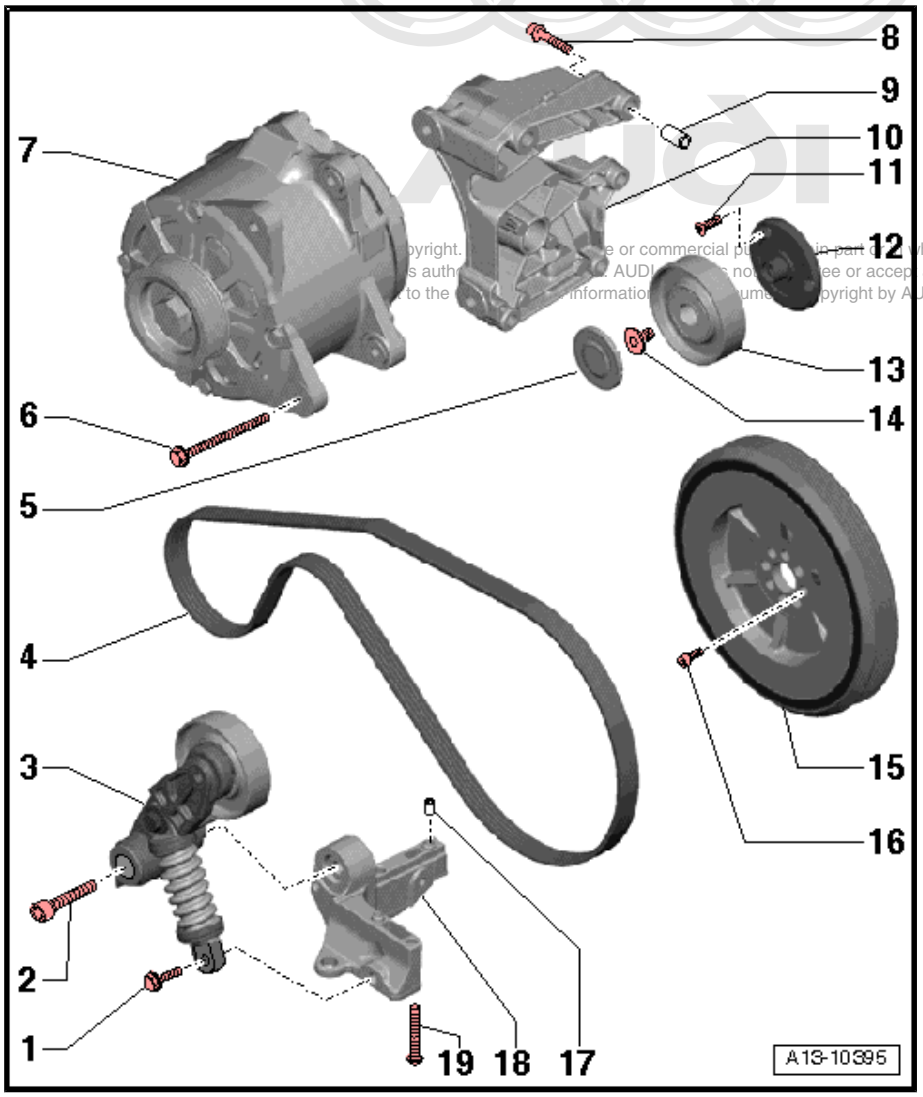
⇒ “1.2 Removing and installing poly V-belt”, page 53

⇒ “1.3 Removing and installing tensioner for poly V-belt”, page 54

⇒ “1.4 Removing and installing vibration damper”, page 55

⇒ “1.5 Renewing crankshaft oil seal (pulley end)”, page 56

1.1 Poly V-belt drive - exploded view



1 - Bolt

- ❑ 22 Nm

2 - Bolt

- ❑ 55 Nm

3 - Tensioner for poly V-belt

4 - Poly V-belt

- ❑ Check for wear
- ❑ Do not kink
- ❑ Before removing, mark direction of rotation with chalk or felt-tip pen
- ❑ Removing and installing ⇒ page 53
- ❑ When installing, make sure it is properly seated on pulleys.

5 - Cover cap

6 - Bolt

- ❑ Tightening torque ⇒ Electrical system; Rep. gr. 27

7 - Alternator

- ❑ Removing and installing ⇒ Electrical system; Rep. gr. 27

8 - Bolt

- ❑ M8: 22 Nm
- ❑ M10: 46 Nm

9 - Dowel sleeve

- ❑ For bracket for alternator
- ❑ 2x

10 - Bracket for alternator

11 - Bolt

- ❑ 9 Nm

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12 - Bearing bracket

- ❑ For idler roller

13 - Idler roller for poly V-belt

14 - Bolt

- ❑ 22 Nm

15 - Vibration damper

- ❑ Removing and installing ⇒ page 55

16 - Bolt

- ❑ Renew
- ❑ Tightening torque and sequence ⇒ page 53

17 - Dowel sleeve

- ❑ 2x

18 - Bracket

- ❑ For tensioner for poly V-belt

19 - Bolt

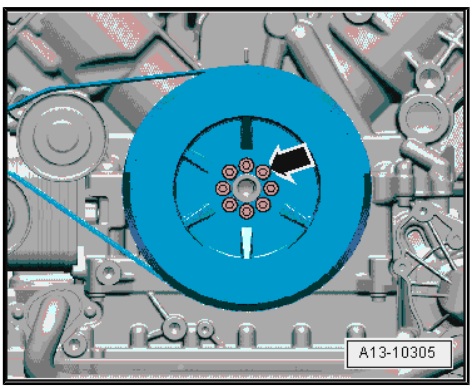
- ❑ Different lengths
- ❑ 9 Nm

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Vibration damper - tightening torque and sequence

– Tighten bolts -arrow- in 3 stages and in diagonal sequence as follows:

1. Tighten bolts to 15 Nm.
2. Tighten bolts to 22 Nm.
3. Turn bolts 90° ($^1/_4$ turn) further.



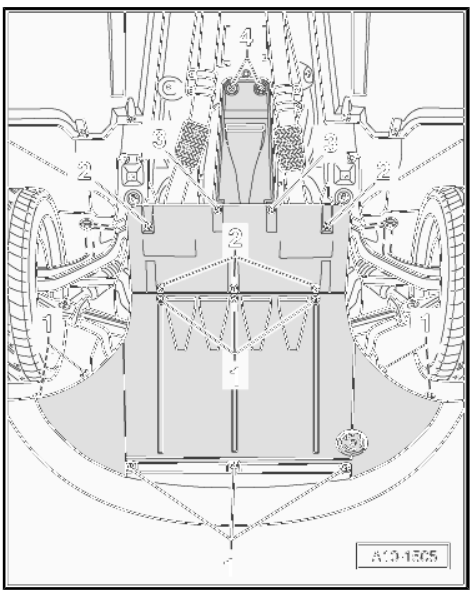
1.2 Removing and installing poly V-belt

Removing

– Release fasteners -1- to remove front noise insulation.

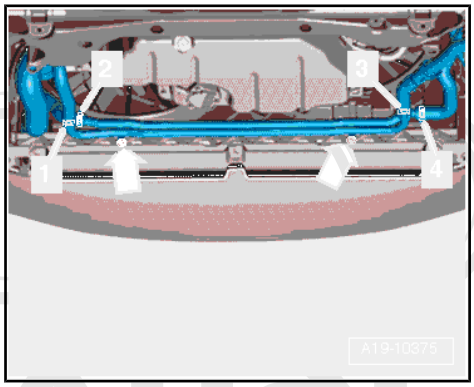
Note

Disregard -items 2, 3, 4-.



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– Unscrew bolts -arrows- and detach coolant pipes going to ATF cooler with coolant hoses -1 … 4- attached from lock carrier.

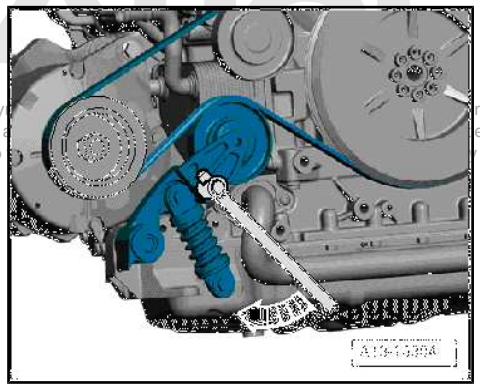


Caution

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

- ***Before removing, mark direction of rotation of poly V-belt with chalk or felt-tip pen for re-installation.***

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

Installing

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

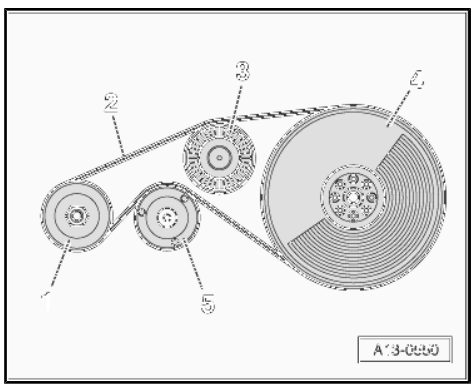
– Fit poly V-belt -2- onto pulleys in the following sequence:

1 - Alternator

3 - Idler roller

4 - Vibration damper

5 - Tensioning roller



Note

When installing poly V-belt, make sure it is properly seated on pulleys.

– Start engine and check that belt runs properly.

1.3 Removing and installing tensioner for poly V-belt

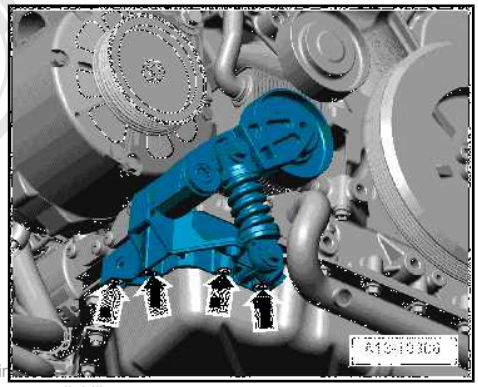
Removing

– Remove poly V-belt ⇒ page 53 .

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– Remove bolts -arrows-.

– Remove poly V-belt tensioner from top section of sump.



Installing

- Tightening torque
  ⇒ “1.1 Poly V-belt drive - exploded view”, page 52

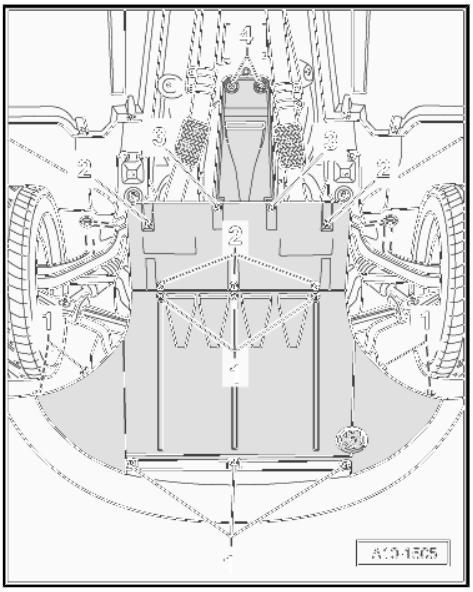
Install in reverse order.

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1.4 Removing and installing vibration damper

Removing

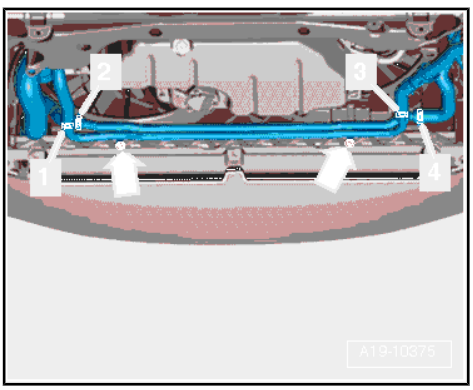
– Release fasteners -1- to remove front noise insulation.



Note

Disregard -items 2, 3, 4-.

– Unscrew bolts -arrows- and detach coolant pipes going to ATF cooler with coolant hoses -1 … 4- attached from lock carrier.

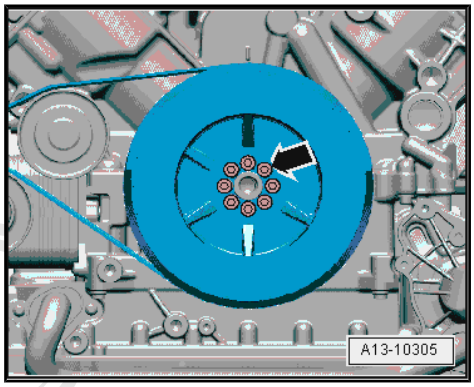


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– Slacken off 8 bolts -arrow- on vibration damper several turns (counterhold with ring spanner on centre nut for alternator pulley).

– Remove poly V-belt ⇒ page 53 .

– Unscrew bolts -arrow- and remove vibration damper.



Installing

- Tightening torque
  ⇒ Fig. ""Vibration damper - tightening torque and sequence"", page 53

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

Note

Renew the bolts tightened with specified tightening angle.

- The vibration damper can only be fitted in one position (note dowel sleeve).

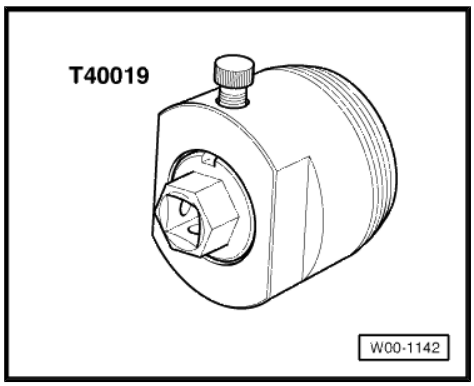
– Install poly V-belt ⇒ page 53 .

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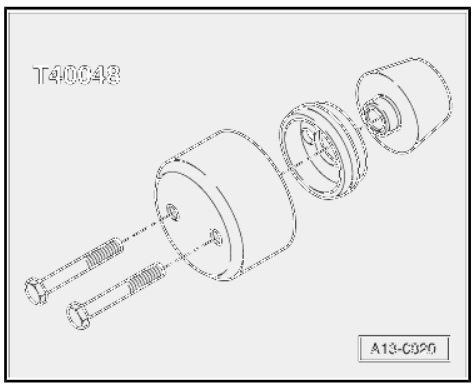
1.5 Renewing crankshaft oil seal (pulley end)

Special tools and workshop equipment required

♦ Oil seal extractor -T40019-



♦ Assembly tool -T40048-



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Procedure

– Remove vibration damper ⇒ page 55 .

– Adjust the inner part of oil seal extractor -T40019- so it is flush with the outer part and lock in position with knurled screw.

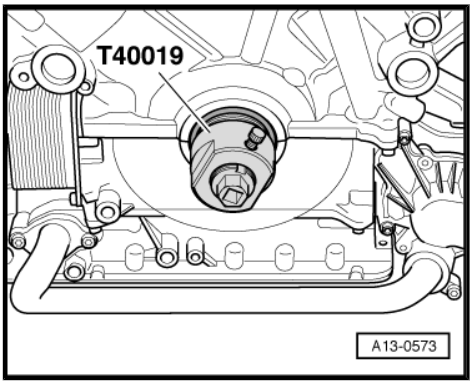
– Lubricate threaded head of oil seal extractor, place it in position and screw it into oil seal as far as possible (applying firm pressure).

– Loosen knurled screw and turn inner part against crankshaft until oil seal is pulled out.

– Clamp flats of oil seal extractor in vice.

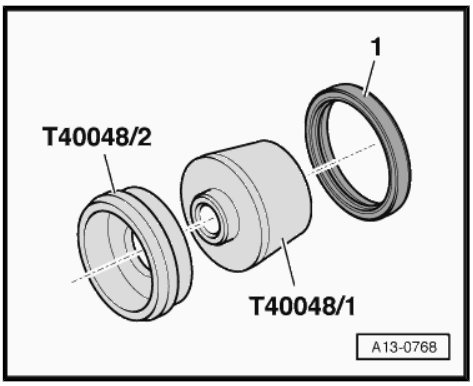
– Remove oil seal with pliers.

– Clean running surface and sealing surface.



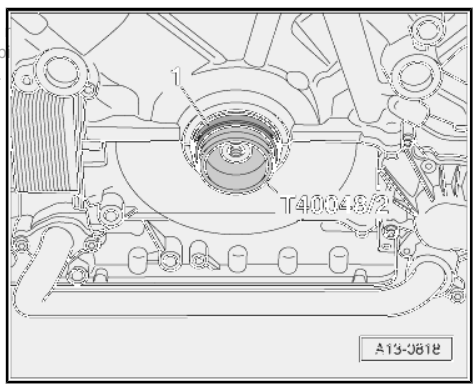
– Fit assembly aid -T40048/1- onto assembly sleeve -T40048/2- and slide oil seal -1- onto assembly sleeve.

– Take off assembly aid.



– Fit assembly sleeve -T40048/2- on crankshaft and slide oil seal -1- into sealing surface in cylinder block.

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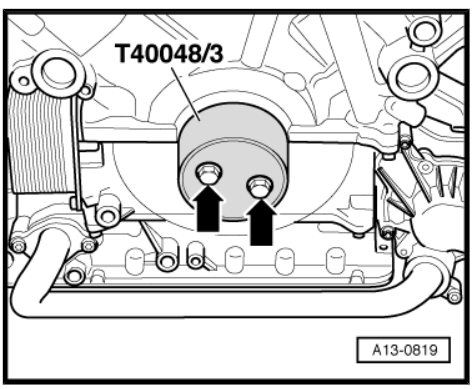
Note

Leave assembly sleeve in position on crankshaft for pressing in seal.

– Apply press sleeve -T40048/3- to crankshaft using two M8×55 mm bolts -arrows-.

– Screw in bolts hand-tight to start with.

– Tighten bolts alternately, $^1/_2$ turn at a time, to press in oil seal onto stop.



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

– Install vibration damper ⇒ page 55 .

– Install poly V-belt ⇒ page 53 .

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2 Cylinder block (gearbox end)

⇒ “2.1 Drive plate - exploded view”, page 58

⇒ “2.2 Removing and installing drive plate”, page 58

⇒ “2.3 Renewing crankshaft oil seal (gearbox end)”, page 59

2.1 Drive plate - exploded view

Note

When carrying out repairs, secure engine to engine and gearbox support -VAS 6095- using bracket for V8 FSI engine -6095/1-6A- ⇒ page 33 .

1 - Drive plate

- ❑ Removing and installing ⇒ page 58
- ❑ Mark installation position for re-installation

2 - Bolt

- ❑ Renew
- ❑ 60 Nm + 90° (1/4 turn further)

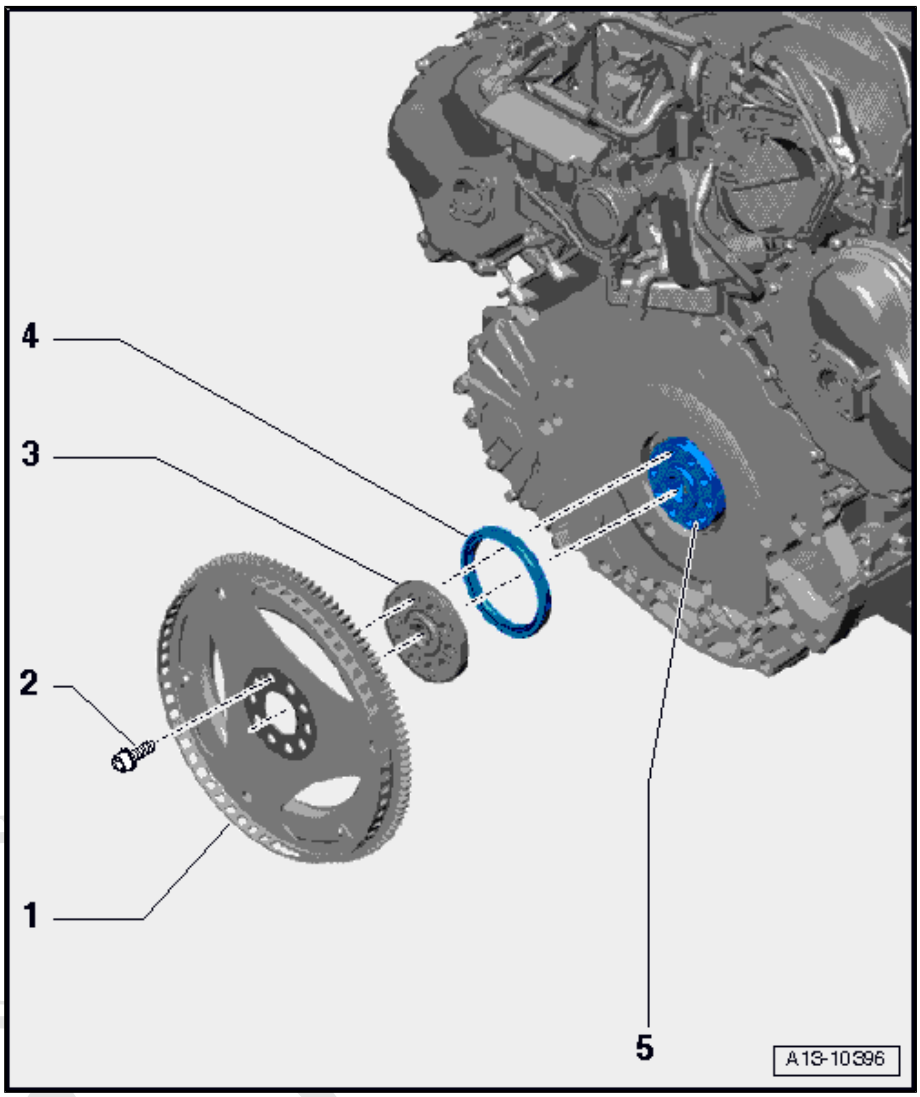
3 - Shim

- ❑ Mark installation position for re-installation

4 - Crankshaft oil seal (gearbox end)

- ❑ Renewing ⇒ page 59

5 - Crankshaft



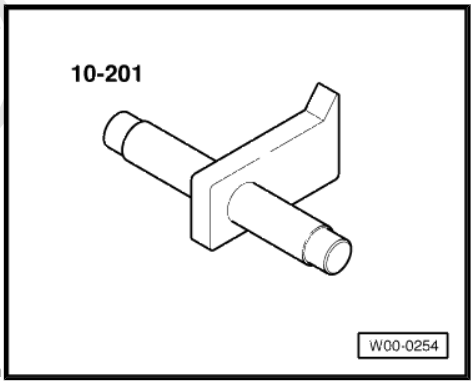
2.2 Removing and installing drive plate

Special tools and workshop equipment required

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♦ Counterhold tool -10 - 201-



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Removing

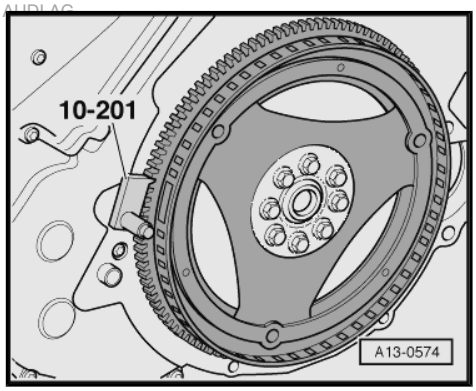
- Engine or gearbox removed.

– Attach counterhold tool -10 - 201- in order to loosen bolts.

– Mark installation position of drive plate on crankshaft with a felt-tip pen for re-installation.

– Unbolt drive plate.

– Take out shim located behind.



Installing

- Tightening torque
⇒ “2.1 Drive plate - exploded view”, page 58

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

Note

Renew the bolts tightened with specified tightening angle.

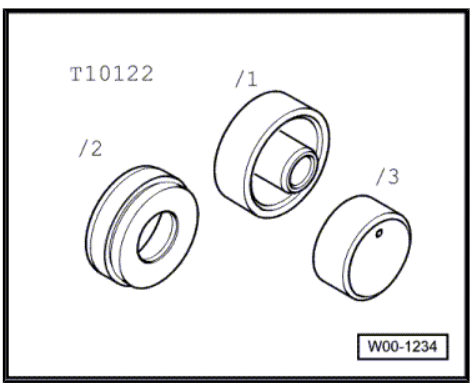
– Install drive plate with shim.

– Reverse position of counterhold tool -10 - 201- in order to tighten bolts.

2.3 Renewing crankshaft oil seal (gearbox end)

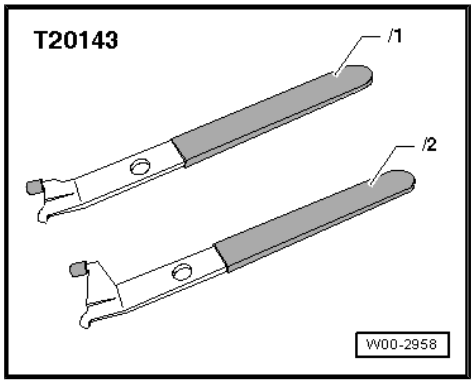
Special tools and workshop equipment required

♦ Fitting tool -T10122-



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♦ Extractor tool -T20143-



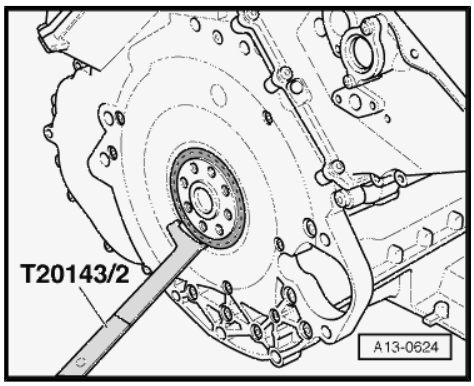
Procedure

- Engine or gearbox removed.

– Remove drive plate ⇒ page 58 .

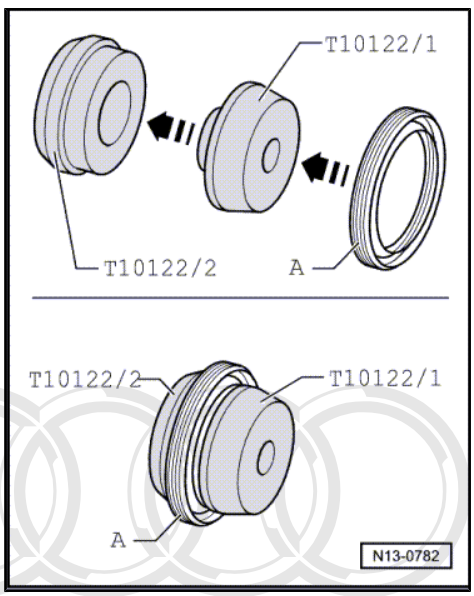
– Pry out oil seal using extractor tool -T20143/2- .

– Clean running surface and sealing surface.

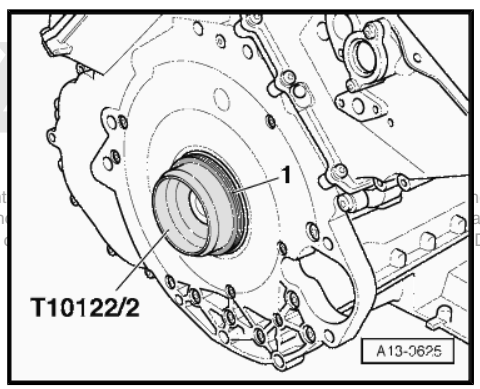


– Fit assembly aid -T10122/1- onto assembly sleeve -T10122/2- and slide oil seal -A- onto assembly sleeve.

– Take off assembly aid.



– Fit the assembly sleeve -T10122/2- with oil seal -1- onto crankshaft.

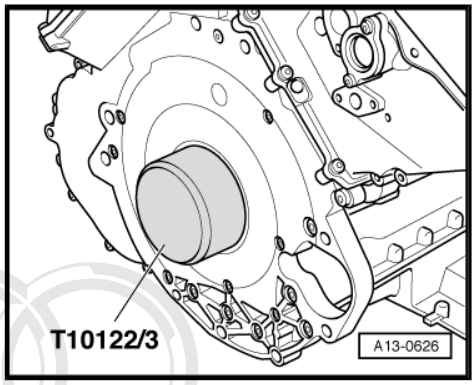


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– Press in the oil seal with press tool -T10122/3- evenly all round until it is flush.

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

– Install drive plate ⇒ page 58 .



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3 Crankshaft

⇒ “3.1 Crankshaft - exploded view”, page 62

⇒ “3.2 Allocation of main bearing shells for new crankshafts”, page 65

⇒ “3.3 Allocation of main bearing shells on used and machined crankshafts”, page 67

⇒ “3.4 Crankshaft dimensions”, page 67

⇒ “3.5 Measuring axial clearance”, page 67

⇒ “3.6 Measuring radial clearance”, page 68

3.1 Crankshaft - exploded view

Note

When carrying out repairs, secure engine to engine and gearbox support -VAS 6095- using bracket for V8 FSI engine -6095/1-6A- ⇒ page 33 .

1 - Cylinder block
- ❑ Matched to -item 12-
- ❑ Applying sealant onto cylinder block (for retaining frame) ⇒ page 64

2 - Gaskets
- ❑ Renew

3 - Crankshaft oil seal (pulley end)
- ❑ Renewing ⇒ page 56

4 - Dowel sleeve
- ❑ 2x
- ❑ Insert in retaining frame
- ❑ Installation position ⇒ page 64

5 - Bolt
- ❑ 9 Nm

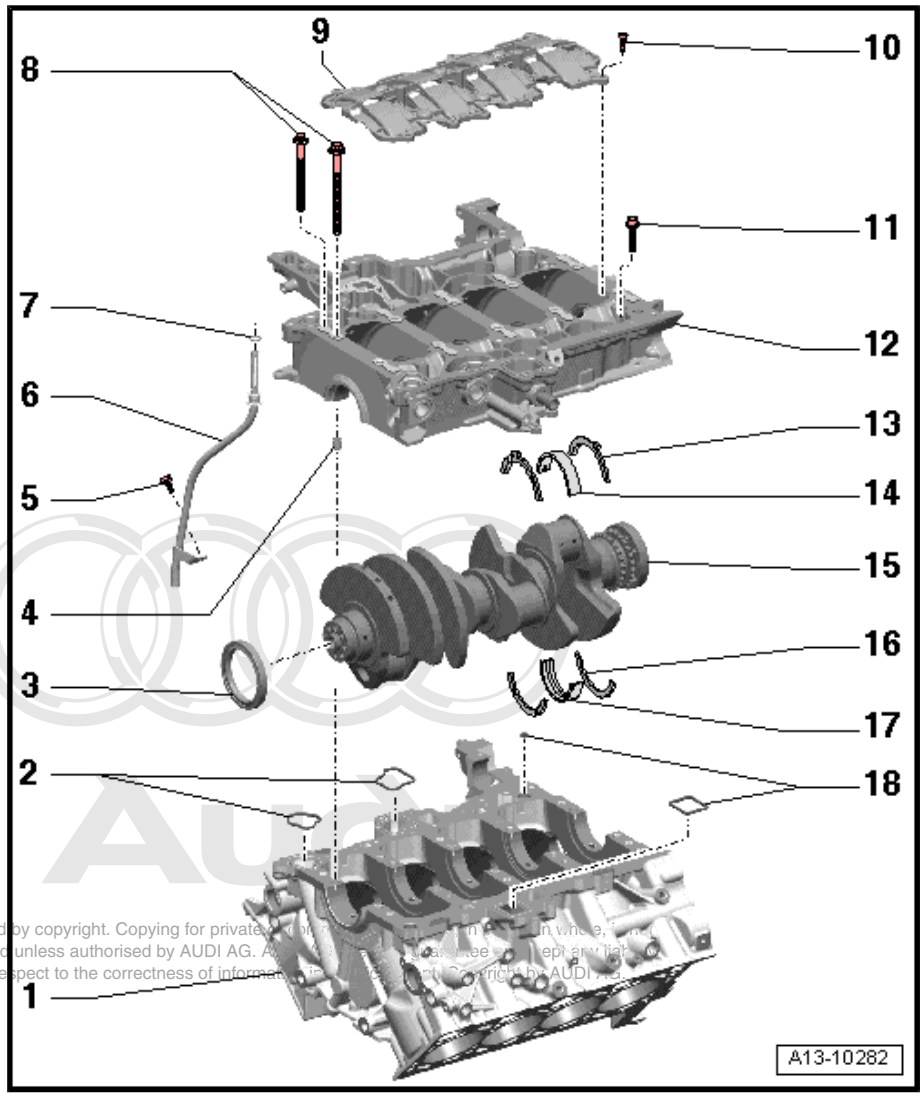
6 - Guide tube for oil dipstick

7 - O-ring
- ❑ Renew

8 - Bolts
- ❑ For retaining frame
- ❑ Renew
- ❑ Different bolt lengths
- ❑ Tightening sequence ⇒ page 65

9 - Baffle plate

10 - Bolt
- ❑ Tightening sequence ⇒ page 64



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11 - Bolt

- ❑ For sealing surfaces: retaining frame to cylinder block
- ❑ Different bolt lengths
- ❑ Tightening sequence ⇒ page 65

12 - Retaining frame

- ❑ Matched to -item 1-
- ❑ Applying sealant onto cylinder block (for retaining frame) ⇒ page 64
- ❑ Tightening sequence for bolts ⇒ page 65

13 - Thrust washer

- ❑ Only fitted on 4th crankshaft bearing
- ❑ Oil grooves face outwards
- ❑ Make sure it engages in retaining frame
- ❑ Measuring axial clearance of crankshaft ⇒ page 67

14 - Bearing shell

- ❑ For retaining frame (without oil groove)
- ❑ Renew used bearing shells
- ❑ Install new bearing shells for retaining frame with correct coloured markings

  New crankshafts ⇒ page 65

  Used or machined crankshafts ⇒ page 67

15 - Crankshaft

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- ❑ Measuring axial clearance ⇒ page 67
- ❑ Measuring radial clearance ⇒ page 68
- ❑ Do not rotate the crankshaft when checking the radial clearance
- ❑ Crankshaft dimensions ⇒ page 67

16 - Thrust washer

- ❑ Only fitted on 4th crankshaft bearing
- ❑ Oil grooves face outwards
- ❑ Measuring axial clearance of crankshaft ⇒ page 67

17 - Bearing shell

- ❑ For cylinder block (with oil groove)
- ❑ Renew used bearing shells
- ❑ Install new bearing shells for the cylinder block with the correct coloured markings

  New crankshafts ⇒ page 65

  Used or machined crankshafts ⇒ page 67

18 - Gaskets

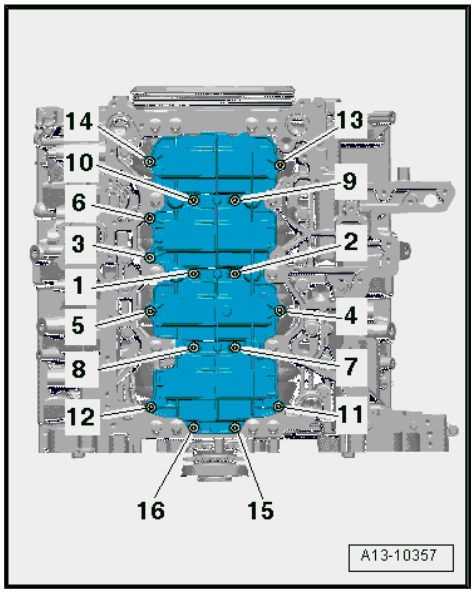
- ❑ Renew

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Tightening sequence for baffle plate

– Tighten bolts in the sequence -1 ... 16-.

• 9 Nm



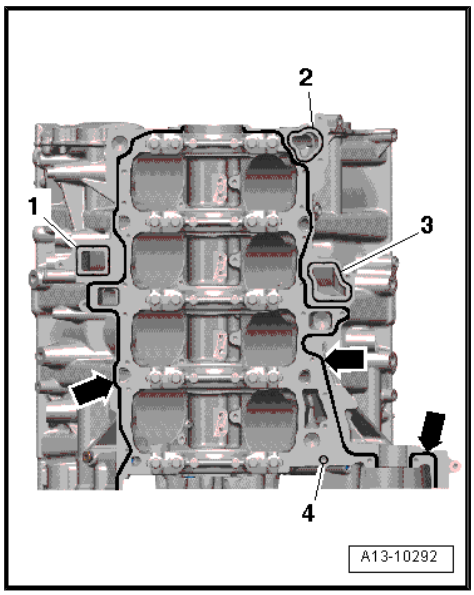
Applying sealant onto cylinder block (for retaining frame)

– Clean sealing surfaces; they must be free of oil and grease.

– Apply beads of sealant -arrows- onto clean sealing surfaces as illustrated.

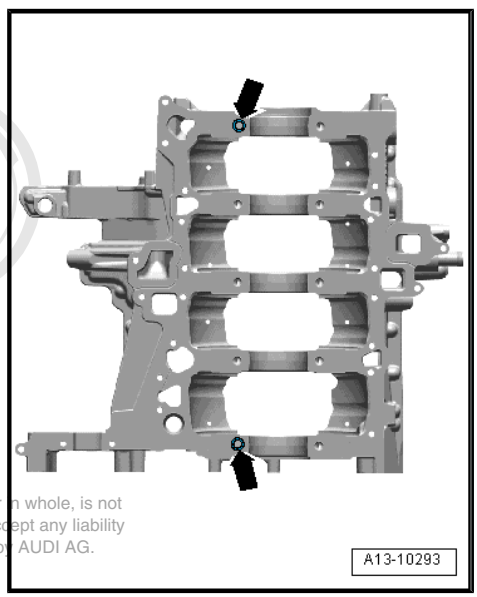
• Width of beads of sealant: 2.0 mm.

– Fit gaskets -1 … 4-.



Fitting location of dowel sleeves

– Check that dowel sleeves -arrows- are inserted in retaining frame at positions shown in illustration.



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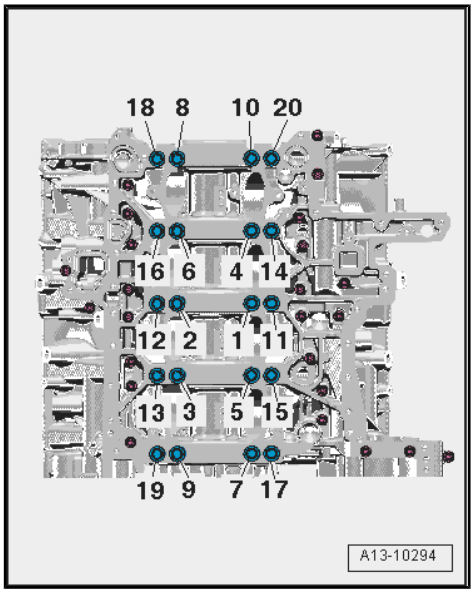
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Tightening sequence for retaining frame

– Renew bolts -1 … 20-.

– Tighten bolts in the following sequence:

1. Tighten bolts -1 ... 10- to 30 Nm.
2. Tighten bolts -11 ... 20- to 20 Nm.
3. Tighten bolts -1 ... 10- to 50 Nm.
4. Tighten bolts -11 ... 20- to 30 Nm.
5. Turn bolts -1 … 10- 90° ($^1/_4$ turn) further.
6. Turn bolts -11 … 20- 90° ($^1/_4$ turn) further.
7. Tighten bolts for sealing surfaces between retaining frame and cylinder block (-highlighted in illustration but not numbered-) to 9 Nm in diagonal sequence.



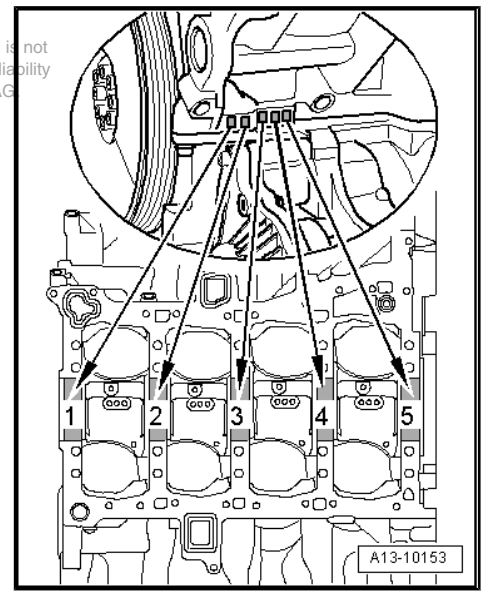
3.2 Allocation of main bearing shells for new crankshafts

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Matching crankshaft bearing shells to bearings in cylinder block

- Bearing shells of the correct thickness are matched to the bearings in the cylinder block at the factory. Coloured dots on the side of the bearing shells are used to identify the bearing shell thickness.
- The allocation of the bearing shells to the cylinder block is indicated by letters on the front left of the cylinder block (legible from outside), as shown in illustration.

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



Note

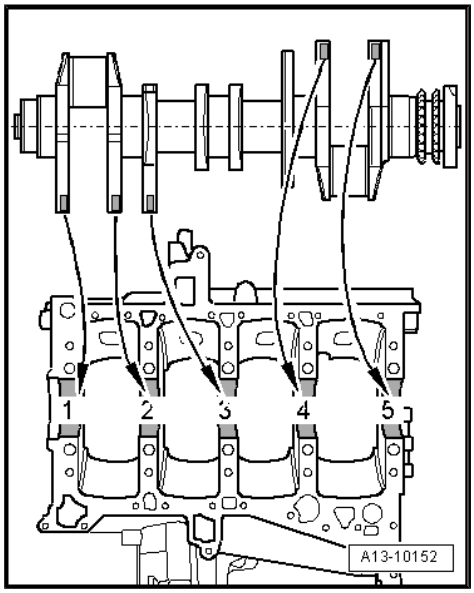
The code letters are also stamped on the retaining frame.

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Allocation of crankshaft bearing shells for retaining frame - version I

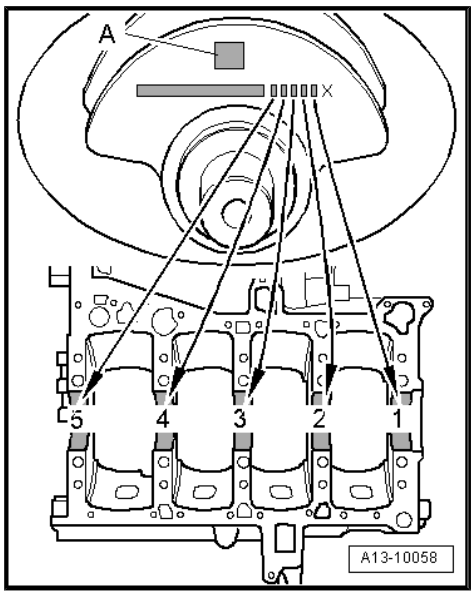
- Bearing shells of the correct thickness are matched to the bearings in the retaining frame at the factory. Coloured dots on the side of the bearing shells are used to identify the bearing shell thickness.
- The allocation of the bearing shells to the retaining frame is indicated by colour codings on the crankshaft webs, as shown in the illustration.

Coloured marking on crankshaft	Colour coding of bearing
Red	Red
Yellow	Yellow
Blue	Blue



Allocation of crankshaft bearing shells for retaining frame - version II

- Bearing shells of the correct thickness are matched to the bearings in the retaining frame at the factory. Coloured dots on the side of the bearing shells are used to identify the bearing shell thickness.
- The allocation of the bearing shells to the retaining frame is indicated by letters on the front crankshaft web, as shown in illustration. The “X” indicates the end of the row of letters and is next to the colour coding for bearing 1 (pulley end).



Note

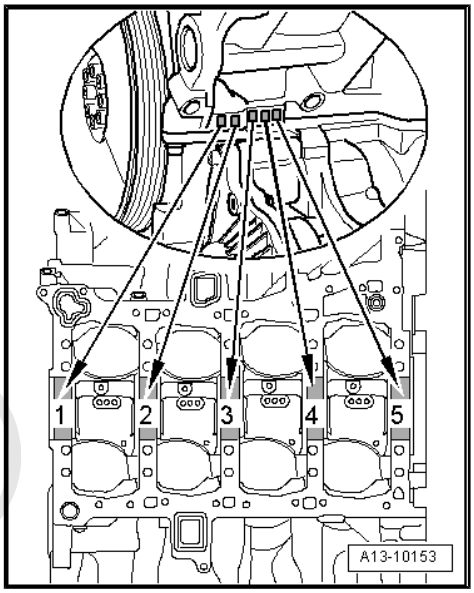
Disregard -item A-.

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

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3.3 Allocation of main bearing shells on used and machined crankshafts



Matching crankshaft bearing shells to bearings in cylinder block

- Bearing shells are allocated to the cylinder block according to the colour codes stamped on the cylinder block.
- On used and machined crankshafts, the main bearing journals must be measured to allocate the correct bearing shells.
- Crankshaft dimensions ⇒ page 67 .
- There are oversized (thicker) bearing shells available for machined crankshafts. These bearing shells have the same coloured marking as the original size bearing shells.

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

Matching crankshaft bearing shells to bearings in retaining frame

- On used and machined crankshafts, the main bearing journals must be measured to allocate the correct bearing shells.
- Any markings still visible on a machined crankshaft are invalid.
- Allocate the bearing shells according to the measured diameter of the crankshaft main bearing journals as follows:

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Main bearing journal ∅	Colour code of bearing shells for retaining frame		
Dimensions (in mm)	**Red**	**Yellow**	**Blue**
Basic dimension 65.000 [1]	64.978 … 64.972	64.972 … 64.965	64.965 … 64.958
Repair undersize 64.750 [1]	64.728 … 64.722	64.722 … 64.715	64.715 … 64.708

- [1] The colour codes for oversized (thicker) bearing shells for machined crankshafts are the same as those on bearing shells for new crankshafts.

3.4 Crankshaft dimensions

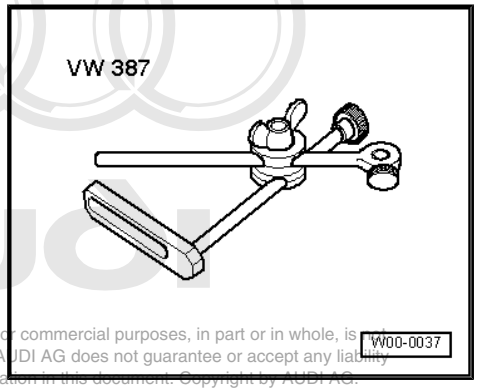
Honing dimension (in mm)	Main bearing journal ∅	Conrod journal ∅
Basic dimension	65.000 – 0.022 – 0.042	54.000 – 0.022 – 0.042
Repair undersize	64.750 – 0.022 – 0.042	53.750 – 0.022 – 0.042

3.5 Measuring axial clearance

Special tools and workshop equipment required

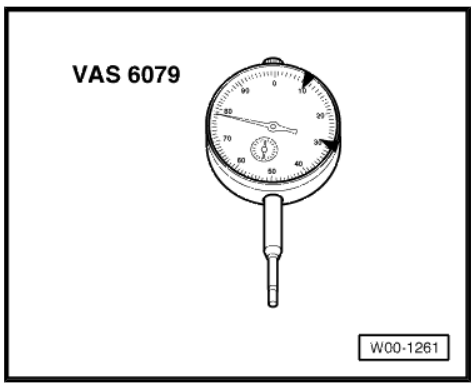
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- Universal dial gauge bracket -VW 387-



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- Dial gauge -VAS 6079-



Procedure

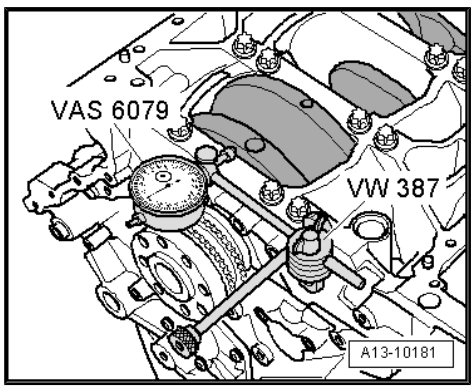
– Secure dial gauge -VAS 6079- with universal dial gauge bracket -VW 387- to cylinder block, as shown in illustration.

– Apply gauge against crank web.

– Push crankshaft against dial gauge by hand and set gauge to “0”.

– Push crankshaft away from dial gauge and read off value.

• Axial clearance: 0.090 ... 0.251 mm



3.6 Measuring radial clearance

Special tools and workshop equipment required

- Plastigage

Procedure

Note

Renew used bearing shells.

– Remove retaining frame and clean bearing journals.

– Place Plastigage onto bearing journal or into bearing shells (length of Plastigage should correspond to width of bearing).

• The Plastigage must be positioned in the centre of the bearing shell.

– Fit retaining frame and tighten to 30 Nm. Do not rotate crankshaft.

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– Remove retaining frame once more.

– Compare width of Plastigage with measurement scale:

Radial clearance:

- New: 0.017 ... 0.044 mm.
- Wear limit: 0.08 mm.

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4 Pistons and conrods

⇒ “4.1 Pistons and conrods - exploded view”, page 70

⇒ “4.2 Removing and installing pistons”, page 72

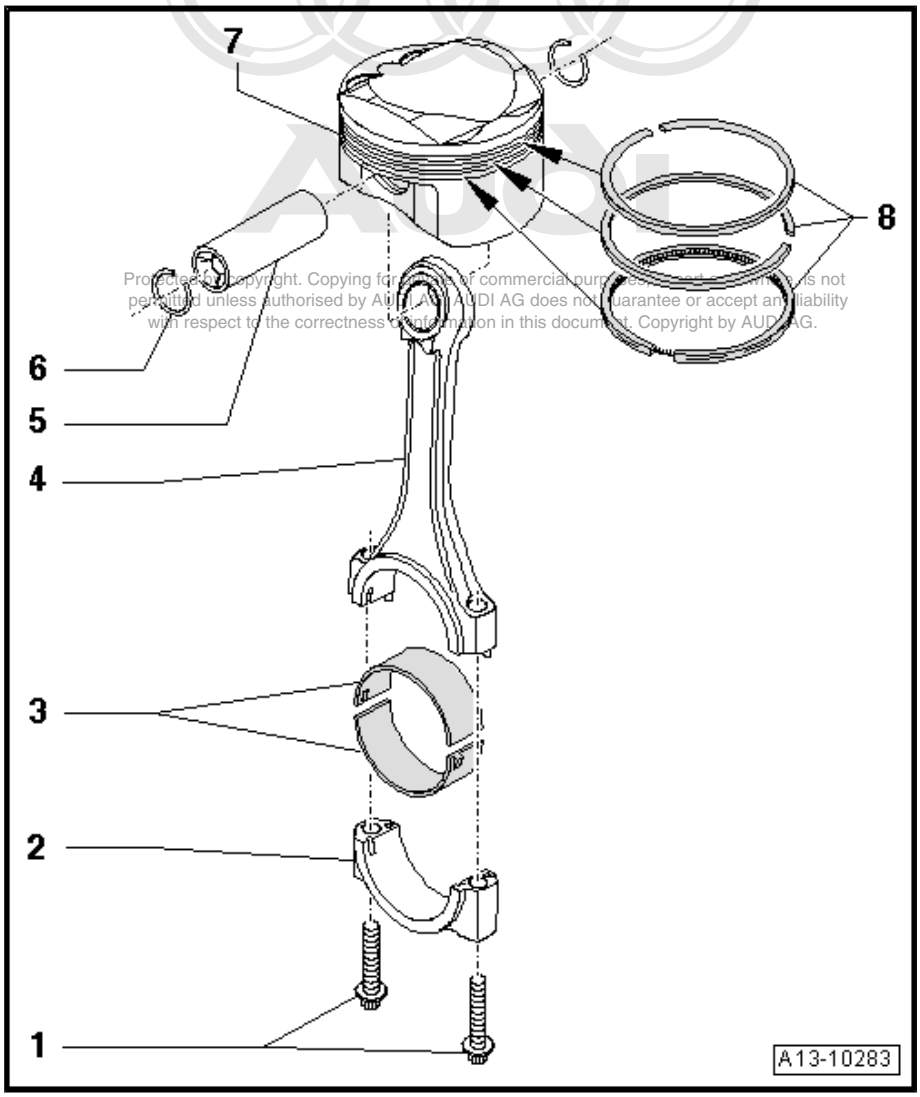
⇒ “4.3 Measuring radial clearance of conrods”, page 73

⇒ “4.4 Checking pistons and cylinder bores”, page 73

4.1 Pistons and conrods - exploded view

Note

Oil spray jet for piston cooling ⇒ page 72 .



1 - Bolt

- ❑ Renew
- ❑ Lubricate threads and contact surface
- ❑ 50 Nm + 90° (1/4 turn further)

2 - Conrod bearing cap

- ❑ Mark installation position for re-installation
- ❑ Mark conrod and cylinder allocation in colour ⇒ page 71
- ❑ Installation position of conrod pairs ⇒ page 71

3 - Bearing shells

- ❑ Ensure that retaining lugs are securely seated.
- ❑ Renew used bearing shells
- ❑ Measuring radial clearance ⇒ page 73
- ❑ There are oversized bearings available for machined crankshaft conrod journals ⇒ Electronic parts catalogue

4 - Conrod

- ❑ Only renew as a complete set
- ❑ Mark conrod bearing cap and cylinder allocation in colour ⇒ page 71
- ❑ Installation position of conrod pairs ⇒ page 71
- ❑ Axial clearance for each conrod pair (when new): 0.20 … 0.27 mm
- ❑ Axial clearance: wear limit: 0.30 mm
- ❑ Measuring radial clearance ⇒ page 73

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5 - Piston pin

- ❑ Removing and installing ⇒ “4.2 Removing and installing pistons”, page 72

6 - Circlip

- ❑ Renew

7 - Piston

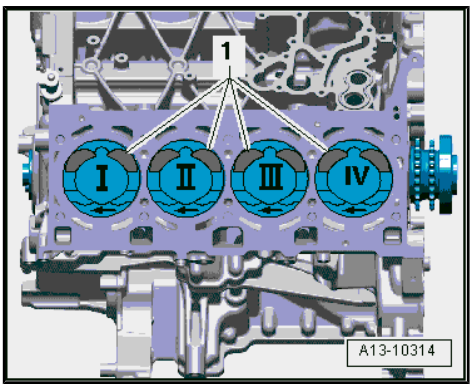
- ❑ Removing and installing ⇒ page 72
- ❑ Installation position for piston ⇒ page 71
- ❑ Checking pistons and cylinder bores ⇒ page 73

8 - Piston rings

- ❑ Measuring ring gap ⇒ page 74
- ❑ Measuring ring-to-groove clearance ⇒ page 74
- ❑ Use piston ring pliers to remove and install
- ❑ Marking “TOP” or side with identification mark must face piston crown
- ❑ Offset gaps by 120°

Installation position of pistons

– Use a coloured pen to mark cylinder allocation on piston crown for re-installation.



Note

Do not use a centre punch or scriber, as this would damage the coating of the piston crown.

Installation position:

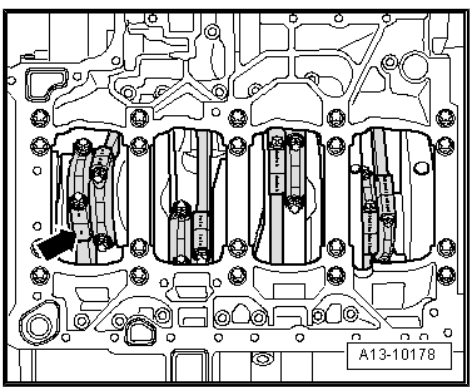
- Arrows on piston crowns point to pulley end.
- Large valve recesses -1- point to centre of engine.

Marking conrods

Note

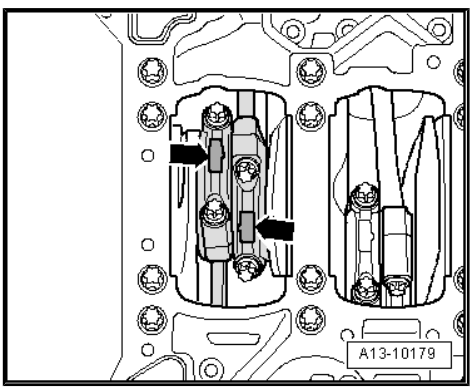
Only renew conrods as a complete set.

– Use a coloured pen to mark matching conrods and conrod bearing caps with cylinder numbers -arrow- for re-installation.



Conrod installation position

- The cast lugs -arrows- on the ground surfaces of conrod pairs 1 and 2, 3 and 4, 5 and 6, and 7 and 8 must face one another.



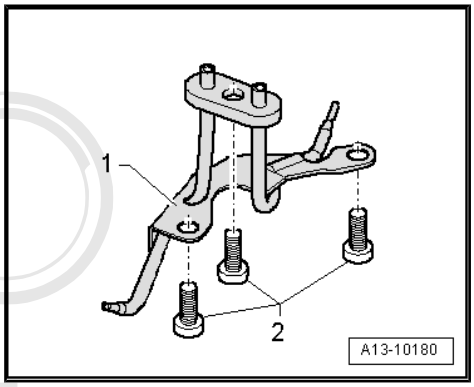
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Oil spray jet for piston cooling

1 - Oil spray jet

2 - Bolts - 9 Nm. Install with locking fluid ⇒ Electronic parts catalogue



Note

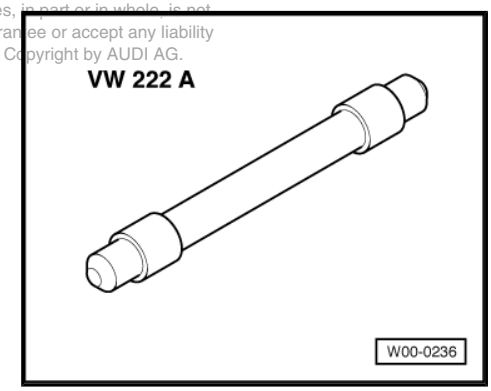
- *Do not bend piston cavity oil jets.*
- *Always renew bent piston cavity oil jets.*

4.2 Removing and installing pistons

Special tools and workshop equipment required

- Drift -VW 222 A-

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- Piston ring clamp, commercially available

Removing

- Engine secured to engine and gearbox support -VAS 6095- ⇒ page 33 .

– Remove cylinder head ⇒ page 120 .

– Remove upper section of sump ⇒ page 162 .

– Mark installation position and matching of conrod bearing caps to conrods and to cylinder for reinstallation ⇒ page 71 .

– Unbolt conrod bearing caps.

– Pull out pistons upwards with conrods.

Note

If piston pin is difficult to remove, heat piston to approx. 60 °C.

– Take circlip out of piston pin boss.

– Use drift -VW 222 A- to drive out piston pin.

Installing

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

- Tightening torques ⇒ “4.1 Pistons and conrods - exploded view”, page 70

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Note

Renew the bolts tightened with specified tightening angle.

– Oil running surfaces of bearing shells.

– Install pistons using commercially available piston ring clamp.

Installation position:

- Pistons ⇒ page 71
- Conrods ⇒ page 71

– Install conrod bearing caps according to markings.

– Install sump (upper section) ⇒ page 162 .

– Install cylinder head ⇒ page 120 .

4.3 Measuring radial clearance of conrods

Special tools and workshop equipment required

♦ Plastigage

Procedure

– Remove conrod bearing caps.

– Clean bearing caps and bearing journals.

– Place Plastigage onto bearing journal or into bearing shells corresponding to width of bearing.

– Fit conrod bearing cap and tighten to 50 Nm. Do not rotate crankshaft.

– Remove conrod bearing caps once more.

– Compare width of Plastigage with measurement scale:

Radial clearance:

- New: 0.020 ... 0.069 mm.
- Wear limit: 0.120 mm.

– Renew conrod bolts.

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4.4 Checking pistons and cylinder bores

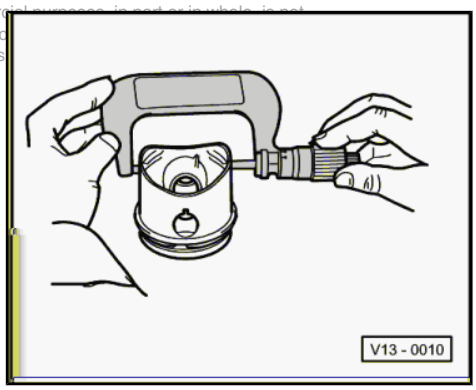
Checking piston

– Using a micrometer (75 ... 100 mm), measure approx. 15 mm from the lower edge, perpendicular to the piston pin axis.

- Maximum deviation from nominal dimension: 0.03 mm.

Piston Ø mm	
Nominal piston dimension I	84.490 [1)]
Nominal piston dimension II	84.590 [1)]

- [1)] Dimensions including coating (thickness 0.01 mm). The coating will wear down in service.



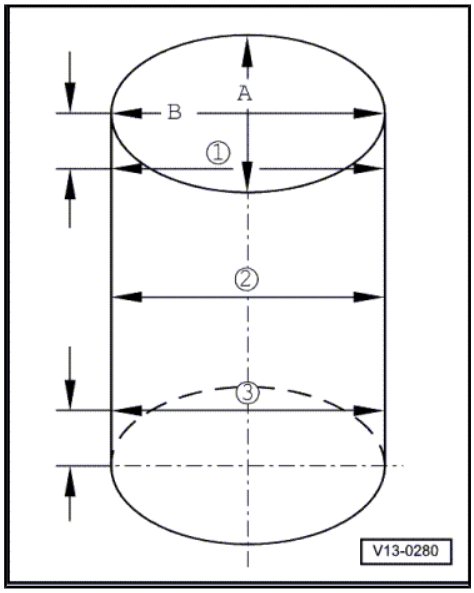
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Measuring cylinder bore

– Use a cylinder gauge -VAS 6078- to take measurements at 3 points in transverse direction -A- and in longitudinal direction -B-.

• Maximum deviation from nominal dimension: 0.08 mm.

Cylinder bore Ø mm	
Nominal bore dimension I	84.510 ± 0.005
Nominal bore dimension II	84.610 ± 0.005

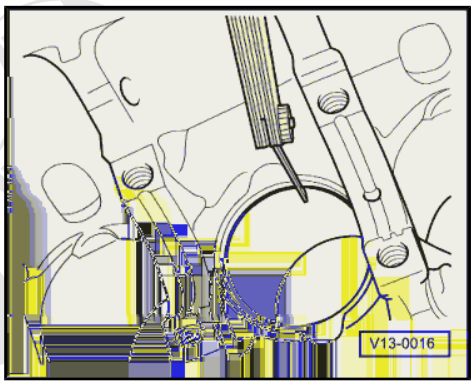


Measuring piston ring gap

– Insert piston ring at right angle to cylinder wall from above and push down into lower cylinder opening approx. 15 mm from bottom of cylinder.

– Use a piston without piston rings to push in the ring.

Piston ring Dimensions in mm	New	Wear limit
1st compression ring	0.20 … 0.35	0.80
2nd compression ring	0.20 … 0.40	0.80
Oil scraper ring	0.20 … 0.40	0.80

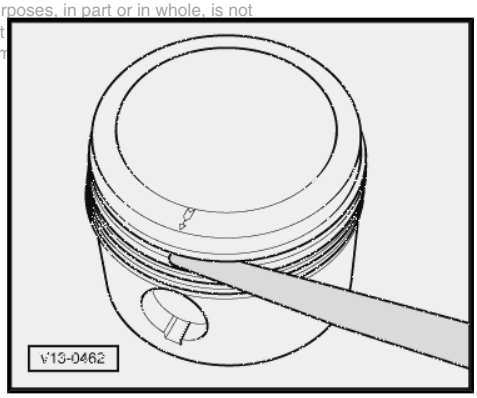


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Measuring ring-to-groove clearance

– Clean groove in piston before checking clearance.

Piston ring Dimensions in mm	New	Wear limit
1st compression ring	0.035 … 0.085	0.200
2nd compression ring	0.005 … 0.045	0.150
Oil scraper ring	0.010 … 0.050	0.200



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1 Chain drive

⇒ “1.1 Timing chain covers - exploded view”, page 76

⇒ “1.2 Removing and installing timing chain covers (left and right)”, page 78

⇒ “1.3 Removing and installing timing chain cover (bottom)”, page 81

⇒ “1.4 Camshaft timing chains - exploded view”, page 86

⇒ “1.5 Removing camshaft timing chains from camshafts”, page 89

⇒ “1.6 Removing and installing camshaft timing chains”, page 96

⇒ “1.7 Drive chain for valve gear - exploded view”, page 100

⇒ “1.8 Removing and installing drive chain for valve gear”, page 101

⇒ “1.9 Drive chain for auxiliary drives - exploded view”, page 104

⇒ “1.10 Removing and installing drive chain for auxiliary drives”, page 104

⇒ “1.11 Auxiliary drives - exploded view”, page 107

⇒ “1.12 Renewing oil seals for auxiliary drives”, page 107

⇒ “1.13 Removing and installing spur gear drive”, page 109

1.1 Timing chain covers - exploded view

1 - Bolt

- ❑ Tightening torque and sequence ⇒ page 78

2 - Crankshaft oil seal (gearbox end)

- ❑ Renewing ⇒ page 59

3 - Dowel sleeve

- ❑ 2x

4 - Cylinder head gasket (left-side)

5 - Bolt

- ❑ Tightening torque and sequence ⇒ page 77

6 - Timing chain cover (left-side)

- ❑ Removing and installing ⇒ page 78

7 - O-ring

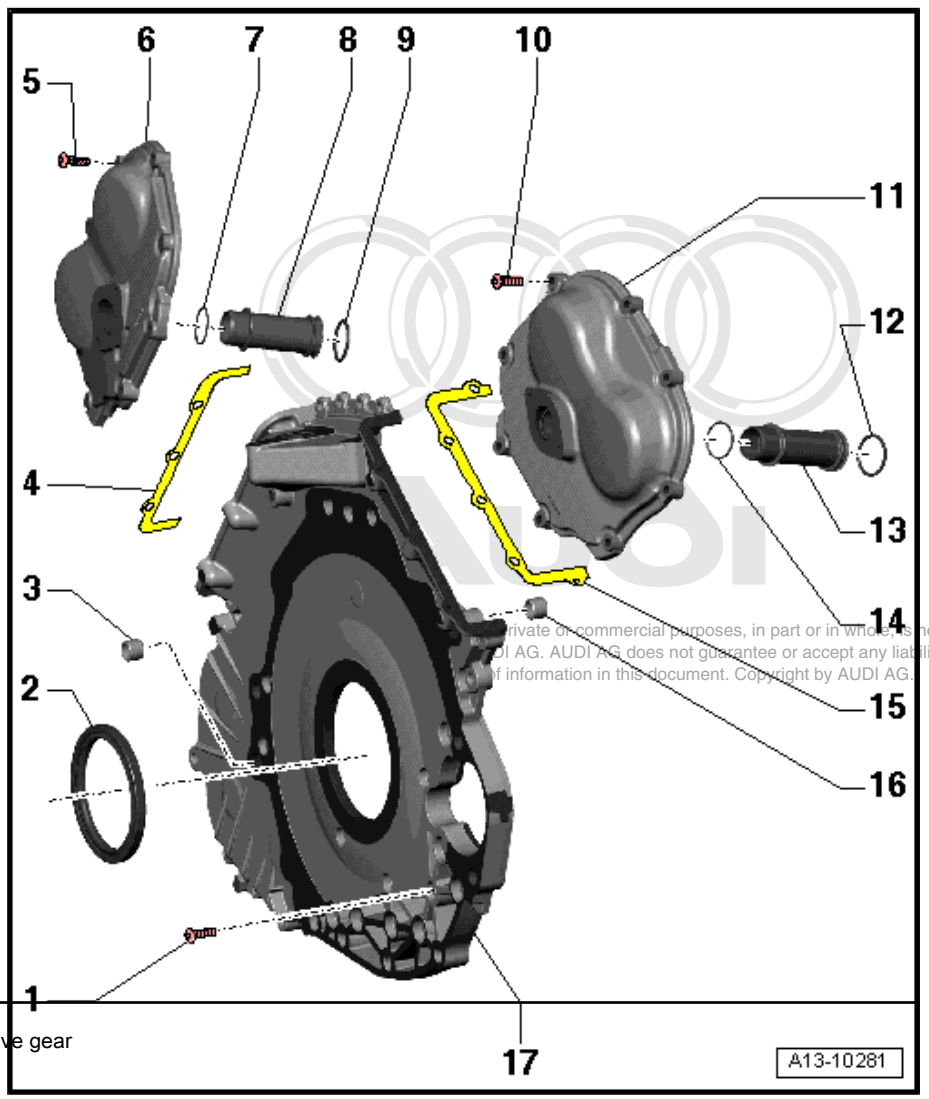
- ❑ Renew

8 - Intermediate coolant pipe (left-side)

- ❑ Drive out with drift

9 - O-ring

- ❑ Renew



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10 - Bolt

- ❑ Tightening torque and sequence ⇒ page 77

11 - Timing chain cover (right-side)

- ❑ Removing and installing ⇒ page 78

12 - O-ring

- ❑ Renew

13 - Intermediate coolant pipe (right-side)

- ❑ Drive out with drift

14 - O-ring

- ❑ Renew

15 - Cylinder head gasket (right-side)

16 - Dowel sleeve

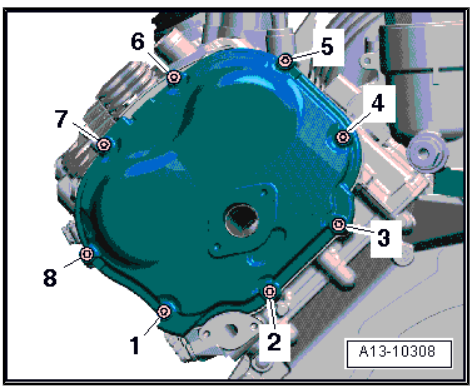
- ❑ 2x

17 - Timing chain cover (bottom)

- ❑ Removing and installing ⇒ page 81

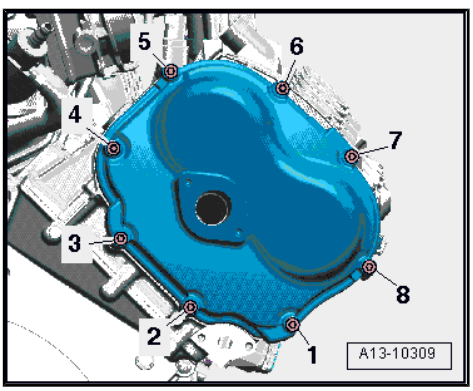
Timing chain cover (left-side) - tightening torque and tightening sequence

– Tighten bolts in the sequence -1 ... 8- to 9 Nm.



Timing chain cover (right-side) - tightening torque and tightening sequence

– Tighten bolts in the sequence -1 ... 8- to 9 Nm.



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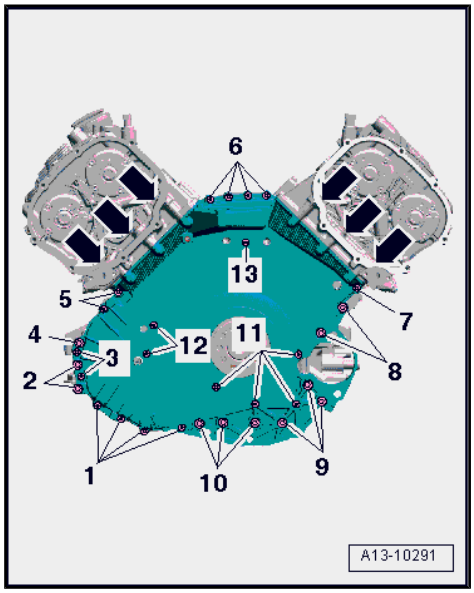
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Timing chain cover (bottom) - tightening torque and tightening sequence

– Renew M6 bolts -1, 3, 5, 6, 7, 11, 12, 13- and -arrows-.

– Tighten bolts in 6 stages as follows:

1. Apply locking fluid to bolts -arrows- and initially tighten to 5 Nm.
2. Tighten bolts -1 ... 13- in diagonal sequence to 8 Nm.
3. Tighten bolts -arrows- to 8 Nm.
4. Tighten M8 bolts -2, 4, 8, 9, 10- in diagonal sequence to 22 Nm.
5. Turn M6 bolts -1, 3, 5, 6, 7, 11, 12, 13- in diagonal sequence 90° ($^1/_4$ turn) further.
6. Turn bolts -arrows- 90° ($^1/_4$ turn) further.

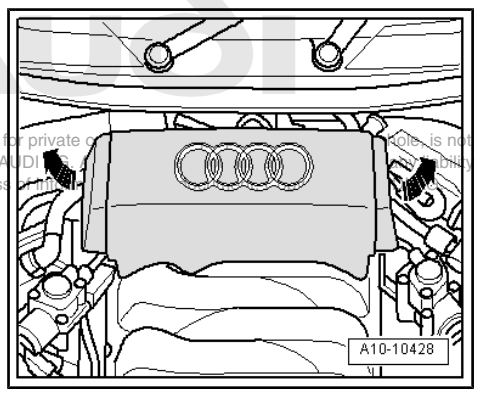


1.2 Removing and installing timing chain covers (left and right)

Special tools and workshop equipment required

- Electric drill with plastic brush attachment
- Safety goggles
- Sealant ⇒ Electronic parts catalogue

Removing



Note

Fit all cable ties in the original positions when installing.

– Pull off engine cover panel (rear) -arrows-.

– Drain off coolant ⇒ page 181 .

– Remove coolant pipe (left-side) ⇒ page 204 .

– Remove coolant pipe (right-side) ⇒ page 214 .

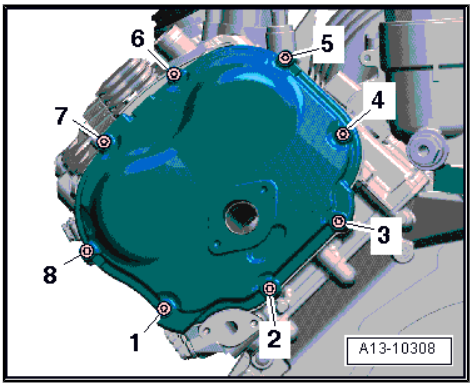
– Remove Lambda probes -G39- and -G108- (before catalytic converter) ⇒ Rep. gr. 24 .

– Remove combination valves for secondary air system: left-side ⇒ page 253 , right-side ⇒ page 254 .

– Remove coolant pipe (rear) ⇒ page 199 .

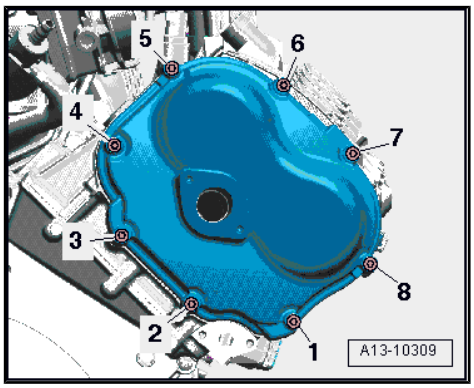
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– Remove bolts -1 ... 8- and detach timing chain cover (left-side).



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– Remove bolts -1 ... 8- and detach timing chain cover (right-side).



Installing

Tightening torques

- ⇒ Fig. ""Timing chain cover (left-side) - tightening torque and tightening sequence"" , page 77 .
- ⇒ Fig. ""Timing chain cover (right-side) - tightening torque and tightening sequence"" , page 77 .

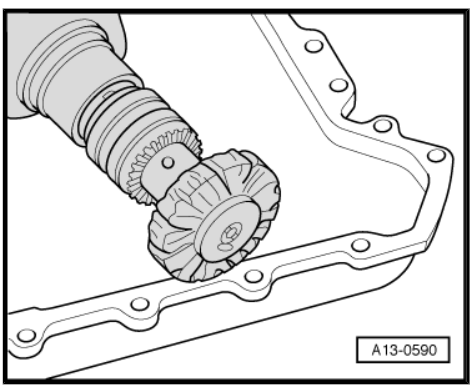
Note

- *Renew M6 bolts and O-rings.*
- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*
- *Fit all cable ties in the original positions when installing.*

Caution

Protect lubrication system against contamination.

- ***Cover exposed parts of the engine.***



WARNING

Protect eyes against injuries.

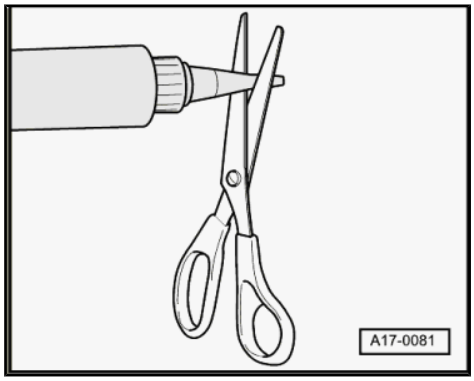
- ***Wear safety goggles.***

– Remove remaining sealant on timing chain covers and cylinder head using rotating plastic brush or similar.

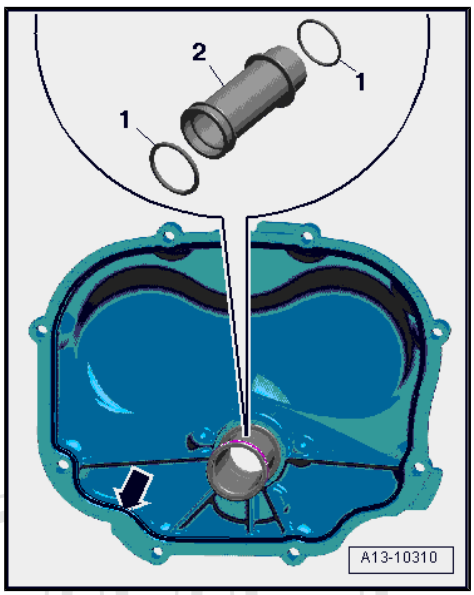
– Clean sealing surfaces; they must be free of oil and grease.

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– Cut off tube nozzle at front marking (diameter of nozzle approx. 2 mm).



– Use drift to drive intermediate coolant pipe (left-side) -2- out of timing chain cover (left-side).
– Fit new O-rings -1- on intermediate coolant pipe -2-.
– Fit intermediate coolant pipe in timing chain cover (left-side).



Caution

Make sure lubrication system is not clogged by excess sealant.

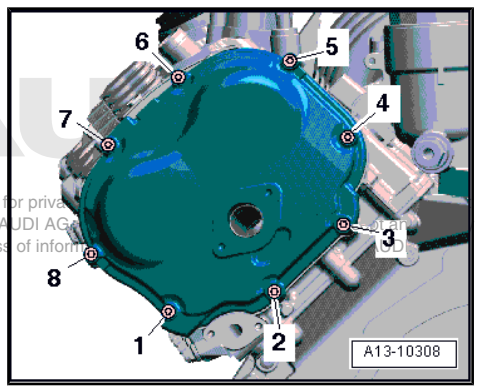
- ***The bead of sealant must not be thicker than specified.***

– Apply the bead of sealant -arrow- onto the clean sealing surfaces of the timing chain cover (left-side) as illustrated.
• Width of sealant bead: 2.5 mm.

Note

The timing chain covers must be installed within 5 minutes after applying the sealant.

– Fit timing chain cover (left-side) and tighten bolts ⇒ page 77 .

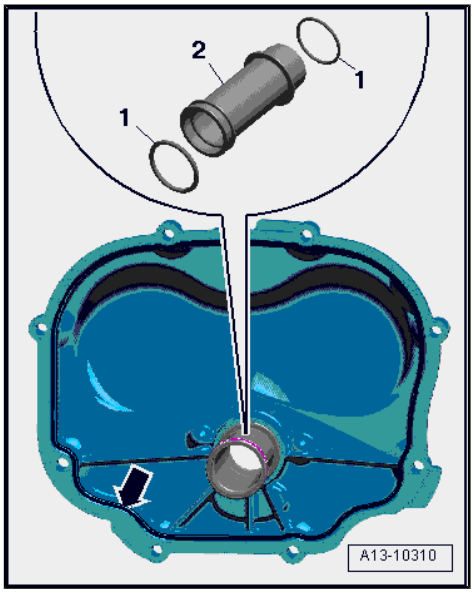


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– Use drift to drive intermediate coolant pipe (right-side) -2- out of timing chain cover (right-side).

– Fit new O-rings -1- on intermediate coolant pipe -2-.

– Fit intermediate coolant pipe in timing chain cover (right-side).



Caution

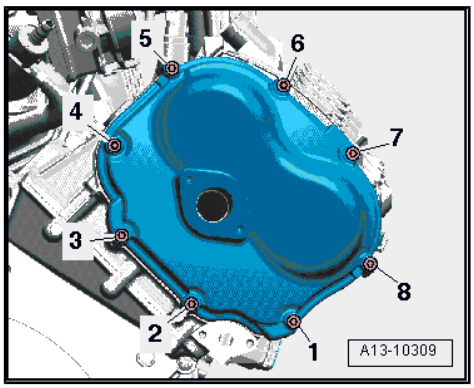
Make sure lubrication system is not clogged by excess sealant.

- *The bead of sealant must not be thicker than specified.*

– Apply the bead of sealant -arrow- onto the clean sealing surfaces of the timing chain cover (right-side) as illustrated.

- Width of sealant bead: 2.5 mm.

– Fit timing chain cover (right-side) and tighten bolts ⇒ page 77 .



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

– Install coolant pipe (rear) ⇒ page 199 .

– Install combination valves for secondary air system: left-side ⇒ page 253 , right-side ⇒ page 254 .

– Install Lambda probes -G39- and -G108- ⇒ Rep. gr. 24 .

– Install coolant pipe (left-side) ⇒ page 204 .

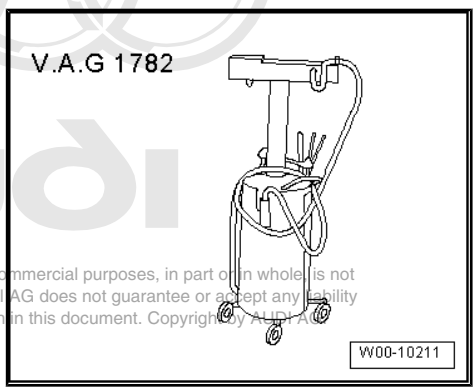
– Install coolant pipe (right-side) ⇒ page 214 .

– Fill cooling system ⇒ page 182 .

1.3 Removing and installing timing chain cover (bottom)

Special tools and workshop equipment required

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



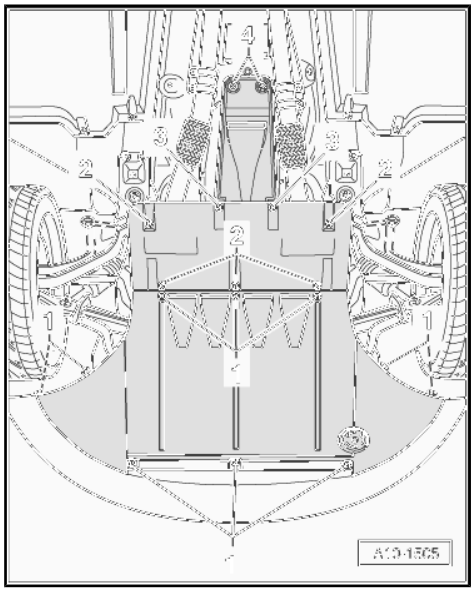
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- Electric drill with plastic brush attachment
- Safety goggles
- Sealant ⇒ Electronic parts catalogue

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Removing

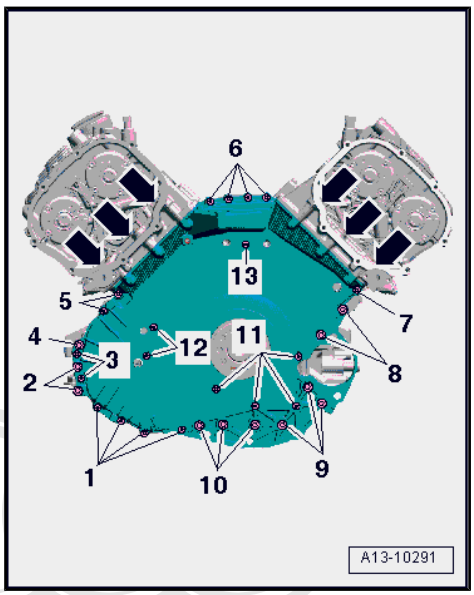
– Release fasteners -1 and 2- and remove rear noise insulation panels.



Note

Disregard -items 3 and 4-.

– Place used oil collection and extraction unit -V.A.G 1782- under engine and drain engine oil.
– Remove automatic gearbox ⇒ Rep. gr. 37 .
– Remove drive plate ⇒ page 58 .
– Remove timing chain covers (left and right) ⇒ page 78 .
– Remove intake manifold ⇒ Rep. gr. 24 .
– Remove oil filter housing ⇒ page 172 .



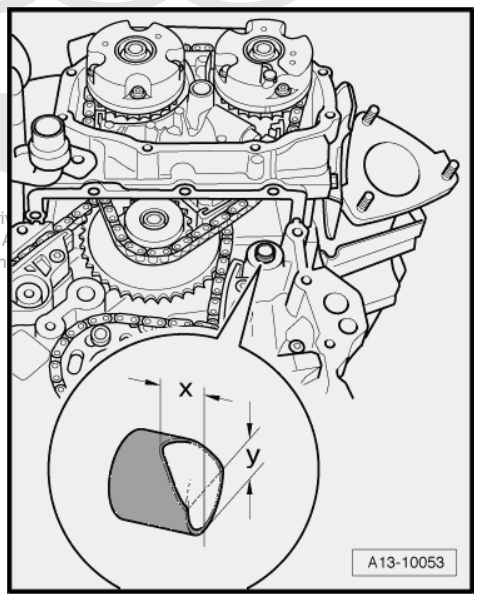
– Remove bolts -arrows-.
– Remove bolts -1 … 13- and remove timing chain cover (bottom).
– Press out crankshaft oil seal (gearbox end) from timing chain cover (bottom).

Installing

• Tightening torques
⇒ Fig. ““Timing chain cover (bottom) - tightening torque and tightening sequence”“ , page 78

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

– Pull dowel sleeve (top right) out of cylinder block.
– Bevel the dowel sleeve with a file, as shown in illustration.
• Dimension -x- = 6.5 mm.
• Dimension -y- = 8 mm.
– Fit dowel sleeve on cylinder block in such a way that the bevelled side points upwards.



Note

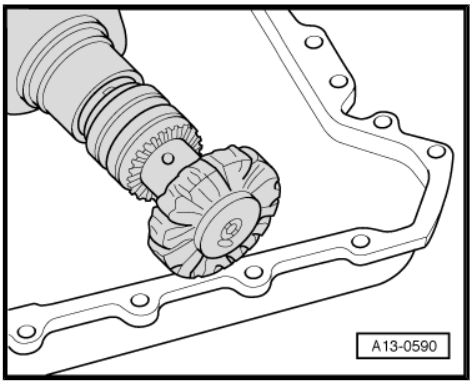
Bevelling the dowel sleeve makes it easier to fit the timing chain cover (bottom) with the cylinder head installed.

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Caution

Protect lubrication system against contamination.

- *Cover exposed parts of the engine.*



WARNING

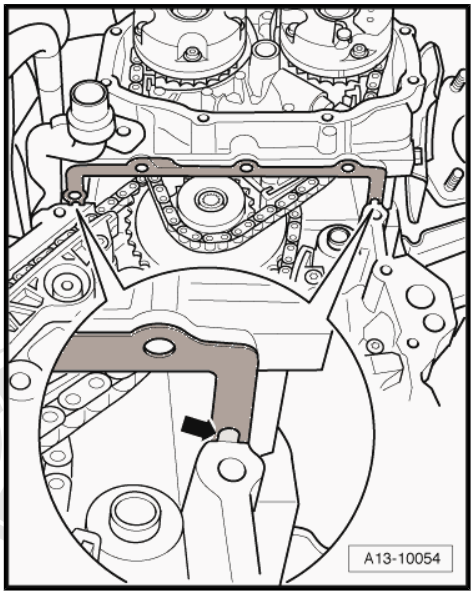
Protect eyes against injuries.

- *Wear safety goggles.*

– Remove remaining sealant on timing chain cover (bottom) and cylinder block and cylinder head using rotating plastic brush or similar.

– Clean sealing surfaces; they must be free of oil and grease.

– Clean any old sealing compound from the bores -arrow- in the cylinder head gaskets.



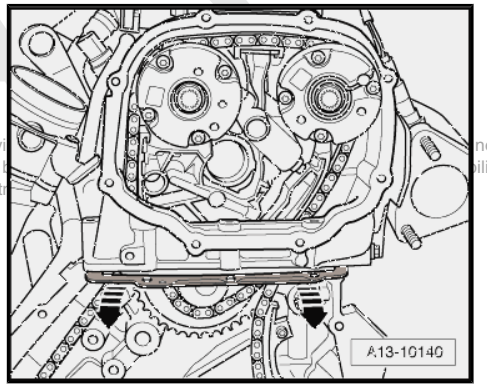
Note

With the cylinder head installed the holes in the cylinder head gasket are only half visible.

Caution

Avoid damage to cylinder head gasket.

- *Only bend the ends of the cylinder head gaskets slightly and do not kink.*



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Note

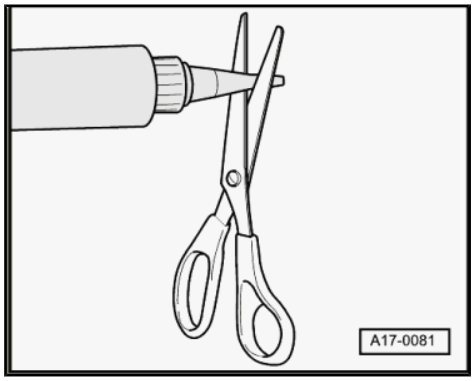
If the cylinder head gasket has been bent and kinked it must be renewed.

– Carefully bend the ends of the cylinder head gaskets down very slightly -arrows-, just far enough to be able to clean the upper sealing surface on the gasket and cylinder head.

– Clean both cylinder head gaskets (top and bottom); they must be free of oil and grease.

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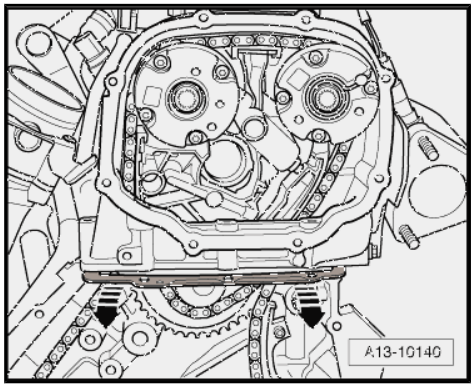
– Cut off tube nozzle at front marking (diameter of nozzle approx. 2 mm).



Caution

Avoid damage to cylinder head gasket.

- *Only bend the ends of the cylinder head gaskets slightly and do not kink.*



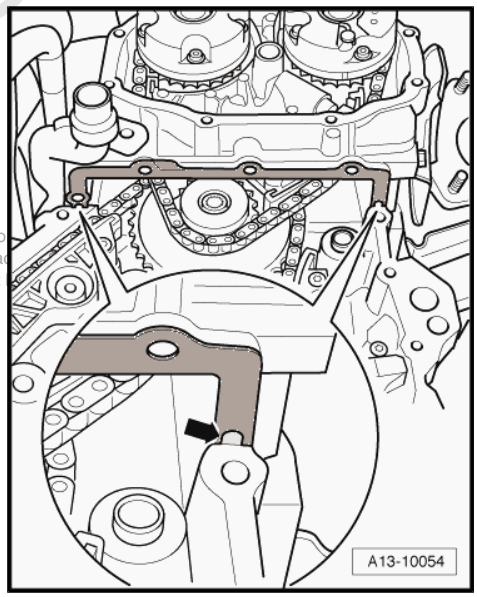
Note

If the cylinder head gasket has been bent and kinked it must be renewed.

– Apply a small amount of sealant to sealing surfaces of cylinder head gaskets (top and bottom). To do so, you again have to bend cylinder head gaskets down very slightly -arrows-.

– Use a flat object (e.g. a feeler gauge) to apply sealant to the area between cylinder head and gasket.

– Clean holes -arrow- in cylinder head gaskets and fill them with sealant.



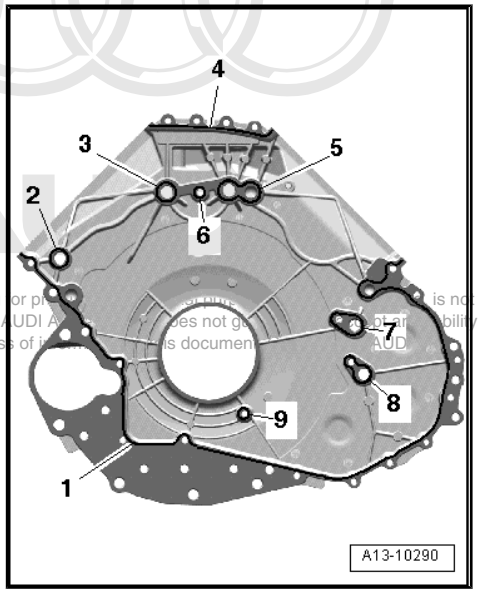
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Caution

Make sure lubrication system is not clogged by excess sealant.

- *The beads of sealant must not be thicker than specified.*



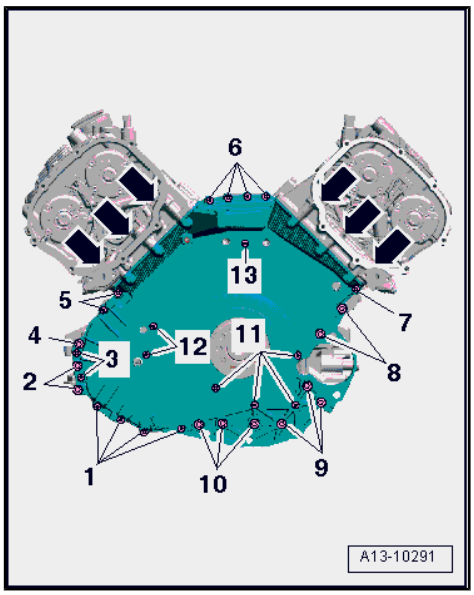
– Apply the beads of sealant -1 ... 9- onto the clean sealing surfaces of the timing chain cover (bottom) as illustrated.

• Width of beads of sealant: 2.5 mm.

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Note

The timing chain cover (bottom) must be installed within 5 minutes after applying the sealant.



– Fit timing chain cover (bottom), guiding it towards the sealing surface on cylinder block and cylinder head at an angle and from below.

– Take care not to damage the cylinder head gaskets when fitting the cover.

Note

If the cylinder head gasket has been damaged it must be renewed.

– Tighten bolts ⇒ page 78 .

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

– Install crankshaft oil seal (gearbox end) ⇒ page 59 .

– Install oil filter housing ⇒ page 172 .

– Install intake manifold ⇒ Rep. gr. 24 .

– Install timing chain covers (left and right) ⇒ page 79 .

– Install drive plate ⇒ page 58 .

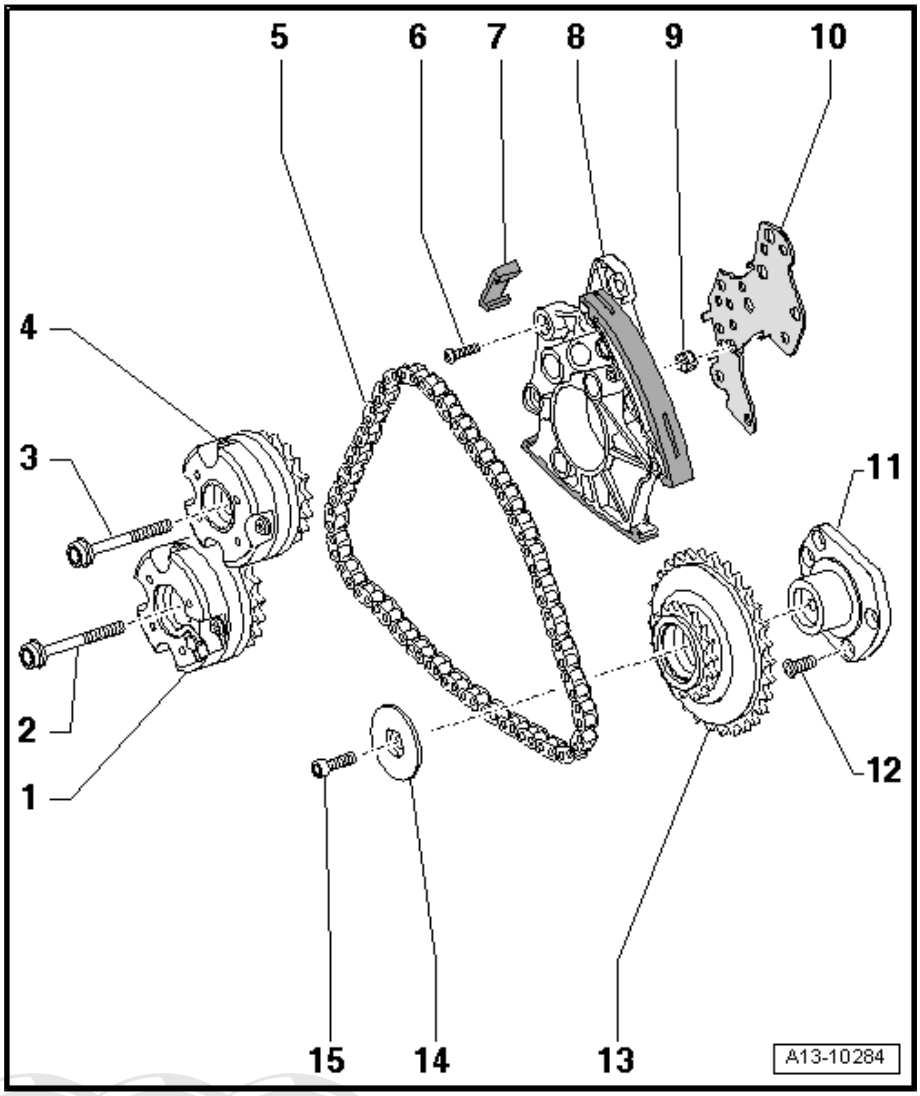
– Install automatic gearbox ⇒ Rep. gr. 37 .

– Fill up with engine oil and check oil level ⇒ page 176 .

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1.4 Camshaft timing chains - exploded view

Camshaft timing chain (left-side)



1 - Camshaft adjuster for exhaust camshaft

- ❑ Identification “Exhaust”
- ❑ Removing and installing ⇒ “1.6 Removing and installing camshaft timing chains”, page 96

2 - Bolt

- ❑ Renew
- ❑ 80 Nm + 90° (1/4 turn further)

3 - Bolt

- ❑ Renew
- ❑ 80 Nm + 90° (1/4 turn further)

4 - Camshaft adjuster for inlet camshaft

- ❑ Identification “Intake”
- ❑ Removing and installing ⇒ “1.6 Removing and installing camshaft timing chains”, page 96

5 - Camshaft timing chain (left-side)

- ❑ Before removing, mark running direction with paint
- ❑ Removing and installing ⇒ page 96

6 - Bolt

- ❑ Renew
- ❑ 5 Nm + 90° (1/4 turn further)

7 - Slide

8 - Chain tensioner for camshaft timing chain (left-side)

- ❑ Removing and installing ⇒ “1.6 Removing and installing camshaft timing chains”, page 96

9 - Oil strainer

- ❑ Inserted in chain tensioner
- ❑ Watch position of locking lug on outer circumference

10 - Gasket

- ❑ Renew
- ❑ Clipped onto chain tensioner

11 - Bearing bracket for drive sprocket

12 - Bolt

- ❑ Renew
- ❑ 5 Nm + 90° (1/4 turn further)

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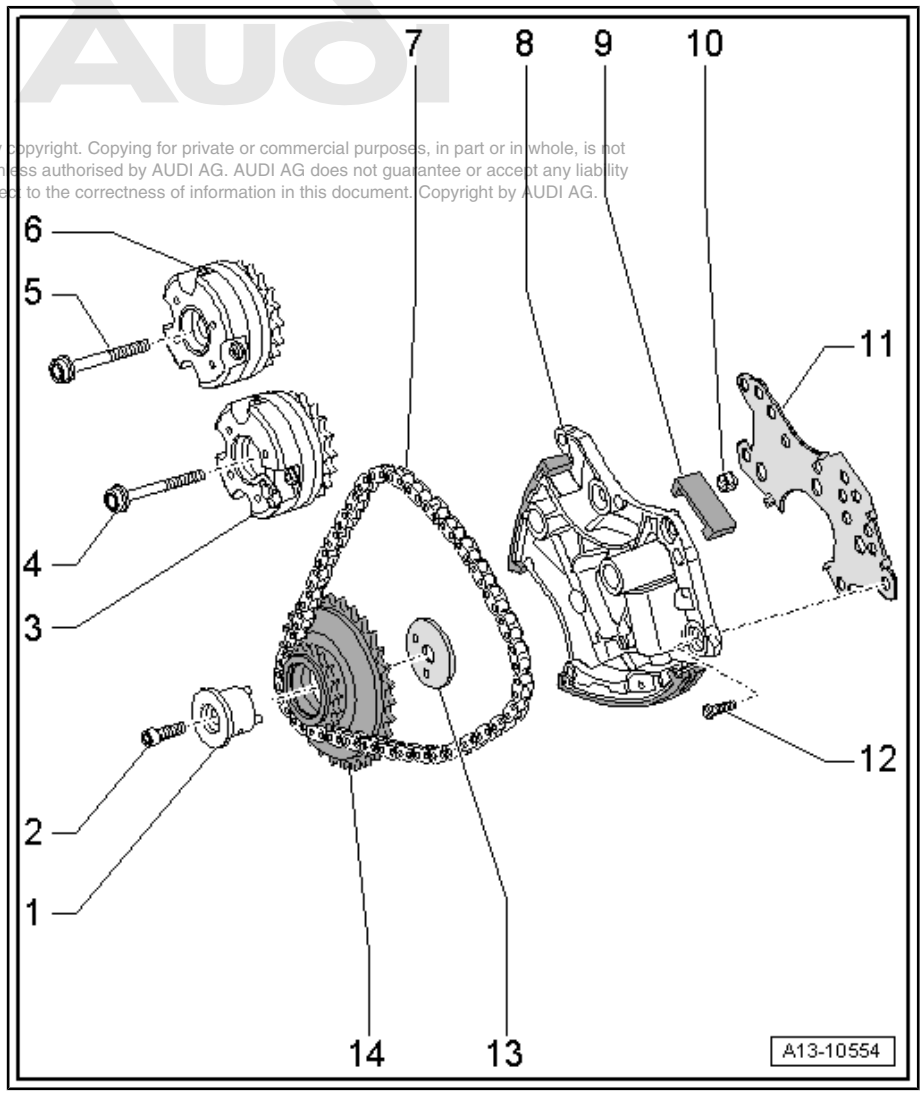
13 - Drive chain sprocket for camshaft timing chain (left-side)

14 - Thrust washer for drive sprocket

15 - Bolt

- ❑ 22 Nm

Camshaft timing chain (right-side)



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1 - Bearing mounting for drive sprocket

- ❑ For camshaft timing chain (right-side)
- ❑ Asymmetric version
- ❑ Installation position ⇒ page 88

2 - Bolt

- ❑ 42 Nm

3 - Camshaft adjuster for exhaust camshaft

- ❑ Identification “Exhaust”
- ❑ Removing and installing ⇒ “1.6 Removing and installing camshaft timing chains”, page 96

4 - Bolt

- ❑ Renew
- ❑ 80 Nm + 90° (1/4 turn further)

5 - Bolt

- ❑ Renew
- ❑ 80 Nm + 90° (1/4 turn further)

6 - Camshaft adjuster for inlet camshaft

- ❑ Identification “Intake”
- ❑ Removing and installing ⇒ “1.6 Removing and installing camshaft timing chains”, page 96

7 - Camshaft timing chain (right-side)

- ❑ Before removing, mark running direction with paint
- ❑ Removing and installing ⇒ page 96

8 - Chain tensioner for camshaft timing chain (right-side)

- ❑ Removing and installing ⇒ “1.6 Removing and installing camshaft timing chains”, page 96

9 - Slide

10 - Oil strainer

- ❑ Inserted in chain tensioner
- ❑ Installation position: note locating lug on outer circumference

11 - Gasket

- ❑ Renew

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- ❑ Clipped onto chain tensioner

12 - Bolt

- ❑ Renew
- ❑ 5 Nm + 90° ($^1/_4$ turn further)

13 - Thrust washer for drive sprocket

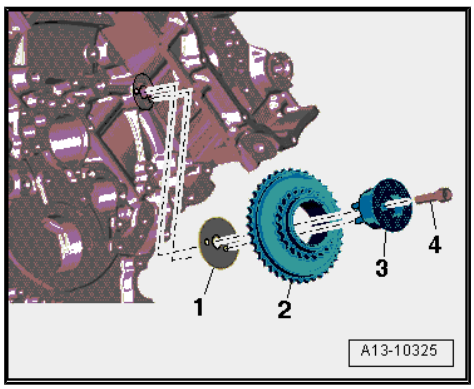
14 - Drive chain sprocket for camshaft timing chain (right-side)

Installation position of bearing mounting for drive chain sprocket for camshaft timing chain (right-side)

- Dowel pins in bearing mounting -3- for drive chain sprocket for camshaft timing chain (right-side) must engage in drillings in thrust washer -1- and in cylinder block drillings.

2 - Drive chain sprocket for camshaft timing chain (right-side)

4 - Bolt



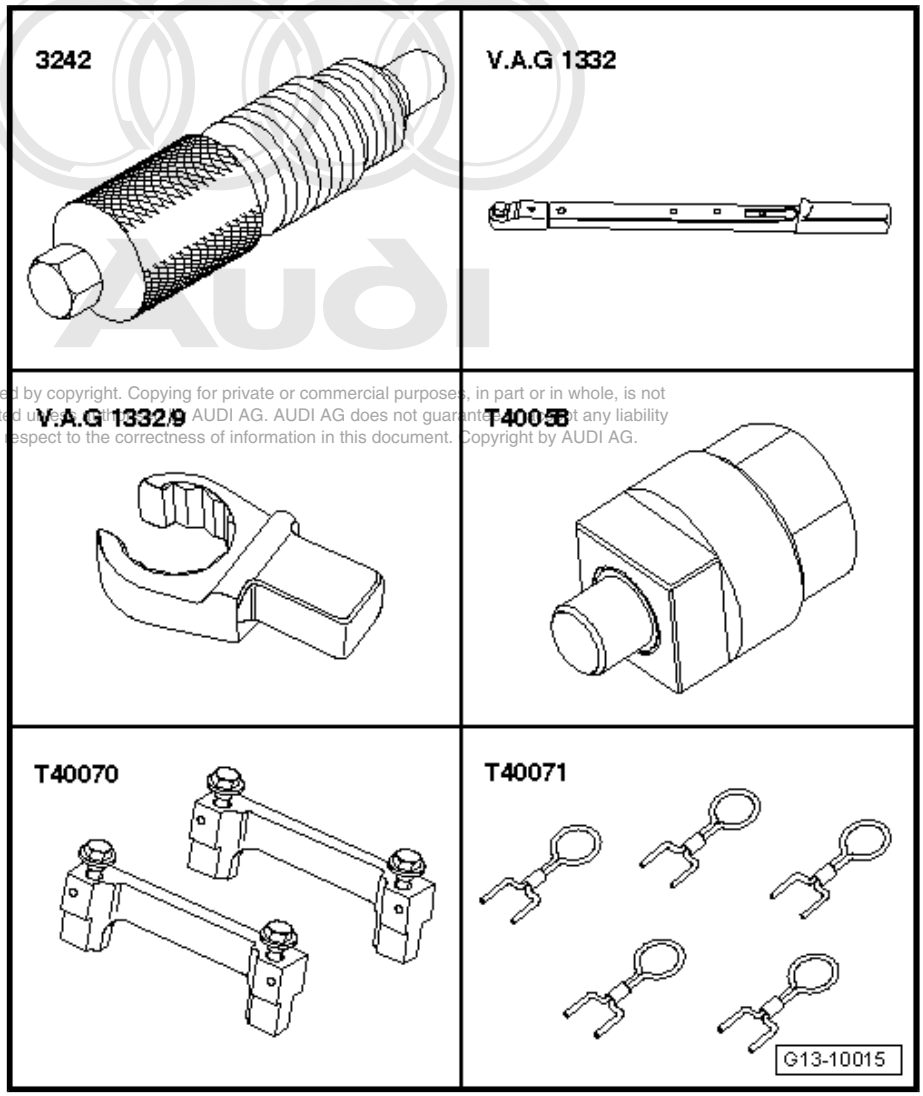
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1.5 Removing camshaft timing chains from camshafts

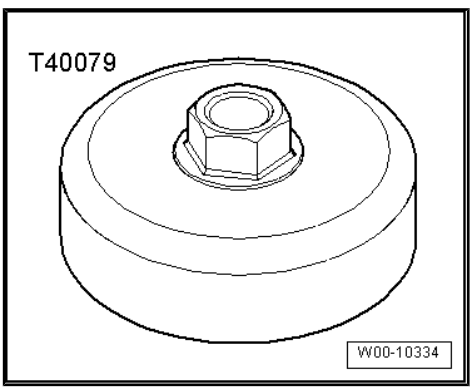
Special tools and workshop equipment required

- Locking pin -3242- , or alternatively locking pin - T40237-
- Torque wrench -V.A.G 1332-
- Open ring spanner insert - V.A.G 1332/9-
- Adapter -T40058-
- 2x Camshaft clamp - T40070-
- 2x Locking pin -T40071-



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- Key -T40079-



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Removing

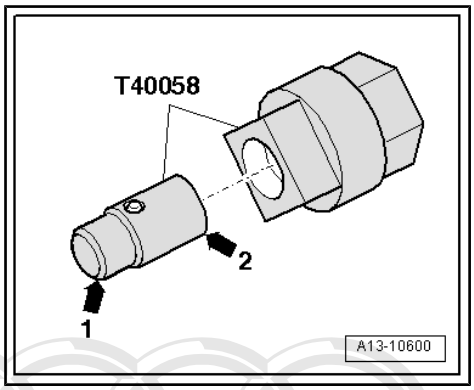
Note

- *In the following procedure the camshaft timing chains remain on the engine.*
- *You must adhere to the described procedures even if you are only working on one of the cylinder heads, since the timing adjustment must be performed for both cylinder heads when work is completed.*

– Remove cylinder head covers: left-side ⇒ page 116 , right-side ⇒ page 117 .

– Remove timing chain covers (left and right) ⇒ page 78 .

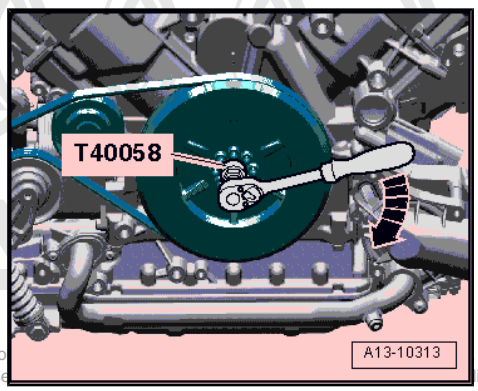
– Insert guide pin of adapter -T40058- as follows:



• The smaller-diameter section -arrow 1- faces the engine.

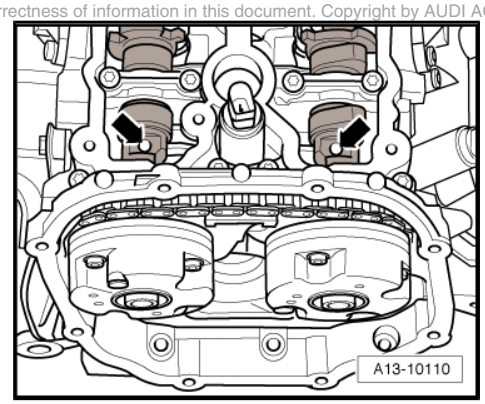
• The larger-diameter section -arrow 2- faces the adapter.

– Using adapter -T40058- turn the crankshaft in the normal direction of rotation -arrow- to “TDC”.



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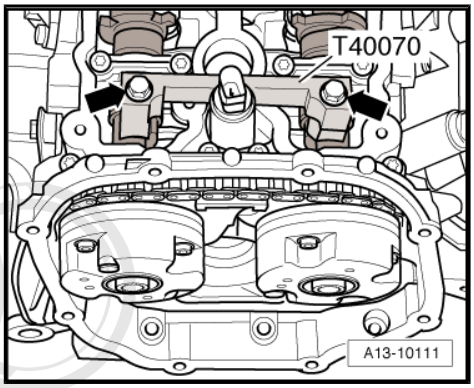
• The threaded holes -arrows- in the camshafts must face upwards.



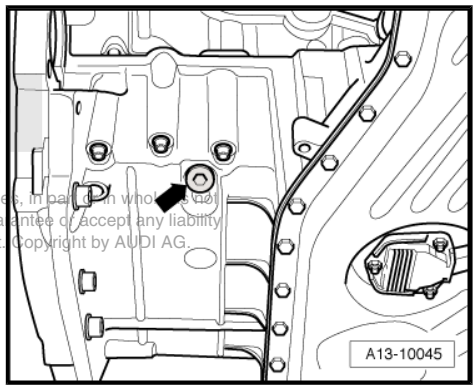
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– Fit camshaft clamps -T40070- to both cylinder heads and tighten bolts -arrows- to 25 Nm.

• The camshaft clamp -T40070- is positioned correctly if the holes for the cylinder head bolts remain free.

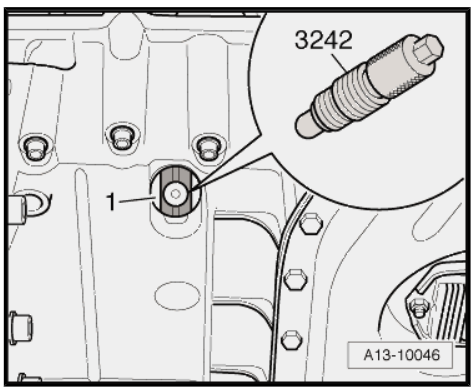


– Unscrew plug -arrow- from sump (top section).



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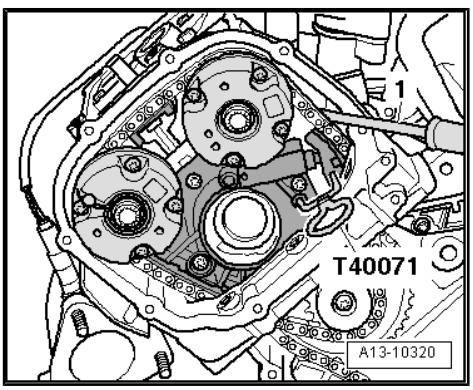
– Screw locking pin -3242- into bore (tightening torque: 20 Nm); if necessary, turn crankshaft backwards and forwards slightly to fully centralise locking pin.



– Press guide rail of chain tensioner for camshaft timing chain (left-side) inwards as far as the stop using a screwdriver -1-. Then lock chain tensioner by inserting locking pin -T40071- .

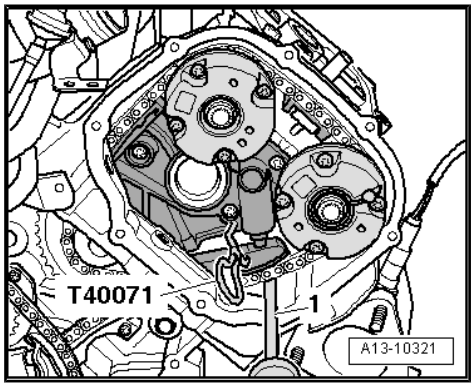
Note

The chain tensioner is oil-damped and can therefore only be compressed slowly by applying constant pressure.



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– Press guide rail of chain tensioner for camshaft timing chain (right-side) inwards as far as the stop using a screwdriver -1-. Then lock chain tensioner by inserting locking pin - T40071- .



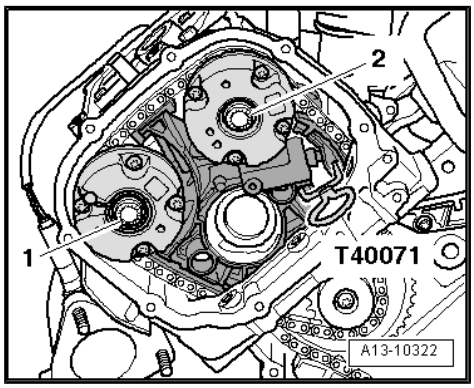
Note

The chain tensioner is oil-damped and can therefore only be compressed slowly by applying constant pressure.

Caution

Risk of irreparable damage to engine.

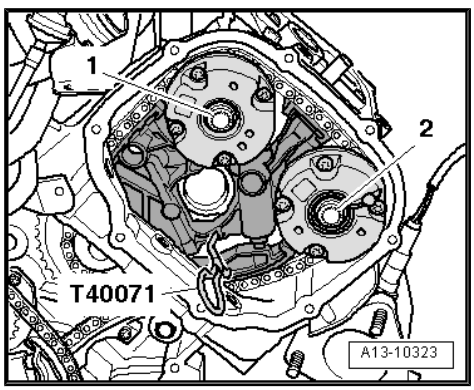
- ***Block off the opening in the valve timing housing with a clean cloth to prevent small items from dropping into the engine.***



– Unscrew bolts -1 and 2- at cylinder head (left-side) and remove both camshaft adjusters.

– Mark positions of camshaft adjusters with paint for re-installation.

– Unscrew bolts -1 and 2- at cylinder head (right-side) and remove both camshaft adjusters.



Installing

Tightening torques

- ⇒ “1.4 Camshaft timing chains - exploded view”, page 86 .
- ⇒ “2.1 Sump (top section) - exploded view”, page 161 .

Note

- *Renew the bolts tightened with specified tightening angle.*
- *Fit new O-ring for screw plug.*

Caution

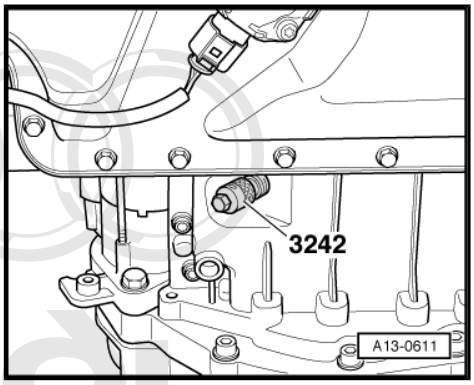
Avoid damage to valves and piston crowns.

- ***The crankshaft must not be at “TDC” at any cylinder when the camshafts are turned.***

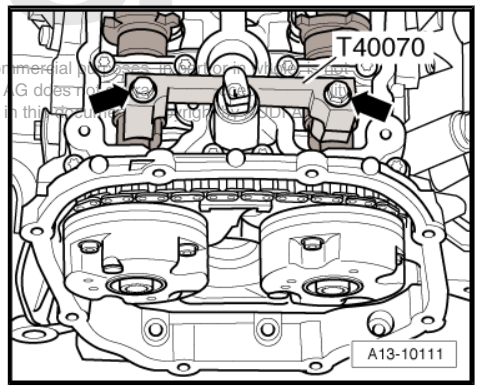
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- Drive chain for valve gear installed ⇒ page 101
- Crankshaft locked in “TDC” position with locking pin -3242- .

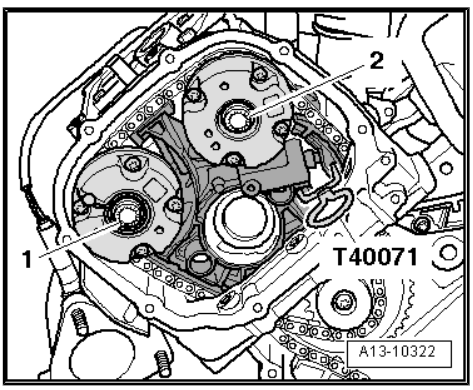


- Camshaft clamps -T40070- installed on both cylinder heads and tightened to 25 Nm -arrows-.

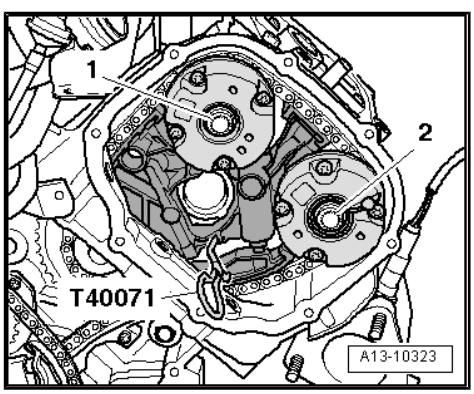


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– Re-install camshaft adjusters on cylinder head (left-side) in the same position as before (pay attention to marks applied when removing).
– Position camshaft timing chain on drive chain sprocket and camshaft adjusters and loosely screw in bolts -1 and 2-.
- It should just be possible to turn both camshaft adjusters on the camshaft without axial movement.
– Remove locking pin -T40071- .



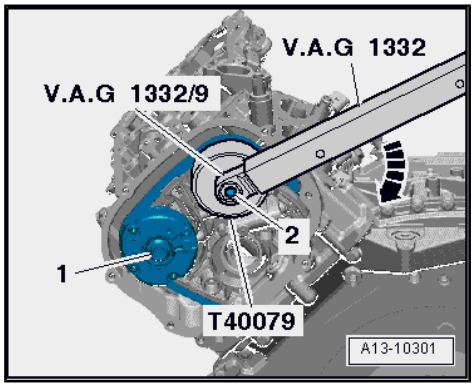
– Re-install camshaft adjusters on cylinder head (right-side) in the same position as before (pay attention to marks applied when removing).
– Position camshaft timing chain on drive chain sprocket and camshaft adjusters and loosely screw in bolts -1 and 2-.
- It should just be possible to turn both camshaft adjusters on the camshaft without axial movement.
– Remove locking pin -T40071- .



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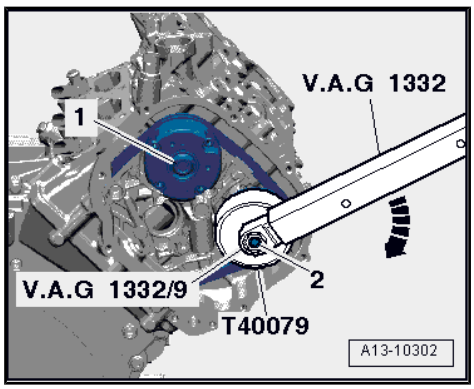
– Fit key -T40079- onto camshaft adjuster of inlet camshaft on cylinder head (left-side).
– Apply torque wrench -V.A.G 1332- with tool insert -V.A.G 1332/9- to key -T40079- .
– Have a 2nd mechanic apply a torque of 40 Nm to camshaft adjuster in direction of -arrow-.
– Tighten bolts as follows while keeping camshaft adjuster under tension:

1. Pre-tighten bolt -1- on exhaust camshaft to 60 Nm.
2. Pre-tighten bolt -2- on inlet camshaft to 60 Nm.

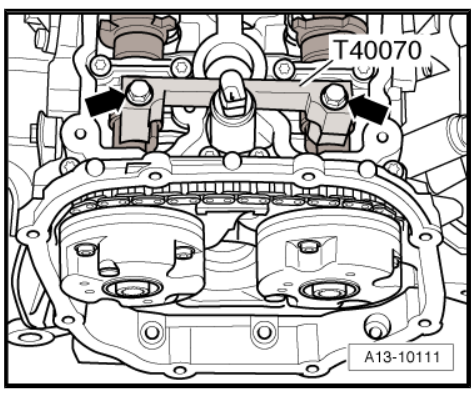


– Fit key -T40079- onto camshaft adjuster of exhaust camshaft on cylinder head (right-side).
– Apply torque wrench -V.A.G 1332- with tool insert -V.A.G 1332/9- to key -T40079- .
– Have a 2nd mechanic apply a torque of 40 Nm to camshaft adjuster in direction of -arrow-.
– Tighten bolts as follows while keeping camshaft adjuster under tension:

1. Pre-tighten bolt -1- on inlet camshaft to 60 Nm.
2. Pre-tighten bolt -2- on exhaust camshaft to 60 Nm.

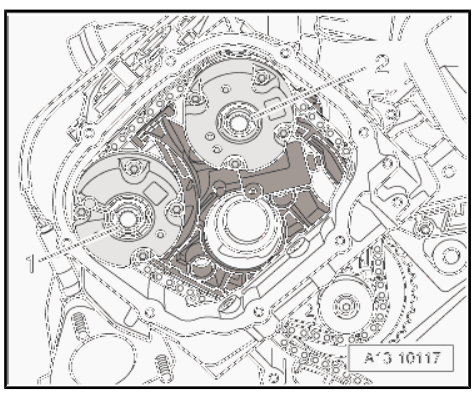


– Detach key -T40079- .
– Remove camshaft clamp -T40070- from both cylinder heads -arrows-.



– Tighten camshaft adjuster bolts on cylinder head (left-side) as follows:

1. Tighten bolt -1- on exhaust camshaft to final tightening torque.
2. Tighten bolt -2- on inlet camshaft to final tightening torque.

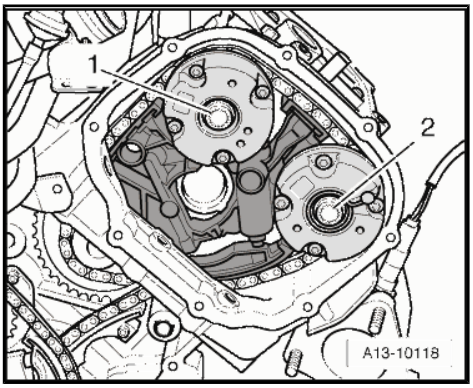


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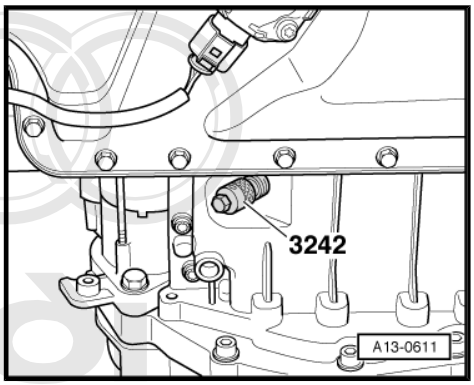
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– Tighten camshaft adjuster bolts on cylinder head (right-side) as follows:

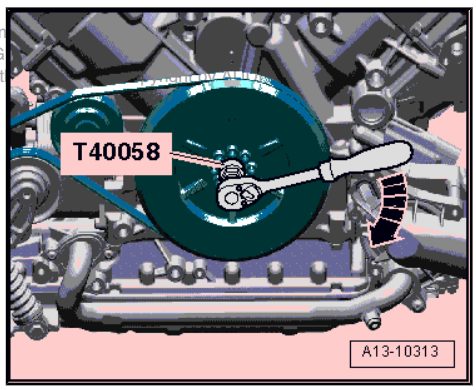
1. Tighten bolt -1- on inlet camshaft to final tightening torque.
2. Tighten bolt -2- on exhaust camshaft to final tightening torque.



– Remove locking pin -3242- .



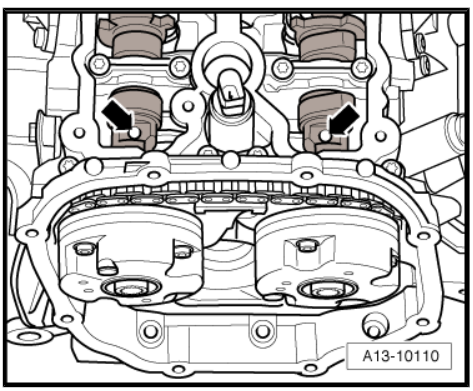
– Using adapter -T40058- , turn crankshaft two rotations in normal direction of rotation -arrow- until crankshaft is at “TDC” again.



Note

If you turned the crankshaft beyond “TDC”, turn it back approx. 30° and set to “TDC” again.

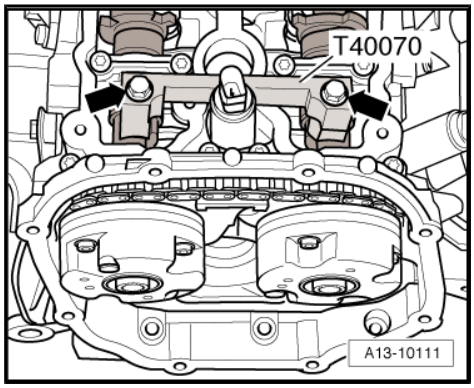
• The threaded holes -arrows- in the camshafts must face upwards.



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– Fit camshaft clamps -T40070- to both cylinder heads and tighten bolts -arrows- to 25 Nm.

• The camshaft clamp -T40070- is positioned correctly if the holes for the cylinder head bolts remain free.

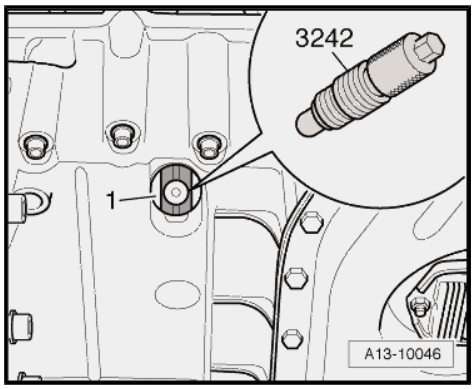


– Screw the locking pin -3242- into the hole (20 Nm).

• The locking pin -3242- must engage in the locating hole in crankshaft -1-. If it does not, reset valve timing.

– Remove camshaft clamps from both cylinder heads.

– Remove locking pin -3242- .

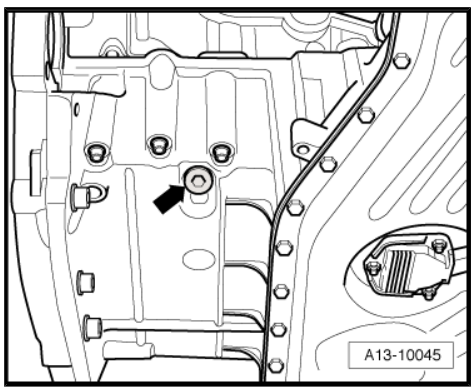


– Secure screw plug for “TDC” marking.

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

– Install timing chain covers (left and right) ⇒ page 79 .

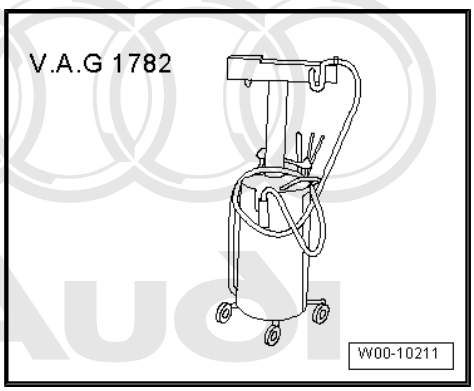
– Install cylinder head covers: left-side ⇒ page 116 , right-side ⇒ page 117 .



1.6 Removing and installing camshaft timing chains

Special tools and workshop equipment required

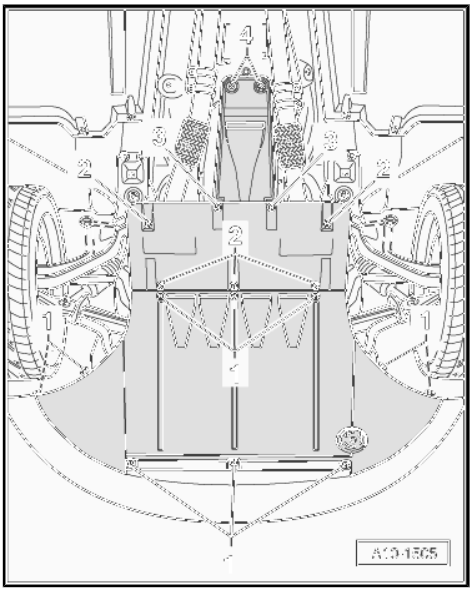
♦ Used oil collection and extraction unit -V.A.G 1782-



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Removing



Note

You must adhere to the described procedures even if you are only working on one of the cylinder heads, since the timing adjustment must be performed for both cylinder heads when work is completed.

– Release fasteners -1 and 2- and remove rear noise insulation panels.

Note

Disregard -items 3 and 4-.

– Place used oil collection and extraction unit -V.A.G 1782- under engine and drain engine oil.

– Remove automatic gearbox ⇒ Rep. gr. 37 .

– Remove drive plate ⇒ page 58 .

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– Remove cylinder head cover: left-side ⇒ page 116 , right-side ⇒ page 117 .

– Remove timing chain covers (left and right) ⇒ page 78 .

– Remove intake manifold ⇒ Rep. gr. 24 .

– Remove oil filter housing ⇒ page 172 .

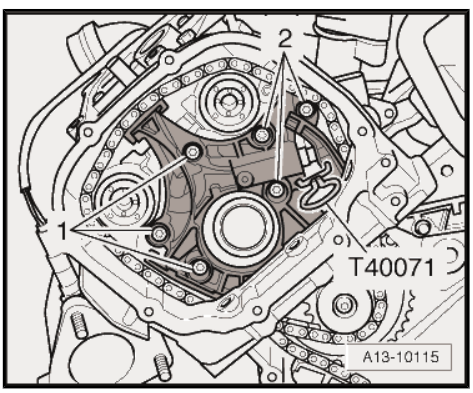
– Remove timing chain cover (bottom) ⇒ page 81 .

– Detach timing chains from camshafts ⇒ page 89 .

Caution

If a used timing chain rotates in the opposite direction when it is refitted, this can cause breakage.

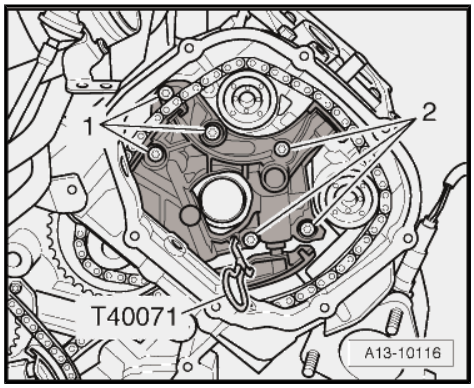
- ***Mark running direction of timing chain with coloured arrows for re-installation. Do not mark timing chain by means of centre punch, notch or the like.***



– Unscrew bolts -1 and 2- and remove chain tensioner (left-side) and camshaft timing chain (left-side).

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– Unscrew bolts -1 and 2- and remove chain tensioner (right-side) and camshaft timing chain (right-side).



Installing

- Tightening torque
  ⇒ “1.4 Camshaft timing chains - exploded view”, page 86

Note

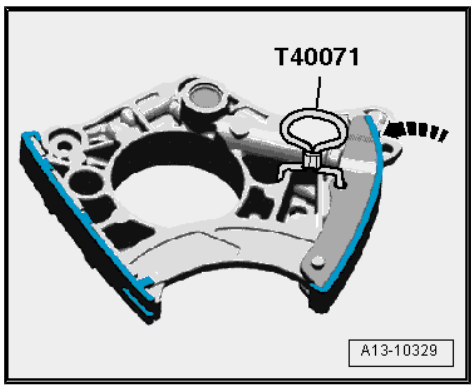
- *Note the correct installation position if the tensioning element has been removed from the chain tensioner: drilling in base of housing faces chain tensioner and piston faces tensioner rail.*
- *Renew the bolts tightened with specified tightening angle.*
- *Renew gasket.*

Caution

Avoid damage to valves and piston crowns.

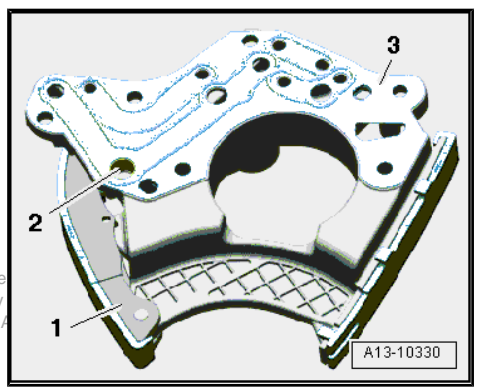
- ***The crankshaft must not be at “TDC” at any cylinder when the camshafts are turned.***

– Press guide rails of chain tensioners for camshaft timing chains (left and right) inwards in direction of -arrow- as far as the stop. Then lock chain tensioners by inserting locking pin -T40071- .



– If necessary, clean oil strainer -2- in both chain tensioners.

– Fit new gasket -3- to rear of chain tensioner -1-.

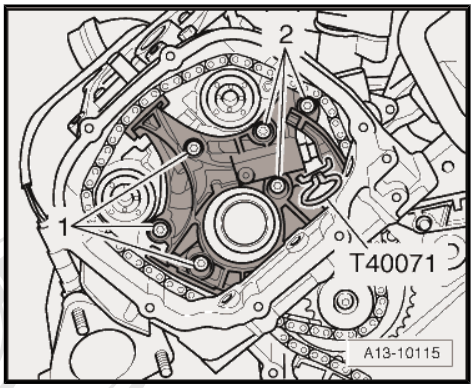


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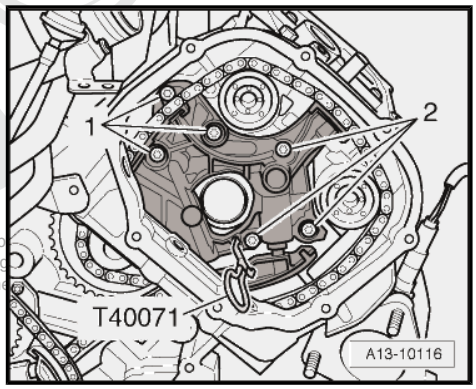
– Install chain tensioner on cylinder head (left-side) and position camshaft timing chain as shown in the illustration (according to marks applied when removing).

– Tighten bolts -1 and 2-.



– Install chain tensioner on cylinder head (right-side) and position camshaft timing chain as shown in the illustration (according to marks applied when removing).

– Tighten bolts -1 and 2-.



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

– Position timing chains on camshafts ⇒ page 92 .

– Install timing chain cover (bottom) ⇒ page 81 .

– Install crankshaft oil seal (gearbox end) ⇒ page 59 .

– Install oil filter housing ⇒ page 172 .

– Install intake manifold ⇒ Rep. gr. 24 .

– Install timing chain covers (left and right) ⇒ page 79 .

– Install cylinder head cover: left-side ⇒ page 116 , right-side ⇒ page 117 .

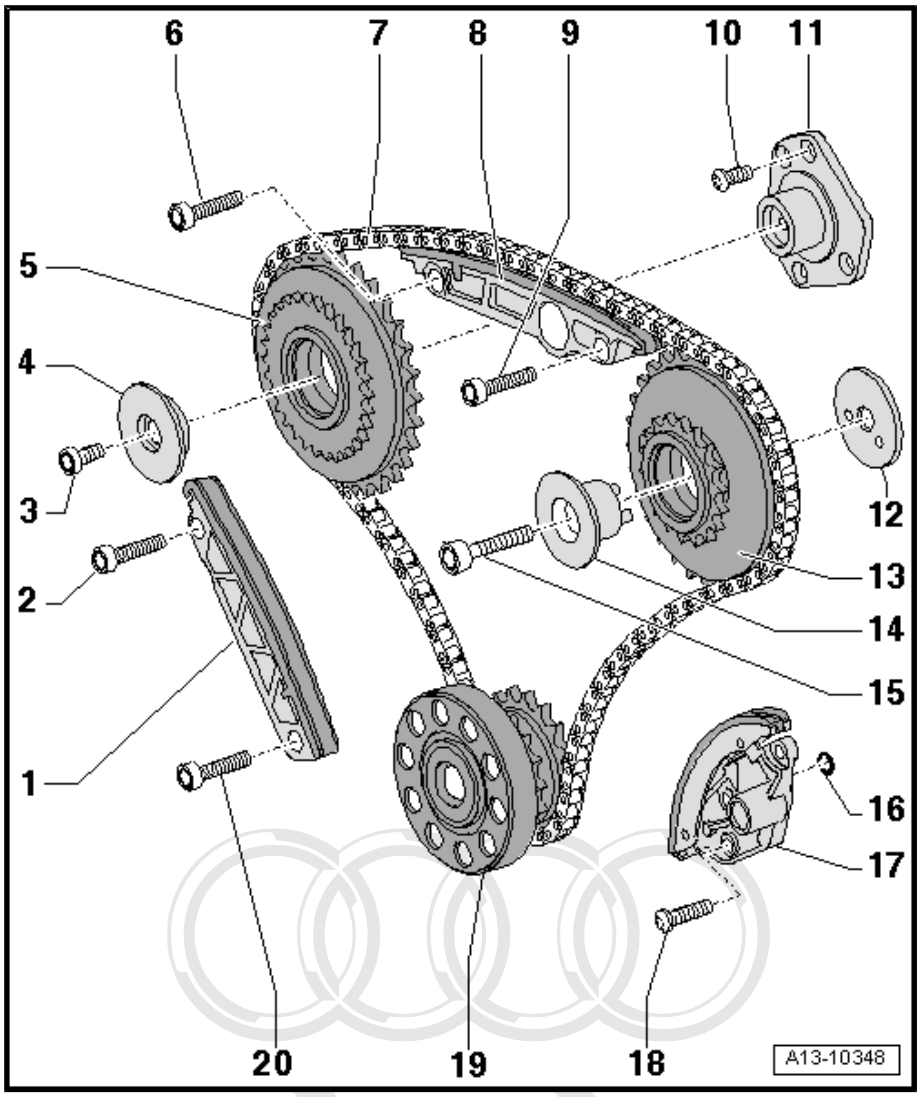
– Install drive plate ⇒ page 58 .

– Install automatic gearbox ⇒ Rep. gr. 37 .

– Fill up with engine oil and check oil level ⇒ page 176 .

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1.7 Drive chain for valve gear - exploded view



1 - Guide rail

2 - Bolt

- ❑ Renew
- ❑ 17 Nm + 90° (1/4 turn further)

3 - Bolt

- ❑ Tightening torque ⇒ Item 15 (page 87)

4 - Thrust washer for drive sprocket

5 - Drive sprocket for timing chain (left-side)

6 - Bolt

- ❑ Renew
- ❑ 17 Nm + 90° (1/4 turn further)

7 - Drive chain for valve gear

- ❑ Before removing, mark running direction with paint
- ❑ Removing and installing ⇒ page 101

8 - Guide rail

9 - Bolt

- ❑ Renew
- ❑ 17 Nm + 90° (1/4 turn further)

10 - Bolt

- ❑ Tightening torque ⇒ Item 12 (page 86)

11 - Bearing bracket for drive sprocket

- ❑ For camshaft timing chain (right-side)
- ❑ Asymmetric version
- ❑ Installation position ⇒ page 101

12 - Thrust washer

13 - Drive sprocket for timing chain (right-side)

14 - Bearing mounting for drive sprocket

15 - Bolt

- ❑ Tightening torque ⇒ page 86

16 - O-ring

- ❑ Renew

17 - Chain tensioner

18 - Bolt

- ❑ Renew
- ❑ 5 Nm + 90° (1/4 turn further)

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19 - Crankshaft

20 - Bolt

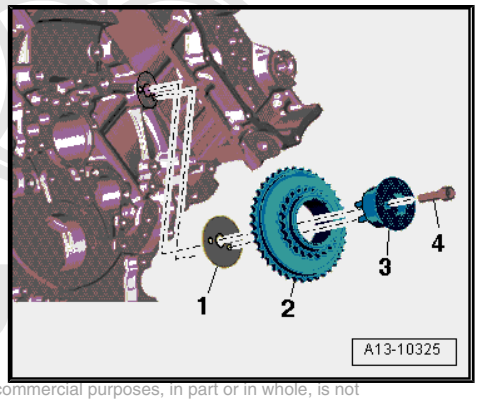
- ❑ Renew
- ❑ 17 Nm + 90° (1/4 turn further)

Installation position of bearing mounting for drive chain sprocket for camshaft timing chain (right-side)

- Dowel pins in bearing mounting -3- for drive chain sprocket for camshaft timing chain (right-side) must engage in drillings in thrust washer -1- and in cylinder block drillings.

2 - Drive chain sprocket for camshaft timing chain (right-side)

4 - Bolt

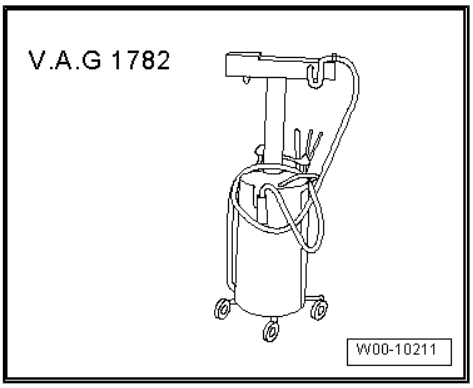


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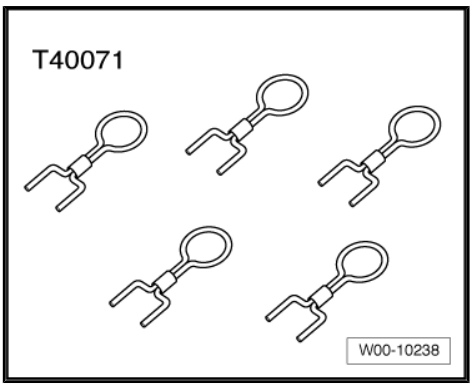
1.8 Removing and installing drive chain for valve gear

Special tools and workshop equipment required

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



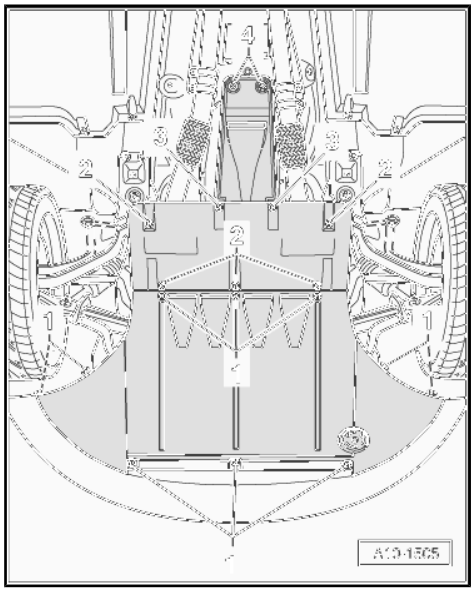
- ♦ Locking pin -T40071-



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Removing

– Release fasteners -1 and 2- and remove rear noise insulation panels.



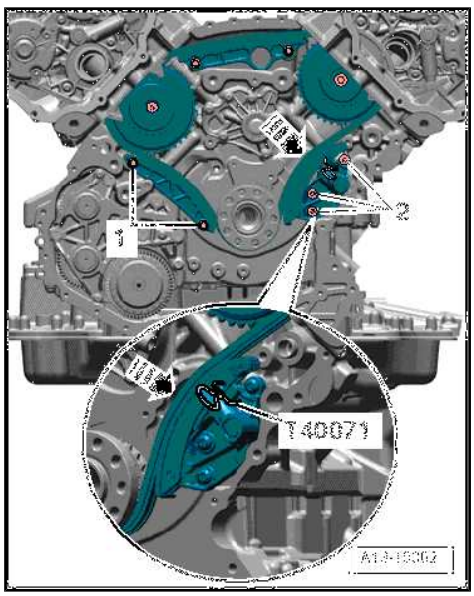
Note

Disregard -items 3 and 4-.

– Place used oil collection and extraction unit -V.A.G 1782- under engine and drain engine oil.
– Remove automatic gearbox ⇒ Rep. gr. 37 .
– Remove drive plate ⇒ page 58 .
– Remove cylinder head covers: left-side ⇒ page 116 , right-side ⇒ page 117 .
– Remove timing chain covers (left and right) ⇒ page 78 .
– Remove intake manifold ⇒ Rep. gr. 24 .
– Remove oil filter housing ⇒ page 172 .
– Remove timing chain cover (bottom) ⇒ page 81 .
– Remove camshaft timing chains ⇒ page 96 .
– Remove drive chain for auxiliary drives ⇒ page 104 .

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– Press guide rail of chain tensioner for drive chain in direction of -arrow- and lock chain tensioner by inserting locking pin -T40071- .



Caution

If a used drive chain rotates in the opposite direction when it is refitted, this can cause breakage.

- ***Mark running direction of drive chain with paint for re-installation. Do not mark drive chain by means of centre punch, notch or the like.***

– Unscrew bolts -1- and remove guide rail.
– Unscrew bolts -2- and remove chain tensioner.
– Detach drive chain for valve gear.

Installing

- Tightening torques
  ⇒ “1.7 Drive chain for valve gear - exploded view”, page 100

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

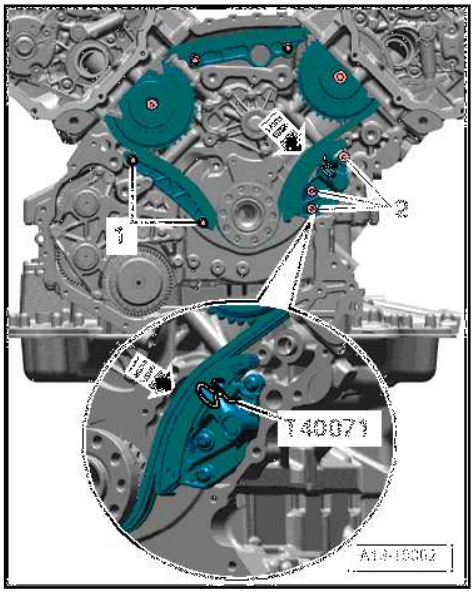
Note

Renew the bolts tightened with specified tightening angle.

– Position drive chain for valve gear onto drive chain sprockets (according to marks applied when removing).

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– Install guide rail and tighten bolts -1-.
– Install chain tensioner and tighten bolts -2-.
– Push guide rail of chain tensioner for drive chain in direction of -arrow- and pull locking pin -T40071- out of chain tensioner.
– Install drive chain for auxiliary drives ⇒ page 104 .
– Install camshaft timing chains ⇒ page 98 .
– Install timing chain cover (bottom) ⇒ page 81 .
– Install crankshaft oil seal (gearbox end) ⇒ page 59 .
– Install oil filter housing ⇒ page 172 .
– Install intake manifold ⇒ Rep. gr. 24 .
– Install timing chain covers (left and right) ⇒ page 79 .
– Install cylinder head covers: left-side ⇒ page 116 , right-side ⇒ page 117 .
– Install drive plate ⇒ page 58 .
– Install automatic gearbox ⇒ Rep. gr. 37 .
– Fill up with engine oil and check oil level ⇒ page 176 .



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1.9 Drive chain for auxiliary drives - exploded view

1 - Bolt
- ❑ Renew
- ❑ 5 Nm + 90° (1/4 turn further)

2 - Chain tensioner
- ❑ With guide rail

3 - Gasket
- ❑ Renew

4 - Compression spring

5 - Bolt
- ❑ 42 Nm

6 - Bearing mounting for idler sprocket

7 - Idler sprocket for chain of auxiliary drives

8 - Bearing bracket for idler sprocket

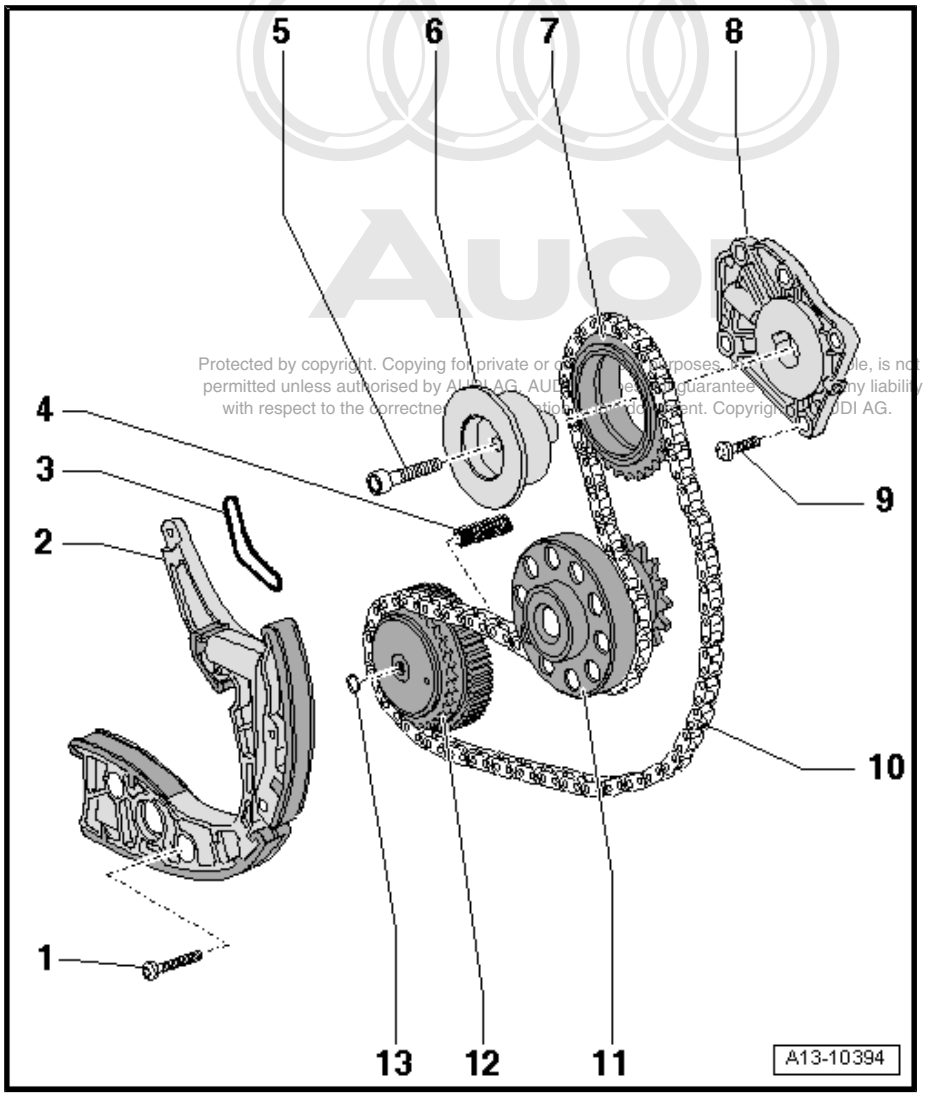
9 - Bolt
- ❑ Renew
- ❑ 5 Nm + 90° (1/4 turn further)

10 - Drive chain for auxiliary drives
- ❑ Before removing, mark running direction with paint
- ❑ Removing and installing ⇒ page 104

11 - Crankshaft

12 - Drive chain sprocket for auxiliary drives

13 - Circlip

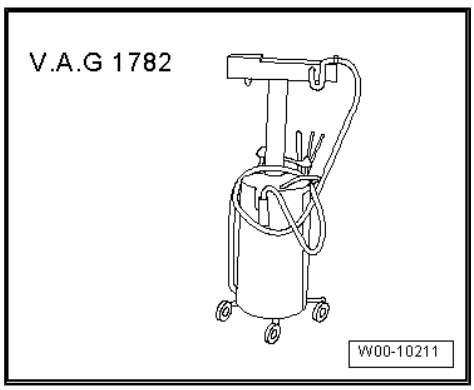


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1.10 Removing and installing drive chain for auxiliary drives

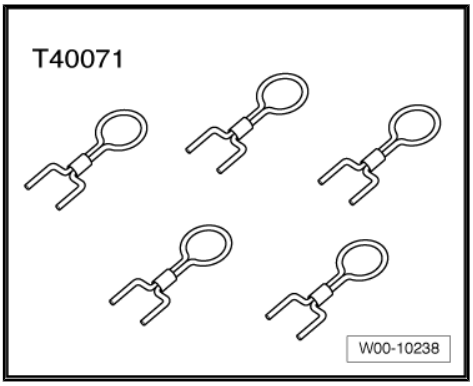
Special tools and workshop equipment required

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



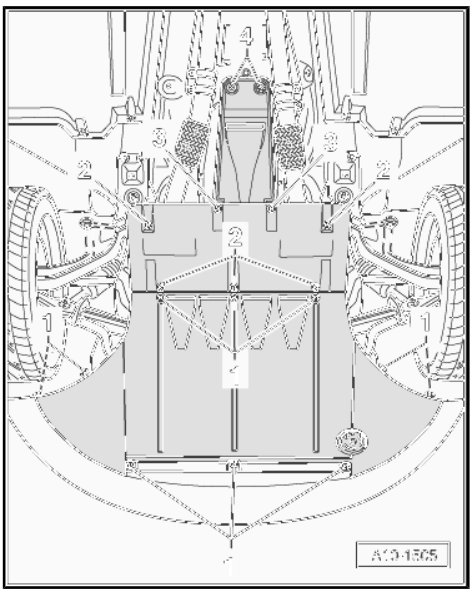
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♦ Locking pin -T40071-



Removing

– Release fasteners -1 and 2- and remove rear noise insulation panels.



Note

Disregard -items 3 and 4-.

– Place used oil collection and extraction unit -V.A.G 1782- under engine and drain engine oil.
– Remove automatic gearbox ⇒ Rep. gr. 37 .
– Remove drive plate ⇒ page 58 .
– Remove timing chain covers (left and right) ⇒ page 78 .
– Remove intake manifold ⇒ Rep. gr. 24 .
– Remove oil filter housing ⇒ page 172 .

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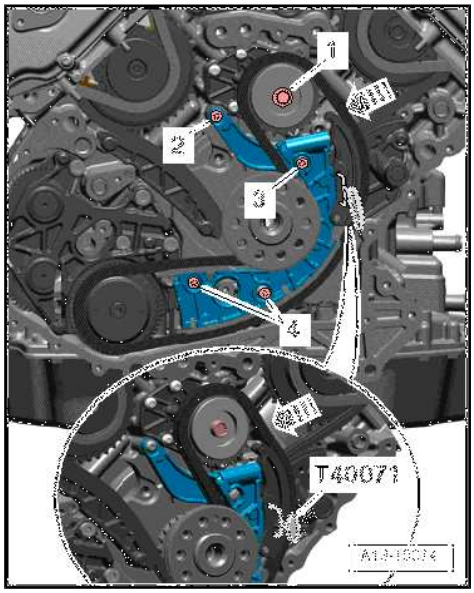
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– Remove timing chain cover (bottom) ⇒ page 81 .

Caution

If a used drive chain rotates in the opposite direction when it is refitted, this can cause breakage.

- *Mark running direction of drive chain with paint for re-installation. Do not mark drive chain by means of centre punch, notch or the like.*



– Press tensioning rail in direction of -arrow- and lock chain tensioner by inserting locking pin -T40071- .

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– Unscrew bolt -1- and remove idler sprocket.

– Unscrew bolts -2 … 4- and remove chain tensioner.

– Remove drive chain for auxiliary drives.

Installing

- Tightening torques ⇒ “1.9 Drive chain for auxiliary drives - exploded view”, page 104

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

Note

- *Renew gasket.*
- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*

– Install timing chain cover (bottom) ⇒ page 81 .

– Install crankshaft oil seal (gearbox end) ⇒ page 59 .

– Install oil filter housing ⇒ page 172 .

– Install intake manifold ⇒ Rep. gr. 24 .

– Install timing chain covers (left and right) ⇒ page 78 .

– Install drive plate ⇒ page 58 .

– Install automatic gearbox ⇒ Rep. gr. 37 .

– Fill up with engine oil and check oil level ⇒ page 176 .

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1.11 Auxiliary drives - exploded view

1 - Circlip

2 - Spur gear drive

- ❑ Do not dismantle
- ❑ Removing and installing ⇒ page 109
- ❑ With flat-section O-ring in power steering pump drive
- ❑ Installation position of flat-section O-ring ⇒ page 107

3 - Bolt

- ❑ 22 Nm

4 - Oil seal for air conditioner compressor drive

- ❑ Renewing ⇒ page 107

5 - Dust cap for air conditioner compressor drive

6 - Clip

7 - Drive shaft for air conditioner compressor

- ❑ 60 Nm

8 - O-ring

- ❑ Renew

9 - Power steering pump

10 - O-ring

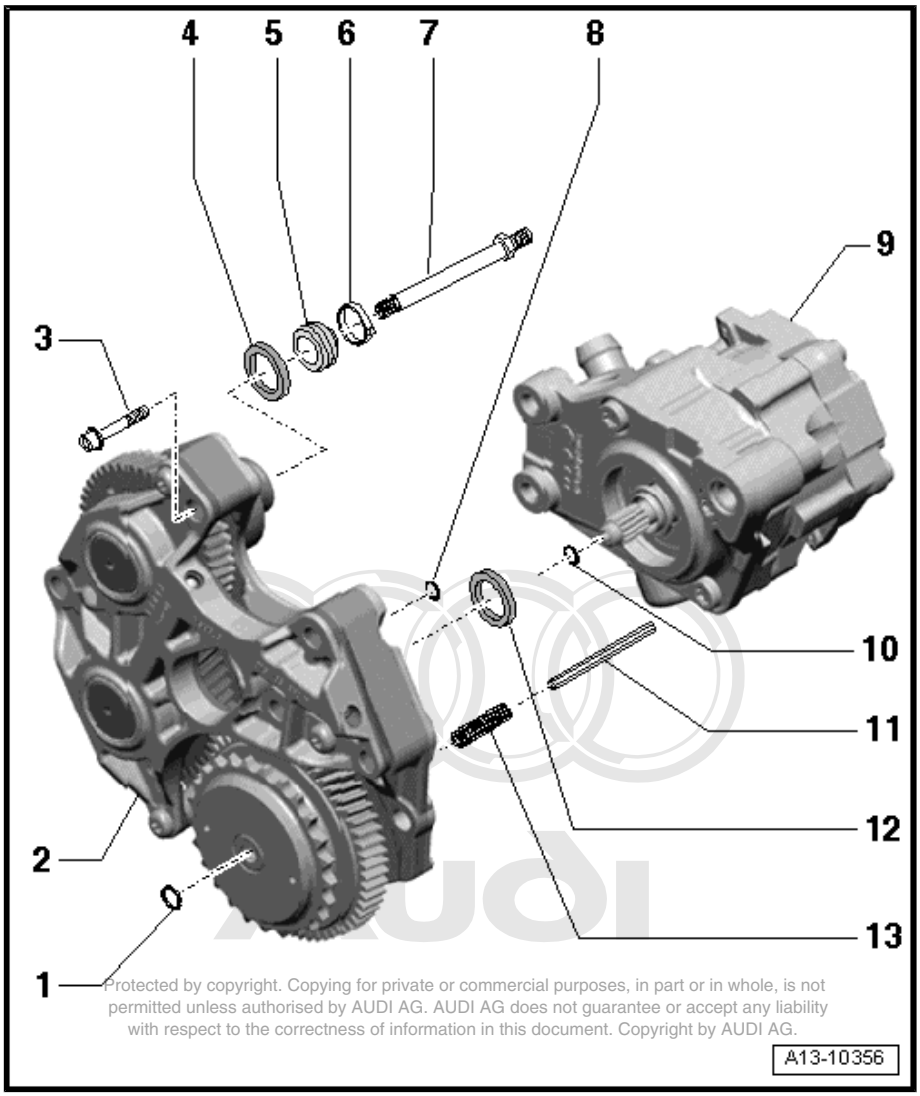
- ❑ Renew

11 - Oil pump drive shaft

12 - Oil seal for power steering pump drive

- ❑ Renewing ⇒ page 107

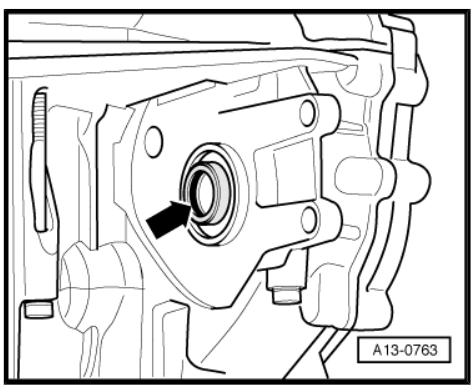
13 - Compression spring



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Installation position of flat-section O-ring

♦ In power steering pump drive -arrow-.

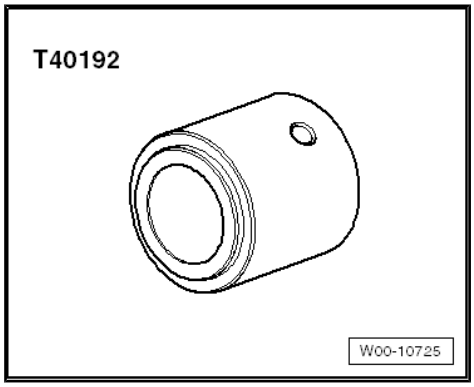


1.12 Renewing oil seals for auxiliary drives

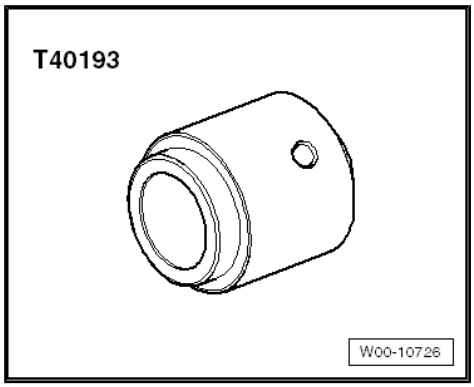
Special tools and workshop equipment required

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- Thrust piece -T40192-

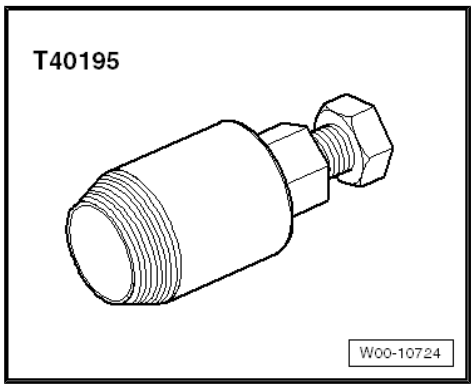


- Thrust piece -T40193-



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- Oil seal extractor -T40195-



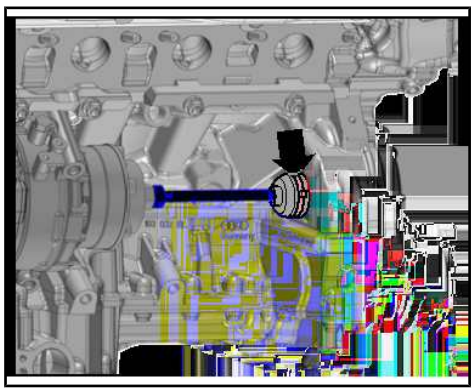
Procedure

– Remove air conditioner compressor ⇒ Rep. gr. 87 .

– Remove power steering pump ⇒ Rep. gr. 48 .

– Remove hose clip on dust cap -arrow-.

– Pull off dust cap together with drive shaft for AC compressor from shaft journal of spur gear for AC compressor drive.

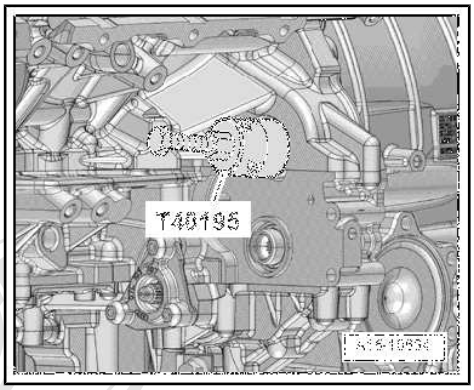


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– Screw spindle of oil seal extractor -T40195- all the way out.

– Lubricate threaded head of oil seal extractor, place it in position and screw it as far as possible into oil seal for AC compressor drive and power steering pump drive (applying firm pressure).

– Turn inner part of oil seal extractor against spur gear drive until the oil seal is pulled out.



Note

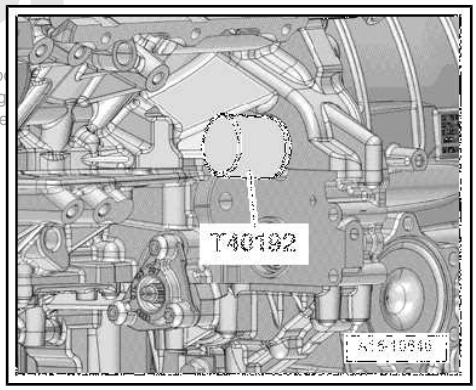
If the sections of the oil seal come apart, apply oil seal extractor again and pull out remaining part of oil seal.

– Clamp hexagon flats of oil seal extractor in vice and use pliers to remove oil seal.

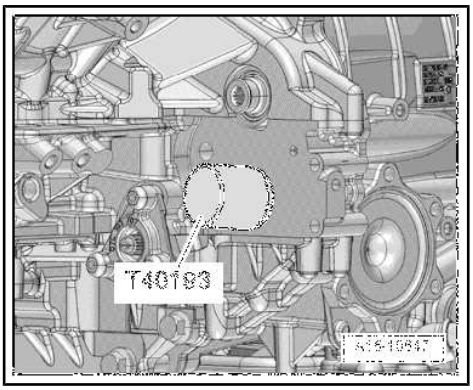
– Clean contact surface and sealing surface.

– Drive in oil seal for air conditioner compressor drive as far as stop using thrust piece -T40192- .

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– Drive in oil seal for power steering pump drive as far as stop using thrust piece -T40193- .

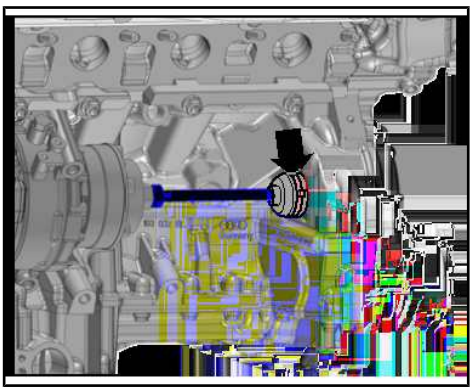


Remaining installation steps are carried out in reverse sequence; note the following:

– Install power steering pump ⇒ Rep. gr. 48 .

Note

Secure dust cap with the correct type of hose clip (same as original equipment) ⇒ Electronic parts catalogue .



– Press dust cap -arrow- with hose clip fitted onto shaft journal of spur gear for AC compressor drive.

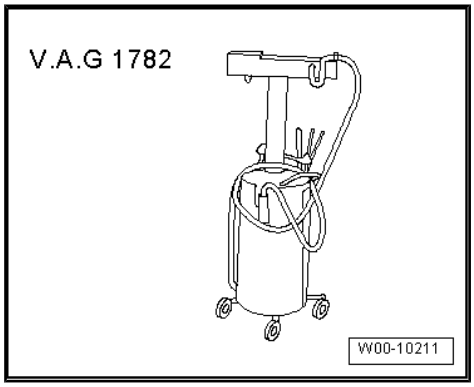
– Install air conditioner compressor ⇒ Rep. gr. 87 .

1.13 Removing and installing spur gear drive

Special tools and workshop equipment required

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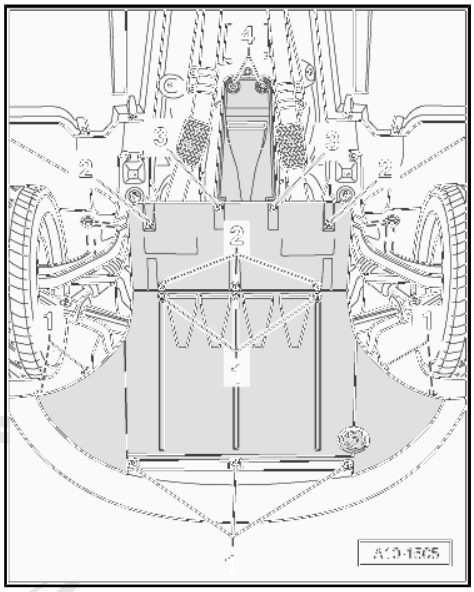
- Used oil collection and extraction unit -V.A.G 1782-



- Sealant ⇒ Electronic parts catalogue

Removing

– Release fasteners -1 and 2- and remove rear noise insulation panels.

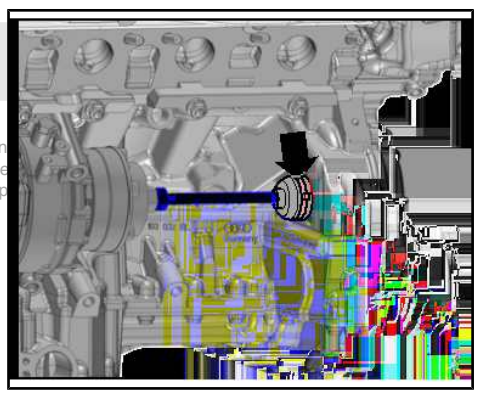


Note

Disregard -items 3 and 4-.

– Place used oil collection and extraction unit -V.A.G 1782- under engine and drain engine oil.
– Remove automatic gearbox ⇒ Rep. gr. 37 .
– Remove drive plate ⇒ page 58 .
– Remove timing chain covers (left and right) ⇒ page 78 .
– Remove intake manifold ⇒ Rep. gr. 24 .
– Remove oil filter housing ⇒ page 172 .
– Remove timing chain cover (bottom) ⇒ page 81 .
– Detach power steering pump from cylinder block.

– Remove hose clip on dust cap -arrow- for air conditioner compressor drive.
– Remove drive chain for auxiliary drives ⇒ page 104 .

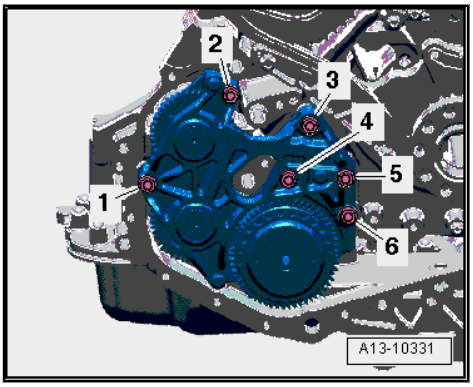


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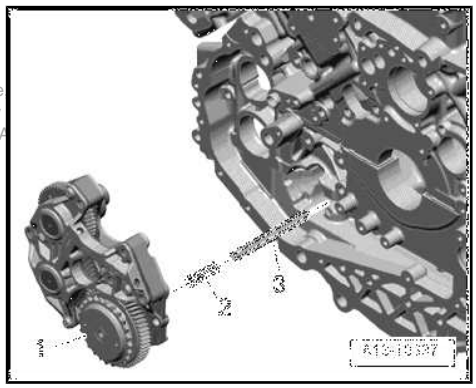
– Remove bolts -1 ... 6-.

– Remove spur gear drive.

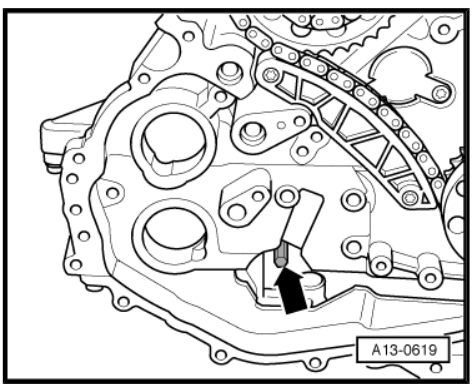


– Remove spring -2- between spur gear drive -1- and drive shaft -3- for oil pump.

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– Remove drive shaft -arrow- for oil pump.



Installing

- Tightening torque ⇒ page 107

Note

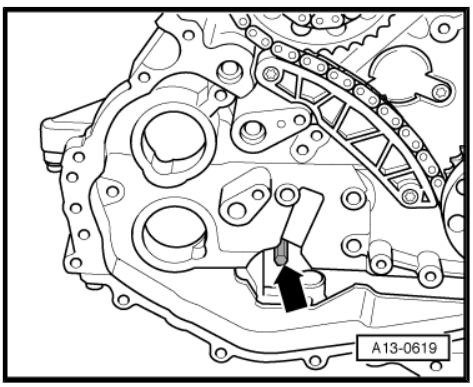
Fit new O-ring.

– Renew oil seals ⇒ Item 12 (page 107) , ⇒ Item 4 (page 107) and flat-section O-ring ⇒ page 107 in power steering pump drive if damaged.

– Remove sealant residue from spur gear drive and cylinder block.

– Clean sealing surfaces; they must be free of oil and grease.

– Insert drive shaft -arrow- for oil pump into guide sleeve at oil pump.

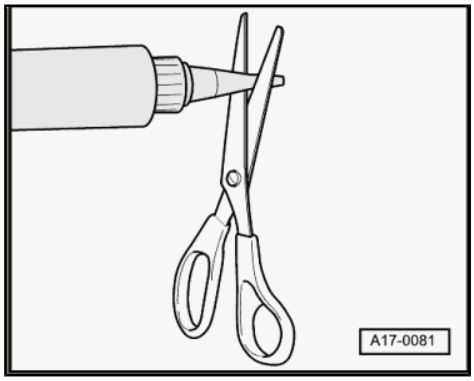


Note

To ensure that drive shaft engages correctly in oil pump, insert drive shaft separately into oil pump (NOT together with spur gear drive).

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– Cut off tube nozzle at front marking (diameter of nozzle approx. 1.5 mm).

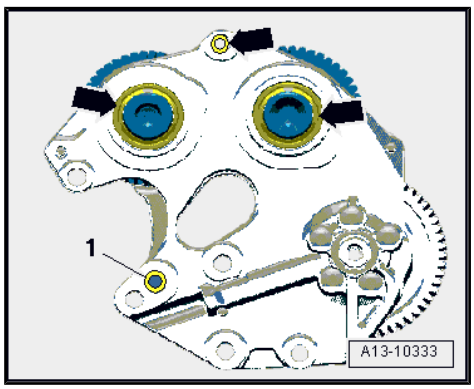


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Caution

Make sure lubrication system is not clogged by excess sealant.

- ***The beads of sealant must not be thicker than specified.***



– Apply the beads of sealant -arrows- onto clean sealing surfaces of spur gear drive, as shown in illustration.

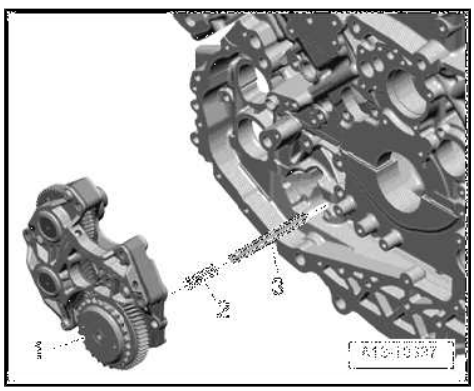
- Width of beads of sealant: 2.0 mm.

– Apply a small amount of grease to O-ring -1- and fit in position.

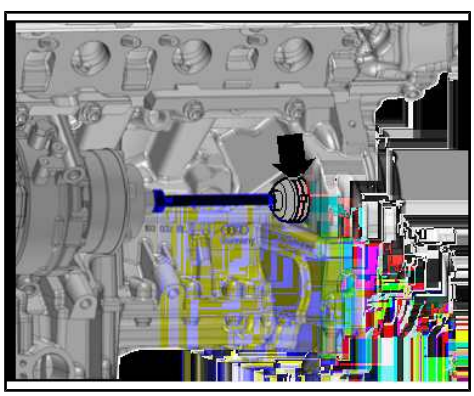
Note

The spur gear drive must be installed within 5 minutes after applying the sealant.

– Insert spring -2- for drive shaft -3- in spur gear drive -1-.



– Press dust cap -arrow- with hose clip fitted onto stub shaft of spur gear for air conditioner compressor drive and secure.



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– Fit spur gear drive and tighten bolts -1 ... 6- in diagonal sequence and in stages.

– Install drive chain for auxiliary drives ⇒ page 104 .

– Press power steering pump with new O-ring onto spur gear for power steering pump drive.

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

– Install timing chain cover (bottom) ⇒ page 81 .

– Install crankshaft oil seal (gearbox end) ⇒ page 59 .

– Install oil filter housing ⇒ page 172 .

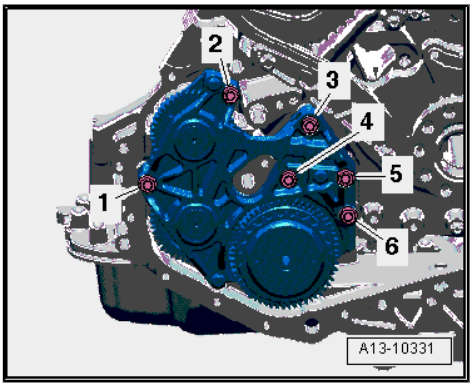
– Install intake manifold ⇒ Rep. gr. 24 .

– Install timing chain covers (left and right) ⇒ page 79 .

– Install drive plate ⇒ page 58 .

– Install automatic gearbox ⇒ Rep. gr. 37 .

– Fill up with engine oil and check oil level ⇒ page 176 .



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2 Cylinder head

⇒ “2.1 Cylinder head - exploded view”, page 114

⇒ “2.2 Removing and installing cylinder head cover (left-side)”, page 116

⇒ “2.3 Removing and installing cylinder head cover (right-side)”, page 117

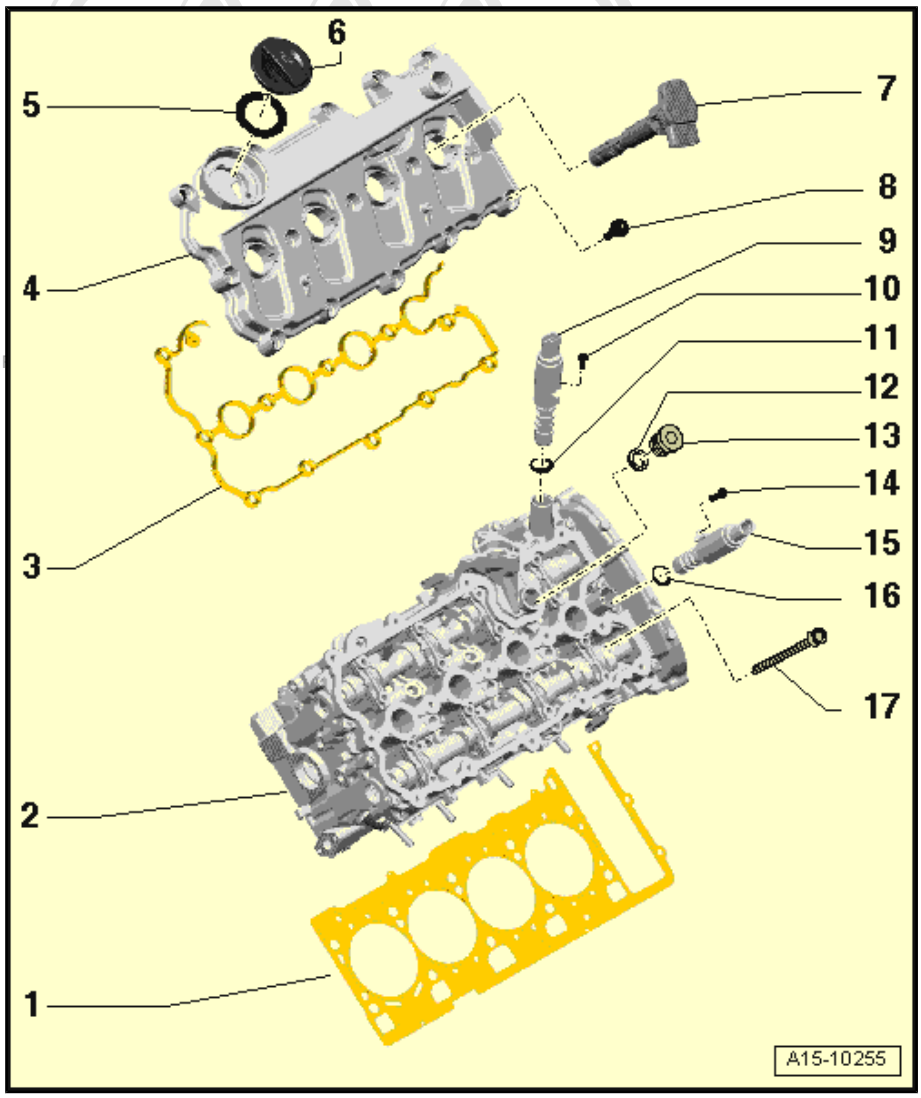
⇒ “2.4 Removing and installing cylinder head”, page 120

⇒ “2.5 Checking compression pressure”, page 128

2.1 Cylinder head - exploded view

Note

The diagram shows the cylinder head on cylinder bank 2 (left-side).



1 - Cylinder head gasket

- ❑ Renewing ⇒ “2.4 Removing and installing cylinder head”, page 120
- ❑ Installation position: Part No. towards cylinder head
- ❑ If renewed, change engine oil and coolant

2 - Cylinder head

- ❑ Removing and installing ⇒ page 120
- ❑ Checking for distortion ⇒ page 116
- ❑ Machining limit ⇒ page 116
- ❑ If renewed, change engine oil and coolant

3 - Gasket for cylinder head cover

- ❑ Renew if damaged or leaking

4 - Cylinder head cover

- ❑ Removing and installing: left-side ⇒ page 116 , right-side ⇒ page 117

5 - Seal

- ❑ For filler cap
- ❑ Renew if damaged or leaking

6 - Filler cap

7 - Ignition coil

- ❑ Remove using puller -T40039-

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8 - Bolt

- ❑ Renew if seal is damaged
- ❑ Tightening torque and tightening sequence: cylinder head cover (left-side) ⇒ page 115 , cylinder head cover (right-side) ⇒ page 115

9 - Camshaft control valve 2 -N208-

10 - Bolt

- ❑ 2.4 Nm

11 - O-ring

- ❑ Renew

12 - Seal

- ❑ Renew

13 - Screw plug

- ❑ 35 Nm

14 - Bolt

- ❑ 2.4 Nm

15 - Exhaust camshaft control valve 2 -N319-

16 - O-ring

- ❑ Renew

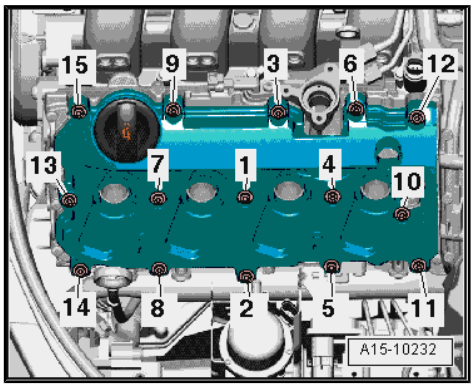
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17 - Bolt

- ❑ Renew
- ❑ Note correct sequence when loosening ⇒ page 124
- ❑ Tightening torque and sequence ⇒ page 116

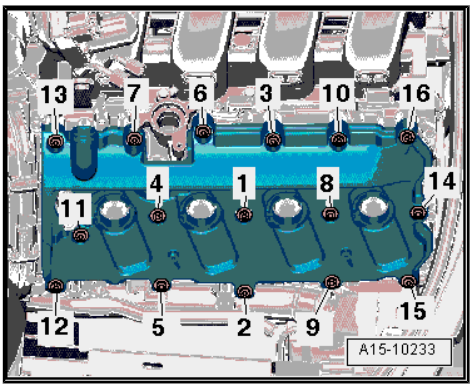
Cylinder head cover (left-side) - tightening torque and sequence

– Tighten bolts in the sequence -1 ... 15- to 9 Nm.



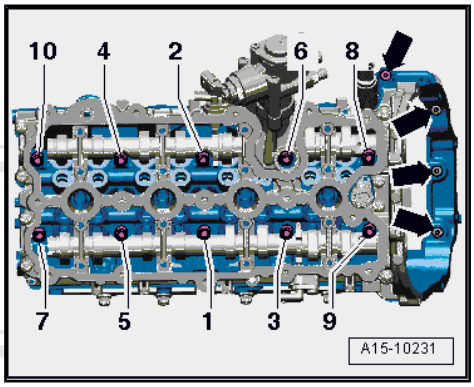
Cylinder head cover (right-side) - tightening torque and sequence

– Tighten bolts in the sequence -1 ... 16- to 9 Nm.



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Cylinder head - tightening torque and sequence



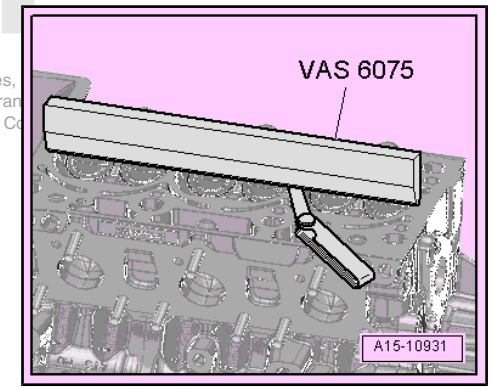
– Tighten bolts in the sequence -1 ... 10- in 5 stages as follows:

1. Screw in bolts by hand until they make contact.
2. Tighten bolts to 30 Nm.
3. Tighten bolts to 60 Nm.
4. Turn bolts 90° ($^1/_4$ turn) further.
5. Turn bolts 90° ($^1/_4$ turn) further.

– Apply locking fluid to bolts -arrows- and tighten to 8 Nm; for locking fluid refer to ⇒ Electronic parts catalogue .

– Turn bolts -arrows- 90° ($^1/_4$ turn) further.

Checking cylinder head for distortion

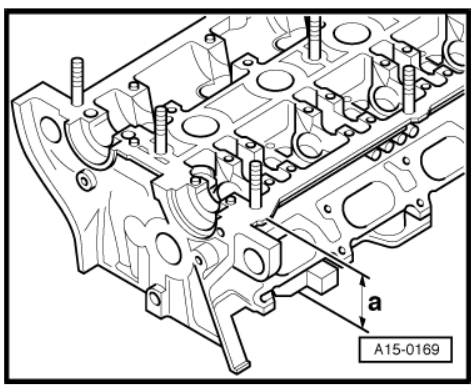


– Use straight edge 500 mm -VAS 6075- and feeler gauge to measure cylinder head for distortion at several points.

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- Max. permissible distortion: 0.1 mm.

Cylinder head machining limit

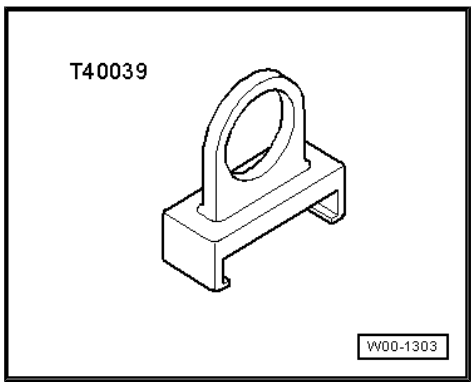


Machining of the cylinder head (surface grinding) is only permissible down to the minimum dimension -a-.

- Minimum dimension: -a- = 139.5 mm

2.2 Removing and installing cylinder head cover (left-side)

Special tools and workshop equipment required



♦ Puller -T40039-

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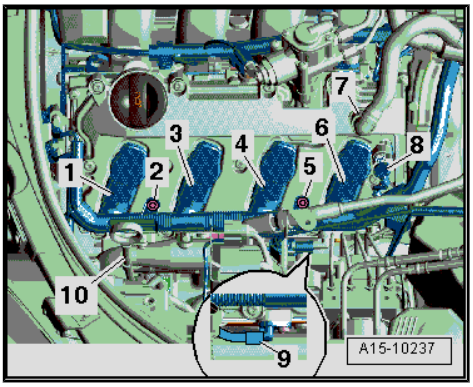
Removing

– Pull dipstick -10- out of guide tube.

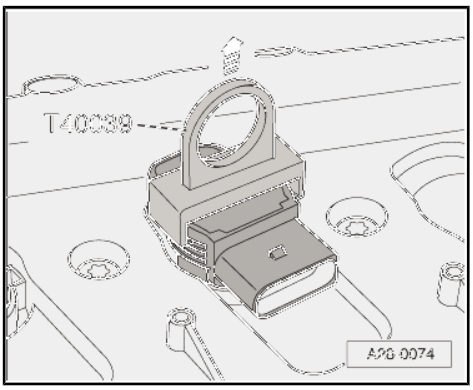
– Remove bolts -2 and 5-.

– Unplug electrical connectors -1, 3, 4, 6, 8, 9- and move wiring harness clear.

– Disconnect crankshaft breather hose -7- by pressing release tabs.

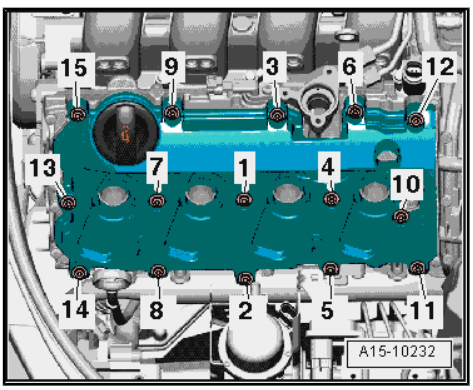


– Pull ignition coils out with puller -T40039- .



– Unscrew cylinder head cover bolts (left-side) in the sequence -15 ... 1-.

– Remove cylinder head cover.



Installing

- Tightening torque
  ⇒ Fig. ""Cylinder head cover (left-side) - tightening torque and sequence"" , page 115

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

Note

♦ *Renew gasket for cylinder head cover if damaged or leaking.*

♦ *Renew cylinder head cover bolts if gasket is damaged.*

– Clean sealing surfaces; they must be free of oil and grease.

– Tighten cylinder head cover bolts ⇒ page 115 .

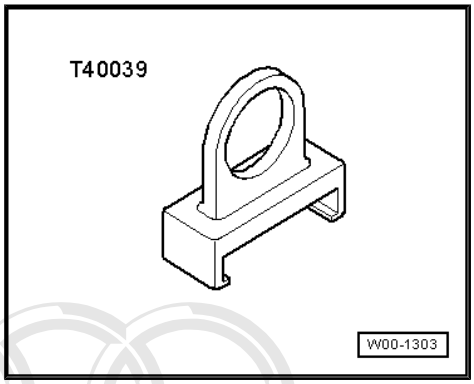
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2.3 Removing and installing cylinder head cover (right-side)

Special tools and workshop equipment required

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♦ Puller -T40039-

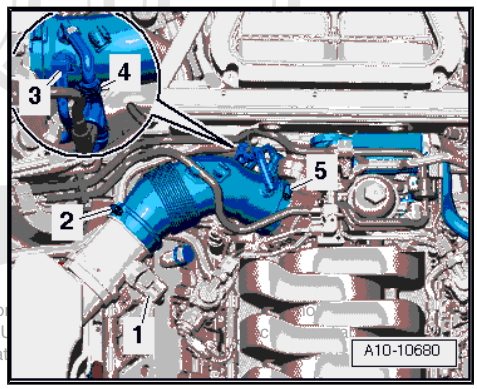


Removing

– Move clear fuel line and line going to activated charcoal filter at air pipe.

– Unplug electrical connector -1- at air mass meter -G70- .

– Detach vacuum line -4- leading to air intake hose from suction-jet pump.



Rest-of-world vehicles:

– Disconnect hose -3- for crankcase breather system from air hose by pressing release tabs.

– Release hose clips -2 and 5- and remove air hose.

USA models:

Caution

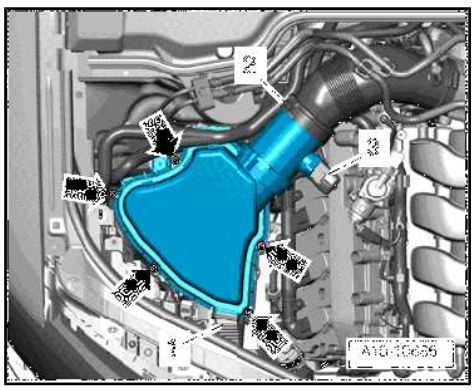
Risk of violating emission legislation applying to USA models.

♦ ***Do NOT open hose connection -3-.***

– Release hose clips -2 and 5- and move air hose clear to one side (crankcase breather hose -3- remains connected).

– Disconnect air duct -1- from air cleaner housing (top section).

– Unscrew bolts -arrows- and detach air cleaner housing (top section).



Note

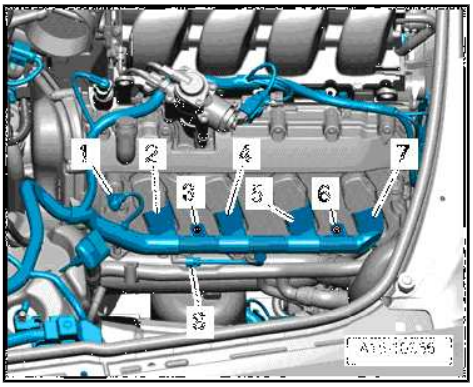
Disregard -items 2 and 3-.

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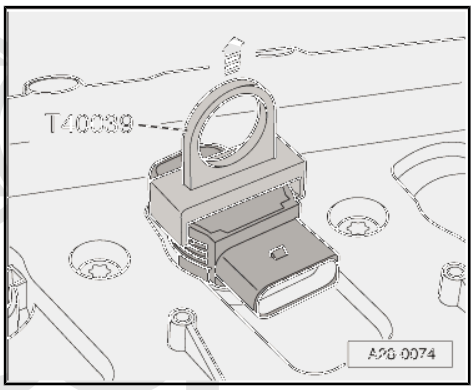
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– Unscrew bolts -3 and 6- at cylinder head (right-side).

– Unplug electrical connectors -1, 2, 4, 5, 7, 8- and place connector console to one side.

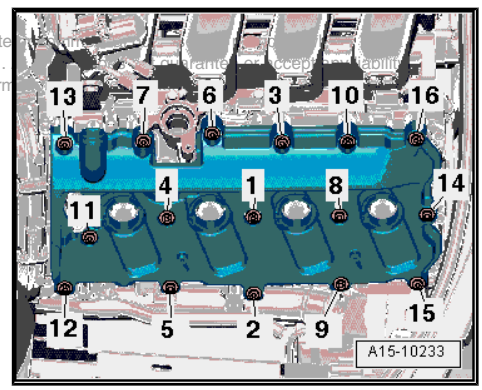


– Pull ignition coils out with puller -T40039- .



– Unscrew cylinder head cover bolts (right-side) in the sequence -16 ... 1-.

– Remove cylinder head cover.



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Installing

- Tightening torques
  ⇒ Fig. ""Cylinder head cover (right-side) - tightening torque and sequence"" , page 115

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

Note

♦ *Renew gasket for cylinder head cover if damaged or leaking.*

♦ *Renew cylinder head cover bolts if gasket is damaged.*

– Clean sealing surfaces; they must be free of oil and grease.

– Tighten cylinder head cover bolts ⇒ page 115 .

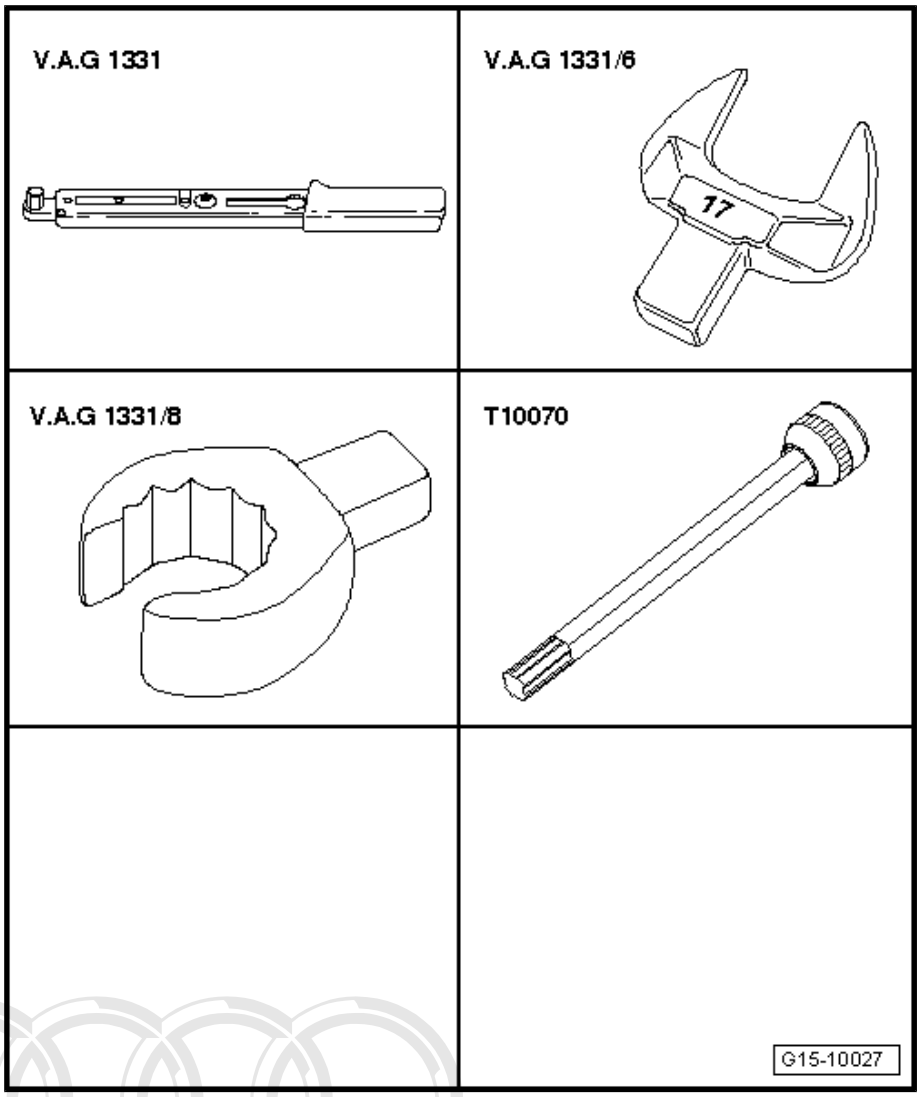
– Fit top section of air cleaner housing ⇒ Rep. gr. 24 .

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2.4 Removing and installing cylinder head

Special tools and workshop equipment required

- Torque wrench -V.A.G 1331-
- Open end spanner insert, AF 17 -V.A.G 1331/6-
- Socket insert AF 14, flared ring spanner -V.A.G 1331/8-
- Special wrench, long reach -T10070-



Removing

Note

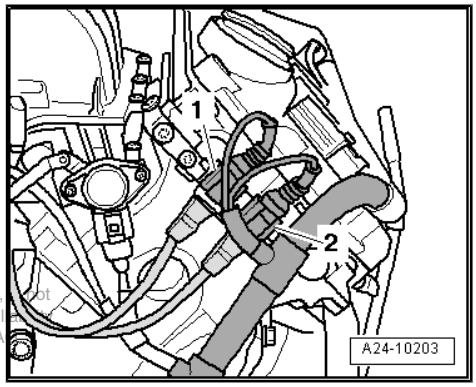
- *The following illustrations show mainly the procedure for the cylinder head (left-side).*
- *Fit all cable ties in the original positions when installing.*

– Drain off coolant ⇒ page 181 .

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– Remove electrical connectors -1 and 2- for knock sensors from bracket.



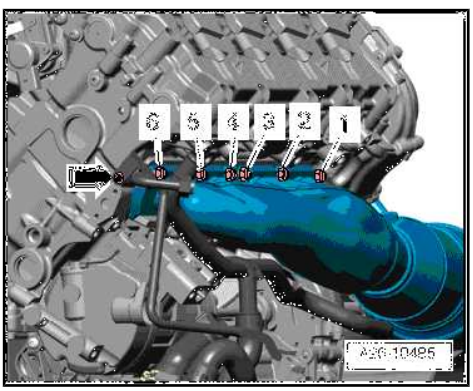
– Remove intake manifold ⇒ Rep. gr. 24 .
– Remove coolant pipe (left-side) ⇒ page 204 .
– Remove coolant pipe (right-side) ⇒ page 214 (for cylinder head right-side).
– Remove secondary air combination valve (left-side) ⇒ page 253 (for cylinder head left-side).
– Remove secondary air combination valve (right-side) ⇒ page 254 .
– Remove coolant pipe (rear) ⇒ page 199 .
– Remove mounting for torque reaction support ⇒ page 47 (for cylinder head right-side).
– Remove cylinder head cover: left-side ⇒ page 116 , right-side ⇒ page 117 .
– Remove appropriate Lambda probe before catalytic converter ⇒ Rep. gr. 24 .
– Remove timing chain covers (left and right) ⇒ page 78 .
– Remove timing chains from camshafts ⇒ page 89 .
– Remove front silencer: left-side ⇒ page 229 , right-side ⇒ page 231 .

Cylinder head (left-side):

– Remove front left wheel.
– Remove front section of front left wheel housing liner ⇒ Rep. gr. 66 .

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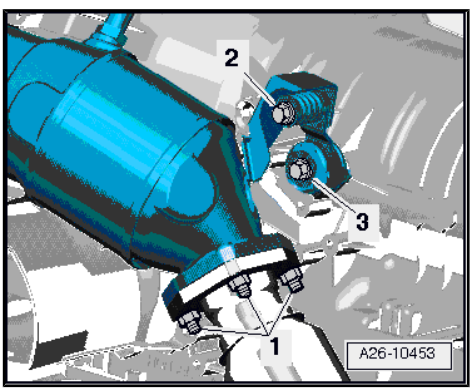
– Unscrew bolt -arrow- and pull pressure pipe for hydraulic fluid slightly towards front.
– Unscrew nuts -6 ... 1-.



Note

- *Shown in illustration with engine removed.*
- *The two mounting strips (bottom) remain installed.*

– Remove bolt -2- on bracket for catalytic converter (left-side).



Note

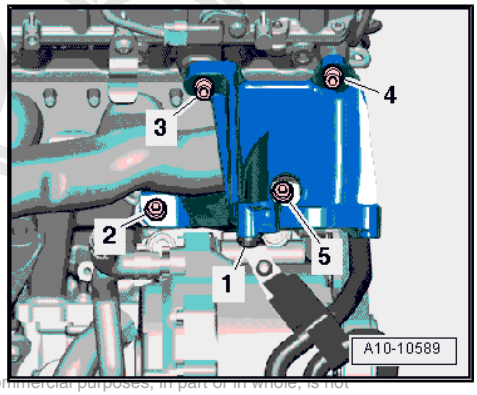
Disregard -items 1 and 3-.

– Pull exhaust manifold (left-side) off cylinder head studs and mounting strips.
– Place exhaust manifold (left-side) with catalytic converter to one side in engine compartment.

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Cylinder head (right-side):

– Unscrew bolts -2 … 5- and remove torque reaction support.

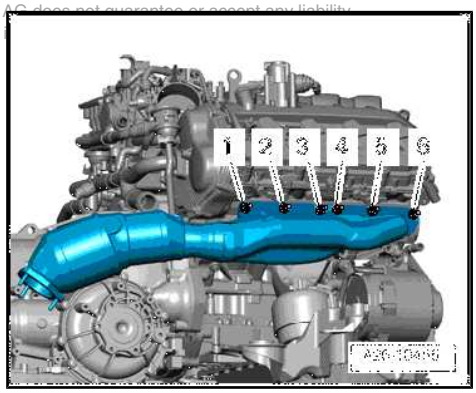


Note

Disregard -item 1-.

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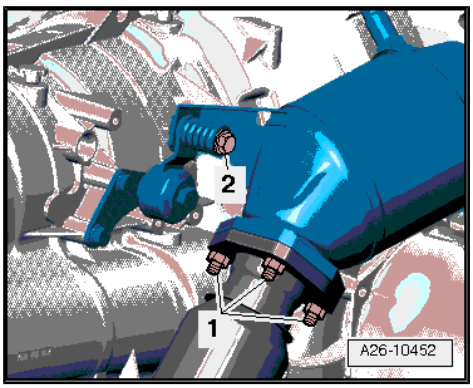
– Unscrew nuts -6 ... 1-.



Note

- *Shown in illustration with engine removed.*
- *The two mounting strips (bottom) remain installed.*

– Remove bolt -2- on bracket for catalytic converter (right-side).



Note

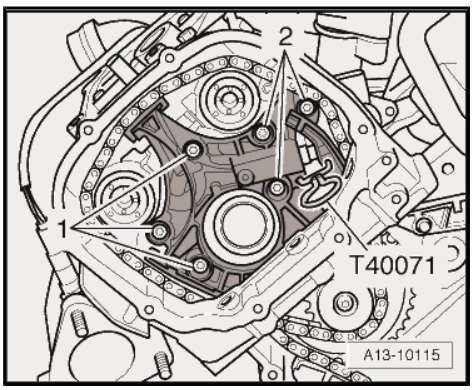
Disregard -item 1-.

– Pull exhaust manifold (right-side) off cylinder head studs and mounting strips.

– Place exhaust manifold (right-side) with catalytic converter to one side in engine compartment.

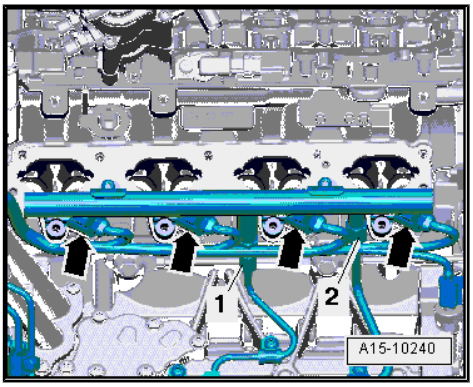
Continuation for both sides:

– Unscrew bolts -1 and 2- and remove appropriate chain tensioner.



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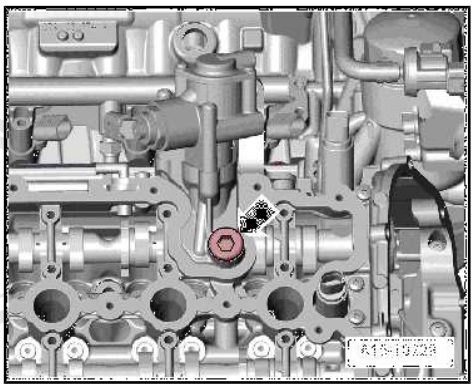
– Unplug electrical connectors -arrows- at injectors.
– Unscrew high-pressure pipe -2- at connection on fuel rail.
– Unscrew high-pressure pipe -1- at connection on fuel rail. To do so, counterhold at hexagon flats with an open-end spanner and slacken union nut.



Note

Do not attempt to bend high-pressure pipes to a different shape.

– Remove screw plug -arrow-.



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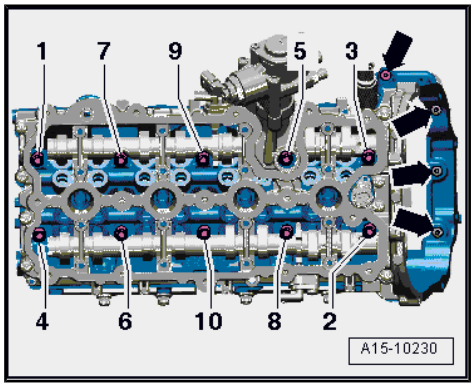
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– Remove bolts -arrows-.

– Use special wrench, long reach -T10070- to loosen cylinder head bolts in the sequence -1 ... 10-.

– Remove bolts and carefully detach cylinder head.

– Place cylinder head onto soft surface (foamed plastic).



Installing

Tightening torques

- ⇒ “2.1 Cylinder head - exploded view”, page 114 .
- ⇒ Fig. ““Cylinder head - tightening torque and sequence”“ , page 116
- ⇒ “1.4 Camshaft timing chains - exploded view”, page 86 .
- ⇒ “3.2 Secondary air system - exploded view”, page 250 .

Caution

Avoid damage to sealing surfaces.

- *Carefully remove sealant residue from cylinder head and cylinder block.*
- *Ensure that no long scores or scratches are made on the surfaces.*

Avoid damage to cylinder block.

- *No oil or coolant must be allowed to remain in the blind holes for the cylinder head bolts in the cylinder block.*

Risk of leaks at cylinder head gasket.

- *Carefully remove any remaining emery and abrasive material.*
- *Do not remove new cylinder head gasket from packaging until it is ready to be fitted.*
- *Handle the cylinder head gasket very carefully to prevent damage to the silicone coating or the indented area of the gasket.*

Avoid damage to open valves.

- *When installing an exchange cylinder head, the plastic protectors fitted to protect the open valves should not be removed until the cylinder head is ready to be fitted.*

Avoid damage to valves and piston crowns after working on valve gear.

- *Turn the engine carefully at least 2 rotations to ensure that none of the valves make contact when the starter is operated.*

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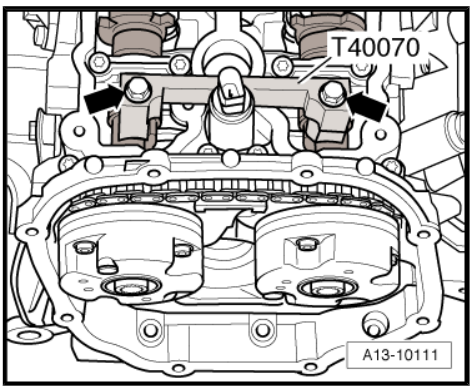
Note

- *Renew the bolts tightened with specified tightening angle.*
- *Renew seals, gaskets and self-locking nuts.*
- *When installing an exchange cylinder head, the contact surfaces between the supporting elements, roller rocker fingers and cams must be oiled before installing the cylinder head cover.*
- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*
- *Fit all cable ties in the original positions when installing.*

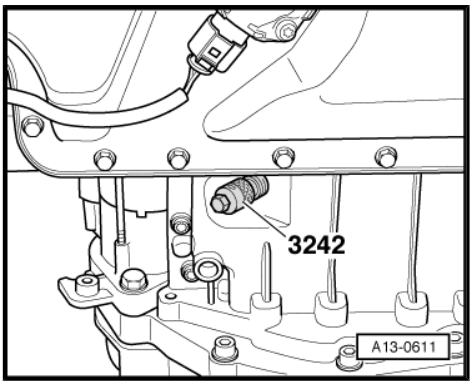
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– Check that camshafts on both cylinder heads are positioned at “TDC”.

• Camshaft clamps -T40070- must be installed on both cylinder heads and tightened to 25 Nm.



• The locking pin -3242- must be screwed in.

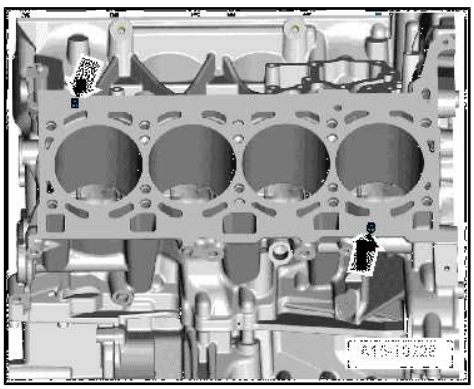


– Fit cylinder head gasket.

• Pay attention to dowel sleeves -arrows- in cylinder block.

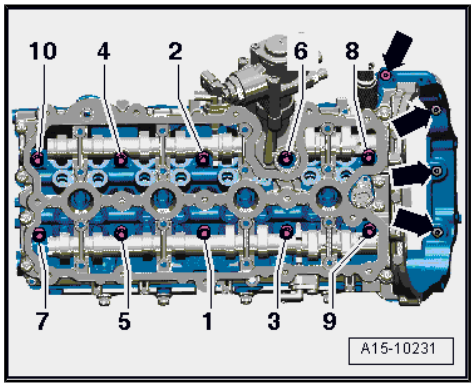
• Check installation position of cylinder head gasket: the word “oben” (top) or the Part No. should face towards the cylinder head.

– Fit cylinder head.



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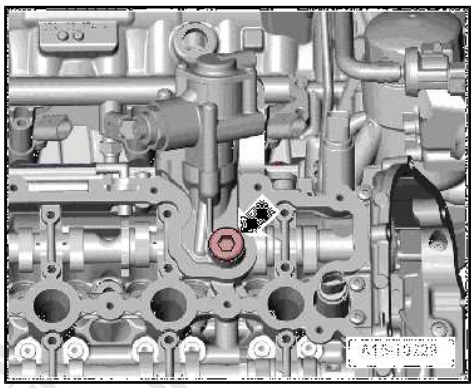
– Tighten cylinder head bolts ⇒ page 116 .



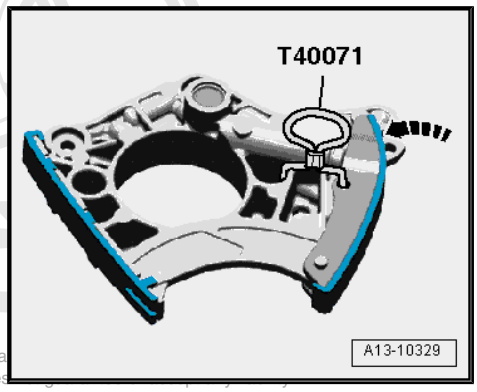
Note

Bolts do not have to be torqued down again later after repair work.

– Tighten screw plug -arrow-.



– Make sure that guide rail of chain tensioner for camshaft timing chain is locked with locking pin -T40071- .



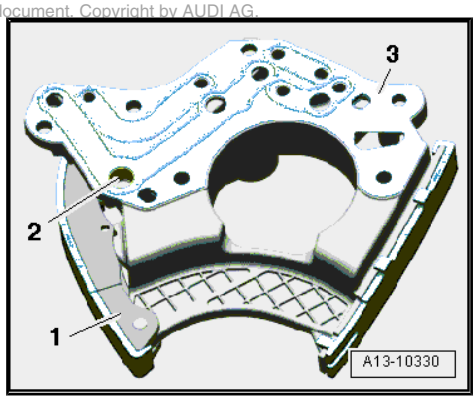
Note

- *Note the correct installation position if the tensioning element has been removed from the chain tensioner: drilling in base of housing faces chain tensioner and piston faces tensioner rail.*
- *Disregard -arrow-.*

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– Clean oil strainer -2- of chain tensioner.

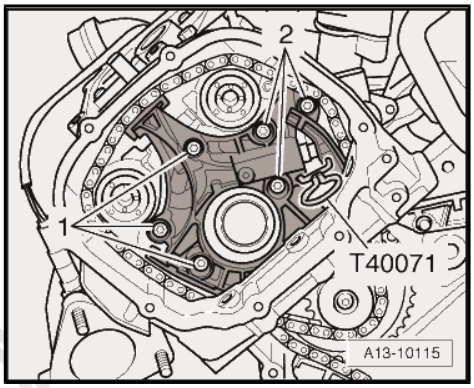
– Fit new gasket -3- to rear of chain tensioner -1-.



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– Install chain tensioner and position camshaft timing chain, as shown in illustration.

– Tighten bolts -1 and 2-.



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

– Install exhaust manifold: left-side ⇒ page 236 , right-side ⇒ page 242 .

– Install torque reaction support and mounting for torque reaction support ⇒ page 42 .

– Install front silencer: left-side ⇒ page 229 , right-side ⇒ page 231 .

– Install camshaft timing chains ⇒ page 98 .

– Install timing chain covers (left and right) ⇒ page 79 .

– Install coolant pipe (rear) ⇒ page 199 .

– Install combination valve for secondary air system: left-side ⇒ page 253 , right-side ⇒ page 254 .

– Install coolant pipe (left-side) ⇒ page 204 .

– Install coolant pipe (right-side) ⇒ page 214 .

– Install cylinder head cover: left-side ⇒ page 116 , right-side ⇒ page 117 .

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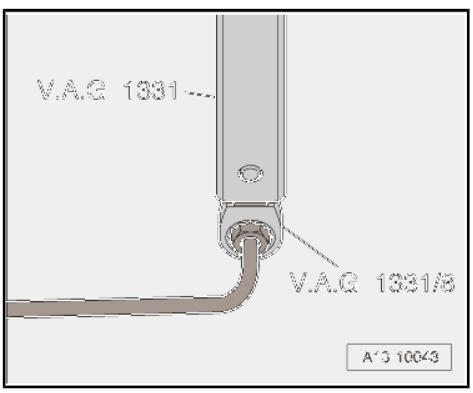
– Install intake manifold ⇒ Rep. gr. 24 .

– Install headlight ⇒ Rep. gr. 94 .

– Install bumper cover (front) ⇒ Rep. gr. 63 .

– Check headlight adjustment ⇒ Maintenance ; Booklet 404 .

– To secure union nut (14 mm) to fuel rail, use torque wrench - V.A.G 1331- with socket insert AF 14, flared ring spanner - V.A.G 1331/8- ⇒ Rep. gr. 24 .

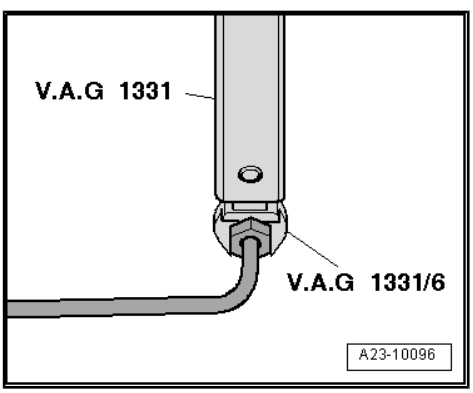


– To secure union nut (17 mm) to fuel rail, use torque wrench - V.A.G 1331- with tool insert AF 17 -V.A.G 1331/6- ⇒ Rep. gr. 24 .

– Align exhaust system so it is free of stress ⇒ page 232 .

– Change engine oil ⇒ Maintenance ; Booklet 404 .

– Fill cooling system with fresh coolant ⇒ page 181 .

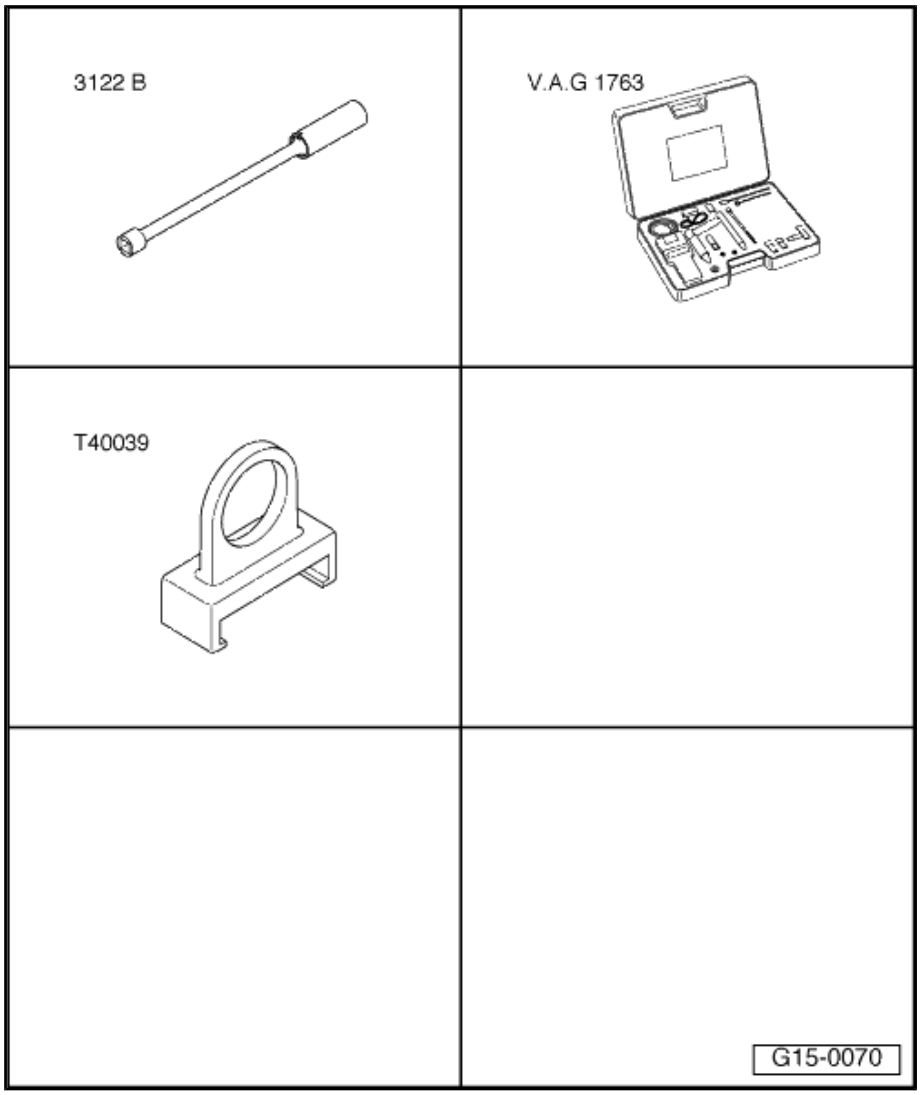


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2.5 Checking compression pressure

Special tools and workshop equipment required

- Spark plug socket and extension -3122 B-
- Compression tester -V.A.G 1763-
- Puller -T40039-



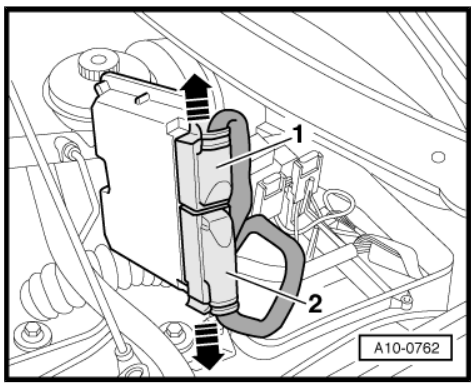
Procedure

- Engine oil temperature at least 30 °C.
- Battery voltage at least 12.5 V.

– Switch off ignition.

– Remove engine control unit -J623- ⇒ Rep. gr. 24 .

– Pull retaining tab -arrow- to unplug only the smaller connector -1- from engine control unit.

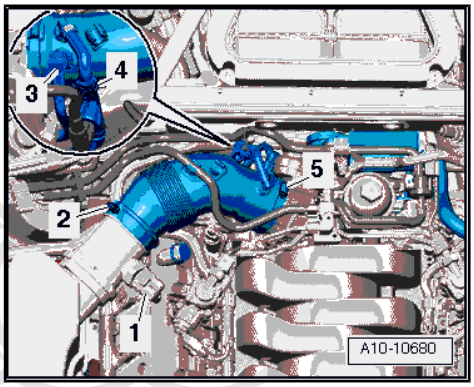


Note

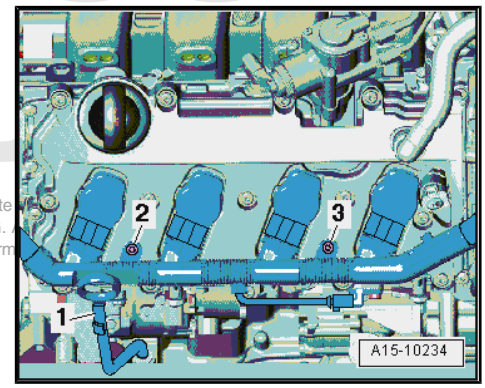
The larger connector -2- remains connected.

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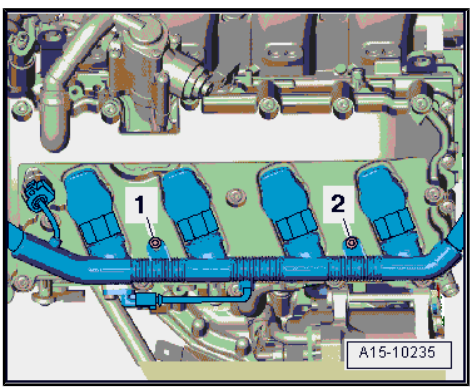
– Move clear fuel line and line going to activated charcoal filter at air pipe.
– Unplug electrical connector -1- at air mass meter -G70- .
– Detach vacuum line -4- leading to air intake hose from suction-jet pump.



– Pull dipstick -1- out of guide tube.
– Remove bolts -2 and 3-.
– Unplug electrical connectors at ignition coils.
– Push wiring harness to one side.



– Remove bolts -1 and 2-.
– Unplug electrical connectors at ignition coils.
– Push wiring harness to one side.



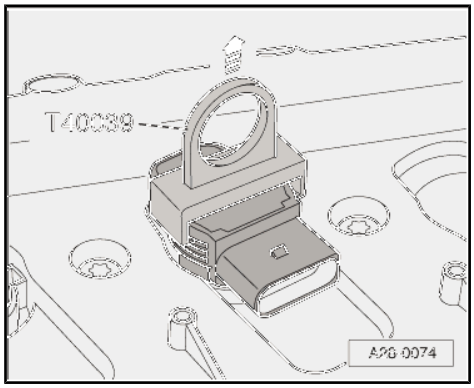
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– Pull all ignition coils out with puller -T40039- .

– Remove spark plugs with spark plug socket and extension -3122 B- .

– Test the compression pressure with the compression tester -V.A.G 1763- .



Note

Using the compression tester ⇒ Operating instructions .

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

Compression pressure	bar
When new	10.0 … 14.0
Wear limit	9.0
Maximum difference between cylinders	3.0

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

– Install spark plugs ⇒ Maintenance ; Booklet 404 .

– Install engine control unit -J623- ⇒ Rep. gr. 24 .

Entries are stored in engine control unit because electrical connectors have been unplugged.

– Erase any entries in event memory ⇒ Vehicle diagnostic tester, Guided Functions, Interrogate event memory, then Generate readiness code.

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3 Valve gear

⇒ “3.1 Valve gear - exploded view”, page 132

⇒ “3.2 Measuring axial clearance of camshafts”, page 134

⇒ “3.3 Removing and installing camshafts”, page 136

⇒ “3.4 Checking supporting elements with hydraulic clearance compensation”, page 143

⇒ “3.5 Renewing valve stem oil seals with cylinder head installed”, page 145

⇒ “3.6 Renewing valve stem oil seals with cylinder head removed”, page 149

⇒ “3.7 Valve dimensions”, page 152

⇒ “3.8 Checking valve guides”, page 152

3.1 Valve gear - exploded view

Note

- *Cylinder heads which have cracks between the valve seats or between a valve seat insert and the spark plug thread can be re-installed without reducing service life, provided the cracks are only slight and do not exceed a maximum of 0.3 mm in width, and no more than the first 4 turns of the spark plug threads are cracked.*
- *The diagram shows the cylinder head on cylinder bank 2 (left-side).*

1 - Sealing plugs

2 - Valve stem oil seal

- ❑ Renewing with cylinder head installed ⇒ page 145
- ❑ Renewing with cylinder head removed ⇒ page 149

3 - Valve spring

- ❑ Installation position ⇒ page 134

4 - Supporting element

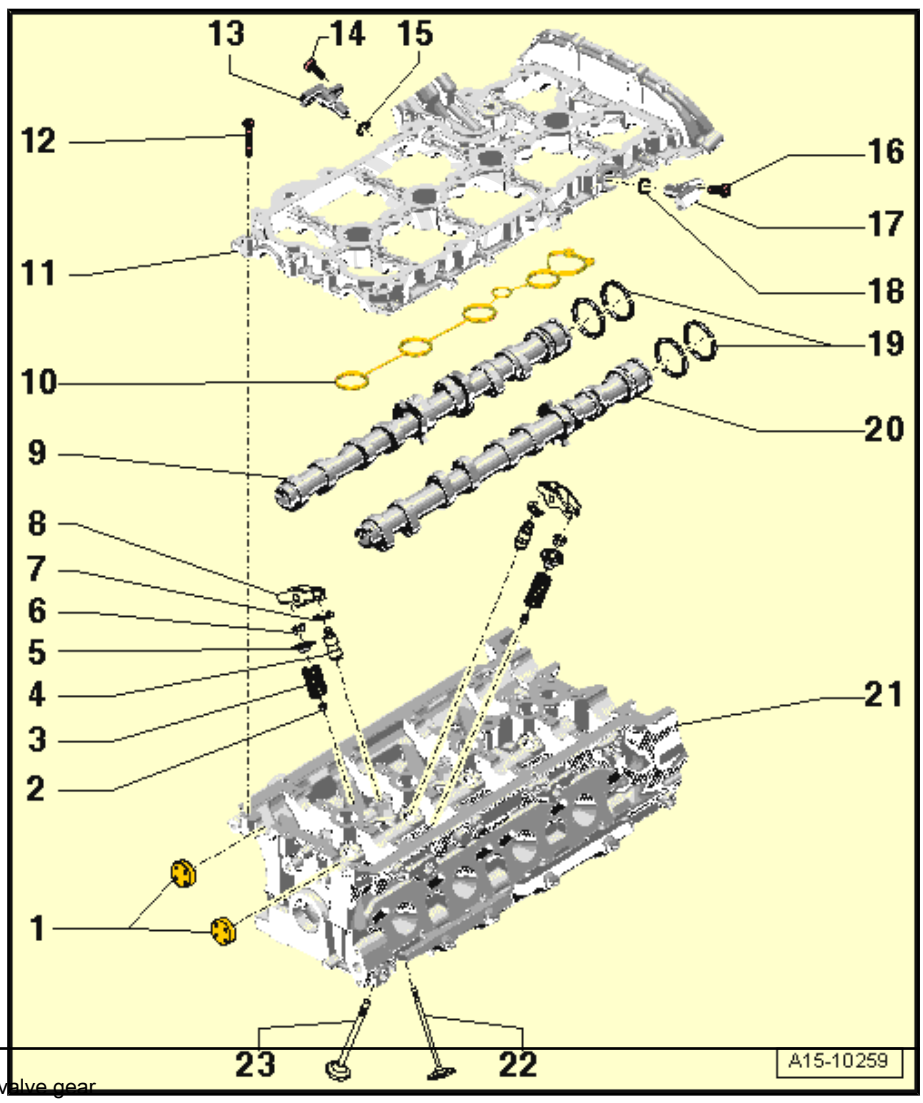
- ❑ With hydraulic valve clearance compensation
- ❑ Clipped into roller rocker finger -item 8-
- ❑ Checking ⇒ page 143
- ❑ Mark installation position for re-installation
- ❑ Lubricate contact surface

5 - Valve spring plate

6 - Valve cotters

7 - Securing clip

- ❑ Check for firm attachment



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8 - Roller rocker finger

- ❑ Mark installation position for re-installation
- ❑ Check roller bearings for ease of movement
- ❑ Lubricate contact surface
- ❑ Assembly: attach to supporting element -item 4- using securing clip -item 7-

9 - Inlet camshaft

- ❑ Removing and installing ⇒ page 136
- ❑ Measuring axial clearance ⇒ page 134
- ❑ Check radial clearance with Plastigage (roller rocker fingers removed)
- ❑ Radial clearance when bearing ∅ is 24 mm: 0.024 ... 0.066 mm
- ❑ Radial clearance when bearing ∅ is 36 mm: 0.032 ... 0.078 mm
- ❑ Runout: max. 0.04 mm

10 - Gasket

- ❑ Renew

11 - Retaining frame

- ❑ With integrated camshaft bearings
- ❑ Removing and installing ⇒ “3.3 Removing and installing camshafts”, page 136

12 - Bolt

- ❑ Tightening torque and sequence ⇒ page 134

13 - Hall sender 2 -G163-

14 - Bolt

- ❑ 9 Nm

15 - O-ring

- ❑ Renew

16 - Bolt

- ❑ 9 Nm

17 - Hall sender 4 -G301-

18 - O-ring

- ❑ Renew

19 - Rectangular section seals

- ❑ For camshaft adjuster

20 - Exhaust camshaft

- ❑ Removing and installing ⇒ page 136
- ❑ Measuring axial clearance ⇒ page 134
- ❑ Check radial clearance with Plastigage (roller rocker fingers removed)
- ❑ Radial clearance when bearing ∅ is 24 mm: 0.024 ... 0.066 mm
- ❑ Radial clearance when bearing ∅ is 36 mm: 0.032 ... 0.078 mm
- ❑ Runout: max. 0.04 mm

21 - Cylinder head

- ❑ Checking valve guides ⇒ page 152

22 - Inlet valve

- ❑ Do not machine, only grinding-in is permitted
- ❑ Mark installation position for re-installation
- ❑ Valve dimensions ⇒ page 152
- ❑ Checking valve guides ⇒ page 152

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23 - Exhaust valve

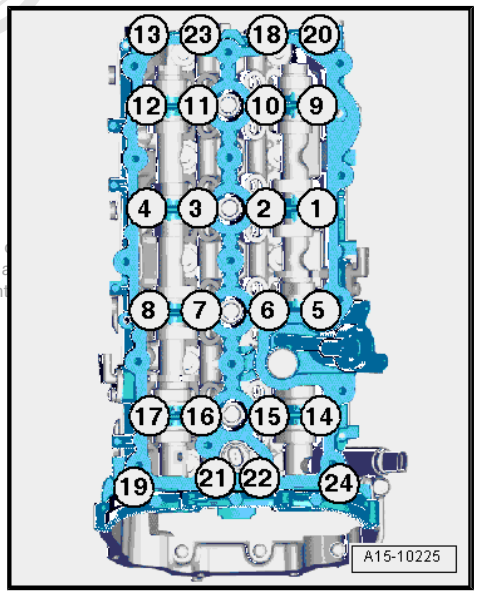
- ❑ Do not machine, only grinding-in is permitted
- ❑ Mark installation position for re-installation
- ❑ Valve dimensions ⇒ page 152
- ❑ Checking valve guides ⇒ page 152

Tightening torque and sequence for retaining frame

– Tighten bolts in the sequence -1 ... 24- in two stages as follows.

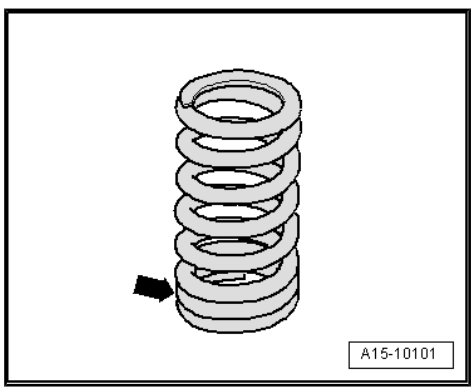
1. Screw in bolts by hand until they make contact.
2. Tighten bolts to 8 Nm.

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Position of valve spring

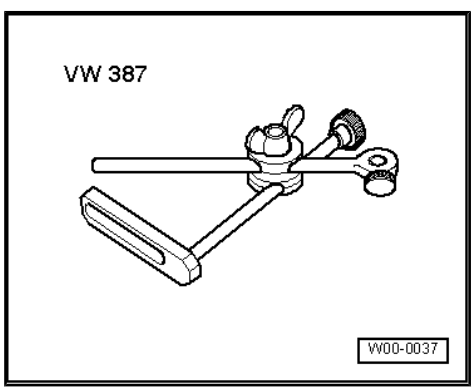
- The closely spaced spring coils -arrow- face the cylinder head.



3.2 Measuring axial clearance of camshafts

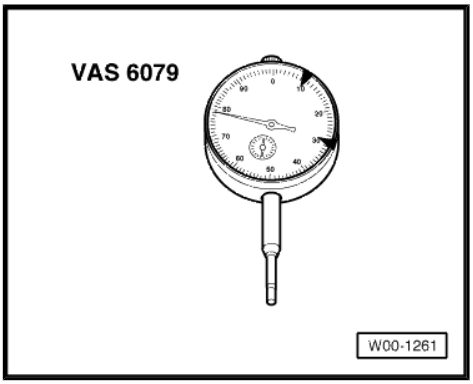
Special tools and workshop equipment required

♦ Universal dial gauge bracket -VW 387-



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♦ Dial gauge -VAS 6079-



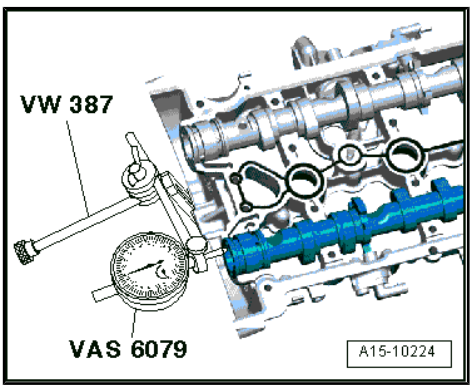
Procedure

– Perform measurement with retaining frame removed.

– Secure universal dial gauge bracket -VW 387- with dial gauge -VAS 6079- to cylinder head, as shown in illustration.

– Determine axial clearance.

• Axial clearance: 0.100 ... 0.191 mm



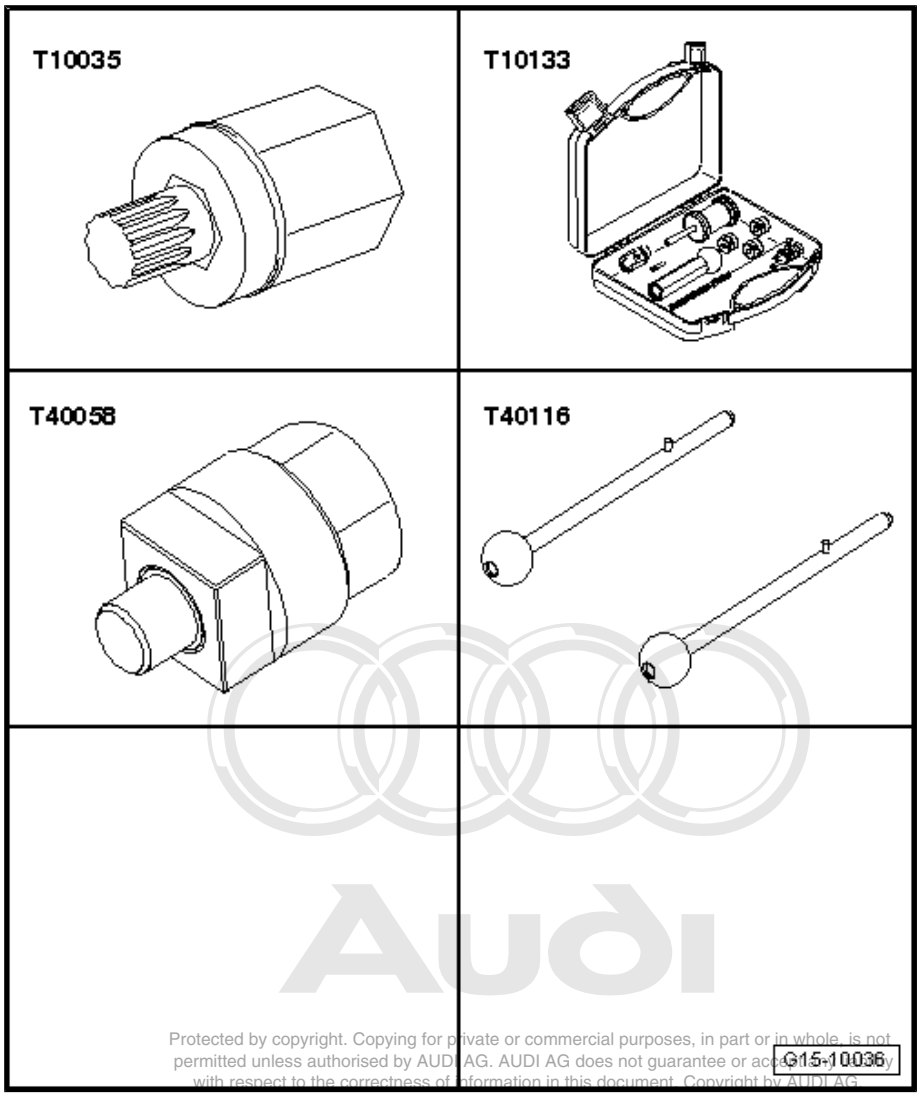
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3.3 Removing and installing camshafts

Special tools and workshop equipment required

- Special wrench -T10035-
- Tool set for FSI engines -T10133-
- Adapter -T40058-
- Locating pins -T40116-
- Electric drill with plastic brush attachment
- Safety goggles
- Sealant ⇒ Electronic parts catalogue



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Note

The following description is for removing and installing on cylinder head (left-side).

Removing

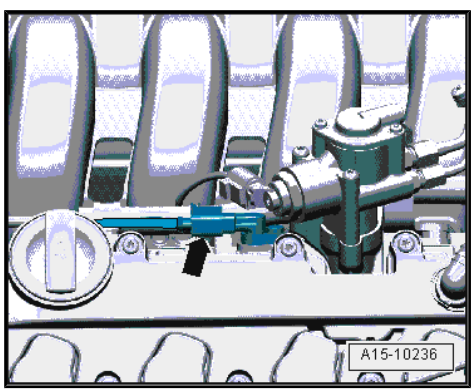
– Remove cylinder head cover: left-side ⇒ page 116 , right-side ⇒ page 117 .

– Remove timing chain covers (left and right) ⇒ page 79 .

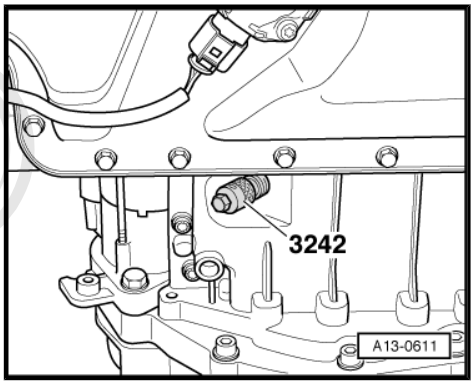
– Remove timing chains from camshafts ⇒ page 89 .

– Unplug electrical connector at Hall sender for inlet camshaft -arrow-.

– Remove high-pressure pump ⇒ Rep. gr. 24 .



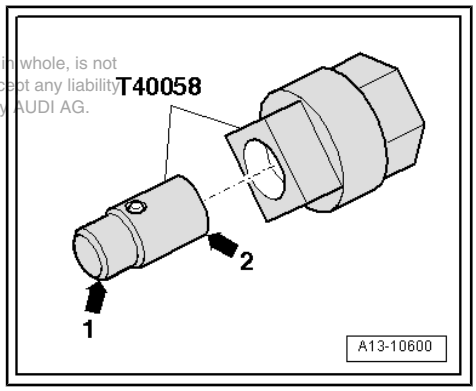
– Unscrew locking pin -3242- from sump (top section).



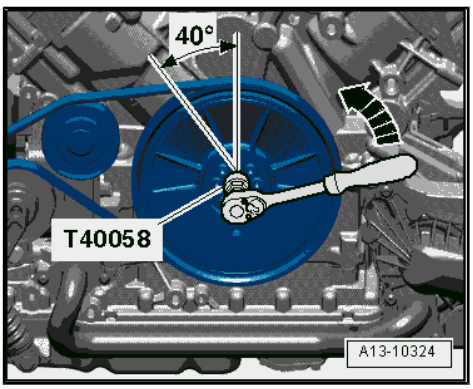
– Insert guide pin of adapter -T40058- as follows:

- The smaller-diameter section -arrow 1- faces the engine.
- The larger-diameter section -arrow 2- faces the adapter.

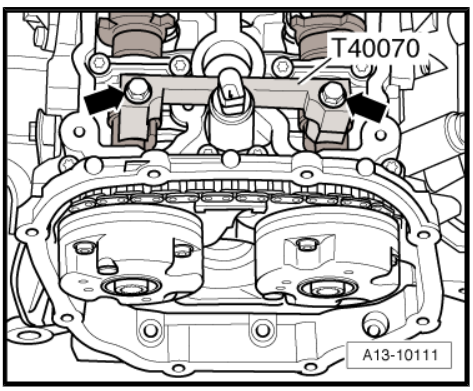
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– Using adapter -T40058- turn the crankshaft through 40° out of “TDC” position in opposite direction of normal rotation -arrow-.

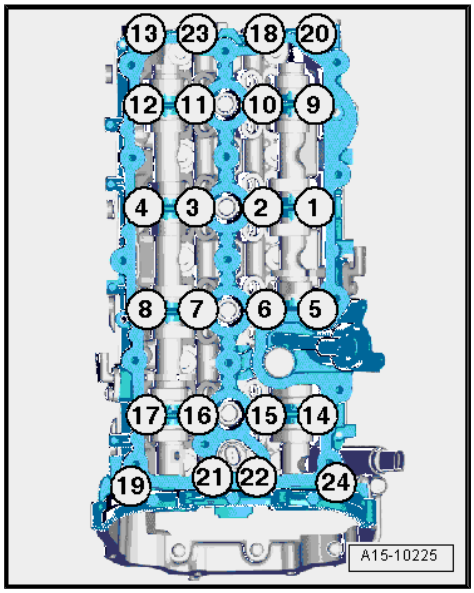


– Remove camshaft clamp -T40070- at cylinder head.



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– Slacken retaining frame bolts in the sequence -24 ... 1-.



Note

Perform the same procedure (laterally reversed) on retaining frame (right-side).

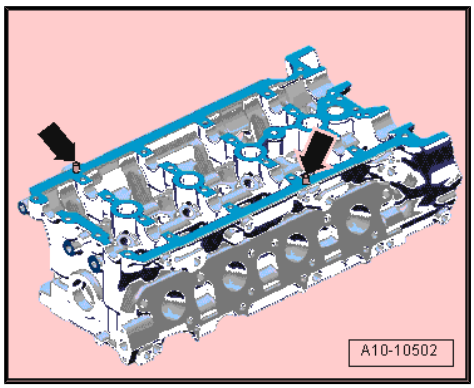
– Carefully remove retaining frame.

– Mark camshafts for re-installation and then remove.

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Note

As the special tool cannot be attached when installing, on engines fitted with dowel pins -arrows- for retaining frame, use roll-pin drift to drive out dowel pins.



Installing

- Tightening torque
  ⇒ Fig. ""Tightening torque and sequence for retaining frame"", page 134

Note

Renew seals and gaskets.

WARNING

Protect eyes against injuries.

- ***Wear safety goggles.***

Caution

Protect lubrication system and bearings against contamination.

- ***Cover exposed parts of the engine.***

– Remove sealant residue from cylinder head and retaining frame using a rotating plastic brush or similar.

– Clean sealing surfaces; they must be free of oil and grease.

– Lubricate running surfaces of camshafts.

– Insert camshafts in cylinder head; note position of camshafts to make sure retaining frame is fitted free of stress.

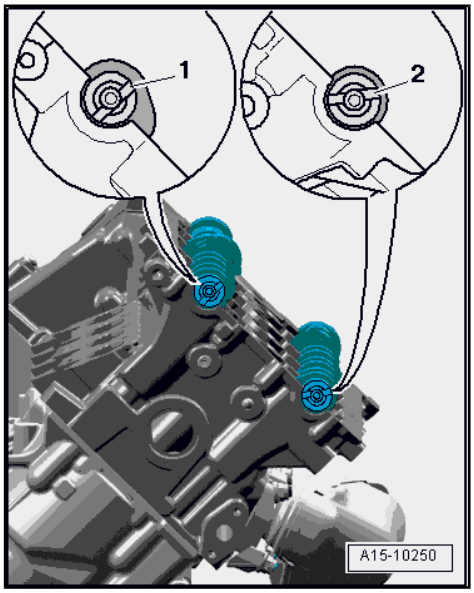
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Cylinder head (left-side):

1 - Inlet camshaft

2 - Exhaust camshaft

- The groove on the end of the shaft must be positioned as shown in the illustration.

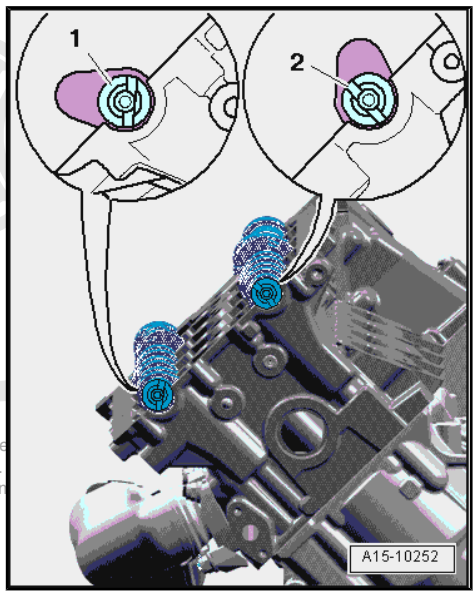


Cylinder head (right-side):

1 - Exhaust camshaft

2 - Inlet camshaft

- The groove on the end of the shaft must be positioned as shown in the illustration.

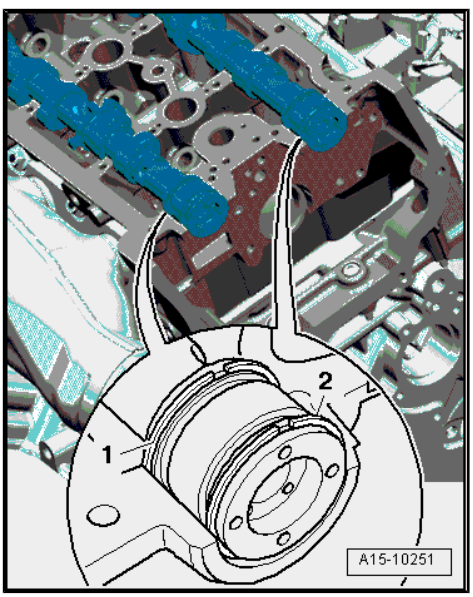


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Continuation for both sides:

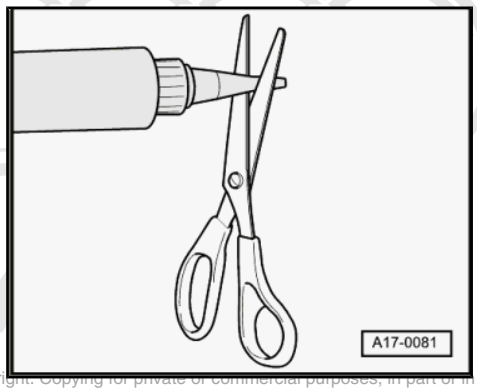
– Check position of ends of rectangular section seals.

- The ends of the rectangular section seals -1 and 2- must point up or down, never to the side.



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– Cut off tube nozzle at front marking (diameter of nozzle approx. 2 mm).

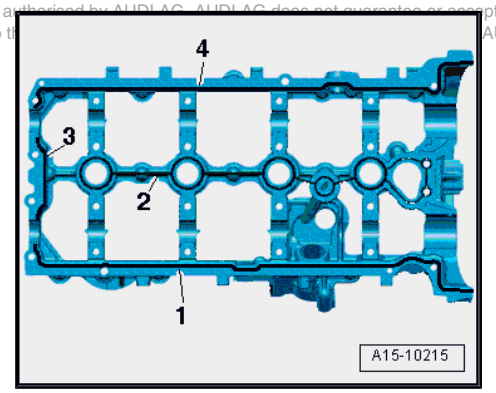


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– Fit gasket -2- in grooves on retaining frame.

– Apply the beads of sealant -1, 3, 4- onto the clean sealing surfaces of the retaining frame, as shown in illustration.

• Width of beads of sealant: 2.5 mm.



Caution

Make sure excess sealant does not contaminate camshaft bearings.

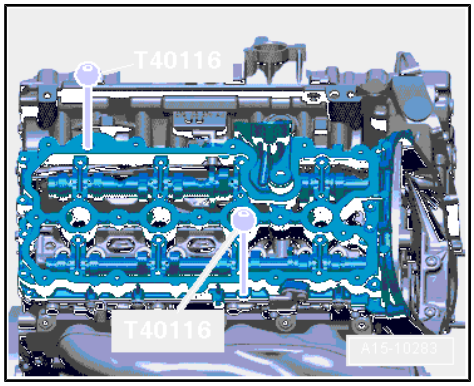
- ***The sealant beads must not be thicker than specified.***

– Fit retaining frame onto cylinder head.

Note

Make sure that camshafts can be inserted into axial bearing of retaining frame without applying force.

– Insert locating pins -T40116- in retaining frame and in cylinder head.

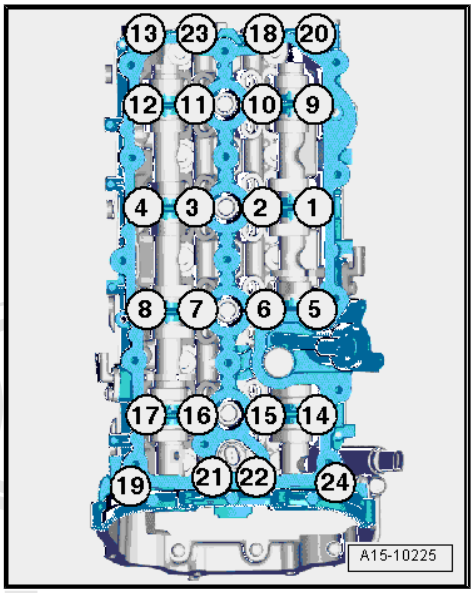


Note

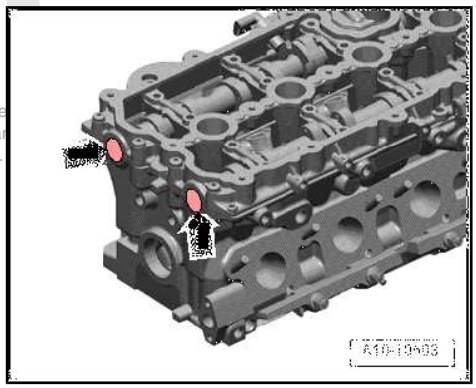
- *Fit and secure the retaining frame without delay, as the sealant starts hardening immediately.*
- *After installing the retaining frame, the sealant must dry for approx. 30 minutes.*

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– Tighten bolts for retaining frame ⇒ page 134 .

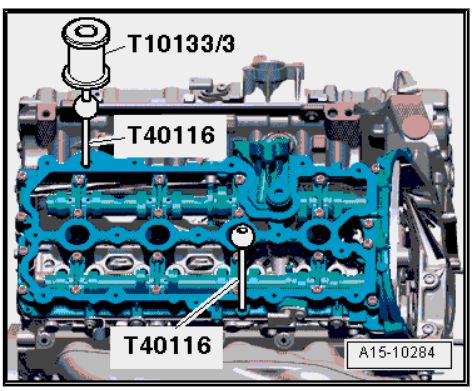


– Knock in sealing plugs -arrows- until flush.



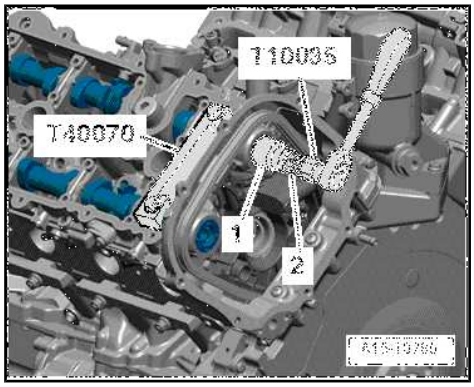
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– Pull out locating pins -T40116- using puller -T10133/3- .



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– Turn inlet camshaft to “TDC” position; to do so, fit a socket (24 mm) -item 1- between inlet camshaft and camshaft adjuster bolt -2- and secure camshaft adjuster bolt to camshaft as shown in illustration.



Note

Use pliers to counterhold socket when tightening bolt.

– Apply lever or ratchet with special wrench -T10035- and turn camshaft until threaded hole for camshaft clamp -T40070- points upwards.

– Initially screw bolt for camshaft clamp -T40070- only a few turns into inlet camshaft.

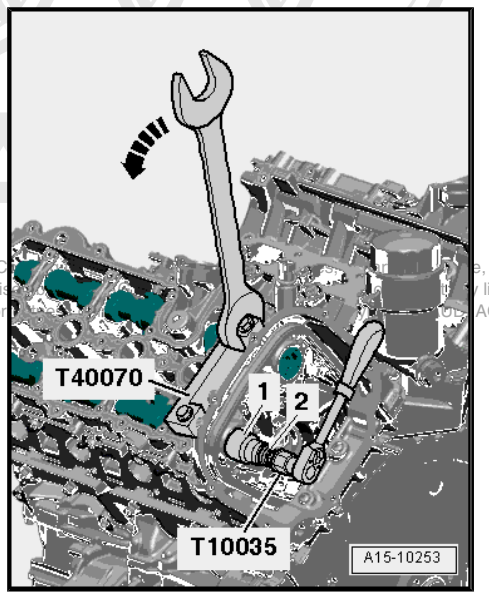
• The camshaft clamp -T40070- is positioned correctly if the holes for the cylinder head bolts remain free.

– Fit camshaft adjuster bolt -2- and socket (24 mm) -item 1- onto exhaust camshaft.

– Turn exhaust camshaft until threaded hole for camshaft clamp -T40070- points upwards.

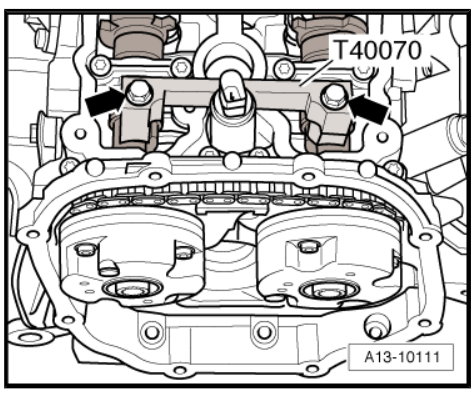
– At the same time apply open-end spanner (24 mm) to camshaft clamp -T40070- and pivot camshaft clamp -T40070- towards exhaust camshaft -arrow- until camshaft clamp can be fastened.

– Secure camshaft clamp -T40070- to exhaust camshaft only hand-tight, to avoid damaging the thread (assistance of 2nd mechanic required).



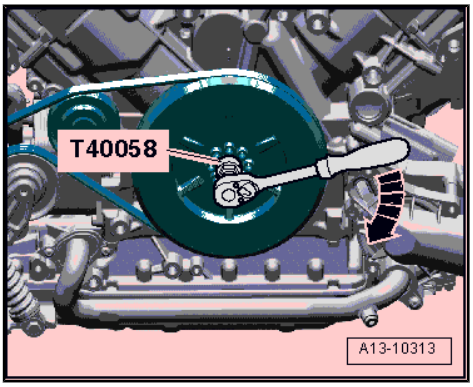
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– Tighten bolts for camshaft clamp -T40070- to 25 Nm.



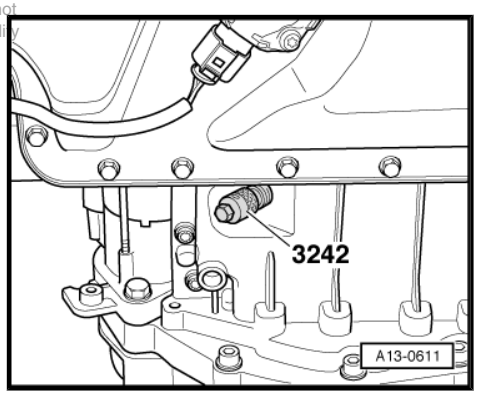
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– Using adapter -T40058- turn the crankshaft in the normal direction of rotation -arrow- to “TDC”.



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– Screw locking pin -3242- into bore (tightening torque: 20 Nm); if necessary, turn crankshaft backwards and forwards slightly to fully centralise locking pin.



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

– Install high-pressure pump ⇒ Rep. gr. 24 .
– Position timing chains on camshafts ⇒ page 92 .
– Install timing chain covers (left and right) ⇒ page 79 .
– Install cylinder head covers: left-side ⇒ page 116 , right-side ⇒ page 117 .

Caution

Avoid damage to valves and piston crowns after working on valve gear.

- ***The hydraulic tappets have to settle; wait for approx. 30 minutes after installing camshafts before starting engine.***
- ***Turn the engine carefully at least 2 rotations to ensure that none of the valves make contact when the starter is operated.***

3.4 Checking supporting elements with hydraulic clearance compensation

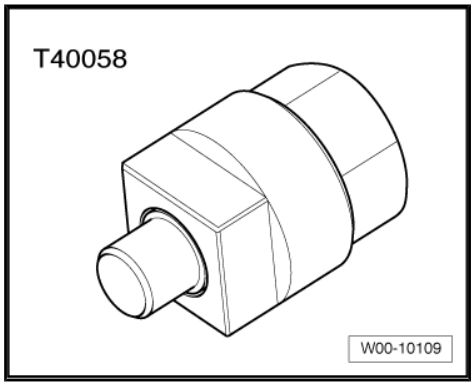
Note

- *It is not possible to service the supporting elements with hydraulic clearance compensation.*
- *Irregular valve noises when starting engine are normal.*

Special tools and workshop equipment required

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♦ Adapter -T40058-



♦ Feeler gauge

Procedure

– Start engine and run until radiator fan has started up once.

– Increase engine speed to about 2500 rpm for approx. 2 minutes; perform test drive if necessary.

Note

If irregular valve noise disappears but repeatedly re-occurs when travelling short distances, renew oil retention valve. Fitting location of oil retention valve ⇒ page 168 .

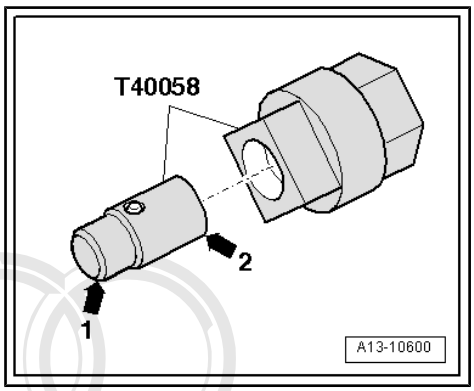
– If the supporting elements with hydraulic clearance compensation are still noisy, proceed as follows to determine the defective supporting element:

– Remove cylinder head cover: left-side ⇒ page 116 , right-side ⇒ page 117 .

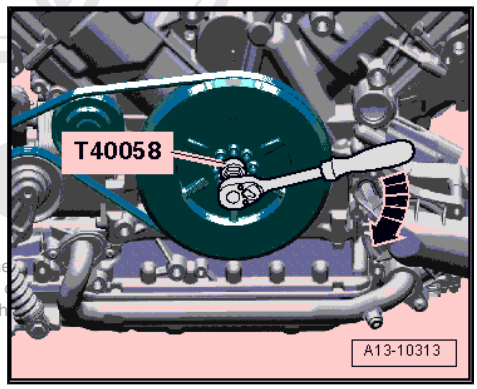
– Insert guide pin of adapter -T40058- as follows:

• The smaller-diameter section -arrow 1- faces the engine.

• The larger-diameter section -arrow 2- faces the adapter.



– Turn crankshaft until cam of supporting element to be tested is facing upwards.

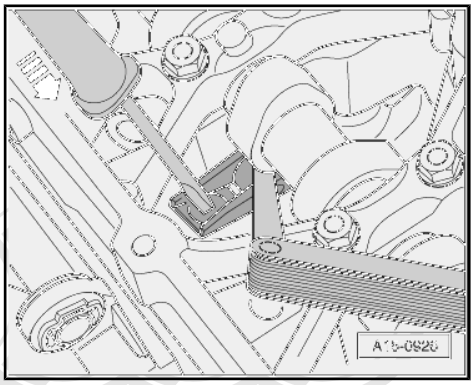


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– Press roller rocker finger down -arrow- to determine clearance between cam and roller rocker finger.

– If it is possible to insert a feeler gauge of 0.20 mm between cam and roller rocker finger, renew supporting element ⇒ “3.3 Removing and installing camshafts”, page 136 .



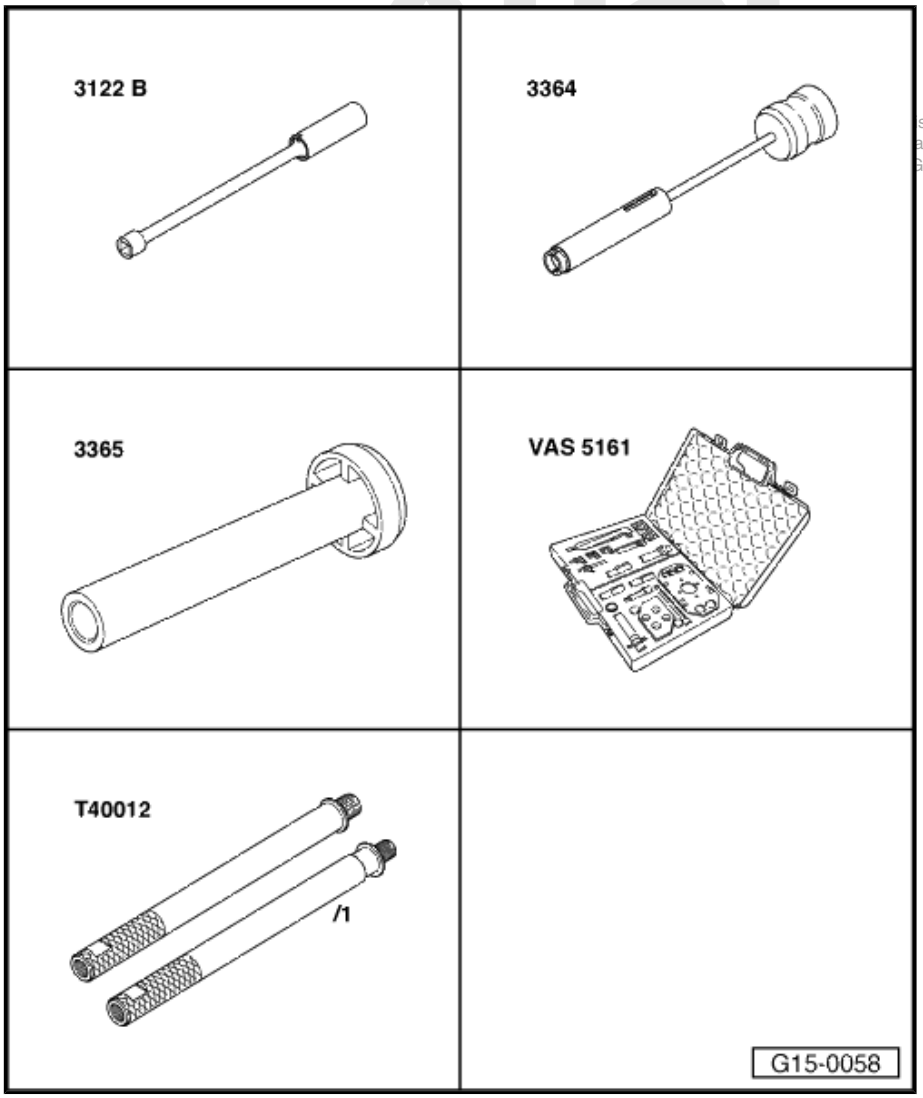
Additional steps required

– Install cylinder head cover: left-side ⇒ page 116 , right-side ⇒ page 117 .

3.5 Renewing valve stem oil seals with cylinder head installed

Special tools and workshop equipment required

- Spark plug socket and extension -3122 B-
- Valve stem seal puller -3364-
- Valve stem seal fitting tool -3365-
- Removal and installation device for valve cotters -VAS 5161- with guide plate -VAS 5161/19C-
- Adapters -T40012-



Removing

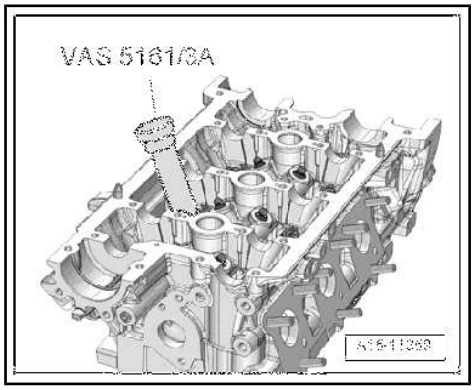
– Remove timing chains from camshafts ⇒ page 89 .

– Remove camshafts ⇒ page 136 .

– Remove spark plugs with spark plug socket -3122 B- .

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– Apply drift -VAS 5161/3A- to valve spring plate and use plastic-headed hammer to release sticking valve cotters.

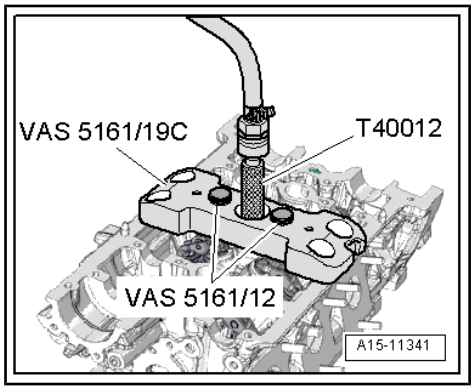


– Fit guide plate -VAS 5161/19C- from removal and installation device for valve cotters -VAS 5161- on cylinder head.

– Secure guide plate using knurled screws -VAS 5161/12- .

– Screw adapter -T40012- with seal hand-tight into the corresponding spark plug thread and apply a steady pressure.

• Minimum pressure: 6 bar



– Screw snap-in device -VAS 5161/6- with engaging fork -VAS 5161/5- into guide plate.

– Insert assembly cartridge -VAS 5161/8A- in guide plate.

– Hook pressure fork -VAS 5161/2- into snap-in device and press assembly cartridge downwards.

– At the same time, turn knurled screw of assembly cartridge clockwise until tips engage in valve cotters.

– Move knurled screw back and forth slightly; the valve cotters are thus forced apart and taken up by the assembly cartridge.

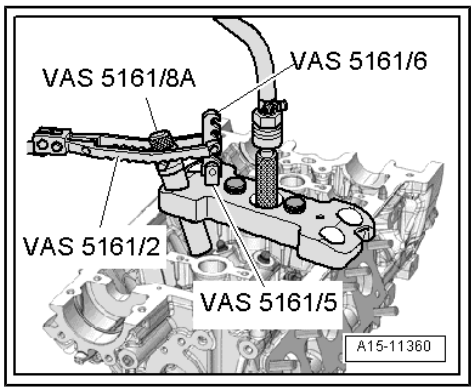
– Release pressure fork.

– Remove assembly cartridge.

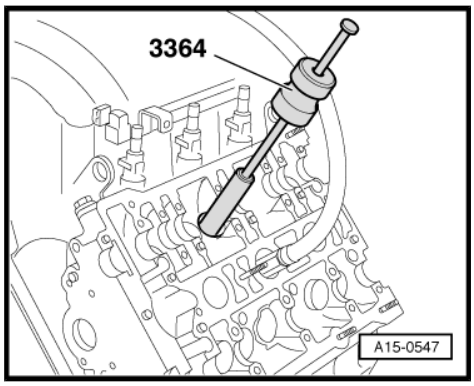
– Detach guide plate and turn to one side.

• The compressed air hose remains connected.

– Remove valve spring with valve spring plate.



– Remove valve stem oil seal using the valve stem seal puller -3364- .

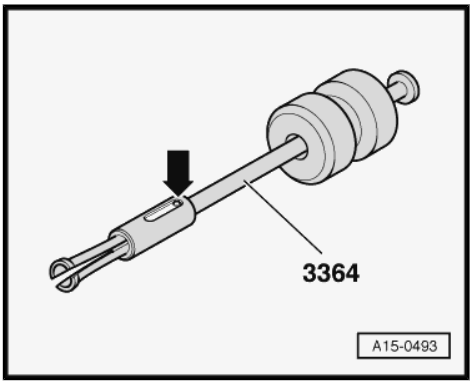


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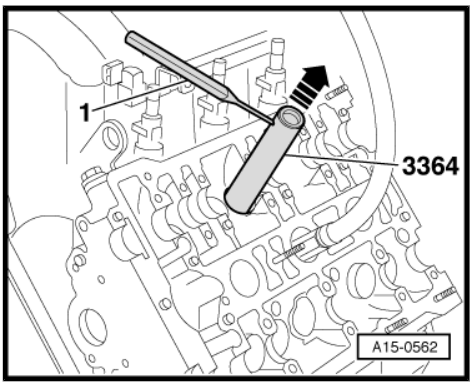
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If the valve stem seal puller -3364- cannot be used on some of the valve stem oil seals due to the confined space, proceed as follows:

– Knock out pin -arrow- of puller using a punch and remove the extractor attachment.



– Apply lower part of puller to valve stem oil seal.
– Secure puller with a punch -1- or other suitable tool as shown in the illustration.
– Apply assembly lever to puller and pull out valve stem oil seal -arrow-.

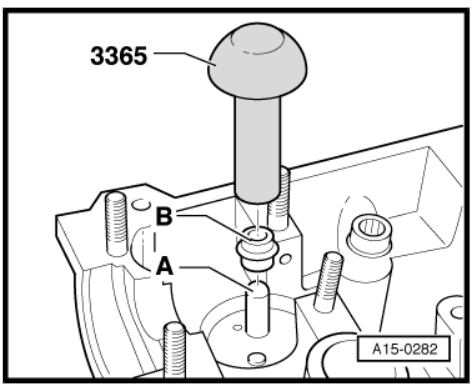


Installing

Caution

Make sure valve stem oil seals are not damaged when installing.

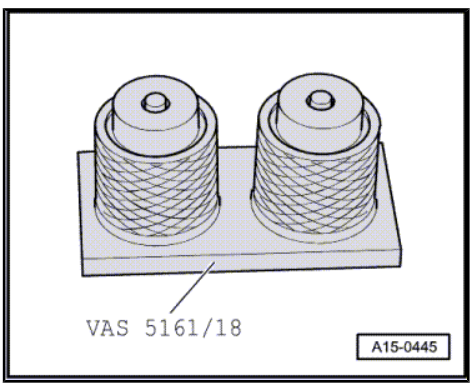
- ***New valve stem oil seals -B- are supplied with plastic sleeve; fit plastic sleeve -A- onto valve stem.***



– Lightly lubricate sealing lip of valve stem oil seal.
– Slip valve stem oil seal over plastic sleeve.
– Carefully press valve stem oil seal onto valve guide using valve stem seal fitting tool -3365- .
– Remove plastic sleeve.

If valve cotters had been removed from assembly cartridge they must first be inserted in insertion device -VAS 5161/18- .

- Larger diameter of valve cotters faces upwards.

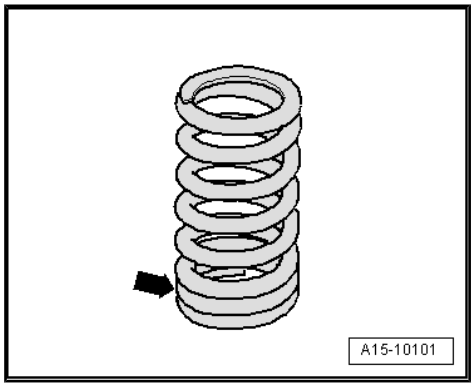


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– Install valve spring and valve spring plate.

• The closely spaced spring coils -arrow- face the cylinder head.



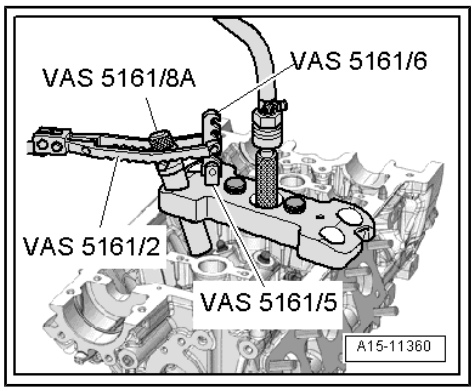
– Screw guide plate back onto cylinder head.

– Insert assembly cartridge into guide plate.

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

– Release pressure fork with knurled screw still in pulled position.

– Ensure that all roller rocker fingers contact the ends of the valve stems correctly and are clipped onto their respective supporting elements.



– Install spark plugs ⇒ Maintenance ; Booklet 404 .

– Install camshafts ⇒ page 136 .

– Position timing chains on camshafts ⇒ page 92 .

– Install timing chain covers (left and right) ⇒ page 79 .

– Install cylinder head cover: left-side ⇒ page 116 , right-side ⇒ page 117 .

Caution

Avoid damage to valves and piston crowns after working on valve gear.

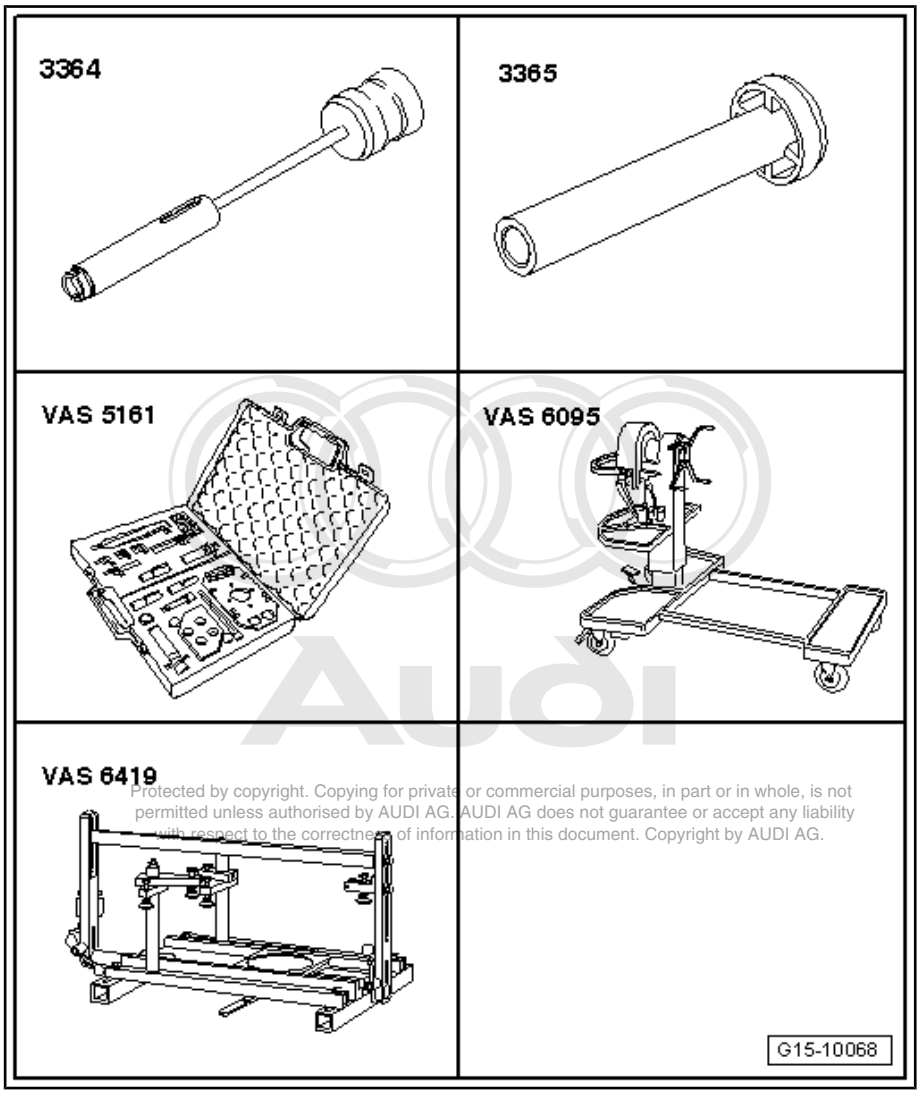
- ***The hydraulic tappets have to settle; wait for approx. 30 minutes after installing camshafts before starting engine.***
- ***Turn the engine carefully at least 2 rotations to ensure that none of the valves make contact when the starter is operated.***

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3.6 Renewing valve stem oil seals with cylinder head removed

Special tools and workshop equipment required

- Valve stem seal puller -3364-
- Valve stem seal fitting tool -3365-
- Removal and installation device for valve cotters -VAS 5161- with guide plate -VAS 5161/19C-
- Engine and gearbox support -VAS 6095-
- Cylinder head tensioning device -VAS 6419-



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Procedure

– Remove camshafts ⇒ page 136 .

– Mark original positions of roller rocker fingers and hydraulic compensation elements for reinstallation.

– Remove roller rocker fingers together with hydraulic compensation elements and put down on a clean surface.

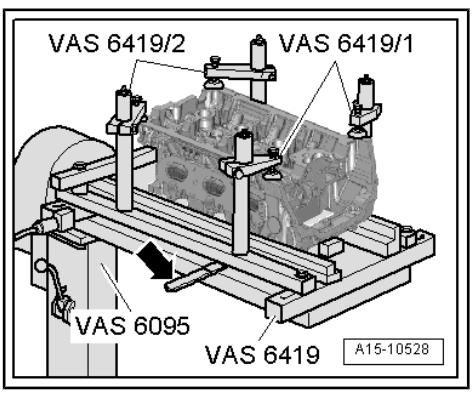
– Insert cylinder head tensioning device -VAS 6419- into engine and gearbox support -VAS 6095- .

– Secure cylinder head in cylinder head tensioning device, as shown in illustration.

– Connect cylinder head tensioning device to compressed air.

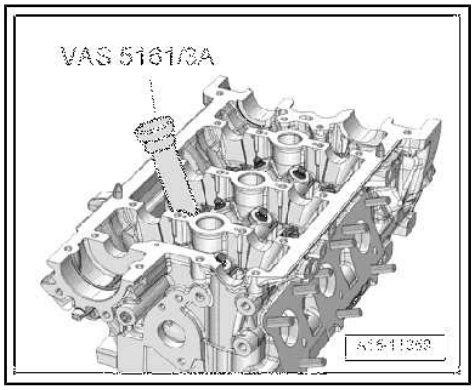
– Using lever -arrow-, slide air pad under combustion chamber where valve stem oil seal is to be removed.

– Apply just enough compressed air to bring air pad into contact with valve heads.

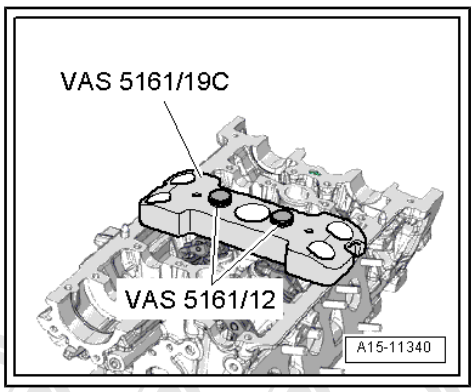


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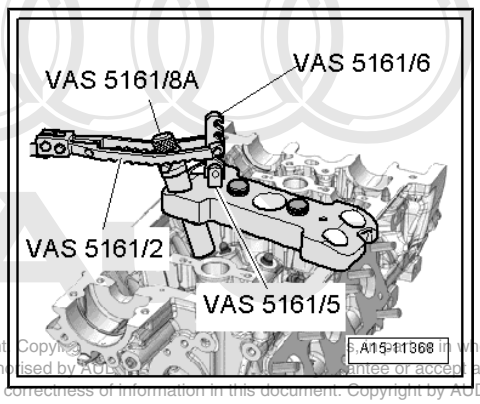
– Apply drift -VAS 5161/3A- to valve spring plate and use plastic-headed hammer to release sticking valve cotters.



– Fit guide plate -VAS 5161/19C- from removal and installation device for valve cotters -VAS 5161- on cylinder head.
– Secure guide plate with knurled screws -VAS 5161/12- .

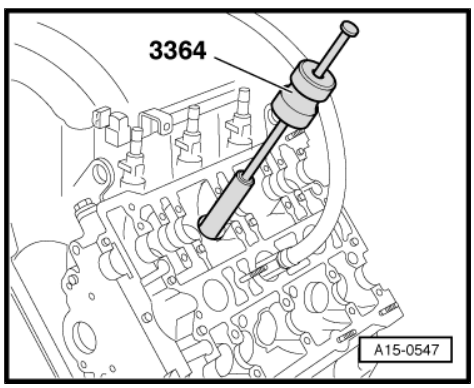


– Screw snap-in device -VAS 5161/6- with engaging fork -VAS 5161/5- into guide plate.
– Insert assembly cartridge -VAS 5161/8A- in guide plate.
– Attach pressure fork -VAS 5161/2- to snap-in device and push assembly cartridge down.
– At the same time, turn knurled screw of assembly cartridge clockwise until tips engage in valve cotters.
– Move knurled screw back and forth slightly; the valve cotters are thus forced apart and taken up by the assembly cartridge.
– Release pressure fork.
– Take out assembly cartridge.
– Detach guide plate and turn to one side.
– Detach valve spring with valve spring plate.



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– Pull off valve stem oil seal with valve stem seal puller -3364- .

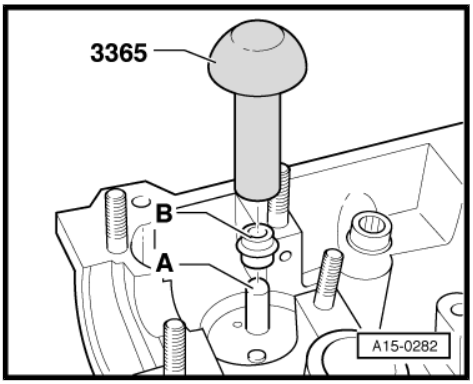


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Caution

Make sure valve stem oil seals are not damaged when installing.

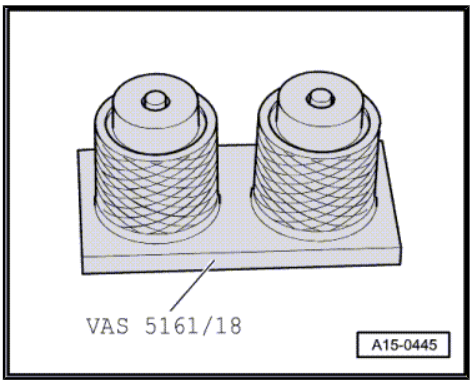
- *New valve stem oil seals -B- are supplied with plastic sleeve; fit plastic sleeve -A- onto valve stem.*



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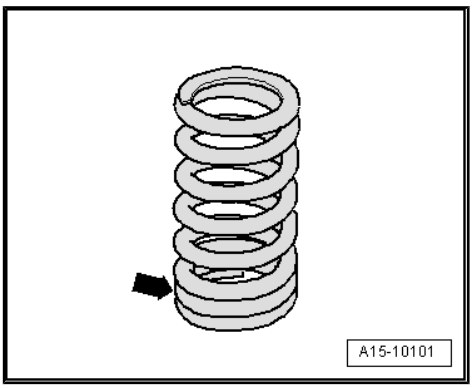
– Lightly oil sealing lip of valve stem oil seal.
– Slide valve stem oil seal onto plastic sleeve.
– Carefully press valve stem oil seal onto valve guide using valve stem seal fitting tool -3365- .
– Take off plastic sleeve.

If valve cotters have been removed from assembly cartridge, they must first be inserted in insertion device -VAS 5161/18- .

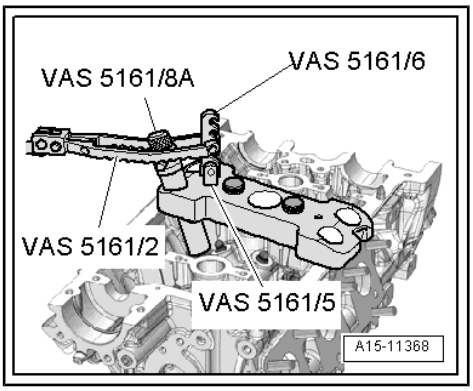


• Larger diameter of valve cotters faces upwards.
– Press assembly cartridge onto insertion device from above and take up valve cotters.

– Insert valve spring and valve spring plate.
• Installation position: Closely spaced spring coils -arrow- face towards cylinder head.



– Secure guide plate back onto cylinder head.
– Insert assembly cartridge in guide plate.
– Press down pressure fork and pull knurled screw upwards while turning screw in both directions - this will insert the valve cotters.
– Release pressure fork with knurled screw still in pulled position.
– Repeat procedure for each valve.



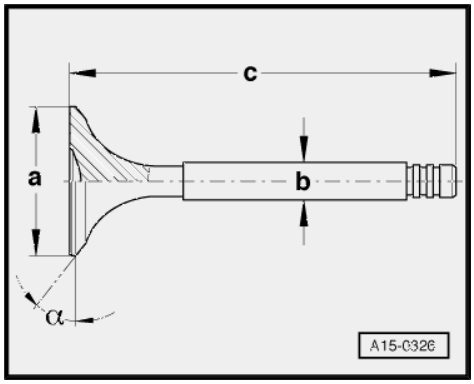
Assembling

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

– Ensure that all roller rocker fingers make contact with the ends of the valve stems correctly and are clipped onto their respective hydraulic compensation elements.
– Install camshafts ⇒ page 136 .

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3.7 Valve dimensions



Note

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

Dimension		Inlet valve	Exhaust valve
∅ a	mm	33.85 ± 0.10	28.0 ± 0.1
∅ b	mm	5.98 ± 0.01	5.96 ± 0.01
c	mm	103.97 ± 0.20	101.9 ± 0.2
α	∠°	45	45

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WARNING

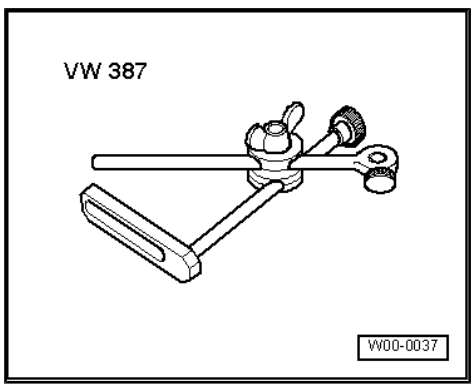
Care must be taken when disposing of old sodium-cooled exhaust valves - risk of injury.

- ***The valves must be sawn in two with a metal saw between the centre of the stem and valve head. When doing so, the valves must not come into contact with water.***
- ***Then throw a maximum of ten valves into a bucket of water and step away immediately.***
- ***A sudden chemical reaction will occur upon contact with water in which the sodium filling burns.***
- ***After performing these steps the valves can be disposed of in the normal way.***

3.8 Checking valve guides

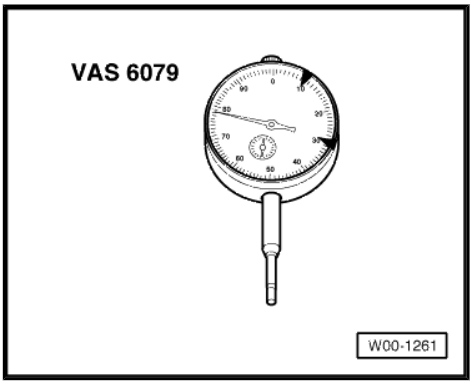
Special tools and workshop equipment required

- Universal dial gauge bracket -VW 387-

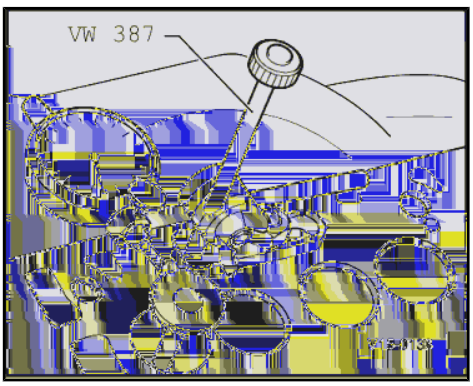


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♦ Dial gauge -VAS 6079-



Procedure



Note

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

♦ *Only insert inlet valve into inlet guide and exhaust valve into exhaust guide, as the stem diameters are different.*

– Insert valve into valve guide.

• End of valve stem must be flush with valve guide.

– Determine amount of sideways play.

• Wear limit: 0.8 mm.

– If the wear limit is exceeded, repeat the measurement with new valves.

– Renew cylinder head if wear limit is still exceeded.

Note

Valve guides cannot be renewed.

3.9 Checking valves

– Visually inspect for scoring on valve stems and valve seat surfaces.

– Renew valve if scoring is clearly visible.

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17 – Lubrication

1 Oil pump and sump (bottom section)

⇒ “1.1 Oil pump and sump (bottom section) - exploded view”, page 154

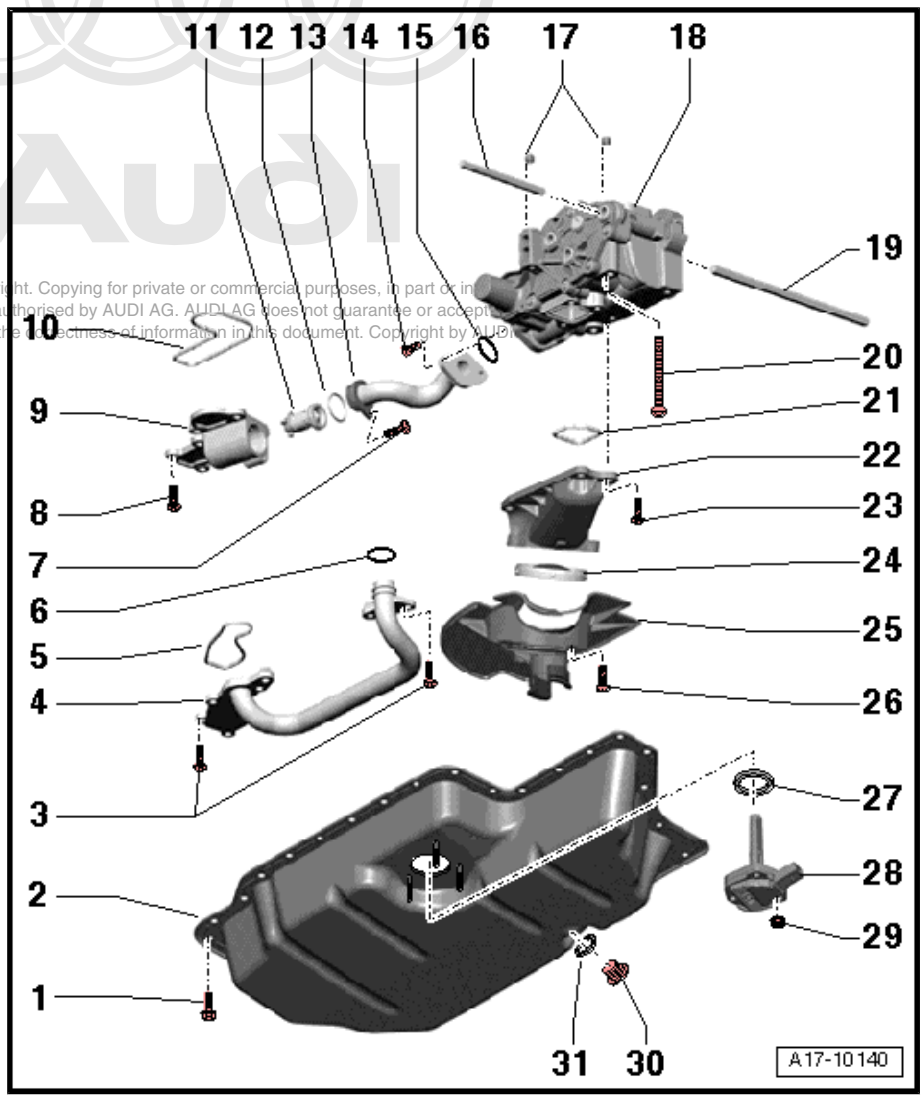
⇒ “1.2 Removing and installing sump (bottom section)”, page 156

⇒ “1.3 Removing and installing oil pump”, page 158

1.1 Oil pump and sump (bottom section) - exploded view

Note

If large quantities of metal shavings or abrasion are found when performing engine repairs, this may be an indication of damage to the crankshaft or conrod bearings. To prevent further damage, the following steps are required after completion of repair work: clean the oil galleries carefully and renew the oil spray jets, oil cooler and oil filter.



1 - Bolt
- ❑ Tightening torque and sequence ⇒ page 155

2 - Sump (bottom section)
- ❑ Removing and installing ⇒ page 156

3 - Bolt
- ❑ 9 Nm

4 - Oil pipe

5 - Gasket
- ❑ Renew

6 - O-ring
- ❑ Renew

7 - Bolt
- ❑ 9 Nm

8 - Bolt
- ❑ 9 Nm

9 - Housing for oil retention valve

10 - Gasket
- ❑ Renew

11 - Oil retention valve

12 - O-ring
- ❑ Renew

13 - Oil pipe

14 - Bolt
- ❑ 9 Nm

15 - O-ring
- ❑ Renew

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16 - Drive shaft for coolant pump

17 - Dowel sleeves

- ❑ 2x

18 - Oil pump

- ❑ Do not dismantle
- ❑ With pressure control valve: approx. 5.5 bar
- ❑ Removing and installing ⇒ page 158

19 - Oil pump drive shaft

20 - Bolt

- ❑ Renew
- ❑ 8 Nm + 90° ($^1/_4$ turn further)

21 - Gasket

- ❑ Renew

22 - Intake connecting pipe

- ❑ For oil pump

23 - Bolt

- ❑ Renew
- ❑ 5 Nm + turn +45° further

24 - Oil strainer

- ❑ Clean

25 - Baffle plate

26 - Bolt

- ❑ Renew
- ❑ 5 Nm + turn +45° further

27 - Seal

- ❑ Renew

28 - Oil level and oil temperature sender -G266-

29 - Nut

- ❑ 9 Nm

30 - Oil drain plug

- ❑ 25 Nm

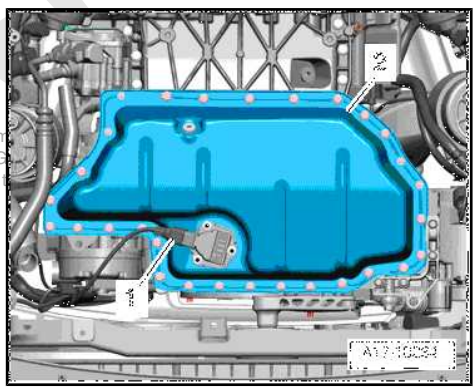
31 - Seal

- ❑ Renew

Tightening torque and sequence for sump (bottom section)

– Tighten bolts in 3 stages as follows:

1. Screw in bolts by hand and in diagonal sequence.
2. Pre-tighten bolts to 5 Nm in diagonal sequence.
3. Tighten bolts to 9 Nm in diagonal sequence.



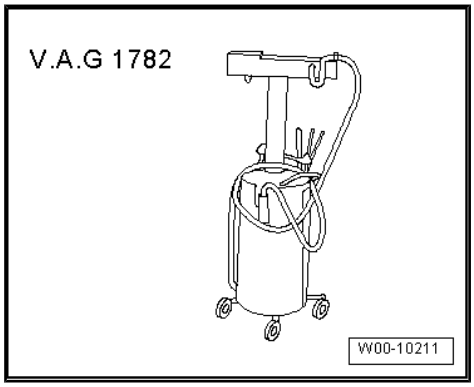
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1.2 Removing and installing sump (bottom section)

Special tools and workshop equipment required

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



- Electric drill with plastic brush attachment
- Safety goggles
- Sealant ⇒ Electronic parts catalogue

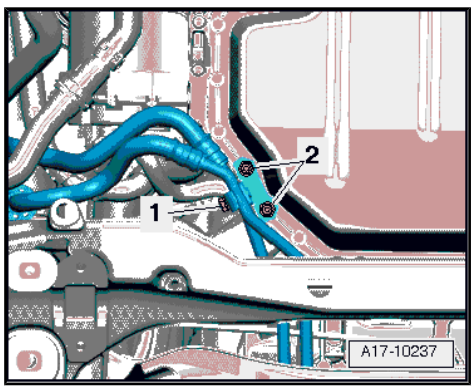
Removing

– Drain off coolant ⇒ page 181 .

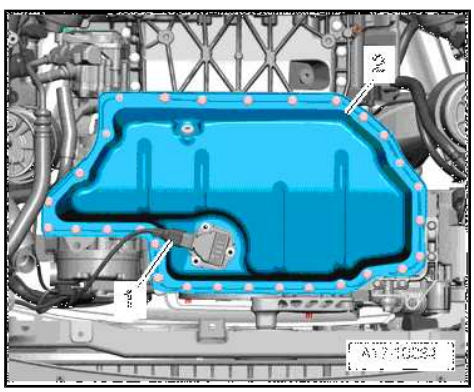
– Remove coolant pipe (front) ⇒ page 198 .

– Unscrew nuts -1 and 2-.

– Detach bracket for ATF lines.



– Unplug electrical connector -1- at oil level and oil temperature sender -G266-.



– Place used oil collection and extraction unit -V.A.G 1782- under engine and drain engine oil.

– Unbolt sump (bottom section) -2- and pry off carefully.

Note

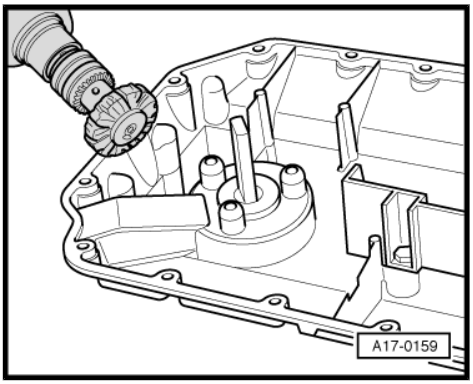
There will still be some oil in the sump (bottom section).

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Installing

- Tightening torque
  ⇒ Fig. ""Tightening torque and sequence for sump (bottom section)"" , page 155



Note

Renew seals.

WARNING

Protect eyes against injuries.

- ***Wear safety goggles.***

Caution

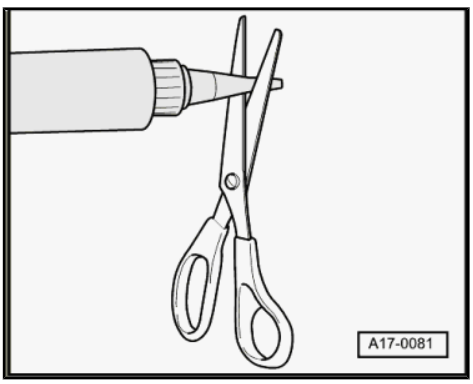
Protect lubrication system and bearings against contamination.

- ***Cover exposed parts of the engine.***

– Remove sealant residue from bottom and top sections of sump with rotating plastic brush or similar.

– Clean sealing surfaces; they must be free of oil and grease.

– Cut off tube nozzle at front marking (diameter of nozzle approx. 2 mm).

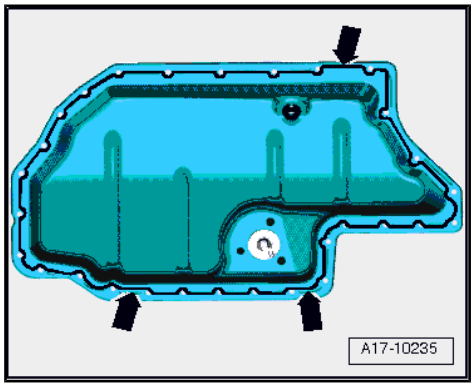


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– Apply bead of sealant -arrow- onto clean sealing surface of sump (bottom section) as illustrated.

- Width of sealant bead: 2.5 mm.



Caution

Make sure oil strainer is not clogged by excess sealant.

- ***The bead of sealant must not be thicker than specified.***

Note

The sump (bottom section) must be installed within 5 minutes after applying sealant.

– Fit sump (bottom section) and tighten bolts ⇒ page 155 .

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

– Install coolant pipe (front) ⇒ page 198 .

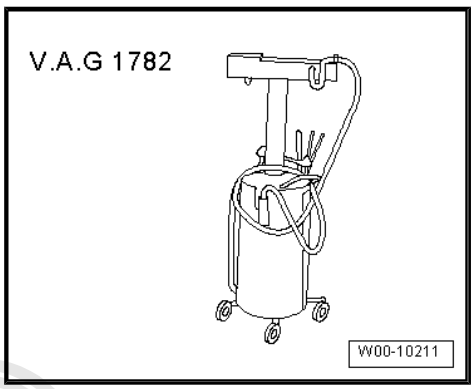
– Fill up with engine oil and check oil level ⇒ page 176 .

– Fill cooling system ⇒ page 182 .

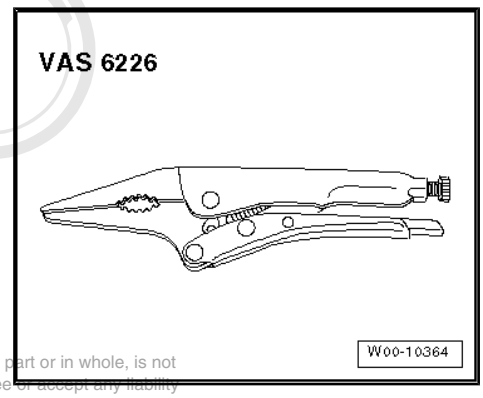
1.3 Removing and installing oil pump

Special tools and workshop equipment required

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



- Long-nose grip pliers -VAS 6226-

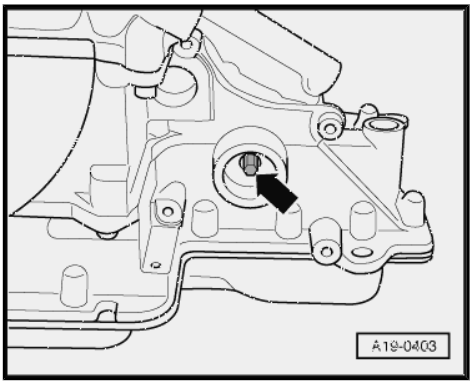


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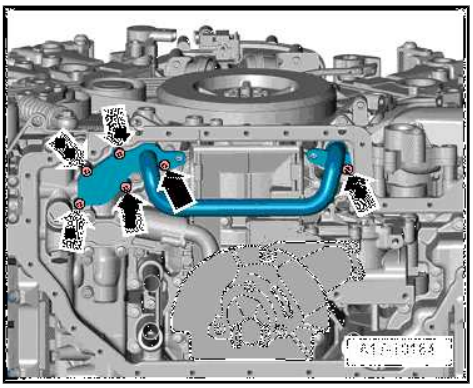
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Removing

– Drain off coolant ⇒ page 181 .
– Remove coolant pipe (front) ⇒ page 198 .
– Remove coolant pump ⇒ page 191 .
– Remove sump (bottom section) ⇒ page 156 .
– Remove drive shaft -arrow- for coolant pump from the oil pump.



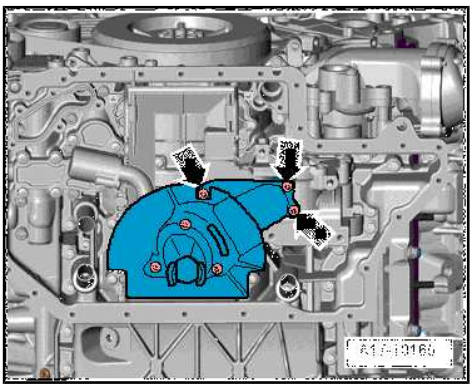
– Place used oil collection and extraction unit -V.A.G 1782- under engine.
– Unscrew bolts -arrows- and remove oil pipe.



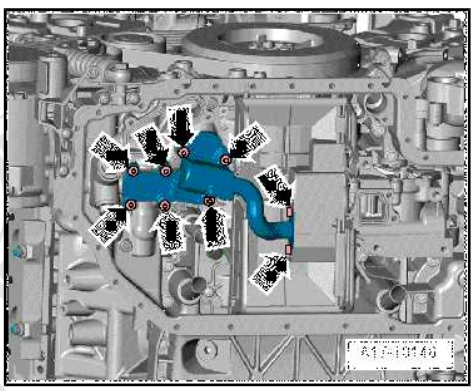
Note

Some oil will come out when oil pipe is removed.

– Unscrew bolts -arrows- and remove intake connecting pipe.



– Remove oil pipe together with oil retention valve housing.



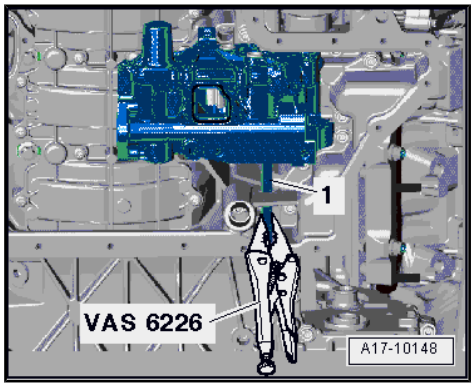
Note

Some oil will come out when oil pipe is removed.

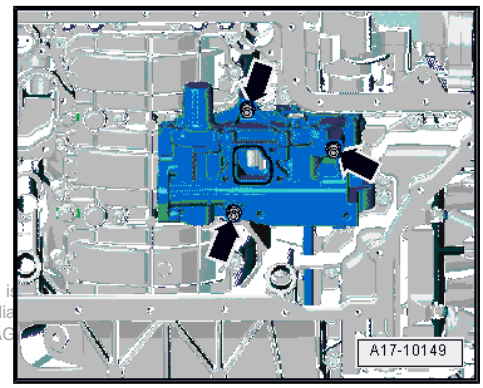
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– Press oil pump drive shaft -1- back against spring pressure and hold firmly with long-nose grip pliers -VAS 6226- .



– Unscrew bolts -arrows- and remove oil pump.



Installing

- Tightening torques
  ⇒ "1.1 Oil pump and sump (bottom section) - exploded view", page 154

Note

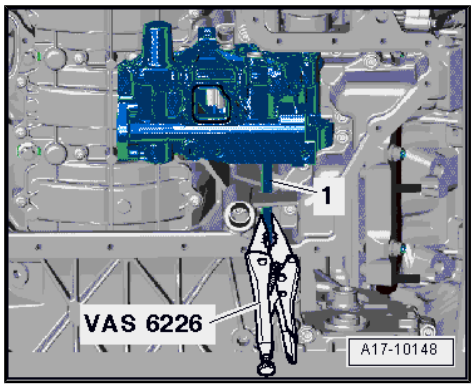
Renew seals and O-rings.

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– Check whether the two dowel sleeves are fitted in the cylinder block; install if necessary.

– Secure the oil pump -arrows-.

– Release long-nose grip pliers -VAS 6226- and let drive shaft -1- slide into oil pump.



– Check to ensure that the drive shaft is positively engaged in the oil pump. Try to turn the oil pump gears by reaching into the opening in the intake pipe -arrow- of oil pump.

- You should not be able to turn the gears.

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

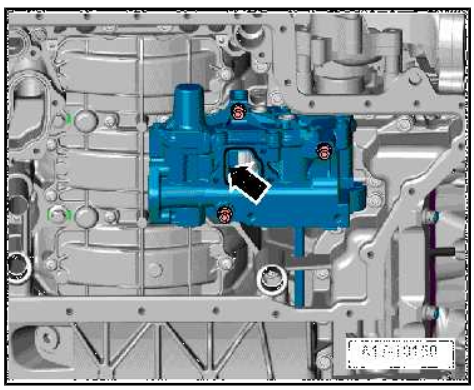
– Install coolant pump ⇒ page 191 .

– Install sump (bottom section) ⇒ page 157 .

– Install coolant pipe (front) ⇒ page 198 .

– Fill up with engine oil and check oil level ⇒ page 176 .

– Fill cooling system ⇒ page 182 .



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2 Sump (top section)

⇒ “2.1 Sump (top section) - exploded view”, page 161

⇒ “2.2 Removing and installing sump (top section)”, page 162

2.1 Sump (top section) - exploded view

1 - Gaskets
- ❑ Renew

2 - O-ring
- ❑ Renew

3 - Gaskets
- ❑ Renew

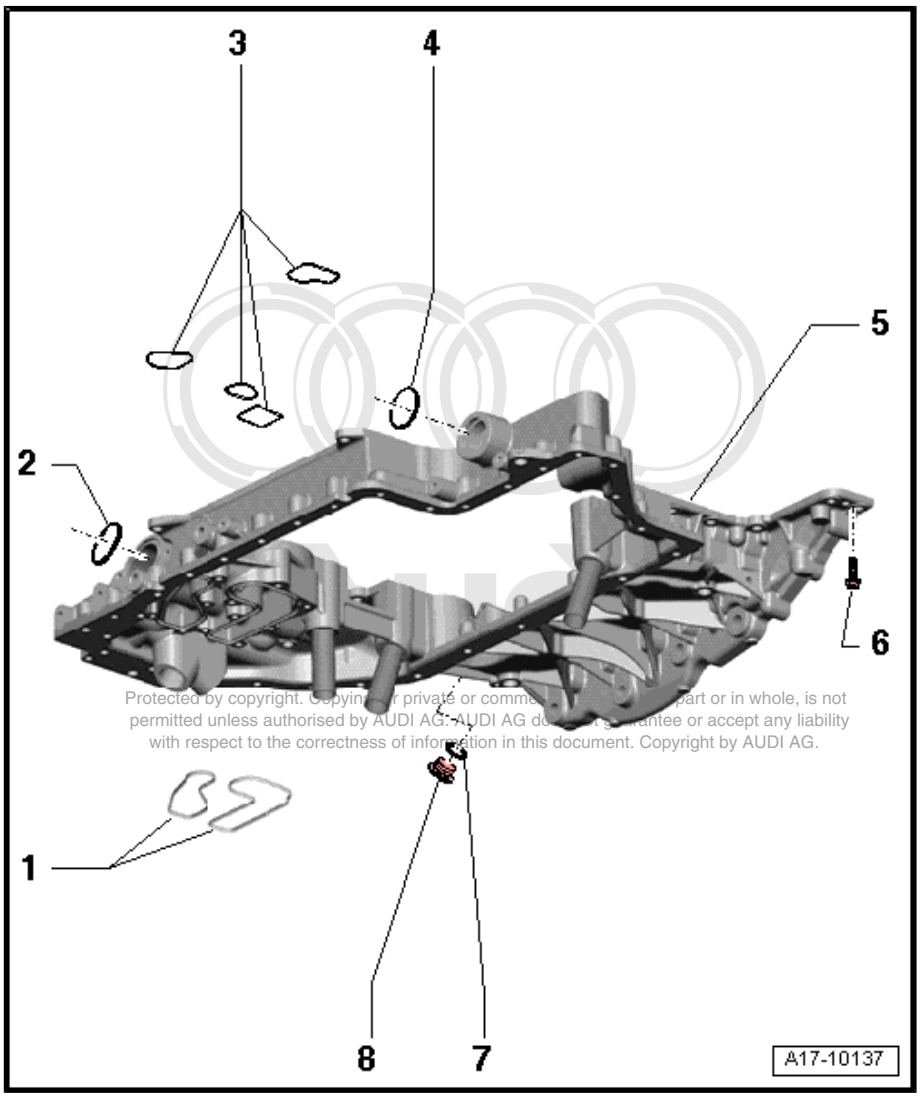
4 - O-ring
- ❑ Renew

5 - Sump (top section)
- ❑ With 2 locating pins
- ❑ Removing and installing ⇒ page 162

6 - Bolt
- ❑ Tightening torque and sequence ⇒ page 162

7 - Seal
- ❑ Renew

8 - Screw plug
- ❑ 35 Nm



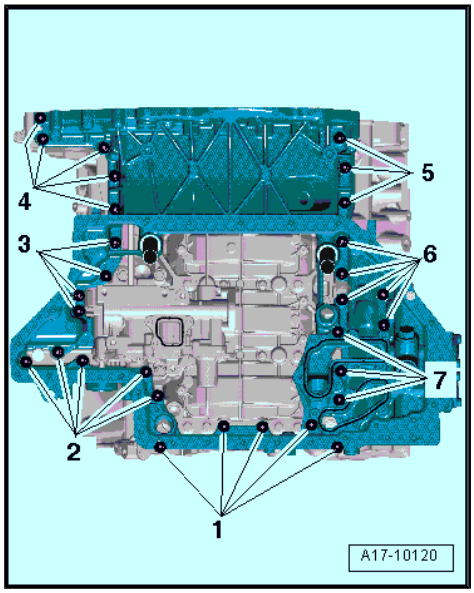
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Tightening torque and sequence for sump (top section)

– Tighten bolts -1 … 7- in 2 stages as follows:

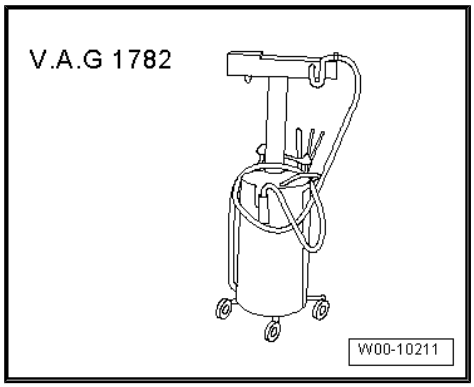
1. Pre-tighten bolts to 5 Nm in diagonal sequence.
2. Tighten bolts to 14 Nm in diagonal sequence.



2.2 Removing and installing sump (top section)

Special tools and workshop equipment required

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



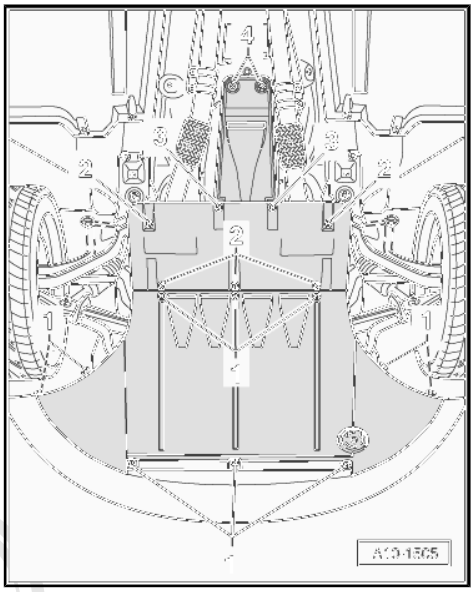
- Safety goggles
- Electric drill with plastic brush attachment
- Sealant ⇒ Electronic parts catalogue

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Removing

– Release fasteners -1, 2, 4- to remove noise insulation panels.



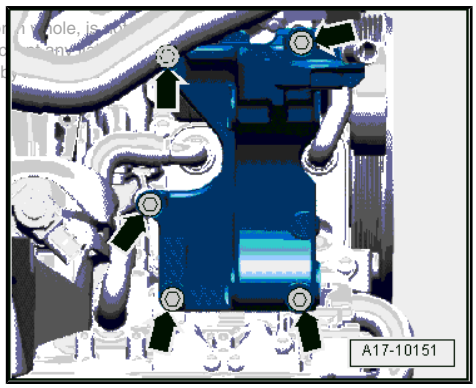
Note

Disregard -item 3-.

– Place used oil collection and extraction unit -V.A.G 1782- under engine and drain engine oil.
– Remove engine ⇒ page 7 .
– Separate engine from gearbox ⇒ page 25 .
– Secure engine to engine stand ⇒ page 33 .
– Remove drive plate ⇒ page 58 .
– Remove timing chain covers (left and right) ⇒ page 78 .
– Remove intake manifold ⇒ Rep. gr. 24 .
– Remove oil filter housing ⇒ page 172 .
– Remove timing chain cover (bottom) ⇒ page 81 .
– Remove tensioner for poly V-belt ⇒ page 53 .
– Remove coolant pipe (front) ⇒ page 198 .
– Remove coolant pump ⇒ page 191 .
– Remove alternator ⇒ Electrical system; Rep. gr. 27

– Remove bolts -arrows- and detach bracket for alternator.

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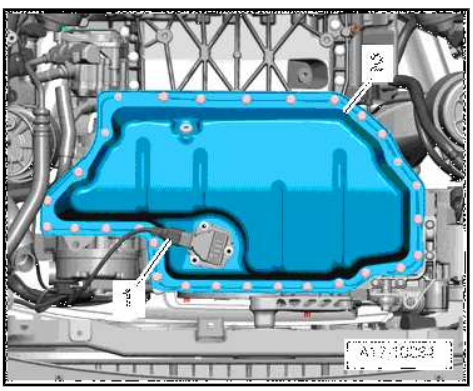


– Unplug electrical connector -1- at oil level and oil temperature sender -G266- .
– Place used oil collection and extraction unit -V.A.G 1782- under engine.

Note

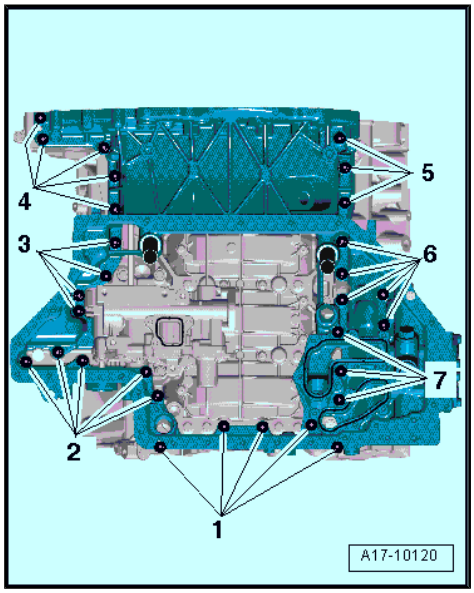
There will still be some oil in the sump (bottom section).

– Unbolt sump (bottom section) -2- and pry off carefully.



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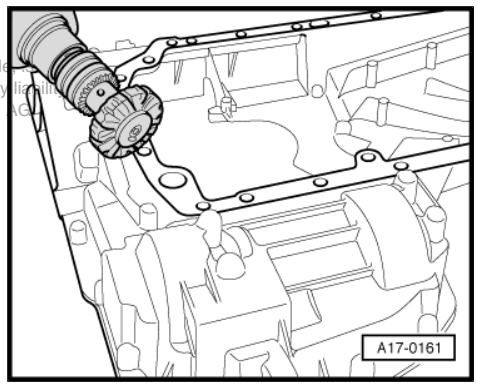
– Remove oil pump ⇒ page 158 .
– Remove bolts -1 … 7- for sump (top section).
– Press sump (top section) off spring pins on cylinder block.



Installing

Tightening torques

- ⇒ “1.1 Poly V-belt drive - exploded view”, page 52 .
- ⇒ Fig. ““Tightening torque and sequence for sump (top section)”“ , page 162 .



Note

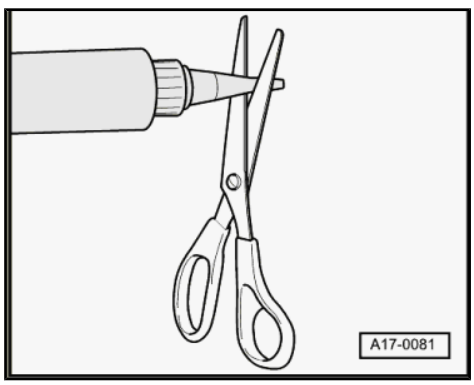
Renew seals and O-rings.

WARNING

Protect eyes against injuries.

- ***Wear safety goggles.***

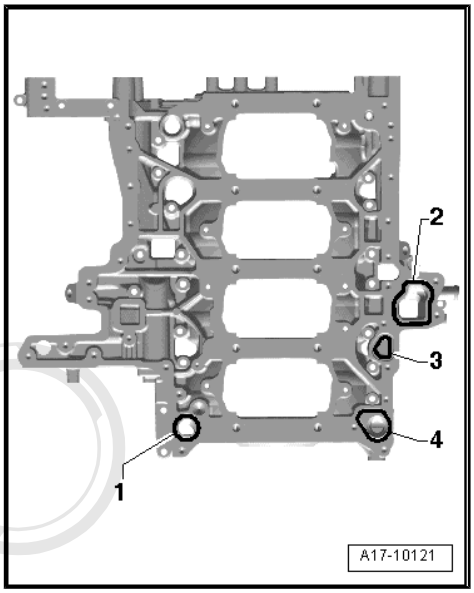
– Remove sealant residue from sump (top section) and cylinder block with rotating plastic brush or similar.
– Clean sealing surfaces; they must be free of oil and grease.
– Cut off tube nozzle at front marking (diameter of nozzle approx. 1 mm).



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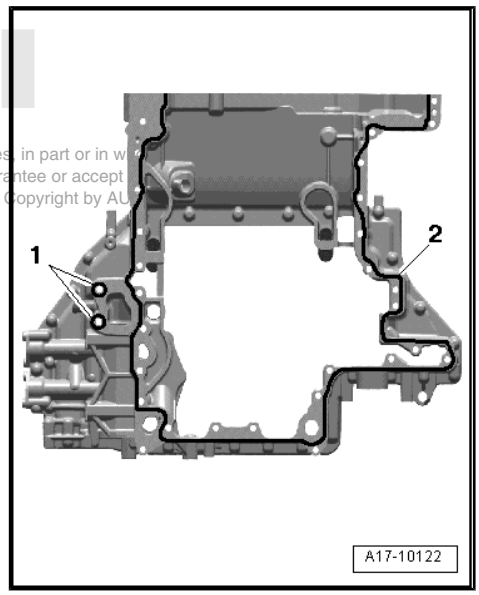
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– Fit new seals -1 ... 4- in grooves on cylinder block.



– Apply beads of sealant -1 and 2- onto clean sealing surface of sump (top section) as illustrated.

♦ Width of beads of sealant: 2.5 mm.



Caution

Make sure oil strainer is not clogged by excess sealant.

- ***The sealant bead must not be thicker than specified.***

Note

The sump (top section) must be installed within 5 minutes after applying sealant.

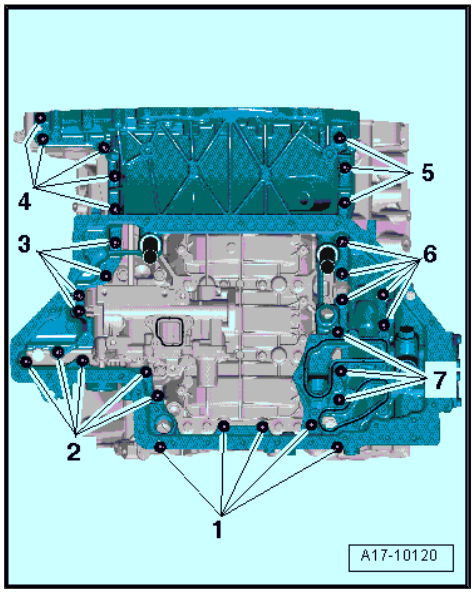
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– Fit sump (top section) and tighten bolts ⇒ page 162 .

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

– Install oil pump ⇒ page 158 .
– Install coolant pump ⇒ page 191 .
– Install sump (bottom section) ⇒ page 157 .
– Install coolant pipe (front) ⇒ page 198 .
– Install tensioner for poly V-belt ⇒ page 53 .
– Install alternator ⇒ Electrical system; Rep. gr. 27
– Install timing chain cover (bottom) ⇒ page 81 .
– Install crankshaft oil seal (gearbox end) ⇒ page 59 .
– Install oil filter housing ⇒ page 172 .
– Install intake manifold ⇒ Rep. gr. 24 .
– Install timing chain covers (left and right) ⇒ page 78 .
– Install drive plate ⇒ page 58 .
– Install engine ⇒ page 35 .
– Fill up with engine oil and check oil level ⇒ page 176 .



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3 Oil retention valve, spray nozzle valve, oil filter housing, oil cooler, oil pressure switch

⇒ “3.1 Oil retention valve and spray nozzle valve - exploded view”, page 168

⇒ “3.2 Removing and installing oil retention valve and spray nozzle valve”, page 169

⇒ “3.3 Removing and installing hose for crankcase breather system”, page 170

⇒ “3.4 Oil filter housing - exploded view”, page 170

⇒ “3.5 Removing and installing oil filter housing”, page 172

⇒ “3.6 Removing and installing oil cooler”, page 172

⇒ “3.7 Removing and installing oil pressure switch F1 ”, page 174

⇒ “3.8 Checking oil pressure and oil pressure switch F1 ”, page 175

⇒ “3.9 Engine oil”, page 176

⇒ “3.10 Checking oil level”, page 176

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3.1 Oil retention valve and spray nozzle valve - exploded view

1 - O-ring
- ❑ Renew

2 - Spray nozzle valve
- ❑ Removing and installing ⇒ page 169

3 - Gasket
- ❑ Renew

4 - Cover

5 - O-ring
- ❑ Renew

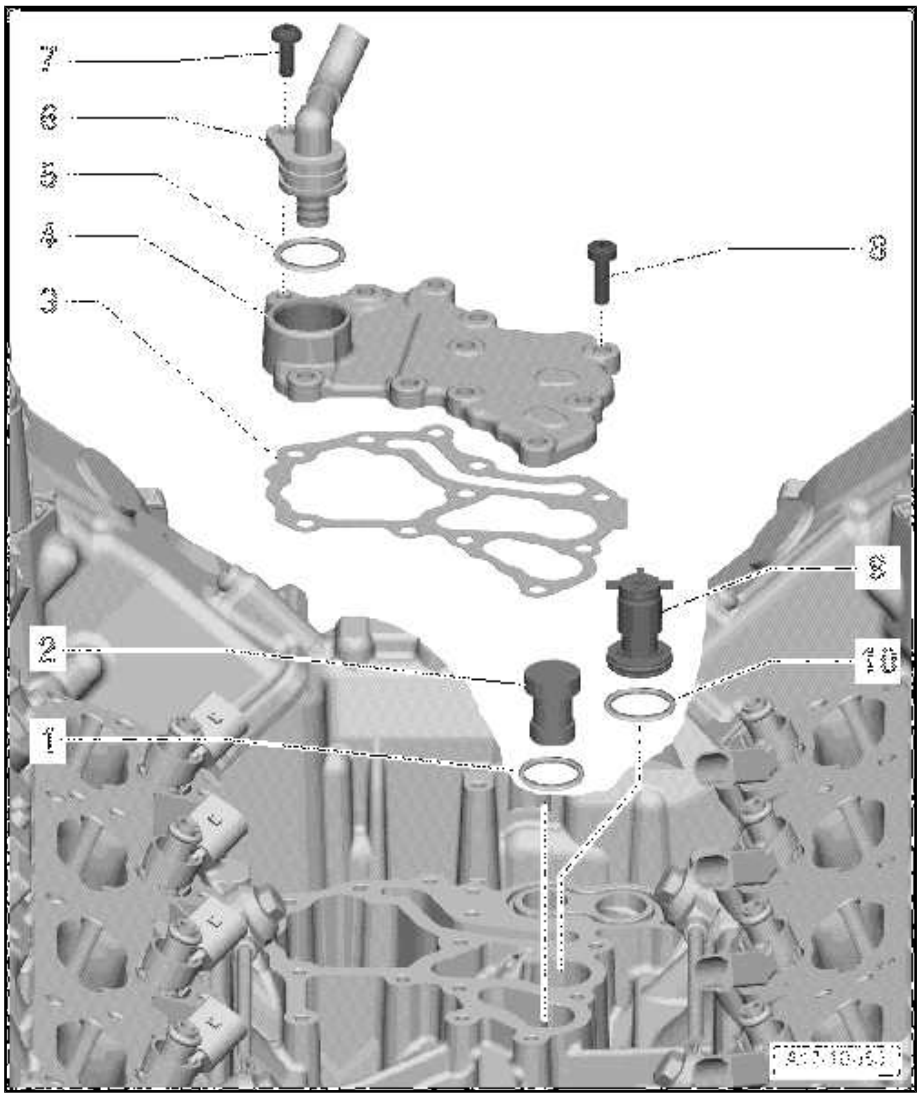
6 - Hose
- ❑ For crankcase breather

7 - Bolt
- ❑ 9 Nm

8 - Bolt
- ❑ 9 Nm

9 - Oil retention valve
- ❑ Removing and installing ⇒ page 169

10 - O-ring
- ❑ Renew



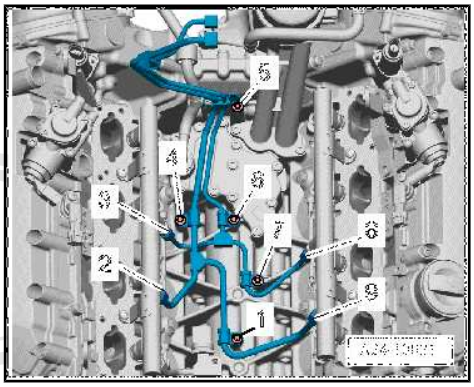
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3.2 Removing and installing oil retention valve and spray nozzle valve

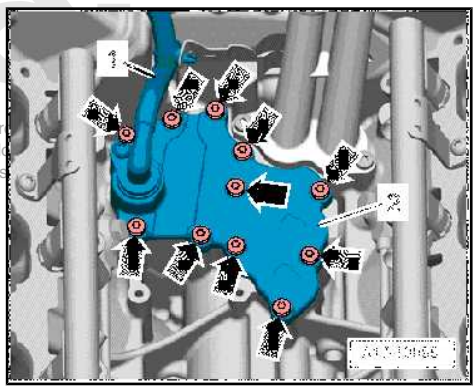
Note

If irregular valve noise disappears after a lengthy drive but repeatedly re-occurs when travelling short distances, renew oil retention valve.

Removing

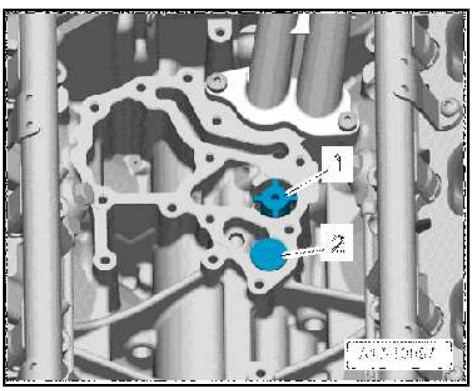


– Remove intake manifold ⇒ Rep. gr. 24 .
– Remove bolts -1, 4, 5, 6, 7- at retaining clips for high-pressure lines.
– Unplug electrical connectors at injectors.
– Unscrew high-pressure pipes -2 and 9- from connections at fuel rail.
– Unscrew high-pressure pipes -3 and 8- from connections at fuel rail. To do so, counterhold at hexagon flats with an open-end spanner and slacken union nut.
– Detach high-pressure pipes.



– Remove bolts -arrows-.
– Detach cover -2- with hose -1- for crankcase breather system.
– Remove gasket.

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– Pull out oil retention valve -1- and spray nozzle valve -2-.

Installing

• Tightening torques ⇒ page 168

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

Note

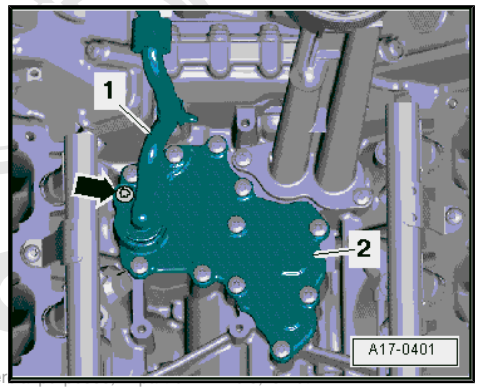
Renew gaskets, seals and O-rings.

– Install high-pressure lines ⇒ Rep. gr. 24 ; procedure described in “Removing and installing injectors”.
– Install intake manifold ⇒ Rep. gr. 24 .

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3.3 Removing and installing hose for crankcase breather system

Removing



– Remove intake manifold ⇒ Rep. gr. 24 .

– Remove bolt -arrow- and pull out crankcase breather hose -1- from cover -2-.

Installing

• Tightening torque ⇒ page 168

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

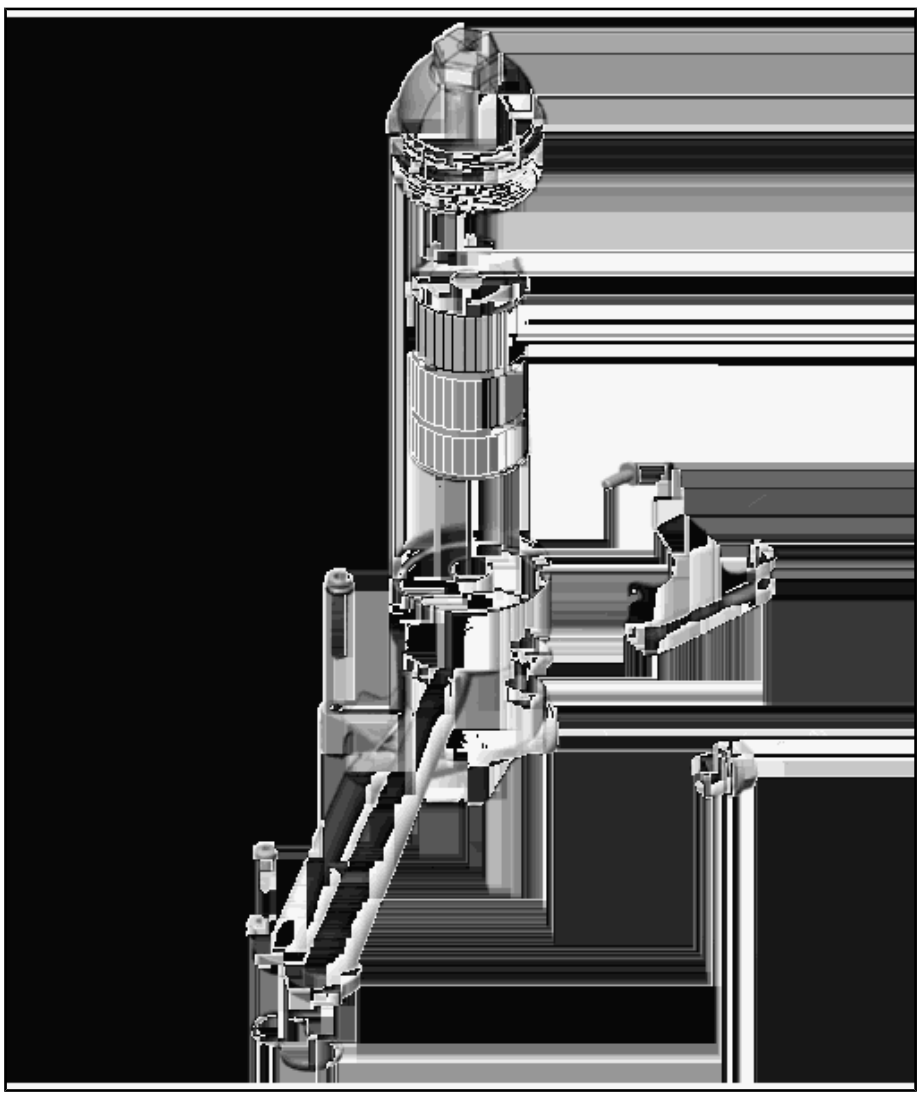
Note

Fit new O-ring.

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– Install intake manifold ⇒ Rep. gr. 24 .

3.4 Oil filter housing - exploded view



1 - Gasket
- ❑ Renew

2 - Bolt
- ❑ 9 Nm

3 - Oil filter housing
- ❑ With oil filter bypass valve 1.3 bar

4 - Bolt
- ❑ 22 Nm

5 - O-ring
- ❑ Part of oil filter element

6 - Oil filter element
- ❑ Renew O-ring -item 7- when renewing filter
- ❑ Observe change intervals ⇒ Maintenance ; Booklet 404

7 - O-ring
- ❑ Renew

8 - Sealing cap
- ❑ 25 Nm

9 - Bolt
- ❑ 9 Nm

10 - Bracket
- ❑ For activated charcoal filter solenoid valve 1 - N80-

11 - Screw plug
- ❑ 50 Nm

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12 - Screw plug

- ❑ 9 Nm

13 - Seal

- ❑ Renew

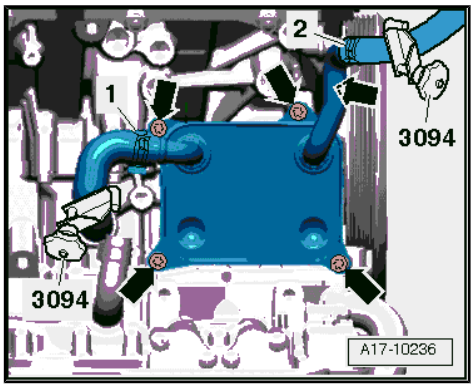
14 - O-ring

- ❑ Renew

Oil cooler

Bolts -arrows-

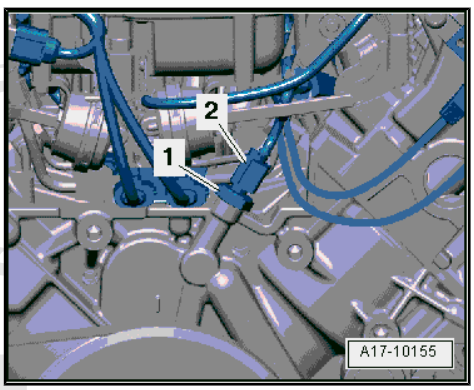
- 9 Nm



Oil pressure switch -F1-

Oil pressure switch -F1- -item 1-

- 20 Nm
- Renew seal

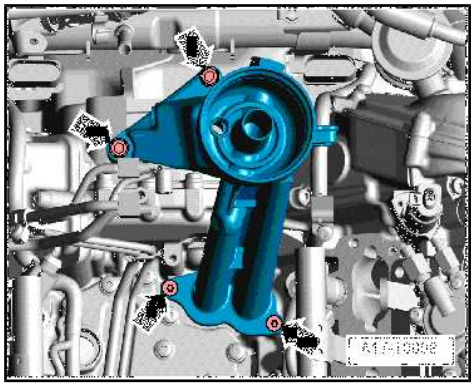


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3.5 Removing and installing oil filter housing

Removing



– Remove intake manifold ⇒ Rep. gr. 24 .

Note

Place a cloth around the oil filter housing to catch escaping oil.

– Unscrew sealing cap and remove oil filter element.
– Unscrew bolts -arrows- and remove oil filter housing.

Installing

• Tightening torques ⇒ page 170

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

Note

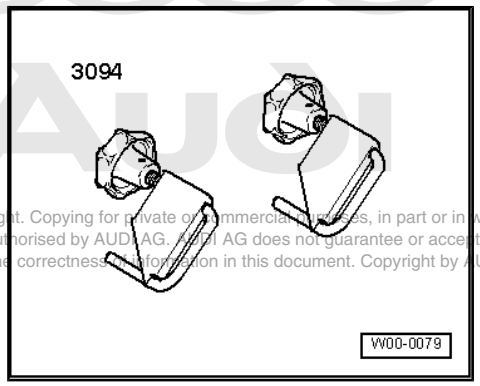
Renew seals and O-rings.

– Install intake manifold ⇒ Rep. gr. 24 .
– Check oil level ⇒ page 176 .

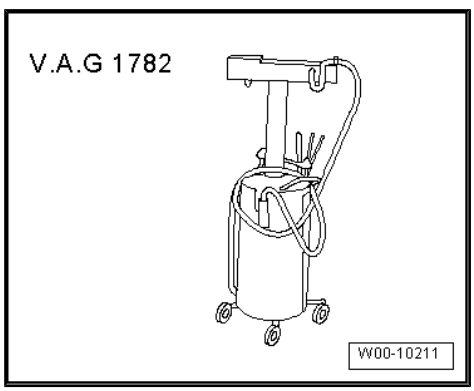
3.6 Removing and installing oil cooler

Special tools and workshop equipment required

♦ Hose clamps for hoses up to 25 mm -3094-



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



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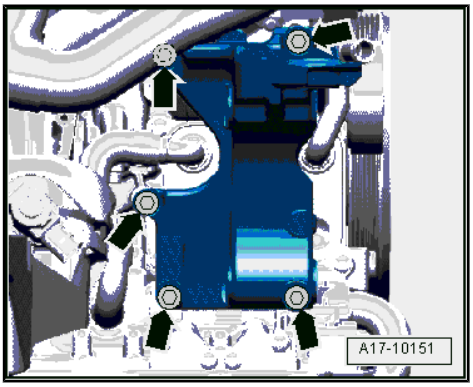
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Removing

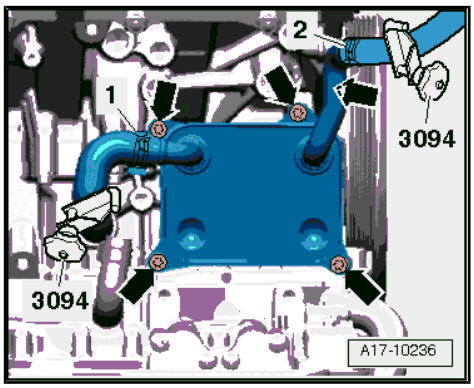
– Drain off coolant ⇒ page 181 .

– Remove alternator ⇒ Electrical system; Rep. gr. 27

– Remove bolts -arrows- and detach bracket for alternator.



– Clamp off coolant hoses using hose clamps -3094- as shown in illustration.



Note

Place a cloth underneath to catch escaping coolant.

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– Detach coolant hoses -1 and 2- at oil cooler.

– Place used oil collection and extraction unit -V.A.G 1782- under engine.

– Unscrew the bolts -arrows- and remove oil cooler.

Installing

• Tightening torques ⇒ page 52 , ⇒ page 170 .

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

Note

♦ *Renew O-rings.*

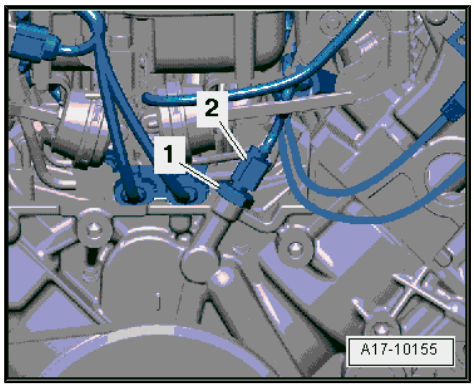
♦ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*

– Install alternator ⇒ Electrical system; Rep. gr. 27

– Check coolant level ⇒ page 182 .

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3.7 Removing and installing oil pressure switch -F1-



Removing

– Move lock carrier to service position ⇒ Rep. gr. 50 .

– Unplug electrical connector -2- at oil pressure switch -F1- -item 1-.

– Unscrew oil pressure switch -F1- .

Installing

• Tightening torque ⇒ page 170

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

Note

♦ *Renew seal.*

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

– Install lock carrier with attachments ⇒ Rep. gr. 50 .

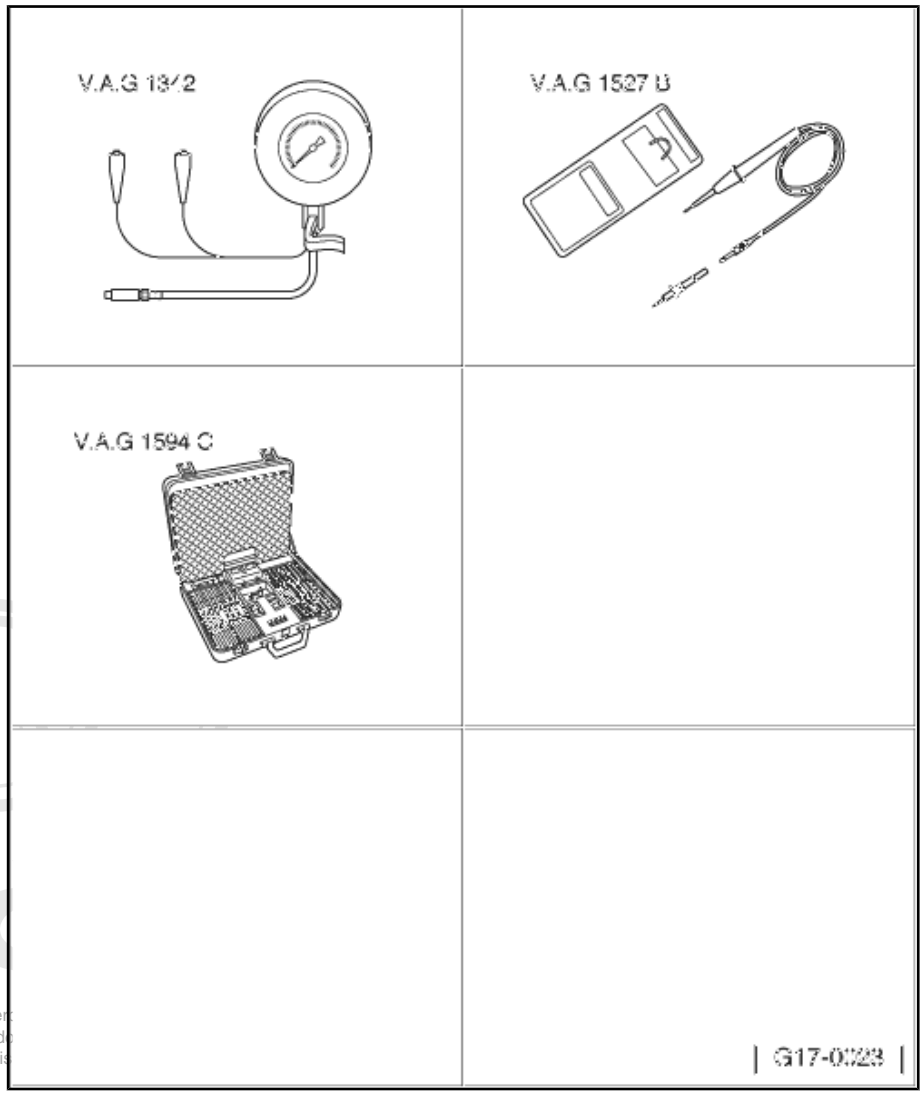
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3.8 Checking oil pressure and oil pressure switch -F1-

Special tools and workshop equipment required

- Oil pressure tester -V.A.G 1342- with adapter -V.A.G 1342/14-
- Voltage tester -V.A.G 1527B-
- Auxiliary measuring set -V.A.G 1594C-



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Procedure

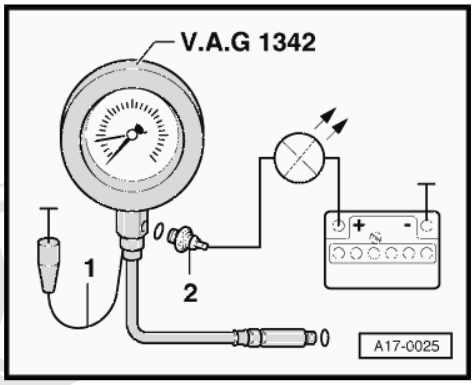
- Oil level OK
- Engine oil temperature approx. 80 °C

– Remove oil pressure switch -F1- ⇒ page 174 .

– Connect oil pressure tester -V.A.G 1342- with adapter -V.A.G 1342/14- to bore for oil pressure switch.

– Screw oil pressure switch -2- into oil pressure tester -V.A.G 1342- .

– Connect brown wire of oil pressure tester to earth (“–”).



Checking oil pressure switch

– Connect voltage tester -V.A.G 1527B- with test leads from auxiliary measuring set -V.A.G 1594C- to oil pressure switch and battery positive (“+”).

- LED should not light up.

If the LED lights up:

– Renew oil pressure switch.

– Start engine.

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Note

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

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

If LED does not light up:

– Renew oil pressure switch.

Checking oil pressure

– Start engine.

- Oil pressure at idling speed: at least 1.5 bar.
- Oil pressure at 2000 rpm: at least 3.5 bar.

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

– Renew oil pump ⇒ page 158 .

Assembling

– Install oil pressure switch -F1- ⇒ page 174 .

3.9 Engine oil

Refer to ⇒ Maintenance tables for viscosity grades, oil specifications and engine oil capacity.

3.10 Checking oil level

– Check oil level ⇒ Maintenance ; Booklet 404 .

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Caution

Risk of damage to catalytic converter.

- *The oil level must not be above the “max” mark on the dipstick.*

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19 – Cooling

1 Cooling system

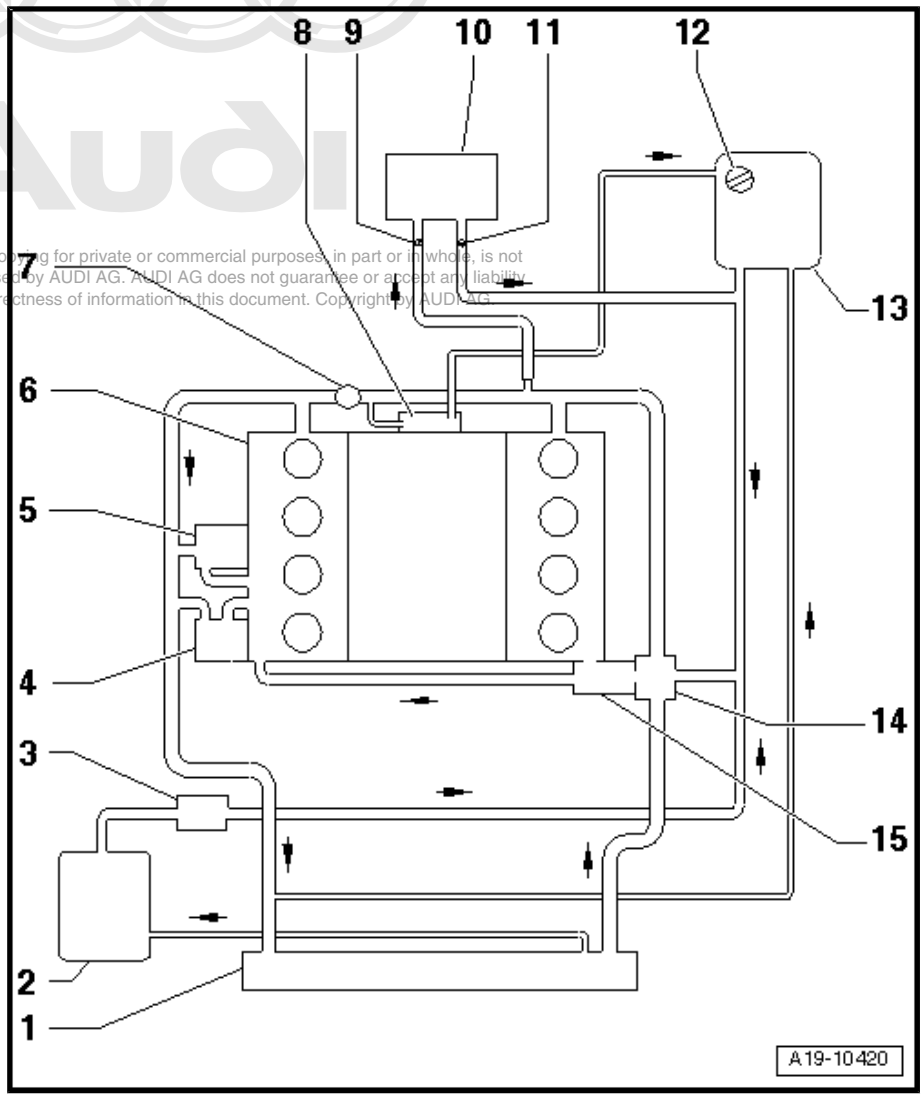
⇒ “1.1 Diagrams of coolant hose connections”, page 178

⇒ “1.2 Draining and filling cooling system”, page 181

⇒ “1.3 Checking cooling system for leaks”, page 187

1.1 Diagrams of coolant hose connections

Vehicles without auxiliary heater



1 - Radiator

- ❑ Removing and installing ⇒ page 219
- ❑ If renewed, refill system with fresh coolant

2 - ATF cooler

- ❑ Removing and installing ⇒ Rep. gr. 37
- ❑ If renewed, refill system with fresh coolant

3 - Thermostat

- ❑ For ATF cooler

4 - Alternator

5 - Oil cooler

- ❑ Removing and installing ⇒ page 172
- ❑ If renewed, refill system with fresh coolant

6 - Cylinder head and cylinder block

- ❑ If renewed, refill system with fresh coolant

7 - Coolant temperature sender -G62-

- ❑ Removing and installing ⇒ page 197

8 - Throttle valve connection

9 - Bleeder screw

- ❑ In coolant hose to heat exchanger

10 - Heat exchanger

- ❑ If renewed, refill system with fresh coolant

11 - Bleeder screw

- ❑ In coolant hose from heat exchanger

12 - Filler cap

- ❑ Checking pressure relief valve ⇒ page 188

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13 - Expansion tank

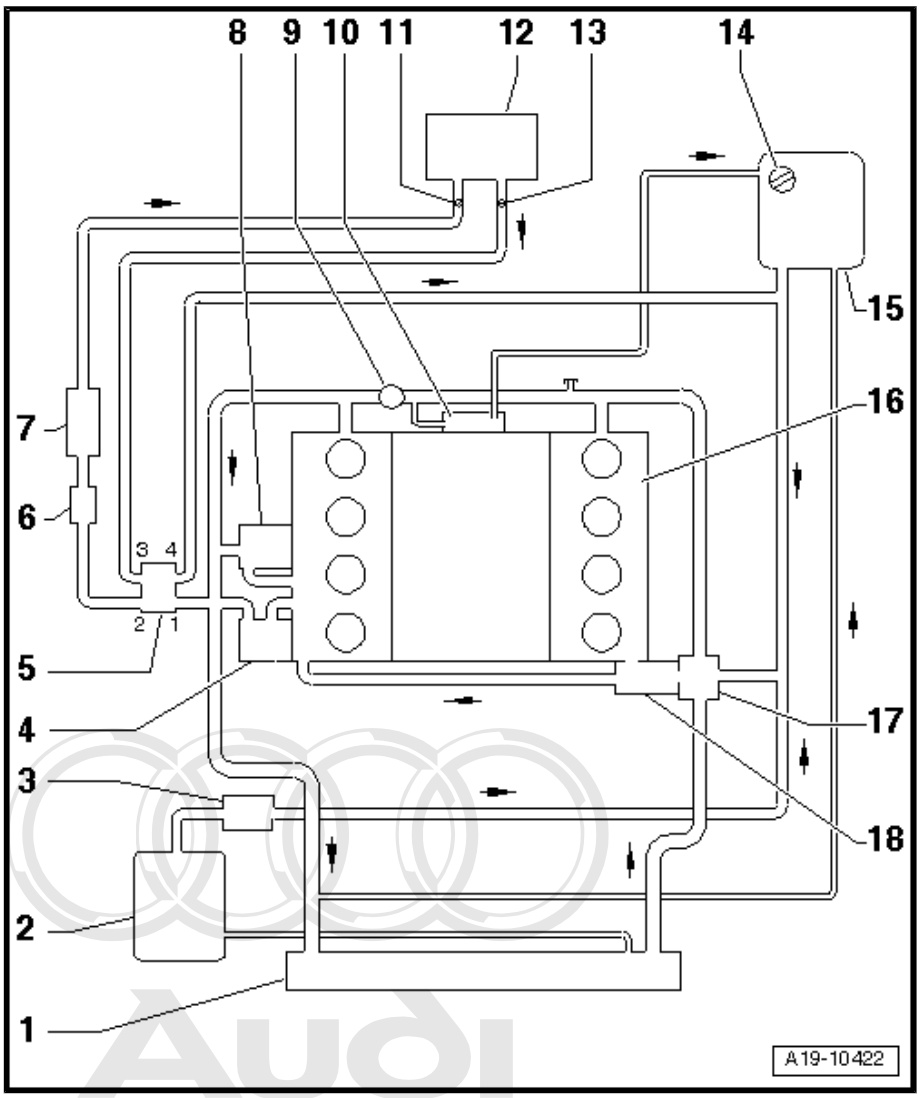
14 - Map-controlled engine cooling system thermostat -F265-

- ❑ Removing and installing ⇒ page 193

15 - Coolant pump

- ❑ Removing and installing ⇒ page 191

Vehicles with auxiliary heater



1 - Radiator

- ❑ Removing and installing ⇒ page 219
- ❑ If renewed, refill system with fresh coolant

2 - ATF cooler

- ❑ Removing and installing ⇒ Rep. gr. 37
- ❑ If renewed, refill system with fresh coolant

3 - Thermostat

- ❑ For ATF cooler

4 - Alternator

5 - Heater coolant shut-off valve -N279-

6 - Circulation pump -V55-

- ❑ Removing and installing ⇒ Rep. gr. 82

7 - Auxiliary heater

8 - Oil cooler

- ❑ Removing and installing ⇒ page 172
- ❑ If renewed, refill system with fresh coolant

9 - Coolant temperature sender -G62-

- ❑ Removing and installing ⇒ page 197

10 - Throttle valve connection

11 - Bleeder screw

- ❑ In coolant hose to heat exchanger

12 - Heat exchanger

- ❑ If renewed, refill system with fresh coolant

13 - Bleeder screw

- ❑ In coolant hose from heat exchanger

14 - Filler cap

- ❑ Checking pressure relief valve ⇒ page 188

15 - Expansion tank

16 - Cylinder head and cylinder block

- ❑ If renewed, refill system with fresh coolant

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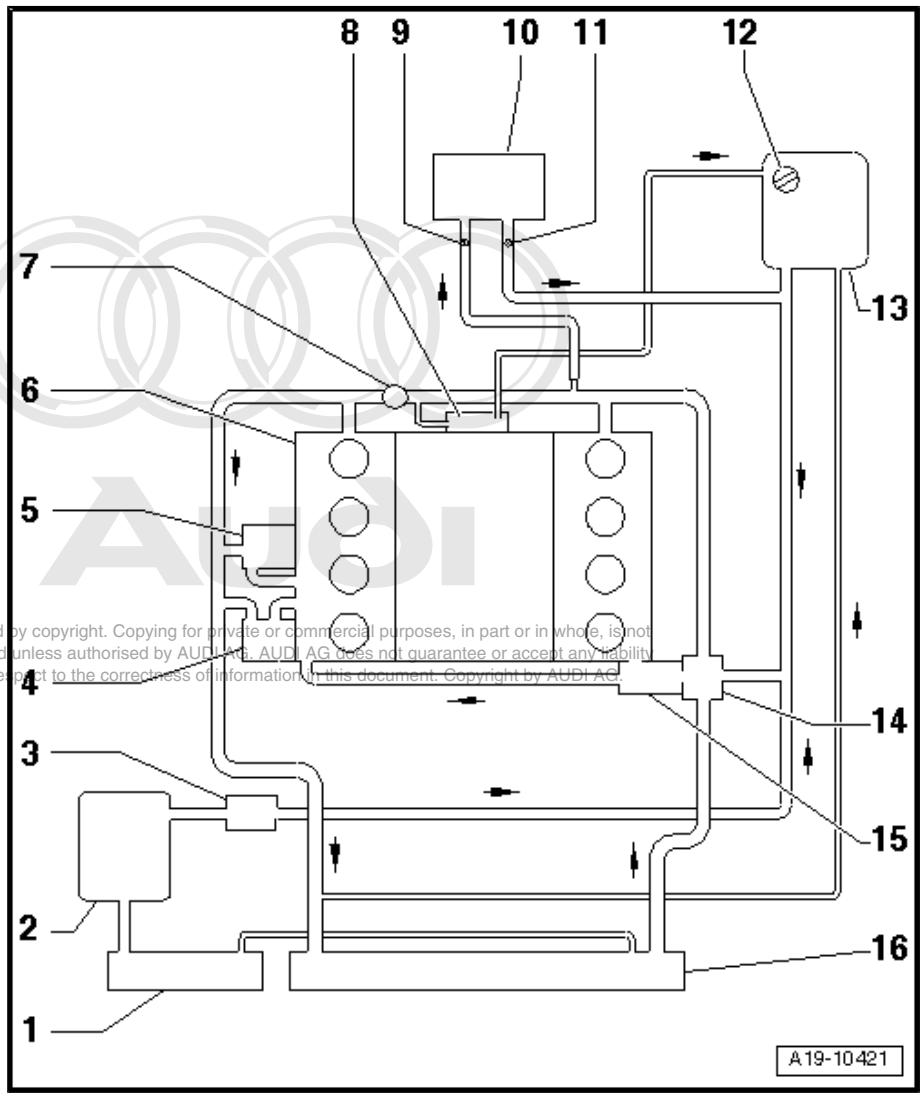
17 - Map-controlled engine cooling system thermostat -F265-

- ❑ Removing and installing ⇒ page 193

18 - Coolant pump

- ❑ Removing and installing ⇒ page 191

Vehicles with auxiliary radiator



1 - Auxiliary radiator

2 - ATF cooler

- ❑ Removing and installing ⇒ Rep. gr. 37
- ❑ If renewed, refill system with fresh coolant

3 - Thermostat for ATF cooler and auxiliary radiator

4 - Alternator

5 - Oil cooler

- ❑ Removing and installing ⇒ page 172
- ❑ If renewed, refill system with fresh coolant

6 - Cylinder head and cylinder block

- ❑ If renewed, refill system with fresh coolant

7 - Coolant temperature sender -G62-

- ❑ Removing and installing ⇒ page 197

8 - Throttle valve connection

9 - Bleeder screw

- ❑ In coolant hose to heat exchanger

10 - Heat exchanger

- ❑ If renewed, refill system with fresh coolant

11 - Bleeder screw

- ❑ In coolant hose from heat exchanger

12 - Filler cap

- ❑ Checking pressure relief valve ⇒ page 188

13 - Expansion tank

14 - Map-controlled engine cooling system thermostat -F265-

- ❑ Removing and installing ⇒ page 193

15 - Coolant pump

- ❑ Removing and installing ⇒ page 191

16 - Radiator

- ❑ Removing and installing ⇒ page 219
- ❑ If renewed, refill system with fresh coolant

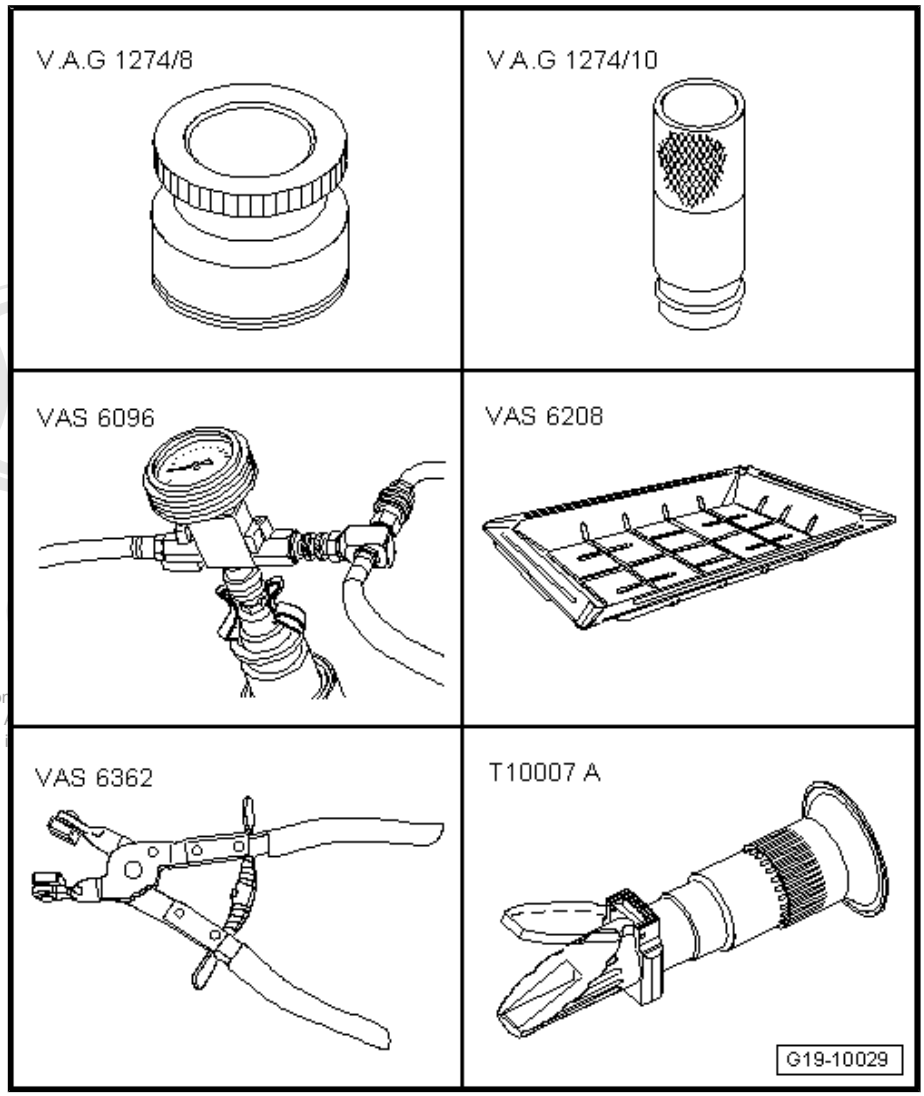
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1.2 Draining and filling cooling system

Special tools and workshop equipment required

- Adapter for cooling system tester -V.A.G 1274/8-
- Pipe for cooling system tester -V.A.G 1274/10-
- Drip tray for workshop hoist -VAS 6208-
- Cooling system charge unit -VAS 6096-
- Hose clip pliers -VAS 6362-
- Refractometer -T10007 A-



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Draining

Note

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

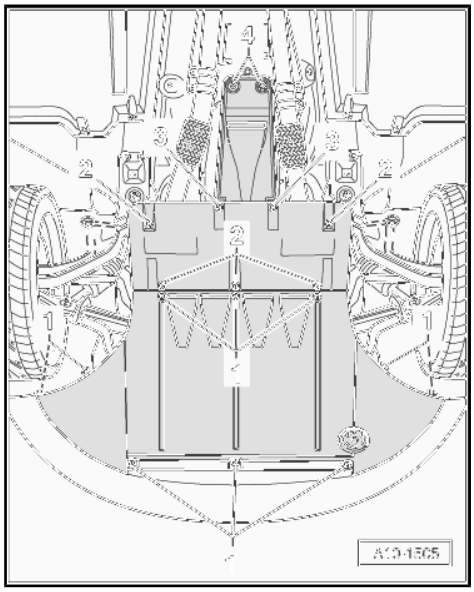
WARNING

Hot steam/hot coolant can escape - risk of scalding.

- ***The cooling system is under pressure when the engine is hot.***
- ***To allow pressure to dissipate, cover filler cap on expansion tank with cloth and open carefully.***

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– Release fasteners -1- to remove front noise insulation.

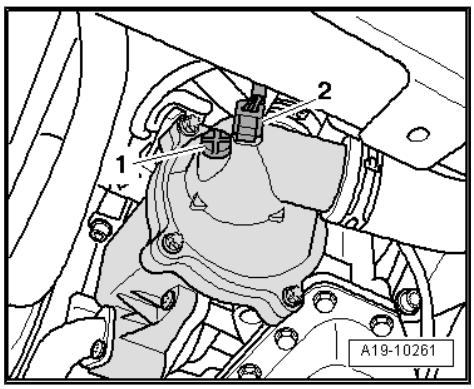


Note

Disregard -items 2, 3, 4-.

– Place drip tray for workshop hoist -VAS 6208- under engine.

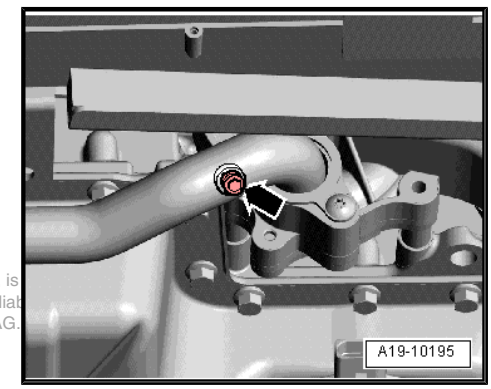
– Remove drain plug -1- at map-controlled engine cooling system thermostat -F265- and drain off coolant.



Note

Disregard -item 2-.

– Remove drain plug -arrow- at front coolant pipe and drain off coolant.



Filling

Tightening torques

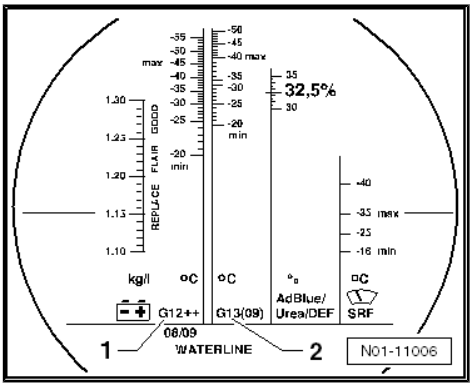
- ⇒ “2.1 Coolant pump and thermostat - exploded view”, page 190 .
- ⇒ “2.5 Coolant pipes - exploded view”, page 194 .
- Ignition off.

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Note

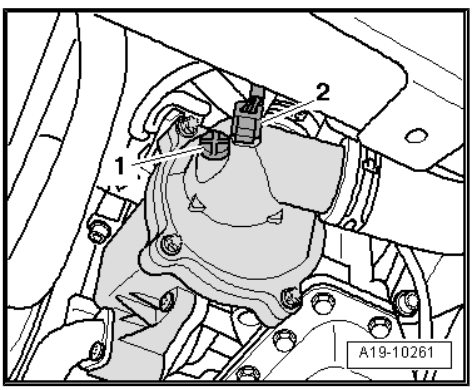
- *The cooling system is filled all year round with a mixture of water and coolant additive. Mixture ratio ⇒ page 183 .*
- *Use only the coolant additive listed in the ⇒ Electronic parts catalogue . Other coolant additives could seriously impair in particular the anti-corrosion properties. The resulting damage could lead to loss of coolant and consequently to serious engine damage.*
- *The specified coolant (based on recommended mixture ratio) ⇒ page 183 prevents frost and corrosion damage and stops scaling. Such additives also raise the boiling point of the coolant. For these reasons the cooling system must be filled all year round with the correct coolant/anticorrosion additive.*
- *Because of its high boiling point, the coolant improves engine reliability under heavy loads, particularly in countries with tropical climates.*
- *Frost protection is required down to about -25 °C (in countries with arctic climate: down to about -35 °C).*
- *The coolant concentration must not be reduced by adding water even in warmer seasons and in warmer countries. The antifreeze concentration must be at least 40 %.*
- *If greater frost protection is required in very cold climates, the amount of antifreeze can be increased, but only up to 60 % (this gives frost protection to about -40 °C), as otherwise frost protection is reduced again, as is cooling effectiveness.*
- *Use only clean tap water for mixing coolant.*
- *If radiator, heat exchanger, cylinder head, cylinder head gasket or cylinder block have been renewed, do not re-use old coolant.*
- *Do not re-use dirty or contaminated coolant.*
- *For checking anti-freeze protection in cooling system with coolant generation G13, refractometer -T10007 A- MUST be used.*



Recommended mixture ratio for coolant

- Coolant (40 %) and water (60 %) for frost protection to -25 °C
- Coolant (50 %) and water (50 %) for frost protection to -35 °C
- Coolant ⇒ Electronic parts catalogue

– Install drain plug -1- with new O-ring on map-controlled engine cooling system thermostat -F265- .

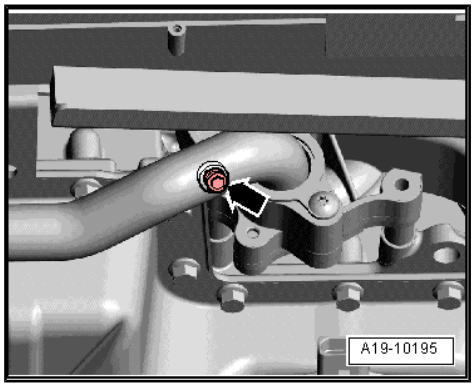


Note

Disregard -item 2-.

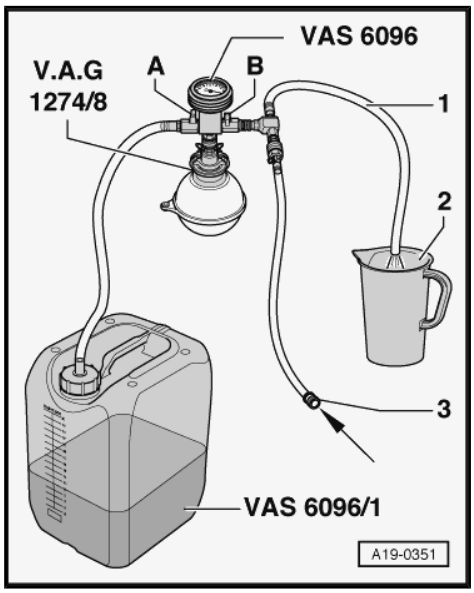
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– Install drain plug -arrow- with new seal on front coolant pipe.



– Fill reservoir of cooling system charge unit -VAS 6096- with at least 15 litres of premixed coolant (based on recommended ratio):
– Screw adapter -V.A.G 1274/8- onto coolant expansion tank.
– Attach cooling system charge unit -VAS 6096- to adapter -V.A.G 1274/8- .
– Run vent hose -1- into a small container -2-. (The vented air draws along a small amount of coolant, which should be collected.)
– Close the two valves -A and B- by setting lever at right angle to direction of flow.
– Connect hose -3- to compressed air.

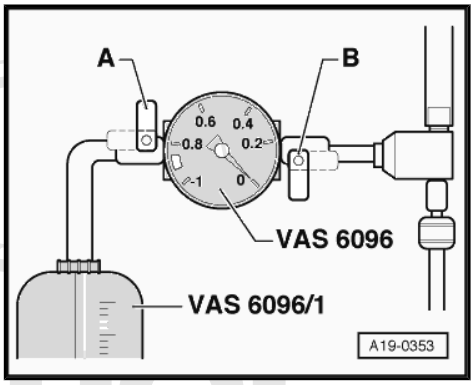
• Pressure: 6 ... 10 bar.



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



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

- The needle on the gauge should move into the green zone.

– Also briefly open valve -A- (turn lever in direction of flow) so that hose on reservoir for cooling system charge unit - VAS 6096- can fill with coolant.

– Close valve -A- again.

– Leave valve -B- open for another 2 minutes.

- The suction jet pump will continue generating a vacuum in the cooling system.
- The needle on the gauge should remain in the green zone.

– Close valve -B-.

- The needle on the gauge should stop in the green zone. The vacuum level in the cooling system is then sufficient for subsequent filling.

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

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

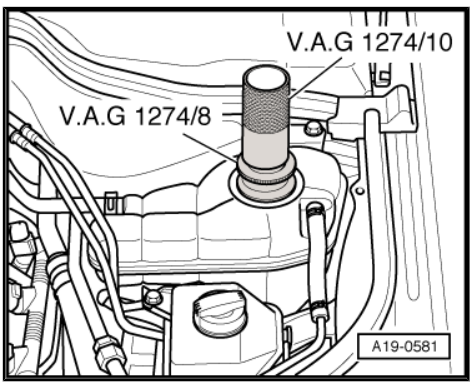
– Detach compressed air hose.

– Open valve -A-.

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

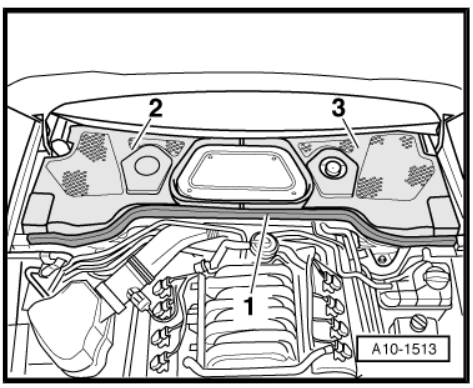
– Detach cooling system charge unit -VAS 6096- from adapter -V.A.G 1274/8- on coolant expansion tank.

– Fit pipe for cooling system tester -V.A.G 1274/10- onto adapter.



– Pull off rubber seal -1- on plenum chamber covers.

– Detach plenum chamber cover -2-.



Note

Disregard -item 3-.

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– Open bleeder screws -arrows-.

– Fill up with coolant until it flows out at bleeder holes in coolant hoses.

– Close the bleeder screws.

– On vehicles with auxiliary heater, switch heater on (for about 30 seconds) and then off again.

– Tighten filler cap on expansion tank.

– Start engine.

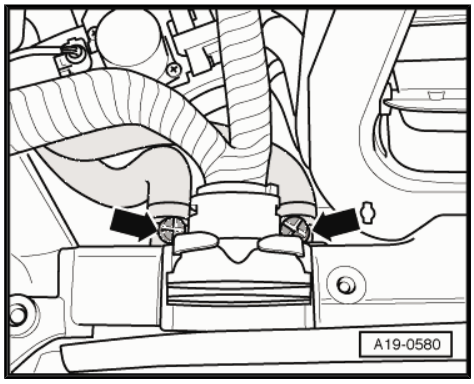
– Set heater/air conditioner (left and right) to “HI”.

– Run the engine for 3 minutes at 2000 rpm.

– Allow the engine to run at idling speed until the two large coolant hoses at main radiator become warm.

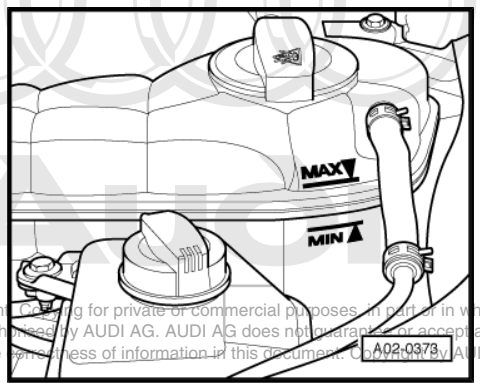
– Run the engine for 1 minute at 2000 rpm.

– Switch off ignition and allow engine to cool down.



– Check coolant level.

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



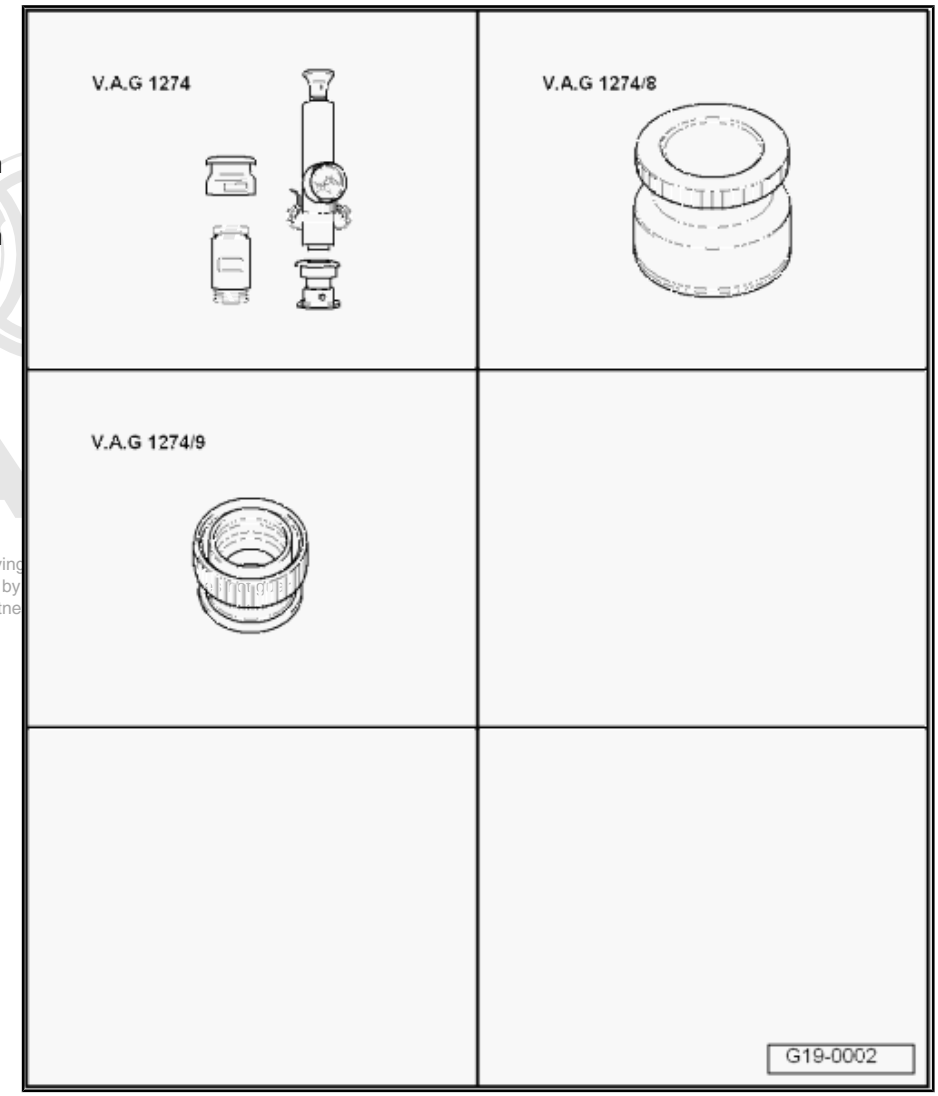
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1.3 Checking cooling system for leaks

Special tools and workshop equipment required

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



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Procedure

- Engine must be warm.

WARNING

Hot steam/hot coolant can escape - risk of scalding.

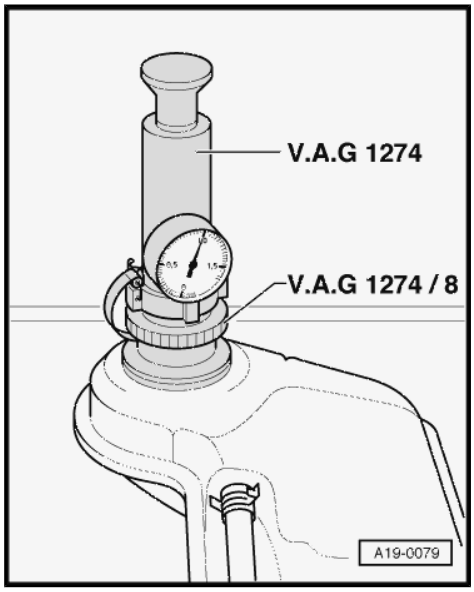
- *The cooling system is under pressure when the engine is hot.*
- *To allow pressure to dissipate, cover filler cap on expansion tank with cloth and open carefully.*

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

If the pressure drops:

– Locate leak and eliminate fault.

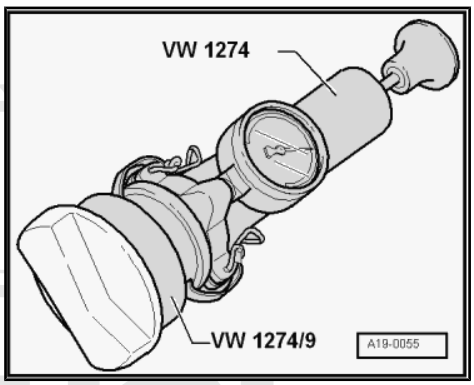


Checking pressure relief valve in filler cap

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

If the pressure relief valve does not open as described:

– Renew filler cap.



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2 Coolant pump, thermostat, coolant pipes

⇒ “2.1 Coolant pump and thermostat - exploded view”, page 190

⇒ “2.2 Removing and installing coolant pump”, page 191

⇒ “2.3 Removing and installing map-controlled engine cooling system thermostat F265 ”, page 193

⇒ “2.4 Thermostat opening values”, page 194

⇒ “2.5 Coolant pipes - exploded view”, page 194

⇒ “2.6 Removing and installing coolant temperature sender G62 ”, page 197

⇒ “2.7 Removing and installing coolant pipe (front)”, page 198

⇒ “2.8 Removing and installing coolant pipe (rear)”, page 199

⇒ “2.9 Removing and installing coolant pipe (left-side)”, page 204

⇒ “2.10 Removing and installing coolant pipe (bottom left)”, page 207

⇒ “2.11 Removing and installing coolant pipe (right-side)”, page 214

2.1 Coolant pump and thermostat - exploded view

1 - Seal
- ❑ Renew

2 - Housing for coolant pump
- ❑ Removing and installing ⇒ page 191

3 - Bolt
- ❑ Tightening torque ⇒ page 194

4 - Coolant pipe (front)
- ❑ Removing and installing ⇒ page 198

5 - O-ring
- ❑ Renew

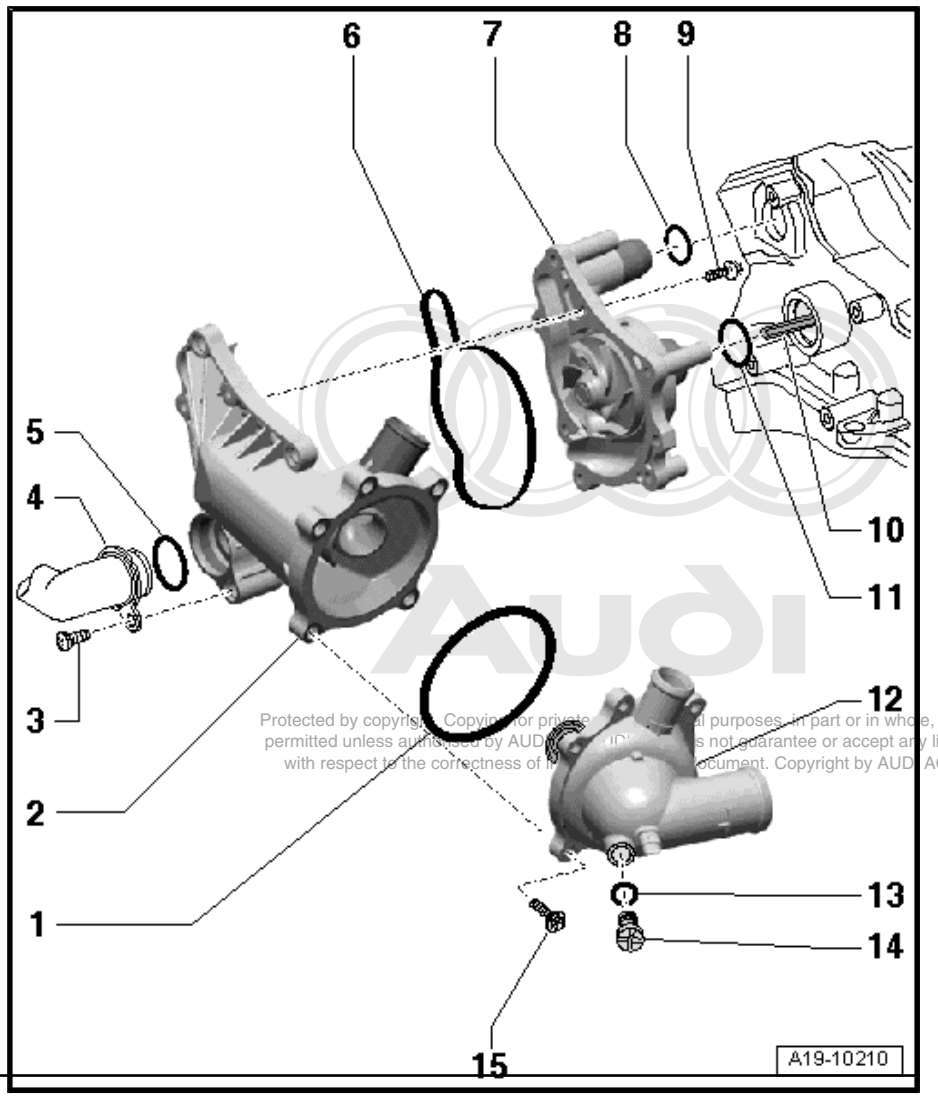
6 - Seal
- ❑ Renew

7 - Coolant pump
- ❑ Removing and installing ⇒ page 191
- ❑ Tightening torque ⇒ page 191

8 - O-ring
- ❑ Renew

9 - Bolt
- ❑ 9 Nm

10 - Drive shaft for coolant



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pump

11 - O-ring

- ❑ Renew

12 - Map-controlled engine cooling system thermostat -F265-

- ❑ Removing and installing ⇒ page 193
- ❑ Thermostat opening values ⇒ page 194

13 - O-ring

- ❑ Renew

14 - Drain plug

- ❑ 4 Nm

15 - Bolt

- ❑ 9 Nm

Tightening torque for coolant pump

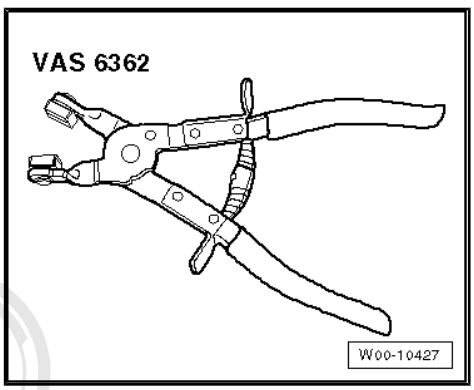
– Tighten bolts -arrows- to 9 Nm.



2.2 Removing and installing coolant pump

Special tools and workshop equipment required

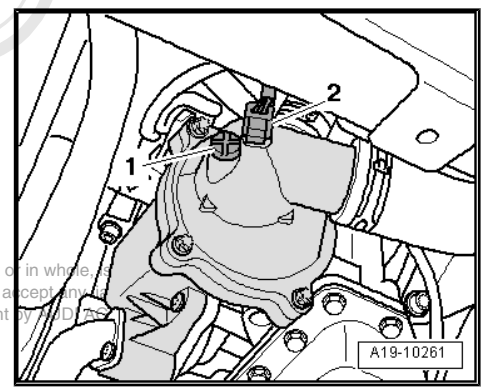
♦ Hose clip pliers -VAS 6362-



Removing

– Remove coolant pipe (front) ⇒ page 198 .

– Unplug connector -2- at map-controlled engine cooling thermostat -F265- .



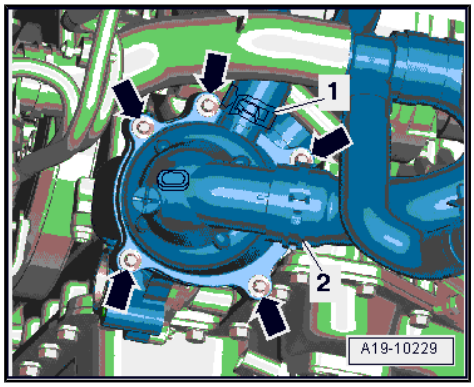
Note

Disregard -item 1-.

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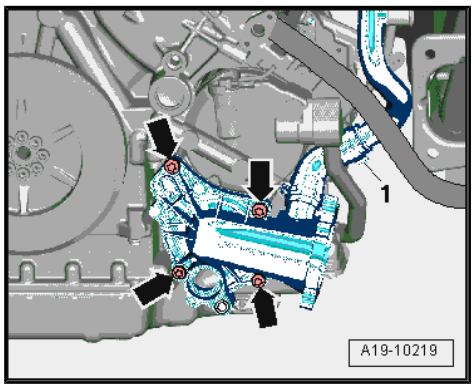
– Detach coolant hoses -1 and 2- from map-controlled engine cooling system thermostat -F265- .



Note

Disregard -arrows-.

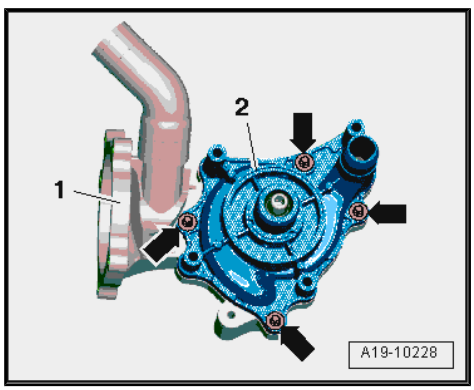
– Slacken hose clip -1- on coolant hose.
– Remove bolts -arrows-.
– Pull off coolant pump housing forwards (note the drive shaft for coolant pump).



Note

The coolant hose can only be disconnected when the coolant pump is removed.

– Unscrew bolts -arrows- and remove coolant pump -2- from housing -1-.

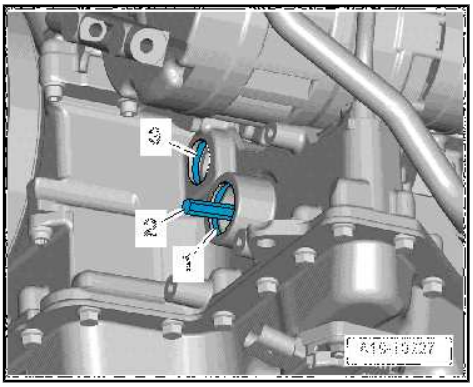


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Installing

- Tightening torques
  ⇒ “2.1 Coolant pump and thermostat - exploded view”, page 190



Note

- *Renew seals and O-rings.*
- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*

– Fit new O-rings -1 and 3-.

– Insert drive shaft -2- for coolant pump in mounting for oil pump as far as stop.

– Fit coolant pump in mounting on sump (top section).

Note

To fit the drive flange onto the hexagon flats of the drive shaft, use your finger to turn the impeller (access through the bottom pipe connection of coolant pump) until the coolant pump can be pressed on all the way.

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

– Install coolant pipe (front) ⇒ page 198 .

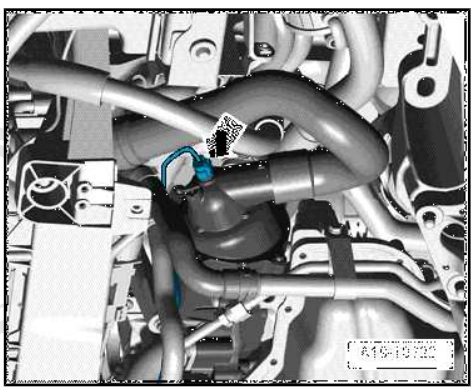
– Fill cooling system ⇒ page 182 .

2.3 Removing and installing map-controlled engine cooling system thermostat - F265-

Removing

– Drain off coolant ⇒ page 181 .

– Unplug electrical connector -arrow- at map-controlled engine cooling system thermostat -F265- .



Note

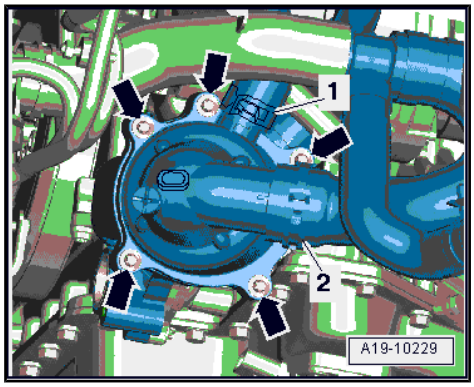
Disregard -item 1-.

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– Detach coolant hoses -1 and 2- from map-controlled engine cooling system thermostat -F265- and drain off coolant.

– Remove bolts -arrows- and detach map-controlled engine cooling system thermostat -F265- .



Installing

- Tightening torque
  ⇒ “2.1 Coolant pump and thermostat - exploded view”, page 190

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

Note

♦ *Renew seals and O-rings.*

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

– Fill cooling system ⇒ page 182 .

2.4 Thermostat opening values

Starts to open	Fully open	Opening travel	Voltage measured at thermostat
approx. 105 °C	approx. 117 °C	at least 8 mm	0 V
–	approx. 105 °C	at least 8 mm	14 V

Note

The thermostat cannot be tested with workshop equipment.

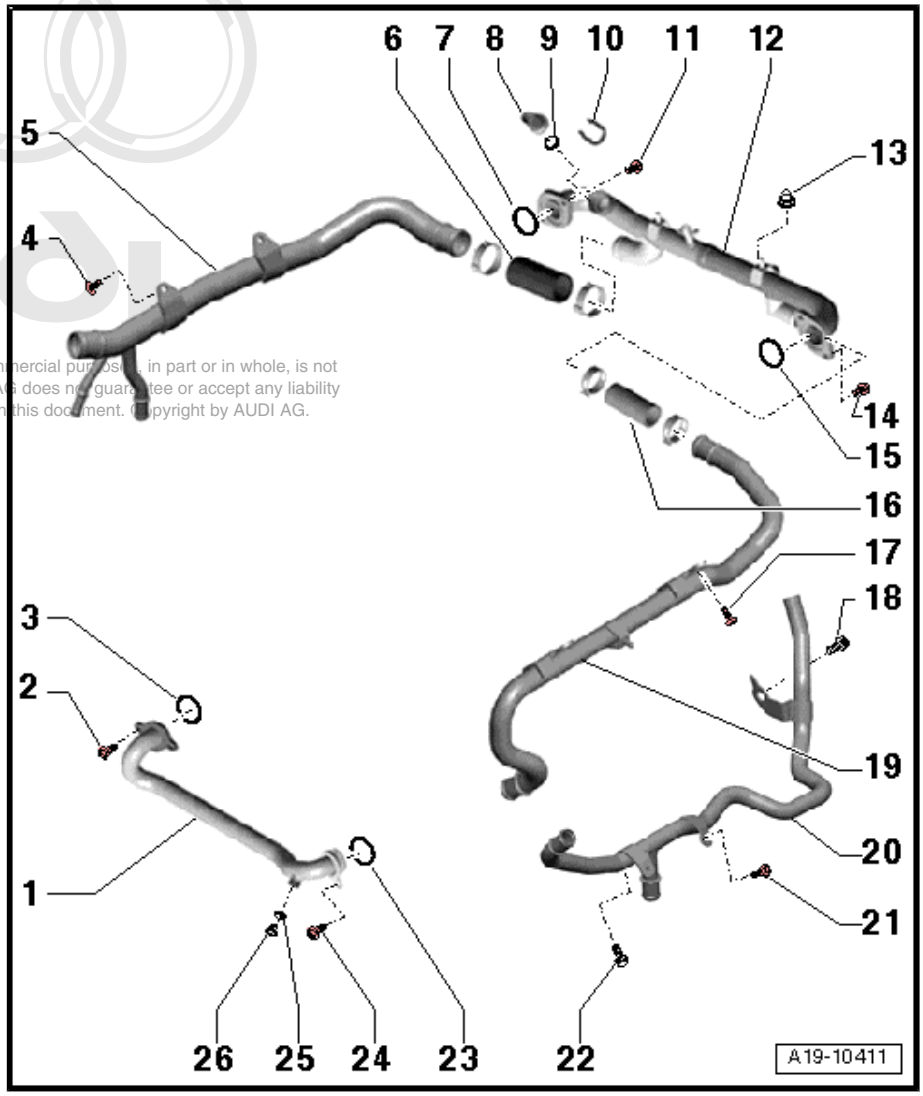
2.5 Coolant pipes - exploded view

Note

The arrow markings on coolant pipes and on ends of hoses must align.

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1 - Coolant pipe (front)
- ❑ Removing and installing ⇒ page 198

2 - Bolt
- ❑ Renew
- ❑ 8 Nm + 90° (1/4 turn further)

3 - O-ring
- ❑ Renew

4 - Bolt
- ❑ 9 Nm

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5 - Coolant pipe (right-side)
- ❑ Removing and installing ⇒ page 214

6 - Coolant hose

7 - O-ring
- ❑ Renew

8 - Coolant temperature sender -G62-
- ❑ Removing and installing ⇒ page 197

9 - O-ring
- ❑ Renew

10 - Retaining clip

11 - Bolt
- ❑ 9 Nm

12 - Coolant pipe (rear)
- ❑ Removing and installing ⇒ page 199

13 - Bolt
- ❑ 9 Nm

14 - Bolt
- ❑ 9 Nm

15 - O-ring
- ❑ Renew

16 - Coolant hose

17 - Bolt
- ❑ 9 Nm

18 - Bolt
- ❑ Tightening torque ⇒ page 35

19 - Coolant pipe (left-side)
- ❑ Removing and installing ⇒ page 204

20 - Coolant pipe (bottom left)
- ❑ Removing and installing ⇒ page 207

21 - Bolt
- ❑ 9 Nm

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22 - Bolt

- ❑ Tightening torque ⇒ Rep. gr. 87

23 - O-ring

- ❑ Renew

24 - Bolt

- ❑ Renew
- ❑ 8 Nm + 90° ($^1/_4$ turn further)

25 - Seal

- ❑ Renew

26 - Drain plug

- ❑ 10 Nm

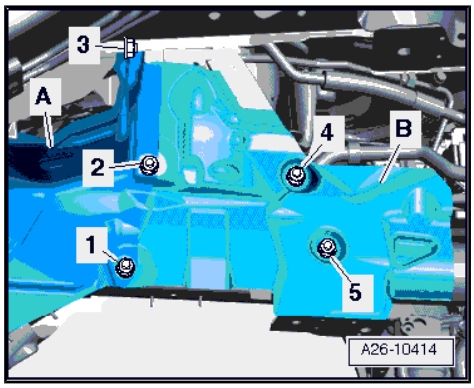
Heat shields -A and B- (left-side)

Nuts -1, 3, 4, 5-

- 2.5 Nm

Nut -2-

- 4.5 Nm



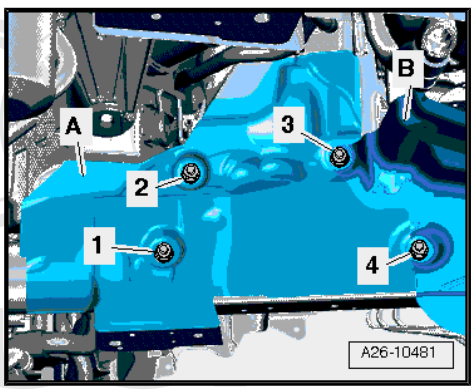
Heat shields -A and B- (right-side)

Nuts -1 and 3-

- 4.5 Nm

Nuts -2 and 4-

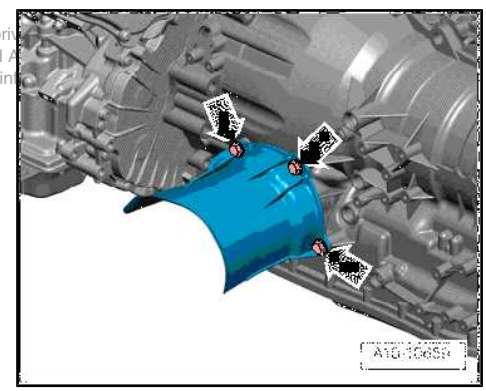
- 2.5 Nm



Heat shield for drive shaft (left-side)

Bolts -arrows-

- 23 Nm



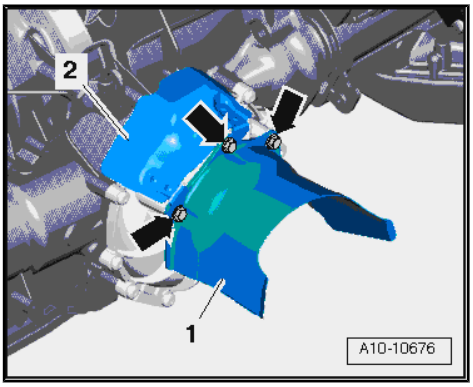
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Heat shield for drive shaft (right-side)

Bolts -arrows-

- 23 Nm



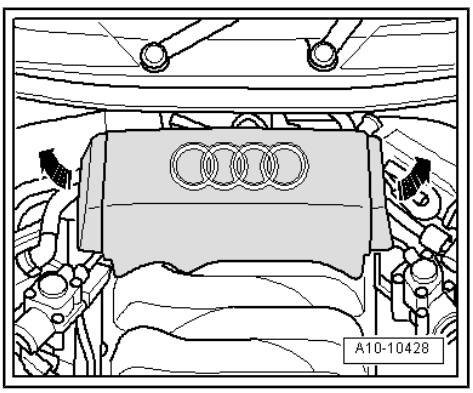
2.6 Removing and installing coolant temperature sender -G62-

Removing

- Engine cold.

– Open filler cap on coolant expansion tank briefly and allow residual pressure in cooling system to dissipate.

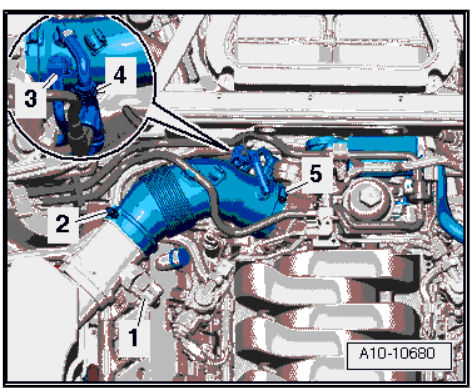
– Pull off engine cover panel (rear).



– Move clear fuel line and line going to activated charcoal filter at air pipe.

– Release hose clips -2 and 5- and remove air hose.

– Move air intake hose to one side, with lines -3 and 4- connected.



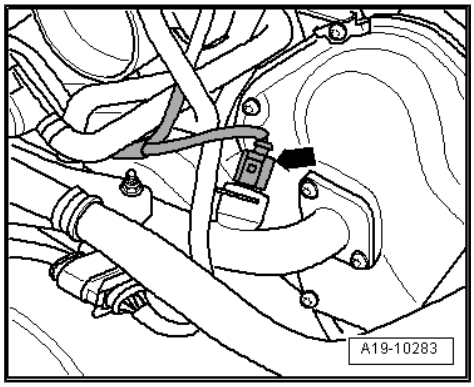
Note

Disregard -item 1-.

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– Unplug electrical connector -arrow- at coolant temperature sender -G62- .



Note

Place a cloth underneath to catch escaping coolant.

– Detach retaining clip and remove coolant temperature sender -G62- .

Note

Shown in illustration with engine removed.

Installing

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

Note

- *Fit new O-ring.*
- *Insert new coolant temperature sender -G62- immediately into connection to avoid loss of coolant.*
- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*

– Check coolant level ⇒ page 182 .

Audi
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2.7 Removing and installing coolant pipe (front)

Special tools and workshop equipment required

- Drip tray for workshop hoist -VAS 6208-



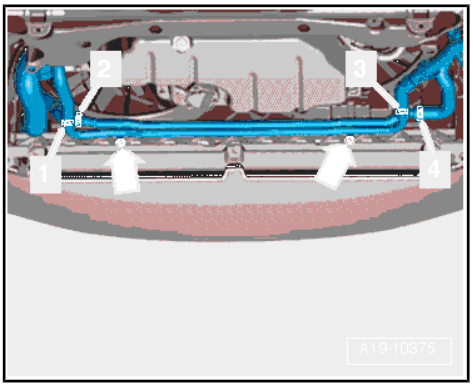
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Removing

– Drain off coolant ⇒ page 181 .

– Remove bolts -arrows-.

– Detach coolant pipes going to ATF cooler from lock carrier.



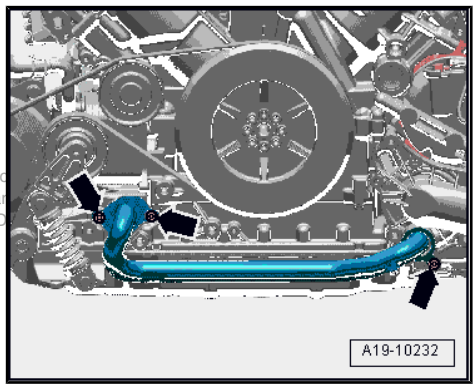
Note

Disregard items marked -1 ... 4-.

– Place drip tray for workshop hoist -VAS 6208- under engine.

– Remove bolts -arrows-.

– Detach front coolant pipe from engine and coolant pump.



Installing

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- Tightening torques
  ⇒ "2.5 Coolant pipes - exploded view", page 194

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

Note

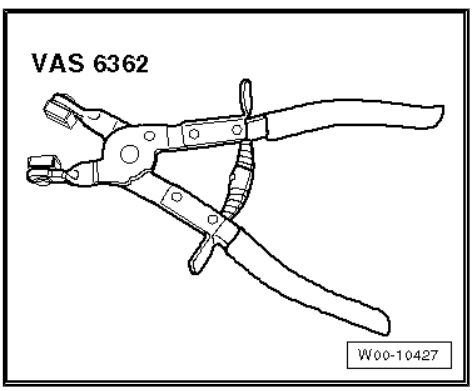
Renew O-rings.

– Fill cooling system ⇒ page 182 .

2.8 Removing and installing coolant pipe (rear)

Special tools and workshop equipment required

♦ Hose clip pliers -VAS 6362-



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Removing

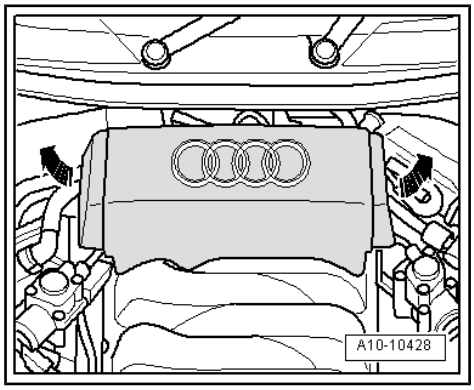
Note

Fit all cable ties in the original positions when installing.

– Pull off engine cover panel (rear) -arrows-.

– Drain off coolant ⇒ page 181 .

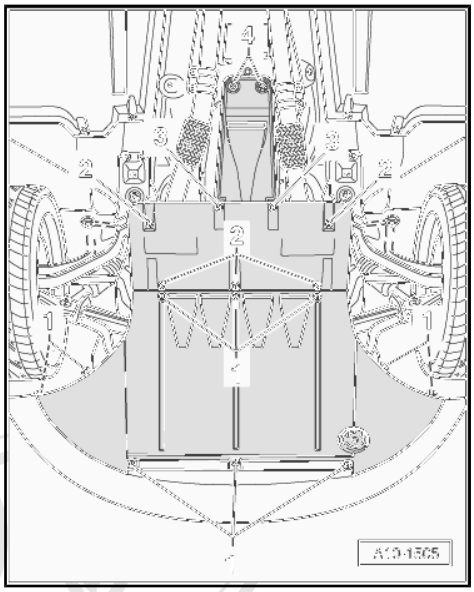
– Remove secondary air combination valve (right-side) ⇒ page 254 .



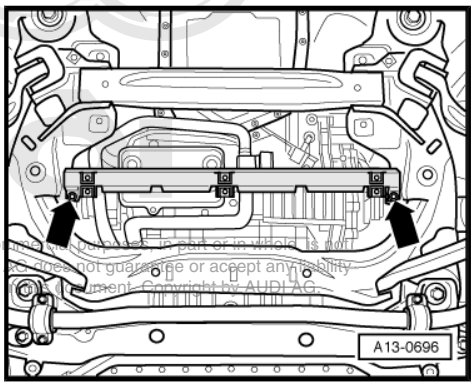
– Release fasteners -2 and 4- and remove rear noise insulation panels.

Note

Disregard -items 1 and 3-.



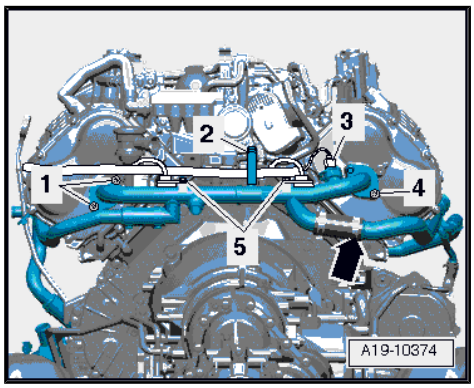
– Unbolt bracket for noise insulation -arrows-.



– Slacken hose clip -arrow-.

Note

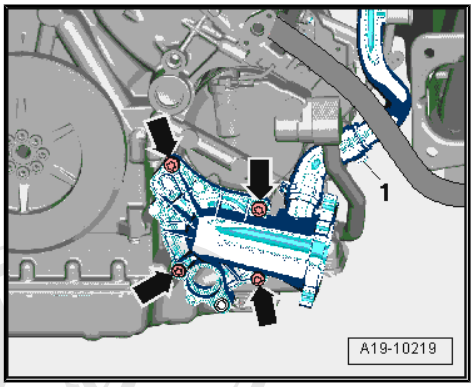
- *Disregard items marked -1 ... 5-.*
- *Shown from rear with engine removed for illustration purposes.*



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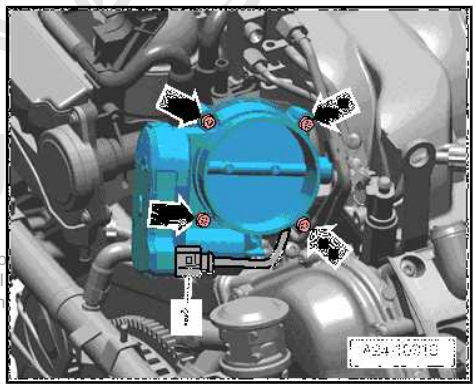
– Slacken hose clip -1- on coolant hose.



Note

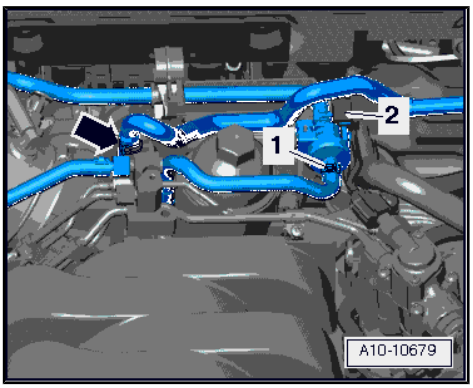
Disregard -arrows-.

– Unplug electrical connector -1- at throttle valve module - J338- .
– Unscrew bolts -arrows- and remove throttle valve module - J338- .



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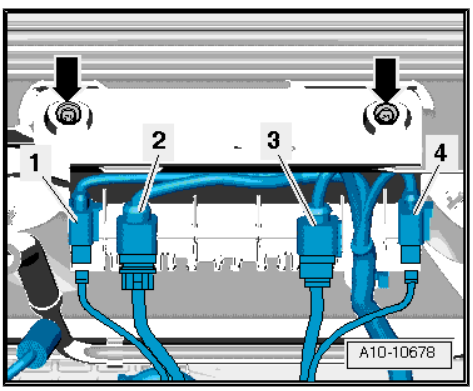
– Unplug electrical connector -2- at activated charcoal filter solenoid valve 1 -N80- and detach vacuum hose -1-.
– Detach activated charcoal filter solenoid valve 1 -N80- from bracket and move it clear to the side with hose still attached.



Note

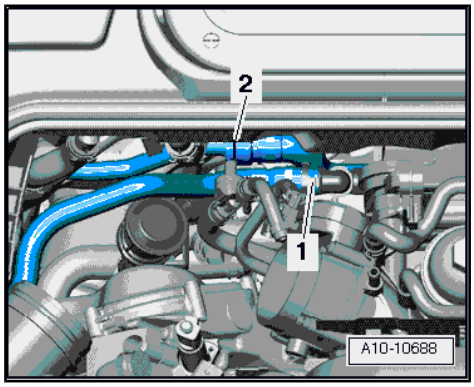
Disregard -arrow-.

– Remove electrical connectors -1 ... 4- from bracket.
– Unscrew nuts -arrows- and detach bracket for electrical connectors from bulkhead.



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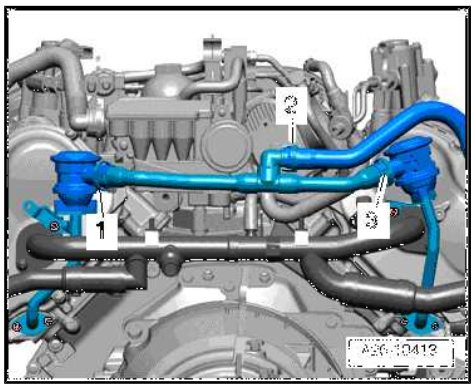
– Detach coolant hose -2-, to do so, pull out clip slightly.



Note

Disregard -item 1-.

– Detach air hose -1-.



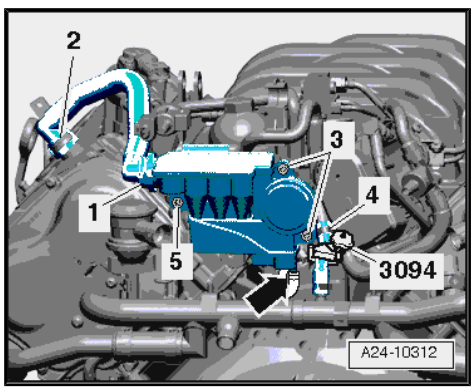
Note

- *Disregard -items 2 and 3-.*
- *Shown from rear with engine removed for illustration purposes.*

– Remove crankcase breather hose -1 and 2-.

– Unscrew bolts -3 and 5- and remove pressure control valve for crankcase breather system from throttle valve housing.

– Remove oil drain hose -arrow-.



Note

- *Disregard -item 4- and -3094- .*
- *Shown from rear with engine removed for illustration purposes.*

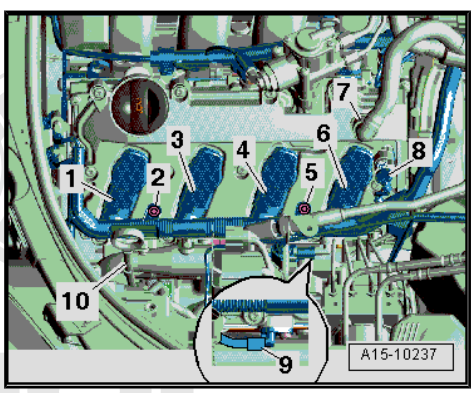
– Pull dipstick -10- out of guide tube.

– Remove bolts -2 and 5-.

– Unplug electrical connectors -1, 3, 4, 6, 8- and move wiring harness clear.

– Remove Hall sender -9-.

– Place wiring harness on top of engine.



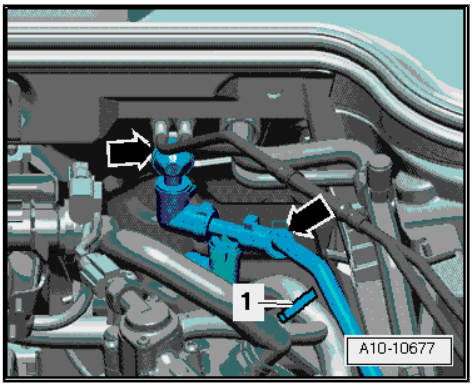
Note

Disregard -item 7-.

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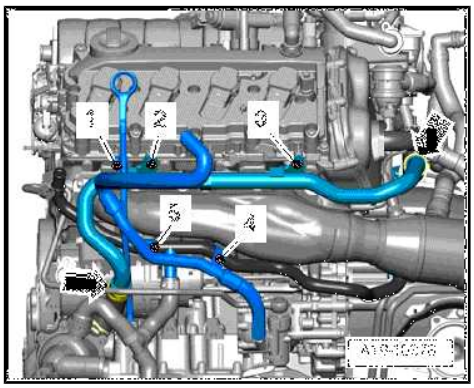
– Detach vacuum lines -arrows- going to brake servo.
– Move vacuum lines clear to one side.



Note

Disregard -item 1-.

– Remove bolt -1- and lift out guide tube for oil dipstick.
– Unscrew bolts -2 and 3- and detach coolant pipe (left-side) from coolant hoses -arrows-.
– Move coolant pipe slightly towards rear.



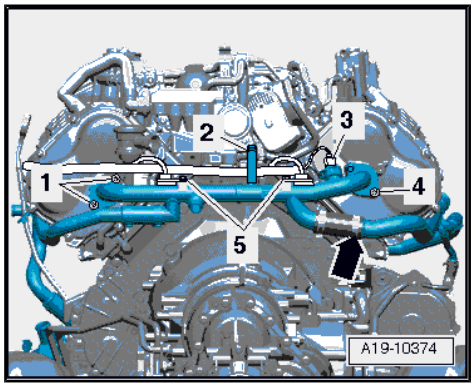
Note

Disregard -items 4 and 5-.

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– Detach coolant hose -2- going to intake manifold.
– Unplug electrical connector -3- at coolant temperature sender -G62- .
– Remove nuts -5-.
– Detach brackets with electrical connectors and wiring harness from coolant pipe (rear).
– Remove bolts -1 and 4-.
– Detach coolant pipe (rear) from coolant pipe (right-side) -arrow-.
– Remove coolant pipe (rear) towards right side of vehicle.



Note

Shown from rear with engine removed for illustration purposes.

Installing

- Tightening torques
  ⇒ “2.5 Coolant pipes - exploded view”, page 194

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

Note

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- *Renew O-rings.*
- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*
- *Fit all cable ties in the original positions when installing.*

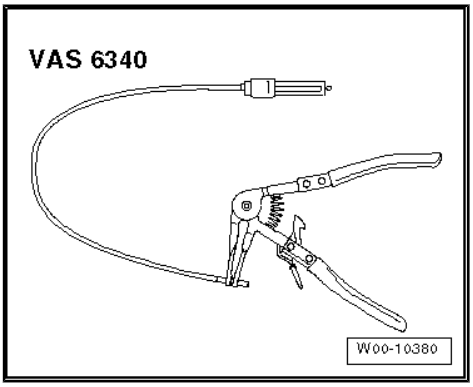
– Clean and smoothen sealing surfaces for O-rings as required.
– Install secondary air combination valve (right-side) ⇒ page 254 .
– Install coolant pipe (left-side) ⇒ page 204 .
– Install Hall sender ⇒ page 132 .
– Install throttle valve module -J338- ⇒ Rep. gr. 24 .
– Install pressure control valve for crankcase breather system ⇒ Rep. gr. 24 .
– Fill cooling system ⇒ page 182 .

2.9 Removing and installing coolant pipe (left-side)

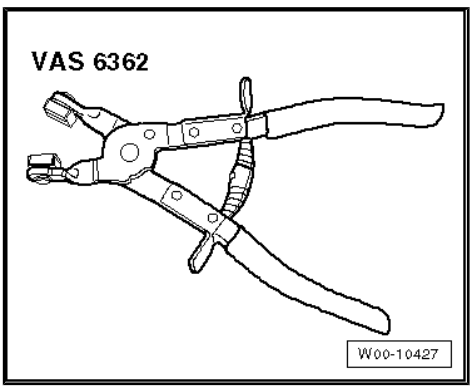
Special tools and workshop equipment required

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♦ Hose clip pliers -VAS 6340-



♦ Hose clip pliers -VAS 6362-



Removing

– Drain off coolant ⇒ page 181 .

– Slacken hose clip -1- on coolant hose.

Note

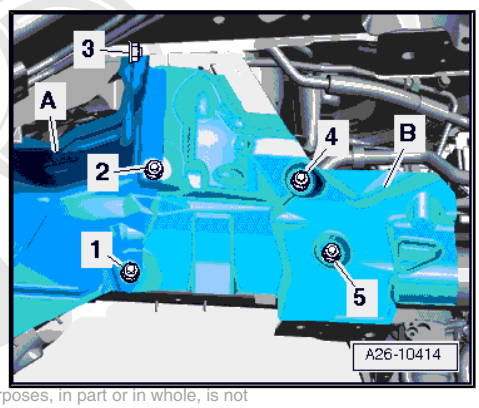
Disregard -arrows-.



– Unscrew nuts -1 and 5- (accessible from below).

Note

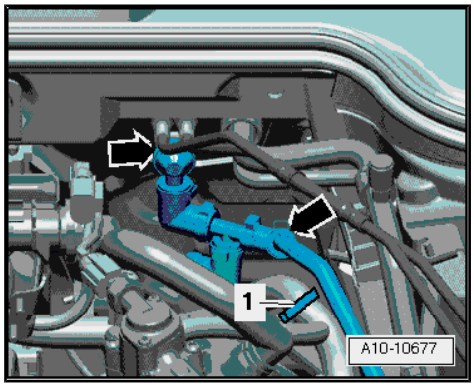
Nuts -2, 3 and 4- are removed at a later stage.



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– Detach vacuum lines -arrows- going to brake servo.
– Move vacuum lines clear to one side.



Note

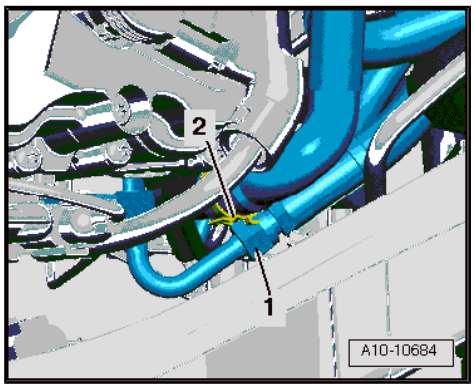
Disregard -item 1-.

– Remove cylinder head cover (left-side) ⇒ page 116 .

Note

Cover cylinder head with a clean cloth to prevent anything falling in.

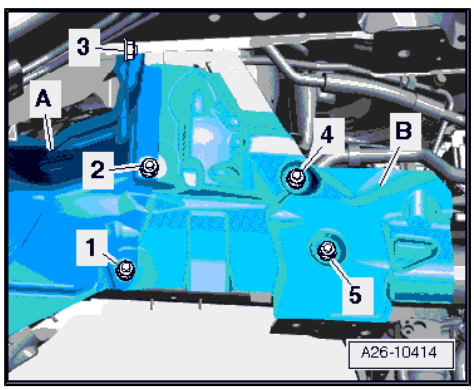
– Detach front coolant hose -2- from coolant pipe (bottom left).



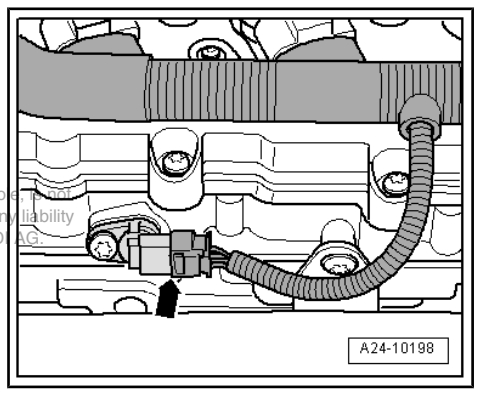
Note

Disregard -item 1-.

– Unscrew nuts -2 … 4- (accessible from above).
– Detach heat shield -A- from studs.
– Lift off heat shield -B-.



– Remove Hall sender 4 -G301- -arrow- (left cylinder bank).



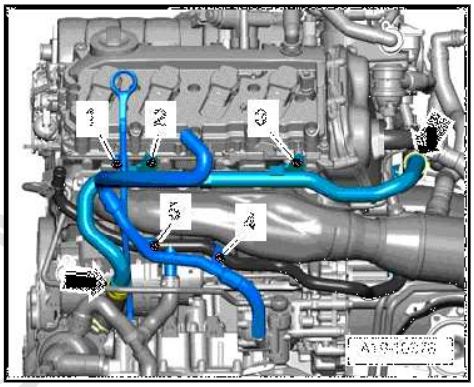
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– Remove bolt -1- and lift out guide tube for oil dipstick.

– Unscrew bolts -4 and 5- and swivel hydraulic fluid pipe to one side.

– Unscrew bolts -2 and 3- and detach coolant pipe (left-side) from coolant hoses -arrows-.



Installing

Tightening torques

- ⇒ “2.5 Coolant pipes - exploded view”, page 194 .
- ⇒ Fig. ““Heat shields -A and B- (left-side)”“ , page 196 .

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

Note

- *Fit new O-ring to guide tube for oil dipstick.*
- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*

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– Insert guide tube for oil dipstick into hole in top section of sump.

– Install Hall sender 4 -G301- (left cylinder bank) ⇒ Rep. gr. 24 .

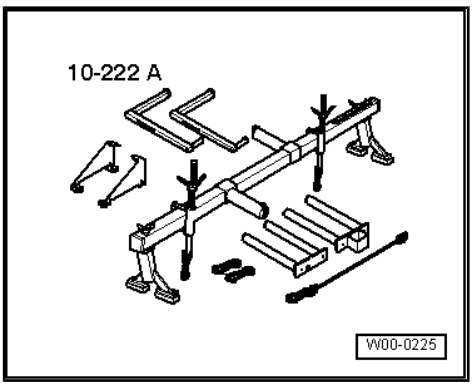
– Install cylinder head cover (left-side) ⇒ page 116 .

– Fill cooling system ⇒ page 182 .

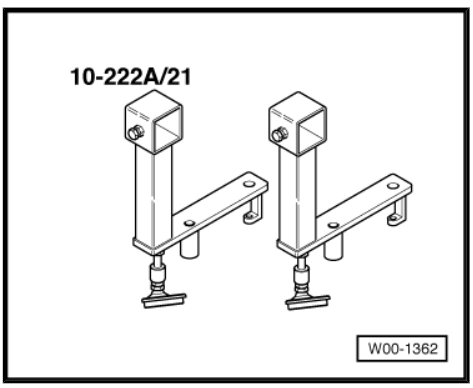
2.10 Removing and installing coolant pipe (bottom left)

Special tools and workshop equipment required

- Support bracket -10 - 222 A-

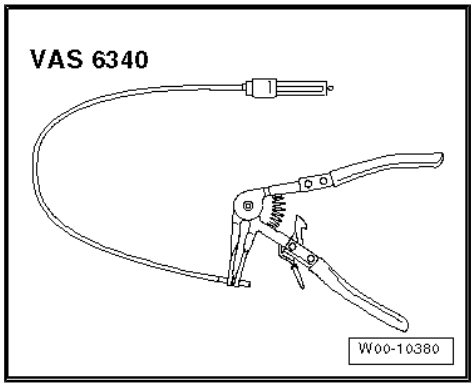


- Adapters -10 - 222 A /21-

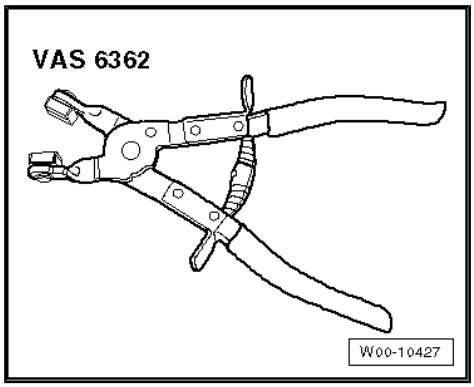


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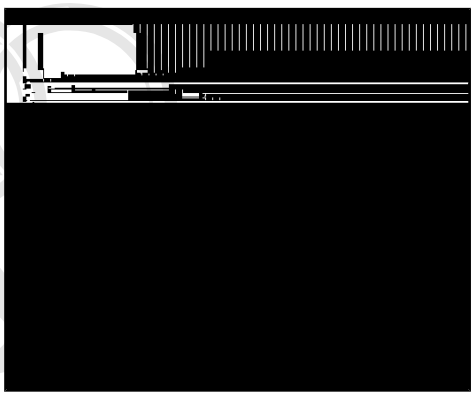
- Hose clip pliers -VAS 6340-



- Hose clip pliers -VAS 6362-



- Engine support bracket (supplementary set) -T40093-



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Removing

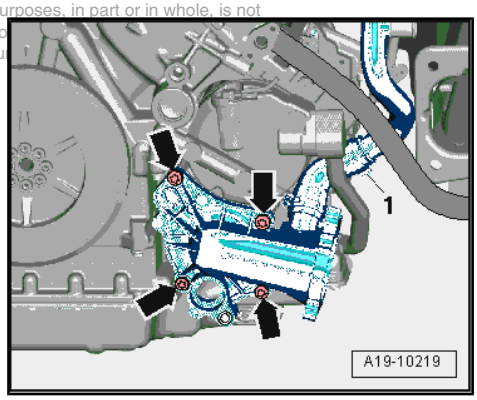
– Drain off coolant ⇒ page 181 .

– Slacken hose clip -1- on coolant hose.

Note

Disregard -arrows-.

– Remove front silencer (left-side) ⇒ page 229 .

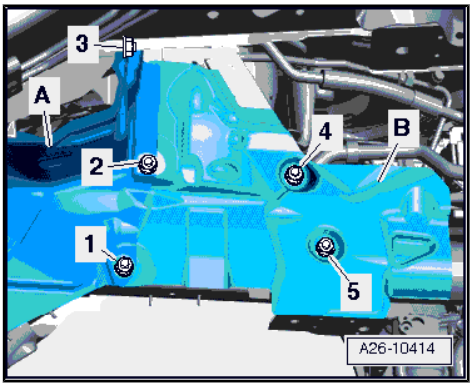


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– Unscrew nuts -1 and 5- (accessible from below).

Note

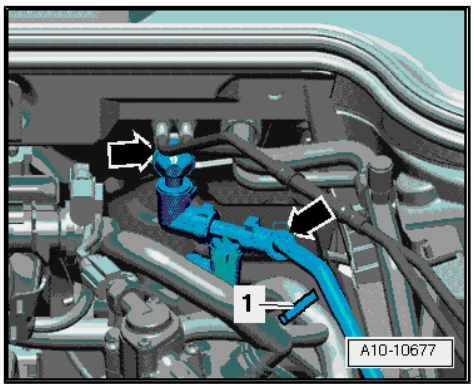
Nuts -2, 3 and 4- are removed at a later stage.



– Detach vacuum lines -arrows- going to brake servo.
– Move vacuum lines clear to one side.

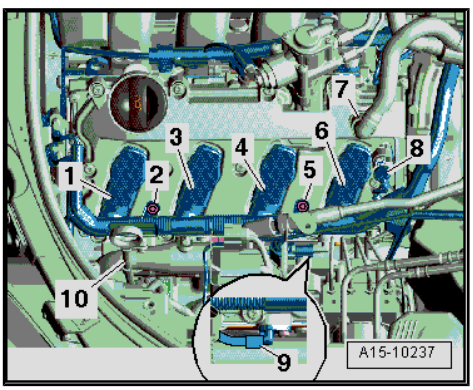
Note

Disregard -item 1-.



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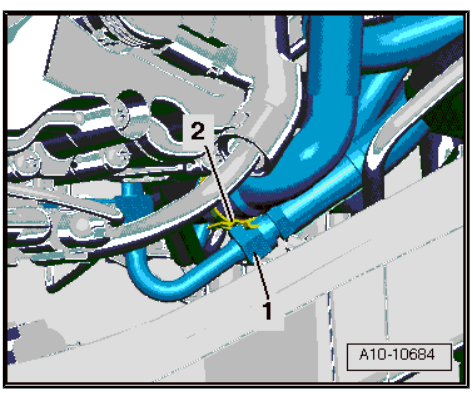
– Pull dipstick -10- out of guide tube.
– Remove bolts -2 and 5-.
– Unplug electrical connectors -1, 3, 4, 6, 8- and move wiring harness clear.
– Remove Hall sender -9-.
– Disconnect crankshaft breather hose -7- by pressing release tabs.
– Place wiring harness on top of engine.



– Detach front coolant hose -2- from coolant pipe (bottom left).

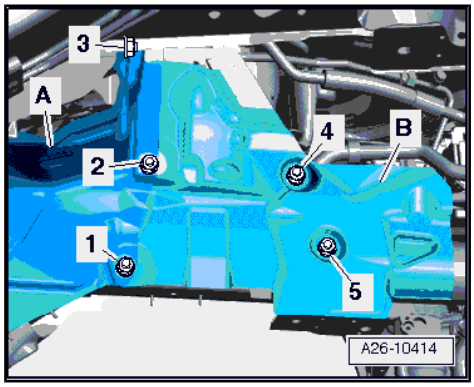
Note

Disregard -item 1-.

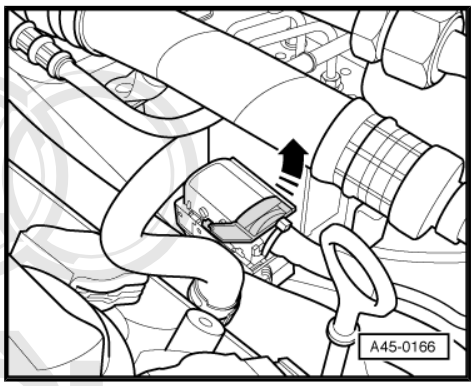


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– Unscrew nuts -2 … 4- (accessible from above).
– Detach heat shield -A- from studs.
– Lift off heat shield -B-.

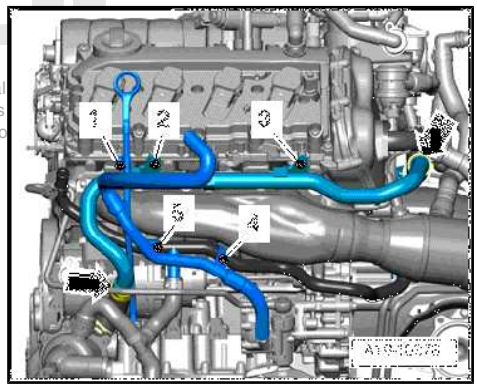


– Unplug electrical connector at ABS control unit -arrow- ⇒ Rep. gr. 45 .



– Remove bolt -1- and lift out guide tube for oil dipstick.
– Unscrew bolts -4 and 5- and swivel hydraulic fluid pipe to one side.
– Unscrew bolts -2 and 3- and detach coolant pipe (left-side) from coolant hose -left arrow-.
– Pivot coolant pipe (left-side) upwards slightly.

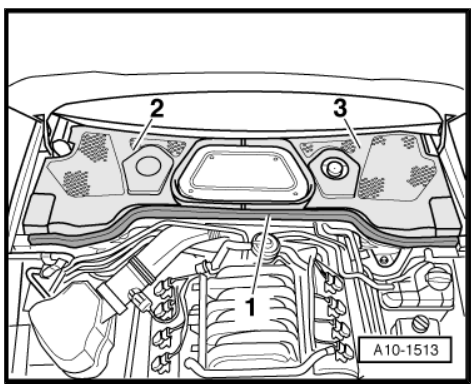
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Note

Disregard -arrow- on right-side of illustration.

– Pull off rubber seal -1- and remove plenum chamber covers -2 and 3-.

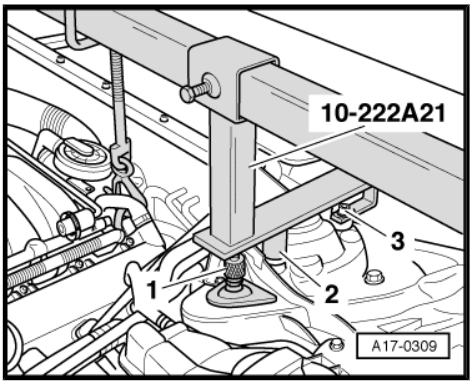


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– Unscrew rear bolts -3- for body brace.

– Attach adapters -10 - 222 A /21- without adapter -10 - 222 A / 4- onto suspension turrets.

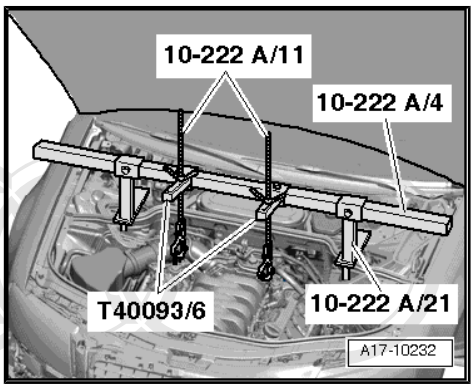
- Supports are marked for left and right side of vehicle.
- The centre resting point -2- of supports is positioned on front bolts for body brace.
- The adapters -10 - 222 A /21- are attached by means of the rear bolts -3- for the body brace.
- The knurled screw -1- must be screwed down until support plate rests on suspension turret.



– Attach adapter -10 - 222 A /4- using adapters -T40093/6- to adapters -10 - 222 A /21- .

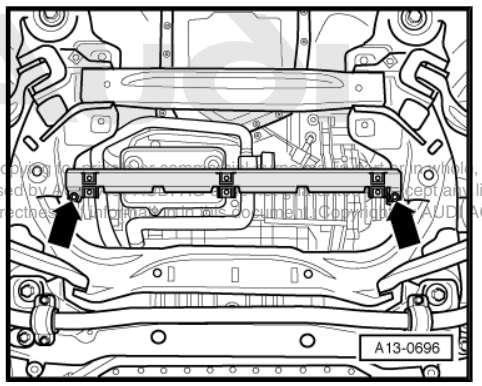
– Secure spindles -10 - 222 A /11- to engine lifting eyes.

– Take up weight of engine using spindles of support bracket.

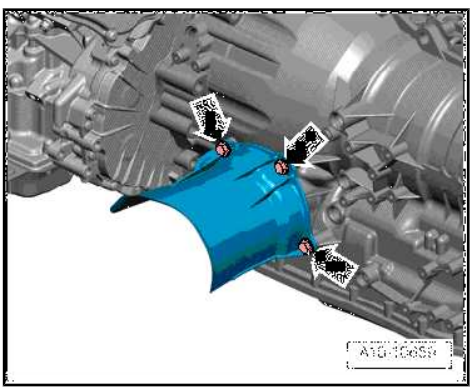


– Remove front left wheel.

– Unbolt bracket for noise insulation -arrows-.



– Unbolt heat shield for drive shaft from gearbox -arrows-.



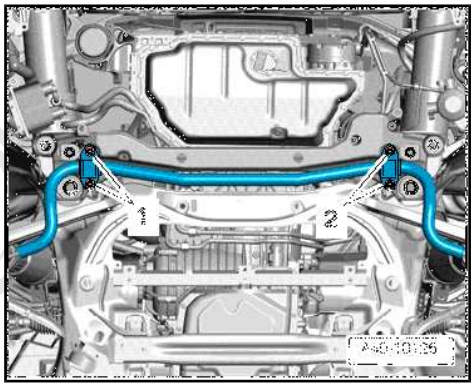
Note

Shown in illustration with engine removed.

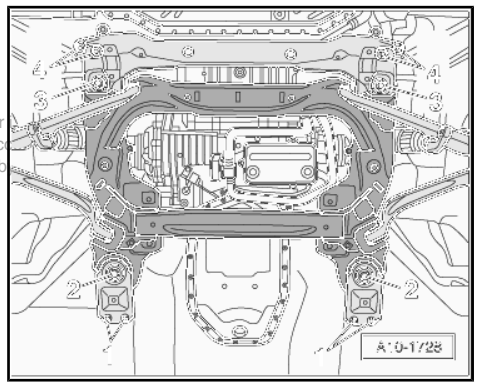
– Detach drive shaft (left-side) from flange shaft.

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– Remove bolts (left and right) -1 and 2- for anti-roll bar mountings.



– Remove bolts -3 and 4-.

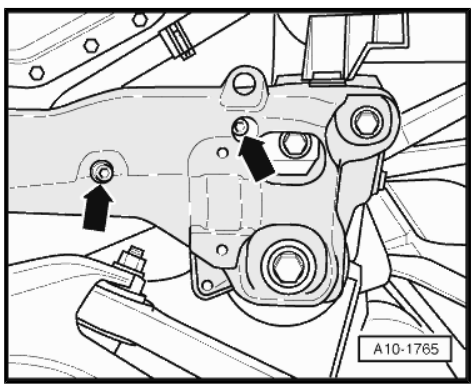


Note

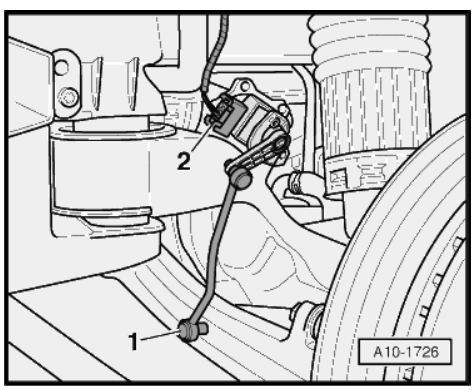
Disregard -items 1 and 2-.

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– Remove bolts for engine mountings -arrows- on both sides.
– Take out engine cross member.



– Unplug electrical connector -2- at vehicle level sender (left and right).

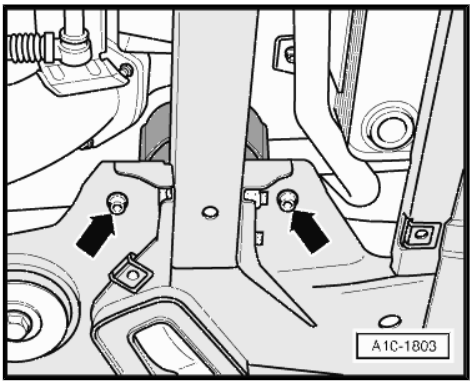


Note

Disregard -item 1-.

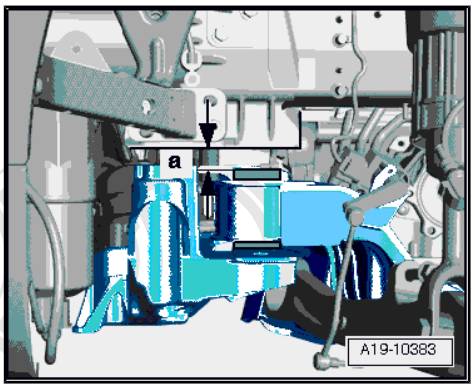
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– Remove bolts (left and right) -arrows- for front gearbox mounting.

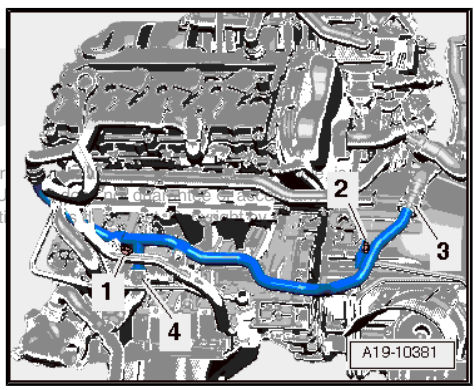


– Turn spindles -10 - 222 A /11- to lower subframe by dimension -a-.

• Dimension -a- = at least 80 mm



– Detach coolant hose -3-, to do so, pull out clip slightly.
– Detach coolant hose -4- from coolant pipe (bottom left).
– Remove bolts -1 and 2-.
– Remove coolant pipe (bottom left).



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Installing

Tightening torques

• ⇒ “2.5 Coolant pipes - exploded view”, page 194 .
• ⇒ Fig. ““Heat shield for drive shaft (left-side)”“ , page 196 .

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

Note

♦ *Fit new O-ring to guide tube for oil dipstick.*
♦ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*

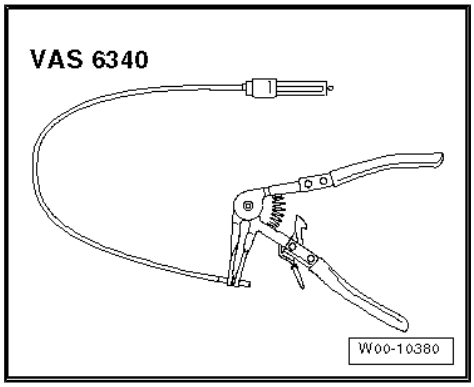
– Install subframe and engine cross member ⇒ Rep. gr. 40 .
– Install drive shaft (left-side) ⇒ Rep. gr. 40 .
– Install anti-roll bar ⇒ Rep. gr. 40 .
– Install front silencer (left-side) ⇒ page 229 .
– Align exhaust system so it is free of stress ⇒ page 232 .
– Install coolant pipe (left-side) ⇒ page 204 .
– Install Hall sender ⇒ page 132 .
– Fill cooling system ⇒ page 182 .

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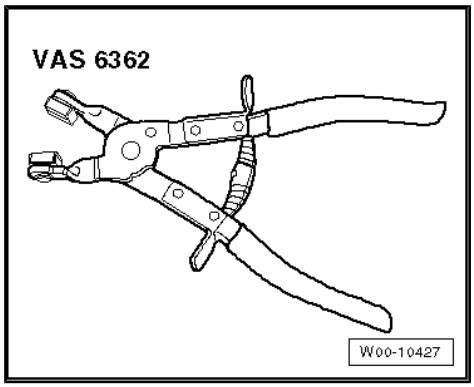
2.11 Removing and installing coolant pipe (right-side)

Special tools and workshop equipment required

- Hose clip pliers -VAS 6340-



- Hose clip pliers -VAS 6362-

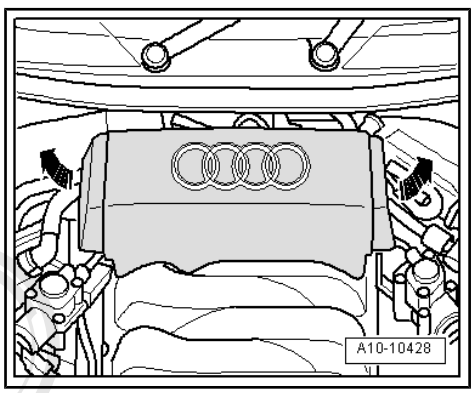


Removing

– Pull off engine cover panel (rear) -arrows-.

– Drain off coolant ⇒ page 181 .

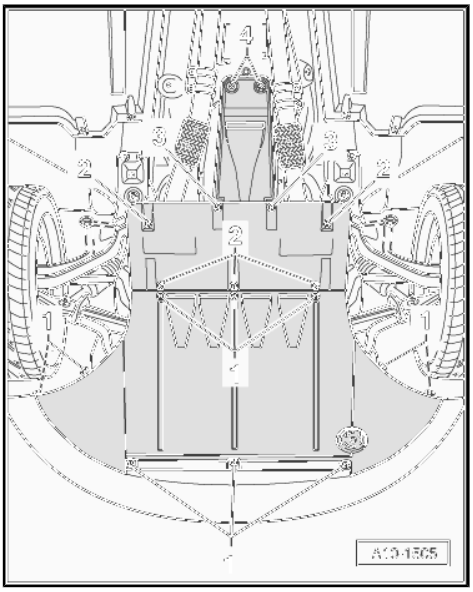
– Remove cylinder head cover (right-side) ⇒ page 117 .



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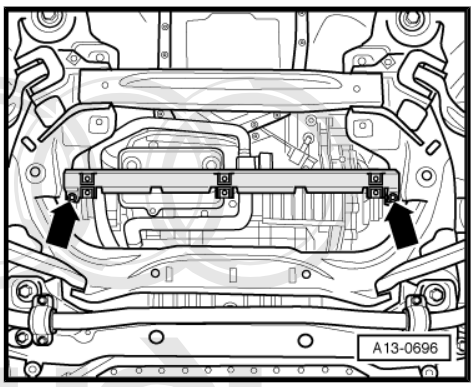
– Release fasteners -2 and 4- and remove rear noise insulation panels.



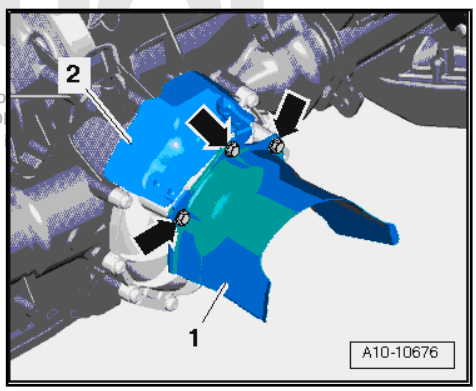
Note

Disregard -items 1 and 3-.

– Unbolt bracket for noise insulation -arrows-.



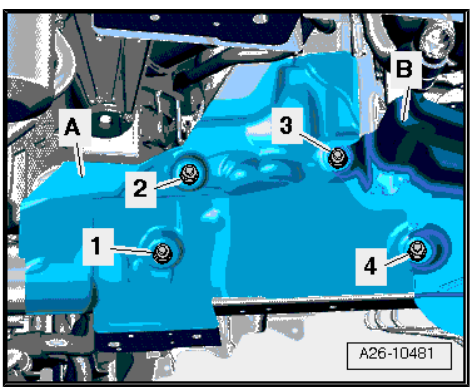
– Unbolt heat shield -1- for drive shaft from gearbox -arrows-.



Note

Disregard -item 2-.

– Unscrew nuts -1 and 4- (accessible from below).

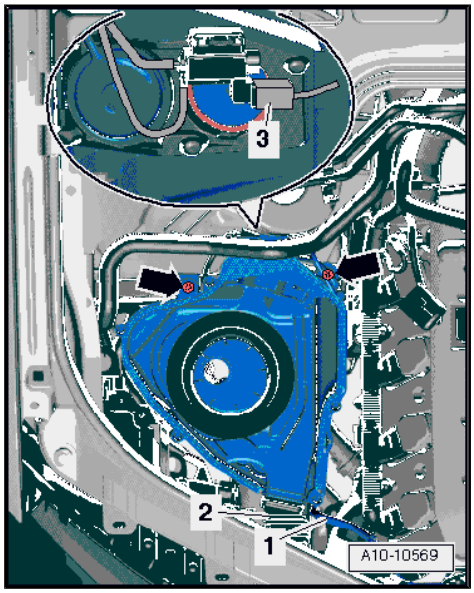


Note

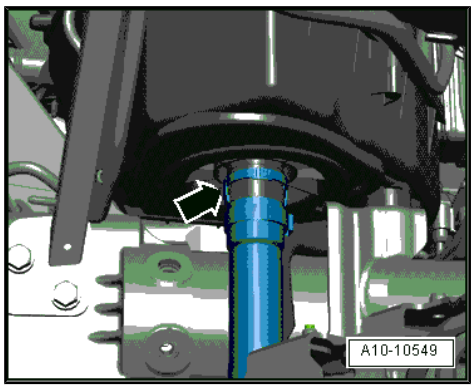
Nuts -2 and 3- are removed at a later stage.

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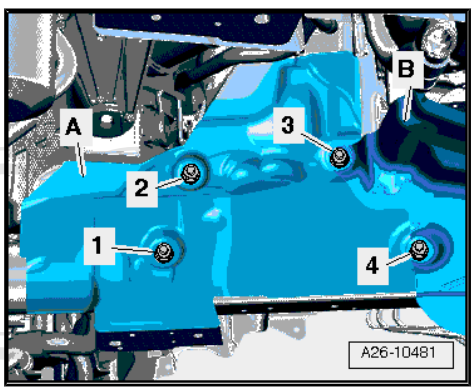
– Disconnect vacuum hose -1- and remove air duct -2-.
– Remove bolts -arrows-.
– Turn air cleaner housing (bottom section) and unplug electrical connector -3- at variable intake manifold change-over valve -N335- .
– Remove bottom section of air cleaner housing.



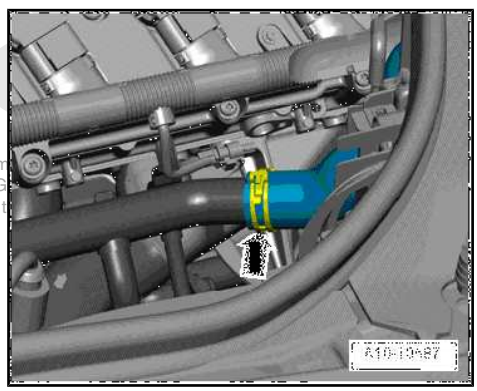
– Disconnect air hose (bottom) from air cleaner housing (bottom section) -arrow-.



– Unscrew nuts -2 and 3- (accessible from above).
– Detach heat shield -B- from studs.
– Lift off heat shield -A-.



– Detach coolant hose -arrow- from coolant pipe (right-side).

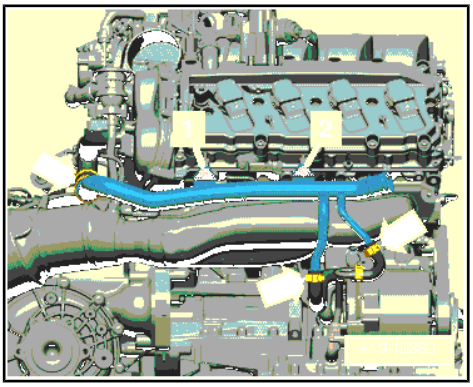


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– Remove bolts -1 and 2-.

– Detach coolant pipe (right-side) from coolant hoses -arrows-.



Installing

Tightening torques

- ⇒ “2.5 Coolant pipes - exploded view”, page 194 .
- ⇒ Fig. ““Heat shields -A and B- (right-side)““ , page 196 .
- ⇒ Fig. ““Heat shield for drive shaft (right-side)““ , page 197 .

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

Note

- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*
- *Fit all cable ties in the original positions when installing.*

– Install cylinder head cover (right-side) ⇒ page 117 .

– Install air cleaner housing ⇒ Rep. gr. 24 .

– Fill cooling system ⇒ page 182 .

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3 Radiator and radiator fans

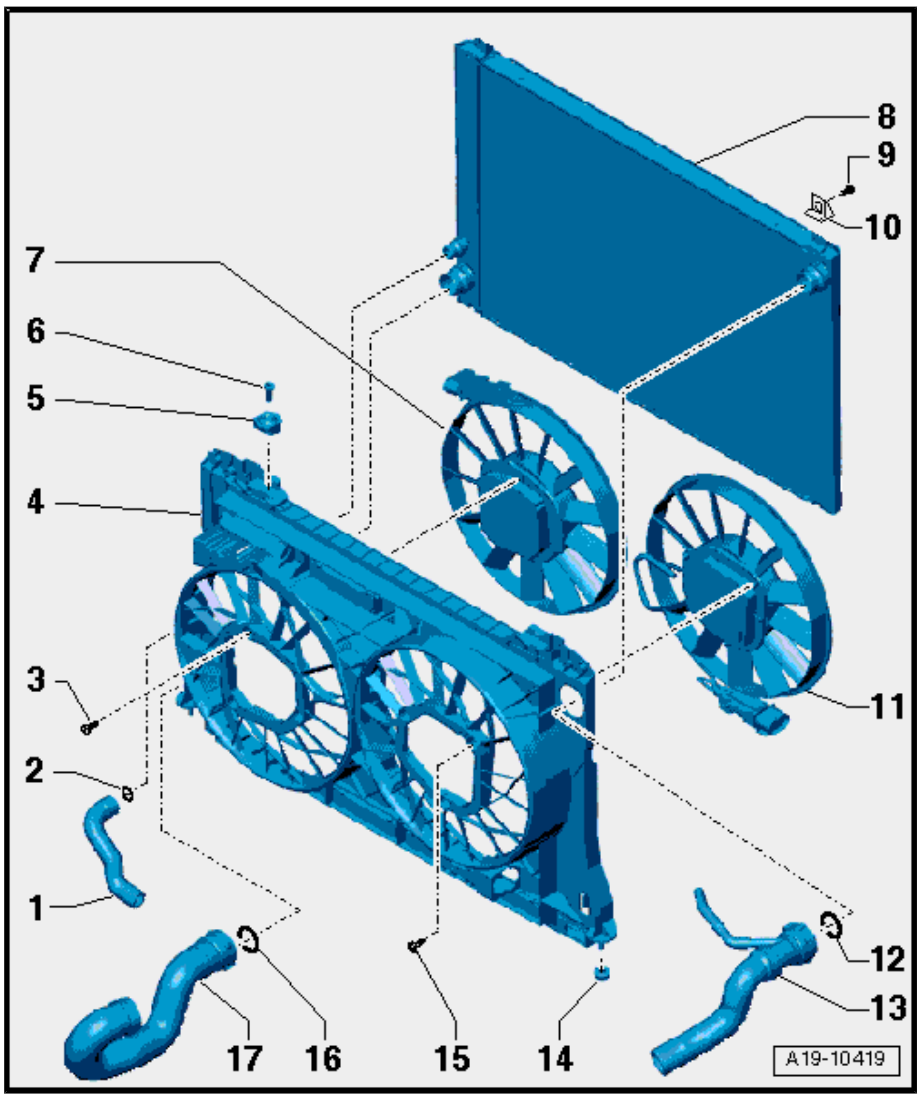
⇒ “3.1 Radiator and radiator fans - exploded view”, page 218

⇒ “3.2 Removing and installing radiator”, page 219

⇒ “3.3 Removing and installing radiator cowl”, page 221

⇒ “3.4 Removing and installing radiator fans”, page 222

3.1 Radiator and radiator fans - exploded view



1 - Coolant hose

- ❑ To detach, release retaining clip

2 - O-ring

- ❑ Renew

3 - Bolt

- ❑ Renew
- ❑ 10 Nm

4 - Radiator cowl

- ❑ Removing and installing ⇒ page 221

5 - Rubber buffer

- ❑ Use screwdriver to release and pull off

6 - Retaining pin

7 - Radiator fan -V7-

- ❑ With radiator fan control unit -J293-
- ❑ Removing and installing ⇒ page 222

8 - Radiator

- ❑ Removing and installing ⇒ page 219
- ❑ If renewed, change coolant in entire system

9 - Bolt

- ❑ 6 Nm

10 - Mounting for radiator

11 - Radiator fan 2 -V177-

- ❑ With radiator fan control unit 2 -J671-
- ❑ Removing and installing ⇒ page 222

12 - O-ring

- ❑ Renew

13 - Coolant hose

- ❑ To detach, release retaining clip

14 - Rubber bush

15 - Bolt

- ❑ 10 Nm

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16 - O-ring

❑ Renew

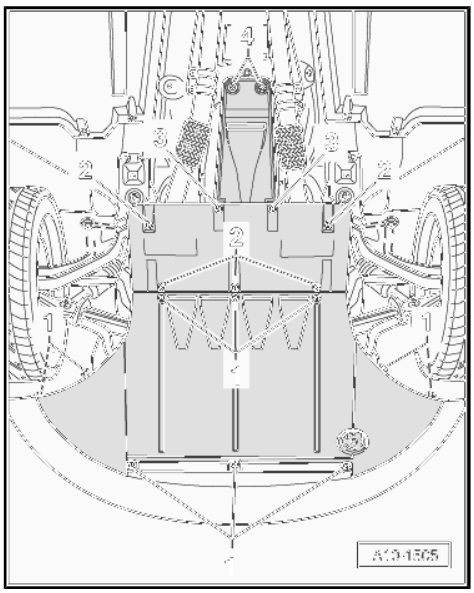
17 - Coolant hose

❑ To detach, release retaining clip

3.2 Removing and installing radiator

Removing

– Release fasteners -1- to remove front noise insulation.

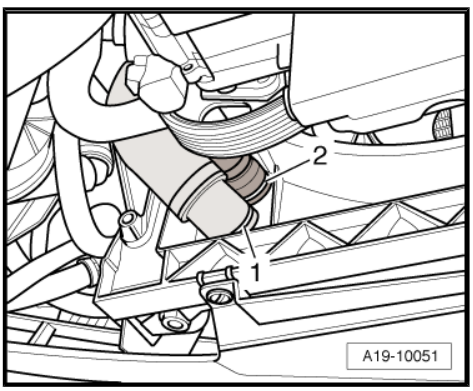


Note

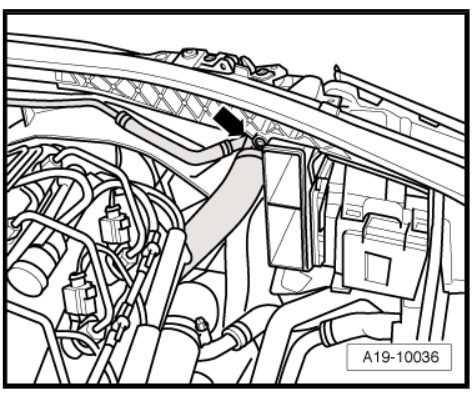
Disregard -items 2, 3, 4-.

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– Pull clips out slightly and remove coolant hoses -1 and 2- from radiator.

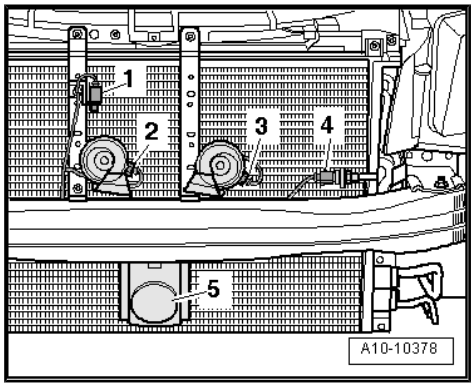


– Pull clips out slightly and remove top coolant hose from radiator -arrow-.

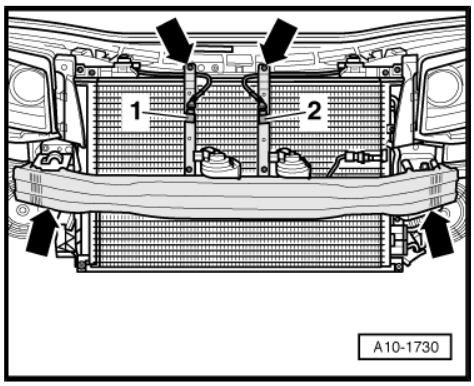


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– Detach ambient temperature sensor -G17- -item 4-.
– Unplug electrical connectors -1, 2, 3-.
– Move electrical wiring harness clear.
– On vehicles with adaptive cruise control, unplug electrical connector at adaptive cruise control unit -J428- -item 5-.



– Unscrew bolts -arrows- and remove bumper together with struts.



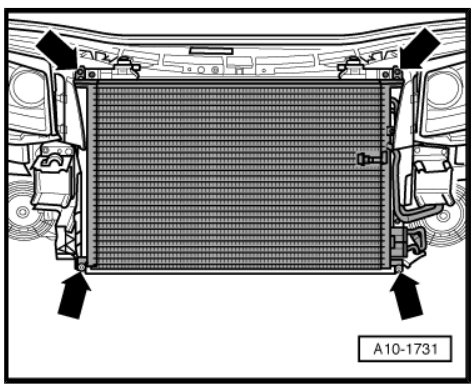
Note

Disregard -items 1 and 2-.

WARNING

Risk of injury caused by refrigerant.

- ***The air conditioner refrigerant circuit must not be opened.***



Caution

Make sure that condenser and refrigerant pipes and hoses are not damaged.

- ***Do NOT stretch, kink or bend refrigerant lines and hoses.***

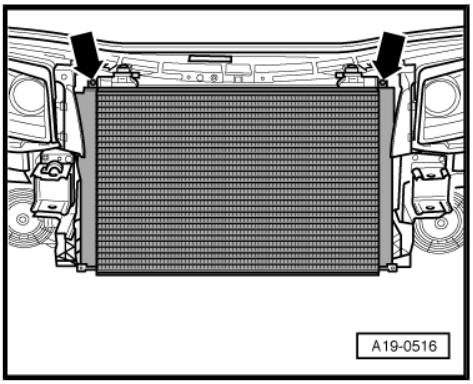
– Remove bolts -arrows-.
– Pivot condenser downwards together with cooler for power steering.
– Tie up condenser on engine.

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– Remove the two brackets for radiator -arrows-.

– Tilt top of radiator forwards slightly and lift out of lock carrier.



Installing

- Tightening torques
  ⇒ "3.1 Radiator and radiator fans - exploded view", page 218

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

– Install bumper cover (front) ⇒ Rep. gr. 63 .

– Fill cooling system ⇒ page 182 .

Note

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

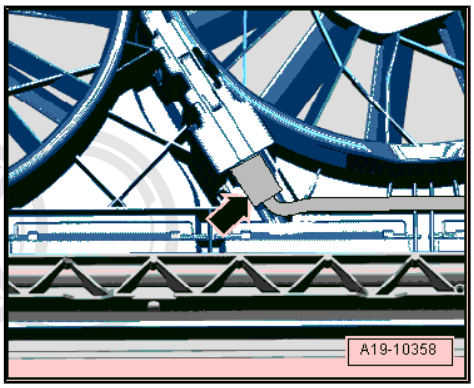
3.3 Removing and installing radiator cowl

Removing

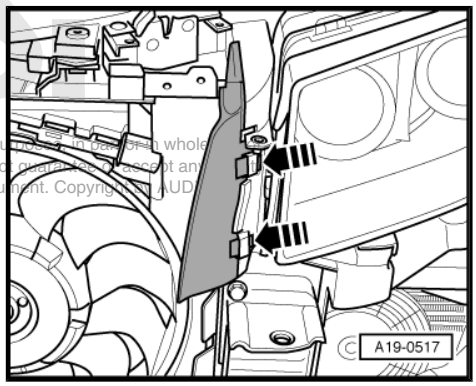
– Drain off coolant ⇒ page 181 .

– Remove radiator ⇒ page 219 .

– Unplug electrical connector -arrow- going to radiator fan.

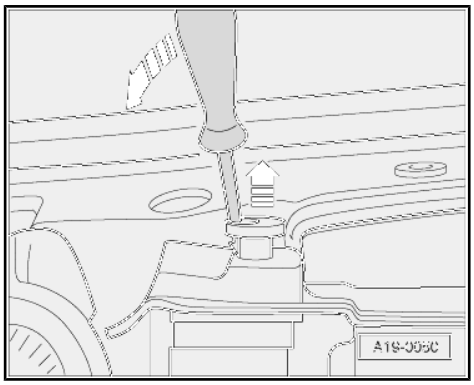


– Remove air duct (left and right) -arrows-.



– Release both retaining pins for radiator cowl and pull out upwards -arrows-.

– Tilt top edge of radiator cowl forwards.



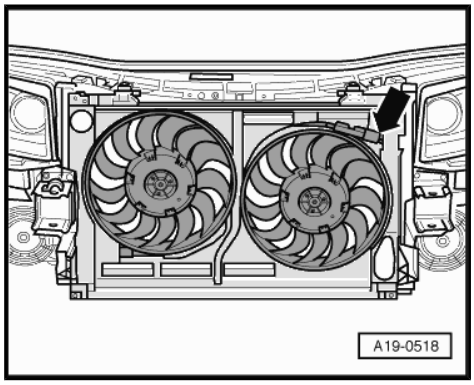
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WARNING

Risk of injury as the radiator fans may start up automatically.

- *Unplug electrical connectors before starting to work in the area of radiator cowl.*



– Reach behind radiator cowl and unplug electrical connector -arrow- for radiator fans.

– Remove radiator cowl.

Installing

- Tightening torques
  ⇒ “3.1 Radiator and radiator fans - exploded view”, page 218

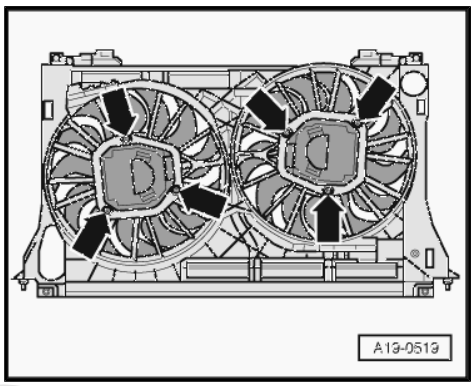
Installation is carried out in the reverse order; note the following:

– Install radiator ⇒ page 219 .

– Fill cooling system ⇒ page 182 .

3.4 Removing and installing radiator fans

Removing



– Drain off coolant ⇒ page 181 .

– Remove radiator ⇒ page 219 .

– Remove radiator cowl ⇒ page 221 .

– Remove bolts -arrows-.

– Unclip electrical connectors and lay wiring aside.

– Remove radiator fans.

Installing

- Tightening torques
  ⇒ “3.1 Radiator and radiator fans - exploded view”, page 218

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

– Install radiator cowl ⇒ page 221 .

– Install radiator ⇒ page 219 .

– Fill cooling system ⇒ page 182 .

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26 – Exhaust system

1 Silencers

⇒ “1.1 Silencers - exploded view”, page 223

⇒ “1.2 Separating front exhaust pipe and front silencer”, page 226

⇒ “1.3 Separating centre and rear silencers”, page 227

⇒ “1.4 Renewing tailpipe”, page 228

⇒ “1.5 Removing and installing front silencer (left-side)”, page 229

⇒ “1.6 Removing and installing front silencer (right-side)”, page 231

⇒ “1.7 Stress-free alignment of exhaust system”, page 232

⇒ “1.8 Aligning tailpipes”, page 233

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1.1 Silencers - exploded view

1 - Centre silencer

- ❑ Combined in one unit with rear silencer as original equipment. Can be renewed individually for repair purposes
- ❑ Cutting point ⇒ page 227
- ❑ Align exhaust system so it is free of stress ⇒ page 232

2 - Rubber mounting

- ❑ Check preload ⇒ “1.7 Stress-free alignment of exhaust system”, page 232

3 - Nut

- ❑ 23 Nm

4 - Bolt

5 - Nut

- ❑ Renew
- ❑ 25 Nm

6 - Gasket

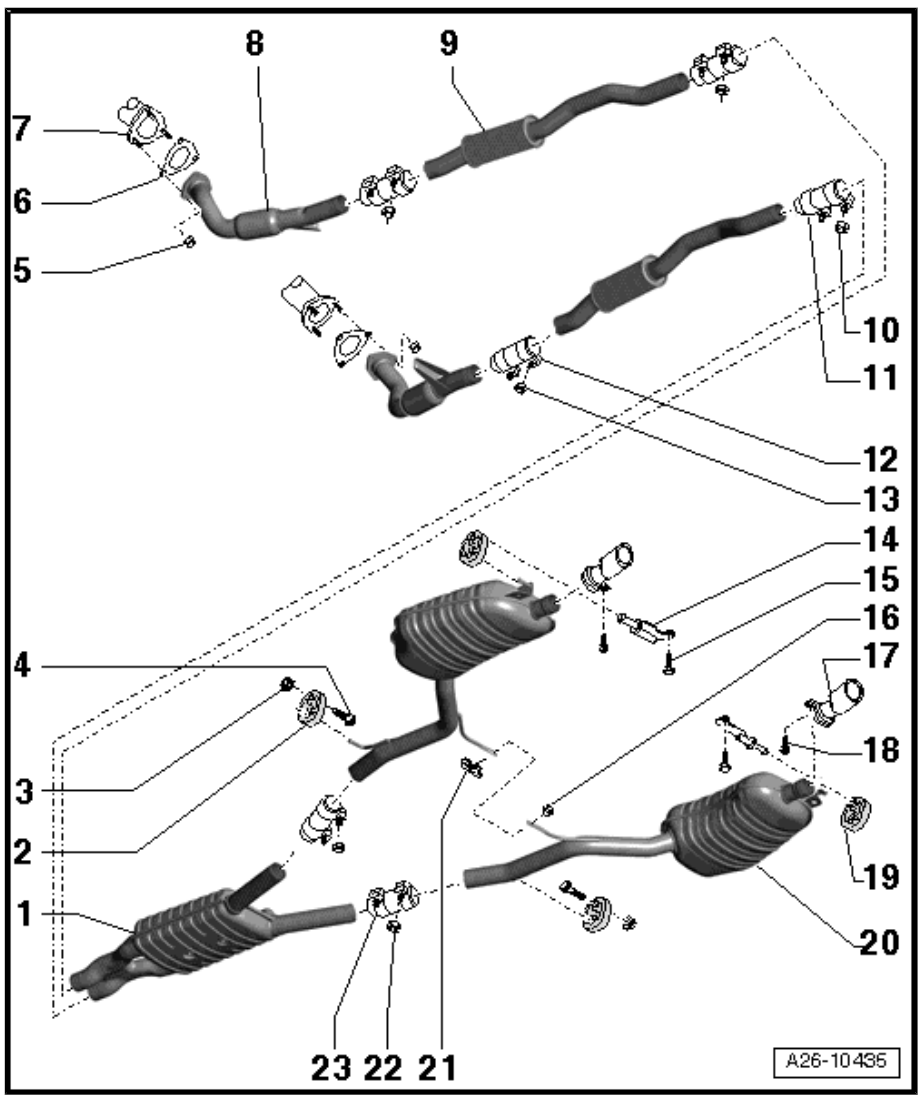
- ❑ Renew

7 - Exhaust manifold with catalytic converter

- ❑ Protect against knocks and impact
- ❑ Removing and installing: left-side ⇒ page 236 , right-side ⇒ page 242

8 - Front exhaust pipe

- ❑ With flexible joint



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Caution

Risk of damage to flexible joints in front exhaust pipe.
Do NOT bend flexible joints in front exhaust pipe more than 10°.

- ❑ Combined with front silencer as original equipment. Can be renewed individually for repair purposes
- ❑ Removing and installing: left-side ⇒ page 229 , right-side ⇒ page 231
- ❑ Cutting point ⇒ page 226
- ❑ Align exhaust system so it is free of stress ⇒ page 232

9 - Front silencer

- ❑ Combined in one unit with front exhaust pipe as original equipment. Can be renewed individually for repair purposes
- ❑ Removing and installing: left-side ⇒ page 229 , right-side ⇒ page 231
- ❑ Cutting point ⇒ page 226
- ❑ Align exhaust system so it is free of stress ⇒ page 232

10 - Nut

- ❑ 23 Nm

11 - Clamp (centre)

- ❑ Position clamp so that it aligns with centre of cutting location
- ❑ Installation position ⇒ page 225
- ❑ Before tightening bolt connections, align exhaust system so it is free of stress ⇒ page 232
- ❑ Tighten bolt connections evenly

12 - Clamp (front)

- ❑ To enable individual renewal of front exhaust pipe and front silencer
- ❑ Position clamp so that it aligns with centre of cutting location
- ❑ Installation position ⇒ page 225
- ❑ Before tightening bolt connections, align exhaust system so it is free of stress ⇒ page 232
- ❑ Tighten bolt connections evenly

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13 - Nut

- ❑ 23 Nm

14 - Mounting

15 - Bolt

- ❑ 22 Nm

16 - Nut

- ❑ Renew
- ❑ 23 Nm

17 - Tailpipe

- ❑ Combined in one unit with rear silencer as original equipment. Can be renewed individually for repair purposes
- ❑ Cutting point ⇒ page 228
- ❑ Aligning ⇒ page 233

18 - Bolt

- ❑ 23 Nm

19 - Rubber mounting

- ❑ Check preload ⇒ “1.7 Stress-free alignment of exhaust system”, page 232

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20 - Rear silencer

- ❑ Combined in one unit with centre silencer as original equipment. Can be renewed individually for repair purposes
- ❑ Cutting point ⇒ page 227
- ❑ Align exhaust system so it is free of stress ⇒ page 232

21 - Connecting bracket

22 - Nut

- ❑ 23 Nm

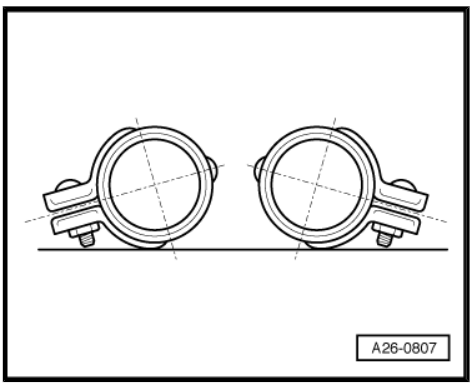
23 - Clamp (rear)

- ❑ For separate replacement of centre and rear silencers
- ❑ Position clamp so that it aligns with centre of cutting location
- ❑ Installation position ⇒ page 225
- ❑ Before tightening bolt connections, align exhaust system so it is free of stress ⇒ page 232
- ❑ Tighten bolt connections evenly

Installation position of front and centre clamps

– Fit clamps so that ends of bolts do not protrude beyond bottom of clamps.

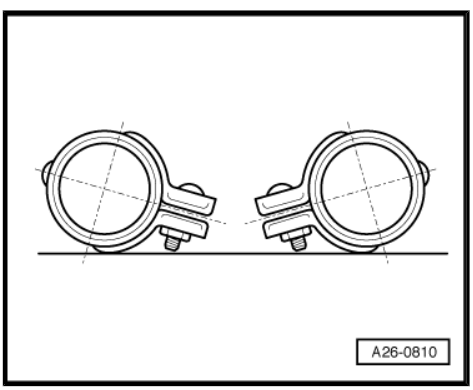
• Bolt connections face outwards.



Installation position of rear clamps

– Fit clamps so that ends of bolts do not protrude beyond bottom of clamps.

• Bolt connections face one another.



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Components of bracket (centre)

1 - Studs

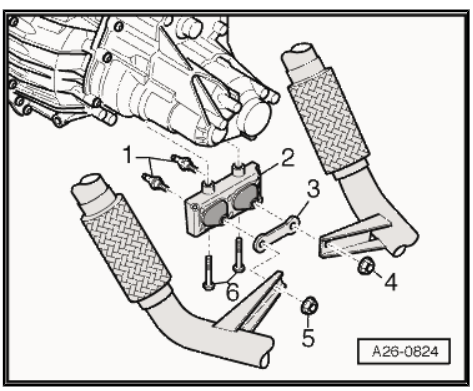
2 - Bracket

3 - Bracket

4 - Nut, self-locking, 25 Nm

5 - Nut, self-locking, 25 Nm

6 - Bolts - 25 Nm



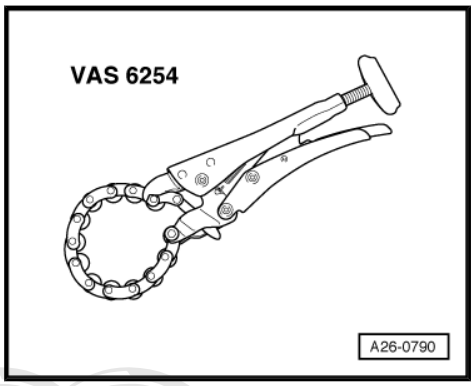
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1.2 Separating front exhaust pipe and front silencer

- A cutting point is provided in order to renew the front exhaust pipe or the front silencer separately.
- The cutting point is marked by an indentation on the circumference of the front exhaust pipe.

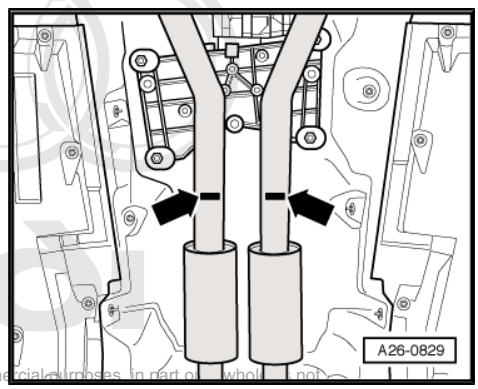
Special tools and workshop equipment required

- Chain pipe cutter -VAS 6254-

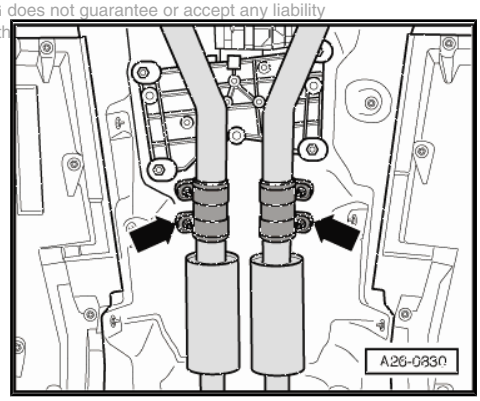


Procedure

– Cut through exhaust pipes at a right angle at cutting point -arrows- using chain pipe cutter -VAS 6254- .



– When reassembling, position the clamps -arrows- centrally over the cutting point.

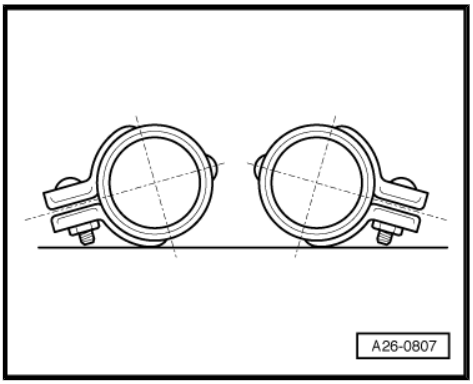


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– Fit clamps so that ends of bolts do not protrude beyond bottom of clamps.

• Bolt connections face outwards.

– Align exhaust system so it is free of stress ⇒ page 232 .



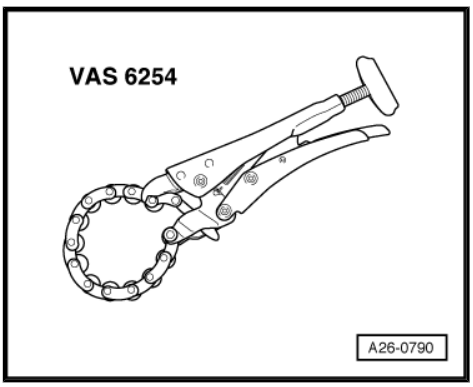
1.3 Separating centre and rear silencers

♦ The connecting pipe can be cut through at the cutting location in order to renew the centre or rear silencer separately.

♦ The cutting point is marked by an indentation on the circumference of the exhaust pipe.

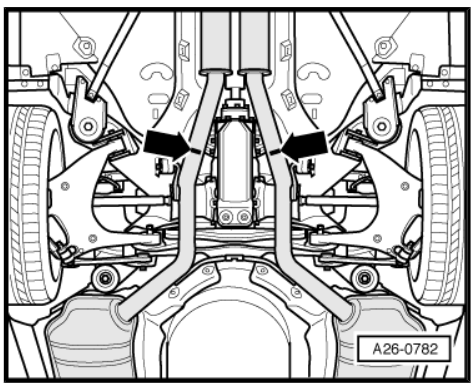
Special tools and workshop equipment required

♦ Chain pipe cutter -VAS 6254-

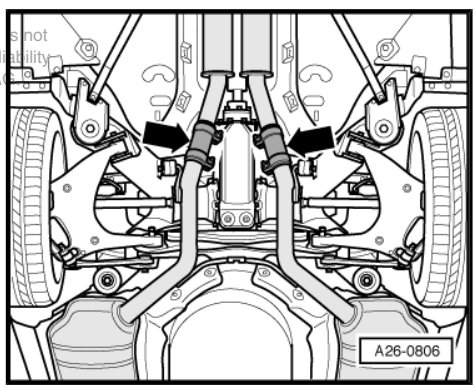


Procedure

– Cut through exhaust pipes at a right angle at cutting point -arrows- using chain pipe cutter -VAS 6254- .



– When reassembling, position the clamps -arrows- centrally over the cutting point.



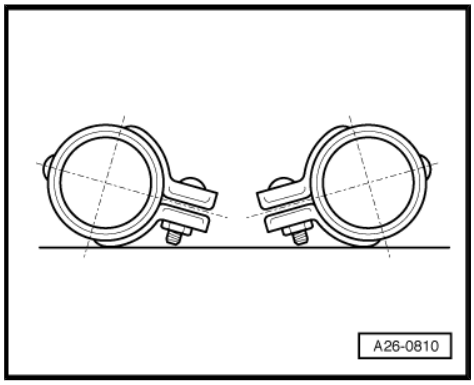
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– Fit clamps so that ends of bolts do not protrude beyond bottom of clamps.

• Threads of bolts point inwards.

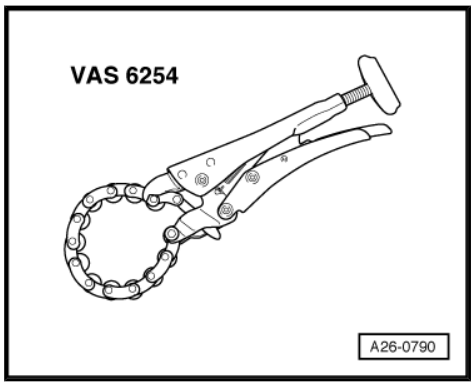
– Align exhaust system so it is free of stress ⇒ page 232 .



1.4 Renewing tailpipe

Special tools and workshop equipment required

♦ Chain pipe cutter -VAS 6254-



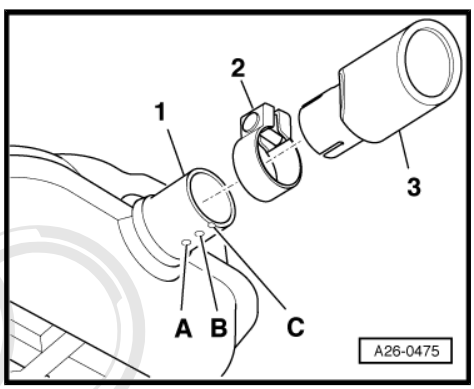
Procedure

• Tightening torque
⇒ “1.1 Silencers - exploded view”, page 223

– Cut through tailpipe -1- with chain-type pipe cutter -VAS 6254- at the position marked -C-.

– Push new tailpipe -3- onto tailpipe as far as marking -A-. Slot on tailpipe should align with marking -B-.

– Tighten nut for clamp -2-.



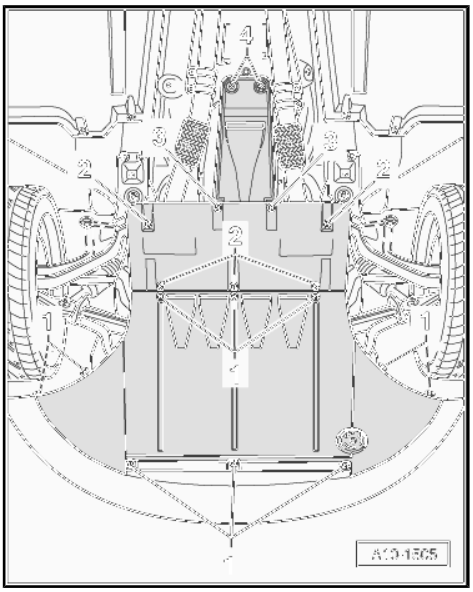
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1.5 Removing and installing front silencer (left-side)

Removing

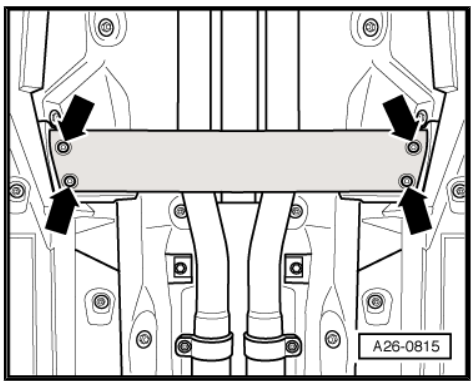
– Release fasteners -2 and 4- and remove rear noise insulation panels.



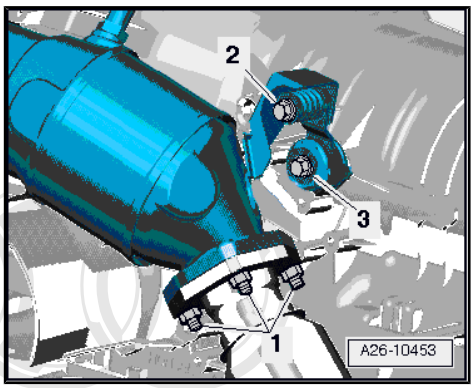
Note

Disregard -items 1 and 3-.

– Unbolt cross piece (front) -arrows-.



– Unscrew nuts -1- for front silencer (left-side).



Note

Disregard -items 2 and 3-.

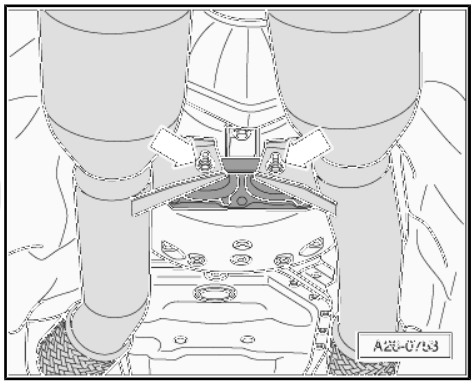
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Caution

Risk of damage to flexible joint in front exhaust pipe.

- *Do NOT bend flexible joint in front exhaust pipe more than 10°.*



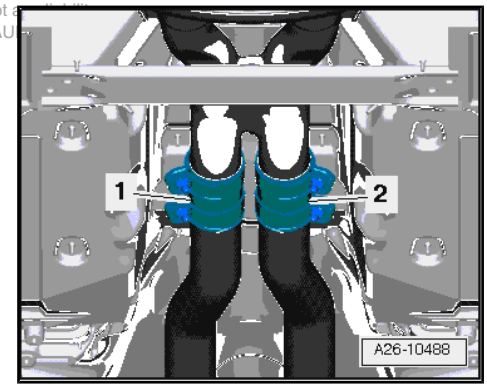
– Unscrew nut -left arrow- at mounting bracket for front silencer (left-side).

Note

Disregard -arrow- on right-side of illustration.

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– Disconnect exhaust system at clamp (left-side) -1- and detach front silencer (left-side).



Note

Disregard -item 2-.

Installing

- Tightening torque
  ⇒ “1.1 Silencers - exploded view”, page 223

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

Note

Renew gaskets and self-locking nuts.

– Install cross piece (front) ⇒ Rep. gr. 40 .

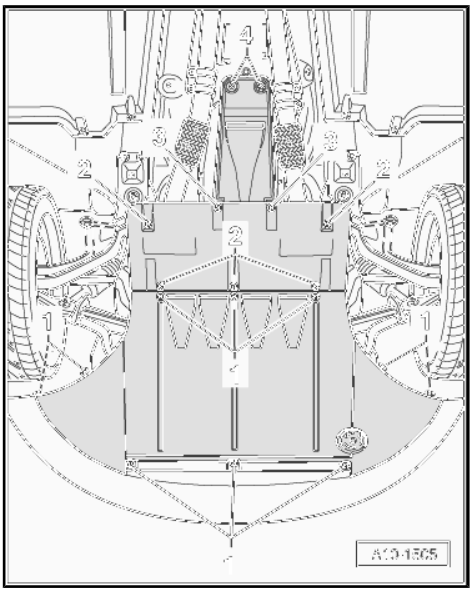
– Align exhaust system so it is free of stress ⇒ page 232 .

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1.6 Removing and installing front silencer (right-side)

Removing

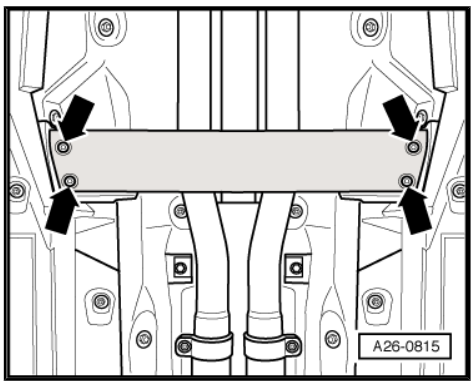
– Release fasteners -2 and 4- and remove rear noise insulation panels.



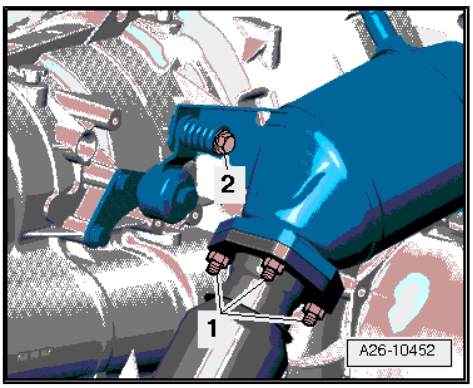
Note

Disregard -items 1 and 3-.

– Unbolt cross piece (front) -arrows-.



– Unscrew nuts -1- for front silencer (right-side).



Note

Disregard -item 2-.

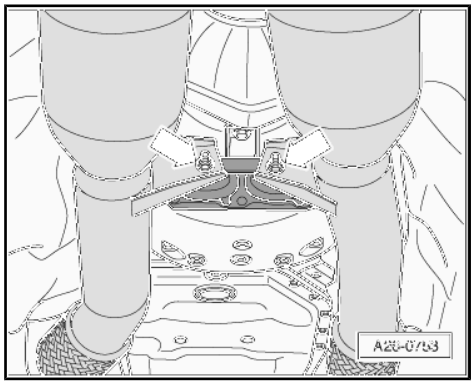
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Caution

Risk of damage to flexible joints in front exhaust pipe.

- *Do NOT bend flexible joints in front exhaust pipe more than 10°.*

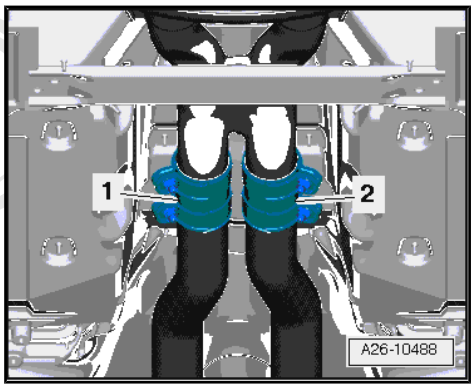


– Unscrew nut -right arrow- at mounting bracket for front silencer (right-side).

Note

Ignore -arrow on left side of illustration-.

– Disconnect exhaust system at clamp (right-side) -2- and detach front silencer (right-side).



Note

Disregard -item 1-.

Installing

- Tightening torque
  ⇒ “1.1 Silencers - exploded view”, page 223

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

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Note

Renew gaskets and self-locking nuts.

– Install cross piece (front) ⇒ Rep. gr. 40 .

– Align exhaust system so it is free of stress ⇒ page 232 .

1.7 Stress-free alignment of exhaust system

Procedure

- The exhaust system must be aligned when it is cool.
- Tightening torques
  ⇒ “1.1 Silencers - exploded view”, page 223

– Align front section of exhaust system including front silencer and clamps ⇒ Item 12 (page 224) .

– Loosen bolts for clamps ⇒ Item 11 (page 224) .

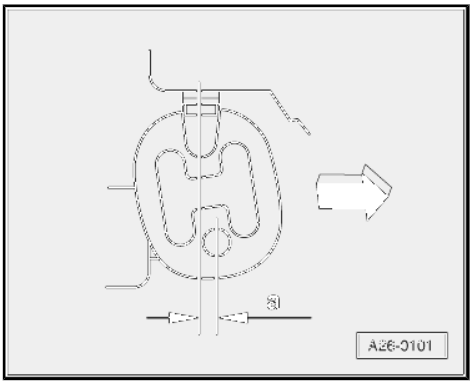
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– Push exhaust system towards front of vehicle -arrow-, so that rubber mountings ⇒ Item 2 (page 223) are pre-loaded by dimension -a-.

• Distance -a- = 11 mm

– Tighten bolt connections on clamps evenly.

– Align tailpipes ⇒ page 233 .



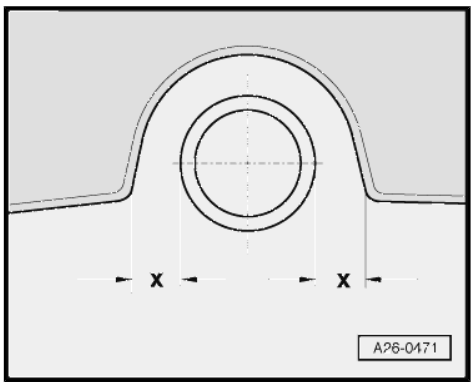
1.8 Aligning tailpipes

Procedure

• Tightening torque
⇒ "1.1 Silencers - exploded view", page 223

– Check clearance between tailpipes and bumper on both sides.

• Dimension -x- (left-side) = dimension -x- (right-side)



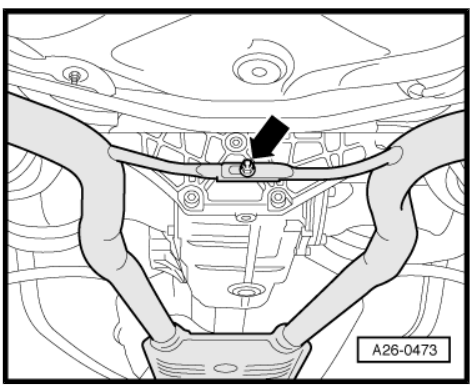
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If necessary, correct dimension -x- as follows:

– Slacken bolt connection -arrow- on brace between exhaust pipes.

– Adjust the distance between the rear silencers.

– Tighten bolt connection.

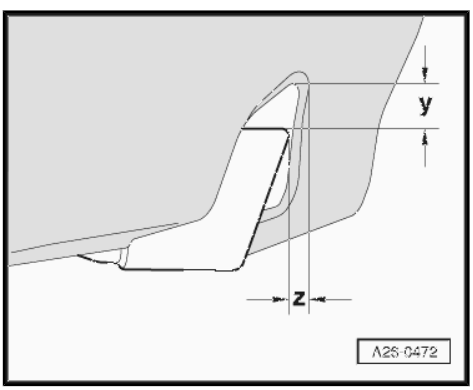


– Check distances -y- and -z- between tailpipes and bumper.

• Dimension -y- = 13 ... 17 mm.

• Dimension -z- = 8 ... 12 mm.

– If tailpipes cannot be aligned, check whether exhaust system is aligned free of stress ⇒ page 232 .



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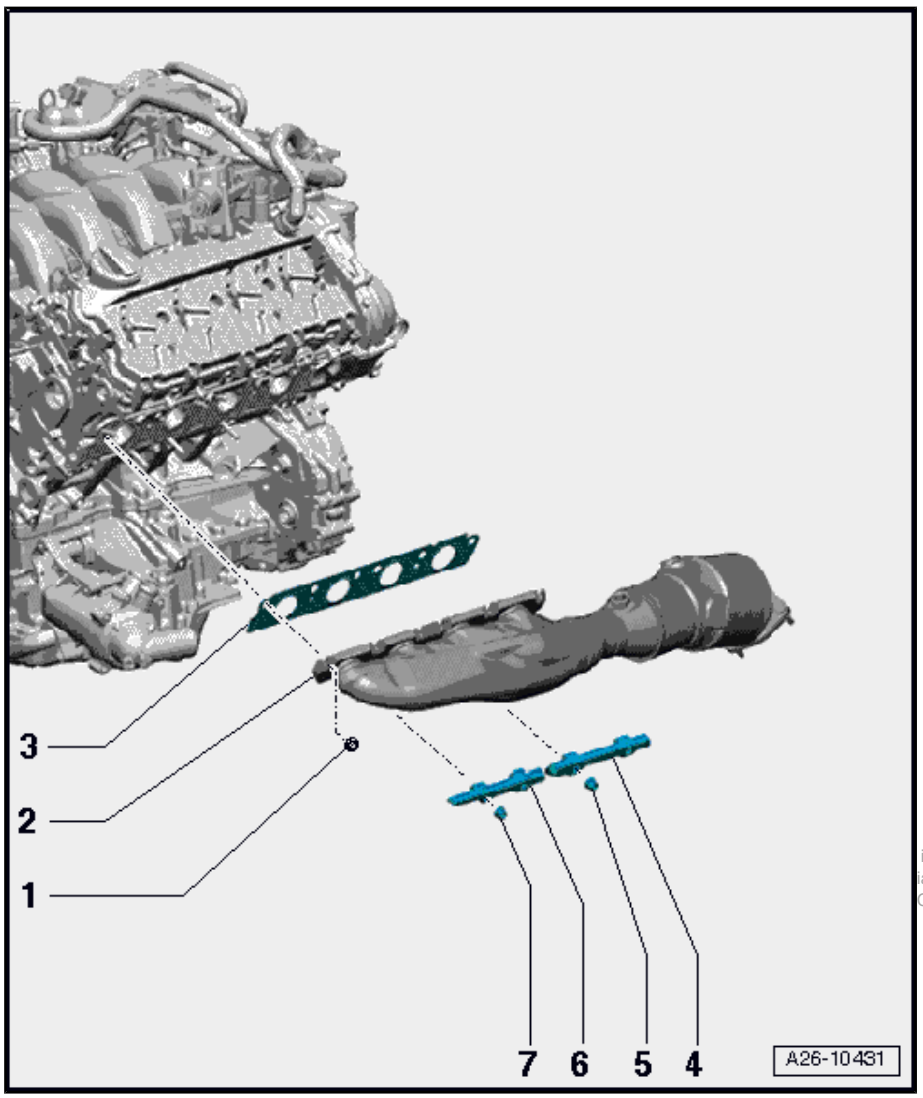
2 Exhaust manifolds

⇒ “2.1 Exhaust manifold - exploded view”, page 234

⇒ “2.2 Removing and installing exhaust manifold (left-side) with catalytic converter”, page 236

⇒ “2.3 Removing and installing exhaust manifold (right-side) with catalytic converter”, page 242

2.1 Exhaust manifold - exploded view



1 - Nut

- ❑ Renew
- ❑ Coat with high-temperature paste; for high-temperature paste refer to ⇒ Electronic parts catalogue
- ❑ Tightening sequence: exhaust manifold (left-side) ⇒ page 235 , exhaust manifold (right-side) ⇒ page 235

2 - Exhaust manifold with catalytic converter

- ❑ Mounting components: left-side ⇒ page 235 , right-side ⇒ page 235
- ❑ Removing and installing: left-side ⇒ page 236 , right-side ⇒ page 242

3 - Gasket

- ❑ Renew

4 - Mounting strip

- ❑ Remains installed when exhaust manifold is removed

5 - Nut

- ❑ Renew
- ❑ Coat with high-temperature paste; for high-temperature paste refer to ⇒ Electronic parts catalogue
- ❑ 25 Nm

6 - Mounting strip

- ❑ Remains installed when exhaust manifold is removed

7 - Nut

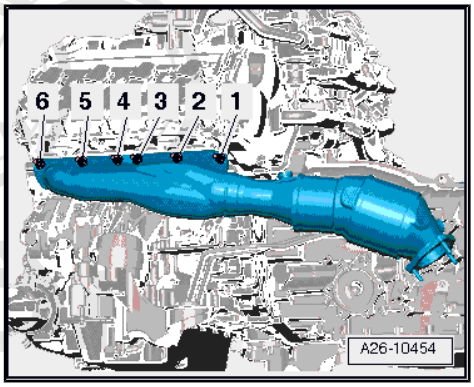
- ❑ Renew
- ❑ Coat with high-temperature paste; for high-temperature paste refer to ⇒ Electronic parts catalogue
- ❑ 25 Nm

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Tightening sequence for exhaust manifold (left-side)

– Tighten nuts in the sequence -1 ... 6- in 3 stages as follows:

1. Screw in nuts hand-tight.
2. Initially tighten nuts to 20 Nm.
3. Tighten nuts to 30 Nm.

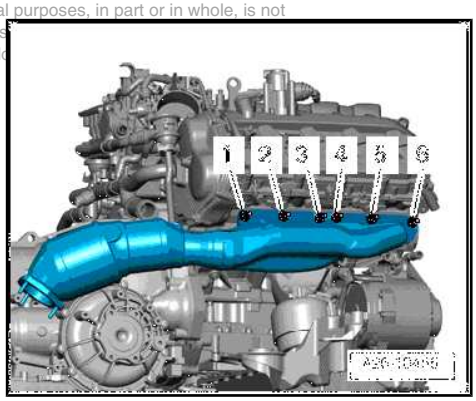


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Tightening sequence for exhaust manifold (right-side)

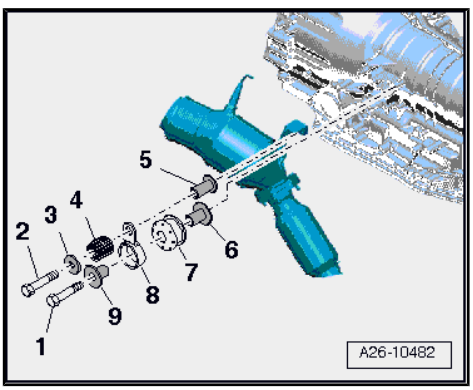
– Tighten nuts in the sequence -1 ... 6- in 3 stages as follows:

1. Screw in nuts hand-tight.
2. Initially tighten nuts to 20 Nm.
3. Tighten nuts to 30 Nm.



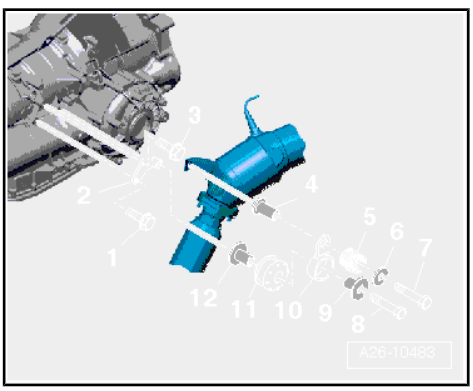
Components of exhaust pipe mountings (left-side)

1 - Bolt, 23 Nm
2 - Bolt, 23 Nm
3 - Washer
4 - Compression spring
5 - Spacer sleeve
6 - Spacer sleeve
7 - Buffer
8 - Bracket
9 - Spacer sleeve



Components of exhaust pipe mountings (right-side)

1 - Bolt, 23 Nm
2 - Bracket
3 - Bolt, 23 Nm
4 - Spacer sleeve
5 - Compression spring
6 - Washer
7 - Bolt, 23 Nm
8 - Bolt, 23 Nm
9 - Spacer sleeve
10 - Bracket
11 - Buffer
12 - Spacer sleeve

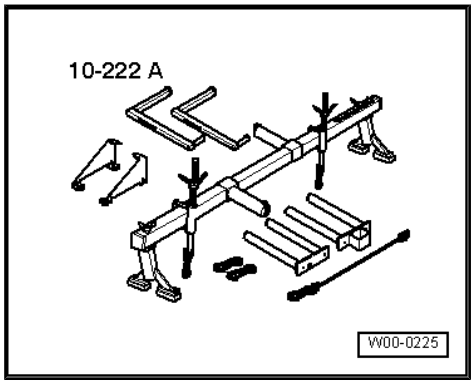


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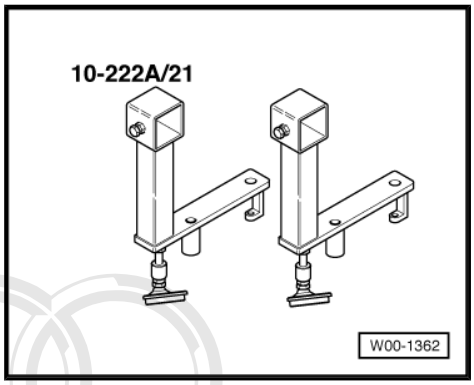
2.2 Removing and installing exhaust manifold (left-side) with catalytic converter

Special tools and workshop equipment required

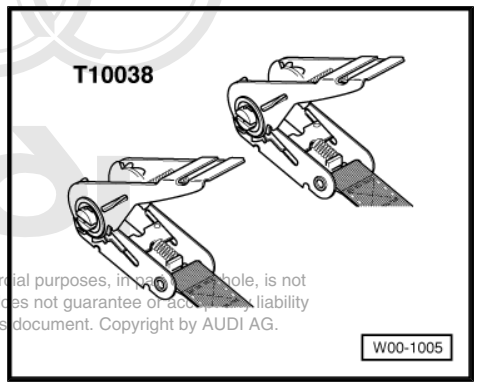
- Support bracket -10 - 222 A-



- Adapters -10 - 222 A /21-



- Tensioning strap -T10038-



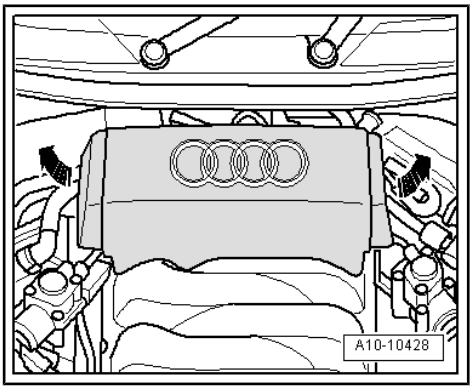
- Engine support bracket (supplementary set) -T40093-



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Removing



Note

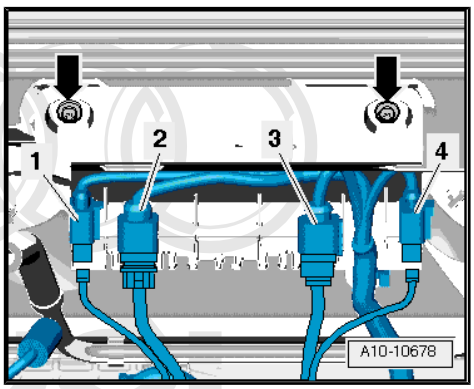
Fit all cable ties in the original positions when installing.

– Pull off engine cover panel (rear) -arrows-.

– Drain off coolant ⇒ page 181 .

– Remove coolant pipe (left-side) ⇒ page 204 .

– Remove front silencer (left-side) ⇒ page 229 .



– Detach electrical connectors from bracket and unplug connectors:

3 - For Lambda probe 2 -G108-

4 - For Lambda probe 2 -G131- (after catalytic converter)

– Move electrical wiring to Lambda probes clear.

Note

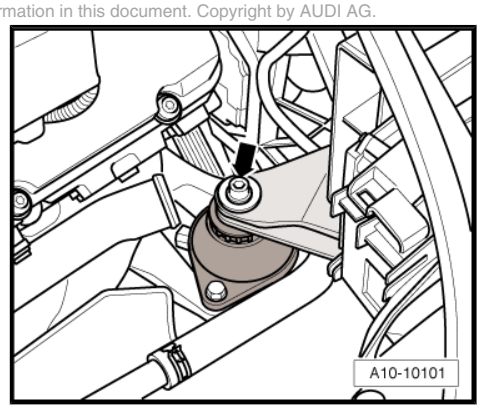
Disregard -items 1 and 2-.

– Remove front left wheel.

– Remove front section of front left wheel housing liner ⇒ Rep. gr. 66 .

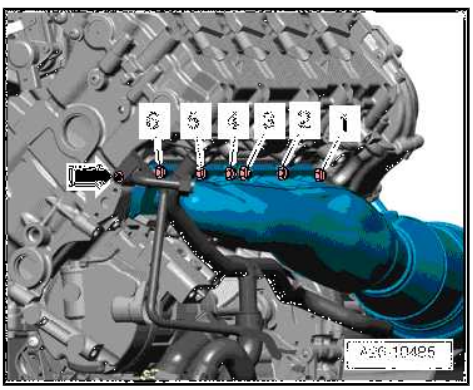
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– Remove bolt -arrow- on mounting for torque reaction support.



– Unscrew bolt -arrow- and pull pressure pipe for hydraulic fluid slightly towards front.

– Unscrew nuts -6 ... 1-.

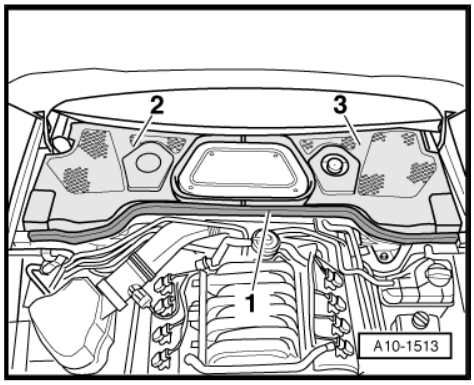


Note

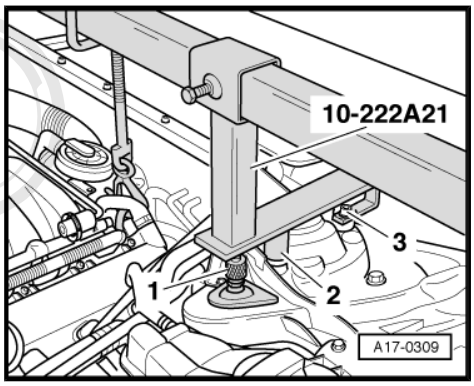
- *Shown in illustration with engine removed.*
- *Nut -1- is accessible from wheel housing.*

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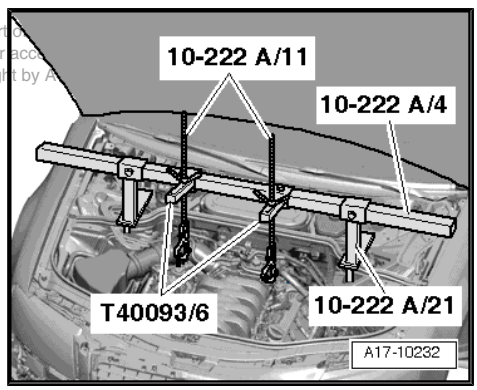
– Pull off rubber seal -1- and remove plenum chamber covers -2 and 3-.



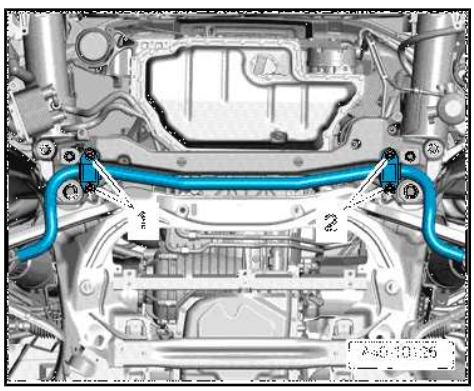
– Unscrew rear bolts -3- for body brace.
– Attach adapters -10 - 222 A /21- without adapter -10 - 222 A / 4- onto suspension turrets.
• Supports are marked for left and right side of vehicle.
• The centre resting point -2- of supports is positioned on front bolts for body brace.
• The adapters -10 - 222 A /21- are attached by means of the rear bolts -3- for the body brace.
• The knurled screw -1- must be screwed down until support plate rests on suspension turret.



– Attach adapter -10 - 222 A /4- using adapters -T40093/6- to adapters -10 - 222 A /21-.
– Secure spindles -10 - 222 A /11- to engine lifting eyes.
– Take up weight of engine using spindles of support bracket.

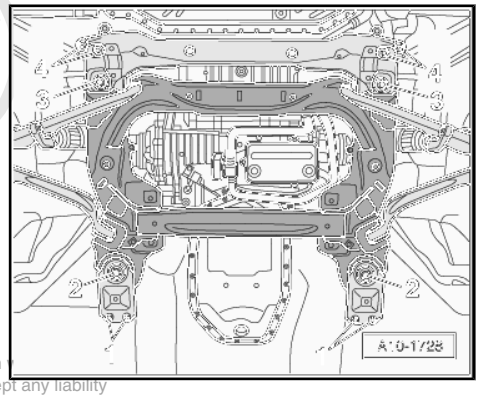


– Remove bolts (left and right) -1 and 2- for anti-roll bar mountings.



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– Remove bolts -3 and 4-.

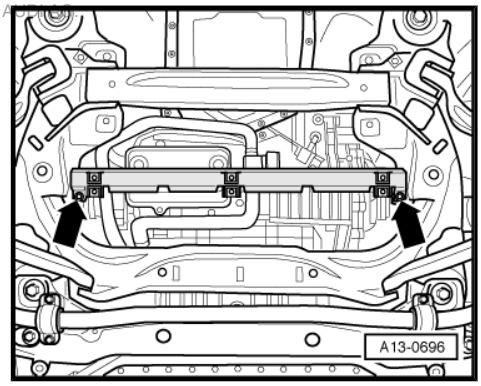


Note

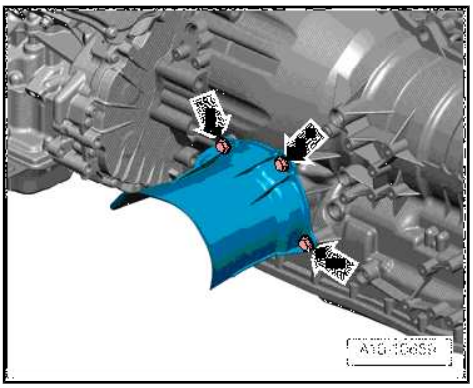
Disregard -items 1 and 2-.

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– Unbolt bracket for noise insulation -arrows-.



– Unbolt heat shield for drive shaft from gearbox -arrows-.

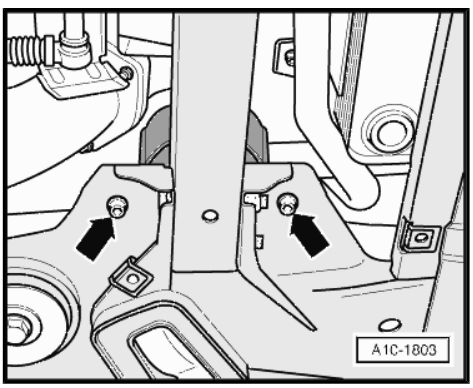


Note

Shown in illustration with engine removed.

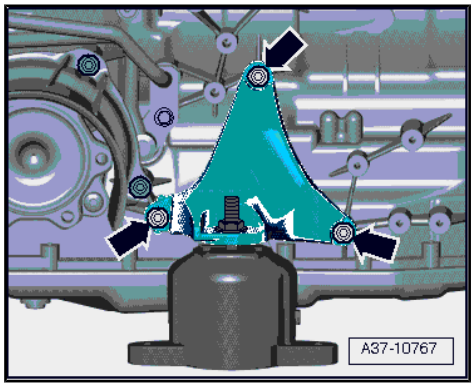
– Detach drive shaft (left-side) from flange shaft on gearbox.

– Remove bolts (left and right) -arrows- for front gearbox mounting.

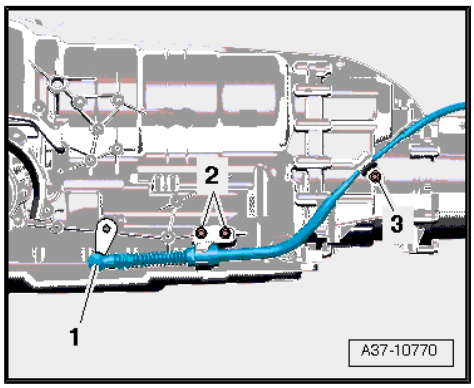


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– Remove bolts -arrows- and take off gearbox support with gearbox mounting.



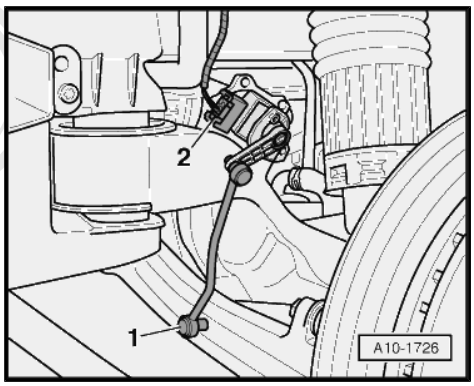
– Mark installation position of support bracket for selector lever cable with felt-tip pen for re-installation.
– Pry ball socket -1- of selector lever cable off selector shaft lever using removal lever -80 - 200- .
– Remove bolts -2- and move selector lever cable clear to one side.



Note

Disregard -item 3-.

– Unplug electrical connector -2- at vehicle level sender (left and right).



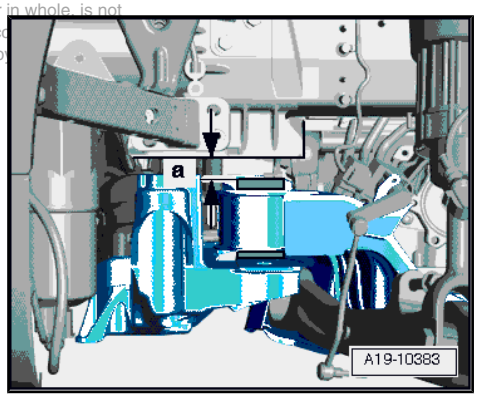
Note

Disregard -item 1-.

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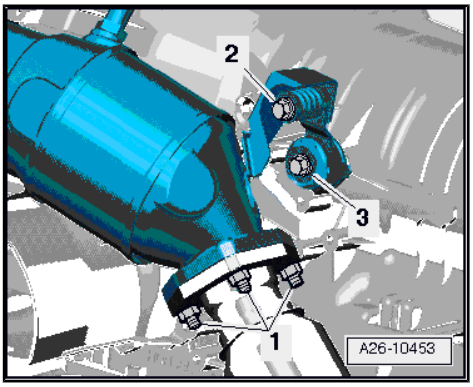
– Turn spindles -10 - 222 A /11- to lower engine/gearbox assembly by dimension -a-.

• Dimension -a- = 80 mm (maximum).



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– Remove bolts - 2 and 3- and detach bracket.

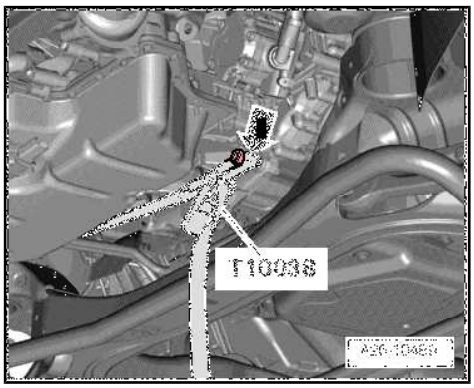


Note

Disregard -item 1-.

– Swivel front of engine/gearbox assembly slightly to right.

– To do so, unscrew one bolt -arrow- securing engine to gearbox approx. 2 turns and wrap tensioning strap -T10038- around bolt and strut on longitudinal member (right-side).



Caution

Risk of damage to drive shaft boot.

- ***Guide exhaust manifold (left-side) with catalytic converter carefully when taking out.***

– Remove exhaust manifold (left-side) with catalytic converter towards rear.

Installing

Tightening torques

- ⇒ “4 Installing engine”, page 35 .
- ⇒ “2.1 Exhaust manifold - exploded view”, page 234 .
- ⇒ Fig. ““Tightening sequence for exhaust manifold (left-side)”“ , page 235 .
- ⇒ Fig. ““Components of exhaust pipe mountings (left-side)”“ , page 235 .
- ⇒ Fig. ““Heat shield for drive shaft (left-side)”“ , page 196 .

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

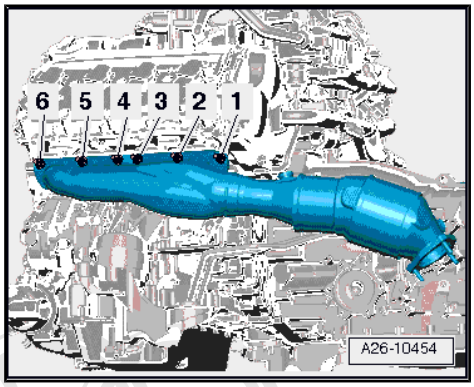
Note

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Renew gasket and self-locking nuts.

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– Fit new gasket onto studs.
– Fit exhaust manifold in mounting strips and tighten ⇒ page 235 .
– Install drive shaft (left-side) ⇒ Rep. gr. 40 .
– Install gearbox mounting ⇒ Rep. gr. 37 .
– Install mounting for torque reaction support ⇒ page 42 .
– Install subframe ⇒ Rep. gr. 40 .
– Install anti-roll bar ⇒ Rep. gr. 40 .
– Install coolant pipe (left-side) ⇒ page 204 .
– Install front silencer (left-side) ⇒ page 229 .
– Align exhaust system so it is free of stress ⇒ page 232 .
– Fill cooling system ⇒ page 182 .

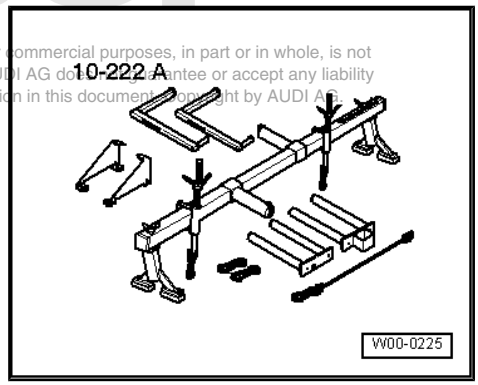


2.3 Removing and installing exhaust manifold (right-side) with catalytic converter

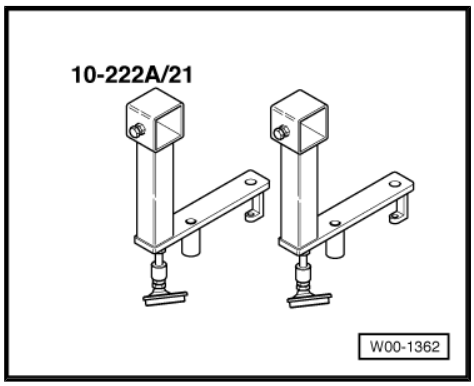
Special tools and workshop equipment required

♦ Support bracket -10 - 222 A-

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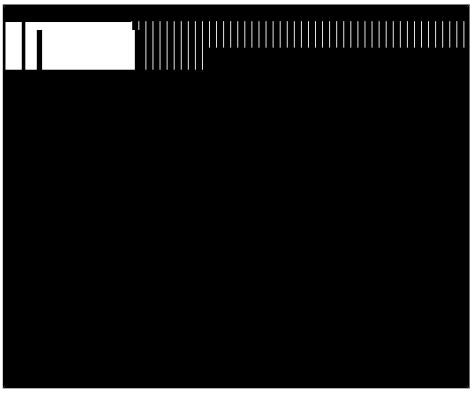


♦ Adapters -10 - 222 A /21-



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♦ Drip tray for workshop hoist -VAS 6208-

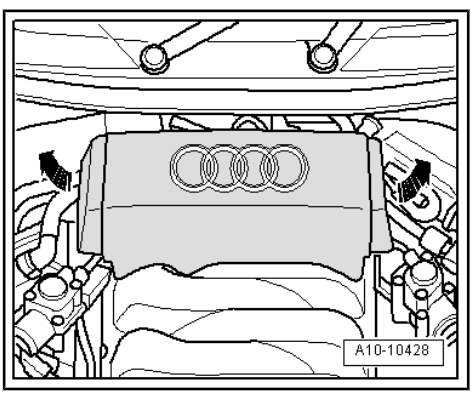


♦ Engine support bracket (supplementary set) -T40093-



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Removing



Note

Fit all cable ties in the original positions when installing.

Caution

To prevent irreparable damage to the electronic components when disconnecting the battery:

- ***Observe notes on procedure for disconnecting the battery.***

– With ignition switched off, disconnect earth cable at battery ⇒ Electrical system; Rep. gr. 27 .
– Pull off engine cover panel (rear).
– Drain off coolant ⇒ page 181 .
– Remove coolant pipe (right-side) ⇒ page 214 .
– Remove poly V-belt ⇒ page 53 .
– Remove alternator ⇒ Electrical system; Rep. gr. 27
– Remove front silencer (right-side) ⇒ page 231 .

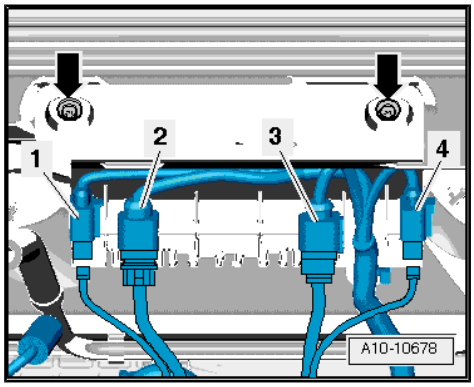
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– Detach electrical connectors from bracket and unplug connectors:

1 - For Lambda probe -G39-

2 - For Lambda probe after catalytic converter -G130-

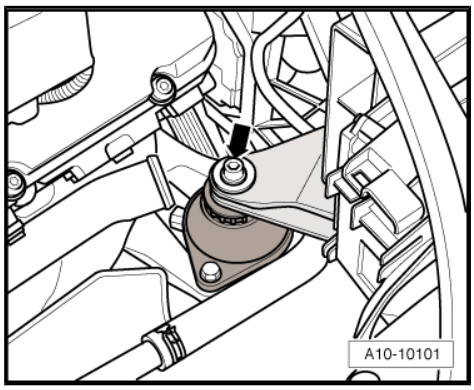
– Move electrical wiring to Lambda probes clear.



Note

Disregard -items 3 and 4-.

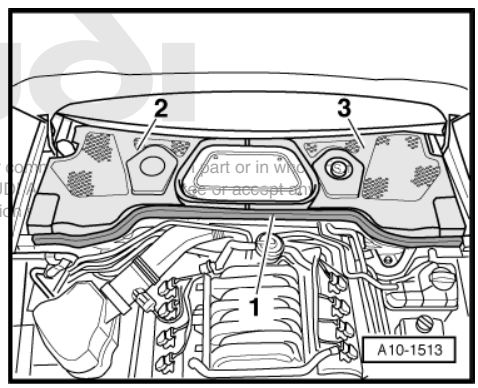
– Remove bolt -arrow- on mounting for torque reaction support.



– Remove bolts -arrows-.



– Pull off rubber seal -1- and remove plenum chamber covers -2 and 3-.

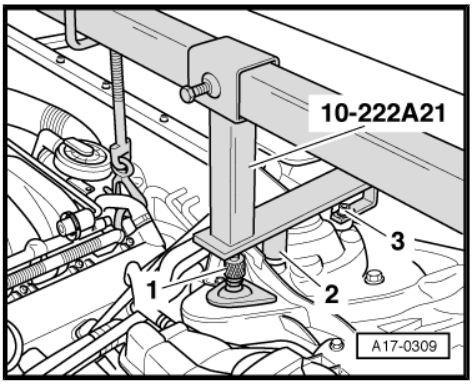


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– Unscrew rear bolts -3- for body brace.

– Attach adapters -10 - 222 A /21- without adapter -10 - 222 A /4- onto suspension turrets.

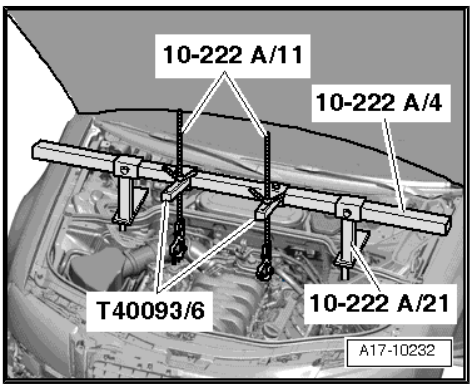
- Supports are marked for left and right side of vehicle.
- The centre resting point -2- of supports is positioned on front bolts for body brace.
- The adapters -10 - 222 A /21- are attached by means of the rear bolts -3- for the body brace.
- The knurled screw -1- must be screwed down until support plate rests on suspension turret.



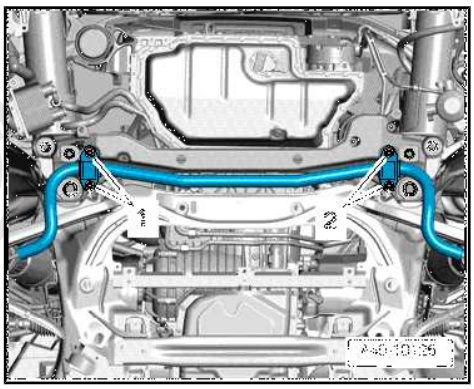
– Attach adapter -10 - 222 A /4- using adapters -T40093/6- to adapters -10 - 222 A /21- .

– Secure spindles -10 - 222 A /11- to engine lifting eyes.

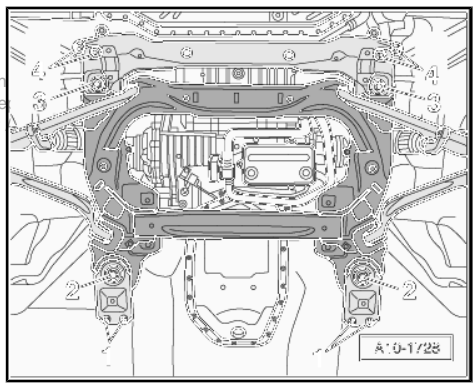
– Take up weight of engine using spindles of support bracket.



– Remove bolts (left and right) -1 and 2- for anti-roll bar mountings.



– Remove bolts -3 and 4-.



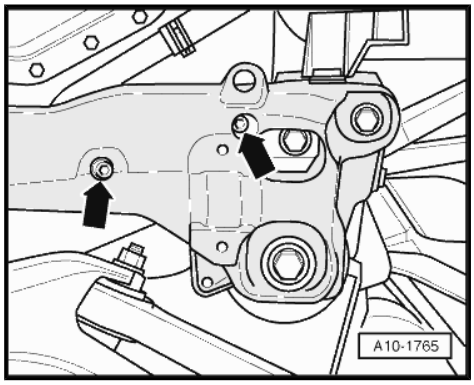
Note

Disregard -items 1 and 2-.

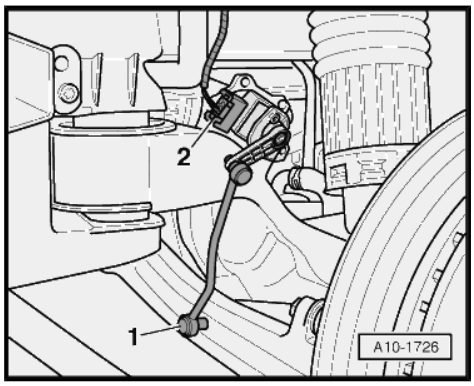
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– Remove bolts for engine mountings -arrows- on both sides.
– Take out engine cross member.



– Unplug electrical connector -2- at vehicle level sender (left and right).

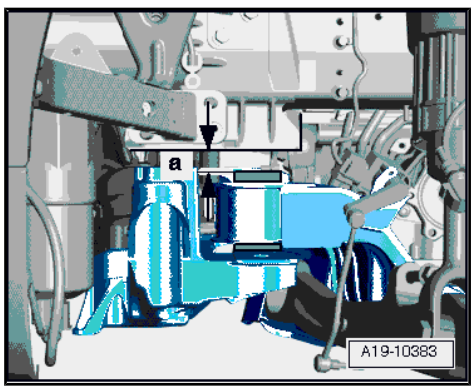


Note

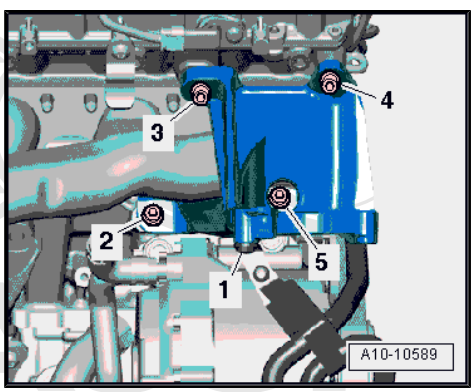
Disregard -item 1-.

– Turn spindles -10 - 222 A /11- to lower engine/gearbox assembly as far as dimension -a-.

• Dimension -a- = 30 mm (maximum).



– Take out mounting for torque reaction support.
– Remove bolts -2 ... 5-.
– Remove torque reaction support.



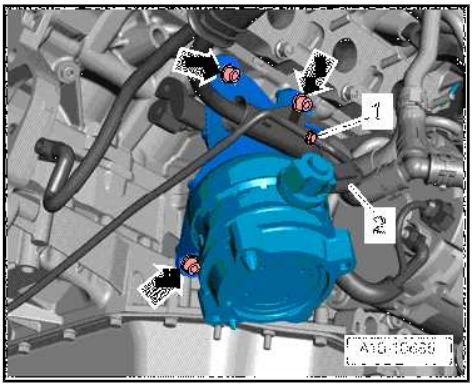
Note

Disregard -item 1-.

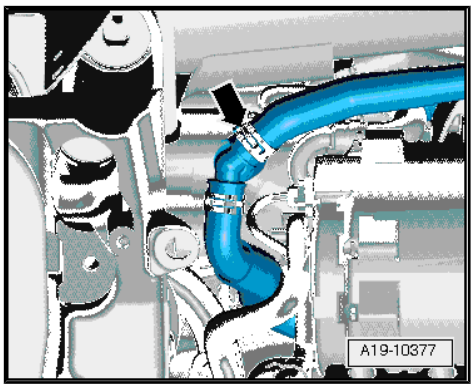
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– Unplug electrical connector -2- at engine mounting (right-side).
– Unbolt bracket for wiring from engine support (right-side) -1-.
– Remove bolts -arrows- and detach engine support with engine mounting.

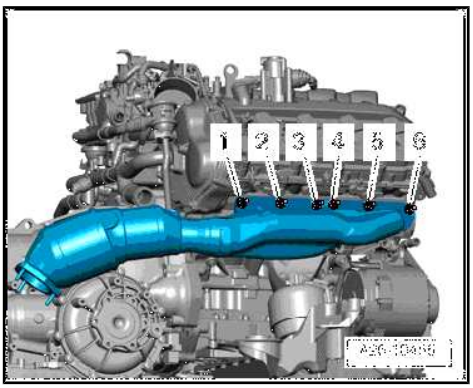


– Place drip tray for workshop hoist -VAS 6208- under engine.
– Disconnect coolant hose (right-side) -arrow- and drain off coolant.



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– Unscrew nuts -6 ... 1-.

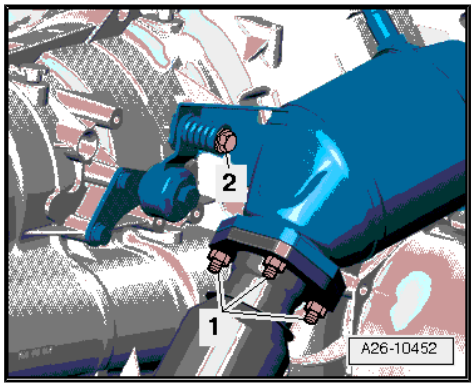


Note

The mounting strips (bottom) remain installed.

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– Unscrew bolt -2- and remove exhaust manifold (right-side) with catalytic converter (accessible from below) towards front.



Note

Disregard -item 1-.

Installing

Tightening torques

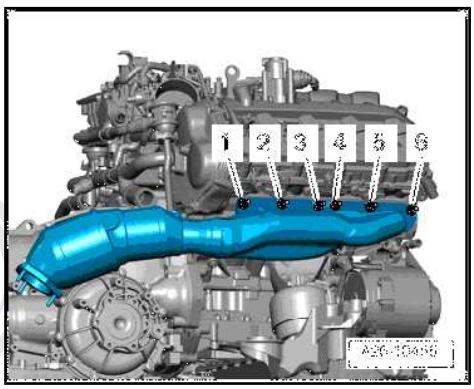
- ⇒ “2.1 Exhaust manifold - exploded view”, page 234 .
- ⇒ Fig. ““Tightening sequence for exhaust manifold (left-side)”“ , page 235 .
- ⇒ Fig. ““Components of exhaust pipe mountings (right-side)”“ , page 235 .

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

Note

Renew gasket and self-locking nuts.

– Fit new gasket onto studs.



– Fit exhaust manifold in mounting strips and tighten ⇒ page 235 .
– Install torque reaction support and mounting for torque reaction support ⇒ page 42 .
– Install front silencer (right-side) ⇒ page 231 .
– Install engine support with engine mounting ⇒ page 42 .
– Install alternator ⇒ Electrical system; Rep. gr. 27
– Install poly V-belt ⇒ page 53 .
– Install subframe and engine cross member ⇒ Rep. gr. 40 .
– Install anti-roll bar ⇒ Rep. gr. 40 .
– Install coolant pipe (right-side) ⇒ page 214 .
– Align exhaust system so it is free of stress ⇒ page 232 .
– Observe notes on procedures required after connecting battery ⇒ Electrical system; Rep. gr. 27 .
– Fill cooling system ⇒ page 182 .

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3 Secondary air system - country-specific version 1

⇒ “3.1 Principle and function”, page 249

⇒ “3.2 Secondary air system - exploded view”, page 250

⇒ “3.3 Removing and installing secondary air pump”, page 251

⇒ “3.4 Checking combination valves for secondary air system for correct operation and leakage”, page 252

⇒ “3.5 Removing and installing combination valve for secondary air system (left-side)”, page 253

⇒ “3.6 Removing and installing combination valve for secondary air system (right-side)”, page 254

3.1 Principle and function

Principle

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

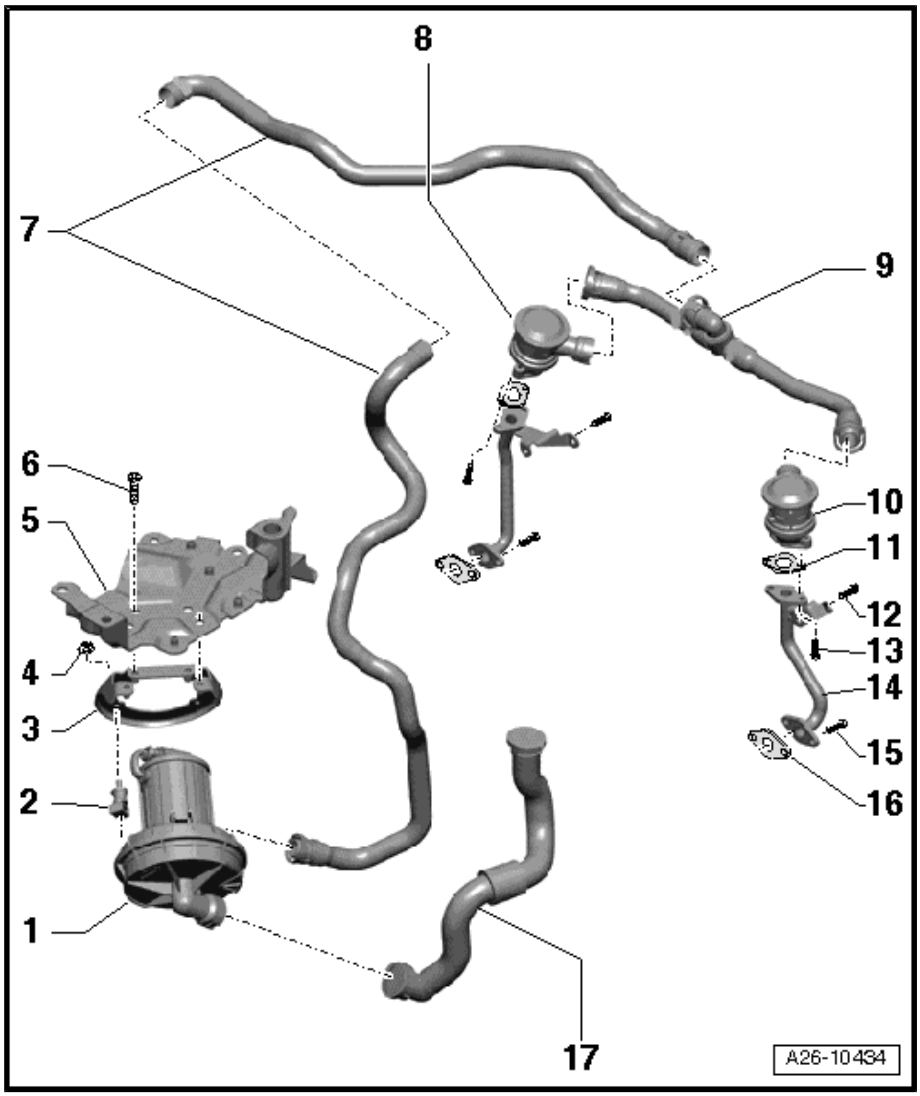
Function

In the warm-up phase, the engine control unit activates the secondary air pump via the secondary air pump relay. The stream of air from the secondary air pump opens the combination valves for secondary air and permits air to flow into the exhaust system upstream of the catalytic converter.

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3.2 Secondary air system - exploded view



1 - Secondary air pump motor -V101-

- ❑ Fitting location: At front right in engine compartment below longitudinal member
- ❑ Removing and installing ⇒ page 251
- ❑ Checking in “Guided Fault Finding” mode ⇒ Vehicle diagnostic tester

2 - Bonded rubber mounting

3 - Bracket

- ❑ For secondary air pump motor -V101-

4 - Nut

- ❑ 9 Nm

5 - Bracket

- ❑ For secondary air pump motor -V101- and ATF cooler

6 - Bolt

- ❑ 9 Nm

7 - Air hoses

- ❑ Between secondary air pump motor -V101- and combination valves for secondary air system

8 - Combination valve for secondary air system (right-side)

- ❑ Fitting location: At rear of cylinder head (right-side)
- ❑ Checking ⇒ page 252
- ❑ Removing and installing ⇒ page 254

9 - Air hose

- ❑ To combination valves for secondary air inlet

10 - Combination valve for secondary air system (left-side)

- ❑ Fitting location: At rear of cylinder head (left-side)
- ❑ Checking ⇒ page 252
- ❑ Removing and installing ⇒ page 253

11 - Gasket

- ❑ Renew

12 - Bolt

- ❑ 9 Nm

13 - Bolt

- ❑ 9 Nm

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14 - Connecting pipe

- ❑ To cylinder head

15 - Bolt

- ❑ 9 Nm

16 - Gasket

- ❑ Renew

17 - Air hose

- ❑ From air cleaner housing

3.3 Removing and installing secondary air pump

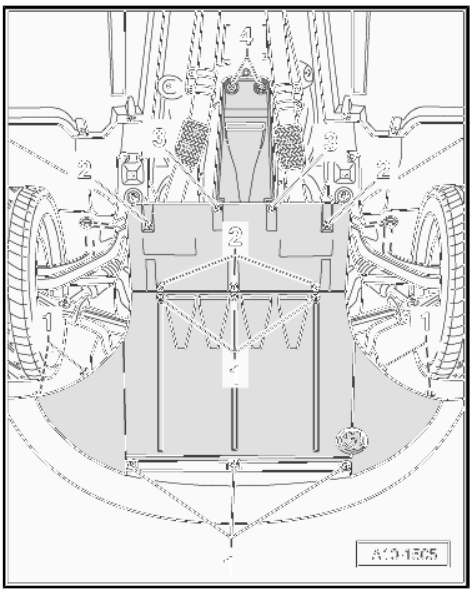
Removing

– Release fasteners -1- to remove front noise insulation.

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Note

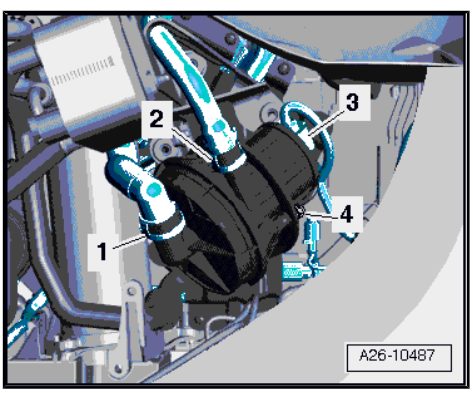
Disregard -items 2, 3, 4-.



– Disconnect air hoses -1 and 2-.

– Unplug electrical connector -3-.

– Unscrew the 3 nuts -4- and detach secondary air pump from bracket.



Installing

- Tightening torque
  ⇒ “3.2 Secondary air system - exploded view”, page 250

Install in reverse order.

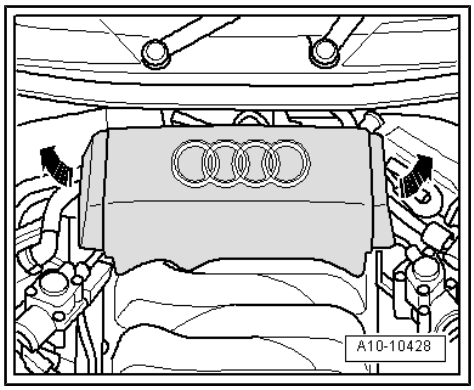
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3.4 Checking combination valves for secondary air system for correct operation and leakage

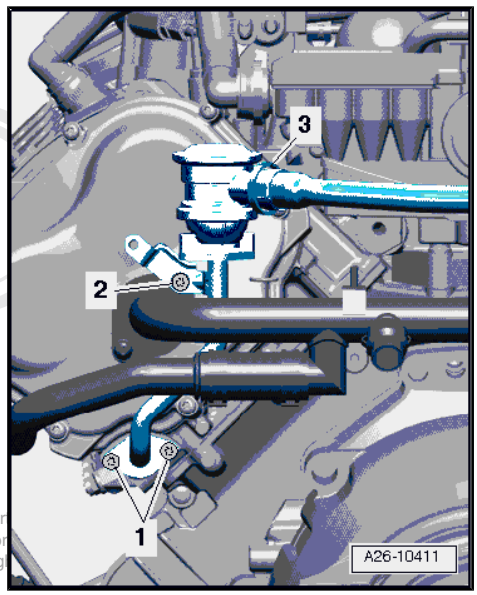
Procedure

- No leaks in hose connections.

– Pull off engine cover panel (rear) -arrows-.



– Detach air intake hose -3- from combination valve for secondary air system.



Note

- *The illustration shows the left-side combination valve for secondary air system.*
- *Disregard -items 1 and 2-.*

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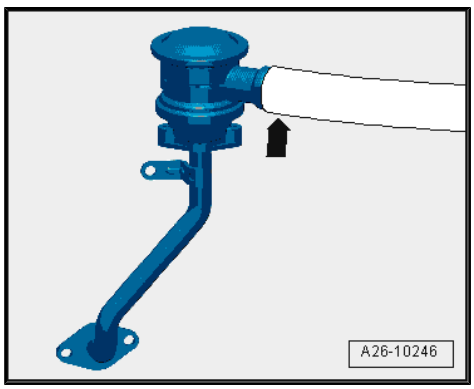
– Connect test hose -arrow- to combination valve for secondary air system.

– Blow lightly into test hose with your mouth (do not use compressed air).

- The combination valve for secondary air system should be closed; it should not be possible to blow through the hose.

– Blow into test hose with your mouth using more force (do not use compressed air).

- The combination valve for secondary air system should open; it should now be possible to blow through the hose.



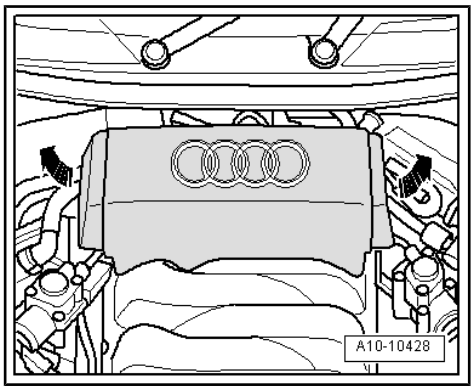
If you cannot determine the switching point:

– Renew combination valve for secondary air system: on left-side ⇒ page 253 , on right-side ⇒ page 254 .

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3.5 Removing and installing combination valve for secondary air system (left-side)

Removing



Note

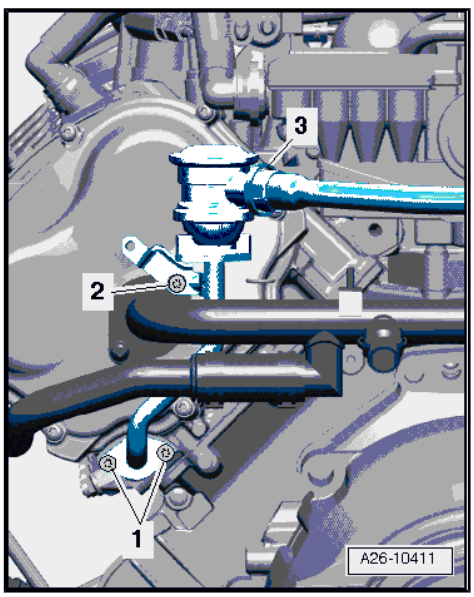
Fit all cable ties in the original positions when installing.

– Pull off engine cover panel (rear) -arrows-.

– Drain off coolant ⇒ page 181 .

– Remove coolant pipe (left-side) ⇒ page 204 .

– Remove Lambda probe 2 -G108- (before catalytic converter) ⇒ Rep. gr. 24 .



– Detach air hose -3- at combination valve for secondary air system by pressing release tabs.

– Remove bolts -1 and 2-.

– Move electrical wiring clear at combination valve for secondary air system.

– Detach combination valve for secondary air system.

Note

Engine is shown from rear for illustration purposes.

Installing

- Tightening torque
  ⇒ “3.2 Secondary air system - exploded view”, page 250

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

Note

♦ *Renew gaskets, seals and O-rings.*

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

♦ *Fit all cable ties in the original positions when installing.*

– Install Lambda probe 2 -G108- (before catalytic converter) ⇒ Rep. gr. 24 .

– Install coolant pipe (left-side) ⇒ page 204 .

– Fill cooling system ⇒ page 182 .

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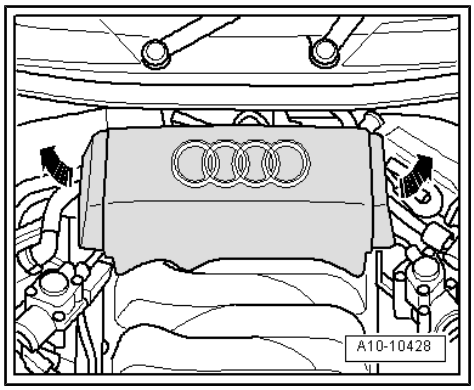
3.6 Removing and installing combination valve for secondary air system (right-side)

Removing

Note

Fit all cable ties in the original positions when installing.

– Pull off engine cover panel (rear) -arrows-.



– Move clear fuel line and line going to activated charcoal filter at air pipe.

– Detach vacuum line -4- leading to air intake hose from suction-jet pump.

Rest-of-world vehicles:

– Disconnect hose -3- for crankcase breather system from air hose by pressing release tabs.

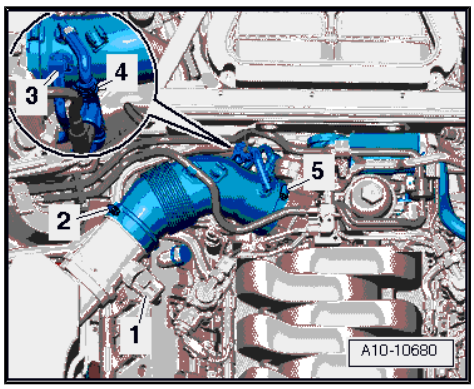
– Release hose clips -2 and 5- and remove air hose.

USA models:

Caution

Risk of violating emission legislation applying to USA models.

- ***Do NOT open hose connection -2-.***

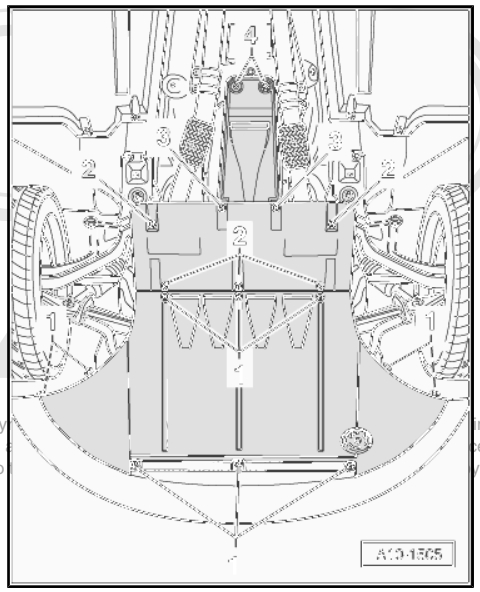


– Release hose clips -2 and 5- and move air hose clear to one side (crankcase breather hose -3- remains connected).

– Release fasteners -1, 2, 4- to remove noise insulation panels.

Note

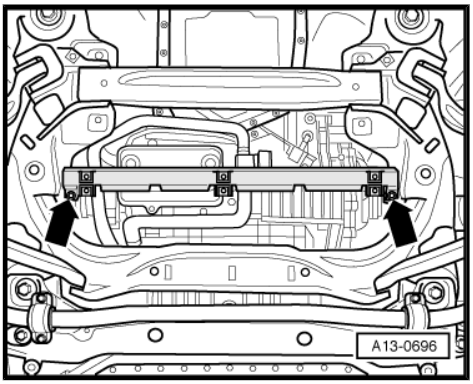
Disregard -item 3-.



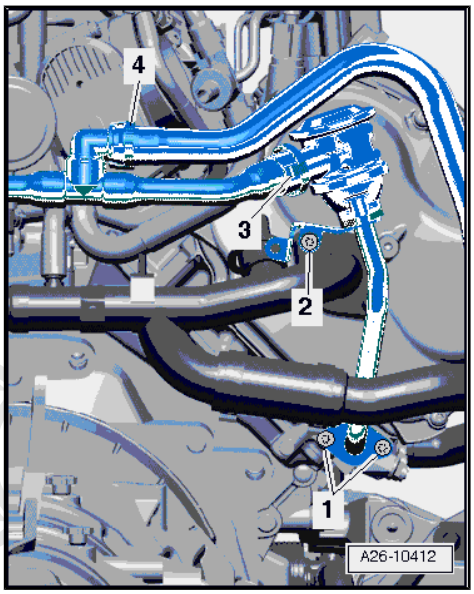
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– Unbolt bracket for noise insulation -arrows-.



– Unscrew bolts -1- from below.
– Detach air hoses -3 and 4- from above and place to one side.
– Unscrew bolt -2- and move electrical wiring at combination valve for secondary air system clear.
– Detach combination valve for secondary air system.



Note

Engine is shown from rear for illustration purposes.

Installing

- Tightening torque
  ⇒ “3.2 Secondary air system - exploded view”, page 250

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

Note

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

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4 Secondary air system - country-specific version 2

⇒ “4.1 Principle and function”, page 256

⇒ “4.2 Secondary air system - exploded view”, page 257

⇒ “4.3 Removing and installing secondary air pump”, page 259

⇒ “4.4 Checking combination valves for secondary air system for correct operation and leakage”, page 259

⇒ “4.5 Removing and installing combination valve for secondary air system (left-side)”, page 261

⇒ “4.6 Removing and installing combination valve for secondary air system (right-side)”, page 262

⇒ “4.7 Removing and installing sender 1 for secondary air pressure G609 ”, page 263

4.1 Principle and function

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

Principle

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

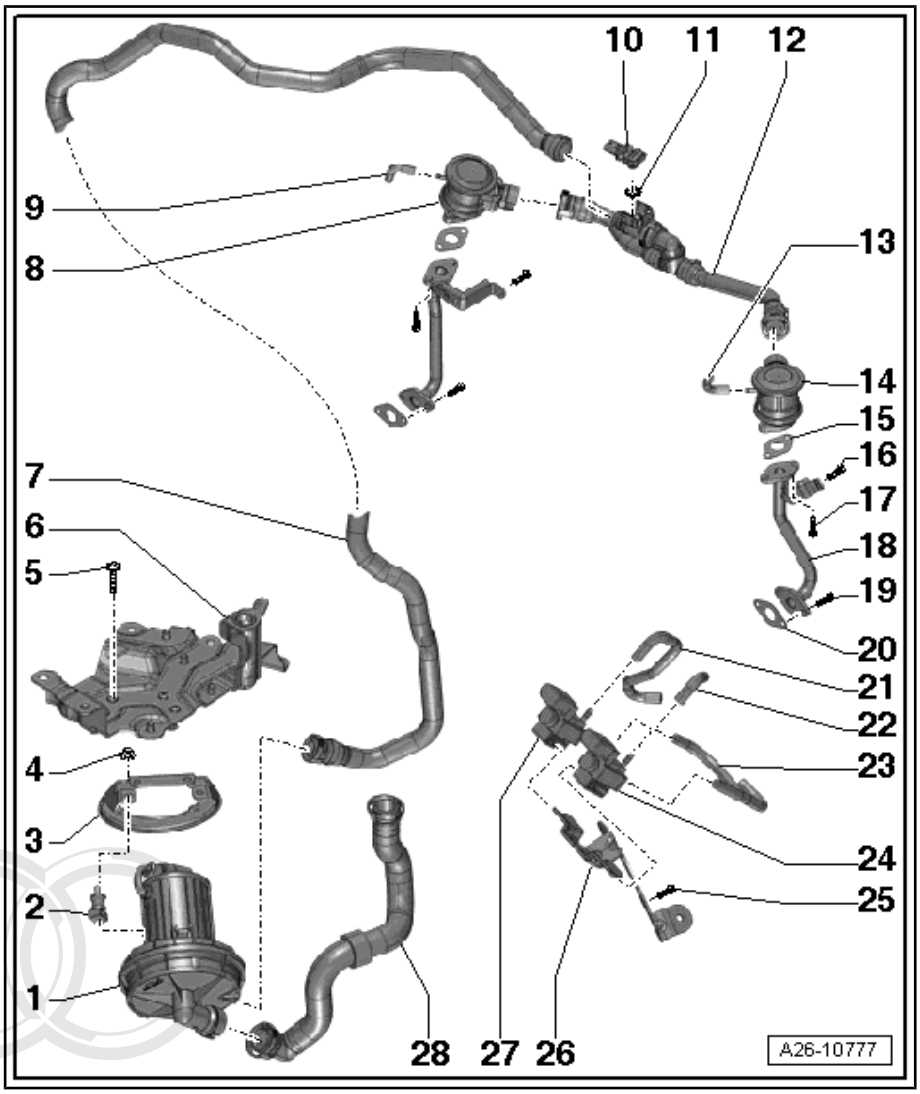
Function

- In the warm-up phase, the engine control unit activates the secondary air pump via the secondary air pump relay. Air is routed to the secondary air combination valves.
- In parallel to this, the secondary air inlet valve is activated and allows vacuum to pass to the secondary air combination valves. In this way, the combination valve opens a passage for the secondary air system to supply air to the exhaust ports in the cylinder head.

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4.2 Secondary air system - exploded view



1 - Secondary air pump motor -V101-

- Fitting location: At front right in engine compartment below longitudinal member
- Removing and installing ⇒ page 259
- Checking in “Guided Fault Finding” mode ⇒ Vehicle diagnostic tester

2 - Bonded rubber mounting

3 - Bracket

- For secondary air pump motor -V101-

4 - Nut

- 9 Nm

5 - Bolt

- 9 Nm

6 - Bracket

- For secondary air pump motor -V101- and ATF cooler

7 - Air hose

- Between secondary air pump motor -V101- and combination valves for secondary air system

8 - Combination valve for secondary air system (right-side)

- Fitting location: At rear of cylinder head (right-side)
- Checking ⇒ page 259
- Removing and installing ⇒ page 262

9 - Vacuum hose

- From secondary air inlet valve -N112-

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10 - Sender 1 for secondary air pressure -G609-

- Removing and installing ⇒ page 263

11 - O-ring

- Renew

12 - Air hose

- To combination valves for secondary air inlet

13 - Vacuum hose

- From secondary air inlet valve 2 -N320-

14 - Combination valve for secondary air system (left-side)

- Fitting location: At rear of cylinder head (left-side)
- Checking ⇒ page 259

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- ❑ Removing and installing ⇒ page 261

15 - Gasket

- ❑ Renew

16 - Bolt

- ❑ 9 Nm

17 - Bolt

- ❑ 9 Nm

18 - Connecting pipe

- ❑ To cylinder head

19 - Bolt

- ❑ 9 Nm

20 - Gasket

- ❑ Renew

21 - Vacuum hose

- ❑ To combination valve for secondary air system (left-side)

22 - Vacuum hose

- ❑ To combination valve for secondary air system (right-side)

23 - Vacuum hose

- ❑ With T piece
- ❑ Vacuum supply from intake manifold

24 - Secondary air inlet valve -N112-

- ❑ Fitting location ⇒ page 258

25 - Bolt

- ❑ 40 Nm

26 - Bracket

- ❑ For secondary air inlet valves

27 - Secondary air inlet valve 2 -N320-

- ❑ Fitting location ⇒ page 258

28 - Air hose

- ❑ From air cleaner housing

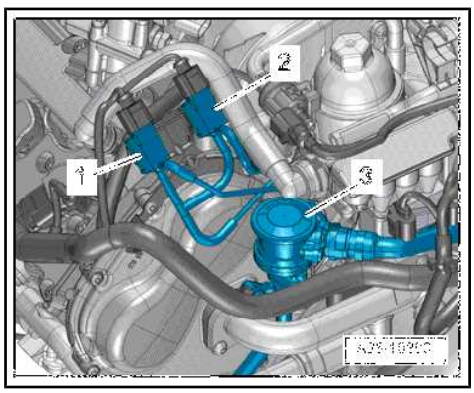
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Fitting location of secondary air inlet valves

♦ At rear of cylinder head (left-side).

1 - Secondary air inlet valve -N112-

2 - Secondary air inlet valve 2 -N320-

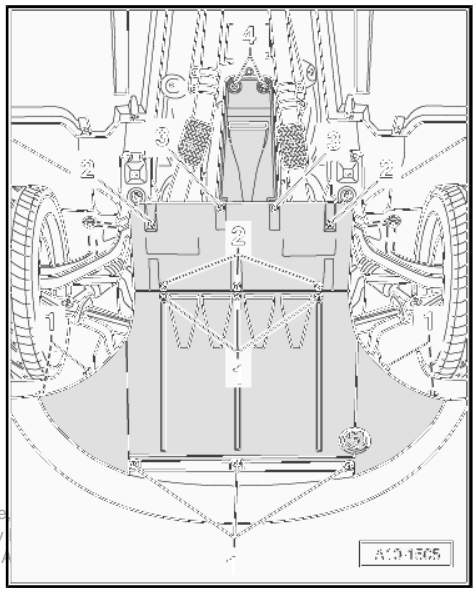


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4.3 Removing and installing secondary air pump

Removing

– Release fasteners -1- to remove front noise insulation.



Note

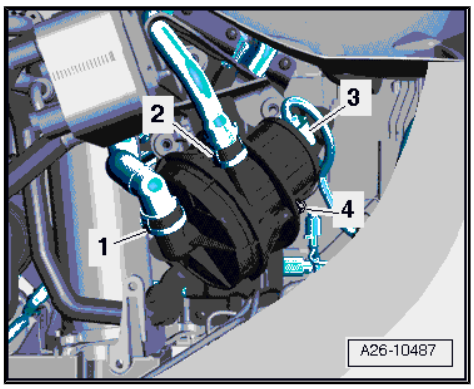
Disregard -items 2, 3, 4-.

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– Disconnect air hoses -1 and 2-.

– Unplug electrical connector -3-.

– Unscrew the 3 nuts -4- and detach secondary air pump from bracket.



Installing

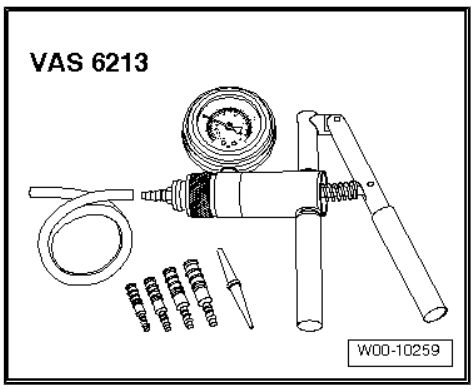
- Tightening torque
  ⇒ “4.2 Secondary air system - exploded view”, page 257

Install in reverse order.

4.4 Checking combination valves for secondary air system for correct operation and leakage

Special tools and workshop equipment required

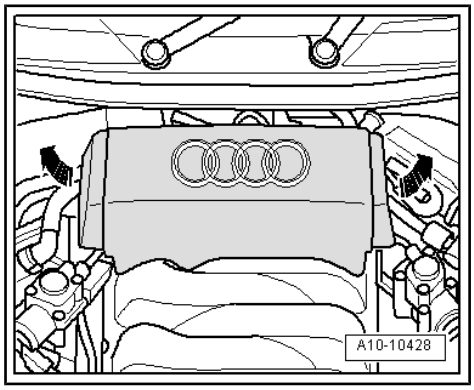
♦ Hand vacuum pump -VAS 6213-



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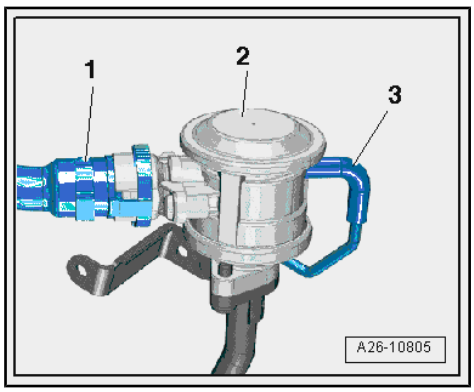
Procedure

– Pull off engine cover panel (rear) -arrows-.



– Detach vacuum hose -3- from combination valve -2- for secondary air system.

– Press release tabs and disconnect secondary air hose -1-.



– Connect hand vacuum pump -VAS 6213- to vacuum connection -1- on relevant combination valve for secondary air system.

– Connect a suitable test hose -2- onto combination valve for secondary air system.

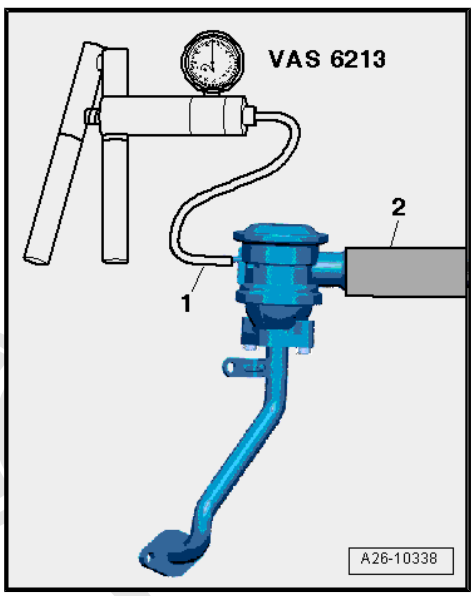
– Blow lightly into test hose with your mouth (do not use compressed air).

• The combination valve for secondary air system should be closed; it should not be possible to blow through the hose.

– Operate hand vacuum pump to produce a vacuum.

• The combination valve for secondary air system should open; it should now be possible to blow through the hose.

– Renew combination valve for secondary air system if valve does not react as described: left-side ⇒ page 261 , right-side ⇒ page 262 .



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

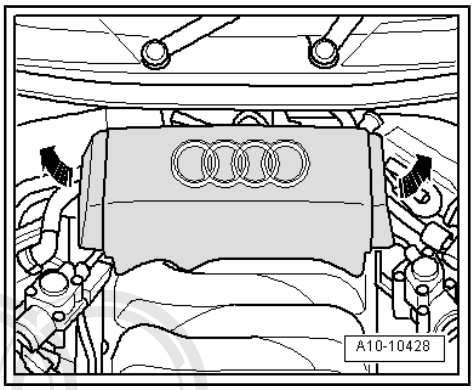
– Install engine compartment trim panel ⇒ Rep. gr. 53 .

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4.5 Removing and installing combination valve for secondary air system (left-side)

Removing

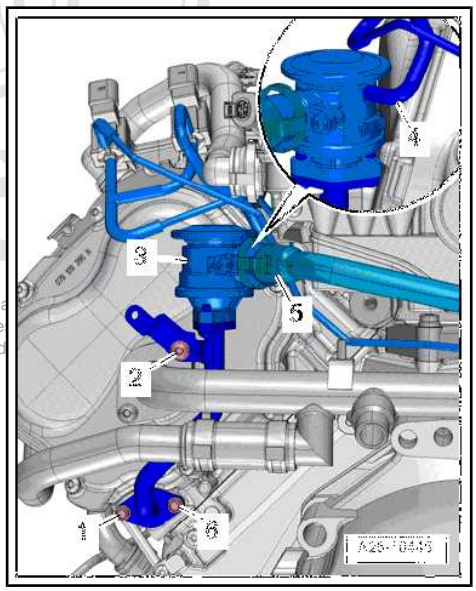


– Pull off engine cover panel (rear) -arrows-.

– Drain off coolant ⇒ page 181 .

– Remove coolant pipe (left-side) ⇒ page 204 .

– Remove Lambda probe 2 -G108- (before catalytic converter) ⇒ Rep. gr. 24 .



– Detach vacuum hose -4- from combination valve for secondary air system.

– Detach air hose -5- at combination valve for secondary air system by pressing release tabs.

– Unscrew bolts -1, 2, 6-.

– Move electrical wiring clear at combination valve for secondary air system.

– Detach combination valve -3- for secondary air system.

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Note

Engine is shown from rear for illustration purposes.

Installing

• Tightening torque
⇒ “4.2 Secondary air system - exploded view”, page 257

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

Note

♦ *Renew gaskets, seals and O-rings.*

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

♦ *Fit all cable ties in the original positions when installing.*

– Install Lambda probe 2 -G108- (before catalytic converter) ⇒ Rep. gr. 24 .

– Install coolant pipe (left-side) ⇒ page 204 .

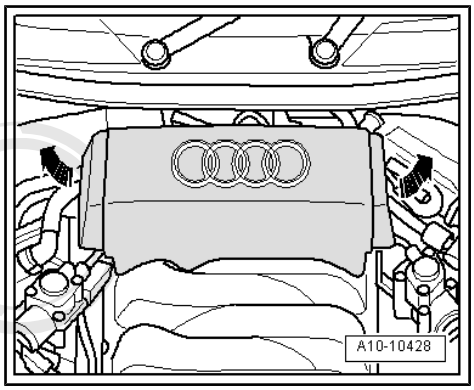
– Fill cooling system ⇒ page 182 .

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4.6 Removing and installing combination valve for secondary air system (right-side)

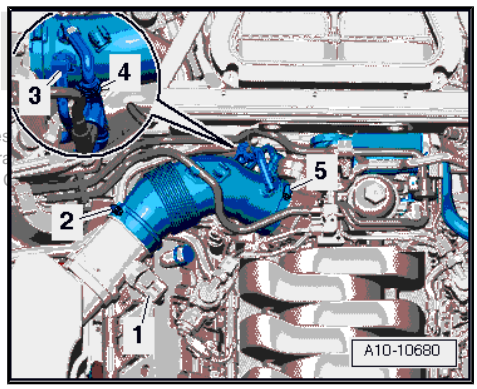
Removing

– Pull off engine cover panel (rear) -arrows-.



– Move clear fuel line and line going to activated charcoal filter at air pipe.

– Detach vacuum line -4- leading to air intake hose from suction-jet pump.



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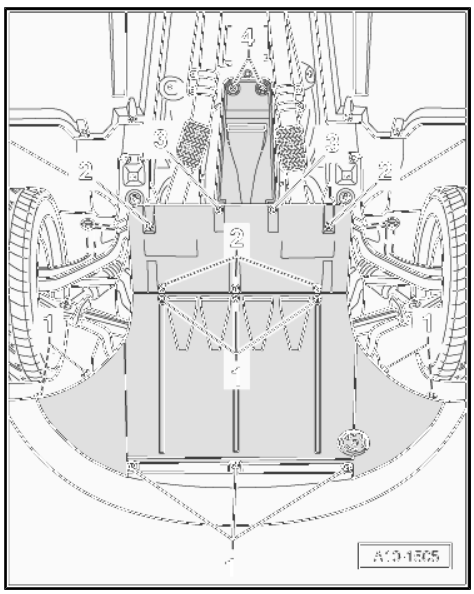
Caution

Risk of infringement against emission legislation.

- *Do NOT open hose connection -2-.*

– Release hose clips -2 and 5- and move air hose clear to one side (crankcase breather hose -3- remains connected).

– Release fasteners -1, 2, 4- to remove noise insulation panels.

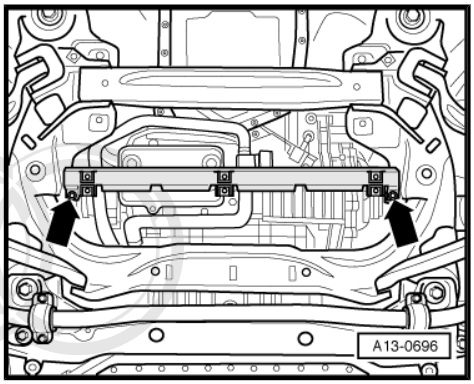


Note

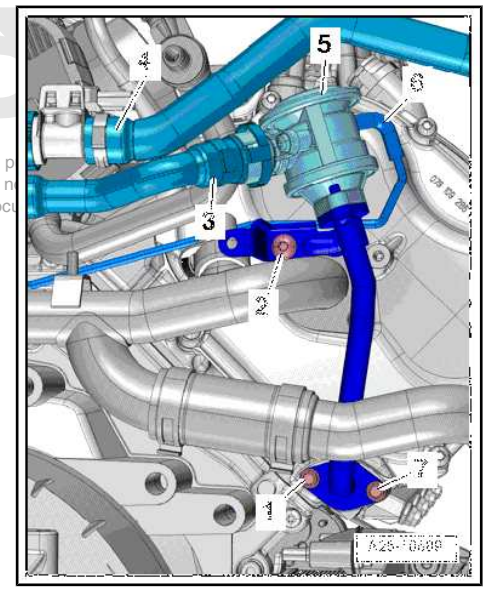
Disregard -item 3-.

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– Unbolt bracket for noise insulation -arrows-.



– Detach vacuum hose -6- from combination valve for secondary air system.
– Remove bolts -1- and -7- from below.
– Press release tabs and detach air hoses -3 and 4- from above.
– Place air hoses to one side.
– Unscrew bolt -2- and move electrical wiring at combination valve for secondary air system clear.
– Detach combination valve -5- for secondary air system.



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Note

Engine is shown from rear for illustration purposes.

Installing

- Tightening torque
⇒ “4.2 Secondary air system - exploded view”, page 257

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

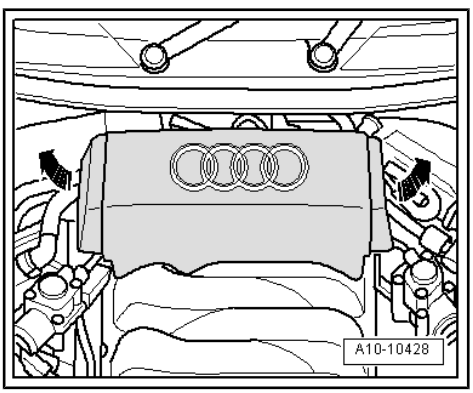
Note

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

4.7 Removing and installing sender 1 for secondary air pressure -G609-

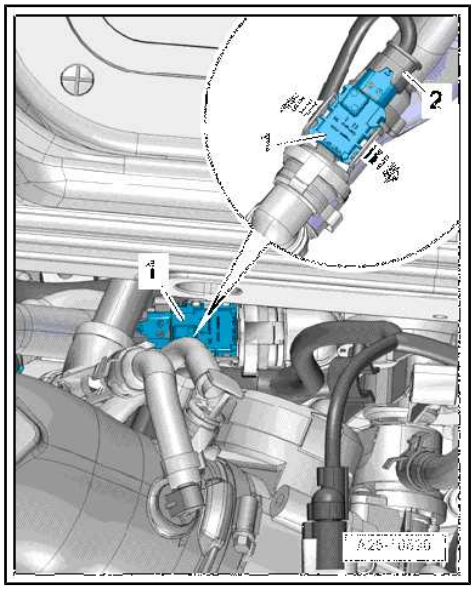
Removing

– Pull off engine cover panel (rear) -arrows-.



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– Unplug electrical connector -2-.
– Carefully press retaining clips outwards -arrows- and detach sender 1 for secondary air pressure -G609- -item 1-.



Installing

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

Note

Fit new O-ring.

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00 – Technical data

1 Safety precautions

(ARL003707; Edition 02.2014)

⇒ "1.1 Safety precautions when working on the fuel system", page 1

⇒ "1.2 Safety precautions when using testers and measuring instruments during a road test", page 2

1.1 Safety precautions when working on the fuel system

When working on the fuel system note the following warnings:

WARNING

Risk of injury - fuel system operates under high pressure.

- *Before opening the system place a clean cloth around the connection. Then release pressure by carefully loosening the connection.*
- *Vehicles with FSI engine: fuel system components on the engine that are fed from the high-pressure pump operate under very high pressure. When working on the engine or injection system, the pressure in the high-pressure section of the system must be reduced to a residual pressure prior to opening ⇒ Rep. gr. 24 .*

Health risk: avoid skin contact with fuel.

- *Avoid skin contact with fuel. Wear fuel-resistant gloves.*

Mobile phones can cause an explosion risk.

- *Ensure that any mobile phones are well clear of the workbay.*

Perform the following steps before starting work on the fuel system:

- Fuel tank must not be full. The amount of fuel which can be left in the fuel tank is indicated in the corresponding procedure description. Drain fuel tank if necessary: rest-of-world vehicles ⇒ page 7 , USA vehicles ⇒ page 112 .
- Before commencing work, switch on exhaust extraction system and place an extraction hose close to the opening in the fuel tank to extract escaping petrol fumes.
- If no exhaust extraction system is available, a radial fan with a displacement of at least 15 m^3/h can be used (the fan motor must be clear of the air stream).

Fuel tank must be empty when installing and removing to reduce weight. Drain fuel tank if necessary: rest-of-world vehicles ⇒ page 7 , USA vehicles ⇒ page 112 .

Observe the following to prevent injuries to persons and damage to the injection and ignition system:

- Persons wearing a cardiac pacemaker must at all times maintain a safe distance from high-voltage components such as the ignition system and xenon headlights.

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Audi

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- Do not touch or disconnect ignition coils with output stages when the engine is running or being turned at cranking speed.
- Always switch off the ignition before connecting or disconnecting electrical wiring for the injection or ignition system or tester cables.
- Always switch off ignition before washing engine.
- When installing, note colour coding of plug-in connectors.
- Plug-in connectors should engage audibly when connecting.
- Pull plug-in connectors to check that they are correctly engaged.
- Erase any entries in event memory resulting from testing or installation ⇒ Vehicle diagnostic tester, `Guided Functions`, `Interrogate event memory`, then `Generate readiness code`.

Caution

To prevent irreparable damage to the electronic components when disconnecting the battery:

- *Observe notes on procedure for disconnecting the battery.*
- *Always switch off the ignition before disconnecting the battery ⇒ Electrical system; Rep. gr. 27 .*

1.2 Safety precautions when using testers and measuring instruments during a road test

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

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WARNING

Accidents can be caused if the driver is distracted by test equipment while road-testing, or if test equipment is not properly secured.

Persons sitting in the front passenger's seat could be injured if the airbag is triggered in an accident.

- *The use of test equipment while driving causes distraction.*
- *There is an increased risk of injury if test equipment is not secured.*
- *Test equipment must always be secured on the rear seat with a strap and operated from the rear seat by a second person.*

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2 Repair instructions

⇒ “2.1 Rules for cleanliness”, page 3

⇒ “2.2 Test conditions”, page 3

⇒ “2.3 Contact corrosion”, page 3

⇒ “2.4 Routing and attachment of pipes, hoses and wiring”, page 4

2.1 Rules for cleanliness

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

- Carefully clean connection points and the surrounding area with engine cleaner or brake cleaner and dry thoroughly before opening.
- Immediately seal open lines and connections with clean plugs, for example from engine bung set - VAS 6122- .
- Place parts that have been removed on a clean surface and cover them over. Use only lint-free cloths.
- Carefully cover or seal open components if repairs cannot be carried out immediately.
- Only install clean components; replacement parts should only be unpacked immediately prior to installation. Do not use parts that have not been stored in their packing (e.g. in tool boxes etc.).
- When the system is open, do not work with compressed air and do not move the vehicle.
- Protect unplugged electrical connectors against dirt and moisture and make sure connections are dry when attaching.

2.2 Test conditions

- Battery voltage at least 12.5 V.
- Fuel pump fuse OK ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.
- Fuel pump relay - J17- / electric fuel pump 2 relay - J49- OK ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.
- Fuel pump control unit - J538- OK, checking in Guided Fault Finding ⇒ Vehicle diagnostic tester.
- Fuel tank at least $^1/_4$ full.
- Fuel filter OK.
- Fuel lines OK (not obstructed or crushed).
- Ignition off.

2.3 Contact corrosion

Contact corrosion can occur if unsuitable fasteners are used (e.g. bolts, nuts, washers, etc.).

For this reason, only fasteners with a special surface coating are used.

Additionally, all rubber and plastic parts and all adhesives are made of non-conductive materials.

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Always install new parts if you are not sure whether used parts can be re-fitted ⇒ Electronic parts catalogue .

Note the following:

- We recommend using only genuine replacement parts; these have been tested and are compatible with aluminium.
- We recommend the use of Audi accessories.
- Damage caused by contact corrosion is not covered under warranty.

2.4 Routing and attachment of pipes, hoses and wiring



Caution

Risk of damage to pipes/hoses/wiring.

- *The original routing must be restored when installing any kind of pipes/hoses/wiring.*
- *Due to the restricted space in the engine compartment, it is important to ensure sufficient clearance from all moving or hot components.*

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20 – Fuel supply system

1 Fuel tank with attached components - all rest-of-world vehicles

⇒ “1.1 Fuel tank with attached components - exploded view”, page 5

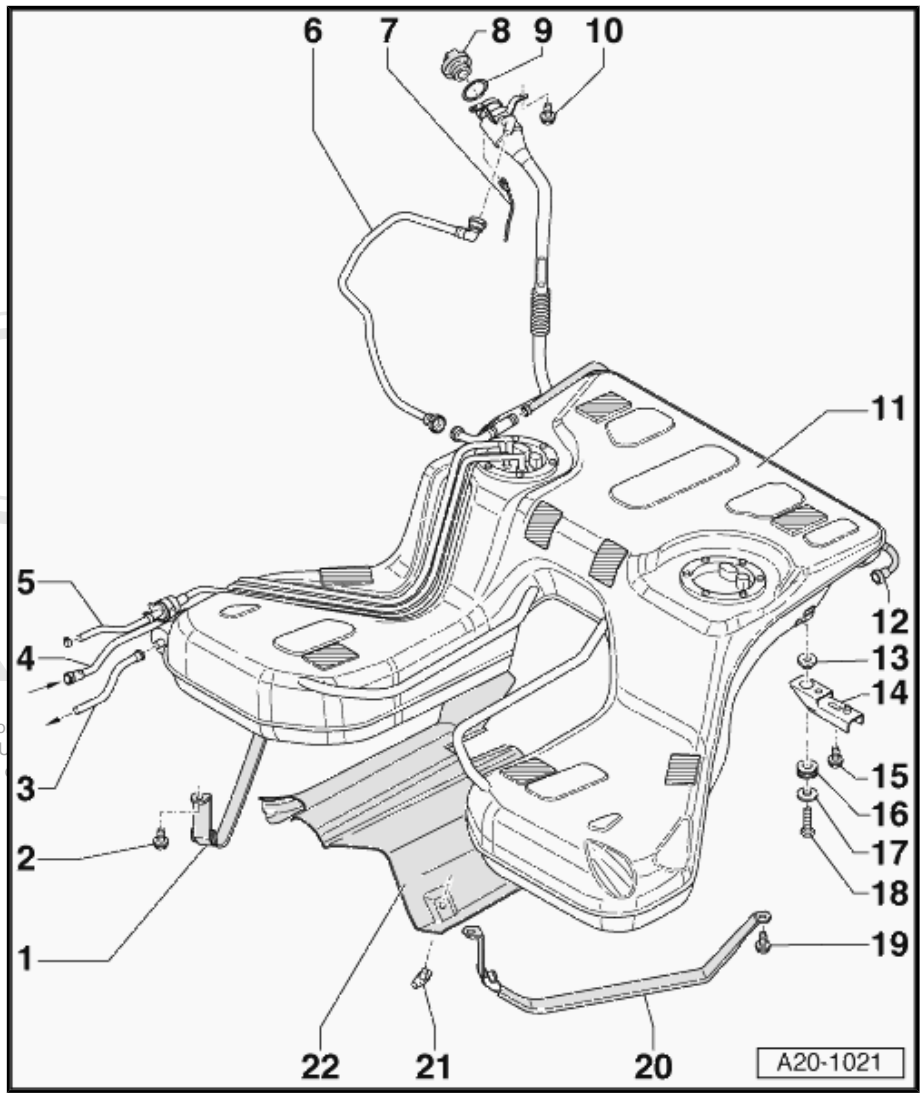
⇒ “1.2 Draining fuel tank”, page 7

⇒ “1.3 Removing and installing fuel tank with attached components”, page 10

1.1 Fuel tank with attached components - exploded view

Note

The illustration shows a fuel system with fuel return line.



1 - Securing strap

- ❑ With spacer, installation position ⇒ page 6

2 - Bolt

- ❑ 22 Nm

3 - Fuel supply line

- ❑ From fuel filter
- ❑ To engine
- ❑ Mark before removing
- ❑ Press release tab on connection piece to disconnect

4 - Fuel return line

- ❑ From engine
- ❑ Mark before removing
- ❑ Press release tab on connection piece to disconnect
- ❑ Note direction of arrow on flange
- ❑ Clip onto fuel tank

5 - Supply line

- ❑ To auxiliary heater

6 - Breather line

7 - Earth connection

- ❑ To eliminate electrostatic charge
- ❑ Installation position / test procedure ⇒ page 7
- ❑ Make sure that connector is securely fitted
- ❑ After installation, use an ohmmeter to check the electrical connection between the fuel filler neck and a bare metal part on the body. Specification: approx. 0 Ω

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8 - Filler cap

9 - Seal

- ❑ Renew if damaged

10 - Bolt

- ❑ 22 Nm

11 - Fuel tank

- ❑ Removing and installing ⇒ page 10

12 - Breather line

- ❑ To activated charcoal filter in rear left wheel housing
- ❑ Clip onto fuel tank
- ❑ Remains on fuel tank when tank is removed

13 - Bush

14 - Fuel tank bracket

15 - Bolt

- ❑ 22 Nm

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16 - Rubber buffer

17 - Washer

18 - Bolt

- ❑ 22 Nm

19 - Bolt

- ❑ 22 Nm

20 - Securing strap

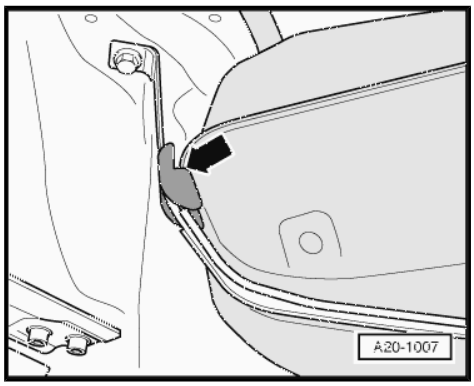
- ❑ With spacer, installation position ⇒ page 6

21 - Retaining clip for heat shield

22 - Heat shield

Installation position of spacers

– Make sure that securing strap spacers are located directly under seam of fuel tank -arrow-.

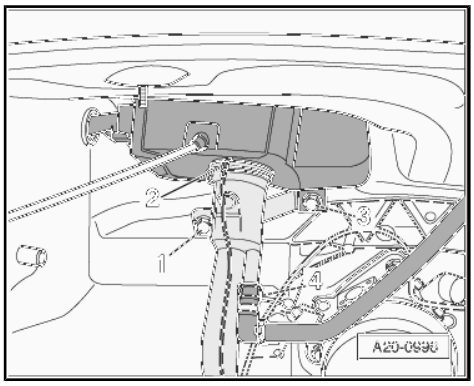


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Installation position of earth connection

– Position the earth connection as illustrated -2-.

– Ensure that plug connector for earth connection is properly seated on metal ring on fuel filler neck.



Caution

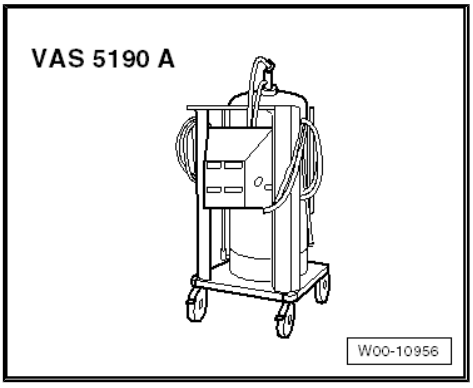
After installation, use an ohmmeter to check the electrical connection between the metal ring on the fuel filler neck and a bare metal part on the body:

- *Specification: approx. 0 Ω.*

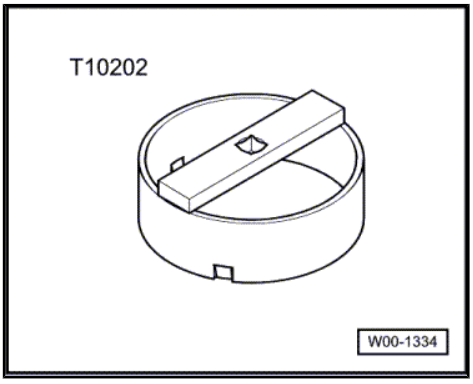
1.2 Draining fuel tank

Special tools and workshop equipment required

♦ Fuel extractor - VAS 5190A-



♦ Vehicles from approx. 11.2002: Wrench - T10202-



Procedure

Observe safety precautions ⇒ page 1 .

Observe rules for cleanliness ⇒ page 3 .

– Briefly open filler cap for fuel tank and close again.

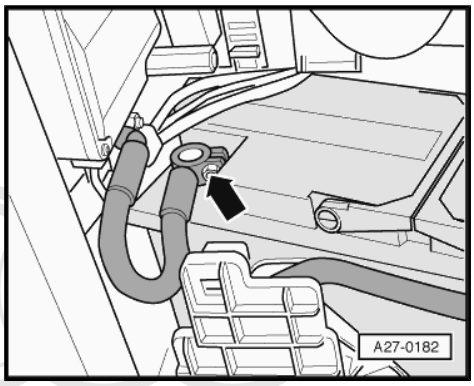
Caution

Observe notes on procedure for disconnecting the battery.

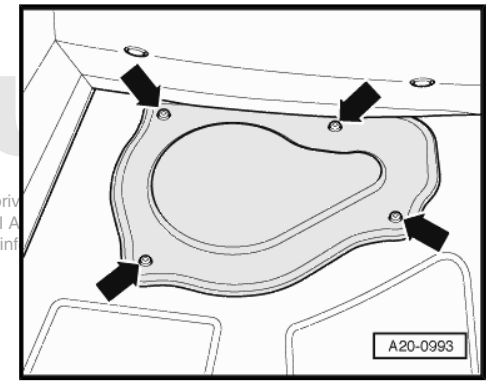
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– With ignition switched off, disconnect battery earth cable -arrow- ⇒ Electrical system; Rep. gr. 27 .

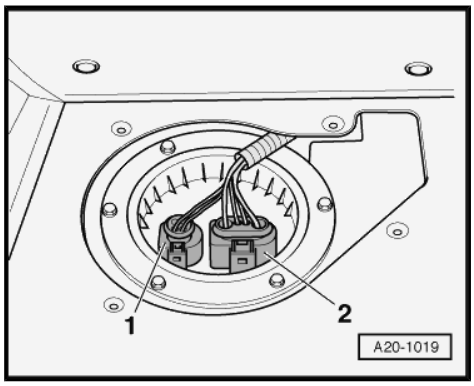


– Remove luggage compartment floor covering.
– Detach cover for flange (left-side) -arrows-.



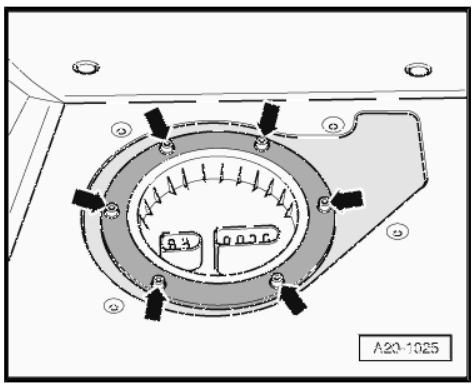
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– Unplug electrical connectors -1- and -2- on flange (left-side).



Vehicles up to approx. 10.2002:

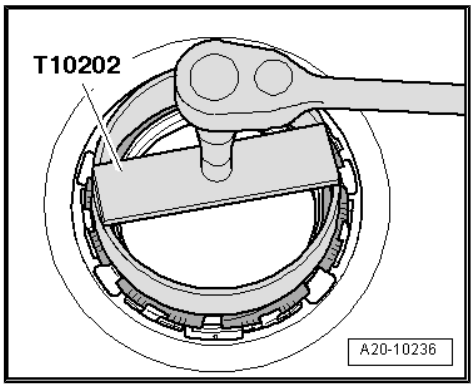
– Remove bolts -arrows- and take off locking ring for flange (left-side).



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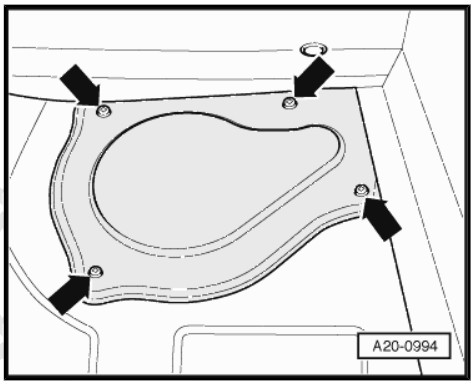
Vehicles from approx. 11.2002 onwards:

– Unscrew locking ring using wrench - T10202- .

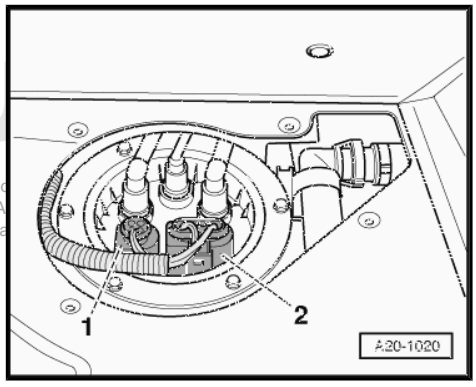


All vehicles (continued):

– Unscrew cover for flange (right-side) -arrows-.



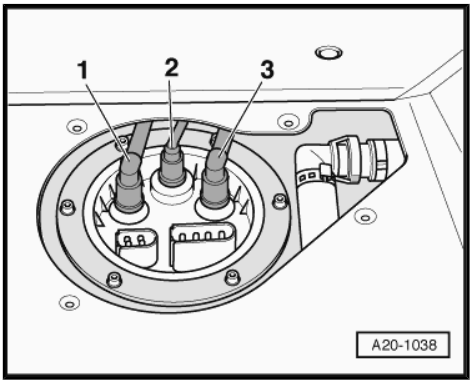
– Unplug electrical connectors -1- and -2- on flange (right-side).



– Mark fuel return line -1- and fuel supply line -3-.

WARNING

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



– Detach both lines from flange (press release tabs).

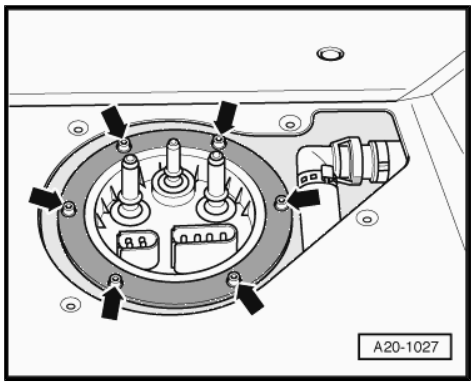
Vehicles with auxiliary heater:

– In addition, disconnect fuel supply line -2- for auxiliary heater.

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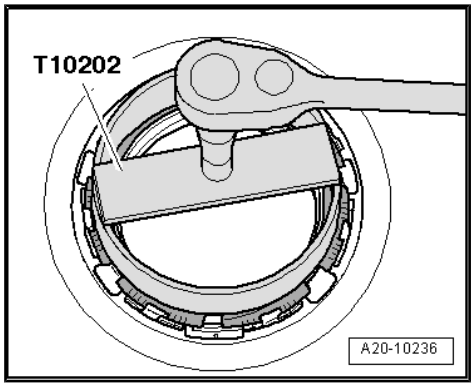
Vehicles up to approx. 10.2002:

– Remove bolts -arrows- and take off locking ring for flange (right-side).



Vehicles from approx. 11.2002 onwards:

– Unscrew locking ring using wrench - T10202- .



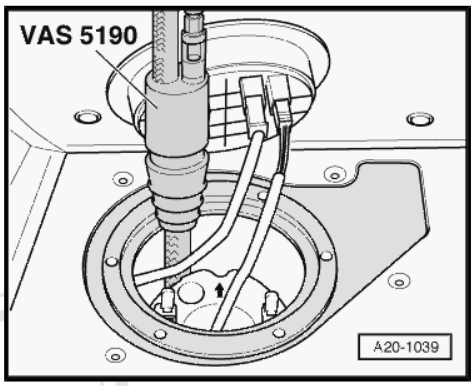
All vehicles (continued):

– Connect earth wire of fuel extractor - VAS 5190A- to earth stud of energy management control unit - J644- .

– Remove flange (left-side) and lay it aside with electrical wires connected.

– Remove seal/O-ring.

– Extract fuel from left fuel tank chamber through fuel tank opening using fuel extractor - VAS 5190A- .

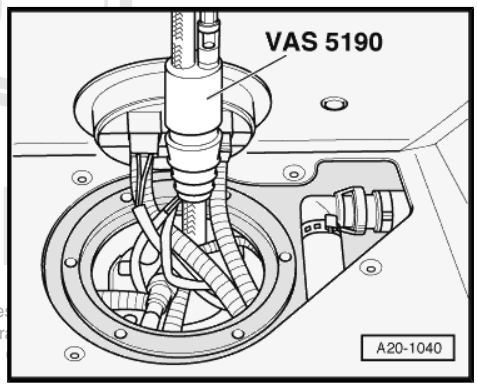


– Remove flange (right-side) and lay it aside with electrical wires and fuel lines connected.

– Remove seal/O-ring.

– Extract fuel from right fuel tank chamber through fuel tank opening using fuel extractor unit - VAS 5190A- .

– Re-install flange: left-side ⇒ page 31 , right-side ⇒ page 48 .



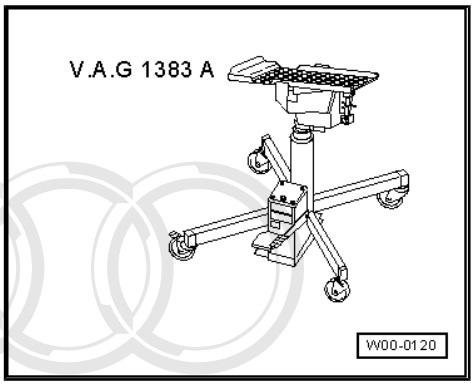
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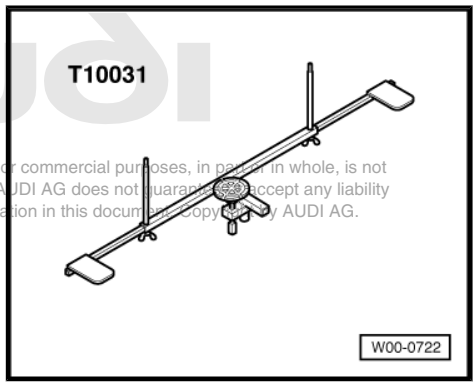
1.3 Removing and installing fuel tank with attached components

Special tools and workshop equipment required

♦ Engine and gearbox jack - V.A.G 1383 A-



♦ Support - T10031-



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Removing

Observe safety precautions ⇒ page 1 .

Observe rules for cleanliness ⇒ page 3 .

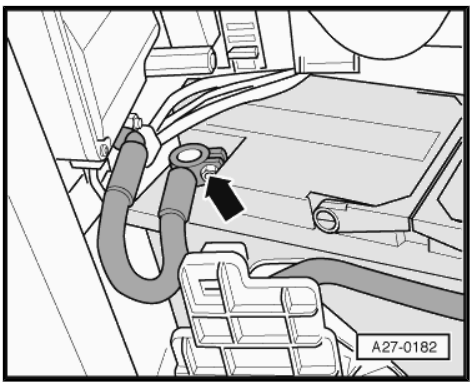
- To reduce weight, the fuel tank must be empty when it is removed from the vehicle. Drain the tank if necessary. Procedure ⇒ page 7

– Release the tank flap.

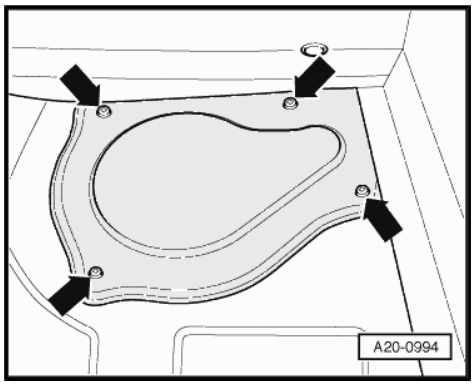
Caution

Observe notes on procedure for disconnecting the battery.

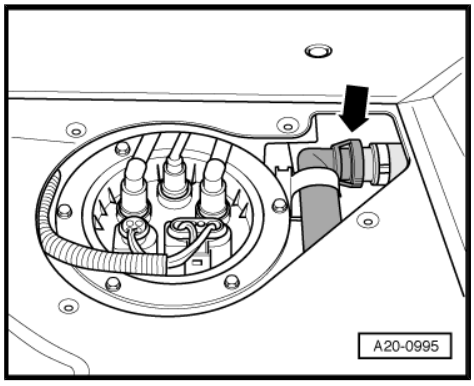
– With ignition switched off, disconnect battery earth cable -arrow- ⇒ Electrical system; Rep. gr. 27 .



– Remove luggage compartment floor covering.
– Unscrew cover for flange (right-side) -arrows-.



– Press release tabs to disconnect breather pipe -arrow-.

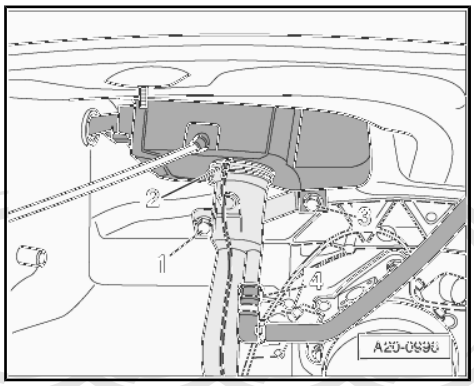


WARNING

BEFORE loosening the subframe bolts, ensure that the vehicle cannot tip forwards (for instance by putting a weight of about 50 kg in the luggage compartment).

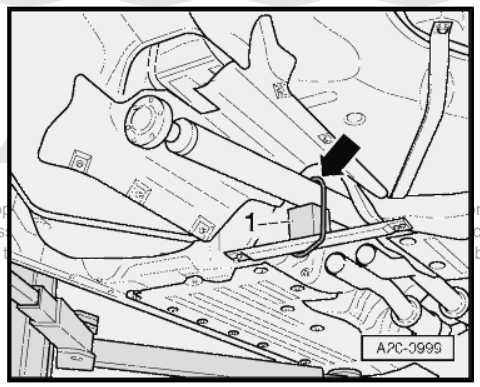
– Remove rear axle ⇒ Rep. gr. 42 .
– Remove rear right wheel housing liner ⇒ Rep. gr. 66 .

– Disconnect earth wire -2- from fuel filler neck.
– Disconnect breather pipe -4- from fuel filler neck.
– Remove bolts -1- and -3- for fuel filler neck.



– Check that propshaft is secured to prevent it falling.

- The propshaft should be placed on a block of wood -1- and secured with wire or a cable tie -arrow-.
- The propshaft should be inclined slightly downwards to ensure there is sufficient space when installing the fuel tank.



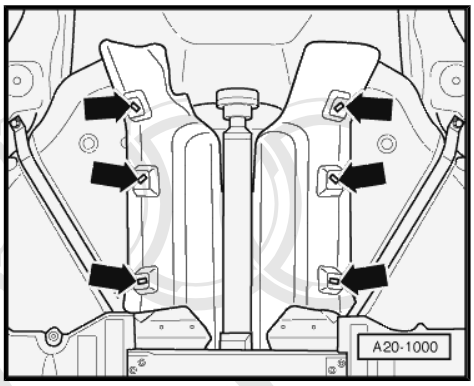
Note

The propshaft must not be bent more than 8°.

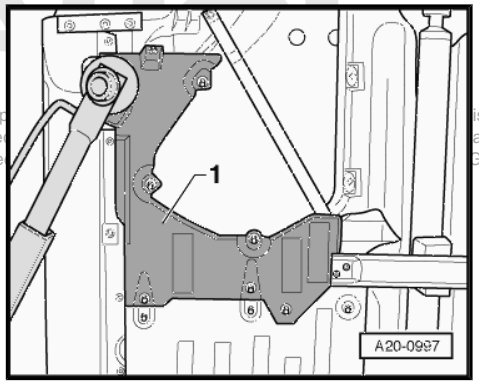
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– Remove heat shield for propshaft -arrows-.

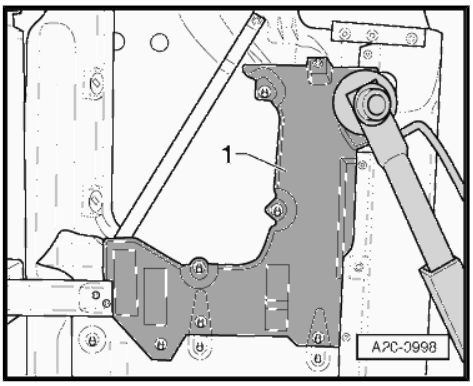


– Remove cover -1- from underside of vehicle (left-side).



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– Remove cover -1- from underside of vehicle (right-side).



– Unplug electrical connectors:

1 - To metering pump for auxiliary/additional heater

3 - To fuel pumps

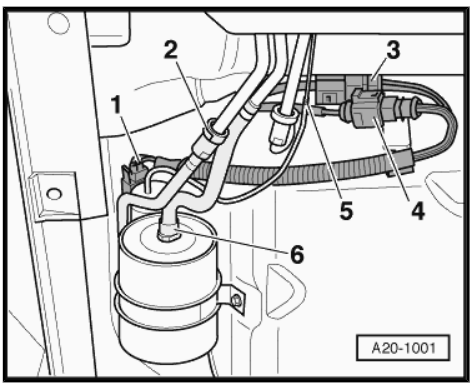
4 - To fuel gauge senders

– Disconnect fuel pipes (press release tabs):

2 - Fuel return line (only MPI engines with return line)

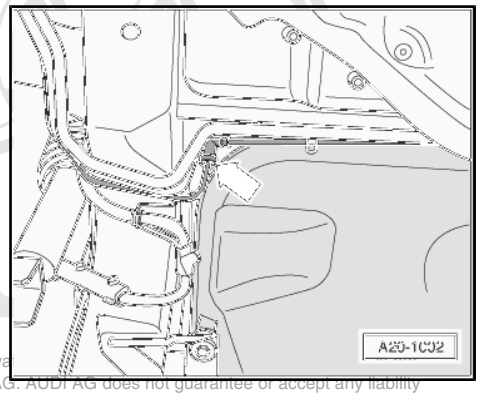
5 - Fuel pipe to metering pump for auxiliary/additional heater

6 - Fuel supply line



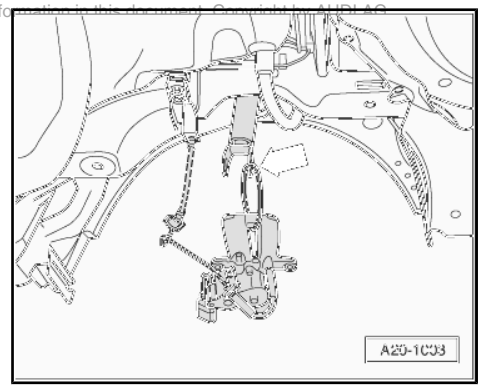
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– Disconnect breather pipe -arrow- at rear left of fuel tank (press release tab).

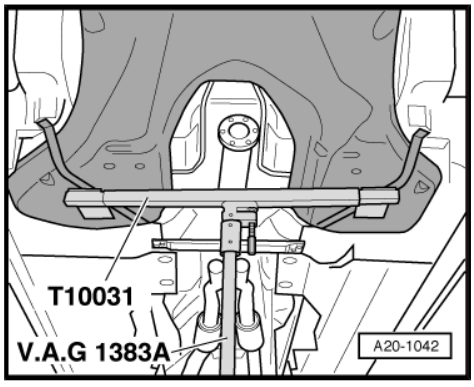


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– Attach brake calipers to suspension struts with wire -arrow- (brake calipers were fastened to fuel tank brackets upon removal of rear suspension).



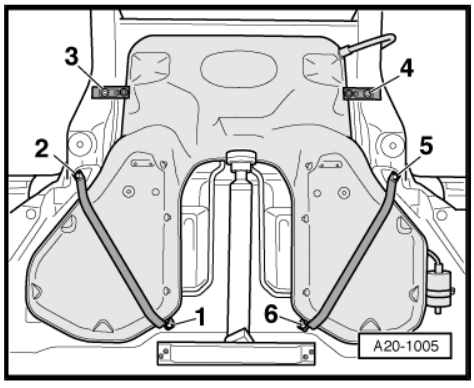
– Position engine and gearbox jack - V.A.G 1383 A- with support - T10031- under vehicle to support tank (do not use threaded rods of support).
– Support fuel tank using engine and gearbox jack - V.A.G 1383 A- and support - T10031- .
– In addition, a 2nd mechanic will be required to support the fuel tank at the rear by hand.



WARNING

To reduce weight, fuel tank must be empty upon removal.

– Unscrew bolts -1 ... 6-; swivel fuel tank brackets forward if necessary.
– First lower fuel tank slightly at the rear so the fuel filler neck can be guided out of the body.
– Then lower fuel tank using engine and gearbox jack - V.A.G 1383 A- .



Note

For illustration purposes the fuel tank is shown without engine and gearbox jack.

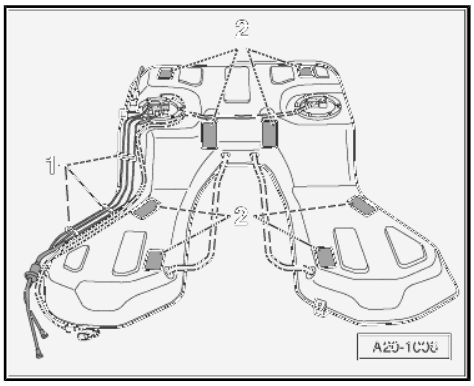
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Installing

- Tightening torques ⇒ page 5

– Check that fuel pipes and wiring harness for fuel pumps and fuel gauge senders are clipped into brackets -1- on fuel tank.

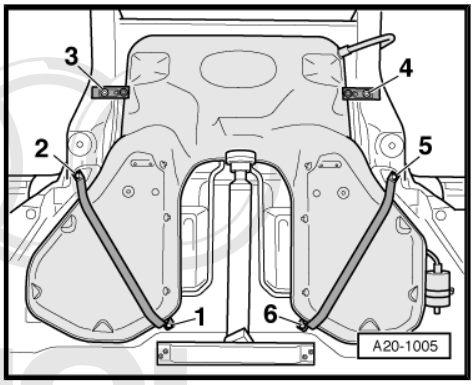
– Bond pads -2- to fuel tank as shown when installing new fuel tank.



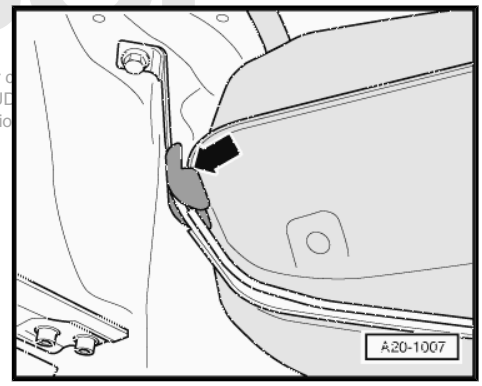
– Position fuel tank with securing straps and brackets on underbody, using engine and gearbox jack - V.A.G 1383 A- and support - T10031- .

– When installing fuel tank, make sure that the fuel filler neck is correctly inserted into the opening on the body.

– Secure fuel tank by first tightening bolts at points -1-, -2-, -5- and -6-, then at points -3- and -4-.



– Make sure that securing strap spacers are located directly under seam of fuel tank -arrow-.



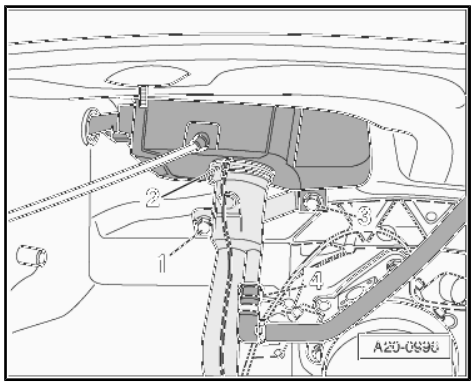
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– Secure fuel filler neck using bolts -1- and -3-.

– Fit breather pipe -4- so that it engages audibly.

– Check the earth wiring -2- and connector tab for traces of oxidation. Remove any traces of oxidation if necessary.



Caution

After installation, use an ohmmeter to check the electrical connection between the metal ring on the fuel filler neck and a bare metal part on the body:

- ***Specification: approx. 0 Ω.***

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

Note

- *Always renew seals and gaskets when assembling.*
- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*

– Install rear axle ⇒ Rep. gr. 42 .

– Install rear right wheel housing liner ⇒ Rep. gr. 66 .

– Install rear section of exhaust system ⇒ Rep. gr. 26 .

– Connect battery. Observe notes on procedures required after connecting battery ⇒ Electrical system; Rep. gr. 27 .

Vehicles with auxiliary heater:

– Let auxiliary heater run with full load for 10 minutes to bleed fuel supply line going to metering pump.

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2 Routing of pipes/hoses (inside fuel tank) - rest-of-world vehicles with MPI engine

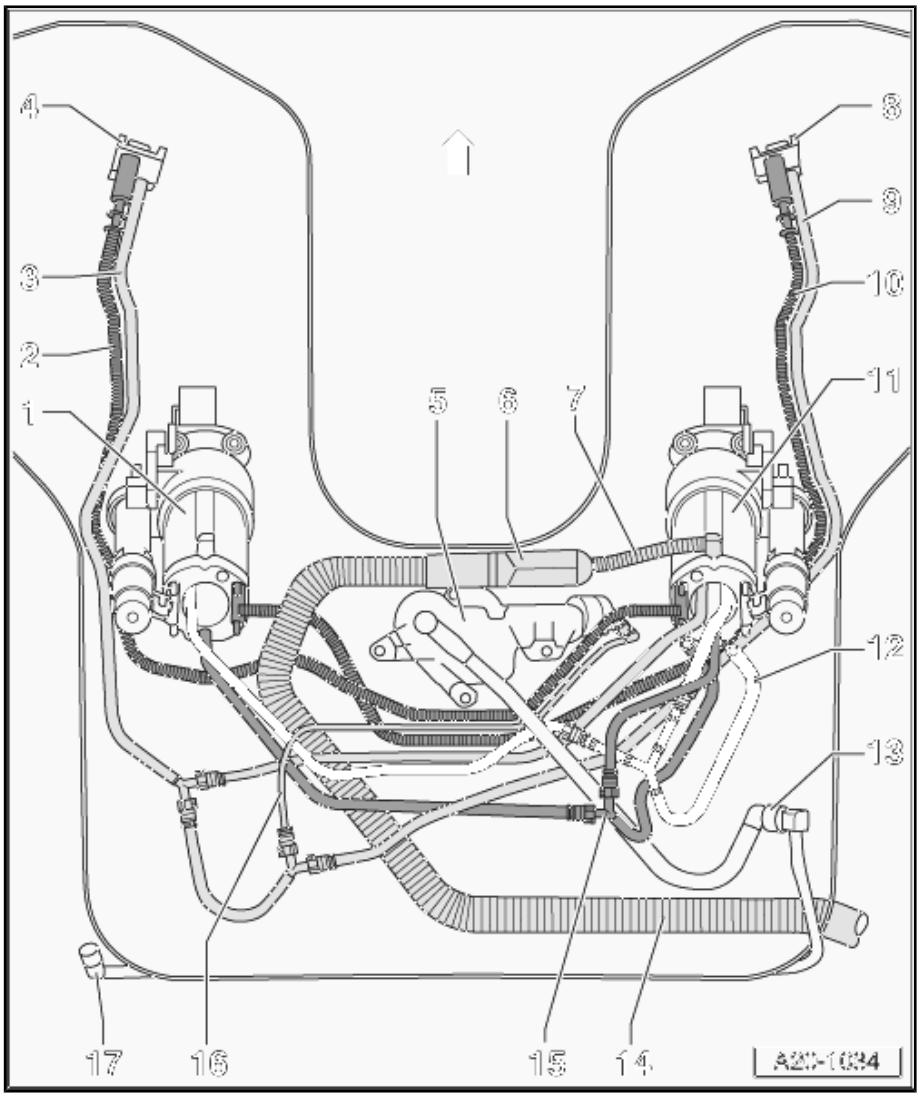
⇒ "2.1 Routing of pipes/hoses (inside fuel tank) - exploded view", page 17

2.1 Routing of pipes/hoses (inside fuel tank) - exploded view

Note

- *The illustration shows the correct routing of pipes/hoses inside the fuel tank (schematic view).*
- *It is not necessary to route the pipes/hoses in exactly the same way as shown in the illustration, except for pipes/hoses shown in ⇒ page 18 . However it is essential to fit the pipes/hoses with sufficient space in relation to each other and to prevent rattling noises.*
- *The -arrow- points in direction of travel.*

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1 - Fuel delivery unit (left-side) with fuel system pressurisation pump - G6-

2 - Fuel supply line

- From suction-jet pump (left-side) to fuel delivery unit (right-side)

3 - Supply line for suction-jet pump

- From fuel pump (right-side) to suction-jet pump (left-side)

4 - Suction-jet pump (left-side)

5 - Expansion tank

- With suction-jet pump to extract fuel from expansion tank

6 - Non-return flap

- For fuel filler pipe

7 - Primary filler pipe

- To fuel delivery unit (right-side).
- Ensures that a small amount of fuel is delivered immediately to the fuel delivery unit when the tank is filled for the first time.

8 - Suction-jet pump (right-side)

9 - Supply line for suction-jet pump

- From fuel pump (right-side) to suction-jet pump (right-side)

10 - Fuel supply line

- From suction-jet pump (right-side) to fuel delivery unit (left-side)

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11 - Fuel delivery unit (right-side) with fuel pump - G23-

12 - Fuel supply line

- ❑ From fuel pumps (left and right) to flange

13 - Breather line

- ❑ From expansion tank to breather connection on outside of fuel tank

14 - Fuel filler pipe

- ❑ From fuel filler neck to non-return flap in fuel tank

15 - Fuel return line

- ❑ From flange to fuel delivery units (left and right)

16 - Supply line for suction-jet pump

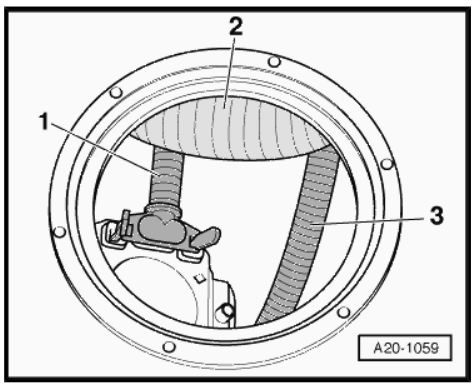
- ❑ To suction-jet pump in expansion tank

17 - Breather line

- ❑ To activated charcoal filter in rear left wheel housing

Installation position of fuel supply lines

- The fuel supply lines -1- and -3- must be routed below the fuel filler pipe -2- at the left fuel tank opening.



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3 Fuel delivery unit with fuel pump and fuel gauge senders - rest-of-world vehicles with MPI engine

⇒ “3.1 Exploded view - fuel delivery unit (left-side) with fuel system pressurisation pump G6 and fuel gauge senders G and G237 ”, page 19

⇒ “3.2 Checking fuel system pressurisation pump G6 (left-side) - electrical test”, page 21

⇒ “3.3 Removing and installing fuel delivery unit (left-side) with fuel system pressurisation pump G6 ”, page 26

⇒ “3.4 Exploded view - fuel delivery unit (right-side) with fuel pump G23 and fuel gauge senders G169 and G393 ”, page 36

⇒ “3.5 Checking fuel pump G23 (right-side) - electrical test”, page 39

⇒ “3.6 Removing and installing fuel delivery unit (right-side) with fuel pump G23 ”, page 42

⇒ “3.7 Checking delivery rate of fuel pumps - vehicles with fuel return line”, page 53

⇒ “3.8 Checking delivery rate of fuel pumps - vehicles with fuel system without fuel return line”, page 56

⇒ “3.9 Suction-jet pumps”, page 60

⇒ “3.10 Removing and installing suction-jet pump (left-side)”, page 62

⇒ “3.11 Removing and installing suction-jet pump (right-side)”, page 63

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3.1 Exploded view - fuel delivery unit (left-side) with fuel system pressurisation pump - G6- and fuel gauge senders -G- and -G237-

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1 - Retainer

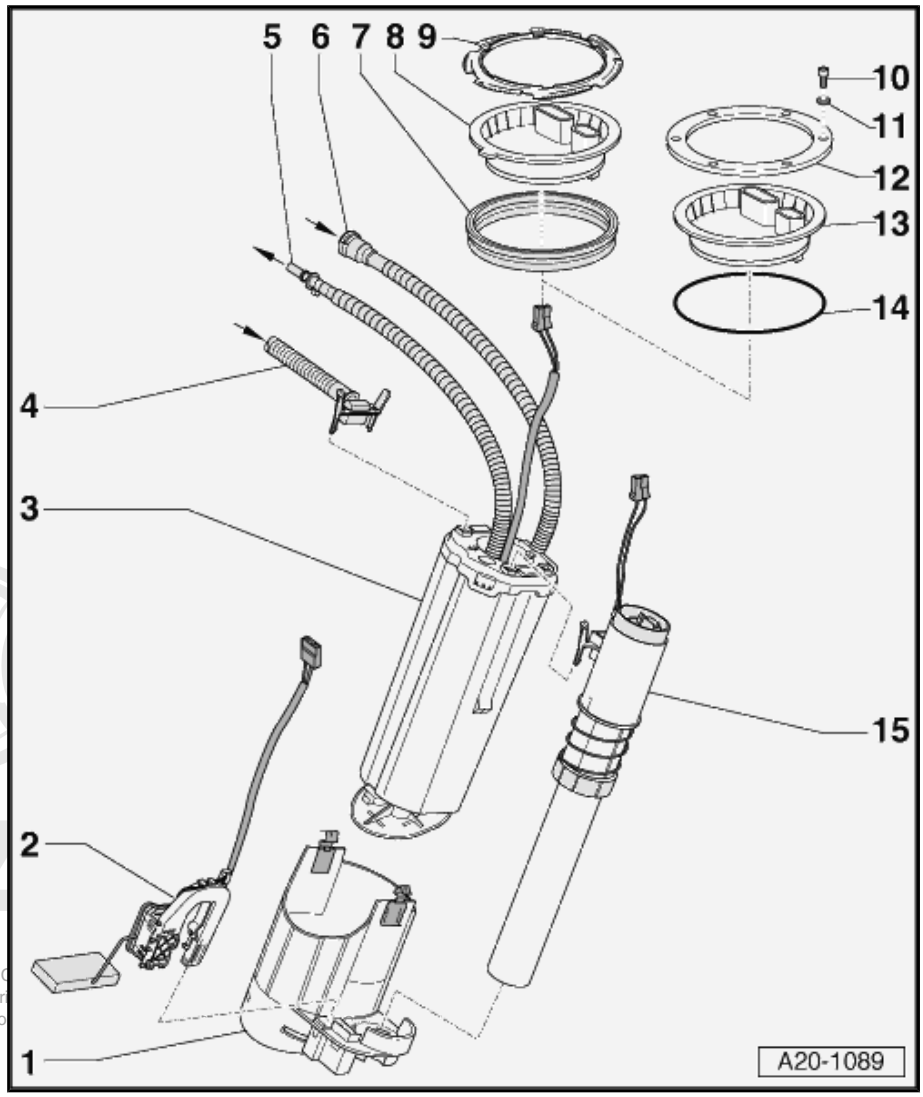
- For fuel delivery unit

2 - Fuel gauge sender - G-

- Black
- Clipped onto retainer -item 1-
- Checking resistance values ⇒ page 201
- Removing and installing ⇒ page 202

3 - Fuel delivery unit (left-side)

- With fuel system pressurisation pump - G6-
- Clipped onto retainer -item 1-
- Different versions available; for correct version refer to ⇒ Electronic parts catalogue
- Checking fuel pump (electrical test) ⇒ page 21
- Checking residual pressure ⇒ Rep. gr. 24
- Removing and installing ⇒ page 26
- Put at least 5 litres of fuel into tank after installing



4 - Fuel supply line

- From suction jet pump (right-side)
- Clipped onto fuel delivery unit -item 3-

5 - Fuel supply line

- The plug connector is located on the right side of the fuel tank
- Press release tab on connection piece to disconnect

6 - Fuel return line

- The plug connector is located on the right side of the fuel tank
- Press release tab on connection piece to disconnect

7 - Seal

- Applies to vehicles from approx. 11.2002
- Renew
- Install dry

8 - Flange (left-side)

- Applies to vehicles from approx. 11.2002
- Installation position ⇒ page 21

9 - Locking ring

- Applies to vehicles from approx. 11.2002
- Remove and install using wrench - T10202-
- Tighten to 120 Nm

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10 - 10 Nm

- ❑ Applies to vehicles up to approx. 10.2002
- ❑ Tighten bolts in diagonal sequence

11 - Washer

- ❑ Applies to vehicles up to approx. 10.2002

12 - Locking ring

- ❑ Applies to vehicles up to approx. 10.2002
- ❑ For flange

13 - Flange (left-side)

- ❑ Applies to vehicles up to approx. 10.2002
- ❑ Installation position ⇒ page 21

14 - O-ring

- ❑ Applies to vehicles up to approx. 10.2002
- ❑ Renew

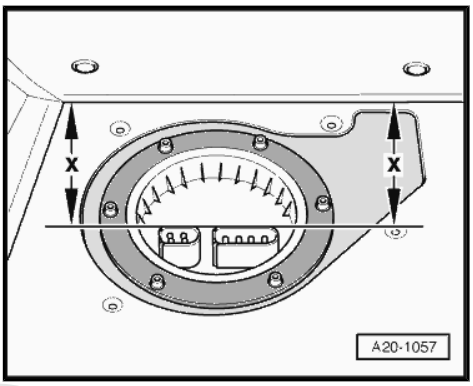
15 - Fuel gauge sender 3 - G237-

- ❑ Grey
- ❑ Clipped onto fuel delivery unit -item 3-
- ❑ Checking resistance values ⇒ page 205
- ❑ Removing and installing ⇒ page 206

Installation position of flange (left-side) - vehicles up to approx. 10.2002

– Fit flange with new O-ring into fuel tank; note correct installation position:

- The electrical connectors are positioned transversely in relation to direction of travel.
- Dimension -x- (left-side) = dimension -x- (right-side)

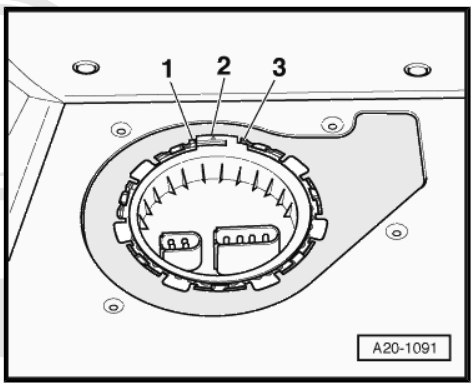


Installation position of flange (left-side) - vehicles from approx. 11.2002

– Install new seal for flange (seal must be installed dry).

– Fit flange into fuel tank; note correct installation position:

- Lug -2- on flange must be between tabs -1- and -3- on fuel tank.



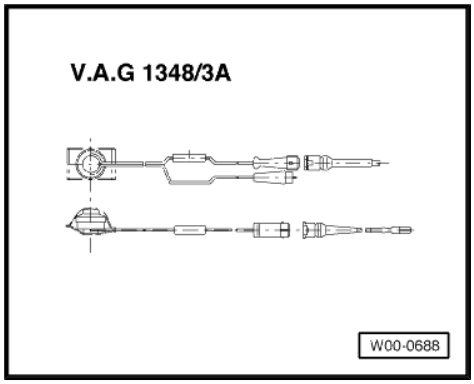
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3.2 Checking fuel system pressurisation pump - G6- (left-side) - electrical test

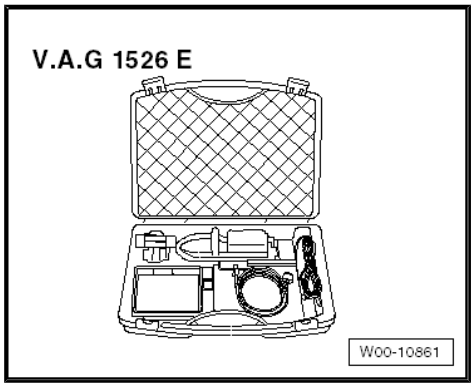
Special tools and workshop equipment required

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- Remote control for V.A.G 1348 - V.A.G 1348/3A-



- Hand-held multimeter - V.A.G 1526 E-

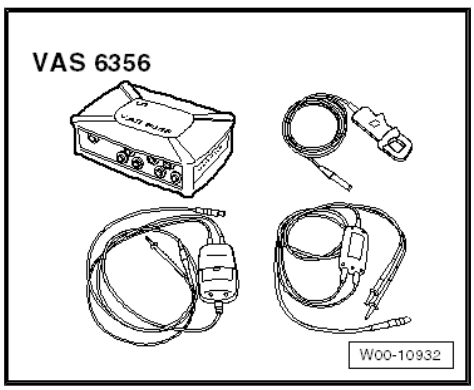


- Auxiliary measuring set - V.A.G 1594C-



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- Test instrument box - VAS 6356- with trigger clamp, 100 A - VAS 6356/4A-



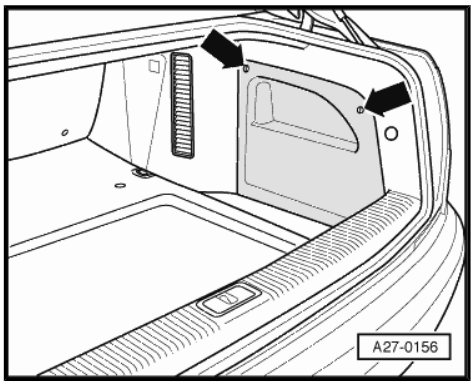
Procedure

– Observe test conditions ⇒ page 3 .

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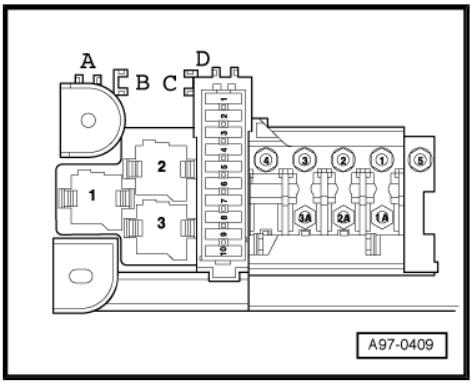
Checking voltage supply

– Remove luggage compartment side trim cover (right-side) -arrows-.



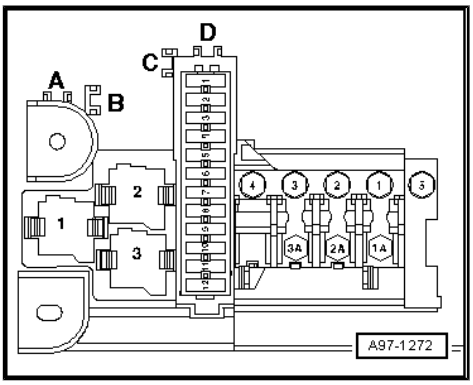
Vehicles built in model year 2003:

– Take fuse 10 out of fuse holder SF10 (located in relay and fuse carrier in luggage compartment (right-side), position 10).



Vehicles from model year 2004 onwards:

– Take fuse 2 out of fuse holder SF2 (located in relay and fuse carrier in luggage compartment (right-side), position 2).



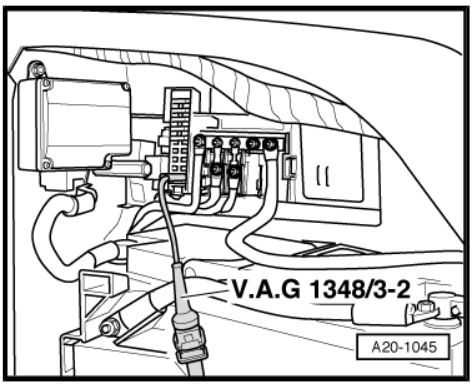
All vehicles (continued):

– Connect remote control - V.A.G 1348/3A- for V.A.G 1348 with adapter cable - V.A.G 1348/3-2- to right-hand terminal of fuse socket from which fuse has been taken out.

– Connect crocodile clip of remote control - V.A.G 1348/3A- for V.A.G 1348 to battery “+” (positive).

– Press remote control button.

• Fuel pump should start running (noise is audible in vicinity of fuel tank).



Note

The fuel pump runs very quietly. Avoid background noise whilst checking fuel pump. Have second mechanic perform check if necessary.

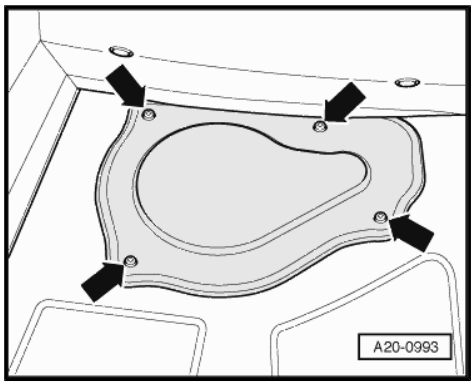
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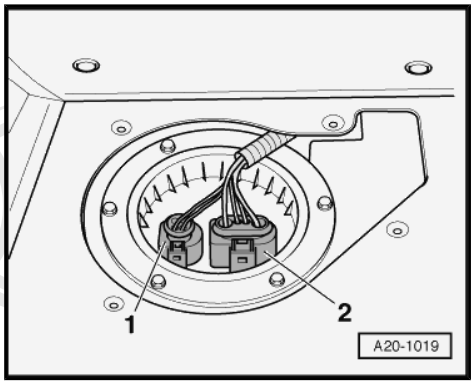
If no noise can be heard from pump:

– Remove luggage compartment floor covering.

– Detach cover for flange (left-side) -arrows-.



– Unplug electrical connector -2- on flange (left-side).



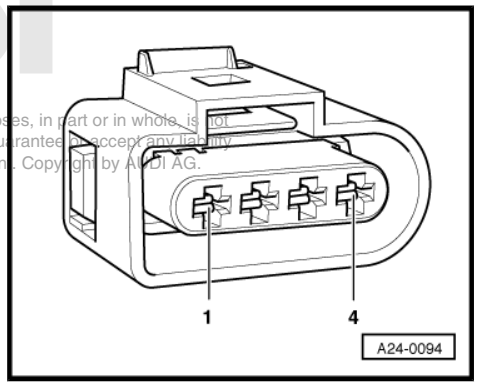
Note

Disregard -item 1-.

– Connect multimeter between contacts -1- and -4- of electrical connector to measure voltage.

– Press remote control button.

• Specification: approx. battery voltage



If specification is not obtained:

– Repair wiring harness according to current flow diagram.

If reading matches specification although no noise can be heard from pump:

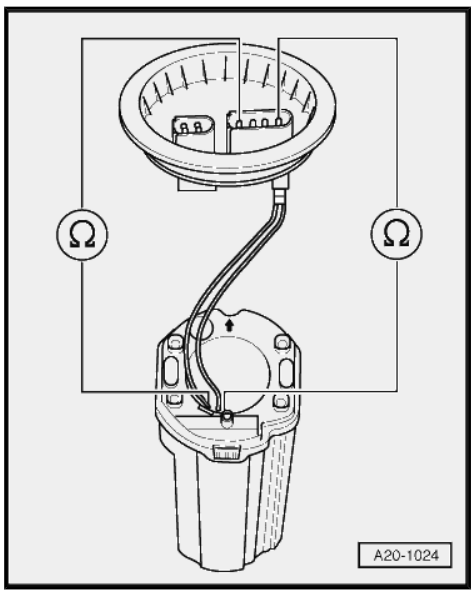
– Remove the fuel delivery unit (left-side) ⇒ page 26 .

– Check that the electrical wires between flange and fuel pump are connected and test for continuity.

If no faults are found in the wiring:

– Fuel pump is defective. Renew the fuel delivery unit (left-side).

– Install fuel delivery unit (left-side) ⇒ page 31 .



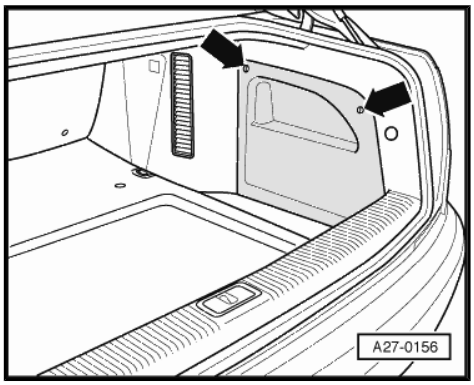
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Checking current draw

- Fuel pump voltage supply OK ⇒ page 23

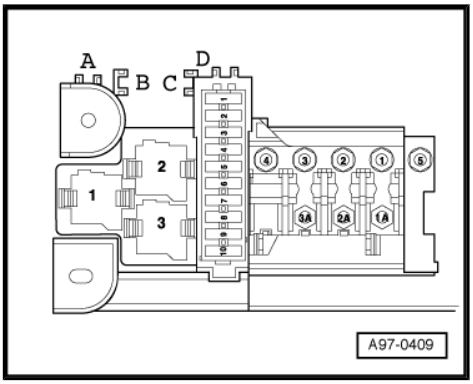
– Remove luggage compartment side trim cover (right-side) -arrows-.



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Vehicles built in model year 2003:

– Take fuse 10 out of fuse holder SF10 (located in relay and fuse carrier in luggage compartment (right-side), position 10).



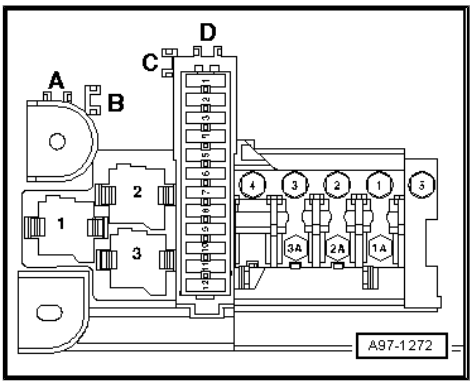
Vehicles from model year 2004 onwards:

– Take fuse 2 out of fuse holder SF2 (located in relay and fuse carrier in luggage compartment (right-side), position 2).

All vehicles (continued):

– Connect remote control - V.A.G 1348/3A- for V.A.G 1348 with adapter cable - V.A.G 1348/3-2- to right-hand terminal of fuse socket from which fuse has been taken out.

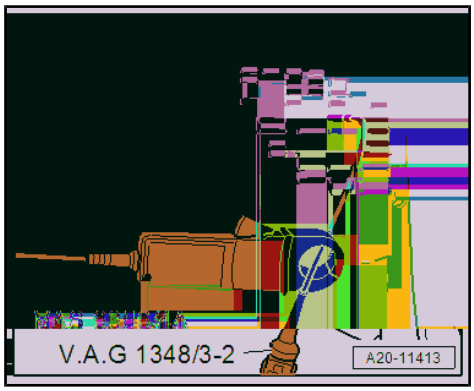
– Connect crocodile clip of remote control - V.A.G 1348/3A- for V.A.G 1348 to battery “+” (positive).



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– Connect test instrument box - VAS 6356- with trigger clamp, 100 A - VAS 6356/4A- to cable of remote control.
– Press remote control button.
– Measure current draw of fuel pump.
• Specification: approx. 8 A.

If specification is not obtained:



Note

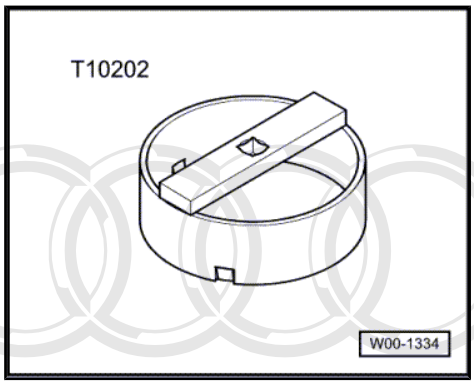
A current draw of 4 A indicates that the fuel pump is running dry.

Readout	Cause of fault	Remedy
approx. 4 A	♦ Fuel tank empty	– Fill tank
	♦ Housing of fuel delivery unit leaking	– Renew fuel delivery unit ⇒ page 26
0 A	♦ Fuel system pressurisation pump - G6- defective	– Renew fuel delivery unit ⇒ page 26

3.3 Removing and installing fuel delivery unit (left-side) with fuel system pressurisation pump - G6-

Special tools and workshop equipment required

♦ Vehicles from approx. 11.2002: Wrench - T10202-



Removing

Observe safety precautions ⇒ page 1 .

Observe rules for cleanliness ⇒ page 3 .

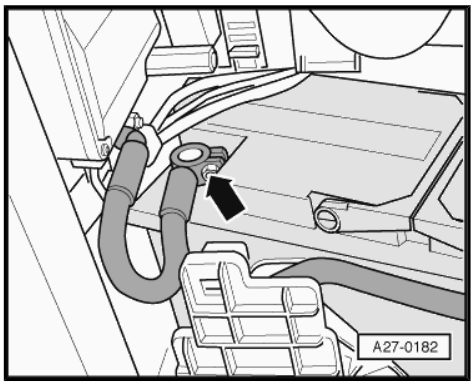
• The fuel tank must not be more than $^{1}/_{3}$ full when removing the fuel delivery unit. Drain the tank if necessary. Procedure ⇒ page 7

Caution

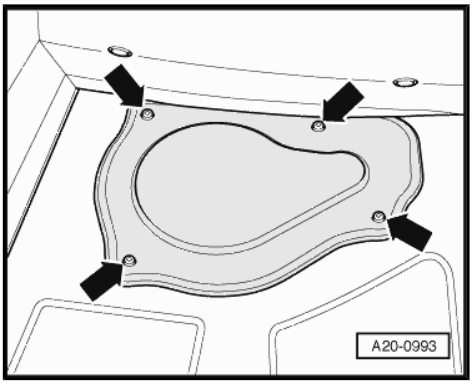
Observe notes on procedure for disconnecting the battery.

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– With ignition switched off, disconnect battery earth cable -arrow- ⇒ Electrical system; Rep. gr. 27 .



– Remove luggage compartment floor covering.

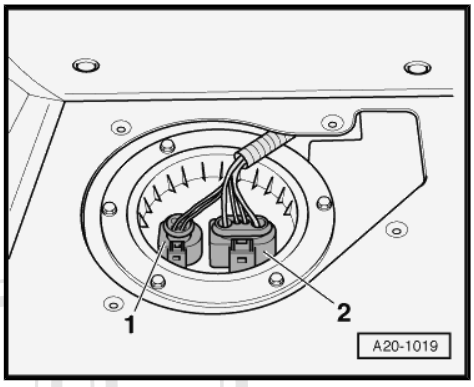


Note

For removing and installing fuel delivery unit, take tool kit and spare wheel out of luggage compartment. You can then sit or kneel in the spare wheel well.

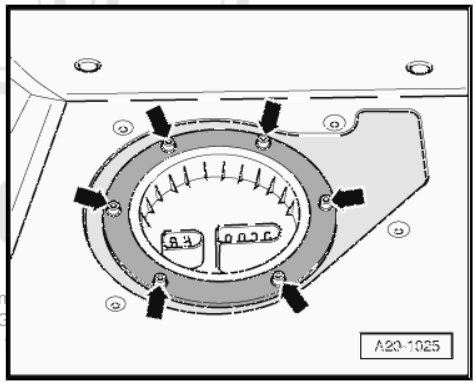
– Detach cover for flange (left-side) -arrows-.

– Unplug electrical connectors -1- and -2- on flange (left-side).



Vehicles up to approx. 10.2002:

– Remove bolts -arrows- and take off locking ring for flange (left-side).

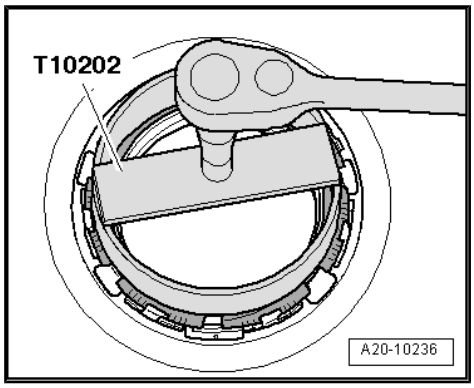


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Vehicles from approx. 11.2002 onwards:

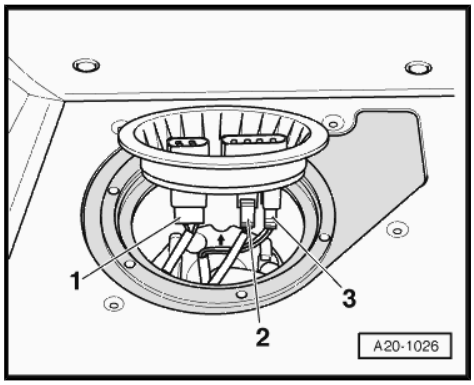
– Unscrew locking ring using wrench - T10202- .



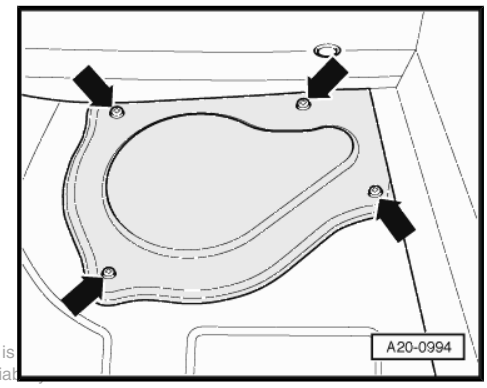
All vehicles (continued):

– Detach flange and remove seal/O-ring.

– Unplug electrical connectors -1 ... 3- on underside of flange (left-side).

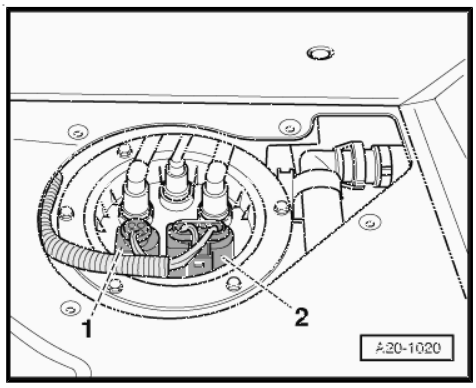


– Unscrew cover for flange (right-side) -arrows-.



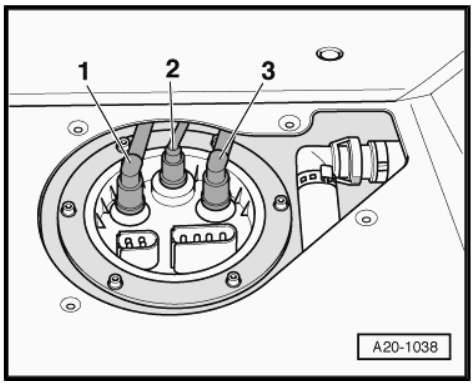
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– Unplug electrical connectors -1- and -2- on flange (right-side).



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– Mark fuel return line -1- and fuel supply line -3-.



WARNING

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

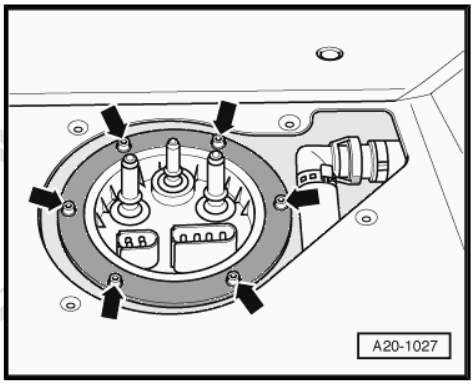
– Detach both lines from flange (press release tabs).

Vehicles with auxiliary heater:

– In addition, disconnect fuel supply line -2- for auxiliary heater.

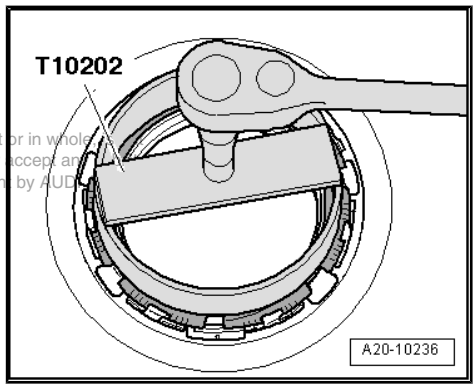
Vehicles up to approx. 10.2002:

– Remove bolts -arrows- and take off locking ring for flange (right-side).



Vehicles from approx. 11.2002 onwards:

– Unscrew locking ring using wrench - T10202- .

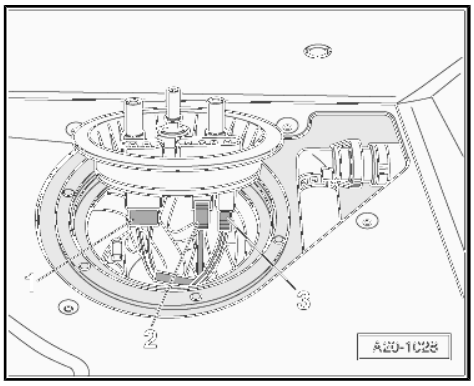


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All vehicles (continued):

– Detach flange and remove seal/O-ring.

– Unplug electrical connectors -1 ... 3- on underside of flange (right-side).



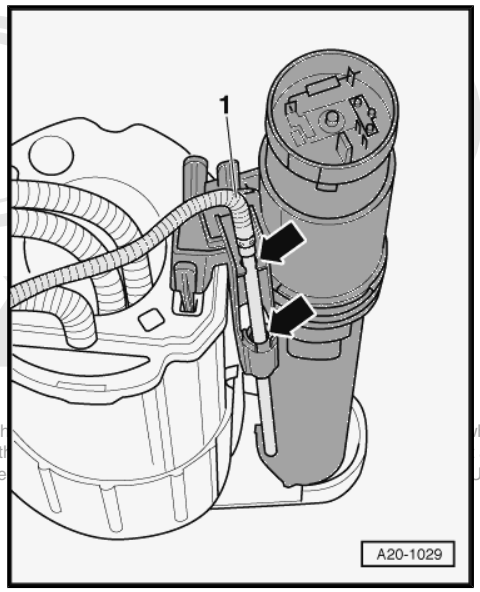
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Note

- *Pull out fuel lines from fuel tank opening prior to disconnecting the pipe connectors mentioned below.*
- *For illustration purposes some of the components are shown removed in the following illustrations.*

Vehicles with auxiliary heater:

– Pull out suction pipe -1- for auxiliary heater from retainers -arrows- on tubular sender.



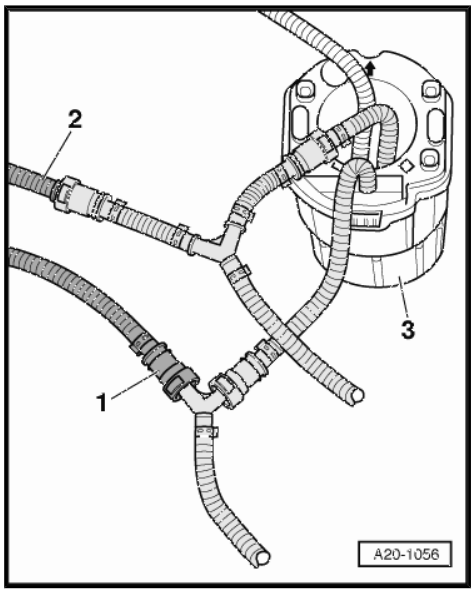
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All vehicles (continued):

– Working through right fuel tank opening, press release tabs and disconnect fuel lines -1- and -2- going to fuel delivery unit (left-side).

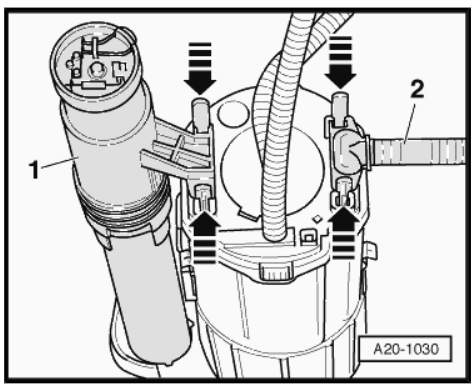
3 - Fuel delivery unit (right-side) with fuel pump - G23-

– Pull the two disconnected fuel lines out of left fuel tank opening.



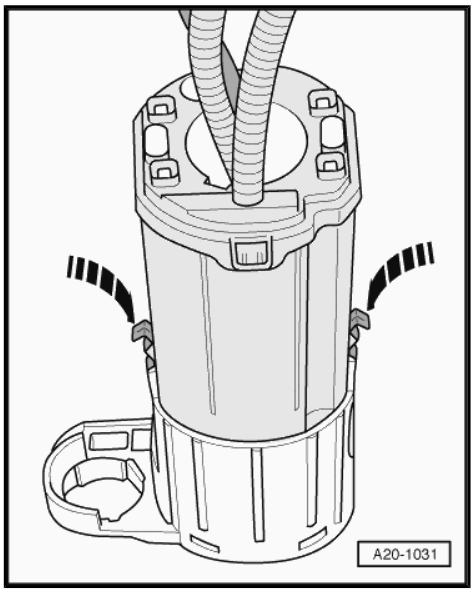
– Working through left fuel tank opening, press release tabs -arrows- and detach fuel supply line -2- and fuel gauge sender 3 - G237- -item 1-.

– Move fuel gauge sender 3 - G237- to left side.



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– Press down both retaining clips on retainer for fuel delivery unit -arrows-.
– Remove fuel delivery unit.



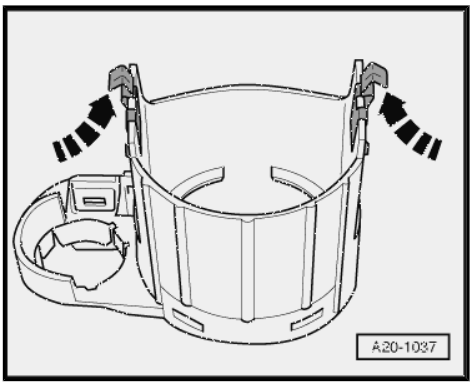
Note

Keep in mind that the fuel delivery unit still contains fuel.

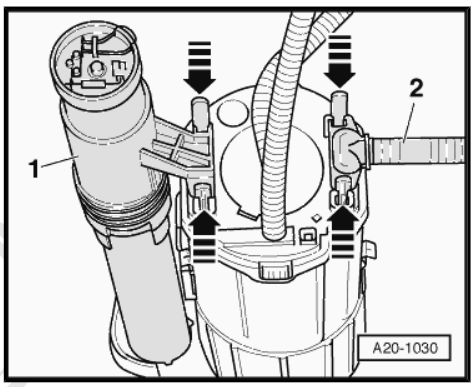
Installing

- Tightening torques ⇒ page 19

– Pull both retaining clips on retainer upwards -arrows- so that they engage audibly before installing the fuel delivery unit.
– Then press fuel delivery unit carefully into retainer so that it engages audibly.



– Fit fuel supply line -2- and fuel gauge sender 3 - G237- -item 1- so that they engage audibly.
– Guide supply line and return line for fuel delivery unit (left-side) into fuel tank chamber (right-side).

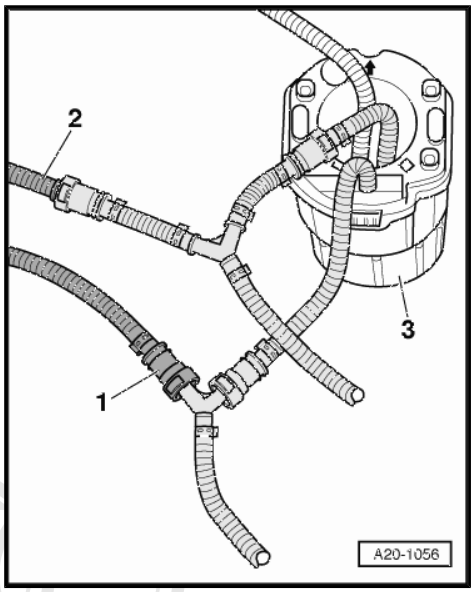


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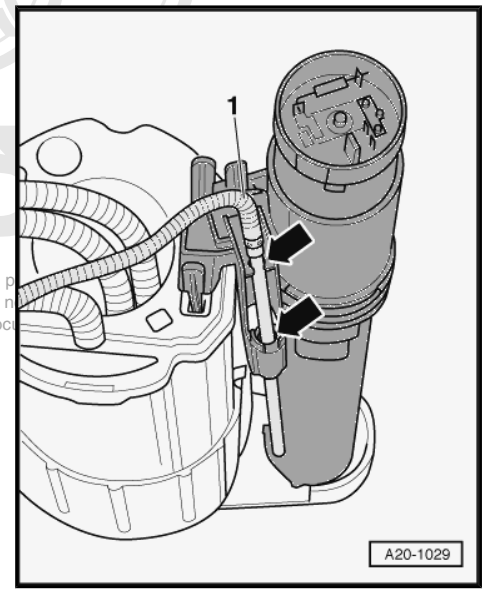
– Fit fuel lines -1- and -2- through right fuel tank opening so that they engage audibly.

3 - Fuel delivery unit (right-side) with fuel pump - G23-



Vehicles with auxiliary heater:

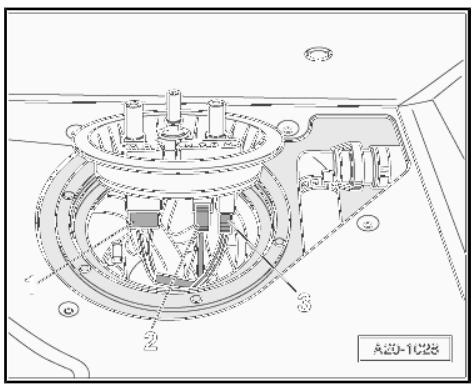
– Fit suction pipe -1- for auxiliary heater into retainers -arrows- on tubular sender.



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All vehicles (continued):

– Connect electrical connectors -1 ... 3- on underside of flange (right-side).



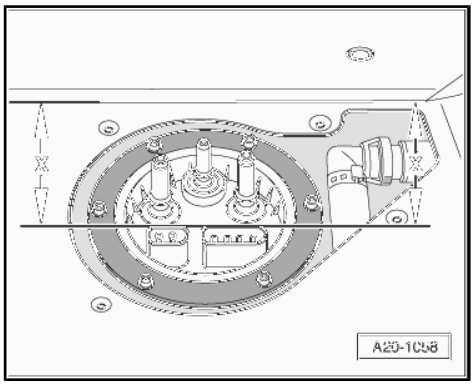
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Vehicles up to approx. 10.2002:

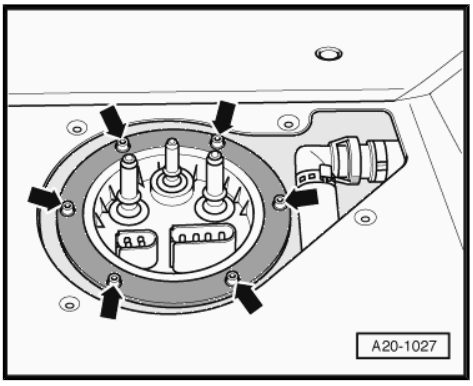
– Fit flange with new O-ring into fuel tank; note correct installation position:

• The electrical connectors are positioned transversely in relation to direction of travel.

• Dimension -x- (left-side) = dimension -x- (right-side)



– Secure locking ring for flange (right-side) in diagonal sequence -arrows-.

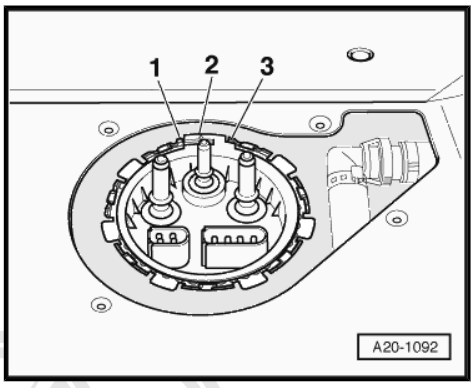


Vehicles from approx. 11.2002 onwards:

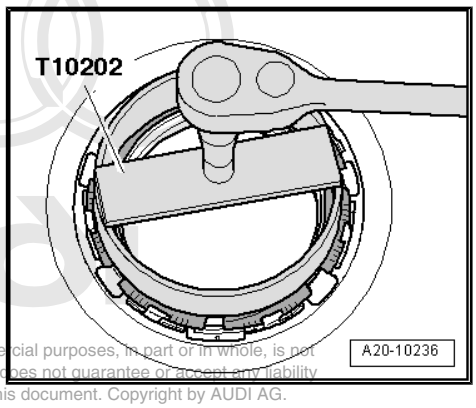
– Install new seal for flange (seal must be installed dry).

– Fit flange into fuel tank; note correct installation position:

• Lug -2- on flange must be between tabs -1- and -3- on fuel tank.



– Tighten locking ring.



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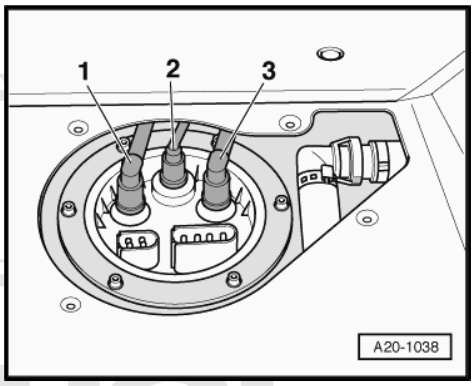
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All vehicles (continued):

– Install fuel supply line -3- and fuel return line -1- (as marked) so that they engage audibly.

Vehicles with auxiliary heater:

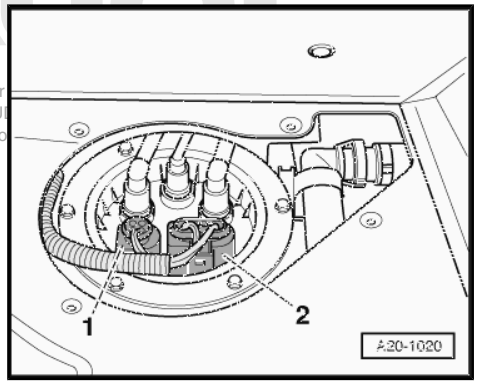
– Also fit supply line -2- going to auxiliary heater so that it engages audibly.



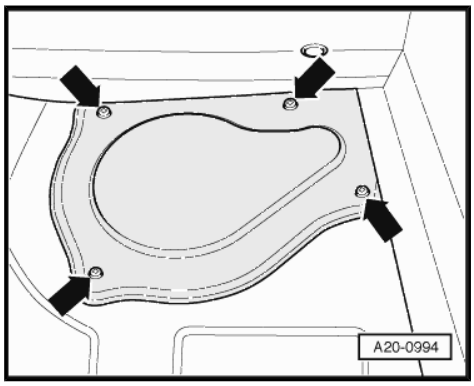
All vehicles (continued):

– Attach electrical connectors -1- and -2- on flange (right-side).

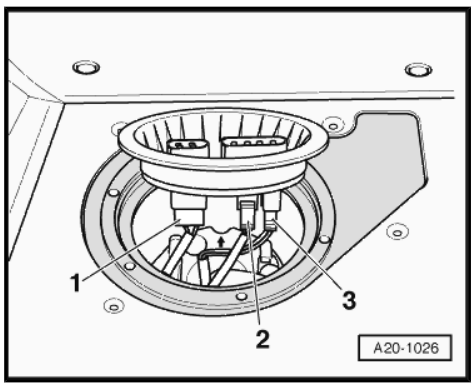
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– Secure cover for flange (right-side) -arrows-.



– Connect electrical connectors -1 ... 3- on underside of flange (left-side).



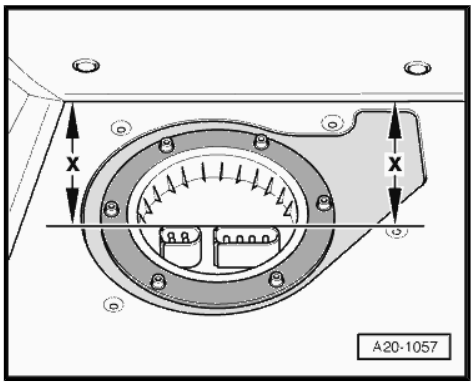
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Vehicles up to approx. 10.2002:

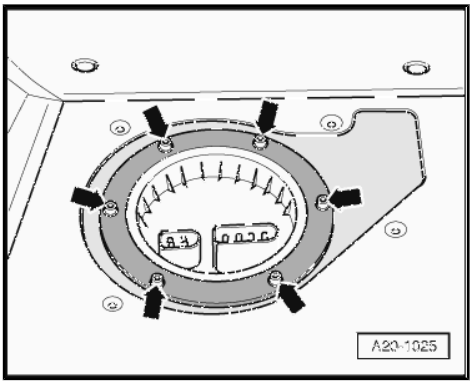
– Fit flange with new O-ring into fuel tank; note correct installation position:

• The electrical connectors are positioned transversely in relation to direction of travel.

• Dimension -x- (left-side) = dimension -x- (right-side)



– Secure locking ring for flange (left-side) in diagonal sequence -arrows-.

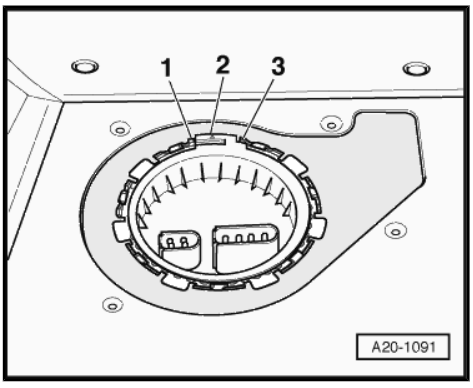


Vehicles from approx. 11.2002 onwards:

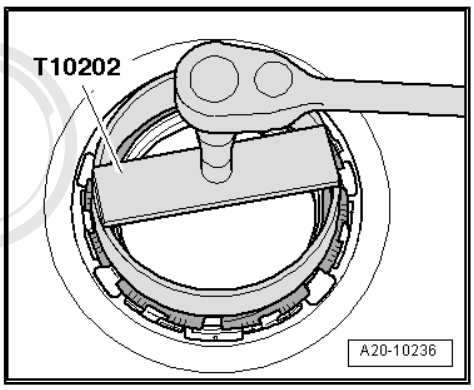
– Install new seal for flange (seal must be installed dry).

– Fit flange into fuel tank; note correct installation position:

• Lug -2- on flange must be between tabs -1- and -3- on fuel tank.



– Tighten locking ring.

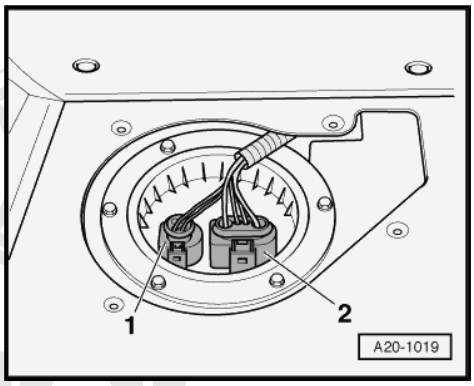


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All vehicles (continued):

– Attach electrical connectors -1- and -2- on flange (left-side).



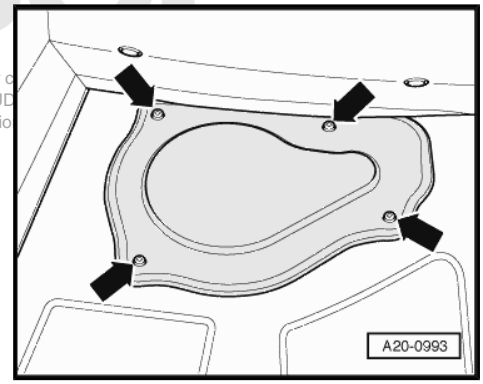
– Secure cover for flange (left-side) -arrows-.

– Connect battery. Observe notes on procedures required after connecting battery ⇒ Electrical system; Rep. gr. 27.

– Put at at least 5 litres of fuel into tank after installing

Vehicles with auxiliary heater:

– Let auxiliary heater run with full load for 10 minutes to bleed fuel supply line going to metering pump.



3.4 Exploded view - fuel delivery unit (right-side) with fuel pump - G23- and fuel gauge senders -G169- and -G393-

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1 - Retainer

- ❑ For fuel delivery unit

2 - Fuel gauge sender 2 - G169-

- ❑ Yellow
- ❑ Clipped onto retainer -item 1-
- ❑ Checking resistance values ⇒ page 203
- ❑ Removing and installing ⇒ page 204

3 - Fuel gauge sender 4 - G393-

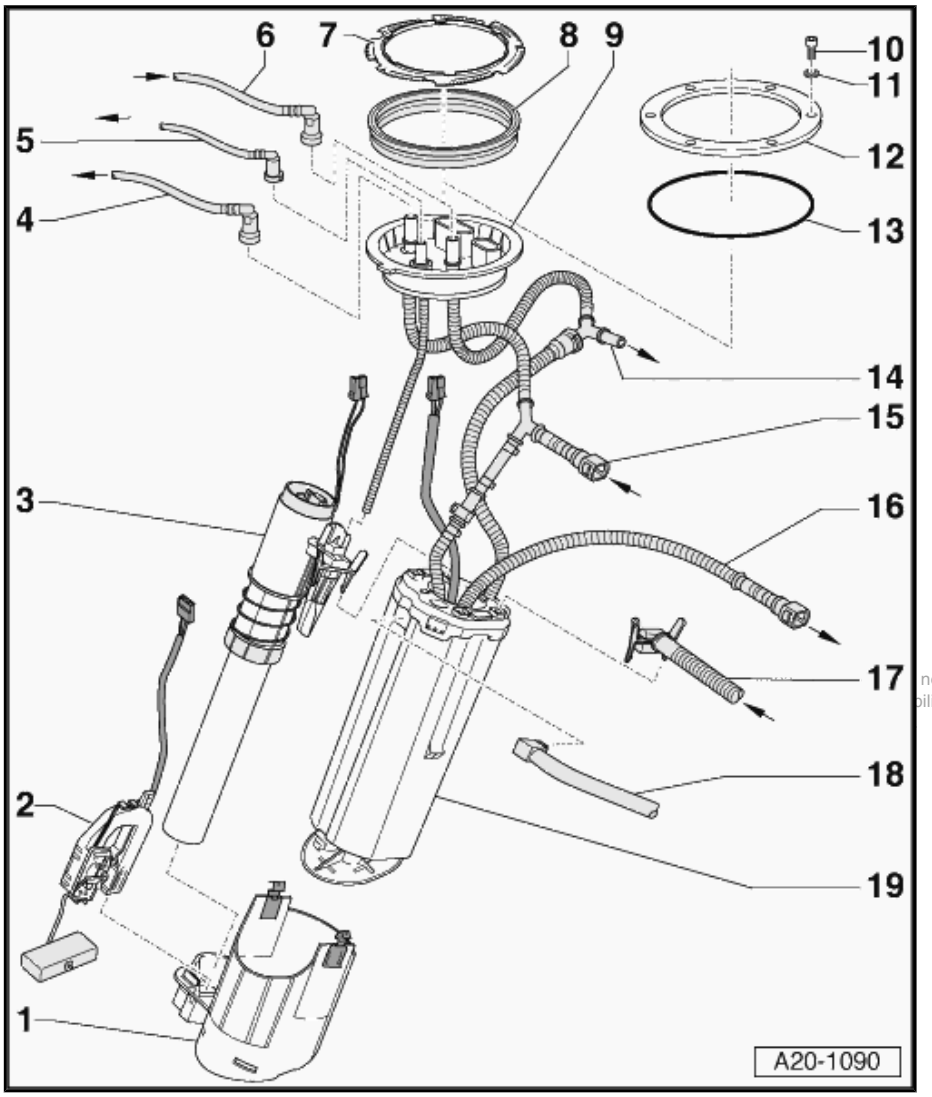
- ❑ White
- ❑ Clipped onto fuel delivery unit -item 19-
- ❑ Checking resistance values ⇒ page 211
- ❑ Removing and installing ⇒ page 213

4 - Fuel supply line

- ❑ To fuel filter
- ❑ Mark before removing
- ❑ Press release tab on connection piece to disconnect
- ❑ Do not kink
- ❑ Clip onto fuel tank

5 - Fuel supply line

- ❑ To auxiliary heater
- ❑ Press release tab on connection piece to disconnect
- ❑ Do not kink
- ❑ Clip onto fuel tank



6 - Fuel return line

- ❑ From engine or fuel filter
- ❑ Mark before removing
- ❑ Press release tab on connection piece to disconnect
- ❑ Do not kink
- ❑ Clip onto fuel tank

7 - Locking ring

- ❑ Applies to vehicles from approx. 11.2002
- ❑ Remove and install using wrench - T10202-
- ❑ Tighten to 120 Nm

8 - Seal

- ❑ Applies to vehicles from approx. 11.2002
- ❑ Renew
- ❑ Install dry

9 - Flange (right-side)

- ❑ Installation position up to approx. 10.2002 ⇒ page 38

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bility
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- ❑ Installation position from approx. 11.2002 ⇒ page 39

10 - 10 Nm

- ❑ Applies to vehicles up to approx. 10.2002
- ❑ Tighten bolts in diagonal sequence

11 - Washer

- ❑ Applies to vehicles up to approx. 10.2002

12 - Locking ring

- ❑ For flange
- ❑ Applies to vehicles up to approx. 10.2002

13 - O-ring

- ❑ Applies to vehicles up to approx. 10.2002
- ❑ Renew

14 - Fuel return line

- ❑ To fuel delivery unit (left-side)

15 - Fuel supply line

- ❑ From fuel delivery unit (left-side)
- ❑ Press release tab on connection piece to disconnect

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16 - Supply line for suction-jet pump

- ❑ For suction-jet pump
- ❑ Press release tab on connection piece to disconnect

17 - Fuel supply line

- ❑ From suction-jet pump (left-side)
- ❑ Clipped onto fuel delivery unit -item 19-

18 - Fuel filler pipe

- ❑ From filler neck
- ❑ Clipped onto fuel delivery unit -item 19-

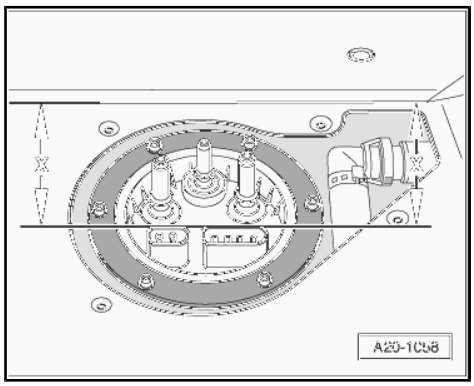
19 - Fuel delivery unit (right-side)

- ❑ With fuel pump - G23-
- ❑ Clipped onto retainer -item 1-
- ❑ Different versions available; for correct version refer to ⇒ Electronic parts catalogue
- ❑ Checking fuel pump (electrical test) ⇒ page 39
- ❑ Checking residual pressure ⇒ Rep. gr. 24
- ❑ Removing and installing ⇒ page 42
- ❑ Put at least 5 litres of fuel into tank after installing

Installation position of flange (right-side) - vehicles up to approx. 10.2002

– Fit flange with new O-ring into fuel tank; note correct installation position:

- The electrical connectors are positioned transversely in relation to direction of travel.
- Dimension -x- (left-side) = dimension -x- (right-side)



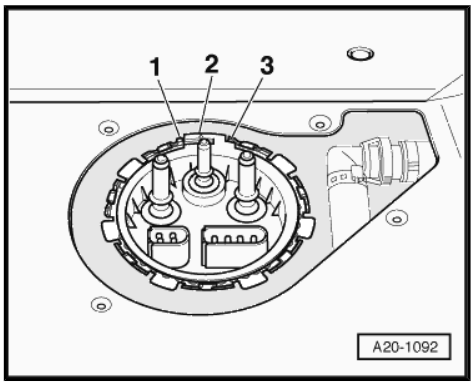
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Installation position of flange (right-side) - vehicles from approx. 11.2002

– Install new seal for flange (seal must be installed dry).

– Fit flange into fuel tank; note correct installation position:

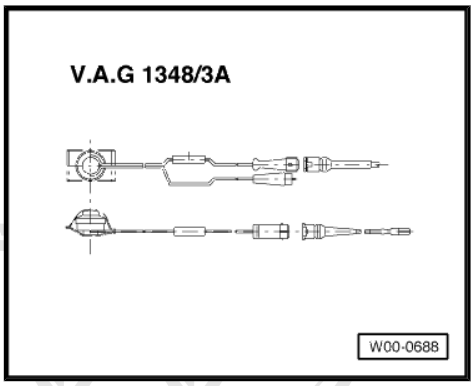
• Lug -2- on flange must be between tabs -1- and -3- on fuel tank.



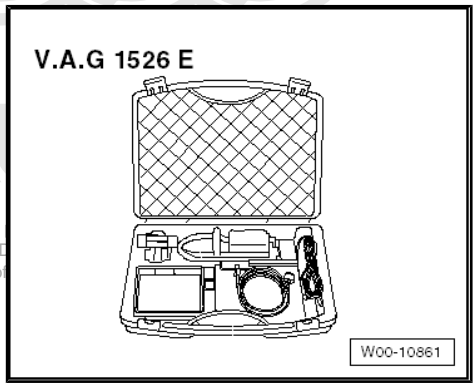
3.5 Checking fuel pump - G23- (right-side) - electrical test

Special tools and workshop equipment required

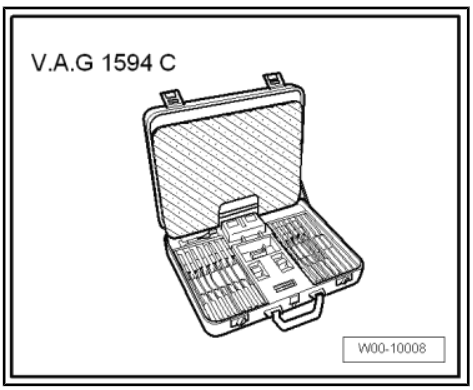
♦ Remote control for V.A.G 1348 - V.A.G 1348/3A-



♦ Hand-held multimeter - V.A.G 1526 E-



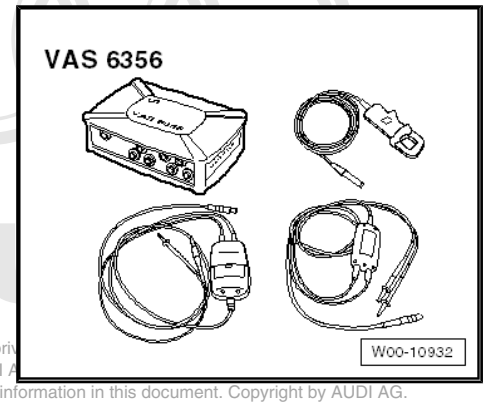
♦ Auxiliary measuring set - V.A.G 1594C-



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◆ Test instrument box - VAS 6356- with trigger clamp, 100 A - VAS 6356/4A-



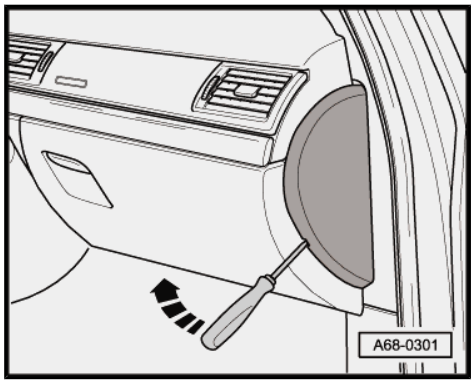
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Procedure

– Observe test conditions ⇒ page 3 .

Checking voltage supply

– Use screwdriver to pry off cover (right-side) at dash panel -arrow-.



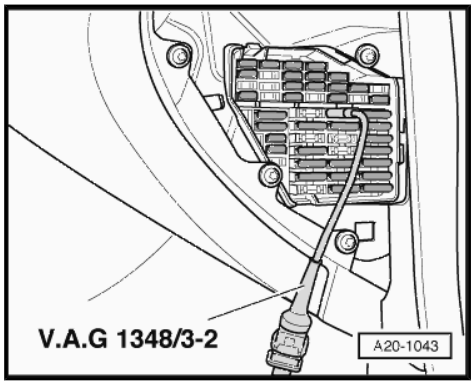
– Take fuse 31 out of fuse holder SC31 (right side of dash panel, middle row, 1st large fuse from the top).

– Connect remote control - V.A.G 1348/3A- for V.A.G 1348 with adapter cable - V.A.G 1348/3-2- to left-hand fuse socket terminal of fuse SC31.

– Connect crocodile clip of remote control - V.A.G 1348/3A- for V.A.G 1348 to battery “+” (positive).

– Press remote control button.

• Fuel pump should start running (noise is audible in vicinity of fuel tank).



Note

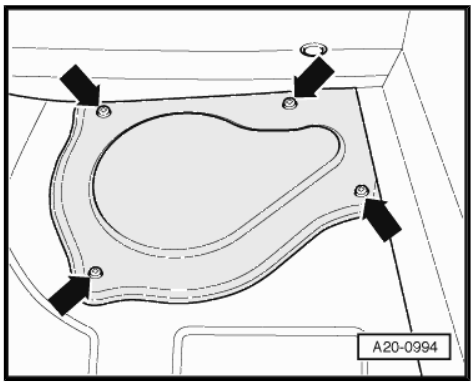
The fuel pump runs very quietly. Avoid background noise whilst checking fuel pump. Have second mechanic perform check if necessary.

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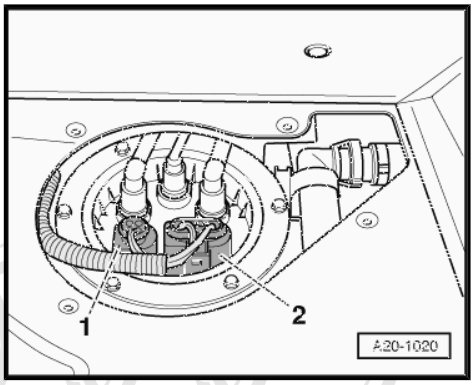
If no noise can be heard from pump:

– Remove luggage compartment floor covering.

– Unscrew cover for flange (right-side) -arrows-.



– Unplug electrical connector -2- on flange (right-side).



Note

Disregard -item 1-.

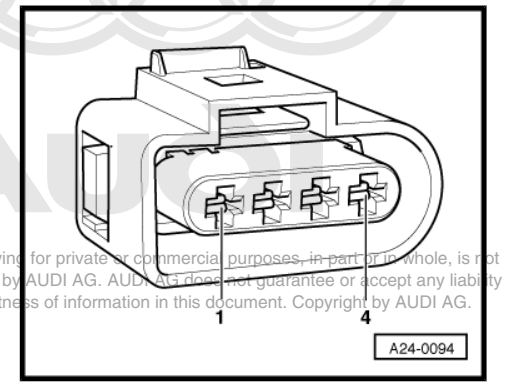
– Connect multimeter between contacts -1- and -4- of electrical connector to measure voltage.

– Press remote control button.

• Specification: approx. battery voltage

If specification is not obtained:

– Repair wiring harness according to current flow diagram.



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If reading matches specification although no noise can be heard from pump:

– Remove fuel delivery unit (right-side) ⇒ page 42 .

– Check that the electrical wires between flange and fuel pump are connected and test for continuity.

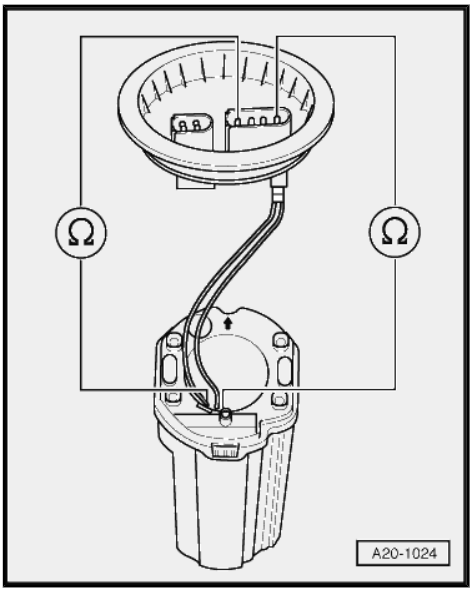
If no faults are found in the wiring:

– Fuel pump is defective. Renew the fuel delivery unit (right-side) ⇒ page 42 .

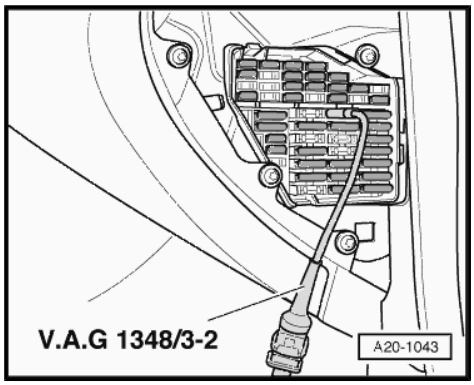
– Install fuel delivery unit (right-side) ⇒ page 48 .

Checking current draw

• Fuel pump voltage supply OK ⇒ page 40

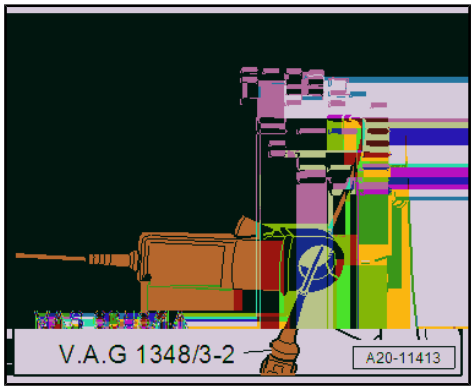


– Take fuse 31 out of fuse holder SC31 (right side of dash panel, middle row, 1st large fuse from the top).
– Connect remote control - V.A.G 1348/3A- for V.A.G 1348 with adapter cable - V.A.G 1348/3-2- to left-hand fuse socket terminal of fuse SC31.
– Connect crocodile clip of remote control - V.A.G 1348/3A- for V.A.G 1348 to battery “+” (positive).



– Connect test instrument box - VAS 6356- with trigger clamp, 100 A - VAS 6356/4A- to cable of remote control.
– Press remote control button.
– Measure current draw of fuel pump.
• Specification: approx. 8 A.

If specification is not obtained:



Note

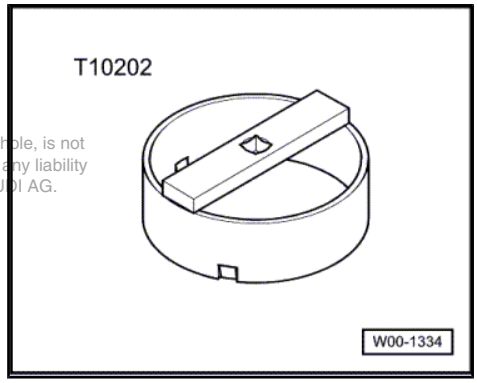
A current draw of 4 A indicates that the fuel pump is running dry.

Readout	Cause of fault	Remedy
approx. 4 A	♦ Fuel tank empty	– Fill tank
	♦ Housing of fuel delivery unit leaking	– Renew fuel delivery unit ⇒ page 42
0 A	♦ Fuel pump - G23- defective	– Renew fuel delivery unit ⇒ page 42

3.6 Removing and installing fuel delivery unit (right-side) with fuel pump - G23-

Special tools and workshop equipment required

♦ Vehicles from approx. 11.2002: Wrench - T10202-



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Removing

Observe safety precautions ⇒ page 1 .

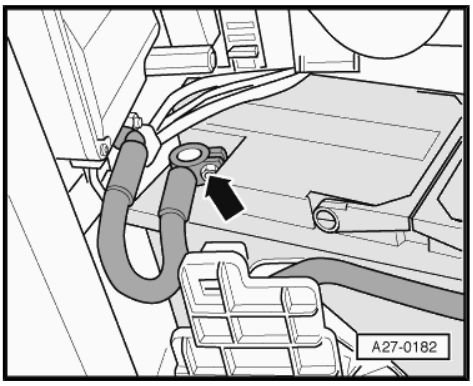
Observe rules for cleanliness ⇒ page 3 .

- The fuel tank must not be more than $^{1}/_{3}$ full when removing the fuel delivery unit. Drain the tank if necessary. Procedure ⇒ page 7

Caution

Observe notes on procedure for disconnecting the battery.

– With ignition switched off, disconnect battery earth cable -arrow- ⇒ Electrical system; Rep. gr. 27 .



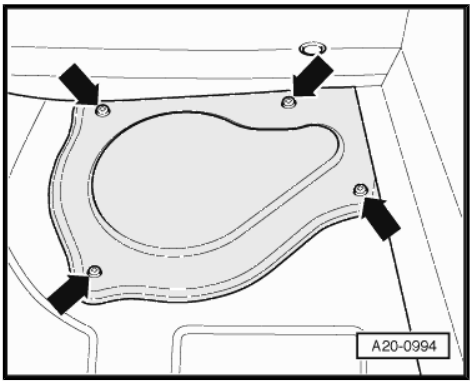
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– Remove luggage compartment floor covering.

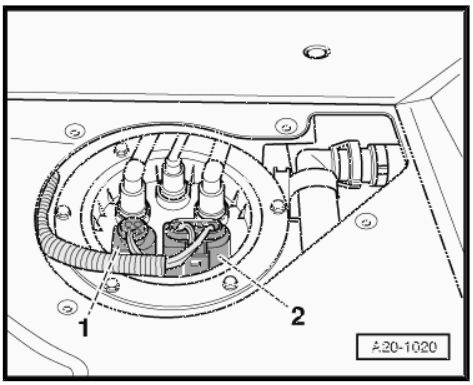
Note

For removing and installing fuel delivery unit, take tool kit and spare wheel out of luggage compartment. You can then sit or kneel in the spare wheel well.

– Unscrew cover for flange (right-side) -arrows-.

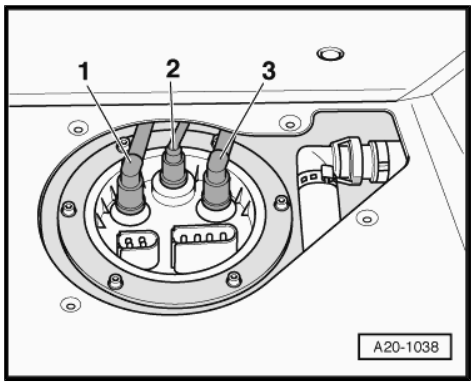


– Unplug electrical connectors -1- and -2- on flange (right-side).



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– Mark fuel return line -1- and fuel supply line -3-.



WARNING

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

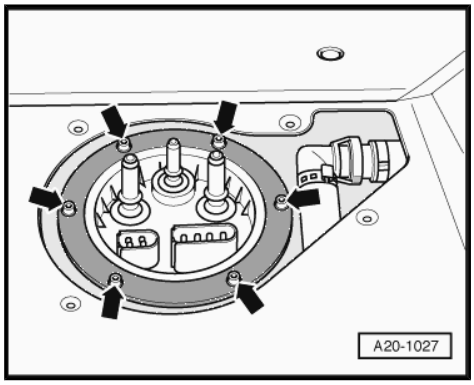
– Detach both lines from flange (press release tabs).

Vehicles with auxiliary heater:

– In addition, disconnect fuel supply line -2- for auxiliary heater.

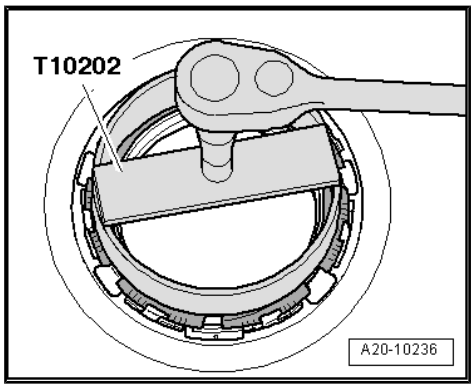
Vehicles up to approx. 10.2002:

– Remove bolts -arrows- and take off locking ring for flange (right-side).



Vehicles from approx. 11.2002 onwards:

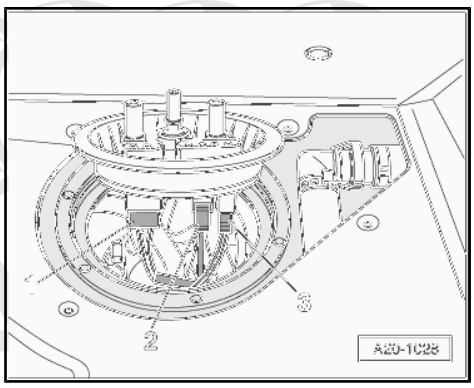
– Unscrew locking ring using wrench - T10202- .



All vehicles (continued):

– Detach flange and remove seal/O-ring.

– Unplug electrical connectors -1 ... 3- on underside of flange (right-side).



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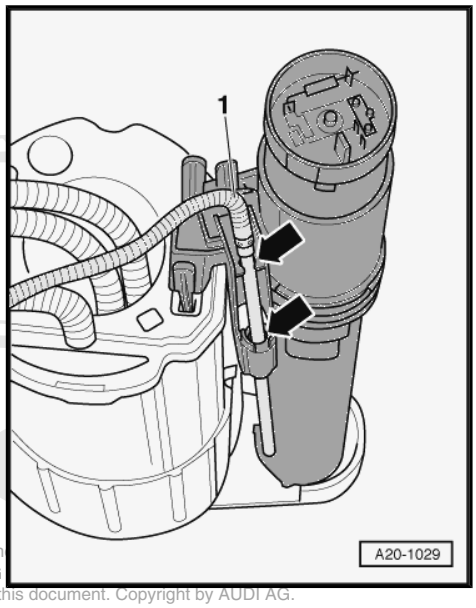
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Note

- *Pull out fuel lines from fuel tank opening prior to disconnecting the pipe connectors mentioned below.*
- *For illustration purposes some of the components are shown removed in the following illustrations.*

Vehicles with auxiliary heater:

– Pull out suction pipe -1- for auxiliary heater from retainers -arrows- on tubular sender.

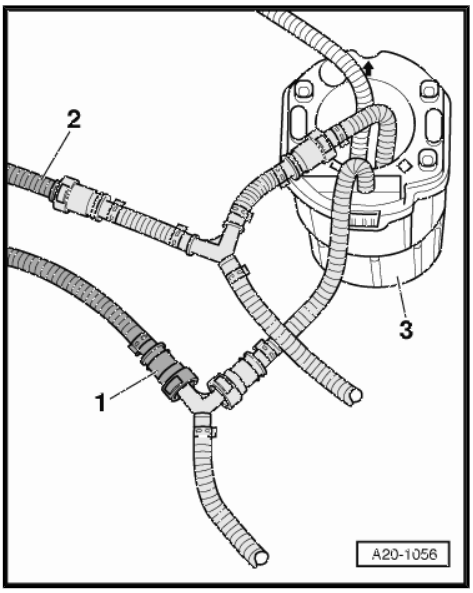


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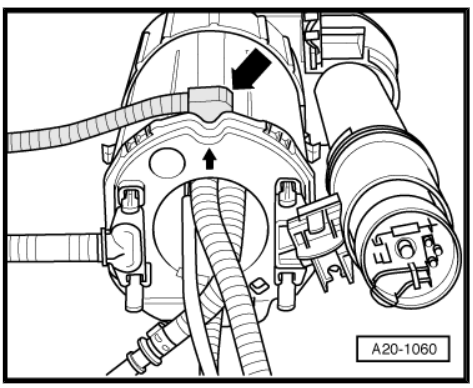
All vehicles (continued):

– Working through right fuel tank opening, press release tabs and disconnect fuel lines -1- and -2- going to fuel delivery unit (left-side).

3 - Fuel delivery unit (right-side) with fuel pump - G23-

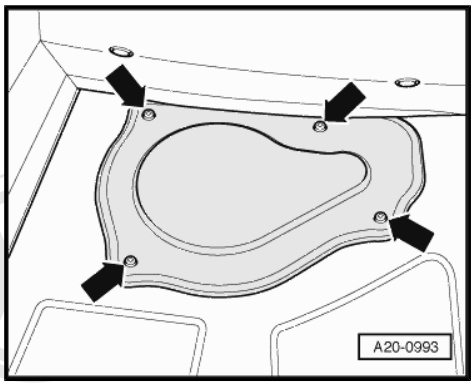


– Unclip fuel filler pipe -arrow- at front of fuel delivery unit (right-side).

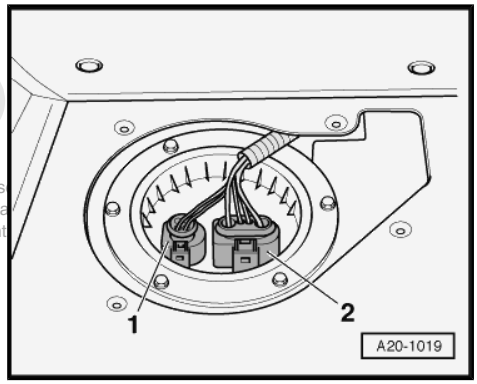


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– Detach cover for flange (left-side) -arrows-.



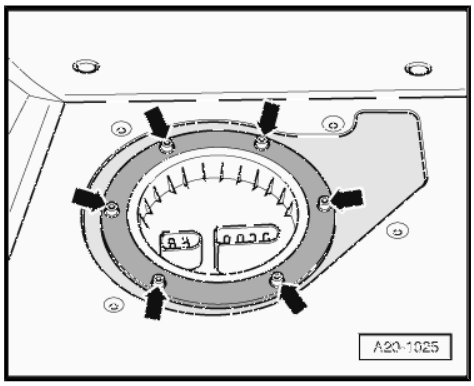
– Unplug electrical connectors -1- and -2- on flange (left-side).



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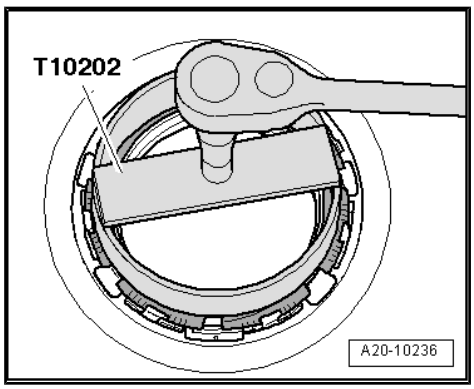
Vehicles up to approx. 10.2002:

– Remove bolts -arrows- and take off locking ring for flange (left-side).



Vehicles from approx. 11.2002 onwards:

– Unscrew locking ring using wrench - T10202- .

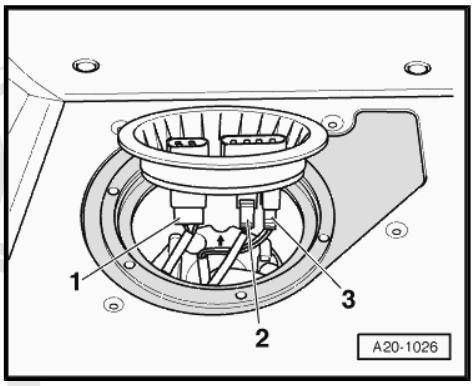


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All vehicles (continued):

– Detach flange and remove seal/O-ring.

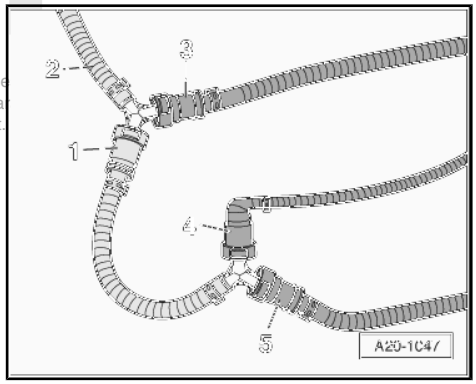
– Unplug electrical connectors -1 ... 3- on underside of flange (left-side).



– Working through left fuel tank opening, disconnect supply line -3- for suction-jet pump from Y-connector (press release tab).

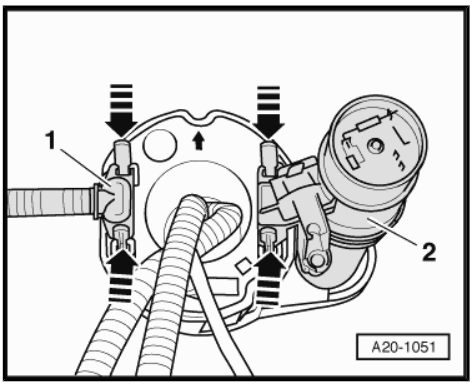
– Pull supply line for suction-jet pump out of right fuel tank opening.

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– Working through right fuel tank opening, press release tabs -arrows- and detach fuel supply line -1- and fuel gauge sender 4 - G393- -item 2-.

– Move fuel gauge sender 4 - G393- to right side.

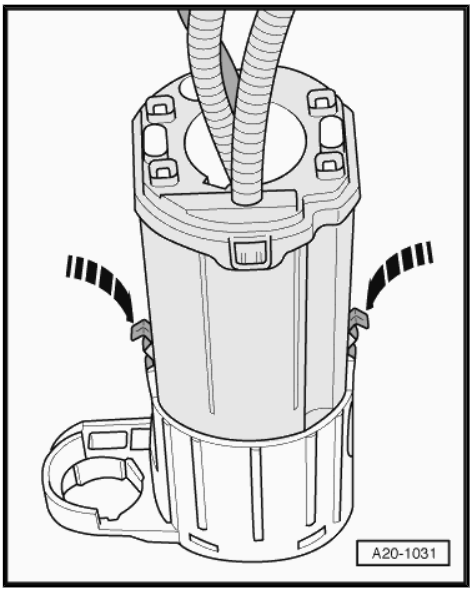


– Press down both retaining clips on retainer for fuel delivery unit -arrows-.

– Remove fuel delivery unit.

Note

Keep in mind that the fuel delivery unit still contains fuel.



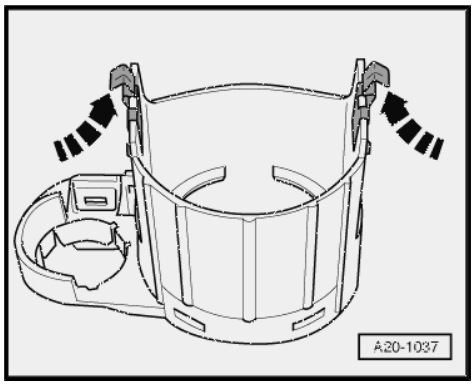
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Installing

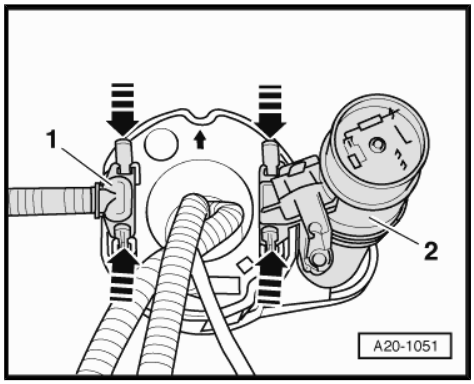
- Tightening torques ⇒ page 36

– Pull both retaining clips on retainer upwards -arrows- so that they engage audibly before installing the fuel delivery unit.

– Then press fuel delivery unit carefully into retainer so that it engages audibly.

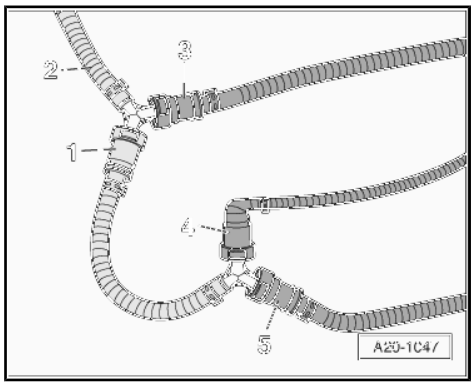


– Fit fuel supply line -1- and fuel gauge sender 4 - G393- -item 2- so that they engage audibly on fuel delivery unit (right-side).

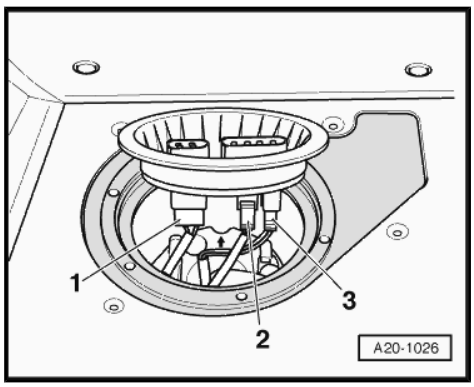


– Push supply line -3- for suction-jet pump through right fuel tank opening into left fuel tank chamber.

– Fit supply line for suction-jet pump onto Y-connector so it engages audibly.



– Connect electrical connectors -1 ... 3- on underside of flange (left-side).



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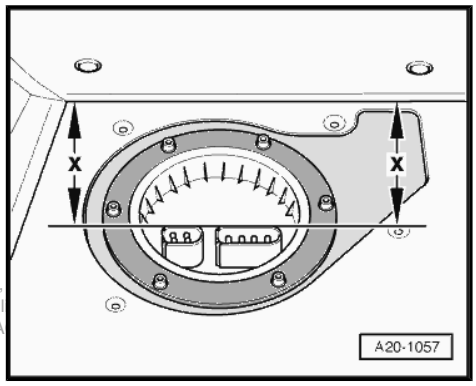
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Vehicles up to approx. 10.2002:

– Fit flange with new O-ring into fuel tank; note correct installation position:

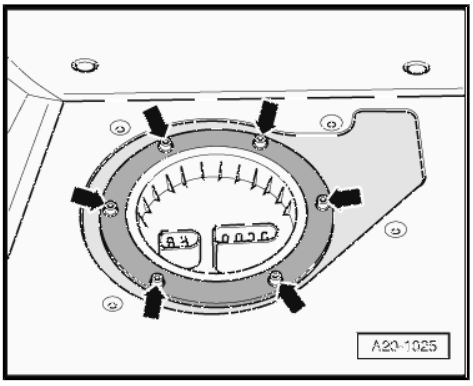
• The electrical connectors are positioned transversely in relation to direction of travel.

• Dimension -x- (left-side) = dimension -x- (right-side)



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– Secure locking ring for flange (left-side) in diagonal sequence -arrows-.

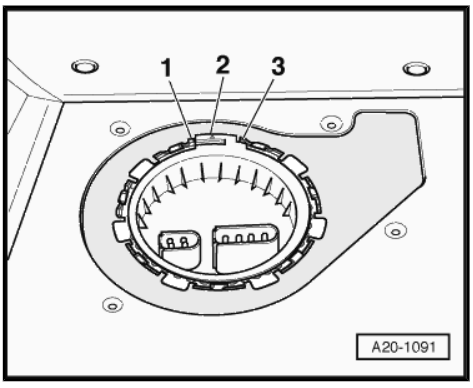


Vehicles from approx. 11.2002 onwards:

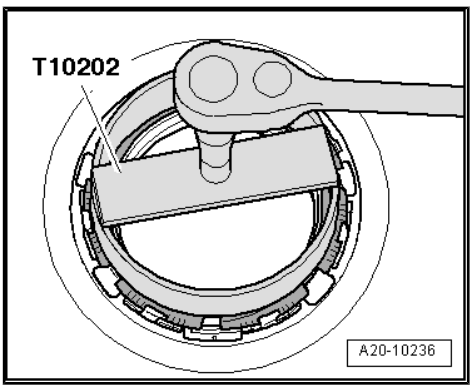
– Install new seal for flange (seal must be installed dry).

– Fit flange into fuel tank; note correct installation position:

• Lug -2- on flange must be between tabs -1- and -3- on fuel tank.



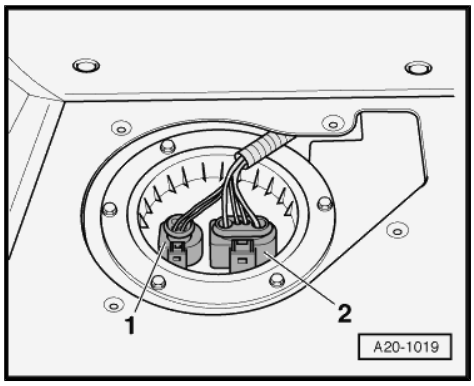
– Tighten locking ring.



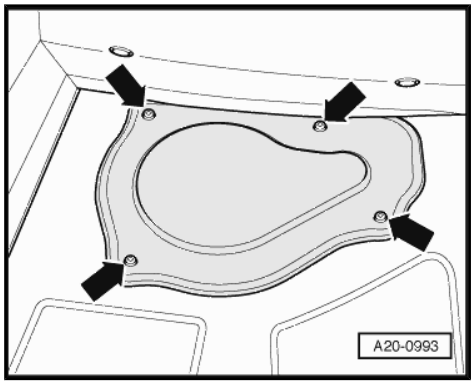
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All vehicles (continued):

– Attach electrical connectors -1- and -2- on flange (left-side).

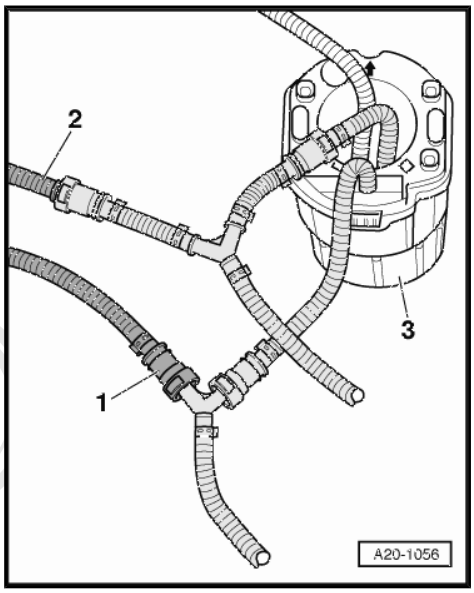


– Secure cover for flange (left-side) -arrows-.



– Working through right fuel tank opening, connect fuel lines -1- and -2- going to left fuel delivery unit so that they engage audibly.

3 - Fuel delivery unit (right-side) with fuel pump - G23-

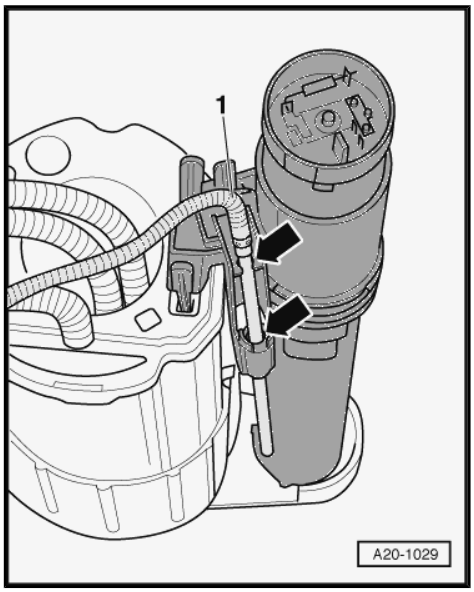


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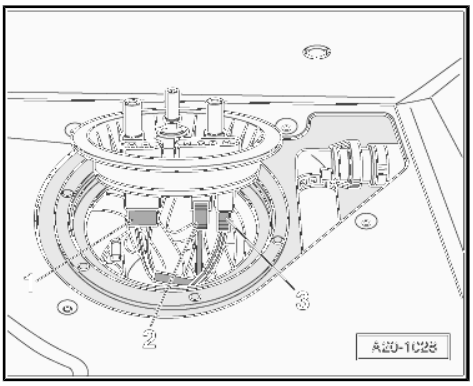
Vehicles with auxiliary heater:

– Fit suction pipe -1- for auxiliary heater into retainers -arrows- on tubular sender.



All vehicles (continued):

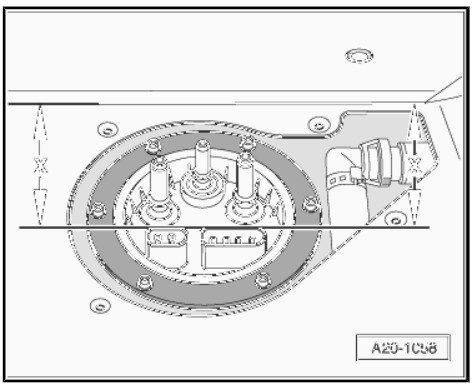
– Connect electrical connectors -1 ... 3- on underside of flange (right-side).



Vehicles up to approx. 10.2002:

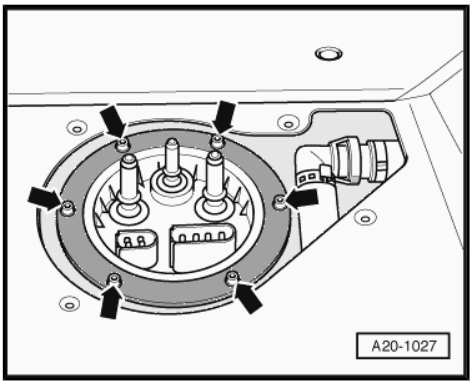
– Fit flange with new O-ring into fuel tank; note correct installation position:

- The electrical connectors are positioned transversely in relation to direction of travel.
- Dimension -x- (left-side) = dimension -x- (right-side)



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– Secure locking ring for flange (right-side) in diagonal sequence -arrows-.



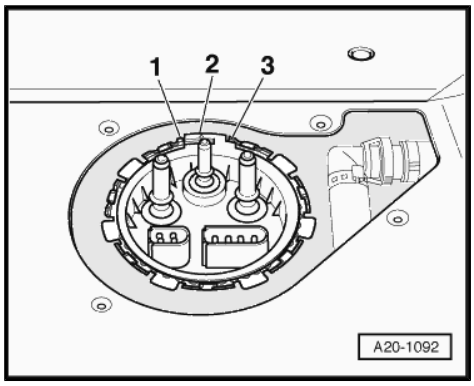
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Vehicles from approx. 11.2002 onwards:

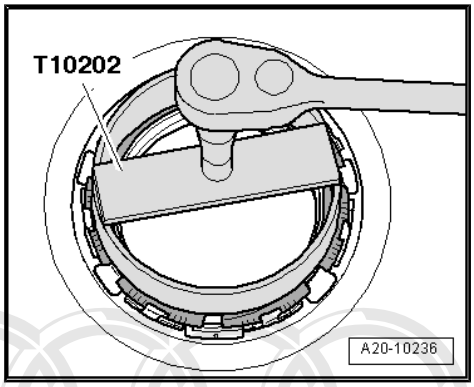
– Install new seal for flange (seal must be installed dry).

– Fit flange into fuel tank; note correct installation position:

• Lug -2- on flange must be between tabs -1- and -3- on fuel tank.



– Tighten locking ring.

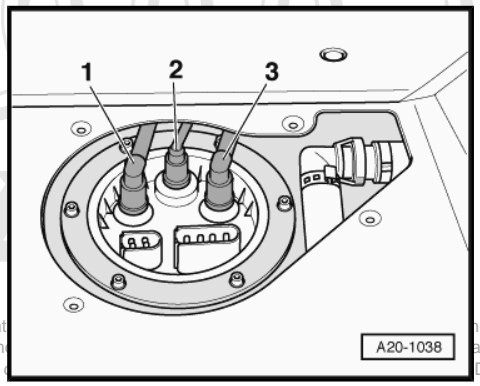


All vehicles (continued):

– Fit fuel return line -1- and fuel supply line -3- so that they engage audibly.

Vehicles with auxiliary heater:

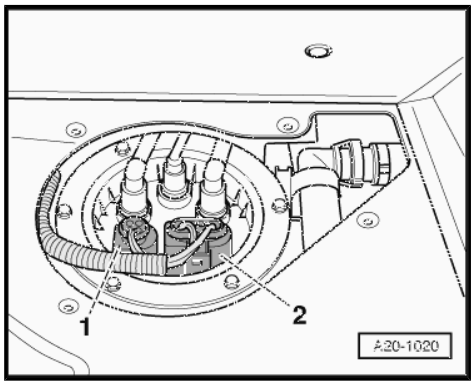
– Also fit supply line -2- going to auxiliary heater so that it engages audibly.



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All vehicles (continued):

– Attach electrical connectors -1- and -2- on flange (right-side).



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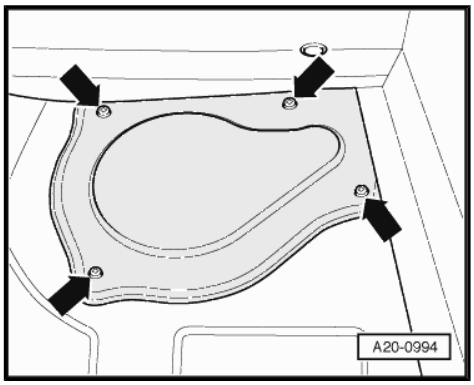
– Secure cover for flange (right-side) -arrows-.

– Connect battery. Observe notes on procedures required after connecting battery ⇒ Electrical system; Rep. gr. 27 .

– Put at least 5 litres of fuel into tank after installing

Vehicles with auxiliary heater:

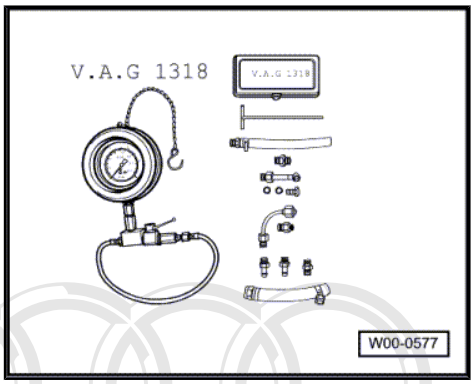
– Let auxiliary heater run with full load for 10 minutes to bleed fuel supply line going to metering pump.



3.7 Checking delivery rate of fuel pumps - vehicles with fuel return line

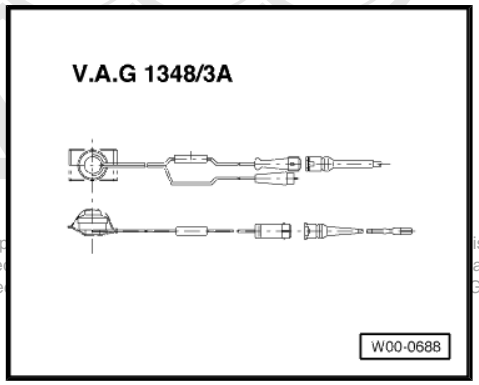
Special tools and workshop equipment required

♦ K-Jetronic pressure tester - V.A.G 1318-



♦ Adapter set - V.A.G 1318/10-12-

♦ Remote control - V.A.G 1348/3A- for V.A.G 1348 with adapter cable -V.A.G 1348/3-3-



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♦ Fuel-resistant measuring container

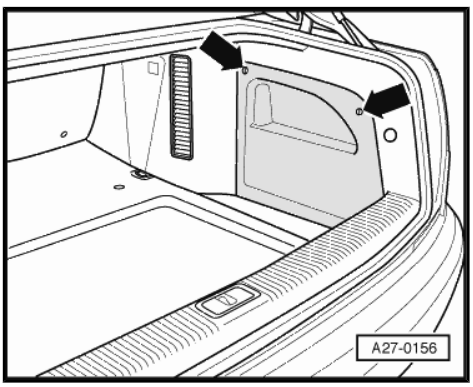
Procedure

– Observe test conditions ⇒ page 3 .

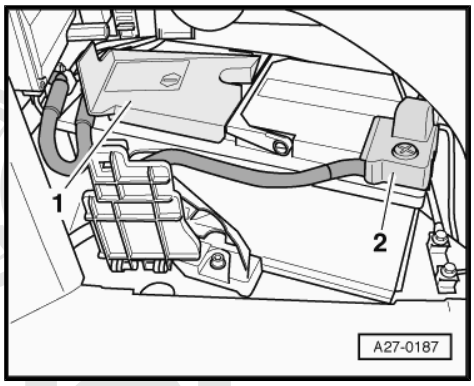
WARNING

Observe safety precautions ⇒ page 1 .

– Remove luggage compartment side trim cover (right-side) -arrows-.



– Remove cover -2- over battery.

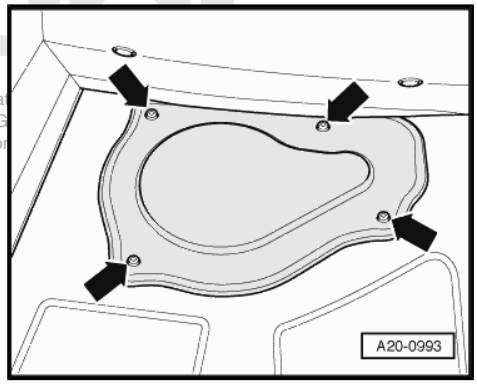


Note

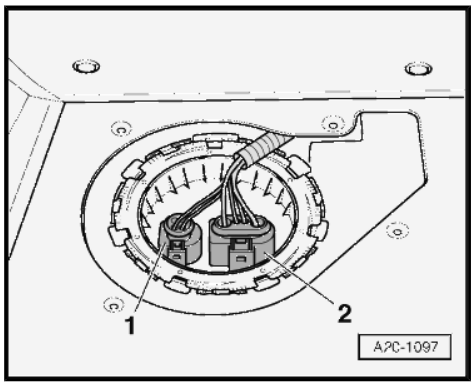
Disregard -item 1-.

– Remove luggage compartment floor covering.
– Detach cover for flange (left-side) -arrows-.

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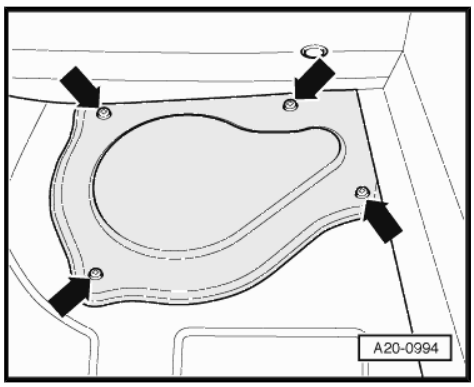
– Unplug electrical connector -2- on flange (left-side).



Note

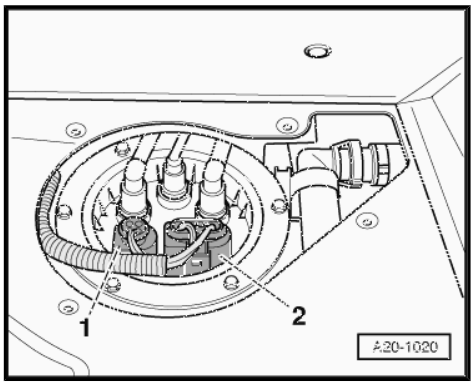
Disregard -item 1-.

– Unscrew cover for flange (right-side) -arrows-.



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– Unplug electrical connector -2- on flange (right-side).



Note

Disregard -item 1-.

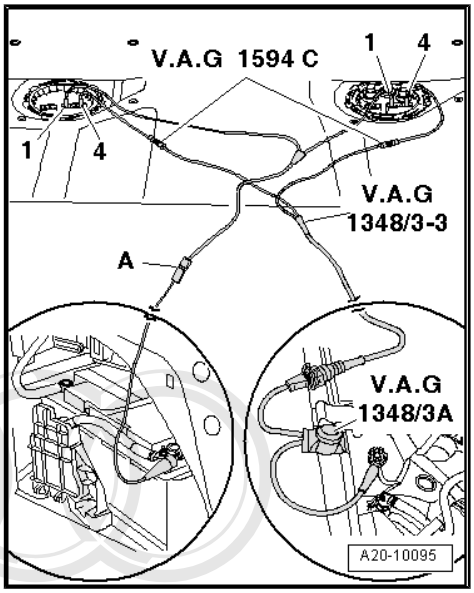
– Connect remote control - V.A.G 1348/3A- for V.A.G 1348 with adapter cable -V.A.G 1348/3-3- to contact -4- (earth) of fuel delivery unit (left-side) and fuel delivery unit (right-side) using test leads from auxiliary measuring set - V.A.G 1594C- .

– Move switch of remote control - V.A.G 1348/3A- for V.A.G 1348 to front of engine compartment.

– Connect crocodile clip to earth point in engine compartment.

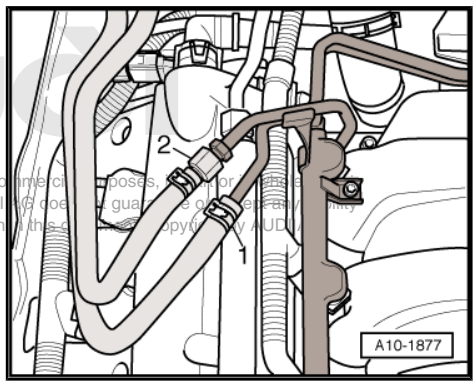
– Connect contact -1- (positive) of fuel delivery unit (left-side) and fuel delivery unit (right-side) to battery “+” via an improvised test lead. For safety reasons an in-line fuse -A- (10 A) must be connected into the lead.

– Remove filler cap from fuel filler neck.



WARNING

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



Caution

Rules for cleanliness when working on the injection system *⇒ page 3* ***.***

– Disconnect fuel supply line -2- at fuel rail.

Note

Disregard -item 1-.

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– Connect K-Jetronic pressure tester - V.A.G 1318- with adapters - V.A.G 1318/11- and -V.A.G 1318/12- to fuel line.

– Fit auxiliary hose -arrow- onto pressure tester and hold it in a measuring container.

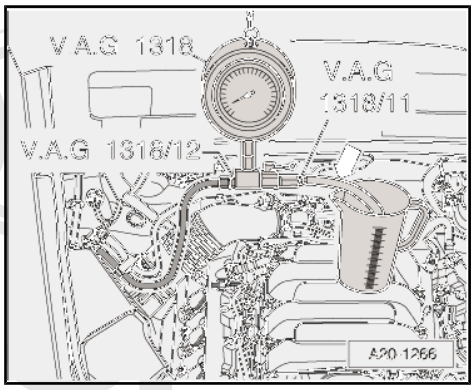
– Open cut-off valve on pressure tester. Lever must point in direction of flow.

– Build up pressure in fuel system by pressing the remote control button and slowly closing the cut-off valve on the pressure tester.

• Specification: 4 bar

– From this point on do not move position of cut-off valve.

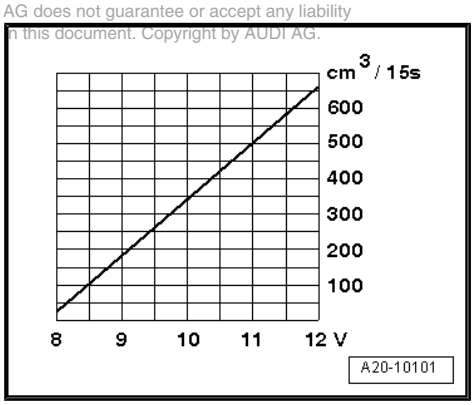
– Empty the measuring container.



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– Press remote control button for 15 seconds.

– Compare amount of fuel delivered with minimum delivery shown in diagram (cm^3/15 sec.).



Note

Voltage at fuel pump with engine stationary and pump running is approx. 2 volts less than battery voltage.

If minimum delivery rate is not reached, check for the following causes:

♦ Fuel lines have been crushed.

♦ Fuel filter is blocked.

♦ Fuel pump is defective.

Note

As there is hardly any difference in the fuel delivery rate if only one of the two fuel pumps is working (because of the hose connections inside the tank), it is difficult to diagnose a defective pump by just measuring the delivery rate.

In this case proceed as follows:

– Unplug the electrical auxiliary lead at the fuel delivery units (one at a time).

– Measure delivery rate of fuel delivery unit located on the opposite side.

If the delivery rate of the fuel delivery unit which has been measured separately is considerably below specification:

– Renew the relevant fuel delivery unit.

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

– Secure fuel supply line to fuel rail ⇒ Rep. gr. 24 .

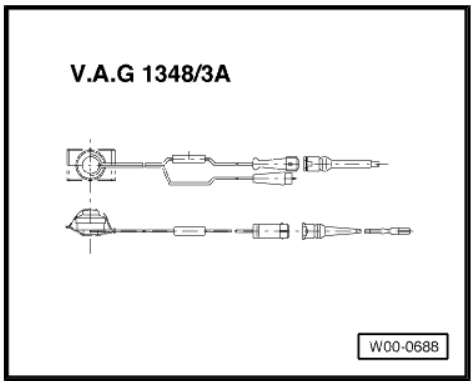
3.8 Checking delivery rate of fuel pumps - vehicles with fuel system without fuel return line

Special tools and workshop equipment required

♦ Adapter -V.A.G 1318/26-

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- Remote control - V.A.G 1348/3A- for V.A.G 1348 with adapter cable -V.A.G 1348/3-3-



- Fuel-resistant measuring container

Procedure

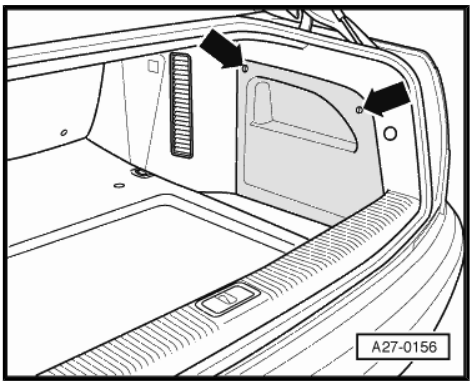
– Observe test conditions ⇒ page 3 .

WARNING

Observe safety precautions ⇒ page 1 .

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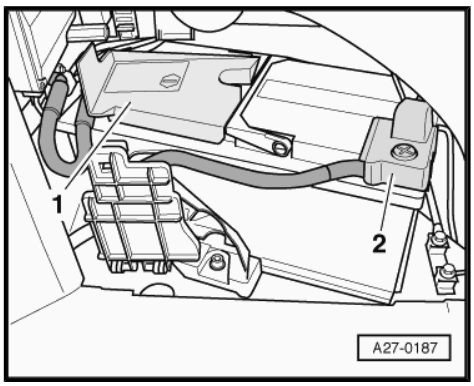
– Remove luggage compartment side trim cover (right-side) -arrows-.



– Remove cover -2- over battery.

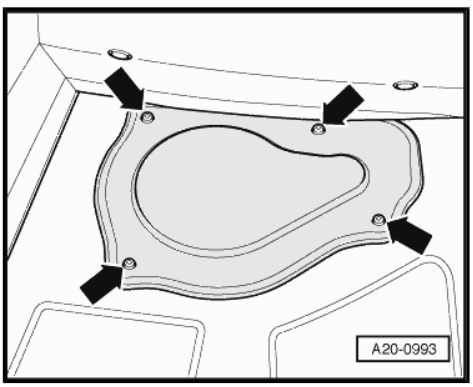
Note

Disregard -item 1-.



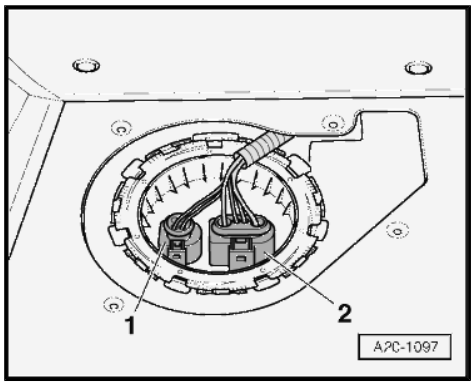
– Remove luggage compartment floor covering.

– Detach cover for flange (left-side) -arrows-.



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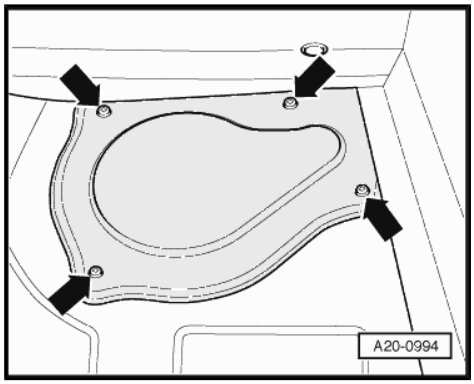
– Unplug electrical connector -2- on flange (left-side).



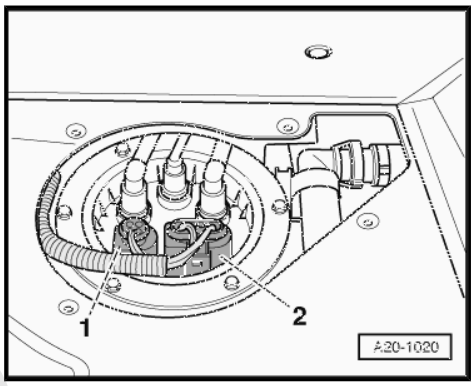
Note

Disregard -item 1-.

– Unscrew cover for flange (right-side) -arrows-.



– Unplug electrical connector -2- on flange (right-side).



Note

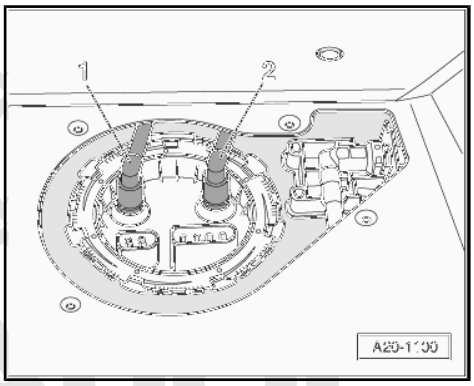
Disregard -item 1-.

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WARNING

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



Caution

Rules for cleanliness when working on the injection system *⇒ page 3* *.*

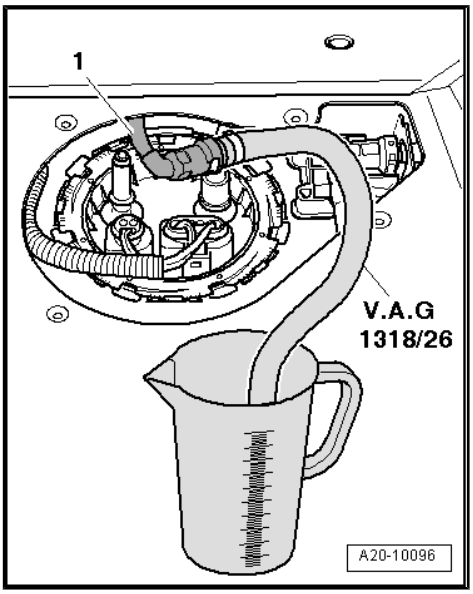
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– Disconnect fuel return line -1- from flange by pressing release tabs.

Note

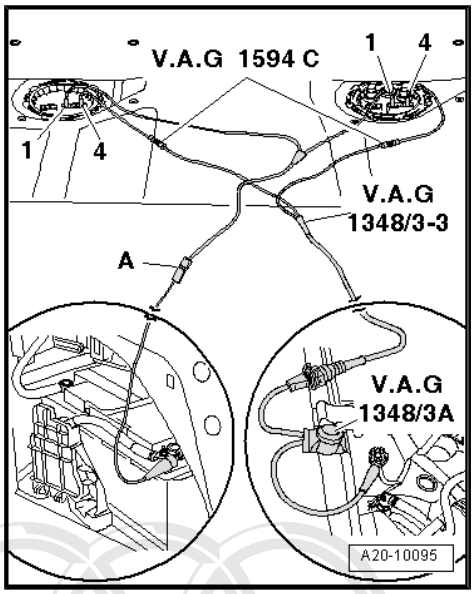
Disregard -item 2-.

– Fit adapter -V.A.G 1318/26- onto disconnected fuel pipe -1- and hold adapter hose in measuring container.

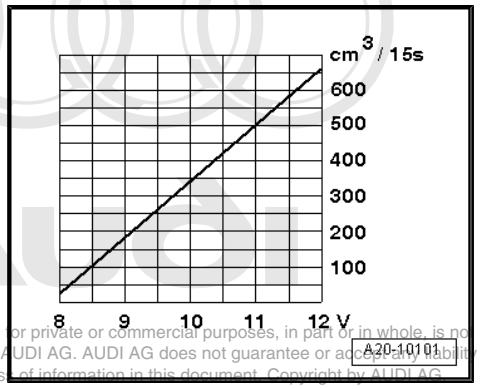


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– Connect remote control - V.A.G 1348/3A- for V.A.G 1348 with adapter cable -V.A.G 1348/3-3- to contact -4- (earth) of fuel delivery unit (left-side) and fuel delivery unit (right-side) using test leads from auxiliary measuring set - V.A.G 1594C- .
– Connect crocodile clip to earth point next to battery.
– Connect contact -1- (positive) of fuel delivery unit (left-side) and fuel delivery unit (right-side) to battery "+" via an improvised test lead. For safety reasons an in-line fuse -A- (10 A) must be connected into the lead.
– Remove filler cap from fuel filler neck.



– Press remote control button for 15 seconds.
– Compare amount of fuel delivered with minimum delivery shown in diagram (cm^3/15 sec.).



Note

Voltage at fuel pump with engine stationary and pump running is approx. 2 volts less than battery voltage.

If minimum delivery rate is not reached, check for the following causes:

- Fuel lines have been crushed.
- Fuel filter is blocked.
- Fuel pumps are defective.

Note

As there is hardly any difference in the fuel delivery rate if only one of the two fuel pumps is working (because of the hose connections inside the tank), it is difficult to diagnose a defective pump by just measuring the delivery rate.

In this case proceed as follows:

– Unplug the electrical auxiliary lead at the fuel delivery units (one at a time).
– Measure delivery rate of fuel delivery unit located on the opposite side.

If the delivery rate of the fuel delivery unit which has been measured separately is considerably below specification:

– Renew the relevant fuel delivery unit.

3.9 Suction-jet pumps

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1 - Suction-jet pump (left-side)

2 - Fuel delivery unit (left-side)

3 - Expansion tank

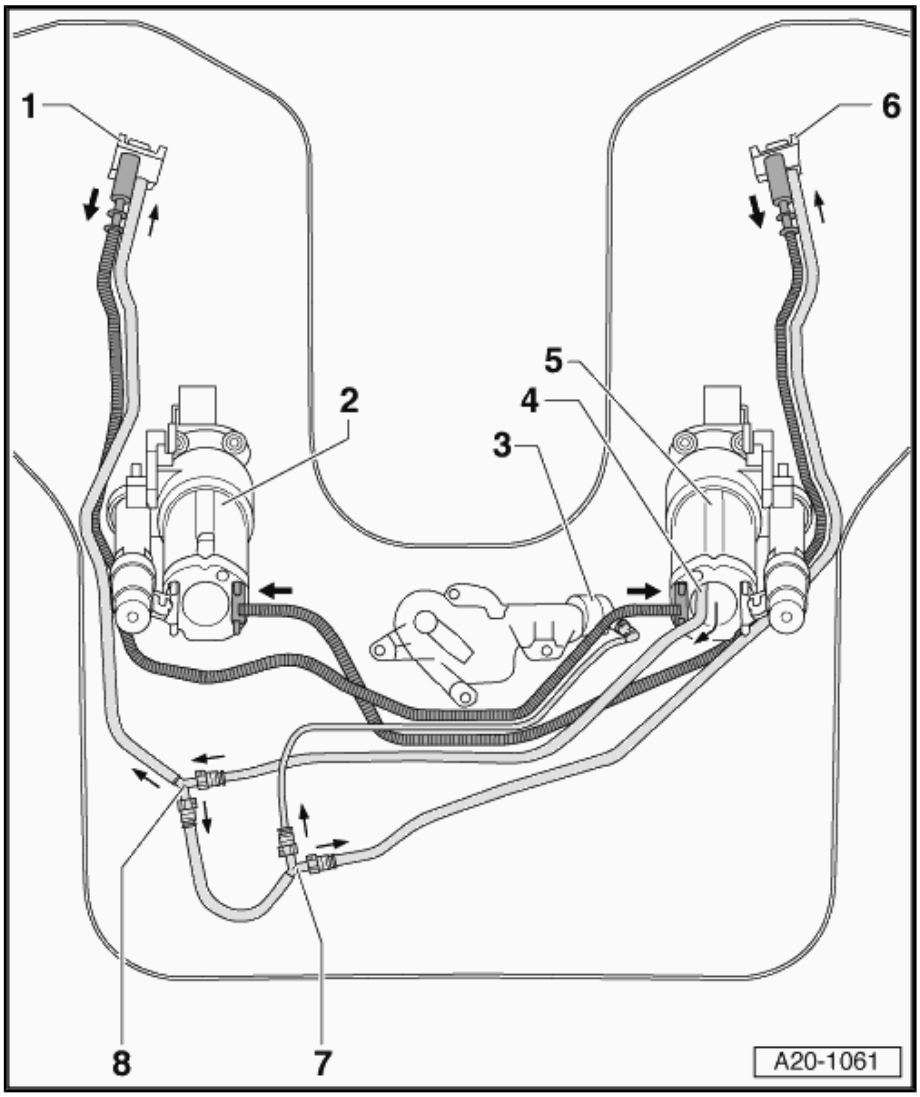
4 - Fuel pump (right-side)

5 - Fuel delivery unit (right-side)

6 - Suction-jet pump (right-side)

7 - Y-connector

8 - Y-connector



Description of operation

To ensure a reliable fuel supply in all situations, the fuel pumps must never draw in air, even under extreme driving conditions such as very sharp bends or under heavy braking. This may happen when the fuel sloshes into one of the corners of a partially filled fuel tank.

- For this reason, the fuel delivery units -item 2- and -item 5- incorporate a baffle housing, in which the fuel pumps are fitted, as well as the fuel pumps themselves. The baffle housing is a container permanently filled with fuel, so that the fuel pumps are surrounded with fuel regardless of the fuel level in the tank.
- Consequently, proper filling of the baffle housings is essential for trouble-free operation of the fuel pumps. This is the purpose of the “suction-jet pumps”.
- The suction-jet pumps operate according to the principle of fluid entrainment: a stream of fuel from the primary stage of the fuel pump (right-side) -item 4- is passed through a nozzle in the suction-jet pumps -item 1- and -item 6-, and is thus accelerated. The accelerated stream of fuel draws off the surrounding fuel and delivers it to the baffle housings in the fuel delivery unit. The suction jet pump (right-side) -item 6- delivers the fuel into the baffle housing (left-side); the suction jet pump (left-side) -item 1- delivers the fuel into the baffle housing (right-side).
- The stream of fuel is distributed from the primary stage of the fuel pump (right-side) to the two suction-jet pumps via two Y-connectors -item 7- and -item 8-.
- Another small suction-jet pump is located in the expansion tank -item 3- and delivers fuel from there back to the fuel tank.

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3.10 Removing and installing suction-jet pump (left-side)

Removing

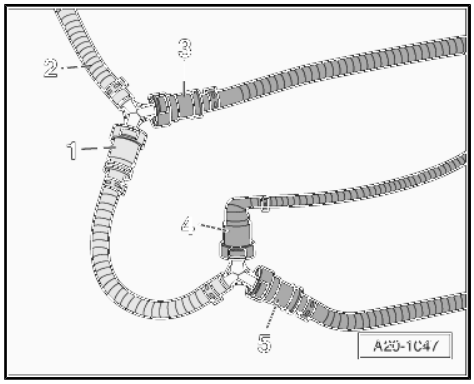
Observe safety precautions ⇒ page 1 .

Observe rules for cleanliness ⇒ page 3 .

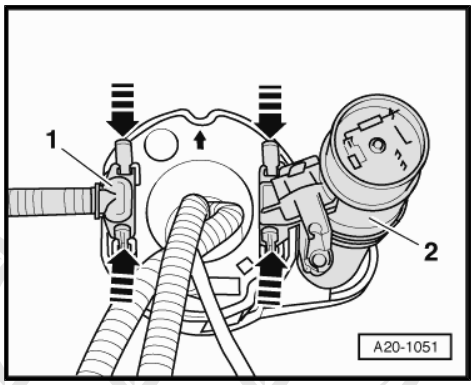
– Remove the fuel delivery unit (left-side) ⇒ page 26 .

– Remove fuel gauge sender 3 - G237- (tubular sender, left-side) from fuel tank.

– Working through left fuel tank opening, disconnect supply lines -1- and -3- for suction-jet pumps from Y-connector (press release tabs).



– Working through right fuel tank opening, press release tabs -arrows- and detach fuel supply line -1-.



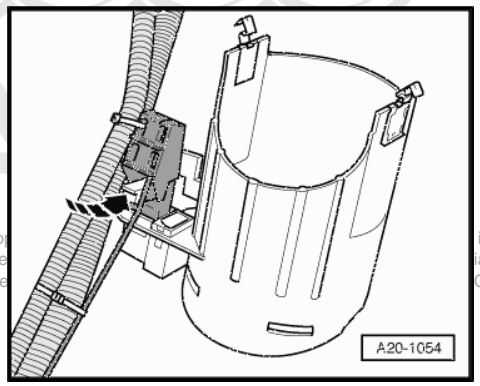
Note

Disregard -item 2-.

– Pull out disconnected fuel supply line through left fuel tank opening.

– Working through left fuel tank opening, press release tab -arrow- and detach retaining clip for suction jet lines from retainer.

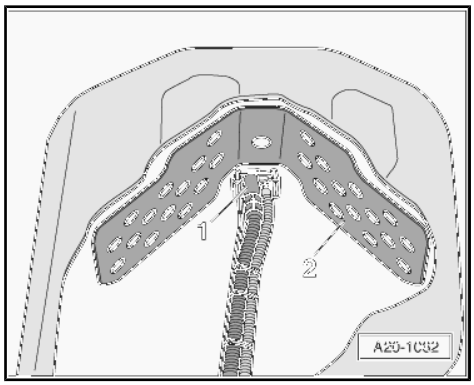
– Pull out suction-jet pump (left-side) together with lines through left fuel tank opening.



Installing

– Insert suction-jet pump (left-side) -1- into fuel tank and place into recess in baffle plate -2- in fuel tank at front, as shown in illustration.

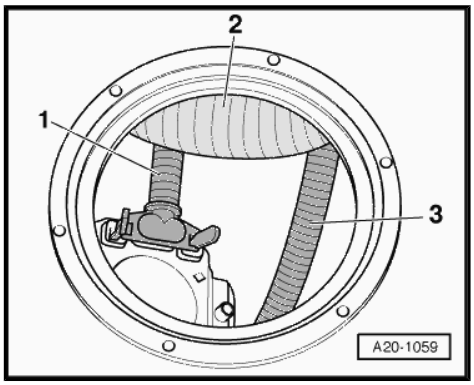
– Then press retaining clip for suction-jet pump into retainer so it engages audibly.



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iability
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– Push fuel supply line through left fuel tank opening into right fuel tank chamber. Note routing:

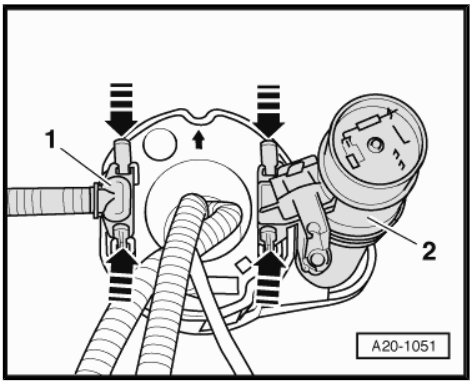
• The fuel supply line -3- must be routed below the fuel filler pipe -2- at the left fuel tank opening.



Note

Disregard -item 1-.

– Fit fuel supply line -1- onto fuel delivery unit (right-side) so that it engages audibly.



Note

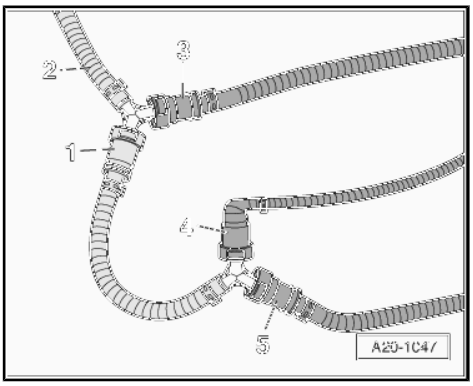
Disregard -item 2-.

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– Working through left fuel tank opening, fit supply lines -1- and -3- for suction-jet pumps onto Y-connector so that they engage audibly.

– Insert fuel gauge sender 3 - G237- into fuel tank.

– Install fuel delivery unit (left-side) ⇒ page 31 .



3.11 Removing and installing suction-jet pump (right-side)

Removing

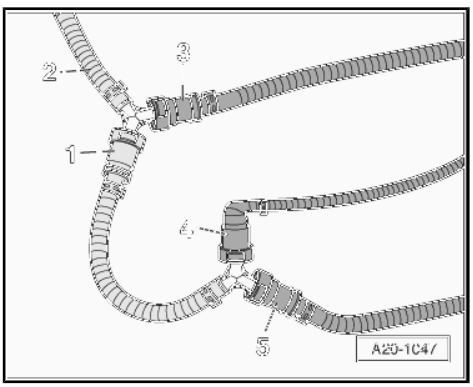
Observe safety precautions ⇒ page 1 .

Observe rules for cleanliness ⇒ page 3 .

– Remove fuel delivery unit (right-side) ⇒ page 42 .

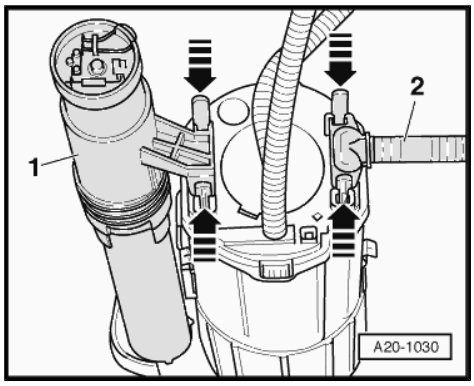
– Remove fuel gauge sender 4 - G393- (tubular sender, right-side) from fuel tank.

– Working through left fuel tank opening, disconnect supply line -5- for suction-jet pump from Y-connector (press release tab).



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– Working through left fuel tank opening, press release tabs -arrows- and detach fuel supply line -2-.



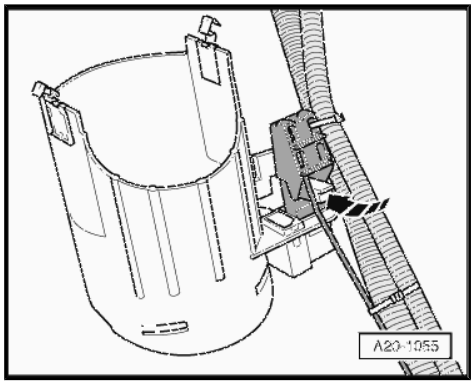
Note

Disregard -item 1-.

– Pull out disconnected fuel supply line through right fuel tank opening.

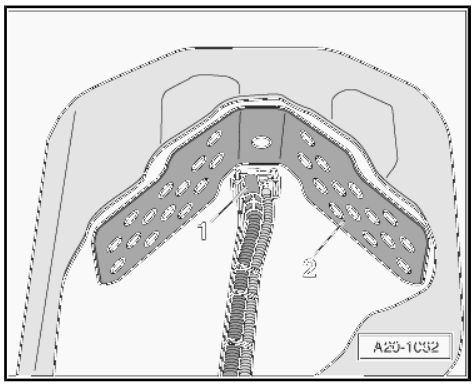
– Working through right fuel tank opening, press release tab -arrow- and detach retaining clip for suction jet lines from retainer.

– Pull suction-jet pump (right-side) together with lines out of right fuel tank opening.



Installing

– Insert suction-jet pump (right-side) -1- into fuel tank and place into recess in baffle plate -2- in fuel tank at front, as shown in illustration.

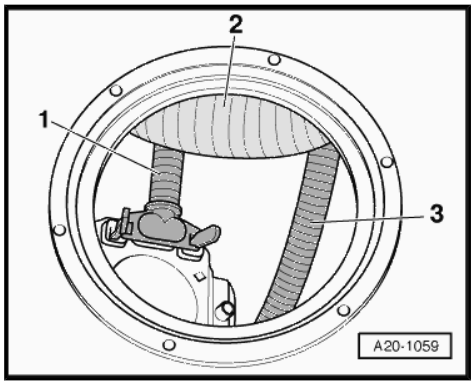


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– Then press retaining clip for suction-jet pump into retainer so it engages audibly.

– Push fuel supply line through right fuel tank opening into left fuel tank chamber. Note routing:

• The fuel supply line -1- must be routed below the fuel filler pipe -2- at the left fuel tank opening.

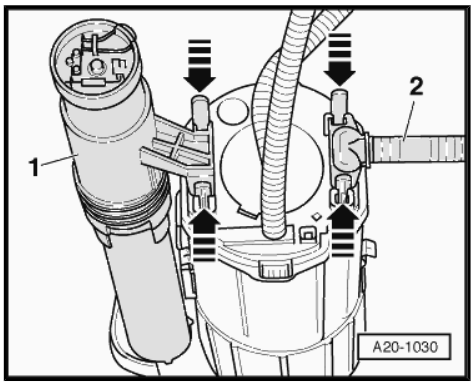


Note

Disregard -item 3-.

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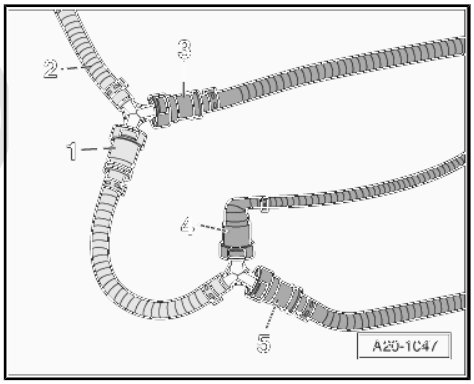
– Fit fuel supply line -2- onto fuel delivery unit (left-side) so that it engages audibly.



Note

Disregard -item 1-.

– Push supply line -5- for suction-jet pump through right fuel tank opening into left fuel tank chamber.
– Fit supply line for suction-jet pump onto Y-connector so it engages audibly.
– Insert fuel gauge sender 4 - G393- into fuel tank.
– Install fuel delivery unit (right-side) ⇒ page 48 .



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4 Routing of pipes/hoses (inside fuel tank) - rest-of-world vehicles with FSI engine

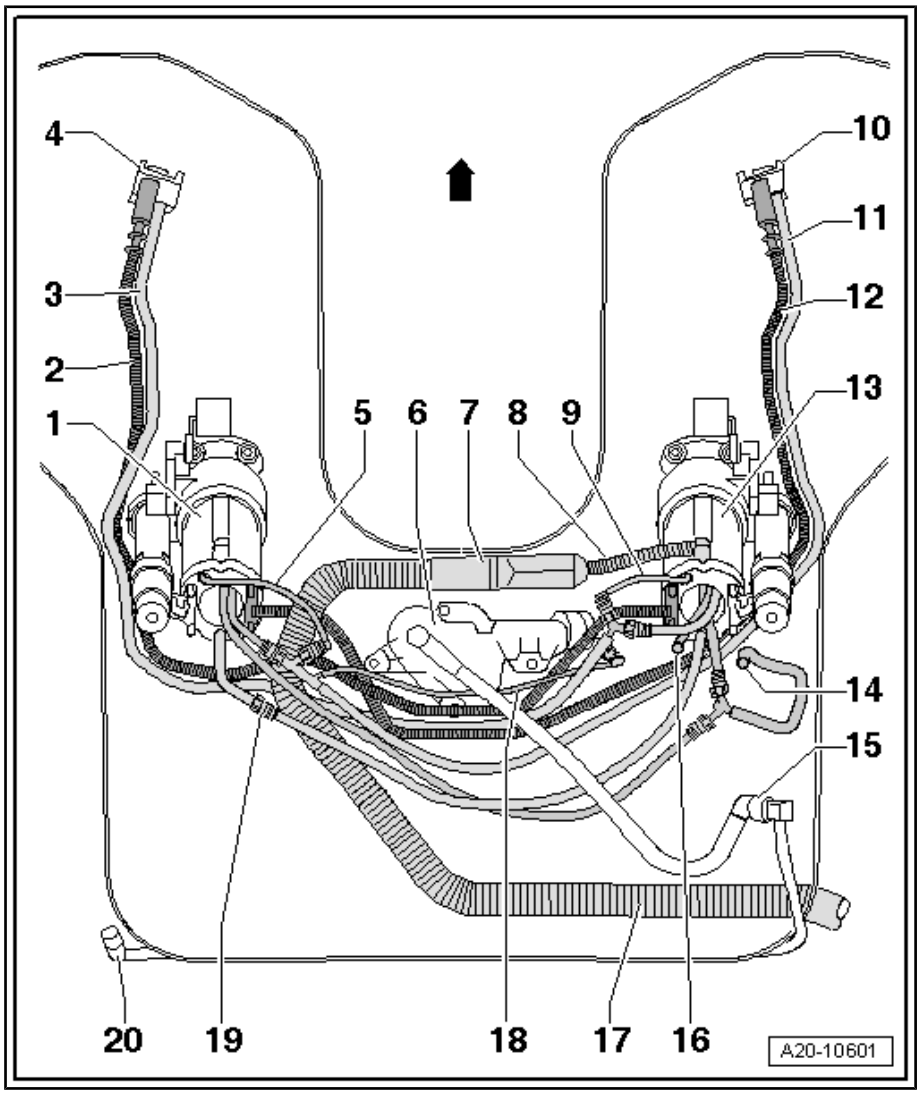
⇒ “4.1 Routing of pipes/hoses (inside fuel tank) - exploded view”, page 66

4.1 Routing of pipes/hoses (inside fuel tank) - exploded view

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Note

- *The illustration shows the correct routing of pipes/hoses inside the fuel tank (schematic view).*
- *It is not necessary to route the pipes/hoses in exactly the same way as shown in the illustration, except for pipes/hoses shown in ⇒ page 67 . However it is essential to fit the pipes/hoses with sufficient space in relation to each other and to prevent rattling noises.*
- *The -arrow- points in direction of travel.*



1 - Fuel delivery unit (left-side) with fuel system pressurisation pump - G6-

2 - Fuel supply line

- From suction-jet pump (left-side) to fuel delivery unit (right-side)

3 - Supply line for suction-jet pump

- From fuel pump (right-side) to suction-jet pump (left-side)

4 - Suction-jet pump (left-side)

5 - Supply line for suction-jet pump

- For fuel delivery unit (left-side)

6 - Expansion tank

- With suction-jet pump to extract fuel from expansion tank

7 - Non-return flap

- For fuel filler pipe

8 - Primary filler pipe

- To fuel delivery unit (right-side).
- Ensures that a small amount of fuel is delivered immediately to the fuel delivery unit when the tank is filled for the first time.

9 - Supply line for suction-jet pump

- For fuel delivery unit (right-side)

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10 - Suction-jet pump (right-side)

11 - Supply line for suction-jet pump

- ❑ From fuel pump (left-side) to suction-jet pump (right-side)

12 - Fuel supply line

- ❑ From suction-jet pump (right-side) to fuel delivery unit (left-side)

13 - Fuel delivery unit (right-side) with fuel pump - G23-

14 - Fuel supply line

- ❑ From fuel pumps (left and right) to flange

15 - Breather line

- ❑ To breather connection at top of fuel filler neck

16 - Fuel return line

- ❑ From flange to fuel delivery unit (right-side)
- ❑ Fitted loosely in fuel delivery unit (right-side)

17 - Fuel filler pipe

- ❑ From fuel filler neck to non-return flap in fuel tank

18 - Supply line for suction-jet pump

- ❑ To suction-jet pump in expansion tank

19 - Balance pipe

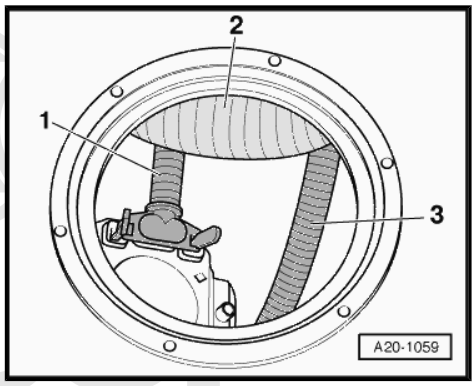
- ❑ Between fuel delivery units

20 - Breather line

- ❑ To activated charcoal filter in rear left wheel housing

Installation position of fuel supply lines

- The fuel supply lines -1- and -3- must be routed below the fuel filler pipe -2- at the left fuel tank opening.



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5 Fuel delivery unit with fuel pump and fuel gauge senders - rest-of-world vehicles with FSI engine

⇒ “5.1 Exploded view - fuel delivery unit (left-side) with fuel system pressurisation pump G6 and fuel gauge senders G and G237 ”, page 68

⇒ “5.2 Checking fuel system pressurisation pump G6 (left-side) - electrical test”, page 70

⇒ “5.3 Removing and installing fuel delivery unit (left-side) with fuel system pressurisation pump G6 ”, page 70

⇒ “5.4 Exploded view - fuel delivery unit (right-side) with fuel pump G23 and fuel gauge senders G169 and G393 ”, page 79

⇒ “5.5 Checking fuel pump G23 (right-side) - electrical test”, page 81

⇒ “5.6 Removing and installing fuel delivery unit (right-side) with fuel pump G23 ”, page 81

⇒ “5.7 Checking delivery rate of fuel pumps - vehicles with 6-cylinder engine”, page 90

⇒ “5.8 Checking delivery rate of fuel pumps - vehicles with 8-cylinder engine”, page 94

⇒ “5.9 Checking delivery rate of fuel pumps - vehicles with 10-cylinder engine (Audi S8)”, page 98

⇒ “5.10 Fuel pump control unit J538 ”, page 102

⇒ “5.11 Removing and installing fuel pump control unit J538 ”, page 102

⇒ “5.12 Suction-jet pumps”, page 103

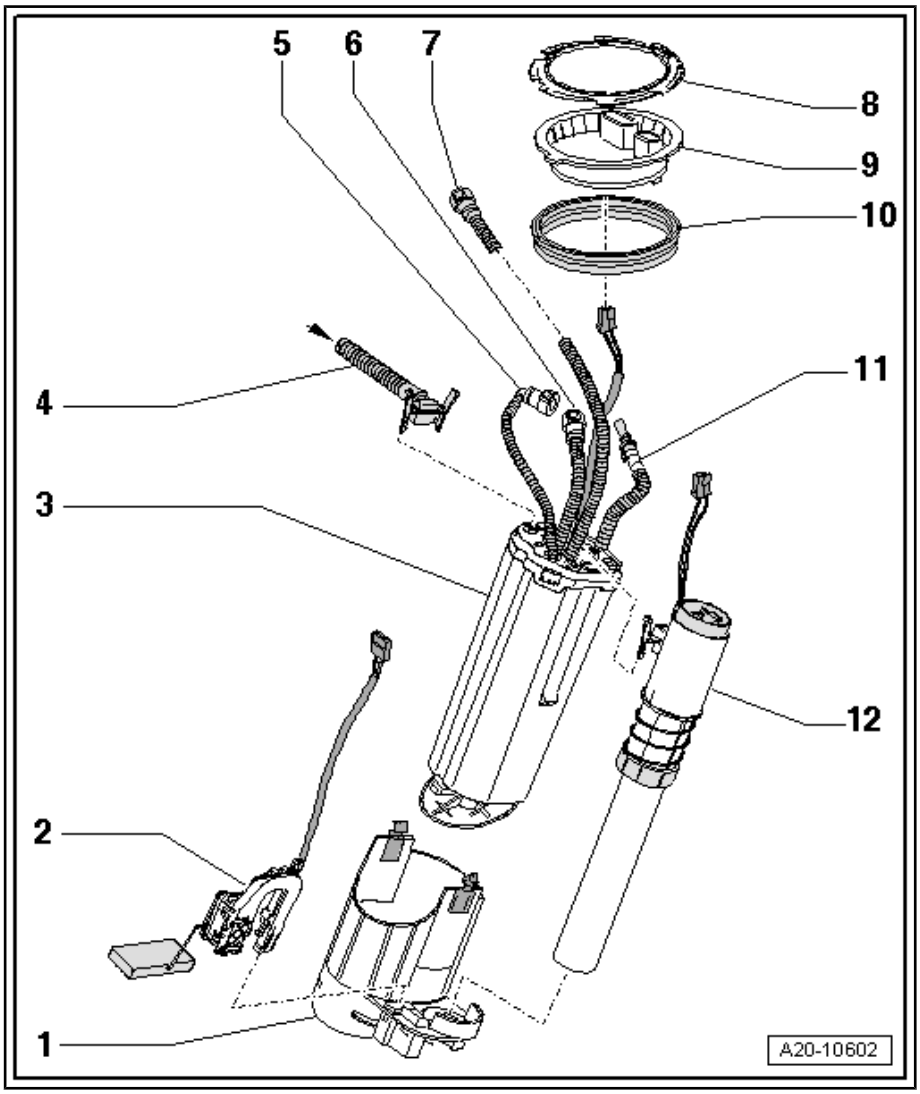
⇒ “5.13 Removing and installing suction-jet pump (left-side)”, page 105

⇒ “5.14 Removing and installing suction-jet pump (right-side)”, page 107

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5.1 Exploded view - fuel delivery unit (left-side) with fuel system pressurisation pump - G6- and fuel gauge senders -G- and -G237-

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1 - Retainer

- For fuel delivery unit

2 - Fuel gauge sender - G-

- Black
- Clipped onto retainer -item 1-
- Checking resistance values ⇒ page 221
- Removing and installing ⇒ page 222

3 - Fuel delivery unit (left-side)

- With fuel system pressurisation pump - G6-
- Clipped onto retainer -item 1-
- Different versions available; for correct version refer to ⇒ Electronic parts catalogue
- Checking fuel pump (electrical test) ⇒ page 125
- Checking residual pressure ⇒ Rep. gr. 24
- Removing and installing ⇒ page 70
- Put at least 5 litres of fuel into tank after installing

4 - Fuel supply line

- From suction jet pump (right-side)
- Clipped onto fuel delivery unit -item 3-

5 - Supply line for suction-jet pump

- For fuel delivery unit (left-side)

6 - Supply line for suction-jet pump

- To suction-jet pump (right-side)

7 - Fuel supply line

- The plug connector is located on the right side of the fuel tank
- Press release tab on connection piece to disconnect

8 - Locking ring

- Remove and install using wrench - T10202-
- Tighten to 120 Nm

9 - Flange (left-side)

- Installation position ⇒ page 70

10 - Seal

- Renew
- Install dry

11 - Balance pipe

- To fuel delivery unit (right-side).

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12 - Fuel gauge sender 3 - G237-

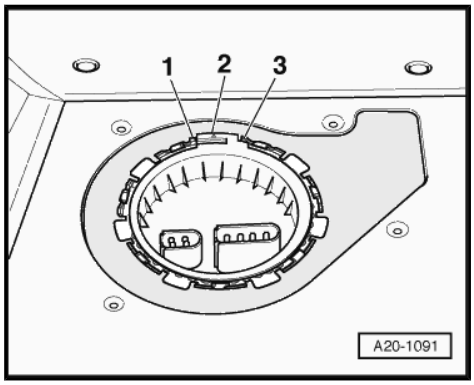
- ❑ Grey
- ❑ Clipped onto fuel delivery unit -item 3-
- ❑ Checking resistance values ⇒ page 225
- ❑ Removing and installing ⇒ page 226

Installation position of flange (left-side)

– Install new seal for flange (seal must be installed dry).

– Fit flange into fuel tank; note correct installation position:

• Lug -2- on flange must be between tabs -1- and -3- on fuel tank.



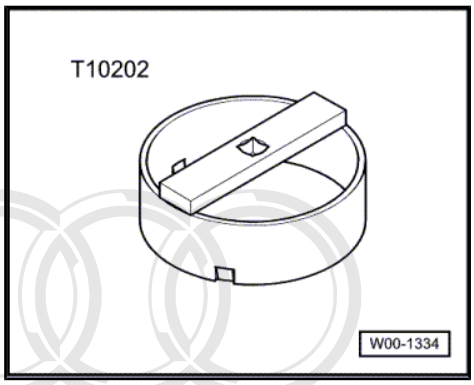
5.2 Checking fuel system pressurisation pump - G6- (left-side) - electrical test

- ♦ On vehicles with FSI engine, voltage for the fuel pumps is supplied via fuel pump control unit - J538- .
- ♦ Check fuel pump control unit - J538- in “Guided Fault Finding” ⇒ Vehicle diagnostic tester.

5.3 Removing and installing fuel delivery unit (left-side) with fuel system pressurisation pump - G6-

Special tools and workshop equipment required

- ♦ Wrench - T10202-



Removing

Observe safety precautions ⇒ page 1 .

Observe rules for cleanliness ⇒ page 3 .

Caution

- *The fuel tank must not be more than 1/3 full when removing the fuel delivery unit. Drain the tank if necessary. Procedure ⇒ page 112*

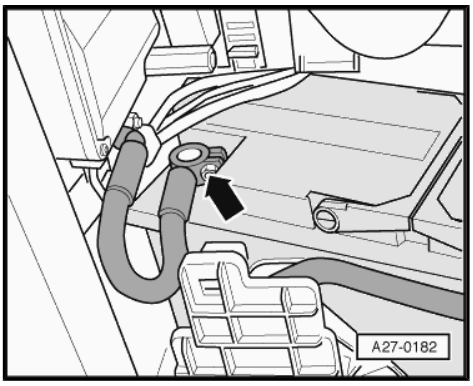
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Caution

Observe notes on procedure for disconnecting the battery.

– With ignition switched off, disconnect battery earth cable -arrow- ⇒ Electrical system; Rep. gr. 27 .

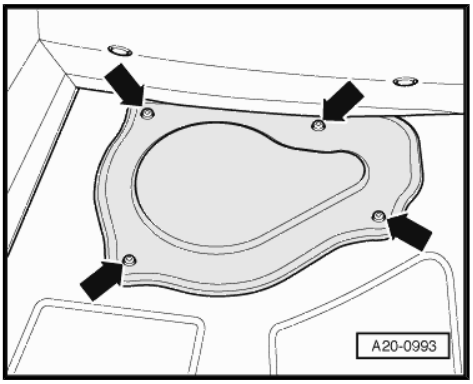


– Remove luggage compartment floor covering.

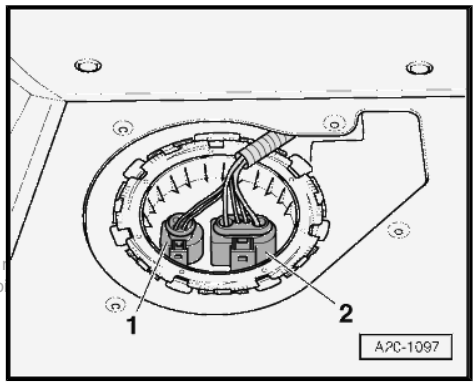
Note

For removing and installing fuel delivery unit, take tool kit and spare wheel out of luggage compartment. You can then sit or kneel in the spare wheel well.

– Detach cover for flange (left-side) -arrows-.

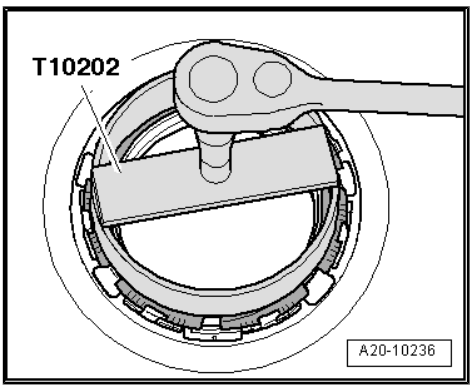


– Unplug electrical connectors -1- and -2- on flange (left-side).



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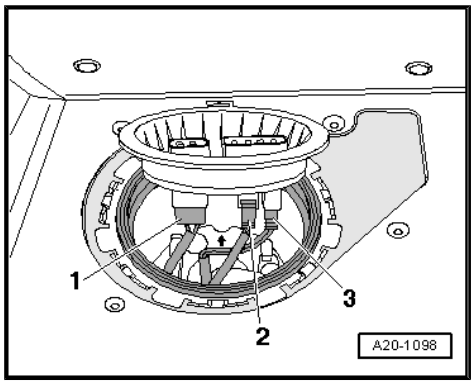
– Unscrew locking ring using wrench - T10202- .



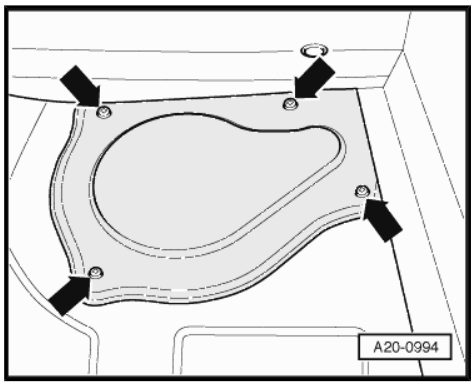
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– Detach flange and remove seal.

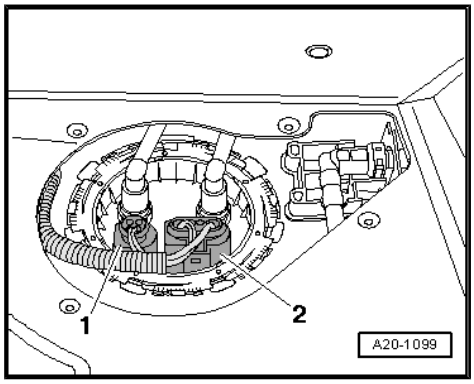
– Unplug electrical connectors -1 ... 3- on underside of flange (left-side).



– Unscrew cover for flange (right-side) -arrows-.

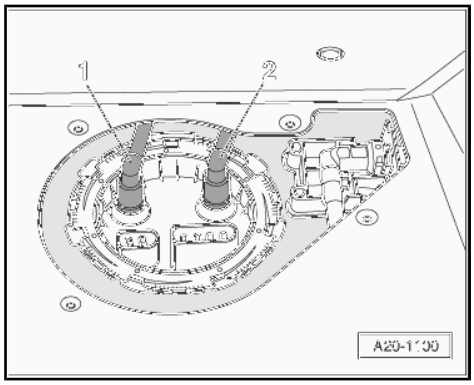


– Unplug electrical connectors -1- and -2- on flange (right-side).



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– Mark fuel return line -1- and fuel supply line -2-.



WARNING

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

– Detach both lines from flange (press release tabs).

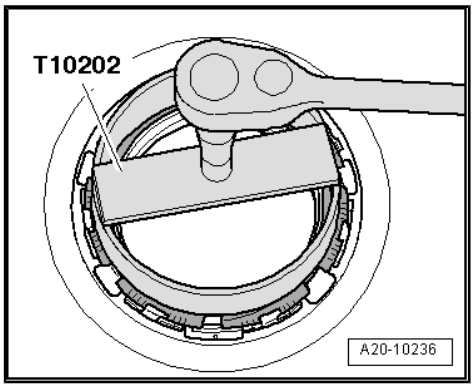
Vehicles with auxiliary heater:

– In addition, disconnect fuel supply line for auxiliary heater.

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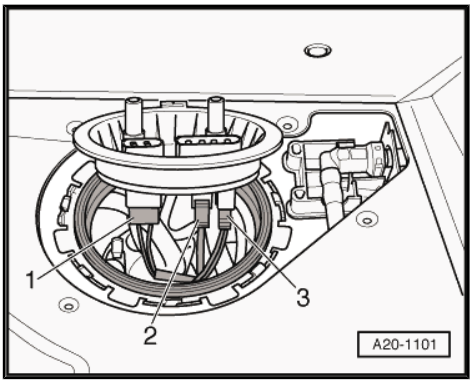
All vehicles (continued):

– Unscrew locking ring using wrench - T10202- .



– Detach flange and remove seal.

– Unplug electrical connectors -1 ... 3- on underside of flange (right-side).

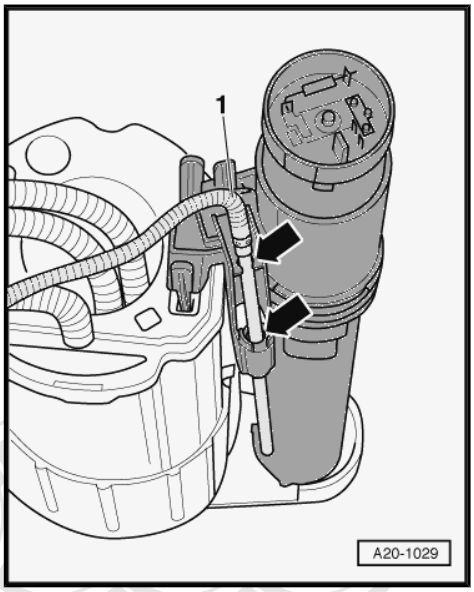


Note

Pull out fuel lines from fuel tank opening prior to disconnecting the pipe connectors mentioned below.

Vehicles with auxiliary heater:

– Pull out suction pipe -1- for auxiliary heater from retainers -arrows- on tubular sender.

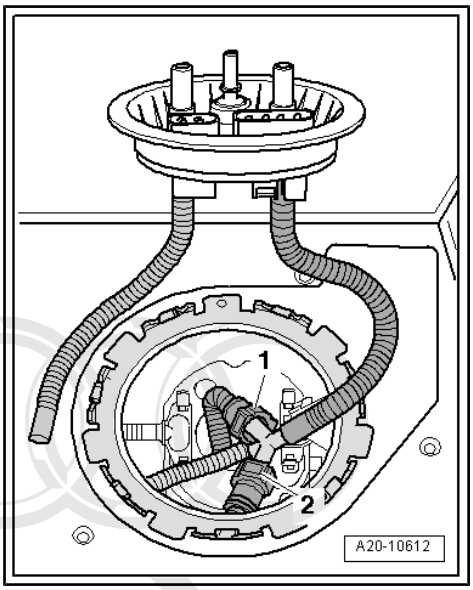


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All vehicles (continued):

– Working through right fuel tank opening, press release tab and disconnect fuel supply line -2- going to fuel delivery unit (left-side).

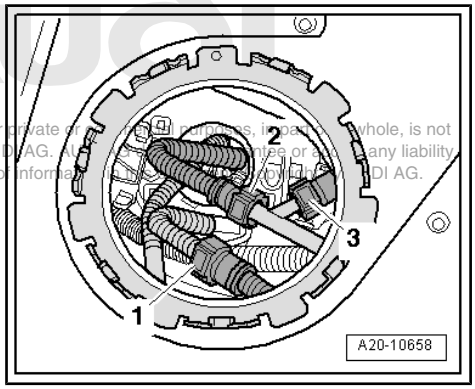


Note

Disregard -item 1-.

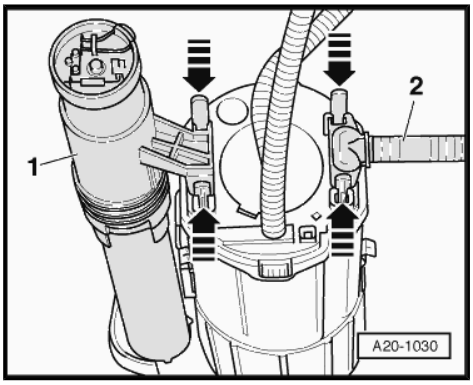
– Working through left fuel tank opening, press release tabs and disconnect balance pipe -1- and supply line -2- going to suction-jet pump (right-side) and supply line -3- going to fuel delivery unit (left-side).

– Pull disconnected fuel lines out of left fuel tank opening.



– Working through left fuel tank opening, press release tabs -arrows- and detach fuel supply line -2- and fuel gauge sender 3 - G237- -item 1-.

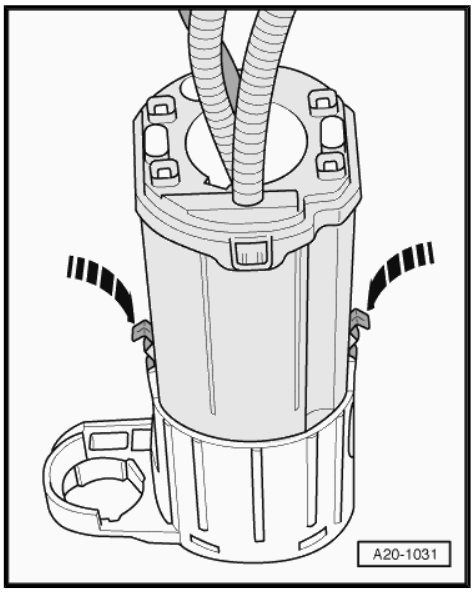
– Move fuel gauge sender 3 - G237- to left side.



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– Press down both retaining clips on retainer for fuel delivery unit -arrows-.
– Remove fuel delivery unit.



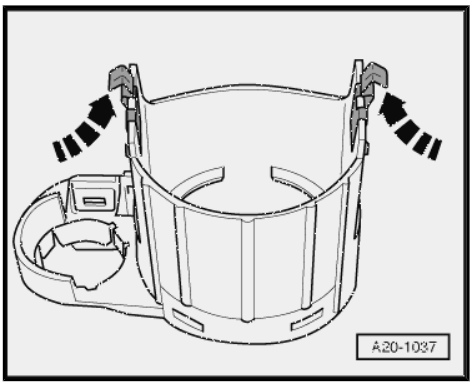
Note

Keep in mind that the fuel delivery unit still contains fuel.

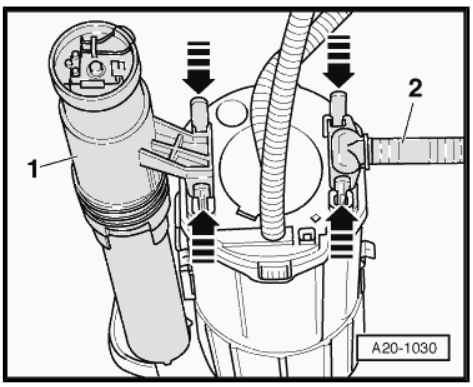
Installing

- Tightening torque ⇒ page 68

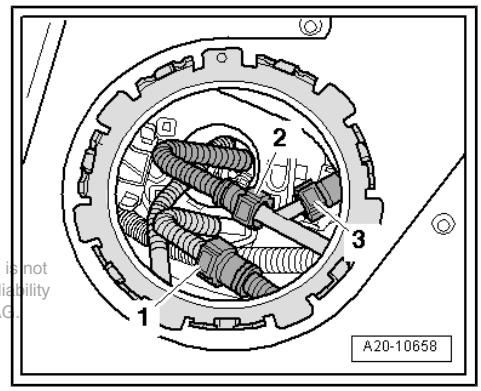
– Pull both retaining clips on retainer upwards -arrows- so that they engage audibly before installing the fuel delivery unit.
– Then press fuel delivery unit carefully into retainer so that it engages audibly.



– Fit fuel supply line -2- and fuel gauge sender 3 - G237- -item 1- so that they engage audibly.
– Guide fuel supply line for fuel delivery unit (left-side) into fuel tank chamber (right-side).



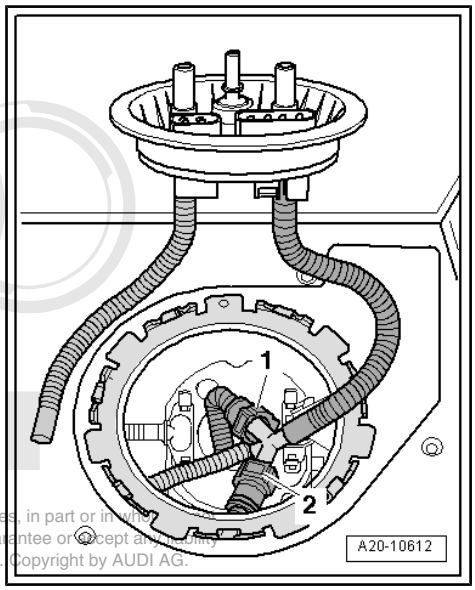
– Working through left fuel tank opening, fit balance pipe -1- and supply line -2- going to suction-jet pump (right-side) and supply line -3- going to fuel delivery unit (left-side) so that they engage audibly.



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– Working through right fuel tank opening, fit fuel supply line -2- so that it engages audibly.



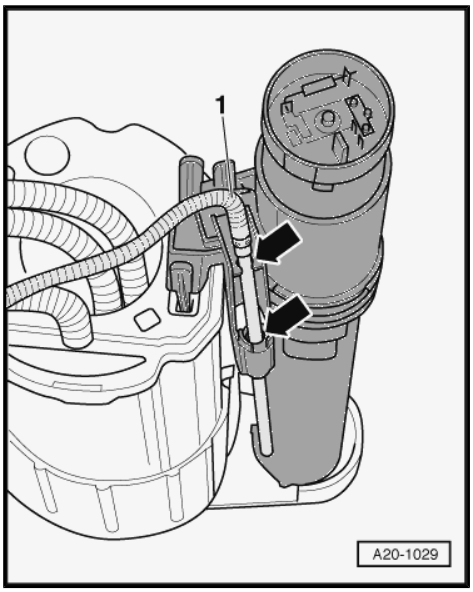
Note

Disregard -item 1-.

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Vehicles with auxiliary heater:

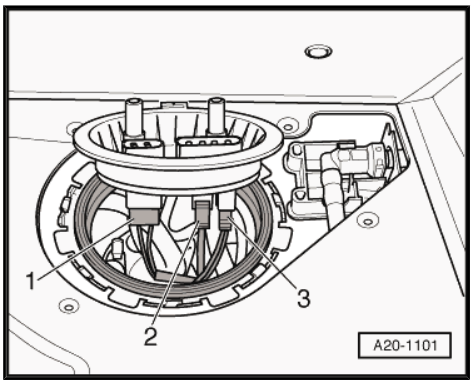
– Fit suction pipe -1- for auxiliary heater into retainers -arrows- on tubular sender.



All vehicles (continued):

– Connect electrical connectors -1 ... 3- on underside of flange (right-side).

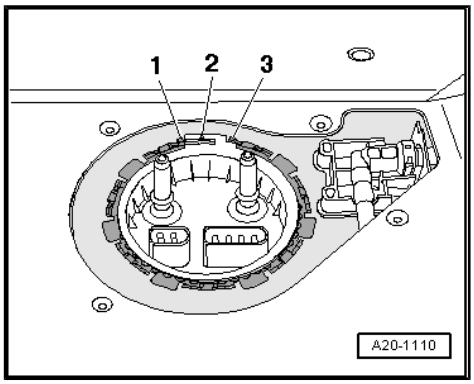
– Install new seal for flange (seal must be installed dry).



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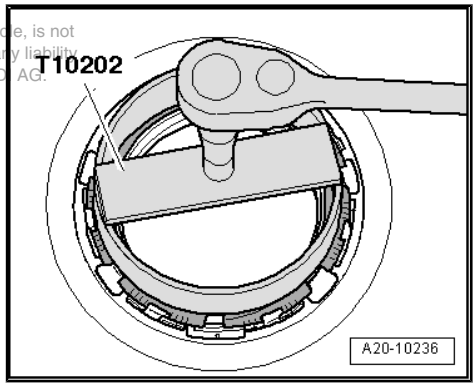
– Fit flange into fuel tank; note correct installation position:

- The hose for the return line must be guided into the opening in the centre of the fuel delivery unit.
- Lug -2- on flange must be between tabs -1- and -3- on fuel tank.



– Tighten locking ring.

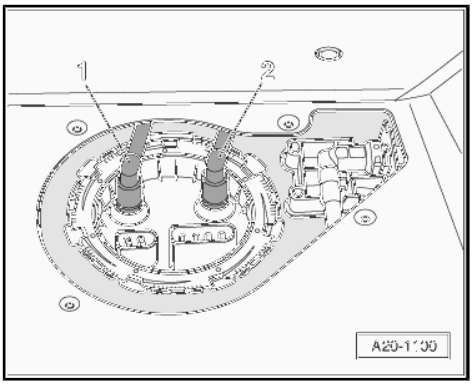
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– Install fuel supply line -2- and fuel return line -1- (as marked) so that they engage audibly.

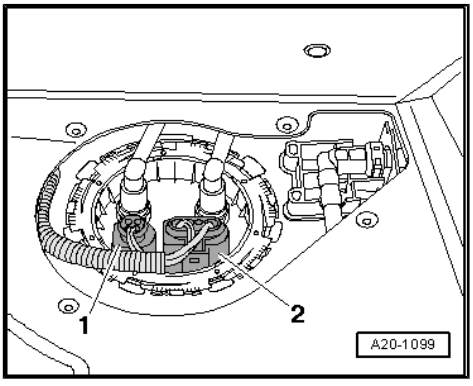
Vehicles with auxiliary heater:

– Also fit fuel supply line going to auxiliary heater so that it engages audibly.



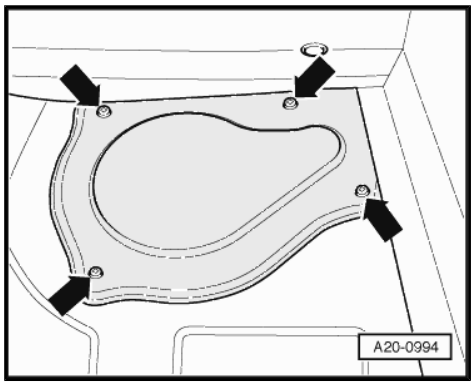
All vehicles (continued):

– Attach electrical connectors -1- and -2- on flange (right-side).

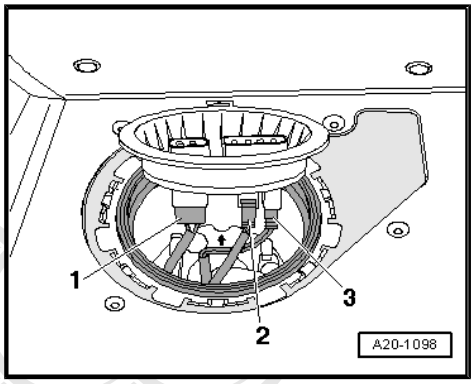


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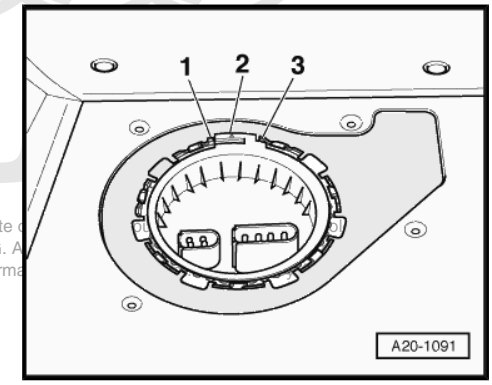
– Secure cover for flange (right-side) -arrows-.



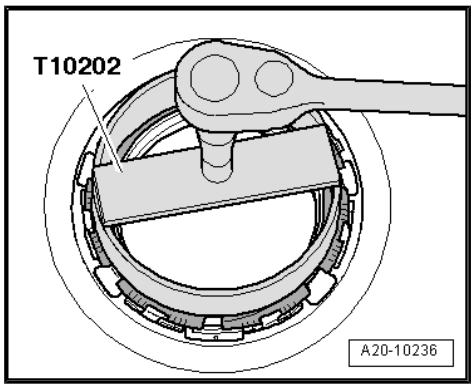
– Connect electrical connectors -1 ... 3- on underside of flange (left-side).
– Install new seal for flange (seal must be installed dry).



– Fit flange into fuel tank; note correct installation position:
• Lug -2- on flange must be between tabs -1- and -3- on fuel tank.



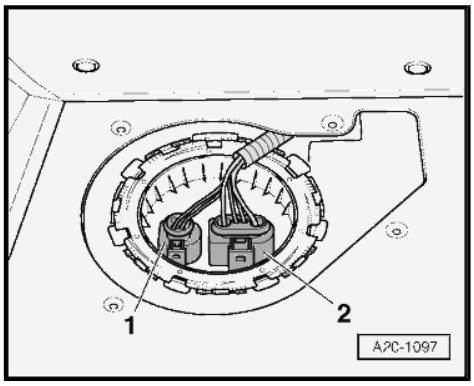
– Tighten locking ring.



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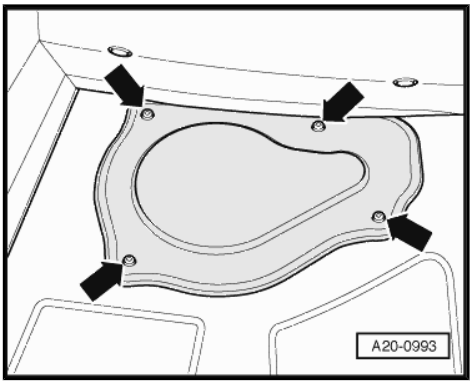
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– Attach electrical connectors -1- and -2- on flange (left-side).



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– Secure cover for flange (left-side) -arrows-.



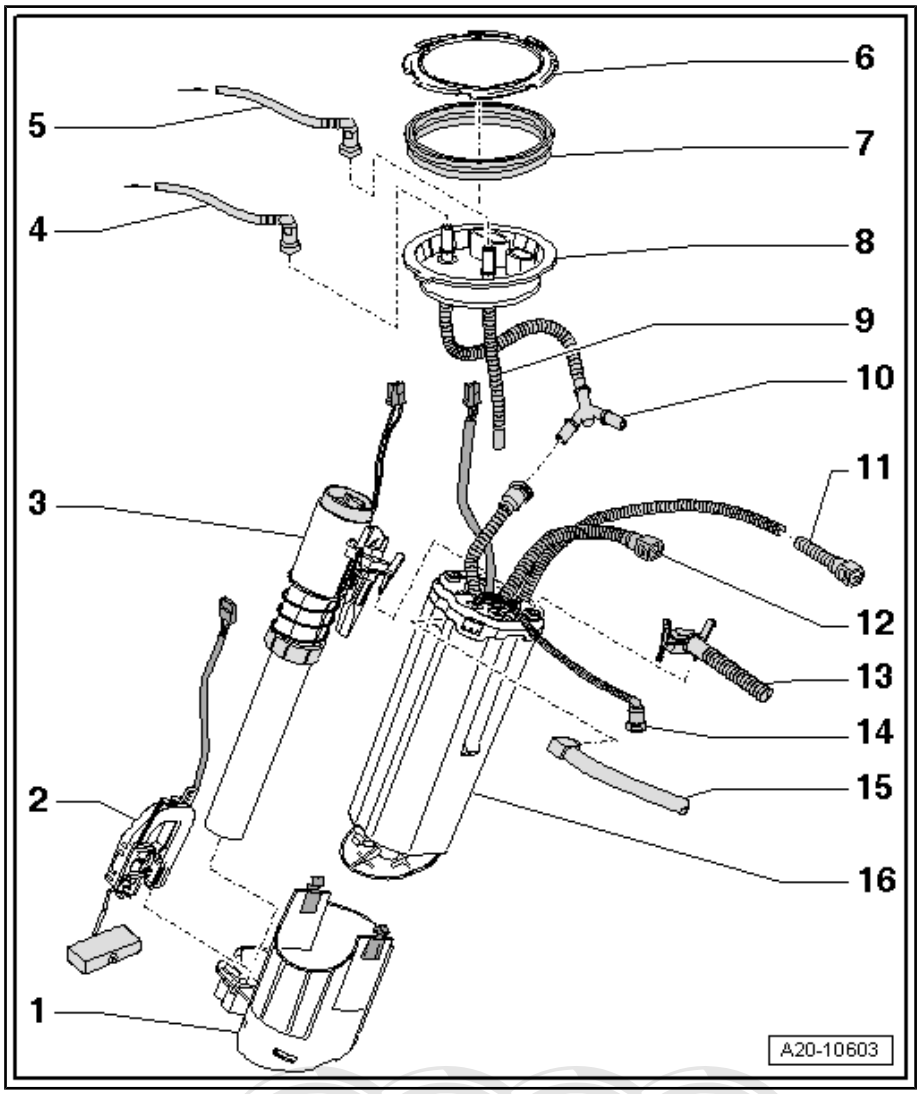
– Connect battery. Observe notes on procedures required after connecting battery ⇒ Electrical system; Rep. gr. 27 .
– Put at least 5 litres of fuel into tank after installing

Vehicles with auxiliary heater:

– Let auxiliary heater run with full load for 10 minutes to bleed fuel supply line going to metering pump.

5.4 Exploded view - fuel delivery unit (right-side) with fuel pump - G23- and fuel gauge senders -G169- and -G393-

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1 - Retainer

- For fuel delivery unit

2 - Fuel gauge sender 2 - G169-

- Yellow
- Clipped onto retainer -item 1-
- Checking resistance values ⇒ page 223
- Removing and installing ⇒ page 224

3 - Fuel gauge sender 4 - G393-

- White
- Clipped onto fuel delivery unit -item 16-
- Checking resistance values ⇒ page 230
- Removing and installing ⇒ page 232

4 - Fuel supply line

- To fuel filter
- Mark before removing
- Press release tab on connection piece to disconnect
- Do not kink
- Clip onto fuel tank

5 - Fuel return line

- From fuel rail
- Mark before removing
- Press release tab on connection piece to disconnect
- Do not kink
- Clip onto fuel tank

6 - Locking ring

- Remove and install using wrench - T10202-
- Tighten to 120 Nm

7 - Seal

- Renew
- Install dry

8 - Flange (right-side)

- Installation position ⇒ page 81

9 - Fuel return line

- From flange to fuel delivery unit (right-side)
- Fitted loosely in fuel delivery unit (right-side)

10 - Fuel supply line

- From fuel delivery units to flange

11 - Balance pipe

- Between fuel delivery units

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12 - Supply line for suction-jet pump

- ❑ For suction-jet pump
- ❑ Press release tab on connection piece to disconnect

13 - Fuel supply line

- ❑ From suction-jet pump (left-side)
- ❑ Clipped onto fuel delivery unit -item 16-

14 - Supply line for suction-jet pump

- ❑ For fuel delivery unit (right-side)

15 - Fuel filler pipe

- ❑ From filler neck
- ❑ Clipped onto fuel delivery unit -item 16-

16 - Fuel delivery unit (right-side)

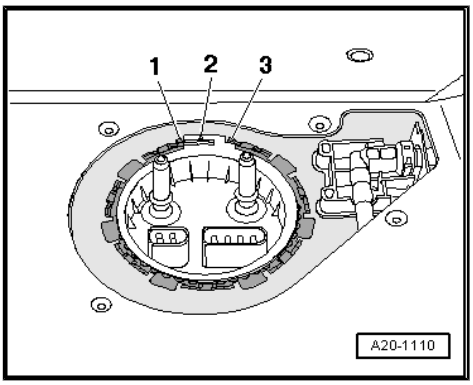
- ❑ With fuel pump - G23-
- ❑ Clipped onto retainer -item 1-
- ❑ Different versions available; for correct version refer to ⇒ Electronic parts catalogue
- ❑ Checking fuel pump (electrical test) ⇒ page 81
- ❑ Checking residual pressure ⇒ Rep. gr. 24
- ❑ Removing and installing ⇒ page 81
- ❑ Put at least 5 litres of fuel into tank after installing

Installation position of flange (right-side)

– Install new seal for flange (seal must be installed dry).

– Fit flange into fuel tank; note correct installation position:

• Lug -2- on flange must be between tabs -1- and -3- on fuel tank.



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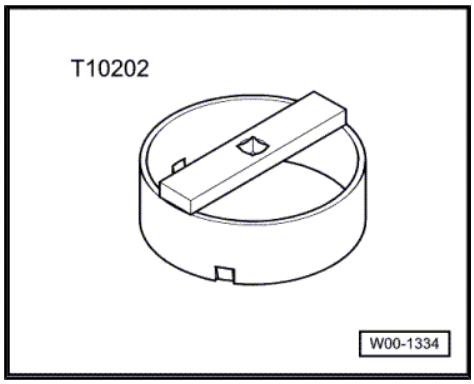
5.5 Checking fuel pump - G23- (right-side) - electrical test

- ♦ On vehicles with FSI engine, voltage for the fuel pumps is supplied via fuel pump control unit - J538- .
- ♦ Check fuel pump control unit - J538- in “Guided Fault Finding” ⇒ Vehicle diagnostic tester.

5.6 Removing and installing fuel delivery unit (right-side) with fuel pump - G23-

Special tools and workshop equipment required

◆ Wrench - T10202-



Removing

Observe safety precautions ⇒ page 1 .

Observe rules for cleanliness ⇒ page 3 .

Caution

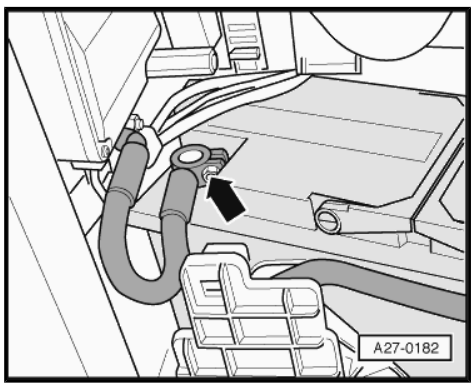
- *The fuel tank must not be more than 1/3 full when removing the fuel delivery unit. Drain the tank if necessary. Procedure ⇒ page 112*

Caution

Observe notes on procedure for disconnecting the battery.

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– With ignition switched off, disconnect battery earth cable -arrow- ⇒ Electrical system; Rep. gr. 27.

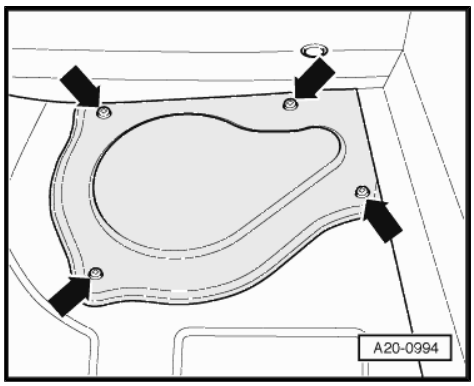


– Remove luggage compartment floor covering.

Note

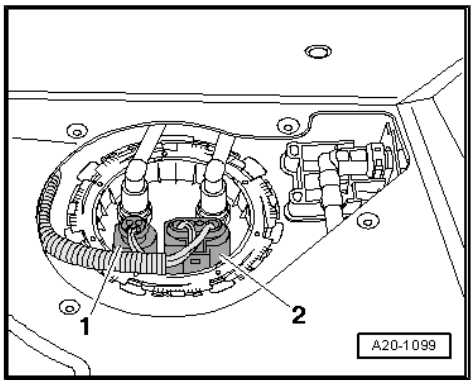
For removing and installing fuel delivery unit, take tool kit and spare wheel out of luggage compartment. You can then sit or kneel in the spare wheel well.

– Unscrew cover for flange (right-side) -arrows-.

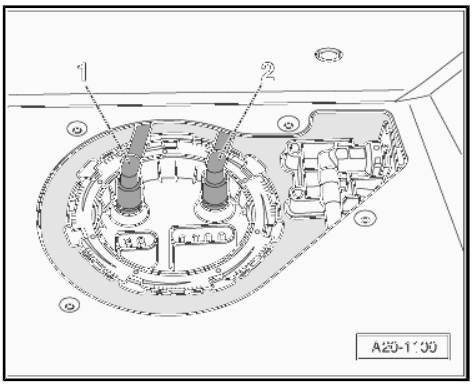


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– Unplug electrical connectors -1- and -2- on flange (right-side).



– Mark fuel return line -1- and fuel supply line -2-.



WARNING

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

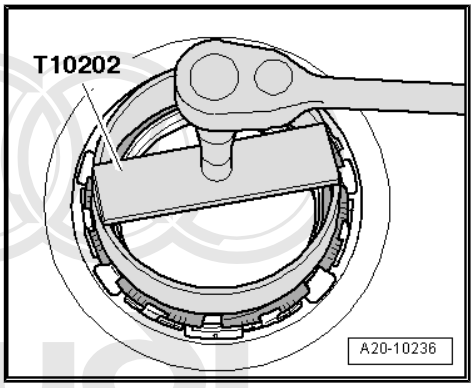
– Detach both lines from flange (press release tabs).

Vehicles with auxiliary heater:

– In addition, disconnect fuel supply line -2- for auxiliary heater.

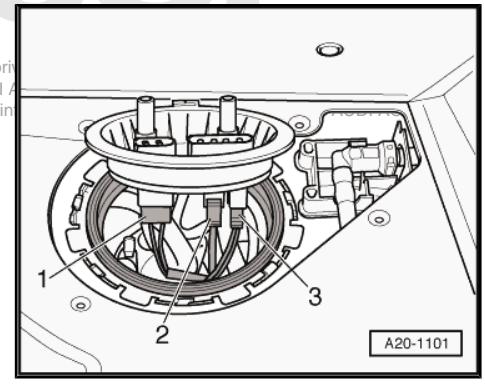
All vehicles (continued):

– Unscrew locking ring using wrench - T10202- .



– Detach flange and remove seal.

– Unplug electrical connectors -1 ... 3- on underside of flange (right-side).

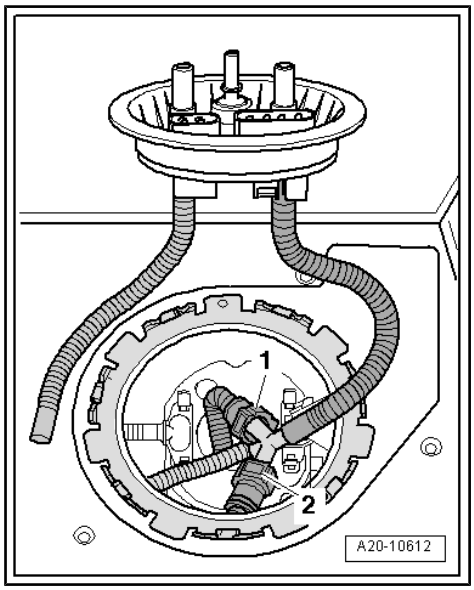


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Note

Pull out fuel lines from fuel tank opening prior to disconnecting the pipe connectors mentioned below.

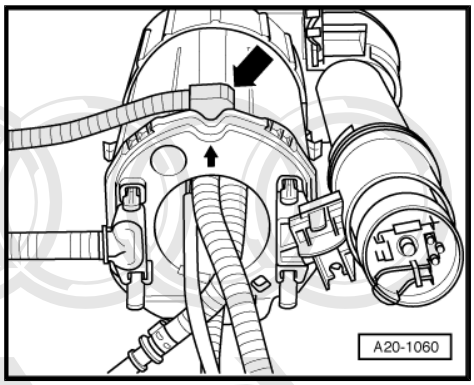
– Working through right fuel tank opening, press release tabs and disconnect fuel supply lines -1- and -2- going to fuel delivery units.



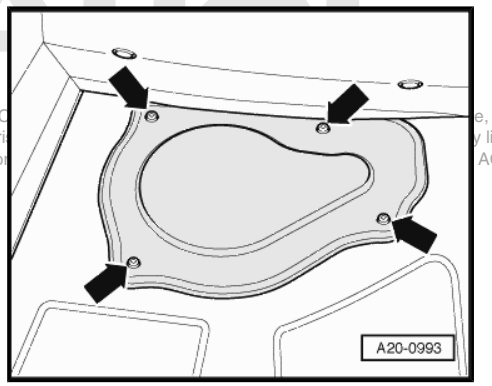
Note

For illustration purposes some of the components are shown removed in the following illustrations.

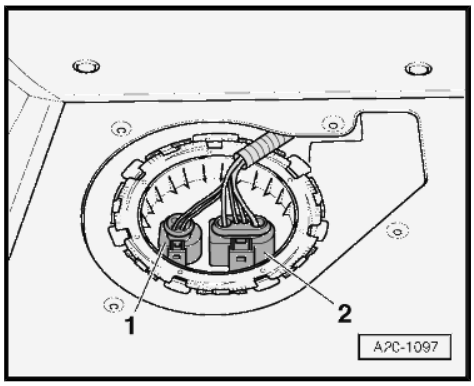
– Unclip fuel filler pipe -arrow- at front of fuel delivery unit (right-side).



– Detach cover for flange (left-side) -arrows-.

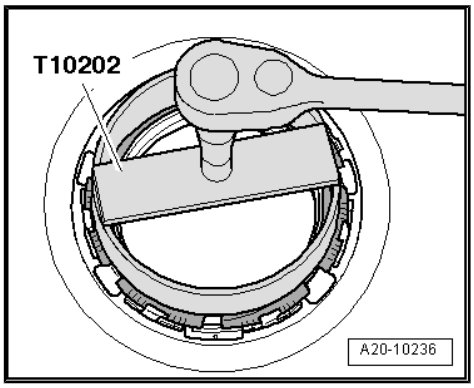


– Unplug electrical connectors -1- and -2- on flange (left-side).

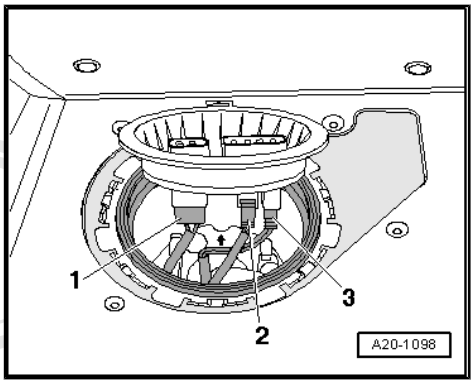


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– Unscrew locking ring using wrench - T10202- .



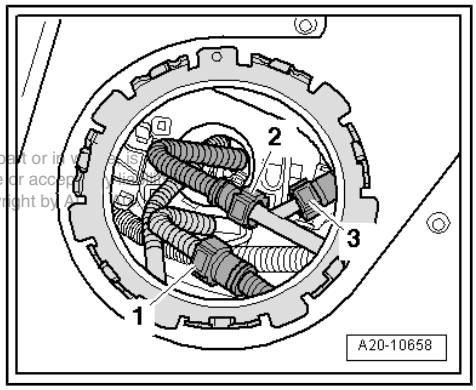
– Detach flange and remove seal.
– Unplug electrical connectors -1 ... 3- on underside of flange (left-side).



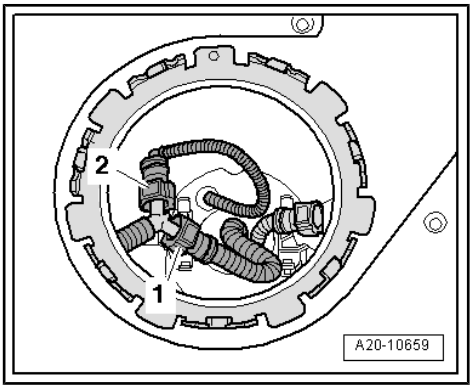
– Working through left fuel tank opening, press release tab and disconnect connecting pipe -1-.
– Pull out connecting pipe from right fuel tank opening.

Note

Disregard -items 2, 3-.

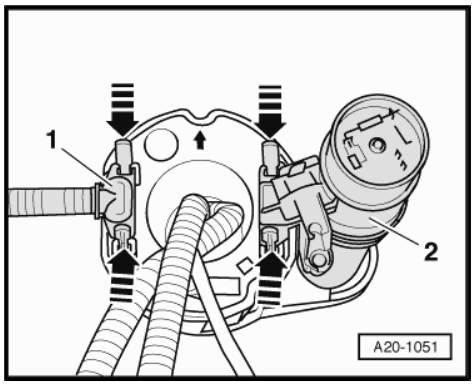


– Working through right fuel tank opening, press release tabs and disconnect supply line -1- going to suction-jet pump (left-side) and supply line -2- going to fuel delivery unit (right-side).



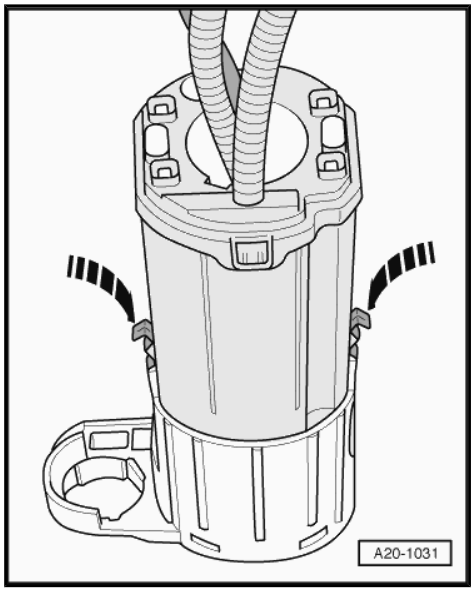
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– Working through right fuel tank opening, press release tabs -arrows- and detach fuel supply line -1- and fuel gauge sender 4 - G393- -item 2-.
– Move fuel gauge sender 4 - G393- to right side.



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– Press down both retaining clips on retainer for fuel delivery unit -arrows-.
– Remove fuel delivery unit.



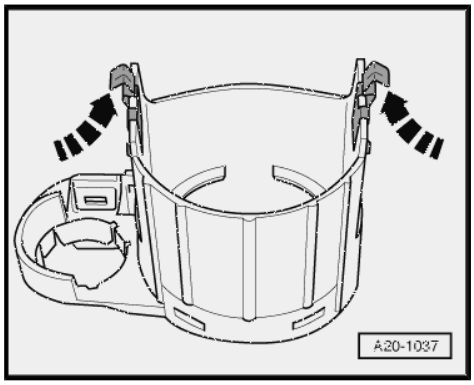
Note

Keep in mind that the fuel delivery unit still contains fuel.

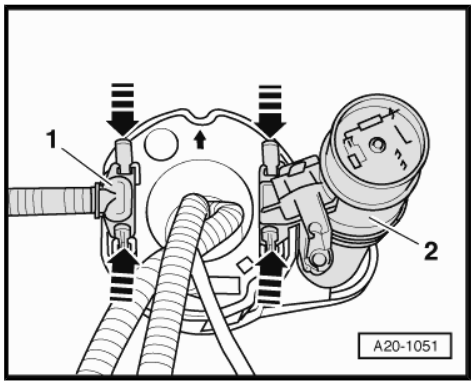
Installing

- Tightening torque ⇒ page 79

– Pull both retaining clips on retainer upwards -arrows- so that they engage audibly before installing the fuel delivery unit.
– Then press fuel delivery unit carefully into retainer so that it engages audibly.

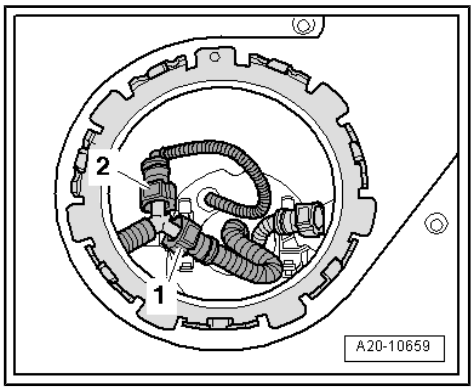


– Fit fuel supply line -1- and fuel gauge sender 4 - G393- -item 2- so that they engage audibly on fuel delivery unit (right-side).

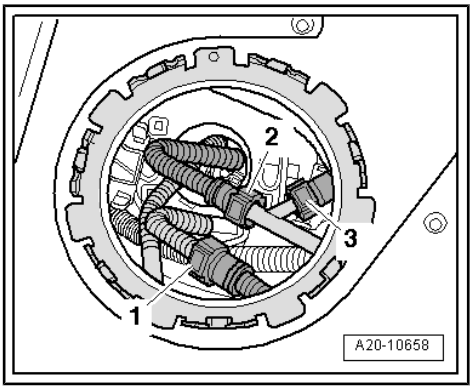


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– Working through right fuel tank opening, fit supply line -1- going to suction-jet pump (left-side) and supply line -2- going to fuel delivery unit (right-side) so that they engage audibly.



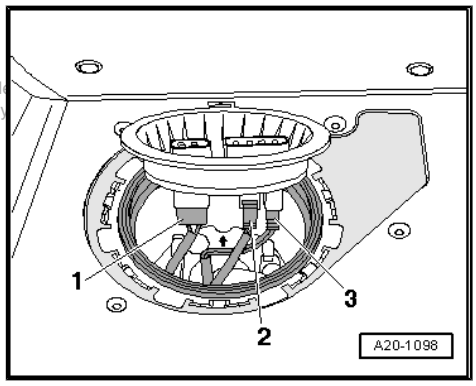
– Fit connecting pipe -1- through left opening on fuel tank so that it engages audibly.



– Connect electrical connectors -1 ... 3- on underside of flange (left-side).

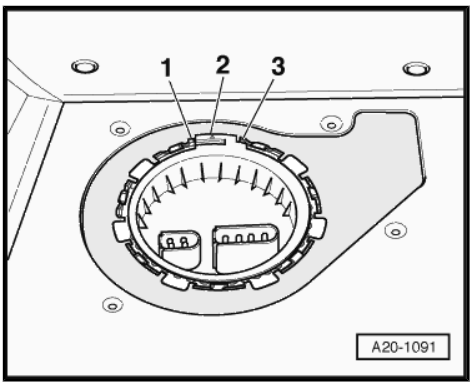
– Install new seal for flange (seal must be installed dry).

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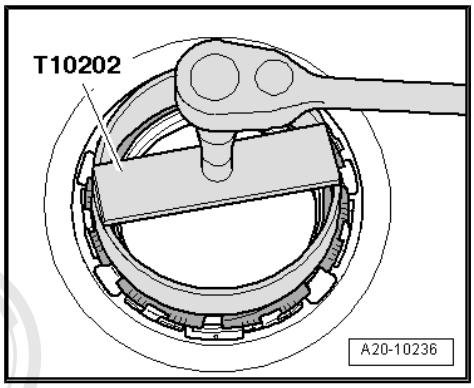
– Fit flange into fuel tank; note correct installation position:

• Lug -2- on flange must be between tabs -1- and -3- on fuel tank.

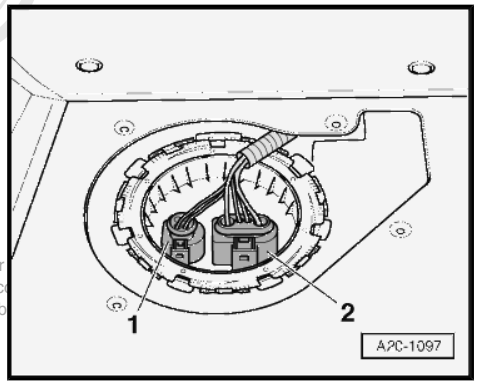


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– Tighten locking ring.

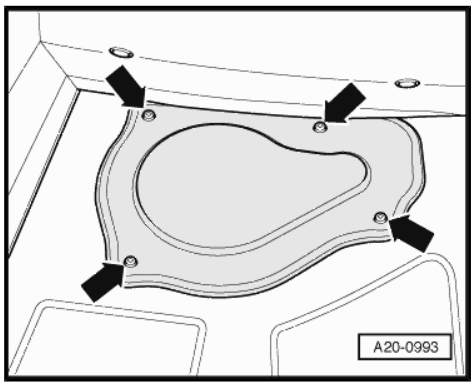


– Attach electrical connectors -1- and -2- on flange (left-side).

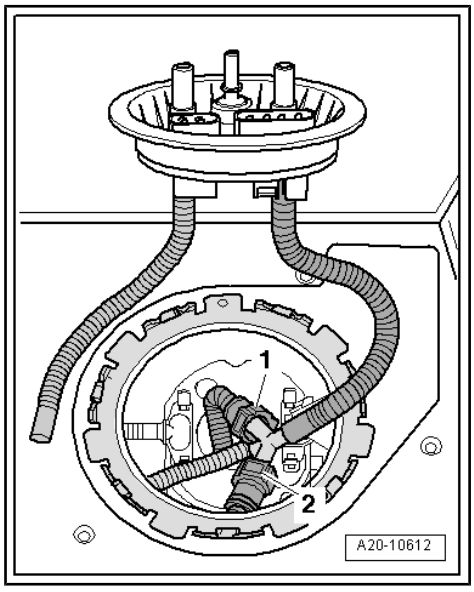


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– Secure cover for flange (left-side) -arrows-.



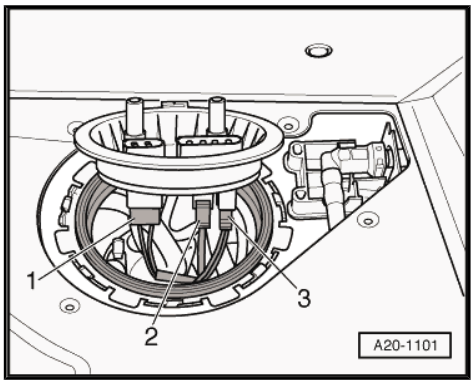
– Working through right fuel tank opening, fit fuel lines -1- and -2- going to fuel delivery units so that they engage audibly.



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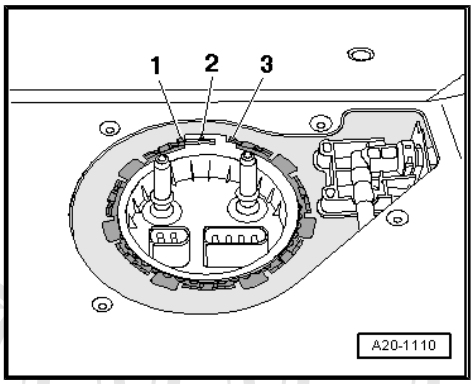
– Connect electrical connectors -1 ... 3- on underside of flange (right-side).

– Install new seal for flange (seal must be installed dry).

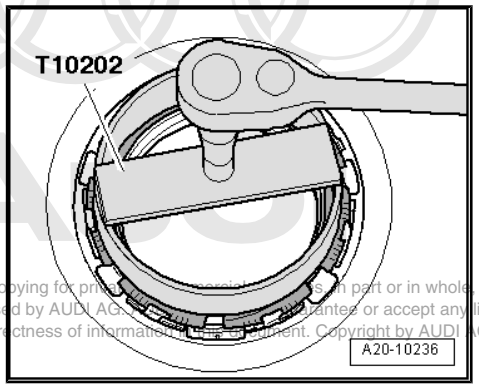


– Fit flange into fuel tank; note correct installation position:

• Lug -2- on flange must be between tabs -1- and -3- on fuel tank.



– Tighten locking ring.

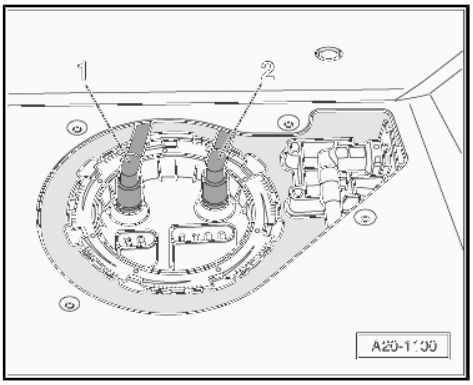


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– Install fuel supply line -2- and fuel return line -1- (as marked) so that they engage audibly.

Vehicles with auxiliary heater:

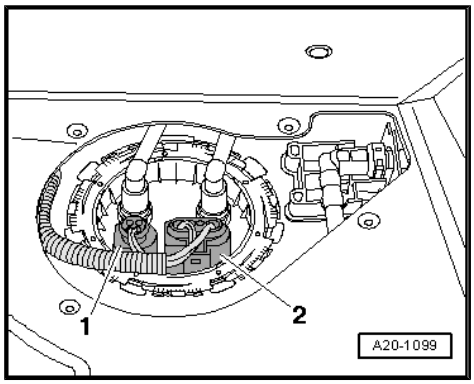
– Also fit fuel supply line going to auxiliary heater so that it engages audibly.



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All vehicles (continued):

– Attach electrical connectors -1- and -2- on flange (right-side).



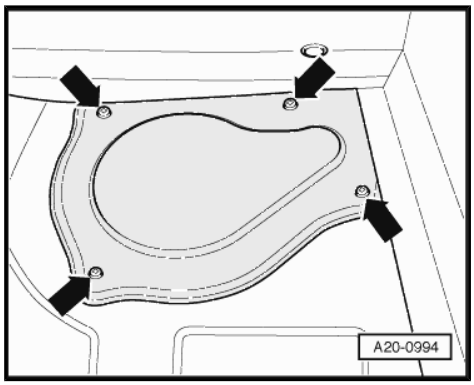
– Secure cover for flange (right-side) -arrows-.

– Connect battery. Observe notes on procedures required after connecting battery ⇒ Electrical system; Rep. gr. 27 .

– Put at least 5 litres of fuel into tank after installing

Vehicles with auxiliary heater:

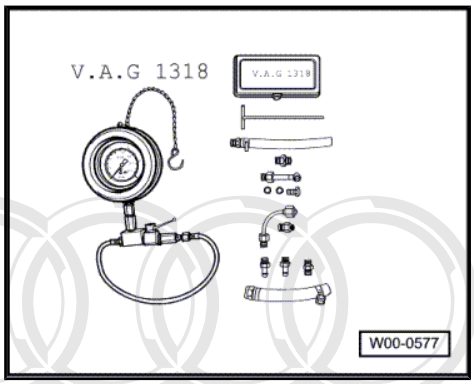
– Let auxiliary heater run with full load for 10 minutes to bleed fuel supply line going to metering pump.



5.7 Checking delivery rate of fuel pumps - vehicles with 6-cylinder engine

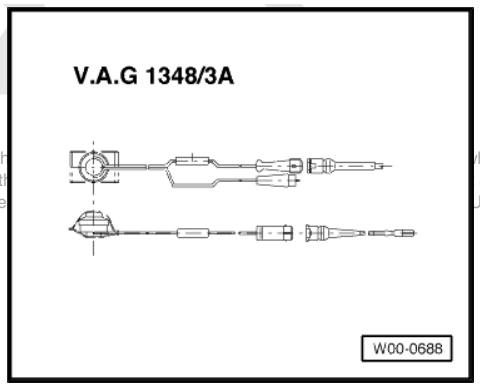
Special tools and workshop equipment required

♦ K-Jetronic pressure tester - V.A.G 1318-



♦ Adapter set - V.A.G 1318/10-12-

♦ Remote control - V.A.G 1348/3A- for V.A.G 1348 with adapter cable -V.A.G 1348/3-3-



♦ Fuel-resistant measuring container

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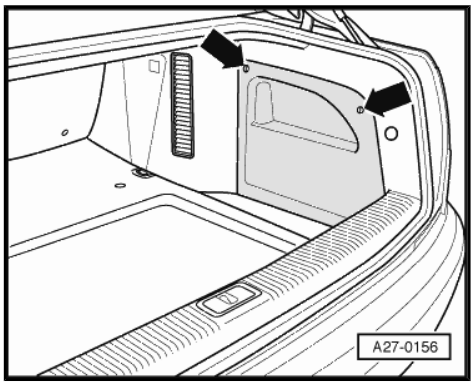
Procedure

– Observe test conditions ⇒ page 3 .

WARNING

Observe safety precautions ⇒ page 1 .

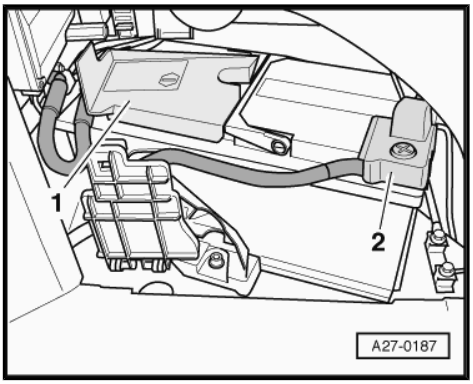
– Remove luggage compartment side trim cover (right-side) -arrows-.



– Remove cover -2- over battery.

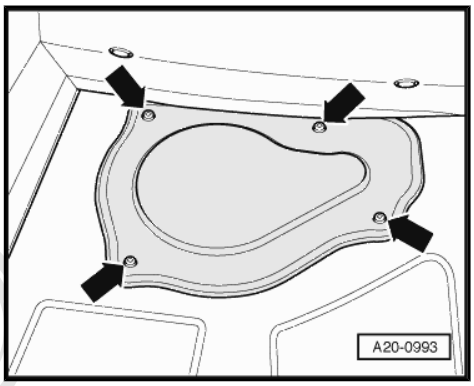
Note

Disregard -item 1-.



– Remove luggage compartment floor covering.

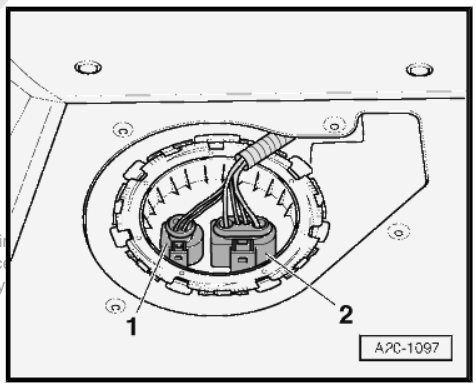
– Detach cover for flange (left-side) -arrows-.



– Unplug electrical connector -2- on flange (left-side).

Note

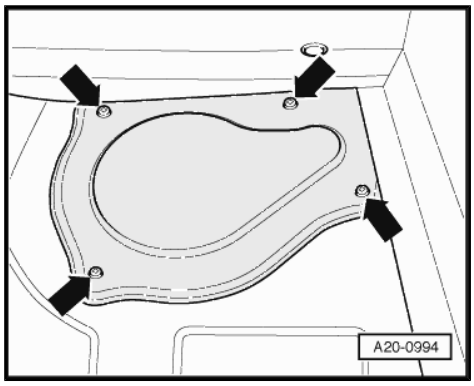
Disregard -item 1-.



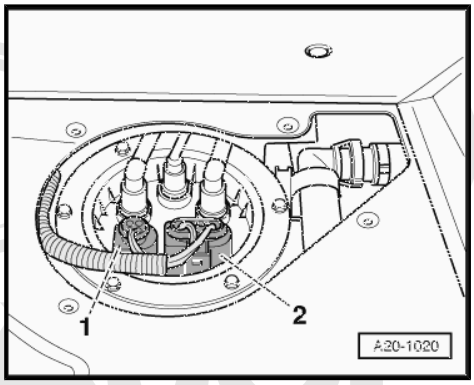
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– Unscrew cover for flange (right-side) -arrows-.



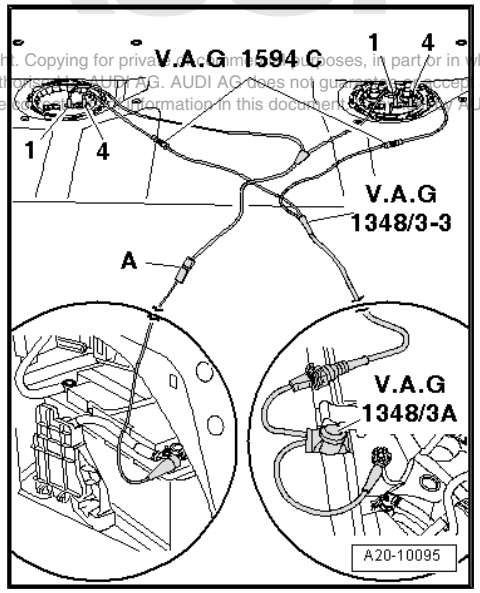
– Unplug electrical connector -2- on flange (right-side).



Note

Disregard -item 1-.

– Connect remote control - V.A.G 1348/3A- for V.A.G 1348 with adapter cable -V.A.G 1348/3-3- to contact -4- (earth) of fuel delivery unit (left-side) and fuel delivery unit (right-side) using test leads from auxiliary measuring set - V.A.G 1594C-.
– Move switch of remote control - V.A.G 1348/3A- for V.A.G 1348 to front of engine compartment.
– Connect crocodile clip to earth point in engine compartment.
– Connect contact -1- (positive) of fuel delivery unit (left-side) and fuel delivery unit (right-side) to battery “+” via an improvised test lead. For safety reasons an in-line fuse -A- (10 A) must be connected into the lead.
– Remove filler cap from fuel filler neck.

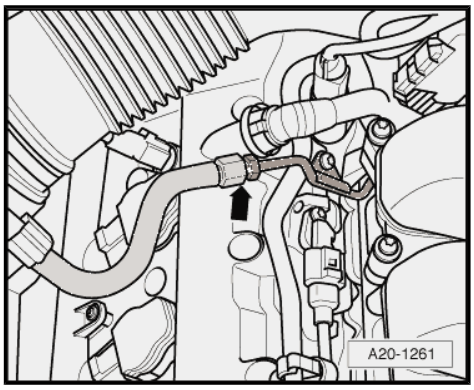


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WARNING

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



Caution

Rules for cleanliness when working on the injection system *⇒ page 3* *.*

– Disconnect fuel line -arrow-.

– Connect K-Jetronic pressure tester - V.A.G 1318- with adapters - V.A.G 1318/11- and -V.A.G 1318/12- to fuel line.

– Fit auxiliary hose -arrow- onto pressure tester and hold it in a measuring container.

– Open cut-off valve on pressure tester.

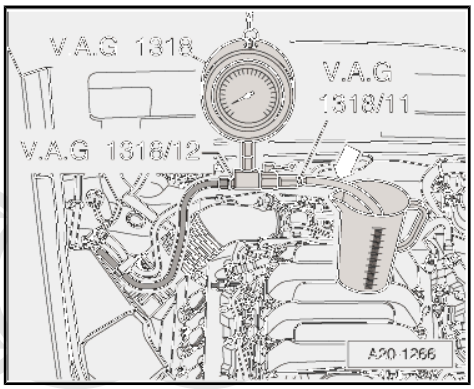
• Lever points in direction of flow.

– Build up pressure in fuel system by pressing the remote control and slowly closing the cut-off valve on the pressure tester.

• Specification: 4 bar

– From this point on do not move position of cut-off valve.

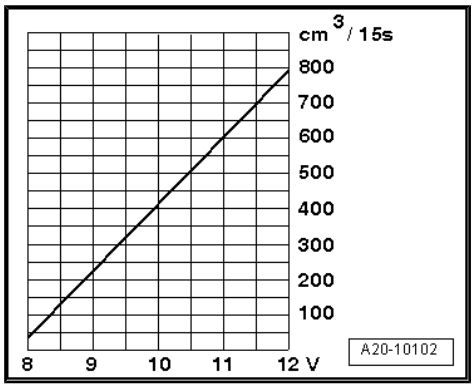
– Empty the measuring container.



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– Press remote control button for 15 seconds.
– Compare amount of fuel delivered with minimum delivery shown in diagram (cm^3/15 sec.).



Note

Voltage at fuel pump with engine stationary and pump running is approx. 2 volts less than battery voltage.

If minimum delivery rate is not reached, check for the following causes:

- Fuel lines have been crushed.
- Fuel filter is blocked.
- Fuel pump is defective.

Note

As there is hardly any difference in the fuel delivery rate if only one of the two fuel pumps is working (because of the hose connections inside the tank), it is difficult to diagnose a defective pump by just measuring the delivery rate.

In this case proceed as follows:

– Unplug the electrical auxiliary lead at the fuel delivery units (one at a time).
– Measure delivery rate of fuel delivery unit located on the opposite side.

If the delivery rate of the fuel delivery unit which has been measured separately is considerably below specification:

– Renew the relevant fuel delivery unit.

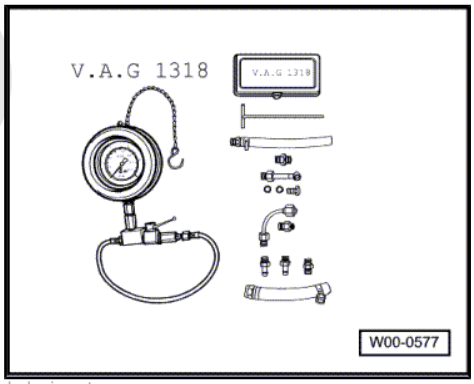
Installation is carried out in the reverse order; note the following:

– Secure fuel line to engine ⇒ Rep. gr. 24 .

5.8 Checking delivery rate of fuel pumps - vehicles with 8-cylinder engine

Special tools and workshop equipment required

- K-Jetronic pressure tester - V.A.G 1318-

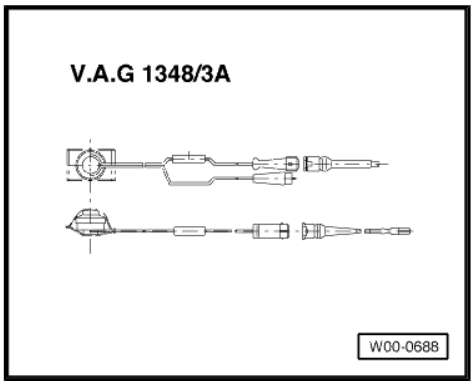


- Adapter set - V.A.G 1318/10-12-

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- Remote control - V.A.G 1348/3A- for V.A.G 1348 with adapter cable -V.A.G 1348/3-3-



- Fuel-resistant measuring container

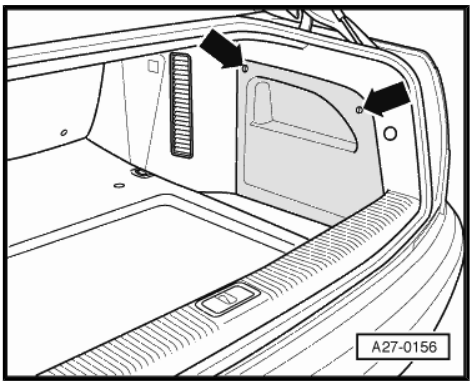
Procedure

– Observe test conditions ⇒ page 3 .

WARNING

Observe safety precautions ⇒ page 1 .

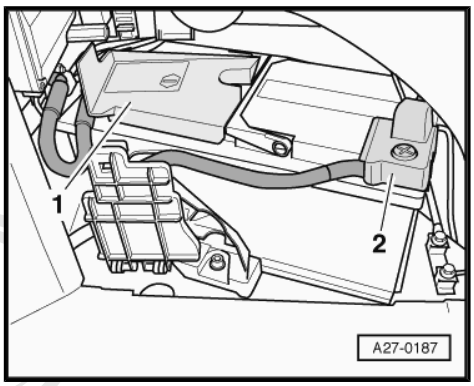
– Remove luggage compartment side trim cover (right-side) -arrows-.



– Remove cover -2- over battery.

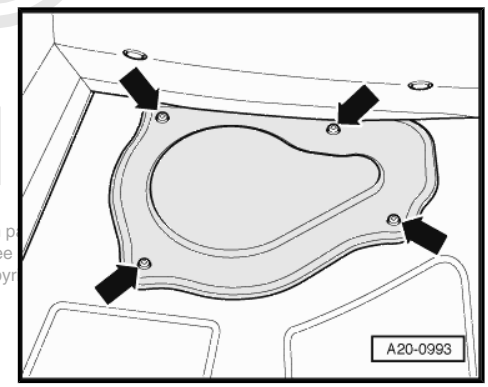
Note

Disregard -item 1-.



– Remove luggage compartment floor covering.

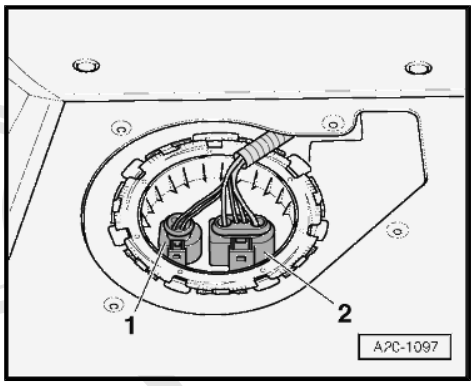
– Detach cover for flange (left-side) -arrows-.



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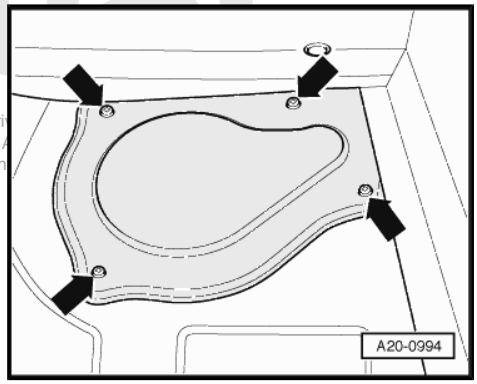
– Unplug electrical connector -2- on flange (left-side).



Note

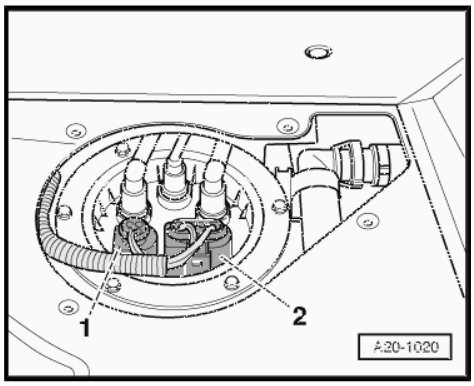
Disregard -item 1-.

– Unscrew cover for flange (right-side) -arrows-.



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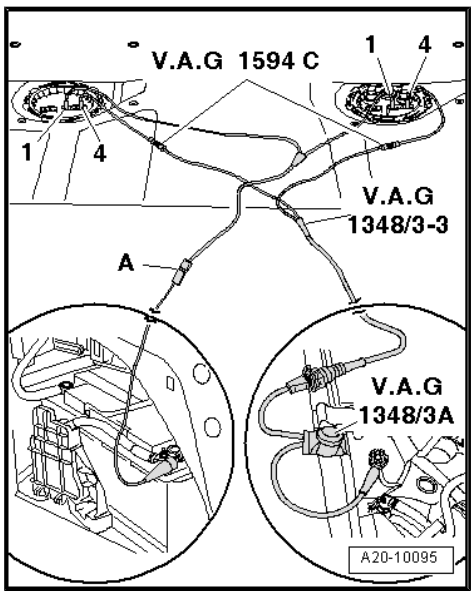
– Unplug electrical connector -2- on flange (right-side).



Note

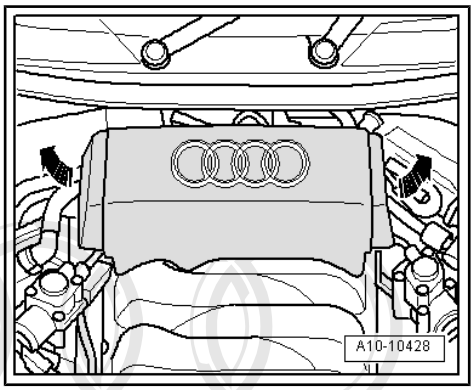
Disregard -item 1-.

– Connect remote control - V.A.G 1348/3A- for V.A.G 1348 with adapter cable -V.A.G 1348/3-3- to contact -4- (earth) of fuel delivery unit (left-side) and fuel delivery unit (right-side) using test leads from auxiliary measuring set - V.A.G 1594C- .
– Move switch of remote control - V.A.G 1348/3A- for V.A.G 1348 to front of engine compartment.
– Connect crocodile clip to earth point in engine compartment.
– Connect contact -1- (positive) of fuel delivery unit (left-side) and fuel delivery unit (right-side) to battery “+” via an improvised test lead. For safety reasons an in-line fuse -A- (10 A) must be connected into the lead.
– Remove filler cap from fuel filler neck.



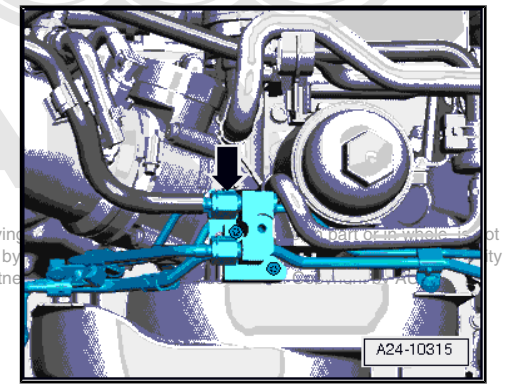
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– Pull off engine cover panel (rear) -arrows-.



WARNING

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



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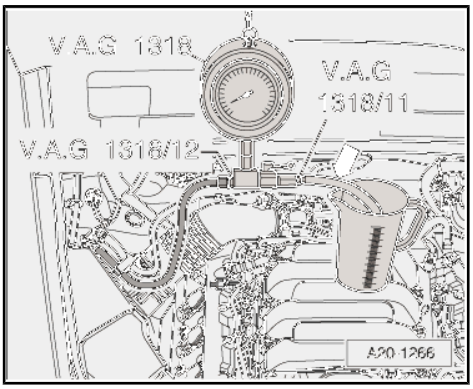
– Disconnect fuel supply line -arrow- at connecting piece.

Caution

Rules for cleanliness when working on the injection system *⇒ page 3* *.*

– Disconnect fuel line -arrow-.

– Connect K-Jetronic pressure tester - V.A.G 1318- with adapters - V.A.G 1318/11- and -V.A.G 1318/12- to fuel line.



– Fit auxiliary hose -arrow- onto pressure tester and hold it in a measuring container.

– Open cut-off valve on pressure tester. Lever must point in direction of flow.

– Build up pressure in fuel system by pressing the remote control button and slowly closing the cut-off valve on the pressure tester.

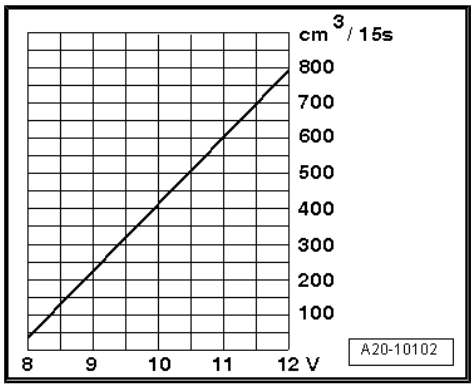
• Specification: 4 bar

– From this point on do not move position of cut-off valve.

– Empty the measuring container.

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– Press remote control button for 15 seconds.
– Compare amount of fuel delivered with minimum delivery shown in diagram (cm^3/15 sec.).



Note

Voltage at fuel pump with engine stationary and pump running is approx. 2 volts less than battery voltage.

If minimum delivery rate is not reached, check for the following causes:

- Fuel lines have been crushed.
- Fuel filter is blocked.
- Fuel pump is defective.

Note

As there is hardly any difference in the fuel delivery rate if only one of the two fuel pumps is working (because of the hose connections inside the tank), it is difficult to diagnose a defective pump by just measuring the delivery rate.

In this case proceed as follows:

– Unplug the electrical auxiliary lead at the fuel delivery units (one at a time).
– Measure delivery rate of fuel delivery unit located on the opposite side.

If the delivery rate of the fuel delivery unit which has been measured separately is considerably below specification:

– Renew the relevant fuel delivery unit.

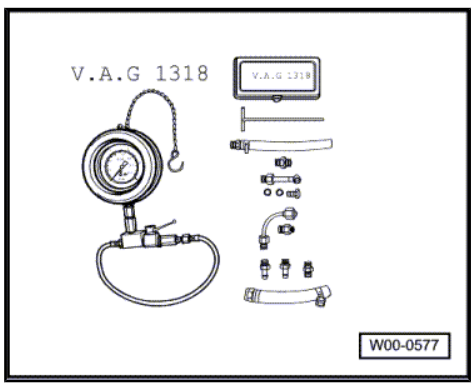
Installation is carried out in the reverse order; note the following:

– Secure fuel line to engine ⇒ Rep. gr. 24 .

5.9 Checking delivery rate of fuel pumps - vehicles with 10-cylinder engine (Audi S8)

Special tools and workshop equipment required

- K-Jetronic pressure tester - V.A.G 1318-

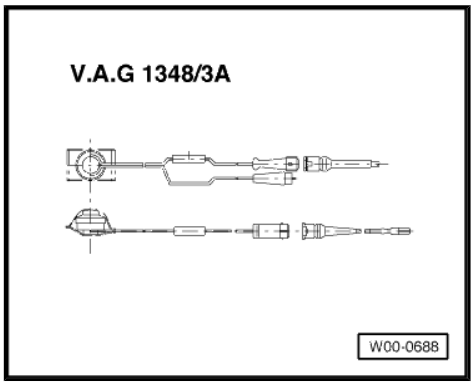


- Adapter set - V.A.G 1318/10-12-

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- Remote control - V.A.G 1348/3A- for V.A.G 1348 with adapter cable -V.A.G 1348/3-3-



- Fuel-resistant measuring container

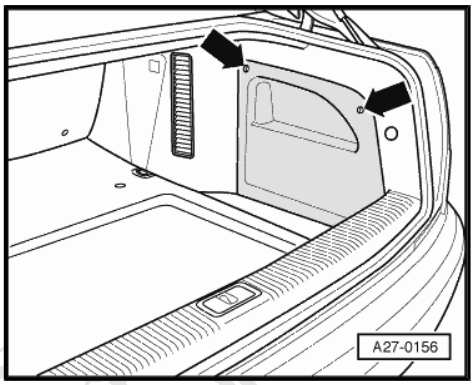
Procedure

– Observe test conditions ⇒ page 3 .

WARNING

Observe safety precautions ⇒ page 1 .

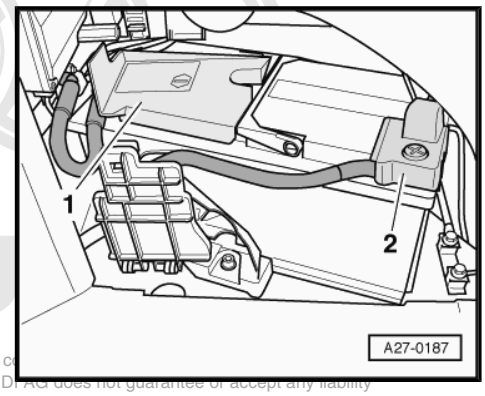
– Remove luggage compartment side trim cover (right-side) -arrows-.



– Remove cover -2- over battery.

Note

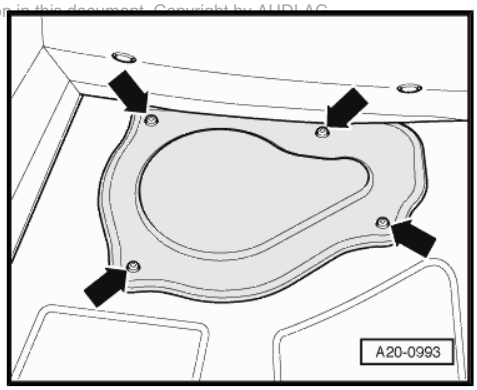
Disregard -item 1-.



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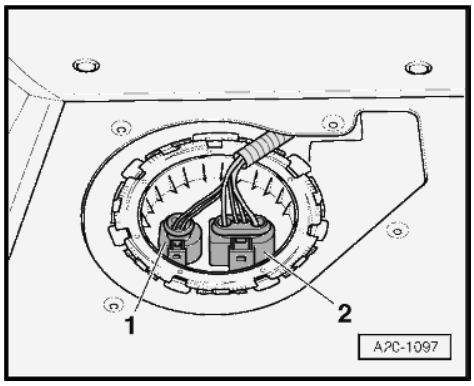
– Remove luggage compartment floor covering.

– Detach cover for flange (left-side) -arrows-.



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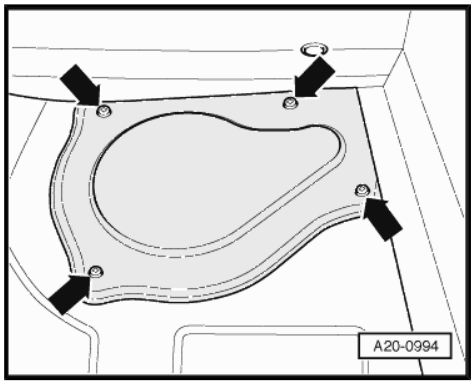
– Unplug electrical connector -2- on flange (left-side).



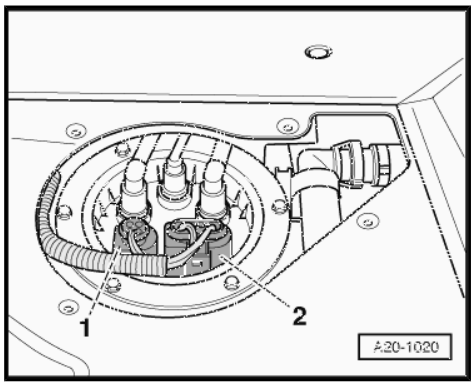
Note

Disregard -item 1-.

– Unscrew cover for flange (right-side) -arrows-.



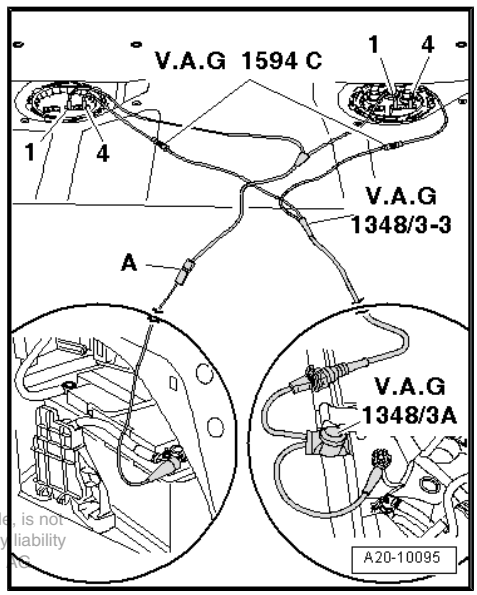
– Unplug electrical connector -2- on flange (right-side).



Note

Disregard -item 1-.

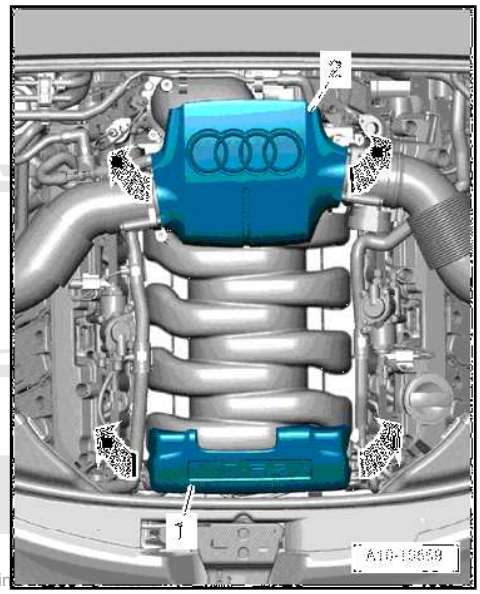
– Connect remote control - V.A.G 1348/3A- for V.A.G 1348 with adapter cable -V.A.G 1348/3-3- to contact -4- (earth) of fuel delivery unit (left-side) and fuel delivery unit (right-side) using test leads from auxiliary measuring set - V.A.G 1594C- .
– Move switch of remote control - V.A.G 1348/3A- for V.A.G 1348 to front of engine compartment.
– Connect crocodile clip to earth point in engine compartment.
– Connect contact -1- (positive) of fuel delivery unit (left-side) and fuel delivery unit (right-side) to battery “+” via an improvised test lead. For safety reasons an in-line fuse -A- (10 A) must be connected into the lead.
– Remove filler cap from fuel filler neck.



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– Pull off engine cover panel (rear) -2- -arrows-.



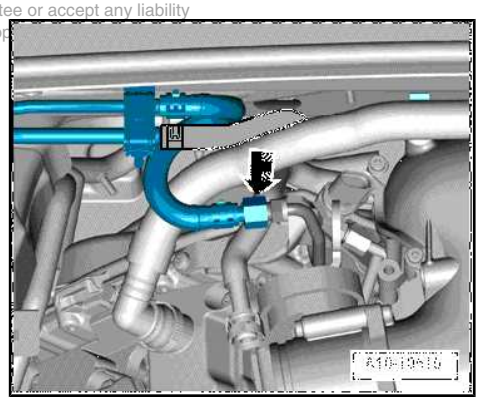
Note

Disregard -item 1-.

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WARNING

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



Caution

Rules for cleanliness when working on the injection system ***⇒ page 3*** ***.***

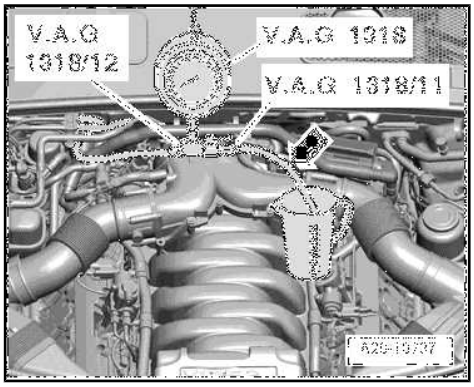
– Disconnect fuel pipe -arrow- at fuel rail.

– Connect K-Jetronic pressure tester - V.A.G 1318- with adapters - V.A.G 1318/11- and -V.A.G 1318/12- to fuel line.

– Fit auxiliary hose -arrow- onto pressure tester and hold it in a measuring container.

– Open cut-off valve on pressure tester. Lever must point in direction of flow.

– Build up pressure in fuel system by pressing the remote control button and slowly closing the cut-off valve on the pressure tester.



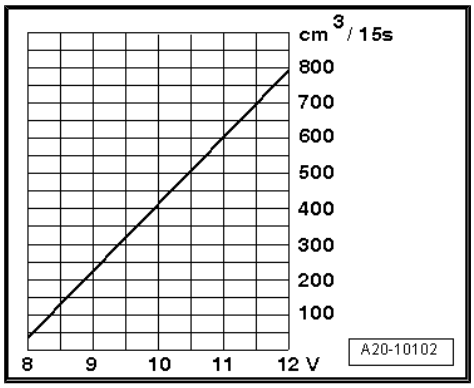
- Specification: 4 bar

– From this point on do not move position of cut-off valve.

– Empty the measuring container.

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– Press remote control button for 15 seconds.
– Compare amount of fuel delivered with minimum delivery shown in diagram (cm^3/15 sec.).



Note

Voltage at fuel pump with engine stationary and pump running is approx. 2 volts less than battery voltage.

If minimum delivery rate is not reached, check for the following causes:

- Fuel lines have been crushed.
- Fuel filter is blocked.
- Fuel pump is defective.

Note

As there is hardly any difference in the fuel delivery rate if only one of the two fuel pumps is working (because of the hose connections inside the tank), it is difficult to diagnose a defective pump by just measuring the delivery rate.

In this case proceed as follows:

– Unplug the electrical auxiliary lead at the fuel delivery units (one at a time).
– Measure delivery rate of fuel delivery unit located on the opposite side.

If the delivery rate of the fuel delivery unit which has been measured separately is considerably below specification:

– Renew the relevant fuel delivery unit.

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

– Secure fuel line to fuel rail ⇒ Rep. gr. 24 .

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5.10 Fuel pump control unit - J538-

Check fuel pump control unit - J538- in “Guided Fault Finding” ⇒ Vehicle diagnostic tester.

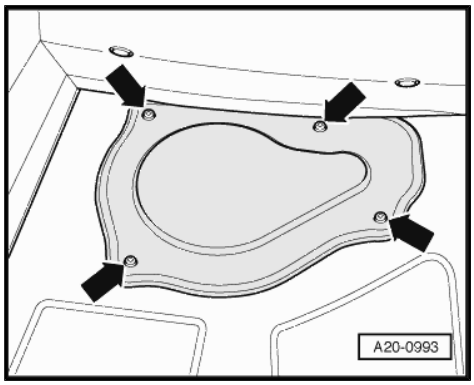
5.11 Removing and installing fuel pump control unit - J538-

Removing

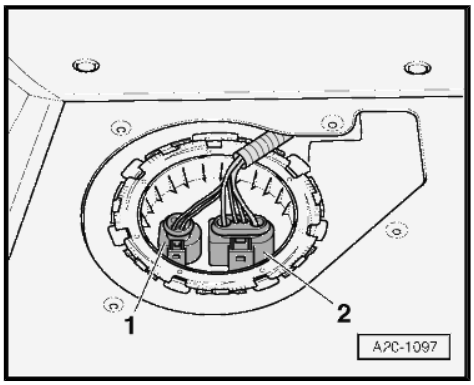
Observe safety precautions ⇒ page 1 .

Observe rules for cleanliness ⇒ page 3 .

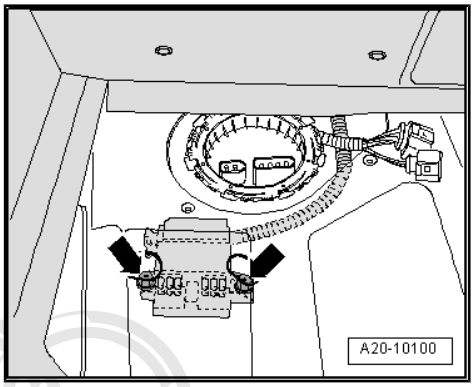
– Switch off ignition and remove ignition key.
– Remove luggage compartment floor covering.
– Detach cover for flange (left-side) -arrows-.



– Unplug electrical connectors -1- and -2- on flange (left-side).



– Remove plugs in luggage compartment floor and unscrew nuts -arrows-.
– Slightly lift floor panel in the area of flange by hand and remove fuel pump control unit - J538- between floor panel and fuel tank flange.
– Unplug electrical connector at control unit.



Installing

Install in reverse order.

Tightening torque

Component	Nm
Fuel pump control unit - J538- to fuel tank	1.6

5.12 Suction-jet pumps

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1 - Suction-jet pump (left-side)

2 - Fuel delivery unit (left-side)

3 - Expansion tank

4 - Fuel delivery unit (right-side)

5 - Suction-jet pump (right-side)

6 - Supply line for suction-jet pump

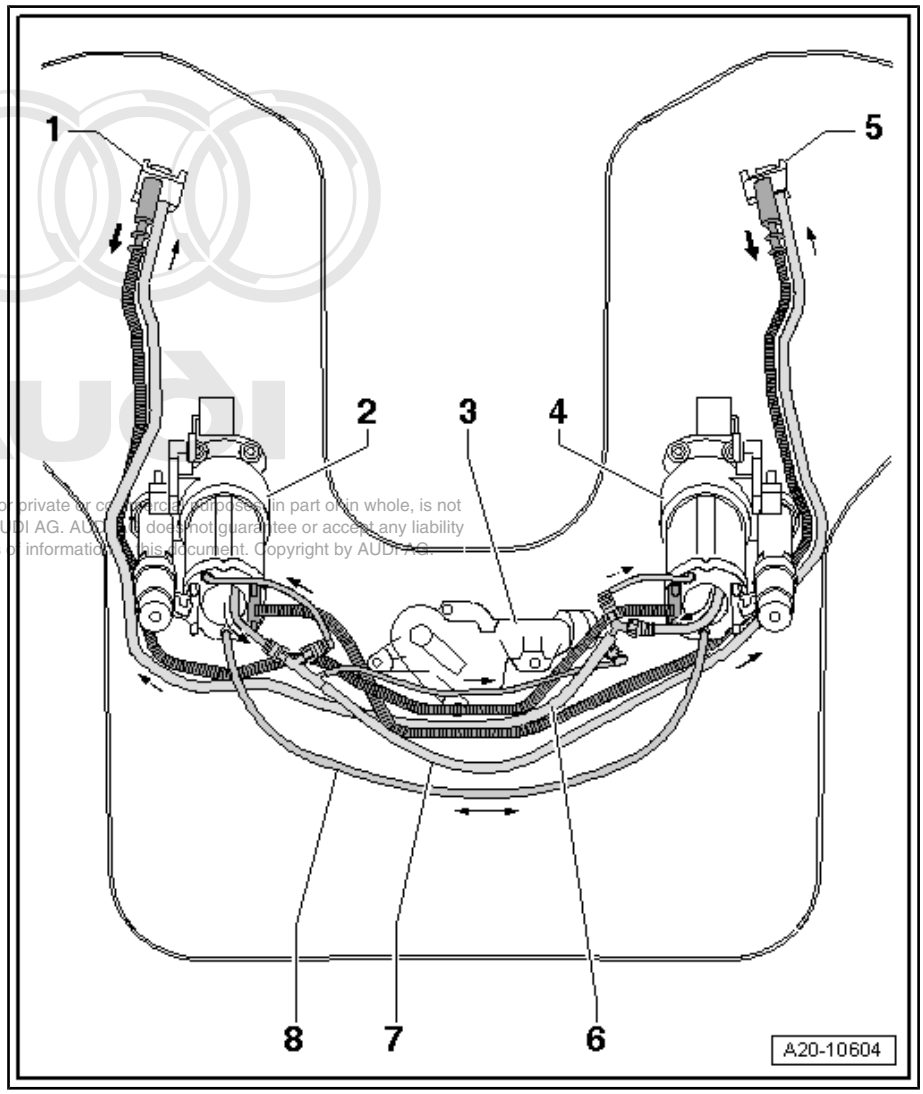
- From fuel delivery unit (right-side) to suction-jet pump (left-side)

7 - Supply line for suction-jet pump

- From fuel delivery unit (left-side) to suction-jet pump (right-side)

8 - Balance pipe

- Between fuel delivery units



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Description of operation

To ensure a reliable fuel supply in all situations, the fuel pumps must never draw in air, even under extreme driving conditions such as very sharp bends or under heavy braking. This may happen when the fuel sloshes into one of the corners of a partially filled fuel tank.

- For this reason, the fuel delivery units -item 2- and -item 4- incorporate a so-called baffle housing, in which the fuel pumps are fitted, as well as the fuel pumps themselves. The baffle housing is a container permanently filled with fuel, so that the fuel pumps are surrounded with fuel regardless of the fuel level in the tank.
- Consequently, proper filling of the baffle housings is essential for trouble-free operation of the fuel pumps. This is the purpose of the "suction-jet pumps".
- The suction-jet pumps operate according to the principle of fluid entrainment: a stream of fuel from the primary stage of the fuel pumps -2- (left-side) and -4- (right-side) is fed via the supply lines -6- and -7- to the suction-jet pumps -1- and -5-, where it is passed through a nozzle and thus accelerated. The accelerated stream of fuel draws off the surrounding fuel and delivers it to the baffle housings in the fuel delivery units. The suction jet pump (right-side) -item 5- delivers the fuel into the baffle housing (left-side); the suction jet pump (left-side) -item 1- delivers the fuel into the baffle housing (right-side).
- In addition, the stream of fuel from the fuel pumps is supplied to the two smaller suction-jet pumps in the baffle housings via two Y-connectors. Working through the balance pipe -item 8-, these ensure that the baffle housings in both fuel delivery units are filled evenly.
- Another small suction-jet pump is located in the expansion tank -item 3- and delivers fuel from there back to the fuel tank.

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5.13 Removing and installing suction-jet pump (left-side)

Removing

Observe safety precautions ⇒ page 1 .

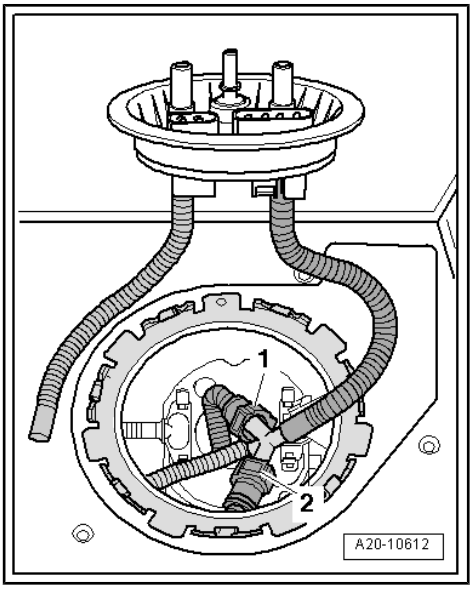
Observe rules for cleanliness ⇒ page 3 .

– Remove the fuel delivery unit (left-side) ⇒ page 26 .

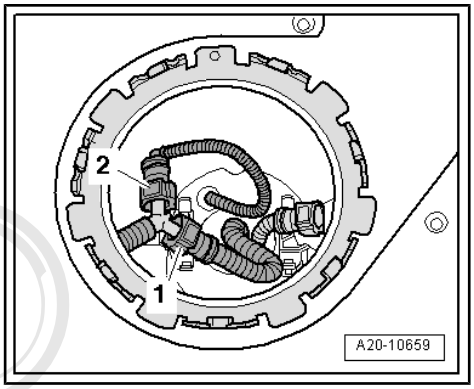
– Remove fuel gauge sender 3 - G237- (tubular sender, left-side) from fuel tank.

– Working through right fuel tank opening, press release tab and disconnect fuel supply line -1-.

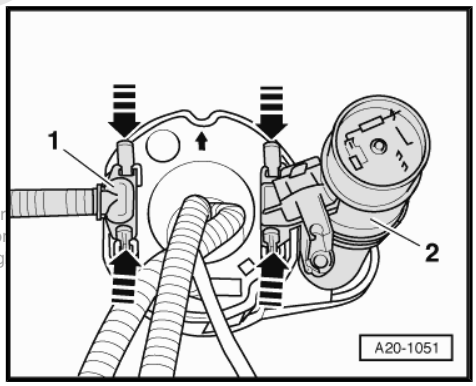
– Detach flange.



– Working through right fuel tank opening, press release tabs and disconnect supply lines -1- and -2- for suction-jet pumps from Y-connector.



– Working through right fuel tank opening, press release tabs -arrows- and detach fuel supply line -1-.



Note

Disregard -item 2-.

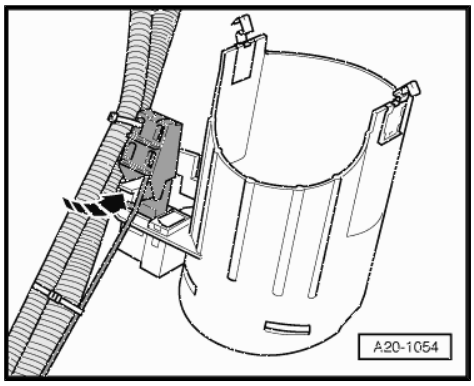
– Pull out disconnected fuel supply line through left fuel tank opening.

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– Working through left fuel tank opening, press release tab -arrow- and detach retaining clip for suction jet lines from retainer.

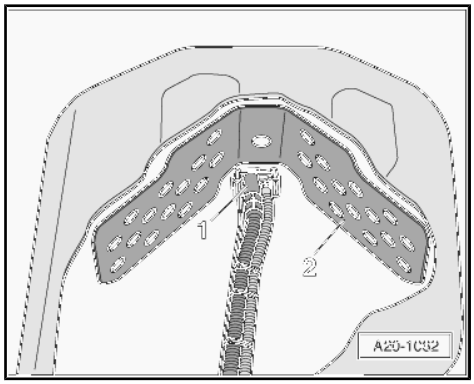
– Pull out suction-jet pump (left-side) together with lines through left fuel tank opening.



Installing

– Version with baffle plate: insert suction-jet pump (left-side) -1- so it fits in recess in baffle plate -2- at front of fuel tank, as shown in illustration.

– Then press retaining clip for suction-jet pump into retainer so it engages audibly.

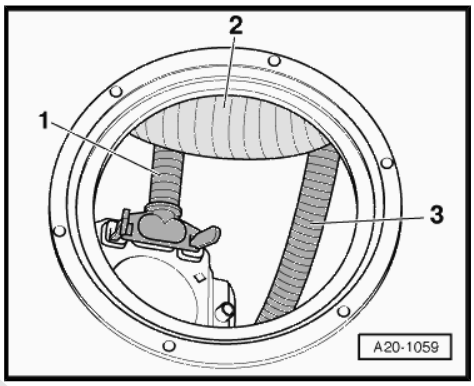


– Push fuel supply line through left fuel tank opening into right fuel tank chamber. Note routing:

• The fuel supply line -3- must be routed below the fuel filler pipe -2- at the left fuel tank opening.

Note

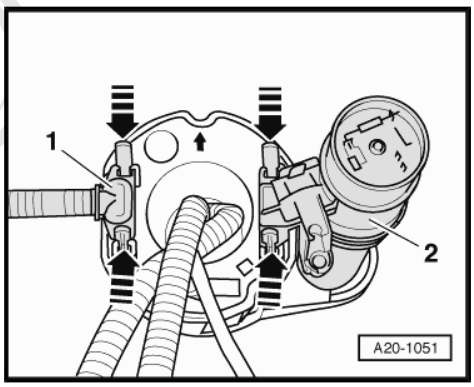
Disregard -item 1-.



– Fit fuel supply line -1- onto fuel delivery unit (right-side) so that it engages audibly.

Note

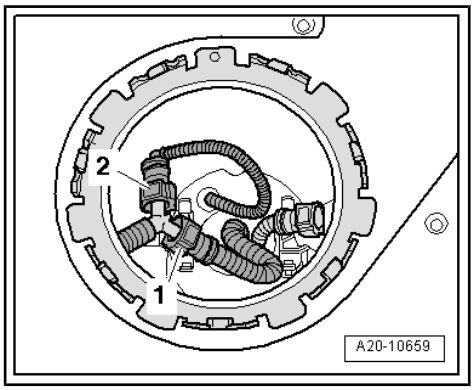
Disregard -item 2-.



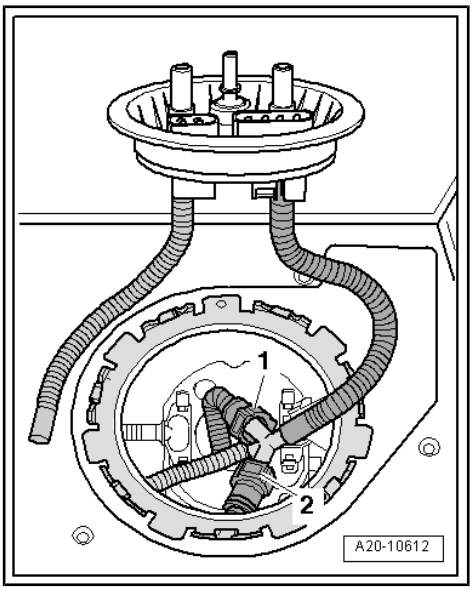
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– Working through right fuel tank opening, fit supply lines -1- and -2- for suction-jet pumps onto Y-connector so that they engage audibly.



– Working through right fuel tank opening, fit fuel supply line -1- so that it engages audibly.
– Insert fuel gauge sender 3 - G237- into fuel tank.
– Install fuel delivery unit (left-side) ⇒ page 31 .



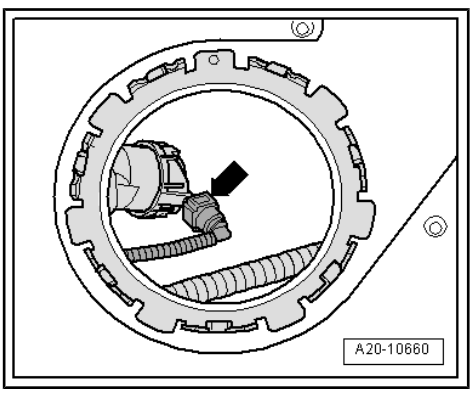
5.14 Removing and installing suction-jet pump (right-side)

Removing

Observe safety precautions ⇒ page 1 .

Observe rules for cleanliness ⇒ page 3 .

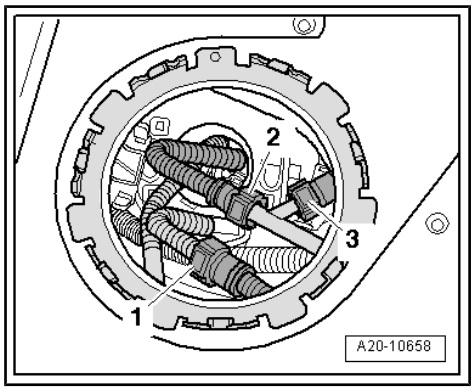
– Remove fuel delivery unit (right-side) ⇒ page 42 .
– Remove fuel gauge sender 4 - G393- (tubular sender, right-side) from fuel tank.
– Working through right fuel tank opening, press release tab and disconnect supply line for suction-jet pump -arrow- from expansion tank.



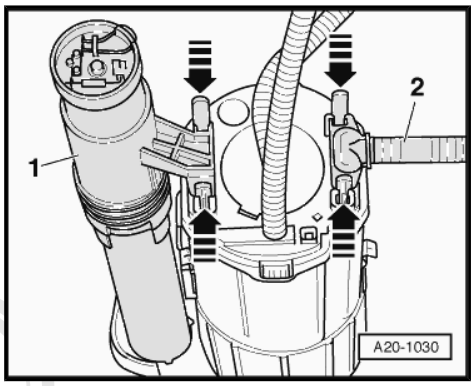
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– Working through left fuel tank opening, press release tabs and disconnect supply lines -2- and -3- for suction-jet pumps from Y-connector.



– Working through left fuel tank opening, press release tabs -arrows- and detach fuel supply line -2-.



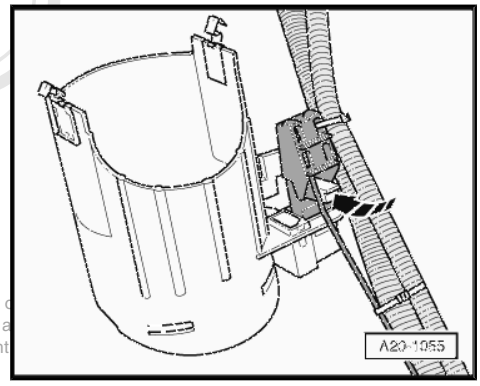
Note

Disregard -item 1-.

– Pull out disconnected fuel supply line through right fuel tank opening.

– Working through right fuel tank opening, press release tab -arrow- and detach retaining clip for suction jet lines from retainer.

– Pull suction-jet pump (right-side) together with lines out of right fuel tank opening.

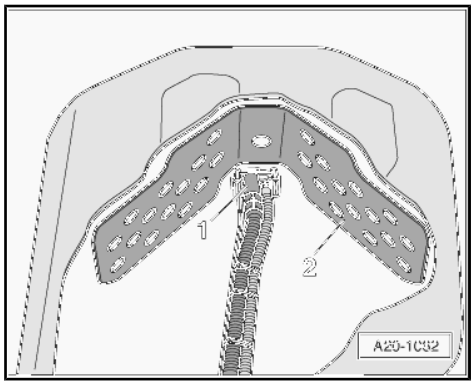


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Installing

– Version with baffle plate: insert suction-jet pump (right-side) -1- so it fits in recess in baffle plate -2- at front of fuel tank, as shown in illustration.

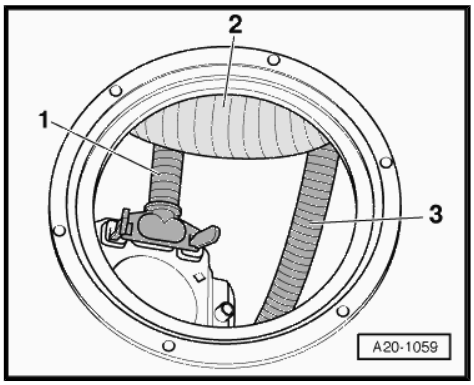
– Then press retaining clip for suction-jet pump into retainer so it engages audibly.



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– Push fuel supply line through right fuel tank opening into left fuel tank chamber. Note routing:

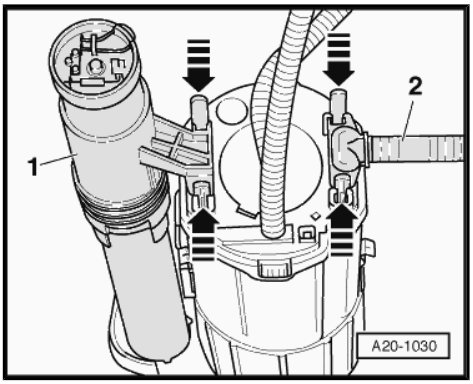
• The fuel supply line -1- must be routed below the fuel filler pipe -2- at the left fuel tank opening.



Note

Disregard -item 3-.

– Fit fuel supply line -2- onto fuel delivery unit (left-side) so that it engages audibly.

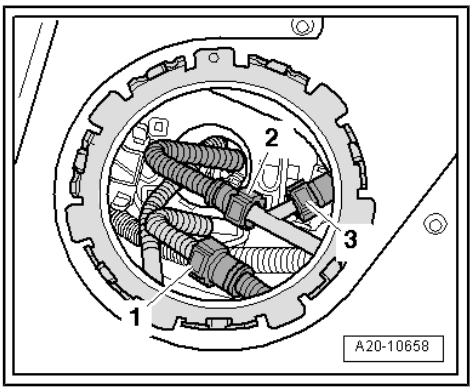


Note

Disregard -item 1-.

– Push supply line for suction-jet pump through right fuel tank opening into left fuel tank chamber.

– Working through left fuel tank opening, fit supply lines -2- and -3- for suction-jet pumps onto Y-connector so that they engage audibly.

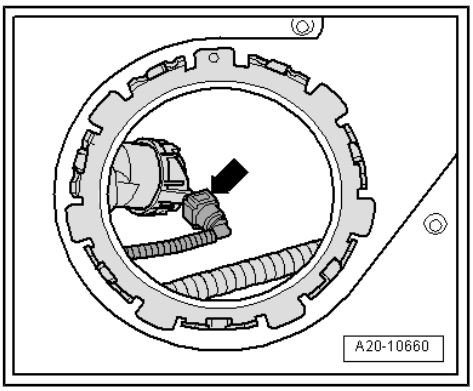


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– Working through right fuel tank opening, fit supply line for suction-jet pump -arrow- onto connection on expansion tank so that it engages audibly.

– Insert fuel gauge sender 4 - G393- into fuel tank.

– Install fuel delivery unit (right-side) ⇒ page 48 .



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6 Fuel tank with attached components - all USA vehicles

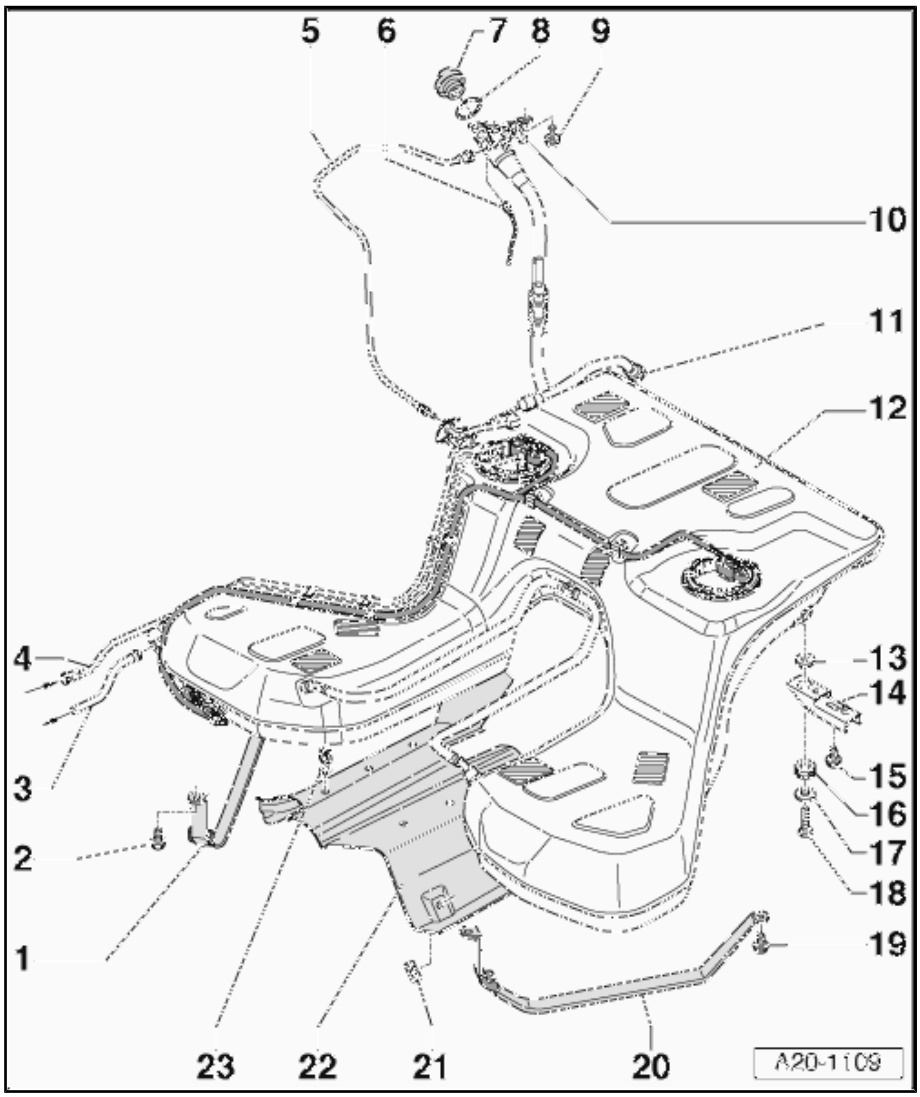
⇒ “6.1 Fuel tank with attached components - exploded view”, page 110

⇒ “6.2 Draining fuel tank”, page 112

⇒ “6.3 Removing and installing fuel tank with attached components”, page 115

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6.1 Fuel tank with attached components - exploded view



1 - Securing strap

- ❑ With spacer, installation position ⇒ page 111

2 - 22 Nm

3 - Fuel line

- ❑ From fuel filter
- ❑ To engine
- ❑ Press release tab on connection piece to disconnect

4 - Fuel return line

- ❑ From engine
- ❑ Press release tab on connection piece to disconnect
- ❑ Clip onto fuel tank

5 - Breather line

6 - Earth connection

- ❑ To eliminate electrostatic charge
- ❑ Installation position / test procedure ⇒ page 111
- ❑ Make sure that connector is securely fitted
- ❑ After installation, use an ohmmeter to check the electrical connection between the fuel filler neck and a bare metal part on the body. Specification: approx. 0 Ω

7 - Filler cap

- ❑ With solenoid for fuel tank cap switch - F314- ⇒ page 112

8 - Seal

- ❑ Renew if damaged

9 - 22 Nm

10 - Electrical connector

- ❑ For fuel tank cap switch - F314- ⇒ page 112

11 - Breather line

- ❑ To activated charcoal filter at bottom of spare wheel well on underbody

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❑ Remains on fuel tank when tank is removed

12 - Fuel tank

❑ Removing and installing ⇒ page 115

13 - Bush

14 - Fuel tank bracket

15 - 22 Nm

16 - Rubber buffer

17 - Washer

18 - 22 Nm

19 - 22 Nm

20 - Securing strap

❑ With spacer, installation position ⇒ page 111

21 - Clip

❑ For heat shield

22 - Heat shield

23 - Clip

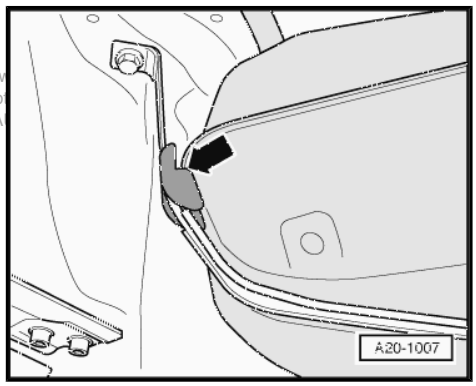
❑ For heat shield

Audi

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Installation position of spacers

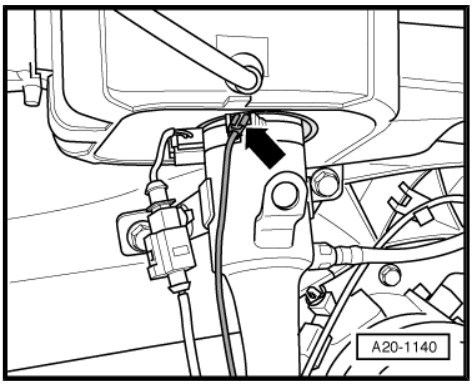
– Make sure that securing strap spacers are located directly under seam of fuel tank -arrow-.



Installation position of earth connection

– Route earth connection as shown in illustration.

– Ensure that connector for earth connection is securely fitted on metal ring on fuel filler neck -arrow-.



WARNING

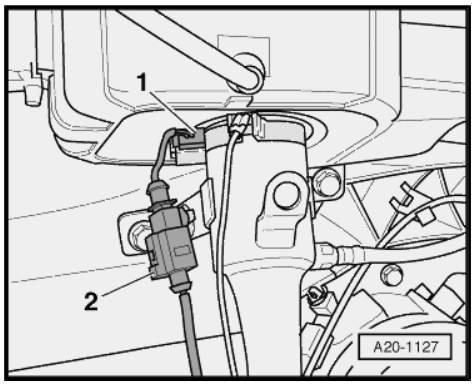
After installation, use an ohmmeter to check the electrical connection between the metal ring on the fuel filler neck and a bare metal part on the body:

- *Specification: approx. 0 Ω.*

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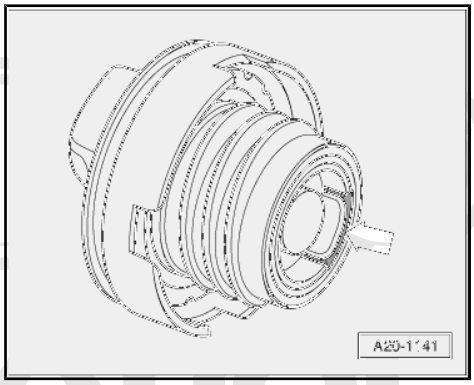
Fuel tank cap switch - F314-

– Ensure that electrical connector -2- for fuel tank cap switch - F314- -item 1- is firmly seated on fuel filler neck.



Filler cap with solenoid

– Solenoid for fuel tank cap switch - F314- -arrow-.



6.2 Draining fuel tank

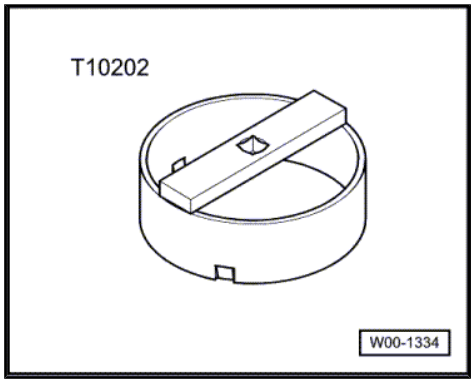
Special tools and workshop equipment required

♦ Fuel extractor - VAS 5190A-

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♦ Vehicles from approx. 11.2002: Wrench - T10202-



Procedure

Observe safety precautions ⇒ page 1 .

Observe rules for cleanliness ⇒ page 3 .

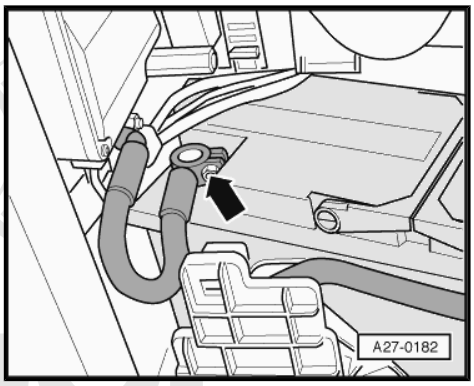
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– Briefly open filler cap for fuel tank and close again.

Caution

Observe notes on procedure for disconnecting the battery.

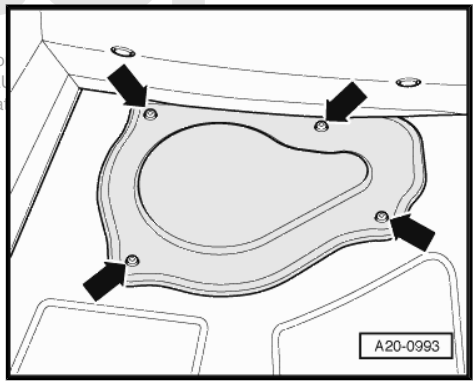
– With ignition switched off, disconnect battery earth cable -arrow- ⇒ Electrical system; Rep. gr. 27 .



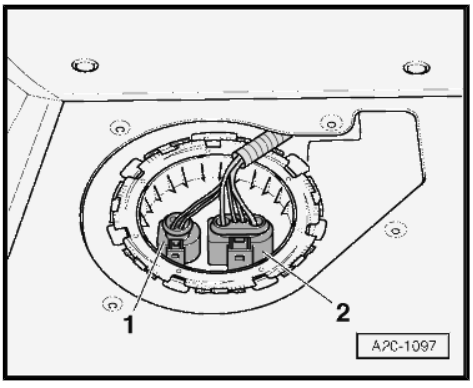
– Remove luggage compartment floor covering.

– Detach cover for flange (left-side) -arrows-.

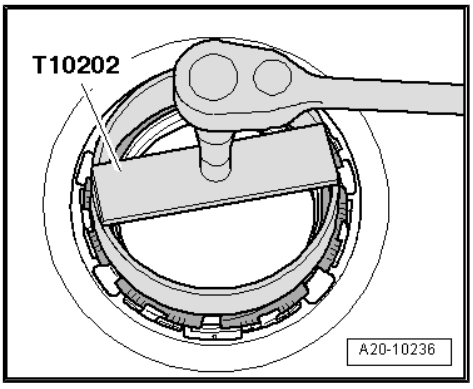
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– Unplug electrical connectors -1- and -2- on flange (left-side).

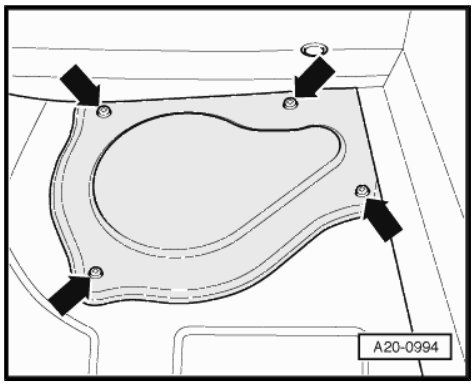


– Unscrew locking ring using wrench - T10202- .

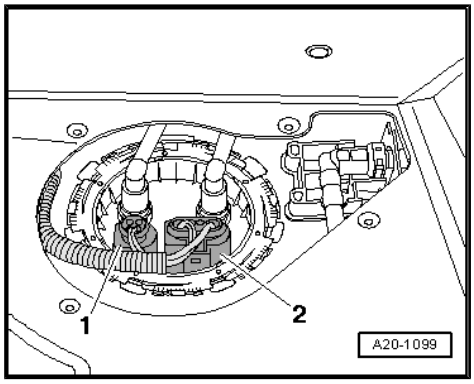


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– Unscrew cover for flange (right-side) -arrows-.



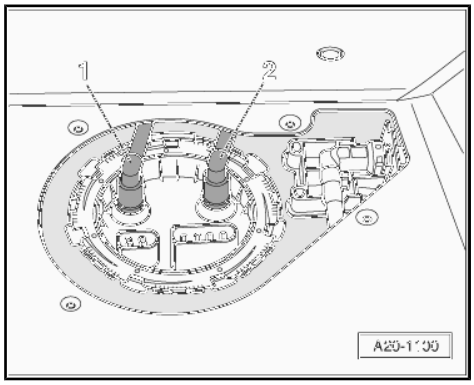
– Unplug electrical connectors -1- and -2- on flange (right-side).



– Mark fuel return line -1- and fuel supply line -2-.

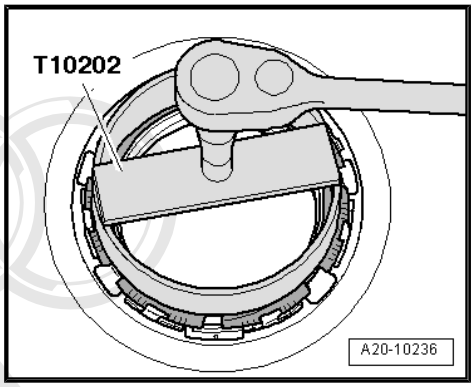
WARNING

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



– Detach both lines from flange (press release tabs).

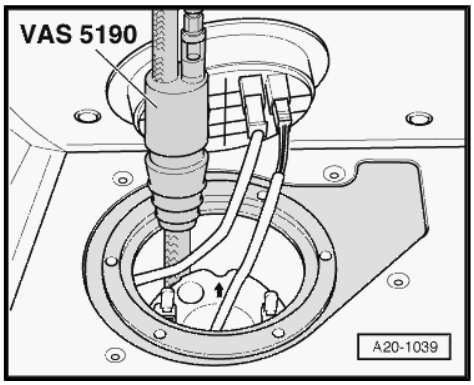
– Unscrew locking ring using wrench - T10202- .



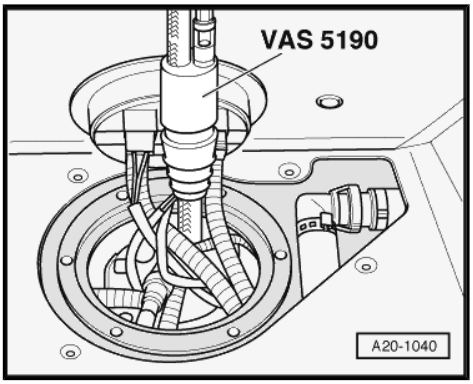
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– Connect earth wire of fuel extractor - VAS 5190A- to earth stud of energy management control unit - J644- .
– Remove flange (left-side) and lay it aside with electrical wires connected.
– Detach seal.
– Extract fuel from left fuel tank chamber through fuel tank opening using fuel extractor - VAS 5190A- .



– Remove flange (right-side) and lay it aside with electrical wires and fuel lines connected.
– Detach seal.
– Extract fuel from right fuel tank chamber through fuel tank opening using fuel extractor unit - VAS 5190A- .
– Re-install flange: left-side ⇒ page 75 , right-side ⇒ page 86 .

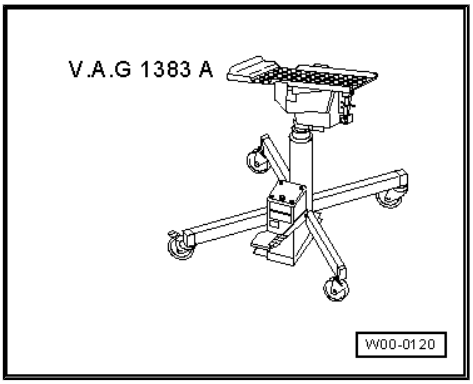


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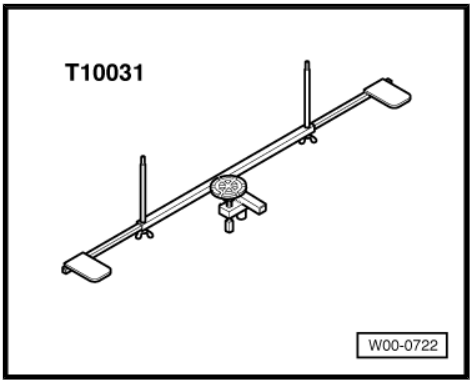
6.3 Removing and installing fuel tank with attached components

Special tools and workshop equipment required

♦ Engine and gearbox jack - V.A.G 1383 A-



♦ Support - T10031-



Removing

Observe safety precautions ⇒ page 1 .

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Observe rules for cleanliness ⇒ page 3 .

WARNING

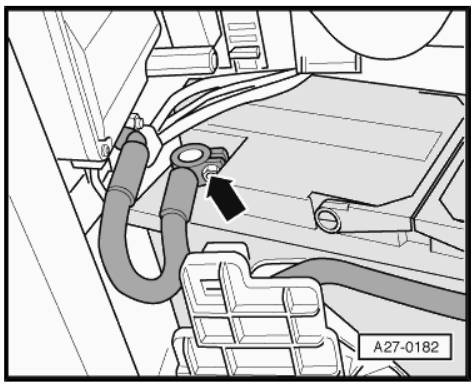
- *To reduce weight, the fuel tank must be empty when it is removed from the vehicle. Drain the tank if necessary. Procedure ⇒ page 112*

– Release the tank flap.

Caution

Observe notes on procedure for disconnecting the battery.

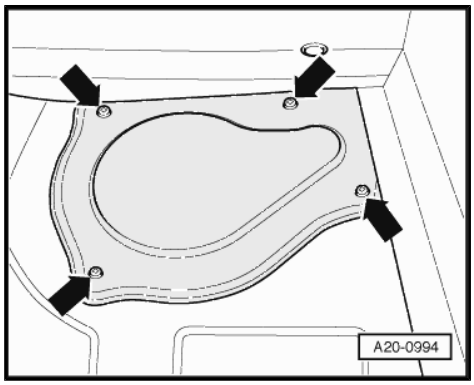
– With ignition switched off, disconnect battery earth cable -arrow- ⇒ Electrical system; Rep. gr. 27 .



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– Remove luggage compartment floor covering.

– Unscrew cover for flange (right-side) -arrows-.



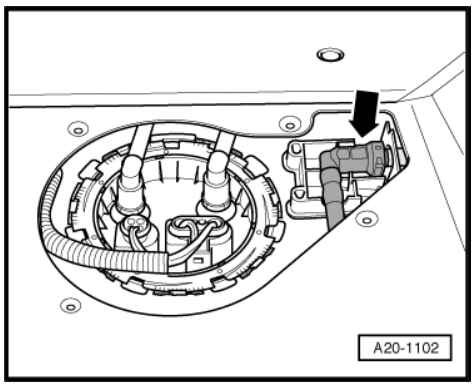
– Press release tabs to disconnect breather pipe -arrow-.

WARNING

BEFORE loosening the subframe bolts, ensure that the vehicle cannot tip forwards (for instance by putting a weight of about 50 kg in the luggage compartment).

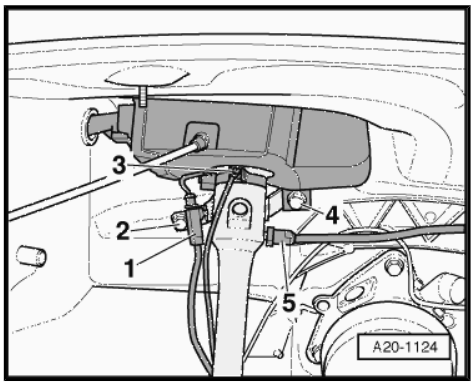
– Remove rear axle ⇒ Rep. gr. 42 .

– Remove rear right wheel housing liner ⇒ Rep. gr. 66 .

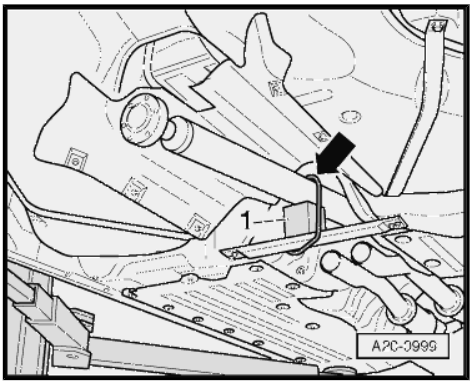


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– Disconnect earth wire -3- from fuel filler neck.
– Unplug electrical connector -1- for fuel tank cap switch - F314- .
– Disconnect breather pipe -5- from fuel filler neck.
– Remove bolts -2- and -4- for fuel filler neck.



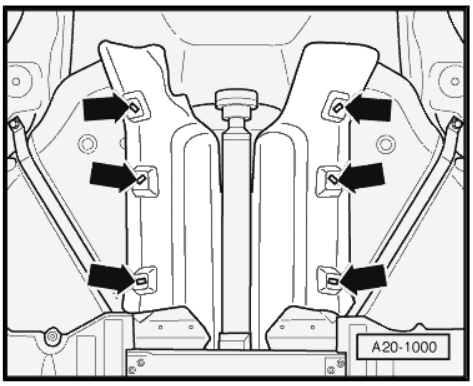
– Check that propshaft is secured to prevent it falling.
- The propshaft should be placed on a block of wood -1- and secured with wire or a cable tie -arrow-.
- The propshaft should be inclined slightly downwards to ensure there is sufficient space when installing the fuel tank.



Note

The propshaft must not be bent more than 8°.

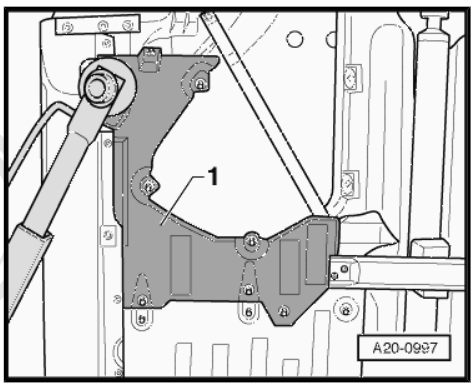
– Remove heat shield for propshaft -arrows-.



Note

The heat shield is also clipped in at the top of the breather pipe.

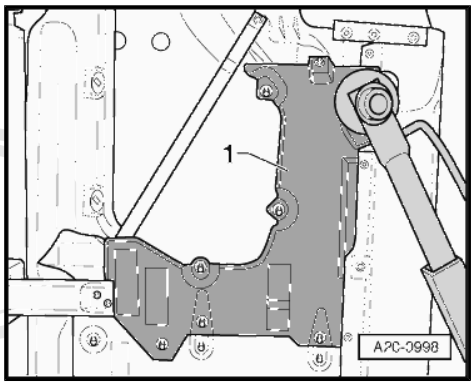
– Remove cover -1- from underside of vehicle (left-side).



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– Remove cover -1- from underside of vehicle (right-side).



– Unplug electrical connectors:

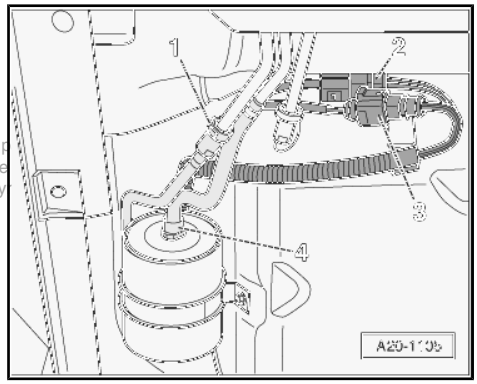
2 - To fuel pumps

3 - To fuel gauge senders

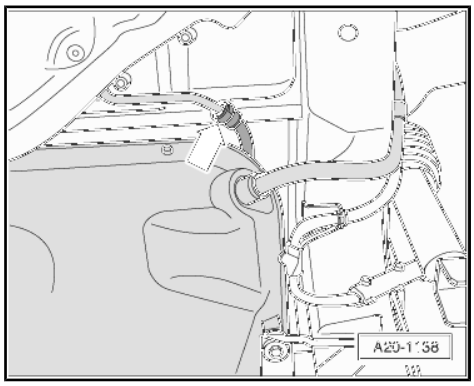
– Disconnect fuel pipes (press release tabs):

1 - Fuel return line

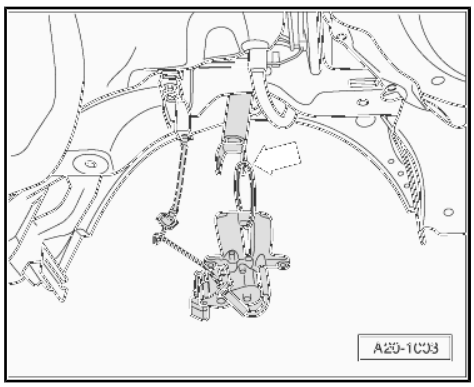
4 - Fuel supply line



– Disconnect breather pipe -arrow- at rear right of fuel tank (press release tab).



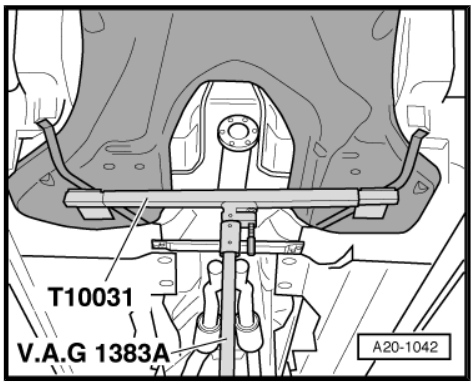
– Attach brake calipers to suspension struts with wire -arrow- (brake calipers were fastened to fuel tank brackets upon removal of rear suspension).



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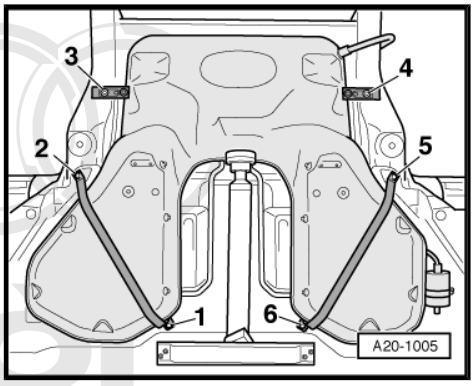
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– Position engine and gearbox jack - V.A.G 1383 A- with support - T10031- under vehicle to support tank (do not use threaded rods of support).
– Support fuel tank using engine and gearbox jack - V.A.G 1383 A- and support - T10031- .
– In addition, a 2nd mechanic will be required to support the fuel tank at the rear by hand.



WARNING

To reduce weight, fuel tank must be empty upon removal.



– Unscrew bolts -1 ... 6-; swivel fuel tank brackets forward if necessary.
– First lower fuel tank slightly at the rear so the fuel filler neck can be guided out of the body.
– Then lower fuel tank using engine and gearbox jack - V.A.G 1383 A- , simultaneously guiding fuel tank down by hand.

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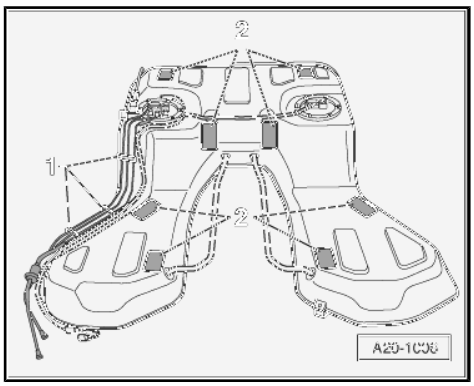
Note

For illustration purposes the fuel tank is shown without engine and gearbox jack.

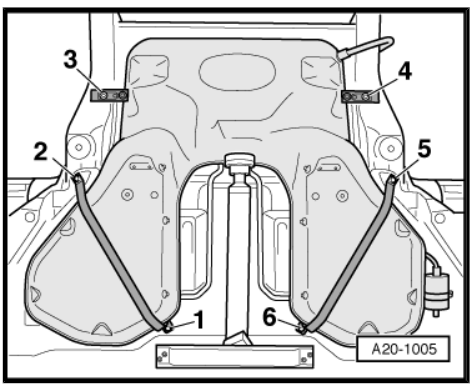
Installing

- Tightening torques ⇒ page 110

– Check that fuel pipes and wiring harnesses for fuel pumps and fuel gauge senders are clipped into brackets -1- on fuel tank.
– Bond pads -2- to fuel tank as shown when installing new fuel tank.
– Position fuel tank with securing straps and brackets on underbody, using engine and gearbox jack - V.A.G 1383 A- and support - T10031- .
– When installing fuel tank, make sure that the fuel filler neck is correctly inserted into the opening on the body.

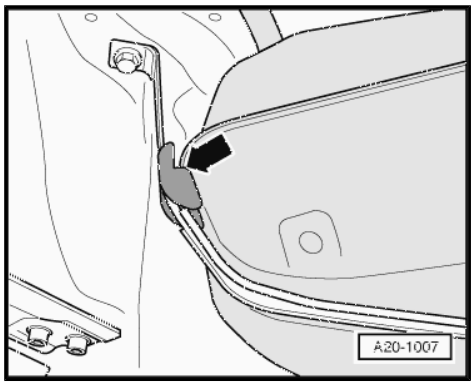


– Secure fuel tank by first tightening bolts at points -1-, -2-, -5- and -6-, then at points -3- and -4-.

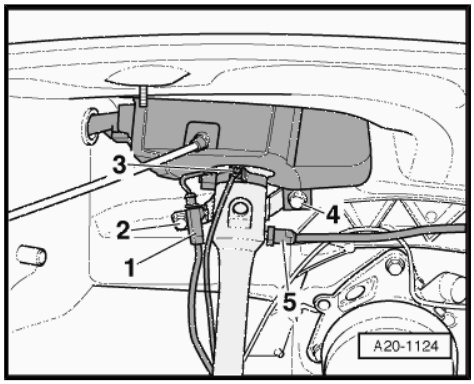


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– Make sure that securing strap spacers are located directly under seam of fuel tank -arrow-.



– Secure fuel filler neck using bolts -2- and -4-.
– Fit breather pipe -5- so that it engages audibly.
– Connect electrical connector -1- for fuel tank cap switch - F314-
– Check the earth wiring -3- and connector tab for traces of oxidation. Remove any traces of oxidation if necessary.



WARNING

After installation, use an ohmmeter to check the electrical connection between the metal ring on the fuel filler neck and a bare metal part on the body:

- ***Specification: approx. 0 Ω.***

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

Note

- *Always renew seals and gaskets when assembling.*
- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*

– Install rear axle ⇒ Rep. gr. 42 .
– Install rear right wheel housing liner ⇒ Rep. gr. 66 .
– Install rear section of exhaust system ⇒ Rep. gr. 26 .
– Connect battery. Observe notes on procedures required after connecting battery ⇒ Electrical system; Rep. gr. 27 .

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7 Routing of pipes/hoses (inside fuel tank) - USA vehicles with MPI engine

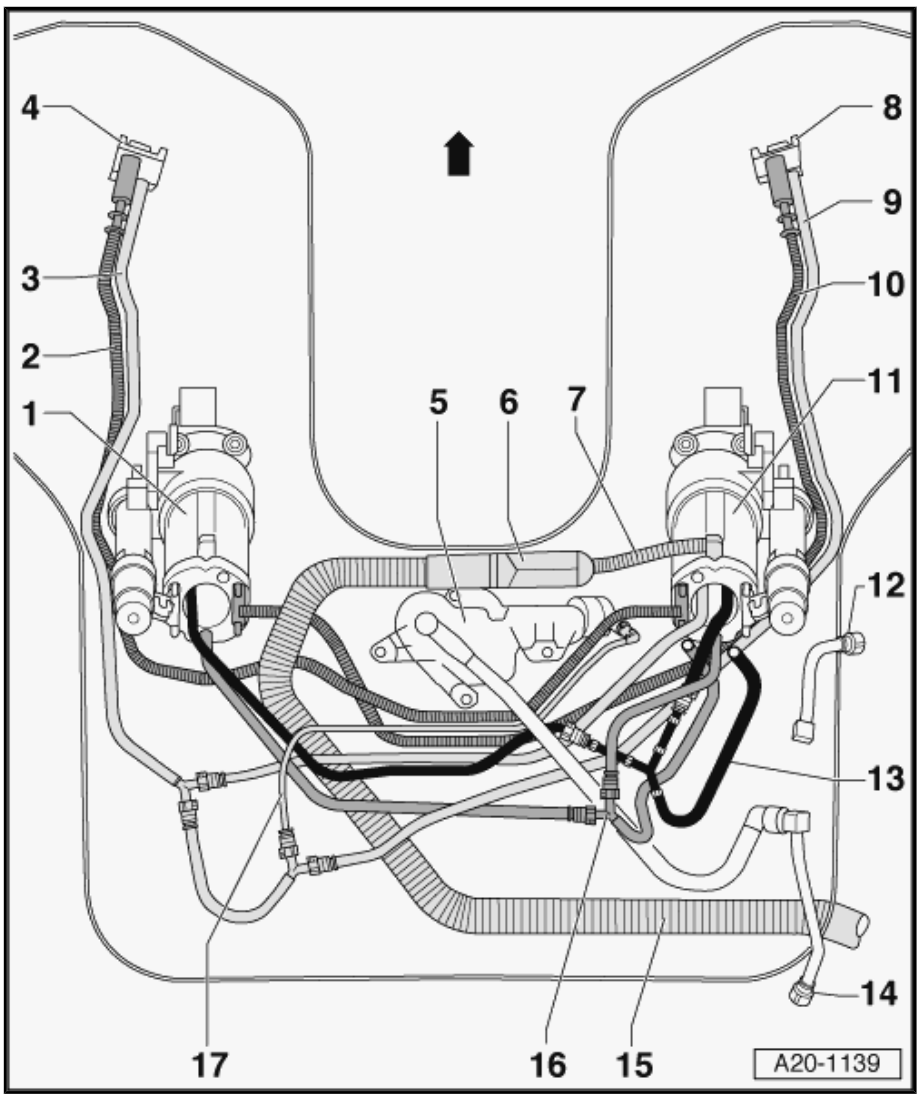
⇒ "7.1 Routing of pipes/hoses (inside fuel tank) - exploded view", page 121

7.1 Routing of pipes/hoses (inside fuel tank) - exploded view

Note

- *The illustration shows the correct routing of pipes/hoses inside the fuel tank (schematic view).*
- *It is not necessary to route the pipes/hoses in exactly the same way as shown in the illustration, except for pipes/hoses shown in ⇒ page 122 . However it is essential to fit the pipes/hoses with sufficient space in relation to each other and to prevent rattling noises.*
- *The -arrow- points in direction of travel.*

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1 - Fuel delivery unit (left-side) with fuel system pressurisation pump - G6-

2 - Fuel supply line

- From suction-jet pump (left-side) to fuel delivery unit (right-side)

3 - Supply line for suction-jet pump

- From fuel pump (right-side) to suction-jet pump (left-side)

4 - Suction-jet pump (left-side)

5 - Expansion tank

- With suction-jet pump to extract fuel from expansion tank

6 - Non-return flap

- For fuel filler pipe

7 - Primary filler pipe

- To fuel delivery unit (right-side).
- Ensures that a small amount of fuel is delivered immediately to the fuel delivery unit when the tank is filled for the first time.

8 - Suction-jet pump (right-side)

9 - Supply line for suction-jet pump

- From fuel pump (right-side) to suction-jet pump (right-side)

10 - Fuel supply line

- From suction-jet pump (right-side) to fuel delivery unit (left-side)

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11 - Fuel delivery unit (right-side) with fuel pump - G23-

12 - Breather line

- ❑ To breather connection at top of fuel filler neck

13 - Fuel supply line

- ❑ From fuel pumps (left and right) to flange

14 - Breather line

- ❑ To activated charcoal filter at bottom of spare wheel well on underbody

15 - Fuel filler pipe

- ❑ From fuel filler neck to non-return flap in fuel tank

16 - Fuel return line

- ❑ From flange to fuel delivery units (left and right)

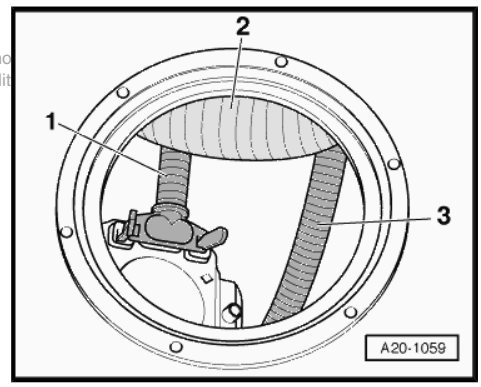
17 - Supply line for suction-jet pump

- ❑ To suction-jet pump in expansion tank

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Installation position of fuel supply lines

- The fuel supply lines -1- and -3- must be routed below the fuel filler pipe -2- at the left fuel tank opening.



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8 Fuel delivery unit with fuel pump and fuel gauge senders - USA vehicles with MPI engine

⇒ “8.1 Exploded view - fuel delivery unit (left-side) with fuel system pressurisation pump G6 and fuel gauge senders G and G237 ”, page 123

⇒ “8.2 Checking fuel system pressurisation pump G6 (left-side) - electrical test”, page 125

⇒ “8.3 Removing and installing fuel delivery unit (left-side) with fuel system pressurisation pump G6 ”, page 129

⇒ “8.4 Exploded view - fuel delivery unit (right-side) with fuel pump G23 and fuel gauge senders G169 and G393 ”, page 136

⇒ “8.5 Checking fuel pump G23 (right-side) - electrical test”, page 138

⇒ “8.6 Removing and installing fuel delivery unit (right-side) with fuel pump G23 ”, page 141

⇒ “8.7 Checking delivery rate of fuel pumps - vehicles with fuel return line”, page 149

⇒ “8.8 Checking delivery rate of fuel pumps - vehicles with fuel system without fuel return line”, page 153

⇒ “8.9 Suction-jet pumps”, page 157

⇒ “8.10 Removing and installing suction-jet pump (left-side)”, page 159

⇒ “8.11 Removing and installing suction-jet pump (right-side)”, page 160

8.1 Exploded view - fuel delivery unit (left-side) with fuel system pressurisation pump - G6- and fuel gauge senders -G- and -G237-

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1 - Retainer

- For fuel delivery unit

2 - Fuel gauge sender - G-

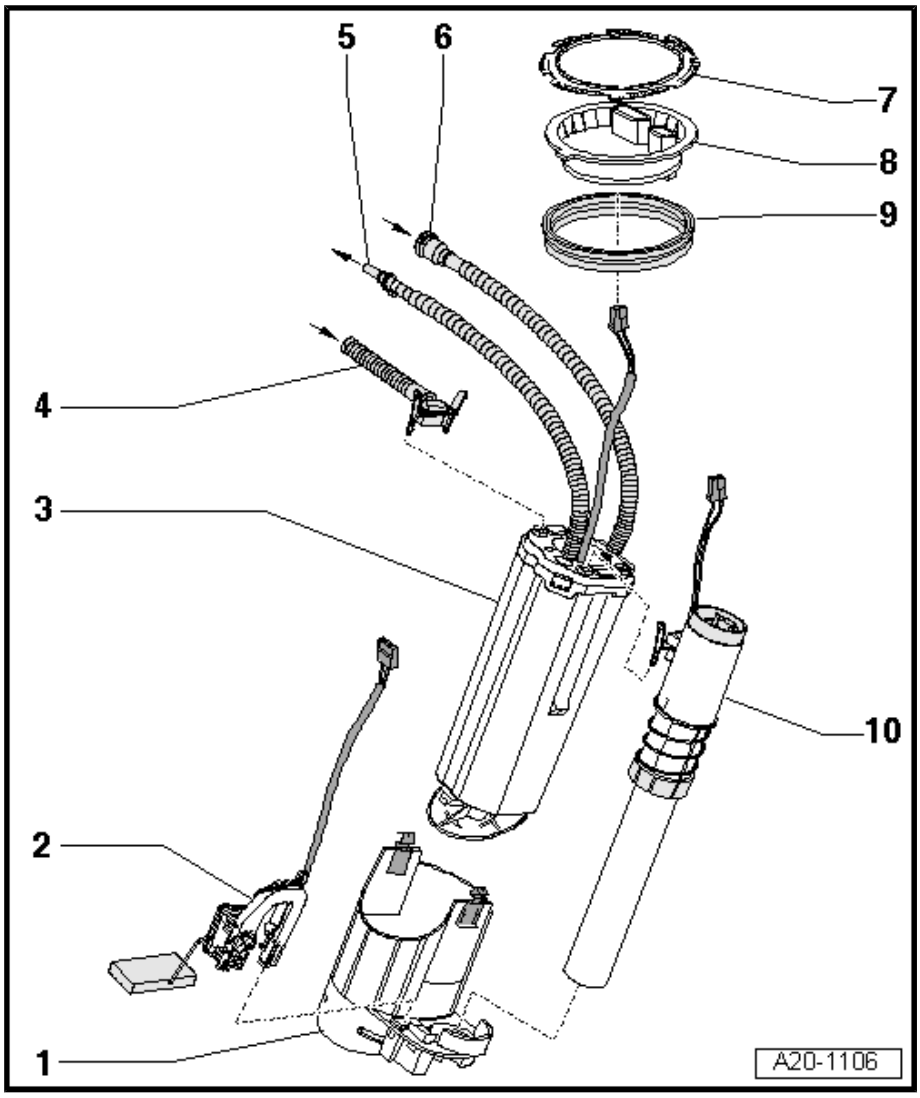
- Black
- Clipped onto retainer -item 1-
- Checking resistance values ⇒ page 221
- Removing and installing ⇒ page 222

3 - Fuel delivery unit (left-side)

- With fuel system pressurisation pump - G6-
- Clipped onto retainer -item 1-
- Different versions available; for correct version refer to ⇒ Electronic parts catalogue
- Checking fuel pump (electrical test) ⇒ page 125
- Checking residual pressure ⇒ Rep. gr. 24
- Removing and installing ⇒ page 129
- Put at least 5 litres of fuel into tank after installing

4 - Fuel supply line

- From suction jet pump (right-side)
- Clipped onto fuel delivery unit -item 3-



5 - Fuel supply line

- The plug connector is located on the right side of the fuel tank
- Press release tab on connection piece to disconnect

6 - Fuel return line

- The plug connector is located on the right side of the fuel tank
- Press release tab on connection piece to disconnect

7 - Locking ring

- Remove and install using wrench - T10202-
- Tighten to 120 Nm

8 - Flange (left-side)

- Installation position ⇒ page 125

9 - Seal

- Renew
- Install dry

10 - Fuel gauge sender 3 - G237-

- Grey
- Clipped onto fuel delivery unit -item 3-
- Checking resistance values ⇒ page 225

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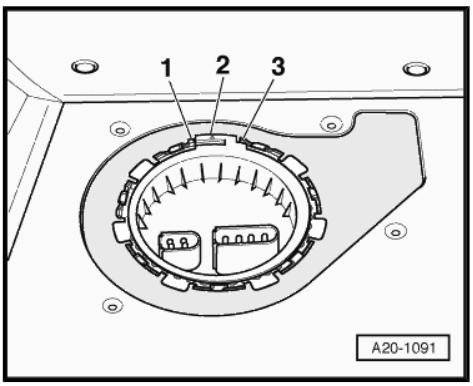
❑ Removing and installing ⇒ page 226

Installation position of flange (left-side)

– Install new seal for flange (seal must be installed dry).

– Fit flange into fuel tank; note correct installation position:

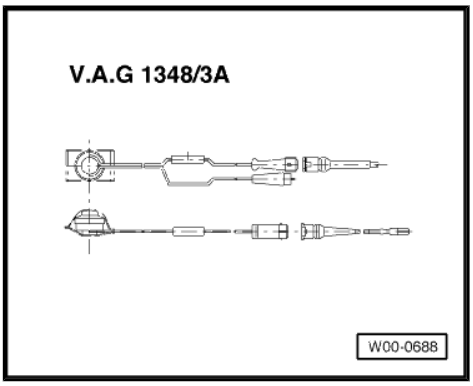
• Lug -2- on flange must be between tabs -1- and -3- on fuel tank.



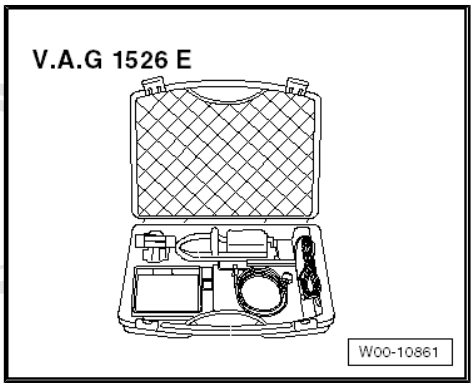
8.2 Checking fuel system pressurisation pump - G6- (left-side) - electrical test

Special tools and workshop equipment required

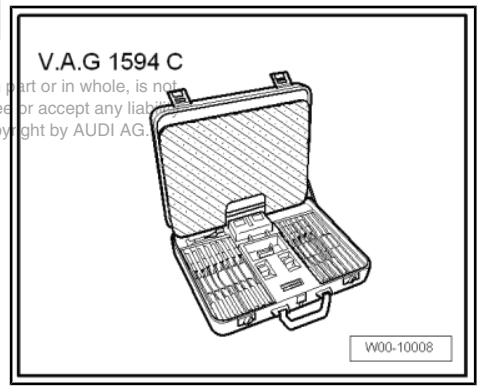
♦ Remote control for V.A.G 1348 - V.A.G 1348/3A-



♦ Hand-held multimeter - V.A.G 1526 E-



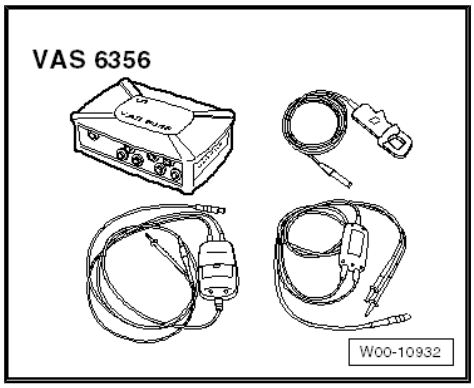
♦ Auxiliary measuring set - V.A.G 1594C-



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- Test instrument box - VAS 6356- with trigger clamp, 100 A - VAS 6356/4A-

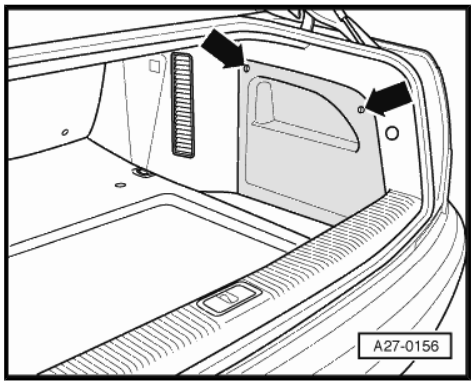


Procedure

– Observe test conditions ⇒ page 3 .

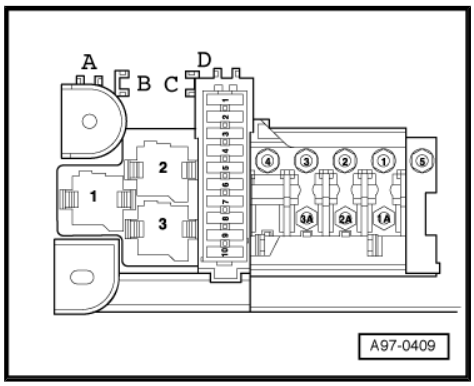
Checking voltage supply

– Remove luggage compartment side trim cover (right-side) -arrows-.



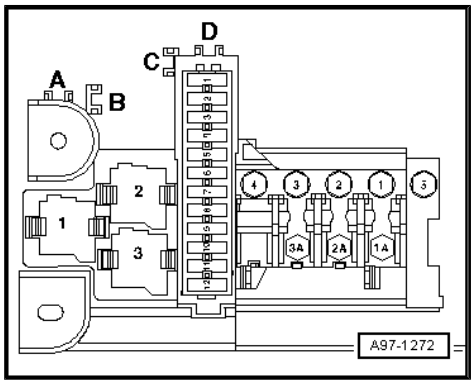
Vehicles built in model year 2003:

– Take fuse 10 out of fuse holder SF10 (located in relay and fuse carrier in luggage compartment (right-side), position 10).



Vehicles from model year 2004 onwards:

– Take fuse 2 out of fuse holder SF2 (located in relay and fuse carrier in luggage compartment (right-side), position 2).



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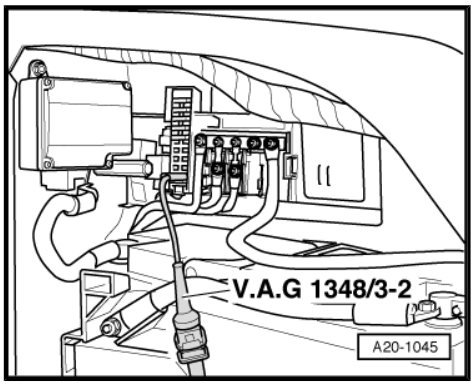
All vehicles (continued):

– Connect remote control - V.A.G 1348/3A- for V.A.G 1348 with adapter cable - V.A.G 1348/3-2- to right-hand terminal of fuse socket from which fuse has been taken out.

– Connect crocodile clip of remote control - V.A.G 1348/3A- for V.A.G 1348 to battery “+” (positive).

– Press remote control button.

• Fuel pump should start running (noise is audible in vicinity of fuel tank).



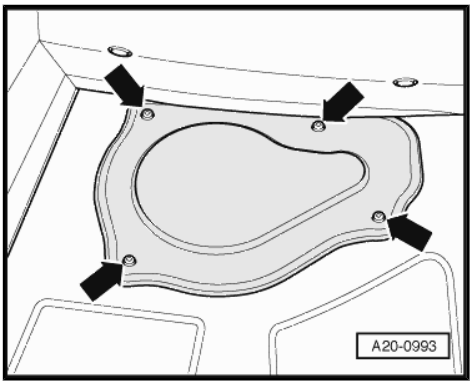
Note

The fuel pump runs very quietly. Avoid background noise whilst checking fuel pump. Have second mechanic perform check if necessary.

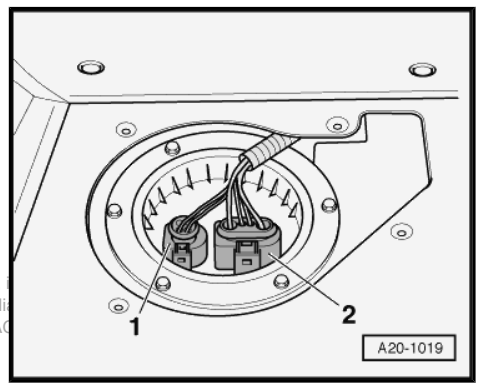
If no noise can be heard from pump:

– Remove luggage compartment floor covering.

– Detach cover for flange (left-side) -arrows-.



– Unplug electrical connector -2- on flange (left-side).



Note

Disregard -item 1-.

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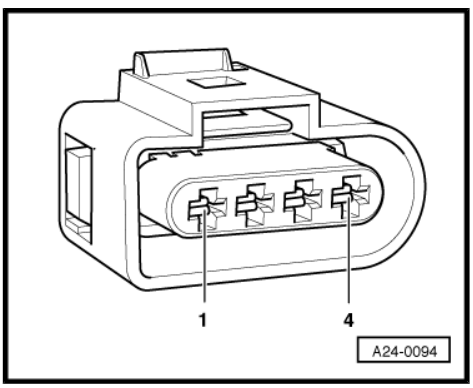
– Connect multimeter between contacts -1- and -4- of electrical connector to measure voltage.

– Press remote control button.

• Specification: approx. battery voltage

If specification is not obtained:

– Repair wiring harness according to current flow diagram.



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If reading matches specification although no noise can be heard from pump:

– Remove the fuel delivery unit (left-side) ⇒ page 129 .

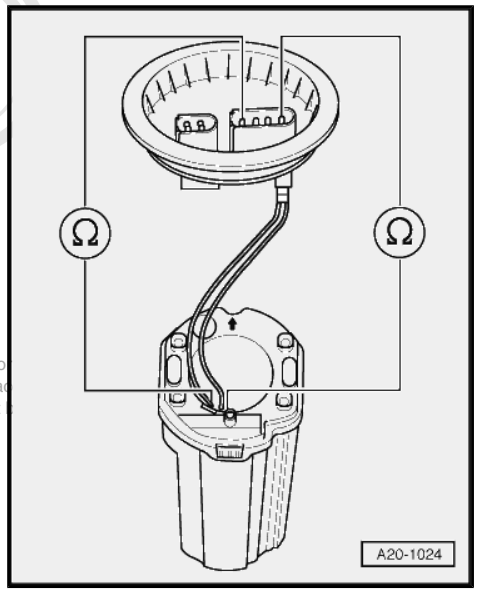
– Check that the electrical wires between flange and fuel pump are connected and test for continuity.

If no faults are found in the wiring:

– Fuel pump is defective. Renew the fuel delivery unit (left-side).

– Install fuel delivery unit (left-side) ⇒ page 75 .

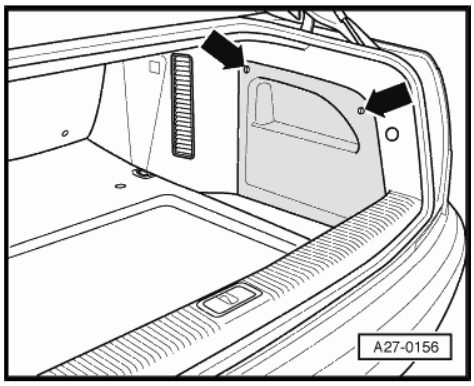
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Checking current draw

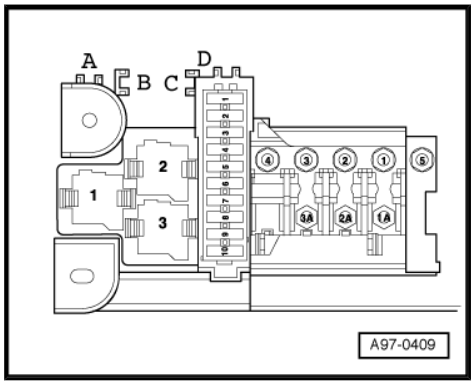
- Fuel pump voltage supply OK ⇒ page 126

– Remove luggage compartment side trim cover (right-side) -arrows-.



Vehicles built in model year 2003:

– Take fuse 10 out of fuse holder SF10 (located in relay and fuse carrier in luggage compartment (right-side), position 10).



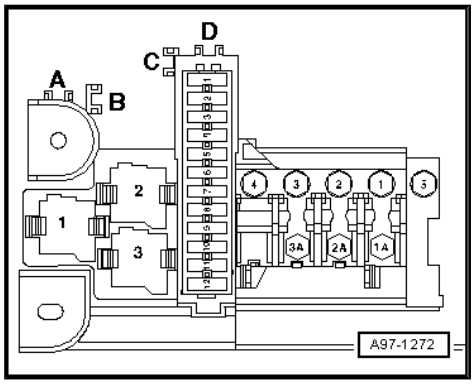
Vehicles from model year 2004 onwards:

– Take fuse 2 out of fuse holder SF2 (located in relay and fuse carrier in luggage compartment (right-side), position 2).

All vehicles (continued):

– Connect remote control - V.A.G 1348/3A- for V.A.G 1348 with adapter cable - V.A.G 1348/3-2- to right-hand terminal of fuse socket from which fuse has been taken out.

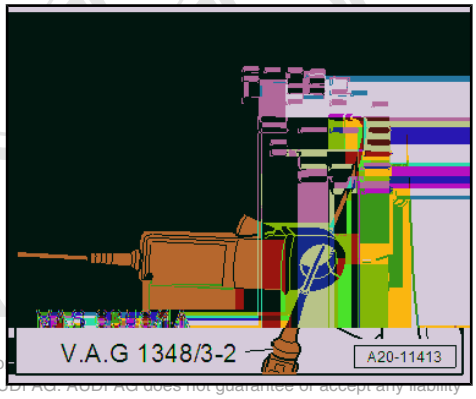
– Connect crocodile clip of remote control - V.A.G 1348/3A- for V.A.G 1348 to battery “+” (positive).



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– Connect test instrument box - VAS 6356- with trigger clamp, 100 A - VAS 6356/4A- to cable of remote control.
– Press remote control button.
– Measure current draw of fuel pump.
• Specification: approx. 8 A.

If specification is not obtained:



Note

A current draw of 4 A indicates that the fuel pump is running dry.

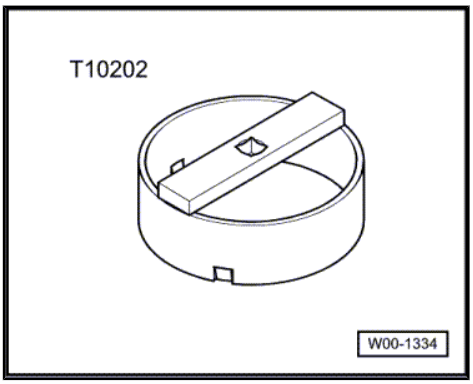
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Readout	Cause of fault	Remedy
approx. 4 A	♦ Fuel tank empty	– Fill tank
	♦ Housing of fuel delivery unit leaking	– Renew fuel delivery unit ⇒ page 129
0 A	♦ Fuel system pressurisation pump - G6- defective	– Renew fuel delivery unit ⇒ page 129

8.3 Removing and installing fuel delivery unit (left-side) with fuel system pressurisation pump - G6-

Special tools and workshop equipment required

♦ Wrench - T10202-



Removing

Observe safety precautions ⇒ page 1 .

Observe rules for cleanliness ⇒ page 3 .

Caution

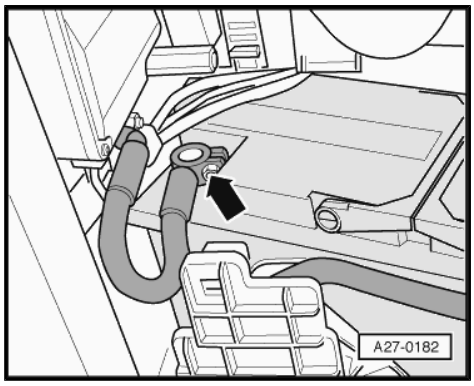
• *The fuel tank must not be more than 1/3 full when removing the fuel delivery unit. Drain the tank if necessary. Procedure ⇒ page 112*

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Caution

Observe notes on procedure for disconnecting the battery.

– With ignition switched off, disconnect battery earth cable -arrow- ⇒ Electrical system; Rep. gr. 27 .

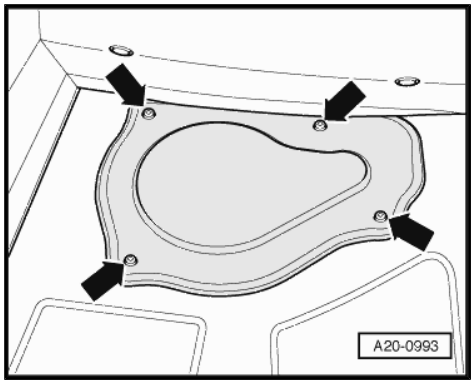


– Remove luggage compartment floor covering.

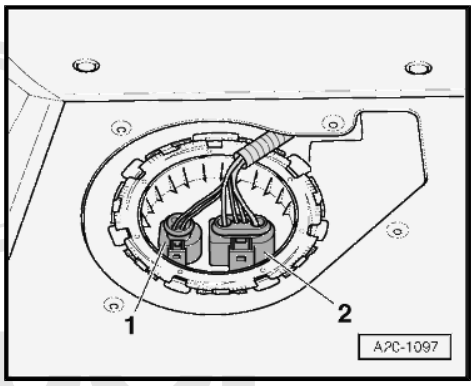
Note

For removing and installing fuel delivery unit, take tool kit and spare wheel out of luggage compartment. You can then sit or kneel in the spare wheel well.

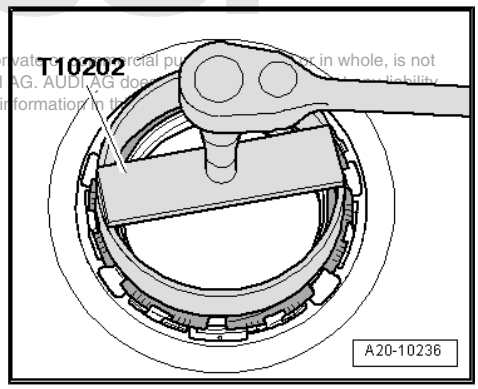
– Detach cover for flange (left-side) -arrows-.



– Unplug electrical connectors -1- and -2- on flange (left-side).



– Unscrew locking ring using wrench - T10202- .

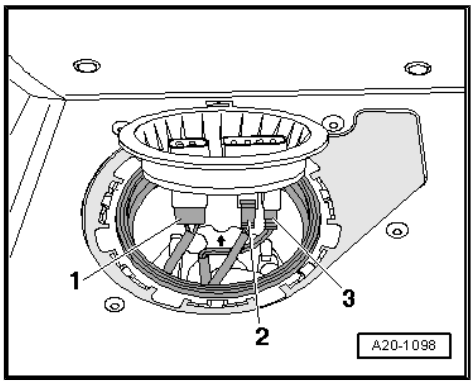


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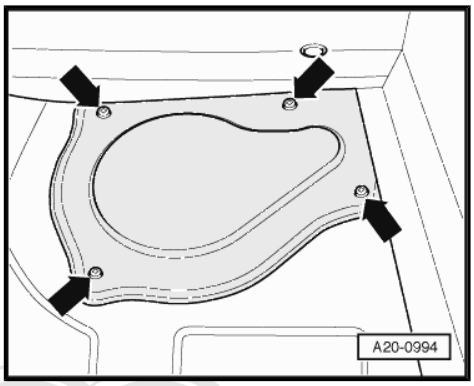
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– Detach flange and remove seal.

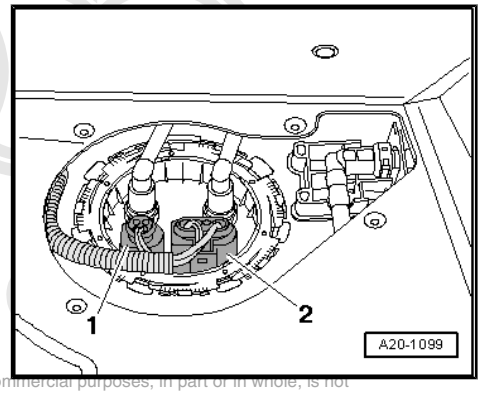
– Unplug electrical connectors -1 ... 3- on underside of flange (left-side).



– Unscrew cover for flange (right-side) -arrows-.

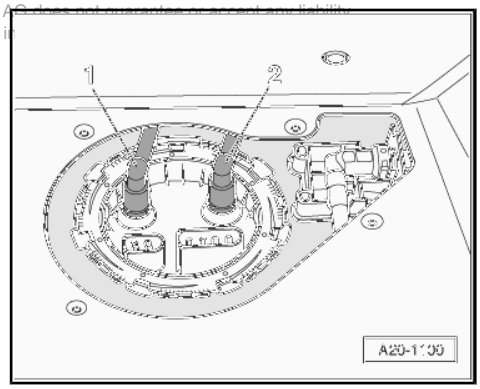


– Unplug electrical connectors -1- and -2- on flange (right-side).



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– Mark fuel return line -1- and fuel supply line -2-.



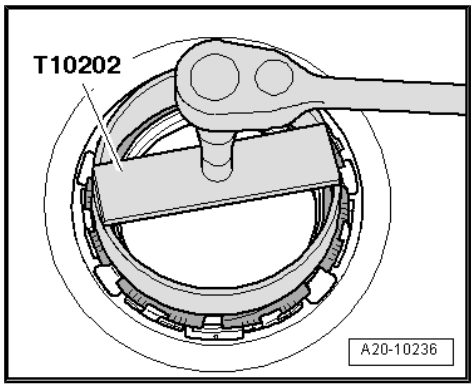
WARNING

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

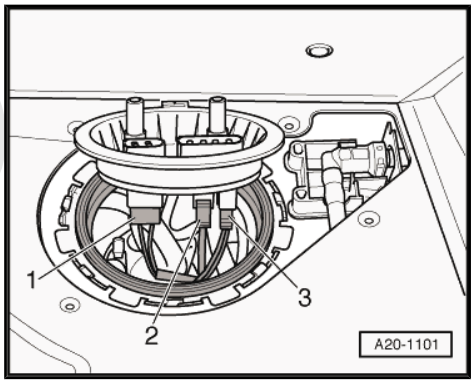
– Detach both lines from flange (press release tabs).

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– Unscrew locking ring using wrench - T10202- .



– Detach flange and remove seal.
– Unplug electrical connectors -1 ... 3- on underside of flange (right-side).



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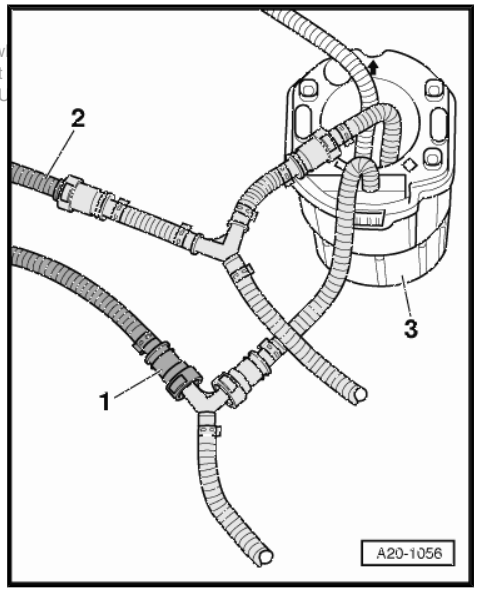
Note

- *Pull out fuel lines from fuel tank opening prior to disconnecting the pipe connectors mentioned below.*
- *For illustration purposes some of the components are shown removed in the following illustrations.*

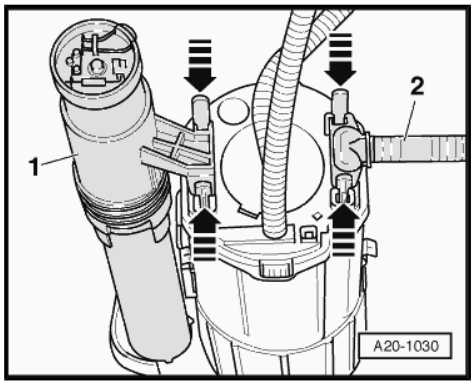
– Working through right fuel tank opening, press release tabs and disconnect fuel lines -1- and -2- going to fuel delivery unit (left-side).

3 - Fuel delivery unit (right-side) with fuel pump - G23-

– Pull the two disconnected fuel lines out of left fuel tank opening.

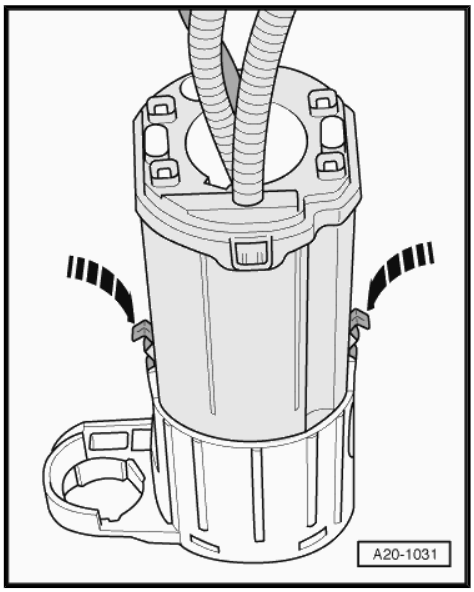


– Working through left fuel tank opening, press release tabs -arrows- and detach fuel supply line -2- and fuel gauge sender 3 - G237- -item 1-.
– Move fuel gauge sender 3 - G237- to left side.



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– Press down both retaining clips on retainer for fuel delivery unit -arrows-.
– Remove fuel delivery unit.



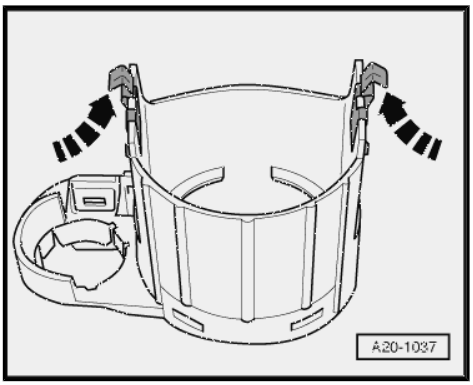
Note

Keep in mind that the fuel delivery unit still contains fuel.

Installing

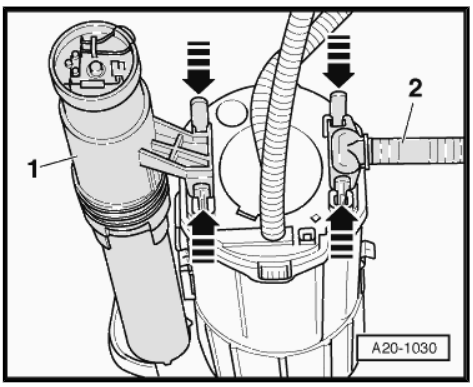
- Tightening torque ⇒ page 123

– Pull both retaining clips on retainer upwards -arrows- so that they engage audibly before installing the fuel delivery unit.
– Then press fuel delivery unit carefully into retainer so that it engages audibly.



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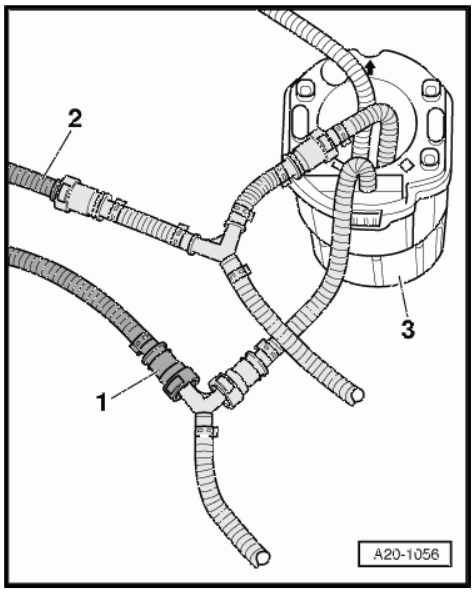
– Fit fuel supply line -2- and fuel gauge sender 3 - G237- -item 1- so that they engage audibly.
– Guide supply line and return line for fuel delivery unit (left-side) into fuel tank chamber (right-side).



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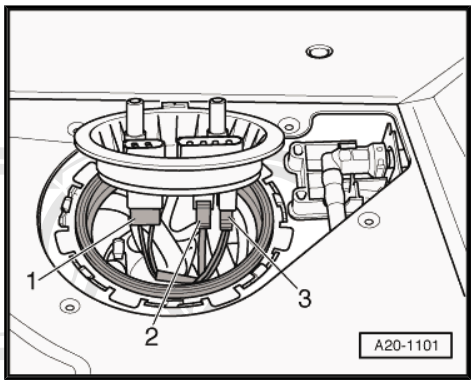
– Fit fuel lines -1- and -2- through right fuel tank opening so that they engage audibly.

3 - Fuel delivery unit (right-side) with fuel pump - G23-



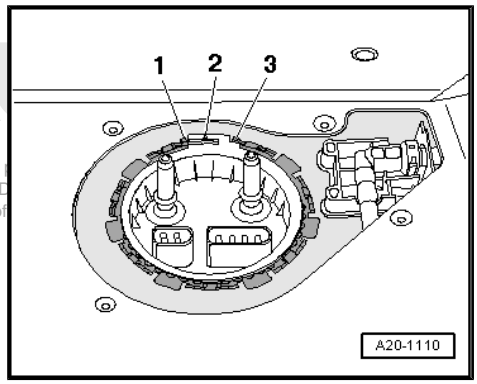
– Connect electrical connectors -1 ... 3- on underside of flange (right-side).

– Install new seal for flange (seal must be installed dry).

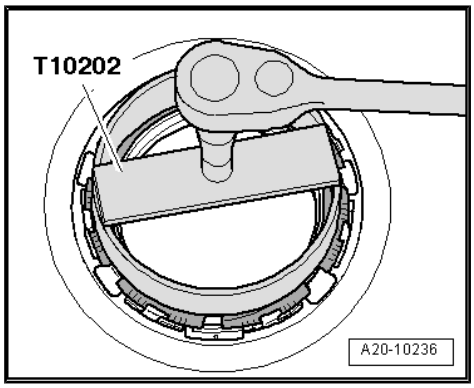


– Fit flange into fuel tank; note correct installation position:

• Lug -2- on flange must be between tabs -1- and -3- on fuel tank.



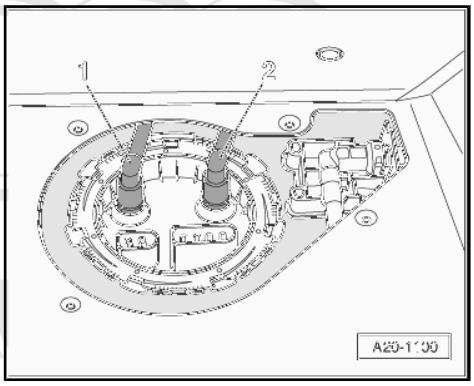
– Tighten locking ring.



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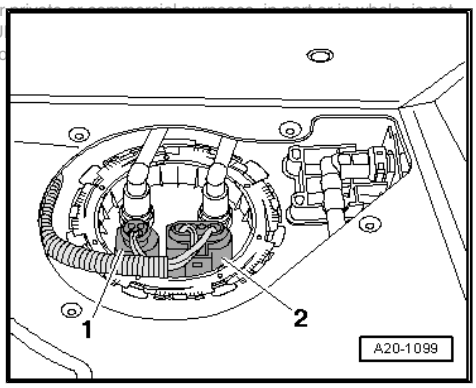
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– Install fuel supply line -2- and fuel return line -1- (as marked) so that they engage audibly.

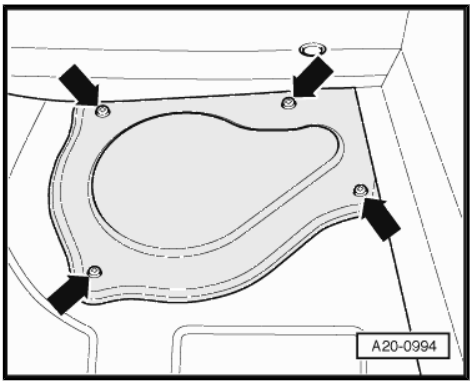


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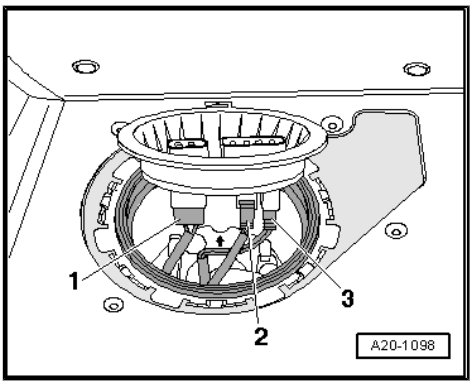
– Attach electrical connectors -1- and -2- on flange (right-side).



– Secure cover for flange (right-side) -arrows-.



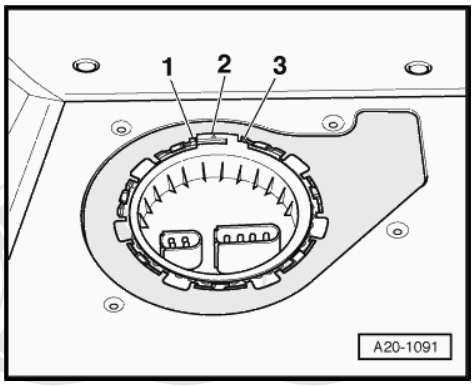
– Connect electrical connectors -1 ... 3- on underside of flange (left-side).
– Install new seal for flange (seal must be installed dry).



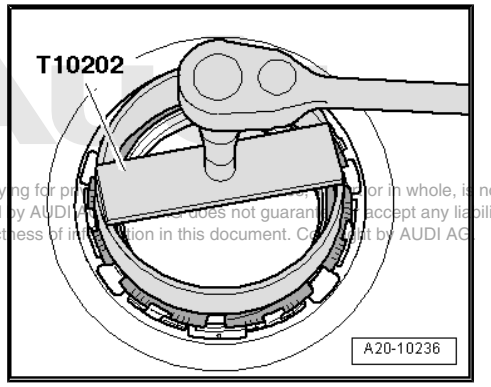
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– Fit flange into fuel tank; note correct installation position:

• Lug -2- on flange must be between tabs -1- and -3- on fuel tank.

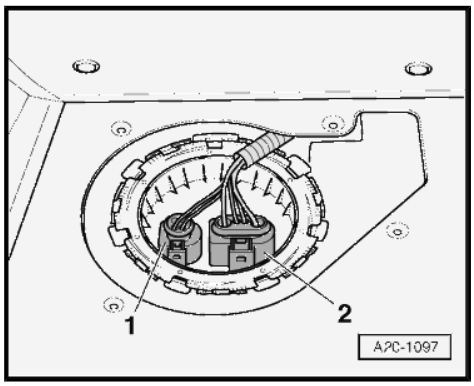


– Tighten locking ring.



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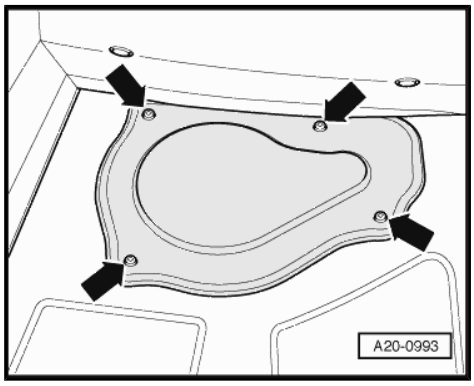
– Attach electrical connectors -1- and -2- on flange (left-side).



– Secure cover for flange (left-side) -arrows-.

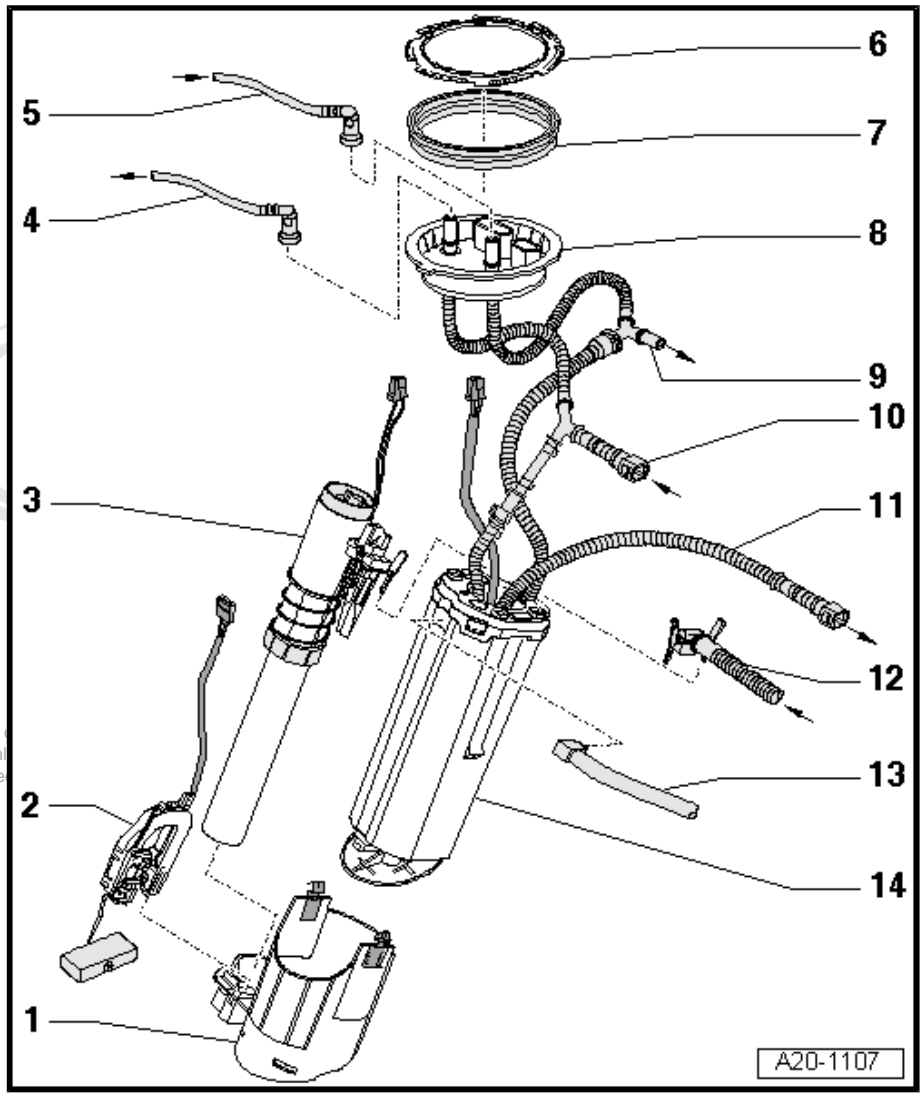
– Connect battery. Observe notes on procedures required after connecting battery ⇒ Electrical system; Rep. gr. 27 .

– Put at at least 5 litres of fuel into tank after installing



8.4 Exploded view - fuel delivery unit (right-side) with fuel pump - G23- and fuel gauge senders -G169- and -G393-

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1 - Retainer

- For fuel delivery unit

2 - Fuel gauge sender 2 - G169-

- Yellow
- Clipped onto retainer -item 1-
- Checking resistance values ⇒ page 223
- Removing and installing ⇒ page 224

3 - Fuel gauge sender 4 - G393-

- White
- Clipped onto fuel delivery unit -item 14-
- Checking resistance values ⇒ page 230
- Removing and installing ⇒ page 232

4 - Fuel supply line

- To fuel filter
- Mark before removing
- Press release tab on connection piece to disconnect
- Do not kink
- Clip onto fuel tank

5 - Fuel return line

- From fuel rail
- Mark before removing
- Press release tab on connection piece to disconnect
- Do not kink
- Clip onto fuel tank

6 - Locking ring

- Remove and install using wrench - T10202-
- Tighten to 120 Nm

7 - Seal

- Renew
- Install dry

8 - Flange (right-side)

- Installation position ⇒ page 138

9 - Fuel return line

- To fuel delivery unit (left-side)

10 - Fuel supply line

- From fuel delivery unit (left-side)
- Press release tab on connection piece to disconnect

11 - Supply line for suction-jet pump

- For suction-jet pump
- Press release tab on connection piece to disconnect

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12 - Fuel supply line

- ❑ From suction-jet pump (left-side)
- ❑ Clipped onto fuel delivery unit -item 14-

13 - Fuel filler pipe

- ❑ From filler neck
- ❑ Clipped onto fuel delivery unit -item 14-

14 - Fuel delivery unit (right-side)

- ❑ With fuel pump - G23-
- ❑ Clipped onto retainer -item 1-
- ❑ Different versions available; for correct version refer to ⇒ Electronic parts catalogue
- ❑ Checking fuel pump (electrical test) ⇒ page 138
- ❑ Checking residual pressure ⇒ Rep. gr. 24
- ❑ Removing and installing ⇒ page 141
- ❑ Put at least 5 litres of fuel into tank after installing

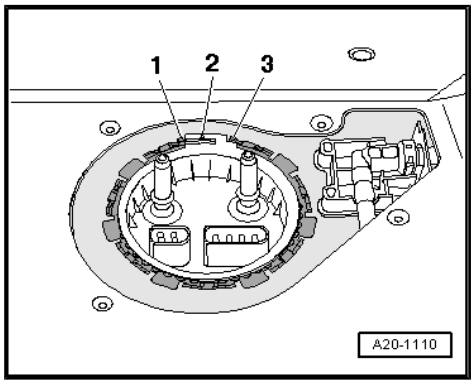
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Installation position of flange (right-side)

– Install new seal for flange (seal must be installed dry).

– Fit flange into fuel tank; note correct installation position:

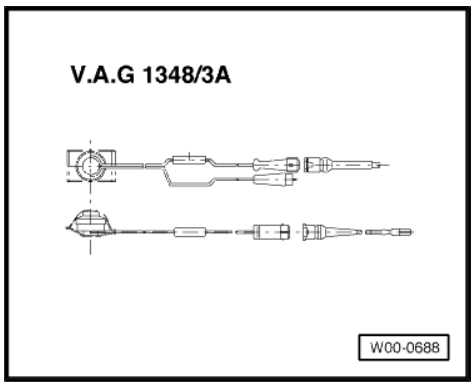
• Lug -2- on flange must be between tabs -1- and -3- on fuel tank.



8.5 Checking fuel pump - G23- (right-side) - electrical test

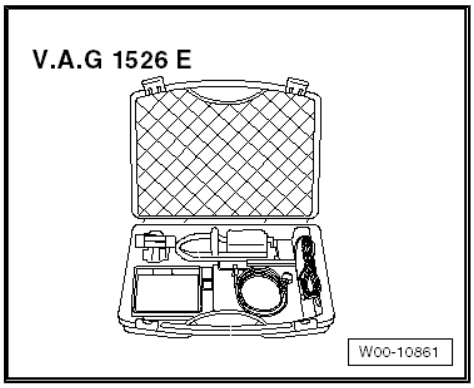
Special tools and workshop equipment required

◆ Remote control for V.A.G 1348 - V.A.G 1348/3A-

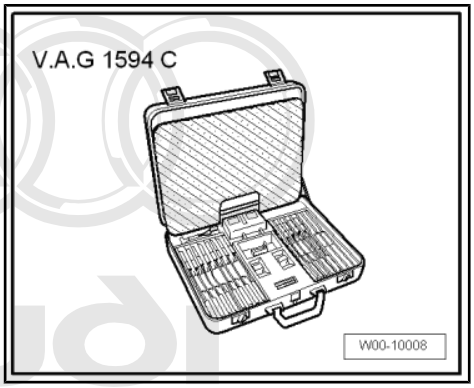


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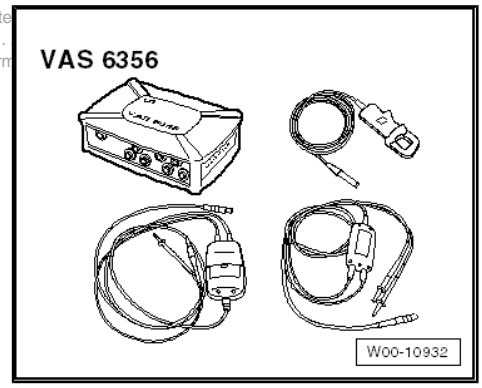
- Hand-held multimeter - V.A.G 1526 E-



- Auxiliary measuring set - V.A.G 1594C-



- Test instrument box - VAS 6356- with trigger clamp, 100 A- VAS 6356/4A-



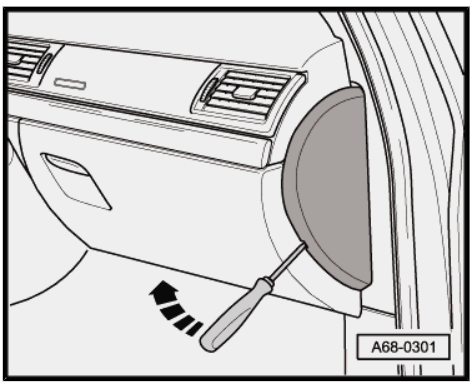
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Procedure

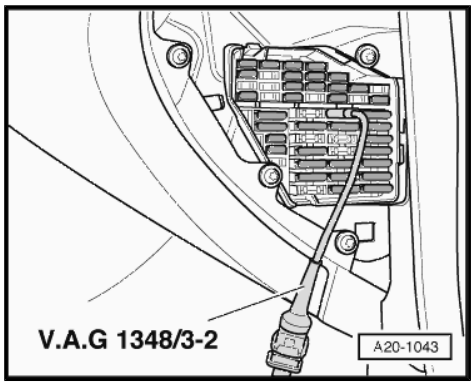
– Observe test conditions ⇒ page 3 .

Checking voltage supply

– Use screwdriver to pry off cover (right-side) at dash panel -arrow-.



– Take fuse 31 out of fuse holder SC31 (right side of dash panel, middle row, 1st large fuse from the top).
– Connect remote control - V.A.G 1348/3A- for V.A.G 1348 with adapter cable - V.A.G 1348/3-2- to left-hand fuse socket terminal of fuse SC31.
– Connect crocodile clip of remote control - V.A.G 1348/3A- for V.A.G 1348 to battery “+” (positive).
– Press remote control button.
• Fuel pump should start running (noise is audible in vicinity of fuel tank).

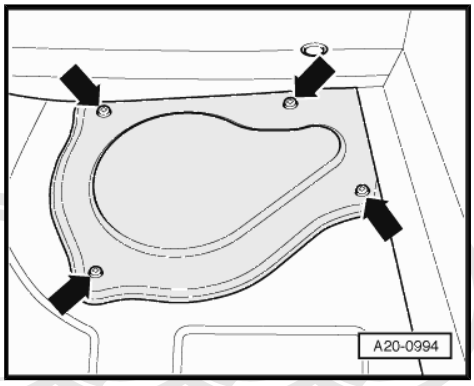


Note

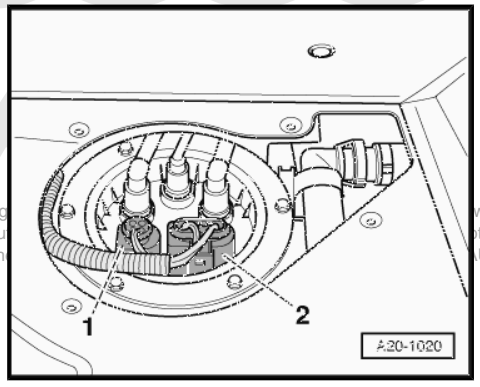
The fuel pump runs very quietly. Avoid background noise whilst checking fuel pump. Have second mechanic perform check if necessary.

If no noise can be heard from pump:

– Remove luggage compartment floor covering.
– Unscrew cover for flange (right-side) -arrows-.



– Unplug electrical connector -2- on flange (right-side).



Note

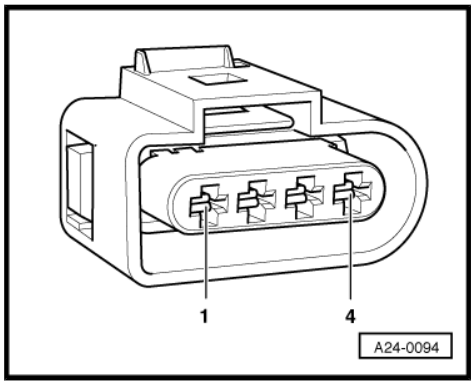
Disregard -item 1-.

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– Connect multimeter between contacts -1- and -4- of electrical connector to measure voltage.
– Press remote control button.
• Specification: approx. battery voltage

If specification is not obtained:

– Repair wiring harness according to current flow diagram.



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If reading matches specification although no noise can be heard from pump:

– Remove fuel delivery unit (right-side) ⇒ page 141 .

– Check that the electrical wires between flange and fuel pump are connected and test for continuity.

If no faults are found in the wiring:

– Fuel pump is defective. Renew fuel delivery unit (right-side).

– Install fuel delivery unit (right-side) ⇒ page 86 .

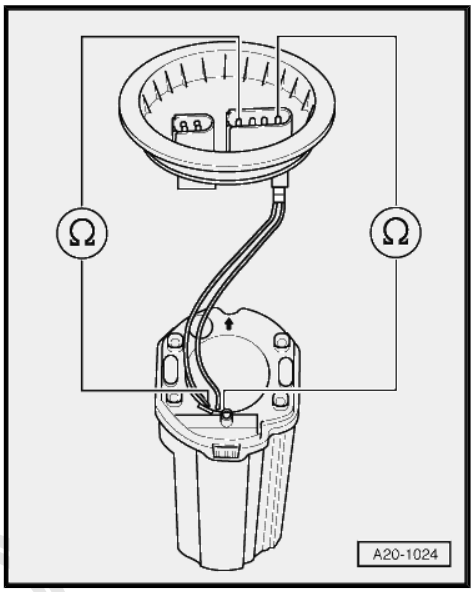
Checking current draw

• Fuel pump voltage supply OK ⇒ page 139

– Take fuse 31 out of fuse holder SC31 (right side of dash panel, middle row, 1st large fuse from the top).

– Connect remote control - V.A.G 1348/3A- for V.A.G 1348 with adapter cable - V.A.G 1348/3-2- to left-hand fuse socket terminal of fuse SC31.

– Connect crocodile clip of remote control - V.A.G 1348/3A- for V.A.G 1348 to battery “+” (positive).



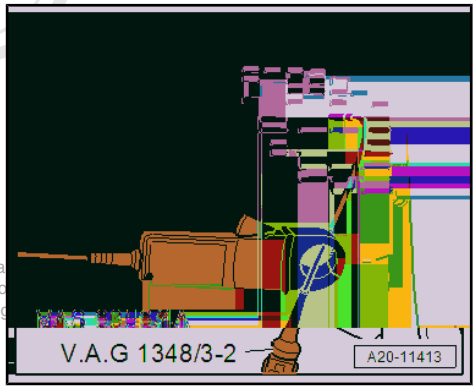
– Connect test instrument box - VAS 6356- with trigger clamp, 100 A - VAS 6356/4A- to cable of remote control.

– Press remote control button.

– Measure current draw of fuel pump.

• Specification: approx. 8 A.

If specification is not obtained:



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Note

A current draw of 4 A indicates that the fuel pump is running dry.

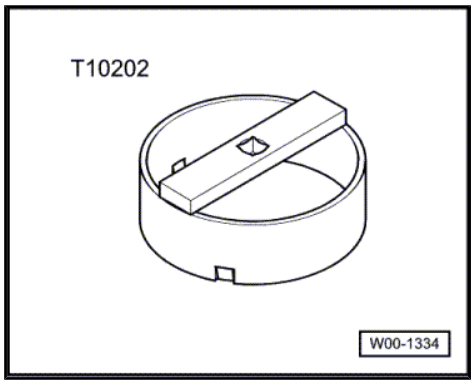
Readout	Cause of fault	Remedy
approx. 4 A	♦ Fuel tank empty	– Fill tank
	♦ Housing of fuel delivery unit leaking	– Renew fuel delivery unit ⇒ page 141
0 A	♦ Fuel pump - G23- defective	– Renew fuel delivery unit ⇒ page 141

8.6 Removing and installing fuel delivery unit (right-side) with fuel pump - G23-

Special tools and workshop equipment required

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◆ Wrench - T10202-



Removing

Observe safety precautions ⇒ page 1 .

Observe rules for cleanliness ⇒ page 3 .

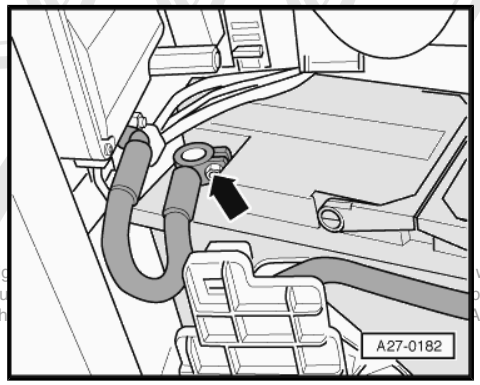
Caution

- *The fuel tank must not be more than 1/3 full when removing the fuel delivery unit. Drain the tank if necessary. Procedure ⇒ page 112*

Caution

Observe notes on procedure for disconnecting the battery.

– With ignition switched off, disconnect battery earth cable -arrow- ⇒ Electrical system; Rep. gr. 27 .

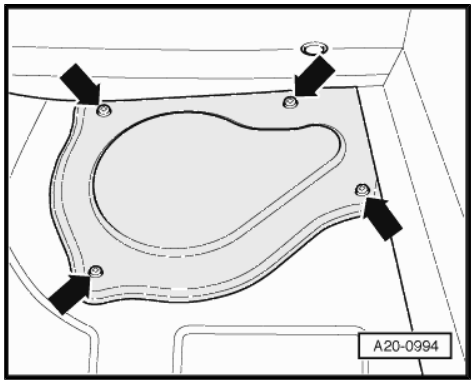


– Remove luggage compartment floor covering.

Note

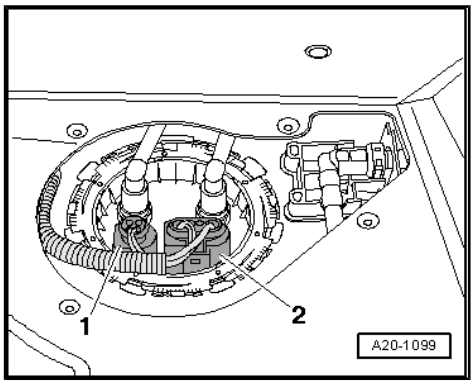
For removing and installing fuel delivery unit, take tool kit and spare wheel out of luggage compartment. You can then sit or kneel in the spare wheel well.

– Unscrew cover for flange (right-side) -arrows-.



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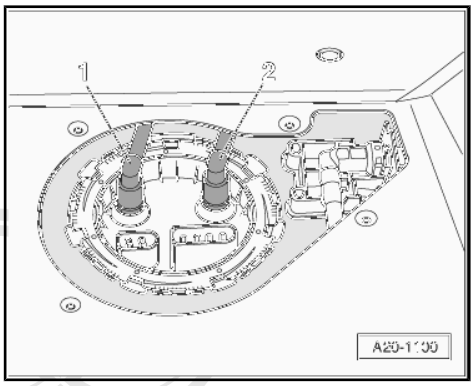
– Unplug electrical connectors -1- and -2- on flange (right-side).



– Mark fuel return line -1- and fuel supply line -2-.

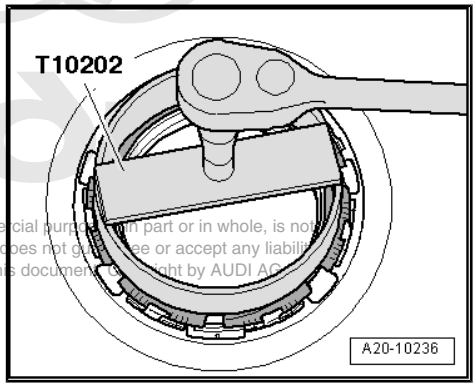
WARNING

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



– Detach both lines from flange (press release tabs).

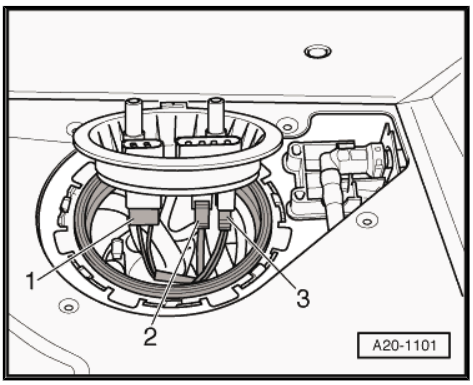
– Unscrew locking ring using wrench - T10202- .



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– Detach flange and remove seal.

– Unplug electrical connectors -1 ... 3- on underside of flange (right-side).



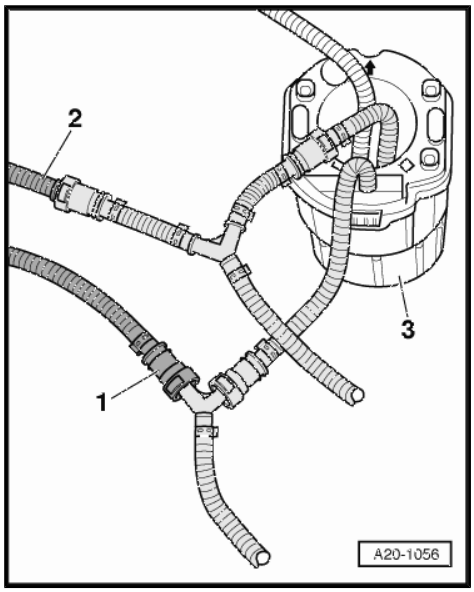
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Note

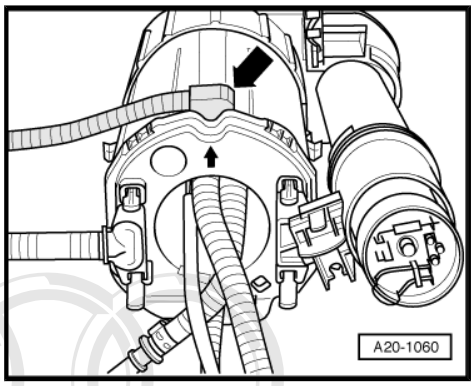
- *Pull out fuel lines from fuel tank opening prior to disconnecting the pipe connectors mentioned below.*
- *For illustration purposes some of the components are shown removed in the following illustrations.*

– Working through right fuel tank opening, press release tabs and disconnect fuel lines -1- and -2- going to fuel delivery unit (left-side).

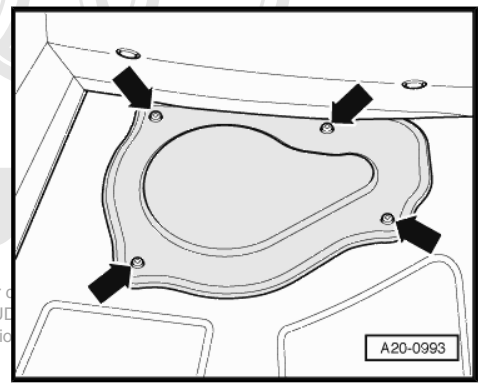
3 - Fuel delivery unit (right-side) with fuel pump - G23-



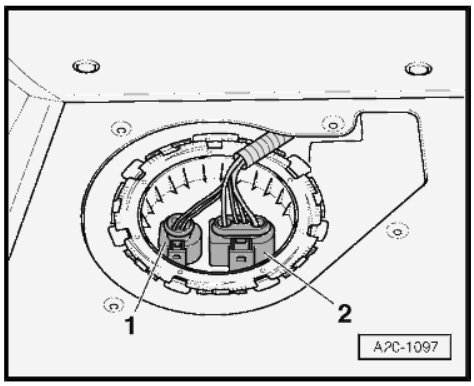
– Unclip fuel filler pipe -arrow- at front of fuel delivery unit (right-side).



– Detach cover for flange (left-side) -arrows-.



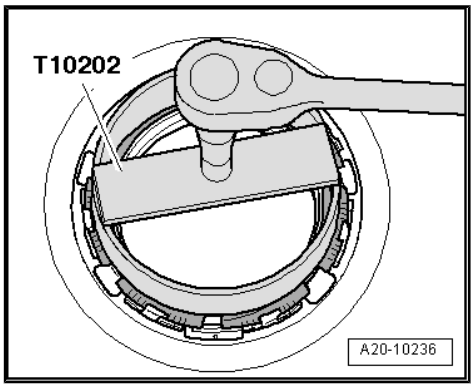
– Unplug electrical connectors -1- and -2- on flange (left-side).



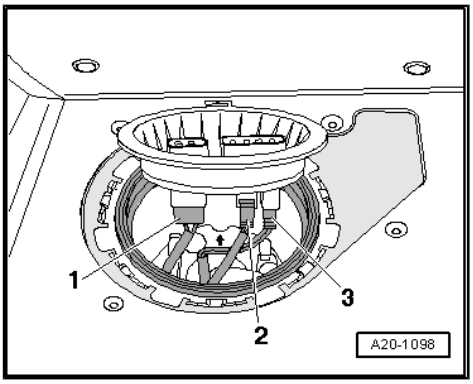
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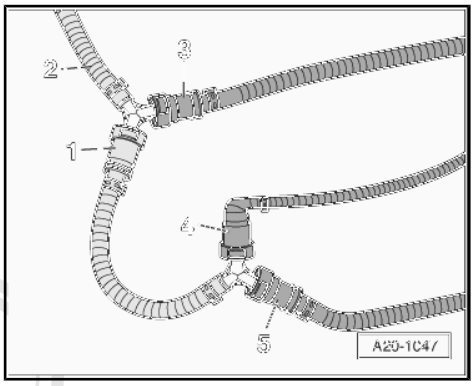
– Unscrew locking ring using wrench - T10202- .



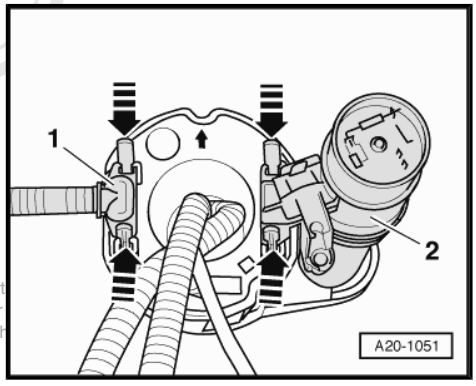
– Detach flange and remove seal.
– Unplug electrical connectors -1 ... 3- on underside of flange (left-side).



– Working through left fuel tank opening, disconnect supply line -3- for suction-jet pump from Y-connector (press release tab).
– Pull supply line for suction-jet pump out of right fuel tank opening.



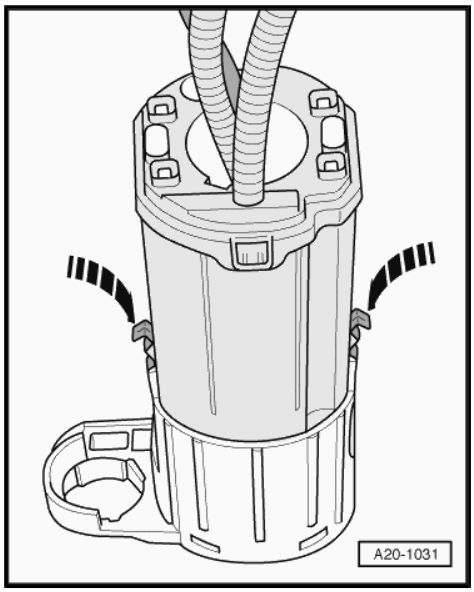
– Working through right fuel tank opening, press release tabs -arrows- and detach fuel supply line -1- and fuel gauge sender 4 - G393- -item 2-.
– Move fuel gauge sender 4 - G393- to right side.



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– Press down both retaining clips on retainer for fuel delivery unit -arrows-.
– Remove fuel delivery unit.



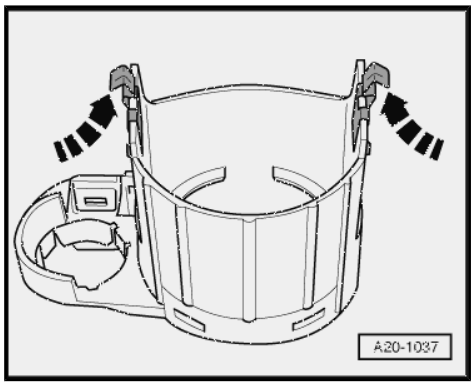
Note

Keep in mind that the fuel delivery unit still contains fuel.

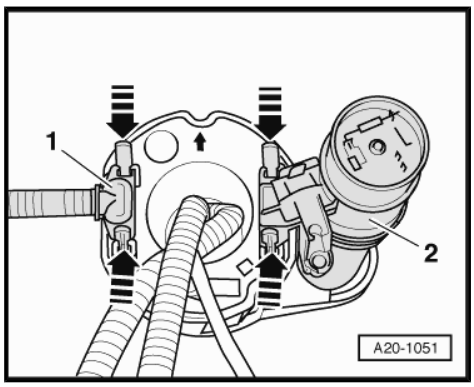
Installing

- Tightening torque ⇒ page 136

– Pull both retaining clips on retainer upwards -arrows- so that they engage audibly before installing the fuel delivery unit.
– Then press fuel delivery unit carefully into retainer so that it engages audibly.

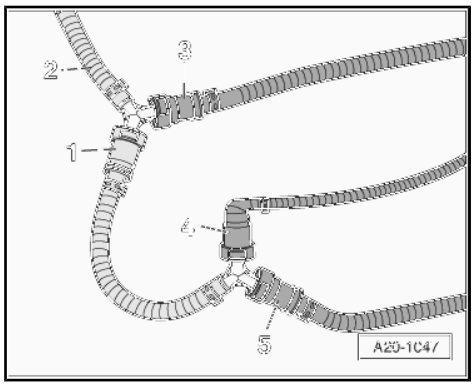


– Fit fuel supply line -1- and fuel gauge sender 4 - G393- -item 2- so that they engage audibly on fuel delivery unit (right-side).



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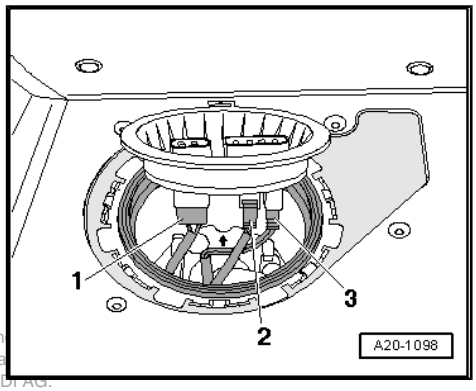
– Push supply line -3- for suction-jet pump through right fuel tank opening into left fuel tank chamber.
– Fit supply line for suction-jet pump onto Y-connector so it engages audibly.



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– Connect electrical connectors -1 ... 3- on underside of flange (left-side).

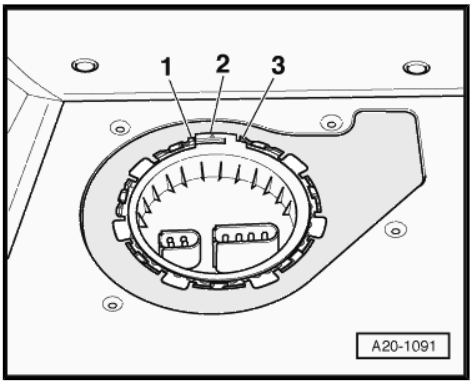
– Install new seal for flange (seal must be installed dry).



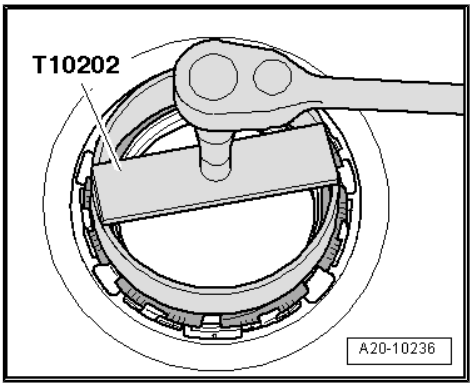
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– Fit flange into fuel tank; note correct installation position:

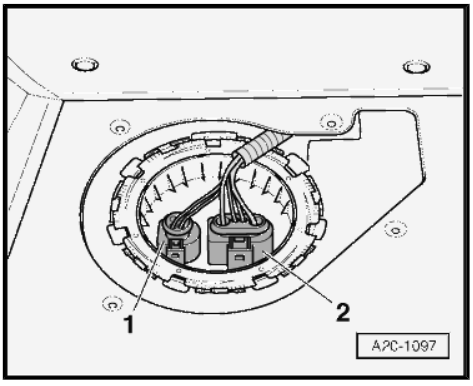
• Lug -2- on flange must be between tabs -1- and -3- on fuel tank.



– Tighten locking ring.

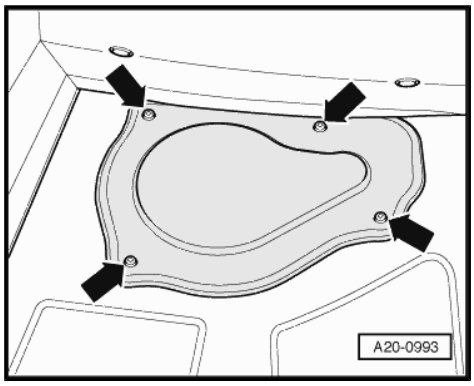


– Attach electrical connectors -1- and -2- on flange (left-side).



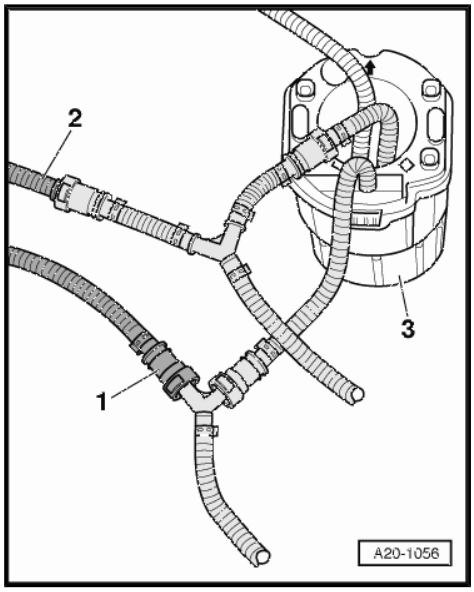
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– Secure cover for flange (left-side) -arrows-.



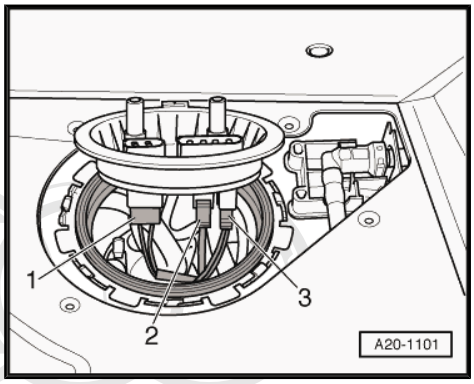
– Working through right fuel tank opening, connect fuel lines -1- and -2- going to left fuel delivery unit so that they engage audibly.

3 - Fuel delivery unit (right-side) with fuel pump - G23-



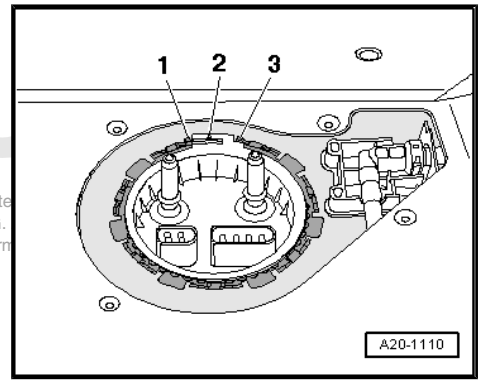
– Connect electrical connectors -1 ... 3- on underside of flange (right-side).

– Install new seal for flange (seal must be installed dry).



– Fit flange into fuel tank; note correct installation position:

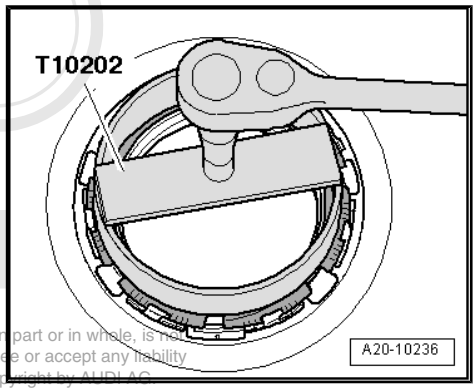
• Lug -2- on flange must be between tabs -1- and -3- on fuel tank.



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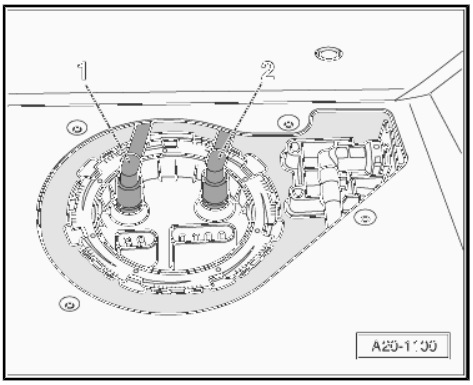
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– Tighten locking ring.

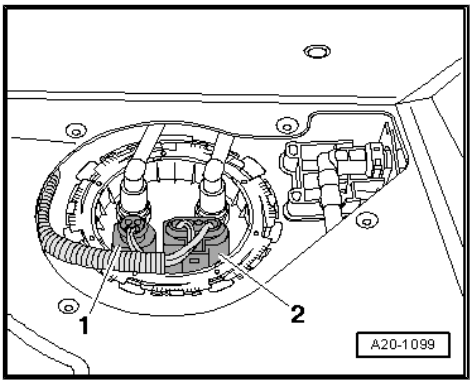


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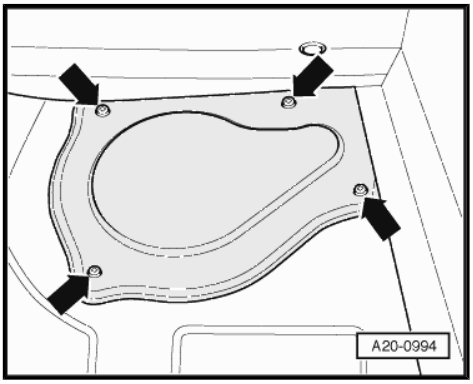
– Install fuel supply line -2- and fuel return line -1- (as marked) so that they engage audibly.



– Attach electrical connectors -1- and -2- on flange (right-side).



– Secure cover for flange (right-side) -arrows-.
– Connect battery. Observe notes on procedures required after connecting battery ⇒ Electrical system; Rep. gr. 27 .
– Put at least 5 litres of fuel into tank after installing

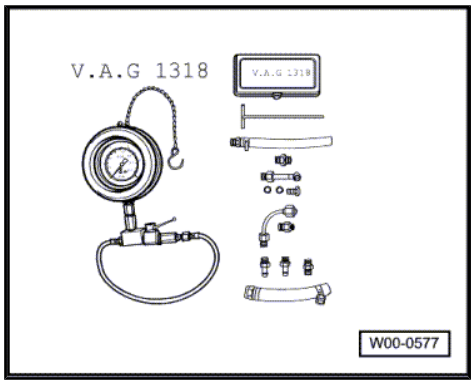


8.7 Checking delivery rate of fuel pumps - vehicles with fuel return line

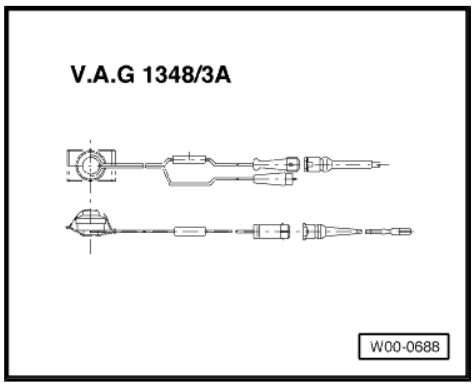
Special tools and workshop equipment required

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- K-Jetronic pressure tester - V.A.G 1318-



- Adapter set - V.A.G 1318/10-12-
- Remote control - V.A.G 1348/3A- for V.A.G 1348 with adapter cable -V.A.G 1348/3-3-



- Fuel-resistant measuring container

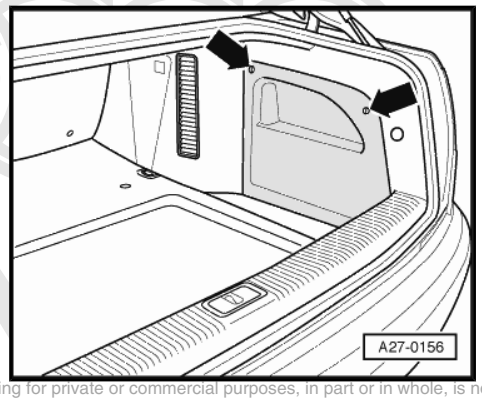
Procedure

– Observe test conditions ⇒ page 3 .

WARNING

Observe safety precautions ⇒ page 1 .

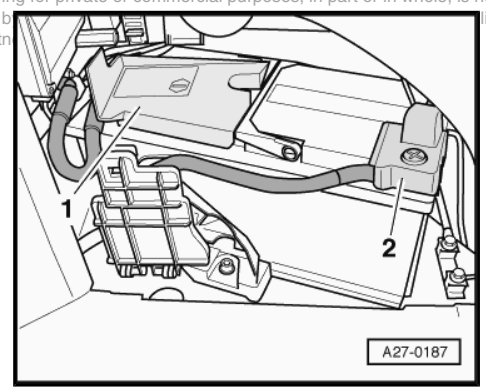
– Remove luggage compartment side trim cover (right-side) -arrows-.



– Remove cover -2- over battery.

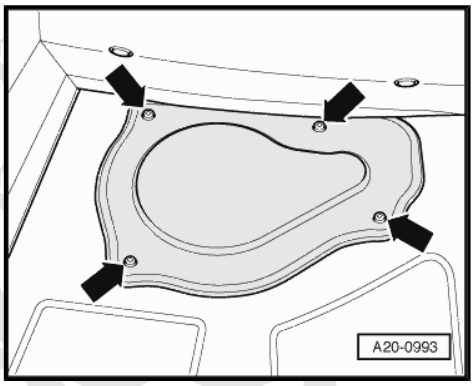
Note

Disregard -item 1-.



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– Remove luggage compartment floor covering.
– Detach cover for flange (left-side) -arrows-.

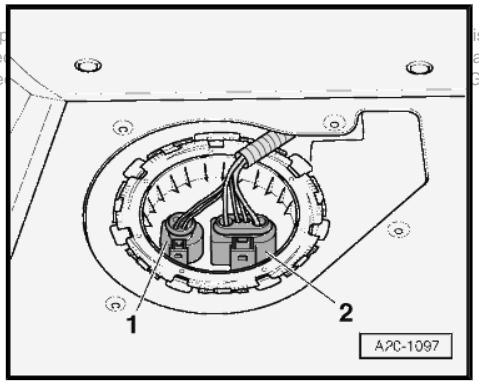


– Unplug electrical connector -2- on flange (left-side).

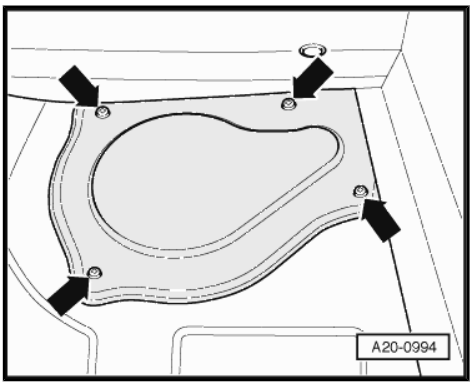
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Note

Disregard -item 1-.



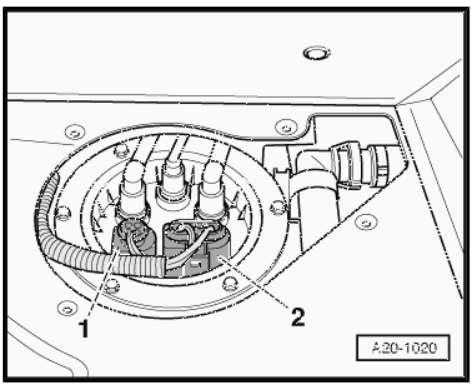
– Unscrew cover for flange (right-side) -arrows-.



– Unplug electrical connector -2- on flange (right-side).

Note

Disregard -item 1-.



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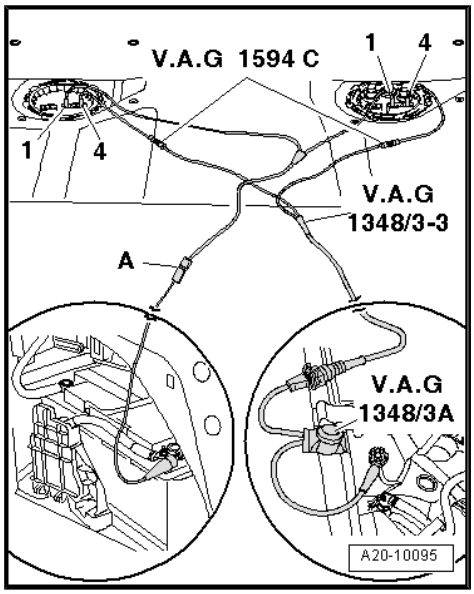
– Connect remote control - V.A.G 1348/3A- for V.A.G 1348 with adapter cable -V.A.G 1348/3-3- to contact -4- (earth) of fuel delivery unit (left-side) and fuel delivery unit (right-side) using test leads from auxiliary measuring set - V.A.G 1594C- .

– Move switch of remote control - V.A.G 1348/3A- for V.A.G 1348 to front of engine compartment.

– Connect crocodile clip to earth point in engine compartment.

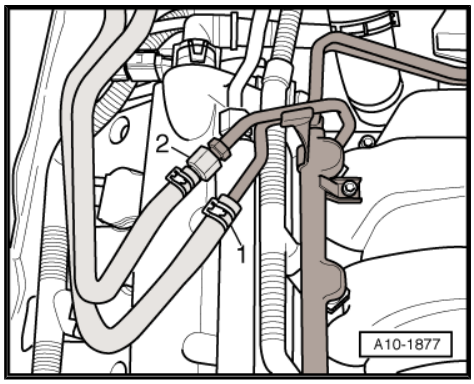
– Connect contact -1- (positive) of fuel delivery unit (left-side) and fuel delivery unit (right-side) to battery “+” via an improvised test lead. For safety reasons an in-line fuse -A- (10 A) must be connected into the lead.

– Remove filler cap from fuel filler neck.



WARNING

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



Caution

Rules for cleanliness when working on the injection system *⇒ page 3* *.*

– Disconnect fuel supply line -2- at fuel rail.

Note

Disregard -item 1-.

– Connect K-Jetronic pressure tester - V.A.G 1318- with adapters - V.A.G 1318/11- and -V.A.G 1318/12- to fuel line.

– Fit auxiliary hose -arrow- onto pressure tester and hold it in a measuring container.

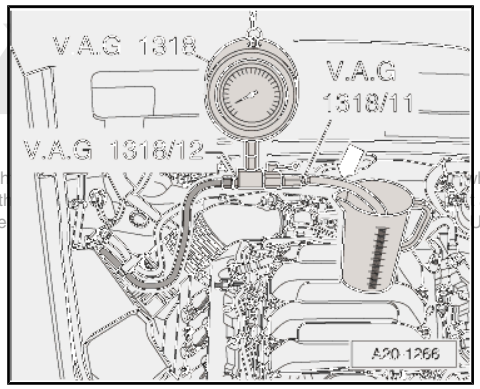
– Open cut-off valve on pressure tester. Lever must point in direction of flow.

– Build up pressure in fuel system by pressing the remote control button and slowly closing the cut-off valve on the pressure tester.

• Specification: 4 bar

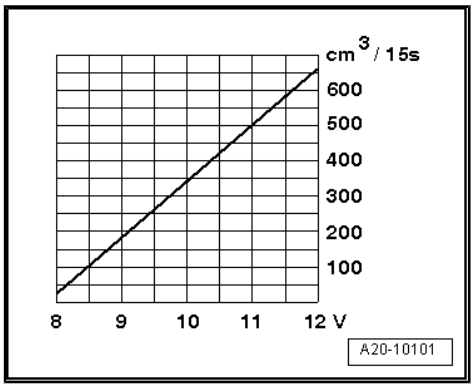
– From this point on do not move position of cut-off valve.

– Empty the measuring container.



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– Press remote control button for 15 seconds.
– Compare amount of fuel delivered with minimum delivery shown in diagram (cm^3/15 sec.).



Note

Voltage at fuel pump with engine stationary and pump running is approx. 2 volts less than battery voltage.

If minimum delivery rate is not reached, check for the following causes:

- Fuel lines have been crushed.
- Fuel filter is blocked.
- Fuel pump is defective.

Note

As there is hardly any difference in the fuel delivery rate if only one of the two fuel pumps is working (because of the hose connections inside the tank), it is difficult to diagnose a defective pump by just measuring the delivery rate.

In this case proceed as follows:

– Unplug the electrical auxiliary lead at the fuel delivery units (one at a time).
– Measure delivery rate of fuel delivery unit located on the opposite side.

If the delivery rate of the fuel delivery unit which has been measured separately is considerably below specification:

– Renew the relevant fuel delivery unit.

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

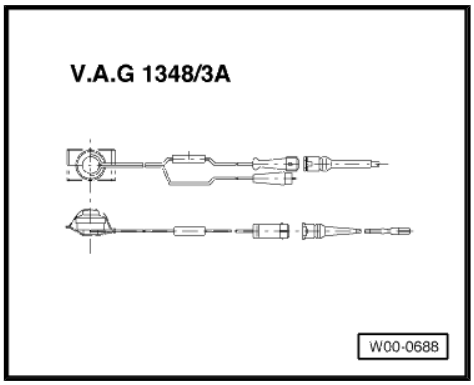
– Secure fuel supply line to fuel rail ⇒ Rep. gr. 24.

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8.8 Checking delivery rate of fuel pumps - vehicles with fuel system without fuel return line

Special tools and workshop equipment required

- Adapter -V.A.G 1318/26-
- Remote control - V.A.G 1348/3A- for V.A.G 1348 with adapter cable -V.A.G 1348/3-3-



- Fuel-resistant measuring container

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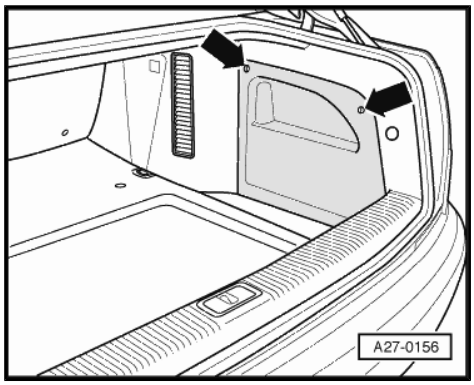
Procedure

– Observe test conditions ⇒ page 3 .

WARNING

Observe safety precautions ⇒ page 1 .

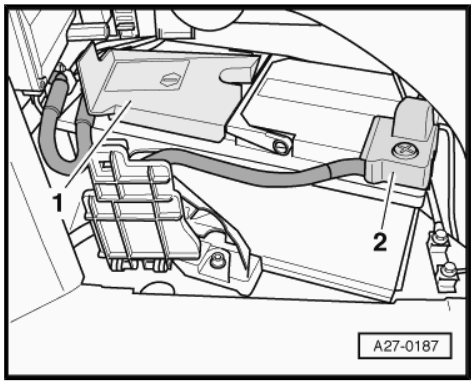
– Remove luggage compartment side trim cover (right-side) -arrows-.



– Remove cover -2- over battery.

Note

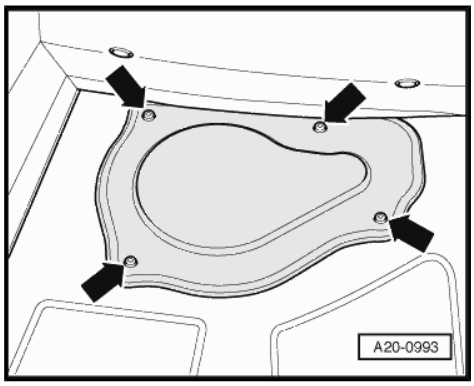
Disregard -item 1-.



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– Remove luggage compartment floor covering.

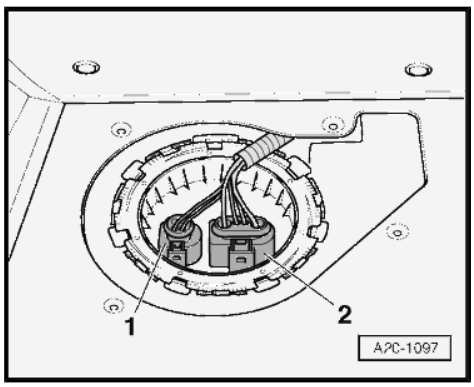
– Detach cover for flange (left-side) -arrows-.



– Unplug electrical connector -2- on flange (left-side).

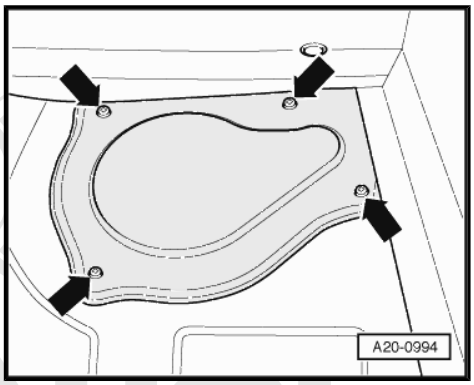
Note

Disregard -item 1-.

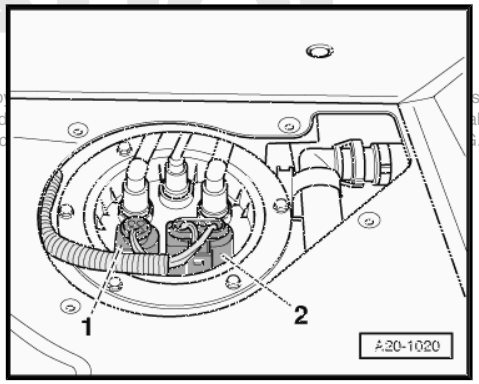


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– Unscrew cover for flange (right-side) -arrows-.



– Unplug electrical connector -2- on flange (right-side).



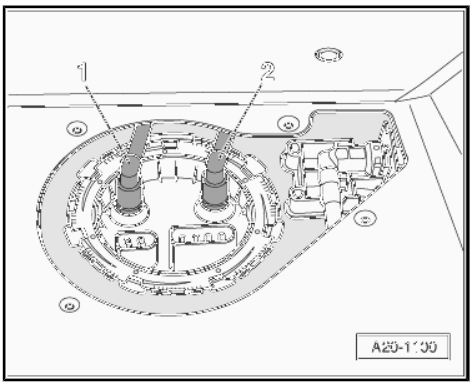
Note

Disregard -item 1-.

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WARNING

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



Caution

Rules for cleanliness when working on the injection system *⇒ page 3* ***.***

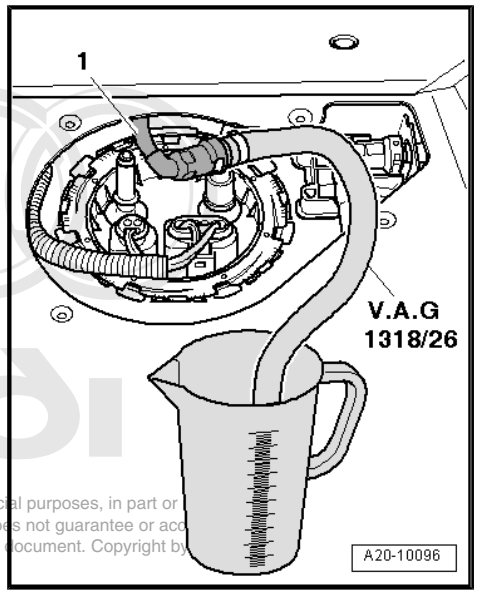
– Disconnect fuel return line -1- from flange by pressing release tabs.

Note

Disregard -item 2-.

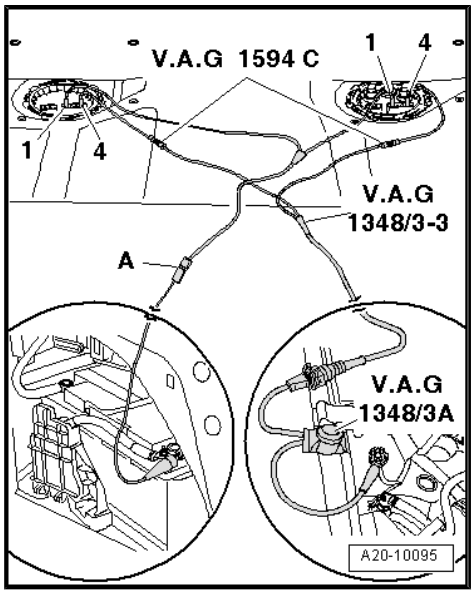
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– Fit adapter -V.A.G 1318/26- onto disconnected fuel pipe -1- and hold adapter hose in measuring container.



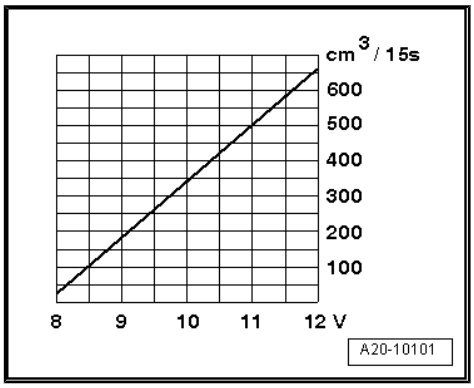
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– Connect remote control - V.A.G 1348/3A- for V.A.G 1348 with adapter cable -V.A.G 1348/3-3- to contact -4- (earth) of fuel delivery unit (left-side) and fuel delivery unit (right-side) using test leads from auxiliary measuring set - V.A.G 1594C- .
– Connect crocodile clip to earth point next to battery.
– Connect contact -1- (positive) of fuel delivery unit (left-side) and fuel delivery unit (right-side) to battery “+” via an improvised test lead. For safety reasons an in-line fuse -A- (10 A) must be connected into the lead.
– Remove filler cap from fuel filler neck.



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– Press remote control button for 15 seconds.
– Compare amount of fuel delivered with minimum delivery shown in diagram (cm^3/15 sec.).



Note

Voltage at fuel pump with engine stationary and pump running is approx. 2 volts less than battery voltage.

If minimum delivery rate is not reached, check for the following causes:

- Fuel lines have been crushed.
- Fuel filter is blocked.
- Fuel pumps are defective.

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Note

As there is hardly any difference in the fuel delivery rate if only one of the two fuel pumps is working (because of the hose connections inside the tank), it is difficult to diagnose a defective pump by just measuring the delivery rate.

In this case proceed as follows:

– Unplug the electrical auxiliary lead at the fuel delivery units (one at a time).
– Measure delivery rate of fuel delivery unit located on the opposite side.

If the delivery rate of the fuel delivery unit which has been measured separately is considerably below specification:

– Renew the relevant fuel delivery unit.

8.9 Suction-jet pumps

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1 - Suction-jet pump (left-side)

2 - Fuel delivery unit (left-side)

3 - Expansion tank

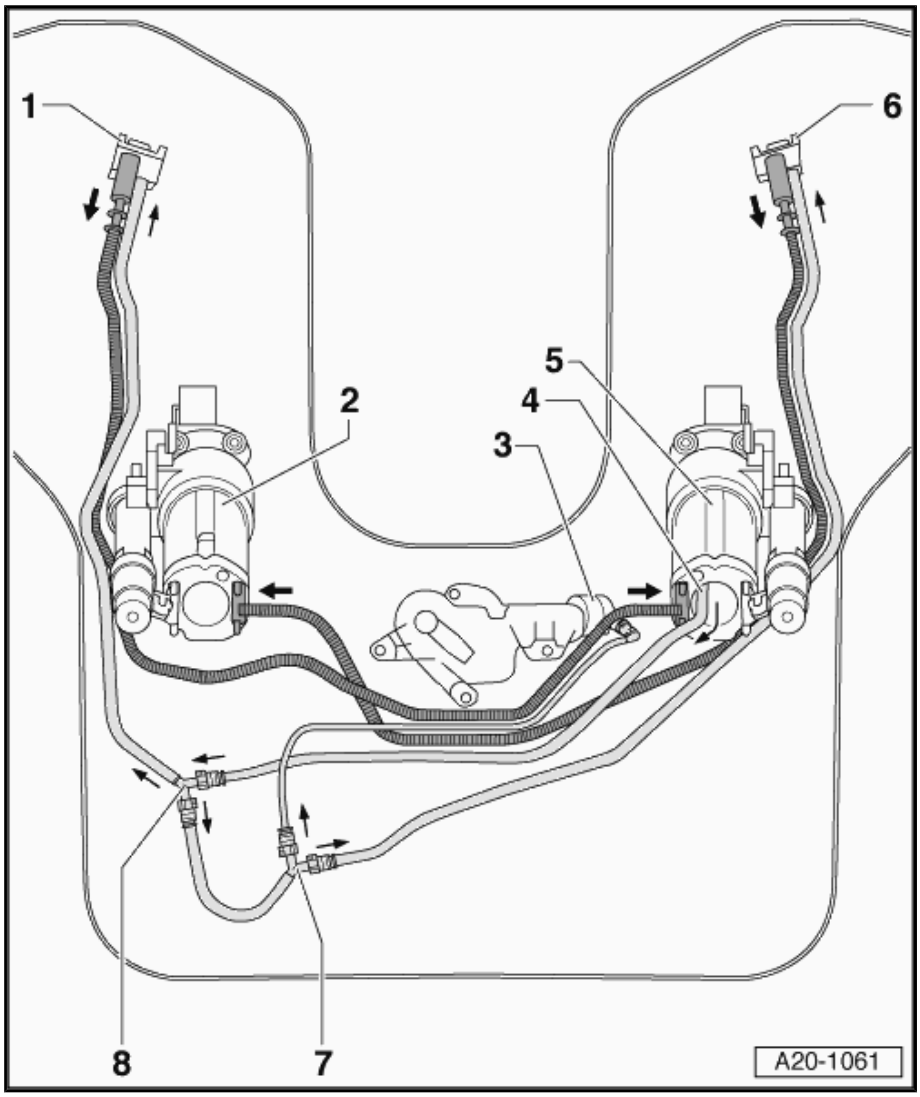
4 - Fuel pump (right-side)

5 - Fuel delivery unit (right-side)

6 - Suction-jet pump (right-side)

7 - Y-connector

8 - Y-connector



Description of operation

To ensure a reliable fuel supply in all situations, the fuel pumps must never draw in air, even under extreme driving conditions such as very sharp bends or under heavy braking. This may happen when the fuel sloshes into one of the corners of a partially filled fuel tank.

- For this reason, the fuel delivery units -item 2- and -item 5- incorporate a so-called baffle housing, in which the fuel pumps are fitted, as well as the fuel pumps themselves. The baffle housing is a container permanently filled with fuel, so that the fuel pumps are surrounded with fuel regardless of the fuel level in the tank.
- Consequently, proper filling of the baffle housings is essential for trouble-free operation of the fuel pumps. This is the purpose of the "suction-jet pumps".
- The suction-jet pumps operate according to the principle of fluid entrainment: a stream of fuel from the primary stage of the fuel pump (right-side) -item 4- is passed through a nozzle in the suction-jet pumps -item 1- and -item 6-, and is thus accelerated. The accelerated stream of fuel draws off the surrounding fuel and delivers it to the baffle housings in the fuel delivery units. The suction jet pump (right-side) -item 6- delivers the fuel into the baffle housing (left-side); the suction jet pump (left-side) -item 1- delivers the fuel into the baffle housing (right-side).
- The stream of fuel is distributed from the primary stage of the fuel pump (right-side) to the two suction-jet pumps via two Y-connectors -item 7- and -item 8-.
- Another small suction-jet pump is located in the expansion tank -item 3- and delivers fuel from there back to the fuel tank.

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8.10 Removing and installing suction-jet pump (left-side)

Removing

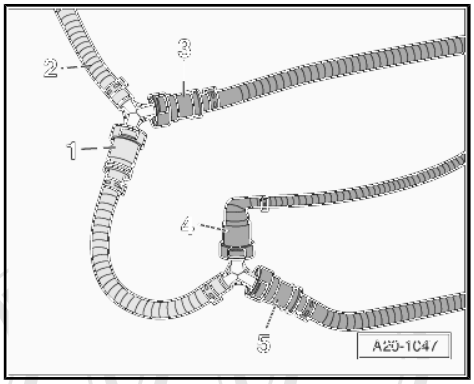
Observe safety precautions ⇒ page 1 .

Observe rules for cleanliness ⇒ page 3 .

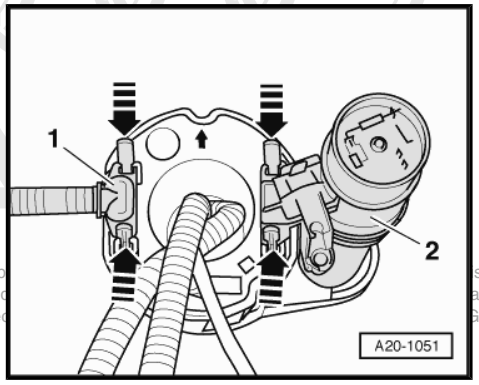
– Remove the fuel delivery unit (left-side) ⇒ page 129 .

– Remove fuel gauge sender 3 - G237- (tubular sender, left-side) from fuel tank.

– Working through left fuel tank opening, disconnect supply lines -1- and -3- for suction-jet pumps from Y-connector (press release tabs).



– Working through right fuel tank opening, press release tabs -arrows- and detach fuel supply line -1-.



Note

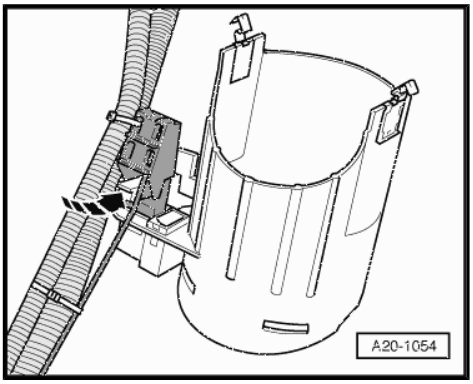
Disregard -item 2-.

– Pull out disconnected fuel supply line through left fuel tank opening.

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– Working through left fuel tank opening, press release tab -arrow- and detach retaining clip for suction jet lines from retainer.

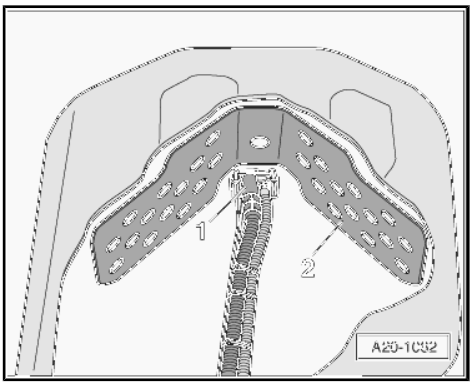
– Pull out suction-jet pump (left-side) together with lines through left fuel tank opening.



Installing

– Insert suction-jet pump (left-side) -1- into fuel tank and place into recess in baffle plate -2- in fuel tank at front, as shown in illustration.

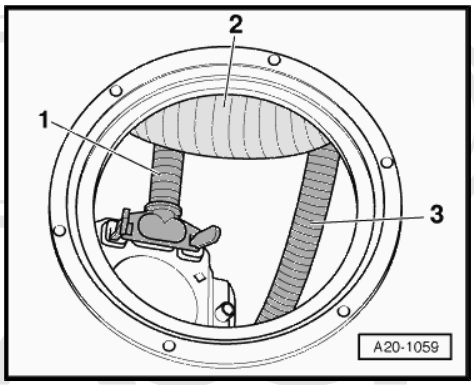
– Then press retaining clip for suction-jet pump into retainer so it engages audibly.



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– Push fuel supply line through left fuel tank opening into right fuel tank chamber. Note routing:

• The fuel supply line -3- must be routed below the fuel filler pipe -2- at the left fuel tank opening.

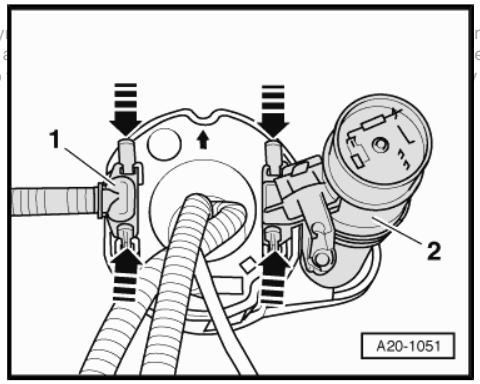


Note

Disregard -item 1-.

– Fit fuel supply line -1- onto fuel delivery unit (right-side) so that it engages audibly.

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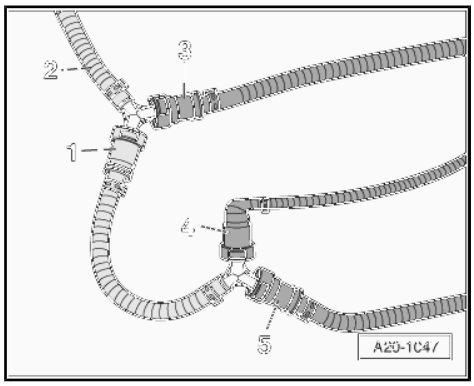
Note

Disregard -item 2-.

– Working through left fuel tank opening, fit supply lines -1- and -3- for suction-jet pumps onto Y-connector so that they engage audibly.

– Insert fuel gauge sender 3 - G237- into fuel tank.

– Install fuel delivery unit (left-side) ⇒ page 129 .



8.11 Removing and installing suction-jet pump (right-side)

Removing

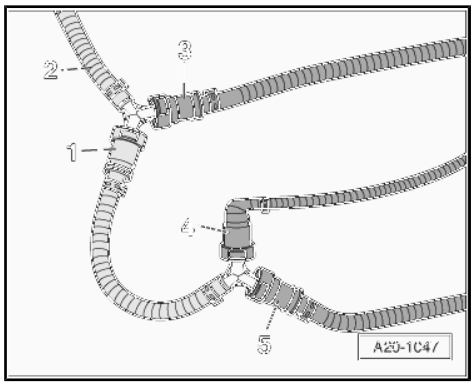
Observe safety precautions ⇒ page 1 .

Observe rules for cleanliness ⇒ page 3 .

– Remove fuel delivery unit (right-side) ⇒ page 141 .

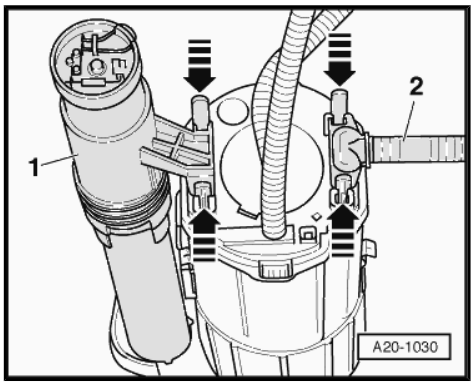
– Remove fuel gauge sender 4 - G393- (tubular sender, right-side) from fuel tank.

– Working through left fuel tank opening, disconnect supply line -5- for suction-jet pump from Y-connector (press release tab).



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– Working through left fuel tank opening, press release tabs -arrows- and detach fuel supply line -2-.



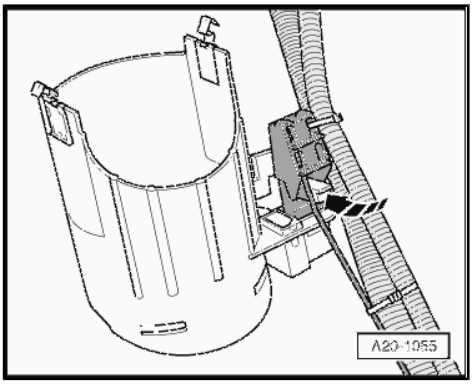
Note

Disregard -item 1-.

– Pull out disconnected fuel supply line through right fuel tank opening.

– Working through right fuel tank opening, press release tab -arrow- and detach retaining clip for suction jet lines from retainer.

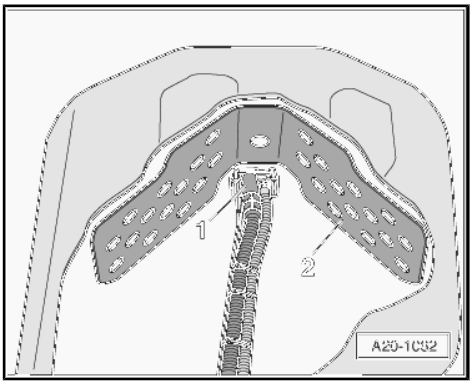
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– Pull suction-jet pump (right-side) together with lines out of right fuel tank opening.

Installing

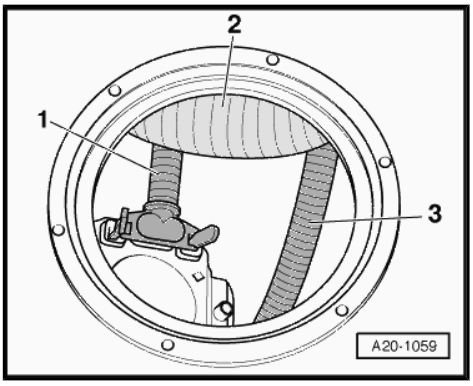
– Insert suction-jet pump (right-side) -1- into fuel tank and place into recess in baffle plate -2- in fuel tank at front, as shown in illustration.



– Then press retaining clip for suction-jet pump into retainer so it engages audibly.

– Push fuel supply line through right fuel tank opening into left fuel tank chamber. Note routing:

• The fuel supply line -1- must be routed below the fuel filler pipe -2- at the left fuel tank opening.

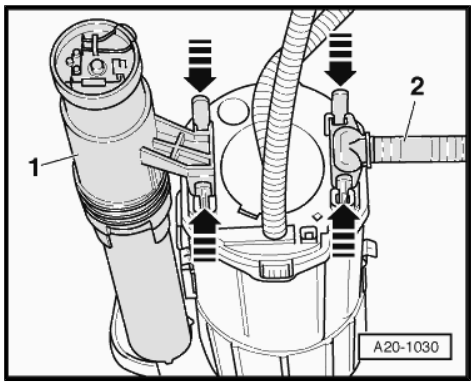


Note

Disregard -item 3-.

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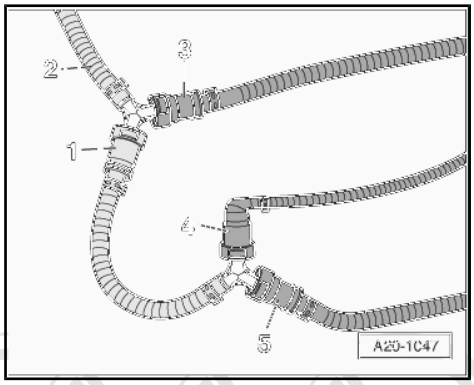
– Fit fuel supply line -2- onto fuel delivery unit (left-side) so that it engages audibly.



Note

Disregard -item 1-.

– Push supply line -5- for suction-jet pump through right fuel tank opening into left fuel tank chamber.
– Fit supply line for suction-jet pump onto Y-connector so it engages audibly.
– Insert fuel gauge sender 4 - G393- into fuel tank.
– Install fuel delivery unit (right-side) ⇒ page 86 .



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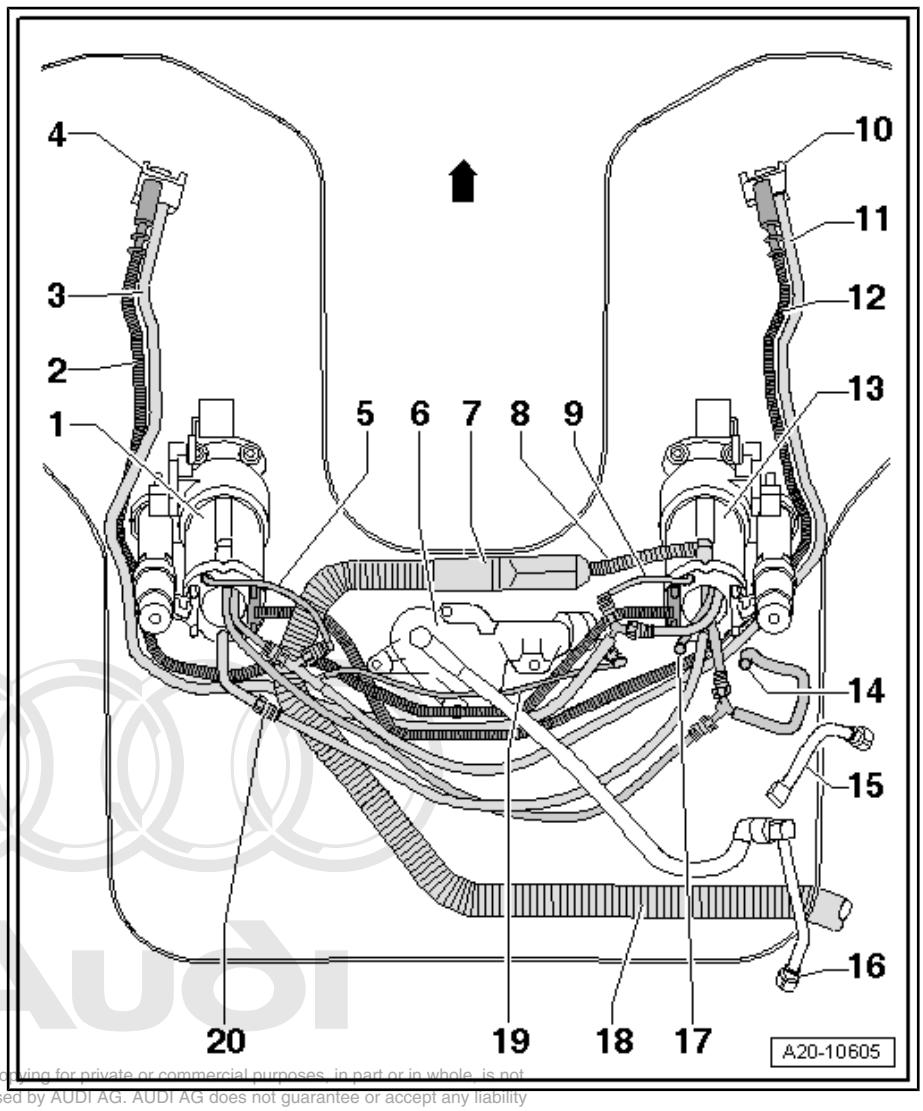
9 Routing of pipes/hoses (inside fuel tank) - USA vehicles with FSI engine

⇒ "9.1 Routing of pipes/hoses (inside fuel tank) - exploded view", page 163

9.1 Routing of pipes/hoses (inside fuel tank) - exploded view

Note

- *The illustration shows the correct routing of pipes/hoses inside the fuel tank (schematic view).*
- *It is not necessary to route the pipes/hoses in exactly the same way as shown in the illustration, except for pipes/hoses shown in ⇒ page 164 . However it is essential to fit the pipes/hoses with sufficient space in relation to each other and to prevent rattling noises.*
- *The -arrow- points in direction of travel.*



1 - Fuel delivery unit (left-side) with fuel system pressurisation pump - G6-

2 - Fuel supply line

- From suction-jet pump (left-side) to fuel delivery unit (right-side)

3 - Supply line for suction-jet pump

- From fuel pump (right-side) to suction-jet pump (left-side)

4 - Suction-jet pump (left-side)

5 - Supply line for suction-jet pump

- For fuel delivery unit (left-side)

6 - Expansion tank

- With suction-jet pump to extract fuel from expansion tank

7 - Non-return flap

- For fuel filler pipe

8 - Primary filler pipe

- To fuel delivery unit (right-side).
- Ensures that a small amount of fuel is delivered immediately to the fuel delivery unit when the tank is filled for the first time.

9 - Supply line for suction-jet pump

- For fuel delivery unit (right-side)

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10 - Suction-jet pump (right-side)

11 - Supply line for suction-jet pump

- ❑ From fuel pump (left-side) to suction-jet pump (right-side)

12 - Fuel supply line

- ❑ From suction-jet pump (right-side) to fuel delivery unit (left-side)

13 - Fuel delivery unit (right-side) with fuel pump - G23-

14 - Fuel supply line

- ❑ From fuel pumps (left and right) to flange

15 - Breather line

- ❑ To breather connection at top of fuel filler neck

16 - Breather line

- ❑ To activated charcoal filter at bottom of spare wheel well on underbody

17 - Fuel return line

- ❑ From flange to fuel delivery unit (right-side)
- ❑ Fitted loosely in fuel delivery unit (right-side)

18 - Fuel filler pipe

- ❑ From fuel filler neck to non-return flap in fuel tank

19 - Supply line for suction-jet pump

- ❑ To suction-jet pump in expansion tank

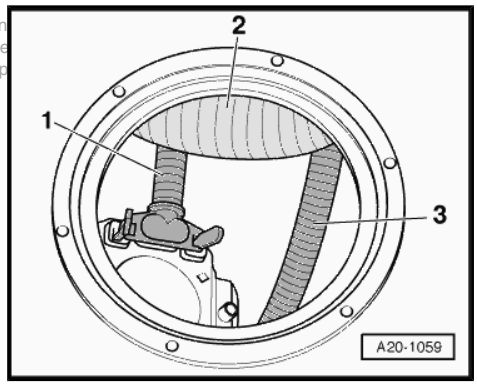
20 - Balance pipe

- ❑ Between fuel delivery units

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Installation position of fuel supply lines

- The fuel supply lines -1- and -3- must be routed below the fuel filler pipe -2- at the left fuel tank opening.



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10 Fuel delivery unit with fuel pump and fuel gauge senders - USA vehicles with FSI engine

⇒ “10.1 Exploded view - fuel delivery unit (left-side) with fuel system pressurisation pump G6 and fuel gauge senders G and G237 ”, page 165

⇒ “10.2 Checking fuel system pressurisation pump G6 (left-side) - electrical test”, page 167

⇒ “10.3 Removing and installing fuel delivery unit (left-side) with fuel system pressurisation pump G6 ”, page 167

⇒ “10.4 Exploded view - fuel delivery unit (right-side) with fuel pump G23 and fuel gauge senders G169 and G393 ”, page 175

⇒ “10.5 Checking fuel pump G23 (right-side) - electrical test”, page 176

⇒ “10.6 Removing and installing fuel delivery unit (right-side) with fuel pump G23 ”, page 177

⇒ “10.7 Checking delivery rate of fuel pumps - vehicles with 8-cylinder engine”, page 185

⇒ “10.8 Checking delivery rate of fuel pumps - vehicles with 10-cylinder engine (Audi S8)”, page 189

⇒ “10.9 Fuel pump control unit J538 ”, page 193

⇒ “10.10 Removing and installing fuel pump control unit J538 ”, page 193

⇒ “10.11 Suction-jet pumps”, page 194

⇒ “10.12 Removing and installing suction-jet pump (left-side)”, page 196

⇒ “10.13 Removing and installing suction-jet pump (right-side)”, page 198

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10.1 Exploded view - fuel delivery unit (left-side) with fuel system pressurisation pump - G6- and fuel gauge senders G and -G237-

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1 - Retainer

- ❑ For fuel delivery unit

2 - Fuel gauge sender - G-

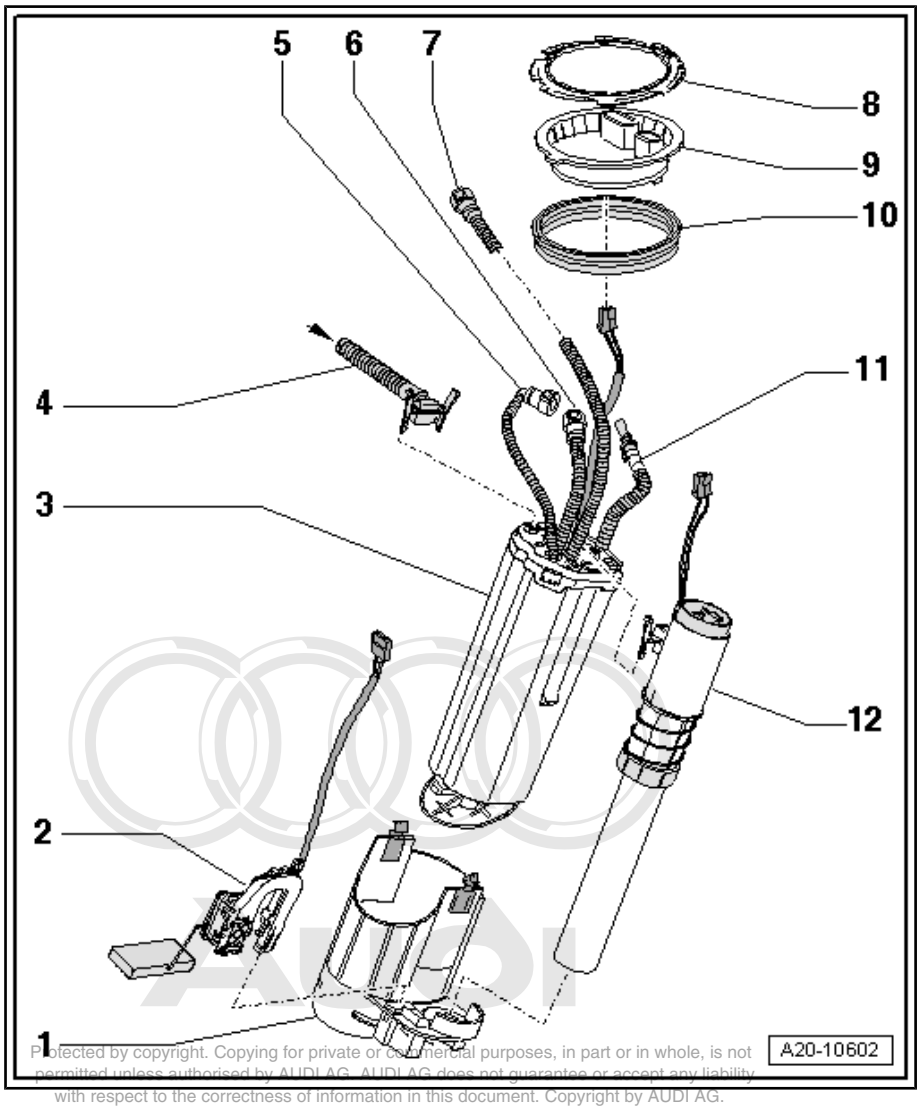
- ❑ Black
- ❑ Clipped onto retainer -item 1-
- ❑ Checking resistance values ⇒ page 221
- ❑ Removing and installing ⇒ page 222

3 - Fuel delivery unit (left-side)

- ❑ With fuel system pressurisation pump - G6-
- ❑ Clipped onto retainer -item 1-
- ❑ Different versions available; for correct version refer to ⇒ Electronic parts catalogue
- ❑ Checking fuel pump (electrical test) ⇒ page 125
- ❑ Checking residual pressure ⇒ Rep. gr. 24
- ❑ Removing and installing ⇒ page 70
- ❑ Put at least 5 litres of fuel into tank after installing

4 - Fuel supply line

- ❑ From suction jet pump (right-side)
- ❑ Clipped onto fuel delivery unit -item 3-



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5 - Supply line for suction-jet pump

- ❑ For fuel delivery unit (left-side)

6 - Supply line for suction-jet pump

- ❑ To suction-jet pump (right-side)

7 - Fuel supply line

- ❑ The plug connector is located on the right side of the fuel tank
- ❑ Press release tab on connection piece to disconnect

8 - Locking ring

- ❑ Remove and install using wrench - T10202-
- ❑ Tighten to 120 Nm

9 - Flange (left-side)

- ❑ Installation position ⇒ page 167

10 - Seal

- ❑ Renew
- ❑ Install dry

11 - Balance pipe

- ❑ To fuel delivery unit (right-side).

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12 - Fuel gauge sender 3 - G237-

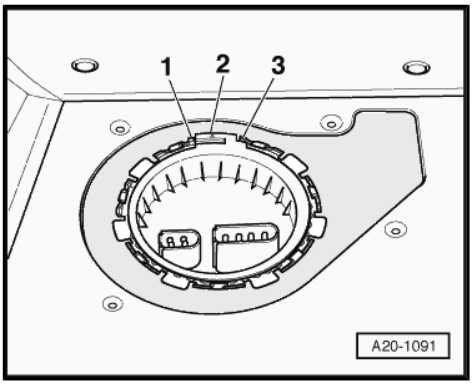
- ❑ Grey
- ❑ Clipped onto fuel delivery unit -item 3-
- ❑ Checking resistance values ⇒ page 225
- ❑ Removing and installing ⇒ page 226

Installation position of flange (left-side)

– Install new seal for flange (seal must be installed dry).

– Fit flange into fuel tank; note correct installation position:

• Lug -2- on flange must be between tabs -1- and -3- on fuel tank.



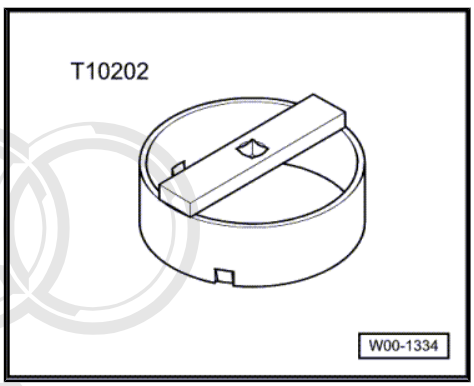
10.2 Checking fuel system pressurisation pump - G6- (left-side) - electrical test

- ♦ On vehicles with FSI engine, voltage for the fuel pumps is supplied via fuel pump control unit - J538- .
- ♦ Check fuel pump control unit - J538- in “Guided Fault Finding” ⇒ Vehicle diagnostic tester.

10.3 Removing and installing fuel delivery unit (left-side) with fuel system pressurisation pump - G6-

Special tools and workshop equipment required

- ♦ Wrench - T10202-



Removing

Observe safety precautions ⇒ page 1 .

Observe rules for cleanliness ⇒ page 3 .

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Caution

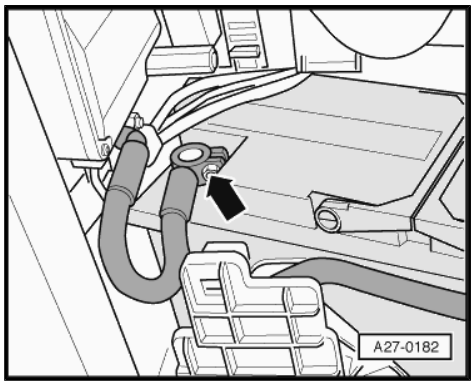
- *The fuel tank must not be more than 1/3 full when removing the fuel delivery unit. Drain the tank if necessary. Procedure ⇒ page 112*

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Caution

Observe notes on procedure for disconnecting the battery.

– With ignition switched off, disconnect battery earth cable -arrow- ⇒ Electrical system; Rep. gr. 27 .

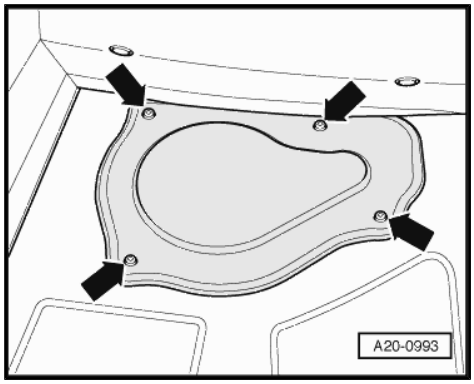


– Remove luggage compartment floor covering.

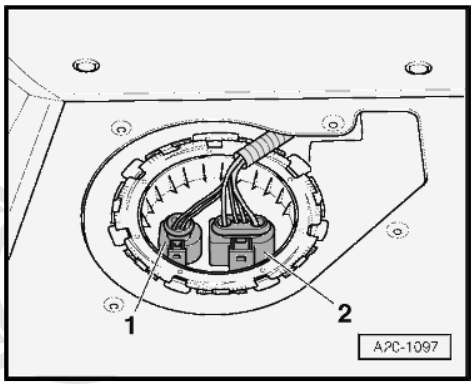
Note

For removing and installing fuel delivery unit, take tool kit and spare wheel out of luggage compartment. You can then sit or kneel in the spare wheel well.

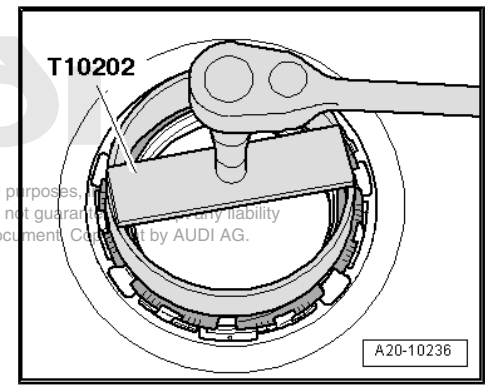
– Detach cover for flange (left-side) -arrows-.



– Unplug electrical connectors -1- and -2- on flange (left-side).



– Unscrew locking ring using wrench - T10202- .

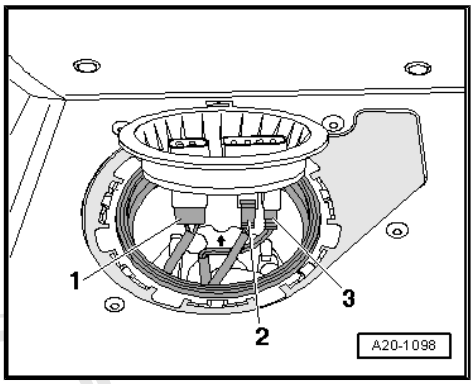


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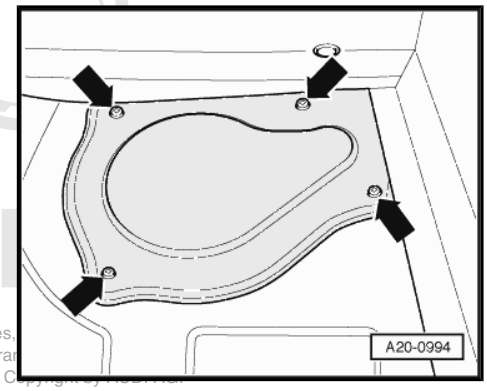
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– Detach flange and remove seal.

– Unplug electrical connectors -1 ... 3- on underside of flange (left-side).

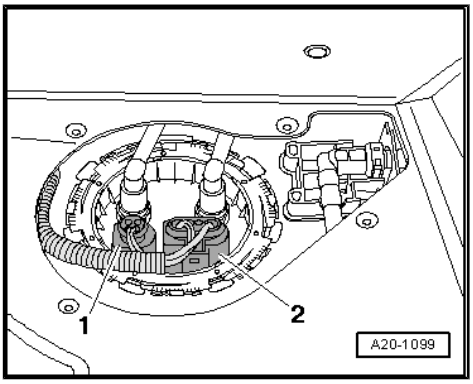


– Unscrew cover for flange (right-side) -arrows-.



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– Unplug electrical connectors -1- and -2- on flange (right-side).

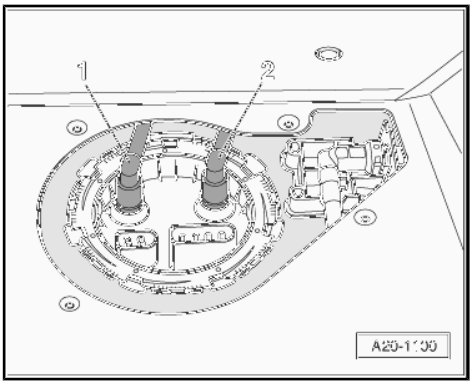


– Mark fuel return line -1- and fuel supply line -2-.

WARNING

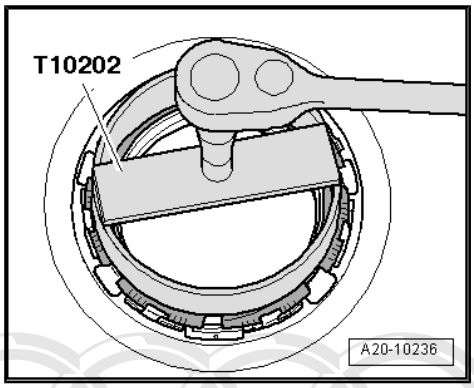
The fuel system is pressurised. Before opening the system place a clean cloth around the connection. Then release pressure by carefully loosening the connection.

– Detach both lines from flange (press release tabs).

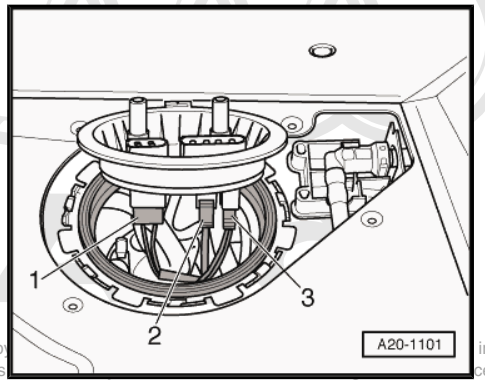


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– Unscrew locking ring using wrench - T10202- .



– Detach flange and remove seal.
– Unplug electrical connectors -1 ... 3- on underside of flange (right-side).

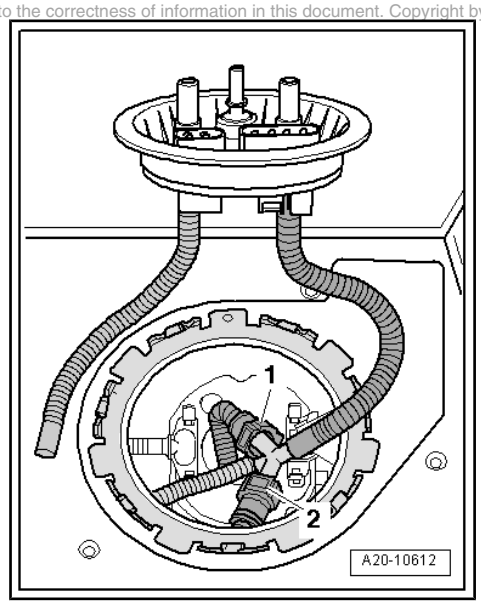


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Note

Pull out fuel lines from fuel tank opening prior to disconnecting the pipe connectors mentioned below.

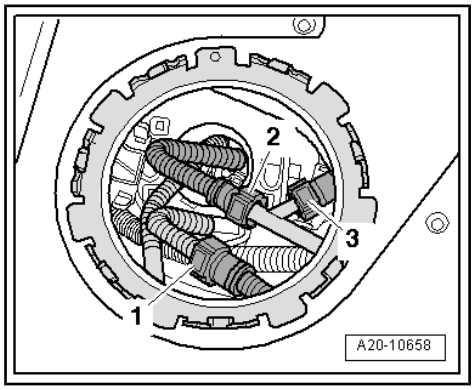
– Working through right fuel tank opening, press release tab and disconnect fuel supply line -2- going to fuel delivery unit (left-side).



Note

Disregard -item 1-.

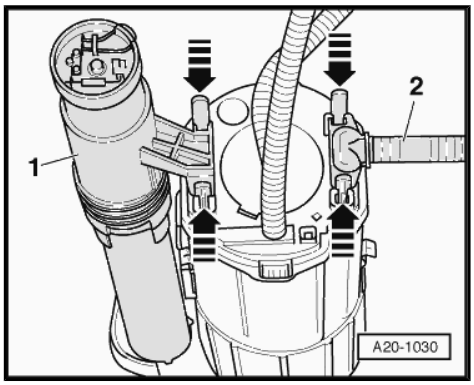
– Working through left fuel tank opening, press release tabs and disconnect balance pipe -1- and supply line -2- going to suction-jet pump (right-side) and supply line -3- going to fuel delivery unit (left-side).
– Pull disconnected fuel lines out of left fuel tank opening.



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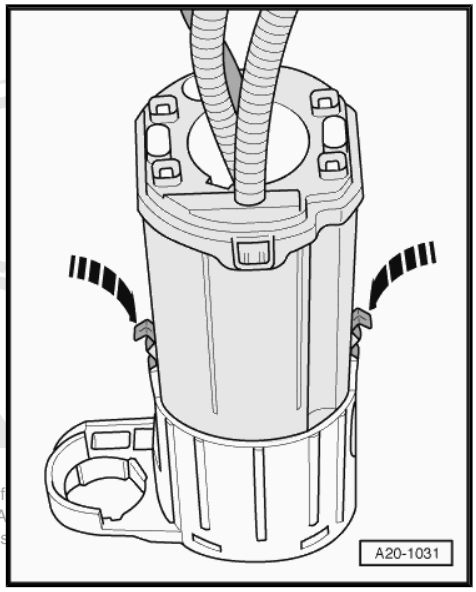
– Working through left fuel tank opening, press release tabs -arrows- and detach fuel supply line -2- and fuel gauge sender 3 - G237- -item 1-.

– Move fuel gauge sender 3 - G237- to left side.



– Press down both retaining clips on retainer for fuel delivery unit -arrows-.

– Remove fuel delivery unit.



Note

Keep in mind that the fuel delivery unit still contains fuel.

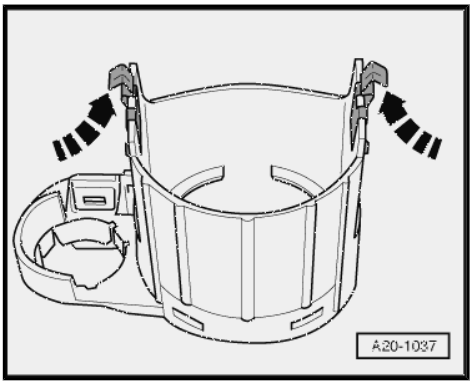
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Installing

- Tightening torque ⇒ page 68

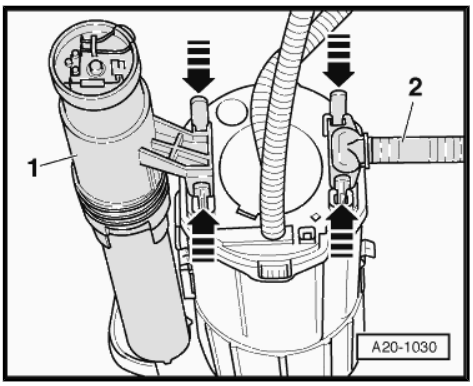
– Pull both retaining clips on retainer upwards -arrows- so that they engage audibly before installing the fuel delivery unit.

– Then press fuel delivery unit carefully into retainer so that it engages audibly.



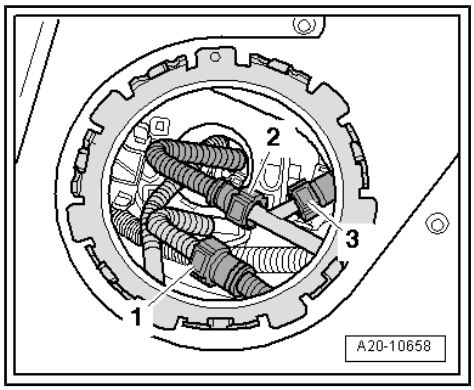
– Fit fuel supply line -2- and fuel gauge sender 3 - G237- -item 1- so that they engage audibly.

– Guide fuel supply line for fuel delivery unit (left-side) into fuel tank chamber (right-side).



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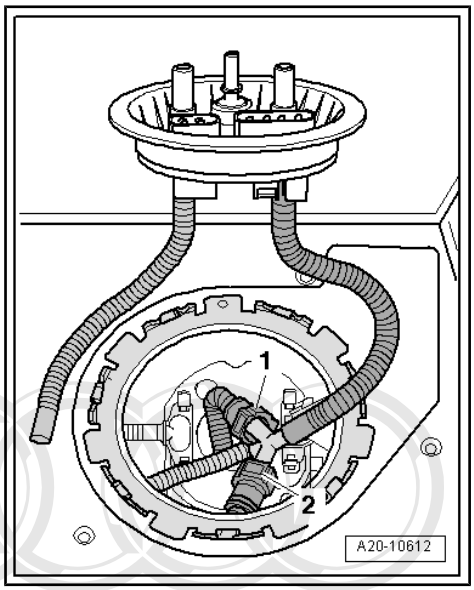
– Working through left fuel tank opening, fit balance pipe -1- and supply line -2- going to suction-jet pump (right-side) and supply line -3- going to fuel delivery unit (left-side) so that they engage audibly.



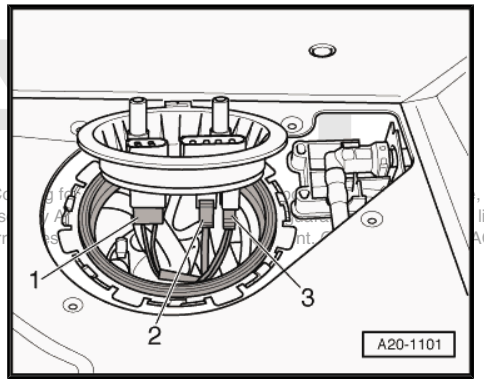
– Working through right fuel tank opening, fit fuel supply line -2- so that it engages audibly.

Note

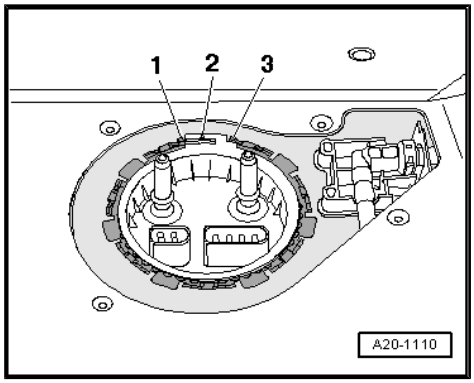
Disregard -item 1-.



– Connect electrical connectors -1 ... 3- on underside of flange (right-side).
– Install new seal for flange (seal must be installed dry).

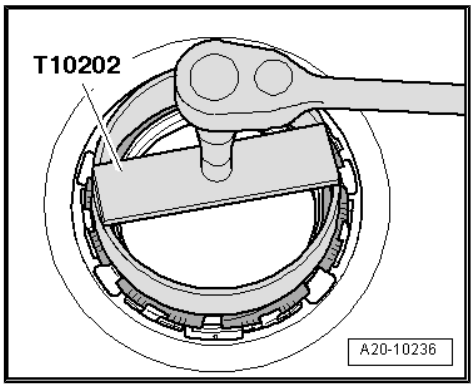


– Fit flange into fuel tank; note correct installation position:
- The hose for the return line must be guided into the opening in the centre of the fuel delivery unit.
- Lug -2- on flange must be between tabs -1- and -3- on fuel tank.

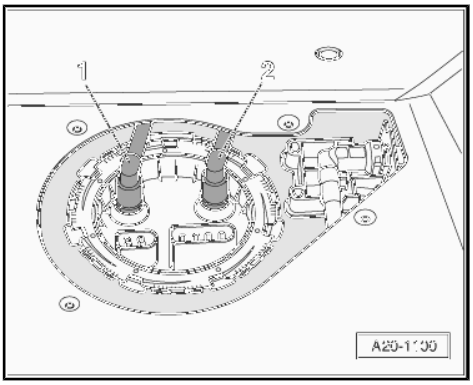


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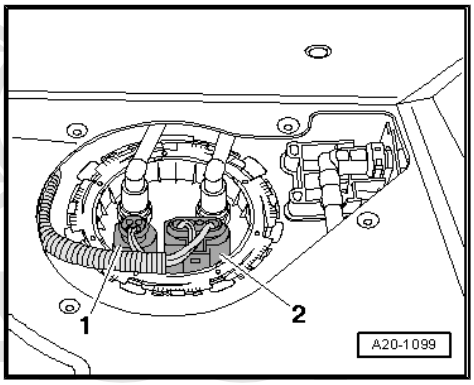
– Tighten locking ring.



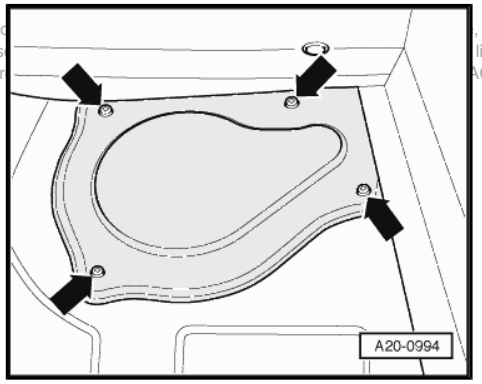
– Install fuel supply line -2- and fuel return line -1- (as marked) so that they engage audibly.



– Attach electrical connectors -1- and -2- on flange (right-side).



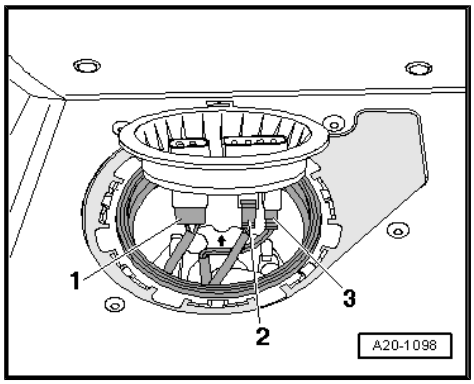
– Secure cover for flange (right-side) -arrows-.



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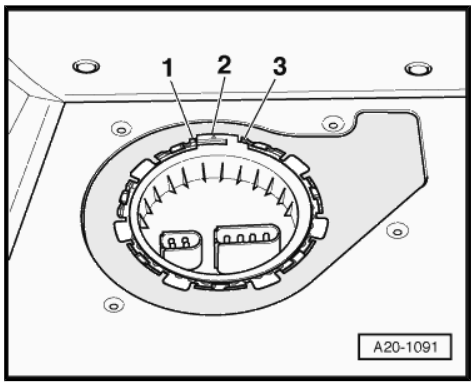
– Connect electrical connectors -1 ... 3- on underside of flange (left-side).

– Install new seal for flange (seal must be installed dry).



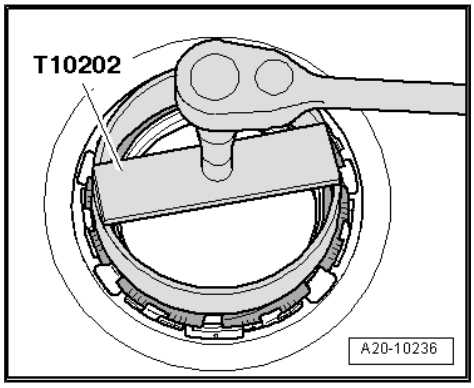
– Fit flange into fuel tank; note correct installation position:

• Lug -2- on flange must be between tabs -1- and -3- on fuel tank.

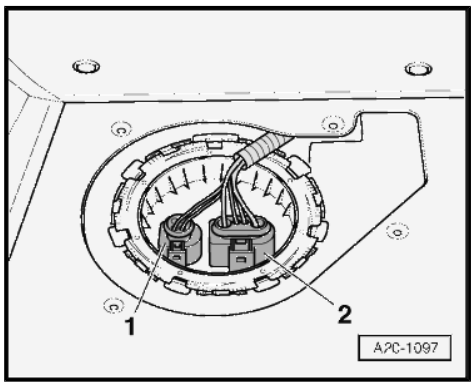


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– Tighten locking ring.



– Attach electrical connectors -1- and -2- on flange (left-side).

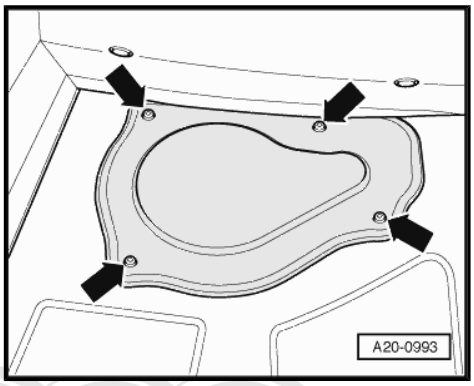


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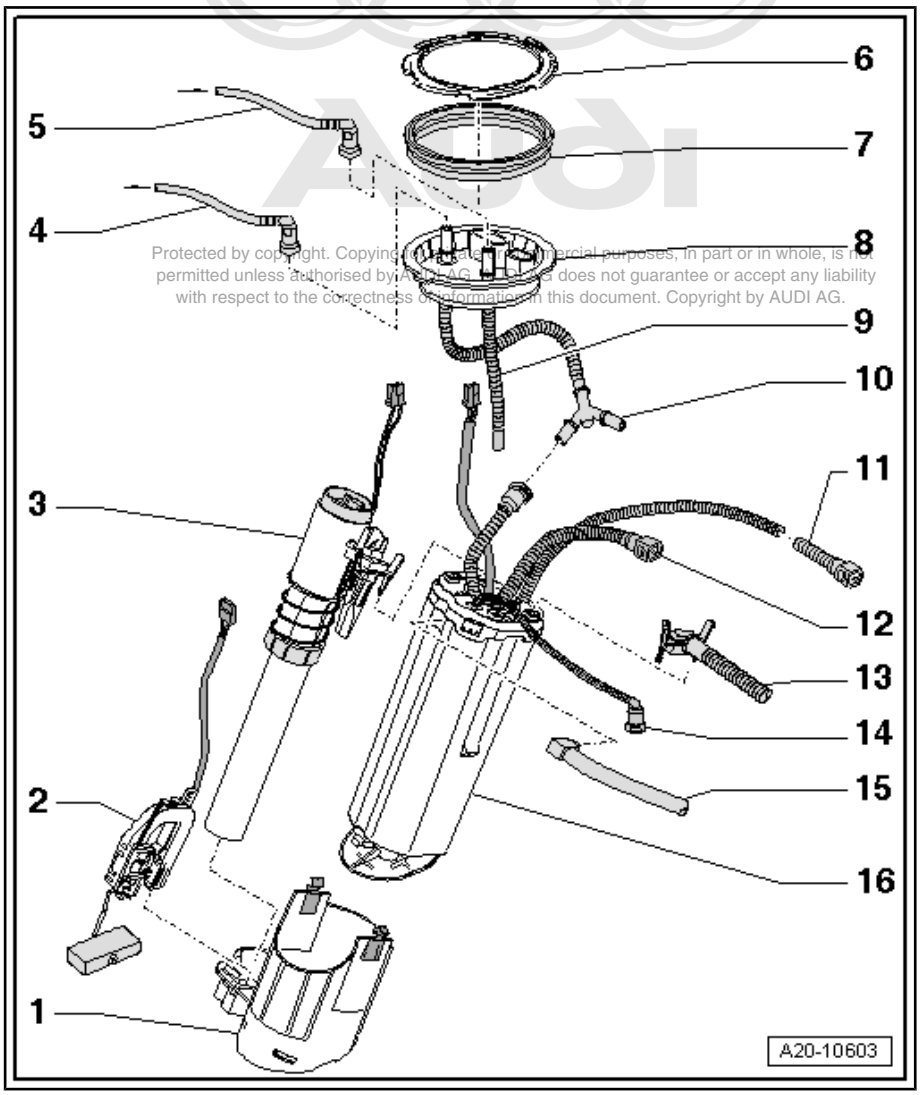
– Secure cover for flange (left-side) -arrows-.

– Connect battery. Observe notes on procedures required after connecting battery ⇒ Electrical system; Rep. gr. 27 .

– Put at least 5 litres of fuel into tank after installing



10.4 Exploded view - fuel delivery unit (right-side) with fuel pump - G23- and fuel gauge senders -G169- and -G393-



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1 - Retainer

- ❑ For fuel delivery unit

2 - Fuel gauge sender 2 - G169-

- ❑ Yellow
- ❑ Clipped onto retainer -item 1-
- ❑ Checking resistance values ⇒ page 223
- ❑ Removing and installing ⇒ page 224

3 - Fuel gauge sender 4 - G393-

- ❑ White
- ❑ Clipped onto fuel delivery unit -item 16-
- ❑ Checking resistance values ⇒ page 230
- ❑ Removing and installing ⇒ page 232

4 - Fuel supply line

- ❑ To fuel filter
- ❑ Mark before removing
- ❑ Press release tab on connection piece to disconnect
- ❑ Do not kink
- ❑ Clip onto fuel tank

5 - Fuel return line

- ❑ From fuel rail
- ❑ Mark before removing
- ❑ Press release tab on connection piece to disconnect
- ❑ Do not kink
- ❑ Clip onto fuel tank

6 - Locking ring

- ❑ Remove and install using wrench - T10202-
- ❑ Tighten to 120 Nm

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7 - Seal

- ❑ Renew
- ❑ Install dry

8 - Flange (right-side)

- ❑ Installation position ⇒ page 176

9 - Fuel return line

- ❑ From flange to fuel delivery unit (right-side)
- ❑ Fitted loosely in fuel delivery unit (right-side)

10 - Fuel supply line

- ❑ From fuel delivery units to flange

11 - Balance pipe

- ❑ Between fuel delivery units

12 - Supply line for suction-jet pump

- ❑ For suction-jet pump
- ❑ Press release tab on connection piece to disconnect

13 - Fuel supply line

- ❑ From suction-jet pump (left-side)
- ❑ Clipped onto fuel delivery unit -item 16-

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14 - Supply line for suction-jet pump

- ❑ For fuel delivery unit (right-side)

15 - Fuel filler pipe

- ❑ From filler neck
- ❑ Clipped onto fuel delivery unit -item 16-

16 - Fuel delivery unit (right-side)

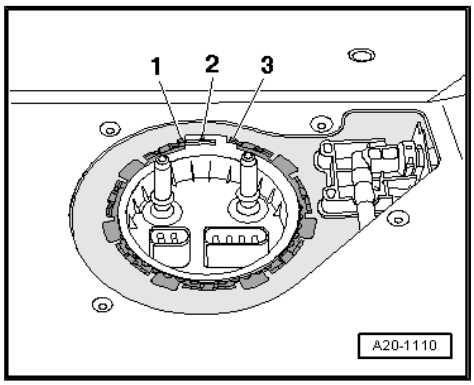
- ❑ With fuel pump - G23-
- ❑ Clipped onto retainer -item 1-
- ❑ Different versions available; for correct version refer to ⇒ Electronic parts catalogue
- ❑ Checking fuel pump (electrical test) ⇒ page 81
- ❑ Checking residual pressure ⇒ Rep. gr. 24
- ❑ Removing and installing ⇒ page 81
- ❑ Put at least 5 litres of fuel into tank after installing

Installation position of flange (right-side)

– Install new seal for flange (seal must be installed dry).

– Fit flange into fuel tank; note correct installation position:

• Lug -2- on flange must be between tabs -1- and -3- on fuel tank.



10.5 Checking fuel pump - G23- (right-side) - electrical test

◆ On vehicles with FSI engine, voltage for the fuel pumps is supplied via fuel pump control unit - J538- .

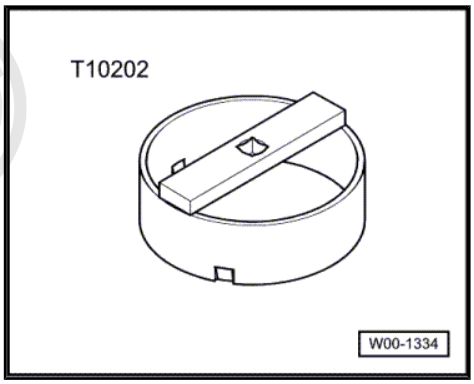
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- Check fuel pump control unit - J538- in “Guided Fault Finding” ⇒ Vehicle diagnostic tester.

10.6 Removing and installing fuel delivery unit (right-side) with fuel pump - G23-

Special tools and workshop equipment required

- Wrench - T10202-



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Removing

Observe safety precautions ⇒ page 1 .

Observe rules for cleanliness ⇒ page 3 .

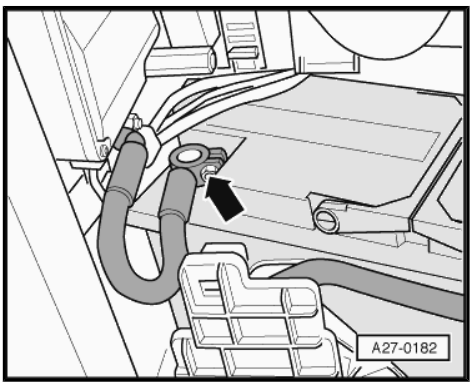
Caution

- *The fuel tank must not be more than 1/3 full when removing the fuel delivery unit. Drain the tank if necessary. Procedure ⇒ page 112*

Caution

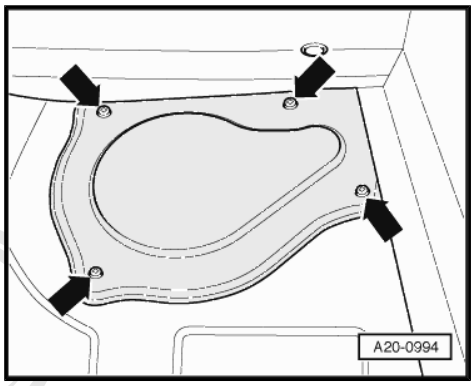
Observe notes on procedure for disconnecting the battery.

– With ignition switched off, disconnect battery earth cable -arrow- ⇒ Electrical system; Rep. gr. 27 .



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– Remove luggage compartment floor covering.

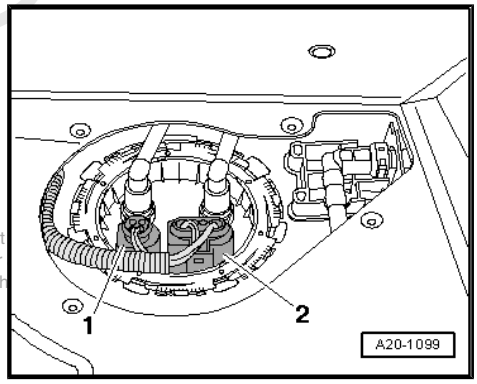


Note

For removing and installing fuel delivery unit, take tool kit and spare wheel out of luggage compartment. You can then sit or kneel in the spare wheel well.

– Unscrew cover for flange (right-side) -arrows-.

– Unplug electrical connectors -1- and -2- on flange (right-side).

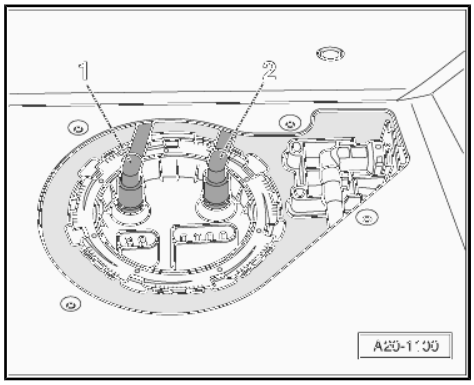


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– Mark fuel return line -1- and fuel supply line -2-.

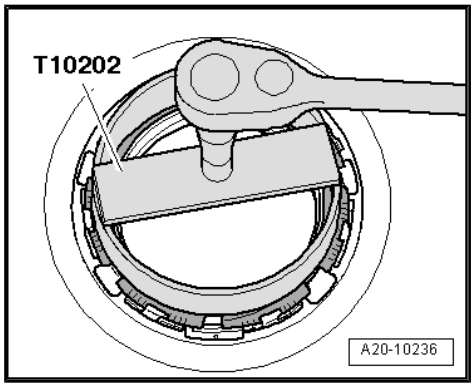
WARNING

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



– Detach both lines from flange (press release tabs).

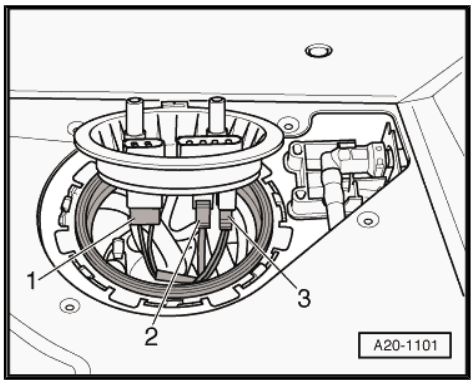
– Unscrew locking ring using wrench - T10202- .



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– Detach flange and remove seal.

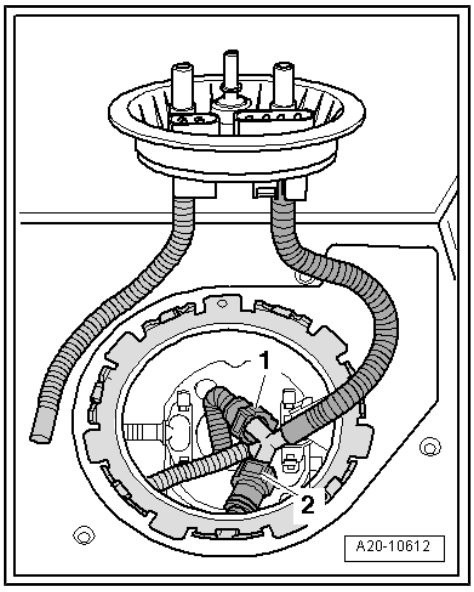
– Unplug electrical connectors -1 ... 3- on underside of flange (right-side).



Note

Pull out fuel lines from fuel tank opening prior to disconnecting the pipe connectors mentioned below.

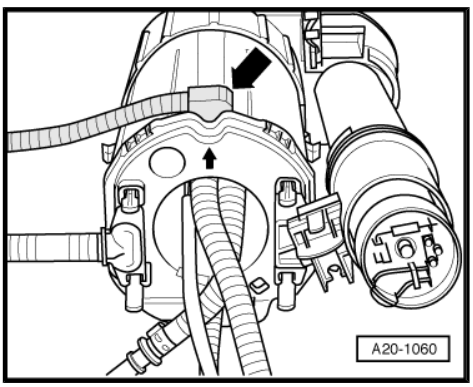
– Working through right fuel tank opening, press release tabs and disconnect fuel supply lines -1- and -2- going to fuel delivery units.



Note

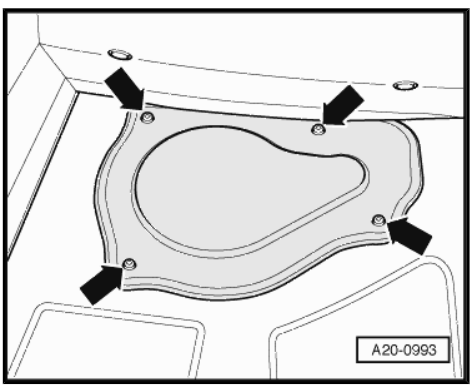
For illustration purposes some of the components are shown removed in the following illustrations.

– Unclip fuel filler pipe -arrow- at front of fuel delivery unit (right-side).



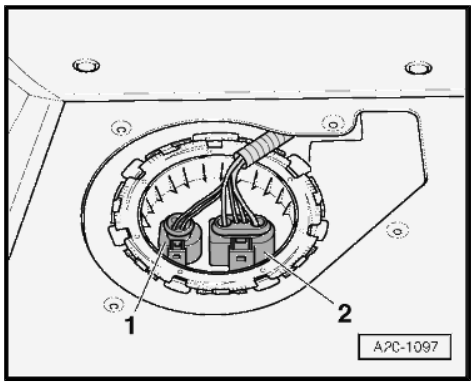
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– Detach cover for flange (left-side) -arrows-.

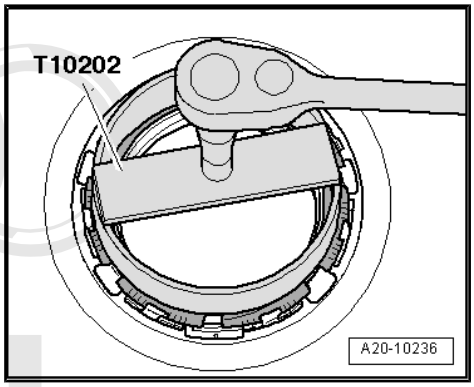


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– Unplug electrical connectors -1- and -2- on flange (left-side).



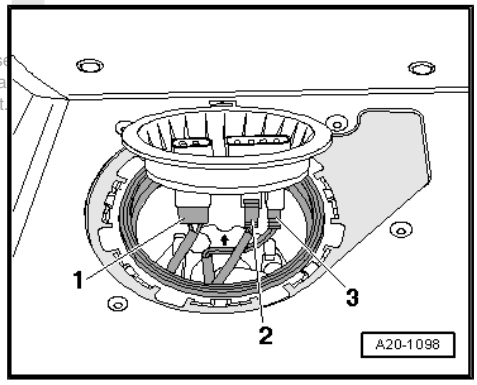
– Unscrew locking ring using wrench - T10202- .



– Detach flange and remove seal.

– Unplug electrical connectors -1 ... 3- on underside of flange (left-side).

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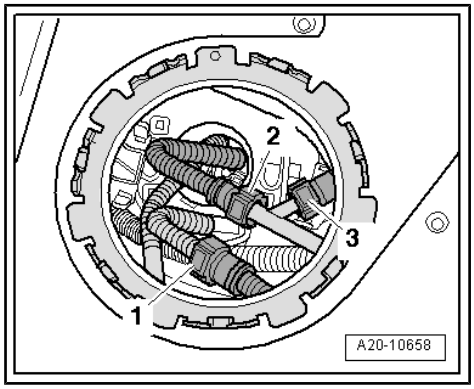


– Working through left fuel tank opening, press release tab and disconnect connecting pipe -1-.

– Pull out connecting pipe from right fuel tank opening.

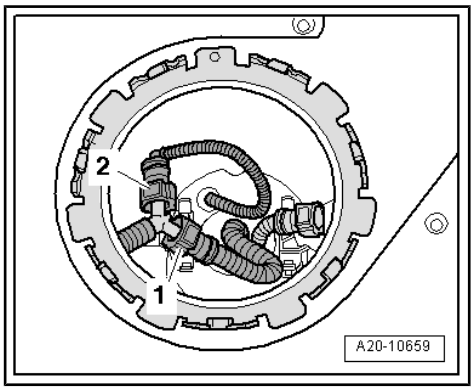
Note

Disregard -items 2, 3-.

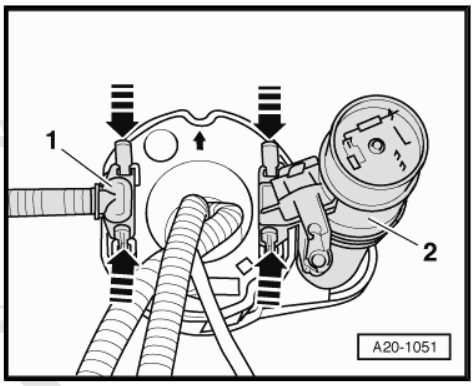


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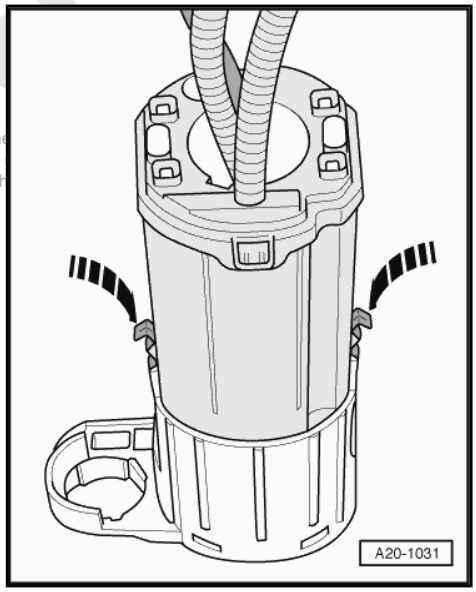
– Working through right fuel tank opening, press release tabs and disconnect supply line -1- going to suction-jet pump (left-side) and supply line -2- going to fuel delivery unit (right-side).



– Working through right fuel tank opening, press release tabs -arrows- and detach fuel supply line -1- and fuel gauge sender 4 - G393- -item 2-.
– Move fuel gauge sender 4 - G393- to right side.



– Press down both retaining clips on retainer for fuel delivery unit -arrows-.
– Remove fuel delivery unit.



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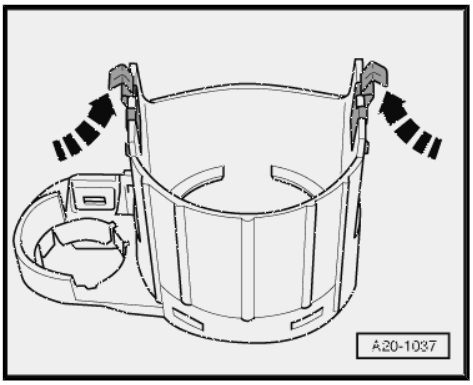
Note

Keep in mind that the fuel delivery unit still contains fuel.

Installing

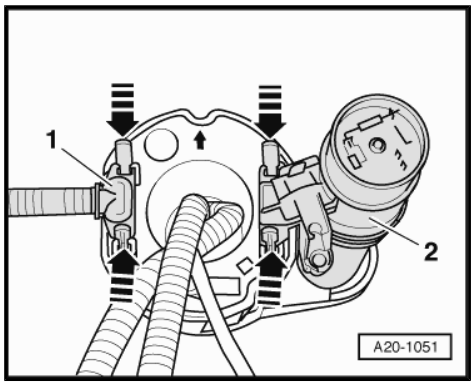
• Tightening torque ⇒ page 79

– Pull both retaining clips on retainer upwards -arrows- so that they engage audibly before installing the fuel delivery unit.
– Then press fuel delivery unit carefully into retainer so that it engages audibly.



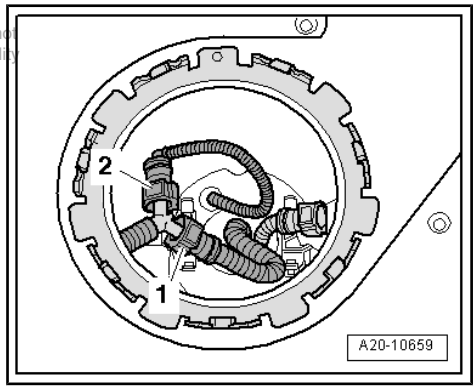
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– Fit fuel supply line -1- and fuel gauge sender 4 - G393- -item 2- so that they engage audibly on fuel delivery unit (right-side).

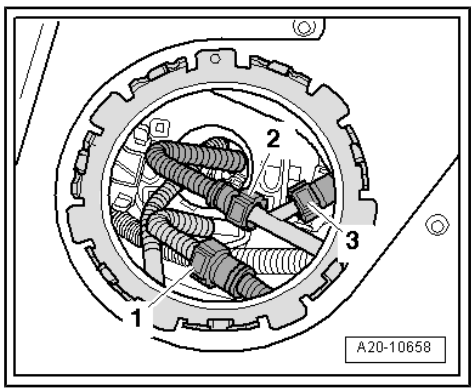


– Working through right fuel tank opening, fit supply line -1- going to suction-jet pump (left-side) and supply line -2- going to fuel delivery unit (right-side) so that they engage audibly.

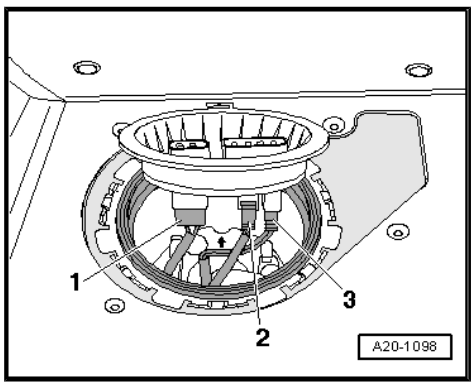
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– Fit connecting pipe -1- through left opening on fuel tank so that it engages audibly.



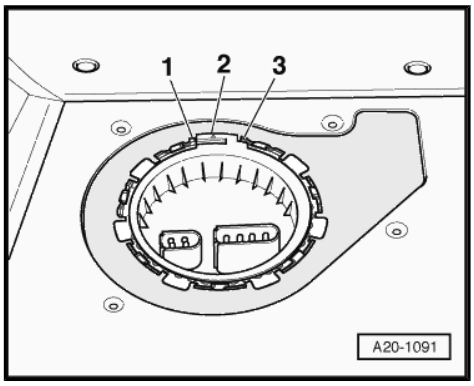
– Connect electrical connectors -1 ... 3- on underside of flange (left-side).
– Install new seal for flange (seal must be installed dry).



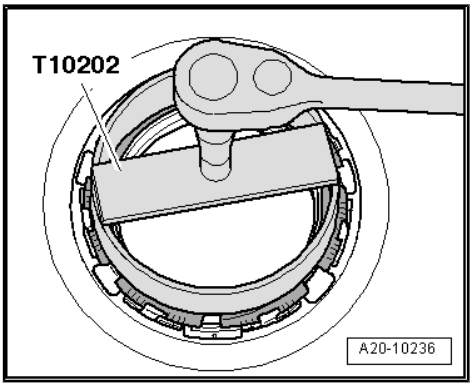
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– Fit flange into fuel tank; note correct installation position:

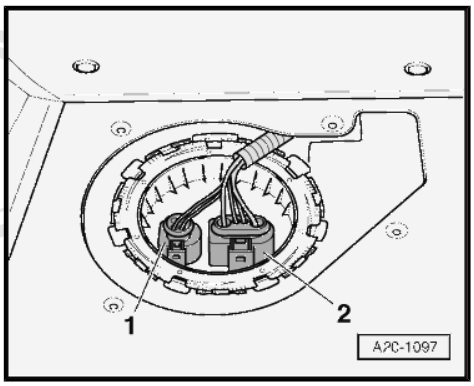
• Lug -2- on flange must be between tabs -1- and -3- on fuel tank.



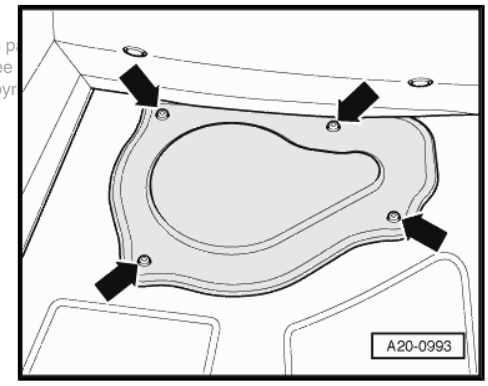
– Tighten locking ring.



– Attach electrical connectors -1- and -2- on flange (left-side).



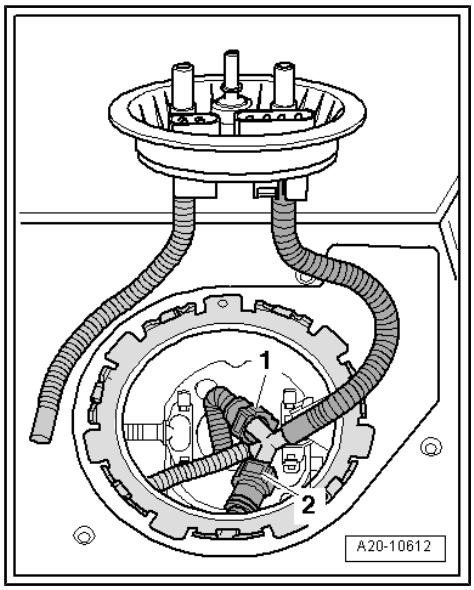
– Secure cover for flange (left-side) -arrows-.



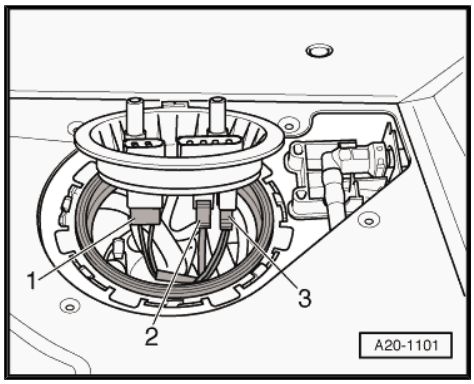
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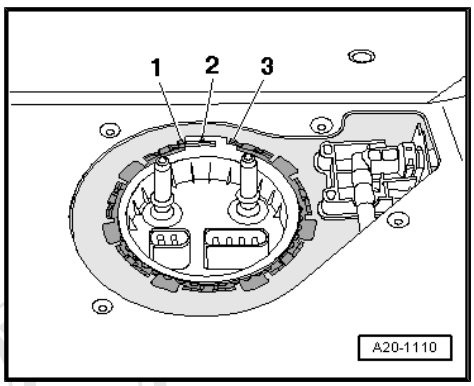
– Working through right fuel tank opening, fit fuel lines -1- and -2- going to fuel delivery units so that they engage audibly.



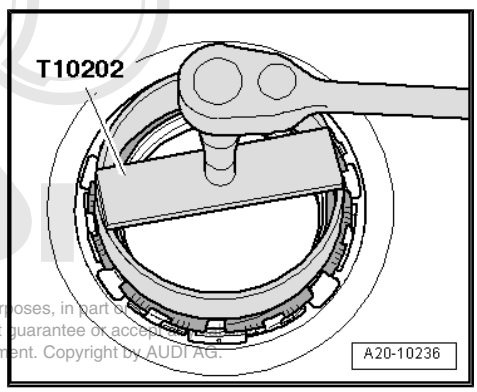
– Connect electrical connectors -1 ... 3- on underside of flange (right-side).
– Install new seal for flange (seal must be installed dry).



– Fit flange into fuel tank; note correct installation position:
• Lug -2- on flange must be between tabs -1- and -3- on fuel tank.



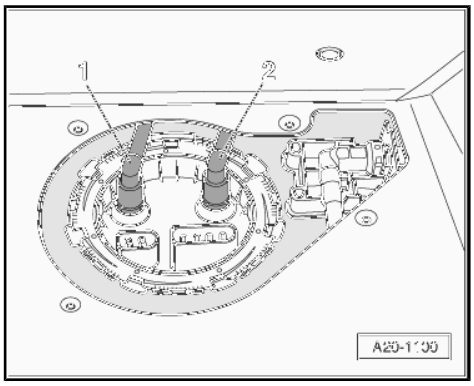
– Tighten locking ring.



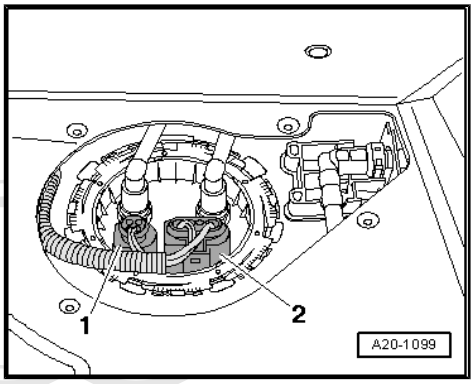
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– Install fuel supply line -2- and fuel return line -1- (as marked) so that they engage audibly.

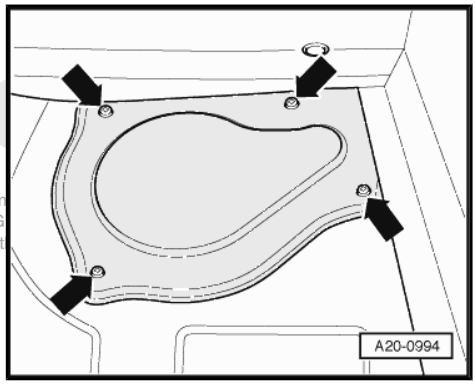


– Attach electrical connectors -1- and -2- on flange (right-side).



– Secure cover for flange (right-side) -arrows-.
– Connect battery. Observe notes on procedures required after connecting battery ⇒ Electrical system; Rep. gr. 27 .
– Put at least 5 litres of fuel into tank after installing

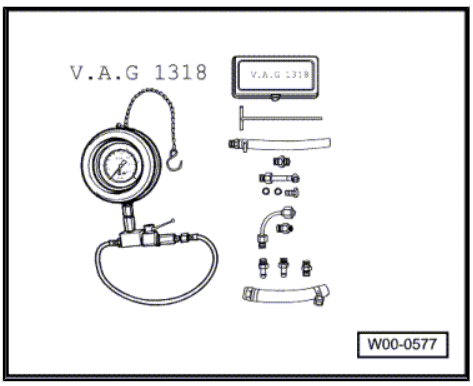
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10.7 Checking delivery rate of fuel pumps - vehicles with 8-cylinder engine

Special tools and workshop equipment required

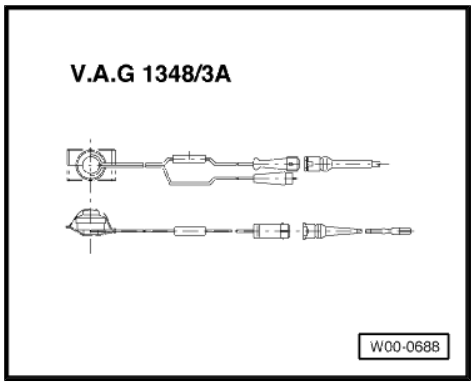
♦ K-Jetronic pressure tester - V.A.G 1318-



♦ Adapter set - V.A.G 1318/10-12-

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- Remote control - V.A.G 1348/3A- for V.A.G 1348 with adapter cable -V.A.G 1348/3-3-



- Fuel-resistant measuring container

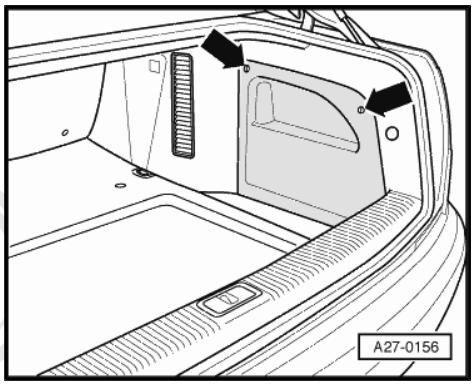
Procedure

– Observe test conditions ⇒ page 3 .

WARNING

Observe safety precautions ⇒ page 1 .

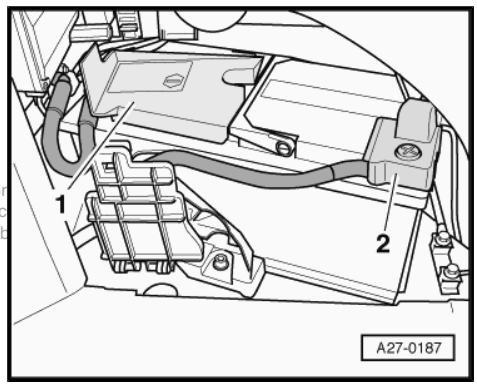
– Remove luggage compartment side trim cover (right-side) -arrows-.



– Remove cover -2- over battery.

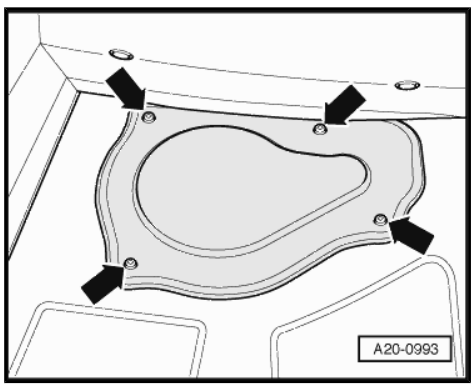
Note

Disregard -item 1-.



– Remove luggage compartment floor covering.

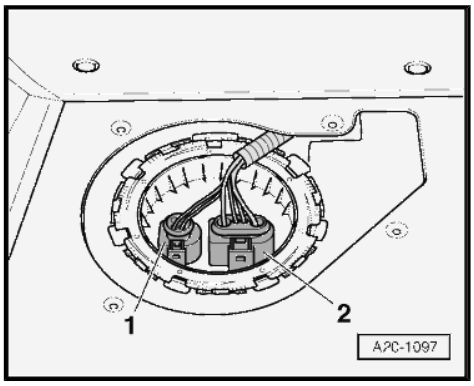
– Detach cover for flange (left-side) -arrows-.



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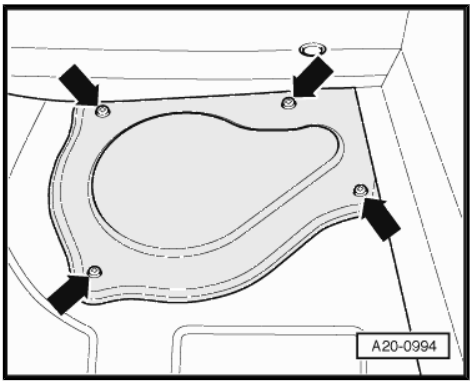
– Unplug electrical connector -2- on flange (left-side).



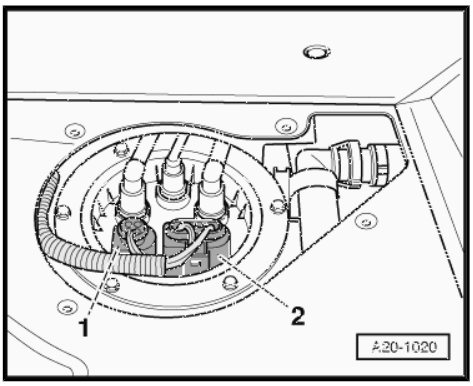
Note

Disregard -item 1-.

– Unscrew cover for flange (right-side) -arrows-.



– Unplug electrical connector -2- on flange (right-side).

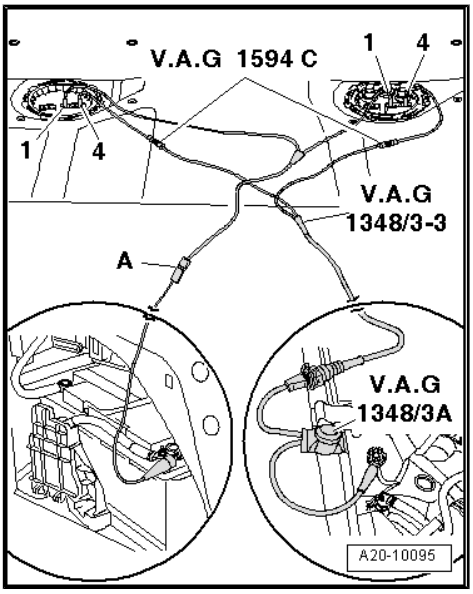


Note

Disregard -item 1-.

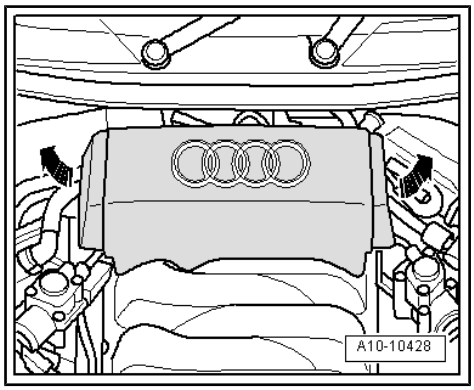
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– Connect remote control - V.A.G 1348/3A- for V.A.G 1348 with adapter cable -V.A.G 1348/3-3- to contact -4- (earth) of fuel delivery unit (left-side) and fuel delivery unit (right-side) using test leads from auxiliary measuring set - V.A.G 1594C- .
– Move switch of remote control - V.A.G 1348/3A- for V.A.G 1348 to front of engine compartment.
– Connect crocodile clip to earth point in engine compartment.
– Connect contact -1- (positive) of fuel delivery unit (left-side) and fuel delivery unit (right-side) to battery “+” via an improvised test lead. For safety reasons an in-line fuse -A- (10 A) must be connected into the lead.
– Remove filler cap from fuel filler neck.



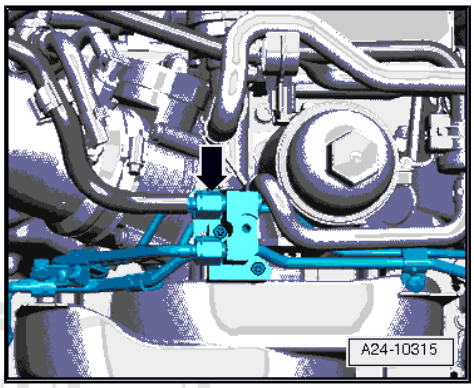
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– Pull off engine cover panel (rear) -arrows-.



WARNING

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



– Disconnect fuel supply line -arrow- at connecting piece.

Caution

Rules for cleanliness when working on the injection system *⇒ page 3* *.*

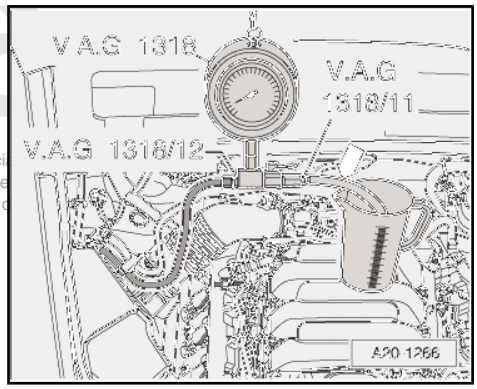
– Disconnect fuel line -arrow-.

– Connect K-Jetronic pressure tester - V.A.G 1318- with adapters - V.A.G 1318/11- and -V.A.G 1318/12- to fuel line.

– Fit auxiliary hose -arrow- onto pressure tester and hold it in a measuring container.

– Open cut-off valve on pressure tester. Lever must point in direction of flow.

– Build up pressure in fuel system by pressing the remote control button and slowly closing the cut-off valve on the pressure tester.



• Specification: 4 bar

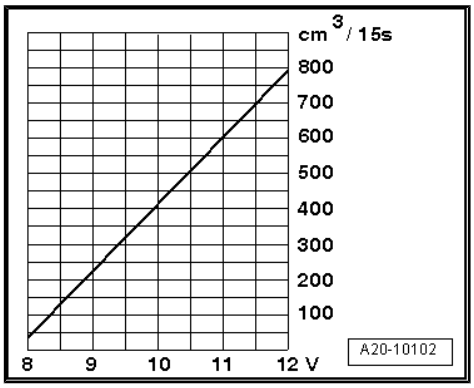
– From this point on do not move position of cut-off valve.

– Empty the measuring container.

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– Press remote control button for 15 seconds.

– Compare amount of fuel delivered with minimum delivery shown in diagram (cm^3/15 sec.).



Note

Voltage at fuel pump with engine stationary and pump running is approx. 2 volts less than battery voltage.

If minimum delivery rate is not reached, check for the following causes:

- Fuel lines have been crushed.
- Fuel filter is blocked.
- Fuel pump is defective.

Note

As there is hardly any difference in the fuel delivery rate if only one of the two fuel pumps is working (because of the hose connections inside the tank), it is difficult to diagnose a defective pump by just measuring the delivery rate.

In this case proceed as follows:

– Unplug the electrical auxiliary lead at the fuel delivery units (one at a time).

– Measure delivery rate of fuel delivery unit located on the opposite side.

If the delivery rate of the fuel delivery unit which has been measured separately is considerably below specification:

– Renew the relevant fuel delivery unit.

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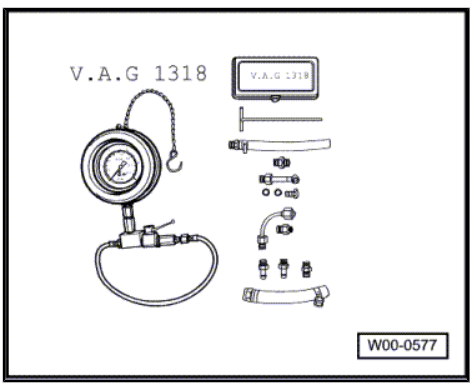
Installation is carried out in the reverse order; note the following:

– Secure fuel line to engine ⇒ Rep. gr. 24 .

10.8 Checking delivery rate of fuel pumps - vehicles with 10-cylinder engine (Audi S8)

Special tools and workshop equipment required

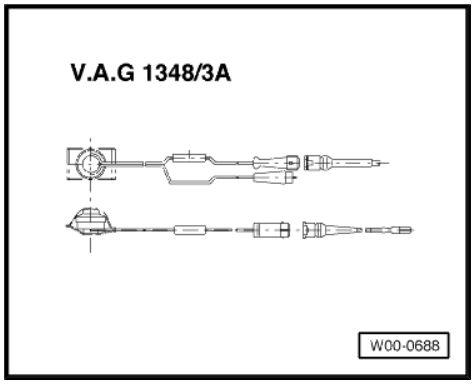
- K-Jetronic pressure tester - V.A.G 1318-



- Adapter set - V.A.G 1318/10-12-

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- Remote control - V.A.G 1348/3A- for V.A.G 1348 with adapter cable -V.A.G 1348/3-3-



- Fuel-resistant measuring container

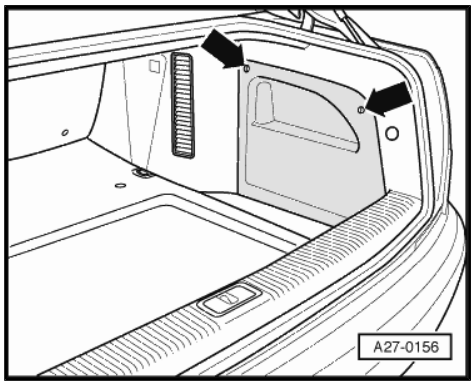
Procedure

– Observe test conditions ⇒ page 3 .

WARNING

Observe safety precautions ⇒ page 1 .

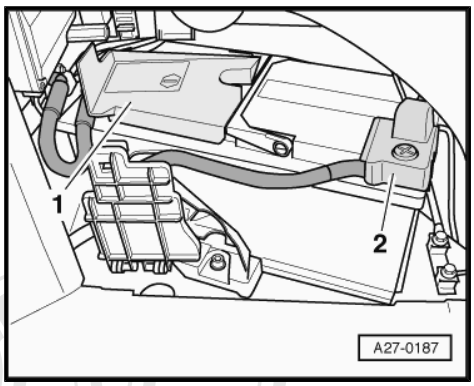
– Remove luggage compartment side trim cover (right-side) -arrows-.



– Remove cover -2- over battery.

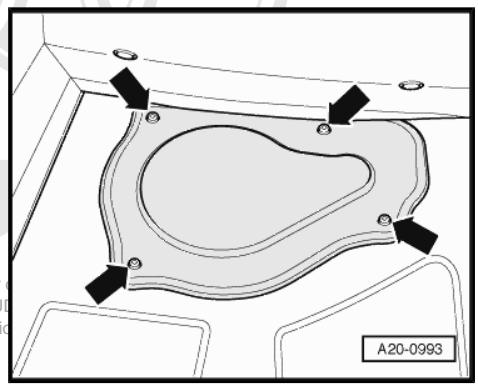
Note

Disregard -item 1-.



– Remove luggage compartment floor covering.

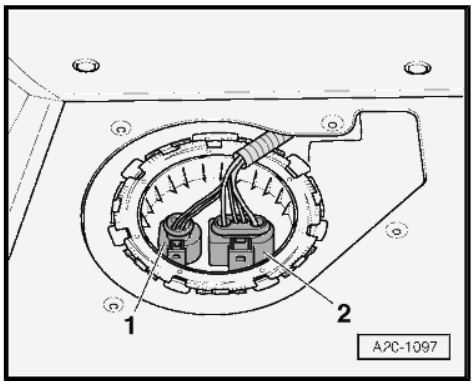
– Detach cover for flange (left-side) -arrows-.



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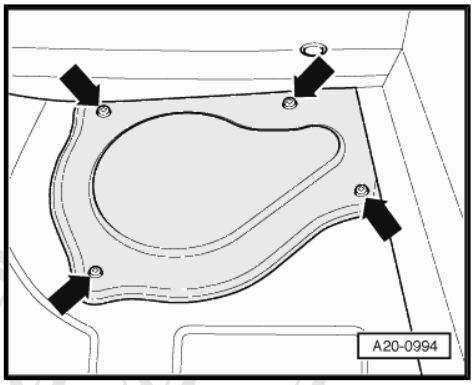
– Unplug electrical connector -2- on flange (left-side).



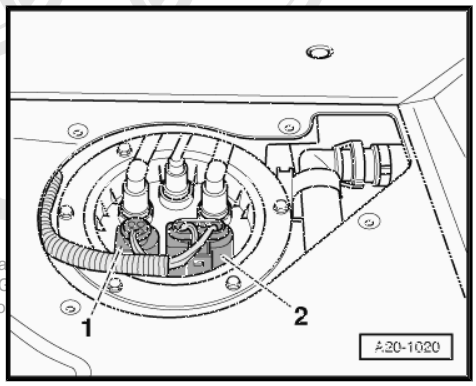
Note

Disregard -item 1-.

– Unscrew cover for flange (right-side) -arrows-.



– Unplug electrical connector -2- on flange (right-side).

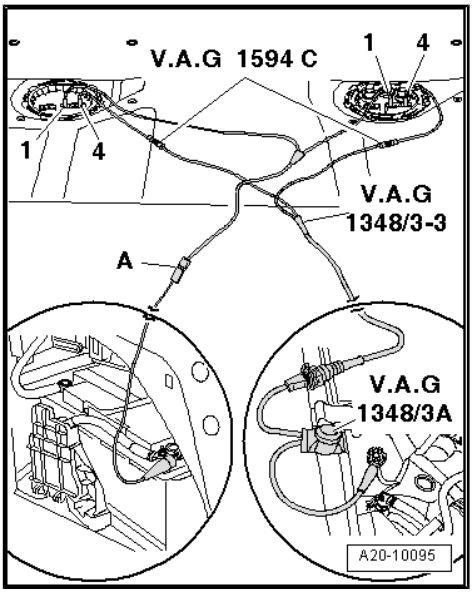


Note

Disregard -item 1-.

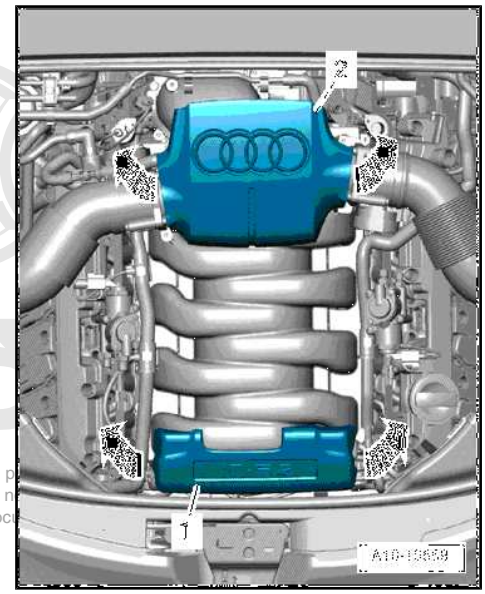
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– Connect remote control - V.A.G 1348/3A- for V.A.G 1348 with adapter cable -V.A.G 1348/3-3- to contact -4- (earth) of fuel delivery unit (left-side) and fuel delivery unit (right-side) using test leads from auxiliary measuring set - V.A.G 1594C- .
– Move switch of remote control - V.A.G 1348/3A- for V.A.G 1348 to front of engine compartment.
– Connect crocodile clip to earth point in engine compartment.
– Connect contact -1- (positive) of fuel delivery unit (left-side) and fuel delivery unit (right-side) to battery “+” via an improvised test lead. For safety reasons an in-line fuse -A- (10 A) must be connected into the lead.
– Remove filler cap from fuel filler neck.



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– Pull off engine cover panel (rear) -2- -arrows-.



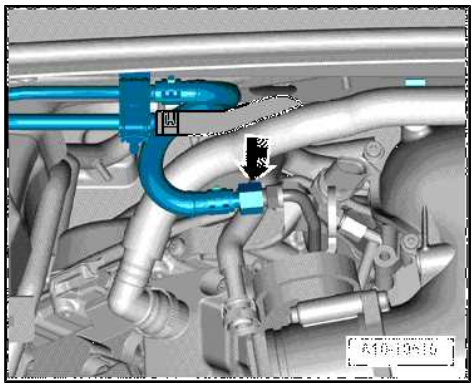
Note

Disregard -item 1-.

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WARNING

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



Caution

Rules for cleanliness when working on the injection system ***⇒ page 3*** ***.***

– Disconnect fuel pipe -arrow- at fuel rail.

– Connect K-Jetronic pressure tester - V.A.G 1318- with adapters - V.A.G 1318/11- and -V.A.G 1318/12- to fuel line.

– Fit auxiliary hose -arrow- onto pressure tester and hold it in a measuring container.

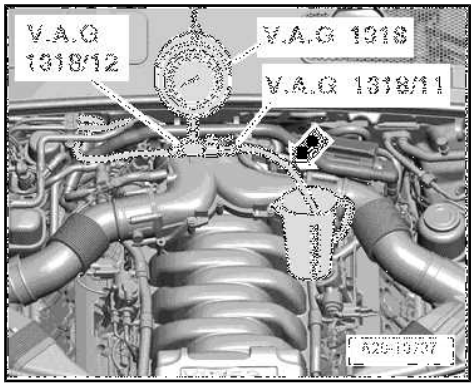
– Open cut-off valve on pressure tester. Lever must point in direction of flow.

– Build up pressure in fuel system by pressing the remote control button and slowly closing the cut-off valve on the pressure tester.

• Specification: 4 bar

– From this point on do not move position of cut-off valve.

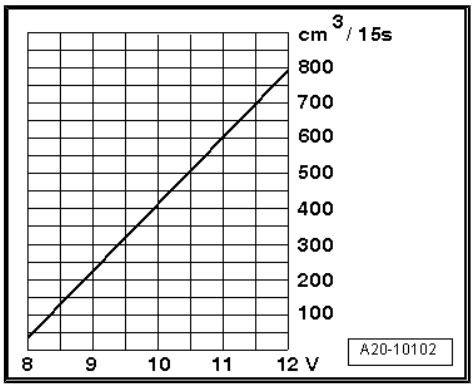
– Empty the measuring container.



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– Press remote control button for 15 seconds.

– Compare amount of fuel delivered with minimum delivery shown in diagram (cm^3/15 sec.).



Note

Voltage at fuel pump with engine stationary and pump running is approx. 2 volts less than battery voltage.

If minimum delivery rate is not reached, check for the following causes:

- Fuel lines have been crushed.
- Fuel filter is blocked.
- Fuel pump is defective.

Note

As there is hardly any difference in the fuel delivery rate if only one of the two fuel pumps is working (because of the hose connections inside the tank), it is difficult to diagnose a defective pump by just measuring the delivery rate.

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In this case proceed as follows:

– Unplug the electrical auxiliary lead at the fuel delivery units (one at a time).

– Measure delivery rate of fuel delivery unit located on the opposite side.

If the delivery rate of the fuel delivery unit which has been measured separately is considerably below specification:

– Renew the relevant fuel delivery unit.

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

– Secure fuel line to fuel rail ⇒ Rep. gr. 24 .

10.9 Fuel pump control unit - J538-

Check fuel pump control unit - J538- in “Guided Fault Finding” ⇒ Vehicle diagnostic tester.

10.10 Removing and installing fuel pump control unit - J538-

Removing

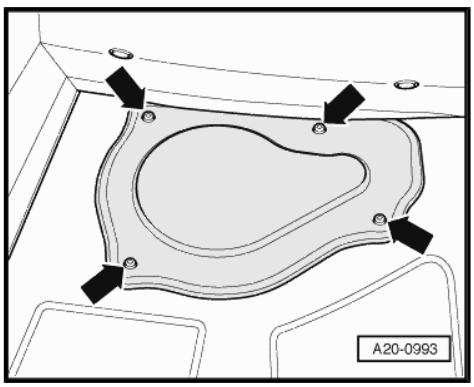
Observe safety precautions ⇒ page 1 .

Observe rules for cleanliness ⇒ page 3 .

– Switch off ignition and remove ignition key.

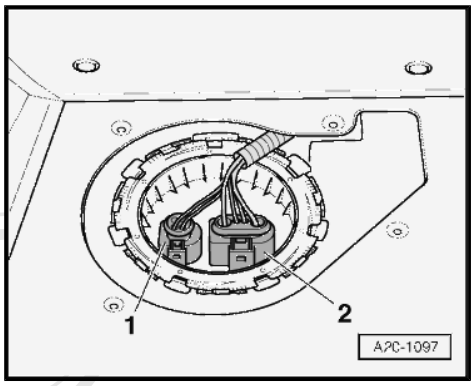
– Remove luggage compartment floor covering.

– Detach cover for flange (left-side) -arrows-.

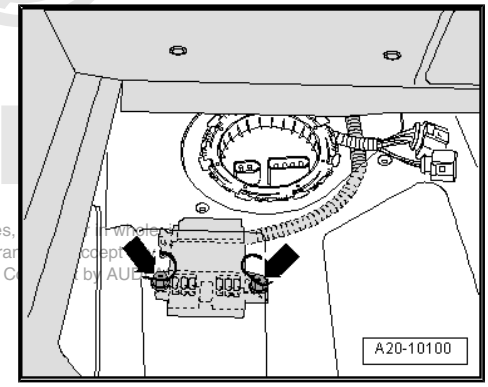


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– Unplug electrical connectors -1- and -2- on flange (left-side).



– Remove plugs in luggage compartment floor and unscrew nuts -arrows-.
– Slightly lift floor panel in the area of flange by hand and remove fuel pump control unit - J538- between floor panel and fuel tank flange.
– Unplug electrical connector at control unit.



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Installing

Install in reverse order.

Tightening torque

Component	Nm
Fuel pump control unit - J538- to fuel tank	1.6

10.11 Suction-jet pumps

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1 - Suction-jet pump (left-side)

2 - Fuel delivery unit (left-side)

3 - Expansion tank

4 - Fuel delivery unit (right-side)

5 - Suction-jet pump (right-side)

6 - Supply line for suction-jet pump

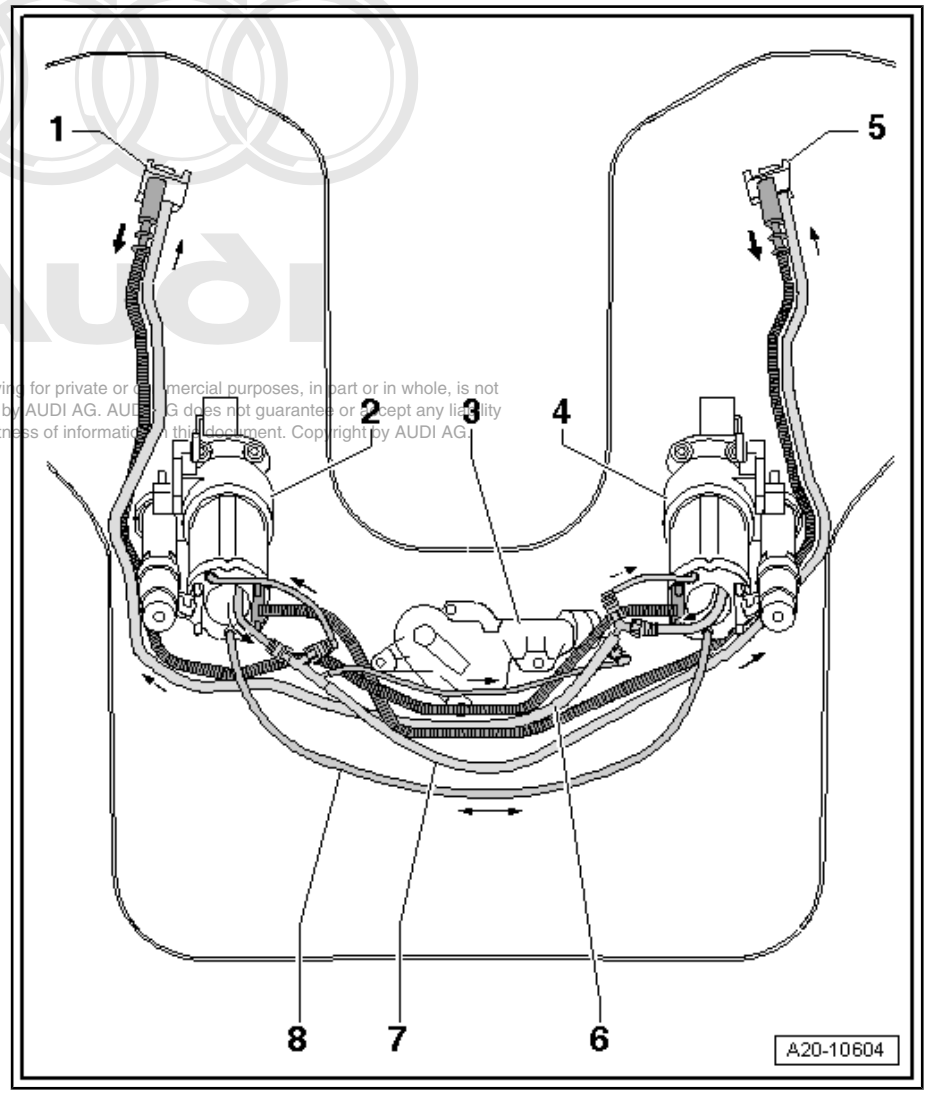
- From fuel delivery unit (right-side) to suction-jet pump (left-side)

7 - Supply line for suction-jet pump

- From fuel delivery unit (left-side) to suction-jet pump (right-side)

8 - Balance pipe

- Between fuel delivery units



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Description of operation

To ensure a reliable fuel supply in all situations, the fuel pumps must never draw in air, even under extreme driving conditions such as very sharp bends or under heavy braking. This may happen when the fuel sloshes into one of the corners of a partially filled fuel tank.

- For this reason, the fuel delivery units -item 2- and -item 4- incorporate a so-called baffle housing, in which the fuel pumps are fitted, as well as the fuel pumps themselves. The baffle housing is a container permanently filled with fuel, so that the fuel pumps are surrounded with fuel regardless of the fuel level in the tank.
- Consequently, proper filling of the baffle housings is essential for trouble-free operation of the fuel pumps. This is the purpose of the "suction-jet pumps".
- The suction-jet pumps operate according to the principle of fluid entrainment: a stream of fuel from the primary stage of the fuel pumps -2- (left-side) and -4- (right-side) is fed via the supply lines -6- and -7- to the suction-jet pumps -1- and -5-, where it is passed through a nozzle and thus accelerated. The accelerated stream of fuel draws off the surrounding fuel and delivers it to the baffle housings in the fuel delivery units. The suction jet pump (right-side) -item 5- delivers the fuel into the baffle housing (left-side); the suction jet pump (left-side) -item 1- delivers the fuel into the baffle housing (right-side).
- In addition, the stream of fuel from the fuel pumps is supplied to the two smaller suction-jet pumps in the baffle housings via two Y-connectors. Working through the balance pipe -item 8-, these ensure that the baffle housings in both fuel delivery units are filled evenly.
- Another small suction-jet pump is located in the expansion tank -item 3- and delivers fuel from there back to the fuel tank.

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10.12 Removing and installing suction-jet pump (left-side)

Removing

Observe safety precautions ⇒ page 1 .

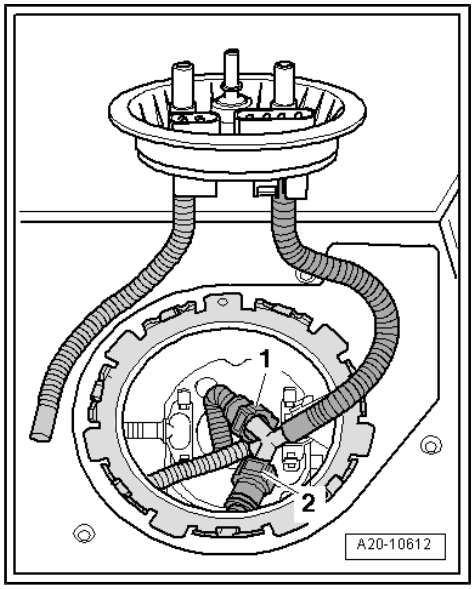
Observe rules for cleanliness ⇒ page 3 .

– Remove the fuel delivery unit (left-side) ⇒ page 26 .

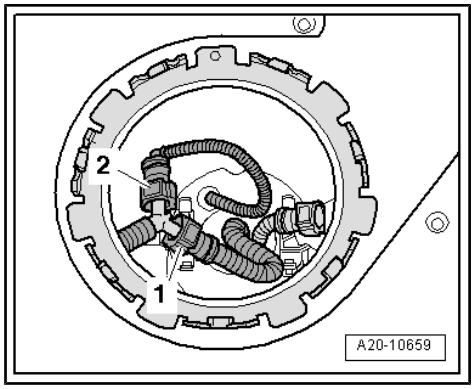
– Remove fuel gauge sender 3 - G237- (tubular sender, left-side) from fuel tank.

– Working through right fuel tank opening, press release tab and disconnect fuel supply line -1-.

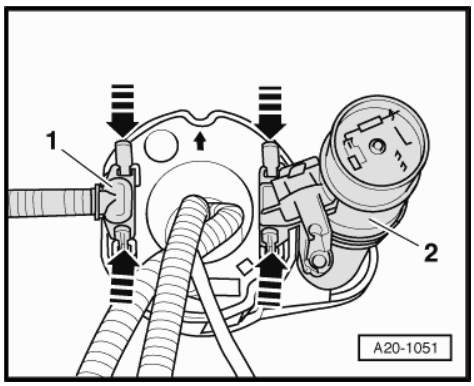
– Detach flange.



– Working through right fuel tank opening, press release tabs and disconnect supply lines -1- and -2- for suction-jet pumps from Y-connector.



– Working through right fuel tank opening, press release tabs -arrows- and detach fuel supply line -1-.



Note

Disregard -item 2-.

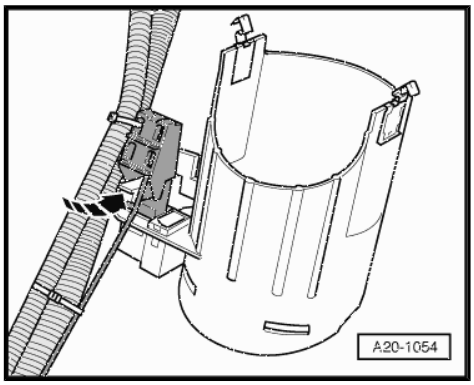
– Pull out disconnected fuel supply line through left fuel tank opening.

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– Working through left fuel tank opening, press release tab -arrow- and detach retaining clip for suction jet lines from retainer.

– Pull out suction-jet pump (left-side) together with lines through left fuel tank opening.

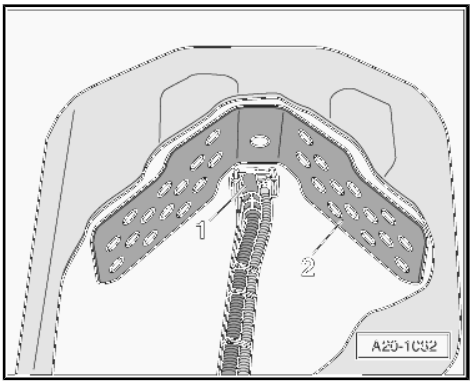


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Installing

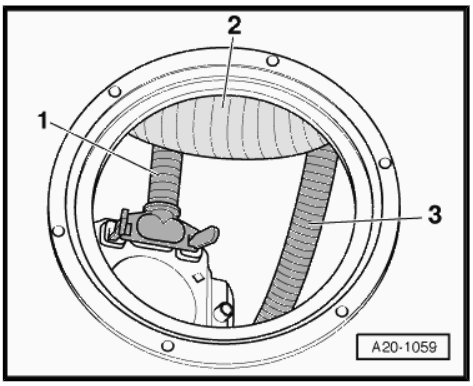
– Version with baffle plate: insert suction-jet pump (left-side) -1- so it fits in recess in baffle plate -2- at front of fuel tank, as shown in illustration.

– Then press retaining clip for suction-jet pump into retainer so it engages audibly.



– Push fuel supply line through left fuel tank opening into right fuel tank chamber. Note routing:

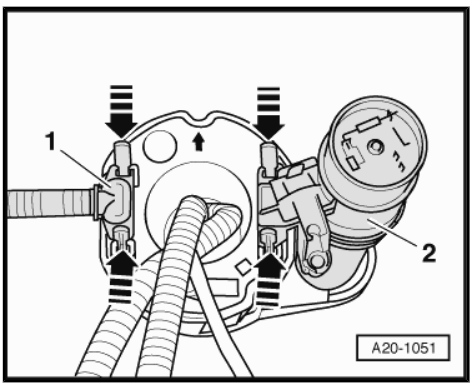
• The fuel supply line -3- must be routed below the fuel filler pipe -2- at the left fuel tank opening.



Note

Disregard -item 1-.

– Fit fuel supply line -1- onto fuel delivery unit (right-side) so that it engages audibly.

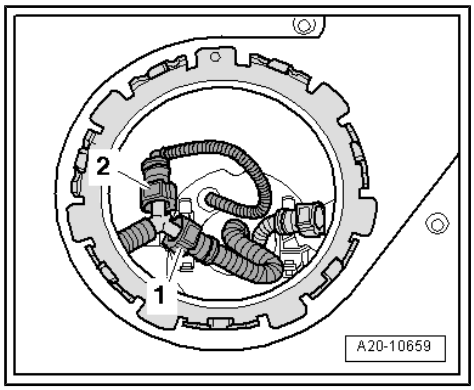


Note

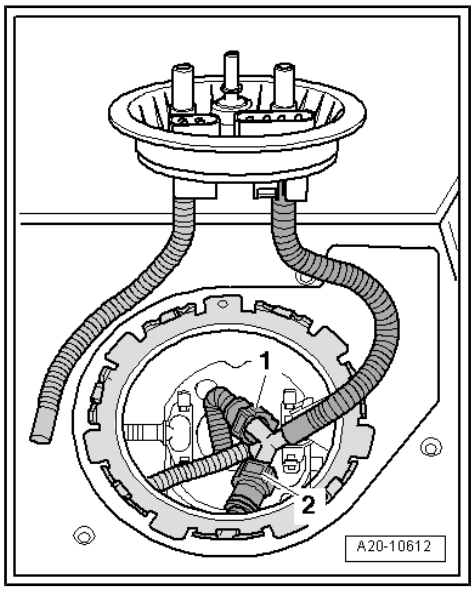
Disregard -item 2-.

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– Working through right fuel tank opening, fit supply lines -1- and -2- for suction-jet pumps onto Y-connector so that they engage audibly.



– Working through right fuel tank opening, fit fuel supply line -1- so that it engages audibly.
– Insert fuel gauge sender 3 - G237- into fuel tank.
– Install fuel delivery unit (left-side) ⇒ page 31 .



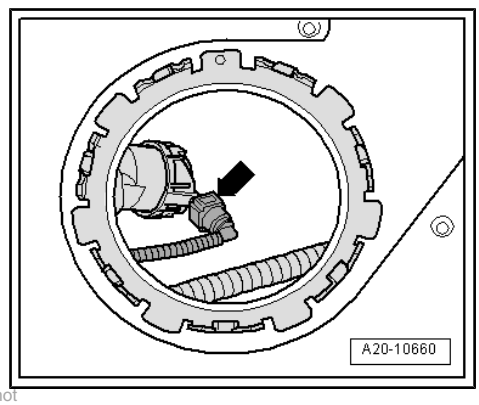
10.13 Removing and installing suction-jet pump (right-side)

Removing

Observe safety precautions ⇒ page 1 .

Observe rules for cleanliness ⇒ page 3 .

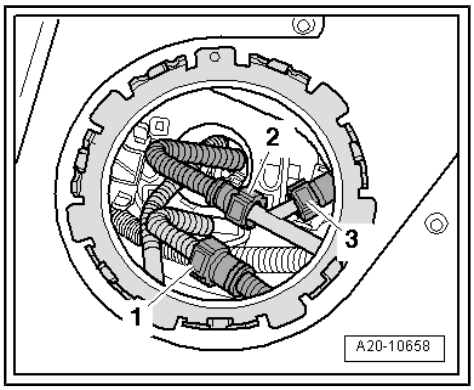
– Remove fuel delivery unit (right-side) ⇒ page 42 .
– Remove fuel gauge sender 4 - G393- (tubular sender, right-side) from fuel tank.
– Working through right fuel tank opening, press release tab and disconnect supply line for suction-jet pump -arrow- from expansion tank.



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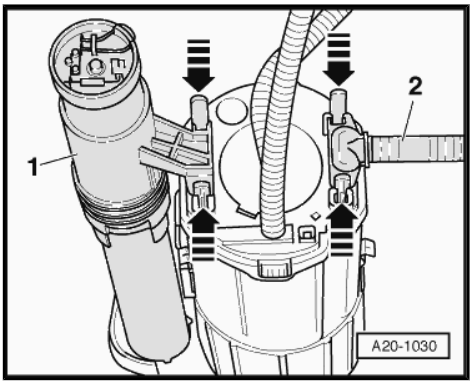
– Working through left fuel tank opening, press release tabs and disconnect supply lines -2- and -3- for suction-jet pumps from Y-connector.



– Working through left fuel tank opening, press release tabs -arrows- and detach fuel supply line -2-.

Note

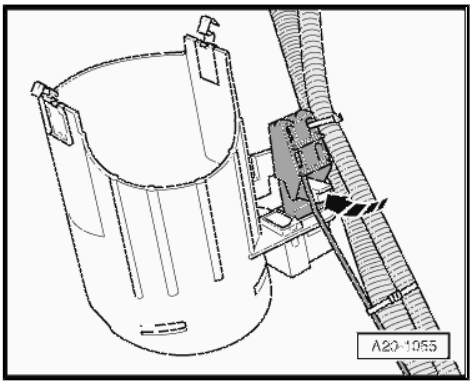
Disregard -item 1-.



– Pull out disconnected fuel supply line through right fuel tank opening.

– Working through right fuel tank opening, press release tab -arrow- and detach retaining clip for suction jet lines from retainer.

– Pull suction-jet pump (right-side) together with lines out of right fuel tank opening.



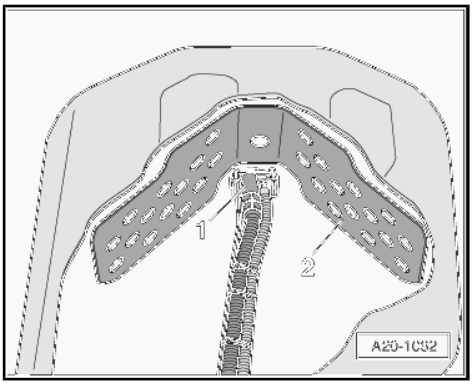
Audi

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Installing

– Version with baffle plate: insert suction-jet pump (right-side) -1- so it fits in recess in baffle plate -2- at front of fuel tank, as shown in illustration.

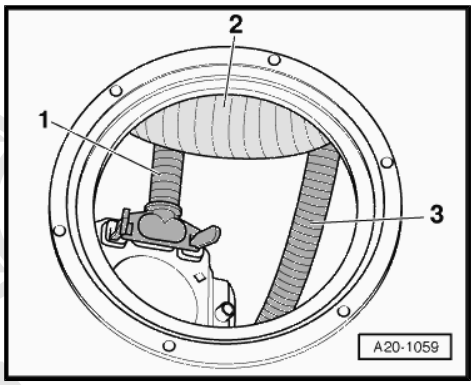
– Then press retaining clip for suction-jet pump into retainer so it engages audibly.



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– Push fuel supply line through right fuel tank opening into left fuel tank chamber. Note routing:

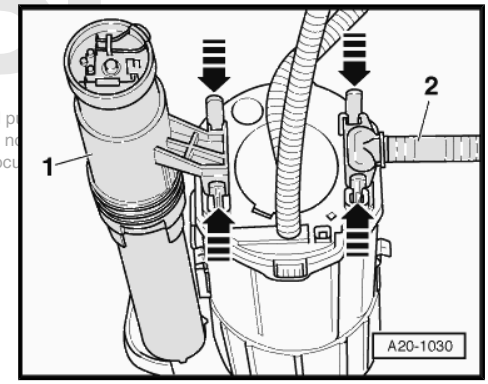
• The fuel supply line -1- must be routed below the fuel filler pipe -2- at the left fuel tank opening.



Note

Disregard -item 3-.

– Fit fuel supply line -2- onto fuel delivery unit (left-side) so that it engages audibly.



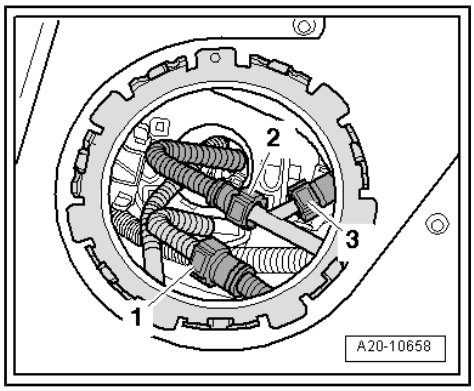
Note

Disregard -item 1-.

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– Push supply line for suction-jet pump through right fuel tank opening into left fuel tank chamber.

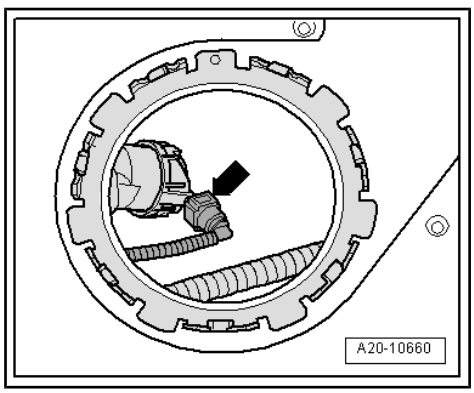
– Working through left fuel tank opening, fit supply lines -2- and -3- for suction-jet pumps onto Y-connector so that they engage audibly.



– Working through right fuel tank opening, fit supply line for suction-jet pump -arrow- onto connection on expansion tank so that it engages audibly.

– Insert fuel gauge sender 4 - G393- into fuel tank.

– Install fuel delivery unit (right-side) ⇒ page 48 .



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11 Fuel gauge senders - rest-of-world vehicles

⇒ “11.1 Checking fuel gauge sender G (lever-type sender, left-side)”, page 201

⇒ “11.2 Removing and installing fuel gauge sender G (lever-type sender, left-side)”, page 202

⇒ “11.3 Checking fuel gauge sender 2 G169 (lever-type sender, right-side)”, page 203

⇒ “11.4 Removing and installing fuel gauge sender 2 G169 (lever-type sender, right-side)”, page 204

⇒ “11.5 Checking fuel gauge sender 3 G237 (tubular sender, left-side)”, page 205

⇒ “11.6 Removing and installing fuel gauge sender 3 G237 (tubular sender, left-side)”, page 206

⇒ “11.7 Checking fuel gauge sender 4 G393 (tubular sender, right-side)”, page 211

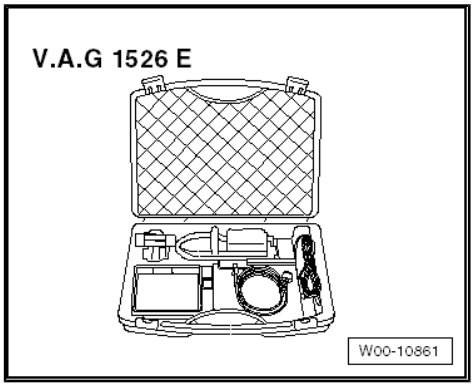
⇒ “11.8 Removing and installing fuel gauge sender 4 G393 (tubular sender, right-side)”, page 213

11.1 Checking fuel gauge sender - G- (lever-type sender, left-side)

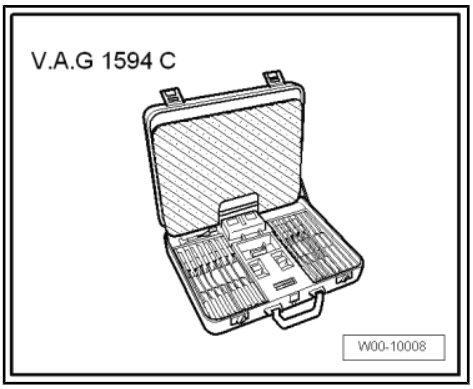
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Special tools and workshop equipment required

- Hand-held multimeter - V.A.G 1526 E-



- Auxiliary measuring set - V.A.G 1594C-

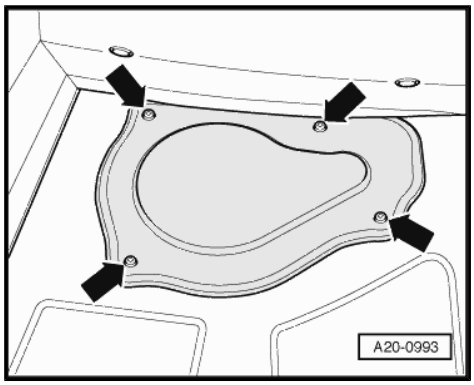


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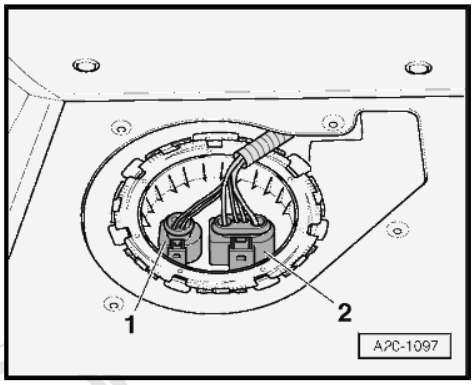
Procedure

– Remove luggage compartment floor covering.

– Detach cover for flange (left-side) -arrows-.



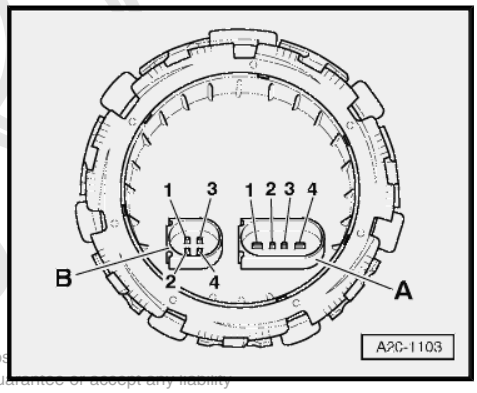
– Unplug electrical connector -1- on flange (left-side).



Note

Disregard -item 2-.

– Connect hand-held multimeter between contacts -2- and -4- of connector -B- to measure resistance.



Sender installed	Sender at lower stop	Sender at upper stop
Fuel gauge sender - G-	approx. 700 Ω	approx. 55 Ω

Note

- *If the resistance is 0 Ω, there is a short circuit. If the resistance is ∞ Ω, there is an open circuit in the wiring.*
- *In order to test the maximum and minimum resistance values for "tank full" and "tank empty", remove the fuel gauge sender - G- ⇒ page 202 and move the float all the way to its top or bottom position.*
- *The following values are obtained with the fuel gauge sender - G- removed, due to the greater travel of the float arm:*

Sender removed	Sender at lower stop	Sender at upper stop
Fuel gauge sender - G-	approx. 990 Ω	approx. 55 Ω

11.2 Removing and installing fuel gauge sender - G- (lever-type sender, left-side)

Observe safety precautions ⇒ page 1 .

Observe rules for cleanliness ⇒ page 3 .

- The fuel tank must be drained completely before removing the lever-type sender. Procedure for draining the fuel tank ⇒ page 7 .

– Remove fuel delivery unit (left-side):

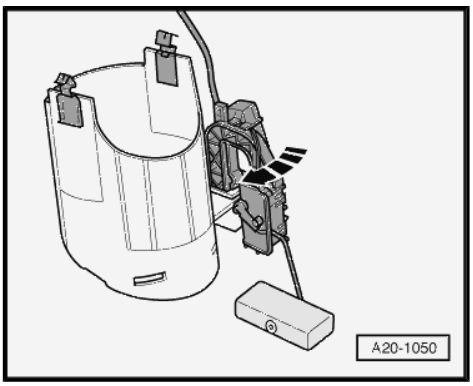
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- ♦ Vehicles with MPI engine ⇒ page 26 .
- ♦ Vehicles with FSI engine ⇒ page 70 .

– Remove fuel gauge sender 3 - G237- (tubular sender, left-side) from fuel tank.

– Release fuel gauge sender - G- -arrow- and detach from retainer.



Installing

– Press fuel gauge sender - G- into retainer so that it engages audibly.

– Insert fuel gauge sender 3 - G237- into fuel tank.

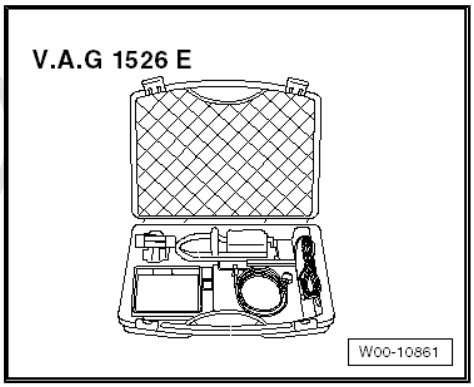
– Install fuel delivery unit (left-side):

- ♦ Vehicles with MPI engine ⇒ page 26 .
- ♦ Vehicles with FSI engine ⇒ page 70 .

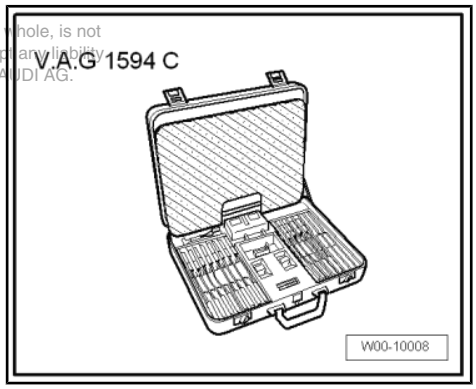
11.3 Checking fuel gauge sender 2 - G169- (lever-type sender, right-side)

Special tools and workshop equipment required

- ♦ Hand-held multimeter - V.A.G 1526 E-



- ♦ Auxiliary measuring set - V.A.G 1594C-



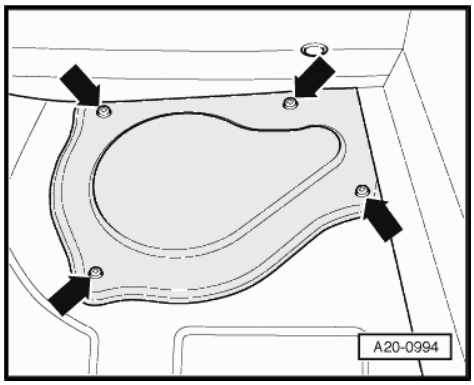
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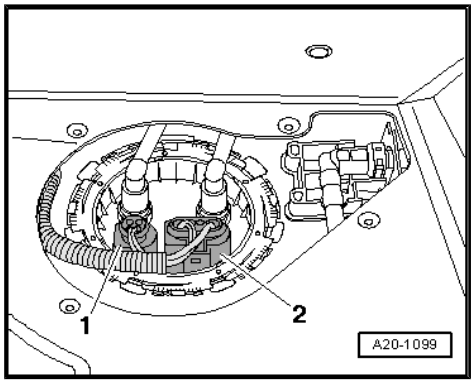
Procedure

– Remove luggage compartment floor covering.

– Unscrew cover for flange (right-side) -arrows-.



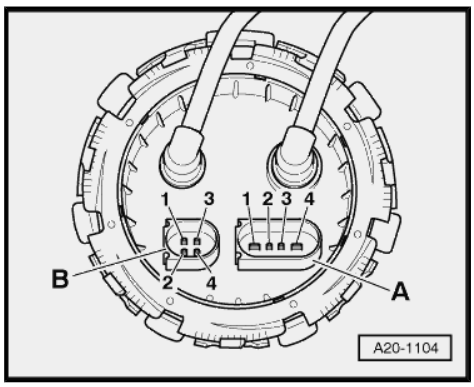
– Unplug electrical connector -1- on flange (right-side).



Note

Disregard -item 2-.

– Connect hand-held multimeter between contacts -2- and -4- of connector -B- to measure resistance.



Sender installed	Sender at lower stop	Sender at upper stop
Fuel gauge sender 2 - G169-	approx. 750 Ω	approx. 55 Ω

Note

- *If the resistance is 0 Ω, there is a short circuit. If the resistance is ∞ Ω, there is an open circuit in the wiring.*
- *In order to test the maximum and minimum values for "tank full" and "tank empty", remove the fuel gauge sender 2 - G169- ⇒ page 204 and move the float all the way to its top or bottom position.*
- *The following values are obtained with the fuel gauge sender 2 - G169- removed, due to the greater travel of the float arm:*

Sender removed	Sender at lower stop	Sender at upper stop
Fuel gauge sender 2 - G169-	approx. 990 Ω	approx. 55 Ω

11.4 Removing and installing fuel gauge sender 2 - G169- (lever-type sender, right-side)

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Removing

Observe safety precautions ⇒ page 1 .

Observe rules for cleanliness ⇒ page 3 .

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- The fuel tank must be drained completely before removing the lever-type sender. Procedure for draining the fuel tank ⇒ page 7 .

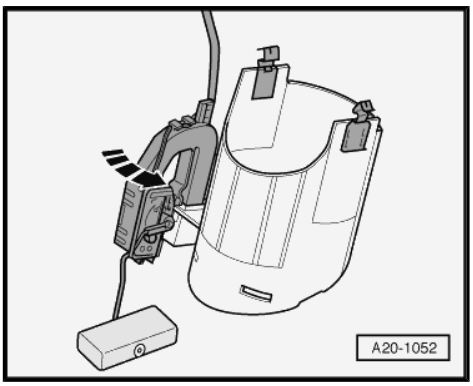
– Remove fuel delivery unit (right-side):

♦ Vehicles with MPI engine ⇒ page 42 .

♦ Vehicles with FSI engine ⇒ page 81 .

– Remove fuel gauge sender 4 - G393- (tubular sender, right-side) from fuel tank.

– Release fuel gauge sender 2 - G169- -arrow- and detach from retainer.



Installing

– Press fuel gauge sender 2 - G169- into retainer so that it engages audibly.

– Insert fuel gauge sender 4 - G393- into fuel tank.

– Install fuel delivery unit (right-side):

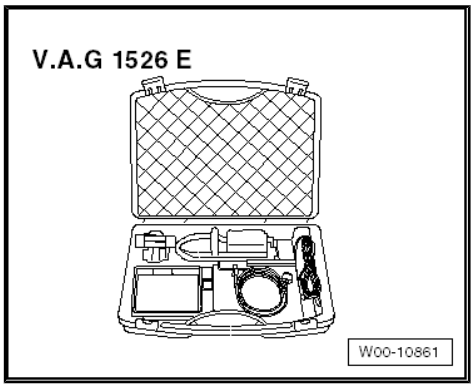
♦ Vehicles with MPI engine ⇒ page 42 .

♦ Vehicles with FSI engine ⇒ page 81 .

11.5 Checking fuel gauge sender 3 - G237- (tubular sender, left-side)

Special tools and workshop equipment required

♦ Hand-held multimeter - V.A.G 1526 E-



♦ Auxiliary measuring set - V.A.G 1594C-



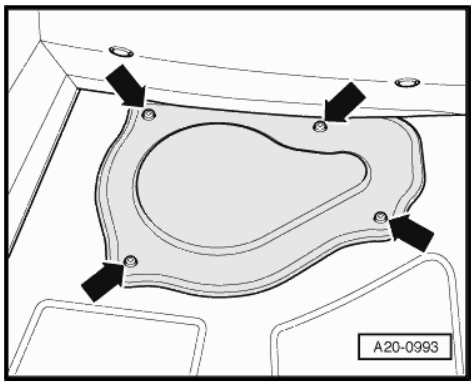
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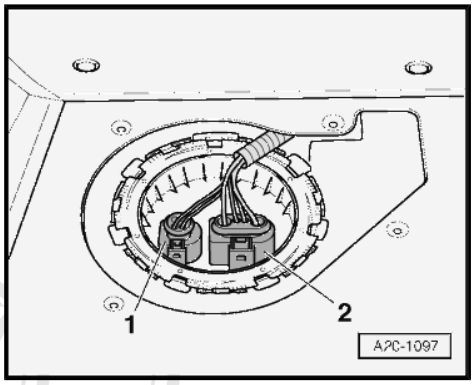
Procedure

– Remove luggage compartment floor covering.

– Detach cover for flange (left-side) -arrows-.



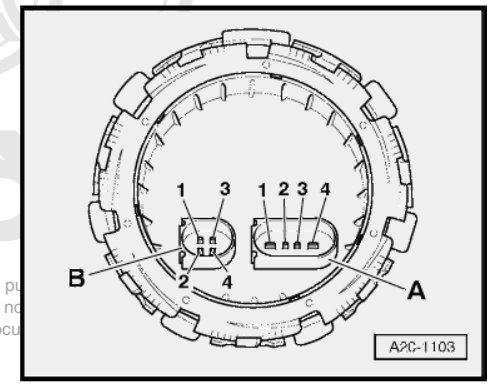
– Unplug electrical connector -2- on flange (left-side).



Note

Disregard -item 1-.

– Connect hand-held multimeter between contacts -2- and -3- of connector -A- to measure resistance.



Sender removed	Sender at lower stop	Sender at upper stop
Fuel gauge sender 3 - G237-	approx. 155 Ω	approx. 70 Ω

Note

- *If the resistance is 0 Ω, there is a short circuit. If the resistance is ∞ Ω, there is an open circuit in the wiring.*
- *In order to test the maximum and minimum values for "tank full" and "tank empty", remove the fuel gauge sender 3 - G237- ⇒ page 206 and move the float all the way to its top or bottom position.*

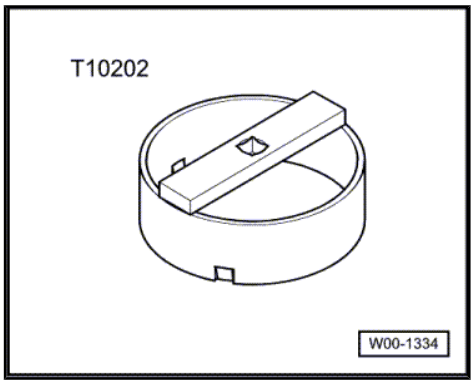
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11.6 Removing and installing fuel gauge sender 3 - G237- (tubular sender, left-side)

Special tools and workshop equipment required

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♦ Vehicles from approx. 11.2002: Wrench - T10202-



Removing

Observe safety precautions ⇒ page 1 .

Observe rules for cleanliness ⇒ page 3 .

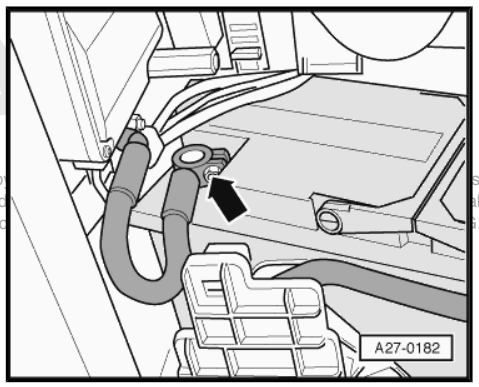
- The left fuel tank chamber must not be more than $^{1}/_{3}$ full when removing the tubular sender. Procedure for draining the fuel tank ⇒ page 7 .

Caution

Observe notes on procedure for disconnecting the battery.

– With ignition switched off, disconnect battery earth cable -arrow- ⇒ Electrical system; Rep. gr. 27 .

– Briefly open filler cap for fuel tank and close again.

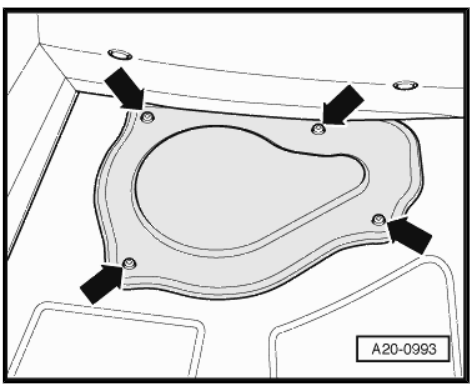


– Remove luggage compartment floor covering.

Note

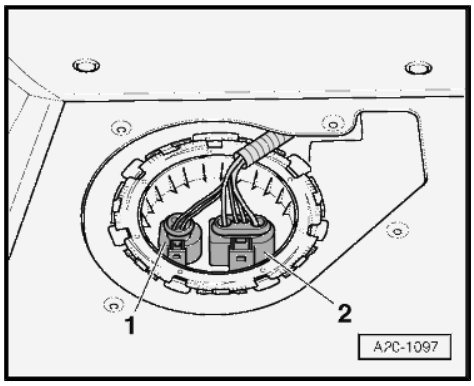
For removing and installing tubular sender, take tool kit and spare wheel out of luggage compartment. You can then sit or kneel in the spare wheel well.

– Detach cover for flange (left-side) -arrows-.



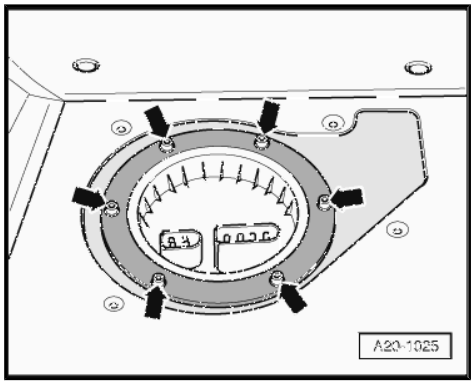
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– Unplug electrical connectors -1- and -2- on flange (left-side).



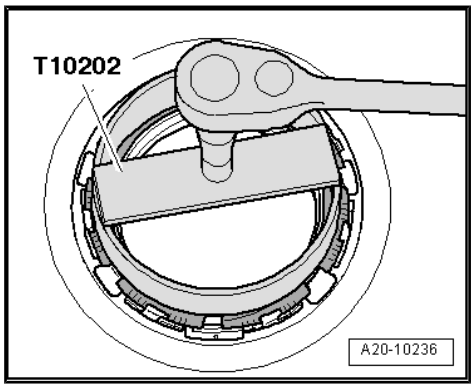
Vehicles up to approx. 10.2002:

– Remove bolts -arrows- and take off locking ring for flange (left-side).



Vehicles from approx. 11.2002 onwards:

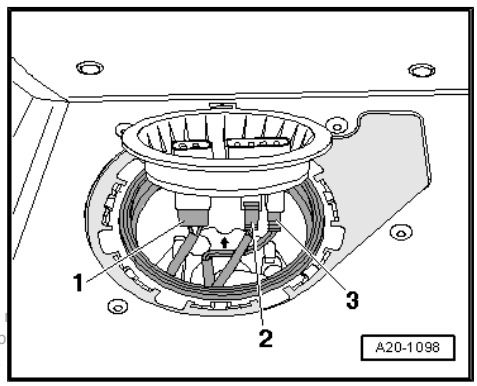
– Unscrew locking ring using wrench - T10202- .



All vehicles (continued):

– Detach flange and remove seal.

– Unplug electrical connectors -1 ... 3- on underside of flange (left-side).

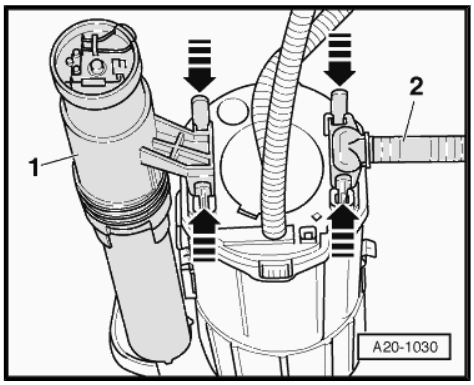


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– Working through left fuel tank opening, press release tabs -arrows- and detach fuel supply line -2- and fuel gauge sender 3 - G237- -item 1-.

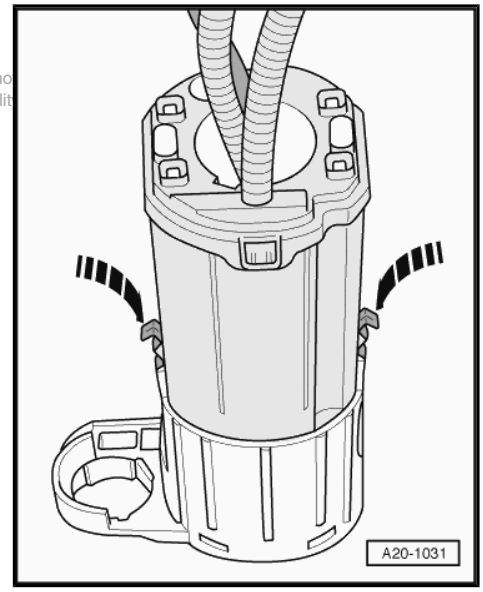
– Move fuel gauge sender 3 - G237- to left side.



– Press down both retaining clips on retainer for fuel delivery unit -arrows-.

– Pull fuel delivery unit slightly upwards and at the same time take out fuel gauge sender 3 - G237- .

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Note

Keep in mind that the fuel gauge sender 3 - G237- still contains fuel.

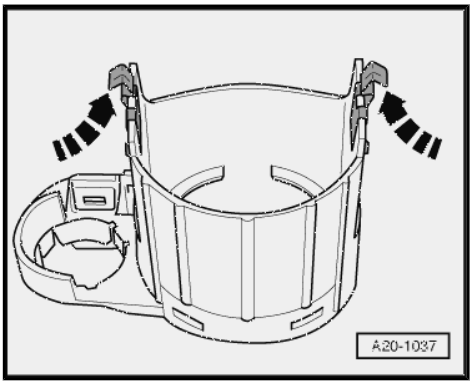
Installing

- Tightening torques ⇒ page 19

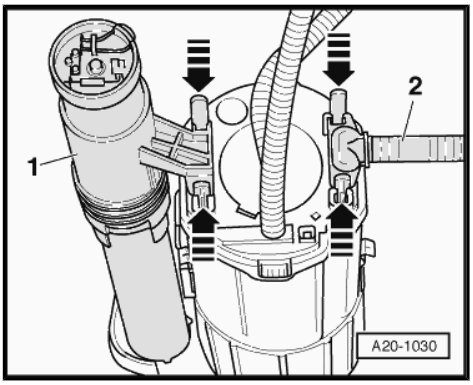
– Pull both retaining clips on retainer upwards -arrows- so that they engage audibly before installing the fuel delivery unit.

– Pull fuel delivery unit up slightly and insert fuel gauge sender 3 - G237- .

– Then press fuel delivery unit carefully into retainer so that it engages audibly.

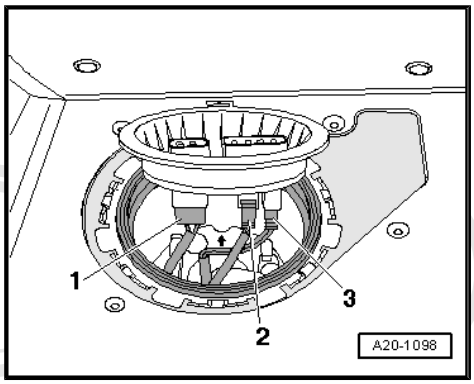


– Fit fuel supply line -2- and fuel gauge sender 3 - G237- -item 1- so that they engage audibly.



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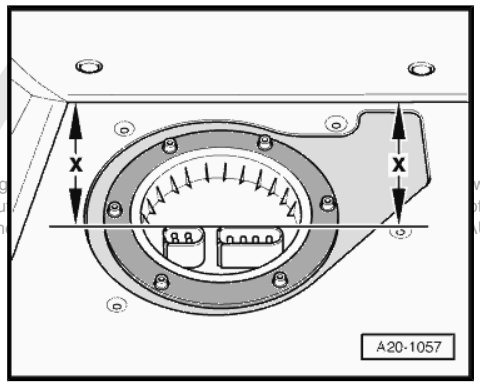
– Connect electrical connectors -1 ... 3- on underside of flange (left-side).



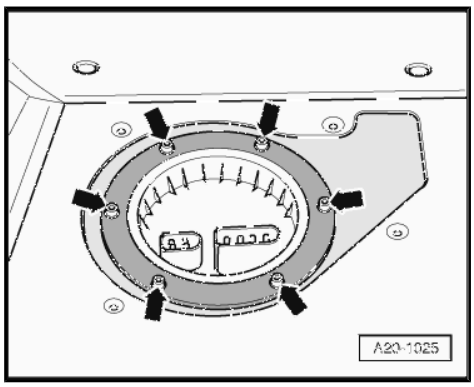
Vehicles up to approx. 10.2002:

– Fit flange with new O-ring into fuel tank; note correct installation position:

- The electrical connectors are positioned transversely in relation to direction of travel.
- Dimension -x- (left-side) = dimension -x- (right-side)



– Secure locking ring for flange (left-side) in diagonal sequence -arrows-.

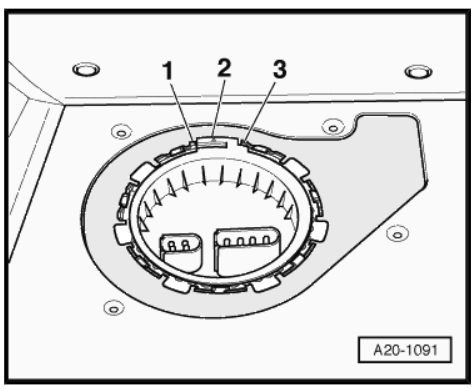


Vehicles from approx. 11.2002 onwards:

– Install new seal for flange (seal must be installed dry).

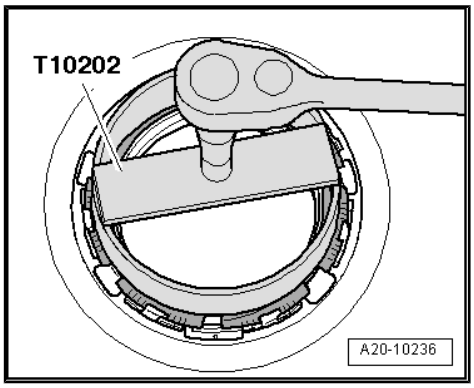
– Fit flange into fuel tank; note correct installation position:

- Lug -2- on flange must be between tabs -1- and -3- on fuel tank.



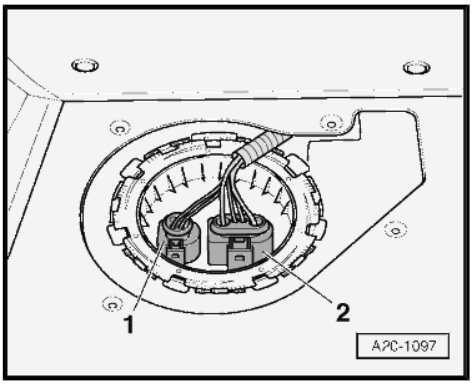
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– Tighten locking ring.



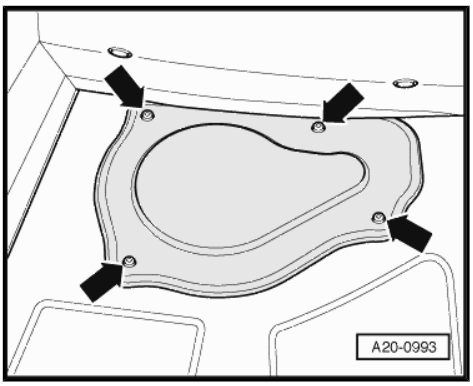
All vehicles (continued):

– Attach electrical connectors -1- and -2- on flange (left-side).



– Secure cover for flange (left-side) -arrows-.

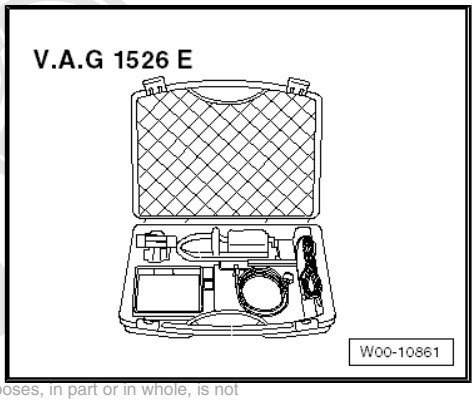
– Connect battery. Observe notes on procedures required after connecting battery ⇒ Electrical system; Rep. gr. 27 .



11.7 Checking fuel gauge sender 4 - G393- (tubular sender, right-side)

Special tools and workshop equipment required

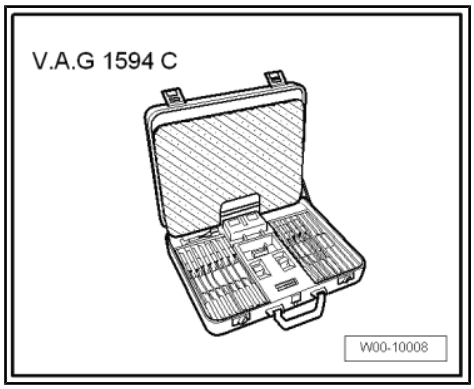
♦ Hand-held multimeter - V.A.G 1526 E-



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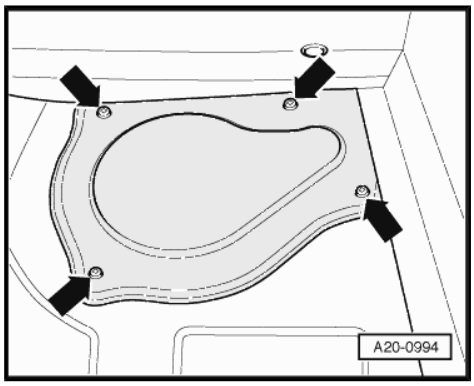
♦ Auxiliary measuring set - V.A.G 1594C-



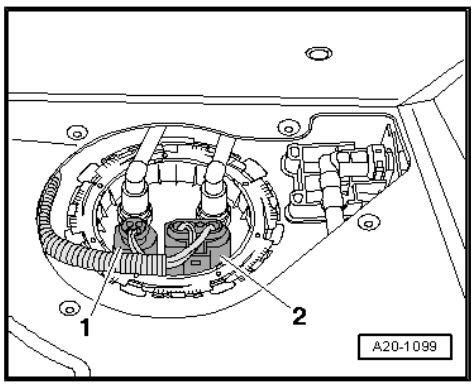
Procedure

– Remove luggage compartment floor covering.

– Unscrew cover for flange (right-side) -arrows-.



– Unplug electrical connector -2- on flange (right-side).

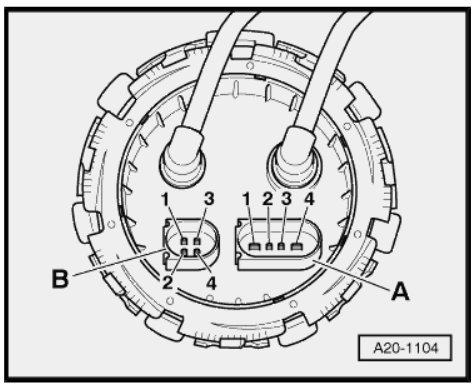


Note

Disregard -item 1-.

– Connect hand-held multimeter between contacts -2- and -3- of connector -A- to measure resistance.

Sender removed	Sender at lower stop	Sender at upper stop
Fuel gauge sender 4 - G393-	approx. 155 Ω	approx. 70 Ω



Note

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♦ *If the resistance is 0 Ω, there is a short circuit. If the resistance is ∞ Ω, there is an open circuit in the wiring.*

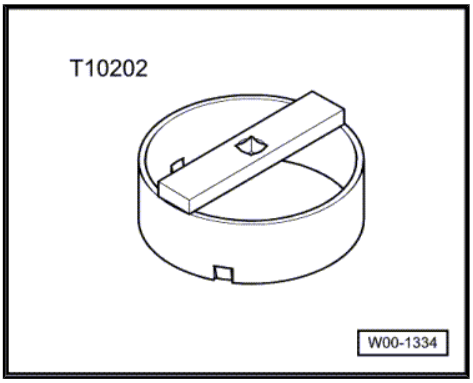
♦ *In order to test the maximum and minimum values for "tank full" and "tank empty", remove the fuel gauge sender 4 - G393- ⇒ page 213 and move the float all the way to its top or bottom position.*

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11.8 Removing and installing fuel gauge sender 4 - G393- (tubular sender, right-side)

Special tools and workshop equipment required

- Vehicles from approx. 11.2002: Wrench - T10202-



Removing

Observe safety precautions ⇒ page 1 .

Observe rules for cleanliness ⇒ page 3 .

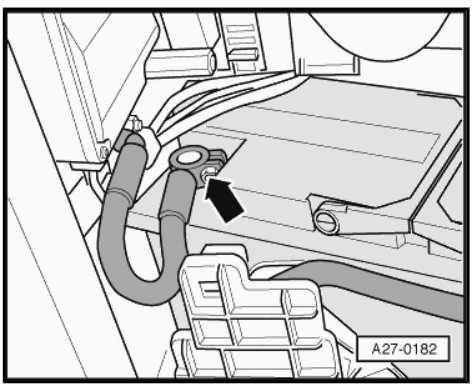
- The right fuel tank chamber must not be more than $^1/_3$ full when removing the tubular sender. Procedure for draining the fuel tank ⇒ page 7 .

Caution

Observe notes on procedure for disconnecting the battery.

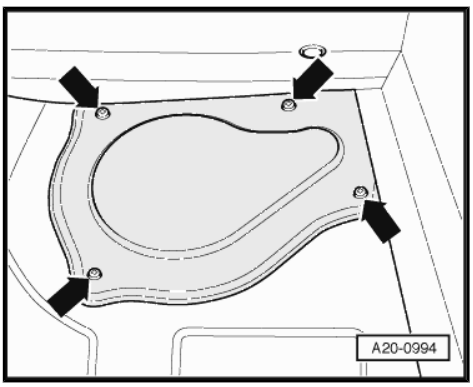
– With ignition switched off, disconnect battery earth cable -arrow- ⇒ Electrical system; Rep. gr. 27 .

– Briefly open filler cap for fuel tank and close again.



– Remove luggage compartment floor covering.

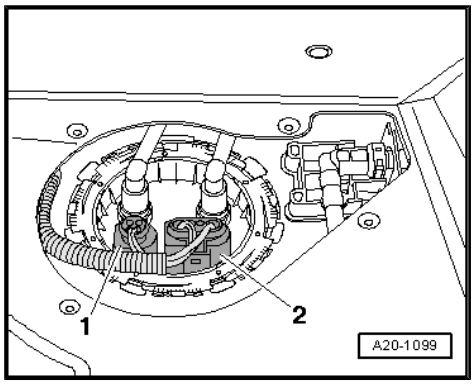
– Unscrew cover for flange (right-side) -arrows-.



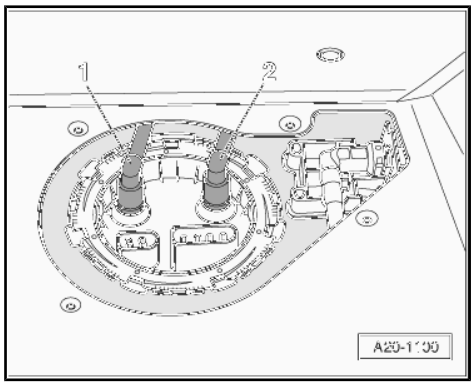
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– Unplug electrical connectors -1- and -2- on flange (right-side).



– Mark fuel return line -1- and fuel supply line -2-.



WARNING

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

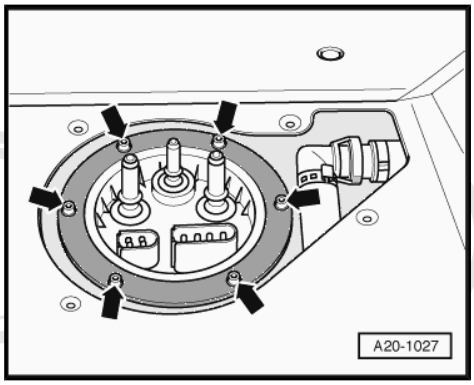
– Detach both lines from flange (press release tabs).

Vehicles with auxiliary heater:

– In addition, disconnect fuel supply line for auxiliary heater.

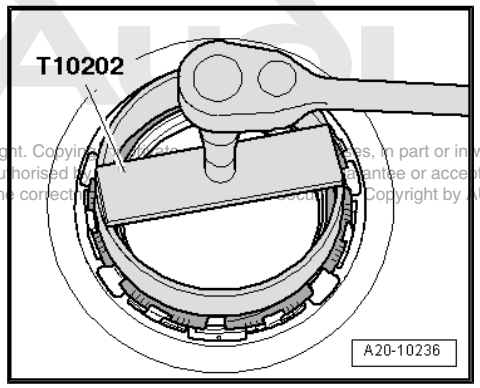
Vehicles up to approx. 10.2002:

– Remove bolts -arrows- and take off locking ring for flange (right-side).



Vehicles from approx. 11.2002 onwards:

– Unscrew locking ring using wrench - T10202- .



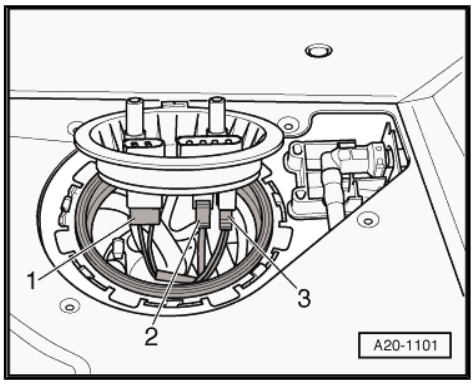
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All vehicles (continued):

– Detach flange and remove seal/O-ring.

– Unplug electrical connectors -1 ... 3- on underside of flange (right-side).

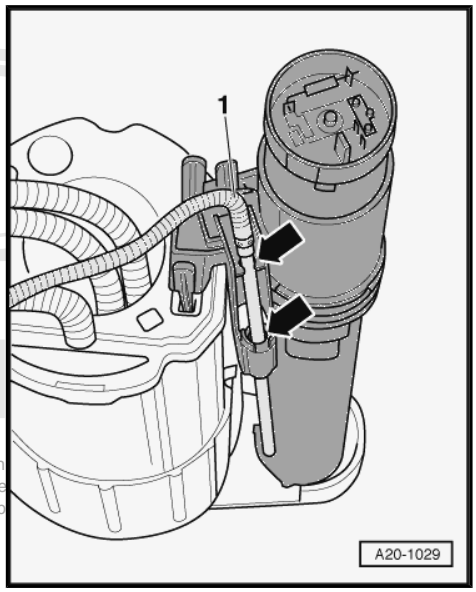


Note

- *Pull out fuel lines from fuel tank opening prior to disconnecting the pipe connectors mentioned below.*
- *For illustration purposes some of the components are shown removed in the following illustrations.*

Vehicles with auxiliary heater:

– Pull out suction pipe -1- for auxiliary heater from retainers -arrows- on tubular sender.

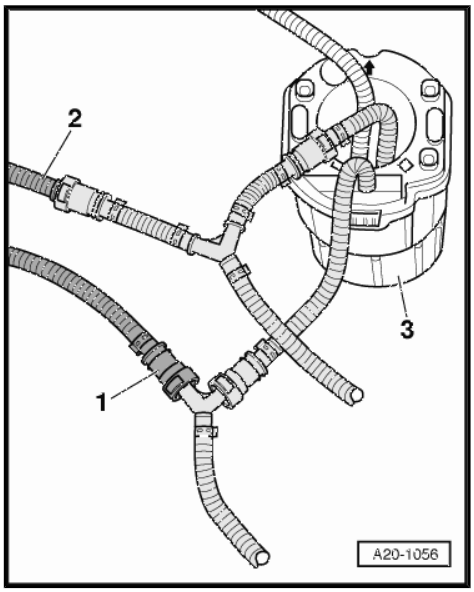


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Vehicles with MPI engine:

– Working through right fuel tank opening, press release tabs and disconnect fuel lines -1- and -2- going to fuel delivery unit (left-side).

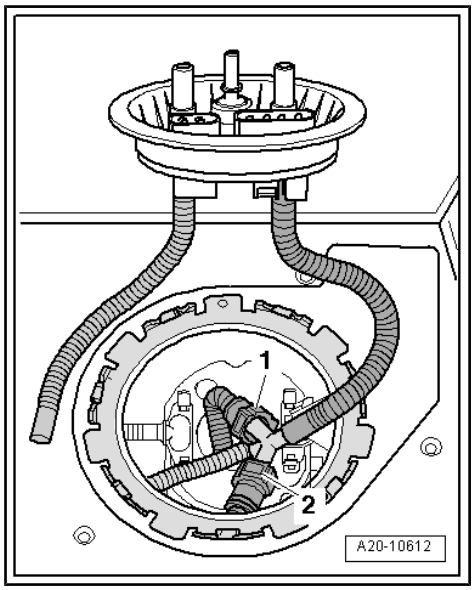
3 - Fuel delivery unit (right-side) with fuel pump - G23-



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Vehicles with FSI engine:

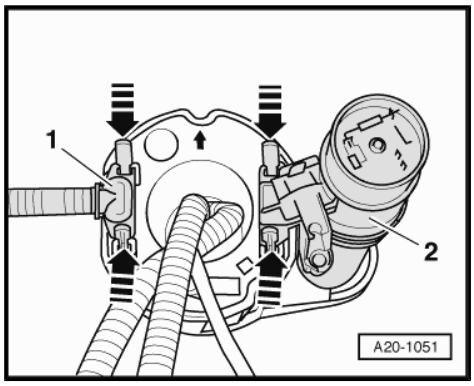
– Working through right fuel tank opening, press release tabs and disconnect fuel supply lines -1- and -2- going to fuel delivery units.



All vehicles (continued):

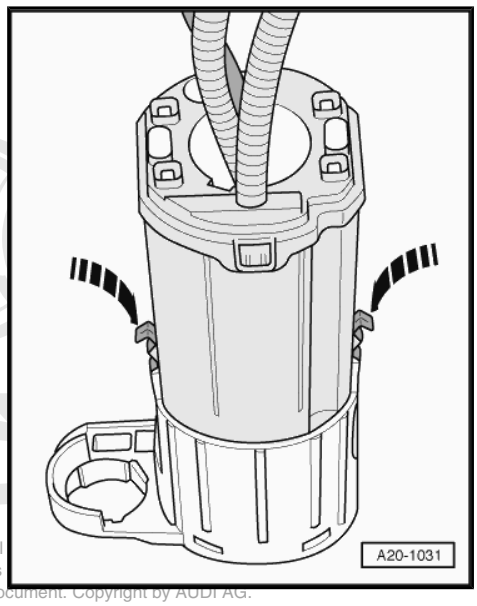
– Working through right fuel tank opening, press release tabs -arrows- and detach fuel supply line -1- and fuel gauge sender 4 - G393- -item 2-.

– Move fuel gauge sender 4 - G393- to right side.



– Press down both retaining clips on retainer for fuel delivery unit -arrows-.

– Pull fuel delivery unit slightly upwards and at the same time take out fuel gauge sender 4 - G393- .



Note

Keep in mind that the fuel gauge sender 4 - G393- still contains fuel.

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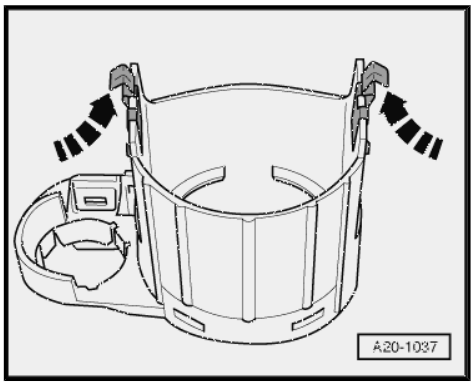
Installing

- Tightening torques ⇒ page 36

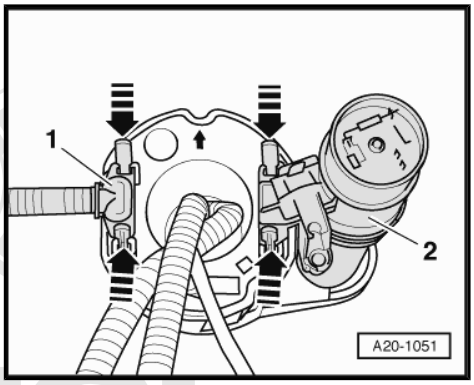
– Pull both retaining clips on retainer upwards -arrows- so that they engage audibly before installing the fuel delivery unit.

– Pull fuel delivery unit up slightly and insert fuel gauge sender 4 - G393- .

– Then press fuel delivery unit carefully into retainer so that it engages audibly.



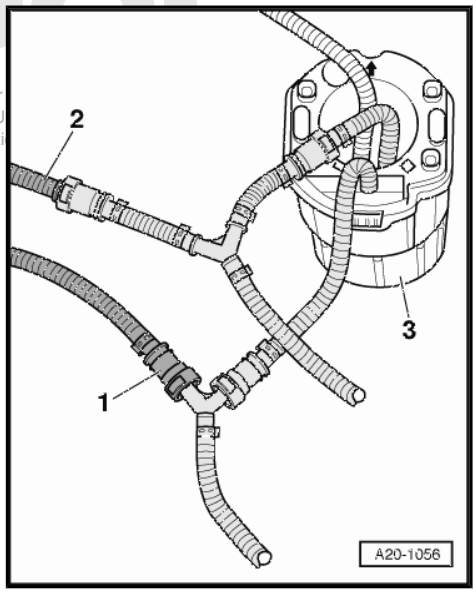
– Fit fuel supply line -1- and fuel gauge sender 4 - G393- -item 2- so that they engage audibly.



Vehicles with MPI engine:

– Working through right fuel tank opening, connect fuel lines -1- and -2- going to left fuel delivery unit so that they engage audibly.

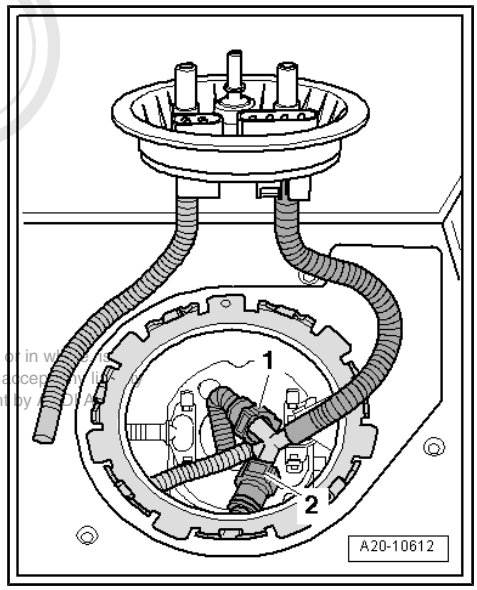
3 - Fuel delivery unit (right-side) with fuel pump - G23-



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Vehicles with FSI engine:

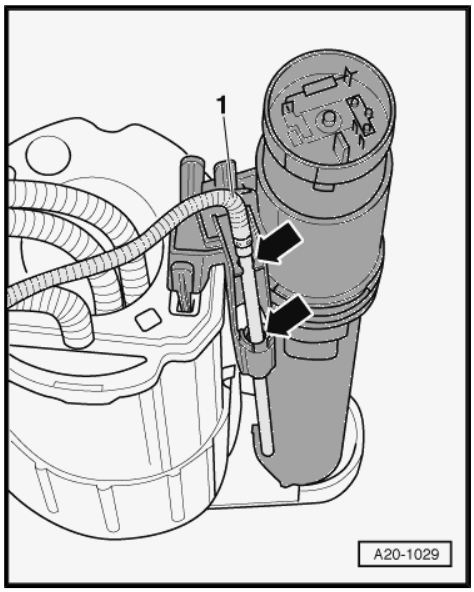
– Working through right fuel tank opening, fit fuel lines -1- and -2- going to fuel delivery units so that they engage audibly.



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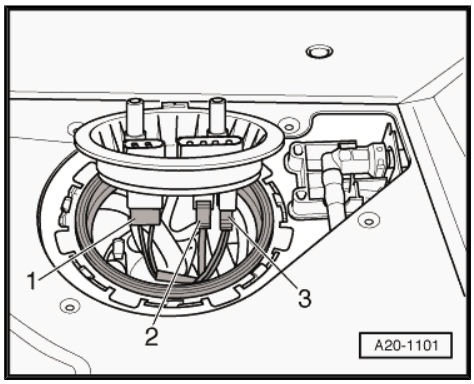
Vehicles with auxiliary heater:

– Fit suction pipe -1- for auxiliary heater into retainers -arrows- on tubular sender.



All vehicles (continued):

– Connect electrical connectors -1 ... 3- on underside of flange (right-side).



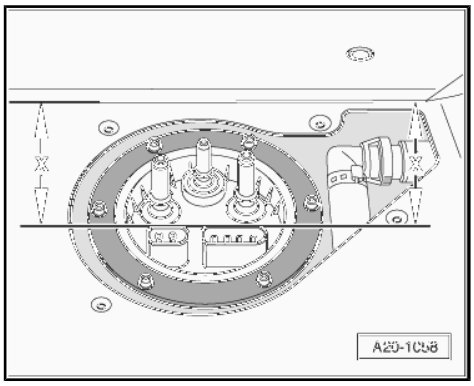
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Vehicles up to approx. 10.2002:

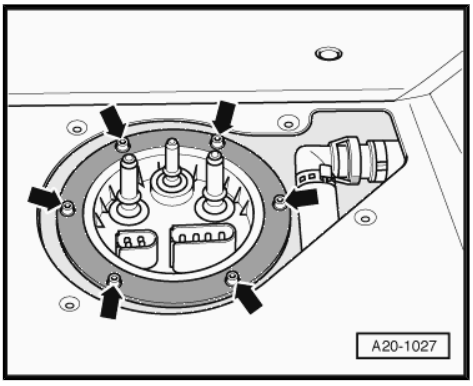
– Fit flange with new O-ring into fuel tank; note correct installation position:

• The electrical connectors are positioned transversely in relation to direction of travel.

• Dimension -x- (left-side) = dimension -x- (right-side)



– Secure locking ring for flange (right-side) in diagonal sequence -arrows-.

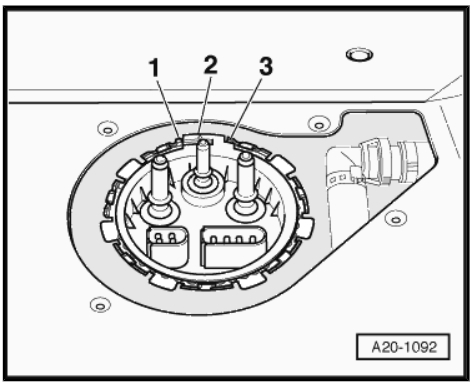


Vehicles from approx. 11.2002 onwards:

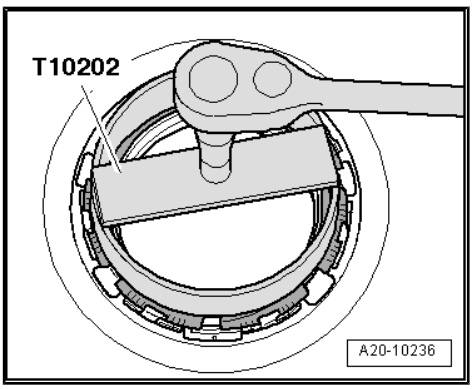
– Install new seal for flange (seal must be installed dry).

– Fit flange into fuel tank; note correct installation position:

• Lug -2- on flange must be between tabs -1- and -3- on fuel tank.



– Tighten locking ring.



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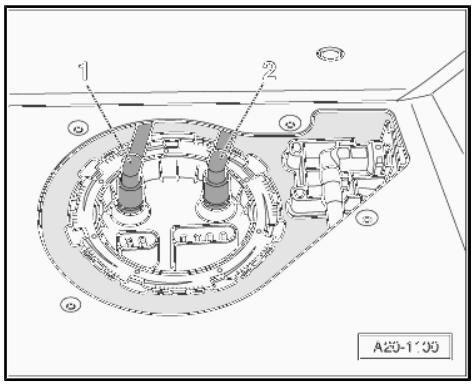
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All vehicles (continued):

– Install fuel supply line -2- and fuel return line -1- (as marked) so that they engage audibly.

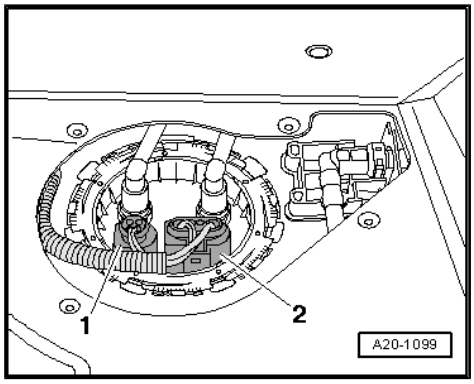
Vehicles with auxiliary heater:

– Also fit fuel supply line going to auxiliary heater so that it engages audibly.



All vehicles (continued):

– Attach electrical connectors -1- and -2- on flange (right-side).

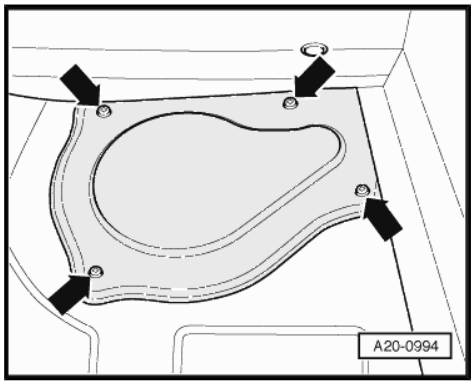


– Secure cover for flange (right-side) -arrows-.

– Connect battery. Observe notes on procedures required after connecting battery ⇒ Electrical system; Rep. gr. 27 .

Vehicles with auxiliary heater:

– Let auxiliary heater run with full load for 10 minutes to bleed fuel supply line going to metering pump.



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12 Fuel gauge senders - USA vehicles

⇒ “12.1 Checking fuel gauge sender G (lever-type sender, left-side)”, page 221

⇒ “12.2 Removing and installing fuel gauge sender G (lever-type sender, left-side)”, page 222

⇒ “12.3 Checking fuel gauge sender 2 G169 (lever-type sender, right-side)”, page 223

⇒ “12.4 Removing and installing fuel gauge sender 2 G169 (lever-type sender, right-side)”, page 224

⇒ “12.5 Checking fuel gauge sender 3 G237 (tubular sender, left-side)”, page 225

⇒ “12.6 Removing and installing fuel gauge sender 3 G237 (tubular sender, left-side)”, page 226

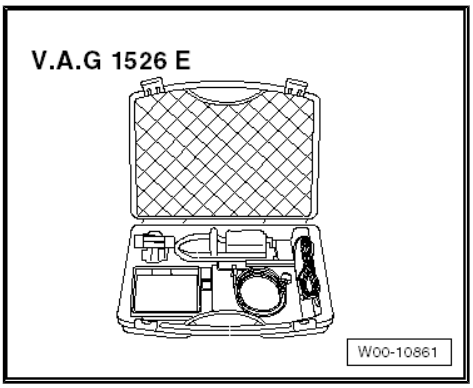
⇒ “12.7 Checking fuel gauge sender 4 G393 (tubular sender, right-side)”, page 230

⇒ “12.8 Removing and installing fuel gauge sender 4 G393 (tubular sender, right-side)”, page 232

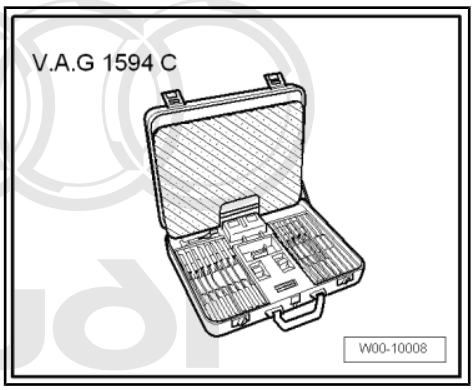
12.1 Checking fuel gauge sender - G- (lever-type sender, left-side)

Special tools and workshop equipment required

- Hand-held multimeter - V.A.G 1526 E-



- Auxiliary measuring set - V.A.G 1594C-



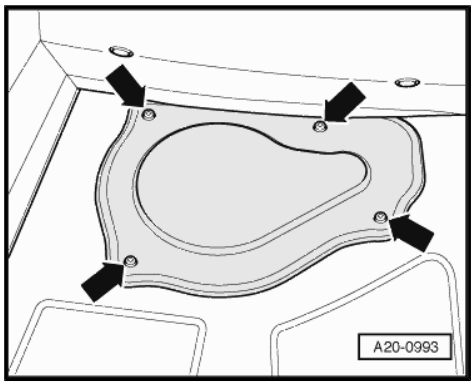
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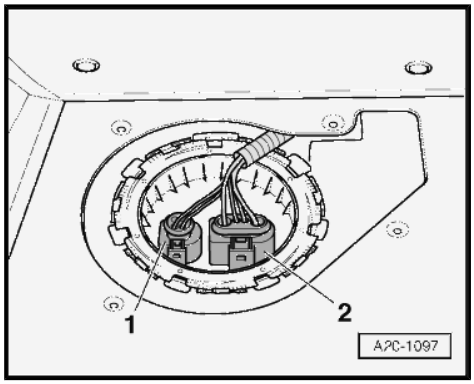
Procedure

– Remove luggage compartment floor covering.

– Detach cover for flange (left-side) -arrows-.



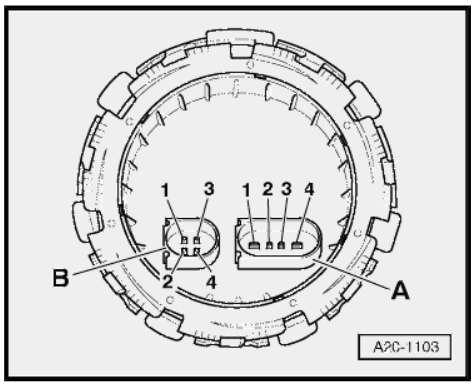
– Unplug electrical connector -1- on flange (left-side).



Note

Disregard -item 2-.

– Connect hand-held multimeter between contacts -2- and -4- of connector -B- to measure resistance.



Sender installed	Sender at lower stop	Sender at upper stop
Fuel gauge sender - G-	approx. 700 Ω	approx. 55 Ω

Note

- *If the resistance is 0 Ω, there is a short circuit. If the resistance is ∞ Ω, there is an open circuit in the wiring.*
- *In order to test the maximum and minimum resistance values for "tank full" and "tank empty", remove the fuel gauge sender - G- ⇒ page 222 and move the float all the way to its top or bottom position.*
- *The following values are obtained with the fuel gauge sender - G- removed, due to the greater travel of the float arm:*

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Sender removed	Sender at lower stop	Sender at upper stop
Fuel gauge sender - G-	approx. 990 Ω	approx. 55 Ω

12.2 Removing and installing fuel gauge sender - G- (lever-type sender, left-side)

Observe safety precautions ⇒ page 1 .

Observe rules for cleanliness ⇒ page 3 .

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Caution

- *The fuel tank must be drained completely before removing the lever-type sender. Procedure for draining the fuel tank ⇒ page 112 .*

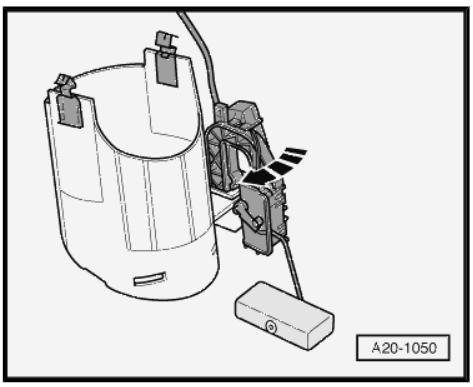
– Remove fuel delivery unit (left-side):

♦ Vehicles with MPI engine ⇒ page 129 .

♦ Vehicles with FSI engine ⇒ page 167 .

– Remove fuel gauge sender 3 - G237- (tubular sender, left-side) from fuel tank.

– Release fuel gauge sender - G- -arrow- and detach from retainer.



Installing

– Press fuel gauge sender - G- into retainer so that it engages audibly.

– Insert fuel gauge sender 3 - G237- into fuel tank.

– Install fuel delivery unit (left-side):

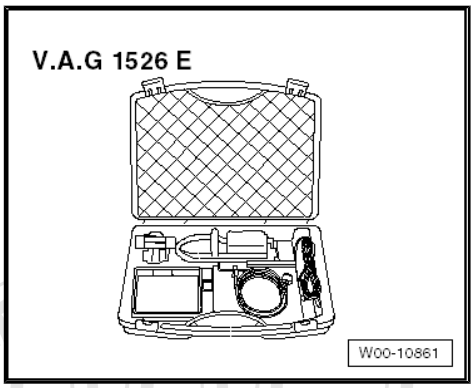
♦ Vehicles with MPI engine ⇒ page 129 .

♦ Vehicles with FSI engine ⇒ page 167 .

12.3 Checking fuel gauge sender 2 - G169- (lever-type sender, right-side)

Special tools and workshop equipment required

♦ Hand-held multimeter - V.A.G 1526 E-



♦ Auxiliary measuring set - V.A.G 1594C-



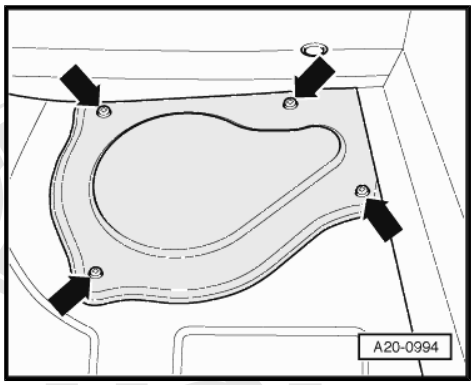
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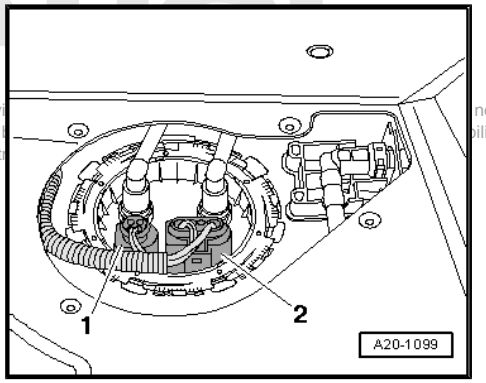
Procedure

– Remove luggage compartment floor covering.

– Unscrew cover for flange (right-side) -arrows-.



– Unplug electrical connector -1- on flange (right-side).

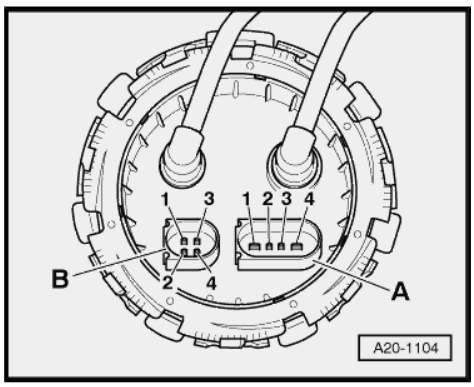


Note

Disregard -item 2-.

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bility

– Connect hand-held multimeter between contacts -2- and -4- of connector -B- to measure resistance.



Sender installed	Sender at lower stop	Sender at upper stop
Fuel gauge sender 2 - G169-	approx. 750 Ω	approx. 55 Ω

Note

- *If the resistance is 0 Ω, there is a short circuit. If the resistance is ∞ Ω, there is an open circuit in the wiring.*
- *In order to test the maximum and minimum values for "tank full" and "tank empty", remove the fuel gauge sender 2 - G169- ⇒ page 224 and move the float all the way to its top or bottom position.*
- *The following values are obtained with the fuel gauge sender 2 - G169- removed, due to the greater travel of the float arm:*

Sender removed	Sender at lower stop	Sender at upper stop
Fuel gauge sender 2 - G169-	approx. 990 Ω	approx. 55 Ω

12.4 Removing and installing fuel gauge sender 2 - G169- (lever-type sender, right-side)

Removing

Observe safety precautions ⇒ page 1 .

Observe rules for cleanliness ⇒ page 3 .

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Caution

- *The fuel tank must be drained completely before removing the lever-type sender. Procedure for draining the fuel tank ⇒ page 112 .*

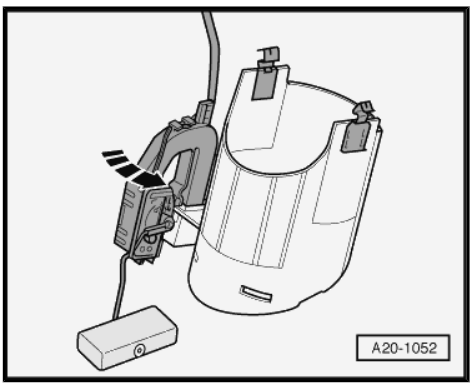
– Remove fuel delivery unit (right-side):

♦ Vehicles with MPI engine ⇒ page 141 .

♦ Vehicles with FSI engine ⇒ page 177 .

– Remove fuel gauge sender 4 - G393- (tubular sender, right-side) from fuel tank.

– Release fuel gauge sender 2 - G169- -arrow- and detach from retainer.



Installing

– Press fuel gauge sender 2 - G169- into retainer so that it engages audibly.

– Insert fuel gauge sender 4 - G393- into fuel tank.

– Install fuel delivery unit (right-side):

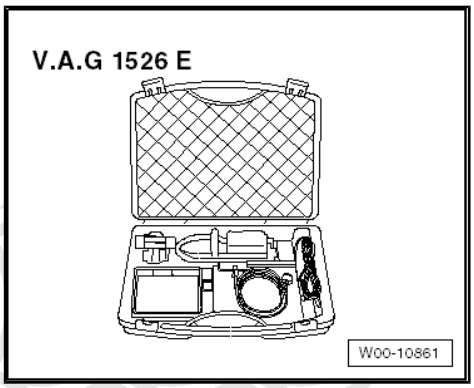
♦ Vehicles with MPI engine ⇒ page 141 .

♦ Vehicles with FSI engine ⇒ page 177 .

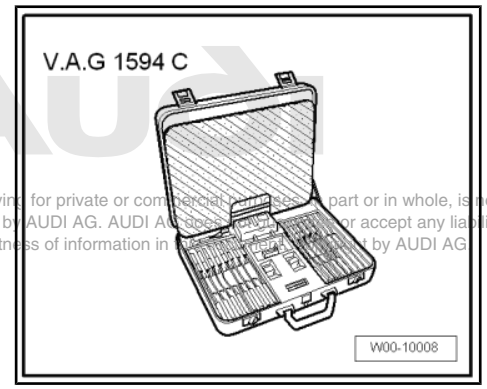
12.5 Checking fuel gauge sender 3 - G237- (tubular sender, left-side)

Special tools and workshop equipment required

♦ Hand-held multimeter - V.A.G 1526 E-



♦ Auxiliary measuring set - V.A.G 1594C-



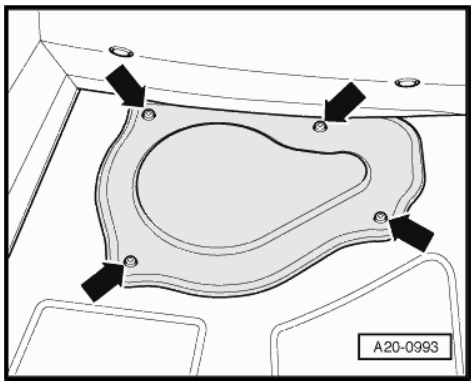
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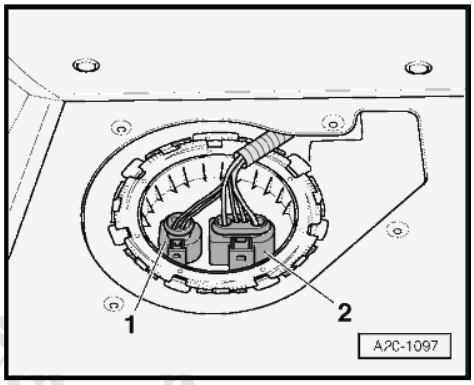
Procedure

– Remove luggage compartment floor covering.

– Detach cover for flange (left-side) -arrows-.



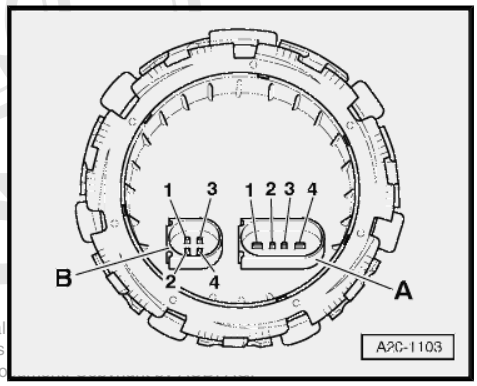
– Unplug electrical connector -2- on flange (left-side).



Note

Disregard -item 1-.

– Connect hand-held multimeter between contacts -2- and -3- of connector -A- to measure resistance.



Sender removed	Sender at lower stop	Sender at upper stop
Fuel gauge sender 3 - G237-	approx. 155 Ω	approx. 70 Ω

Note

- *If the resistance is 0 Ω, there is a short circuit. If the resistance is ∞ Ω, there is an open circuit in the wiring.*
- *In order to test the maximum and minimum values for "tank full" and "tank empty", remove the fuel gauge sender 3 - G237- ⇒ page 226 and move the float all the way to its top or bottom position.*

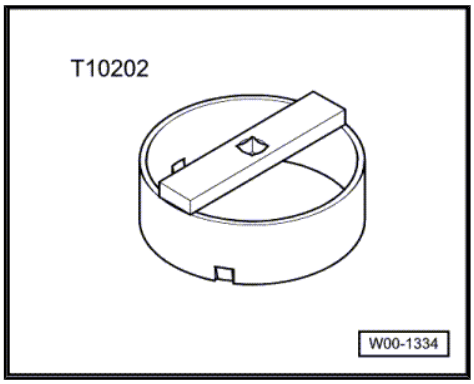
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12.6 Removing and installing fuel gauge sender 3 - G237- (tubular sender, left-side)

Special tools and workshop equipment required

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♦ Wrench - T10202-



Removing

Observe safety precautions ⇒ page 1 .

Observe rules for cleanliness ⇒ page 3 .

Caution

- *The left fuel tank chamber must not be more than 1/3 full when removing the tubular sender. Procedure for draining the fuel tank ⇒ page 112 .*

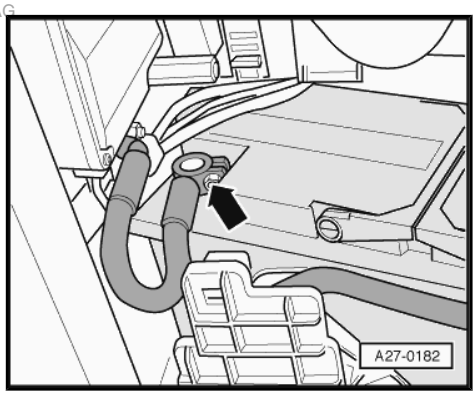
Caution

Observe notes on procedure for disconnecting the battery.

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– With ignition switched off, disconnect battery earth cable -arrow- ⇒ Electrical system; Rep. gr. 27 .

– Briefly open filler cap for fuel tank and close again.

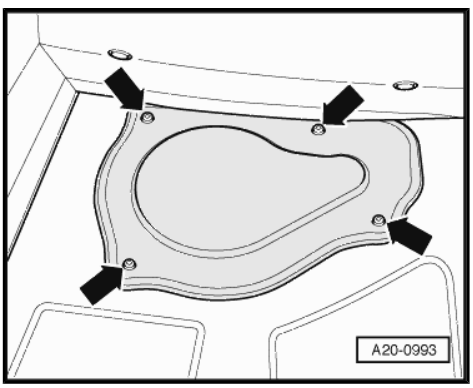


– Remove luggage compartment floor covering.

Note

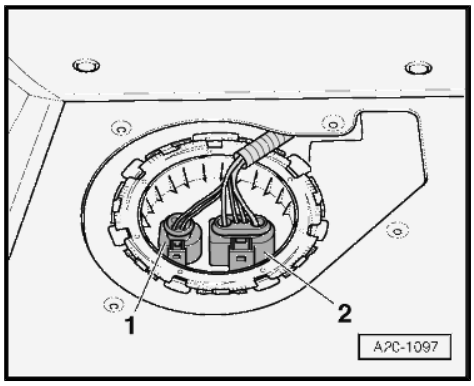
For removing and installing tubular sender, take tool kit and spare wheel out of luggage compartment. You can then sit or kneel in the spare wheel well.

– Detach cover for flange (left-side) -arrows-.

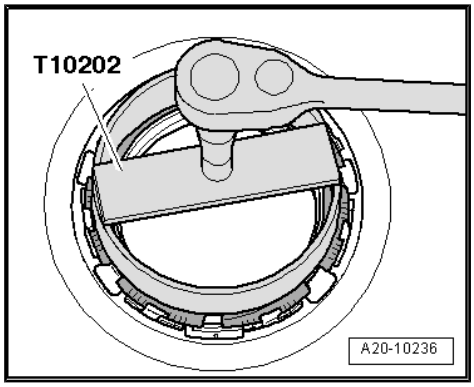


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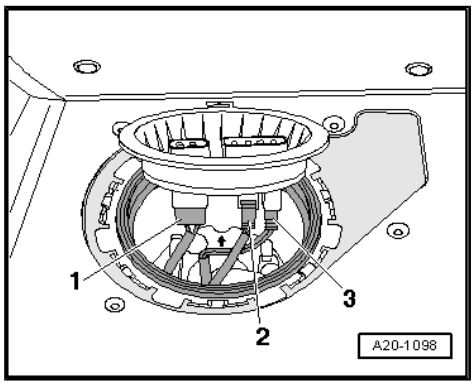
– Unplug electrical connectors -1- and -2- on flange (left-side).



– Unscrew locking ring using wrench - T10202- .

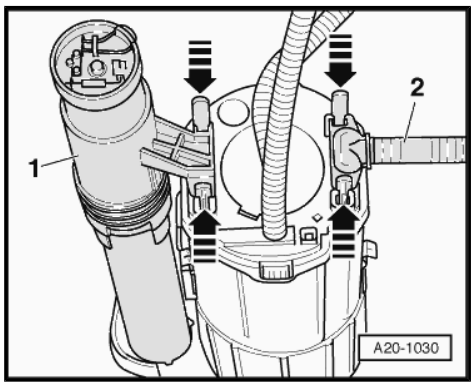


– Detach flange and remove seal.
– Unplug electrical connectors -1 ... 3- on underside of flange (left-side).



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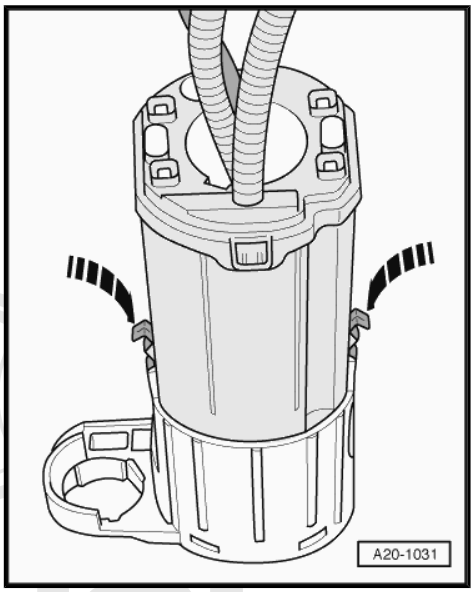
– Working through left fuel tank opening, press release tabs -arrows- and detach fuel supply line -2- and fuel gauge sender 3 - G237- -item 1-.
– Move fuel gauge sender 3 - G237- to left side.



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– Press down both retaining clips on retainer for fuel delivery unit -arrows-.

– Pull fuel delivery unit slightly upwards and at the same time take out fuel gauge sender 3 - G237- .



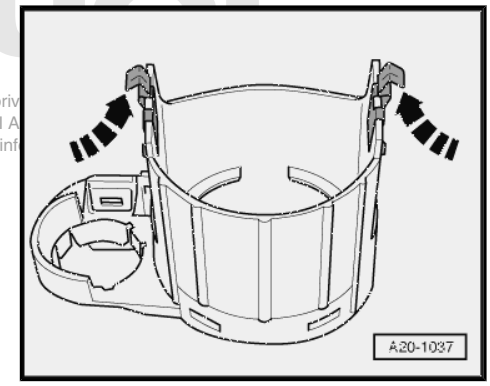
Note

Keep in mind that the fuel gauge sender 3 - G237- still contains fuel.

Installing

- Tightening torques ⇒ page 123

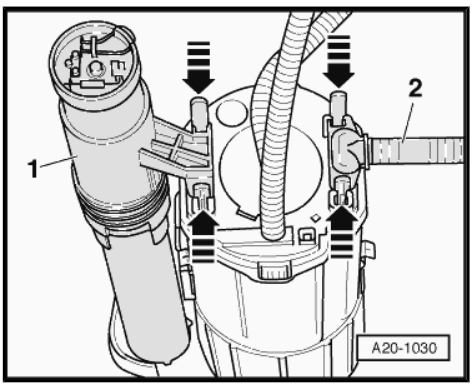
– Pull both retaining clips on retainer upwards -arrows- so that they engage audibly before installing the fuel delivery unit.



– Pull fuel delivery unit up slightly and insert fuel gauge sender 3 - G237- .

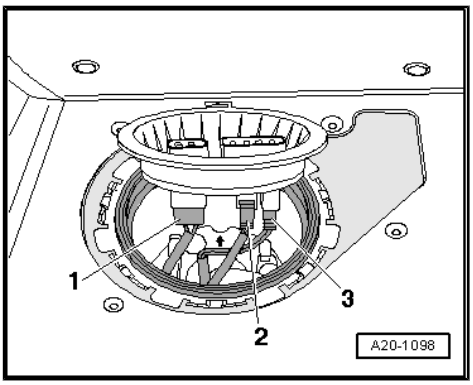
– Then press fuel delivery unit carefully into retainer so that it engages audibly.

– Fit fuel supply line -2- and fuel gauge sender 3 - G237- -item 1- so that they engage audibly.



– Connect electrical connectors -1 ... 3- on underside of flange (left-side).

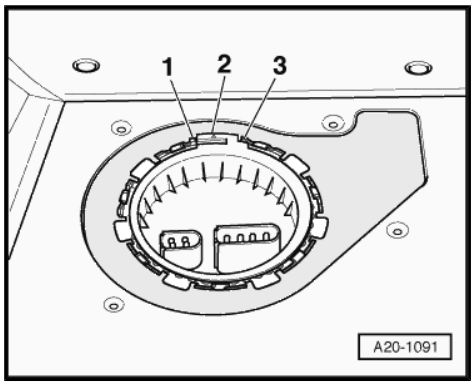
– Install new seal for flange (seal must be installed dry).



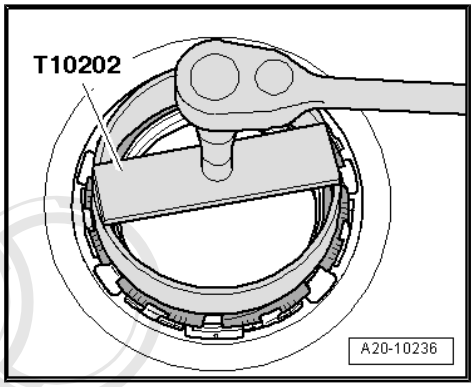
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– Fit flange into fuel tank; note correct installation position:

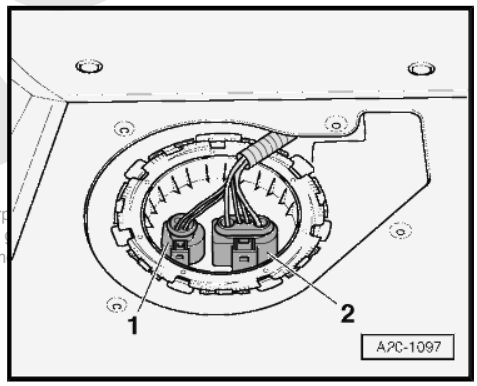
• Lug -2- on flange must be between tabs -1- and -3- on fuel tank.



– Tighten locking ring.

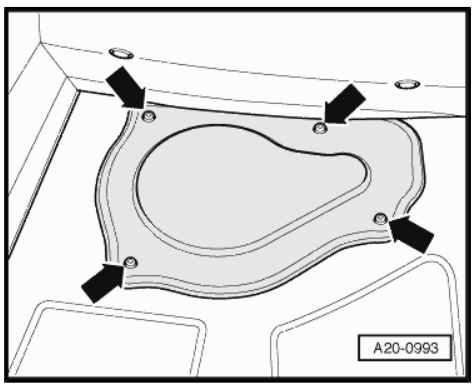


– Attach electrical connectors -1- and -2- on flange (left-side).



– Secure cover for flange (left-side) -arrows-.

– Connect battery. Observe notes on procedures required after connecting battery ⇒ Electrical system; Rep. gr. 27 .



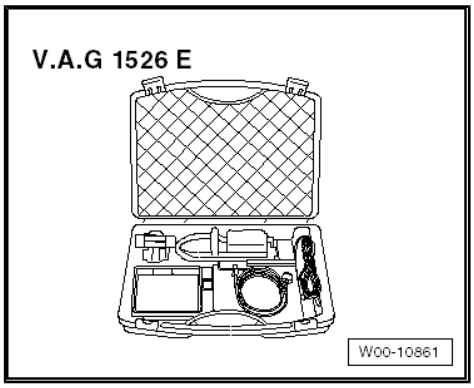
12.7 Checking fuel gauge sender 4 - G393- (tubular sender, right-side)

Special tools and workshop equipment required

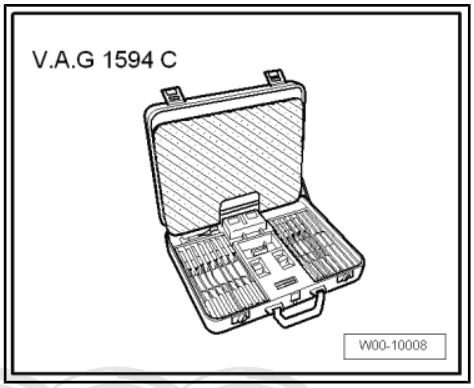
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♦ Hand-held multimeter - V.A.G 1526 E-



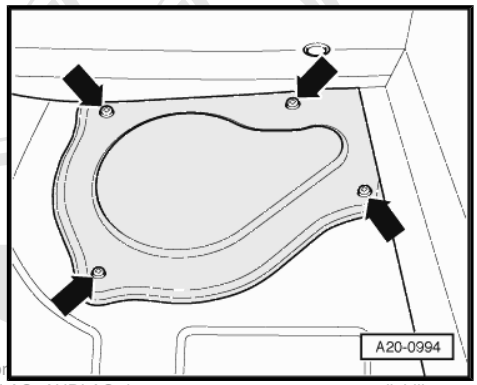
♦ Auxiliary measuring set - V.A.G 1594C-



Procedure

– Remove luggage compartment floor covering.

– Unscrew cover for flange (right-side) -arrows-.

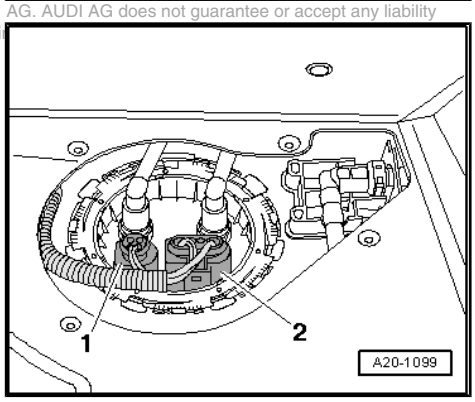


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– Unplug electrical connector -2- on flange (right-side).

Note

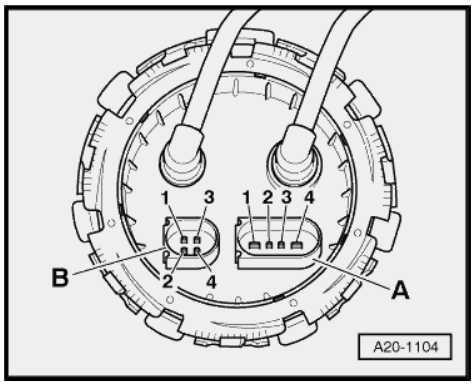
Disregard -item 1-.



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– Connect hand-held multimeter between contacts -2- and -3- of connector -A- to measure resistance.

Sender removed	Sender at lower stop	Sender at upper stop
Fuel gauge sender 4 - G393-	approx. 155 Ω	approx. 70 Ω



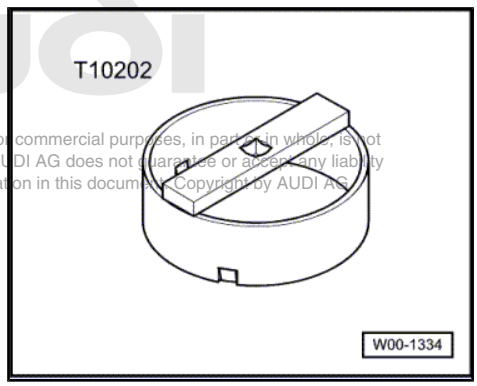
Note

- *If the resistance is 0 Ω, there is a short circuit. If the resistance is ∞ Ω, there is an open circuit in the wiring.*
- *In order to test the maximum and minimum values for "tank full" and "tank empty", remove the fuel gauge sender 4 - G393- ⇒ page 232 and move the float all the way to its top or bottom position.*

12.8 Removing and installing fuel gauge sender 4 - G393- (tubular sender, right-side)

Special tools and workshop equipment required

- Wrench - T10202-



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Removing

Observe safety precautions ⇒ page 1 .

Observe rules for cleanliness ⇒ page 3 .

Caution

- *The right fuel tank chamber must not be more than 1/3 full when removing the tubular sender. Procedure for draining the fuel tank ⇒ page 112 .*

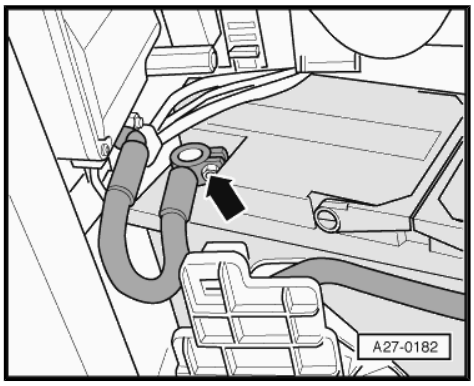
Caution

Observe notes on procedure for disconnecting the battery.

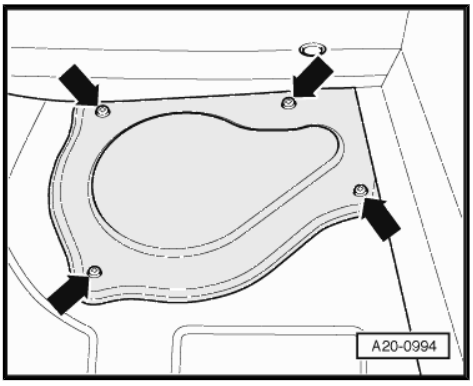
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– With ignition switched off, disconnect battery earth cable -arrow- ⇒ Electrical system; Rep. gr. 27 .

– Briefly open filler cap for fuel tank and close again.



– Remove luggage compartment floor covering.

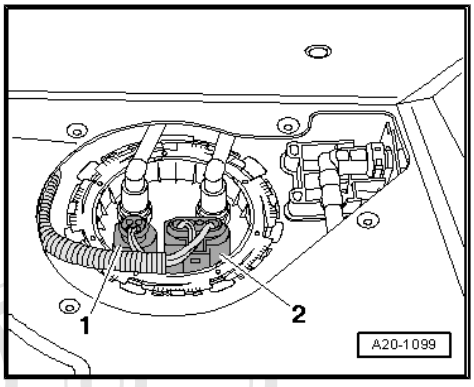


Note

For removing and installing tubular sender, take tool kit and spare wheel out of luggage compartment. You can then sit or kneel in the spare wheel well.

– Unscrew cover for flange (right-side) -arrows-.

– Unplug electrical connectors -1- and -2- on flange (right-side).

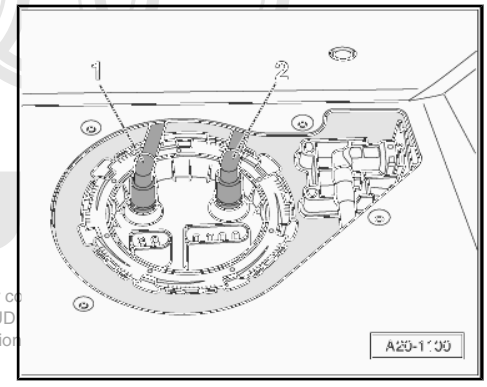


– Mark fuel return line -1- and fuel supply line -2-.

WARNING

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

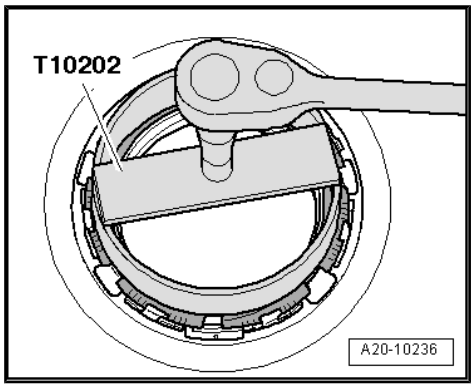
– Detach both lines from flange (press release tabs).



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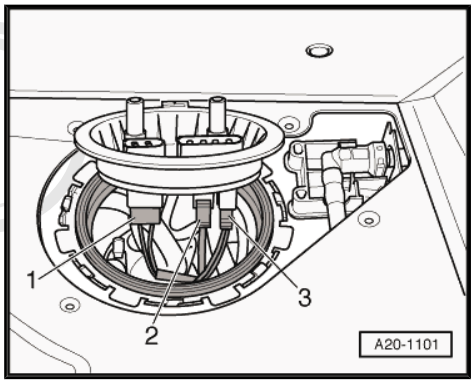
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– Unscrew locking ring using wrench - T10202- .



– Detach flange and remove seal.

– Unplug electrical connectors -1 ... 3- on underside of flange (right-side).



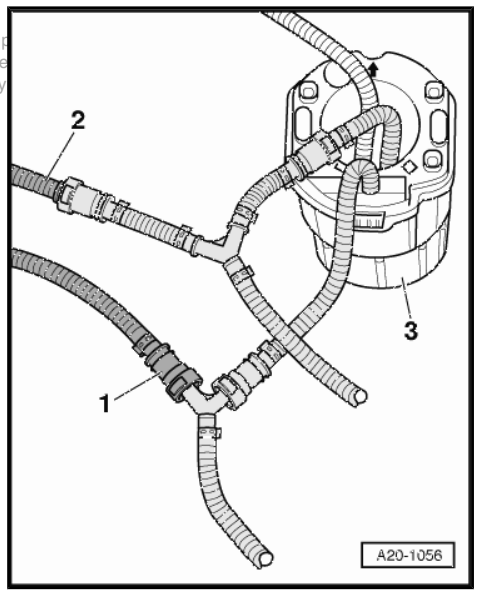
Note

- *Pull out fuel lines from fuel tank opening prior to disconnecting the pipe connectors mentioned below.*
- *For illustration purposes some of the components are shown removed in the following illustrations.*

Vehicles with MPI engine:

– Working through right fuel tank opening, press release tabs and disconnect fuel lines -1- and -2- going to fuel delivery unit (left-side).

3 - Fuel delivery unit (right-side) with fuel pump - G23-

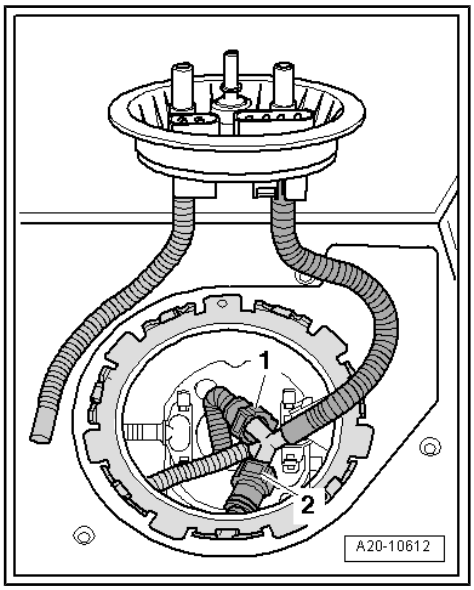


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Vehicles with FSI engine:

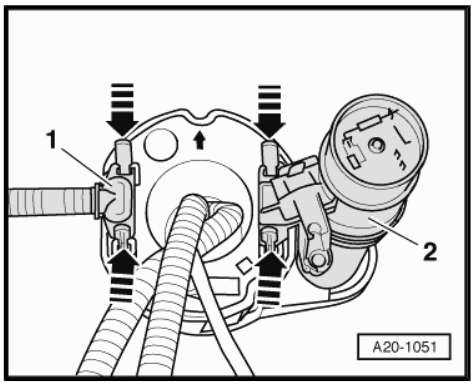
– Working through right fuel tank opening, press release tabs and disconnect fuel supply lines -1- and -2- going to fuel delivery units.



All vehicles (continued):

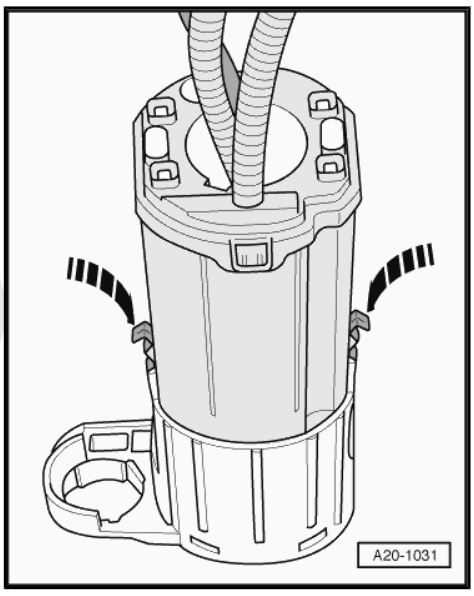
– Working through right fuel tank opening, press release tabs -arrows- and detach fuel supply line -1- and fuel gauge sender 4 - G393- -item 2-.

– Move fuel gauge sender 4 - G393- to right side.



– Press down both retaining clips on retainer for fuel delivery unit -arrows-.

– Pull fuel delivery unit slightly upwards and at the same time take out fuel gauge sender 4 - G393- .



Note

Keep in mind that the fuel gauge sender 4 - G393- still contains fuel.

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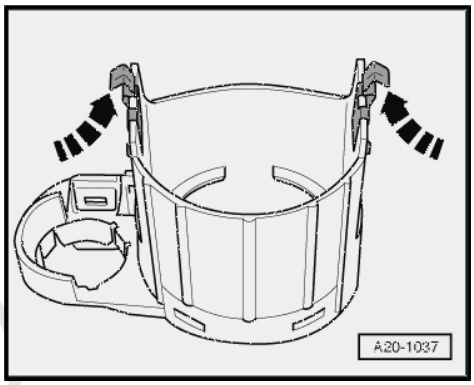
Installing

- Tightening torques ⇒ page 136

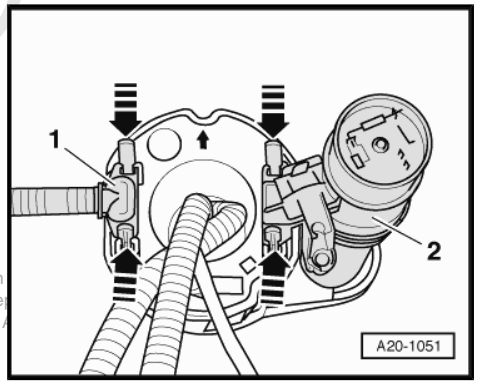
– Pull both retaining clips on retainer upwards -arrows- so that they engage audibly before installing the fuel delivery unit.

– Pull fuel delivery unit up slightly and insert fuel gauge sender 4 - G393- .

– Then press fuel delivery unit carefully into retainer so that it engages audibly.



– Fit fuel supply line -1- and fuel gauge sender 4 - G393- -item 2- so that they engage audibly.

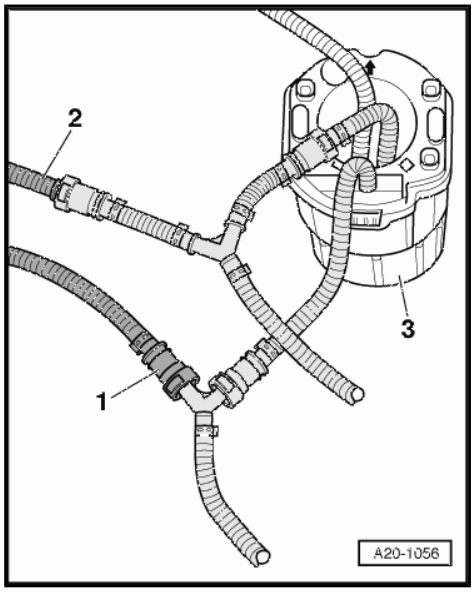


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Vehicles with MPI engine:

– Working through right fuel tank opening, connect fuel lines -1- and -2- going to left fuel delivery unit so that they engage audibly.

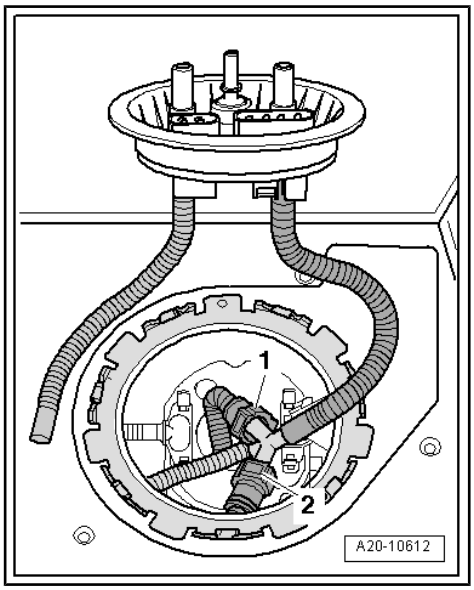
3 - Fuel delivery unit (right-side) with fuel pump - G23-



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Vehicles with FSI engine:

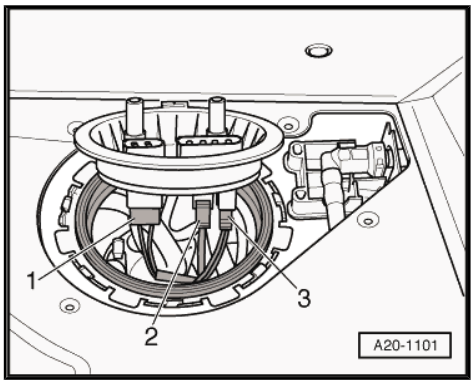
– Working through right fuel tank opening, fit fuel lines -1- and -2- going to fuel delivery units so that they engage audibly.



All vehicles (continued):

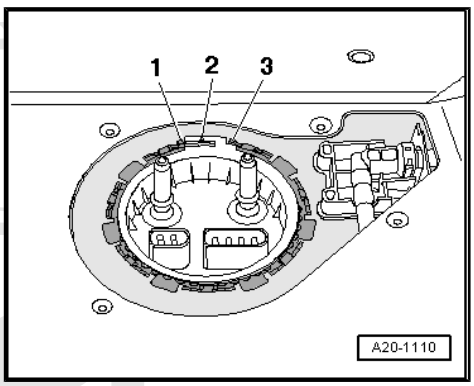
– Connect electrical connectors -1 ... 3- on underside of flange (right-side).

– Install new seal for flange (seal must be installed dry).

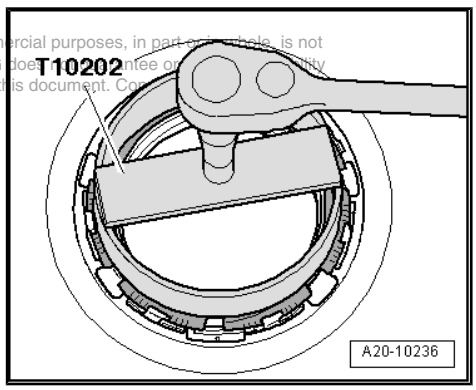


– Fit flange into fuel tank; note correct installation position:

• Lug -2- on flange must be between tabs -1- and -3- on fuel tank.



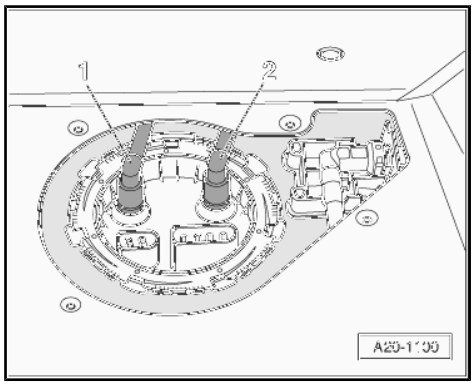
– Tighten locking ring.



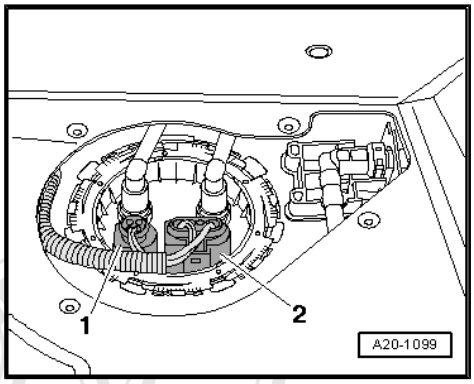
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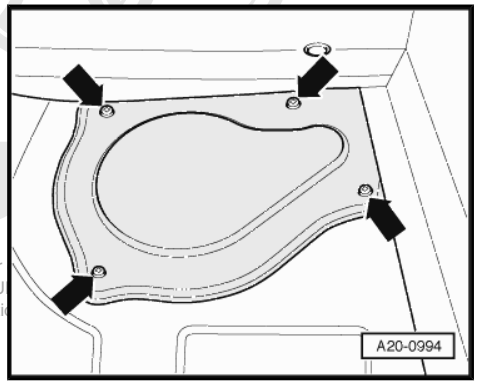
– Install fuel supply line -2- and fuel return line -1- (as marked) so that they engage audibly.



– Attach electrical connectors -1- and -2- on flange (right-side).



– Secure cover for flange (right-side) -arrows-.
– Connect battery. Observe notes on procedures required after connecting battery ⇒ Electrical system; Rep. gr. 27 .



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13 Fuel filter - all vehicles

⇒ “13.1 Fuel filter on vehicles without auxiliary heater - exploded view”, page 239

⇒ “13.2 Removing and installing fuel filter on vehicles without auxiliary heater”, page 240

⇒ “13.3 Fuel filter on vehicles with auxiliary heater - exploded view”, page 240

⇒ “13.4 Removing and installing fuel filter on vehicles with auxiliary heater”, page 241

⇒ “13.5 Fuel filter on vehicles with fuel system without fuel return line - exploded view”, page 242

⇒ “13.6 Removing and installing fuel filter on vehicles with fuel system without fuel return line”, page 243

13.1 Fuel filter on vehicles without auxiliary heater - exploded view

1 - Fuel return line

- ❑ From engine
- ❑ Clipped onto fuel filter bracket
- ❑ Press release tab on connection piece to disconnect

2 - Fuel filter

- ❑ Flow direction is marked by arrows
- ❑ Do not interchange connections
- ❑ Removing and installing ⇒ page 240

3 - Fuel supply line

- ❑ From fuel tank
- ❑ Press release tab on connection piece to disconnect

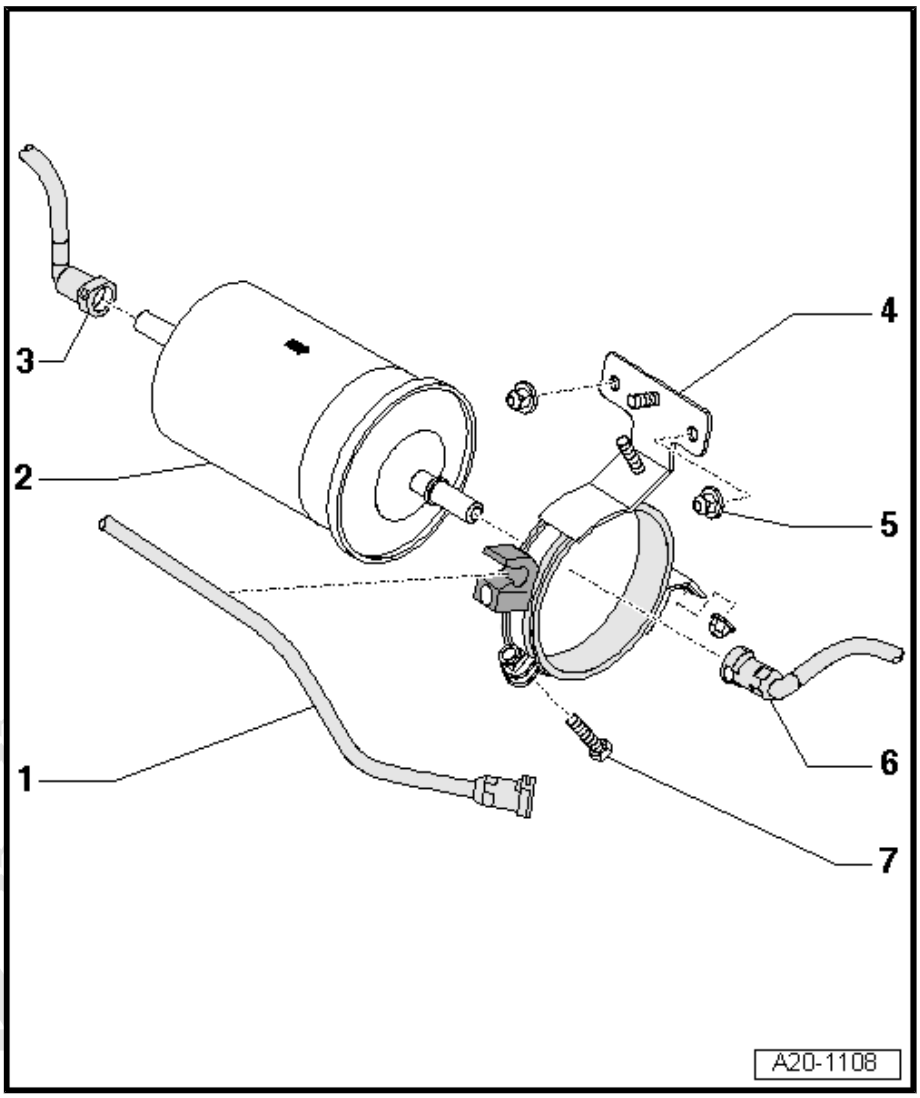
4 - Bracket for fuel filter

5 - 1.5 Nm

6 - Fuel supply line

- ❑ To engine
- ❑ Press release tab on connection piece to disconnect

7 - 3 Nm



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13.2 Removing and installing fuel filter on vehicles without auxiliary heater

Special tools and workshop equipment required

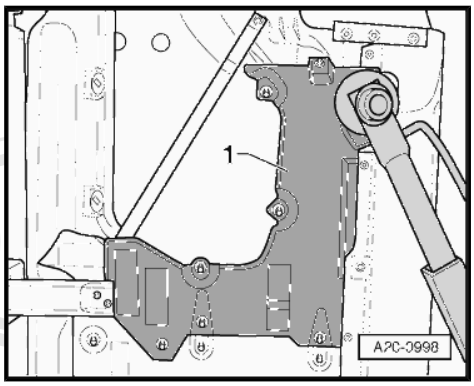
- Drip tray

Removing

Observe safety precautions ⇒ page 1 .

Observe rules for cleanliness ⇒ page 3 .

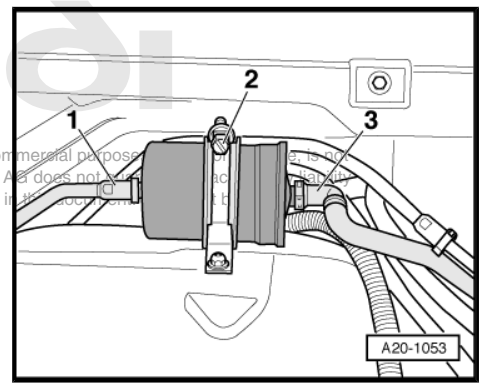
– Remove cover -1- from underside of vehicle (right-side).



– Place drip tray under fuel filter.

WARNING

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



– Disconnect fuel pipes -1- and -3- by pressing the release tabs.

– Remove bolt -2-.

– Remove fuel filter.

Installing

- Tightening torque ⇒ page 239

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

- Flow direction is marked by arrows

13.3 Fuel filter on vehicles with auxiliary heater - exploded view

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1 - Fuel return line

- ❑ From engine
- ❑ Clipped onto fuel filter bracket
- ❑ Press release tab on connection piece to disconnect

2 - Fuel filter

- ❑ Flow direction is marked by arrows
- ❑ Do not interchange connections
- ❑ Removing and installing ⇒ page 241

3 - Fuel supply line

- ❑ From fuel tank
- ❑ Press release tab on connection piece to disconnect

4 - Fuel supply line

- ❑ To metering pump for auxiliary heater

5 - 10 Nm

- ❑ Self-locking
- ❑ Renew

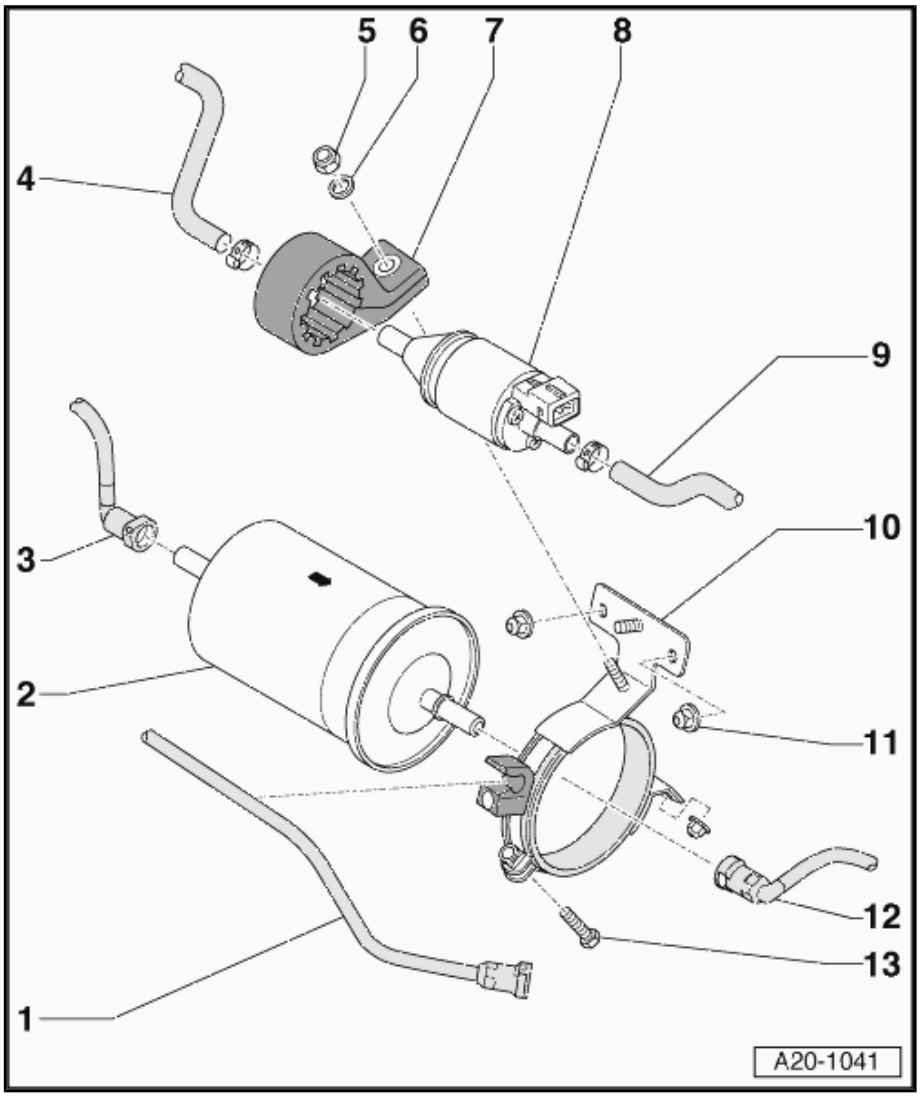
6 - Washer

7 - Retainer

- ❑ For metering pump for auxiliary heater

8 - Metering pump for auxiliary heater

- ❑ Secure with retainer -item 7- to bracket -item 10-



9 - Fuel supply line

- ❑ To auxiliary heater

10 - Bracket for fuel filter

11 - 1.5 Nm

12 - Fuel supply line

- ❑ To engine
- ❑ Press release tab on connection piece to disconnect

13 - 3 Nm

13.4 Removing and installing fuel filter on vehicles with auxiliary heater

Special tools and workshop equipment required

- ♦ Drip tray

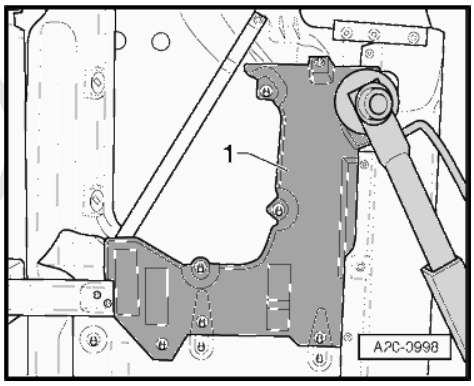
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Removing

Observe safety precautions ⇒ page 1 .

Observe rules for cleanliness ⇒ page 3 .

– Remove cover -1- from underside of vehicle (right-side).

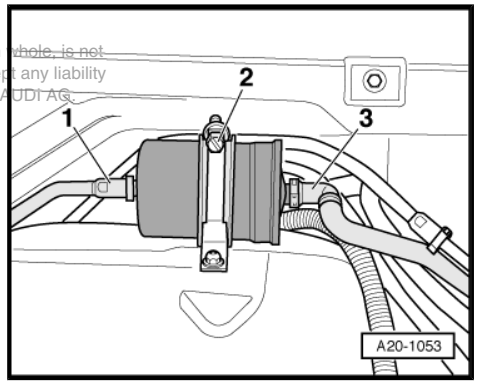


– Place drip tray under fuel filter.

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WARNING

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



– Disconnect fuel pipes -1- and -3- by pressing the release tabs.

– Remove bolt -2-.

– Remove fuel filter.

Installing

• Tightening torque ⇒ page 240

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

• Flow direction is marked by arrows

13.5 Fuel filter on vehicles with fuel system without fuel return line - exploded view

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1 - Fuel filter with pressure control valve, 4 bar

- ❑ Flow direction is marked by arrows
- ❑ Do not interchange connections
- ❑ Removing and installing ⇒ page 243

2 - Fuel supply line

- ❑ From fuel tank
- ❑ Press release tab on connection piece to disconnect

3 - Fuel return line

- ❑ To fuel tank
- ❑ Press release tab on connection piece to disconnect

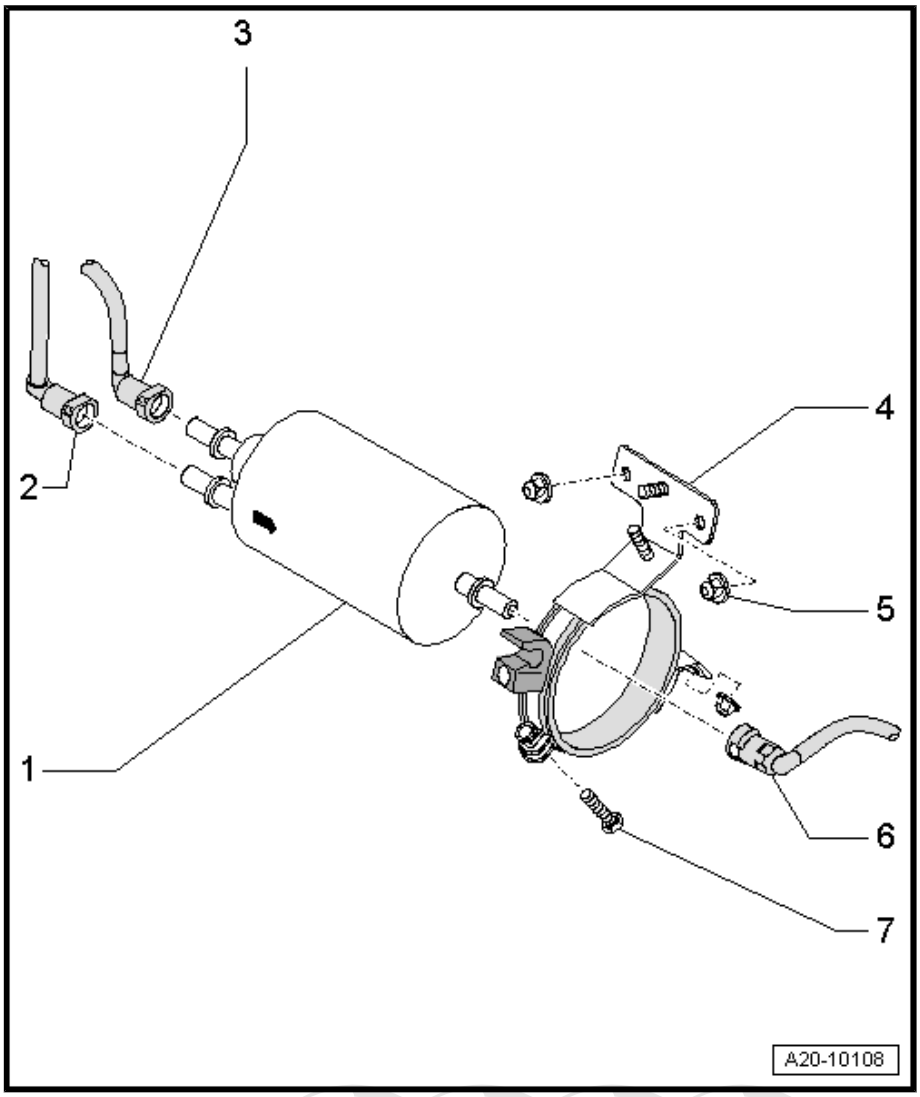
4 - Bracket for fuel filter

5 - 1.5 Nm

6 - Fuel line

- ❑ To engine
- ❑ Press release tab on connection piece to disconnect

7 - 3 Nm



13.6 Removing and installing fuel filter on vehicles with fuel system without fuel return line

Special tools and workshop equipment required

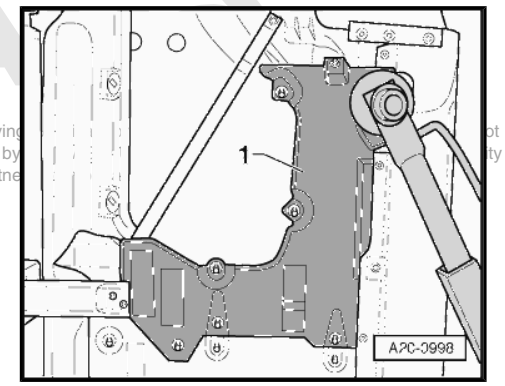
♦ Drip tray

Removing

Observe safety precautions ⇒ page 1 .

Observe rules for cleanliness ⇒ page 3 .

– Remove cover -1- from underside of vehicle (right-side).

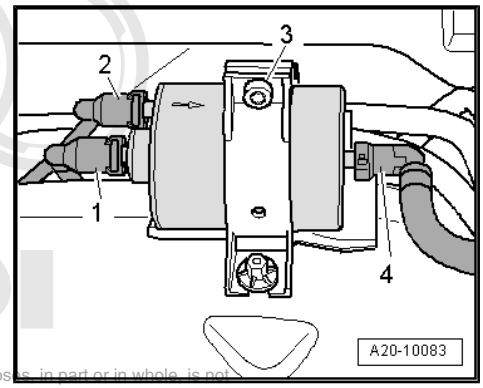


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– Place drip tray under fuel filter.

WARNING

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



– Disconnect fuel pipes -1-, -2- and -4- by pressing the release tabs.
– Remove bolt -3-.
– Remove fuel filter.

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Installing

• Tightening torque ⇒ page 242 .

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

• Flow direction is marked by arrows

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14 Activated charcoal filter system - rest-of-world vehicles

⇒ “14.1 Activated charcoal filter system - exploded view”, page 245

⇒ “14.2 Removing and installing activated charcoal filter”, page 245

14.1 Activated charcoal filter system - exploded view

1 - Activated charcoal filter

2 - Breather line

- ❑ To fuel tank

3 - 10 Nm

4 - Bracket

5 - 10 Nm

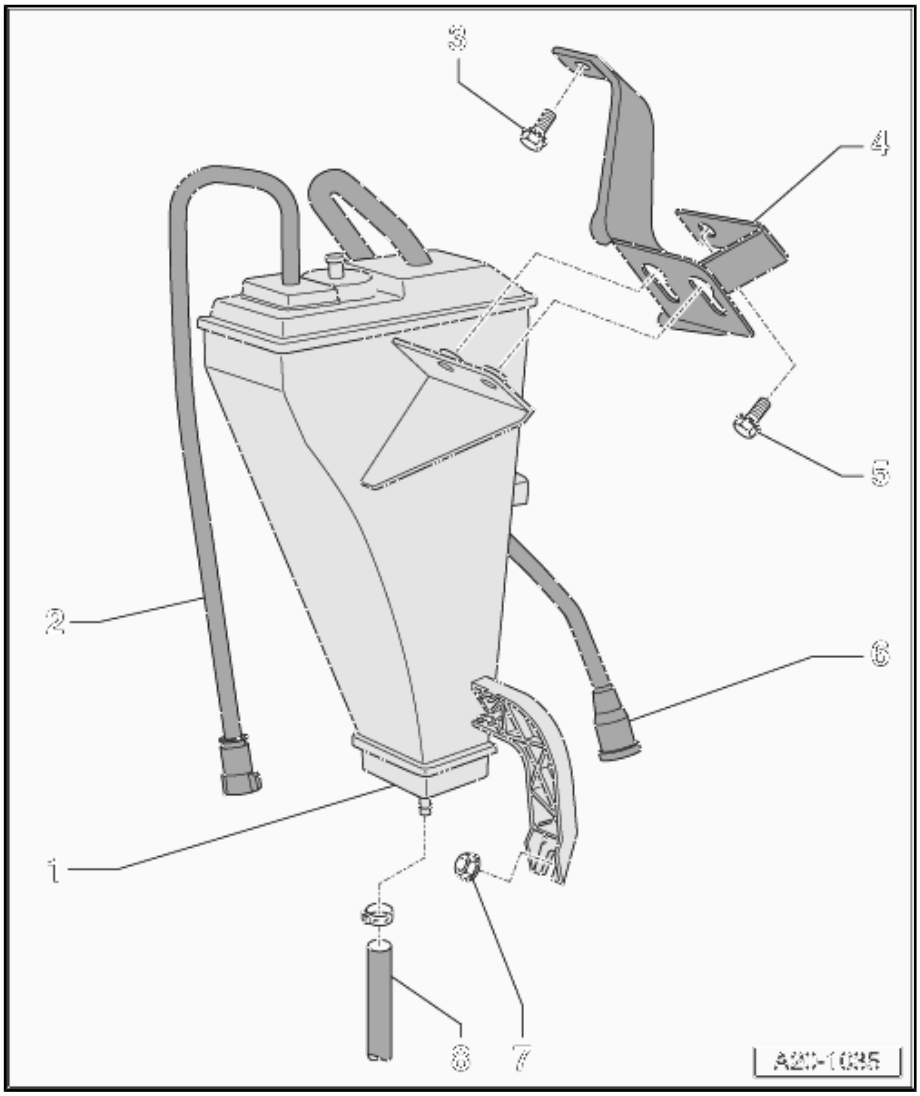
6 - Breather line

- ❑ To activated charcoal filter solenoid valve 1 - N80-

7 - 10 Nm

8 - Hose

- ❑ Open to atmosphere at rear of vehicle (centre)



14.2 Removing and installing activated charcoal filter

Removing

Observe safety precautions ⇒ page 1 .

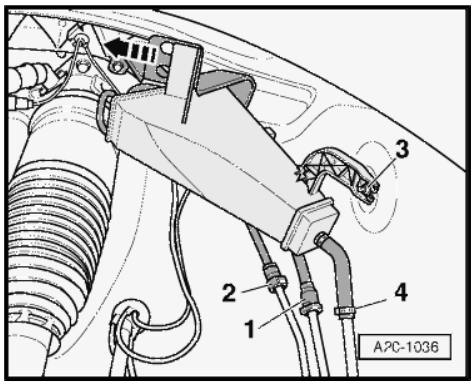
Observe rules for cleanliness ⇒ page 3 .

– Remove rear wheel (left-side).

– Remove rear left wheel housing liner ⇒ Rep. gr. 66 .

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– Disconnect breather lines -1- and -2- by pressing release tabs.
– Detach breather pipe -4-.
– Unscrew nut -3- and detach activated charcoal filter at top mounting -arrow-.
– Remove activated charcoal filter with breather pipes.



Installing

- Tightening torque ⇒ page 245

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

Note

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

– Attach activated charcoal filter at top mounting.
– Secure activated charcoal filter to wheel housing.
– Install rear left wheel housing liner ⇒ Rep. gr. 66 .

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15 Activated charcoal filter system - USA vehicles

⇒ “15.1 Activated charcoal filter system - exploded view”, page 247

⇒ “15.2 Removing and installing activated charcoal filter”, page 248

⇒ “15.3 Routing of pipes/hoses for activated charcoal filter system with tank leak diagnostic system - vehicles with 8-cylinder and 10-cylinder engines”, page 249

⇒ “15.4 Routing of pipes/hoses for activated charcoal filter system with tank leak diagnostic system - vehicles with 12-cylinder engine”, page 251

⇒ “15.5 Tank leak diagnostic system”, page 251

⇒ “15.6 Performing tank leak diagnosis”, page 252

⇒ “15.7 Fuel system diagnostic pump V144 - exploded view”, page 253

⇒ “15.8 Removing and installing fuel system diagnostic pump V144 ”, page 254

⇒ “15.9 Removing and installing activated charcoal filter solenoid valve 2 N115 ”, page 255

15.1 Activated charcoal filter system - exploded view

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1 - Cover for activated charcoal filter

2 - Breather line

- ❑ To activated charcoal filter solenoid valve 1 - N80-

3 - Breather line

- ❑ To fuel tank

4 - Activated charcoal filter

- ❑ Fitting location: at bottom of spare wheel well on underbody

5 - Connecting hose

- ❑ Diagnostic pump / activated charcoal filter

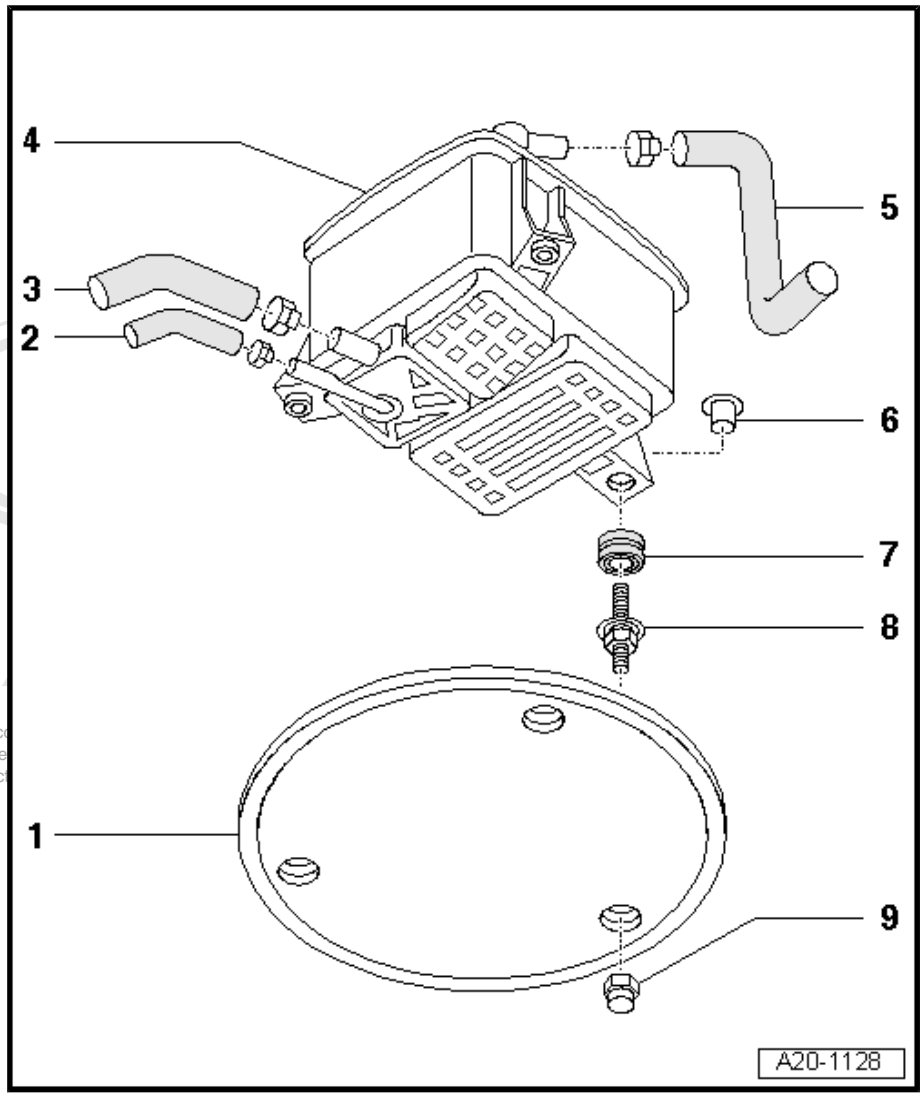
6 - Bush

7 - Rubber grommet

8 - Stud, 16 Nm

9 - Cap nut, 9 Nm

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15.2 Removing and installing activated charcoal filter

Note

Checking for leaks
⇒ "15.6 Performing tank leak diagnosis", page 252

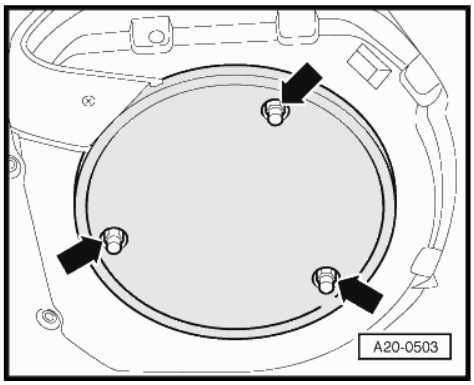
Removing

Observe safety precautions ⇒ page 1 .

Observe rules for cleanliness ⇒ page 3 .

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– Unscrew cover for activated charcoal filter at underside of spare wheel well -arrows-.

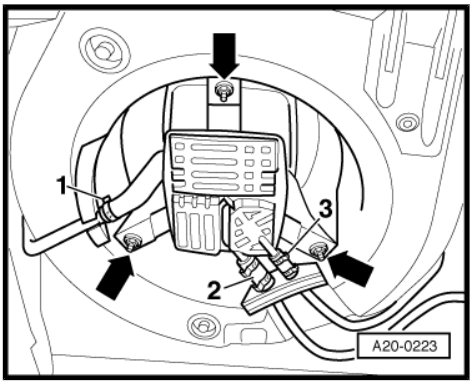


– Detach hose connections -1 ... 3- from breather pipes.
– Unscrew studs -arrows- and remove activated charcoal filter.

Installing

- Tightening torques ⇒ page 247

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



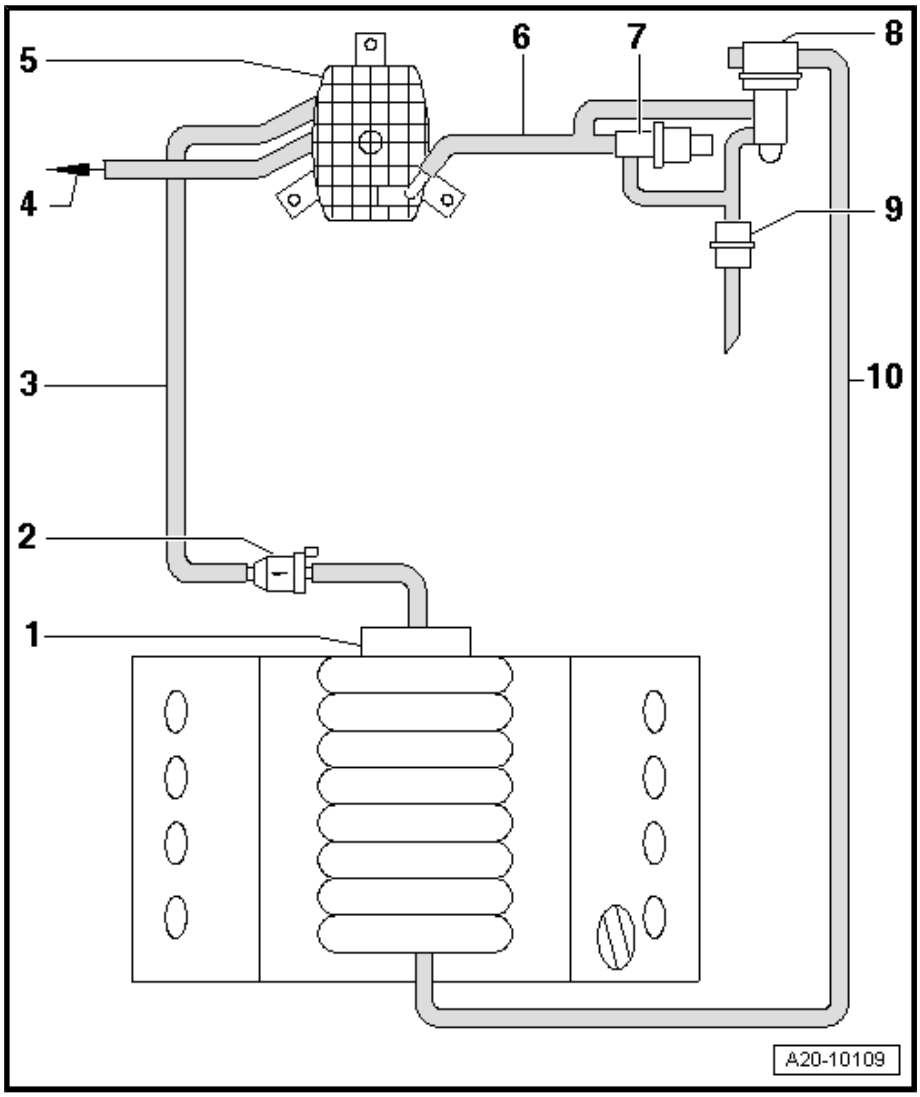
Note

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

15.3 Routing of pipes/hoses for activated charcoal filter system with tank leak diagnostic system - vehicles with 8-cylinder and 10-cylinder engines

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1 - Throttle valve module - J338-

2 - Activated charcoal filter solenoid valve 1 - N80-

- Fitting location: in engine compartment

3 - Breather line

- From activated charcoal filter to activated charcoal filter solenoid valve 1 - N80-
- Installation position: on underside of vehicle (right-side)

4 - Breather line

- To fuel tank

5 - Activated charcoal filter

- Fitting location: at bottom of spare wheel well on underbody

6 - Connecting hose

- Diagnostic pump / activated charcoal filter
- Pressure side

7 - Activated charcoal filter solenoid valve 2 - N115-

- Fitting location: in rear left wheel housing beneath liner

8 - Fuel system diagnostic pump - V144-

- Vacuum-driven
- Fitting location: in rear left wheel housing beneath liner

9 - Air filter for diagnostic pump

- Installation position: arrow on filter housing points to diagnostic pump -item 8-

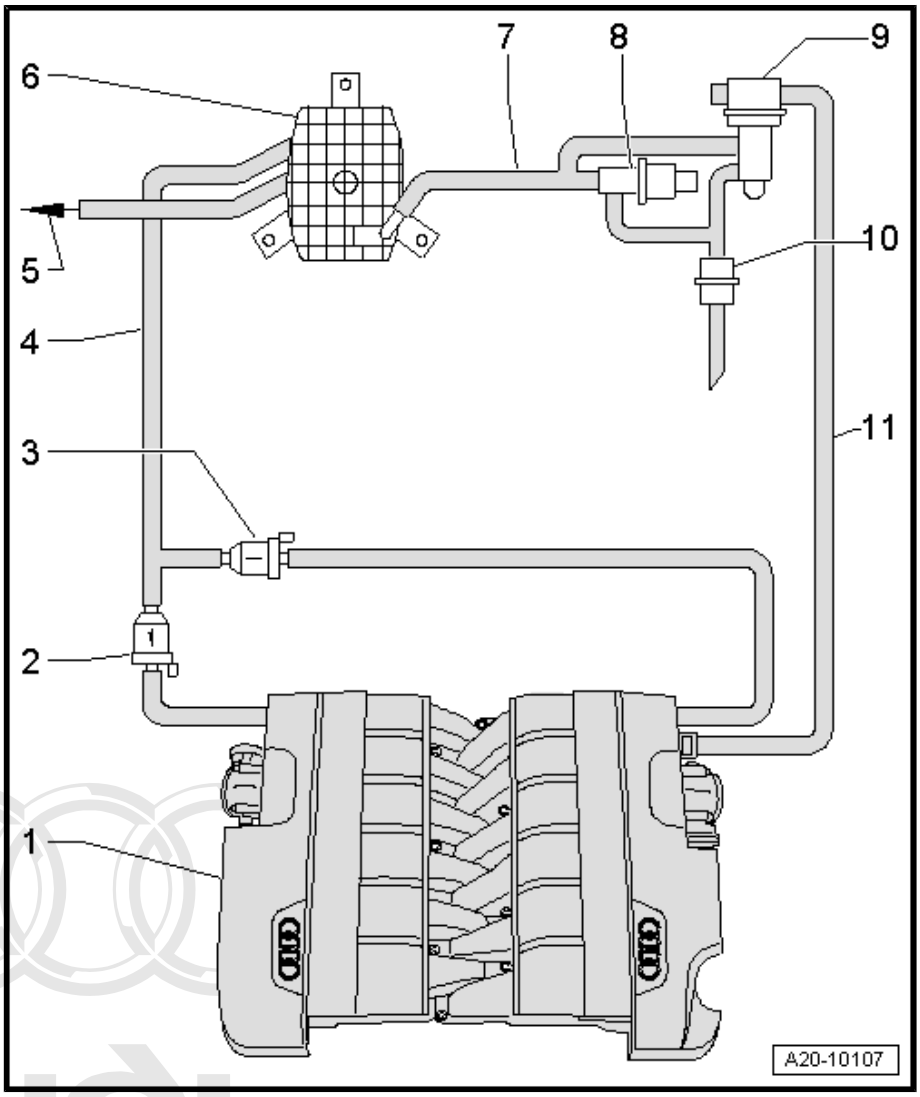
10 - Vacuum line

- Supplies diagnostic pump with vacuum from intake manifold

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15.4 Routing of pipes/hoses for activated charcoal filter system with tank leak diagnostic system - vehicles with 12-cylinder engine



1 - Intake manifold

2 - Activated charcoal filter solenoid valve 1 - N80-

- ❑ Fitting location: in engine compartment

3 - Activated charcoal filter system solenoid valve 2 - N333-

- ❑ Fitting location: in engine compartment

4 - Breather line

- ❑ From activated charcoal filter to solenoid valves for activated charcoal filter in engine compartment
- ❑ Installation position: on underside of vehicle (right-side)

5 - Breather line

- ❑ To fuel tank

6 - Activated charcoal filter

- ❑ Fitting location: at bottom of spare wheel well on underbody

7 - Connecting hose

- ❑ Diagnostic pump / activated charcoal filter
- ❑ Pressure side

8 - Activated charcoal filter solenoid valve 2 - N115-

- ❑ Fitting location: in rear left wheel housing beneath liner

9 - Fuel system diagnostic pump - V144-

- ❑ Vacuum-driven
- ❑ Fitting location: in rear left wheel housing beneath liner

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10 - Air filter for diagnostic pump

- ❑ Installation position: arrow on filter housing points to diagnostic pump -item 9-

11 - Vacuum line

- ❑ Supplies diagnostic pump with vacuum from intake manifold

15.5 Tank leak diagnostic system

How the system works

The tank leak diagnostic system detects leaks in the complete fuel system, including fuel tank, activated charcoal filter and activated charcoal filter solenoid valve 1 - N80- .

The mechanical components of the tank leak diagnostic system consist primarily of a vacuum-driven diaphragm pump, with a reed

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contact located on the operating rod of the pump diaphragm. The vacuum required is supplied to the pump from the engine intake.

- The diaphragm pump delivers a pressure of 20 ... 30 mbar to the fuel system when the tank leak diagnostic system starts up. In this condition the pump diaphragm is extended, so the reed contact located on the operating rod is in the “open” position.
- The diagnostic system detects whether the reed contact remains open for 10 seconds. In this case the fuel system is free of leaks.
- If the pressure drops (indicating a leak), the diaphragm returns and the reed contact closes.
- If the reed contact closes within 10 seconds, a further test is performed. The diaphragm pump is then activated for another 4 strokes. For each of these strokes the engine control unit measures the period of time it takes for the reed contact to close again after pressure delivery. In this way the control unit can distinguish between a “small leak” (smaller than 1 mm diameter) and a “large leak”.

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The diagnosis is activated automatically shortly after every engine start. If a fault is detected, the fault is stored in the fault memory. A fault message is displayed in the instrument cluster if the fault is detected during two consecutive road trips. The diagnosis function can also be activated with the vehicle diagnostic tester ⇒ page 252 .

Automatic tank leak diagnosis

The engine control unit performs a tank leak diagnosis at regular intervals when the engine is running.

15.6 Performing tank leak diagnosis

Check the fuel tank leak diagnosis system using the “Guided Fault Finding” function ⇒ Vehicle diagnostic tester.

Checking fuel tank system and tank breather system for leaks

Note

The following locations/components must be checked when checking the fuel tank system and tank breather system for leaks. Initiate a tank leak diagnosis after eliminating a suspected leak to make sure the diagnosed leak has been eliminated.

– Switch off ignition.
– Check whether the filler cap of the fuel tank was properly closed when performing the diagnosis.
– Check whether the seal of the filler cap is damaged or deformed. Renew if necessary.
– Remove luggage compartment floor covering.
– Detach covers for flanges on fuel tank (left and right sides).

Note

Observe notes on re-installing flanges: left-side ⇒ page 75 , right-side ⇒ page 86 .

– Check that the seals under the fuel tank flanges are undamaged and that the locking rings on the flanges are properly

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tightened. Also check whether the fuel lines are connected properly.

– Perform a visual check on all pipe/hose connections of the fuel tank system and renew leaking pipes/hoses, e.g.:

- Pipe between activated charcoal filter and activated charcoal filter solenoid valve 1 - N80- / activated charcoal filter system solenoid valve 2 - N333- (in engine compartment).
- Pipes from activated charcoal filter to diagnostic pump for fuel system - V144- / activated charcoal filter solenoid valve 2 - N115- .
- Pipe between fuel tank and activated charcoal filter (behind cover for activated charcoal filter).
- Fuel lines to engine

Note

Leaks in pipes and components of the fuel tank system can sometimes be detected by applying a non-flammable, environment-friendly leak detecting spray. Initiate a tank leak diagnosis repeatedly to build up pressure in the system. Bubbles will form at the leak.

– Perform a visual check on the components of the fuel tank system/fuel tank breather system:

- Fuel tank
- Activated charcoal filter
- Fuel system diagnostic pump - V144-
- Activated charcoal filter solenoid valve 1 - N80-
- Activated charcoal filter solenoid valve 2 - N115-
- Activated charcoal filter system solenoid valve 2 - N333-

Note

Due to the shape or function of these components it is not always possible to detect leaks by applying leak detecting spray. If this is the case, clamp off hoses going to the respective component using hose clamps up to 25 mm - 3094- and initiate tank leak diagnosis. If no leak is then found after clamping off the hoses, the corresponding component is defective. If the hoses are clamped off directly at the diagnostic pump and a leak is still indicated, there is a leak in the diagnostic pump itself.

15.7 Fuel system diagnostic pump - V144- - exploded view

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1 - Retaining peg

2 - Bracket for diagnostic pump

3 - Vacuum line

- To intake manifold (front)

4 - Fuel system diagnostic pump - V144-

- Fitting location: in rear left wheel housing beneath liner
- Checking in “Guided Fault Finding” ⇒ Vehicle diagnostic tester
- Removing and installing ⇒ page 254

5 - Elbow hose with branch

6 - Elbow hose with branch

- To activated charcoal filter

7 - Activated charcoal filter solenoid valve 2 - N115-

- Checking in “Guided Fault Finding” ⇒ Vehicle diagnostic tester
- Removing and installing ⇒ page 255

8 - 1.2 Nm

9 - Air filter for diagnostic pump

10 - Hose

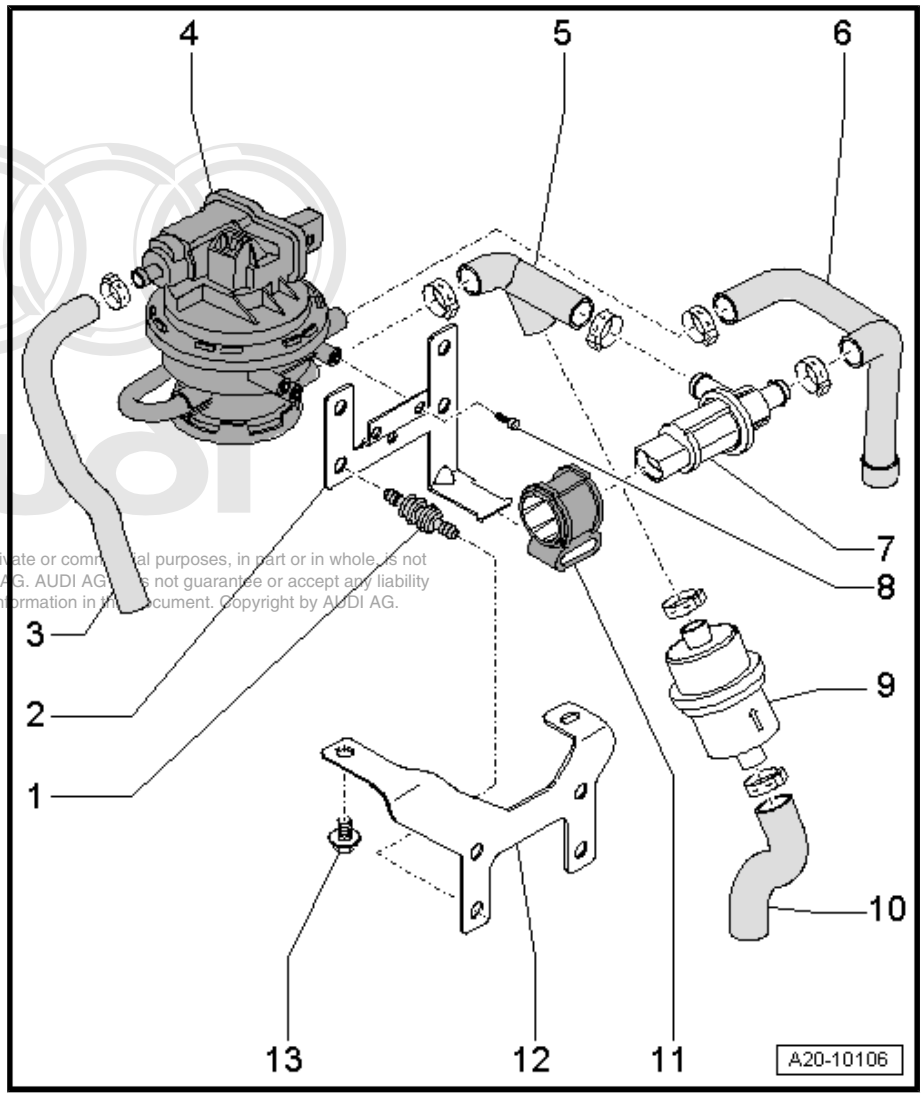
11 - Retainer

- For activated charcoal filter solenoid valve 2 - N115-

12 - Bracket

- To body

13 - 9 Nm



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15.8 Removing and installing fuel system diagnostic pump - V144-

Removing

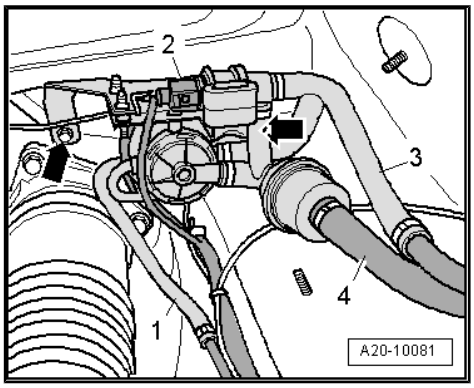
– Switch off ignition.

– Remove rear wheel (left-side).

– Remove rear left wheel housing liner ⇒ Rep. gr. 66 .

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– Detach hose connections -1-, -3- and -4-.
– Unplug electrical connector -2- at activated charcoal filter solenoid valve 2 - N115- .
– Unscrew securing bolts -arrows-.
– Detach fuel system diagnostic pump - V144- and disconnect electrical connector.
– Detach diagnostic pump from bracket.



Installing

- Tightening torques ⇒ page 253

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

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Note

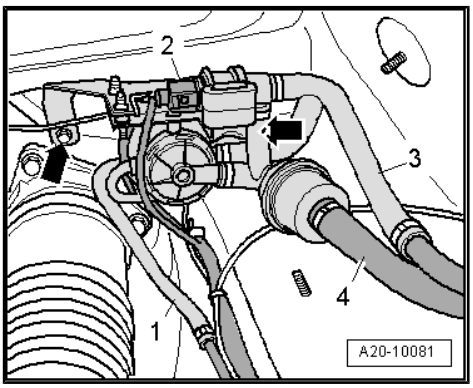
Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .

– Install rear left wheel housing liner ⇒ Rep. gr. 66 .

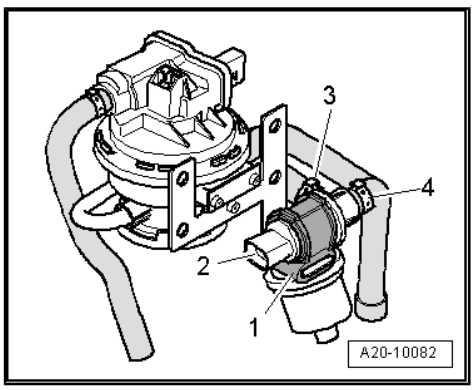
15.9 Removing and installing activated charcoal filter solenoid valve 2 - N115-

Removing

– Switch off ignition.
– Remove rear wheel (left-side).
– Remove rear left wheel housing liner ⇒ Rep. gr. 66 .
– Disconnect hose connections -1-, -3- and -4-.
– Unplug electrical connector -2- at activated charcoal filter solenoid valve 2 - N115- .



– Detach vacuum hoses -3- and -4- from activated charcoal filter solenoid valve 2 - N115- -item 2-.
– Detach solenoid valve from mounting -1-.



Installing

- Tightening torque ⇒ page 253

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

Note

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

– Install rear left wheel housing liner ⇒ Rep. gr. 66 .

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16 Accelerator mechanism - all vehicles

⇒ “16.1 Accelerator mechanism - exploded view”, page 256

⇒ “16.2 Removing and installing accelerator pedal module with accelerator position sender”, page 257

⇒ “16.3 Removing and installing kickdown switch F8 ”, page 257

16.1 Accelerator mechanism - exploded view

Note

There is a separate kickdown switch - F8- installed in vehicles with automatic gearbox. Removing and installing kickdown switch - F8- ⇒ page 257 .

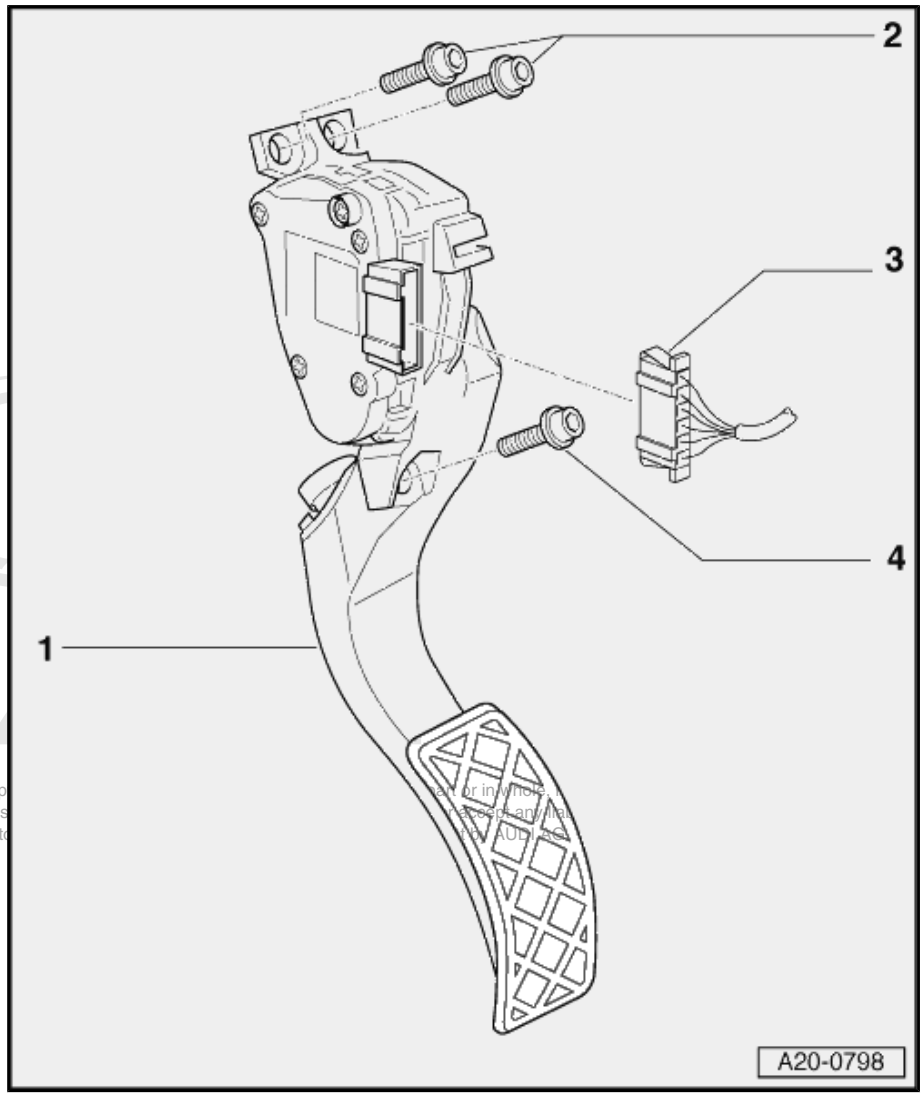
1 - Accelerator pedal module

- ❑ With accelerator position sender - G79- and accelerator position sender 2 - G185-
- ❑ Removing and installing ⇒ page 257

2 - 10 Nm

3 - Electrical connector

4 - 10 Nm



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16.2 Removing and installing accelerator pedal module with accelerator position sender

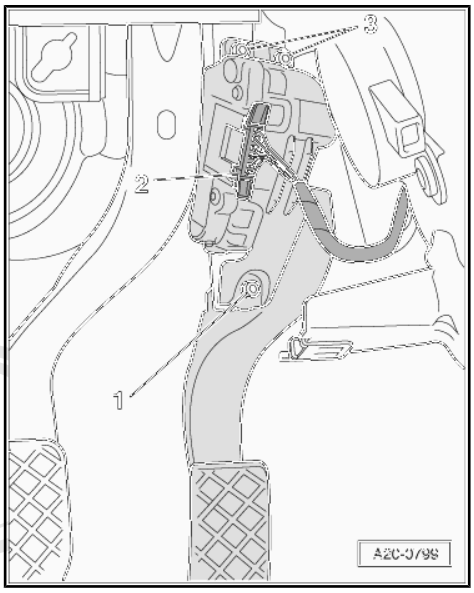
Removing

– Remove storage compartment on driver's side ⇒ Rep. gr. 68 .

– Unplug electrical connector -2-.

– Remove bolts -1- and -3-.

– Remove accelerator pedal module.



Installing

• Tightening torque ⇒ page 256

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

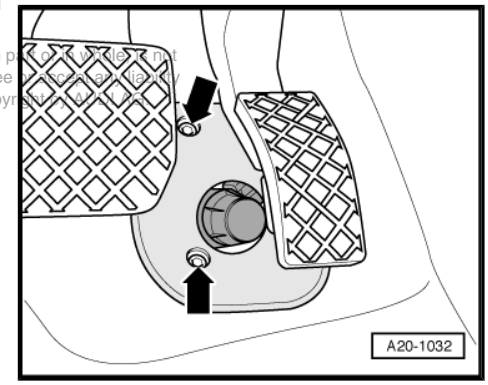
– Install storage compartment on driver's side ⇒ Rep. gr. 68 .

16.3 Removing and installing kickdown switch - F8-

Removing

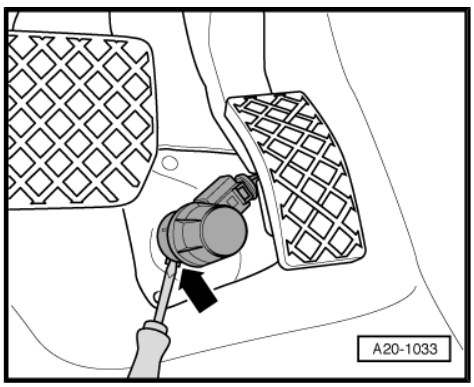
– Use screwdriver to prise off cover caps.

– Unscrew bolts -arrows- and remove cover for kickdown switch.



– Use a small screwdriver to release retainer tab -arrow- and turn kickdown switch anti-clockwise.

– Unplug electrical connector.



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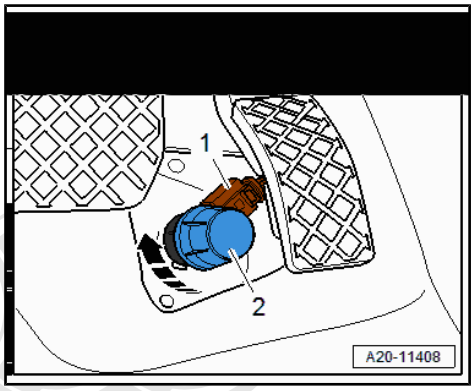
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Installing

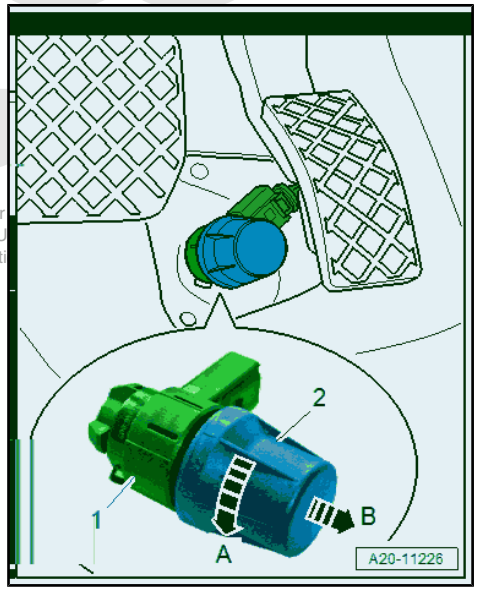
Installation is carried out in the reverse order; note the following:

– Connect electrical connector -1- on kickdown switch - F8- .

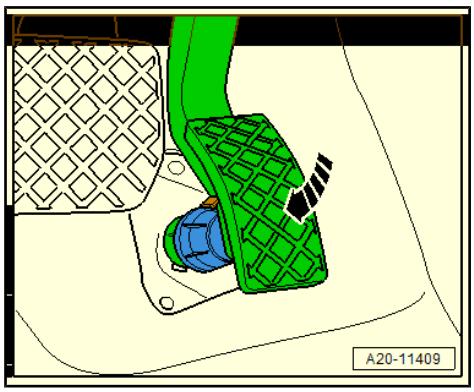
– Insert kickdown switch in mounting on vehicle floor and engage by turning clockwise -arrow-.



– Disengage cap -2- of kickdown switch -1-; to do so turn cap anti-clockwise -arrow A-. Pull cap out as far as stop -arrow B-.



– Press accelerator pedal down as far as stop -arrow- and release again.

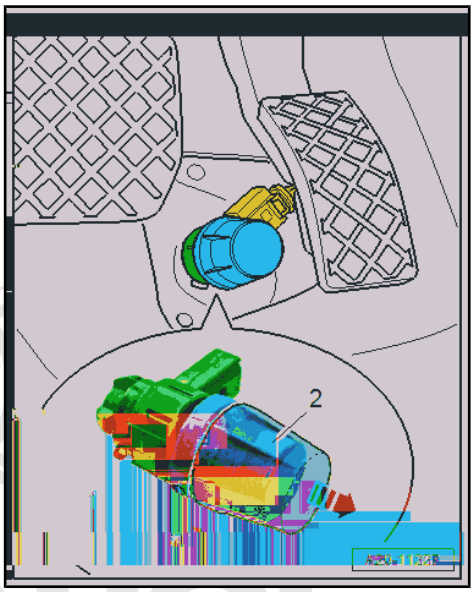


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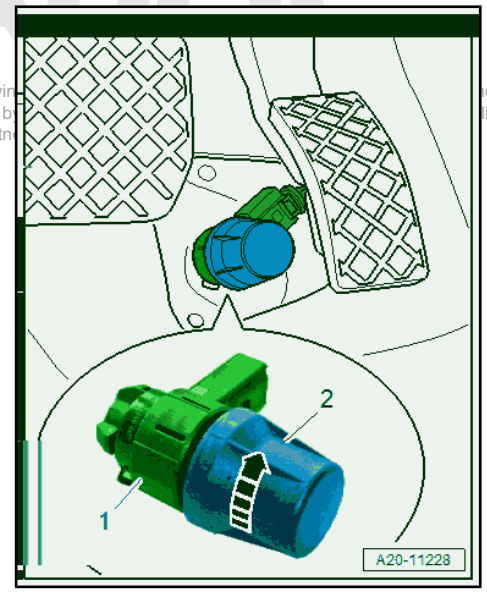
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– Pull cap -2- of kickdown switch -1- outwards by distance -a- -arrow-.

• Distance -a- = 5 mm.

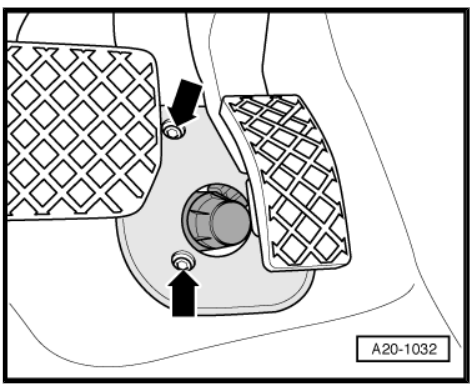


– Lock cap -2- of kickdown switch -1- in place by turning cap 15° in clockwise direction -arrow- as far as stop.



– Fit cover -arrows-.

– Perform a test drive and check that kickdown switch -F8- is functioning correctly.



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24 – Mixture preparation - injection

1 Safety precautions and rules for cleanliness

1.1 General notes on self-diagnosis

- The engine control unit has a fault memory.
- Before carrying out any repairs or Fault Finding, the fault memory must be interrogated.
- The vacuum hoses and connections must be checked (to prevent unmetered air).
- Fuel hoses in engine compartment must only be secured with spring-type clips. O-type clips or screw-type clips must not be used.
- A voltage of at least 11.5 V is required for proper operation of the electrical components.
- Do not use sealants containing silicone. Particles of silicone drawn into the engine will not be burnt in the engine and will damage the Lambda probe.
- The vehicles are fitted with a crash/fuel shut-off system. This function is designed to reduce the risk of a vehicle fire after a crash by deactivating the fuel pump via the fuel pump relay.
- At the same time, this system also improves the engine's starting performance. When the driver's door is opened, the fuel pump is activated for approx. 2 seconds in order to build up pressure in the fuel system; observe safety precautions ⇒ page 1 .

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1.2 Safety precautions

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



WARNING

Accidents can be caused if the driver is distracted by test equipment while road-testing, or if test equipment is not properly secured.

Persons sitting in the front passenger's seat could be injured if the airbag is triggered in an accident.

- *The use of test equipment while driving causes distraction.*
- *There is an increased risk of injury if test equipment is not secured.*
- *Test equipment must always be secured on the rear seat with a strap and operated from the rear seat by a second person.*

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To prevent injuries to persons and/or damage to the fuel injection and ignition system, the following must be noted:

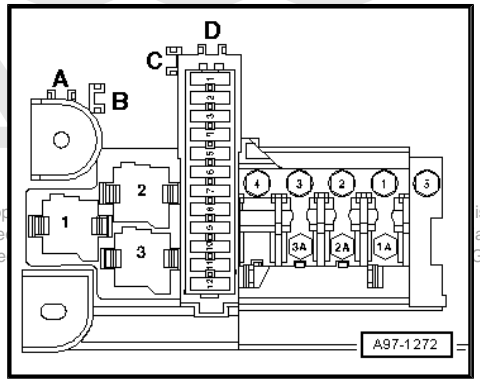
WARNING

- *The fuel system operates under high pressure. The pressure in the high-pressure part of the injection system must be reduced to a residual pressure prior to opening the system ⇒ page 3 .*
- *A clean cloth must then be wrapped around the connection and the residual pressure dissipated by carefully loosening the connection.*

Caution

- *Always switch off the ignition before connecting or disconnecting the battery, otherwise the engine control unit may be damaged.*
- *Observe notes on procedure for disconnecting the battery ⇒ Rep. Gr. 27 .*

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- If the battery is NOT disconnected, fuse in -relay and fuse holder in luggage compartment (right-side)- for the fuel pump control unit -J538- must be removed as a precautionary measure before opening the fuel system, because the fuel pump will otherwise be activated by the contact switch on the driver's door.
- Persons wearing a cardiac pacemaker must at all times maintain a safe distance from high-voltage components such as the ignition system and gas-discharge headlights.
- Do not open any fuel line connections while the engine is running.
- Always switch off the ignition before connecting or disconnecting injection or ignition system wiring or tester cables.
- If the engine is to be operated at cranking speed without it starting (e.g. compression test), unplug the connectors from the ignition coils and remove the fuse for the electric fuel pump.
- Certain tests may lead to a fault being detected by the control unit and stored. The fault memory should therefore be interrogated and (if necessary) erased after completing the tests and any repair work that may be required.
- Always switch off the ignition before cleaning the engine.
- Always switch off the ignition before connecting or disconnecting the battery, otherwise the engine control unit may be damaged.

1.3 Rules for cleanliness when working on the injection system

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

- Carefully clean connection points and the surrounding area with engine cleaner or brake cleaner and dry thoroughly before opening.

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

1.4 Important: Required procedure prior to opening high-pressure injection system

Caution

The injection system consists of a high-pressure section (maximum approx. 150 bar) and a low-pressure section (approx. 7 bar).

Prior to opening the high-pressure section (e.g. when removing the high-pressure pump, fuel rail, injectors, fuel pipes or fuel pressure sender -G247-), the fuel pressure in the high-pressure section must be reduced to a residual pressure of approx. 7 bar. The procedure is described below.

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Special tools and workshop equipment required

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

Reducing fuel pressure in high-pressure section

– Connect up the vehicle diagnostic, testing and information system -VAS 5051B- .

– Start engine and run at idling speed.

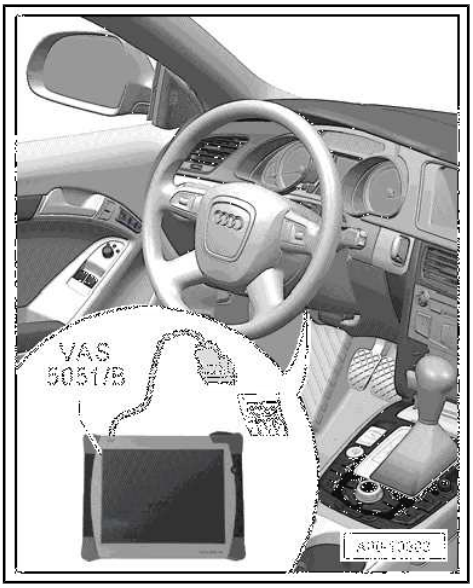
– Select “Engine electronics” in vehicle self-diagnosis.

– Then select function read “Measured values”.

– Select measured value block 140.

– With engine idling the fuel pressure is displayed in zone 3.

- Specification: between 35 and 45 bar



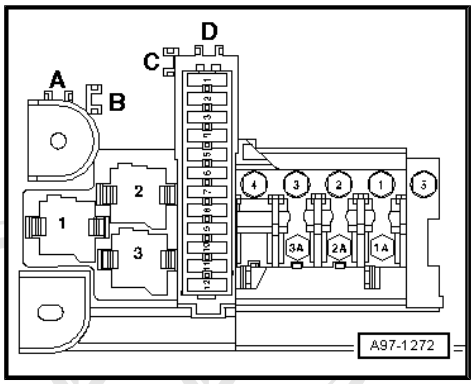
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– With engine idling, pull out fuse in -relay and fuse holder in luggage compartment (right-side)- for fuel pump control unit -J538- ; refer to ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.

– Observe fuel pressure displayed on tester.

• The fuel pressure will decrease very quickly because the mechanical high-pressure pump is no longer being supplied with fuel by the fuel system pressurisation pump -G6- .

– Switch off ignition as soon as fuel pressure has dropped to approx. 8 bar.



Note

Fuel pressure must not fall below 6 bar, otherwise the engine will stall (this could damage the catalytic converter).

WARNING

There is a risk of injury: avoid skin contact with fuel.

- ***Wear safety goggles and protective clothing when opening the fuel system.***
- ***Before opening the high-pressure section of the fuel system, place a clean cloth around the connection to catch escaping fuel.***

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– The high-pressure system must be opened “immediately” after reducing the fuel pressure; wrap a clean cloth around the connection. Catch the escaping fuel.

Additional steps required

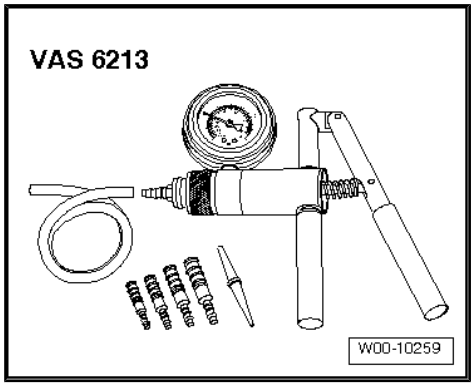
– Re-install fuse in -relay and fuse holder in luggage compartment (right-side)- for fuel pump control unit -J538- .

– Erase fault memory and generate readiness code in engine control unit using “Guided Functions” mode of vehicle diagnostic, testing and information system -VAS 5051B- .

1.5 Checking vacuum system

Special tools and workshop equipment required

♦ Hand vacuum pump -VAS 6213-



Procedure

– Check all vacuum lines in the complete vacuum system for:

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- ♦ Cracks
- ♦ Traces of animal bites
- ♦ Kinked or crushed lines
- ♦ Lines porous or leaking

– Check vacuum line to solenoid valve and from solenoid valve to corresponding component.

– If a fault is stored in the fault memory, check the vacuum lines leading to the corresponding component and also check the remaining vacuum lines leading to other components.

– If it is not possible to build up pressure with the hand vacuum pump -VAS 6213- or if the pressure drops again immediately, check the hand vacuum pump and connecting hoses for leaks.

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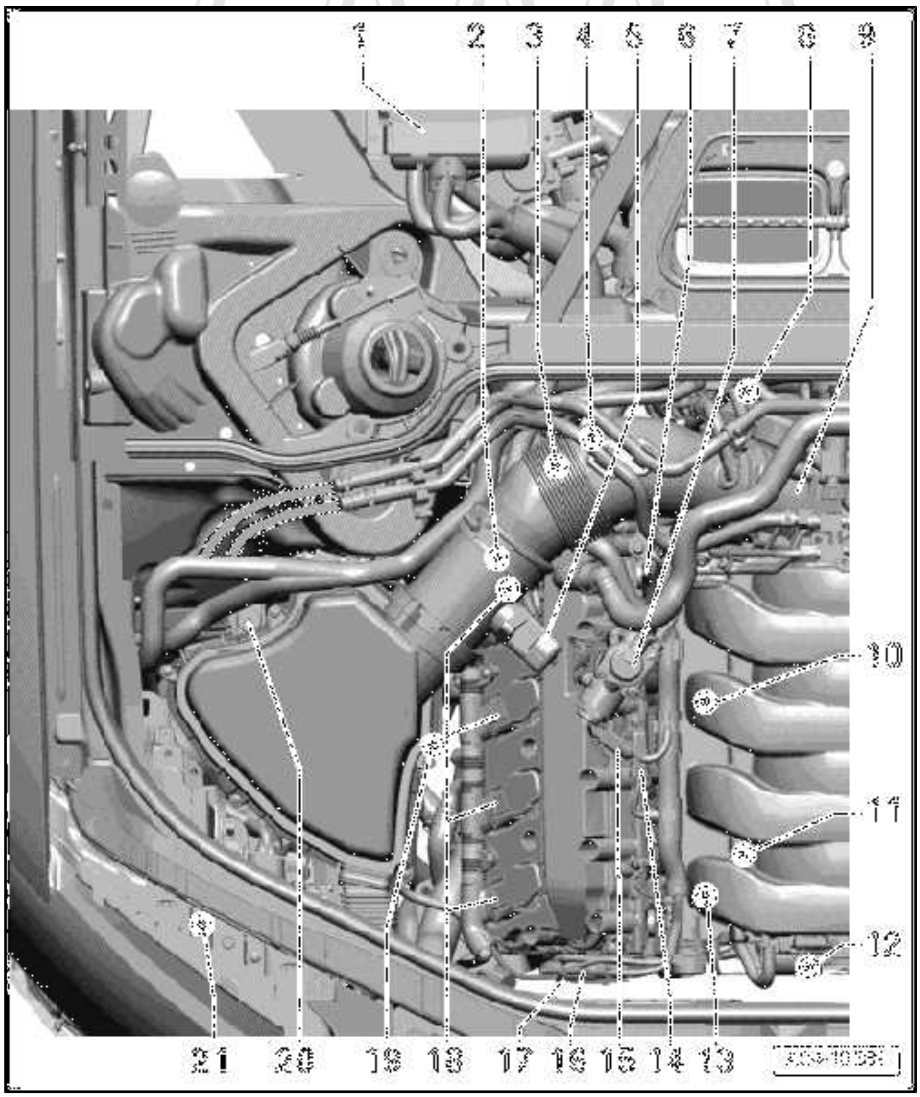
2 Injection system

2.1 Technical data

Engine data	4.2 ltr. / 4V / 257 kW engine
Idling speed (not adjustable)	approx. 650 rpm [1]
Fuel pressure after high-pressure pump	18 ... 120 bar
Fuel pressure before high-pressure pump	approx. 6 bar
• [1] Depending on demands placed on engine control unit.	

2.2 Overview of fitting locations

Engine compartment (right-side)



1 - Engine control unit -J623-

- ❑ Fitting location ⇒ page 10
- ❑ Removing and installing ⇒ page 71

2 - Exhaust camshaft control valve 1 -N318-

3 - Combination valve for secondary air system

- ❑ Cylinder bank 1 (right-side)
- ❑ Removing, installing and testing ⇒ Rep. Gr. 26

4 - Coolant temperature sender -G62-

- ❑ Fitting location ⇒ page 13
- ❑ Removing and installing ⇒ Rep. Gr. 19

5 - Air mass meter -G70- / intake air temperature sender -G42-

- ❑ Removing and installing ⇒ page 21

6 - Camshaft control valve 1 -N205-

- ❑ Fitting location ⇒ page 14

7 - High-pressure pump

- ❑ With fuel metering valve -N290-
- ❑ Fitting location ⇒ page 17
- ❑ Removing and installing ⇒ page 63

8 - Electrical connectors

- ❑ For Lambda probe before catalytic converter -G39- with Lambda probe heater -Z19-

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- ❑ For Lambda probe after catalytic converter -G130- with Lambda probe 1 heater after catalytic converter -Z29-
- ❑ Fitting location ⇒ page 12

9 - Throttle valve module -J338-

- ❑ After renewing throttle valve module -J338- , select “Adapt throttle valve module” in “Guided Functions” mode

10 - Knock sensor 2 -G66-

- ❑ Fitting location ⇒ page 14
- ❑ Electrical connector ⇒ page 16
- ❑ 20 Nm

11 - Fuel pressure sender -G247-

- ❑ Fitting location ⇒ page 14
- ❑ 25 Nm
- ❑ Lubricate threads lightly with clean oil

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12 - Components at front of engine

- ❑ Fitting location ⇒ page 16
- ❑ Intake manifold flap motor -V157-
- ❑ In model year 2009 intake manifold flap motor -V157- is replaced with intake manifold flap valve -N316-
- ❑ Intake manifold flap potentiometer -G336-
- ❑ Variable intake manifold motor -V183-
- ❑ In model year 2009 variable intake manifold motor -V183- is replaced with variable intake manifold change-over valve -N156-
- ❑ Intake manifold flap potentiometer 2 -G512-
- ❑ Electrical connector for knock sensor 1 -G61-
- ❑ Electrical connector for knock sensor 2 -G66-
- ❑ Electrical connector for knock sensor 3 -G198-
- ❑ Electrical connector for knock sensor 4 -G199-

13 - Knock sensor 1 -G61-

- ❑ Fitting location ⇒ page 14
- ❑ Electrical connector ⇒ page 16
- ❑ 20 Nm

14 - Hall sender -G40-

- ❑ Fitting location ⇒ page 14

15 - Fuel metering valve -N290-

- ❑ Fitting location ⇒ page 17

16 - Electrical connector for knock sensor 1 -G61-

- ❑ Fitting location ⇒ page 16

17 - Electrical connector for knock sensor 2 -G66-

- ❑ Fitting location ⇒ page 16

18 - Ignition coils for cylinder bank 1

- ❑ Ignition coil 1 with output stage -N70-
- ❑ Ignition coil 2 with output stage -N127-
- ❑ Ignition coil 3 with output stage -N291-
- ❑ Ignition coil 4 with output stage -N292-
- ❑ Removing and installing ⇒ page 78

19 - Hall sender 3 -G300-

- ❑ Secured to outside of cylinder head
- ❑ Fitting location ⇒ page 14

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20 - Variable intake manifold change-over valve -N335-

- For fitting location refer to exploded view of air cleaner ⇒ page 18

21 - Secondary air pump motor -V101-

- At front right, beneath headlight.
- Removing and installing ⇒ Rep. Gr. 26

Engine compartment (left-side)

1 - High-pressure pump

- With fuel metering valve 2 -N402-
- Fitting location ⇒ page 17
- Removing and installing ⇒ page 63

2 - Fuel pressure sender for low pressure -G410-

- Fitting location ⇒ page 17
- Fitting location changes in model year 2009 ⇒ page 15

3 - Electrical connectors

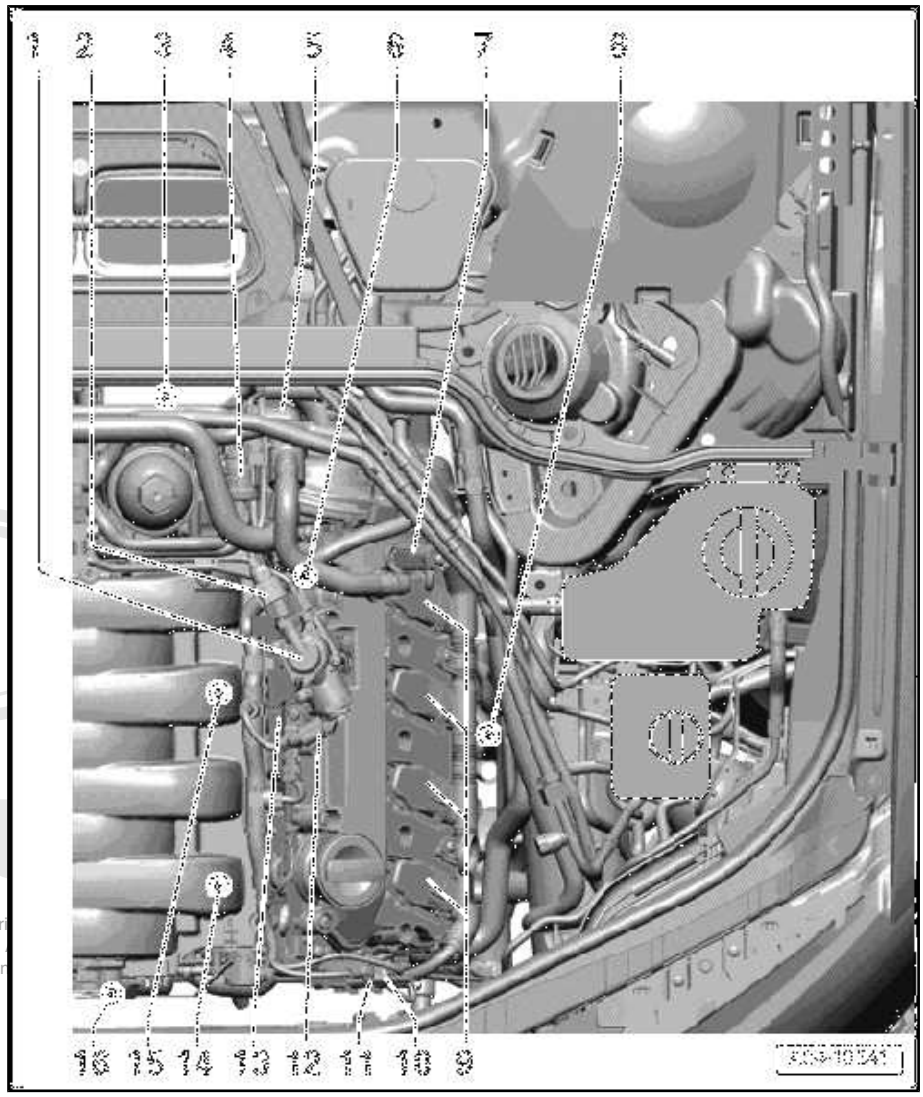
- For Lambda probe 2 before catalytic converter -G108- with Lambda probe 2 heater -Z28-
- For Lambda probe 2 after catalytic converter -G131- with Lambda probe 2 heater after catalytic converter -Z30-
- Fitting location ⇒ page 12

4 - Activated charcoal filter solenoid valve 1 -N80-

- Activated charcoal filter solenoid valve 2 -N115- (only on USA vehicles)

5 - Combination valve for secondary air system

- Cylinder bank 2 (left-side)
- Removing, installing and testing ⇒ Rep. Gr. 26



6 - Camshaft control valve 2 -N208-

- Fitting location ⇒ page 15

7 - Exhaust camshaft control valve 2 -N319-

- Fitting location ⇒ page 14

8 - Hall sender 4 -G301-

- Fitting location ⇒ page 14

9 - Ignition coils for cylinder bank 2

- Ignition coil 5 with output stage -N323-
- Ignition coil 6 with output stage -N324-

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- ❑ Ignition coil 7 with output stage -N325-
- ❑ Ignition coil 8 with output stage -N326-
- ❑ Fitting location ⇒ page 14
- ❑ Removing and installing ⇒ page 78

10 - Electrical connector for knock sensor 3 -G198-

- ❑ Fitting location ⇒ page 16

11 - Electrical connector for knock sensor 4 -G199-

- ❑ Fitting location ⇒ page 16

12 - Fuel metering valve 2 -N402-

- ❑ Combined with high-pressure pump in one unit
- ❑ Fitting location ⇒ page 17

13 - Hall sender 2 -G163-

- ❑ Fitting location ⇒ page 15

14 - Knock sensor 3 -G198-

- ❑ Fitting location ⇒ page 15
- ❑ 20 Nm

15 - Knock sensor 4 -G199-

- ❑ Fitting location ⇒ page 15
- ❑ 20 Nm

16 - Components at front of engine

- ❑ Fitting location ⇒ page 16
- ❑ Intake manifold flap motor -V157- or intake manifold flap valve -N316-
- ❑ Intake manifold flap potentiometer -G336-
- ❑ Variable intake manifold motor -V183- or intake manifold flap valve -N316-
- ❑ Intake manifold flap potentiometer 2 -G512-
- ❑ Electrical connector for knock sensor 1 -G61-
- ❑ Electrical connector for knock sensor 2 -G66-
- ❑ Electrical connector for knock sensor 3 -G198-
- ❑ Electrical connector for knock sensor 4 -G199-

A - Engine speed sender -G28-

- ❑ Fitting location ⇒ page 13

B - Accelerator position sender -G79- and accelerator position sender 2 -G185-

- ❑ In footwell on accelerator pedal (both senders are accommodated in one housing)
- ❑ Fitting location ⇒ page 11
- ❑ Removing and installing ⇒ Rep. Gr. 20

C - Kickdown switch -F8-

- ❑ In footwell on accelerator pedal
- ❑ Fitting location ⇒ page 12
- ❑ Removing and installing ⇒ Rep. Gr. 20

D - Brake light switch -F- / brake pedal switch -F47-

- ❑ In footwell on brake pedal
- ❑ Fitting location ⇒ page 12

E - Clutch pedal switch -F36-

- ❑ In footwell on clutch pedal

F - Fuel pump control unit -J538-

- ❑ Fitting location ⇒ page 12
- ❑ Removing, installing and testing ⇒ Rep. Gr. 20

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G - Oil pressure switch -F1-

- ❑ Fitting location ⇒ page 16
- ❑ Removing, installing and testing ⇒ Rep. Gr. 17

H - Lambda probe before catalytic converter -G39- with Lambda probe heater -Z19-

- ❑ Fitting location of electrical connector ⇒ page 12
- ❑ Fitting location of Lambda probe ⇒ page 13
- ❑ Removing and installing ⇒ page 66
- ❑ 55 Nm

I - Lambda probe 2 before catalytic converter -G108- with Lambda probe 2 heater -Z28-

- ❑ Fitting location of electrical connector ⇒ page 12
- ❑ Fitting location of Lambda probe ⇒ page 13
- ❑ Removing and installing ⇒ page 68
- ❑ 55 Nm

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J - Lambda probe after catalytic converter -G130- with Lambda probe 1 heater after catalytic converter -Z29-

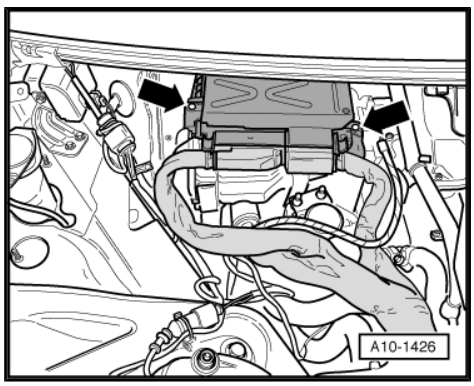
- ❑ Fitting location of electrical connector ⇒ page 12
- ❑ Fitting location of Lambda probe ⇒ page 13
- ❑ Removing and installing ⇒ page 66
- ❑ 55 Nm

K - Lambda probe 2 after catalytic converter -G131- with Lambda probe 2 heater after catalytic converter -Z30-

- ❑ Fitting location of electrical connector ⇒ page 12
- ❑ Fitting location of Lambda probe ⇒ page 13
- ❑ Removing and installing ⇒ page 68
- ❑ 55 Nm

Fitting location of engine control unit -J623-

Removing and installing ⇒ page 71



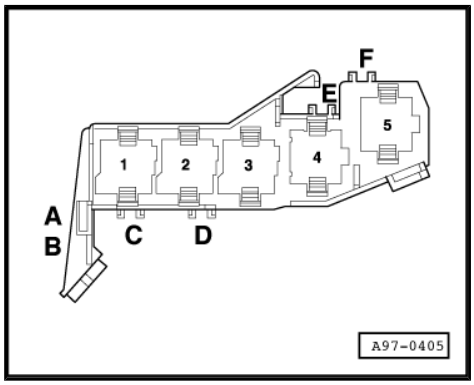
Relay and fuse holder in footwell (right-side)

2 - Starter motor relay -J53-

3 - Starter motor relay 2 -J695-

4 - Fuel pump relay -J17-

Refer to ⇒ Current flow diagrams, Electrical fault finding and Fitting locations

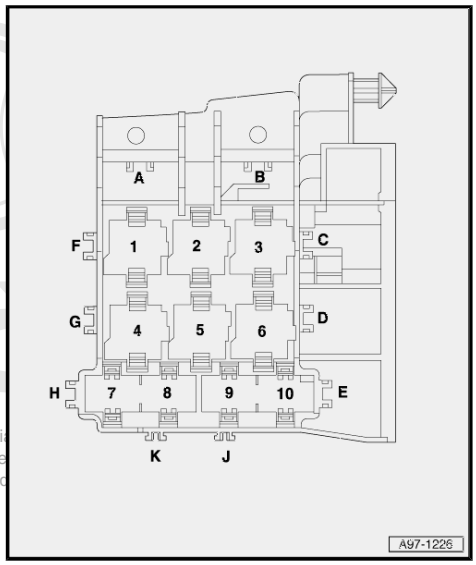


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Relay and fuse holder behind dash panel (left-side)

3 - Terminal 15 voltage supply relay -J329-

Refer to ⇒ Current flow diagrams, Electrical fault finding and Fitting locations



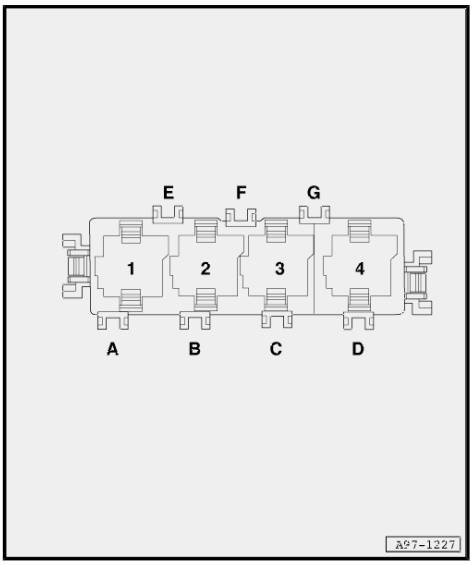
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4-position relay carrier in electronics box in plenum chamber

1 - Secondary air pump relay -J299-

2 - Motronic current supply relay -J271-

Refer to ⇒ Current flow diagrams, Electrical fault finding and Fitting locations

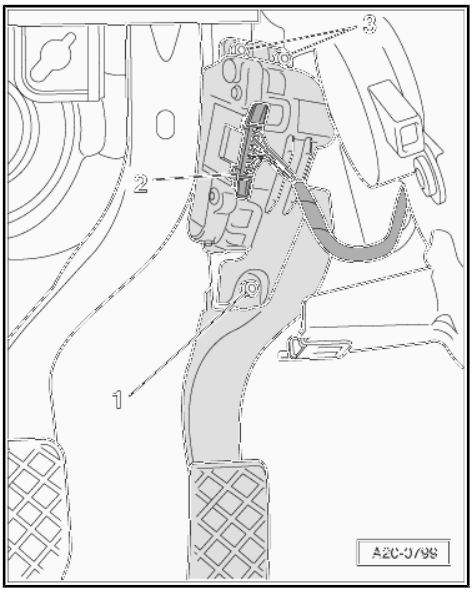


Fitting location of accelerator position sender -G79- / accelerator position sender 2 -G185-

♦ Removing and installing ⇒ Rep. Gr. 20

Note

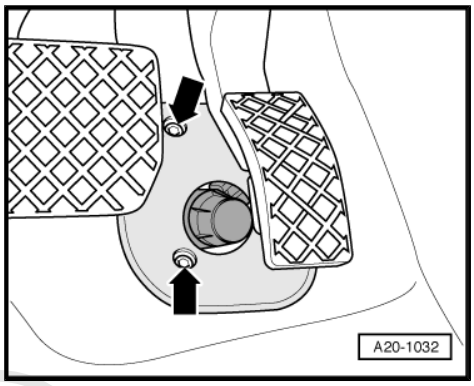
The accelerator position sender -G79- and accelerator position sender 2- -G185- are integrated in the accelerator pedal module and cannot be renewed individually.



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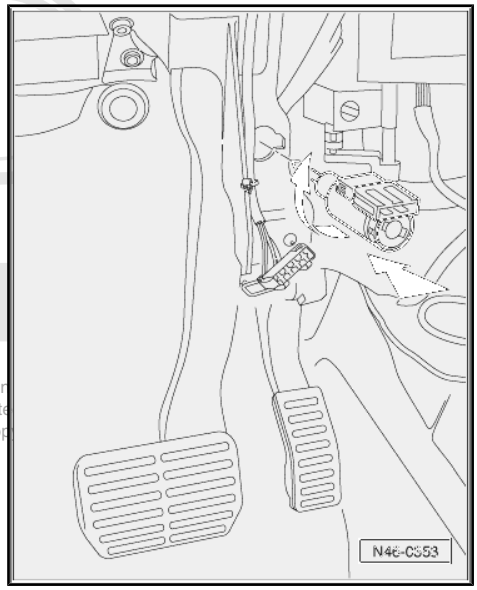
Kickdown switch -F8-

- Removing and installing ⇒ Rep. Gr. 20



Fitting location of brake light switch -F- / brake pedal switch -F47-

- For removing and installing refer to Brake system ⇒ Rep. Gr. 45 .



Note

Switches must not be installed more than once, otherwise they may not fit securely.

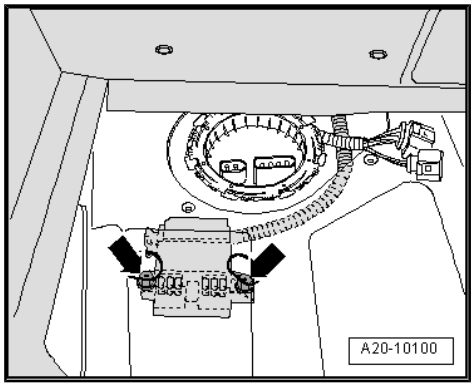
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Fuel pump control unit -J538-

Fitting location under floor panel in luggage compartment (left-side)

Securing bolts -arrows-

Removing and installing ⇒ Rep. Gr. 20



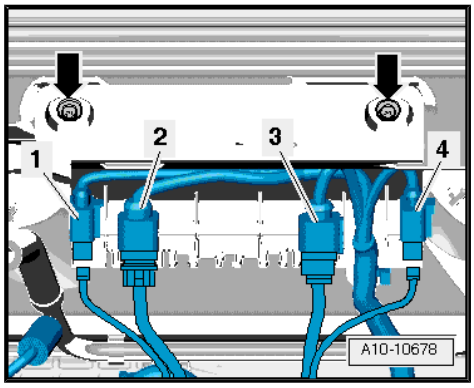
Connectors for Lambda probes

1 - To Lambda probe -G39-

2 - To Lambda probe after catalytic converter -G130-

3 - To Lambda probe 2 -G108-

4 - To Lambda probe 2 after catalytic converter -G131-



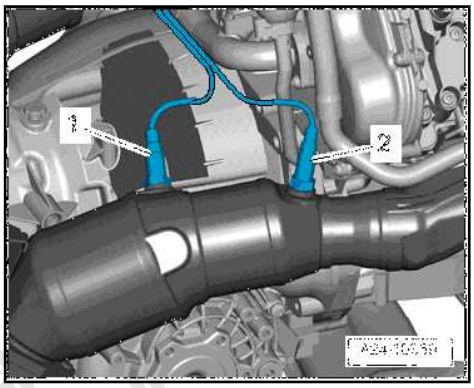
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Fitting location of Lambda probes on cylinder bank 1 (right-side)

1 - Lambda probe after catalytic converter -G130-

2 - Lambda probe -G39-

Tightening torque: 55 Nm

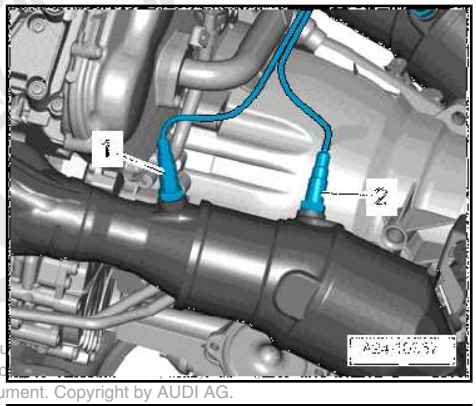


Fitting location of Lambda probes on cylinder bank 2 (left-side)

1 - Lambda probe 2 -G108-

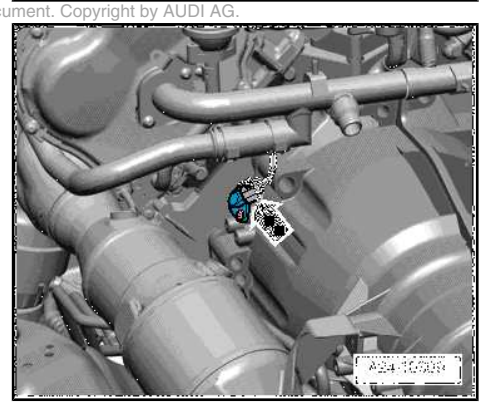
2 - Lambda probe 2 after catalytic converter -G131-

Tightening torque: 55 Nm



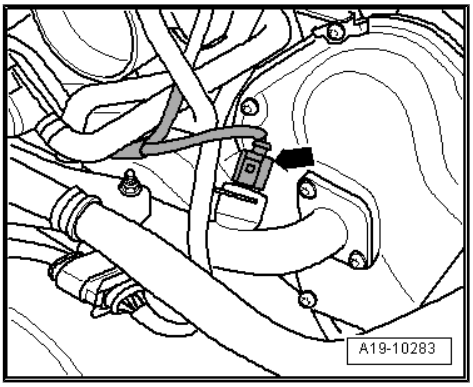
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Fitting location of engine speed sender -G28- -arrow-



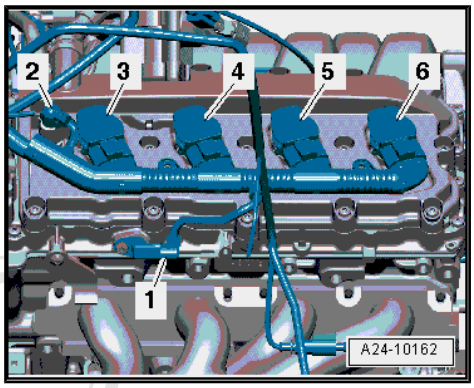
Fitting location of coolant temperature sender -G62- -arrow-

- On rear coolant pipe (right-side) -arrow-.
- Removing and installing ⇒ Rep. Gr. 19



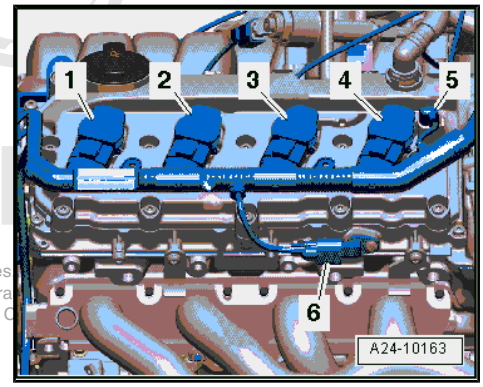
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Fitting locations on cylinder bank 1 (right-side)



1 - Hall sender 3 -G300-
2 - Exhaust camshaft control valve 1 -N318-
3 - Ignition coil 4 with output stage -N292-
4 - Ignition coil 3 with output stage -N291-
5 - Ignition coil 2 with output stage -N127-
6 - Ignition coil 1 with output stage -N70-

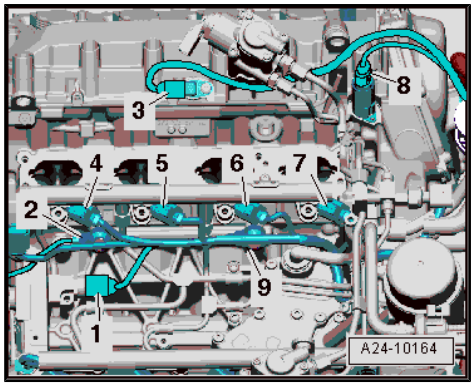
Fitting locations on cylinder bank 2 (left-side)



1 - Ignition coil 5 with output stage -N323-
2 - Ignition coil 6 with output stage -N324-
3 - Ignition coil 7 with output stage -N325-
4 - Ignition coil 8 with output stage -N326-
5 - Exhaust camshaft control valve 2 -N319-
6 - Hall sender 4 -G301-

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Fitting locations: components on inside of right cylinder head

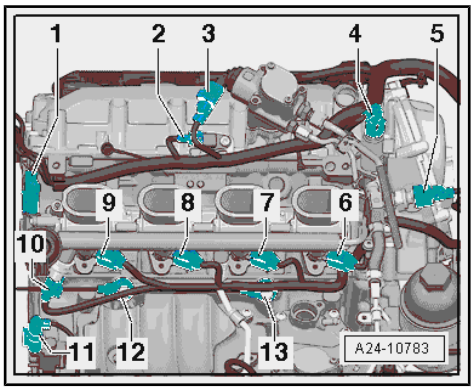


1 - Fuel pressure sender -G247-
2 - Knock sensor 1 -G61-
3 - Hall sender -G40-
4 - Injector, cylinder 1 -N30-
5 - Injector, cylinder 2 -N31-
6 - Injector, cylinder 3 -N32-
7 - Injector, cylinder 4 -N33-
8 - Camshaft control valve 1 -N205-
9 - Knock sensor 2 -G66-

For fitting locations of components on inside of cylinder head, right-side (gradual introduction from model year 2009 onwards), see next illustration.

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Fitting locations on inside of cylinder head, right-side (gradual introduction from model year 2009 onwards)



1 - Intake manifold flap potentiometer -G336-

2 - Hall sender -G40-

3 - Fuel metering valve -N290-

4 - Camshaft control valve 1 -N205-

5 - Fuel pressure sender for low pressure -G410-

6 - Injector, cylinder 1 -N30-

7 - Injector, cylinder 2 -N31-

8 - Injector, cylinder 3 -N32-

9 - Injector, cylinder 4 -N33-

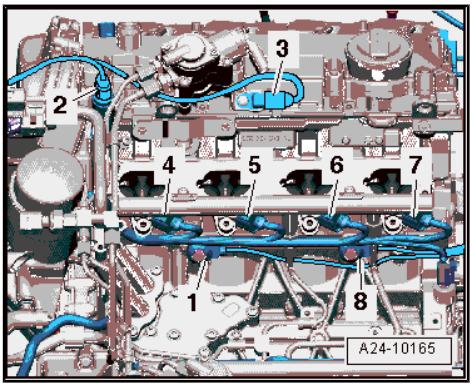
10 - Fuel pressure sender -G247-

11 - Intake manifold flap valve -N316-

12 - Knock sensor 1 -G61-

13 - Knock sensor 2 -G66-

Fitting locations: components on inside of left cylinder head



1 - Knock sensor 4 -G199-

2 - Camshaft control valve 2 -N208-

3 - Hall sender 2 -G163-

4 - Injector, cylinder 8 -N86-

5 - Injector, cylinder 7 -N85-

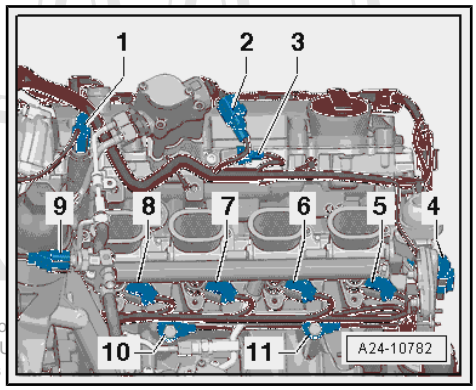
6 - Injector, cylinder 6 -N84-

7 - Injector, cylinder 5 -N83-

8 - Knock sensor 3 -G198-

For fitting locations of components on inside of cylinder head, left-side (gradual introduction from model year 2009 onwards), see next illustration.

Fitting locations on inside of cylinder head, left-side (gradual introduction from model year 2009 onwards)



1 - Camshaft control valve 2 -N208-

2 - Fuel metering valve 2 -N402- (screwed into high-pressure pump)

3 - Hall sender 2 -G163-

4 - Intake manifold flap potentiometer 2 -G512-

5 - Injector, cylinder 5 -N83-

6 - Injector, cylinder 6 -N84-

7 - Injector, cylinder 7 -N85-

8 - Injector, cylinder 8 -N86-

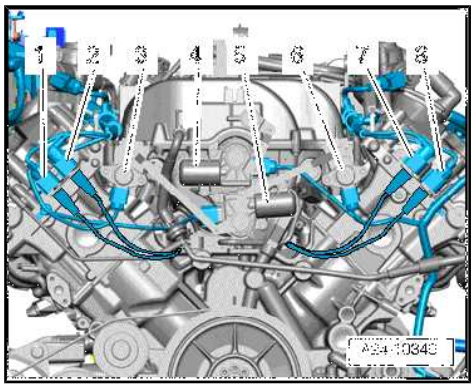
9 - Fuel pressure sender for low pressure -G410-

10 - Knock sensor 4 -G199-

11 - Knock sensor 3 -G198-

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Fitting location: at front of engine



1 - Knock sensor 2 -G66- (brown connector)

2 - Knock sensor 1 -G61- (black connector)

3 - Intake manifold flap potentiometer -G336-

4 - Variable intake manifold motor -V183- (black connector)

5 - Intake manifold flap motor -V157- (brown connector)

6 - Intake manifold flap potentiometer 2 -G512-

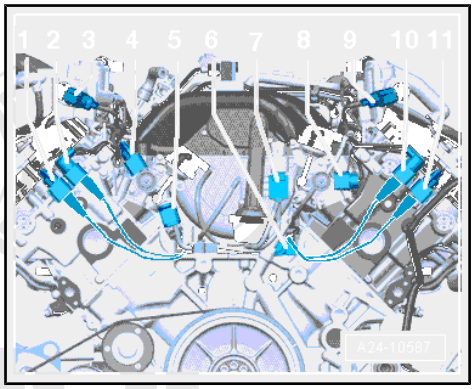
7 - Knock sensor 4 -G199- (black connector)

8 - Knock sensor 3 -G198- (brown connector)

In model year 2009, -items 4 and 5- are replaced with vacuum-controlled valves (see following illustration).

- Intake manifold flap motor -V157- is replaced with intake manifold flap valve -N316- .
- Variable intake manifold motor -V183- is replaced with variable intake manifold change-over valve -N156- .

Fitting locations at front of engine (gradual introduction of modification in model year 2009)



1 - Knock sensor 2 -G66- (brown connector)

2 - Knock sensor 1 -G61- (black connector)

3 - Fuel pressure sender for low pressure -G410-

4 - Intake manifold flap potentiometer -G336-

5 - Fuel pressure sender -G247-

6 - Intake manifold flap valve -N316- (CVTS tumble flaps)

7 - Variable intake manifold change-over valve -N156-

8 - Intake manifold flap potentiometer 2 -G512-

9 - Fuel metering valve -N290-

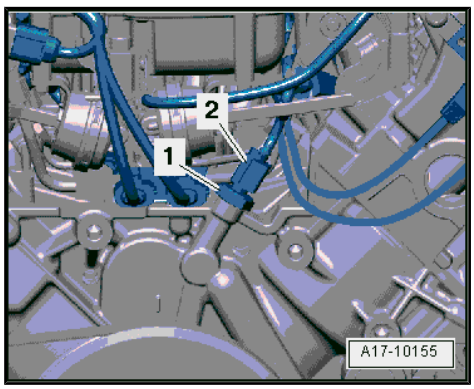
10 - Knock sensor 4 -G199- (black connector)

11 - Knock sensor 3 -G198- (brown connector)

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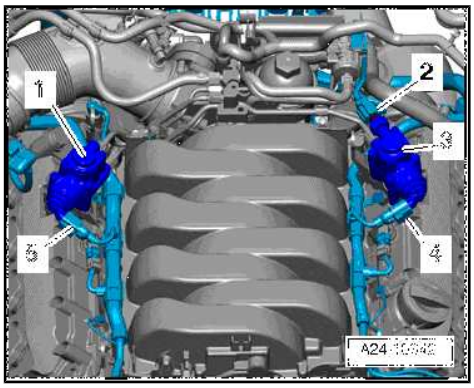
Oil pressure switch -F1- -1- and electrical connector -2-

Removing, installing and testing ⇒ Rep. Gr. 17



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Fitting location of high-pressure fuel pumps



1 - High-pressure pump on right side (cylinder bank 1)

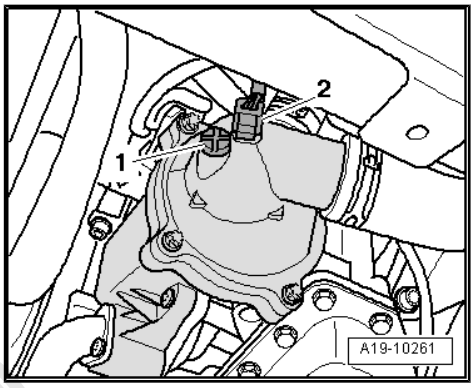
2 - Fuel pressure sender for low pressure -G410-

3 - High-pressure pump on left side (cylinder bank 2)

4 - Fuel metering valve 2 -N402-

5 - Fuel metering valve -N290-

Fitting location of map-controlled engine cooling system thermostat -F265-



- On engine (front left).

2 - Map-controlled engine cooling system thermostat -F265-

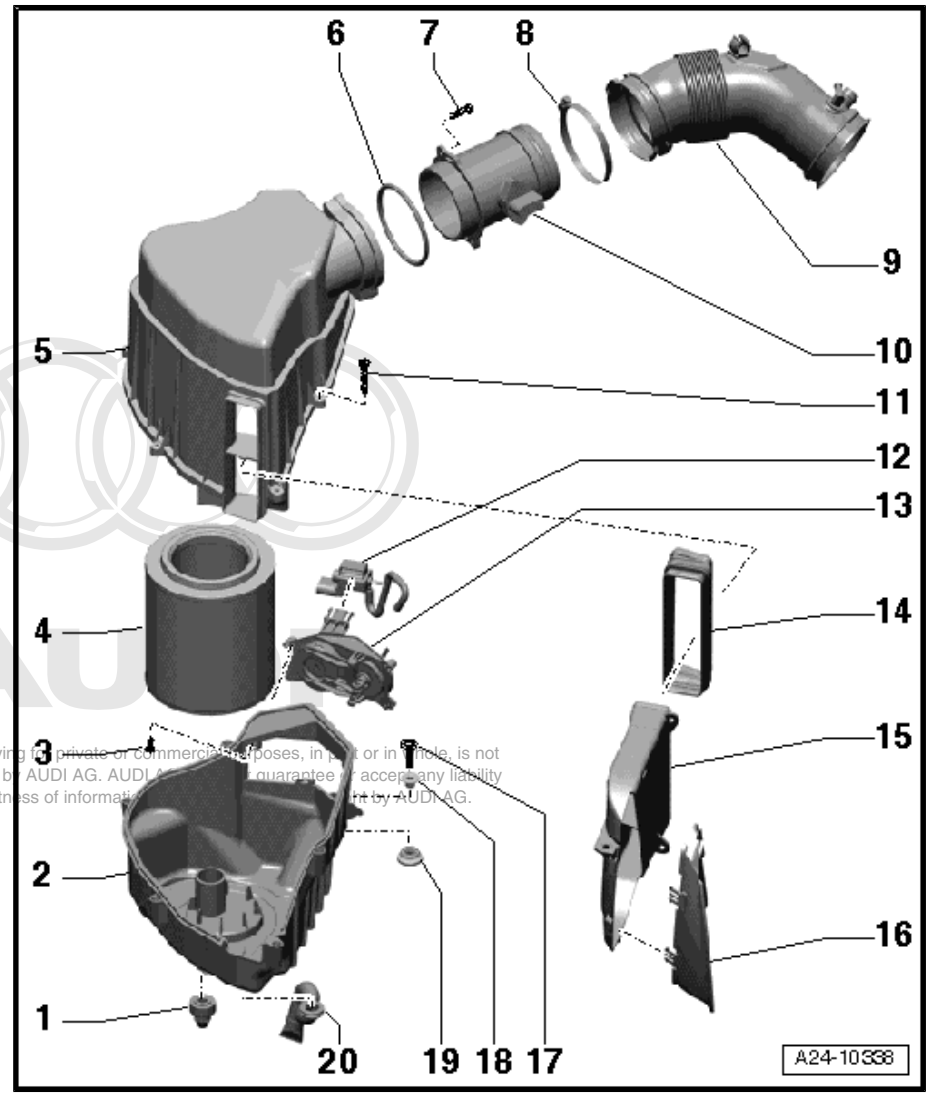
Note

Disregard -item 1-.

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2.3 Air cleaner - exploded view



1 - Grommet

2 - Air cleaner (bottom section)

- ❑ Clean any salt residue, leaves and dirt out of air cleaner (bottom section)
- ❑ Important: Check for dirt in water drain and clean as required
- ❑ Removing air cleaner (bottom section) ⇒ page 19

3 - Bolt

- ❑ For flap for variable intake manifold change-over valve -N335-

4 - Air filter element

- ❑ Always use genuine part for air filter element
- ❑ Maintenance intervals ⇒ Maintenance ; Booklet 404
- ❑ Removing and installing ⇒ page 19
- ❑ Also clean snow screen (if fitted)

5 - Air cleaner (top section)

- ❑ Clean any salt residue, leaves and dirt out of air cleaner (top section)

6 - O-ring

- ❑ Renew if damaged

7 - Bolts

- ❑ 1.5 Nm

8 - Hose clip

9 - Air hose

- ❑ To throttle valve module -J338-

10 - Air mass meter

- ❑ Removing and installing air mass meter -G70- with intake air temperature sender -G42- ⇒ page 21

11 - Bolt

- ❑ 1.5 Nm

12 - Variable intake manifold change-over valve -N335-

13 - Flap for variable intake manifold change-over valve

14 - Air duct

- ❑ Clean dirt and leaves out of air duct

15 - Air duct

- ❑ To lock carrier
- ❑ Clean dirt and leaves out of air duct

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16 - Air duct

- ❑ To lock carrier
- ❑ Clean dirt and leaves out of air duct

17 - Bolt

18 - Bush

19 - Rubber grommet

20 - Bush

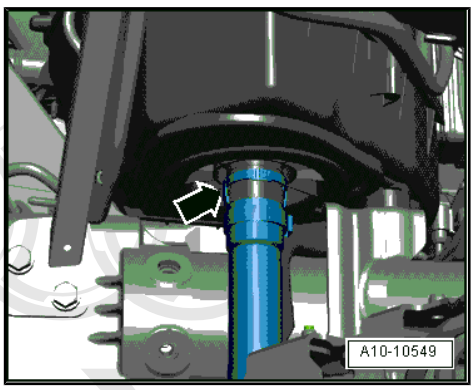
21 - Water drain hose

- ❑ Clean any leaves and dirt out of water drain hose

Removing air cleaner (bottom section)

Remove wheel housing liner (right-side).

Disconnect air hose -arrow- at bottom of air cleaner (bottom section).



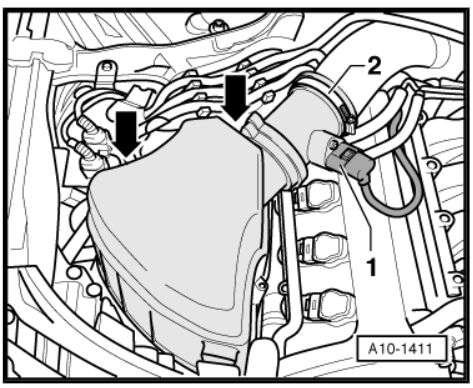
2.4 Removing and installing air filter element

Removing

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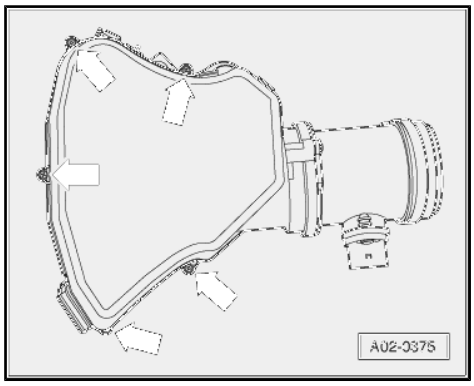
– Open hose clip -2- and disconnect air intake hose from air cleaner housing.

– Unplug electrical connector -1- at air mass meter -G70- .



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– Unscrew bolts -arrows- from air cleaner housing and detach air cleaner housing (top section).
– Pull out air filter element.
– Cover the open air cleaner housing with a clean cloth.



Note

Make sure no dirt gets into the air cleaner housing.

Installing

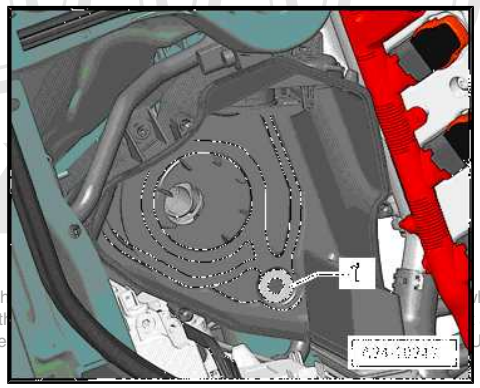
Installation is carried out in the reverse order; note the following:

To ensure the proper function of the air mass meter it is important to observe the following notes and instructions.

Note

- *If the air filter element is very dirty or wet, dirt or water could reach the air mass meter and affect the air mass value. This would lead to loss of power, since a smaller injection quantity is calculated.*
- *Always use genuine part for air filter element.*
- *The air cleaner housing MUST be clean.*
- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Parts catalogue.*
- *To prevent malfunctions, cover all critical parts of the engine air intake tract (air mass meter, intake pipes, etc.) with a clean cloth when blowing out the air cleaner housing with compressed air.*
- *Please observe requirements for disposal.*

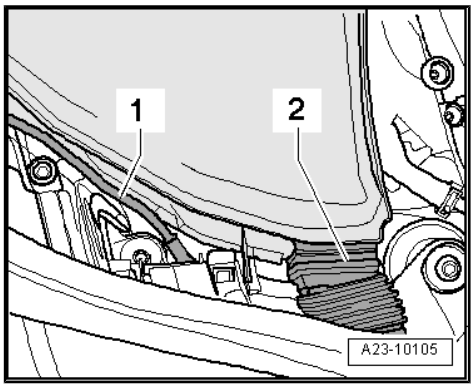
– Blow out water drain (small hole in bottom section of air cleaner -1-) with compressed air.
– Clean salt residue, dirt and leaves out of air cleaner housing (top and bottom sections); use a vacuum cleaner if necessary.
– Check for salt residue, dirt and leaves in air mass meter and air hose (engine intake side).
– Check for dirt and leaves in air duct going from lock carrier to air cleaner housing.
– When installing the air filter element, check that it is properly centred in the retainer in the air cleaner (bottom section).
– Fit the top section of the air cleaner carefully on the bottom section, without using force (make sure sealing lip and air duct -2- are positioned properly to prevent “unmetered air” from being drawn in).



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– Make sure that the electrical wiring -1- does not become trapped in the air cleaner housing when fitting top section of air cleaner housing.

– Make sure that air intake hose is seated securely between air mass meter -G70- and throttle valve module -J338- .



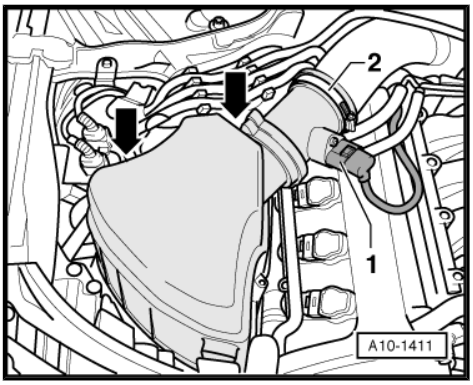
2.5 Removing and installing air mass meter -G70-

Removing

– Unplug electrical connector at air mass meter -G70- -1-.

– Unscrew both bolts from air mass meter -G70- .

– Open hose clip and carefully pull air mass meter -G70- out of guide on air cleaner housing.



Installing

To ensure the proper function of the air mass meter -G70- it is important to observe the following notes and instructions.

Note

- *If the air filter element is very dirty or wet, dirt or water could reach the air mass meter -G70- and affect the air mass value. This would lead to loss of power, since a smaller injection quantity is calculated.*
- *Always use genuine part for air filter element.*
- *Use a silicone-free lubricant when installing the intake hose.*
- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Parts catalogue*

– Check for salt residue, dirt and leaves in air mass meter and air intake hose (engine intake side).

– Check for dirt in air duct leading to air filter element. If necessary, clean salt residue, dirt and leaves out of air cleaner housing (top and bottom sections); wash out or use a vacuum cleaner as required. Removing and installing air cleaner ⇒ page 19 .

– If air filter element has been removed, clean water drain hose in air cleaner (bottom section).

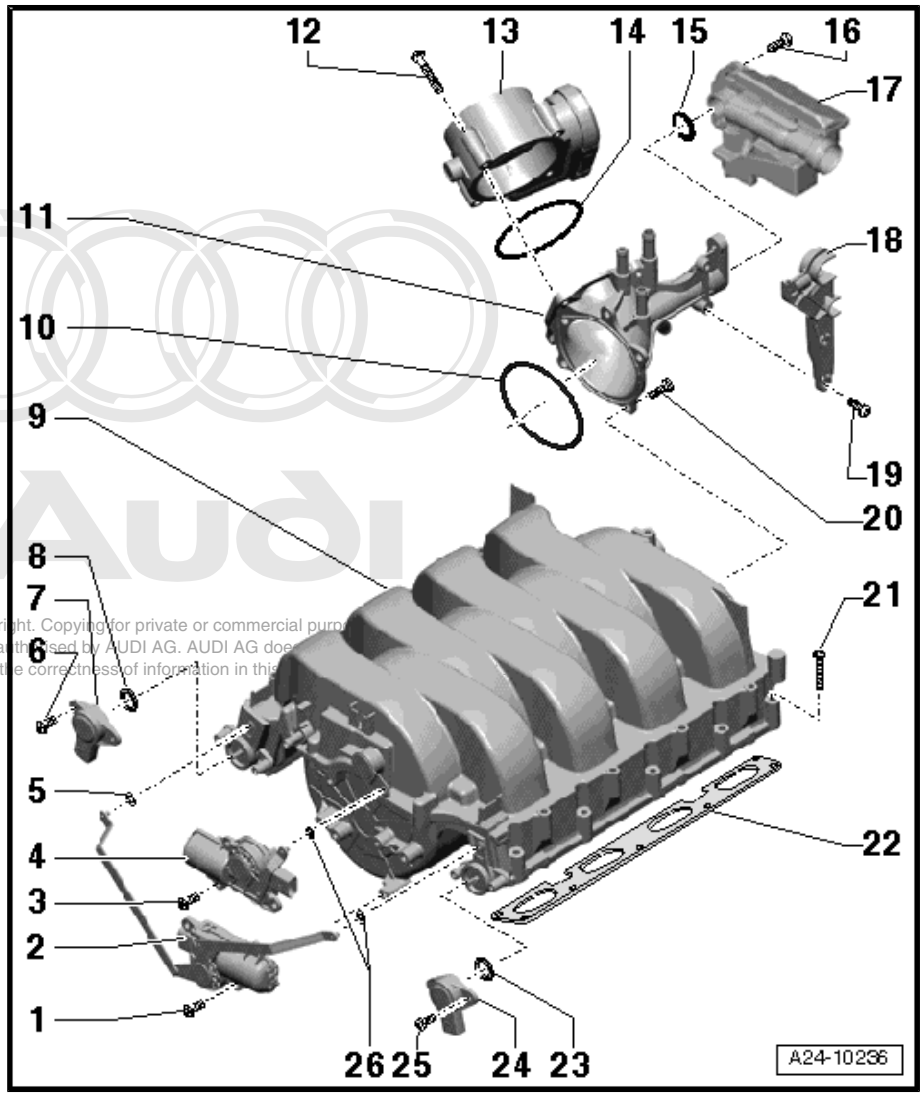
– Align seal in slot on air cleaner housing and carefully push air mass meter -G70- into air cleaner housing.

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

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2.6 Intake manifold (magnesium) - exploded view



1 - Bolt

- ❑ 9 Nm

2 - Intake manifold flap motor -V157-

- ❑ In model year 2009 intake manifold flap motor -V157- is replaced with intake manifold flap valve -N316- (see intake manifold (plastic) - exploded view ⇒ page 37)

3 - Bolt

- ❑ 9 Nm

4 - Variable intake manifold motor -V183-

- ❑ In model year 2009 variable intake manifold motor -V183- is replaced with variable intake manifold changeover valve -N156- (see intake manifold (plastic) - exploded view ⇒ page 37)

5 - Circlip

6 - Bolt

- ❑ 2.5 Nm

7 - Intake manifold flap potentiometer -G336-

- ❑ Cylinder bank 1
- ❑ After renewing, perform “Adaption” in “Guided Functions”, vehicle diagnostic, testing and information system -VAS 5051B- .

8 - Seal

- ❑ Renew if damaged
- ❑ Open side faces towards intake manifold flap potentiometer -G336-

9 - Intake manifold

- ❑ Removing and installing ⇒ page 24

10 - O-ring

- ❑ Renew

11 - Connection for intake manifold

12 - Bolt

- ❑ 9 Nm

13 - Throttle valve module -J338-

- ❑ After renewing, perform “Adaption” in “Guided Functions”, vehicle diagnostic, testing and information system -VAS 5051B- .

14 - O-ring

- ❑ Renew

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15 - O-ring

- ❑ Renew

16 - Bolt

- ❑ 9 Nm

17 - Pressure control valve for crankcase breather system

18 - Bracket

- ❑ For vacuum hose

19 - Bolt

- ❑ 9 Nm

20 - Bolt

- ❑ 9 Nm

21 - Bolts

- ❑ For tightening torque and tightening sequence, refer to ⇒ page 23

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22 - Gaskets for intake manifold

- ❑ Renew

23 - Seal

- ❑ Renew if damaged
- ❑ Open side faces towards intake manifold flap potentiometer 2 -G512-

24 - Intake manifold flap potentiometer 2 -G512-

- ❑ Cylinder bank 2
- ❑ After renewing, perform “Adaption” in “Guided Functions”, vehicle diagnostic, testing and information system -VAS 5051B- .

25 - Bolt

- ❑ 2.5 Nm

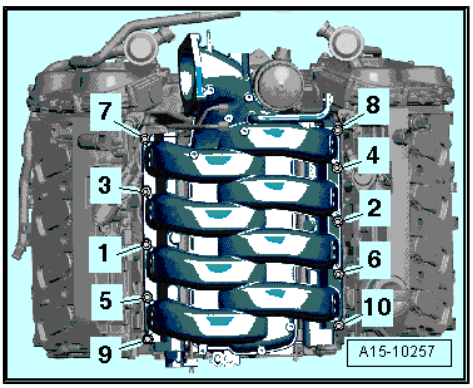
26 - Circlip

Tightening sequence for intake manifold

– Tighten bolts for intake manifold in the sequence -1 to 10-.

♦ Tighten initially to 8 Nm.

♦ Subsequently tighten to 9 Nm and then tighten 90° further.

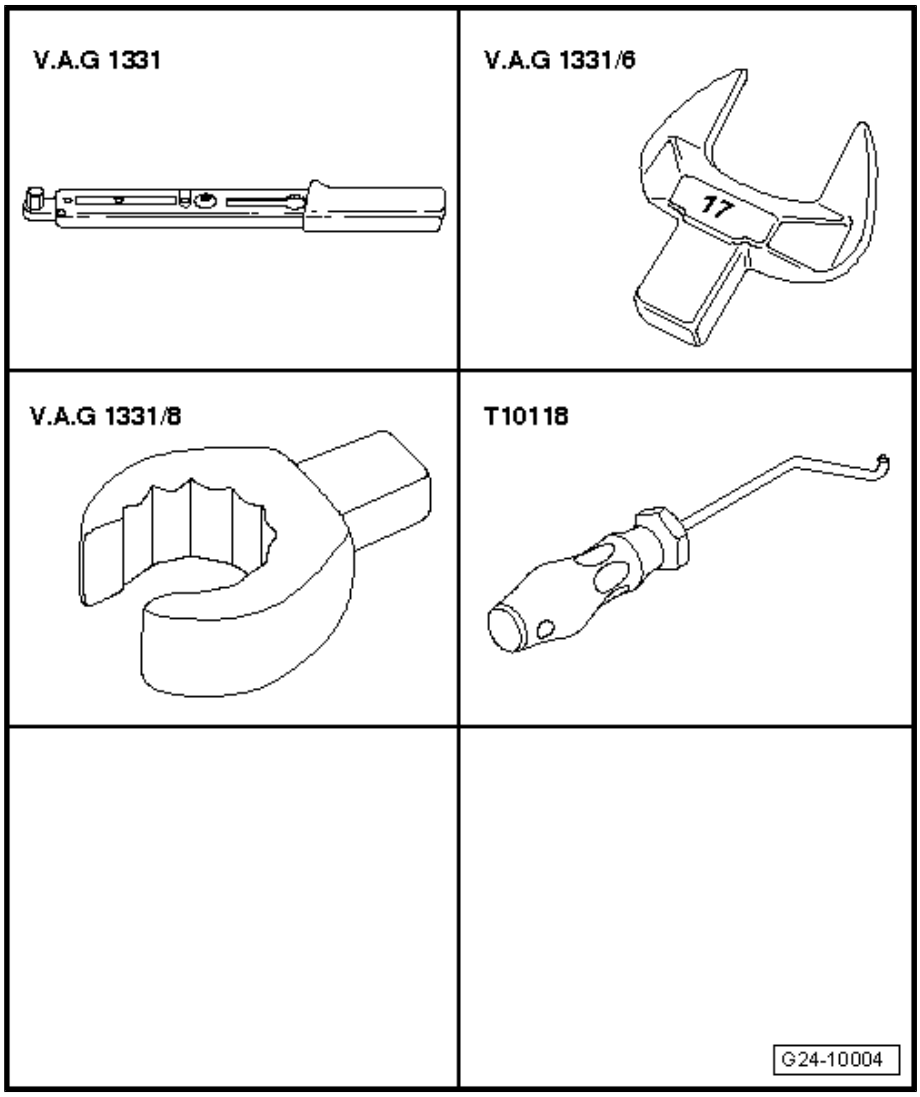


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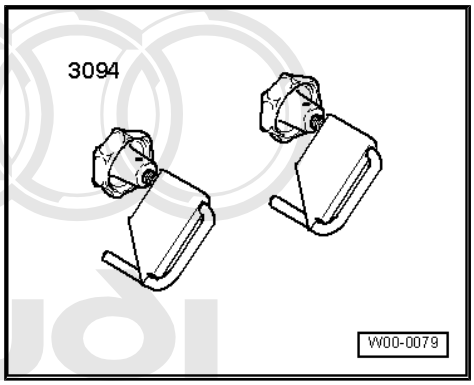
2.6.1 Removing and installing intake manifold

Special tools and workshop equipment required

- Torque wrench -V.A.G 1331-
- Tool insert AF 17 -V.A.G 1331/6-
- Socket insert AF 14, flared ring spanner -V.A.G 1331/8-
- Assembly tool -T10118-



- Hose clamps for hoses up to 25 mm -3094-



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Removing

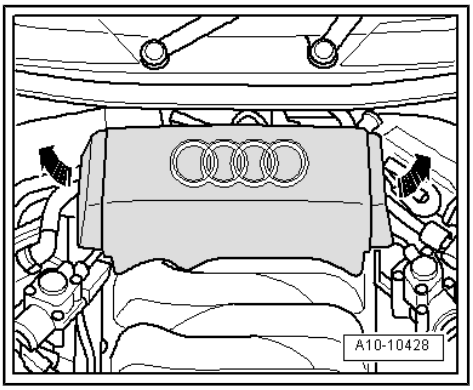
WARNING

- *The fuel system operates under high pressure. The pressure in the high-pressure part of the injection system must be reduced to a residual pressure prior to opening the system ⇒ page 3 .*
- *A clean cloth must then be wrapped around the connection and the residual pressure dissipated by carefully loosening the connection.*

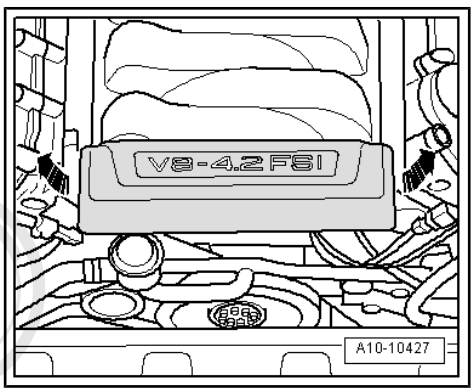
Note

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

– Pull off engine cover panel (rear) -arrows-.



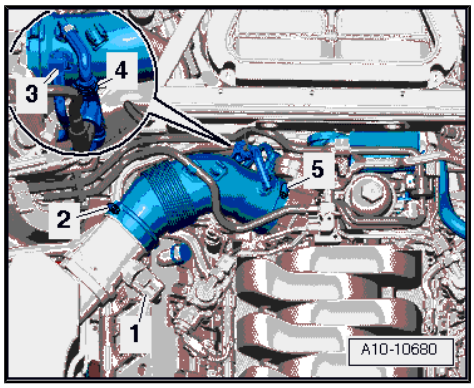
– Pull off engine cover panel (front) -arrows-.



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– Move fuel line and vacuum line going to activated charcoal filter clear at air intake hose.



Note

Disregard -item 1-.

– Detach vacuum line -4- at air intake hose.

Rest-of-world vehicles:

– Disconnect hose -3- for crankcase breather system from air hose by pressing release tabs.

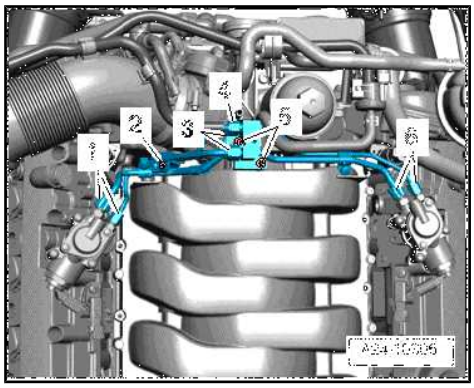
– Release hose clips -2- and -5- and remove air intake hose.

USA models:

– Release hose clips -2- and -5- and move air intake hose clear to one side (crankcase breather hose -3- remains connected).

Caution

Do not open hose connection -3- on USA models.

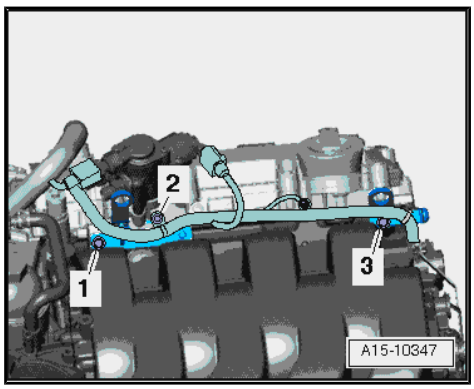


– Disconnect fuel lines -1, 3, 4, 6-.

– Remove bolts -2- and -5- and detach fuel rail with high-pressure pipes.

– Unscrew bolt -2-, move wiring harness clear and press towards the left.

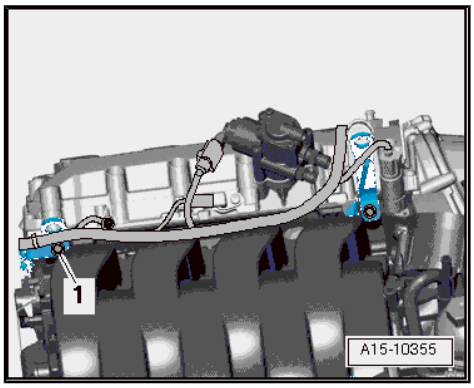
– Unscrew bolt -1- and remove engine lifting eye (rear left).



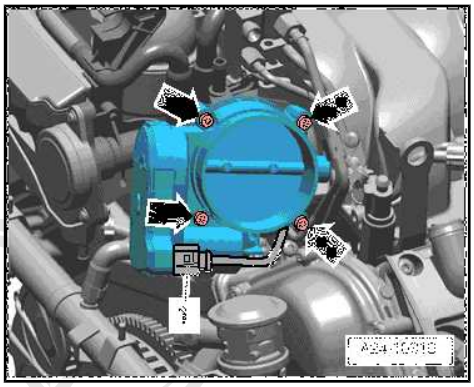
– Unscrew bolt -3- and remove engine lifting eye (front left).

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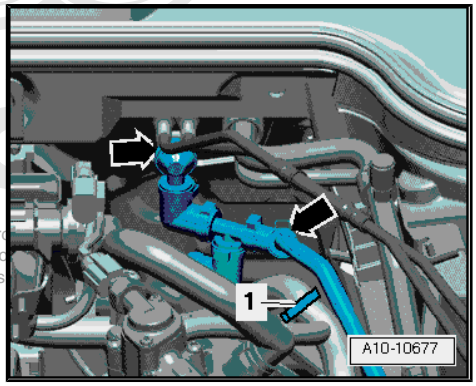
– Unscrew bolt -1- and remove engine lifting eye (front right).
– Move wiring harness clear and press towards the right.



– Unplug electrical connector -1- at throttle valve module - J338- .
– Unscrew bolts -arrows- and remove throttle valve module - J338- .



– Detach vacuum lines -arrows- going to brake servo.
– Move vacuum lines clear to one side.



Note

Disregard -item 1-.

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WARNING

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

– Open filler cap on coolant expansion tank.

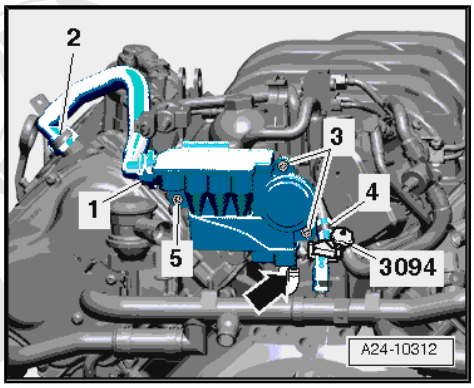
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– Detach crankcase breather hose at the points marked with -item 1- and -item 2- (press release tabs).

– Clamp off coolant hose -4- using hose clamp (up to 25 mm) -3094- and detach coolant hose from intake manifold connection.

– Slacken bolt -5- a few turns.

– Unscrew bolts -3- and carefully remove pressure control valve for crankcase breather system from intake manifold connection.



Note

♦ *Disregard -arrow-.*

♦ *Shown from rear with engine removed for illustration purposes.*

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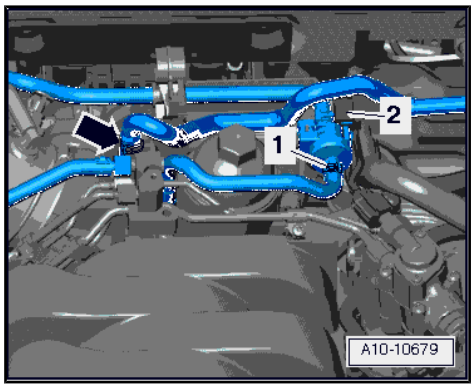
Note

Lay a cloth under the intake manifold connection to catch escaping coolant.

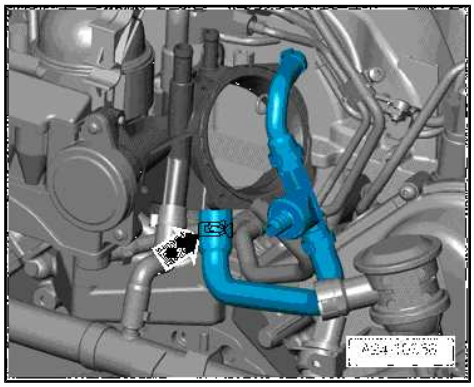
– Unplug electrical connector -2- at activated charcoal filter solenoid valve 1 -N80- and detach vacuum hose -1-.

– Detach activated charcoal filter solenoid valve 1 -N80- from bracket and move it clear to the side with hose still attached.

– Detach coolant hose -arrow- and move clear to one side.



– Detach vacuum hose -arrow- going to intake manifold connection.



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– Detach vacuum hose -arrow-.

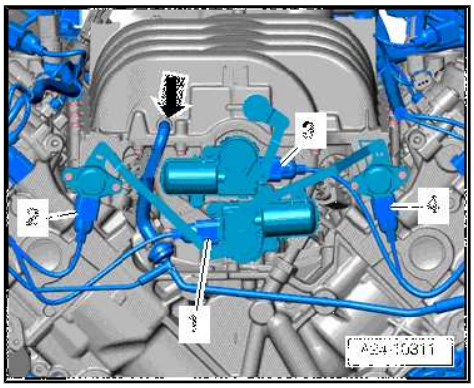
– Unplug electrical connectors at:

1 - Intake manifold flap motor -V157- (brown connector)

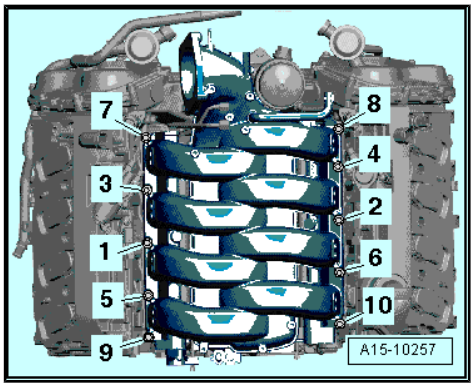
2 - Intake manifold flap potentiometer -G336-

3 - Variable intake manifold motor -V183- (black connector)

4 - Intake manifold flap potentiometer 2 -G512-



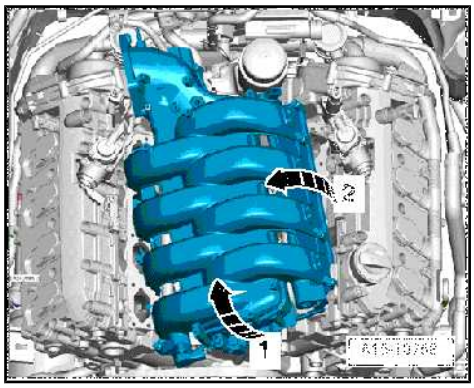
– Remove intake manifold bolts in the sequence -10 ... 1-.



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– To prevent scratches, mask off intake manifold in vicinity of high-pressure pipes with adhesive tape.
– First lift up intake manifold at the front -arrow 1-.
– Then pivot out intake manifold below high-pressure fuel pipes towards right side of vehicle -arrow 2-.
– Remove intake manifold from engine compartment.



Note

Seal intake ports on cylinder heads with clean cloths.

Installing

Note

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

- Tightening torques: refer to exploded view of intake manifold ⇒ page 22 .
- Tightening torques: refer to exploded view of fuel rail with injectors ⇒ page 31 .

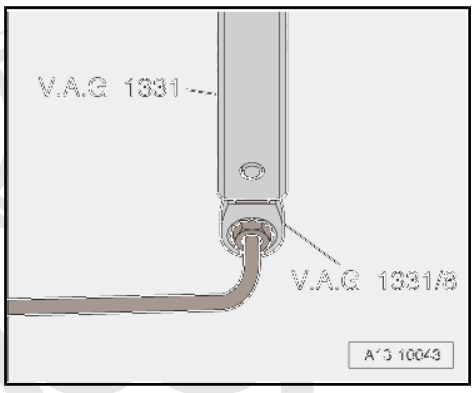
Installation is carried out in the reverse order; note the following:

Note

- *The connections of the high-pressure pipes must not be damaged.*
- *Do not attempt to bend high-pressure pipes to a different shape.*

– Tighten union nuts on high-pressure pipes hand-tight initially.
– Ensure that high-pressure pipes are not under tension.

– To tighten union nuts (14 mm) for high-pressure pipes, use torque wrench -V.A.G 1331- with socket insert AF 14, flared ring spanner -V.A.G 1331/8- .



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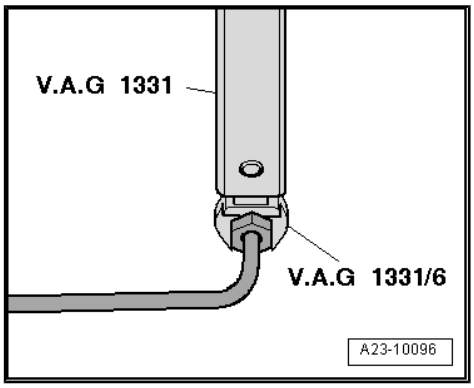
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– To tighten union nuts (17 mm) for high-pressure pipes, use torque wrench -V.A.G 1331- with tool insert (17 mm) -V.A.G 1331/6- .

– Do not install mounting brackets until high-pressure pipes have been finally secured.

– Observe notes on procedures required after connecting battery ⇒ Rep. Gr. 27 .

– If necessary, fill up with coolant ⇒ Rep. Gr. 19 .



2.6.2 Fuel rail with injectors - exploded view

1 - Radial compensation element

- ❑ Renew if damaged
- ❑ Clip onto support ring ⇒ Item 6 (page 31)

2 - Combustion chamber ring seal

- ❑ Do not apply grease to ring seal or use any other lubricants
- ❑ Renew

3 - Injector

- ❑ Removing and installing ⇒ page 33

4 - Spacer ring

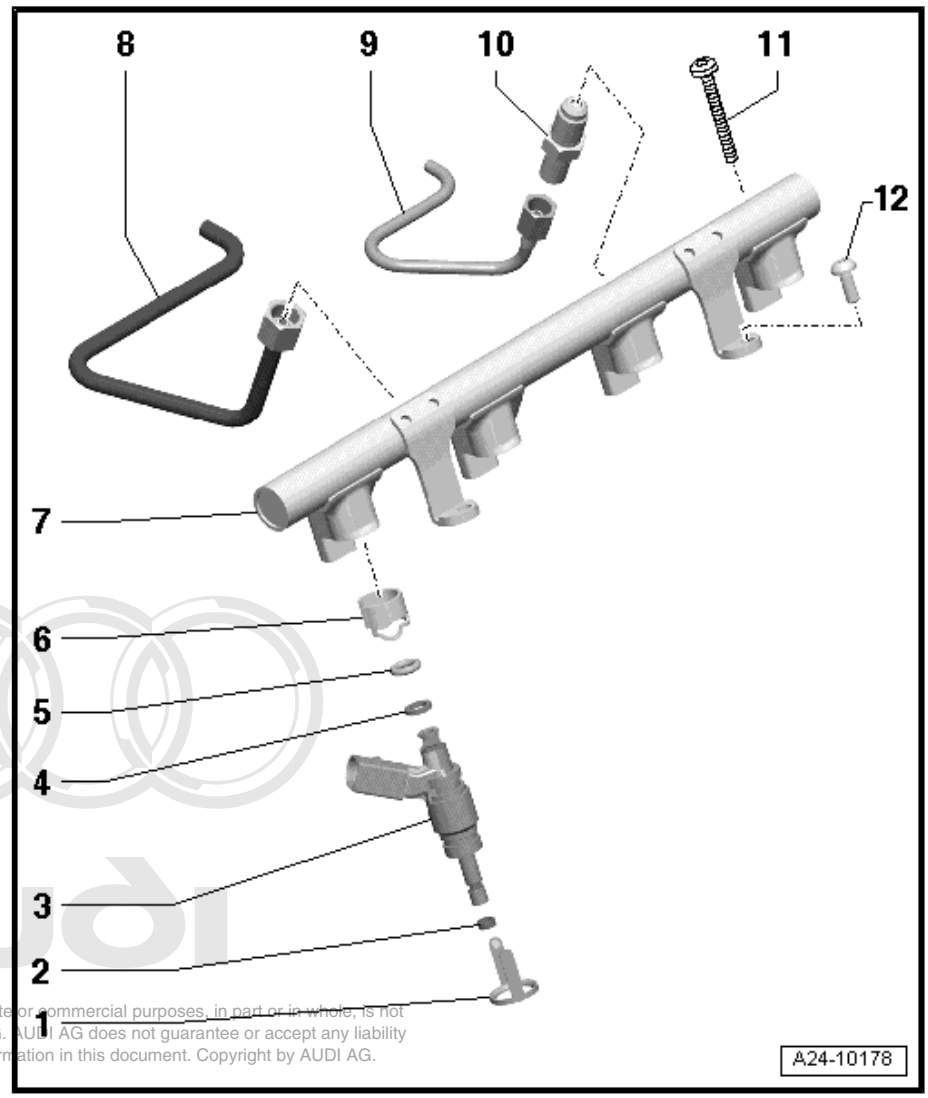
- ❑ Renew if damaged

5 - O-ring

- ❑ Renew
- ❑ Lubricate lightly with clean engine oil

6 - Support ring

- ❑ Renew
- ❑ Via this support ring, the fuel rail exerts the clamping force that holds the injector in the cylinder head



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7 - Fuel rail

8 - High-pressure pipe

> **WARNING**
>
> *The pressure in the high-pressure part of the injection system must be reduced to a residual pressure prior to opening the system ⇒ page 3 .*
>
> *A clean cloth must then be wrapped around the connection and the residual pressure dissipated by carefully loosening the connection.*

- ❑ Connections must not be damaged
- ❑ Do not alter shape
- ❑ 25 Nm

9 - High-pressure pipe

> **WARNING**
>
> *The pressure in the high-pressure part of the injection system must be reduced to a residual pressure prior to opening the system ⇒ page 3 .*
>
> *A clean cloth must then be wrapped around the connection and the residual pressure dissipated by carefully loosening the connection.*

- ❑ Connections must not be damaged
- ❑ Do not alter shape
- ❑ 25 Nm

10 - Pressure relief valve, 140 bar

- ❑ For high-pressure pipe
- ❑ 25 Nm

11 - Bolt

- ❑ 9 Nm
- ❑ Tighten in stages and in diagonal sequence

12 - Bolt

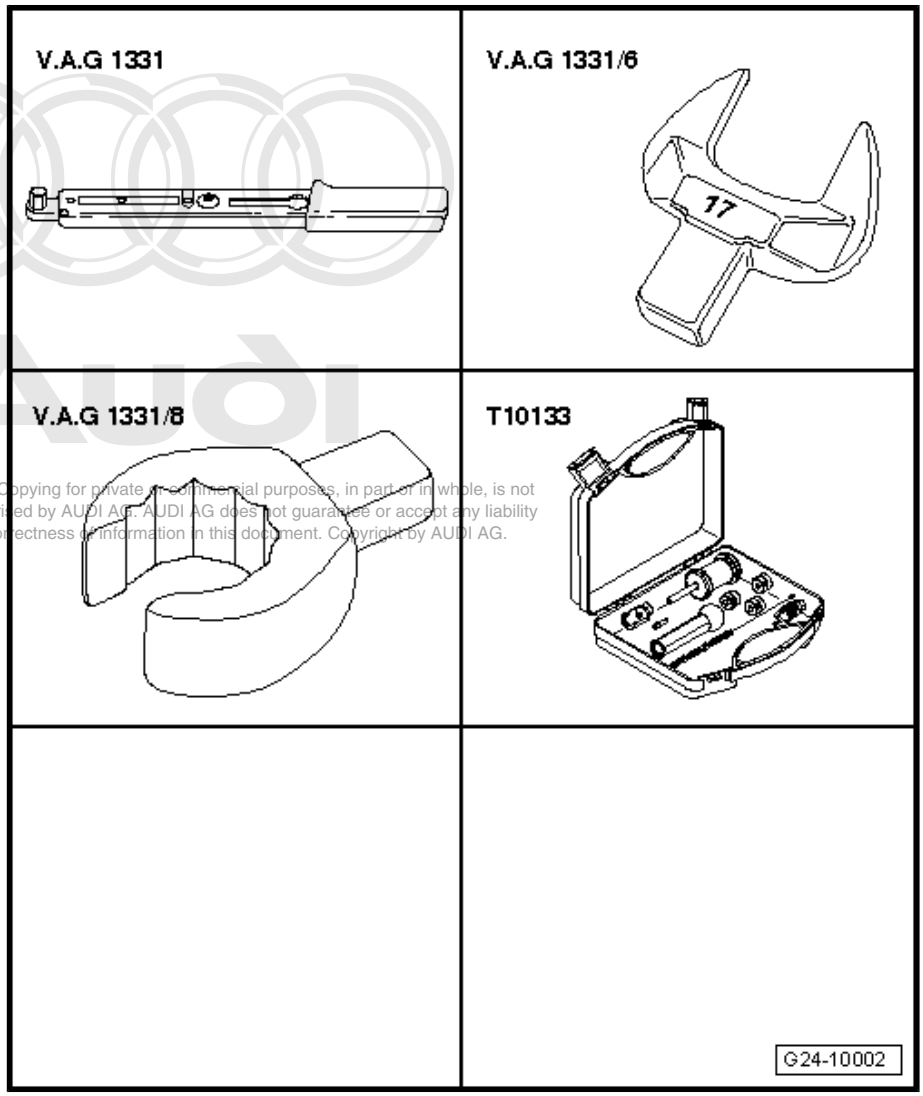
- ❑ 9 Nm
- ❑ Tighten in stages and in diagonal sequence

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2.6.3 Removing and installing injectors

Special tools and workshop equipment required

- Torque wrench -V.A.G 1331-
- Tool insert AF 17 -V.A.G 1331/6-
- Socket insert AF 14, flared ring spanner -V.A.G 1331/8-
- Tool set for FSI engines - T10133-



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Removing

WARNING

- *The fuel system operates under high pressure. The pressure in the high-pressure part of the injection system must be reduced to a residual pressure prior to opening the system ⇒ page 3 .*
- *A clean cloth must then be wrapped around the connection and the residual pressure dissipated by carefully loosening the connection.*

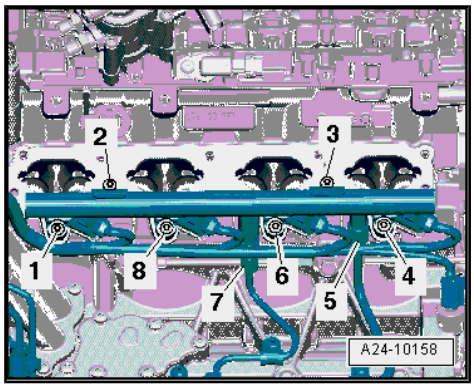
– Remove intake manifold ⇒ page 24 .

Note

Seal off the injector openings in the cylinder heads with clean cloths.

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– Unplug electrical connectors at injectors.
– Unscrew high-pressure pipe -5- at connection on fuel rail.
– Unscrew high-pressure pipe -7- at connection on fuel rail. To do so, counterhold at hexagon flats with an open-end spanner and slacken union nut.
– Remove bolts -1, 2, 3, 4, 6 and 8-.



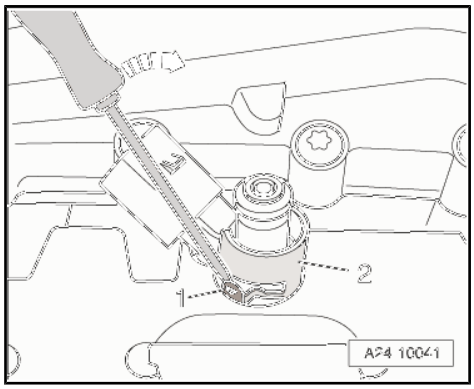
Note

Do not attempt to bend high-pressure pipes to a different shape.

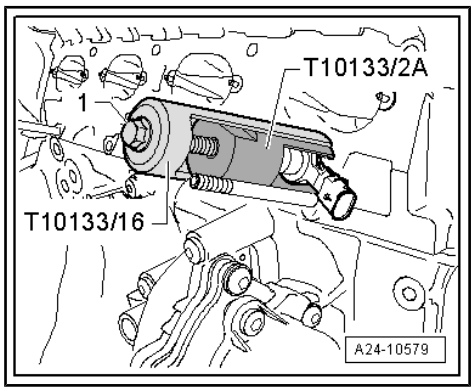
– Pull off fuel rail together with injectors.

If injectors cannot be pulled out of cylinder head by hand, proceed as follows:

– Use a screwdriver to bend retainer tabs -1- of radial compensation element to side -arrow- and pull support ring -2- off injector.
– Remove O-ring from injector.



– Guide puller -T10133/2A- into groove on injector.
– Then attach removal tool -T10133/16- and pull out injector by turning bolt -1-.

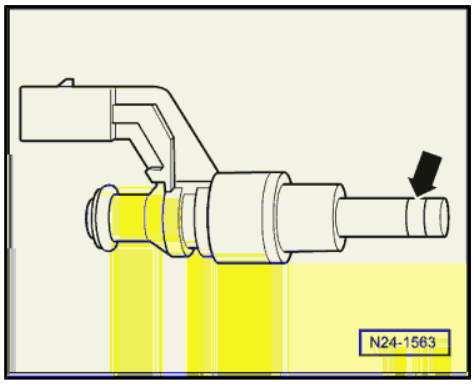


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Note

When inserting the puller, there is a risk of destroying the radial compensation element due to the retainer tabs breaking.

– Carefully remove old combustion chamber ring seal -arrow-. To do so, cut open ring using knife or prise open ring with small screwdriver and then pull off forwards.
– Take care not to damage groove on injector. The injector must be renewed if the groove is damaged.

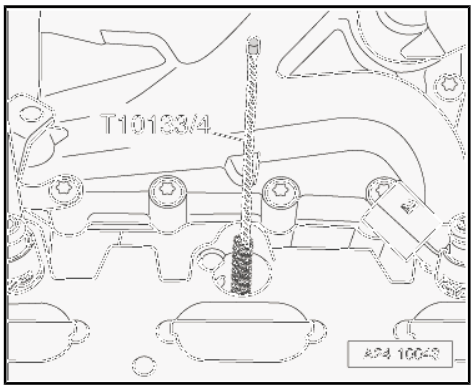


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Installing

Note

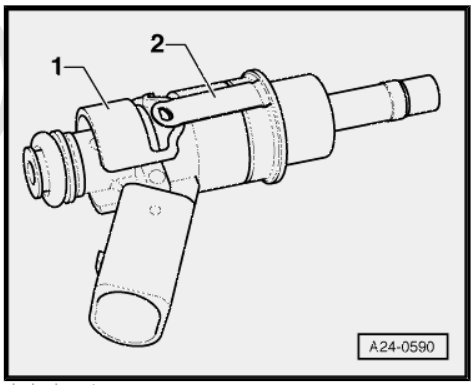
- *Renew combustion chamber ring seal and O-ring.*
- *Renew spacer ring if damaged.*
- *Lightly lubricate O-rings for injectors with clean engine oil.*
- *The injector pipes must be re-installed on the same cylinders.*



– Clean bore in cylinder head with nylon cylinder brush - T10133/4- .

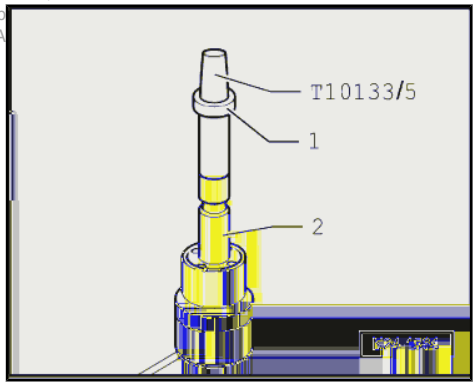
– Clip radial compensation element -1- into support ring -2-.

– When re-installing an injector, clean any combustion residue off groove for combustion chamber ring seal and injector stem with a clean cloth.



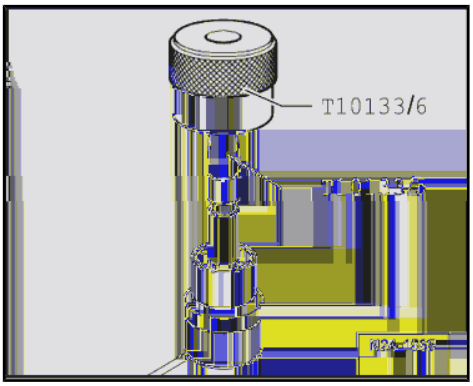
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– Fit assembly cone -T10133/5- with new combustion chamber ring seal -1- onto injector -2-.



– Push combustion chamber ring seal onto assembly cone - T10133/5- as far as it will go using assembly sleeve - T10133/6- .

– Turn assembly sleeve -T10133/6- upside down and push combustion chamber ring seal into sealing ring groove.



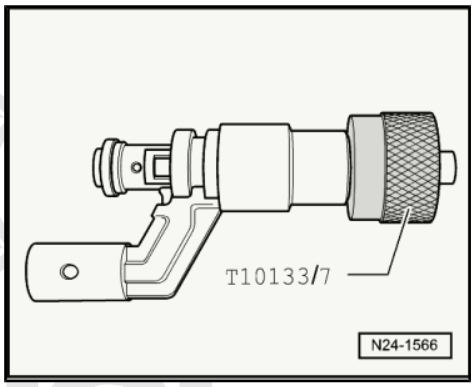
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Note

The combustion chamber ring seal is widened when it is pushed onto the injector. After pushing it on, it therefore has to be compressed again. This is done in two stages, as described below.

– Push calibration sleeve -T10133/7- onto injector as far as it will go and simultaneously turn it slightly (approx. 180°).

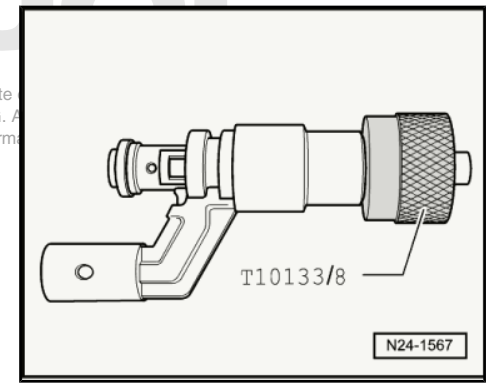
– Pull calibration sleeve -T10133/7- off again by turning it in the opposite direction.



– Push calibration sleeve -T10133/8- onto injector as far as it will go and simultaneously turn it slightly (approx. 180°).

– Pull calibration sleeve -T10133/8- off again by turning it in the opposite direction.

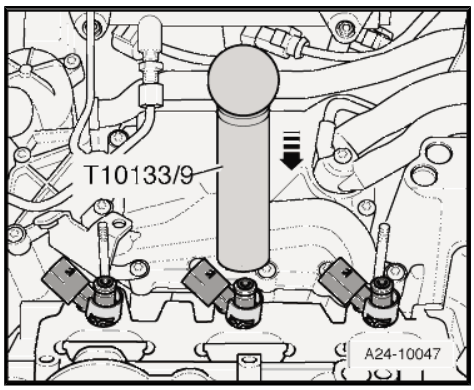
– Lubricate new O-ring lightly with clean engine oil before installing.



Note

The combustion chamber ring seal must not be lubricated.

– Use assembly tool -T10133/9- to push injector as far as it will go into hole in cylinder head.



Note

It should be possible to insert the injector easily. If necessary wait until the combustion chamber ring seal has contracted sufficiently.

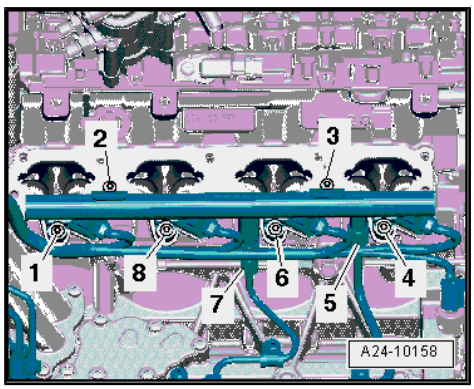
– Make sure injector is in correct installation position in cylinder head:

• Electrical connector of injector must engage in recess in cylinder head.

– Press fuel rail evenly onto injectors.

– Tighten bolts -1, 2, 3, 4, 6 and 8- in diagonal sequence and in stages.

• Tightening torque: refer to exploded view of fuel rail with injectors ⇒ page 31

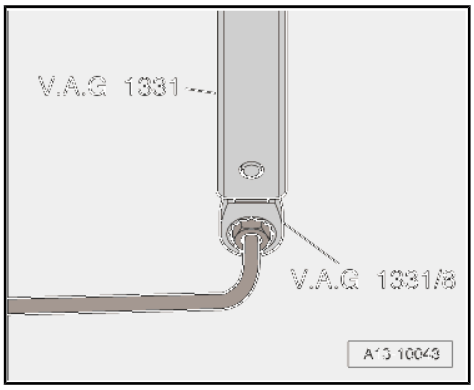


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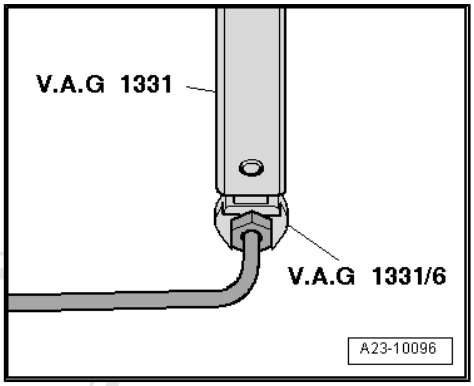
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Note

- *The connections of the high-pressure pipes must not be damaged.*
- *Do not attempt to bend high-pressure pipes to a different shape.*



– Tighten union nuts on high-pressure pipes hand-tight initially.
– Ensure that high-pressure pipes are not under tension.
– To tighten union nut (14 mm) for high-pressure pipe, use torque wrench -V.A.G 1331- with socket insert AF 14, flared ring spanner -V.A.G 1331/8- .



– To tighten union nut (17 mm) for high-pressure pipe, use torque wrench -V.A.G 1331- with tool insert (17 mm) -V.A.G 1331/6- .
– Do not install mounting brackets until high-pressure pipes have been finally secured.

Perform further installation in reverse order, paying attention to the following:

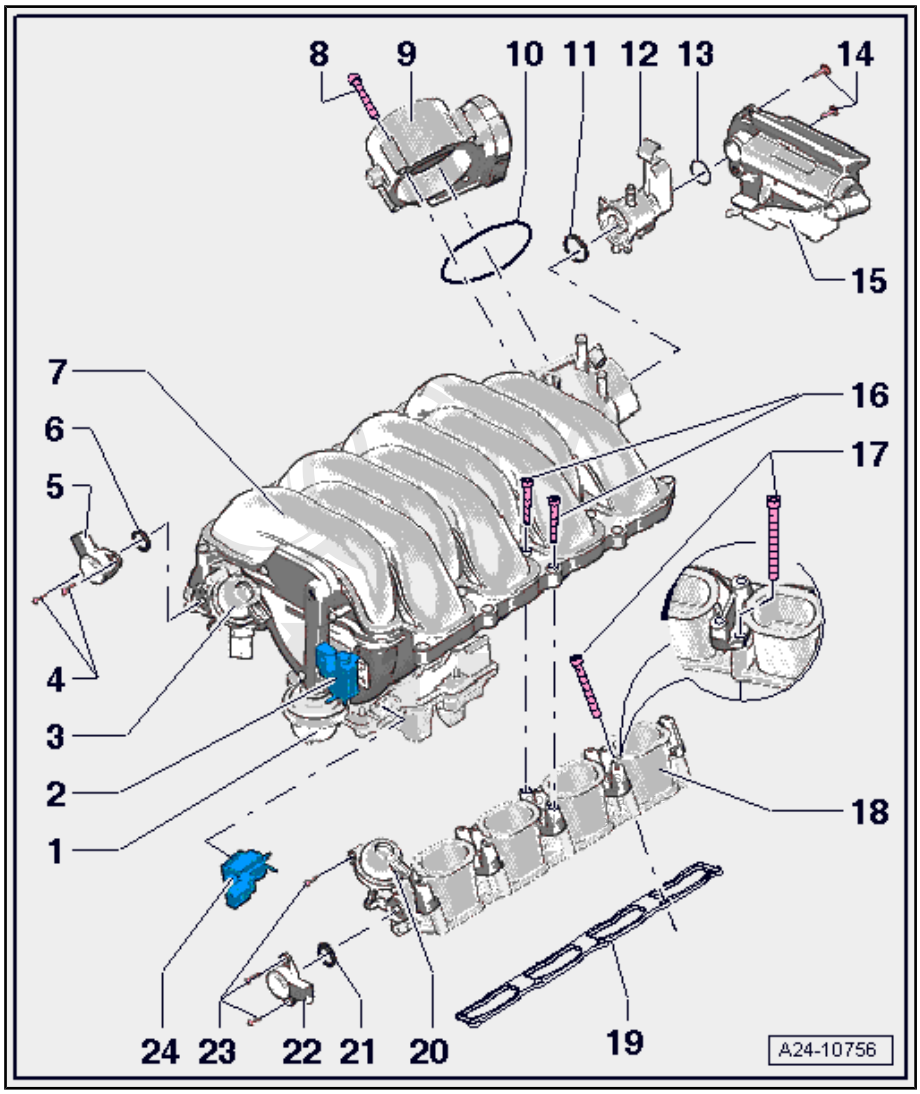
– Install intake manifold ⇒ page 24 .

2.7 Intake manifold (plastic - gradual introduction from model year 2009 onwards) - exploded view

From model year 2009 onwards, a plastic intake manifold is installed (a combination is possible in model year 2009).

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1 - Vacuum unit for intake manifold change-over

2 - Variable intake manifold change-over valve -N156-

3 - Vacuum unit for intake manifold flaps (cylinder bank 1)

- ❑ For CVTS tumble flaps (cylinder bank 1)

4 - Bolt

- ❑ 2.5 Nm

5 - Intake manifold flap potentiometer -G336-

- ❑ Cylinder bank 1
- ❑ After renewing, perform “Adaption” in “Guided Functions”, vehicle diagnostic, testing and information system -VAS 5051B- .

6 - Seal

- ❑ Renew if damaged
- ❑ Open side faces towards potentiometer

7 - Intake manifold

- ❑ Removing and installing ⇒ page 40

8 - Bolt

- ❑ 9 Nm

9 - Throttle valve module -J338-

- ❑ After renewing, perform “Adaption” in “Guided Functions”, vehicle diagnostic, testing and information system -VAS 5051B- .

10 - O-ring

- ❑ Renew

11 - O-ring

- ❑ Renew

12 - Adapter for crankcase breather system

- ❑ Tighten to 2.5 Nm

13 - O-ring

- ❑ Renew

14 - Bolt

- ❑ 9 Nm

15 - Pressure control valve for crankcase breather system

16 - Bolts for intake manifold

- ❑ For tightening torque and tightening sequence, refer to ⇒ page 39

17 - Bolts for intake manifold (bottom section)

- ❑ For tightening torque and tightening sequence, refer to ⇒ page 39

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18 - Intake manifold (bottom section)

19 - Intake manifold gasket

- ❑ Renew

20 - Vacuum unit for intake manifold flaps (cylinder bank 2)

- ❑ For CVTS tumble flaps (cylinder bank 2)

21 - Seal

- ❑ Renew if damaged
- ❑ Open side faces towards potentiometer

22 - Intake manifold flap potentiometer 2 -G512-

- ❑ Cylinder bank 2
- ❑ After renewing, perform “Adaption” in “Guided Functions”, vehicle diagnostic, testing and information system -VAS 5051B- .

23 - Bolt

- ❑ 2.5 Nm

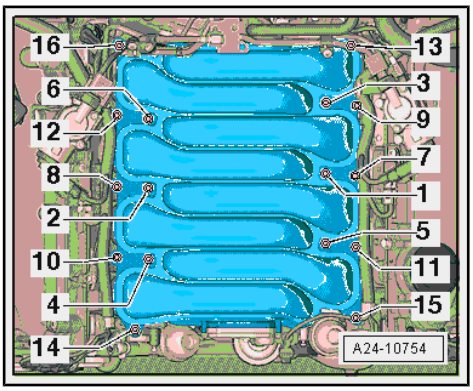
24 - Intake manifold flap valve -N316-

Tightening torque and tightening sequence for intake manifold

– Tighten bolts for intake manifold in the sequence -1 to 16-.

♦ Tighten initially to 8 Nm

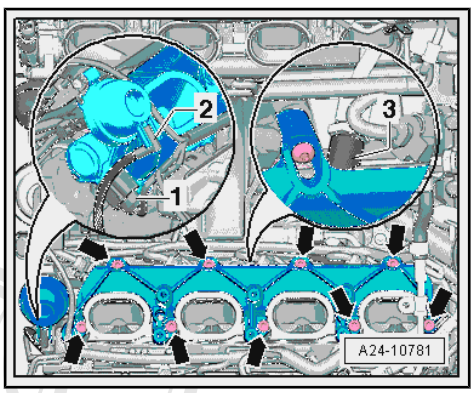
♦ Subsequently tighten to 11 Nm



Intake manifold (bottom section) - tightening torque

– Tighten bolts -arrows- for intake manifold (bottom section) in diagonal sequence and in stages.

• 10 Nm



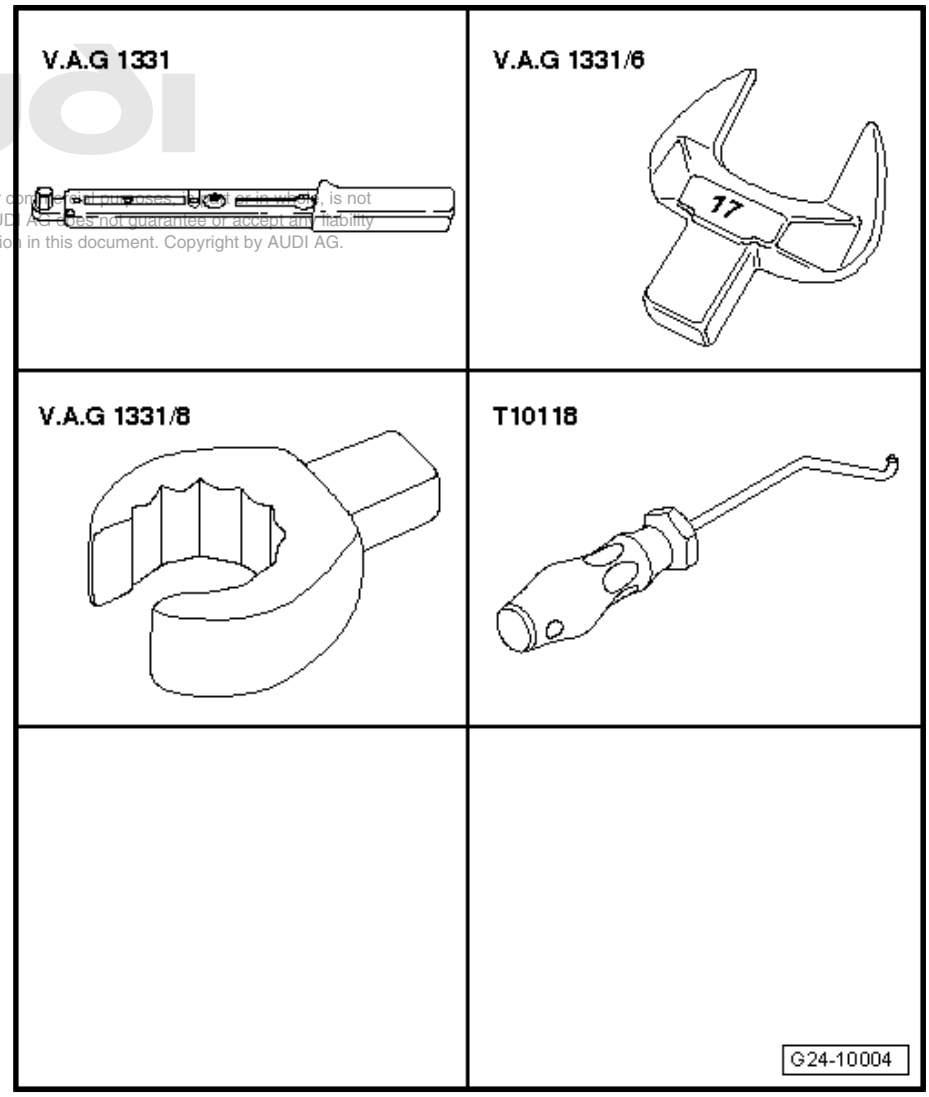
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2.7.1 Removing and installing intake manifold

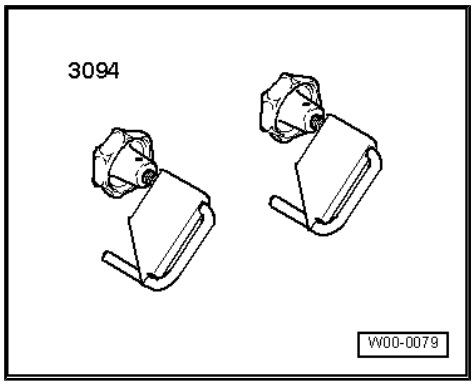
Special tools and workshop equipment required

- Torque wrench -V.A.G 1331-
- Tool insert AF 17 -V.A.G 1331/6-
- Socket insert AF 14, flared ring spanner -V.A.G 1331/8-
- Assembly tool -T10118-



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- Hose clamps for hoses up to 25 mm -3094-



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Removing

WARNING

- *The fuel system operates under high pressure. The pressure in the high-pressure part of the injection system must be reduced to a residual pressure prior to opening the system ⇒ page 3 .*
- *A clean cloth must then be wrapped around the connection and the residual pressure dissipated by carefully loosening the connection.*

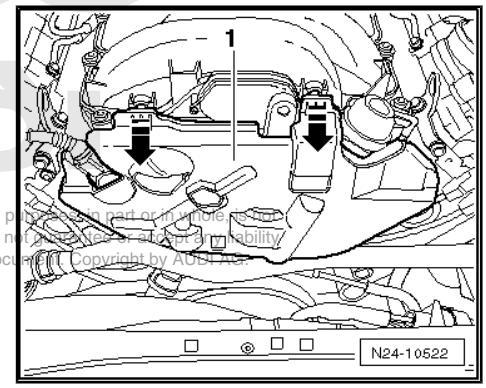
Note

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

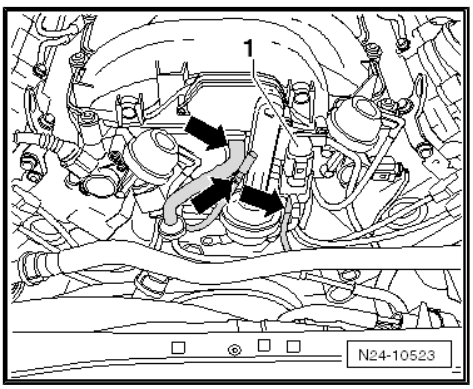
– Disconnect earth wire at battery with ignition switched off.

– Pull off engine cover panel.

– Pull cover -1- towards front and lift off.



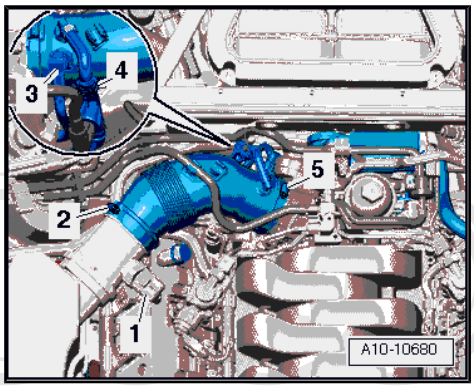
– Unplug electrical connector -1- and detach vacuum lines -arrows-.



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– Detach vacuum line -4- at air intake hose.



Note

Disregard -item 1-.

Rest-of-world vehicles:

– Disconnect hose -3- for crankcase breather system from air hose by pressing release tabs.

– Release hose clips -2- and -5- and remove air intake hose.

USA models:

– Release hose clips -2- and -5- and move air intake hose clear to one side (crankcase breather hose -3- remains connected).

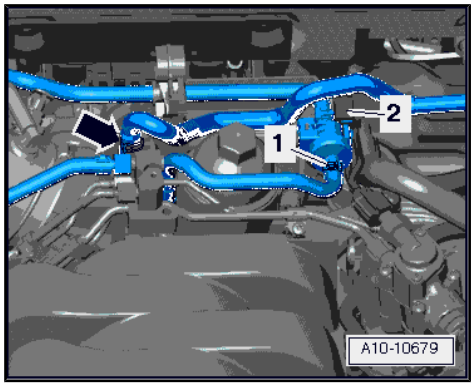
Caution

Do not open hose connection -3- on USA models.

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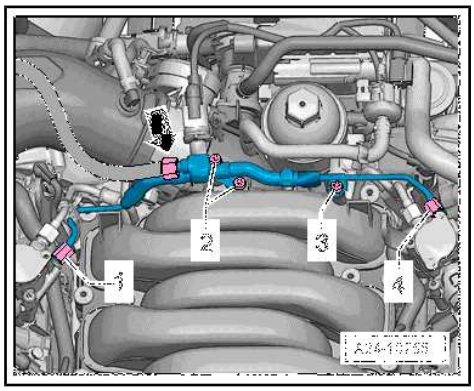
– Unplug electrical connector -2- at activated charcoal filter solenoid valve 1 -N80- and detach vacuum hose -1-.

– Detach activated charcoal filter solenoid valve 1 -N80- from bracket and move it clear to the side with hose still attached.



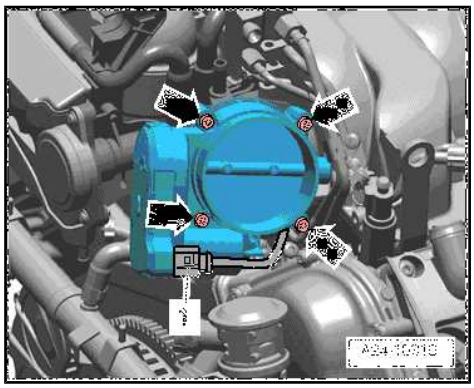
– Disconnect fuel lines -1 and 4- at high-pressure pumps.

– Remove bolts -2 and 3-.



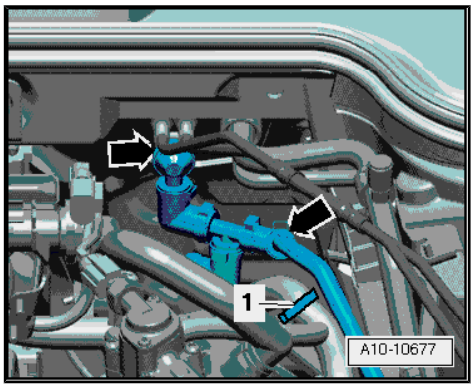
– Unplug electrical connector -1- at throttle valve module - J338- .

– Unscrew bolts -arrows- and remove throttle valve module - J338- .



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– Detach vacuum lines -arrows- going to brake servo.
– Move vacuum lines clear to one side.



Note

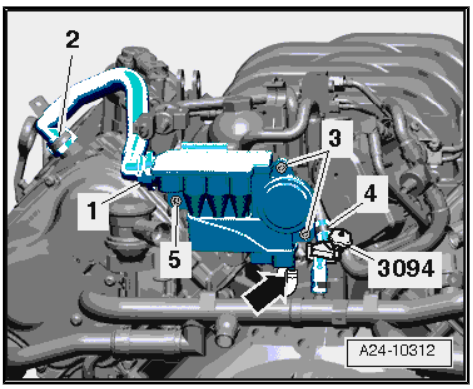
Disregard -item 1-.

WARNING

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

– Open filler cap on coolant expansion tank.

– Detach crankcase breather hose at the points marked with -item 1- and -item 2- (press release tabs).
– Clamp off coolant hose -4- using hose clamp -3094- and detach coolant hose from intake manifold connection.
– Slacken bolt -5- a few turns.
– Unscrew bolts -3- and carefully remove pressure control valve for crankcase breather system from intake manifold connection.



Note

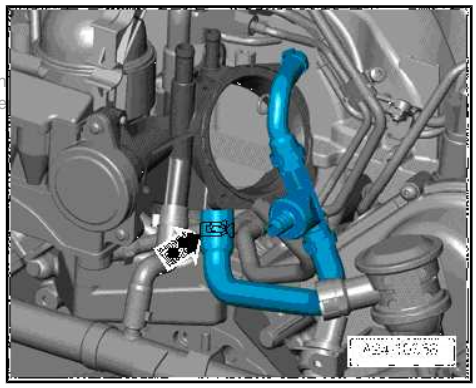
- *Disregard -arrow-.*
- *Shown from rear with engine removed for illustration purposes.*

Note

Lay a cloth under the intake manifold connection to catch escaping coolant.

– Detach coolant hose -arrow- and move clear to one side.

– Detach vacuum hose -arrow- going to intake manifold connection.

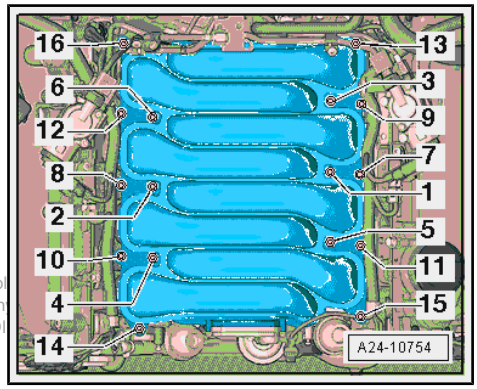


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– Remove bolts for intake manifold in the sequence -16 to 1-.

– Remove intake manifold from engine compartment.



Note

Seal intake ports on cylinder heads with clean cloths.

Installing

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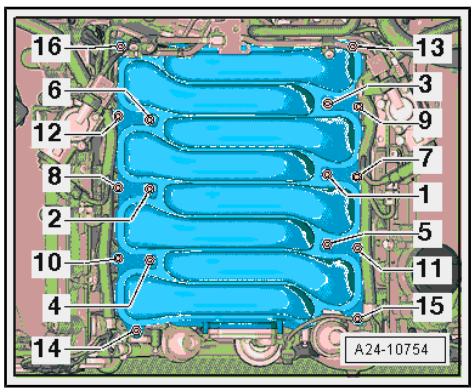
Note

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

– Check seals in intake manifold for damage and make sure they are positioned correctly.

– Make sure that hoses and wires are not trapped.

– Tighten bolts for intake manifold in the sequence -1 to 16-.



- Tightening torques: refer to exploded view of intake manifold ⇒ page 37 .
- Tightening torques: refer to exploded view of fuel rail with injectors ⇒ page 46 .

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

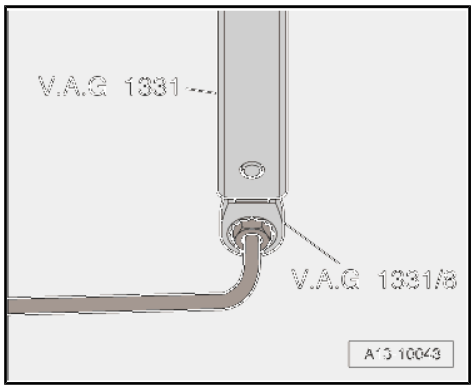
Note

- *The connections of the high-pressure pipes must not be damaged.*
- *Do not attempt to bend high-pressure pipes to a different shape.*

– Tighten union nuts on high-pressure pipes hand-tight initially.

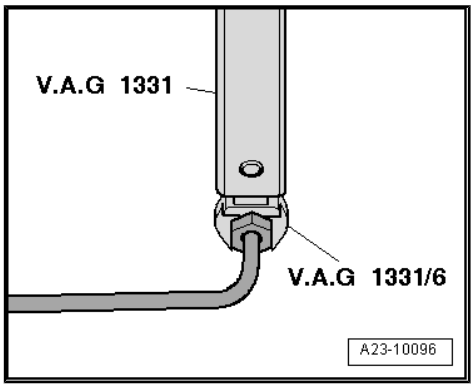
– Ensure that high-pressure pipes are not under tension.

– To tighten union nuts (14 mm) for high-pressure pipes, use torque wrench -V.A.G 1331- with socket insert AF 14, flared ring spanner -V.A.G 1331/8- .



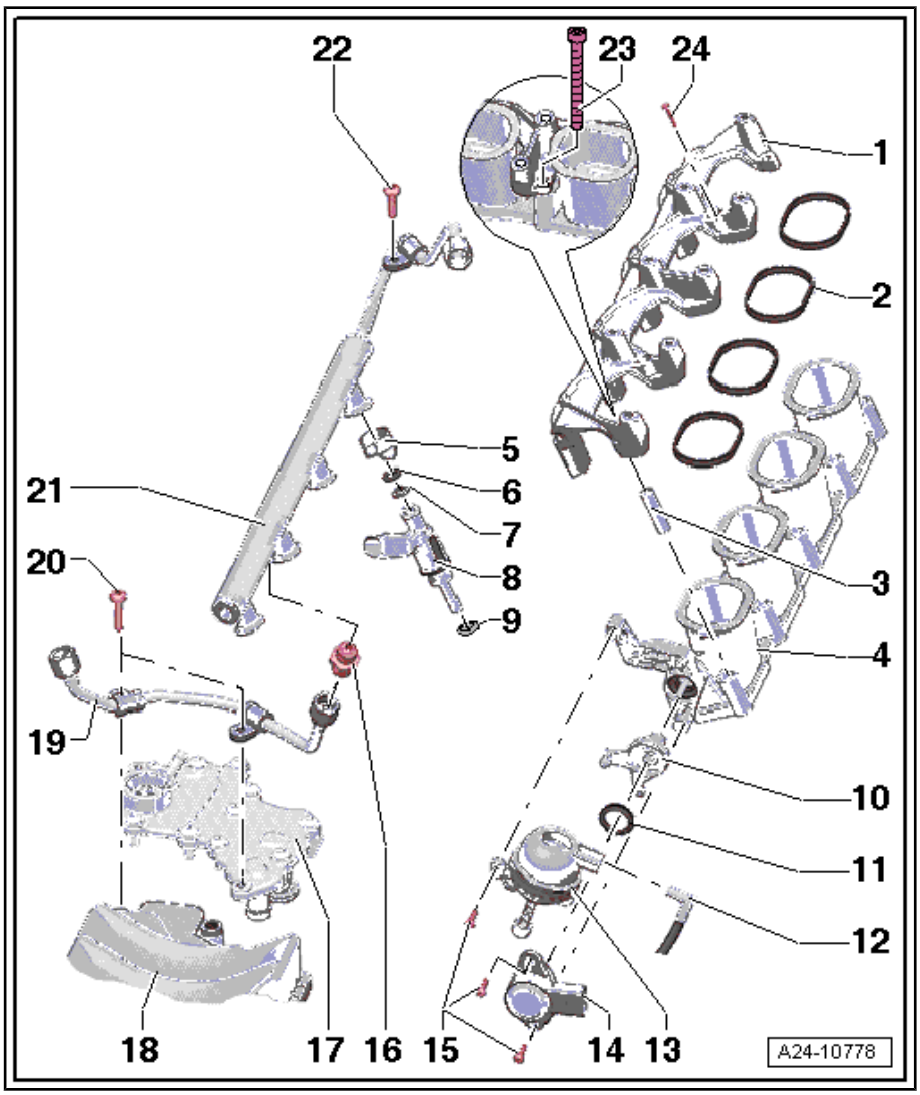
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– To tighten union nuts (17 mm) for high-pressure pipes, use torque wrench -V.A.G 1331- with tool insert (17 mm) -V.A.G 1331/6- .
– Do not install mounting brackets until high-pressure pipes have been finally secured.
– Observe notes on procedures required after connecting battery ⇒ Rep. Gr. 27 .
– If necessary, fill up with coolant ⇒ Rep. Gr. 19 .



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2.7.2 Intake manifold (bottom section) with fuel rail - exploded view



1 - Bracket
- ❑ For flange and fuel rail

2 - Seal
- ❑ Renew

3 - Sleeve

4 - Intake manifold (bottom section)
- ❑ When installing intake manifold (bottom section), intake manifold flaps must be in output position (intake channel fully open)
- ❑ Removing and installing ⇒ page 47
- ❑ 9 Nm

5 - Support ring
- ❑ Renew if damaged
- ❑ When installing, make sure it is seated correctly

6 - O-ring
- ❑ Renew
- ❑ Lubricate lightly with clean engine oil

7 - Spacer ring
- ❑ Renew if damaged

8 - Injector
- ❑ Removing and installing ⇒ page 50

9 - Combustion chamber ring seal
- ❑ Do not apply grease to ring seal or use any other lubricants
- ❑ Renew

10 - Operating lever
- ❑ For vacuum unit

11 - Seal
- ❑ Renew if damaged

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- ❑ When renewing lever out with screwdriver
- ❑ Press in by hand

12 - Vacuum hose

- ❑ From intake manifold flap valve -N316-

13 - Vacuum unit for actuating intake manifold flaps

14 - Intake manifold flap potentiometer 2 -G512-

15 - Bolts

- ❑ 2.5 Nm

16 - Threaded connection

- ❑ 40 Nm

17 - Cover

- ❑ For spray nozzle valve and oil retention valve
- ❑ Removing and installing ⇒ Rep. Gr. 17

18 - Vacuum reservoir

19 - High-pressure fuel pipe

20 - Bolts

- ❑ 9 Nm

21 - Fuel rail

22 - Bolts

- ❑ 9 Nm

23 - Bolts

- ❑ 9 Nm

24 - Bolts

- ❑ 0.3 Nm

2.7.3 Injectors and fuel rail - exploded view

Note

The illustration shows the fuel rail (right-side) for cylinder bank 1.

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1 - Bolts

- ❑ 0.3 Nm

2 - Bracket

- ❑ For flange and fuel rail

3 - Radial compensation element

- ❑ Renew if damaged
- ❑ Clip onto support ring ⇒ Item 8 (page 47)

4 - O-ring

- ❑ Renew
- ❑ Lubricate lightly with clean engine oil

5 - Spacer ring

- ❑ Renew if damaged

6 - Injector

- ❑ Removing and installing ⇒ page 50

7 - Combustion chamber ring seal

- ❑ Do not apply grease to ring seal or use any other lubricants
- ❑ Renewing ⇒ page 50

8 - Support ring

- ❑ Renew
- ❑ Via this support ring, the fuel rail exerts the clamping force that holds the injector in the cylinder head

9 - Fuel rail

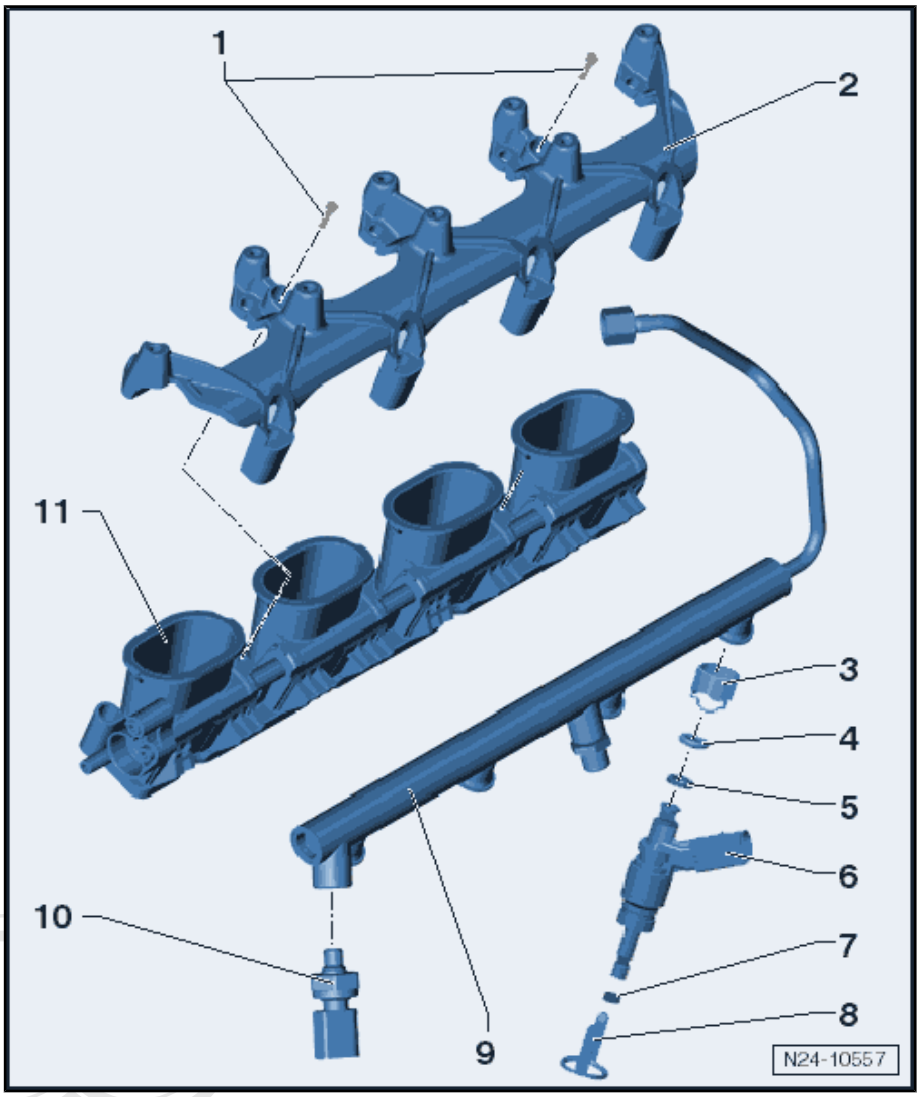
- ❑ Removing and installing ⇒ page 50

10 - Fuel pressure sender -G247-

- ❑ 25 Nm
- ❑ Lubricate threads lightly with clean oil

11 - Intake manifold (bottom section)

- ❑ Removing and installing ⇒ page 47
- ❑ 9 Nm



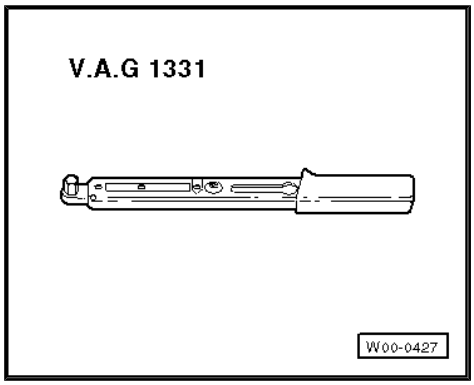
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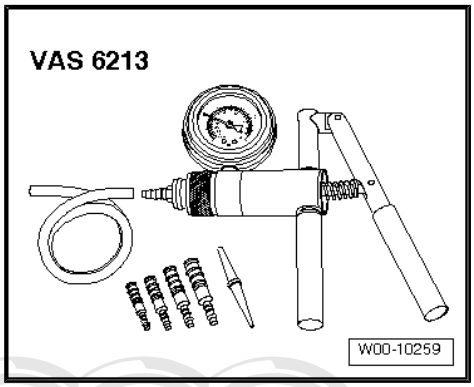
2.7.4 Removing and installing intake manifold (bottom section) with fuel rail

Special tools and workshop equipment required

- Torque wrench -V.A.G 1331-



- Tool insert (open-end ring spanner, 17 mm) -V.A.G 1331/2-
- Hand vacuum pump -VAS 6213-



Removing

Note

The following description shows the removal and installation of the bottom section of the intake manifold (left-side). The procedure for the other side is more or less identical.

WARNING

The fuel system operates at extremely high pressure. This can cause injury.

- ***The fuel pressure in the high-pressure section of the injection system must be reduced to a residual pressure prior to opening the system ⇒ page 3 .***

– Reduce fuel pressure in high-pressure section of injection system ⇒ page 3 .

– Detach vacuum hose from vacuum unit for intake manifold flaps.

– Unscrew union nut for high-pressure fuel pipe at high-pressure pump (counterhold threaded connection).

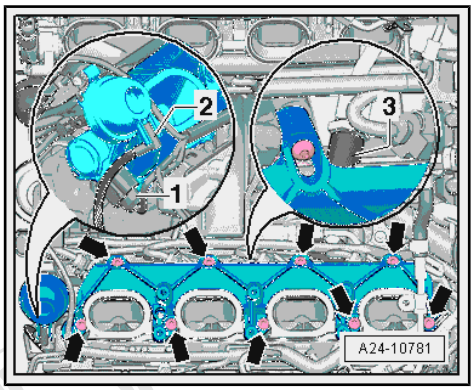
– Unplug electrical connector -1- at intake manifold flap potentiometer and pull off vacuum hose -2-.

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– Unscrew union nut -3- (counterhold threaded connection).

– Remove bolts -arrows- and detach intake manifold (bottom section) with fuel rail.



Caution

Risk of damage to engine.

- ***Block off the intake ports with clean cloths to prevent small objects from dropping into the engine through the intake ports in the cylinder heads.***

Installing

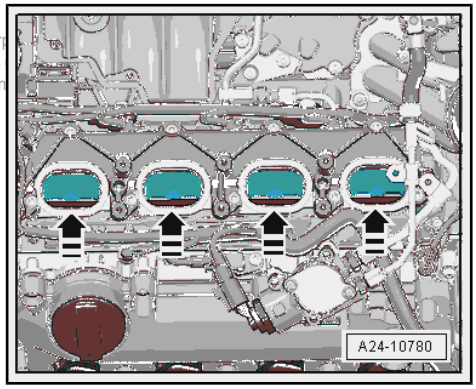
Installation is carried out in the reverse order; note the following:

Note

- *Renew gaskets and O-rings.*
- *Lubricate O-rings of injectors lightly with clean engine oil.*

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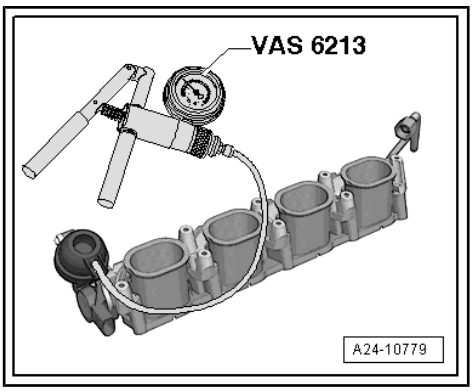
When installing intake manifold (bottom section) move intake manifold flaps in direction of -arrow-.



– Connect hand vacuum pump -VAS 6213- to connection for vacuum unit for intake manifold flaps, as shown in illustration.

– Use hand vacuum pump to generate vacuum.

• This will cause the intake manifold flaps to open.



Note

If the intake manifold flaps are not opened, they can catch on the guide plates in the cylinder head when the intake manifold (bottom section) is installed.

– Then press intake manifold (bottom section) evenly onto injectors.

– Tighten bolts for intake manifold (bottom section) in diagonal sequence to specified torque.

• Tightening torque: refer to intake manifold - exploded view ⇒ page 37

– Detach hand vacuum pump from connection for vacuum unit for intake manifold flaps.

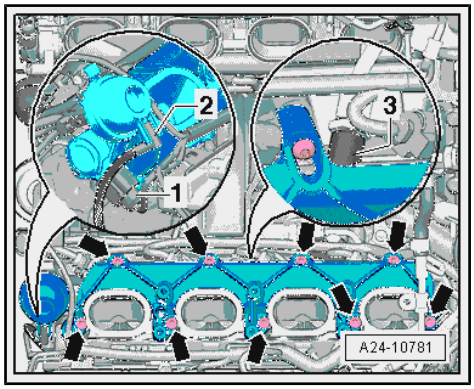
– Tighten union nut for high-pressure fuel pipe at high-pressure pump (counterhold threaded connection).

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– Tighten union nut -3- (counterhold threaded connection).

- Tightening torque: refer to high-pressure pump - exploded view ⇒ page 61 .

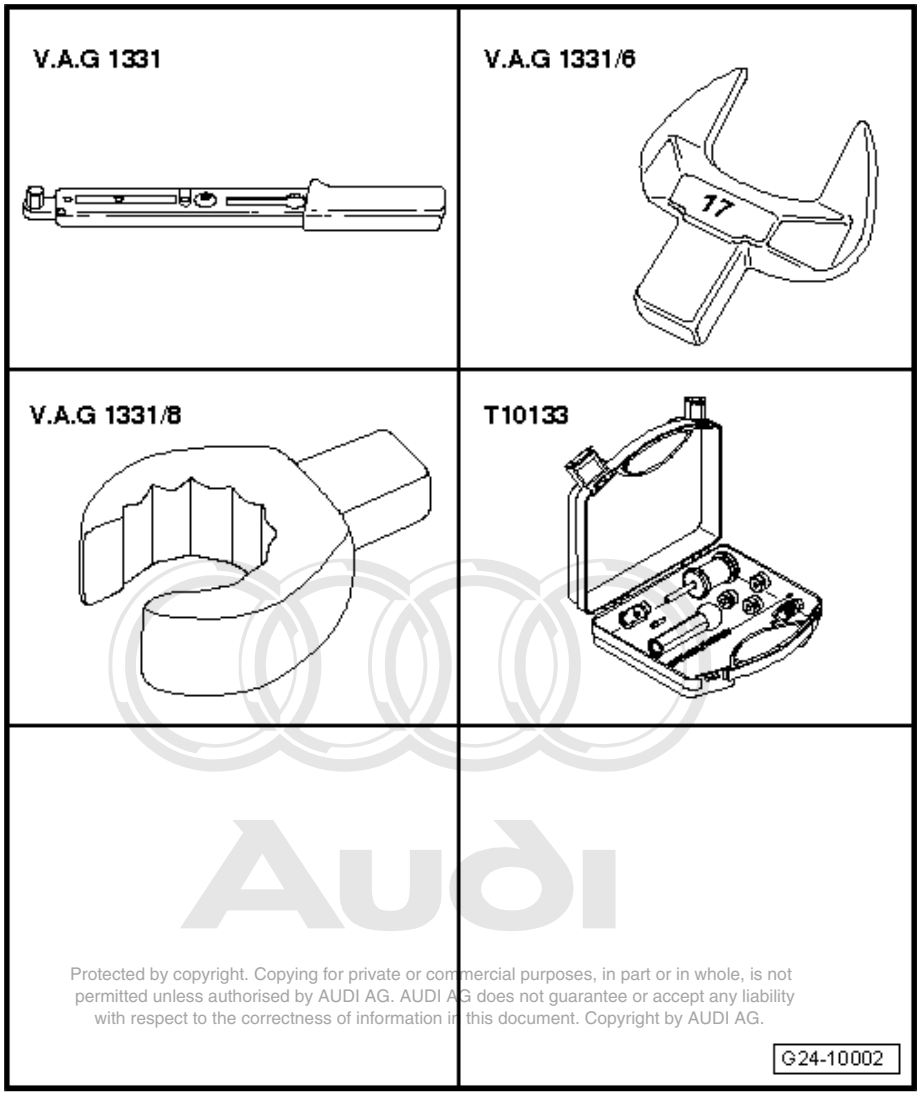
– Ensure that high-pressure pipe is not under tension.



2.7.5 Removing and installing injectors

Special tools and workshop equipment required

- Torque wrench -V.A.G 1331-
- Tool insert AF 17 -V.A.G 1331/6-
- Socket insert AF 14, flared ring spanner -V.A.G 1331/8-
- Tool set for FSI engines -T10133-



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Removing

Note

The following description is for removing and installing the injectors on the left side (cylinder bank 2).

WARNING

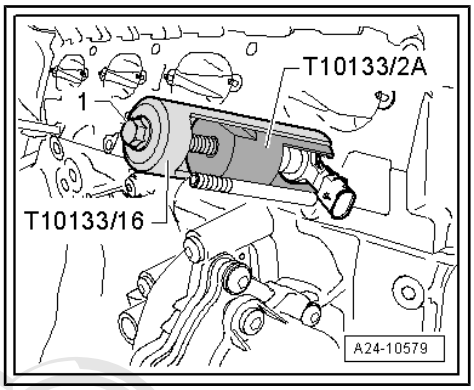
- *The fuel system operates under high pressure. The pressure in the high-pressure part of the injection system must be reduced to a residual pressure prior to opening the system ⇒ page 3 .*
- *A clean cloth must then be wrapped around the connection and the residual pressure dissipated by carefully loosening the connection.*

– Remove intake manifold ⇒ page 40 .

– Remove intake manifold (bottom section) on relevant side ⇒ page 47 .

– Guide puller -T10133/2A- into groove on injector.

– Then attach removal tool -T10133/16- and pull out injector by turning bolt -1-.

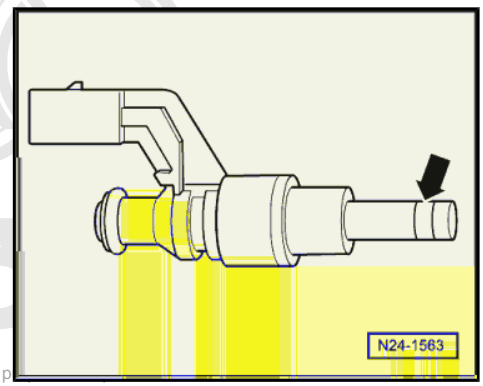


Note

When inserting the puller, there is a risk of destroying the radial compensation element due to the retainer tabs breaking.

– Carefully remove old combustion chamber ring seal -arrow-. To do so, cut open ring using knife or prise open ring with small screwdriver and then pull off forwards.

– Take care not to damage groove on injector. The injector must be renewed if the groove is damaged.



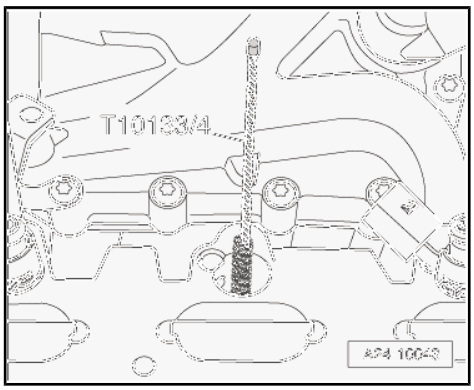
Installing

Note

- *Renew combustion chamber ring seal and O-ring.*
- *Renew spacer ring if damaged.*
- *Lightly lubricate O-rings for injectors with clean engine oil.*
- *The injectors must be re-installed on the same cylinders.*

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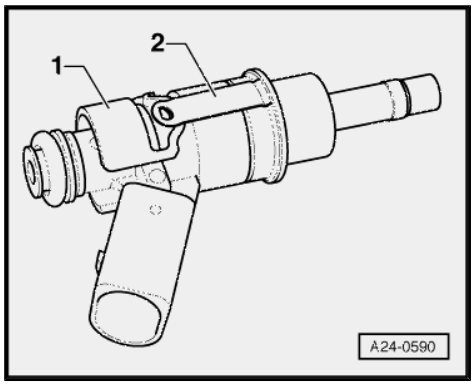
– Clean bore in cylinder head with nylon cylinder brush - T10133/4- .



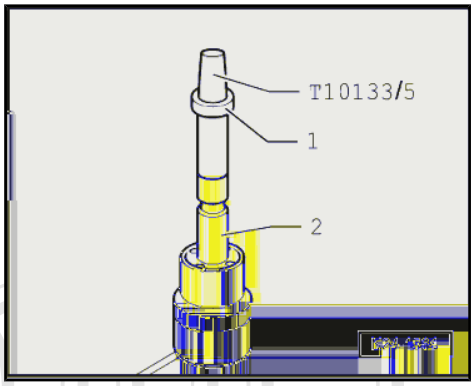
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– Clip radial compensation element -1- into support ring -2-.

– When re-installing an injector, clean any combustion residue off groove for combustion chamber ring seal and injector stem with a clean cloth.

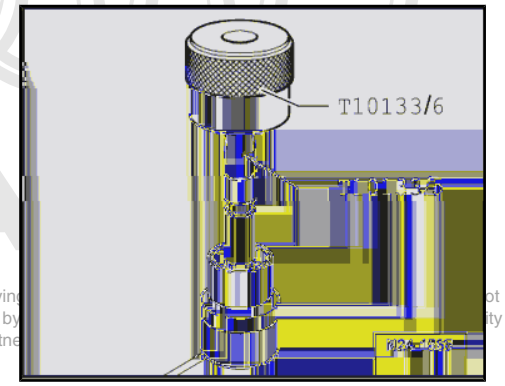


– Fit assembly cone -T10133/5- with new combustion chamber ring seal -1- onto injector -2-.



– Push combustion chamber ring seal onto assembly cone -T10133/5- as far as it will go using assembly sleeve -T10133/6- .

– Turn assembly sleeve -T10133/6- upside down and push combustion chamber ring seal into sealing ring groove.



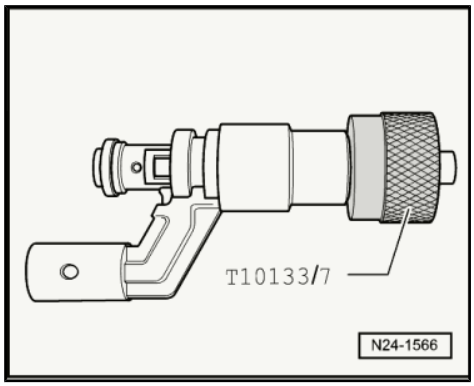
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Note

The combustion chamber ring seal is widened when it is pushed onto the injector. After pushing it on, it therefore has to be compressed again. This is done in two stages, as described below.

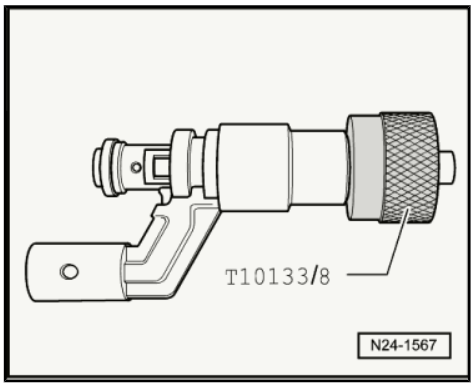
– Push calibration sleeve -T10133/7- onto injector as far as it will go and simultaneously turn it slightly (approx. 180°).

– Pull calibration sleeve -T10133/7- off again by turning it in the opposite direction.



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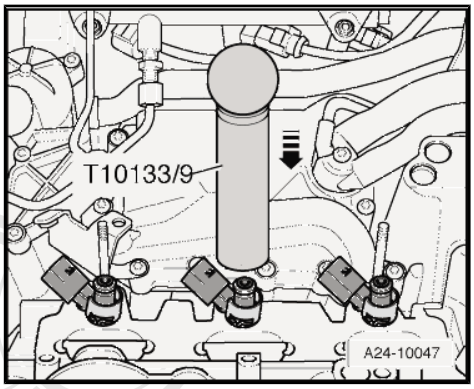
– Push calibration sleeve -T10133/8- onto injector as far as it will go and simultaneously turn it slightly (approx. 180°).
– Pull calibration sleeve -T10133/8- off again by turning it in the opposite direction.



Note

The combustion chamber ring seal must not be lubricated.

– Use assembly tool -T10133/9- to push injector as far as it will go into hole in cylinder head.



Note

It should be possible to insert the injector easily. If necessary wait until the combustion chamber ring seal has contracted sufficiently.

– Make sure injector is in correct installation position in cylinder head:
- Electrical connector of injector must engage in recess in cylinder head.
- Coat O-rings of injectors with clean engine oil to facilitate insertion into fuel rail.
- Renew all seals.

Perform further installation in reverse order, paying attention to the following:

- Tightening torque: Intake manifold - exploded view ⇒ page 37

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Note

♦ *The connections of the high-pressure pipes must not be damaged.*

♦ *Do not attempt to bend high-pressure pipes to a different shape.*

– Do not install mounting brackets until high-pressure pipes have been finally secured.
– Install relevant bottom section of intake manifold ⇒ page 47 .
– Install intake manifold ⇒ page 40 .

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2.7.6 Connection diagram for vacuum hoses at intake manifold (plastic)

1 - Vacuum hose with non-return valve

2 - Vacuum unit for intake manifold flap

- ❑ For cylinder bank 1
- ❑ Check with hand vacuum pump -VAS 6213-

3 - Vacuum unit for intake manifold flap 2

- ❑ For cylinder bank 2
- ❑ Check with hand vacuum pump -VAS 6213-

4 - Variable intake manifold change-over valve -N156-

5 - Vacuum unit for intake manifold change-over

- ❑ Check with hand vacuum pump -VAS 6213-

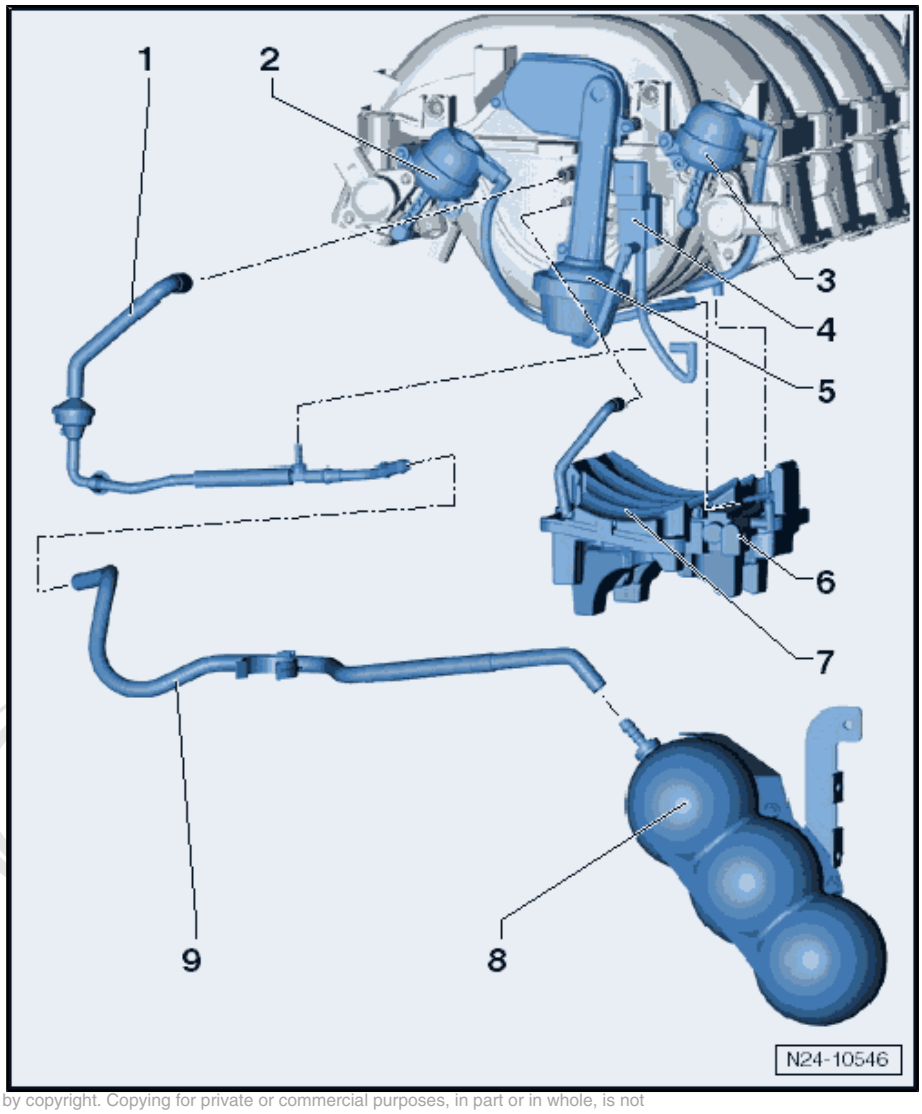
6 - Intake manifold flap valve -N316-

- ❑ Take out intake manifold for removal and installation

7 - Vacuum reservoir

- ❑ Fitting location: beneath intake manifold
- ❑ Take out intake manifold for removal and installation

8 - Vacuum reservoir



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2.8 Removing and installing fuel pressure sender -G247-

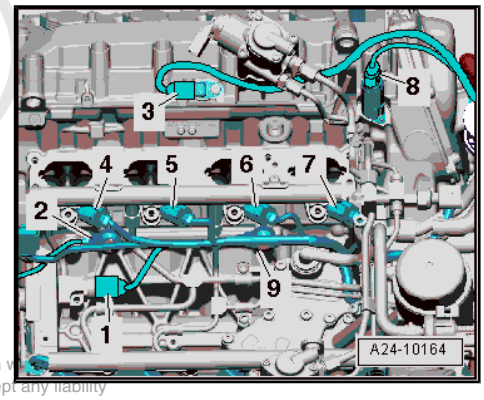
Removing

– Remove intake manifold.

– Loosen union nut securing high-pressure pipe to fuel rail.

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– Unscrew bolt from fuel pressure sender -G247- -1-.



Note

Fitting location may differ on vehicles from model year 2009.

– Detach fuel pressure sender -G247- with high-pressure pipe.

Note

Do not attempt to bend high-pressure pipes to a different shape.

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Installing

– Tighten fuel pressure sender -G247- .

Note

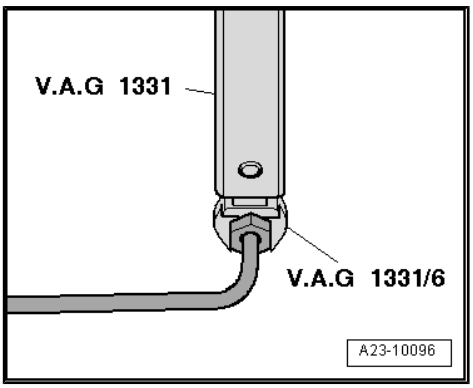
- *The connections -arrows- of the high-pressure pipe must not be damaged.*
- *Do not attempt to bend high-pressure pipe to a different shape.*

– Tighten union nut on high-pressure pipe hand-tight initially.

– Ensure that high-pressure pipe is not under tension.

- Tightening torque: refer to overview of fitting locations ⇒ page 6 .

– To tighten union nut (17 mm) for high-pressure pipe, use torque wrench -V.A.G 1331- with tool insert (17 mm) -V.A.G 1331/6- .



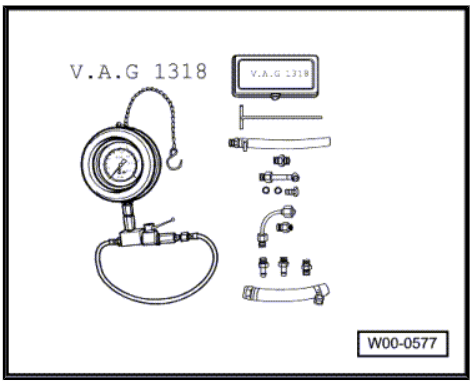
The remaining installation steps are carried out in the reverse sequence.

– Install intake manifold.

2.9 Checking fuel pressure and residual pressure (up to high-pressure pump)

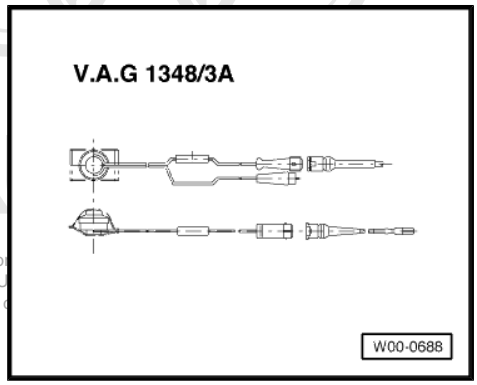
Special tools and workshop equipment required

- K-Jetronic pressure tester -V.A.G 1318-



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- Adapter set -V.A.G 1318/10-12-
- Auxiliary measuring set -V.A.G 1594C-
- Remote control -V.A.G 1348/3A- for V.A.G 1348 with adapter cable -V.A.G 1348/3-3-



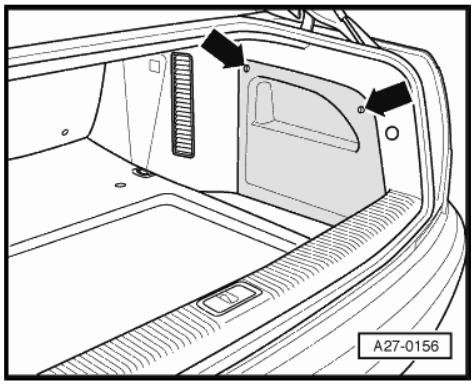
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- Fuel-resistant measuring container
- Protective gloves

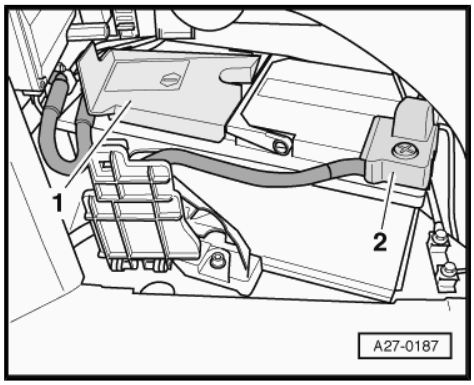
Checking fuel pressure:

- Battery voltage at least 12.5 V
- Fuel filter OK
- Fuel tank at least $^1/_4$ full.
- Fuel pump control unit -J538- OK
- Ignition off.

– Remove luggage compartment side trim cover (right-side) -arrows-.



– Remove cover -2- over battery.

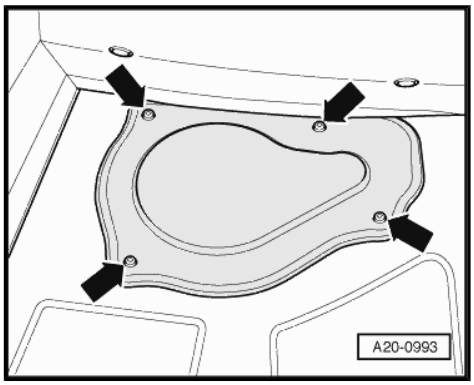


Note

Disregard -item 1-.

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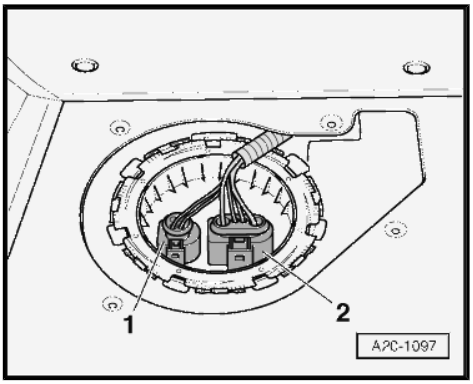
– Remove lining for luggage compartment floor.
– Detach cover for flange (left-side) -arrows-.



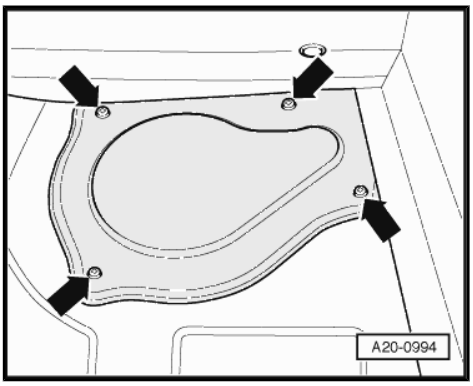
– Unplug electrical connector -2- on flange (left-side).

Note

Disregard -item 1-.



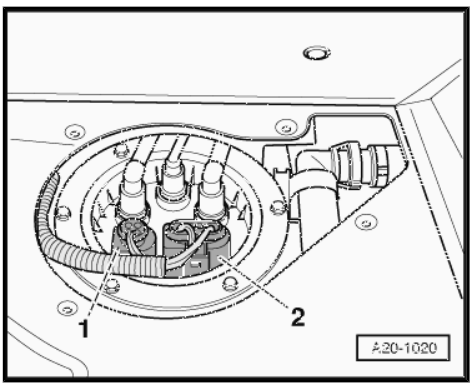
– Unscrew cover for flange (right-side) -arrows-.



– Unplug electrical connector -2- on flange (right-side).

Note

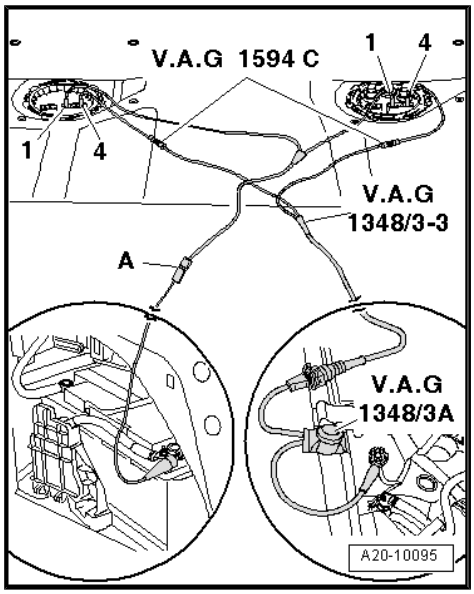
Disregard -item 1-.



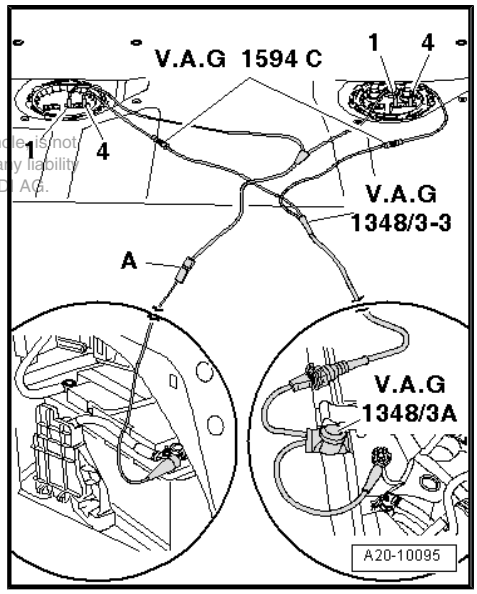
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– Connect remote control -V.A.G 1348/3A- for V.A.G 1348 with adapter cable -V.A.G 1348/3-3- to contact -4- (earth) of fuel delivery unit (left-side) and fuel delivery unit (right-side) using test leads from auxiliary measuring set -V.A.G 1594C- .
– Move switch of remote control -V.A.G 1348/3A- for V.A.G 1348 to front of engine compartment.
– Connect crocodile clip to earth point in engine compartment.

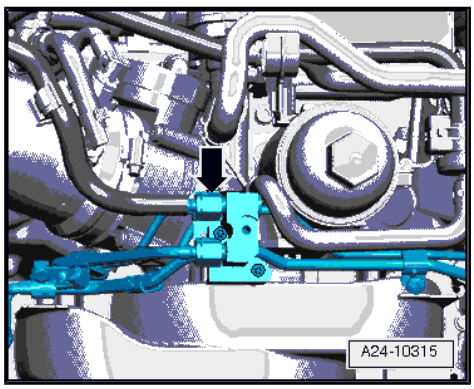


– Connect contact -1- (positive) of fuel delivery unit (left-side) and fuel delivery unit (right-side) to vehicle battery “+” via an improvised test lead. For safety reasons an in-line fuse -A- (10 A) must be connected into the lead.
– Remove filler cap from fuel filler neck.
– Pull off engine cover panel (rear) -arrows-.



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Disconnecting fuel supply pipe -arrow- from connecting piece (engines with magnesium intake manifolds)

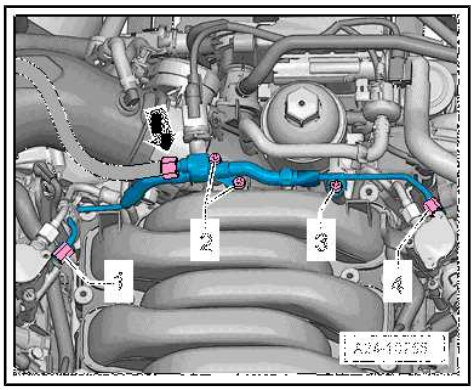


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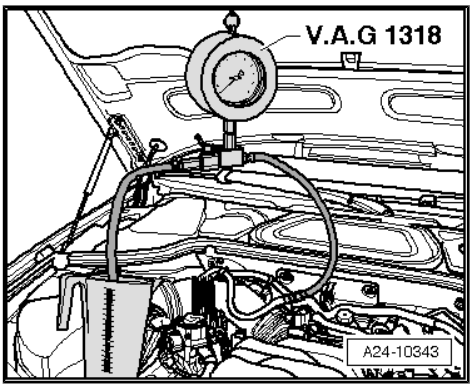
Disconnecting fuel supply pipe -arrow- from connecting piece (engines with plastic intake manifolds)

WARNING

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



- Connect K-Jetronic pressure tester -V.A.G 1318- with adapter from adapter set -V.A.G 1318/10-12- to fuel line.
- Fit auxiliary hose to K-Jetronic pressure tester -V.A.G 1318- and hold it in a container.
- Open cut-off valve on pressure tester.
- Lever points in direction of flow.
- Bleed fuel system by pressing remote control switch briefly.



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– Close cut-off valve on pressure gauge.

• Lever is at right angle to direction of flow -arrow-.

– Press switch on remote control until pressure gauge shows no further increase in pressure.

• Specification: approx. 5.5 bar (4.5 ... 6.5 bar)

If specification is not obtained:

– Check fuel delivery rate of individual fuel pumps ⇒ Rep. Gr. 20 .

Checking residual pressure:

– Check for leaks and check residual pressure by watching drop in pressure on pressure tester.

• After 10 minutes pressure should still be at least 3 bar.

If the residual pressure drops below 3 bar:

♦ Check union between pressure gauge and fuel line for leaks.

♦ Test pressure gauge for leaks.

♦ Check fuel lines and their connections for leaks.

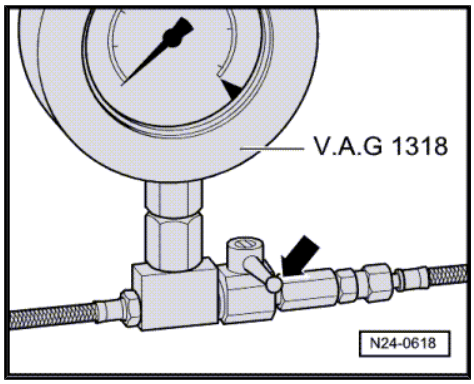
♦ Check fuel delivery rate of individual fuel pumps ⇒ Rep. Gr. 20 .

♦ Renew fuel filter with integral fuel pressure regulator ⇒ Rep. Gr. 20 .

♦ Non-return valve in one of the two fuel pumps is defective ⇒ Rep. Gr. 20 .

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

– Switch off ignition.



Note

Before removing pressure gauge, release fuel pressure by opening cut-off valve. Hold a container under the connection.

– Secure fuel supply pipe to connecting piece again.

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2.10 High-pressure pump - exploded view

1 - High-pressure pump

- ❑ Fuel metering valve - N290- is installed in high-pressure pump on right-side (cylinder bank 1).
- ❑ Fuel metering valve 2 - N402- is installed in high-pressure pump on left-side (cylinder bank 2).
- ❑ Removing and installing ⇒ page 63

2 - Bolt

- ❑ 9 Nm

3 - Seal

- ❑ Renew

4 - Screw plug

- ❑ 10 Nm
- ❑ On left high-pressure pump (cylinder bank 2), fuel pressure sender for low pressure -G410- is fitted at this location (up to model year 2009)

5 - High-pressure pipe

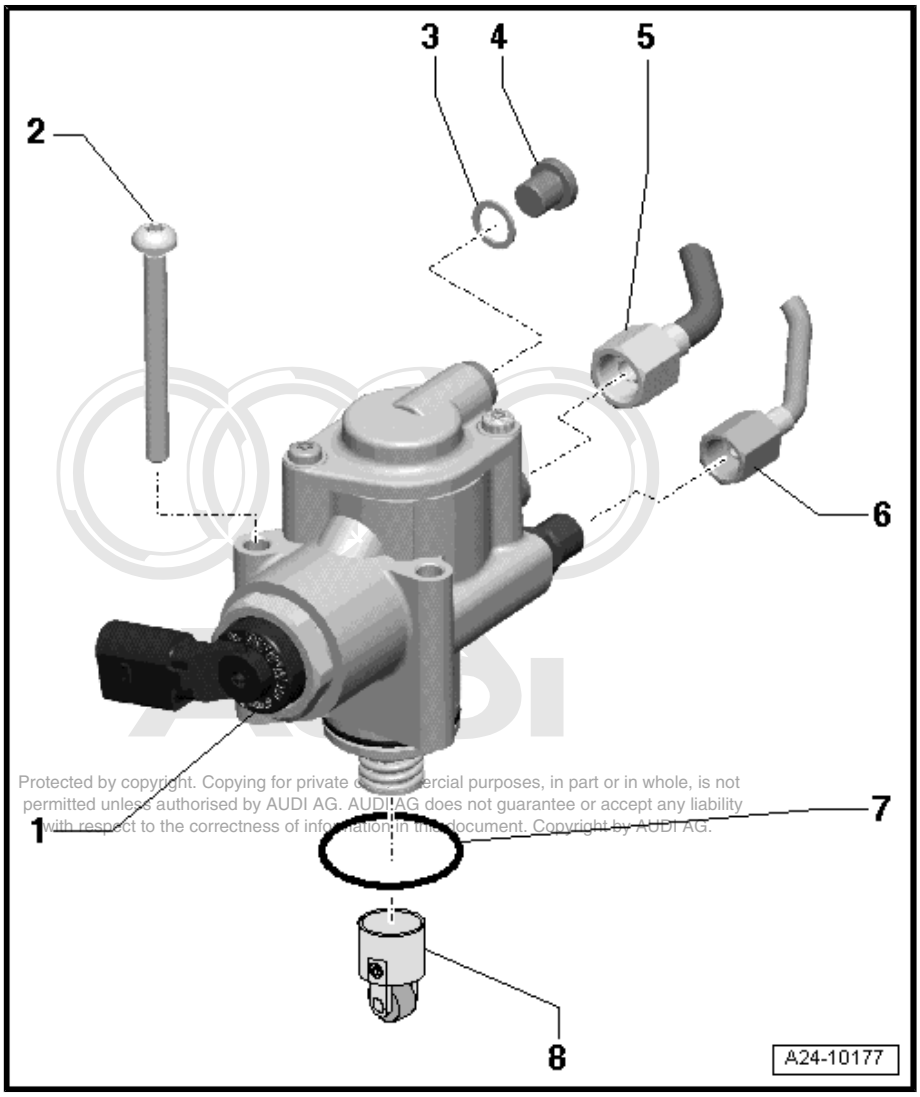
WARNING

The pressure in the high-pressure part of the injection system must be reduced to a residual pressure prior to opening the system ⇒ page 3 .

A clean cloth must then be wrapped around the connection and the residual pressure dissipated by carefully loosening the connection.

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

- ❑ Before loosening, first disconnect earth wire at battery with ignition switched off
- ❑ Connections must not be damaged
- ❑ Do not alter shape
- ❑ 25 Nm



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6 - Fuel supply pipe

WARNING

The pressure in the high-pressure part of the injection system must be reduced to a residual pressure prior to opening the system ⇒ page 3 .

A clean cloth must then be wrapped around the connection and the residual pressure dissipated by carefully loosening the connection.

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

- ❑ Before loosening, first disconnect earth wire at battery with ignition switched off
- ❑ Connections must not be damaged
- ❑ Do not alter shape
- ❑ 25 Nm

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7 - O-ring

- ❑ Renew

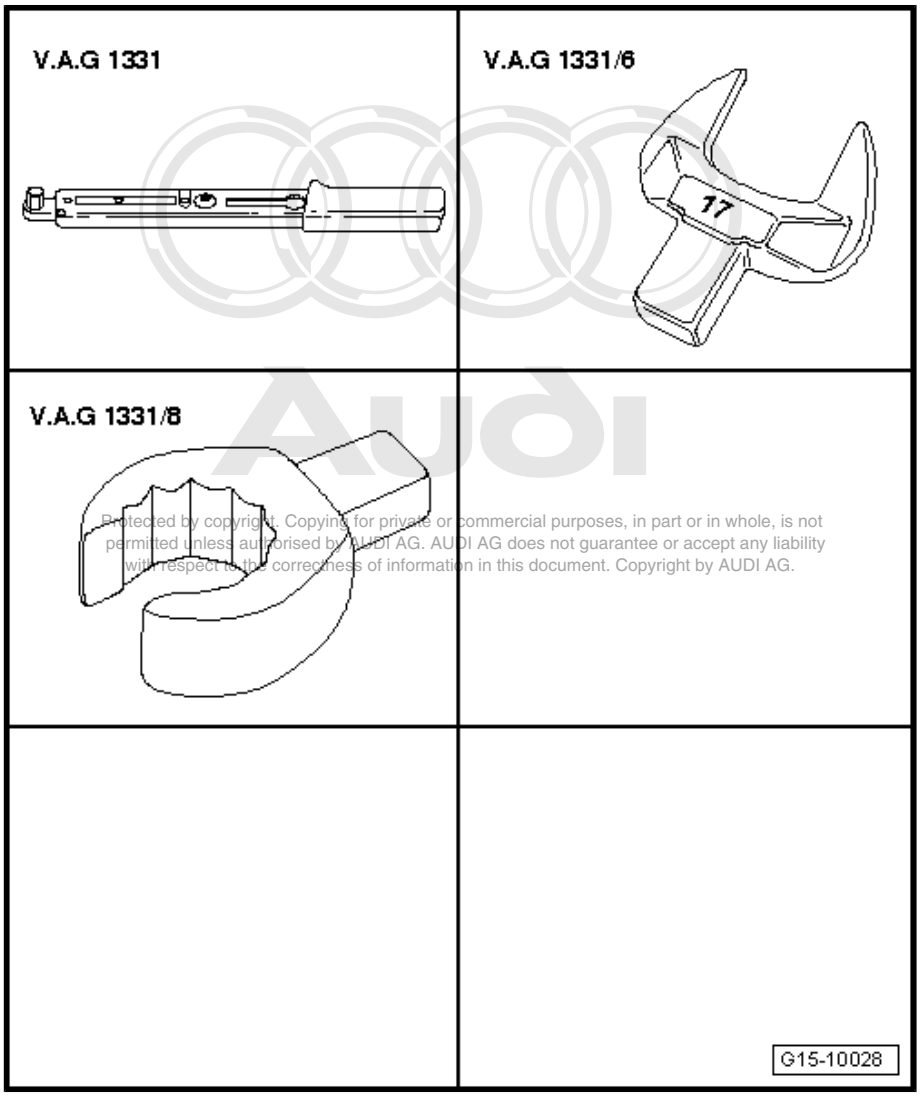
8 - Roller tappet

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2.11 Removing and installing high-pressure pump

Special tools and workshop equipment required

- Torque wrench -V.A.G 1331-
- Tool insert AF 17 -V.A.G 1331/6-
- Socket insert AF 14, flared ring spanner -V.A.G 1331/8-



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Removing

Note

The following description is for removing and installing the high-pressure pump on the left side.

WARNING

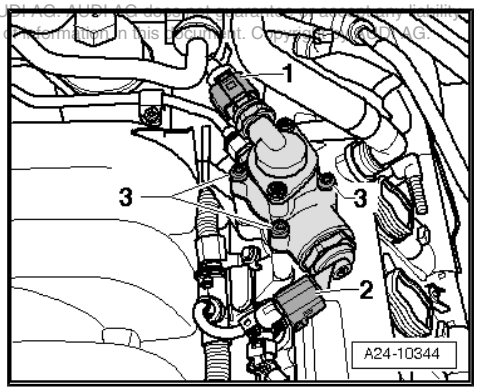
- *The fuel system operates under high pressure. The pressure in the high-pressure part of the injection system must be reduced to a residual pressure prior to opening the system ⇒ page 3 .*
- *A clean cloth must then be wrapped around the connection and the residual pressure dissipated by carefully loosening the connection.*
- *Observe notes on procedure for disconnecting the battery ⇒ Rep. Gr. 27 .*

– Disconnect earth wire at battery with ignition switched off.

– Pull off engine cover panel (rear).

– Unplug electrical connectors for fuel pressure sender for low pressure -G410- -1- and fuel metering valve 2 -N402- -2-.

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Note

Fitting location of fuel pressure sender for low pressure -G410- : in high-pressure pump only up to model year 2009.

– Detach both union nuts for fuel lines.

– Remove bolts -3-.

Note

Do not attempt to bend high-pressure pipes to a different shape.

– Carefully pull out high-pressure pump.

– Pull roller tappet out of cylinder head.

Installing

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

Note

Renew O-ring.

– Fit roller tappet in cylinder head.

– Only lift high-pressure pipes slightly to fit the high-pressure pump.

– Fit high-pressure pump in cylinder head and secure in position.

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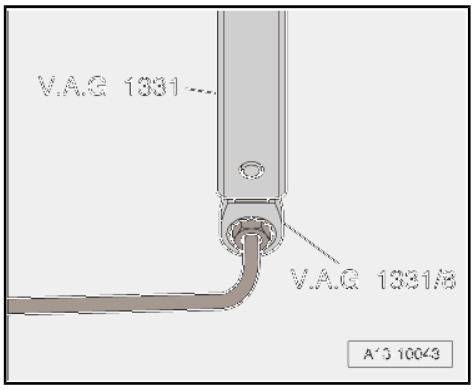
Note

- *The connections of the high-pressure pipes must not be damaged.*
- *Do not attempt to bend high-pressure pipes to a different shape.*

– Tighten union nuts on high-pressure pipes hand-tight initially.

– Ensure that high-pressure pipes are not under tension.

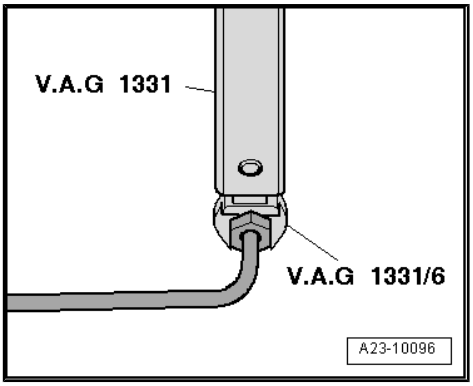
– To tighten union nut (14 mm) for high-pressure pipe, use torque wrench -V.A.G 1331- with socket insert AF 14, flared ring spanner -V.A.G 1331/8- .



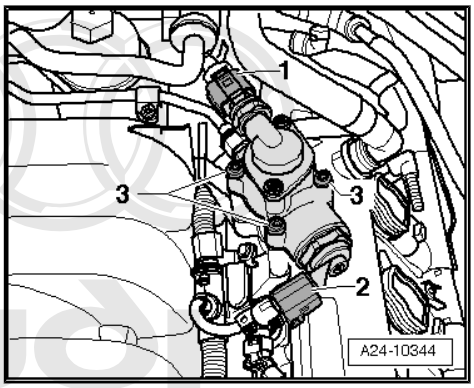
– To tighten union nut (17 mm) for high-pressure pipe, use torque wrench -V.A.G 1331- with tool insert (17 mm) -V.A.G 1331/6- .

– For tightening torques refer to exploded view of high-pressure pump ⇒ page 61 .

– Observe notes on procedures required after connecting battery ⇒ Rep. Gr. 27 .



– Reattach electrical connectors for fuel pressure sender for low pressure -G410- -1- and fuel metering valve 2 -N402- -2-.



Note

Check fuel system for leaks.

2.12 Lambda probes - overview

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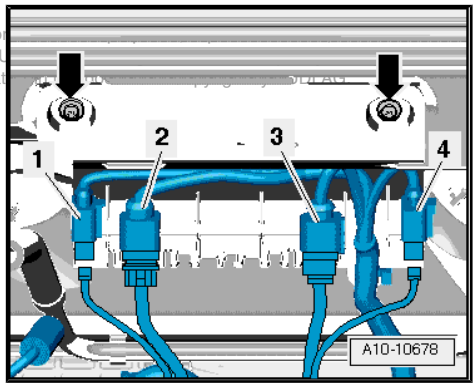
Connectors for Lambda probes

1 - To Lambda probe -G39-

2 - To Lambda probe after catalytic converter -G130-

3 - To Lambda probe 2 -G108-

4 - To Lambda probe 2 after catalytic converter -G131-



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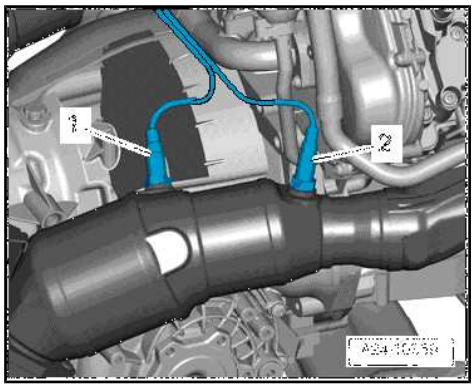
Lambda probes, cylinder bank 1 (right-side)

1 - Lambda probe after catalytic converter -G130-

2 - Lambda probe -G39-

Removing and installing ⇒ page 66

Tightening torque: 55 Nm



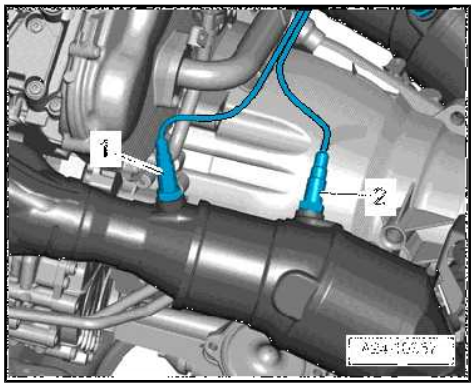
Lambda probes, cylinder bank 2 (left-side)

1 - Lambda probe 2 -G108-

2 - Lambda probe 2 after catalytic converter -G131-

Removing and installing ⇒ page 68

Tightening torque: 55 Nm



Note

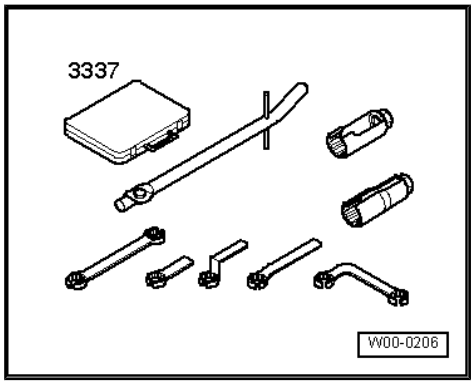
- *Threads of new Lambda probes are already coated with assembly paste; the paste must not get into the slots on the probe body.*
- *In the case of a used Lambda probe grease only the thread with high-temperature paste. The paste must not get into the slots on the probe body. High-temperature paste ⇒ Parts catalogue*
- *When installing, it is important to re-attach the Lambda probe wiring at the same locations to prevent it from coming into contact with the exhaust pipe.*

2.13 Removing and installing Lambda probe before catalytic converter -G39- and Lambda probe after catalytic converter -G130- (cylinder bank 1)

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Special tools and workshop equipment required

- Lambda probe open ring spanner set -3337-



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Removing

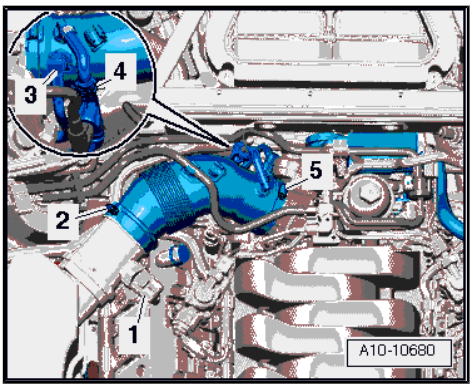
Note

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

– Pull off engine cover panel (rear).

– Move fuel line and line going to activated charcoal filter clear at air intake hose.

– Detach vacuum line -4- at air intake hose.



Rest-of-world vehicles:

– Disconnect hose -3- for crankcase breather system from air hose by pressing release tabs.

– Release hose clips -2- and -5- and remove air intake hose.

USA models:

– Release hose clips -2- and -5- and move air intake hose clear to one side (crankcase breather hose -3- remains connected).

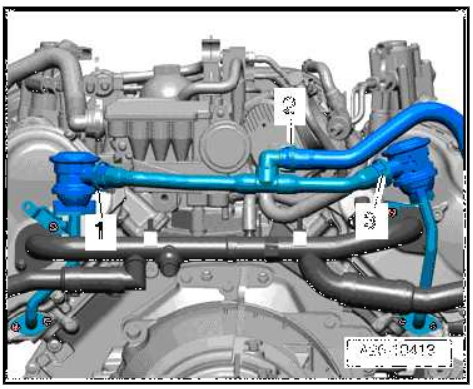
Caution

Do not open hose connection -3- on USA models.

Note

Disregard -item 1-.

– Detach air hose for secondary air system by pressing release tabs at ends of hose -1 ... 3-.



Note

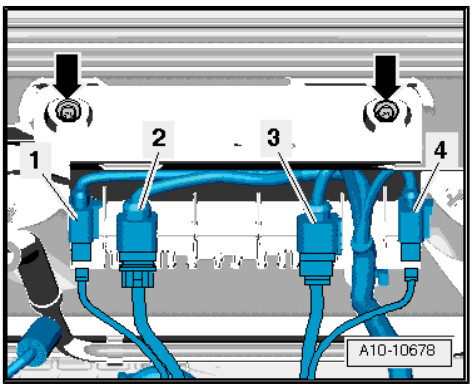
Shown from rear with engine removed for illustration purposes.

– Take corresponding electrical connector out of bracket and unplug it.

1 - To Lambda probe -G39-

2 - To Lambda probe after catalytic converter -G130-

– Move electrical wiring to Lambda probes clear.



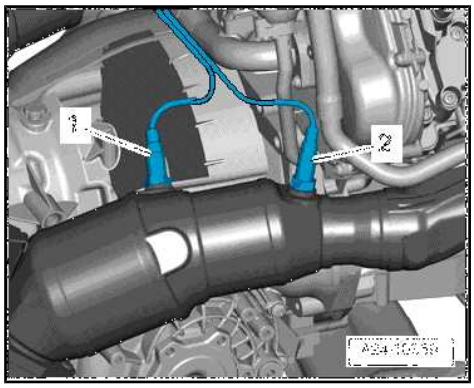
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Note

-Arrows- and -items marked 3 and 4- can be disregarded.

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– Unscrew Lambda probe -G39- -item 2- and Lambda probe after catalytic converter -G130- -item 1- using a tool from the Lambda probe open ring spanner set -3337- .



Installing

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

Note

- *Threads of new Lambda probes are already coated with assembly paste; the paste must not get into the slots on the probe body.*
- *In the case of a used Lambda probe grease only the thread with high-temperature paste. The paste must not get into the slots on the probe body. High-temperature paste ⇒ Parts catalogue*
- *When installing, the Lambda probe wire must always be reattached at the same locations to prevent it from coming into contact with the exhaust pipe.*
- *Fit all cable ties in the original positions when installing.*

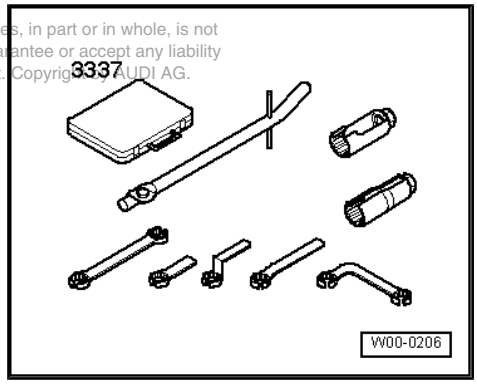
- Tightening torque: refer to exploded view of Lambda probes ⇒ page 65 .

2.14 Removing and installing Lambda probe 2 before catalytic converter -G108- and Lambda probe after catalytic converter -G131- (cylinder bank 2)

Special tools and workshop equipment required

- Lambda probe open ring spanner set -3337-

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Removing

Note

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

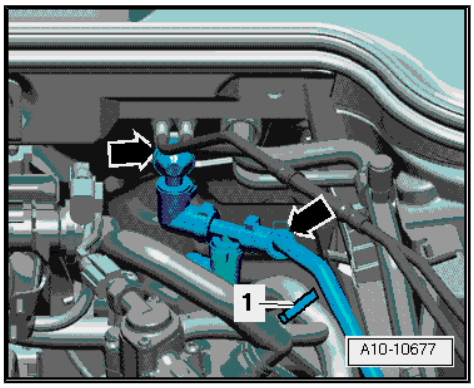
– Pull off engine cover panel (rear).

– Detach vacuum lines -arrows- going to brake servo.

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– Move vacuum lines clear to one side.

– Cut though cable tie -1- and move clear engine wiring harness at rear (pull wiring harness slightly to the right).

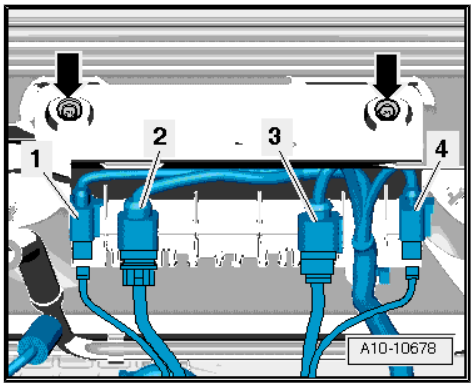


– Take corresponding electrical connector out of bracket and unplug it.

3 - To Lambda probe 2 -G108-

4 - To Lambda probe 2 after catalytic converter -G131-

– Move electrical wiring to Lambda probes clear.

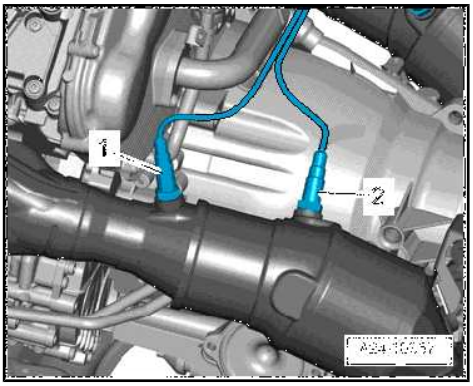


Note

-Arrows- and -items marked 1 and 2- can be disregarded.

– Unscrew Lambda probe 2 -G108- -item 1- using a tool from Lambda probe open ring spanner set -3337- .

– Unscrew Lambda probe 2 after catalytic converter -G131- -item 2- using a tool from Lambda probe open ring spanner set -3337- .



Installing

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

Note

- *Threads of new Lambda probes are already coated with assembly paste; the paste must not get into the slots on the probe body.*
- *In the case of a used Lambda probe grease only the thread with high-temperature paste. The paste must not get into the slots on the probe body. High-temperature paste ⇒ Parts catalogue*
- *When installing, the Lambda probe wire must always be reattached at the same locations to prevent it from coming into contact with the exhaust pipe.*
- *Fit all cable ties in the original positions when installing.*

- Tightening torque: refer to exploded view of Lambda probes ⇒ page 65 .

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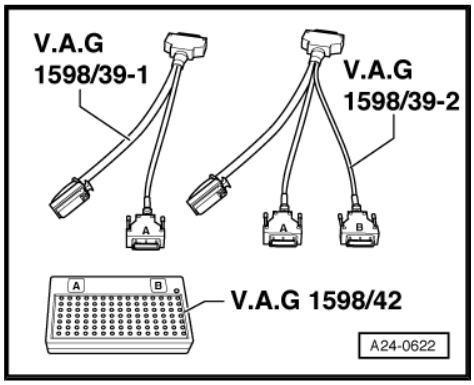
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3 Engine control unit

3.1 Wiring and component check with test box -V.A.G 1598/42-

Special tools and workshop equipment required

- Adapter cable -V.A.G 1598/39-
- Test box -V.A.G 1598/42-



Note

- *The test box -V.A.G 1598/42- has 105 sockets. It can be connected to the engine control unit via 2 different adapter cables.*
- *The engine control unit is connected to the vehicle's wiring harness via two connectors, one of which has 60 pins, the other has 94 pins.*
- *To carry out tests on the 60-pin wiring harness connector, the adapter cable -V.A.G 1598/39-1- is connected to connector -A- on the test box. For components connected to 60-pin wiring harness connector ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.*
- *To carry out tests on the 94-pin wiring harness connector, the adapter cable -V.A.G 1598/39-2- must be connected to connectors -A- and -B- on the test box. For components connected to 94-pin wiring harness connector ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.*
- *The test box -V.A.G 1598/42- is designed so it can be connected both to the wiring harness for the engine control unit and to the engine control unit itself at the same time. The advantage of this is that the electronic engine control system remains fully functional when the test box is connected (for example, for measuring signals when the engine is running).*
- *Always use auxiliary measuring set -V.A.G 1594C- to connect test equipment (e.g. voltage tester -V.A.G 1527B- , hand-held multimeter -V.A.G 1526C- etc.).*

The engine control unit has to be removed before multi-pin connectors can be unplugged from engine control unit ⇒ page 71 .

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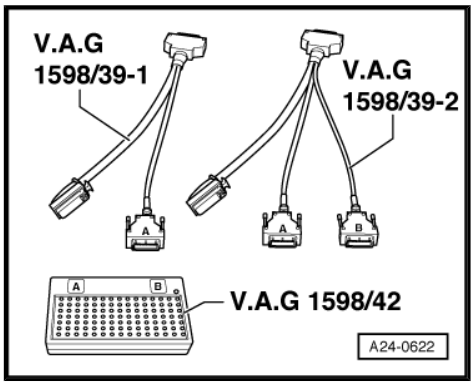
Caution

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

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– Connect test box -V.A.G 1598/42- to wiring harness with adapter cable -V.A.G 1598/39-1- or adapter cable -V.A.G 1598/39-2- . Connect earth clip of test box to negative terminal of battery. The instructions for performing the individual tests indicate whether or not the engine control unit itself also needs to be connected to the test box.

– Carry out test as described in relevant repair procedure.



Installing engine control unit:

Installation is performed in the reverse sequence.

– After installation, the locking plate must be re-fitted on the control unit.

– Clean threaded holes for shear bolts to remove any residue from locking fluid. This can be done using a thread tap.

– Always use new shear bolts.

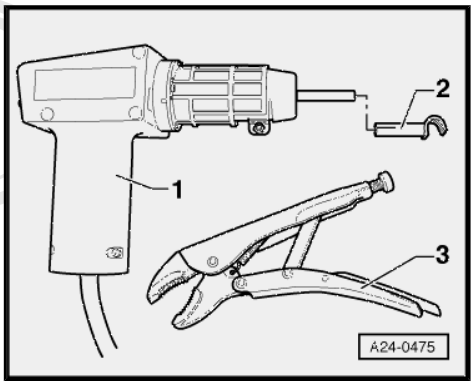
Note

After completion of the Guided Fault Finding routine, the tester will attempt to erase the fault memories of all control units. If this is not successful, the remaining faults registered in the memories must be rectified before all fault entries can be erased.

3.2 Removing and installing engine control unit -J623-

Special tools and workshop equipment required

♦ Hot air blower 220 V/ 50 Hz -VAS 1978/14- -item 1- with nozzle attachment -2- from wiring harness repair set -VAS 1978A-



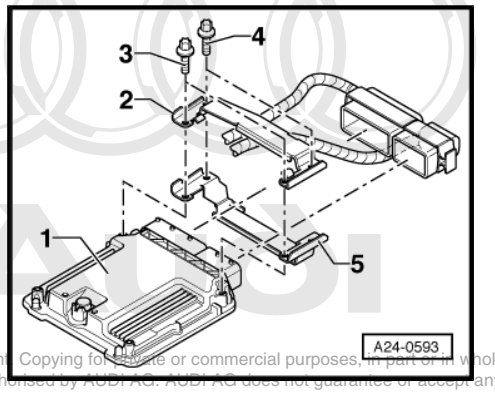
♦ Vice-grip pliers -3- (commercially available)

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Note

- *The engine control unit -1- is bolted to the protective housing -5-. To make it more difficult to unscrew the shear bolts -4- for locking plate -2-, their threads have been coated with locking fluid.*
- *The protective housing has to be removed before the connectors can be unplugged from the engine control unit (e.g. to connect the test box or renew the engine control unit).*



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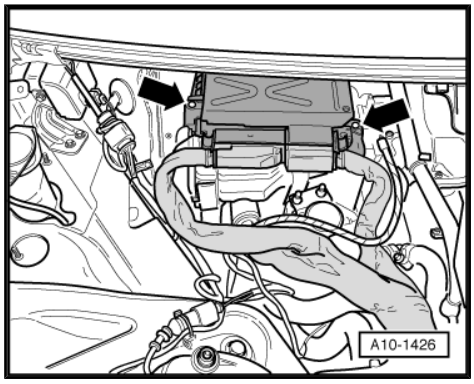
Removing

– When renewing engine control unit, select diagnosis object “Replace engine control unit” in “Guided Functions” on vehicle diagnostic, testing and information system -VAS 5051B- .

– Switch off ignition and remove ignition key.

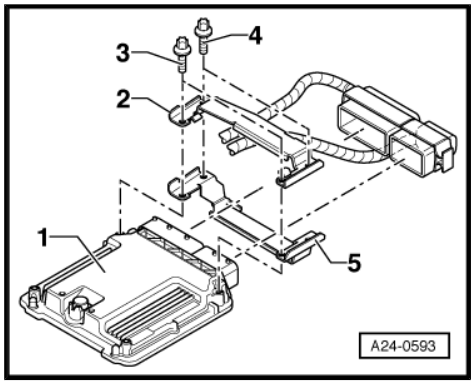
– Remove cover from plenum chamber (right-side).

– Remove engine control unit -J623- (unscrew bolts -arrows-).

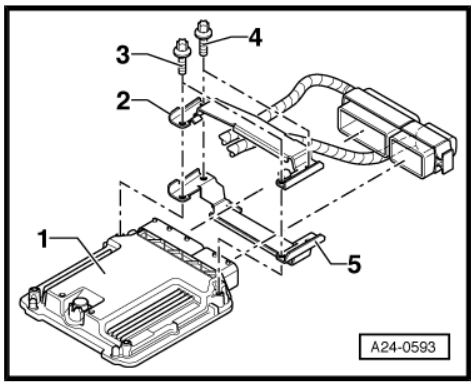


To help prevent unauthorised access to the connectors on the engine control unit, the control unit is secured by means of shear bolts to a locking plate and a metal casing.

Remove engine control unit -J623- .

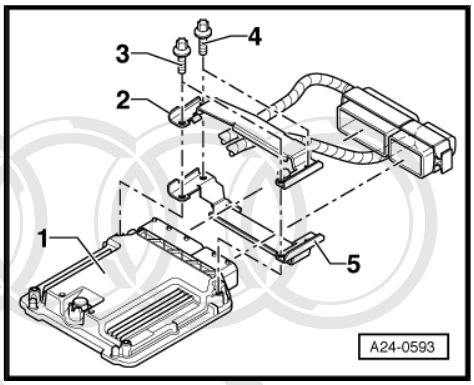


The threads of the two shear bolts -4- which are not screwed into the engine control unit are secured with locking fluid. To unscrew these two bolts, the threads must therefore be heated with the hot air blower.

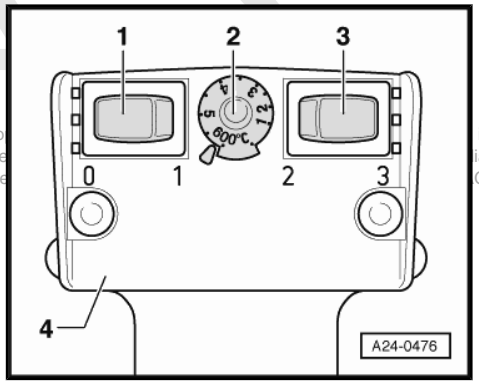


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The threads of the two shear bolts -3- which are screwed into the engine control unit are not secured with locking fluid. Do not apply heat to the threads in the control unit housing; this is not necessary and would cause overheating of the control unit.



Select settings on hot air blower as shown in illustration, i.e. set temperature potentiometer -2- to maximum heat output and two-stage air flow switch -3- to position 3.



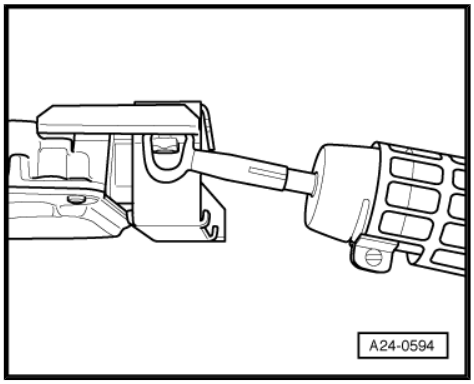
WARNING

Heating the thread of the locking plate also heats up the shear bolts and parts of the metal housing. Take care to avoid burns. It is also important to ensure that only the thread is heated and none of the surrounding components if at all possible. These should be covered if necessary.

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Apply heat to the threads of the shear bolts on the connector side as shown in the illustration.

Switch on the hot air blower and heat the bolt for approximately 20 ... 30 seconds.



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– Unscrew shear bolts using vice-grip pliers (see arrow in illustration).

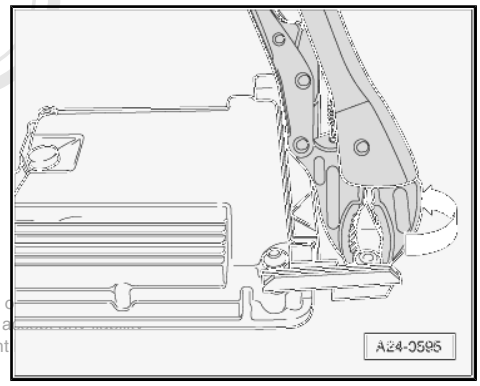
– The two shear bolts screwed into the engine control unit do not need to be heated. They can be removed without heating.

– Detach metal locking plate from connectors.

– Unscrew both securing bolts from engine control unit -J623- .

– Release connectors on engine control unit -J623- and unplug connectors.

– Take out old engine control unit -J623- and install new engine control unit -J623- .



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Installing

Installation is performed in the reverse sequence.

– After installation, the locking plate must be re-fitted on the engine control unit -J623- .

– Clean threaded holes for shear bolts to remove any residue from locking fluid. This can be done using a thread tap.

– Always use new shear bolts.

– Carefully clip cowl panel trim into retainer at windscreen.

The procedure required after connecting the new engine control unit is described in the Guided Fault Finding or Guided Functions.

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28 – Ignition system

1 General notes and safety precautions

1.1 General notes on ignition system

- The engine control unit has a self-diagnosis capability.
- A voltage of at least 11.5 V is required for proper operation of the electrical components.
- Certain tests may lead to a fault being detected by the control unit and stored. The fault memory should therefore be interrogated and (if necessary) erased after completing the tests and any repair work that may be required.
- If the engine starts, runs for a short period and then cuts out after completing fault finding, repairs or component tests, this may be due to the immobiliser disabling the engine control unit. The fault memory must then be interrogated and, if necessary, the control unit must be adapted.

Audi
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1.2 Safety precautions

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



WARNING

Accidents can be caused if the driver is distracted by test equipment while road-testing, or if test equipment is not properly secured.

Injuries can also be caused if the passenger's airbag is triggered in a collision.

- *The use of test equipment while driving causes distraction.*
- *There is an increased risk of injury if test equipment is not secured.*
- *Test equipment must always be secured on the rear seat with a strap and operated from the rear seat by a second person.*

To avoid any risk of injuries to persons and/or damage to the fuel injection and ignition system, always observe the following safety precautions.

- Do not touch or disconnect ignition wiring when the engine is running or being turned at starter speed.
- The ignition must be switched off before disconnecting or connecting ignition system wiring, high-voltage wires and test leads.
- If you want to crank the engine at starting speed without actually starting it (e.g. compression test), first unplug the connectors from the ignition coils and the injectors. After completing the work, interrogate and erase the fault memory.
- Always switch off the ignition before cleaning the engine.

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- Always switch off the ignition before connecting or disconnecting the battery, otherwise the engine control unit may be damaged.

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2 Servicing ignition system

2.1 Test data

Test data		4.2 ltr. / 4V / 257 kW engine
Idling speed (not adjustable)		approx. 650 rpm 1)
Ignition timing		Not adjustable (determined by control unit)
Ignition system		Multi-coil system with 8 ignition coils (output stages integrated) connected directly to spark plugs via spark plug connectors
Spark plugs	Designations	⇒ Data sheets for exhaust emission test
	Removing and installing	⇒ Maintenance ; Booklet 404
Firing order		1-5-4-8-6-3-7-2

• 1) Depending on demands placed on engine control unit.

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2.2 Ignition system - exploded view

1 - Connector for ignition coil
- ❑ 4-pin

2 - Bolt
- ❑ 10 Nm

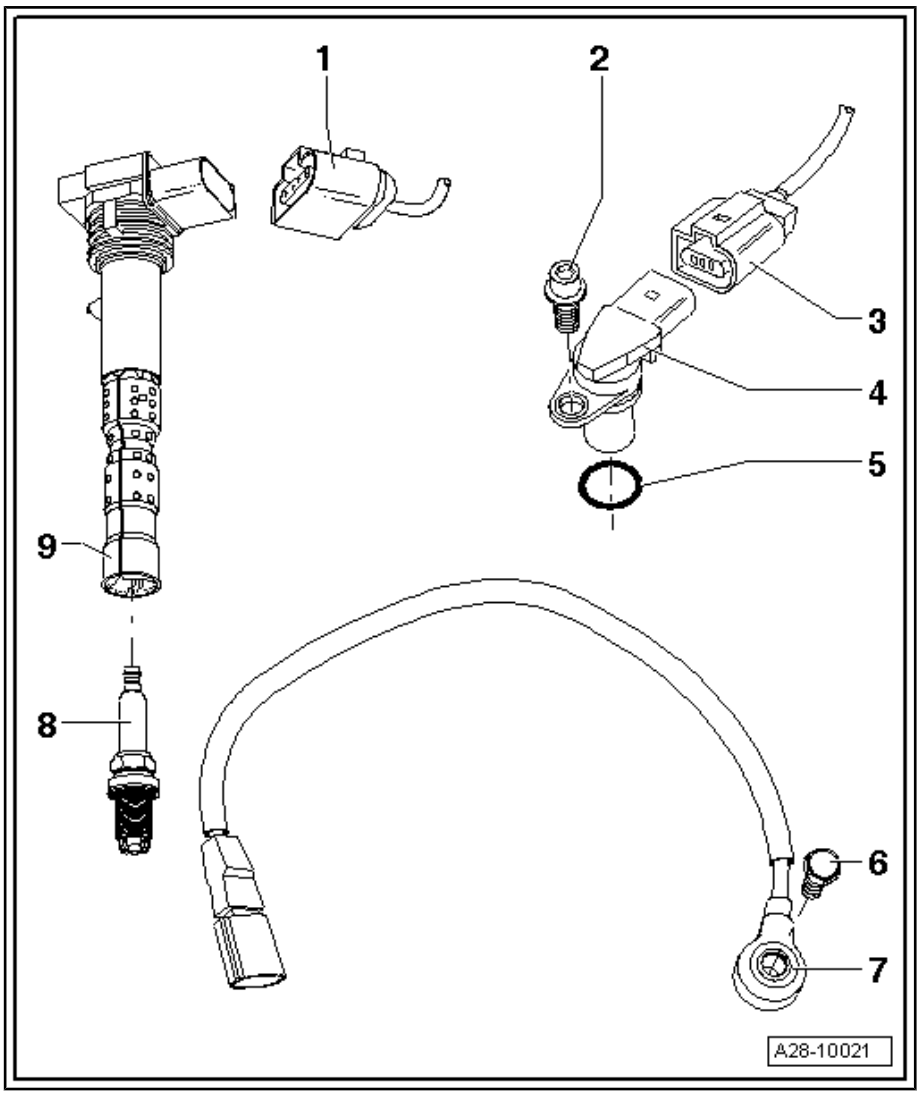
3 - 3-pin connector

4 - Hall sender
- ❑ Hall sender -G40- (cylinder bank 1)
- ❑ Hall sender 3 -G300- (cylinder bank 1)
- ❑ Hall sender 2 -G163- (cylinder bank 2)
- ❑ Hall sender 4 -G301- (cylinder bank 2)

5 - O-ring
- ❑ Renew if damaged
- ❑ Lubricate lightly with clean engine oil

6 - Bolt
- ❑ 20 Nm
- ❑ Tightening torque influences the function of the knock sensor

7 - Knock sensors
- ❑ Contact surfaces between knock sensor and cylinder block must be free of corrosion, oil and grease.
- ❑ Knock sensor 1 -G61- (cylinder bank 1)



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- ❑ Knock sensor 2 -G66- (cylinder bank 1)
- ❑ Knock sensor 3 -G198- (cylinder bank 2)
- ❑ Knock sensor 4 -G199- (cylinder bank 2)
- ❑ Removing and installing ⇒ page 78

8 - Spark plug

- ❑ Remove and install with spark plug socket and extension -3122 B- ⇒ Maintenance ; Booklet 404
- ❑ 30 Nm

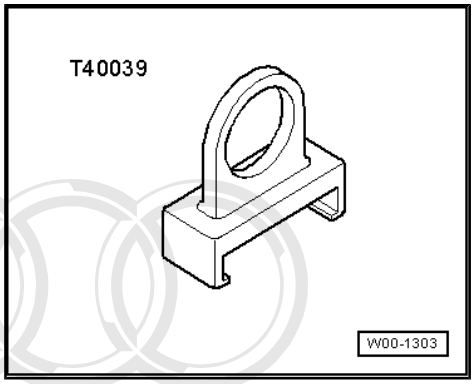
9 - Ignition coil

- ❑ Ignition coil 1 with output stage -N70-
- ❑ Ignition coil 2 with output stage -N127-
- ❑ Ignition coil 3 with output stage -N291-
- ❑ Ignition coil 4 with output stage -N292-
- ❑ Ignition coil 5 with output stage -N323-
- ❑ Ignition coil 6 with output stage -N324-
- ❑ Ignition coil 7 with output stage -N325-
- ❑ Ignition coil 8 with output stage -N326-
- ❑ Removing and installing ⇒ page 78
- ❑ Use puller -T40039- for removal

2.3 Removing and installing ignition coils

Special tools and workshop equipment required

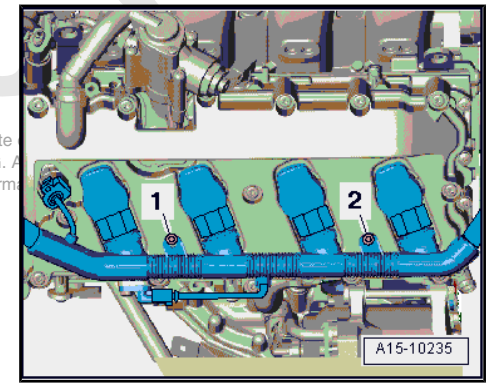
- ♦ Puller -T40039-



Removing from cylinders 1, 2 and 3 (cylinder bank 1):

– Remove bolts -1- and -2-.

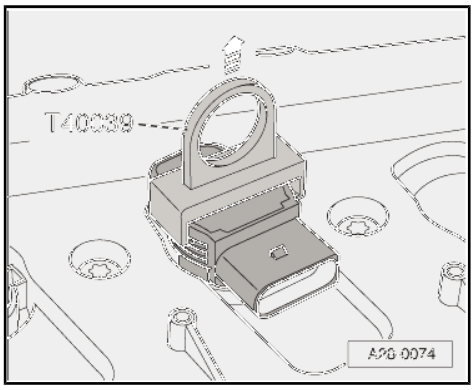
– Release electrical connectors and pull all connectors off ignition coils at the same time.



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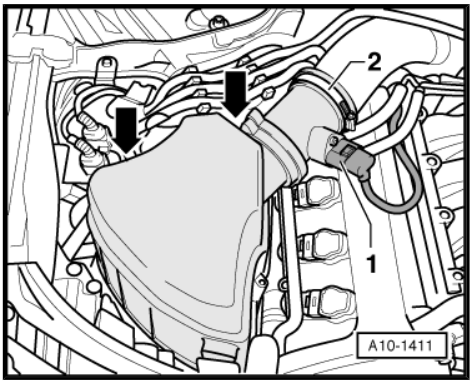
– Pull ignition coils out of spark plug apertures using puller - T40039- .



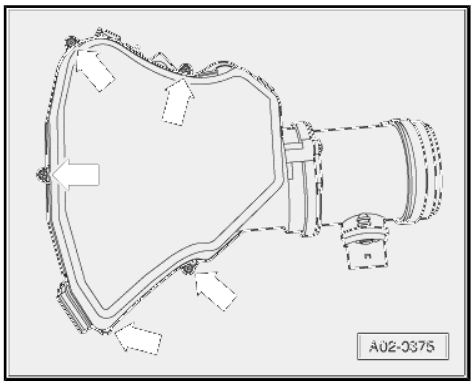
Removing from cylinder 4 (cylinder bank 1):

– Unplug electrical connector -1- at air mass meter -G70- .

– Release hose clip -2-.

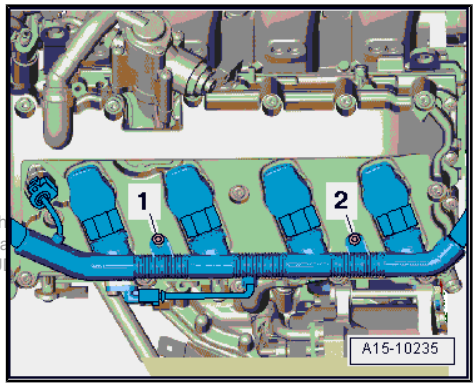


– Unscrew bolts -arrows- from air cleaner housing and detach top section of air cleaner housing.



– Remove bolts -1- and -2-.

– Release electrical connectors and pull all connectors off ignition coils at the same time.



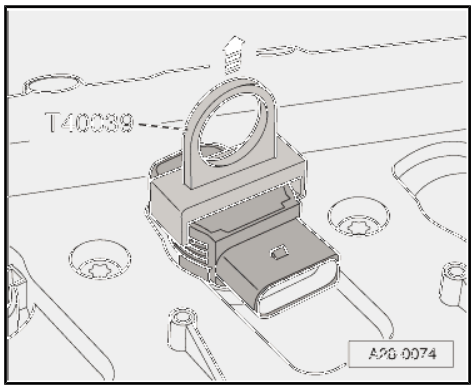
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– Pull ignition coil (cylinder 4) out with puller -T40039- .

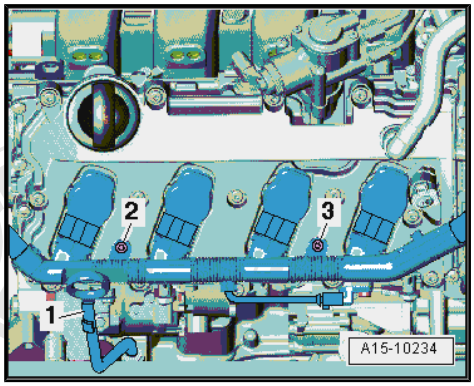
Removing from cylinders 5, 6, 7 and 8 (cylinder bank 2):

– Pull dipstick -1- out of guide tube.

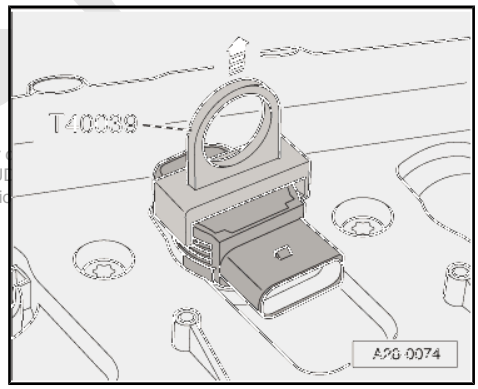


– Remove bolts -2- and -3-.

– Release electrical connectors and pull all connectors off ignition coils at the same time.



– Pull ignition coils out of spark plug apertures using puller -T40039- .



Installing

– Fit all ignition coils loosely into spark plug holes.

– Align the ignition coils with the connectors and attach all connectors onto ignition coils simultaneously.

– Press ignition coils onto spark plugs by hand evenly (do NOT use tool).

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

Tightening torque

Component	Nm
Wiring guide for ignition coils to cylinder head cover	5

2.4 Removing and installing knock sensors

WARNING

- *The fuel system operates under high pressure. The pressure in the high-pressure part of the injection system must be reduced to a residual pressure prior to opening the system* *⇒ page 3* *.*
- *A clean cloth must then be wrapped around the connection and the residual pressure dissipated by carefully loosening the connection.*

Removing

– Remove relevant intake manifold.

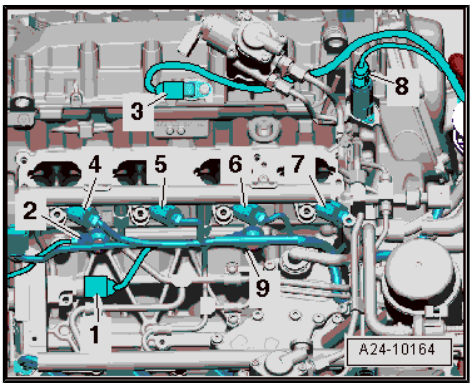
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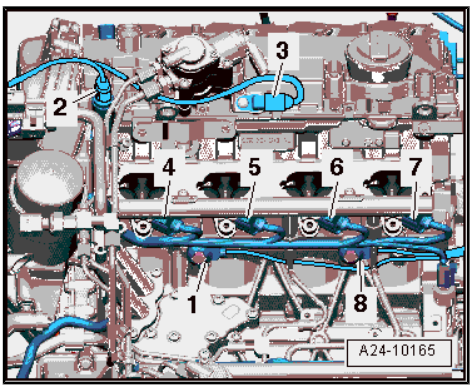
Vehicles with magnesium intake manifold ⇒ page 24 .

Vehicles with plastic intake manifold ⇒ page 40 .

– Remove knock sensor 1 -G61- -2- or knock sensor 2 -G66- -9-.



– Remove knock sensor 3 -G198- -8- or knock sensor 4 -G199- -1-.



Installing

– Secure relevant knock sensor (removed before) at fitting location.

• Tightening torque: refer to exploded view of ignition system ⇒ page 77 .

Note

The tightening torque influences the function of the knock sensor.

– Install relevant intake manifold.

Vehicles with magnesium intake manifold (magnesium) ⇒ page 24 .

Vehicles with plastic intake manifold ⇒ page 40 .

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ENGINE

4.2 Liter V8 5V Engine Mechanical, Engine Code(s): BHF

00 - GENERAL, TECHNICAL DATA

ENGINE NUMBER

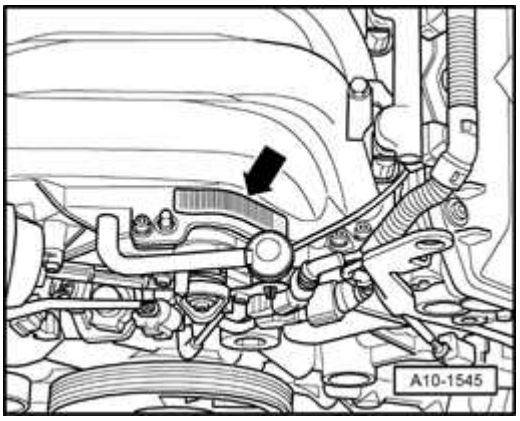


Fig. 1: Locating "Engine Code" And "Serial Number"
Courtesy of VOLKSWAGEN UNITED STATES, INC.

NOTE:

- **A sticker - arrow - with "engine code" and "serial number" is affixed at right on intake manifold.**
- **The engine code is also located on the vehicle data plate.**
- **The engine number is only visible after a work step.**

- Bring lock carrier into service position --> **Lock carrier, moving into service position**.

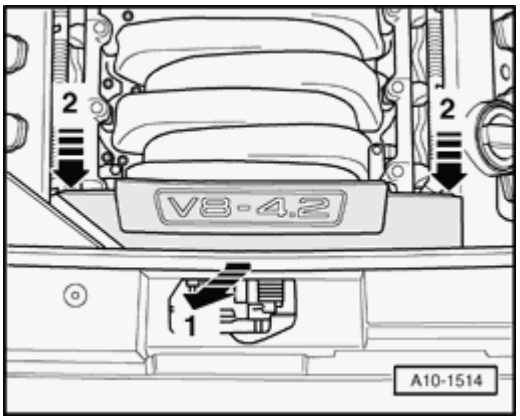


Fig. 2: Removing Front Engine Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove front engine cover - **arrows 1 and 2** -.

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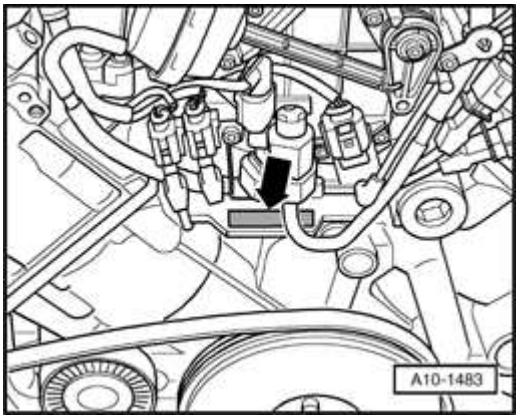


Fig. 3: Locating "Engine Code" And "Serial Number" At Front On Cylinder Block At Top
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Engine number ("engine code" and "serial number") is located at front on cylinder block at top - **arrow** -.

ENGINE DATA

Engine data

Code letters		**BHF**
Displacement	ltr.	4,163
Output	kW at RPM	221/6200
Torque	Nm at RPM	380/2600 to 4700
Bore	dia. mm	84.5
Stroke	mm	92.8
Compression ratio		11.0
RON		98 * See note
Fuel injection and ignition system		Bosch Motronic
Ignition sequence		1-5-4-8-6-3-7-2
Exhaust gas recirculation (EGR)		No
Charging		No
Knock control		Yes
Variable valve timing		Yes
Variable intake manifold		Yes
Secondary air injection (AIR) system		Yes

*Super unleaded RON 95 is permissible, but with reduced power.

SAFETY PRECAUTIONS

Safety precautions

Note the following when working on the fuel system:

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CAUTION: There is a risk of injury because the fuel is under high pressure.

- **To reduce pressure in fuel system, lay a clean cloth around the connector and carefully loosen connector.**

To prevent personal injury and damage to the injection and ignition system, observe the following:

- The ignition must be switched off before connecting or disconnecting injection and ignition system wiring or tester cables.
- Only clean engine with ignition switched off.
- If electrical connectors were disconnected, faults are saved in ECM:

- Connect Vehicle Diagnosis, Testing and Information System VAS 5051B.
- Start "Guided Functions" operating mode.
- Generate readiness code in ECM.

CAUTION: Risk of destroying electrical components when battery is disconnected.

- **Observe measures when disconnecting battery.**
- **Only disconnect battery with ignition switched off.**

- Disconnect battery -->
  - **27 BATTERY, STARTER, GENERATOR, CRUISE CONTROL**
  - **27 BATTERY, STARTER, GENERATOR, CRUISE CONTROL** for ELECTRICAL EQUIPMENT, CABRIOLET

.

Note the following when working on the cooling system:

CAUTION: Risk of scalding due to hot steam and hot coolant.

- **When the engine is warm the cooling system is under pressure.**
- **To reduce pressure, cover coolant reservoir cap with cloth and carefully open.**

If it is necessary to use testing and measuring devices on road tests, observe the following:

CAUTION: Risk of accident due to distraction and testing and measuring instruments not be sufficiently secured.

Risk of passenger airbag deploying in an accident.

- **Operating testing and measuring equipment while driving creates a**

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distraction.

- **There is an increased risk of injury due to unsecured testing and measuring equipment.**
- **Always secure testers on the rear seat with a strap and have a second person on the rear seat to operate them.**

GENERAL REPAIR NOTES

Rules for cleanliness

Even a little contamination can lead to faults. Therefore when working on the fuel supply and injection system, pay careful attention to the following rules of cleanliness:

- Before loosening, connections and surrounding areas must be cleaned thoroughly with engine or brake cleaner, and then cleaned area must be dried completely.
- Seal open lines and connections immediately using suitable protective caps.
- Place parts that have been removed on a clean surface and cover them. Use lint-free cloths.
- Only install clean components: Only unpack replacement parts immediately prior to installation. Do not use parts that have been stored unpackaged (e.g. in tool boxes etc.).
- Carefully cover over opened components or seal, if repairs are not performed immediately.
- When system is open: Do not work with compressed air. Do not move vehicle unless absolutely necessary.
- Protect disconnected electrical connectors from dirt and moisture and only connect if dry.

Fuel supply system, checking for leaks

- Let engine run a few minutes at average RPM.
- Switch off ignition.
- Check entire fuel supply system for leaks.
- If there are leaks in spite of correct tightening torque, the corresponding component must be replaced.

Contact corrosion!

Contact corrosion can occur if appropriate connecting elements (bolts, nuts, washers, etc.) are not used.

For this reason, only install connecting elements that are treated with a special coating.

Also, rubber or plastic parts and adhesive consist of non-conductive materials.

If there are doubts about the suitability of parts, generally use new parts .

NOTE:

- **Only original replacement parts are recommended, they are checked and compatible with aluminum.**

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- **Audi accessories are recommended.**
- **Damage due to contact corrosion is not covered by warranty.**

10 - ENGINE - ASSEMBLY

ENGINE (VEHICLES WITH MANUAL TRANSMISSION)

Engine (vehicles with manual transmission)

NOTE:

- **With lock carrier removed, engine is removed downward with transmission and subframe.**

Engine (vehicles with manual transmission), removing

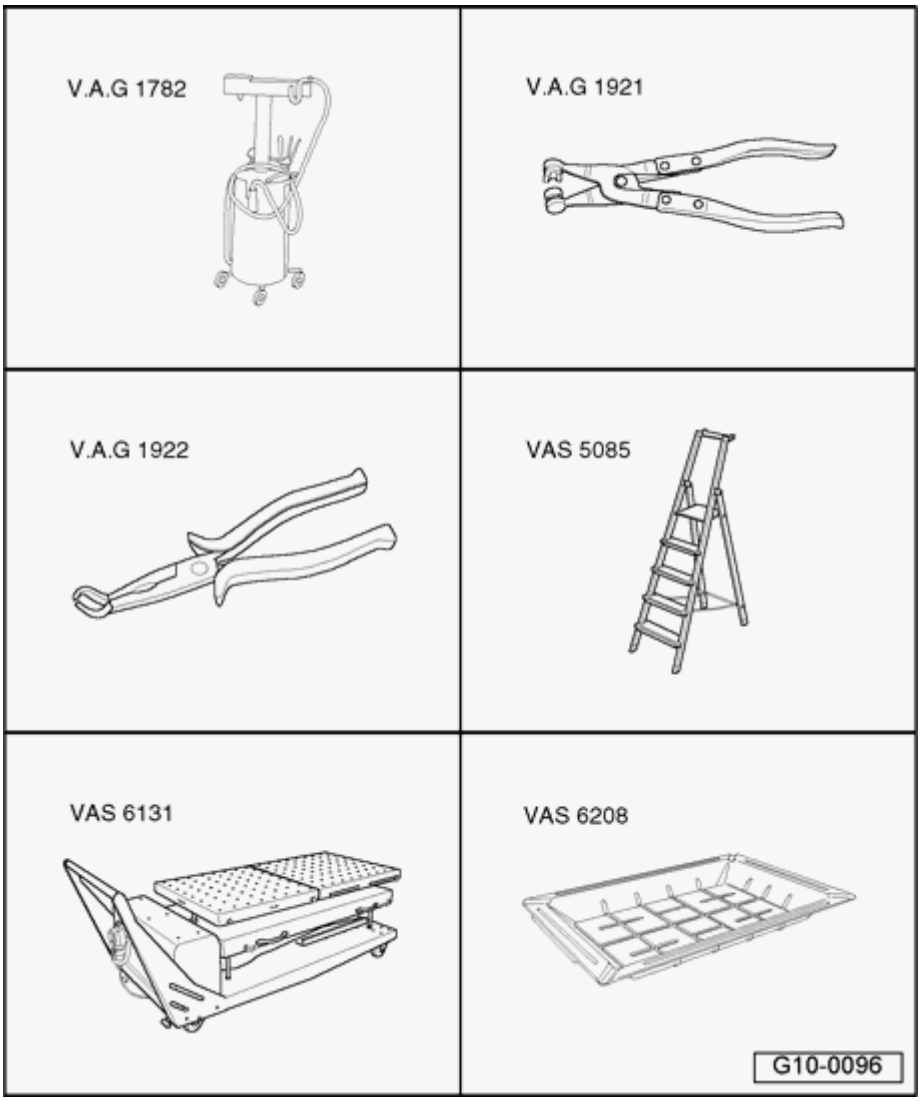


Fig. 4: Identifying Special Tools - Engine (Vehicles With Manual Transmission), Removing

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Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools, testers and auxiliary items required

- Old oil collecting and extracting device V.A.G 1782
- Hose clamp pliers V.A.G 1921
- Spark plug connector pliers V.A.G 1922
- Step ladder VAS 5085
- Scissor lift platform VAS 6131 A with support set for Audi VAS 6131/10
- Drip tray for workshop crane VAS 6208

NOTE:

- **If engine and transmission are to be separated after removal, the Supplementary Set, Audi A8 > 2002 VAS 6131/11 will also be required.**

Special tools, testers and auxiliary items required

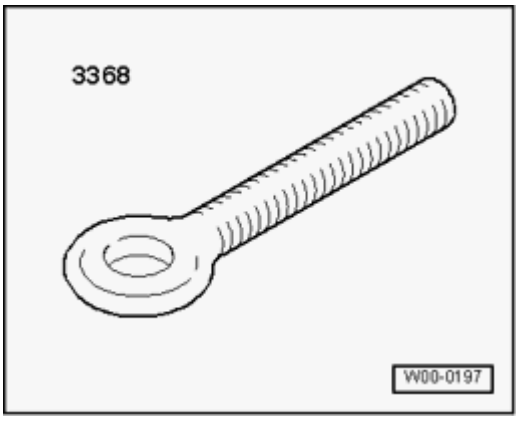
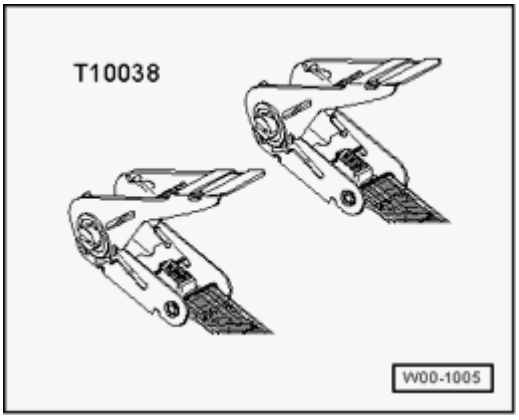


Fig. 5: Lifting Eyebolt 3368
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Lifting Eyebolt 3368



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Fig. 6: Tension Strap T10038
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Tension strap T10038

Work procedure

NOTE:

- **Drained coolant must be stored in a clean container for disposal or reuse.**
- **All cable ties opened or cut during engine removal must be reinstalled at the same locations during installation.**

- Remove plenum chamber cover rubber seal.

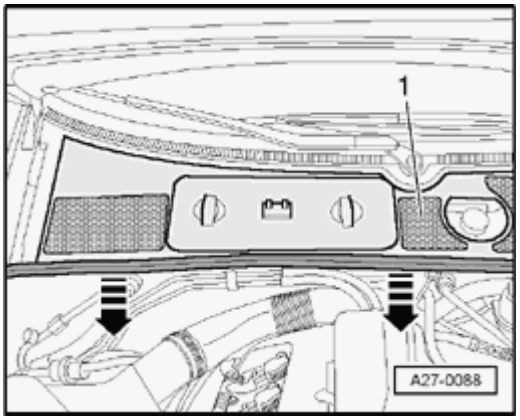


Fig. 7: Identifying Plenum Chamber Cover & Removing Rubber Seal
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove plenum chamber cover - **1** - toward front - **arrows** -.

CAUTION: Observe procedures when connecting battery -->

- **27 BATTERY, STARTER, GENERATOR, CRUISE CONTROL**
- **27 BATTERY, STARTER, GENERATOR, CRUISE CONTROL for ELECTRICAL EQUIPMENT, CABRIOLET**

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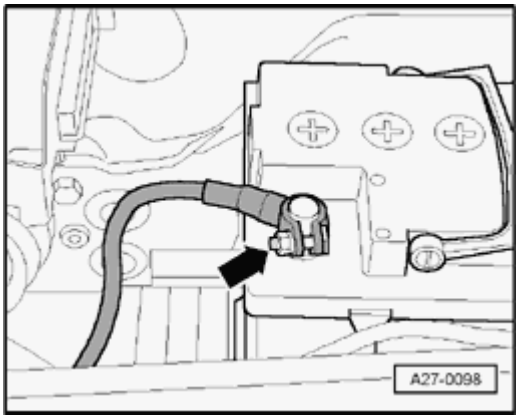


Fig. 8: Disconnecting Battery Ground (GND) Strap
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- With ignition switched off, disconnect Battery Ground (GND) strap - **arrow** -.
- Discharge refrigerant circuit --> **87 - AIR CONDITIONING** .
- Extract hydraulic oil for power-steering from reservoir using old oil collecting and extracting device V.A.G 1782.

CAUTION: Cover cap of expansion tank with rag and open carefully, as hot steam i.e. hot coolant may escape when opening.

- Open cap of coolant expansion tank.
- Remove both front wheels.

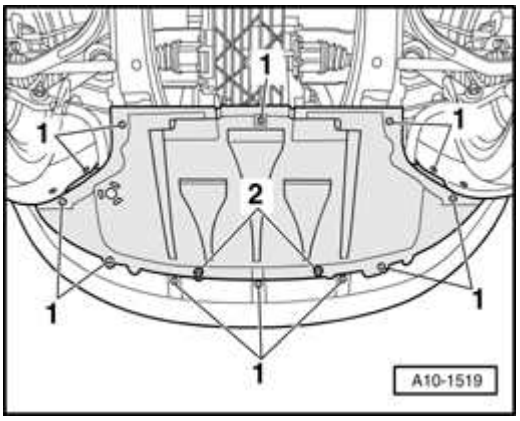


Fig. 9: Removing Quick-Release Fasteners, Screws And Noise Insulation
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove quick-release fasteners - **1** - , remove screws - **2** - and remove noise insulation.

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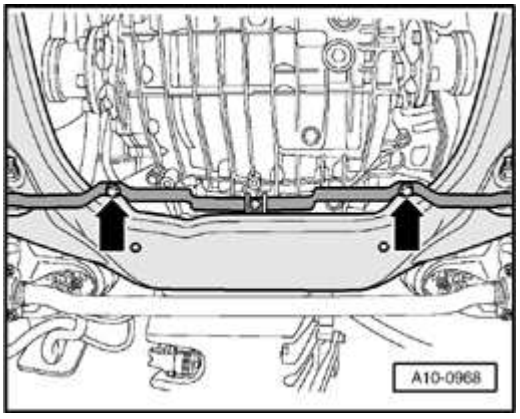


Fig. 10: Removing Bracket For Noise Insulation
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bracket for noise insulation - **arrows** -.
- Remove left front and right front wheel housing liners -->
  - **66 EXTERIOR EQUIPMENT**
  - **66 - EXTERIOR EQUIPMENT** for BODY EXTERIOR - CABRIOLET

  .
- Remove front bumper cover -->
  - **63 BUMPER**
  - **63 - BUMPERS** for BODY EXTERIOR - CABRIOLET

  .

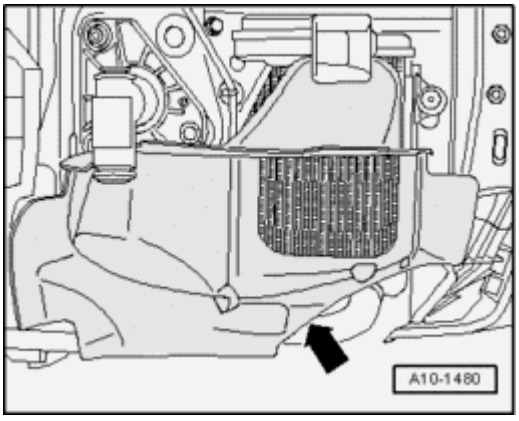


Fig. 11: Removing Left Air Guide In Front Of Auxiliary Cooler
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove left air guide - **arrow** - in front of auxiliary cooler.

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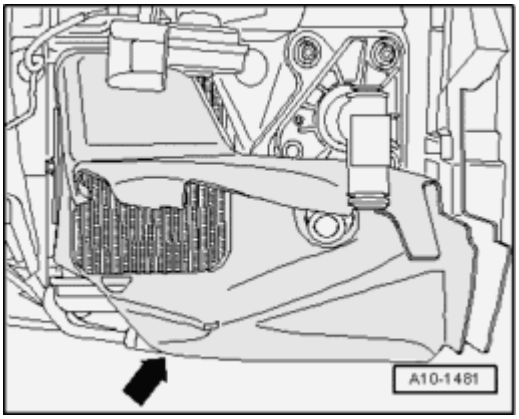


Fig. 12: Removing Right Air Guide In Front Of Auxiliary Cooler
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove right air guide - **arrow** - in front of auxiliary cooler.
- Place drip tray for workshop crane VAS 6208 under engine.

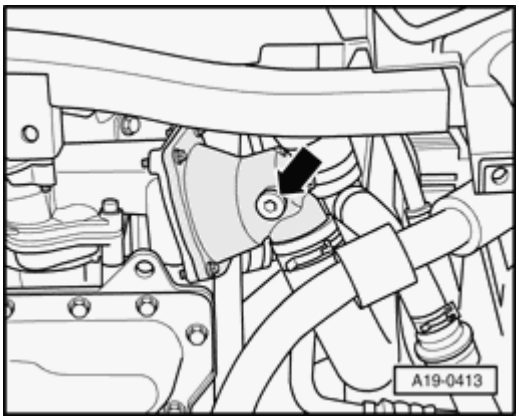


Fig. 13: Removing Drain Plug On Coolant Thermostat Housing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove drain plug - **arrow** - on coolant thermostat housing and drain coolant from engine.

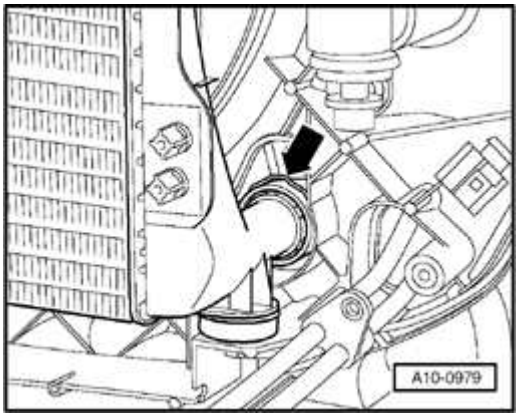


Fig. 14: Disconnecting Lower Coolant Hose From Radiator

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Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect lower coolant hose from radiator - **arrow** - and drain residual coolant.

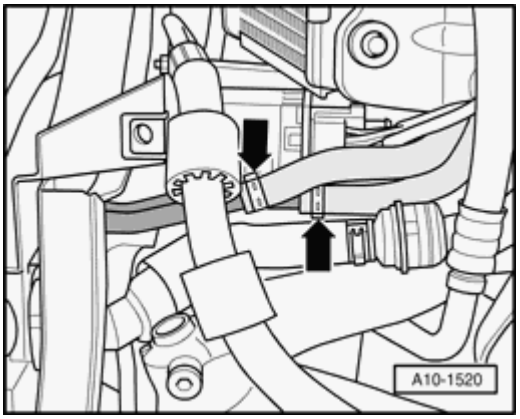


Fig. 15: Disconnecting Hydraulic Lines To Cooling Coil At Left Rear Of Bumper
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Place old oil collecting and extracting device V.A.G 1782 under engine.
- Disconnect hydraulic lines to cooling coil at left rear of bumper - **arrows** -.

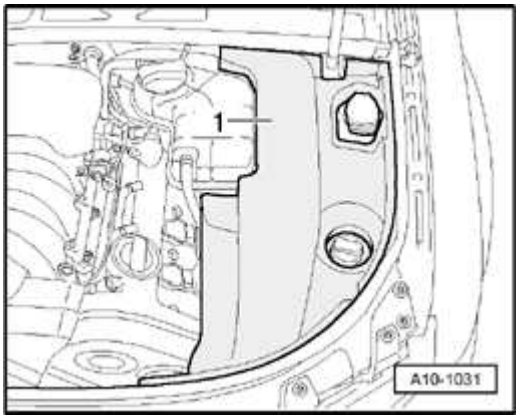


Fig. 16: Removing Cover In Engine Compartment (Left Side)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove cover - **1** - in engine compartment (left side).

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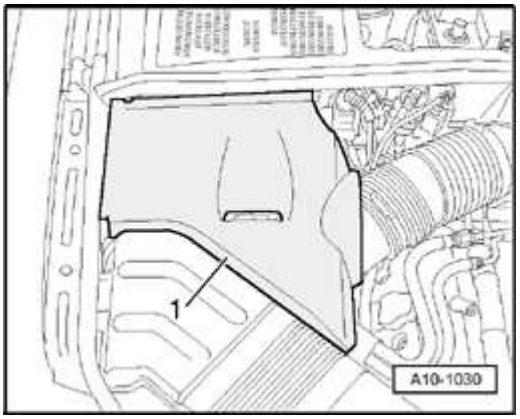


Fig. 17: Removing Cover In Engine Compartment (Right Side)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove cover - **1** - in engine compartment (right side).

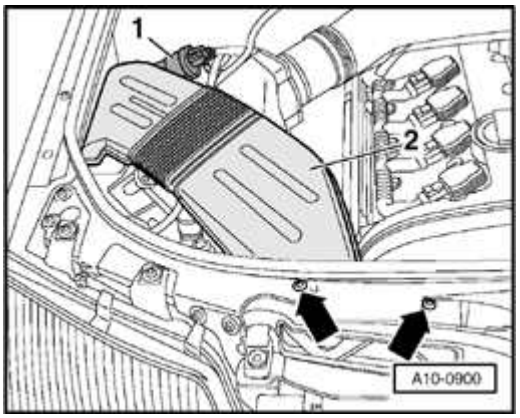
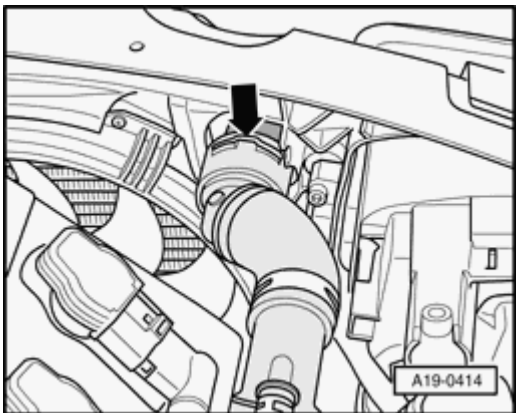


Fig. 18: Identifying Evaporative Emission Canister Purge Regulator Valve N80 And Air Duct
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disengage Evaporative Emission (EVAP) Canister Purge Regulator Valve N80 - **1** - from air guide.
- Remove bolts - **arrows** -.
- Remove air duct - **2** -.



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Fig. 19: Disconnecting Top Coolant Hose From Radiator
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect top coolant hose - **arrow** - from radiator.

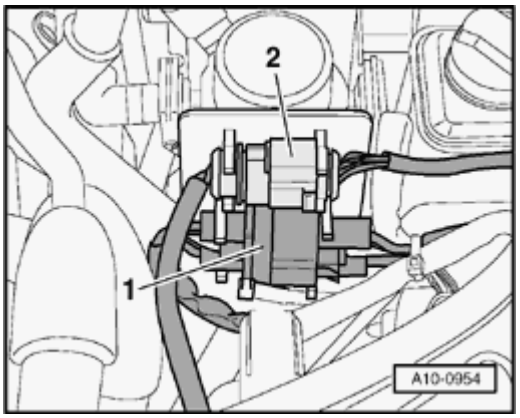


Fig. 20: Removing Electrical Harness Connectors And From Bracket
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove electrical harness connectors - **1** - and - **2** - from bracket and disconnect them.
- Free up wires to lock carrier.

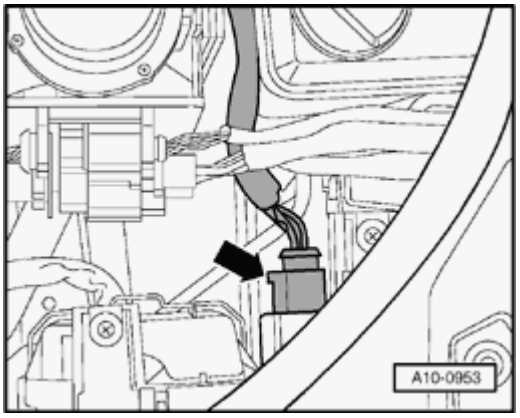


Fig. 21: Disconnecting Electrical Harness Connector For Headlights At Both Sides Of Vehicle
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical harness connector - **arrow** - for headlights at both sides of the vehicle.
- Free up electrical wiring.

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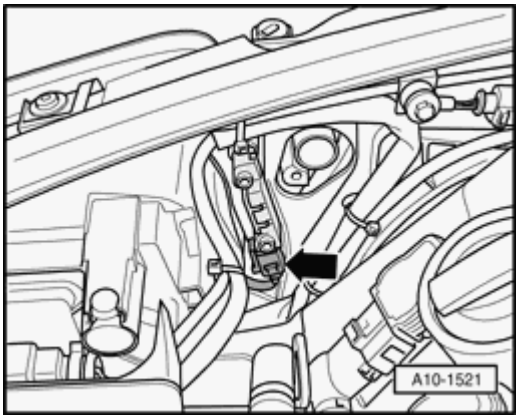


Fig. 22: Disconnecting Electrical Harness Connector For Left/Right Airbag Sensors On Lock Carrier
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical harness connector - **arrow** - for left and right airbag sensors on lock carrier.
- Free up cables.
- Remove hood cable at lock carrier -->
  - **55 HOOD, LIDS**
  - **55 - HOOD, LIDS** for BODY EXTERIOR - CABRIOLET

.

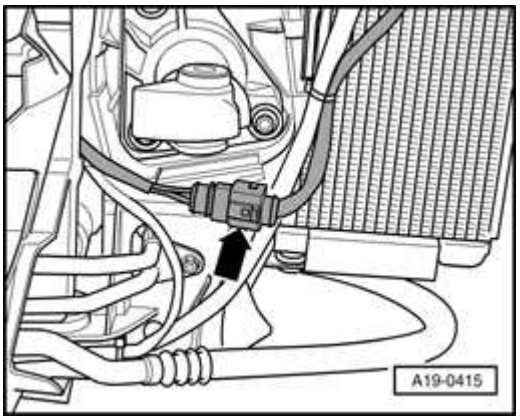


Fig. 23: Disconnecting Electrical Harness Connector For Right Fan
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical harness connector - **arrow** - for right fan.

NOTE:

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

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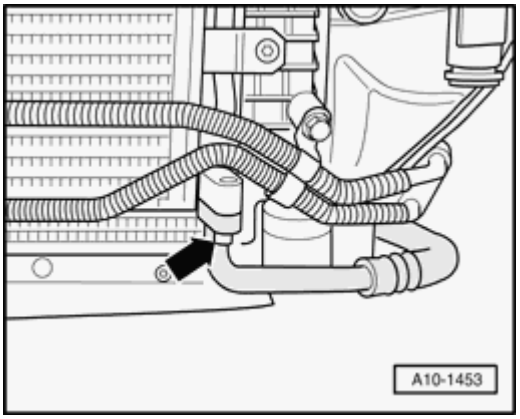


Fig. 24: Removing Refrigerant Line Leading To A/C Compressor
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove refrigerant line - **arrow** - leading to A/C compressor.

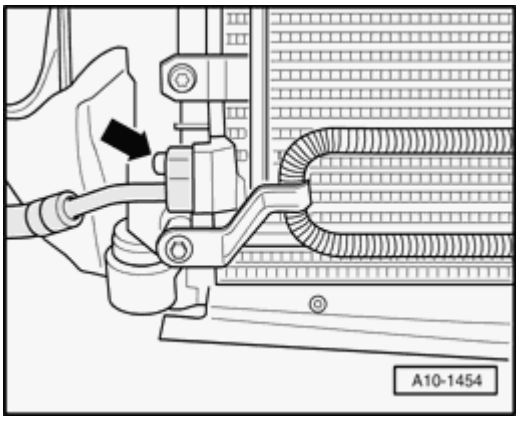


Fig. 25: Removing Refrigerant Line Leading To A/C Evaporator
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove refrigerant line - **arrow** - leading to A/C evaporator.

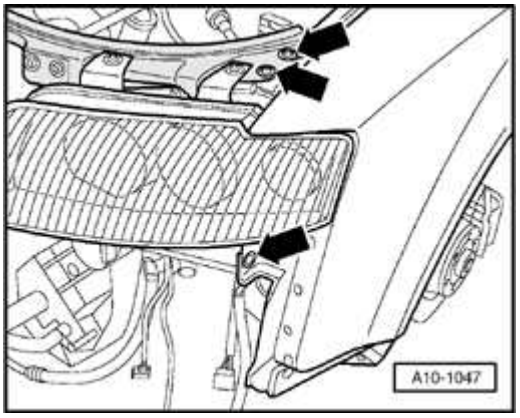


Fig. 26: Removing Bolts At Left/Right Side Of Bumper
Courtesy of VOLKSWAGEN UNITED STATES, INC.

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- Remove bolts - **arrows** - at left and right side of bumper.
- Remove hood seal from lock carrier and fender edges.

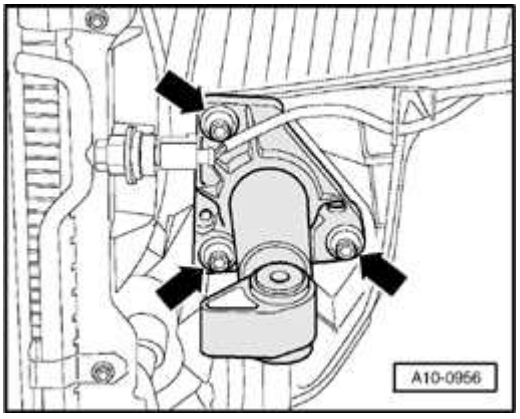


Fig. 27: Removing Bolts At Impact Absorbers At Left/Right
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts at impact absorbers - **arrows** - at left and right.

NOTE:

- **A second technician is required to remove lock carrier.**

- Remove lock carrier and set aside so it cannot topple.

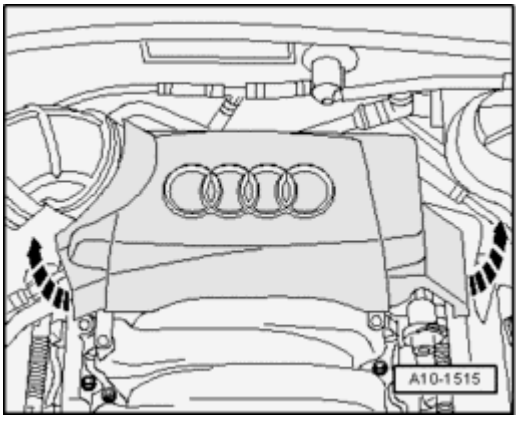


Fig. 28: Removing Rear Engine Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove rear engine cover - **arrows** -.

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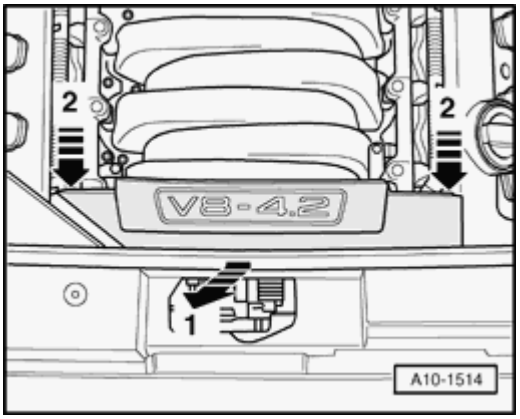


Fig. 29: Removing Front Engine Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove front engine cover - **arrows 1 and 2** -.

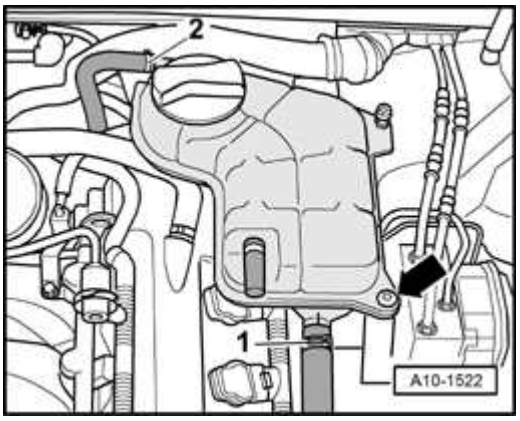


Fig. 30: Removing Coolant Hoses & Coolant Expansion Tank
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove coolant hoses - **1** - and - **2** -.
- Remove coolant expansion tank - **arrow** -.
- Disconnect electrical wiring to Engine Coolant Level (ECL) Warning Switch F66 at bottom of expansion tank.

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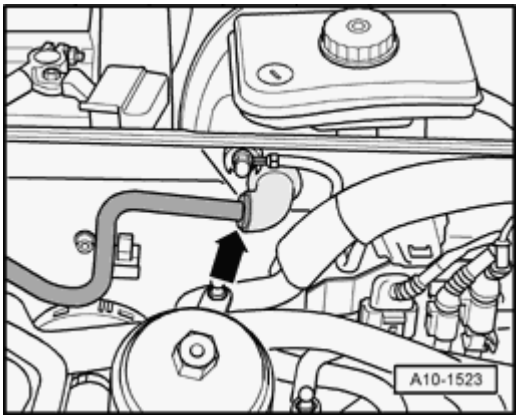


Fig. 31: Disconnecting Brake Booster Vacuum Hose From Grommet On Bulkhead
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect vacuum line - **arrow** - to brake booster at bulkhead.

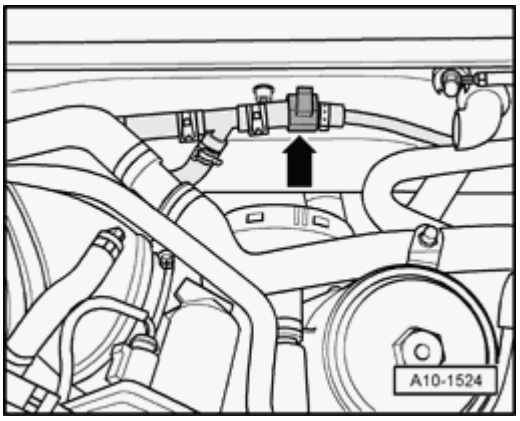


Fig. 32: Uncliping Coolant Hose From Bracket On Bulkhead
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unclip coolant hose - **arrow** - from bracket on bulkhead.

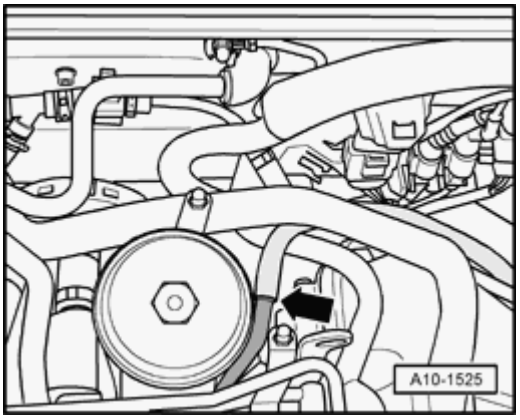


Fig. 33: Disconnecting Vacuum Line To Vacuum Reservoir
Courtesy of VOLKSWAGEN UNITED STATES, INC.

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- If installed, disconnect vacuum line - **arrow** - to vacuum reservoir.

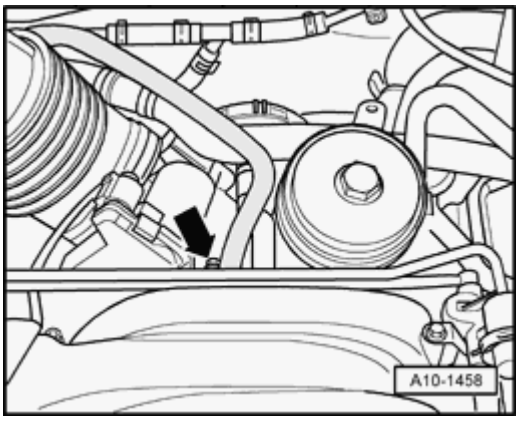


Fig. 34: Disconnecting Vacuum Hose From Intake Manifold
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect vacuum hose - **arrow** - from intake manifold.

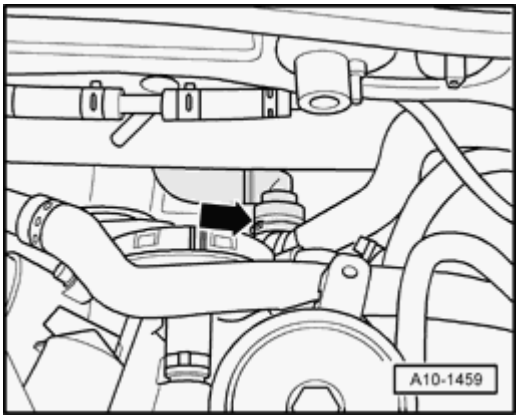
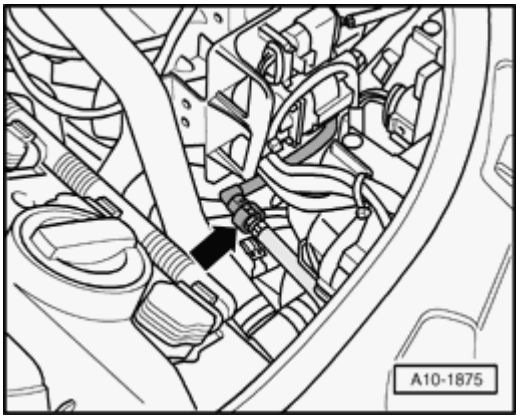


Fig. 35: Disconnecting Coolant Hose To Heater Core At Rear Coolant Pipe On Engine
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect coolant hose - **arrow** - to heater core at rear coolant pipe on engine.



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Fig. 36: Disconnecting Vacuum Line
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- If installed, disconnect vacuum line at area designated with - **arrow** -.

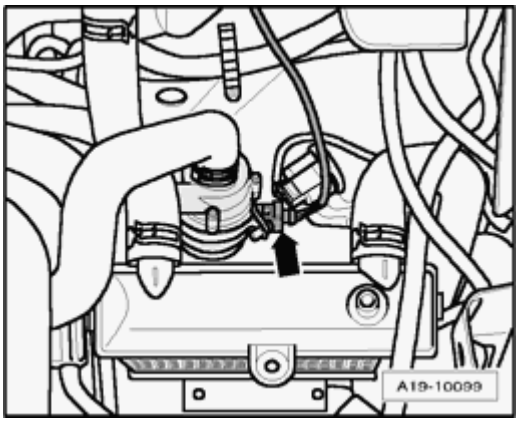


Fig. 37: Disconnecting Electrical Harness Connector For After-Run Coolant Pump V51
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- If installed, disconnect electrical harness connector - **arrow** - for After-Run Coolant Pump V51 (behind auxiliary cooler at left) and free up electrical wire.

NOTE:

- **Place a rag under separating point to catch escaping hydraulic fluid.**

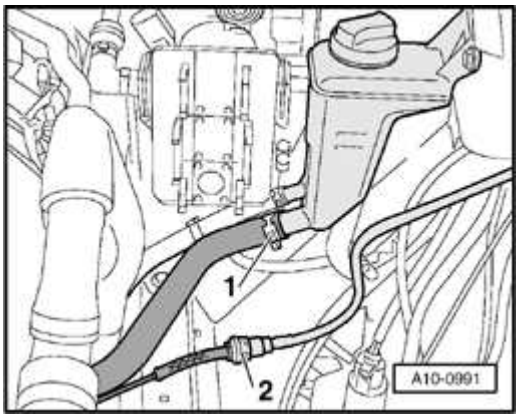


Fig. 38: Disconnecting Hose From Power Steering Fluid Reservoir & Vacuum Hose To Vacuum Reservoir
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect hose - **1** - from power steering fluid reservoir.

NOTE:

- **Ignore - 2 -.**

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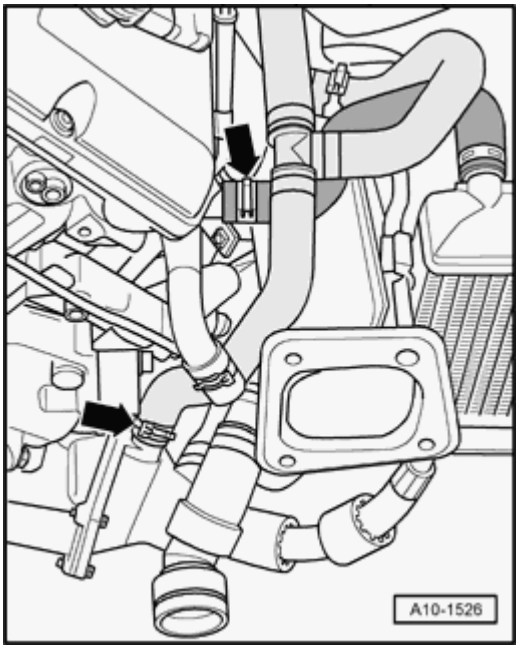


Fig. 39: Disconnecting Coolant Hoses
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect coolant hoses at positions indicated by - **arrows** -.

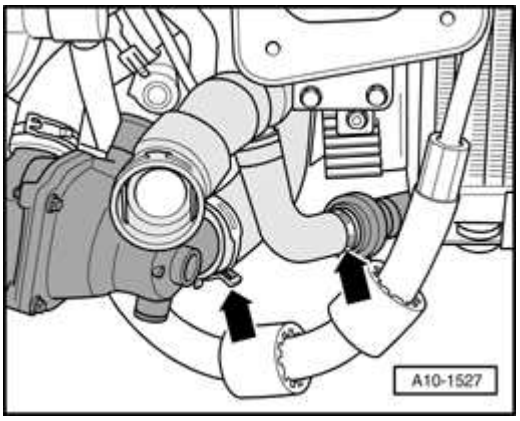


Fig. 40: Disconnecting Coolant Hoses
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect coolant hoses at positions indicated by - **arrows** -.

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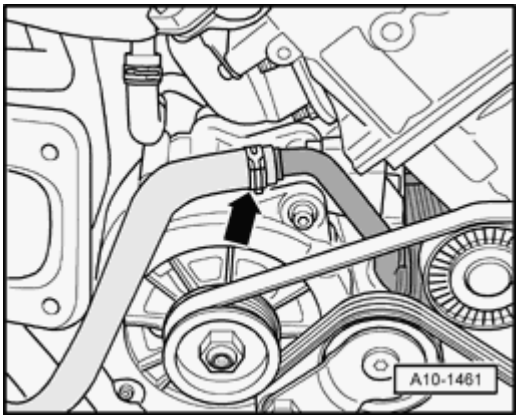


Fig. 41: Disconnecting Coolant Hose To Oil Cooler
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect coolant hose to oil cooler - **arrow** -.

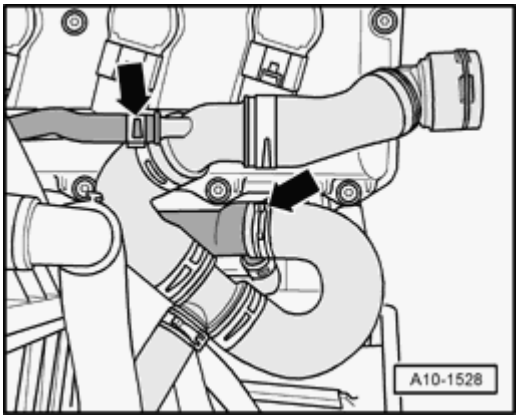


Fig. 42: Disconnecting Coolant Hoses
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect coolant hoses at positions indicated by - **arrows** -.

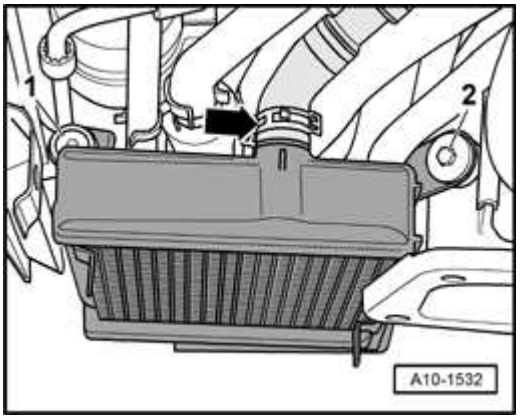


Fig. 43: Removing Bolts & Right Auxiliary Cooler Together With Coolant Hoses
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- Remove bolts - **1** - and - **2** -.
- Remove right auxiliary cooler together with coolant hoses.

NOTE:

- **The hose - arrow - can remain connected at auxiliary cooler.**

CAUTION: Note rules of cleanliness for working on the fuel injection system --> Rules for cleanliness.

CAUTION: Fuel system is under pressure! Before opening system, place clean rags around connection. Then release pressure by carefully loosening connection.

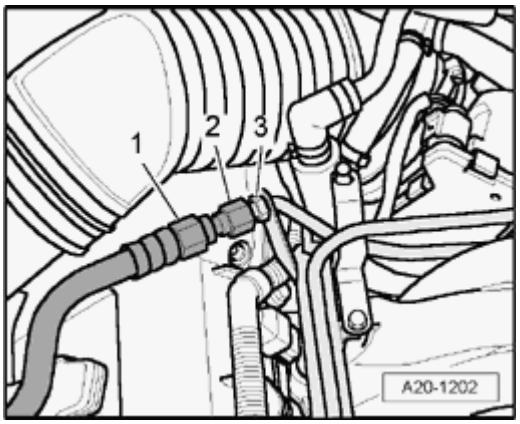


Fig. 44: Installing/Removing Fuel Hose To/From Connection On Fuel Rail Line
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove fuel hose from connection on fuel rail line. To do so, counter hold using an open-end wrench at hex head - **1** - and - **3** - and remove union nut - **2** -.

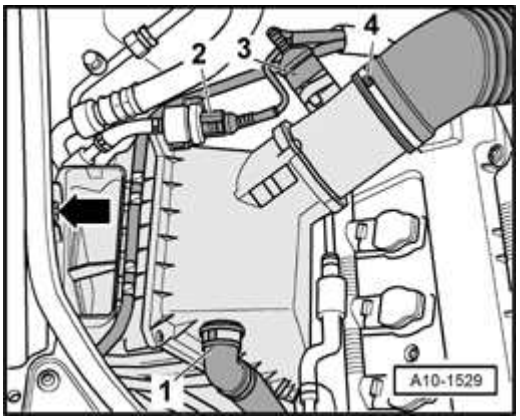


Fig. 45: Identifying Electrical Harness Connectors, Secondary Air Injection (AIR) Pump Hose, Air Guide Hose & Mass Air Flow (MAF) Sensor
Courtesy of VOLKSWAGEN UNITED STATES, INC.

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- Disconnect electrical harness connector - **2** - from Evaporative Emission (EVAP) Canister Purge Regulator Valve N80.
- Disconnect electrical harness connector - **3** - at Mass Air Flow (MAF) Sensor G70.
- Disconnect hose - **1** - to Secondary Air Injection (AIR) pump.
- Disconnect air guide hose - **4** - at Mass Air Flow (MAF) sensor.

- Move wiring harness clear at air filter housing.
- Remove clip - **arrow** - and remove air filter housing with Mass Air Flow (MAF) sensor.

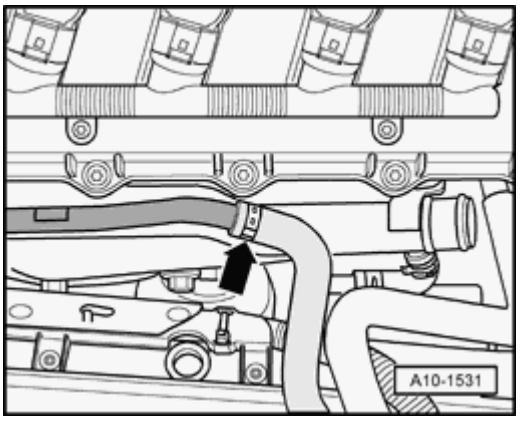


Fig. 46: Disconnecting Air Hose At Right On Engine
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect air hose - **arrow** - at right on engine.

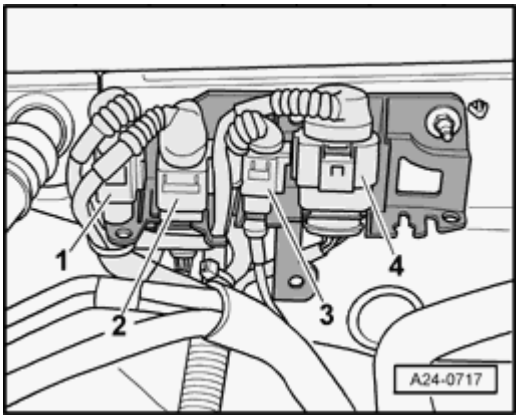


Fig. 47: Removing Bracket For Electrical Harness Connectors At Right From Bulkhead
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bracket for electrical harness connectors - **1 to 4** - at right from bulkhead.

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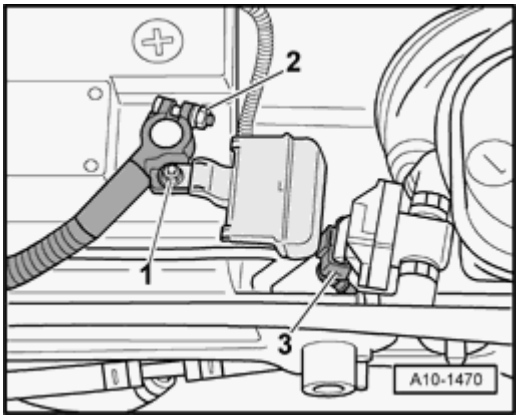


Fig. 48: Removing Nut And Fuse Strip On Plus Wire Terminal Clamp
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove nut - **1** - and remove fuse strip on battery positive (+) cable terminal clamp.
- Disconnect battery positive (+) cable - **2** - on battery positive terminal.
- Pull battery positive (+) cable through bulkhead toward front.
- Free up wiring harness.

NOTE:

- **Disregard item - 3 -.**

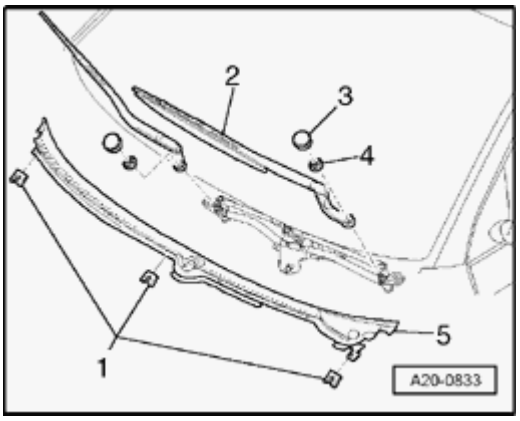


Fig. 49: Removing Securing Clips And Cowl
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Pry off both covers - **3** - using a screwdriver.
- Loosen hex-nuts - **4** - by several turns.
- Loosen wiper arms - **2** - from the respective wiper axle by tilting slightly.
- Remove nuts completely and remove wiper arms.

CAUTION: To prevent the cowl grille - 5 - from tearing when removing, coat transition between windshield and cowl grille with a soapy solution and pull grille up vertically out of fastening strip beginning at edge of window.

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- Disconnect securing clips - **1** - and remove cowl grille - **5** -.

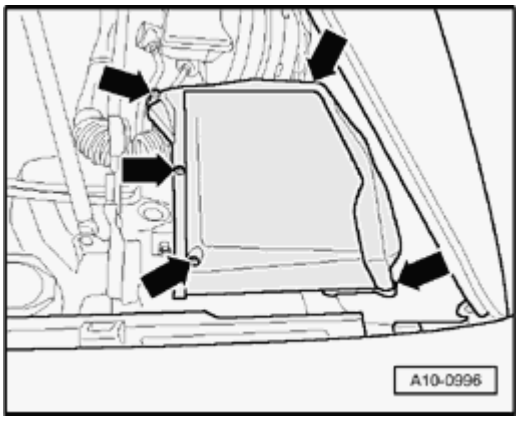


Fig. 50: Removing Screws And Cover From E-Box In Plenum Chamber
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove cover for E-Box in plenum chamber - **arrows** -.

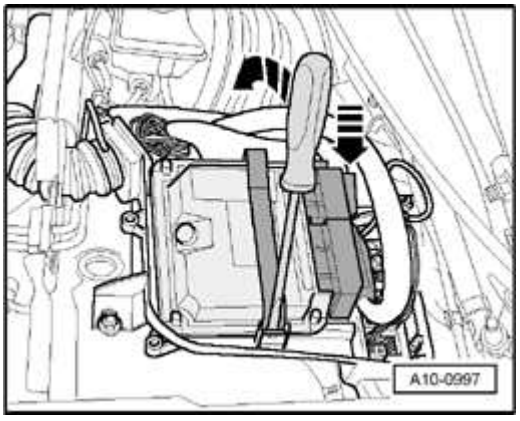


Fig. 51: Using Screwdriver To Remove Retainer Bar And Engine Control Module (ECM) J623
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Using a screwdriver, carefully pry off mounting bracket - **arrow** - and remove Engine Control Module (ECM) from E-Box.

NOTE:

- **Engine Control Module (ECM) remains connected at wiring harness.**

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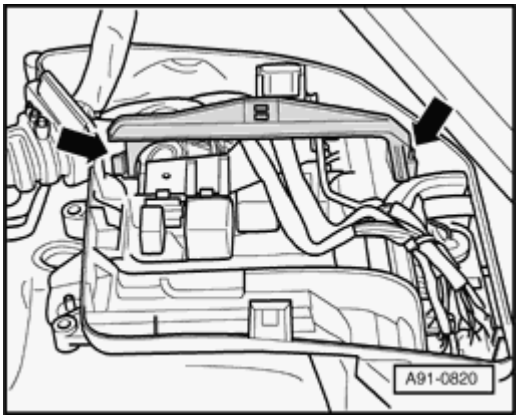


Fig. 52: Releasing Retaining Hooks Toward Outside And Removing Retaining Bracket
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Release retaining hooks - **arrows** - toward outside and remove retaining bracket.

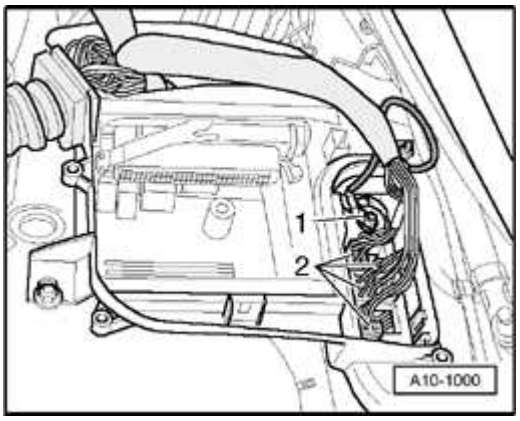


Fig. 53: Disconnecting All Electrical Harness Connectors On Connector Station Using Spark Plug Connector Pliers V.A.G 1922
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect all electrical harness connectors on connector station - **2** - using spark plug connector pliers V.A.G 1922.
- Remove electrical wire connection - **1** -.

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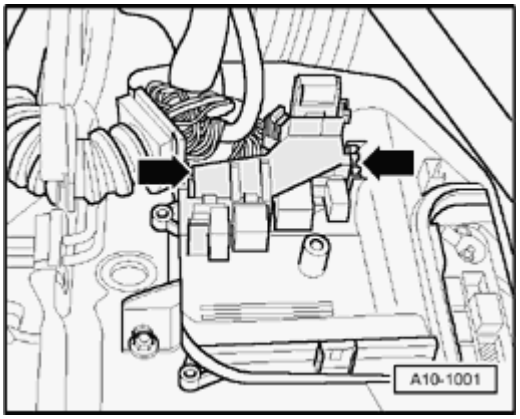


Fig. 54: Disengaging Locking Mechanisms And Removing Secondary Relay Carrier In E-Box Toward Top
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disengage locking mechanisms - **arrows** - and remove secondary relay carrier in E-Box toward top.
- Disengage engine wiring harness at E-Box and bulkhead.

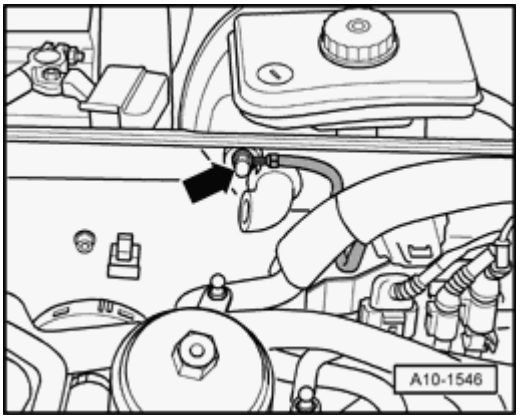
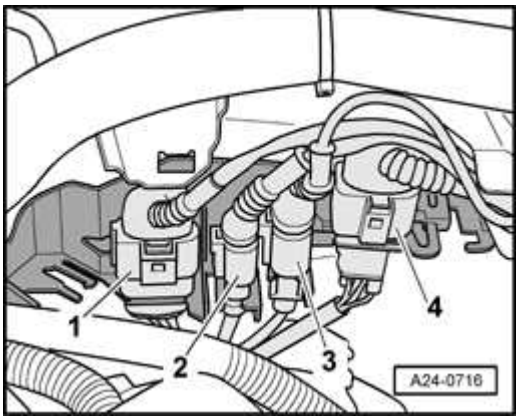


Fig. 55: Removing Ground (GND) Connection
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove Ground (GND) connection - **arrow** -.



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Fig. 56: Removing Bracket For Electrical Harness Connectors At Left From Bulkhead
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bracket for electrical harness connectors - **1 to 4** - at left from bulkhead.
- Free up wiring harness.
- Set electrical wiring harness on engine and secure Engine Control Module (ECM) against falling down.

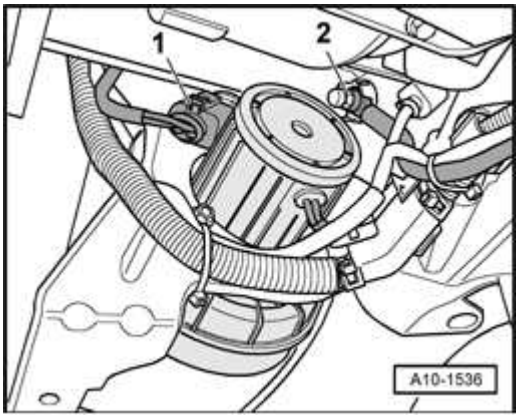


Fig. 57: Disconnecting Electrical Harness Connector At Secondary Air Injection (AIR) Pump Motor V101 & Removing Ground (GND) Wire On Long Member
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical harness connector - **1** - at Secondary Air Injection (AIR) Pump Motor V101.
- Remove Ground (GND) wire - **2** - on long member.

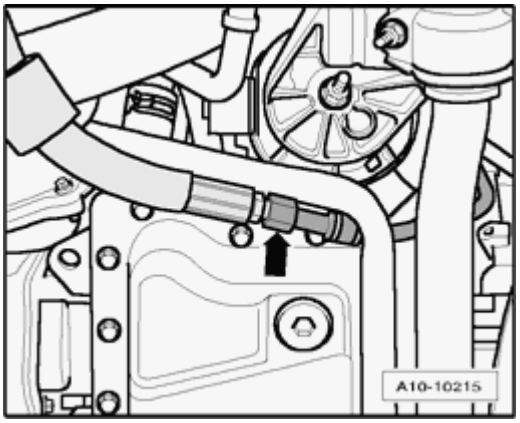


Fig. 58: Disconnecting Hydraulic Pressure Line For Power-Steering At Left Next To Oil Pan
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Place old oil collecting and extracting device V.A.G 1782 under engine.
- Disconnect hydraulic pressure line for power-steering - **arrow** - at left next to oil pan.

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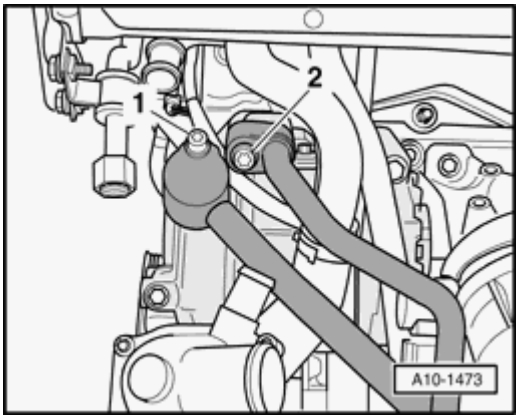


Fig. 59: Removing Bolts & Right Refrigerant Line From A/C Compressor
Courtesy of VOLKSWAGEN UNITED STATES, INC.

NOTE:

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

- Remove bolts - **1** - and - **2** -.
- Remove right refrigerant line from A/C compressor.

NOTE:

- **The left refrigerant line will be removed at a later point in time.**

- Seal open connections on A/C compressor using clean plugs.

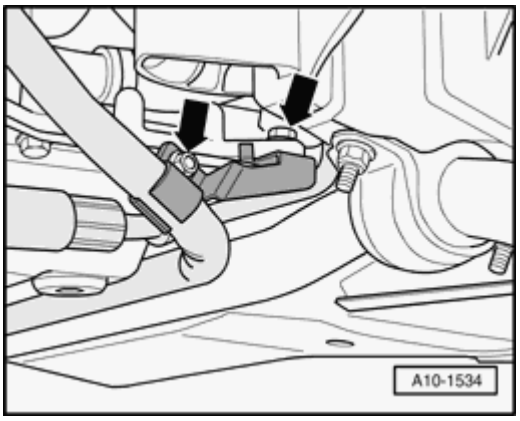


Fig. 60: Removing Left Bracket For Refrigerant Line
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove left bracket for refrigerant line - **arrows** -.

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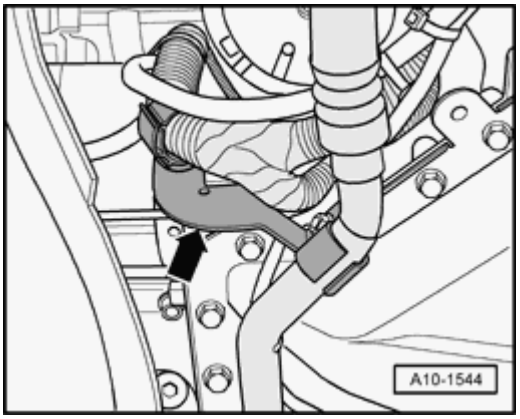


Fig. 61: Removing Refrigerant Line On Bracket
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove refrigerant line on bracket - **arrow** -.

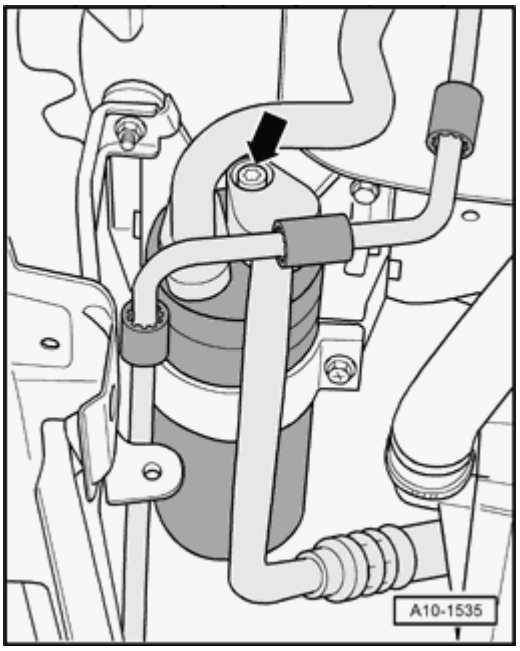


Fig. 62: Removing Bolt And Disconnecting Refrigerant Line To A/C Compressor
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolt - **arrow** - and disconnect refrigerant line to A/C compressor.

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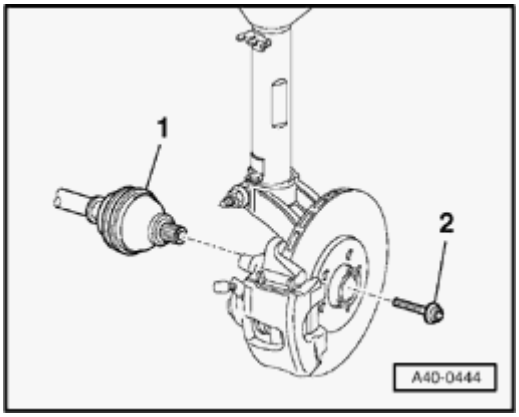


Fig. 63: Identifying Collar Bolt For Right Drive Axle
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Have a second technician press brake pedal.

CAUTION: To loosen collar bolt for drive axle, the wheel bearing must not be under load (vehicle must not be standing on its wheels).

- Remove collar bolt - **2** - at left and right drive axles - **1** -.

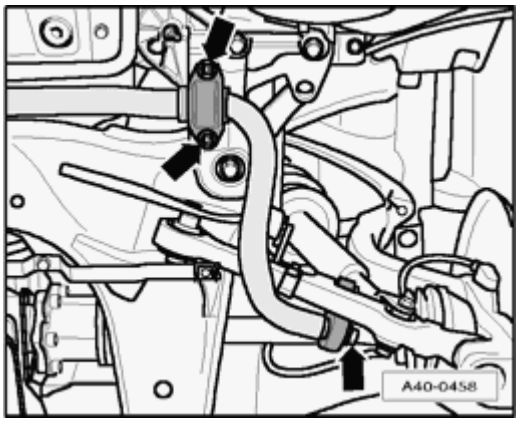


Fig. 64: Removing Bolts And Nuts Uniformly At Left/Right
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts and nuts - **arrows** - uniformly at left and right.
- Remove stabilizer.

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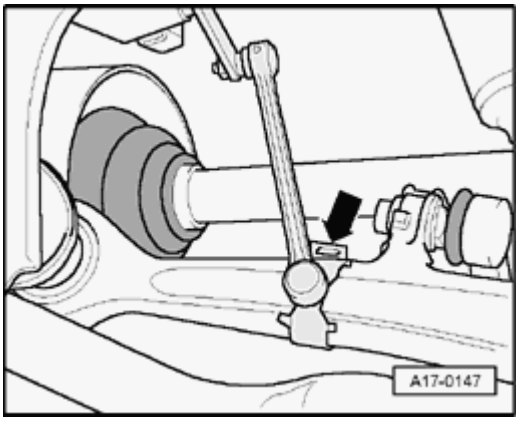


Fig. 65: Disconnecting Electrical Harness Connector At Left Front Level Control System Sensor G78
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical harness connector at Left Front Level Control System Sensor G78.
- Unclip operating rod for Left Front Level Control System Sensor G78 at bottom on control arm.
- Remove outer suspension strut bolt from left and right of engine compartment.

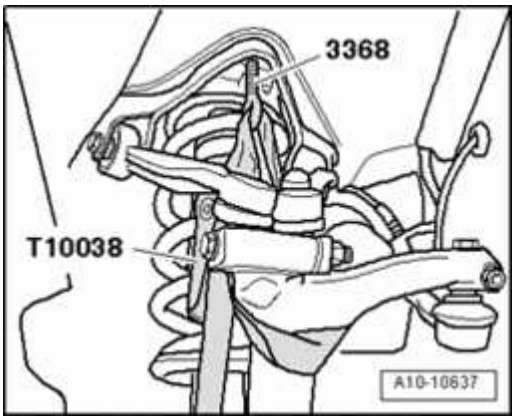


Fig. 66: Rotating Lifting Eyebolt 3368 At Left/Right In Suspension Strut Mount Hole From Below
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Rotate Lifting Eyebolt 3368 at left and right in suspension strut mount hole from below.

CAUTION: Only install Lifting Eyebolt 3368 until it is flush with upper edge of suspension strut mount so that hood is not damaged when closed.

- Tie up wheel bearing housing at left and right with Tensioning Strap T10038 as shown in illustration.

CAUTION: To prevent upper control arm joints from being damaged, wheel bearing housing must be supported before loosening lower suspension strut bolts.

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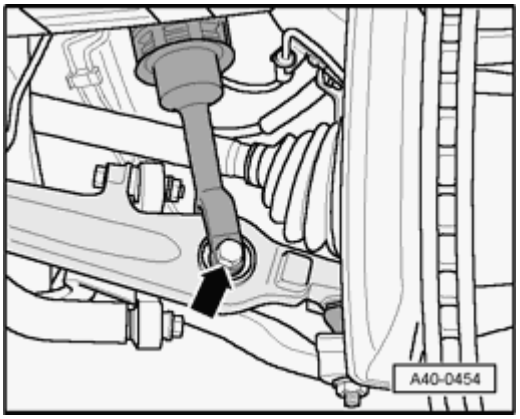


Fig. 67: Removing Bolt And Suspension Strut From Control Arm
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolt and remove suspension strut from control arm - **arrow** -.

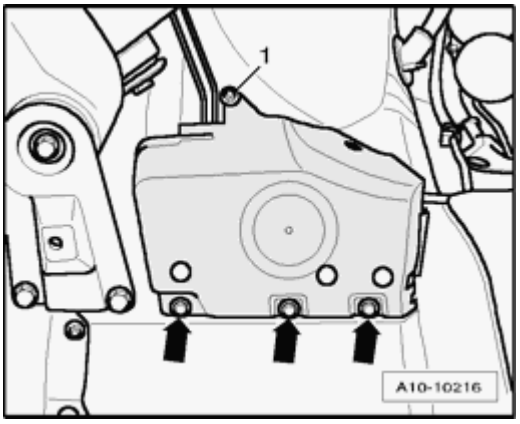


Fig. 68: Removing Expanding Clips, Nut And Cover Behind Wheel Housing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove expanding clips - **arrows** -.
- Remove nut - **1** - and remove cover behind wheel housing.

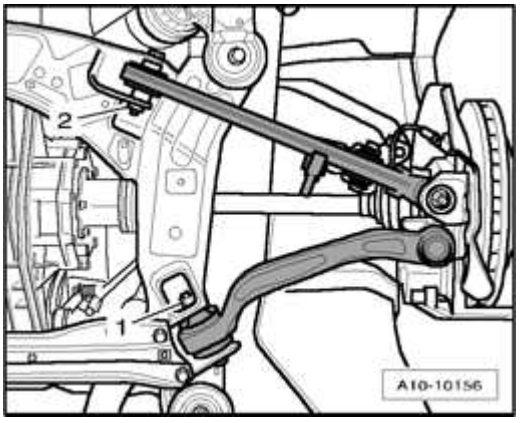


Fig. 69: Removing Guide Control Arm And Control Arm On Subframe

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Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove guide control arm - **1** - and control arm - **2** - on subframe.

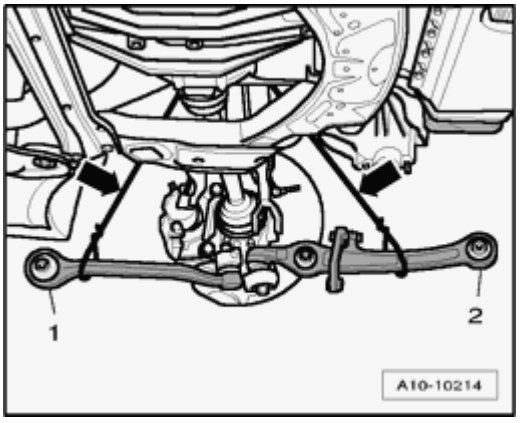


Fig. 70: Pivoting Guide Control Arm And Control Arm Outward
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Pivot guide control arm - **1** - and control arm - **2** - outward.

CAUTION: Guide control arm and control arm must not hang free. Tie up both control arms on wheel bearing housing - arrows - as shown in illustration.

- Repeat work procedure on opposite side of the vehicle.

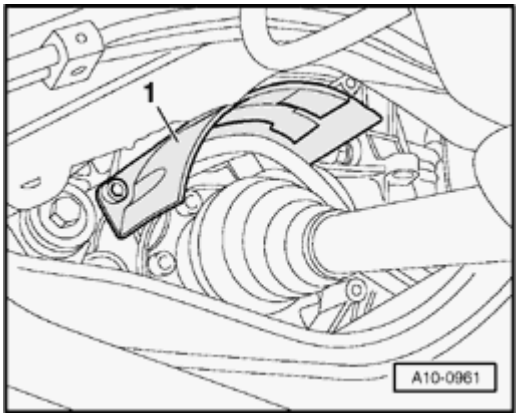


Fig. 71: Removing Heat Shield For Left Drive Axle
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove heat shield - **1** - for left drive axle.
- Remove drive axle from transmission flanged shaft.
- Swing left wheel bearing housing outward and remove drive axle.
- Repeat work procedure on opposite side of the vehicle.

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NOTE:

- **Flex joint in front exhaust pipe must not be bent more than 10 ° , otherwise it may be damaged.**

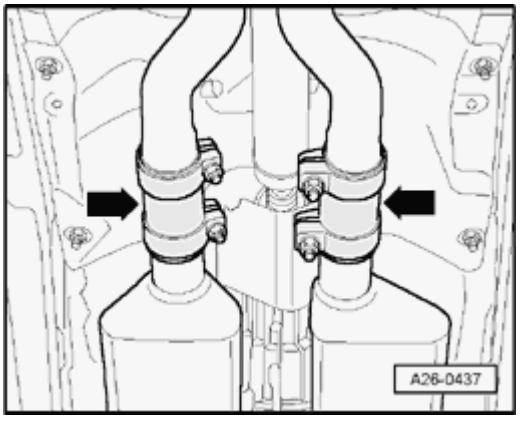


Fig. 72: Disconnecting Exhaust System At Double Clamps
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect exhaust system at double clamps - **arrows** -.

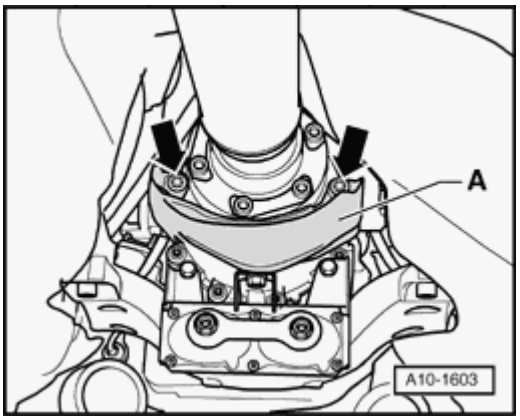


Fig. 73: Removing Heat Shield For Driveshaft
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove heat shield - **A** - for driveshaft - **arrows** -.
- Remove bolts at transmission/driveshaft flange.
- Push driveshaft together with rear final drive. The constant velocity (CV) joints can move axially.
- Tie up driveshaft to body.

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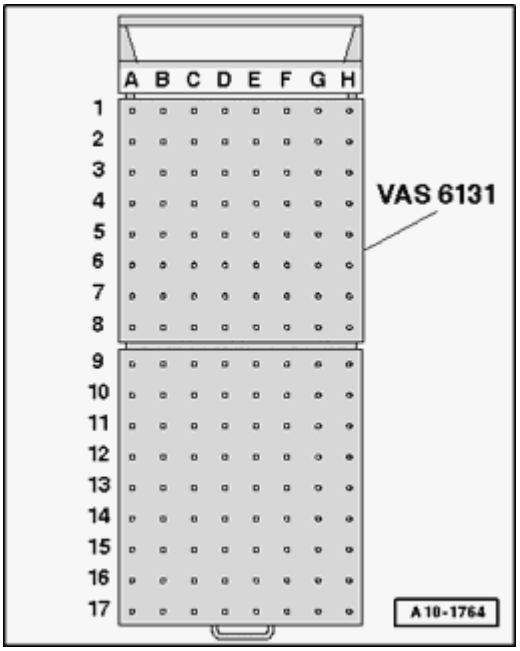


Fig. 74: Identifying Scissor Lift Platform VAS 6131
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Prepare scissor lift platform:

- Equip scissor lift platform VAS 6131 A with support set for Audi VAS 6131/10 as follows:

Platform coordinates	Parts of support set for Audi VAS 6131/10			
B4	/10-1	/10-4	/10-5	/10-11
G3	/10-1	/10-4	/10-5	/10-11
B10	/10-1	/10-2	/10-5	/10-8
G10	/10-1	/10-2	/10-5	/10-8
C14	/10-1	/10-3	/10-5	/10-7
E14	/10-1	/10-3	/10-5	/10-7

- Install attachments on scissor lift table by hand first.
- Place scissor lift platform VAS 6131 A in horizontal position.

- Note bubble level (sight glass) on support platform.

- Drive scissor lift platform VAS 6131 A under engine/transmission subassembly.

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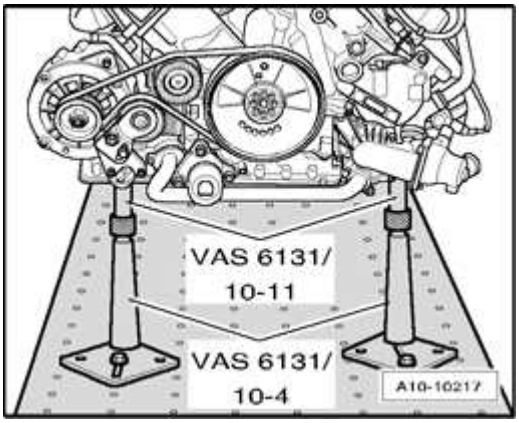


Fig. 75: Positioning Support Elements From VAS 6131/10 At Front On Engine
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Position support elements from VAS 6131/10 at front on engine as shown in illustration.

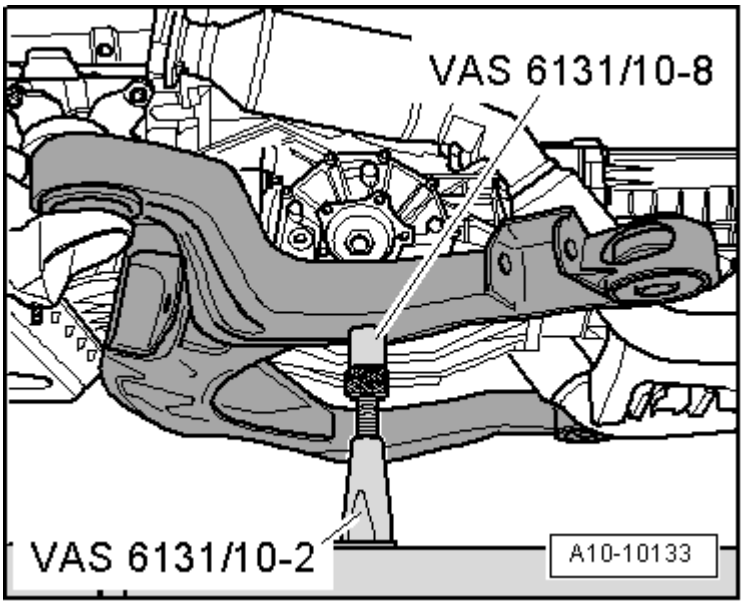


Fig. 76: Positioning Support Elements From VAS 6131/10 At Left/Right On Subframe
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Position support elements from VAS 6131/10 at left and right on subframe as shown in illustration.

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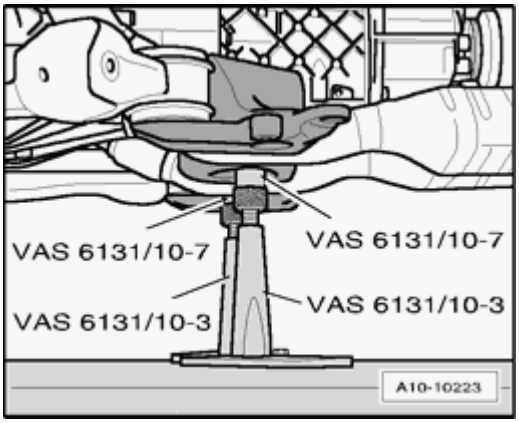


Fig. 77: Positioning Support Elements From VAS 6131/10 At Left/Right On Tunnel Cross Member
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Position support elements from VAS 6131/10 at left and right on tunnel cross member as shown in illustration.
- Turn all spindles of support elements upward far enough until all support pins make contact at support points.
- Tighten base plates for support elements to 20 Nm on scissor lift platform VAS 6131 A.

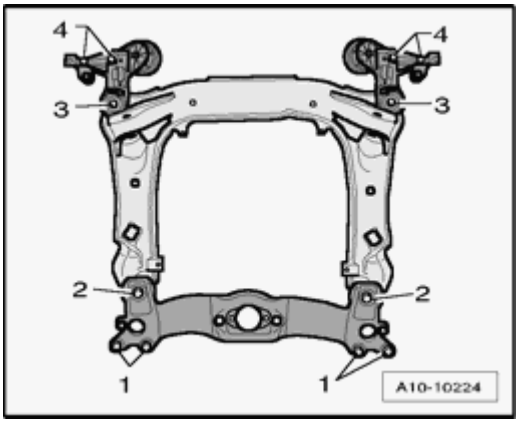


Fig. 78: Removing/Installing Bolts In Diagonal Sequence And In Stages
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Mark installation position of subframe and of both engine mount plates to long members using a felt-tip marker.
- Remove bolts - **1 to 4** - in diagonal sequence and in stages.

NOTE:

- **Verify that all hoses and lines between engine/transmission subassembly and body have been disconnected.**
- **While lowering, carefully guide engine/transmission subassembly with subframe out of engine compartment in order to prevent damage.**

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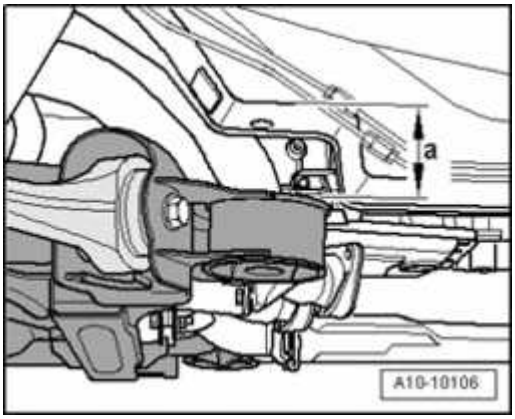


Fig. 79: Lowering Engine/Transmission Assembly Using Scissor Lift Platform VAS 6131 Only Approx. By Dimension
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Lower engine/transmission subassembly using scissor lift platform VAS 6131 A first only approx. dimension - **a** -.

- Dimension - **a** - = 100 mm.

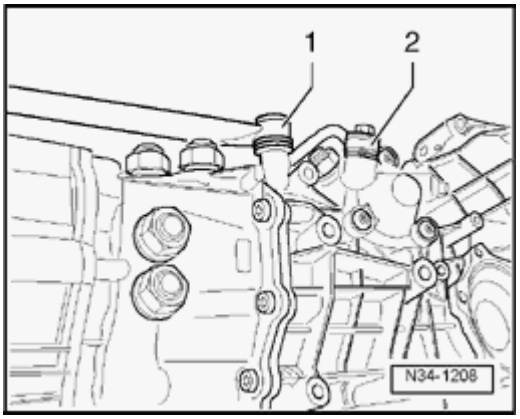


Fig. 80: Identifying Push Rod And Connecting Rod For Selector Rod
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect connecting rod - **2** - of shift rod.
- Remove socket head bolt of pivot rod - **1** -.

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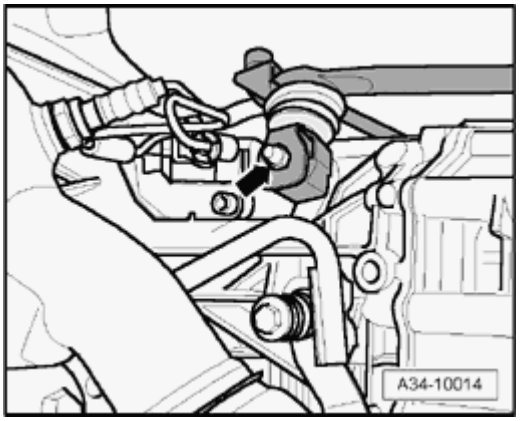


Fig. 81: Installing Lever For Selector Shaft
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove nut - **arrow** - and remove lever from selector shaft.

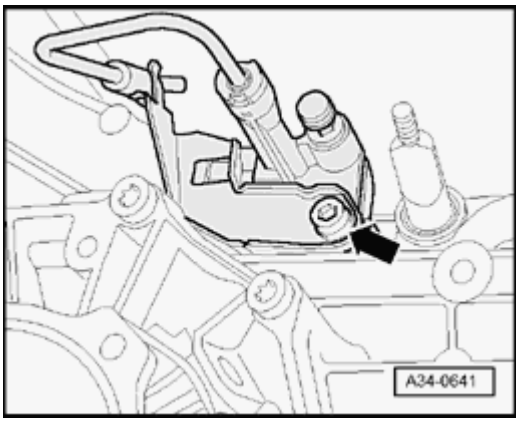


Fig. 82: Removing Clutch Slave Cylinder
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove clutch slave cylinder - **arrow** - , do not disconnect lines.
- Tie up clutch slave cylinder together with shift rods.
- Lower engine/transmission subassembly downward.
- Push scissor lift platform VAS 6131 A with engine/transmission subassembly under vehicle.

Engine (vehicles with manual transmission), separating

Special tools, testers and auxiliary items required

- Support set for Audi VAS 6131/10 and VAS 6131/11

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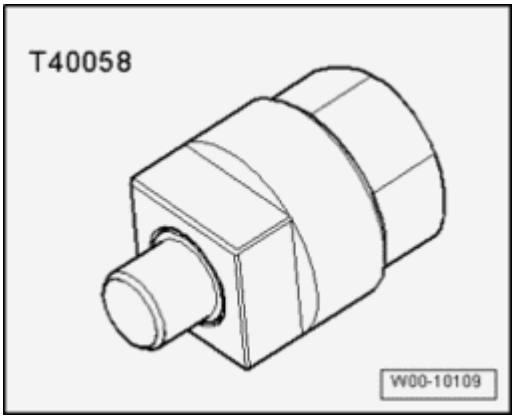


Fig. 83: Adapter T40058
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Adapter T40058

Work procedure

- Engine/transmission unit removed and attached to scissor lift platform VAS 6131 A.

NOTE:

- **All cable ties opened or cut during engine removal must be reinstalled at the same locations during installation.**
- **All heat insulation sleeves removed during engine removal must be reinstalled at the same locations during installation.**

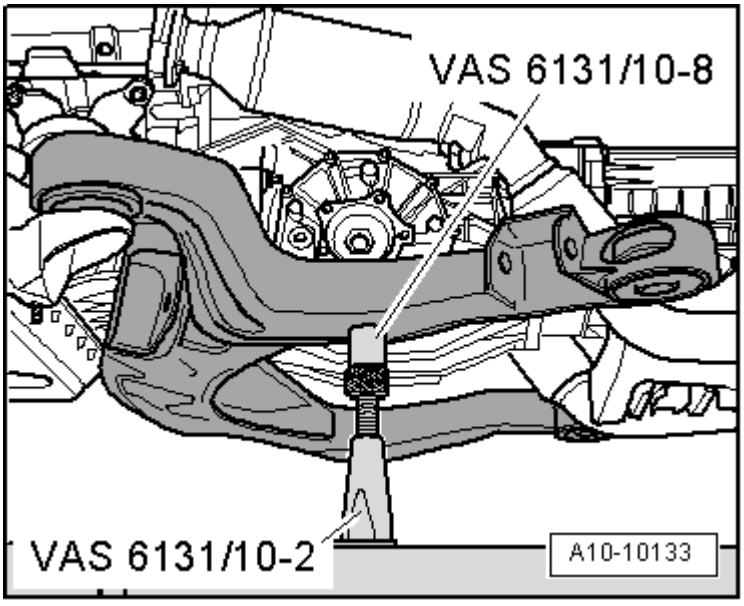


Fig. 84: Positioning Support Elements From VAS 6131/10 At Left/Right On Subframe
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Turn spindles of support elements from VAS 6131/10 at left and right at subframe completely downward.

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- Remove support pins from spindles.
- Remove subframe to side.

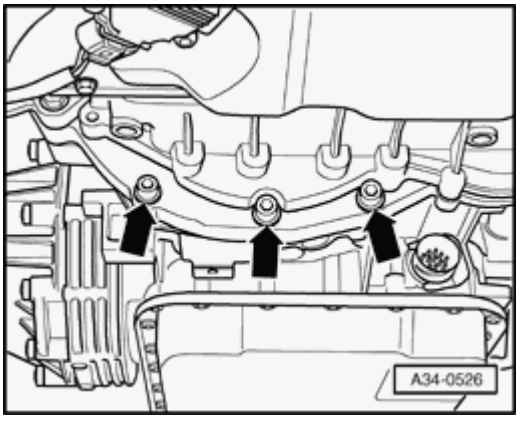


Fig. 85: Removing Bottom Engine/Transmission Connecting Bolts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bottom engine/transmission connecting bolts **- arrows -**.

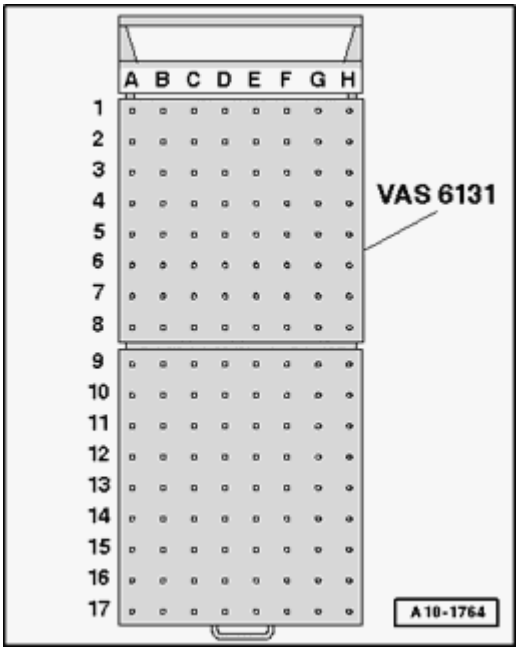


Fig. 86: Identifying Scissor Lift Platform VAS 6131
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Equip scissor lift platform VAS 6131 A with support set for Audi VAS 6131/10 and VAS 6131/11 as follows:

Platform coordinates	**Parts of support set for Audi VAS 6131/10 and VAS 6131/11**			

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B4 * See note	/10-1	/10-4	/10-5	/10-11
G3 * See note	/10-1	/10-4	/10-5	/10-11
C7	/10-1	/10-4	/10-5	/10-12
G7	/10-1	/10-4	/10-5	/10-12
F10	/10-1	/10-4	/10-5	/11-3
D12	/10-1	/10-2	/10-5	/11-2
C14 * See note	/10-1	/10-3	/10-5	/10-7
E14 * See note	/10-1	/10-3	/10-5	/10-7

*Support elements remain unchanged.

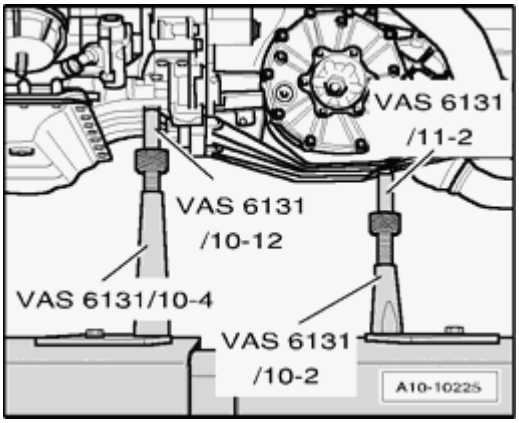


Fig. 87: Positioning Support Elements From VAS 6131/10 And VAS 6131/11 At Left On Engine/Transmission
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Position support elements from VAS 6131/10 and VAS 6131/11 at left on engine/transmission as shown in illustration.

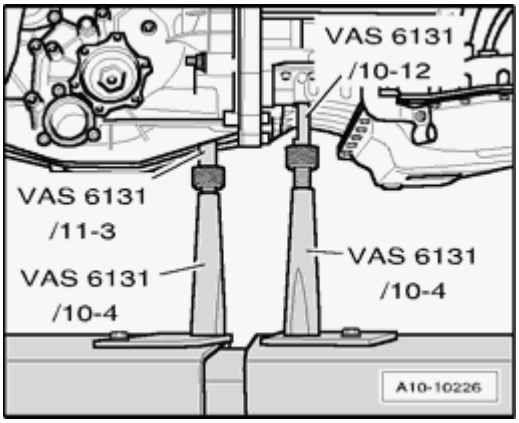


Fig. 88: Positioning Support Elements From VAS 6131/10 And VAS 6131/11 At Right On Engine/Transmission
Courtesy of VOLKSWAGEN UNITED STATES, INC.

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- Position support elements from VAS 6131/10 and VAS 6131/11 at right on engine/transmission as shown in illustration.
- Turn spindles of attachments upward far enough until all support pins make contact at support points.
- Tighten base plates for support elements to 20 Nm on scissor lift platform VAS 6131 A.

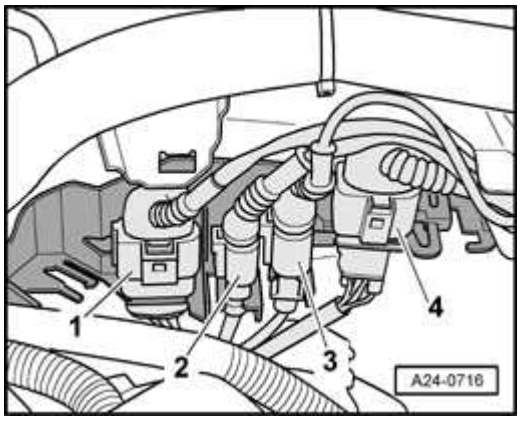


Fig. 89: Removing Bracket For Electrical Harness Connectors At Left From Bulkhead
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove electrical harness connectors - **1** - and - **4** - from bracket and disconnect.
- Remove heat insulation sleeve on wiring harness and free up individual wires.

NOTE:

- **In the illustration, the electrical harness connectors are depicted as installed.**

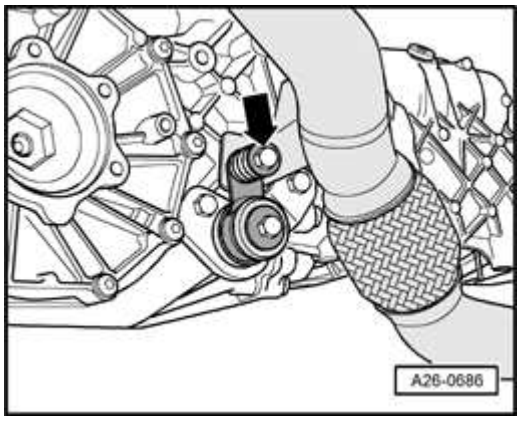


Fig. 90: Removing Bolt At Strap For Left Front Exhaust Pipe
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolt - **arrow** - at strap for left front exhaust pipe.

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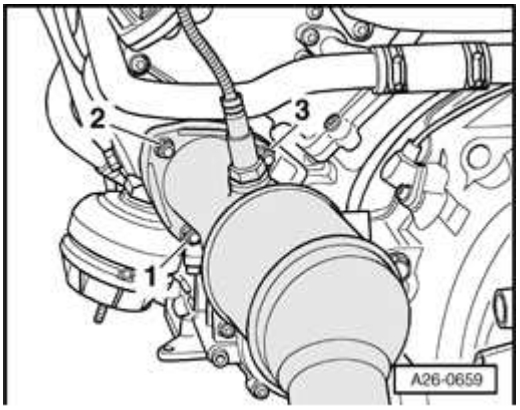


Fig. 91: Removing Nuts For Left Front Exhaust Pipe/Exhaust Manifold
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove nuts - **1 to 3** - for left front exhaust pipe/exhaust manifold.
- Remove front exhaust pipe with pre- and main catalytic converters.

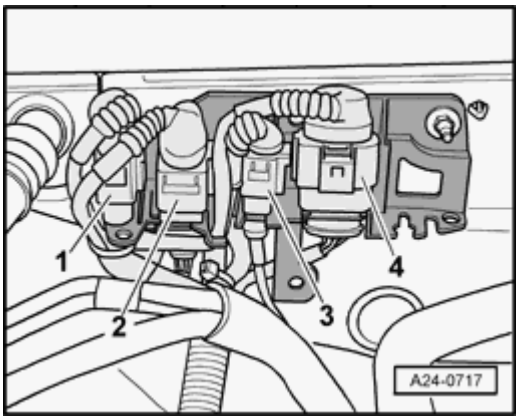


Fig. 92: Removing Electrical Harness Connectors From Bracket
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove electrical harness connectors - **2** - and - **4** - from bracket and disconnect.
- Free up wiring harnesses.

NOTE:

- **In the illustration, the electrical harness connectors are depicted as installed.**

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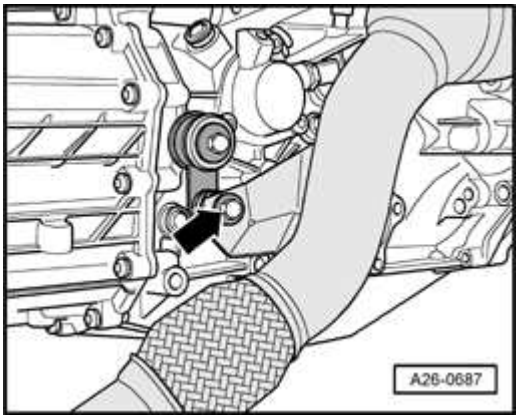


Fig. 93: Removing Bolt At Strap For Right Front Exhaust Pipe
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolt - **arrow** - at strap for right front exhaust pipe.

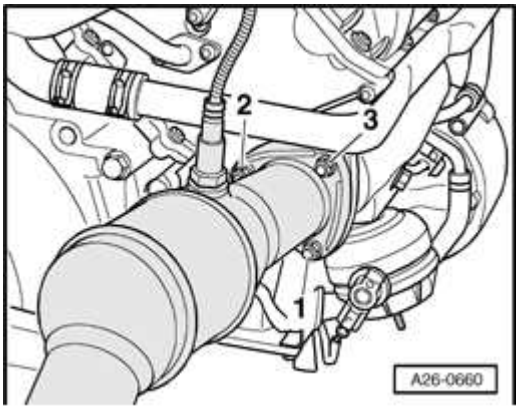


Fig. 94: Removing Nuts For Right Front Exhaust Pipe/Exhaust Manifold
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove nuts - **1 to 3** - for right front exhaust pipe/exhaust manifold.
- Remove front exhaust pipe with pre- and main catalytic converters.

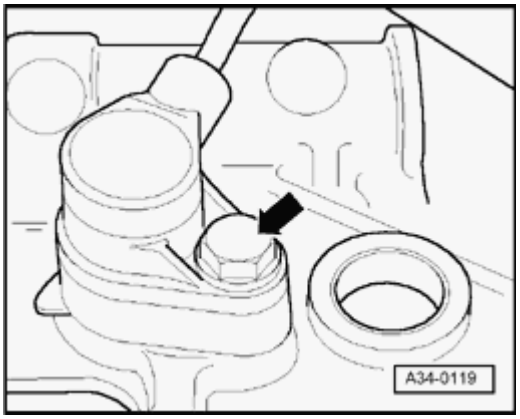


Fig. 95: Location Of Engine Speed (RPM) Sensor G28 On Coupling Housing

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Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolt and Engine Speed (RPM) Sensor G28 on transmission - **arrow** -.

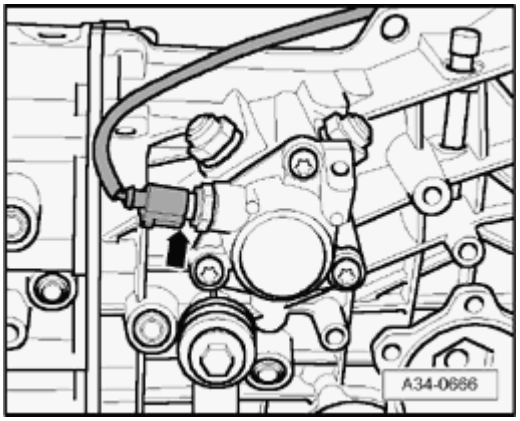


Fig. 96: Disconnecting Electrical Harness Connector At Back-Up Light Switch F4
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical harness connector - **arrow** - at Back-Up Light Switch F4 and free up electrical wire.

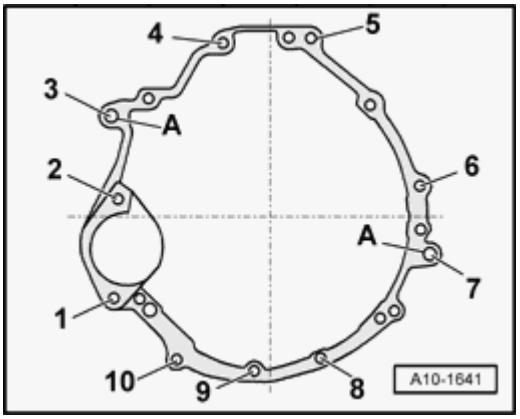


Fig. 97: Identifying Engine/Transmission Threaded Connections
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove engine/transmission threaded connections - **1 to 7** -.

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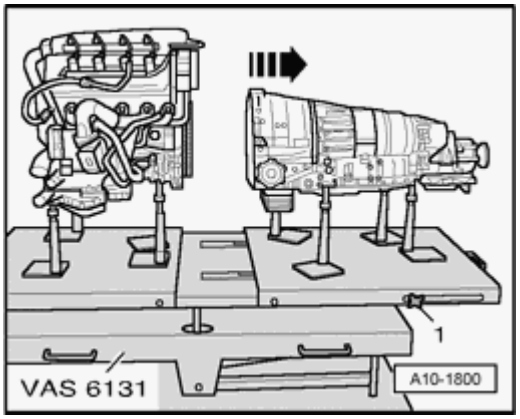


Fig. 98: Loosening Clamping Bolts On Side Of Scissor Lift Table VAS 6131 And Pull Rear Table Section With Transmission Rearward
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Loosen side clamping bolts - **1** - on scissor lift platform VAS 6131 A and pull rear platform top with transmission toward rear - **arrow** - , simultaneously push torque converter through opening of drive plate while doing this.

Engine (vehicles with manual transmission), securing to engine and transmission holder

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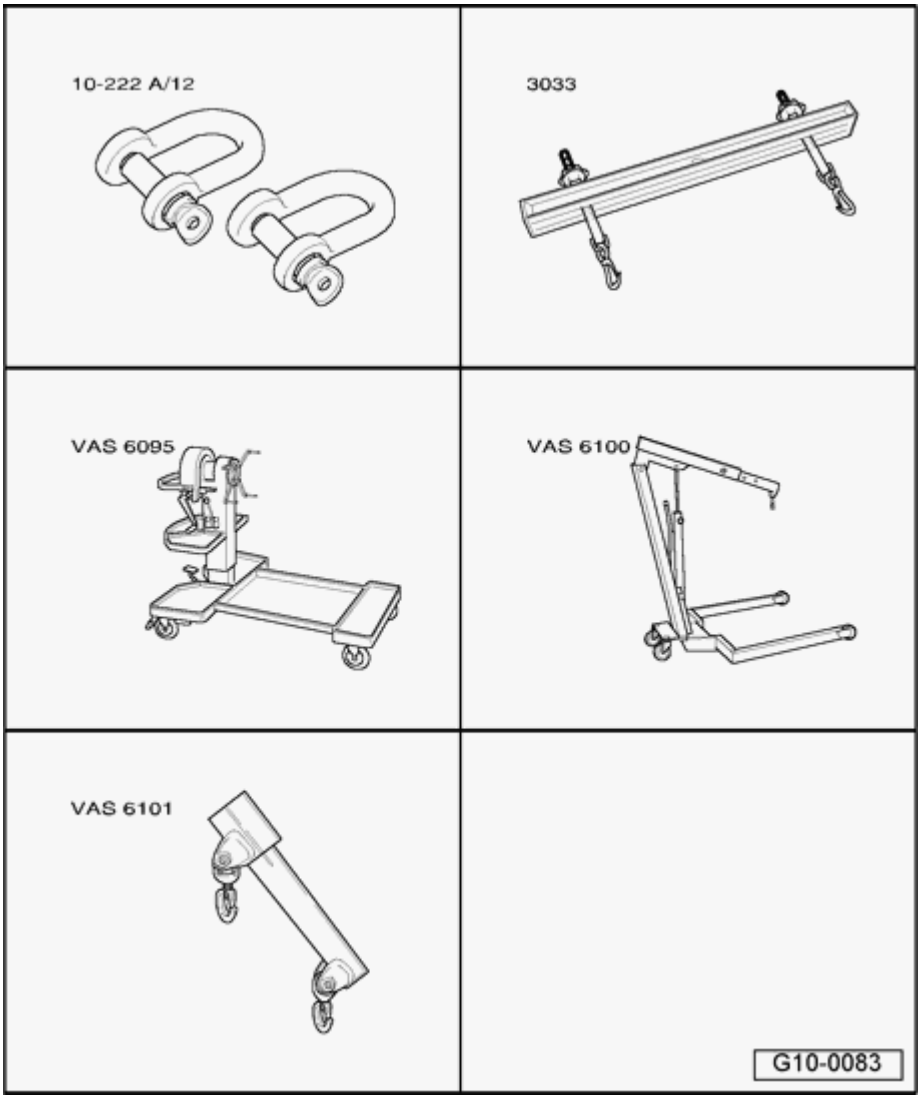


Fig. 99: Identifying Special Tools - Engine (Vehicles With Manual Transmission), Securing To Engine And Transmission Holder
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools, testers and auxiliary items required

- Shackle 10-222 A/12
- Lifting tackle 3033
- Engine and Transmission Holder VAS 6095 with Holder for V8 Engine Audi S4, allroad quattro VAS 6095/1-6 or Holder for V8 Engine Audi S4, allroad quattro VAS 6095/1-6A
- Shop crane VAS 6100
- Lift arm extension for workshop crane VAS 6101

Special tools, testers and auxiliary items required

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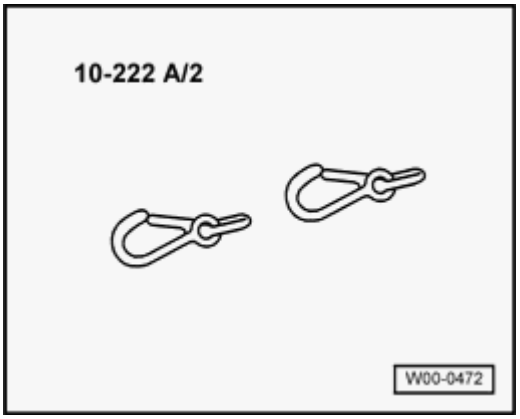


Fig. 100: Identifying Additional Hooks (2) 10-222 A/2
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Additional hooks 10-222 A/2

Work procedure

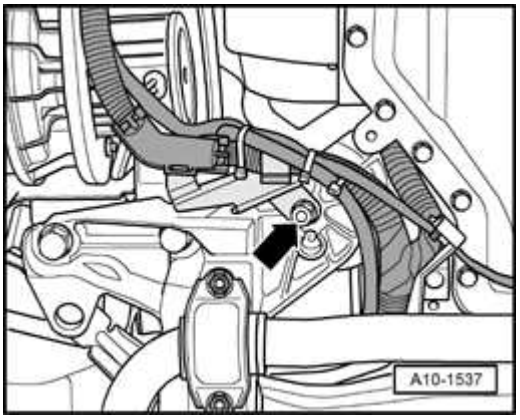
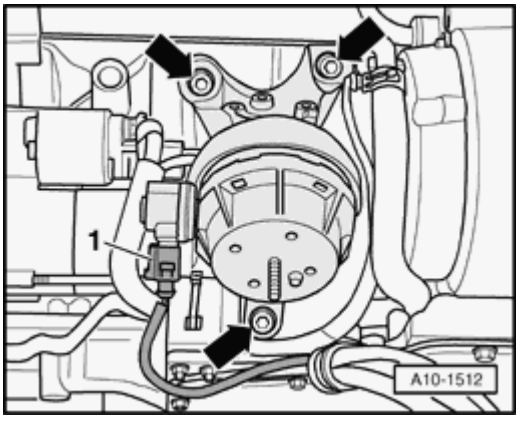


Fig. 101: Removing Wiring Harness Bracket At Right Engine Plate
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove wiring harness bracket at right engine plate - **arrows** -.



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Fig. 102: Disconnecting Electrical Harness Connector At Right Engine Mount
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical harness connector - **1** - at right engine mount.
- Remove bolts - **arrows** - and remove right engine mount.

NOTE:

- **Shown without engine mount plate to provide a better illustration.**

- Repeat work procedure on opposite side of vehicle.

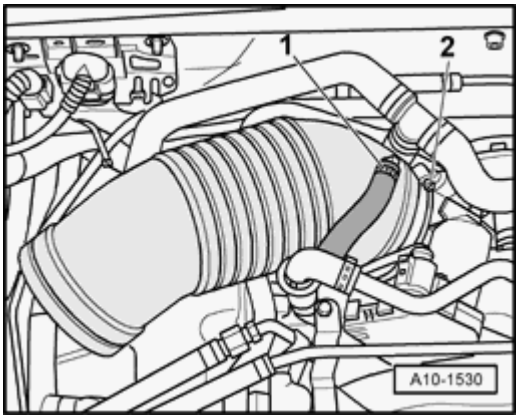
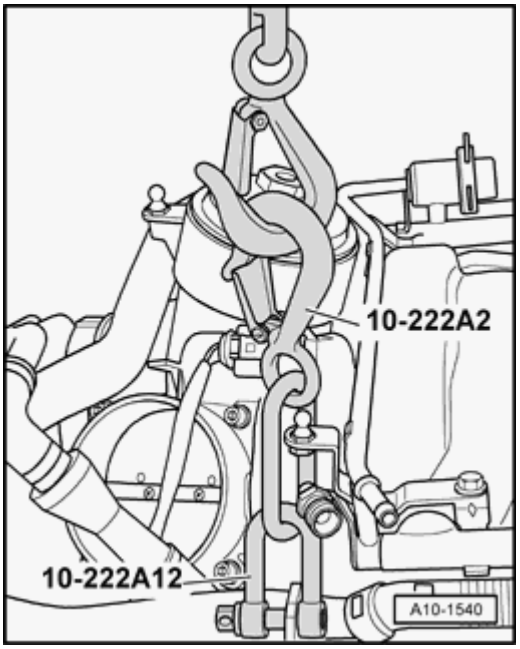


Fig. 103: Disconnecting Vacuum Hose & Air Guide Hose From Throttle Valve Control Module
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect vacuum hose - **1** -.
- Disconnect air guide hose - **2** - from throttle valve control module.



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Fig. 104: Securing Shackle 10-222 A/12 To Right Rear Engine Lifting Eyelet & Hooking Additional Hook 10-222 A/2 On Shackle 10-222 A/12
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Secure shackle 10-222 A/12 to right rear engine lifting eyelet.
- Hook additional hook 10-222 A/2 on shackle 10-222 A/12.

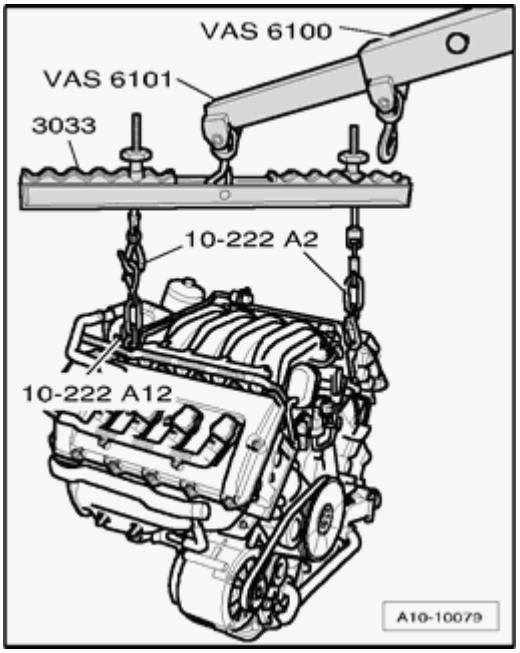


Fig. 105: Engaging Engine Sling 3033 On Additional Hook 10-222 A/2 And On Workshop Crane VAS 6100 With Lift Arm Extension For Workshop Crane VAS 6101
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Engage engine sling 3033 on additional hook 10-222 A/2 and on workshop crane VAS 6100 with lift arm extension for workshop crane VAS 6101 as shown in the illustration.
- Lift engine from support elements of scissor lift platform VAS 6131 A.

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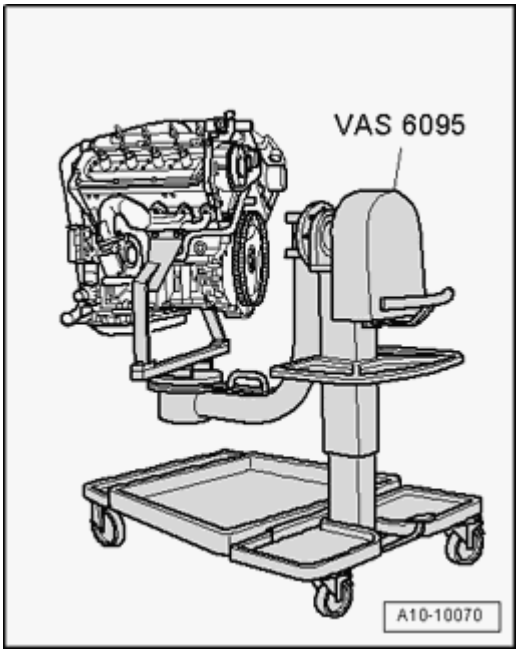


Fig. 106: Securing Engine With Transmission Holder VAS 6095
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Secure engine with Holder for V8 Engine Audi S4, allroad quattro VAS 6095/1-6 or Holder for V8 Engine Audi S4, allroad quattro VAS 6095/1-6A tightened to 42 Nm to Engine and Transmission Holder VAS 6095 as shown in the illustration.

Engine (vehicles with manual transmission), installing

NOTE:

- **During assembly, replace self-locking nuts and bolts.**
- **Always replace bolts that are tightened to torque as well as sealing rings, gaskets and O-rings.**
- **Secure all hose connections using hose clamps appropriate for the model type .**
- **During installation, re-install all heat insulation sleeves at the same locations.**
- **During installation, all cable ties must be re-installed at the same location.**

- When installing a new clutch disc in combination with a used SAC clutch pressure plate (self-adjusting pressure plate), the adjustment ring of the pressure plate must be turned back to impact. Otherwise the pressure plate works with decreased contact pressure (clutch slips) --> **30 CLUTCH** .

NOTE:

- **If clutch disc is not being replaced, the adjustment ring must not be turned back.**
- **New SAC-pressure plates are already pre-adjusted and must not be reset.**

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- Clean input shaft splines and (in case of used clutch plates) clean hub splines, remove corrosion and apply only a very thin coating of lubricant on splines. Do not grease the guide sleeve.
- If necessary, check centering of clutch drive plate.
- Check clutch release bearing for wear and replace if necessary.

If plastic ring of clutch release bearing is loose:

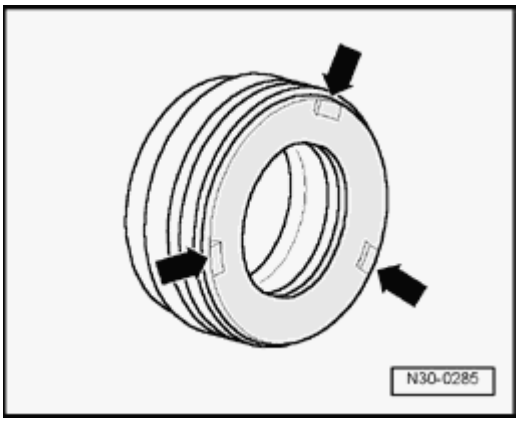


Fig. 107: Servicing Release Bearing With Plastic Ring
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Adhere clutch release bearing plastic ring to bearing ring, adhesive

- 3 rectangular tabs - **arrows** - of plastic ring reach into cutouts of bearing ring.
- If grooves with depth of more than 0.5 mm are present, the release bearing must be replaced.

- Make sure alignment sleeves for engine to transmission are installed in cylinder block. Install if necessary.
- Install intermediate plate between engine and transmission onto alignment bushings.
- Bolt transmission to engine.

NOTE:

- **Torque specifications only apply to lightly greased, oiled, phosphated or blackened nuts and bolts.**
- **Additional lubricants, such as engine or transmission oil are permissible, although lubricants containing graphite are not.**
- **Do not use any degreased parts.**
- **Tolerance for torque specifications ± 15%.**

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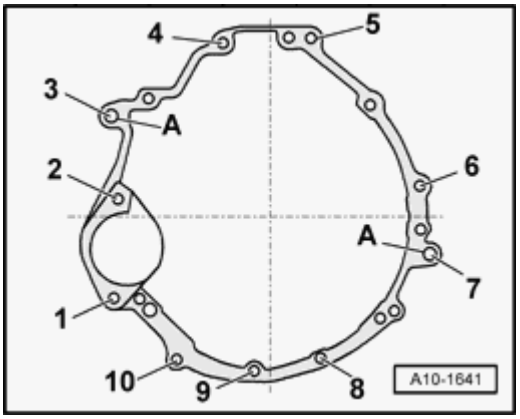


Fig. 108: Identifying Engine/Transmission Threaded Connections
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Engine/transmission, fastening

Item	Bolt	Nm
1, 2	M12x120	65
3	M12x110	65
4, 5	M12x105	65
6	M12x130	65
7	M12x170	65
8, 9, 10	M10x60	45
A	Alignment sleeves for centering	

The rest of installation is in reverse order of removal, note the following:

- Install front exhaust pipes with catalytic converters: Left --> **Left front exhaust pipe with primary and main catalytic converter (vehicles with manual transmission), removing and installing** , right --> **Right front exhaust pipe with primary and main catalytic converter (vehicles with automatic transmission), removing and installing**.
- Always clean threaded driveshaft bores in transmission flanged shaft of locking fluid residue using a tap before installation.

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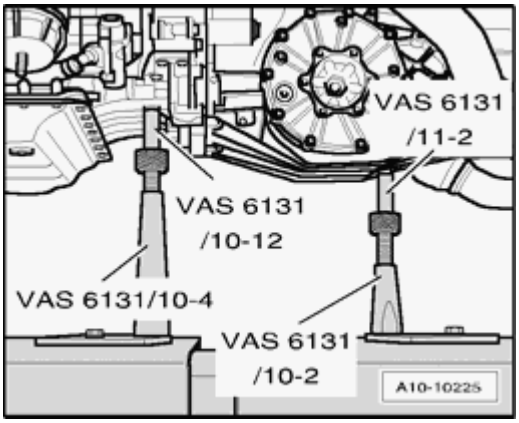


Fig. 109: Positioning Support Elements From VAS 6131/10 And VAS 6131/11 At Left On Engine/Transmission
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Rotate spindles of support elements downward at left of engine/transmission assembly.
- Remove both base plates for left support element on scissor lift platform VAS 6131 A.

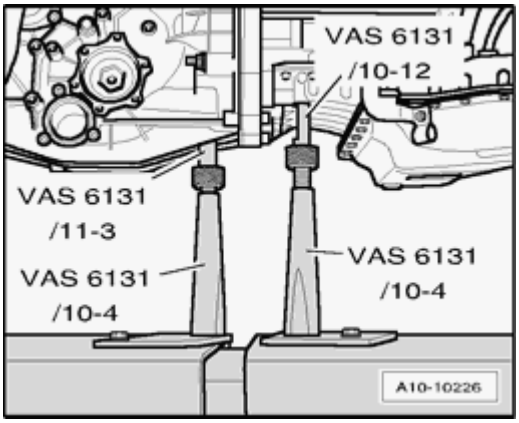


Fig. 110: Positioning Support Elements From VAS 6131/10 And VAS 6131/11 At Right On Engine/Transmission
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Rotate spindles of support elements downward at right of engine/transmission assembly.
- Remove both base plates for right support element on Scissor Lift Table VAS 6131 A.

NOTE:

- **The support points for front of engine and tunnel cross member remain unchanged.**

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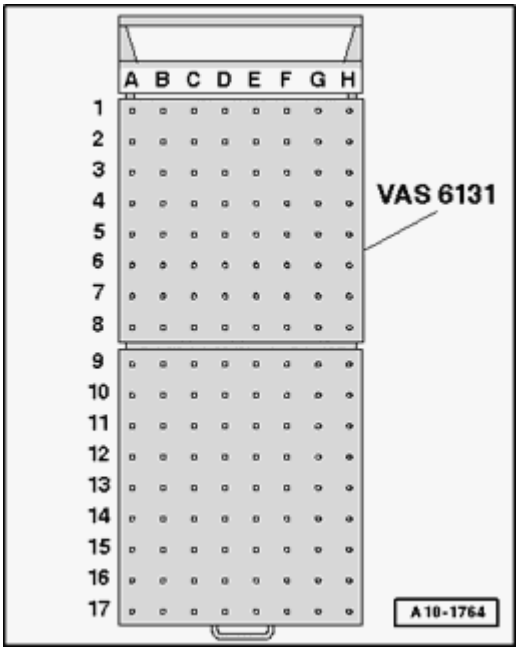


Fig. 111: Identifying Scissor Lift Platform VAS 6131
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Equip scissor lift platform VAS 6131 A with support set for Audi VAS 6131/10 as follows:

Platform coordinates	**Parts of support set for Audi VAS 6131/10**			
B4 * See note	/10-1	/10-4	/10-5	/10-11
G3 * See note	/10-1	/10-4	/10-5	/10-11
B10	/10-1	/10-2	/10-5	/10-8 * See note
G10	/10-1	/10-2	/10-5	/10-8 * See note
C14 * See note	/10-1	/10-3	/10-5	/10-7
E14 * See note	/10-1	/10-3	/10-5	/10-7

*Support elements remain unchanged.

*Only install support elements after installing subframe.

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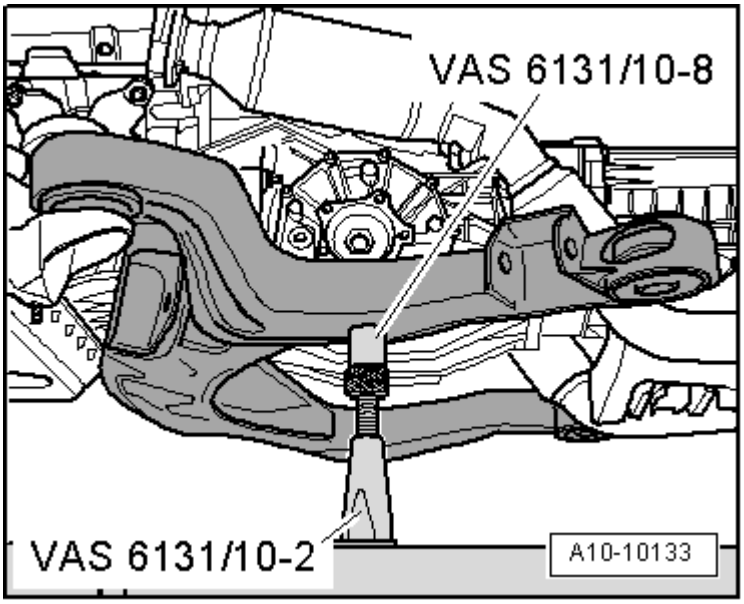


Fig. 112: Positioning Support Elements From VAS 6131/10 At Left/Right On Subframe
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Position subframe on both attachments VAS 6131/10-8.
- Turn spindles of support elements upward on both sides.
- Tighten base plates for support elements to 20 Nm on scissor lift platform VAS 6131 A.
- Using scissor lift platform VAS 6131 A , slowly guide engine/transmission unit with subframe into body from below.

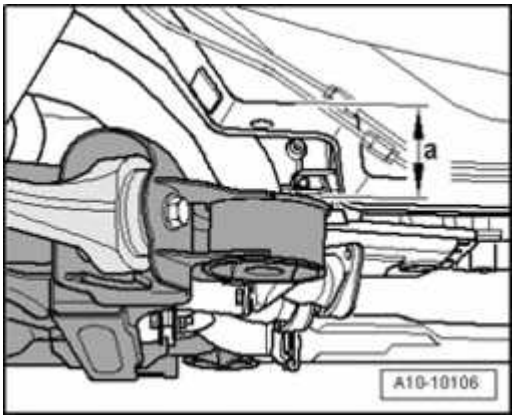


Fig. 113: Lowering Engine/Transmission Assembly Using Scissor Lift Platform VAS 6131 Only Approx. By Dimension
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Lift engine/transmission subassembly using scissor lift platform VAS 6131 A until dimension - **a** - is reached.

- Dimension - **a** - = 100 mm.

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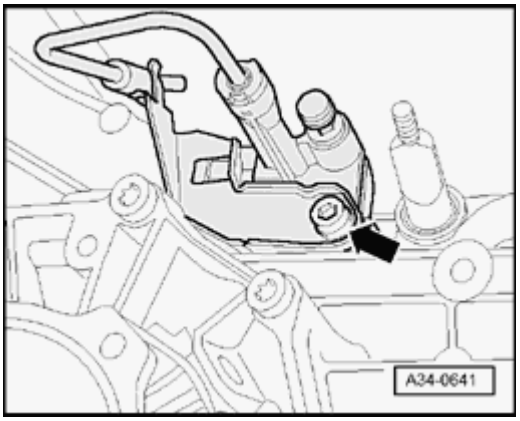


Fig. 114: Slave Cylinder Bracket And Fastener
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Secure clutch slave cylinder with a new bolt - **arrow** -.

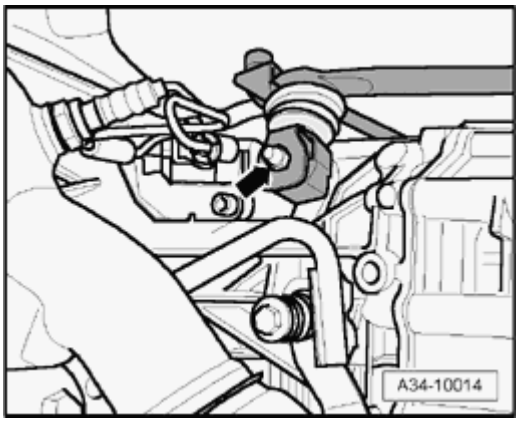


Fig. 115: Installing Lever For Selector Shaft
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Install lever for selector shaft - **arrow** -.

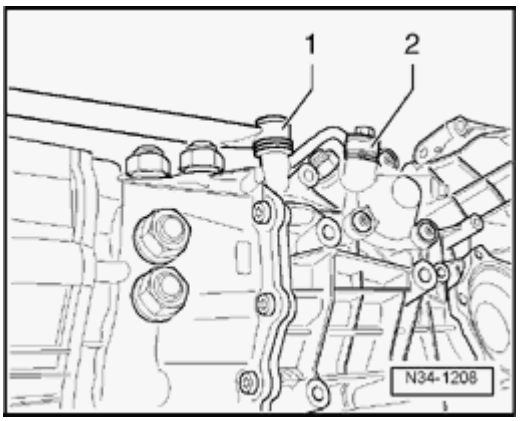


Fig. 116: Identifying Push Rod And Connecting Rod For Selector Rod
Courtesy of VOLKSWAGEN UNITED STATES, INC.

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- Install connecting rod - **2** - of shift rod.
- Install socket head bolt of pivot rod - **1** -.

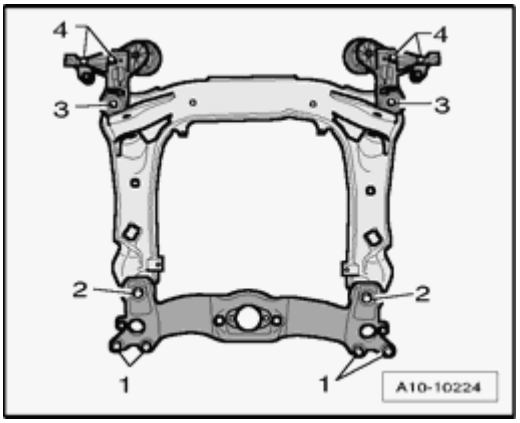


Fig. 117: Removing/Installing Bolts In Diagonal Sequence And In Stages
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Align subframe, engine bearing plated and tunnel cross member according to markings applied on long members during removal.
- Tighten bolts for subframe, engine mount plates as well as tunnel cross member only to specified torque. Do not tighten further (tighten bolts only after axle alignment).

1. 65 Nm
2. 110 Nm
3. 110 Nm
4. 75 Nm

CAUTION: Vehicle must not be driven in this condition.

- Install driveshafts --> **40 - FRONT SUSPENSION** .
- Install guide control arm, control arm, stabilizer bar and suspension strut --> **40 - FRONT SUSPENSION** .
- Install driveshaft -->
  - **39 - FINAL DRIVE, DIFFERENTIAL** for 5 SPD. AUTOMATIC TRANSMISSION 01V
  - **39 - FINAL DRIVE, DIFFERENTIAL** for 5 SPD. AUTOMATIC TRANSMISSION 01V FRONT AND ALL WHEEL DRIVE - INTERNAL COMPONENTS, SERVICING
  - **39 FINAL DRIVE, DIFFERENTIAL** for 5 SPD. MANUAL TRANSMISSION 012/01W FRONT WHEEL DRIVE
  - **39 FINAL DRIVE, DIFFERENTIAL** for 5 SPD. MANUAL TRANSMISSION 01A ALL WHEEL DRIVE
  - **39 FINAL DRIVE, DIFFERENTIAL** for 6 SPD. MANUAL TRANSMISSION 01E ALL

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WHEEL DRIVE

- **39 FINAL DRIVE, DIFFERENTIAL** for 6-SPEED MANUAL TRANSMISSION 0A3, ALL WHEEL DRIVE

.

- Align exhaust system free of tension --> **Exhaust system, installing free of tension**.
- Install refrigerant lines --> **87 AIR CONDITIONING** .

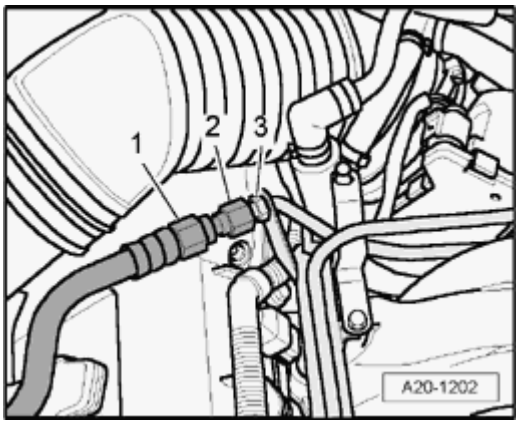


Fig. 118: Installing/Removing Fuel Hose To/From Connection On Fuel Rail Line
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Secure fuel hose to connection on fuel rail line. To do so, counter hold using an open-end wrench at each hex head - **1** - and - **3** - and tighten union nut - **2** - to 22 Nm.
- Install lock carrier with attachments -->
  - **50 BODY, FRONT**
  - **50 - BODY - FRONT** for BODY EXTERIOR - CABRIOLET

.

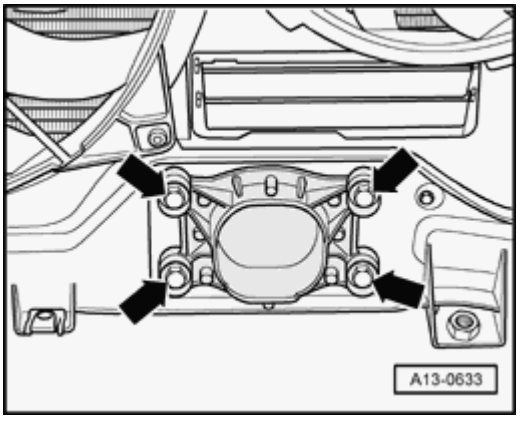


Fig. 119: Placing Torque Support On Rubber Buffer For Torque Support And Tightening Bolts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Place torque support on rubber buffer for torque support and tighten bolts - **arrows** -.

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- Install front bumper cover -->
  - **63 BUMPER**
  - **63 - BUMPERS** for BODY EXTERIOR - CABRIOLET

  .
- Electrical connections and routing --> Electrical Wiring Diagrams, Troubleshooting and Component Locations.
- Observe safety precautions after connecting battery -->
  - **27 BATTERY, STARTER, GENERATOR, CRUISE CONTROL**
  - **27 BATTERY, STARTER, GENERATOR, CRUISE CONTROL** for ELECTRICAL EQUIPMENT, CABRIOLET

  .

CAUTION: Do not use a battery charger for starting assistance! There is the risk that the vehicle control modules could be damaged.

- Mount wiper arms and adjust -->
  - **92 WINDSHIELD WIPER WASHER SYSTEM**
  - **92 WINDSHIELD WIPER & WASHER SYSTEM** for ELECTRICAL EQUIPMENT, CABRIOLET

  .
- Check oil level --> **Oil level, checking**.
- Before starting engine for the first time, fill power steering reservoir with hydraulic oil --> **48 - STEERING** .

NOTE:

- **Power-steering pump must not run dry.**

- Fill with coolant **Filling**.

NOTE:

- **Only reuse drained coolant if cylinder head or engine block was not replaced.**
- **Dirty coolant must not be re-used.**

- Fill refrigerant circuit --> **87 - AIR CONDITIONING** .
- Align subframe and both engine bearing plates --> **40 - FRONT SUSPENSION**
- Perform axle alignment --> **44 - WHEELS, TIRES, VEHICLE ALIGNMENT** .

CAUTION: After axle alignment, tighten subframe bolts to final torque.

- Check headlight adjustment -->

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- **01 - MAINTENANCE**
- **01 - MAINTENANCE** for MAINTENANCE PROCEDURES - CABRIOLET

.

Torque specifications

NOTE:

- **Torque specifications only apply to lightly greased, oiled, phosphated or blackened nuts and bolts.**
- **Additional lubricants, such as engine or transmission oil are permissible, although lubricants containing graphite are not.**
- **Do not use any degreased parts.**
- **Tolerance for torque specifications ± 15%.**

Component		**Nm**
Bolts/nuts	M6	9
	M8	20
	M10	40
	M12	65
Exceptions:		
Engine support to engine		42 * See note
Clutch slave cylinder to transmission		23 * See note
Selector shaft lever to transmission		23
Pivot rod on transmission		40
Shift rod connecting rod on transmission		23
Heat shield for drive shaft to transmission		23
Hydraulic pressure line		40
Torque support stop to lock carrier		28
Fuel hose to fuel line		22

* Insert using locking compound; locking compound .

*Replace screw.

ENGINE (VEHICLES WITH AUTOMATIC TRANSMISSION)

Engine (vehicles with automatic transmission), removing

NOTE:

- **With lock carrier removed, engine is removed downward with transmission and subframe.**

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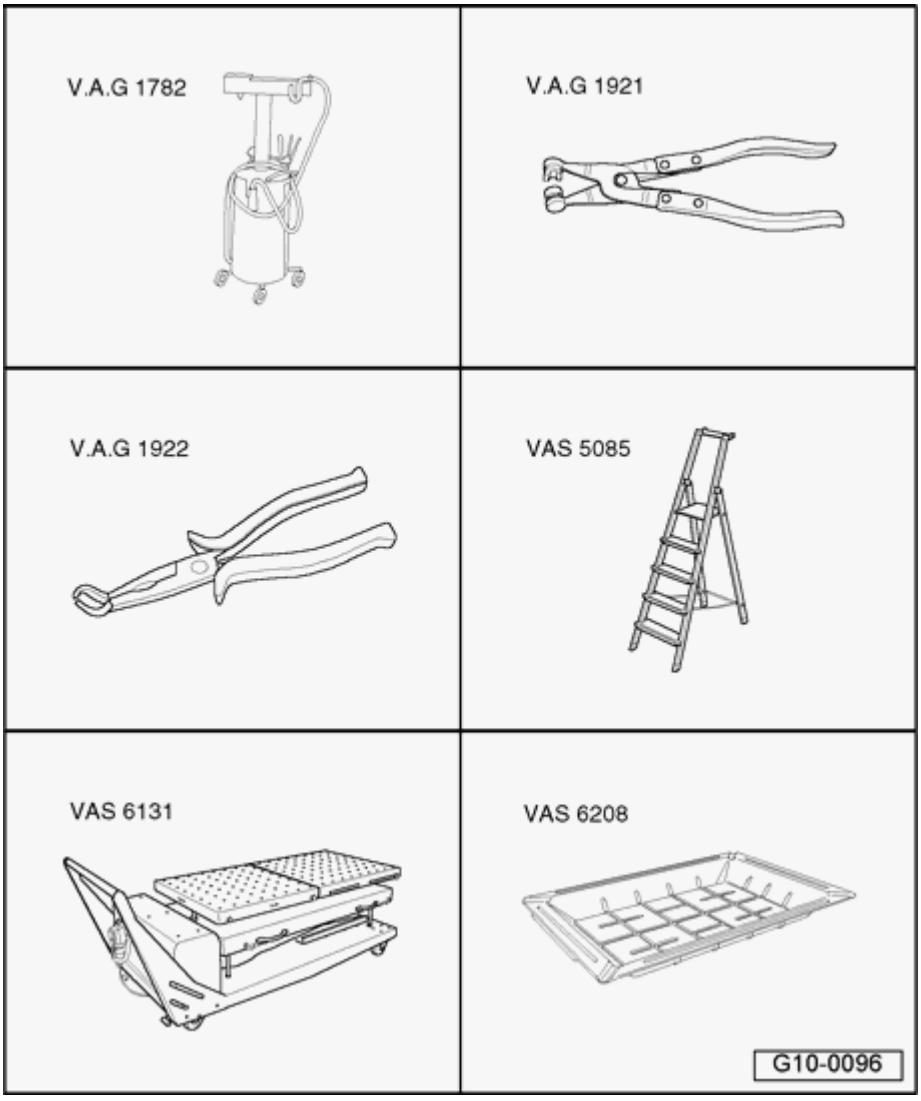


Fig. 120: Identifying Special Tools - Engine (Vehicles With Automatic Transmission), Removing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools, testers and auxiliary items required

- Old oil collecting and extracting device V.A.G 1782
- Hose clamp pliers V.A.G 1921
- Spark plug connector pliers V.A.G 1922
- Step ladder VAS 5085

- Scissor lift platform VAS 6131 A with support set for Audi VAS 6131/10
- Drip tray for workshop crane VAS 6208

NOTE:

- **If engine and transmission are to be separated after removal, Supplementary Set, Audi A8 > 2002 VAS 6131/11 and Supplementary Set,**

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Audi A6 > 2005 VAS 6131/12 will also be required.

Special tools, testers and auxiliary items required

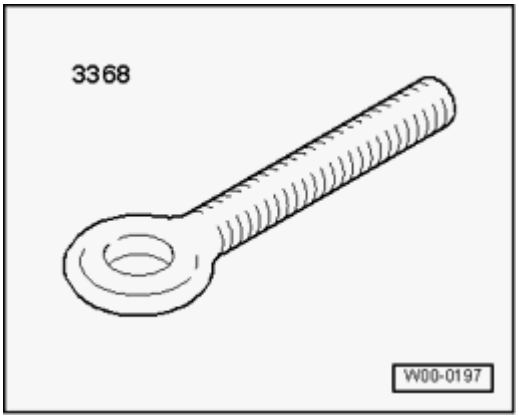


Fig. 121: Lifting Eyebolt 3368
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Lifting Eyebolt 3368

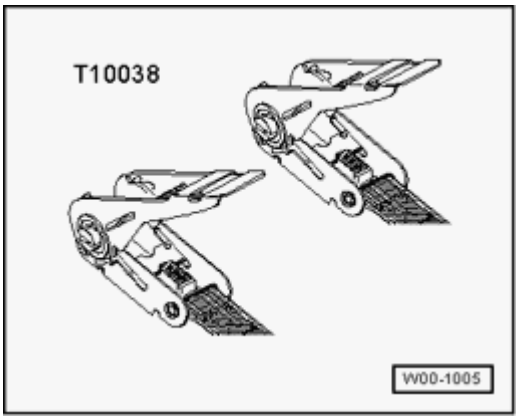


Fig. 122: Tension Strap T10038
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Tension strap T10038

Work procedure

NOTE:

- **All cable ties opened or cut during engine removal must be reinstalled at the same locations during installation.**
- **Drained coolant must be stored in a clean container for disposal or reuse.**

- Remove plenum chamber cover rubber seal.

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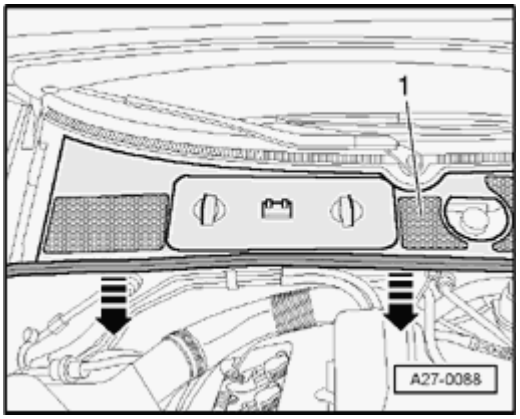


Fig. 123: Identifying Plenum Chamber Cover & Removing Rubber Seal
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove plenum chamber cover - **1** - toward front - **arrows** -.

CAUTION: Observe safety precautions when disconnecting battery -->

- **27 BATTERY, STARTER, GENERATOR, CRUISE CONTROL**
- **27 BATTERY, STARTER, GENERATOR, CRUISE CONTROL for ELECTRICAL EQUIPMENT, CABRIOLET**

.

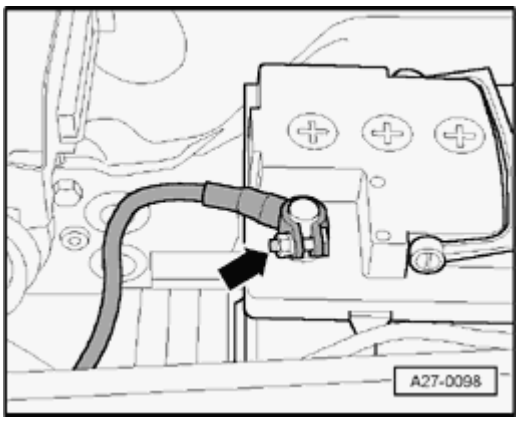


Fig. 124: Disconnecting Battery Ground (GND) Strap
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- With ignition switched off, disconnect Battery Ground (GND) strap - **arrow** -.
- Discharge refrigerant circuit --> **87 - AIR CONDITIONING** .
- Extract hydraulic oil for power-steering from reservoir using old oil collecting and extracting device V.A.G 1782.

CAUTION: Cover cap of expansion tank with rag and open carefully, as hot steam i.e.

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hot coolant may escape when opening.

- Open cap of coolant expansion tank.
- Remove both front wheels.

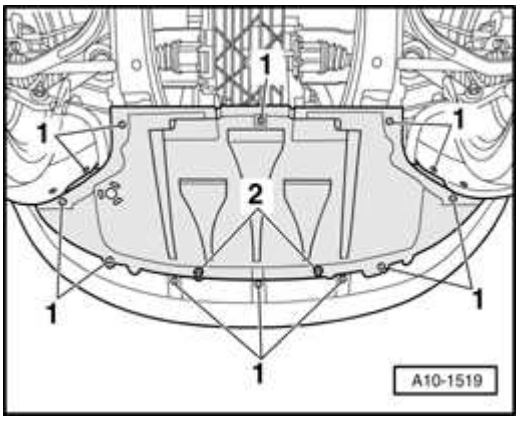


Fig. 125: Removing Quick-Release Fasteners, Screws And Noise Insulation
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove quick-release fasteners - **1** - , remove screws - **2** - and remove noise insulation.

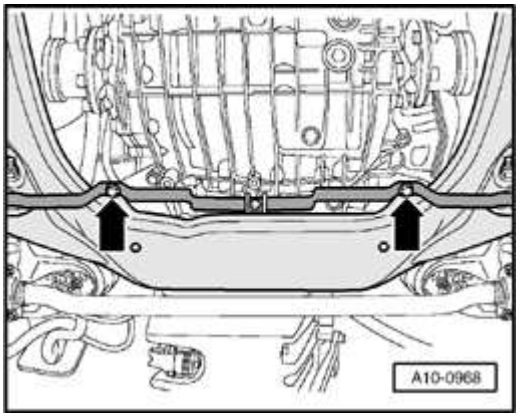


Fig. 126: Removing Bracket For Noise Insulation
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bracket for noise insulation - **arrows** -.
- Remove left and right front wheel housing liners -->
  - **66 EXTERIOR EQUIPMENT**
  - **66 - EXTERIOR EQUIPMENT** for BODY EXTERIOR - CABRIOLET

  .
- Remove front bumper cover -->
  - **63 BUMPER**
  - **63 - BUMPERS** for BODY EXTERIOR - CABRIOLET

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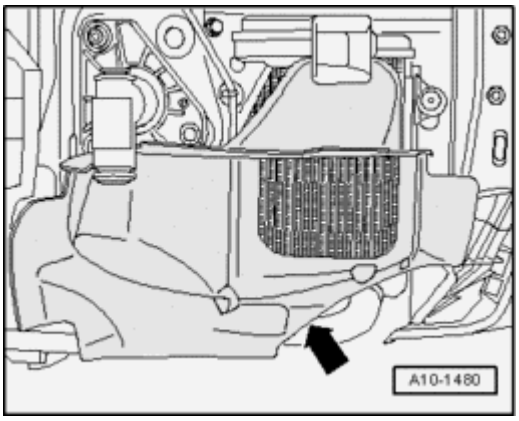


Fig. 127: Removing Left Air Guide In Front Of Auxiliary Cooler
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove left air guide - **arrow** - in front of auxiliary cooler.

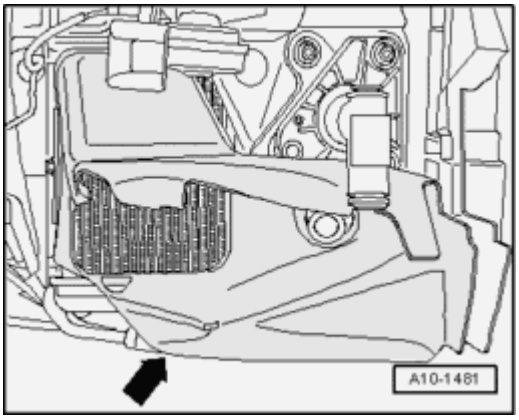
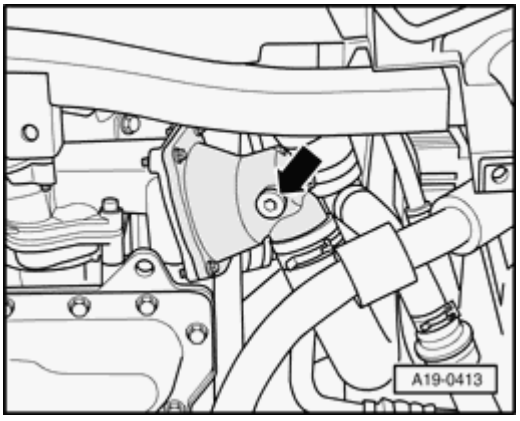


Fig. 128: Removing Right Air Guide In Front Of Auxiliary Cooler
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove right air guide - **arrow** - in front of auxiliary cooler.



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Fig. 129: Removing Drain Plug On Coolant Thermostat Housing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Place drip tray for workshop crane VAS 6208 under engine.
- Remove drain plug - **arrow** - on coolant thermostat housing and drain coolant from engine.

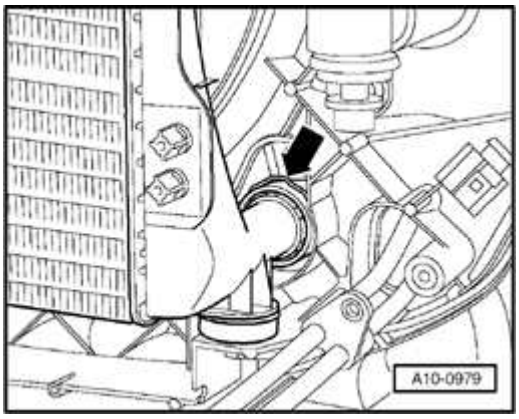


Fig. 130: Disconnecting Lower Coolant Hose From Radiator
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect lower coolant hose from radiator - **arrow** - and drain residual coolant.
- Place old oil collecting and extracting device V.A.G 1782 under engine.

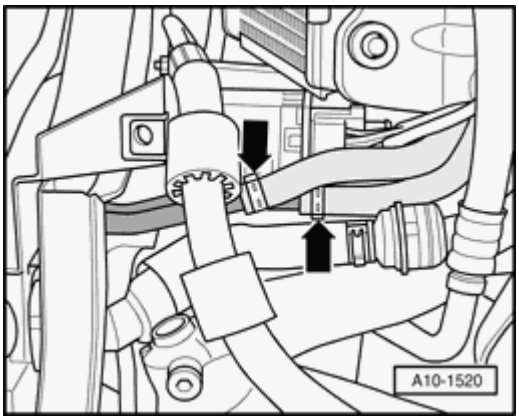


Fig. 131: Disconnecting Hydraulic Lines To Cooling Coil At Left Rear Of Bumper
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect hydraulic lines to cooling coil at left rear of bumper - **arrows** -.

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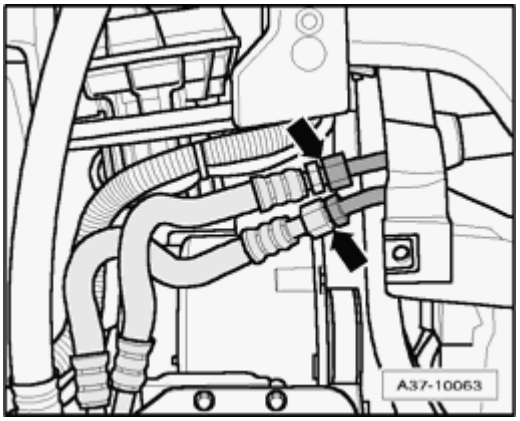


Fig. 132: Loosening Union Nuts And Disconnecting ATF Lines
Courtesy of VOLKSWAGEN UNITED STATES, INC.

NOTE:

- **Observe the rules of cleanliness for working on automatic transmissions --> 00 TECHNICAL DATA .**

- Place old oil collecting and extracting device V.A.G 1782 under engine.
- Loosen union nuts - **arrows** - and disconnect ATF lines.

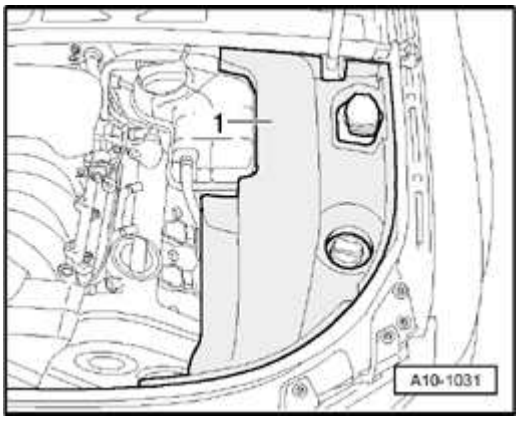


Fig. 133: Removing Cover In Engine Compartment (Left Side)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove cover - **1** - in engine compartment (left side).

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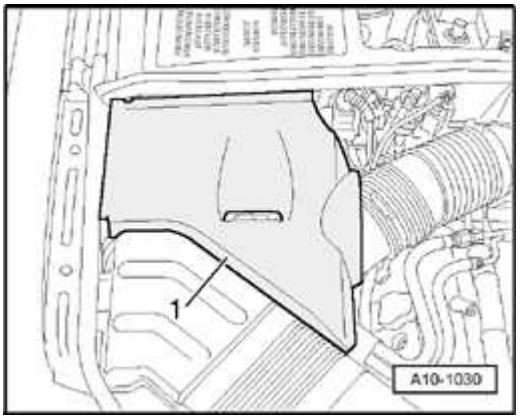


Fig. 134: Removing Cover In Engine Compartment (Right Side)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove cover - **1** - in engine compartment (right side).

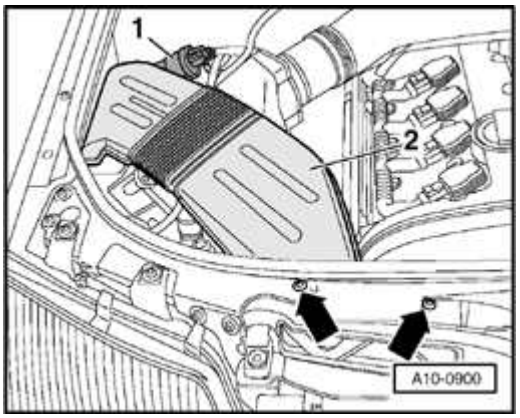
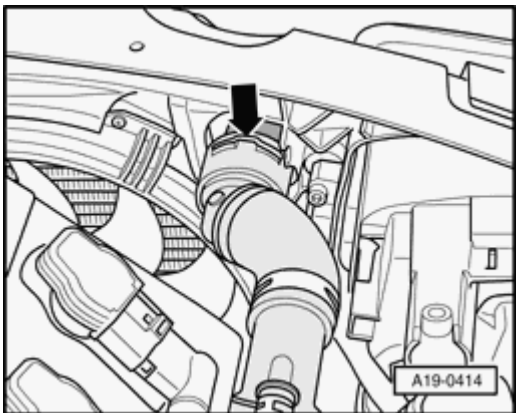


Fig. 135: Identifying Evaporative Emission Canister Purge Regulator Valve N80 And Air Duct
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disengage Evaporative Emission (EVAP) Canister Purge Regulator Valve N80 - **1** - from air guide.
- Remove bolts - **arrows** -.
- Remove air duct - **2** -.



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Fig. 136: Disconnecting Top Coolant Hose From Radiator
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect top coolant hose - **arrow** - from radiator.

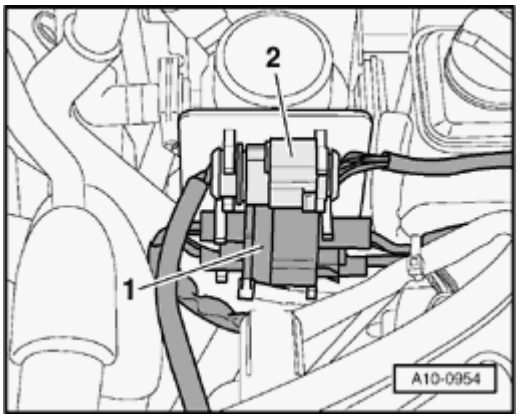


Fig. 137: Removing Electrical Harness Connectors And From Bracket
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove electrical harness connectors - **1** - and - **2** - from bracket and disconnect them.
- Free up wires to lock carrier.

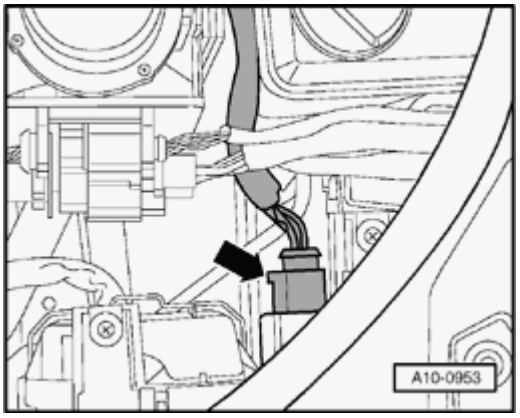


Fig. 138: Disconnecting Electrical Harness Connector For Headlights At Both Sides Of Vehicle
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical harness connector - **arrow** - for headlights at both sides of vehicle.
- Free up electrical wiring.

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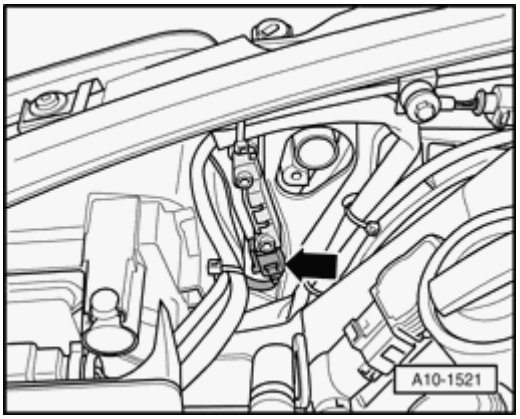


Fig. 139: Disconnecting Electrical Harness Connector For Left/Right Airbag Sensors On Lock Carrier
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical harness connector - **arrow** - for left and right airbag sensors on lock carrier.
- Free up cables.
- Remove hood cable at lock carrier -->
  - **55 HOOD, LIDS**
  - **55 - HOOD, LIDS** for BODY EXTERIOR - CABRIOLET

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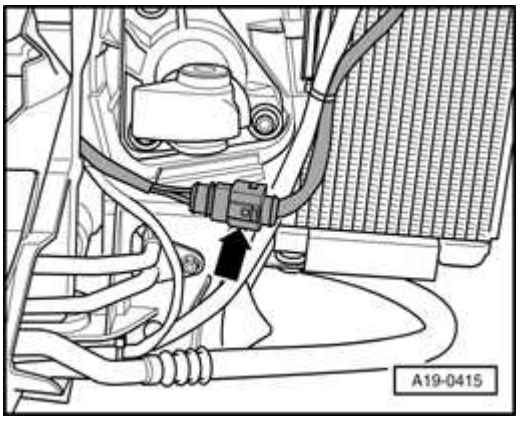


Fig. 140: Disconnecting Electrical Harness Connector For Right Fan
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical harness connector - **arrow** - for right fan.

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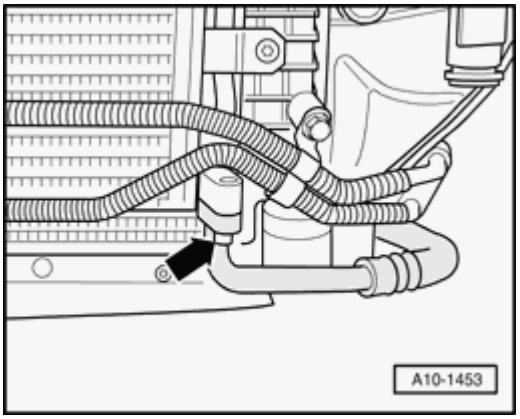


Fig. 141: Removing Refrigerant Line Leading To A/C Compressor
Courtesy of VOLKSWAGEN UNITED STATES, INC.

NOTE:

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

- Remove refrigerant line - **arrow** - leading to A/C compressor.

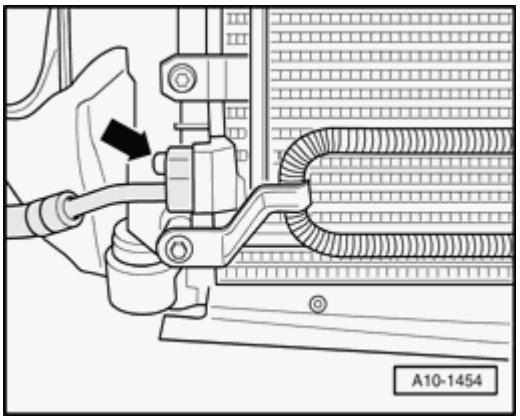


Fig. 142: Removing Refrigerant Line Leading To A/C Evaporator
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove refrigerant line - **arrow** - leading to A/C evaporator.

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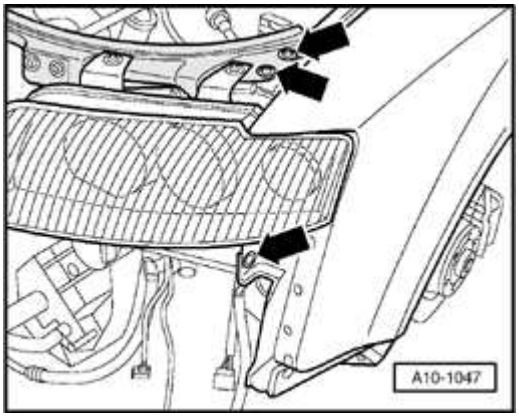


Fig. 143: Removing Bolts At Left/Right Side Of Bumper
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts - **arrows** - at left and right side of bumper.
- Pull off hood seal from lock carrier and fender edges.

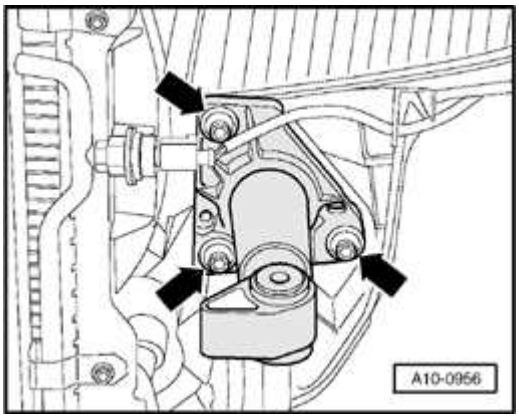


Fig. 144: Removing Bolts At Impact Absorbers At Left/Right
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts at impact absorbers - **arrows** - at left and right.

NOTE:

- **A second technician is required to remove the lock carrier.**

- Remove lock carrier and set aside so it cannot topple.

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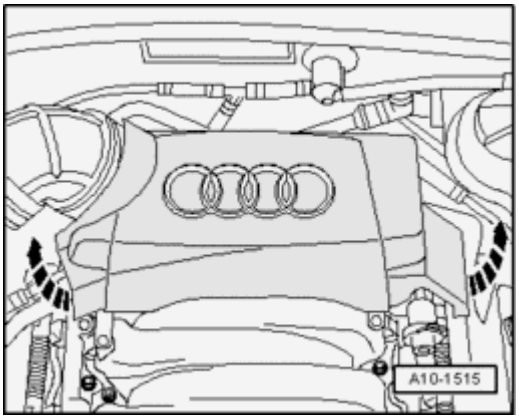


Fig. 145: Removing Rear Engine Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove rear engine cover - **arrows** -.

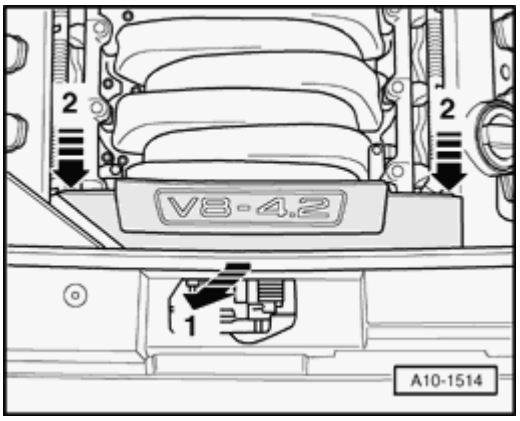


Fig. 146: Removing Front Engine Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove front engine cover - **arrows 1 and 2** -.

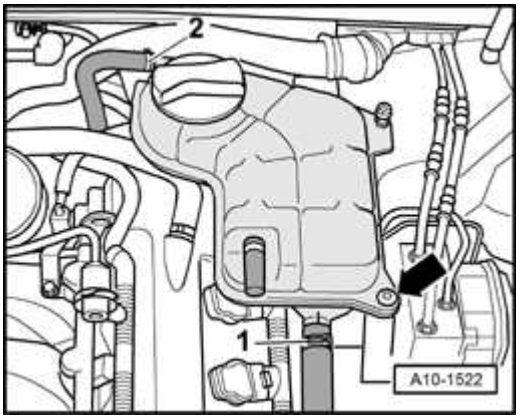


Fig. 147: Removing Coolant Hoses & Coolant Expansion Tank
Courtesy of VOLKSWAGEN UNITED STATES, INC.

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- Remove coolant hoses - **1** - and - **2** -.
- Remove coolant expansion tank - **arrow** -.
- Disconnect electrical wiring to Engine Coolant Level (ECL) Warning Switch F66 at bottom of expansion tank.

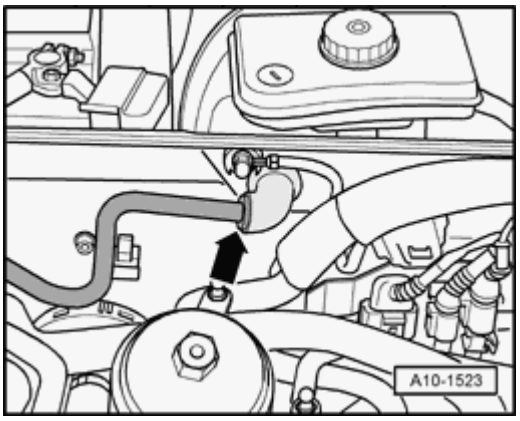


Fig. 148: Disconnecting Brake Booster Vacuum Hose From Grommet On Bulkhead
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect vacuum line - **arrow** - to brake booster at bulkhead.

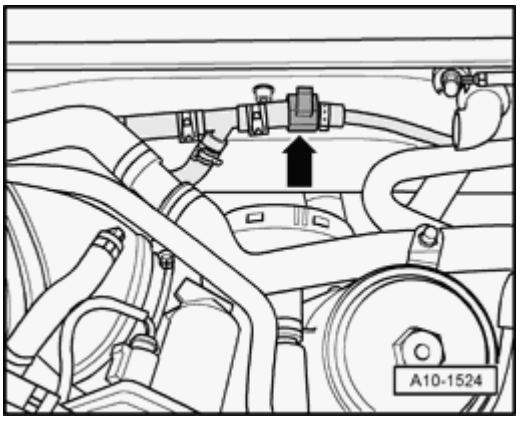


Fig. 149: Unclipping Coolant Hose From Bracket On Bulkhead
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unclip coolant hose - **arrow** - from bracket on bulkhead.

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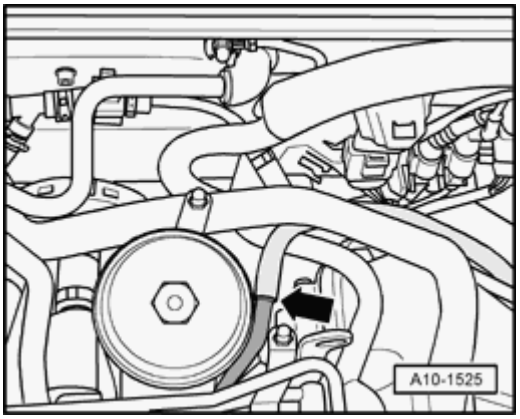


Fig. 150: Disconnecting Vacuum Line To Vacuum Reservoir
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- If installed, disconnect vacuum line - **arrow** - to vacuum reservoir.

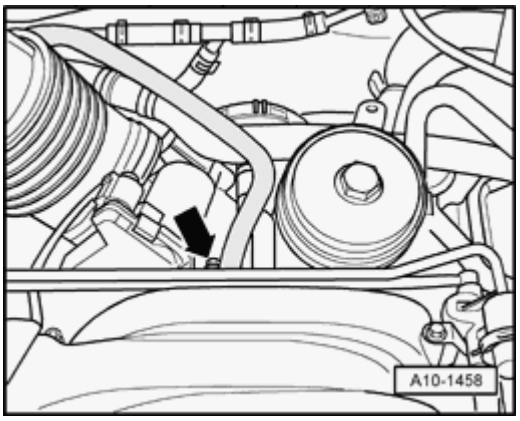


Fig. 151: Disconnecting Vacuum Hose From Intake Manifold
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect vacuum hose - **arrow** - from intake manifold.

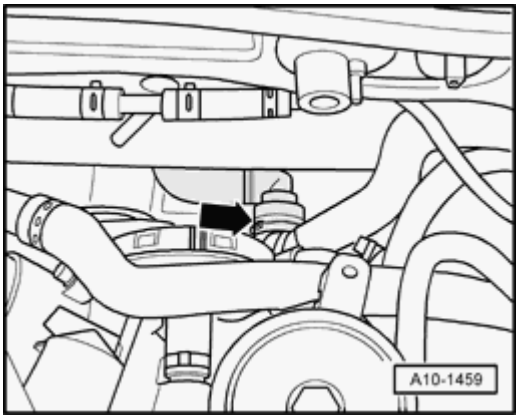


Fig. 152: Disconnecting Coolant Hose To Heater Core At Rear Coolant Pipe On Engine
Courtesy of VOLKSWAGEN UNITED STATES, INC.

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- Disconnect coolant hose - **arrow** - to heater core at rear coolant pipe on engine.

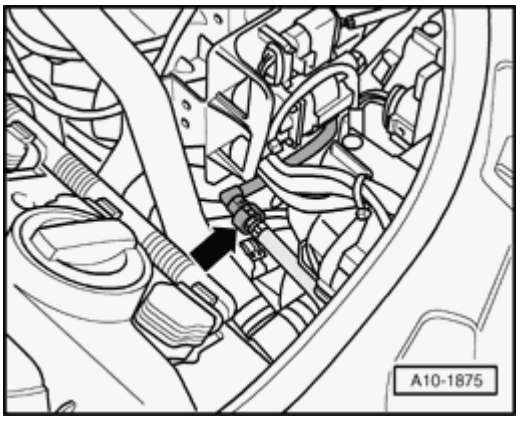


Fig. 153: Disconnecting Vacuum Line
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- If installed, disconnect vacuum line at area designated with - **arrow** -.

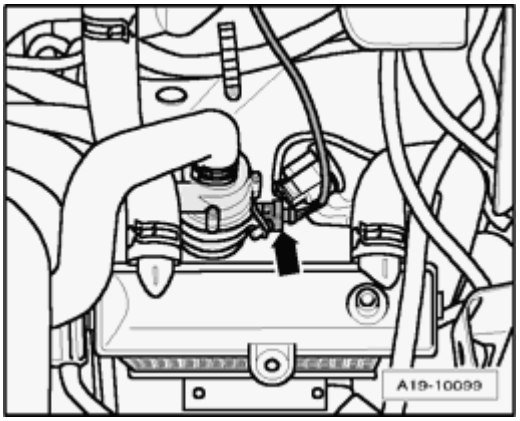


Fig. 154: Disconnecting Electrical Harness Connector For After-Run Coolant Pump V51
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- If installed, disconnect electrical harness connector - **arrow** - for After-Run Coolant Pump V51 (behind auxiliary cooler at left) and free up electrical wire.

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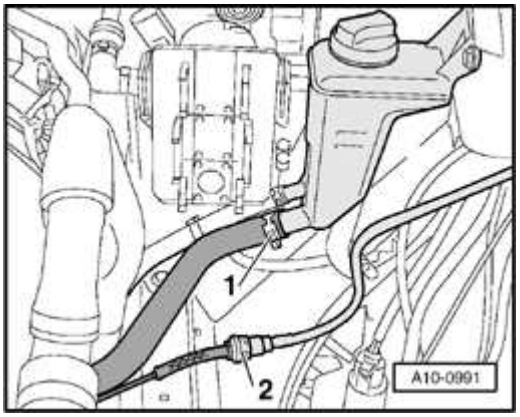


Fig. 155: Disconnecting Hose From Power Steering Fluid Reservoir & Vacuum Hose To Vacuum Reservoir
Courtesy of VOLKSWAGEN UNITED STATES, INC.

NOTE:

- **Place a rag under separating point to catch escaping hydraulic fluid.**

- Disconnect hose - **1** - from power steering fluid reservoir.

NOTE:

- **Ignore - 2 -.**

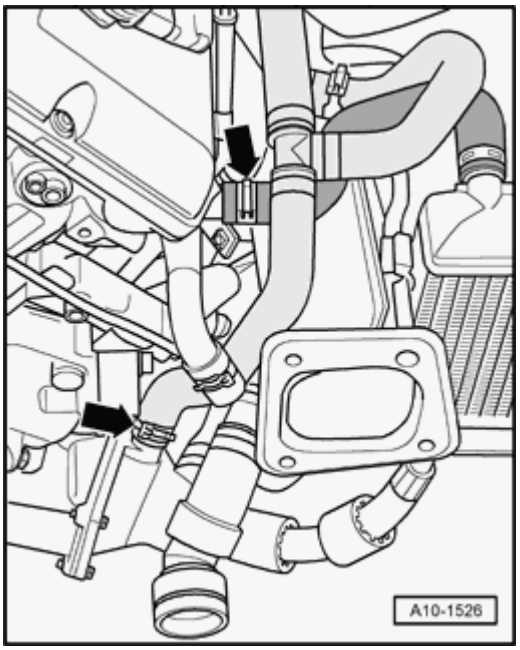


Fig. 156: Disconnecting Coolant Hoses
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect coolant hoses at positions indicated by - **arrows** -.

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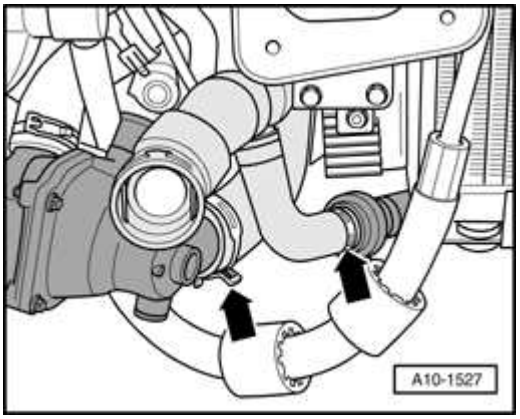


Fig. 157: Disconnecting Coolant Hoses
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect coolant hoses at positions indicated by - **arrows** -.

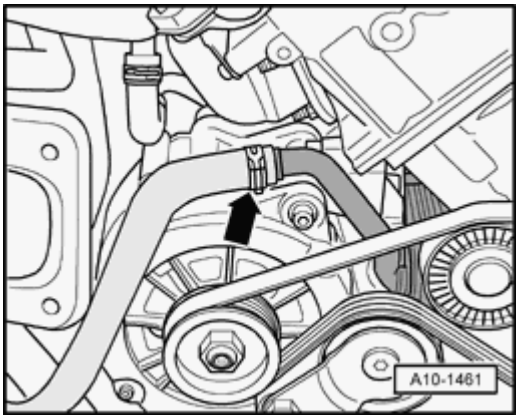


Fig. 158: Disconnecting Coolant Hose To Oil Cooler
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect coolant hose to oil cooler - **arrow** -.

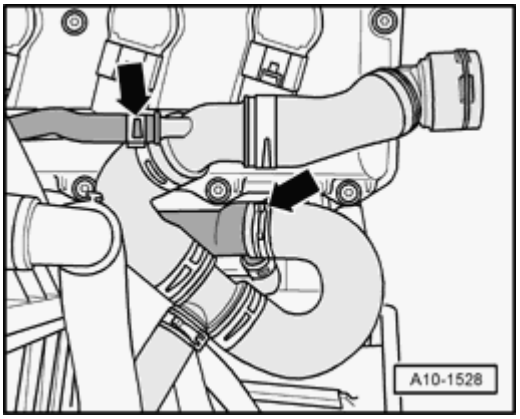


Fig. 159: Disconnecting Coolant Hoses
Courtesy of VOLKSWAGEN UNITED STATES, INC.

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- Disconnect coolant hoses at positions indicated by - **arrows** -.

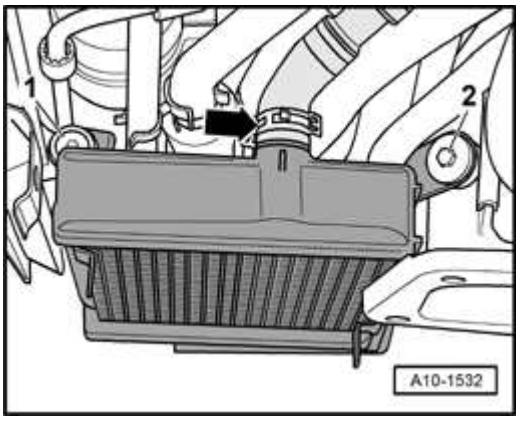


Fig. 160: Removing Bolts & Right Auxiliary Cooler Together With Coolant Hoses
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts - **1** - and - **2** -.
- Remove right auxiliary cooler together with coolant hoses.

NOTE:

- **The hose - arrow - can remain connected at auxiliary cooler.**

CAUTION: Note rules of cleanliness for working on the fuel injection system --> Rules for cleanliness.

CAUTION: Fuel system is under pressure! Before opening system, place clean rags around the connection. Then release pressure by carefully loosening connection.

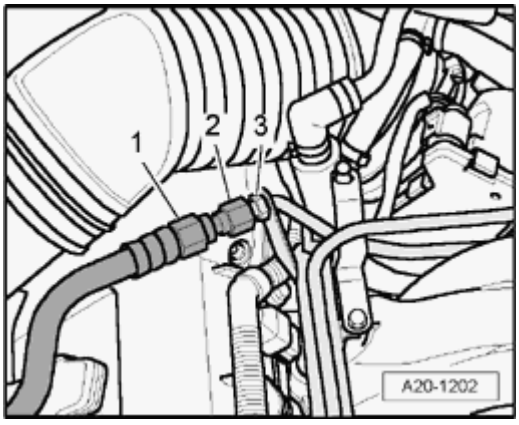


Fig. 161: Installing/Removing Fuel Hose To/From Connection On Fuel Rail Line
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove fuel hose from connection on fuel rail line. To do so, counter hold using an open-end wrench at

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hex head - **1** - and - **3** - and remove union nut - **2** -.

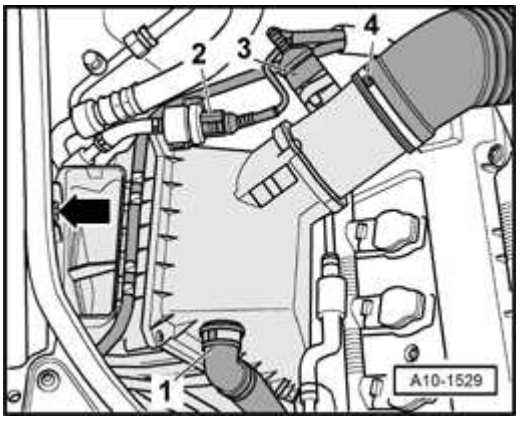


Fig. 162: Identifying Electrical Harness Connectors, Secondary Air Injection (AIR) Pump Hose, Air Guide Hose & Mass Air Flow (MAF) Sensor
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical harness connector - **2** - from Evaporative Emission (EVAP) Canister Purge Regulator Valve N80.
- Disconnect electrical harness connector - **3** - at Mass Air Flow (MAF) Sensor G70.
- Disconnect hose - **1** - to Secondary Air Injection (AIR) pump.
- Disconnect air guide hose - **4** - at Mass Air Flow (MAF) sensor.

- Move wiring harness clear at air filter housing.
- Remove clip - **arrow** - and remove air filter housing with Mass Air Flow (MAF) sensor.

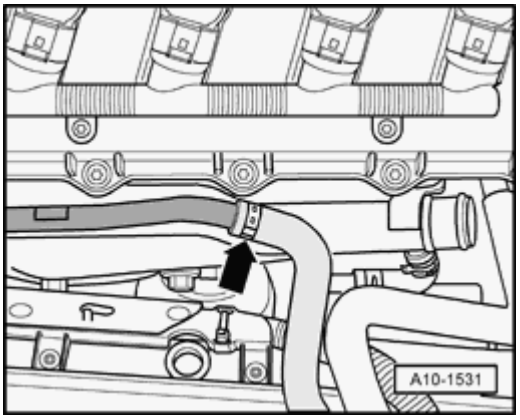


Fig. 163: Disconnecting Air Hose At Right On Engine
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect air hose - **arrow** - at right on engine.

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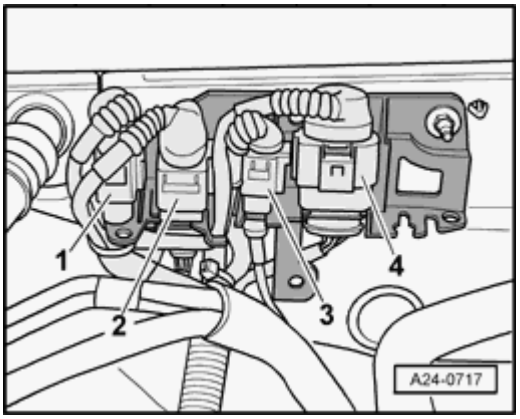


Fig. 164: Removing Bracket For Electrical Harness Connectors At Right From Bulkhead
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bracket for electrical harness connectors - **1 to 4** - at right from bulkhead.

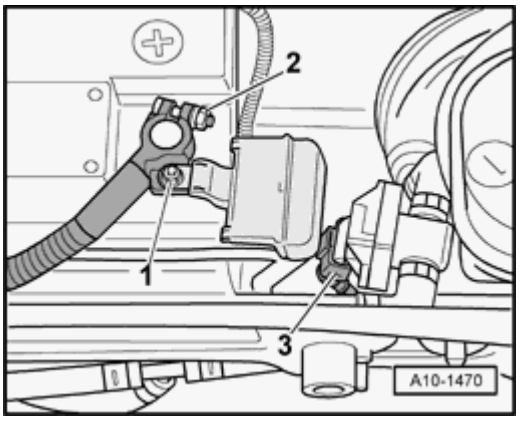


Fig. 165: Removing Nut And Fuse Strip On Plus Wire Terminal Clamp
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove nut - **1** - and remove fuse strip on plus wire terminal clamp.
- Disconnect battery positive (+) cable - **2** - on battery positive terminal.
- Pull battery positive (+) cable through bulkhead toward front.
- Free up the wiring harness.

NOTE:

- **Disregard item - 3 -.**

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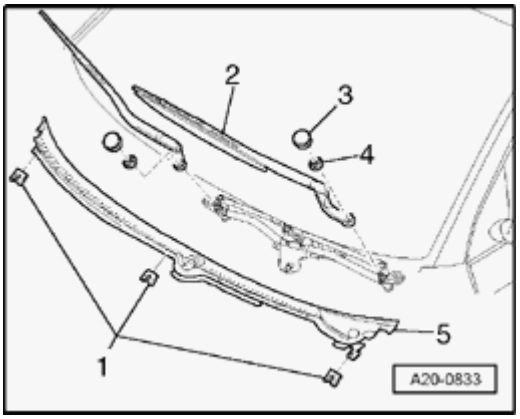


Fig. 166: Removing Securing Clips And Cowl
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Pry off both covers - **3** - using a screwdriver.
- Loosen hex-nuts - **4** - by several turns.
- Loosen wiper arms - **2** - from respective wiper axle by tilting slightly.
- Remove nuts completely and remove wiper arms.

CAUTION: To prevent the cowl grille - 5 - from tearing when removing, coat transition between windshield and cowl grille with a soapy solution and pull grille up vertically out of fastening strip beginning at edge of window.

- Disconnect securing clips - **1** - and remove cowl grille - **5** -.

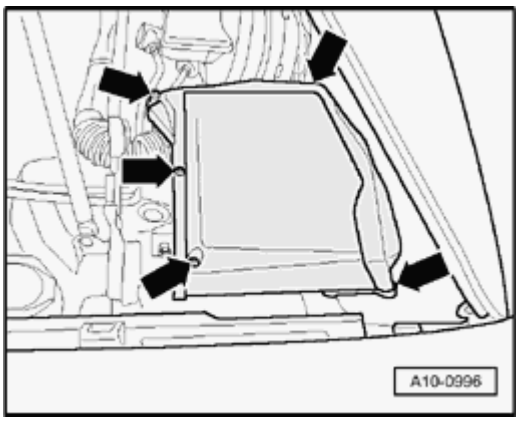


Fig. 167: Removing Screws And Cover From E-Box In Plenum Chamber
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove cover for E-Box in plenum chamber - **arrows** -.

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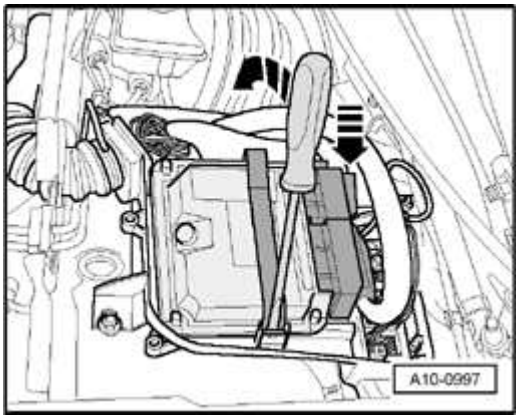


Fig. 168: Using Screwdriver To Remove Retainer Bar And Engine Control Module (ECM) J623
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Using a screwdriver, carefully pry off mounting bracket - **arrow** - and remove Engine Control Module (ECM) from E-Box.

NOTE:

- **Engine Control Module (ECM) remains connected at wiring harness.**

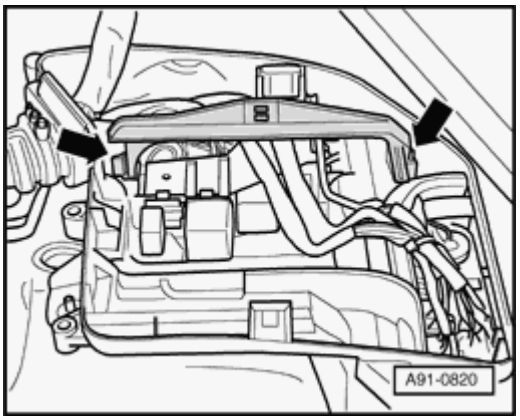


Fig. 169: Releasing Retaining Hooks Toward Outside And Removing Retaining Bracket
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Release retaining hooks - **arrows** - toward outside and remove retaining bracket.

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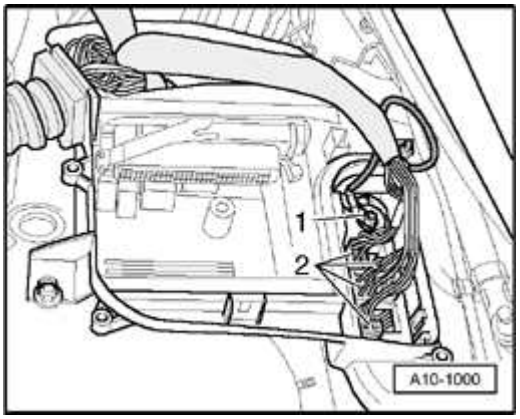


Fig. 170: Disconnecting All Electrical Harness Connectors On Connector Station Using Spark Plug Connector Pliers V.A.G 1922
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect all electrical harness connectors on connector station - **2** - using spark plug connector pliers V.A.G 1922.
- Remove electrical wire connection - **1** -.

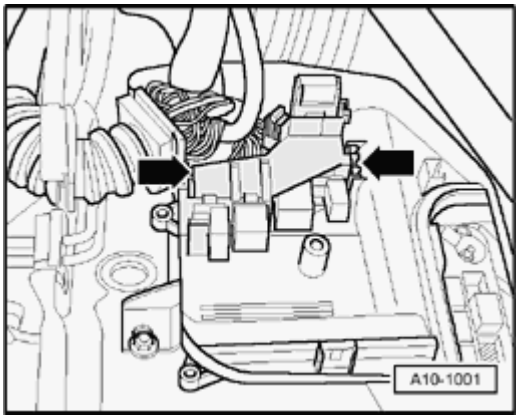


Fig. 171: Disengaging Locking Mechanisms And Removing Secondary Relay Carrier In E-Box Toward Top
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disengage locking mechanisms - **arrows** - and remove secondary relay carrier in E-Box toward top.
- Disengage engine wiring harness at E-Box and bulkhead.

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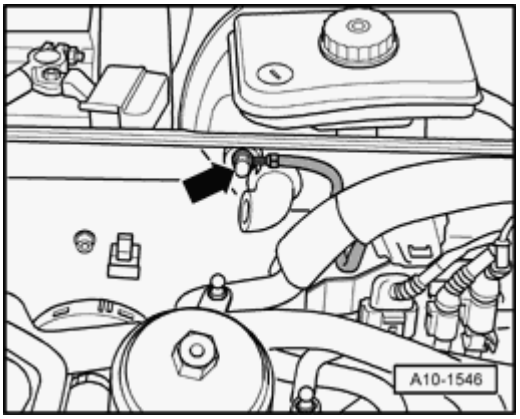


Fig. 172: Removing Ground (GND) Connection
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove Ground (GND) connection - **arrow** -.

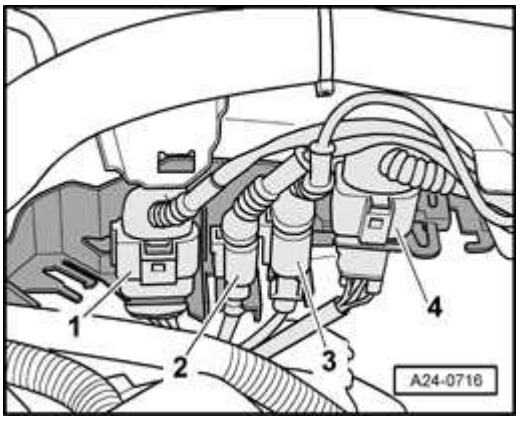
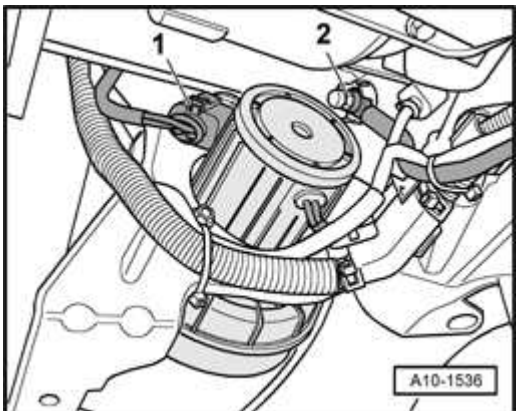


Fig. 173: Removing Bracket For Electrical Harness Connectors At Left From Bulkhead
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bracket for electrical harness connectors - **1 to 4** - at left from bulkhead.
- Free up wiring harness.
- Set electrical wiring harness on engine and secure Engine Control Module (ECM) against falling down.



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Fig. 174: Disconnecting Electrical Harness Connector At Secondary Air Injection (AIR) Pump Motor V101 & Removing Ground (GND) Wire On Long Member
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical harness connector - **1** - at Secondary Air Injection (AIR) Pump Motor V101.
- Remove Ground (GND) wire - **2** - on long member.

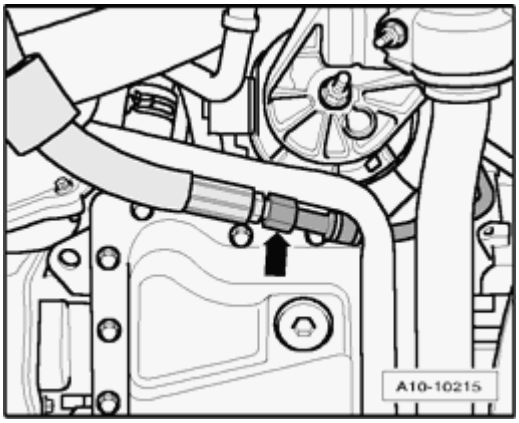


Fig. 175: Disconnecting Hydraulic Pressure Line For Power-Steering At Left Next To Oil Pan
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Place old oil collecting and extracting device V.A.G 1782 under engine.
- Disconnect hydraulic pressure line for power-steering - **arrow** - at left next to oil pan.

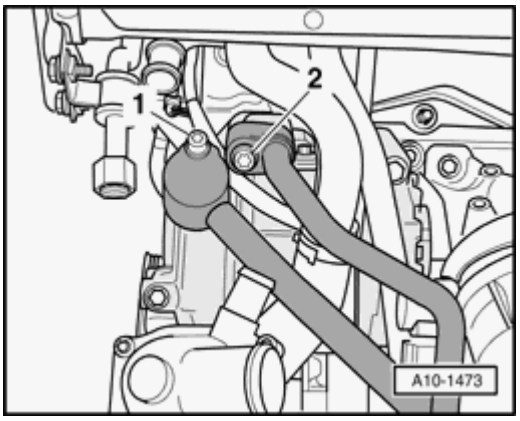


Fig. 176: Removing Bolts & Right Refrigerant Line From A/C Compressor
Courtesy of VOLKSWAGEN UNITED STATES, INC.

NOTE:

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

- Remove bolts - **1** - and - **2** -.
- Remove right refrigerant line from A/C compressor.

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NOTE:

- **The left refrigerant line will be removed at a later point in time.**

- Seal open connections on A/C compressor using clean plugs.

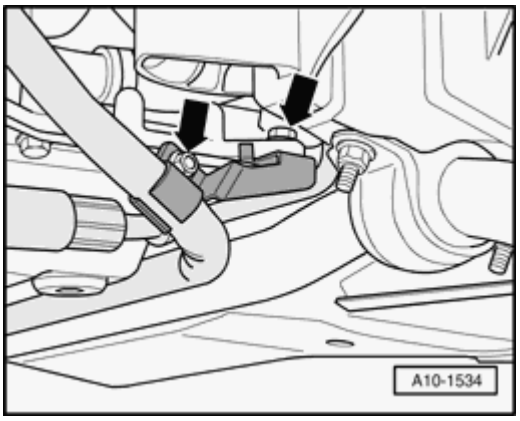


Fig. 177: Removing Left Bracket For Refrigerant Line
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove left bracket for refrigerant line - **arrows** -.

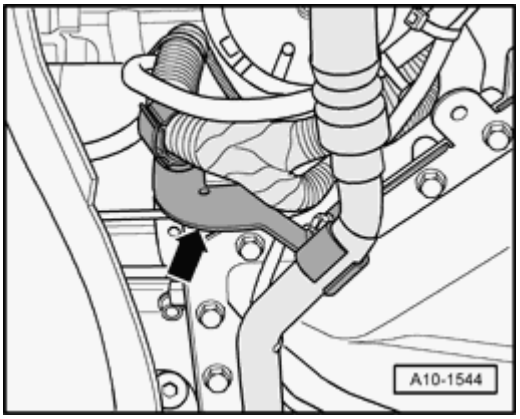


Fig. 178: Removing Refrigerant Line On Bracket
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove refrigerant line on bracket - **arrow** -.

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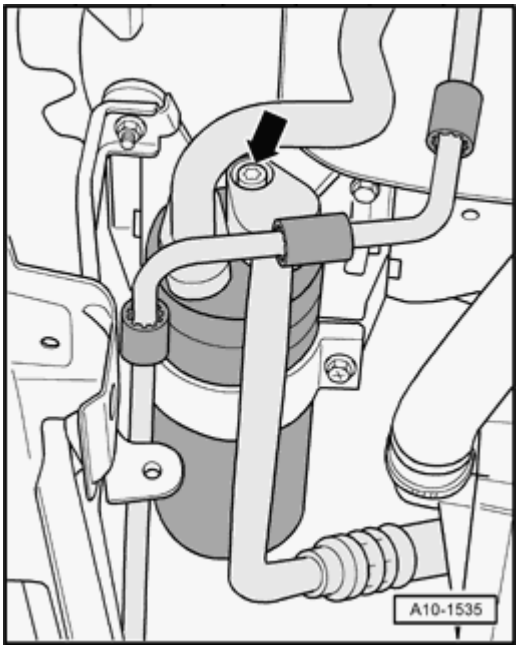


Fig. 179: Removing Bolt And Disconnecting Refrigerant Line To A/C Compressor
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolt - **arrow** - and disconnect refrigerant line to A/C compressor.

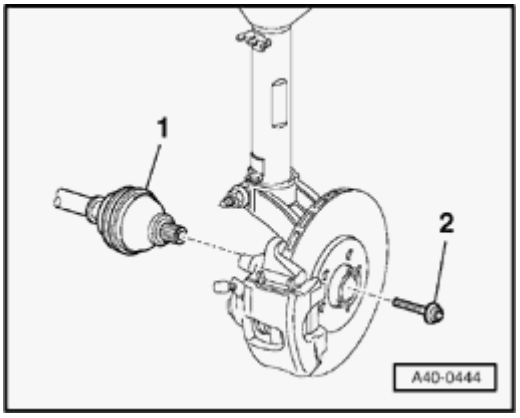


Fig. 180: Identifying Collar Bolt For Right Drive Axle
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Have a second technician press brake pedal.

CAUTION: To loosen collar bolt for drive axle, the wheel bearing must not be under load (vehicle must not be standing on its wheels).

- Remove collar bolt - **2** - at left and right drive axles - **1** -.

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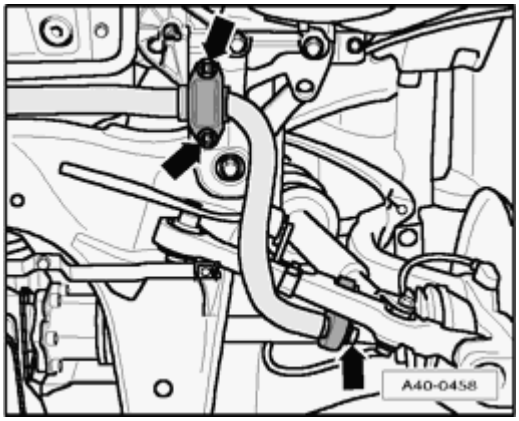


Fig. 181: Removing Bolts And Nuts Uniformly At Left/Right
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts and nuts - **arrows** - uniformly at left and right.
- Remove stabilizer.

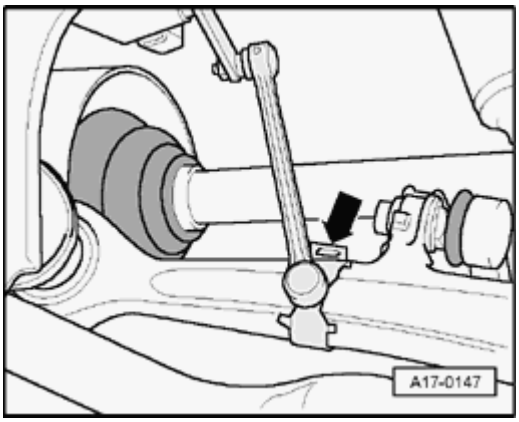


Fig. 182: Disconnecting Electrical Harness Connector At Left Front Level Control System Sensor G78
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical harness connector at Level Control System Sensor.
- Unclip operating rod for Left Front Level Control System Sensor G78 at bottom on control arm.
- Remove outer suspension strut bolt from left and right of engine compartment.

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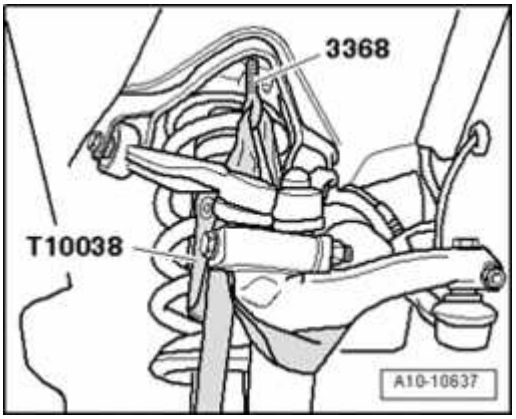


Fig. 183: Rotating Lifting Eyebolt 3368 At Left/Right In Suspension Strut Mount Hole From Below
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Rotate Lifting Eyebolt 3368 at left and right in suspension strut mount hole from below.

CAUTION: Only install Lifting Eyebolt 3368 until it is flush with upper edge of suspension strut mount so that hood is not damaged when closed.

- Tie up wheel bearing housing at left and right with Tensioning Strap T10038 as shown in illustration.

CAUTION: To prevent upper control arm joints from being damaged, wheel bearing housing must be supported before loosening lower suspension strut bolts.

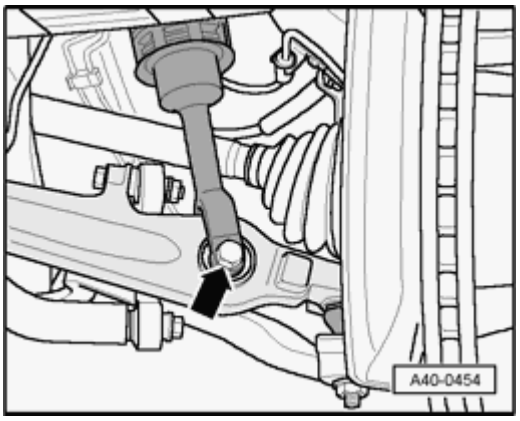


Fig. 184: Removing Bolt And Suspension Strut From Control Arm
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolt and remove suspension strut from control arm - **arrow** -.

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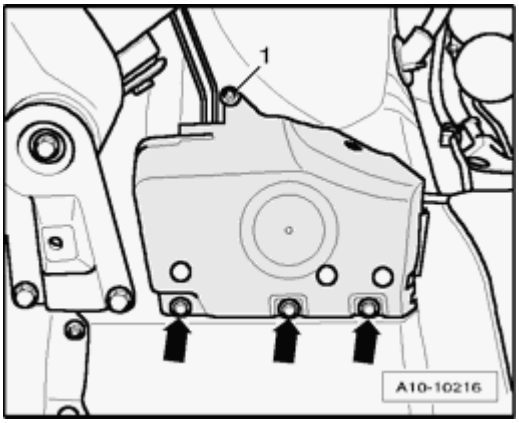


Fig. 185: Removing Expanding Clips, Nut And Cover Behind Wheel Housing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove expanding clips - **arrows** -.
- Remove nut - **1** - and remove cover behind wheel housing.

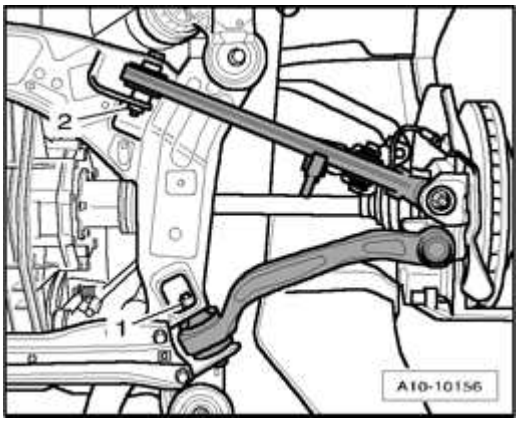
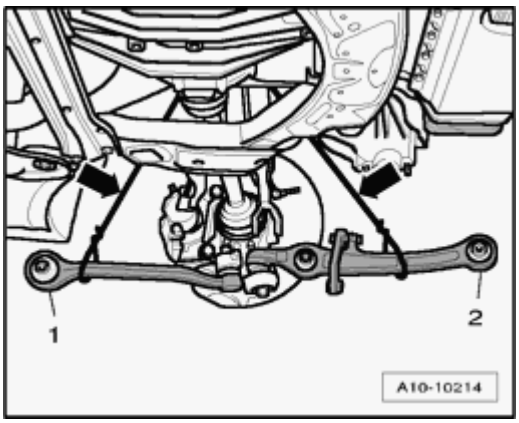


Fig. 186: Removing Guide Control Arm And Control Arm On Subframe
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove guide control arm - **1** - and control arm - **2** - on subframe.



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Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Pivot guide control arm - **1** - and control arm - **2** - outward.

CAUTION: Guide control arm and control arm must not hang free. Tie up both control arms on wheel bearing housing - arrows - as shown in illustration.

- Repeat work procedure on opposite side of vehicle.

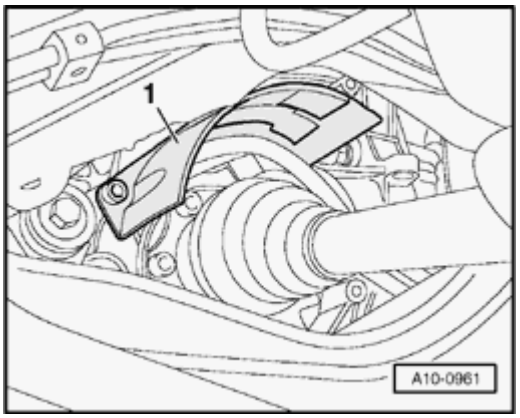


Fig. 188: Removing Heat Shield For Left Drive Axle
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove heat shield - **1** - for left drive axle.
- Remove drive axle from transmission flanged shaft.
- Swing left wheel bearing housing outward and remove drive axle.
- Repeat work procedure on opposite side of vehicle.

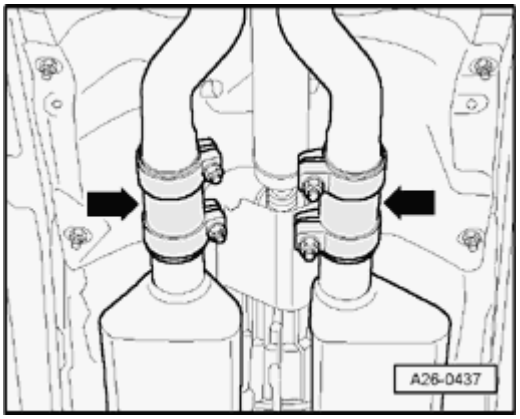


Fig. 189: Disconnecting Exhaust System At Double Clamps
Courtesy of VOLKSWAGEN UNITED STATES, INC.

NOTE:

- **Flex joint in front exhaust pipe must not be bent more than 10 ° , otherwise it may be damaged.**

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- Disconnect exhaust system at double clamps - **arrows** -.

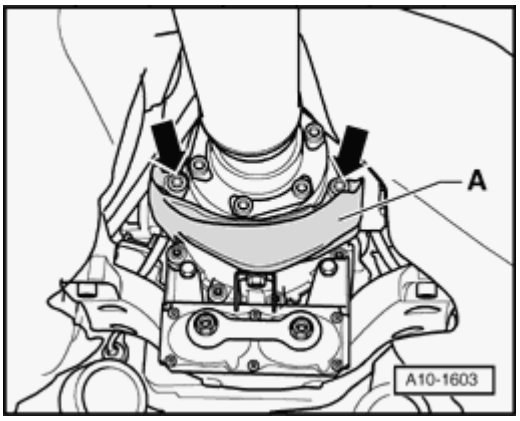


Fig. 190: Removing Heat Shield For Driveshaft
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove heat shield - **A** - for drive shaft - **arrows** -.
- Remove bolts at transmission/driveshaft flange.
- Push driveshaft together with rear final drive. The constant velocity (CV) joints can move axially.
- Tie up driveshaft to body.

NOTE:

- **Mark the installation position of bracket for selector lever cable using a felt-tip marker.**

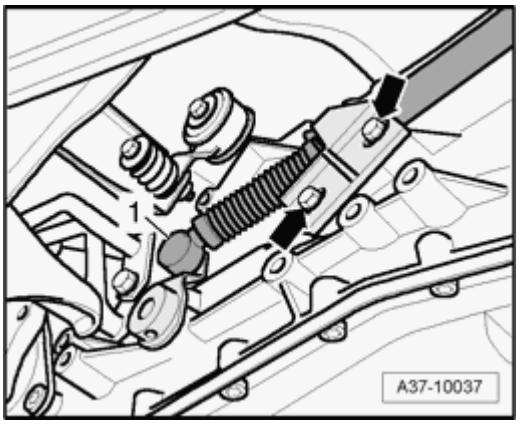


Fig. 191: Pressing Ball Socket Of Selector Lever Cable From Selector Shaft Lever & Removing Bracket On Transmission
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Press ball socket - **1** - of selector lever cable from selector shaft lever.
- Remove bracket on transmission - **arrows** -.
- Move selector lever cable clear.

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NOTE:

- **To improve clarity, the transmission supports are shown removed in the illustration.**

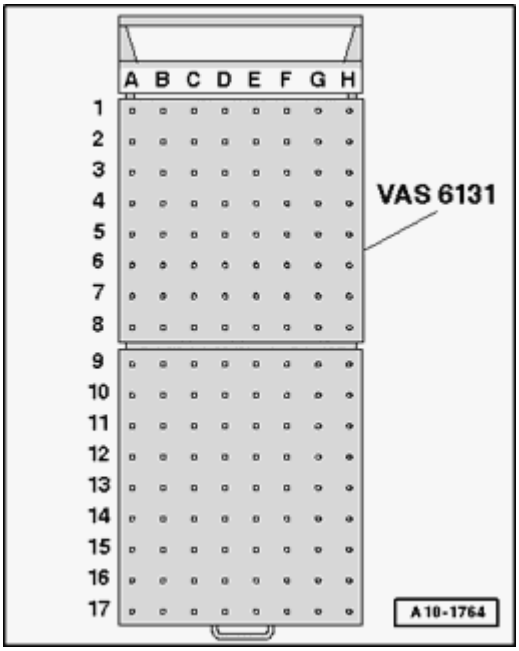


Fig. 192: Identifying Scissor Lift Platform VAS 6131
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Prepare scissor lift platform:

- Equip scissor lift platform VAS 6131 A with support set for Audi VAS 6131/10 as follows:

Platform coordinates	Parts of support set for Audi VAS 6131/10			
B4	/10-1	/10-4	/10-5	/10-11
G3	/10-1	/10-4	/10-5	/10-11
B10	/10-1	/10-2	/10-5	/10-8
G10	/10-1	/10-2	/10-5	/10-8
C15	/10-1	/10-3	/10-5	/10-12
F15	/10-1	/10-3	/10-5	/10-12

- Install attachments on scissor lift table by hand first.
- Place scissor lift platform VAS 6131 A in horizontal position.

- Note bubble level (sight glass) on support platform.

- Drive scissor lift platform VAS 6131 A under engine/transmission subassembly.

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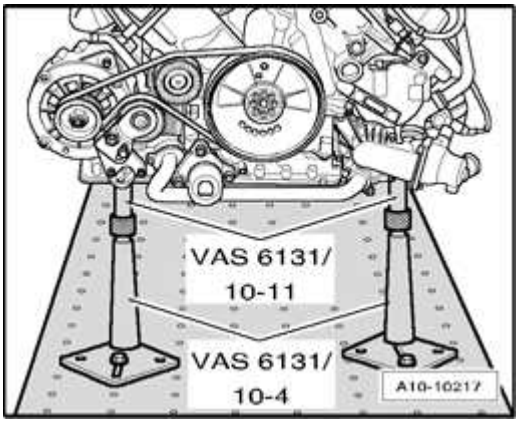


Fig. 193: Positioning Support Elements From VAS 6131/10 At Front On Engine
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Position support elements from VAS 6131/10 at front on engine as shown in illustration.

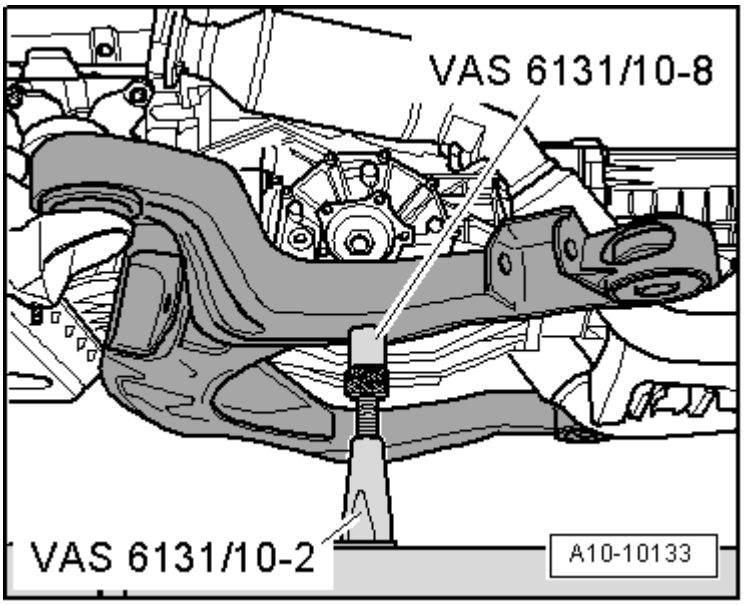


Fig. 194: Positioning Support Elements From VAS 6131/10 At Left/Right On Subframe
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Position support elements from VAS 6131/10 at left and right on subframe as shown in illustration.

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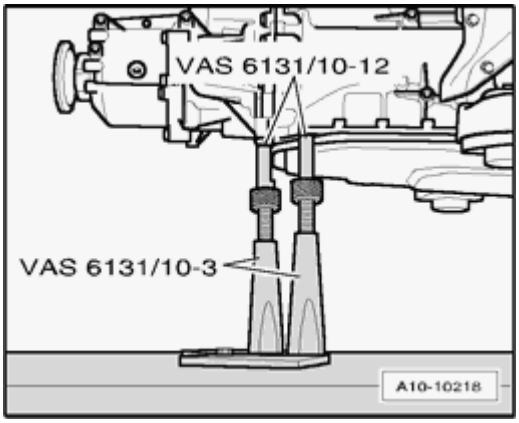


Fig. 195: Positioning Support Elements From VAS 6131/10 At Rear On Transmission
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Position support elements from VAS 6131/10 at rear on transmission as shown in illustration.
- Turn all spindles of support elements upward far enough until all support pins make contact at support points.
- Tighten base plates for support elements to 20 Nm on scissor lift platform VAS 6131 A.

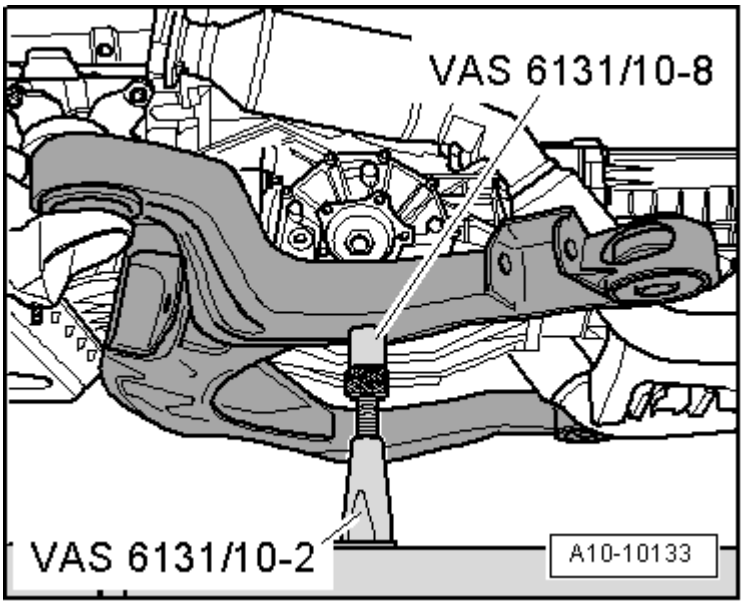


Fig. 196: Positioning Support Elements From VAS 6131/10 At Left/Right On Subframe
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Turn both spindles at subframe 2 rotations upward.

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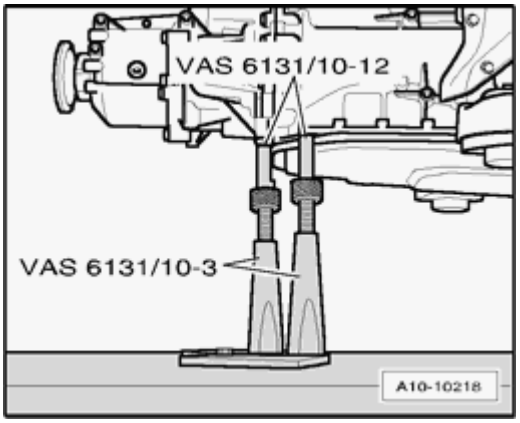


Fig. 197: Positioning Support Elements From VAS 6131/10 At Rear On Transmission
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Turn both spindles at transmission 4 rotations upward.

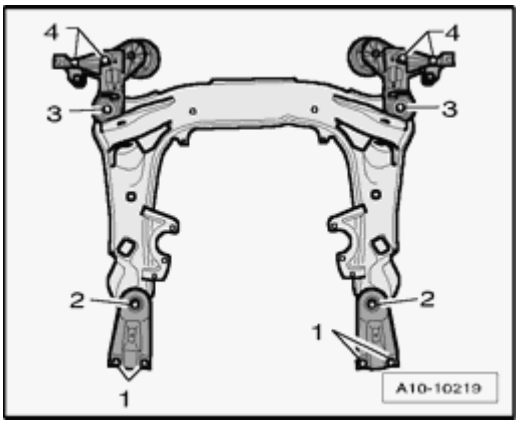


Fig. 198: Removing/Installing Bolts In Diagonal Sequence And In Stages
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts - **1** -.
- Mark installation position of subframe and of both engine mount plates to long members using a felt-tip marker.
- Remove bolts - **2** - , - **3** - and - **4** - in diagonal sequence and in stages.

NOTE:

- **Verify that all hoses and lines between engine, transmission, subframe and body have been disconnected.**
- **While lowering, carefully guide engine/transmission subassembly with subframe out of engine compartment in order to prevent damage.**

- Slowly lower engine/transmission subassembly downward.
- Push scissor lift platform VAS 6131 A with engine/transmission subassembly under vehicle.

Engine and transmission (vehicles with automatic transmission), separating

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Special tools, testers and auxiliary items required

- Support set for Audi VAS 6131/10 , VAS 6131/11 and VAS 6131/12

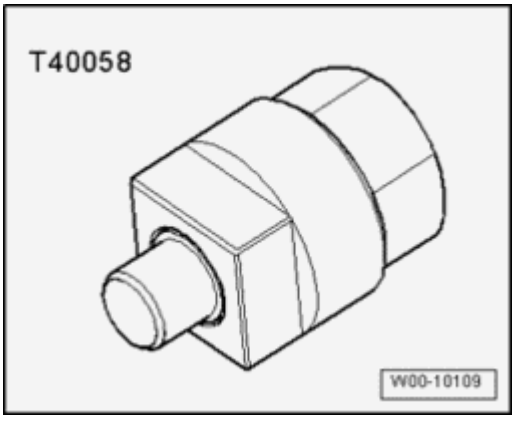


Fig. 199: Adapter T40058
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Adapter T40058

Work procedure

- Engine/transmission unit removed and attached to scissor lift platform VAS 6131 A.

NOTE:

- **All cable ties opened or cut during engine removal must be reinstalled at the same locations during installation.**
- **All heat insulation sleeves removed during engine removal must be reinstalled at the same locations during installation.**

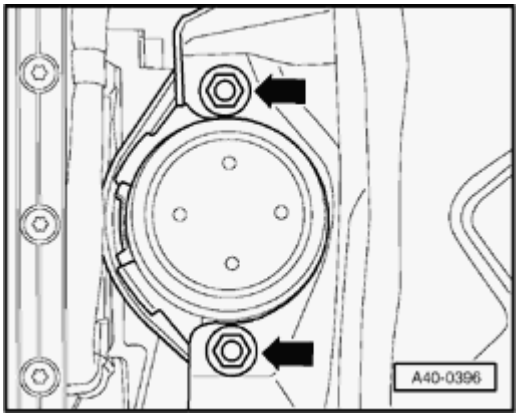


Fig. 200: Removing Bolts For Left/Right Transmission Mount
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts - **arrows** - for left and right transmission mount.

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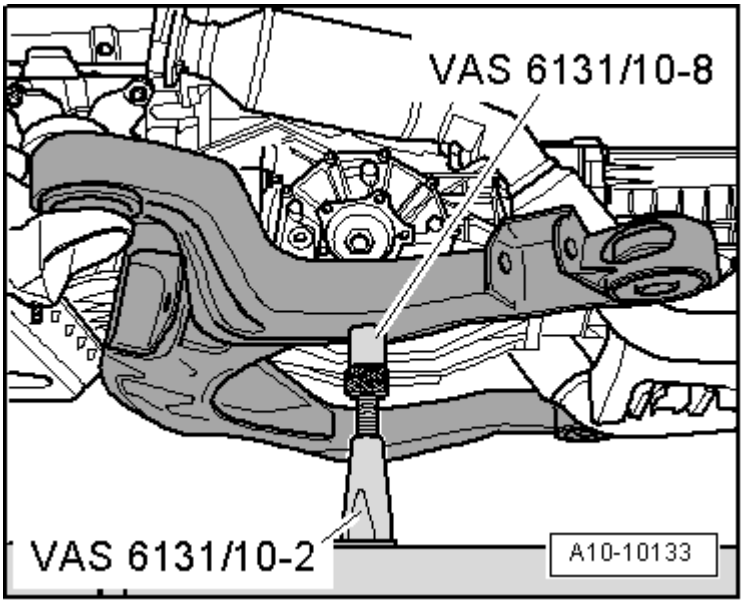


Fig. 201: Positioning Support Elements From VAS 6131/10 At Left/Right On Subframe
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Turn spindles of support elements from VAS 6131/10 at left and right at subframe completely downward.
- Remove support pins from spindles.
- Remove subframe to side.

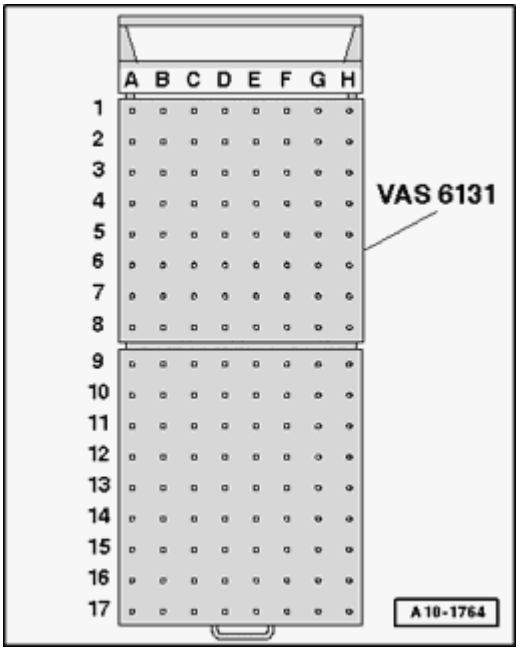


Fig. 202: Identifying Scissor Lift Platform VAS 6131
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Equip scissor lift platform VAS 6131 A with support set for Audi VAS 6131/10 , VAS 6131/11 and VAS

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Platform coordinates	Parts of support set for Audi VAS 6131/10 , VAS 6131/11 and VAS 6131/12			
B4 * See note	/10-1	/10-4	/10-5	/10-11
G3 * See note	/10-1	/10-4	/10-5	/10-11
B7	/10-1	/10-4	/10-5	/11-2
G7	/10-1	/10-4	/10-5	/10-9
B10	/10-1	/10-2	/10-5	/12-1
G10	/10-1	/10-2	/10-5	/11-3
C15 * See note	/10-1	/10-3	/10-5	/10-12
F15 * See note	/10-1	/10-3	/10-5	/10-12

*Support elements remain unchanged.

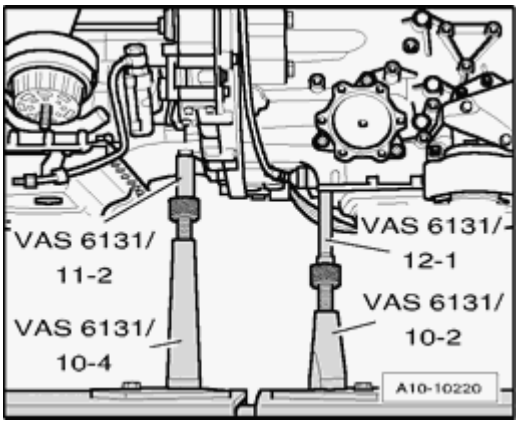


Fig. 203: Positioning Support Elements From VAS 6131/11 And VAS 6131/12 At Left On Engine/Transmission
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Position support elements from VAS 6131/11 and VAS 6131/12 at left on engine/transmission as shown in illustration.

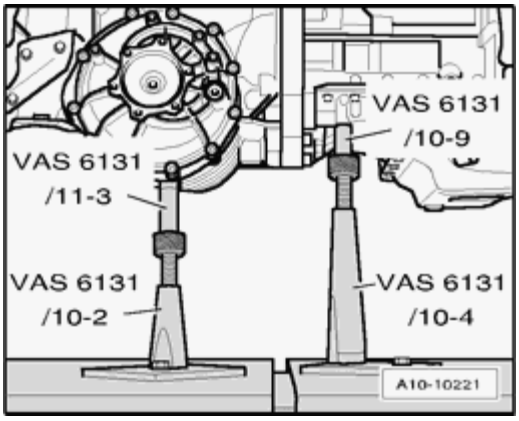


Fig. 204: Positioning Support Elements From VAS 6131/10 And VAS 6131/11 At Right On Engine/Transmission

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Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Position support elements from VAS 6131/10 and VAS 6131/11 at right on engine/transmission as shown in illustration.
- Twist spindles of attachments upward far enough until all support pins make contact at support points.
- Tighten base plates for support elements to 20 Nm on scissor lift platform VAS 6131 A.

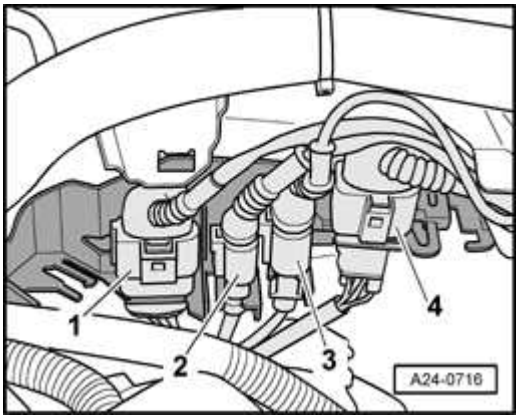


Fig. 205: Removing Bracket For Electrical Harness Connectors At Left From Bulkhead
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove electrical harness connectors - **1** - and - **4** - from bracket and disconnect.
- Remove heat insulation sleeve on wiring harness and free up individual wires.

NOTE:

- **In the illustration, the electrical harness connectors are depicted as installed.**

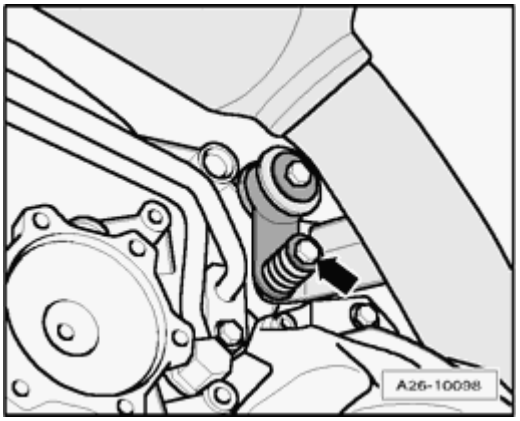


Fig. 206: Removing Bolt At Strap For Left Front Exhaust Pipe
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolt - **arrow** - at strap for left front exhaust pipe.

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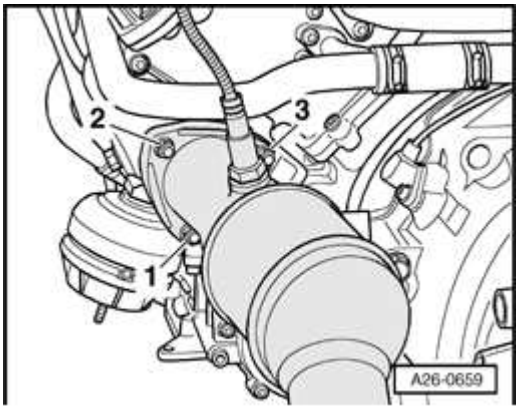


Fig. 207: Removing Nuts For Left Front Exhaust Pipe/Exhaust Manifold
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove nuts - **1 to 3** - for left front exhaust pipe/exhaust manifold.
- Remove front exhaust pipe with pre- and main catalytic converters.

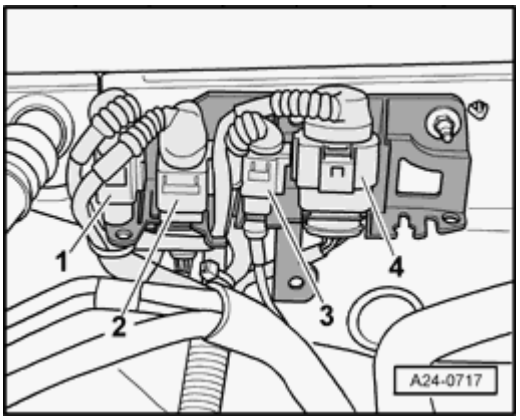


Fig. 208: Removing Bracket For Electrical Harness Connectors At Right From Bulkhead
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove electrical harness connectors - **2** - and - **4** - from bracket and disconnect.
- Free up the wiring harnesses.

NOTE:

- **In the illustration, the electrical harness connectors are depicted as installed.**

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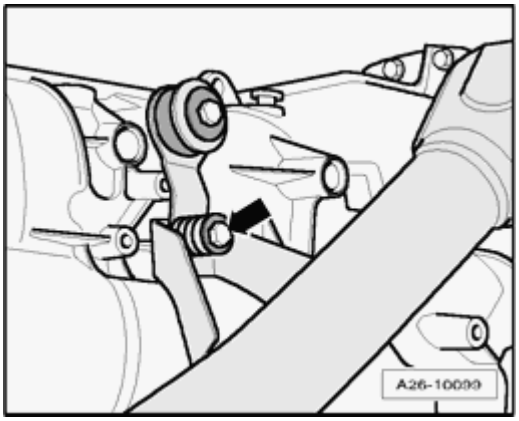


Fig. 209: Removing Bolt At Strap For Right Front Exhaust Pipe
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolt - **arrow** - at strap for right front exhaust pipe.

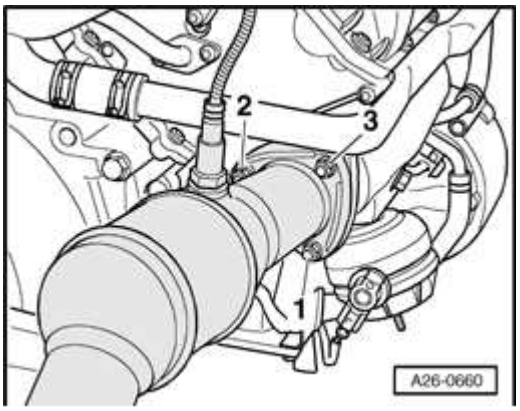


Fig. 210: Removing Nuts For Right Front Exhaust Pipe/Exhaust Manifold
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove nuts - **1 to 3** - for right front exhaust pipe/exhaust manifold.
- Remove front exhaust pipe with pre- and main catalytic converters.

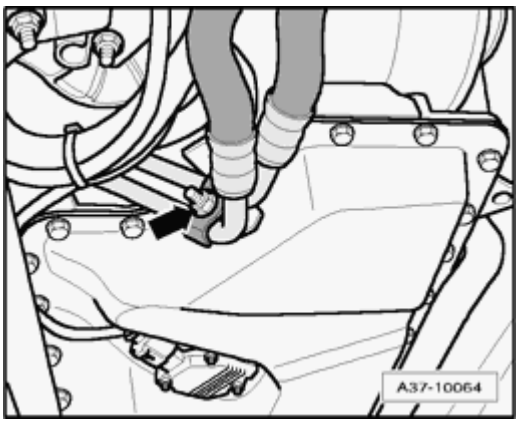


Fig. 211: Removing Bracket For ATF Lines At Right On Oil Pan

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Courtesy of VOLKSWAGEN UNITED STATES, INC.

NOTE:

- **Observe rules of cleanliness for working on automatic transmissions --> 00 TECHNICAL DATA .**

- Remove bracket - **arrow** - for ATF lines at right on oil pan.

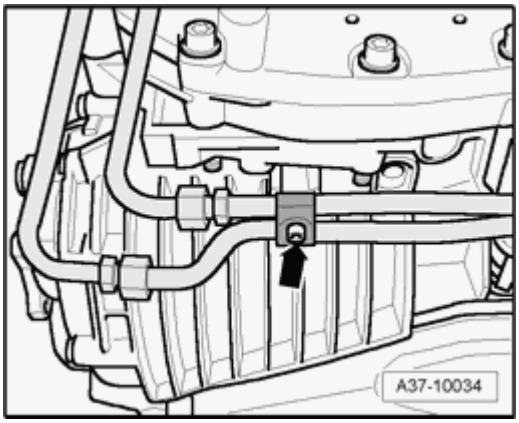


Fig. 212: Removing Bracket For ATF Lines At Bottom On Transmission
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bracket - **arrow** - for ATF lines at bottom on transmission.

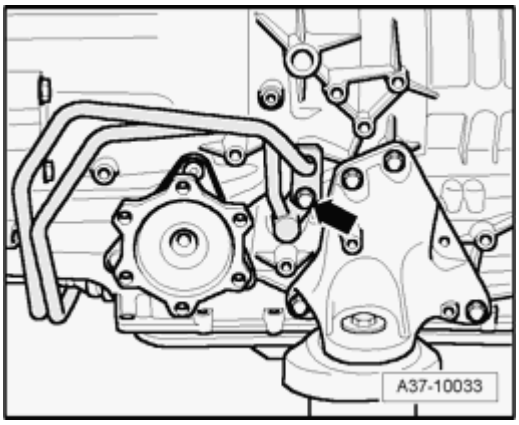


Fig. 213: Removing Bolt & Disconnecting ATF Lines From Transmission
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolt - **arrow** -.
- Disconnect ATF lines from transmission.

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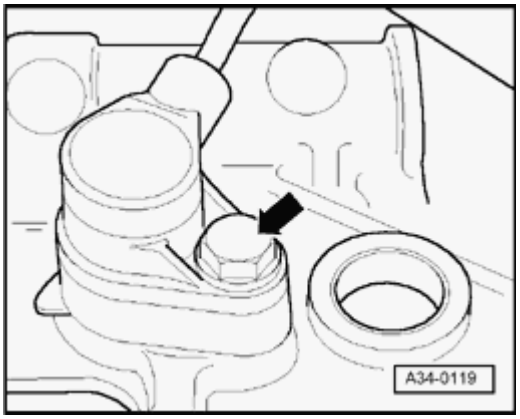


Fig. 214: Location Of Engine Speed (RPM) Sensor G28 On Coupling Housing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolt and Engine Speed (RPM) Sensor G28 on transmission - **arrow** -.

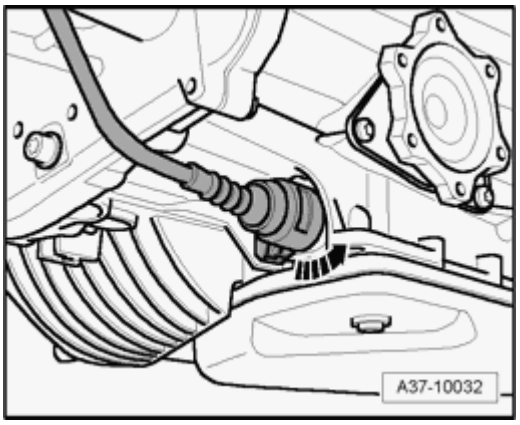


Fig. 215: Disconnecting Electrical Harness Connector On Transmission
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical harness connector on transmission, to do this swing twist lock counterclockwise - **arrow** -.

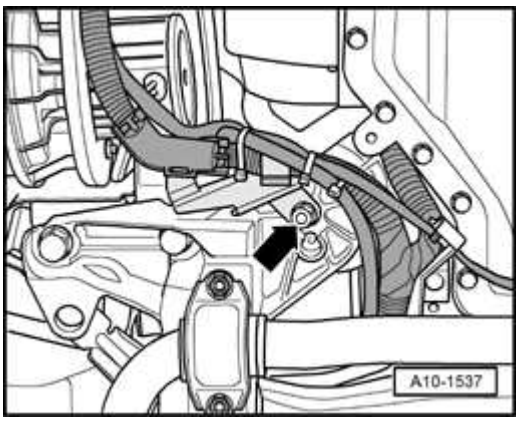


Fig. 216: Removing Wiring Harness Bracket At Right Engine Plate

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Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove wiring harness bracket at right engine plate - **arrows** -.

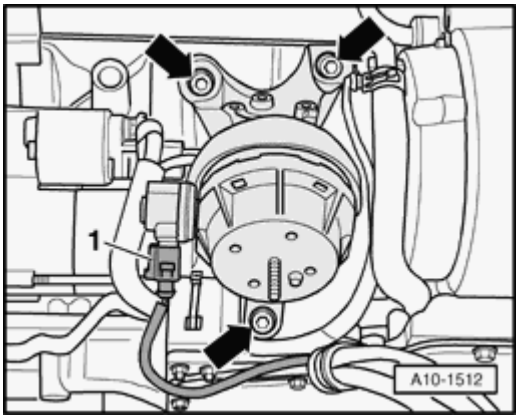


Fig. 217: Disconnecting Electrical Harness Connector At Right Engine Mount
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical harness connector - **1** - at right engine mount.
- Remove bolts - **arrows** - and remove right engine mount.

NOTE:

- **Shown without engine mount plate to provide a better illustration.**

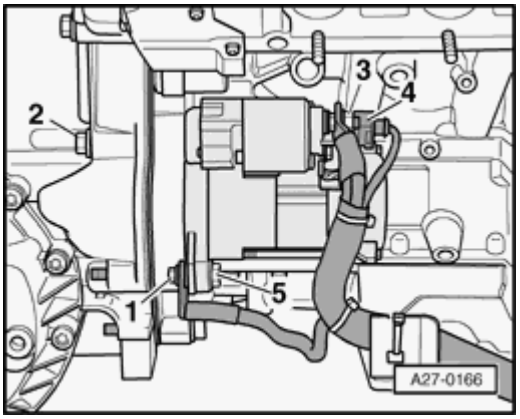


Fig. 218: Identifying Ground (GND) Wire, Starter Electrical Wires, Bolts & Starter
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove Ground (GND) wire - **1** -.
- Disconnect electrical wires - **3** - and - **4** - on starter.
- Remove bolts - **2** - and - **5** - and remove starter.

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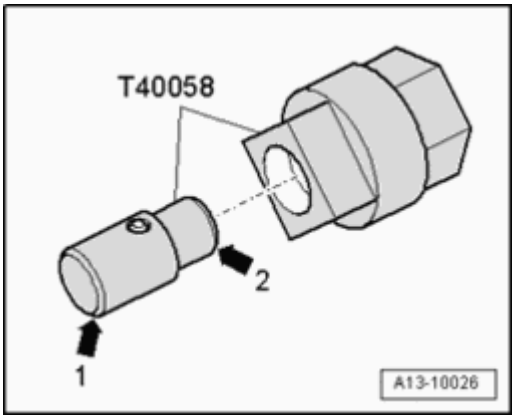


Fig. 219: Inserting Guide Pin Of Adapter T40058 So Small Diameter Points To Engine
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Insert guide pin of adapter T40058 so that small diameter - **arrow 2** - points to engine. Large diameter - **arrow 1** - points to adapter.

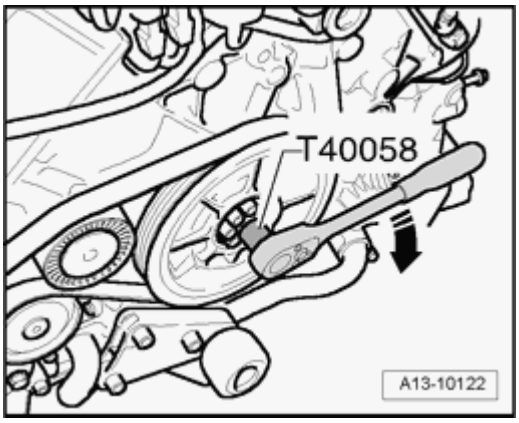


Fig. 220: Counter Holding Crankshaft Using Adapter T40058 To Loosen Torque Converter Bolts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- To loosen torque converter bolts, counter hold crankshaft using adapter T40058.

NOTE:

- **Disregard - arrow -.**

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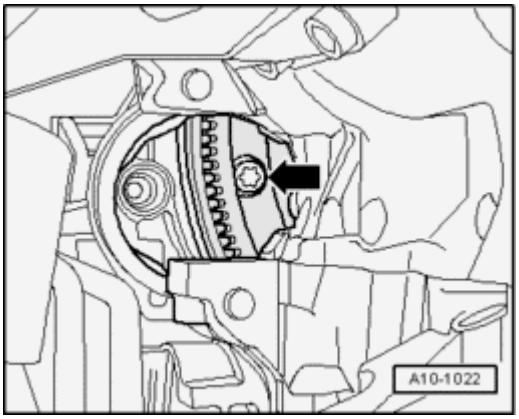


Fig. 221: Torque Converter Bolts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove 3 torque converter bolts - **arrows** - in opening on removed starter (turn crankshaft $^{1}/_{3}$ rotation in each case).

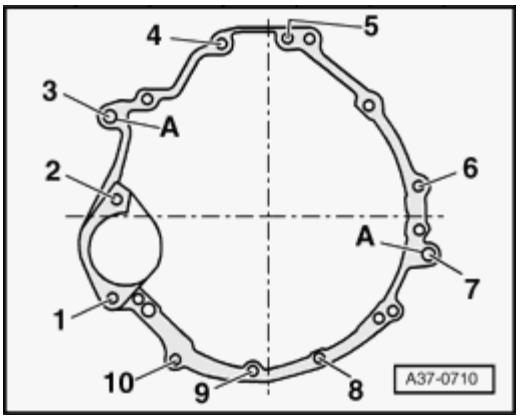
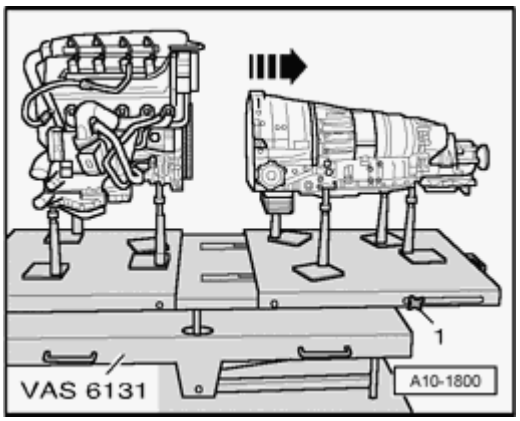


Fig. 222: Identifying Engine/Transmission Threaded Connections
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove engine/transmission threaded connections - **3 to 10** -.



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Section With Transmission Rearward
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Loosen side clamping bolts - **1** - on scissor lift platform VAS 6131 A and pull rear platform top with transmission toward rear - **arrow** - , simultaneously push torque converter through opening of drive plate while doing this.

Engine (vehicles with automatic transmission), securing to assembly stand

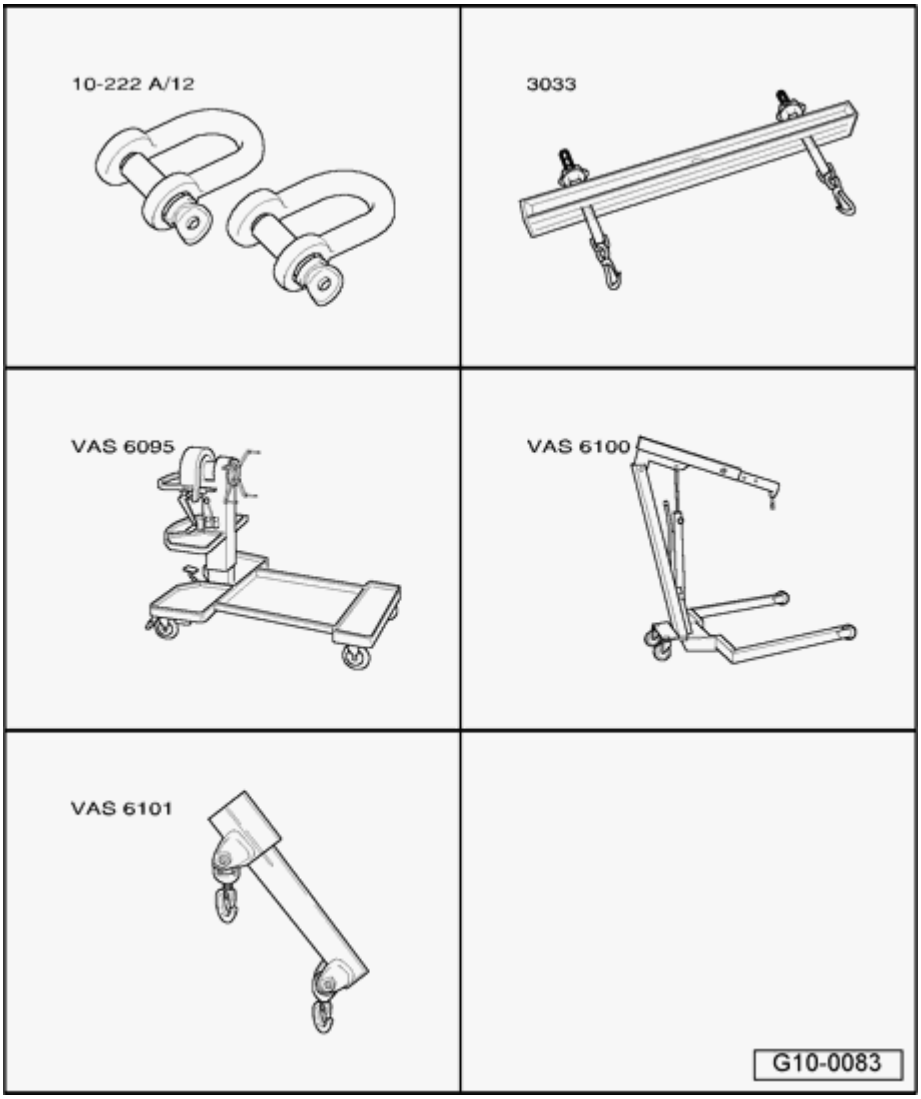


Fig. 224: Identifying Special Tools - Engine (Vehicles With Automatic Transmission), Securing To Assembly Stand
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools, testers and auxiliary items required

- Shackle 10-222 A/12

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- Lifting tackle 3033
- Engine and Transmission Holder VAS 6095 with Holder for V8 Engine Audi S4, allroad quattro VAS 6095/1-6 or Holder for V8 Engine Audi S4, allroad quattro VAS 6095/1-6A
- Shop crane VAS 6100
- Lift arm extension for workshop crane VAS 6101

Special tools, testers and auxiliary items required

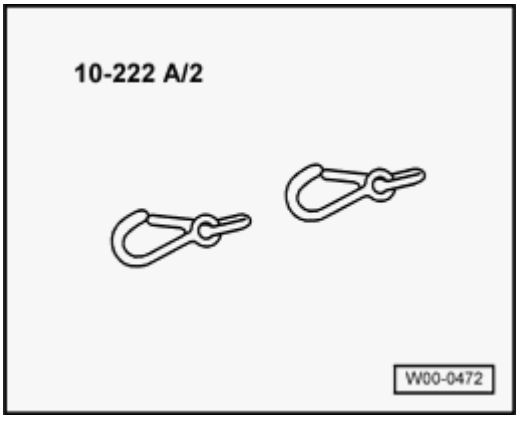


Fig. 225: Identifying Additional Hooks (2) 10-222 A/2
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Additional hooks (2) 10-222 A/2

Work procedure

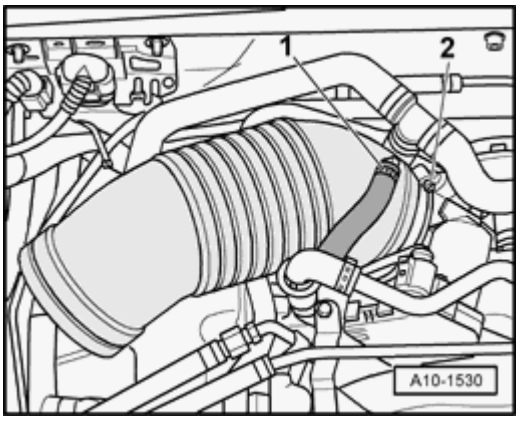


Fig. 226: Disconnecting Vacuum Hose & Air Guide Hose From Throttle Valve Control Module
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect vacuum hose - **1** -.
- Disconnect air guide hose - **2** - from throttle valve control module.

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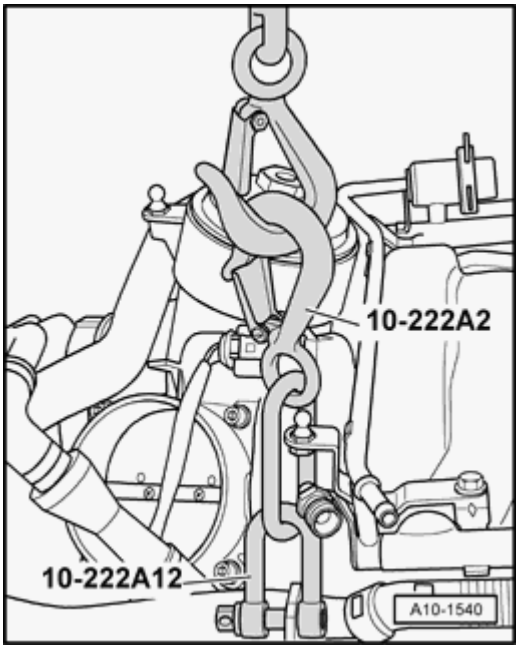


Fig. 227: Securing Shackle 10-222 A/12 To Right Rear Engine Lifting Eyelet & Hooking Additional Hook 10-222 A/2 On Shackle 10-222 A/12
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Secure shackle 10-222 A/12 to right rear engine lifting eyelet.
- Hook additional hook 10-222 A/2 on shackle 10-222 A/12.

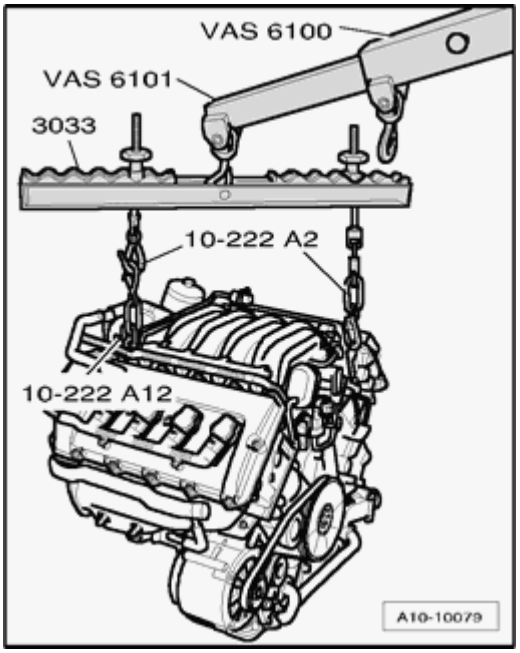


Fig. 228: Engaging Engine Sling 3033 On Additional Hook 10-222 A/2 And On Workshop Crane VAS 6100 With Lift Arm Extension For Workshop Crane VAS 6101
Courtesy of VOLKSWAGEN UNITED STATES, INC.

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- Engage engine sling 3033 on additional hook 10-222 A/2 and on workshop crane VAS 6100 with lift arm extension for workshop crane VAS 6101 as shown in the illustration.
- Lift engine from support elements of scissor lift platform VAS 6131 A.
- Remove engine mount with left engine support.

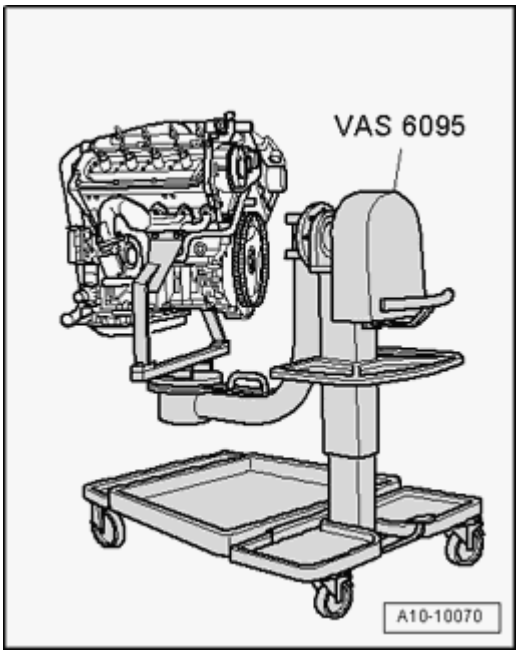


Fig. 229: Securing Engine With Transmission Holder VAS 6095
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Secure engine with Holder for V8 Engine Audi S4, allroad quattro VAS 6095/1-6 or Holder for V8 Engine Audi S4, allroad quattro VAS 6095/1-6A tightened to 42 Nm to Engine and Transmission Holder VAS 6095 as shown in the illustration.

Engine (vehicles with automatic transmission), installing

NOTE:

- **During assembly, replace self-locking nuts and bolts.**
- **Always replace bolts that are tightened to torque as well as sealing rings, gaskets and O-rings.**
- **Secure all hose connections using hose clamps appropriate for the model type .**
- **During installation, re-install all heat insulation sleeves at the same locations.**
- **During installation, all cable ties must be re-installed at the same location.**

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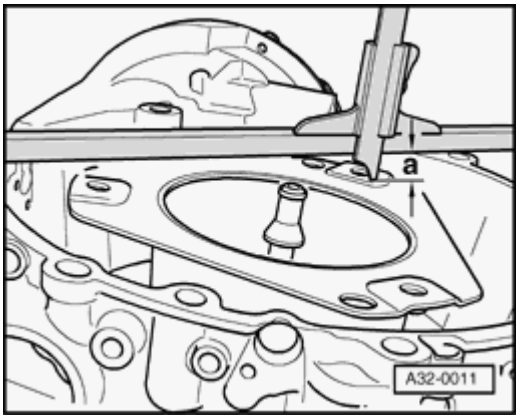


Fig. 230: Checking Installation Dimension For Torque Converter
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Installation dimension for torque converter, checking

When torque converter is installed correctly, distance between contact surface of threaded holes at torque converter and contact surface of converter housing on Automatic Transmission 09L is approx. 19 mm.

CAUTION: If torque converter is incorrectly installed, torque converter coupling and ATF pump could be damaged when transmission and engine are flanged together.

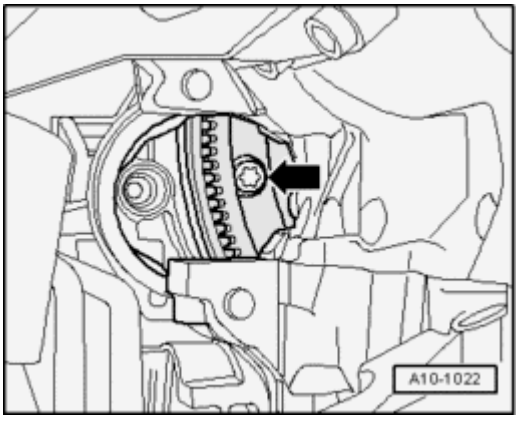


Fig. 231: Torque Converter Bolts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Before connecting engine and transmission, rotate torque converter and engine drive plate so that one hole or one threaded hole stands at height of opening of removed starter - **arrow** -.
- To secure torque converter to drive plate, use new original ribbed bolts .
- Bolt transmission to engine.

CAUTION: Keep checking whether the torque converter behind the drive plate can be turned before and during tightening of the bolts at engine/transmission flange. If the torque converter cannot be turned, it must be assumed that it

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has not been inserted properly and that the coupling plate of the ATF pump and therefore the transmission will be destroyed during final tightening of the bolts.

NOTE:

- **Torque specifications only apply to lightly greased, oiled, phosphated or blackened nuts and bolts.**
- **Additional lubricants, such as engine or transmission oil are permissible, although lubricants containing graphite are not.**
- **Do not use any degreased parts.**
- **Tolerance for torque specifications ± 15%.**

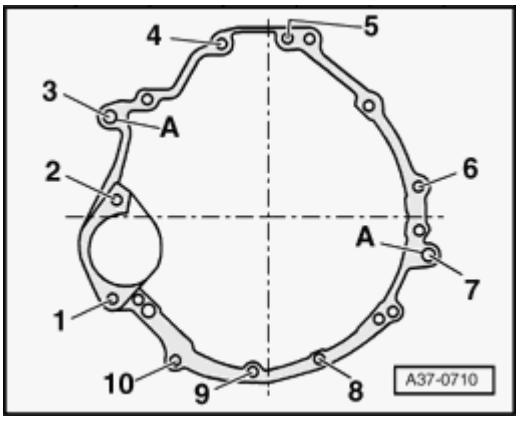


Fig. 232: Identifying Engine/Transmission Threaded Connections
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Engine/transmission, fastening

Item	Bolt	Nm
1	M12x80	65
2, 4, 5	M12x105	65
3	M12x110	65
6	M12x130	65
7	M12x170	65
8, 9, 10	M10x60	45
A	Alignment sleeves for centering	

The rest of installation is in reverse order of removal, note the following:

- Install front exhaust pipes with catalytic converters: Left --> **Left front exhaust pipe with primary and main catalytic converter (vehicles with manual transmission), removing and installing** , right --> **Right front exhaust pipe with primary and main catalytic converter (vehicles with automatic transmission), removing and installing**.
- Install ATF lines --> **37 CONTROLS, HOUSING** .

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- Always clean threaded driveshaft bores in transmission flanged shaft of locking fluid residue using a tap before installation.

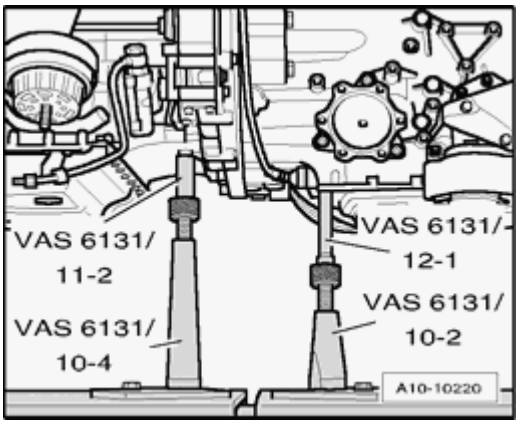


Fig. 233: Positioning Support Elements From VAS 6131/11 And VAS 6131/12 At Left On Engine/Transmission
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Rotate spindles of support elements downward at left of engine/transmission assembly.
- Remove both base plates for left support element on scissor lift platform VAS 6131 A.

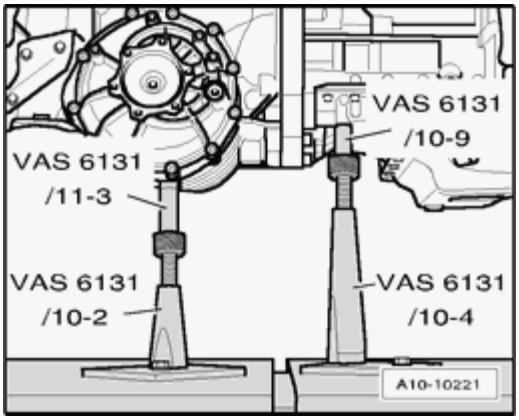


Fig. 234: Positioning Support Elements From VAS 6131/10 And VAS 6131/11 At Right On Engine/Transmission
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Rotate spindles of support elements downward at right of engine/transmission assembly.
- Remove both base plates for right support element on Scissor Lift Table VAS 6131 A.

NOTE:

- **The support points for front of engine and rear of transmission remain unchanged.**

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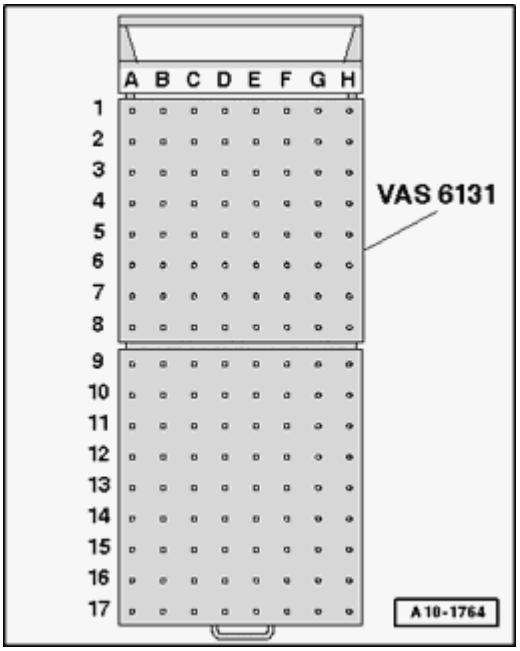


Fig. 235: Identifying Scissor Lift Platform VAS 6131
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Equip scissor lift platform VAS 6131 A with support set for Audi VAS 6131/10 as follows:

Platform coordinates	**Parts of support set for Audi VAS 6131/10**			
B4 * See note	/10-1	/10-4	/10-5	/10-11
G3 * See note	/10-1	/10-4	/10-5	/10-11
B10	/10-1	/10-2	/10-5	/10-8 * See note
G10	/10-1	/10-2	/10-5	/10-8 * See note
C15 * See note	/10-1	/10-3	/10-5	/10-12
F15 * See note	/10-1	/10-3	/10-5	/10-12

*Support elements remain unchanged.

*Only install support elements after installing subframe.

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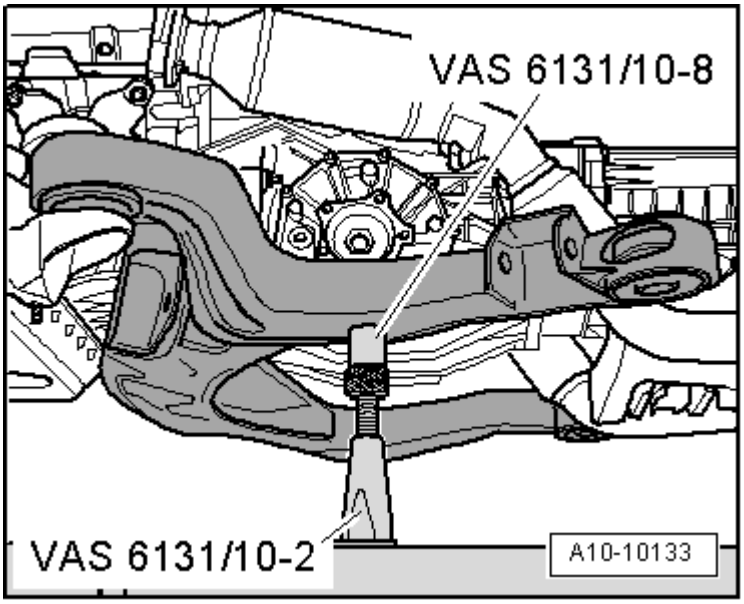


Fig. 236: Positioning Support Elements From VAS 6131/10 At Left/Right On Subframe
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Position subframe on both attachments VAS 6131/10-8.
- Turn spindles of support elements upward on both sides.
- Tighten base plates for support elements to 20 Nm on scissor lift platform VAS 6131 A.
- Install left and right transmission mounts --> **37 CONTROLS, HOUSING** .

- Using scissor lift platform VAS 6131 A , slowly guide engine/transmission unit with subframe into body from below.

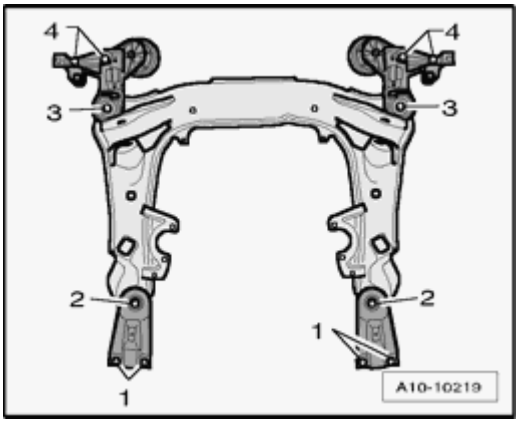


Fig. 237: Removing/Installing Bolts In Diagonal Sequence And In Stages
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Align subframe and engine bearing plates according to markings applied on long members during removal.
- Tighten bolts for subframe and engine mount plates only to specified torque. Do not tighten further

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(tighten bolts only after axle alignment).

1. 65 Nm
2. 110 Nm
3. 110 Nm
4. 75 Nm

CAUTION: Vehicle must not be driven in this condition.

The rest of installation is in reverse order of removal, note the following:

- Install selector lever cable, adjust if necessary -->**37 CONTROLS, HOUSING** .
- Install drive axles --> **40 - FRONT SUSPENSION** .
- Install guide control arm, control arm, stabilizer bar and suspension strut --> **40 - FRONT SUSPENSION** .
- Align exhaust system free of tension --> **Exhaust system, installing free of tension**.
- Install refrigerant lines --> **87 AIR CONDITIONING** .

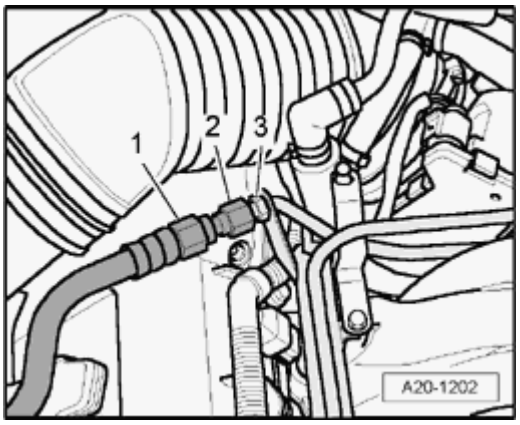


Fig. 238: Installing/Removing Fuel Hose To/From Connection On Fuel Rail Line
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Secure fuel hose to connection on fuel rail line. To do so, counter hold using an open-end wrench at each hex head - **1** - and - **3** - and tighten union nut - **2** - to 22 Nm.
- Install lock carrier with attachments -->
  - **50 BODY, FRONT**
  - **50 - BODY - FRONT** for BODY EXTERIOR - CABRIOLET

  .
- Install ATF lines -->
  - **37 - AUTOMATIC TRANSMISSION - CONTROLS, HOUSING** for 5 SPD. AUTOMATIC

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TRANSMISSION 01V

- **37 - AUTOMATIC TRANSMISSION - CONTROLS, HOUSING** for 5 SPD. AUTOMATIC TRANSMISSION 01V FRONT AND ALL WHEEL DRIVE - INTERNAL COMPONENTS, SERVICING
- **37 CONTROLS, HOUSING** for 6 SPD. AUTOMATIC TRANSMISSION 09L ALL WHEEL DRIVE

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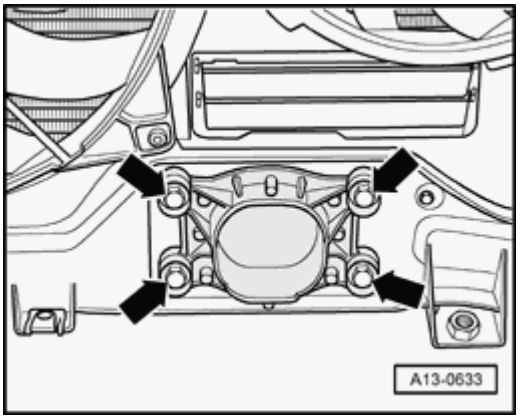


Fig. 239: Placing Torque Support On Rubber Buffer For Torque Support And Tightening Bolts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Place torque support on rubber buffer for torque support and tighten bolts - **arrows** -.
- Install front bumper cover -->
  - **63 BUMPER**
  - **63 - BUMPERS** for BODY EXTERIOR - CABRIOLET

  .
- Electrical connections and routing --> Electrical Wiring Diagrams, Troubleshooting and Component Locations.
- Observe safety precautions after connecting battery -->
  - **97 WIRING**
  - **97 WIRING** for ELECTRICAL EQUIPMENT, CABRIOLET

  .

CAUTION: Do not use a battery charger for starting assistance! There is the risk that the vehicle control modules could be damaged.

- Mount wiper arms and adjust -->
  - **92 WINDSHIELD WIPER WASHER SYSTEM**
  - **92 WINDSHIELD WIPER & WASHER SYSTEM** for ELECTRICAL EQUIPMENT, CABRIOLET

  .

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- Check oil level --> **Oil level, checking**.
- Before starting engine for the first time, fill power steering reservoir with hydraulic oil --> **48 - STEERING** .

CAUTION: Power-steering pump must not run dry.

- Fill with coolant **Filling**.

NOTE:

- **Only reuse drained coolant if cylinder head or engine block was not replaced.**
- **Dirty coolant must not be re-used.**

- Fill refrigerant circuit --> **87 - AIR CONDITIONING** .
- Align subframe and both engine mount plate --> **40 - FRONT SUSPENSION** .
- Perform axle alignment --> **44 - WHEELS, TIRES, VEHICLE ALIGNMENT** .

CAUTION: After axle alignment, tighten subframe bolts to final torque.

- Check headlight adjustment -->
  - **01 - MAINTENANCE**
  - **01 - MAINTENANCE** for MAINTENANCE PROCEDURES - CABRIOLET

.

Torque specifications

NOTE:

- **Torque specifications only apply to lightly greased, oiled, phosphated or blackened nuts and bolts.**
- **Additional lubricants, such as engine or transmission oil are permissible, although lubricants containing graphite are not.**
- **Do not use any degreased parts.**
- **Tolerance for torque specifications ± 15%.**

Component		Nm
Bolts/nuts	M6	9
	M8	20
	M10	40
	M12	65
Exceptions:		

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Drive plate to torque converter	85 * See note
Clamp B+ to starter	16
Engine support to engine	42 * See note
Heat shield for drive shaft to transmission	23
Hydraulic pressure line	40
Torque support stop to lock carrier	28
Fuel hose to fuel line	22

*Replace bolts.

*Insert bolts with locking fluid.

13 - ENGINE - CRANKSHAFT, CYLINDER BLOCK

ENGINE, DISASSEMBLING AND ASSEMBLING

Lock carrier in service position, overview

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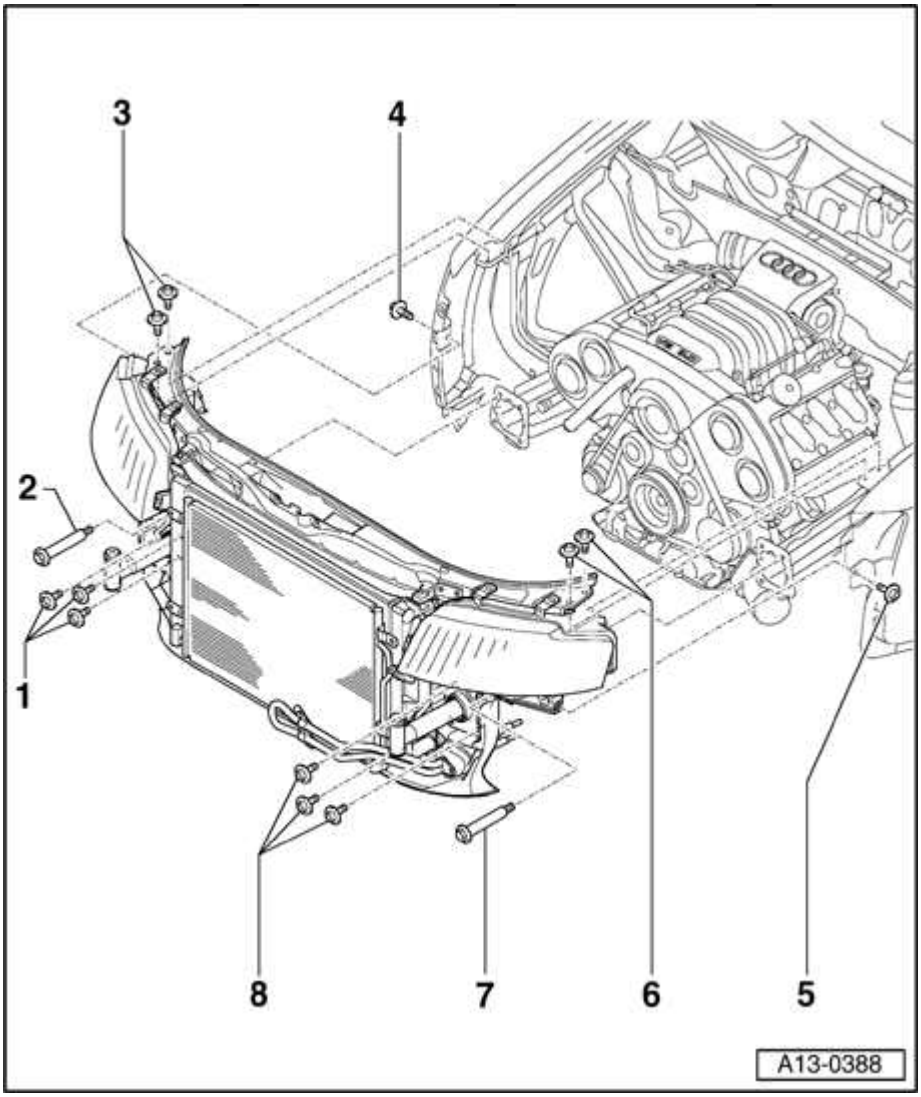


Fig. 240: Lock Carrier In Service Position, Overview
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - 40 Nm

2 - Support tool 3369

- Tighten to 10 Nm

3 - 10 Nm

4 - 10 Nm

5 - 10 Nm

6 - 10 Nm

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7 - Support tool 3369

- Tighten to 10 Nm

8 - 40 Nm

Lock carrier, moving into service position

Special tools, testers and auxiliary items required

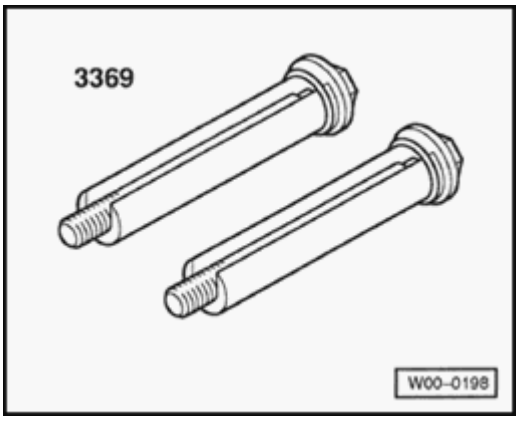


Fig. 241: Support Tool 3369
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Support tool 3369

Work procedure

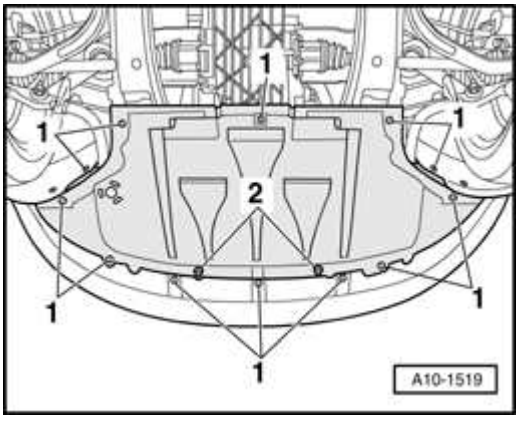


Fig. 242: Removing Quick-Release Fasteners, Screws And Noise Insulation
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove quick-release fasteners - **1** - , remove screws - **2** - and remove noise insulation.
- Remove both front wheels.
- Loosen left and right wheel housing liners in front area.

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- Remove front bumper cover -->
  - **63 BUMPER**
  - **63 - BUMPERS** for BODY EXTERIOR - CABRIOLET

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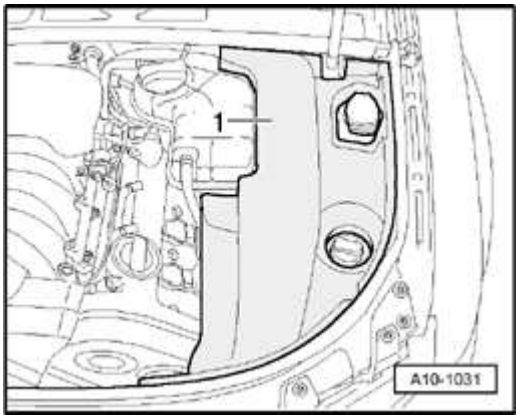


Fig. 243: Removing Cover In Engine Compartment (Left Side)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove cover - **1** - in engine compartment (left side).

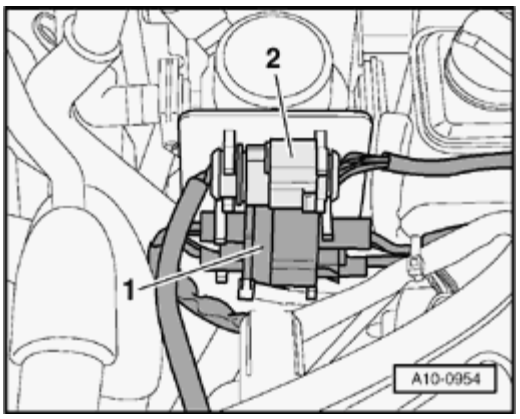


Fig. 244: Removing Electrical Harness Connectors And From Bracket
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove electrical harness connectors - **1** - and - **2** - from bracket.
- Free up wires to lock carrier.

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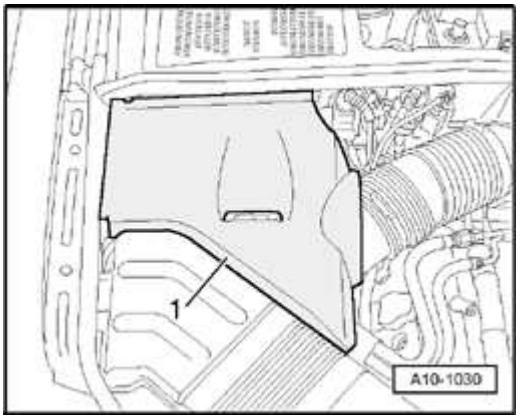


Fig. 245: Removing Cover In Engine Compartment (Right Side)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove cover - **1** - in engine compartment (right side).

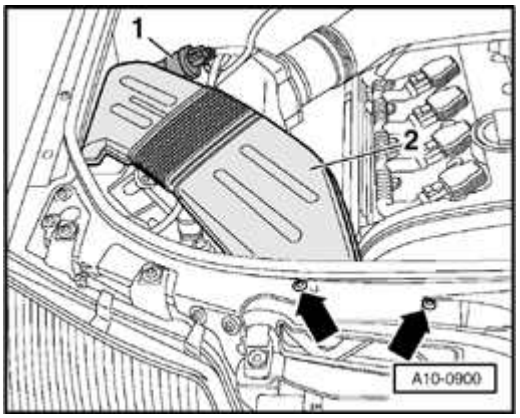
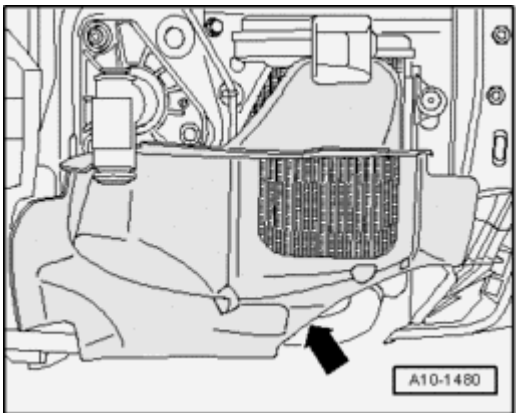


Fig. 246: Identifying Evaporative Emission Canister Purge Regulator Valve N80 And Air Duct
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disengage Evaporative Emission (EVAP) Canister Purge Regulator Valve N80 - **1** - from air guide.
- Remove bolts - **arrows** -.
- Remove air duct - **2** -.



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Fig. 247: Removing Left Air Guide In Front Of Auxiliary Cooler
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove left air guide - **arrow** - in front of auxiliary cooler.

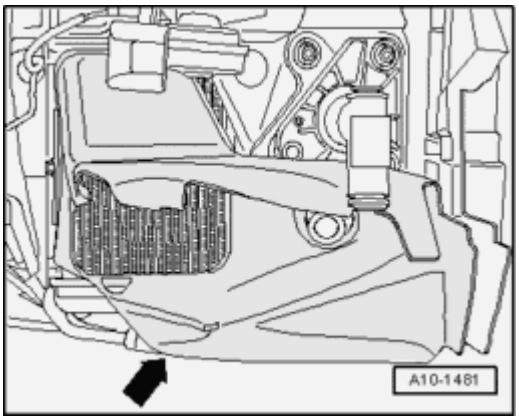


Fig. 248: Removing Right Air Guide In Front Of Auxiliary Cooler
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove right air guide - **arrow** - in front of auxiliary cooler.

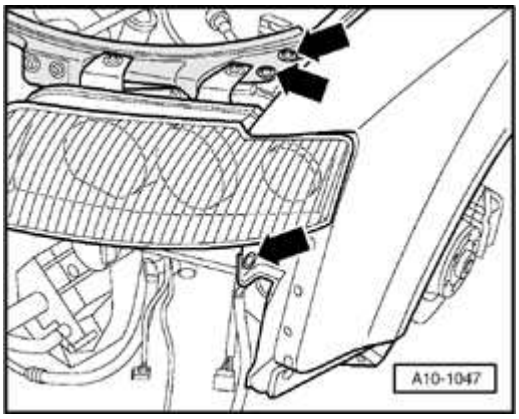


Fig. 249: Removing Bolts At Left/Right Side Of Bumper
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts - **arrows** - at left and right side of bumper.
- Pull off hood seal from lock carrier and fender edges.

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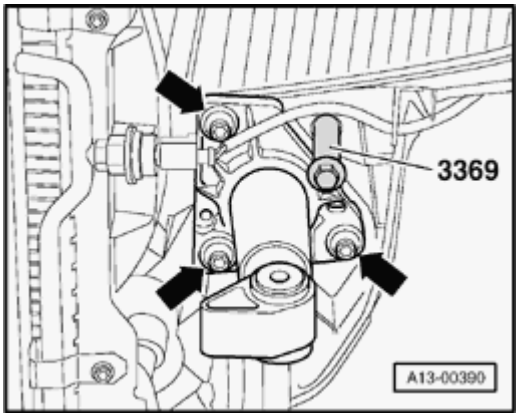


Fig. 250: Threading 3369 Support Tool Into Empty Holes At Left/Right
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Thread support tool 3369 into empty bores at left and right.
- Remove bolts at impact absorbers - **arrows** - at left and right.
- Carefully pull lock carrier toward front.

Installing

Installation is in reverse order of removal, note the following:

- Install lock carrier with attachments -->
  - **50 BODY, FRONT**
  - **50 - BODY - FRONT** for BODY EXTERIOR - CABRIOLET

.

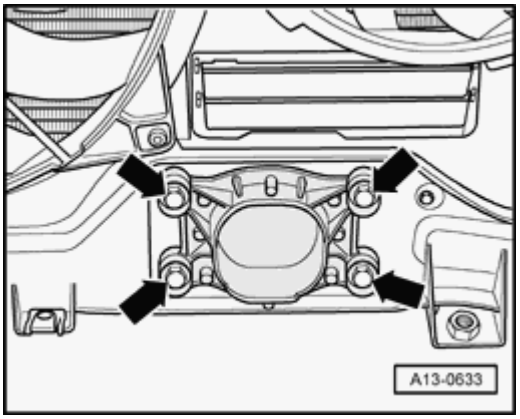


Fig. 251: Placing Torque Support On Rubber Buffer For Torque Support And Tightening Bolts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Place torque support on rubber buffer for torque support and tighten bolts - **arrows** -.
- Install the front bumper cover -->
  - **63 BUMPER**

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- **63 - BUMPERS** for BODY EXTERIOR - CABRIOLET

.

- Check headlight adjustment -->
  - **01 - MAINTENANCE**
  - **01 - MAINTENANCE** for MAINTENANCE PROCEDURES - CABRIOLET

.

Torque specifications

Component	Nm
Torque support stop to lock carrier	28

BELT PULLEY SIDE, SERVICING

Ribbed belt drive for generator, component overview

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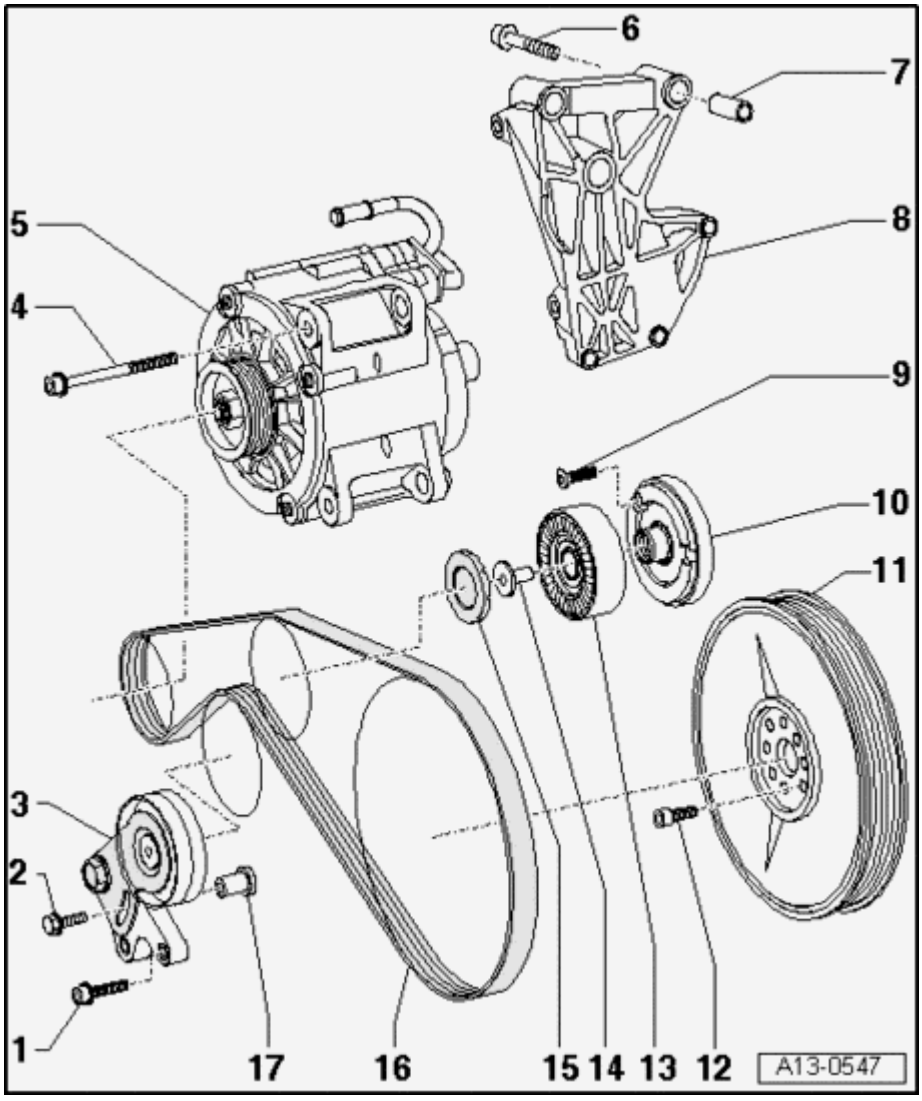


Fig. 252: Ribbed Belt Drive For Generator, Component Overview
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - 22 Nm

2 - 22 Nm

3 - Ribbed belt tensioner

4 - 22 Nm

5 - Generator

- Removing and installing -->
  - **27 BATTERY, STARTER, GENERATOR, CRUISE CONTROL**
  - **27 BATTERY, STARTER, GENERATOR, CRUISE CONTROL** for ELECTRICAL

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EQUIPMENT, CABRIOLET

6 - M8 - 22 Nm; M10 - 46 Nm

7 - Alignment bushing

- For generator bracket
- 2 pieces

8 - Generator bracket

9 - 10 Nm

10 - Idler roller holder

11 - Vibration damper

- Removing and installing --> **Vibration damper, removing and installing**

12 - 22 Nm plus an additional 45 ° ($^{1}/_{8}$ turn)

- Replace

13 - Idler roller for ribbed belt

14 - 22 Nm

15 - Cover cap

16 - Ribbed belt

- Check for wear
- Do not kink
- Before removing, mark direction of rotation using chalk or felt-tip marker. Reversing direction of rotation of a run-in belt can destroy the belt
- Removing and installing --> **Ribbed belt, removing and installing**

- When installing ribbed belt, make sure it is seated correctly on pulleys

17 - Threaded bushing

Ribbed belt, removing and installing

Special tools, testers and auxiliary items required

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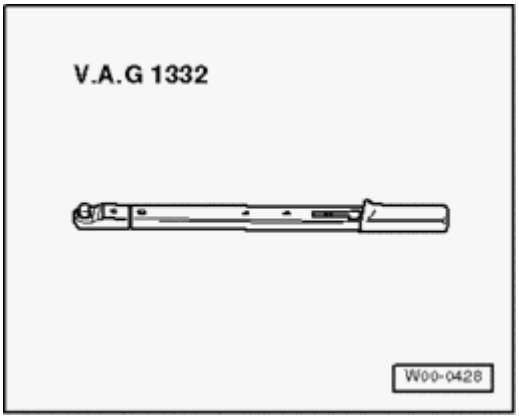


Fig. 253: Identifying Torque Wrench V.A.G. 1332
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Torque wrench V.A.G 1332

Removing

- Bring lock carrier into service position --> **Lock carrier, moving into service position**.

NOTE:

- **Before removing ribbed belt, mark the turning direction on it with chalk or a felt tip pen. A reversed direction of rotation can cause damage to the belt under operating conditions.**

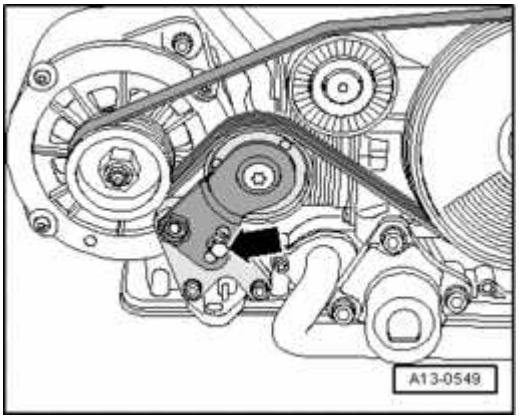


Fig. 254: Loosening Tensioning Bolt And Ribbed Belt
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Loosen tensioning bolt - **arrow** - and remove ribbed belt.

Installing

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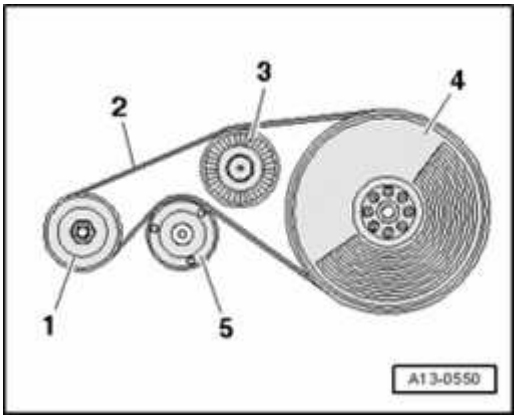


Fig. 255: Placing Ribbed Belt Over Belt Pulley In Sequence
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Place ribbed belt over belt pulley in specified sequence.

1. Generator
2. Ribbed belt
3. Idler roller
4. Vibration damper
5. Tensioning roller

NOTE:

- **When installing the ribbed belt, make sure it is seated correctly on the pulleys.**

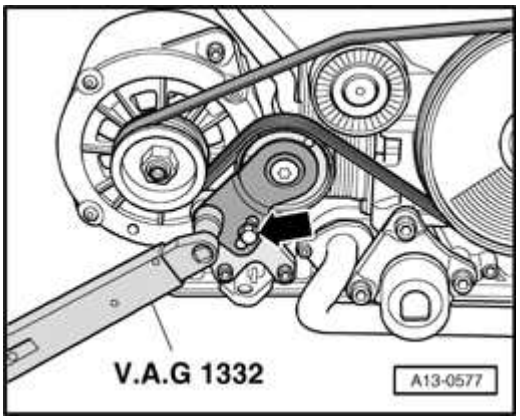


Fig. 256: Positioning Torque Wrench On Belt Tensioner Hex Bolt
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Position torque wrench on belt tensioner hex bolt and pre-tighten ribbed belt to 70 Nm.
- At the same time, tighten tensioning bolt - **arrow** - to 22 Nm.

The rest of installation is in reverse order of removal, note the following:

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- Install lock carrier with attachments -->
  - **50 BODY, FRONT**
  - **50 - BODY - FRONT** for BODY EXTERIOR - CABRIOLET

  .
- Start engine and check belt running.

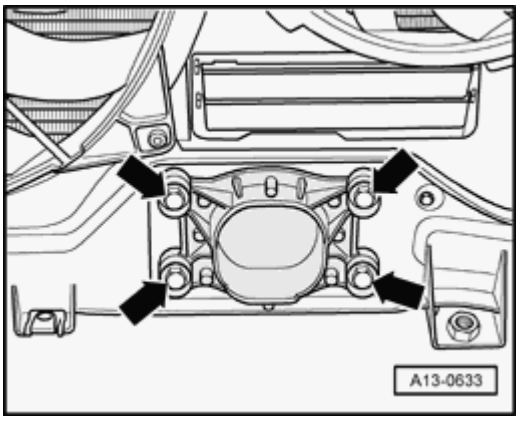


Fig. 257: Placing Torque Support On Rubber Buffer For Torque Support And Tightening Bolts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Place torque support on rubber buffer for torque support and tighten bolts - **arrows** -.
- Install the front bumper cover -->
  - **63 BUMPER**
  - **63 - BUMPERS** for BODY EXTERIOR - CABRIOLET

  .
- Check headlight adjustment -->
  - **01 - MAINTENANCE**
  - **01 - MAINTENANCE** for MAINTENANCE PROCEDURES - CABRIOLET

  .

Torque specifications

Component	Nm
Torque support stop to lock carrier	28

Vibration damper, removing and installing

Removing

- Bring lock carrier into service position --> **Lock carrier, moving into service position**.

NOTE:

- **To loosen and tighten vibration damper, counter hold on center nut of**

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generator belt pulley using open end wrench.

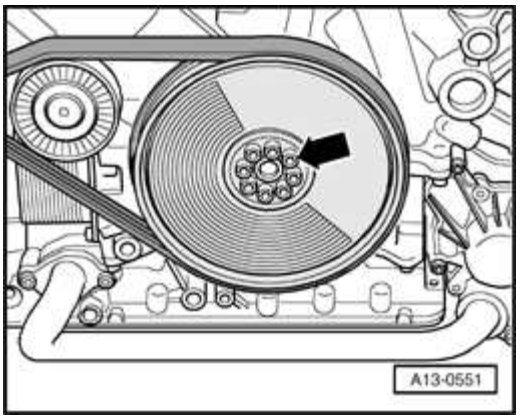


Fig. 258: Loosening Mounting Bolts On Vibration Damper Few Turns
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Loosen 8 mounting bolts - **arrow** - on vibration damper a few turns.

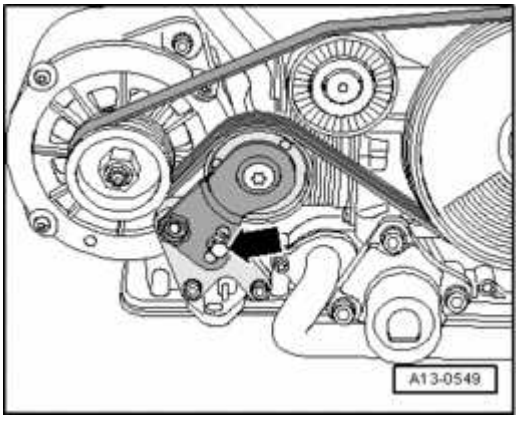


Fig. 259: Loosening Tensioning Bolt And Ribbed Belt
Courtesy of VOLKSWAGEN UNITED STATES, INC.

NOTE:

- **Before removing ribbed belt, mark the turning direction on it with chalk or a felt tip pen. A reversed direction of rotation can cause damage to the belt under operating conditions.**

- Loosen tensioning bolt - **arrow** - and remove ribbed belt.
- Remove vibration damper.

Installing

Installation is in reverse order of removal, note the following:

NOTE:

- **Replace bolts which have been tightened to torque.**

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- **Installation of vibration damper is only possible in one position - note alignment bushing.**

- Install ribbed belt **Installing**.
- Install lock carrier with attachments -->
  - **50 BODY, FRONT**
  - **50 - BODY - FRONT** for BODY EXTERIOR - CABRIOLET

.

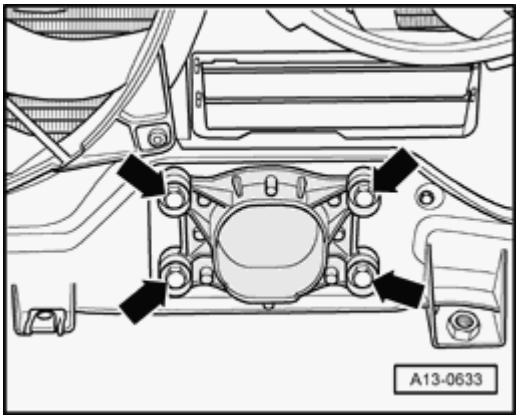


Fig. 260: Placing Torque Support On Rubber Buffer For Torque Support And Tightening Bolts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Place torque support on rubber buffer for torque support and tighten bolts - **arrows** -.
- Install front bumper cover -->
  - **63 BUMPER**
  - **63 - BUMPERS** for BODY EXTERIOR - CABRIOLET

.

- Check headlight adjustment -->
  - **01 - MAINTENANCE**
  - **01 - MAINTENANCE** for MAINTENANCE PROCEDURES - CABRIOLET

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Torque specifications

Component	Nm
Vibration damper to crankshaft	22 plus an additional 45 ° * See note
Torque support stop to lock carrier	28

* 45 ° corresponds to a 1/8 turn

*Replace bolts.

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Crankshaft seal (ribbed belt side), replacing

Special tools, testers and auxiliary items required

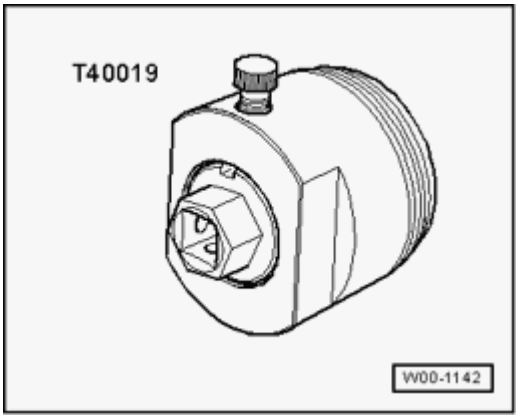


Fig. 261: Oil Seal Extractor T40019
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Oil Seal Extractor T40019

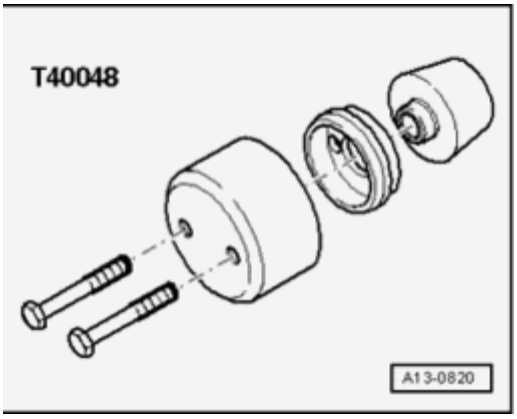


Fig. 262: Assembly Tool T40048
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Assembly tool T40048

Removing

- Bring lock carrier into service position --> **Lock carrier, moving into service position**.
- Remove vibration damper --> **Vibration damper, removing and installing**.
- Place inner part of Oil Seal Extractor T40019 flush with outer part and secure using knurled-head screw.

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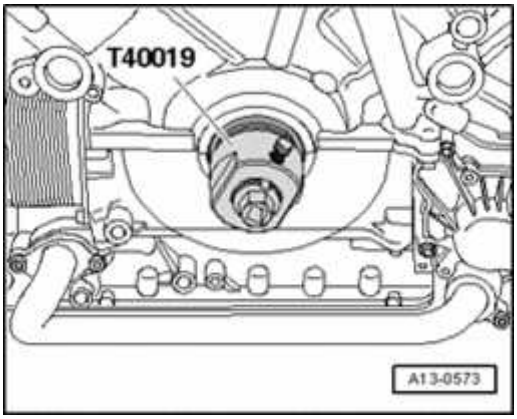


Fig. 263: Installing Oil Seal Extractor T40019
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Lubricate threaded head of Oil Seal Extractor T40019 , position and with forced pressure screw into oil seal as far as possible.
- Loosen knurled thumb screw and turn inner portion against crankshaft until seal is pulled out.
- Clamp seal extractor at mounting points in a vise.
- Remove seal using pliers.

Installing

- Clean operating and sealing surfaces.

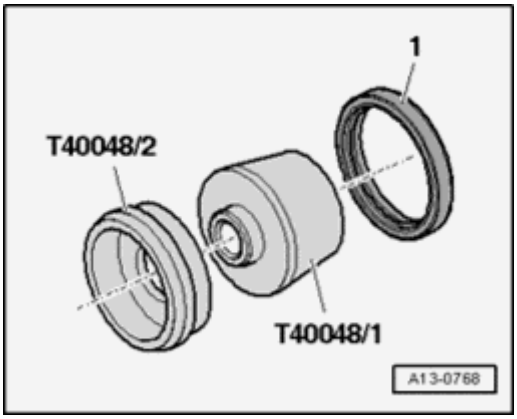


Fig. 264: Inserting Assembly Device T40048/1 Onto Pull Sleeve T40048/2 And Sliding Seal Onto Pull Sleeve
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Insert assembly device T40048/1 onto pull sleeve T40048/2 and slide seal - **1** - onto pull sleeve.
- Remove assembly device.

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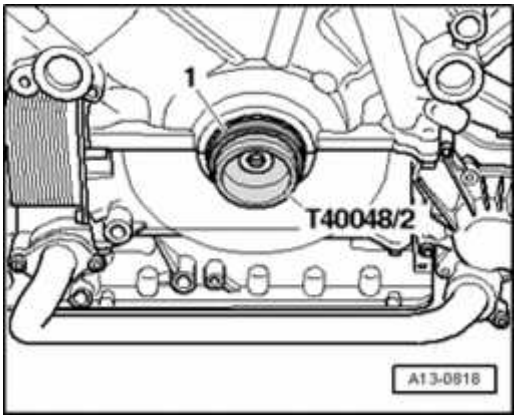


Fig. 265: Placing Pull Sleeve T40048/2 On Crankshaft And Sliding Seal Into Sealing Surface On Engine
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Place pull sleeve T40048/2 on crankshaft and slide seal - **1** - into sealing surface on engine.

NOTE:

- **Pull sleeve remains on crankshaft for pressing in.**

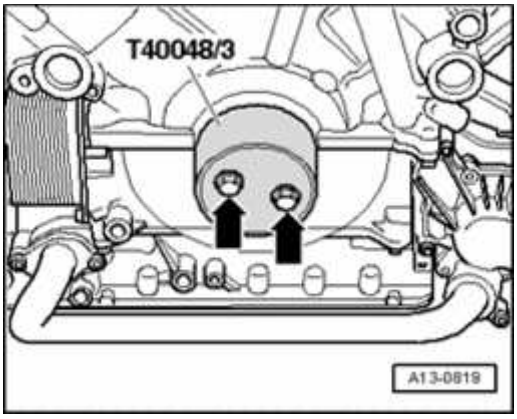


Fig. 266: Positioning Pressure Sleeve T40048/3 With Bolts On Crankshaft
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Position pressure sleeve T40048/3 with bolts M8x55 mm - **arrows** - on crankshaft.
- Then tighten bolts by hand.
- Tighten bolts each $^{1}/_{2}$ rotation by alternating sides to press in seal until it reaches stop.

The rest of installation is in reverse order of removal, note the following:

- Install vibration damper --> **Vibration damper, removing and installing**.
- Install lock carrier with attachments -->
  - **50 BODY, FRONT**
  - **50 - BODY - FRONT** for BODY EXTERIOR - CABRIOLET

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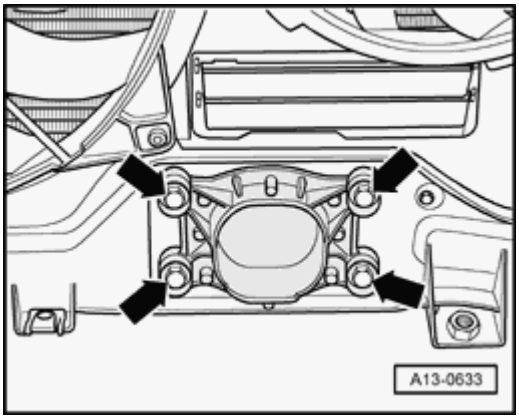


Fig. 267: Placing Torque Support On Rubber Buffer For Torque Support And Tightening Bolts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Place torque support on rubber buffer for torque support and tighten bolts - **arrows** -.
- Install front bumper cover -->
  - **63 BUMPER**
  - **63 - BUMPERS** for BODY EXTERIOR - CABRIOLET

  .
- Check headlight adjustment -->
  - **01 - MAINTENANCE**
  - **01 - MAINTENANCE** for MAINTENANCE PROCEDURES - CABRIOLET

  .

Torque specifications

Component	Nm
Torque support stop to lock carrier	28

TIMING CHAIN SIDE, SERVICING

Dual-mass flywheel, component overview

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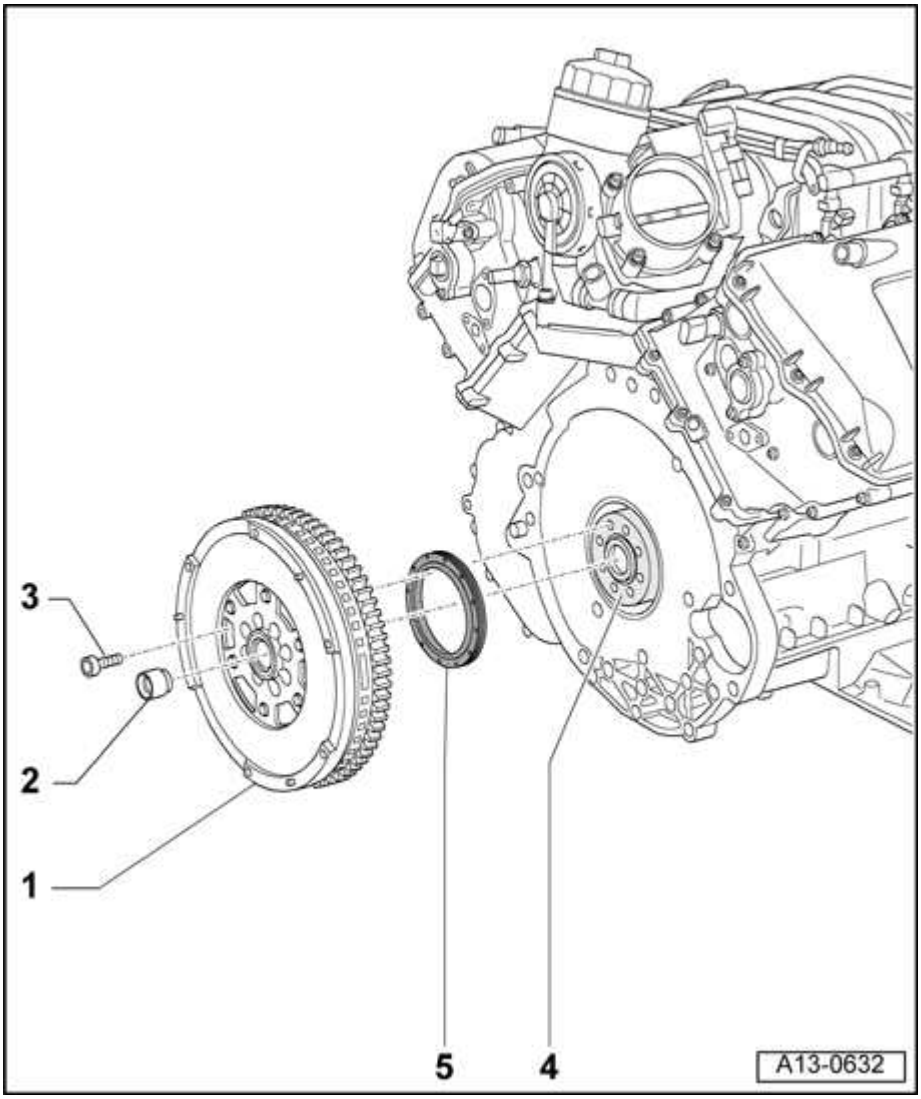


Fig. 268: Dual-Mass Flywheel, Component Overview
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Dual mass flywheel

- Removing and installing --> **Dual-mass flywheel, removing and installing**

2 - Needle bearing

- Pulling out and driving in --> **Dual-mass flywheel needle bearings, pulling out and driving in**

3 - Special bolt

- Replace
- Tightening torque **Torque specification**

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4 - Crankshaft

5 - Sealing ring for crankshaft -timing chain side-

- Replacing --> **Crankshaft seal (timing chain side), replacing**.

Dual-mass flywheel, removing and installing

Special tools, testers and auxiliary items required

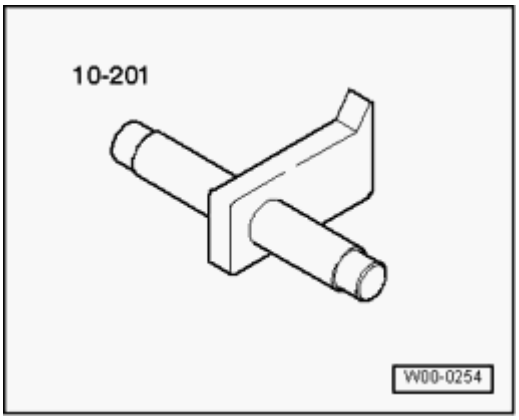


Fig. 269: Counter-Holder Tool 10-201
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Counter-holder tool 10-201

Removing

- Transmission removed.

- Remove clutch pressure plate --> **30 CLUTCH** .
- Mark dual mass flywheel to crankcase.

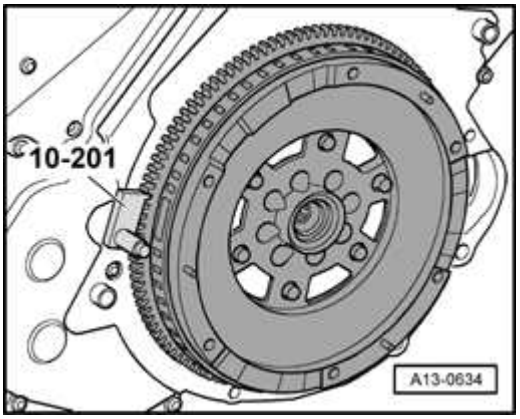


Fig. 270: Inserting Counter Hold Tool 10-201 To Loosen Bolts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

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- Insert counterhold tool 10-201 to loosen bolts.

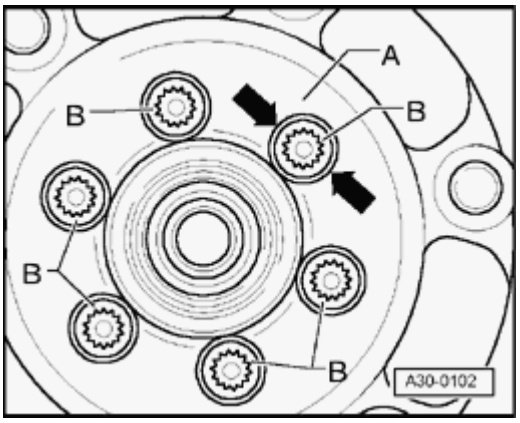


Fig. 271: Identifying Dual-Mass Flywheel & Bolts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

NOTE:

- **To prevent damage to dual-mass flywheel when removing, bolts - B - must not be removed using an air-powered or impact wrench. Only removing bolts by hand is permitted.**

- Rotate dual-mass flywheel - **A** - so that bolts stand centered to holes - **arrows** -.
- When removing bolts, make sure that no bolt head makes contact on dual-mass flywheel because it will otherwise be damaged when further installing the bolt.

Installing

Installation is in reverse order of removal, note the following:

NOTE:

- **Needle bearing is located in the flywheel and must be driven in when flywheel is replaced --> Dual-mass flywheel needle bearings, pulling out and driving in.**

- Use new bolts when securing.
- Turn over counterhold tool 10-201 to tighten bolts.
- Install clutch pressure plate --> **30 CLUTCH** .

Torque specification

Component	Nm
Dual-mass flywheel to crankshaft	
Bolt length 22.5 mm	60 plus an additional 90 ° * See note

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*Replace bolts.

Dual-mass flywheel needle bearings, pulling out and driving in

Special tools, testers and auxiliary items required

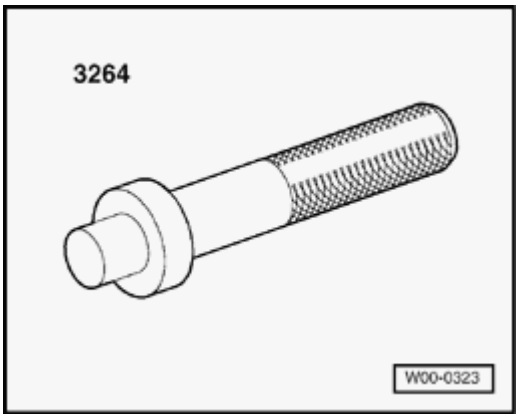


Fig. 272: Bearing Driver 3264
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Bearing driver 3264

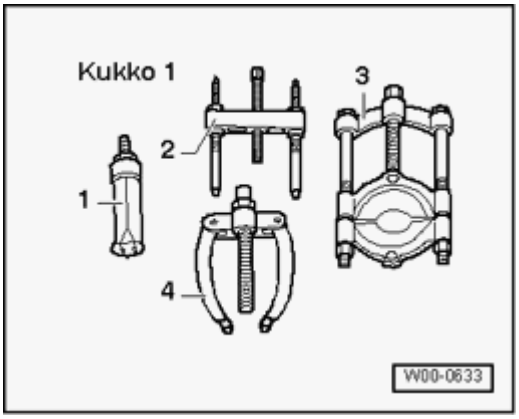


Fig. 273: Kukko 21/2 Internal puller, Kukko 21/4 Internal puller, Kukko 22/2 Counter support
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- 1 - Internal puller Kukko 21/1
- 4 - Counter-support Kukko 22/1

Work procedure

- Transmission removed.

  - Remove clutch pressure plate --> **30 CLUTCH** .

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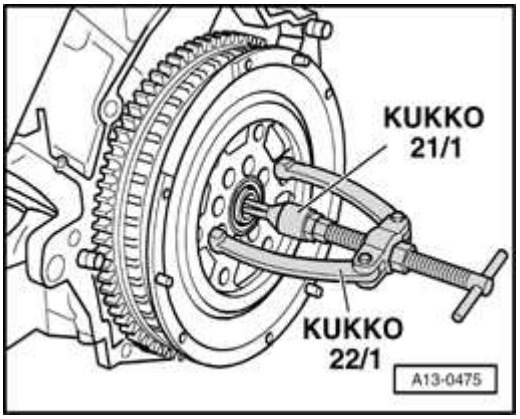


Fig. 274: Pulling Out Needle Bearing Using Internal Puller Kukko 21/1 And Support Kukko 22/1
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Pull out needle bearing using internal puller Kukko 21/1 and support Kukko 22/1.

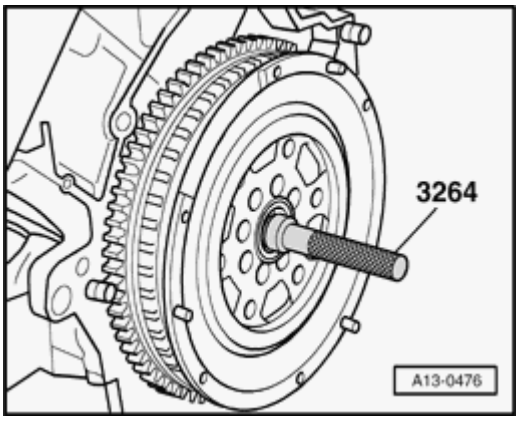


Fig. 275: Driving In Needle Bearing Using Bearing Driver 3264 Into Dual-Mass Flywheel Until It Reaches Stop
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Drive in needle bearing using bearing driver 3264 into dual-mass flywheel until it reaches stop.
- Install clutch pressure plate --> **30 CLUTCH** .

Drive plate, component overview

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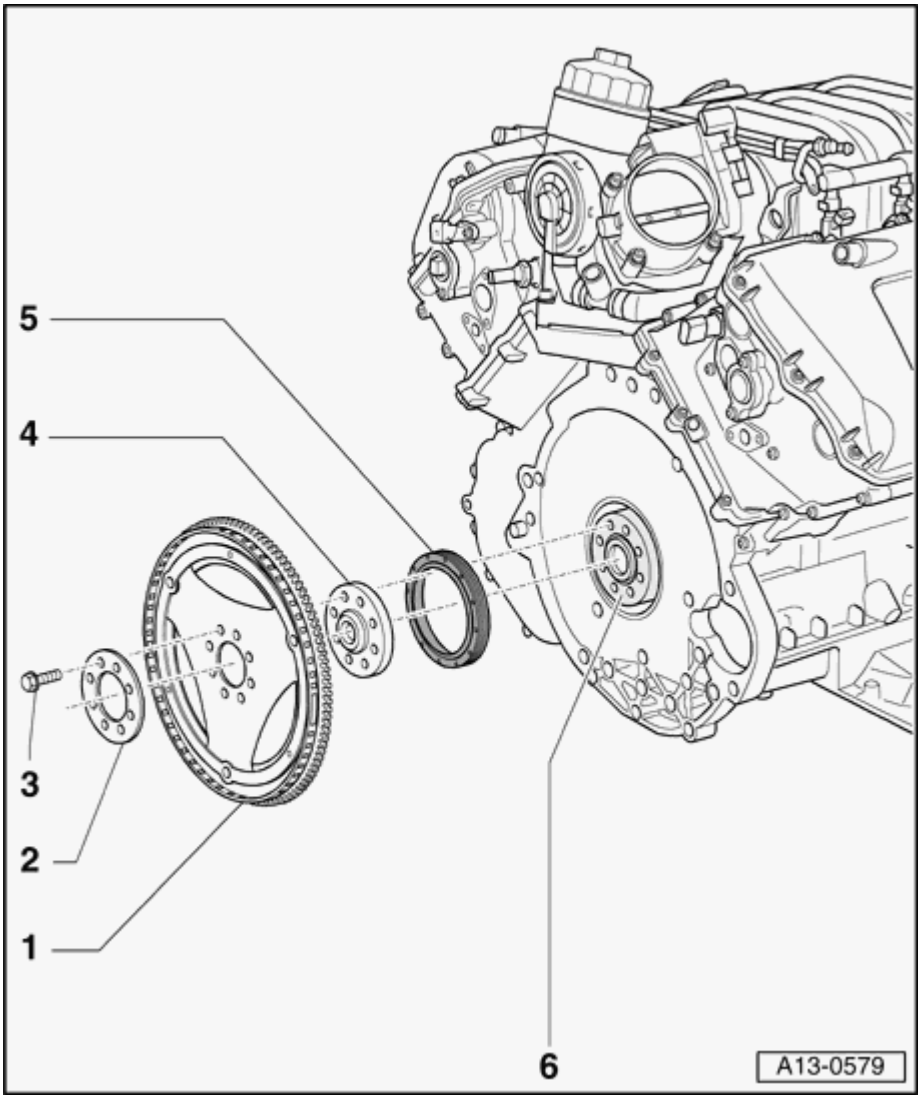


Fig. 276: Drive Plate, Component Overview
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Drive plate

- Removing and installing --> **Drive plate, removing and installing**

2 - Washer

- Mark for re-installation

3 - Special bolt

- Replace
- Tightening torque **Torque specification**

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4 - Shim

- Mark for re-installation

5 - Sealing ring for crankshaft - timing chain side

- Removing and installing --> **Crankshaft seal (timing chain side), replacing**

6 - Crankshaft

Drive plate, removing and installing

Special tools, testers and auxiliary items required

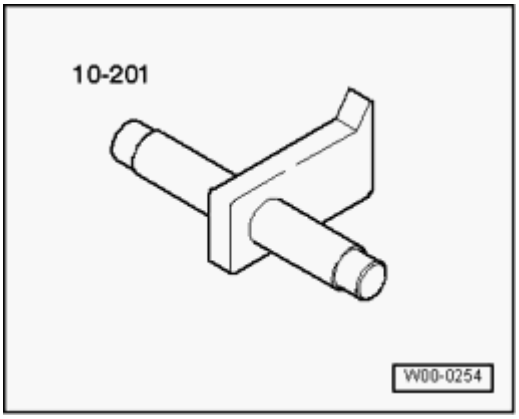


Fig. 277: Counter-Holder Tool 10-201
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Counter-holder tool 10-201

Removing

- Transmission removed.
  - Mark drive plate and washer to crankshaft.

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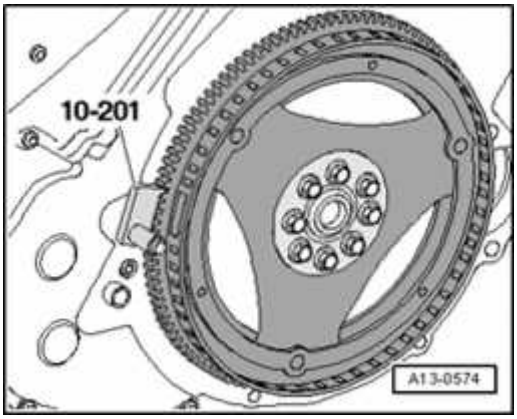


Fig. 278: Inserting Counter Hold Tool 10-201 To Loosen Bolts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Insert counterhold tool 10-201 to loosen bolts.
- Remove drive plate.

Installing

Installation is in reverse order of removal, note the following:

- Install drive plate with washer.
- Use new bolts when securing.
- Turn over counterhold tool 10-201 to tighten bolts.

Torque specification

Component	Nm
Drive plate to crankshaft	30 plus an additional 90 ° * See note

* 90 ° corresponds to one quarter rotation.

*Replace bolts.

Crankshaft seal (timing chain side), replacing

Special tools, testers and auxiliary items required

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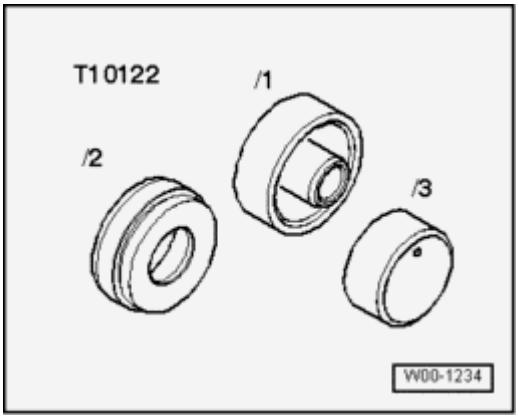


Fig. 279: Identifying Pulling Fixture T10122
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Assembly Tool T10122

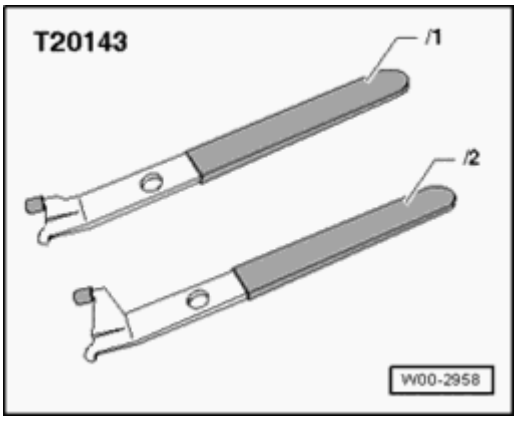


Fig. 280: Identifying Extractor Hook T20143
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Pulling Hook T20143

Work procedure

- Transmission removed.

  - Remove dual-mass flywheel --> **Dual-mass flywheel, removing and installing** , drive plate --> **Drive plate, removing and installing**.

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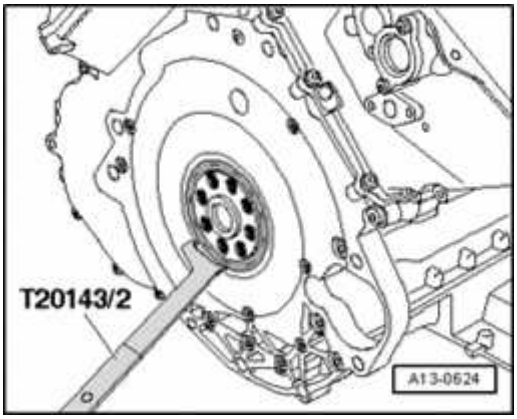


Fig. 281: Prying Out Sealing Ring Using Pulling Hook T20143/2
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Pry out sealing ring using Pulling Hook T20143/2.
- Clean operating and sealing surfaces.

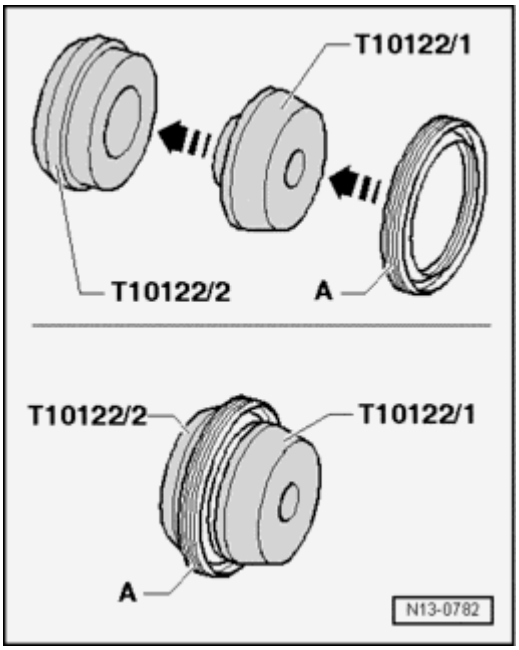


Fig. 282: Identifying Seal, Sleeve T10122/1 And Assembly Tool T10122/2
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Insert assembly device T10122/1 onto pull sleeve T10122/2 and slide seal - **A** - onto pull sleeve.
- Remove assembly device.

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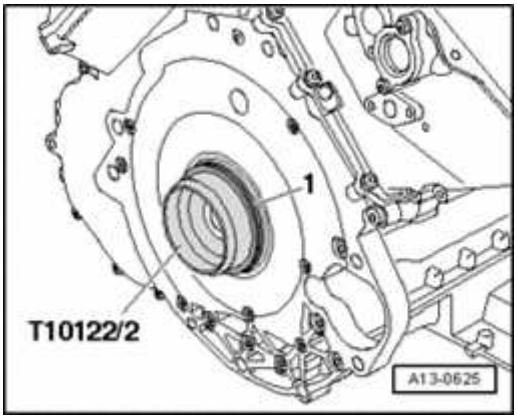


Fig. 283: Installing Pull Sleeve T10122/2 With Sealing Ring Onto Crankshaft
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Install pull sleeve T10122/2 with sealing ring - **1** - onto crankshaft.

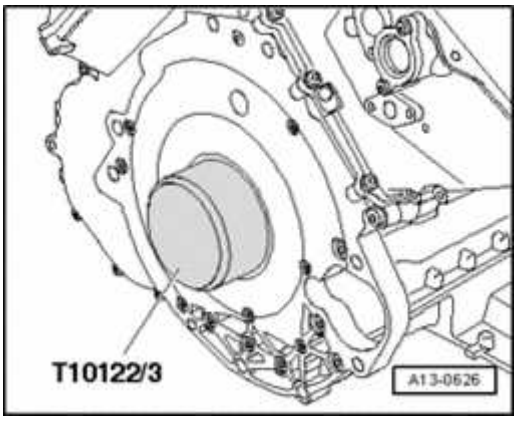


Fig. 284: Pressing In Seal Evenly All Around Until It Reaches Stop Using T10122/3
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Press in seal evenly all around until it reaches stop using T10122/3.

The rest of installation is in reverse order of removal, note the following:

- Install dual-mass flywheel --> **Dual-mass flywheel, removing and installing** , drive plate --> **Drive plate, removing and installing**.

Timing chains covers, component overview

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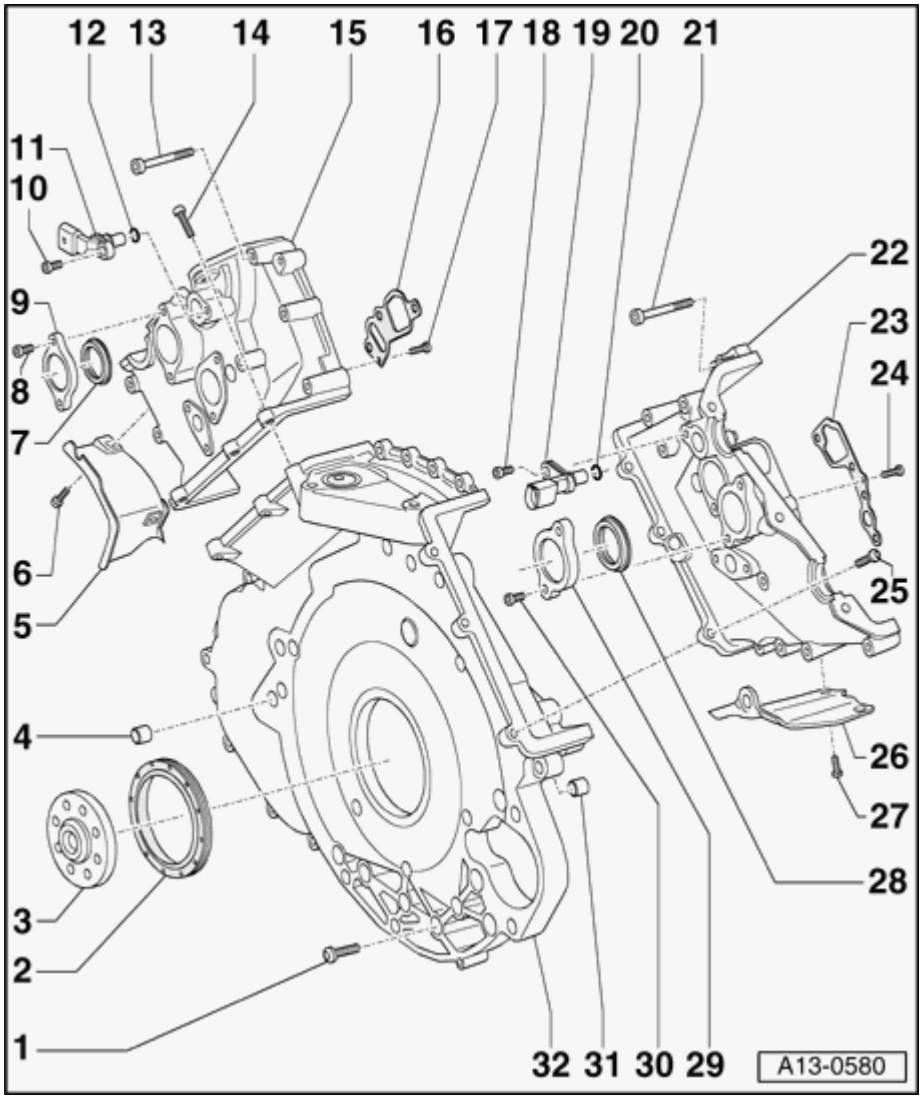


Fig. 285: Timing Chains Covers, Component Overview
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - M6 - 10 Nm; M8 - 22 Nm

- Note tightening sequence *Position lower cover for timing chain and tighten bolts as follows.* under **Installing**

2 - Seal

- for crankshaft - timing chain side
- Removing and installing --> **Crankshaft seal (timing chain side), replacing**

3 - Shim

- For vehicles with automatic transmission

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- Mark for re-installation

4 - Alignment bushing

- 2 pieces

5 - Heat shield

6 - 10 Nm

7 - Seal

- Replace

8 - 10 Nm

9 - Sealing flange

10 - 10 Nm

11 - Camshaft position (CMP) sensor 2 G163

12 - O-ring

- Replace

13 - 10 Nm

- Note tightening sequence *Position left cover for timing chain and tighten bolts as follows.* under **Installing**

14 - 10 Nm

- Note tightening sequence *Position left cover for timing chain and tighten bolts as follows.* under **Installing**

15 - Left timing chain cover

16 - Gasket

- Replace

17 - 4 Nm

- Insert using locking compound; locking compound .

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18 - 10 Nm

19 - Camshaft Position (CMP) sensor G40

20 - O-ring

- Replace

21 - 10 Nm

- Note tightening sequence *Position right cover for timing chain and tighten bolts as follows.* under **Installing**

22 - Right timing chain cover

23 - Gasket

- Replace

24 - 4 Nm

- Insert using locking compound; locking compound .

25 - 10 Nm

- Note tightening sequence *Position right cover for timing chain and tighten bolts as follows.* under **Installing**

26 - Heat shield

27 - 10 Nm

28 - Seal

- Replace

29 - Sealing flange

30 - 10 Nm

31 - Alignment bushing

- 2 pieces

32 - Lower timing chain cover

Timing chain covers (All), removing and installing

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Special tools, testers and auxiliary items required

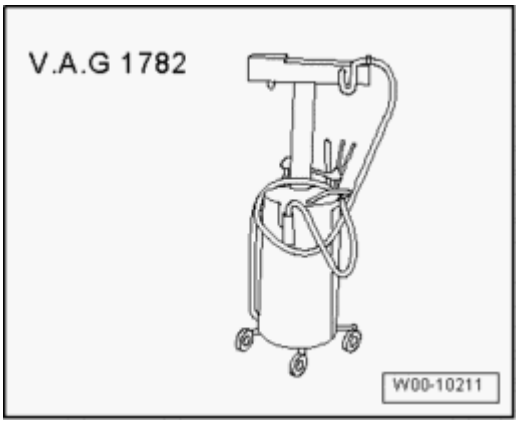


Fig. 286: Identifying Old Oil Collecting And Extracting Device V.A.G 1782
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Old oil collecting and extracting device V.A.G 1782
- Hand drill with plastic brush attachment
- Protective glasses
- Sealant

Removing

NOTE:

- **All cable ties opened or cut during engine removal must be reinstalled at the same locations during installation.**

- Place old oil collecting and extracting device V.A.G 1782 under engine and drain engine oil.
- Remove engine: --> **Engine (vehicles with manual transmission)** , --> **Engine (vehicles with automatic transmission), removing**.
- Disconnect engine and transmission: --> **Engine (vehicles with manual transmission), separating** , --> **Engine and transmission (vehicles with automatic transmission), separating**.
- Leave engine on Scissor Lift Table VAS 6131 A or secure engine to engine and transmission holder: --> **Engine (vehicles with manual transmission), securing to engine and transmission holder** , --> **Engine (vehicles with automatic transmission), securing to assembly stand**.
- Remove dual-mass flywheel --> **Dual-mass flywheel, removing and installing** , drive plate --> **Drive plate, removing and installing**.

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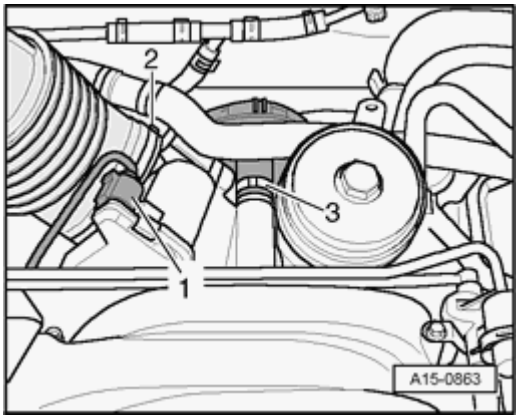


Fig. 287: Disconnecting Electrical Connection At Throttle Valve Control Module J338 & Crankcase Ventilation Hose At Intake Pipe
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical connection - **1** - at throttle valve control module J338.
- Disconnect crankcase ventilation hose - **3** - at intake pipe.

NOTE:

- **Ignore - 2 -.**

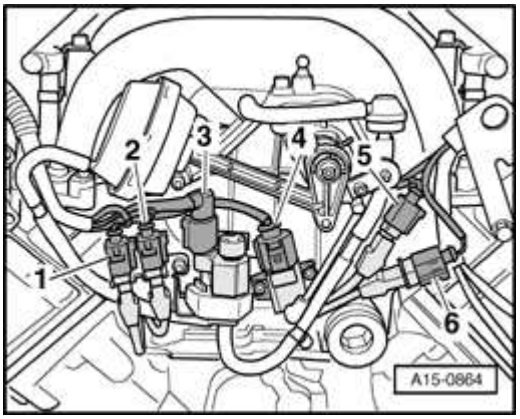


Fig. 288: Remove Electrical Harness Connectors Toward Front From Brackets On Intake Line
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove electrical harness connectors - **1** - , - **2** - , - **5** - and - **6** - toward front from brackets on intake line.
- Separate the electrical connectors - **3** - and - **4** -.

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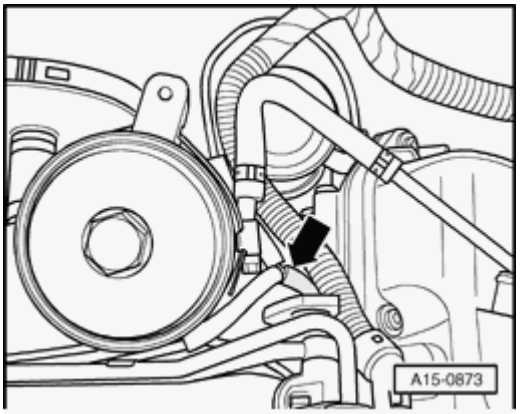


Fig. 289: Disconnecting Vacuum Hose At T-Piece
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect vacuum hose - **arrow** - at T-piece.

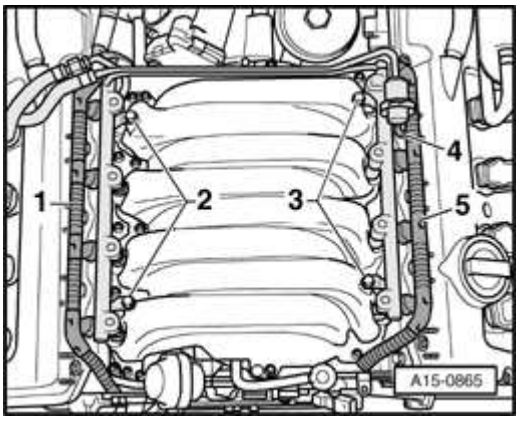


Fig. 290: Identifying Connector Strips At Fuel Injectors, Vacuum Line On Fuel Pressure Regulator & Retaining Bolts For Fuel Rail Line
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect connector strips - **1** - and - **5** - at fuel injectors.
- For vehicles with fuel return line, disconnect vacuum line - **4** - on fuel pressure regulator.
- Remove retaining bolts - **2** - and - **3** - for fuel rail line.
- Remove fuel rail line together with fuel injectors from intake manifold uniformly upward.

NOTE:

- **Carefully protect the removed fuel injectors from contamination.**

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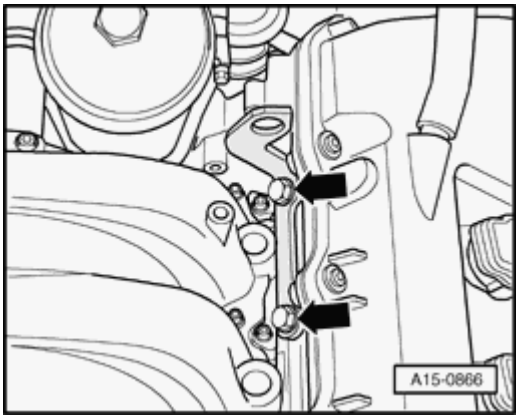


Fig. 291: Removing Left/Rear Engine Lifting Eye
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove left rear engine lifting eye - **arrows** -.

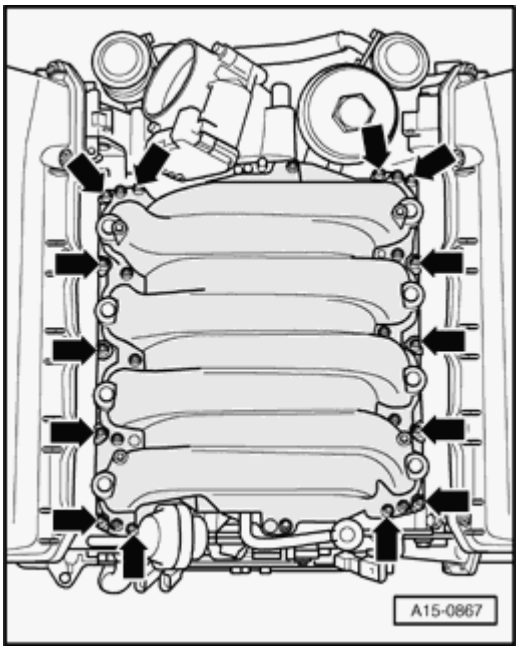


Fig. 292: Removing Intake Manifold Bolts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove intake manifold bolts - **arrows** - and remove it.

NOTE:

- **Plug the intake ports of the cylinder head with clean rags.**

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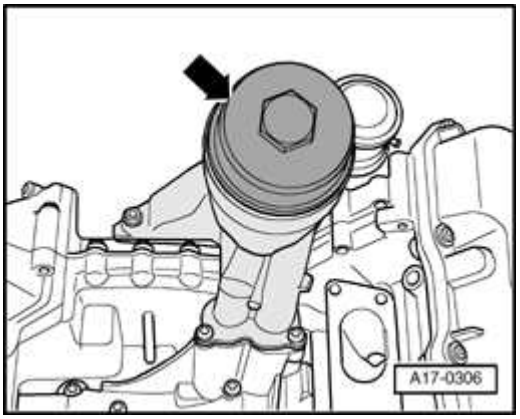


Fig. 293: Removing Cap For Oil Filter Housing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove cap - **arrow** - for oil filter housing.
- Remove oil filter element.
- Extract engine oil using old oil collecting and extracting device V.A.G 1782 from oil filter housing.

NOTE:

- **Place a rag around oil filter housing to catch escaping engine oil.**

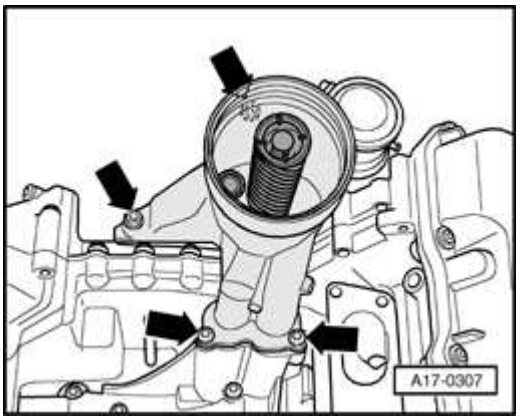


Fig. 294: Removing Bolts & Oil Filter Housing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts - **arrows** -.
- Remove oil filter housing.

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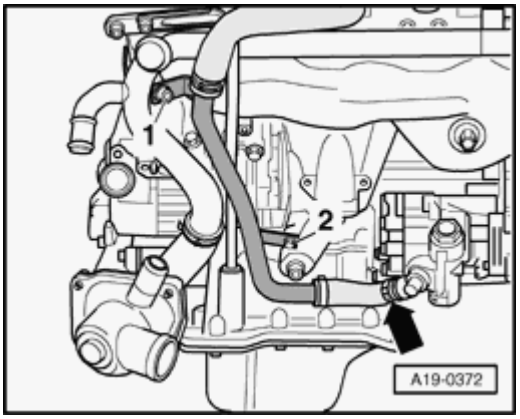


Fig. 295: Removing Bolts & Return Line From Power-Steering Pump
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts - **1** - and - **2** -.
- Place old oil collecting and extracting device V.A.G 1782 underneath.
- Remove return line from power-steering pump - **arrow** -.

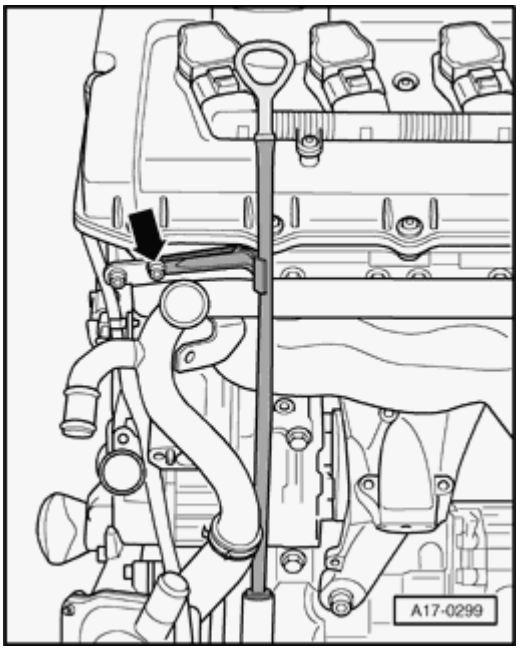


Fig. 296: Removing Bolt From Oil Dipstick Guide Tube At Cylinder Head
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolt - **arrow** - from oil dipstick guide tube at cylinder head, pull up and remove guide tube.

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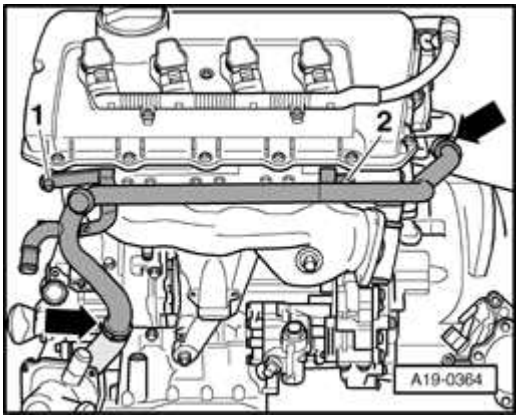


Fig. 297: Removing Bolts, Loosening Hose Clamps And Removing Left Coolant Pipe From Coolant Hoses
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts - **1** - and - **2** -.
- Loosen hose clamps - **arrows** - and remove left coolant pipe from coolant hoses.

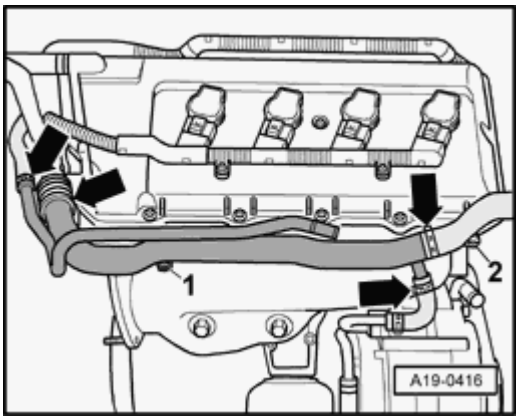


Fig. 298: Removing Bolts, Loosening Hose Clamps And Removing Right Coolant Pipe From Coolant Hoses
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts - **1** - and - **2** -.
- Loosen hose clamps - **arrows** - and remove right coolant pipe from coolant hoses.

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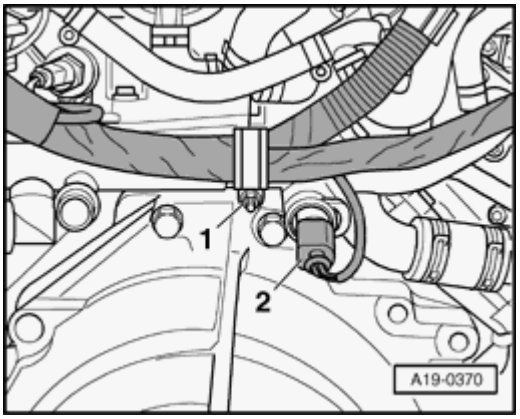


Fig. 299: Disconnecting Electrical Harness Connector On Engine Coolant Temperature (ECT) Gauge Sensor G2/G62
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical harness connector - **2** - on Engine Coolant Temperature (ECT) Gauge Sensor G2/G62.
- Remove nut - **1** - and remove electrical wiring harness at rear of coolant pipe.

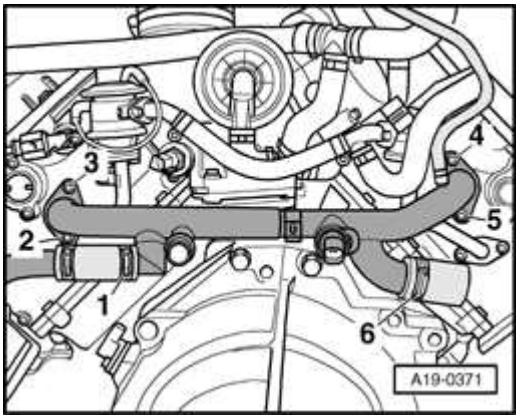


Fig. 300: Removing Bolts & Rear Coolant Pipe
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts - **2 to 5** -.
- Remove rear coolant pipe.

NOTE:

- **Ignore - 1 - and - 6 -.**

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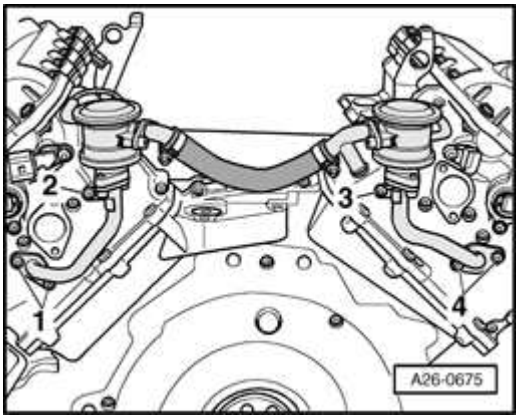


Fig. 301: Removing Mounting Bolts Of Combination Valves For Secondary Air Injection (AIR) System
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove mounting bolts - **1 to 4** - of combination valves for Secondary Air Injection (AIR) system.

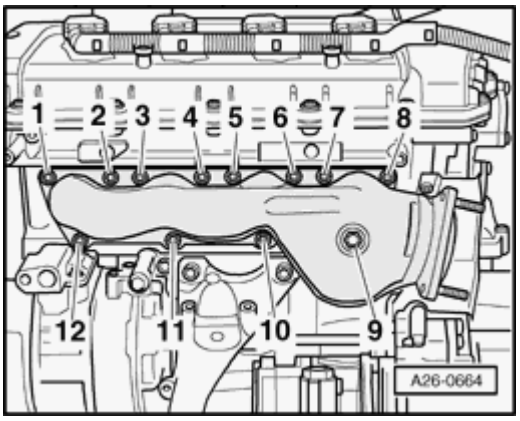


Fig. 302: Removing Nuts And Left Exhaust Manifold
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove nuts - **1 to 12** - and remove left exhaust manifold.

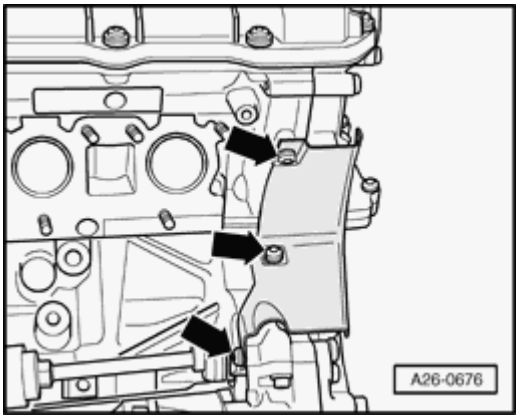


Fig. 303: Removing Left Heat Shield
Courtesy of VOLKSWAGEN UNITED STATES, INC.

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- Remove left heat shield - **arrows** -.

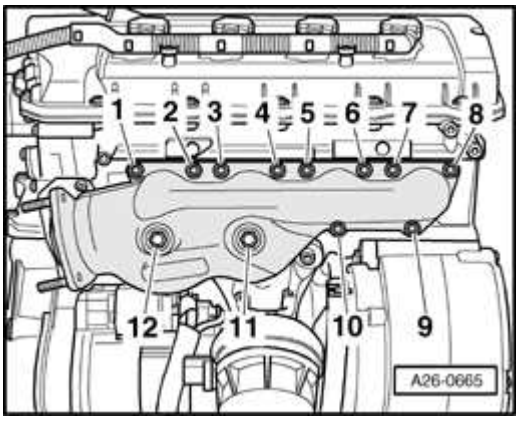


Fig. 304: Removing Nuts And Right Exhaust Manifold
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove nuts - **1 to 12** - and remove right exhaust manifold.

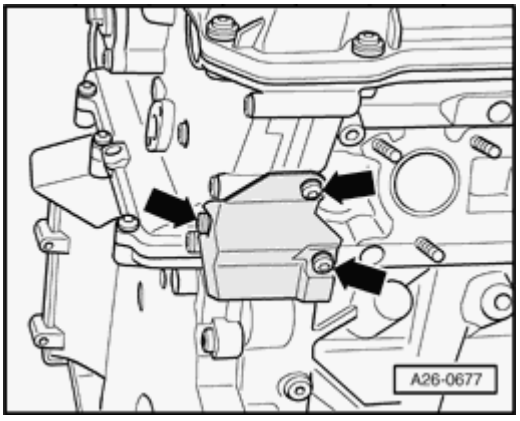
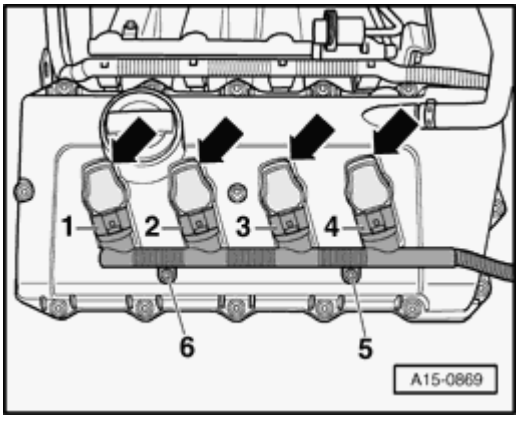


Fig. 305: Removing Right Heat Shield
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove right heat shield - **arrows** -.



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Fig. 306: Removing Bolts On Left Cylinder Head, Disconnecting Electrical Harness Connectors & Removing Ignition Coils
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts - **5** - and - **6** - on left cylinder head.
- Disconnect electrical harness connectors - **1 to 4** -.
- Remove ignition coils - **arrows** -.

NOTE:

- **Extractor T40039 can be used for removal.**

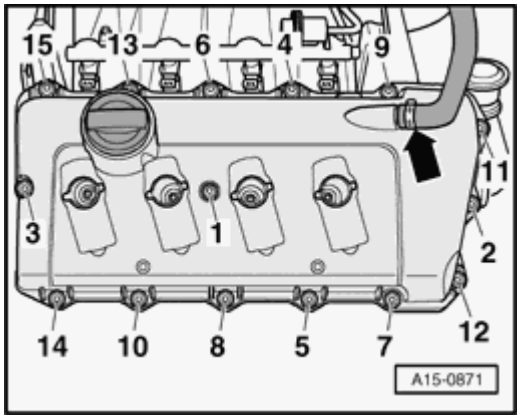


Fig. 307: Disconnecting Hose Of Crankshaft Housing Ventilation & Removing Left Cylinder Head Cover Bolts In Sequence
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect hose of crankshaft housing ventilation - **arrow** -.
- Remove left cylinder head cover bolts in sequence - **15 to 1** -.
- Remove cylinder head cover.

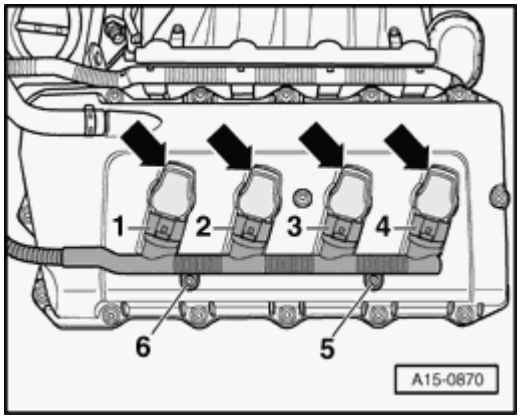


Fig. 308: Removing Bolts On Right Cylinder Head, Disconnecting Electrical Harness Connectors & Removing Ignition Coils
Courtesy of VOLKSWAGEN UNITED STATES, INC.

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- Remove bolts - **5** - and - **6** - on right cylinder head.
- Disconnect electrical harness connectors - **1 to 4** -.
- Remove ignition coils - **arrows** -.

NOTE:

- **Extractor T40039 can be used for removal.**

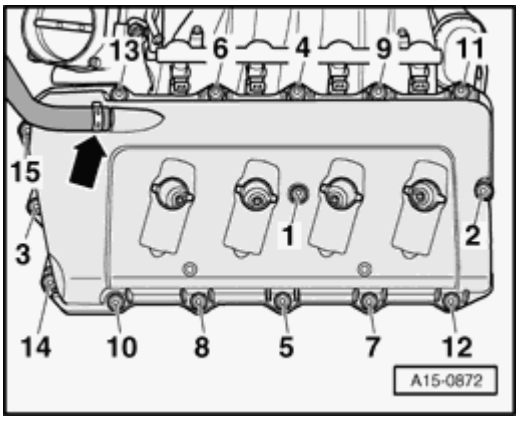


Fig. 309: Disconnecting Hose Of Crankshaft Housing Ventilation & Removing Right Cylinder Head Cover Screws In Sequence
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect hose of crankshaft housing ventilation - **arrow** -.
- Remove right cylinder head cover screws in sequence - **15 to 1** -.
- Remove cylinder head cover.

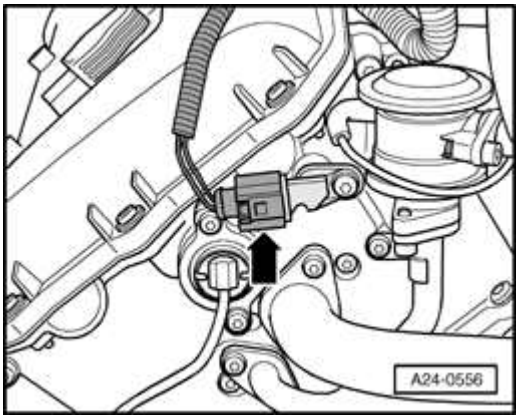


Fig. 310: Disconnecting Electrical Harness Connector For Camshaft Position (CMP) Sensor 2 G163 On Left Cylinder Head
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical harness connector - **arrow** - for Camshaft Position (CMP) Sensor 2 G163 on left cylinder head.
- Disconnect electrical harness connector - **arrow** - for Camshaft Position (CMP) Sensor G40 on right

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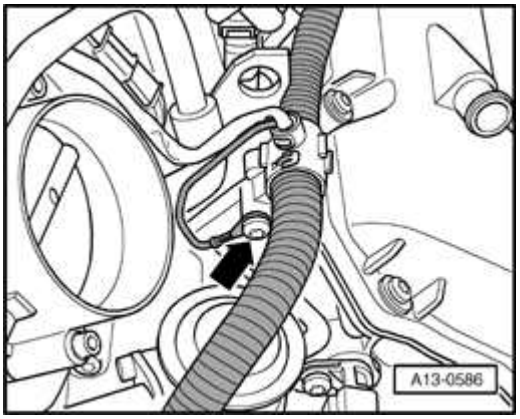


Fig. 311: Removing Ground (GND) Cable On Right Cylinder Head
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove Ground (GND) cable on right cylinder head - **arrow** -.
- Set wiring harness aside.

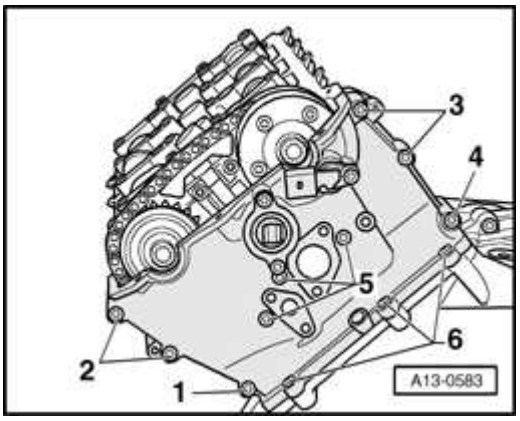


Fig. 312: Removing/Installing Bolts And Left Timing Chain Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts - **1 to 6** - and remove left timing chain cover.

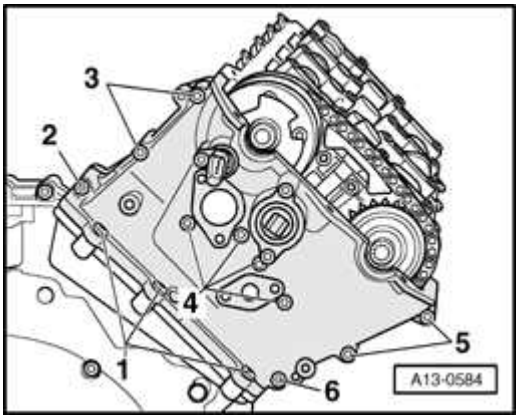


Fig. 313: Removing Bolts And Right Timing Chain Cover

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Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts - **1 to 6** - and remove right timing chain cover.

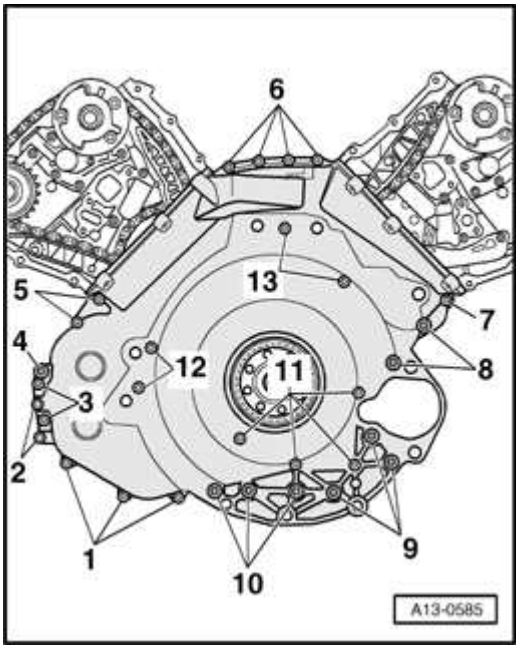


Fig. 314: Removing Bolts And Lower Timing Chain Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts - **1 to 13** - and remove lower timing chain cover.

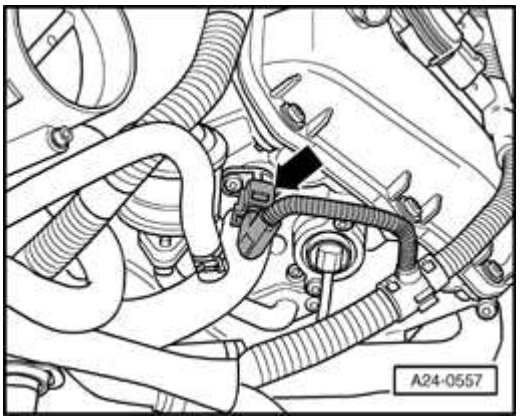


Fig. 315: Pressing Sealing Ring For Crankshaft At Rear Out Of Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Press sealing ring for crankshaft at rear out of cover.

Installing

NOTE:

- **Replace gaskets, seals and O-rings.**

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- **During installation, all cable ties must be re-installed at the same location.**

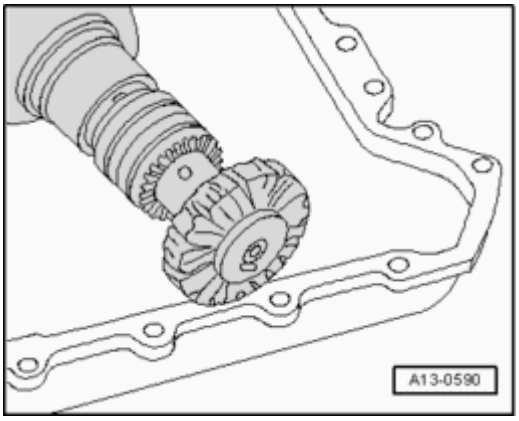


Fig. 316: Using Rotating Plastic Brush To Remove Any Sealant Residue From Sealing Flange, Cylinder Block And Upper Part Of Oil Pan
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Using e.g. a rotating plastic brush, remove sealant residue on covers for timing chain and on cylinder block and head.

CAUTION: Wear safety glasses.

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

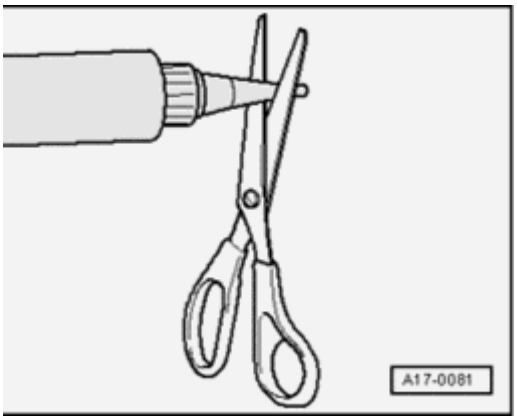


Fig. 317: Cutting Tube Nozzle At Front Marking
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Cut off nozzle on the tube of sealant at front mark (dia. of nozzle approx. 1 mm).

NOTE:

- **Covers for timing chain must be installed within 5 minutes after applying sealant.**

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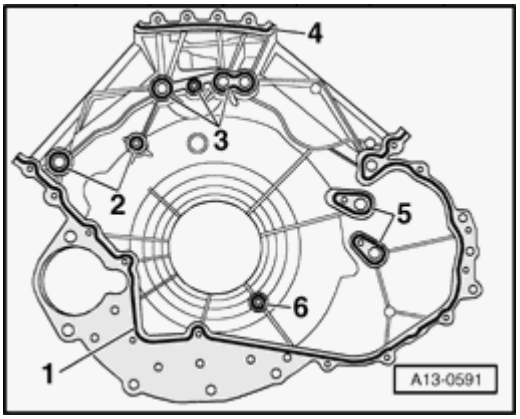


Fig. 318: Applying Sealant Beads On Clean Sealing Surfaces Of Lower Cover For Timing Chain
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Apply sealant beads - **1 to 6** - , as shown in illustration, on clean sealing surfaces of lower cover for timing chain.

- Thickness of sealant bead: 1.5 to 2.0 mm.

- Check whether 2 alignment bushings are present in cylinder block, install if necessary.

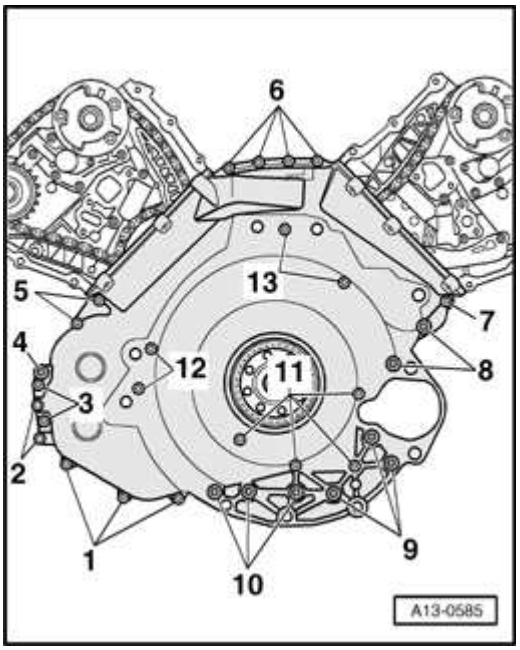


Fig. 319: Removing Bolts And Lower Timing Chain Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Position lower cover for timing chain and tighten bolts as follows.

1. Tighten bolts 11 , 12 , 13 to 10 Nm
2. Tighten bolts 1 , 3 , 4 , 5 , 6 , 7 , 8 , 9 , 10 to 10 Nm

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3. Tighten bolts 4 , 8 , 9 , 10 to 22 Nm
4. Tighten bolts 2 for power-steering pump to 22 Nm

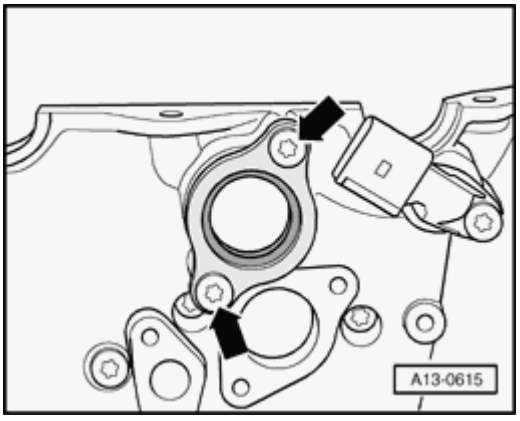


Fig. 320: Removing/Installing Sealing Flanges For Camshaft Adjuster On Left/Right Covers For Timing Chain
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove sealing flanges for camshaft adjuster on left and right covers for timing chain - **arrows** -.

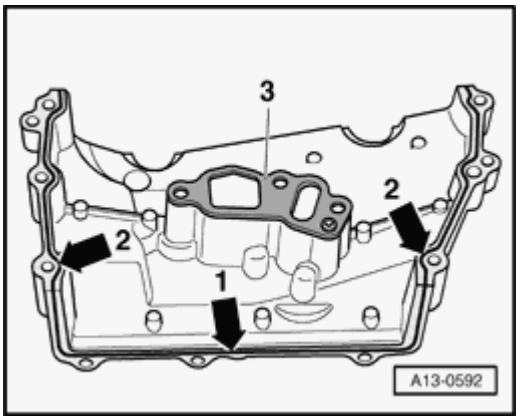


Fig. 321: Applying Sealant Bead On Clean Sealing Surfaces Of Left Cover For Timing Chain
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Apply sealant bead - **arrow** - , as shown in illustration, on clean sealing surfaces of left cover for timing chain.

- Groove on lower sealing surface - **arrow 1** - must be completely filled with sealant. Sealant bead must stand 1.5 to 2.0 mm above sealing surface.
- Sealant bead on front sealing surface - **arrows 2** - must be 1.5 to 2.0 mm thick.

- Install new seal - **3** - on left cover for timing chain.

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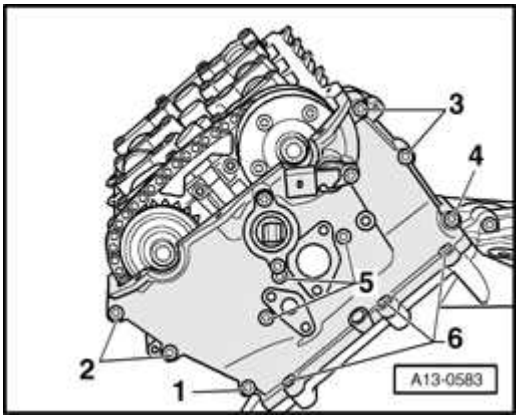


Fig. 322: Removing/Installing Bolts And Left Timing Chain Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Position left cover for timing chain and tighten bolts as follows.

1. Tighten bolts to 1 to 4 to 5 Nm
2. Tighten bolts to 6 to 10 Nm
3. Tighten bolts to 5 to 10 Nm
4. Tighten bolts to 1 to 4 to 10 Nm

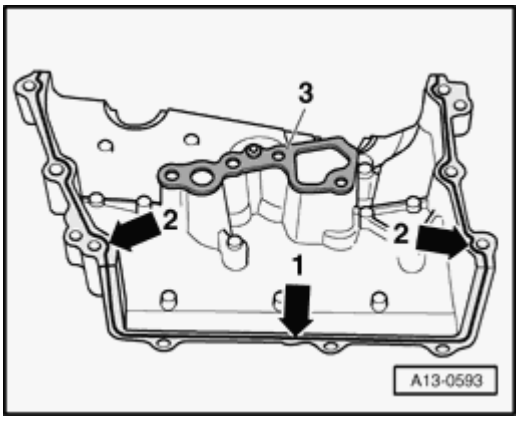


Fig. 323: Applying Sealant Beads On Clean Sealing Surfaces Of Right Cover For Timing Chain
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Apply sealant beads - **arrow** - , as shown in illustration, on clean sealing surfaces of right cover for timing chain.

- Groove on lower sealing surface - **arrow 1** - must be completely filled with sealant. Sealant bead must stand 1.5 to 2.0 mm above sealing surface.
- Sealant bead on front sealing surface - **arrows 2** - must be 1.5 to 2.0 mm thick.

- Install new seal - **3** - on right cover for timing chain.

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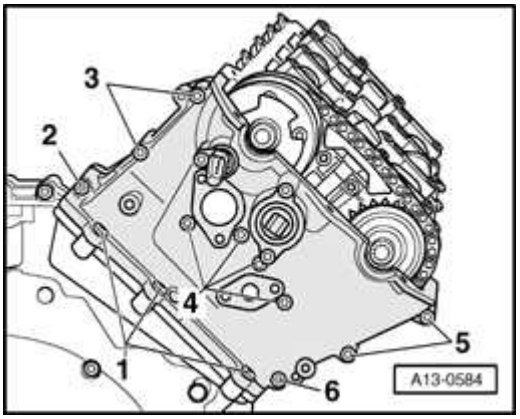


Fig. 324: Removing/Installing Bolts And Right Timing Chain Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Position right cover for timing chain and tighten bolts as follows.

1. Tighten bolts 2 , 3 , 5 , 6 to 5 Nm
2. Tighten bolts to 1 to 10 Nm
3. Tighten bolts to 4 to 10 Nm
4. Tighten bolts 2 , 3 , 5 , 6 to 10 Nm

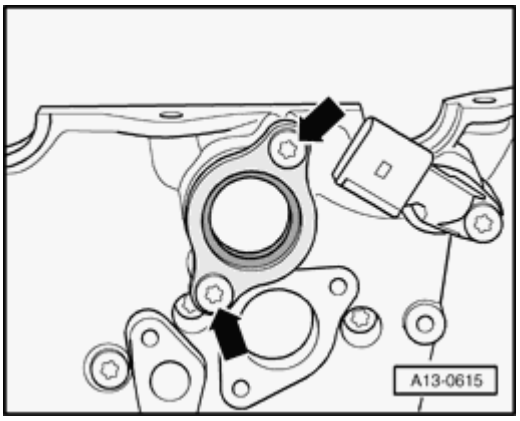


Fig. 325: Removing/Installing Sealing Flanges For Camshaft Adjuster On Left/Right Covers For Timing Chain
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Install sealing flanges for camshaft adjuster with new sealing rings on left and right covers for timing chain - **arrows** -.

The rest of installation is in reverse order of removal, note the following:

- Install crankshaft seal, timing chain side --> **Crankshaft seal (timing chain side), replacing**.
- Install cylinder head cover: --> **Left cylinder head cover, removing and installing** , --> **Right cylinder head cover, removing and installing**.

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- Install exhaust manifold: --> **Left exhaust manifold, removing and installing** , --> **Right exhaust manifold, removing and installing**.
- Install combination valve for Secondary Air Injection (AIR) system: --> **Left combination valve for Secondary Air Injection, removing and installing** , --> **Right combination valve for Secondary Air Injection, removing and installing**.
- Install rear coolant pipe --> **Rear coolant pipe, removing and installing**.
- Install left and right coolant pipe --> **Right coolant pipe, removing and installing** and --> **Left coolant pipe, removing and installing**.
- Install oil filter housing --> **Oil filter housing, removing and installing**.
- Install intake manifold --> **Intake manifold, removing and installing**.
- Install dual-mass flywheel --> **Dual-mass flywheel, removing and installing** , --> **Drive plate, removing and installing**.
- Install engine: --> **Engine (vehicles with manual transmission), installing** , --> **Engine (vehicles with automatic transmission), installing**.
- Add engine oil and check oil level --> **Oil level, checking**.

Torque specifications

Component			Nm
Lower cover	Power-steering pump		22
For timing chain	Engine	M6	10
to		M8	22
Seal on cover for timing chain			4 * See note
Left and right cover for timing chain on engine			10
Sealing flange on cover for timing chain			10
Hall sensor on cover for timing chain			10
Ground (GND) wire to cylinder head			10
Heat shield to engine			10
Oil drain plug			50

* Insert using locking compound; locking compound .

Camshaft timing chain, component overview

Left camshaft timing chain

NOTE:

- **Before removing timing chain, mark direction of travel with paint. Reversing the rotation direction of a used chain can destroy it.**

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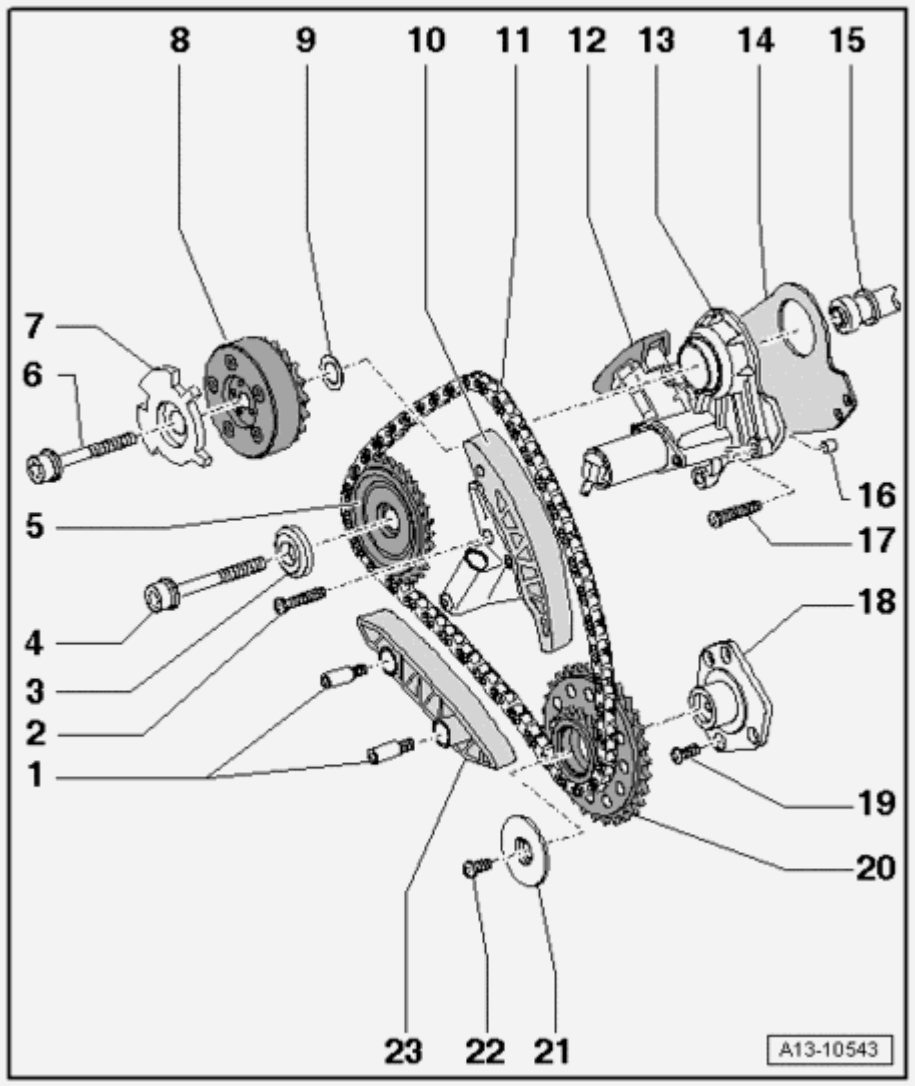


Fig. 326: Camshaft Timing Chain, Component Overview (Left Camshaft Timing Chain)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Pivot pin -10 Nm

2 - 5 Nm plus an additional $^{1}/_{4}$ turn (90 °)

- Replace

3 - Washer

- Note installation position

4 - Camshaft bolt

- Replace

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- Initial tightening torque: 40 Nm
- Final tightening torque: 100 Nm plus an additional $^{1}/_{4}$ turn (90 °)

5 - Chain sprocket

- For exhaust camshaft

6 - Camshaft bolt

- Replace
- Initial tightening torque: 40 Nm
- Final tightening torque: 100 Nm plus an additional $^{1}/_{4}$ turn (90 °)

7 - Hall sensor wheel

- When installing timing chain, adjust using setting gauge T40047

8 - Camshaft adjuster

- For intake camshaft

9 - Diamond disc

- Replace

10 - Chain tensioner

- For left timing chain

11 - Left camshaft timing chain

- Removing and installing --> **Camshaft timing chain, removing and installing**

12 - Guide rail

- Can be replaced separately

13 - Control housing

- For camshaft adjuster

14 - Gasket

- Replace

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15 - Camshaft

16 - Alignment bushing

- 2 pieces

17 - 5 Nm plus an additional $^{1}/_{4}$ turn (90 °)

- Replace

18 - Bracket

- For drive sprocket

19 - 10 Nm

20 - Drive sprocket

- For left timing chain

21 - Thrust washer

- For drive sprocket

22 - 5 Nm plus an additional $^{1}/_{4}$ turn (90 °)

- Replace

23 - Guide rail

Right camshaft timing chain

NOTE:

- **Before removing timing chain, mark direction of travel with paint. Reversing the rotation direction of a used chain can destroy it.**

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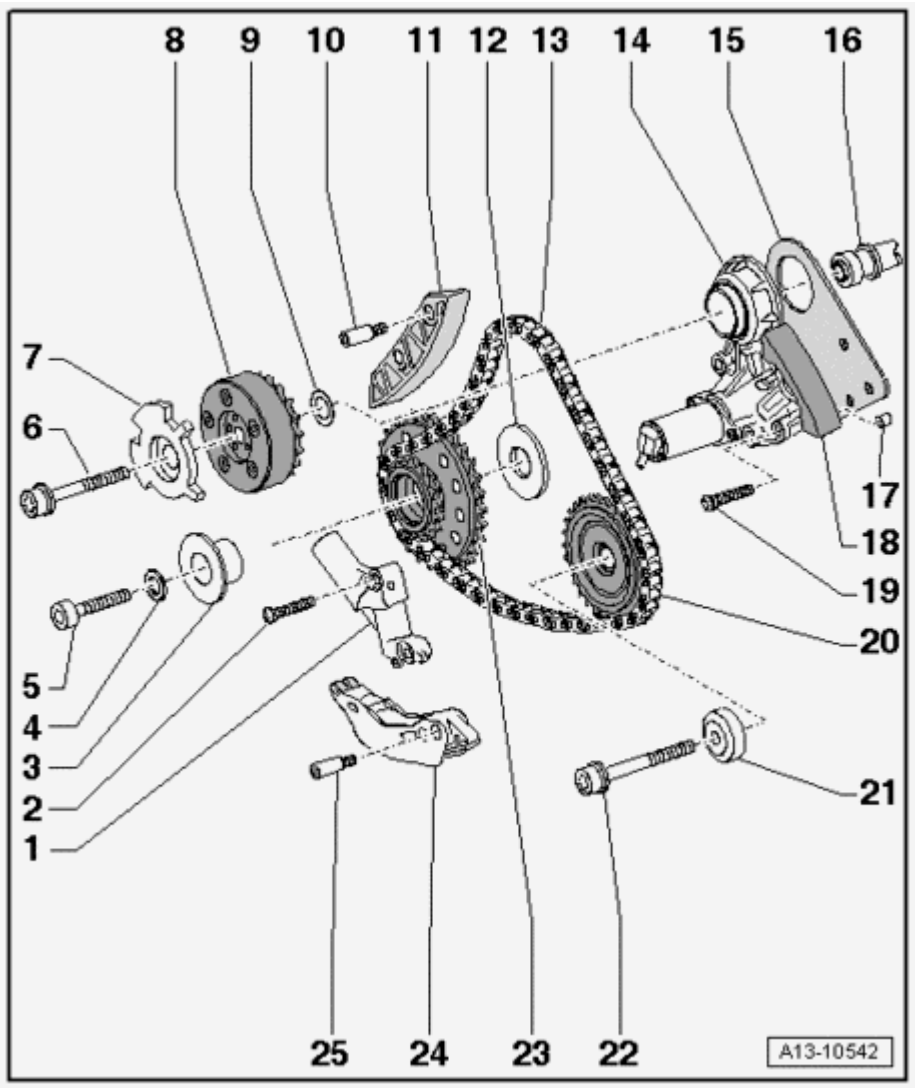


Fig. 327: Camshaft Timing Chain, Component Overview (Right Camshaft Timing Chain)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Chain tensioner

- For right timing chain

2 - 5 Nm plus an additional $^{1}/_{4}$ turn (90 °)

- Replace

3 - Mounting pin

- For drive sprocket

4 - Washer

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5 - 42 Nm

6 - Camshaft bolt

- Replace
- Initial tightening torque: 40 Nm
- Final tightening torque: 100 Nm plus an additional $^{1}/_{4}$ turn (90 °)

7 - Hall sensor wheel

- When installing timing chain, adjust using setting gauge T40047

8 - Camshaft adjuster

- For intake camshaft

9 - Diamond disc

- Replace

10 - Pivot pin -10 Nm

11 - Guide rail

12 - Thrust washer

- For drive sprocket

13 - Right camshaft timing chain

- Removing and installing --> **Camshaft timing chain, removing and installing**

14 - Control housing

- For camshaft adjuster

15 - Gasket

- Replace

16 - Camshaft

17 - Alignment bushing

- 2 pieces

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18 - Guide rail

- Can be replaced separately

19 - 5 Nm plus an additional $^{1}/_{4}$ turn (90 °)

- Replace

20 - Chain sprocket

- For exhaust camshaft

21 - Washer

- Note installation position

22 - Camshaft bolt

- Replace
- Initial tightening torque: 40 Nm
- Final tightening torque: 100 Nm plus an additional $^{1}/_{4}$ turn (90 °)

23 - Drive sprocket

- For right timing chain

24 - Guide rail

- For timing chain

25 - Pivot pin -10 Nm

Camshaft timing chain, removing and installing

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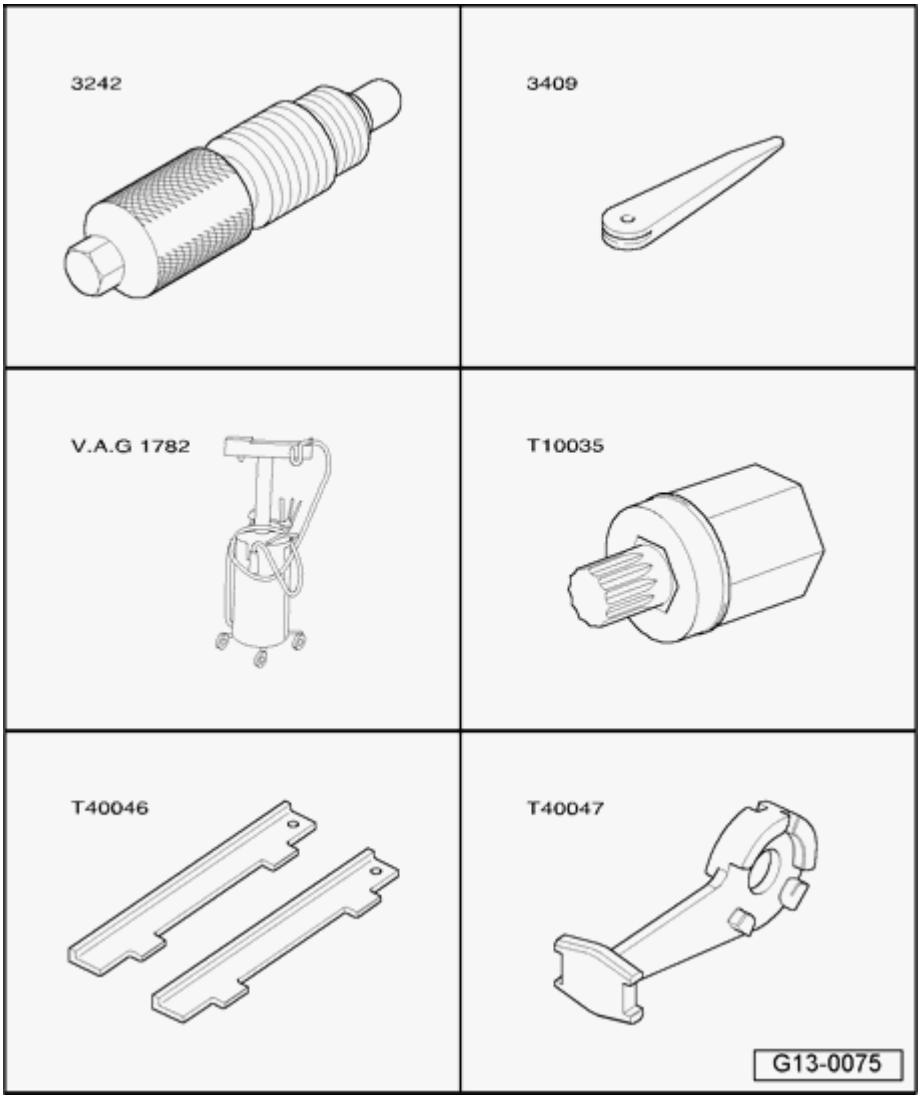


Fig. 328: Identifying Special Tools - Camshaft Timing Chain, Removing And Installing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools, testers and auxiliary items required

- Crankshaft Holder 3242
- Trim removal wedge 3409 (2x)
- Old oil collecting and extracting device V.A.G 1782
- Multi-point socket T10035
- Camshaft locator T40046 (qty. 2)
- Setting gauge T40047

Special tools, testers and auxiliary items required

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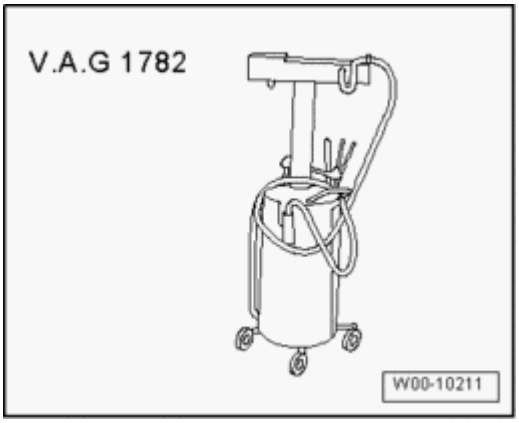


Fig. 329: Identifying Old Oil Collecting And Extracting Device V.A.G 1782
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Old oil collecting and extracting device V.A.G 1782

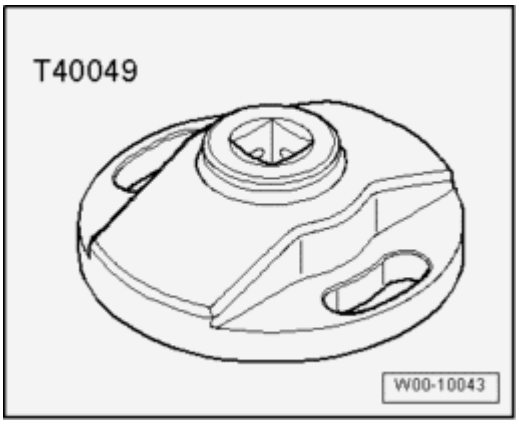


Fig. 330: Identifying Key T40049
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Key T40049
- Drill 3.3 mm diameter (2x)

Removing

- Place old oil collecting and extracting device V.A.G 1782 under engine and drain engine oil.
- Remove engine: Vehicles with manual transmission --> **Engine (vehicles with manual transmission)** , vehicles with automatic transmission --> **Engine (vehicles with automatic transmission), removing**.
- Disconnect engine and transmission: Vehicles with manual transmission --> **Engine (vehicles with manual transmission), separating** , vehicles with automatic transmission --> **Engine and transmission (vehicles with automatic transmission), separating**.
- Leave engine on Scissor Lift Table VAS 6131 A or secure engine to the engine and transmission holder: Vehicles with manual transmission --> **Engine (vehicles with manual transmission), securing to engine and transmission holder** , vehicles with automatic transmission --> **Engine (vehicles with automatic transmission), securing to assembly stand**.

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- Remove covers for timing chains --> **Timing chain covers (All), removing and installing**.

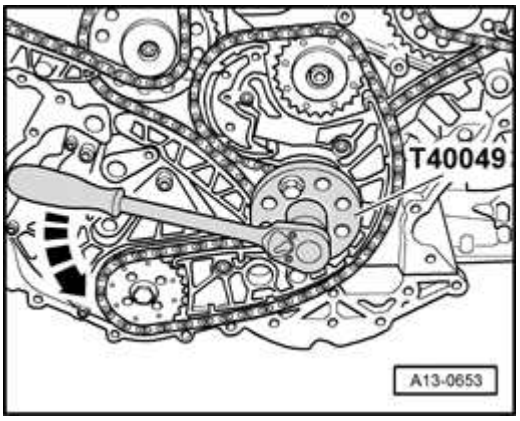


Fig. 331: Rotating Crankshaft To TDC Ignition Timing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Install key T40049 at rear on crankshaft e.g. using 2 old bolts for dual-mass flywheel.
- Rotate crankshaft in direction of engine rotation - **arrow** - to TDC ignition timing.

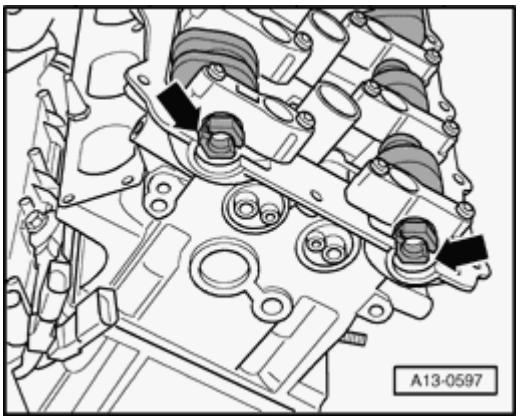


Fig. 332: Identifying Slits At Front In Camshafts Stand Parallel At Same Height With Upper Edge Of Cylinder Head
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Slits - **arrows** - at front in camshafts must stand parallel at same height with upper edge of cylinder head.

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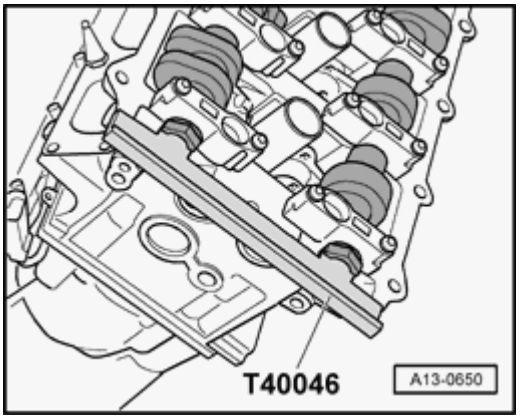


Fig. 333: Removing/Installing Camshaft Locator T40046
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Rotate camshafts at hex head slightly back or forth if necessary so that camshaft locator T40046 can be inserted.
- If camshaft locator T40046 cannot be inserted, rotate crankshaft 1 rotation (360 °) further.
- Remove camshaft locator T40046 again.

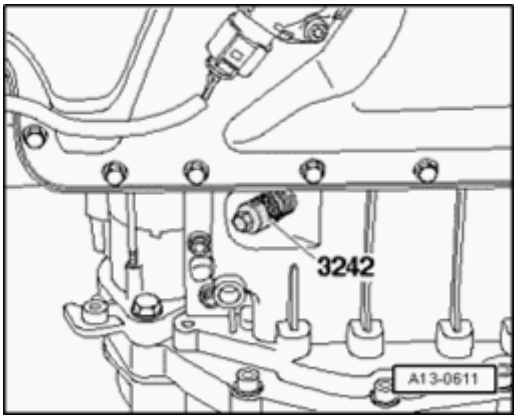


Fig. 334: Removing/Installing Crankshaft Holder 3242 Into Hole
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove drain plug from upper section of oil pan.
- Install Crankshaft Holder 3242 into hole (20 Nm), if necessary rotate crankshaft very slightly back and forth to completely center holder.

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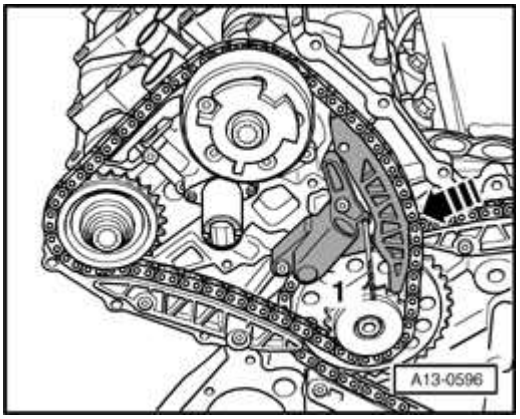


Fig. 335: Pushing Glide Track Of Chain Tensioner For Left Timing Chain
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Push glide track of chain tensioner for left timing chain in direction of - **arrow** - and pull off chain tensioner using a drill bit 3.3 mm dia. - **1** -.

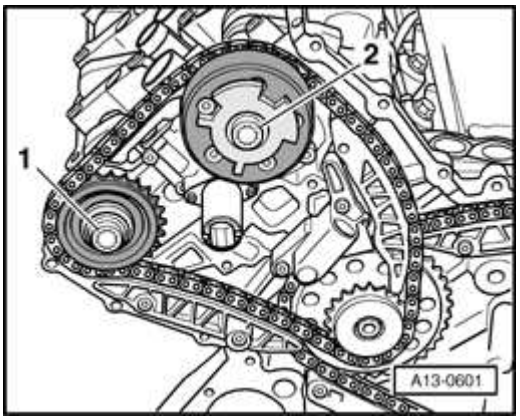


Fig. 336: Removing Bolts For Camshaft Chain Sprocket Or Camshaft Adjuster Using Multipoint Socket T10035
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Mark running direction of left timing chain with paint.
- Remove bolts - **1** - and - **2** - for camshaft chain sprocket or camshaft adjuster using multipoint socket T10035.
- Remove camshaft chain sprocket, camshaft adjuster and timing chain.

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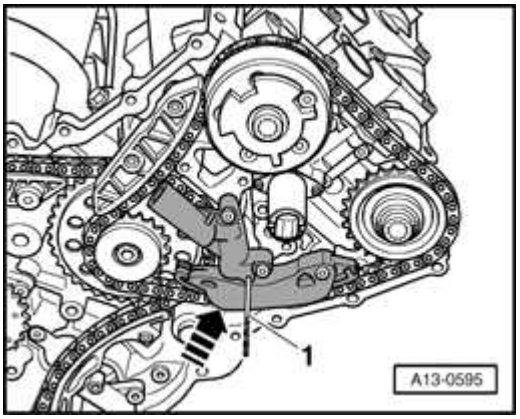


Fig. 337: Pushing Glide Track Of Chain Tensioner For Right Timing Chain
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Push glide track of chain tensioner for right timing chain in direction of - **arrow** - and pull off chain tensioner using a drill bit 3.3 mm dia. - **1** -.
- Mark running direction of right timing chain with paint.

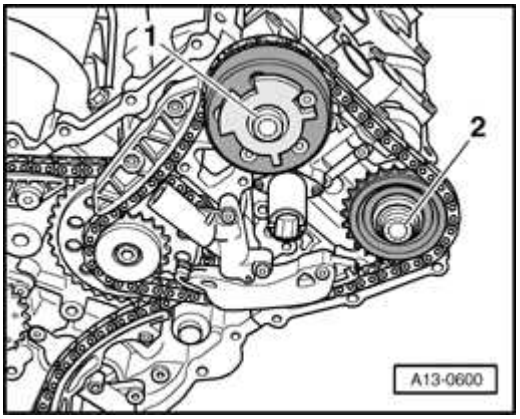


Fig. 338: Removing Bolts For Camshaft Chain Sprocket Or Camshaft Adjuster Using Multipoint Socket T10035
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts - **1** - and - **2** - for camshaft chain sprocket or camshaft adjuster using multipoint socket T10035.
- Remove camshaft chain sprocket, camshaft adjuster and timing chain.

Installing

- Secure crankshaft in TDC position using Crankshaft Holder 3242.
- Drive chain for timing mechanism installed --> **Drive chain for timing mechanism, removing and installing**.

NOTE:

- **Always replace bolts that are tightened to torque as well as O-rings and gaskets.**

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- **When turning camshaft, crankshaft must not be at TDC for any cylinder. Valves and/or pistons may be damaged.**

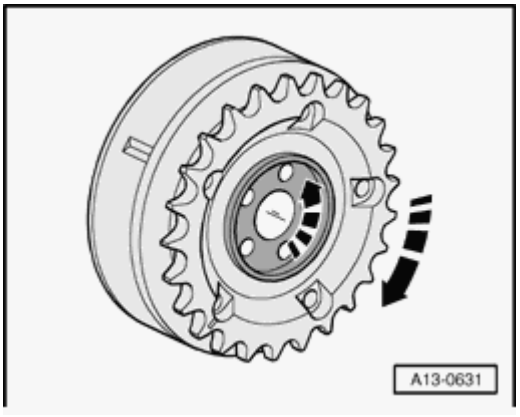


Fig. 339: Rotating Inner Part And Outer Part Of Both Camshaft Adjusters Against Each Other Up To Lock Position
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Rotate inner part and outer part of both camshaft adjusters against each other up to lock position - **arrows** -.

- Inner part and outer part must not be able to be against each other in lock position (slight play can still be felt).

- Check whether camshafts of both cylinder heads stand in TDC position.

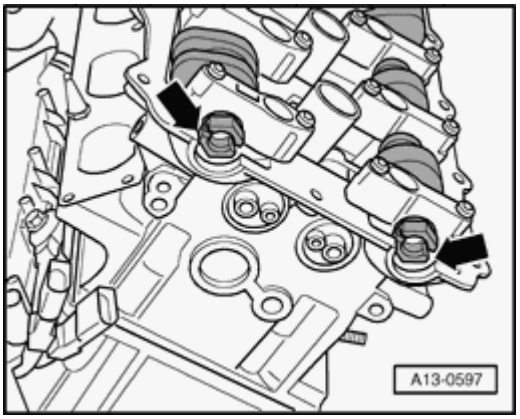


Fig. 340: Identifying Slits At Front In Camshafts Stand Parallel At Same Height With Upper Edge Of Cylinder Head
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Slits - **arrows** - at front in camshafts must stand parallel at same height with upper edge of cylinder head.

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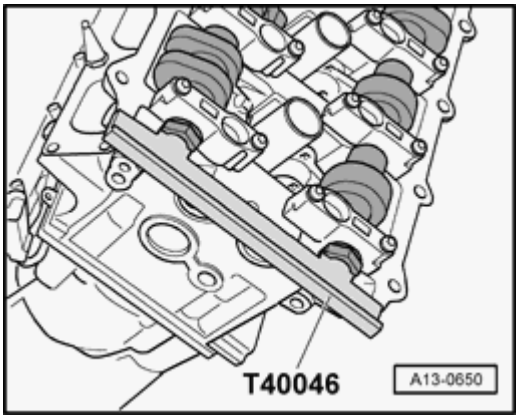


Fig. 341: Removing/Installing Camshaft Locator T40046
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Insert camshaft locator T40046 into camshafts of left cylinder head, to do so rotate camshafts back or forth at hex head if necessary.

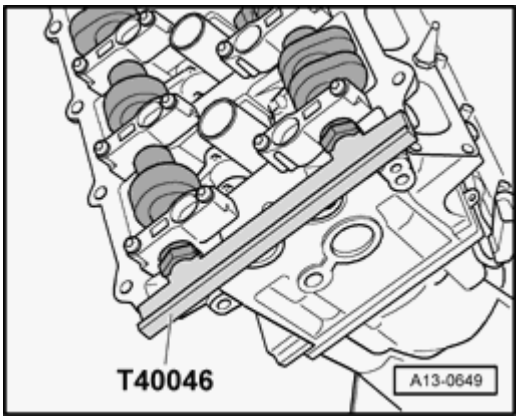


Fig. 342: Removing/Inserting Camshaft Locator T40046 From/Into Camshafts Of Right Cylinder Head
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Insert camshaft locator T40046 into camshafts of right cylinder head, to do so rotate camshafts back or forth at hex head if necessary.
- Replace all four camshaft bolts.
- Replace diamond disc between camshaft and left cylinder head camshaft adjuster.
- Assemble left timing chain with chain sprocket and camshaft adjuster.

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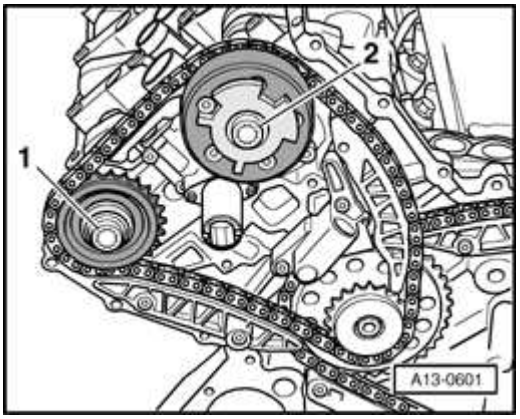


Fig. 343: Removing Bolts For Camshaft Chain Sprocket Or Camshaft Adjuster Using Multipoint Socket T10035
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Loosely install bolts - **1** - and - **2** -.

- Chain sprocket and camshaft adjuster must be able to still be rotated on camshaft and must not tip.

- Replace diamond disc between camshafts and right cylinder head camshaft adjuster.
- Assemble right timing chain with chain sprocket and camshaft adjuster.

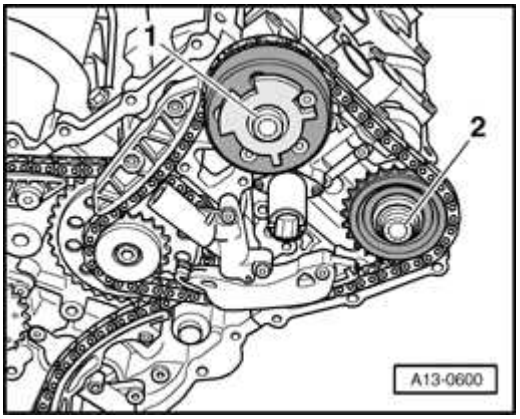


Fig. 344: Removing Bolts For Camshaft Chain Sprocket Or Camshaft Adjuster Using Multipoint Socket T10035
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Loosely install bolts - **1** - and - **2** -.

- Chain sprocket and camshaft adjuster must be able to still be rotated on camshaft and must not tip.

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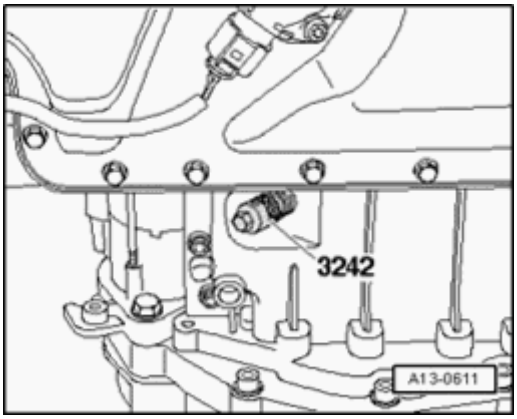


Fig. 345: Removing/Installing Crankshaft Holder 3242 Into Hole
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove Crankshaft Holder 3242.

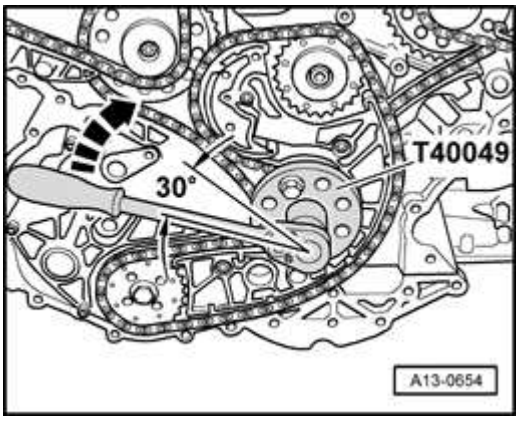


Fig. 346: Using Key T40049 To Rotate Crankshaft In Opposite Direction Of Engine Rotation
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Using key T40049 , rotate crankshaft approx. 30 ° in opposite direction of engine rotation - **arrow** -.
- Pull drill bit out of alignment hole, which loosens left chain tensioner.

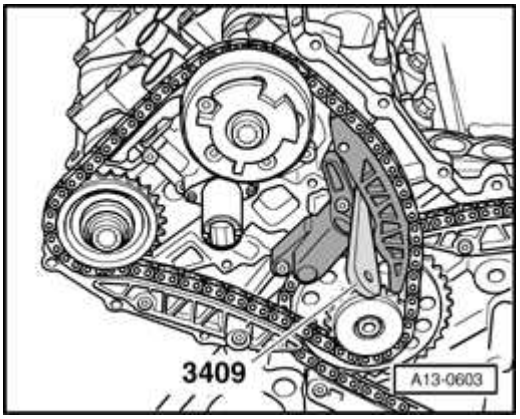


Fig. 347: Inserting Trim Removal Wedge 3409

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Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Insert trim removal wedge 3409 as shown in illustration and bring chain tensioner into contact with trim removal wedge 3409.
- Lightly pressing in an extra 0.5 mm is permitted.
- Pull drill bit out of alignment hole, which loosens right chain tensioner.

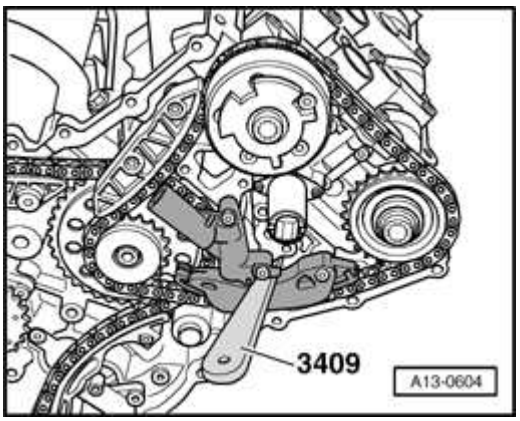


Fig. 348: Insert Trim Removal Wedge 3409
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Insert trim removal wedge 3409 as shown in illustration and bring chain tensioner into contact with trim removal wedge 3409.
- Lightly pressing in an extra 0.5 mm is permitted.

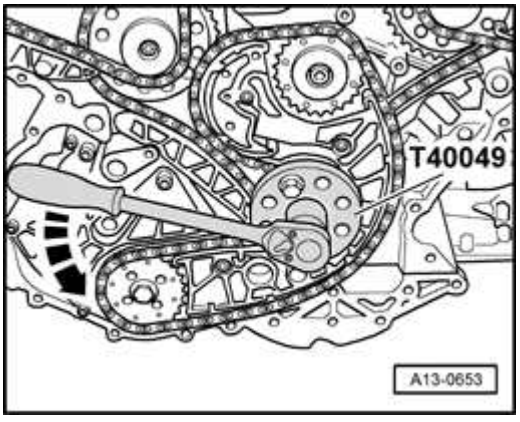


Fig. 349: Rotating Crankshaft To TDC Ignition Timing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Using key T40049 , rotate crankshaft in direction of engine rotation - **arrow** - to TD ignition timing.

NOTE:

- **If rotated unintentionally beyond TDC, turn back crankshaft again approx.**

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30 ° and set to TDC again.

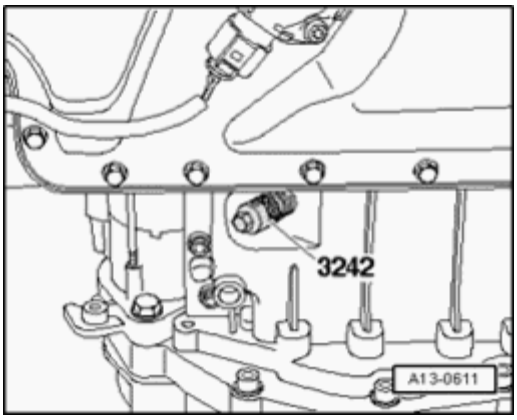


Fig. 350: Removing/Installing Crankshaft Holder 3242 Into Hole
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Install Crankshaft Holder 3242 into hole (20 Nm), if necessary rotate crankshaft very slightly back and forth to completely center holder.

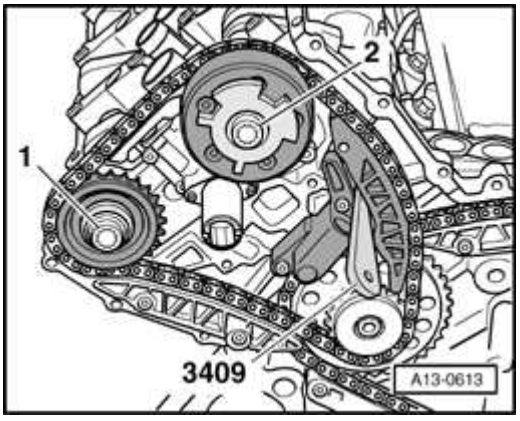


Fig. 351: Tightening Camshaft Bolt On Exhaust Camshaft Of Left Cylinder Head To Initial Tightening Torque
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Tighten camshaft bolt - **1** - on exhaust camshaft of left cylinder head to initial tightening torque.

- Torque specification: 40 Nm.

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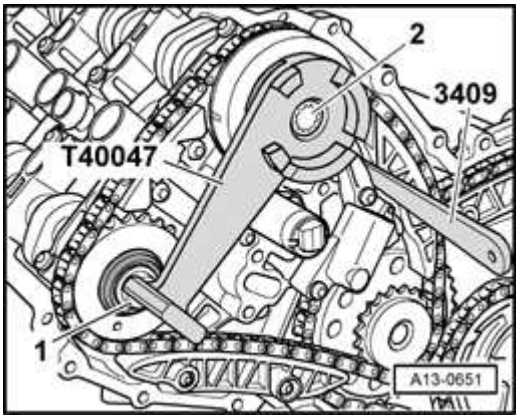


Fig. 352: Securing Hall Sensor Wheel On Camshaft Adjuster Of Intake Camshaft Of Left Cylinder Head Using Setting Gauge T40047
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Secure Hall sensor wheel on camshaft adjuster of intake camshaft of left cylinder head using setting gauge T40047.
- Place setting gauge T40047 on bolt - **1** -.
- Tighten camshaft bolt - **2** - on intake camshaft to initial tightening torque.

- Torque specification: 40 Nm.

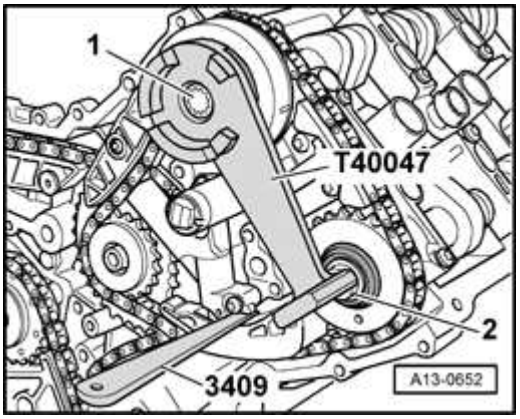


Fig. 353: Securing Hall Sensor Wheel On Camshaft Adjuster Of Intake Camshaft Of Right Cylinder Head Using Setting Gauge T40047
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Secure Hall sensor wheel on camshaft adjuster of intake camshaft of right cylinder head using setting gauge T40047.
- Place setting gauge T40047 on bolt - **2** -.
- Tighten camshaft bolt - **1** - on intake camshaft to initial tightening torque.

- Torque specification: 40 Nm.

- Remove setting gauge T40047.

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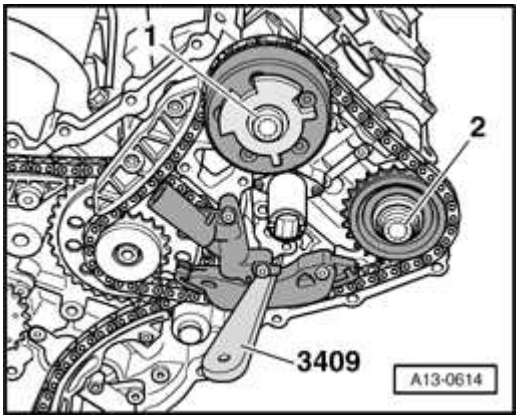


Fig. 354: Tightening Camshaft Bolt On Exhaust Camshaft Of Right Cylinder Head To Initial Tightening Torque
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Tighten camshaft bolt - **2** - on exhaust camshaft of right cylinder head to initial tightening torque.
- Torque specification: 40 Nm.

NOTE:

- **Camshaft locators T40046 must not be used as counter holder for final tightening of camshaft bolts.**

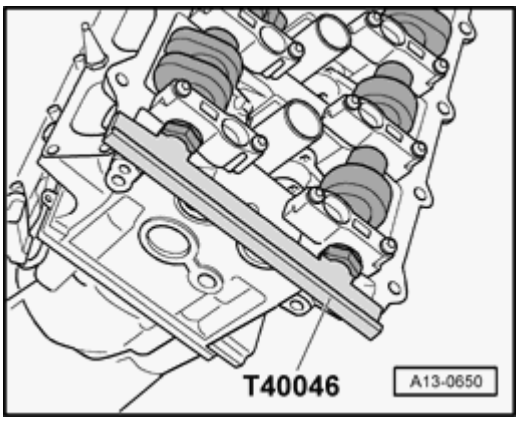


Fig. 355: Removing/Installing Camshaft Locator T40046
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove camshaft locators T40046 on both cylinder heads.

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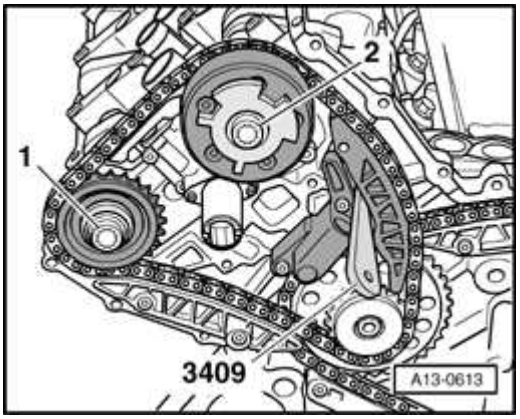


Fig. 356: Tightening Camshaft Bolt On Exhaust Camshaft Of Left Cylinder Head To Initial Tightening Torque
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Tighten camshaft bolt - **1** - on exhaust camshaft of left cylinder head to final tightening torque.

- Torque specification: 100 Nm plus an additional $^{1}/_{4}$ turn (90 °).

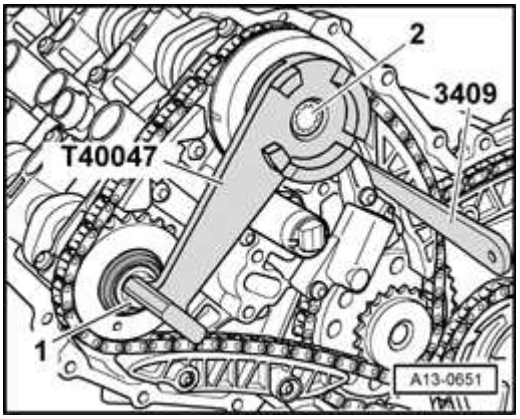


Fig. 357: Securing Hall Sensor Wheel On Camshaft Adjuster Of Intake Camshaft Of Left Cylinder Head Using Setting Gauge T40047
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Secure Hall sensor wheel on camshaft adjuster of intake camshaft of left cylinder head using setting gauge T40047.
- Place setting gauge T40047 on bolt - **1** -.
- Tighten camshaft bolt - **2** - on intake camshaft to final tightening torque.

- Torque specification: 100 Nm plus an additional $^{1}/_{4}$ turn (90 °).

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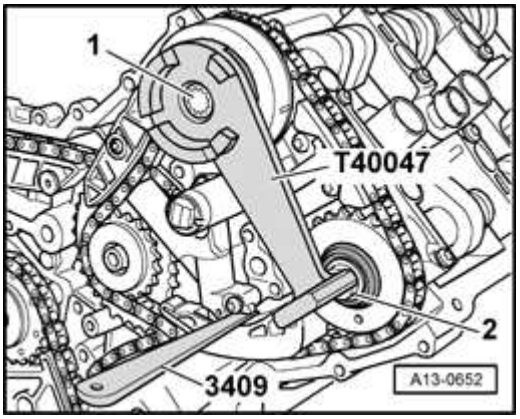


Fig. 358: Securing Hall Sensor Wheel On Camshaft Adjuster Of Intake Camshaft Of Right Cylinder Head Using Setting Gauge T40047
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Secure Hall sensor wheel on camshaft adjuster of intake camshaft of right cylinder head using setting gauge T40047.
- Place setting gauge T40047 on bolt - **2** -.
- Tighten camshaft bolt - **1** - on intake camshaft to final tightening torque.

- Torque specification: 100 Nm plus an additional $^{1}/_{4}$ turn (90 °).

- Remove setting gauge T40047.

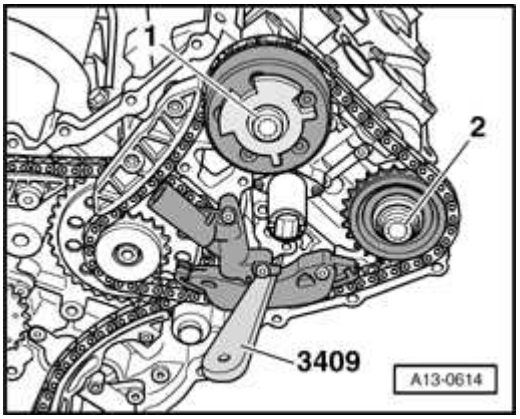


Fig. 359: Tightening Camshaft Bolt On Exhaust Camshaft Of Right Cylinder Head To Initial Tightening Torque
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Tighten camshaft bolt - **2** - on exhaust camshaft of right cylinder head to final tightening torque.

- Torque specification: 100 Nm plus an additional $^{1}/_{4}$ turn (90 °).

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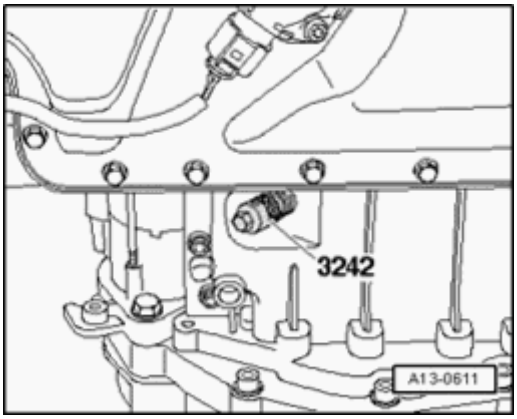


Fig. 360: Removing/Installing Crankshaft Holder 3242 Into Hole
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove Crankshaft Holder 3242.

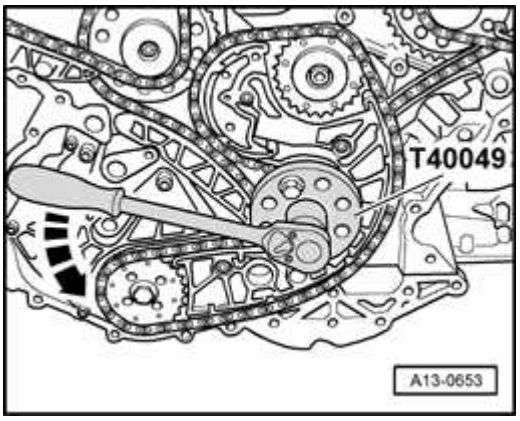


Fig. 361: Rotating Crankshaft To TDC Ignition Timing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Using key T40049 turn crankshaft two complete rotations in direction of engine rotation - **arrow** - until crankshaft stands at TDC again.

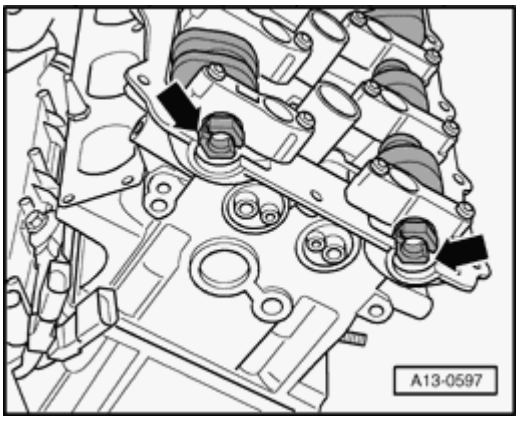


Fig. 362: Identifying Slits At Front In Camshafts Stand Parallel At Same Height With Upper Edge Of

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Cylinder Head
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Slits - **arrows** - at front in camshafts must stand parallel at same height with upper edge of cylinder head.

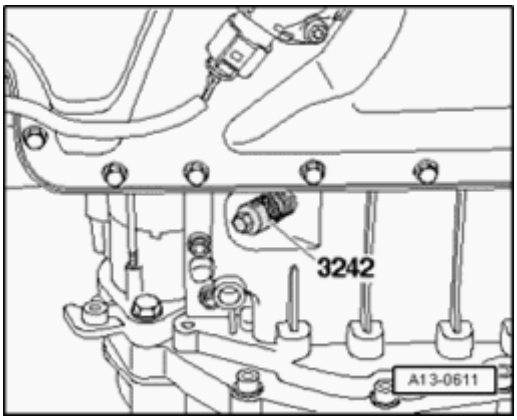


Fig. 363: Removing/Installing Crankshaft Holder 3242 Into Hole
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Install Crankshaft Holder 3242 into hole (20 Nm), if necessary rotate crankshaft very slightly back and forth to completely center holder.

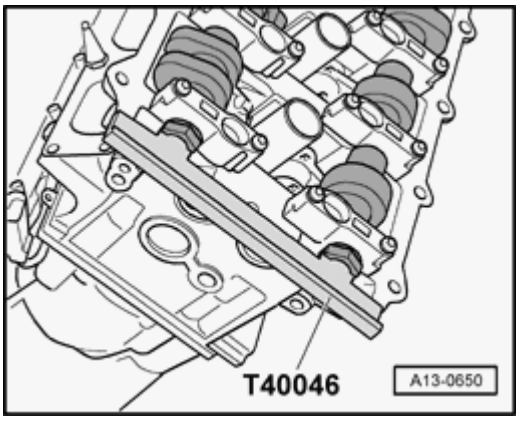


Fig. 364: Removing/Installing Camshaft Locator T40046
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Insert camshaft locator T40046 into camshafts of left cylinder head.

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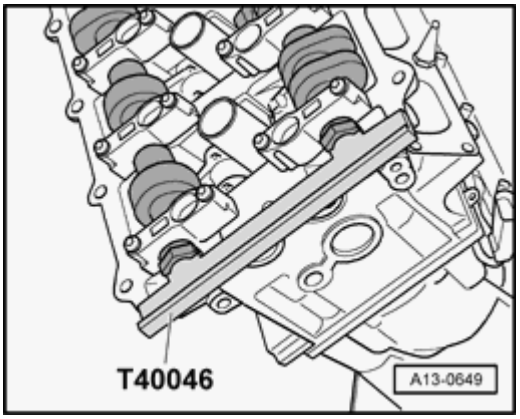


Fig. 365: Removing/Inserting Camshaft Locator T40046 From/Into Camshafts Of Right Cylinder Head
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Insert camshaft locator T40046 into camshafts of right cylinder head.

If camshaft locators cannot be inserted:

- Repeat adjustment.
- Pull out trim removal wedge 3409.
- Remove camshaft locator T40046 on both cylinder heads.
- Remove Crankshaft Holder 3242.

- Install sealing plug of TDC marking with new sealing ring into upper section of oil pan.

The rest of installation is in reverse order of removal, note the following:

- Install covers for timing chains **Installing**.
- Install engine: Vehicles with manual transmission --> **Engine (vehicles with manual transmission), installing** , vehicles with automatic transmission --> **Engine (vehicles with automatic transmission), installing**.
- Add engine oil and check oil level --> **Oil level, checking**.

Torque specifications

Component	Nm
Camshaft bolts	100 plus an additional 90 ° * See note
Sealing plug in upper section of oil pan	35
Oil drain plug	50

* 90 ° corresponds to one quarter rotation.

*Replace bolts.

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Camshaft timing chains, removing from camshafts

NOTE:

- **For the removal of the cylinder head or camshafts, it is sufficient to remove camshaft timing chains only from the camshafts. Chains remain on the engine; only the top covers at left and right are removed.**
- **Even if work is performed only on one of the cylinder heads, the procedure described must be followed, since then the valve timing at both cylinder heads must be adjusted.**

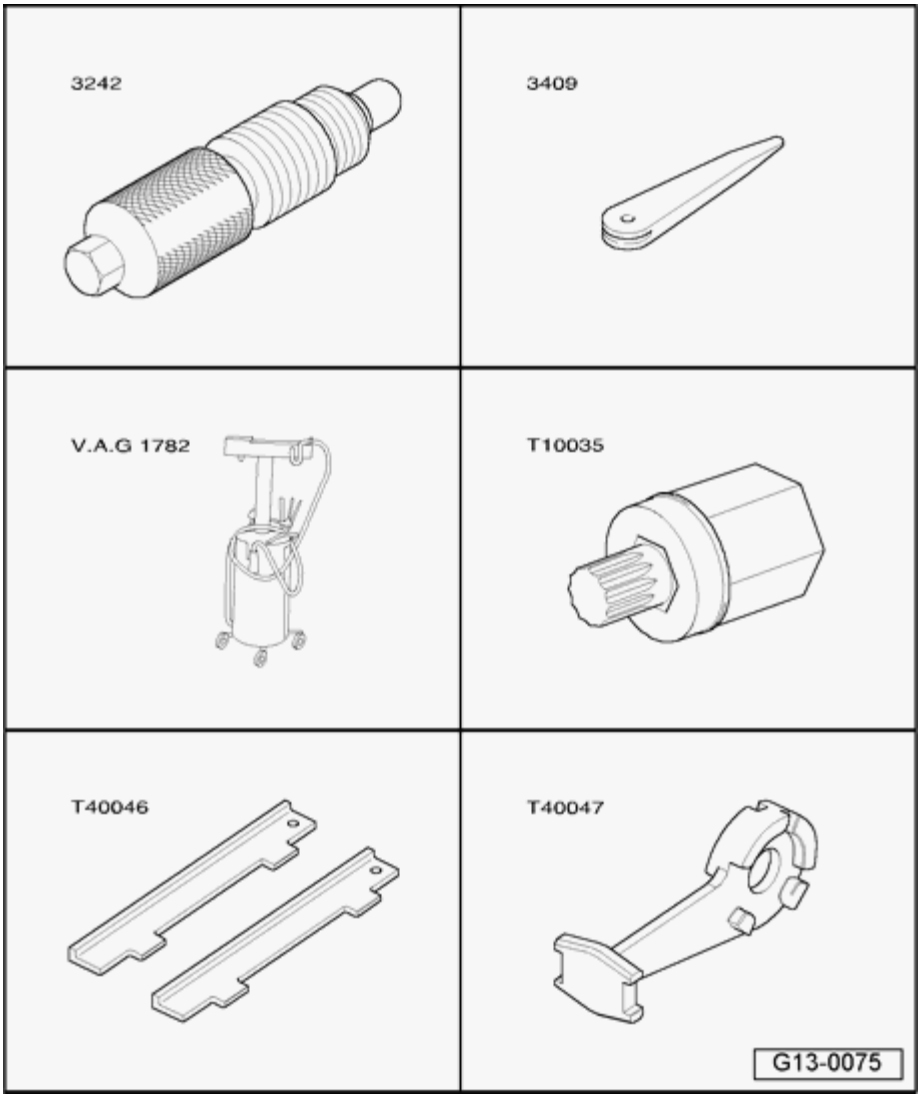


Fig. 366: Identifying Special Tools - Camshaft Timing Chains, Removing From Camshafts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools, testers and auxiliary items required

- Crankshaft Holder 3242

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- Trim removal wedge 3409 (2x)
- Old oil collecting and extracting device V.A.G 1782
- Multi-point socket T10035
- Camshaft locator T40046 (qty. 2)
- Setting gauge T40047

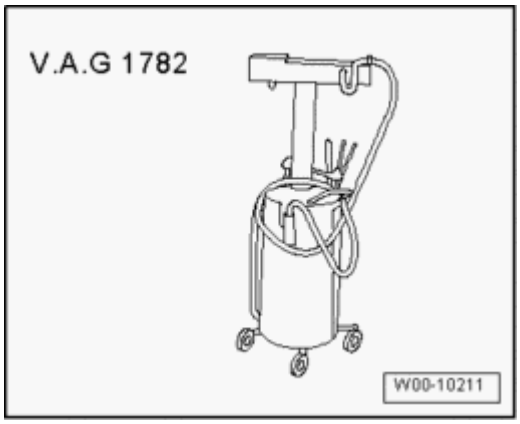


Fig. 367: Identifying Old Oil Collecting And Extracting Device V.A.G 1782
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Old oil collecting and extracting device V.A.G 1782

Drill bit 3.3 mm dia. (2x)

Work procedure

NOTE:

- **All cable ties opened or cut during engine removal must be reinstalled at the same locations during installation.**

- Place old oil collecting and extracting device V.A.G 1782 under engine and drain engine oil.
- Remove engine: Vehicles with manual transmission --> **Engine (vehicles with manual transmission)** , vehicles with automatic transmission --> **Engine (vehicles with automatic transmission), removing**.
- Leave engine with transmission installed on scissor lift platform VAS 6131 A.

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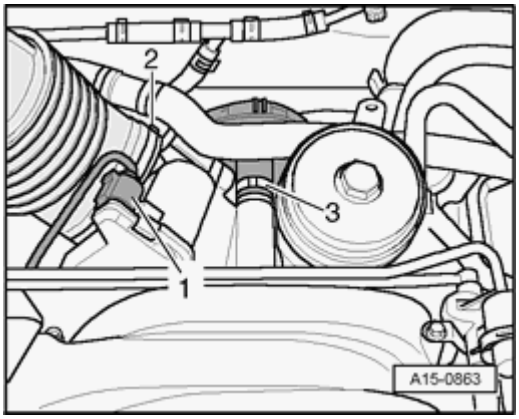


Fig. 368: Disconnecting Electrical Connection At Throttle Valve Control Module J338 & Crankcase Ventilation Hose At Intake Pipe
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical connection - **1** - at throttle valve control module J338.
- Disconnect crankcase ventilation hose - **3** - at intake pipe.

NOTE:

- **Disregard item - 2 -.**

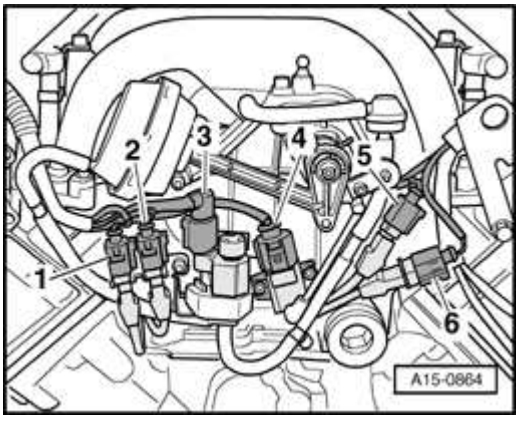


Fig. 369: Remove Electrical Harness Connectors Toward Front From Brackets On Intake Line
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove electrical harness connectors - **1** - , - **2** - , - **5** - and - **6** - toward front from brackets on intake line.
- Disconnect electrical connectors - **3** - and - **4** -.

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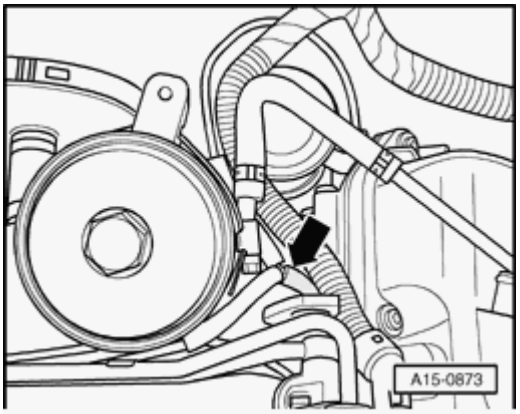


Fig. 370: Disconnecting Vacuum Hose At T-Piece
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect vacuum hose - **arrow** - at T-piece.

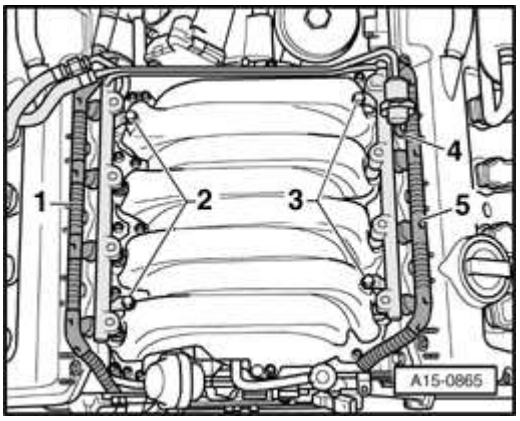


Fig. 371: Identifying Connector Strips At Fuel Injectors, Vacuum Line On Fuel Pressure Regulator & Retaining Bolts For Fuel Rail Line
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect connector strips - **1** - and - **5** - at fuel injectors.
- For vehicles with fuel return line, disconnect vacuum line - **4** - on fuel pressure regulator.
- Remove retaining bolts - **2** - and - **3** - for fuel rail line.
- Remove fuel rail line together with fuel injectors from intake manifold uniformly upward.

NOTE:

- **Carefully protect the removed fuel injectors from contamination.**

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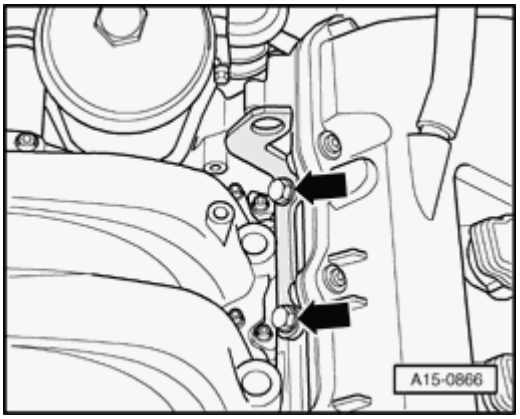


Fig. 372: Removing Left/Rear Engine Lifting Eye
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove left rear engine lifting eye - **arrows** -.

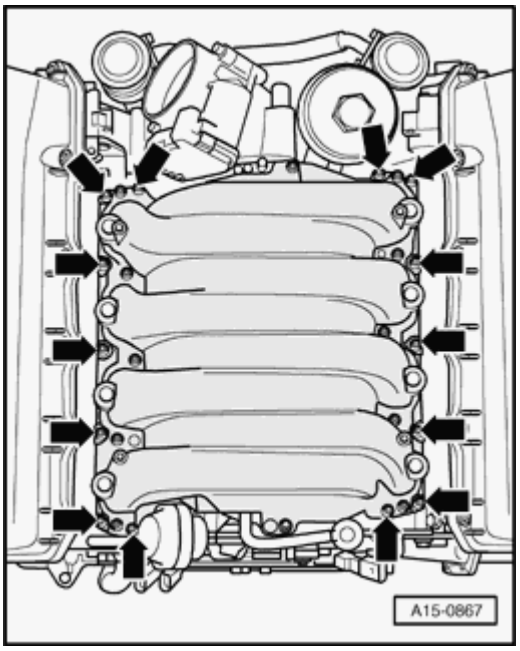


Fig. 373: Removing Intake Manifold Bolts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove intake manifold bolts - **arrows** - and remove it.

NOTE:

- **Plug intake ports of the cylinder head with clean rags.**

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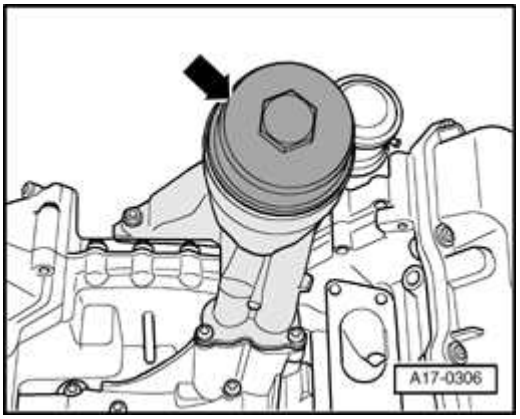


Fig. 374: Removing Cap For Oil Filter Housing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove cap - **arrow** - for oil filter housing.
- Remove oil filter element.
- Extract engine oil using old oil collecting and extracting device V.A.G 1782 from oil filter housing.

NOTE:

- **Place a rag around oil filter housing to catch escaping engine oil.**

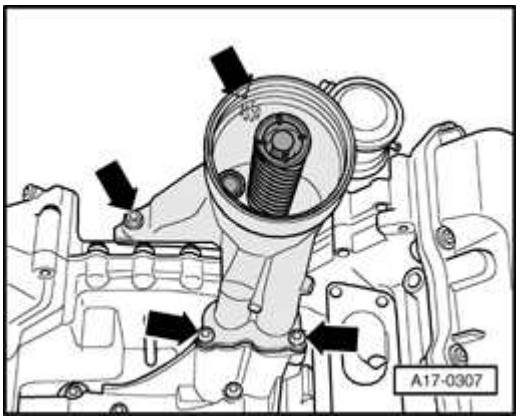


Fig. 375: Removing Bolts & Oil Filter Housing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts - **arrows** -.
- Remove oil filter housing.

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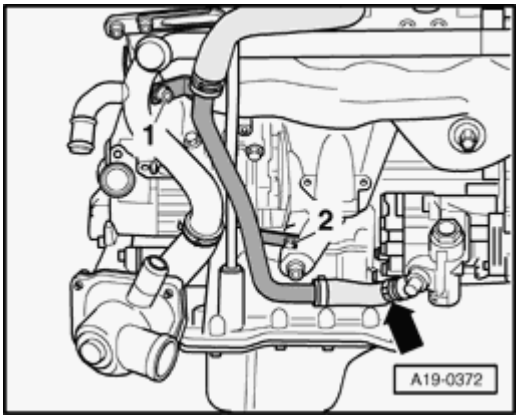


Fig. 376: Removing Bolts & Return Line From Power-Steering Pump
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts - **1** - and - **2** -.
- Place old oil collecting and extracting device V.A.G 1782 underneath.
- Remove return line from power-steering pump - **arrow** -.

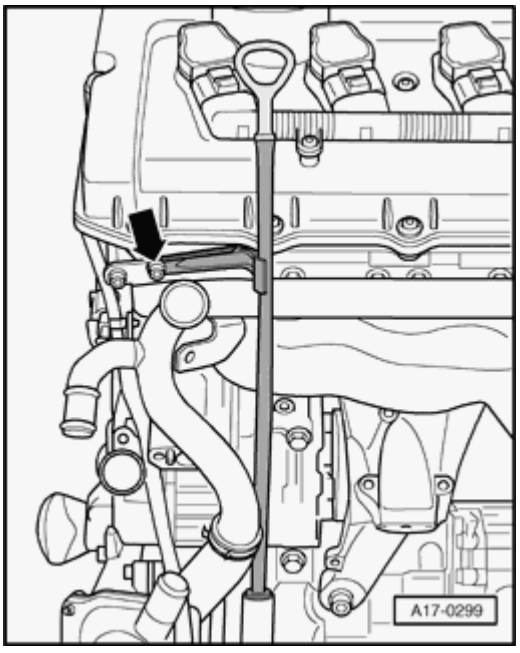


Fig. 377: Removing Bolt From Oil Dipstick Guide Tube At Cylinder Head
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove guide pipe bolt - **arrow** - for oil dipstick at cylinder head, pull up and remove.

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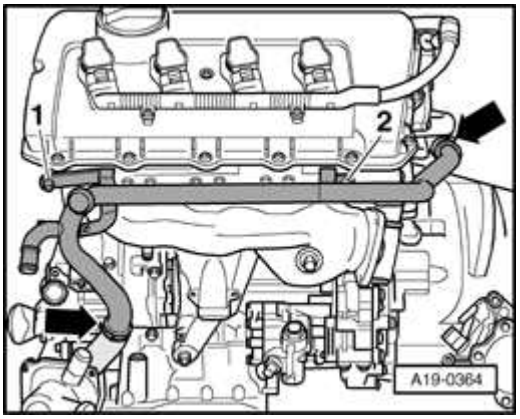


Fig. 378: Removing Bolts, Loosening Hose Clamps And Removing Left Coolant Pipe From Coolant Hoses
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts - **1** - and - **2** -.
- Loosen hose clamps - **arrows** - and remove left coolant pipe from coolant hoses.

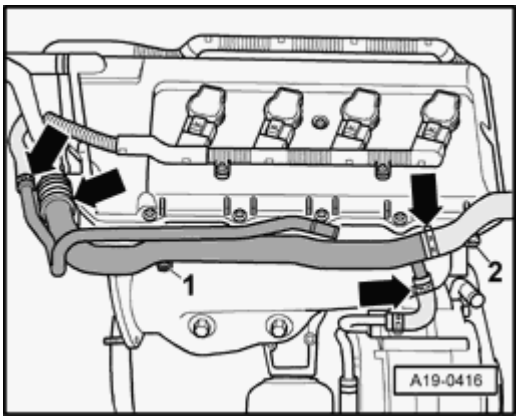


Fig. 379: Removing Bolts, Loosening Hose Clamps And Removing Right Coolant Pipe From Coolant Hoses
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts - **1** - and - **2** -.
- Loosen hose clamps - **arrows** - and remove right coolant pipe from coolant hoses.

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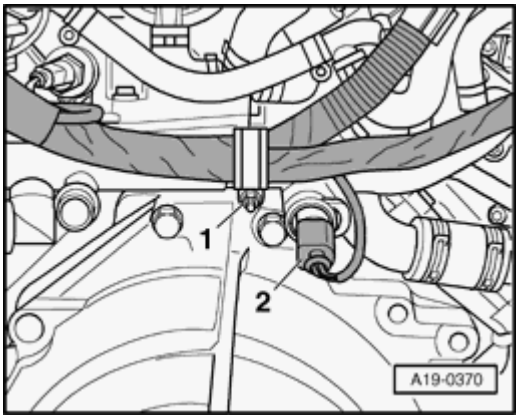


Fig. 380: Disconnecting Electrical Harness Connector On Engine Coolant Temperature (ECT) Gauge Sensor G2/G62
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical harness connector - **2** - on Engine Coolant Temperature (ECT) Gauge Sensor G2/G62.
- Remove nut - **1** - and remove electrical wiring harness at rear coolant pipe.

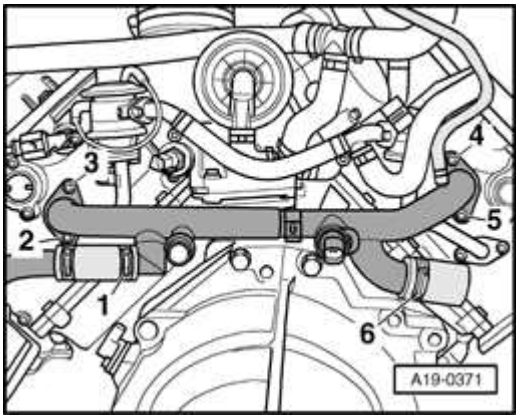


Fig. 381: Removing Bolts & Rear Coolant Pipe
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts - **2 to 5** -.
- Remove rear coolant pipe.

NOTE:

- **Ignore - 1 - and - 6 -.**

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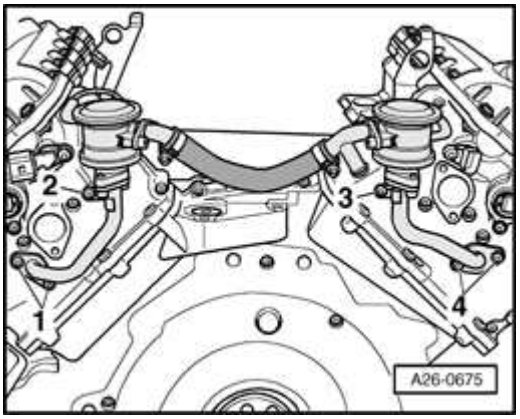


Fig. 382: Removing Mounting Bolts Of Combination Valves For Secondary Air Injection (AIR) System
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove mounting bolts - **1 to 4** - of combination valves for Secondary Air Injection (AIR) system.

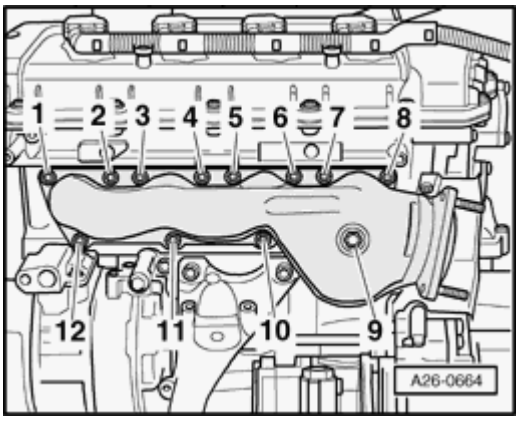


Fig. 383: Removing Nuts And Left Exhaust Manifold
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove nuts - **1 to 12** - and remove left exhaust manifold.

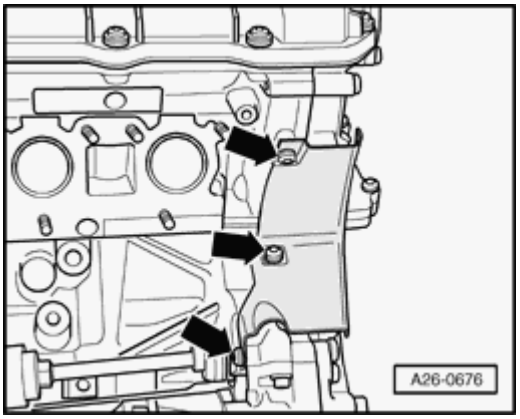


Fig. 384: Removing Left Heat Shield
Courtesy of VOLKSWAGEN UNITED STATES, INC.

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- Remove left heat shield - **arrows** -.

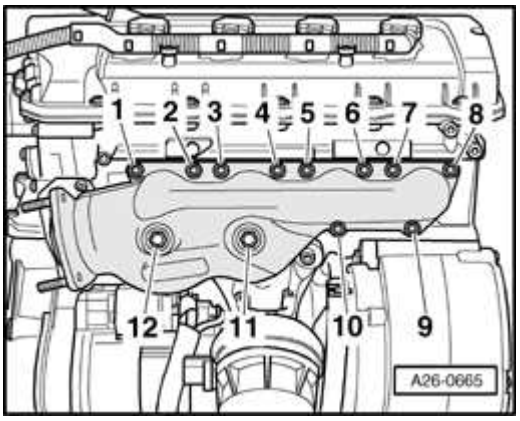


Fig. 385: Removing Nuts And Right Exhaust Manifold
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove nuts - **1 to 12** - and remove right exhaust manifold.

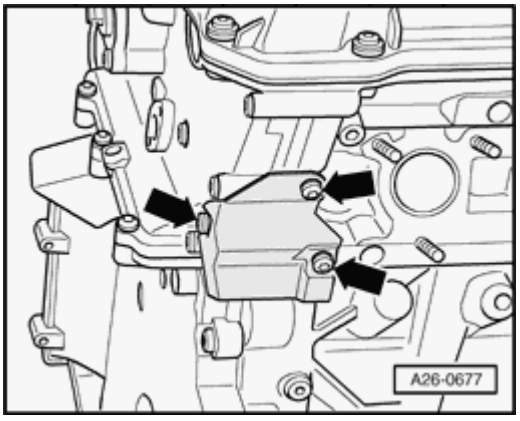
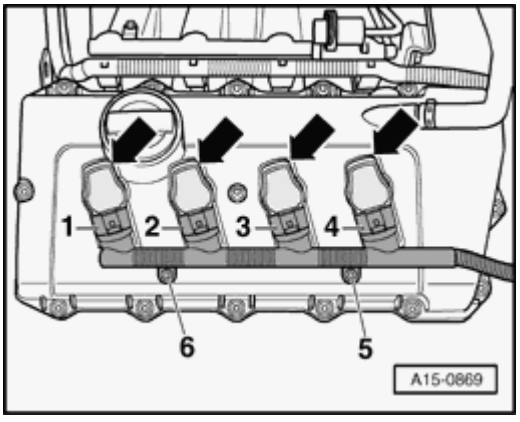


Fig. 386: Removing Right Heat Shield
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove right heat shield - **arrows** -.



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Fig. 387: Removing Bolts On Left Cylinder Head, Disconnecting Electrical Harness Connectors & Removing Ignition Coils
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts - **5** - and - **6** - on left cylinder head.
- Disconnect electrical harness connectors - **1 to 4** -.
- Remove ignition coils - **arrows** -.

NOTE:

- **Extractor T40039 can be used for removal.**

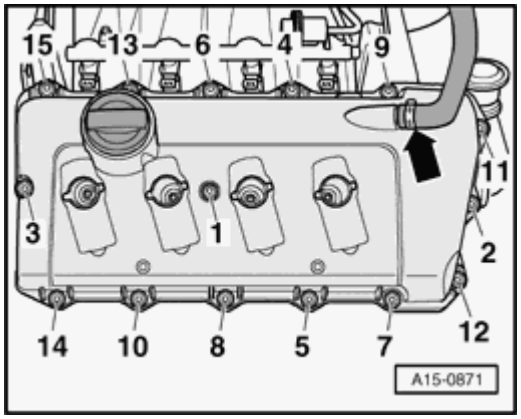


Fig. 388: Disconnecting Hose Of Crankshaft Housing Ventilation & Removing Left Cylinder Head Cover Bolts In Sequence
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect hose of crankshaft housing ventilation - **arrow** -.
- Remove left cylinder head cover bolts in sequence - **15 to 1** -.
- Remove cylinder head cover.

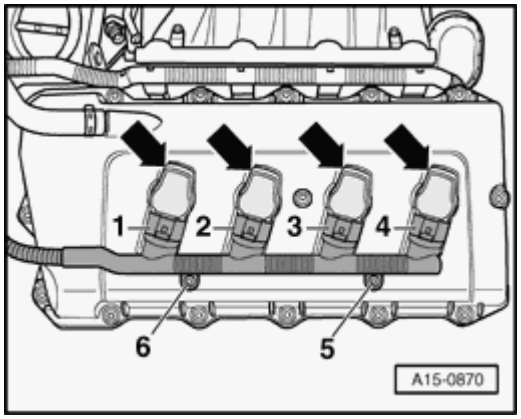


Fig. 389: Removing Bolts On Right Cylinder Head, Disconnecting Electrical Harness Connectors & Removing Ignition Coils
Courtesy of VOLKSWAGEN UNITED STATES, INC.

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- Remove bolts - **5** - and - **6** - on right cylinder head.
- Disconnect electrical harness connectors - **1 to 4** -.
- Remove ignition coils - **arrows** -.

NOTE:

- **Extractor T40039 can be used for removal.**

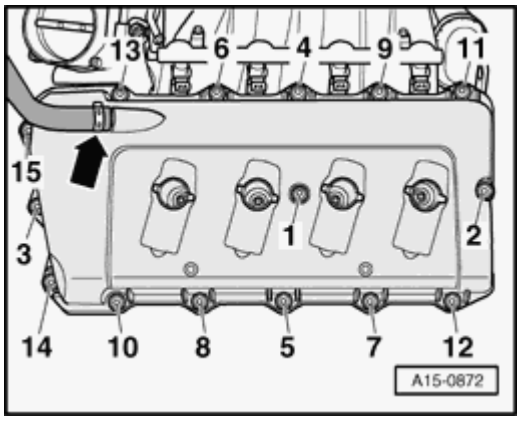


Fig. 390: Disconnecting Hose Of Crankshaft Housing Ventilation & Removing Right Cylinder Head Cover Screws In Sequence
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect hose of crankshaft housing ventilation - **arrow** -.
- Remove right cylinder head cover bolts in sequence - **15 to 1** -.
- Remove cylinder head cover.

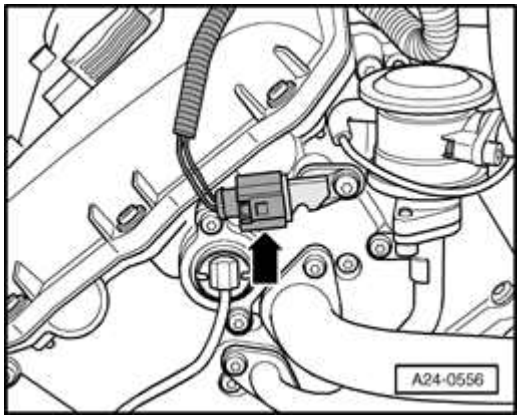


Fig. 391: Disconnecting Electrical Harness Connector For Camshaft Position (CMP) Sensor 2 G163 On Left Cylinder Head
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical harness connector - **arrow** - for Camshaft Position (CMP) Sensor 2 G163 on left cylinder head.

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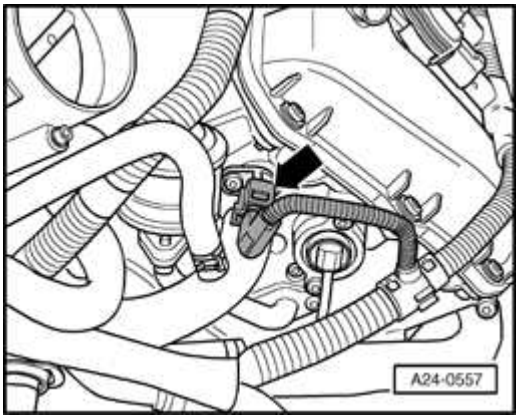


Fig. 392: Pressing Sealing Ring For Crankshaft At Rear Out Of Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical harness connector - **arrow** - for Camshaft Position (CMP) Sensor G40 on right cylinder head.

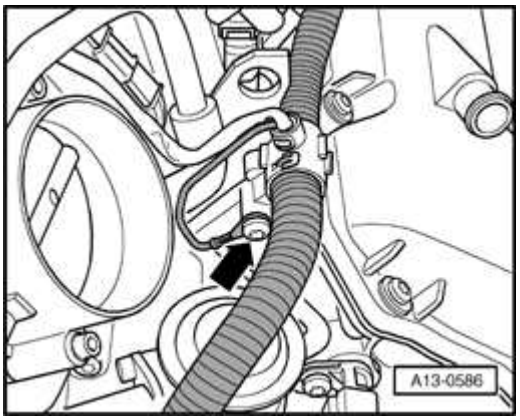
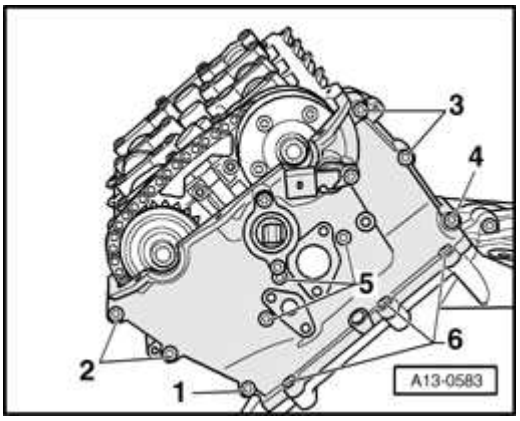


Fig. 393: Removing Ground (GND) Cable On Right Cylinder Head
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove Ground (GND) wire on right cylinder head - **arrow** -.
- Set wiring harness aside.



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Fig. 394: Removing/Installing Bolts And Left Timing Chain Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts - **1 to 6** - and remove left timing chain cover.

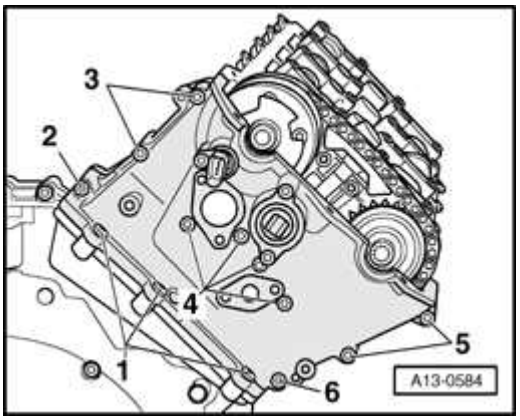


Fig. 395: Removing Bolts And Right Timing Chain Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts - **1 to 6** - and remove right timing chain cover.

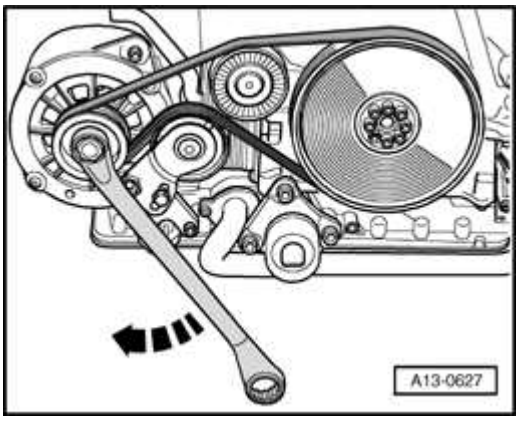


Fig. 396: Rotating Crankshaft To TDC Ignition Timing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Rotate crankshaft in direction of engine rotation - **arrow** - to TDC ignition timing.

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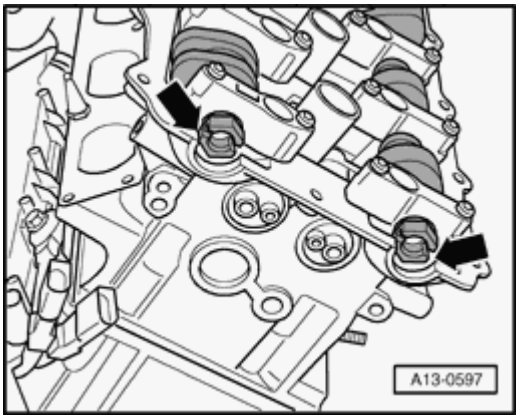


Fig. 397: Identifying Slits At Front In Camshafts Stand Parallel At Same Height With Upper Edge Of Cylinder Head
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Slits - **arrows** - at front in camshafts must stand parallel at same height with upper edge of cylinder head.

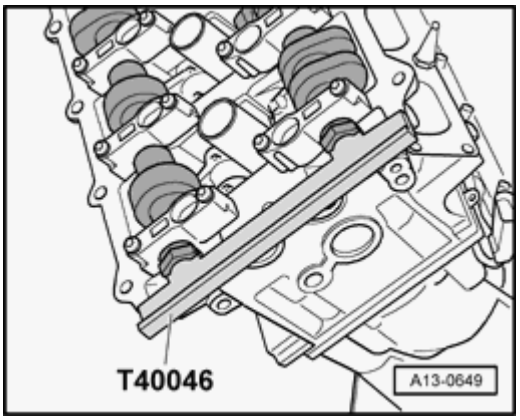


Fig. 398: Removing/Inserting Camshaft Locator T40046 From/Into Camshafts Of Right Cylinder Head
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Rotate camshafts at hex head slightly back and forth if necessary so that camshaft locator T40046 can be inserted.
- If camshaft locator T40046 cannot be inserted, rotate crankshaft 1 rotation (360 °) further.
- Remove camshaft locator T40046 again.
- Remove drain plug from upper section of oil pan.

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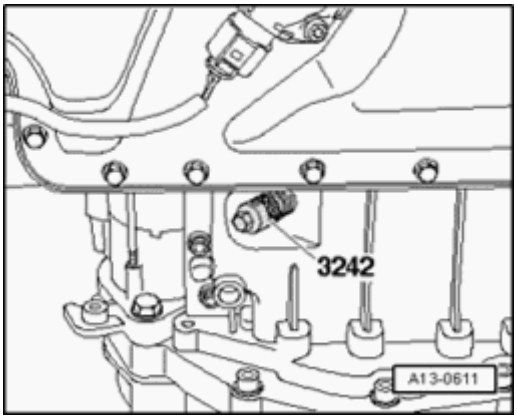


Fig. 399: Removing/Installing Crankshaft Holder 3242 Into Hole
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Install Crankshaft Holder 3242 into hole (20 Nm), if necessary rotate crankshaft very slightly back and forth to completely center holder.

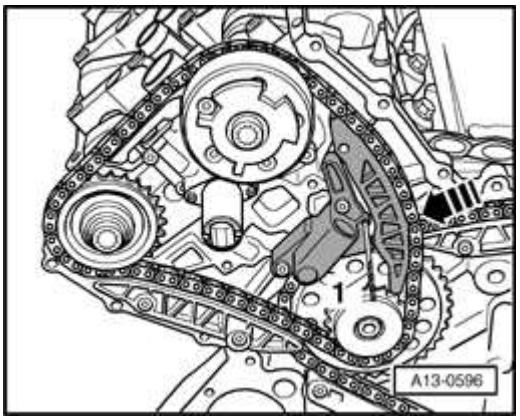


Fig. 400: Pushing Glide Track Of Chain Tensioner For Left Timing Chain
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Push glide track of chain tensioner for left timing chain in direction of - **arrow** - and pull off chain tensioner using a drill bit - **1** - 3.3 mm in dia.

NOTE:

- **In the following illustration, the timing mechanism is depicted with covers completely removed.**

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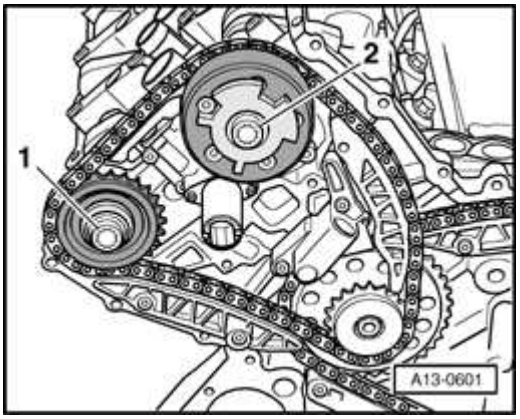


Fig. 401: Removing Bolts For Camshaft Chain Sprocket Or Camshaft Adjuster Using Multipoint Socket T10035
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts - **1** - and - **2** - for camshaft chain sprocket or camshaft adjuster using multipoint socket T10035.
- Remove camshaft chain sprocket and camshaft adjuster.

NOTE:

- **Camshaft timing chain remains on engine.**
- **Also, if only one of the two cylinder heads is removed, bolts for camshaft gears must be loosened at both cylinder heads.**

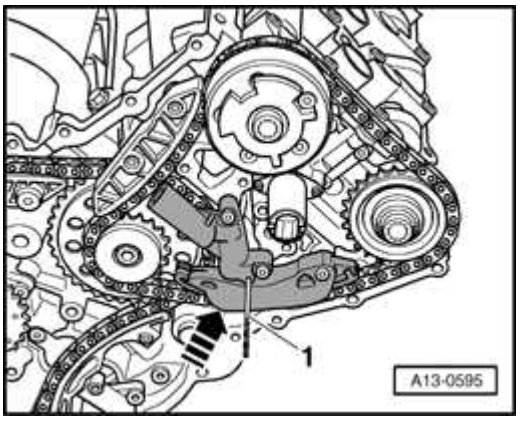


Fig. 402: Pushing Glide Track Of Chain Tensioner For Right Timing Chain
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Push glide track of chain tensioner for right timing chain in direction of - **arrow** - and pull off chain tensioner using a drill bit - **1** - 3.3 mm in dia.

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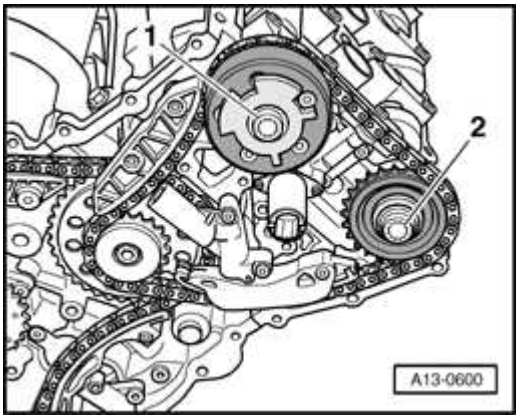


Fig. 403: Removing Bolts For Camshaft Chain Sprocket Or Camshaft Adjuster Using Multipoint Socket T10035
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts - **1** - and - **2** - for camshaft chain sprocket or camshaft adjuster using multipoint socket T10035.
- Remove camshaft chain sprocket and camshaft adjuster.

NOTE:

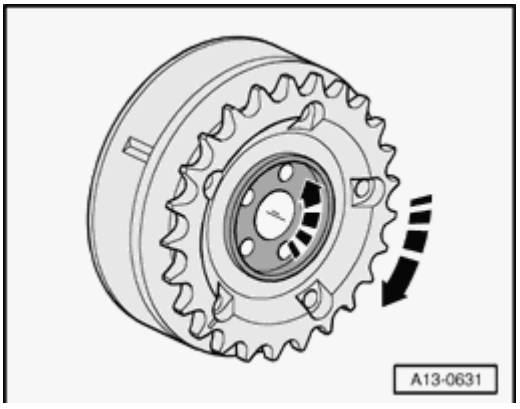
- **Camshaft timing chain remains on engine.**
- **Also, if only one of the two cylinder heads is removed, bolts for camshaft gears must be loosened at both cylinder heads.**

Installing

- Secure crankshaft in TDC position using Crankshaft Holder 3242.

NOTE:

- **Always replace bolts that are tightened to torque as well as O-rings and gaskets.**
- **When turning camshaft, crankshaft must not be at TDC for any cylinder. Valves and/or pistons may be damaged.**
- **During installation, all cable ties must be re-installed at the same location.**



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Fig. 404: Rotating Inner Part And Outer Part Of Both Camshaft Adjusters Against Each Other Up To Lock Position
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Rotate inner part and outer part of both camshaft adjusters against each other up to lock position - **arrows** -.

- Inner part and outer part must not be able to be against each other in lock position (slight play can still be felt).

- Check whether camshafts of both cylinder heads stand in TDC position.

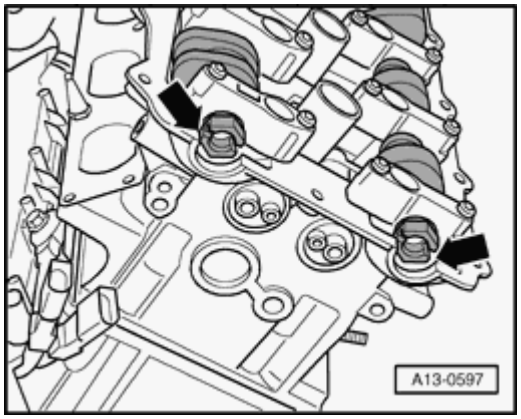


Fig. 405: Identifying Slits At Front In Camshafts Stand Parallel At Same Height With Upper Edge Of Cylinder Head
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Slits - **arrows** - at front in camshafts must stand parallel at same height with upper edge of cylinder head.

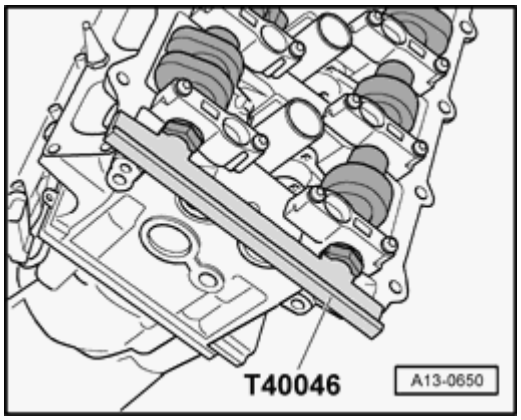


Fig. 406: Removing/Installing Camshaft Locator T40046
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Insert camshaft locator T40046 into camshafts of left cylinder head, to do so rotate camshafts back and forth at hex head if necessary.

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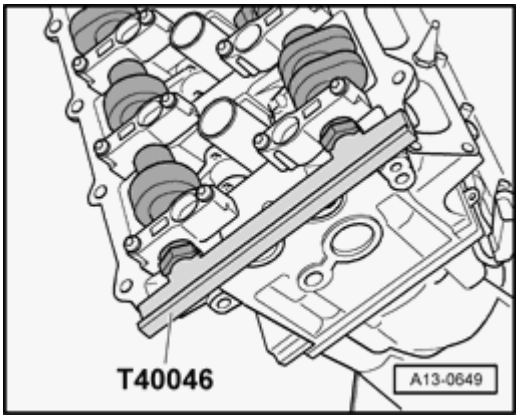


Fig. 407: Removing/Inserting Camshaft Locator T40046 From/Into Camshafts Of Right Cylinder Head
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Insert camshaft locator T40046 into camshafts of right cylinder head, to do so rotate camshafts back and forth at hex head if necessary.
- Replace all four camshaft bolts.
- Replace diamond disc between camshaft and left cylinder head camshaft adjuster.
- Assemble left timing chain with chain sprocket and camshaft adjuster.

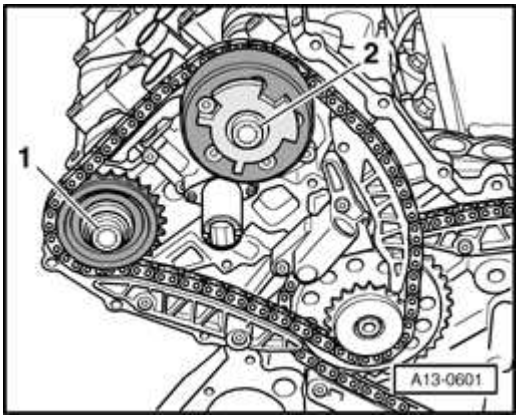


Fig. 408: Removing Bolts For Camshaft Chain Sprocket Or Camshaft Adjuster Using Multipoint Socket T10035
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Loosely install bolts - **1** - and - **2** -.

- Chain sprocket and camshaft adjuster must be able to still be rotated on camshaft and must not tip.

- Replace diamond disc between camshafts and right cylinder head camshaft adjuster.
- Assemble right timing chain with chain sprocket and camshaft adjuster.

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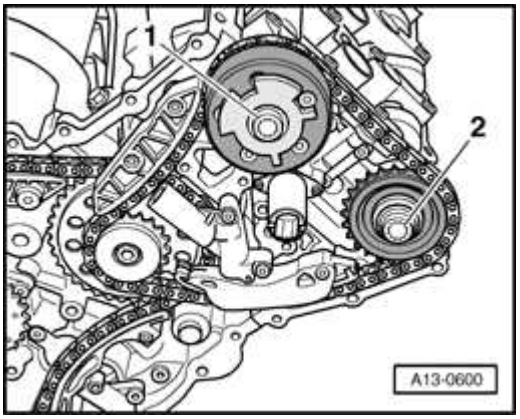


Fig. 409: Removing/Installing Bolts For Camshaft Chain Sprocket Or Camshaft Adjuster Using Multipoint Socket T10035
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Loosely install bolts - **1** - and - **2** -.

- Chain sprocket and camshaft adjuster must be able to still be rotated on camshaft and must not tip

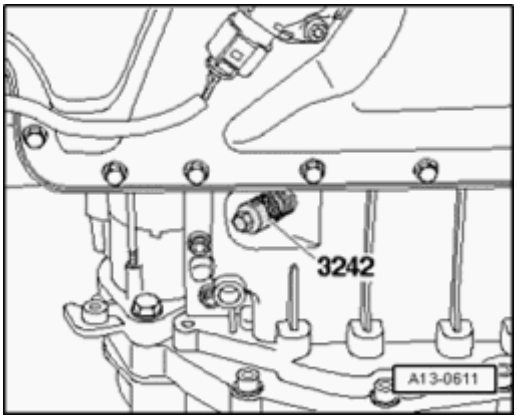


Fig. 410: Removing/Installing Crankshaft Holder 3242 Into Hole
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove Crankshaft Holder 3242.

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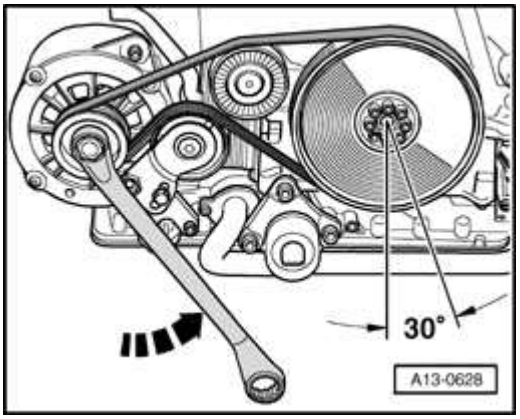


Fig. 411: Rotating Crankshaft 30 ° In Opposite Direction Of Engine Rotation
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Rotate crankshaft 30 ° in opposite direction of engine rotation - **arrow** -.
- Pull drill out of alignment hole, which loosens left chain tensioner.

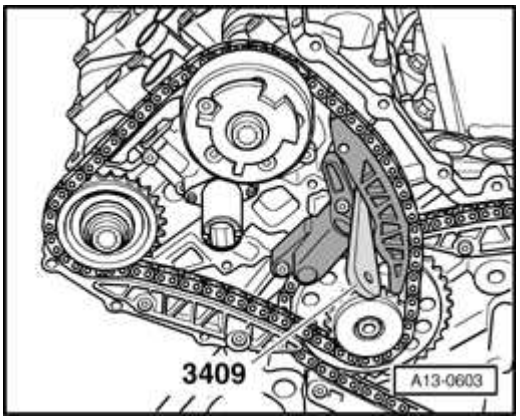


Fig. 412: Inserting Trim Removal Wedge 3409
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Insert trim removal wedge 3409 as shown in illustration and bring chain tensioner into contact with trim removal wedge 3409.

- Lightly pressing in an extra 0.5 mm is permitted.

- Pull drill out of alignment hole, which loosens right chain tensioner.

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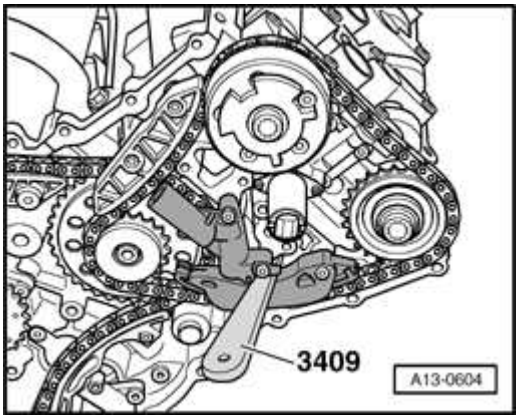


Fig. 413: Insert Trim Removal Wedge 3409
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Insert trim removal wedge 3409 as shown in illustration and bring chain tensioner into contact with trim removal wedge 3409.

- Lightly pressing in an extra 0.5 mm is permitted.

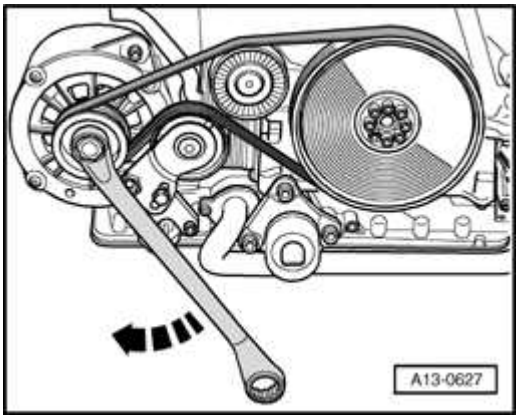


Fig. 414: Rotating Crankshaft To TDC Ignition Timing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Rotate crankshaft in direction of engine rotation - **arrow** - to TDC ignition timing.

NOTE:

- **If rotated unintentionally beyond TDC, turn back crankshaft again approx. 30 ° and set to TDC again.**

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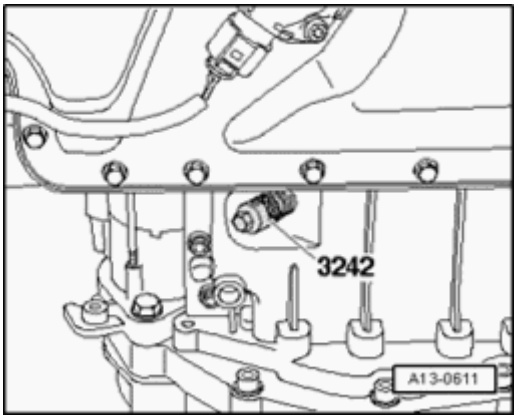


Fig. 415: Removing/Installing Crankshaft Holder 3242 Into Hole
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Install Crankshaft Holder 3242 into hole (20 Nm), if necessary rotate crankshaft very slightly back and forth to completely center holder.

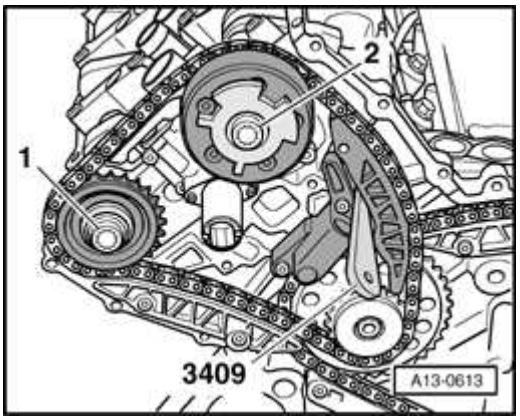


Fig. 416: Tightening Camshaft Bolt On Exhaust Camshaft Of Left Cylinder Head To Initial Tightening Torque
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Tighten camshaft bolt - **1** - on exhaust camshaft of left cylinder head to initial tightening torque.

- Torque specification: 40 Nm.

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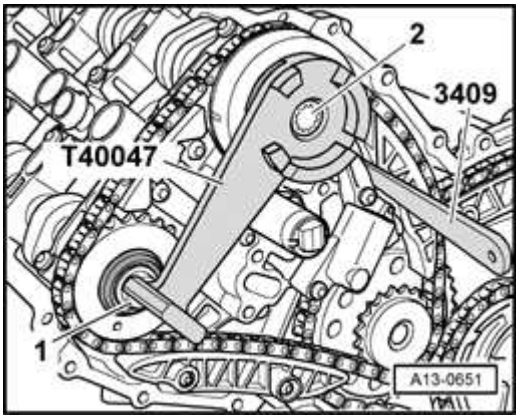


Fig. 417: Securing Hall Sensor Wheel On Camshaft Adjuster Of Intake Camshaft Of Left Cylinder Head Using Setting Gauge T40047
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Secure Hall sensor wheel on camshaft adjuster of intake camshaft of left cylinder head using setting gauge T40047.
- Place setting gauge on bolt - **1** -.
- Tighten camshaft bolt - **2** - on intake camshaft to initial tightening torque.

- Torque specification: 40 Nm.

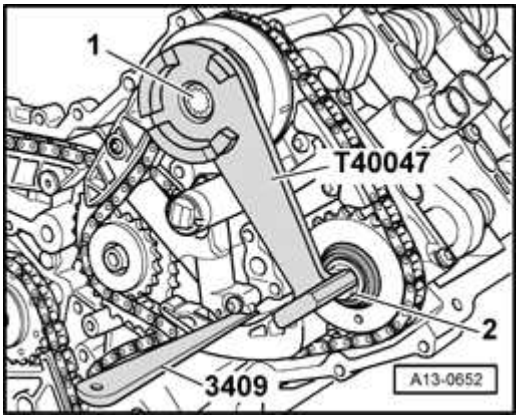


Fig. 418: Securing Hall Sensor Wheel On Camshaft Adjuster Of Intake Camshaft Of Right Cylinder Head Using Setting Gauge T40047
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Secure Hall sensor wheel on camshaft adjuster of intake camshaft of right cylinder head using setting gauge T40047.
- Place setting gauge on bolt - **2** -.
- Tighten camshaft bolt - **1** - on intake camshaft to initial tightening torque.

- Torque specification: 40 Nm.

- Remove setting gauge.

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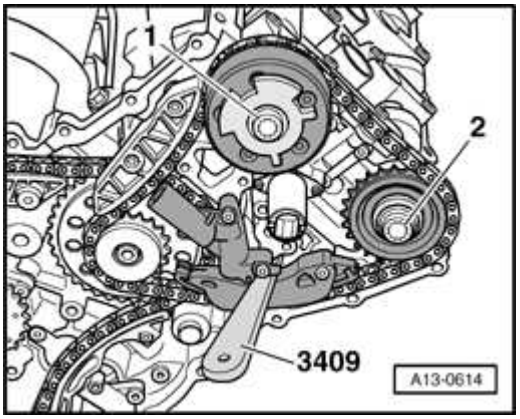


Fig. 419: Tightening Camshaft Bolt On Exhaust Camshaft Of Right Cylinder Head To Initial Tightening Torque
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Tighten camshaft bolt - **2** - on exhaust camshaft of right cylinder head to initial tightening torque.
- Torque specification: 40 Nm.

NOTE:

- **Camshaft locators must not be used as counter holder for final tightening of camshaft bolts.**

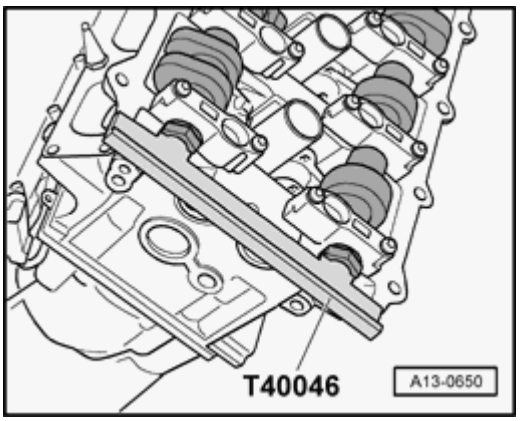


Fig. 420: Removing/Installing Camshaft Locator T40046
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove camshaft locators T40046 on both cylinder heads.

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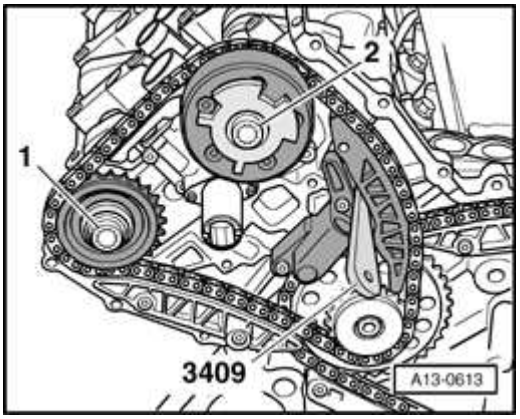


Fig. 421: Tightening Camshaft Bolt On Exhaust Camshaft Of Left Cylinder Head To Initial Tightening Torque
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Tighten camshaft bolt - **1** - on exhaust camshaft of left cylinder head to final tightening torque.

- Torque specification: 100 Nm plus an additional ($^{1}/_{4}$ turn (90 °).

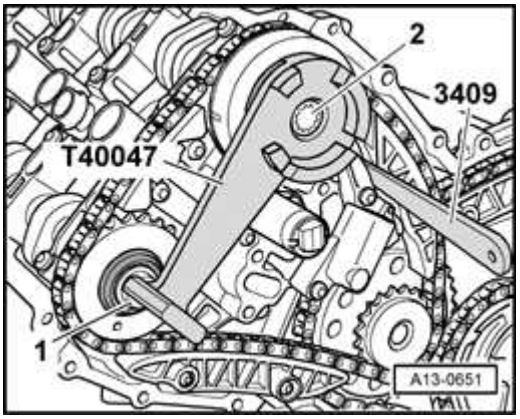


Fig. 422: Securing Hall Sensor Wheel On Camshaft Adjuster Of Intake Camshaft Of Left Cylinder Head Using Setting Gauge T40047
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Secure Hall sensor wheel on camshaft adjuster of intake camshaft of left cylinder head using setting gauge T40047.
- Place locator on bolt - **1** -.
- Tighten camshaft bolt - **2** - on intake camshaft to final tightening torque.

- Torque specification: 100 Nm plus an additional ($^{1}/_{4}$ turn (90 °).

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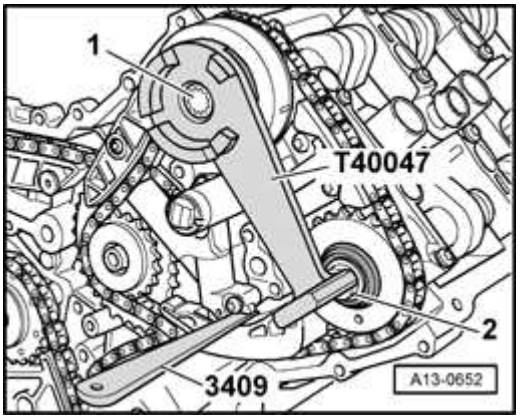


Fig. 423: Securing Hall Sensor Wheel On Camshaft Adjuster Of Intake Camshaft Of Right Cylinder Head Using Setting Gauge T40047
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Secure Hall sensor wheel on camshaft adjuster of intake camshaft of right cylinder head using setting gauge T40047.
- Place setting gauge T40047 on bolt - **2** -.
- Tighten camshaft bolt - **1** - on intake camshaft to final tightening torque.

- Torque specification: 100 Nm plus an additional ($^{1}/_{4}$ turn (90 °).

- Remove setting gauge T40047.

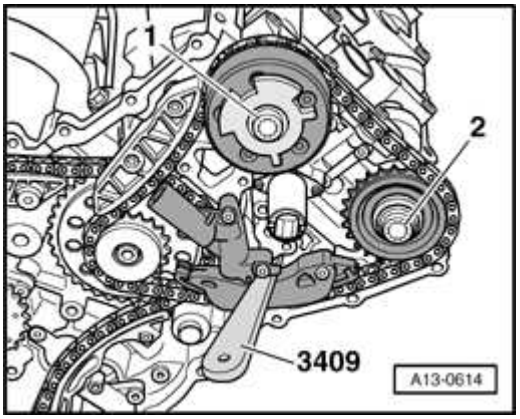


Fig. 424: Tightening Camshaft Bolt On Exhaust Camshaft Of Right Cylinder Head To Initial Tightening Torque
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Tighten camshaft bolt - **2** - on exhaust camshaft of right cylinder head to final tightening torque.

- Torque specification: 100 Nm plus an additional ($^{1}/_{4}$ turn (90 °).

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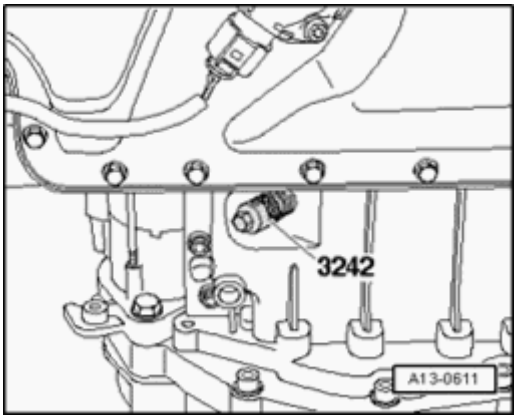


Fig. 425: Removing/Installing Crankshaft Holder 3242 Into Hole
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove Crankshaft Holder 3242.

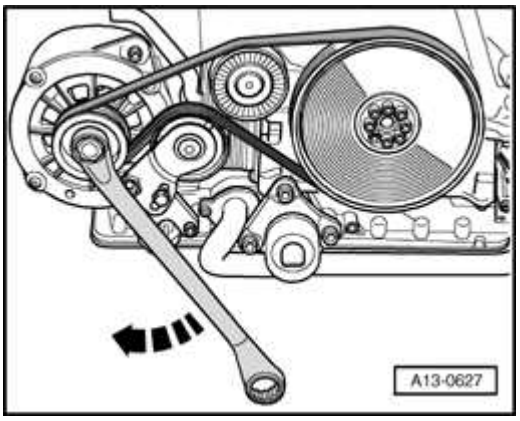


Fig. 426: Rotating Crankshaft To TDC Ignition Timing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Turn crankshaft two complete rotations in direction of engine rotation - **arrow** - until crankshaft stands at TDC again.

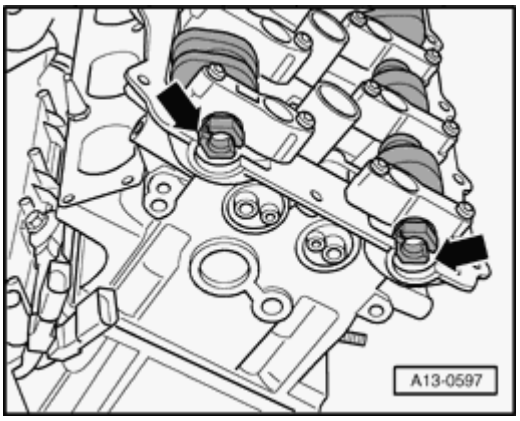


Fig. 427: Identifying Slits At Front In Camshafts Stand Parallel At Same Height With Upper Edge Of

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Cylinder Head
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Slits - **arrows** - at front in camshafts must stand parallel at same height with upper edge of cylinder head.

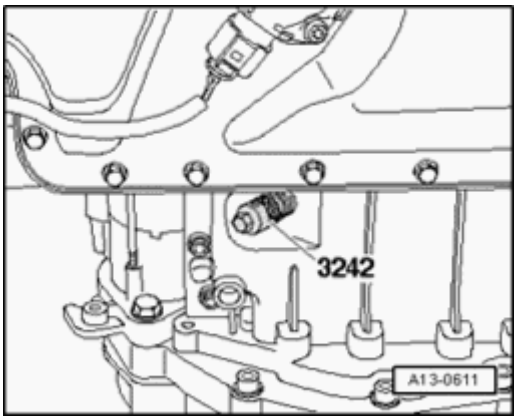


Fig. 428: Removing/Installing Crankshaft Holder 3242 Into Hole
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Install Crankshaft Holder 3242 into hole (20 Nm), if necessary rotate crankshaft very slightly back and forth to completely center holder.

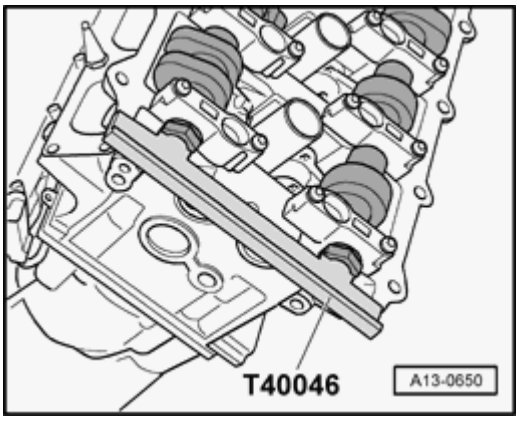


Fig. 429: Removing/Installing Camshaft Locator T40046
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Insert camshaft locator T40046 into camshafts of left cylinder head.

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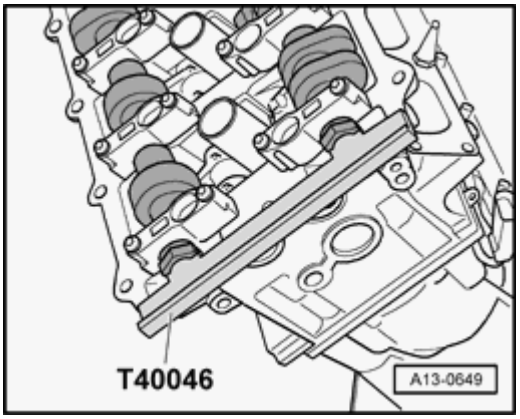


Fig. 430: Removing/Inserting Camshaft Locator T40046 From/Into Camshafts Of Right Cylinder Head
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Insert camshaft locator T40046 into camshafts of right cylinder head.

If camshaft locators cannot be inserted:

- Repeat adjustment.
- Pull out trim removal wedge 3409.
- Remove camshaft locator T40046 on both cylinder heads.
- Remove Crankshaft Holder 3242.

- Install sealing plug of TDC marking with new sealing ring into upper section of oil pan.

The rest of installation is in reverse order of removal, note the following:

- Install covers for timing chains **Installing**.
- Install engine: Vehicles with manual transmission --> **Engine (vehicles with manual transmission), installing** , vehicles with automatic transmission --> **Engine (vehicles with automatic transmission), installing**.
- Add engine oil and check oil level --> **Oil level, checking**.

Torque specifications

Component	Nm
Camshaft bolts	100 plus an additional 90 ° * See note
Sealing plug in upper section of oil pan	35
Oil drain plug	50

* 90 ° corresponds to one quarter rotation.

*Replace bolts.

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Drive chain for timing mechanism - component overview

NOTE:

- **Before removing timing chain, mark direction of travel with paint. Reversing the rotation direction of a used chain can destroy it.**

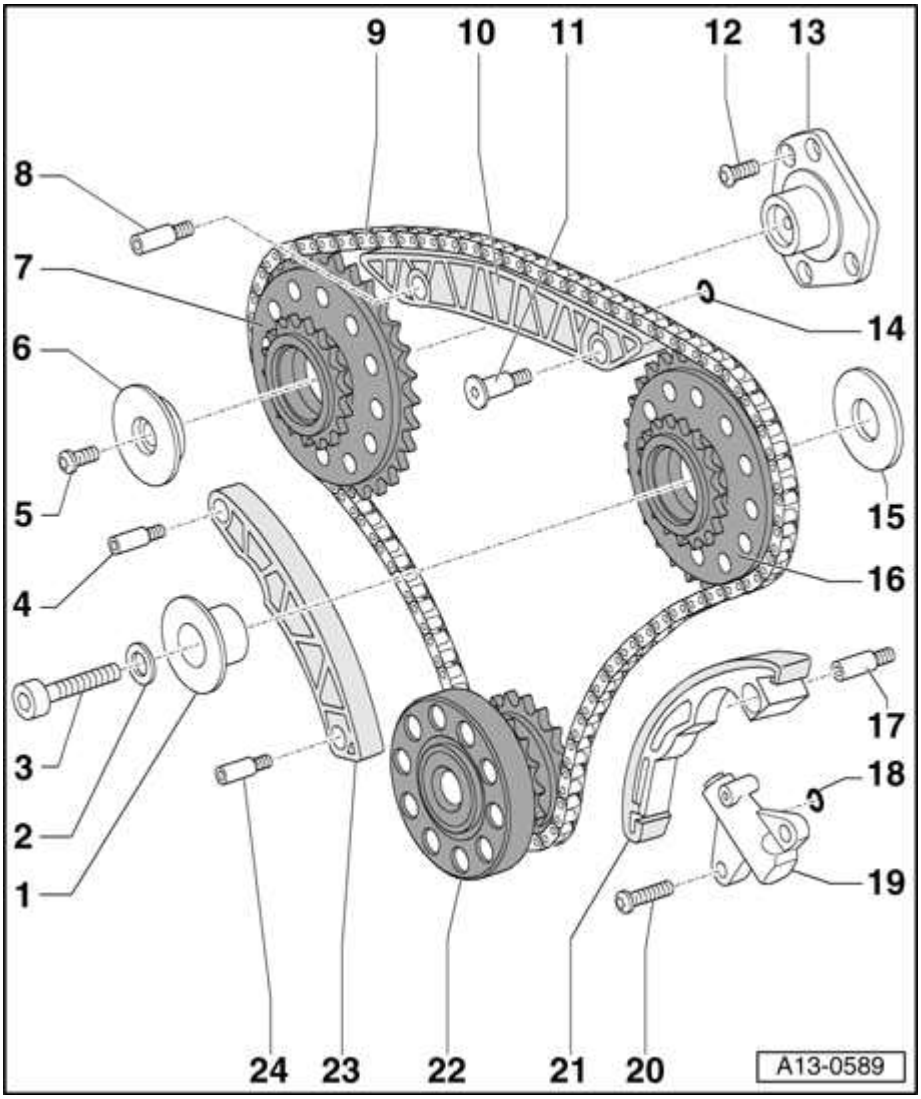


Fig. 431: Drive Chain For Timing Mechanism - Component Overview
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Pivot pin for drive sprocket

2 - Washer

3 - 42 Nm

4 - Pivot pin -10 Nm

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5 - 5 Nm plus an additional ($^{1}/_{4}$ turn (90 °).

- Replace

6 - Thrust washer for drive sprocket

7 - Drive sprocket for left timing chain

8 - Pivot pin -10 Nm

9 - Drive chain for timing mechanism

10 - Guide rail

11 - Pivot pin -10 Nm

12 - 10 Nm

13 - Mounting bracket for drive sprocket

14 - O-ring

- Replace

15 - Thrust washer

16 - Drive sprocket for right timing chain

17 - Pivot pin -10 Nm

18 - O-ring

- Replace

19 - Chain tensioner

20 - 10 Nm

21 - Glide track for chain tensioner

22 - Crankshaft

23 - Guide rail

24 - Pivot pin -10 Nm

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Drive chain for timing mechanism, removing and installing

Removing

- Remove camshaft timing chains --> **Camshaft timing chain, removing and installing**.
- Remove chain for power take-off --> **Chain for power take-off, removing and installing**.

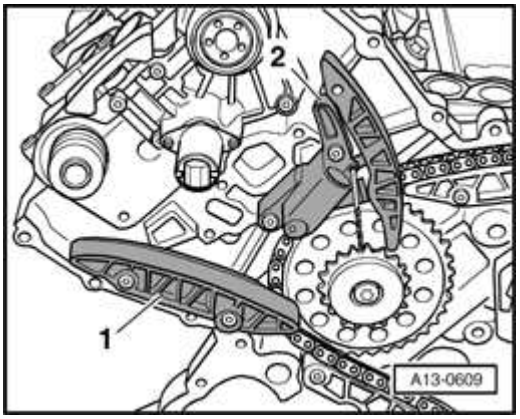


Fig. 432: Removing Glide Track At Left Cylinder Head & Chain Tensioner
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove glide track - **1** - at left cylinder head.
- Remove chain tensioner - **2** -.

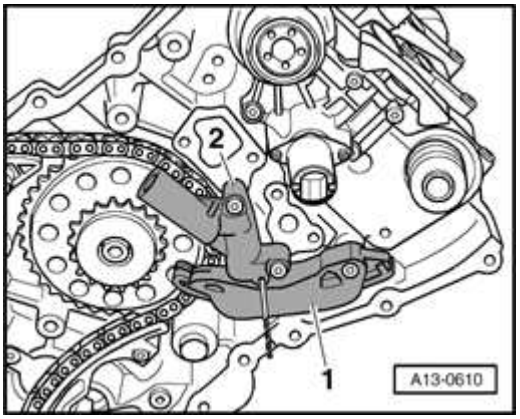


Fig. 433: Removing Glide Track At Right Cylinder Head
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove glide track - **1** - at right cylinder head.
- Remove chain tensioner - **2** -.

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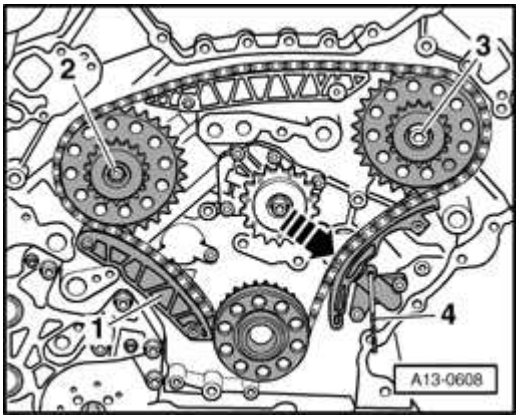


Fig. 434: Pushing Glide Track Of Chain Tensioner For Chain Drive And Pull
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Push glide track of chain tensioner for chain drive in direction of - **arrow** - and pull off chain tensioner using a drill bit - **4** - 3.3 mm dia.
- Mark running direction of timing chain with paint.
- Remove bolts - **2** - and - **3** - and remove chain sprockets with drive chain and glide track - **1** -.

Installing

Installation is in reverse order of removal, note the following:

NOTE:

- **Replace bolts which have been tightened to torque.**

- Install chain for power take-off --> **Chain for power take-off, removing and installing**.
- Install camshaft timing chains **Installing**.

Torque specifications

Component	Nm
Left drive sprocket to mounting bracket	5 plus an additional 90 ° * See note
Right drive sprocket to cylinder block	42
Chain tensioner for left camshaft timing chain to cylinder head	5 plus an additional 90 ° * See note
Chain tensioner for right camshaft timing chain to cylinder head	5 plus an additional 90 ° * See note

*Replace bolts.

* 90 ° corresponds to one quarter turn.

Chain for power take-off, component overview

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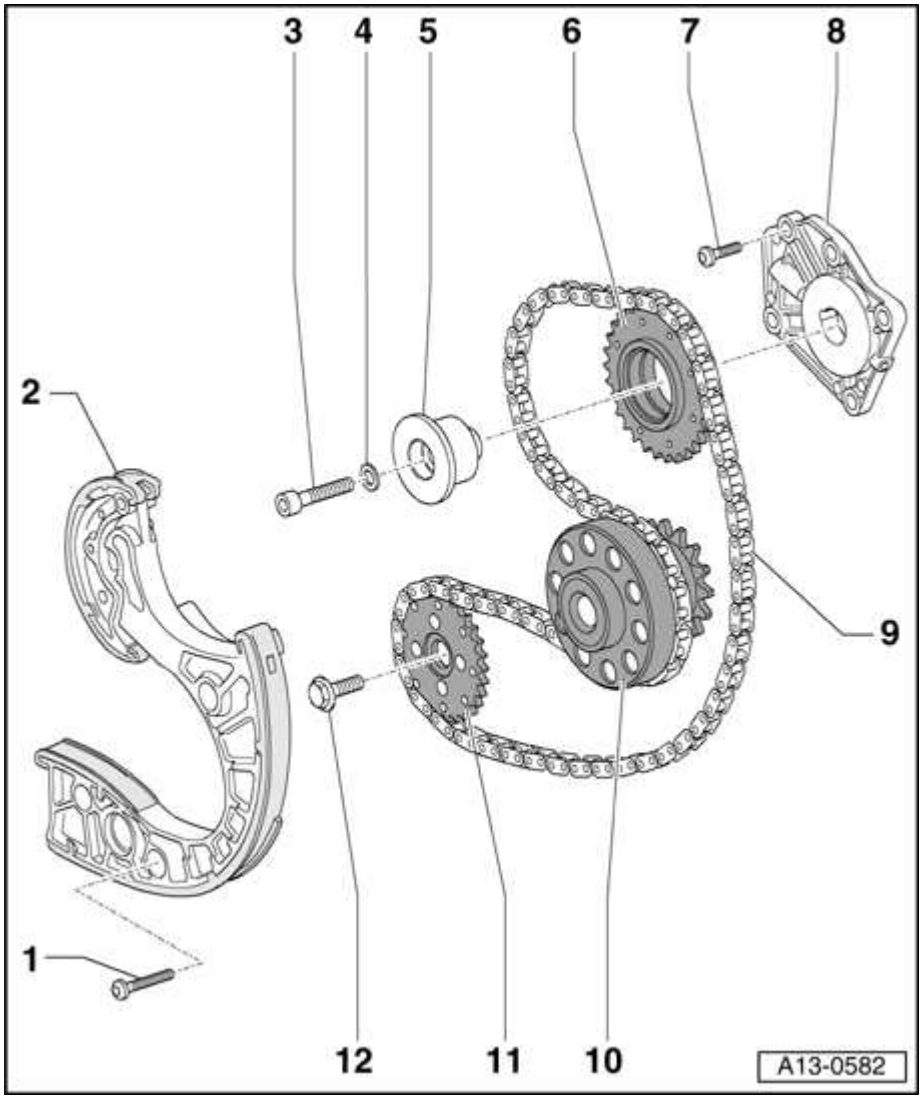


Fig. 435: Identifying Special Tools - Chain For Power Take-Off, Component Overview
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - 10 Nm

2 - Chain tensioner

- With glide track

3 - 42 Nm

4 - Washer

5 - Pivot pin for idler sprocket

6 - Idler sprocket for chain for power take-off

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7 - 10 Nm

8 - Mounting bracket for idler chain sprocket

9 - Chain for power take-off

- Removing and installing --> **Chain for power take-off, removing and installing**

10 - Crankshaft

11 - Drive sprocket for power take-off

12 - 62 Nm

Chain for power take-off, removing and installing

Special tools, testers and auxiliary items required

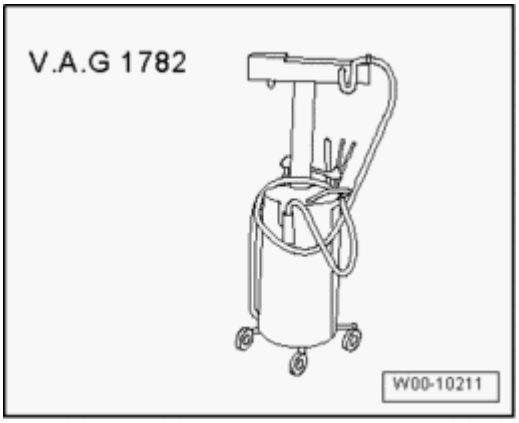


Fig. 436: Identifying Old Oil Collecting And Extracting Device V.A.G 1782
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Old oil collecting and extracting device V.A.G 1782

Removing

- Place old oil collecting and extracting device V.A.G 1782 under engine and drain engine oil.
- Remove engine: Vehicles with manual transmission --> **Engine (vehicles with manual transmission)** , vehicles with automatic transmission --> **Engine (vehicles with automatic transmission), removing**.
- Disconnect engine and transmission: Vehicles with manual transmission --> **Engine (vehicles with manual transmission), separating** , vehicles with automatic transmission --> **Engine and transmission (vehicles with automatic transmission), separating**.
- Leave engine on Scissor Lift Table VAS 6131 A or secure engine to engine and transmission holder: Vehicles with manual transmission --> **Engine (vehicles with manual transmission), securing to engine and transmission holder** , vehicles with automatic transmission --> **Engine (vehicles with**

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automatic transmission), securing to assembly stand.

- Remove covers for timing chains --> **Timing chain covers (All), removing and installing**.

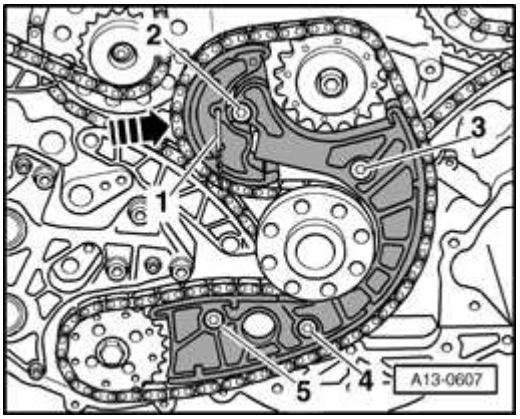


Fig. 437: Pushing Glide Track Of Chain Tensioner and Pull Off Chain Tensioner Using Drill Bit
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Push glide track of chain tensioner in direction of - **arrow** - and pull off chain tensioner using a drill bit - **1** - 3.3 mm dia.

NOTE:

- **If chain sprocket for power take-off is to be removed, mounting bolt must be loosened before removing chain.**

- Mark running direction of chain for power take-off with paint.
- Remove bolts - **2 to 5** - and remove chain tensioner.
- Remove chain for power take-off.

Installing

Installation is in reverse order of removal, note the following:

- First install chain for power take-off.
- Install chain tensioner starting at top on engine.
- Install covers for timing chains **Installing**.
- Install engine: Vehicles with manual transmission --> **Engine (vehicles with manual transmission), installing** , vehicles with automatic transmission --> **Engine (vehicles with automatic transmission), installing**.

- Add engine oil and check oil level --> **Oil level, checking**.

Torque specifications

Component	Nm

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Chain tensioner on cylinder block	10
Oil drain plug	50

Power take-off, component overview

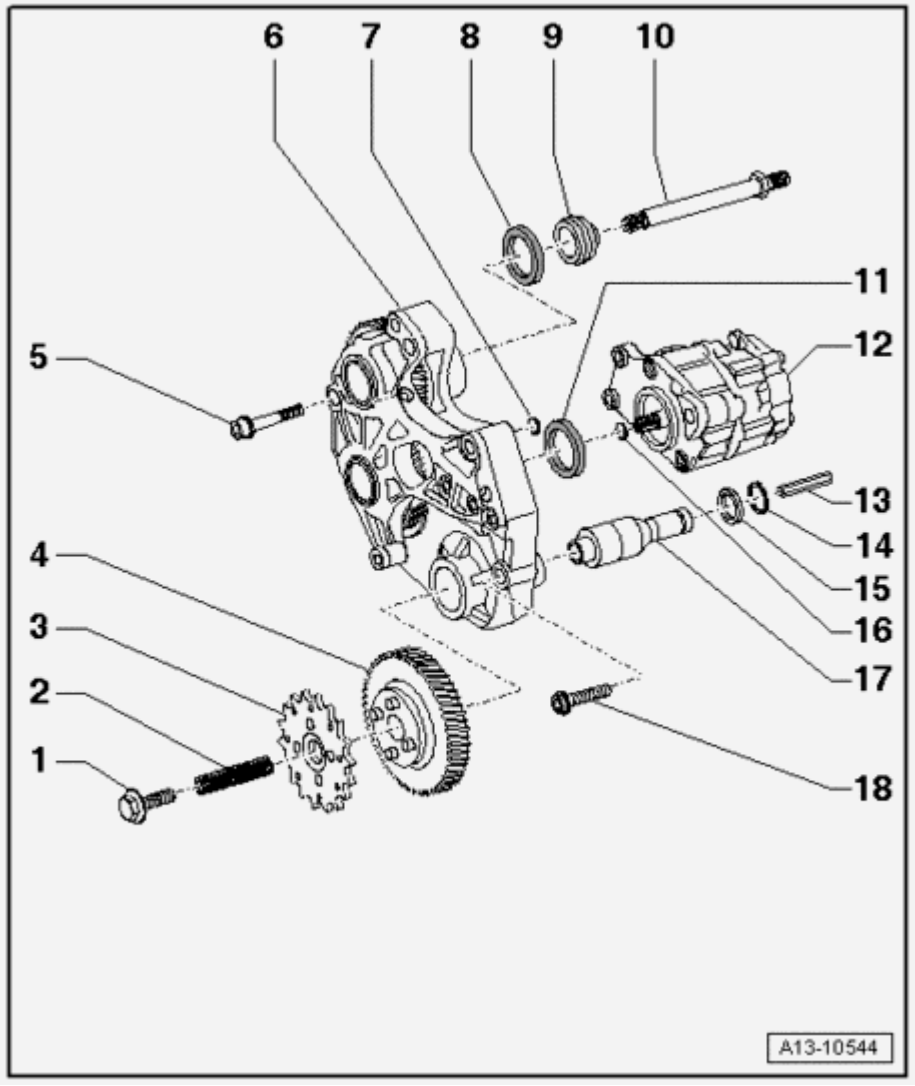


Fig. 438: Power Take-Off, Component Overview
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - 62 Nm

2 - Spring

3 - Drive sprocket

- For power take-off

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4 - Drive spur gear

- For power take-off

5 - 22 Nm

6 - Spur gear unit

7 - O-ring

- Replace

8 - Seal

- For A/C compressor drive
- Replacing --> **Power take-off seals, replacing**.

9 - Protective dust cap

- For A/C compressor drive

10 - Input shaft

- For air conditioning compressor
- Tighten to 60 Nm

11 - Seal

- For power steering pump drive
- Replacing --> **Power take-off seals, replacing**.

12 - Power-steering pump

13 - Input shaft

- For oil pump

14 - Circlip

15 - Thrust washer

16 - O-ring

- Replace

17 - Shaft for drive spur gear

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18 - Bolt -22 Nm

Power take-off seals, replacing

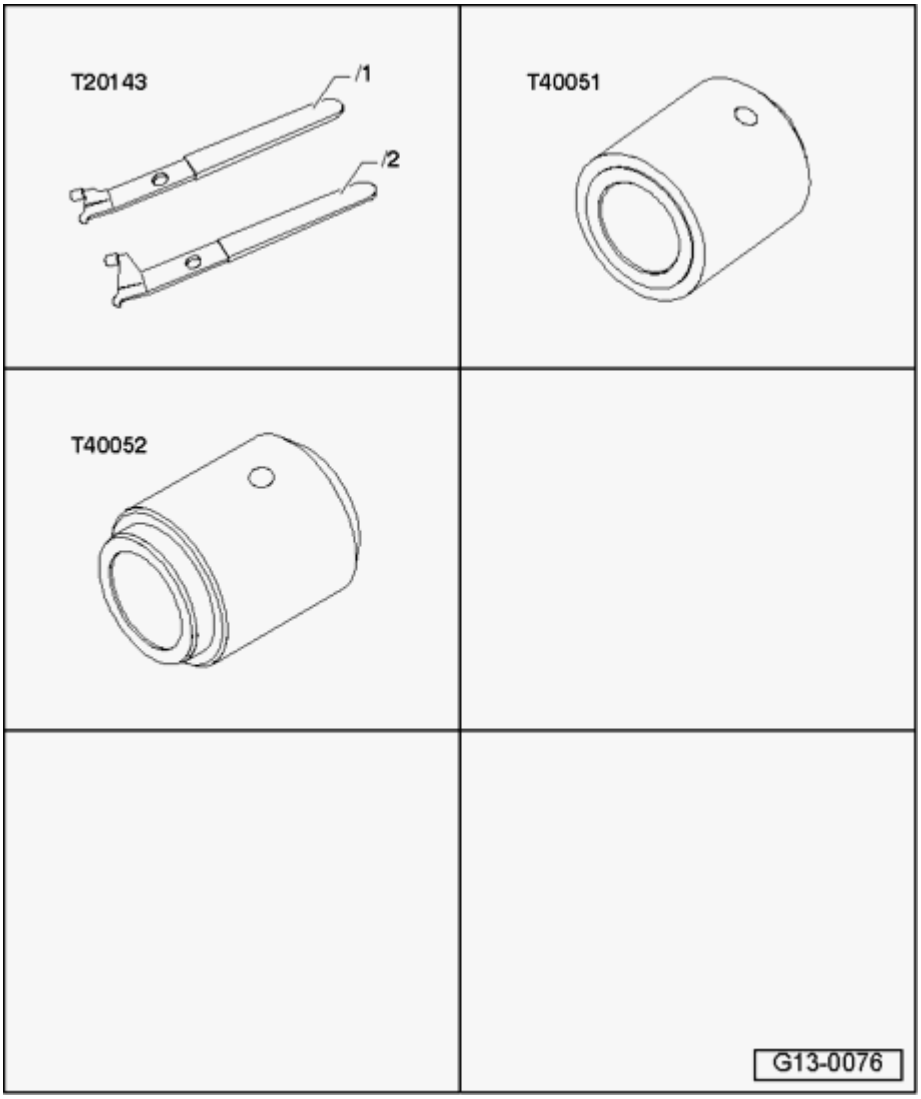


Fig. 439: Identifying Special Tools - Power Take-Off Seals, Replacing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools, testers and auxiliary items required

- Pulling Hook T20143
- Pressure piece T40051
- Pressure piece T40052

Work procedure

- Remove air conditioning compressor --> **87 AIR CONDITIONING** .

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- Remove power steering pump --> **48 - STEERING** .

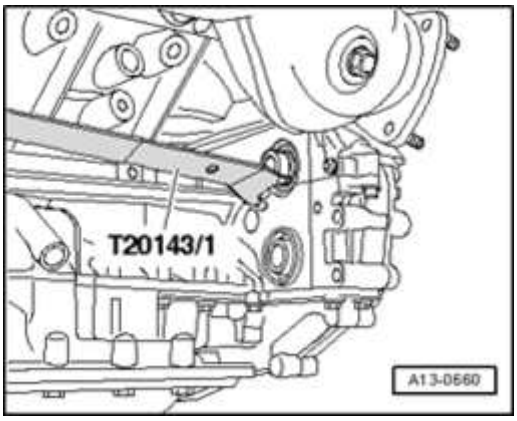


Fig. 440: Prying Out Sealing Ring For A/C Compressor Drive Using Pulling Hook T20143/1
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Pry out sealing ring for A/C compressor drive using pulling hook T20143/1.

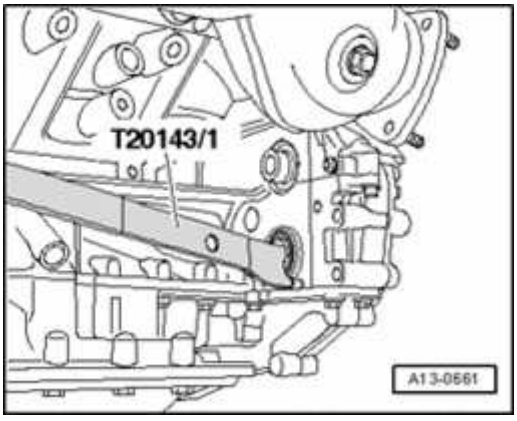
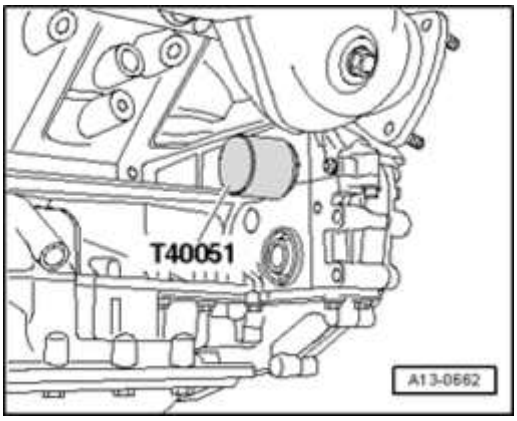


Fig. 441: Prying Out Power-Steering Pump Drive Seal Using Pulling Hook T20143/1
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Pry out power-steering pump drive seal using pulling hook T20143/1.



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Fig. 442: Driving In Sealing Ring For A/C Compressor Drive Using Thrust Piece T40051
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Drive in sealing ring for A/C compressor drive using thrust piece T40051.

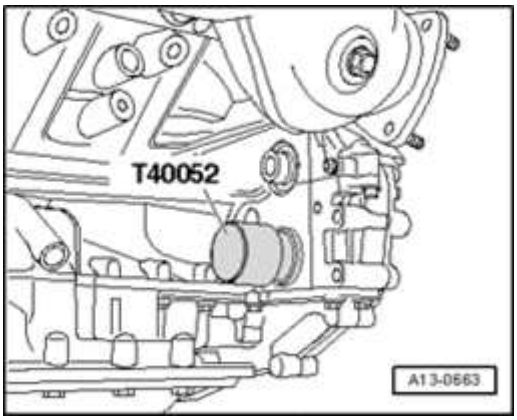


Fig. 443: Driving In Sealing Ring For Power-Steering Pump Drive Using Thrust Piece T40052
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Drive in sealing ring for power-steering pump drive using thrust piece T40052.

The rest of installation is in reverse order of removal, note the following:

- Install the power steering pump --> **48 - STEERING** .
- Install A/C compressor --> **87 AIR CONDITIONING** .

Spur gear unit, removing and installing

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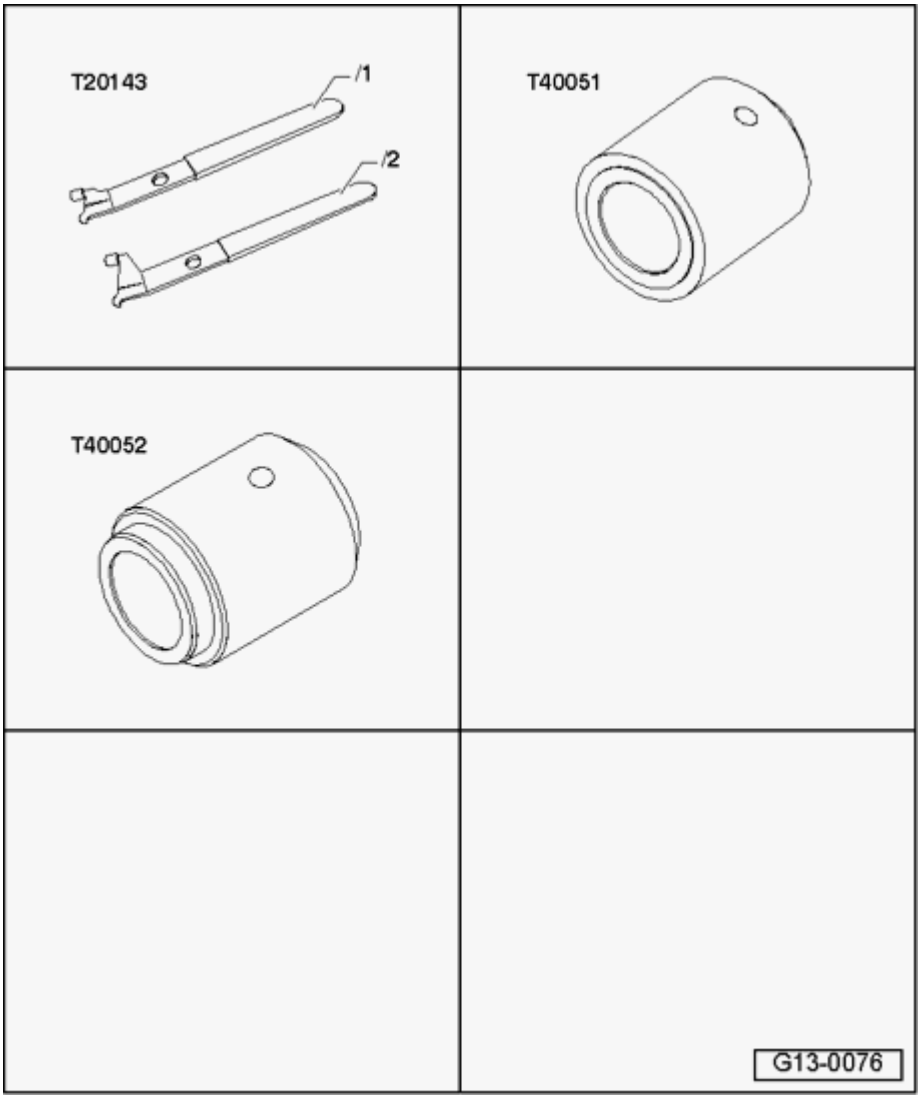


Fig. 444: Identifying Special Tools - Spur Gear Unit, Removing And Installing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools, testers and auxiliary items required

- Pulling Hook T20143
- Pressure piece T40051
- Pressure piece T40052
- Sealant

Special tools, testers and auxiliary items required

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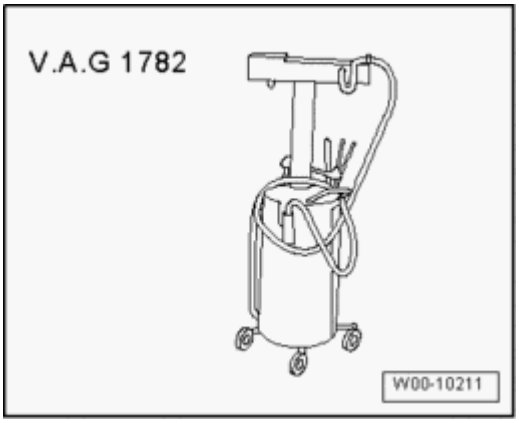


Fig. 445: Identifying Old Oil Collecting And Extracting Device V.A.G 1782
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Old oil collecting and extracting device V.A.G 1782
- Hand drill with plastic brush attachment
- Protective glasses
- Sealant

Removing

- Place old oil collecting and extracting device V.A.G 1782 under engine and drain engine oil.
- Remove engine: Vehicles with manual transmission --> **Engine (vehicles with manual transmission)** , vehicles with automatic transmission --> **Engine (vehicles with automatic transmission), removing**.
- Disconnect engine and transmission: Vehicles with manual transmission --> **Engine (vehicles with manual transmission), separating** , vehicles with automatic transmission --> **Engine and transmission (vehicles with automatic transmission), separating**.
- Leave engine on Scissor Lift Table VAS 6131 A or secure engine to engine and transmission holder: Vehicles with manual transmission --> **Engine (vehicles with manual transmission), securing to engine and transmission holder** , vehicles with automatic transmission --> **Engine (vehicles with automatic transmission), securing to assembly stand**.
- Remove covers for timing chains --> **Timing chain covers (All), removing and installing**.
- Remove power-steering pump from cylinder block.

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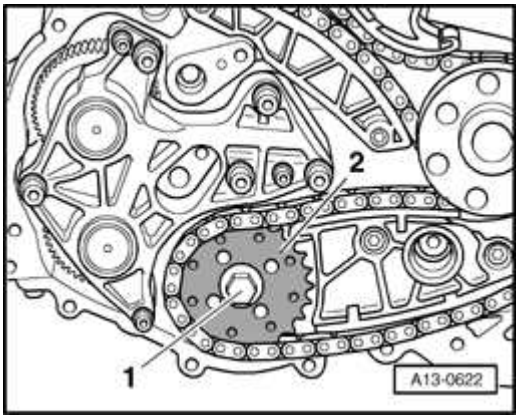


Fig. 446: Loosen Bolt On Drive Sprocket
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Loosen bolt - **1** - on drive sprocket - **2** - a few turns.
- Remove chain for power take-off --> **Chain for power take-off, removing and installing**.
- Remove drive sprocket for power take-off.

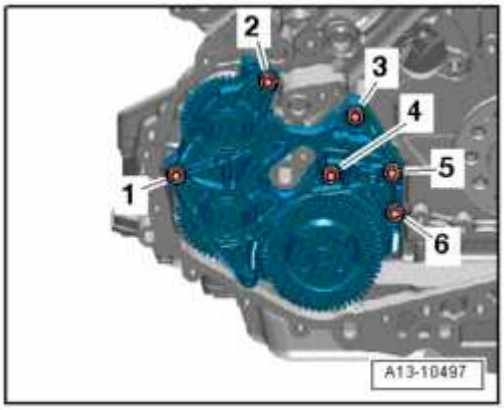


Fig. 447: Removing Bolts & Spur Gear Unit
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts - **1 to 6** -.
- Remove spur gear unit.

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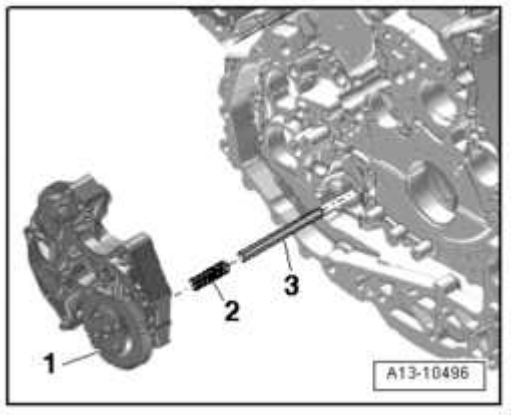


Fig. 448: Removing Compression Spring Between Spur Gear Unit And Oil Pump Input Shaft
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove compression spring - **2** - between spur gear unit - **1** - and oil pump input shaft - **3** -.

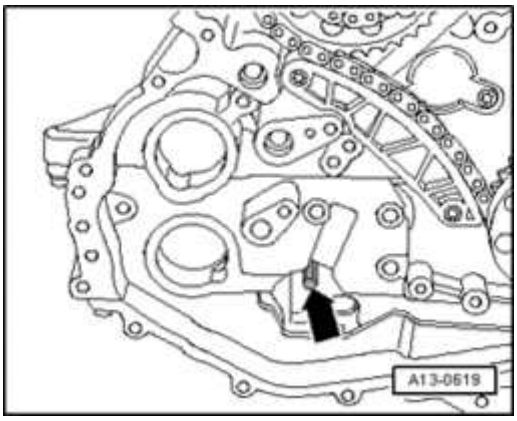


Fig. 449: Removing Drive Shaft For Oil Pump
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove drive shaft - **arrow** - for oil pump.

Installing

NOTE:

- **Replace seals and O-rings.**

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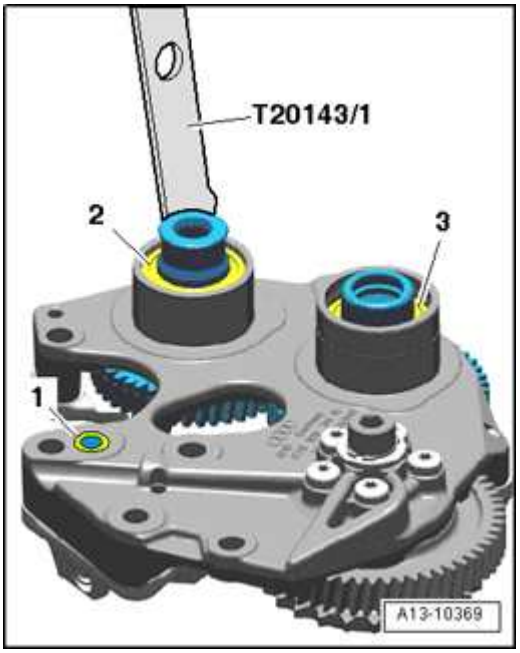


Fig. 450: Removing A/C Compressor Drive Seal And Power Steering Pump Drive Seal Using Pulling Hook T20143/1
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove A/C compressor drive seal - **2** - and power steering pump drive seal - **3** - using pulling hook T20143/1.
- Remove O-ring - **1** -.
- Remove sealant residue on spur gear unit and cylinder block.
- Clean sealing surfaces so they are completely free of any oil or grease.

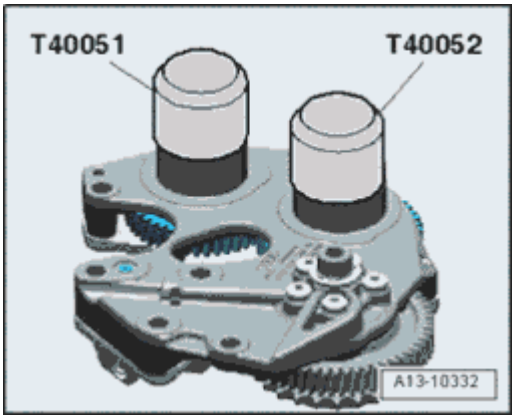


Fig. 451: Driving In Sealing Ring For A/C Compressor Drive Using Thrust Piece T40051 & Sealing Ring For Power-Steering Pump Drive Using Thrust Piece T40052
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Drive in sealing ring for A/C compressor drive using thrust piece T40051.
- Drive in sealing ring for power-steering pump drive using thrust piece T40052.

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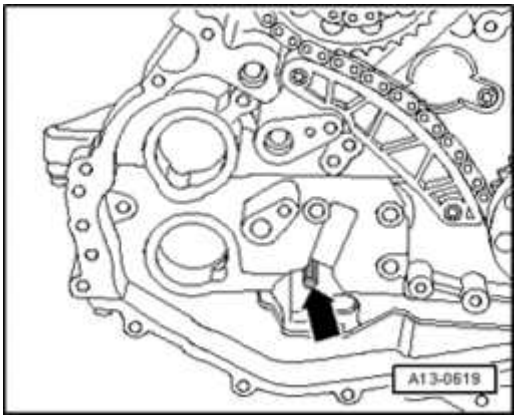


Fig. 452: Removing Drive Shaft For Oil Pump
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Insert drive shaft - **arrow** - for oil pump into guide on oil pump.

NOTE:

- **To guarantee that the drive shaft engages correctly in the oil pump, insert the drive shaft into the oil pump separately, do not install together with the front bearing cap.**

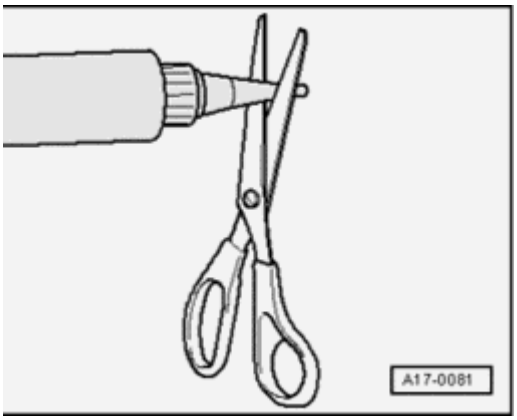


Fig. 453: Cutting Tube Nozzle At Front Marking
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Cut off nozzle on tube of sealant at front mark (dia. of nozzle approx. 1.5 mm).

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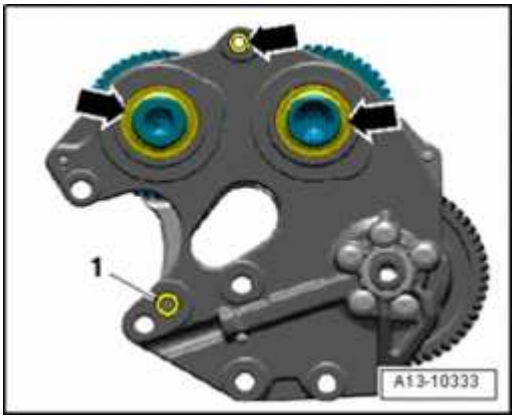


Fig. 454: Applying Sealant Beads To Clean Sealing Surfaces Of Spur Gear Unit
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Apply sealant beads - **arrows** - to clean sealing surfaces of spur gear unit as shown in illustration.
- Thickness of sealant beads: 2.0 mm.
- Position O-ring - **1** - and secure it with some grease.

NOTE:

- **The spur gear unit must be installed within 5 minutes after application of sealant.**

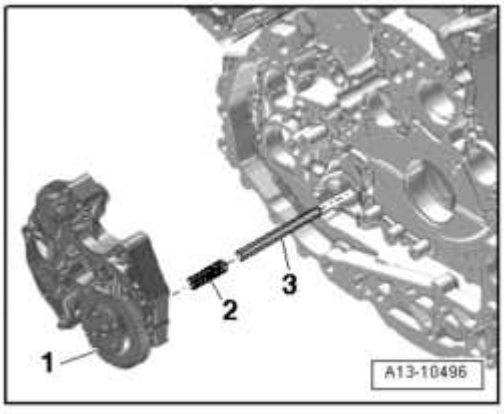


Fig. 455: Removing Compression Spring Between Spur Gear Unit And Oil Pump Input Shaft
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Position compress spring - **2** - for input shaft - **3** - in spur gear unit - **1** -.

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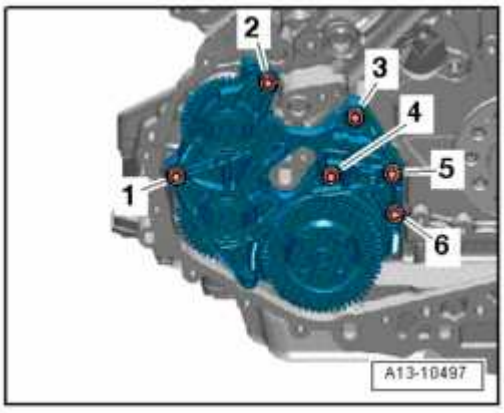


Fig. 456: Removing Bolts & Spur Gear Unit
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Position spur gear unit and tighten bolts - **1 to 6** - in a diagonal sequence in stages.

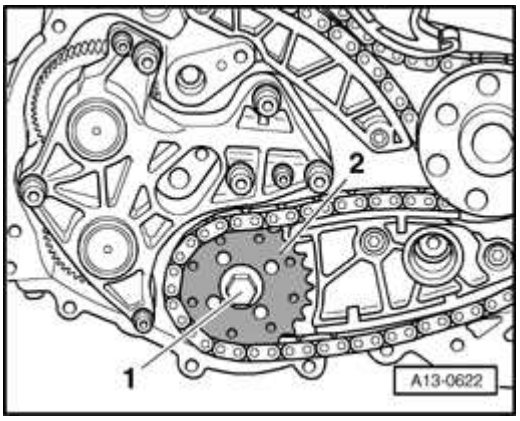


Fig. 457: Loosen Bolt On Drive Sprocket
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Hand tighten power take-off drive sprocket - **2** -.
- Install chain for power take-off --> **Chain for power take-off, removing and installing**.
- Tighten power take-off drive sprocket bolt - **1** -.
- Slide power steering pump with new O-ring onto spur gear for power-steering pump drive.

The rest of installation is in reverse order of removal, note the following:

- Install covers for timing chains **Installing**.
- Install engine: Vehicles with manual transmission --> **Engine (vehicles with manual transmission), installing** , vehicles with automatic transmission --> **Engine (vehicles with automatic transmission), installing**.
- Add engine oil and check oil level --> **Oil level, checking**.

Torque specifications

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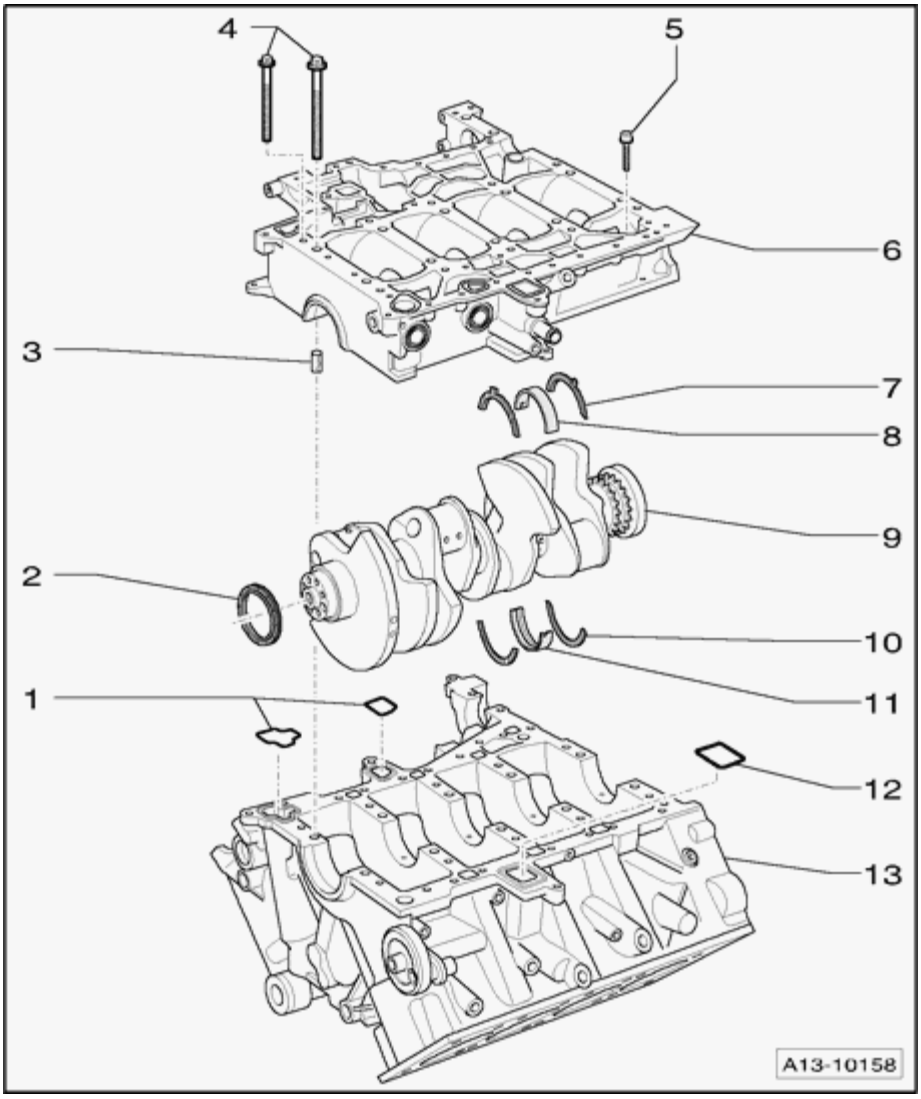
Component	Nm
Spur gear unit to cylinder block	22
Drive sprocket for power take-off to shaft	62
Oil drain plug	50

CRANKSHAFT, REMOVING AND INSTALLING

Crankshaft, component overview

NOTE:

- **To perform assembly work, secure engine with Holder for V8 Engine Audi S4, allroad quattro VAS 6095/1-6 or Holder for V8 Engine Audi S4, allroad quattro VAS 6095/1-6A to Engine and Transmission Holder VAS 6095 --> Engine (vehicles with automatic transmission), securing to assembly stand.**



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Fig. 458: Crankshaft, Component Overview
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Seals

- Replace

2 - Seal for crankshaft - ribbed belt side

- Replacing --> **Crankshaft seal (ribbed belt side), replacing**.

3 - Alignment bushing

- 3 pieces
- Insert into guide frame
- Installed location **Sealant applied on cylinder block (for guide frame)**

4 - Screws

- For guide frame
- Replace
- Different bolt sizes
- Tightening order **Installing guide frame**

5 - Bolt

- For sealing surfaces of cylinder block/guide frame
- Different bolt lengths
- Tightening order **Installing guide frame**

6 - Bearing bracket

- Sealant applied on cylinder block (for guide frame) **Sealant applied on cylinder block (for guide frame)**
- Tightening sequence for manifold mounting bolts **Installing guide frame**

7 - Thrust washer

- Only at 4th crankshaft bearing
- Lubricating grooves face outward
- Note locating point in guide frame
- Measuring crankshaft axial clearance --> **Axial clearance, measuring**

8 - Bearing shell

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- For guide frame without lubricating groove
- Do not interchange used bearing shells (mark)
- Insert new bearing shells for guide frame with proper color marking --> **Allocation of main bearing shells for new crankshafts** or --> **Allocation of main bearing shells for used and reworked crankshafts**

9 - Crankshaft

- Measuring axial play --> **Axial clearance, measuring**
- Radial clearance, measuring --> **Radial clearance, measuring**
- Do not turn crankshaft when measuring radial play
- Crankshaft dimensions --> **Crankshaft dimensions**

10 - Thrust washer

- Only at 4th crankshaft bearing
- Lubricating grooves face outward
- Measuring crankshaft axial clearance --> **Axial clearance, measuring**

11 - Bearing shell

- For cylinder block with oil groove
- Do not interchange used bearing shells (mark)
- Insert new bearing shells for cylinder block with proper color marking --> **Allocation of main bearing shells for new crankshafts** or --> **Allocation of main bearing shells for used and reworked crankshafts**

12 - Gasket

- Replace

13 - Cylinder block

- Sealant applied on cylinder block (for guide frame) **Sealant applied on cylinder block (for guide frame)**

Sealant applied on cylinder block (for guide frame)

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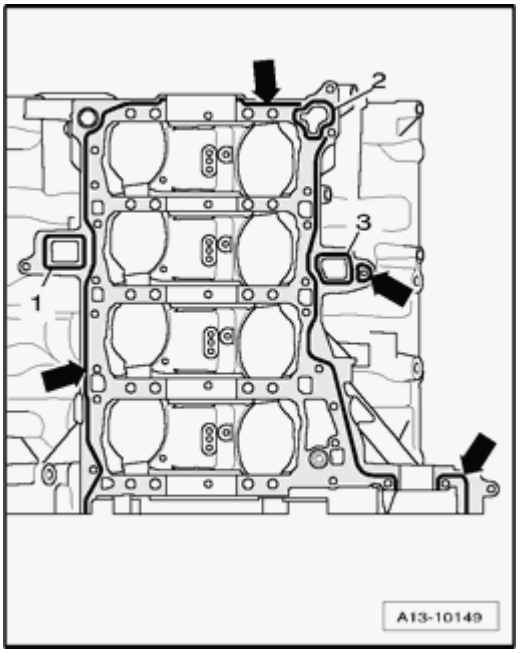


Fig. 459: Sealant Applied On Cylinder Block (For Guide Frame)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Clean sealing surfaces, they must be free of oil and grease.
- Apply sealant beads - **arrows** - on clean sealing surfaces of guide frame as shown in illustration.
- Thickness of sealant beads: 1.5 to 2.0 mm.
- Install seals - **1 to 3** -.

Installation position of alignment bushings

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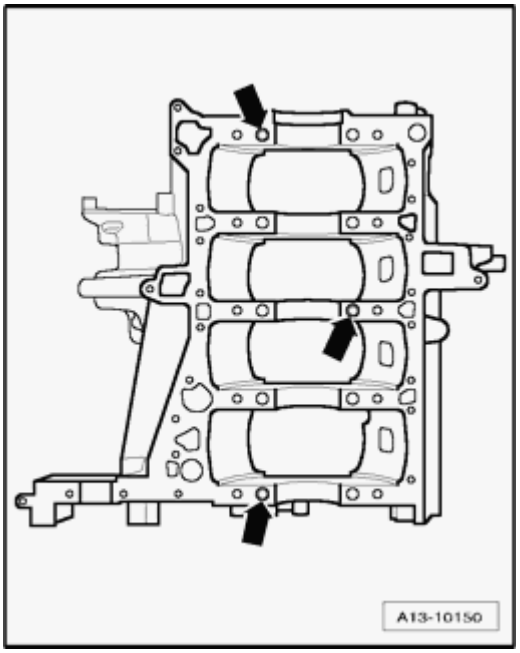


Fig. 460: Installation Position Of Alignment Bushings
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Check whether alignment bushings - **arrows** - are inserted at locations in guide frame as shown in the illustration.

Installing guide frame

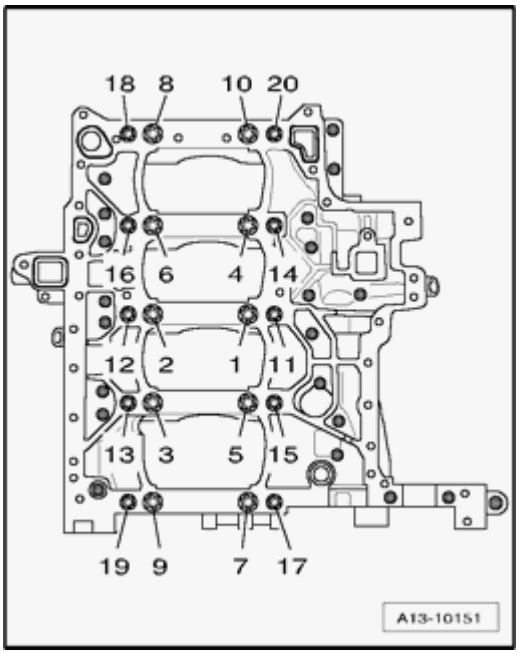


Fig. 461: Installing Guide Frame Bolts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

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- Replace bolts - **1 to 20** -.
- Tighten bolts for guide frame as follows:
- Tighten bolts - **1 to 10** - to 30 Nm with torque wrench.
- Tighten bolts - **11 to 20** - to 20 Nm with torque wrench.

- Tighten bolts - **1 to 10** - to 50 Nm with torque wrench.
- Tighten bolts - **11 to 20** - to 30 Nm with torque wrench.
- Tighten bolts - **1 to 10** - 90 ° ($^1/_4$ additional turn) using a rigid wrench.
- Tighten bolts - **11 to 20** - 90 ° ($^1/_4$ additional turn) using a rigid wrench.

- Tighten bolts for sealing surfaces of cylinder block/guide frame - **dark hatching in the illustration** - to 9 Nm in diagonal sequence.

Allocation of main bearing shells for new crankshafts

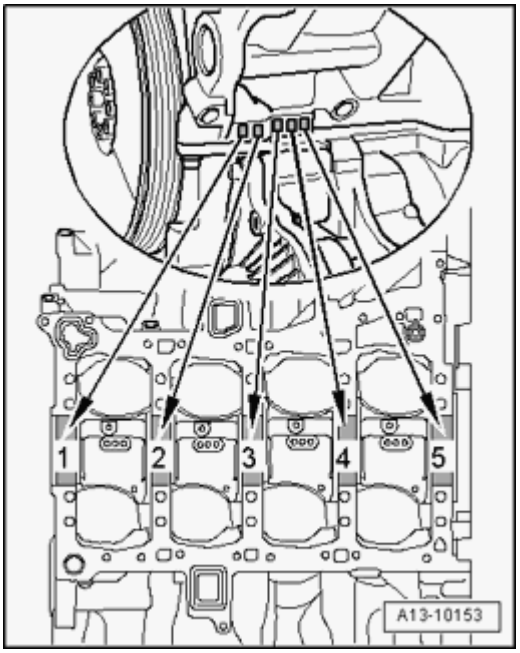


Fig. 462: Allocation Of Crankshaft Bearing Shells For Cylinder Block
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Allocation of crankshaft bearing shells for cylinder block

- Bearing shells with correct thickness are allocated to cylinder block in factory. Colored dots on sides of bearing shells serve for identifying bearing shell thickness.
- Allocation of bearing shells to cylinder block is marked by one letter each at left front on cylinder block (can be read from outside) as shown in the illustration.

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

NOTE:

- **In addition, the letters are also stamped on the guide frame.**

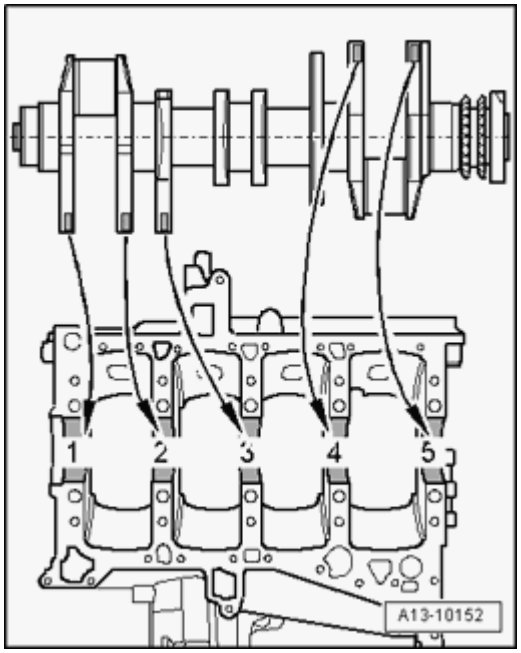


Fig. 463: Allocation Of Crankshaft Bearing Shells For Guide Frame - Crankshaft Manufactured By Alfing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Allocation of crankshaft bearing shells for guide frame - crankshaft manufactured by Alfing

- Bearing shells with correct thickness are allocated to guide frame in the factory. Colored dots on sides of bearing shells serve for identifying bearing shell thickness.
- Allocation of bearing shells to guide frame is marked by one colored dot each on crankshaft counterweight as shown in the illustration.
- Crankshafts manufactured by Alfing have no manufacturers identification.

Colored dot on crankshaft	Color of bearing
Red	Red
Yellow	Yellow
Blue	Blue

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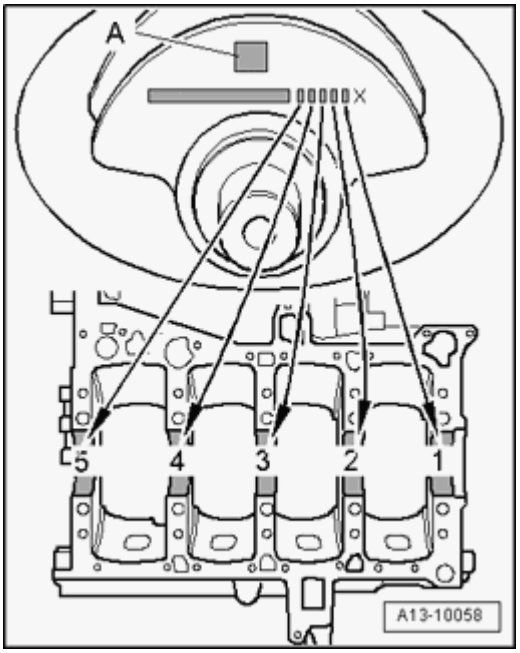


Fig. 464: Allocation Of Crankshaft Bearing Shells For Guide Frame - Crankshaft Manufactured By Weber
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Allocation of crankshaft bearing shells for guide frame - crankshaft manufactured by Weber

- Bearing shells with correct thickness are allocated to guide frame in the factory. Colored dots on sides of bearing shells serve for identifying bearing shell thickness.
- Allocation of bearing shells to guide frame is marked by one colored dot each on front crankshaft counterweight as shown in the illustration. The "X" marks the end of the letter series and stand next to color identification for bearing 1 (belt pulley side).
- Crankshafts manufactured by Weber have a manufacturers identification - **A** - on front crankshaft counterweight.

NOTE:

- **The letter series begins at left with bearing 5 (flywheel side).**

Letter on crankshaft		Color of bearing
R	=	Red
G	=	Yellow
B	=	Blue

Allocation of main bearing shells for used and reworked crankshafts

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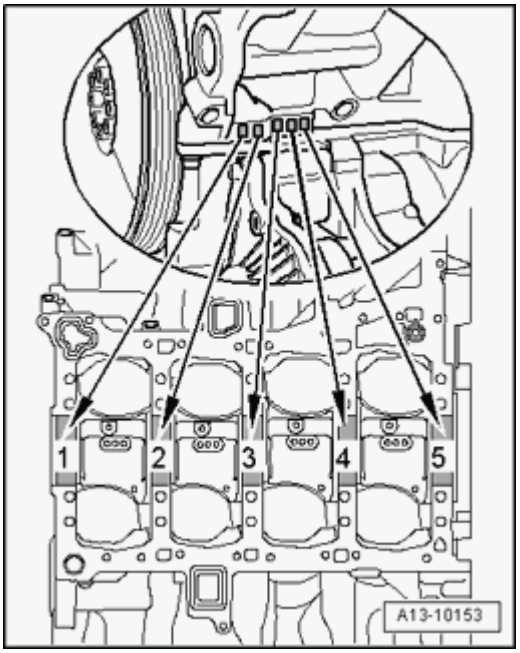


Fig. 465: Allocation Of Crankshaft Bearing Shells For Cylinder Block
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Allocation of crankshaft bearing shells for cylinder block

- Bearing shells are allocated to cylinder block corresponding to color markings stamped into cylinder block.
- For used and reworked crankshafts, the main crankshaft journals must be measured in order to allocate matching bearing shells.
- Basic dimension of main crankshaft journals = 65 mm dia.
- Repair stage of main crankshaft journals = 64.75 mm dia.

- Thicker over-sized bearing shells are available for reworked crankshafts. These have the same color markings as the original-size bearing shells.

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

Allocation of crankshaft bearing shells for guide frame

- For used and reworked crankshafts, the main crankshaft journals must be measured in order to allocate the matching bearing shells.
- Any other markings on the crankshaft are invalid when reworking crankshafts.
- Allocate bearing shells to determined diameter of main crankshaft journals according to the following table.

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Main crankshaft journals diameter	Color identification of bearing shells for guide frame		
Dimension in mm	**Red**	**Yellow**	**Blue**
Basic dimension 65 * See note	64.978 to 64.972	64.972 to 64.965	64.965 to 64.958
Repair stage 64.75 * See note	64.728 to 64.722	64.722 to 64.715	64.715 to 64.708

*Colored markings on bearing shells do not indicate if they are for new or used crankshafts.

Crankshaft dimensions

Reconditioning dimension in mm	Crankshaft journal diameter		Connecting rod journal diameter	
Basic dimension	65.00	0.022 0.042	54.00	0.022 0.042
Repair stage	64.75	0.022 0.042	53.75	0.022 0.042

Axial clearance, measuring

Special tools, testers and auxiliary items required

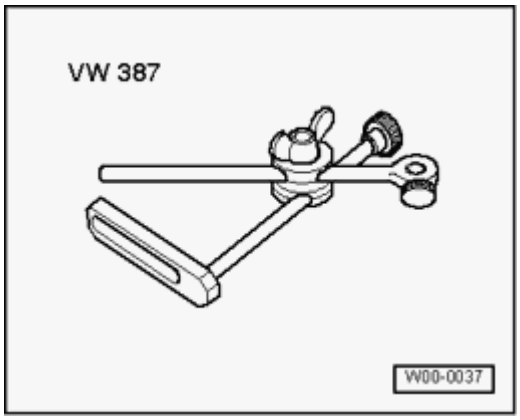


Fig. 466: Identifying Dial Gauge Holder VW 387
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Dial gauge holder VW 387

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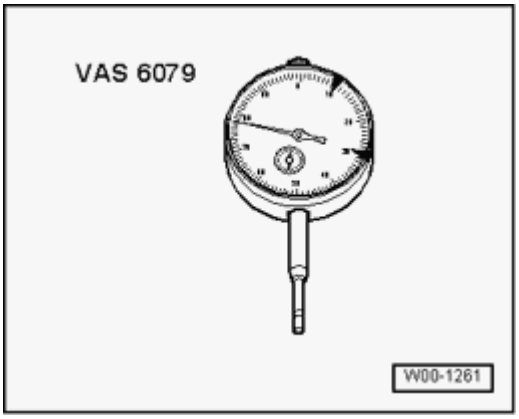


Fig. 467: Dial Gauge VAS 6079
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Dial gauge VAS 6079

Work procedure

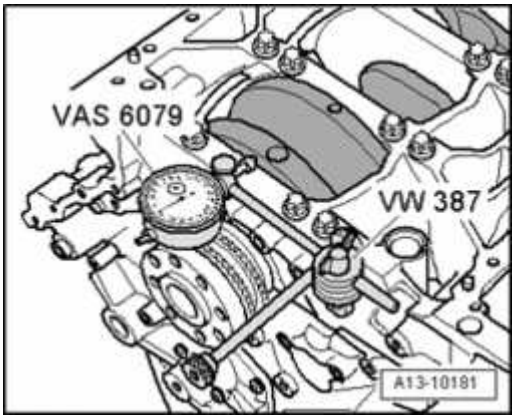


Fig. 468: Attaching Dial Indicator VAS 6079 Together With Dial Gauge Holder VW 387 To Cylinder Block And Setting Indicator Against Crankshaft Counterweight
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Attach dial indicator VAS 6079 together with dial gauge holder VW 387 to cylinder block and set indicator against crankshaft counterweight.
- Press crankshaft against dial indicator by hand, set indicator to "0".
- Press crankshaft off dial indicator and read off value:

- Axial clearance: 0.090 to 0.251 mm.

Radial clearance, measuring

Special tools, testers and auxiliary items required

- Plastigage

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Work procedure

NOTE:

- **Do not interchange used bearings**
- **Bearing shells that are worn down to the nickel layer must be replaced.**

- Remove guide frame and clean journals.
- Place Plastigage over entire width of bearing journal or into bearing shells.

- Plastigage must rest in center of bearing shell.

- Install guide frame and tighten to 30 Nm. Do not turn crankshaft.
- Remove guide frame again.
- Compare width of Plastigage with measuring scale:

- Radial clearance, new: 0.010 to 0.039 mm.
- Radial clearance wear limit: 0.08 mm.

PISTON AND CONNECTING ROD, DISASSEMBLING AND ASSEMBLING

Piston and connecting rod, component overview

NOTE:

- **Oil injector jet for piston cooling Oil spray jet for piston cooling**

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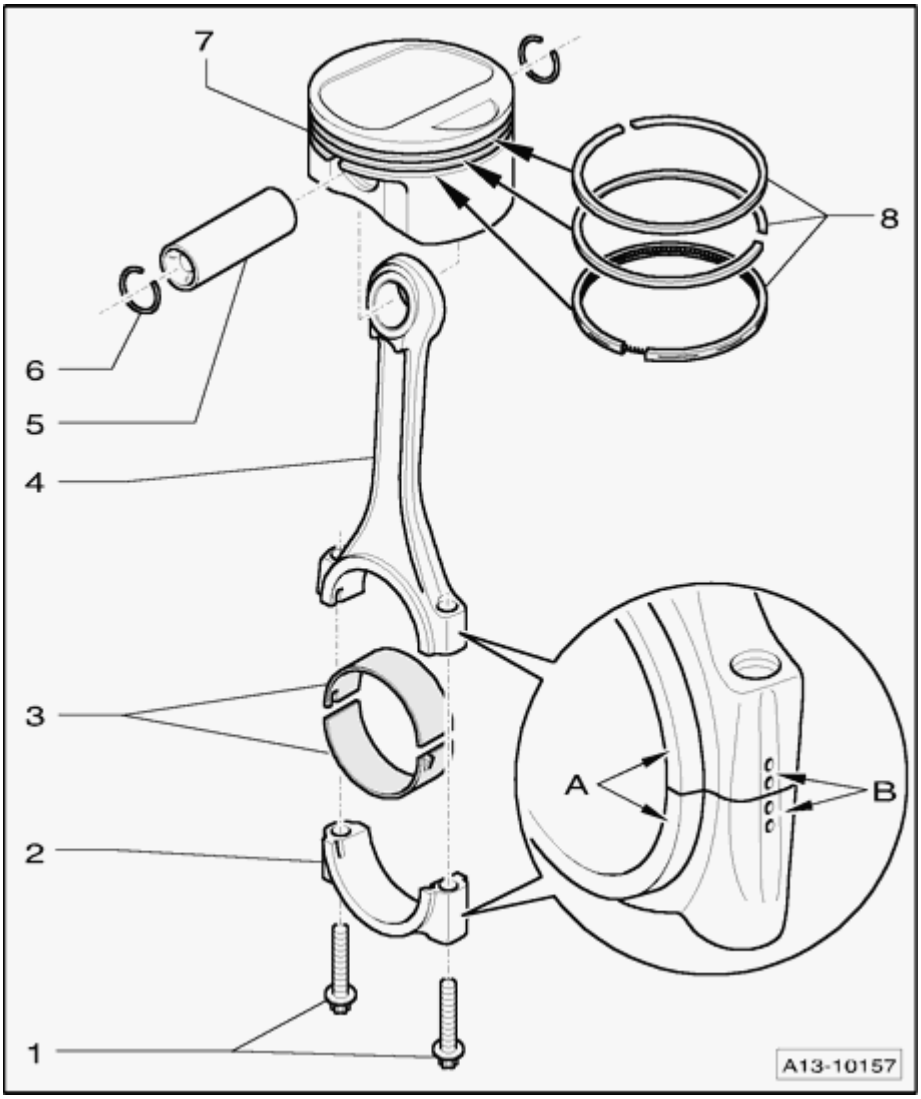


Fig. 469: Piston And Connecting Rod, Component Overview
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Connecting rod bolt - 30 Nm plus an additional $^{1}/_{4}$ turn (90 °)

- Replace
- Lubricate threads and contact surface
- Tighten to 30 Nm to measure radial play, do not turn further

2 - Connecting rod bearing cap

- Do not interchange
- Mark allocation to cylinder using a color marker - **B** - **Mark connecting rod**
- When installing bearing cap, observe: The wide thrust flange - **A** - must point to same side on connecting rod and connecting rod bearing cap

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- Installation position of connecting rod pairs **Connecting rod, installed location**

3 - Bearing shells

- Check that retaining tabs are secured
- Do not interchange used bearing shells (mark, but not on running surface)
- Radial clearance, measuring --> **Connecting rod radial clearance, measuring**
- Over-sized bearings are available for reworked crankshaft connecting rod journals

4 - Connecting rod

- Only replace as set
- Mark allocation to cylinder with paint - **B** - **Mark connecting rod**
- When installing bearing cap, observe: The wide thrust flange - **A** - must point to the same side on connecting rod and connecting rod bearing cap
- Installation position of connecting rod pairs **Connecting rod, installed location**

- Axial play for each new connecting rod pair: 0.20 to 0.38 mm
- Axial play wear limit: 0.60 mm
- Radial clearance, measuring --> **Connecting rod radial clearance, measuring**

5 - Piston pin

- If tight, heat piston to 60 ° C
- Removing and installing using a drift VW 222 A

6 - Circlip

7 - Piston

- Installation position of pistons **Piston installation position**
- Piston and cylinder dimensions --> **Piston and cylinder dimensions**
- Checking **Checking piston**
- Install with piston ring compressor

- Measuring cylinder bore **Measuring cylinder bore**

8 - Piston rings

- Offset gaps by 120 °
- Use piston ring pliers for removal and installation
- "TOP" marking or inscribed side must point to piston head

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- Measuring side clearance **Measuring piston ring side clearance**

Measuring piston ring gap

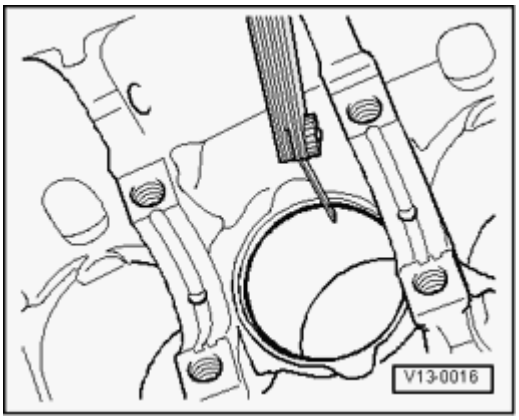


Fig. 470: Checking Piston Ring Gap
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Push ring squarely from above down to approx. 15 mm from bottom end of cylinder. To do this use a piston without rings.

Piston ring dimensions in mm	New	Wear limit
1. Compression ring	0.25 to 0.40	0.8
2. Compression ring	0.20 to 0.40	0.8
Oil scraping ring		0.4

Measuring piston ring side clearance

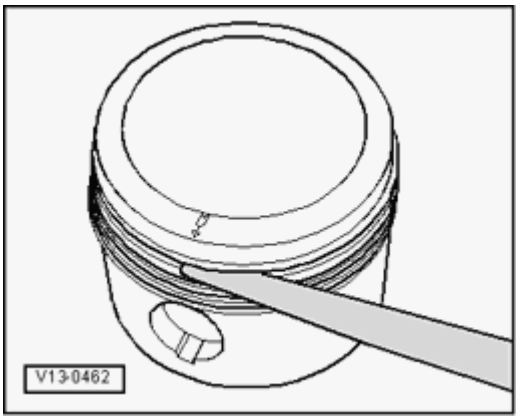


Fig. 471: Measuring Piston Ring Side Clearance
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Clean ring groove of piston before checking.

Piston ring dimensions in mm	New	Wear limit

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1. Compression ring	0.04 to 0.08	0.20
2. Compression ring	0.005 to 0.045	0.20
Oil scraping ring	0.01 to 0.05	0.15

Checking piston

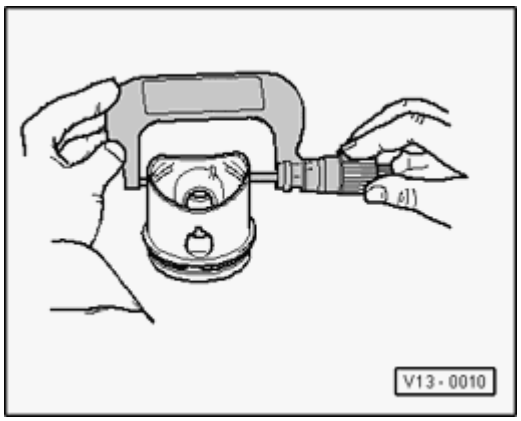


Fig. 472: Checking Piston
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Measure approx. 10 mm from the lower edge, at a 90 ° angle to piston pin axis using an external micrometer 75 to 100 mm.
- Maximum deviation from nominal dimension: 0.04 mm.

Nominal dimension --> **Piston and cylinder dimensions**.

Measuring cylinder bore

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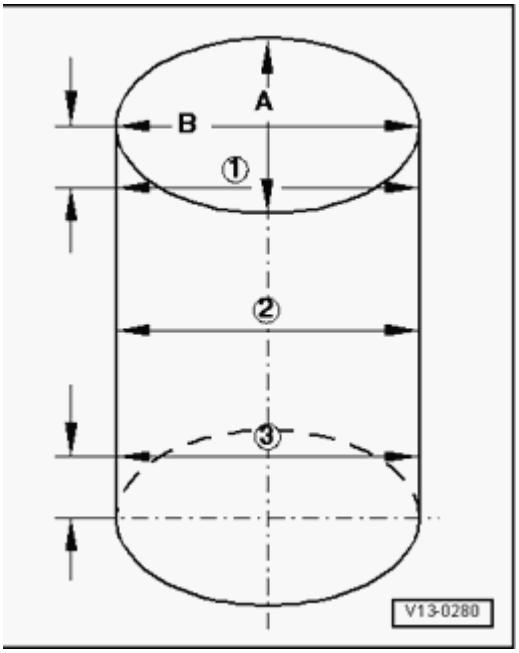


Fig. 473: Checking Cylinder Bores
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Using an internal dial gauge 50 to 100 mm, measure at 3 points in diagonal sequence horizontally - **A** - and vertically - **B** -.

- Maximum deviation from nominal dimension: 0.08 mm.

Nominal dimension --> **Piston and cylinder dimensions**.

Piston installation position

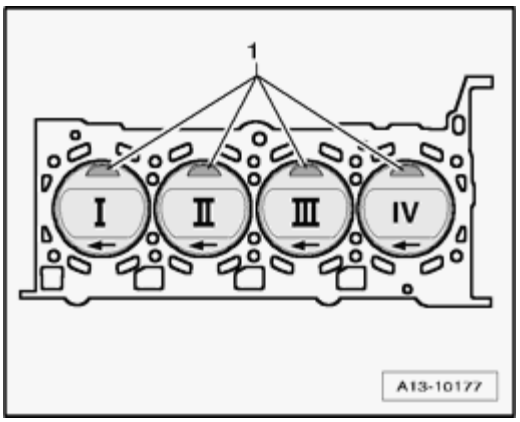


Fig. 474: Piston Installation Position
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Mark allocation to cylinder on piston head using chalk or water-proof felt pen.

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NOTE:

- **Do not use a center punch or scribe, since the piston head coating will be damaged.**

Installed location:

- Arrows on piston heads point to belt pulley side.
- Valve recesses - **1** - point toward center of engine.

Mark connecting rod

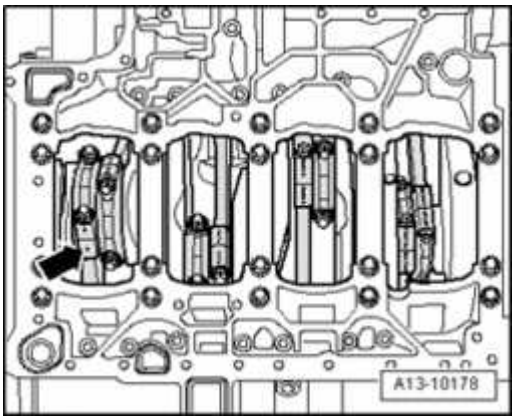


Fig. 475: Mark Connecting Rod
Courtesy of VOLKSWAGEN UNITED STATES, INC.

NOTE:

- **Only replace connecting rod as a set.**
- **Do not interchange connecting rod bearings.**

- Before removing, mark allocation of connecting rod and connecting rod bearing caps to each other and to cylinder with paint - **arrow** -.

Connecting rod, installed location

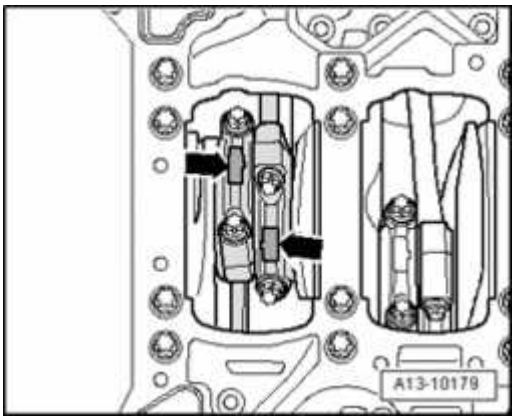


Fig. 476: Connecting Rod, Installed Location

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Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Molded tabs - **arrows** - at beveled surfaces of connecting rod pairs 1 and 2, 3 and 4, 5 and 6 as well as 7 and 8 must point toward each other.

Oil spray jet for piston cooling

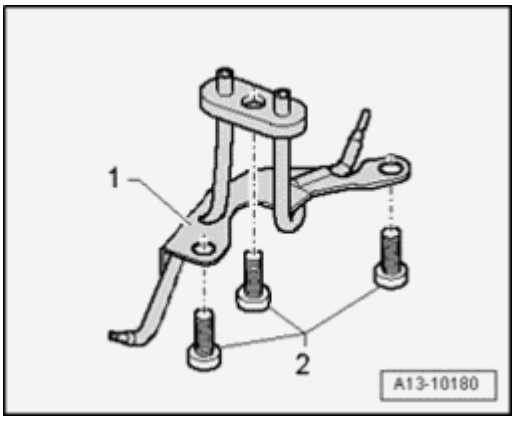


Fig. 477: Oil Spray Jet For Piston Cooling
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1. Oil injector jet (opening pressure 2 to 2.4 bar positive pressure)
2. Bolts - 9 Nm. Insert using locking compound; locking compound

Piston and cylinder dimensions

Matching pistons are allocated to the different manufacturing stages of the cylinder block.

Cylinder bore diameter mm	Piston diameter mm
84.510 ± 0.005	84.490 ± 0.010 * See note
84.610 ± 0.005	84.590 ± 0.010 * See note
84.710 ± 0.005	84.690 ± 0.010 * See note

*Dimension with graphite coating (thickness = 0.01 mm). The graphite coating wears off.

Connecting rod radial clearance, measuring

Special tools, testers and auxiliary items required

- Plastigage

Test sequence

- Remove connecting rod bearing caps.
- Clean bearing caps and journals

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- Place Plastigage over entire width of bearing journal or into bearing shells.
- Install connecting rod bearing cap and tighten to 30 Nm. Do not turn crankshaft.
- Remove connecting rod bearing caps again.
- Compare width of Plastigage with measuring scale:

- Radial clearance, new: 0.028 to 0.077 mm.
- Radial clearance wear limit: 0.12 mm.

- Replace bolts for connecting rod bearings.

15 - ENGINE - CYLINDER HEAD, VALVETRAIN

CYLINDER HEAD, REMOVING AND INSTALLING

Cylinder head, component overview

NOTE:

- **Right cylinder head is shown in illustration.**

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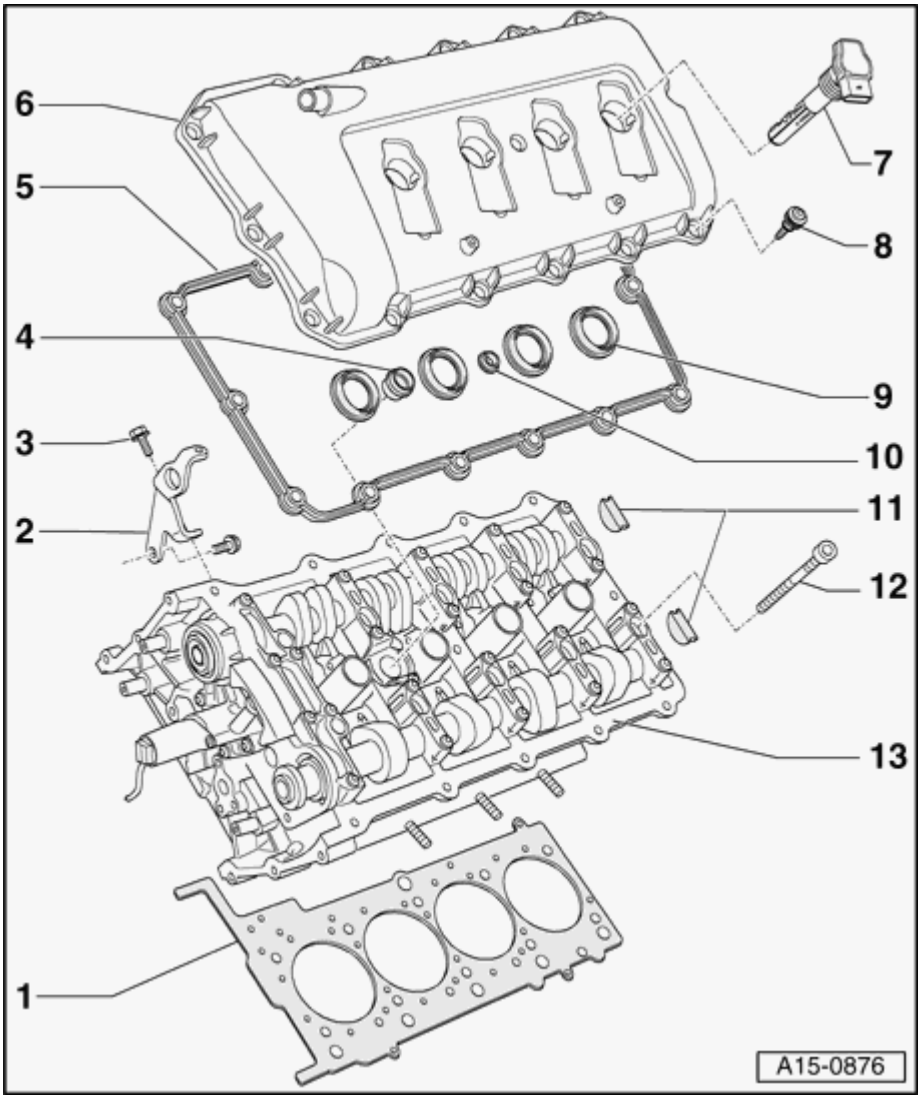


Fig. 478: Cylinder Head, Component Overview
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Cylinder head gasket

- Replacing --> **Cylinder head, removing and installing**.
- Installed location: Part Number, points to cylinder head
- After replacing, change coolant and engine oil

2 - Lifting eye

3 - 22 Nm

4 - Gasket

- Replace if damaged or leaking

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5 - Cylinder head cover gasket

- Replace if damaged or leaking

6 - Cylinder head cover

- Removing and installing left cylinder head cover --> **Left cylinder head cover, removing and installing**
- Removing and installing right cylinder head cover --> **Right cylinder head cover, removing and installing**

7 - Ignition coil

- Extractor T40039 can be used for removal.

8 - Special bolt - 10 Nm

- Replace if damaged or leaking
- Observe sequence for tightening *Tighten cylinder head cover in sequence* under **Installing**

9 - Cylinder head cover gaskets

- Replace if damaged or leaking

10 - Cylinder head cover gasket

- Replace if damaged or leaking

11 - Semicircular seal

- Replace if damaged or leaking

12 - Cylinder head bolt

- Replace
- Observe sequence for loosening *Loosen cylinder head bolts in the sequence* under **Cylinder head, removing and installing**
- Observe sequence for tightening --> **Fig. 490**

13 - Cylinder head

- Removing --> **Cylinder head, removing and installing**
- Check for distortion *Checking cylinder head for distortion* under **Cylinder head, component overview**
- Reworking dimension **Reworking dimension of cylinder head**
- Installing **Installing**

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- After replacing, change coolant and engine oil

Checking cylinder head for distortion

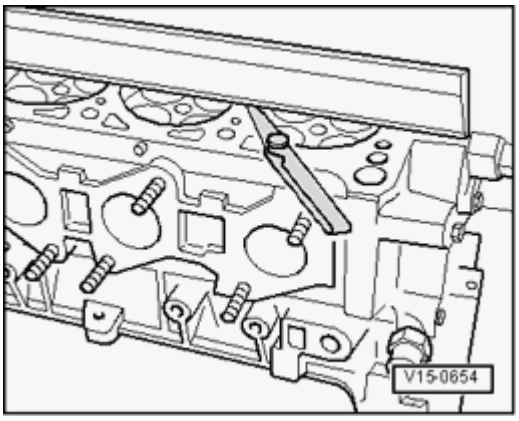


Fig. 479: Checking Cylinder Head For Distortion
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Check cylinder head at multiple points for distortion, using straight edge and feeler gauges.
- Max. permissible distortion: 0.1 mm

Reworking dimension of cylinder head

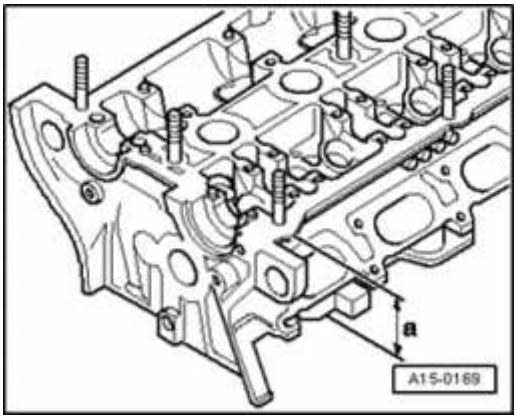


Fig. 480: Reworking Dimension Of Cylinder Head
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- It is only permitted to reface cylinder head to minimum dimension - **a** -.
- Minimum dimension: - **a** - = 139.25 mm.

Left cylinder head cover, removing and installing

Special tools, testers and auxiliary items required

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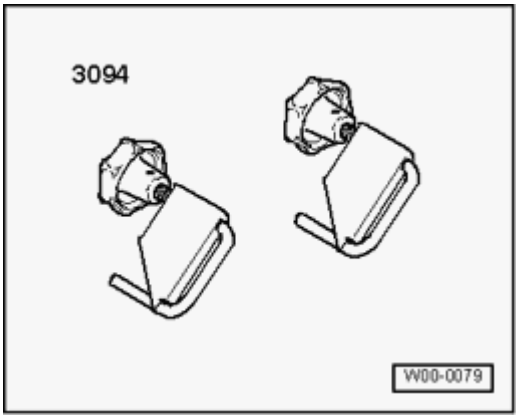


Fig. 481: Identifying Hose Clamps 3094
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Hose clamps up to 25 mm diameter 3094

Removing

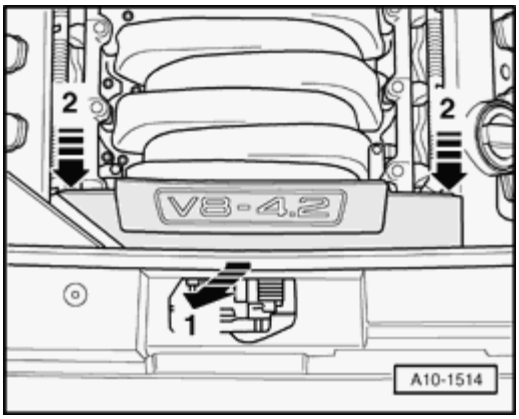
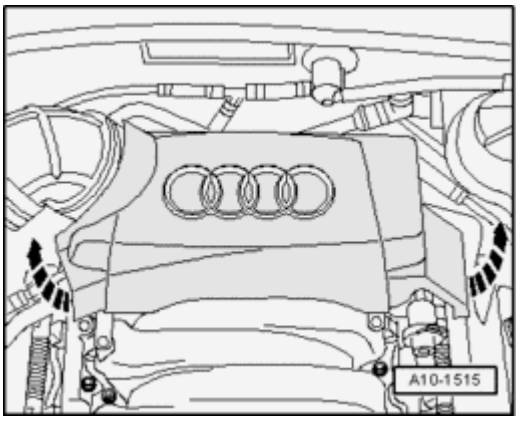


Fig. 482: Removing Front Engine Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove front engine cover - **arrows 1 and 2** -.



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Fig. 483: Removing Rear Engine Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove rear engine cover - **arrows** -.

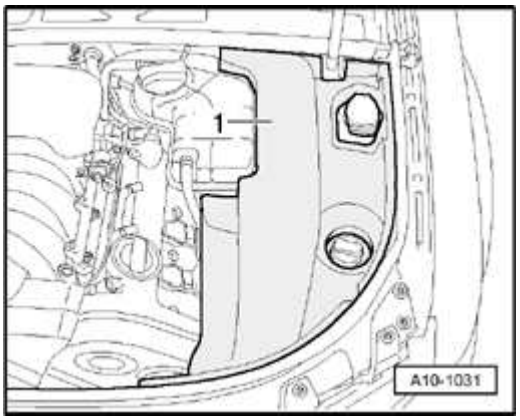


Fig. 484: Removing Cover In Engine Compartment (Left Side)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove cover - **1** - in engine compartment (left side).

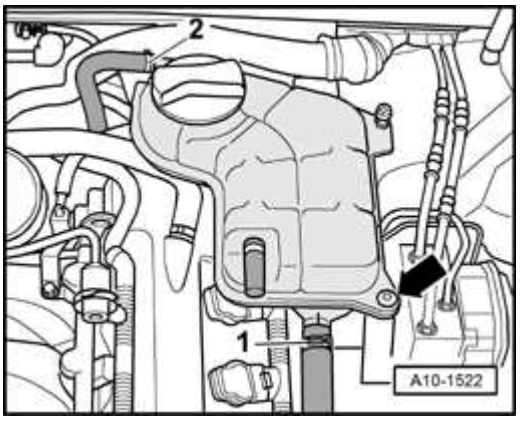


Fig. 485: Removing Coolant Hoses & Coolant Expansion Tank
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Clamp off coolant hose - **2** - using Hose clamps up to 25 mm diameter 3094 and disconnect from coolant expansion tank.
- Seal connection using a plug that fits.
- Remove coolant expansion tank - **arrow** -.
- Disconnect electrical wire to Engine Coolant Level (ECL) Warning Switch F66 at bottom on expansion tank and set aside coolant expansion tank with coolant hose - **1** - connected.

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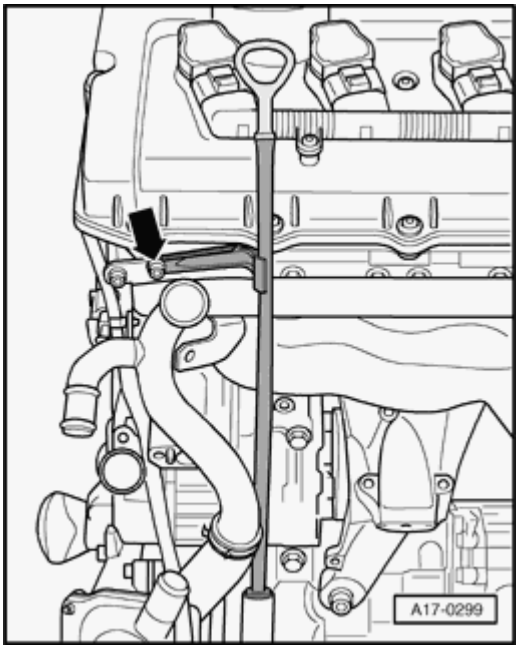


Fig. 486: Removing Bolt From Oil Dipstick Guide Tube At Cylinder Head
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolt - **arrow** - at oil dipstick guide tube.

NOTE:

- **Guide tube remains inserted in upper part of oil pan.**

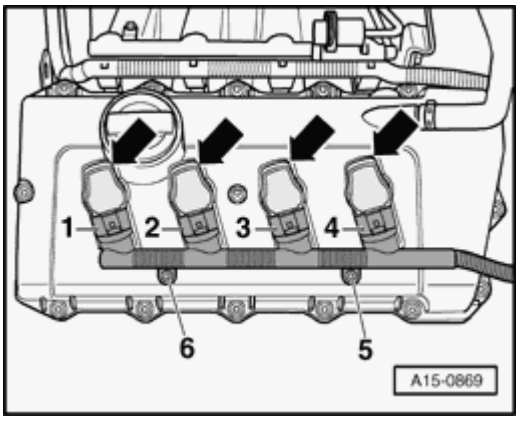


Fig. 487: Removing Bolts On Left Cylinder Head, Disconnecting Electrical Harness Connectors & Removing Ignition Coils
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts - **5** - and - **6** -.
- Disconnect electrical harness connectors - **1 to 4** -.
- Remove ignition coils - **arrows** -.

NOTE:

- **Extractor T40039 can be used for removal.**

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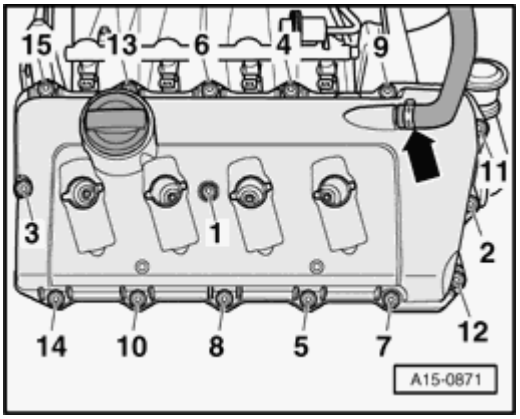


Fig. 488: Disconnecting Hose Of Crankshaft Housing Ventilation & Removing Left Cylinder Head Cover Bolts In Sequence
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect hose of crankshaft housing ventilation - **arrow** -.
- Remove left cylinder head cover screws in sequence - **15 to 1** -.
- Remove cylinder head cover.

Installing

Installation is in reverse order of removal, note the following:

NOTE:

- **Replace cylinder head cover gaskets if damaged.**
- **Replace bolts for cylinder head cover if gasket is damaged.**

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

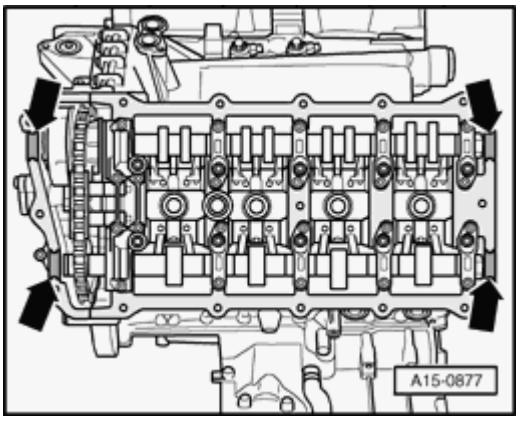


Fig. 489: Coating Semicircular Seals Lightly With Oil And Insert
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Coat semicircular seals - **arrows** - lightly with oil and insert.

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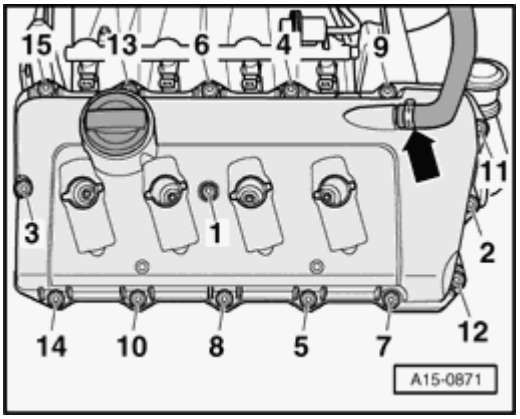


Fig. 490: Tightening Cylinder Head Cover In Sequence
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Tighten cylinder head cover in sequence - **1 to 15** -.

Torque specifications

Component	Nm
Cylinder head cover to cylinder head	10
Wiring for ignition coils at cylinder head cover	5 * See note
Oil dip stick guide tube to cylinder head	10

* Insert using locking compound; locking compound .

Right cylinder head cover, removing and installing

Removing

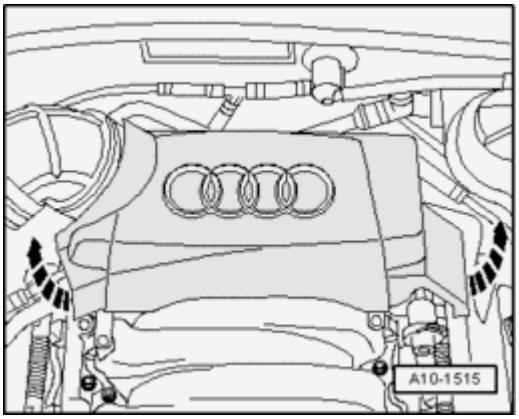


Fig. 491: Removing Rear Engine Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove rear engine cover - **arrows** -.

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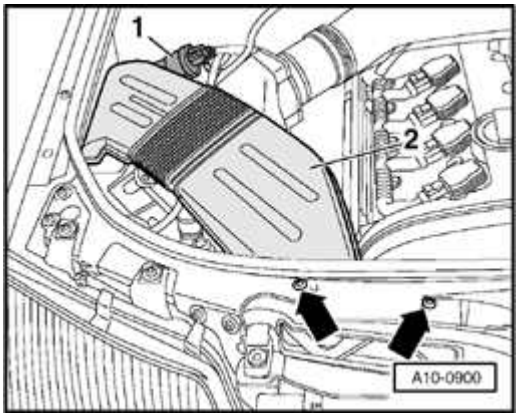


Fig. 492: Identifying Evaporative Emission Canister Purge Regulator Valve N80 And Air Duct
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disengage Evaporative Emission (EVAP) Canister Purge Regulator Valve N80 - **1** - from air guide.
- Remove bolts - **arrows** -.
- Remove air duct - **2** -.

CAUTION: Note rules of cleanliness for working on the fuel injection system --> Rules for cleanliness.

CAUTION: Fuel system is under pressure! Before opening system, place clean rags around connection. Then release pressure by carefully loosening connection.

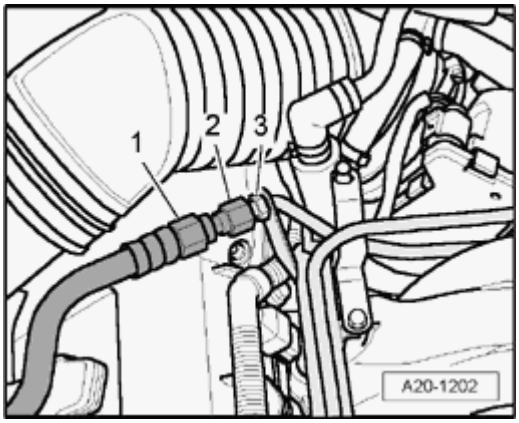


Fig. 493: Installing/Removing Fuel Hose To/From Connection On Fuel Rail Line
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove fuel hose from connection on fuel rail line. To do so, counter hold using an open-end wrench at hex head - **1** - and - **3** - and remove union nut - **2** -.

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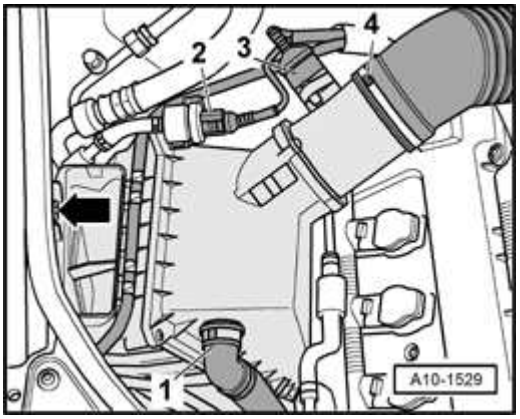


Fig. 494: Identifying Electrical Harness Connectors, Secondary Air Injection (AIR) Pump Hose, Air Guide Hose & Mass Air Flow (MAF) Sensor
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical harness connector - **2** - from Evaporative Emission (EVAP) Canister Purge Regulator Valve N80.
- Disconnect electrical harness connector - **3** - at Mass Air Flow (MAF) Sensor G70.
- Disconnect hose - **1** - to Secondary Air Injection (AIR) pump.
- Disconnect air guide hose - **4** - at Mass Air Flow (MAF) Sensor G70.

- Move wiring harness clear at air filter housing.
- Remove clip and remove air filter housing with Mass Air Flow (MAF) Sensor G70.

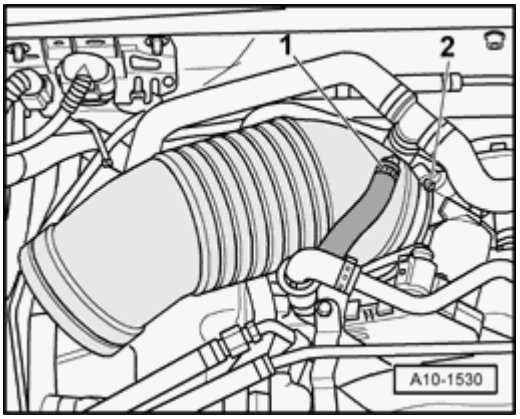


Fig. 495: Disconnecting Vacuum Hose & Air Guide Hose From Throttle Valve Control Module
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect vacuum hose - **1** -.
- Disconnect air guide hose - **2** - from Throttle Valve Control Module J338.

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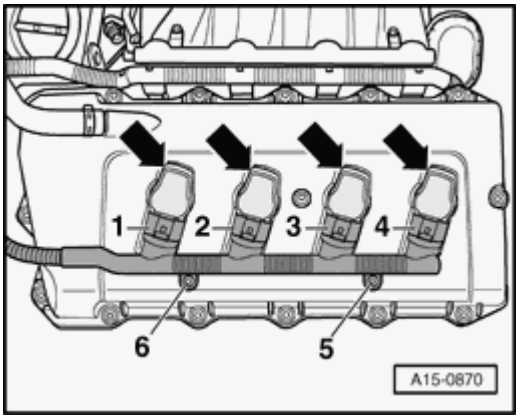


Fig. 496: Removing Bolts On Right Cylinder Head, Disconnecting Electrical Harness Connectors & Removing Ignition Coils
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts - **5** - and - **6** - on right cylinder head.
- Disconnect electrical harness connectors - **1 to 4** -.
- Remove ignition coils - **arrows** -.

NOTE:

- **Extractor T40039 can be used for removal.**

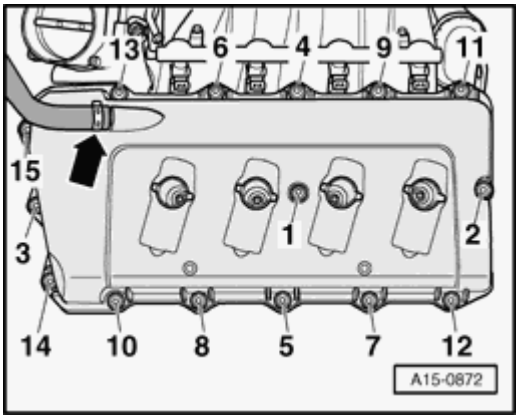


Fig. 497: Disconnecting Hose Of Crankshaft Housing Ventilation & Removing Right Cylinder Head Cover Screws In Sequence
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect hose of crankshaft housing ventilation - **arrow** -.
- Remove right cylinder head cover bolts in sequence - **15 to 1** -.
- Remove cylinder head cover.

Installing

Installation is in reverse order of removal, note the following:

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NOTE:

- **Replace cylinder head cover gaskets if damaged.**
- **Replace bolts for cylinder head cover if gasket is damaged.**

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

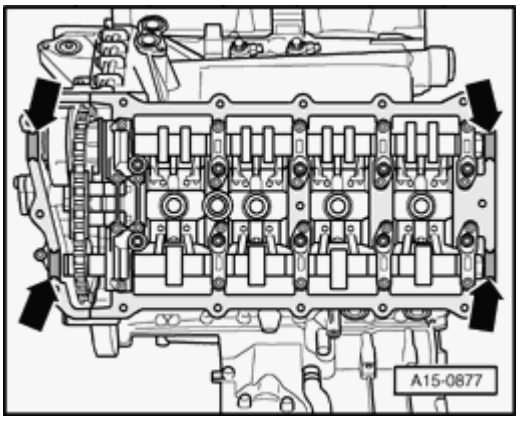


Fig. 498: Coating Semicircular Seals Lightly With Oil And Insert
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Coat semicircular seals - **arrows** - lightly with oil and insert.

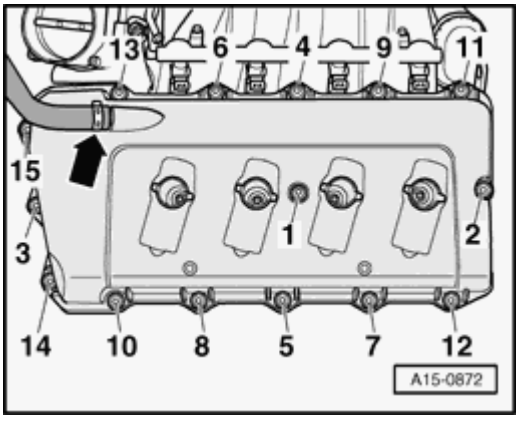


Fig. 499: Disconnecting Hose Of Crankshaft Housing Ventilation & Removing Right Cylinder Head Cover Screws In Sequence
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Tighten cylinder head cover in sequence - **1 to 15** -.

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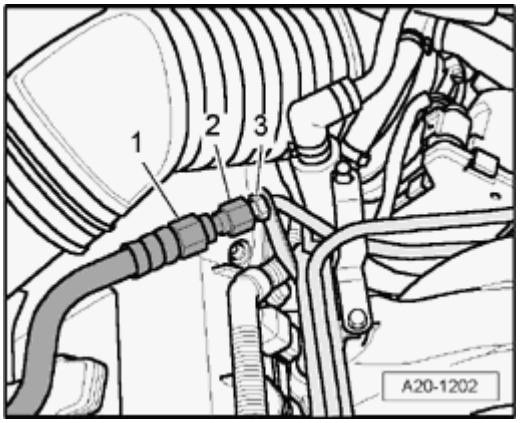


Fig. 500: Installing/Removing Fuel Hose To/From Connection On Fuel Rail Line
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Secure fuel hose to connection on fuel rail line. To do so, counter hold using an open-end wrench at each hex head - **1** - and - **3** - and tighten union nut - **2** - to 22 Nm.

Torque specifications

Component	Nm
Cylinder head cover to cylinder head	10
Wiring for ignition coils at cylinder head cover	5 * See note
Fuel supply line to fuel rail	22

* Insert using locking compound; locking compound .

Cylinder head, removing and installing

Removing

NOTE:

- **All cable ties opened or cut during engine removal must be reinstalled at the same locations during installation.**

- Remove engine: Vehicles with manual transmission --> **Engine (vehicles with manual transmission)** , vehicles with automatic transmission --> **Engine (vehicles with automatic transmission), removing**.
- Leave engine with transmission installed on scissor lift platform VAS 6131 A.
- Remove camshaft timing chains from camshafts --> **Camshaft timing chains, removing from camshafts**.

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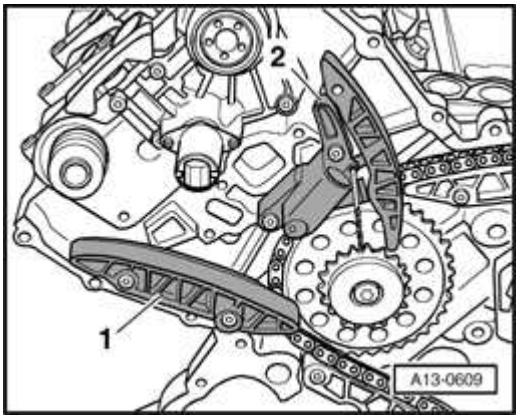


Fig. 501: Removing Glide Track At Left Cylinder Head & Chain Tensioner
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove glide track - **1** - at left cylinder head.
- Remove chain tensioner - **2** -.

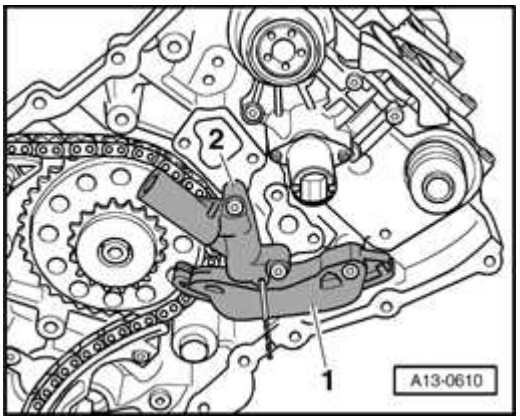
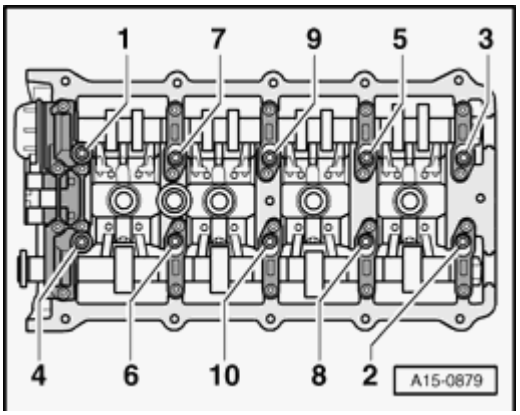


Fig. 502: Removing Glide Track At Right Cylinder Head
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove glide track - **1** - at right cylinder head.
- Remove chain tensioner - **2** -.



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Fig. 503: Loosening Cylinder Head Bolts In Sequence
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Loosen cylinder head bolts in the sequence - **1 to 10** -.
- Remove cylinder head and place it on a soft surface (foam).

Installing

NOTE:

- **Replace cylinder head bolts.**
- **During assembly, replace self-locking nuts and bolts.**
- **Always replace bolts that are tightened to torque as well as O-rings and gaskets.**
- **Carefully remove residual sealant from cylinder head and cylinder block. Make sure that no long scrapes or scratches result.**
- **Carefully remove all grinding and sanding residue.**
- **There must be no oil or coolant in the blind holes for the cylinder head bolts in the cylinder block.**
- **After installing a replacement cylinder head with camshafts installed, oil contact surfaces between roller rocker levers and cam lubricating surfaces after installing cylinder head.**
- **Do not remove plastic bases protecting exposed valves until immediately before installing cylinder head.**
- **Cylinder heads with cracks between the valve seats, or between the valve seat and the spark plug threads, can continue to be used without reducing the service life, as long as the cracks have a width of max. 0.3 mm, or only the first 4 threads of the spark plug threads are cracked.**
- **Only unpack new cylinder head gasket immediately prior to installation.**
- **Handle gasket with extra care. Damages to the silicone layer and in areas of recesses may result in leaks.**
- **Install cylinder head gasket onto guide sleeves. Marking "oben" (top) or part number must face toward cylinder head.**
- **Secure all hose connections using hose clamps appropriate for the model type .**
- **When replacing the cylinder head or cylinder head seal, all of the coolant and engine oil must be replaced.**
- **After working on the valvetrain and lifters, carefully rotate the crankshaft by hand at least 2 full revolutions before starting to be sure that valves do not strike the pistons.**
- **During installation, all cable ties must be re-installed at the same location.**

- Check whether camshafts of both cylinder heads stand in TDC position.

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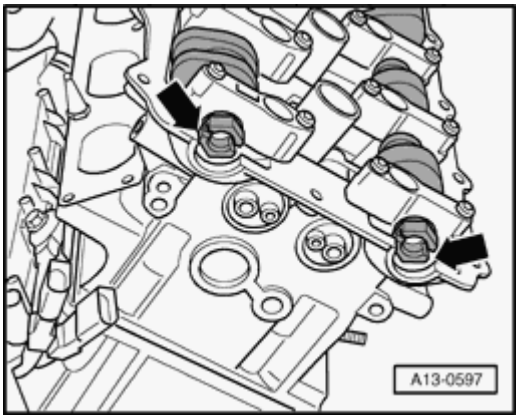


Fig. 504: Identifying Slits At Front In Camshafts Stand Parallel At Same Height With Upper Edge Of Cylinder Head
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Slits - **arrows** - at front in camshafts must stand parallel at same height with upper edge of cylinder head.

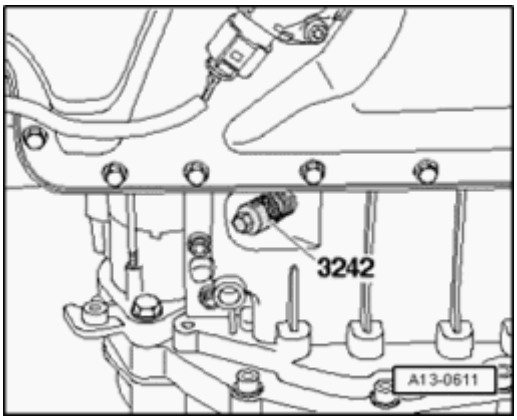


Fig. 505: Removing/Installing Crankshaft Holder 3242 Into Hole
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Crankshaft holder 3242 must be installed.

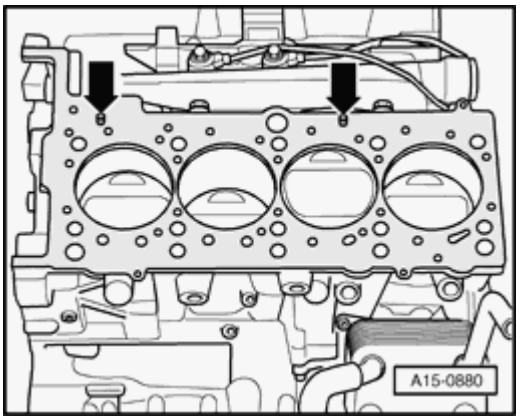


Fig. 506: Positioning Cylinder Head Gasket

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Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Position cylinder head gasket.

- Pay close attention to alignment bushings in cylinder block - **arrows** -.
- Pay attention to installation position of cylinder head gasket, marking "oben" (top) or part number must face toward cylinder head.

- Install cylinder head.
- Insert new cylinder head bolts and tighten by hand.

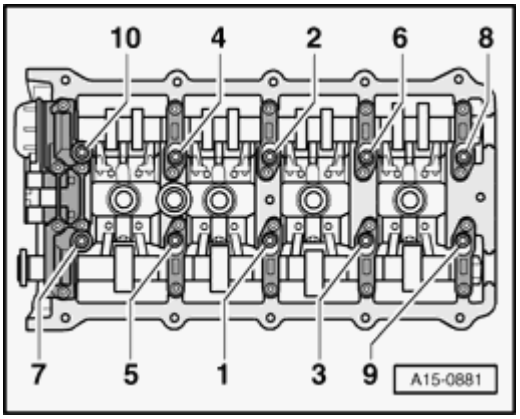


Fig. 507: Tightening Cylinder Head Bolts In 4 Stages In Tightening Sequence
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Tighten cylinder head bolts in 4 stages in tightening sequence shown as follows:
- Using torque wrench, tighten to 30 Nm.
- Using torque wrench, tighten to 60 Nm.
- With Torx key, 90 ° ($^{1}/_{4}$ turn) additional turn.

- With Torx key, 90 ° ($^{1}/_{4}$ turn) additional turn.

NOTE:

- **There is no requirement to retighten the cylinder head bolts after repairs.**

The rest of installation is in reverse order of removal, note the following:

- Install camshaft timing chains **Installing**.
- Install engine: Vehicles with manual transmission --> **Engine (vehicles with manual transmission), installing** , vehicles with automatic transmission --> **Engine (vehicles with automatic transmission), installing**.
- Change engine oil -->
  - **01 - MAINTENANCE**

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- **01 - MAINTENANCE** for MAINTENANCE PROCEDURES - CABRIOLET

.

- Replace coolant **Filling**.

Torque specifications

Component	Nm
Chain tensioner to cylinder head	5 plus an additional 90 ° * See note

*Replace bolts.

* 90 ° corresponds to one quarter turn.

INTAKE MANIFOLD, REMOVING AND INSTALLING

Intake manifold (vehicles with fuel return line), component overview

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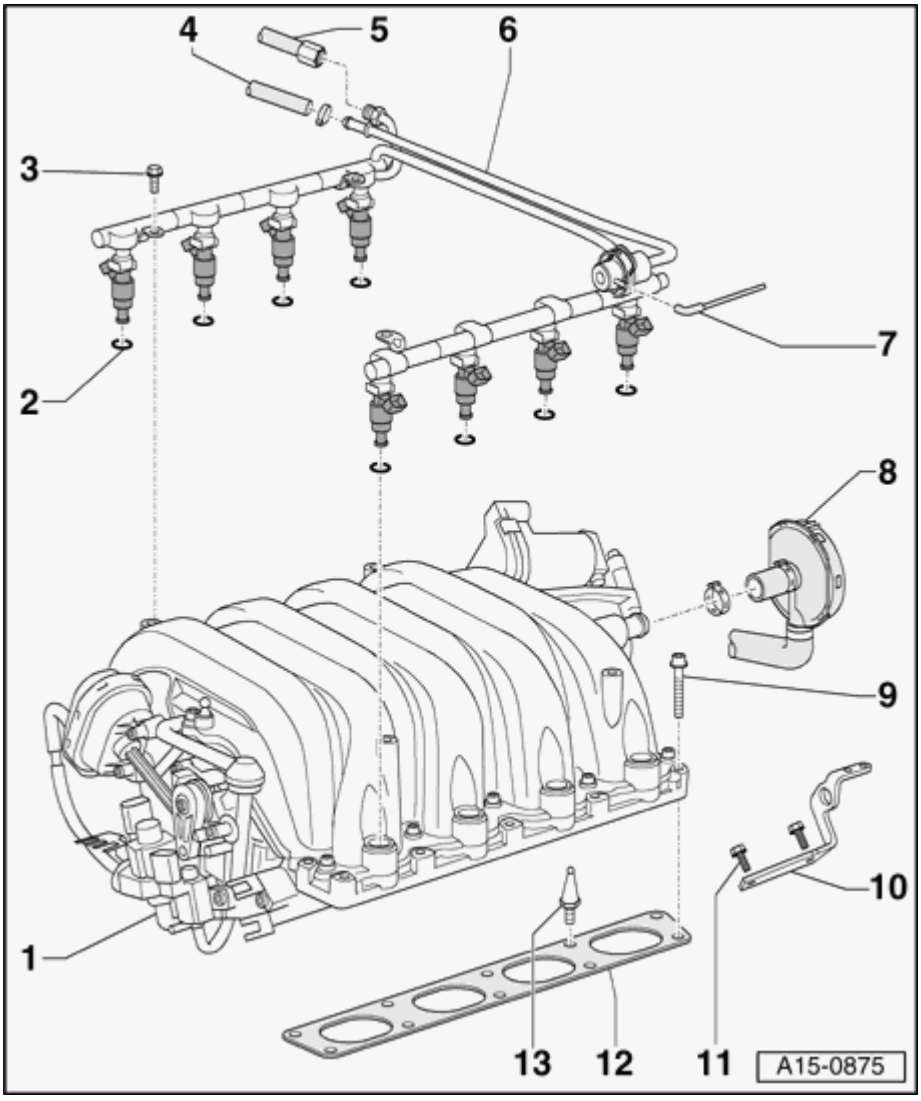


Fig. 508: Intake Manifold (Vehicles With Fuel Return Line), Component Overview
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Intake manifold

- Removing and installing --> **Intake manifold, removing and installing**

2 - O-rings for fuel injectors

- Replace

3 - 10 Nm

4 - Fuel return line

5 - Fuel supply line

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- Tighten union nut to 22 Nm

6 - Fuel rail

7 - Vacuum line

8 - Crankcase housing ventilation pressure regulator valve

9 - 10 Nm

- Fasten in diagonal sequence in steps

10 - Lifting eye

11 - 23 Nm

12 - Gasket for intake manifold

- Replace

13 - Locking pin - 0.6 Nm

Intake manifold (vehicles without fuel return line), component overview

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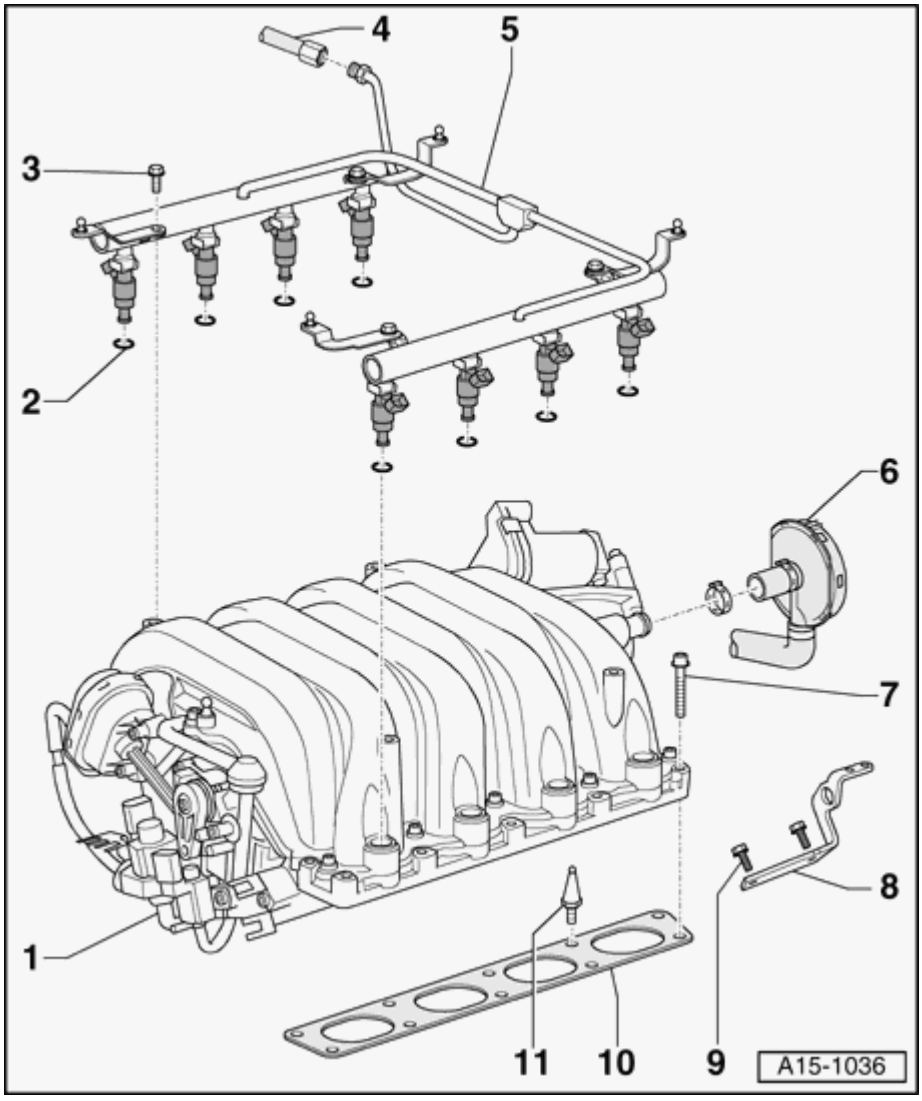


Fig. 509: Intake Manifold (Vehicles Without Fuel Return Line), Component Overview
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Intake manifold

- Removing and installing --> **Intake manifold, removing and installing**

2 - O-rings for fuel injectors

- Replace

3 - 10 Nm

4 - Secure the fuel line from the connector flange of the fuel tank using hose clamps appropriate for the model type

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- Loosening and tightening union nut --> **Loosening and tightening union nut for fuel hose**

5 - Fuel rail

6 - Pressure regulator valve

- For crankcase ventilation

7 - 10 Nm

- Fasten diagonally in steps

8 - Lifting eye

9 - 23 Nm

10 - Gasket

- For intake manifold
- Replace

11 - Locking pin - 0.6 Nm

Loosening and tightening union nut for fuel hose

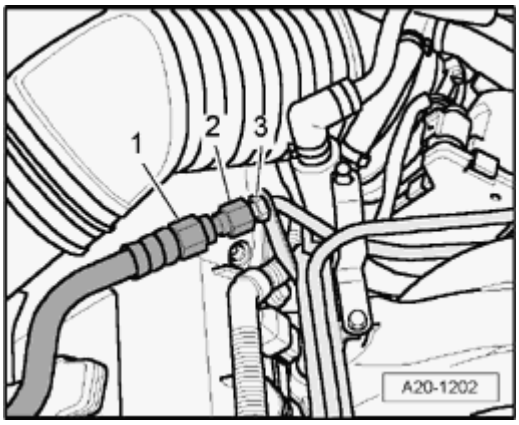


Fig. 510: Installing/Removing Fuel Hose To/From Connection On Fuel Rail Line
Courtesy of VOLKSWAGEN UNITED STATES, INC.

CAUTION: Note rules of cleanliness for working on the fuel injection system --> Rules for cleanliness.

CAUTION: Fuel system is under pressure! Before opening system, place clean rags around connection. Then release pressure by carefully loosening connection.

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Loosening:

- Remove fuel hose from connection on fuel rail line. To do so, counter hold using an open-end wrench at each hex head - **1** - and - **3** - and remove union nut - **2** -.

Tightening:

- Secure fuel hose to connection on fuel rail line. To do so, counter hold using an open-end wrench at each hex head - **1** - and - **3** - and tighten union nut - **2** - to 22 Nm.

Intake manifold, removing and installing

Removing

NOTE:

- **All cable ties opened or cut during engine removal must be reinstalled at the same locations during installation.**

- Bring lock carrier into service position --> **Lock carrier, moving into service position**.

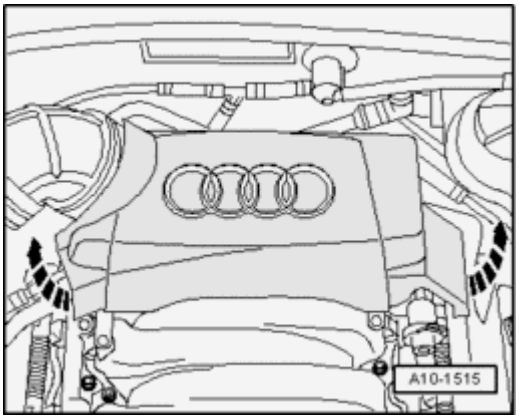


Fig. 511: Removing Rear Engine Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove rear engine cover - **arrows** -.

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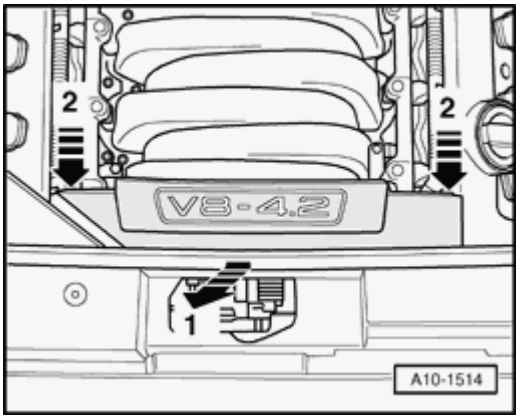


Fig. 512: Removing Front Engine Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove front engine cover - **arrows 1 and 2** -.

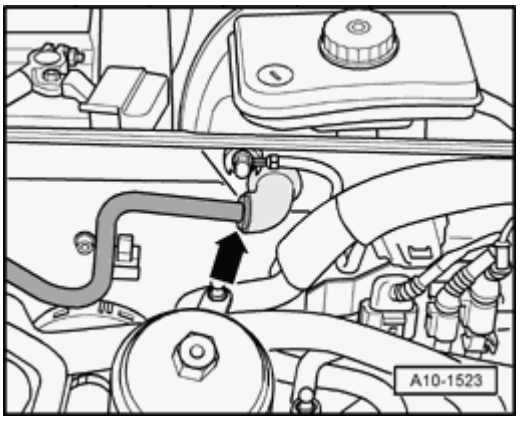


Fig. 513: Disconnecting Brake Booster Vacuum Hose From Grommet On Bulkhead
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect vacuum line - **arrow** - to brake booster at bulkhead.

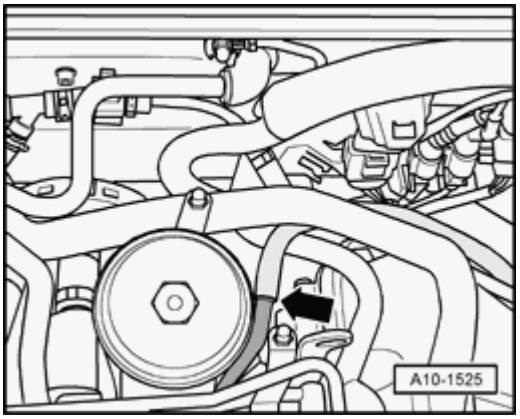


Fig. 514: Disconnecting Vacuum Line To Vacuum Reservoir
Courtesy of VOLKSWAGEN UNITED STATES, INC.

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- If installed, disconnect vacuum line - **arrow** - to vacuum reservoir.

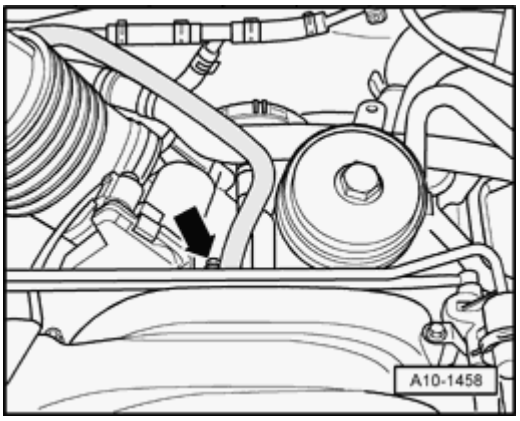


Fig. 515: Disconnecting Vacuum Hose From Intake Manifold
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect vacuum hose - **arrow** - from intake manifold.

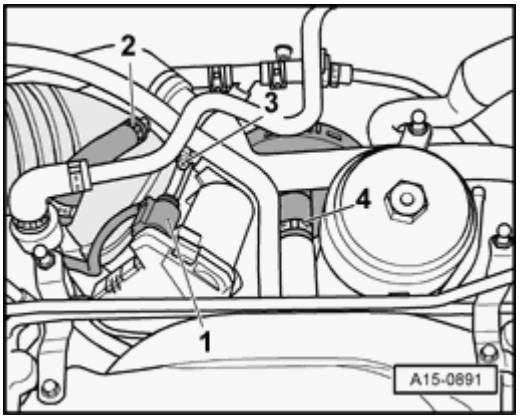


Fig. 516: Disconnecting Electrical Connection At Throttle Valve Control Module J338
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical connection - **1** - at throttle valve control module J338.
- Disconnect vacuum hose - **2** -.
- Remove air guide hose - **3** -.
- Disconnect crankcase ventilation hose - **4** - at intake pipe.

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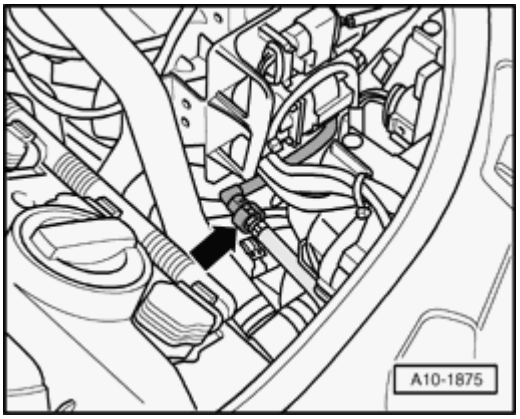


Fig. 517: Disconnecting Vacuum Line
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- If installed, disconnect vacuum line at area designated with - **arrow** -.

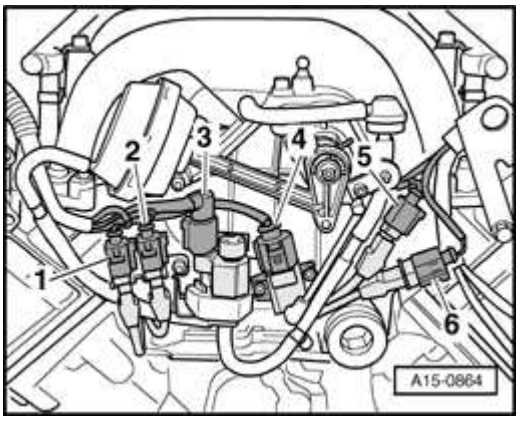
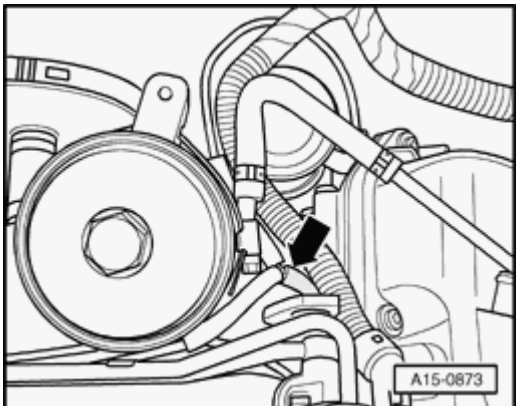


Fig. 518: Remove Electrical Harness Connectors Toward Front From Brackets On Intake Line
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove electrical harness connectors - **1 to 4** - toward front from brackets on intake pipe.

NOTE:

- **The electrical connections must not be separated.**



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Fig. 519: Disconnecting Vacuum Hose At T-Piece
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect vacuum hose - **arrow** - at T-piece.

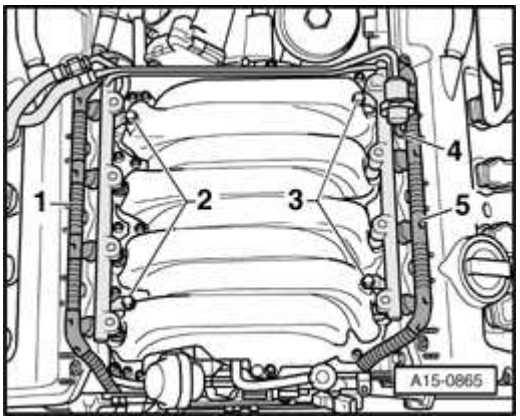


Fig. 520: Identifying Connector Strips At Fuel Injectors, Vacuum Line On Fuel Pressure Regulator & Retaining Bolts For Fuel Rail Line
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect connector strips - **1** - and - **5** - at fuel injectors.
- For vehicles with fuel return line, disconnect vacuum line - **4** - on fuel pressure regulator.
- Remove retaining bolts - **2** - and - **3** - for fuel rail line.
- Remove fuel distributor together with fuel injectors from intake manifold simultaneously upward and place it on a clean rag in engine compartment.

NOTE:

- **Carefully protect the removed fuel injectors from contamination.**

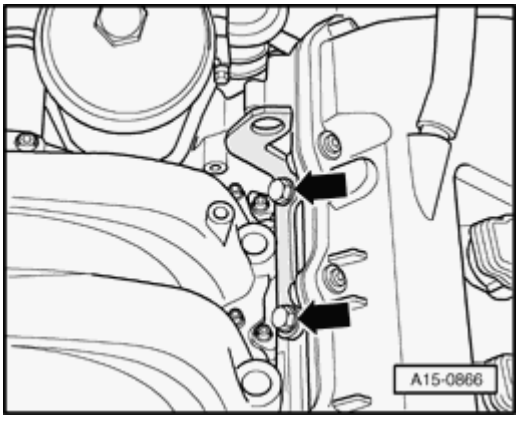


Fig. 521: Removing Left/Rear Engine Lifting Eye
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts - **arrows** - for left rear engine lifting eye.

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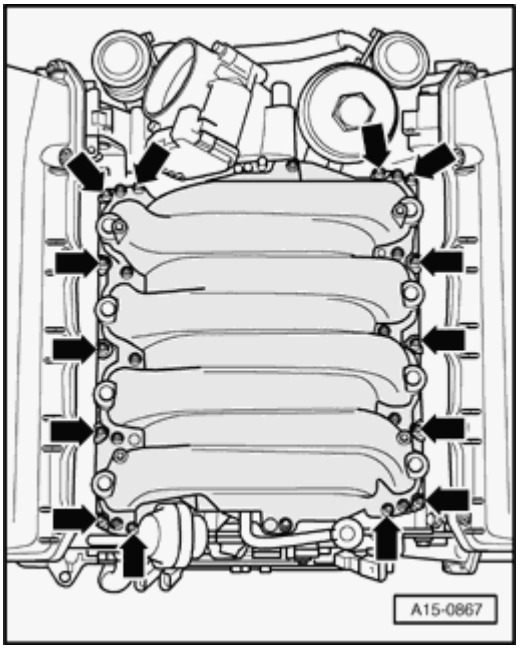


Fig. 522: Removing Intake Manifold Bolts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove intake manifold bolts - **arrows** - and remove manifold.

NOTE:

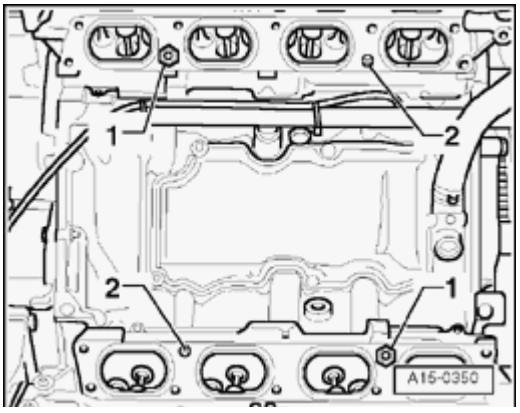
- **Plug intake ports of cylinder head with clean rags.**

Installing

Installation is in reverse order of removal, note the following:

NOTE:

- **Replace gaskets and O-rings.**
- **Secure all hose connections using hose clamps appropriate for the model type .**
- **During installation, all cable ties must be re-installed at the same location.**



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Fig. 523: Replacing Intake Manifold Gaskets, Thereby Removing Locking Bolt
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Replace intake manifold gaskets, thereby removing locking bolt - **1** -.
- Be aware of alignment pins - **2** - when setting intake manifold in place.

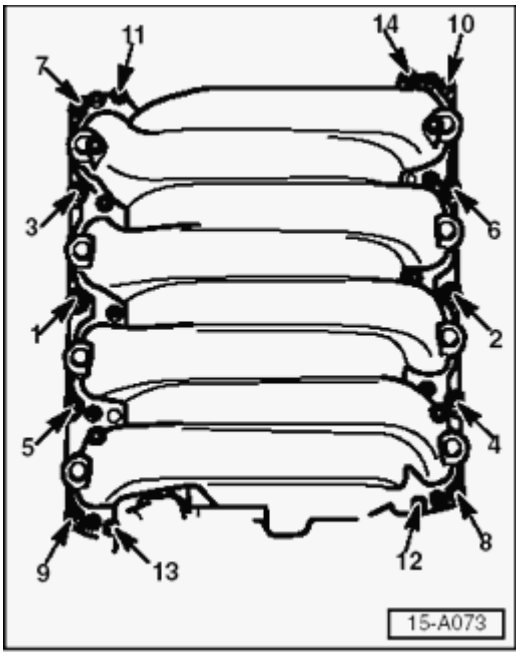


Fig. 524: Tightening Intake Manifold Bolts In Diagonal Sequence And In Steps
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Tighten intake manifold bolts - **arrows** - in a diagonal sequence and in steps.

Tightening torque: 11 Nm

- Install lock carrier with attachments -->
  - **50 BODY, FRONT**
  - **50 - BODY - FRONT** for BODY EXTERIOR - CABRIOLET

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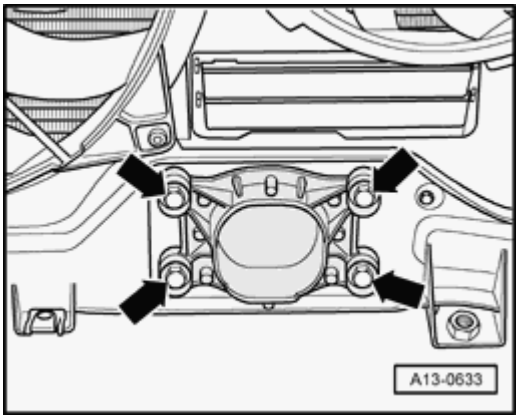


Fig. 525: Placing Torque Support On Rubber Buffer For Torque Support And Tightening Bolts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Place torque support on rubber buffer for torque support and tighten bolts - **arrows** -.
- Install front bumper cover -->
  - **63 BUMPER**
  - **63 - BUMPERS** for BODY EXTERIOR - CABRIOLET

  .
- Run engine for 5 minutes.
- Retighten intake manifold bolts in sequence shown.

Tightening torque: 11 Nm

- Check headlight adjustment -->
  - **01 - MAINTENANCE**
  - **01 - MAINTENANCE** for MAINTENANCE PROCEDURES - CABRIOLET

  .

Torque specifications

Component	Nm
Locking bolt to cylinder head	0.6
Intake manifold to cylinder head	11
Engine lifting eyelet to cylinder head	22
Fuel rail pipe to intake manifold	10
Torque support stop to lock carrier	28

Compression pressures, checking

Special tools, testers and auxiliary items required

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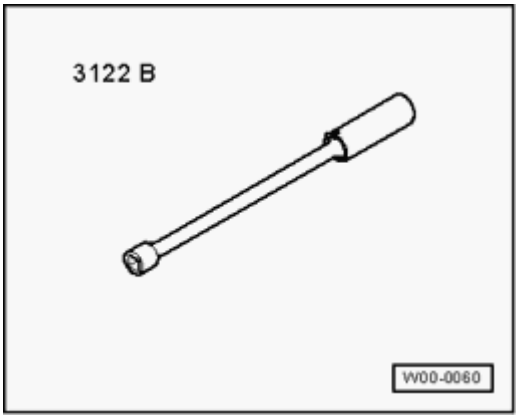


Fig. 526: Identifying Spark Plug Wrench 3122 B
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Spark plug removal tool 3122 B

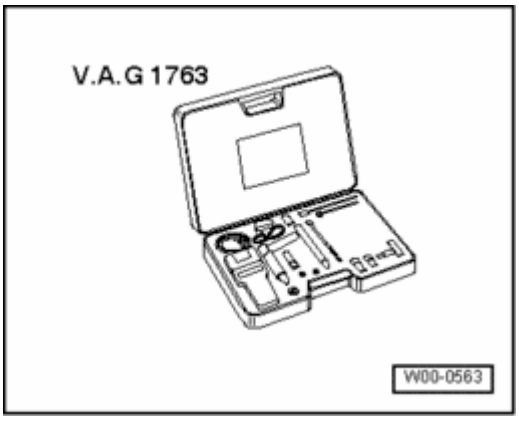


Fig. 527: Compression Tester V.A.G 1763
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Compression tester V.A.G 1763

Test conditions

- Engine oil temperature min. 30 ° C
- Battery voltage at least 12.5 V

Test sequence

- Switch off ignition.

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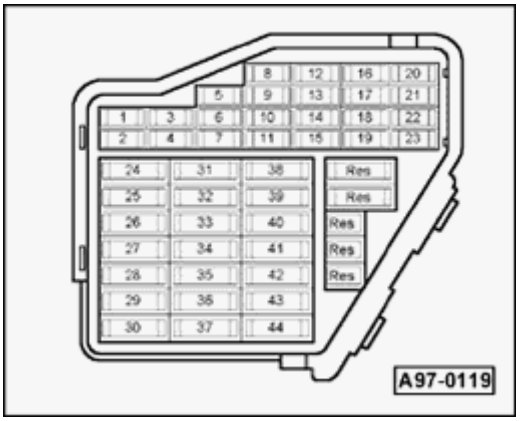


Fig. 528: Removing Fuse For Fuel Pump (FP) From Socket
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove fuse for Fuel Pump (FP) from socket - **28** -.

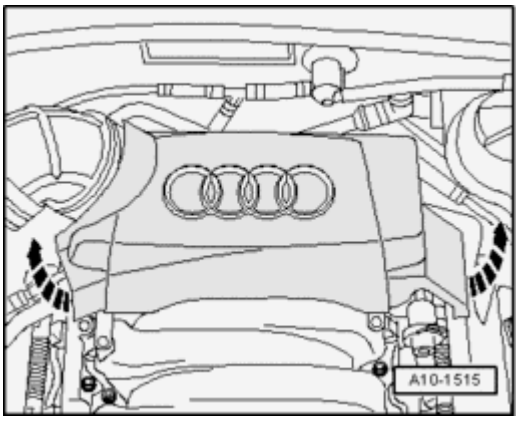


Fig. 529: Removing Rear Engine Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove rear engine cover - **arrows** -.

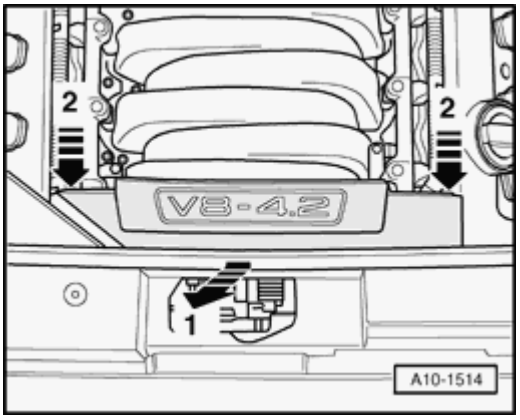


Fig. 530: Removing Front Engine Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

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- Remove front engine cover - **arrows 1 and 2** -.

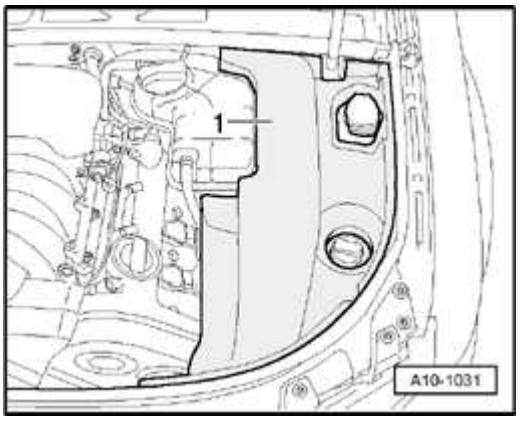


Fig. 531: Removing Cover In Engine Compartment (Left Side)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove cover - **1** - in engine compartment (left side).

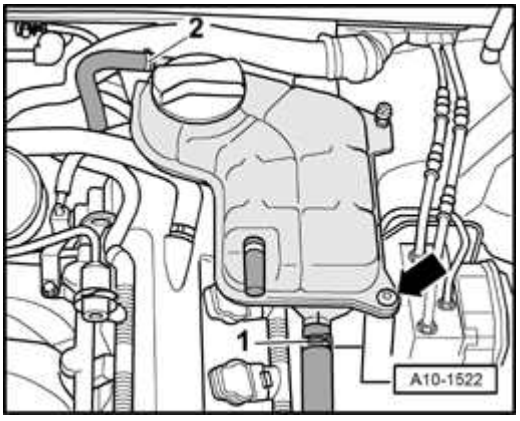


Fig. 532: Removing Coolant Hoses & Coolant Expansion Tank
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove coolant expansion tank - **arrow** -.
- Disconnect electrical wire from Engine Coolant Level (ECL) Warning Switch F66 and set aside coolant reservoir with coolant hoses - **1** - and - **2** - connected.

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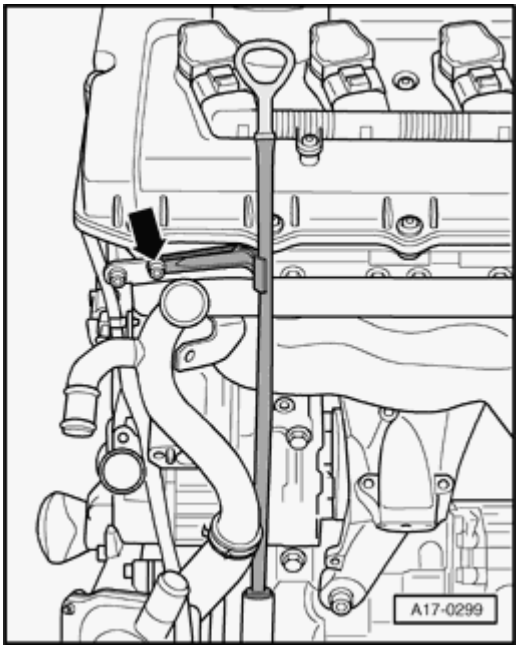


Fig. 533: Removing Bolt From Oil Dipstick Guide Tube At Cylinder Head
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolt - **arrow** - at oil dipstick guide tube.

NOTE:

- **Guide tube remains inserted in upper part of oil pan.**

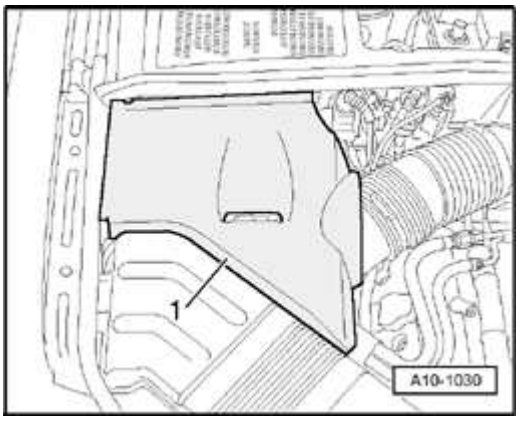


Fig. 534: Removing Cover In Engine Compartment (Right Side)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove cover - **1** - in engine compartment (right side).

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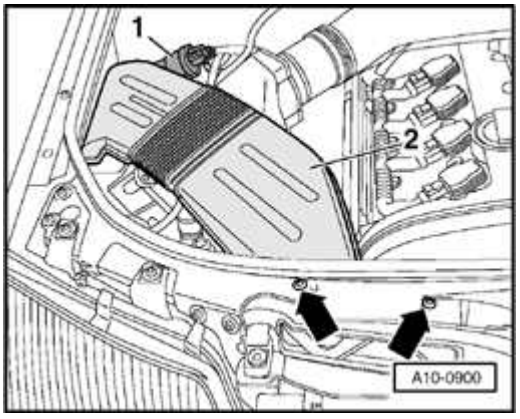


Fig. 535: Identifying Evaporative Emission Canister Purge Regulator Valve N80 And Air Duct
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disengage Evaporative Emission (EVAP) Canister Purge Regulator Valve N80 - **1** - from air guide.
- Remove bolts - **arrows** -.
- Remove air duct - **2** -.

CAUTION: Note rules of cleanliness for working on the fuel injection system --> Rules for cleanliness.

CAUTION: Fuel system is under pressure! Before opening system, place clean rags around connection. Then release pressure by carefully loosening connection.

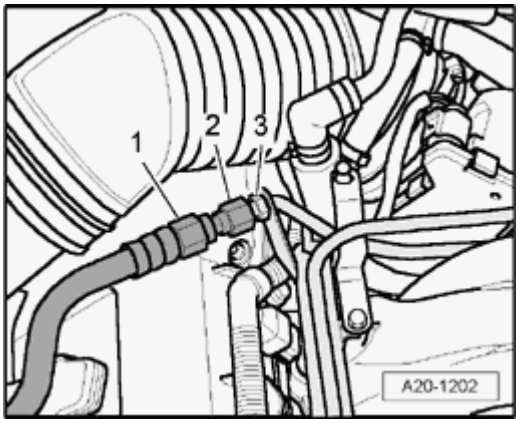


Fig. 536: Installing/Removing Fuel Hose To/From Connection On Fuel Rail Line
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove fuel hose from connection on fuel rail line. To do so, counter hold using an open-end wrench at hex head - **1** - and - **3** - and remove union nut - **2** -.

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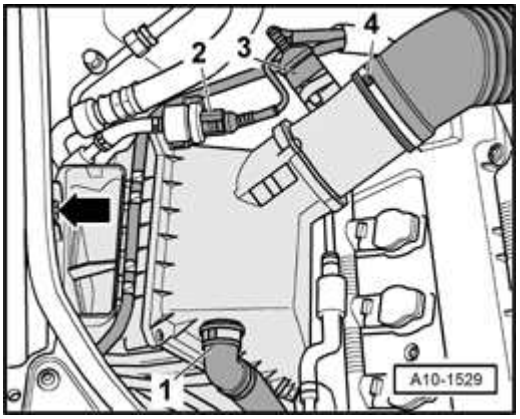


Fig. 537: Identifying Electrical Harness Connectors, Secondary Air Injection (AIR) Pump Hose, Air Guide Hose & Mass Air Flow (MAF) Sensor
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical harness connector - **2** - from Evaporative Emission (EVAP) Canister Purge Regulator Valve N80.
- Disconnect electrical harness connector - **3** - at Mass Air Flow (MAF) Sensor G70.
- Disconnect hose - **1** - to Secondary Air Injection (AIR) pump.
- Disconnect air guide hose - **4** - at Mass Air Flow (MAF) sensor.

- Move wiring harness clear at air filter housing.
- Remove clip and remove air filter housing with Mass Air Flow (MAF) sensor.

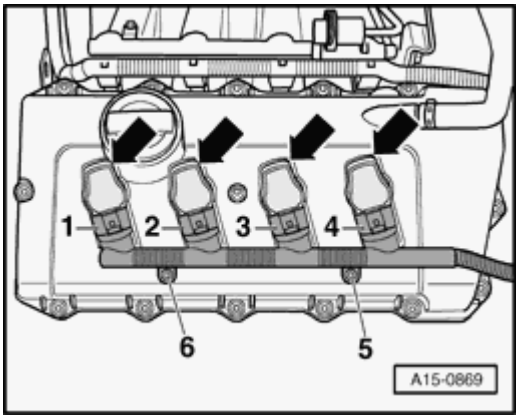


Fig. 538: Removing Bolts On Left Cylinder Head, Disconnecting Electrical Harness Connectors & Removing Ignition Coils
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts - **5** - and - **6** - on left cylinder head.
- Disconnect electrical harness connectors - **1 to 4** -.
- Remove ignition coils - **arrows** -.

NOTE:

- **Extractor T40039 can be used for removal.**

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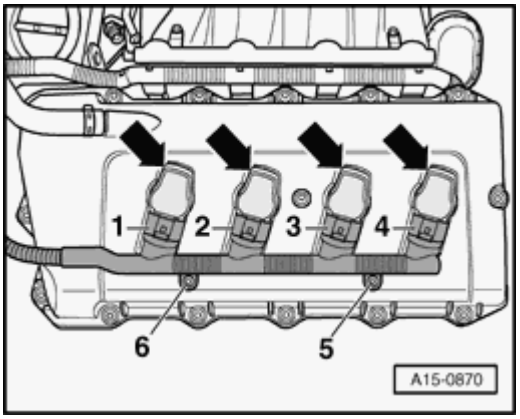


Fig. 539: Removing Bolts On Right Cylinder Head, Disconnecting Electrical Harness Connectors & Removing Ignition Coils
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts - **5** - and - **6** - on right cylinder head.
- Disconnect electrical harness connectors - **1 to 4** -.
- Remove ignition coils - **arrows** -.

NOTE:

- **Extractor T40039 can be used for removal.**

- Using spark plug removal tool 3122 B , remove spark plugs.
- Open throttle valve completely.
- Check compression using compression tester V.A.G 1763.

NOTE:

- **Using the compression tester Operating instructions.**

- Have a second technician press accelerator pedal completely and at the same time operate starter long enough until pressure increase no longer appears on tester.

Compression pressure:

New bar positive pressure	Wear limit bar positive pressure	Difference between cylinders bar positive pressure
10.0 to 14.0	9.0	max. 3.0

Assembly is in reverse order of removal, note the following:

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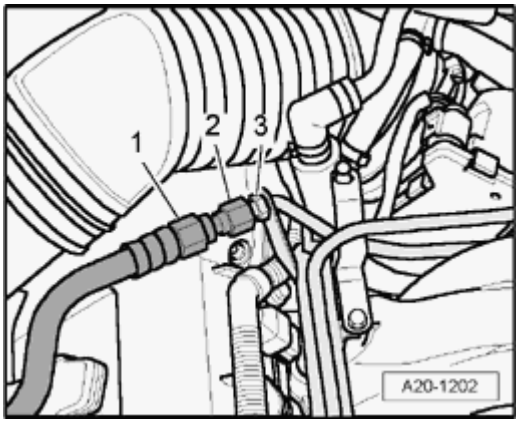


Fig. 540: Installing/Removing Fuel Hose To/From Connection On Fuel Rail Line
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Secure fuel hose to connection on fuel rail line. To do so, counter hold using an open-end wrench at each hex head - **1** - and - **3** - and tighten union nut - **2** - to 22 Nm.
- Install sparks plugs -->
  - **01 - MAINTENANCE**
  - **01 - MAINTENANCE** for MAINTENANCE PROCEDURES - CABRIOLET

.

Faults are saved in the ECM when the electrical connectors are disconnected:

- Connect Vehicle Diagnosis, testing info. system VAS 5051B.
- Start "Guided Functions" operating mode.
- Generate readiness code in ECM.

Torque specifications

Component	Nm
Wiring for ignition coils at cylinder head cover	5 * See note
Oil dip stick guide tube to cylinder head	10
Fuel supply line to fuel rail	22

* Insert using locking compound; locking compound .

VALVETRAIN, SERVICING

Valvetrain, servicing

NOTE:

- **Cylinder heads with cracks between the valve seats, or between the valve seat and the spark plug threads, can continue to be used without reducing the service life, as long as the cracks have a width of max. 0.3 mm, or only**

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the first 4 threads of the spark plug threads are cracked.

- **After installing the camshafts, the engine may not be started for approx. 30 minutes. The hydraulic equalization elements must seat themselves (otherwise the valves will crash into the pistons).**
- **After working on the valvetrain, carefully rotate engine by hand at least 2 full revolutions to ensure that valves do not strike the pistons when starting.**
- **Always replace seals, sealing rings and O-rings.**

Valvetrain, component overview

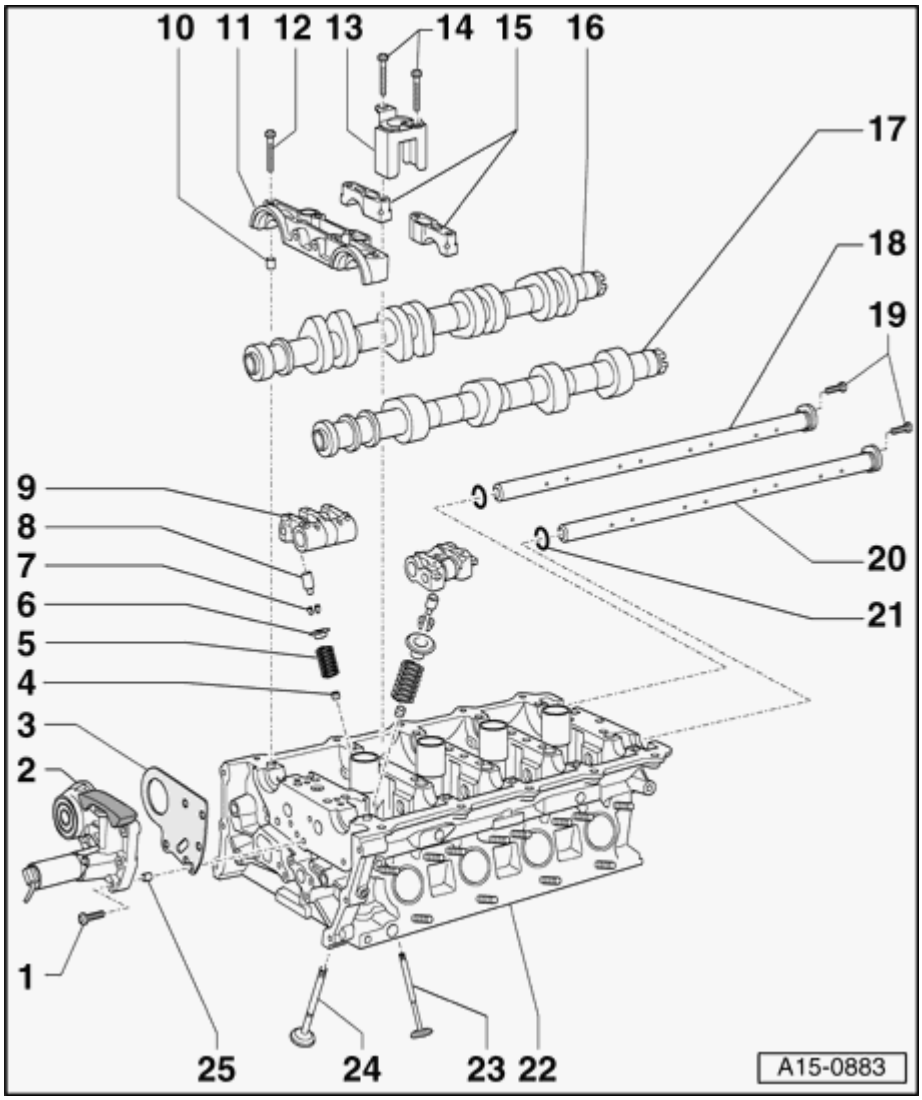


Fig. 541: Valvetrain, Component Overview
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - 5 Nm plus an additional $^{1}/_{4}$ turn (90 °)

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- Replace

2 - Housing for camshaft adjustment solenoid valve

3 - Gasket

- Replace

4 - Valve stem seal

- Replacing --> **Valve stem seals, replacing**.

5 - Valve spring

6 - Valve spring plate

7 - Valve keepers

8 - Hydraulic valve lifter

- Pressed into roller rocker lever
- Not removable without being damaged

9 - Roller rocker lever

- Removing and installing --> **Roller rocker lever, removing and installing**

10 - Alignment bushing

- 2 pieces

11 - Double bearing cap

12 - 5 Nm plus an additional $^{1}/_{4}$ turn (90 °)

- Replace

13 - Oil deflector

- On cylinder head at right between bearing cap E4 and A4
- On cylinder head at left between bearing cap E2 and A2

14 - 5 Nm plus an additional $^{1}/_{4}$ turn (90 °)

- Replace

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15 - Bearing cap

- Note installation position and allocation **Installing**

16 - Intake camshaft

- Removing and installing --> **Camshafts, removing and installing**
- Checking axial play --> **Camshaft (axial clearance), checking**
- Check radial clearance using Plastigage (roller rocker lever removed) wear limit 0.1 mm run-out max. 0.01 mm

17 - Exhaust camshaft

- Removing and installing --> **Camshafts, removing and installing**
- Checking axial play --> **Camshaft (axial clearance), checking**
- Check radial clearance using Plastigage (roller rocker lever removed) wear limit 0.1 mm run-out max. 0.01 mm

18 - Shaft for roller rocker lever, intake side

- Removing and installing --> **Roller rocker lever, removing and installing**

19 - 10 Nm

20 - Shaft for roller rocker lever, exhaust side

- Removing and installing --> **Roller rocker lever, removing and installing**

21 - O-ring for shaft of roller rocker lever

- Replace

22 - Cylinder head

- See note --> **Valvetrain, servicing**
- Check valve guides, grind valve seats --> **Valve guides, checking**
- Rework valve seats --> **Valve seats, refacing**

23 - Intake valve

- Do not rework, only lapping is permitted
- Valve dimensions --> **Valve dimensions**
- Check valve guides, grind valve seats --> **Valve guides, checking**

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- Do not rework, only lapping is permitted
- Valve dimensions --> **Valve dimensions**
- Check valve guides, grind valve seats --> **Valve guides, checking**

25 - Alignment bushing

- 2 pieces

Camshafts, removing and installing

NOTE:

- **Removal and installation at right cylinder head is depicted in the following description.**

Removing

- Remove engine: Vehicles with manual transmission --> **Engine (vehicles with manual transmission)** , vehicles with automatic transmission --> **Engine (vehicles with automatic transmission), removing**.
- Disconnect engine and transmission: Vehicles with manual transmission --> **Engine (vehicles with manual transmission), separating** , vehicles with automatic transmission --> **Engine and transmission (vehicles with automatic transmission), separating**.
- Remove camshaft timing chains from camshafts --> **Camshaft timing chains, removing from camshafts**.

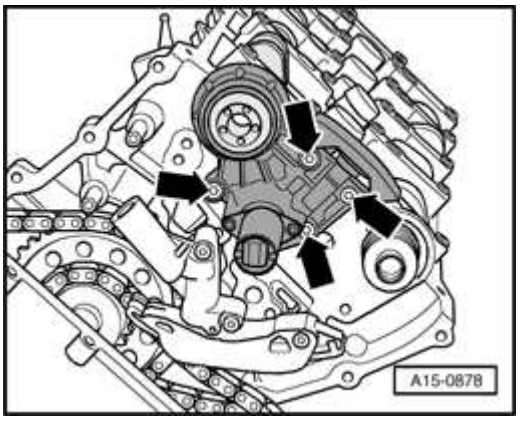


Fig. 542: Removing Housing For Camshaft Adjustment Solenoid Valves
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove housing for camshaft adjustment solenoid valves - **arrows** -.

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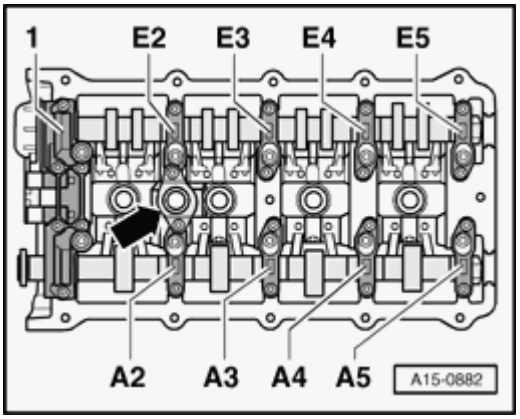


Fig. 543: Removing/Installing Bearing Caps
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bearing caps - **1** - , - **E3** - , - **E5** - , - **A3** - and - **A5** -.
- Remove oil deflector - **arrow** -.
- Loosen and remove bearing caps - **E2** - , - **E4** - , - **A2** - and - **A4** - for intake and exhaust camshafts, alternating and in diagonal sequence.
- Remove intake and exhaust camshaft.

Installing

- Secure crankshaft in TDC position using Crankshaft Holder 3242.

NOTE:

- **Always replace bolts that are tightened to torque as well as O-rings and gaskets.**

- Install camshafts at TDC position into cylinder head.

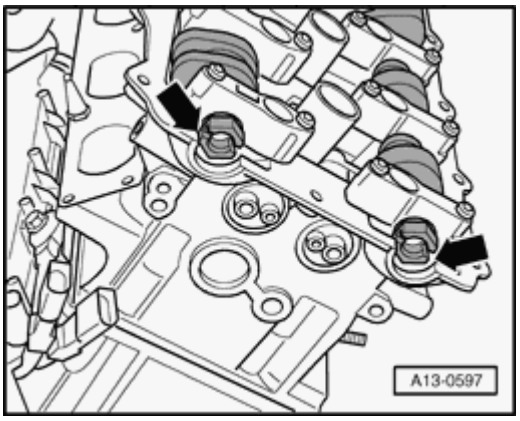


Fig. 544: Identifying Slits At Front In Camshafts Stand Parallel At Same Height With Upper Edge Of Cylinder Head
Courtesy of VOLKSWAGEN UNITED STATES, INC.

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- Slits - **arrows** - at front in camshafts must stand parallel at same height with upper edge of cylinder head.

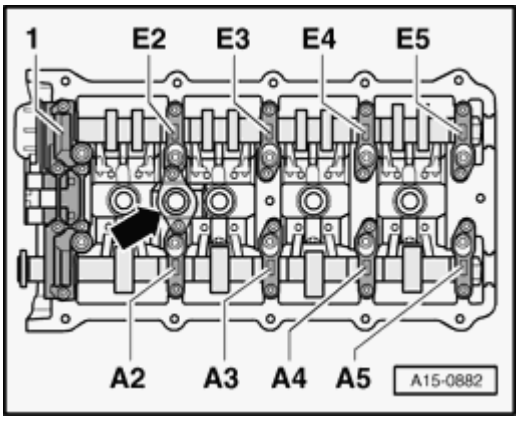


Fig. 545: Removing/Installing Bearing Caps
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Install bearing caps - **E2** - , - **E4** - , - **A2** - and - **A4** -.
- Install oil deflector - **arrow** - :

- On cylinder head at right between bearing cap - **E4** - and - **A2** -
- On cylinder head at left between bearing cap - **E2** - and - **A2** -

- Tighten bearing caps - **E2** - , - **E4** - , - **A2** - and - **A4** - for intake and exhaust camshafts, alternating and in diagonal sequence.
- Tighten remaining bearing caps in diagonal sequence.

NOTE:

- **Note alignment bushing on bearing cap - 1 -.**

The rest of installation is in reverse order of removal, note the following:

- Install camshaft timing chains **Installing**.
- Install engine: Vehicles with manual transmission --> **Engine (vehicles with manual transmission), installing** , vehicles with automatic transmission --> **Engine (vehicles with automatic transmission), installing**.

Torque specifications

Component	Nm
Bearing cap to cylinder head	5 plus an additional 90 ° * See note
Housing for camshaft adjustment solenoid valve	5 plus an additional 90 ° * See note

* 90 ° corresponds to one quarter turn.

*Replace bolts.

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Camshaft (axial clearance), checking

Special tools, testers and auxiliary items required

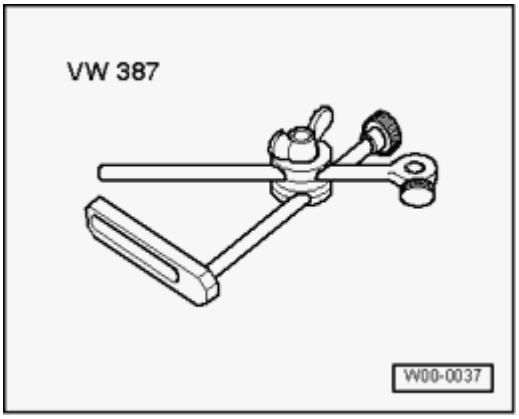


Fig. 546: Identifying Dial Gauge Holder VW 387
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Dial gauge holder VW 387
- Dial gauge

Test sequence

- Camshafts removed.
- Roller rocker lever removed.

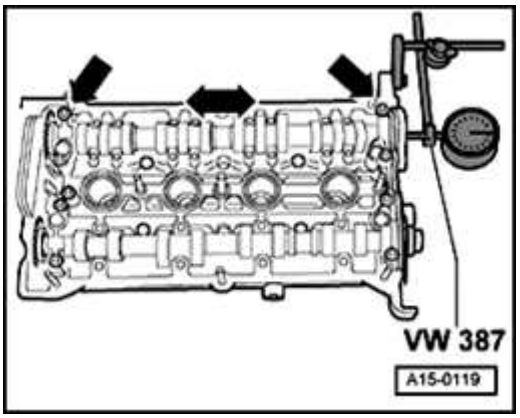


Fig. 547: Inserting Camshafts In Cylinder Head And Tighten With Outer Bearing Caps
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Insert camshafts in cylinder head and tighten with outer bearing caps - **arrows** -.
- Secure dial gauge holder VW 387 to dial gauge on cylinder head:

Wear limit for intake and exhaust camshaft.

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- Axial clearance: max. 0.20 mm.

Roller rocker lever, removing and installing

Removing

- Remove engine: Vehicles with manual transmission --> **Engine (vehicles with manual transmission)** , vehicles with automatic transmission --> **Engine (vehicles with automatic transmission), removing**.
- Remove camshaft timing chains from camshafts --> **Camshaft timing chains, removing from camshafts**.
- Remove camshafts --> **Camshafts, removing and installing**.
- Mark allocation of roller rocker lever and shafts for roller cam follower for re-installation.

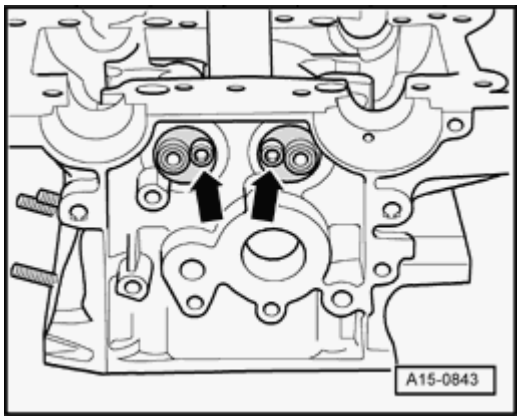


Fig. 548: Removing bolts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts - **arrows** -.
- Thread a M6-bolt into hole in shaft for roller rocker lever.
- Remove shaft from cylinder head and remove roller rocker lever.

Installing

Installation is in reverse order of removal, note the following:

NOTE:

- **Replace O-rings.**

- Lubricate bearing areas of roller rocker lever with oil before installation.
- Install camshafts --> **Camshafts, removing and installing**.
- Install camshaft timing chains **Installing**.
- Install engine: Vehicles with manual transmission --> **Engine (vehicles with manual transmission), installing** , vehicles with automatic transmission --> **Engine (vehicles with automatic transmission), installing**.

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Torque specifications

Component	Nm
Shaft for roller rocker lever to cylinder head	10

Valve stem seals, replacing

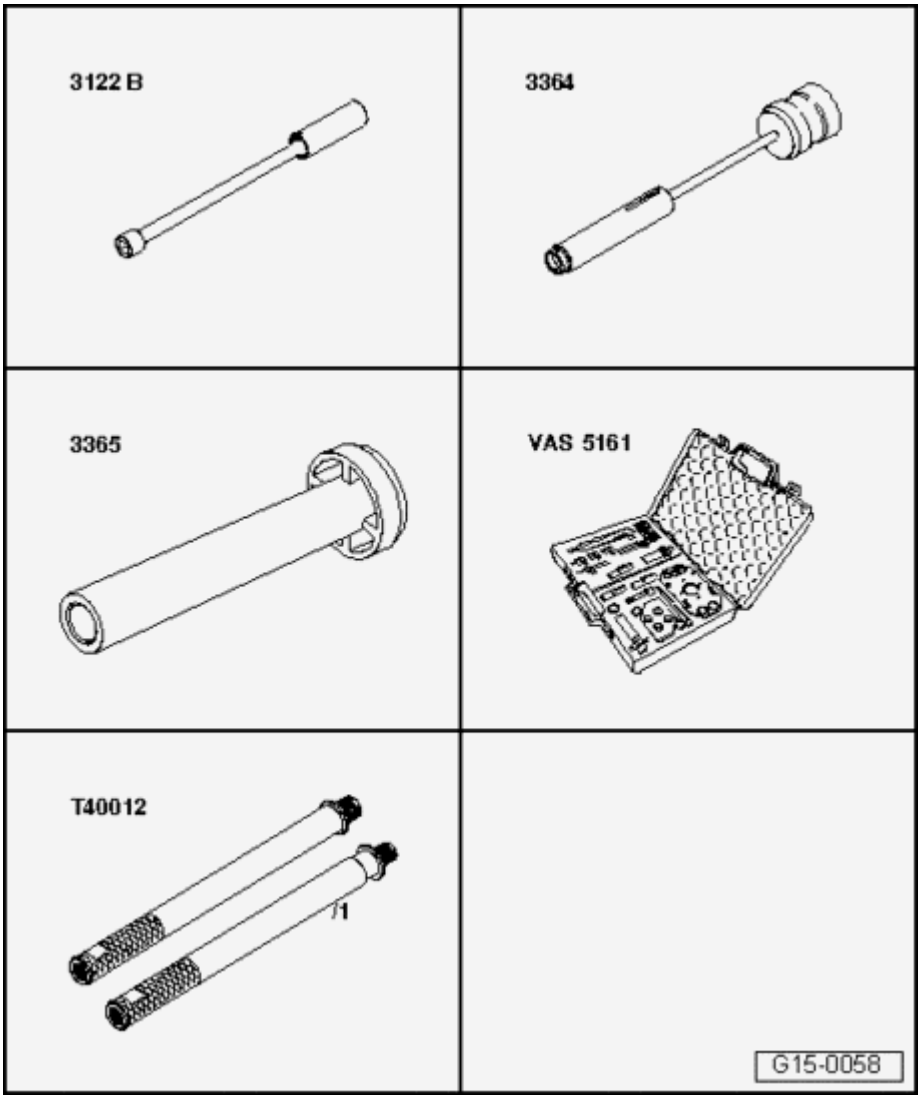


Fig. 549: Identifying Special Tools - Valve Stem Seals, Replacing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools, testers and auxiliary items required

- Spark plug removal tool 3122 B
- Valve seal removal tool 3364
- Valve stem seal driver 3365

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- Valve cotter disassembly and assembly device VAS 5161
- Adapter T40012

Work procedure

- Remove engine: Vehicles with manual transmission --> **Engine (vehicles with manual transmission)** , vehicles with automatic transmission --> **Engine (vehicles with automatic transmission), removing**.
- Remove camshaft timing chains from camshafts --> **Camshaft timing chains, removing from camshafts**.
- Remove camshafts --> **Camshafts, removing and installing**.
- Using spark plug removal tool 3122 B , remove spark plugs.

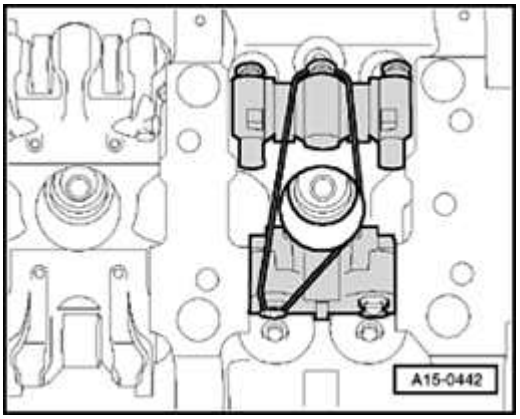


Fig. 550: Turning Roller Rocker Lever Upward And Securing With A Rubber Band
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Turn roller rocker lever upward and secure it with a rubber band.

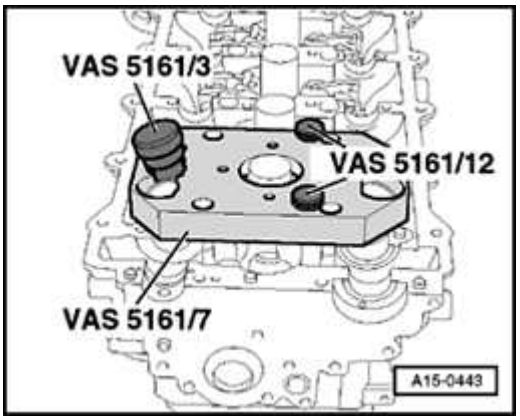


Fig. 551: Placing Guide Plate VAS 5161/7 From Valve Cotter Disassembly, Assembly Device VAS 5161 On Cylinder Head & Securing Guide Plate VAS 5161/7 With Knurled Screws VAS 5161/12
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Place guide plate VAS 5161/7 from valve cotter disassembly and assembly device VAS 5161 on cylinder

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head.

- Secure guide plate VAS 5161/7 with knurled screws VAS 5161/12.

NOTE:

- **If guide plate cannot be installed, drill mounting bores to approx. 0.5 mm.**

- Insert drift VAS 5161/3 into guide plate and loosen stuck valve keepers using a plastic hammer.

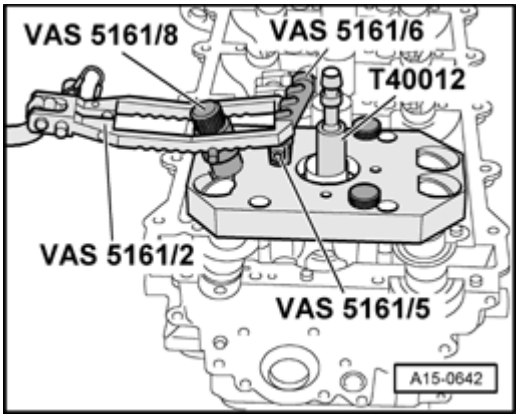


Fig. 552: Installing Engaging Device VAS 5161/6 With Installation Forks VAS 5161/5 Into Guide Plate VAS 5161/7
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Install engaging device VAS 5161/6 with installation forks VAS 5161/5 into guide plate VAS 5161/7.
- Guide installation cartridge VAS 5161/8 into guide plate VAS 5161/7.
- Install adapter T40012 with gasket by hand into respective spark plug thread and apply constant pressure.

- Minimum pressure: 6 bar positive pressure.

- Engage pressure fork VAS 5161/2 at engaging device VAS 5161/6 and press down installation cartridge VAS 5161/8.
- At the same time, turn knurled bolt of installation cartridge VAS 5161/8 toward right, until points engage in valve keepers.
- Lightly move knurled bolt back and forth, this causes valve keys to be pressed apart and captured in installation cartridge VAS 5161/8.
- Release pressure fork VAS 5161/2.

- Take out installation cartridge VAS 5161/8.
- Remove guide plate VAS 5161/7.

- Pressurized air hose remains connected

- Remove valve spring with valve spring plate.

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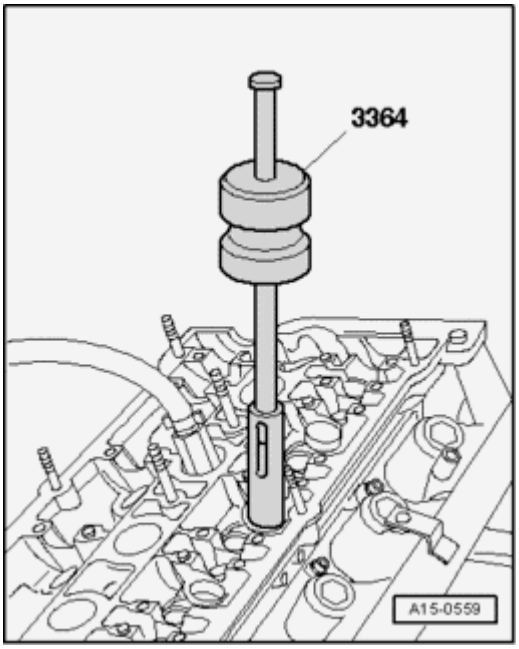


Fig. 553: Identifying Valve Seal Removal Tool 3364
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Pull off valve stem oil seals using Valve Seal Removal Tool 3364.

Installing

NOTE:

- **For pressing on valve stem seals from delivery program, the Valve Stem Seal Driver 3365 must be drilled to dia. of 10.5 mm.**

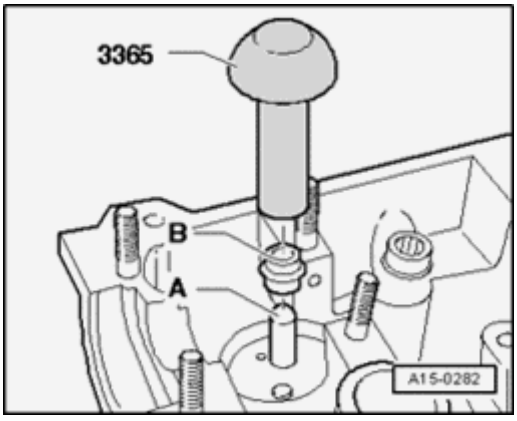


Fig. 554: Identifying Plastic Sleeve, Valve Stem Oil Seal & Valve Stem Seal Driver 3365
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- A plastic sleeve - **A** - is supplied with new valve shaft seals.

- Place plastic sleeve - **A** - on valve stem to prevent damage to new valve stem seals - **B** -.

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- Lightly coat sealing lips of valve stem seal with oil.
- Push valve stem seal onto plastic sleeve.
- Carefully press valve stem oil seal onto valve guide using valve stem seal driver 3365.
- Remove plastic sleeve again.

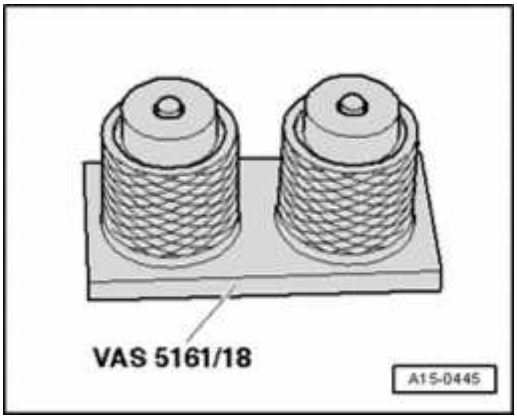


Fig. 555: Identifying Installation Cartridge VAS 5161/8
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- If valve keepers were removed from Installation Cartridge VAS 5161/8 , they must then be inserted into Insertion Device VAS 5161/18.

NOTE:

- **The large diameter of the valve keepers points upward.**

- Insert valve spring and valve spring plate.
- Install Guide Plate VAS 5161/7 onto cylinder head again.

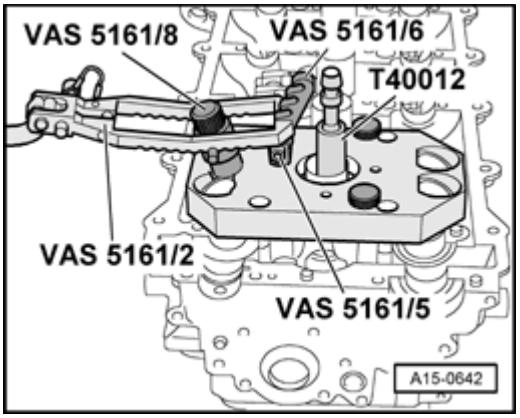


Fig. 556: Installing Engaging Device VAS 5161/6 With Installation Forks VAS 5161/5 Into Guide Plate VAS 5161/7
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Insert installation cartridge VAS 5161/8 into guide plate VAS 5161/7.

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- Press down Pressure Fork VAS 5161/2 and pull knurled bolt upward - the valve keepers are inserted in this manner.
- Release pressure fork VAS 5161/2 with knurled bolt still pulled.
- Install sparks plugs -->
  - **01 - MAINTENANCE**
  - **01 - MAINTENANCE** for MAINTENANCE PROCEDURES - CABRIOLET

  .
- Install camshafts --> **Camshafts, removing and installing**.
- Install camshaft timing chains **Installing**.
- Install engine: Vehicles with manual transmission --> **Engine (vehicles with manual transmission), installing** , vehicles with automatic transmission --> **Engine (vehicles with automatic transmission), installing**.

NOTE:

- **After installing camshafts, do not crank engine for at least 30 minutes. The hydraulic equalization elements must seat themselves (otherwise valves will strike the pistons).**
- **After working on the valvetrain and lifters, carefully rotate the crankshaft by hand at least 2 full revolutions before starting to be sure that valves do not strike the pistons.**

Valve guides, checking

Special tools, testers and auxiliary items required

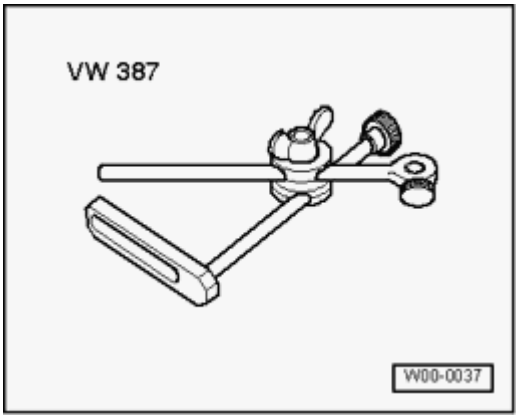


Fig. 557: Identifying Dial Gauge Holder VW 387
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Dial gauge holder VW 387
- Dial gauge

Work sequence

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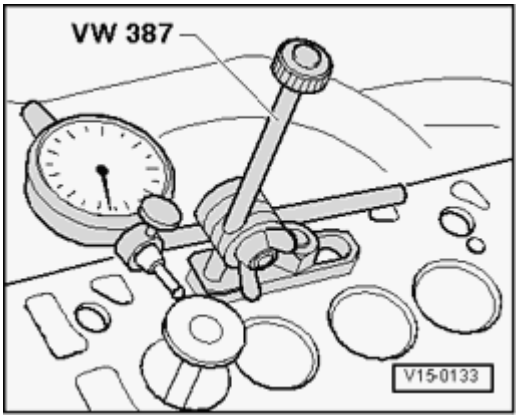


Fig. 558: Identifying Special Tool - VW 387 Installed
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Insert valve into valve guide.
- Valve stem tip must seal with valve guide.

NOTE:

- **Due to differences in valve stem diameter, make sure that only intake valves are used to check intake valve guides, and only exhaust valves are used to check exhaust valve guides.**

- Determine tilt clearance.
- Wear limit of intake and exhaust valve guide: 0.80 mm.

NOTE:

- **If wear limit is exceeded, re-measure using new valves.**
- **If wear limit is still exceeded, replace cylinder head. The valve guides cannot be replaced.**
- **If valve is replaced during repair, use new valve for measurement.**

Valves, checking

- Perform a visual check for signs of wear at stem and at seating surface.
- Replace valves with significant traces of wear.

Valve dimensions

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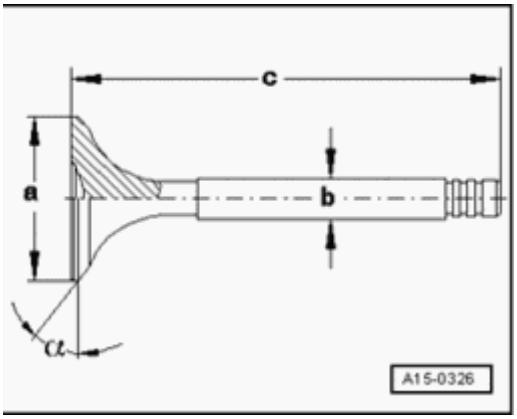


Fig. 559: Valve Dimensions
Courtesy of VOLKSWAGEN UNITED STATES, INC.

NOTE:

- **Intake and exhaust valves must not be refaced by grinding. Only lapping is permitted.**

Dimension	Intake valve	Exhaust valve
a = diameter mm	26.8 to 27.0	29.8 to 30.0
b = diameter mm	5.956 to 5.970	5.936 to 5.950
c = mm	96.39 to 96.59	94.79 to 94.99
a = Angle °	45	45

CAUTION:

- **Worn sodium-filled exhaust valves must not be scrapped without first being properly treated.**
- **Using a metal saw, the valves must be cut in half between the shaft center and valve plate. While doing this, do not come into contact with water. After cutting open valves, throw not more than 10 at a time into a bucket of water. Then, move quickly away, because a sudden chemical reaction will occur during which the sodium is burnt away.**
- **The treated parts may then be discarded through conventional disposal channels.**

Valve seats, refacing

NOTE:

- **If a perfect contact pattern is not achieved by grinding the valve seats, reface the valve seats.**

Special tools, testers and auxiliary items required

- Depth gauge
- Valve seat refacing tool

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NOTE:

- **When repairing engines with leaking valves, it is not sufficient to rework or replace valve seats and valves. It is particularly important to check valve guides for wear on engines with higher mileage --> Valve guides, checking**
- **Only reface valve seats enough until a perfect contact pattern is obtained.**
- **Before refacing, determine maximum refacing dimension.**
- **If refaced dimension is exceeded, hydraulic valve lifter function is no longer guaranteed and cylinder head must be replaced.**

Determining maximum allowable refacing dimension

- Insert valve and press it firmly against valve seat.

NOTE:

- **If the valve is to be replaced as part of a repair, use a new valve for the calculation.**

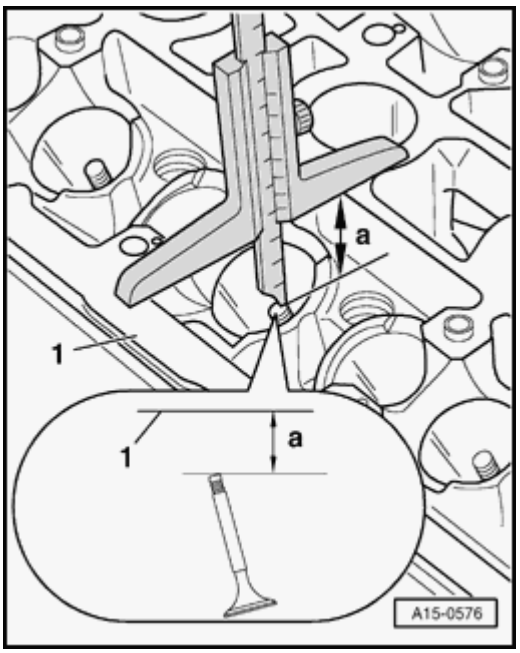


Fig. 560: Measuring Distance Between Valve Stem End (Upper Edge) And Top Surface Of Cylinder Head Using Depth Gauge
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Measure distance - **a** - between end of valve stem and camshaft center axle (camshaft center axle is located at the level of cylinder head upper edge).
- Calculate maximum permissible refacing dimension from measured distance and the minimum dimension.

Minimum dimension		
Outer intake valves	Center intake valves	Exhaust valves

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39.3 mm	41.0 mm	39.9 mm

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

Example for outer intake valve:		
	Measured distance	39.7 mm
	Minimum dimension	-39.3 mm
=	Maximum permissible refacing dimension	= 0.4 mm

NOTE:

- **If the maximum allowed refaced dimension is 0 mm or less than 0 mm, repeat measurement using new valve. If measurement result is still 0 mm or less than 0 mm, replace cylinder head.**

Refacing valve seats

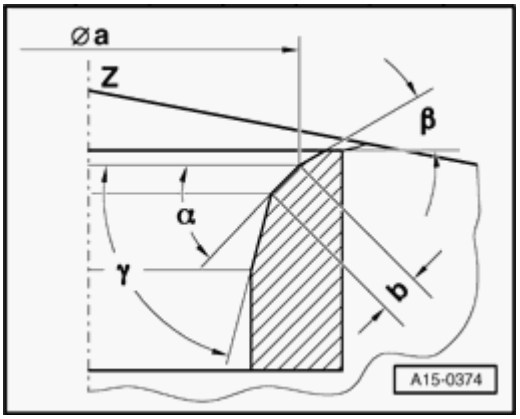


Fig. 561: Refacing Valve Seats
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Intake valve seat

a - Dia. 26.6 mm

b - Approx. 1.0 mm

Z - Lower edge of cylinder head

a - 45 ° valve seat angle

ß - 30 ° upper correction angle

gamma - 60 ° lower correction angle

Exhaust valve seat

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a - Dia. 26.0 mm

b - Approx. 1.0 mm

Z - Lower edge of cylinder head

a - 45 ° valve seat angle

ß - 30 ° upper correction angle

gamma - 60 ° lower correction angle

NOTE:

- **Determining maximum allowable refacing dimension Determining maximum allowable refacing dimension.**

Camshaft adjustment, checking

The adjustment of intake camshafts is load- and RPM dependent. Oil pressure is switched to respective camshaft adjuster (mechanical adjustment devices) via solenoid valve for camshaft adjustment.

NOTE:

- **Camshaft adjustment is active only 25 seconds after engine start.**

Solenoid valves for camshaft adjustment, checking

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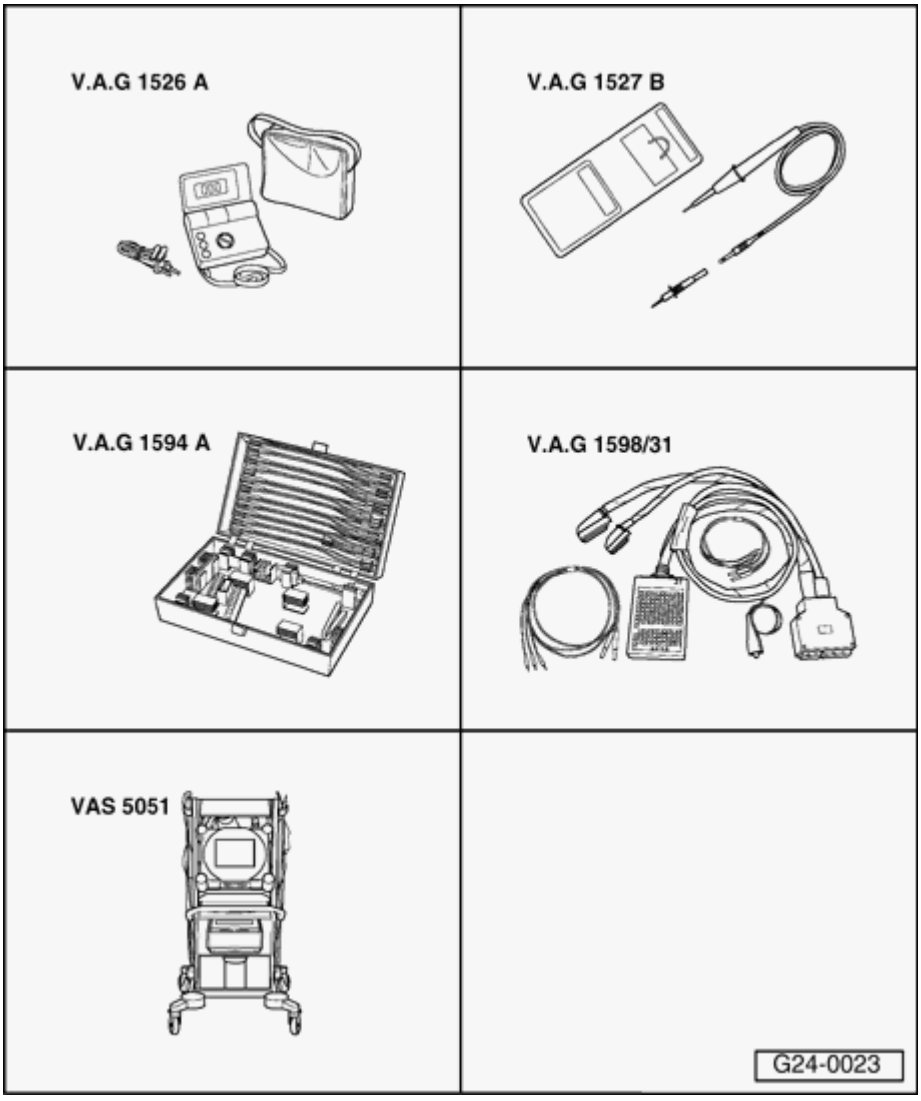


Fig. 562: Identifying Special Tools - Solenoid Valves For Camshaft Adjustment, Checking
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools, testers and auxiliary items required

- Hand multimeter V.A.G 1526 B or V.A.G 1526 A
- Voltage tester V.A.G 1527 B
- Connector test kit V.A.G 1594 C or V.A.G 1594 A
- Test box 1598/31

- Vehicle Diagnostic, Testing and Information System VAS 5051 A with diagnostic cable VAS 5051/1

Preparation

Cylinder bank 1 (right):

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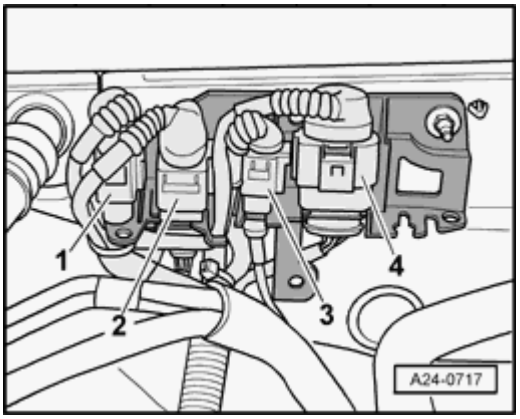


Fig. 563: Removing Bracket For Electrical Harness Connectors At Right From Bulkhead
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical harness connector - **3** - to Camshaft Adjustment Valve 1 N205.

Cylinder bank 2 (left):

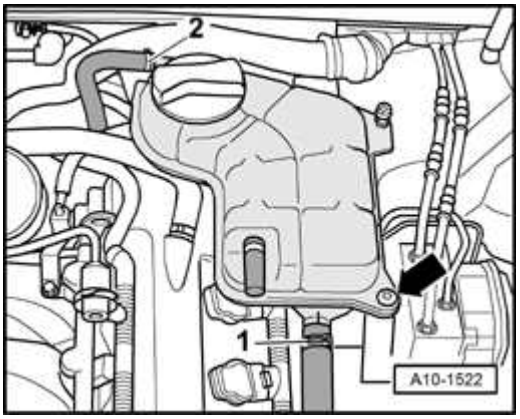


Fig. 564: Removing Coolant Hoses & Coolant Expansion Tank
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove coolant expansion tank bolt - **arrow** -.
- Disconnect electrical wire from Engine Coolant Level (ECL) Warning Switch F66 and set aside coolant reservoir with coolant hoses - **1** - and - **2** - connected.

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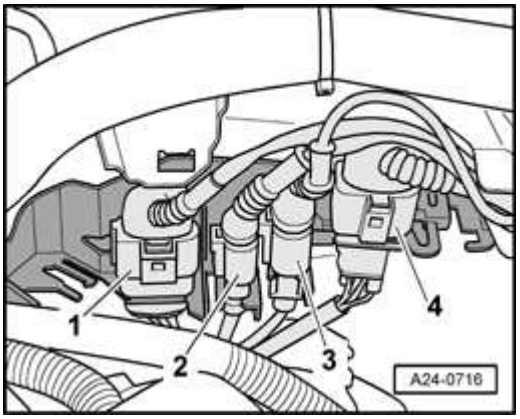


Fig. 565: Disconnecting Electrical Harness Connector To Camshaft Adjustment Valve 2 N208
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical harness connector - **2** - to Camshaft Adjustment Valve 2 N208.

Checking internal resistance

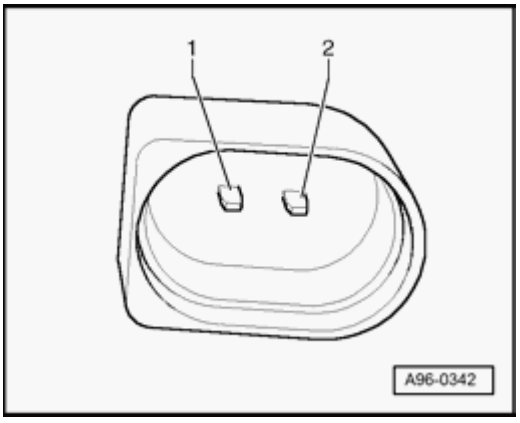


Fig. 566: Identifying Exhaust Flap Valve 1 N321 Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect multimeter to valve for resistance measurement.

- Specification: 8 to 13 ohms.

If specification is not obtained:

- Replace valve.

If specified value is not achieved:

Checking voltage supply

- Fuse for valve for camshaft adjustment is OK --> Electrical Wiring Diagrams, Troubleshooting and

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- Motronic Engine Control Module (ECM) Power Supply Relay J271 OK.

NOTE:

- **Voltage for camshaft adjustment valves is supplied via Motronic Engine Control Module (ECM) Power Supply Relay J271.**

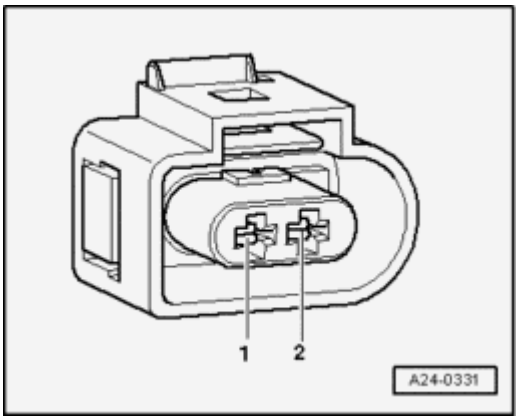


Fig. 567: Identifying 2-Pin Electrical Harness Connector & Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect voltage tester V.A.G 1527 B as follows:

Harness connector Terminal	Measure to
- 1 -	Engine Ground (GND)

- Operate starter briefly.

- LED must light up.

If LED does not light up:

- Check wire connection from terminal 1 of electrical harness connector via fuse to Motronic Engine Control Module (ECM) Power Supply Relay J271 for open circuit according to wiring diagram.
- Repair wire connection if necessary.

If LED lights up:

Check activation

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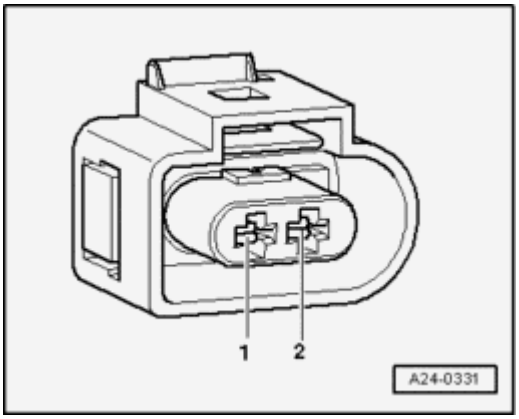


Fig. 568: Identifying 2-Pin Electrical Harness Connector & Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect voltage tester V.A.G 1527 B to terminals - **1** - (B+) and - **2** - of electrical harness connector.
- Connect Vehicle Diagnostic, Testing and Information System VAS 5051 and select vehicle system "01 - engine electronics". Ignition must be switched on Guided Fault Finding in VAS 5051.

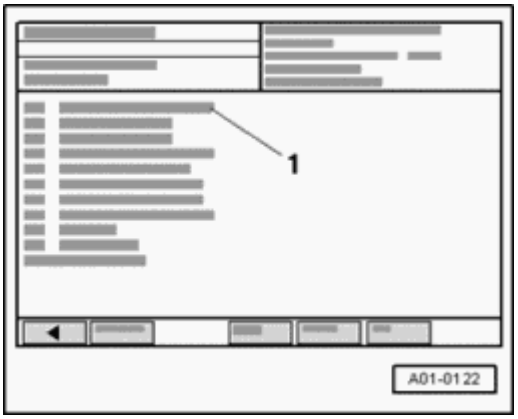


Fig. 569: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS 5051 :

- In selection - **1** - , click on the function "03 - output Diagnostic Test Mode (DTM)".
- Press --> button repeatedly until Camshaft Adjustment Valve 1 N205 is activated.

- LED must blink.

- Press --> button repeatedly until Camshaft Adjustment Valve 2 N208 is activated.

- LED must blink.

- End function "03 - output Diagnostic Test Mode (DTM)" by pressing <-- button.
- Select "06 - End Output".

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- Switch off ignition.

If LED does not blink or it remains lit:

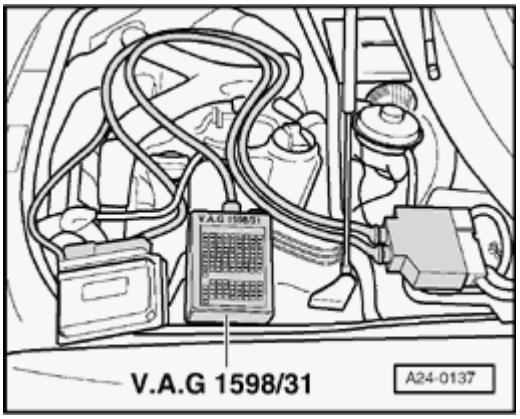


Fig. 570: Connecting Test Box VAG1598/31 To Engine Control Module Wiring Harness
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect test box V.A.G 1598/31 to wiring harness connectors, Engine Control Module (ECM) is not connected. Connect Ground (GND) clip at test box (not visible in illustration) to Ground (GND) --> **24 MULTIPORT FUEL INJECTION (MFI)** .

CAUTION: To avoid damaging electronic components, set measuring range before connecting test leads and observe all test requirements.

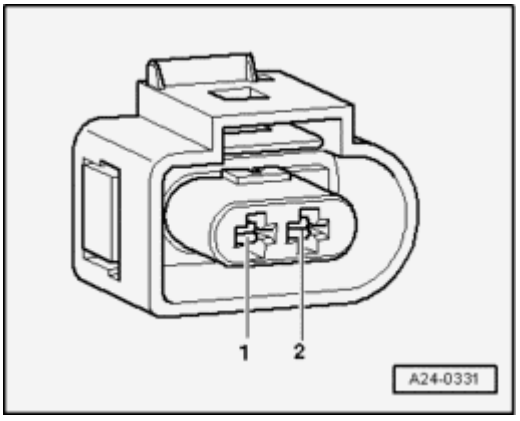


Fig. 571: Identifying 2-Pin Electrical Harness Connector & Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Check following wire connections for open circuit and short circuit to Ground (GND) and B+:

- Camshaft Adjustment Valve 1 N205

Harness connector Terminal	Test box V.A.G 1598/31 Socket

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- 2 -	115

- Camshaft Adjustment Valve 2 N208

Harness connector Terminal	Test box V.A.G 1598/31 Socket
- 2 -	120

- Repair wire connection if necessary.

If wiring connection is OK:

- Replace Engine Control Module (ECM) --> **24 MULTIPORT FUEL INJECTION (MFI)** .

If no malfunctions are detected:

- Replace mechanical camshaft adjuster --> **Camshafts, removing and installing**.

17 - ENGINE - LUBRICATION

LUBRICATION SYSTEM COMPONENTS, REMOVING AND INSTALLING

Lubrication system components, removing and installing

NOTE:

- **If large quantities of metal shavings or abraded material are found in the engine oil while servicing the engine, oil passages must be carefully cleaned to prevent resulting damage and the oil cooler must be replaced.**
- **Oil level must not exceed max. marking danger of catalytic converter damage!**
- **Oil quantities, oil specifications and viscosity classes Fluid Capacity Chart.**

Oil pump, lower section of oil pan, component overview

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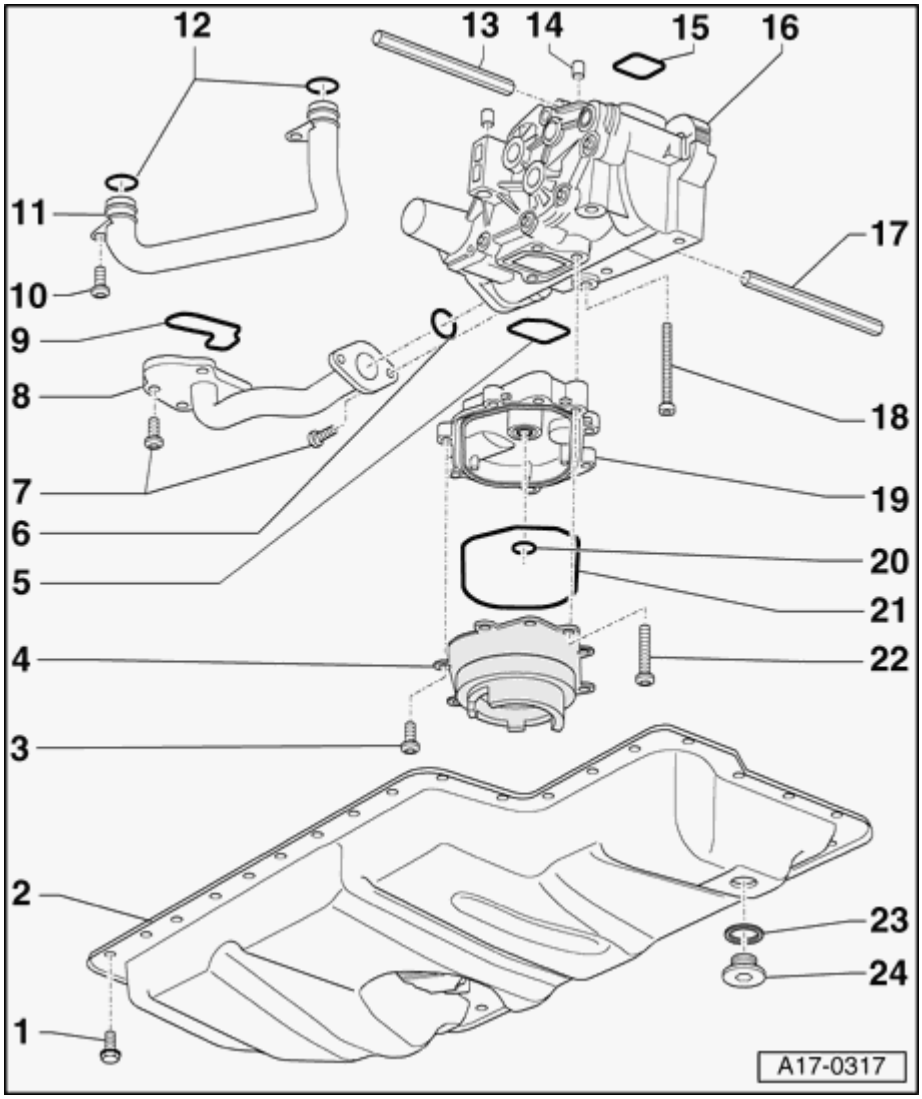


Fig. 572: Oil Pump, Lower Section Of Oil Pan, Component Overview
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - 10 Nm

2 - Oil pan (lower section)

- Removing and installing --> **Oil pan (lower part), removing and installing**
- With Oil Level Thermal Sensor G266
- Oil Level Thermal Sensor G266 , removing and installing --> **Oil Level Thermal Sensor G266 , removing and installing**

3 - 10 Nm

4 - Intake tube

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- With oil strainer

5 - Seal

- Replace

6 - O-ring

- Replace

7 - 10 Nm

8 - Oil pipe

9 - Seal

- Replace

10 - 10 Nm

11 - Oil pipe

12 - O-rings

- Replace

13 - Drive shaft for coolant pump

14 - Fitting sleeves

- 2 pieces

15 - Seal

- Replace

16 - Oil pump

- Do not disassemble
- With relief valve approx. 4 bar
- Removing and installing --> **Oil pump, removing and installing**

17 - Drive shaft for oil pump

18 - 10 Nm

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19 - Housing for intake tube

20 - O-ring

- Replace

21 - Seal

- Replace

22 - 10 Nm

23 - Seal

- Replace

24 - Oil drain plug - 50 Nm

Oil Level Thermal Sensor G266 , removing and installing

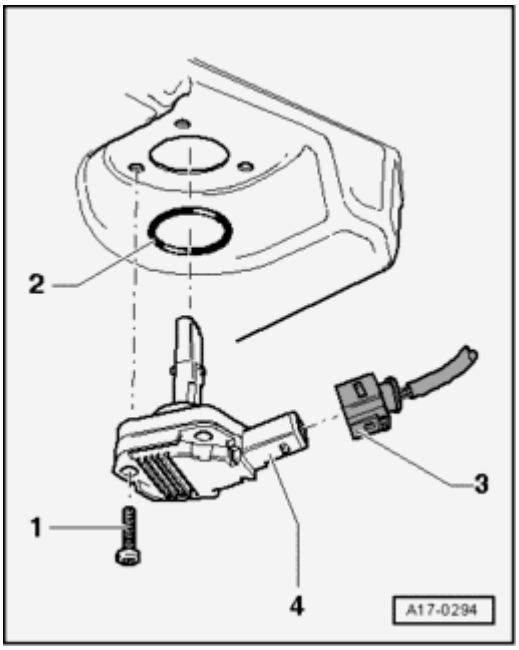


Fig. 573: Oil Level Thermal Sensor G266 , Removing And Installing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1. Bolt - 10 Nm. Insert using locking compound; locking compound
2. Sealing ring; replace
3. Electrical harness connector
4. Oil Level Thermal Sensor G266

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Oil pan (lower part), removing and installing

Special tools, testers and auxiliary items required

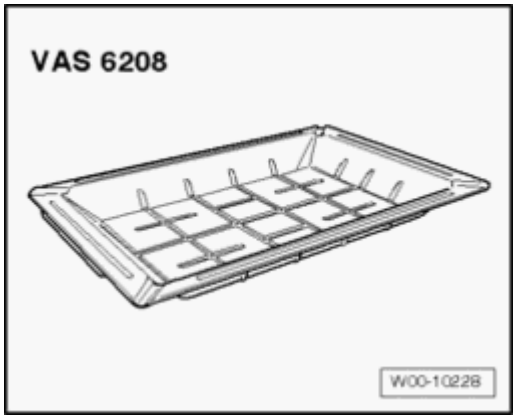


Fig. 574: Drip Tray For VAS 6100, VAS 6208
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Drip tray for workshop crane VAS 6208

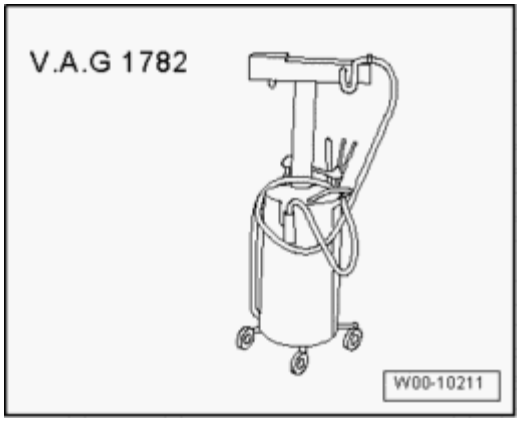


Fig. 575: Identifying Old Oil Collecting And Extracting Device V.A.G 1782
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Old oil collecting and extracting device V.A.G 1782
- Hand drill with plastic brush attachment
- Protective glasses
- Sealant

Removing

- Drain coolant --> **Cooling system, draining and filling**.
- Bring lock carrier into service position --> **Lock carrier, moving into service position**.

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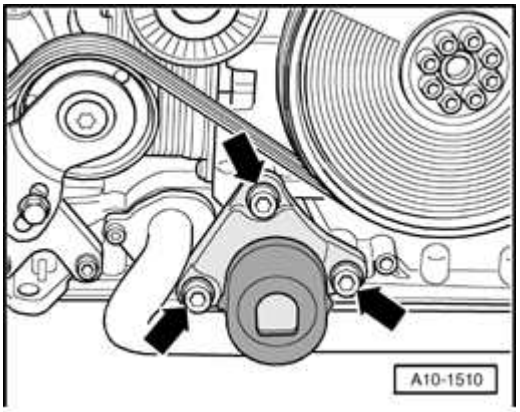


Fig. 576: Removing Bolts And Torque Support From Engine
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts - **arrows** - and remove torque support from engine.

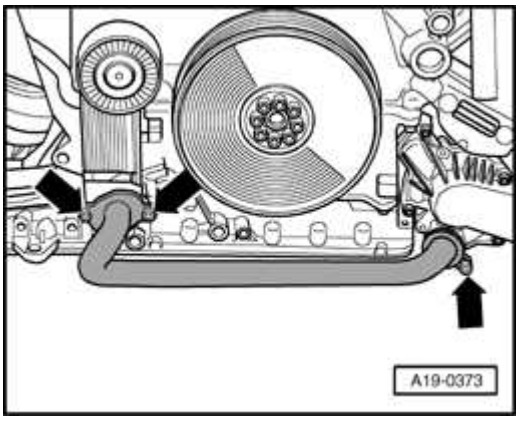


Fig. 577: Removing Front Coolant Pipe On Engine
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Place drip tray for workshop crane VAS 6208 under engine.
- Remove front coolant pipe on engine - **arrows** -.

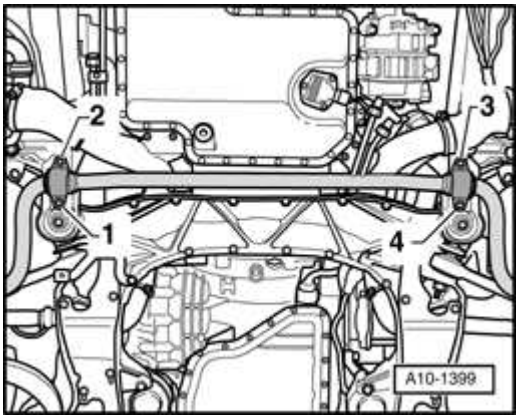


Fig. 578: Removing Nuts For Left/Right Stabilizer Mounts

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Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove nuts - **1 to 4** - for left and right stabilizer mounts.

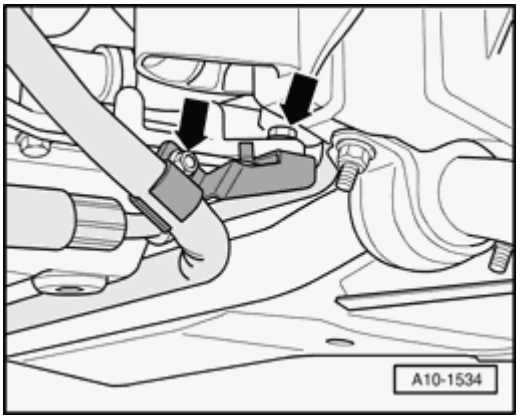


Fig. 579: Removing Left Bracket For Refrigerant Line
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove left bracket for refrigerant line - **arrows** -.

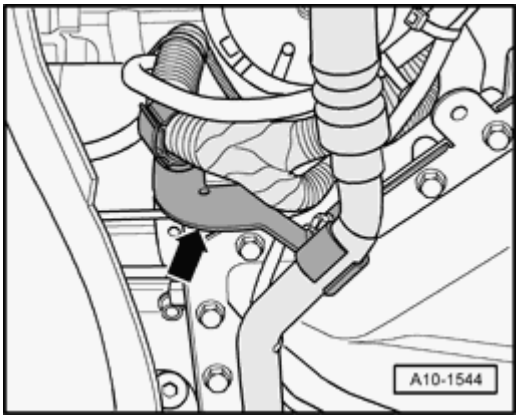


Fig. 580: Removing Refrigerant Line On Bracket
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove refrigerant line on bracket - **arrow** -.

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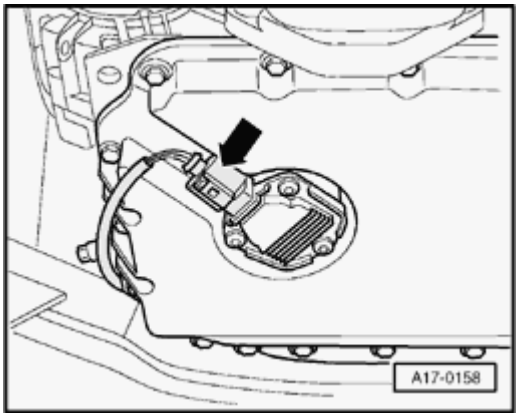


Fig. 581: Disconnecting Electrical Harness Connector On Oil Level Thermal Sensor G266 And Free Up Electrical Wire
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical harness connector on Oil Level Thermal Sensor G266 - **arrow** - and free up electrical wire.

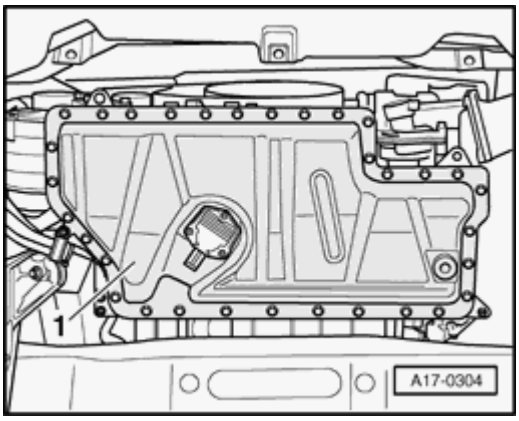


Fig. 582: Removing Oil Pan (Lower Part)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Place old oil collecting and extracting device V.A.G 1782 under engine and drain engine oil.
- Remove oil pan (lower part) - **1** - and pry out carefully.

NOTE:

- **There is still a residual amount of oil in lower section of oil pan.**

Installing

NOTE:

- **Replace seals.**

CAUTION: Wear safety glasses.

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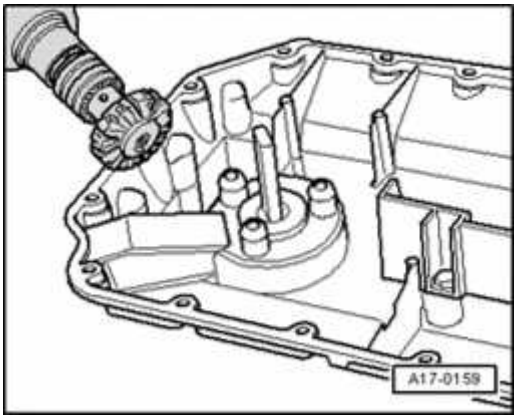


Fig. 583: Using Rotating Plastic Brush To Remove Any Remaining Sealant From Oil Pan (Lower Part) And At Upper Part
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Using rotating plastic brush, remove any remaining sealant from oil pan (lower part) and at upper part.
- Clean sealing surfaces, they must be free of oil and grease.

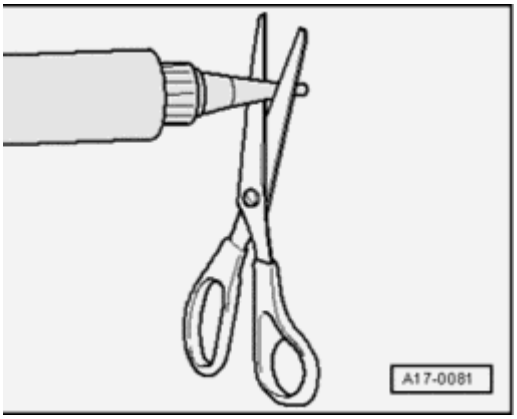
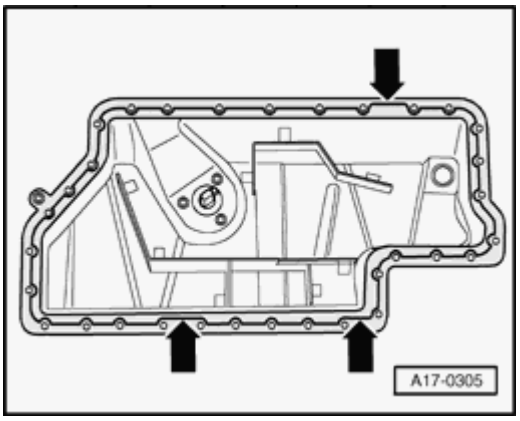


Fig. 584: Cutting Tube Nozzle At Front Marking
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Cut off nozzle on tube of sealant at front mark (dia. of nozzle approx. 1 mm).



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Fig. 585: Applying Sealant Bead On Clean Sealing Surface Of Lower Section Of Oil Pan
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Apply sealant bead - **arrows** - on clean sealing surface of lower section of oil pan as shown in illustration.

- Thickness of sealant bead: 1.5 to 2.0 mm.

NOTE:

- **Observe the position of the sealant bead at areas indicated with - arrows -.**
- **The oil pan (lower part) must be installed within 5 minutes after application of sealant.**
- **Sealant bead must not be thicker than specified, otherwise excess sealant may get into lower section of oil pan and clog strainer in intake tube.**

- Set lower part of oil pan in place and fasten all bolts in diagonal sequence to 5 Nm.
- Tighten bolts of lower section of oil pan in diagonal sequence to 10 Nm.

The rest of installation is in reverse order of removal, note the following:

- Install stabilizer bar --> **40 - FRONT SUSPENSION** .
- Install front coolant pipe --> **Front coolant pipe, removing and installing**.
- Install lock carrier with attachments -->
  - **50 BODY, FRONT**
  - **50 - BODY - FRONT** for BODY EXTERIOR - CABRIOLET

.

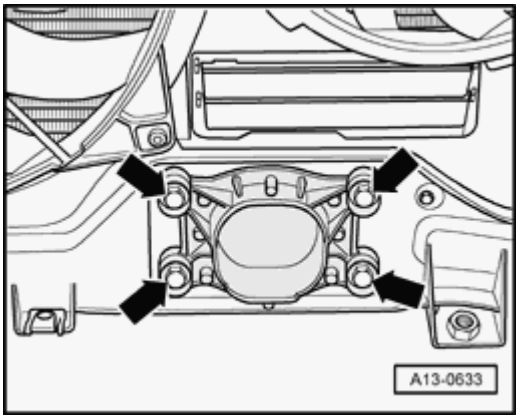


Fig. 586: Placing Torque Support On Rubber Buffer For Torque Support And Tightening Bolts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Place torque support on rubber buffer for torque support and tighten bolts - **arrows** -.
- Install the front bumper cover -->
  - **63 BUMPER**
  - **63 - BUMPERS** for BODY EXTERIOR - CABRIOLET

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.

- Add engine oil and check oil level --> **Oil level, checking**.
- Fill with coolant **Filling**.

- Check headlight adjustment -->
  - **01 - MAINTENANCE**
  - **01 - MAINTENANCE** for MAINTENANCE PROCEDURES - CABRIOLET

.

Torque specifications

Component	Nm
Lower part of oil pan to upper part of oil pan	10
Oil drain plug	50
Bracket for refrigerant line to upper section of oil pan	10
Clamp to bracket for refrigerant line	10
Torque support stop to lock carrier	28

Oil pump, removing and installing

Special tools, testers and auxiliary items required

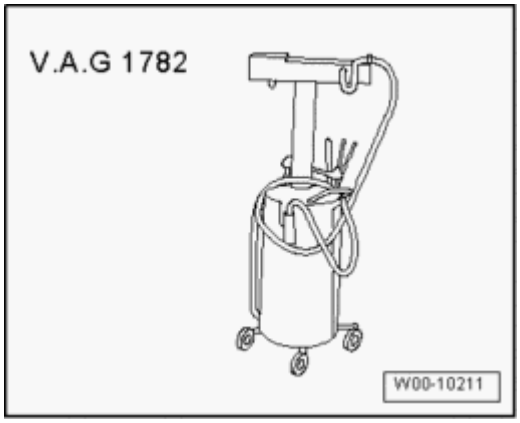


Fig. 587: Identifying Old Oil Collecting And Extracting Device V.A.G 1782
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Old oil collecting and extracting device V.A.G 1782

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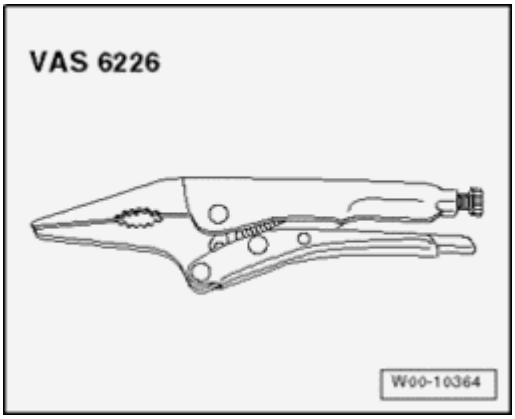


Fig. 588: Long-Nose Gripping Pliers VAS 6226
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Long-nose gripping pliers VAS 6226

Removing

- Remove lower section of oil pan --> **Oil pan (lower part), removing and installing**.

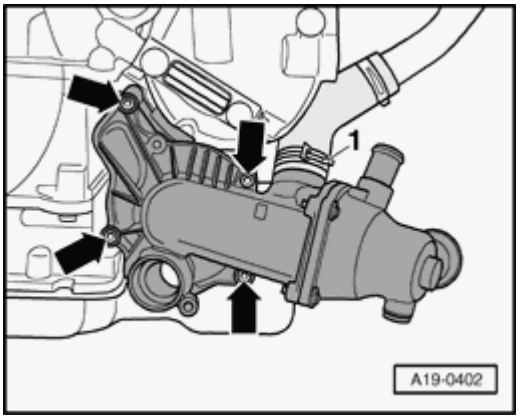


Fig. 589: Disconnecting Coolant Hose & Removing Coolant Pump
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect coolant hose - **1** -.
- Remove coolant pump - **arrows** -.

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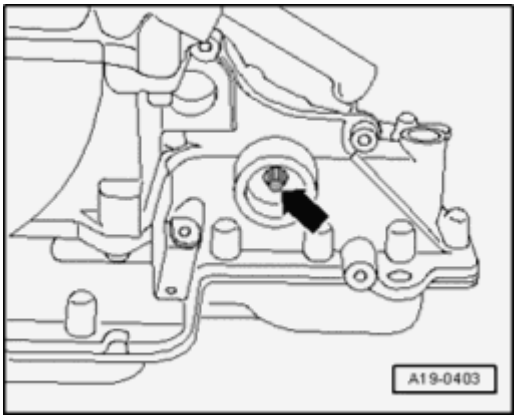


Fig. 590: Removing/Installing Drive Shaft For Coolant Pump From Oil Pump
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove drive shaft - **arrow** - for coolant pump from oil pump.

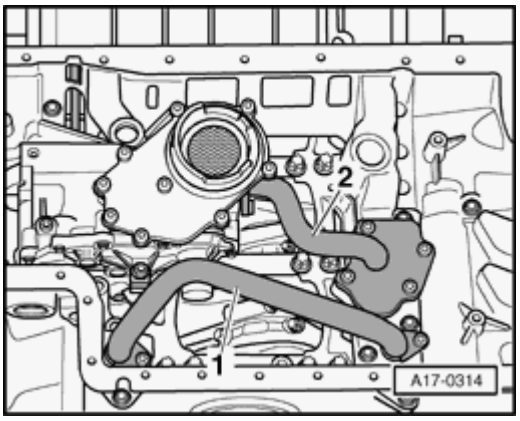


Fig. 591: Removing Bolts And Oil Pipes
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Place old oil collecting and extracting device V.A.G 1782 under engine.
- Remove bolts and remove oil pipes - **1** - and - **2** -.

NOTE:

- **Oil escapes when removing oil pipes.**

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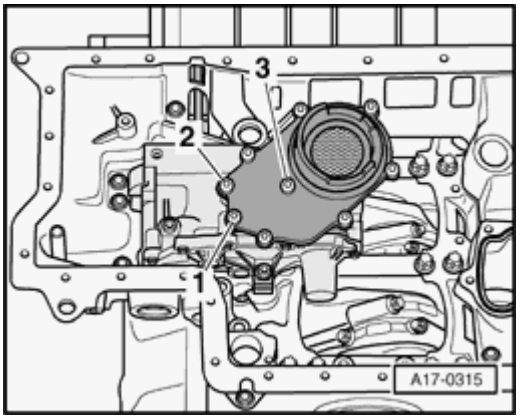


Fig. 592: Removing Bolts And Intake Tube With Housing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts - **1 to 3** - and remove intake tube with housing.

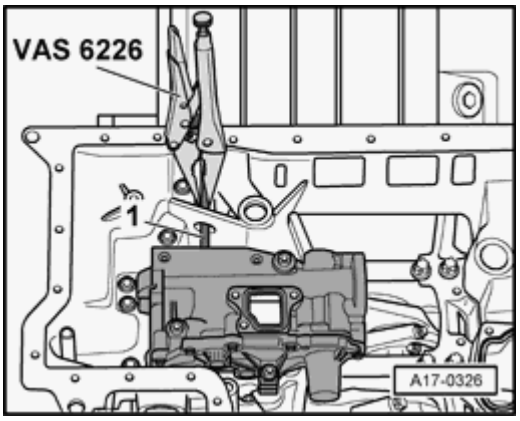
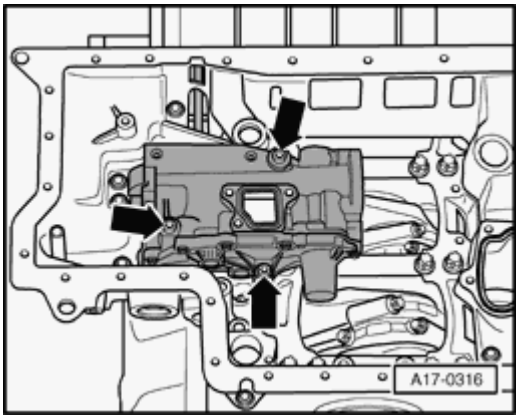


Fig. 593: Pressing Back Drive Shaft For Oil Pump Against Spring Force And Clamping Tightly Using Long-Nose Gripping Pliers VAS 6226
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Press back drive shaft - **1** - for oil pump against spring force and clamp tightly using Long-nose gripping pliers VAS 6226.



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Fig. 594: Removing Bolts And Oil Pump
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts - **arrows** - and remove oil pump.

Installing

NOTE:

- **Replace seals and O-rings.**

- Check whether 2 alignment bushings are present in cylinder block, install if necessary.
- Tighten oil pump - **arrows** -.

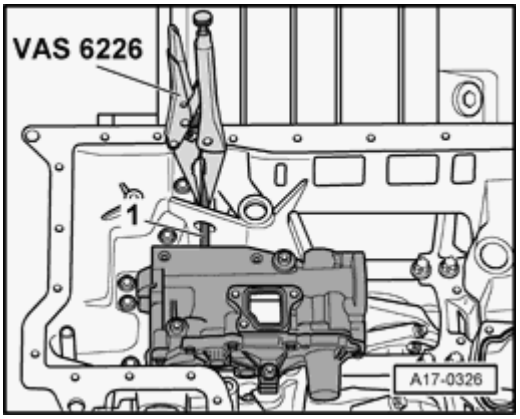


Fig. 595: Pressing Back Drive Shaft For Oil Pump Against Spring Force And Clamping Tightly Using Long-Nose Gripping Pliers VAS 6226
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unlock Long-nose gripping pliers VAS 6226 and let drive shaft - **1** - glide into oil pump.

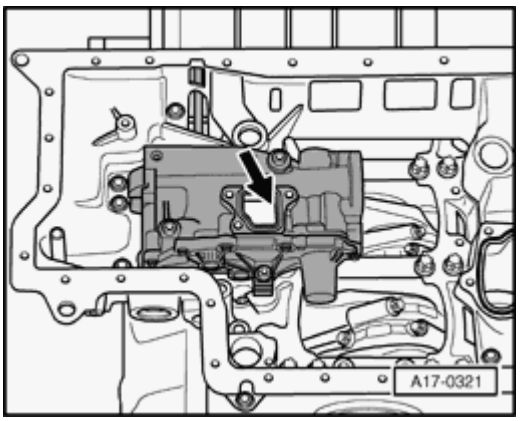


Fig. 596: Checking Whether Drive Shaft Is Friction Locked To Oil Pump
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Check whether drive shaft is friction locked to oil pump. To do so, reach into intake opening - **arrow** - of oil pump and try to rotate oil pump gears.

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- Toothed gears must not be able to be rotated

The rest of installation is in reverse order of removal, note the following:

- Install coolant pump --> **Coolant pump, removing and installing**.
- Install lower section of oil pan **Installing**.
- Check oil level --> **Oil level, checking**.
- Fill with coolant **Filling**.

Torque specifications

Component	Nm
Oil pump to cylinder block	10
Housing for intake tube to oil pump	10
Oil pipes to upper section of oil pan and oil pump	10

Upper section of oil pan, component overview

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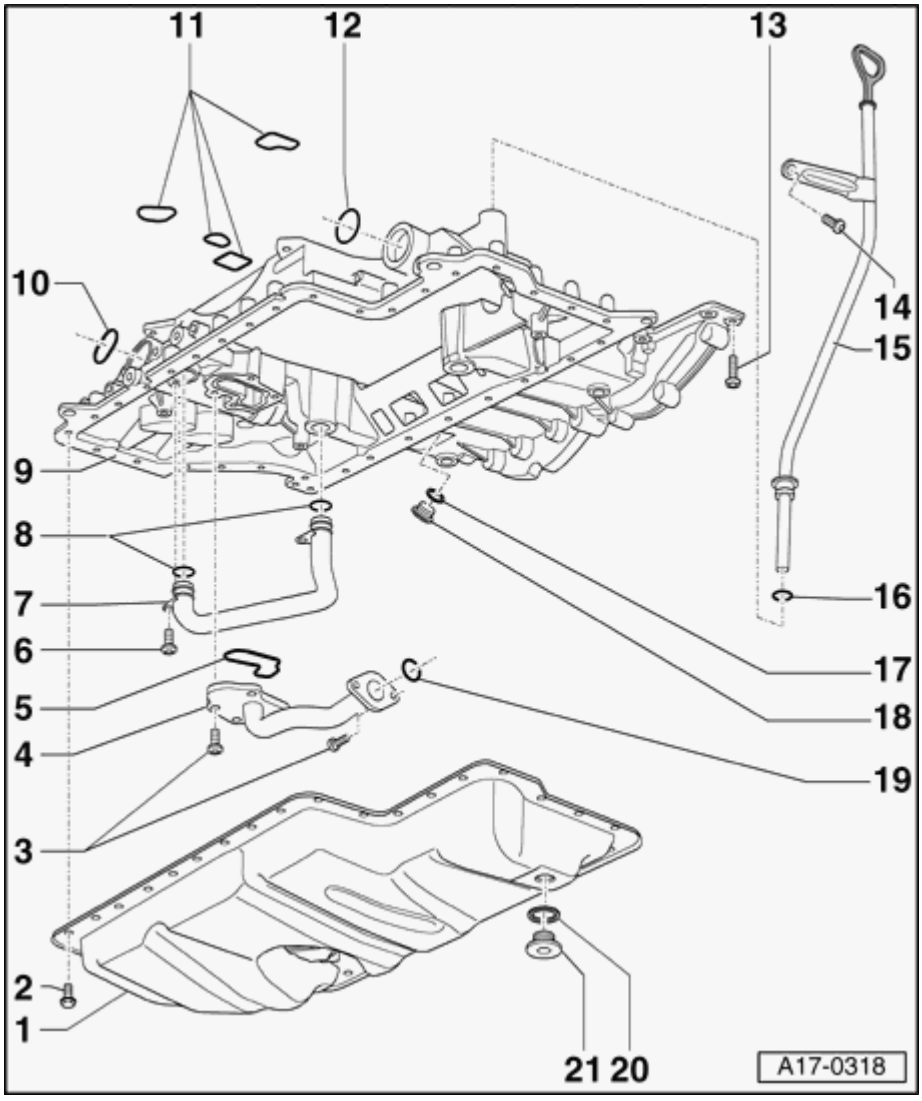


Fig. 597: Upper Section Of Oil Pan, Component Overview
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Oil pan (lower section)

- Removing and installing --> **Oil pan (lower part), removing and installing**
- With Oil Level Thermal Sensor G266
- Oil Level Thermal Sensor G266 , removing and installing , *removing and installing* under **Oil Level Thermal Sensor G266 , removing and installing**

2 - 10 Nm

3 - 10 Nm

4 - Oil pipe

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5 - Gasket

- Replace

6 - 10 Nm

7 - Oil pipe

8 - O-rings

- Replace

9 - Oil pan (upper section)

- Removing and installing --> **Oil pan (upper part), removing and installing**

10 - Seal

- Replace

11 - Gasket

- Replace

12 - O-ring

- Replace

13 - 15 Nm

14 - 10 Nm

15 - Guide tube for oil dipstick

16 - O-ring

- Replace

17 - Seal

- Replace

18 - Locking bolt - 35 Nm

19 - O-ring

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- Replace

20 - Seal

- Replace

21 - Oil drain plug - 50 Nm

Oil pan (upper part), removing and installing

Special tools, testers and auxiliary items required

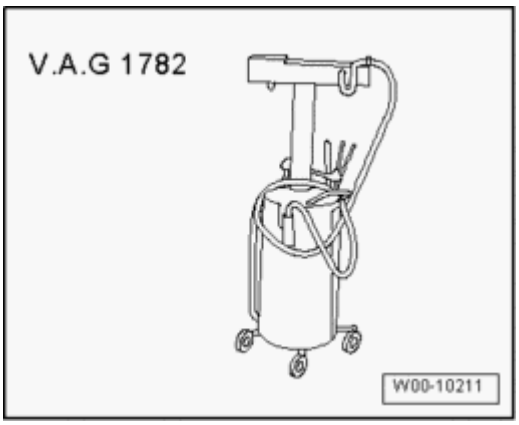


Fig. 598: Identifying Old Oil Collecting And Extracting Device V.A.G 1782
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Old oil collecting and extracting device V.A.G 1782
- Protective glasses
- Hand drill with plastic brush attachment
- Sealant

Removing

- Place old oil collecting and extracting device V.A.G 1782 under engine and drain engine oil.
- Remove engine: Vehicles with manual transmission --> **Engine (vehicles with manual transmission)** , vehicles with automatic transmission --> **Engine (vehicles with automatic transmission), removing**.
- Disconnect engine and transmission: Vehicles with manual transmission --> **Engine (vehicles with manual transmission), separating** , vehicles with automatic transmission --> **Engine and transmission (vehicles with automatic transmission), separating**.
- Secure engine on engine and transmission holder: Vehicles with manual transmission --> **Engine (vehicles with manual transmission), securing to engine and transmission holder** , vehicles with automatic transmission --> **Engine (vehicles with automatic transmission), securing to assembly stand**.

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- Remove covers for timing chains --> **Timing chain covers (All), removing and installing**.

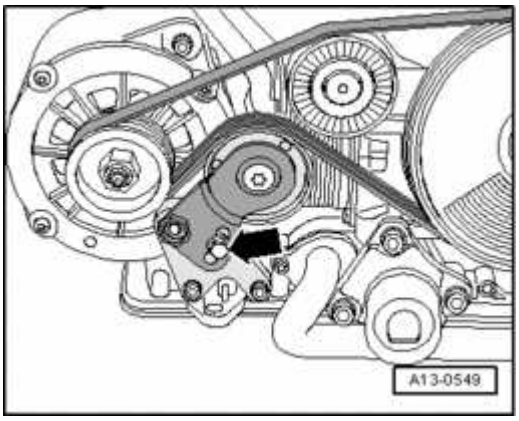


Fig. 599: Loosening Tensioning Bolt And Ribbed Belt
Courtesy of VOLKSWAGEN UNITED STATES, INC.

NOTE:

- **Before removing ribbed belt, mark the turning direction on it with chalk or a felt tip pen. A reversed direction of rotation can cause damage to the belt under operating conditions.**

- Loosen tensioning bolt - **arrow** - and remove ribbed belt.

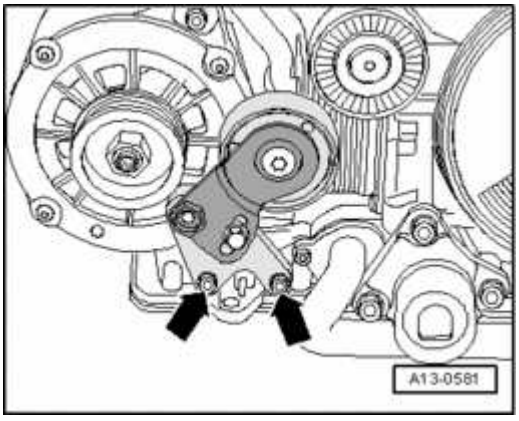


Fig. 600: Removing Tensioning Roller
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove tensioning roller - **arrows** -.

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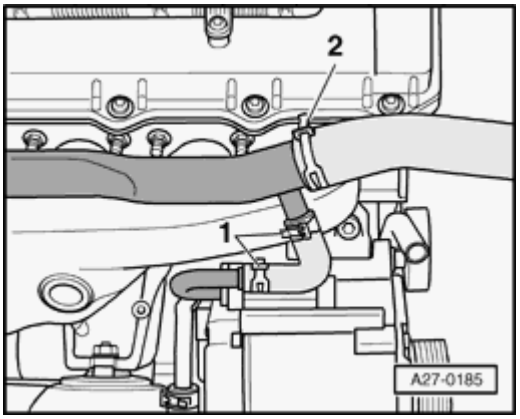


Fig. 601: Removing Hose Clamps And Disconnecting Coolant Hose
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove hose clamps - **1** - and disconnect coolant hose.

NOTE:

- **Ignore - 2 -.**

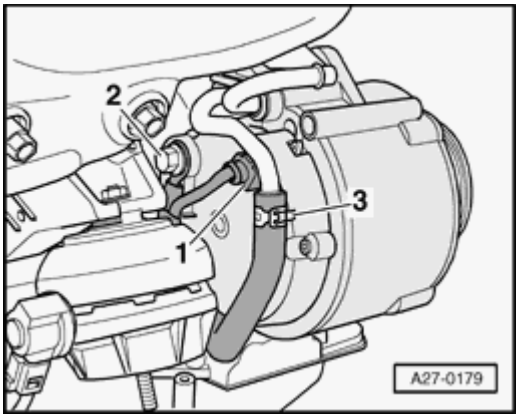


Fig. 602: Disconnecting Coolant Hose On Generator, Electrical Connector & Removing Electrical Wire On Generator
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect coolant hose - **3** - on generator.
- Disconnect electrical connector - **1** -.
- Remove electrical wire - **2** - on generator.

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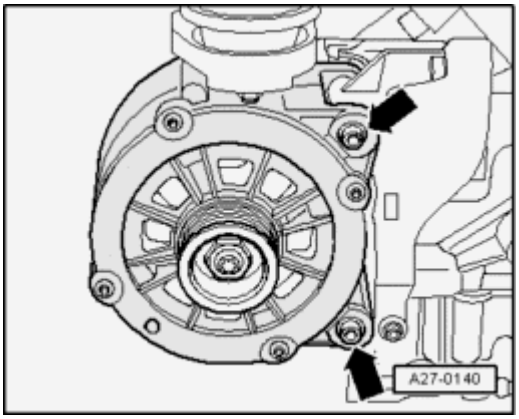


Fig. 603: Removing Generator Bolts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts - **arrows** -.

NOTE:

- **If generator is stuck in its bracket, install mounting bolt again up to 2 rotations.**
- **Carefully strike on bolt heads using flat side of hammer - doing this loosens threaded sleeves of generator mount.**

- Remove generator.

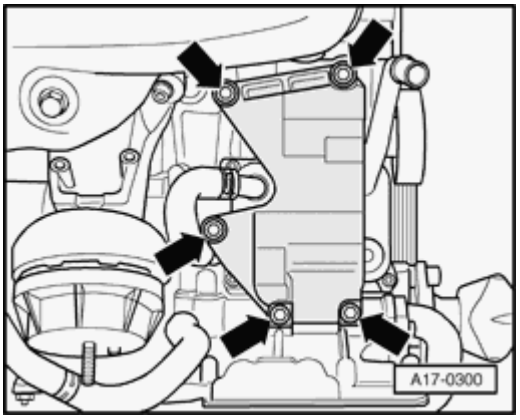


Fig. 604: Removing Bolts & Bracket For Generator
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts - **arrows** -.
- Remove bracket for generator.

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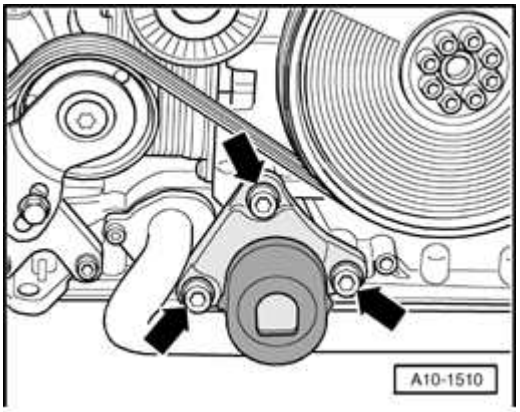


Fig. 605: Removing Bolts And Torque Support From Engine
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts - **arrows** - and remove torque support from engine.

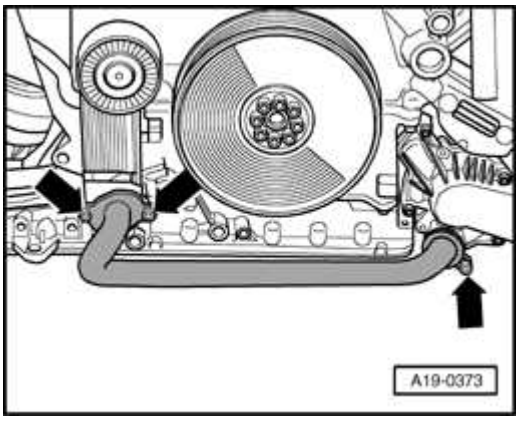


Fig. 606: Removing Front Coolant Pipe On Engine
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove front coolant pipe on engine - **arrows** -.

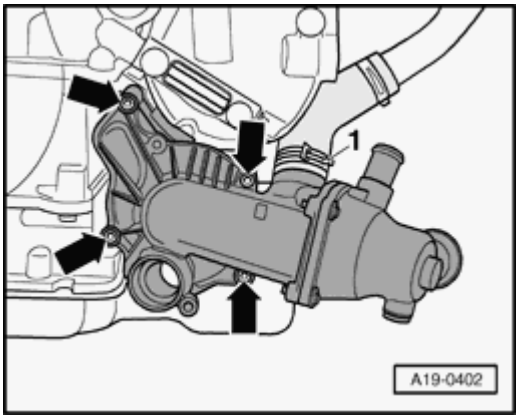


Fig. 607: Disconnecting Coolant Hose & Removing Coolant Pump
Courtesy of VOLKSWAGEN UNITED STATES, INC.

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- Disconnect coolant hose - **1** -.
- Remove coolant pump - **arrows** -.

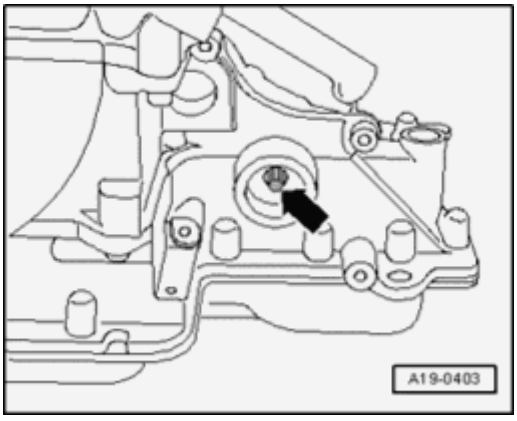


Fig. 608: Removing/Installing Drive Shaft For Coolant Pump From Oil Pump
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove drive shaft - **arrow** - for coolant pump from oil pump.

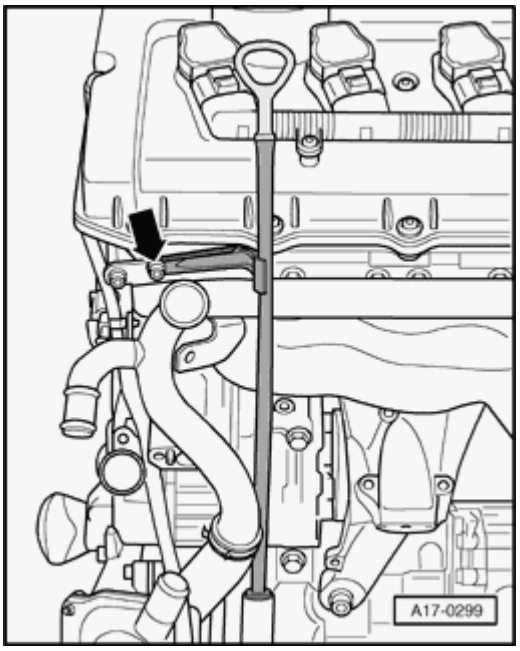


Fig. 609: Removing Bolt From Oil Dipstick Guide Tube At Cylinder Head
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove guide pipe for oil dipstick at cylinder head - **arrow** - , pull up and remove.

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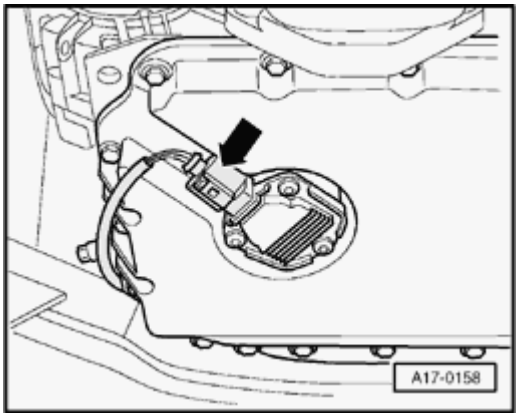


Fig. 610: Disconnecting Electrical Harness Connector On Oil Level Thermal Sensor G266 And Free Up Electrical Wire
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical connector on Oil Level Thermal Sensor G266 - **arrow** - and free up electrical wire.

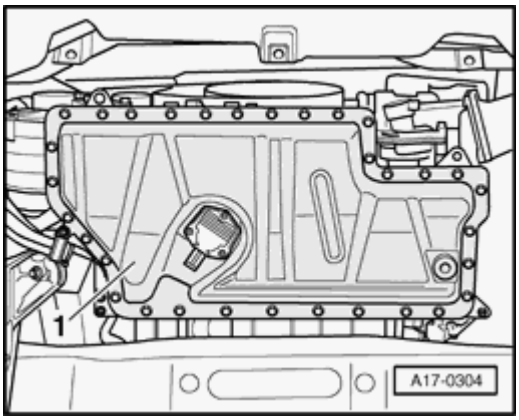


Fig. 611: Removing Oil Pan (Lower Part)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove oil pan (lower part) - **1** - and pry out carefully.

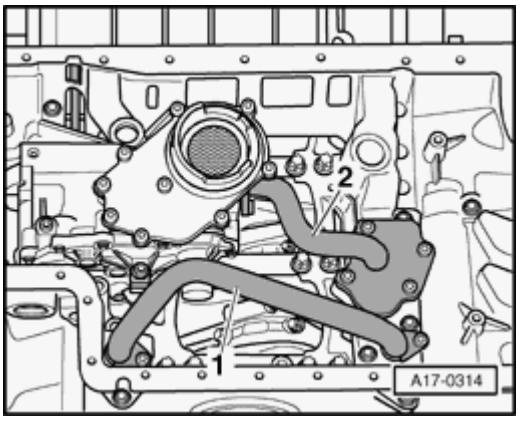


Fig. 612: Removing Bolts And Oil Pipes

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Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts and remove oil pipes - **1** - and - **2** -.

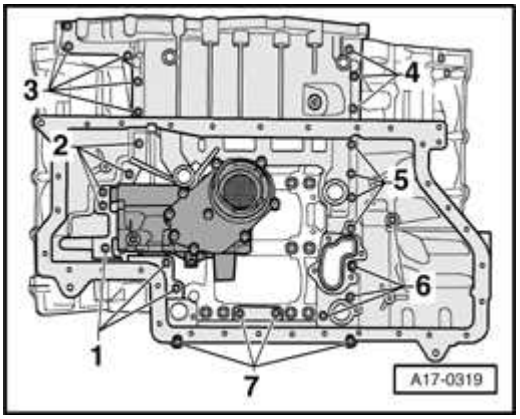


Fig. 613: Removing Bolts For Upper Section Of Oil Pan
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts - **1 to 7** - for upper section of oil pan.
- Press upper part of oil pan from alignment pins of cylinder block.

Installing

NOTE:

- **Replace seals and O-rings.**

CAUTION: Wear safety glasses.

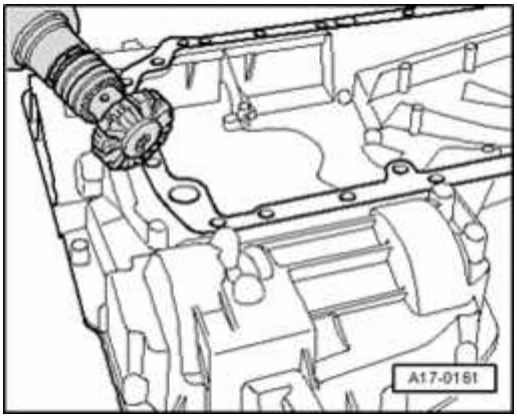


Fig. 614: Using Rotating Plastic Brush To Remove Remaining Sealant From Oil Pan (Upper Part) And At Cylinder Block
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Using rotating plastic brush, remove any remaining sealant from oil pan (upper part) and at cylinder

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block.

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

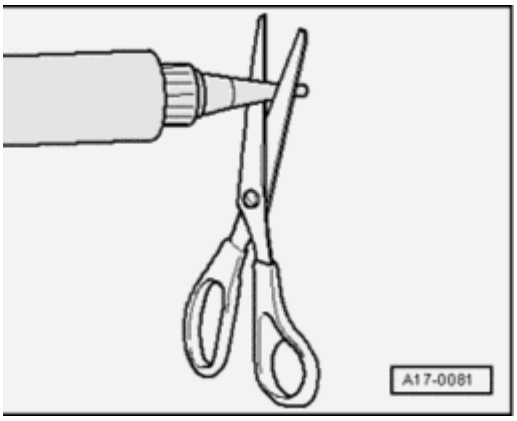


Fig. 615: Cutting Tube Nozzle At Front Marking
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Cut off nozzle on tube of sealant at front mark (dia. of nozzle approx. 1 mm).

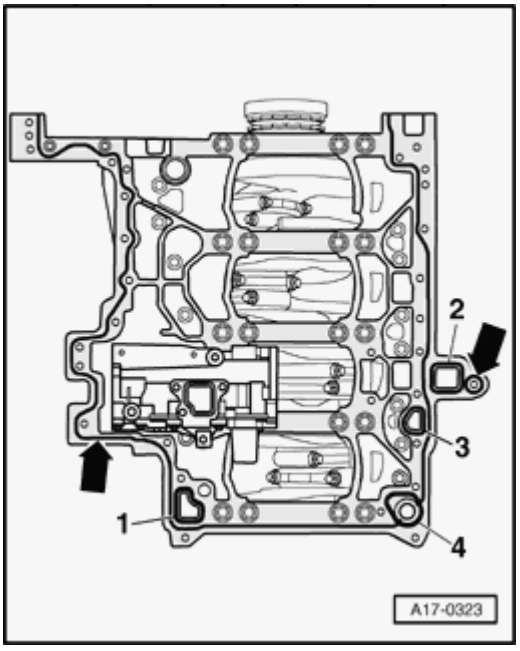


Fig. 616: Inserting New Seals Into Grooves On Cylinder Block
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Insert new seals - **1 to 4** - into grooves on cylinder block.
- Apply sealant beads - **arrows** - to clean sealing surface of cylinder block as depicted in illustration.

- Thickness of sealant bead: 1.5 to 2.0 mm.

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NOTE:

- **The oil pan (upper part) must be installed within 5 minutes after application of sealant.**
- **Sealant bead must not be thicker than specified, otherwise sealant could get into oil pan and clog the strainer on intake tube.**

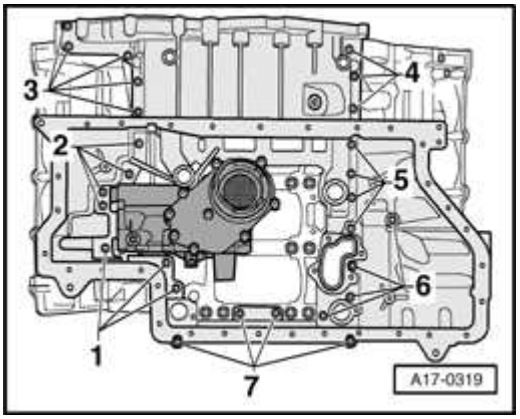


Fig. 617: Removing Bolts For Upper Section Of Oil Pan
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- With a second technician, position upper section of oil pan and pre-tighten screws - **1 to 7** - to 5 Nm in diagonal sequence.
- Tighten bolts - **1 to 7** - diagonally to 15 Nm.

The rest of installation is in reverse order of removal, note the following:

- Install coolant pump --> **Coolant pump, removing and installing**.
- Install lower section of oil pan **Installing**.
- Replace O-ring at guide tube for oil dipstick and insert guide tube into hole in oil pan (upper part).
- When installing generator bracket, note two alignment bushings.

- Install covers for timing chains **Installing**.
- Install ribbed belt **Installing**.
- Install engine: Vehicles with manual transmission --> **Engine (vehicles with manual transmission), installing** , vehicles with automatic transmission --> **Engine (vehicles with automatic transmission), installing**.
- Add engine oil and check oil level --> **Oil level, checking**.

Torque specifications

Component	Nm
Oil pipes to upper section of oil pan	10
Coolant pump housing to upper section of oil pan	10
Bracket for refrigerant line to upper section of oil pan	10

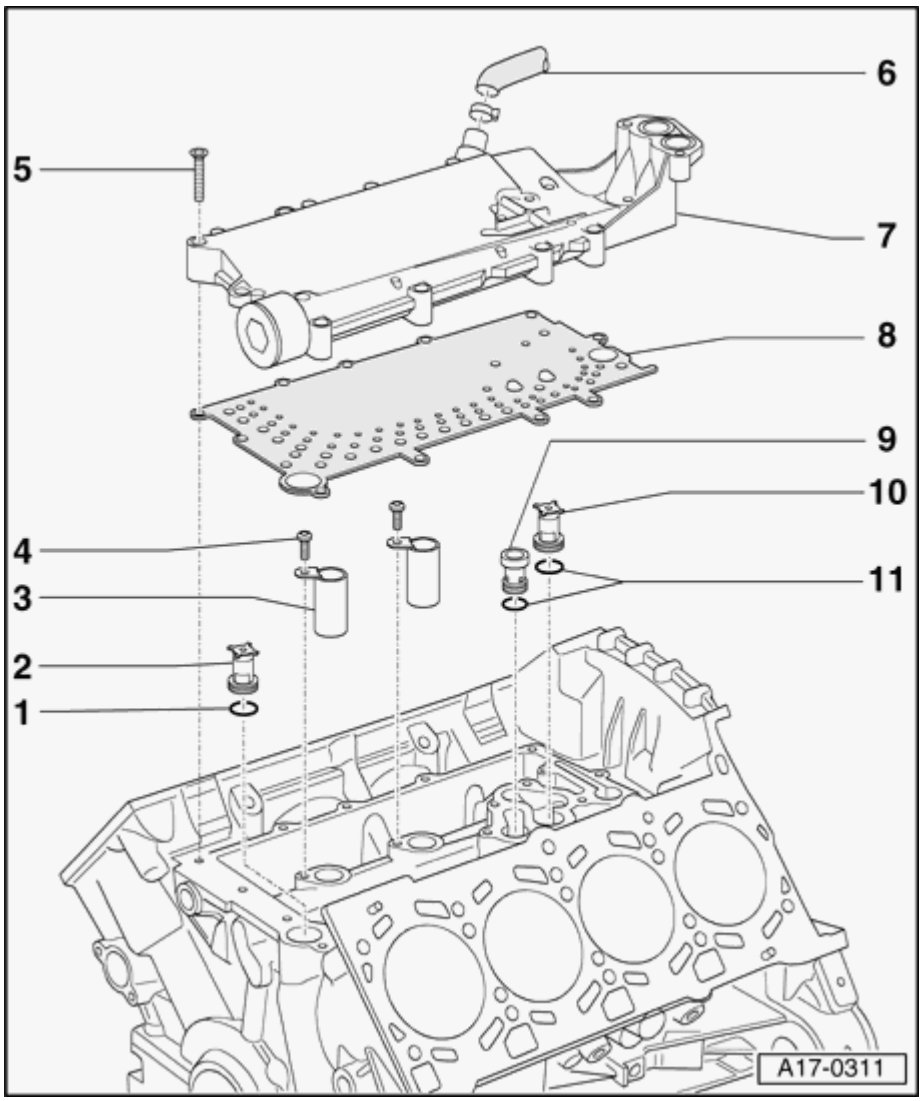
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Oil dip stick guide tube to cylinder head			10
Coolant line	Coolant pump		10
front to	Oil pan (upper section)		10
Torque bracket to upper part of oil pan			42
Generator bracket		M8	22
to engine		M10	45
Generator to generator bracket			23
Terminal 30/B+ to generator			16

Oil check valves and spray nozzle valve - component overview

NOTE:

- **If irregular valve noise occurs repeatedly during short journeys and disappears after extended driving, the oil check valves must be replaced.**



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Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - O-ring

- Replace

2 - Oil check valve

- Removing and installing --> **Oil check valves and spray nozzle valve, removing and installing**

3 - Ventilation pipe

4 - 10 Nm

- Insert using locking compound; locking compound .

5 - 10 Nm

6 - Hose

- To pressure regulating valve for crankshaft housing ventilation

7 - Cover

8 - Gasket

- Replace

9 - Spray nozzle valve

- Removing and installing --> **Oil check valves and spray nozzle valve, removing and installing**

10 - Oil check valve

- Removing and installing --> **Oil check valves and spray nozzle valve, removing and installing**

11 - O-rings

- Replace

Oil check valves and spray nozzle valve, removing and installing

NOTE:

- **If irregular valve noise occurs repeatedly during short journeys and disappears after extended driving, the oil check valves must be replaced.**

Removing

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- Remove intake manifold --> **Intake manifold, removing and installing**.
- Remove oil filter housing --> **Oil filter housing, removing and installing**.

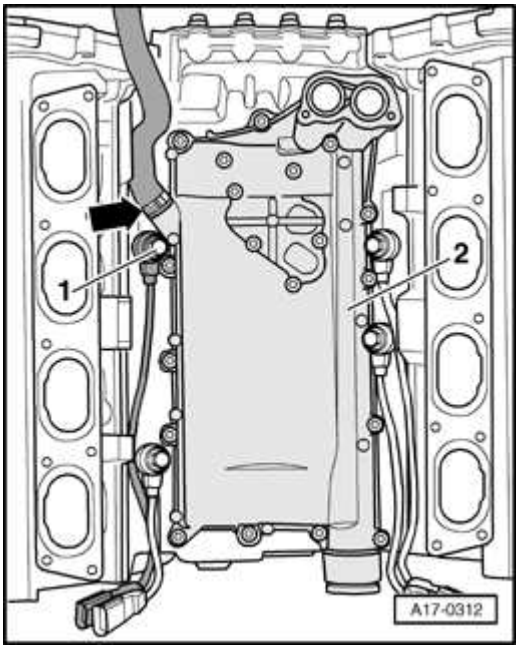


Fig. 619: Identifying Right Rear Knock Sensor Bolt, Crankshaft Housing Ventilation & Oil Check Valves Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolt - **1** - and remove right rear knock sensor.
- Remove hose of crankshaft housing ventilation - **arrow** -.
- Unscrew cover - **2** - for oil check valves.
- Remove seal.

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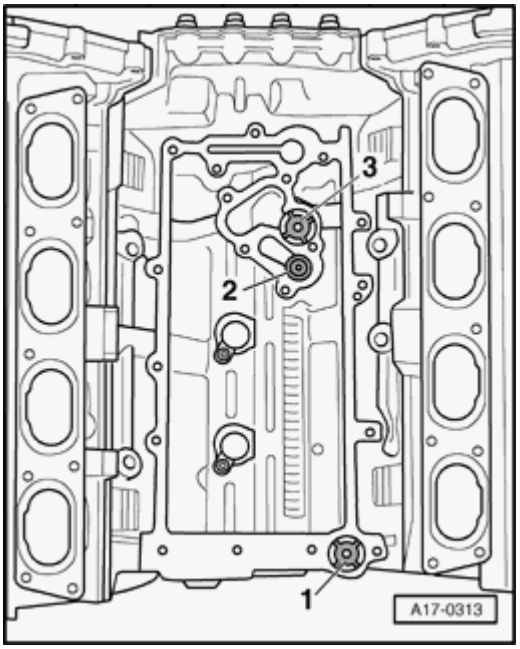


Fig. 620: Removing Oil Check Valves & Spray Nozzle Valve
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove oil check valves - **1** - and - **3** -.
- Remove spray nozzle valve - **2** -.

Installing

Installation is in reverse order of removal, note the following:

NOTE:

- **Replace gaskets and O-rings.**
- **Secure all hose connections using hose clamps appropriate for the model type .**

- Install oil filter housing --> **Oil filter housing, removing and installing**.
- Install intake manifold --> **Intake manifold, removing and installing**.

Torque specifications

Component	Nm
Cover for oil check valves to cylinder block	10
Knock sensor to cylinder block	25 * See note

*Do not oil bolt.

Oil filter housing, component overview

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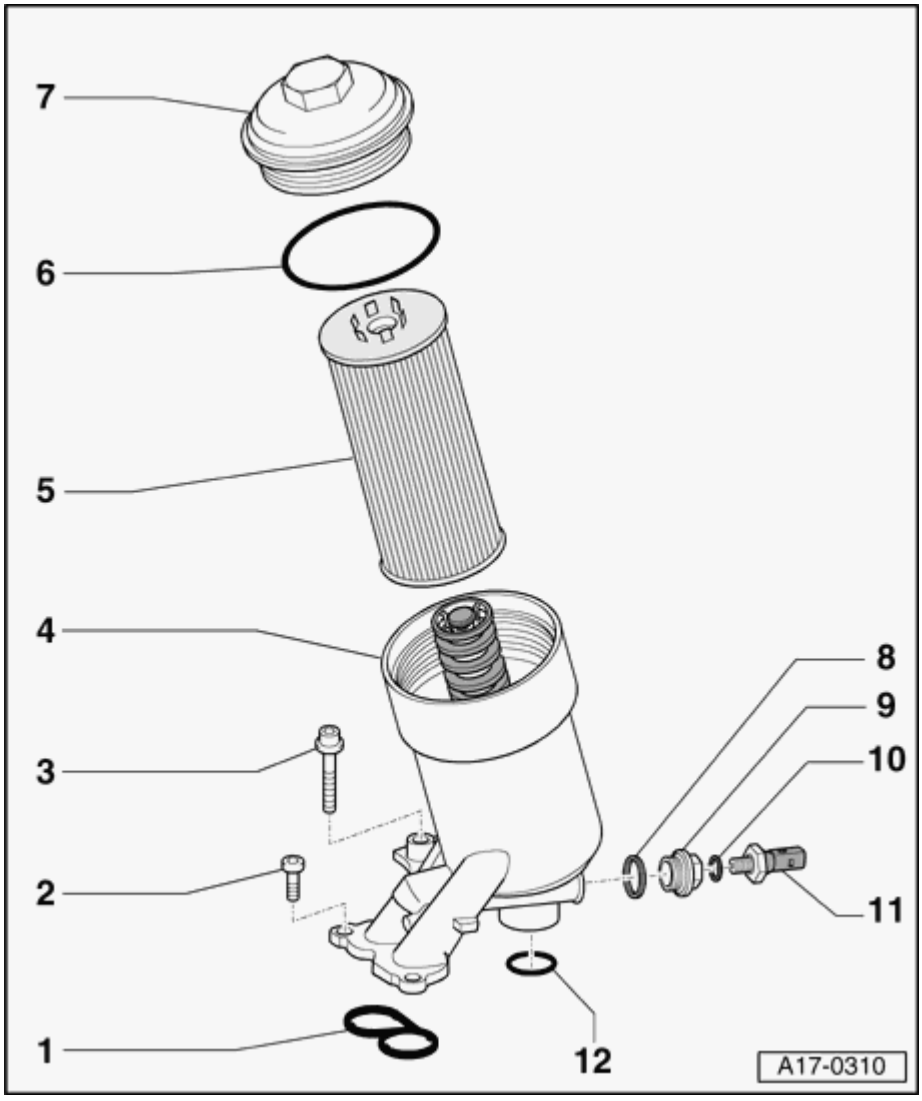


Fig. 621: Oil Filter Housing, Component Overview
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Gasket

- Replace

2 - 10 Nm

3 - 22 Nm

4 - Oil filter housing

5 - Oil filter element

- Removing and installing -->

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- **01 - MAINTENANCE**
- **01 - MAINTENANCE** for MAINTENANCE PROCEDURES - CABRIOLET

6 - O-ring

- Replace

7 - Cap - 25 Nm

8 - Seal

- Replace

9 - Locking bolt - 50 Nm

10 - Seal

- Replace

11 - Oil Pressure Switch F1 , 1.4 bar

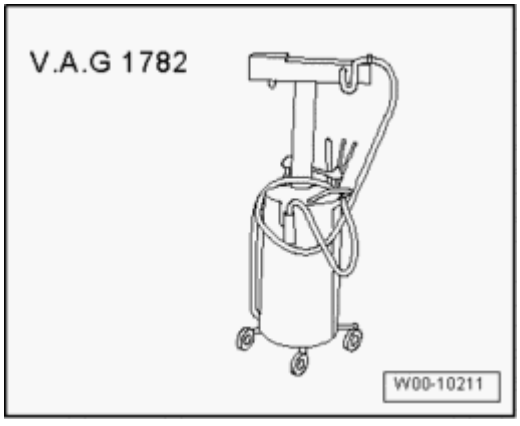
- Black insulation
- Checking --> **Oil pressure and oil pressure switch, checking**
- Removing and installing --> **Oil Pressure Switch F1 , removing and installing**
- Tighten to 25 Nm

12 - O-ring

- Replace

Oil filter housing, removing and installing

Special tools, testers and auxiliary items required



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Fig. 622: Identifying Old Oil Collecting And Extracting Device V.A.G 1782
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Old oil collecting and extracting device V.A.G 1782

Removing

- Remove intake manifold --> **Intake manifold, removing and installing**.

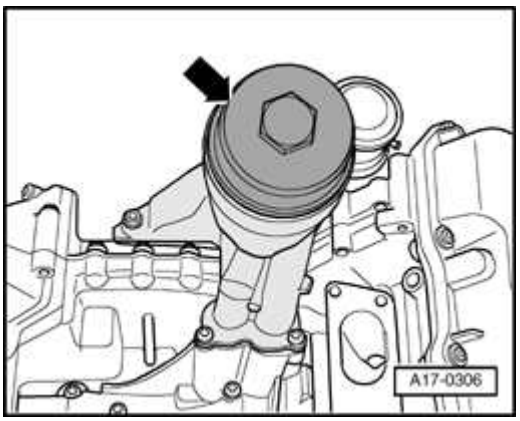


Fig. 623: Removing Cap For Oil Filter Housing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove cap - **arrow** - for oil filter housing.
- Remove oil filter element.
- Extract engine oil using old oil collecting and extracting device V.A.G 1782 from oil filter housing.

NOTE:

- **Place a rag around oil filter housing to catch escaping engine oil.**

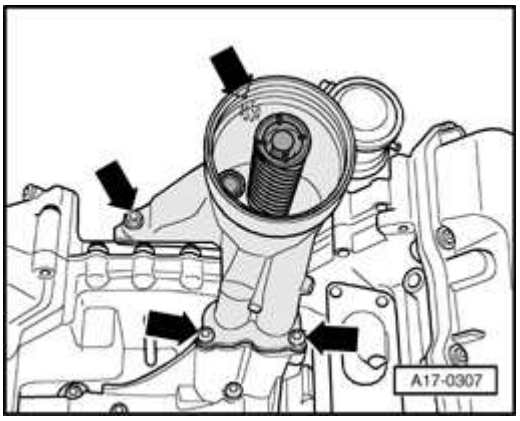


Fig. 624: Removing Bolts & Oil Filter Housing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts - **arrows** -.

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- Remove oil filter housing.

Installing

Installation is in reverse order of removal, note the following:

NOTE:

- **Replace seals and O-rings.**

- Install intake manifold --> **Intake manifold, removing and installing**.
- Add engine oil and check oil level --> **Oil level, checking**.

Torque specifications

Component		Nm
Oil filter housing	Cylinder block	10
to	Cover for timing chain	22
Cap to oil filter housing		25

Oil cooler, removing and installing

Special tools, testers and auxiliary items required

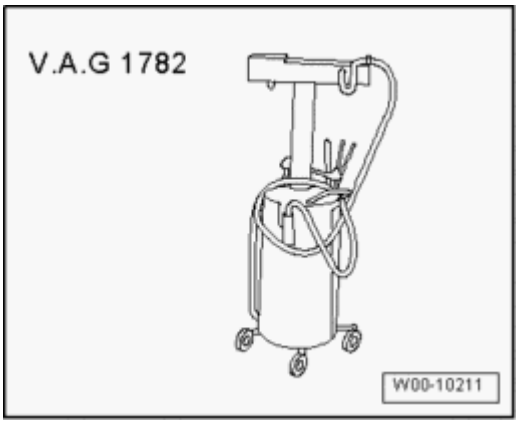


Fig. 625: Identifying Old Oil Collecting And Extracting Device V.A.G 1782
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Old oil collecting and extracting device V.A.G 1782

Removing

- Remove generator -->
  - **27 BATTERY, STARTER, GENERATOR, CRUISE CONTROL**
  - **27 BATTERY, STARTER, GENERATOR, CRUISE CONTROL** for ELECTRICAL EQUIPMENT, CABRIOLET

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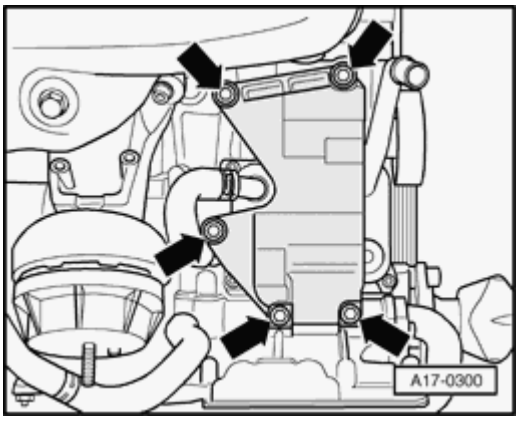


Fig. 626: Removing Bolts & Bracket For Generator
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts - **arrows** -.
- Remove bracket for generator.

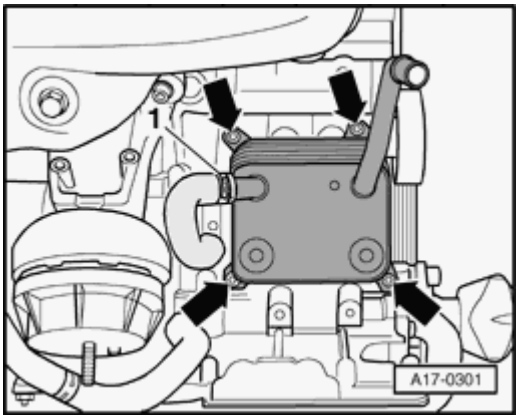


Fig. 627: Disconnecting Coolant Hose From Oil Cooler & Removing Bolts And Oil Cooler
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect coolant hose - **1** - from oil cooler.
- Place old oil collecting and extracting device V.A.G 1782 under engine.
- Remove bolts - **arrows** - and remove oil cooler.

Installing

Installation is in reverse order of removal, note the following:

NOTE:

- **Replace O-rings.**
- **Secure all hose connections using hose clamps appropriate for the model type .**

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- When installing generator bracket, note the two alignment bushings.
- Install generator -->
  - **27 BATTERY, STARTER, GENERATOR, CRUISE CONTROL**
  - **27 BATTERY, STARTER, GENERATOR, CRUISE CONTROL** for ELECTRICAL EQUIPMENT, CABRIOLET

.

Torque specifications

Component		Nm
Oil cooler to cylinder block		10
Generator bracket	M8	22
to engine	M10	45

Oil Pressure Switch F1 , removing and installing

Removing

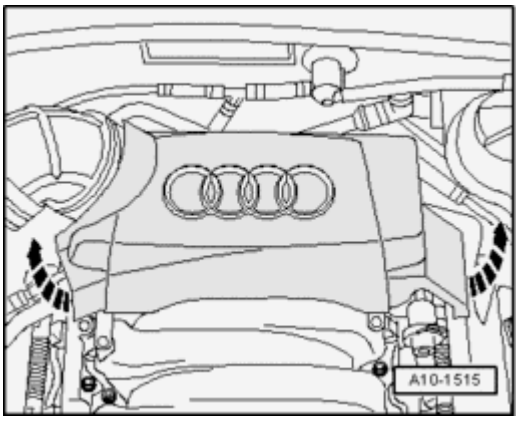


Fig. 628: Removing Rear Engine Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove rear engine cover - **arrows** -.

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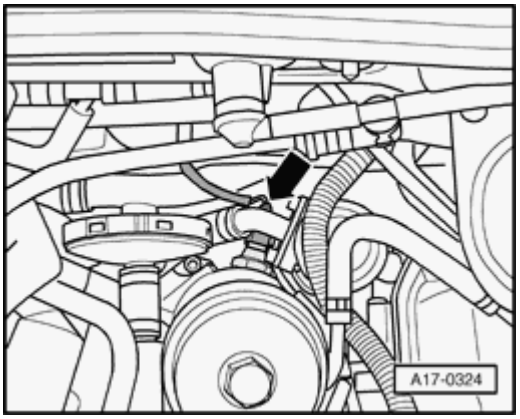


Fig. 629: Disconnecting Electrical Harness Connector From Oil Pressure Switch
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical harness connector from oil pressure switch - **arrow** -.
- Remove oil pressure switch.

Installing

Installation is in reverse order of removal, note the following:

NOTE:

- **Replace seal.**

Torque specifications

Component	Nm
Oil pressure switch to oil filter housing	25

Oil pressure and oil pressure switch, checking

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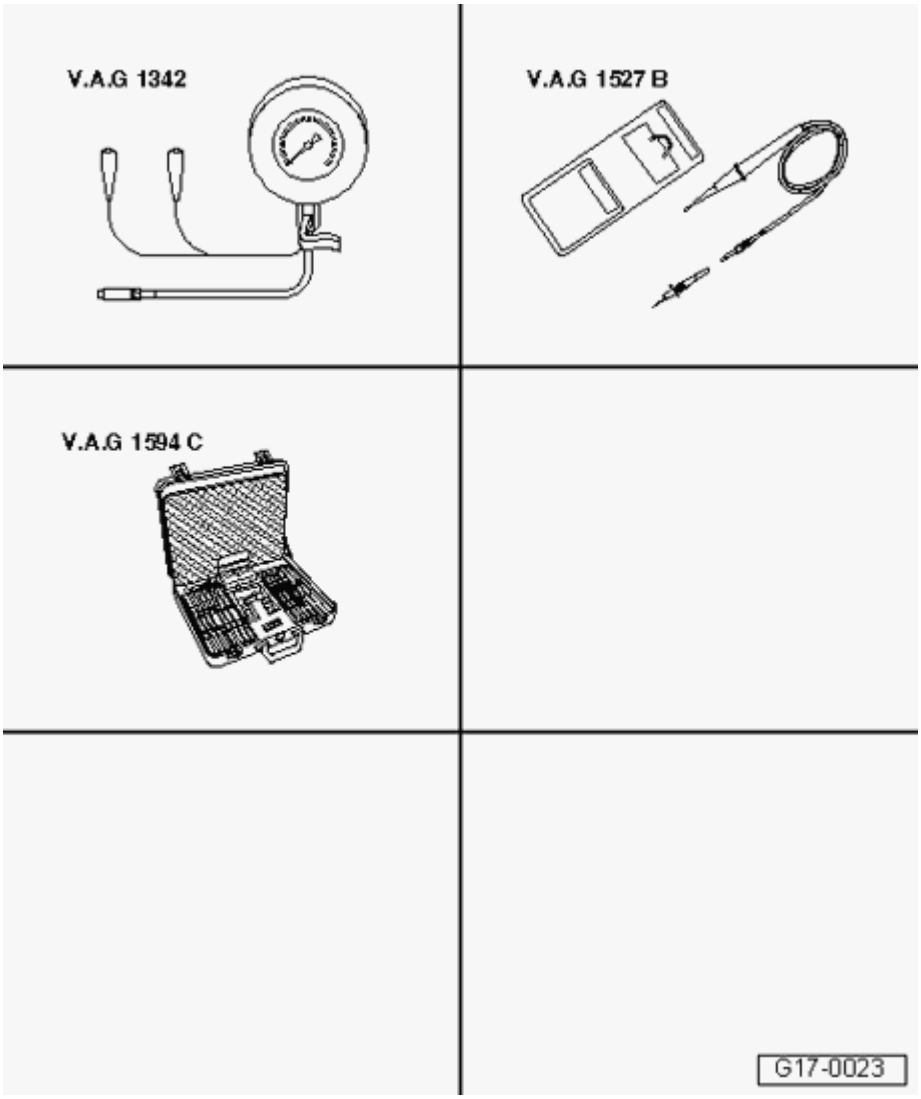


Fig. 630: Identifying Special Tools - Oil Pressure And Oil Pressure Switch, Checking
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools, testers and auxiliary items required

- Oil pressure gauge V.A.G 1342 with adapter V.A.G 1342/14
- Voltage tester V.A.G 1527 B
- Connector test set V.A.G 1594 C

Test conditions

- Oil level OK
- Engine oil temperature approximately 90 ° C.

Test sequence

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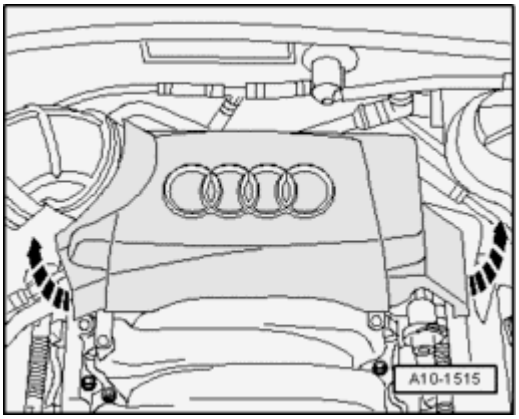


Fig. 631: Removing Rear Engine Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove rear engine cover - **arrows** -.

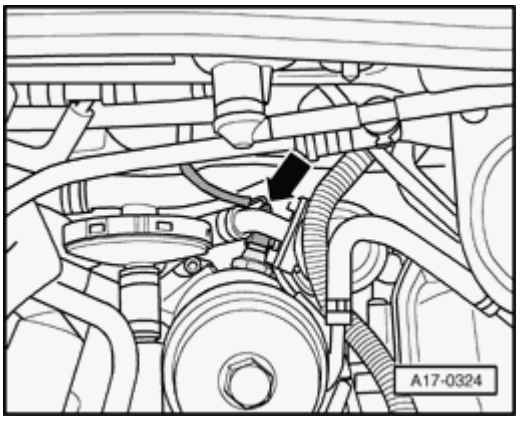


Fig. 632: Disconnecting Electrical Harness Connector From Oil Pressure Switch
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical harness connector from Oil Pressure Switch F1 - **arrow** -.
- Remove oil pressure switch --> **Oil Pressure Switch F1 , removing and installing**.

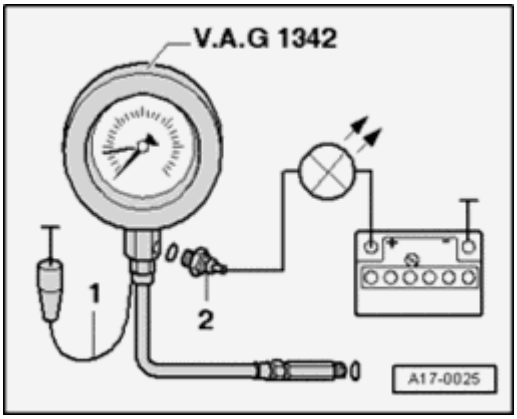


Fig. 633: Connecting Oil Pressure Tester V.A.G 1342 With Adapter V.A.G 1342/14 To Hole For Oil

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Pressure Switch
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect oil pressure tester V.A.G 1342 with adapter V.A.G 1342/14 to hole for oil pressure switch.
- Install oil pressure switch - **2** - into oil pressure gauge V.A.G 1342.
- Place the brown wire of oil pressure gauge on Ground (GND).

Oil pressure switch, checking

- Connect voltage tester V.A.G 1527 B - **1** - with adapter cables from connector test kit V.A.G 1594 C to oil pressure switch and battery positive ("+").

- LED must not light up.

If LED lights up:

- Replace Oil Pressure Switch.
- Start engine.

NOTE:

- **While starting engine, watch Pressure Tester and LED as oil pressure switch may open during start.**
- **At 1.2 to 1.6 bar pressure, LED must light up.**

If LED does not light up:

- Replace Oil Pressure Switch.

Oil pressure, checking

- Start engine.

- Oil pressure at 2000 RPM: min. 2.0 bar
- Oil pressure at 3500 RPM: min. 3.5 bar

Assembling

Assembly is in reverse order of removal, note the following:

- Install oil pressure switch --> **Oil Pressure Switch F1 , removing and installing**.

Engine oil

Oil quantities, oil specifications and viscosity classes Fluid Capacity Chart.

Oil level, checking

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NOTE:

- **Oil level must not exceed max. marking danger of catalytic converter damage!**

Test conditions

- Engine oil temperature min. 60 ° C.
- Vehicle in level position.
- After stopping engine, wait a few minutes to allow oil to flow back into oil pan.

Test sequence

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

Range of markings on dipstick:

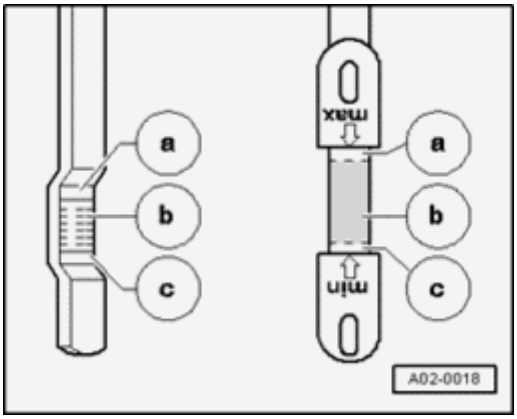


Fig. 634: Range Of Markings On Dipstick
Courtesy of VOLKSWAGEN UNITED STATES, INC.

a - Oil must not be added.

b - Oil may be topped off.

c - Oil must be added. After topping off, it is sufficient if oil level is somewhere in range - **b** - (shaded area).

NOTE:

- **Oil level must not exceed max. marking - a - and must not fall short of min. marking - c -.**

19 - ENGINE - COOLING SYSTEM

COOLING SYSTEM COMPONENTS, REMOVING AND INSTALLING

Cooling system components, removing and installing

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CAUTION: Cover cap of expansion tank with rag and open carefully, as hot steam i.e. hot coolant may escape when opening.

NOTE:

- **When the engine is warm the cooling system is under pressure. If necessary release pressure before commencing repair work.**
- **Arrows on coolant pipes and coolant hoses must line up across from each other.**

Coolant hose connection diagram

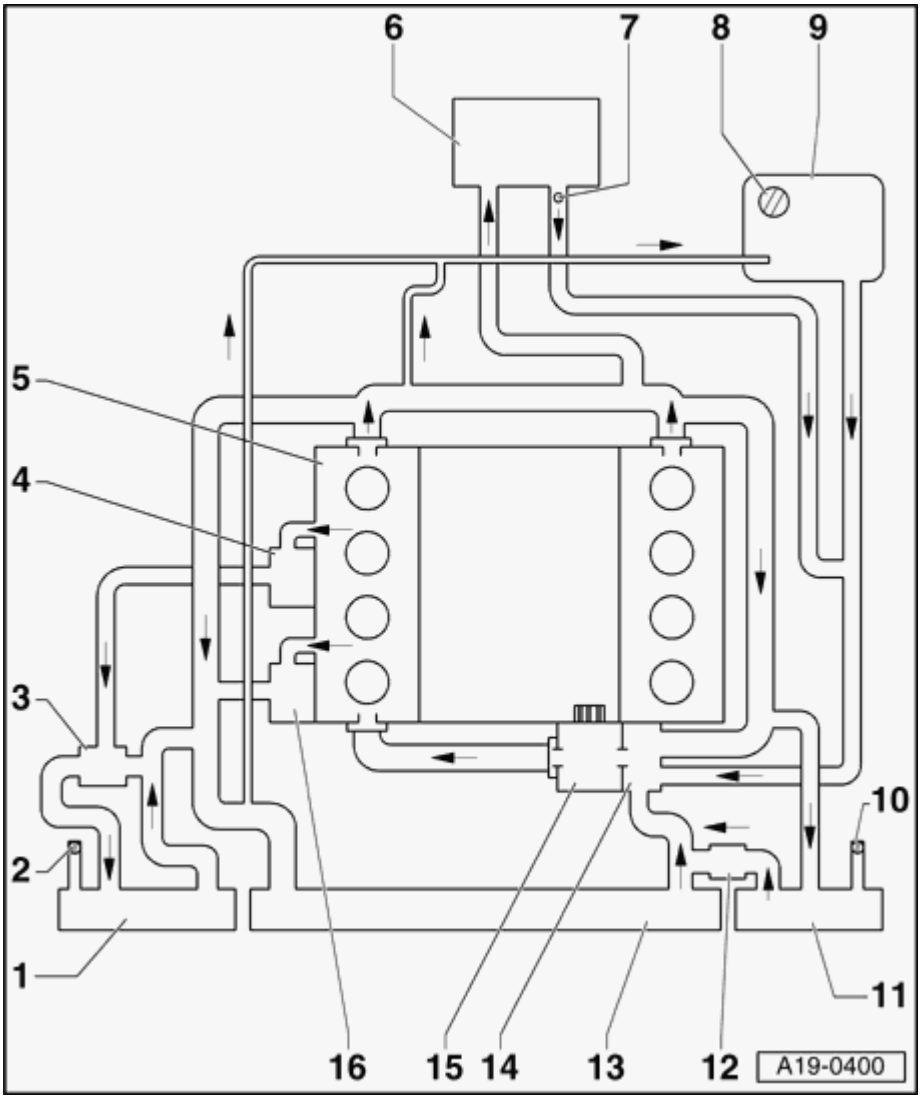


Fig. 635: Coolant Hose Connection Diagram
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Right auxiliary cooler

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- Removing and installing --> **Right auxiliary cooler, removing and installing**
- Replace coolant after replacing

2 - Not installed

3 - Coolant regulator for auxiliary cooler

4 - Oil cooler

- Removing and installing --> **Oil cooler, removing and installing**

5 - Cylinder head/cylinder block

- Renew coolant after replacing

6 - Heater core

- Replace coolant after replacing

7 - Bleeder hole

- At coolant hose to heater core

8 - Cap

- Pressure relief valve in cap, checking **Pressure relief valve in cap, checking**

9 - Coolant expansion tank

10 - Not installed

11 - Left auxiliary cooler

- Removing and installing --> **Left auxiliary cooler, removing and installing**
- Renew coolant after replacing

12 - Non-return valve

- Opens in direction of arrow, locks against direction of arrow

13 - Radiator

- Removing and installing --> **Radiator, removing and installing**
- Replace coolant after replacing

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14 - Coolant thermostat

- Removing and installing --> **Coolant thermostat, removing and installing**
- Checking --> **Thermostat, checking**

15 - Coolant pump

- Removing and installing --> **Coolant pump, removing and installing**

16 - Generator

Cooling system, draining and filling

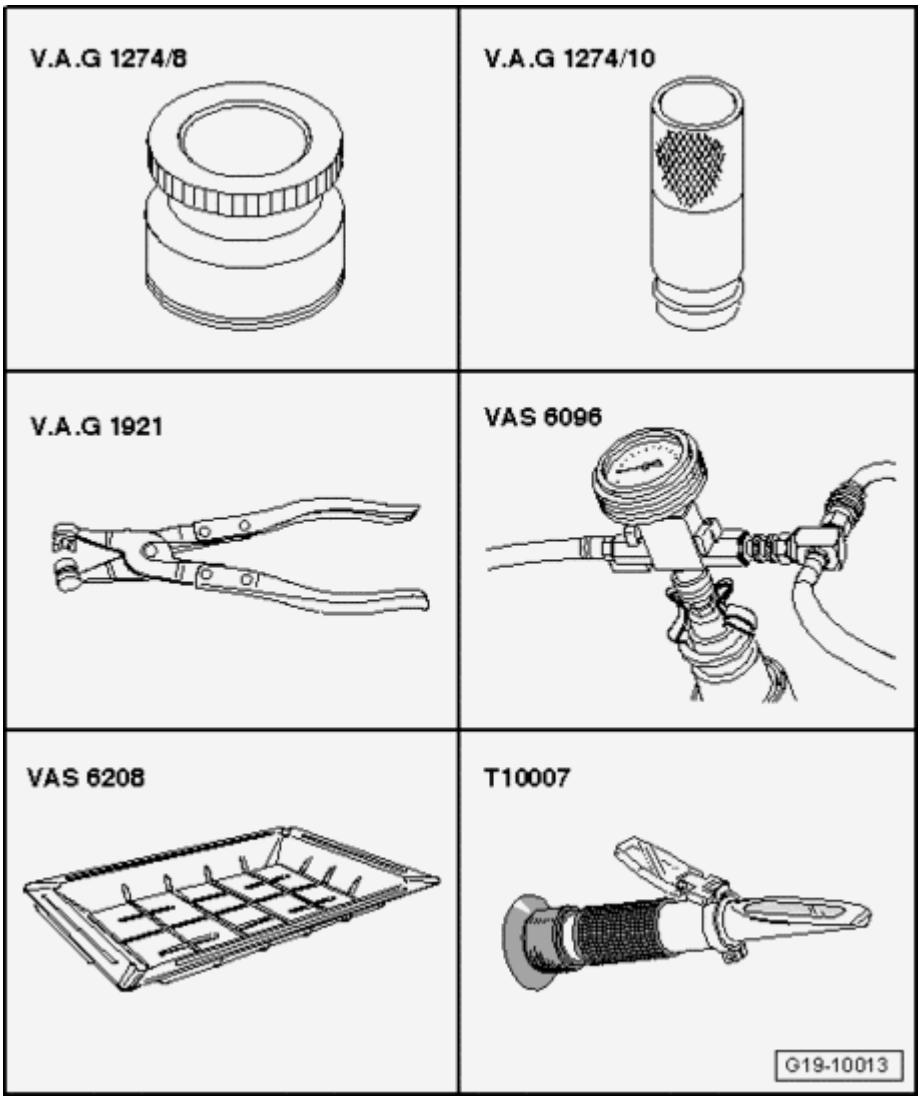


Fig. 636: Identifying Special Tools - Cooling System, Draining And Filling
Courtesy of VOLKSWAGEN UNITED STATES, INC.

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Special tools, testers and auxiliary items required

- Adapter V.A.G 1274/8
- Adapter V.A.G 1274 tester V.A.G 1274/10
- Hose clamp pliers V.A.G 1921
- Cooling system charge unit VAS 6096
- Drip tray for workshop crane VAS 6208
- Refractometer T10007

Draining

NOTE:

- **Drained coolant must be stored in a clean container for disposal or reuse.**

CAUTION: Cover cap of expansion tank with rag and open carefully, as hot steam i.e. hot coolant may escape when opening.

- Open cap of coolant expansion tank.

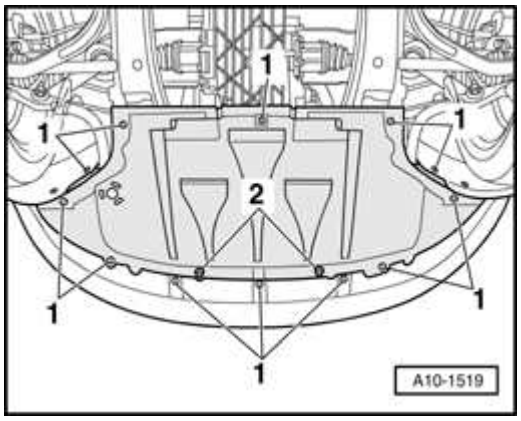


Fig. 637: Removing Quick-Release Fasteners, Screws And Noise Insulation
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove quick-release fasteners - **1** - , remove screws - **2** - and remove noise insulation.
- Place drip tray for workshop crane VAS 6208 under engine.

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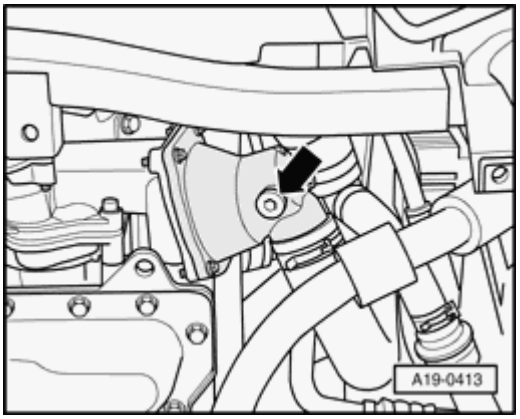


Fig. 638: Removing Drain Plug On Coolant Thermostat Housing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove drain plug - **arrow** - on coolant thermostat housing and drain coolant from engine.

Filling

NOTE:

- **The cooling system is filled all year round with a mixture of frost and corrosion protection additives and water.**
- **Use only *coolant additive Plus G 012 A8F A1* (short: G12+) "according to TL VW 774 F". Other coolant additives may above all reduce the corrosion protection effect significantly. The damage resulting from this may lead to loss of coolant and consequently to severe engine damage.**
- **G12+ and coolant additives with the designation "according to TL VW 774 F" reduce frost and corrosion damage as well as lime deposits. They also raise the boiling point. For this reason the system must be filled all year round with frost and corrosion protection additives.**
- **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 arctic climatic countries to about -35 ° C).**
- **The coolant concentration must not be reduced by adding water even in warmer seasons and in warmer countries. The coolant additive portion must be at least 40%.**
- **If for climatic reasons greater frost protection is required, the amount of G12+ can be increased, but only up to 60% (frost protection to about -40 ° C), otherwise frost protection and cooling effectiveness will be reduced.**
- **Only clean drinking water may be used for mixing coolant.**
- **If the radiator, heater core, cylinder head and cylinder head gasket or cylinder block is replaced, completely replace the engine coolant.**
- **Dirty coolant must not be re-used.**
- **For coolant G12+ , use refractometer T10007 to test frost protection in**

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cooling system.

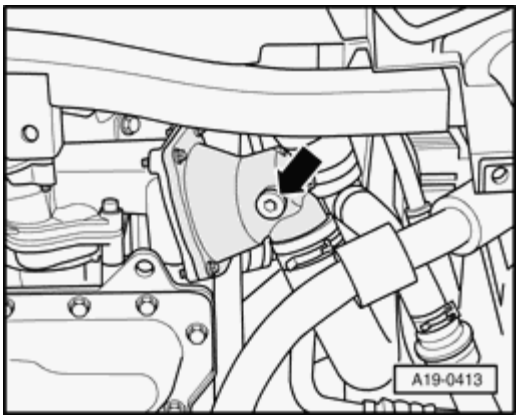


Fig. 639: Removing Drain Plug On Coolant Thermostat Housing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Re-install drain plug - **arrow** - with new sealing ring.

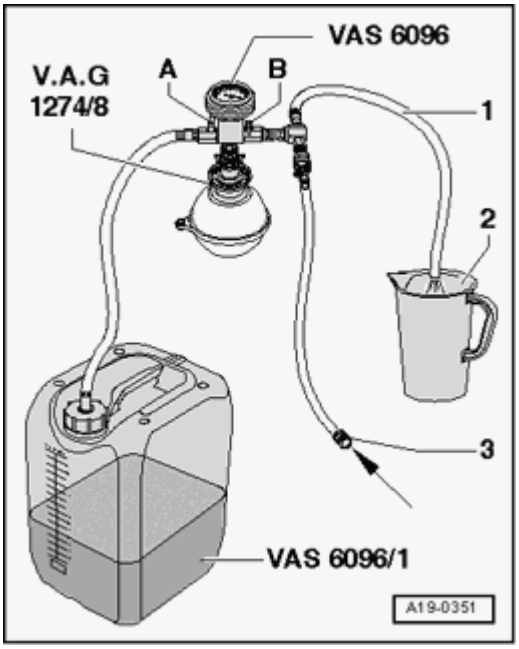


Fig. 640: Filling Reservoir VAS 6096/1 With At Least 12 Liters Of Premixed Coolant
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Fill coolant reservoir of Cooling System Charge Unit VAS 6096 with at least 12 liters of pre-mixed coolant with correct mixture ratio:

- G12+ (40%) and water (60%) for frost protection up to -25 ° C
- G12+ (50%) and water (50%) for frost protection up to -35 ° C
- G12+ (60%) and water (40%) for frost protection up to -40 ° C

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- Install adapter V.A.G 1274/8 onto expansion tank.
- Assemble Cooling System Charge Unit VAS 6096 on adapter V.A.G 1274/8.
- Place air outlet hose - **1** - into a small container - **2** -. (A small amount of coolant is drawn off which should be reserved with the discharged air.)
- Close both valves - **A** - and - **B** - , turn lever perpendicular to direction of flow to do this.
- Connect hose - **3** - to pressurized air.

- Pressure: 6 to 10 bar positive pressure.

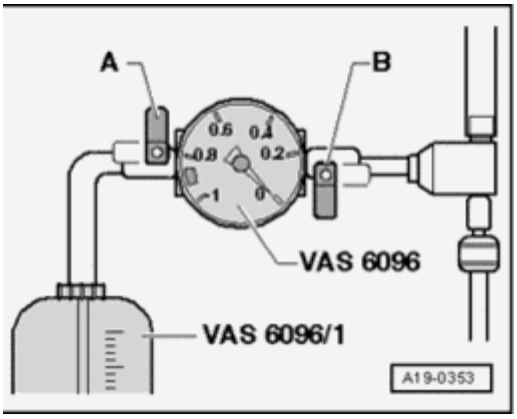


Fig. 641: Opening Valve
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Open valve - **B** - , to do this, turn lever in direction of flow.

A vacuum is created in cooling system by suction jet pump.

- Needle on instrument display must travel into green region.
- Also briefly open valve - **A** - , turn lever in direction of flow to do this, so that coolant reservoir hose of cooling system filler unit VAS 6096 is filled with coolant.
- Close valve - **A** - again.
- Let valve - **B** - remain open another 2 minutes.

- A further vacuum is created in cooling system by suction jet pump.
- Needle on instrument display must still remain in green region.

- Close valve - **B** -.

- Needle in the display instrument must remain in green region, then sufficient vacuum in cooling system is obtained for the upcoming filling.

If needle stands below the green region, repeat procedure.

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If vacuum decreases, cooling system is leaking.

- Disconnect pressurized air hose.
- Open valve - **A** -.

The vacuum in cooling system has effect of extracting coolant from coolant reservoir of VAS 6096 ; cooling system is filled.

- Detach cooling system filler unit VAS 6096 from adapter V.A.G 1274/8 on coolant expansion tank.

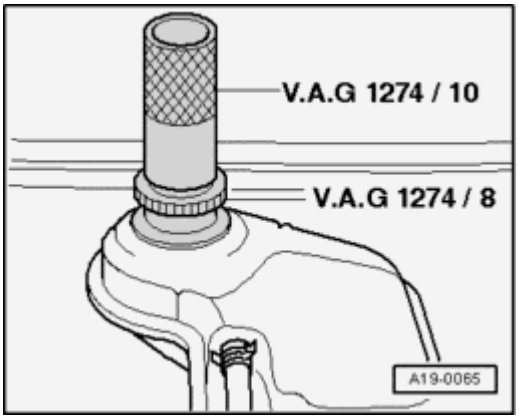


Fig. 642: Connecting Pipe For Cooling System Tester V.A.G 1274/10 To Adapter
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect pipe for cooling system tester V.A.G 1274/10 to adapter.

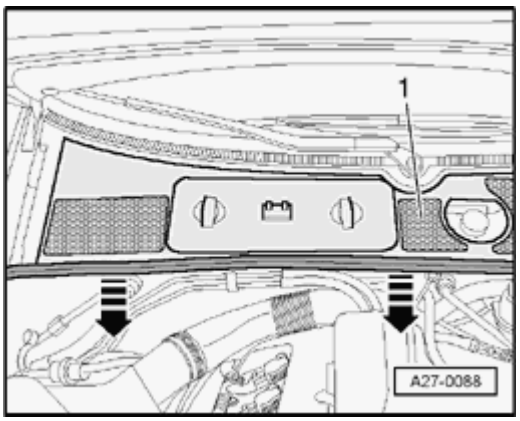


Fig. 643: Identifying Plenum Chamber Cover & Removing Rubber Seal
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove plenum chamber cover rubber seal.
- Remove plenum chamber cover - **1** - toward front - **arrows** -.

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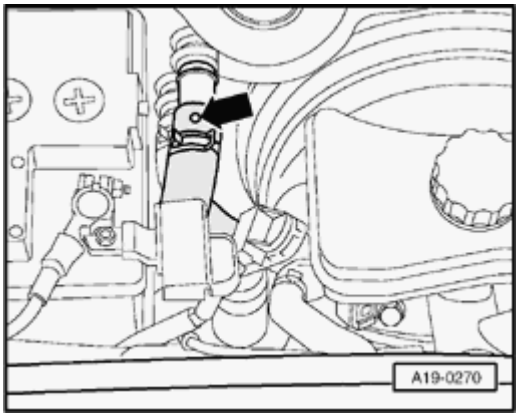


Fig. 644: Sliding Back Boot For Coolant Hoses At Connection Of Heater Core
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Slide back boot for coolant hoses at connection of heater core.
- Loosen coolant hose to heater core and pull back hose sufficiently so that the bleeder hole - **arrow** - is no longer sealed by connection.
- Fill up coolant until it escapes from the coolant hose bleeder hole without bubbles.
- Push coolant hose on connection and tighten.

- Twist cap for expansion tank closed.
- Start engine.
- Set heating air conditioning system to "HI".
- Let engine run at 2000 RPM for 3 minutes.

- Let engine run at idle long enough until both large coolant hoses on main cooler are warm.
- Let engine run at 2000 RPM for 1 minute.
- Turn off engine and allow it to cool off.

Check coolant level

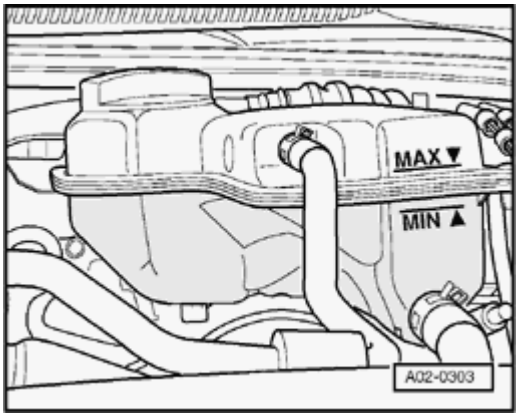


Fig. 645: Check Coolant Level
Courtesy of VOLKSWAGEN UNITED STATES, INC.

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- Coolant level may be above MAX marking with engine at operating temperature.

Torque specifications

Component	Nm
Drain plug in coolant regulator housing	25

Coolant pump and coolant thermostat, component overview

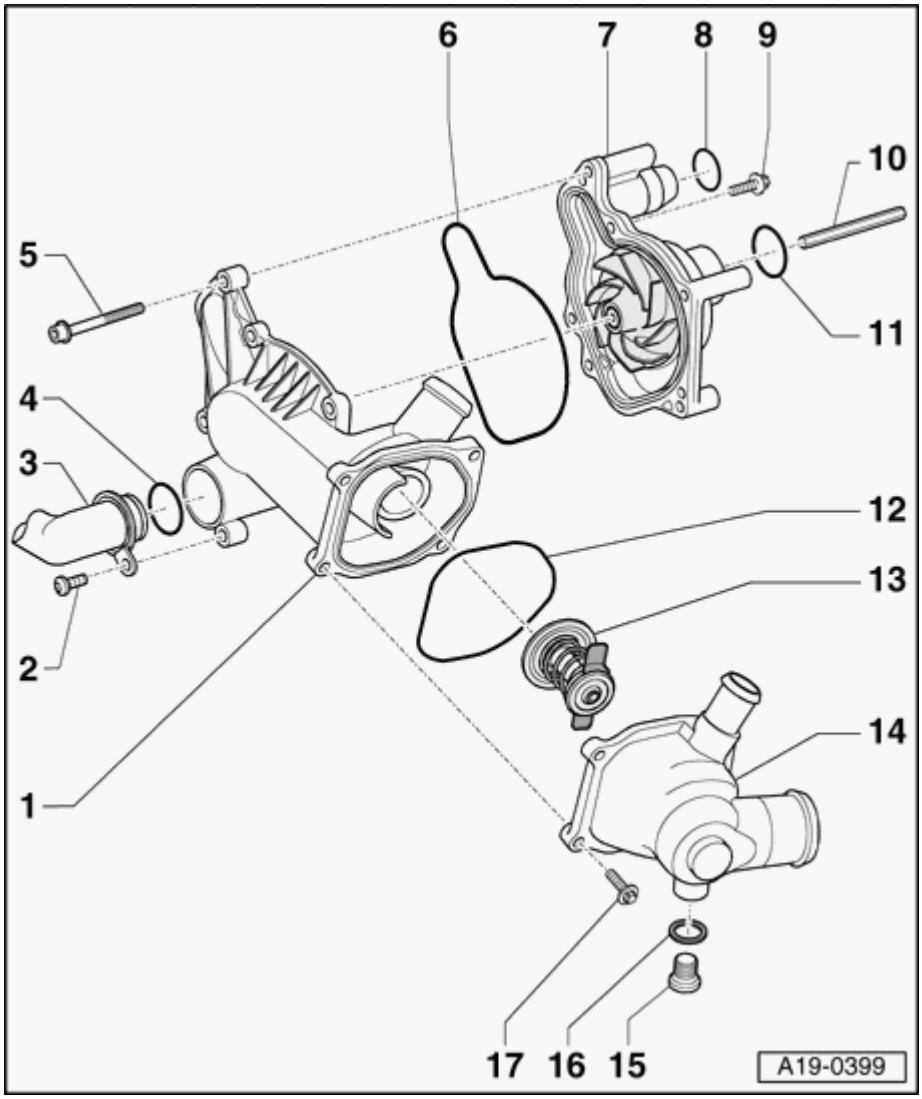


Fig. 646: Coolant Pump And Coolant Thermostat, Component Overview
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Coolant pump housing

- Removing and installing --> **Coolant pump, removing and installing**

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2 - 10 Nm

3 - Front coolant line

- Removing and installing --> **Front coolant pipe, removing and installing**

4 - O-ring

- Replace

5 - 10 Nm

6 - Seal

- Replace

7 - Coolant pump

- Removing and installing --> **Coolant pump, removing and installing**

8 - O-ring

- Replace

9 - 10 Nm

10 - Drive shaft for oil pump

11 - O-ring

- Replace

12 - Seal

- Replace

13 - Coolant thermostat

- Removing and installing --> **Coolant thermostat, removing and installing**
- Installed location **Coolant thermostat installation location**
- Checking --> **Thermostat, checking**

14 - Thermostat housing

- Removing and installing --> **Coolant thermostat, removing and installing**

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15 - Drain plug, 25 Nm

16 - Seal

- Replace

17 - 10 Nm

Coolant thermostat installation location

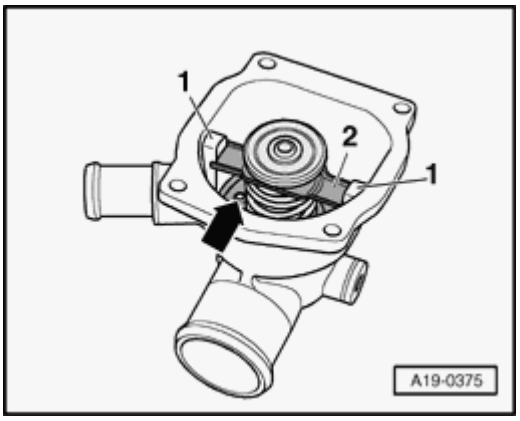


Fig. 647: Installed Location Of Bleeder Valve
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Bleeder valve - **arrow** - toward top.

Coolant pump, removing and installing

Removing

- Bring lock carrier into service position --> **Lock carrier, moving into service position**.
- Remove front coolant pipe --> **Front coolant pipe, removing and installing**.

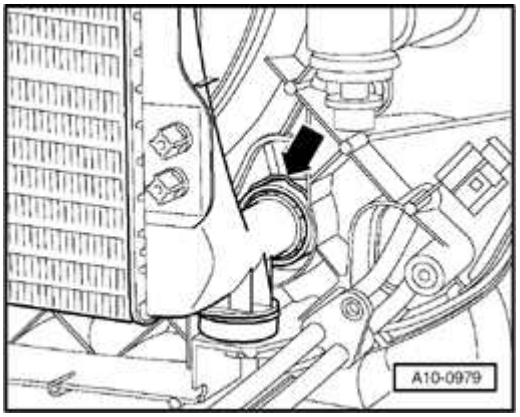


Fig. 648: Disconnecting Lower Coolant Hose From Radiator
Courtesy of VOLKSWAGEN UNITED STATES, INC.

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- Disconnect lower coolant hose from radiator - **arrow** - and drain residual coolant.

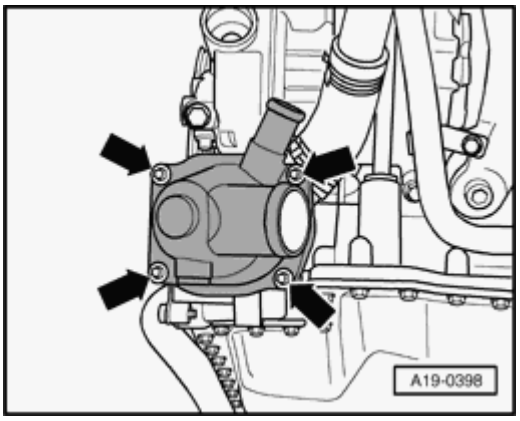


Fig. 649: Removing Bolts & Coolant Regulator Housing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect coolant hoses at coolant regulator housing.
- Remove bolts - **arrows** -.
- Remove coolant regulator housing.

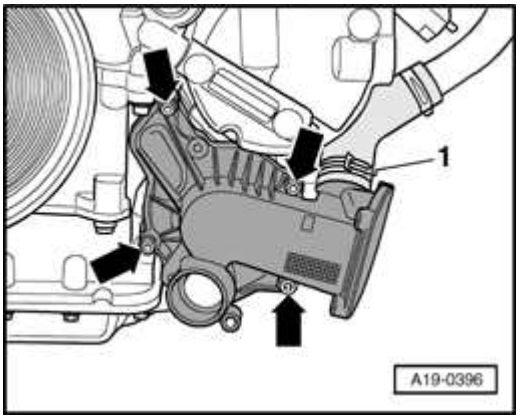


Fig. 650: Identifying Coolant Hose & Coolant Pump Housing Bolts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect - **1** -.
- Remove bolts - **arrows** -.
- Remove coolant pump housing toward front, pay attention to drive shaft for coolant pump while doing this.

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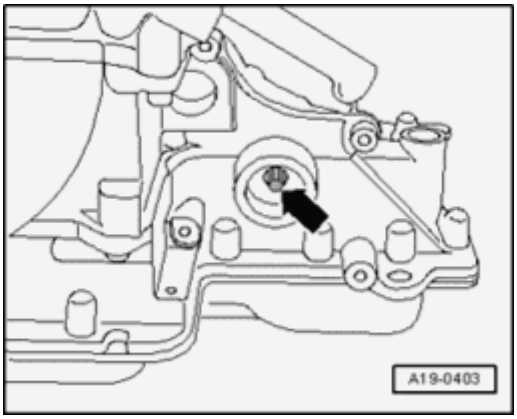


Fig. 651: Removing/Installing Drive Shaft For Coolant Pump From Oil Pump
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove drive shaft - **arrow** - for coolant pump from guide on oil pump.

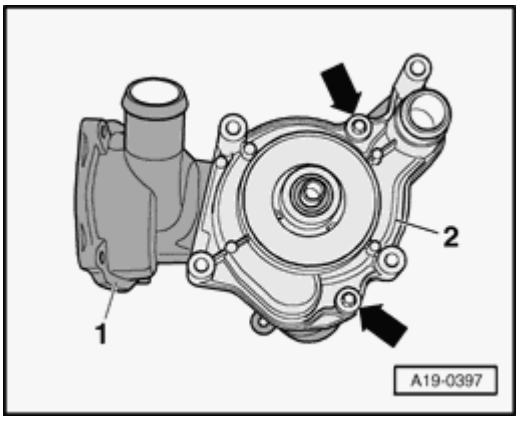


Fig. 652: Removing Bolts & Coolant Pump From Housing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts - **arrows** -.
- Remove coolant pump - **2** - from housing - **1** -.

Installing

NOTE:

- **Replace seals and O-rings.**
- **Secure all hose connections using hose clamps appropriate for the model type .**

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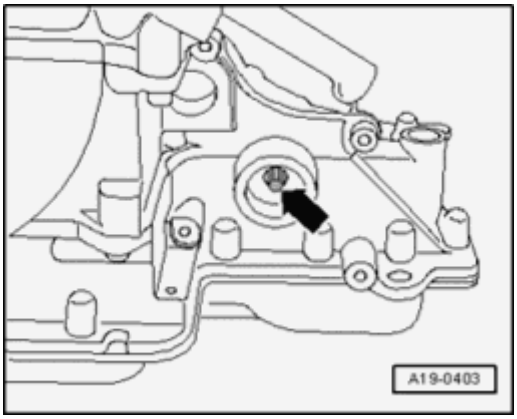


Fig. 653: Removing/Installing Drive Shaft For Coolant Pump From Oil Pump
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Insert drive shaft - **arrow** - for coolant pump into oil pump mount on engine.
- Slide coolant pump into mounts on upper section of oil pan.

NOTE:

- **To connect drive flange onto hex head of drive shaft, reach with the finger into the lower pipe connection of coolant pump and twist at impeller until coolant pump can be inserted completely.**

The rest of installation is in reverse order of removal, note the following:

- Install coolant regulator --> **Coolant thermostat, removing and installing**.
- Install front coolant pipe --> **Front coolant pipe, removing and installing**.
- Install lock carrier with attachments -->
  - **50 BODY, FRONT**
  - **50 - BODY - FRONT** for BODY EXTERIOR - CABRIOLET

.

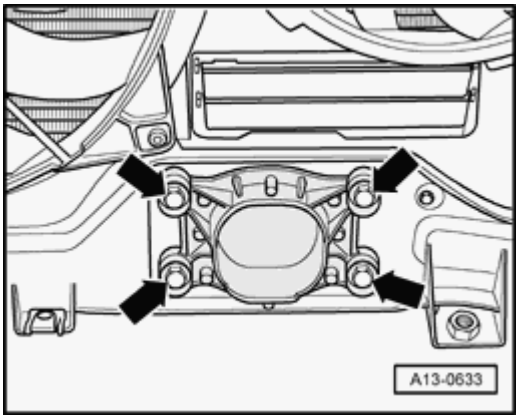


Fig. 654: Placing Torque Support On Rubber Buffer For Torque Support And Tightening Bolts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

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- Place torque support on rubber buffer for torque support and tighten bolts - **arrows** -.
- Install front bumper cover -->
  - **63 BUMPER**
  - **63 - BUMPERS** for BODY EXTERIOR - CABRIOLET

  .
- Fill with coolant **Filling**.
- Check headlight adjustment -->
  - **01 - MAINTENANCE**
  - **01 - MAINTENANCE** for MAINTENANCE PROCEDURES - CABRIOLET

  .

Torque specifications

Component	Nm
Coolant pump to housing	10
Coolant pump housing to upper section of oil pan	10
Torque support stop to lock carrier	28

After-Run Coolant Pump V51 , removing and installing

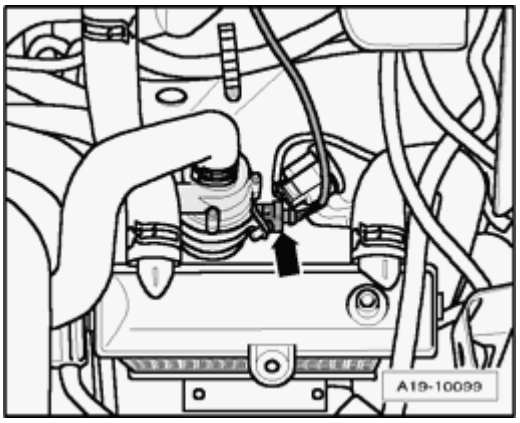


Fig. 655: Disconnecting Electrical Harness Connector For After-Run Coolant Pump V51
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Location: In coolant hose behind left headlight.

- Disconnect electrical harness connector - **arrow** - for After-Run Coolant Pump V51 (behind auxiliary radiator at left) and move electrical wiring clear.
- Activating After-Run Coolant Pump V51 or after connecting new ECM.
- Follow instructions in Guided Fault-finding.
- Enter correct vehicle into Guided Fault-finding.

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- Press "Go to" button
- Select "Function/component selection"
- Select "Powertrain"
- Select "Engine code"

- 01 - On Board Diagnostic (OBD) capable system
- Select "Functions"
- Select "Engine Control Module (ECM)"

Coolant thermostat, removing and installing

Special tools, testers and auxiliary items required

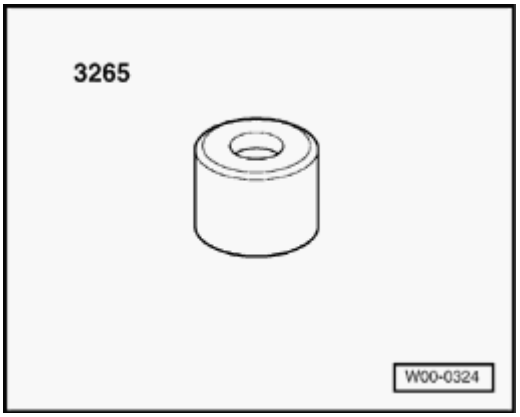


Fig. 656: Seal Installer 3265
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Seal installer 3265

Removing

- Drain coolant --> **Cooling system, draining and filling**.
- Disconnect coolant hoses at coolant regulator housing.

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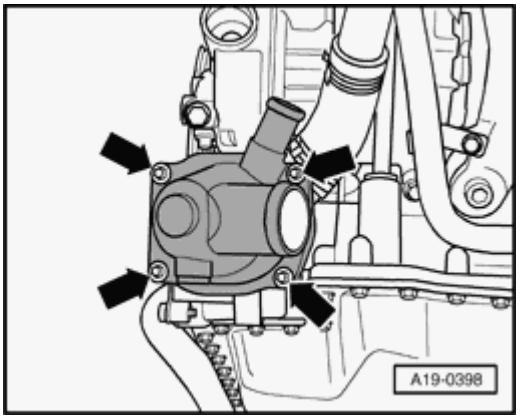


Fig. 657: Removing Bolts & Coolant Regulator Housing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts - **arrows** -.
- Remove coolant regulator housing.

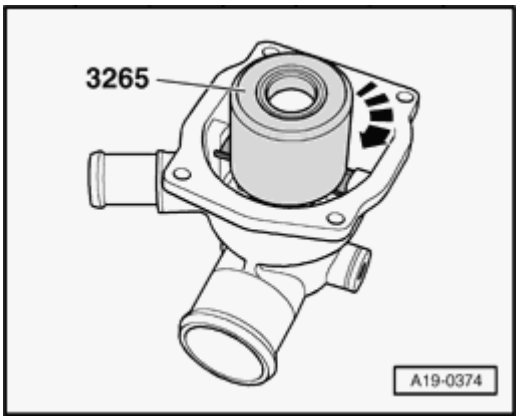


Fig. 658: Pressing Down Retaining Bracket Using Seal Installer 3265
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Press down retaining bracket using Seal installer 3265 and rotate approx. 180 ° (one half turn) - **arrow** -.

Installing

Installation is in reverse order of removal, note the following:

NOTE:

- **Replace seals.**
- **Secure all hose connections using hose clamps appropriate for the model type.**

- Clean and smooth sealing surface.
- Insert coolant regulator.

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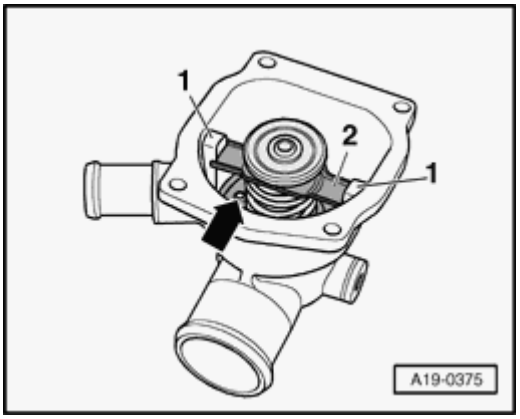


Fig. 659: Installed Location Of Bleeder Valve
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Installed location: Bleeder valve - **arrow** - toward top.
  - Press down retaining bracket using Seal installer 3265 and rotate approx. 180 ° (one half rotation).
- Retaining bracket must be engaged beneath pin of connection.
- Fill with coolant **Filling**.

Torque specifications

Component	Nm
Coolant regulator housing to coolant pump housing	10

Thermostat, checking

- Heat up removed thermostat in water.

Opening begins	Opening ends	Opening lift
approx. 87 ° C	approx. 102 ° C 1)	min. 8 mm
• 1) Cannot be tested.		

Coolant pipes/hoses, component overview

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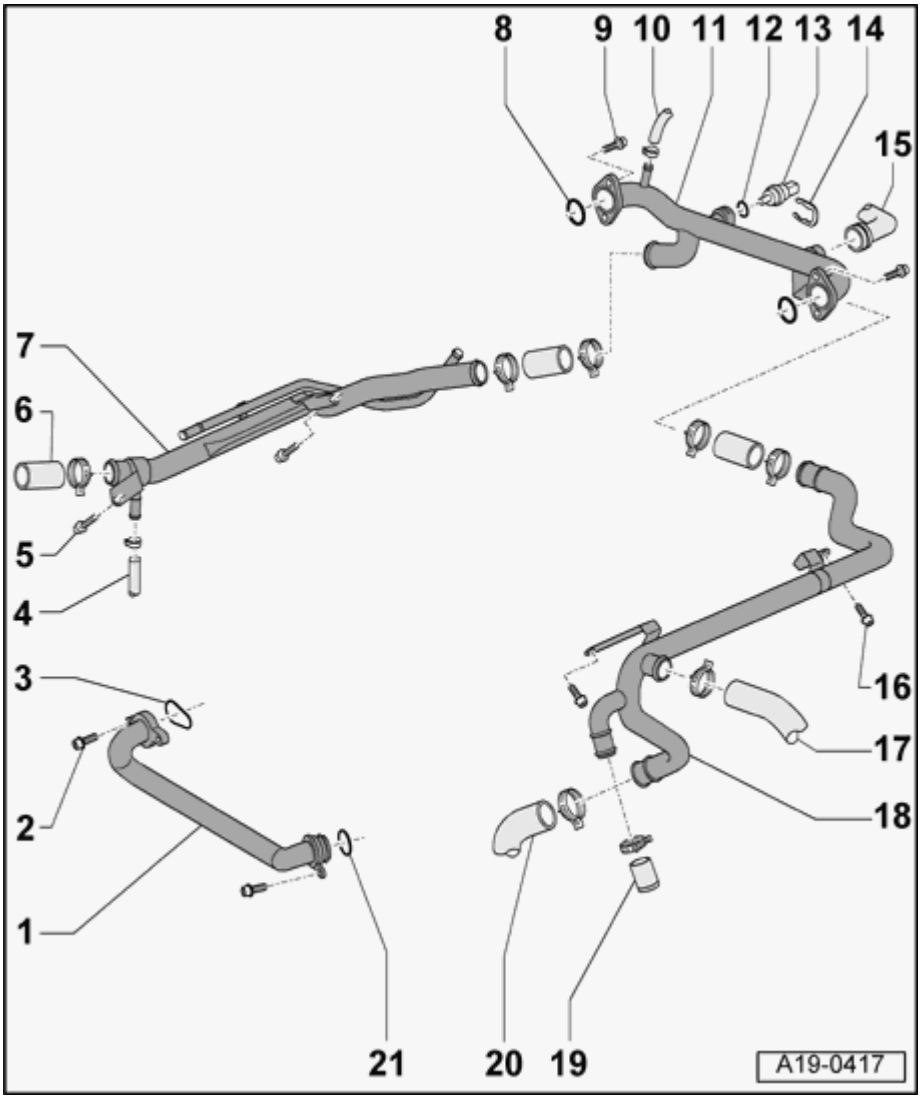


Fig. 660: Coolant Pipes/Hoses, Component Overview
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Front coolant line

- Removing and installing --> **Front coolant pipe, removing and installing**

2 - 10 Nm

3 - Seal

- Replace

4 - Coolant hose

- To generator

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5 - 10 Nm

6 - Coolant hose

- To upper radiator

7 - Right coolant line

- Removing and installing --> **Right coolant pipe, removing and installing**

8 - O-ring

- Replace

9 - 10 Nm

10 - Coolant hose

- To coolant expansion tank

11 - Rear coolant pipe

- Removing and installing --> **Rear coolant pipe, removing and installing**

12 - O-ring

- Replace

13 - Engine Coolant Temperature (ECT) Gauge Sensor G2/G62

14 - Retaining clip

15 - Coolant hose

- To heater core

16 - 10 Nm

17 - Coolant hose

- To left auxiliary cooler

18 - Left coolant line

- Removing and installing --> **Left coolant pipe, removing and installing**

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19 - Plug

20 - Coolant hose

- To coolant regulator housing

21 - O-ring

- Replace

Front coolant pipe, removing and installing

Special tools, testers and auxiliary items required

- Drip tray for workshop crane VAS 6208

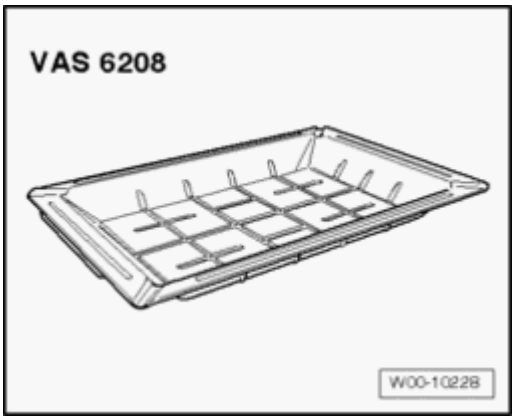
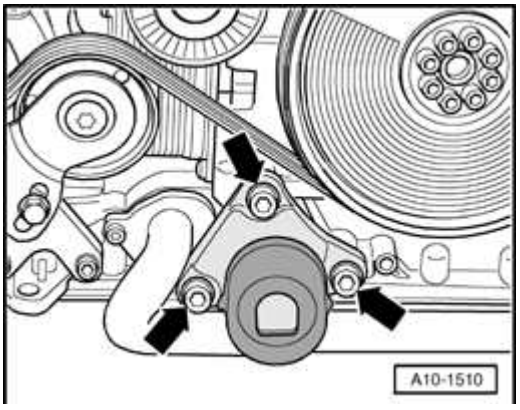


Fig. 661: Drip Tray For VAS 6100, VAS 6208
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Removing

- Drain coolant --> **Cooling system, draining and filling**.
- Bring lock carrier into service position --> **Lock carrier, moving into service position**.



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Fig. 662: Removing Bolts And Torque Support From Engine
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts - **arrows** - and remove torque support from engine.
- Place drip tray for workshop crane VAS 6208 under engine.

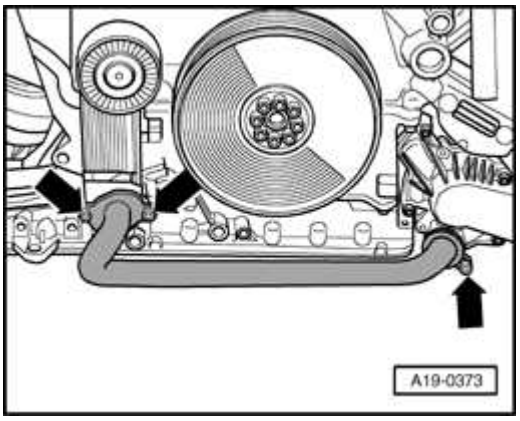


Fig. 663: Removing Front Coolant Pipe On Engine
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove front coolant pipe on engine - **arrows** -.

Installing

Installation is in reverse order of removal, note the following:

NOTE:

- **Replace seals and O-rings.**
- **Secure all hose connections using hose clamps appropriate for the model type .**

- Install the lock carrier with attachments -->
  - **50 BODY, FRONT**
  - **50 - BODY - FRONT** for BODY EXTERIOR - CABRIOLET

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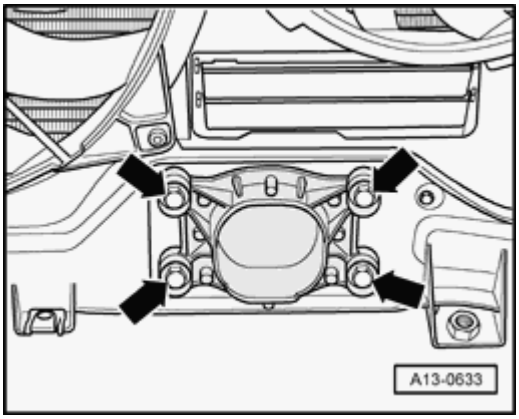


Fig. 664: Placing Torque Support On Rubber Buffer For Torque Support And Tightening Bolts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Place torque support on rubber buffer for torque support and tighten bolts - **arrows** -.
- Install front bumper cover -->
  - **63 BUMPER**
  - **63 - BUMPERS** for BODY EXTERIOR - CABRIOLET

  .
- Fill with coolant **Filling**.
- Check headlight adjustment -->
  - **01 - MAINTENANCE**
  - **01 - MAINTENANCE** for MAINTENANCE PROCEDURES - CABRIOLET

  .

Torque specifications

Component		Nm
Coolant line	Coolant pump	10
front to	Oil pan (upper section)	10
Torque bracket to upper part of oil pan		42
Torque support stop to lock carrier		28

Rear coolant pipe, removing and installing

Special tools, testers and auxiliary items required

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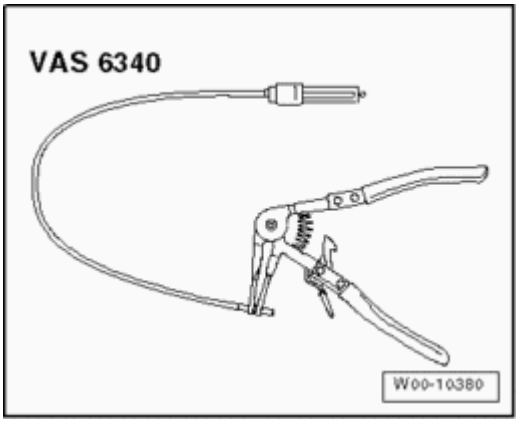


Fig. 665: Identifying Spring-Type Clip Pliers VAS 6340
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Hose clamp pliers VAS 6340

Removing

NOTE:

- **All cable ties opened or cut during engine removal must be reinstalled at the same locations during installation.**

- Drain coolant --> **Cooling system, draining and filling**.
- Bring lock carrier into service position --> **Lock carrier, moving into service position**.
- Remove right coolant pipe --> **Right coolant pipe, removing and installing**.
- Remove engine support bridge 10-222 A from engine compartment.

NOTE:

- **Engine support bridge was necessary to remove right coolant pipe, but it hinders the following work sequence.**

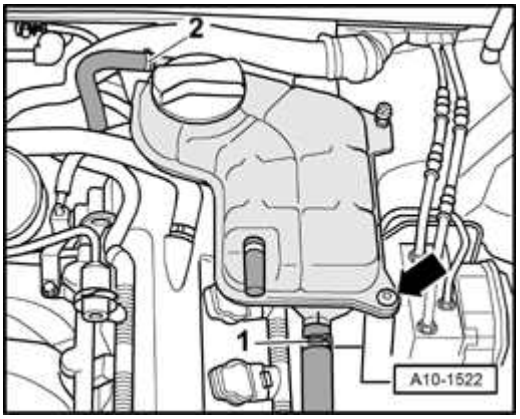


Fig. 666: Removing Coolant Hoses & Coolant Expansion Tank
Courtesy of VOLKSWAGEN UNITED STATES, INC.

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- Remove coolant expansion tank - **arrow** -.
- Disconnect electrical wiring to Engine Coolant Level (ECL) Warning Switch F66 at bottom of expansion tank.

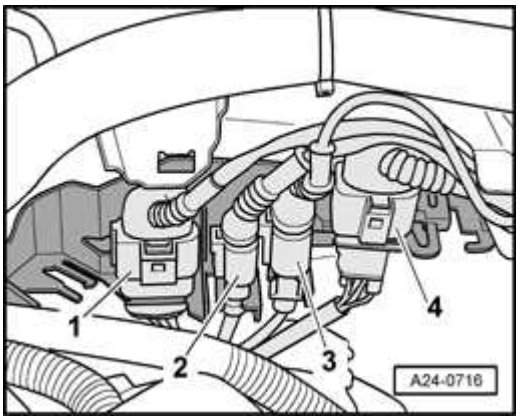


Fig. 667: Removing Bracket For Electrical Harness Connectors At Left From Bulkhead
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove electrical harness connectors - **1 to 4** - from bracket at left of bulkhead.
- Remove bracket from bulkhead.

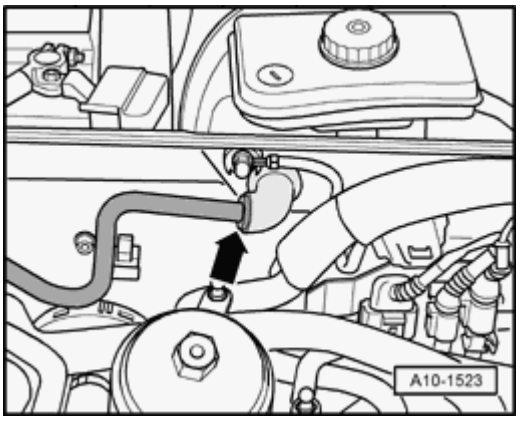


Fig. 668: Disconnecting Brake Booster Vacuum Hose From Grommet On Bulkhead
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect vacuum line - **arrow** - to brake booster at bulkhead.

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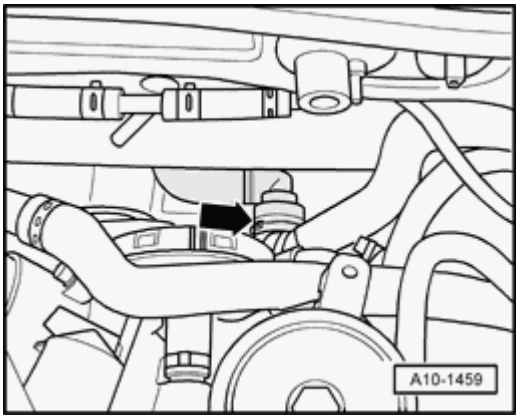


Fig. 669: Disconnecting Coolant Hose To Heater Core At Rear Coolant Pipe On Engine
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect coolant hose to heater core at rear coolant pipe on engine.

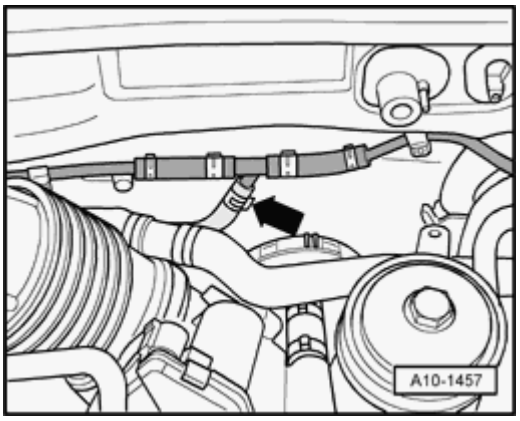


Fig. 670: Disconnecting Coolant Hose From Y-Connector
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect coolant hose from Y-connector - **arrow** -.

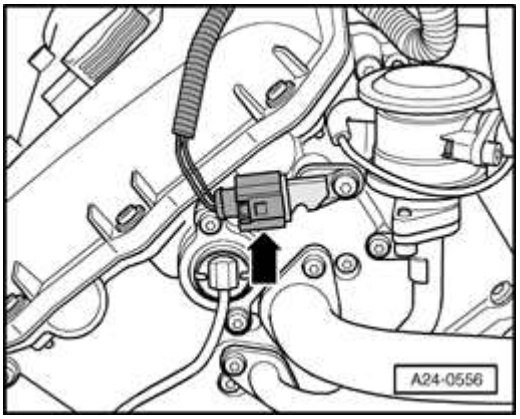


Fig. 671: Disconnecting Electrical Harness Connector For Camshaft Position (CMP) Sensor 2 G163 On Left Cylinder Head

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Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical harness connector - **arrow** - for Camshaft Position (CMP) Sensor 2 G163 on left cylinder head.

NOTE:

- **The following illustration shows the engine as removed, from behind.**

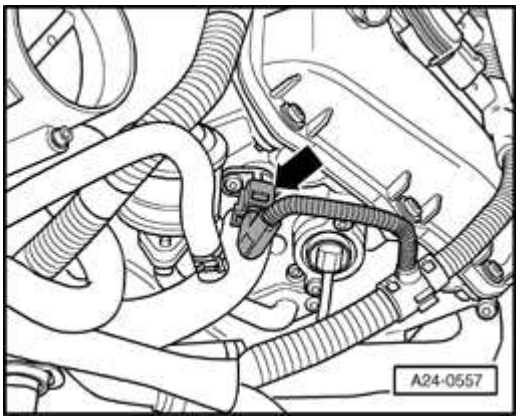


Fig. 672: Pressing Sealing Ring For Crankshaft At Rear Out Of Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical harness connector - **arrow** - for Camshaft Position (CMP) Sensor G40 on right cylinder head.

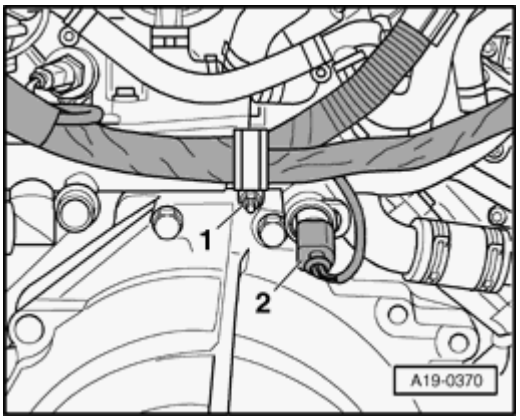


Fig. 673: Disconnecting Electrical Harness Connector On Engine Coolant Temperature (ECT) Gauge Sensor G2/G62
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect the electrical connector - **2** - on Engine Coolant Temperature (ECT) Gauge Sensor G2/G62.
- Remove nut - **1** - and remove electrical wiring harness at rear coolant pipe.

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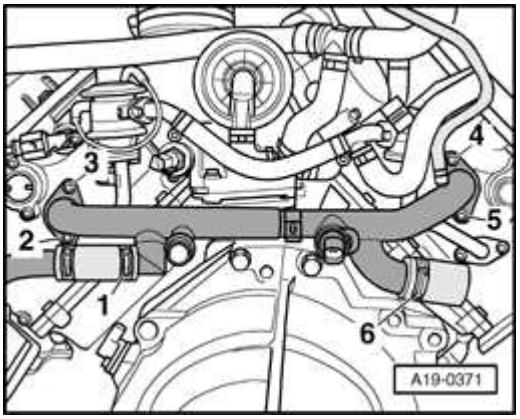


Fig. 674: Removing Bolts & Rear Coolant Pipe
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Loosen hose clips - **1** - using Hose Clip Pliers VAS 6340.
- Loosen hose clip - **6** - using Hose Clips Pliers VAS 6340 and remove coolant hose.
- Remove bolts - **2 to 5** -.
- Remove rear coolant pipe.

Installing

Installation is in reverse order of removal, note the following:

NOTE:

- **Replace O-rings.**
- **Secure all hose connections using hose clamps appropriate for the model type .**
- **During installation, all cable ties must be re-installed at the same location.**

- Clean and/or smooth O-rings sealing surface before installing.
- Coat new O-rings with non-corrosive lubricant (Vaseline), install rear coolant pipe and tighten.
- Install right coolant pipe --> **Right coolant pipe, removing and installing**.
- Install lock carrier with attachments -->
  - **50 BODY, FRONT**
  - **50 - BODY - FRONT** for BODY EXTERIOR - CABRIOLET

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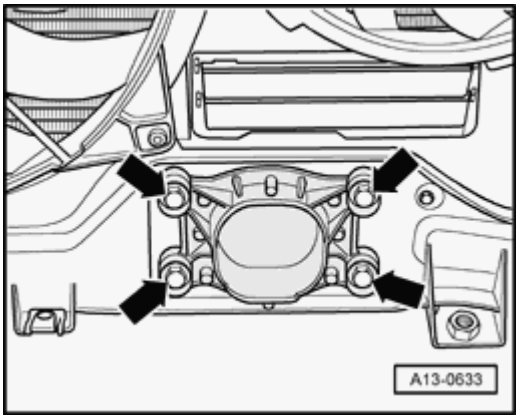


Fig. 675: Placing Torque Support On Rubber Buffer For Torque Support And Tightening Bolts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Place torque support on rubber buffer for torque support and tighten bolts - **arrows** -.
- Install front bumper cover -->
  - **63 BUMPER**
  - **63 - BUMPERS** for BODY EXTERIOR - CABRIOLET

  .
- Fill with coolant **Filling**.
- Check headlight adjustment -->
  - **01 - MAINTENANCE**
  - **01 - MAINTENANCE** for MAINTENANCE PROCEDURES - CABRIOLET

  .

Torque specifications

Component	Nm
Rear coolant pipe to cylinder head	10
Retaining clamps to rear coolant pipe	10

Left coolant pipe, removing and installing

Special tools, testers and auxiliary items required

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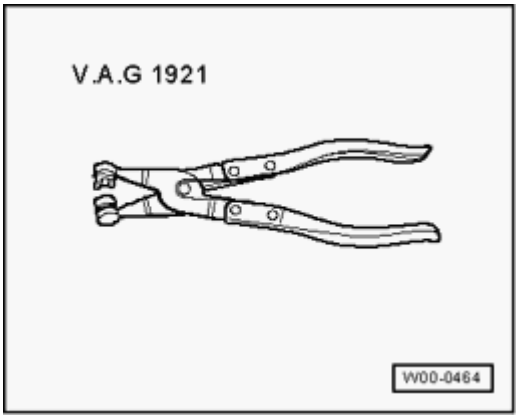


Fig. 676: Identifying Hose Clip Pliers Vag 1921
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Hose clamp pliers V.A.G 1921

Removing

- Remove engine: Vehicles with manual transmission --> **Engine (vehicles with manual transmission)** , vehicles with automatic transmission --> **Engine (vehicles with automatic transmission), removing**.

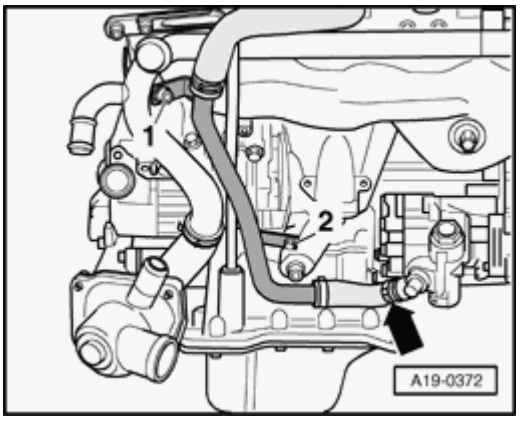


Fig. 677: Removing Bolts & Return Line From Power-Steering Pump
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts - **1** - and - **2** -.

NOTE:

- **To prevent oil from escaping, the hose - arrow - remains connected to power steering.**

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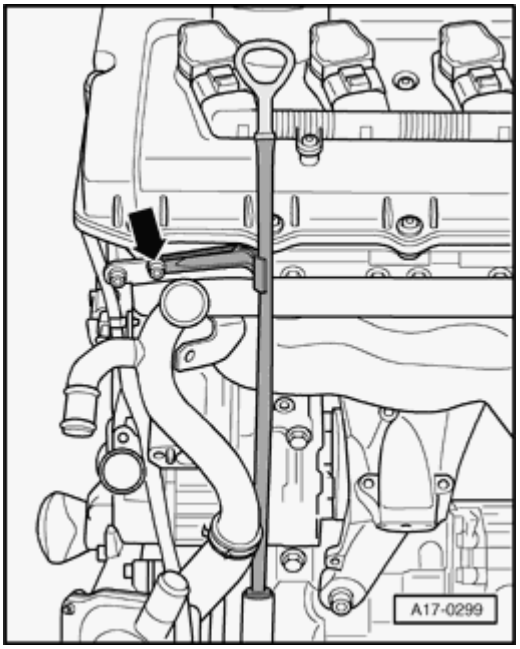


Fig. 678: Removing Bolt From Oil Dipstick Guide Tube At Cylinder Head
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove guide pipe for oil dipstick at cylinder head - **arrow** - , pull up and remove.

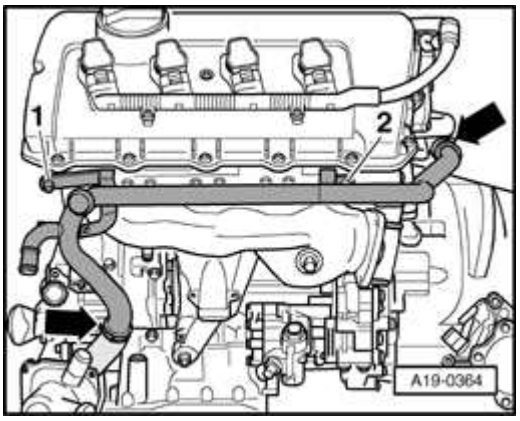


Fig. 679: Removing Bolts, Loosening Hose Clamps And Removing Left Coolant Pipe From Coolant Hoses
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts - **1** - and - **2** -.
- Loosen hose clamps - **arrows** - and remove left coolant pipe from coolant hoses.

Installing

Installation is in reverse order of removal, note the following:

NOTE:

- **Replace O-ring.**

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- **Secure all hose connections using hose clamps appropriate for the model type .**

- Replace O-ring at guide tube for oil dipstick and insert guide tube into hole in oil pan (upper part).
- Install engine: Vehicles with manual transmission --> **Engine (vehicles with manual transmission), installing** , vehicles with automatic transmission --> **Engine (vehicles with automatic transmission), installing**.

Torque specifications

Component		Nm
Left coolant pipe to cylinder head		10
Oil dip stick guide tube to cylinder head		10
Return line of	Bracket	10
power-steering to	Engine support	10

Right coolant pipe, removing and installing

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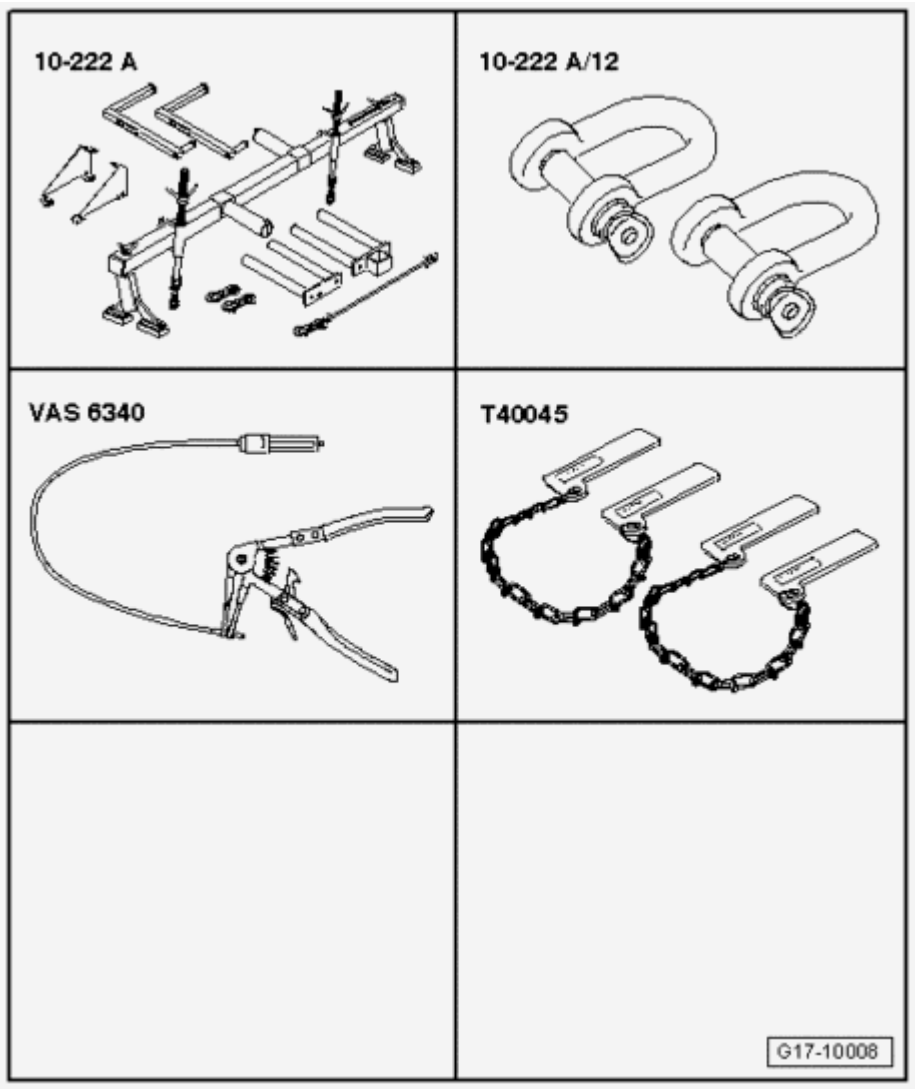


Fig. 680: Identifying Special Tools - Right Coolant Pipe, Removing And Installing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools, testers and auxiliary items required

- Engine support bridge 10-222 A
- Shackle 10-222 A/12
- Hose clamp pliers VAS 6340
- Insert pad for front fender T40045

Removing

NOTE:

- **All cable ties opened or cut during engine removal must be reinstalled at the same locations during installation.**

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- Drain coolant --> **Cooling system, draining and filling**.
- Bring lock carrier into service position --> **Lock carrier, moving into service position**.

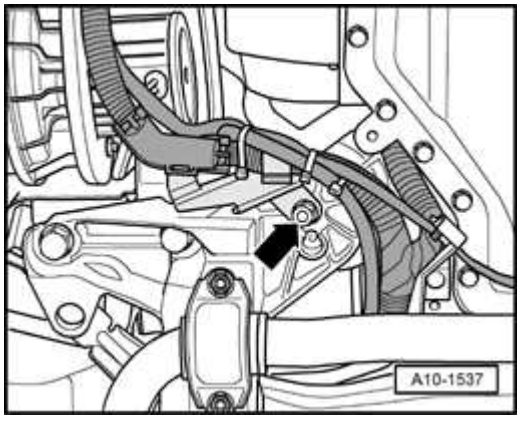


Fig. 681: Removing Wiring Harness Bracket At Right Engine Plate
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove wiring harness bracket at right engine console - **arrows** -.

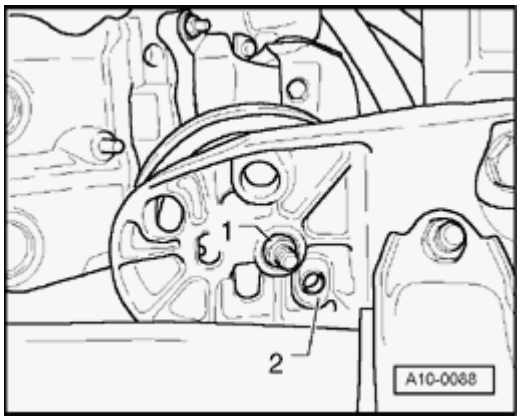


Fig. 682: Removing Lower Nut On Right Engine Mount
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove lower nut - **1** - on right engine mount.

NOTE:

- **Ignore - 2 -.**

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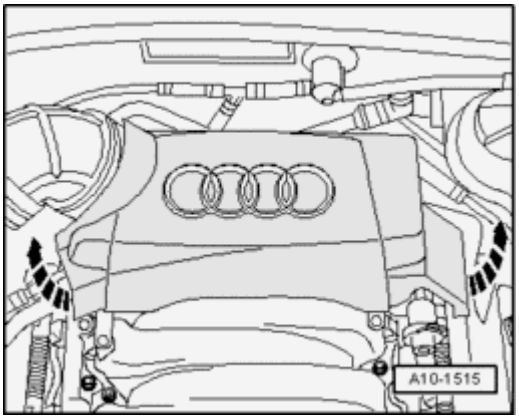


Fig. 683: Removing Rear Engine Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove rear engine cover - **arrows** -.

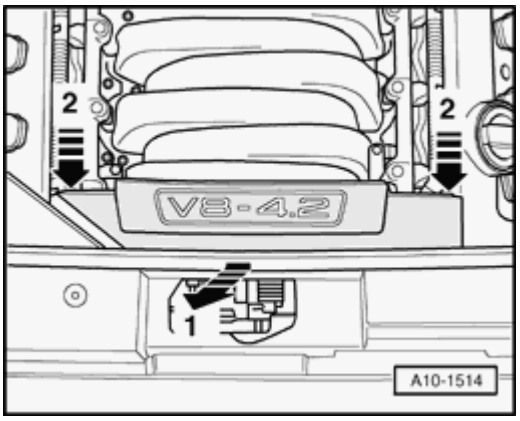


Fig. 684: Removing Front Engine Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove front engine cover - **arrows 1 and 2** -.

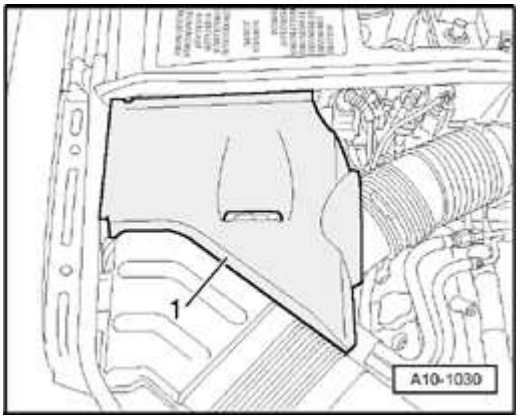


Fig. 685: Removing Cover In Engine Compartment (Right Side)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

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- Remove cover - **1** - in engine compartment (right side).

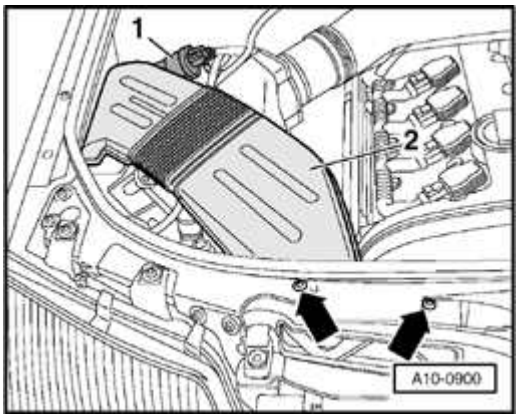


Fig. 686: Identifying Evaporative Emission Canister Purge Regulator Valve N80 And Air Duct
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disengage Evaporative Emission (EVAP) Canister Purge Regulator Valve N80 - **item 1** - from air guide.
- Remove bolts - **arrows** -.
- Remove air duct - **2** -.

CAUTION: Note rules of cleanliness for working on the fuel injection system --> Rules for cleanliness.

CAUTION: Fuel system is under pressure! Before opening system, place rags around connection area. Then release pressure by carefully loosening connection.

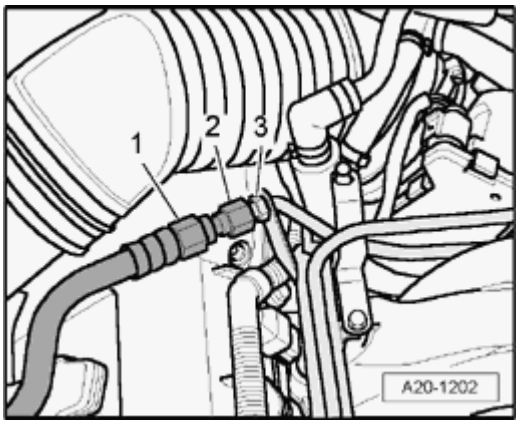


Fig. 687: Installing/Removing Fuel Hose To/From Connection On Fuel Rail Line
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove fuel hose from connection on fuel rail line. To do so, counter hold using an open-end wrench at hex head - **1** - and - **3** - and remove union nut - **2** -.

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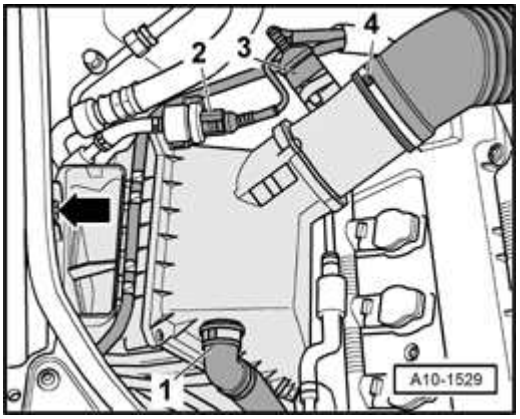


Fig. 688: Identifying Electrical Harness Connectors, Secondary Air Injection (AIR) Pump Hose, Air Guide Hose & Mass Air Flow (MAF) Sensor
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical harness connector - **2** - from Evaporative Emission (EVAP) Canister Purge Regulator Valve N80.
- Disconnect electrical harness connector - **3** - at Mass Air Flow (MAF) Sensor G70.
- Disconnect hose - **1** - to Secondary Air Injection (AIR) pump.
- Disconnect air guide hose - **4** - at Mass Air Flow (MAF) sensor.

- Move wiring harness clear at air filter housing.
- Remove clip and remove air filter housing with Mass Air Flow (MAF) sensor.

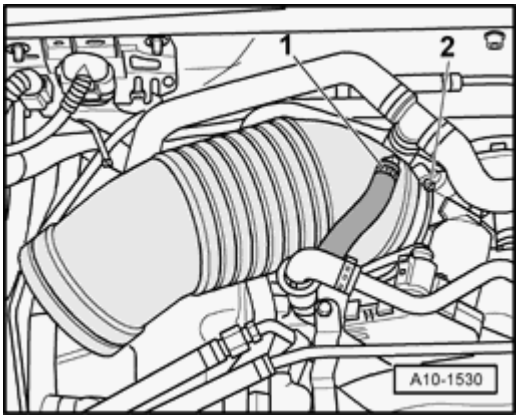


Fig. 689: Disconnecting Vacuum Hose & Air Guide Hose From Throttle Valve Control Module
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect vacuum hose - **1** -.
- Disconnect air guide hose - **2** - from throttle valve control module.

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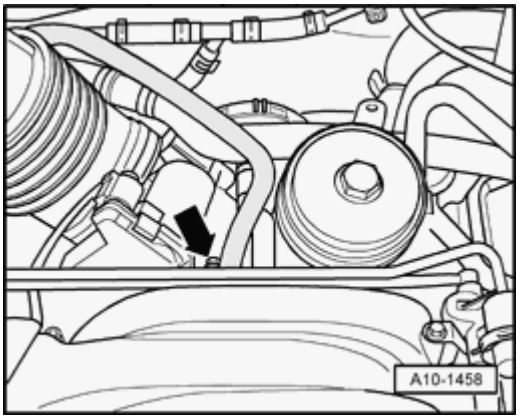


Fig. 690: Disconnecting Vacuum Hose From Intake Manifold
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect vacuum hose - **arrow** - from intake manifold.

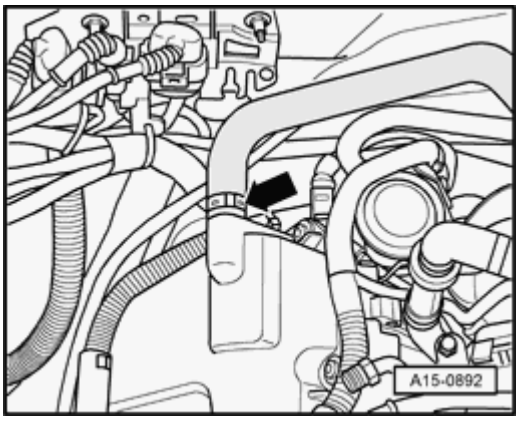


Fig. 691: Disconnecting Hose For Crankcase Ventilation From Right Cylinder Head Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect hose for crankcase ventilation from right cylinder head cover - **arrow** -.

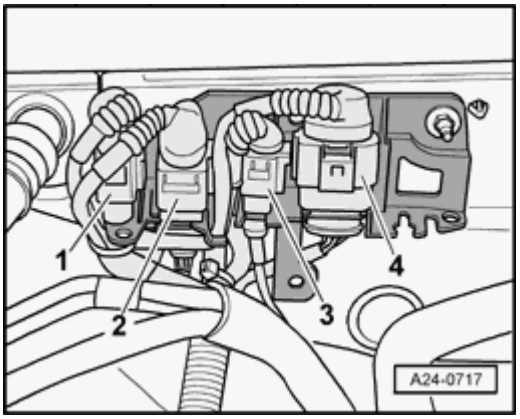


Fig. 692: Removing Bracket For Electrical Harness Connectors At Right From Bulkhead
Courtesy of VOLKSWAGEN UNITED STATES, INC.

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- Remove electrical harness connectors - **1 to 4** - from bracket at right of bulkhead.
- Free up cables.

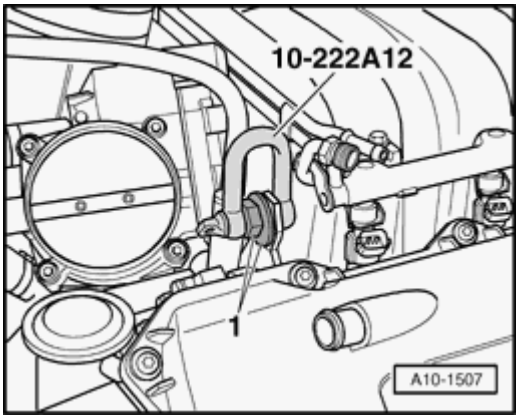


Fig. 693: Securing Shackle 10-222 A/12 To Right Rear Engine Lifting Eyelet
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Secure shackle 10-222 A/12 to right rear engine lifting eyelet.

NOTE:

- **Ignore - 1 -.**

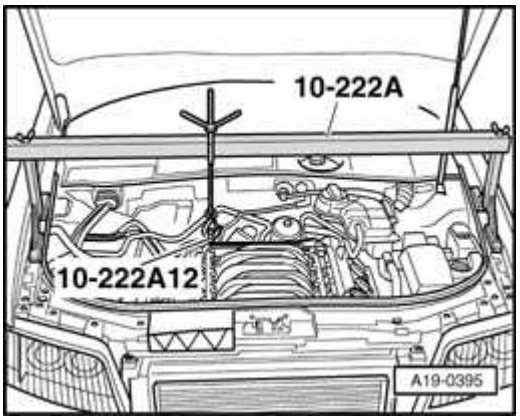


Fig. 694: Engaging Shackle 10-222 A/12 On Spindle Of Engine Support Bridge 10-222 A
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Position engine support bridge 10-222 A onto bolted flange of fenders.
- Engage shackle 10-222 A/12 on spindle of engine support bridge 10-222 A.
- Raise engine slightly using spindle on engine support bridge.

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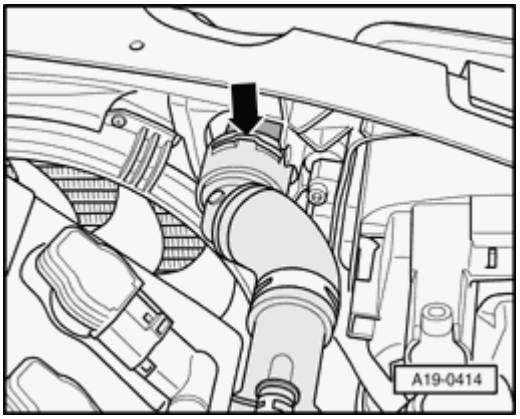


Fig. 695: Disconnecting Top Coolant Hose From Radiator
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect top coolant hose - **arrow** - from radiator.

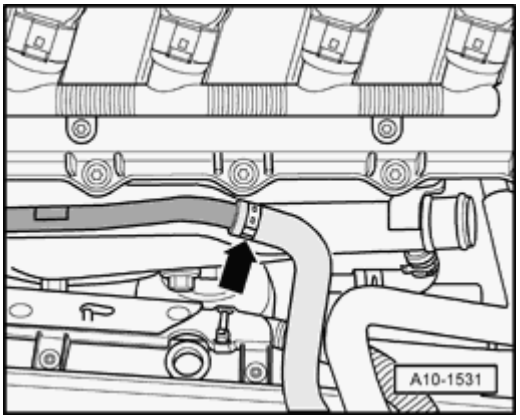


Fig. 696: Disconnecting Air Hose At Right On Engine
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect air hose - **arrow** - to combination valves for Secondary Air Injection (AIR).

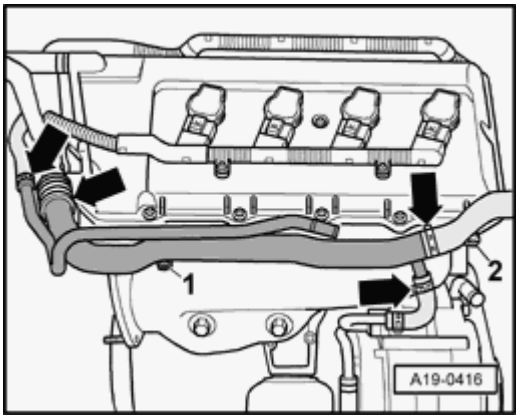


Fig. 697: Removing Bolts, Loosening Hose Clamps And Removing Right Coolant Pipe From Coolant Hoses

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Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts - **1** - and - **2** -.
- Loosen hose clamps - **arrows** - and remove right coolant pipe from coolant hoses.
- If necessary, remove engine support bridge to remove coolant pipe.

Installing

Installation is in reverse order of removal, note the following:

NOTE:

- **Secure all hose connections using hose clamps appropriate for the model type .**
- **During installation, all cable ties must be re-installed at the same location.**

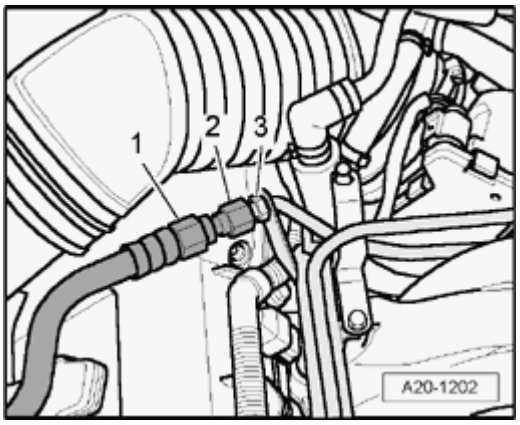


Fig. 698: Installing/Removing Fuel Hose To/From Connection On Fuel Rail Line
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Secure fuel hose to connection on fuel rail line. To do so, counter hold using an open-end wrench at each hex head - **1** - and - **3** - and tighten union nut - **2** - to 22 Nm.
- Install lock carrier with attachments -->
  - **50 BODY, FRONT**
  - **50 - BODY - FRONT** for BODY EXTERIOR - CABRIOLET

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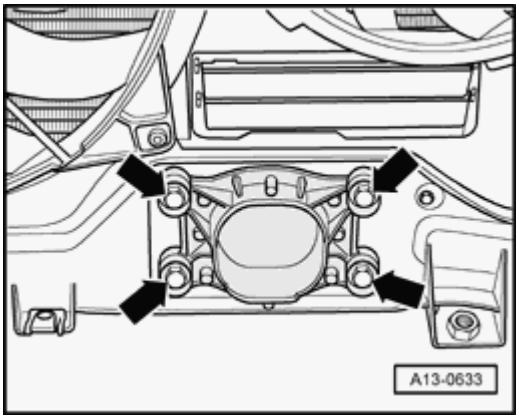


Fig. 699: Placing Torque Support On Rubber Buffer For Torque Support And Tightening Bolts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Place torque support on rubber buffer for torque support and tighten bolts - **arrows** -.
- Install front bumper cover -->
  - **63 BUMPER**
  - **63 - BUMPERS** for BODY EXTERIOR - CABRIOLET

  .
- Fill with coolant **Filling**.
- Check headlight adjustment -->
  - **01 - MAINTENANCE**
  - **01 - MAINTENANCE** for MAINTENANCE PROCEDURES - CABRIOLET

  .

Torque specifications

Component	Nm
Right coolant pipe to cylinder head	10
Left engine mount to engine console	23
Oil pipes to rear air guide pipe	10
Fuel supply line to fuel rail	22
Torque support stop to lock carrier	28

Radiator, removing and installing

Special tools, testers and auxiliary items required

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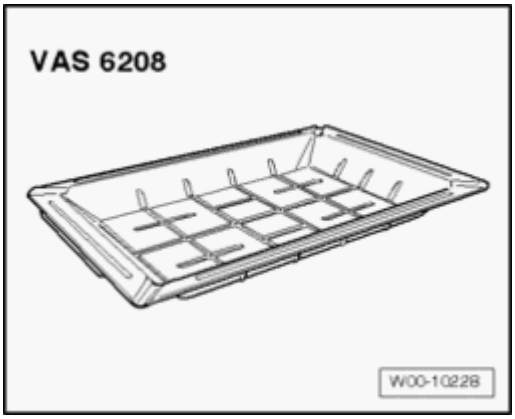


Fig. 700: Drip Tray For VAS 6100, VAS 6208
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Drip tray for workshop crane VAS 6208

Removing

NOTE:

- **Drained coolant must be stored in a clean container for disposal or reuse.**
- **When assembled correctly, radiator and condenser can show slight impressions on fins. This is not damage. Radiators or condensers should not be replaced because of slight impressions like these.**

CAUTION: Cover cap of expansion tank with rag and open carefully, as hot steam i.e. hot coolant may escape when opening.

- Open cap of coolant expansion tank.

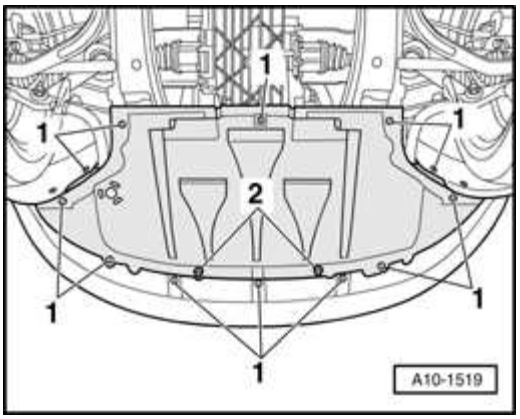


Fig. 701: Removing Quick-Release Fasteners, Screws And Noise Insulation
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove quick-release fasteners - **1** - , remove screws - **2** - and remove noise insulation.
- Remove front bumper cover -->

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- **63 BUMPER**
- **63 - BUMPERS** for BODY EXTERIOR - CABRIOLET

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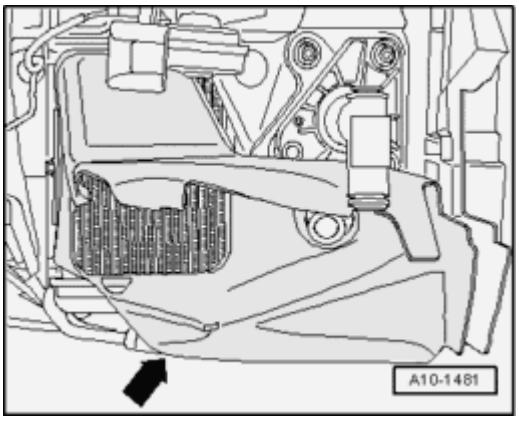


Fig. 702: Removing Right Air Guide In Front Of Auxiliary Cooler
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove right air guide - **arrow** - in front of auxiliary cooler.

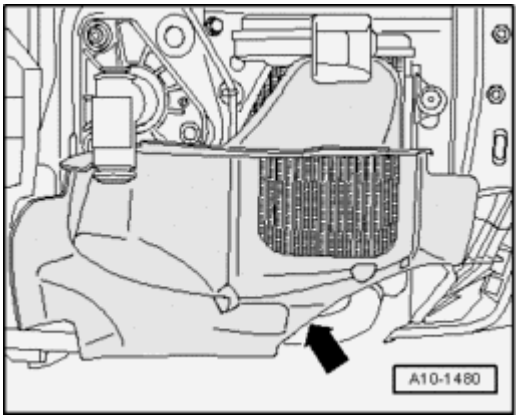


Fig. 703: Removing Left Air Guide In Front Of Auxiliary Cooler
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove left air guide - **arrow** - in front of auxiliary cooler.

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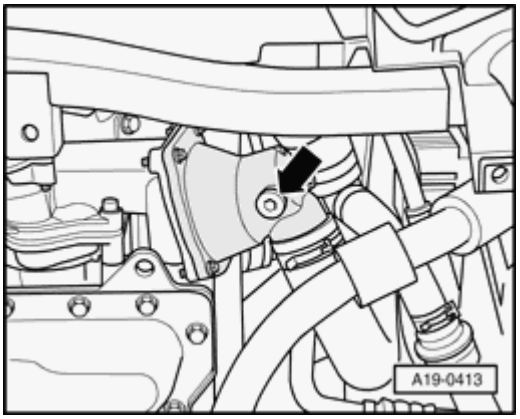


Fig. 704: Removing Drain Plug On Coolant Thermostat Housing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Place drip tray for workshop crane VAS 6208 under engine.
- Remove drain plug - **arrow** - on coolant thermostat housing and drain coolant from engine.

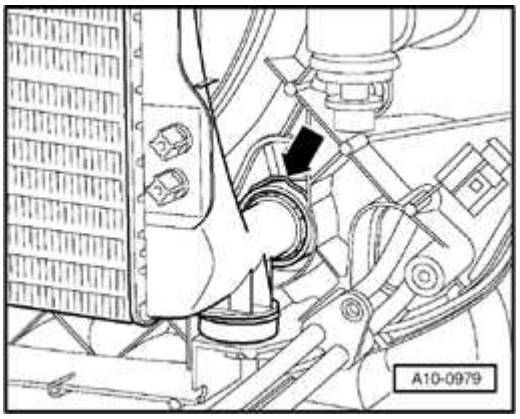


Fig. 705: Disconnecting Lower Coolant Hose From Radiator
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect lower coolant hose from radiator - **arrow** - and drain residual coolant.

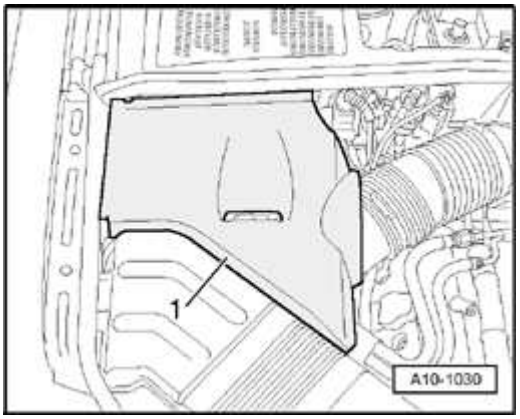


Fig. 706: Removing Cover In Engine Compartment (Right Side)

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Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove cover - **1** - in engine compartment (right side).

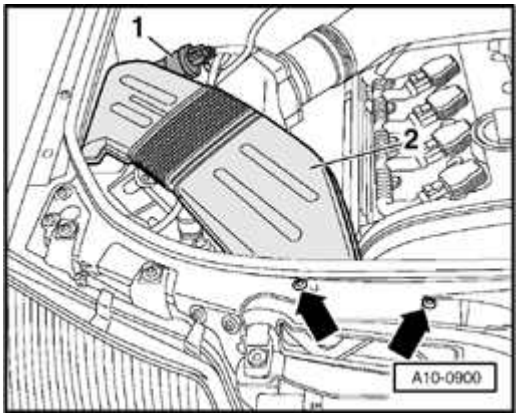


Fig. 707: Identifying Evaporative Emission Canister Purge Regulator Valve N80 And Air Duct
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disengage Evaporative Emission (EVAP) Canister Purge Regulator Valve N80 - **item 1** - from air guide.
- Remove bolts - **arrows** -.
- Remove air duct - **2** -.

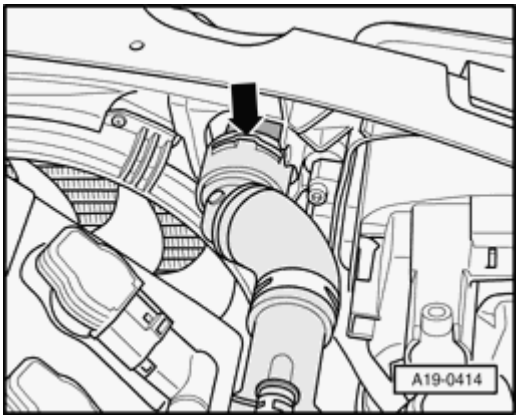


Fig. 708: Disconnecting Top Coolant Hose From Radiator
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect top coolant hose - **arrow** - from radiator.

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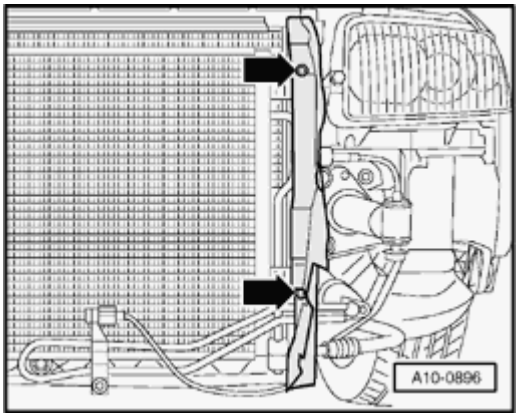


Fig. 709: Removing Bolts On Left/Right Air Guides At Cooler
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts - **arrows** - on left and right air guides at cooler.

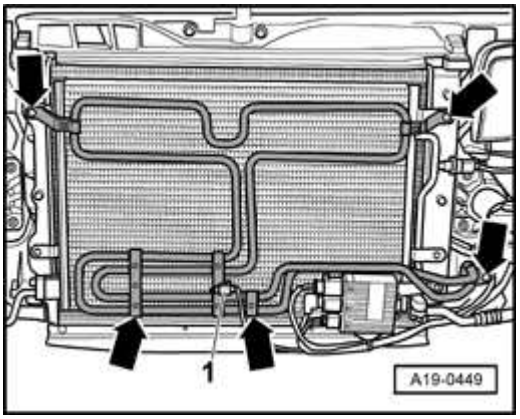
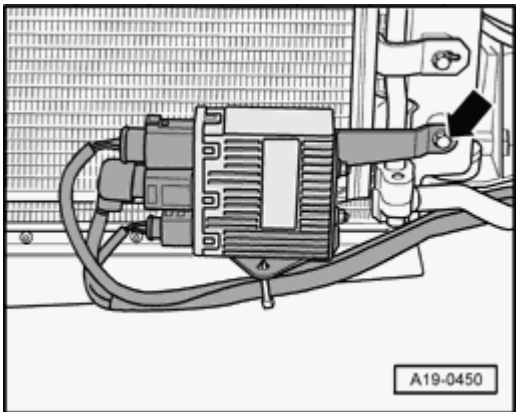


Fig. 710: Removing Power Steering Hydraulic Oil Cooling Pipe
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unclip Outside Air Temperature Sensor G17 - **1** - from bracket and free up wire.
- Remove power steering hydraulic oil cooling pipe - **arrows** - ; do not open hydraulic oil circuit.
- Tie up power steering hydraulic oil cooling pipe to side.



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Fig. 711: Removing Coolant Fan Control (FC) Control Module J293 From Radiator
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove Coolant Fan Control (FC) Control Module J293 from radiator - **arrow** -.

CAUTION: The air conditioning refrigerant circuit must not be opened.

NOTE:

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

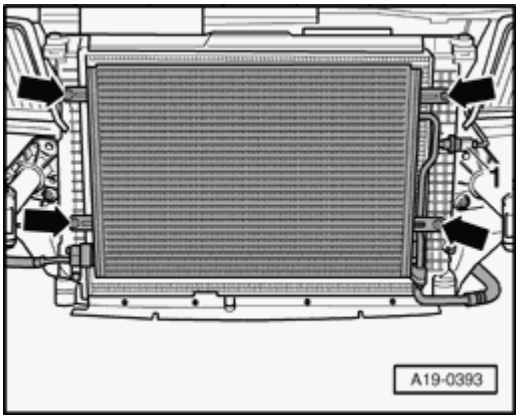


Fig. 712: Disconnecting Electrical Harness Connector At High Pressure Sensor G65
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical harness connector - **1** - at High Pressure Sensor G65.
- Remove bolts - **arrows** -.
- Remove condenser and swing downward with lines connected.

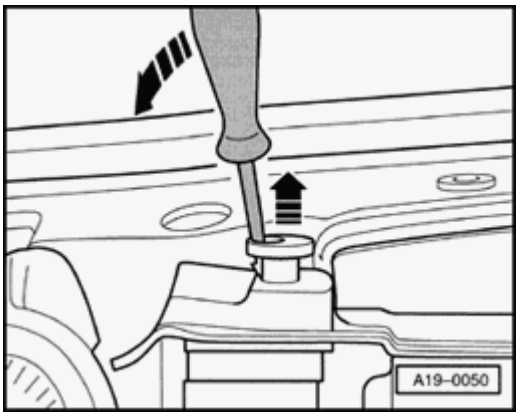


Fig. 713: Releasing Both Radiator Retaining Pins And Removing By Pulling Upward
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Release both radiator retaining pins and remove by pulling upward - **arrows** -.

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- Tilt radiator at upper edge forward, pull up and remove.

Installing

Installation is in reverse order of removal, note the following:

- Install the front bumper cover -->
  - **63 BUMPER**
  - **63 - BUMPERS** for BODY EXTERIOR - CABRIOLET

  .
- Fill with coolant **Filling**.

NOTE:

- **Complete coolant must be replaced if the radiator was replaced.**

Torque specifications

Component	Nm
Condenser to radiator	10
Cooling coil to radiator	10
Coolant Fan Control (FC)Control Module J293 to radiator	10
Drain plug to coolant regulator housing	25

Left auxiliary cooler, removing and installing

Special tools, testers and auxiliary items required

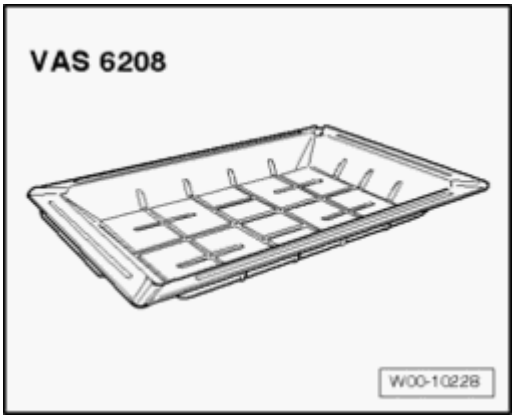


Fig. 714: Drip Tray For VAS 6100, VAS 6208
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Drip tray for workshop crane VAS 6208

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Removing

- Drain coolant --> **Cooling system, draining and filling**.
- Bring lock carrier into service position --> **Lock carrier, moving into service position**.

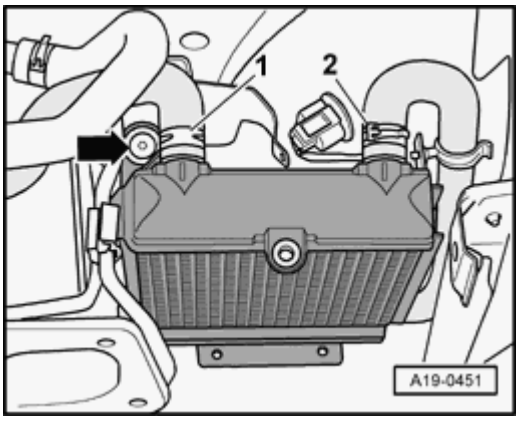


Fig. 715: Disconnecting Coolant Hoses & Removing Bolt
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect coolant hoses - **1** - and - **2** -.
- Remove bolt - **arrow** -.
- Remove left auxiliary cooler.

Installing

Installation is in reverse order of removal, note the following:

NOTE:

- **Secure all hose connections using hose clamps appropriate for the model type .**

- Install lock carrier with attachments -->
  - **50 BODY, FRONT**
  - **50 - BODY - FRONT** for BODY EXTERIOR - CABRIOLET

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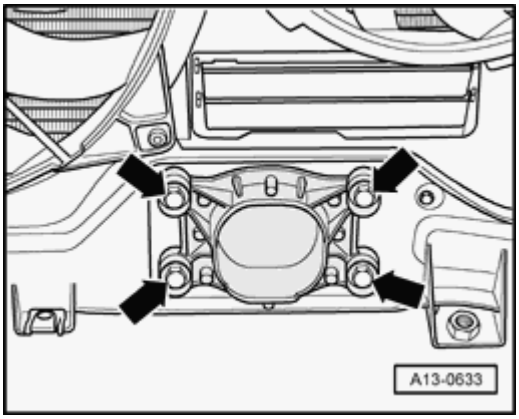


Fig. 716: Placing Torque Support On Rubber Buffer For Torque Support And Tightening Bolts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Place torque support on rubber buffer for torque support and tighten bolts - **arrows** -.
- Install front bumper cover -->
  - **63 BUMPER**
  - **63 - BUMPERS** for BODY EXTERIOR - CABRIOLET

  .
- Fill with coolant **Filling**.

NOTE:

- **Complete coolant must be replaced if the radiator was replaced.**

- Check headlight adjustment -->
  - **01 - MAINTENANCE**
  - **01 - MAINTENANCE** for MAINTENANCE PROCEDURES - CABRIOLET

  .

Torque specifications

Component	Nm
Left auxiliary cooler to bracket	10

Right auxiliary cooler, removing and installing

Special tools, testers and auxiliary items required

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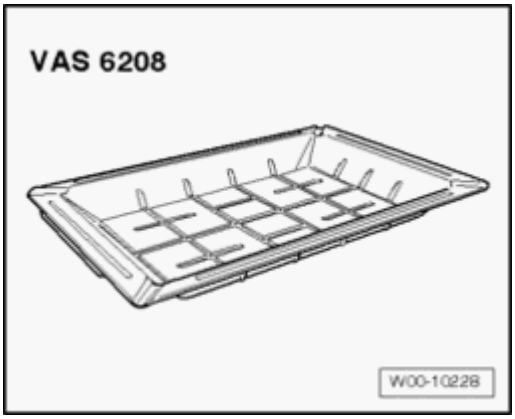


Fig. 717: Drip Tray For VAS 6100, VAS 6208
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Drip tray for workshop crane VAS 6208

Removing

- Drain the coolant --> **Cooling system, draining and filling**.
- Bring the lock carrier into service position --> **Lock carrier, moving into service position**.

CAUTION: Note rules of cleanliness for working on the fuel injection system --> Rules for cleanliness.

CAUTION: Fuel system is under pressure! Before opening system, place rags around connection area. Then release pressure by carefully loosening connection.

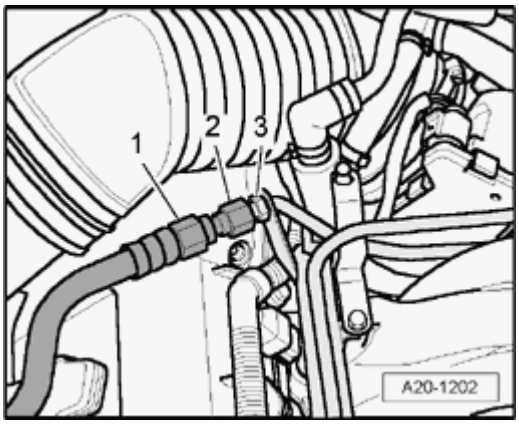


Fig. 718: Installing/Removing Fuel Hose To/From Connection On Fuel Rail Line
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove fuel hose from connection on fuel rail line. To do so, counter hold using an open-end wrench at hex head - **1** - and - **3** - and remove union nut - **2** -.

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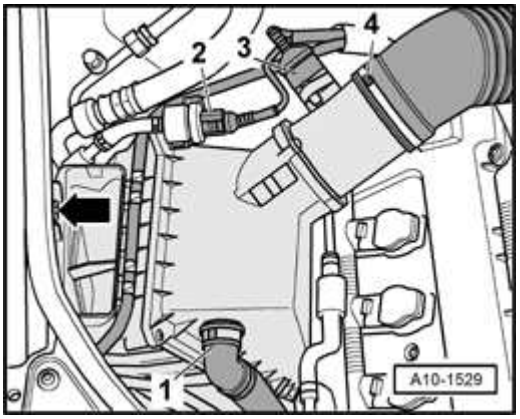


Fig. 719: Identifying Electrical Harness Connectors, Secondary Air Injection (AIR) Pump Hose, Air Guide Hose & Mass Air Flow (MAF) Sensor
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical harness connector - **2** - from Evaporative Emission (EVAP) Canister Purge Regulator Valve N80.
- Disconnect electrical harness connector - **3** - at Mass Air Flow (MAF) Sensor G70.
- Disconnect hose - **1** - to Secondary Air Injection (AIR) pump.
- Disconnect air guide hose - **4** - at Mass Air Flow (MAF) sensor.

- Move wiring harness clear at air filter housing.
- Remove clip and remove air filter housing with Mass Air Flow (MAF) sensor.

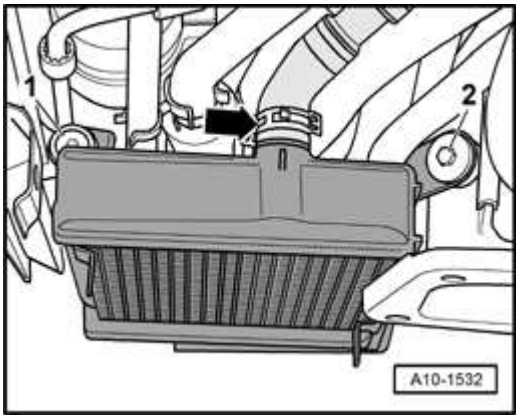


Fig. 720: Removing Bolts & Right Auxiliary Cooler Together With Coolant Hoses
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect upper hose on auxiliary cooler - **arrow** -.
- Remove bolts - **1** - and - **2** -.

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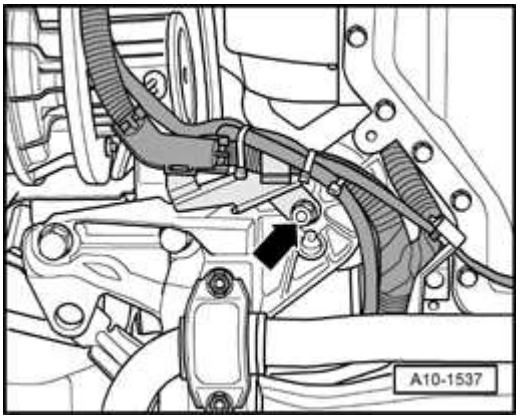


Fig. 721: Removing Wiring Harness Bracket At Right Engine Plate
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove wiring harness bracket at right engine plate - **arrows** -.

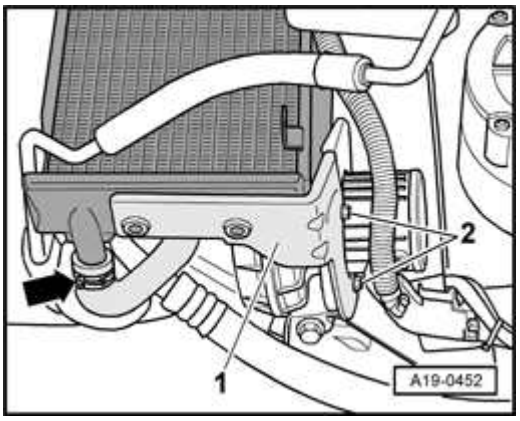


Fig. 722: Disconnecting Lower Coolant Hose On Auxiliary Cooler & Removing Nuts And Bracket
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect lower coolant hose on auxiliary cooler - **arrow** -.
- Remove nuts - **2** - and remove bracket - **1** -.
- Remove right auxiliary cooler.

Installing

Installation is in reverse order of removal, note the following:

NOTE:

- **Secure all hose connections using hose clamps appropriate for the model type .**

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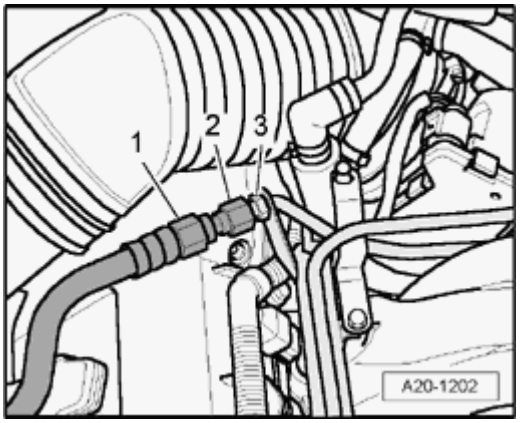


Fig. 723: Installing/Removing Fuel Hose To/From Connection On Fuel Rail Line
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Secure fuel hose to connection on fuel rail line. To do so, counter hold using an open-end wrench at each hex head - **1** - and - **3** - and tighten union nut - **2** - to 22 Nm.
- Install lock carrier with attachments -->
  - **50 BODY, FRONT**
  - **50 - BODY - FRONT** for BODY EXTERIOR - CABRIOLET

  .

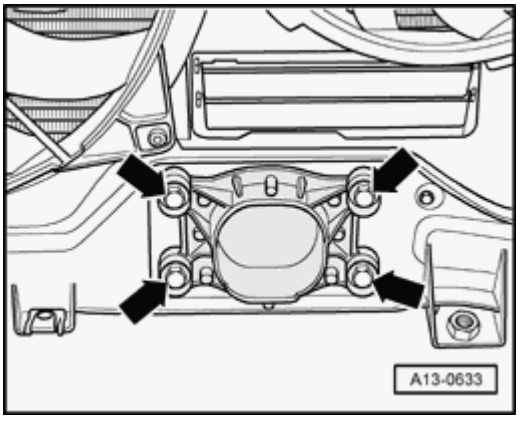


Fig. 724: Placing Torque Support On Rubber Buffer For Torque Support And Tightening Bolts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Place torque support on rubber buffer for torque support and tighten bolts - **arrows** -.
- Install front bumper cover -->
  - **63 BUMPER**
  - **63 - BUMPERS** for BODY EXTERIOR - CABRIOLET

  .
- Fill with coolant **Filling**.

NOTE:

- **Complete coolant must be replaced if the radiator was replaced.**

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- Check headlight adjustment -->
  - **01 - MAINTENANCE**
  - **01 - MAINTENANCE** for MAINTENANCE PROCEDURES - CABRIOLET

.

Torque specifications

Component		Nm
Bracket for auxiliary cooler to bracket for Secondary Air Injection (AIR) pump		10
Auxiliary cooler	Bracket	10
to	Long member	10 * See note
Fuel supply line to fuel rail		22

* Insert using locking compound; locking compound .

Cooling system, checking for leaks

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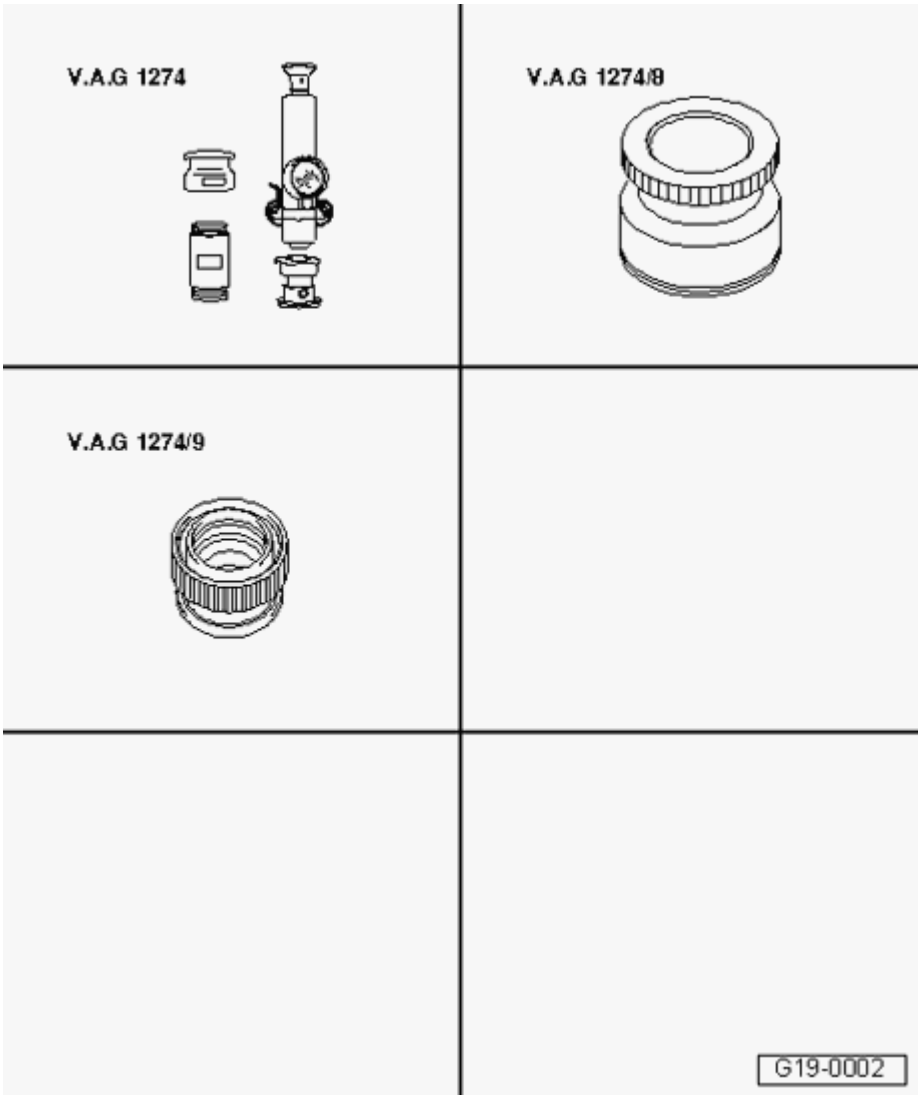


Fig. 725: Identifying Special Tools - Cooling System, Checking For Leaks
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools, testers and auxiliary items required

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

Test conditions

- Engine at operating temperature.

Test sequence

CAUTION: Cover cap of expansion tank with rag and open carefully, as hot steam i.e.

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hot coolant may escape when opening.

- Open cap of coolant expansion tank.

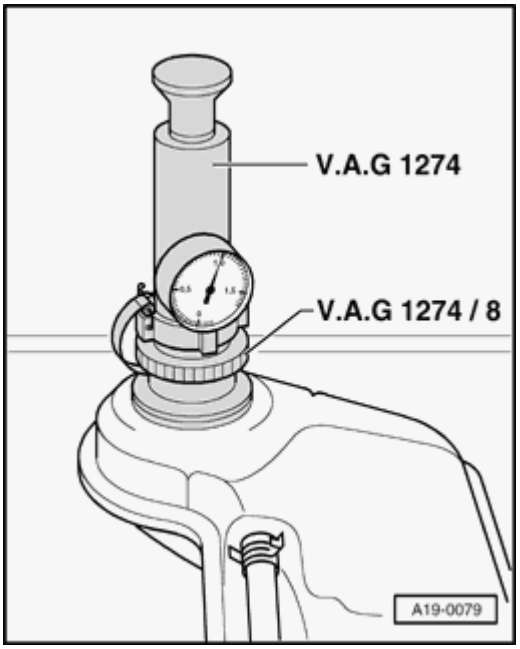


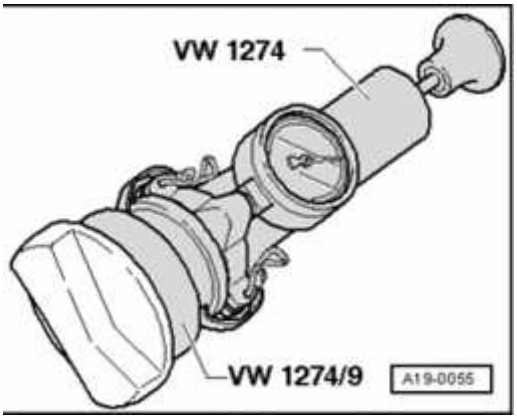
Fig. 726: Positioning Cooling System Tester V.A.G 1274 With Adapter V.A.G 1274/8 On Expansion Tank
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Position cooling system tester V.A.G 1274 with adapter V.A.G 1274/8 on expansion tank.
- Generate a positive pressure of approx. 1.0 bar using hand pump of cooling system tester.

If pressure drops:

- Search for leaking areas and repair malfunction.

Pressure relief valve in cap, checking



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Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Position cooling system tester V.A.G 1274 with adapter V.A.G 1274/9 on cap.
- Generate a positive pressure using hand pump of cooling system tester.

- Pressure release valve must open at a positive pressure of 1.4 to 1.6 bar.

If check-valve does not open as indicated:

- Replace cap.

Electric coolant fan, function

Cooling system is equipped with 2 electric coolant fans:

- Coolant Fan V7 at left in direction of travel with Coolant Fan Control (FC) Control Module J293
- Coolant Fan 2 V177 at right in direction of travel with Coolant Fan Control (FC) Control Module 2 J671

Both fans are activated continuously via respective Coolant Fan Control (FC) Control Module.

- Terminal 66 of Engine Control Module (ECM) is the control output to Coolant Fan Control (FC) Control Module J293.
- Terminal 104 of Engine Control Module (ECM) is the control output to Coolant Fan Control (FC) Control Module 2 J671.

Coolant fans are activated by reason of the following criteria:

- Fan request from A/C system: A fan request is transmitted by A/C control head via CAN-Bus to Engine Control Module (ECM), it is sent directly to the fans.
- Normal engine operation: During normal driving operation and engine running at idle, fans are regulated by coolant temperature and ambient temperature.

Electric coolant fan, checking

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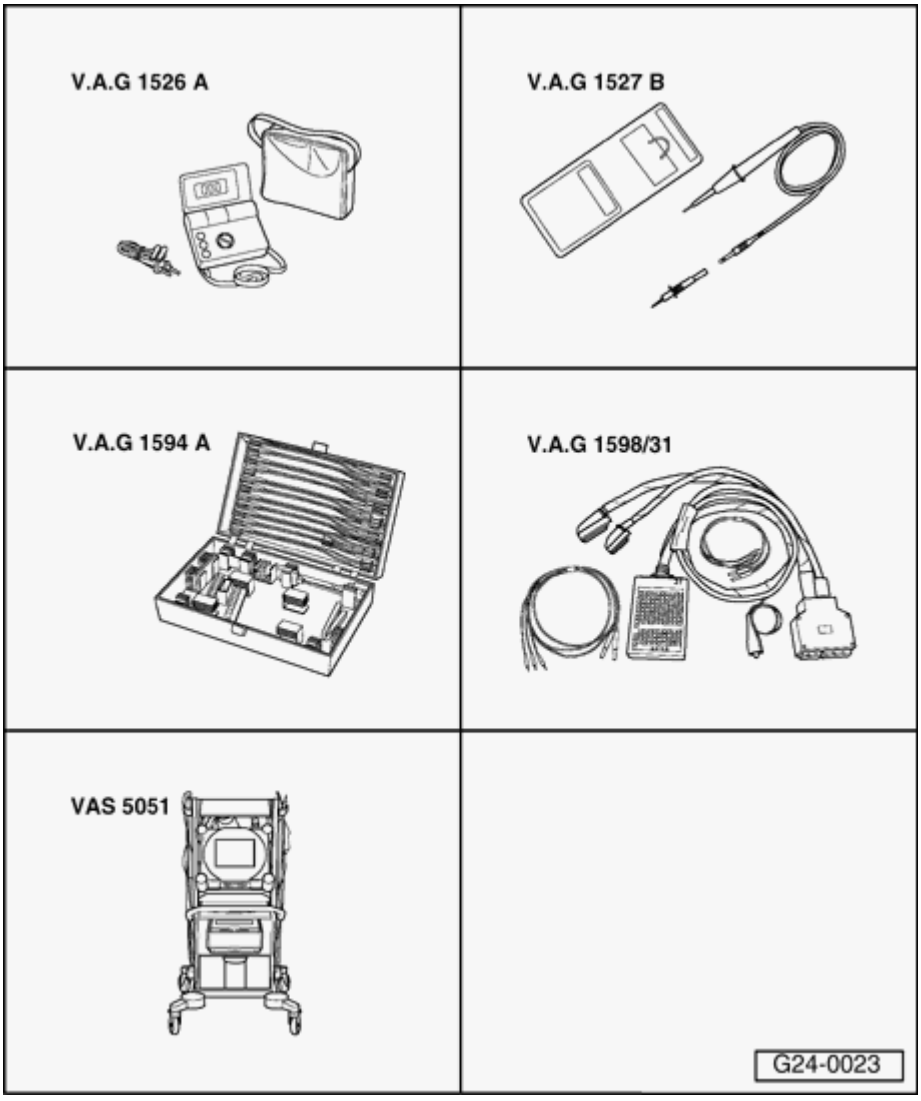


Fig. 728: Identifying Special Tools - Electric Coolant Fan, Checking
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools, testers and auxiliary items required

- Hand multimeter V.A.G 1526 B or V.A.G 1526 A
- Voltage tester V.A.G 1527 B
- Connector test kit V.A.G 1594 C or V.A.G 1594 A
- Test box V.A.G 1598/31
- Vehicle Diagnostic, Testing and Information System VAS 5051 with diagnostic cable VAS 5051/1

Work sequence

- Connect Vehicle Diagnostic, Testing and Information System VAS 5051 A and select vehicle system "01

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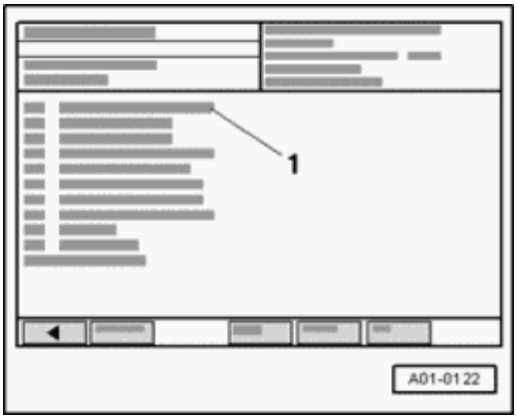


Fig. 729: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS 5051 :

- In selection - **1** - , click on the function "03 - output Diagnostic Test Mode (DTM)".
- Press --> button repeatedly, until "coolant fan activation 2" is activated.

- Coolant Fan Control (FC) Control Module 2 J671 switches on Coolant Fan 2 V177 (right) 1 time slowly to full speed.

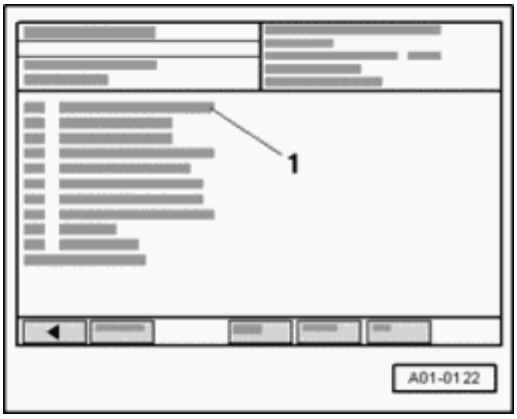
- Press --> button repeatedly, until "coolant fan activation 1" is activated.

- Coolant Fan Control (FC) Control Module J293 switches on Coolant Fan V7 (left) 1 time slowly to full speed.

- End function "03 - output Diagnostic Test Mode (DTM)" by pressing <-- button.

If fan activation does not react as described:

- Produce conditions for starting up coolant fan according to required input criteria (e.g. switch on A/C system, increase engine temperature correspondingly).



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Fig. 730: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS 5051 :

- In selection - **1** - , click on function "08 - Read measuring value block".



Fig. 731: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS 5051 :

1 - Enter display group

- Select function "135" in button field - **2** - for "display group 135" and press Q to confirm input.

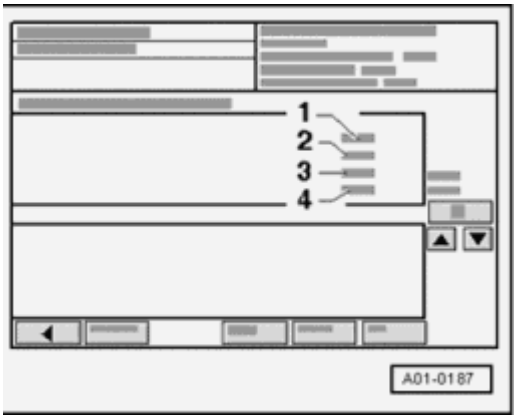


Fig. 732: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS 5051 :

- Check indication in display fields - **2** - and - **3** -.

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Display field	Indicated	Specified value
- 2 -	Duty cycle for fan 1 (left) in %	min. 10%
- 3 -	Duty cycle for fan 2 (right) in %	min. 10%

NOTE:

- **At fan request by A/C system and/or coolant temperature greater than 98 ° C, duty cycle must rise above 10% and fans must start up.**

- Press <-- button to end function "08 - Read measuring value block".

If duty cycle does not rise above 10%:

- Read out DTC memory of engine control module (ECM).
- Select "06 - End Output".
- Switch off ignition.
- Repair displayed malfunctions if necessary.

If respective fan does not start up even though duty cycle is above 10%:

- Check Coolant Fan V7 or Coolant Fan 2 V177.

Checking Coolant Fan V7 (left)

- Fuses for Coolant Fan V7 and Coolant Fan Control (FC) Control Module J293 OK --> Electrical Wiring Diagrams, Troubleshooting and Component Locations.

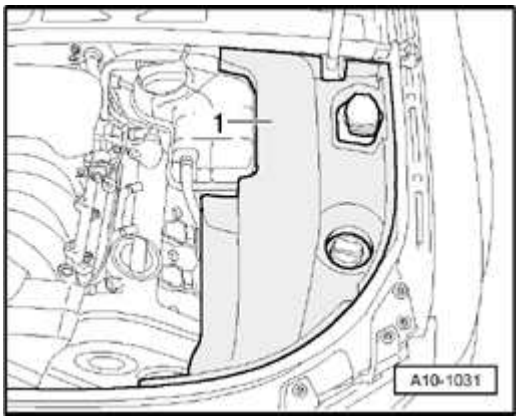


Fig. 733: Removing Cover In Engine Compartment (Left Side)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove cover - **1** - in engine compartment (left side).

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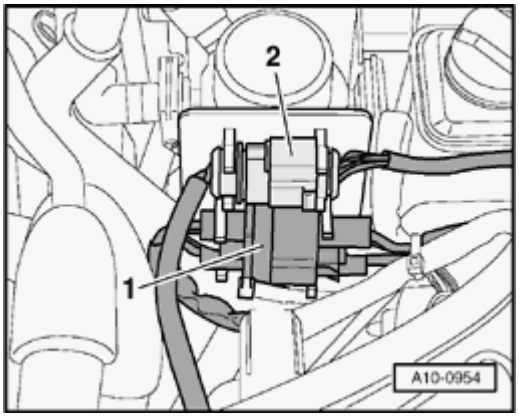


Fig. 734: Removing Electrical Harness Connectors And From Bracket
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove electrical harness connector - **1** - from bracket and disconnect it.

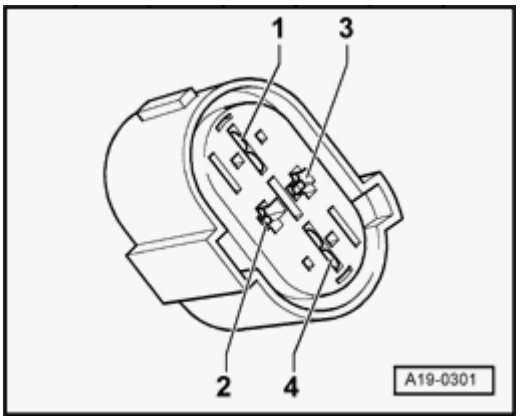


Fig. 735: Identifying 4-Pin Connector & Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect multimeter for voltage measurement as follows.

Harness connector Terminal	Measure to
- 1 -	Engine Ground (GND)
- 4 -	Battery positive (B+)

- Specification: approx. battery voltage respectively

If specifications are not obtained:

- Repair wire connection if necessary.

If specified values are achieved:

- Connect multimeter for voltage measurement as follows:

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Harness connector Terminal	Measure to
- 2 -	Engine Ground (GND)

- Specification: approx. battery voltage

If specification is not obtained:

- Repair wire connection if necessary.

If specified value is not achieved:

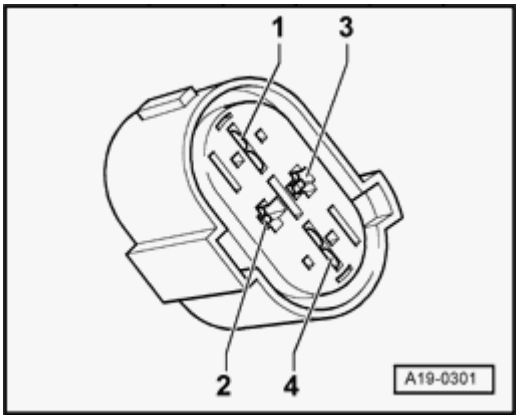


Fig. 736: Identifying 4-Pin Connector & Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect multimeter between terminal - **2** - and - **3** - of harness connector for voltage measurement.

- Vehicle Diagnostic, Testing and Information System VAS 5051 connected, "Vehicle Self-Diagnosis" and vehicle system "01 Engine electronics" selected. The ignition must be switched on.

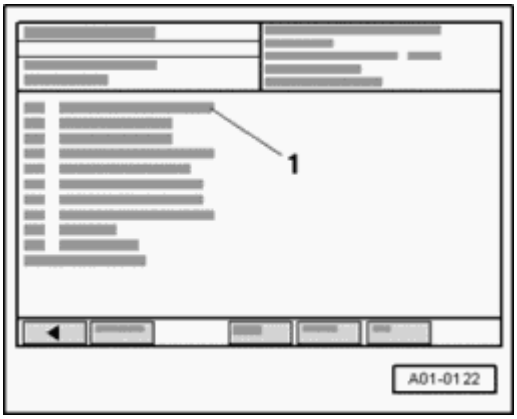


Fig. 737: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS 5051 :

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- In selection - **1** - , click on function "03 - output Diagnostic Test Mode (DTM)".
- Press --> key repeatedly, until "coolant fan activation 1" is activated.

- Voltage value must decrease slowly from approx. battery voltage to approx. 8 volts (and then increase again).

- End function "03 - output Diagnostic Test Mode (DTM)" by pressing <-- button.
- Select "06 - End Output".
- Switch off ignition.

If specification is not obtained:

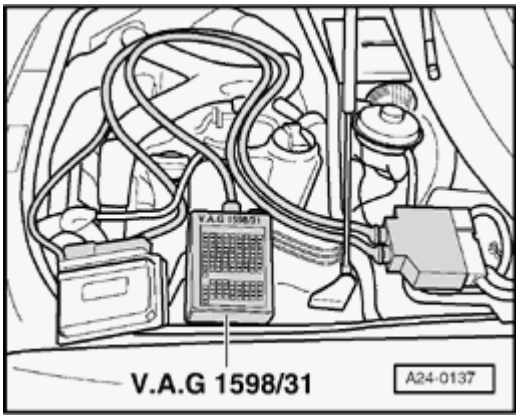
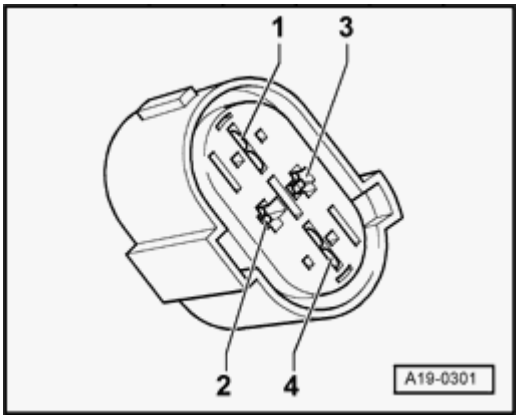


Fig. 738: Connecting Test Box VAG1598/31 To Engine Control Module Wiring Harness
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect test box V.A.G 1598/31 to wiring harness connectors, Engine Control Module (ECM) is not connected. Connect Ground (GND) clip at test box (not visible in illustration) to Ground (GND) --> **24 MULTIPORT FUEL INJECTION (MFI)** .

CAUTION: To avoid damaging electronic components, set measuring range before connecting test leads and observe all test requirements.



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Fig. 739: Identifying 4-Pin Connector & Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Check following wire connection for open circuit and short circuit to Ground (GND) and B+:

Harness connector Terminal	Test box V.A.G 1598/31 Socket
- 4 -	66

- Repair wire connection if necessary.

If no malfunctions are detected:

- Remove front bumper cover -->
  - **63 BUMPER**
  - **63 - BUMPERS** for BODY EXTERIOR - CABRIOLET

.

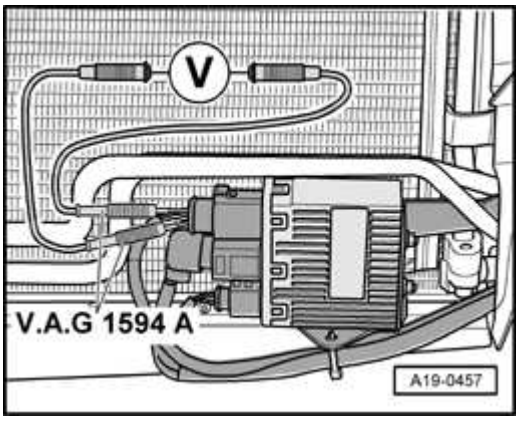


Fig. 740: Connecting Multimeter With Measuring Probes And Connector Adapters From Connector Test Kit V.A.G 1594 C (Harness Connector Remains Connected)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect multimeter with measuring probes and connector adapters from connector test kit V.A.G 1594 C between terminal - **1** - and terminal - **2** - of brown harness connector on Coolant Fan Control (FC) Control Module J293 ; harness connector remains connected.

- Vehicle Diagnostic, Testing and Information System VAS 5051 A connected, "Vehicle Self-Diagnosis" and vehicle system "01 Engine electronics" selected. The ignition must be switched on.

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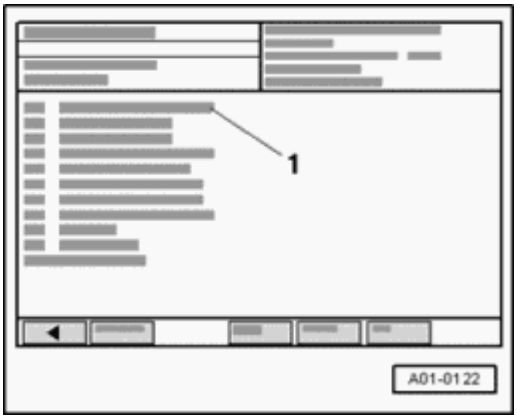


Fig. 741: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS 5051 :

- In selection - **1** - , click on function "03 - output Diagnostic Test Mode (DTM)".
- Press --> key repeatedly, until "coolant fan activation 1" is activated.

- Voltage value must increase up to approx. 10.5 volts (and then decrease again).

- End function "03 - output Diagnostic Test Mode (DTM)" by pressing <-- button.
- Select "06 - End Output".
- Switch off ignition.

If specified value is reached but fan does not run:

- Replace Coolant Fan V7 --> **Coolant Fan V7 (left), removing and installing**.

If specification is not obtained:

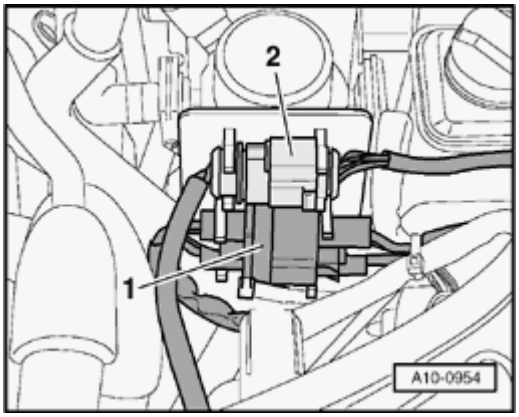


Fig. 742: Removing Electrical Harness Connectors And From Bracket
Courtesy of VOLKSWAGEN UNITED STATES, INC.

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- Check wire connections from harness connector at left front in engine compartment to Coolant Fan Control (FC) Control Module J293 according to wiring diagram.

If no malfunctions are detected:

- Replace Coolant Fan Control (FC) Control Module J293.

Checking Coolant Fan 2 V177 (right)

- Fuses for Coolant Fan 2 V177 and Coolant Fan Control (FC) Control Module 2 J671 OK --> Electrical Wiring Diagrams, Troubleshooting and Component Locations.

- Remove front bumper cover -->
  - **63 BUMPER**
  - **63 - BUMPERS** for BODY EXTERIOR - CABRIOLET

  .

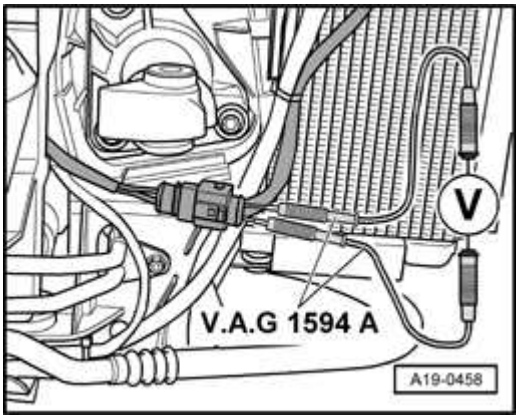


Fig. 743: Connecting Multimeter With Measuring Probes And Connector Adapters From Connector Test Kit V.A.G 1594 C (Harness Connector For Coolant Fan 2 V177 Remains Connected)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect multimeter with measuring probes and connector adapters from connector test kit V.A.G 1594 C between terminal - **1** - and terminal - **2** - ; harness connector for Coolant Fan 2 V177 remains connected.

- Vehicle Diagnostic, Testing and Information System VAS 5051 connected, "Vehicle Self-Diagnosis" and vehicle system "01 Engine electronics" selected. The ignition must be switched on.

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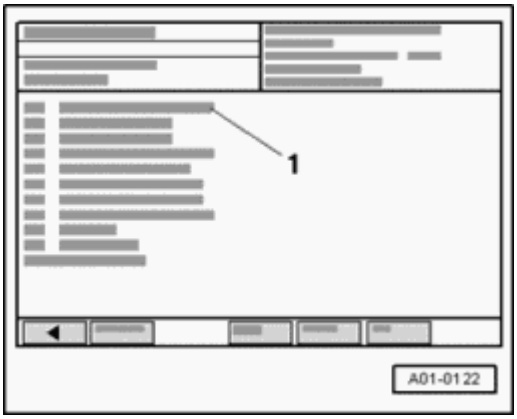


Fig. 744: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS 5051 :

- In selection - **1** - , click on function "03 - output Diagnostic Test Mode (DTM)".
- Press --> key repeatedly, until "coolant fan activation 2" is activated.

- Voltage value must increase up to approx. 9 volts

- End function "03 - output Diagnostic Test Mode (DTM)" by pressing <-- button.
- Select "06 - End Output".
- Switch off ignition.

If specified value is reached but fan does not run:

- Replace Coolant Fan 2 V177 --> **Coolant Fan 2 V177 (right), removing and installing**.

If specification is not obtained:

- Bring lock carrier into service position --> **Lock carrier, moving into service position**.

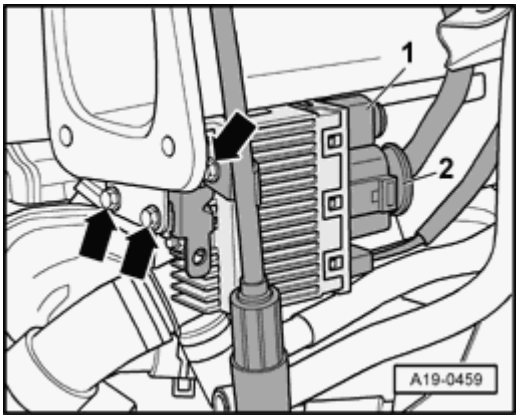


Fig. 745: Removing Coolant Fan Control (FC) Control Module 2 J671 On Left Front Longmember

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Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove Coolant Fan Control (FC) Control Module 2 J671 on left front longmember - **arrows** -.
- Disconnect electrical harness connector - **2** - on Coolant Fan Control (FC) Control Module 2 J671.

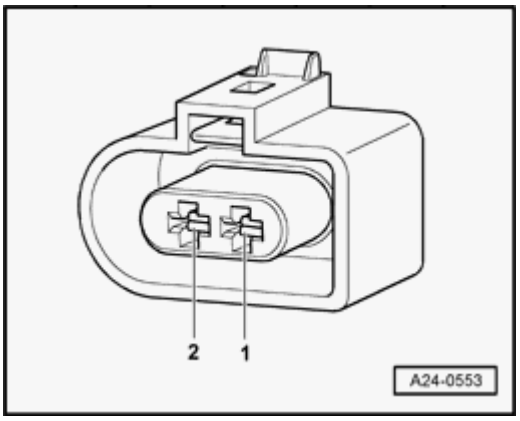


Fig. 746: Identifying Harness Connector Terminal
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect multimeter for voltage measurement as follows.

Harness connector Terminal	Measure to
- 1 -	Battery positive (B+)
- 2 -	Engine Ground (GND)

- Specification: approx. battery voltage respectively

If specifications are not obtained:

- Repair wire connection if necessary.

If specified values are achieved:

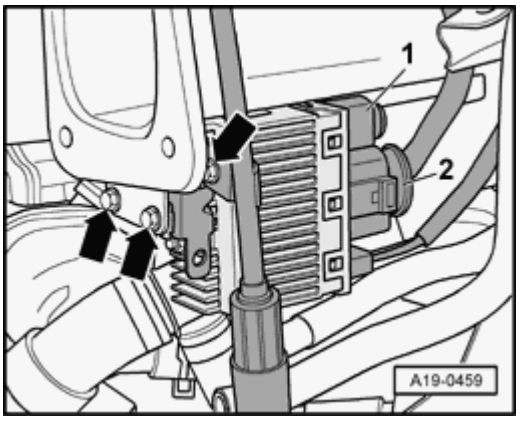


Fig. 747: Disconnecting Electrical Harness Connector On Coolant Fan Control (FC) Control Module 2

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J671
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical harness connector - **1** - on Coolant Fan Control (FC) Control Module 2 J671.

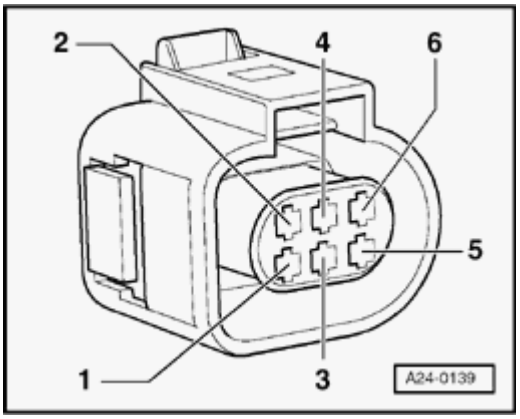


Fig. 748: Identifying 6-Pin Electrical Harness Connector & Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect multimeter between terminal - **1** - and - **2** - of harness connector for voltage measurement.

- Vehicle Diagnostic, Testing and Information System VAS 5051 A connected, "Vehicle Self-Diagnosis" and vehicle system "01 Engine electronics" selected. The ignition must be switched on.

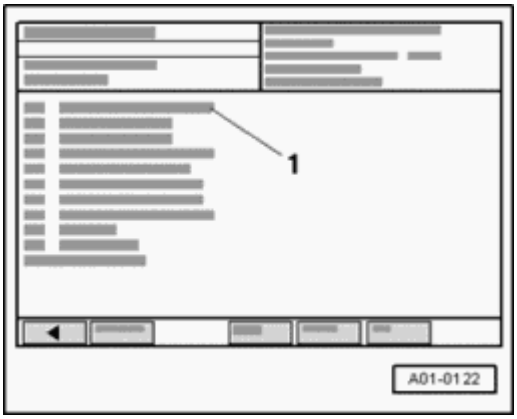


Fig. 749: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS 5051 :

- In selection - **1** - , click on function "03 - output Diagnostic Test Mode (DTM)".
- Press --> button repeatedly, until "coolant fan activation 2" is activated.

- Voltage value must decrease slowly from approx. battery voltage to approx. 8 volts (and then increase again)

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- End function "03 - output Diagnostic Test Mode (DTM)" by pressing <-- button.
- Select "06 - End Output".
- Switch off ignition.

If specification is not obtained:

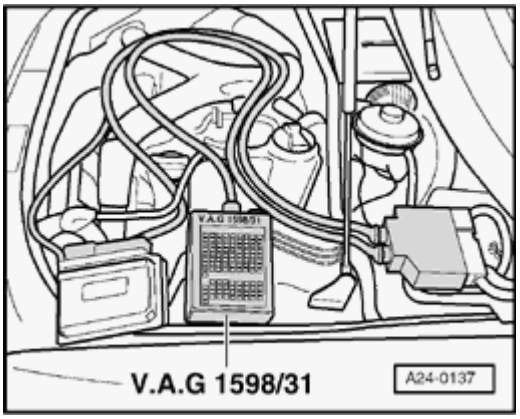


Fig. 750: Connecting Test Box VAG1598/31 To Engine Control Module Wiring Harness
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect test box V.A.G 1598/31 to wiring harness connectors, Engine Control Module (ECM) is not connected. Connect Ground (GND) clip at test box to Ground (GND) (not visible in illustration) --> **24 MULTIPORT FUEL INJECTION (MFI)** .

CAUTION: To avoid damaging electronic components, set measuring range before connecting test leads and observe all test requirements.

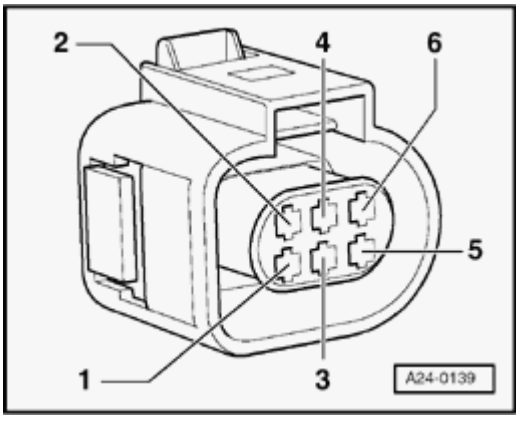


Fig. 751: Identifying 6-Pin Electrical Harness Connector & Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Check the following wire connection for open circuit and short circuit to Ground (GND) and B+:

Harness connector Terminal	Test box V.A.G 1598/31 Socket

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- Repair wire connection if necessary.

If no malfunctions are detected:

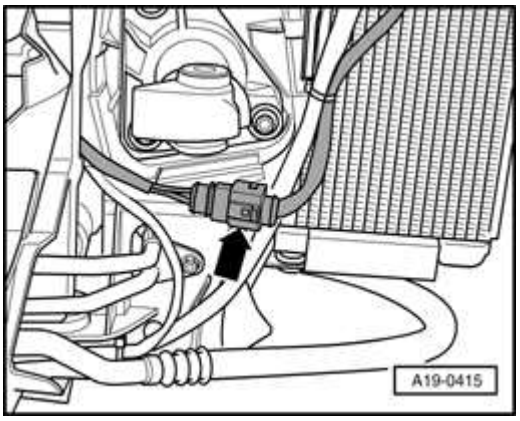


Fig. 752: Disconnecting Electrical Harness Connector For Right Fan
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Check wire connection from Coolant Fan Control (FC) Control Module 2 J671 to harness connector on longmember - **arrow** -.

If no malfunctions are detected in wiring:

- Replace Coolant Fan Control (FC) Control Module 2 J671.

Coolant Fan V7 (left), removing and installing

Removing

NOTE:

- **All cable ties opened or cut during engine removal must be reinstalled at the same locations during installation.**

- Bring lock carrier into service position --> **Lock carrier, moving into service position**.

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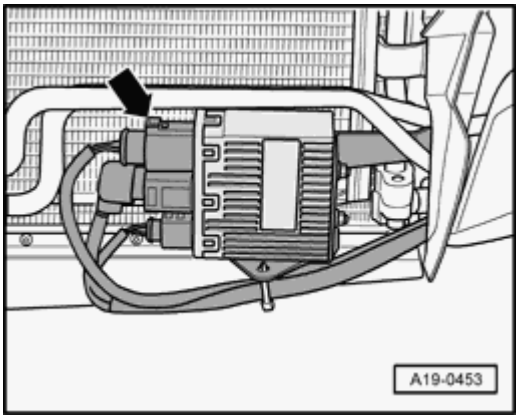


Fig. 753: Disconnecting Electrical Connector On Fuel Pump (FP) Control Module J293
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical connector - **arrow** - on Fuel Pump (FP) Control Module J293.
- Move wiring harness to coolant fan clear.

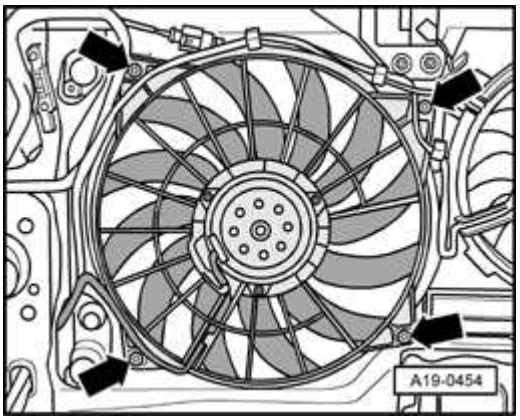


Fig. 754: Removing Bolts And Fan
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts - **arrows** - and remove fan.

Installing

Installation is in reverse order of removal, note the following:

NOTE:

- **During installation, all cable ties must be re-installed at the same location.**

- Install lock carrier with attachments -->
  - **50 BODY, FRONT**
  - **50 - BODY - FRONT** for BODY EXTERIOR - CABRIOLET

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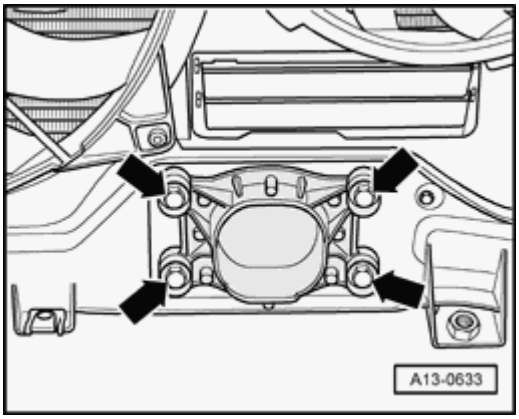


Fig. 755: Placing Torque Support On Rubber Buffer For Torque Support And Tightening Bolts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Place torque support on rubber buffer for torque support and tighten bolts - **arrows** -.
- Install front bumper cover -->
  - **63 BUMPER**
  - **63 - BUMPERS** for BODY EXTERIOR - CABRIOLET

  .
- Check headlight adjustment -->
  - **01 - MAINTENANCE**
  - **01 - MAINTENANCE** for MAINTENANCE PROCEDURES - CABRIOLET

  .

Torque specifications

Component	Nm
Coolant fan to lock carrier	10
Torque support stop to lock carrier	28

Coolant Fan 2 V177 (right), removing and installing

Removing

NOTE:

- **All cable ties opened or cut during engine removal must be reinstalled at the same locations during installation.**

- Bring lock carrier into service position --> **Lock carrier, moving into service position**.

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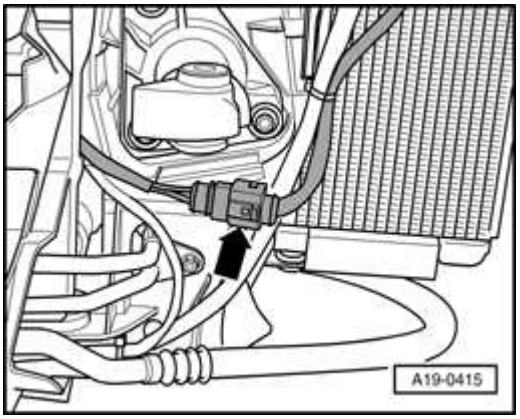


Fig. 756: Disconnecting Electrical Harness Connector For Right Fan
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical harness connector - **arrow** -.
- Move wiring harness to coolant fan clear.

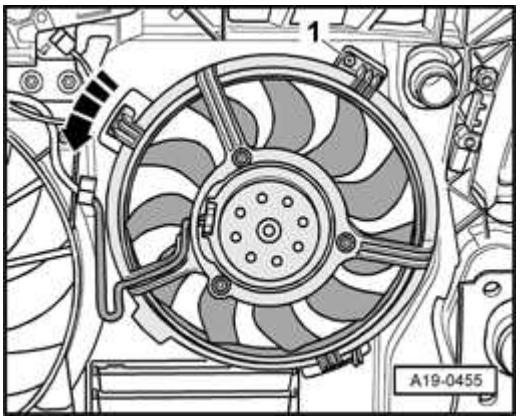


Fig. 757: Removing Coolant Fan
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts - **1** -.
- Turn coolant fan in direction of - **arrow** - and remove it.

Installing

Installation is in reverse order of removal, note the following:

NOTE:

- **During installation, all cable ties must be re-installed at the same location.**

- Install lock carrier with attachments -->
  - **50 BODY, FRONT**
  - **50 - BODY - FRONT** for BODY EXTERIOR - CABRIOLET

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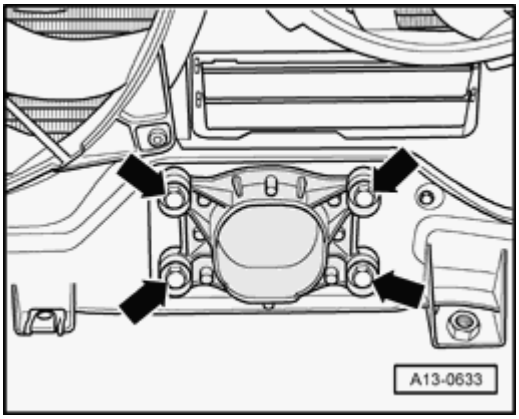


Fig. 758: Placing Torque Support On Rubber Buffer For Torque Support And Tightening Bolts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Place torque support on rubber buffer for torque support and tighten bolts - **arrows** -.
- Install front bumper cover -->
  - **63 BUMPER**
  - **63 - BUMPERS** for BODY EXTERIOR - CABRIOLET

  .
- Check headlight adjustment -->
  - **01 - MAINTENANCE**
  - **01 - MAINTENANCE** for MAINTENANCE PROCEDURES - CABRIOLET

  .

Torque specifications

Component	Nm
Coolant fan to lock carrier	10
Torque support stop to lock carrier	28

26 - EXHAUST SYSTEM, EMISSION CONTROLS

EXHAUST SYSTEM COMPONENTS, REMOVING AND INSTALLING

Exhaust system components, removing and installing

NOTE:

- **Replace gaskets and self-locking nuts.**
- **During installation, protective heat boots must be re-installed at the same location.**
- **All cable ties opened or cut during engine removal must be reinstalled at the same locations during installation.**
- **After exhaust system repairs, make sure exhaust system is not under**

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stress and is far enough from the body. If necessary, loosen double clamps and align mufflers and exhaust pipes so that there is adequate distance to vehicle body, and weight is evenly distributed among the exhaust hangers.

- **Flex joint in front exhaust pipe must not be bent more than 10 ° , otherwise it may be damaged.**

Exhaust system, component overview

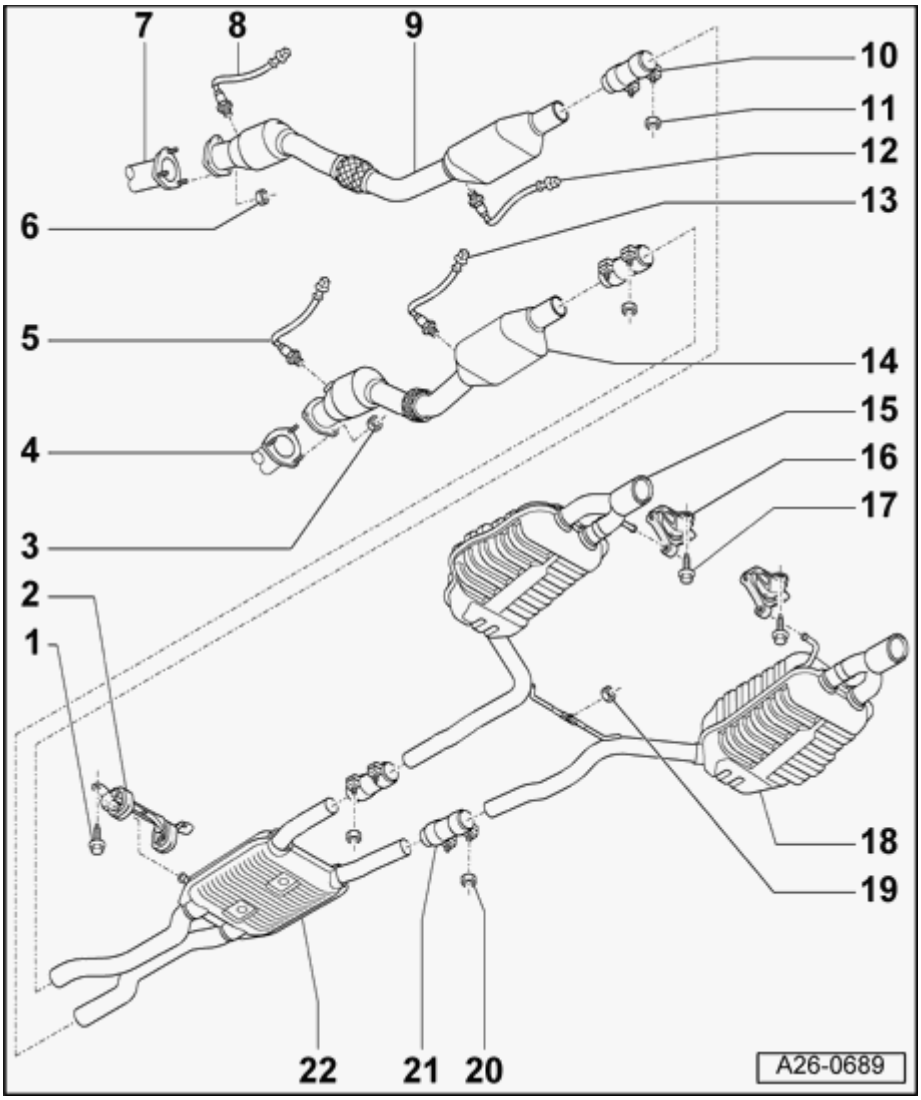


Fig. 759: Exhaust System, Component Overview
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - 23 Nm

2 - Suspended mount

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- Replace if damaged

3 - 27 Nm

- Replace
- Tighten uniformly in several stages

4 - Exhaust manifold

- For cylinder bank 1 (right)
- Removing and installing --> **Right exhaust manifold, removing and installing**

5 - Heated Oxygen Sensor (HO2S) G39 (before catalytic converter)

- For cylinder bank 1 (right)
- The threads of new oxygen sensors are coated with assembly paste; the paste must not get into slots of oxygen sensor body
- When re-using the previous oxygen sensor, grease threads with hot bolt paste; the paste must not get into slots of oxygen sensor body. Hot bolt paste
- Removing and installing --> **24 MULTIPORT FUEL INJECTION (MFI)**

6 - 27 Nm

- Replace
- Tighten uniformly in several stages

7 - Exhaust manifold

- Cylinder bank 2 (left)
- Removing and installing --> **Left exhaust manifold, removing and installing**

8 - Heated Oxygen Sensor (HO2S) 2 G108 (in front of catalytic converter)

- For cylinder bank 2 (left)
- The threads of new oxygen sensors are coated with assembly paste; the paste must not get into slots of oxygen sensor body
- When re-using the previous oxygen sensor, grease threads with hot bolt paste; the paste must not get into slots of oxygen sensor body. Hot bolt paste
- Removing and installing --> **24 MULTIPORT FUEL INJECTION (MFI)**

9 - Front exhaust pipe with pre- and main catalytic converters

- For left side of vehicle

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- Decoupling element must not be bent more than 10 ° otherwise it may be damaged
- Protect from hit- and impact stress

- Removing and installing: Vehicles with manual transmission --> **Left front exhaust pipe with primary and main catalytic converter (vehicles with manual transmission), removing and installing** , vehicles with automatic transmission --> **Left front exhaust pipe with primary and main catalytic converter (vehicles with automatic transmission), removing and installing**
- Individual mounting components for vehicles with manual transmission **Individual left mounting components - vehicles with manual transmission**
- Individual mounting components for vehicles with automatic transmission **Individual left mounting components - vehicles with automatic transmission**
- Install exhaust system free of stress --> **Exhaust system, installing free of tension**

10 - Front clamping sleeve

- Installed location **Installed position of front double clamps**
- Before tightening, ensure exhaust system is tension-free --> **Exhaust system, installing free of tension**
- Tighten bolts evenly

11 - 40 Nm

12 - Oxygen Sensor (O2S) Behind Three Way Catalytic Converter (TWC) G131

- For cylinder bank 2 (left)
- The threads of new oxygen sensors are coated with assembly paste; the paste must not get into slots of oxygen sensor body
- When re-using previous oxygen sensor, grease threads with hot bolt paste; the paste must not get into slots of oxygen sensor body. Hot bolt paste
- Removing and installing --> **24 MULTIPORT FUEL INJECTION (MFI)**

13 - Oxygen Sensor (O2S) Behind Three Way Catalytic Converter (TWC) G130

- For cylinder bank 1 (right)
- The threads of new oxygen sensors are coated with assembly paste; paste must not get into slots of oxygen sensor body
- When re-using previous oxygen sensor, grease threads with hot bolt paste; the paste must not get into slots of oxygen sensor body. Hot bolt paste
- Removing and installing --> **24 MULTIPORT FUEL INJECTION (MFI)**

14 - Front exhaust pipe with pre- and main catalytic converters

- For right side of vehicle
- With flex joint

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- Decoupling element must not be bent more than 10 ° otherwise it may be damaged
- Protect from hit and impact stress

- Removing and installing: Vehicles with manual transmission --> **Right front exhaust pipe with primary and main catalytic converter (vehicles with manual transmission), removing and installing** , vehicles with automatic transmission --> **Right front exhaust pipe with primary and main catalytic converter (vehicles with automatic transmission), removing and installing**
- Individual components of suspension **Individual components of suspension, right side**
- Install exhaust system free of stress --> **Exhaust system, installing free of tension**

15 - Rear muffler

- For left side of vehicle
- Original equipment as one unit with center muffler. For repairs, replace each separately.
- Separating point *Separate exhaust pipes at separating point* under **Center muffler and rear muffler, separating**
- With exhaust flap - checking exhaust flap --> **Exhaust flap, checking**

- Install exhaust system free of stress --> **Exhaust system, installing free of tension**

16 - Suspended mount

- Replace if damaged

17 - 23 Nm

18 - Rear muffler

- For right side of vehicle
- Original equipment as one unit with center muffler. For repairs, replace each separately.
- Separating point *Separate exhaust pipes at separating point* under **Center muffler and rear muffler, separating**
- With exhaust flap - checking exhaust flap --> **Exhaust flap, checking**

- Install exhaust system free of stress --> **Exhaust system, installing free of tension**

19 - 25 Nm

20 - 40 Nm

21 - Rear clamping sleeve

- For individual replacement of center and rear mufflers
- Installed location **Installed position of rear double clamps**

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- Before tightening, ensure exhaust system is tension-free --> **Exhaust system, installing free of tension**
- Tighten bolts evenly

22 - Center muffler

- Original equipment as one unit with rear muffler. For repairs, replace each separately.

Installed position of front double clamps

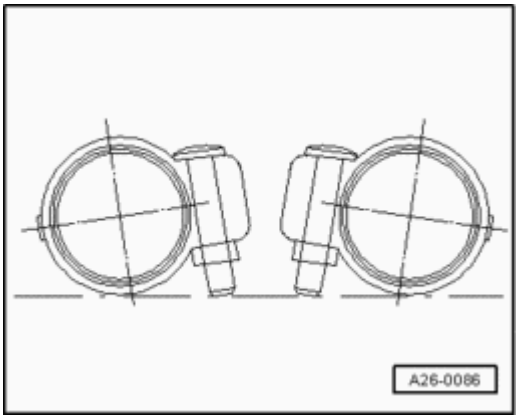


Fig. 760: Installed Position Of Front Double Clamps
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Install double clamps so that the bolt ends do not project over lower edge of double clamp.

- Threaded connections face each other.

Installed position of rear double clamps

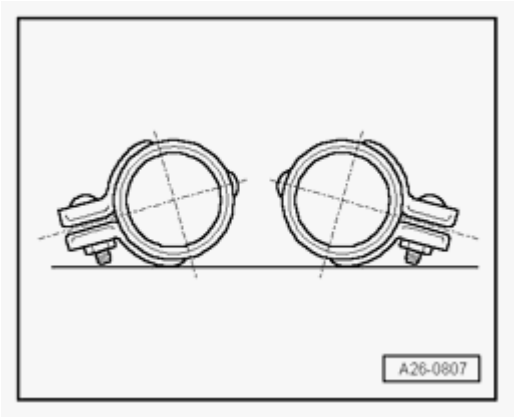


Fig. 761: Installing Double Clamps So That Bolt Ends Do Not Project Over Lower Edge Of Double Clamp
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Install double clamps so that the bolt ends do not project over lower edge of double clamp.

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- Threaded connections point toward outside.

Individual left mounting components - vehicles with manual transmission

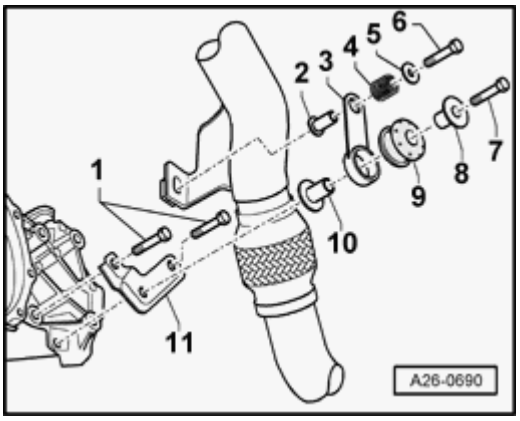


Fig. 762: Individual Left Mounting Components - Vehicles With Manual Transmission
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1. Bolt -25 Nm
2. Spacing sleeve
3. Tab
4. Spring
5. Washer
6. Bolt -25 Nm
7. Bolt -25 Nm
8. Spacing sleeve
9. Buffer
10. Spacing sleeve
11. Bracket
12. Washer

Individual left mounting components - vehicles with automatic transmission

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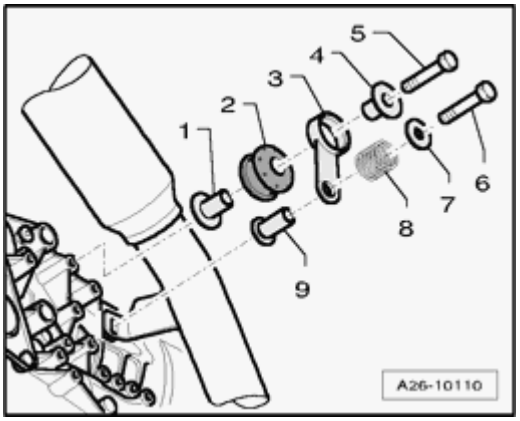


Fig. 763: Individual Left Mounting Components - Vehicles With Automatic Transmission
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1. Spacing sleeve
2. Buffer
3. Tab
4. Spacing sleeve
5. Bolt -25 Nm
6. Bolt -25 Nm
7. Washer
8. Spring
9. Spacing sleeve

Individual components of suspension, right side

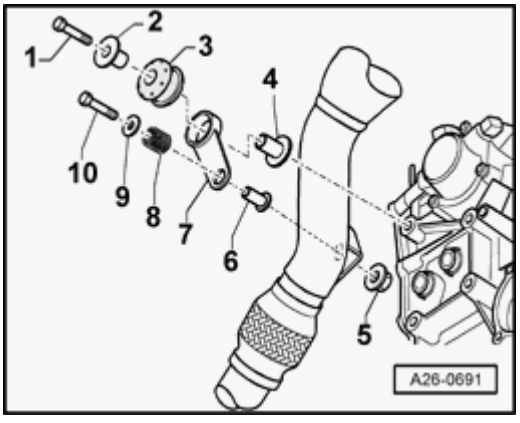


Fig. 764: Individual Components Of Suspension, Right Side
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1. Bolt -25 Nm
2. Spacing sleeve
3. Buffer

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4. Spacing sleeve
5. Nut, self-locking - 25 Nm
6. Spacing sleeve
7. Tab
8. Spring
9. Washer
10. Bolt -25 Nm

Center muffler and rear muffler, separating

- A separating point has been provided in the connecting pipe for individual replacement of the center or rear muffler
- The separating point is marked by depressions around circumference of exhaust pipe.

Special tools, testers and auxiliary items required

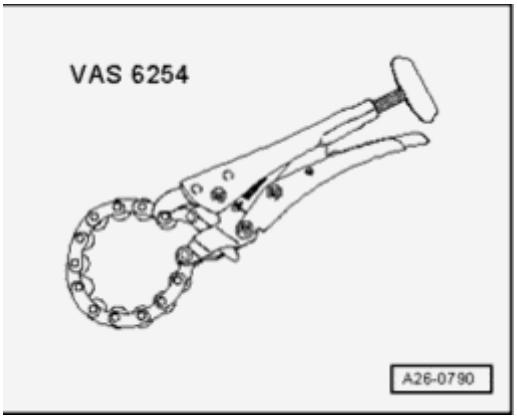


Fig. 765: Chain Pipe Cutter VAS 6254
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Chain pipe cutter VAS 6254

Work procedure

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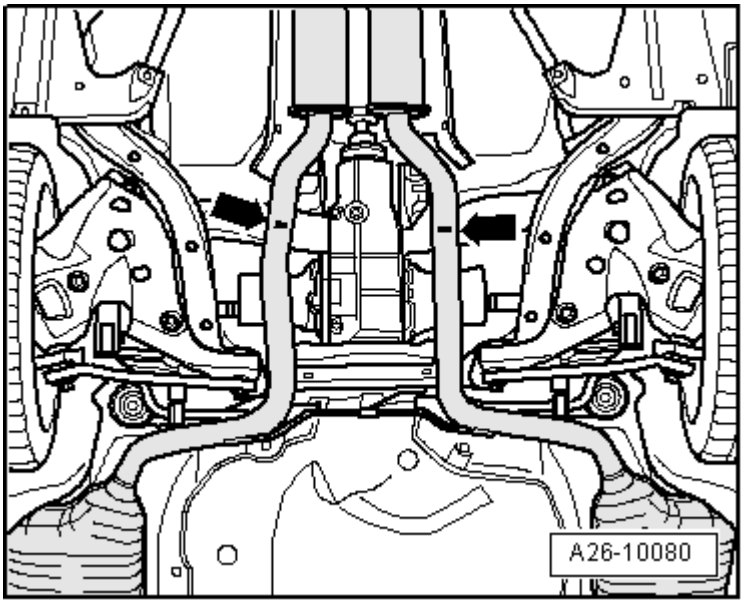


Fig. 766: Separating Exhaust Pipes At Separating Point Using Chain Pipe Cutter VAS 6254 At Right Angle
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Separate exhaust pipes at separating point - **arrows** - using chain pipe cutter VAS 6254 at a right angle.

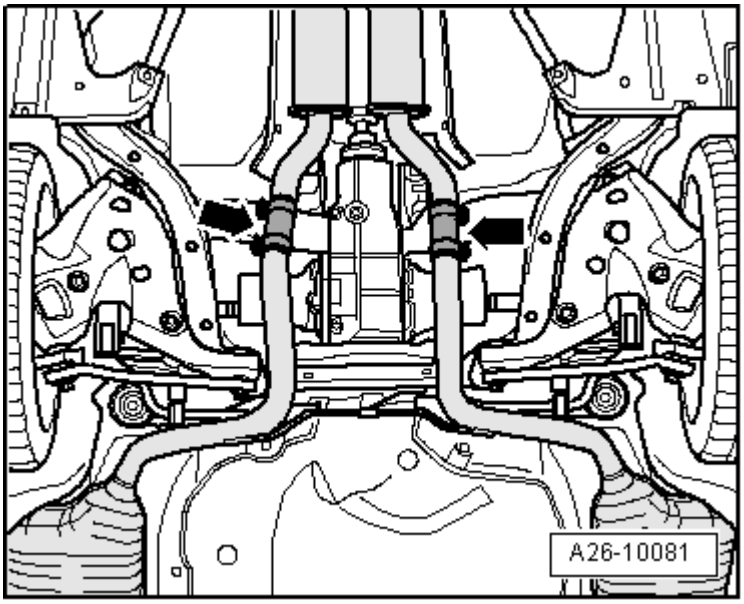


Fig. 767: Positioning Clamping Sleeves At Center Of Separating Cut
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Position clamping sleeves - **arrows** - at center of separating cut.

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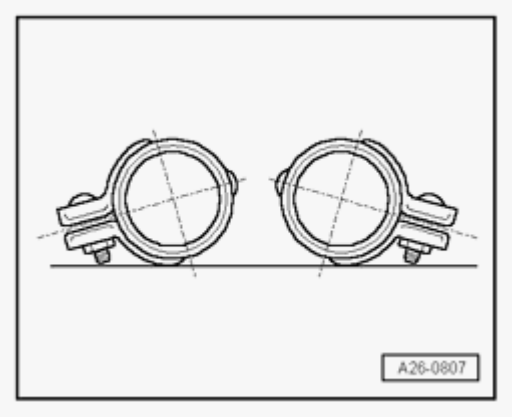


Fig. 768: Installing Double Clamps So That Bolt Ends Do Not Project Over Lower Edge Of Double Clamp
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- When installing the double clamps, ensure that the bolt ends do not project beyond lower edge of the double clamp.
- Threaded connections point toward outside.
- Align exhaust system free of tension --> **Exhaust system, installing free of tension**.

Left front exhaust pipe with primary and main catalytic converter (vehicles with manual transmission), removing and installing

Special tools, testers and auxiliary items required

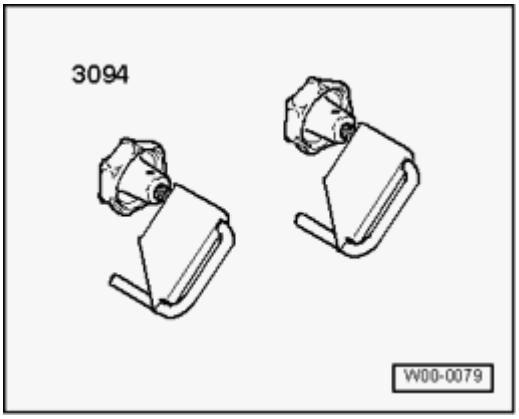


Fig. 769: Identifying Hose Clamps 3094
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Hose clamps up to 25 mm diameter 3094

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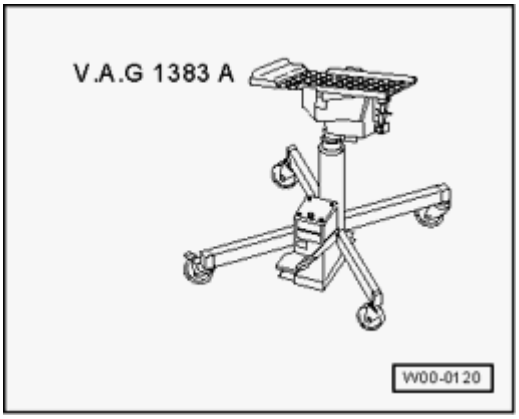


Fig. 770: Identifying Engine/Transmission Jack V.A.G. 1383 A
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Engine/transmission jack V.A.G 1383 A

Removing

NOTE:

- **All cable ties opened or cut during engine removal must be reinstalled at the same locations during installation.**

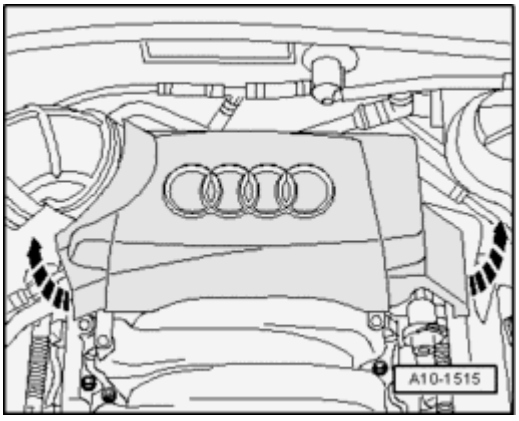


Fig. 771: Removing Rear Engine Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove rear engine cover - **arrows** -.

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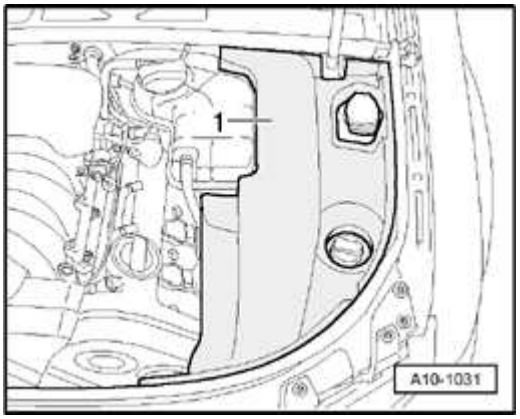


Fig. 772: Removing Cover In Engine Compartment (Left Side)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove cover - **1** - in engine compartment (left side).

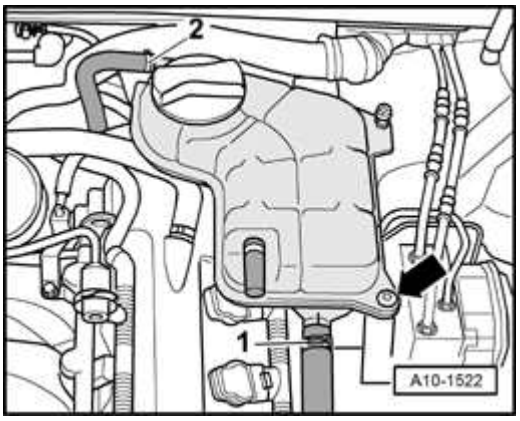


Fig. 773: Removing Coolant Hoses & Coolant Expansion Tank
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Clamp off coolant hose - **2** - using Hose clamps up to 25 mm diameter 3094 and disconnect from coolant expansion tank.
- Seal connection using a plug that fits.
- Remove coolant expansion tank - **arrow** -.
- Disconnect electrical wire to Engine Coolant Level (ECL) Warning Switch F66 at bottom on expansion tank and set aside coolant expansion tank with coolant hose - **1** - connected.

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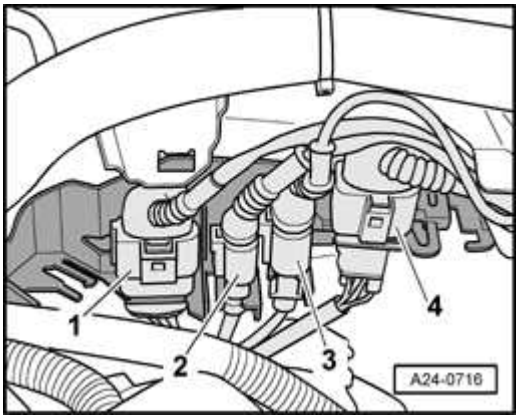


Fig. 774: Removing Bracket For Electrical Harness Connectors At Left From Bulkhead
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove electrical harness connectors - **1 to 4** - from bracket at left of bulkhead.
- Disconnect electrical harness connectors - **1** - and - **4** -.
- Remove bracket from bulkhead.
- Remove heat insulation sleeve on wiring harness and lay open wiring harness.

- Free up oxygen sensor wires downward.
- Remove left front wheel.

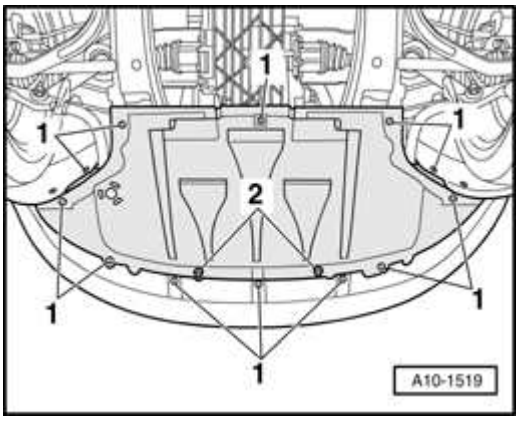


Fig. 775: Removing Quick-Release Fasteners, Screws And Noise Insulation
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove quick-release fasteners - **1** - , remove screws - **2** - and remove noise insulation.

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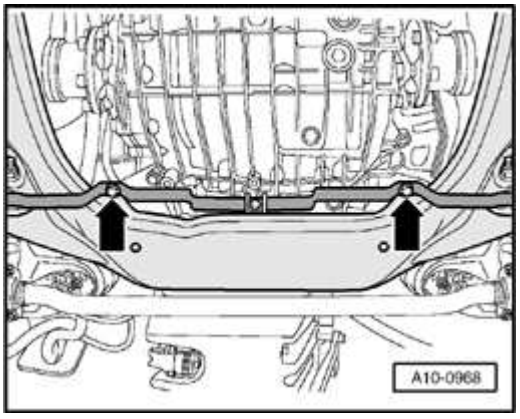


Fig. 776: Removing Bracket For Noise Insulation
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bracket for noise insulation - **arrows** -.

NOTE:

- **Flex joint in front exhaust pipe must not be bent more than 10 ° , otherwise it may be damaged.**

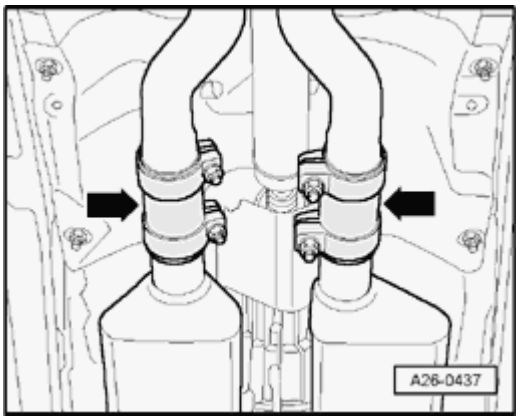


Fig. 777: Disconnecting Exhaust System At Double Clamps
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect exhaust system at left double clamp - **left arrow** -.

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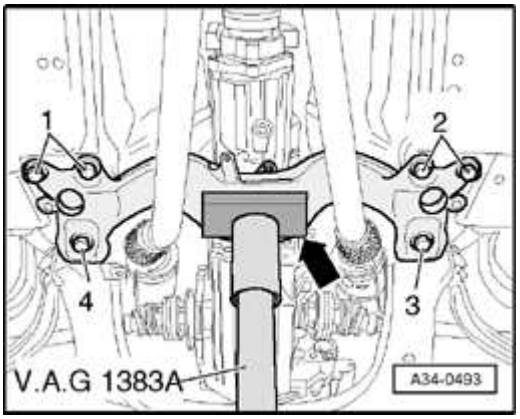


Fig. 778: Supporting Tunnel Cross Member Using VAG1383A Engine/Transmission Lift And A Piece Of Wood
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Place Engine/transmission jack V.A.G 1383 A plunger with a block of wood inserted in between - **arrow** - beneath rear cross member.
- First remove bolts - **1** - and - **2** - , then bolts - **3** - and - **4** -.

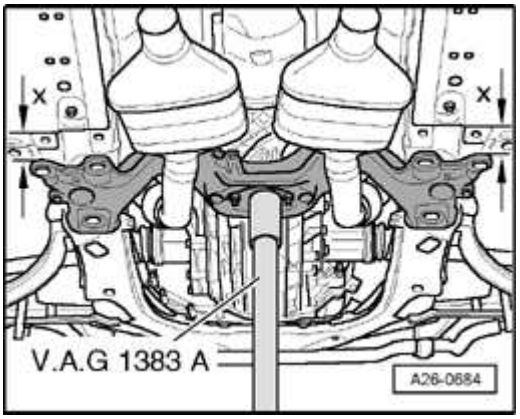


Fig. 779: Identifying Distance Between Cross Member And Body Reaches Dimension
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Slowly lower rear cross member using engine/transmission jack V.A.G 1383 A until distance between rear cross member/chassis acquires dimension - **x** -.

- Dimension - **x** - = 60 mm.

NOTE:

- **Transmission must not be lowered further because otherwise driveshaft joint and decoupling element in front exhaust pipe may be damaged.**

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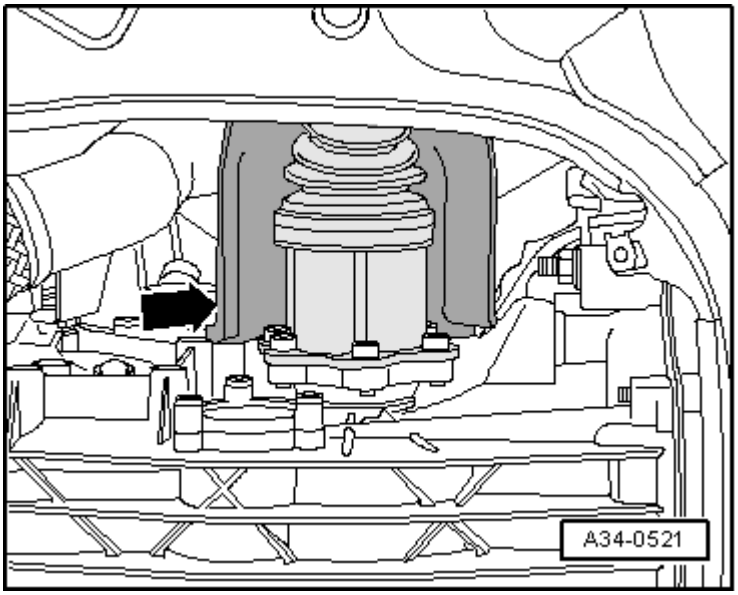


Fig. 780: Drive Axle Heat Shield
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove heat shield for left and right drive axles - **arrow** -.

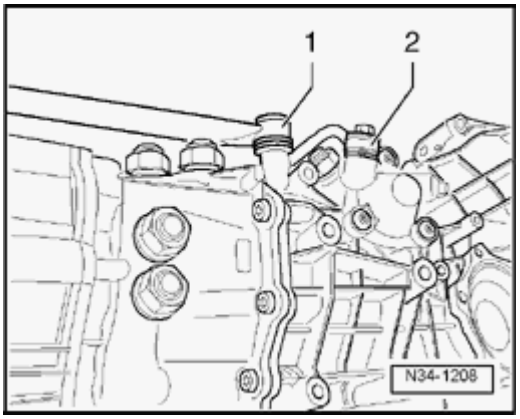


Fig. 781: Identifying Push Rod And Connecting Rod For Selector Rod
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect connecting rod - **2** - of shift rod.
- Remove socket head bolt of pivot rod - **1** -.

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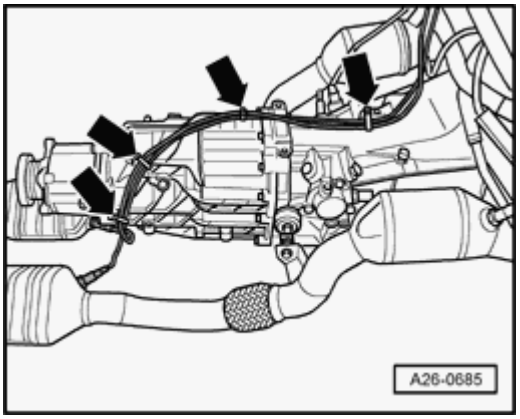


Fig. 782: Freeing Up Oxygen Sensor Wires At Areas Indicated By On Transmission
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Free up oxygen sensor wires at areas indicated by - **arrows** - on transmission.

NOTE:

- **Illustration shows engine/transmission assembly removed.**

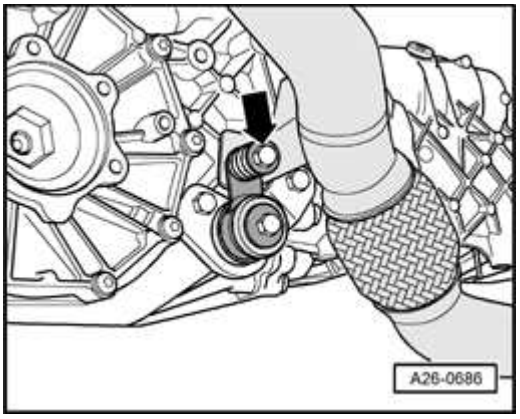
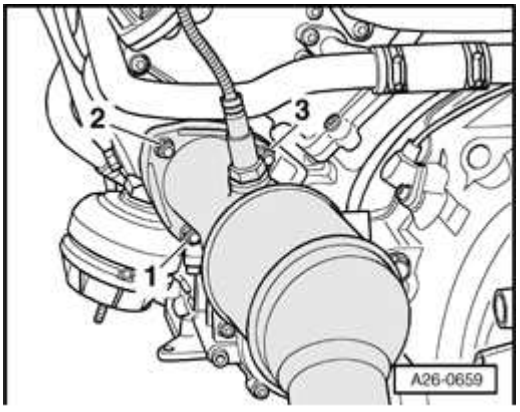


Fig. 783: Removing Bolt At Strap For Left Front Exhaust Pipe
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolt - **arrow** - at strap for left front exhaust pipe.



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Fig. 784: Removing Nuts For Left Front Exhaust Pipe/Exhaust Manifold
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove nuts - **1 to 3** - for left front exhaust pipe/exhaust manifold.

NOTE:

- **Illustration shows engine removed.**

- Disconnect front exhaust pipe from left exhaust manifold.
- Remove front exhaust pipe with pre- and main catalytic converters.

Installing

Installation is in reverse order of removal, note the following:

NOTE:

- **Replace self-locking nuts.**
- **Secure all hose connections using hose clamps appropriate for the model type .**
- **During installation, all cable ties must be re-installed at the same location.**

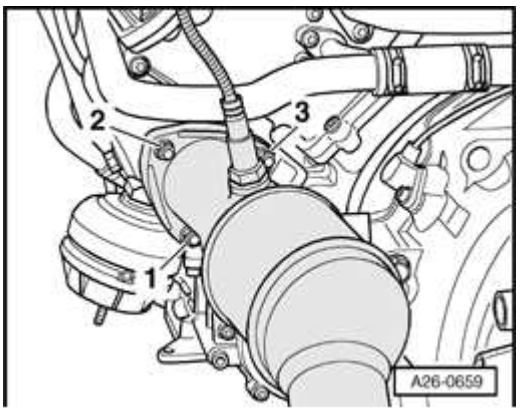


Fig. 785: Removing Nuts For Left Front Exhaust Pipe/Exhaust Manifold
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Tighten nuts - **1 to 3** - of front exhaust pipe/exhaust manifold bolts uniformly in stages, while doing so, align catalytic converter horizontally.
- Install subframe --> **40 - FRONT SUSPENSION** .

NOTE:

- **Individual mounting components of exhaust system on transmission *Individual components of suspension, right side* under**

- Align exhaust system free of tension --> **Exhaust system, installing free of tension**.

Torque specifications

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Component	Nm
Front exhaust pipe with pre- and main catalytic converters to exhaust manifold	27
Front exhaust pipe with pre- and main catalytic converters to mounting strap	25
Pivot rod on transmission	40
Shift rod connecting rod on transmission	23
Driveshaft guard on transmission	23

Right front exhaust pipe with primary and main catalytic converter (vehicles with manual transmission), removing and installing

Special tools, testers and auxiliary items required

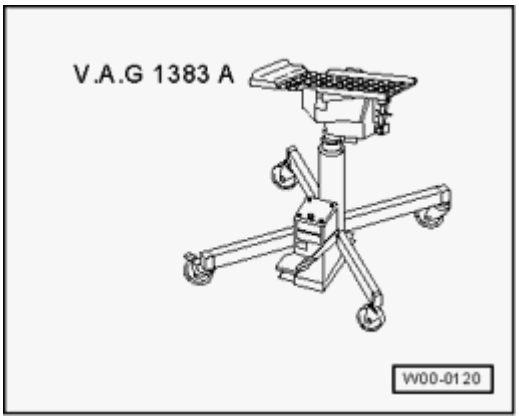


Fig. 786: Identifying Engine/Transmission Jack V.A.G. 1383 A
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Engine/transmission jack V.A.G 1383 A

Removing

NOTE:

- **All cable ties opened or cut during engine removal must be reinstalled at the same locations during installation.**

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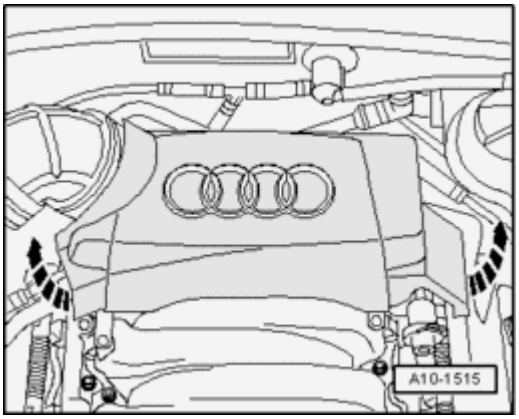


Fig. 787: Removing Rear Engine Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove rear engine cover - **arrows** -.

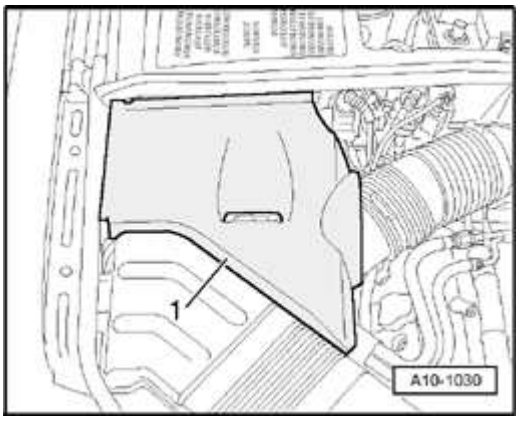


Fig. 788: Removing Cover In Engine Compartment (Right Side)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove cover - **1** - in engine compartment (right side).

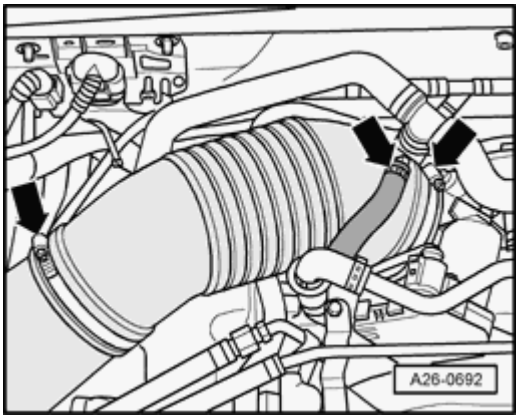


Fig. 789: Removing Air Guide Hose
Courtesy of VOLKSWAGEN UNITED STATES, INC.

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- Remove air guide hose - **arrows** -.

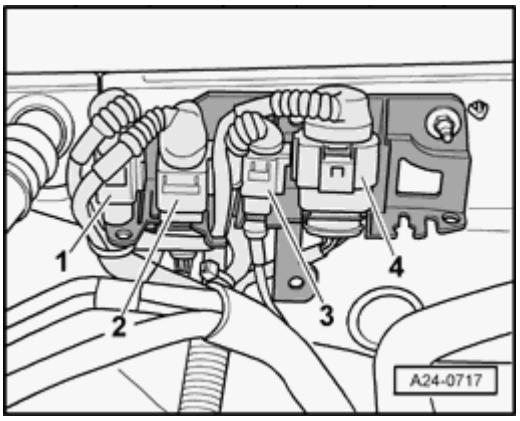


Fig. 790: Removing Bracket For Electrical Harness Connectors At Right From Bulkhead
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove harness connectors - **1 to 4** - from bracket at right of bulkhead.
- Disconnect electrical harness connectors - **2** - and - **4** -.
- Free up oxygen sensor wires downward.
- Remove right front wheel.

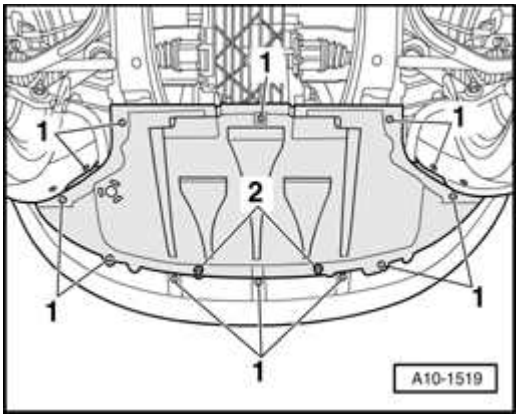


Fig. 791: Removing Quick-Release Fasteners, Screws And Noise Insulation
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove quick-release fasteners - **1** - , remove screws - **2** - and remove noise insulation.

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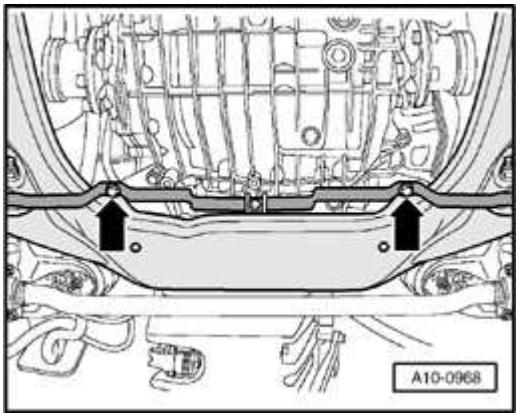


Fig. 792: Removing Bracket For Noise Insulation
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bracket for noise insulation - **arrows** -.

NOTE:

- **Flex joint in front exhaust pipe must not be bent more than 10 ° , otherwise it may be damaged.**

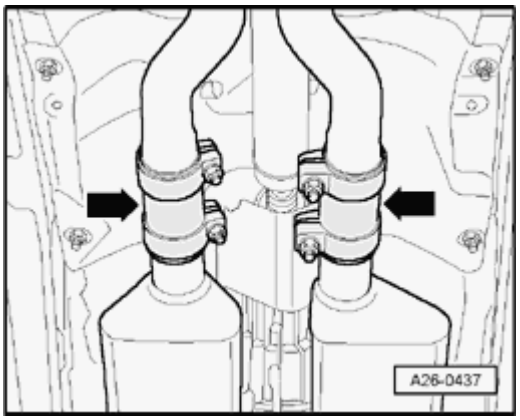


Fig. 793: Disconnecting Exhaust System At Double Clamps
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect exhaust system at right double clamp - **right arrow** -.

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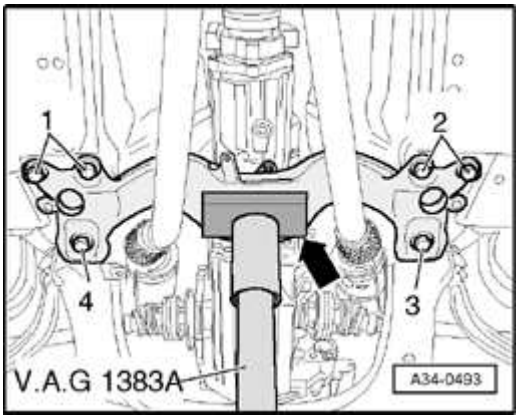


Fig. 794: Supporting Tunnel Cross Member Using VAG1383A Engine/Transmission Lift And A Piece Of Wood
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Place Engine/Transmission Jack V.A.G 1383 A plunger with a block of wood inserted in between - **arrow** - beneath rear cross member.
- First remove bolts - **1** - and - **2** - , then bolts - **3** - and - **4** -.

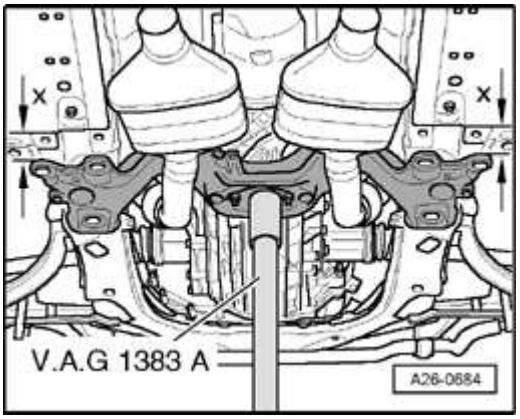


Fig. 795: Identifying Distance Between Cross Member And Body Reaches Dimension
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Slowly lower rear cross member using Engine/transmission jack V.A.G 1383 A until distance between rear cross member/chassis acquires dimension - **x** -.

- Dimension - **x** - = 60 mm

NOTE:

- **Transmission must not be lowered further because otherwise driveshaft joint and decoupling element in front exhaust pipe may be damaged.**

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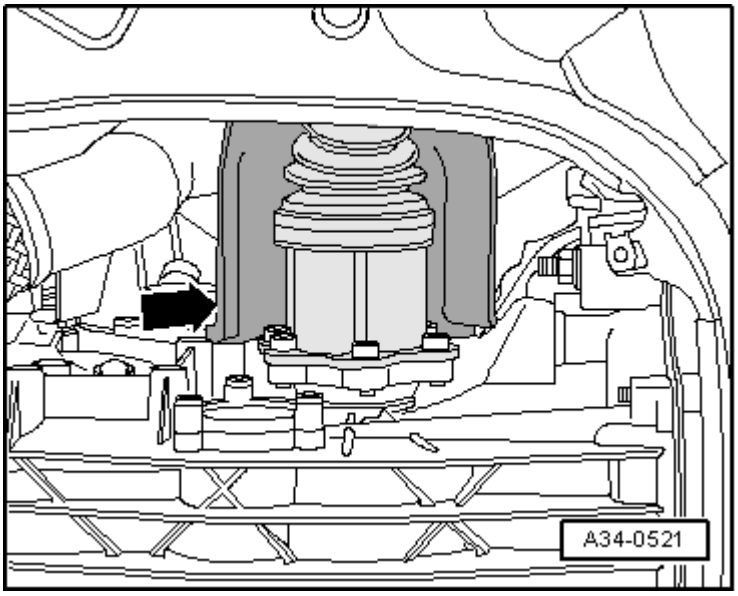


Fig. 796: Drive Axle Heat Shield
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove heat shield - **arrow** - for right drive axle.

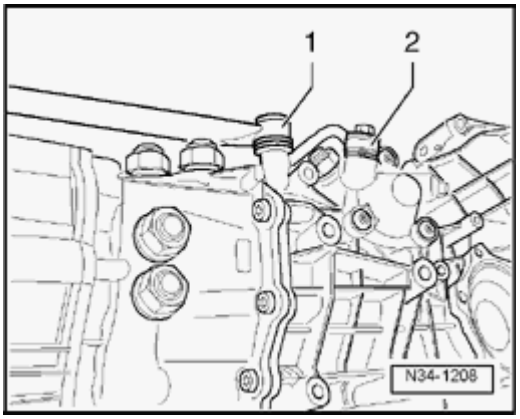


Fig. 797: Identifying Push Rod And Connecting Rod For Selector Rod
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect connecting rod - **2** - of shift rod.
- Remove socket head bolt of pivot rod - **1** -.

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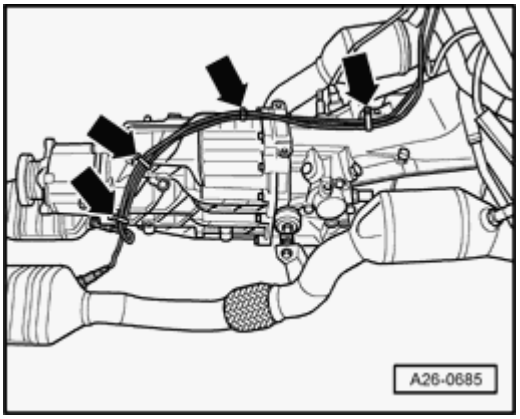


Fig. 798: Freeing Up Oxygen Sensor Wires At Areas Indicated By On Transmission
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Free up oxygen sensor wires at areas indicated by - **arrows** - on transmission.

NOTE:

- **Illustration shows engine/transmission assembly removed.**

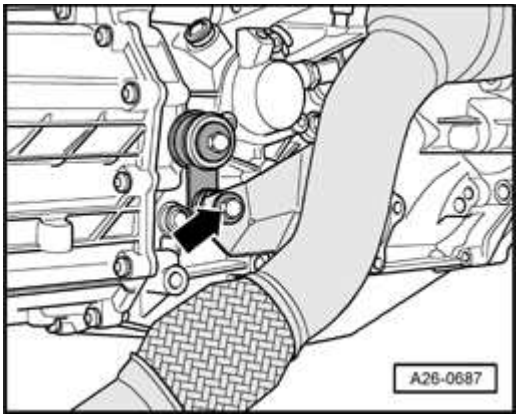
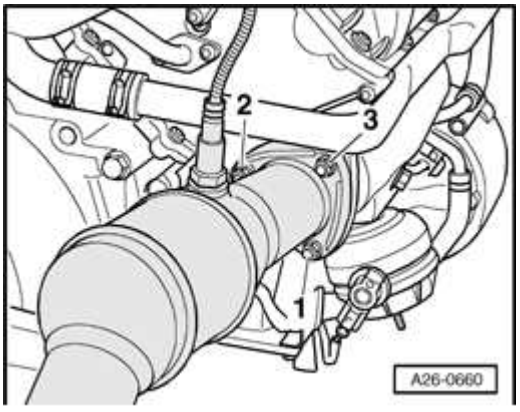


Fig. 799: Removing Bolt At Strap For Right Front Exhaust Pipe
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolt - **arrow** - at strap for right front exhaust pipe.



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Fig. 800: Removing Nuts For Right Front Exhaust Pipe/Exhaust Manifold
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove nuts - **1 to 3** - for right front exhaust pipe/exhaust manifold.

NOTE:

- **Illustration shows engine removed.**

- Remove front exhaust pipe with pre- and main catalytic converters.

Installing

Installation is in reverse order of removal, note the following:

NOTE:

- **Replace self-locking nuts.**
- **Secure all hose connections using hose clamps appropriate for the model type .**
- **During installation, all cable ties must be re-installed at the same location.**

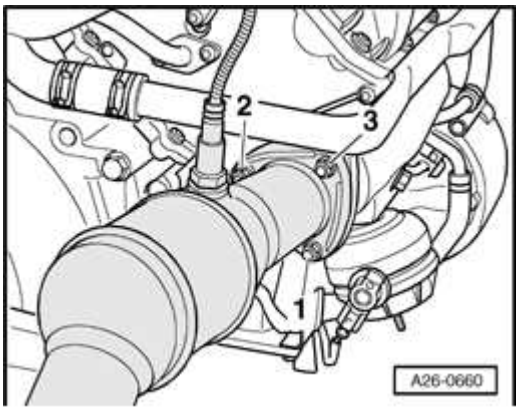


Fig. 801: Removing Nuts For Right Front Exhaust Pipe/Exhaust Manifold
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Tighten nuts - **1 to 3** - of front exhaust pipe/exhaust manifold bolts uniformly in stages, align catalytic converter horizontally while doing so.
- Install subframe --> **40 - FRONT SUSPENSION** .

NOTE:

- **Individual mounting components of exhaust system on transmission**
  Individual components of suspension, right side

- Align exhaust system free of tension --> **Exhaust system, installing free of tension**.

Torque specifications

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Component	Nm
Front exhaust pipe with pre- and main catalytic converters to exhaust manifold	27
Front exhaust pipe with pre- and main catalytic converters to mounting strap	25
Pivot rod on transmission	40
Shift rod connecting rod on transmission	23
Driveshaft guard on transmission	23

Left front exhaust pipe with primary and main catalytic converter (vehicles with automatic transmission), removing and installing

Special tools, testers and auxiliary items required

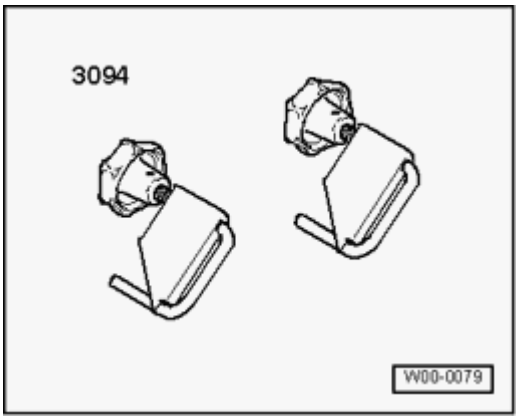


Fig. 802: Identifying Hose Clamps 3094
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Hose clamps up to 25 mm diameter 3094

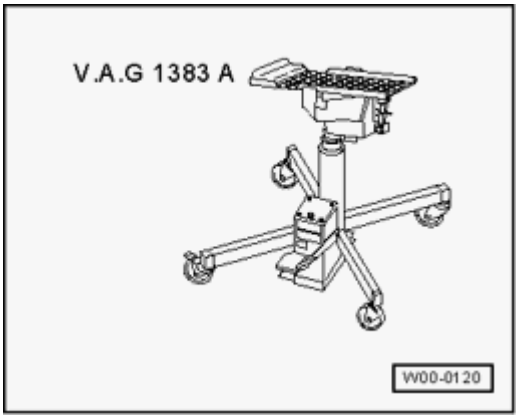


Fig. 803: Identifying Engine/Transmission Jack V.A.G. 1383 A
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Engine/transmission jack V.A.G 1383 A

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Removing

NOTE:

- **All heat insulation sleeves removed during engine removal must be reinstalled at the same locations during installation.**
- **All cable ties opened or cut during engine removal must be reinstalled at the same locations during installation.**

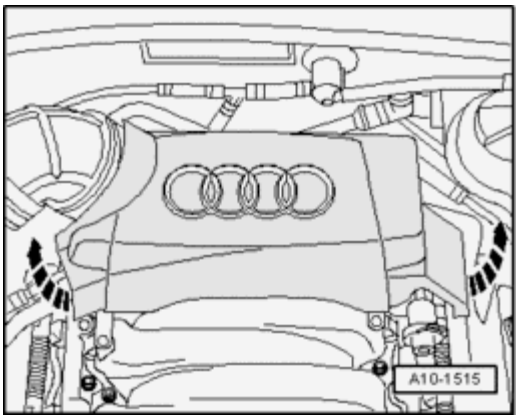


Fig. 804: Removing Rear Engine Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove rear engine cover - **arrows** -.

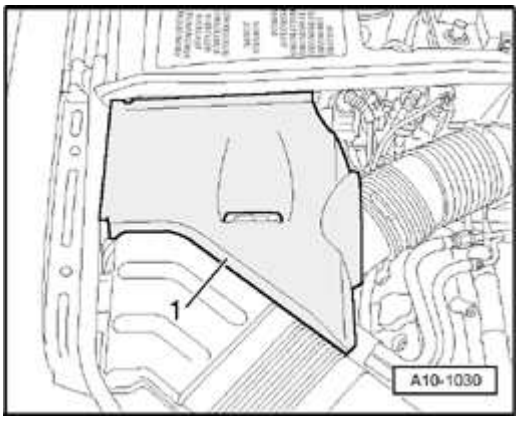


Fig. 805: Removing Cover In Engine Compartment (Right Side)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove cover - **1** - in engine compartment (right side).

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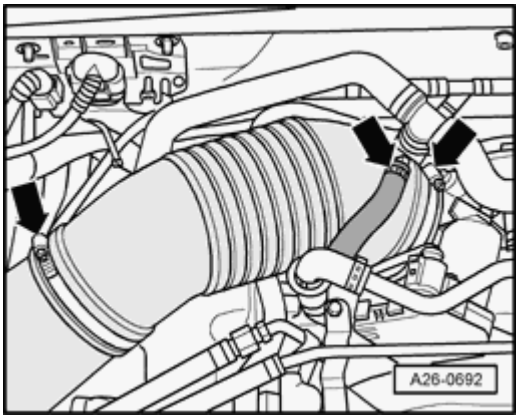


Fig. 806: Removing Air Guide Hose
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove air guide hose - **arrows** -.

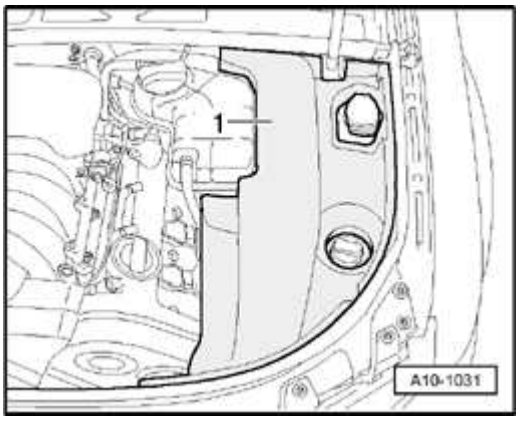


Fig. 807: Removing Cover In Engine Compartment (Left Side)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove cover - **1** - in engine compartment (left side).

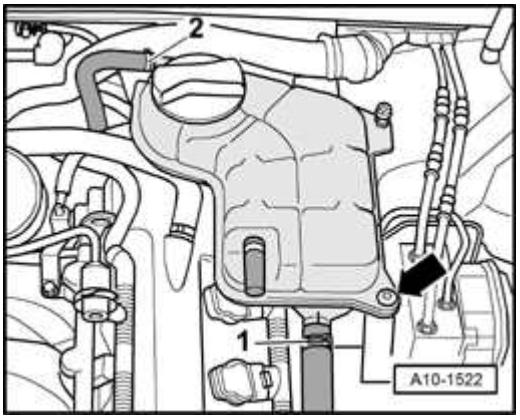


Fig. 808: Removing Coolant Hoses & Coolant Expansion Tank
Courtesy of VOLKSWAGEN UNITED STATES, INC.

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- Clamp off coolant hose - **2** - using Hose clamps up to 25 mm diameter 3094 and disconnect from coolant expansion tank.
- Seal connection using a plug that fits.
- Remove coolant expansion tank - **arrow** -.
- Disconnect electrical wire to Engine Coolant Level (ECL) Warning Switch F66 at bottom on expansion tank and set aside coolant expansion tank with coolant hose - **1** - connected.

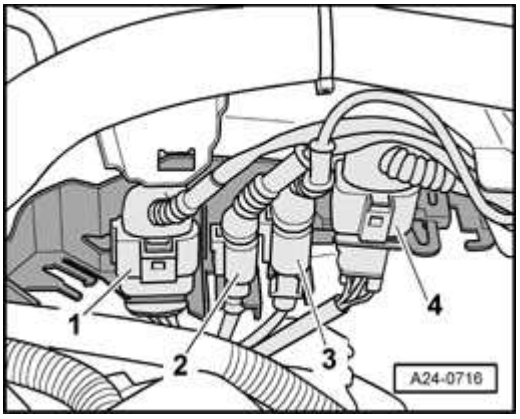


Fig. 809: Removing Bracket For Electrical Harness Connectors At Left From Bulkhead
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove electrical harness connectors - **1 to 4** - from bracket at left of bulkhead.
- Disconnect electrical harness connectors - **1** - and - **4** -.
- Remove bracket from bulkhead.
- Remove heat insulation sleeve on wiring harness and lay open wiring harness.

- Free up oxygen sensor wires downward.
- Remove left front wheel.

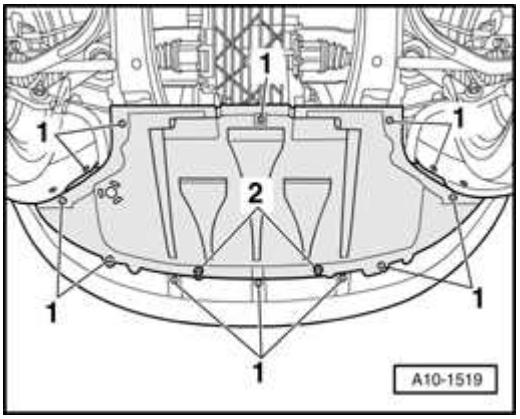


Fig. 810: Removing Quick-Release Fasteners, Screws And Noise Insulation
Courtesy of VOLKSWAGEN UNITED STATES, INC.

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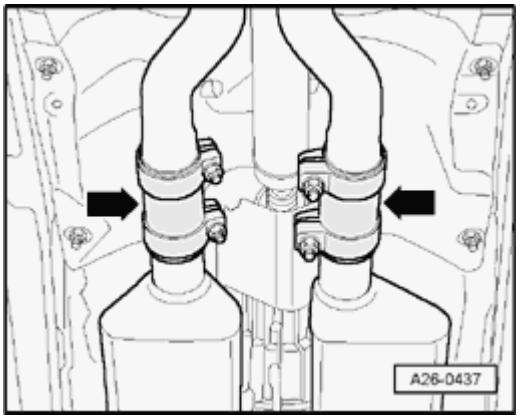


Fig. 811: Disconnecting Exhaust System At Double Clamps
Courtesy of VOLKSWAGEN UNITED STATES, INC.

NOTE:

- **Decoupling elements in front exhaust pipes must not be bent more than 10 ° danger of damage.**

- Disconnect exhaust system at double clamps - **arrows** -.

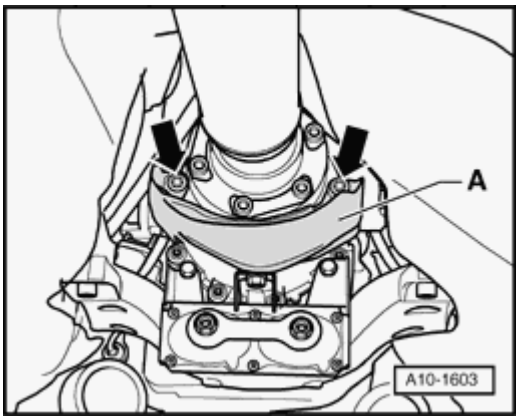


Fig. 812: Removing Heat Shield For Driveshaft
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove heat shield - **A** - for driveshaft - **arrows** -.
- Remove bolts at transmission/driveshaft flange.
- Push driveshaft together with rear final drive. The constant velocity (CV) joints can move axially.
- Tie up drive shaft to body.

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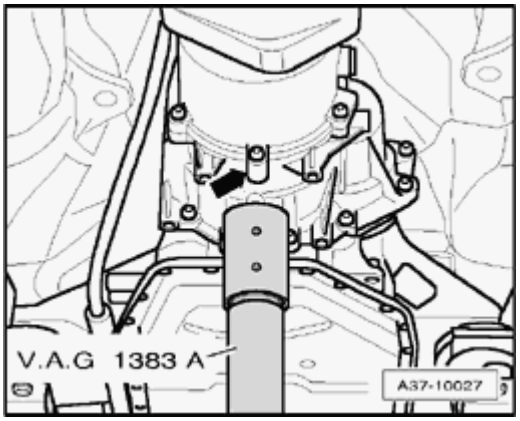


Fig. 813: Placing Lifting Surface Of Engine/Transmission Jack V.A.G 1383 A Centered On Housing Casing And Support Transmission From Below
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Place lifting surface of Engine/transmission jack V.A.G 1383 A centered on housing casing - **arrow** - and support transmission from below.

CAUTION: The lock carrier must be installed.

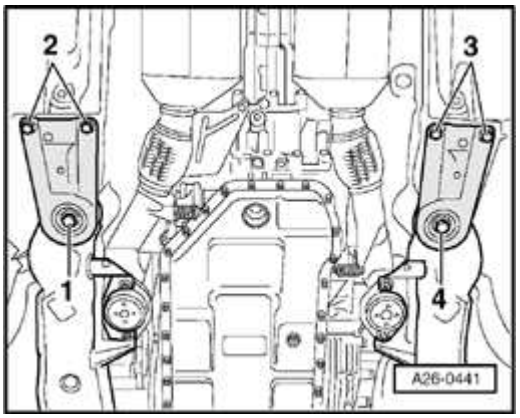


Fig. 814: Removing Bolts And Mounting Bolts Of Subframe
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- First remove bolts - **2** - and - **3** - and then mounting bolts - **1** - and - **4** - of subframe.

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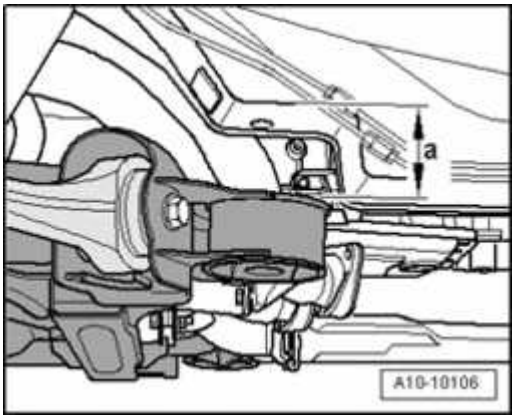


Fig. 815: Lowering Engine/Transmission Assembly Using Scissor Lift Platform VAS 6131 Only Approx. By Dimension
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Lower transmission and subframe using Engine/transmission jack V.A.G 1383 A to dimension - **a** -.

- Dimension - **a** - = 50 mm.

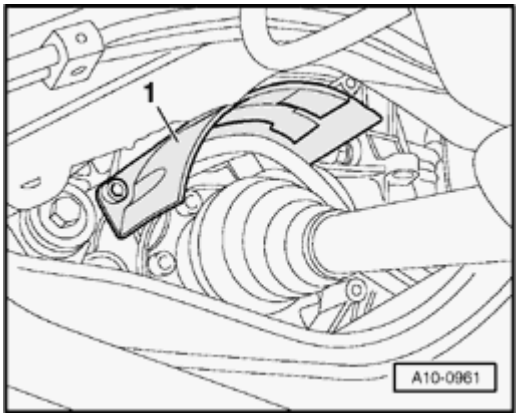


Fig. 816: Removing Heat Shield For Left Drive Axle
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove heat shield - **1** - for left drive axle.

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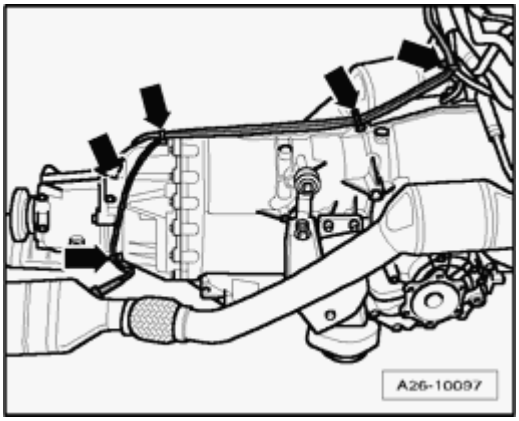


Fig. 817: Freeing Up Oxygen Sensor Wires At Areas Indicated By On Transmission
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Free up oxygen sensor wires at areas indicated by - **arrows** - on transmission.

NOTE:

- **Illustration shows engine/transmission assembly removed.**

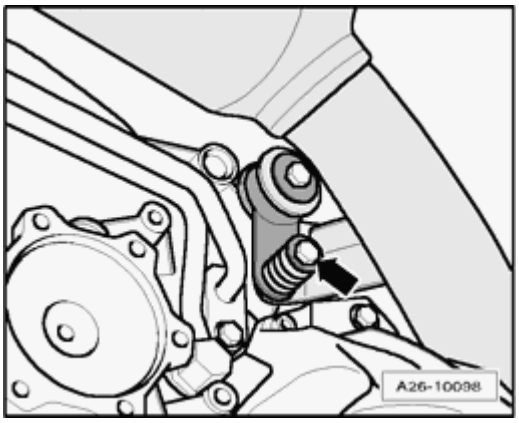
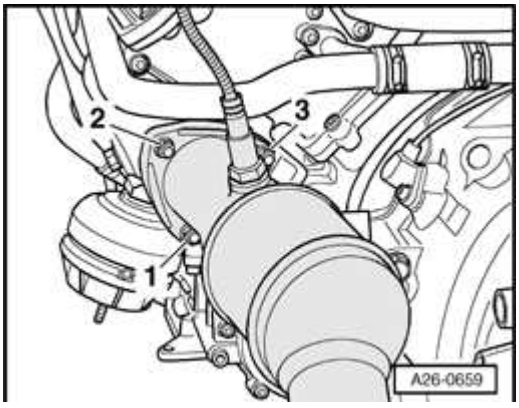


Fig. 818: Removing Bolt At Strap For Left Front Exhaust Pipe
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolt - **arrow** - at strap for left front exhaust pipe.



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Fig. 819: Removing Nuts For Left Front Exhaust Pipe/Exhaust Manifold
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove nuts - **1 to 3** - for left front exhaust pipe/exhaust manifold.

NOTE:

- **Illustration shows engine/transmission assembly removed.**

- Remove front exhaust pipe with pre- and main catalytic converters.

Installing

Installation is in reverse order of removal, note the following:

NOTE:

- **Replace self-locking nuts.**
- **During installation, re-install all heat insulation sleeves at the same locations.**
- **Secure all hose connections using hose clamps appropriate for the model type .**
- **During installation, all cable ties must be re-installed at the same location.**

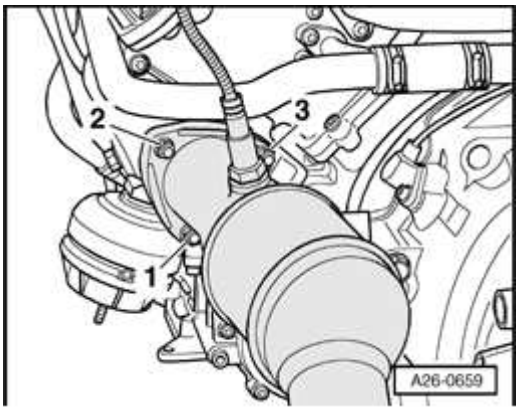


Fig. 820: Removing/Installing Nuts For Left Front Exhaust Pipe/Exhaust Manifold
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Tighten nuts - **1 to 3** - of front exhaust pipe/exhaust manifold bolts uniformly in stages, align catalytic converter horizontally while doing so.
- Install subframe --> **40 - FRONT SUSPENSION** .

NOTE:

- **Individual mounting components of exhaust system on transmission Individual left mounting components - vehicles with automatic transmission**

- Align exhaust system free of tension --> **Exhaust system, installing free of tension**.

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Torque specifications

Component	Nm
Front exhaust pipe with pre- and main catalytic converters to exhaust manifold	27
Front exhaust pipe with pre- and main catalytic converters to mounting strap	25
Heat shield for drive shaft to transmission	23

Right front exhaust pipe with primary and main catalytic converter (vehicles with automatic transmission), removing and installing

Special tools, testers and auxiliary items required

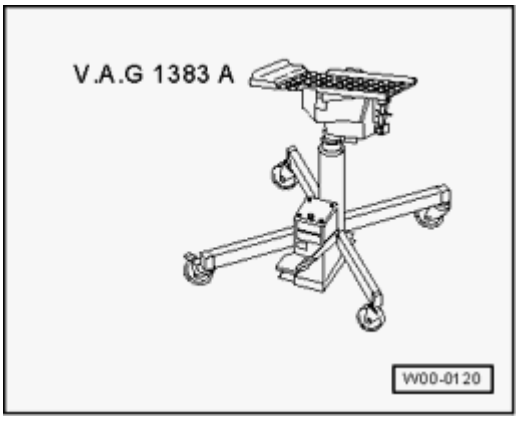


Fig. 821: Identifying Engine/Transmission Jack V.A.G. 1383 A
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Engine/transmission jack V.A.G 1383 A

Removing

NOTE:

- **All cable ties opened or cut during engine removal must be reinstalled at the same locations during installation.**

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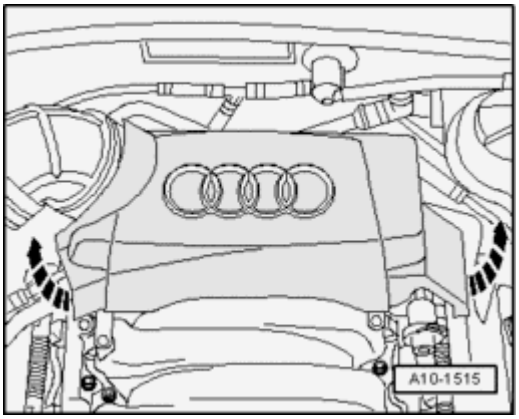


Fig. 822: Removing Rear Engine Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove rear engine cover - **arrows** -.

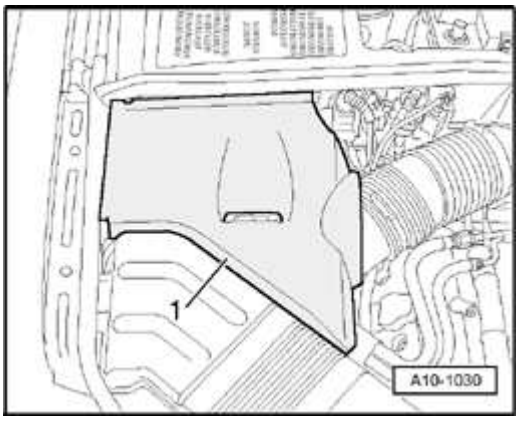


Fig. 823: Removing Cover In Engine Compartment (Right Side)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove cover - **1** - in engine compartment (right side).

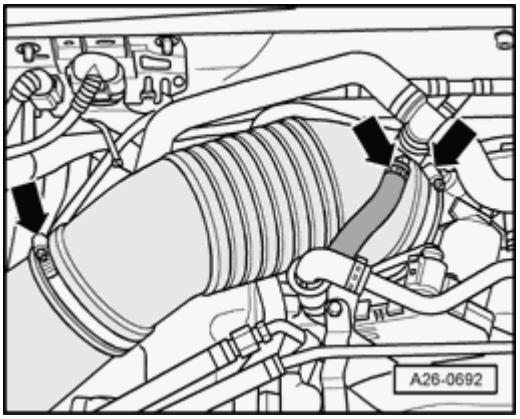


Fig. 824: Removing Air Guide Hose
Courtesy of VOLKSWAGEN UNITED STATES, INC.

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- Remove air guide hose - **arrows** -.

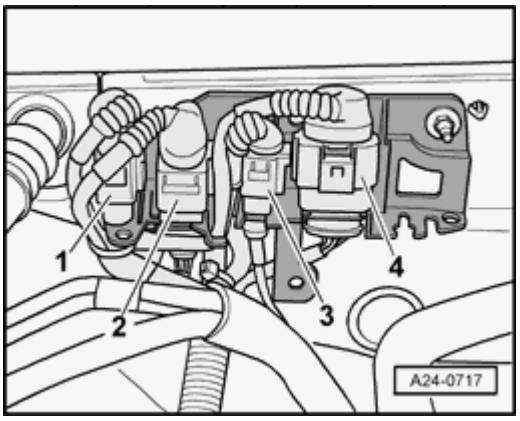


Fig. 825: Removing Bracket For Electrical Harness Connectors At Right From Bulkhead
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove harness connectors - **1 to 4** - from bracket at right of bulkhead.
- Disconnect electrical harness connectors - **2** - and - **4** -.
- Free up oxygen sensor wires downward.
- Remove right front wheel.

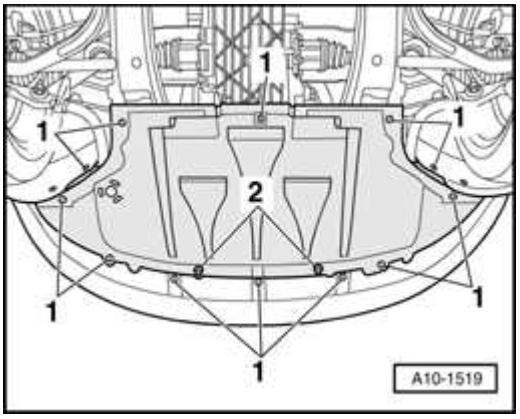


Fig. 826: Removing Quick-Release Fasteners, Screws And Noise Insulation
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove quick-release fasteners - **1** - , remove screws - **2** - and remove noise insulation.

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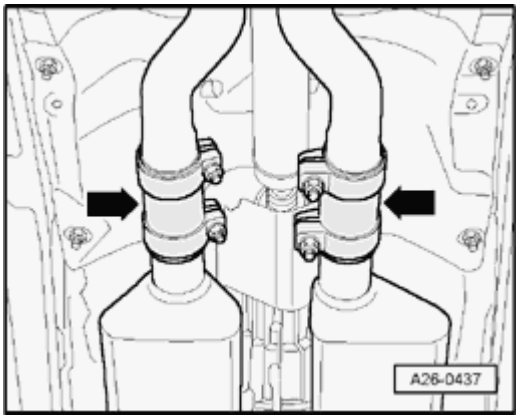


Fig. 827: Disconnecting Exhaust System At Double Clamps
Courtesy of VOLKSWAGEN UNITED STATES, INC.

NOTE:

- **Decoupling elements in front exhaust pipes must not be bent more than 10 ° danger of damage.**

- Disconnect exhaust system at double clamps - **arrows** -.

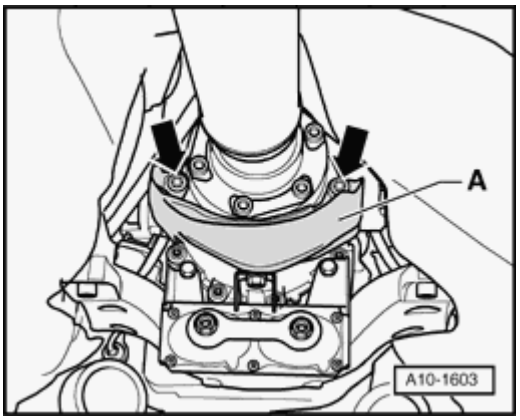


Fig. 828: Removing Heat Shield For Driveshaft
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove heat shield - **A** - for driveshaft - **arrows** -.
- Remove bolts at transmission/driveshaft flange.
- Push driveshaft together with rear final drive. The constant velocity (CV) joints can move axially.
- Tie up driveshaft to body.

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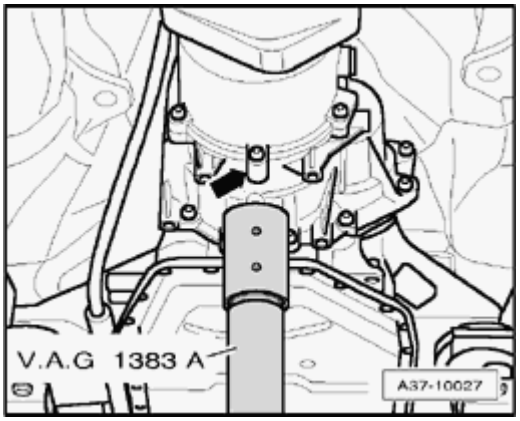


Fig. 829: Placing Lifting Surface Of Engine/Transmission Jack V.A.G 1383 A Centered On Housing Casing And Support Transmission From Below
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Place lifting surface of Engine/transmission jack V.A.G 1383 A centered on housing casing - **arrow** - and support transmission from below.

CAUTION: The lock carrier must be installed.

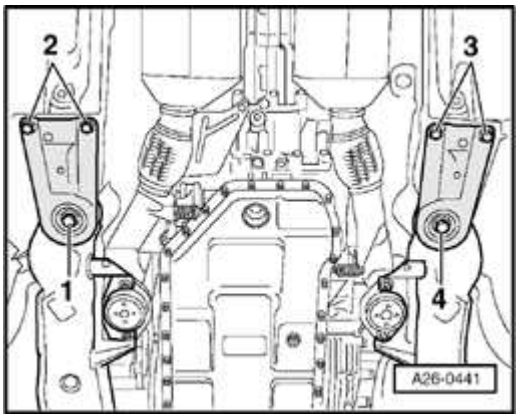


Fig. 830: Removing Bolts And Mounting Bolts Of Subframe
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- First remove bolts - **2** - and - **3** - and then mounting bolts - **1** - and - **4** - of subframe.

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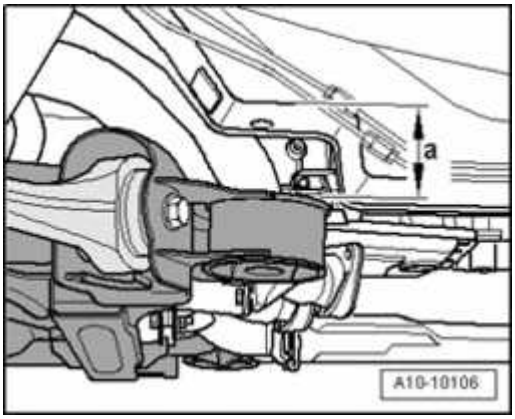


Fig. 831: Lowering Transmission And Subframe Using Engine/Transmission Jack V.A.G 1383 A To Dimension
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Lower transmission and subframe using Engine/transmission jack V.A.G 1383 A to dimension - **a** -.

- Dimension - **a** - = 50 mm.

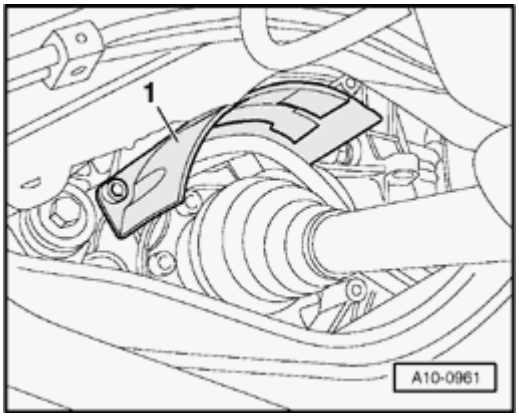


Fig. 832: Removing Heat Shield For Left Drive Axle
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove heat shield - **1** - for left drive axle.

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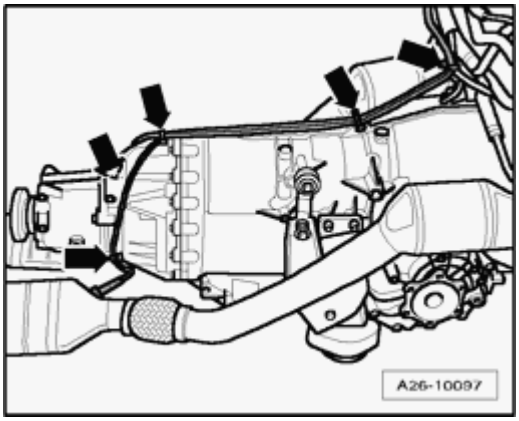


Fig. 833: Freeing Up Oxygen Sensor Wires At Areas Indicated By On Transmission
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Free up oxygen sensor wires at areas indicated by - **arrows** - on transmission.

NOTE:

- **Illustration shows engine/transmission assembly removed.**

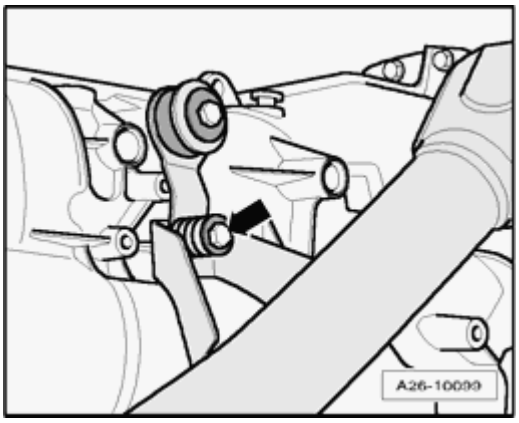
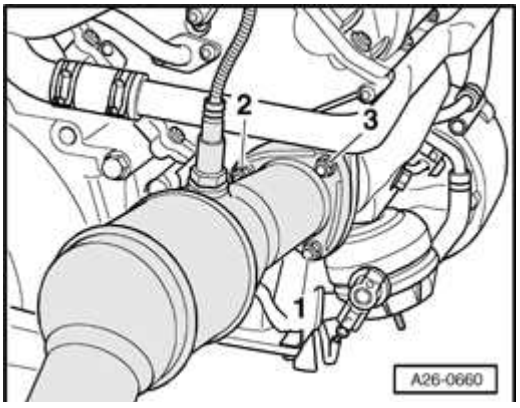


Fig. 834: Removing Bolt At Strap For Right Front Exhaust Pipe
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolt - **arrow** - at strap for right front exhaust pipe.



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Fig. 835: Removing Nuts For Right Front Exhaust Pipe/Exhaust Manifold
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove nuts - **1 to 3** - for right front exhaust pipe/exhaust manifold.

NOTE:

- **Illustration shows engine/transmission assembly removed.**

- Next, disconnect front exhaust pipe from exhaust manifold.

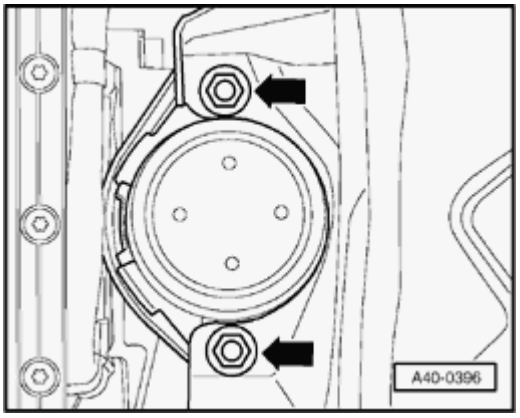


Fig. 836: Removing Bolts For Left/Right Transmission Mount
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts - **arrows** - for right transmission mount at bottom.

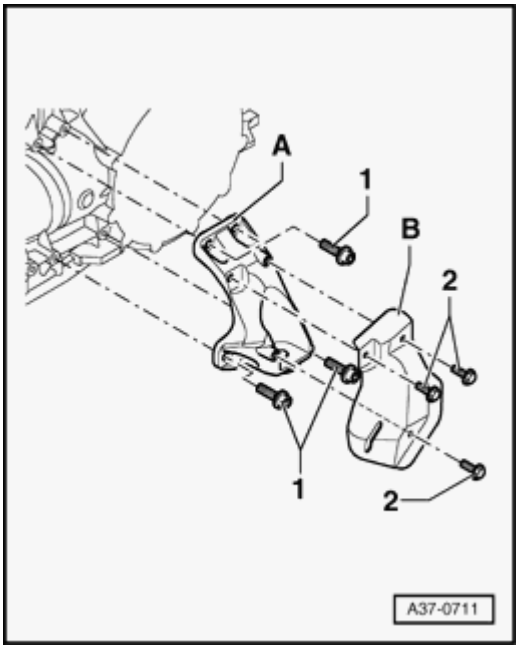


Fig. 837: Removing Bolts, Heat Shield, Transmission Support
Courtesy of VOLKSWAGEN UNITED STATES, INC.

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- Remove bolts - **2** - and remove heat shield - **B** -.
- Remove bolts - **1** - and remove transmission support.
- Remove front exhaust pipe with pre- and main catalytic converters.

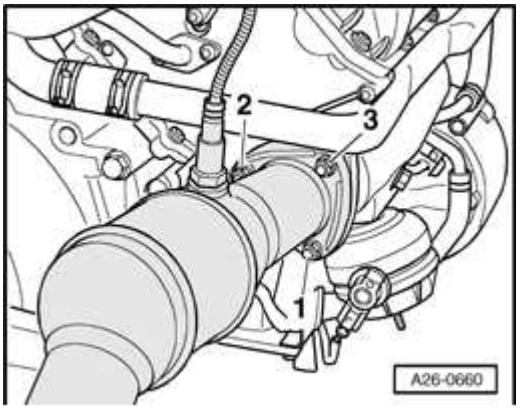
Installing

Installation is in reverse order of removal, note the following:

NOTE:

- **Replace self-locking nuts.**
- **During installation, all cable ties must be re-installed at the same location.**
- **Secure all hose connections using hose clamps appropriate for the model type .**

- Install transmission supports --><u>**37 CONTROLS, HOUSING**</u> .



<u>Fig. 838: Removing/Installing Nuts For Right Front Exhaust Pipe/Exhaust Manifold</u>
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Tighten nuts - **1 to 3** - of front exhaust pipe/exhaust manifold bolts uniformly in stages, align catalytic converter horizontally while doing so.
- Install subframe --> <u>**40 - FRONT SUSPENSION**</u> .

NOTE:

- **Individual mounting components of exhaust system on transmission <u>Individual components of suspension, right side</u>**

- Align exhaust system free of tension --> <u>**Exhaust system, installing free of tension**</u>.

Torque specifications

Component	Nm
Front exhaust pipe with pre- and main catalytic converters to exhaust manifold	27

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Front exhaust pipe with pre- and main catalytic converters to mounting strap	25
Driveshaft guard on transmission	23

Left exhaust manifold, removing and installing

Special tools, testers and auxiliary items required

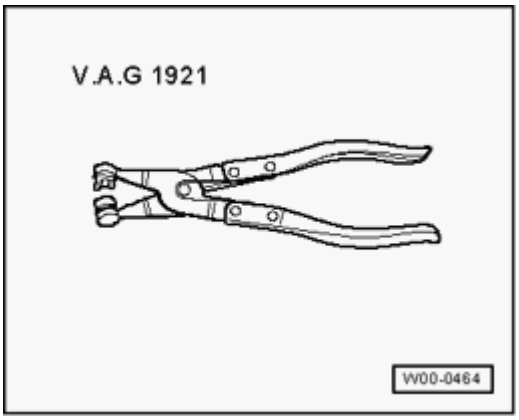


Fig. 839: Identifying Hose Clip Pliers Vag 1921
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Hose clamp pliers V.A.G 1921

Removing

- Remove engine: Vehicles with manual transmission --> **Engine (vehicles with manual transmission)** , vehicles with automatic transmission --> **Engine (vehicles with automatic transmission), removing**.

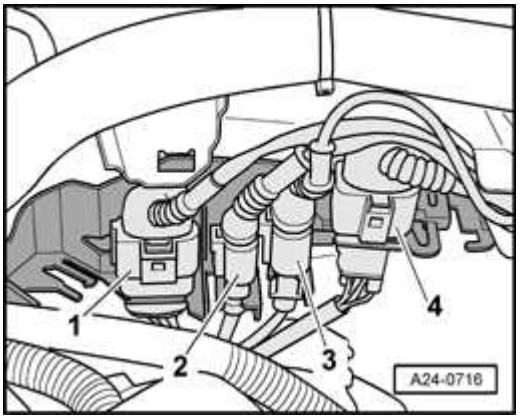


Fig. 840: Removing Bracket For Electrical Harness Connectors At Left From Bulkhead
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove electrical harness connectors - **1** - and - **4** - for oxygen sensors in left front exhaust pipe out of bracket and disconnect.

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- Remove heat insulation sleeve on wiring harness and free up individual wires.

NOTE:

- **In the illustration, the electrical harness connectors are depicted as installed.**

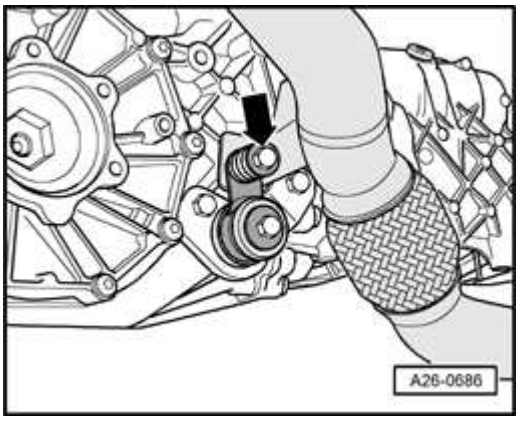


Fig. 841: Removing Bolt At Strap For Left Front Exhaust Pipe
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolt - **arrow** - at strap for left front exhaust pipe.

NOTE:

- **Illustration shows the strap for a vehicle with manual transmission.**

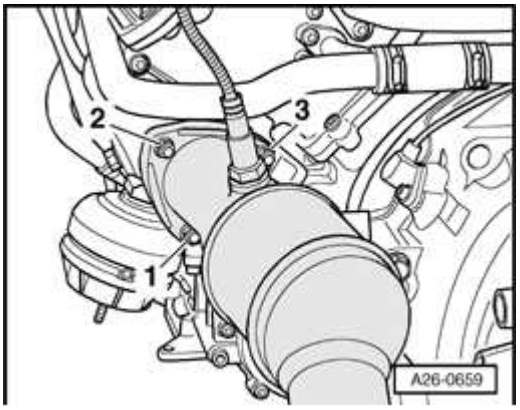


Fig. 842: Removing Nuts For Left Front Exhaust Pipe/Exhaust Manifold
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove nuts - **1 to 3** - for left front exhaust pipe/exhaust manifold.

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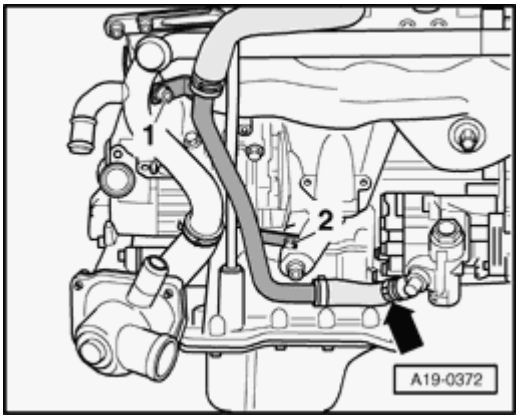


Fig. 843: Removing Bolts & Return Line From Power-Steering Pump
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts - **1** - and - **2** -.

NOTE:

- **To prevent oil from escaping, the hose - arrow - remains connected to power steering.**

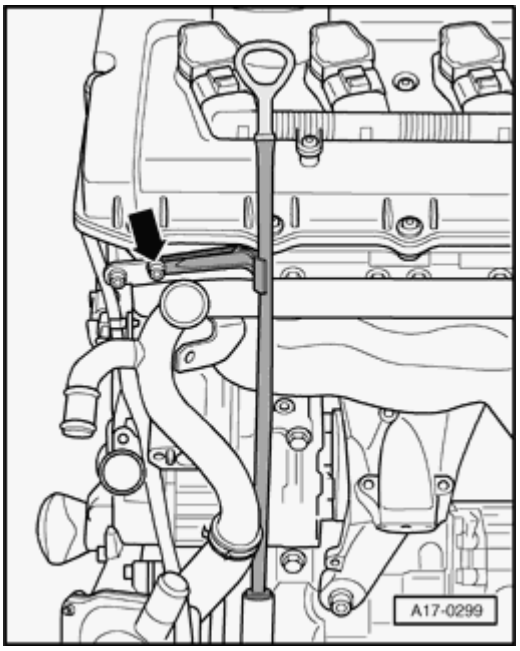


Fig. 844: Removing Bolt From Oil Dipstick Guide Tube At Cylinder Head
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unscrew guide pipe for oil dipstick at cylinder head - **arrow** - , pull up and remove.

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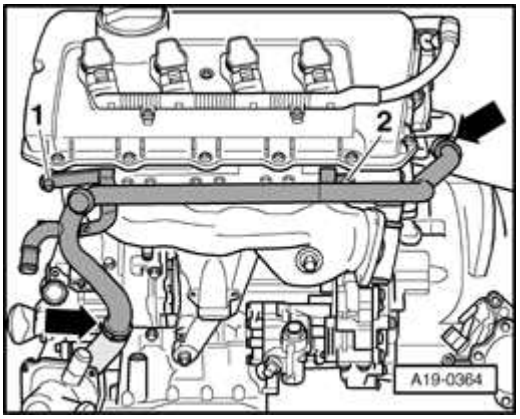


Fig. 845: Removing Bolts, Loosening Hose Clamps And Removing Left Coolant Pipe From Coolant Hoses
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts - **1** - and - **2** -.
- Loosen hose clamps - **arrows** - and remove left coolant pipe from coolant hoses.

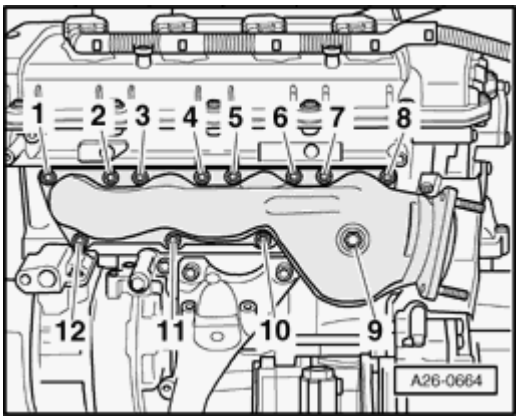


Fig. 846: Removing Nuts And Left Exhaust Manifold
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove nuts - **1 to 12** - and remove left exhaust manifold.

Installing

Installation is in reverse order of removal, note the following:

NOTE:

- **Always replace self-locking nuts and O-ring.**

- Install left coolant pipe --> **Left coolant pipe, removing and installing**.
- Install left front exhaust pipe: Vehicles with manual transmission --> **Left front exhaust pipe with primary and main catalytic converter (vehicles with manual transmission), removing and installing** , vehicles with automatic transmission --> **Left front exhaust pipe with primary and main catalytic converter (vehicles with automatic transmission), removing and installing**.

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- Install engine: Vehicles with manual transmission --> **Engine (vehicles with manual transmission), installing** , vehicles with automatic transmission --> **Engine (vehicles with automatic transmission), installing**.

Torque specifications

Component	Nm
Exhaust manifold to cylinder head	25 * See note

*Replace nuts.

Right exhaust manifold, removing and installing

Special tools, testers and auxiliary items required

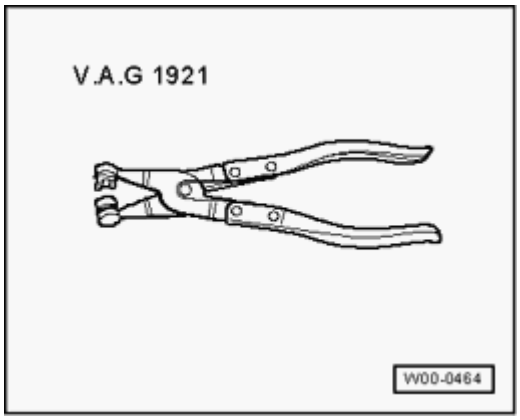


Fig. 847: Identifying Hose Clip Pliers Vag 1921
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Hose clamp pliers V.A.G 1921

Removing

- Remove engine: Vehicles with manual transmission --> **Engine (vehicles with manual transmission)** , vehicles with automatic transmission --> **Engine (vehicles with automatic transmission), removing**.

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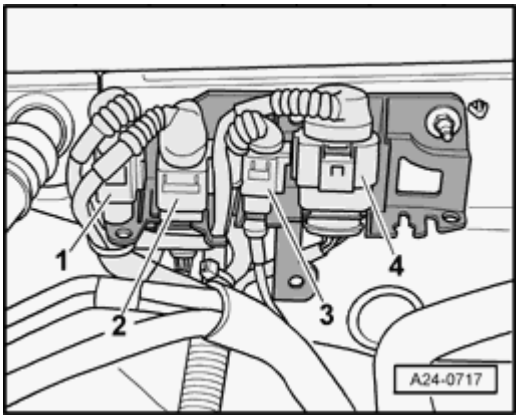


Fig. 848: Removing Bracket For Electrical Harness Connectors At Right From Bulkhead
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove electrical harness connectors - **2** - and - **4** - for oxygen sensors in right front exhaust pipe out of bracket and disconnect.

NOTE:

- **In the illustration, the electrical harness connectors are depicted as installed.**

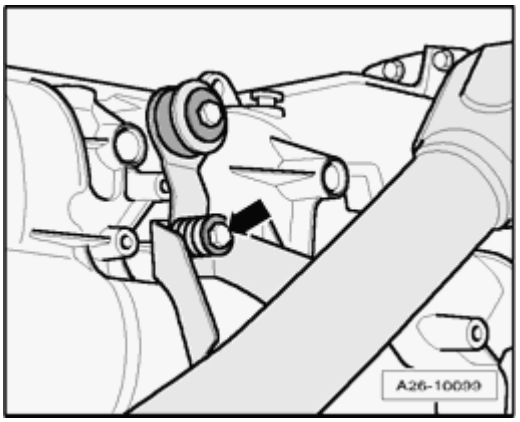


Fig. 849: Removing Bolt At Strap For Right Front Exhaust Pipe
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolt - **arrow** - at strap for right front exhaust pipe.

NOTE:

- **Illustration shows the strap for a vehicle with manual transmission.**

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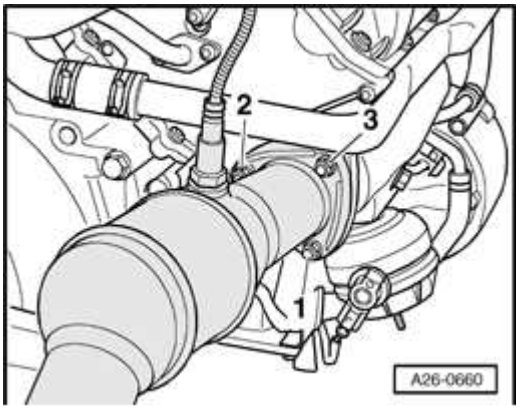


Fig. 850: Removing Nuts For Right Front Exhaust Pipe/Exhaust Manifold
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove nuts - **1 to 3** - for right front exhaust pipe/exhaust manifold.
- Remove front exhaust pipe with pre- and main catalytic converters.

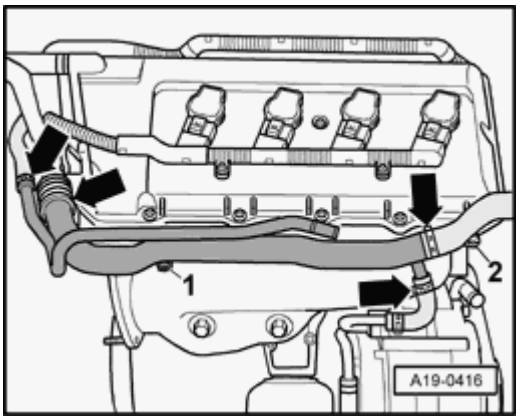


Fig. 851: Removing Bolts, Loosening Hose Clamps And Removing Right Coolant Pipe From Coolant Hoses
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts - **1** - and - **2** -.
- Loosen hose clamps - **arrows** - and remove right coolant pipe from coolant hoses.

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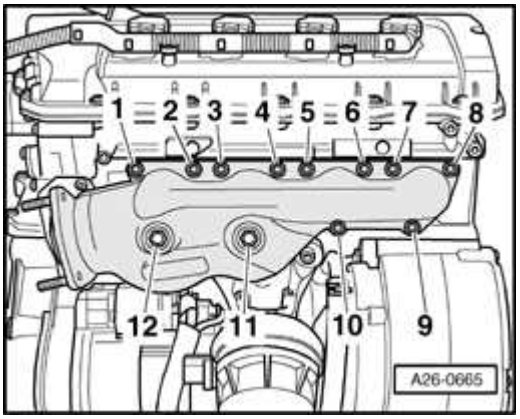


Fig. 852: Removing Nuts And Right Exhaust Manifold
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove nuts - **1 to 12** - and remove right exhaust manifold.

Installing

Installation is in reverse order of removal, note the following:

NOTE:

- **Replace self-locking nuts.**

- Install right front exhaust pipe: --> **Right front exhaust pipe with primary and main catalytic converter (vehicles with manual transmission), removing and installing** , --> **Right front exhaust pipe with primary and main catalytic converter (vehicles with automatic transmission), removing and installing**.
- Install right coolant pipe --> **Right coolant pipe, removing and installing**.
- Install engine: --> **Engine (vehicles with manual transmission), installing** , --> **Engine (vehicles with automatic transmission), installing**.

Torque specifications

Component	Nm
Exhaust manifold to cylinder head	25 * See note

*Replace nuts.

Exhaust system, installing free of tension

NOTE:

- **Align exhaust system when cold.**

Vehicles without double clamps between center and rear muffler

- Loosen clamping sleeves bolts.

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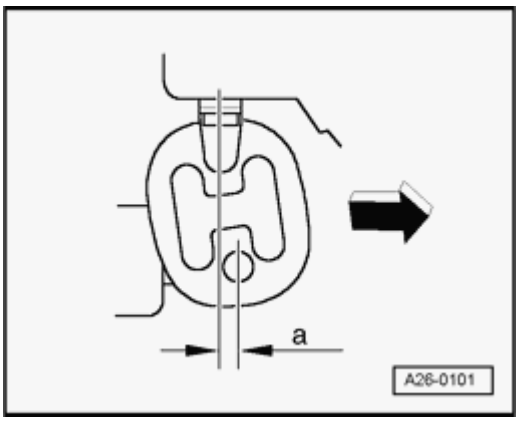


Fig. 853: Pushing Exhaust System Toward Front Of Vehicle
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Push exhaust system far enough forward - **arrow** - until pre-load on retaining loops at right of center muffler - **a** - = 5 to 9 mm.
- Tighten of clamping sleeve threaded connections evenly to 40 Nm.
- Align end pipes **Tailpipes, aligning**.

Vehicles with double clamps between center and rear muffler

NOTE:

- **Only for vehicles with double clamps between center and rear mufflers, the center muffler must also be aligned.**

- Loosen bolts of double clamps and.

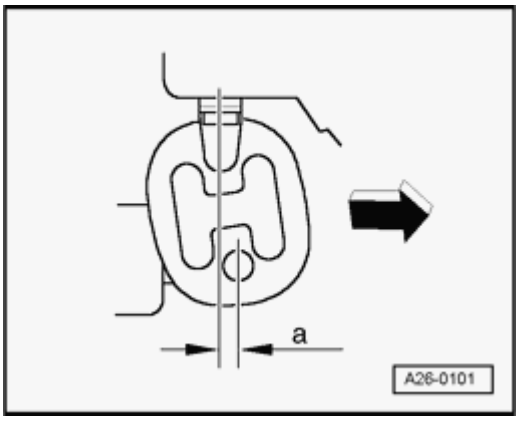


Fig. 854: Pushing Exhaust System Toward Front Of Vehicle
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Push forward part of exhaust system far enough forward - **arrow** - until pre-load on retaining loops on center muffler - **a** - = 5 to 9 mm.
- Tighten threaded connections of front double clamps evenly to 40 Nm.

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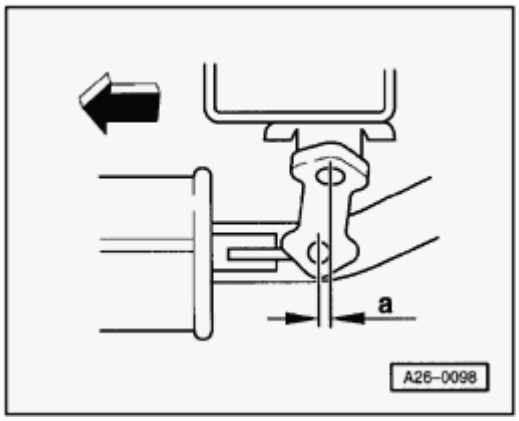


Fig. 855: Pushing Rear Part Of Exhaust System Far Enough Forward Until Pre-Load On Retaining Loops At Rear On Rear Muffler
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Push rear part of exhaust system far enough forward - **arrow** - until pre-load on retaining loops at rear on rear muffler - **a** - = 7 to 11 mm.
- Align rear muffler horizontally.
- Tighten threaded connections of rear double clamps evenly to 40 Nm.
- Align end pipes.

Tailpipes, aligning

- Check distance of end pipes at left and right to bumper:

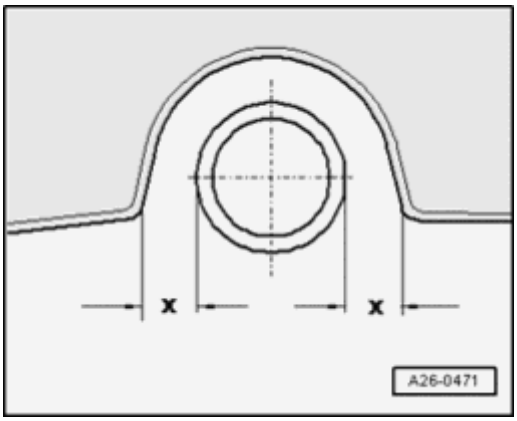


Fig. 856: Checking Distance Of End Pipes At Left/Right To Bumper
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Dimension - **x** - left = dimension - **x** - right.

If necessary, correct dimension x as follows:

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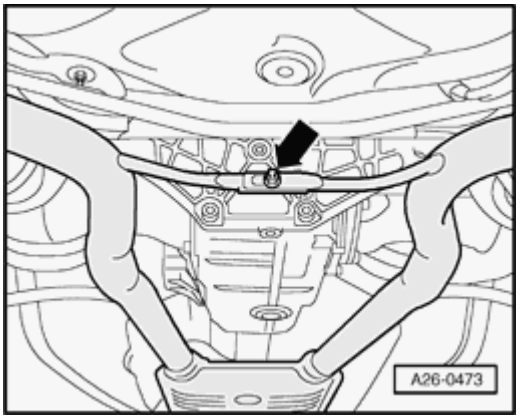


Fig. 857: Loosening Nut Of Brace Between Exhaust Pipes
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Loosen nuts - **arrows** - of brace between exhaust pipes.
- Adjust distance between rear mufflers.
- Tighten nut to 25 Nm.

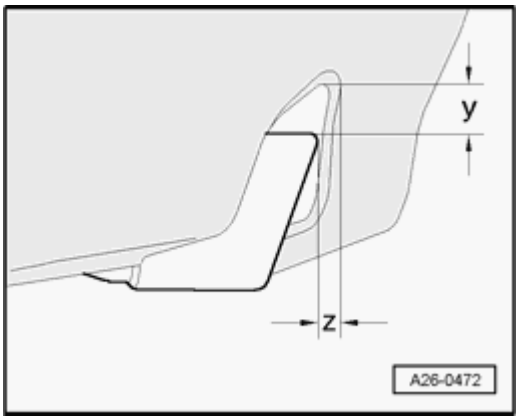


Fig. 858: Checking Distances Of End Pipes To Bumper
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Check distances - **y** - and - **z** - of end pipes to bumper:

- Dimension - **y** - = greater than 20 mm.
- Dimension - **z** - = 10 to 16 mm.

- If necessary, check whether exhaust system is aligned tension-free --> **Exhaust system, installing free of tension**.

Exhaust system, checking for leaks

- Start engine and let run at idle.
- Seal tailpipes with cloths or plug for duration of the leak test.

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- Check for leaks by listening at connection areas of cylinder head/exhaust manifold, exhaust manifold/front exhaust pipe etc.
- Repair leaks detected.

SECONDARY AIR INJECTION (AIR), SERVICING

Secondary Air Injection (AIR), servicing

The Secondary Air Injection (AIR) system heats up the engine faster, and thereby the catalytic converter achieves operation readiness earlier after a cold start.

Principle and function

Principle

Due to the rich mixture during the cold start phase, the exhaust emissions contain an increased level of unburned hydrocarbons. The Secondary Air Injection (AIR) system improves the secondary oxidation within the catalytic converter, thereby reducing harmful emissions. The heat released by secondary oxidation shortens the start-up time of the catalytic converter considerably, as well as significantly improves emissions quality during the cold-running phase.

Function

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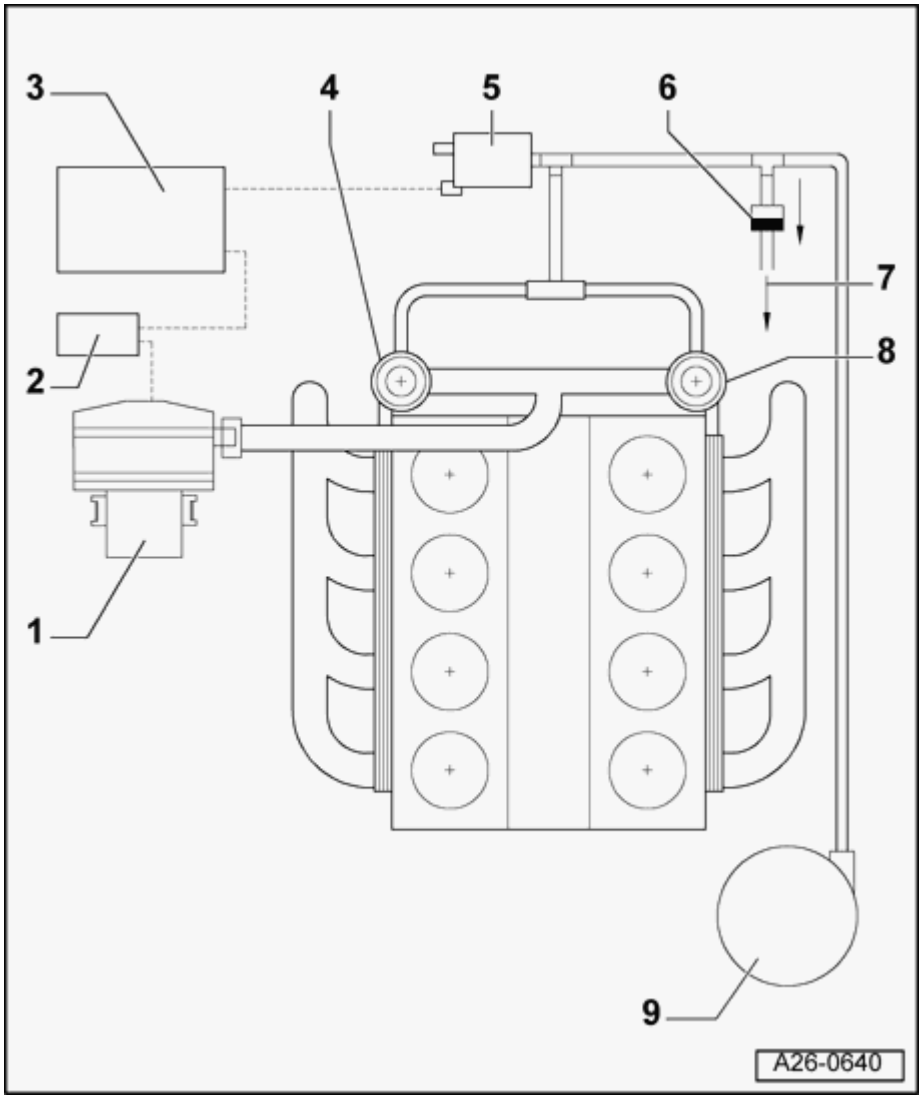


Fig. 859: Secondary Air Injection (Air), Component Overview
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- In the cold start phase, the ECM - **3** - activates secondary air pump - **1** - via relay for secondary air pump - **2** -. Air reaches combination valves for Secondary Air Injection (AIR) - **4** - and - **8** -.
- The Secondary Air Injection (AIR) valve - **5** - is activated in parallel, which allows the vacuum to reach the combination valves for Secondary Air Injection (AIR) - **4** - and - **8** -. The appropriate combination valve for Secondary Air Injection (AIR) thereby opens the path for secondary air to the exhaust channels of the cylinder head.

Secondary Air Injection (AIR), component overview

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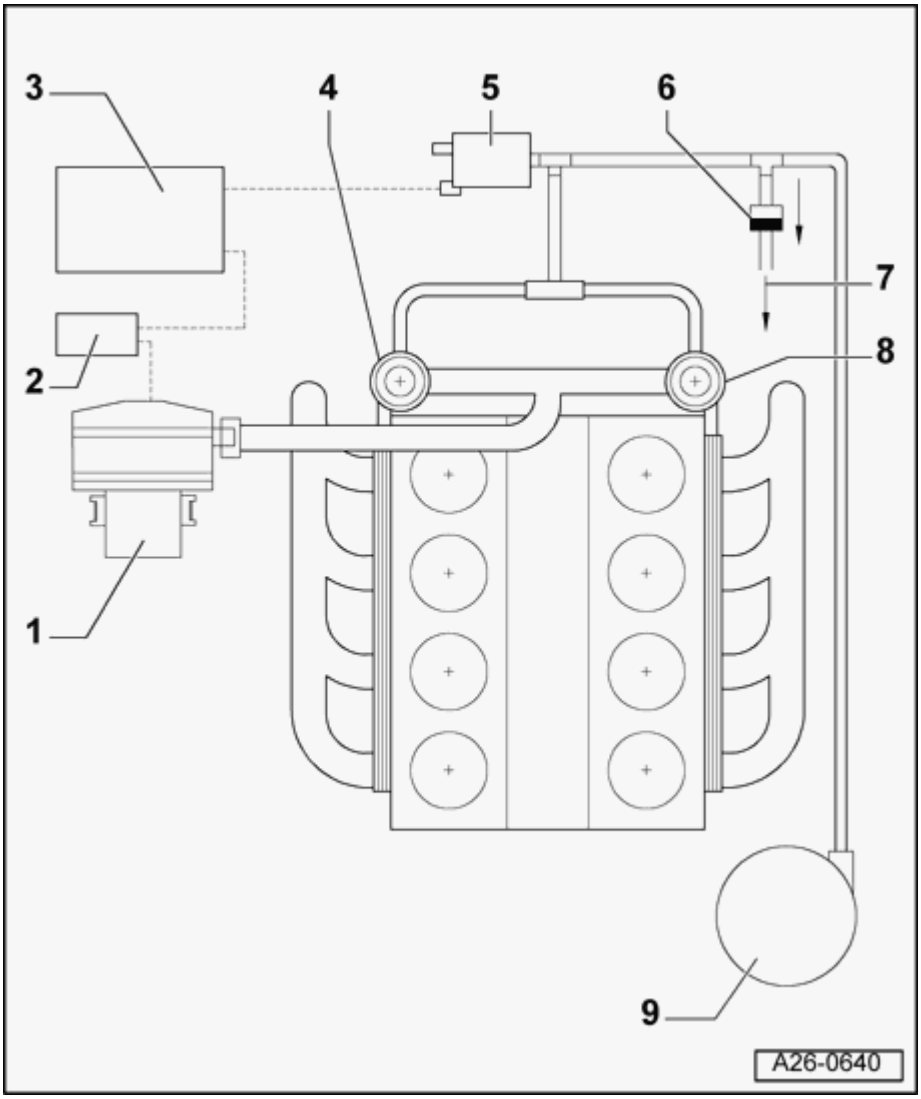


Fig. 860: Secondary Air Injection (Air), Component Overview
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Secondary Air Injection (AIR) Pump Motor V101

- Component location *Component location of* under **Component location of Secondary Air Injection (AIR) Pump Motor V101**
- Removing and installing --> **Secondary Air Injection (AIR) pump, removing and installing**

2 - Secondary Air Injection (AIR) Pump Relay J299

- Component location --> **Component location for Secondary Air Injection (AIR) Pump Relay J299**

3 - Motronic engine control module J220

4 - Right combination valve for Secondary Air Injection (AIR)

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- Component location **Secondary Air Injection (AIR) combi-valve**
- Checking --> **Combination valve for Secondary Air Injection (AIR), checking function and for proper seal**
- Removing and installing --> **Right combination valve for Secondary Air Injection, removing and installing**

5 - Secondary air injection (AIR) solenoid valve N112

- Component location --> **Installation location of Secondary Air Injection (AIR) Solenoid Valve N112**

6 - Non-return valve

- Installed location: - **Arrow** - points in direction of flow, as shown in **Fig. 860**.

7 - To Intake manifold

8 - Left combination valve for Secondary Air Injection (AIR)

- Component location **Secondary Air Injection (AIR) combi-valve**
- Checking --> **Combination valve for Secondary Air Injection (AIR), checking function and for proper seal**
- Removing and installing --> **Left combination valve for Secondary Air Injection, removing and installing**

9 - Vacuum reservoir

- Component location: In left front wheel housing behind wheel housing liner

Installation location of Secondary Air Injection (AIR) Solenoid Valve N112

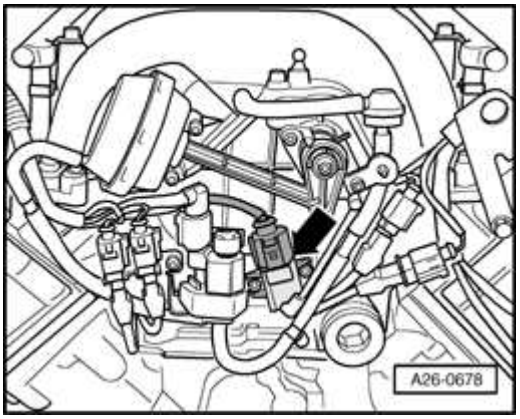


Fig. 861: Installation Location Of Secondary Air Injection (AIR) Solenoid Valve N112
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Front at intake manifold - **arrow** -.

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Component location of Secondary Air Injection (AIR) Pump Motor V101

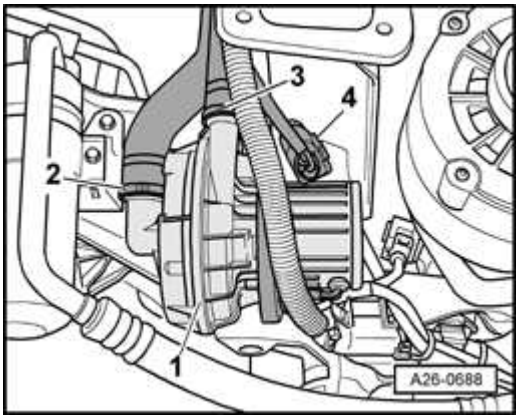


Fig. 862: Component Location Of Secondary Air Injection (AIR) Pump Motor V101
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- At right front in engine compartment below long member.

1 - Secondary Air Injection (AIR) Pump Motor V101

Component location for Secondary Air Injection (AIR) Pump Relay J299

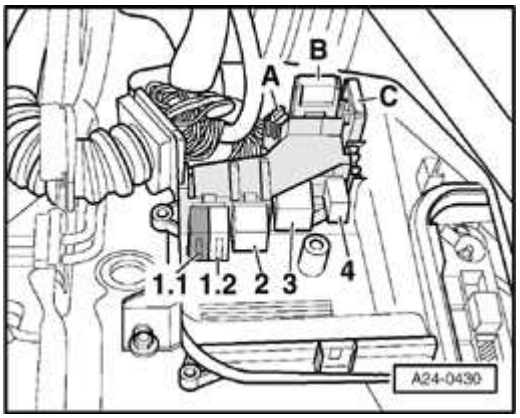


Fig. 863: Component Location For Secondary Air Injection (AIR) Pump Relay J299
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- In E-box, plenum chamber.

2 - Secondary Air Injection (AIR) Pump Relay J299

B - Secondary Air Injection (AIR) Pump Fuse S130

Secondary Air Injection (AIR) combi-valve

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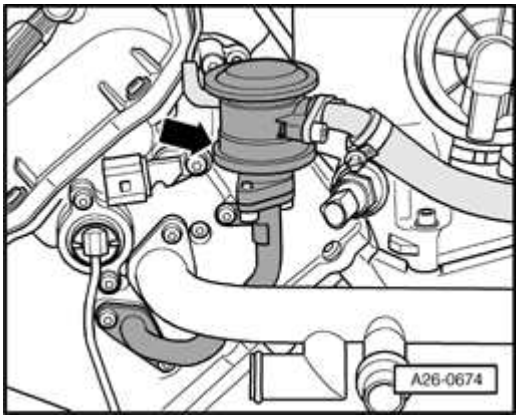


Fig. 864: Secondary Air Injection (AIR) Combi-Valve
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- At rear of cylinder heads.

NOTE:

- **The left combination valve for Secondary Air Injection (AIR) is depicted in the illustration.**

Secondary Air Injection (AIR) pump, removing and installing

Removing

- Bring lock carrier into service position --> **Lock carrier, moving into service position**.
- Remove right auxiliary cooler --> **Right auxiliary cooler, removing and installing**.

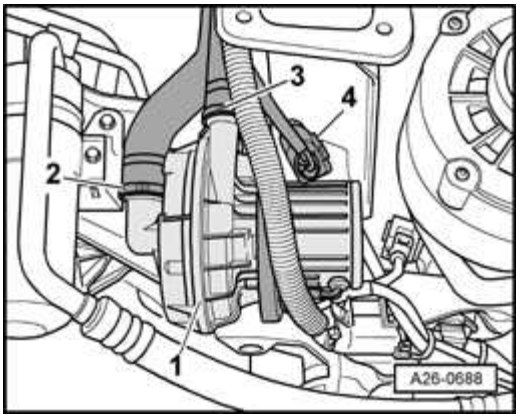


Fig. 865: Disconnecting Hoses At Secondary Air Injection (AIR) Pump
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect hoses - **2** - and - **3** - at Secondary Air Injection (AIR) pump - **1** -.
- Disconnect electrical connector - **4** -.
- Remove nut and remove Secondary Air Injection (AIR) pump from bracket.

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Installing

Installation is in reverse order of removal, note the following:

- Install right auxiliary cooler --> **Right auxiliary cooler, removing and installing**.
- Install lock carrier with attachments -->
  - **50 BODY, FRONT**
  - **50 - BODY - FRONT** for BODY EXTERIOR - CABRIOLET

.

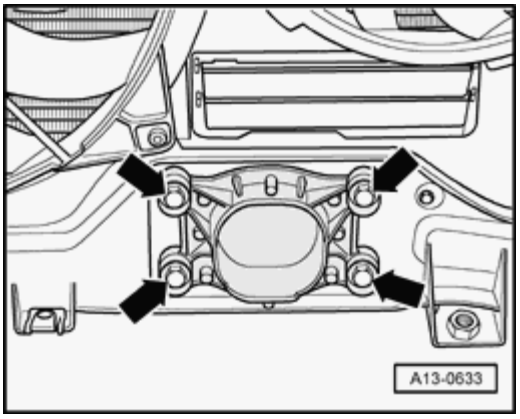


Fig. 866: Placing Torque Support On Rubber Buffer For Torque Support And Tightening Bolts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Place torque support on rubber buffer for torque support and tighten bolts - **arrows** -.
- Install front bumper cover -->
  - **63 BUMPER**
  - **63 - BUMPERS** for BODY EXTERIOR - CABRIOLET

.

- Check headlight adjustment -->
  - **01 - MAINTENANCE**
  - **01 - MAINTENANCE** for MAINTENANCE PROCEDURES - CABRIOLET

.

Torque specifications

Component	Nm
Secondary Air Injection (AIR) pump to bracket	10
Torque support stop to lock carrier	28

Combination valve for Secondary Air Injection (AIR), checking function and for proper seal

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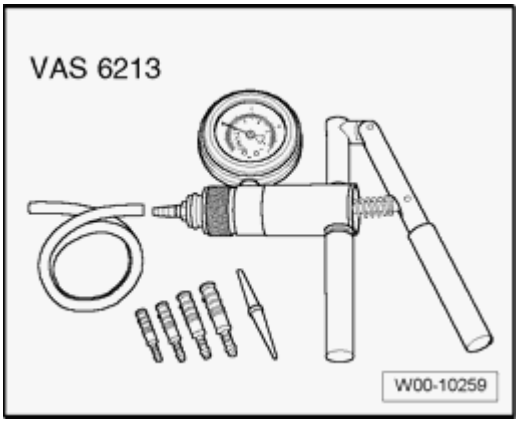


Fig. 867: Identifying Hand Vacuum Pump VAS 6213
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Hand vacuum pump VAS 6213

Test conditions

- Vacuum lines and hose connections free of leaks.
- Vacuum lines not plugged.

Test sequence

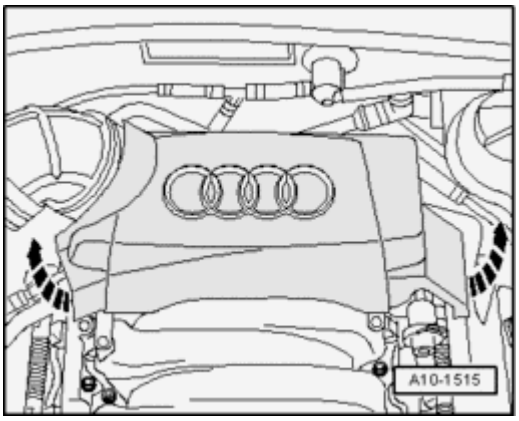


Fig. 868: Removing Rear Engine Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove rear engine cover - **arrows** -.

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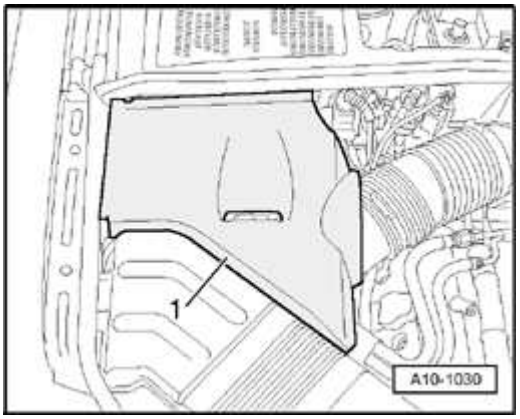


Fig. 869: Removing Cover In Engine Compartment (Right Side)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove cover - **1** - in engine compartment (right side).

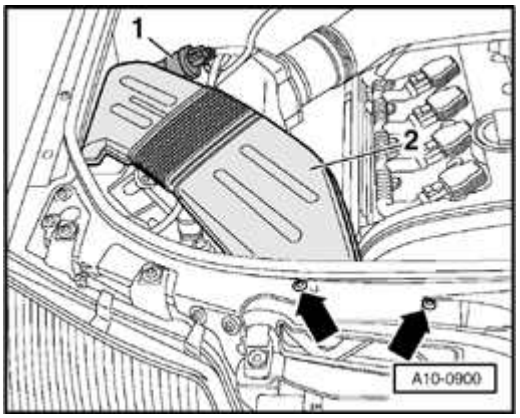
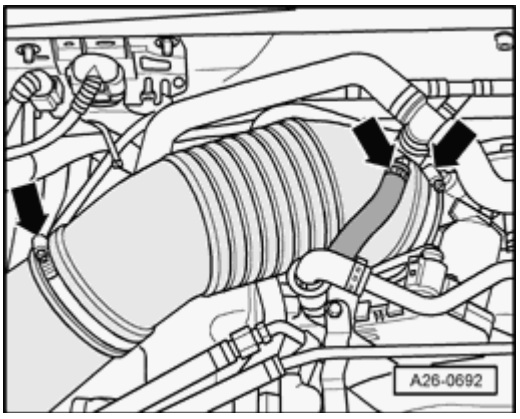


Fig. 870: Identifying Evaporative Emission Canister Purge Regulator Valve N80 And Air Duct
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disengage Evaporative Emission (EVAP) Canister Purge Regulator Valve N80 - **1** - from air guide.
- Remove bolts - **arrows** -.
- Remove air duct - **2** -.



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Fig. 871: Removing Air Guide Hose
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove air guide hose - **arrows** -.

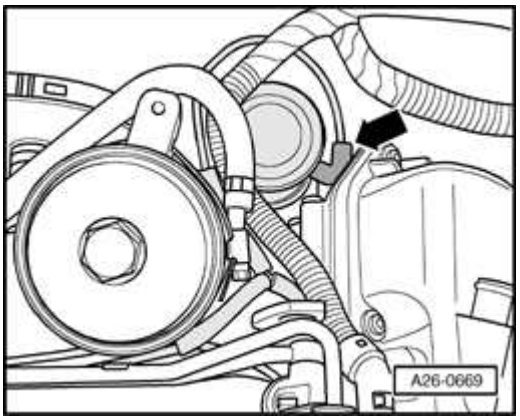


Fig. 872: Disconnecting Vacuum Hose At Combination Valve To Be Tested
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect vacuum hose - **arrow** - at combination valve to be tested.

NOTE:

- **Left combination valve is shown in illustration.**

- Connect hand vacuum pump VAS 6213 to vacuum hose of combination valve to be checked.

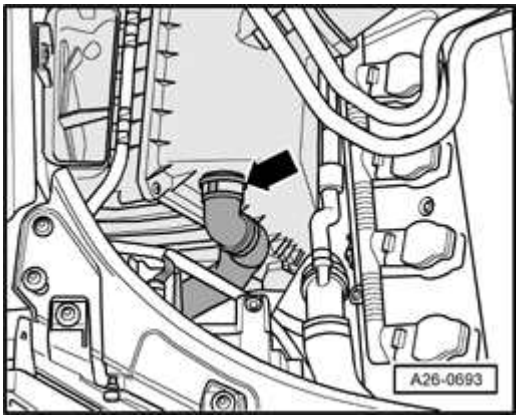


Fig. 873: Disconnecting Hose For Secondary Air Injection (AIR) Pump At Air Filter Housing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect hose - **arrow** - for Secondary Air Injection (AIR) pump at air filter housing, press release buttons to do so.
- Blow with light pressure into pipe (do not use pressurized air).

- Both combination valves must be closed, it must not be possible to blow through hose.

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- Operate hand vacuum pump.

- The relevant combination valve must open, it must not be possible to blow through

If relevant combination valve does not open:

- Replace combination valve: Left --> **Left combination valve for Secondary Air Injection, removing and installing** , right --> **Right combination valve for Secondary Air Injection, removing and installing**.

Left combination valve for Secondary Air Injection, removing and installing

Special tools, testers and auxiliary items required

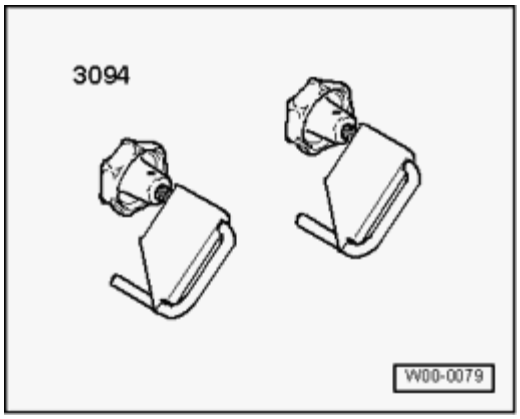


Fig. 874: Identifying Hose Clamps 3094
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Hose clamps up to 25 mm diameter 3094

Removing

NOTE:

- **All cable ties opened or cut during engine removal must be reinstalled at the same locations during installation.**

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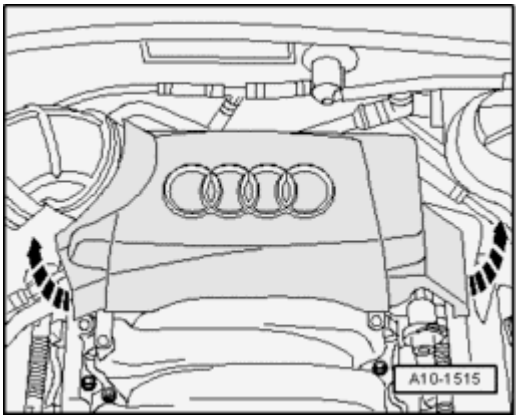


Fig. 875: Removing Rear Engine Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove rear engine cover - **arrows** -.

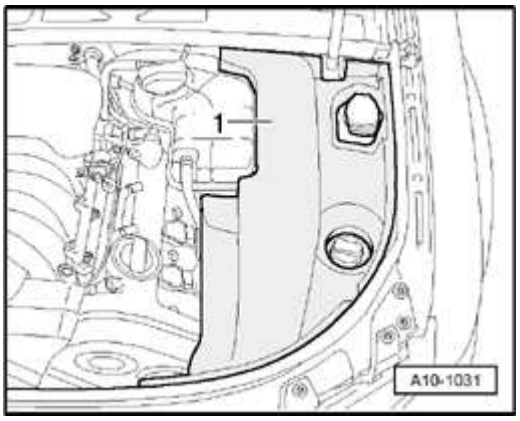


Fig. 876: Removing Cover In Engine Compartment (Left Side)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove cover - **1** - in engine compartment (left side).

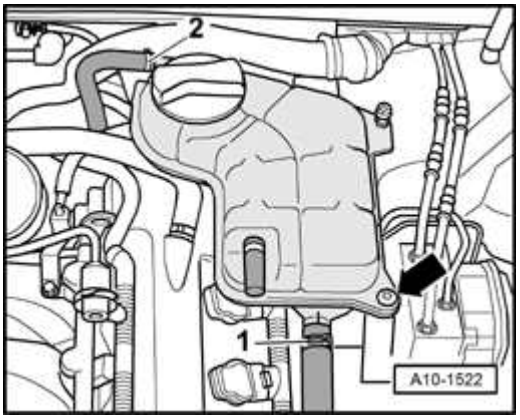


Fig. 877: Removing Coolant Hoses & Coolant Expansion Tank
Courtesy of VOLKSWAGEN UNITED STATES, INC.

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- Clamp off coolant hose - **2** - using Hose clamps up to 25 mm diameter 3094 and disconnect from coolant expansion tank.
- Seal connection using a plug that fits.
- Remove coolant expansion tank - **arrow** -.
- Disconnect electrical wire to Engine Coolant Level (ECL) Warning Switch F66 at bottom on expansion tank and set aside coolant expansion tank with coolant hose - **1** - connected.

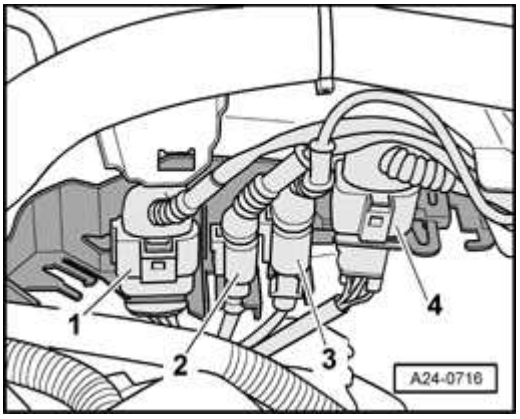


Fig. 878: Removing Bracket For Electrical Harness Connectors At Left From Bulkhead
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove electrical harness connectors - **1 to 4** - from bracket at left of bulkhead.
- Remove bracket from bulkhead.

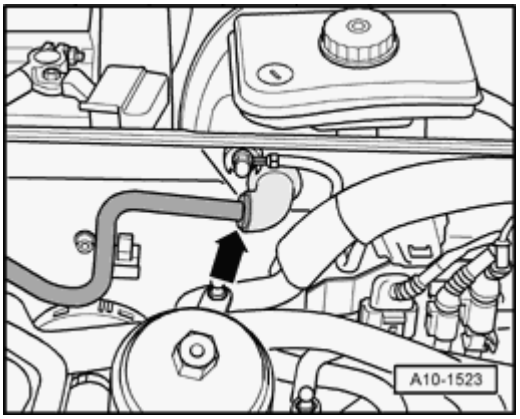


Fig. 879: Disconnecting Brake Booster Vacuum Hose From Grommet On Bulkhead
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect vacuum line - **arrow** - to brake booster at bulkhead.

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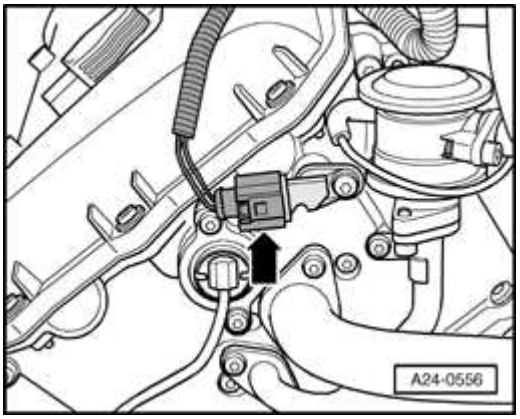


Fig. 880: Disconnecting Electrical Harness Connector For Camshaft Position (CMP) Sensor 2 G163 On Left Cylinder Head
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical harness connector - **arrow** - for Camshaft Position (CMP) Sensor 2 G163 on left cylinder head.

NOTE:

- **Illustration depicts engine from rear.**

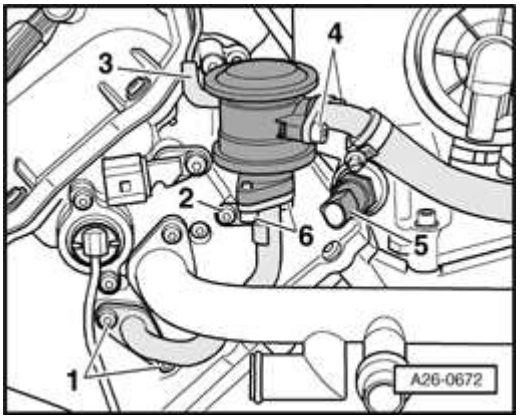


Fig. 881: Disconnect Vacuum Hose, Electrical Harness Connector From Oil Pressure Switch F1, Removing Bolts & Oil Pressure Switch
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect vacuum hose - **3** -.
- Remove bolts - **4** -.
- Disconnect electrical harness connector from Oil Pressure Switch F1 - **5** -.
- Remove oil pressure switch.

- Remove bolts - **1** - and - **2** -.
- Swing combination valve and remove bolts - **6** -.
- Remove combination valve and connecting tube.

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NOTE:

- **Illustration depicts engine from rear.**

Installing

Installation is in reverse order of removal, note the following:

NOTE:

- **Always replace gaskets and seals.**
- **Note installation position of seal between cylinder head and connecting tube.**
- **Secure all hose connections using hose clamps appropriate for the model type .**
- **During installation, all cable ties must be re-installed at the same location.**

- Check coolant level --> **Check coolant level**.

Torque specifications

Component	Nm
Connecting tube to cylinder head	10
Connecting tubes to combination valve	10
Oil pressure switch to oil filter housing	25

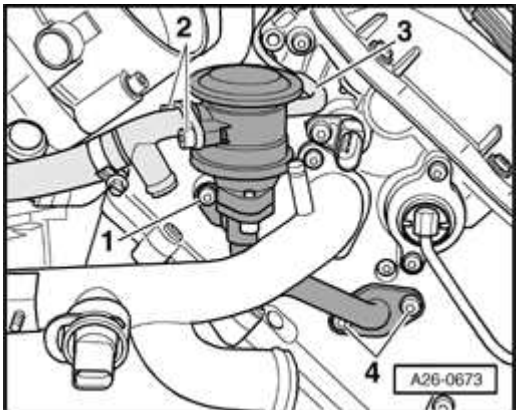
Right combination valve for Secondary Air Injection, removing and installing

Removing

- Remove right coolant pipe --> **Right coolant pipe, removing and installing**.
- Remove engine support bridge 10-222 A from engine compartment.

NOTE:

- **Engine support bridge 10-222 A was necessary to remove right coolant pipe, but it hinders the following work sequence.**



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Fig. 882: Disconnecting Vacuum Hose And Remove Bolts & Combination Valve
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect vacuum hose - **3** -.
- Remove bolts - **1** - , - **2** - and - **4** - and remove combination valve.

NOTE:

- **Illustration depicts engine from rear.**

Installing

Installation is in reverse order of removal, note the following:

NOTE:

- **Replace seals.**

- Install right coolant pipe --> **Right coolant pipe, removing and installing**.

Torque specifications

Component	Nm
Connecting tube to cylinder head	10
Connecting tubes to combination valve	10

EXHAUST FLAP

Exhaust flap, checking

Special tools, testers and auxiliary items required

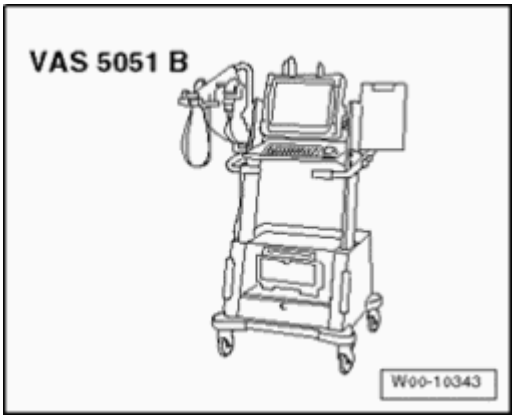


Fig. 883: Identifying Vehicle Diagnosis, Testing And Information System VAS 5051B
Courtesy of VOLKSWAGEN UNITED STATES, INC.

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

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Test sequence

- Let engine run briefly so that the required vacuum for the test is present in vacuum reservoir.
- Switch engine off and connect Vehicle Diagnosis, Testing and Information System VAS 5051B.
- Switch ignition on.
- Press Vehicle Self-Diagnosis button, select vehicle system "01 - Engine electronics" and activate with --> button.

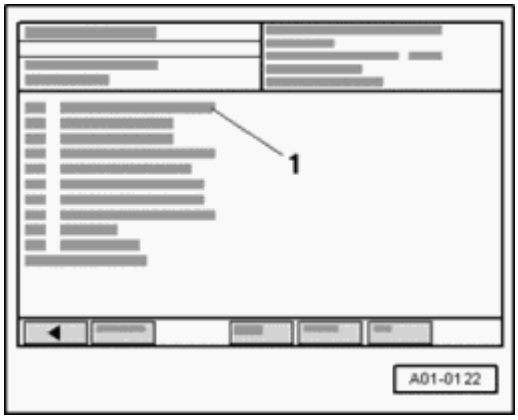


Fig. 884: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS 5051B :

- In selection - **1** - , press "011 - Measured values" and activate by pressing --> button.
- Press --> button repeatedly until Exhaust Flap Valve 1 N321 is activated.

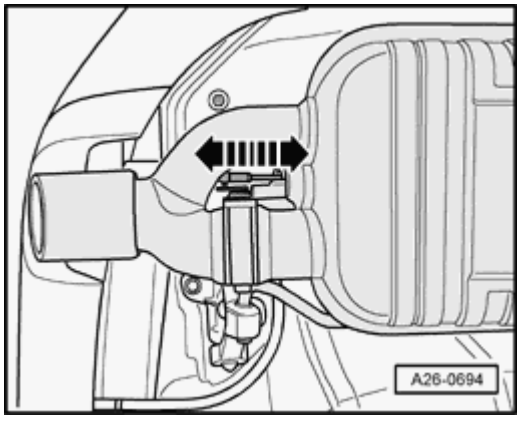


Fig. 885: Generating Vacuum Using Hand Vacuum Pump
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Operating rod - **arrow** - for exhaust flap must move back and forth at both rear mufflers.

If actuator rod does not move:

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- Check exhaust flap vacuum reservoir --> **Exhaust flap vacuum reservoir, checking**.
- Check vacuum line to vacuum reservoir and to Exhaust Flap Valve 1 N321 under left side trim in luggage compartment.
- Check Exhaust Flap Valve 1 N321 in "Guided Fault Finding" operating mode.
- End function "03 - Output Diagnostic Test Mode (DTM)" by pressing <-- button.
- Press "06 - End Output".
- Switch off ignition.

Exhaust flap vacuum reservoir, checking

Special tools, testers and auxiliary items required

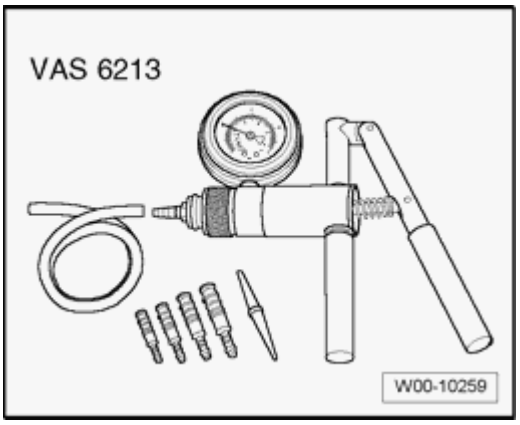
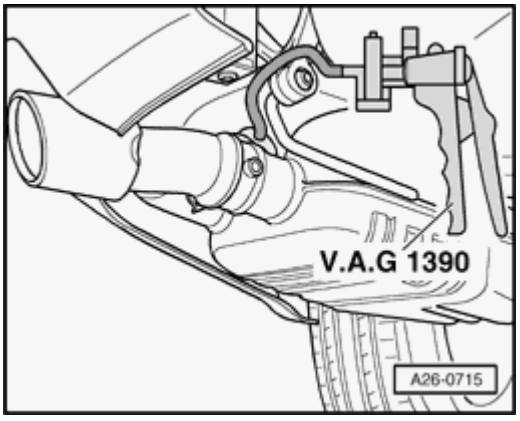


Fig. 886: Identifying Hand Vacuum Pump VAS 6213
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Hand vacuum pump VAS 6213

Test sequence

- Disconnect hose on vacuum diaphragm for exhaust flap at rear muffler.



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Fig. 887: Connecting Hand Vacuum Pump V.A.G 1390 To Vacuum Diaphragm
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect Hand Vacuum Pump V.A.G 1390 to vacuum diaphragm.

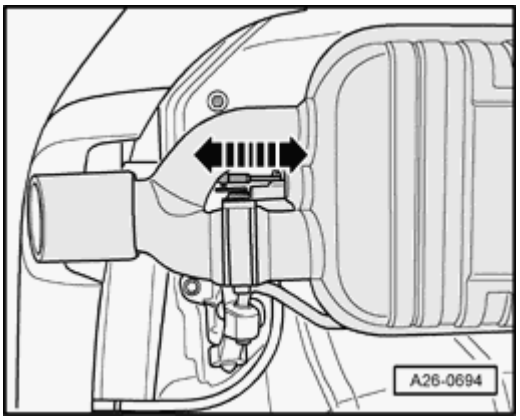


Fig. 888: Generating Vacuum Using Hand Vacuum Pump
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Generate vacuum using hand vacuum pump.
- Linkage must move toward front.
- Vent the hand vacuum pump.
- Linkage must move toward rear.

If linkage does not move:

- Check the linkage for ease of movement and check the vacuum diaphragm for leaks.

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DTC INDEX

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DIAGNOSTIC TROUBLE CODES (DTC) INDEX

DTC Index - 4.2L (BHF Engine)

SAE Code	VAG Code	Code Description	Corrective Action
P0010	16394	Bank 1, Camshaft adjustment malfunction	○ Check Camshaft Adjustment Valve 1 N205 , Camshaft Adjustment Valve 2 N208 , Camshaft Adjustment Valve 1 (exhaust) N318 --> **SOLENOID VALVE 1, CHECKING Camshaft Adjustment Valve 1 N205 and Camshaft Adjustment Valve 2 (exhaust) N208 , checking** .
P0011	16395	Bank 1, camshaft retardation adjustment Specification not reached	
P0012	16396	"A" Camshaft Position - Timing Over-Retarded Bank 1	
P0020	16404	"Intake" Camshaft Position Actuator Circuit, Bank 2	
P0021	16405	"Intake" Camshaft Position - Timing Over-Advanced or System Performance, Bank 2	
P0022	16406	"A" Camshaft Position - Timing Over-Retarded Bank 2	
P0030	16414	HO2S Heater Control Circuit, Bank 1 Sensor 1	○ Check Oxygen Sensor (O2S) Heater Z19 and Oxygen Sensor (O2S) 2 Heater Z28 --> **HEATED OXYGEN SENSOR (HO2S) G39/HEATED OXYGEN SENSOR (HO2S) 2 G108 AND OXYGEN SENSOR REGULATION BEFORE CATALYTIC CONVERTER, CHECKING** --> **Oxygen Sensor (O2S) Heater Z19 f and Oxygen Sensor (O2S) 2 Heater Z28 before catalytic converter, checking.** .
P0031	16415	HO2S Heater Control Circuit Low, Bank 1 Sensor 1	
P0032	16416	HO2S Heater Control Circuit High, Bank 1 Sensor 1	
P0036	16420	HO2S Heater Control Circuit Bank, 1 Sensor 2	
P0037	16421	HO2S Heater Control Circuit Low, Bank 1 Sensor 2	
P0038	16422	HO2S Heater Control Circuit High, Bank 1 Sensor 2	
P0040	16424	O2 Sensor Signals Swapped Bank 1 Sensor 1/ Bank 2 Sensor 1	Note
P0041	16425	O2 Sensor Signals Swapped Bank 1 Sensor 2/ Bank 2 Sensor 2	
P0050	16434	HO2S Heater Control Circuit Bank 2 Sensor 1	○ Check Oxygen Sensor (O2S) Heater Z19 and Oxygen Sensor (O2S) 2 Heater Z28 --> **HEATED OXYGEN SENSOR (HO2S) G39/HEATED OXYGEN**
P0051	16435	HO2S Heater Control Circuit Low Bank 2 Sensor 1	

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P0052	16436	HO2S Heater Control Circuit High Bank 2 Sensor 1	**SENSOR (HO2S) 2 G108 AND OXYGEN SENSOR REGULATION BEFORE CATALYTIC CONVERTER, CHECKING** --> **Oxygen Sensor (O2S) Heater Z19 f and Oxygen Sensor (O2S) 2 Heater Z28 before catalytic converter, checking.** .
P0056	16440	HO2S Heater Control Circuit Bank 2 Sensor 2	
P0057	16441	HO2S Heater Control Circuit Low Bank 2 Sensor 2	
P0058	16442	HO2S Heater Control Circuit High Bank 2 Sensor 2	
P0101	16485	Mass or Volume Air Flow Circuit Range/Performance	○ Check Mass Air Flow (MAF) Sensor G70 --> **Mass Air Flow (MAF) Sensor G70 , checking** .
P0102	16486	Mass or Volume Air Flow Circuit Low Input	
P0103	16487	Mass or Volume Air Flow Circuit High Input	
P0106	16490	Manifold Absolute Pressure/Barometric Pressure Circuit Range/Performance	○ **MOTRONIC ENGINE CONTROL MODULE (ECM) J623 , REPLACING**
P0111	16495	Intake Air Temperature Sensor 1 Circuit Range/Performance	○ Check Intake Air Temperature (IAT) Sensor G42 --> **Mass Air Flow (MAF) Sensor G70 , checking** .
P0112	16496	Intake Air Temperature Sensor 1 Circuit Low	
P0113	16497	Intake Air Temperature Sensor 1 Circuit High	
P0116	16500	Engine Coolant Temperature Circuit Range/Performance	○ Check Engine Coolant Temperature (ECT) Sensor G62 --> **Engine Coolant Temperature (ECT) Sensor G62 , checking** .
P0117	16501	Engine Coolant Temperature Circuit Low	
P0118	16502	Engine Coolant Temperature Circuit High	
P0121	16505	Throttle/Pedal Position Sensor/Switch "A" Circuit Range/Performance	○ Check Throttle Valve Control Module J338 --> **Throttle Position (TP) Sensor G79/Accelerator Pedal Position Sensor 2 G185 , checking** .
P0122	16506	Throttle/Pedal Position Sensor/Switch "A" Circuit Low	
P0123	16507	Throttle/Pedal Position Sensor/Switch "A" Circuit High	
P0130	16514	O2 Sensor Circuit, Bank 1 Sensor 1	○ Check Oxygen Sensor (O2S) Heater Z19 and Oxygen Sensor (O2S) 2 Heater Z28 --> **HEATED OXYGEN SENSOR (HO2S) G39/HEATED OXYGEN SENSOR (HO2S) 2 G108 AND OXYGEN SENSOR REGULATION BEFORE**
P0131	16515	O2 Sensor Circuit Low Voltage, Bank 1 Sensor 1	
P0132	16516	O2 Sensor Circuit High Voltage, Bank 1 Sensor 1	

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P0133	16517	O2 Sensor Circuit Slow Response, Bank 1 Sensor 1	**CATALYTIC CONVERTER, CHECKING** --> **Oxygen Sensor (O2S) Heater Z19 f and Oxygen Sensor (O2S) 2 Heater Z28 before catalytic converter, checking.** .
P0135	16519	O2 Sensor Heater Circuit, Bank 1 Sensor 1	
P0136	16520	O2 Sensor Circuit, Bank 1 Sensor 2	○ Check Oxygen Sensor (O2S) 1 (behind Three Way Catalytic Converter (TWC)) Heater Z29 and Oxygen Sensor (O2S) 2 (behind Three Way Catalytic Converter (TWC)) Heater Z30 behind Three Way Catalytic Converter (TWC) --> **Oxygen Sensor (O2S) 1 (behind Three Way Catalytic Converter (TWC)) Heater Z29 and Oxygen Sensor (O2S) 2 (behind Three Way Catalytic Converter (TWC)) Heater Z30 , checking** .
P0137	16521	O2 Sensor Circuit Low Voltage, Bank 1 Sensor 2	
P0138	16522	O2 Sensor Circuit High Voltage, Bank 1 Sensor 2	
P0139	16523	O2 Sensor Circuit Slow Response, Bank 1 Sensor 2	
P0140	16524	O2 Sensor Circuit No Activity Detected, Bank 1 Sensor 2	
P0141	16525	O2 Sensor Heater Circuit, Bank 1 Sensor 2	
P0150	16534	O2 Sensor Circuit Bank 2 Sensor 1	○ Check Oxygen Sensor (O2S) Heater Z19 and Oxygen Sensor (O2S) 2 Heater Z28 --> **HEATED OXYGEN SENSOR (HO2S) G39/HEATED OXYGEN SENSOR (HO2S) 2 G108 AND OXYGEN SENSOR REGULATION BEFORE CATALYTIC CONVERTER, CHECKING** --> **Oxygen Sensor (O2S) Heater Z19 f and Oxygen Sensor (O2S) 2 Heater Z28 before catalytic converter, checking.** .
P0151	16535	O2 Sensor Circuit Low Voltage Bank 2 Sensor 1	
P0152	16536	O2 Sensor Circuit High Voltage Bank 2 Sensor 1	
P0153	16537	O2 Sensor Circuit Slow Response Bank 2 Sensor 1	
P0155	16539	O2 Sensor Heater Circuit Bank 2 Sensor 1	
P0156	16540	O2 Sensor Circuit Bank 2 Sensor 2	○ Check Oxygen Sensor (O2S) 1 (behind Three Way Catalytic Converter (TWC)) Heater Z29 and Oxygen Sensor (O2S) 2 (behind Three Way Catalytic Converter (TWC)) Heater Z30 behind Three Way Catalytic Converter (TWC) --> **OXYGEN SENSOR (O2S) BEHIND THREE WAY CATALYTIC CONVERTER (TWC) G130/OXYGEN SENSOR (O2S) 2 BEHIND THREE WAY CATALYTIC**
P0157	16541	O2 Sensor Circuit Low Voltage Bank 2 Sensor 2	
P0158	16542	O2 Sensor Circuit High Voltage Bank 2 Sensor 2	
		O2 Sensor Circuit Slow Response Bank 2 Sensor 2	

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P0159	16543		**CONVERTER (TWC) G131 AND OXYGEN SENSOR REGULATION BEHIND CATALYTIC CONVERTER, CHECKING** --> **Oxygen Sensor (O2S) 1 (behind Three Way Catalytic Converter (TWC)) Heater Z29 and Oxygen Sensor (O2S) 2 (behind Three Way Catalytic Converter (TWC)) Heater Z30 , checking** .
P0160	16544	O2 Sensor Circuit No Activity Detected Bank 2 Sensor 2	
P0161	16545	O2 Sensor Heater Circuit Bank 2 Sensor 2	
P0171	16555	System Too Lean, Bank 1	○ Check fuel pump delivery and quantity. ○ Check fuel injectors N30, N31, N32, N33, N83, N84, N85, N86 --> **Fuel Injectors N30, N31, N32, N33, N83, N84, N85, N86 , checking** . ○ Check intake system for leaks (false air). ○ Check exhaust system for proper seal. ○ Check vacuum lines for leaks
P0172	16556	System Too Rich, Bank 1	
P0174	16558	System Too Lean Bank 2	
P0175	16559	System Too Rich Bank 2	
P0201	16585	Injector Circuit/Open - Cylinder 1	○ Check fuel injectors N30, N31, N32, N33, N83, N84, N85, N86 --> **Fuel Injectors N30, N31, N32, N33, N83, N84, N85, N86 , checking** .
P0202	16586	Injector Circuit/Open - Cylinder 2	
P0203	16587	Injector Circuit/Open - Cylinder 3	
P0204	16588	Injector Circuit/Open - Cylinder 4	
P0205	16589	Cylinder 5 Fuel Injector N83 Electrical malfunction	
P0206	16590	Cylinder 6 Fuel Injector N84 Electrical malfunction	
P0207	16591	Injector Circuit/Open - Cylinder 7	
P0208	16592	Injector Circuit/Open - Cylinder 8	
P0221	16605	Throttle/Pedal Position Sensor/Switch "B" Circuit Range/Performance	○ Check Throttle Valve Control Module J338 --> **Throttle Position (TP) Sensor G79/Accelerator Pedal Position Sensor 2 G185 , checking** .
P0222	16606	Throttle/Pedal Position Sensor/Switch "B" Circuit Low	
P0223	16607	Throttle/Pedal Position Sensor/Switch "B" Circuit High	
P0230	16614	Fuel Pump Primary Circuit	J17 - Fuel Pump (FP) Relay Fuel Pump (FP) Relay -J17- and activation checking

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			Overview of component locations
P0261	16645	Cylinder 1 Injector Circuit Low	○ Check fuel injectors N30, N31, N32, N33, N83, N84, N85, N86 --> **Fuel Injectors N30, N31, N32, N33, N83, N84, N85, N86 , checking** .
P0262	16646	Cylinder 1 Injector Circuit High	
P0264	16648	Cylinder 2 Injector Circuit Low	
P0265	16649	Cylinder 2 Injector Circuit High	
P0267	16651	Cylinder 3 Injector Circuit Low	
P0268	16652	Cylinder 3 Injector Circuit High	
P0270	16654	Cylinder 4 Injector Circuit Low	
P0271	16655	Cylinder 4 Injector Circuit High	
P0273	16657	Cylinder 5 Fuel Injector N83 Short to Ground (GND)	
P0274	16658	Cylinder 5 Fuel Injector N83 Short to positive	
P0276	16660	Cylinder 6 Fuel Injector N84 Short to Ground (GND)	
P0277	16661	Cylinder 6 Fuel Injector N84 Short to positive	
P0279	16663	Cylinder 7 Injector Circuit Low	
P0280	16664	Cylinder 7 Injector Circuit High	
P0282	16666	Cylinder 8 Injector Circuit Low	
P0283	16667	Cylinder 8 Injector Circuit High	
P0300	16684	Random/Multiple Cylinder Misfire Detected	○ Check fuel injectors N30, N31, N32, N33, N83, N84, N85, N86 --> **Fuel Injectors N30, N31, N32, N33, N83, N84, N85, N86 , checking** . ○ Check Ignition Coils with Power Output Stage N70, N127, N291, N292, N323, N324, N325, N326 --> **Ignition Coils with Power Output Stage N70, N127, N291, N292, N323, N324, N325, N326 , checking** .
P0301	16685	Cylinder 1 Misfire Detected	
P0302	16686	Cylinder 2 Misfire Detected	
P0303	16687	Cylinder 3 Misfire Detected	
P0304	16688	Cylinder 4 Misfire Detected	
P0305	16689	Cyl. 5 misfire detected	
P0306	16690	Cyl. 6 misfire detected	
P0307	16691	Cylinder 7 Misfire Detected	
P0308	16692	Cylinder 8 Misfire Detected	
P0321	16705	Ignition/Distributor Engine Speed Input Circuit Range/Performance	○ Check Engine Speed (RPM) Sensor G28 --> **Engine Speed (RPM) Sensor G28 , checking** .
P0322	16706	Ignition/Distributor Engine Speed Input Circuit No Signal	
P0340	16724	Camshaft Position Sensor "A" Circuit, Bank 1 or Single Sensor	
P0341	16725	Camshaft Position Sensor "A" Circuit Range/Performance, Bank 1 or Single Sensor	
P0342	16726	Camshaft Position Sensor "A" Circuit	

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		Low, Bank 1 or Single Sensor	
P0343	16727	Camshaft Position Sensor "A" Circuit High, Bank 1 or Single Sensor	
P0345	16729	Camshaft Position Sensor "A" Circuit Bank 2	○ Check Camshaft Position (CMP) Sensor G40 --> **Camshaft Position (CMP) Sensor G40 and Camshaft Position (CMP) Sensor 2 G163 , checking** .
P0346	16730	Camshaft Position Sensor "A" Circuit Range/Performance Bank 2	
P0347	16731	Camshaft Position Sensor "A" Circuit Low Bank 2	
P0348	16732	Camshaft Position Sensor "A" Circuit High Bank 2	
P0351	16735	Ignition Coil "A" Primary/Secondary Circuit	
P0352	16736	Ignition Coil "B" Primary/Secondary Circuit	
P0353	16737	Ignition Coil "C" Primary/Secondary Circuit	○ Check Ignition Coils with Power Output Stage N70, N127, N291, N292, N323, N324, N325, N326 --> **Ignition Coils with Power Output Stage N70, N127, N291, N292, N323, N324, N325, N326 , checking** .
P0354	16738	Ignition Coil "D" Primary/Secondary Circuit	
P0355	16739	Ignition Coil "E" Primary/Secondary Circuit	
P0356	16740	Ignition Coil "F" Primary/Secondary Circuit	
P0357	16741	Ignition Coil "G" Primary/Secondary Circuit	
P0358	16742	Ignition Coil "H" Primary/Secondary Circuit	
P0412	16796	Secondary Air Injection System Switching Valve "A" Circuit	
P0413	16797	Secondary Air Injection solenoid valve N112 Open	○ Check Secondary Air Injection (AIR) Pump Relay -J299- --> **Secondary Air Injection (AIR) Pump Relay -J299- , checking**
P0414	16798	Secondary Air Injection solenoid valve N112 Short circuit	
P0418	16802	Secondary Air Injection System Control "A" Circuit	
P0421	16805	Warm Up Catalyst Efficiency Below Threshold, Bank 1	○ Check Three Way Catalytic Converter (TWC) --> **TEST-ID 01 ($01): OXYGEN SENSOR IN FRONT OF CATALYTIC CONVERTER BANK 1 - SENSOR 1.** --> **Three Way Catalytic Converter (TWC), checking**
P0431	16815	Warm Up Catalyst Efficiency Below Threshold, Bank 2	
		Evaporative Emission System Incorrect	

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P0441	16825	Purge Flow	○ Check Evaporative Emission (EVAP) Canister Purge Regulator Valve N80 --> **Evaporative Emission (EVAP) Canister Purge Regulator Valve N80 , checking** . ○ Check Evaporative Emission (EVAP) Canister System for proper seal --> **Evaporative Emission (EVAP) canister system, checking for proper seal** .
P0442	16826	Evaporative Emission System Leak Detected (small leak)	
P0443	16827	Evaporative Emission System Purge Control Valve Circuit	
P0444	16828	Evaporative Emission System Purge Control Valve Circuit Open	
P0445	16829	Evaporative Emission System Purge Control Valve Circuit Shorted	
P0455	16839	Evaporative Emission System Leak Detected (large leak)	
P0456	16840	Evaporative Emission System Leak Detected (very small leak)	
P0458	16842	Evaporative Emission System Purge Control Valve Circuit Low	
P0459	16843	Evaporative Emission System Purge Control Valve Circuit High	
P0491	16875	Secondary Air Injection System Insufficient Flow Bank 1	○ Check Secondary Air Injection (AIR) Pump Relay -J299- --> **Secondary Air Injection (AIR) Pump Relay -J299- , checking**
P0492	16876	Secondary Air Injection System Insufficient Flow Bank 2	
P0501	16885	Vehicle Speed Sensor "A" Range/Performance	Vehicle Speed Signal Speed signal checking
P0506	16890	Idle Air Control System RPM Lower Than Expected	○ Check Throttle Valve Control Module J338 --> **Throttle Valve Control Module J338 , checking** .
P0507	16891	Idle Air Control System RPM Higher Than Expected	
P0601	16985	Internal Control Module Memory Check Sum Error	○ Replace the Engine Control Module (ECM) J623 --> **Motronic Engine Control Module (ECM) J623 , replacing** .
P0602	16986	Control Module Programming Error/Malfunction	
P0604	16988	Internal Control Module Random Access Memory (RAM) Error	
P0605	16989	Internal Control Module Read Only Memory (ROM) Error	
P0606	16990	ECM/PCM Processor	
P0638	17022	Throttle Actuator Control Range/Performance	○ Check Throttle Valve Control Module J338 --> **Throttle Valve Control Module J338 , checking** . ○ Check Throttle Position (TP) Sensor G79/Accelerator Pedal Position Sensor 2 G185 --> **Throttle Position (TP) Sensor G79/Accelerator Pedal Position**

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			Sensor 2 G185 , checking .
P0685	17069	ECM/PCM Power Relay Control Circuit/Open	○ Check voltage supply for Engine Control Module (ECM) J623 --> **Voltage supply, checking** . ○ Check activation of Motronic Engine Control Module (ECM) Power Supply Relay J271 --> **Motronic Engine Control Module (ECM) J623** .
P0686	17070	ECM/PCM Power Relay Control Circuit Low	
P0687	17071	ECM/PCM Power Relay Control Circuit High	
P0688	17072	Power supply relay J271 , load circuit open	
P2096	18528	Post Catalyst Fuel Trim System Too Lean, Bank 1	○ Check Oxygen Sensor (O2S) Heater Z19 and Oxygen Sensor (O2S) 2 Heater Z28 --> **Oxygen Sensor (O2S) Heater Z19 f and Oxygen Sensor (O2S) 2 Heater Z28 before catalytic converter, checking.** . ○ Check Oxygen Sensor (O2S) 1 (behind Three Way Catalytic Converter (TWC)) Heater Z29 and Oxygen Sensor (O2S) 2 (behind Three Way Catalytic Converter (TWC)) Heater Z30 behind Three Way Catalytic Converter (TWC) --> **Oxygen Sensor (O2S) 1 (behind Three Way Catalytic Converter (TWC)) Heater Z29 and Oxygen Sensor (O2S) 2 (behind Three Way Catalytic Converter (TWC)) Heater Z30 , checking** .
P2097	18529	Post Catalyst Fuel Trim System Too Rich	
P2098	18530	Post Catalyst Fuel Trim System Too Lean Bank 2	
P2099	18531	Post Catalyst Fuel Trim System Too Rich Bank 2	
P2101	18533	Throttle Actuator Control Motor Circuit Range/Performance	○ Check Throttle Valve Control Module J338 --> **Throttle Valve Control Module J338 , checking** .
P2106	18538	Throttle Actuator Control System, Forced Limited Power	
P2122	18554	Throttle/Pedal Position Sensor/Switch "D" Circuit Low Input	○ Check Throttle Position (TP) Sensor G79/Accelerator Pedal Position Sensor 2 G185 --> **Throttle Position (TP) Sensor G79/Accelerator Pedal Position Sensor 2 G185 , checking** .
P2123	18555	Throttle/Pedal Position Sensor/Switch "D" Circuit High Input	
P2127	18559	Throttle/Pedal Position Sensor/Switch "E" Circuit Low Input	
P2128	18560	Throttle/Pedal Position Sensor/Switch "E" Circuit High Input	
P2138	18570	Throttle/Pedal Position Sensor/Switch "D" / "E" Voltage Correlation	
		Cooling System Performance	○ Check Engine Coolant Temperature

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P2181	18613		(ECT) Sensor G62 --> **Engine Coolant Temperature (ECT) Sensor G62 , checking** .
P2195	18627	O2 Sensor Signal Stuck Lean Bank 1 Sensor 1	**HEATED OXYGEN SENSOR (HO2S) G39/HEATED OXYGEN SENSOR (HO2S) 2 G108 AND OXYGEN SENSOR REGULATION BEFORE CATALYTIC CONVERTER, CHECKING**
P2196	18628	O2 Sensor Signal Stuck Rich Bank 1 Sensor 1	
P2197	18629	O2 Sensor Signal Stuck Lean Bank 2 Sensor 1	
P2198	18630	O2 Sensor Signal Stuck Rich Bank 2 Sensor 1	
P2231	18663	O2 Sensor Signal Circuit Shorted to Heater Circuit Bank 1 Sensor 1	**OXYGEN SENSOR (O2S) HEATER Z19 F AND OXYGEN SENSOR (O2S) 2 HEATER Z28 BEFORE CATALYTIC CONVERTER, CHECKING.**
P2234	18666	O2 Sensor Signal Circuit Shorted to Heater Circuit Bank 2 Sensor 1	
P2237	18669	O2 Sensor Positive Current Control Circuit/Open Bank 1 Sensor 1	**HEATED OXYGEN SENSOR (HO2S) G39/HEATED OXYGEN SENSOR (HO2S) 2 G108 AND OXYGEN SENSOR REGULATION BEFORE CATALYTIC CONVERTER, CHECKING**
P2240	18672	O2 Sensor Positive Current Control Circuit/Open Bank 2 Sensor 1	
P2243	18675	O2 Sensor Reference Voltage Circuit/Open, Bank 1 Sensor 1	
P2247	18679	O2 Sensor Reference Voltage Circuit/Open Bank 2 Sensor 1	
P2251	18683	O2 Sensor Negative Current Control Circuit/Open, Bank 1 Sensor 1	
P2254	18686	O2 Sensor Negative Current Control Circuit/Open Bank 2 Sensor 1	
P2257	18689	Secondary Air Injection System Control "A" Circuit Low	J299 - Secondary Air Injection (AIR) Pump Relay Secondary Air Injection (AIR) pump relay -J299- and activation, checking Secondary Air Injection (AIR), Component overview
P2258	18690	Secondary Air Injection System Control "A" Circuit High	
P2400	18832	Evaporative Emission System Leak Detection Pump Control Circuit/Open	○ Check Leak Detection Pump (LDP) V144. --> **Leak Detection Pump (LDP) V144 , checking** ○ Check Evaporative Emission (EVAP) Canister System for proper seal --> **Evaporative Emission (EVAP) canister system, checking for proper seal** .
P2401	18833	Evaporative Emission System Leak Detection Pump Control Circuit Low	
P2402	18834	Evaporative Emission System Leak Detection Pump Control Circuit High	
P2403	18835	Evaporative Emission System Leak Detection Pump Sense Circuit/Open	
P2404	18836	Evaporative Emission System Leak Detection Pump Sense Circuit Range/Performance	

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P2414	18846	O2 Sensor Exhaust Sample Error Bank 1 Sensor 1	**HEATED OXYGEN SENSOR (HO2S) G39/HEATED OXYGEN SENSOR (HO2S) 2 G108 AND OXYGEN SENSOR REGULATION BEFORE CATALYTIC CONVERTER, CHECKING** Intake system for leaks (false air) checking
P2415	18847	O2 Sensor Exhaust Sample Error Bank 2 Sensor 1	
P2626	19058	O2 Sensor Pumping Current Trim Circuit/Open Bank 1 Sensor 1	**HEATED OXYGEN SENSOR (HO2S) G39/HEATED OXYGEN SENSOR (HO2S) 2 G108 AND OXYGEN SENSOR REGULATION BEFORE CATALYTIC CONVERTER, CHECKING**
P2629	19061	O2 Sensor Pumping Current Trim Circuit/Open Bank 2 Sensor 1	
P3081	19537	Engine Temperature Too Low	Cooling System Operation Cooling system components overview
U0001	28673	High Speed CAN Communication Bus	○ Check terminal resistance of CAN-Bus --> **CAN-Bus terminal resistance, checking** .
U0101	28773	Lost Communication With TCM	
U0155	28827	Lost Communication With Instrument Panel Cluster (IPC) Control Module	
U0302	28974	Software Incompatibility with Transmission Control Module	○ Replace Transmission Control Module (TCM) J217 --> **Transmission Control Module (TCM) J217 , replacing** .

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