Workshop Manual

Crafter 2006 ➤

4-cylinder diesel engine (2 l engine, common rail)									
Engine ID	CKT B	CKT C	CKU B	CKU C	CSLB	CSN	CSLA	CSL C	

Edition 03.2016

List of Workshop Manual Repair Groups

Repair Group

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

Contents

00 – Technical data

1 Safety instructions

(VRL008949; Edition 03.2016)

1.1 Safety precautions when working on fuel supply system

WARNING

When doing any repair work, especially in the engine compartment, pay attention to the following due to the cramped conditions:

- *Route lines of any kind so that the original routing can be restored.*
- *Ensure that there is sufficient clearance to all moving or hot components.*
- *The fuel and the fuel lines in the fuel system can become very hot (danger of scalding)!*
- *The fuel system is also under pressure! Before opening the system, wrap a cloth around the connection and carefully loosen to release the pressure!*
- *Wear eye and hand protection when performing any type of repair work on the fuel system!*

When removing and installing fuel gauge sender or fuel pump (fuel delivery unit) from a full or partly full fuel tank, observe the following:

- Place the suction hose of an activated exhaust gas extraction system close to the assembly opening of the fuel tank to extract any fuel vapours that are released. If no exhaust gas extraction system is available, a radial fan with a displacement greater than 15 m^3/h can be used providing that motor is not in air flow.
- Prevent skin contact with fuel! Wear fuel-resistant gloves!

1.2 Safety precautions when working on charge air system

WARNING

When doing any repair work, especially in the engine compartment, pay attention to the following due to the cramped conditions:

- *Route all the various lines (e.g. for fuel, hydraulics, activated charcoal filter system, coolant and refrigerant, brake fluid and vacuum) and electrical wiring in their original positions.*
- *Ensure that there is sufficient clearance to all moving or hot components.*

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

- Test equipment must always be secured on the rear seat and operated by a second person.

If test and measuring instruments are operated from front passenger seat and the vehicle is involved in an accident, there is a possibility that the person sitting in this seat may receive serious injuries when the airbag is triggered.

1.3 Safety precautions when working on fuel supply system

Caution

Due to the enclosed spaces, observe the following during all assembly work, particularly in the engine compartment:

- *Route lines of any kind and cables so that original routing can be restored.*
- *Ensure that there is sufficient clearance to all moving or hot components.*

To prevent injuries to persons and/or destruction of the injection and glow plug system, the following must be noted:

- With piezo systems and control devices, high voltages can occur in some cases. Directly touching certain components can therefore result in injury due to electric shock.
- Persons with a cardiac pacemaker should keep away from hazardous area where there are high-voltage systems, e.g. piezo systems, xenon light.
- Always switch off the ignition before connecting or disconnecting electrical wiring of injection and glow plug system or connecting/disconnecting tester cables.
- It must be ensured that no fuel lines are open when the engine is running.
- Wash the engine only with the ignition switched off.
- During some tests, it is possible that entries will be stored in the event memory of the engine control unit. After completion of all checks and repairs, therefore, the event memory must be read and if necessary deleted ⇒ Vehicle diagnostic tester.

1.4 Safety precautions when working on the SCR system

WARNING

Danger of skin irritation due to reducing agent.

- *Do not allow reducing agent to come into contact with skin or eyes! Always wear protective gloves and safety goggles.*
- *If reducing agent gets onto the skin, wash with soap and water.*
- *If reducing agent gets into the eyes, rinse with water for several minutes.*
- *Do not breathe in or swallow reducing agent!*
- *If you have swallowed reducing agent, rinse out your mouth, drink a lot of water and immediately go to the medical office or inform a doctor.*

Caution

Make sure that no reducing agent gets onto the trim panels or parts of vehicle body.

If this occurs, wash out reducing agent using clear water and a lint-free cotton cloth.

If the reduction agent has already crystallised, use warm water and a sponge.

Reduction agent that has not been removed will crystallise and damage the surface after some time.

For information on storage and disposal, see ⇒ Service net → Environment → Workshop disposal . For country specific information about storage and disposal, ask the importer.

1.5 Safety precautions during road tests in which test and measuring equipment is used

WARNING

Danger of accidents due to distraction because of inadequately secured testing and measuring equipment!

Danger due to triggering of front passenger airbag in the even of an accident!

- *Using testing and measuring equipment while the vehicle is moving leads to distraction.*
- *Increased risk of injury due to inadequately secured testing and measuring devices!*
- *Always strap test and measuring instruments in place on rear seat and have a 2nd person operate them.*

1.6 Safety precautions when working on vehicles with a start/stop system

WARNING

Risk of injury from automatic start of engine belonging to vehicles with start/stop system!

- *In the case of vehicles with activated start/stop system (indicated by a message in the dash panel insert), it is possible that the engine will start automatically when necessary.*
- *Always ensure that the start/stop system is deactivated when working on vehicle (switch ignition off, switch ignition on again as required).*

1.7 Safety precautions during work on fuel system

WARNING

Danger of scalding due to very hot fuel!

- *In extreme cases the fuel lines and fuel can reach a temperature of 100 °C in vehicles with a common rail engine after the engine has been switched off. Allow the fuel to cool down before disconnecting the lines - danger of scalding.*
- *Wear protective gloves.*
- *Wear eye protection.*

Risk of injury due to highly-pressurised fuel.

- *Wrap a clean cloth around the connection before opening the fuel system. Then release pressure by carefully loosening the connection.*
- *Wear protective gloves.*
- *Wear eye protection.*

Caution

Risk of the electronic components being destroyed when battery is disconnected!

- *Observe notes on procedure for disconnecting the battery.*
- *Only disconnect battery with ignition switched off.*

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

2 Identification

⇒ “2.1 Engine number, engine data”, page 5

2.1 Engine number, engine data

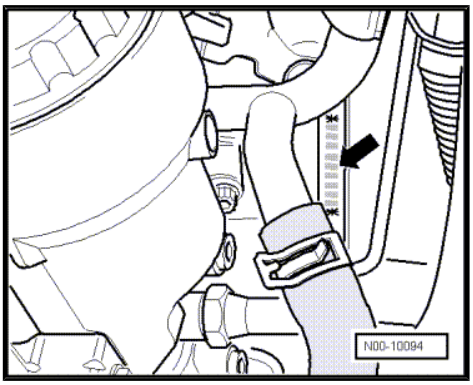
New four digit engine codes were introduced in model year 2009. The first 3 digits refer to the mechanical configuration of the engine. They are stamped onto the engine. The fourth digit denotes the power output of the engine and depends on the engine control unit. The four digit engine code can be found on the identification plate, the vehicle data sticker and the engine control unit.

The engine number (“engine code” and “serial number”) can be found at the joint between engine and gearbox -arrow-.

In addition, there is a sticker attached to the toothed belt guard showing the “engine code” and “serial number”.

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

The engine number consists of up to nine characters (alphanumeric). The first part (maximum 4 characters) makes up the “engine code”, and the second part (6 characters), the “serial number”. If more than 999,999 engines were produced with the same code letters, the first of the six digits is replaced by a letter.



Engine code		CKTB	CKTC	CKUB	CKUC
Manufactured	from to	05/11 ▸	05/11 ▸	05/11 ▸	05/11 ▸
Emissions fulfil		EU 5 EU 4 EU 5	EU 5	EU 5 EU 4 EU5	EU 5
Capacity	l	2.0	2.0	2.0	2.0
Output	kW at rpm	80 3500	100 3500	120 3600	105 3500
Torque	Nm at rpm	300 1500 … 2250	340 1575 … 2250	400 1800	340 1575 … 2250
Idling speed	1 rpm	830 ± 100	830 ± 100	830 ± 100	830 ± 100
Capacity	cm^3	1968	1968	1968	1968
Bore	Diameter, mm	81.0	81.0	81.0	81.0
Stroke	mm	95.5	95.5	95.5	95.5
Valves per cylinder		4	4	4	4
Compression ratio: 1		16.0	16.0	16.0	16.0
Fuel	according to	DIN EN 590	DIN EN 590	DIN EN 590	DIN EN 590
Firing order		1-3-4-2	1-3-4-2	1-3-4-2	1-3-4-2
Balancer shaft module		no	no	no	no
Catalytic converter		yes	yes	yes	yes
Turbocharging/supercharging		Mono-turbo	Mono-turbo	Bi-turbo	Bi-turbo
Exhaust gas recirculation		yes	yes	yes	yes
Charge air cooling		yes	yes	yes	yes
Particulate filter		yes, in the case of EU 5	yes, in the case of EU 5	yes, in the case of EU 5	yes, in the case of EU 5
Selective catalytic reduction (SCR system)		no	no	no	no

Engine code		CSLB	CSNA	CSLA	CSLC
Manufactured	from to	45/13 ▸	45/13 ▸	11/15 ▸	11/15 ▸
Emissions fulfil		EU 6	EU 6	EU 6	EU 6
Capacity	l	2.0	2.0	2.0	2.0
Output	kW at rpm	84 3500	120 3600	80 3500	103 3500
Torque	Nm at rpm	300 1500 … 2250	400 1800	300 1500 … 2250	340 1600 … 2250
Idling speed	1 rpm	830 ± 50	830 ± 50	830 ± 50	830 ± 50
Capacity	cm^3	1968	1968	1968	1968
Bore	Diameter, mm	81.0	81.0	81.0	81.0
Stroke	mm	95.5	95.5	95.5	95.5
Valves per cylinder		4	4	4	4
Compression ratio: 1		15.5	15.5	15.5	15.5
Fuel	according to	DIN EN 590	DIN EN 590	DIN EN 590	DIN EN 590
Firing order		1-3-4-2	1-3-4-2	1-3-4-2	1-3-4-2
Balancer shaft module		no	no	no	no
Catalytic converter		yes	yes	yes	yes
Turbocharging/supercharging		Mono-turbo	Bi-turbo	Mono-turbo	Mono-turbo
Exhaust gas recirculation		yes	yes	yes	yes
Charge air cooling		yes	yes	yes	yes
Particulate filter		yes	yes	yes	yes
Selective catalytic reduction (SCR system)		yes	yes	yes	yes

3 Repair instructions

3.1 Rules for cleanliness when working on fuel supply system

When working on the fuel supply and injection system, pay careful attention to the following “6 rules” for cleanliness:

- Thoroughly clean all unions and surrounding areas before disconnecting.
- Place removed parts on a clean surface and cover. Use only lint-free cloths.
- Carefully cover opened components or seal if repairs cannot be carried out immediately.
- Install clean components only. Do not remove replacement parts from packing until immediately before installing. 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. Do not move vehicle.
- Also ensure that no diesel fuel comes into contact with the coolant hoses. Should this occur, the hoses must be cleaned immediately. Damaged hoses must be renewed.

3.2 Rules for cleanliness and instructions for working on fuel system

Caution

To prevent the high-pressure pump from running while it is empty (very tight tolerances) and to ensure that the engine starts quickly after parts have been renewed, it is important to observe the following:

- *If fuel system components between fuel tank and high-pressure pump are removed or renewed, the fuel system must be bled ⇒ Vehicle diagnostic tester* `Test electric fuel pump`*.*
- *If the high-pressure pump is removed or renewed, the fuel system must be filled with fuel before engine is started for the first time ⇒ page 312 .*

General instructions:

- Clean tools and workbench etc. before working on injection system.
- Thoroughly clean all unions and surrounding areas with engine or brake system cleanser before disconnecting. Dry cleaned area thoroughly.
- When removing components, plug all open connections immediately with a suitable clean sealing cap.
- Do not remove sealing caps from components until immediately prior to installation. Keep components that are to be reused in a new, sealable plastic bag.
- The injectors and locations are to be checked before installation by means of a visual inspection for damage and dirt. It must be ensured that the injector bore is clean. If necessary, clean injector bore.
- Only the cleaning set - VAS 6811- may be used for cleaning the sealing surface of the injector bore.
- For detailed information on how to use the cleaning set as well as the order in which its components are applied, refer to the ⇒ operating manual provided with the cleaning set - VAS 6811- .
- If high-pressure lines are not renewed, they must be labelled on removal. High-pressure fuel lines must always be re-installed in their original positions (i.e. on the same cylinder).
- Take care not to damage the injectors when removing the old copper seals.
- Check all new O-rings for damage before installing. Lubricate O-rings with engine oil or assembly oil before installing.
- Align high-pressure lines so that they are not subjected to stress . First tighten all unions hand-tight and then tighten to torque.
- Never attempt to reshape high-pressure fuel lines.
- When working on any parts of the high-pressure fuel system, tools may only be used for loosening and tightening pipe unions. All other components must always be removed and installed by hand without using tools or other equipment.
- Press the fuel return lines onto the injectors by hand from above so that they engage audibly on each injector (do not press in the release pins when doing this). Then press down the release pin after connecting the return line. Pull fuel return lines upwards by hand to check that they are firmly attached and are not leaking.
- Disassembling individual common rail components is not permitted. The components should be replaced as complete units if faulty.
- Do not carry out any installation work on common rail system whilst engine is running.
- Never attempt to bleed the common rail system by loosening high-pressure components after starting the engine.
- All cable ties which are opened or cut open when engine is removed must be replaced in the same position when engine is installed.
- When the system is open, do not work with compressed air. Do not move vehicle.

- Also ensure that no diesel fuel comes into contact with the coolant hoses. Should this occur, the hoses must be cleaned immediately. Damaged hoses must be renewed.

3.3 Rules for cleanliness when working on charge air system

When working on the charge air system, pay careful attention to the following rules for cleanliness:

- Thoroughly clean all unions and surrounding areas before disconnecting.
- Place removed parts on a clean surface and cover. Use only lint-free cloths.
- Carefully cover opened components or seal if repairs cannot be carried out immediately.
- Install clean components only. Do not remove replacement parts from packing until immediately before installing. Do not use parts that have not been stored in their packing (e.g. in tool boxes or similar).
- Existing transport and protective packaging and sealing caps must only be removed immediately prior to installation.
- When making repairs, remove oil from connection and hose ends.
- Do not use substances containing oil, silicone or grease when assembling.
- When the system is open: Do not work with compressed air. Do not move vehicle.

3.4 Rules for cleanliness when working on the SCR system

Caution

Immediately after disconnecting the connectors of reducing agent delivery lines, the disconnected connectors as well as all open connections must be sealed with suitable sealing plugs in order to prevent ingress of dirt.

Even the smallest particles of dirt can cause extensive damage to the SCR system.

Caution

Protect disconnected connectors against wetting from reducing agent by suitable means, e.g. plastic bag and cable ties.

Electrical connections may be damaged due to the high penetration ability along with subsequent crystallisation of the reducing agent.

Caution

Never reuse extracted reduction agent.

For information on storage and disposal, see ⇒ Service net → Environment → Workshop disposal .

Request country-specific information concerning storage and disposal from your importer.

3.5 General notes on the lubrication system

Note

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

Caution

Finding metal shavings or a large quantity of small metal particles during engine repair could indicate that the crankshaft bearings or conrod bearings are damaged. To prevent this from causing further damage, perform the following repairs:

- *Thoroughly clean oil channels.*
- *Renew oil spray jets.*
- *Renew engine oil cooler.*
- *Renew oil filter element.*

3.6 General notes on cooling system

WARNING

Steam may escape when expansion tank is opened. Wear eye protection and protective clothing to avoid eye injuries and scalding. Cover cap with cloth and open carefully.

Caution

When doing any repair work, especially in the engine compartment, pay attention to the following due to the cramped conditions:

- *Route all the various lines (e.g. for fuel, hydraulics, activated charcoal filter system, coolant and refrigerant, brake fluid and vacuum) and electrical wiring in their original positions.*
- *To avoid damage to lines, ensure sufficient clearance from all moving or hot components.*

Note

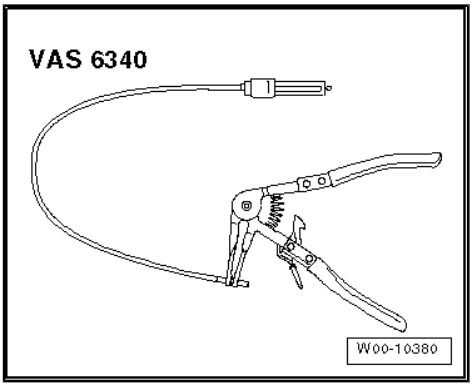
- *When the engine is warm, the cooling system is under pressure. If necessary, release pressure before beginning repair work.*
- *Hoses are secured with spring-type clips. In case of repair, only use spring-type clips.*
- *Spring-type clip pliers - VAS 6340- or hose clip pliers - VAS 6362- are recommended for installation of spring-type clips.*
- *When installing coolant hoses, route stress-free so that they do not come into contact with other components (observe markings on coolant connection and hose).*
- *The arrows on the coolant pipes and coolant hoses must be aligned with each other.*
- *Only demineralised / distilled water to standard VDE-0510 may be used for mixing. Tap water does not have the required quality to ensure the coolant's function.*

3.7 General notes on fuel system

Caution

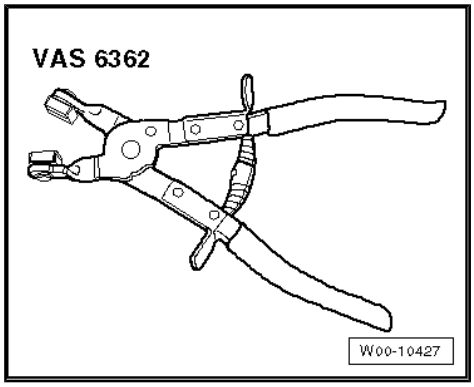
When doing any repair work, especially in the engine compartment, pay attention to the following due to the cramped conditions:

- ***Route all the various lines (e.g. for fuel, hydraulics, activated charcoal filter system, coolant and refrigerant, brake fluid and vacuum) and electrical wiring in their original positions.***
- ***Ensure that there is sufficient clearance to all moving or hot components.***



Note

- *When the engine is warm, the cooling system is under pressure. If necessary, release pressure before beginning repair work.*
- *Hoses are secured with spring-type clips. In case of repair, only use spring-type clips.*
- *When installing or removing spring-type clips, we recommend using spring-type clip pliers - VAS 6340- or*
- *… we recommend hose clip pliers - VAS 6362- .*
- *When installing coolant hoses, route stress-free so that they do not come into contact with other components (observe markings on coolant connection and hose).*
- *Arrows on the coolant pipes and on the ends of the hoses must be aligned with each other.*



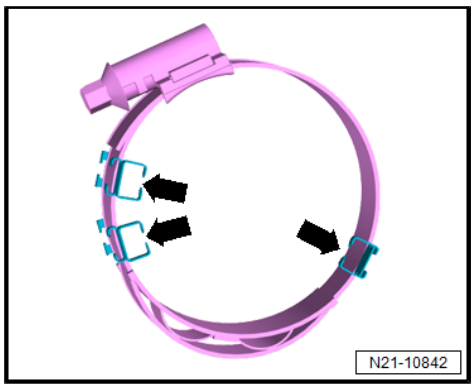
3.8 Instructions for hose connections with screw-type clips

Normal screw-type clips are used on the hose connections on the “intake side”.

On the hose connections on the pressure side, there are screw-type clips with barbs -arrows-.

Caution

- ***Do not loosen these screw-type clips and pull back over the delivery hose. Risk of damage to the hose!***
- ***If a clip has been removed, it must be renewed together with the hose.***



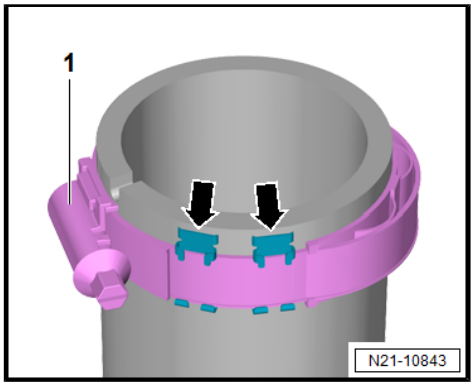
Screw-type clips with locking hooks -arrows- must only be loosened.

– Loosen bolt of screw-type clips -1- sufficiently to allow for removing hoses.

Screw-type clips that are only loosened can be reused.

Hose and clip are supplied together as one part.

– Do not use substances containing oil, silicone or grease when assembling. Only use clean water.



Caution

Screw-type clips on the charge air lines must always be tightened with specified torque. If the torque is too low or too high, the charge air hose may slip off the charge air pipe during vehicle operation.

Specified torque

Component	Specified torque
Screw-type clip	5.5 Nm

10 – Removing and installing engine

1 Removing and installing engine

⇒ “1.1 Removing engine”, page 14

⇒ “1.2 Securing engine on engine and gearbox support”, page 22

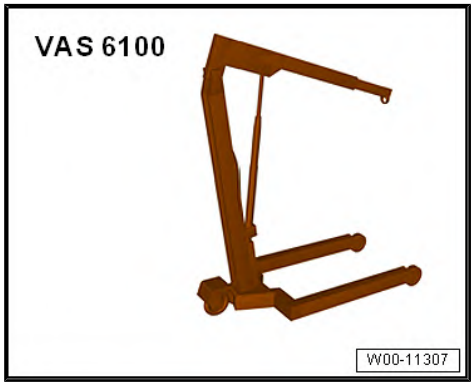
⇒ “1.3 Removing engine, Crafter 4MOTION with Achleitner four-wheel drive”, page 23

⇒ “1.4 Installing engine”, page 33

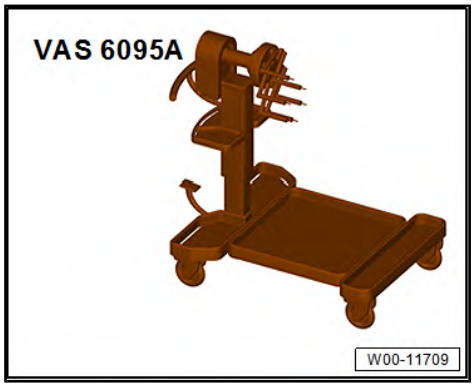
1.1 Removing engine

Special tools and workshop equipment required

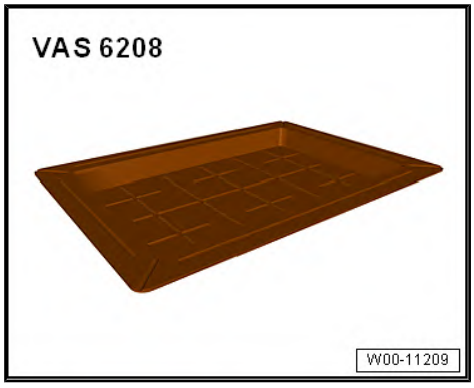
- Workshop hoist - VAS 6100-



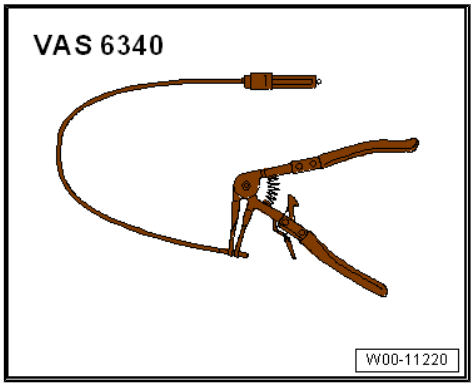
- Engine and gearbox support - VAS 6095A-



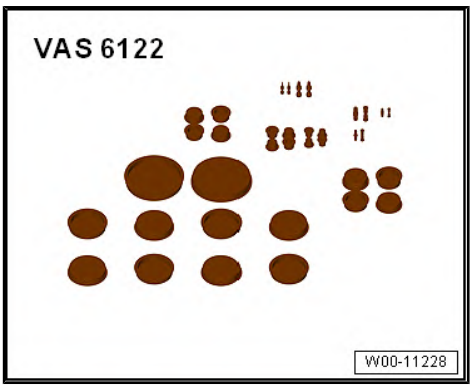
- Drip tray for workshop hoist - VAS 6208-



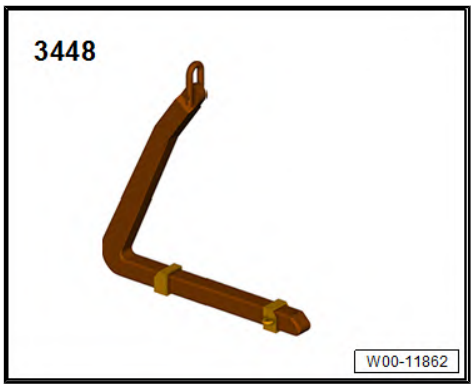
- Hose clip pliers - VAS 6340-



- Engine bung set - VAS 6122-



- Supplement tool - 3448-



- Vehicle diagnostic tester

Note

- *The engine is removed forwards together with the gearbox.*
- *All cable ties that are opened or cut through when the engine is removed must be renewed/replaced in the same position when the engine is installed.*
- *Seal open lines and unions with clean plugs from engine bung set - VAS 6122- .*

Caution

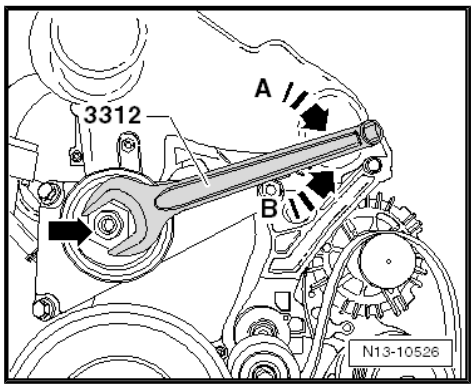
When installing a new short engine, it is compulsory to fix and tighten the clamping jaws of the injectors with the specified torque after installing the high-pressure lines ⇒ page 278 . Clamping jaws are only secured »hand-tight« for setting the injectors while installing high-pressure lines. Non-observance of these notes may lead to damage to engine.

When doing any repair work, especially in the engine compartment, pay attention to the following due to the cramped conditions:

- *Route all the various lines (e.g. for fuel, hydraulics, activated charcoal filter system, coolant and refrigerant, brake fluid and vacuum) and electrical wiring in their original positions.*
- *To avoid damage to lines, ensure sufficient clearance from all moving or hot components.*
- *Cut through cable ties carefully and reinstall them in the same position.*

Caution

Under no circumstances may the engine be turned counter to its direction of rotation -arrow B- at the viscous fan shaft -arrow-. This can result in the shaft being loosened and the vehicle breaking down. When tightening the viscous fan bolt, only counterhold in the engine's direction of rotation -arrow A- using the open-end spanner - 3312- .



Removing

– Before removing, read event memories of all control units ⇒ Vehicle diagnostic tester.

– Disconnect earth strap of battery and second battery ⇒ Electrical system; Rep. gr. 27 ; Starter, power supply, CCS .

– Remove bonnet ⇒ General body repairs, exterior; Rep. gr. 55 ; Bonnet .

– Remove air filter ⇒ page 277 .

– Remove radiator grille ⇒ General body repairs, exterior; Rep. gr. 50 .

– Remove front bumper ⇒ General body repairs, exterior; Rep. gr. 63 ; Bumpers .

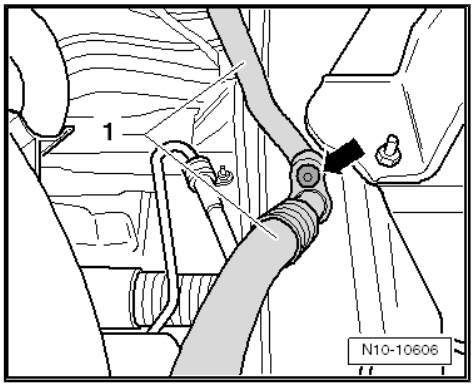
– Remove front bumper support ⇒ General body repairs, exterior; Rep. gr. 50 ; Front bumper support .

Vehicles with air conditioning system:

– Extract refrigerant ⇒ Air conditioning system with R134a refrigerant .

– Detach refrigerant lines from condenser.

– Undo and remove bolt -arrow- and detach refrigerant line -1-.



Continuation for all vehicles:

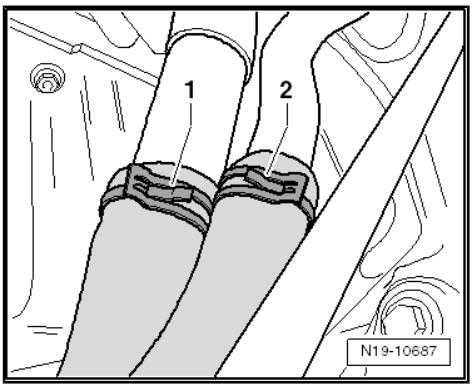
– Remove lock carrier together with cooler, charge air cooler and, if present, the condenser ⇒ General body repairs, exterior; Rep. gr. 50 ; Lock carrier .

– Remove vacuum line leading to brake servo and vacuum pump.

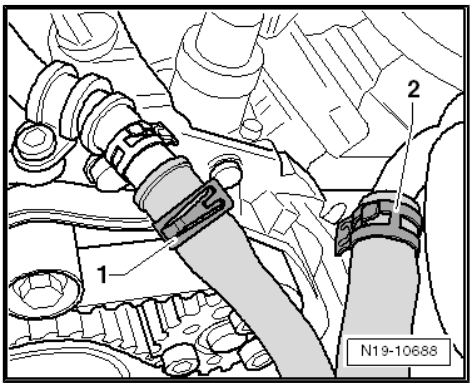
– Remove any noise insulation ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation .

– Drain coolant ⇒ page 179 .

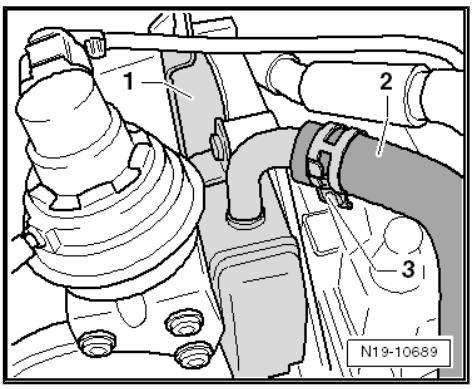
– Loosen hose clamps -1 and 2-, and pull off lower coolant hoses.



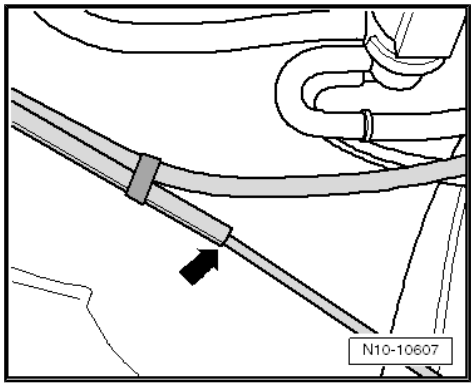
– Loosen hose clamps -1 and 2-, and pull off upper coolant hoses.



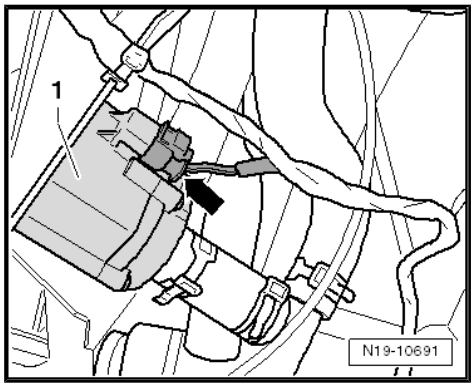
– Loosen hose clamp -3- and pull coolant hose -2- off exhaust gas recirculation cooler -1-.



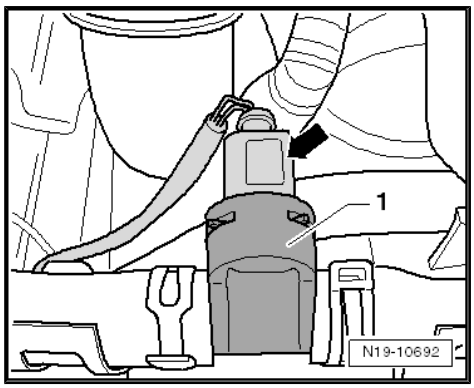
– Detach vacuum hose -arrow-.



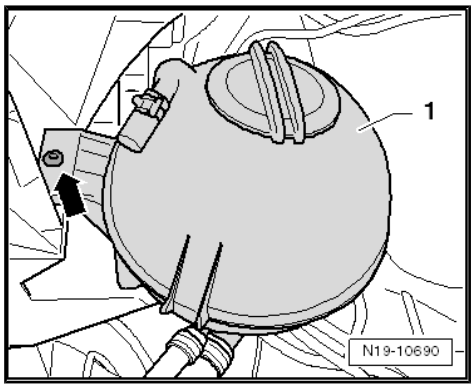
– Detach connector -arrow- from pump for exhaust gas recirculation cooler - V400- -1-.



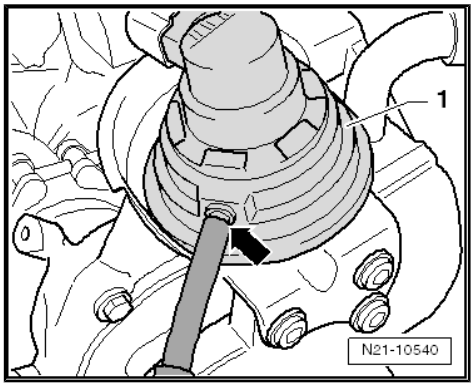
– Disconnect connector -arrow- from radiator outlet coolant temperature sender - G83- -1-.



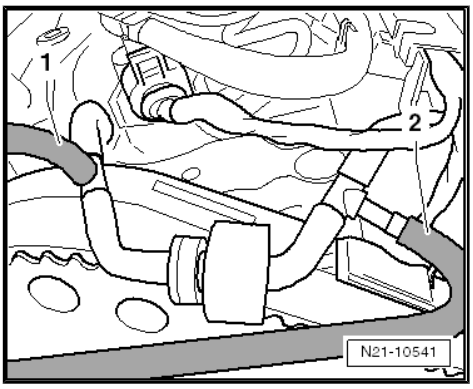
– Undo and remove bolt -arrow- and remove coolant expansion tank -1- together with hoses.



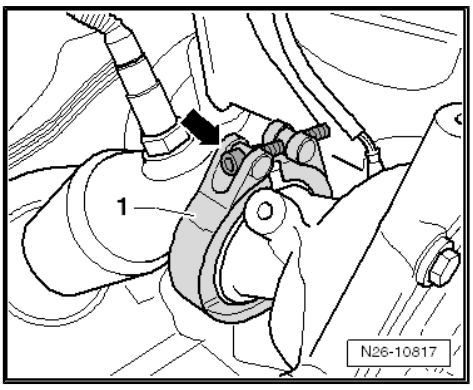
– Detach hose -arrow- from regulating flap potentiometer - G584- -1- and place to one side.



– Pull hoses -1 and 2- off and place to one side.



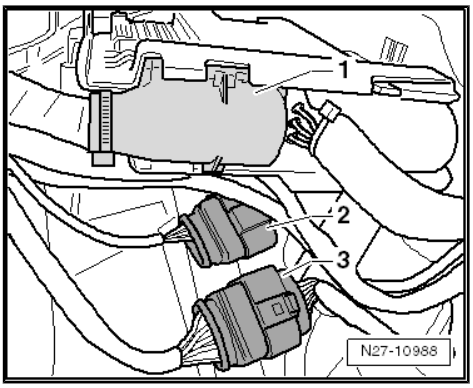
– Loosen bolt -arrow- and remove clamp -1- from particulate filter.
– Remove poly V-belt and place it to one side ⇒ page 43 .
– Remove power-assisted steering vane pump and place to one side ⇒ Steering; Rep. gr. 48 .



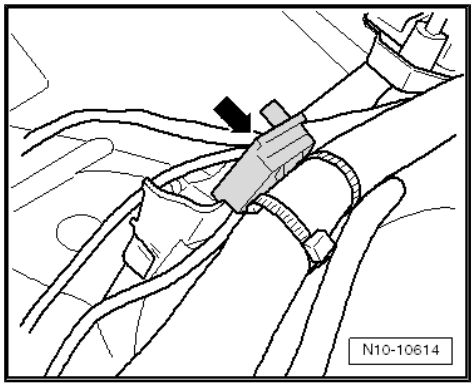
Note

Do not open power-assisted steering circuit!

– Detach connector -1- from engine control unit - J623- .
– Detach connectors -2 and 3-.



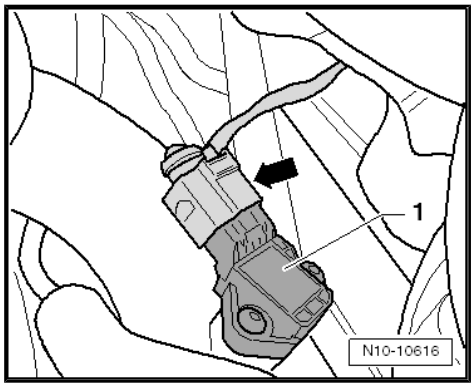
– Unclip wiring harness, place it on engine and secure.



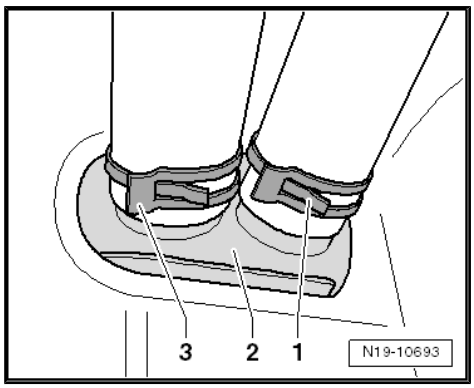
Note

Make sure that the cable ties are not destroyed!

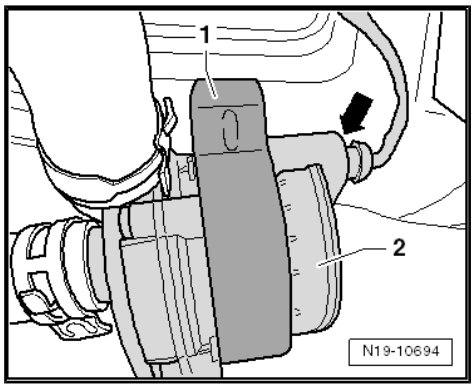
– Detach connector -arrow- from intake manifold pressure sender - G71- -1-.



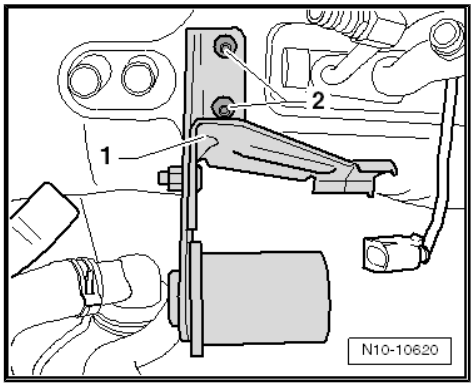
– Loosen clips -1 and 3-, and pull coolant hoses off heat exchanger connection -2-.



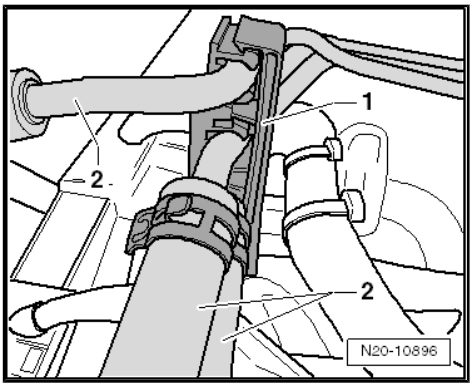
– Detach connector -arrow- from coolant circulation pump - V50- -2-.
– Pull coolant circulation pump - V50- -2- out of retainer -1-.



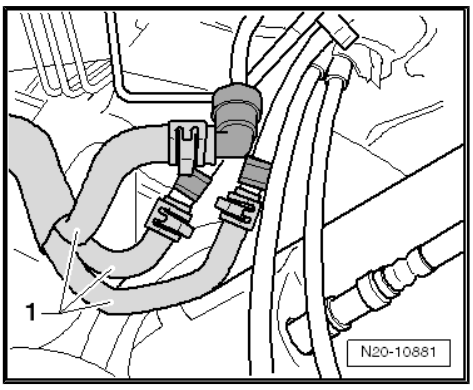
– Unscrew nuts -2- from air filter bracket -1- and remove bracket.



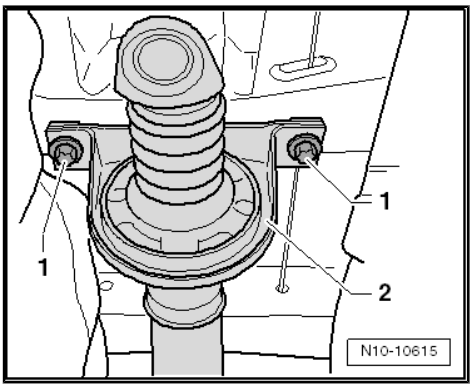
– Unclip fuel lines -2- from retainer -1-.
– Disconnect battery positive cable from battery positive terminal and place cable far away to one side.



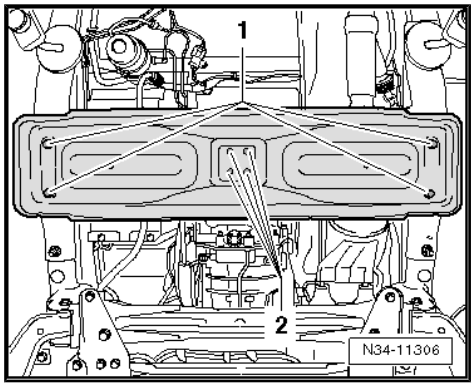
– Detach and seal fuel lines -1-.
– Detach selector cables from gearbox ⇒ Rep. gr. 34 .
– Disconnect and seal line from slave cylinder on gearbox ⇒ Rep. gr. 30 .



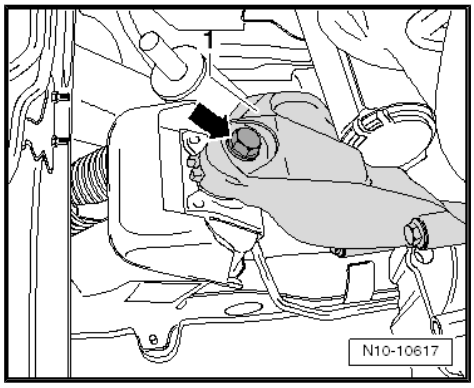
– Undo and remove bolts -1- of propshaft mounting -2-.
– Disconnect propshaft from gearbox, and secure it to body ⇒ Rep. gr. 39 ; Propshaft .



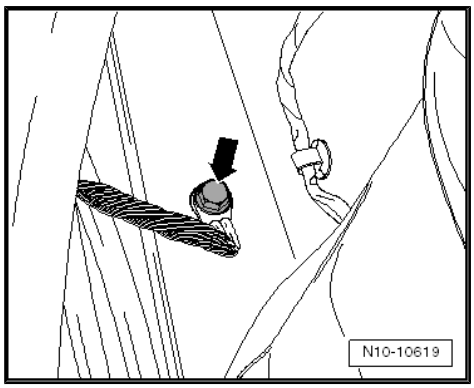
– Undo and remove bolts -2- from gearbox mounting.
– Attach lifting tackle - 3448- to workshop hoist - VAS 6100- .
– Attach lifting tackle - 3448- to engine.



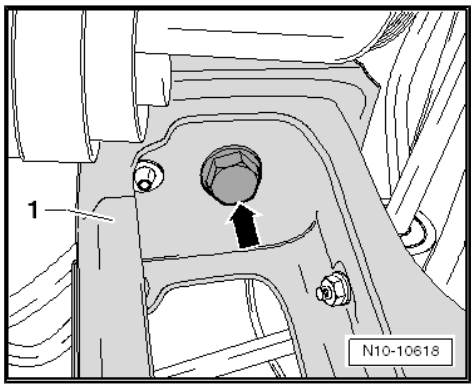
– Undo and remove bolt -arrow- from engine mounting on right -1-.



– Undo and remove earth wire bolt -arrow-.



– Undo and remove bolt -arrow- from engine mounting on left -1-.



Note

When being lifted out, the engine together with gearbox must be handled carefully in order to prevent damage to the body and steering rack.

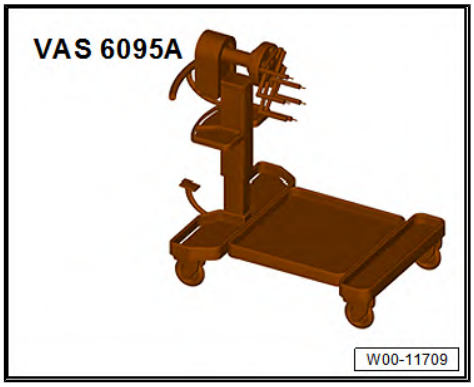
– Lift engine together with gearbox and pull them out towards the front of the vehicle.

Secure engine to engine and gearbox support - VAS 6095A- to carry out repairs ⇒ page 22 .

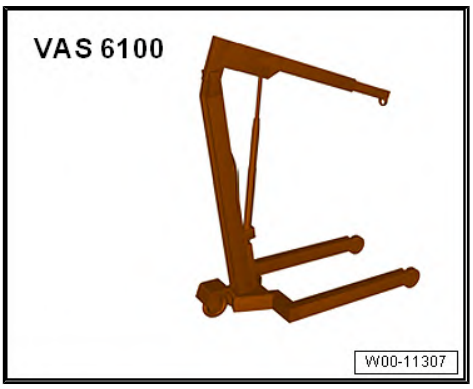
1.2 Securing engine on engine and gearbox support

Special tools and workshop equipment required

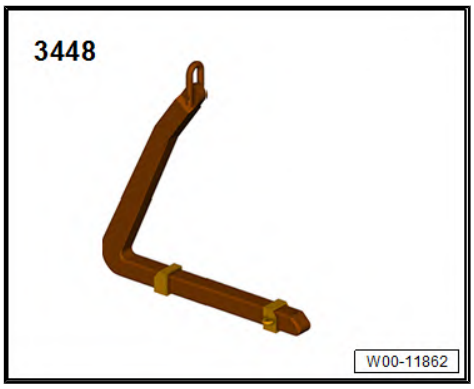
♦ Engine and gearbox support - VAS 6095A-



♦ Workshop hoist - VAS 6100-



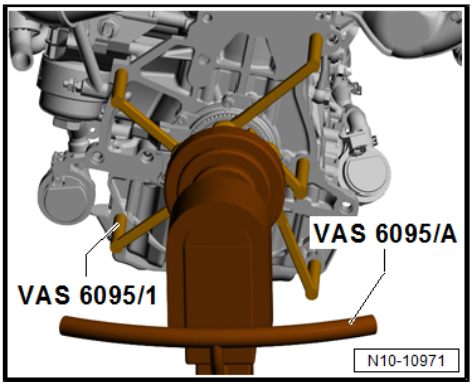
♦ Supplement tool - 3448-



Procedure

- Engine is removed.
- Engine and gearbox separated.
- Engine attached to lifting tackle - 3448- and workshop hoist - VAS 6100- .

– Secure engine on engine and gearbox support - VAS 6095A- .

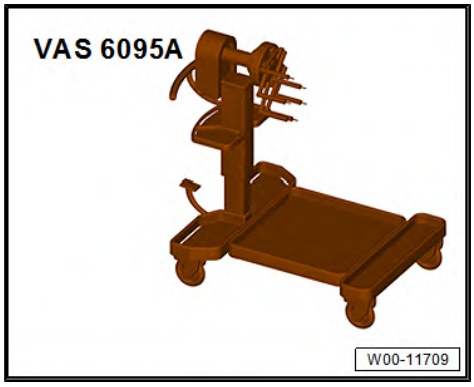


1.3 Removing engine, Crafter 4MOTION with Achleitner four-wheel drive

Special tools and workshop equipment required

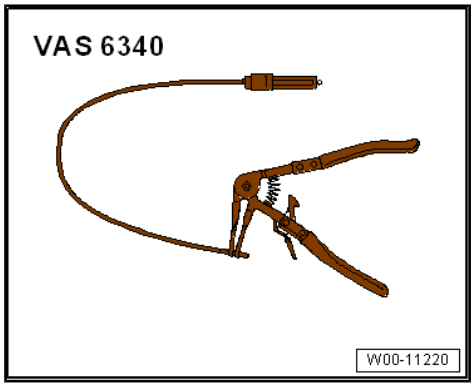
- Workshop hoist - VAS 6100-

- Engine and gearbox support - VAS 6095A-

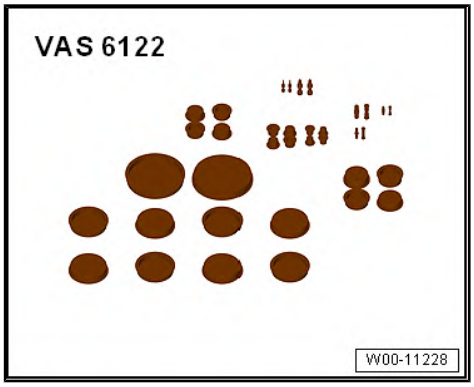


- Drip tray for workshop hoist - VAS 6208-

- Hose clip pliers - VAS 6340-



♦ Engine bung set - VAS 6122-



♦ Supplement tool - 3448-

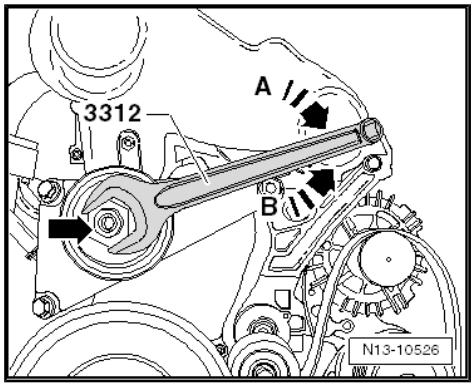
♦ Vehicle diagnostic tester

Caution

When installing a new short engine, it is compulsory to fix and tighten the clamping jaws of the injectors with the specified torque after installing the high-pressure lines *⇒ page 278* *. Clamping jaws are only secured »hand-tight« for setting the injectors while installing high-pressure lines. Non-observance of these notes may lead to damage to engine.*

WARNING

Under no circumstances may the engine be turned counter to its direction of rotation -arrow B- at the viscous fan shaft -arrow-. This can result in the shaft being loosened and the vehicle breaking down. When tightening the viscous fan bolt, only counterhold in the engine's direction of rotation -arrow A- using the open-end spanner - 3312- .



Note

- *During the further course of work, it may be necessary to remove the battery. For this reason, first check whether a coded radio is fitted. Obtain anti-theft coding beforehand if necessary.*
- *The engine is removed together with gearbox towards the front.*
- *All cable ties that are opened or cut through when the engine is removed must be renewed/replaced in the same position when the engine is installed.*
- *Seal open lines and unions with clean plugs from engine bung set - VAS 6122- .*

Caution

When doing any repair work, especially in the engine compartment, pay attention to the following due to the cramped conditions:

- ***Route all the various lines (e.g. for fuel, hydraulics, activated charcoal filter system, coolant and refrigerant, brake fluid and vacuum) and electrical wiring in their original positions.***
- ***To avoid damage to lines, ensure sufficient clearance from all moving or hot components.***
- ***Cut through cable ties carefully and reinstall them in the same position.***

Removing

– Before removing, read event memories of all control units ⇒ Vehicle diagnostic tester.

– Disconnect earth strap of battery and second battery ⇒ Electrical system; Rep. gr. 27 ; Starter, power supply, CCS .

– Remove bonnet ⇒ General body repairs, exterior; Rep. gr. 55 ; Bonnet .

– Remove air filter ⇒ page 277 .

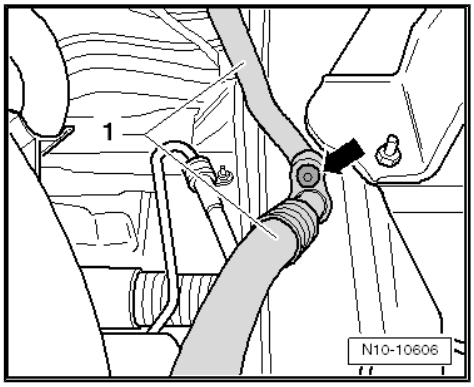
– Remove radiator grille ⇒ General body repairs, exterior; Rep. gr. 50 .

– Remove front bumper ⇒ General body repairs, exterior; Rep. gr. 63 ; Bumpers .

– Remove front bumper support ⇒ General body repairs, exterior; Rep. gr. 50 ; Front bumper support .

Vehicles with air conditioning system:

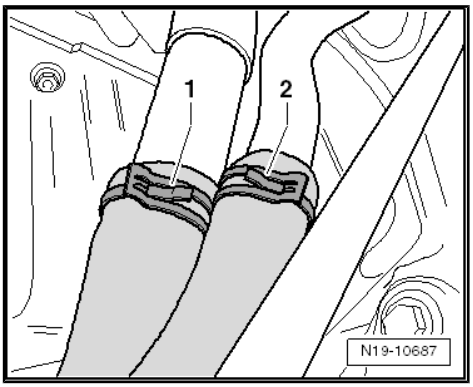
– Extract refrigerant ⇒ Air conditioning system with R134a refrigerant .
– Detach refrigerant lines from condenser.
– Undo and remove bolt -arrow- and detach refrigerant line -1-.



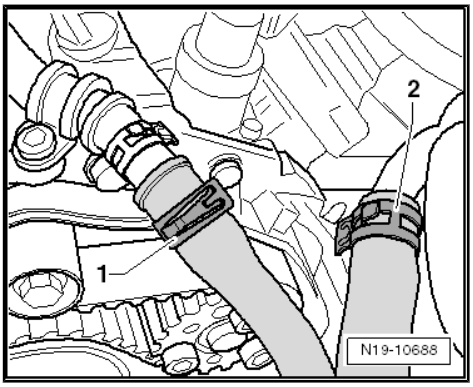
Continuation for all vehicles:

– Remove lock carrier together with cooler, charge air cooler and, if present, the condenser ⇒ General body repairs, exterior; Rep. gr. 50 ; Lock carrier .
– Remove vacuum line leading to brake servo and vacuum pump.
– Remove any noise insulation ⇒ General body repairs, exterior; Rep. gr. 50 ; Noise insulation .
– Drain coolant ⇒ page 179 .

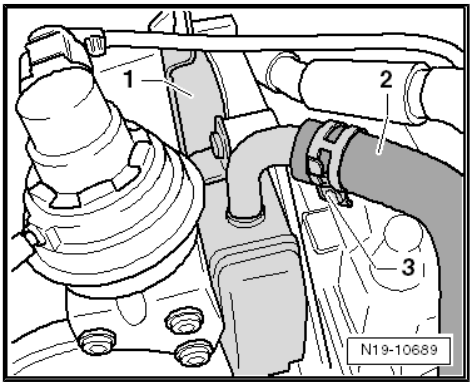
– Loosen hose clamps -1 and 2-, and pull off lower coolant hoses.



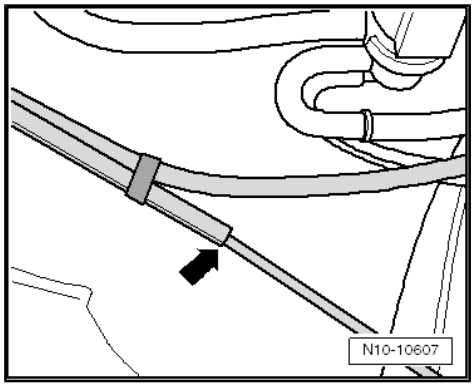
– Loosen hose clamps -1 and 2-, and pull off upper coolant hoses.



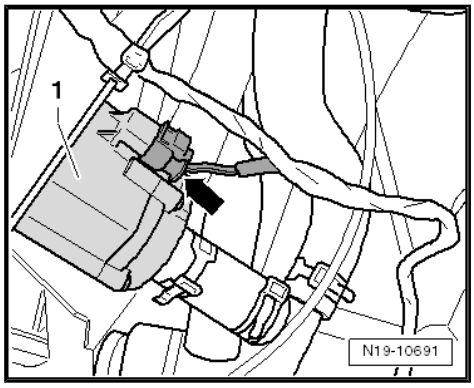
– Loosen hose clamp -3- and pull coolant hose -2- off exhaust gas recirculation cooler -1-.



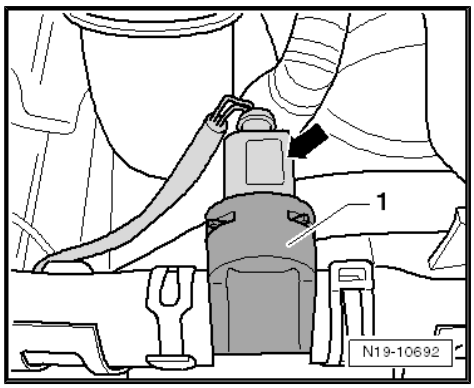
– Detach vacuum hose -arrow-.



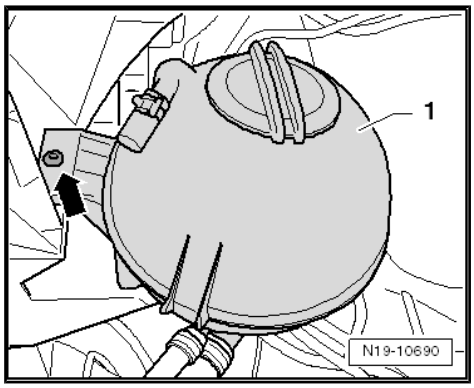
– Detach connector -arrow- from pump for exhaust gas recirculation cooler - V400- -1-.



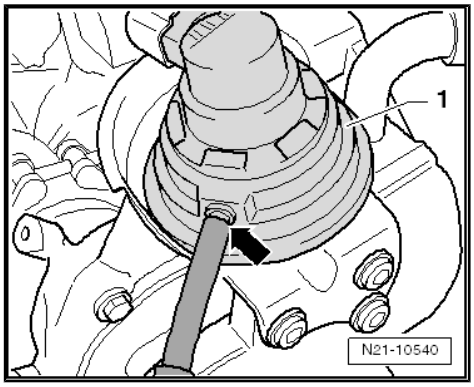
– Disconnect connector -arrow- from radiator outlet coolant temperature sender - G83- -1-.



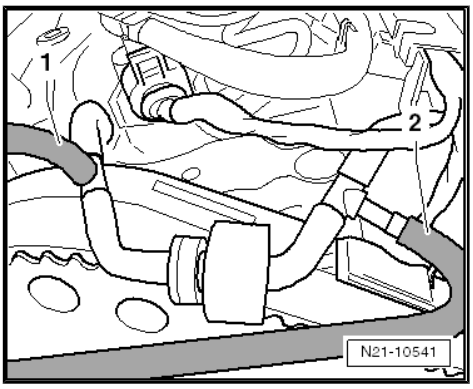
– Undo and remove bolt -arrow- and remove coolant expansion tank -1- together with hoses.



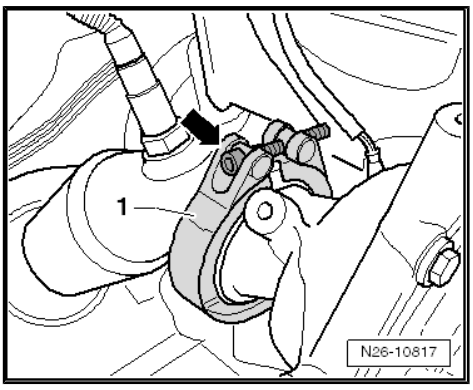
– Detach hose -arrow- from regulating flap potentiometer - G584- -1- and place to one side.



– Pull hoses -1 and 2- off and place to one side.



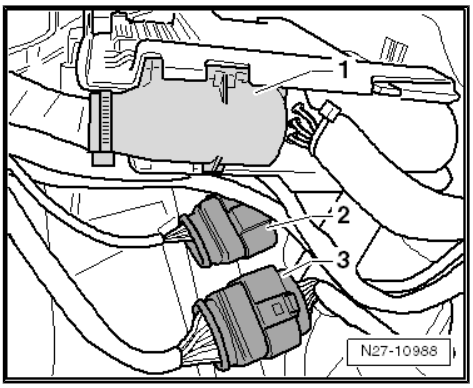
– Loosen bolt -arrow- and remove clamp -1- from particulate filter.
– Remove poly V-belt and place it to one side ⇒ page 43 .
– Remove power steering vane pump, and lay it aside ⇒ Running gear, axles, steering; Rep. gr. 48 .



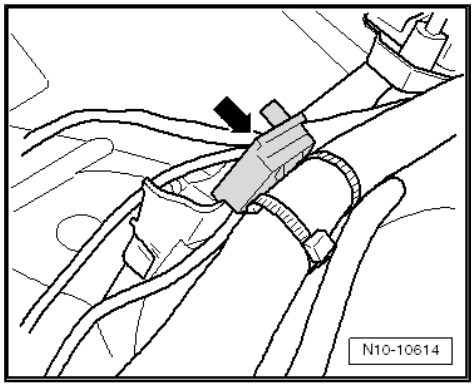
Note

Do not open power-assisted steering circuit!

– Detach connector -1- from engine control unit - J623- .
– Detach connectors -2 and 3-.



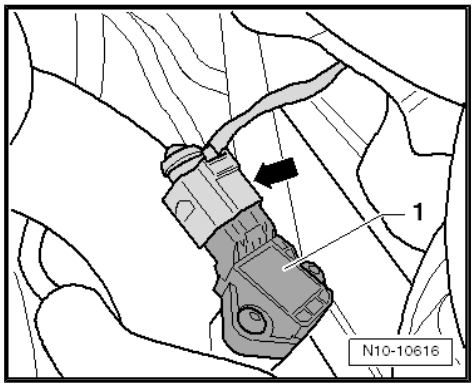
– Unclip wiring harness, place it on engine and secure.



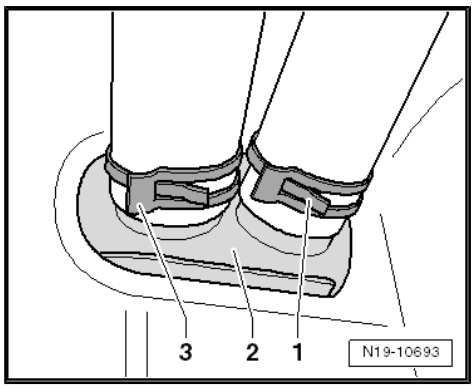
Note

Make sure that the cable ties are not destroyed!

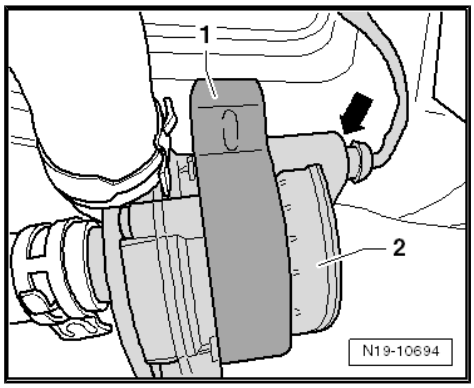
– Detach connector -arrow- from intake manifold pressure sender - G71- -1-.



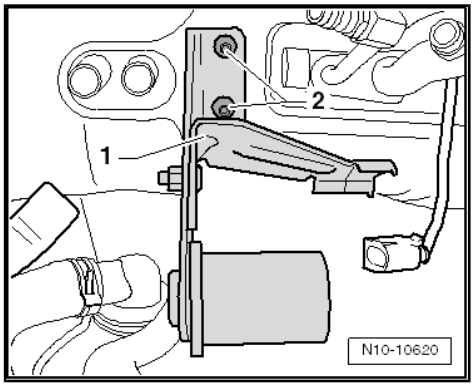
– Loosen clips -1 and 3-, and pull coolant hoses off heat exchanger connection -2-.



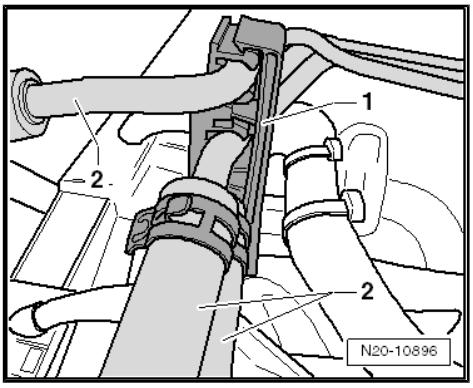
– Detach connector -arrow- from coolant circulation pump - V50- -2-.
– Pull coolant circulation pump - V50- -2- out of retainer -1-.



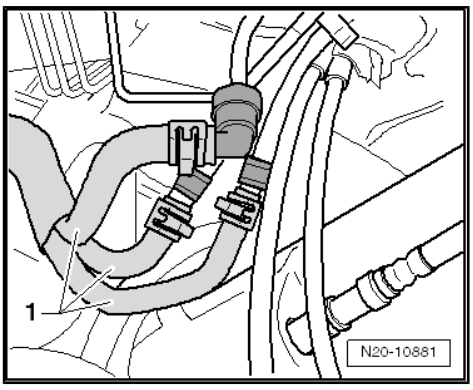
– Unscrew nuts -2- from air filter bracket -1- and remove bracket.



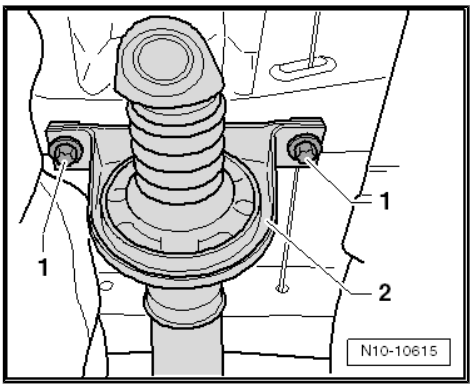
– Unclip fuel lines -2- from retainer -1-.
– Disconnect battery positive cable from battery positive terminal and place it far away to one side.



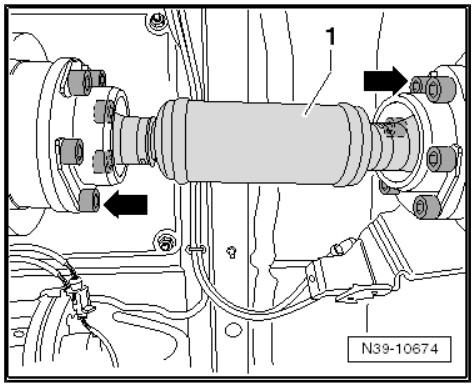
– Detach and seal fuel lines -1-.
– Release selector cables at gearbox ⇒ Power transmission; Rep. gr. 34 .
– Disconnect line from slave cylinder on gearbox and seal the line ⇒ Power transmission; Rep. gr. 30 .



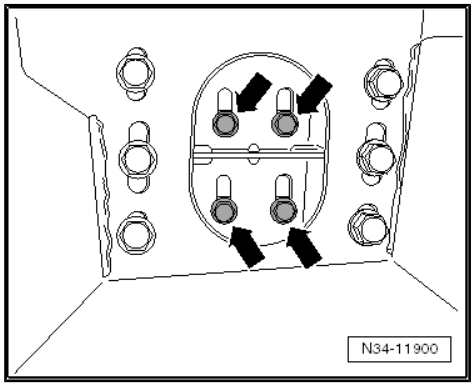
– Undo and remove bolts -1- of propshaft mounting -2-.
– Detach propshaft from gearbox flange and secure to body ⇒ Power transmission; Rep. gr. 39 ; Propshaft .



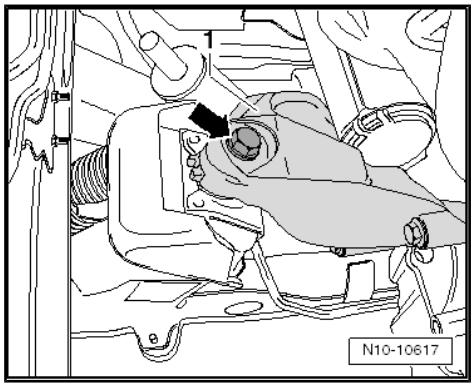
– Remove bolts -arrows- for constant velocity joint shaft -1- and take shaft out downwards.



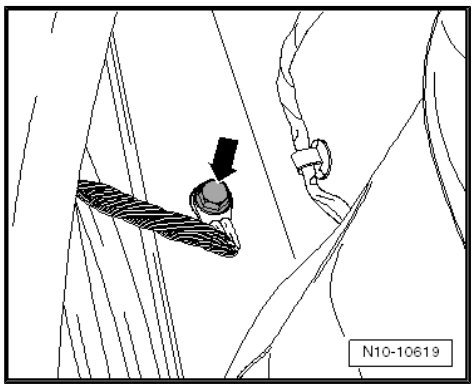
– Remove bolts -2- from gearbox mounting.
– Attach lifting tackle - 3448- to workshop hoist - VAS 6100- .
– Attach lifting tackle - 3448- to engine.



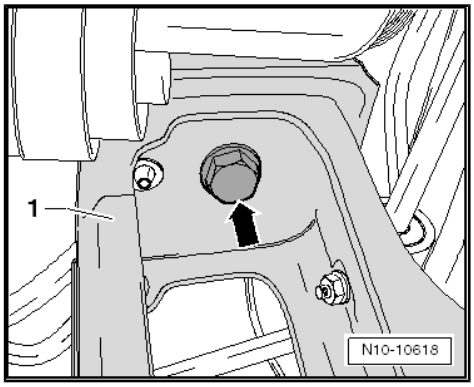
– Undo and remove bolt -arrow- from engine mounting on right -1-.



– Undo and remove earth wire bolt -arrow-.



– Undo and remove bolt -arrow- from engine mounting on left -1-.



Note

When being lifted out, the engine together with gearbox must be handled carefully in order to prevent damage to the body and steering rack.

– Lift engine together with gearbox and pull them out towards the front of the vehicle.

Secure engine to engine and gearbox support - VAS 6095A- to carry out repairs ⇒ page 22 .

1.4 Installing engine

Installing

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

Caution

When installing a new short engine, it is compulsory to fix and tighten the clamping jaws of the injectors with the specified torque after installing the high-pressure lines ⇒ page 278 . Clamping jaws are only secured »hand-tight« for setting the injectors while installing high-pressure lines. Non-observance of these notes may lead to damage to engine.

Specified torques

- ⇒ “2.1 Assembly overview - assembly mountings”, page 34
- Vane pump; Assembly overview - vane pump ⇒ Rep. gr. 48 ; Assembly overview - vane pump
- Lock carrier; Assembly overview - lock carrier ⇒ Rep. gr. 50 ; Assembly overview - lock carrier
- Bonnet; Assembly overview - bonnet ⇒ Rep. gr. 55 ; Assembly overview - bonnet
- Front bumper; Assembly overview - front bumper ⇒ Rep. gr. 63 ; Assembly overview - front bumper
- Noise insulation; Assembly overview - noise insulation ⇒ Rep. gr. 66 ; Assembly overview - noise insulation
- Propshaft; Assembly overview - propshaft ⇒ Rep. gr. 39 ; Assembly overview - propshaft

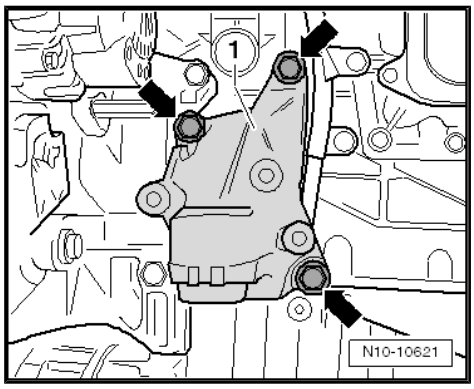
2 Assembly mountings

⇒ “2.1 Assembly overview - assembly mountings”, page 34

2.1 Assembly overview - assembly mountings

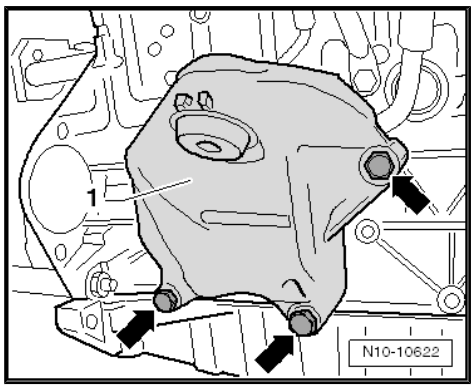
Left engine support to crankcase

– Secure engine support -1- to crankcase with bolts -arrows-.



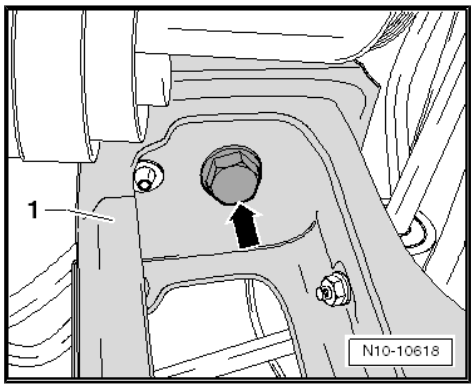
Right engine support to crankcase

– Secure engine support -1- to crankcase with bolts -arrows-.



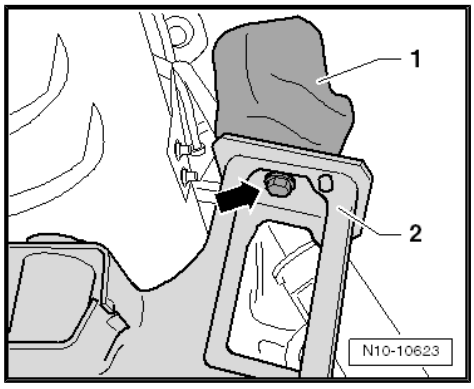
Left engine mounting to frame

– Secure engine mounting to frame -arrow- with bolt -1-.



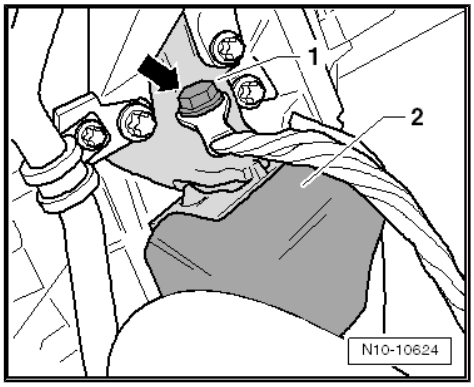
Right engine mounting to frame

– Secure engine mounting-1- to frame -2- with bolt -arrow-.



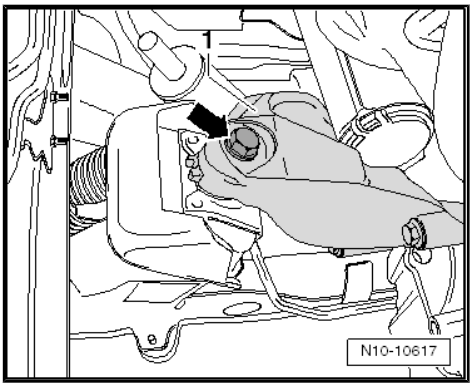
Left engine support to engine mounting

– Secure engine support -1- to engine mounting -2- with bolt -arrow-.



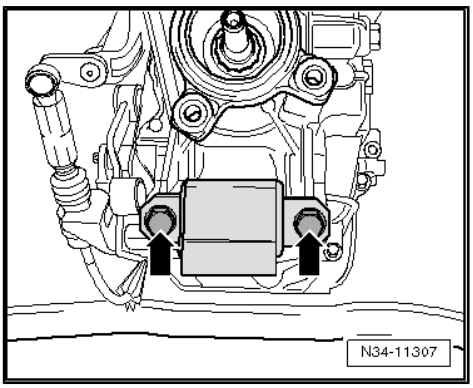
Right engine support to engine mounting

– Secure engine support -1- to engine mounting with bolt -arrow-.



Gearbox mounting to gearbox

– Secure gearbox mounting to gearbox with bolts -arrows-.

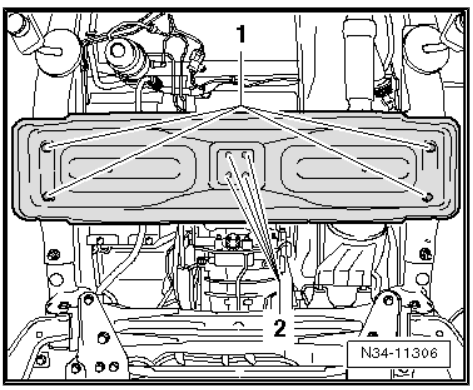


Gearbox mounting to gearbox cross member

– Secure gearbox mounting to gearbox cross member with bolts -2-.

Specified torques

Component	Specified torque
Engine support to crankcase	50 Nm +180°
Right engine mounting to frame	55 Nm
Engine support to engine mounting	50 Nm
Gearbox mounting to gearbox	55 Nm
Gearbox mounting to gearbox cross member	30 Nm

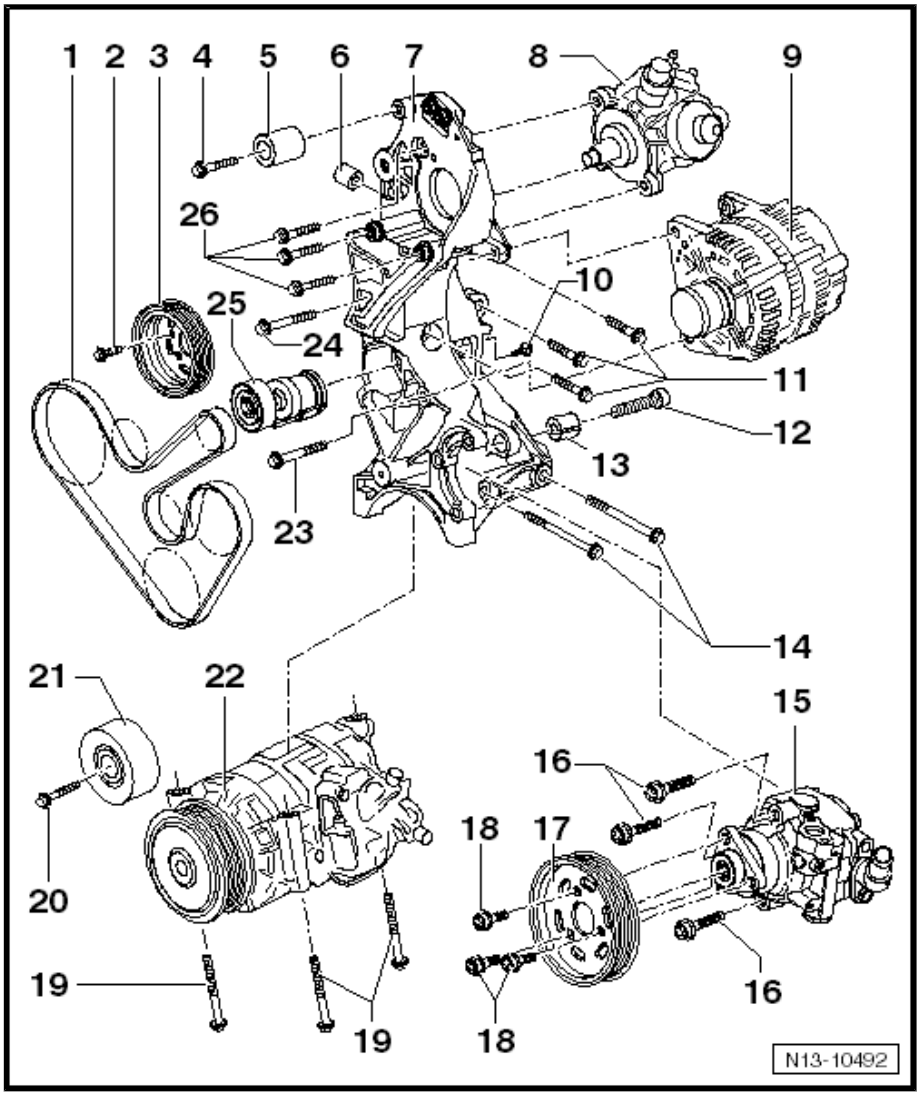


13 – Crankshaft group

1 Cylinder block (pulley end)

1.1 Assembly overview - poly V-belt drive

1.1.1 Assembly overview - poly V-belt drive, vehicles with air conditioning system



1 - Poly V-belt

- ❑ Mark direction of rotation before removing.
- ❑ Do not kink
- ❑ Checking ⇒ Maintenance ; Booklet 11 ; Descriptions of work; Checking poly V-belt
- ❑ Removing and installing ⇒ page 43

2 - Bolt

- ❑ Renew after removing.
- ❑ 10 Nm + 90°

3 - Belt pulley and vibration damper

- ❑ Removing and installing ⇒ page 49 .
- ❑ Installation position: hole in vibration damper must align over protrusion on crankshaft pulley.
- ❑ Can only be installed in one position. Holes are offset.

4 - Bolt

- ❑ 20 Nm

5 - Idler pulley

6 - Dowel sleeve

- ❑ Check for correct seating in ancillary bracket.
- ❑ Inserted in hole for the left-hand (direction of travel) bolt -11- on the rear side of the bracket.

7 - Bracket for ancillaries

- ❑ Observe tightening sequence during installation ⇒ page 51

8 - High-pressure pump

- ❑ Removing and installing ⇒ page 309 .

9 - Alternator

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

10 - Bolt

- ❑ 20 Nm +180°

Note

After removal, adjust torque to 20 Nm + 90°.

11 - Bolt

- ❑ 40 Nm + 90°
- ❑ Observe tightening sequence ⇒ page 51 .

12 - Bolt

- ❑ 25 Nm

13 - Sleeve

- ❑ Drive back slightly before installing vane pump.

14 - Bolt

- ❑ 40 Nm + 90°
- ❑ Observe tightening sequence ⇒ page 51 .

15 - Vane pump

- ❑ Removing and installing ⇒ Running gear, axles, steering; Rep. gr. 48 ; Hydraulic power-assisted steering; Removing and installing vane pump

16 - Bolt

- ❑ 23 Nm

17 - Belt pulley

18 - Bolt

- ❑ 23 Nm

19 - Bolt

- ❑ 23 Nm

20 - Bolt

- ❑ Renew after removing.
- ❑ 20 Nm + 90°

21 - Idler pulley

- ❑ Removing and installing, using door alignment tool - 3320- or XZN 10 socket - T10154- and suitable extension piece

22 - Air conditioner compressor

- ❑ Removing and installing ⇒ Heating, air conditioning system; Rep. gr. 87 .

23 - Bolt

- ❑ 20 Nm

24 - Bolt

- ❑ 20 Nm

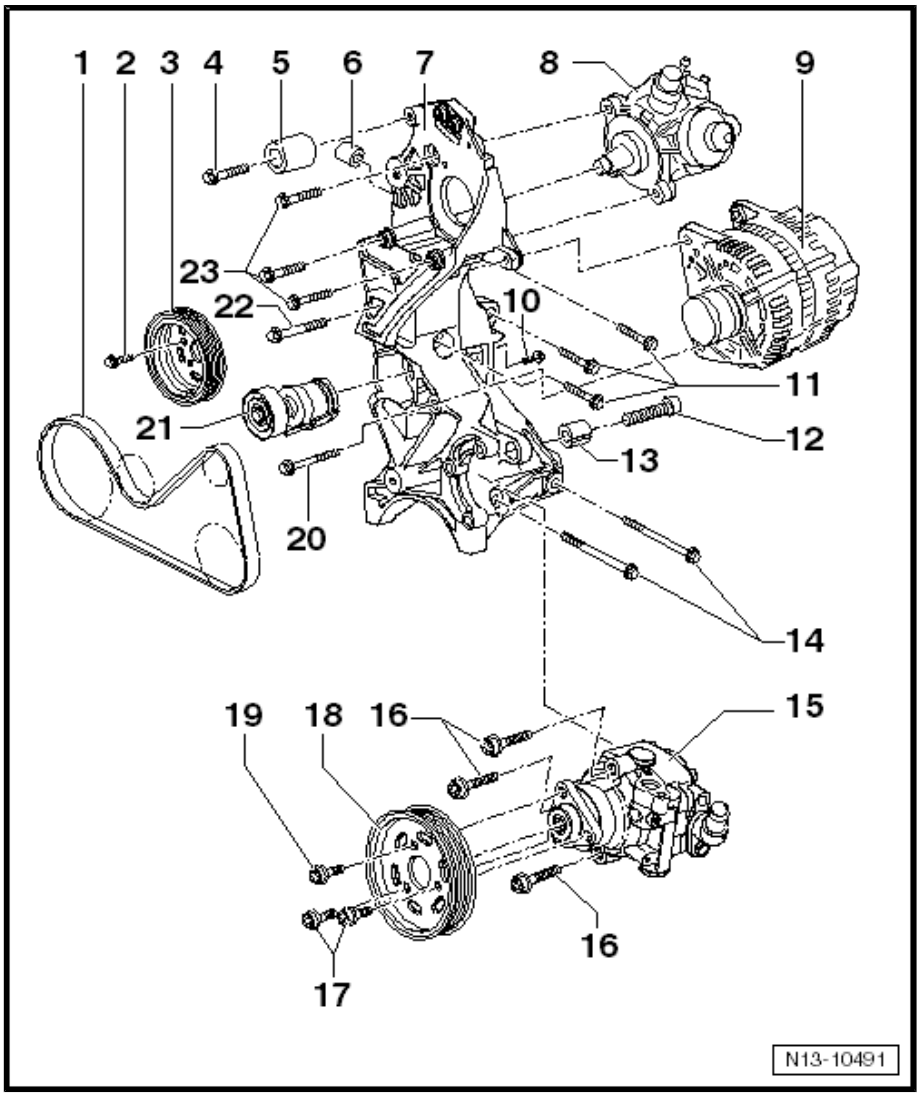
25 - Poly V-belt tensioning element

- ❑ Swing with ring spanner to slacken poly V-belt ⇒ page 43

26 - Bolt

- ❑ Renew after removing.
- ❑ 20 Nm +45°

1.1.2 Assembly overview - poly V-belt drive, vehicles without A/C system



1 - Poly V-belt

- ❑ Mark direction of rotation before removing.
- ❑ Do not kink
- ❑ Checking ⇒ Maintenance ; Booklet 11 ; Descriptions of work; Checking poly V-belt
- ❑ Removing and installing ⇒ page 43

2 - Bolt

- ❑ Renew after removing
- ❑ 10 Nm + 90°

3 - Vibration damper

- ❑ Removing and installing ⇒ page 49 .
- ❑ Installation position: hole in vibration damper must align over protrusion on crankshaft pulley.
- ❑ Can only be installed in one position. Holes are offset.

4 - Bolt

- ❑ 20 Nm

5 - Idler pulley

6 - Dowel sleeve

- ❑ Check for correct seating in ancillary bracket.
- ❑ Inserted in hole for the left-hand (direction of travel) bolt -11- on the rear side of the bracket.

7 - Bracket for ancillaries

8 - High-pressure pump

- ❑ Removing and installing ⇒ page 309 .

9 - Alternator

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

10 - Bolt

- ❑ 20 Nm +180°

Note

After removal, adjust torque to 20 Nm + 90°.

11 - Bolt

- ❑ Renew after removing.
- ❑ 40 Nm + 90°
- ❑ Observe tightening sequence ⇒ page 51 .

12 - Bolt

- ❑ 25 Nm

13 - Sleeve

- ❑ Drive back slightly before installing vane pump.

14 - Bolt

- ❑ Renew after removing.
- ❑ 40 Nm +180°
- ❑ Observe tightening sequence ⇒ page 51 .

15 - Vane pump

- ❑ Removing and installing ⇒ Running gear, axles, steering; Rep. gr. 48 ; Hydraulic power-assisted steering; Removing and installing vane pump

16 - Bolt

- ❑ 23 Nm

17 - Bolt

- ❑ 23 Nm

18 - Belt pulley

19 - Bolt

- ❑ 23 Nm

20 - Bolt

- ❑ 20 Nm

21 - Poly V-belt tensioning element

- ❑ Swing with ring spanner to slacken poly V-belt ⇒ page 43

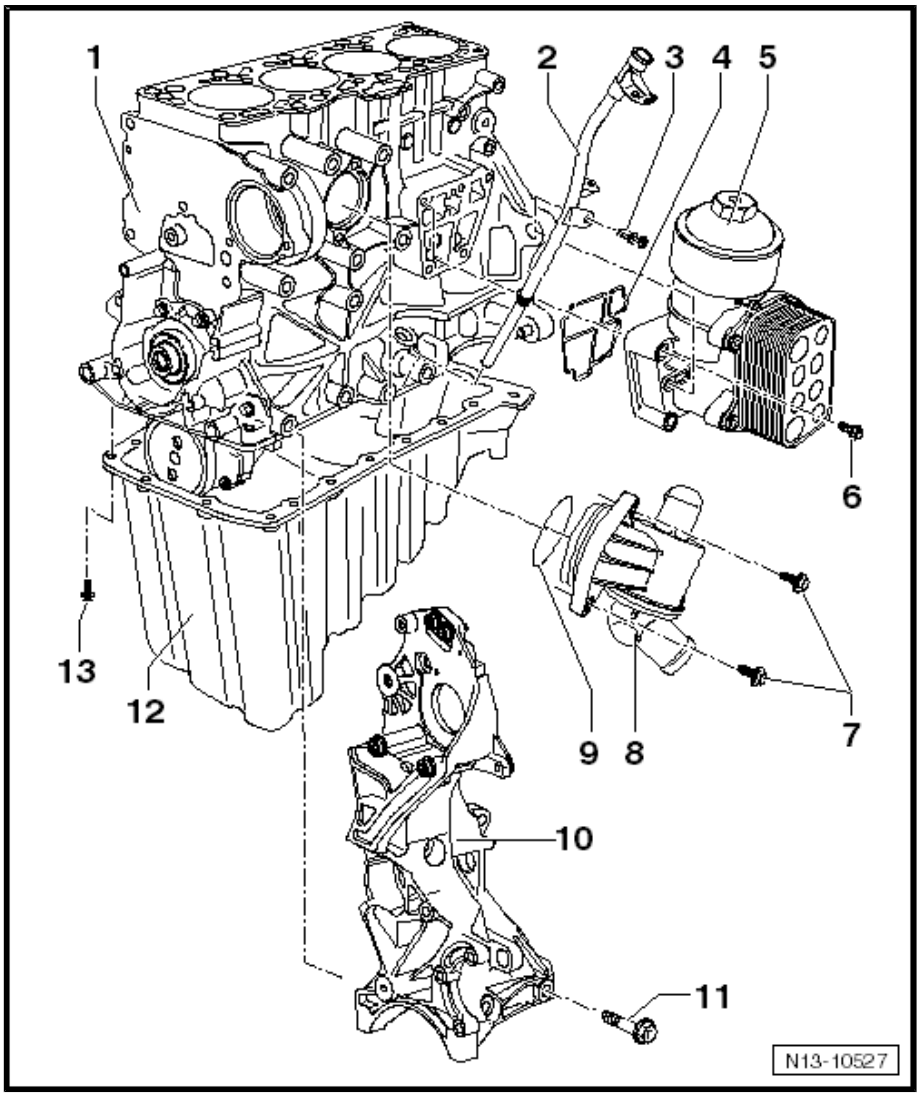
22 - Bolt

- ❑ 20 Nm

23 - Bolt

- ❑ Renew after removing.
- ❑ 20 Nm +45°

1.2 Assembly overview - cylinder block (pulley end)



1 - Cylinder block

- ❑ Removing and installing sealing flange on belt pulley end ⇒ page 54 .
- ❑ Removing and installing flywheel ⇒ page 59
- ❑ Removing and installing sealing flange on flywheel end ⇒ page 60 .
- ❑ Assembly overview - crankshaft ⇒ page 68 .
- ❑ Pistons and conrods ⇒ page 80 .

2 - Guide tube

- ❑ Renew O-ring.

3 - Spreader clip

4 - Gaskets

- ❑ Renew after removing.

5 - Oil filter bracket

- ❑ Oil filter bracket and engine oil cooler ⇒ page 157 .

6 - Bolt

- ❑ Renew after removing.
- ❑ 14 Nm +180°
- ❑ First, fit upper left and lower right bolts in place. Then, tighten all 4 bolts alternately in diagonal sequence .

7 - Bolt

- ❑ 13 Nm

8 - Thermostat (4/2-way valve)

- ❑ Removing and installing ⇒ page 188 .
- ❑ Thermostat is firmly installed in valve.
- ❑ Can only be renewed complete.

9 - O-ring

- ❑ Renew after removing.

10 - Bracket for ancillaries

- ❑ Removing and installing ⇒ page 50 .
- ❑ Observe tightening sequence ⇒ page 51 .

11 - Bolt

- ❑ Renew after removing.
- ❑ 40 Nm +180°
- ❑ Observe varying tightening sequence ⇒ page 51

12 - Oil sump

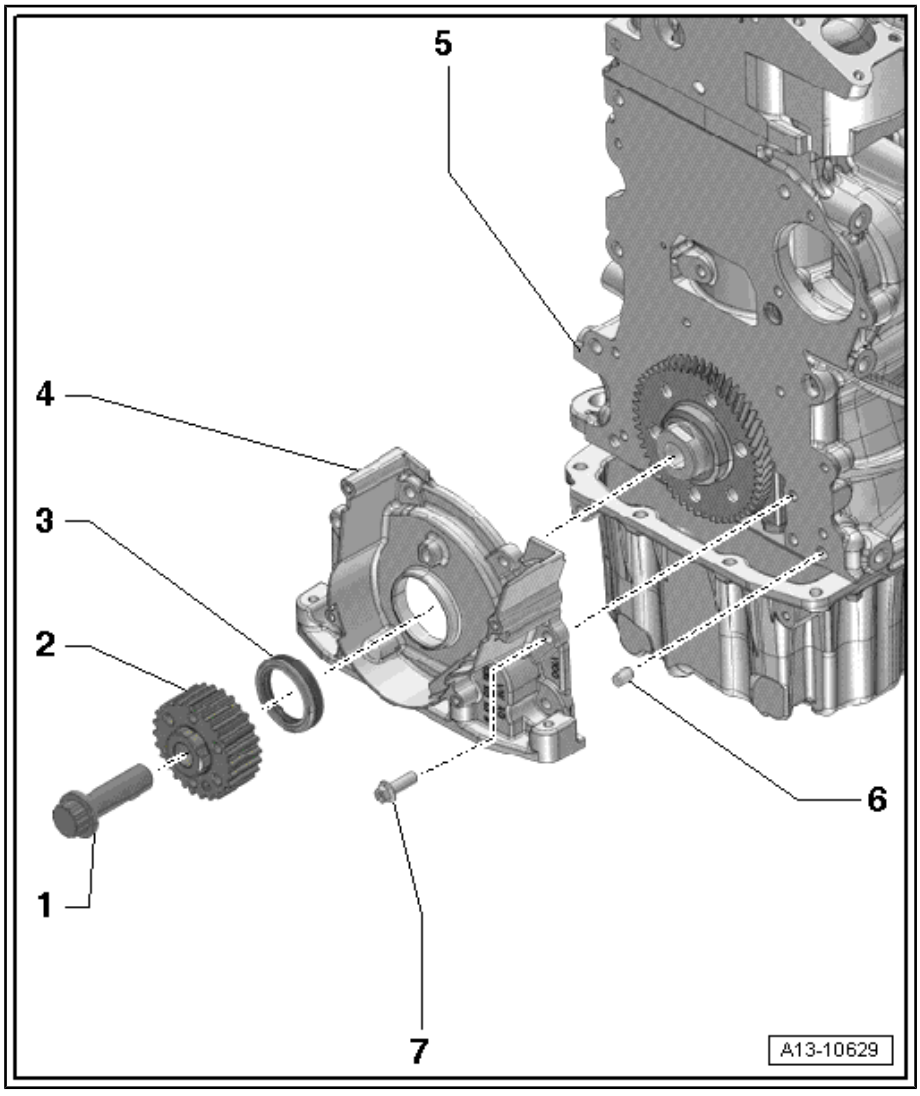
- ❑ Removing and installing ⇒ page 151 .
- ❑ Clean sealing surface before fitting.

- ❑ Fit with silicone sealant ⇒ Electronic Parts Catalogue (ETKA) .

13 - Bolt

- ❑ 15 Nm

1.3 Assembly overview - sealing flange, belt pulley end



1 - Bolt

- ❑ Renew after removing.
- ❑ Loosen and tighten with counter-hold tool - 3415- .
- ❑ Do not additionally oil the thread and shoulder.
- ❑ 180 Nm + 135°

2 - Crankshaft pulley

- ❑ With or without mark (depending on version)
- ❑ The contact surface between toothed belt pulley and crankshaft must be free of oil.
- ❑ Fitting possible in one position only.

3 - Crankshaft oil seal for belt pulley end

> **WARNING**
> *A new seal is used from 07.12. The sealing lip of this seal faces outwards, not inwards, as before.*

- ❑ Renewing ⇒ page 52 .
- ❑ Do not apply additional oil or grease the sealing lip of the oil seal.
- ❑ Before installing, remove oil residue from crankshaft journal using a clean cloth.

4 - Sealing flange at belt pulley end

- ❑ Removing and installing ⇒ page 54 .
- ❑ Fit with silicone sealant ⇒ Electronic Parts Catalogue (ETKA) .
- ❑ Must sit on dowel pins.

5 - Cylinder block

6 - Dowel pin

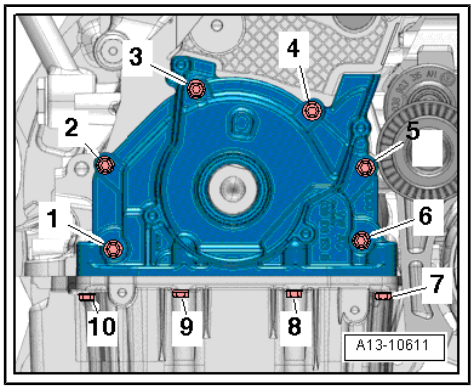
7 - Bolt

- ❑ Specified torque and tightening sequence ⇒ page 43 .

Sealing flange at belt pulley end - Prescribed torque and tightening sequence

– Tighten bolts for sealing flange at belt pulley end in the sequence -1 … 10- in 3 stages as follows:

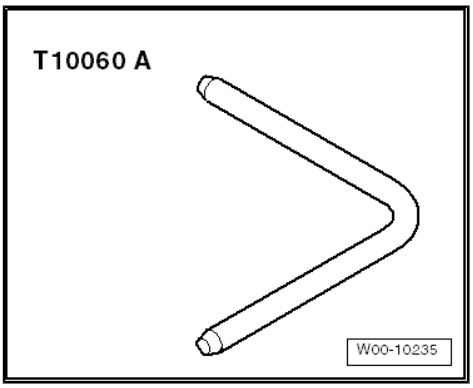
1. Screw bolts -1 ... 10- in as far as stop by hand.
2. Tighten bolts -1 … 6- in diagonal sequence to 15 Nm.
3. Tighten bolts -7 … 10- to 15 Nm.



1.4 Removing and installing poly V-belt

Special tools and workshop equipment required

♦ Locking pin - T10060 A-

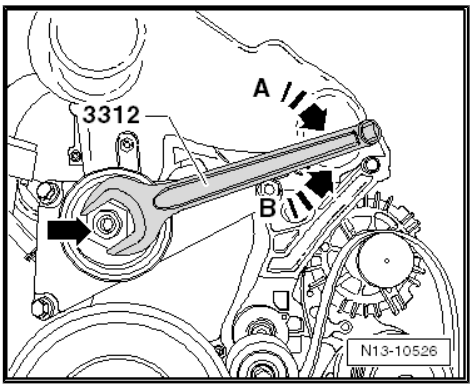


WARNING

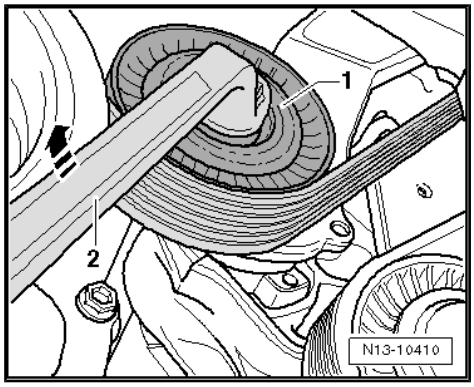
Under no circumstances may the engine be turned counter to its direction of rotation -arrow B- at the viscous fan shaft -arrow-. This can result in the shaft being loosened and the vehicle breaking down. When tightening the viscous fan bolt, only counterhold in the engine's direction of rotation -arrow A- using the open-end spanner - 3312- .

Removing

– Remove any noise insulation ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation .
– Remove poly V-belt for viscous fan ⇒ page 46 .
– Mark direction of rotation of poly V-belt.

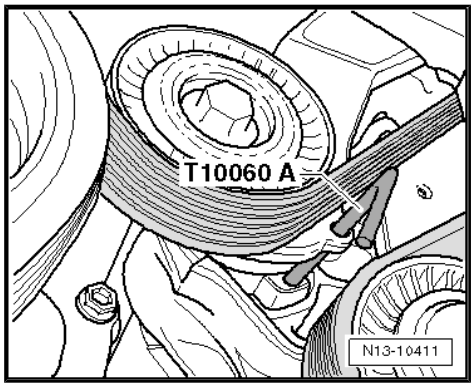


– Turn the tensioning element -1- in -direction of arrow- with ring spanner SW 16 -2- to slacken the poly-V belt.



– Lock tensioning element using locking pin - T10060 A- .

– Remove poly V-belt.



Installing

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

Note

- *Before installing poly V-belt, ensure that all sub-assemblies (alternator, air conditioner compressor and vane pump) are securely mounted.*
- *When installing poly V-belt, check direction of belt rotation and proper seating of belt in pulleys.*
- *Place the poly-V belt last on the tensioning element.*

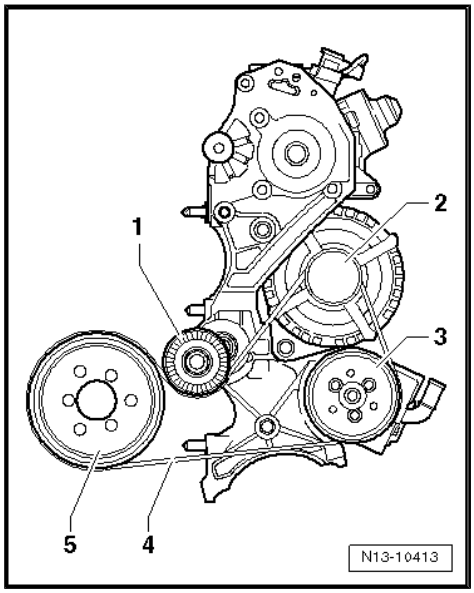
– Remove locking pin - T10060 A- .

After completing repair, always:

– Start engine and check that belt runs properly.

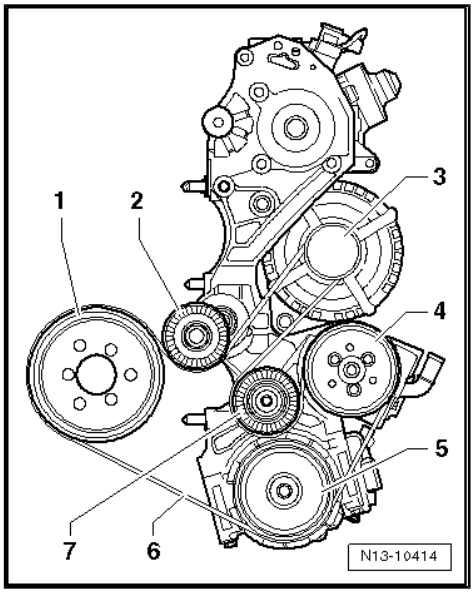
Belt drive without air conditioner compressor

1 - Tensioning roller
2 - Alternator pulley
3 - Vane pump
4 - Poly V-belt
5 - Crankshaft pulley



Belt drive with air conditioner compressor

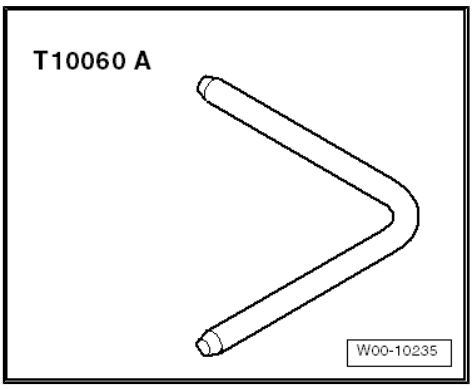
1 - Crankshaft pulley
2 - Tensioning roller
3 - Alternator pulley
4 - Vane pump
5 - Air conditioner compressor pulley
6 - Poly V-belt
7 - Guide roller



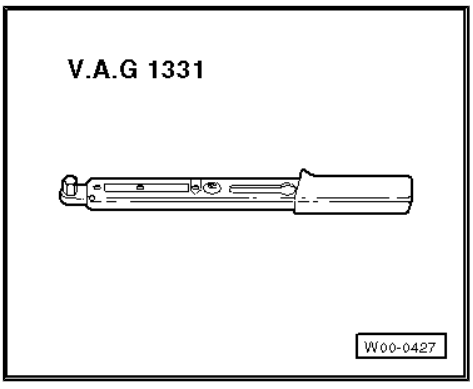
1.5 Removing and installing tensioner for poly V-belt

Special tools and workshop equipment required

♦ Locking pin - T10060 A-



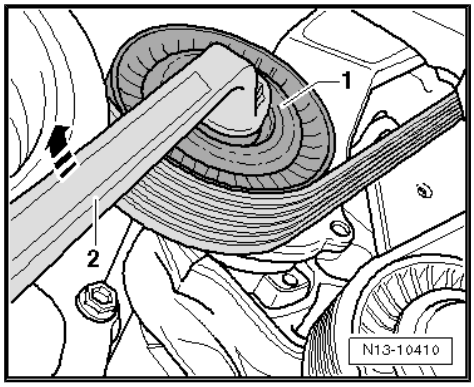
♦ Torque wrench - V.A.G 1331-



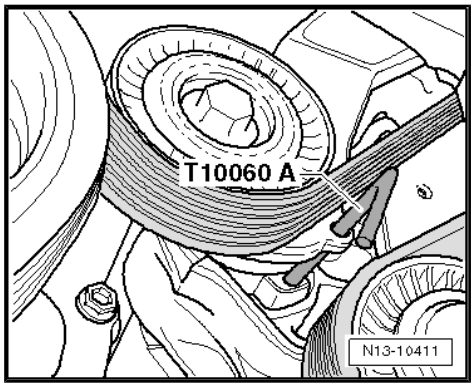
Removing

– Disconnect earth strap of battery and second battery ⇒ Electrical system; Rep. gr. 27 ; Starter, power supply, CCS .
– Remove air filter ⇒ page 277 .
– Mark direction of rotation of poly V-belt.

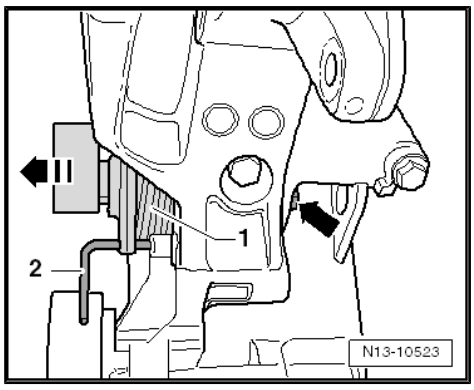
– Turn the tensioning element -1- in -direction of arrow- with ring spanner SW 16 -2- to slacken the poly-V belt.



– Lock tensioning element using locking pin - T10060 A- .
– Remove poly V-belt.
– Remove alternator ⇒ Electrical system; Rep. gr. 27 ; Alternator .



– Loosen bolt -arrow- and remove tensioning element for poly V-belt -1- in -direction of arrow-.



Note

The bolt -arrow- can be reused. The torque setting must be adjusted to 20 Nm + 90°.

Installing

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

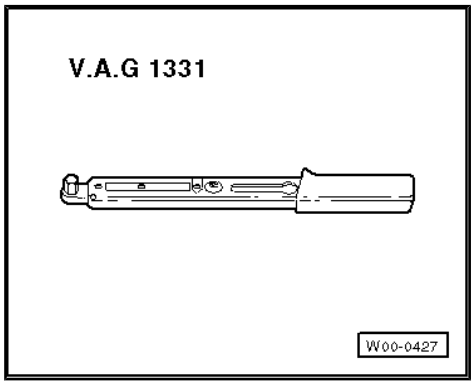
Specified torques

- ⇒ “1.1 Assembly overview - poly V-belt drive”, page 36

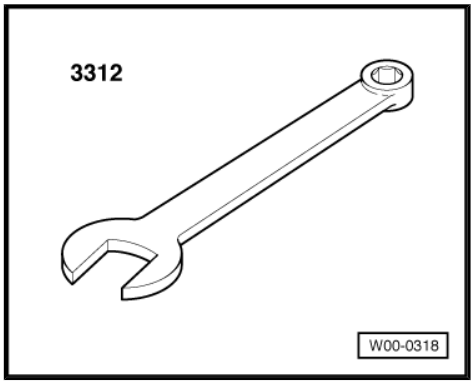
1.6 Removing and installing poly V-belt for viscous fan

Special tools and workshop equipment required

- Torque wrench - V.A.G 1331-



♦ Open jaw spanner - 3312-



Not illustrated

Note

The assembly aid for poly V-belts - T50045- is included in the repair set ⇒ Electronic Parts Catalogue (ETKA) .

Special tools and workshop equipment required

♦ Assembly aid for poly V-belts - T50045-

Note

The viscous fan poly V-belt must be renewed after every dismantling operation and may therefore be cut to remove it.

Removing

– Remove any noise insulation ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation .

– Remove radiator grille ⇒ General body repairs, exterior; Rep. gr. 50 .

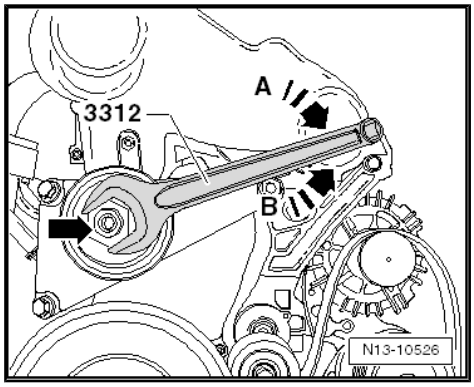
– Remove front bumper ⇒ General body repairs, exterior; Rep. gr. 63 ; Bumpers .

– Remove charge air cooler ⇒ page 253 .

– Remove viscous fan ⇒ page 205 .

WARNING

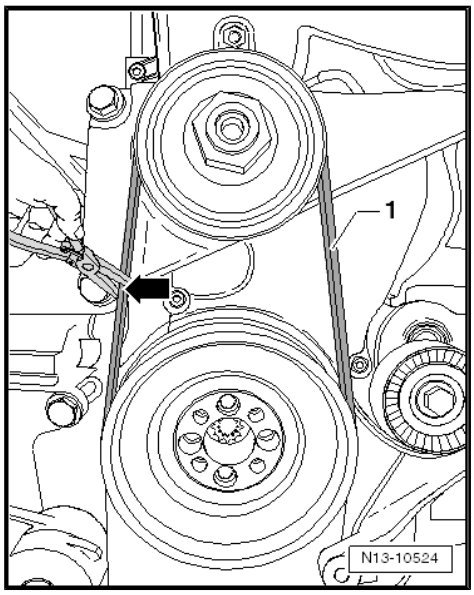
Under no circumstances may the engine be turned counter to its direction of rotation -arrow B- at the viscous fan shaft -arrow-. This can result in the shaft being loosened and the vehicle breaking down. When tightening the viscous fan bolt, only counterhold in the engine's direction of rotation -arrow A- using the open-end spanner - 3312- .



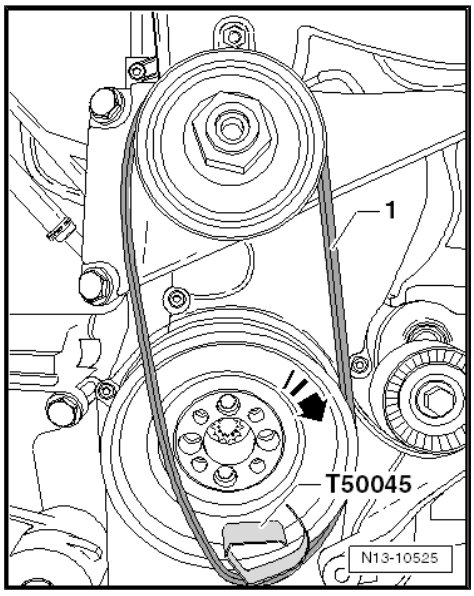
– Cut through viscous fan poly V-belt -1- using commercially available side cutters -arrow-.
– Remove poly V-belt.

Installing

– Fit new poly V-belt -1- on viscous fan pulley.



– Mount poly V-belt fitting tool - T50045- on vibration damper.
– Tension poly V-belt -1- in -direction of arrow- using poly V-belt fitting tool - T50045- .
– Turn engine in -direction of arrow- at crankshaft, thereby fitting poly V-belt -1- onto vibration damper.
– The remaining installation steps are carried out in the reverse sequence.

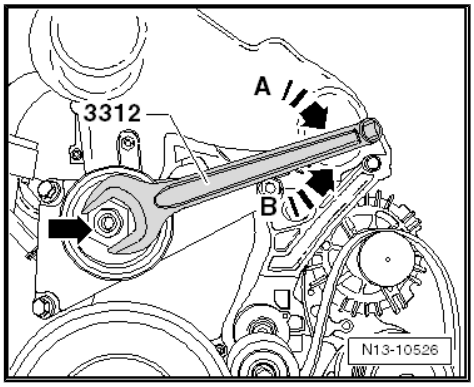


WARNING

Under no circumstances may the engine be turned counter to its direction of rotation -arrow B- at the viscous fan shaft -arrow-. This can result in the shaft being loosened and the vehicle breaking down. When tightening the viscous fan bolt, only counterhold in the engine's direction of rotation -arrow A- using the open-end spanner - 3312- .

Specified torques

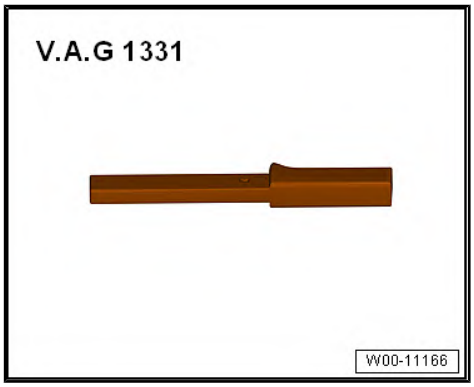
- Lock carrier; Assembly overview - lock carrier ⇒ General body repairs, exterior; Rep. gr. 50 ; Lock carrier; Assembly overview - lock carrier
- Front bumper; Assembly overview - front bumper ⇒ General body repairs, exterior; Rep. gr. 63 ; Front bumper; Assembly overview - bumper cover
- Noise insulation; Assembly overview - noise insulation ⇒ Rep. gr. 66 ; Assembly overview - noise insulation



1.7 Removing and installing vibration damper

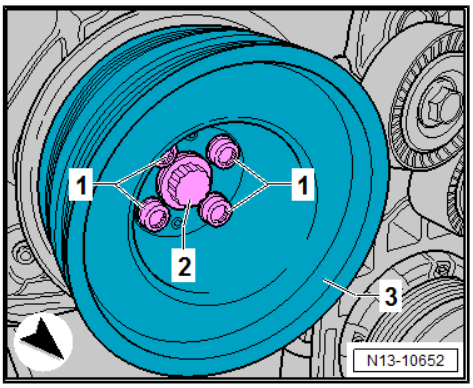
Special tools and workshop equipment required

- Torque wrench - V.A.G 1331-



Removing

– Remove poly V-belt ⇒ page 43 .
– Unscrew bolts -1- while counterholding on centre bolt -2-.
– Remove vibration damper -3-.



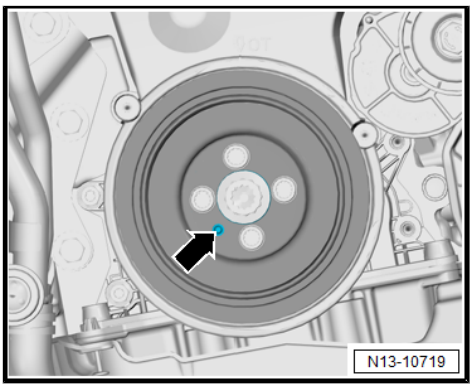
Installing

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

- Installation position: hole -arrow- in vibration damper must align over protrusion on crankshaft pulley.

Specified torque

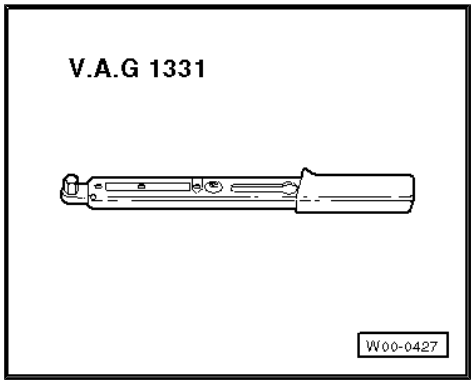
- ⇒ “1.1 Assembly overview - poly V-belt drive”, page 36



1.8 Removing and installing ancillary bracket

Special tools and workshop equipment required

- Torque wrench - V.A.G 1331-



Removing

– Remove high-pressure pump ⇒ page 309 .

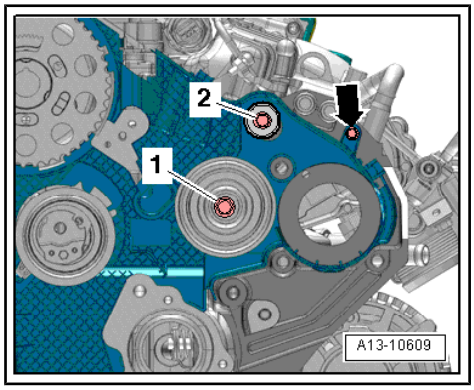
– Unbolt vane pump with hoses still connected ⇒ Running gear, axles, steering; Rep. gr. 48 ; Hydraulic power-assisted steering; Removing and installing vane pump .

– Remove alternator ⇒ Electrical system; Rep. gr. 27 ; Alternator; Removing and installing alternator .

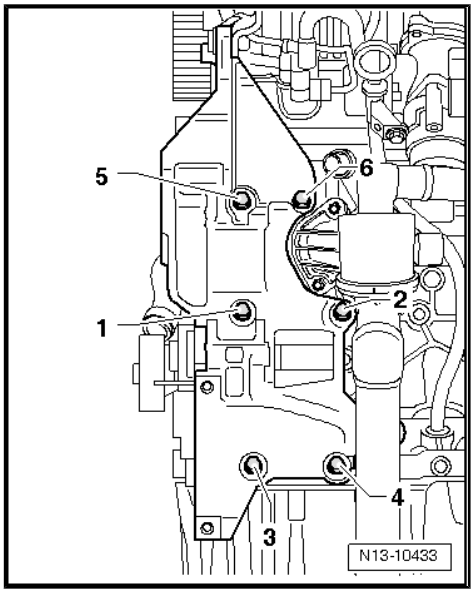
– If fitted, unbolt air conditioner compressor with lines still connected ⇒ Heating, air conditioning; Rep. gr. 87 ; Air conditioner compressor; Removing and installing air conditioner compressor from and to bracket .

– Unscrew bolts -1 and 2-, and remove idler pulleys.

– Remove bolt -arrow-.



– Unscrew bolts -1 ... 6-.



Note

Bolt -2- can only be unscrewed with the left engine support disconnected and the engine lifted slightly.

– Detach engine support from engine ⇒ page 34 .

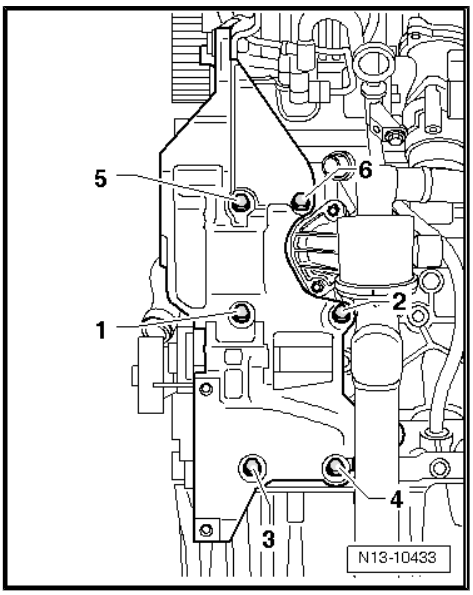
– Remove ancillary bracket.

Installing

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

Ancillary bracket - specified torques and tightening sequence

– Insert securing bolts for ancillary bracket as follows:



Note

Make sure that the dowel sleeve on the rear of the bracket is in the hole for the bolt -6-. If the dowel sleeve is missing, it must be replaced.

- ♦ Bolts -1- and -2-
- ♦ Bolts -3- and -4-
- ♦ Bolts -5- and -6-

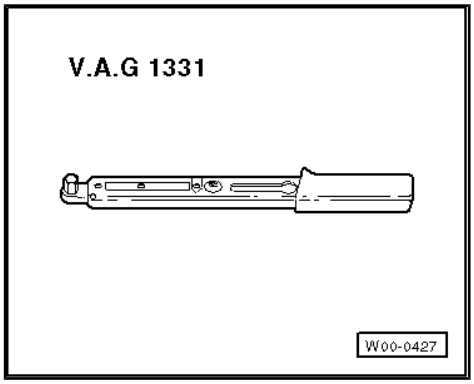
– Tighten securing bolts for ancillary bracket in sequence -1 … 6- in 2 stages as follows:

1. Screw all bolts in to stop by hand.
2. Tighten all bolts to 40 Nm.
3. Turn bolts -1, 2, 5 and 6- 90° further.
4. Turn bolts -3- and -4- 180° further.

1.9 Removing and installing bracket with belt pulley

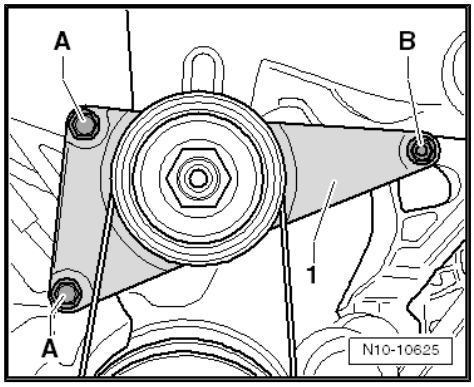
Special tools and workshop equipment required

- ♦ Torque wrench - V.A.G 1331-



Removing

– Remove any noise insulation ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation .
– Remove air filter ⇒ page 277 .
– Remove viscous fan ⇒ page 205 .
– Remove cowling ⇒ page 207 .
– Remove poly V-belt for auxiliary drive ⇒ page 46 .
– Unscrew bolts -A and B-, and remove bracket -1-.



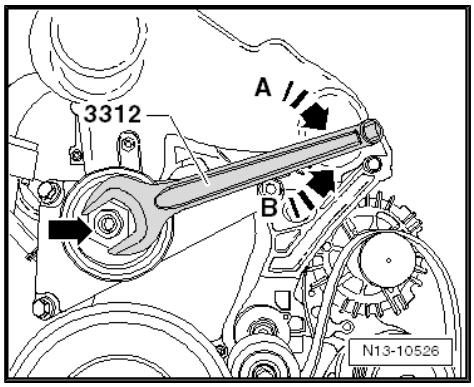
Installing

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

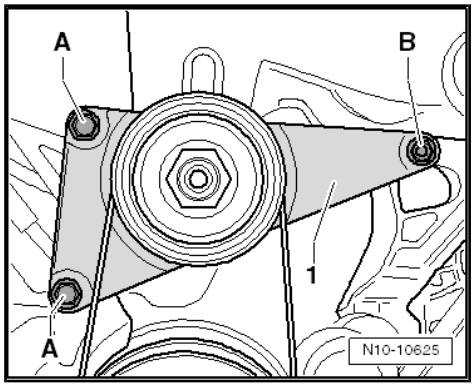
WARNING

Under no circumstances may the engine be turned counter to its direction of rotation -arrow B- at the viscous fan shaft -arrow-. This can result in the shaft being loosened and the vehicle breaking down. When tightening the viscous fan bolt, only counterhold in the engine's direction of rotation -arrow A- using the open-end spanner - 3312- .

Specified torques



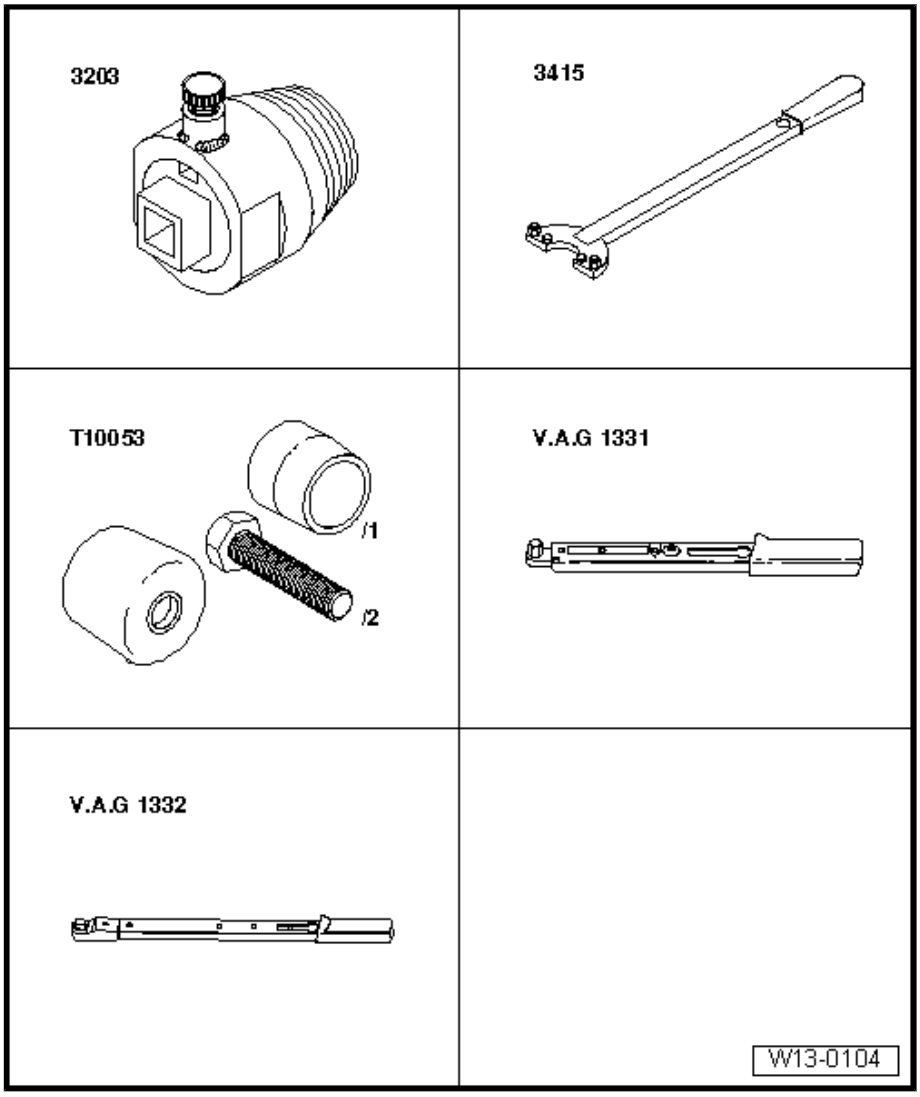
- Securing bolts -A- and -B-: 40 Nm + 180°
- ⇒ “4.2 Assembly overview - viscous fan”, page 204
- Noise insulation; Assembly overview - noise insulation ⇒ Rep. gr. 66 ; Assembly overview - noise insulation



1.10 Renewing crankshaft oil seal - belt pulley end

Special tools and workshop equipment required

- Oil seal extractor - 3203-
- Counterhold tool - 3415-
- Assembly tool - T10053-
- Torque wrench (5…50 Nm) - V.A.G 1331-
- Torque wrench (40…200 Nm) - V.A.G 1332-



Removing

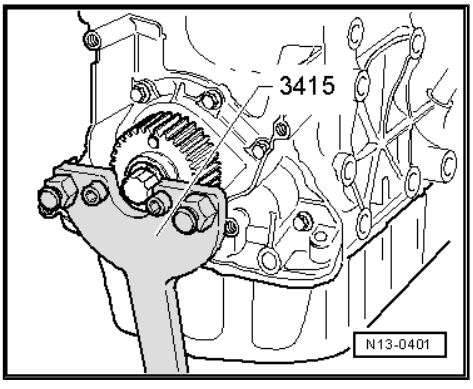
– Remove toothed belt ⇒ page 112 .

– Remove crankshaft pulley. To do this, lock toothed belt pulley using counterhold - 3415- .

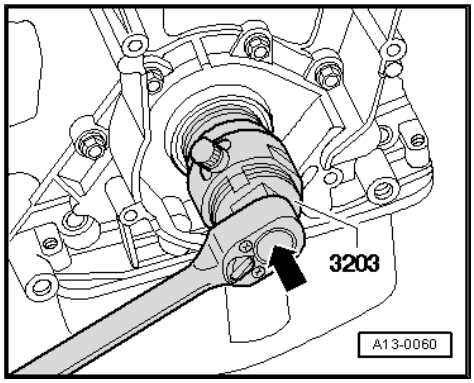
– To guide seal extractor - 3203- , screw centre bolt into crankshaft as far as stop by hand.

– Unscrew inner part of oil seal extractor 2 turns (approx. 3 mm) from the outer part and lock in position with the knurled screw.

– Oil threaded head of seal extractor.



– Screw oil seal extractor forcibly as far as possible into oil seal.
– Loosen knurled screw and turn inner part against crankshaft until the oil seal is pulled out.



Installing

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

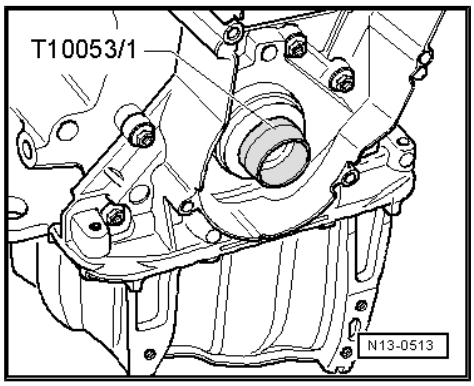
WARNING

A new seal is used from 07.12. The sealing lip of this seal faces outwards, not inwards, as before.

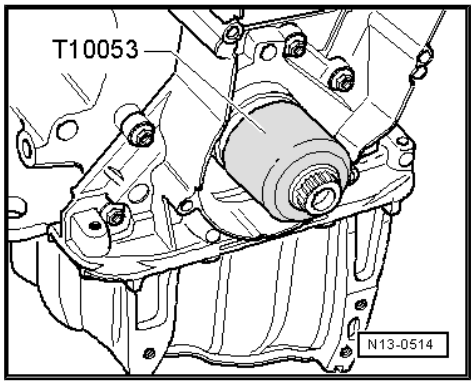
Note

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

– Remove oil residues from crankshaft journal with a clean cloth.
– Fit guide sleeve - T10053/1- onto crankshaft journal.
– Slide seal over guide sleeve - T10053/1- onto crankshaft journal.



– Press oil seal in as far as stop with press sleeve - T10053- and central bolt.



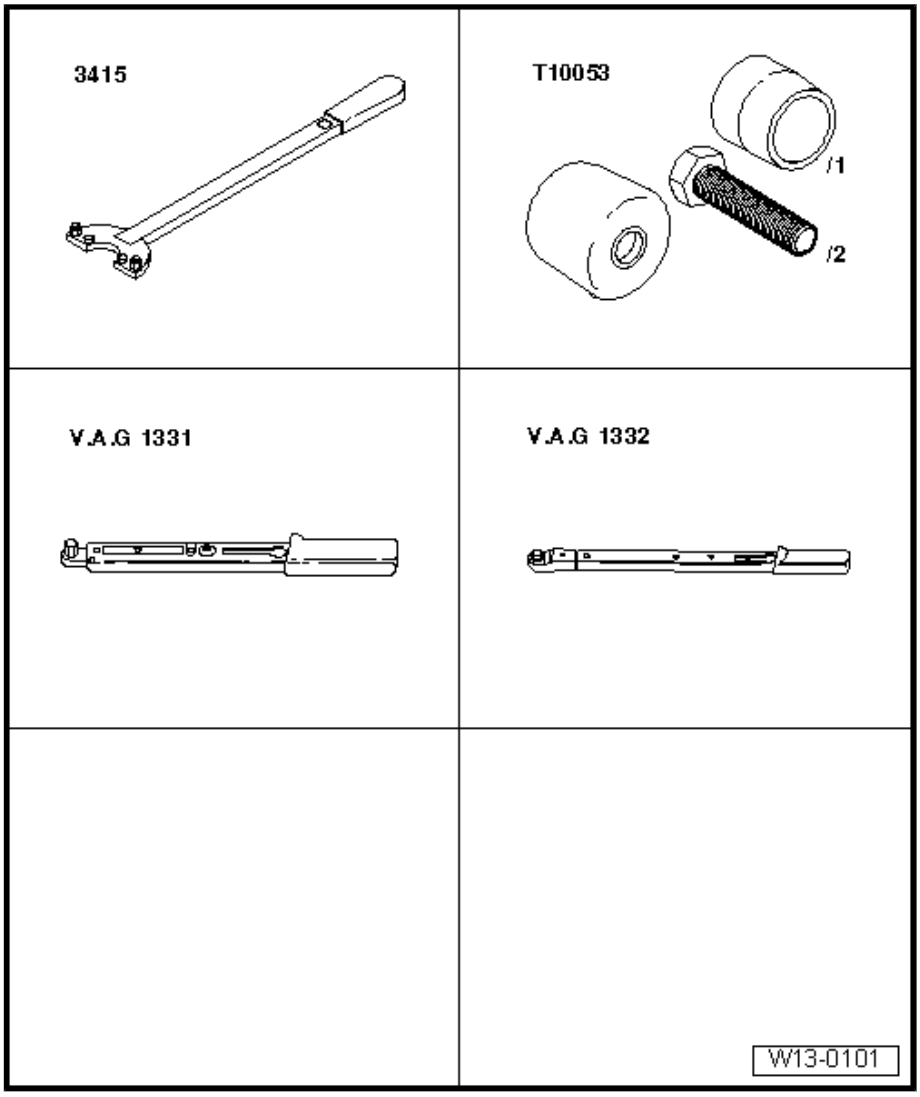
Specified torques

- ⇒ “1.3 Assembly overview - sealing flange, belt pulley end”, page 42
- ⇒ “2.1 Assembly overview - toothed belt”, page 110
- Noise insulation; Assembly overview - noise insulation ⇒ Rep. gr. 66 ; Assembly overview - noise insulation

1.11 Removing and installing sealing flange on pulley end

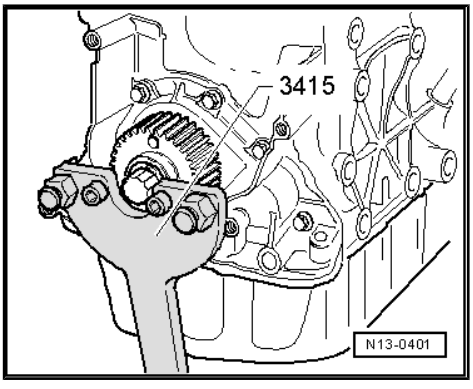
Special tools and workshop equipment required

- Counterhold tool - 3415-
- Assembly tool - T10053-
- Torque wrench (5…50 Nm) - V.A.G 1331-
- Torque wrench (40…200 Nm) - V.A.G 1332-
- Hand drill with plastic brush
- Flat scraper
- Silicone sealant ⇒ Electronic Parts Catalogue (ETKA)

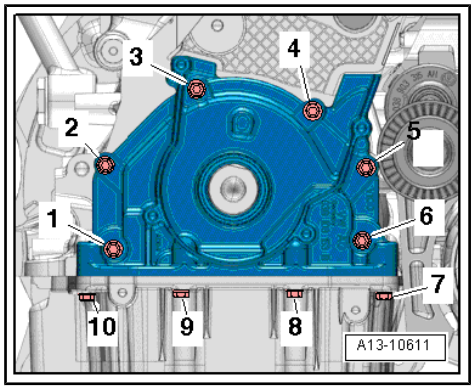


Removing

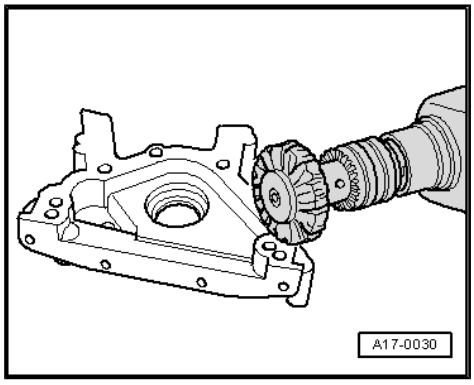
– Remove toothed belt ⇒ page 112 .
– Remove crankshaft pulley. To do this, lock toothed belt pulley using counterhold - 3415- .
– Drain off engine oil.
– Remove sump ⇒ page 151 .



– Unscrew bolts -1 … 10- and carefully remove sealing flange from the glued joint.
– Remove sealing flange. If necessary, loosen sealing flange using light blows with a rubber headed hammer.
– Remove sealant residues from cylinder block with a flat scraper.



– Remove residual sealant on sealing flange using a rotating plastic brush (wear protective goggles).
– Clean sealing surfaces. They must be free of oil and grease.



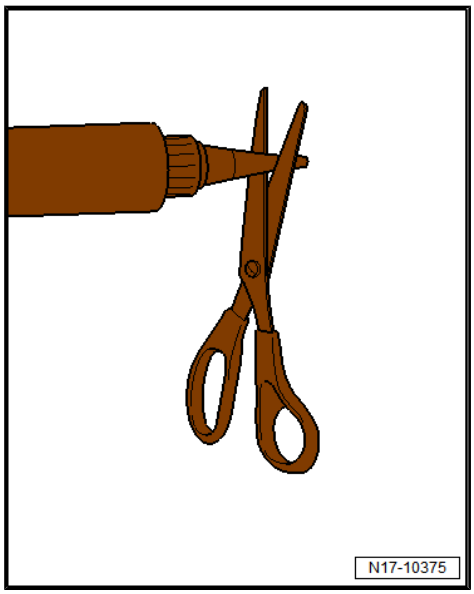
Installing

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

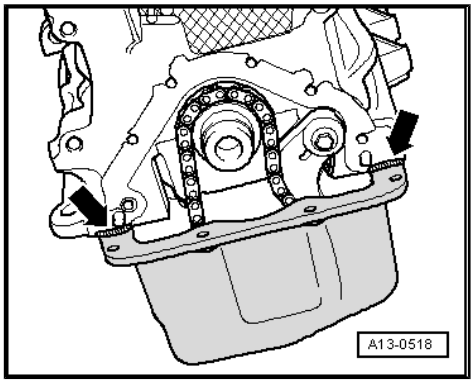
Note

- *Observe use-by-date of sealant.*
- *The sealing flange must be installed within 5 minutes of applying the silicone sealant.*
- *Sealant bead must be no thicker than 2…3 mm. Excess sealant can find its way into the sump and block the strainer in the suction line and drip on the sealing surface of the crankshaft seal.*
- *Before applying sealant bead, cover the sealing surface of the sealing ring with a clean cloth.*

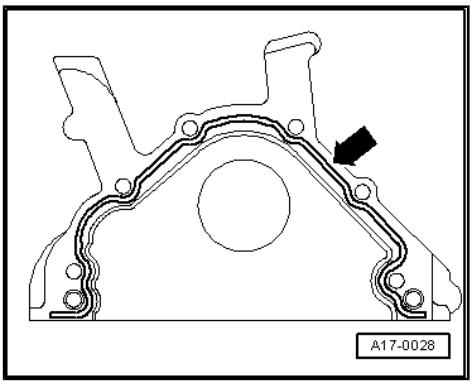
– Cut off nozzle on tube at front marking (diameter of nozzle approx. 3 mm).



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

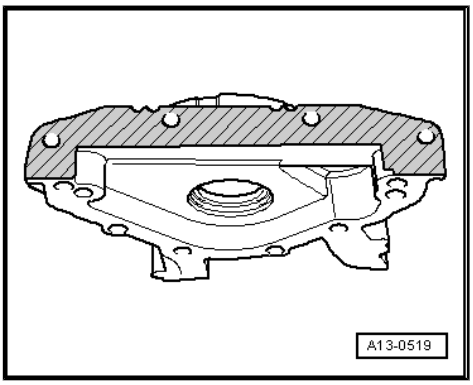


– Apply silicone sealant bead as shown in the illustration to clean sealing surface of sealing flange.



– Thinly coat lower sealing surface -shaded area- on sealing flange with sealant.

– Fit sealing flange immediately and lightly tighten all bolts.



Note

- *When fitting sealing flange with oil seal installed use the guide sleeve - T10053/1- .*
- *Sealing compound must dry for approx. 30 minutes after installation. Only then fill with engine oil.*

Specified torques

- ⇒ “1.3 Assembly overview - sealing flange, belt pulley end”, page 42
- ⇒ “2.1 Assembly overview - toothed belt”, page 110
- Noise insulation; Assembly overview - noise insulation ⇒ Rep. gr. 66 ; Assembly overview - noise insulation

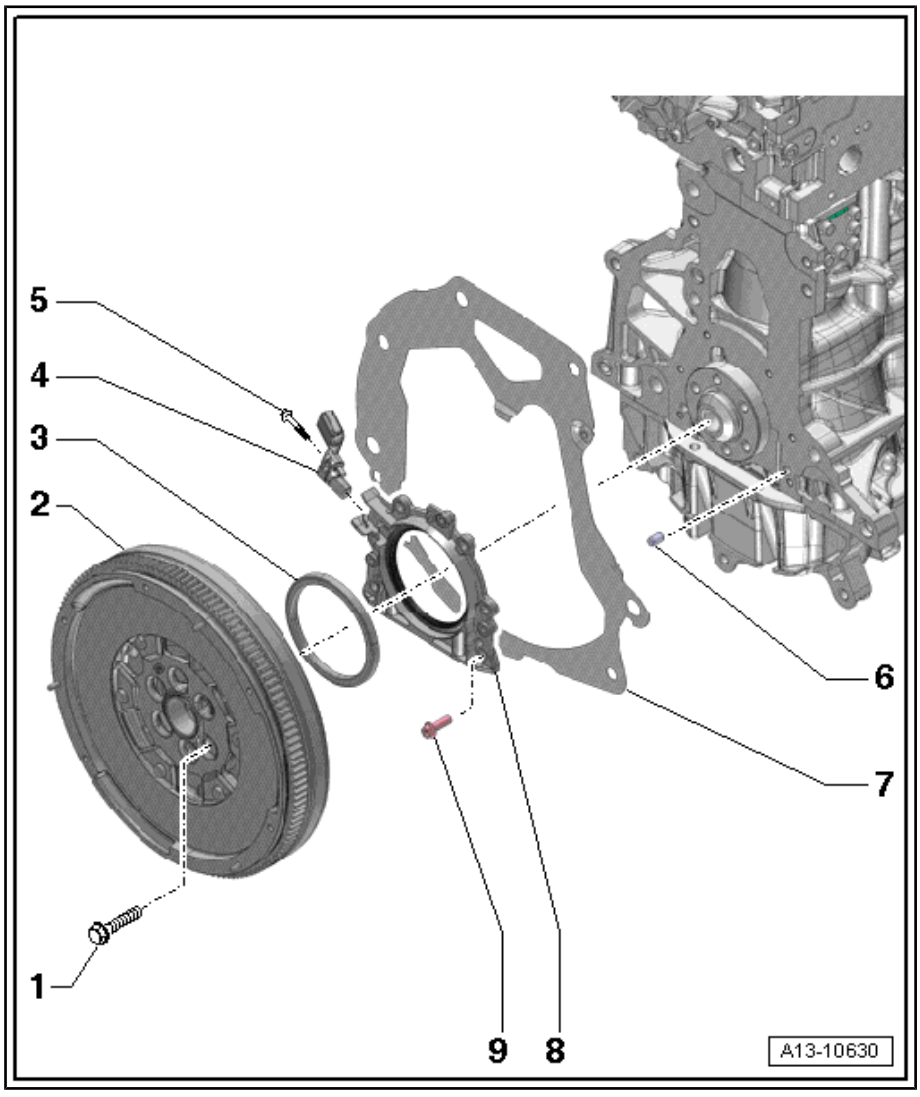
2 Cylinder block, gearbox end

⇒ “2.1 Assembly overview - cylinder block, gearbox end”, page 58

⇒ “2.2 Removing and installing flywheel”, page 59

⇒ “2.3 Removing and installing sealing flange on gearbox side”, page 60

2.1 Assembly overview - cylinder block, gearbox end



1 - Bolt

- ❑ Renew after removing.
- ❑ 60 Nm + 90°

2 - Flywheel

- ❑ Removing and installing ⇒ page 59 .
- ❑ Assembly through offset holes only possible in one position

3 - Sender wheel

- ❑ Removing and installing ⇒ page 60 .

4 - Engine speed sender - G28-

- ❑ Removing and installing ⇒ page 373 .

5 - Bolt

- ❑ 5 Nm

6 - Dowel pin

7 - Cover

- ❑ Attach to sealing flange ⇒ page 59
- ❑ Must sit on dowel pins.
- ❑ Do not damage or bend when assembling.

8 - Sealing flange, gearbox side

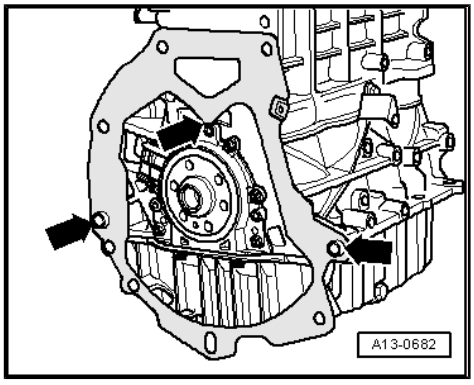
- ❑ Renewing ⇒ page 60 .
- ❑ with shaft seal
- ❑ With sender wheel for engine speed.
- ❑ Renew complete unit only.
- ❑ Do not additionally oil or grease the oil seal sealing lip.
- ❑ Before installing, remove oil residue from crankshaft journal using a clean cloth.
- ❑ Use support sleeve supplied when installing.

9 - Bolt

- ❑ 15 Nm

Fit cover.

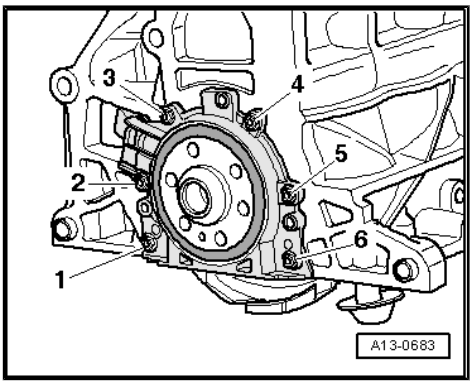
– Attach cover to sealing flange -arrow at top- and push onto dowel pins -arrows at bottom-.



Sealing flange on gearbox side - Specified torque and tightening sequence

– Renew bolts for sealing flange on gearbox side.

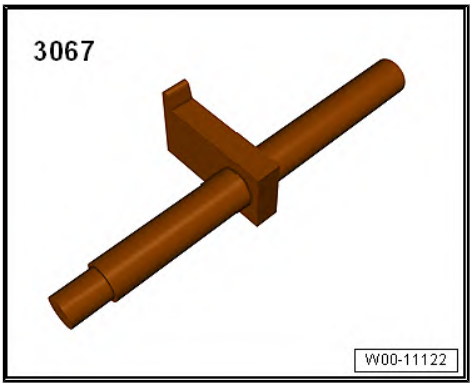
– Tighten bolts -1 … 6- in two stages as follows:
⇒ Item 9 (page 58) .



2.2 Removing and installing flywheel

Special tools and workshop equipment required

♦ Counterhold tool - 3067-

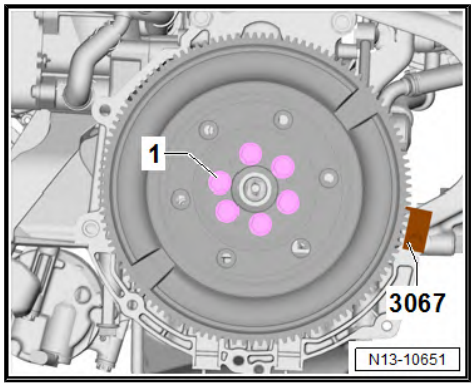


♦ Torque wrench - V.A.G 1332-

Removing

– Remove clutch ⇒ Rep. gr. 30 ; Removing and installing clutch .

– Insert counterhold - 3067- in hole on cylinder block.



Caution

To avoid damaging the flywheel when removing, the bolts -1- must not be unscrewed using pneumatic or impact wrench.

- *The bolts may be removed only by hand.*

– Unscrew bolts -1-.

– Remove flywheel.

Installing

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

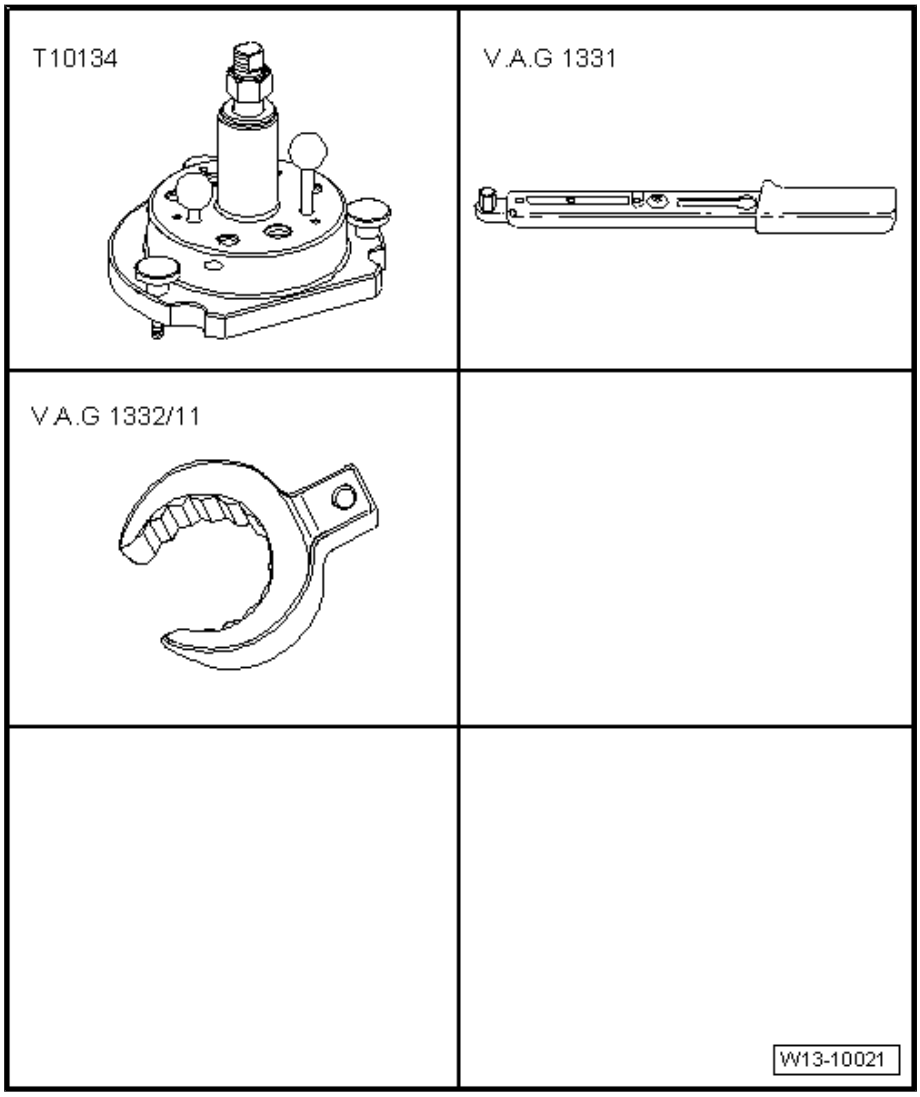
Specified torque

- ⇒ “2.1 Assembly overview - cylinder block, gearbox end”, page 58

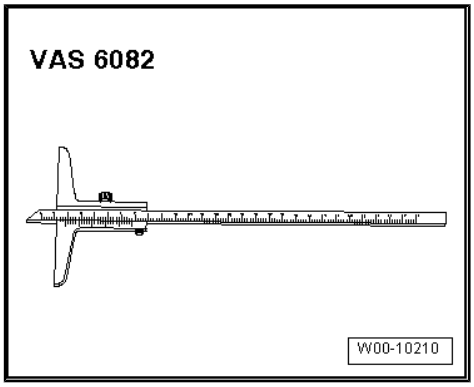
2.3 Removing and installing sealing flange on gearbox side

Special tools and workshop equipment required

- Assembly tool - T10134-
- Torque wrench - V.A.G 1331-
- Tool insert 24 mm - V.A.G 1332/11-



♦ Depth gauge - VAS 6082-



♦ 3 hexagon bolts M6 x 35 mm

♦ 2 hexagon bolts M7 x 35 mm

Removing

Note

♦ *For the sake of clarity, the work is performed with the engine removed.*

♦ *The procedure is identical whether the engine is installed or removed.*

– Removing gearbox ⇒ Rep. gr. 34 ; Removing and installing gearbox .

– Remove flywheel ⇒ page 59 .

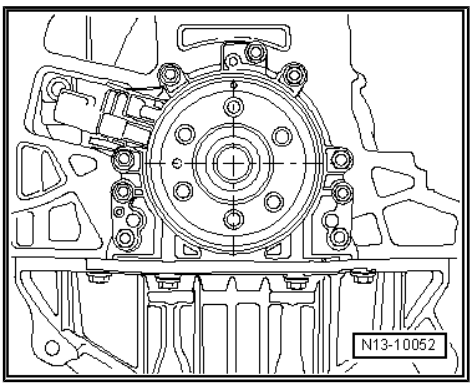
– Remove clutch ⇒ Rep. gr. 30 .

– Remove intermediate plate.

Pressing out sealing flange with sender wheel:

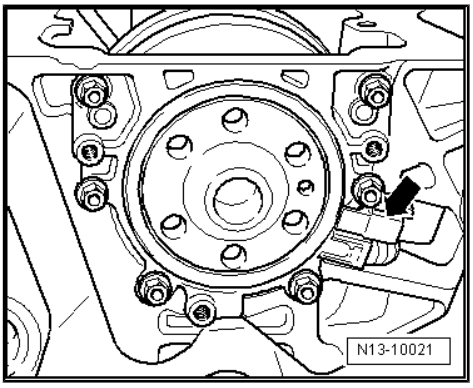
– Turn crankshaft on the TDC of cylinder 1 as shown.

– Remove sump ⇒ page 151 .



– Remove engine speed sender - G28- -arrow-

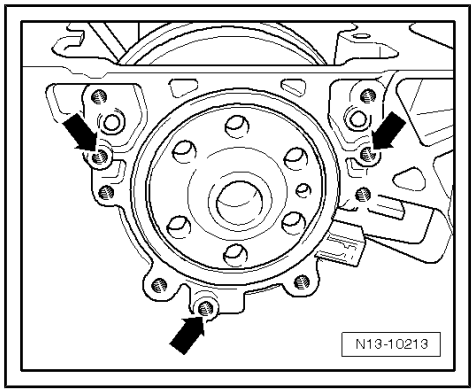
– Unscrew bolts of sealing flange.



Note

Sealing flange and sender wheel are pressed off the crankshaft together using 3 M6 x 35 mm bolts.

– Screw in 3 M6 x 35 mm bolts into threaded holes of sealing flange -arrows-.
– Screw bolts (max. 180° per bolt) into sealing flange alternately in order to press it and the sender wheel of crankshaft together.



Pressing in sealing flange with sender wheel:

Note

- *Sealing flange with a PTFE seal is equipped with a sealing lip support ring. This support serves as an assembly sleeve. It must not be removed before installation.*
- *Sealing flange and sender wheel must not be separated or turned after removal from packaging.*
- *Sender wheel is held in its installation position on the assembly device - T10134- by a locating pin.*
- *The sealing flange and seal are one unit. They can only be renewed together with the sender wheel.*
- *Assembly device - T10134- is held in its position relative to the crankshaft by a guide pin inserted into a hole in the crankshaft.*

Assembly tool - T10134-

A - Clamping surface

B - Hexagon nut

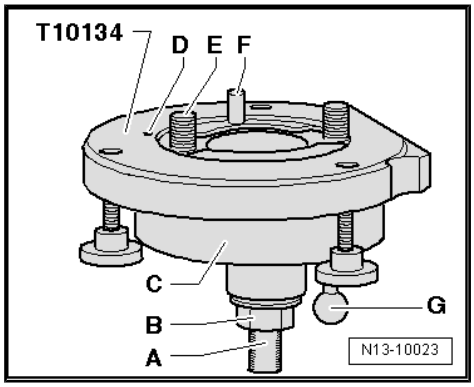
C - Assembly housing

D - Locating pin

E - Hexagon socket head bolt

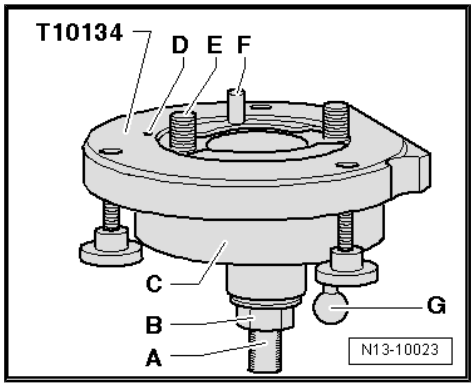
F - Guide pin for diesel engines (black knob)

G - Guide pin for petrol engines (red knob)

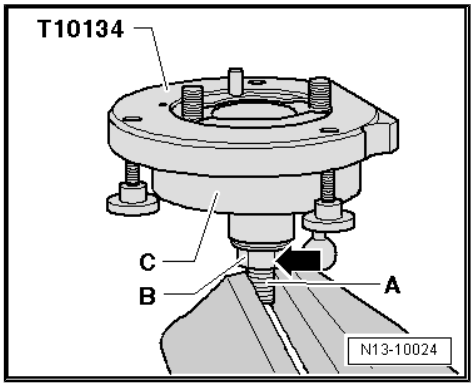


A - Fitting seal with sender wheel on assembly tool - T10134- :

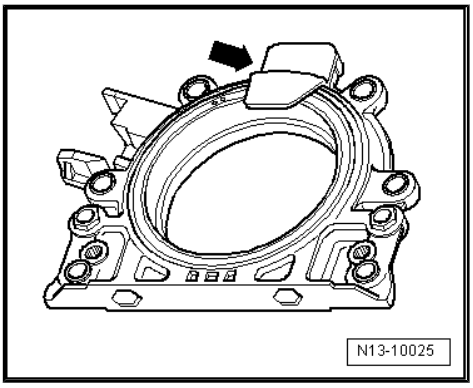
– Screw on nut -B- until just before it touches the clamping surface -A- of the threaded spindle.



– Clamp assembly device - T10134- in a vice on clamping surface -A- of threaded spindle.
– Press assembly housing -C- downwards until it lies on nut -B- -arrow-.
– Screw nut onto threaded spindle until inner part of assembly device and assembly housing are at same height.



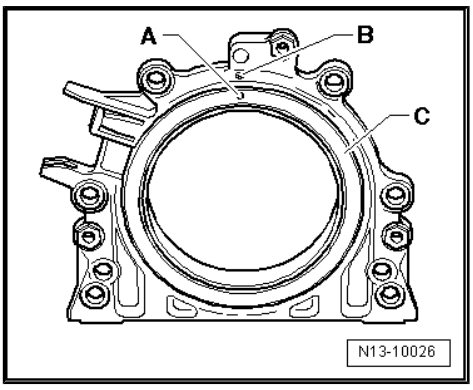
– Remove safety clip -arrow- of the new sealing flange.



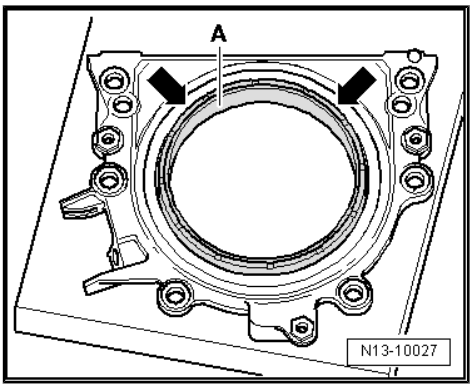
Note

Sender wheel must not be taken out of the sealing flange or twisted.

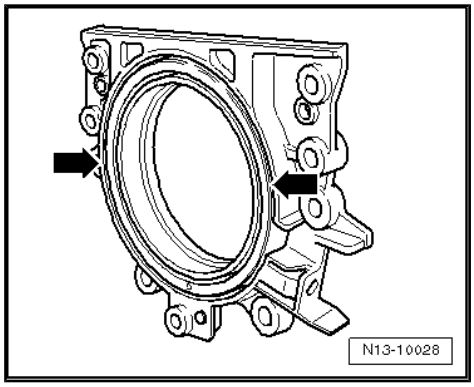
– Locating hole -A- on sender wheel -C- must align with marking -B- on sealing flange.
– Place sealing flange with front side facing down on a clean level surface.



– Push sealing lip support ring -A- downwards in direction of arrow until it lies on flat surface.



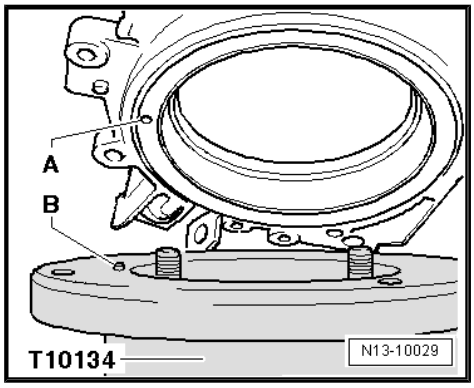
– Upper edge of sender wheel and front edge of sealing flange must align -arrows-.



– Place sealing flange with front side facing downwards onto assembly tool - T10134- so that locating pin -B- can be inserted in sender wheel hole -A-.

Note

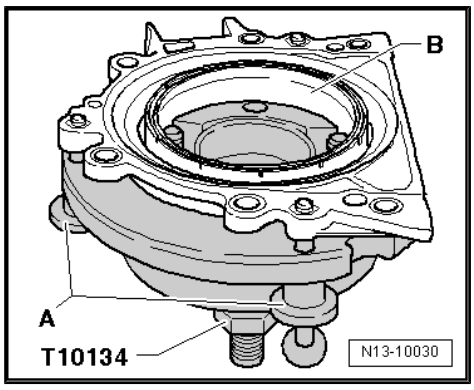
Ensure sealing flange lies flat on assembly tool.



– Push sealing flange and support ring for sealing lip -B- against surface of assembly tool - T10134- whilst tightening the 3 knurled screws -A- so that locating pin cannot slide out of sender wheel hole.

Note

When installing sealing flange, ensure that sender wheel remains fixed in assembly device.



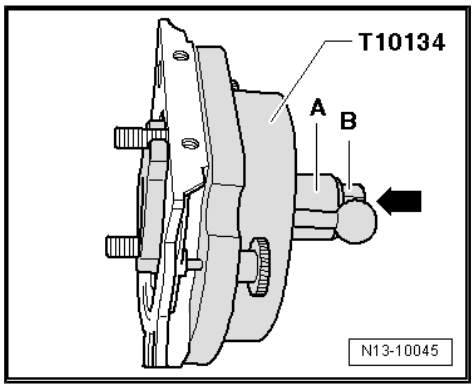
B - Fitting assembly tool - T10134- with sealing flange on crankshaft flange:

- Crankshaft flange must be free of oil and grease.
- Engine is positioned at TDC of cylinder 1

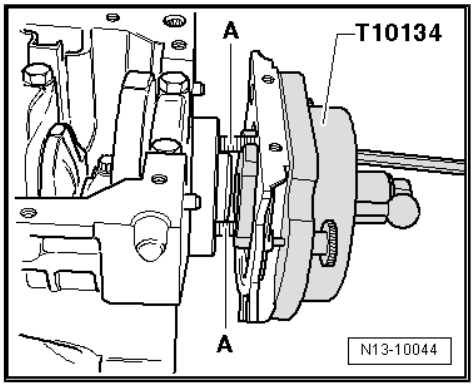
– Screw nut -B- on until it reaches end of threaded spindle.

– Press threaded spindle of assembly tool - T10134- in direction of arrow, until hexagon nut -B- lies against assembly housing -A-.

– Align flat side of assembly housing to crankcase's sealing surface on the oil sump side.



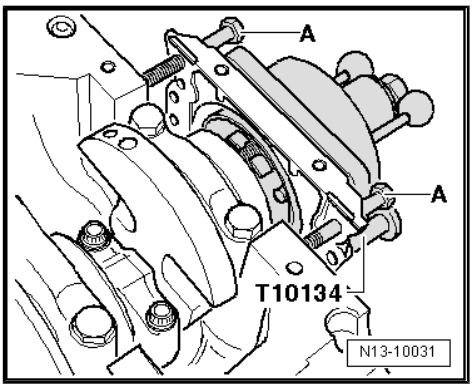
– Secure assembly tool - T10134- to crankshaft flange with hexagon socket head bolts -A-.



Note

Screw hexagon socket head bolts -A- into crankshaft flange (approx. 5 full turns).

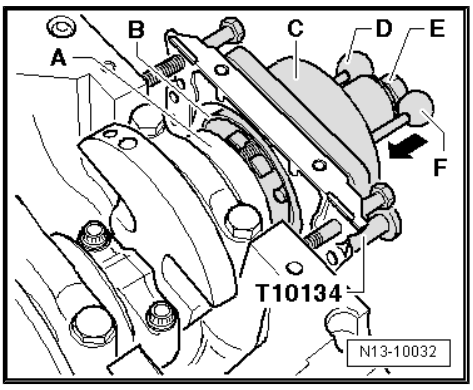
– To guide sealing flange into cylinder block, screw in 2 M7 × 35 mm bolts -A-.



C - Bolting assembly tool - T10134- onto crankshaft flange:

– Push assembly housing -C- by hand in direction of arrow until sealing lip support ring -B- touches crankshaft flange -A-.

– Push guide pin for diesel engines (black knob) -D- into hole in crankshaft. This ensures that the sender wheel reaches its final installation position.



Note

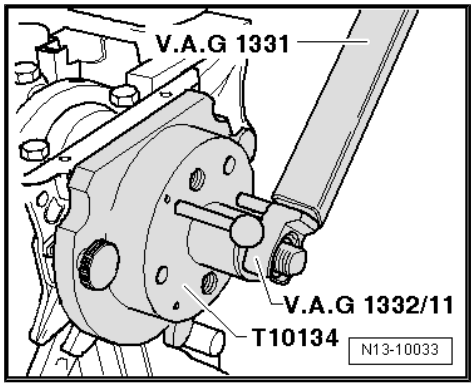
The guide pin for petrol engines (red knob) -F- must not be inserted in threaded hole of crankshaft.

– Tighten the two hexagon socket head bolts of the assembly tool hand-tight.

– Screw nut -E- onto threaded spindle by hand until it lies against assembly housing -C-.

D - Pressing sender wheel onto crankshaft flange using assembly tool - T10134- :

– Tighten nut of assembly tool - T10134- using torque wrench - V.A.G 1331- and flared ring spanner tool insert AF 24 - V.A.G 1332/11- .



Specified torque

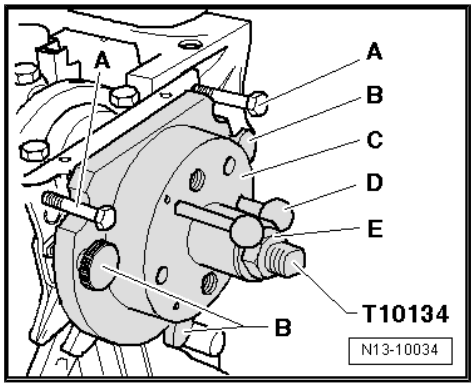
Component	Specified torque
Assembly tool	35 Nm

Note

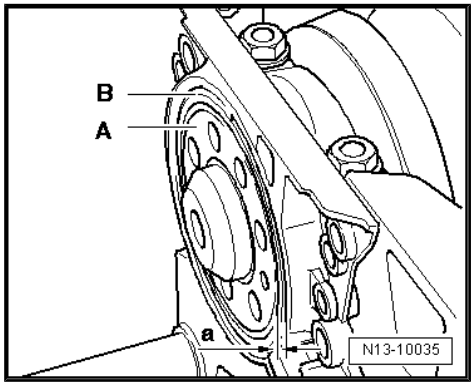
After hexagon nut is tightened to 35 Nm, a small air gap must still be present between cylinder block and sealing flange.

E - Checking sender wheel installation position on crankshaft

– Screw nut -E- on until it reaches end of threaded spindle.
– Unscrew 2 bolts -A- from cylinder block.
– Unscrew the three knurled screws -B- out of sealing flange.
– Remove assembly tool - T10134- .
– Remove sealing lip support ring.



– The sender wheel is in the correct installation position on the crankshaft if a gap -a- = 0.5 mm exists between crankshaft flange -A- and sender wheel -B-.



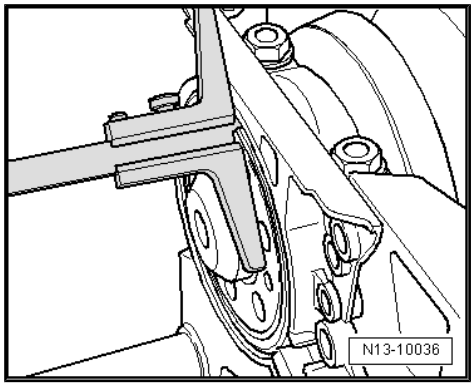
– Place caliper gauge on crankshaft flange.
– Measured distance -a- between crankshaft flange and sender wheel.

If dimension -a- is too small:

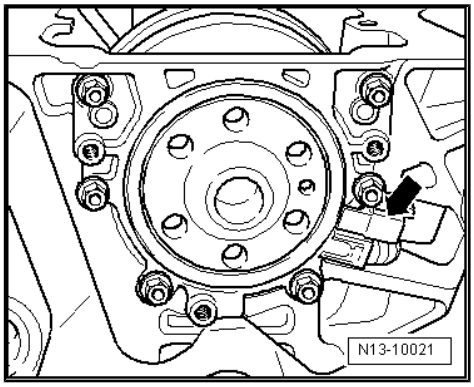
– Re-press sender wheel ⇒ page 67 .

If dimension -a- is achieved:

– Diagonally tighten the new sealing flange bolts alternately to a torque of 15 Nm.

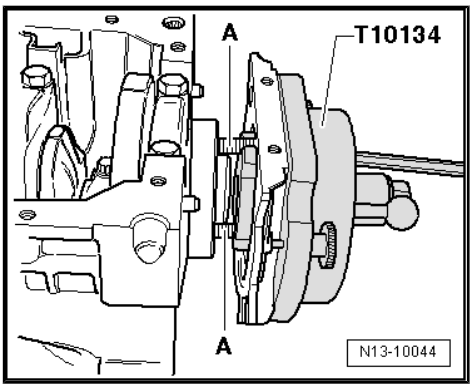


– Install engine speed sender - G28- -arrow- and tighten securing bolt.
– Install sump ⇒ page 151 .
– Install intermediate plate.
– Install flywheel with new bolts.

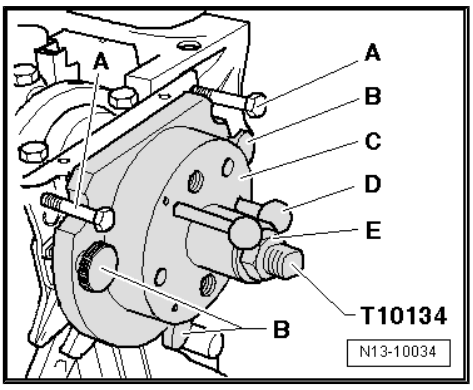


F - Re-pressing sender wheel

– Secure assembly tool - T10134- to crankshaft flange with hexagon socket head bolts -A-.
– Tighten the two hexagon socket head bolts hand-tight.
– Push the assembly tool - T10134- against the sealing flange by hand.



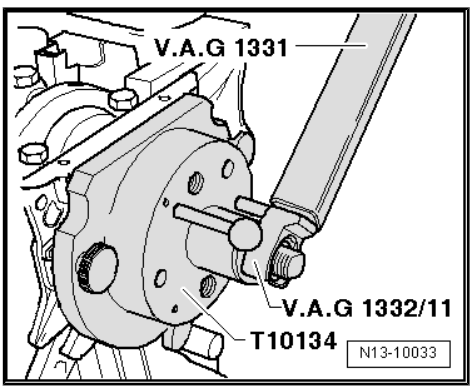
– Screw nut -E- onto threaded spindle by hand until it lies against assembly housing -C-.



– Tighten nut of assembly tool - T10134- using torque wrench - V.A.G 1331- and flared ring spanner tool insert AF 24 - V.A.G 1332/11- .

Specified torque

Component	Specified torque
Assembly tool	40 Nm



– Check the sender wheel installation position on crankshaft again ⇒ page 67

If dimension -a- is too small again:

– Tighten nuts of assembly tool - T10134- .

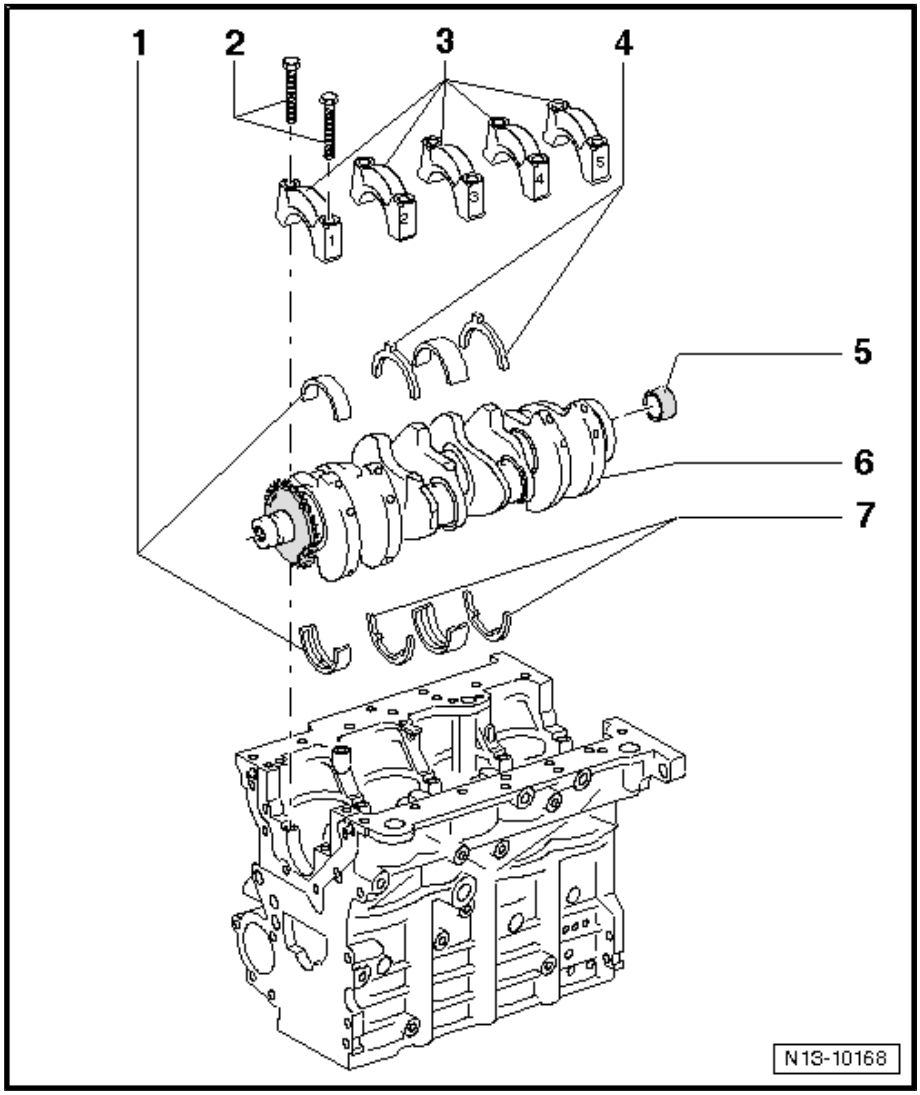
Specified torque

Component	Specified torque
Assembly tool	45 Nm

– Check the sender wheel installation position on crankshaft again ⇒ page 66

3 Crankshaft

3.1 Assembly overview - crankshaft



1 - Bearing shell

- For bearings 1, 2, 4 and 5.
- Do not interchange used bearing shells (mark).

2 - Bolt

- Renew after removing.
- To measure radial clearance, tighten to 65 Nm but not further.
- 65 Nm + 90°

3 - Bearing cap

- Bearing cap 1: belt pulley end.
- Bearing cap 3 with recesses for thrust washers.
- Bearing shell retaining lugs in cylinder block and bearing caps must align.

4 - Thrust washer

- For bearing cap 3.
- Note fixing arrangement.

5 - Needle bearing

- Removing and installing ⇒ page 69 .
- Only vehicles with dual clutch gearbox.

6 - Crankshaft

- Crankshaft dimensions ⇒ page 70 .
- Axial clearance new: 0.07…0.17 mm , wear limit: 0.37 mm.
- Check radial clearance with Plastigage.
- New: 0.03…0.08 mm, wear limit: 0.17 mm.
- Do not rotate crankshaft when checking radial clearance.

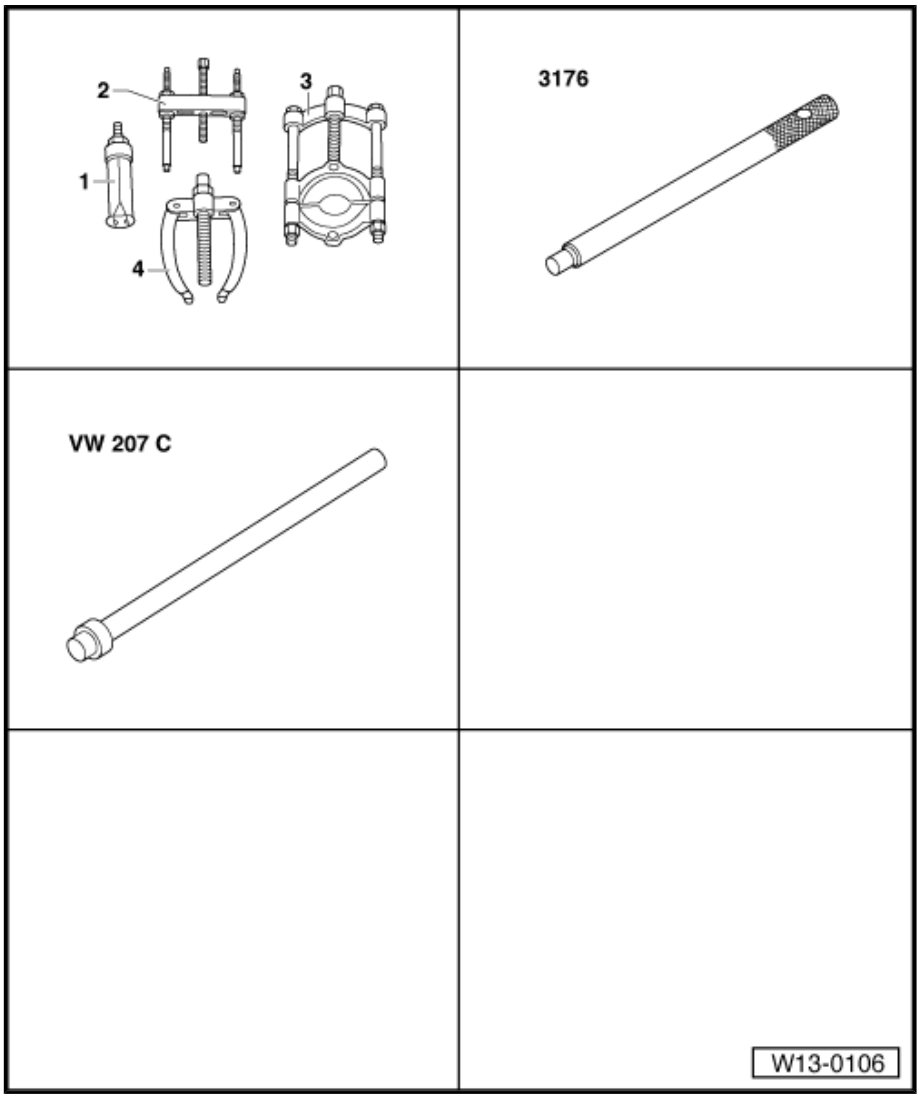
7 - Thrust washer

- For cylinder block, bearing 3

3.2 Renewing needle bearing in crankshaft

Special tools and workshop equipment required

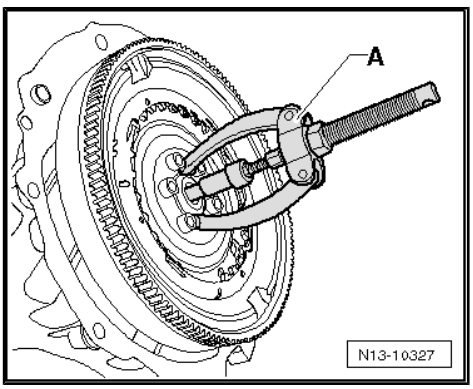
- Internal puller - Kukko 21/2- and internal puller - Kukko 22/1-
- Centring mandrel - 3176-
- Drift - VW 207 C-



Removing

- Gearbox is separated from engine.

– Pull needle bearing out using commercially available internal puller, e.g. KUKKO 21/2 and KUKKO 22/1, -A-.

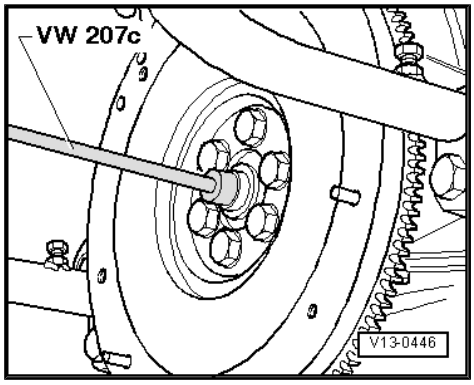


Installing

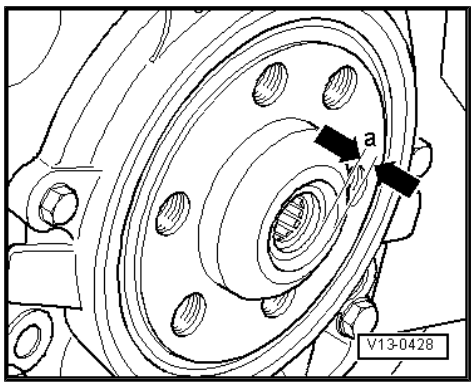
Note

The lettering on the needle bearing must be visible when installed.

– Drive in needle bearing using drift - VW 207 C- or centring mandrel - 3176- .
– Drive needle bearing in carefully.
– Constantly measure insertion depth when driving in.
– Renew bearing, if driving depth is too deep.



Installation depth dimension -a- = 1.5 to 1.8 mm.



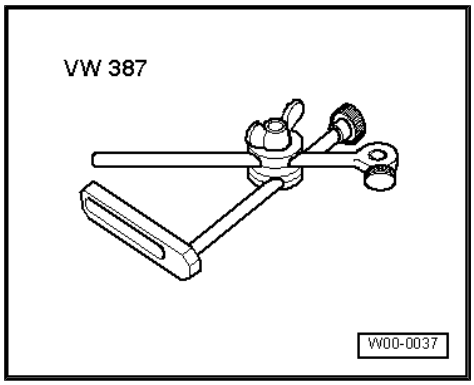
3.3 Crankshaft dimensions

	Crankshaft bearing journal diameter mm	Conrod bearing journal diameter mm
Basic dimension	54.00 -0.022 -0.042	50.90 -0.022 -0.042

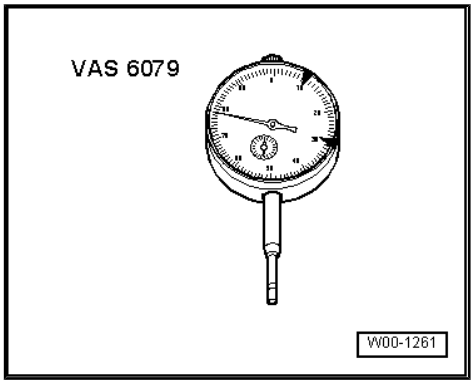
3.4 Measuring axial clearance of crankshaft

Special tools and workshop equipment required

♦ Universal dial gauge bracket - VW 387-



♦ Dial gauge - VAS 6079-



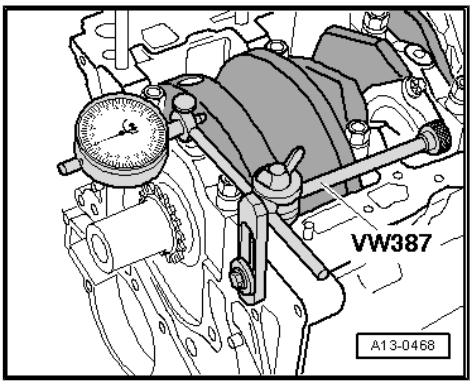
Procedure

– Attach dial gauge - VAS 6079- with universal dial gauge holder - VW 387- to cylinder block as shown in illustration and set against crank web.

– Press crankshaft against dial gauge by hand.

– Set dial gauge to “0”.

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



Axial clearance:

• New: 0.07 … 0.17 mm

• Wear limit: 0.37 mm

3.5 Measuring radial clearance of crankshaft

Special tools and workshop equipment required

♦ Plastigage

Procedure:

Note

♦ *Mark used bearings for re-installation but not on bearing surface.*

♦ *If bearing shells have worn down to nickel layer, they must be renewed.*

– Remove bearing cap and clean crankshaft journal.

– Place a Plastigage corresponding to the width of the bearing on the journal or into the bearing shells.

• The Plastigage must lie in the middle of the bearing shell.

– Fit bearing cap and tighten. Do not rotate crankshaft.

– Remove bearing cap again.

– Compare width of Plastigage with the measurement scale.

Radial clearance:

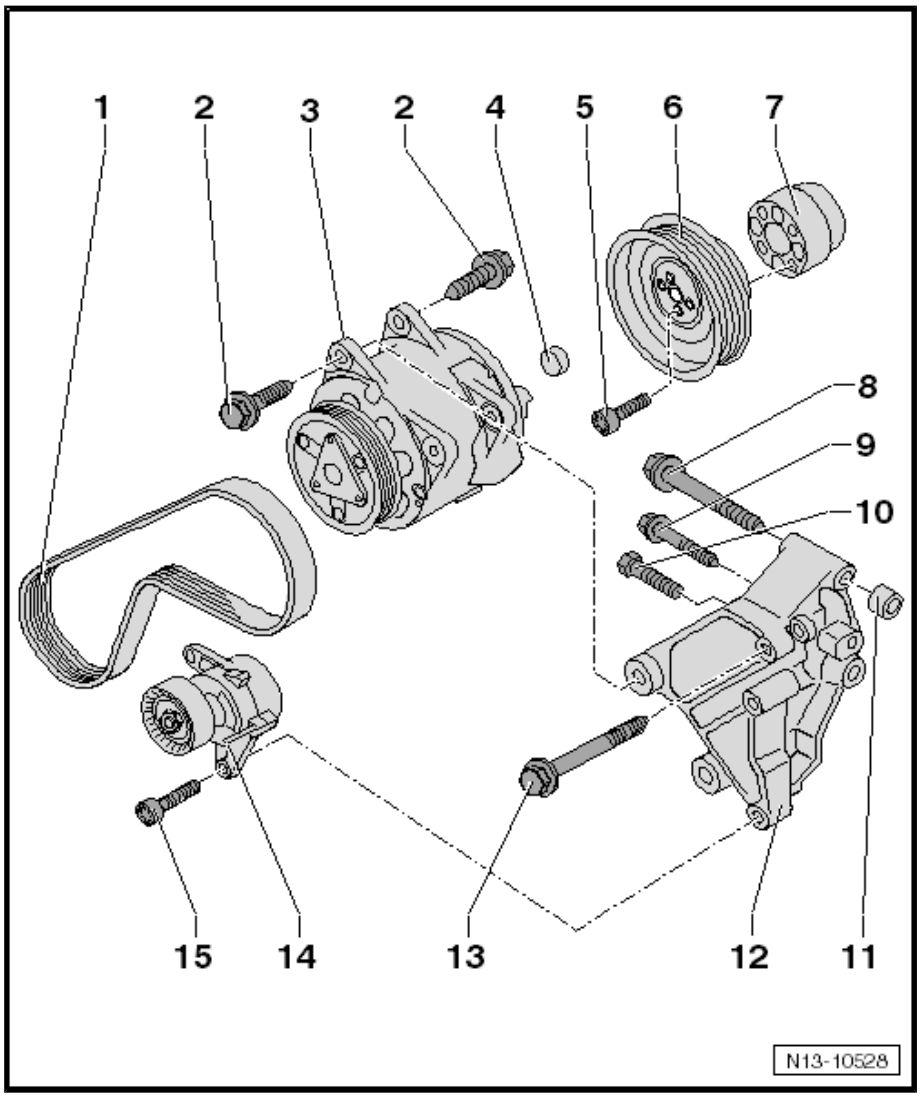
• New: 0.03 … 0.08 mm

• Wear limit: 0.17 mm

4 Auxiliary drive

4.1 Assembly overview - ancillary drive

4.1.1 Assembly overview - auxiliary drive, 2nd air conditioner compressor (genuine parts set)



1 - Poly V-belt
- ❑ Removing and installing ⇒ page 79 .

2 - Bolts
- ❑ Renew after removing
- ❑ 20 Nm + 45°

3 - Air conditioner compressor
- ❑ Retrofitting ⇒ page 76

4 - Plug

5 - Bolts
- ❑ Renew after removing
- ❑ Qty. 4
- ❑ Internal multi-point: 23 Nm +180°
- ❑ Hexagon: 23 Nm + 90°

6 - Belt pulley

7 - Hub

8 - Bolt
- ❑ Renew after removing
- ❑ Note specified procedure ⇒ page 78
- ❑ 50 Nm +180°

9 - Bolt
- ❑ Renew after removing
- ❑ Note specified procedure ⇒ page 78
- ❑ 20 Nm +180°

10 - Bolt
- ❑ Renew after removing
- ❑ Note specified procedure ⇒ page 78

- ❑ 50 Nm +90°

11 - Thrust pad

- ❑ Only in vehicles with mono-turbo

12 - Bracket

- ❑ Note specified procedure ⇒ page 78

13 - Bolt

- ❑ Renew after removing
- ❑ Note specified procedure ⇒ page 78
- ❑ 50 Nm +180°

14 - Tensioning element

- ❑ For poly V-belt.

15 - Bolt

- ❑ Renew after removing
- ❑ Qty. 2
- ❑ 20 Nm +90°

4.1.2 Assembly overview - auxiliary drive, 2nd air conditioner compressor

1 - Poly V-belt

- ❑ Removing and installing ⇒ page 79

2 - Bolts

- ❑ Renew after removing
- ❑ Qty. 4
- ❑ 55 Nm +90°

3 - Air conditioner compressor

4 - Plug

5 - Bolts

- ❑ Renew after removing
- ❑ Qty. 4
- ❑ 30 Nm + 45°

6 - Belt pulley

7 - Bolts

- ❑ Renew after removing
- ❑ Qty. 4
- ❑ 30 Nm +90°

8 - Hub

9 - Bolt

- ❑ Renew after removing
- ❑ 50 Nm +180°

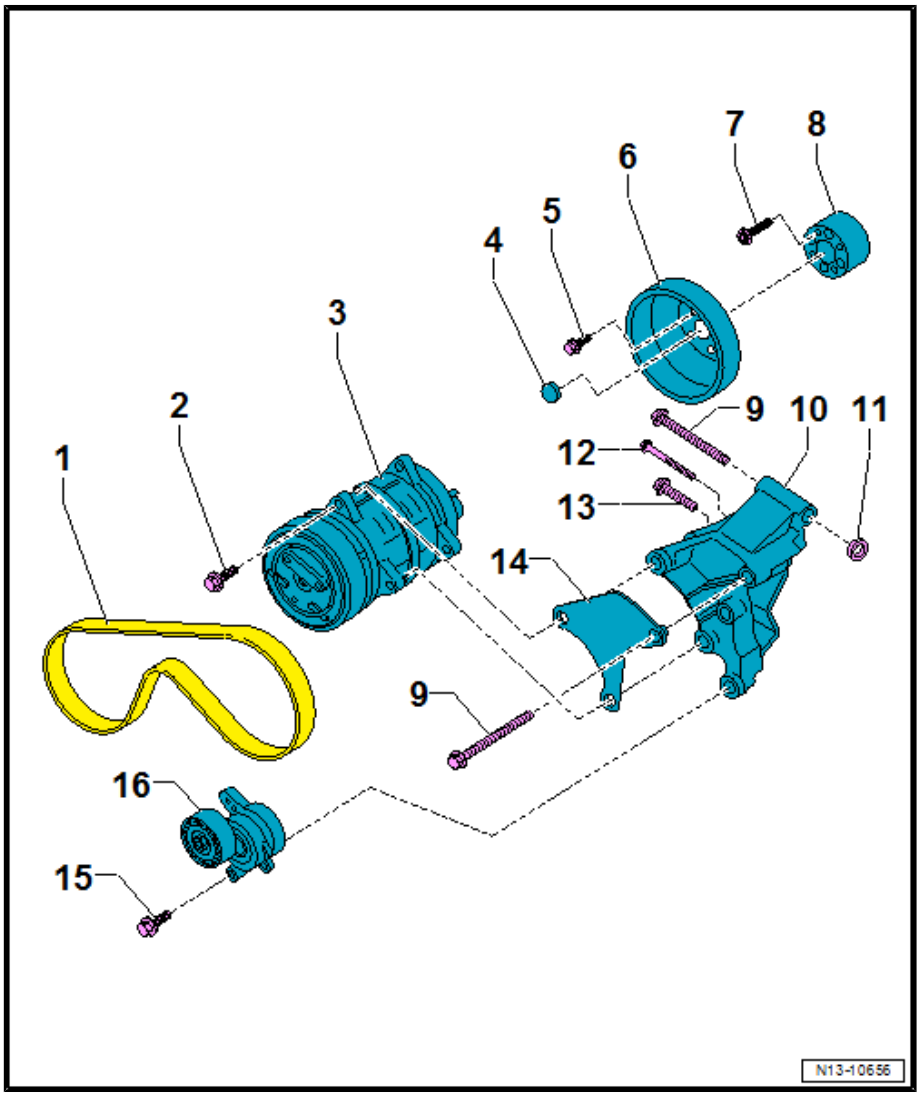
10 - Bracket

11 - Thrust pad

- ❑ Only in vehicles with mono-turbo

12 - Bolt

- ❑ Renew after removing



- ❑ 30 Nm + 90°

13 - Bolt

- ❑ Renew after removing
- ❑ 50 Nm + 90°

14 - Spacer plate

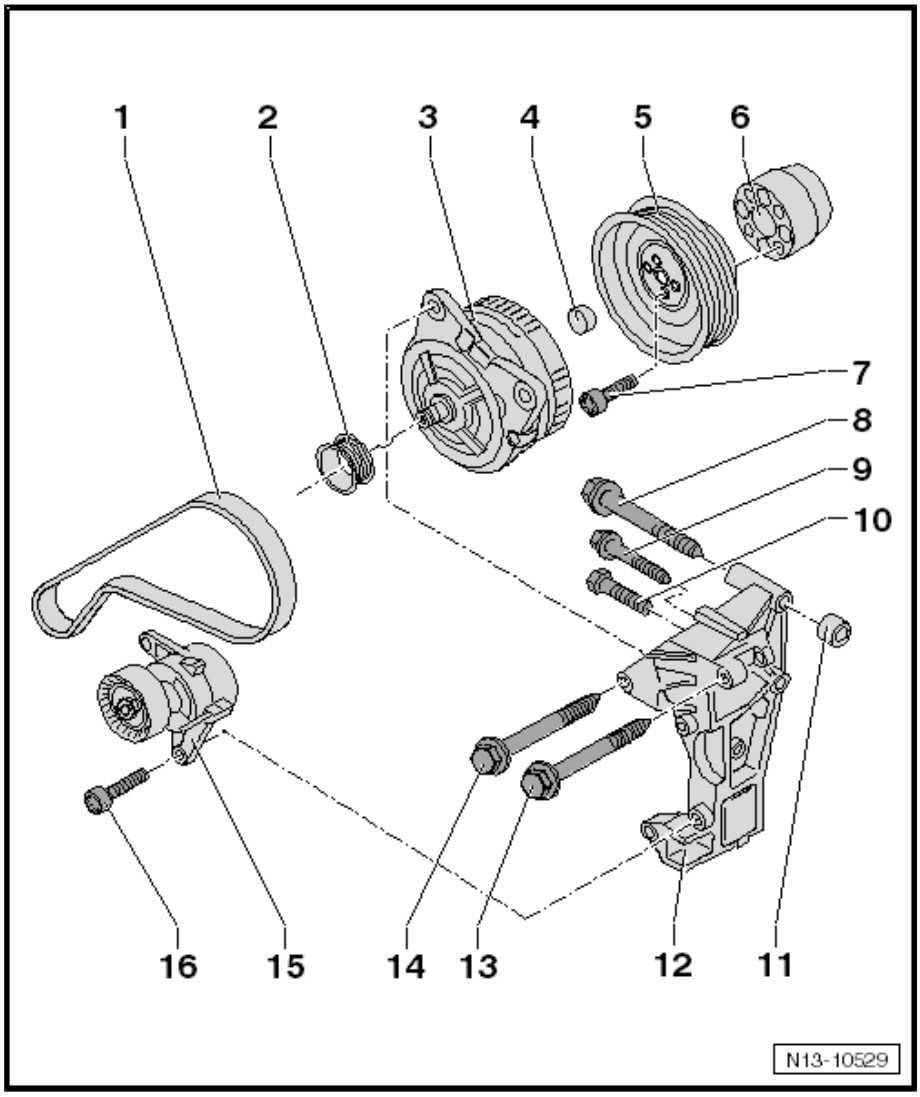
15 - Bolts

- ❑ Renew after removing
- ❑ Qty. 2
- ❑ 20 Nm + 90°

16 - Tensioning element

- ❑ For poly V-belt.

4.1.3 Assembly overview - auxiliary drive, 2nd alternator (genuine parts set)



1 - Poly V-belt

- ❑ Removing and installing ⇒ page 79

2 - Poly V-belt pulley

- ❑ With freewheel

3 - Alternator

- ❑ Retrofitting ⇒ page 76

4 - Plug

5 - Belt pulley

6 - Hub

7 - Bolts

- ❑ Renew after removing
- ❑ Qty. 4
- ❑ Internal multi-point: 23 Nm +180°
- ❑ Hexagon: 23 Nm + 90°

8 - Bolt

- ❑ Renew after removing
- ❑ Note specified procedure ⇒ page 78
- ❑ 50 Nm +180°

9 - Bolt

- ❑ Renew after removing
- ❑ Note specified procedure ⇒ page 78
- ❑ 20 Nm +180°

10 - Bolt

- ❑ Renew after removing
- ❑ Note specified procedure ⇒ page 78
- ❑ 50 Nm +90°

11 - Shim

- ❑ Only in vehicles with mono-turbo

12 - Bracket
- ❑ Note specified procedure ⇒ page 78

13 - Bolt
- ❑ Renew after removing
- ❑ Note specified procedure ⇒ page 78
- ❑ 50 Nm +180°

14 - Bolt
- ❑ Renew after removing
- ❑ 40 Nm + 90°

15 - Tensioning element
- ❑ For poly V-belt.

16 - Bolts
- ❑ Renew after removing
- ❑ Qty. 2
- ❑ 20 Nm +90°

4.1.4 Assembly overview - auxiliary drive, 2nd alternator

1 - Hub

2 - Bolts
- ❑ Renew after removing
- ❑ Qty. 4
- ❑ 30 Nm +90°

3 - Belt pulley

4 - Bolts
- ❑ Renew after removing
- ❑ Qty. 2
- ❑ 50 Nm +180°

5 - Bolts
- ❑ Renew after removing
- ❑ Qty. 4
- ❑ 30 Nm + 45°

6 - Plug

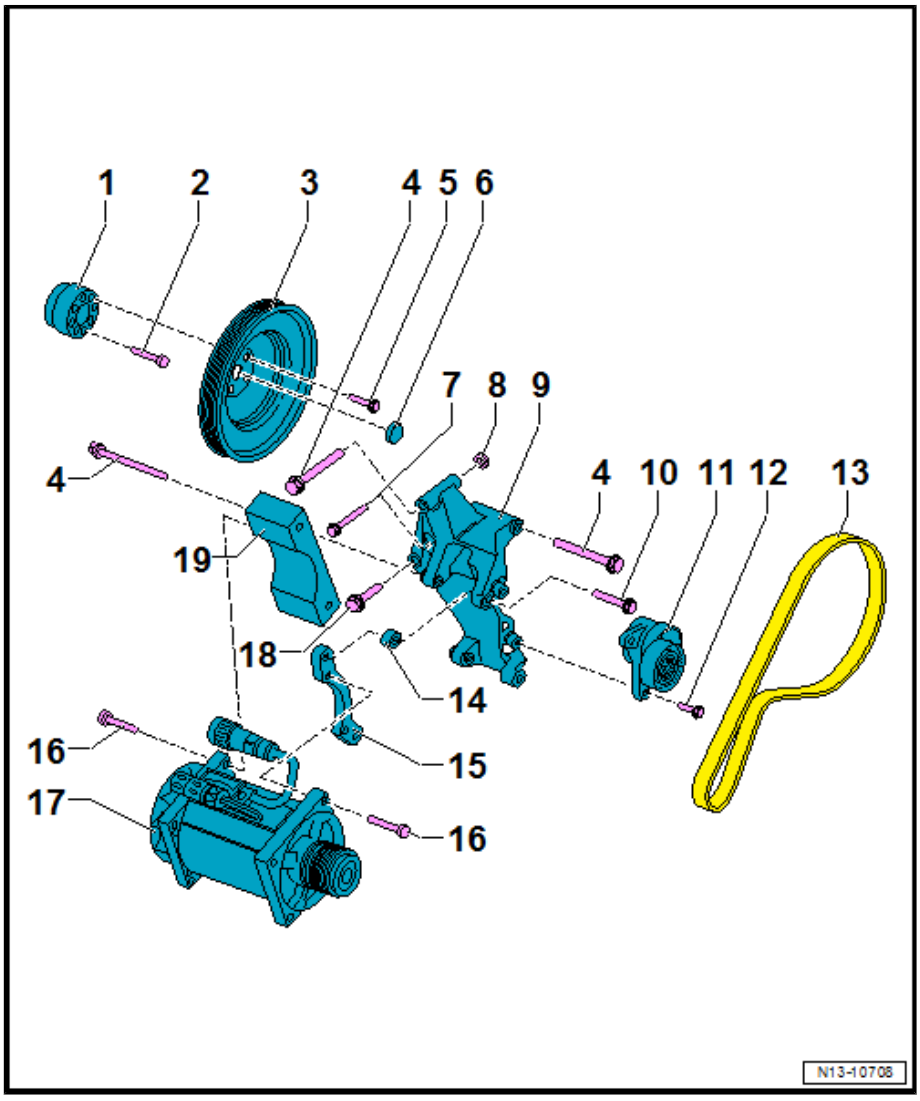
7 - Bolt
- ❑ Renew after removing
- ❑ 30 Nm +90°

8 - Thrust pad
- ❑ Only in vehicles with mono-turbo

9 - Bracket

10 - Bolt
- ❑ Renew after removing
- ❑ Qty. 2
- ❑ 50 Nm +90°

11 - Tensioning element
- ❑ For poly V-belt.



12 - Bolts

- ❑ Renew after removing
- ❑ Qty. 2
- ❑ 20 Nm +90°

13 - Poly V-belt

- ❑ Removing and installing ⇒ page 79 .

14 - Spacer

15 - Alternator adapter T1

16 - Bolts

- ❑ Renew after removing
- ❑ Qty. 4
- ❑ 55 Nm +90°

17 - Alternator

18 - Bolt

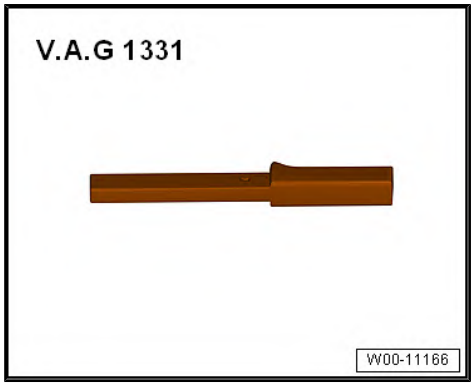
- ❑ Renew after removing
- ❑ 50 Nm +90°

19 - Alternator adapter T2

4.2 Retrofitting auxiliary drive (genuine parts set)

Special tools and workshop equipment required

- ♦ Torque wrench - V.A.G 1331-



- ♦ Torque wrench - V.A.G 1332-

Caution

When doing any repair work, especially in the engine compartment, pay attention to the following due to the cramped conditions:

- *Route all the various lines (e.g. for fuel, hydraulics, activated charcoal filter system, coolant and refrigerant, brake fluid and vacuum) and electrical wiring in their original positions.*
- *To avoid damage to lines, ensure sufficient clearance from all moving or hot components.*

Note

If an auxiliary drive is retrofitted to a vehicle, noise insulation should also be fitted ⇒ ETKA (Electronic Parts Catalogue) .

Procedure

- For the following work measures, the engine needs to be locked. Engage a gear to do so.

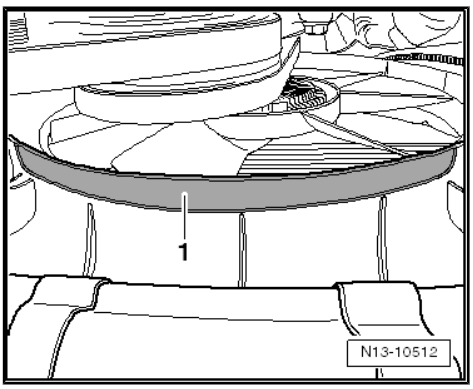
– Cut out cowling in marked area -1-.

– Deburr sharp edges if there are any.

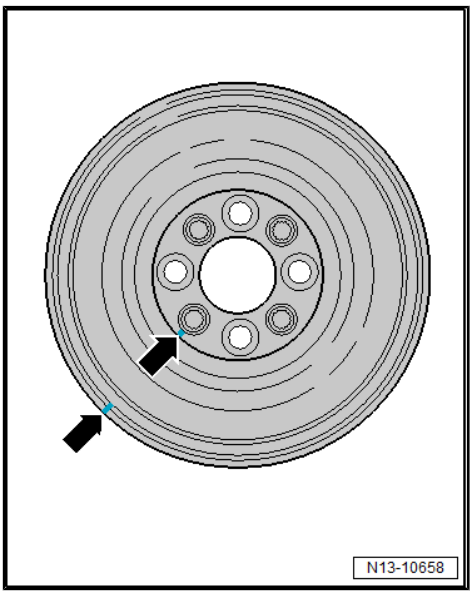
– Remove poly V-belt for viscous fan ⇒ page 46 .

– Remove poly V-belt ⇒ page 43 .

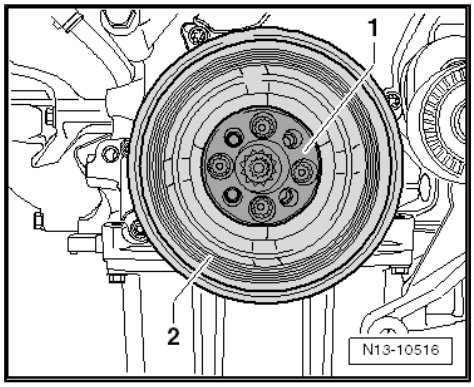
– Remove vibration damper ⇒ page 49 .



– Align position of hub relative to vibration damper -arrows-, and make a corresponding mark on vibration damper.



– Install hub -1- with vibration damper -2-.
– Tighten bolts to specified torque.

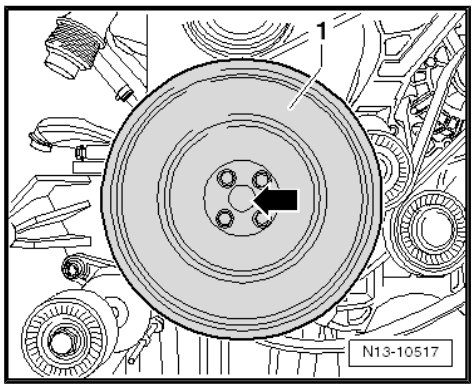


Note

- *The hub fits in one position only. If positioned incorrectly, the bolt holes are offset.*
- *Installation is possible in one position only, i.e. when the hole in the vibration damper is located over the projection on the toothed belt pulley* ⇒ page 49 *.*

– Install poly V-belt ⇒ page 43 .
– Install poly V-belt for viscous fan ⇒ page 46 .

– Install auxiliary drive pulley -1-.
– Tighten bolts to specified torque.

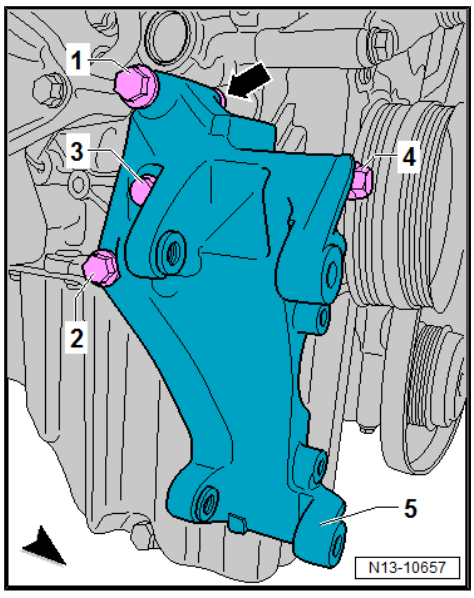


Note

- *Pay attention to the marks indicating the position of the pulley relative to the hub and that of the vibration damper.*
- *The auxiliary drive belt pulley fits in one position only. If incorrectly positioned, the bolt holes are offset.*

– Clip plug -arrow- into place.

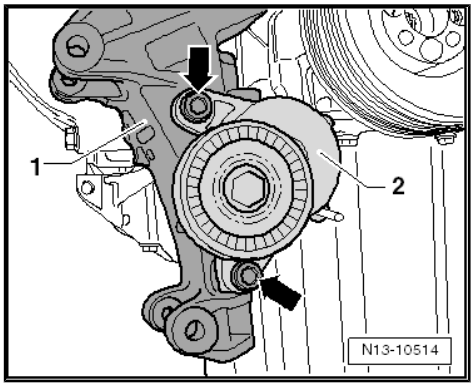
– Mount bracket -5- on cylinder crankshaft, observing following procedure:



- On vehicles with single turbo, thrust pad -arrow- must also be used.
- Manually locate all bolts for securing bracket and spacer plate.
- Tighten bolts -1 ... 3- to specified torque.
- After having installed air conditioner compressor, tighten bolt -4- to specified torque.

– Install air conditioner compressor or alternator.
– Tighten bolt -4- to specified torque.

– Fit tensioning element -2- to bracket -1-.
– Tighten bolts -arrows-.
– Install poly V-belt for auxiliary drive ⇒ page 79 .
• Always check belt running after completing work.



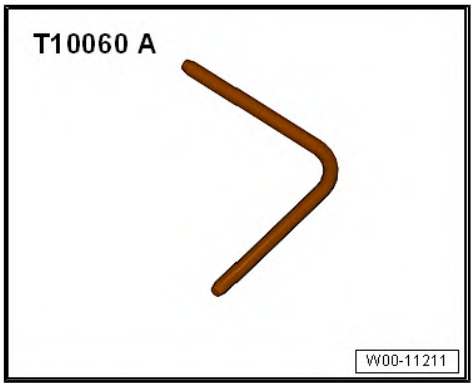
Specified torque

◆ ⇒ “4.1.1 Assembly overview - auxiliary drive, 2nd air conditioner compressor (genuine parts set)”, page 72
◆ ⇒ “4.1.3 Assembly overview - auxiliary drive, 2nd alternator (genuine parts set)”, page 74

4.3 Removing and installing poly V-belt for auxiliary drive

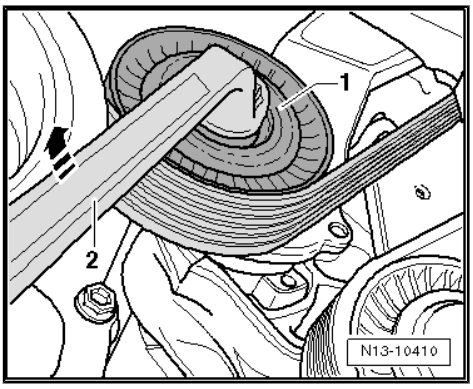
Special tools and workshop equipment required

◆ Locking pin - T10060 A-

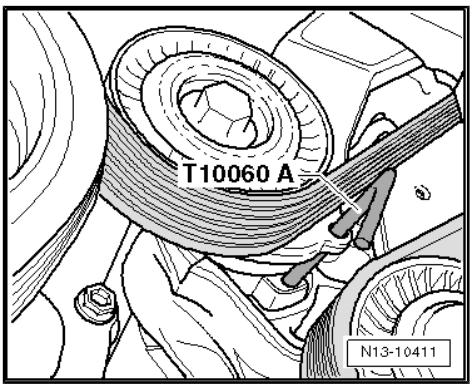


Removing

– If fitted, remove noise insulation ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Removing and installing noise insulation .
– Mark direction of rotation of poly V-belt.
– To slacken poly V-belt, swing tensioning element -1- in direction of -arrow- using ring spanner -2-.



– Lock tensioning element using locking pin - T10060 A- .
– Remove poly V-belt.



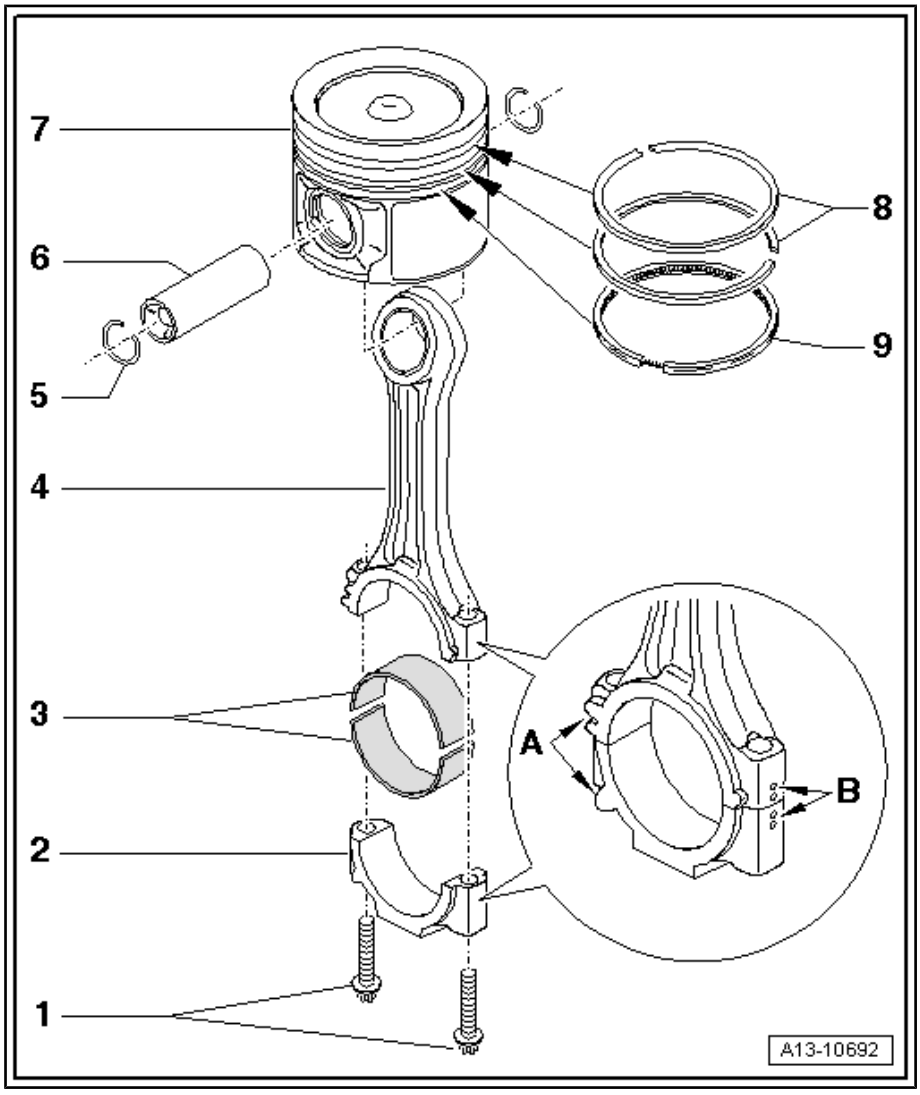
Installing

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

– When fitting poly V-belt, check direction of belt rotation and proper seating of belt.
• Always check belt running after completing work.

5 Pistons and conrods

5.1 Assembly overview - pistons and conrods



1 - Conrod bolt

- ❑ Renew after removing.
- ❑ Oil threads and contact surface.
- ❑ Use old bolt for measuring radial clearance.
- ❑ 30 Nm + 90°

2 - Conrod bearing cap

- ❑ The caps only fit in one position and only on the appropriate conrod due to the breaking procedure (cracking) separating the cap from the conrods.
- ❑ Mark cylinder allocation in colour -B-.
- ❑ Installation position: markings -A- face towards belt pulley end.

3 - Bearing shell

- ❑ Installation position ⇒ page 84 .
- ❑ Mark used bearing shells for re-installation but not on bearing surface.
- ❑ Renew bearing shells worn down to base layer.
- ❑ Upper bearing shell (towards piston) made of a more wear resistant material. Identification on new bearing shells: black line on bearing surface in area of joint
- ❑ Check for secure seating.

4 - Conrod

- ❑ Separate new conrod ⇒ page 83
- ❑ Measuring radial clearance ⇒ page 86
- ❑ Renew as set only.
- ❑ With industrially cracked conrod bearing cap
- ❑ Mark cylinder allocation in colour -B-.
- ❑ Installation position: markings -A- towards belt pulley end
- ❑ Axial clearance: wear limit: 0.37 mm

5 - Circlip

- ❑ Renew after removing.

6 - Piston pin

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

7 - Piston

- ❑ With combustion chamber.
- ❑ Mark installation position and cylinder number ⇒ page 83 .
- ❑ Check ⇒ page 83 .
- ❑ Install using piston ring clamp.
- ❑ Piston and cylinder dimensions ⇒ page 83 .
- ❑ Measuring cylinder bore ⇒ page 82
- ❑ Measuring piston projection at “TDC” ⇒ page 84

8 - Piston rings

- ❑ Checking ring gap ⇒ page 81 .
- ❑ Checking ring-to-groove clearance ⇒ page 82 .
- ❑ Compression rings
- ❑ Offset gaps by 120°.
- ❑ Use piston ring pliers to remove and install.
- ❑ Installation position: “TOP” marking or side with lettering towards piston crown

9 - Piston ring

- ❑ Checking ring gap ⇒ page 81 .
- ❑ Checking ring-to-groove clearance ⇒ page 82 .
- ❑ Oil scraper ring
- ❑ Offset gaps by 120° relative to lower compression ring.
- ❑ Use piston ring pliers to remove and install.

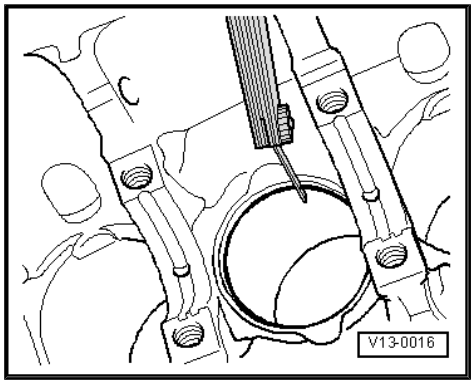
5.2 Checking piston ring gap

Special tools and workshop equipment required

- ♦ Feeler gauges

– Insert piston ring at right angles from above and push down into cylinder approx. 15 mm from bottom end of cylinder.

Piston ring dimensions in mm	New (mm)	Wear limit (mm)
1st compression ring	0.20 … 0.40	1.00
2nd compression ring	0.20 … 0.40	1.00
Oil scraper ring	0.25 … 0.50	1.00



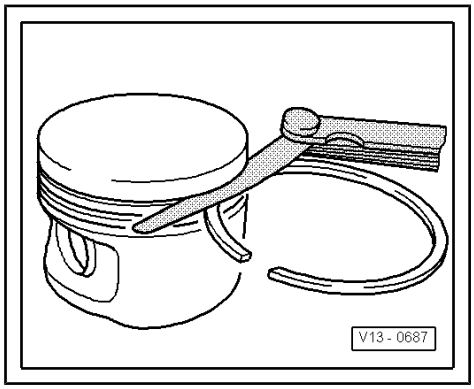
5.3 Checking ring-to-groove clearance

Special tools and workshop equipment required

- Feeler gauges

– Clean annular groove before check.

Piston ring dimensions in mm	New (mm)	Wear limit (mm)
1st compression ring	0.06 … 0.09	0.25
2nd compression ring	0.05 … 0.08	0.25
Oil scraper ring	0.03 … 0.06	0.15



5.4 Checking cylinder bores

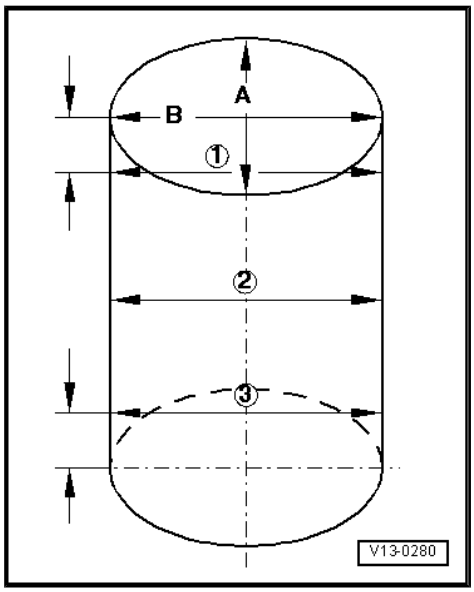
Special tools and workshop equipment required

- Internal dial test indicator 50…100 mm

– Take measurements at 3 positions in both lateral direction -A- and longitudinal direction -B-. Difference between actual and nominal diameter max. 0.10 mm.

Note

Cylinder bores must not be measured when the cylinder block is secured to engine and gearbox support - VAS 6095A- , as measurements may be incorrect.

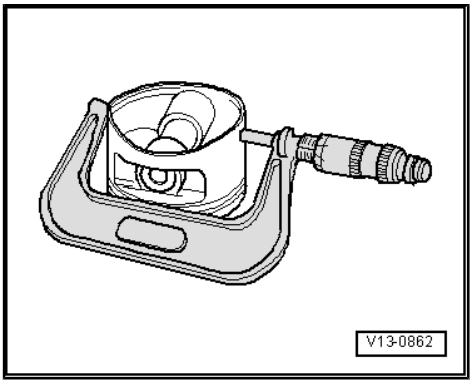


5.5 Checking piston

– 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: 0.04 mm

Nominal dimension ⇒ page 83

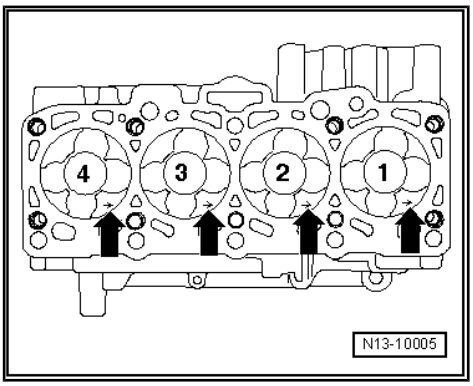


Note

If piston skirt is cracked, renew piston.

5.6 Installation position and allocation of piston to cylinder

Arrow on piston crown -arrows- points in direction of cylinder 1.



5.7 Piston and cylinder dimensions

	Piston diameter mm	Cylinder bore diameter mm
Basic dimension	80.96 [1)]	81.01

• [1)] Dimensions include coating (thickness 0.02 mm). The coating will wear down.

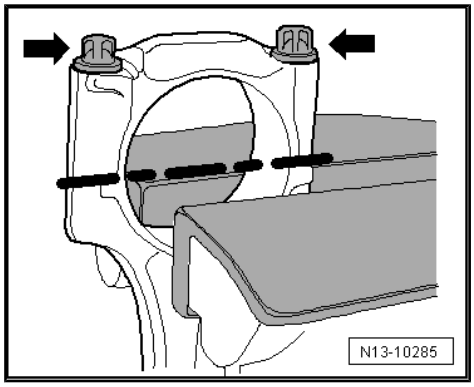
5.8 Separating new conrod

Carry out the following work:

On a new conrod, it is possible that the breaking point has not been fully separated. Proceed as follows if the conrod bearing cap cannot be removed by hand:

– Mark allocation of conrod to cylinder.

– Lightly clamp the conrod in a vice using aluminium vice clamps, as shown in the illustration.

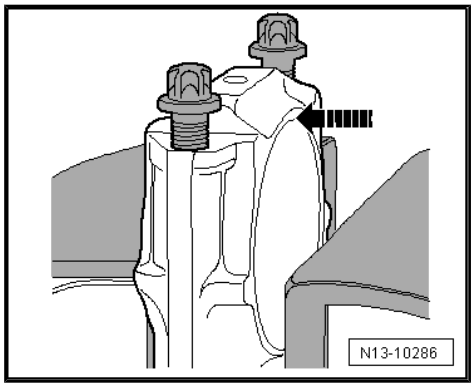


Note

- *Only clamp the conrod lightly in order to avoid damaging it.*
- *Conrod is clamped below the dashed line.*

– Unscrew bolts -arrows- around 5 turns.

– Using a plastic hammer, carefully knock against conrod bearing cap in -direction of arrow- until it is loose.



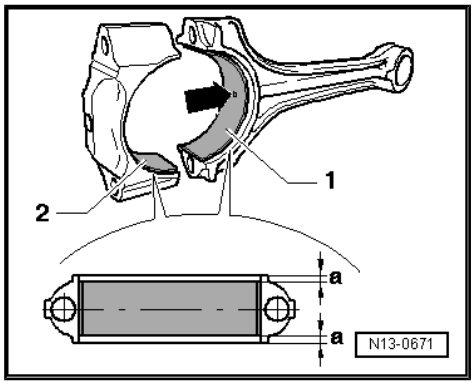
5.9 Bearing shells - installation position

Bearing shell -1- with oil drilling -arrow- for conrod.

Bearing shell -2- without oil hole for conrod bearing cap

– Position bearing shells in centre of conrod and conrod bearing cap when fitting.

Dimension -A- must be identical on both sides.



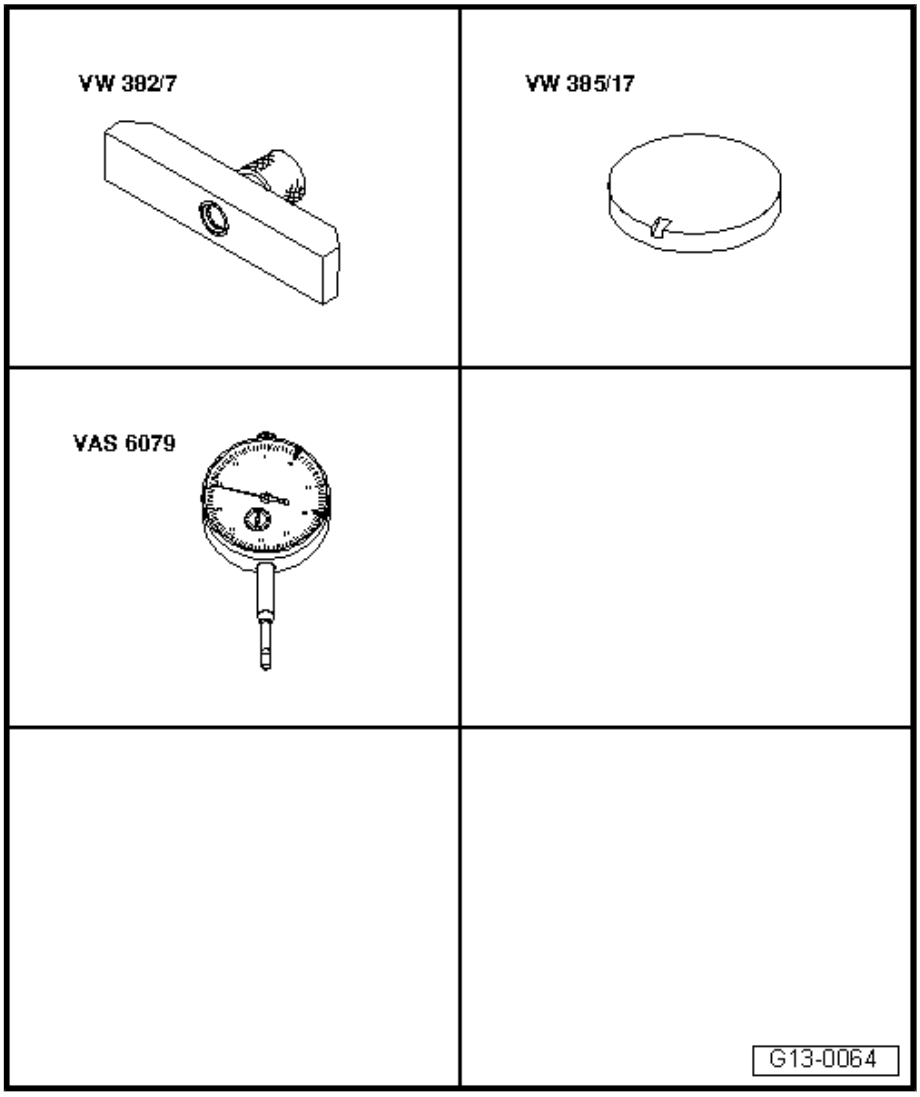
5.10 Measuring piston projection at TDC

Note

Piston projection at "TDC" must be measured when new pistons or a short engine are/is installed.

Special tools and workshop equipment required

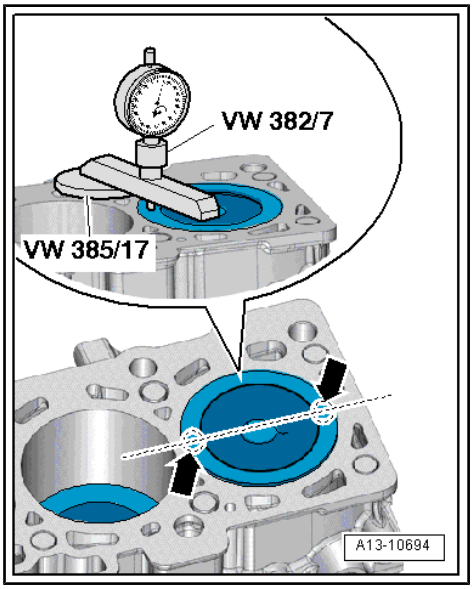
- Measuring bridge - VW 382/7- from measuring tool - VW 382-
- Measuring plate - VW 385/17- from universal measuring tool - VW 385-
- Dial gauge - VAS 6079-



Procedure

– Secure dial gauge - VAS 6079- with measuring bridge - VW 382/7- and measuring plate -VW 385/17- to cylinder block as shown in the illustration.

– Measure piston projection of each piston at the two places marked by -arrows-.



Note

If you have measured the piston projection and it is not same for all pistons, use the highest value to determine the correct gasket size.

– Install the appropriate cylinder head gasket depending upon piston projection, according to following table:

Piston projection over upper edge of cylinder block mm	Identification (No. of holes)
0.91 … 1.00	1
1.01 … 1.10	2
1.11 … 1.20	3

5.11 Checking radial clearance of conrods

Special tools and workshop equipment required

♦ Plastigage

Procedure

– Remove conrod bearing cap. Clean bearing cap and bearing journal.

– Place a Plastigage corresponding to the width of the bearing on the journal or into the bearing shells.

– Fit conrod bearing cap and tighten to 30 Nm (without additional turning further to a torque angle). Do not rotate crankshaft.

– Remove conrod bearing cap again.

– Compare width of Plastigage with the measurement scale.

Radial clearance:

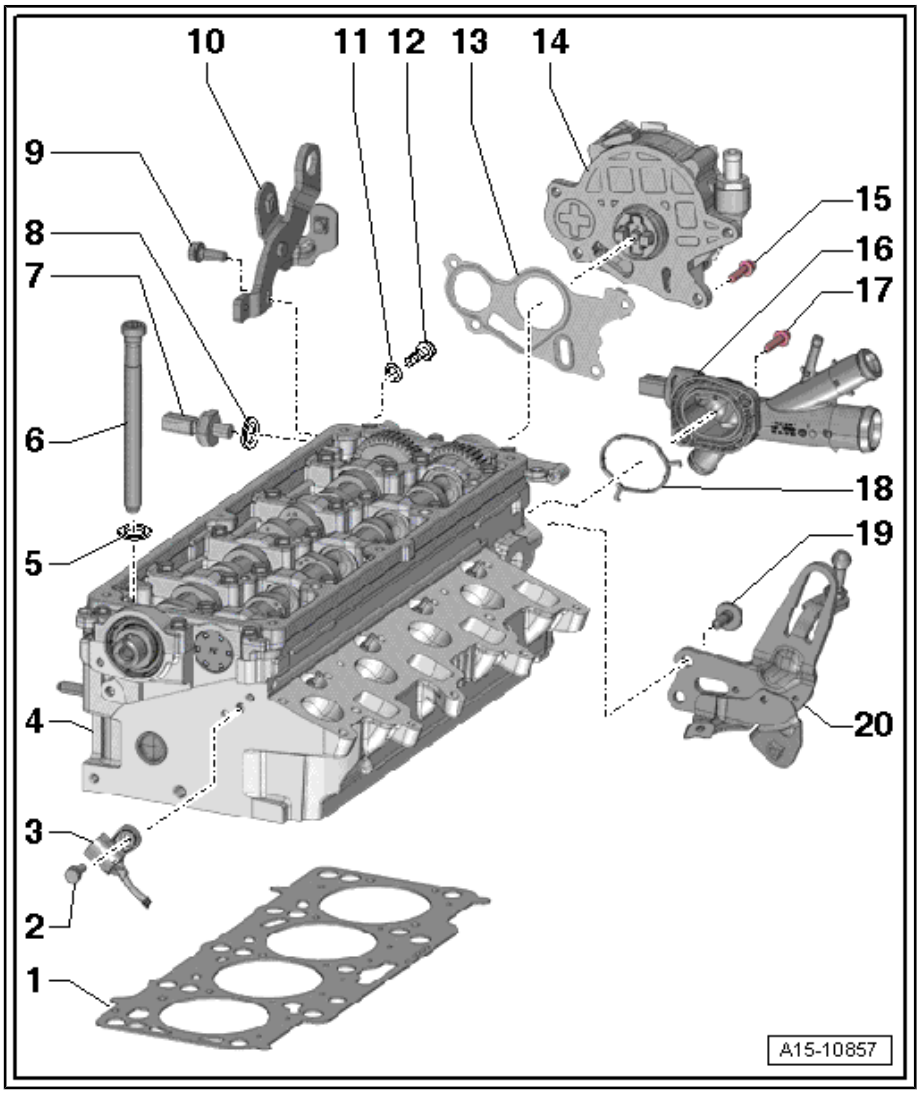
• Wear limit: 0.08 mm

– Renew conrod bolts.

15 – Cylinder head, valve gear

1 Cylinder head

1.1 Assembly overview - cylinder head



1 - Cylinder head gasket

- ❑ Renewing ⇒ page 92 .
- ❑ Cylinder head gasket identification ⇒ page 89 .
- ❑ Renew coolant and engine oil after replacing.

2 - Bolt

- ❑ Insert with locking fluid, locking fluid ⇒ Electronic Parts Catalogue .
- ❑ 10 Nm

3 - Hall sender - G40-

- ❑ For camshaft position.

4 - Cylinder head

- ❑ To prevent damage to glow plugs, always place cylinder head on a soft foam surface after removal.
- ❑ Must not be reworked.
- ❑ Before installing, check whether two dowel sleeves for centring cylinder head on cylinder block are fitted.
- ❑ Renew coolant and engine oil after replacing.
- ❑ If there is no pipe connection fitted on the new cylinder head, install it to the new cylinder head ⇒ page 92 .
- ❑ For information on the pipe connection and silicone adhesive sealant , refer to ⇒ Electronic Parts Catalogue (ETKA) .

- ❑ Removing and installing ⇒ page 92 .
- ❑ Check for distortion ⇒ page 89 .

5 - Washer

6 - Bolt

- ❑ Renew after removing.
- ❑ Sequence when loosening ⇒ page 98 .
- ❑ Specified torque and tightening sequence ⇒ page 89 .

7 - Oil pressure switch - F1-

- ❑ Removing and installing ⇒ page 160 .
- ❑ Check ⇒ page 163 .
- ❑ Switch pressure 0.3…0.6 bar.
- ❑ 20 Nm

8 - Seal

- ❑ Renew after removing.

9 - Bolt

- ❑ 20 Nm

10 - Engine lifting eye

11 - Seal

- ❑ Renew after removing.

12 - Plug

- ❑ 20 Nm

13 - Gasket

- ❑ Renew after removing.

14 - Vacuum pump

DANGER!

It is not permissible to dismantle the vacuum pump under any circumstances as otherwise the vacuum part could malfunction. This would result in failure of the brake servo.

- ❑ Removing and installing ⇒ page 107 .

15 - Bolt

- ❑ 10 Nm

16 - Connection

- ❑ For coolant hoses
- ❑ With coolant temperature sender - G62-
- ❑ Illustration does not show version installed in vehicle.

17 - Bolt

- ❑ 9 Nm

18 - Gasket

- ❑ Renew after removing.

19 - Bolt

- ❑ 20 Nm

20 - Engine lifting eye

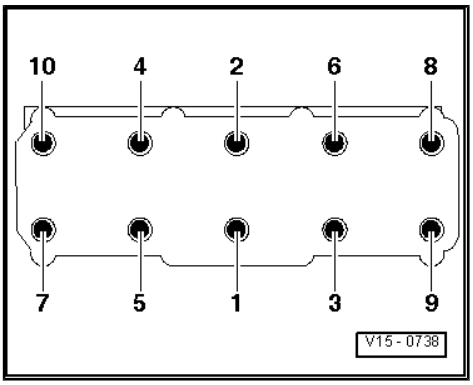
1.1.1 Cylinder head - specified torque and sequence

Note

Replace bolts that are tightened with specified tightening angle.

– Tighten bolts in 4 stages in the sequence shown:

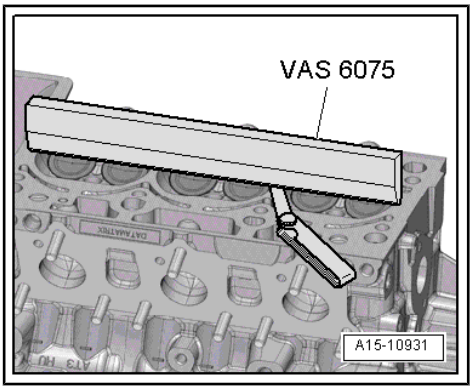
Stage	Bolts	Specified torque/ additional specified angle
1.	-1 … 10-	30 Nm
2.	-1 … 10-	50 Nm
3.	-1 … 10-	+90°
4.	-1 … 10-	+90°



1.1.2 Checking cylinder head for distortion

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

• Max. permissible distortion: 0.1 mm.



1.1.3 Cylinder head gasket identification

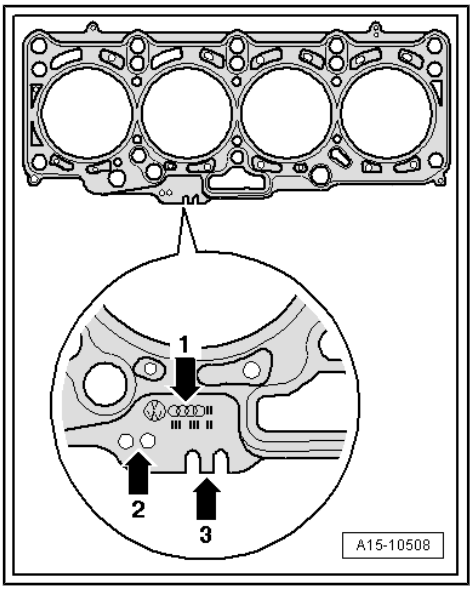
1 - Part number

2 - Holes

3 - Ignore

Note

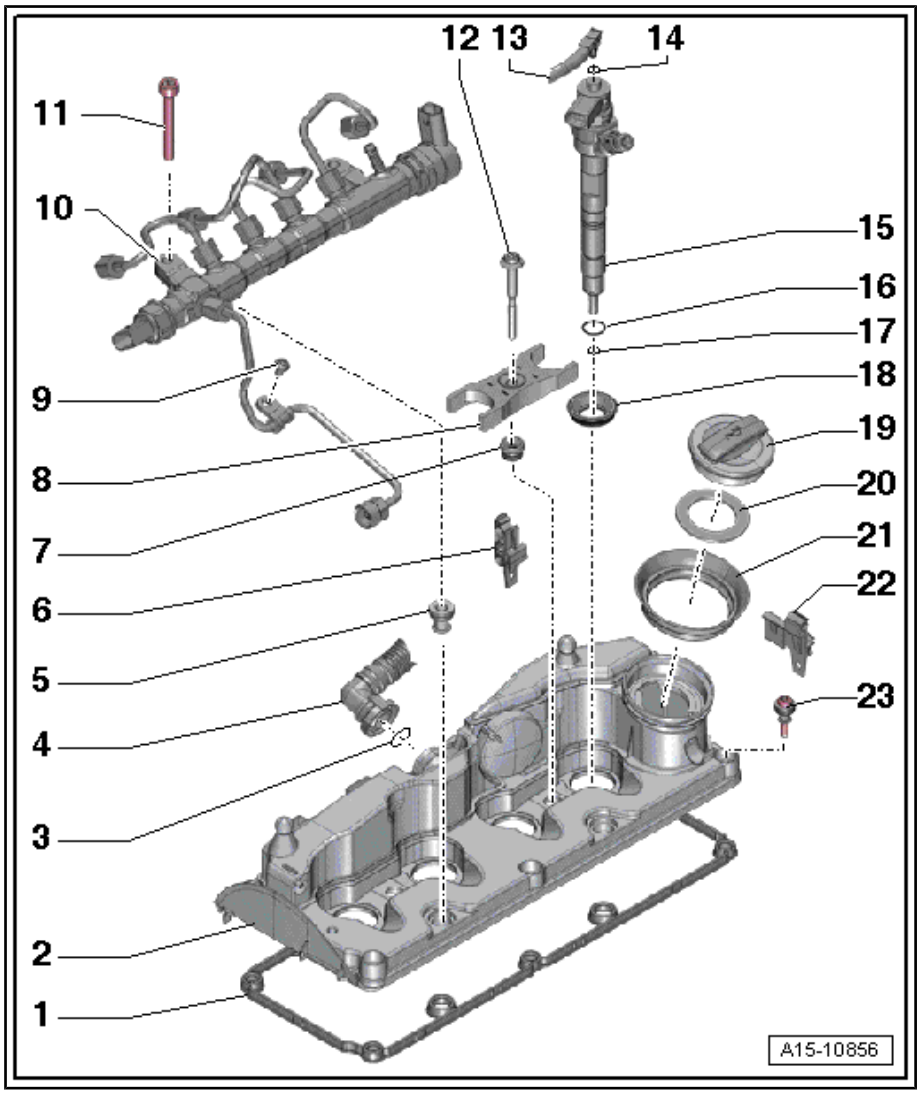
Different thicknesses of cylinder head gasket are fitted depending on the piston projection *⇒ page 84* *. If only cylinder head gasket is removed, install a new cylinder head gasket with same identification.*



1.2 Assembly overview - cylinder head cover

Caution

When installing a new short engine, it is compulsory to fix and tighten the clamping jaws of the injectors with the specified torque after installing the high-pressure lines ⇒ page 278 . Clamping jaws are only secured »hand-tight« for setting the injectors while installing high-pressure lines. Non-observance of these notes may lead to damage to engine.



1 - Gasket
- ❑ Renew if damaged or leaking.

2 - Cylinder head cover
- ❑ Removing and installing ⇒ page 101 .

3 - O-ring
- ❑ Renew after removing.

4 - Hose
- ❑ Press release buttons to remove.

5 - Sealing bushing
- ❑ Renew if damaged or leaking.

6 - Bracket

7 - Grommet

8 - Clamping piece

9 - 8 Nm

10 - High-pressure accumulator (fuel rail)
- ❑ Observe rules for cleanliness ⇒ page 7 .
- ❑ Installing high-pressure lines ⇒ page 295 .
- ❑ Do not attempt to re-shape high-pressure lines.

11 - Bolt
- ❑ 22 Nm

12 - Bolt
- ❑ Renew after removing.
- ❑ 8 Nm + 270° further

13 - Fuel return line

14 - O-ring
- ❑ Renew after removing.

15 - Injector
- ❑ Observe rules for cleanliness ⇒ page 7 .
- ❑ Assembly overview ⇒ page 278 .

- ❑ Check ⇒ page 286 .
- ❑ Removing and installing ⇒ page 280 .

16 - O-ring

- ❑ Renew after removing.

17 - Heat shield seal

- ❑ Renew after removing.

18 - Seal

- ❑ Renewing ⇒ page 105 .

19 - Cap

20 - Gasket

- ❑ For cap.

21 - Grommet

22 - Bracket

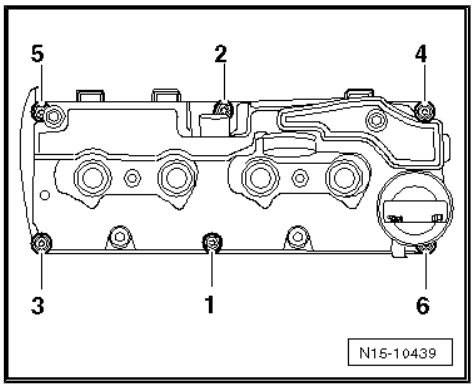
- ❑ For electrical cables.

23 - Bolt

- ❑ 9 Nm
- ❑ Renew gasket if damaged.
- ❑ Tightening sequence ⇒ page 91 .

Tightening sequence for cylinder head cover

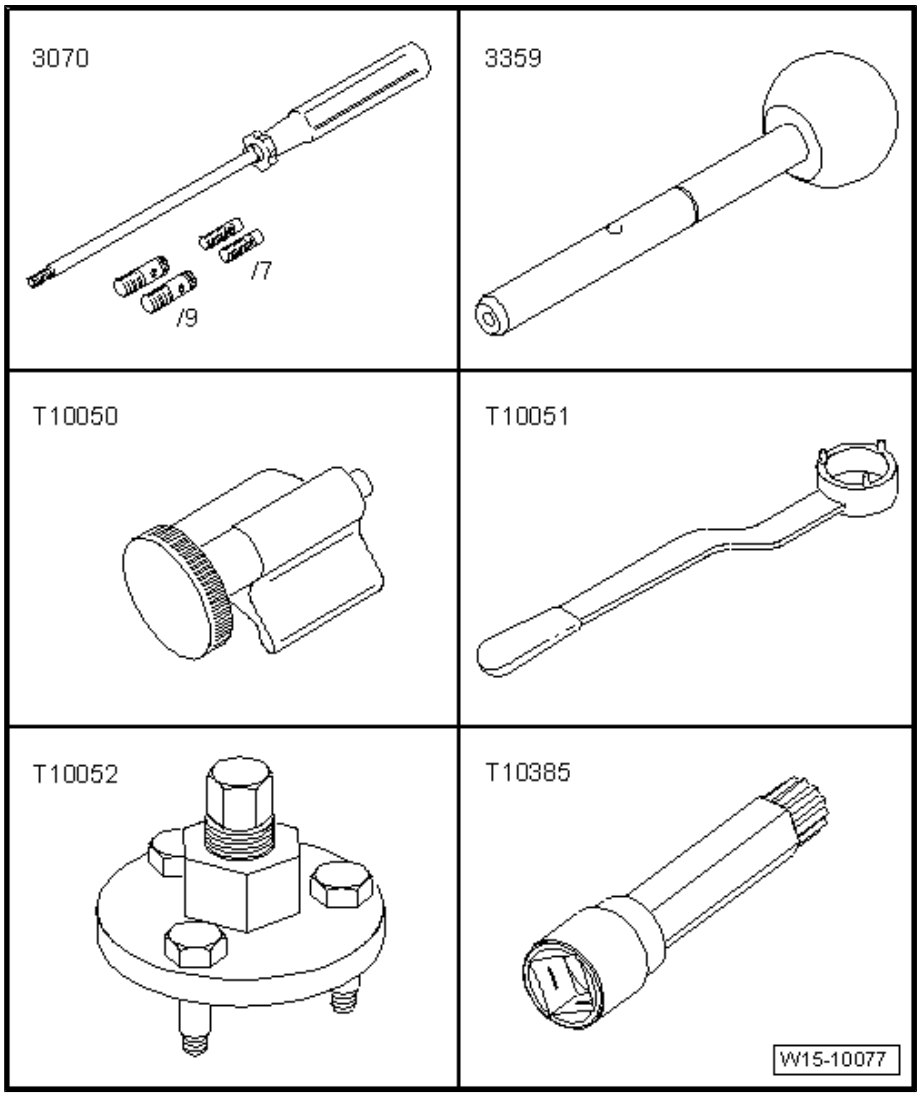
– Tighten cylinder head cover bolts in the sequence -1 … 6-.



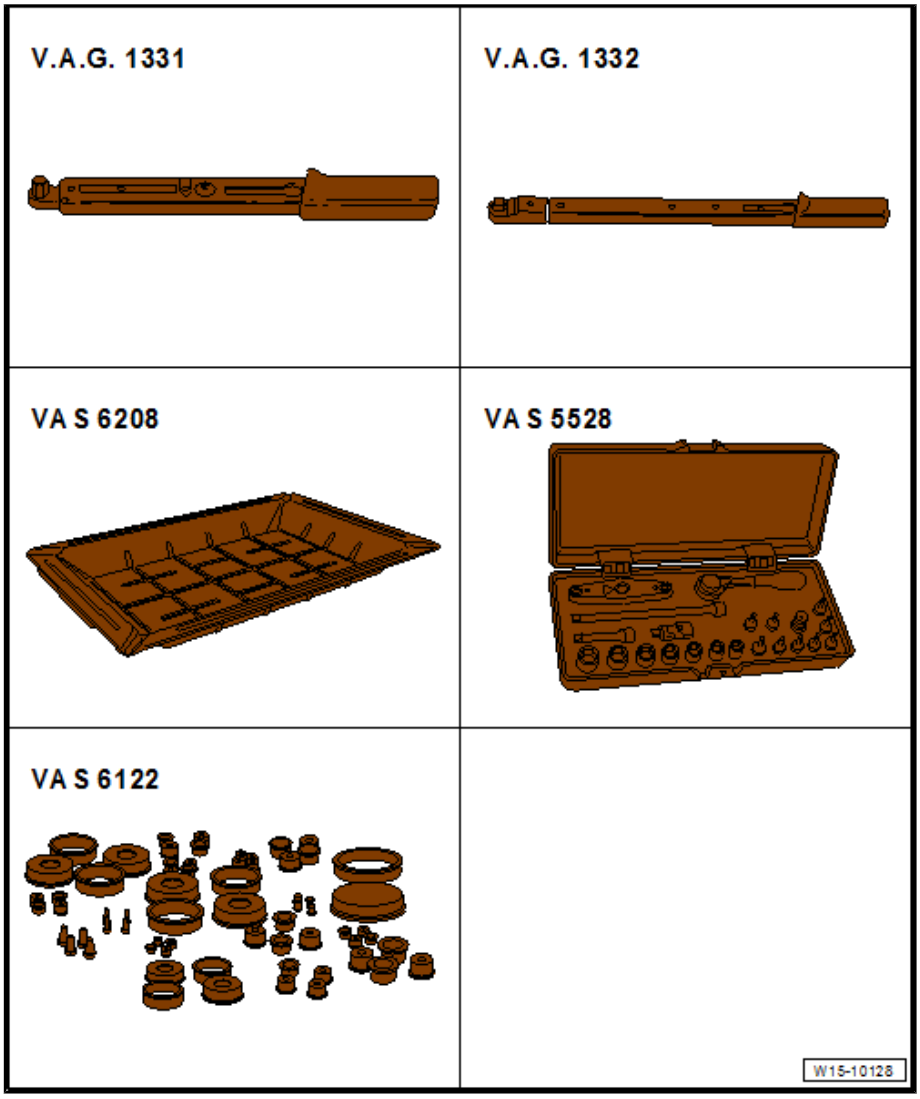
1.3 Removing and installing cylinder head

Special tools and workshop equipment required

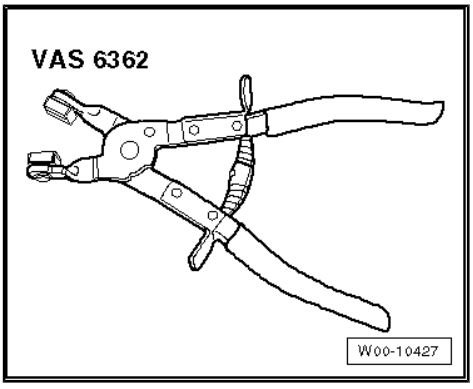
- Guide pins - 3070-
- Diesel injection pump locking pin - 3359-
- Crankshaft stop - T10050-
- Counterhold tool - T10051-
- Puller - T10052-
- Bit XZN 10 - T10385-



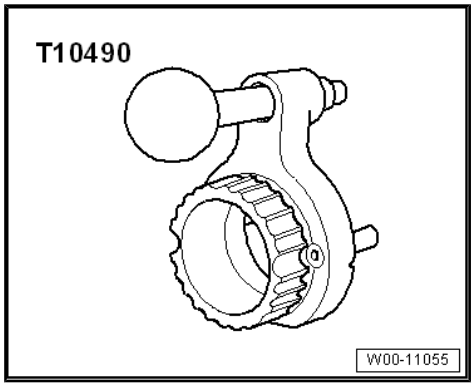
- Torque wrench - V.A.G 1331-
- Torque wrench - V.A.G 1332-
- Socket set 1/4", 22-piece - VAS 5528-
- Engine bung set - VAS 6122-
- Drip tray for workshop hoist - VAS 6208-



- Hose clip pliers - VAS 6362-



- Crankshaft stop - T10490-



- Vehicle diagnostic tester

Note

- *All cable ties which are opened or cut through when cylinder head is removed must be fastened in the same position when cylinder head is installed.*
- *All connectors which are separated during disassembly must be reconnected in the original position when installing.*
- *Seal open lines and unions with clean plugs from engine bung set - VAS 6122- .*
- *Collect drained coolant in a clean container for re-use or disposal.*

Caution

When doing any repair work, especially in the engine compartment, pay attention to the following due to the cramped conditions:

- ***Route all the various lines (e.g. for fuel, hydraulics, activated charcoal filter system, coolant and refrigerant, brake fluid and vacuum) and electrical wiring in their original positions.***
- ***To avoid damage to lines, ensure sufficient clearance from all moving or hot components.***

Removing

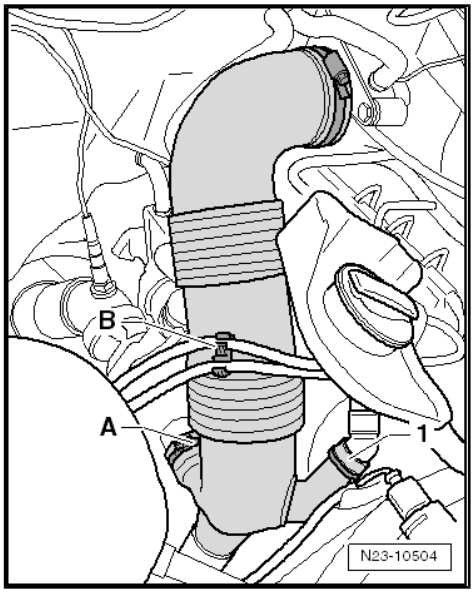
– Disconnect battery ⇒ Electrical system; Rep. gr. 27 ; Battery; Disconnecting and reconnecting battery .

– Remove air filter housing ⇒ page 277 .

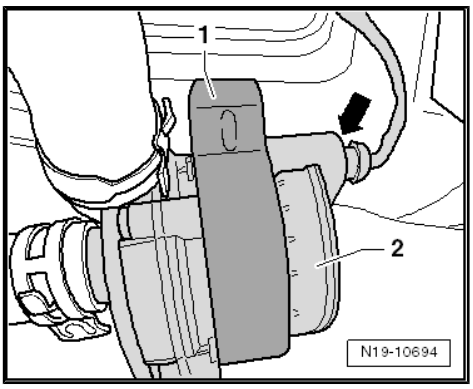
– If fitted, remove noise insulation ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Removing and installing noise insulation .

– Drain coolant ⇒ page 179 .

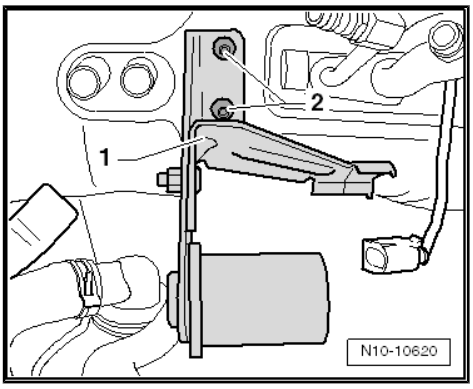
– Unclip vacuum lines-B- from retainer.
– Pull crankcase breather hose -1- off.
– Loosen clip -A- and remove intake hose.



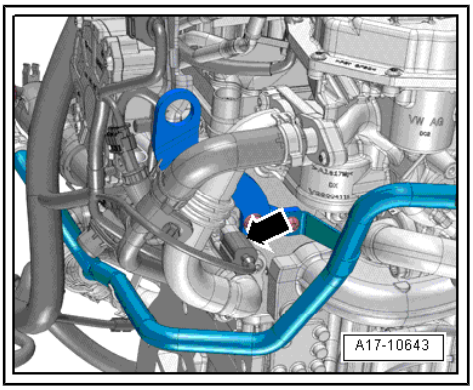
– Detach connector -arrow- from coolant circulation pump - V50- -2-.
– Pull coolant circulation pump - V50- -2- out of retainer -1- and secure somewhere with a cable tie.



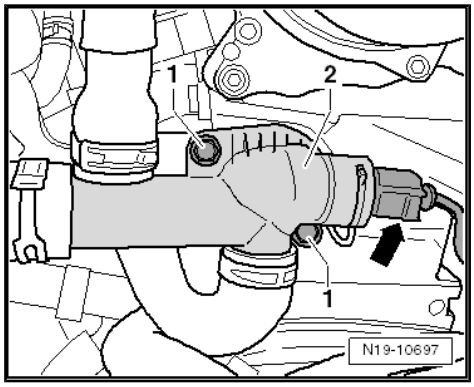
– Unscrew nuts -2- from air filter bracket -1- and remove bracket.
– Remove oil filler hose.
– Remove vacuum line leading to brake servo and vacuum pump.
– Remove cylinder head cover ⇒ page 101 .
– Remove exhaust gas recirculation cooler ⇒ page 361 .
– Remove turbocharger ⇒ page 211 .



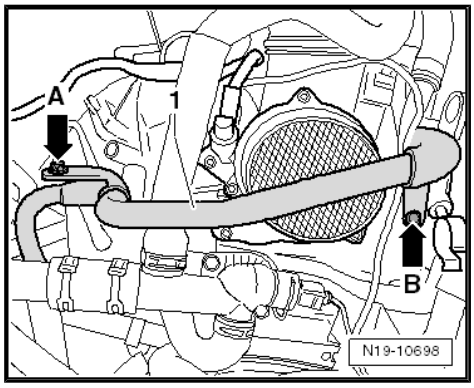
– Detach electrical connector -arrow- from oil pressure switch - F1- .



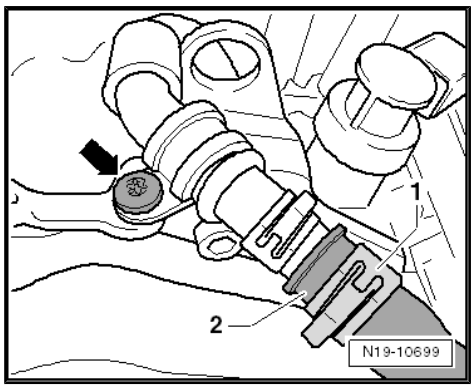
– Detach connector -arrow- from coolant temperature sender - G62- .
– Undo and remove bolts -1- securing coolant flange -2- and allow coolant flange to hang suspended.



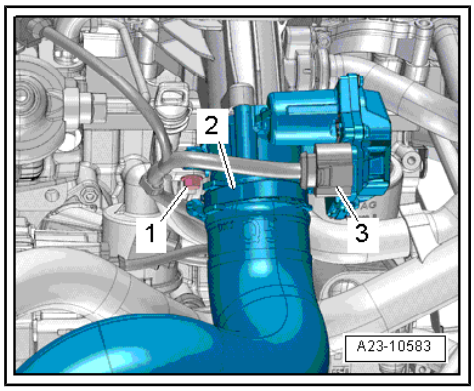
– Undo and remove bolts -arrows A and B- from water pipe -1-.



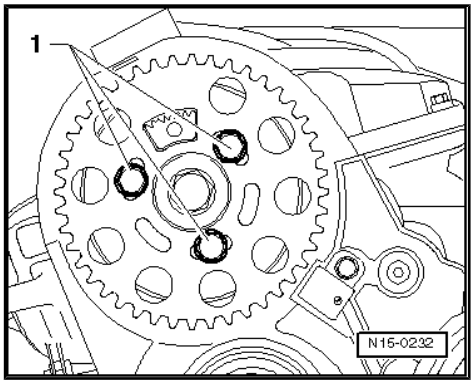
– Loosen clip -2- and pull coolant hose -1- off.
– Remove bolt -arrow-.



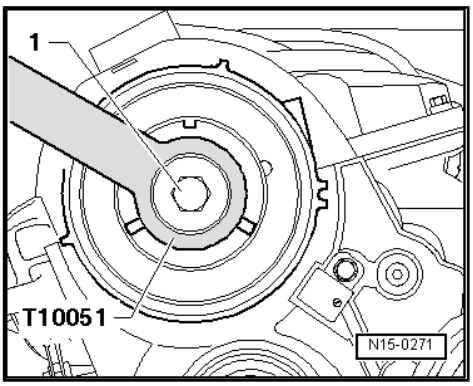
– Remove bolt -1- for dipstick guide tube.
– Disconnect electrical connector -3- at throttle valve module - J338- .
– Loosen clip -2- and pull pressure pipe off throttle valve module - J338- .
– Remove intake manifold ⇒ page 272 .



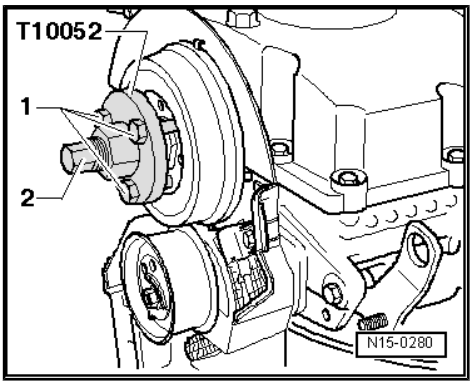
– Remove toothed belt from camshaft pulley ⇒ page 112 .
– Undo and remove bolts -1- and remove camshaft pulley.



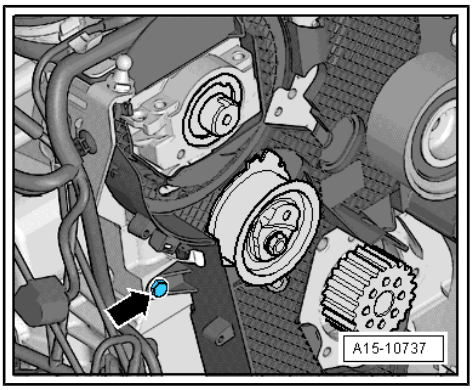
– Loosen bolt -1- for camshaft hub while counterholding with the counterhold tool - T10051- .
– Unscrew bolts approximately 2 turns.



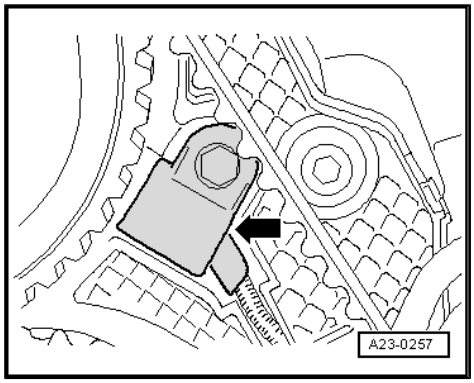
– Fit puller - T10052- on hub of camshaft. Screw bolts -1- into hub.
– In order to pull camshaft hub off, screw bolt -2- in while counterholding with the counterhold tool on the hexagonal sides (30 mm) of the puller.
– Remove hub from taper of camshaft.



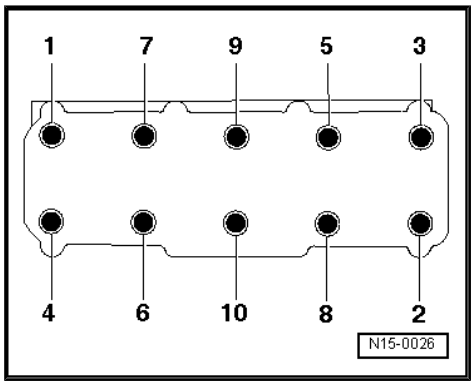
– Unscrew bolt -arrow- for toothed belt guard at rear.



– Undo and remove bolt for Hall sender - G40- -arrow- and place Hall sender - G40- to one side.

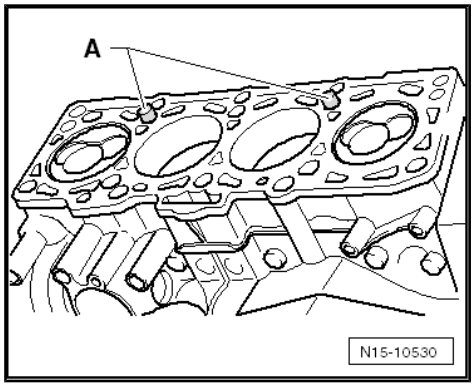


– Loosen cylinder head bolts in the sequence -1 … 10-.



Note

- *A second mechanic is required for the removal of the cylinder head.*
- *The toothed belt tensioning roller is pulled off the stud when the cylinder head is lifted out.*
- *Check that all necessary hoses and lines have been disconnected.*
- *Do not place cylinder head onto dowel sleeves -A- when removing and installing.*



– First raise cylinder head on gearbox side and pull slightly to left. Whilst doing this, remove toothed belt tensioner from stud.

– When lifting cylinder head out, guide electrical lines and coolant hoses past transport eyelet.

Caution

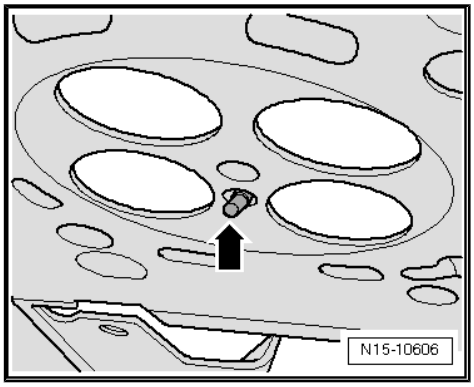
Risk of damage to glow pins when cylinder head is lowered!

- ***Do not lay removed cylinder head with installed glow plugs down on sealing surface, as glow pins project past sealing surface.***

Caution

Risk of damage to sealing surfaces!

- *When using abrasive paper do not use a grade less than 100.*
- *Carefully remove any sealant residue from the cylinder head and cylinder block. Ensure that no long scores or scratches are made on the surfaces.*
- *Carefully remove remains of emery and abrasives.*



Installing

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

Caution

Risk of damage to cylinder block!

- *No oil or coolant may be contained in hole pockets for cylinder head bolts in cylinder block.*

Danger of cylinder head gasket leaks!

- *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.*

Risk of 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.*

Risk of damage to valves and piston crowns after work is done on valve gear!

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

Note

- *Proceed with extreme caution. The assistance of a second mechanic is vital.*
- *Always renew cylinder head bolts.*
- *Renew oil seals, gaskets, self-locking nuts, bolts tightened through an additional specified angle and securing clamps.*
- *Do not remove new cylinder head gasket from packaging until it is ready to be fitted.*
- *If an exchange cylinder head is installed, contact surfaces between roller rocker fingers and running surface of cam must be oiled.*
- *Hose unions and air intake pipes/hoses must be free of oil and grease when installing.*
- *When cylinder head or cylinder head gasket is renewed, the entire coolant ⇒ page 179 and the engine oil must be changed.*

Renewing cylinder head:

- If there is no pipe connection fitted on the new cylinder head, install it to the new cylinder head.
- For information on the pipe connection and silicone adhesive sealant , refer to ⇒ Electronic Parts Catalogue (ETKA) .

– Insert pipe connection with silicone adhesive sealant into cylinder head.

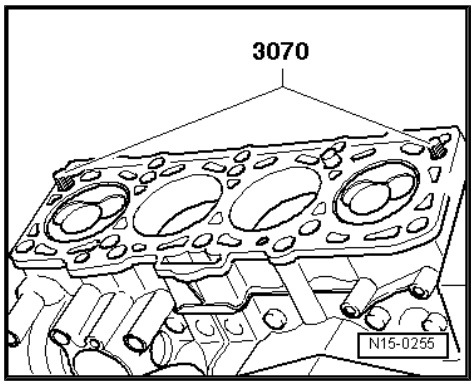
– Use a suitable tool to drive pipe connection into cylinder head.

Continued:

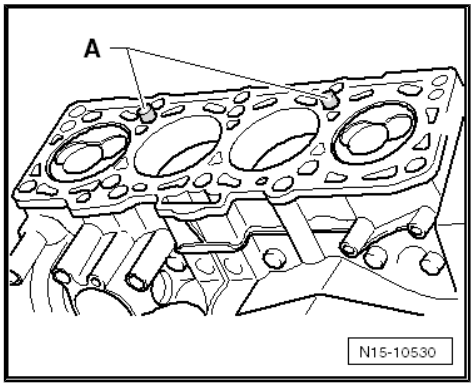
– To centre, screw guide pins -3070/9- into outer threaded holes on intake side.

• Cylinder head gasket installation position: marking “top” or part number towards cylinder head

– Position cylinder head gasket.



– Thread cylinder head into toothed belt guard and position belt tensioner onto stud. When doing this, cylinder head must not scrape over dowel sleeves -A-.



– Fit cylinder head.

– Insert 8 cylinder head bolts and screw in by hand until contact is made.

– Unscrew guide pins -3070/9- through bolt holes in cylinder head and screw remaining cylinder head bolts by hand until contact is made.

To prevent the high-pressure pump from running while it is empty and to ensure that the engine starts quickly after parts have been renewed, it is important to observe the following:

♦ If fuel system components between fuel tank and high-pressure pump are removed or renewed, bleeding of the fuel system must be carried out using ⇒ Vehicle diagnostic tester.

♦ This process takes 130 seconds. Fuel pumps are actuated a total of 3 times in this case. The process must not be terminated prematurely.

Specified torques

♦ ⇒ “1.1 Assembly overview - cylinder head”, page 87

♦ ⇒ “2.1 Assembly overview - toothed belt”, page 110

♦ ⇒ “1.2 Assembly overview - cylinder head cover”, page 90

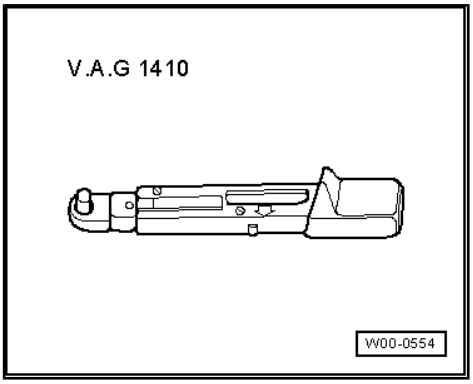
♦ ⇒ “4.1 Assembly overview - air filter housing”, page 276

– Carry out road test and read all event memories.

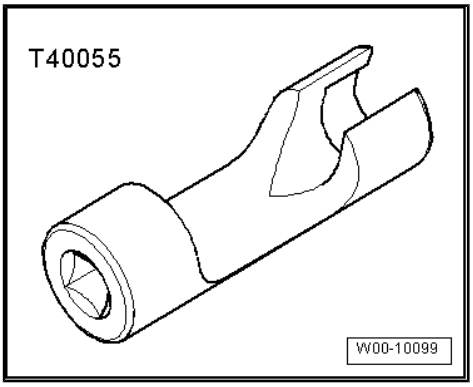
1.4 Removing and installing cylinder head cover

Special tools and workshop equipment required

♦ Torque wrench - V.A.G 1410-



♦ Socket - T40055-

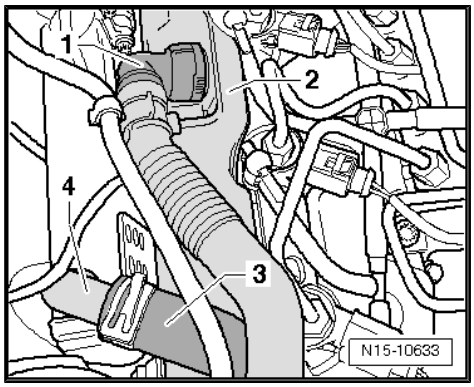


Removing

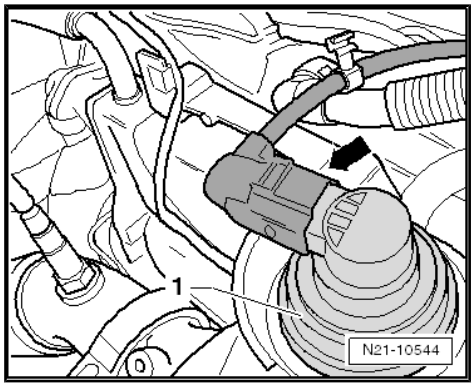
– Remove oil filler hose.

– Unclip crankcase breather -1- from cylinder head cover -2-.

– Remove coolant hose -3- from exhaust gas recirculation cooler connection -4-.

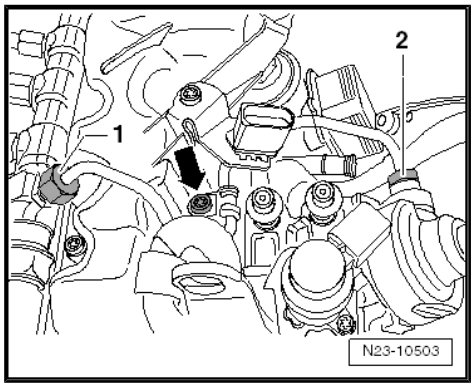


– Detach connector -arrow- from regulating flap potentiometer -G584- -1-.

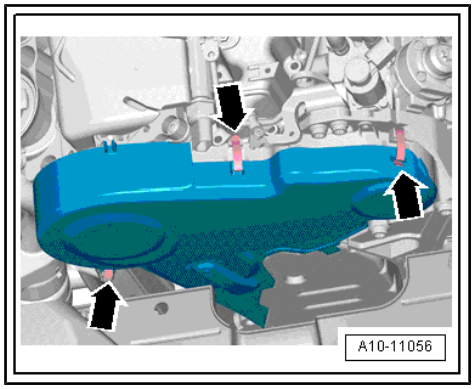


– Undo and remove bolt -arrow- from retainer of high-pressure line.

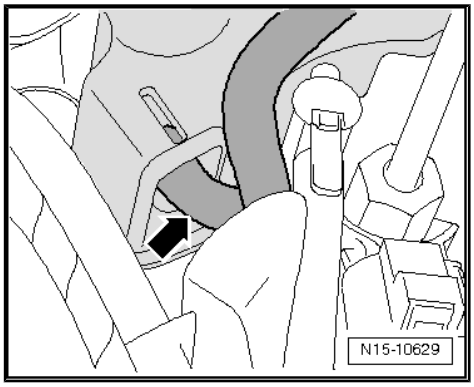
– Unscrew union nuts -1 and 2-, and remove high-pressure line.



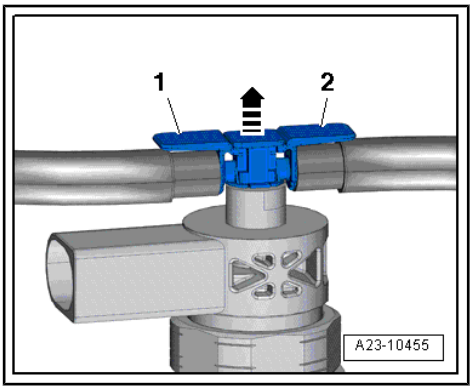
– Open clasps -arrows- and remove toothed belt guard.



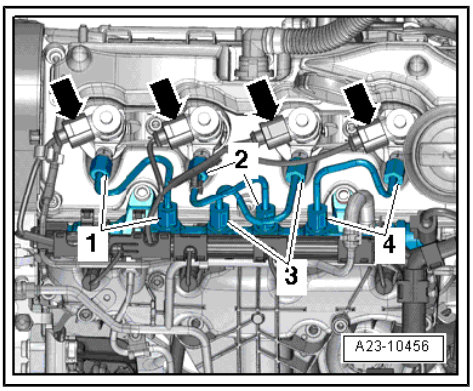
– Pull vacuum hose -arrow- off from cylinder head cover.



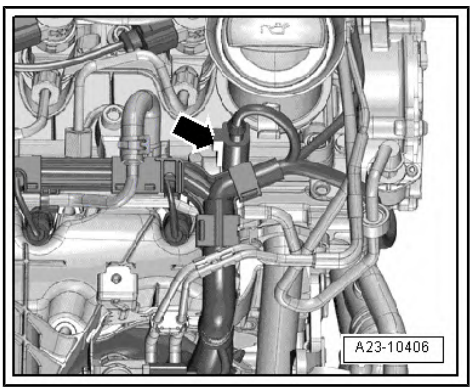
– Pull return line connections off injectors by counterholding slightly on catches -1 and 2- and pulling release pin upwards -arrow-.



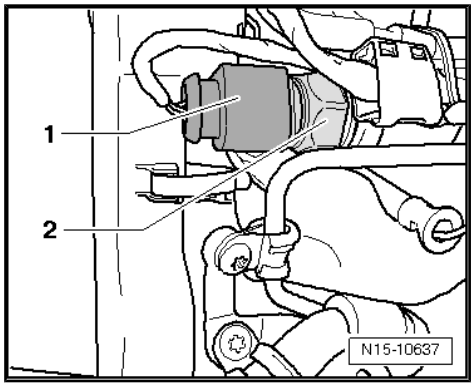
– Detach electrical connectors -arrows- from injectors.



– Detach electrical connector -arrow- from fuel pressure regulating valve - N276- .



– Pull connector -1- off fuel pressure sender - G247- -2-.

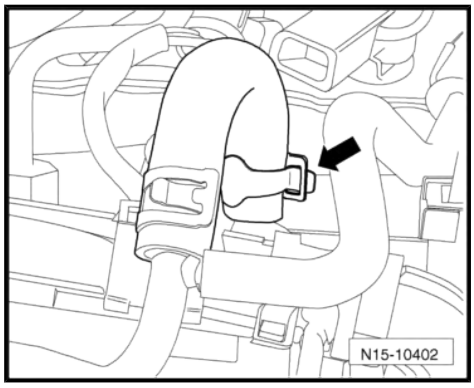


Caution

When releasing high-pressure line, counterhold high-pressure connection using an open-ended spanner. Leaks occur if high-pressure connection is released.

– Remove fuel return hose from high-pressure accumulator (fuel rail); release hose clip -arrow- to do so.

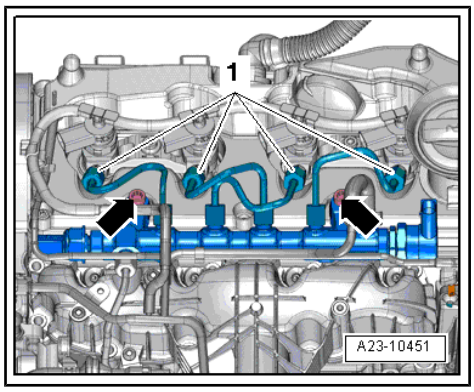
– Remove line guide from high-pressure accumulator (fuel rail) and place to one side.



– Undo union nuts of 4 high-pressure lines -1-.

– Undo and remove bolts -arrows-, remove high-pressure accumulator (fuel rail) and place to one side.

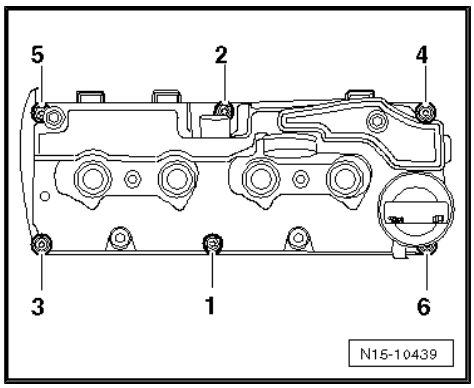
– Remove injectors ⇒ page 280 .



– Release and unscrew bolts for cylinder head cover in the sequence -6…1-.

Note

To unscrew the bolt -4-, it might be necessary to slightly loosen the coolant pipe.



– Remove cylinder head cover.

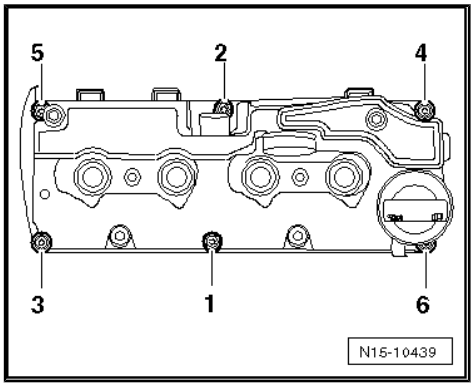
Installing

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

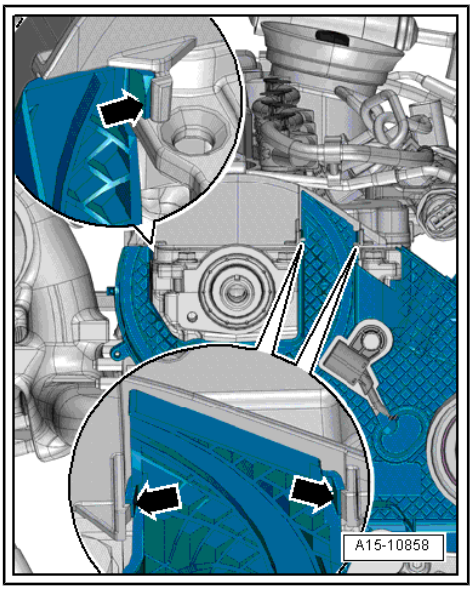
Note

- *Renew gasket for cylinder head cover and bolts for cylinder head cover if damaged or leaking.*
- *Renew grommets and seals for injectors if damaged or leaking.*

– Tighten cylinder head cover bolts hand-tight in the sequence -1 … 6-.



– Ensure that cylinder head cover is correctly clipped to toothed belt guard -arrows-.



Note

For reasons of clarity, illustration shows installation position with camshaft sprocket removed.

– Check clearance between hub and toothed belt guard.

– Bleeding fuel system ⇒ Vehicle diagnostic tester.

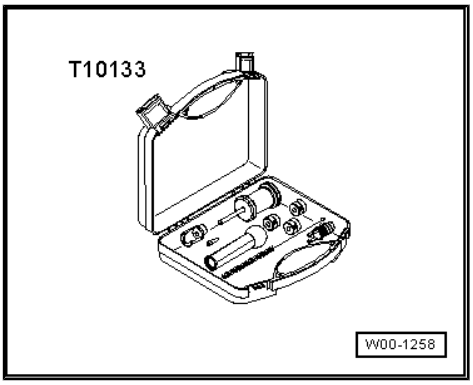
Specified torques

♦ ⇒ “1.2 Assembly overview - cylinder head cover”, page 90

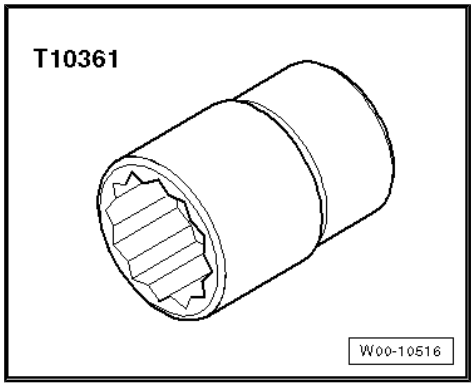
1.5 Removing and installing injector seals

Special tools and workshop equipment required

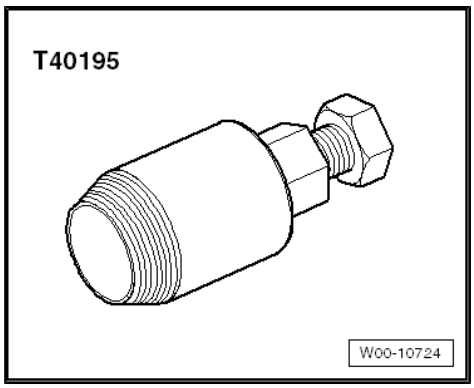
♦ Tool set for FSI engines - T10133-



- 24 mm socket insert - T10361-



- Oil seal extractor - T40195-

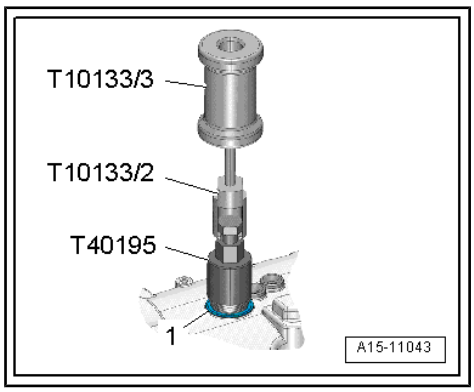


Removing

– Remove corresponding injector ⇒ page 280 .

– Twist oil seal extractor - T40195- into oil seal -1-.

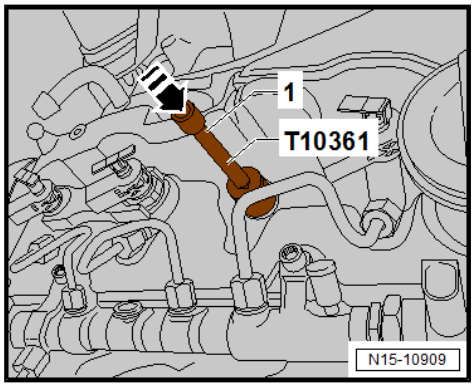
– Place impact hammer -T10133/3- together with adapter - T10133/2- in position on oil seal extractor as shown in the illustration and then pull out upwards using tapping movements.



Installing

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

– Drive in new oil seal for injector as far as the stop, using socket 24 mm - T10361- and short extension -1-.



Specified torques

- ⇒ “1.2 Assembly overview - cylinder head cover”, page 90
- ⇒ “5.1 Assembly overview - injectors”, page 278

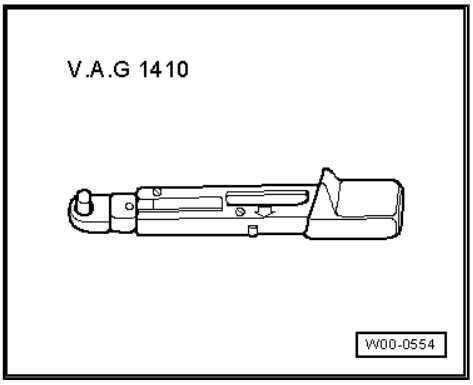
1.6 Removing and installing vacuum pump

DANGER!

It is not permissible to dismantle the vacuum pump under any circumstances as otherwise the vacuum part could malfunction. This would result in failure of the brake servo.

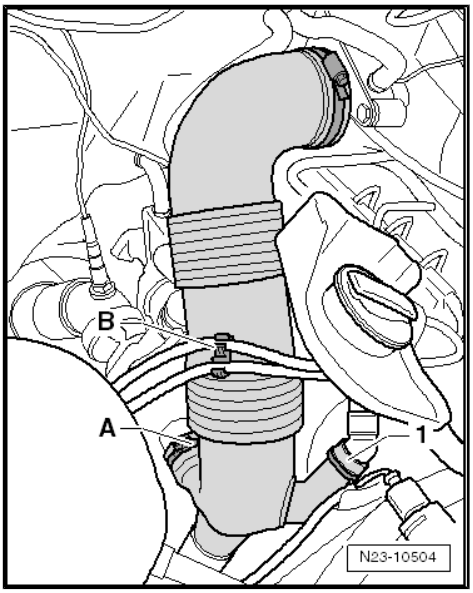
Special tools and workshop equipment required

- Torque wrench - V.A.G 1410-

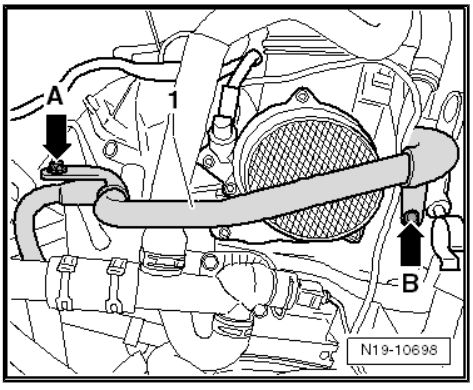


Removing

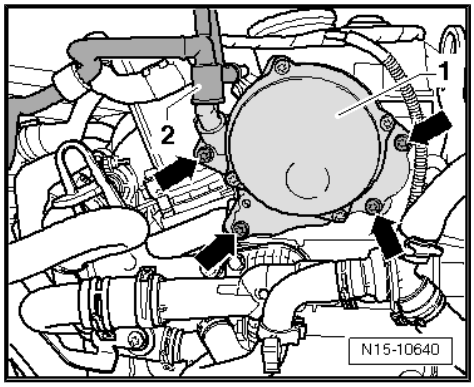
– Remove air filter ⇒ page 277 .
– Unclip vacuum lines-B- from retainer.
– Pull crankcase breather hose -1- off.
– Loosen clip -A- and remove intake hose.



– Undo and remove bolts -arrows A and B- from water pipe -1-.



– Place cloths under the vacuum pump -1-.
– Pull vacuum line -2- off vacuum pump -1-.
– Undo and remove bolts -arrows- of vacuum pump -1-.
– Remove vacuum pump -1- from cylinder head.



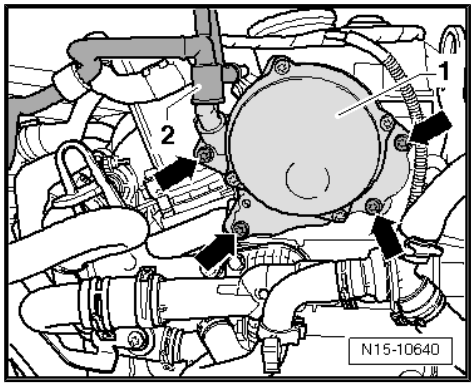
Installing

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

Note

- *Ensure that vacuum pump coupling is seated properly in camshaft.*
- *Vacuum pump has been correctly seated in camshaft if it is lying completely against the cylinder head.*
- *Seal must be renewed.*

– Install vacuum pump -1- and tighten securing bolts -arrows-.
– Connect brake servo vacuum line -1- to vacuum pump.



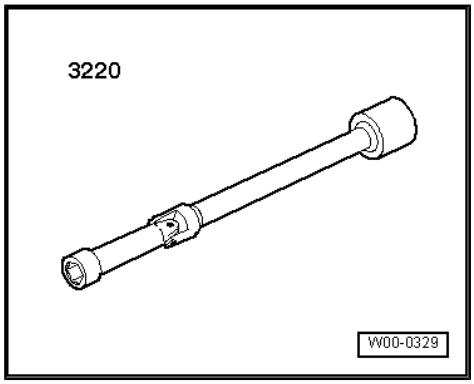
Specified torques

- ⇒ “1.1 Assembly overview - cylinder head”, page 87

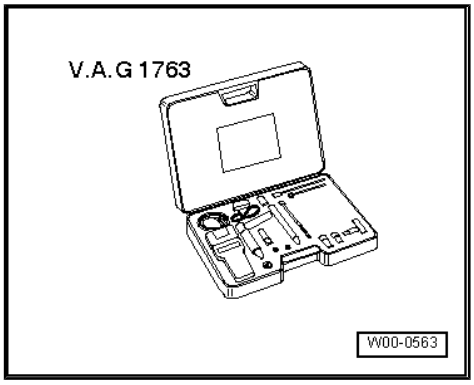
1.7 Checking compression

Special tools and workshop equipment required

- Jointed spanner - 3220-



♦ Compression tester - V.A.G 1763- with adapter - V.A.G 1763/8-



♦ Torque wrench (5…50 Nm) - V.A.G 1331-

Test prerequisite

- Engine oil temperature min. 30 °C.

Test procedure

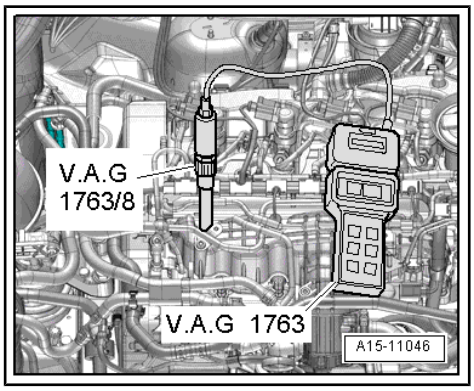
– Pull injector connectors (piezo injectors) off.

– Remove glow plug from relevant cylinder using U/J extension and 10 mm socket - 3220- ⇒ page 370 .

– Screw in adapter - V.A.G 1763/8- in place of the glow plugs.

– Check compression using compression tester - V.A.G 1763- . Using compression tester ⇒ operating instructions .

– Start engine until tester shows no further pressure increase.



Compression pressures:

Compression pressures	bar
New	25.0 … 31.0
Wear limit	19.0
Maximum difference between cylinders	5.0

– Install glow plugs with the U/J extension and 10 mm socket - 3220- ⇒ page 370 .

– Read engine control unit event memory.

Note

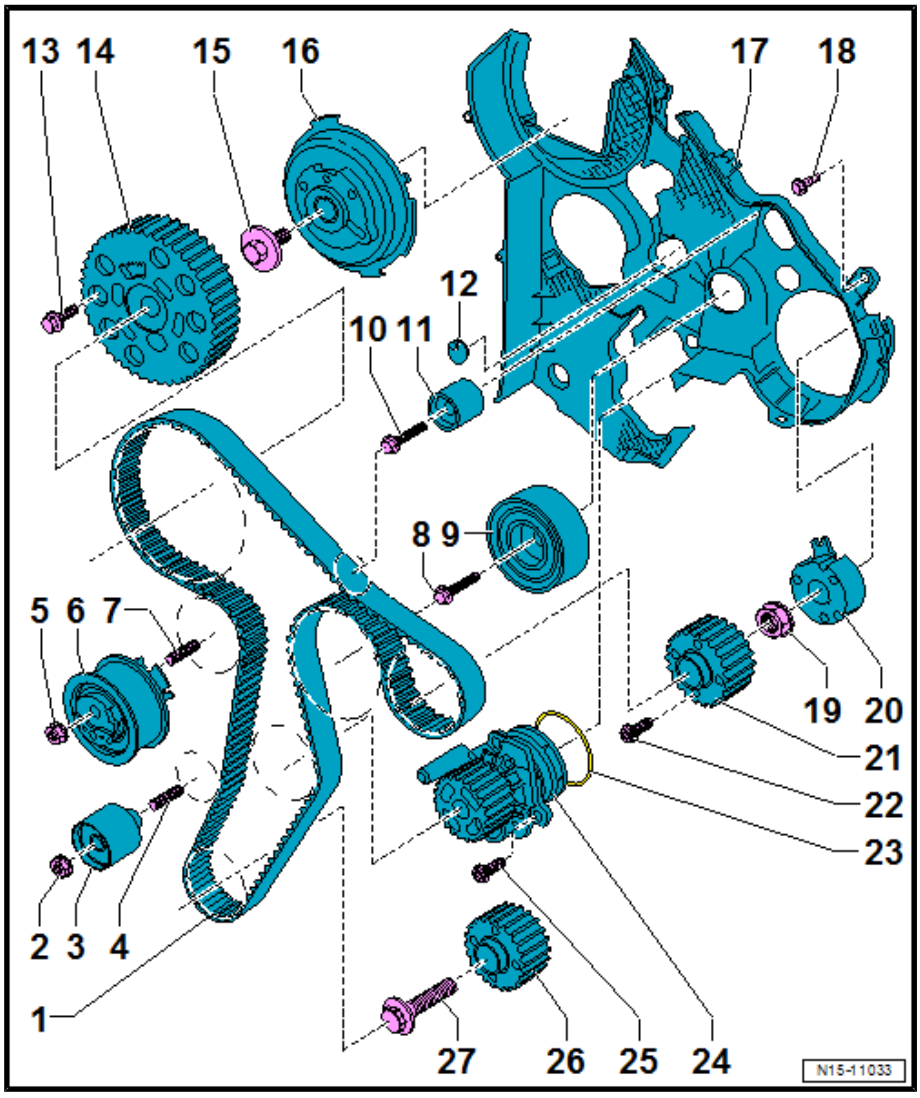
Detachment of the injector connectors (piezo injectors) results in faults being stored. Read event memory and delete corresponding faults.

2 Toothed belt drive

⇒ “2.1 Assembly overview - toothed belt”, page 110

⇒ “2.2 Removing and installing toothed belt”, page 112

2.1 Assembly overview - toothed belt



1 - Toothed belt

- ❑ Before removing, mark direction of rotation with chalk or felt-tipped marker pen.
- ❑ Removing and installing ⇒ page 112

2 - Nut

- ❑ 20 Nm

3 - Idler pulley

4 - Stud

- ❑ 15 Nm

5 - Nut

- ❑ 20 Nm + 45°

6 - Tensioning roller

7 - Stud

- ❑ 15 Nm

8 - Bolt

- ❑ Renew after removing.
- ❑ 50 Nm + 90°

9 - Idler pulley

10 - Bolt

- ❑ 20 Nm

11 - Idler pulley

12 - Plug

13 - Bolts

- ❑ Renew after removing
- ❑ Qty. 3
- ❑ 20 Nm +45°

14 - Toothed belt pulley

- ❑ For camshaft.

15 - Bolt

- ❑ 100 Nm

16 - Hub

- ❑ Removing and installing ⇒ page 131

17 - Toothed belt guard

- ❑ rear

18 - Bolts

- ❑ Qty. 2
- ❑ 9 Nm

19 - Nut

- ❑ Specified torque ⇒ page 308

20 - Hub

- ❑ Removing and installing ⇒ page 309

21 - Toothed belt pulley

- ❑ For high-pressure pump
- ❑ Removing and installing ⇒ page 309

22 - Bolts

- ❑ Specified torque ⇒ page 308

23 - Seal

- ❑ Renew after removing.

24 - Coolant pump

- ❑ Removing and installing ⇒ page 187 .

25 - Bolts

- ❑ Specified torque ⇒ page 186

26 - Toothed belt pulley

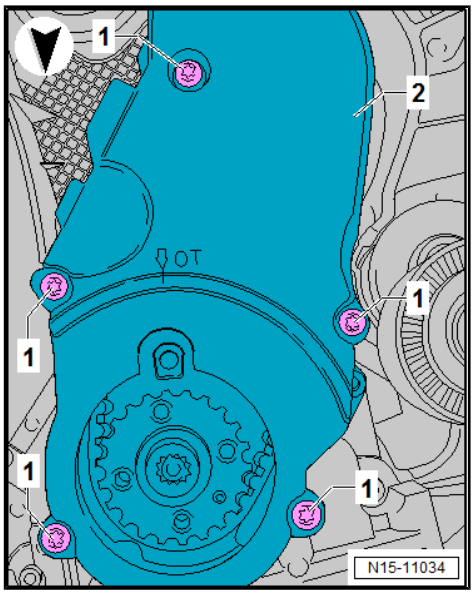
- ❑ For crankshaft.
- ❑ Contact surface between toothed belt pulley and crankshaft must be free from oil
- ❑ Fitting possible in one position only.
- ❑ Removing and installing ⇒ page 52

27 - Bolt

- ❑ Renew after removing
- ❑ Do not additionally oil the thread and shoulder.
- ❑ 180 Nm +135°

Lower part of toothed belt guard - specified torque

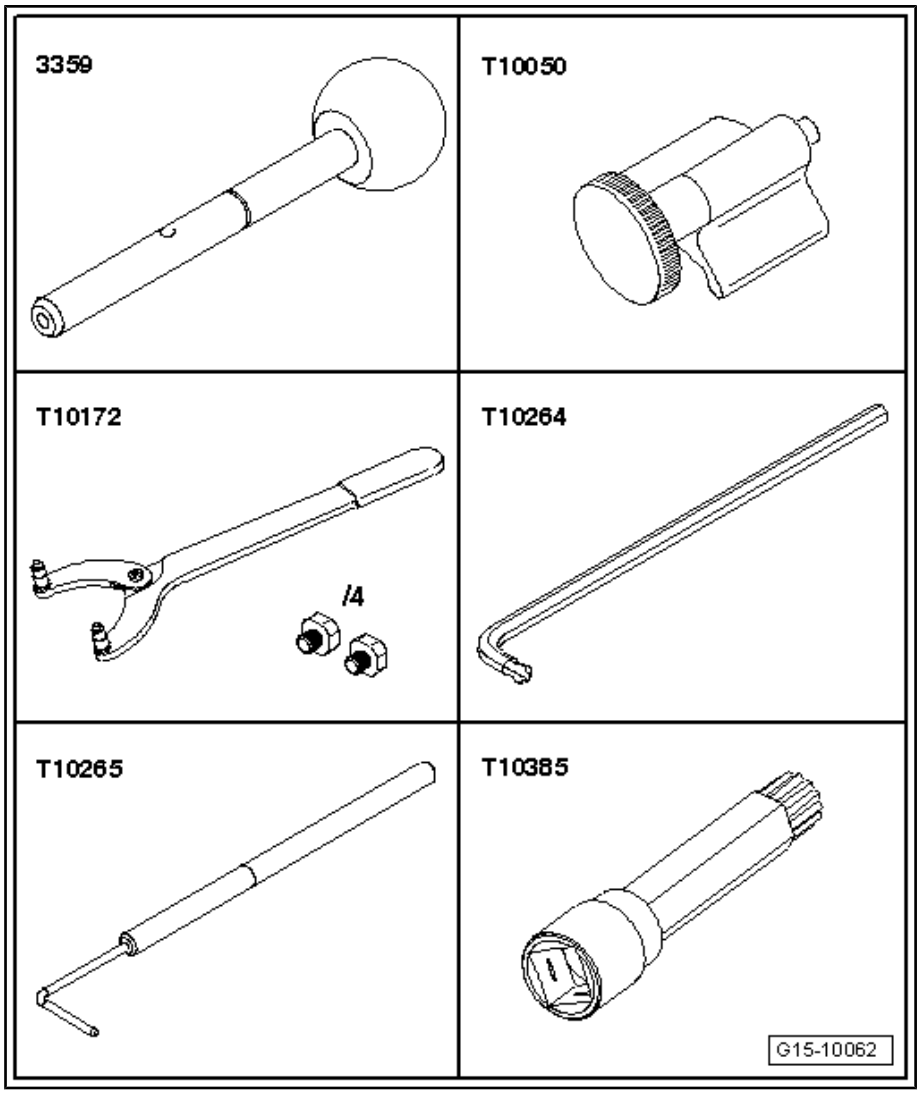
Component	Specified torque
Bolts -1-	9 Nm



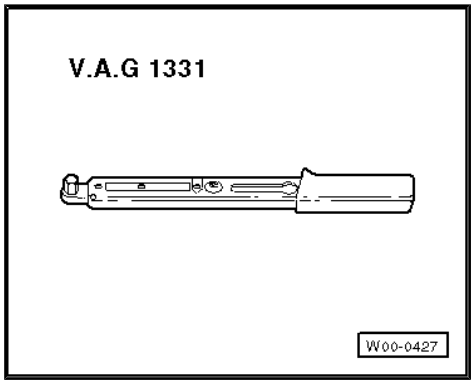
2.2 Removing and installing toothed belt

Special tools and workshop equipment required

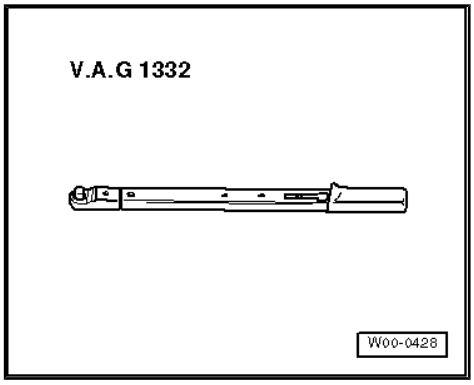
- 2x diesel injection pump locking pin - 3359-
- Crankshaft stop - T10050-
- Counterhold tool - T10172-
- Special wrench, long reach - T10264-
- Locking tool - T10265-
- Bit XZN 10 - T10385-



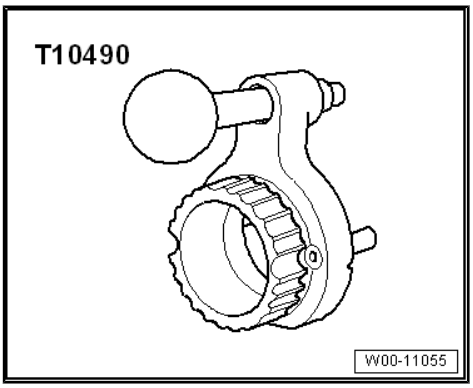
- Torque wrench - V.A.G 1331-



♦ Torque wrench - V.A.G 1332-



♦ Crankshaft stop - T10490-



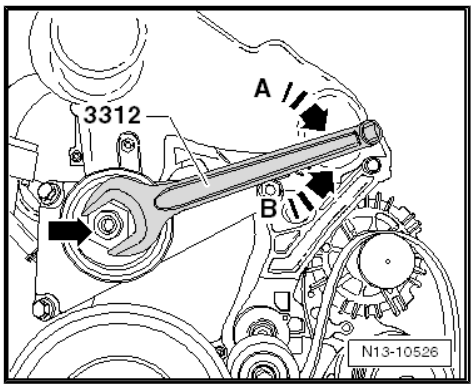
Removing

WARNING

Under no circumstances may the engine be turned counter to its direction of rotation -arrow B- at the viscous fan shaft -arrow-. This can result in the shaft being loosened and the vehicle breaking down. When tightening the viscous fan bolt, only counterhold in the engine's direction of rotation -arrow A- using the open-end spanner - 3312- .

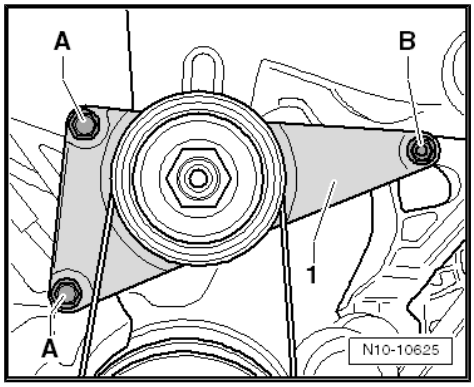
Note

Whenever adjustment work is done on toothed belts, it must be performed only when the engine is cold, as the indicator position on the tensioning element varies depending on the engine temperature.

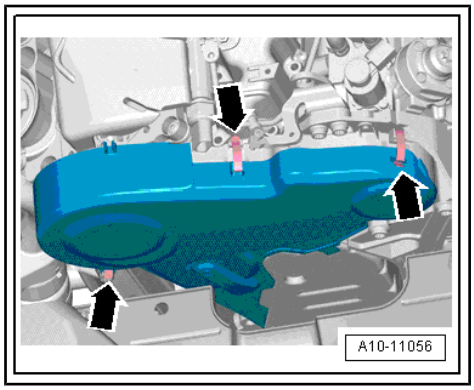


– If fitted, remove noise insulation ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Removing and installing noise insulation .
– Remove air filter housing ⇒ page 277 .
– Remove viscous fan ⇒ page 205 .
– Remove cowling ⇒ page 207 .
– Remove poly V-belt for auxiliary drive ⇒ page 46 .

– Unscrew bolts -A and B-, and remove bracket -1-.
– Remove vibration damper ⇒ page 49 .



– Release clips -arrows-.
– Remove toothed belt cover.

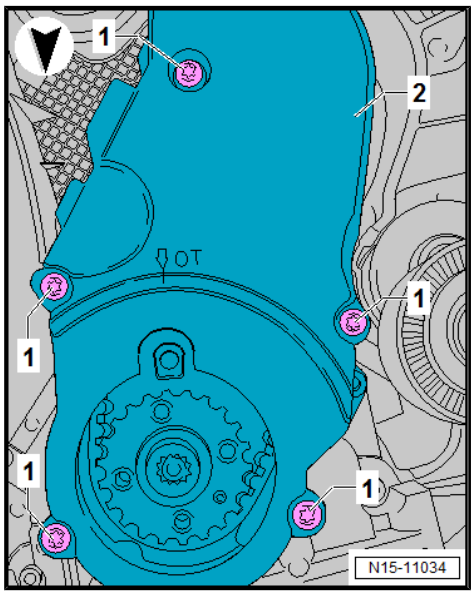


– Unscrew bolts -1-.
– Remove lower toothed belt guard -2-.

Caution

Risk of destruction due to toothed belt jumping!

- *Only turn crankshaft in engine direction of rotation.*

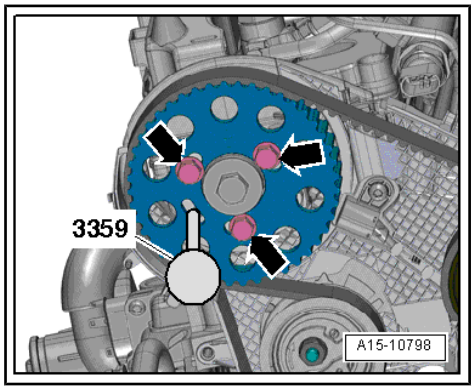


– Turn crankshaft by bolt for toothed belt sprocket until toothed belt for camshaft is at “TDC”.

– Fix the hub in place with locking pin for diesel injection pump - 3359- .

Note

Ignore -arrows-.



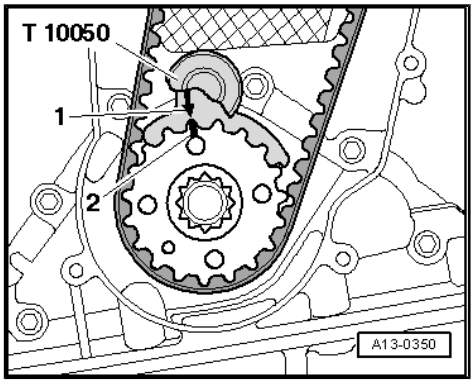
Version A: lock crankshaft pulley with mark in position

– Lock crankshaft pulley in position with crankshaft stop - T10050- .

• Marks on toothed belt pulley -2- and crankshaft stop - T10050- -1- must align.

• Pin of crankshaft stop - T10050- must engage in drilling in sealing flange.

• The crankshaft stop - T10050- can be pushed onto the toothed belt pulley only from the face side.

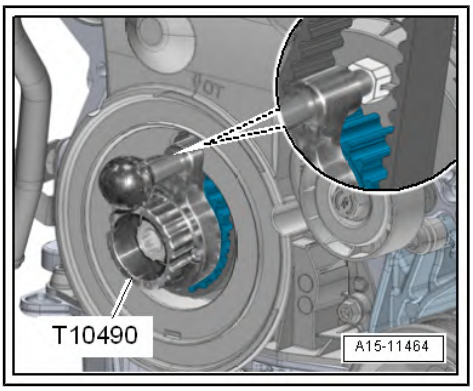


For crankshaft pulleys with a mark, it is also possible to use crankshaft stop - T10490- .

– Lock crankshaft pulley in position with crankshaft stop - T10490- .

• Pins of crankshaft stop - T10490- must engage in threaded holes of toothed belt pulley.

• Locking pin of crankshaft stop - T10490- must engage in hole in sealing flange.



Version B: lock crankshaft pulley without mark in position

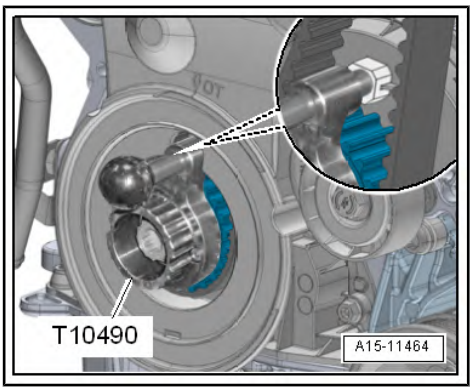
Note

Use only the crankshaft stop - T10490- to lock crankshaft pulleys without a mark in position.

– Lock crankshaft pulley in position with crankshaft stop - T10490- .

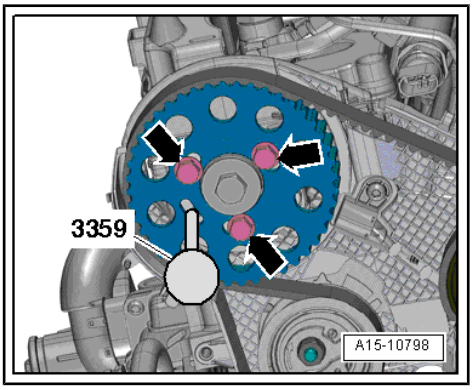
• Pins of crankshaft stop - T10490- must engage in threaded holes of toothed belt pulley.

• Locking pin of crankshaft stop - T10490- must engage in hole in sealing flange.

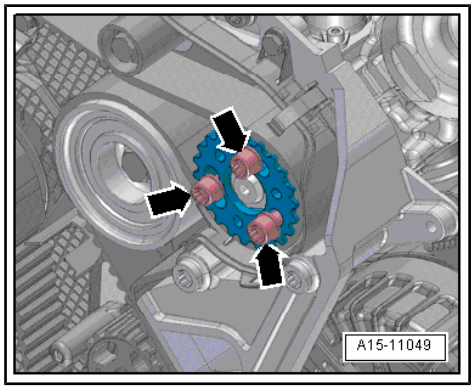


Continuation for all

– Loosen bolts -arrows- approx. 90°.

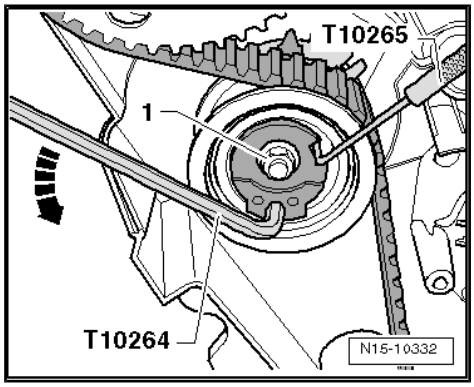


– Loosen bolts -arrows- by approx. 90° using bit XZN 10 - T10385- .

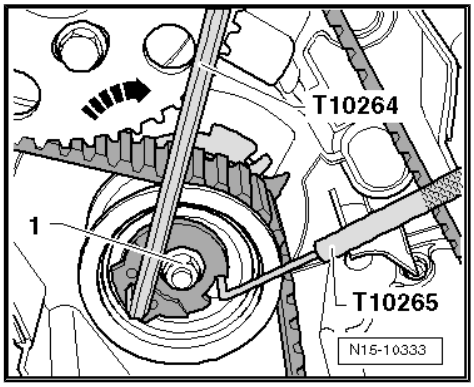


– Loosen nut -1- for belt tensioner.

– Turn eccentric of tensioning roller anti-clockwise -arrow- using offset wrench - T10264- , until the tensioning roller can be locked with locking tool - T10265- .



– Turn belt tensioner eccentric clockwise -arrow- to stop using special wrench, long reach - T10264- . Tighten nut -1- hand-tight.



Caution

Risk of irreparable damage if direction of rotation is reversed on previously used toothed belt!

- *Before removing toothed belt, mark direction of rotation with chalk or felt tipped pen for installation purposes.*

– Mark direction of rotation of toothed belt.

– Remove toothed belt first from coolant pump and then from remaining toothed belt pulleys.

Note

For vehicles with a power take-off, due to service life, the crankshaft pulley should also be renewed when the toothed belt is renewed.

Installing

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

Caution

Risk of damage to valves and piston crowns!

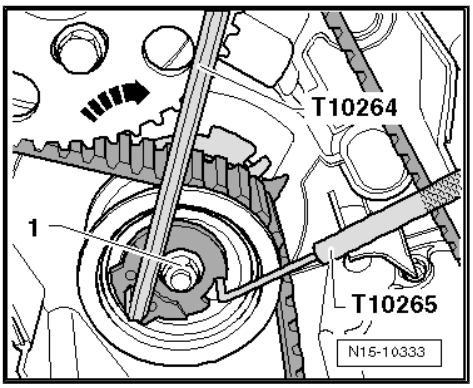
- *When turning camshaft, crankshaft must be positioned so that no piston is positioned at "TDC".*

Note

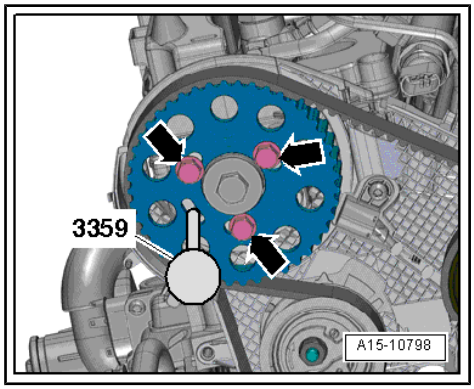
- *For vehicles with a power take-off, due to service life, the crankshaft pulley should also be renewed when the toothed belt is renewed.*
- *For adjusting work on the toothed belt, the engine must be cold.*

Prerequisites:

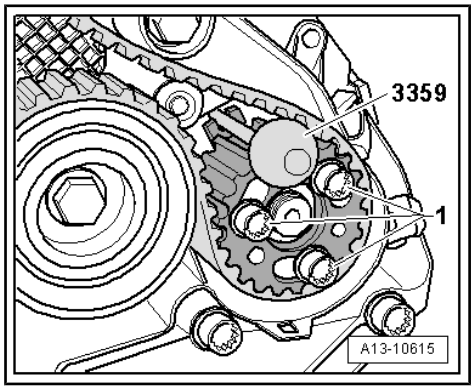
- Tensioning roller locked with locking tool - T10265- and secured to right stop with nut -1-.



- Camshaft hub locked in place with locking pin for diesel injection pump - 3359- .
- Bolts -arrows- screwed in loosely.
- It should just be possible to turn camshaft toothed belt pulley without axial movement.
- Crankshaft locked in position using crankshaft stop - T10050- or crankshaft stop - T10490- .

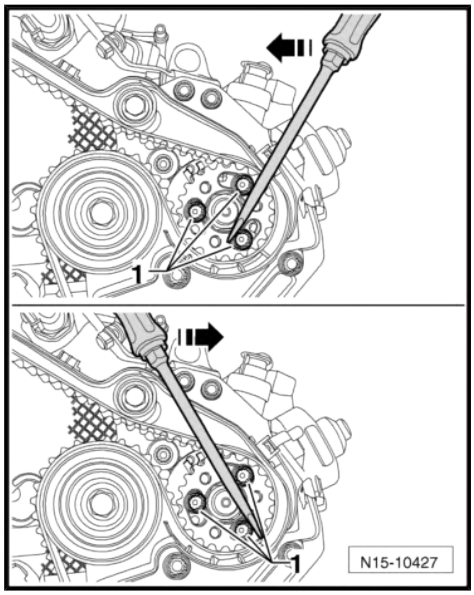


- Hub of high-pressure pump locked in place with locking pin for diesel injection pump - 3359- .
- Bolts -1- screwed in loosely.
- It should just be possible to turn high-pressure pump toothed belt pulley without axial movement.



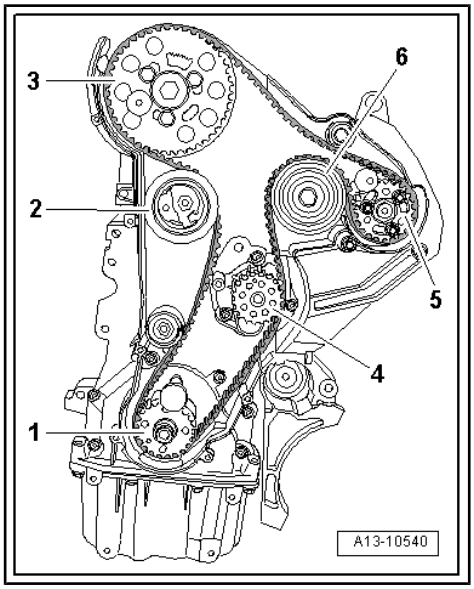
Note

If necessary, turn the hub of the high-pressure pump with a screwdriver -arrows- wedged against the heads of the bolts -1- until the hub can be locked with the locking pin.

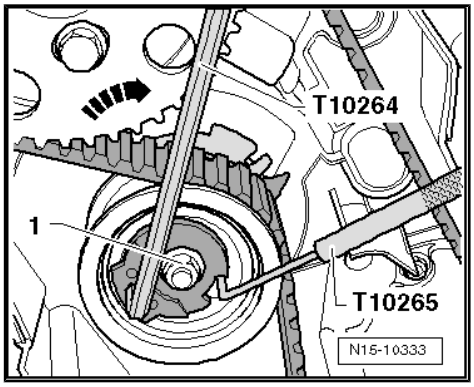


– Turn toothed belt sprocket of camshaft and toothed belt sprocket of high-pressure pump in their elongated holes clockwise as far as the stop.
– Fit toothed belt in sequence described:

1 - Crankshaft pulley
2 - Tensioning roller
3 - Camshaft toothed belt pulley
4 - Coolant pump toothed belt pulley
5 - High-pressure pump toothed belt pulley
6 - Guide roller

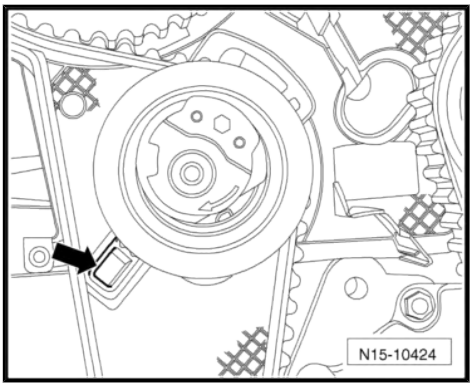


– Loosen nut -1- for belt tensioner and remove locking tool - T10265- .

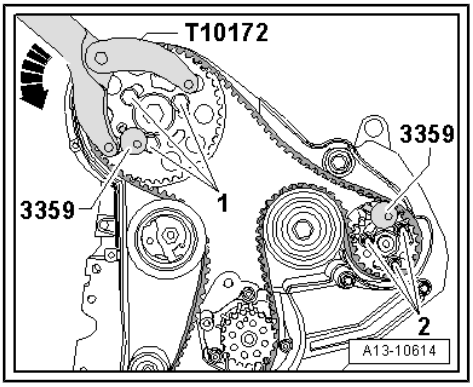


Note

Ensure that tensioning roller seats correctly in rear toothed belt guard -arrow-.



– Place counterhold tool - T10172- on toothed belt sprocket of camshaft, as shown in illustration.
– Push counterhold anti-clockwise -arrow- and maintain tension.
– Carefully turn belt tensioner eccentric clockwise -arrow- with angle driver - T10264- until indicator -2- is in the middle of gap in base plate.

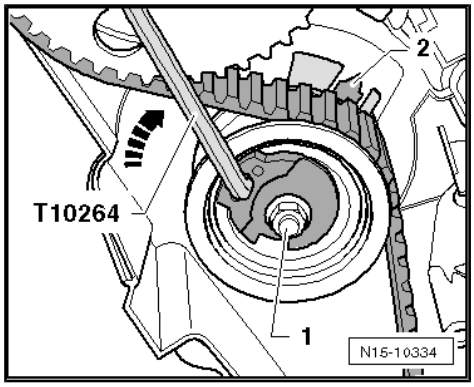


– In this position, tighten bolts -1- for toothed belt sprocket of camshaft and bolts -2- for toothed belt sprocket of high-pressure pump.

• Make sure that the nut -1- does not turn at the same time.

– Hold belt tensioner in this position and tighten nut.

– Remove locking pin for diesel injection pump - 3359- and crankshaft stop - T10050- or crankshaft stop - T10490- .



Checking valve timing:

Caution

Risk of destruction due to toothed belt jumping!

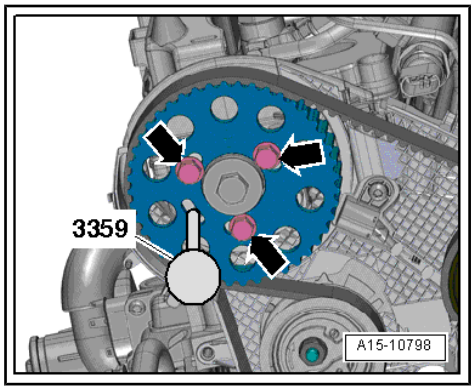
♦ *Only turn crankshaft in engine direction of rotation.*

– Turn crankshaft by bolt for toothed belt sprocket 2 turns in engine's direction of rotation until crankshaft is at a position shortly before “TDC”.

– Fit crankshaft stop - T10050- or crankshaft stop - T10490- on crankshaft pulley again.

– Turn crankshaft in direction of engine rotation until pin of crankshaft stop engages in sealing flange whilst turning.

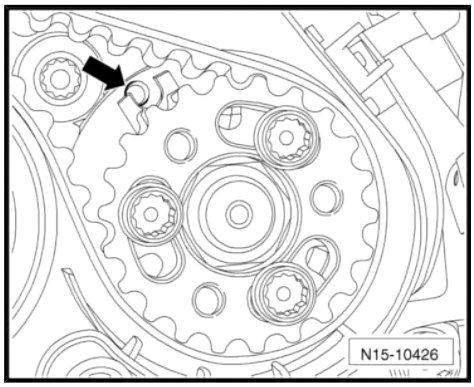
• It must be possible to lock the hub of the camshaft in place with the locking pin for diesel injection pump - 3359- .



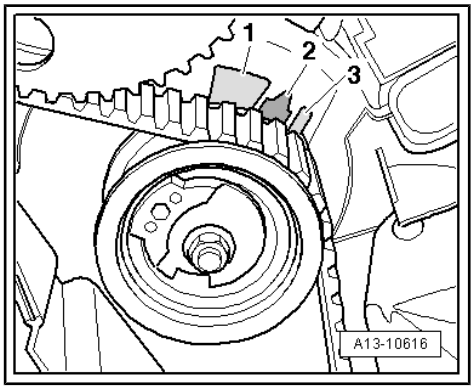
Note

Ignore -arrows-.

• It is very difficult to find the locking point of the high-pressure pump hub again. However, a slight deviation -arrow- does not influence operation of the engine.



- The belt tensioner indicator -2- must be in the middle between tabs -1- and -3- of the base plate.



Note

A maximum lateral offset of 5 mm is permissible.

Specified torque

- ⇒ “2.1 Assembly overview - toothed belt”, page 110
- ⇒ “1 Cylinder block (pulley end)”, page 36
- If the conditions are not fulfilled, correct the valve timing ⇒ page 121 .
- If the conditions are fulfilled, continue with the valve timing correctly adjusted ⇒ page 121 .

Correcting the valve timing:

– If the hub of the camshaft can not be locked in position, pull camshaft stop back until the lug exposes the hole.

– Twist crankshaft out at little past “TDC” by turning it in the opposite direction of engine rotation.

– Now turn crankshaft slowly in direction of engine rotation until camshaft hub can be locked in position.

– After locking, loosen bolts for toothed belt sprocket of camshaft.

A - pin of crankshaft stop - T10050- or crankshaft stop - T10490- is to the left of hole:

– Turn crankshaft in engine direction of rotation until crankshaft stop pin engages in sealing flange whilst turning.

– Tighten bolts for camshaft toothed belt pulley.

B - pin of crankshaft stop - T10050- or crankshaft stop - T10490- is to the right of hole:

– First, turn crankshaft a little in direction opposite to engine's direction of rotation.

– Turn crankshaft in engine's direction of rotation again until crankshaft stop pin engages in sealing flange whilst turning.

– Tighten bolts for camshaft toothed belt pulley.

Continuation with the valve timing correctly adjusted:

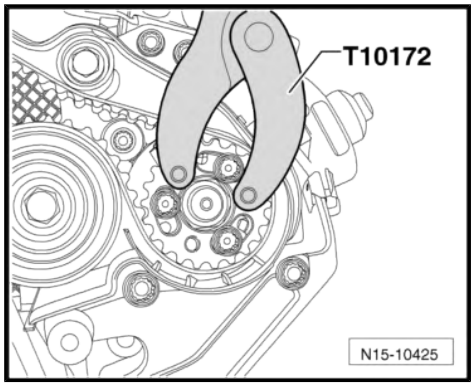
– Remove locking pin for diesel injection pump - 3359- and crankshaft stop .

– Turn crankshaft by bolt for toothed belt sprocket 2 turns in engine's direction of rotation until crankshaft is at a position shortly before “TDC”.

– Check valve timing again ⇒ page 120 .

– If camshaft hub can be secured in position, tighten securing bolts as follows:

- ♦ Camshaft pulley: tighten bolts. Counterhold with counterhold - T10172- and adapters - T10172/4- .
- ♦ High-pressure pump pulley: tighten bolts. Counterhold with counterhold - T10172- and adapters - T10172/8- .

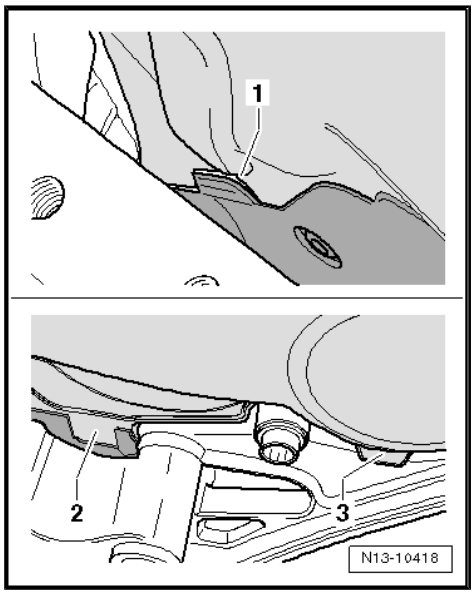


– Install lower part of toothed belt guard.

– Install vibration damper/belt pulley.

– First, fit top part of toothed belt guard to middle -1- of toothed belt guard from the rear.

– Then, fit toothed belt guard to middle -2- and -3- of toothed belt guard at the top.



– Secure toothed belt guard with clasps -arrows-.

Further assembly is basically the reverse of the dismantling sequence.

– Install poly V-belt ⇒ page 43 .

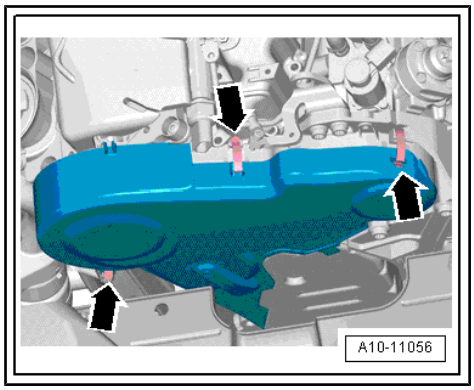
– Install poly V-belt for auxiliary drive ⇒ page 46 .

– Install viscous fan ⇒ page 205 .

– Install cowling ⇒ page 207 .

– Install any noise insulation ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation .

– Install air filter ⇒ page 277 .



Specified torque

- ♦ ⇒ “2.1 Assembly overview - toothed belt”, page 110
- ♦ ⇒ “1 Cylinder block (pulley end)”, page 36

3 Valve gear

3.1 Assembly overview - valve gear

1 - Valve

- ❑ Do not rework. Only lapping in is permitted.
- ❑ Mark installation position for re-installation.
- ❑ Checking ⇒ page 147 .
- ❑ Valve dimensions ⇒ page 147
- ❑ Checking valve guides ⇒ page 146 .

2 - Cylinder head

3 - Valve stem seal

- ❑ Renew with cylinder head installed ⇒ page 125
- ❑ Renewing with cylinder head removed ⇒ page 128 .

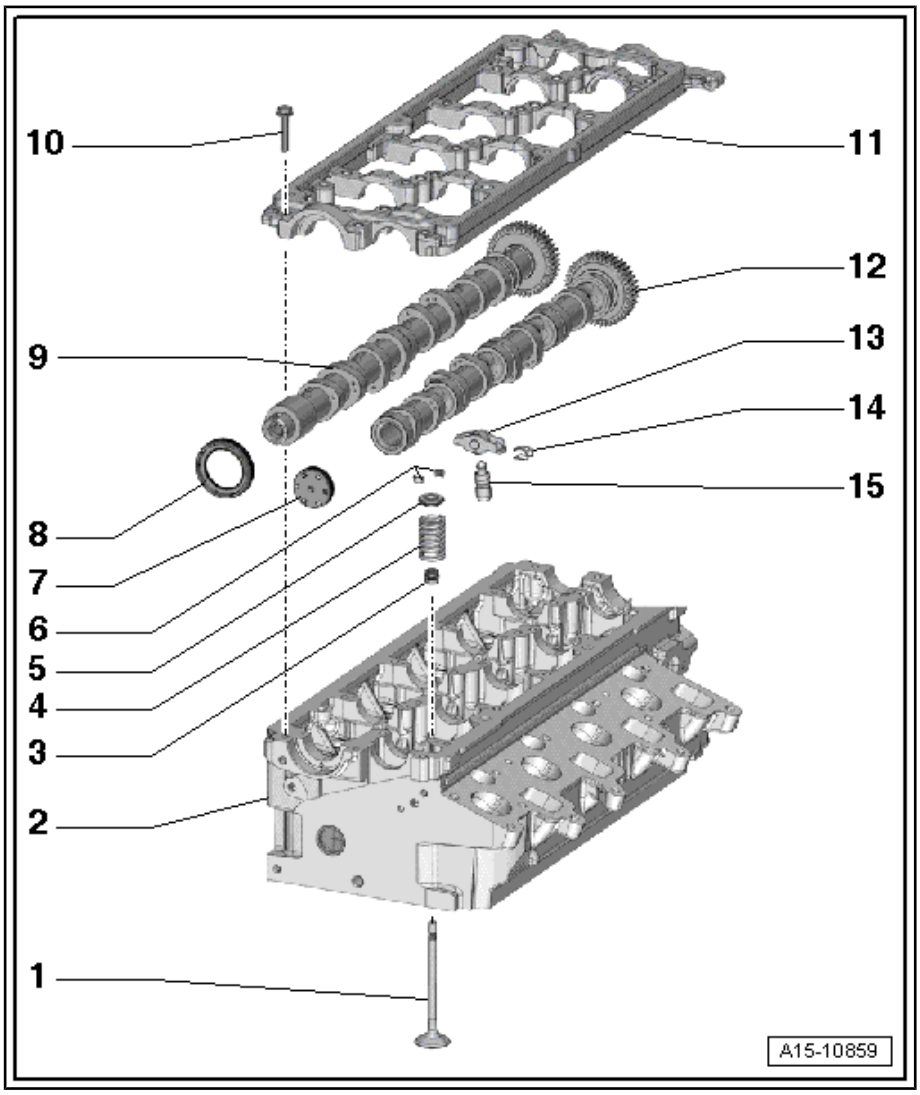
4 - Valve spring

5 - Valve spring plate

6 - Valve cotters

7 - Cap

- ❑ Renew after removing.
- ❑ Removing: with retaining frame installed, pierce one side of cap with an awl and prise out.
- ❑ Installing: drive in without sealant using an appropriate thrust piece.
- ❑ Insertion depth 1 … 2 mm



8 - Oil seal

Note

From week 29/12, a modified oil seal is used; distinguishing characteristics ⇒ page 140 .

- ❑ Removing and installing, to 07.12 ⇒ page 140
- ❑ Removing and installing, from 07.12 ⇒ page 142

9 - Exhaust camshaft

- ❑ Removing and installing ⇒ page 131 .
- ❑ Measuring axial clearance ⇒ page 138 .
- ❑ Measuring radial clearance ⇒ page 139

10 - Bolt

- ❑ Sequence when loosening ⇒ page 134 .
- ❑ Specified torque and tightening sequence ⇒ page 125 .

11 - Retaining frame

- ❑ Removing and installing ⇒ page 131 .
- ❑ With integrated camshaft bearings.

12 - Inlet camshaft

- ❑ Removing and installing ⇒ page 131 .
- ❑ Measuring axial clearance ⇒ page 138 .
- ❑ Measuring radial clearance ⇒ page 139

13 - Roller rocker finger

- ❑ Removing and installing ⇒ page 144 .
- ❑ Mark installation position for re-installation.
- ❑ Check roller bearing for ease of movement.
- ❑ Lubricate contact surfaces before installing.

14 - Securing clip

- ❑ For hydraulic compensation element.

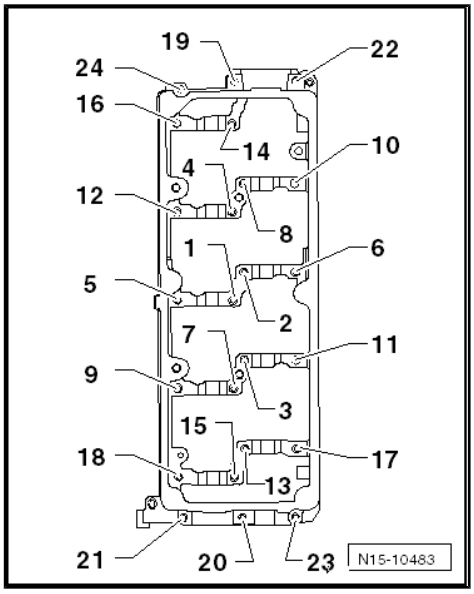
15 - Hydraulic compensation element

- ❑ Mark installation position for re-installation.
- ❑ Lubricate contact surfaces before installing.

3.1.1 Retaining frame - specified torques and installation sequence

– Tighten bolts in 2 stages in the sequence shown:

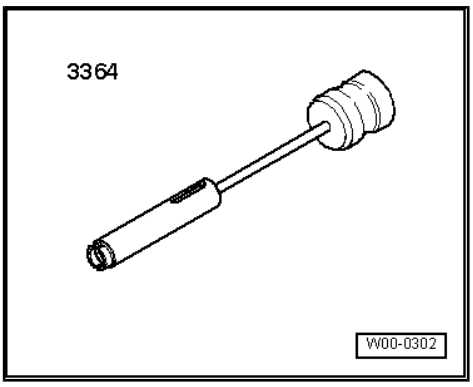
Stage	Bolts	Specified torque
1.	-1 … 24-	Screw in as far as stop by hand. • The retaining frame should make contact with the cylinder head over the complete surface.
2.	-1 … 24-	10 Nm



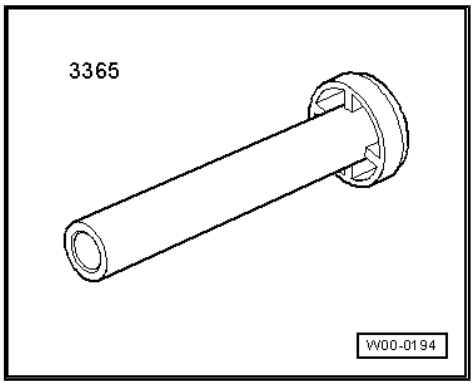
3.2 Removing and installing valve stem seals

Special tools and workshop equipment required

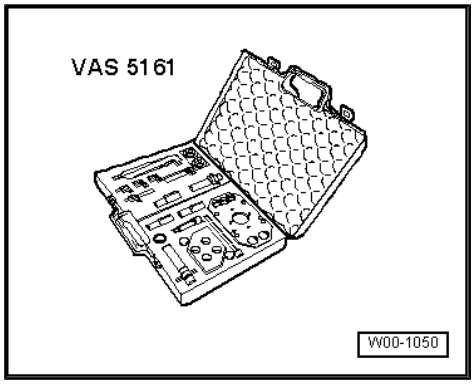
♦ Valve stem seal puller - 3364-



♦ Valve stem seal fitting tool - 3365-



♦ Removal and installation device for valve cotters - VAS 5161- with guide plate -VAS 5161/23- and sleeve -VAS 5161/23-1-



♦ 2x M6x30 bolts

Procedure

– Remove all glow plugs ⇒ page 370 .

– Remove camshafts ⇒ page 131 .

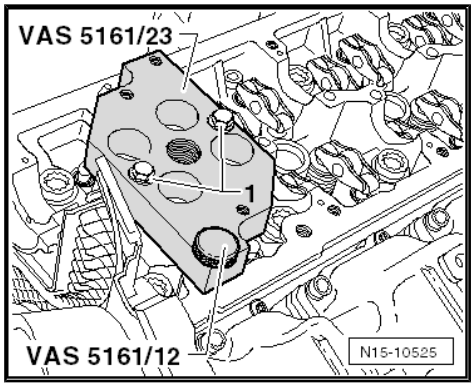
– Mark allocation of roller rocker fingers and hydraulic compensation elements for reinstallation.

– Remove roller rocker fingers together with hydraulic compensation elements and place down on a clean surface.

– Set piston of respective cylinder to “bottom dead centre”.

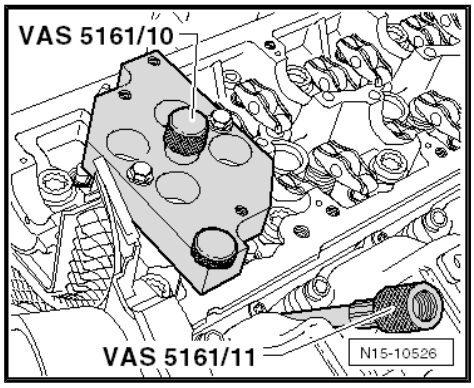
– Place guide plate -VAS 5161/23- onto cylinder head.

– Tighten guide plate on intake manifold side by hand using knurled screw -VAS 5161/12- and 2 M6x30 bolts -item 1- until it makes contact.

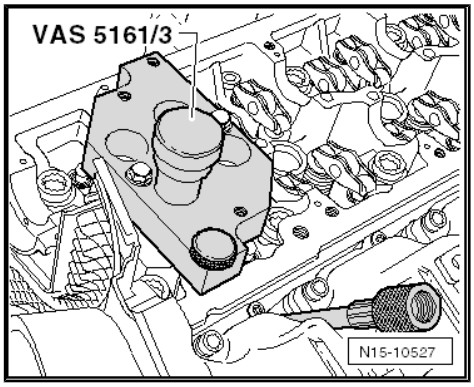


– Screw sealing pins -VAS 5161/10- into guide plate.

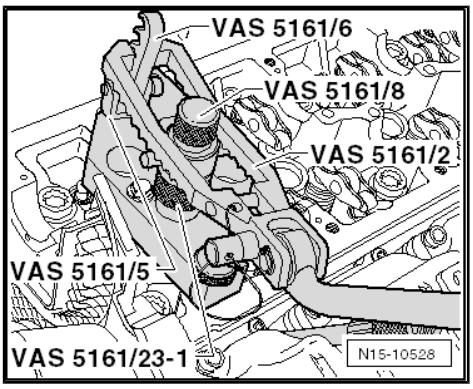
– Screw adapter -VAS 5161/11- hand-tight into relevant glow plug thread.



– Insert drift -VAS 5161/3- into guide plate and use a plastic hammer to knock loose the firmly seated valve cotters.



– Screw toothed piece -VAS 5161/6- with hooking fork -VAS 5161/5- into guide plate.
– Push sleeve -VAS 5161/23-1- onto assembly cartridge -VAS 5161/8- .
– Connect adapter to compressed air supply using a commercially available union and apply pressure continuously.
• Minimum pressure: 6 bar
– Attach pressure fork -VAS 5161/2- to toothed piece and press 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 to press apart valve cotters and capture them in assembly cartridge.
– Release pressure fork.
– Remove assembly cartridge together with spacer.
– Remove valve spring and valve spring plate.

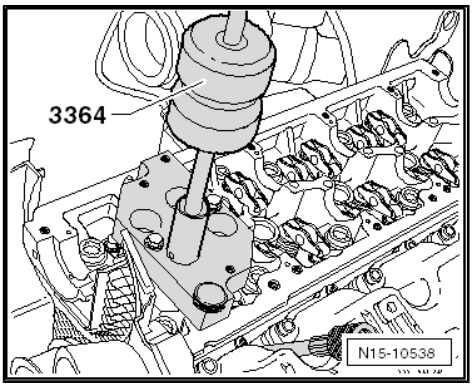


– Pull off valve stem seal using valve stem seal puller - 3364- .

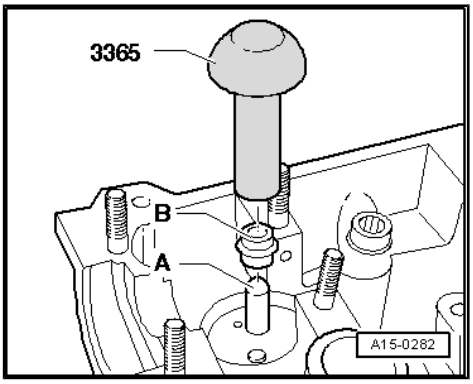
Caution

Risk of damage when valve stem seals are being installed!

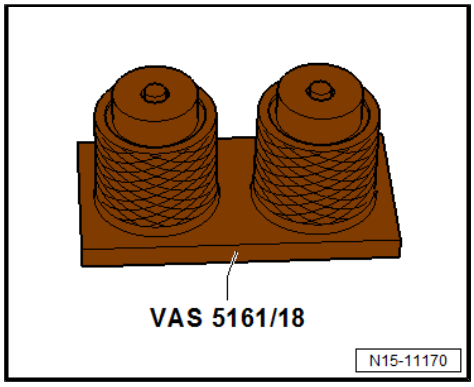
- *Place plastic sleeve -A-, enclosed with new valve stem seals -B-, onto valve stem.*



– Lightly oil sealing lip of valve stem seal.
– Push valve stem oil seal onto plastic sleeve.
– Carefully press valve stem oil seal onto valve guide using valve stem seal fitting tool - 3365- .
– Remove plastic sleeve.



If the valve cotters have been removed from the assembly cartridge, they must first be inserted into the valve insertion device -VAS 5161/18- .

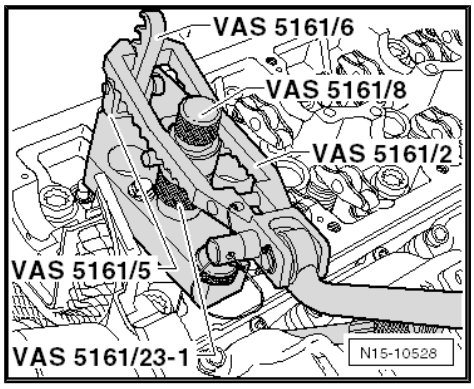


- Larger diameter of valve cotters faces upwards.

– Insert valve spring and valve spring plate.

– Press assembly cartridge onto valve cotter insertion device from above and pick up valve cotters.

– Insert assembly cartridge into guide plate -VAS 5161/23- again.



– Press pressure fork downwards and pull knurled screw upwards, turning it clockwise and anticlockwise. This inserts the valve cotters.

– Reduce pressure on pressure fork whilst pulling on knurled screw.

– Repeat procedure on each valve.

Installing

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

– Ensure that all roller rocker fingers contact valve stem ends correctly and are clipped into relevant hydraulic compensation elements.

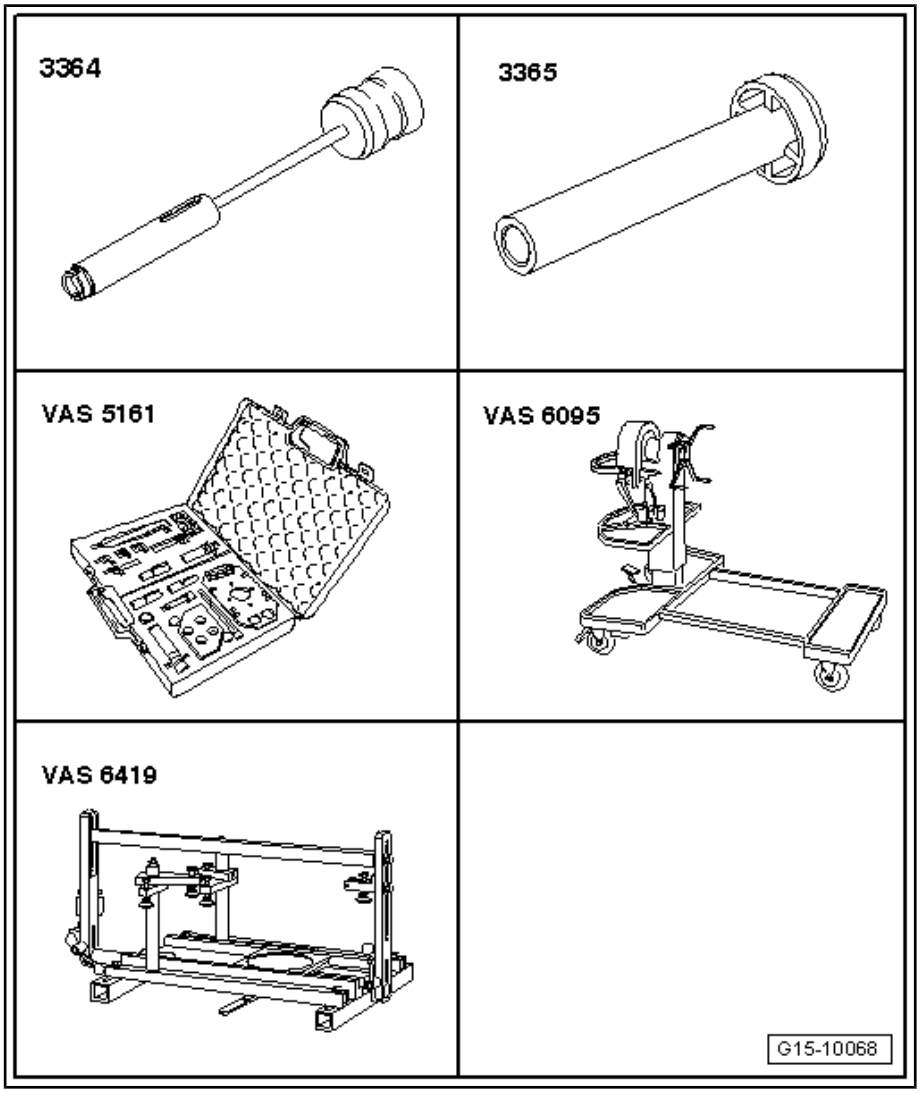
Specified torque

♦ ⇒ “3.1 Assembly overview - valve gear”, page 123

3.3 Renewing valve stem 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 5161/23- and sleeve - VAS 5161/23-1-
- Engine and gearbox support - VAS 6095-
- Cylinder head tensioning device - VAS 6419-
- 2x M6x30 bolts



Procedure

– Remove camshafts ⇒ page 131 .

– Mark allocation of roller rocker fingers and hydraulic compensation elements for reinstallation.

– Remove roller rocker fingers together with hydraulic compensation elements and place down on a clean surface.

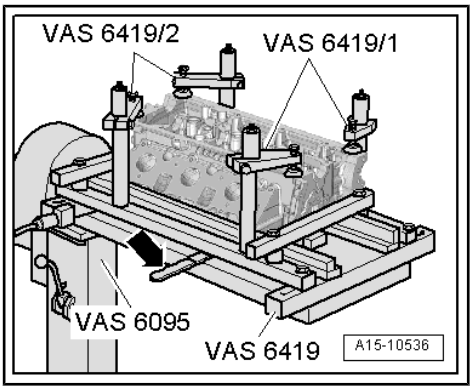
– Insert cylinder head tensioning device - VAS 6419- into engine and gearbox support - VAS 6095- .

– Tension cylinder head on cylinder head tensioning device as shown in illustration.

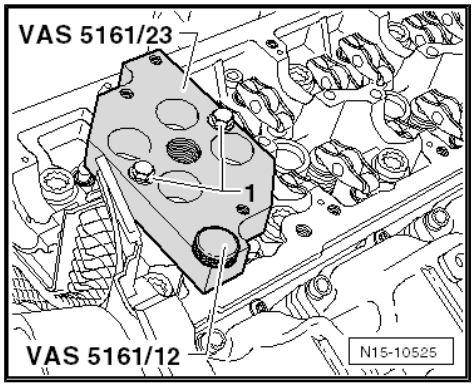
– Connect cylinder head tensioning device to compressed air.

– Use lever -arrow- to slide air cushion under combustion chamber from which valve stem seal is to be removed.

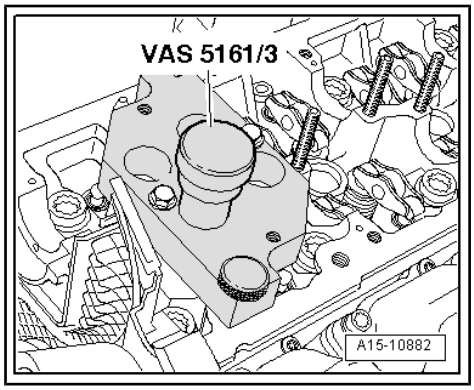
– Allow compressed air to flow into air cushion until it lies against valve disc.



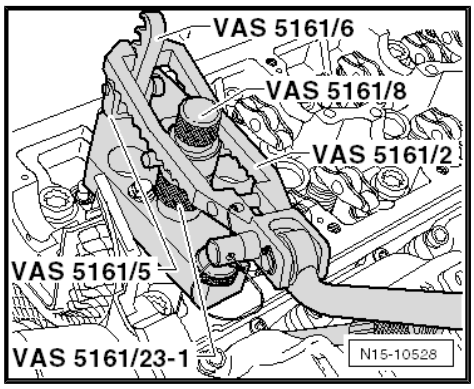
– Place guide plate -VAS 5161/23- onto cylinder head.
– Tighten guide plate on intake manifold side by hand using knurled screw -VAS 5161/12- and 2 M6x30 bolts -item 1- until it makes contact.



– Insert drift -VAS 5161/3- into guide plate and use a plastic hammer to knock loose the firmly seated valve cotters.



– Screw toothed piece -VAS 5161/6- with hooking fork - VAS 5161/5- into guide plate.
– Push sleeve -VAS 5161/23-1- onto assembly cartridge - VAS 5161/8- .
– Attach pressure fork -VAS 5161/2- to toothed piece and press 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 to press apart valve cotters and capture them in assembly cartridge.
– Release pressure fork.
– Remove assembly cartridge together with spacer.
– Remove valve spring and valve spring plate.

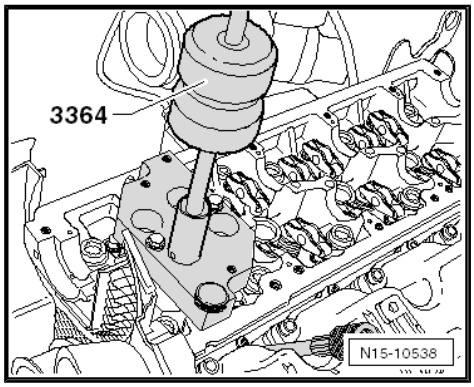


– Pull off valve stem seal using valve stem seal puller - 3364- .

Caution

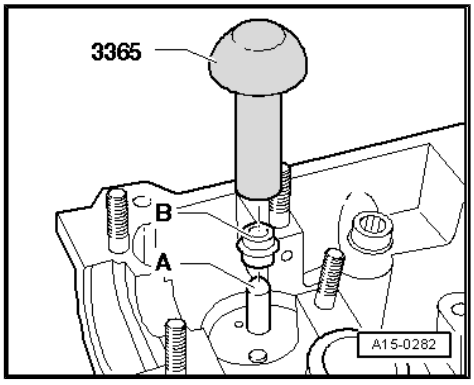
Risk of damage when valve stem seals are being installed!

- *Place plastic sleeve -A-, enclosed with new valve stem seals -B-, onto valve stem.*



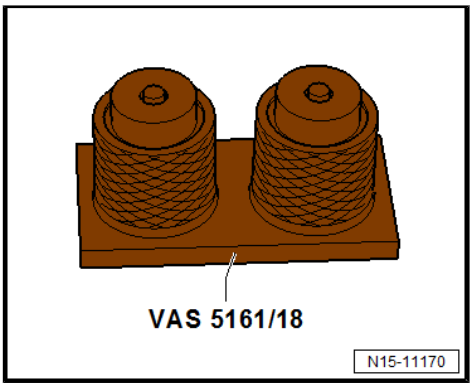
– Lightly oil sealing lip of valve stem seal.
– Push valve stem oil seal onto plastic sleeve.

– Carefully press valve stem oil seal onto valve guide using valve stem seal fitting tool - 3365- .
– Remove plastic sleeve.

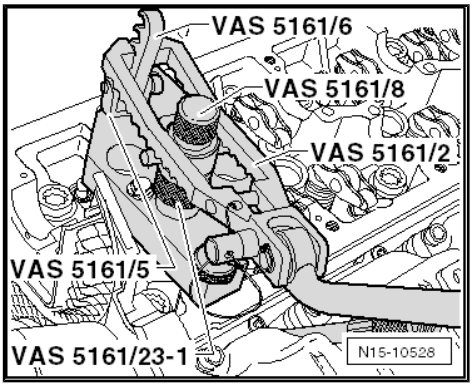


If the valve cotters have been removed from the assembly cartridge, they must first be inserted into the valve insertion device - VAS 5161/18- .

• Larger diameter of valve cotters faces upwards.
– Insert valve spring and valve spring plate.
– Press assembly cartridge onto valve cotter insertion device from above and pick up valve cotters.



– Insert assembly cartridge into guide plate -VAS 5161/23- again.
– Press pressure fork downwards and pull knurled screw upwards, turning it clockwise and anticlockwise. This inserts the valve cotters.
– Reduce pressure on pressure fork whilst pulling on knurled screw.
– Repeat procedure on each valve.



Installing

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

– Ensure that all roller rocker fingers contact valve stem ends correctly and are clipped into relevant hydraulic compensation elements.

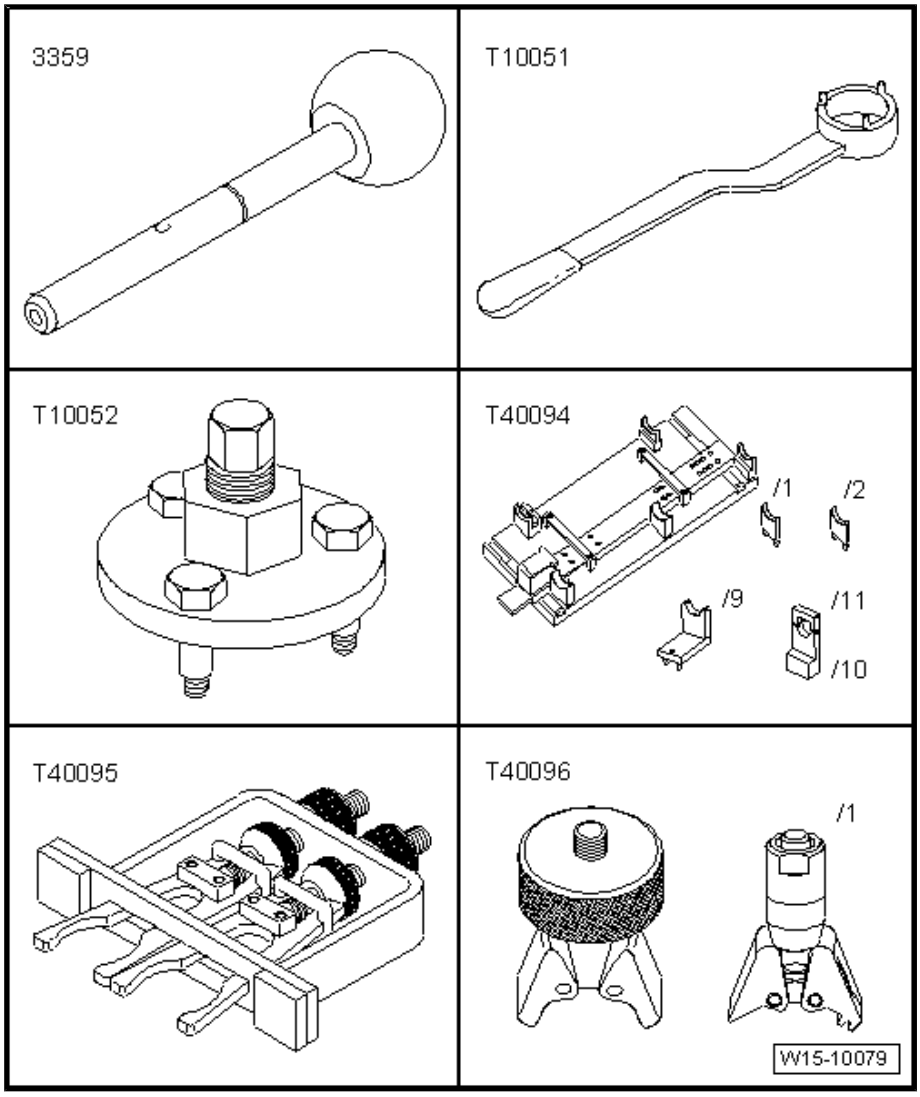
Specified torque

♦ ⇒ “3.1 Assembly overview - valve gear”, page 123

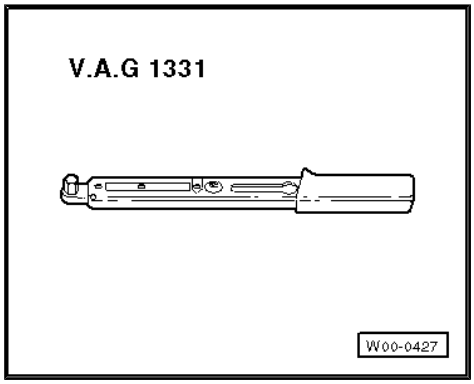
3.4 Removing and installing camshaft

Special tools and workshop equipment required

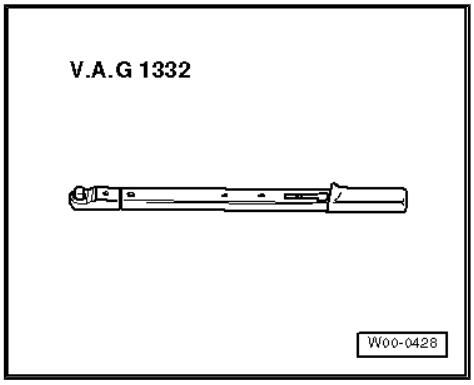
- Diesel injection pump locking pin - 3359-
- Counterhold tool - T10051-
- Puller - T10052-
- Camshaft fitting tool - T40094-
- Camshaft clamping tool - T40095-
- Camshaft fitting tool - T40096-



- Torque wrench - V.A.G 1331/-



♦ Torque wrench - V.A.G 1332/-



♦ Silicone adhesive sealant ⇒ Electronic Parts Catalogue (ET-KA)

Removing

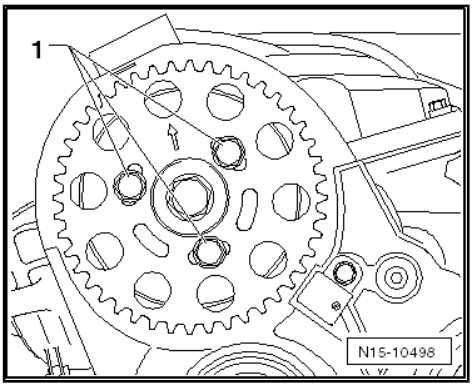
– Remove air filter ⇒ page 277 .

– Removed toothed belt from camshaft and high-pressure pump ⇒ page 112 .

– Remove cylinder head cover ⇒ page 101 .

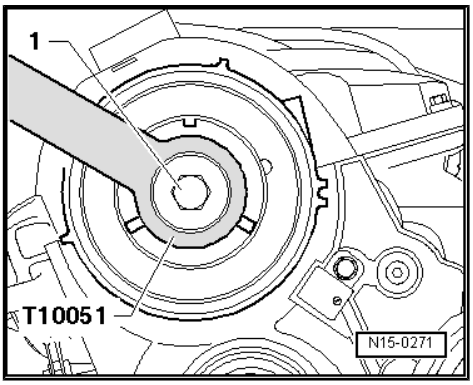
– Unscrew and remove bolts -arrows- for toothed belt and camshaft.

– Remove camshaft sprocket from hub.

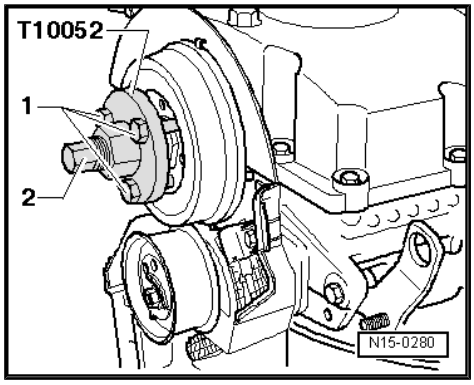


– Counterhold hub with counter-hold tool - T10051- and release hub securing bolt -1-.

– Unscrew hub securing bolt approx. 2 turns.



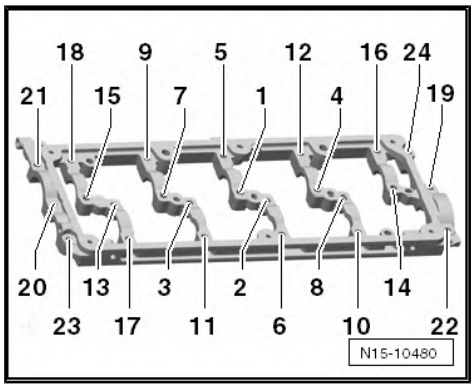
– Position puller - T10052- and align with hub holes.
– Tighten securing bolts -1-.
– Apply tension to hub by evenly tightening puller -2- until hub separates from taper of camshaft.



Note

Hold puller with a spanner 30 mm whilst doing this.

– Remove hub from taper of camshaft.
– Remove vacuum pump ⇒ page 107 .
– Unscrew retaining frame securing bolts in sequence -24…1- .
– Unscrew 2 bolts securing exhaust gas recirculation cooler to retaining frame.
– Remove retaining frame.
– Carefully remove camshafts.



Installing

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

– Ensure that all roller rocker fingers contact valve stem ends correctly and are clipped into relevant hydraulic compensation elements.

Note

Seal parting surface between retaining frame and cylinder head using silicone adhesive sealant ⇒ Electronic Parts Catalogue .

Caution

It is only permissible to install the camshafts with the camshaft fitting tool - T40094- as described below. Otherwise the axial bearings in the retaining frame will be destroyed and the cylinder head must be replaced.

– Remove remaining sealant and from cylinder block and retaining frame using, for example, a rotating plastic brush.

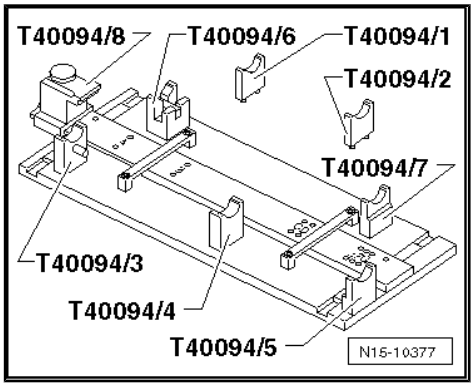
Caution

Make sure that no sealant residue gets into the cylinder head or the bearings.

– Clean sealing surfaces. They must be free of oil and grease.
– Oil running surfaces of both camshafts.

Set up camshaft fitting tool - T40094- for camshafts as follows:

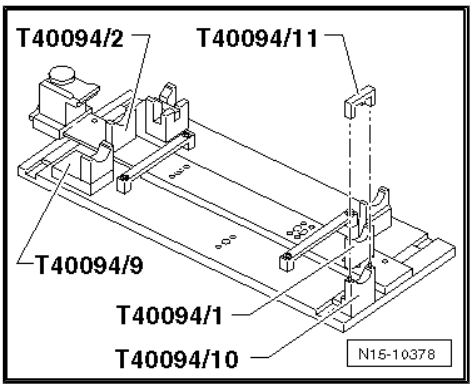
– Remove supports -T40094/3-, -T40094/4- and -T40094/5- from base plate (threaded connection from below).



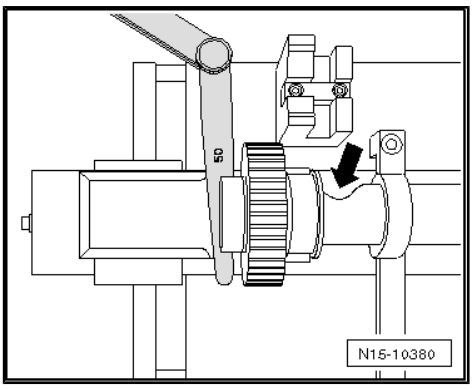
Note

If the supports of the camshaft fitting tool - T40094- are not yet marked, mark the removed supports, e.g. with number stamps, so they can be fitted in the original positions later.

– Install supports -T40094/9- and -T40094/10- instead at vacant outer positions.
– Place support -T40094/2- at position “A” and support -T40094/1- at position “F”.
– First insert inlet camshaft as shown. Ensure that indentation -arrow- for cylinder head bolt faces »outwards«.



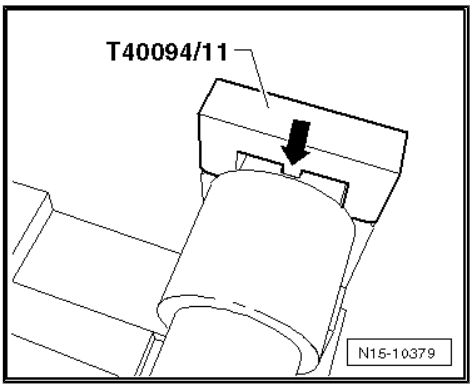
– Position 0.50 mm feeler gauge and push support -T40094/8- into inlet camshaft groove.



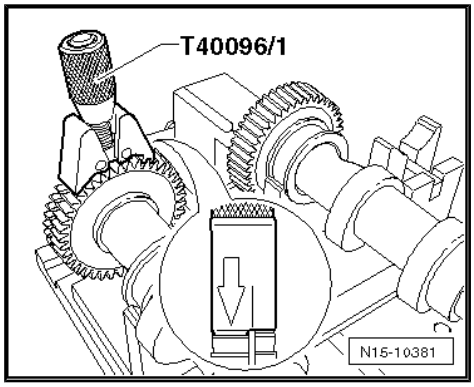
– Insert exhaust camshaft and lock via groove -arrow- with -cover T40094/11-.
– Position clamping tool - T40096/1- on exhaust camshaft sprockets.

Caution

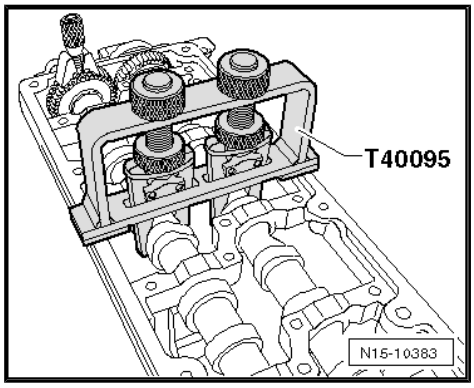
Ensure that the clamping jaw marked with an arrow is seated on the wider gear.



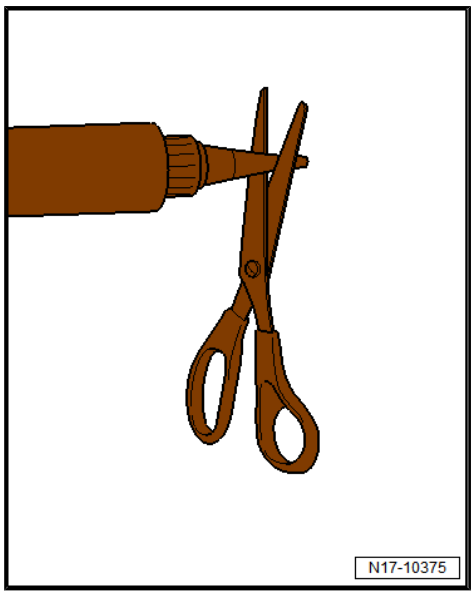
– Tension camshaft fitting tool - T40096/1- with knurled wheel until teeth flanks align. If necessary, use an open-ended spanner AF 13 mm to assist.
– Slide exhaust camshaft towards inlet camshaft until teeth engage.
– Place retaining frame on camshafts.
• All camshaft bearings must be seated on the camshafts.



– Position camshaft fitting tool - T40095- as shown, thereby fixing camshafts in position in retaining frame.
– Remove cover - T40094/11- .
– Pull support - T40094/8- out of inlet camshaft groove.

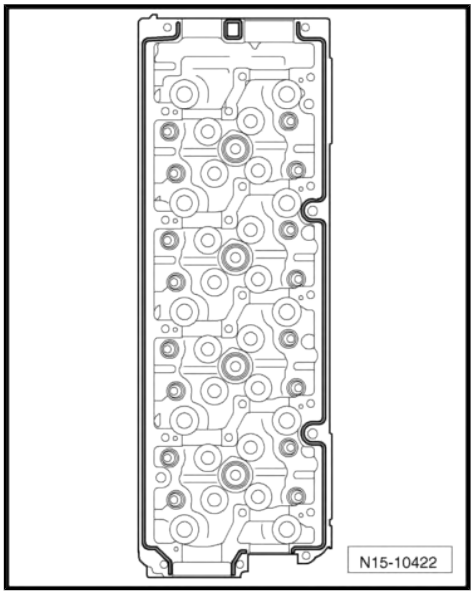


– Cut off nozzle on tube at front marking (diameter of nozzle approx. 2 mm).
– Apply beads of sealant (approx. 2…3 mm wide) -arrows- onto clean sealing surfaces of cylinder head as illustrated.

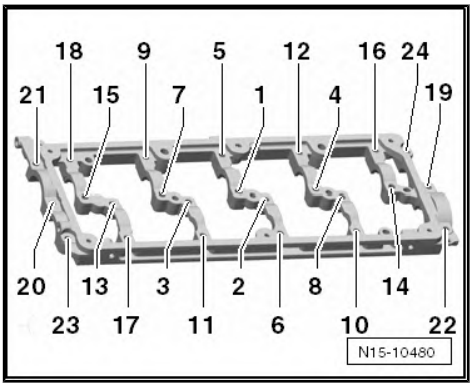


Note

The sealant beads must not be thicker than specified, otherwise excess sealant could enter the camshaft bearings.



– Install new cap flush on cylinder head.
– Remove camshafts from camshaft fitting tool - T40095- together with retaining frame and camshaft fitting tool - T40094- .
– Carefully insert camshafts and retaining frame into cylinder head.



– First tighten securing bolts of retaining frame hand-tight in sequence -1….24-.
• The retaining frame should make contact with the cylinder head over the complete surface.
– Tighten retaining frame bolts in sequence -1…24-.
– Remove camshaft fitting tool - T40095- and clamping tool - T40096/1- .
– Renew camshaft seal ⇒ page 140 .

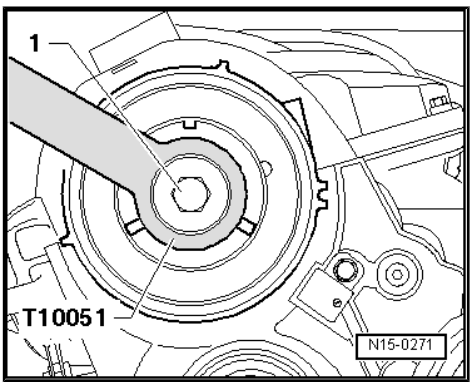
Further installation is carried out in the reverse order. In the process, note the following:

Note

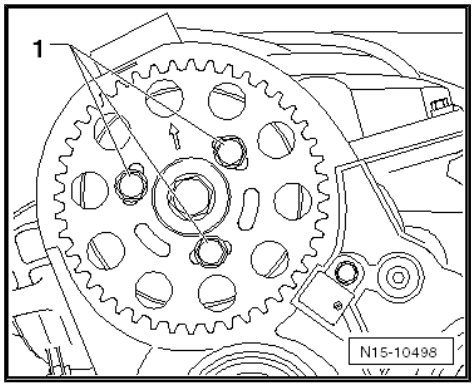
♦ *After installing camshafts wait for approx. 30 minutes before starting engine. The hydraulic compensation elements must settle (otherwise valves will strike pistons).*
♦ *After working on valve gear, carefully crank engine at least 2 revolutions by hand to ensure that no valves make contact on starting.*

– Fit hub on camshaft.

– Tighten securing bolt -1- of hub. Use counter-hold tool - T10051- to do this.



– Push camshaft sprocket onto hub.

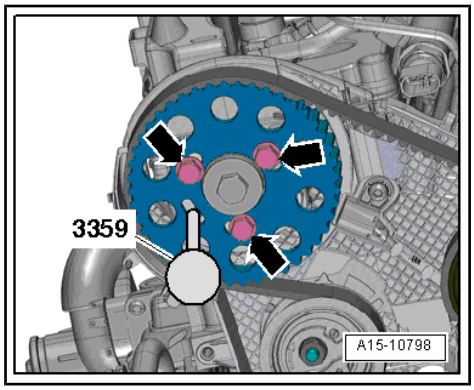


Note

The toothed segment -arrow- of the camshaft belt pulley must be on top.

– Insert securing bolts -1- by hand without play to camshaft sprocket.

– Lock hub with diesel injection pump locking pin - 3359- .



– Install toothed belt and adjust valve timing ⇒ page 112 .
– Install vacuum pump ⇒ page 107 .
– Install cylinder head cover ⇒ page 101 .

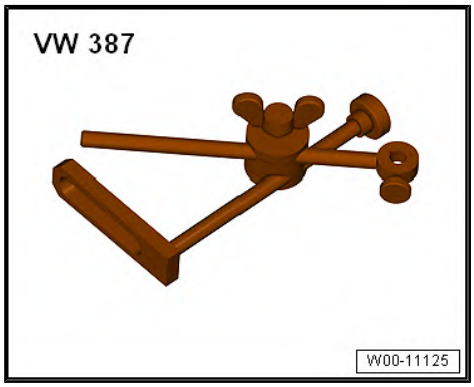
Specified torque

- ⇒ “1.1 Assembly overview - cylinder head”, page 87
- ⇒ “2.1 Assembly overview - toothed belt”, page 110
- ⇒ “3.1 Assembly overview - valve gear”, page 123

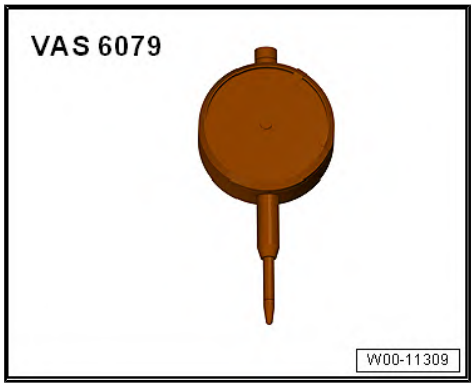
3.5 Measuring axial play of camshaft

Special tools and workshop equipment required

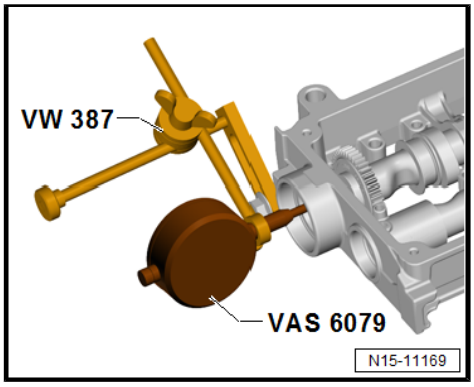
- Universal dial gauge bracket - VW 387-



- Dial gauge - VAS 6079-



Procedure



– Remove retaining frame ⇒ page 131 .
– Fasten dial gauge - VAS 6079- to cylinder head with universal dial gauge bracket - VW 387- as shown in the illustration.
– Press camshaft against dial gauge by hand.
– Set dial gauge to “0”.
– Press camshaft away from dial gauge and read off value:

Axial clearance of inlet and outlet camshafts:

- Specification: 0.048…0.118 mm
- Wear limit: 0.17 mm

3.6 Measuring radial play of camshaft

Special tools and workshop equipment required

◆ Plastigage

Procedure:

– Remove roller rocker finger
⇒ “3.4 Removing and installing camshaft”, page 131 .
– Remove bearing cap and clean crankshaft journal.
– Place a length of Plastigage corresponding to the width of the bearing on the journal to be measured or into the bearings.

- Plastigage must lie in the middle of the bearing.

– Fit retaining frame and tighten to 10 Nm ⇒ page 125 without twisting crankshafts.
– Remove retaining frame.
– Compare width of Plastigage with the measurement scale.

Radial clearance: 0.035 … 0.085 mm.

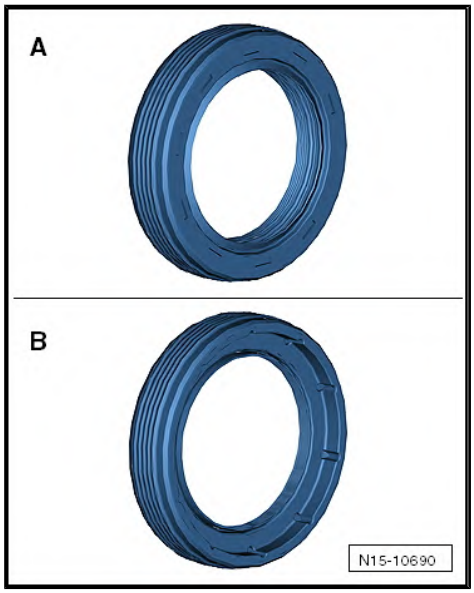
3.7 Removing and installing camshaft oil seal

⇒ “3.7.1 Vehicles to 07.12”, page 140

⇒ “3.7.2 Vehicles from 07.12”, page 142

Note

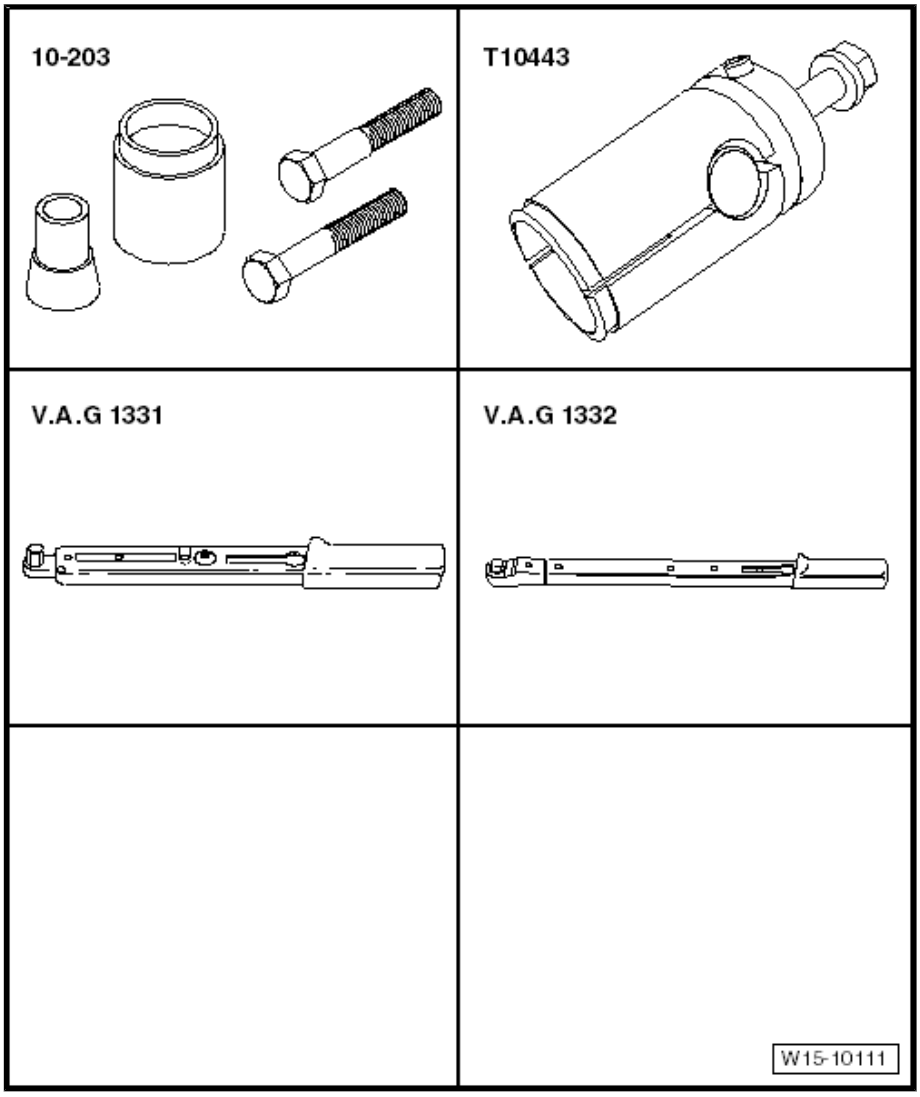
From 07.12, a new seal -B- is used, which does not show continuous surface between the camshaft and cylinder head and can be identified by a fillet.



3.7.1 Vehicles to 07.12

Special tools and workshop equipment required

- Fitting tool - 10-203-
- Oil seal extractor - T10443-
- Torque wrench - V.A.G 1331/-
- Torque wrench - V.A.G 1332/-
- Bolt M12 x 1.5 x 75



Removing

– Removed toothed belt from camshaft and high-pressure pump ⇒ page 112 .

– Remove camshaft sprocket and hub ⇒ page 131 .

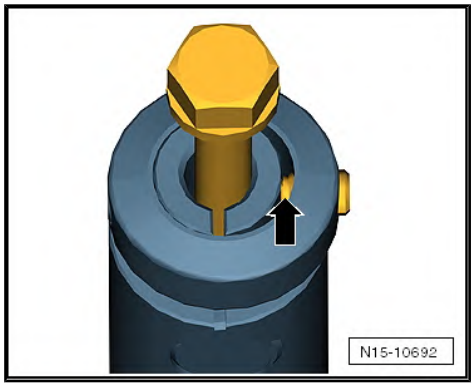
Caution

If turned too far anti-clockwise, the inner thrust plate becomes detached from the pressure screw. In this case, the thrust plate must be pushed back onto the pressure screw.

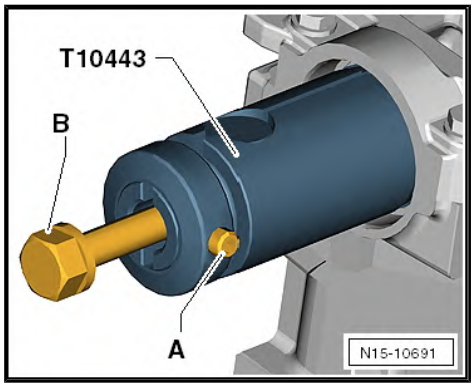
– Turn pressure screw of oil seal extractor anti-clockwise »very carefully« until slight resistance can be felt.

Note

The clamping sleeves of the oil seal extractor are fitted with grub screws. However, only one of these grub screws -arrow- effects clamping, the other is fixed.



– Fit oil seal extractor as shown and screw in grub screw -A- to clamp it in place.
– Screw pressure screw -B- in until oil ring has been pulled out.



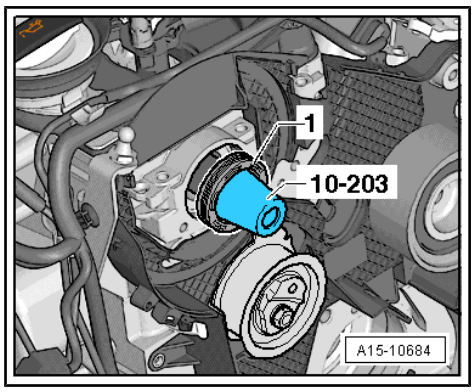
Installing

Note

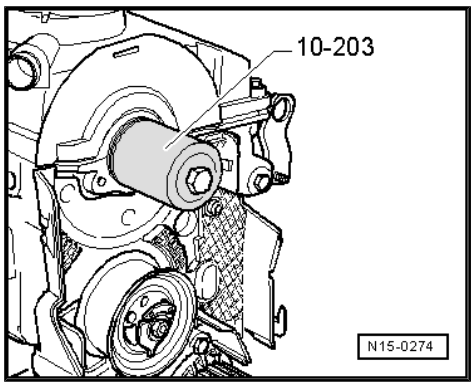
The oil seal sealing lip must not be additionally oiled or greased.

– Remove oil residues from crankshaft journal with a clean cloth.

– Fit guide sleeve of fitting tool - 10 - 203- onto camshaft as shown in illustration. The lettering on the oil seal faces outwards.
– Carefully slide oil seal -1- over guide sleeve onto camshaft.



– Press seal in onto stop using thrust piece - 10-203- and bolt M12 x 1.5 x 75.
– Install camshaft sprocket and hub ⇒ page 131 .
– Install toothed belt and adjust valve timing ⇒ page 112 .
– Ensure that all roller rocker fingers contact valve stem ends correctly and are clipped into relevant hydraulic compensation elements.



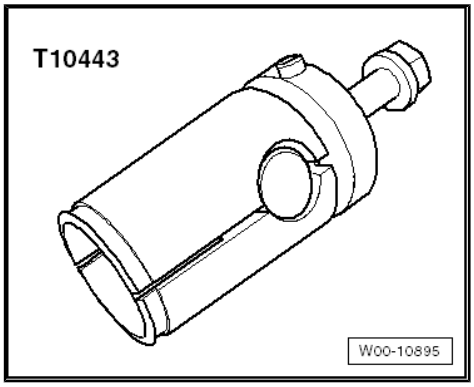
Specified torque

- ⇒ “1.1 Assembly overview - cylinder head”, page 87
- ⇒ “2.1 Assembly overview - toothed belt”, page 110

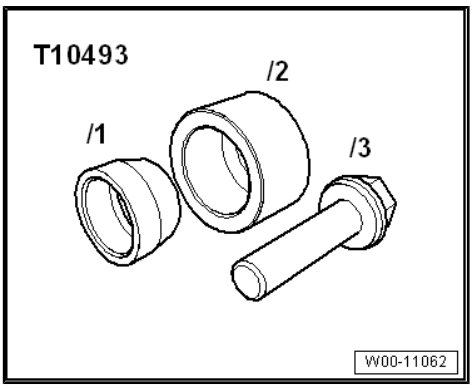
3.7.2 Vehicles from 07.12

Special tools and workshop equipment required

♦ Puller - T10443-



♦ Assembly tool -T10493-

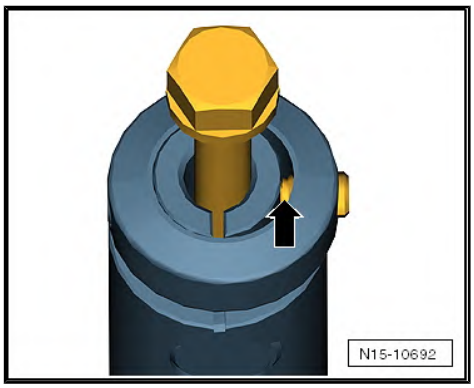


Removing

– Remove toothed belt from camshaft ⇒ page 112 .

Caution

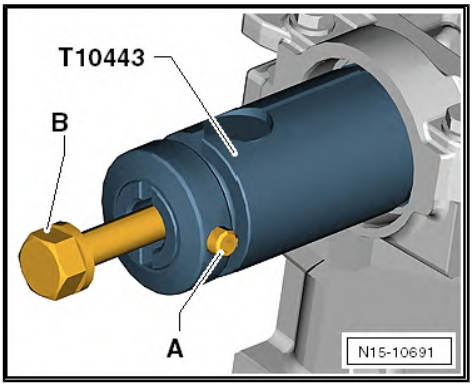
♦ *If unscrewed too far, the internal thrust plate of the puller -T10443- detaches from the thrust screw. In this case, the pressure plate must be pressed back on to the thrust bolt.*



– Carefully turn back grub screw -arrow- of puller -T10443- until a slight resistance is felt.

– Position puller - T10443- straight, as shown in illustration, and lock by screwing grub screw -A- in.

– Screw in thrust bolt -B- until seal is extracted.



Installing

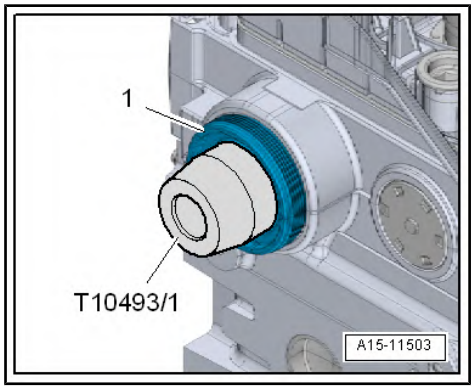
Installation is carried out in the reverse order; note the following:

– Clean contact surface and sealing surface.

Note

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

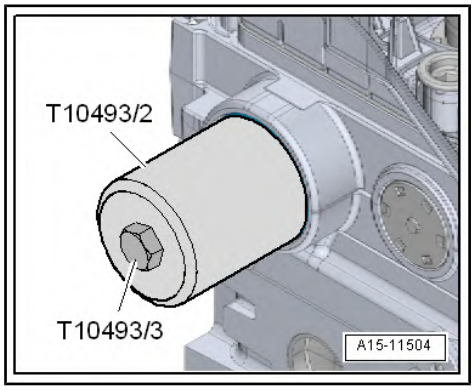
– Fit guide sleeve -T10493/1- onto camshaft as shown in illustration.
– Carefully slide oil seal -1- over guide sleeve onto camshaft.



Note

The guide sleeve remains on the camshaft as a stop while the oil seal is being pressed in.

– Press oil seal in onto stop using thrust piece -T10493/2- and bolt -T10493/3- .
– Install toothed belt (adjust valve timing) ⇒ page 112 .



Specified torques

- ⇒ “1.1 Assembly overview - cylinder head”, page 87
- ⇒ “2.1 Assembly overview - toothed belt”, page 110

3.8 Checking hydraulic compensation elements

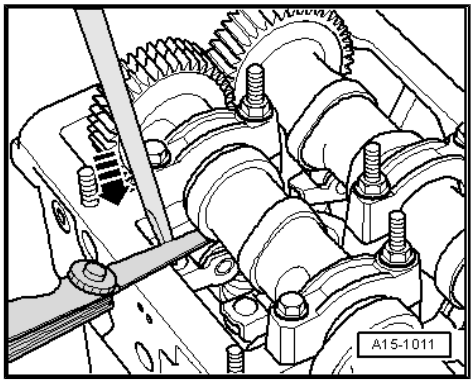
Note

- *The hydraulic compensation elements cannot be repaired.*
- *Irregular valve noise during starting is normal.*

Procedure

– Start engine and run until the radiator fan has switched on once.
– Increase engine speed to about 2500 rpm for 2 minutes; perform road test if necessary.
– If the hydraulic compensation elements are still noisy, find out which is the defective compensation element as follows:
– Remove cylinder head cover ⇒ page 101 .
– Turn crankshaft by the bolt for the toothed belt wheel until cam of supporting element to be tested is facing upwards.

– Press roller rocker finger downwards -arrow- to check clearance between cam and roller rocker finger.
– If a 0.20 mm feeler gauge can be inserted between cam and roller rocker finger, replace hydraulic compensation element ⇒ “3.4 Removing and installing camshaft”, page 131 .
– Install cylinder head cover ⇒ page 101 .



4 Inlet and exhaust valves

4.1 Reworking valve seats

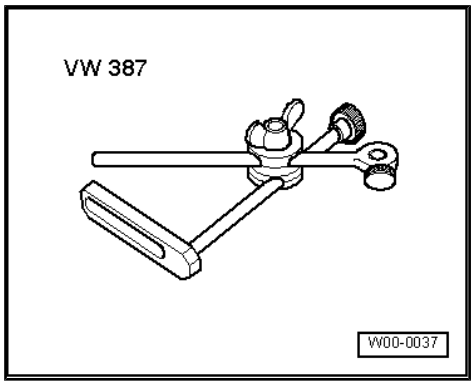
Note

Valve seats must not be reworked due to the very small tolerances.

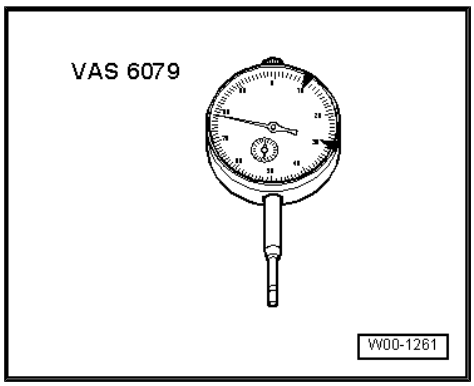
4.2 Checking valve guides

Special tools and workshop equipment required

- Universal dial gauge bracket - VW 387-



- Dial gauge - VAS 6079-

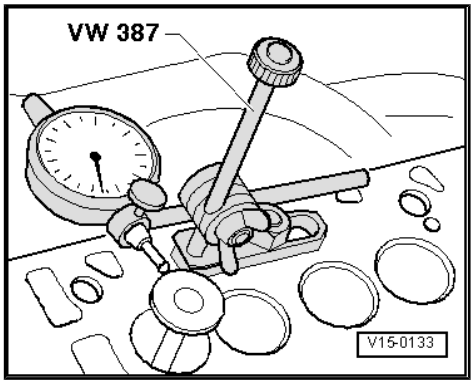


Procedure

Note

- *If the valve is to be renewed as part of a repair, use a new valve for the calculation.*
- *Due to differing stem diameters, only use intake valve in intake guide and exhaust valve in exhaust guide.*

– Attach dial gauge - VAS 6079- with universal dial gauge holder - VW 387- to cylinder head.
– Insert valve into valve guide.
• The end of the valve stem must be flush with the guide.
– Determine rock.
• Wear limit: 1.0 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 exchanged.

4.3 Checking valves

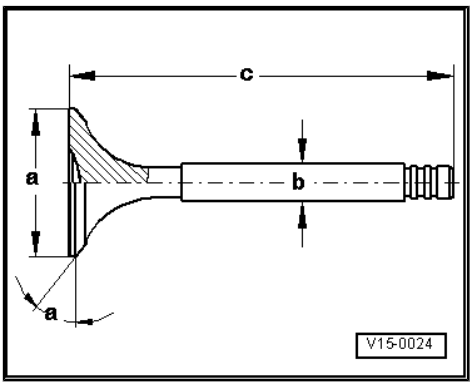
– Check for scoring on valve stems and valve seat surfaces.
– Exchange valve if significant scoring can be seen.

4.4 Valve dimensions

Note

Valves must not be reworked. Only lapping-in is permitted.

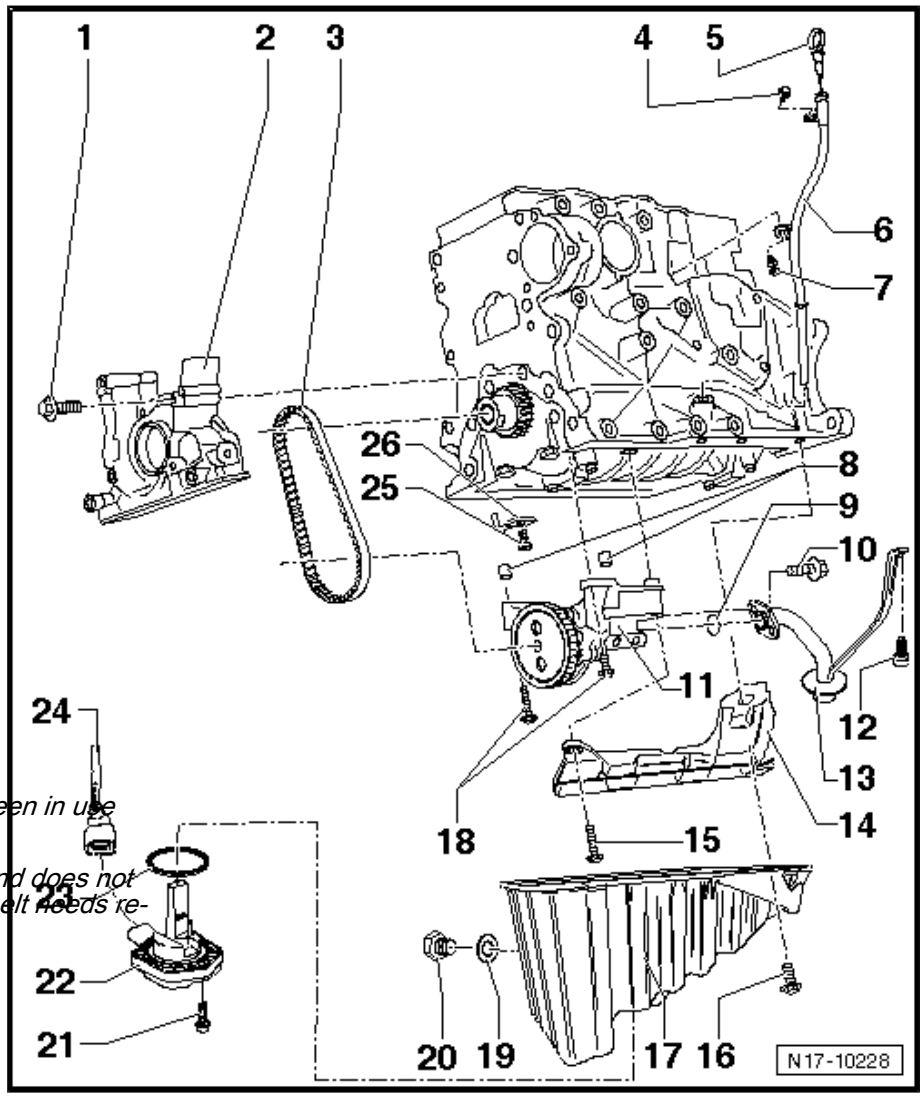
Dimension		Inlet valve	Exhaust valve
Diameter a	mm	28.10	26.00
Diameter b	mm	5.975	5.965
c	mm	99.30	99.10
α	∠°	45	45



17 – Lubrication

1 Sump, oil pump

1.1 Assembly overview - sump, oil pump



1 - Bolt

- ❑ 15 Nm

2 - Sealing flange

- ❑ Removing and installing ⇒ page 54 .
- ❑ With seal.
- ❑ Must sit on dowel sleeves.
- ❑ Do not apply additional oil or grease the sealing lip of the oil seal.
- ❑ Before installing, remove oil residue from crankshaft journal using a clean cloth.
- ❑ Fit with silicone sealant ⇒ Electronic Parts Catalogue (ETKA) .

3 - Toothed belt for oil pump

- ❑ Check for damage.
- ❑ Replace if necessary

Note

- ♦ *Belts which have been in use longer can sag.*
- ♦ *This is not a fault and does not necessarily mean belt needs replacing.*

4 - Bolt

- ❑ 10 Nm

5 - Oil dipstick

- ❑ The oil level must not be above the MAX mark!
- ❑ Markings ⇒ page 155 .

6 - Guide tube

7 - Clip

8 - Dowel sleeves

9 - O-ring

- ❑ Renew after removing.

10 - 15 Nm

11 - Oil pump with pressed-on toothed belt pulley

- ❑ With 12 bar pressure relief valve.
- ❑ Before installing, check that both dowel sleeves for centring oil pump on cylinder block are fitted.

If toothed belt or oil pump have to be removed:

- ♦ Check oil pump for free movement.
- ♦ It must be possible to turn toothed belt sprocket easily.
- ♦ Renew if tight/sticking.

12 - Bolt

- ❑ 15 Nm

13 - Suction line

- ❑ Clean strainer if soiled.

14 - Baffle plate

15 - Bolt

- ❑ 15 Nm

16 - Bolt

- ❑ 15 Nm

17 - Oil sump

- ❑ Removing and installing ⇒ page 151 .
- ❑ Clean sealing surface before fitting.
- ❑ Fit with silicone sealant ⇒ Electronic Parts Catalogue (ETKA) .

18 - Bolt

- ❑ 15 Nm

19 - Seal

- ❑ Renew.

20 - Oil drain plug

- ❑ Renew after removing.
- ❑ 30 Nm

21 - Bolt

- ❑ Renew after removing.
- ❑ 10 Nm
- ❑ For vehicles with EU5 emissions standard only.

22 - Oil level and oil temperature sender - G266-

- ❑ Removing and installing ⇒ page 155 .
- ❑ For vehicles with EU5 emissions standard only.
- ❑ Black 3-pin connector

23 - Seal

- ❑ For vehicles with EU5 emissions standard only.
- ❑ Renew after removing.

24 - Oil level and oil temperature sender - G266- wiring harness

- ❑ For vehicles with EU5 emissions standard only.

25 - Bolt

- ❑ 27 Nm
- ❑ Insert without sealant.

26 - Oil spray jet

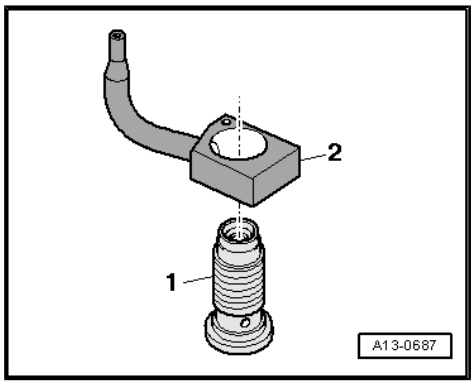
- ❑ For piston cooling.

Oil spray jet and pressure relief valve

1 - Bolt with pressure relief valve

2 - Oil spray jet (for cooling of pistons)

Component	Specified torque
Bolt with pressure relief valve	27 Nm



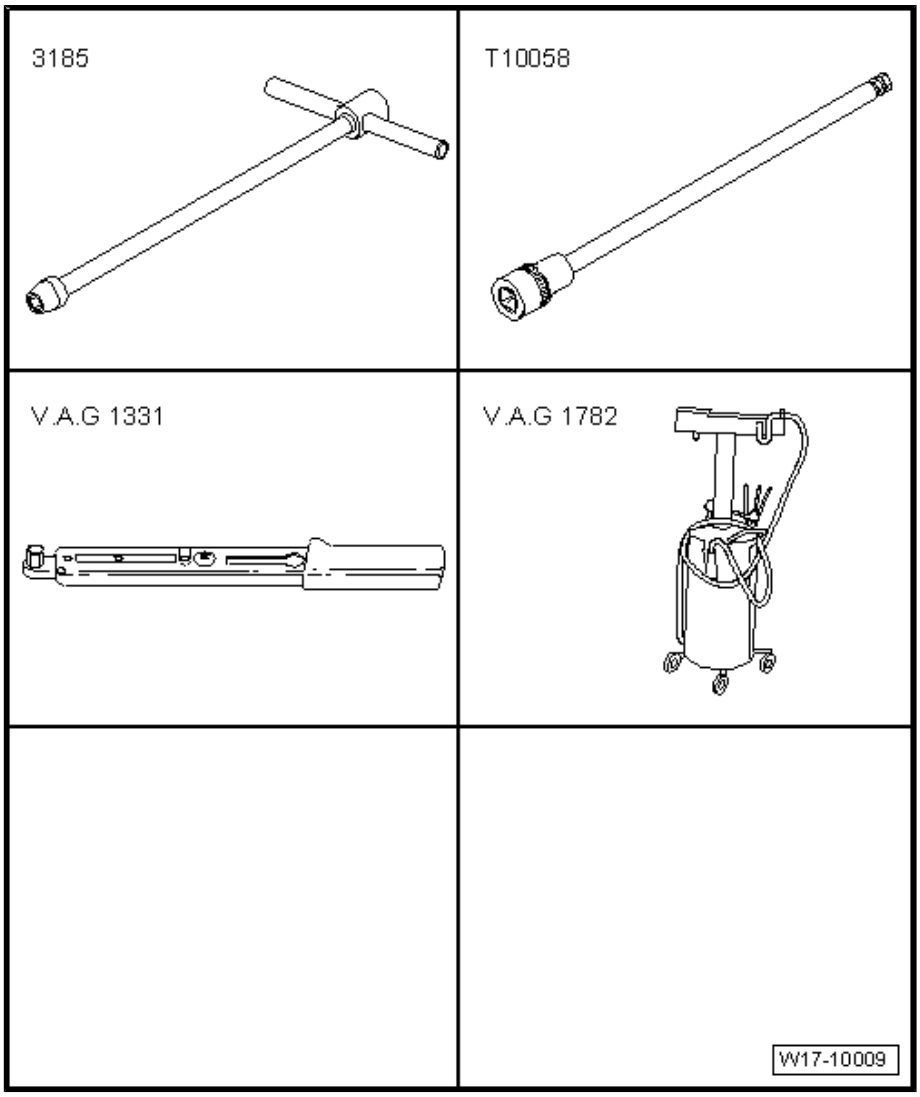
Note

When renewing the oil spray jet, ensure correct allocation to piston ⇒ ETKA (Electronic Parts Catalogue) .

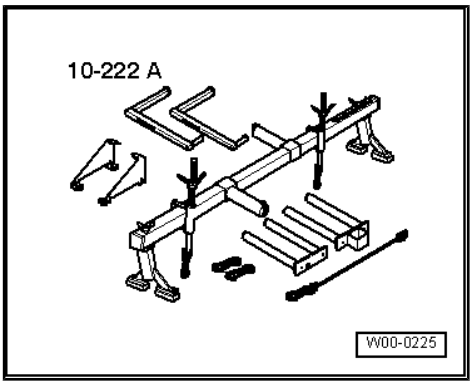
1.2 Removing and installing oil sump

Special tools and workshop equipment required

- Jointed wrench 10 mm - 3185-
- Allen key, long reach - T10058-
- Torque wrench (5…50 Nm) - V.A.G 1331-
- Used oil collection and extraction unit - V.A.G 1782-



- Support bracket - 10 - 222 A-



Removing

– Remove air filter ⇒ page 277 .

– Remove washer fluid reservoir ⇒ Rep. gr. 92

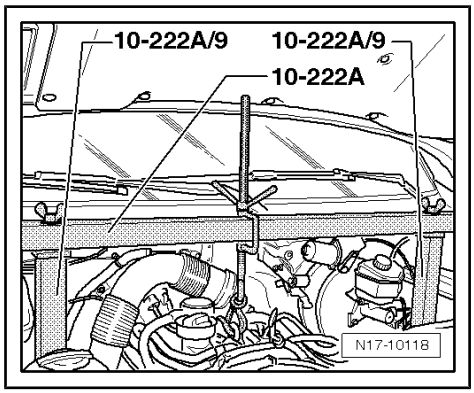
– Remove any noise insulation ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation .

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

Note

Observe environmental regulations for disposal.

– Position engine with support bracket - 10 - 222 A- as shown and take up weight of engine in installation position.

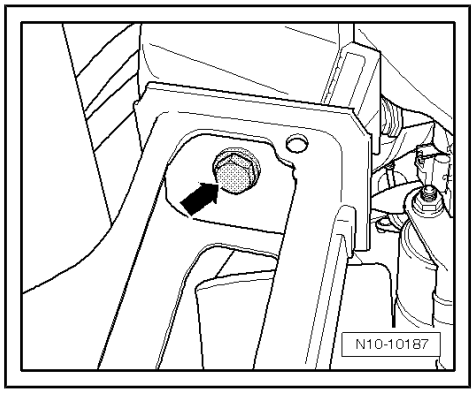


Note

The long adapters from each of 2 adapter sets are needed as adapters - 10 - 222 A /9- .

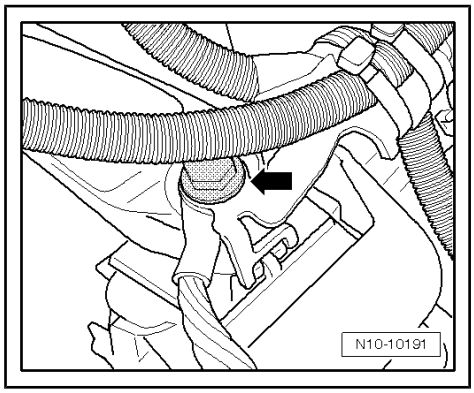
– Remove flywheel ⇒ page 59 .

– Remove bolt -arrow-.

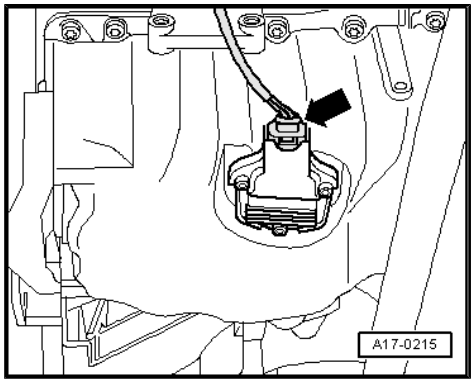


– Remove bolt -arrow-.

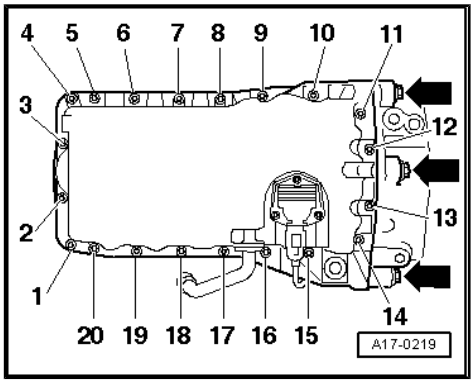
– Lift engine together with support bracket - 10 - 222 A- .



– Pull connector -arrow- off oil level and oil temperature sender - G266- .



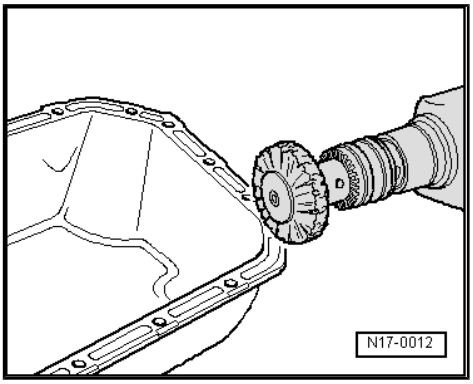
– Remove connecting bolts for sump and gearbox.
– Diagonally unscrew bolts of oil sump.
– Loosen sump with light blows of a rubber headed hammer if necessary.
– Remove sump.
– Remove sealant remaining on crankcase with flat scraper.



WARNING

Wear eye protection.

– Remove sealant residues on oil sump using a rotating brush, e.g. with a hand drill with a plastic brush attachment.
– Clean sealing surfaces. They must be free of oil and grease.



Installing

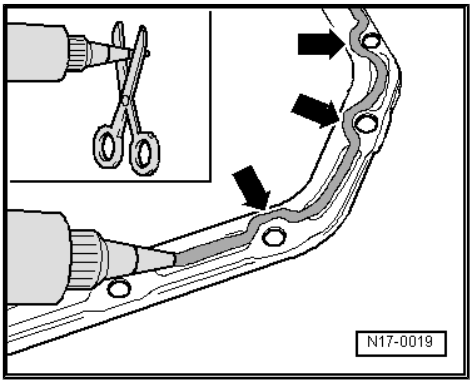
Installation is carried out in the reverse order; note the following:

Note

- *Observe use-by-date of sealant.*
- *The sump must be installed within 5 minutes of applying silicone sealing compound.*

– Cut off nozzle on tube at front marking (diameter of nozzle: approx. 3 mm).
– Apply silicone sealant to clean sealing surface of sump as shown. Sealant bead must be:

- 2…3 mm thick.
- run along inner side of bolt holes -arrows-.



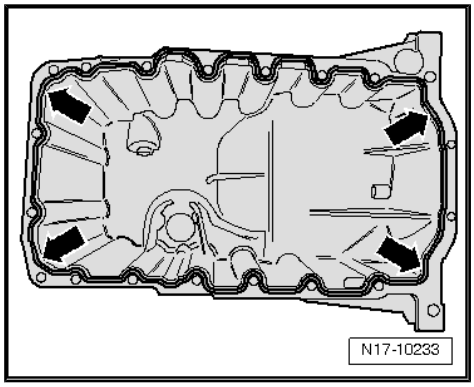
Caution

Danger of lubrication system becoming clogged due to excess sealant.

- *Do not apply sealant bead thicker than specified.*

– Apply bead of sealant onto clean sealing surface of sump as illustrated.

• Thickness of sealant bead: 2…3 mm



Note

- *Take particular care when applying sealant bead at front and rear of sealing flange -arrows-.*
- *Oil sump must be installed within 5 minutes after applying sealant.*
- *When installing sump with engine removed, ensure that sump is flush with crankcase at flywheel end.*

– Place oil sump in position and slightly tighten the sump--to-gearbox connecting bolts and all the oil sump bolts. Ensure that sump is flush against intermediate plate and gearbox flange.

Note

Let sealing compound dry for approx. 30 minutes after installing oil sump. Only then fill with engine oil.

Specified torque

- ⇒ “1.1 Assembly overview - sump, oil pump”, page 148
- ⇒ “2.1 Assembly overview - cylinder block, gearbox end”, page 58
- ⇒ “2.1 Assembly overview - assembly mountings”, page 34
- Windscreen wash system; Assembly overview - windscreen wash system ⇒ Rep. gr. 92 ; Assembly overview - windscreen wash system
- Noise insulation; Assembly overview - noise insulation ⇒ Rep. gr. 66 ; Assembly overview - noise insulation

1.3 Removing and installing oil pump

Removing

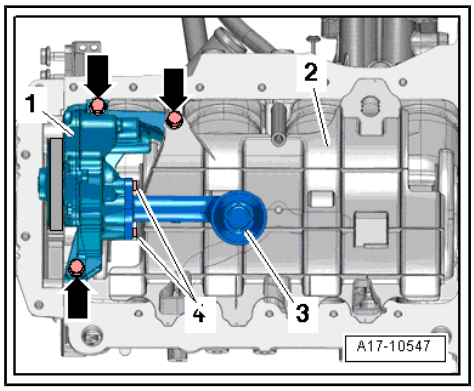
– Remove sump ⇒ page 151 .

– When oil pump is to be renewed, unscrew bolts -4- and remove oil intake pipe -3-.

– Unscrew bolts -arrows- for oil pump -1- and baffle plate -2-.

– Remove baffle plate.

– Detach oil pump -1- from toothed belt and remove pump.



Installing

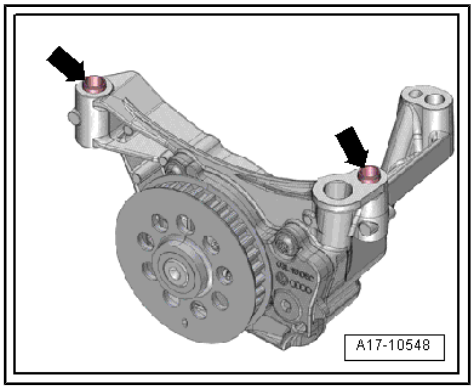
Installation is carried out in the reverse order; note the following:

Note

Renew O-ring.

– Insert new dowel sleeves when oil pump has no dowel sleeves -arrows- for centring oil pump.

– Check oil pump for ease of movement, turn toothed belt pulley with one finger for this.



Note

- *Renew oil pump if sluggish.*
- *Renew toothed belt if damaged.*
- *The toothed belt can sag after long use, this is not a fault.*

– Check toothed belt for oil pump.

Specified torque

- ⇒ “1.1 Assembly overview - sump, oil pump”, page 148

– Replenish engine oil and check oil level ⇒ page 155 .

1.4 Engine oil

Oil capacities:

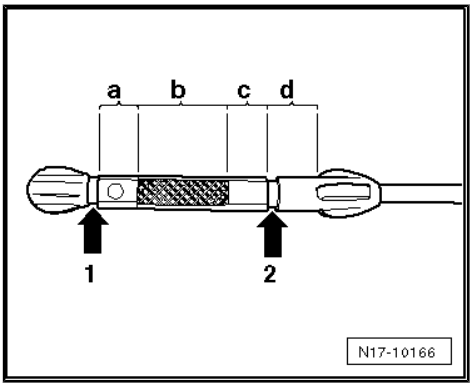
With oil filter change: 7.0 l

Without oil filter change: 6.7 l

Engine oil specifications:

⇒ Maintenance ; Booklet 10.2

Markings on oil dipstick



Note

The oil level may be in area -d- due to the infiltration of fuel in the engine oil as a result of unfavourable driving conditions after filling. This is a perfectly normal and self-regulating characteristic. It is not necessary to adjust the engine oil level.

1 - Min. mark

2 - Max. mark

a - Oil level in min. mark area: replenish engine oil!

b - Oil level in middle range: can be topped-up with engine oil.

c - Oil level in max. mark area: Do not replenish engine oil!

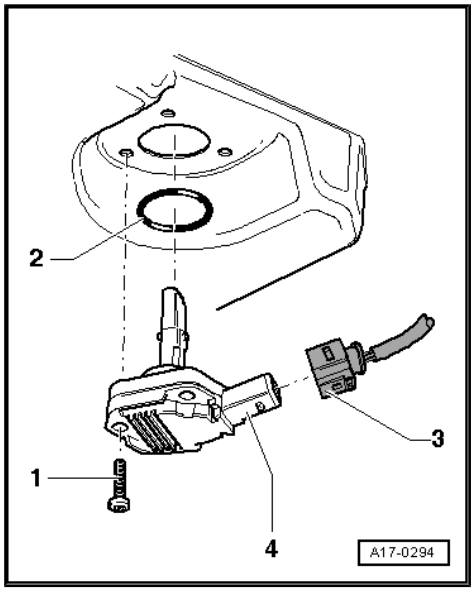
d - The oil level may be in this area as a result of particular driving conditions.

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

Removing

– Drain off engine oil.

– Disconnect connector -3-.
– Unscrew bolts -1- and remove oil level and oil temperature sender - G266- -item 4-.



Installing

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

Specified torque

◆ ⇒ “1.1 Assembly overview - sump, oil pump”, page 148

– Replenish engine oil and check oil level ⇒ page 155 .

1.6 Measure oil consumption

Procedure

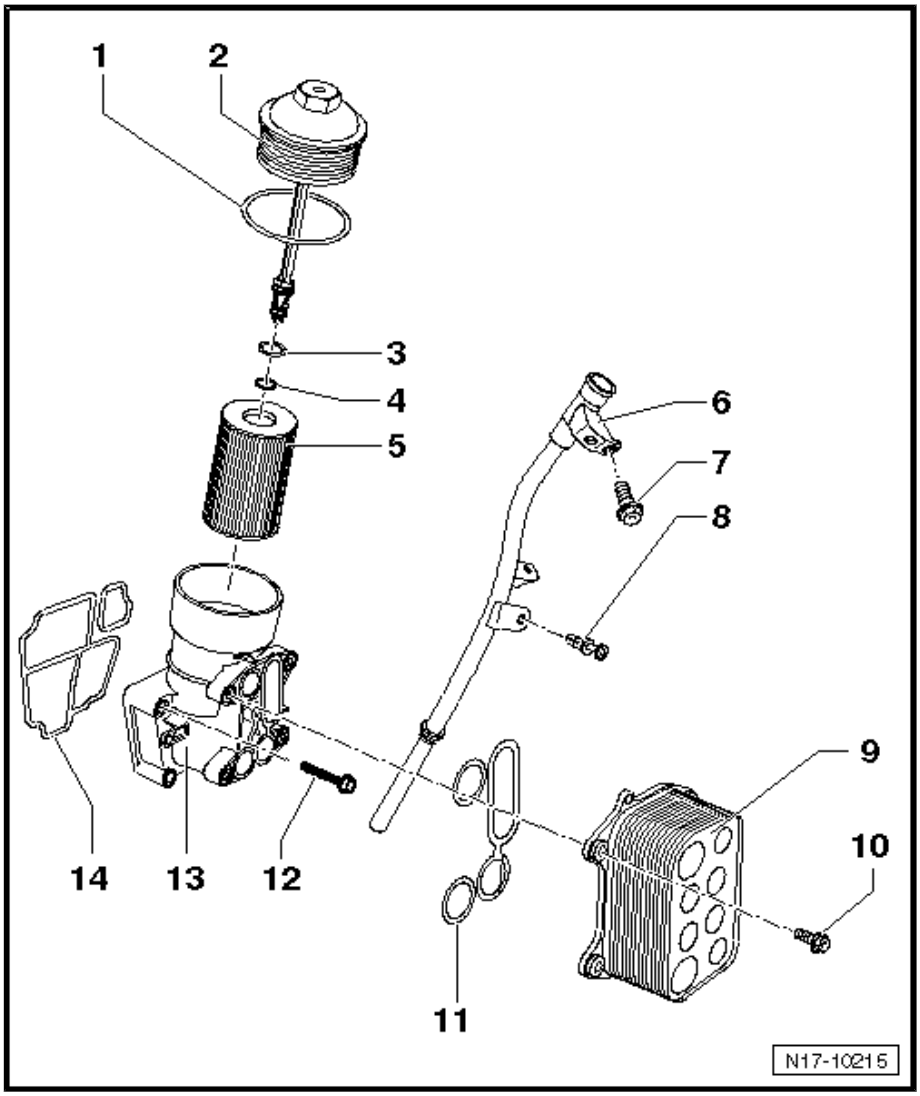
– Pull handbrake on.
– Manual gearbox: gear stick in neutral.
– Shiftmatic gearbox: move selector lever to position “N”.
– Connect ⇒ Vehicle diagnostic tester.
– Switch ignition on.
– Carry out program “oil consumption measurement” using ⇒ Vehicle diagnostic tester.

2 Oil filter, oil pressure switch

2.1 Assembly overview - oil filter housing with engine oil cooler

WARNING

Do not lubricate rubber seals (11 and 14) with oil. The coolant seals would otherwise swell up.



1 - O-ring
- ❑ Renew after removing.

2 - Cap
- ❑ 25 Nm

3 - O-ring
- ❑ Renew after removing.

4 - O-ring
- ❑ Renew after removing.

5 - Oil filter element
- ❑ Observe general notes on the lubrication system ⇒ page 10 .
- ❑ Observe change intervals ⇒ Maintenance ; Booklet 10.2 ; Procedures .

6 - Guide tube
- ❑ Renew O-ring after removal.

7 - Bolt
- ❑ 10 Nm

8 - Spreader clip

9 - Engine oil cooler
- ❑ Observe general notes on the lubrication system ⇒ page 10 .
- ❑ Ensure clearance to adjacent components.
- ❑ Coolant hose schematic diagram ⇒ page 170 .
- ❑ Removing and installing engine oil cooler ⇒ page 158 .

10 - Bolt

- ❑ 11 Nm

11 - Rubber seals

- ❑ Renew after removing.
- ❑ May not be lubricated with oil
- ❑ Fit into lugs on engine oil cooler.

12 - Bolt

- ❑ Renew after removing.
- ❑ Specified torque and tightening sequence ⇒ page 158 .

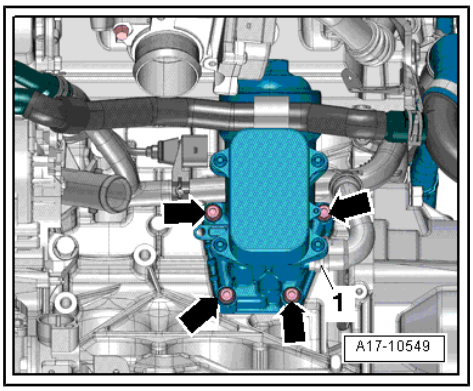
13 - Oil filter bracket

- ❑ Ensure clearance to adjacent components.
- ❑ Removing and installing oil filter bracket ⇒ page 158 .

14 - Rubber seals

- ❑ Renew after removing.
- ❑ May not be lubricated with oil
- ❑ Fit into lugs on oil filter bracket.

Oil filter bracket - specified torques and installation sequence



Note

Renew bolts for oil filter bracket.

– First tighten upper left and lower right bolts.
– Screw in bolts hand-tight.
– Tighten bolts in 2 stages:

Stage	Bolts	Specified torque/turning further angle
1.	-arrows-	in diagonal sequence, 14 Nm
2.	-arrows-	turn 180° further using diagonal sequence

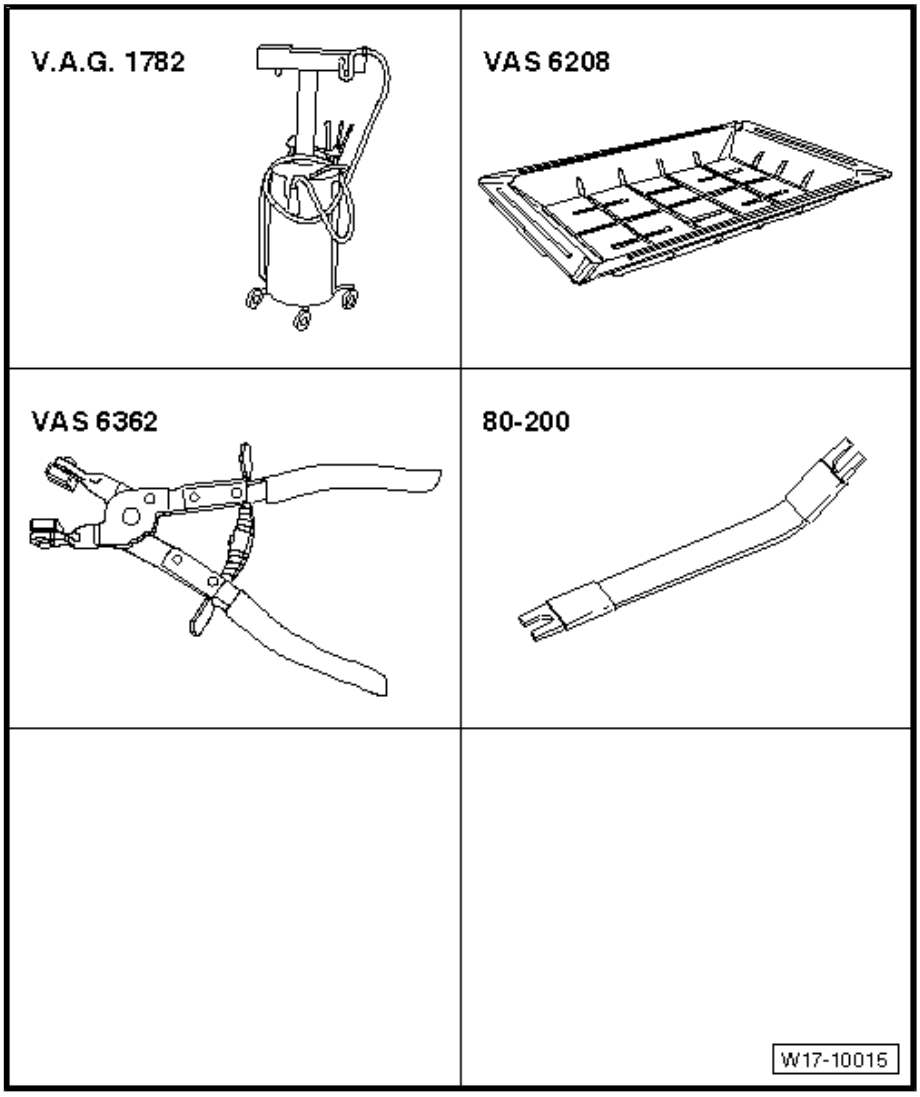
2.2 Removing and installing oil filter housing

WARNING

Do not lubricate rubber seals (8 and 11) with oil. The coolant seals would otherwise swell up.

Special tools and workshop equipment required

- Used oil collection and extraction unit - V.A.G 1782-
- Drip tray for workshop hoist - VAS 6208-
- Hose clip pliers - VAS 6362-
- Removal lever - 80 - 200-

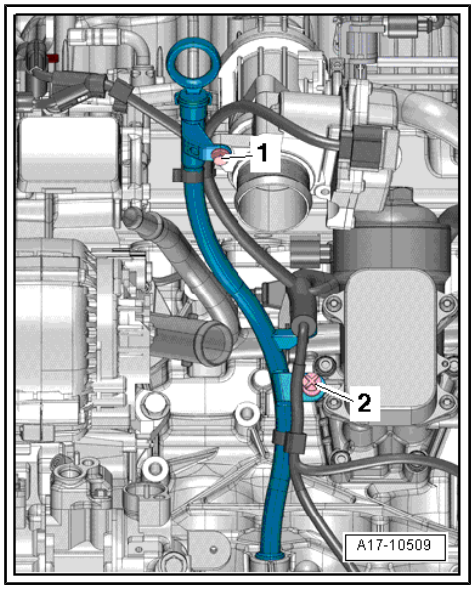


– Remove any noise insulation ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation .

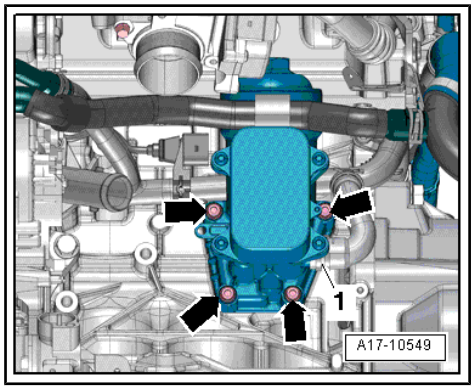
– Drain coolant ⇒ page 179 .

– Remove exhaust gas recirculation valve - N18- ⇒ page 361 .

– Pull oil dipstick guide tube off cylinder block upwards and push to side.
– Place used oil collection and extraction unit - V.A.G 1782- under engine.



– Remove bolts -arrows-. Guide oil filter bracket with engine oil cooler under water pipe, and remove it.



Installing

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

Note

All cable ties which are opened or cut open when engine is removed must be replaced in the same position when engine is installed.

Specified torques

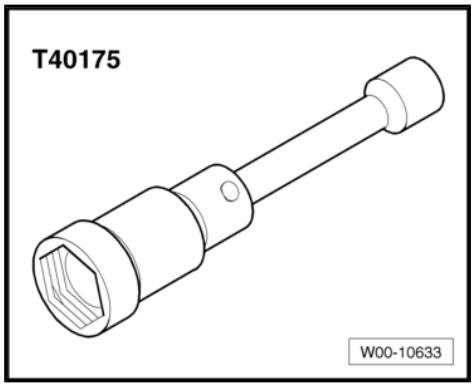
- ⇒ “2.1 Assembly overview - oil filter housing with engine oil cooler”, page 157
- ⇒ “4.1 Assembly overview - exhaust gas recirculation”, page 360
- ⇒ “3.1 Assembly overview - intake manifold”, page 271
- ⇒ “2.1 Assembly overview - charge air system”, page 252

– Fill engine oil ⇒ page 155 .

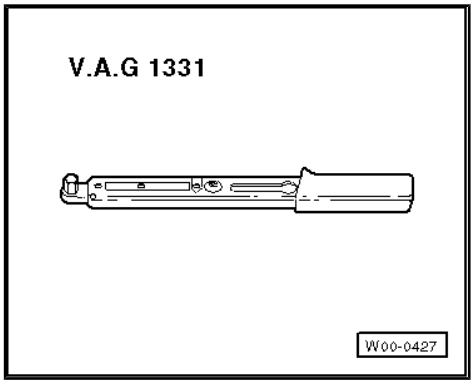
2.3 Removing and installing oil pressure switch - F1-

Special tools and workshop equipment required

♦ Jointed wrench 24 mm - T40175-



♦ Torque wrench (5…50 Nm) - V.A.G 1331-



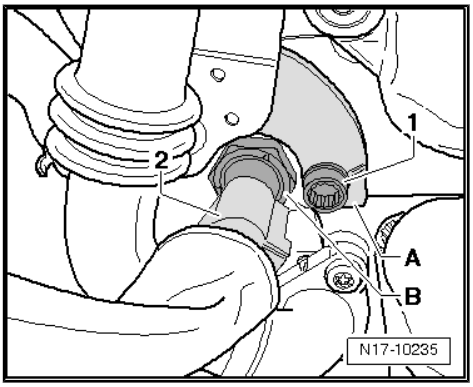
Removing

– Remove air filter ⇒ page 277 .

– Undo and remove bolt -1- and remove engine lifting eye -A-.

– Detach connector -2-.

– Unscrew oil pressure switch - F1- -B- using articulated wrench, 24 mm - T40175- .



Note

Collect escaping engine oil with cloths.

Installing

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

– Install air filter ⇒ page 277 .

Specified torques

- ⇒ “2.1 Assembly overview - oil filter housing with engine oil cooler”, page 157
- ⇒ “4.1 Assembly overview - air filter housing”, page 276

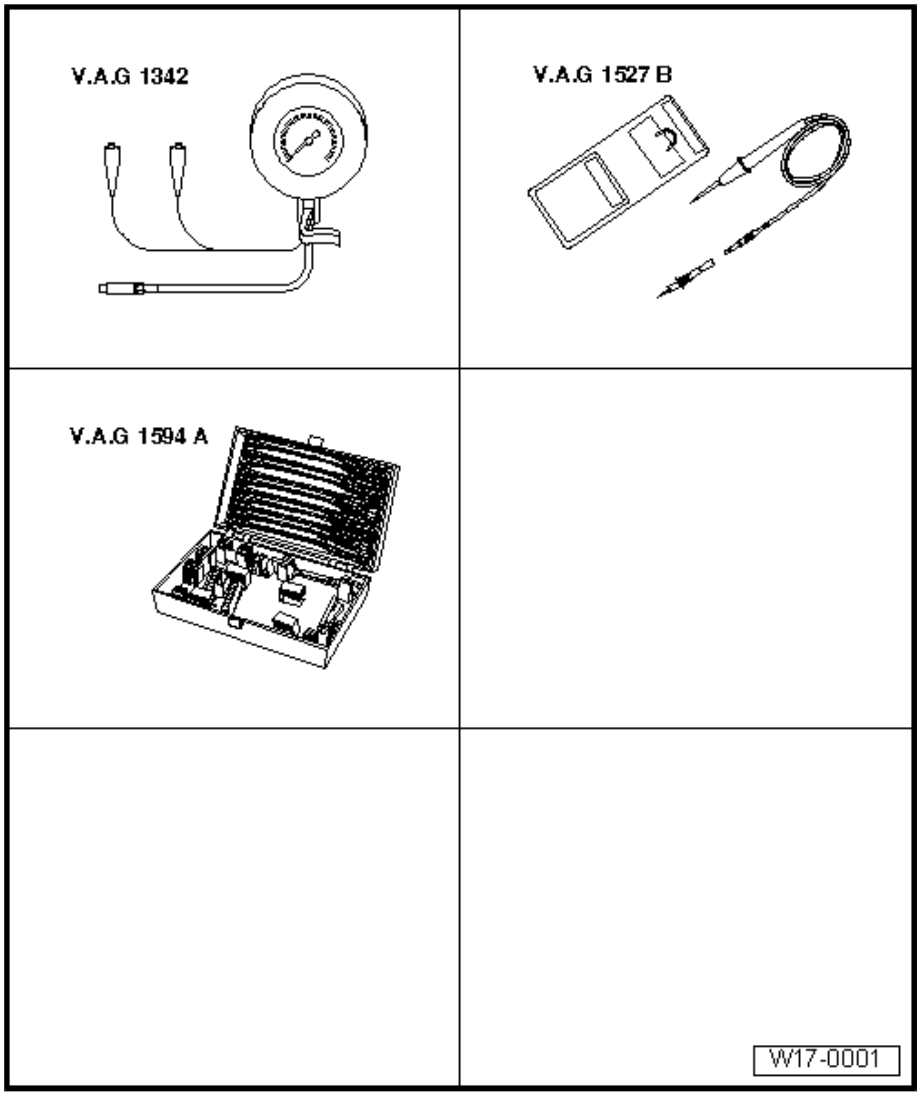
Component	Specified torque
Oil pressure switch	22 Nm

– Check oil level ⇒ page 155 .

2.4 Checking oil pressure switch - F1-

Special tools and workshop equipment required

- Oil pressure tester - V.A.G 1342-
- Voltage tester - V.A.G 1527/B-
- Auxiliary measuring set - V.A.G 1594/C-
- Current flow diagram ⇒ Current flow diagrams, Electrical fault finding and Fitting locations

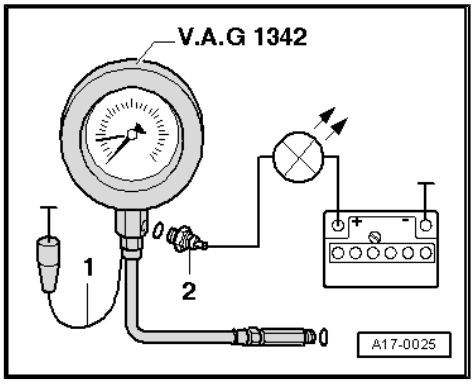


Procedure

- Oil level OK.
- Engine oil temperature approx. 80°C

– Remove oil pressure switch - F1- ⇒ page 160 .

– Connect oil pressure tester - V.A.G 1342- to hole for oil pressure switch.
– Screw oil pressure switch - F1- -item 2- into hole in oil pressure tester.
– Connect brown line -1- of oil pressure tester to earth (–).
– Connect voltage tester - V.A.G 1527B- to battery positive (+) and oil pressure switch - F1- using cables from auxiliary test set - V.A.G 1594C- .
• LED should not light up.



Note

If LED lights up now, replace oil pressure switch - F1- .

Note

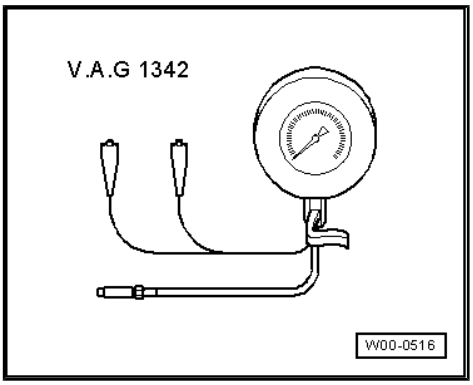
Observe oil pressure tester and LED while starting, as switching point of oil pressure switch may already be exceeded when starting.

• LED should light up at 0.3…0.6 bar.
– If LED does not light up, replace oil pressure switch - F1- ⇒ page 160 .

2.5 Checking oil pressure

Special tools and workshop equipment required

♦ Oil pressure tester - V.A.G 1342-



Procedure

• Oil level OK.
• Engine oil temperature approx. 80°C

Note

The specified test values refer to an oil temperature of approx. 80°C. The oil pressure falls at higher oil temperatures. If the specified values are not reached, check whether the oil temperature is too high for this test (>120°C).

– Remove oil pressure switch - F1- ⇒ page 160 .
– Connect oil pressure tester - V.A.G 1342- to hole for oil pressure switch.

– Screw an old oil pressure switch into hole on oil pressure tester - V.A.G 1342- to seal hole.

- Oil pressure at idling speed: at least 0.6 bar
- Minimum oil pressure at 2,000 rpm: 1.0 bar

3 Oil circuit

⇒ “3.1 Removing and installing oil supply line, single turbo”, page 165

⇒ “3.2 Removing and installing oil supply line, bi-turbo”, page 165

3.1 Removing and installing oil supply line, single turbo

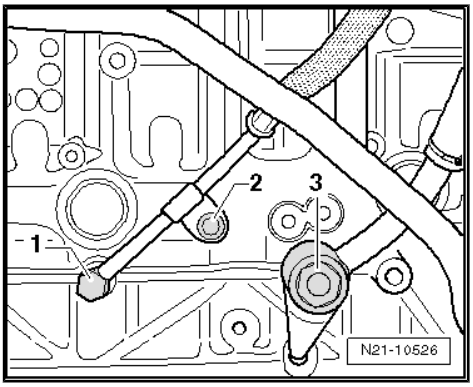
– Remove air filter ⇒ page 277 .

– Remove starter ⇒ Electrical system; Rep. gr. 27 ; Removing and installing starter .

– Remove bolt -2-.

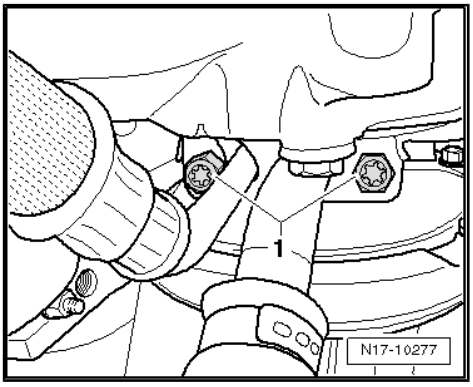
– Undo and remove banjo bolts -1 and 3-.

– Collect escaping oil with a cloth.



– Undo and remove bolts -1- and remove oil pressure line.

– Collect escaping oil with a cloth.



Installing

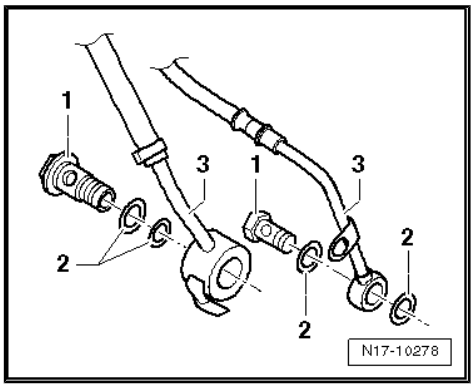
Installation is carried out in the reverse order; note the following:

– Renew seals, gaskets and self-locking nuts.

– Fit new seals -2- onto the respective line connection -3- and also fit the corresponding banjo bolts -1- and screw them in.

– Install starter ⇒ Electrical system; Rep. gr. 27 ; Removing and installing starter .

– Install air filter ⇒ page 277 .



Specified torques

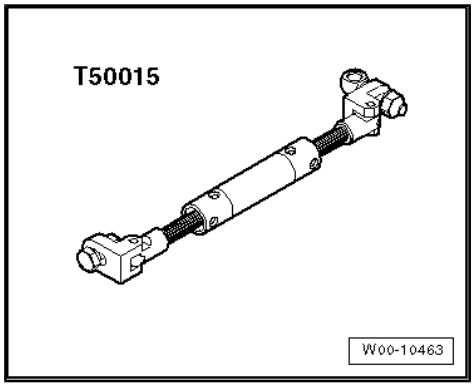
- ⇒ “1.1 Assembly overview - turbocharger, single turbo”, page 211
- ⇒ “4.1 Assembly overview - air filter housing”, page 276
- Starter; Assembly overview - starter ⇒ Electrical system; Rep. gr. 27 ; Starter; Assembly overview - starter

– Check oil level ⇒ page 155 .

3.2 Removing and installing oil supply line, bi-turbo

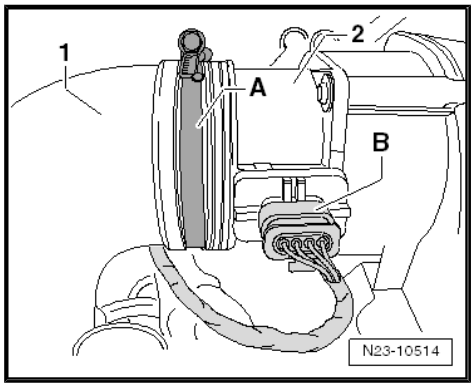
Special tools and workshop equipment required

♦ Engine support - T50015-

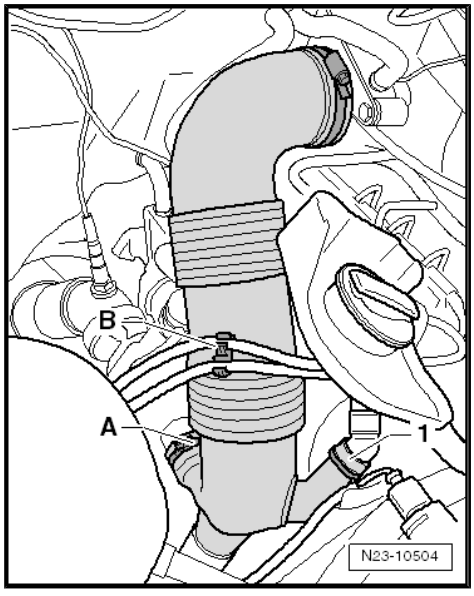


Removing

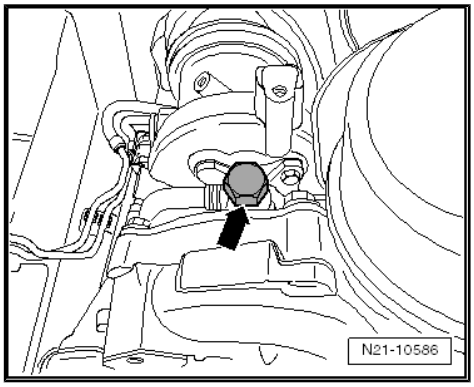
– Loosen clip -A- from intake hose -1-.
– Detach intake hose -1- from air mass meter - G70- .
– Unclip vacuum lines-B- from retainer.



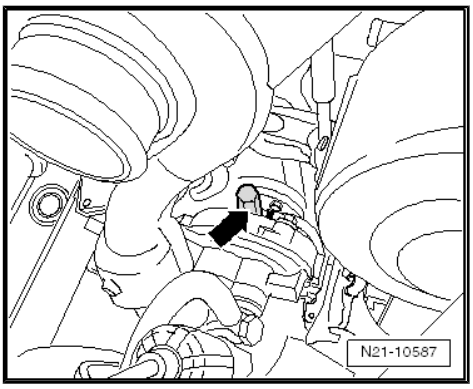
– Pull crankcase breather hose -1- off.
– Loosen clip -A- and remove intake hose.



– Undo and remove banjo bolt -arrow- from top oil supply line.



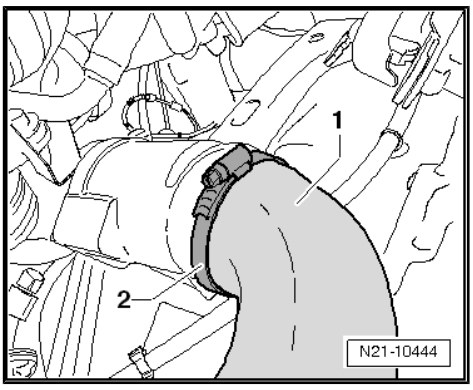
– Undo and remove banjo bolt -arrow- from bottom oil supply line.



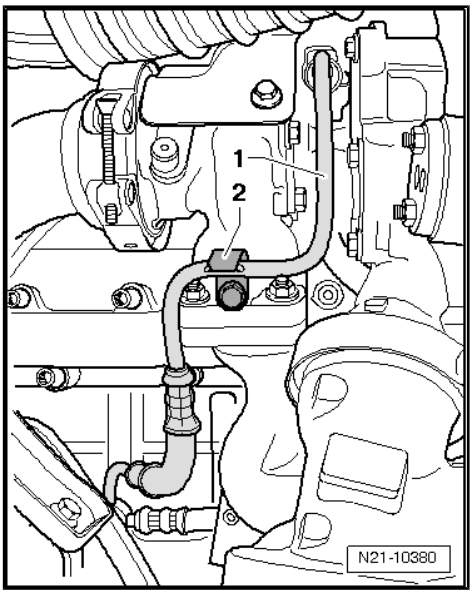
– Loosen clip -2- for connecting hose -1- and detach connecting hose from pulsation damper.

Note

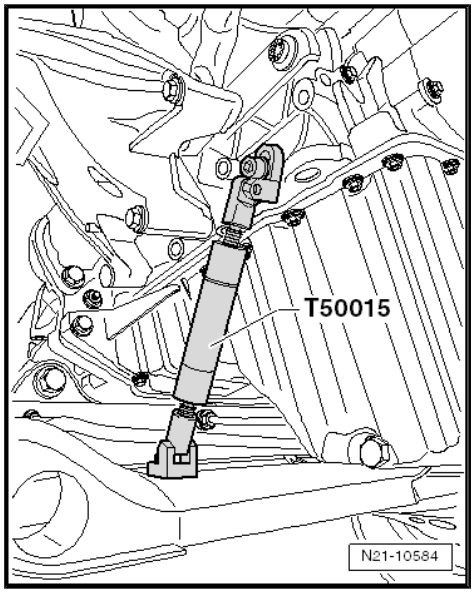
Seal opening in turbocharger with clean cloths or similar.



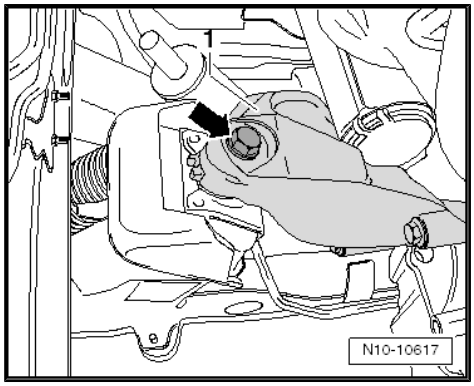
– Unbolt bracket -2- for oil supply line -1- from turbocharger.



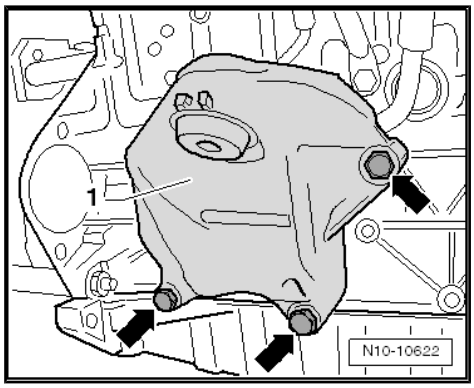
– Locate engine support - T50015- as shown and brace engine.



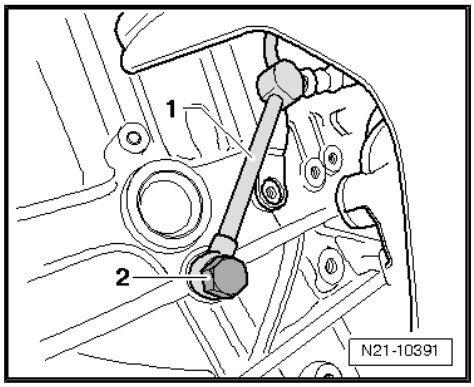
– Undo and remove bolt -arrow- from engine mount on right -1-.



– Undo and remove bolt -arrow- from engine mount on right -1- and remove engine mount.
– Remove starter ⇒ Electrical system; Rep. gr. 27 ; Removing and installing starter .



– Unscrew banjo bolt -2- for oil supply line -1-.
– Collect escaping oil with a cloth.
– Completely remove oil supply line.



Installing

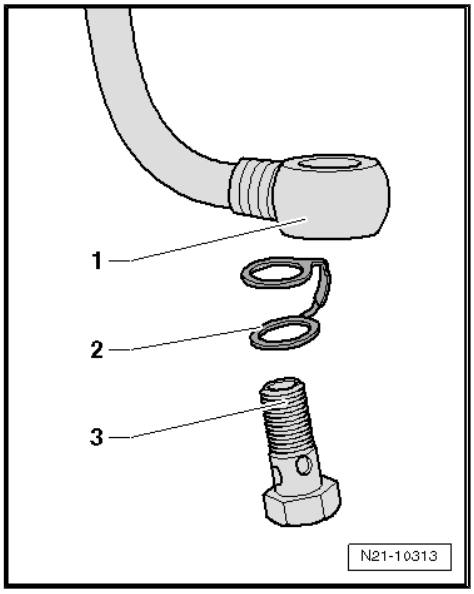
Installation is carried out in the reverse order; note the following:

– Renew seals, gaskets and self-locking nuts.

– Fit new double seal -2- onto the respective line connection -1- and secure by screwing in the corresponding banjo bolt -3-.
– Install starter ⇒ Electrical system; Rep. gr. 27 ; Removing and installing starter .
– Install right engine support ⇒ page 34 .
– Install intake hose.

Specified torques

- ⇒ “1.2 Assembly overview - turbocharger, bi-turbo”, page 214
- ⇒ “4.1 Assembly overview - air filter housing”, page 276
- ⇒ “2.1 Assembly overview - assembly mountings”, page 34
- Starter; Assembly overview - starter ⇒ Electrical system; Rep. gr. 27 ; Starter; Assembly overview - starter
– Check oil level ⇒ page 155 .

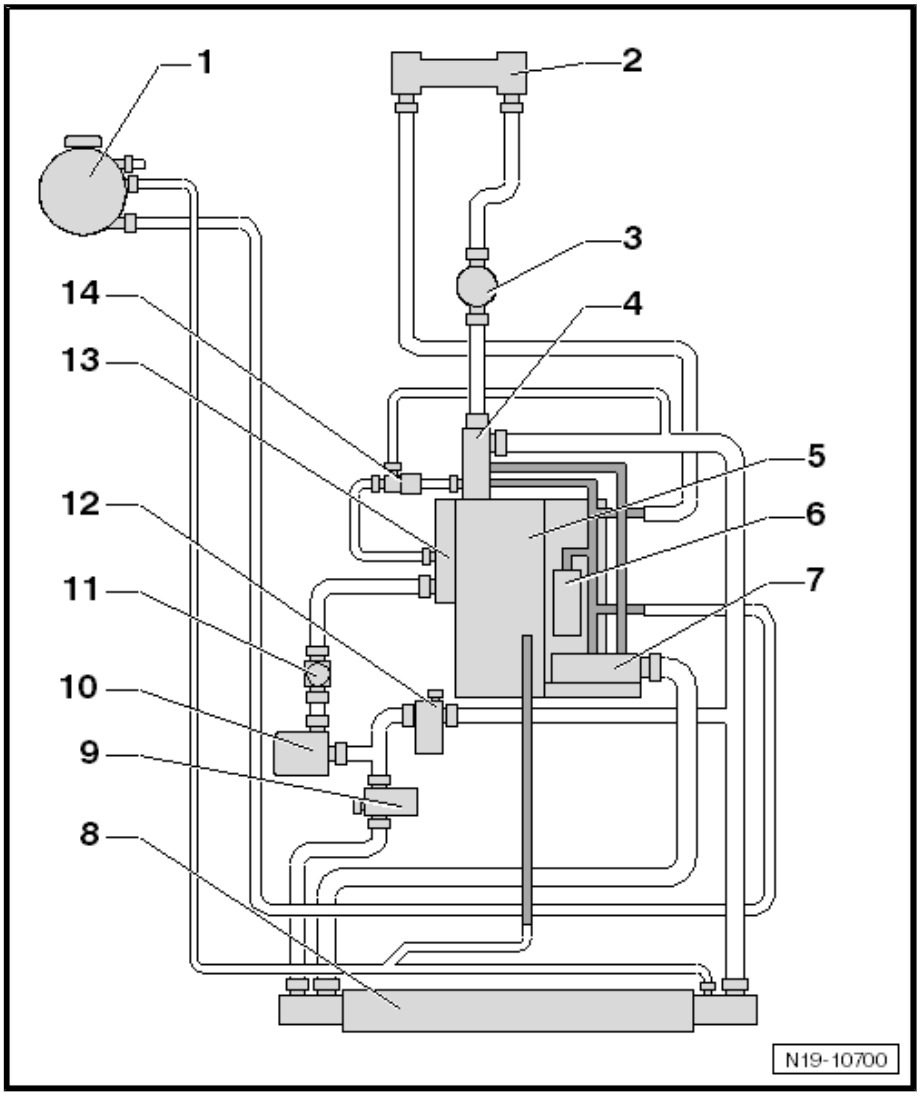


19 – Cooling

1 Cooling system, coolant

1.1 Coolant hose schematic diagram

1.1.1 Coolant hose schematic diagram, vehicles with basic equipment



1 - Coolant expansion tank

2 - Heat exchangers

- ❑ Removing and installing ⇒ Heating; Rep. gr. 80

3 - Coolant circulation pump - V50-

- ❑ Assembly overview ⇒ page 187 .
- ❑ Removing and installing ⇒ page 195 .

4 - Coolant flange on rear of cylinder head

- ❑ With coolant temperature sender - G62-
- ❑ Removing and installing coolant temperature sender - G62- ⇒ page 190
- ❑ Removing and installing coolant flange ⇒ page 192

5 - Cylinder head

- ❑ Assembly overview ⇒ page 87 .
- ❑ Removing and installing ⇒ page 92 .

6 - Engine oil cooler

- ❑ Assembly overview ⇒ page 157 .
- ❑ Removing and installing ⇒ page 158 .

7 - Coolant pump and 4/2-way valve with thermostat

- ❑ Assembly overview ⇒ page 186 .
- ❑ Removing and installing coolant pump ⇒ page 187 .
- ❑ Removing and installing 4/2-way valve with thermostat ⇒ page 188 .

8 - Radiator/cooler

- ❑ Removing and installing ⇒ page 208 .

9 - Exhaust gas recirculation cooling bypass valve - N386-

Note

Bear in mind direction of flow!

- ❑ Basic position: open
- ❑ Colour: black
- ❑ Functional description ⇒ page 178

10 - Pump for exhaust gas recirculation cooler - V400-

- ❑ Removing and installing ⇒ page 367 .

11 - Radiator outlet coolant temperature sender - G83-

- ❑ Removing and installing ⇒ page 191

12 - Exhaust gas recirculation cooling bypass valve 2 - N387-

Note

Bear in mind direction of flow!

- ❑ Basic position: closed
- ❑ Colour: grey
- ❑ Functional description ⇒ page 178

13 - Exhaust gas recirculation cooler

- ❑ Removing and installing ⇒ page 361 .

14 - Y-thermostat

- ❑ Removing and installing ⇒ page 193 .

1.1.2 Coolant hose schematic diagram, vehicles with auxiliary heater

1 - Coolant expansion tank

2 - Heat exchangers

- ❑ Removing and installing ⇒ Heating; Rep. gr. 80

3 - Coolant circulation pump - V50-

- ❑ Assembly overview ⇒ page 187 .
- ❑ Removing and installing ⇒ page 195 .

4 - Coolant flange on rear of cylinder head

- ❑ With coolant temperature sender - G62-
- ❑ Removing and installing coolant temperature sender - G62- ⇒ page 190
- ❑ Removing and installing coolant flange ⇒ page 192

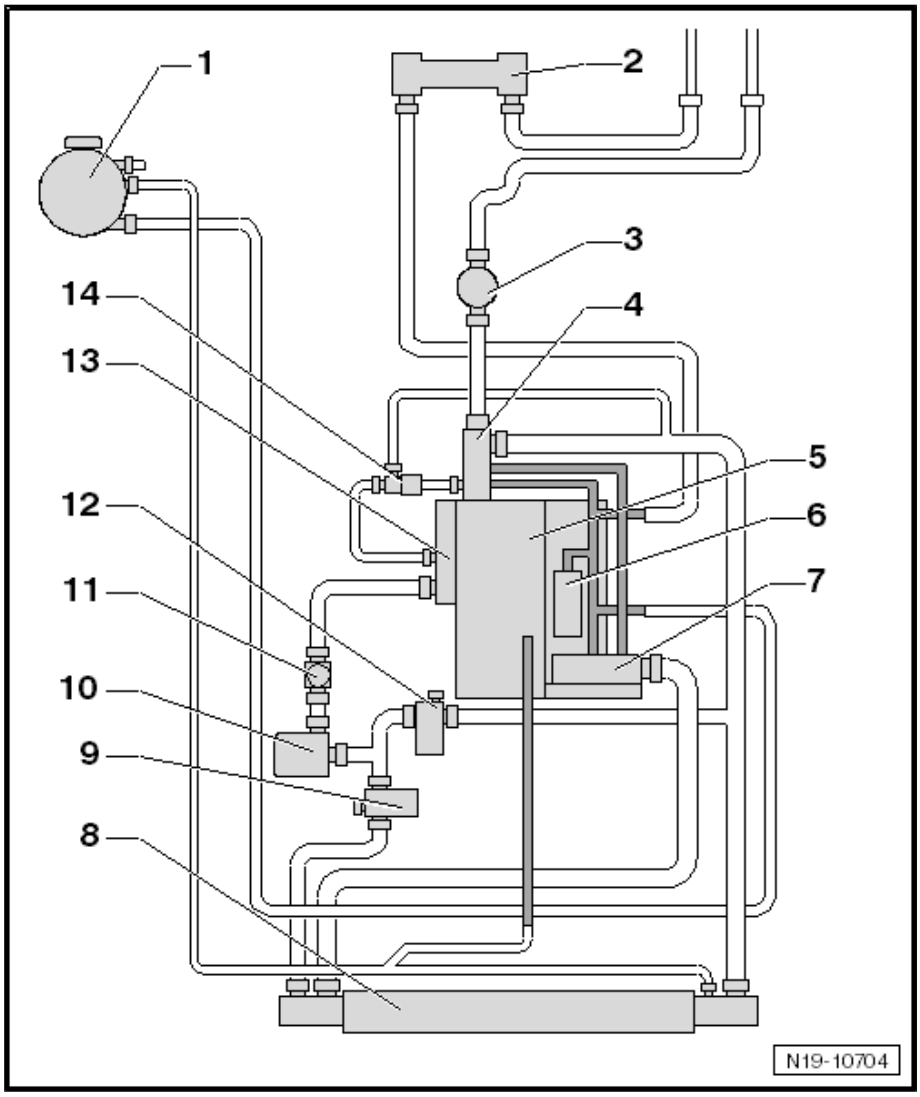
5 - Cylinder head

- ❑ Assembly overview ⇒ page 87 .
- ❑ Removing and installing ⇒ page 92 .

6 - Engine oil cooler

- ❑ Assembly overview ⇒ page 157 .
- ❑ Removing and installing ⇒ page 158 .

7 - Coolant pump and 4/2-way valve with thermostat



- ❑ Assembly overview ⇒ page 186 .
- ❑ Removing and installing coolant pump ⇒ page 187 .
- ❑ Removing and installing 4/2-way valve with thermostat ⇒ page 188

8 - Radiator/cooler

- ❑ Removing and installing ⇒ page 208 .

9 - Exhaust gas recirculation cooling bypass valve - N386-

Note

Bear in mind direction of flow!

- ❑ Basic position: open
- ❑ Colour: black
- ❑ Functional description ⇒ page 178

10 - Pump for exhaust gas recirculation cooler - V400-

- ❑ Removing and installing ⇒ page 367 .

11 - Radiator outlet coolant temperature sender - G83-

- ❑ Removing and installing ⇒ page 191

12 - Exhaust gas recirculation cooling bypass valve 2 - N387-

Note

Bear in mind direction of flow!

- ❑ Basic position: closed
- ❑ Colour: grey
- ❑ Functional description ⇒ page 178

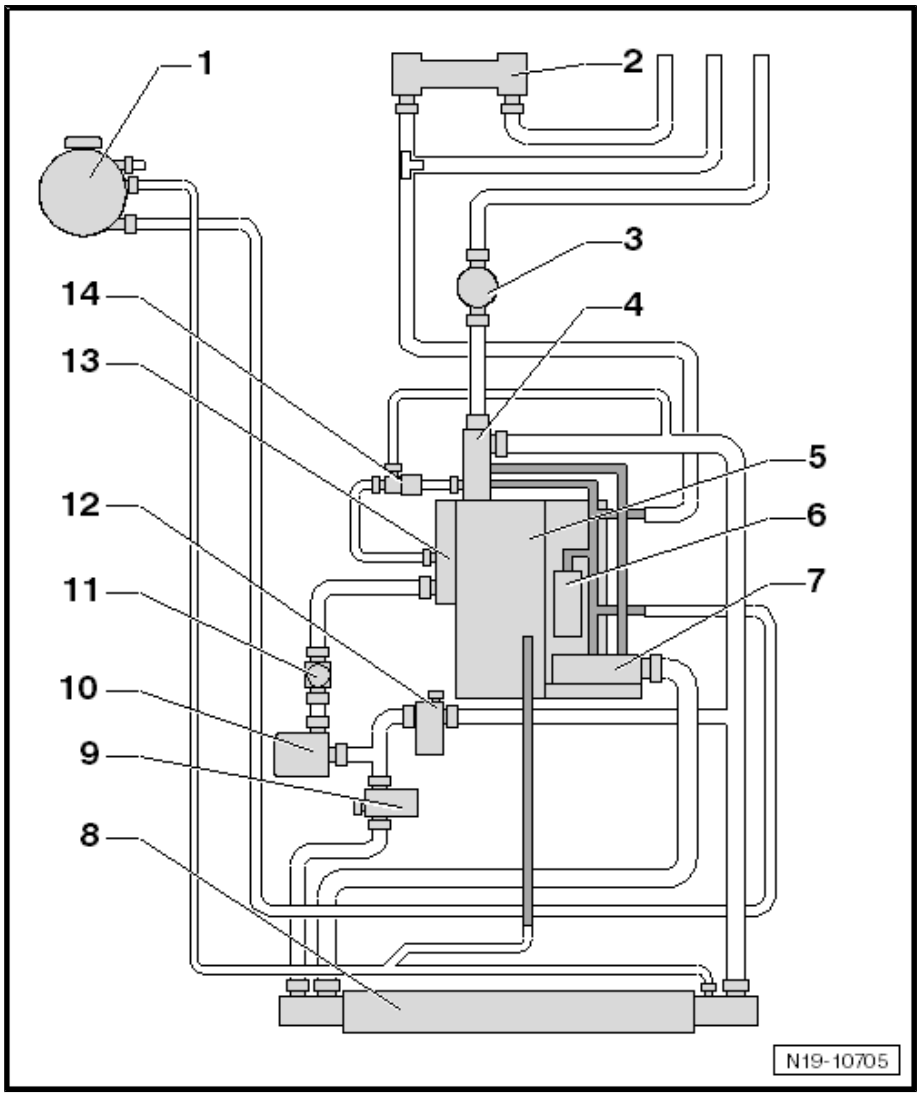
13 - Exhaust gas recirculation cooler

- ❑ Removing and installing ⇒ page 361 .

14 - Y-thermostat

- ❑ Removing and installing ⇒ page 193 .

1.1.3 Coolant hose schematic diagram, vehicles with auxiliary heater and auxiliary heat exchanger



1 - Coolant expansion tank

2 - Heat exchangers

- ❑ Removing and installing ⇒ Heating; Rep. gr. 80

3 - Coolant circulation pump - V50-

- ❑ Assembly overview ⇒ page 187 .
- ❑ Removing and installing ⇒ page 195 .

4 - Coolant flange on rear of cylinder head

- ❑ With coolant temperature sender - G62-
- ❑ Removing and installing coolant temperature sender - G62- ⇒ page 190
- ❑ Removing and installing coolant flange ⇒ page 192

5 - Cylinder head

- ❑ Assembly overview ⇒ page 87 .
- ❑ Removing and installing ⇒ page 92 .

6 - Engine oil cooler

- ❑ Assembly overview ⇒ page 157 .
- ❑ Removing and installing ⇒ page 158 .

7 - Coolant pump and 4/2-way valve with thermostat

- ❑ Assembly overview ⇒ page 186 .
- ❑ Removing and installing coolant pump ⇒ page 187 .
- ❑ Removing and installing 4/2-way valve with thermostat ⇒ page 188 .

8 - Radiator/cooler

- ❑ Removing and installing ⇒ page 208 .

9 - Exhaust gas recirculation cooling bypass valve - N386-

Note

Bear in mind direction of flow!

- ❑ Basic position: open
- ❑ Colour: black
- ❑ Functional description ⇒ page 178

10 - Pump for exhaust gas recirculation cooler - V400-

- ❑ Removing and installing ⇒ page 367 .

11 - Radiator outlet coolant temperature sender - G83-

- ❑ Removing and installing ⇒ page 191

12 - Exhaust gas recirculation cooling bypass valve 2 - N387-

Note

Bear in mind direction of flow!

- ❑ Basic position: closed
- ❑ Colour: grey
- ❑ Functional description ⇒ page 178

13 - Exhaust gas recirculation cooler

- ❑ Removing and installing ⇒ page 361 .

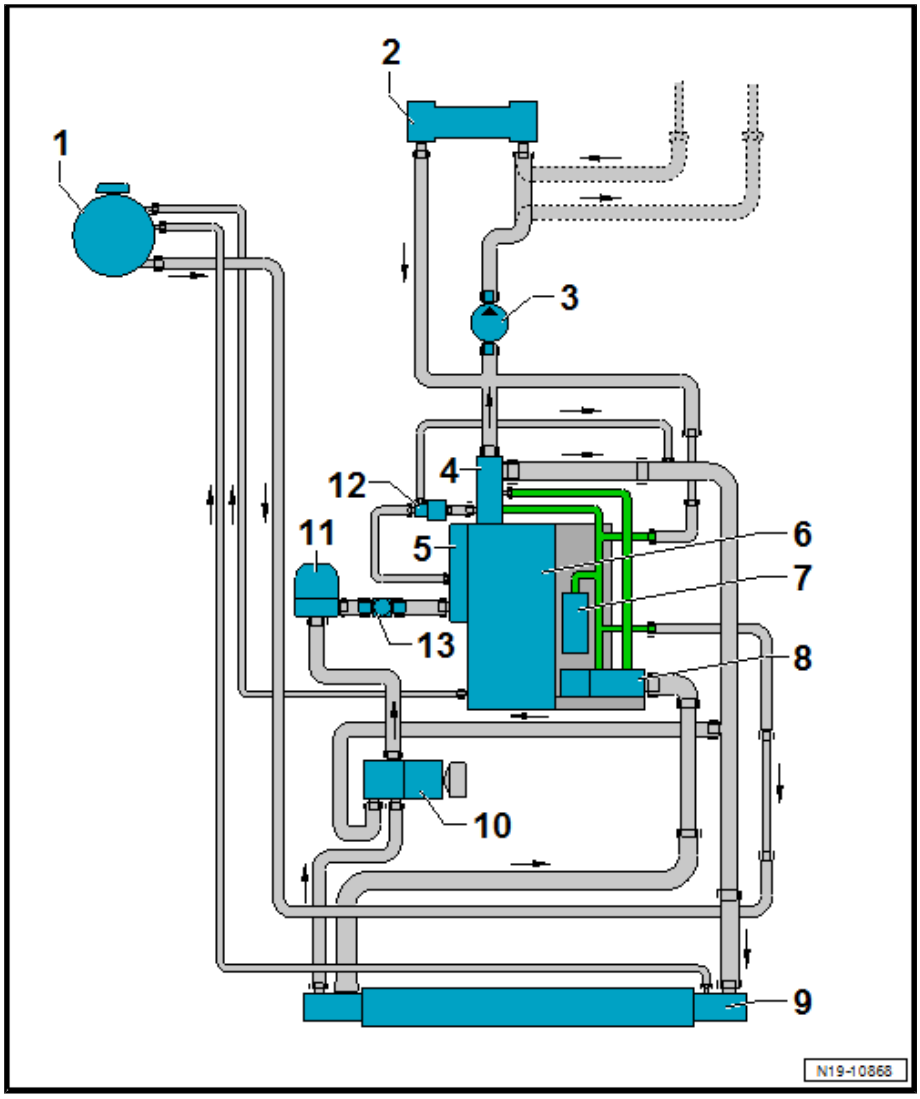
14 - Y-thermostat

- ❑ Removing and installing ⇒ page 193 .

1.1.4 Coolant hose schematic diagram, vehicles with auxiliary heater, Euro 6

Note

Cylinder head with two-piece water jacket.



1 - Coolant expansion tank

2 - Heat exchangers

- Removing and installing ⇒ Heating, air conditioning; Rep. gr. 80 ; Heater unit; Removing and installing heat exchanger .

3 - Coolant circulation pump - V50-

- Assembly overview ⇒ page 187 .
- Removing and installing ⇒ page 195 .

4 - Coolant flange on rear of cylinder head

- With coolant temperature sender - G62-
- Removing and installing coolant temperature sender - G62- ⇒ page 190 .
- Removing and installing coolant flange ⇒ page 192

5 - Exhaust gas recirculation cooler

- Assembly overview ⇒ page 360 .
- Removing and installing ⇒ page 361 .

6 - Cylinder head

- Assembly overview ⇒ page 87 .
- Removing and installing ⇒ page 92 .

7 - Engine oil cooler

- Assembly overview ⇒ page 157 .
- Removing and installing ⇒ page 158 .

8 - Coolant pump and thermostat

- Assembly overview ⇒ page 186 .
- Removing and installing coolant pump ⇒ page 187 .

9 - Radiator

- Assembly overview ⇒ page 203 .
- Removing and installing ⇒ page 208 .

10 - 3/2-way valve

- Euro 6 vehicles
- Fitting location: on right of radiator.
- Removing and installing ⇒ page 196 .

11 - Pump for exhaust gas recirculation cooler - V400-

- Removing and installing ⇒ page 367 .

12 - Y-thermostat

- Removing and installing ⇒ page 193 .

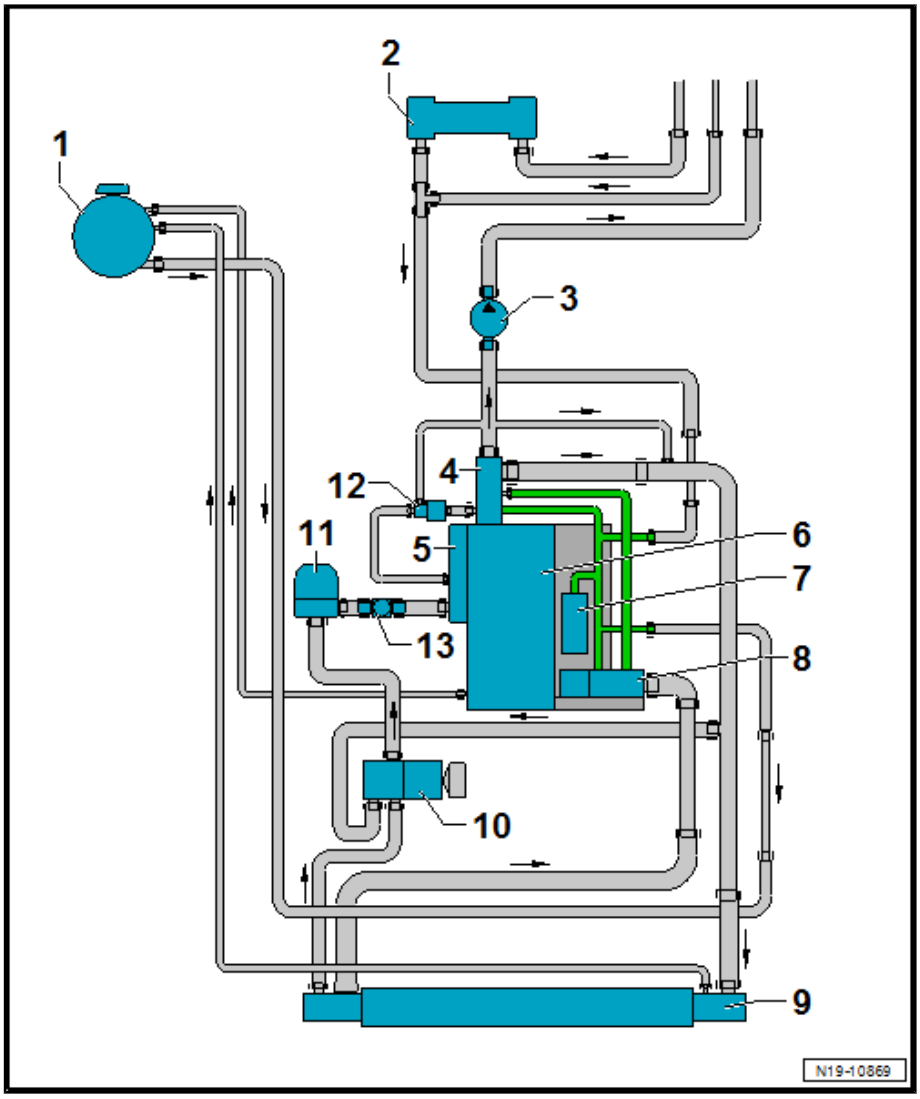
13 - Radiator outlet coolant temperature sender - G83-

- ❑ Removing and installing ⇒ page 191

1.1.5 Coolant hose schematic diagram, vehicles with auxiliary heater auxiliary heat exchanger, Euro 6

Note

Cylinder head with two-piece water jacket.



1 - Coolant expansion tank

2 - Heat exchangers

- ❑ Removing and installing ⇒ Heating, air conditioning; Rep. gr. 80 ; Heater unit; Removing and installing heat exchanger .

3 - Coolant circulation pump - V50-

- ❑ Assembly overview ⇒ page 187 .
- ❑ Removing and installing ⇒ page 195 .

4 - Coolant flange on rear of cylinder head

- ❑ With coolant temperature sender - G62-
- ❑ Removing and installing coolant temperature sender - G62- ⇒ page 190 .
- ❑ Removing and installing coolant flange ⇒ page 192

5 - Exhaust gas recirculation cooler

- ❑ Assembly overview ⇒ page 360 .
- ❑ Removing and installing ⇒ page 361 .
- ❑ Checking for leaks ⇒ page 364 .

6 - Cylinder head

- ❑ Assembly overview ⇒ page 87 .
- ❑ Removing and installing ⇒ page 92 .

7 - Engine oil cooler

- ❑ Assembly overview ⇒ page 157 .
- ❑ Removing and installing ⇒ page 158 .

8 - Coolant pump and thermostat

- ❑ Assembly overview ⇒ page 186 .

- ❑ Removing and installing coolant pump ⇒ page 187 .

9 - Radiator

- ❑ Assembly overview ⇒ page 203 .
- ❑ Removing and installing ⇒ page 208 .

10 - 3/2-way valve

- ❑ Euro 6 vehicles
- ❑ Fitting location: on right of radiator.
- ❑ Removing and installing ⇒ page 196 .

11 - Pump for exhaust gas recirculation cooler - V400-

- ❑ Removing and installing ⇒ page 367 .

12 - Y-thermostat

- ❑ Removing and installing ⇒ page 193 .

13 - Radiator outlet coolant temperature sender - G83-

- ❑ Removing and installing ⇒ page 191

1.1.6 Functional description of vacuum water valves

Purpose/task

Integration of the exhaust gas recirculation cooler into the coolant circuit so that a sufficient amount of coolant is provided via the exhaust gas recirculation cooler and also so that the inflow temperature of the exhaust gas recirculation cooler can be influenced in relation to the outside temperature.

Function

Basic setting of the 2/2-way vacuum water valves:

- ♦ Connection of cooler return flow (cold side) is open. “OPEN/CLOSE valve” is fitted.
- ♦ Connection of cooler inflow (warm side) is closed. “CLOSE/OPEN valve” is fitted.

As a result, the exhaust gas recirculation cooler is cooled with the cold coolant from the coolant cooler. The two 2/2-way vacuum valves are connected to the vacuum of the vacuum system by means of an electric changeover valve at the same time. The temperature level of the coolant for the exhaust gas recirculation cooler changes.

- ♦ Connection of cooler return flow (cold side) is then in closed position.
- ♦ Connection of cooler inflow (warm side) is then in open position.

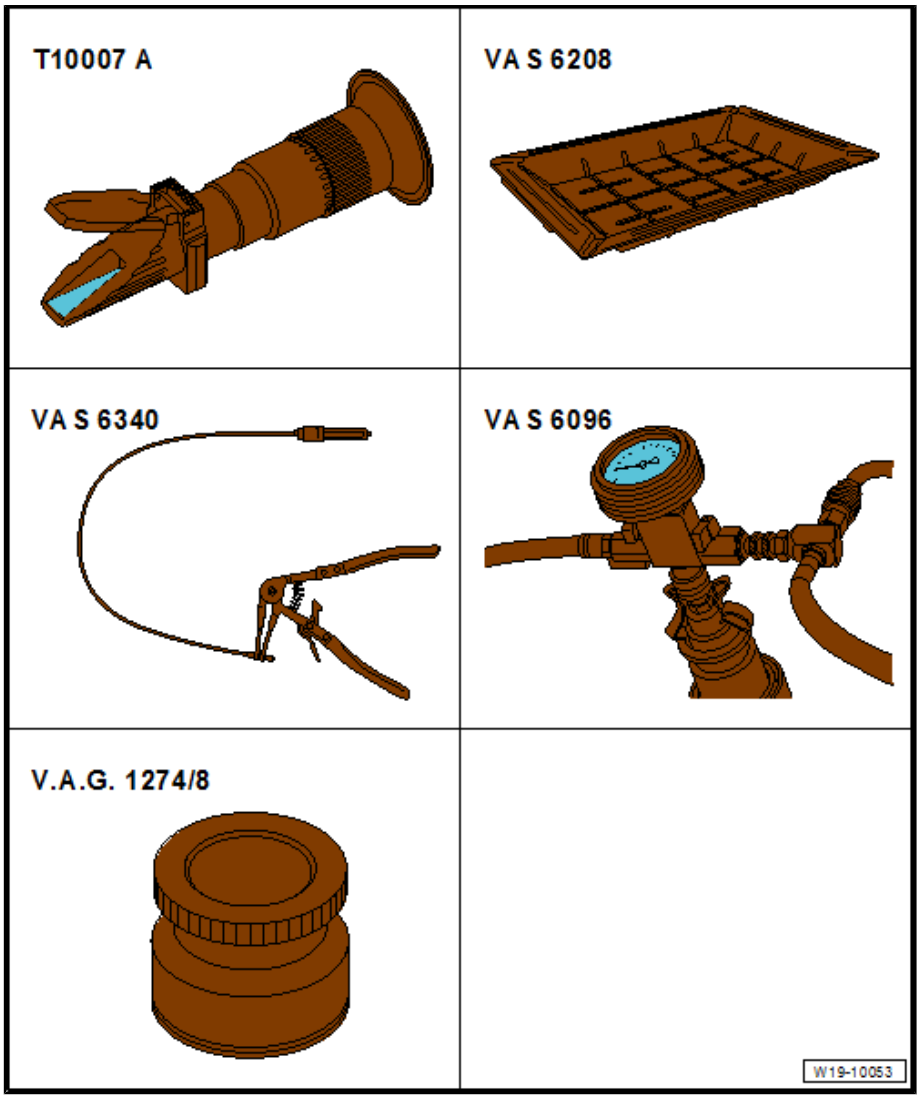
As a result, the exhaust gas recirculation cooler is cooled with the warm coolant before the coolant cooler.

Changeover takes place in relation to the outside temperature, for example, and is intended to prevent the formation of condensation in the exhaust gas recirculation cooler, among other things.

1.2 Draining and filling coolant

Special tools and workshop equipment required

- Refractometer - T10007 A-
- Drip tray for workshop hoist - VAS 6208-
- Hose clip pliers - VAS 6340-
- Cooling system charge unit - VAS 6096-
- Adapter for cooling system tester - V.A.G 1274/8-

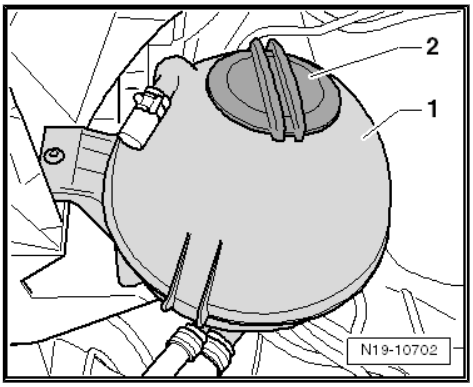


Draining

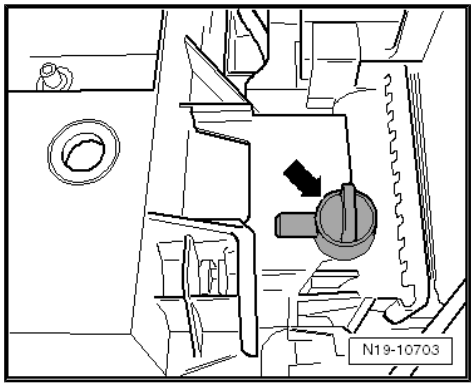
> **WARNING**
>
> *Steam may escape when expansion tank is opened. Wear eye protection and protective clothing to avoid eye injuries and scalding. Cover cap with cloth and open carefully.*

– Open cap -2- on expansion tank -1-.

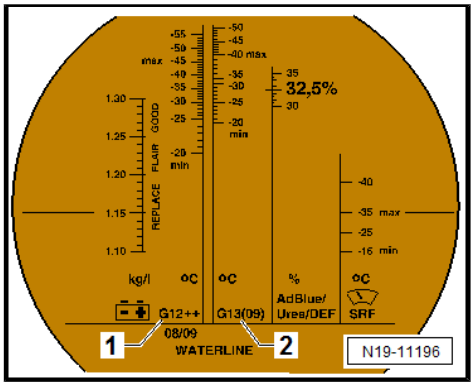
– Remove any noise insulation ⇒ General body repairs, exterior; Rep. gr. 66 ; Exterior equipment; Noise insulation .



– Open drainage screw and allow coolant to drain off.



Filling



Note

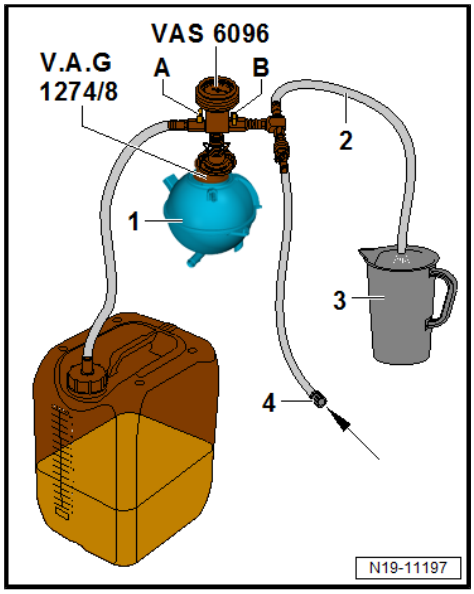
- *Only distilled water may be used for mixing with coolant additives. The use of distilled water ensures optimum protection against corrosion.*
- *The amount of water used in the coolant mixture has a great influence on its effectiveness. Since water quality differs from country to country and even region to region, it is necessary to set a standard for the quality of water to be used. Distilled water fulfils all requirements. For this reason, we recommend using distilled water when mixing coolant for topping up or replacing coolant.*
- *Use only coolant additives in accordance with the ⇒ Electronic Parts Catalogue (ETKA) . Other coolant additives may reduce corrosion protection substantially. The resulting damage could lead to loss of coolant and subsequent severe damage to the engine.*
- *The correct coolant solution ratio helps prevent damage from freezing and corrosion as well as scaling. Moreover, the boiling temperature is raised. Therefore, the cooling system must be filled all year round with coolant additive.*
- *Because of its higher boiling point, the coolant improves engine reliability under heavy loads, particularly in countries with tropical climates.*
- *The refractometer - T10007A- must be used to determine the current anti-freeze value.*
- *Frost protection must be guaranteed down to -25°C as a minimum and, in countries with arctic conditions, down to approx. -36°C. Increasing the frost protection is permissible only if climatic conditions require stronger frost protection. It may, however, only be increased to a maximum of -48°C. Otherwise, the cooling effect of the coolant will be impaired.*
- *The coolant concentration must not be reduced by adding water even in warmer seasons and in warmer countries. Frost protection must be guaranteed down to at least -25°C.*
- *Read the frost protection value from the respective scale for the coolant additive being used.*
- *The temperature read off the refractometer - T10007A- equates to the »ice flocculation point«. Flakes of ice may start forming in the coolant below this temperature.*
- *Do not reuse old coolant.*
- *Use only a water/coolant additive mixture as a slip agent for coolant hoses.*

Recommended mixture ratios:

Frost protection to	Coolant additive portion	Coolant additive 1)	Distilled water 1)
-25°C -36°C	40% 50%	5.0 l 6.25 l	7.5 l 6.25 l

1) The quantity of coolant can vary depending upon vehicle equipment.

– Fill tank of cooling system charge unit - VAS 6096- with at least 8 litres of pre-mixed coolant in correct mixture ratio:
– Screw adapter for cooling system tester - V.A.G 1274/8- onto coolant expansion tank -1-.
– Mount cooling system charge unit - VAS 6096- on adapter - V.A.G 1274/8- .
– Feed vent hose -2- into a small container -3-.



Note

Exhaust air takes a slight quantity of coolant along with it; this should be collected.

– Close valves -A- and -B- (turn lever transverse to direction of flow to do this).
– Connect hose -4- to compressed air.
• Pressure: 6 … 10 bar.

– Open valve -B-; turn lever in direction of flow to do this.

• In cooling system, vacuum is generated by suction jet pump; needle of gauge must move into green area.

– In addition, open valve -A- briefly by turning lever in direction of flow until hose of coolant expansion tank of cooling system charge unit - VAS 6096- fills with coolant.

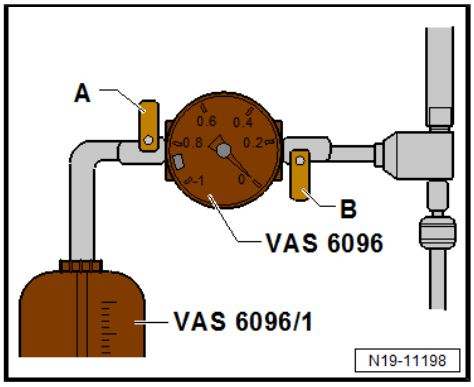
– Close valve -A- again.

– Leave valve -B- open for a further 2 minutes.

• Vacuum continues to be generated in the cooling system by the suction jet pump; the needle of the gauge must remain in the green range.

– 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.



Note

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

♦ *If vacuum drops, cooling system must be checked for leaks.*

– Pull off compressed air hose.

– Open valve -A-.

• The vacuum in the cooling system causes coolant to be extracted from coolant expansion tank of cooling system charge unit - VAS 6096- and the cooling system to be filled.

– Then install cooling system charge unit - VAS 6096- again on coolant expansion tank.

– Fill coolant up to max. mark.

– Fit expansion tank cap.

– Start engine and keep engine speed at approx. 2000 rpm for about 3 minutes.

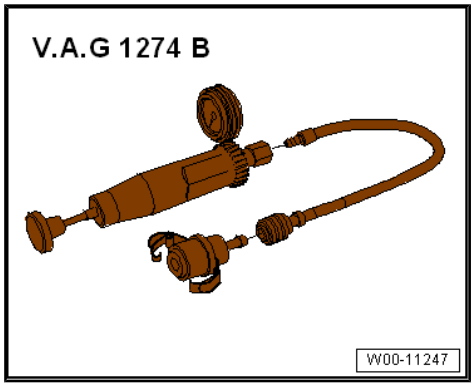
– Then run engine at idling speed until radiator fan cuts in.

– Check coolant level and top-up if necessary. When the engine is at normal operating temperature, the coolant level must be at the upper mark and, when the engine is cold, in the middle of the hatched field.

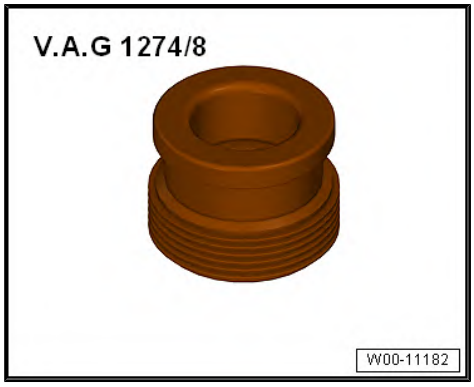
1.3 Checking cooling system for leaks

Special tools and workshop equipment required

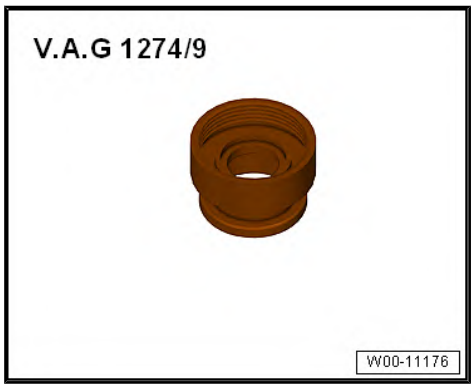
♦ Cooling system tester - V.A.G 1274 B-



♦ Adapter for cooling system tester - V.A.G 1274/8-



♦ Adapter for cooling system tester - V.A.G 1274/9-



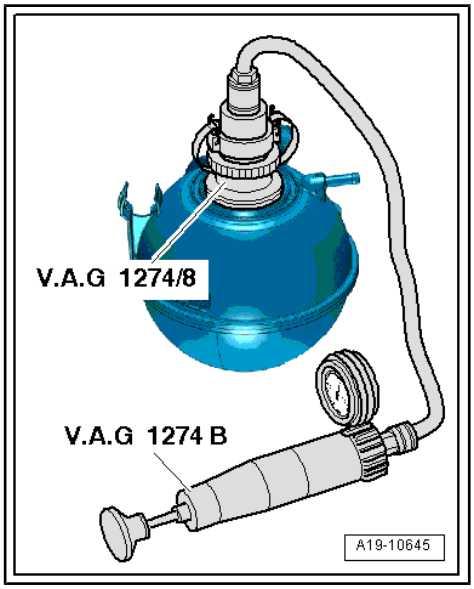
Procedure

- Engine at operating temperature.

WARNING

Steam may escape when expansion tank is opened. Cover cap with cloth and open carefully.

– Fit cooling system tester - V.A.G 1274 B- with adapter - V.A.G 1274/8- on coolant expansion tank.
– Using hand pump on tester, build up a pressure of approx. 1.0 bar.



DANGER!

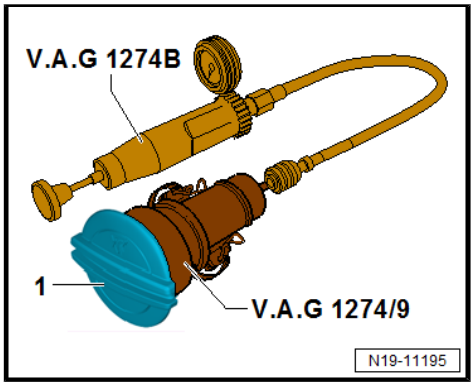
Risk of scalding! Before the cooling system tester - V.A.G 1274 B- is disconnected from the connecting hose or the connector - V.A.G 1274 B/1- , reduction of the pressure is essential. To do this, press pressure relief valve on cooling system tester - V.A.G 1274 B- until pressure gauge displays value of »0«.

If pressure drops:

– Find leaks and rectify.

Checking pressure relief valve in filler cap:

– Fit cooling system tester - V.A.G 1274 B- with adapter - V.A.G 1274/9- to filler cap -1-.
– Build up pressure using hand pump of cooling system tester.
• The pressure relief valve should open at a pressure of 1.4 ... 1.6 bar.
– Renew filler cap, if pressure relief valve does not open as described.



2 Coolant pump, regulation of cooling system

2.1 Assembly overview - coolant pump, thermostat

1 - Coolant pump

- ❑ Removing and installing ⇒ page 187 .

2 - Bolt

- ❑ 15 Nm

3 - O-ring

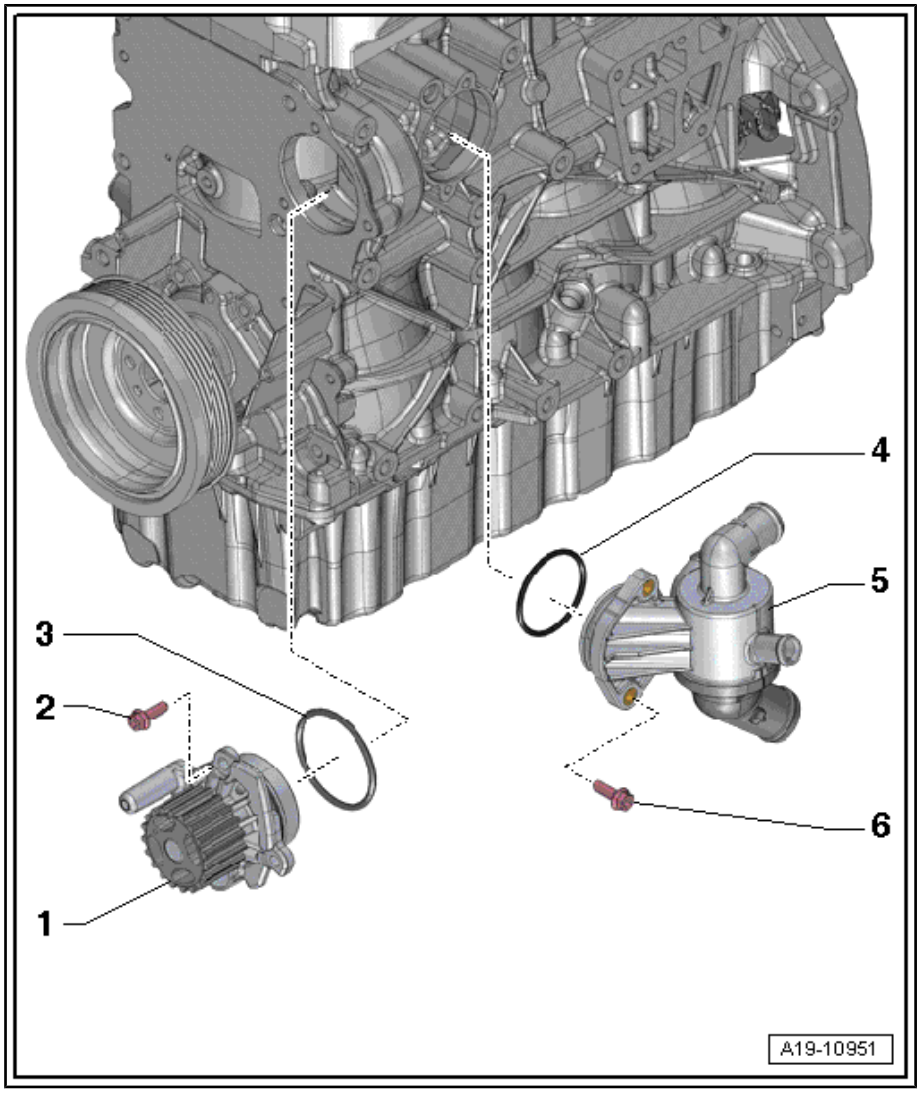
- ❑ Renew after removing.

4 - O-ring

- ❑ Renew after removing.

5 - 4/2-way valve with thermostat

- ❑ The thermostat is located within the 4/2-way valve and cannot be replaced separately.
- ❑ Removing and installing ⇒ page 188 .



6 - Bolt

- ❑ 15 Nm

2.2 Assembly overview - electric coolant pump

1 - Coolant hose

- ❑ Inlet of continued coolant circulation pump - V50-

2 - Hose clip

3 - Hose clip

4 - Coolant hose

- ❑ Outlet of continued coolant circulation pump - V50- .

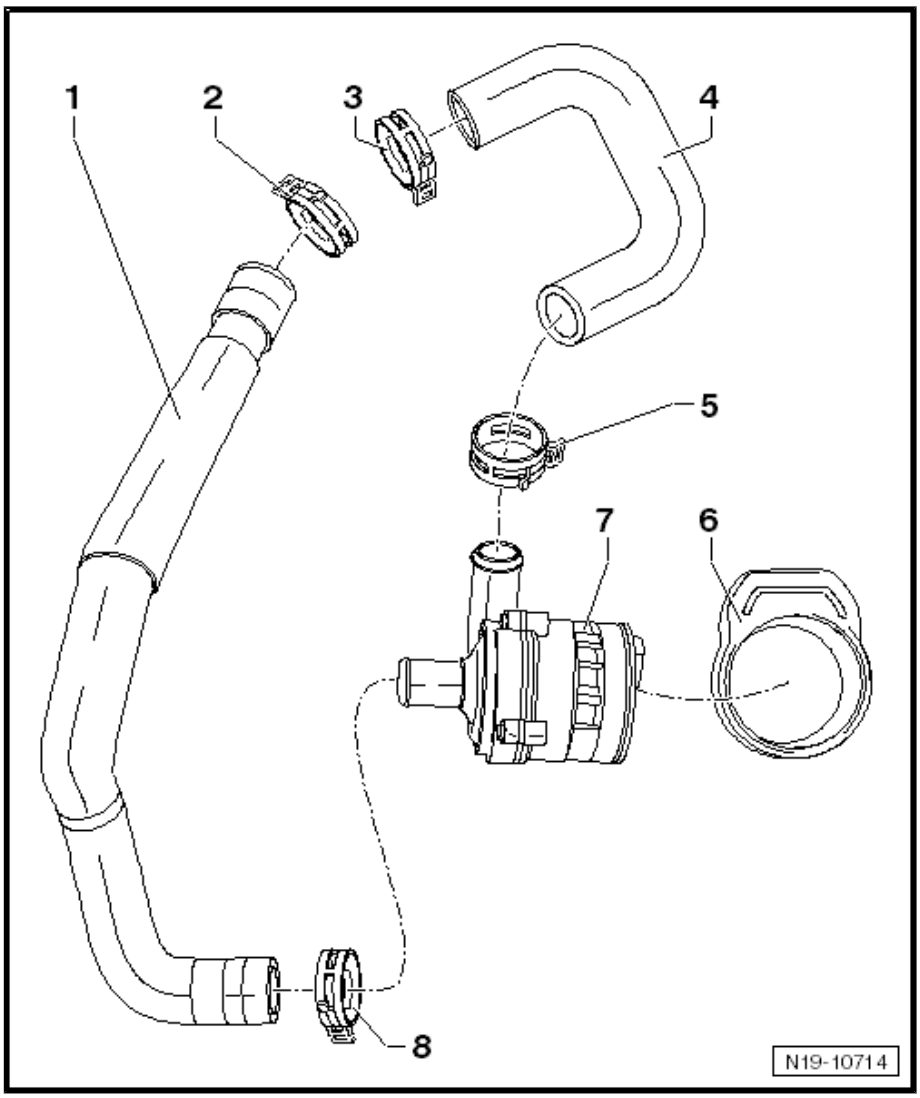
5 - Hose clip

6 - Rubber bush

7 - Coolant circulation pump - V50-

- ❑ Removing and installing ⇒ page 195 .

8 - Hose clip



2.3 Removing and installing coolant pump

Removing

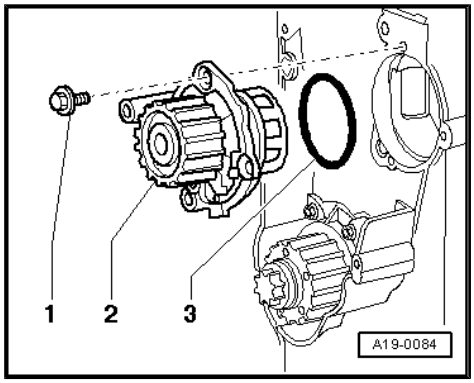
– Remove any noise insulation ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation .

– Drain coolant ⇒ page 179 .

– Remove toothed belt ⇒ page 112 .

– Unscrew bolts -1- and remove coolant pump -2-.

– Remove O-ring -3-.



Installing

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

Note

Renew O-ring.

– Clean and smoothen sealing surface for O-ring.

– Moisten O-ring -3- with coolant.

– Insert coolant pump -2-.

• Installation position: plug in housing faces downwards.

– Install toothed belt (adjust valve timing) ⇒ page 112 .

– Replenish coolant ⇒ page 179 .

Specified torque

◆ ⇒ “2.1 Assembly overview - coolant pump, thermostat”, page 186

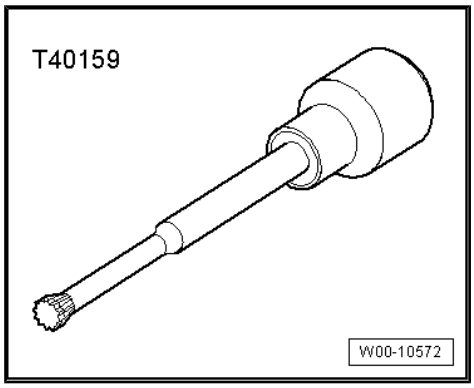
◆ ⇒ “2.1 Assembly overview - toothed belt”, page 110

◆ Noise insulation; Assembly overview - noise insulation ⇒ Rep. gr. 66 ; Assembly overview - noise insulation

2.4 Removing and installing 4/2-way valve with thermostat

Special tools and workshop equipment required

◆ Bit XZN 8 - T40159-



Removing

Note

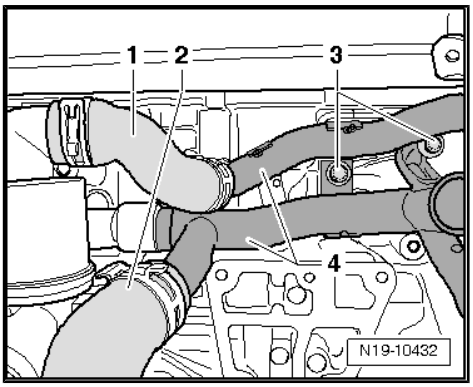
The thermostat is located within the 4/2-way valve and cannot be replaced separately.

– Remove any noise insulation ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation .

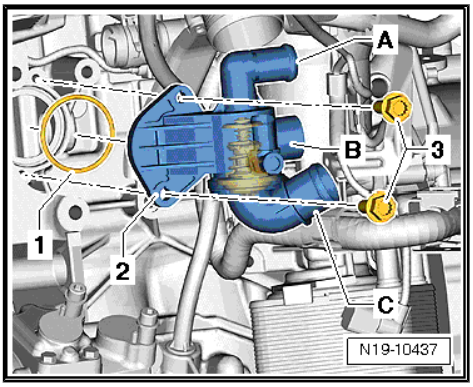
– Drain coolant ⇒ page 179 .

– Remove air filter ⇒ page 277 .

– Remove alternator ⇒ Electrical system; Rep. gr. 27 ; Alternator; Removing and installing alternator .
– Remove charge air pipe ⇒ page 257 .
– Remove oil filter housing ⇒ page 158 .
– Unscrew bolts -3- for coolant pipes -4- at cylinder block.
– Loosen clips of coolant hoses -1 and 2-.



– Pull coolant hoses off unions -A and C-.
– Pull coolant pipe out of connection -B-.
– Undo and remove bolts -2- of 4/2-way valve -2- using XZN 8 bit - T40159- .
– Pull valve out of cylinder block and then to the left to separate connection -C- from coolant pipe.



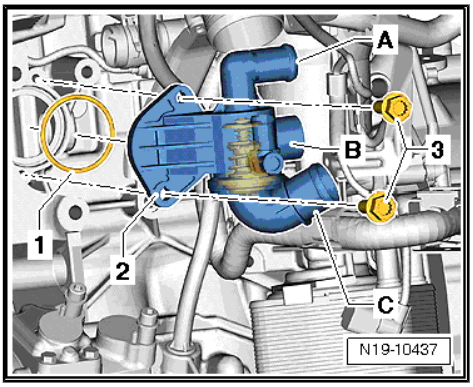
Installing

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

Note

Renew gaskets and seals.

– First position 4/2-way valve with connection -B- on coolant pipe.
♦ -A-: Bypass line to cylinder head
♦ -C-: Radiator return line
– Install oil filter housing ⇒ page 158 .
– Install alternator ⇒ Electrical system; Rep. gr. 27 ; Alternator; Removing and installing alternator .
– Install charge air pipe ⇒ page 257 .
– Install air filter ⇒ page 277 .
– Fill cooling system ⇒ page 179 .
– Install any noise insulation ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation .



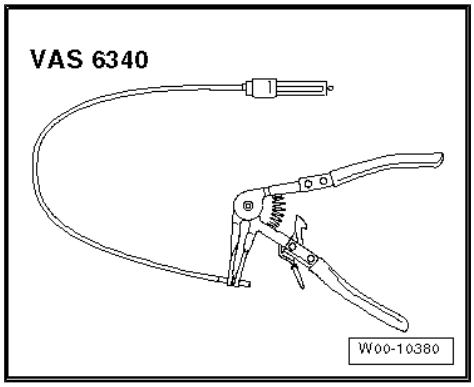
Specified torques

♦ ⇒ “2.1 Assembly overview - coolant pump, thermostat”, page 186
♦ ⇒ “2.1 Assembly overview - oil filter housing with engine oil cooler”, page 157
♦ ⇒ “4.1 Assembly overview - air filter housing”, page 276
♦ Noise insulation; Assembly overview - noise insulation ⇒ Rep. gr. 66 ; Assembly overview - noise insulation

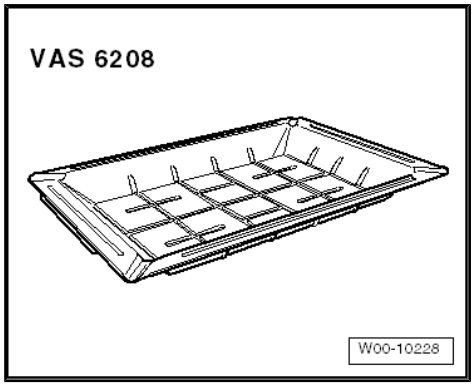
2.5 Removing and installing coolant temperature sender - G62-

Special tools and workshop equipment required

- Hose clip pliers - VAS 6340-



- Drip tray for workshop hoist - VAS 6208-



Removing

– Remove any noise insulation ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation .

– Drain coolant ⇒ page 179 .

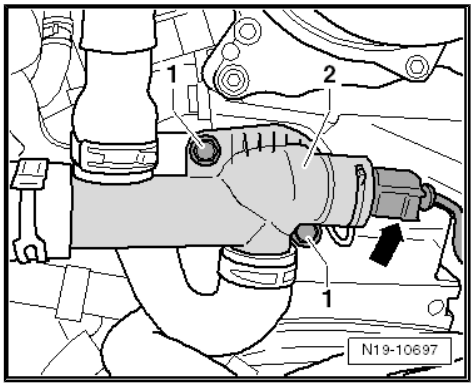
Note

Since the coolant temperature sender - G62- is installed on the rear of the cylinder head, it cannot be removed or installed without having to remove the gearbox beforehand.

– Remove gearbox ⇒ Power transmission; Rep. gr. 34 ; Controls, housing; Removing and installing gearbox .

– Release and disconnect connector -arrow-.

– Loosen retaining clip, and pull coolant temperature sender - G62- out of coolant flange -2-.



Installing

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

– Install coolant temperature sender - G62- with new O-ring only.

– Replenish coolant ⇒ page 179 .

Specified torques

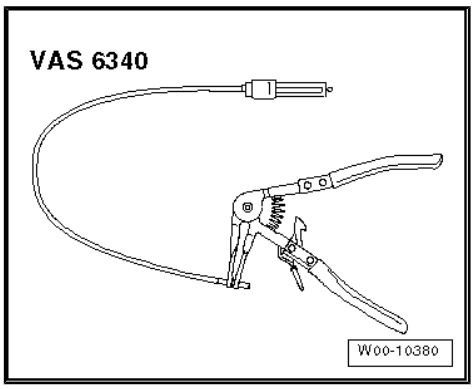
♦ ⇒ “1.1 Assembly overview - cylinder head”, page 87

♦ Noise insulation; Assembly overview - noise insulation ⇒ Rep. gr. 66 ; Assembly overview - noise insulation

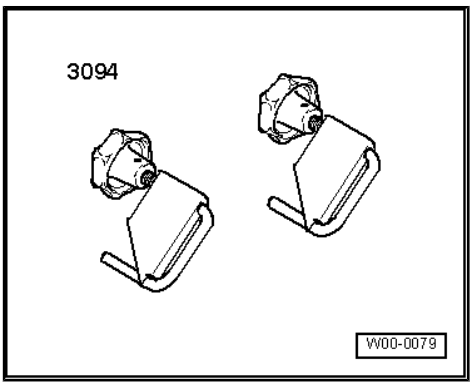
2.6 Removing and installing coolant temperature sender at radiator outlet - G83-

Special tools and workshop equipment required

♦ Hose clip pliers - VAS 6340-

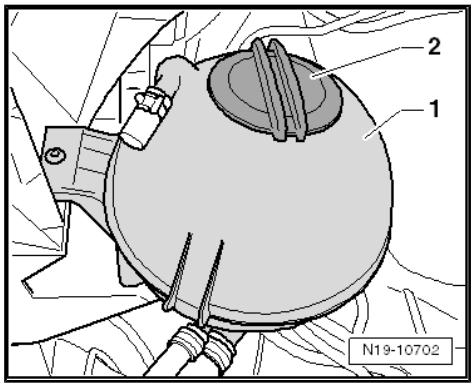


♦ Hose clamps up to 25 mm - 3094-

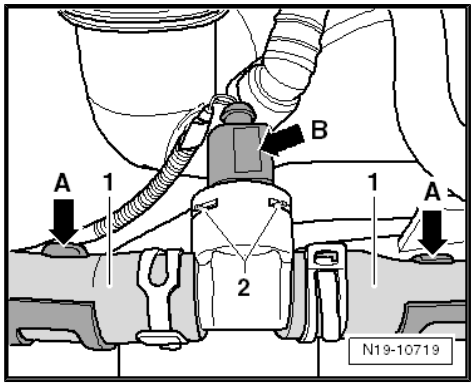


Removing

– Briefly open filler cap -2- for coolant expansion tank -1- in order to reduce pressure in cooling system.



– Disconnect connector -arrow B- from radiator outlet coolant temperature sender - G83- .
– Detach coolant hoses -1- from holder -arrows A-.
– Clamp off coolant hoses -1- with hose clips up to 25 mm - 3094- .
– Pull off retaining clip -2-, and pull out radiator outlet coolant temperature sender - G83- .



Installing

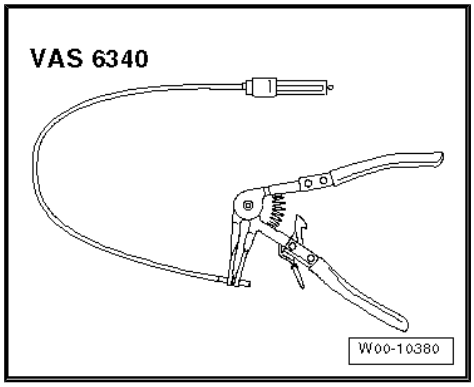
Installation is carried out in the reverse order; note the following:

– Install radiator outlet coolant temperature sender - G83- with new O-ring only.
– Check coolant and top up if necessary ⇒ page 179 .

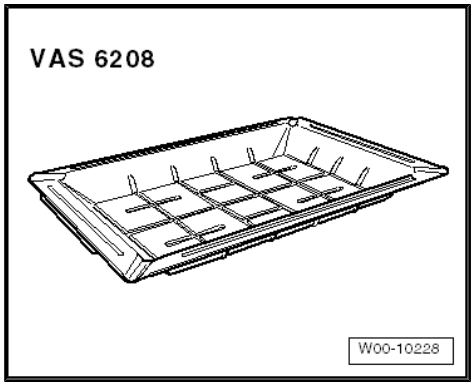
2.7 Removing and installing coolant flange

Special tools and workshop equipment required

♦ Hose clip pliers - VAS 6340-



♦ Drip tray for workshop hoist - VAS 6208-

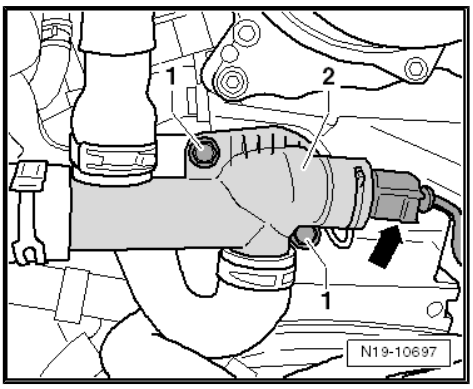


– Remove any noise insulation ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation .
– Drain coolant ⇒ page 179 .

Note

Since the coolant flange is installed on the rear of the cylinder head, it cannot be removed or installed without having to remove the gearbox beforehand.

– Remove gearbox ⇒ Power transmission; Rep. gr. 34 ; Controls, housing; Removing and installing gearbox .
– Release and disconnect connector -arrow-.
– Open hose clips of all coolant hoses secured to coolant flange -2-, and pull off coolant hoses.
– Remove securing bolts -1-.
– Pull coolant flange -2- out of cylinder head.



Installing

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

– If coolant flange has been renewed, make sure always to use new O-ring when installing coolant temperature sender - G62- ⇒ page 190 .
– Replenish coolant ⇒ page 179 .

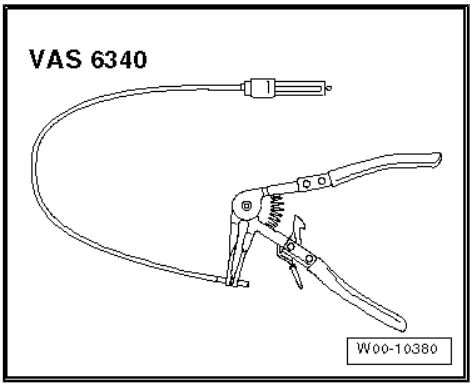
Specified torques

♦ ⇒ “1.1 Assembly overview - cylinder head”, page 87
♦ Noise insulation; Assembly overview - noise insulation ⇒ Rep. gr. 66 ; Assembly overview - noise insulation

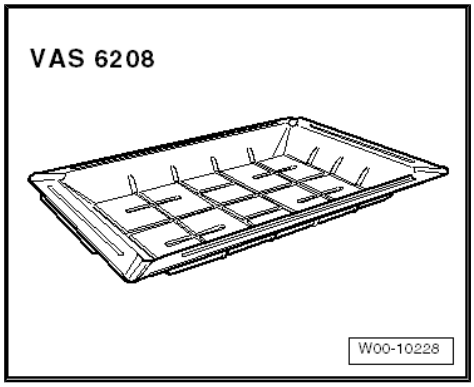
2.8 Removing and installing Y-thermostat .

Special tools and workshop equipment required

♦ Hose clip pliers - VAS 6340-



♦ Drip tray for workshop hoist - VAS 6208-



Removing

Note

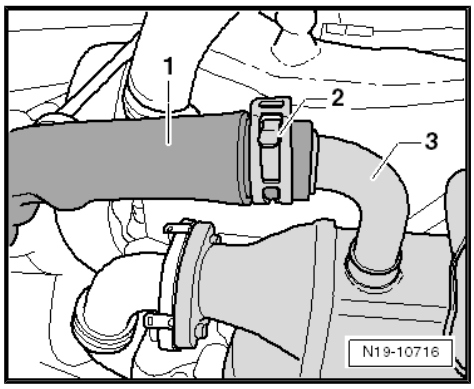
Due to space restrictions, the Y-thermostat should be removed with hoses to facilitate removal.

– Remove air filter ⇒ page 277 .

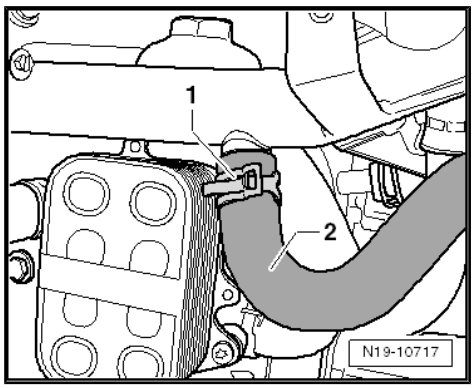
– Remove any noise insulation ⇒ General body repairs, exterior; Rep. gr. 66 ; Exterior equipment; Noise insulation .

– Drain coolant ⇒ page 179 .

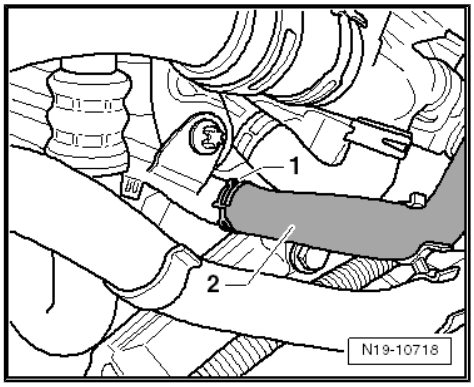
– Loosen clip -2- from exhaust gas recirculation cooler -3- and pull coolant hose -1- off.



– Loosen clip -2- and pull coolant hose -1- off.



– Loosen clip -2- and pull coolant hose -1- off.
– Release coolant hoses from retainers.
– Remove Y-thermostat together with hoses.



Installing

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

– Clip coolant hoses into retainers.
– Replenish coolant ⇒ page 179 .
– Install air filter ⇒ page 277 .
– Install any noise insulation ⇒ General body repairs, exterior; Rep. gr. 66 ; Exterior equipment; Noise insulation .

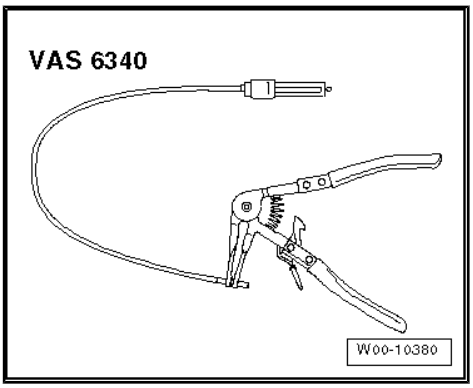
Specified torques

- ⇒ “4.1 Assembly overview - air filter housing”, page 276
- Noise insulation; Assembly overview - noise insulation ⇒ Rep. gr. 66 ; Assembly overview - noise insulation

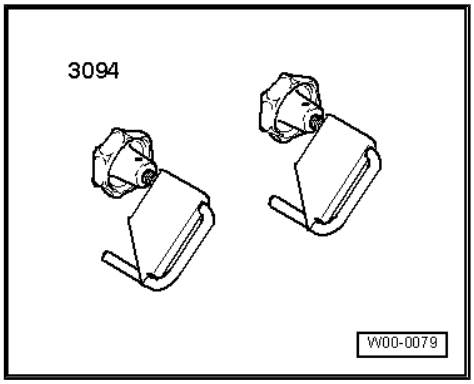
2.9 Removing and installing coolant circulation pump - V50-

Special tools and workshop equipment required

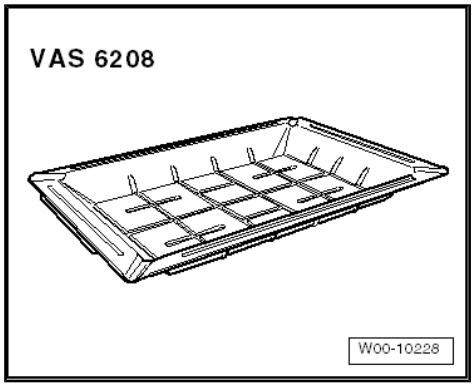
- Hose clip pliers - VAS 6340-



- Hose clamps up to 25 mm - 3094-



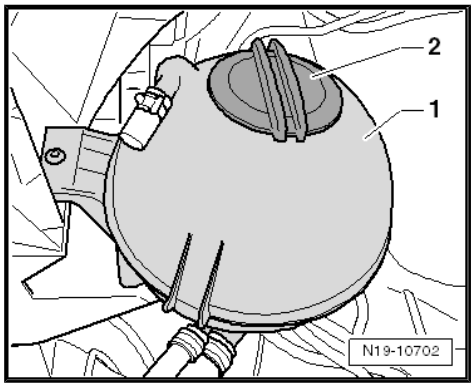
♦ Drip tray for workshop hoist - VAS 6208-



Removing

– Remove air filter ⇒ page 277 .

– Briefly open filler cap -2- for coolant expansion tank -3- in order to reduce pressure in cooling system.

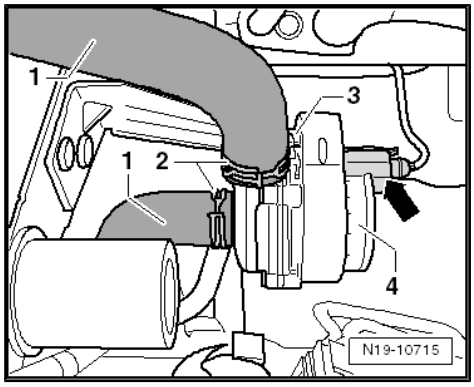


– Detach connector -arrow- from coolant circulation pump - V50- -4-.

– Clamp off coolant hoses -1- with hose clips up to 25 mm - 3094- .

– Loosen clips -2- and pull coolant hoses -1- off.

– Pull coolant circulation pump - V50- -4- out of retainer -3-.



Installing

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

– Check coolant level ⇒ page 179 .

– Install air filter ⇒ page 277 .

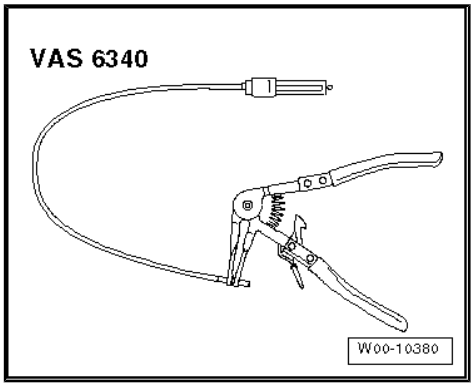
Specified torques

♦ ⇒ “4.1 Assembly overview - air filter housing”, page 276

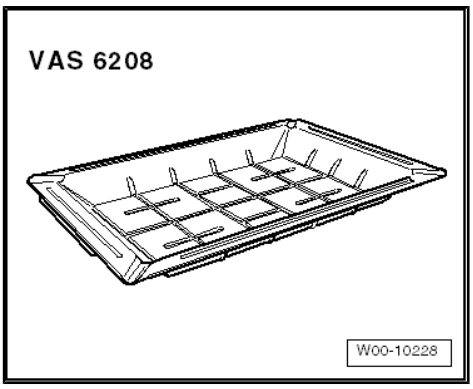
2.10 Removing and installing 3/2-way valve, Euro 6 vehicles

Special tools and workshop equipment required

♦ Hose clip pliers - VAS 6340-



♦ Drip tray for workshop hoist - VAS 6208-



Removing

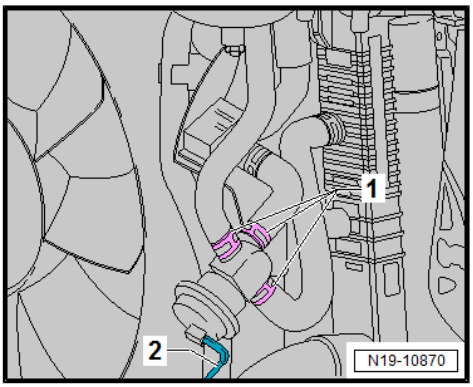
– Detach coolant expansion tank and lay it aside ⇒ Item 7 (page 203) .

Note

Coolant hoses remain connected.

– Drain coolant ⇒ page 179 .

– Pull off vacuum hose -2-. Then, release clamps -1- and pull off water hoses.



Installing

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

– Replenish coolant ⇒ page 179 .

Specified torques

♦ ⇒ “4.1 Assembly overview – radiator, radiator fan”, page 203

3 Coolant pipes/coolant hoses

⇒ “3.1 Assembly overview - coolant pipe/coolant hose”, page 198

⇒ “3.2 Removing and installing coolant pipe with coolant hose”, page 199

3.1 Assembly overview - coolant pipe/coolant hose

Note

- *Coolant hoses without an installation marking must be routed free of stress.*
- *Install clamps at a distance of approx. 5 mm from the connecting piece.*

1 - Clips

2 - Coolant pipe

- ❑ With bracket
- ❑ Removing and installing ⇒ page 199
- ❑ Cannot be renewed individually; refer to ⇒ Electronic Parts Catalogue (ETKA)

3 - Bolts

- ❑ 10 Nm

4 - Coolant hose

- ❑ Removing and installing ⇒ page 199
- ❑ Cannot be renewed individually; refer to ⇒ Electronic Parts Catalogue (ETKA)

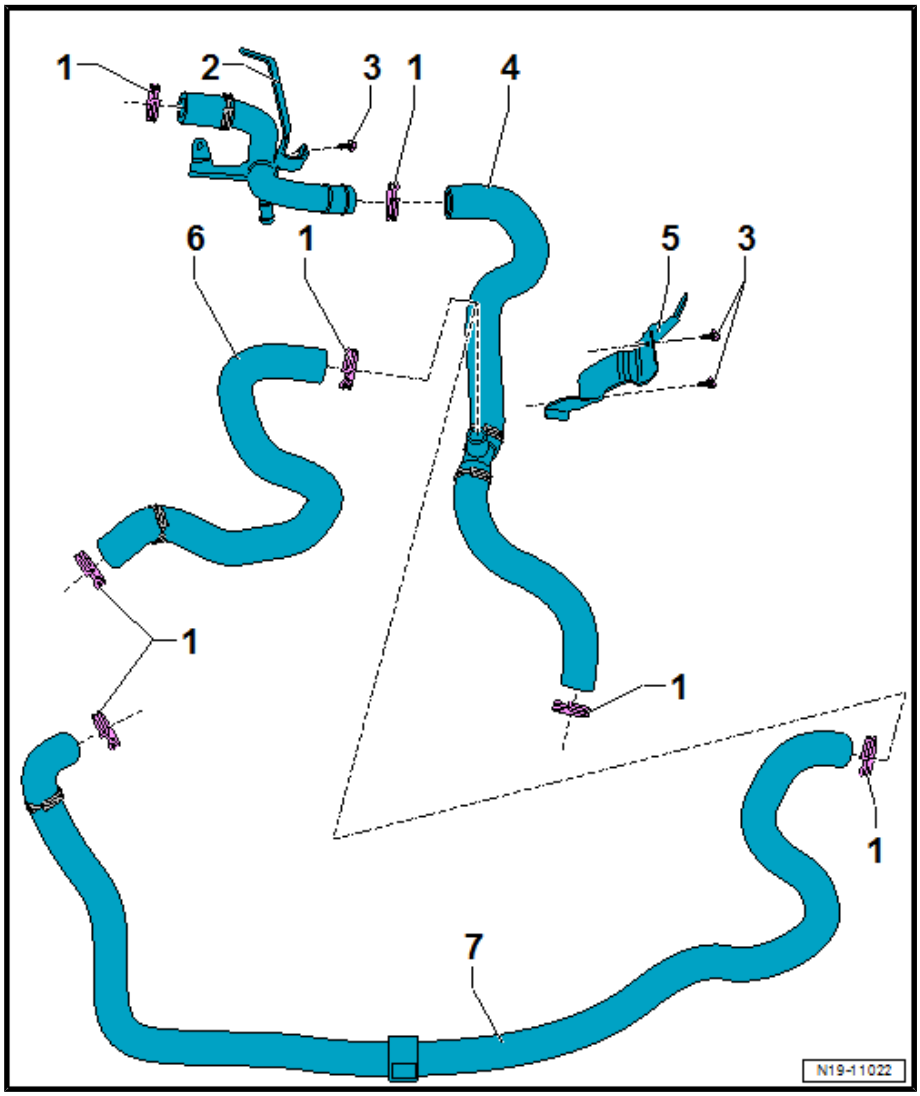
5 - Bracket

6 - Coolant hose

- ❑ One-piece water jacket ⇒ page 199
- ❑ Refer to ⇒ Electronic Parts Catalogue (ETKA)

7 - Coolant hose

- ❑ Two-piece water jacket ⇒ page 199
- ❑ Refer to ⇒ Electronic Parts Catalogue (ETKA)

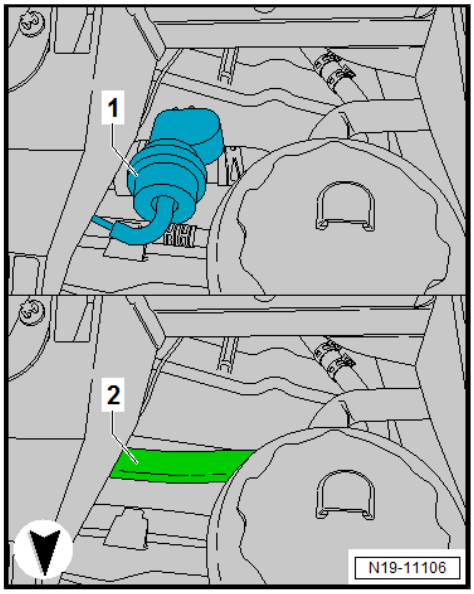


Distinguishing features of one-piece and two-piece water jackets

Note

The vacuum valve -1- and the coolant hose -2- are located below the power steering reservoir.

- One-piece water jacket: vacuum valve -1- in coolant hose
- Two-piece water jacket: coolant hose -2- without vacuum valve

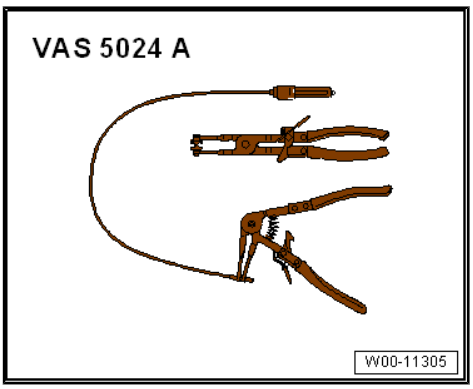


3.2 Removing and installing coolant pipe with coolant hose

Special tools and workshop equipment required

- Drip tray for workshop hoist - VAS 6208-

- Spring-type clip pliers - VAS 5024A-



Removing

– Remove throttle valve module - J338- ⇒ page 275 .

WARNING

When the engine is warm, the cooling system is under pressure.

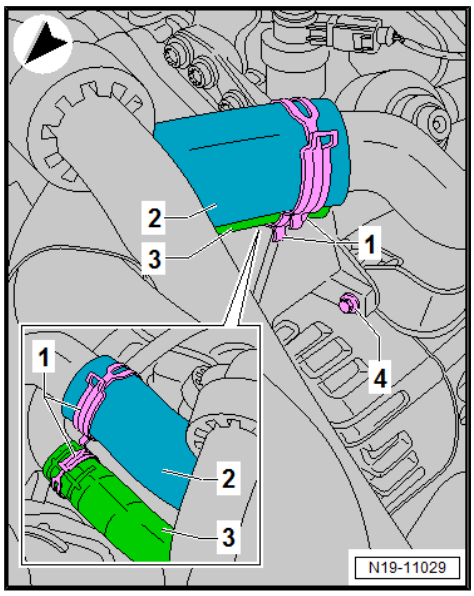
Steam or hot coolant can escape – risk of scalding.

Cover filler cap on expansion tank with a cloth and open carefully to dissipate pressure.

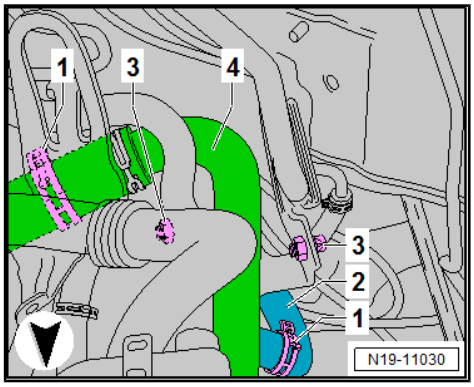
Note

Fit all cable ties at the same positions at which they were detached or cut open during removal.

– Unclip wiring harness from bracket.
– Loosen clamps -1-.
– Set drip tray for workshop hoist - VAS 6208- underneath.
– Pull off coolant hoses -2 and 3-.
– Remove bolt -4-.



– Loosen clamps -1-.



Note

The rear bolt -3- is difficult to access. Use a hand mirror, if necessary.

– Pull off coolant hose -2-.
– Unscrew bolts -3-.
– Remove coolant pipe -4- with coolant hose.

Installing

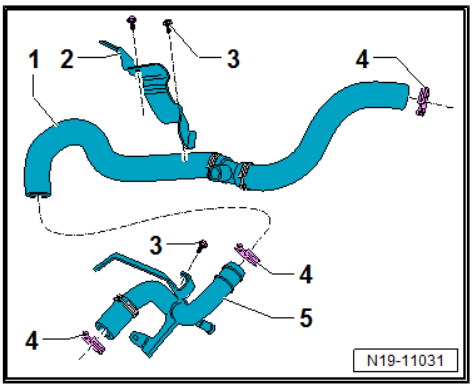
Installation is carried out in the reverse order; note the following:

Note

- *Coolant hoses without an installation marking must be routed free of stress.*
- *Install clamps at a distance of approx. 5 mm from the connecting piece.*
- *A new spacer and lower cable tie with clip must be installed; refer to ⇒ Electronic Parts Catalogue (ETKA) .*

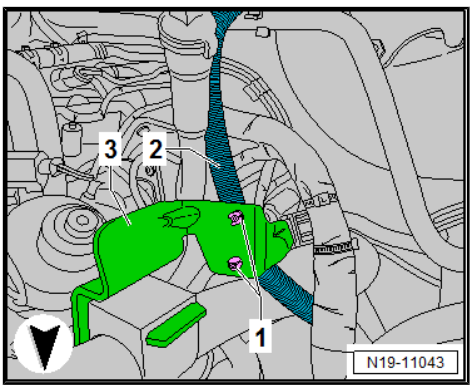
Installing coolant hose/coolant pipe:

Refer to ⇒ Electronic Parts Catalogue (ETKA) . If the coolant pipe/coolant hose have been renewed, the coolant hose ⇒ Item 6 (page 198) or ⇒ Item 7 (page 198) must be renewed as well.



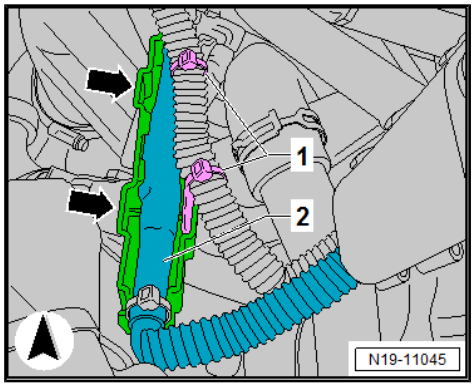
Installing alternator wiring harness to bracket

– Secure cable tie with clip -1- to alternator wiring harness -2-.
– Then, secure clips -1- to bracket -3-.



Installing alternator wiring harness to cable retainers

– In addition, the alternator wiring harness must be routed differently. To do this, use cable retainers -1- to move wiring harness -2- in area below charge air pipe from rear towards front -arrows-.



Installing spacers

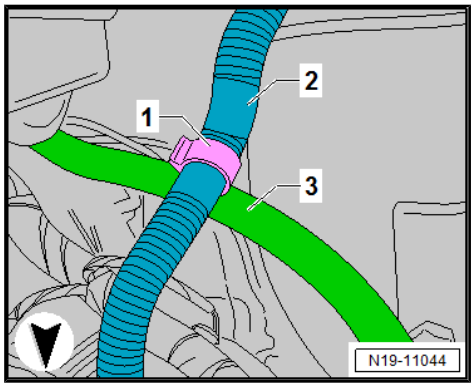
– Secure spacers -1- to alternator wiring harness -2- and vacuum pipe for brake servo -3-.

– Install throttle valve module - J338- ⇒ page 275 .

– Replenish coolant ⇒ page 179 .

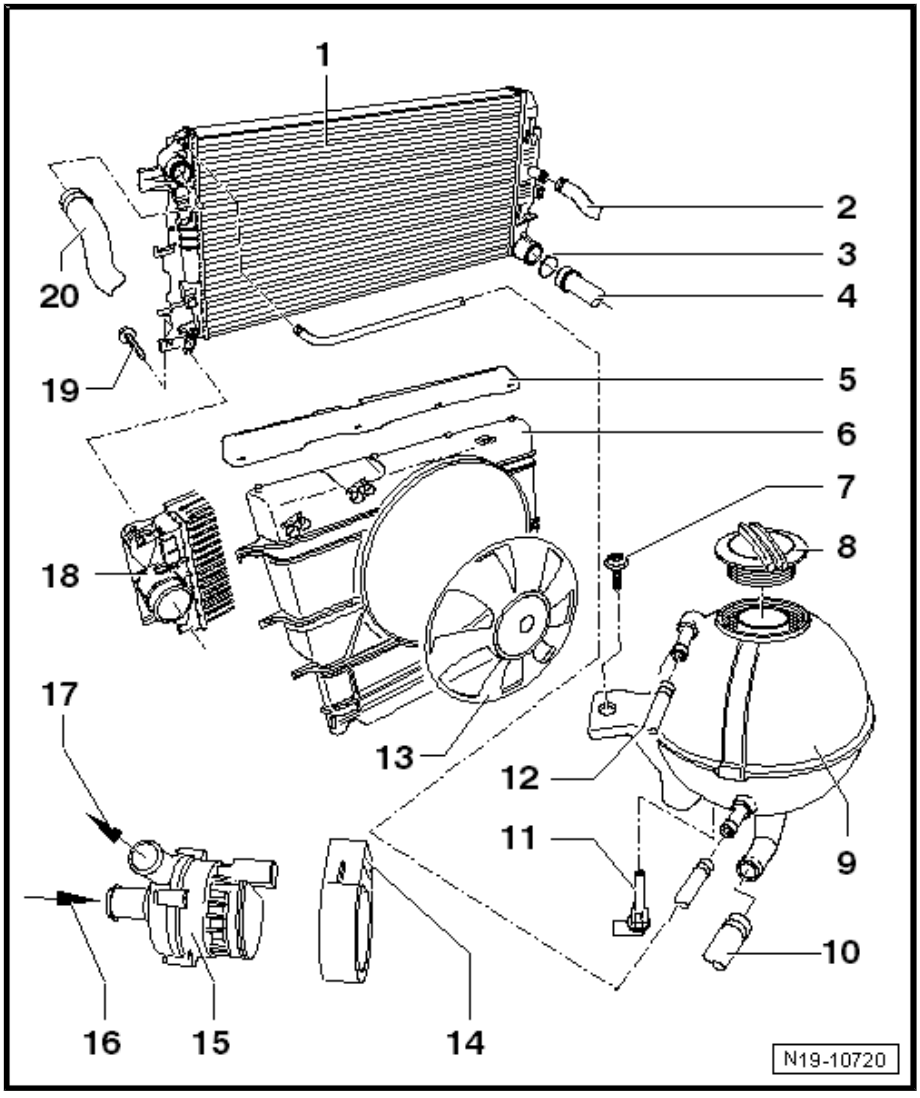
Specified torques

- ⇒ “3.1 Assembly overview - coolant pipe/coolant hose”, page 198
- ⇒ “3.1 Assembly overview - intake manifold”, page 271



4 Radiator, radiator fan

4.1 Assembly overview – radiator, radiator fan



1 - Radiator/cooler
- ❑ Removing and installing ⇒ page 208 .
- ❑ After replacing, renew entire coolant ⇒ page 179 .

2 - Coolant hose
- ❑ To pump for exhaust gas recirculation cooler - V400-

3 - O-ring
- ❑ Renew if damaged.

4 - Lower coolant hose

5 - Air duct

6 - Cowling
- ❑ Removing and installing ⇒ page 207 .

7 - Bolt
- ❑ 10 Nm

8 - Cap
- ❑ Check ⇒ page 183 .

9 - Expansion tank
- ❑ Checking cooling system for leaks ⇒ page 183 .

10 - Coolant hose

11 - Coolant shortage indicator sender - G32-

12 - Plug

13 - Viscous fan
- ❑ Removing and installing ⇒ page 205

14 - Bracket

15 - Coolant circulation pump - V50-
- ❑ Removing and installing ⇒ page 195 .

16 - From water flange.

17 - To heat exchanger for heater unit.

18 - Charge air cooler
- ❑ Removing and installing ⇒ page 253 .

19 - Bolt

- ❑ 8 Nm

20 - Upper coolant hose

4.2 Assembly overview - viscous fan

⇒ “4.2.1 Variant: A (bracket and poly V-belt pulley separate)”, page 204

⇒ “4.2.2 Variant: B (bracket with poly V-belt pulley)”, page 205

4.2.1 Variant: A (bracket and poly V-belt pulley separate)

1 - Bolt

- ❑ Renew after removing
- ❑ Left-hand thread.
- ❑ 50 Nm +90°

2 - Viscous fan

- ❑ Removing and installing ⇒ page 205 .

3 - Bolt

- ❑ 6 Nm

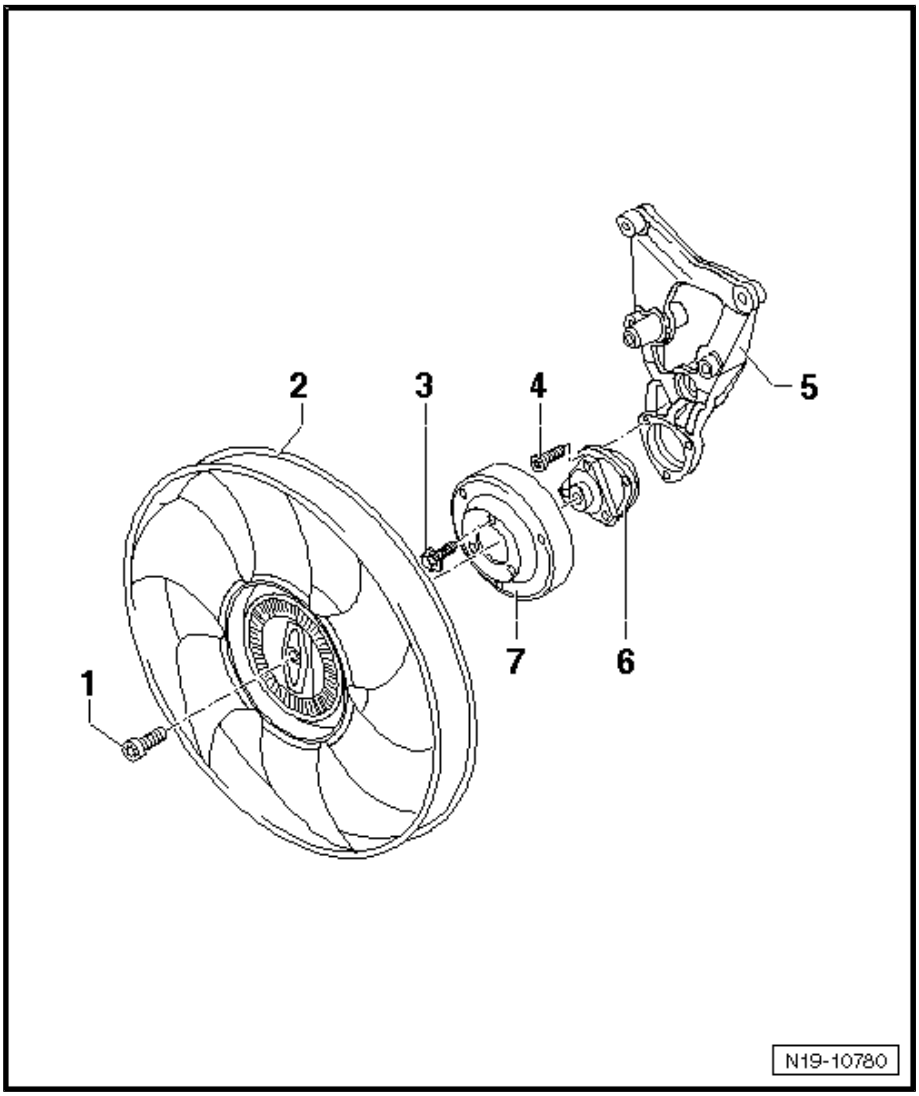
4 - Bolt

- ❑ 5 Nm

5 - `Bracket

6 - Flange shaft with bearing

7 - Poly V-belt pulley



4.2.2 Variant: B (bracket with poly V-belt pulley)

1 - Bolt
- ❑ Renew after removing
- ❑ Left-hand thread.
- ❑ 50 Nm +90°

2 - Viscous fan
- ❑ Removing and installing ⇒ page 205 .

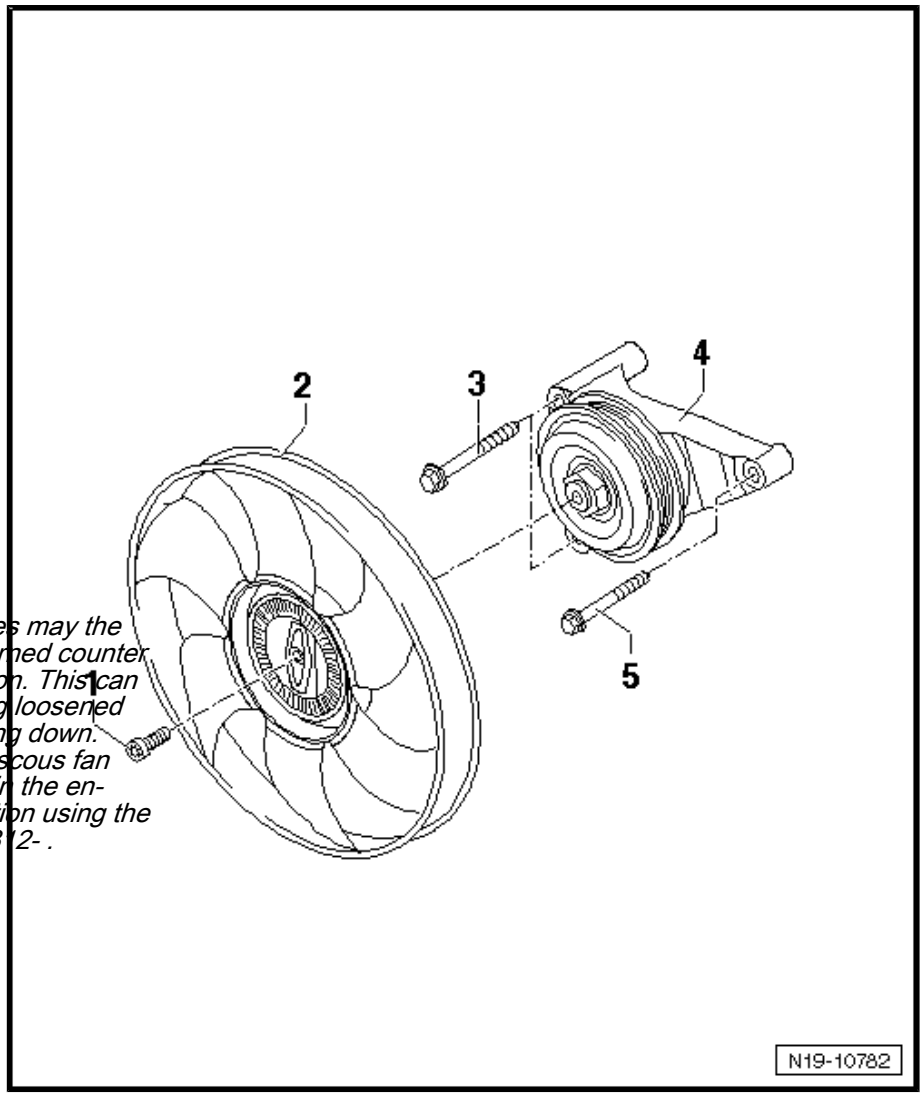
3 - Bolt
- ❑ Renew after removing
- ❑ 40 Nm +180°

4 - Bracket
- ❑ for viscous coupling
- ❑ Removing and installing ⇒ page 51 .

Note

Under no circumstances may the viscous fan shaft be turned counter to its direction of rotation. This can result in the shaft being loosened and the vehicle breaking down. When tightening the viscous fan bolt, only counterhold in the engine's direction of rotation using the open-end spanner - 3312- .

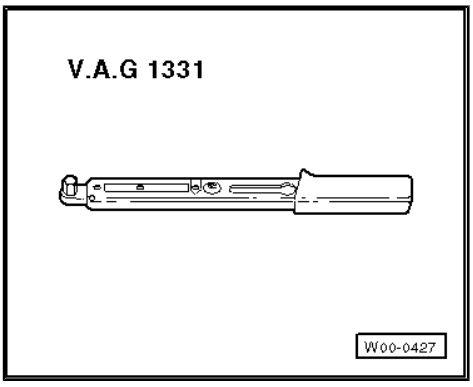
5 - Bolt
- ❑ Renew after removing
- ❑ 40 Nm +180°



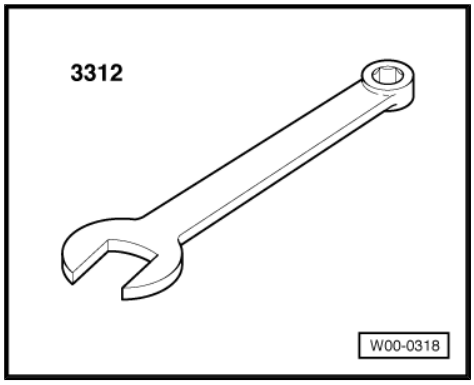
4.3 Removing and installing viscous fan

Special tools and workshop equipment required

♦ Torque wrench - V.A.G 1331-



♦ Open jaw spanner - 3312-



Removing

– Remove any noise insulation ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation .

– Remove radiator grille ⇒ General body repairs, exterior; Rep. gr. 66 .

– Remove front bumper ⇒ General body repairs, exterior; Rep. gr. 63 ; Bumpers .

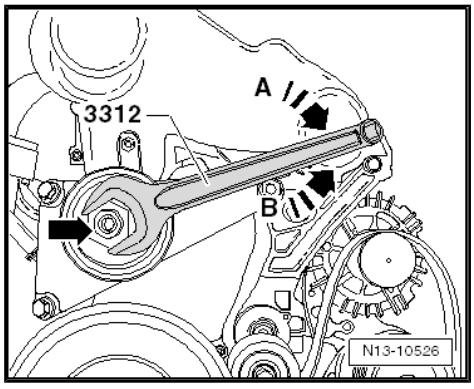
– Remove charge air cooler ⇒ page 253 .

Note

The bolt of the viscous fan has a left-handed thread!

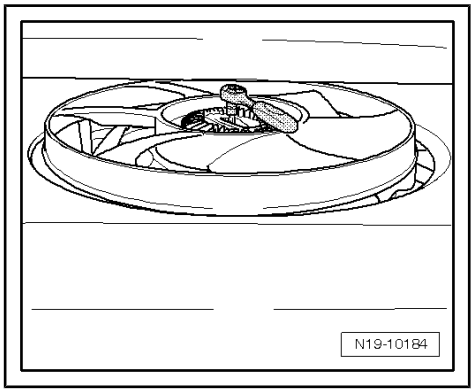
WARNING

Under no circumstances may the engine be turned counter to its direction of rotation -arrow B- at the viscous fan shaft -arrow-. This can result in the shaft being loosened and the vehicle breaking down. When tightening the viscous fan bolt, only counterhold in the engine's direction of rotation -arrow A- using the open-end spanner - 3312- .



– Loosen viscous fan . Counterhold with open jaw spanner - 3312- on shaft.

– Remove viscous fan towards front of vehicle.



Installing

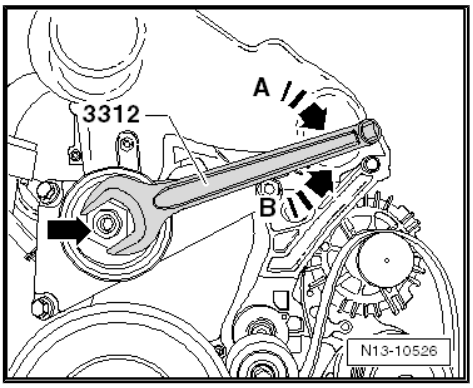
Installation is carried out in the reverse order; note the following:

WARNING

Under no circumstances may the engine be turned counter to its direction of rotation -arrow B- at the viscous fan shaft -arrow-. This can result in the shaft being loosened and the vehicle breaking down. When tightening the viscous fan bolt, only counterhold in the engine's direction of rotation -arrow A- using the open-end spanner - 3312- .

Specified torques

- ⇒ “4.2 Assembly overview - viscous fan”, page 204
- Radiator grille; Assembly overview - radiator grille ⇒ Rep. gr. 66 ; Trim parts
- Front bumper; Assembly overview - front bumper ⇒ Rep. gr. 63 ; Assembly overview - front bumper
- Noise insulation; Assembly overview - noise insulation ⇒ Rep. gr. 66 ; Assembly overview - noise insulation



4.4 Removing and installing cowling

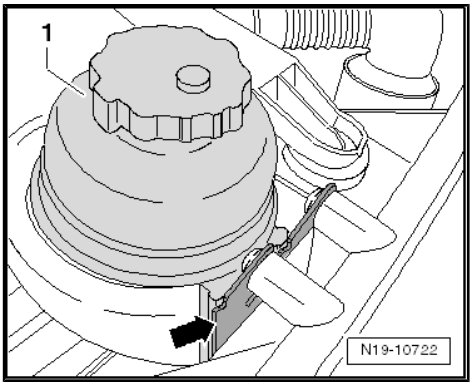
Removing

– Remove air filter ⇒ page 277 .

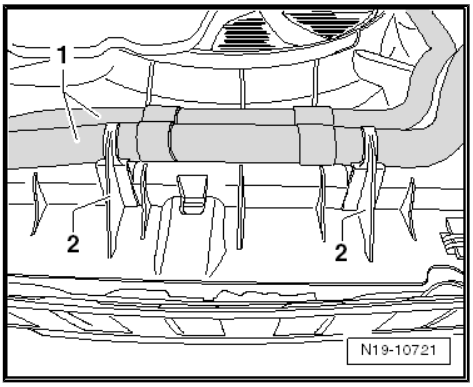
– Unclip power-assisted steering reservoir -1- from retainer -arrow- and place to one side.

– Remove any noise insulation ⇒ Front body; Rep. gr. 66 ; Noise insulation .

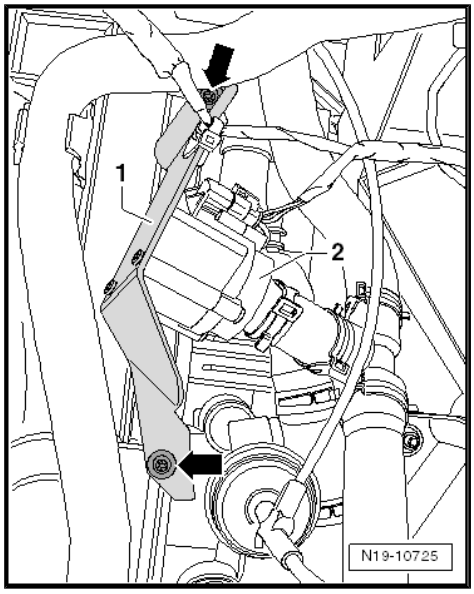
– Remove viscous fan ⇒ page 205 .



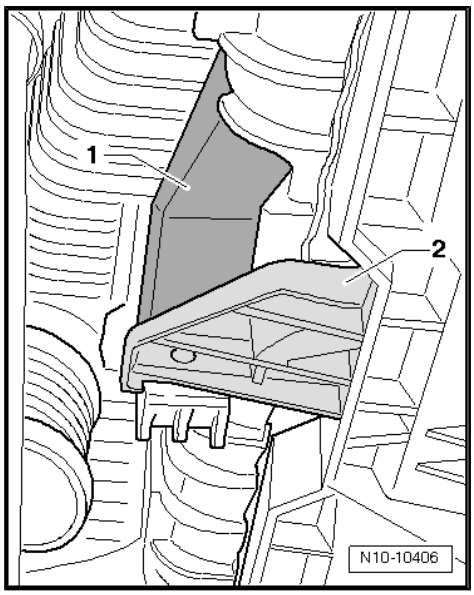
– Unclip coolant hoses -1- and remove from cowling -2-.



– Undo and remove bolts -arrows- from bracket -1- for pump for exhaust gas recirculation cooler - V400- -2-.
– Unclip all other coolant hoses and remove from cowling.



– Disengage cowling -2- at left and right. To do this, press retaining lever -1- forwards using a screwdriver and raise air ducting -2- slightly.
– Remove cowling upwards.



Installing

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

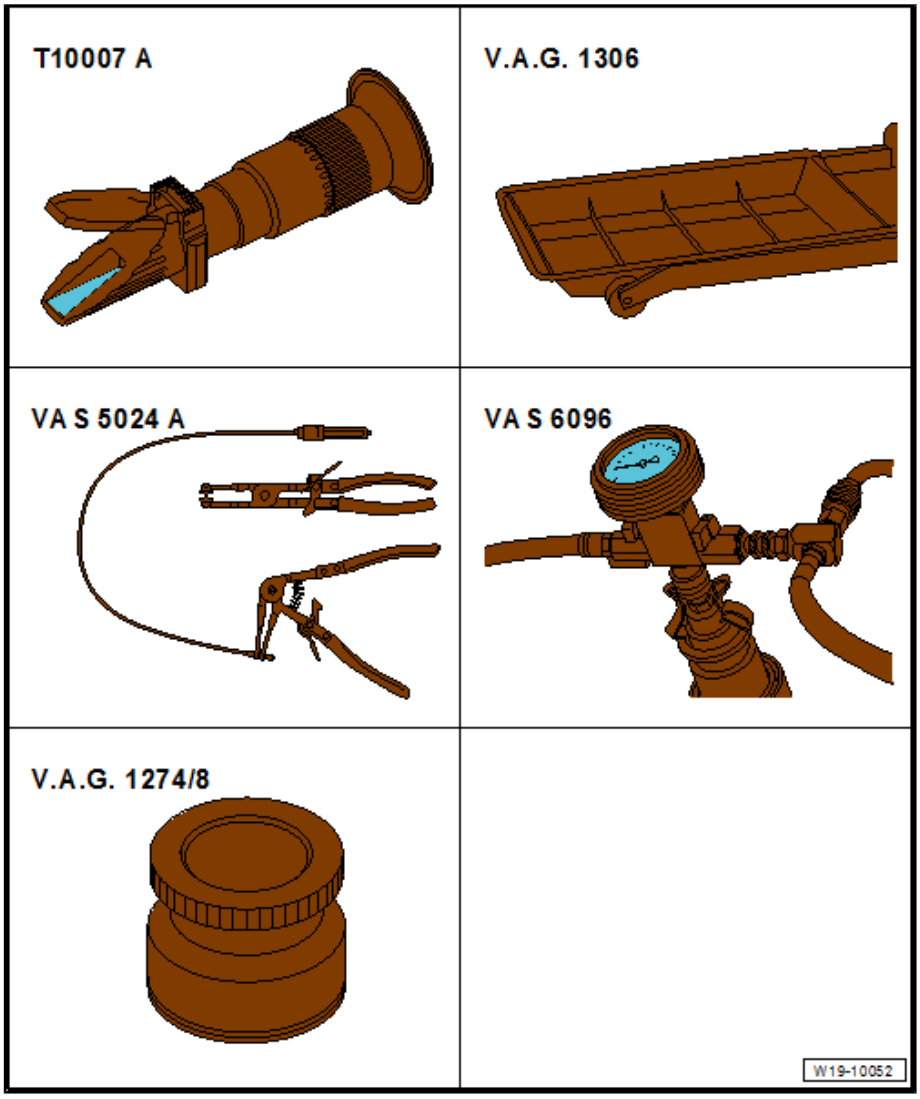
Specified torques

- ⇒ “4.1 Assembly overview – radiator, radiator fan”, page 203
- ⇒ “4.2 Assembly overview - viscous fan”, page 204
- ⇒ “4.1 Assembly overview - air filter housing”, page 276
- Noise insulation; Assembly overview - noise insulation ⇒ Rep. gr. 66 ; Assembly overview - noise insulation

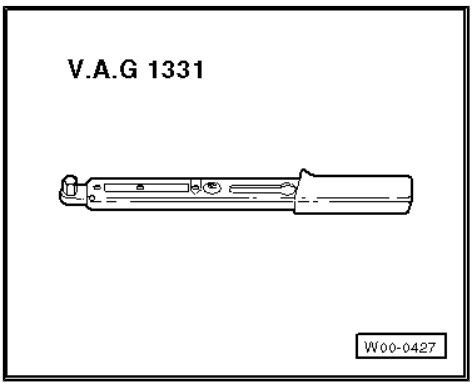
4.5 Removing and installing radiator

Special tools and workshop equipment required

- Refractometer - T10007 A-
- Drip tray - V.A.G 1306- or drip tray for workshop hoist - VAS 6208-
- Spring-type clip pliers - VAS 5024A-
- Cooling system charge unit - VAS 6096-
- Adapter for cooling system tester - V.A.G 1274/8-



Torque wrench - V.A.G 1331-



Removing

– Remove any noise insulation ⇒ General body repairs, exterior; Rep. gr. 66 ; Exterior equipment; Noise insulation .

– Drain coolant ⇒ page 179 .

– Remove air filter ⇒ page 277 .

– Remove radiator grille ⇒ General body repairs, exterior; Rep. gr. 66 .

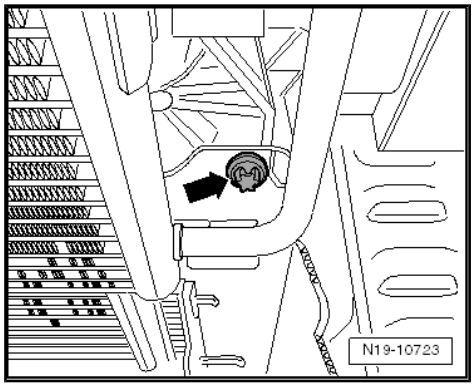
– Remove front bumper ⇒ General body repairs, exterior; Rep. gr. 63 ; Bumpers .

– If fitted, remove radiator blower housing ⇒ Air conditioning system; Rep. gr. 87 .

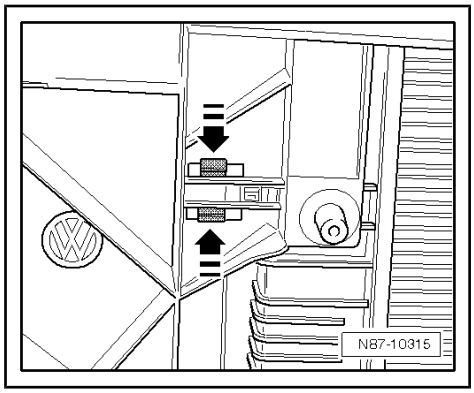
– Remove viscous fan ⇒ page 205 .

– Remove cowling ⇒ page 207 .

– Undo and remove bolts on left and right -arrow-.



– Release retaining clips -arrows- from radiator and push radiator in direction of engine compartment.



– If fitted, detach condenser from radiator and secure to the lock carrier ⇒ Air conditioning system; Rep. gr. 87 .

– Remove radiator upwards.

Installing

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

Specified torques

- ⇒ “4.1 Assembly overview – radiator, radiator fan”, page 203
- ⇒ “4.2 Assembly overview - viscous fan”, page 204
- Lock carrier; Assembly overview - lock carrier ⇒ Rep. gr. 50 ; Assembly overview - lock carrier
- Front bumper; Assembly overview - front bumper ⇒ Rep. gr. 63 ; Assembly overview - front bumper
- Radiator grille; Assembly overview - radiator grille ⇒ Rep. gr. 66 ; Trim parts
- Noise insulation; Assembly overview - noise insulation ⇒ Rep. gr. 66 ; Assembly overview - noise insulation

– Replenish coolant ⇒ page 179 .

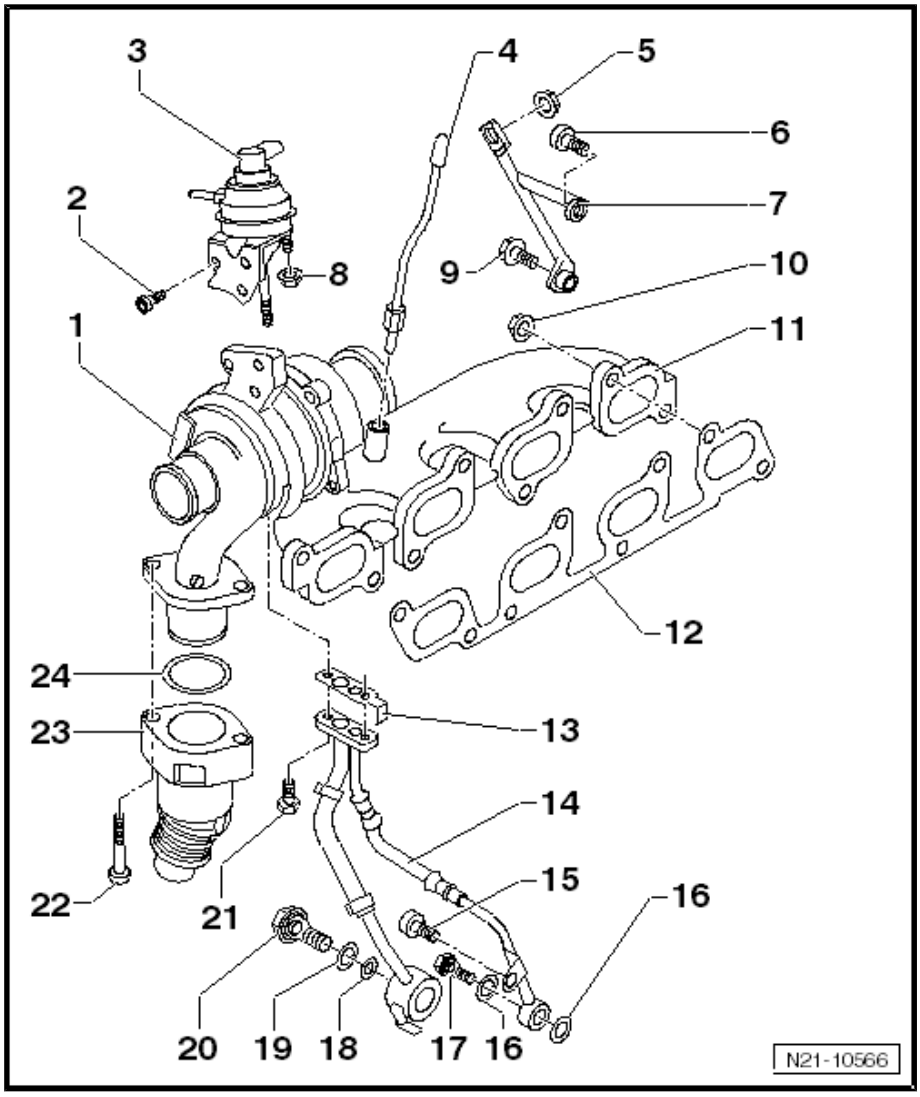
21 – Turbocharging/supercharging

1 Turbocharger

1.1 Assembly overview - turbocharger, single turbo

Note

- *Sealed bolts and nuts must not be loosened.*
- *All hose connections are secured.*
- *Charge air system must be free of leaks.*
- *Renew self-locking nuts.*
- *Before screwing on oil pressure line, fill turbocharger at union with engine oil.*
- *After installing turbocharger, allow engine to run at idling speed for about 1 minute to ensure that oil is supplied to turbocharger.*



1 - Turbocharger

- ❑ Renew complete unit only.
- ❑ Note tightening sequence and installation procedure ⇒ page 214 .
- ❑ Installation position of connecting hose at turbocharger ⇒ page 253
- ❑ Removing and installing ⇒ page 218 .

2 - Bolt

- ❑ No replacement part available

3 - Regulating flap potentiometer - G584-

- ❑ No replacement part available

4 - Exhaust gas temperature sender 1 - G235-

- ❑ Lubricate thread of sender using high-temperature paste ⇒ Electronic Parts Catalogue .
- ❑ Exhaust temperature sender 1 - G235- must not be bent or twisted when removing and installing.
- ❑ Exhaust temperature sender 1 - G235- must not contact any other component on installation.
- ❑ 45 Nm

5 - Hexagon head collar bolt

- ❑ 40 Nm

6 - Cheese-head collar bolt

- ❑ 55 Nm

7 - Support

8 - Hexagon nut

- ❑ No replacement part available

9 - Hexagon head collar bolt

- ❑ 40 Nm + 45°

10 - Hexagon nut

- ❑ Renew after removing.
- ❑ 25 Nm
- ❑ Self-locking.

- Procedure for dismantling and assembling:

♦ Position turbocharger on studs on cylinder head.

♦ First tighten nut hand-tight and then tighten firmly.

♦ Tighten turbocharger bolts in specified sequence ⇒ page 214

11 - Exhaust manifold with turbocharger

- ❑ Renew complete unit only.
- ❑ Tightening sequence ⇒ page 214 .
- ❑ Removing and installing ⇒ page 218 .

12 - Gasket

- ❑ Renew after removing.

13 - Gasket

- ❑ Renew after removing.

14 - Oil pressure line

- ❑ Supply and return lines
- ❑ Renew oil pressure line if this has been separated at the clamps or if an older style oil pressure line is installed ⇒ page 213 .

15 - Hexagon bolt

16 - Seal

- ❑ Renew after removing.

17 - Banjo bolt

- ❑ 32 Nm

18 - Seal

- ❑ Renew after removing.

19 - O-ring

- ❑ Renew after removing.

20 - Banjo bolt

- ❑ Renew after removing.
- ❑ 60 Nm

21 - Hexagon-socket cheese-head bolt

- ❑ M6 x 16
- ❑ 14 Nm

22 - Bolt

- ❑ No replacement part available

23 - Connection

- ❑ No replacement part available

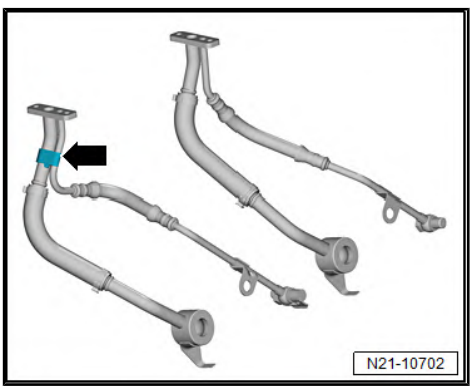
24 - Seal

- ❑ No replacement part available

Oil pressure line old/new

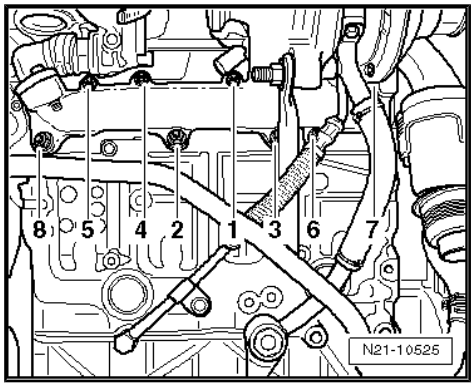
Oil pressure line with fitting -arrow- corresponds to new version (need not be replaced).

Oil pressure line with no fitting is the older version (must be replaced).



Tightening sequence and installation procedure

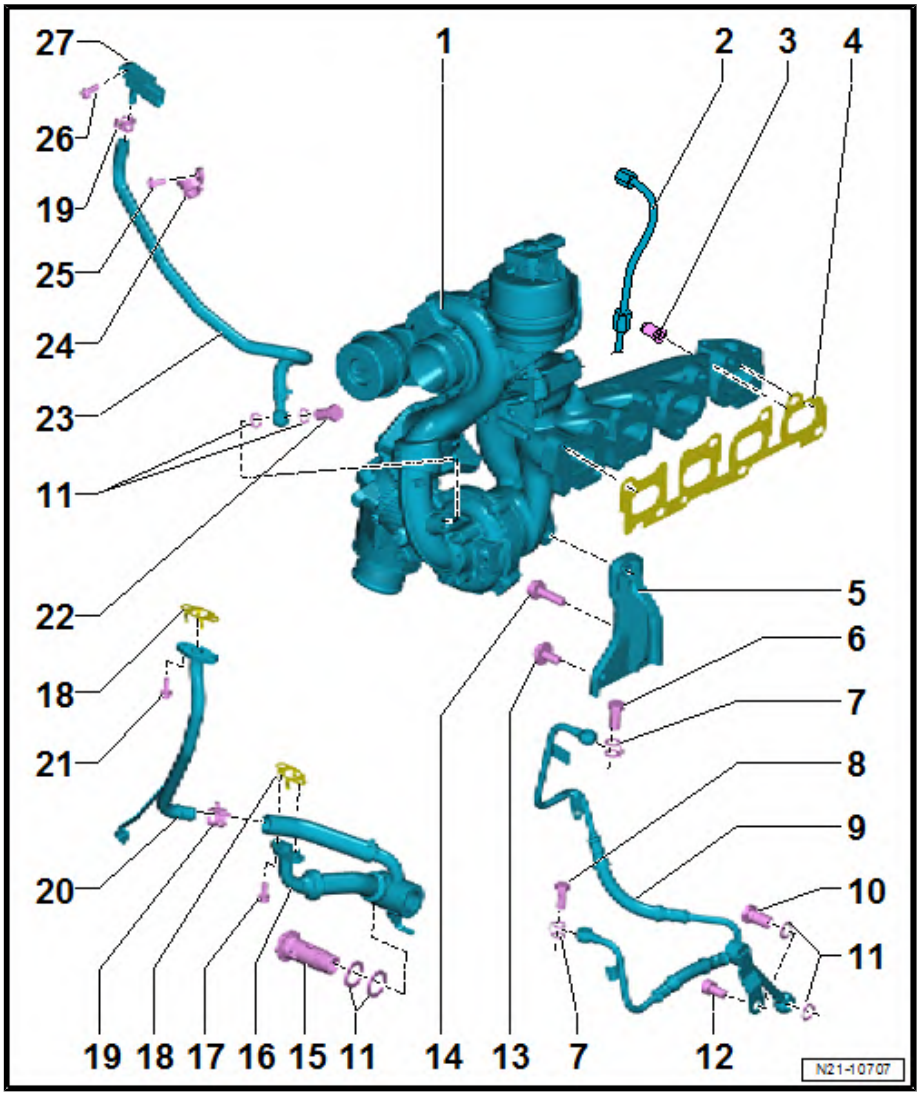
- Position exhaust manifold together with turbocharger on studs on cylinder head.
- Start nuts -1 ... 8- and tighten to 4 Nm in the sequence indicated.
- Tighten nuts -1 ... 8- to 25 Nm in the sequence indicated.
- Then, re-tighten nuts -1 ... 8- to 25 Nm in the sequence indicated.



1.2 Assembly overview - turbocharger, bi-turbo

Note

- *Sealed bolts and nuts must not be loosened.*
- *All hose connections are secured.*
- *Charge air system must be free of leaks.*
- *Renew self-locking nuts.*
- *Before securing the oil pressure line, fill turbocharger with engine oil through connecting piece.*
- *After installing turbocharger, allow engine to run at idling speed for about 1 minute to ensure that oil is supplied to turbocharger.*



1 - Exhaust manifold with turbocharger

- ❑ Renew complete unit only.
- ❑ Removing and installing ⇒ page 222 .

If the oil return line is separated at the hose clip ⇒ Item 19 (page 217) or if it is damaged, the hoses of the oil return line must be renewed.

- ❑ Check oil supply lines for damage before installing them.
- ❑ Note tightening sequence and installation procedure ⇒ page 217 .
- ❑ When turbocharger and connecting pipes are being assembled, it is essential that the correct repair set ⇒ ETKA (Electronic Parts Catalogue) is used.

2 - Exhaust gas temperature sender 1 - G235-

- ❑ Lubricate thread of sender using high-temperature paste ⇒ Electronic Parts Catalogue .
- ❑ Exhaust temperature sender 1 - G235- must not be bent or twisted when removing and installing.
- ❑ Exhaust temperature sender 1 - G235- must not contact any other component on installation.
- ❑ 45 Nm

3 - Nut

- ❑ Renew after removing.
- ❑ 24 Nm

- Tightening sequence ⇒ page 217 .
- Procedure for dismantling and assembling:

♦ Position turbocharger on studs on cylinder head.

♦ Tighten turbocharger bolts in specified tightening sequence ⇒ page 217 .

♦ Initially, tighten nut hand-tight, then tighten it completely. Then tighten bolts again to prescribed torque.

4 - Gasket

- ❑ Renew after removing.

5 - Bracket

6 - Banjo bolt

- ❑ 30 Nm

7 - Double seal

- ❑ Remember that there are various sizes
- ❑ Renew after removing.

8 - Banjo bolt

- ❑ 24 Nm

9 - Oil supply line

- ❑ For complete removal of the oil supply line, the engine supports and the starter must first be removed.

Note

- *Risk of damage when removing and installing turbocharger.*
- *Check oil supply line for damage after removing (kinks in hose). Oil supply line must be renewed if damaged.*
- *Check oil supply line for damage (kinks in hose) after installing turbocharger.*
- *Removing and installing* *⇒ page 165*

10 - Banjo bolt

- ❑ 40 Nm

11 - Seal

- ❑ Renew after removing.

12 - Bolt

- ❑ 25 Nm

13 - Bolt

- ❑ 40 Nm

14 - Bolt

- ❑ Renew after removing.
- ❑ 40 Nm

Caution

Note tightening sequence and procedure when bolting turbocharger on.

- ❑ Tightening sequence and procedure ⇒ page 217 .

15 - Banjo bolt

- ❑ 60 Nm

16 - Oil return line

Note

- *If the oil return line is separated at the hose clip* *⇒ Item 19 (page 217)* *or if it is damaged, the hoses of the oil return line must be renewed.*
- *The turbocharger is delivered with a new oil return line. When renewing the turbocharger, always use the new oil return line for the turbocharger.*

17 - Bolt

- ❑ 11 Nm

18 - Gasket

- ❑ Renew after removing.

19 - Clip

20 - Oil return line

Note

- ♦ *If the oil return line is separated at the hose clip ⇒ Item 19 (page 217) or if it is damaged, the hoses of the oil return line must be renewed.*
- ♦ *The turbocharger is delivered with a new oil return line. When renewing the turbocharger, always use the new oil return line for the turbocharger.*

21 - Bolt

- ❑ 15 Nm

22 - Banjo bolt

- ❑ 30 Nm

23 - Line to charge pressure sender 2 - G447-

24 - Retaining clamp

25 - Bolt

- ❑ 9 Nm

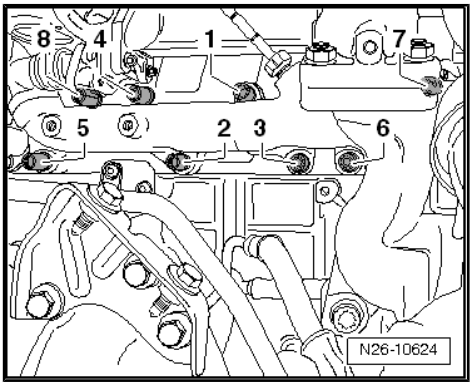
26 - Bolt

- ❑ 3 Nm

27 - Charge pressure sender 2 - G447-

Tightening sequence and installation procedure

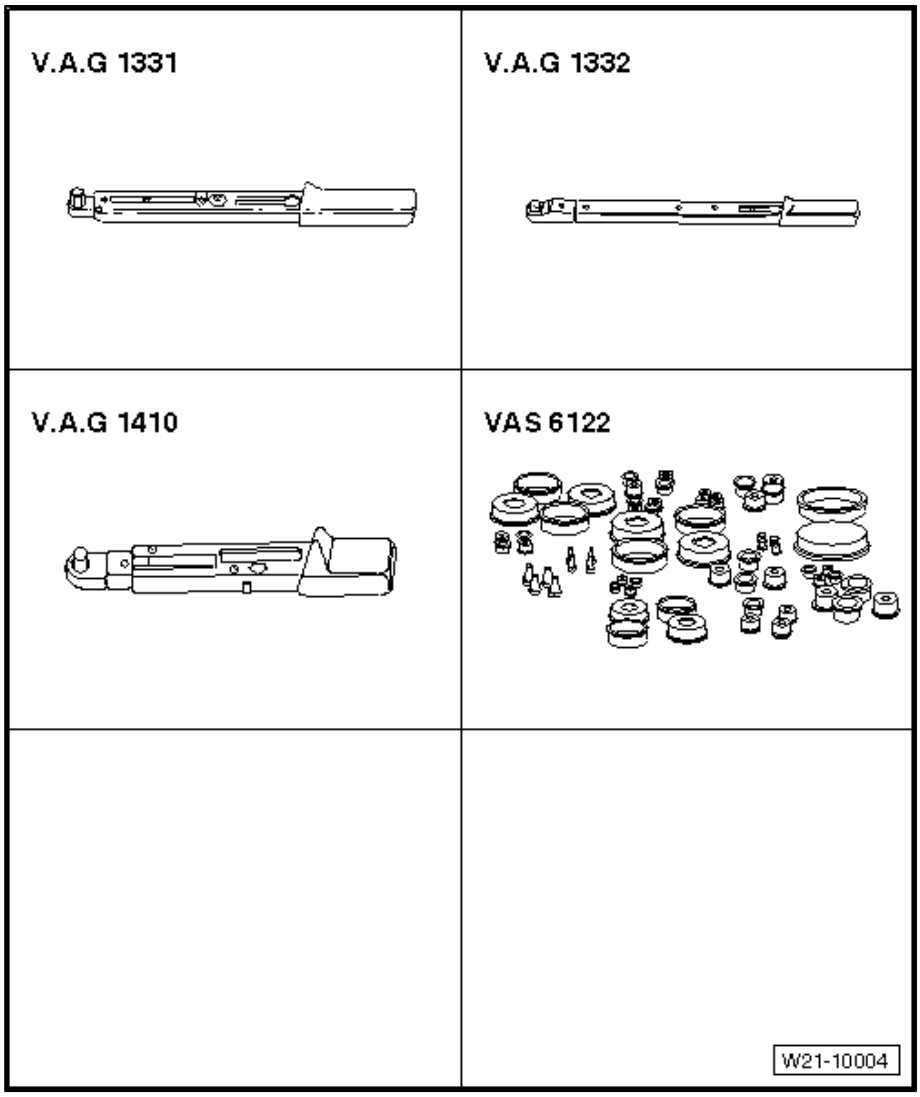
- ♦ Position exhaust manifold together with turbocharger on studs on cylinder head.
- ♦ Only screw bolt ⇒ Item 14 (page 216) loosely into turbocharger.
- ♦ Tighten nuts -1- to -8- to 25 Nm in specified sequence. Then tighten nuts to 25 Nm again in specified sequence.
- ♦ Tighten bolt ⇒ Item 14 (page 216) .



1.3 Removing and installing turbocharger, single turbo

Special tools and workshop equipment required

- Torque wrench (5…50 Nm) - V.A.G 1331-
- Torque wrench (40…200 Nm) - V.A.G 1332-
- Torque wrench - V.A.G 1410-
- Engine bung set - VAS 6122-



Caution

When a mechanical fault is found on the turbocharger, e.g. a destroyed compressor impeller, it is not only sufficient to renew the turbocharger. To avoid subsequent damage, the following work must be carried out:

- *Check air filter container, air filter element and intake hoses for dirt.*
- *Check the whole charge air path and charge air cooler for foreign objects.*

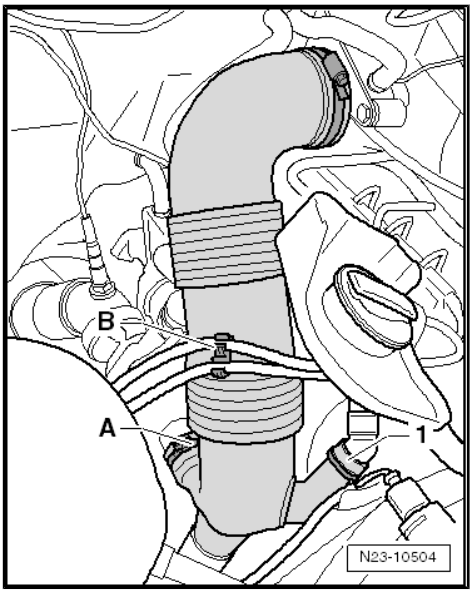
If foreign objects are found in the charge air system, the charged air routing must be cleaned and the charge air cooler must be renewed, if necessary.

Removing

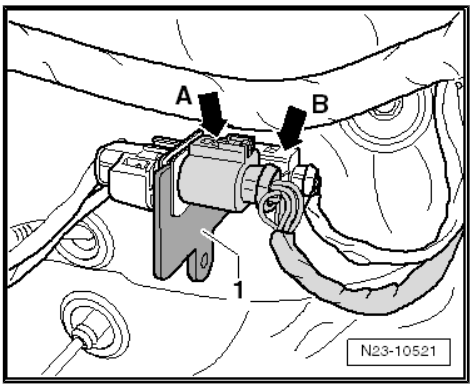
Note

- *After lines and hoses have been removed, the open connections are to be sealed immediately with a plug from the engine bung set - VAS 6122- .*
- *Only use clean plugs.*

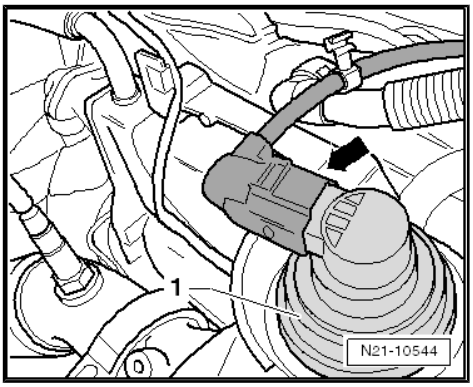
– Remove air filter housing ⇒ page 277 .
– Unclip vacuum lines-B- from retainer.
– Pull crankcase breather hose -1- off.
– Loosen clip -A- and remove intake hose.



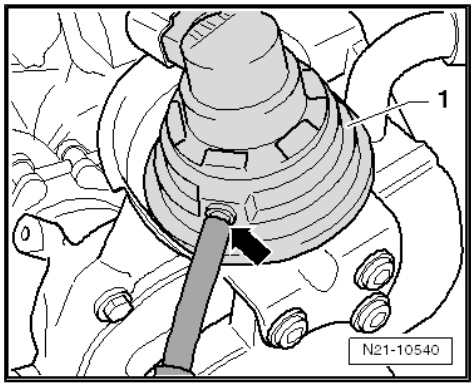
– Separate connector -arrow B- from exhaust temperature sender 1 - G235- and uncover wiring harness.



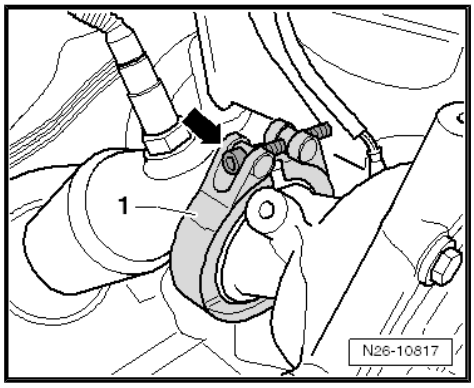
– Detach connector -arrow- from regulating flap potentiometer - G584- -1-.



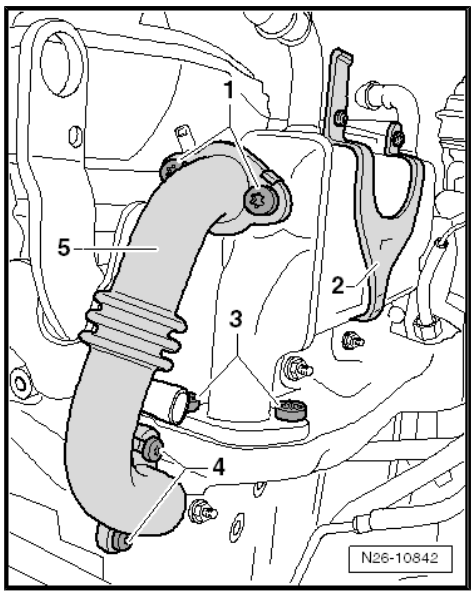
– Detach vacuum hose -arrow- from regulating flap potentiometer - G584- -1-.



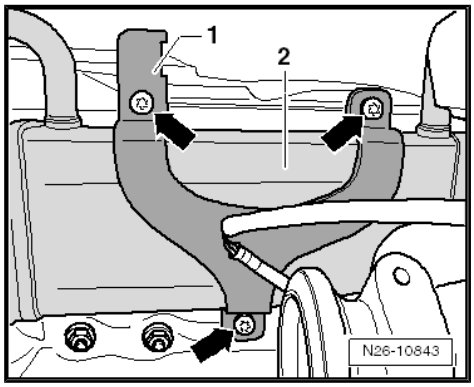
– Loosen bolt -arrow- of clamp -1- and push clamp onto particulate filter.



– Unscrew bolts -1- and -4- from connecting pipe, and remove connecting pipe -5-.
– Undo and remove bolts -3-.



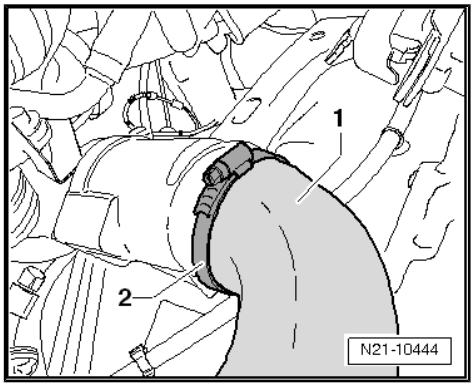
– Undo and remove bolts -arrows- from bracket -1- and remove bracket.
– Place exhaust gas recirculation cooler -2- on the engine.



Note

Coolant hoses can remain connected.

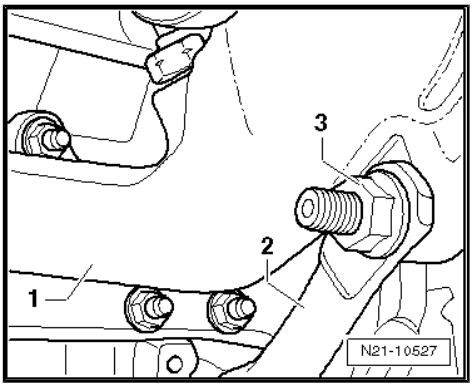
– Loosen clip -2- for connecting hose -1- and detach connecting hose from pulsation damper.



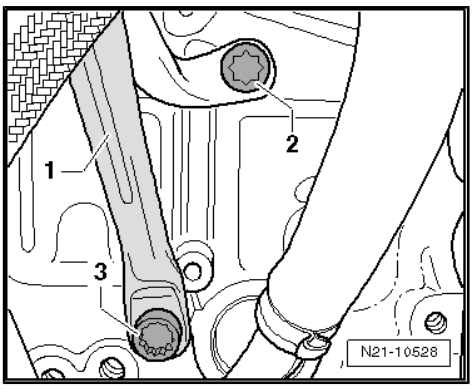
Note

Seal opening in turbocharger with clean cloths or similar.

– Undo nut -3- for support -2- of turbocharger -1-.



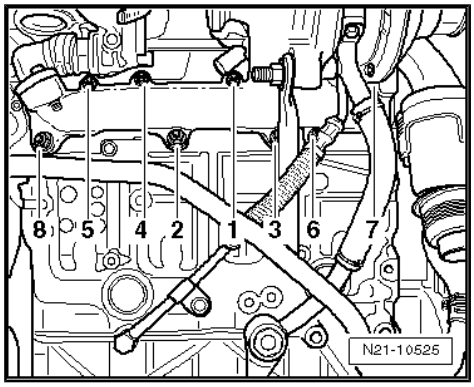
– Undo and remove bolts -2 and 3- securing support -1-.
– Unscrew bolts ⇒ Item 21 (page 213) from oil pressure line.



Note

Do not separate clamps of oil pressure line. If the oil pressure line is disconnected at the clamps, it must be renewed.

– Undo and remove nuts -1 ... 8- for exhaust manifold with turbocharger.
– Remove exhaust manifold together with turbocharger upwards.



Installing

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

– Check version of oil pressure line, renew if necessary ⇒ page 213 .

Note

- *Check pressure supply line for damage (kinks in hose) after installing turbocharger.*
- *Renew connecting pipes after each removal.*
- *Renew all gaskets, O-rings and self-locking nuts.*
- *Adhere to tightening sequence and specified procedure.*

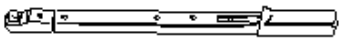
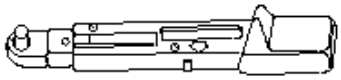
Specified torques

- ⇒ “1.1 Assembly overview - turbocharger, single turbo”, page 211
- ⇒ “4.1 Assembly overview - air filter housing”, page 276
- ⇒ “4.1 Assembly overview - exhaust gas recirculation”, page 360
- ⇒ “2.1 Assembly overview - emission control”, page 329

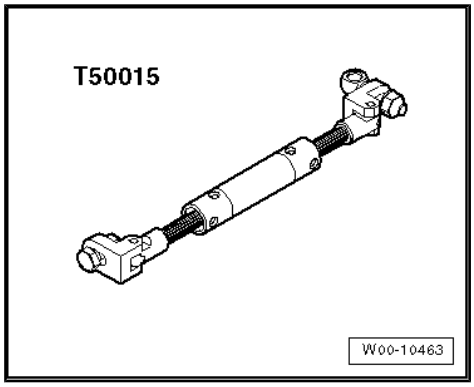
1.4 Removing and installing turbocharger, bi-turbo

Special tools and workshop equipment required

- Torque wrench (5…50 Nm) - V.A.G 1331-
- Torque wrench (40…200 Nm) - V.A.G 1332-
- Torque wrench - V.A.G 1410-
- Engine bung set - VAS 6122-

V.A.G 1331 	V.A.G 1332 
V.A.G 1410 	VAS 6122 
	W21-10004

Engine support - T50015-



Caution

When a mechanical fault is found on the turbocharger, e.g. a destroyed compressor impeller, it is not only sufficient to renew the turbocharger. To avoid subsequent damage, the following work must be carried out:

- *Check air filter container, air filter element and intake hoses for dirt.*
- *Check the whole charge air path and charge air cooler for foreign objects.*

If foreign objects are found in the charge air system, the charged air routing must be cleaned and the charge air cooler must be renewed, if necessary.

Removing

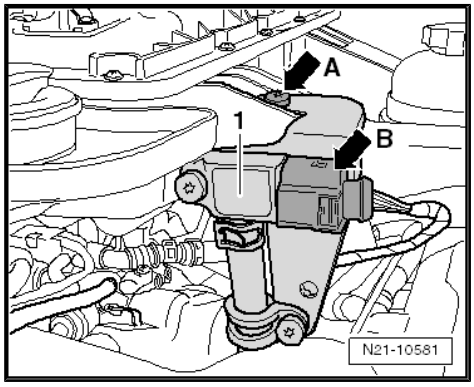
Note

- *After lines and hoses have been removed, the open connections are to be sealed immediately with a plug from the engine bung set - VAS 6122- .*
- *Only use clean plugs.*

– Detach connector -arrow B- from charge pressure sender 2 - G447- -1-.

– Unscrew bolt -arrow A-, remove charge pressure sender 2 - G447- -1- with bracket from air filter and lay aside.

– Remove air filter housing ⇒ page 277 .

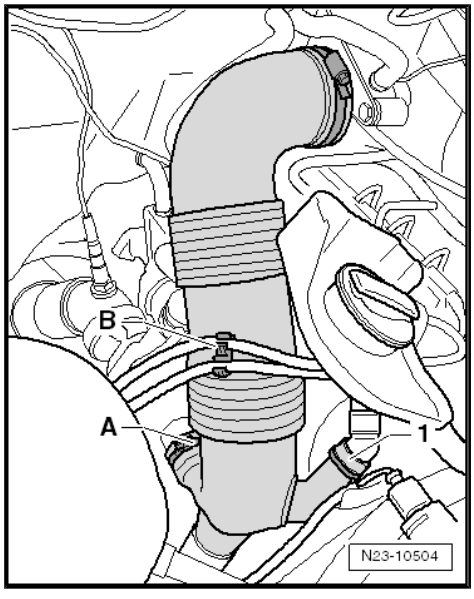


– Unclip vacuum lines-B- from retainer.

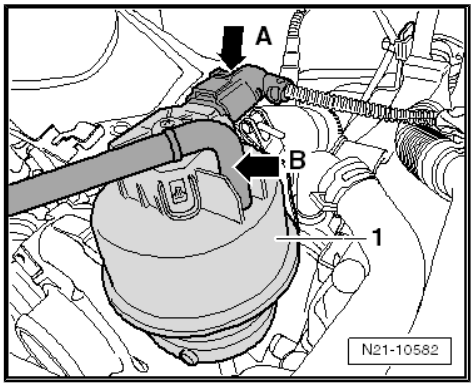
– Pull crankcase breather hose -1- off.

– Loosen clip -A- and remove intake hose.

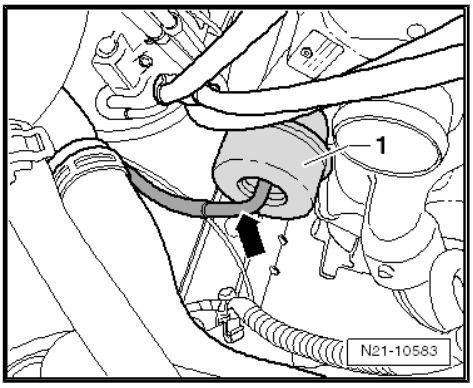
– Detach connector -arrow A- from regulating flap potentiometer - G584- -1-.



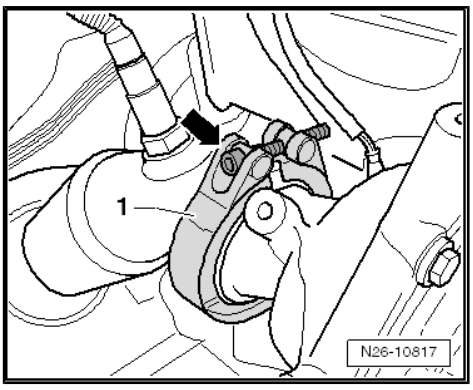
– Detach hose -arrow B- from regulating flap potentiometer - G584- -1- and place to one side.



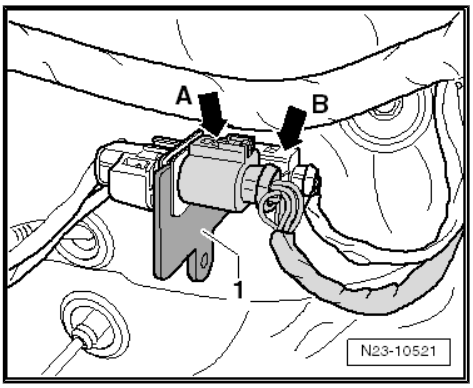
– Detach vacuum hose -arrow- from vacuum pump -1- and place to one side.



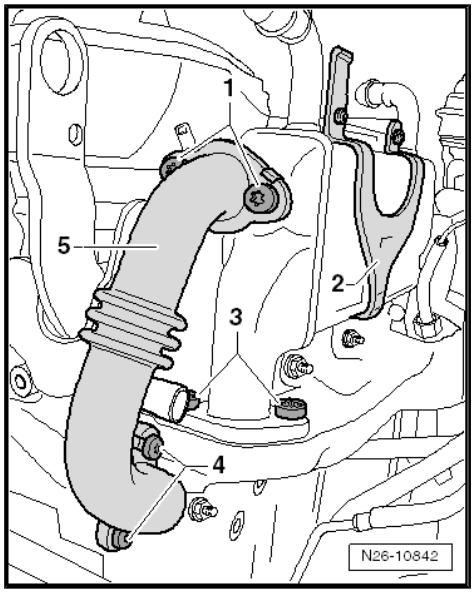
– Loosen bolt -arrow- of clamp -1- and push clamp onto particulate filter.



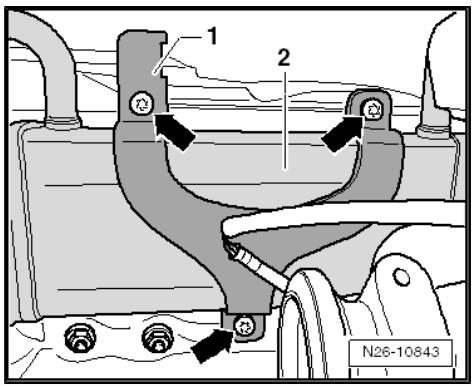
– Disconnect connector -arrow B- from exhaust temperature sender 1 - G235- and lay wiring harness to one side.



– Screw bolts -1- out of connecting pipe -5-.
– Unscrew bolts -3-.



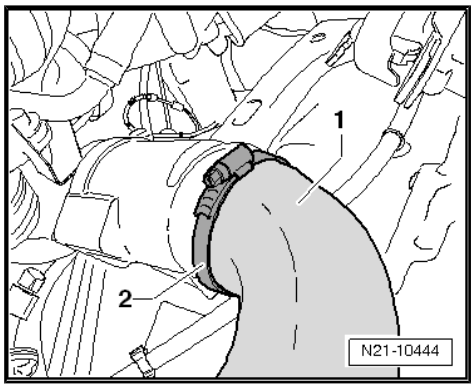
– Undo and remove bolts -arrows- from bracket -1- and remove bracket.
– Place exhaust gas recirculation cooler -2- on the engine.



Note

Coolant hoses can remain connected.

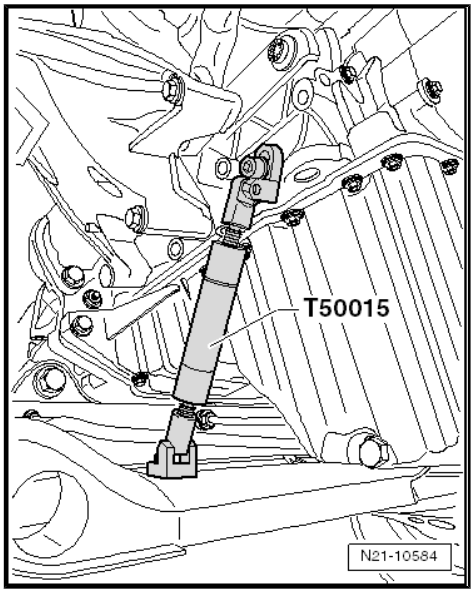
– Loosen clip -2- for connecting hose -1- and detach connecting hose from pulsation damper.



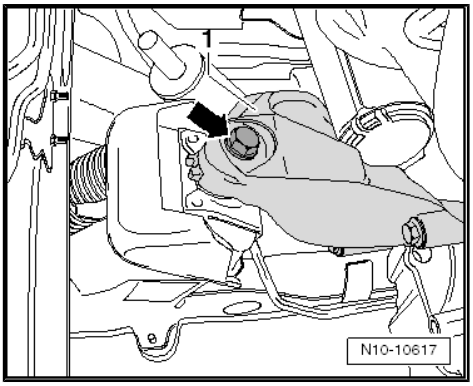
Note

Seal opening in turbocharger with clean cloths or similar.

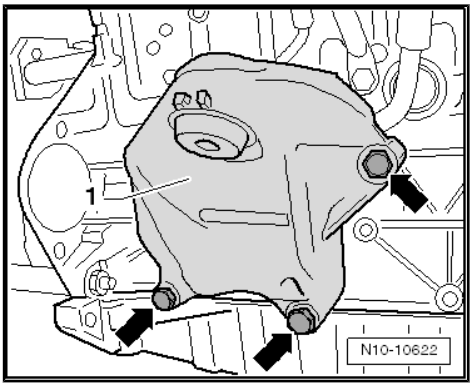
– Locate engine support - T50015- as shown and brace engine.



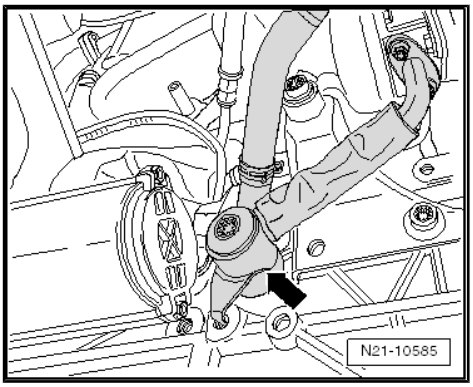
– Undo and remove bolt -arrow- from engine mount on right -1-.



– Undo and remove bolt -arrow- from engine mount on right -1- and remove engine mount.



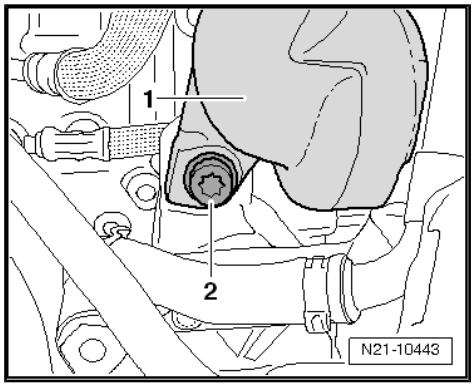
– Loosen banjo bolt -arrow-.



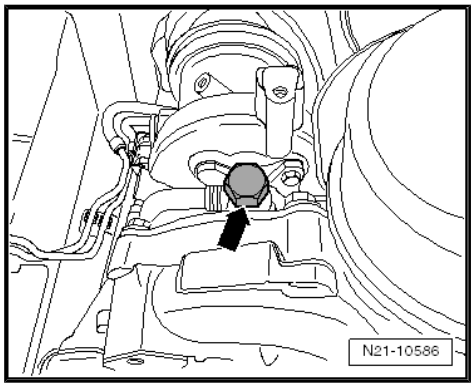
Note

- *Renew the oil return line if it is separated at the clip ⇒ Item 19 (page 217) or is damaged.*
- *The turbocharger is delivered with a new oil return line. When renewing the turbocharger, always use the new oil return line for the turbocharger.*

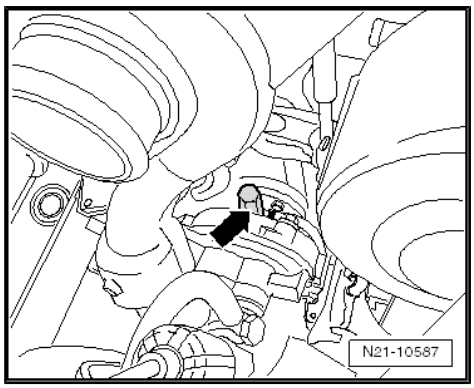
– Undo and remove bolt -2- for turbocharger -1- at lower bracket.



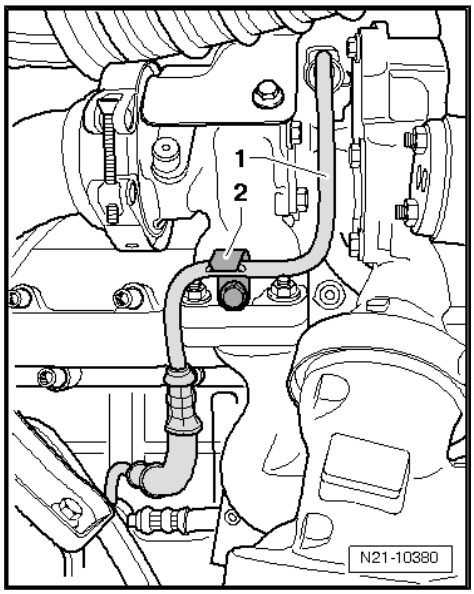
– Undo and remove banjo bolt -arrow- from top oil supply line.



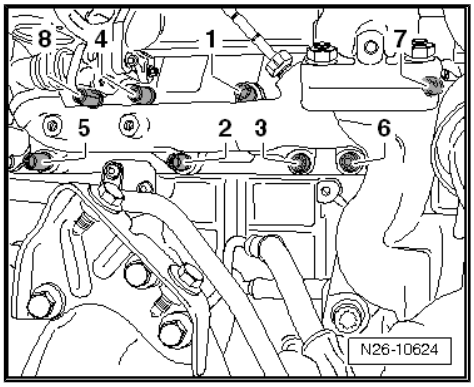
– Undo and remove banjo bolt -arrow- from bottom oil supply line.



– Unbolt bracket -2- for oil supply line -1- from turbocharger.



– Undo and remove bolts -1- to -8- for exhaust manifold with turbocharger.
– Carefully remove turbocharger with exhaust manifold upwards.



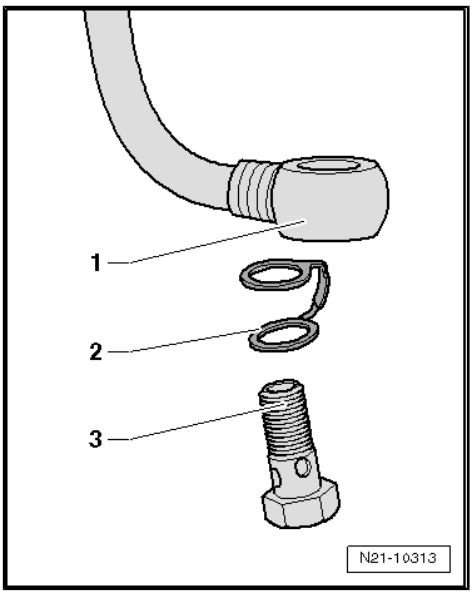
Installing

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

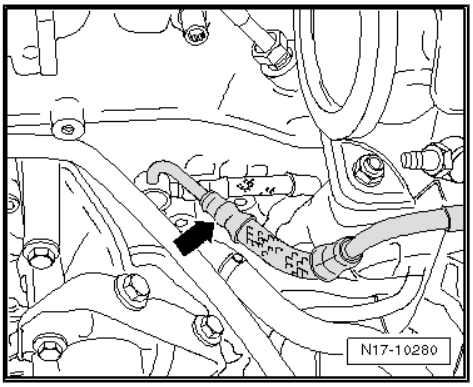
Note

- *Renew connecting pipes after each removal.*
- *Renew all gaskets, O-rings and self-locking nuts.*
- *The turbocharger is delivered with a new oil return line. When renewing the turbocharger, always use the new oil return line for the turbocharger.*

– Fit new double seal -2- onto the respective line connection -1- and secure by screwing in the corresponding banjo bolt -3-.



– Check oil supply line -arrow- for damage after installing ⇒ Item 16 (page 216) .



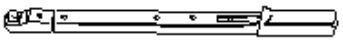
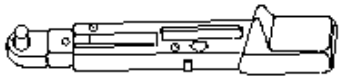
Specified torques

- ⇒ “1.2 Assembly overview - turbocharger, bi-turbo”, page 214
- ⇒ “4.1 Assembly overview - air filter housing”, page 276
- ⇒ “4.1 Assembly overview - exhaust gas recirculation”, page 360
- ⇒ “2.1 Assembly overview - emission control”, page 329
- ⇒ “2.1 Assembly overview - assembly mountings”, page 34

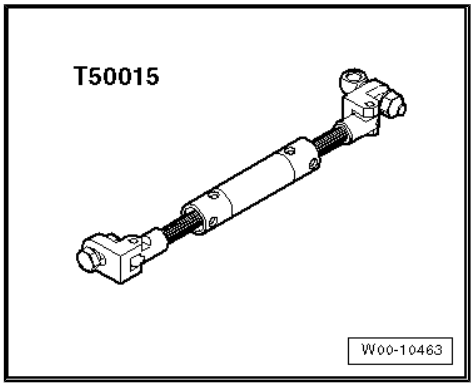
1.5 Removing and installing turbocharger, Crafter 4MOTION with Achleitner four-wheel drive

Special tools and workshop equipment required

- Torque wrench (5…50 Nm) - V.A.G 1331-
- Torque wrench (40…200 Nm) - V.A.G 1332-
- Torque wrench - V.A.G 1410-
- Engine bung set - VAS 6122-

V.A.G 1331 	V.A.G 1332 
V.A.G 1410 	VAS 6122 
	W21-10004

Engine support - T50015-



Caution

When a mechanical fault is found on the turbocharger, e.g. a destroyed compressor impeller, it is not only sufficient to renew the turbocharger. To avoid subsequent damage, the following work must be carried out:

- *Check air filter container, air filter element and intake hoses for dirt.*
- *Check the whole charge air path and charge air cooler for foreign objects.*

If foreign objects are found in the charge air system, the charged air routing must be cleaned and the charge air cooler must be renewed, if necessary.

Observe general notes on the charge air system ⇒ page 2

Observe instructions for hose connections with screw-type clips ⇒ page 12 **.**

Removing

Note

- *After lines and hoses have been removed, the open connections are to be sealed immediately with a plug from the engine bung set - VAS 6122- .*
- *Only use clean plugs.*

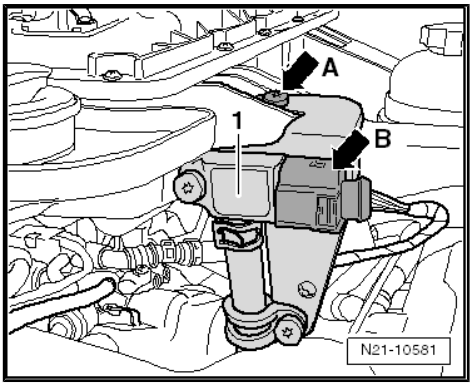
– Detach air supply unit from plenum chamber bulkhead, and move it aside slightly ⇒ Rear axle and rear final drive; Rep. gr. 39 .

– Detach connector -arrow B- from charge pressure sender 2 - G447- -1-.

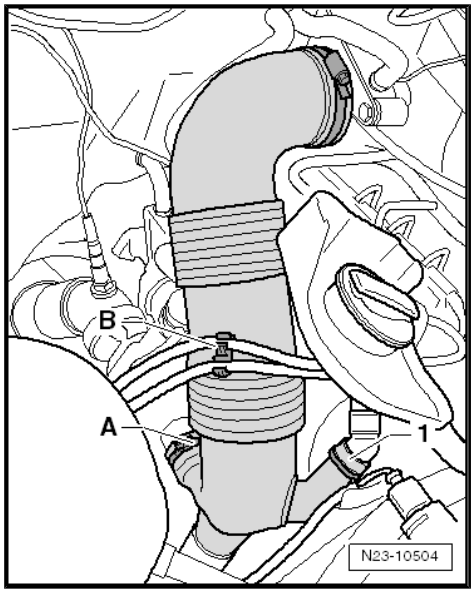
– Unscrew bolt -arrow A-, remove charge pressure sender 2 - G447- -1- with bracket from air filter and lay aside.

– Remove air filter ⇒ page 277 .

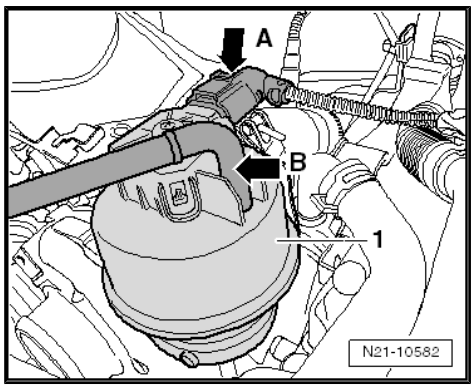
– Unclip vacuum lines-B- from retainer.



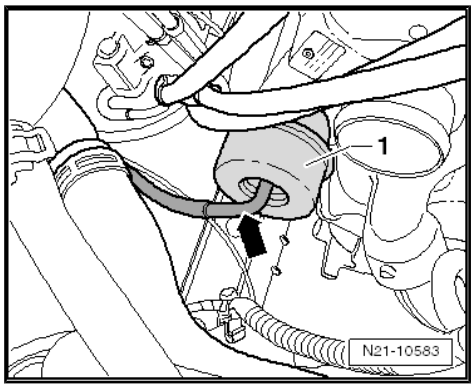
– Pull crankcase breather hose -1- off.
– Loosen clip -A- and remove intake hose.
– Detach connector -arrow A- from regulating flap potentiometer - G584- -1-.



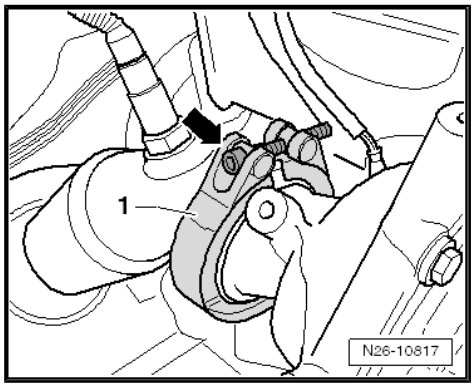
– Detach hose -arrow B- from regulating flap potentiometer - G584- -1- and place to one side.



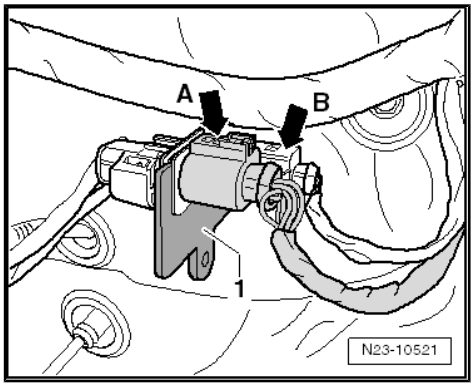
– Detach vacuum hose -arrow- from vacuum pump -1- and place to one side.



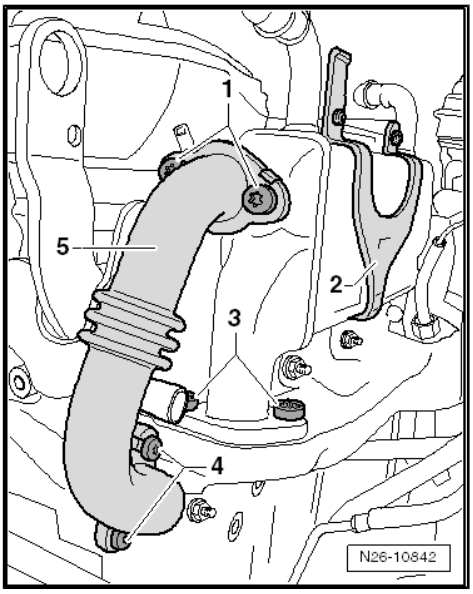
– Loosen bolt -arrow- of clamp -1- and push clamp onto particulate filter.



– Disconnect connector -arrow B- from exhaust temperature sender 1 - G235- and lay wiring harness to one side.



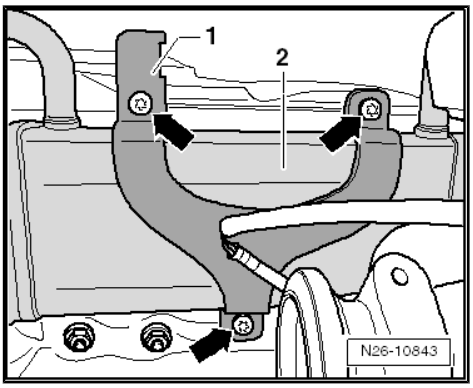
– Screw bolts -1- out of connecting pipe -5-.
– Unscrew bolts -3-.



– Undo and remove bolts -arrows- from bracket -1- and remove bracket.
– Place exhaust gas recirculation cooler -2- on the engine.

Note

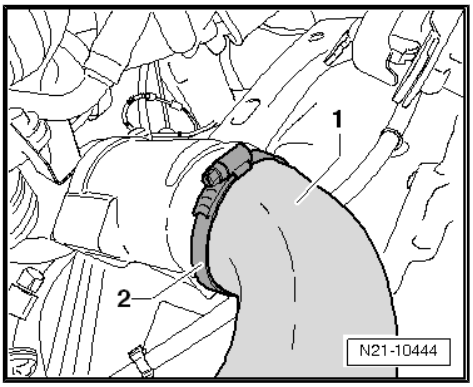
Coolant hoses can remain connected.



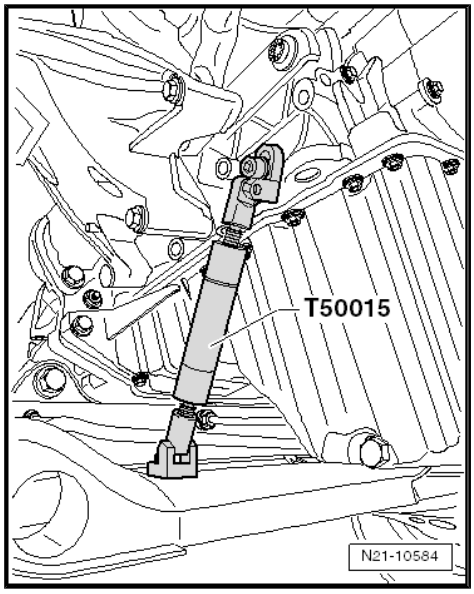
– Loosen clip -2- for connecting hose -1- and detach connecting hose from pulsation damper.

Note

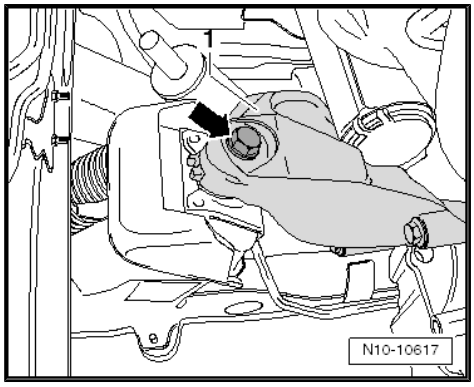
Seal opening in turbocharger with clean cloths or similar.



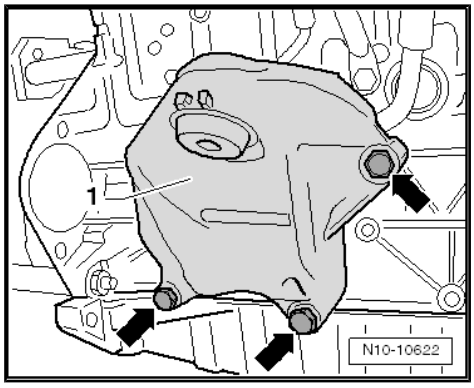
– Locate engine support - T50015- as shown and brace engine.



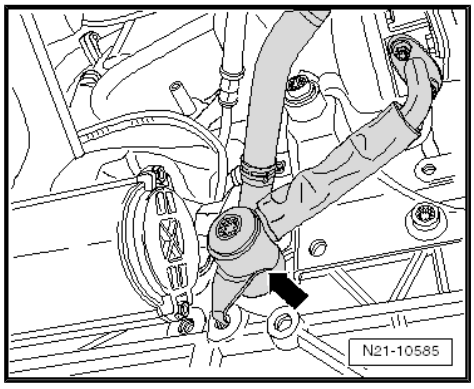
– Undo and remove bolt -arrow- from engine mount on right -1-.



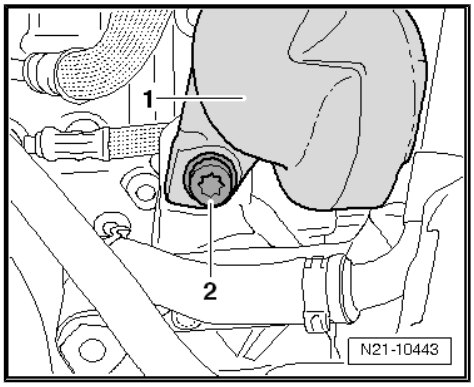
– Undo and remove bolt -arrow- from engine mount on right -1- and remove engine mount.



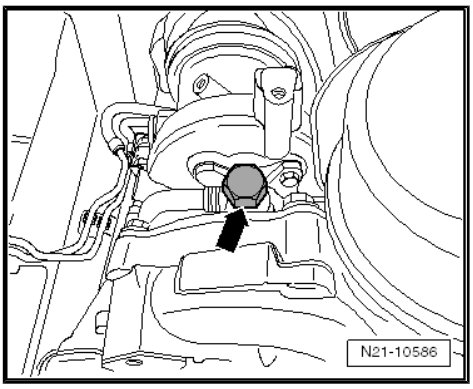
– Loosen banjo bolt -arrow-.



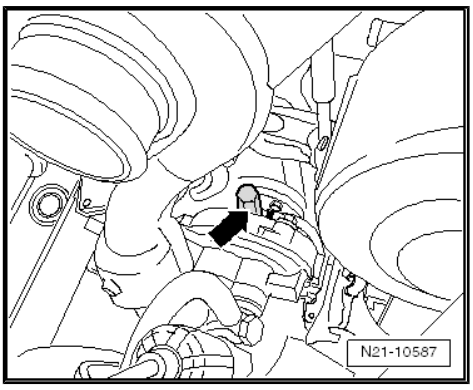
– Undo and remove bolt -2- for turbocharger -1- at lower bracket.



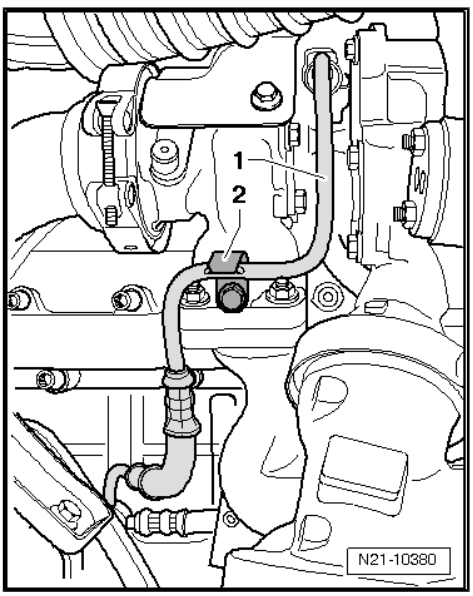
– Undo and remove banjo bolt -arrow- from top oil supply line.



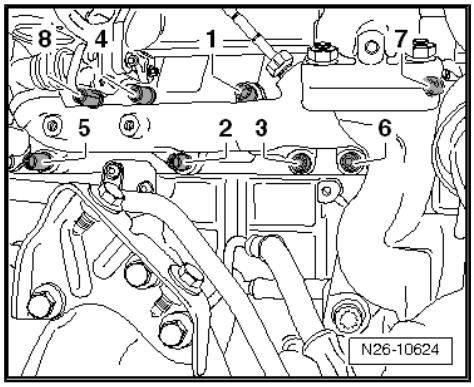
– Undo and remove banjo bolt -arrow- from bottom oil supply line.



– Unbolt bracket -2- for oil supply line -1- from turbocharger.



– Undo and remove bolts -1- to -8- for exhaust manifold with turbocharger.
– Carefully remove turbocharger with exhaust manifold upwards.



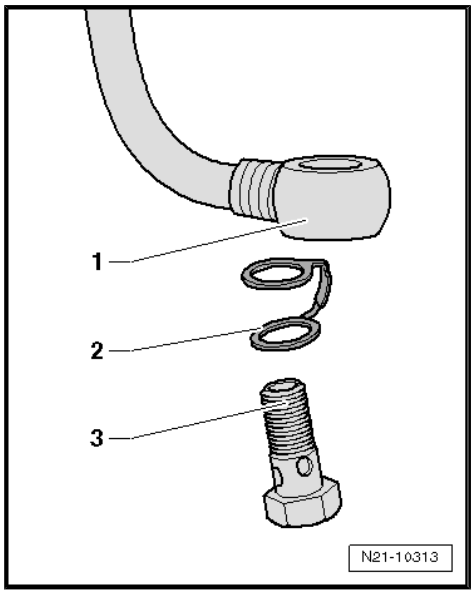
Installing

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

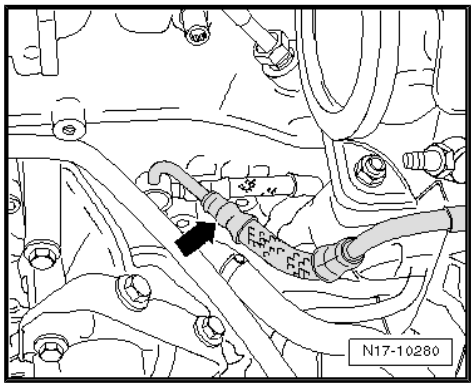
Note

- *Renew all gaskets, O-rings and self-locking nuts.*
- *Install turbocharger with new oil return line.*

– Fit new double seal -2- onto the respective line connection -1- and secure by screwing in the corresponding banjo bolt -3-.



– Check oil supply line -arrow- for damage after installing ⇒ Item 16 (page 216) .



Specified torques

- ⇒ “1.2 Assembly overview - turbocharger, bi-turbo”, page 214
- ⇒ “4.1 Assembly overview - air filter housing”, page 276
- ⇒ “4.1 Assembly overview - exhaust gas recirculation”, page 360
- ⇒ “2.1 Assembly overview - emission control”, page 329
- ⇒ “2.1 Assembly overview - assembly mountings”, page 34

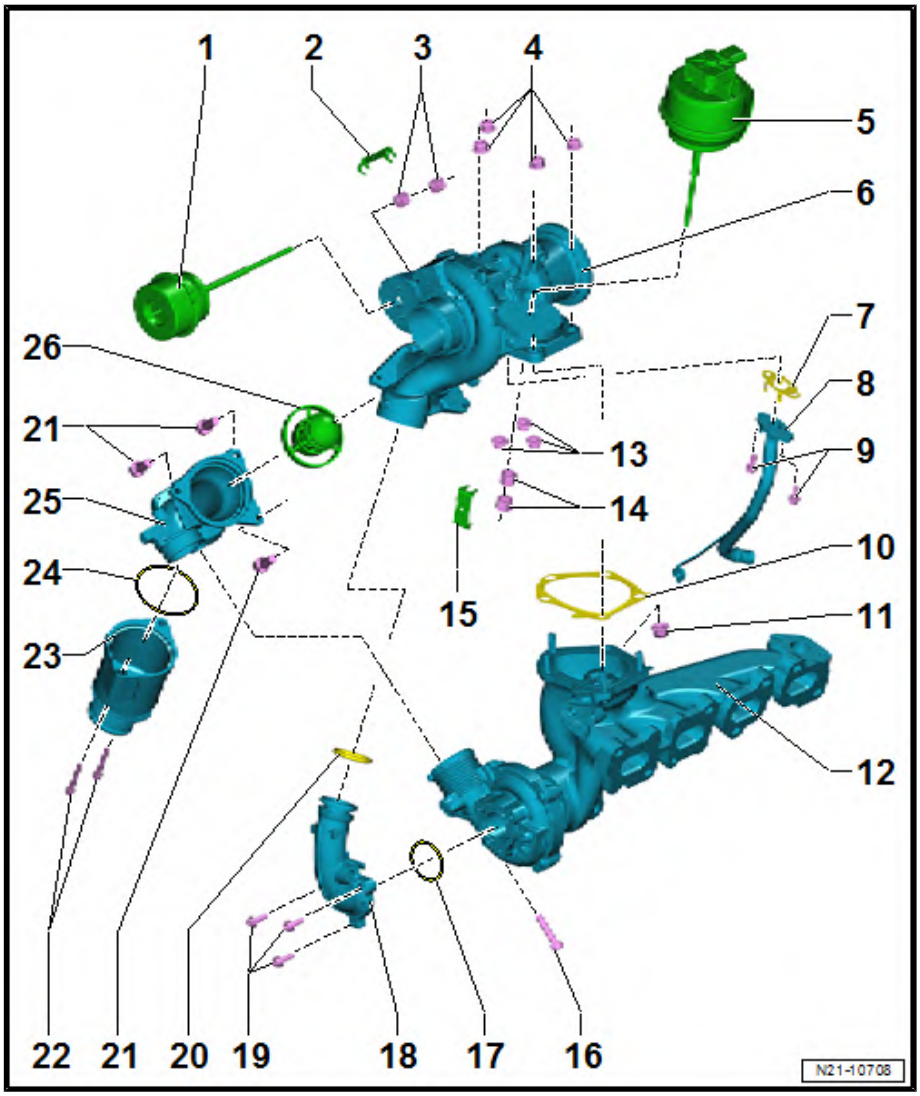
1.6 Assembly overview - turbocharger, bi-turbo, dismantling

Note

When working on the turbocharger, please note ⇒ Technical Product Information 2024785 .

Note

- *The turbocharger is removed.*
- *All hoses and oil lines have been disconnected and sealed with sealing plugs as necessary to protect them from soiling.*
- *Renew self-locking nuts.*



1 - Vacuum unit for wastegate

2 - Locking plate

3 - Nut

- ❑ 8 Nm

4 - Nut

- ❑ On flange between the stages.
- ❑ 24 Nm
- ❑ Tightening sequence: diagonal sequence

5 - Vacuum unit with regulating flap potentiometer - G584-

6 - ASSY - low-pressure turbocharger

7 - Gasket

- ❑ Renew after removing.

8 - Oil return line

9 - Bolt

- ❑ 14 Nm

10 - Gasket ⇒ page 238

- ❑ Between output stages.

11 - Nut

- ❑ On flange between the stages.
- ❑ 24 Nm
- ❑ Not installed on all versions.

12 - ASSY - high-pressure turbocharger

13 - Nut

- ❑ 8 Nm

14 - Nut

- ❑ 8 Nm

15 - Locking plate

16 - Bolt with Viton ring

- ❑ 1 Nm
- ❑ Counterlock nut with 12 Nm

17 - O-ring

18 - Connecting pipe

19 - Bolt

- ❑ 8 Nm

20 - O-ring

21 - Bolt

- ❑ 8 Nm

22 - Bolt

- ❑ 9 Nm

23 - Pulsation damper

24 - O-ring

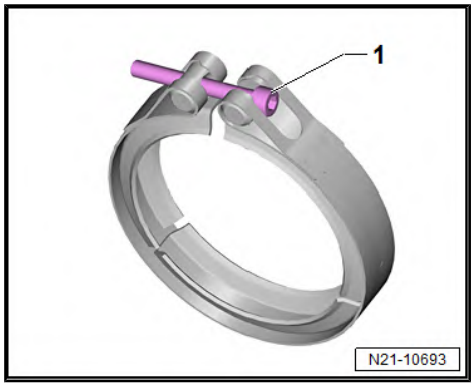
25 - Bypass

26 - Compressor bypass valve

- ❑ With two O-rings

V-band clamp

A V-band clamp (secured with bolt -1- which is tightened to 10 Nm) may be installed instead of bolts ⇒ Item 21 (page 238) .



1.7 Renewing gasket between bi-turbo turbine housings

Observe general notes on the charge air system

Observe instructions for hose connections with screw-type clips

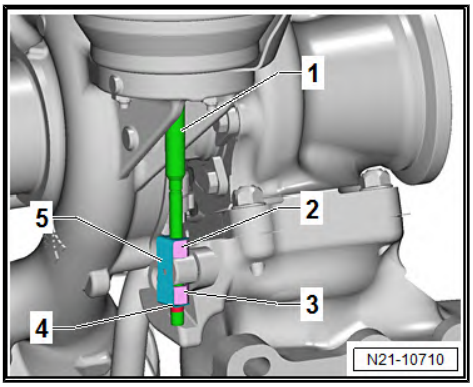
Note

When working on the turbocharger, please note ⇒ Technical Product Information 2024785 .

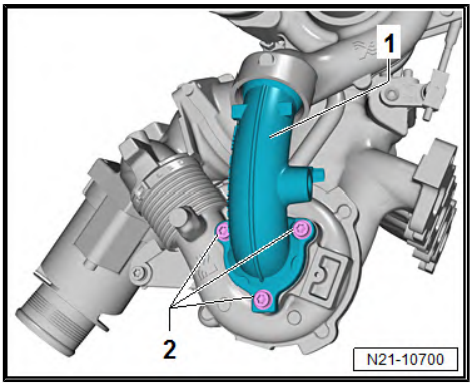
Dismantling

– Carefully release locking plate -5- on regulating rod -1- of vacuum unit with regulating flap potentiometer - G584- from the bolts with sealing paint -4- using a screwdriver or similar, and remove the locking plate.

– Remove outer nut -3- on the regulating rod -1-, break open the sealing paint and then unscrew the nut from regulating rod. Do not turn inner nut -2-!



– Unscrew the three hexagon socket head bolts -2- at the compressor inlet. Then, carefully pull off connecting pipe -1-.

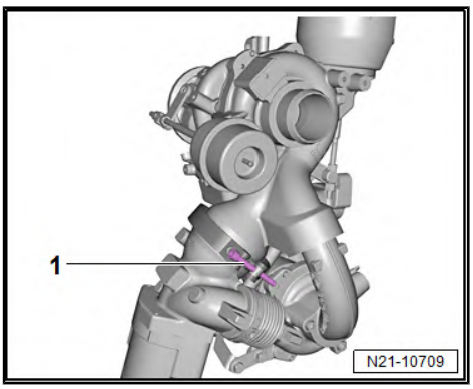


Note

When pulling the connecting pipes apart, ATE brake cylinder paste ⇒ ETKA (Electronic Parts Catalogue) can be used as a »lubricant«.

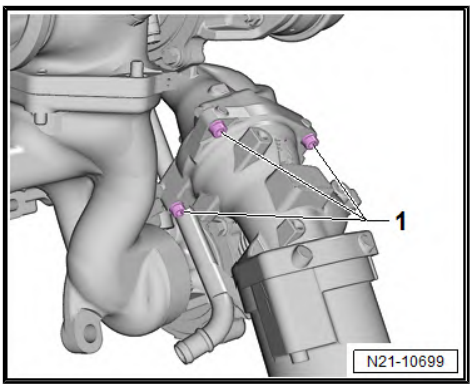
Turbochargers with V-band clamp

– Mark position of V-band clamp, and loosen bolt -1- of V-band clamp.



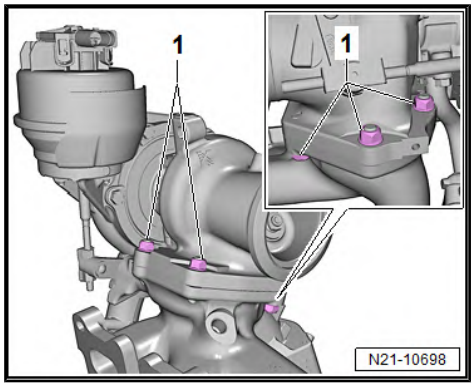
Turbochargers with bolts

– Unscrew the three bolts -1- on flange near compressor bypass valve.

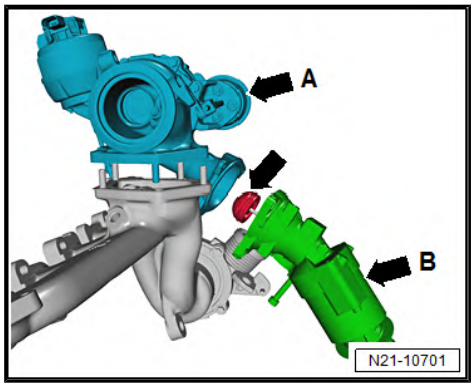


Continued for both versions

– Unscrew nuts -1- on flange between stages.



– Carefully pull apart the two components -A- and -B-. When pulling apart, pay particular attention to bypass valve -arrow-.



Caution

- ***When pulling both output stages apart, ensure that no pressure is exerted on the linkage or the pressure actuator.***
- ***When carrying the turbocharger, always hold it by the pipes and not by the actuator or the rods.***
- ***Bent linkage will impair the function of the turbocharger. Loading/stressing the actuator can damage it.***

Assembling

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

Note

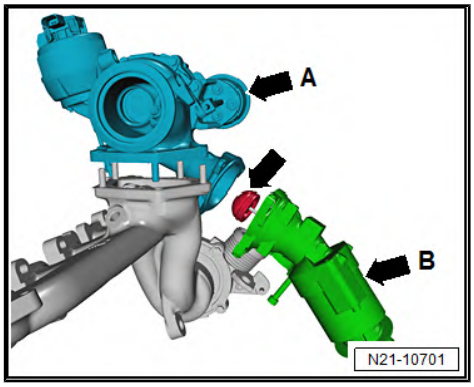
- *Renew seals and self-locking nuts.*
- *Check thoroughly whether all sealing plugs have been removed.*
- *Clean sealing surfaces.*
- *Renew studs as required.*
- *Always screw in lines initially, and then tighten them to specified torque.*
- *When fitting the connecting pipes, ATE brake cylinder paste ⇒ ETKA (Electronic Parts Catalogue) can be used as a »lubricant«.*
- *Reapply sealing lack to all positions that were broken open for removal.*
- *When assembling turbochargers, it is essential that the correct repair set ⇒ ETKA (Electronic Parts Catalogue) is used.*

Renewing studs

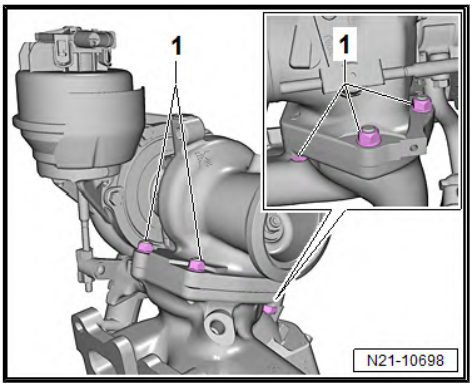
Note

- *Use a commercially available stud extractor to remove studs from flange.*
- *Note the installation location of the studs.*

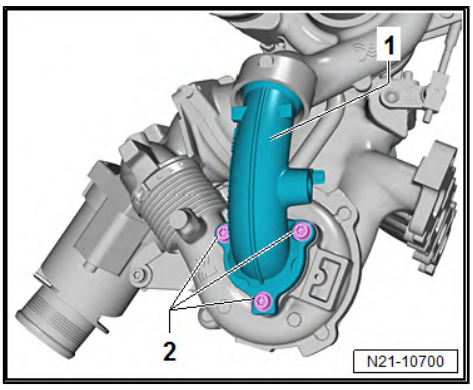
– First, fit component -A- to manifold. Then, carefully guide section -B- towards component -A-, and secure it with V-band clamp or three bolts, depending on the respective version.
– In case of a V-band clamp, make sure it is seated correctly at the position marked during removal.



– Secure both turbocharger stages by tightening self-locking nuts -1- from repair kit ⇒ ETKA (Electronic Parts Catalogue) to specified torque in specified sequence.



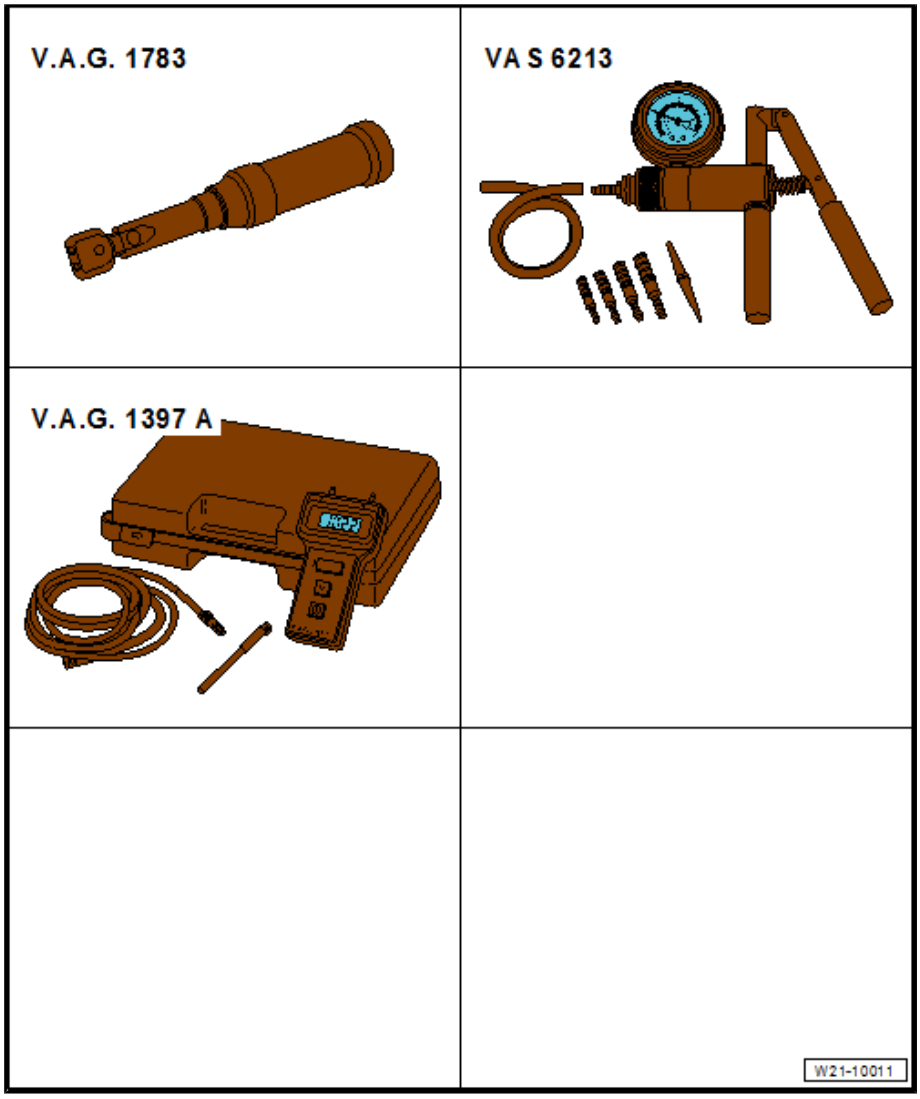
– Carefully fit connecting pipe -1-, and start the 3 bolts -2-. Then, tighten them to specified torque.



1.8 Removing and installing regulating flap potentiometer - G584-

Special tools and workshop equipment required

- Hand vacuum pump - VAS 6213- or hand vacuum pump - V.A.G. 1390- .
- Turbocharger tester - V.A.G 1397A-
- Torque wrench - V.A.G 1783- with open end spanner insert AF10 - V.A.G 1783/1-



Special tools and workshop equipment required

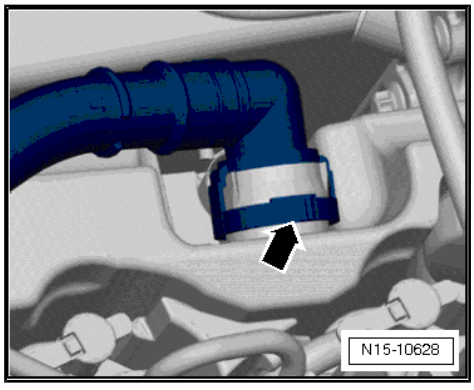
- Vehicle diagnostic tester

Note

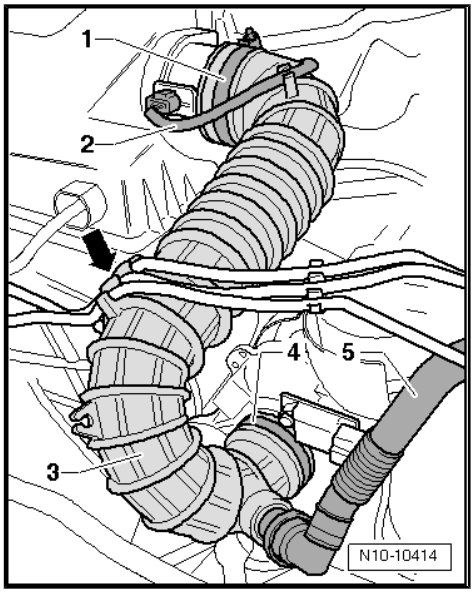
A replacement-parts kit ⇒ ETKA (Electronic Parts Catalogue) is available for replacing the regulating flap potentiometer - G584- .

Removing

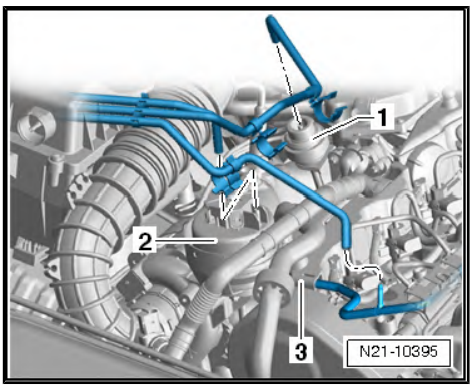
– Remove pipe -arrow- from cylinder head cover.



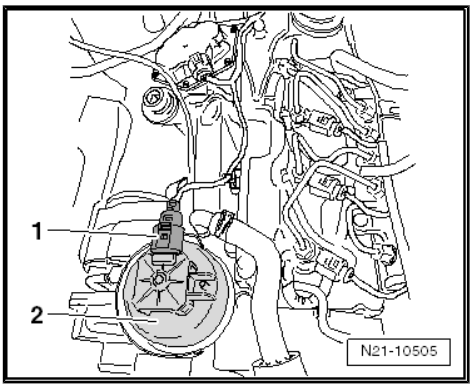
– Detach hoses from retainer -arrow- on connecting hose -3-.
– Release and pull off wiring harness connector -2-. Detach wiring harness -2- from connecting hose retainer -3-.
– Open clips -1- and -4-.
– Remove connecting hose -3-.



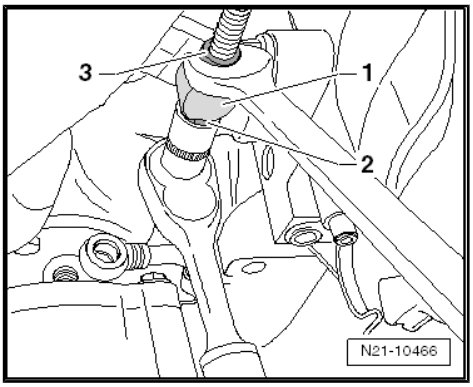
– Pull hose off regulating flap potentiometer - G584- -2-.



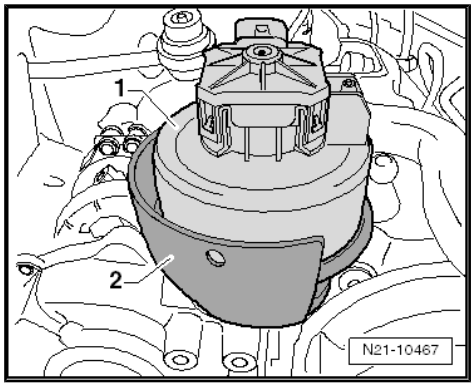
– Unclip connector -1- from regulating flap potentiometer - G584- -2-.
– Seal opening -3- of turbocharger with a suitable cover.
– Lever securing clip off control rod



– Loosen and completely remove nut -2- securing control rod.
– Counterhold lock nut -3- with open-end spanner.



– Working from below, detach regulating flap potentiometer - G584- -1- together with bracket -2- from mounting of turbocharger (3 nuts).
– Remove regulating flap potentiometer - G584- upwards together with bracket.



Installing

Caution

Use only new bolts and nuts from the replacement-parts kit if the regulating flap potentiometer - G584- is being renewed completely!

New part

– If necessary, remove lower securing nut on control rod of new regulating flap potentiometer - G584- .

Note

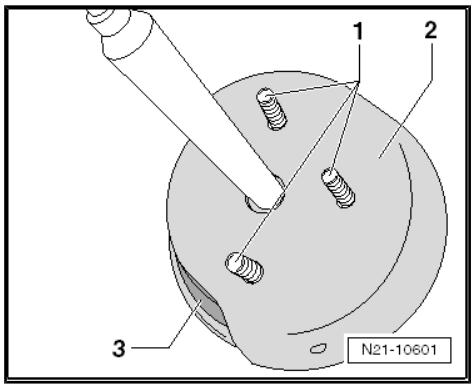
Lock nut must be screwed onto control rod.

Old part

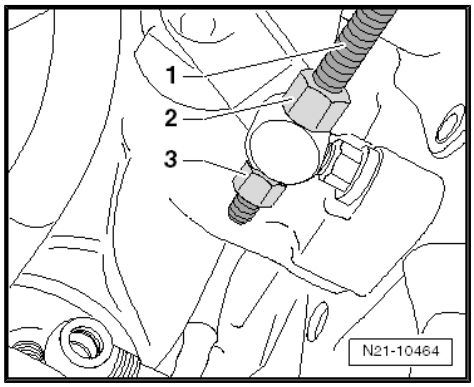
– Remove lock nut from control rod and carefully remove sealing paint from control rod completely.
– Screw new lock nut from replacement-parts kit onto control rod.

Continuation for all

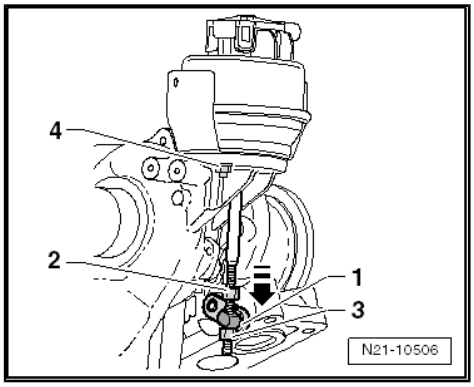
– Carefully clean contact surfaces of regulating flap potentiometer - G584- -3- and bracket -2-.
– Carefully clean mounting for regulating flap potentiometer - G584- on turbocharger.



– Install regulating flap potentiometer - G584- and guide control rod -1- through adjusting lever on turbocharger as shown in illustration.



– Fit regulating flap potentiometer - G584- on the turbocharger mounting with new nuts from the replacement-parts kit -4- and tighten nuts.
– Screw securing nut -2- onto control rod by hand in direction of vacuum unit.

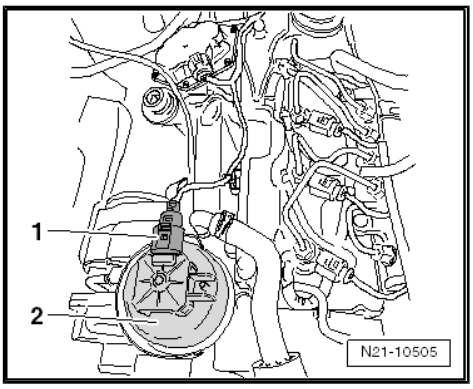


Note

Make sure that the guiding element -1- of the flap lever moves easily along the control rod.

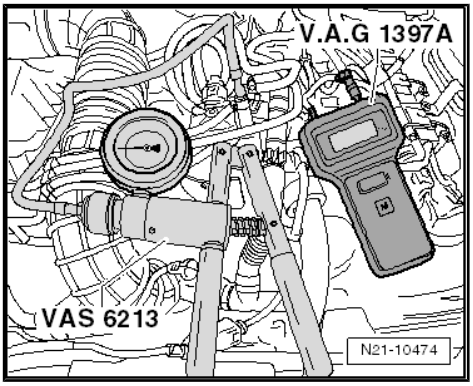
– Attach connector -1- to regulating flap potentiometer - G584- -2-.

  Connect ⇒ Vehicle diagnostic tester.
– Read measured values.
– The display shows the individual components.
– Select “Bypass Valve Turbocharger High Pressure Turbine Input, Input Voltage” and confirm entry with Q.
– Connect turbocharger tester - V.A.G 1397A- and hand vacuum pump - VAS 6213- or hand vacuum pump - V.A.G. 1390- to vacuum connection -1- of regulating flap potentiometer - G584- using a T-piece to do so.

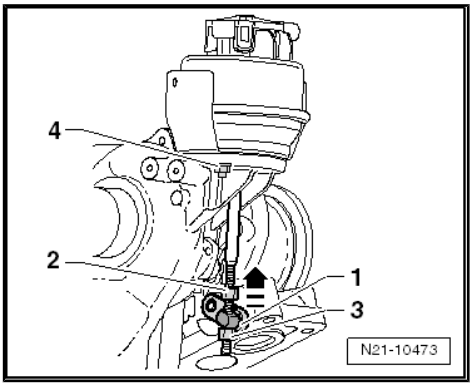


Switch turbocharger tester - V.A.G 1397A- on and move sliding switch on device to position II.

– Apply a vacuum of 500 ± 50 mbar to regulating flap potentiometer - G584- .



– Move flap lever -1- on turbocharger in direction of -arrow- to “Closed” position, and hold it there.
– Screw securing nut -3- in direction of vacuum unit until it contacts flap lever -1-.
– Continue turning securing nut -3- until a voltage of 0.75 volt ± 0.02 volt of regulating flap potentiometer - G584- is reached.
– Tighten lock nut -2-.



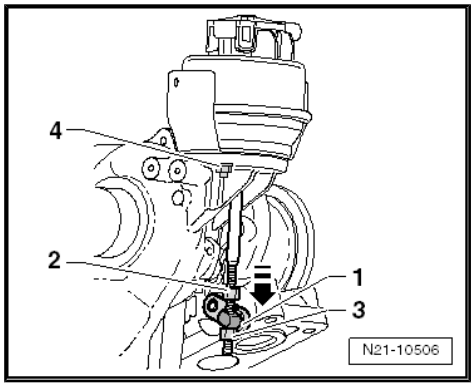
Note

Counterhold on the nut -2- to make sure that the control rod does not turn.

Slowly reduce vacuum. Flap lever -1- now moves in -direction of arrow- “Open”.

– Apply a vacuum of 500 ± 50 mbar to regulating flap potentiometer - G584- again.
– Check voltage setting (0.75 volt ± 0.02 volt) of regulating flap potentiometer - G584- and, if necessary, reset.

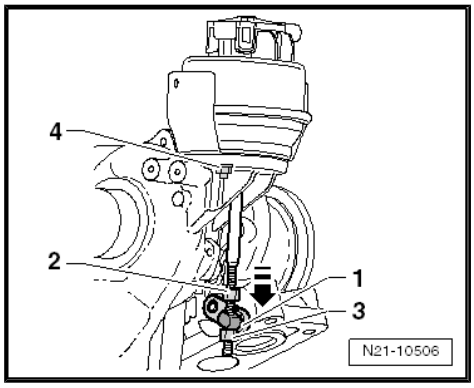
Slowly reduce vacuum.



Note

Flap lever -1- must now be resting against the stop. If the flap lever is not resting against the stop, setting must be carried out again until the set values agree with each other.

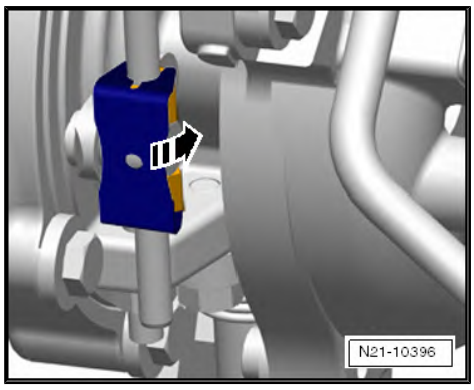
– After this, secure the nuts and lock nuts with sealing paint from the replacement-parts kit.



– Press securing clip from replacement-parts kit onto control rod and turn 90° in -direction of arrow-.

Specified torque

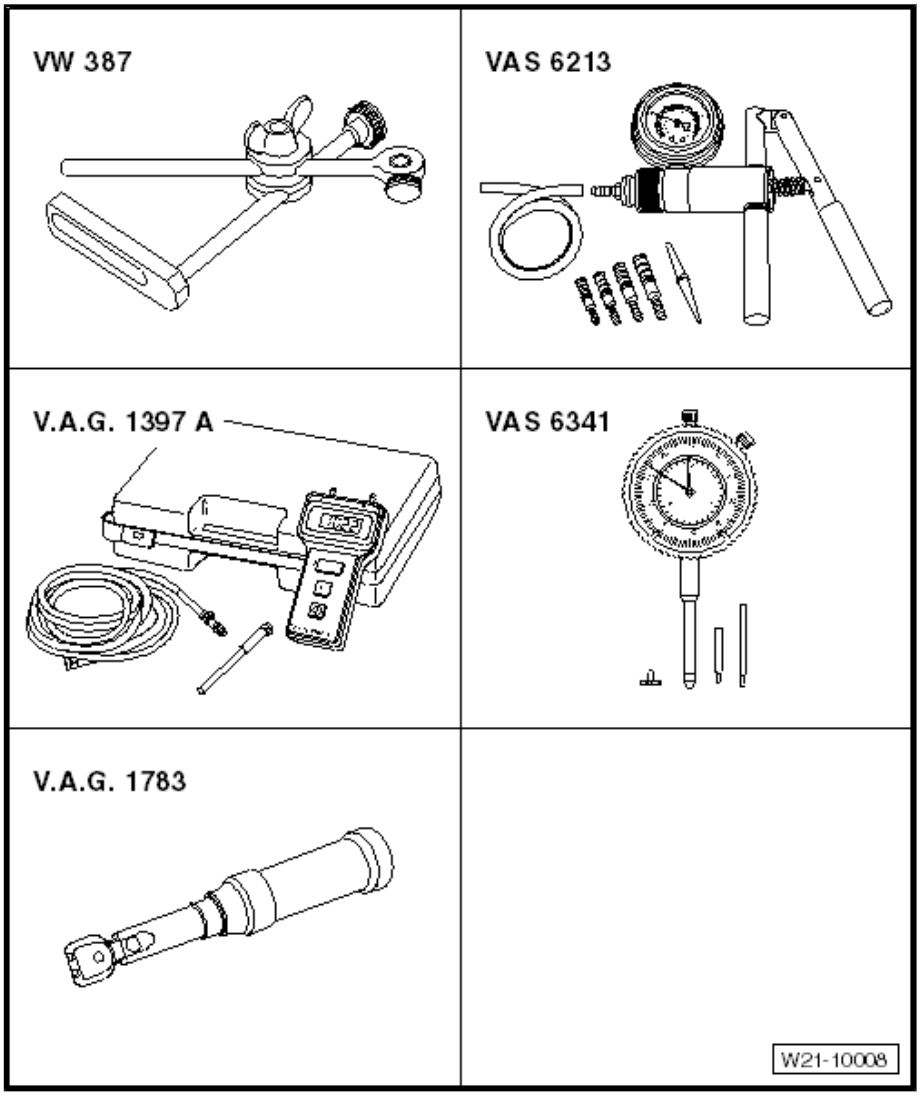
Component	Specified torque
Lock nut for control rod	8 Nm
Nut for potentiometer	8 Nm



1.9 Renewing vacuum unit for turbocharger

Special tools and workshop equipment required

- Universal dial gauge bracket - VW 387-
- Hand vacuum pump - VAS 6213- or hand vacuum pump - V.A.G. 1390- .
- Turbocharger tester - V.A.G 1397A-
- Dial gauge set, 4-part - VAS 6341-
- Torque wrench - V.A.G 1783- with open end spanner insert AF10 - V.A.G 1783/1-

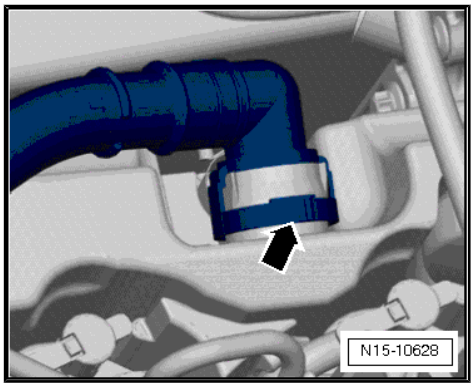


Note

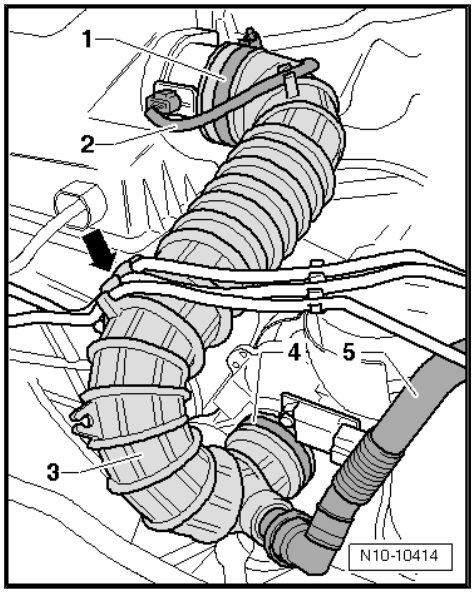
A replacement-parts kit ⇒ ETKA (Electronic Parts Catalogue) is available for replacing the vacuum unit.

Removing

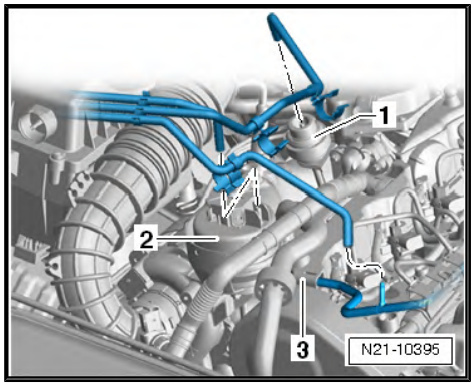
– Remove pipe -arrow- from cylinder head cover.



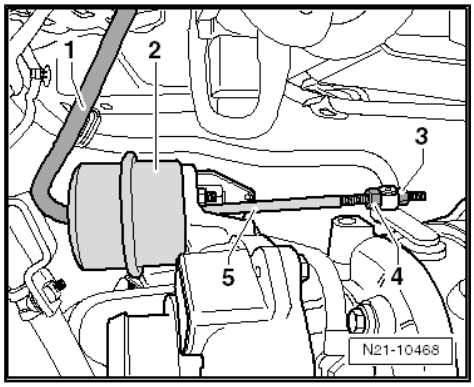
– Detach vacuum hoses from retainer -arrow- on connecting hose -3-.
– Release and pull off wiring harness connector -2-. Detach wiring harness -2- from connecting hose retainer -3-.
– Open clips -1- and -4-.
– Remove connecting hose -3-.



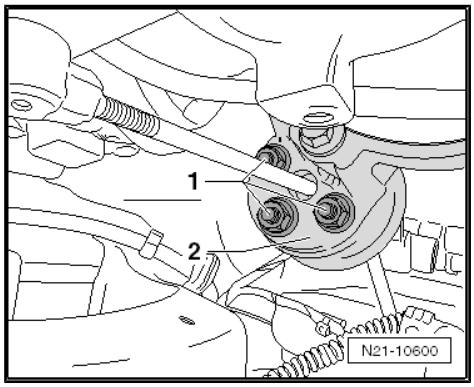
– Pull hose off regulating flap potentiometer - G584- -2-.



– Pull hose -1- off vacuum unit -2-.
– Loosen and completely remove lower securing nut -3- of control rod -5-.



– Remove nuts of vacuum unit -1- and remove vacuum unit -2-.



Installing

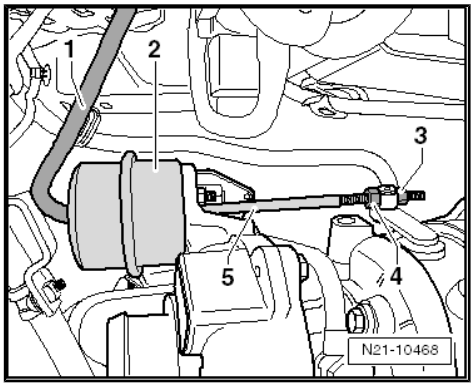
Installation is carried out in the reverse order; note the following:

Caution

Use only new nuts from the replacement-parts kit!

– Carefully clean contact surfaces of vacuum unit.

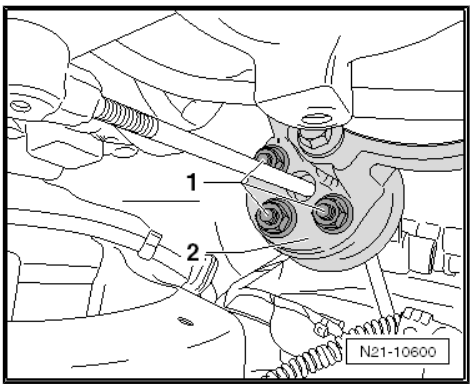
– If necessary, remove lower securing nut -3- of control rod from new vacuum unit -2-.
– Install new vacuum unit -2- and push control rod -5- through adjusting lever on turbocharger as shown in illustration.



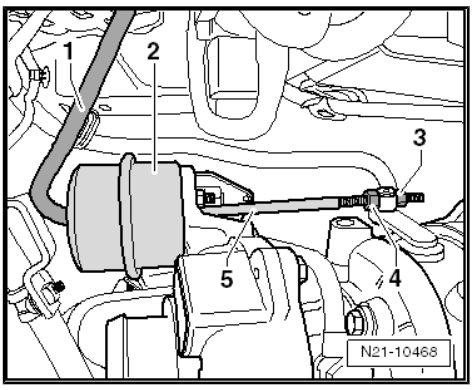
Note

Location marker on vacuum unit must fit into mounting on turbocharger.

– Fit vacuum unit -2- with nuts -1- and tighten.



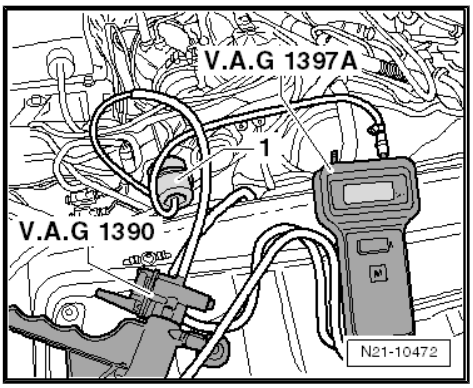
– Screw securing nut -3- onto control rod by hand in direction of vacuum unit.



Note

Make sure that the guiding element of the flap lever moves easily along the control rod.

– Connect turbocharger tester - V.A.G 1397A- -2- and hand vacuum pump - VAS 6213- or hand vacuum pump - V.A.G. 1390- -3- to vacuum connection of vacuum unit -1- using a T-piece to do so.



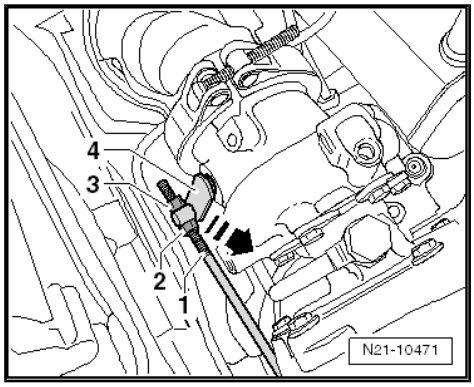
Switch turbocharger tester - V.A.G 1397A- on and move sliding switch on device to position II.

– Apply a vacuum of 390 ± 10 mbar to vacuum unit.

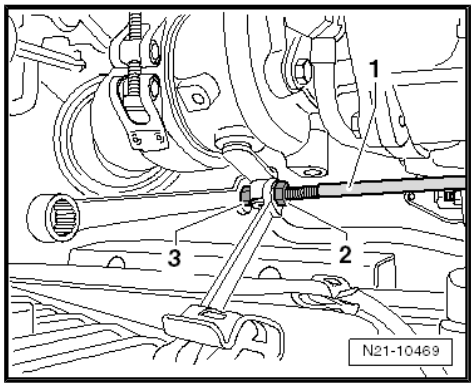
Caution

The following adjusting work must be carried out with extreme care and precision as, otherwise, there is a risk that the turbocharger will be damaged.

– Move flap lever -4- on turbocharger in -direction of arrow- to “Closed” position.



– Turn securing nut -3- in direction of vacuum unit until it contacts flap lever and tighten lock nut -2-.



Note

Make sure that control rod -1- does not turn by counterholding on securing nut -3-.

– Reduce vacuum again and apply a vacuum of 390 ± 10 mbar to vacuum unit again.

Note

Flap lever must now be resting against the stop (closed position).

– Check set value and, if necessary, reset.

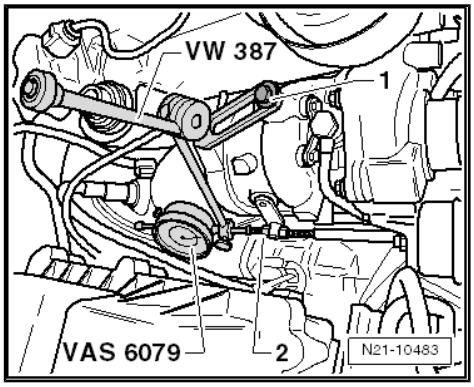
Note

The check must be repeated at least 3 to 5 times in order to ensure that the vacuum unit has been set precisely and in order to avoid possible damage to the turbocharger.

Repeat this procedure approx. 3-5 times.

– Reduce vacuum again.

– Secure dial gauge - VAS 6079- together with universal dial gauge bracket - VW 387- to turbocharger with a suitable bolt -1- (as shown in illustration) and move gauge to end of control rod -2-.



Note

The dial gauge rod and the control rod of the vacuum unit must align with each other.

– Operate hand vacuum pump - VAS 6213- until the turbocharger tester - V.A.G 1397A- indicates 390 ± 10 mbar.

– Set dial gauge -VAS 6341/1- to 0.

– Operate hand vacuum pump - VAS 6213- until turbocharger tester - V.A.G 1397A- indicates 410 ± 10 mbar.

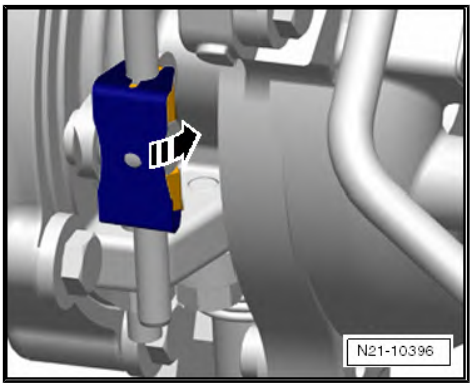
– Read value on dial gauge - VAS 6079- .

– Make sure that value on dial gauge - VAS 6079- does not change.

– If value has changed, correct setting of vacuum unit and repeat measurement until setting agrees with specified values.

– Secure securing nut and lock nut with sealing paint from replacement-parts kit.

– Press securing clip from replacement-parts kit onto control rod and turn 90° in -direction of arrow-.

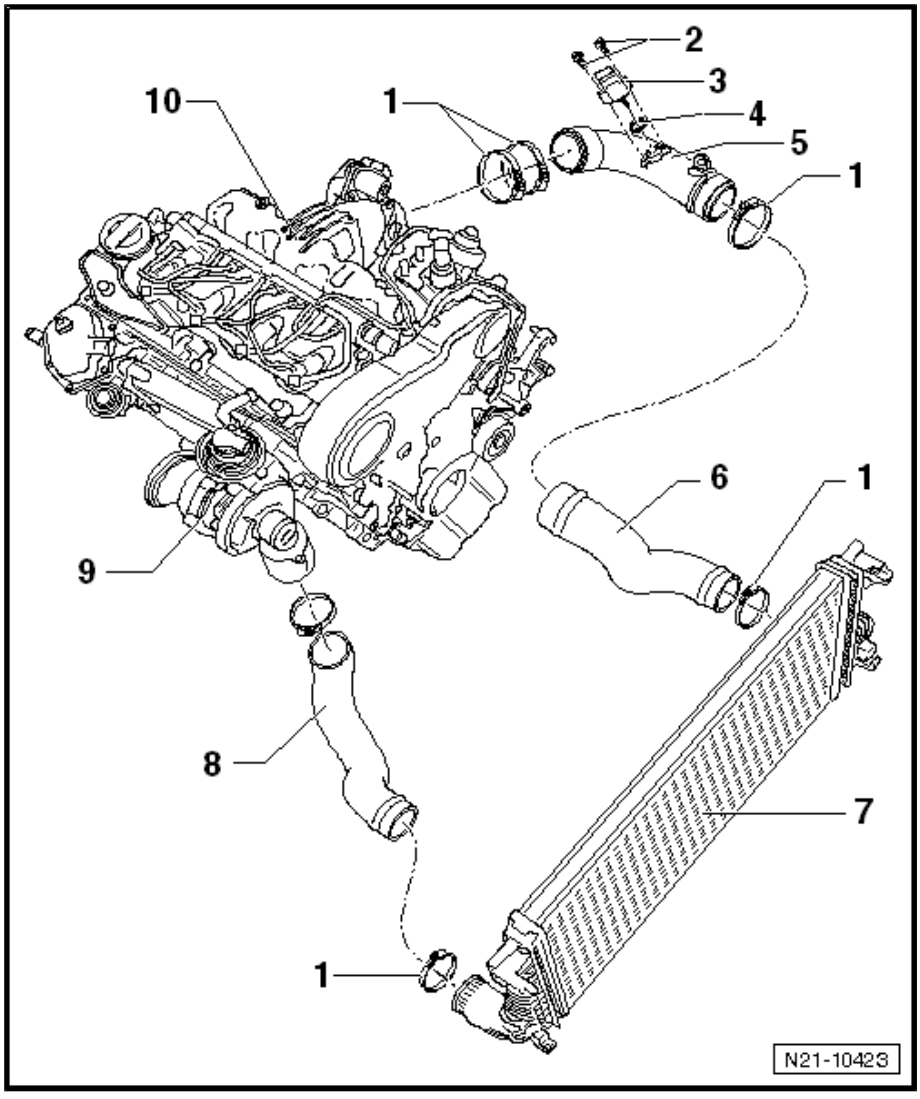


Specified torque

Component	Specified torque
Lock nut for control rod	8 Nm
Nut for vacuum unit	8 Nm

2 Charge air system

2.1 Assembly overview - charge air system



1 - Quick-release clips for pressure hoses

- ❑ Are permanently fitted to the pressure hoses.

2 - Bolt

- ❑ 2 Nm

3 - Intake air temperature sender - G42- with charge air pressure sender - G31-

- ❑ Removing and installing ⇒ page 254 .

4 - O-ring

- ❑ Renew if damaged or leaking.

5 - Charge air pipe

- ❑ Removing and installing ⇒ page 257
- ❑ Note installation position ⇒ page 253

6 - Connecting hose

- ❑ Note installation position ⇒ page 253 .

7 - Charge air cooler

- ❑ Removing and installing ⇒ page 253 .

8 - Connecting hose

- ❑ Note installation position ⇒ page 253
- ❑ On vehicles with EU6 standard-compliant engines: with additional charge air temperature sender after charge air cooler - G811-
- ❑ Removing and installing charge air temperature sender after charge air cooler - G811- ⇒ page 255
- ❑ Specified torque for charge air temperature sender after charge air cooler - G811- : 22 Nm

9 - Turbocharger

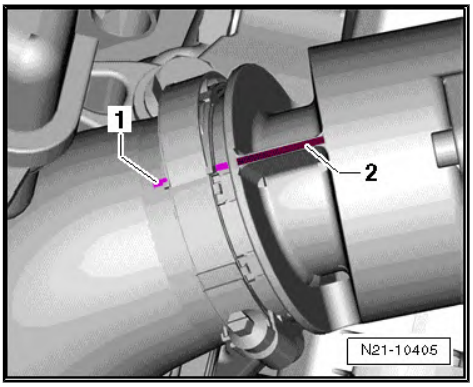
- ❑ Assembly overview ⇒ “1.1 Assembly overview - turbocharger, single turbo”, page 211 .
- ❑ Assembly overview ⇒ “1.2 Assembly overview - turbocharger, bi-turbo”, page 214 .
- ❑ Removing and installing ⇒ “1.3 Removing and installing turbocharger, single turbo”, page 218 .
- ❑ Removing and installing ⇒ “1.4 Removing and installing turbocharger, bi-turbo”, page 222 .
- ❑ Removing and installing ⇒ “1.5 Removing and installing turbocharger, Crafter 4MOTION with Achleitner four-wheel drive”, page 229 .

10 - Intake manifold

- ❑ Assembly overview ⇒ page 271 .
- ❑ Removing and installing ⇒ page 272 .

Installation position of connecting hoses

– Install connecting hose in such a way that marking -1- on connecting hose is opposite marking -2- on respective connecting piece.



2.2 Removing and installing charge air cooler

Removing

Note

Observe general notes on the charge air system ⇒ page 2 .

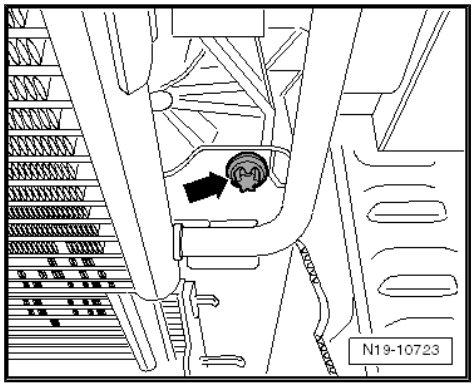
– Remove radiator grille ⇒ General body repairs, exterior; Rep. gr. 50 .
– Remove front bumper ⇒ General body repairs, exterior; Rep. gr. 63 ; Bumpers .
– If fitted, remove radiator blower housing ⇒ Air conditioning system; Rep. gr. 87 .
– Remove pressure hoses from charge air cooler.

Note

In vehicles with air conditioning the condenser on the left must be disengaged and raised slightly.

– Undo and remove bolts on right and left -arrow-.

– Take out charge air cooler from underneath.



Installing

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

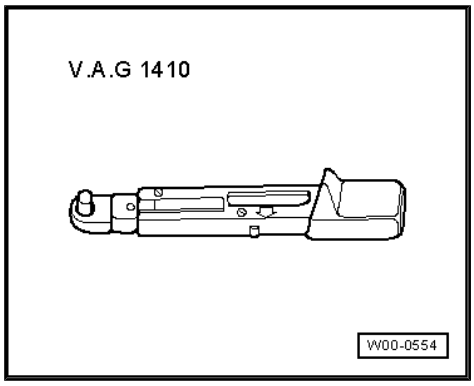
Specified torques

- ⇒ “2.1 Assembly overview - charge air system”, page 252
- Lock carrier; Assembly overview - lock carrier ⇒ Rep. gr. 50 ; Assembly overview - lock carrier
- Noise insulation; Assembly overview - noise insulation ⇒ Rep. gr. 66 ; Assembly overview - noise insulation
- Front bumper; Assembly overview - front bumper ⇒ Rep. gr. 63 ; Assembly overview - front bumper

2.3 Removing and installing charge air pressure sender - G31- / intake air temperature sender - G42-

Special tools and workshop equipment required

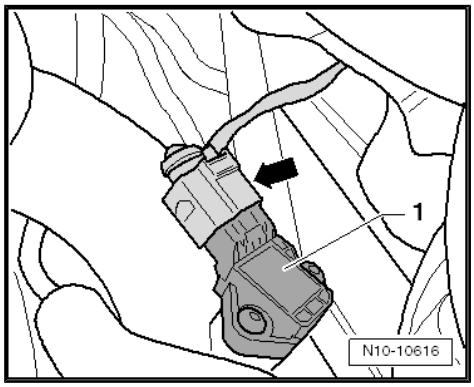
- Torque wrench - V.A.G 1410-



Removing

– Detach connector -arrow- from intake air temperature sender - G42- with charge air pressure sender - G31- -1-.

– Undo and remove screws and pull intake air temperature sender - G42- together with charge air pressure sender - G31- out of pressure pipe.



Installing

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

Specified torques

- ⇒ “2.1 Assembly overview - charge air system”, page 252

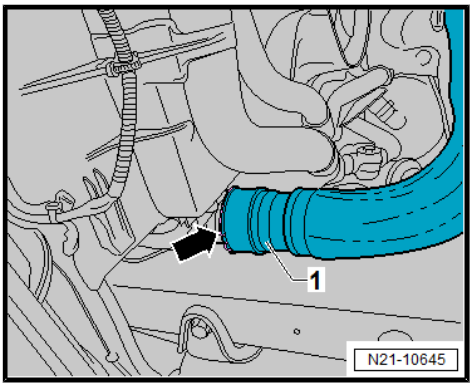
2.4 Removing and installing charge air temperature sender after charge air cooler - G811- , engines compliant with EU6 standard

Note

On vehicles with EU6 standard-compliant engines, there is an additional temperature sender fitted at the lower connection of the connecting hose ⇒ Item 8 (page 252) .

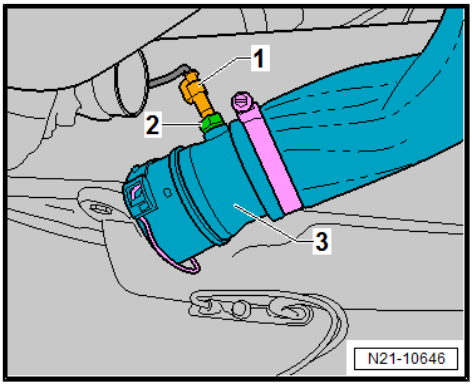
Removing:

– Release quick-release fastener for pressure hose -arrow-, and pull pressure hose -1- off charge air cooler.



– Release and disconnect connector -1-.

– Unscrew charge air temperature sender after charge air cooler - G811- -2- from pressure hose -3-.



Installing:

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

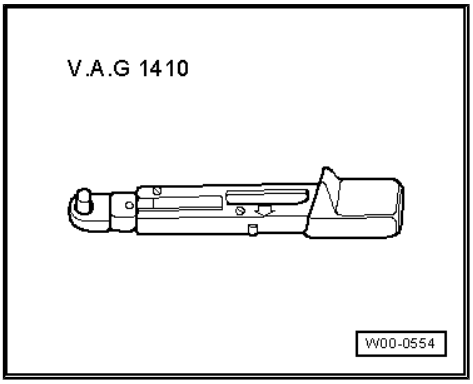
Specified torques

- charge air temperature sender after charge air cooler - G811- : 22 Nm

2.5 Removing and installing charge pressure control solenoid valve - N75-

Special tools and workshop equipment required

- Torque wrench - V.A.G 1410-

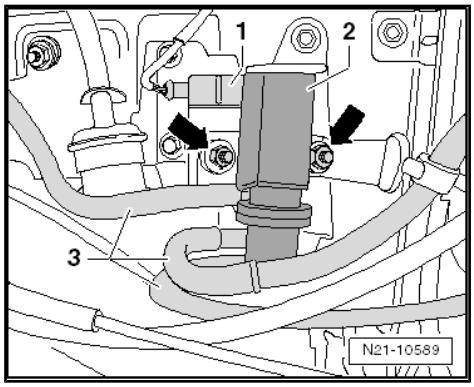


Removing

– Detach connector -1- from charge pressure control solenoid valve - N75- -2-.

– Detach vacuum hoses -3- from charge pressure control solenoid valve - N75- -2-.

– Undo bolts -arrows - and pull charge pressure control solenoid valve - N75- -2- off.



Installing

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

Caution

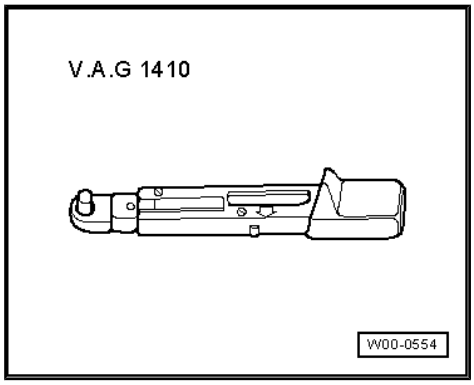
Do not kink, twist or crush the vacuum lines when routing. This may cause breakdowns.

Connect all hoses to stop or at least 10 mm on the relevant connection piece.

2.6 Removing and installing exhaust gas flap valve - N220-

Special tools and workshop equipment required

♦ Torque wrench - V.A.G 1410-

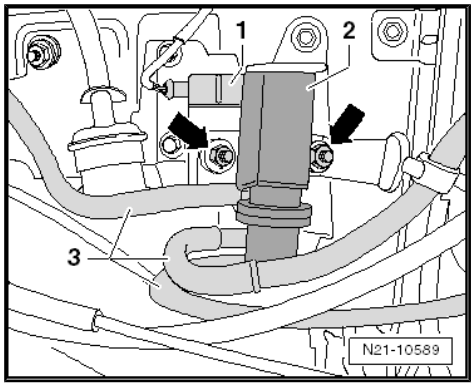


Removing

– Detach connector -1- from exhaust flap valve - N220- -2-.

– Detach vacuum hoses -3- from exhaust flap valve - N220- -2-.

– Undo bolts -arrows - and pull exhaust flap valve - N220- -2- off.



Installing

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

Caution

Do not kink, twist or crush the vacuum lines when routing. This may cause breakdowns.

Connect all hoses to stop or at least 10 mm on the relevant connection piece.

2.7 Removing and installing charge air pipe

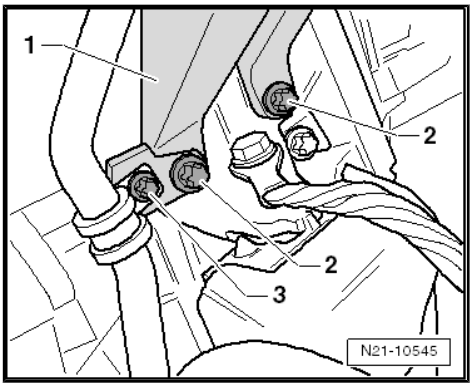
Removing

Note

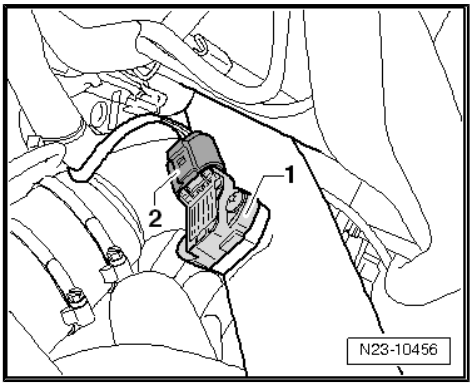
Observe general notes on the charge air system ⇒ page 2 .

– Remove air filter housing ⇒ page 277 .

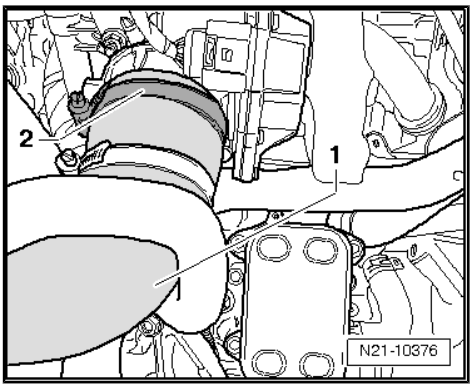
– Unscrew lower securing bolts -2 and 3- from charge air pipe -1-.



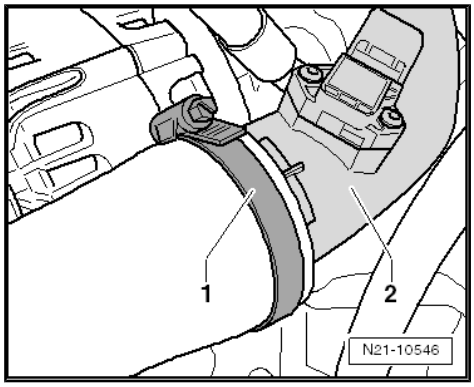
– Release and disconnect connector -2- from intake air temperature sender - G42- -1-.



– Loosen screw-type clip -2-, and pull charge air pipe -1- off throttle valve module - J338- .



– Loosen screw-type clip -1-, and pull intake hose off charge air pipe -2-.
– Unclip engine wiring harness from retainers, and remove charge air pipe -2- from vehicle.



Installing

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

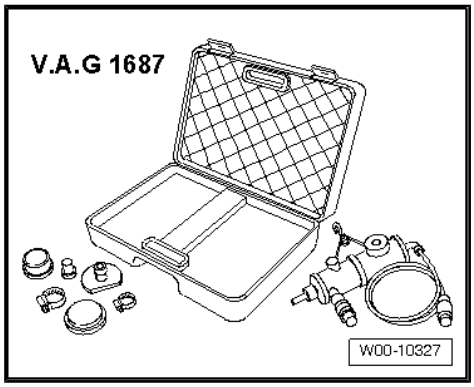
Specified torques

♦ ⇒ “2.1 Assembly overview - charge air system”, page 252

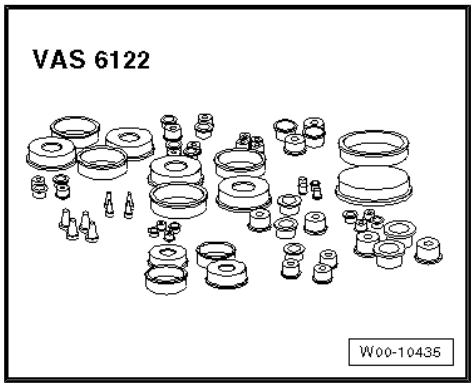
2.8 Checking charge air system for leaks

Special tools and workshop equipment required

♦ Charge air system tester - V.A.G 1687-



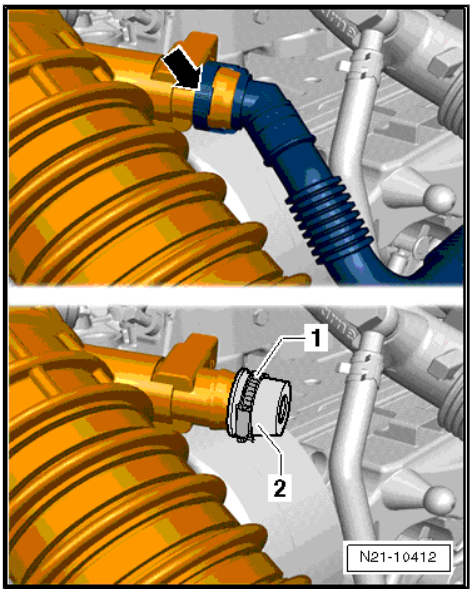
♦ Adapter - V.A.G 1687/10-
♦ Engine bung set - VAS 6122-



Removing

– Remove connecting pipe -arrow-.

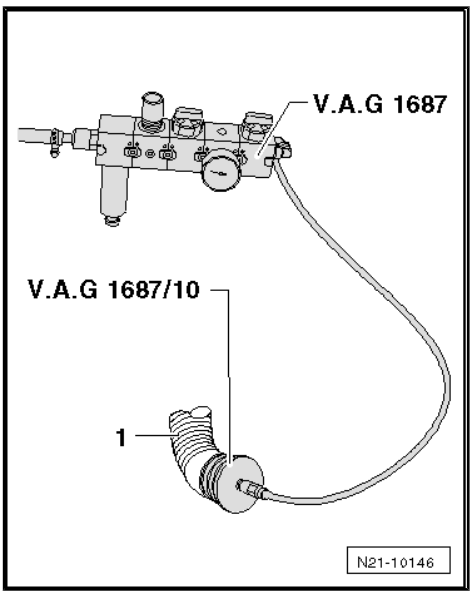
– Seal union with a bung -2- (diameter 28 mm) from engine bung set - VAS 6122- . Secure bung with a clip -1-.



– Remove intake hose -1- from air filter.

– Insert adapter - V.A.G 1687/10- into intake hose -1- and secure with a clip.

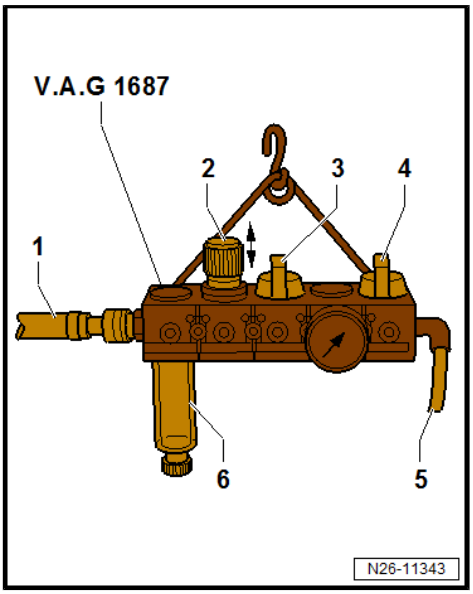
Prepare charge air system tester - V.A.G 1687- as follows:



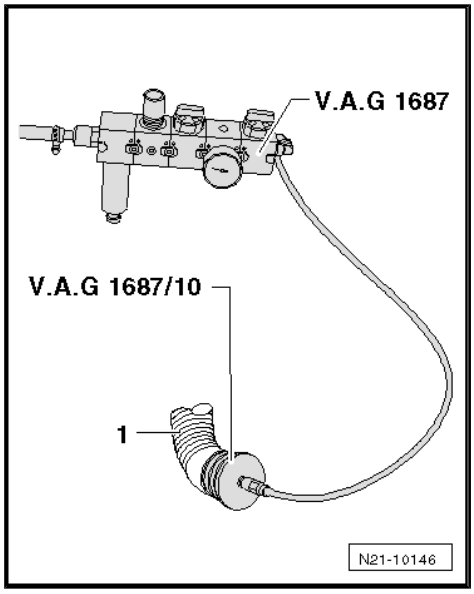
– Unscrew pressure control valve -2- completely and close valves -3- and -4-.

Note

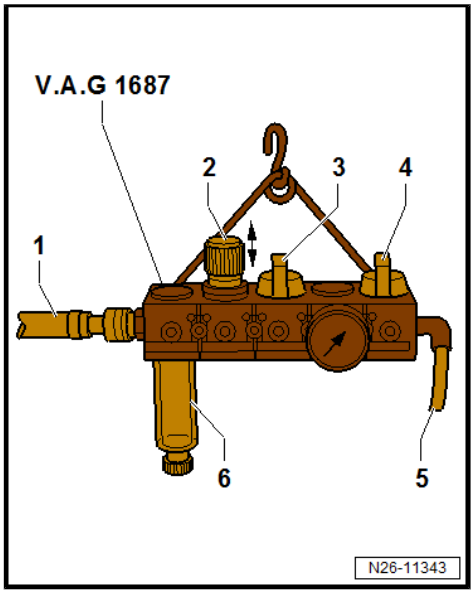
To turn the pressure regulating valve -2- the knob must be pulled upwards.



– Connect charge air system tester - V.A.G 1687- to adapter - V.A.G 1687/10- as shown.



– Connect compressed air hose -1- (compressed air supply) to charge air system tester - V.A.G 1687- , using a standard connecting piece.



Note

Drain water in sight glass by removing drain plug -6-.

– Open valve -3-.

Caution

The pressure must not exceed 0.5 bar! If the pressure is too high, this can cause damage to the charge air system.

– Adjust pressure to 0.5 bar with pressure control valve -2-.

– Open valve -4- and wait until test circuit is full. If necessary, adjust pressure to 0.5 bar.

– Check charge air system for leaks as follows:

- by listening
- by feeling
- with leak detector spray
- or with the ultrasonic tester - V.A.G 1842- .

Note

- *Slight leaks on the intake side of turbocharger are permissible, as the intake hoses are not designed for high-pressure.*
- *A small amount of air escapes through the valves and enters the engine. Therefore a holding pressure test is not possible.*
- *How to use the ultrasonic tester - V.A.G 1842- ⇒ operating instructions*
- *If a leak has been located, observe notes on charge air system specified in assembly work ⇒ page 2 .*
- *Depressurise test circuit by detaching coupling from adapter - V.A.G 1687/10- before removing adapter.*

23 – Mixture preparation - injection

1 Injection system

⇒ “1.1 Schematic overview - fuel system”, page 262

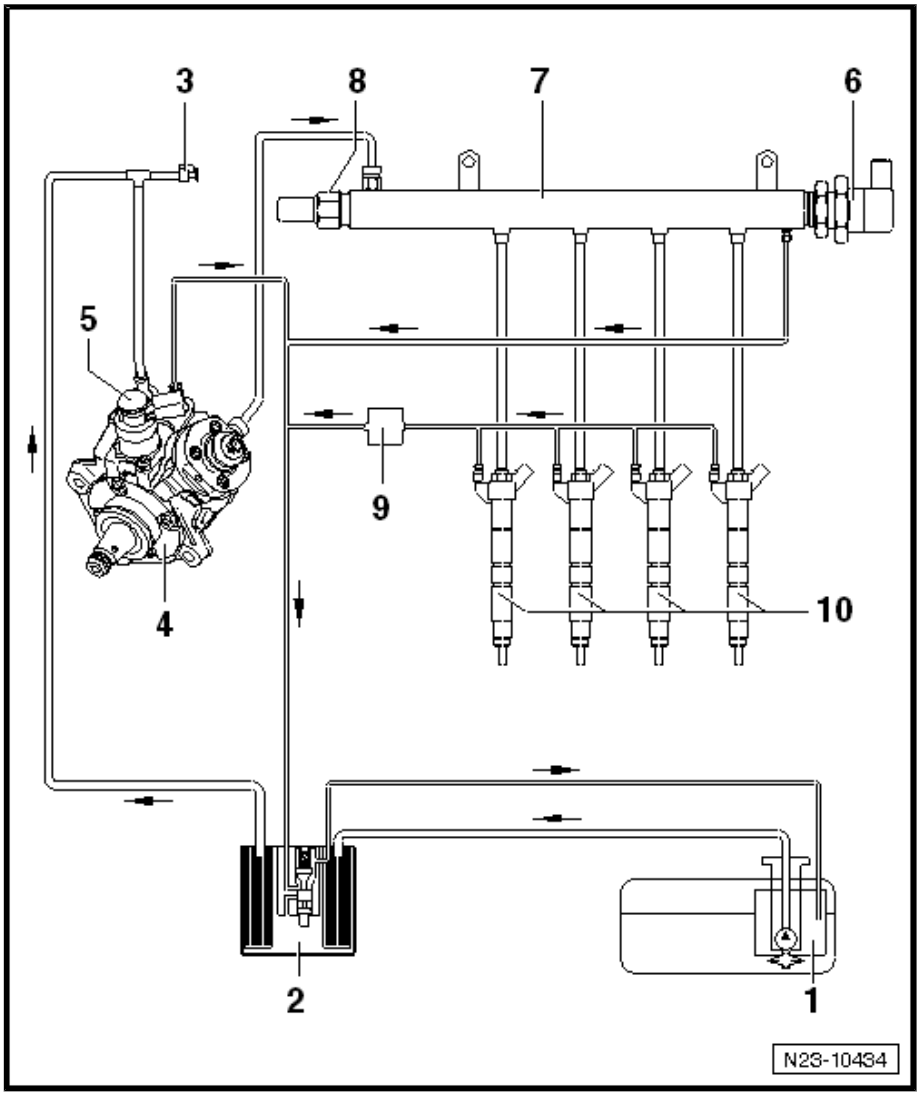
⇒ “1.2 Overview of fitting locations - injection system”, page 264

⇒ “1.3 Checking fuel system for leaks”, page 268

1.1 Schematic overview - fuel system

WARNING

- *Always read rules for cleanliness and instructions for working on fuel system ⇒ page 7 .*
- *Always follow these rules for cleanliness and instructions before starting work and while working on the fuel system.*
- *If components of the fuel system between the tank and the high-pressure fuel pump are removed or renewed, the fuel system must be filled to be bled ⇒ page 312 . (It is important not to allow the high-pressure pump to run while still empty.)*



1 - Fuel tank

- ❑ With fuel system pressurisation pump - G6- .
- ❑ Removing and installing ⇒ Rep. gr. 20 ; Fuel tank; Removing and installing fuel tank

2 - Fuel filter

- ❑ With pre-heating valve.
- ❑ Assembly overview ⇒ Rep. gr. 20 ; Fuel tank; Assembly overview - fuel tank
- ❑ Removing and installing ⇒ Rep. gr. 20 ; Fuel filter; Removing and installing fuel filter

3 - Fuel temperature sender - G81-

4 - High-pressure pump

- ❑ After renewing, initial fuel filling must be carried out (never allow the pump to run while it is still empty) ⇒ page 312 .
- ❑ Removing and installing ⇒ page 309 .

5 - Fuel metering valve - N290-

> **DANGER!**
> *Valve must not be removed.*

- ❑ Valve is not available as separate part.

6 - Fuel pressure regulating valve - N276-

- ❑ Removing and installing ⇒ page 299 .

7 - High-pressure accumulator (fuel rail)

- ❑ Removing and installing ⇒ page 292 .

8 - Fuel pressure sender - G247-

- ❑ Removing and installing ⇒ page 302 .

9 - Restrictor

- ❑ Cannot be renewed separately

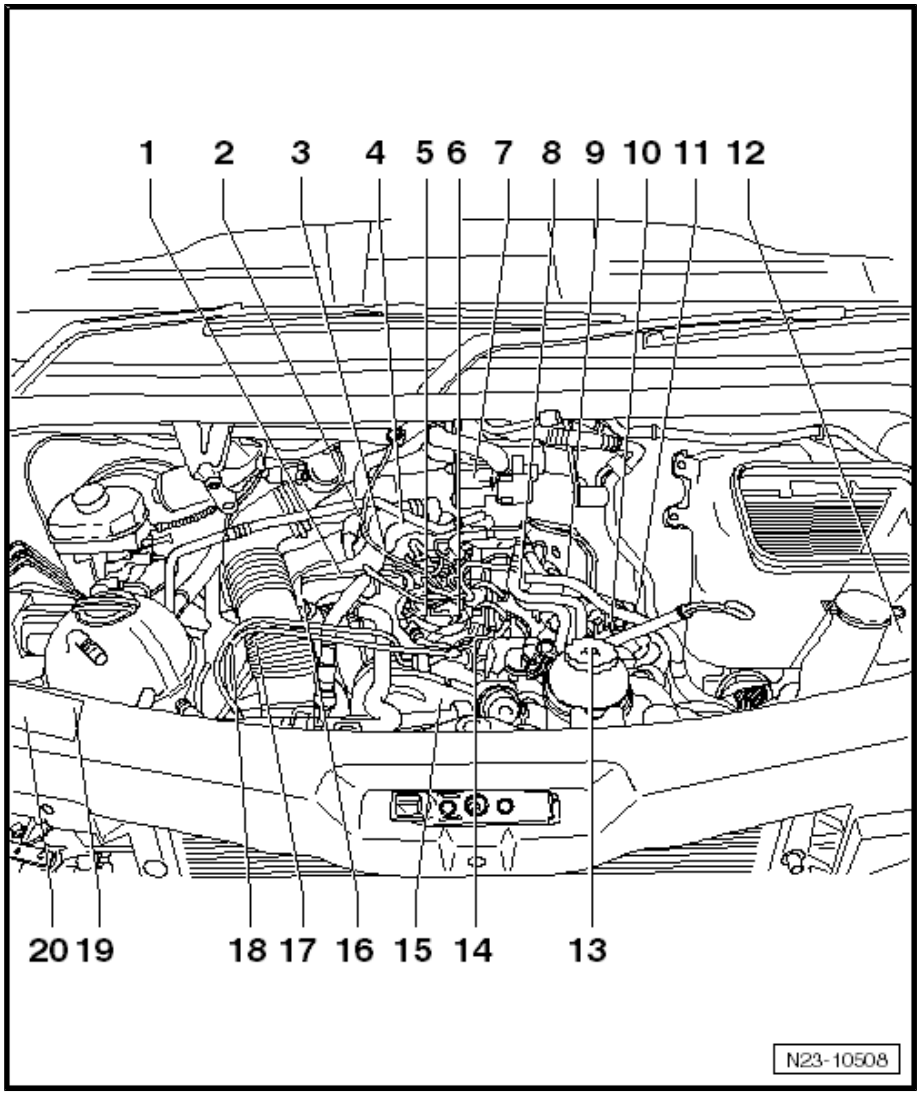
10 - Injectors

- ❑ Injector, cylinder 1 - N30-
- ❑ Injector, cylinder 2 - N31-
- ❑ Injector, cylinder 3 - N32-
- ❑ Injector, cylinder 4 - N33-
- ❑ Assembly overview ⇒ page 278 .
- ❑ Removing and installing ⇒ page 280 .

1.2 Overview of fitting locations - injection system

Note

The overview of locations is for rough orientation of the build-in components.



1 - Exhaust gas temperature sender 1 - G235-

- ❑ Fitting location ⇒ page 268

2 - Coolant temperature sender - G62-

- ❑ Locations on engine ⇒ page 266
- ❑ Removing and installing ⇒ page 190 .

3 - Intake manifold pressure sender - G71-

- ❑ Fitting location on air filter

4 - Air mass meter - G70-

- ❑ Fitting location on air filter
- ❑ Removing and installing ⇒ page 305 .

5 - Injectors

- ❑ Locations on engine ⇒ page 266
- ❑ Removing and installing ⇒ page 280 .

6 - Glow plugs

- ❑ Locations on engine ⇒ page 266
- ❑ Removing and installing ⇒ page 370 .

7 - Engine speed sender - G28-

- ❑ Locations on engine ⇒ page 266
- ❑ Removing and installing ⇒ page 373 .

8 - Fuel pressure regulating valve - N276-

- ❑ Locations on engine ⇒ page 266
- ❑ Removing and installing ⇒ page 299 .

9 - Exhaust gas recirculation valve - N18-

- ❑ Locations on engine ⇒ page 266
- ❑ Removing and installing ⇒ page 361 .

10 - Intake air temperature sender - G42- with charge air pressure sender - G31-

- ❑ Fitting location ⇒ page 267
- ❑ Removing and installing ⇒ page 254 .

11 - Throttle valve module - J338-

- ❑ Locations on engine ⇒ page 266

- ❑ Removing and installing ⇒ page 275 .

12 - Engine control unit - J623-

- ❑ Fitting location ⇒ page 264
- ❑ Removing and installing ⇒ page 306 .

13 - Fuel metering valve - N290-

- ❑ Location on high-pressure pump

14 - Fuel pressure sender - G247-

- ❑ Locations on engine ⇒ page 266
- ❑ Removing and installing ⇒ page 302 .

15 - Hall sender - G40-

- ❑ Locations on engine ⇒ page 266
- ❑ Removing and installing ⇒ page 372 .

16 - Regulating flap potentiometer - G584-

- ❑ Fitting location ⇒ page 268

17 - Exhaust temperature sender 3 - G495- and exhaust temperature sender 4 - G648-

- ❑ Location on particulate filter

18 - Lambda probe - G39-

- ❑ Removing and installing ⇒ page 313 .

19 - Charge pressure control solenoid valve - N75- and exhaust flap valve - N220-

- ❑ Fitting location ⇒ page 268
- ❑ Removing and installing charge pressure control solenoid valve - N75- ⇒ page 255
- ❑ Removing and installing exhaust gas flap valve - N220- ⇒ page 256

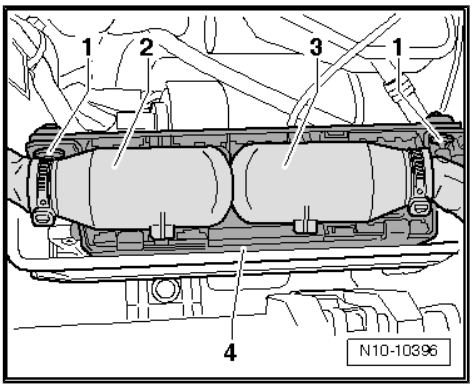
20 - Exhaust gas recirculation cooler changeover valve - N345-

- ❑ Fitting location ⇒ page 267

Engine control unit - J623-

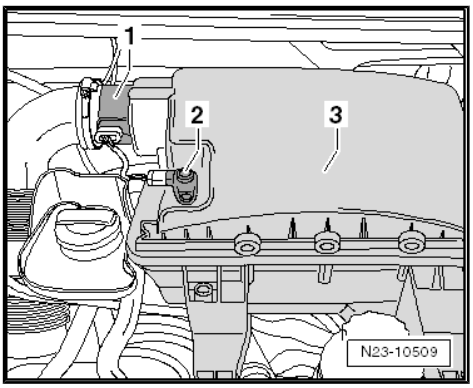
Location under the battery on left in engine compartment

1 - Securing bolts/shear bolts
2 - 60-pin connector - T60-
3 - 94-pin connector - T94-
4 - Engine control unit - J623-

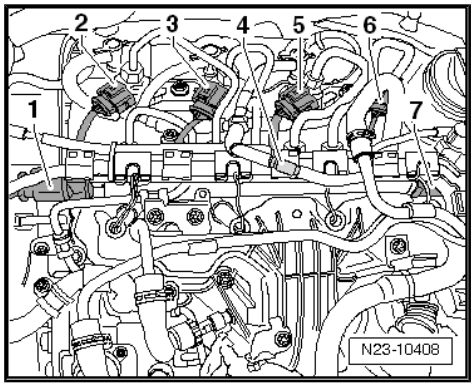


Air filter housing

1 - Air mass meter - G70-
2 - Intake manifold pressure sender - G71-
3 - Air filter

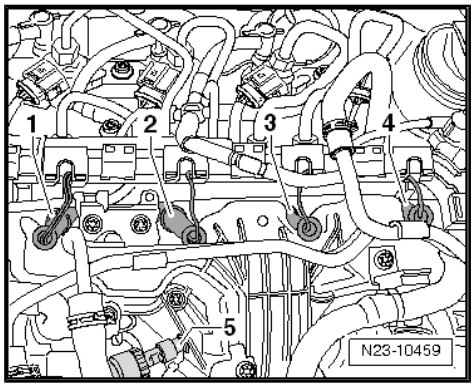


Mounting locations on top of engine



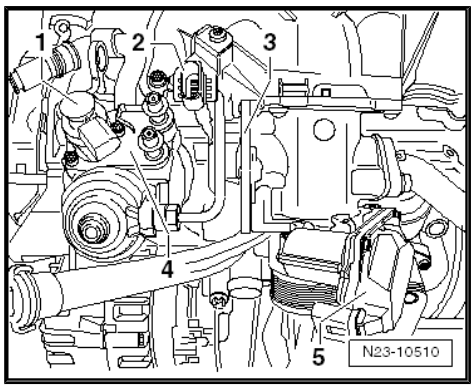
1 - Fuel pressure sender - G247-
2 - Injector, cylinder 1 - N30-
3 - Injector, cylinder 2 - N31-
4 - Return line restrictor
5 - Injector, cylinder 3 - N32-
6 - Injector, cylinder 4 - N33-
7 - Fuel pressure regulating valve - N276-

Mounting locations on top of engine (continued)



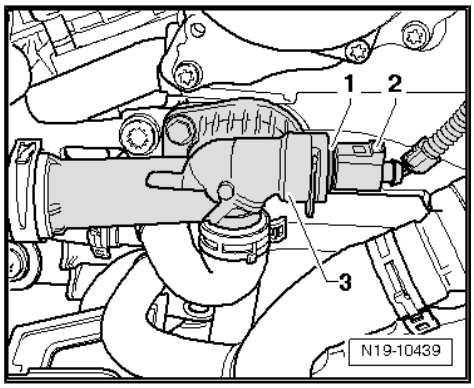
1 - Glow plug 1 - Q10-
2 - Glow plug 2 - Q11-
3 - Glow plug 3 - Q12-
4 - Glow plug 4 - Q13-
5 - Fuel temperature sender - G81-

Mounting locations on left of engine



1 - Fuel metering valve - N290-
2 - Connector for Hall sender - G40-
3 - Exhaust gas recirculation valve - N18-
4 - High-pressure pump
5 - Throttle valve module - J338-

Location on rear of engine

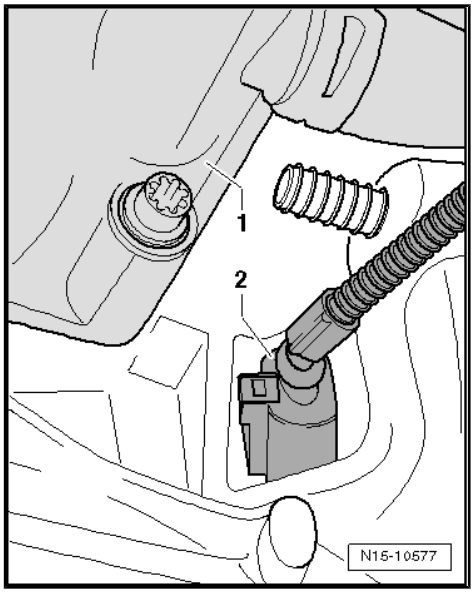


1 - Coolant temperature sender - G62-
2 - Connector
3 - Coolant flange

Location on bottom of engine

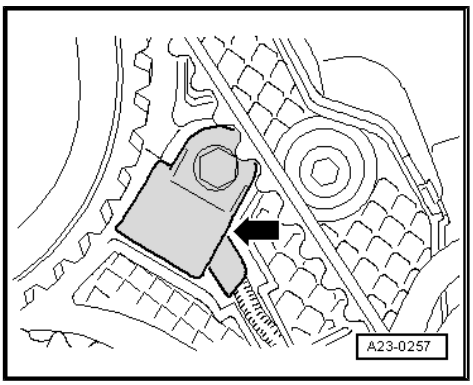
1 - Oil filter bracket

2 - Engine speed sender - G28-



Location on front of engine

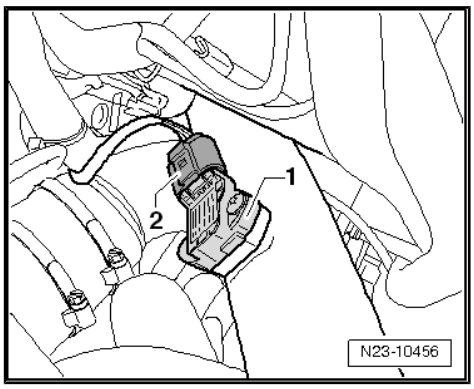
♦ Hall sender - G40- -arrow-



In pressure pipe leading to throttle valve

1 - Intake air temperature sender - G42- with charge air pressure sender - G31-

2 - Connector

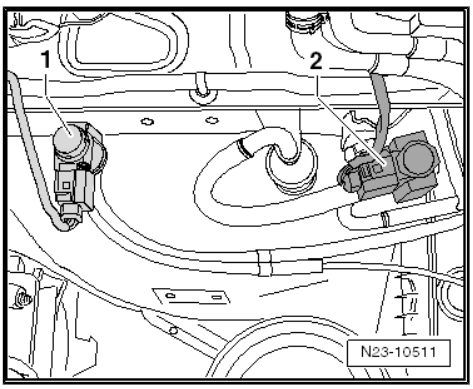


Mono-turbo

On right in engine compartment:

1 - Exhaust gas recirculation cooler changeover valve - N345-

2 - Charge pressure control solenoid valve - N75-



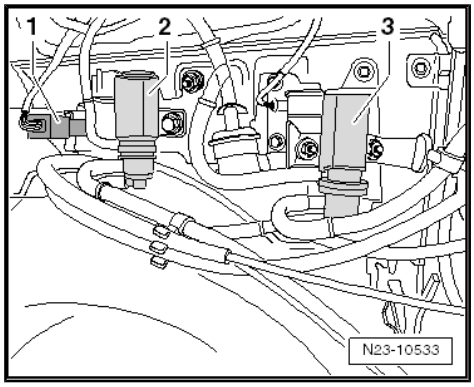
Bi-turbo

On right in engine compartment:

1 - Exhaust gas recirculation cooler changeover valve - N345-

2 - Exhaust gas flap valve - N220-

3 - Charge pressure control solenoid valve - N75-



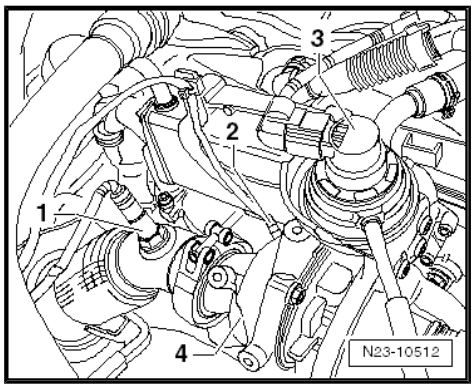
Turbocharger

1 - Lambda probe - G39-

2 - Exhaust gas temperature sender 1 - G235-

3 - Regulating flap potentiometer - G584-

4 - Turbocharger



1.3 Checking fuel system for leaks

DANGER!

- *Note*
  ⇒ "3.2 Rules for cleanliness and instructions for working on fuel system", page 7 .

Follow these instructions before starting work and while working on system.

Test procedure

– Allow engine to idle for a few minutes but do not accelerate, then switch off engine again. Fuel system will bleed itself automatically.

– Check entire fuel system for leaks .

Renew the affected component if leakage still occurs after tightening to the correct torque.

– Then test drive the vehicle, accelerating to full throttle at least once.

– Then check high-pressure section of fuel system again for leakage.

Note

If there is any air left in the fuel system, the engine may switch to the backup mode ('emergency running' mode) during the road test. Switch off engine and delete event memory. Then continue road test.

2 Vacuum system

⇒ “2.1 Schematic diagram - vacuum system”, page 269

2.1 Schematic diagram - vacuum system

Caution

Do not kink, twist or crush the vacuum lines when routing. This may cause breakdowns.

Connect all hoses to stop or at least 10 mm on the relevant connection piece.

1 - Bracket

- In engine compartment on right

2 - Connecting piece

3 - Turbocharger

- ⇒ “1.3 Removing and installing turbocharger, single turbo”, page 218
- ⇒ “1.4 Removing and installing turbocharger, bi-turbo”, page 222
- ⇒ “1.5 Removing and installing turbocharger, Crafter 4MOTION with Achleitner four-wheel drive”, page 229

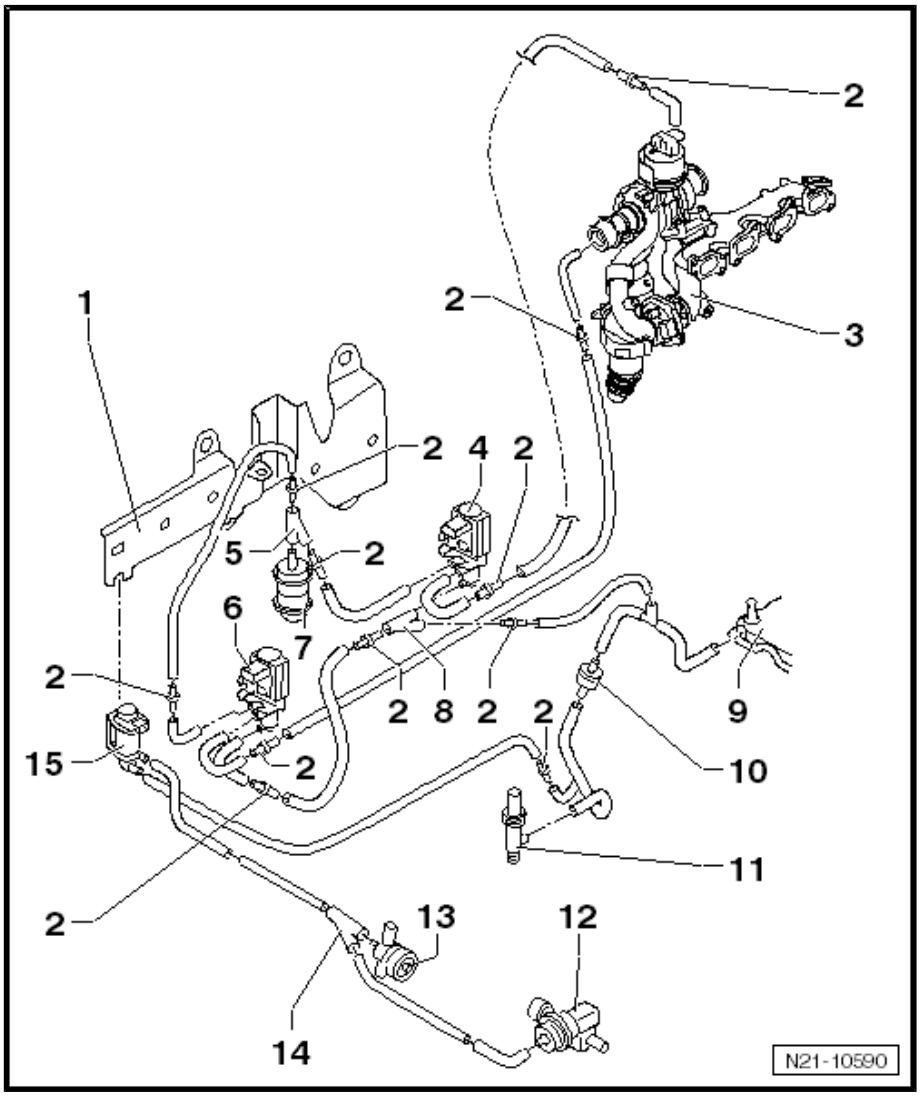
4 - Exhaust gas flap valve - N220-

- Fitting location ⇒ page 268
- Removing and installing exhaust gas flap valve - N220- ⇒ page 256

5 - Y-piece

6 - Charge pressure control solenoid valve - N75-

- Fitting location ⇒ page 268
- Removing and installing charge pressure control solenoid valve - N75- ⇒ page 255



7 - Filter

8 - Y-piece

9 - Cylinder head cover

10 - Non-return valve

11 - Vacuum line to brake servo

12 - Exhaust gas recirculation cooling bypass valve 2 - N387-

Note

Bear in mind direction of flow!

- ❑ Basic position: closed
- ❑ Colour: grey
- ❑ Functional description ⇒ page 178

13 - Exhaust gas recirculation cooling bypass valve - N386-

Note

Bear in mind direction of flow!

- ❑ Basic position: open
- ❑ Colour: black
- ❑ Functional description ⇒ page 178

14 - Y-piece

15 - Exhaust gas recirculation cooler changeover valve - N345-

- ❑ Fitting location ⇒ page 268

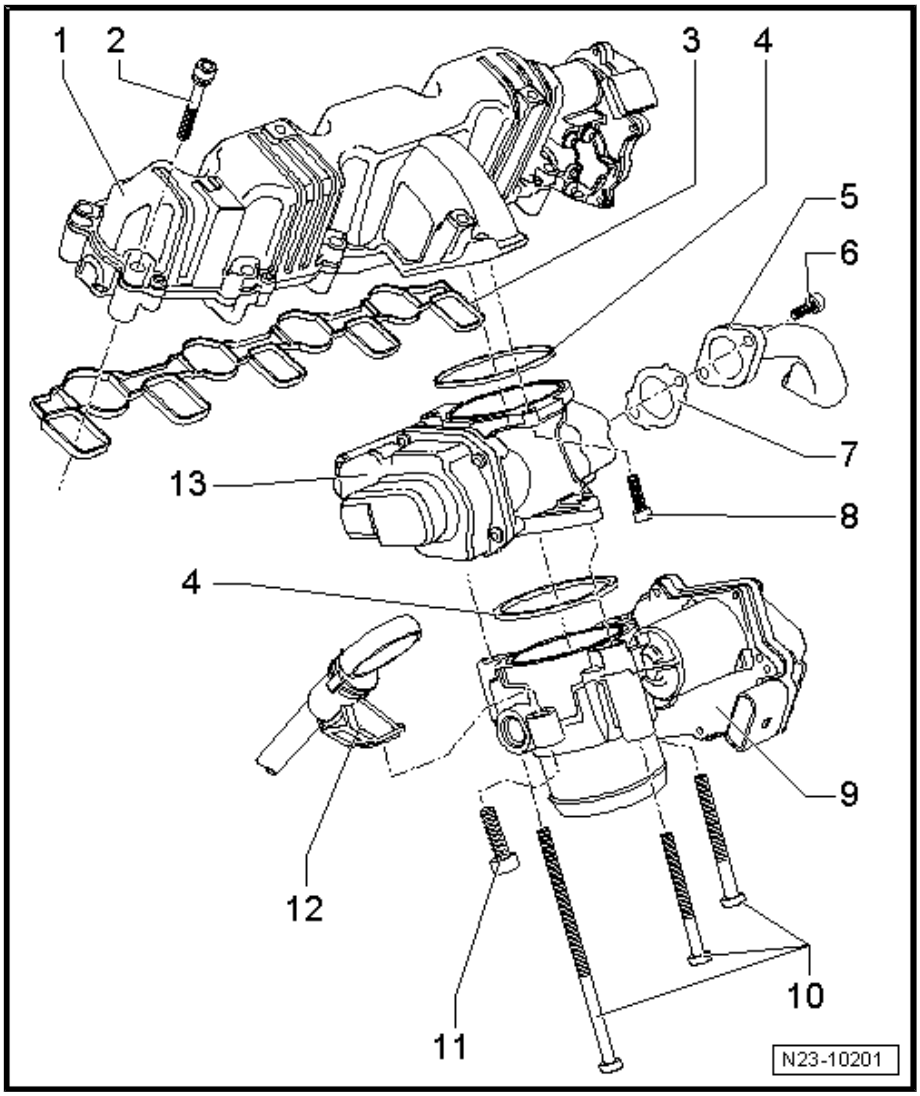
3 Intake manifold

⇒ “3.1 Assembly overview - intake manifold”, page 271

⇒ “3.2 Removing and installing intake manifold”, page 272

⇒ “3.3 Removing and installing throttle valve module J338 ”, page 275

3.1 Assembly overview - intake manifold



1 - Intake manifold

- ❑ Removing and installing ⇒ page 272 .

2 - Bolt

- ❑ 8 Nm

3 - Gasket

- ❑ Renew after removing.

4 - Seal

- ❑ Renew after removing.

5 - Connecting pipe

- ❑ Renew after removing

> **Caution**
> *Ensure that decoupling element of connecting pipe is not bent and thus stretched. There is a danger of cracking.*

- ❑ Install so that component is not stressed

6 - Bolt

- ❑ 20 Nm
- ❑ Use socket - T10385- to loosen and tighten.

7 - Gasket

- ❑ Renew after removing.

8 - Bolt

- ❑ 8 Nm

9 - Throttle valve module - J338-

- ❑ Do not dismantle.
- ❑ Removing and installing ⇒ page 275 .
- ❑ With throttle valve potentiometer - G69- and intake manifold flap motor - V157-

10 - Bolt

- ❑ 8 Nm
- ❑ Remove and install with socket - T40159- .

11 - Bolt

- ❑ 8 Nm
- ❑ Remove and install with socket - T40159- .

12 - Oil dipstick

- ❑ Checking engine oil level ⇒ page 155

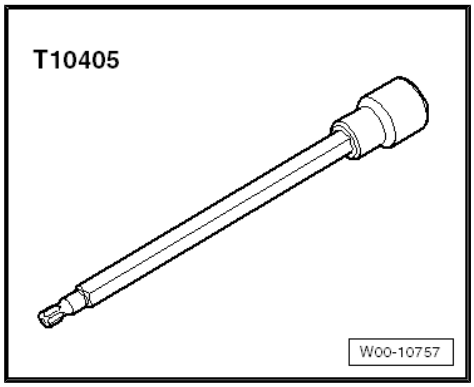
13 - Exhaust gas recirculation valve - N18-

- ❑ Removing and installing ⇒ page 361 .
- ❑ With exhaust gas recirculation potentiometer - G212- .

3.2 Removing and installing intake manifold

Special tools and workshop equipment required

- ♦ Socket Torx T 30 - T10405-



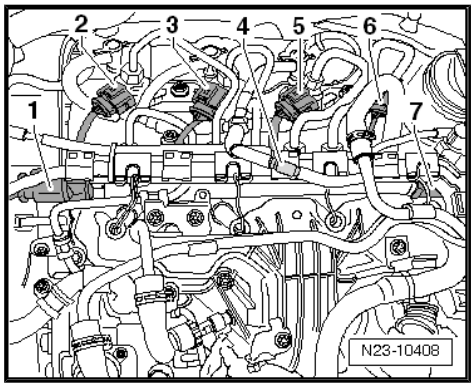
- ♦ Removal lever - 80 - 200-

> **WARNING**
>
> ♦ *Note*
> *⇒ "3.2 Rules for cleanliness and instructions for working on fuel system", page 7 .*

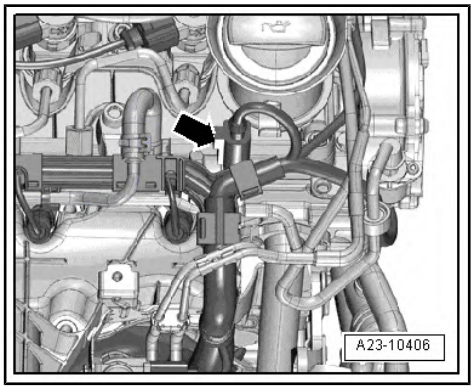
Removing

– Remove exhaust gas recirculation valve - N18- ⇒ page 361 .

– Pull connectors -1 to 4- off glow plugs.



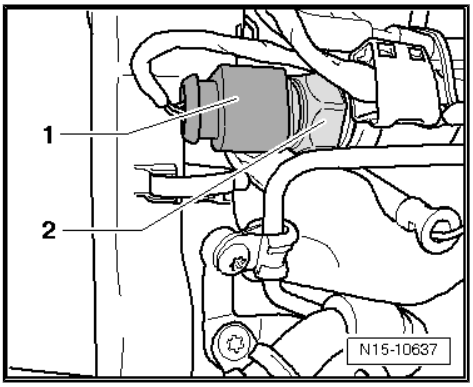
– Detach connector -arrow- from fuel pressure regulating valve - N276- .



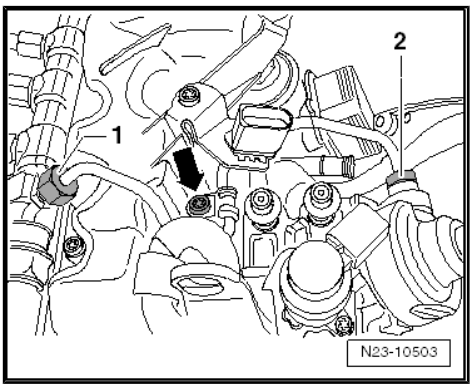
– Pull connector -2- off fuel pressure sender - G247- -1-.

Caution

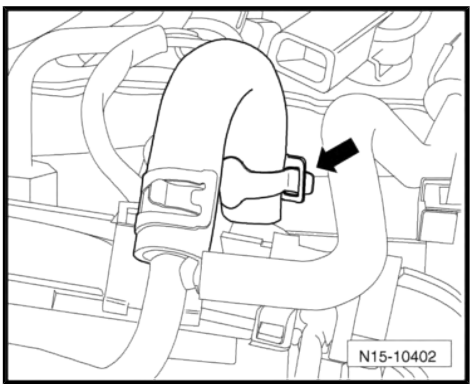
When releasing high-pressure line, counterhold high-pressure connection using an open-ended spanner. Leaks occur if high-pressure connection is released.



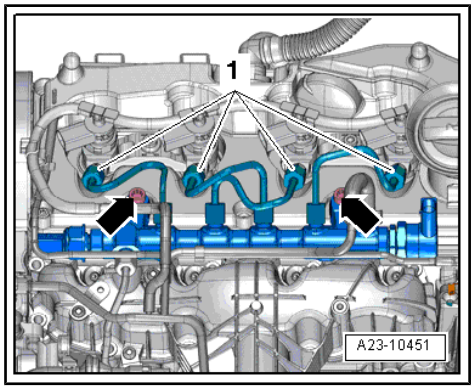
– Undo and remove bolt -arrow- from retainer of high-pressure line.
– Unscrew union nuts -1 and 2-, and remove high-pressure line.



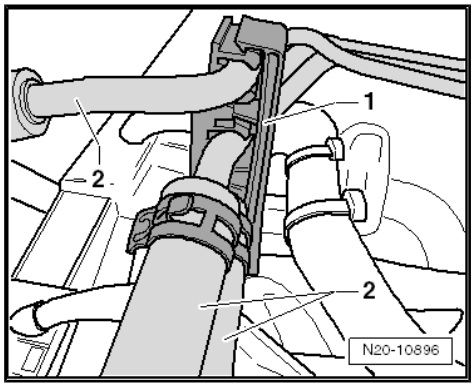
– Remove fuel return hose from high pressure accumulator (fuel rail). To do this, release hose clip -arrow-.
– Remove line guide from high-pressure accumulator (fuel rail) and place to one side.



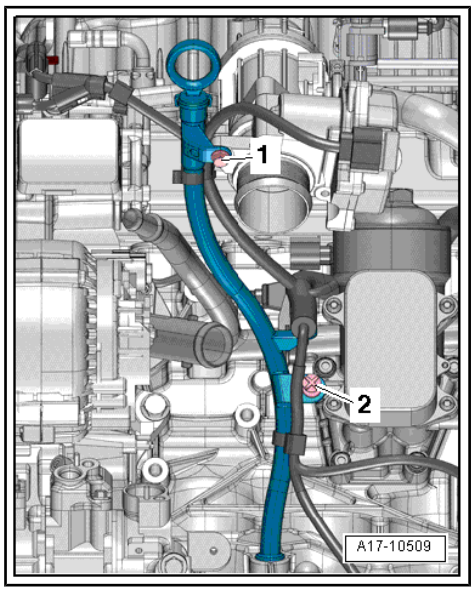
– Undo union nuts of 4 high-pressure lines -1-.
– Undo and remove bolts -arrows-, remove high-pressure accumulator (fuel rail) and place to one side.



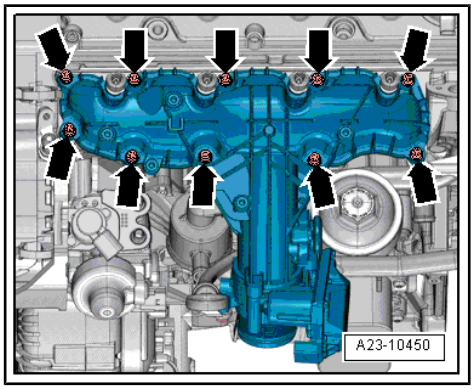
– Unclip fuel lines -2- from retainer -1- and place to one side.



– Loosen lower securing element -2- on oil dipstick. Press off spreader clip -2- using removal lever - 80 - 200- if necessary (depending on type).



– Remove bolts -arrows- for intake manifold diagonally from outside to inside using Torx T30 socket - T10405- .



Installing

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

Note

Renew seals and gaskets.

– Tighten intake manifold bolts from inside out in diagonal sequence.

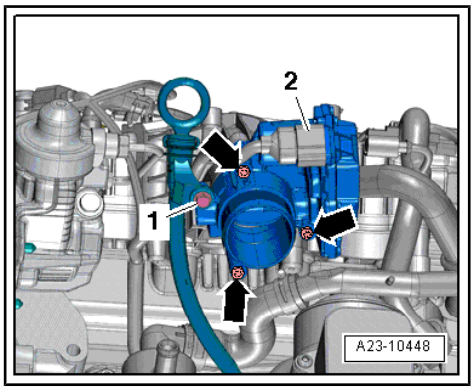
Specified torques

- ⇒ “3.1 Assembly overview - intake manifold”, page 271
- ⇒ “5.1 Assembly overview - injectors”, page 278
- ⇒ “4.1 Assembly overview - exhaust gas recirculation”, page 360

3.3 Removing and installing throttle valve module - J338-

Removing

– Remove charge air pipe ⇒ page 257 .
– Remove bolt -1-.
– Disconnect electrical connector -2-.
– Remove bolts -arrows-.
– Remove throttle valve module - J338- .



Installing

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

Note

Renew O-ring.

Specified torques

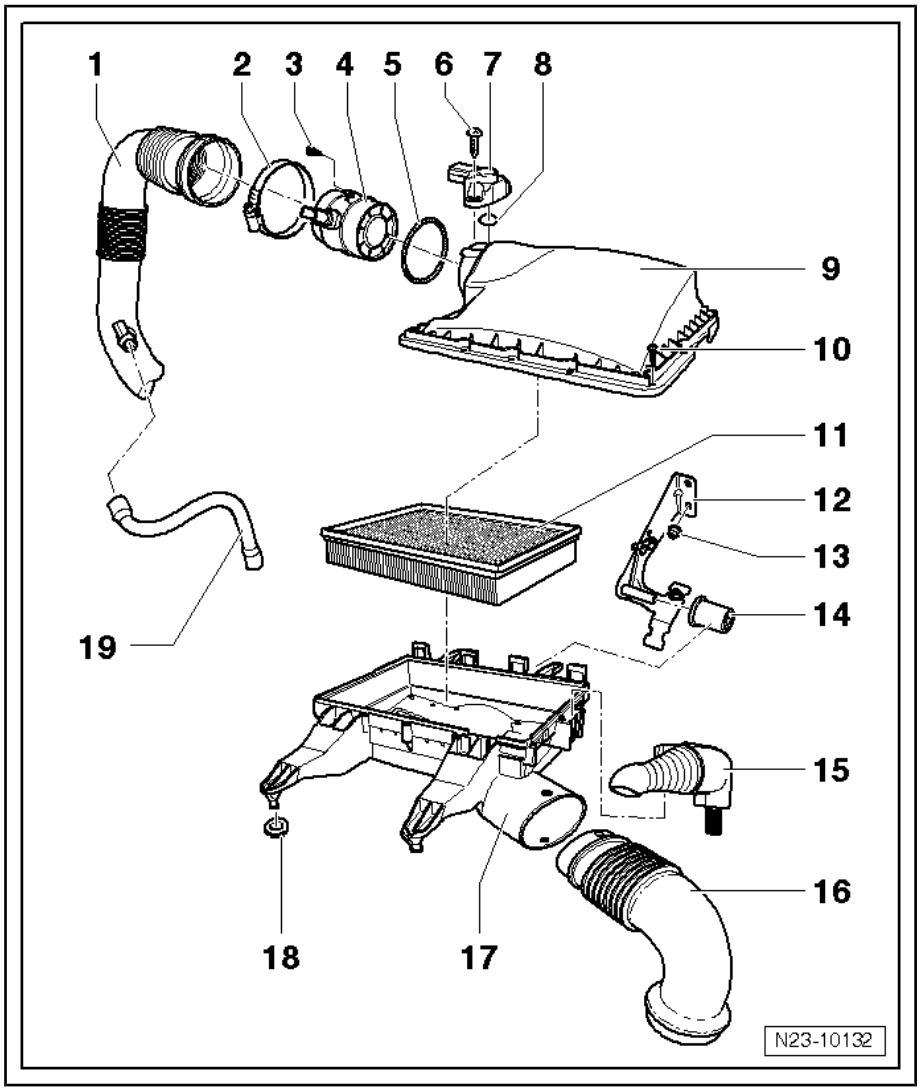
- ⇒ “3.1 Assembly overview - intake manifold”, page 271
- ⇒ “2.1 Assembly overview - charge air system”, page 252

4 Air filter

⇒ “4.1 Assembly overview - air filter housing”, page 276

⇒ “4.2 Removing and installing air filter housing”, page 277

4.1 Assembly overview - air filter housing



1 - Intake hose
- ❑ To turbocharger.

2 - Screw-type clip
- ❑ 3.5 Nm

3 - Bolt
- ❑ 1.6 Nm

4 - Air mass meter - G70-
- ❑ Removing and installing ⇒ page 305 .

5 - O-ring
- ❑ Renew if damaged.

6 - Bolt
- ❑ 1.6 Nm

7 - Intake manifold pressure sender - G71-

8 - O-ring
- ❑ Renew if damaged.

9 - Air filter upper part

10 - Bolt
- ❑ 1.6 Nm

11 - Filter element

12 - Bracket
- ❑ For air filter

13 - Nut
- ❑ 15 Nm

14 - Rubber bush

15 - Jump starting point

16 - Air duct
- ❑ Secured to lock carrier.

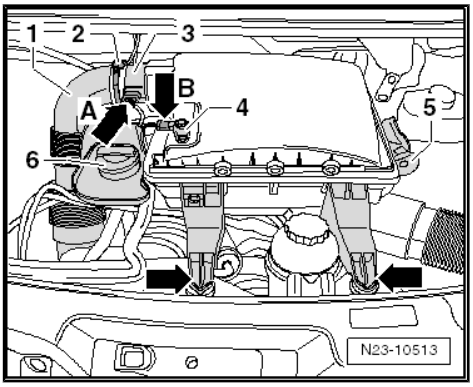
17 - Air filter lower part

18 - Rubber bush
- ❑ Secured to lock carrier.

19 - Hose
- ❑ To cylinder head cover

4.2 Removing and installing air filter housing

Removing



- Loosen clip -2- and pull intake hose -1- off the air mass meter - G70- -3-.
- Detach connector -arrow A- from air mass meter - G70- -3-.
- Detach connector -arrow B- from intake manifold pressure sender - G71- -4-.
- Unlock oil filler neck -6- and pull off upwards.
- Unlock jump starting point -5- and pull off upwards.
- Pull air filter upwards out of the rubber bushes -arrows-.
- Pull air filter upwards out of the brackets and take out towards front of vehicle.

Installing

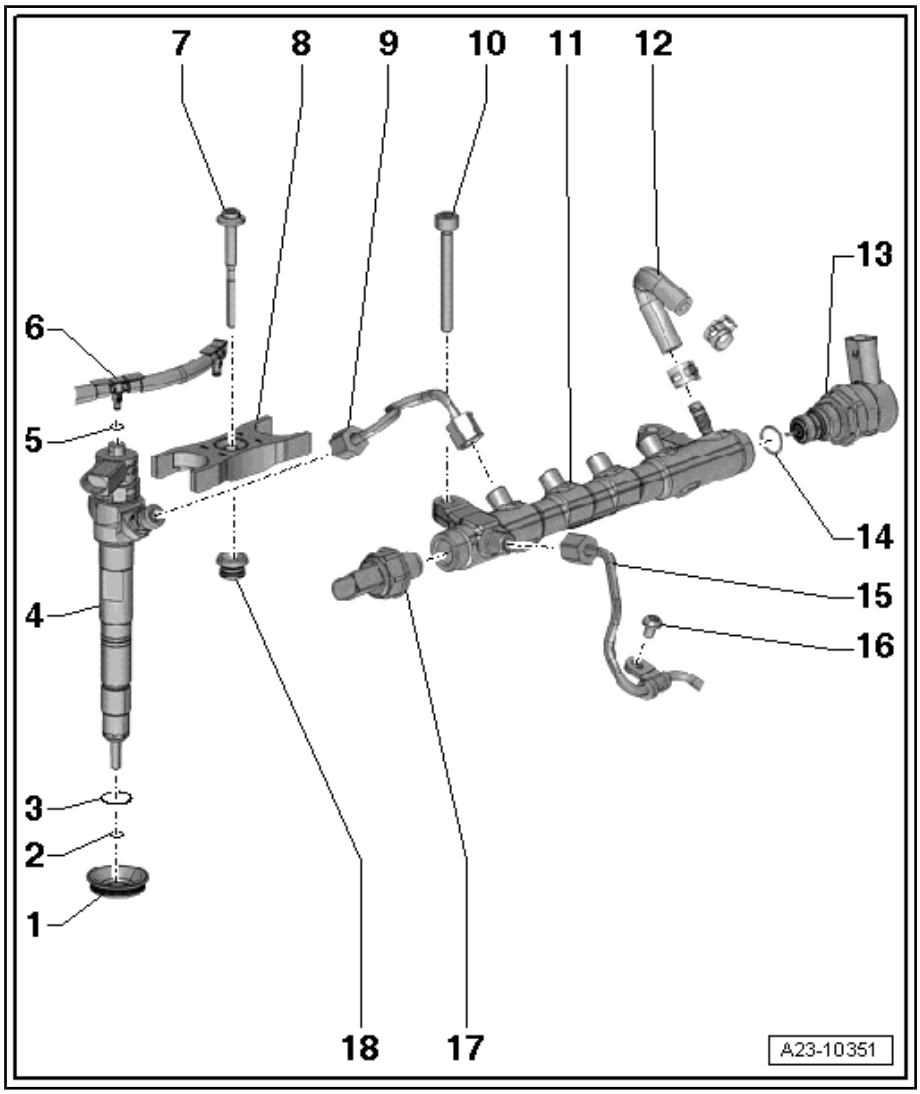
Installation is carried out in the reverse order; note the following:

Specified torques

- ⇒ “4.1 Assembly overview - air filter housing”, page 276

5 Injectors/high-pressure accumulator (rail)

5.1 Assembly overview - injectors



1 - Seal

- ❑ Removing and installing ⇒ page 105 .
- ❑ In cylinder head cover.

2 - Copper washer

- ❑ Renew after removing.

3 - O-ring

- ❑ Renew after removing.

4 - Injector

> **WARNING**
>
> *Only the cleaning set - VAS 6811- may be used for cleaning the sealing surface of the injector bore.*
>
> *For detailed information on how to use the cleaning set as well as the order in which its components are applied, refer to the ⇒ operating manual provided with the cleaning set - VAS 6811- .*

- ❑ Removing and installing ⇒ page 280 .
- ❑ When removing and installing, always renew the following components and seals/O-rings: “copper seal”, “O-ring for injector bore”, “O-ring for injector return connection”.
- ❑ The following components and seals/O-rings must always be renewed when an injector is renewed: “clamping piece”, “copper seal”, “O-ring for injector bore” and “O-ring for injector return connection”.

- ❑ Before re-using “high-pressure line”, perform visual check of taper seats for damage such as transverse scores or corrosion. Always replace them if damaged.
- ❑ If they are to be reinstalled, the injectors, high-pressure lines and clamping pieces must only ever be refitted on the same cylinder.

5 - O-ring

- ❑ Renew after removing.

6 - Fuel return line

- ❑ To fuel tank.
- ❑ Must not be kinked, damaged or blocked.
- ❑ Do not dismantle.
- ❑ Bleed fuel system after renewing ⇒ Vehicle diagnostic tester `Test electric fuel pump`. Then check coolant return lines for leaks.

7 - Bolt

- ❑ Renew after removing.
- ❑ 8 Nm + 270° further

8 - Clamping piece

- ❑ Installation position ⇒ page 280 .
- ❑ If they are to be reinstalled, the injectors and clamping pieces must only ever be refitted on the same cylinder.
- ❑ When an injector is renewed, the corresponding clamping piece must be renewed at the same time.

9 - High-pressure line

- ❑ Install so that component is not under tension.
- ❑ 28 Nm

Note

- *Observe cylinder specific markings when reusing high-pressure lines.*
- *The high-pressure lines may be re-used after the following checks:*
- *Check taper seat of respective high-pressure line for deformation and cracks.*
- *The inside of the line must not be deformed, constricted or damaged.*
- *Corroded lines should no longer be used.*

10 - Bolt

- ❑ 22 Nm

11 - High-pressure accumulator

- ❑ Removing and installing ⇒ page 292 .

12 - Fuel return hose

13 - Fuel pressure regulating valve - N276- , 80 Nm.

- ❑ Renew after removing.
- ❑ Removing and installing ⇒ page 299 .

14 - O-ring

- ❑ Renew after removing.

15 - High-pressure line

- ❑ 28 Nm

Note

- ♦ *Observe cylinder specific markings when reusing high-pressure lines.*
- ♦ *The high-pressure lines may be re-used after the following checks:*
- ♦ *Check taper seat of respective high-pressure line for deformation and cracks.*
- ♦ *The inside of the line must not be deformed, constricted or damaged.*
- ♦ *Corroded lines should no longer be used.*

16 - Bolt

Note

Make sure that the clip is correctly fitted. Mark before removal.

- ❑ 8 Nm

17 - Fuel pressure sender - G247-

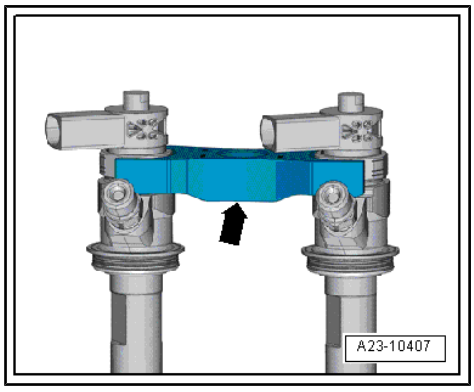
- ❑ Removing and installing ⇒ page 302 .
- ❑ Renew after removing.
- ❑ 100 Nm

18 - Grommet

- ❑ In cylinder head cover.

Clamping piece installation position

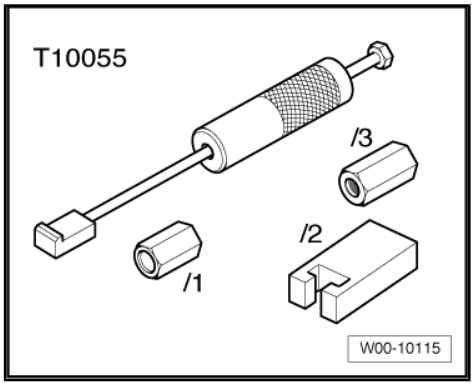
- One clamping piece encompasses 2 injectors each.
- Thick part -arrow- of clamping piece points downwards.



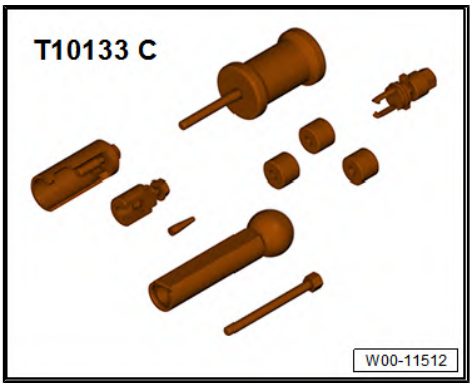
5.2 Removing and installing injectors

Special tools and workshop equipment required

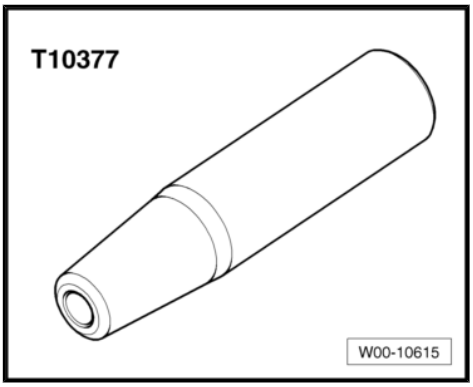
- Puller - T10055-



- Tool set for FSI engines - T10133C- (for cylinders 3 and 4)



- Assembly sleeve - T10377-



- Puller -T10415-

Removing

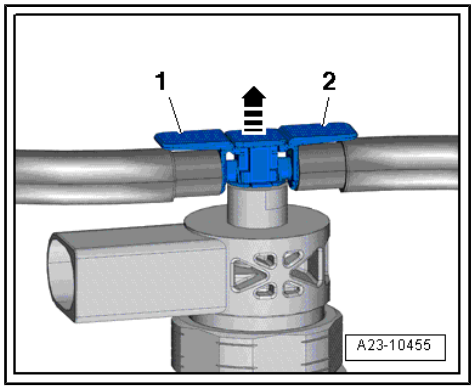
– Remove air filter housing ⇒ page 277 .

– If necessary, remove oil filler hose or oil filler neck.

WARNING

- *Always read rules for cleanliness and instructions for working on fuel system ⇒ page 7 .*
- *Always follow these rules for cleanliness and instructions before starting work and while working on the fuel system.*

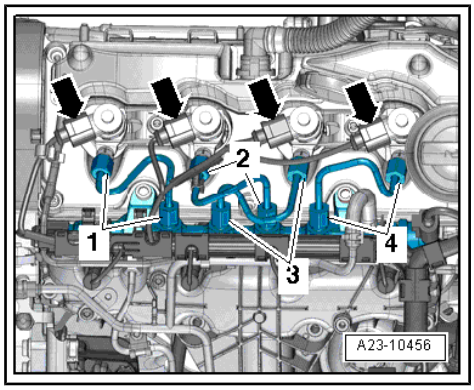
– Pull return line connections off injectors by counterholding slightly on catches -1 and 2- and pulling release pin upwards -arrow-.



– Detach connectors -arrows- from injectors.

Caution

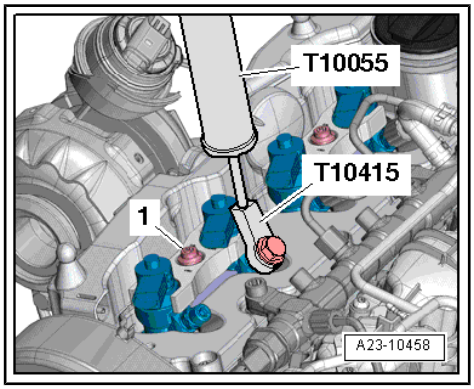
When releasing high-pressure line, counterhold high-pressure connection using an open-ended spanner. Leaks occur if high-pressure connection is released.



– Unscrew union nuts of relevant high-pressure line -1 to 4- and remove corresponding high-pressure line.

– Unscrew bolt -1- of the clamping piece of the injector that is to be removed.

– Fit puller - T10055- with puller - T10415- .



Note

To pull out the injectors of the cylinders 3 and 4, use the hammer from the tool set for FSI engines - T10133C- .

Caution

- ***Mark cylinder numbers on injectors. Injectors must always be re-installed on the same cylinders.***
- ***Observe rules for cleanliness when working on the injection system.***
- ***Plug open connections with suitable sealing caps immediately.***

– Pull injector out upwards by tapping gently.

Note

Pull injector out using rotary movements in order not to damage sealing lip.

– Place the removed injectors on a clean cloth.

Installing

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

When a fitting a new injector, the following must be replaced:

- Clamping piece
- Copper seal
- O-ring for shaft of injector
- O-ring for fuel return connection

Note

- *Observe cylinder specific markings when reusing high-pressure lines.*
- *The high-pressure lines may be re-used after the following checks:*
- *Check taper seat of respective high-pressure line for deformation and cracks.*
- *The inside of the line must not be deformed, constricted or damaged.*
- *Corroded lines should no longer be used.*

When a used injector is re-fitted, the following must be replaced:

- Clamping piece
- Copper seal
- O-ring for shaft of injector

♦ O-ring for fuel return connection

– Spray tip of injector with a rust removal spray. Wait approx. 5 minutes and wipe off soot and oil particles with a cloth.

– If an injector is very dirty, the tip of the nozzle should also be cleaned with a soft brass wire brush to make it easier to remove the copper seal. Do not apply the wire brush to the bores in the nozzle.

– To remove old copper seal from injector, clamp seal carefully in a vice so that it is just held between jaws without turning. Then carefully pull and twist the injector out of the copper seal by hand.

– Use a scraper to clean off the deposits under the copper seal.

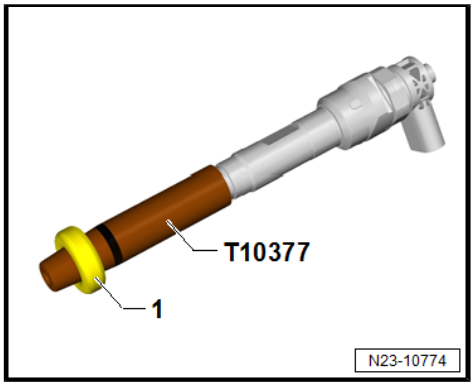
WARNING

Only the cleaning set - VAS 6811- may be used for cleaning the sealing surface of the injector bore.

For detailed information on how to use the cleaning set as well as the order in which its components are applied, refer to the ⇒ operating manual provided with the cleaning set - VAS 6811- .

– Renew O-ring -1- for injector bore. Use assembly sleeve -T10377- to do this.

– Install injectors.



Note

If any of the seals for injectors in cylinder head cover are damaged, replace the affected seal ⇒ *page 105* *.*

– Tighten union nuts of high-pressure lines hand-tight. Check they are seated without stress.

• Press return line connections carefully over the seals and onto the injectors (first check seal for damage). The catch should engage audibly. Then press release pin down carefully.

After one or more injectors has been replaced, the correction values for the new injectors must be entered into the engine control unit ⇒ Vehicle diagnostic tester.

Also check all the other injectors to find out whether the correct correction values have been stored in the engine control unit. Do not attempt to re-enter these values if the correct values are already stored in the engine control unit.

Note

The high-pressure connections must not be opened for bleeding.

– Start engine and run at idling speed for a few minutes, then switch off again.

– Switch off ignition.

– Check the complete fuel system and return line connections for leaks ⇒ page 268 .

Renew the affected component if leakage still occurs after tightening to the correct torque.

Note

The return lines can only be renewed together with the pressure retention valve as one unit.

– Then, road-test vehicle over a distance of more than 20 km, accelerating with full throttle at least once, then check the high-pressure system for leaks again.

Note

If there is any air left in the fuel system, the engine may switch to the backup mode ('emergency running' mode) during the road test. Switch off engine and clear event memory ⇒ Vehicle diagnostic tester. Then continue the road test.

Specified torques

◆ ⇒ “5.1 Assembly overview - injectors”, page 278

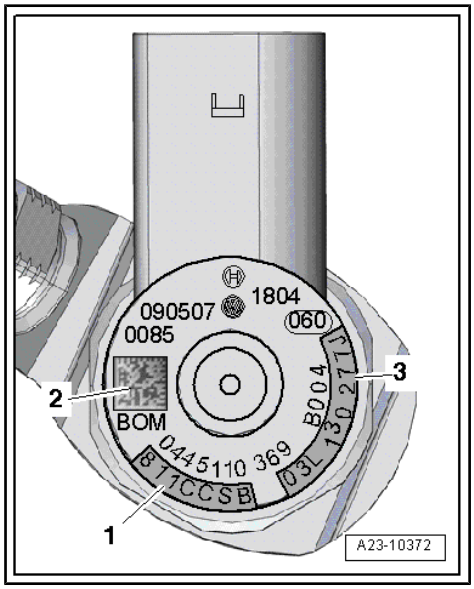
5.3 Adapting correction values for injectors

Special tools and workshop equipment required

♦ Vehicle diagnostic tester

The function “Adaptation of correction values for injectors” serves to correct the injection rates for each cylinder of a common rail system individually across the entire ignition map range.

The 7-digit correction values -1- (details in illustration are only an example) are marked separately on each injector. The marked values may consist of letters and/or numbers.



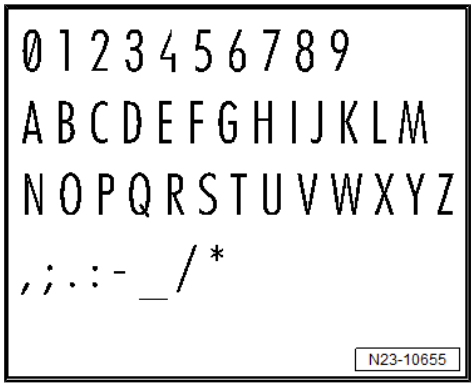
Top view of injector

1 - Checksum

2 - Data Matrix Code

3 - Part number

Table of characters for reading the characters on the injector



After renewing an injector, the correction value must be written into the engine control unit.

After the engine control unit has been replaced, the “correction values for the injectors” must be transferred to the new engine control unit.

The work procedure for the adaptation is described in ⇒ Vehicle diagnostic tester.

Also check that the “injector delivery calibration values” are correctly entered for all other injectors. Do not attempt to re-enter these values if the correct values are already stored in the engine control unit.

Select “Adapt injector delivery calibration” ⇒ Vehicle diagnostic tester.

5.4 Testing injectors

There are 3 different ways of testing the injectors.

- Check adaptation of “injector delivery calibration values” and “injector voltage calibration values” ⇒ Vehicle diagnostic tester.
- Check return flow rate of injectors with engine running ⇒ page 288
- Check return flow rate of injectors at starter speed ⇒ page 290

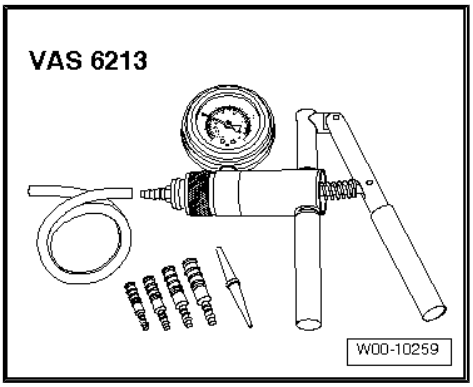
5.5 Testing jammed-open injectors

WARNING

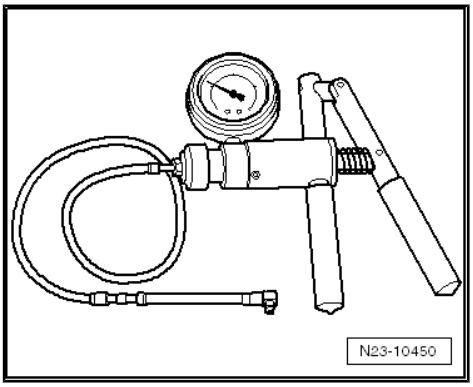
- *Always read rules for cleanliness and instructions for working on fuel system ⇒ page 7 .*
- *Always follow these rules for cleanliness and instructions before starting work and while working on the fuel system.*

Special tools and workshop equipment required

- Hand vacuum pump - VAS 6213-



- Make an -adapter- from a return line.



– Delete event memory entry with ⇒ Vehicle diagnostic tester.
– Clean all connections (e.g. with commercial cleaning solution) before removing.

Note

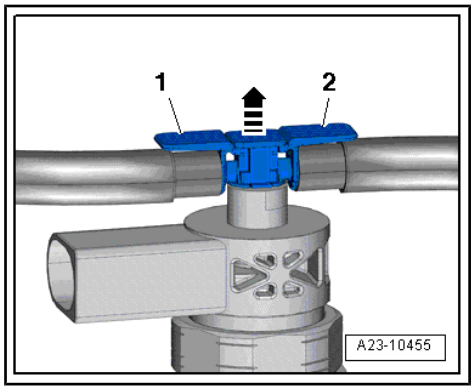
- *Ensure cleanliness. Under no circumstances may dirt enter the fuel system.*
- *Check one cylinder after the other.*

– Remove air filter housing ⇒ page 277 .
– If necessary, remove oil filler hose or oil filler neck.
– Dry all cleaned parts.

Begin with cylinder 1.

– Pull return line connections off injectors by counterholding slightly on catches -1 und 2- and pulling release pin upwards -arrow-.

– Connect clean, blown-out adapter to injector to be tested.



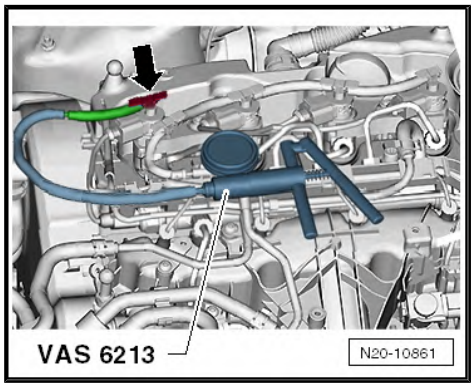
– Use hand vacuum pump - VAS 6213- to generate vacuum of approx. 500 mbar.

If injector is working properly, pressure remains constant for 30 seconds.

If injectors are defective, the pressure drops within 2 ... 3 s to 0 bar

Repeat check is necessary, observe pressure loss at hand-operated vacuum pump - VAS 6213- .

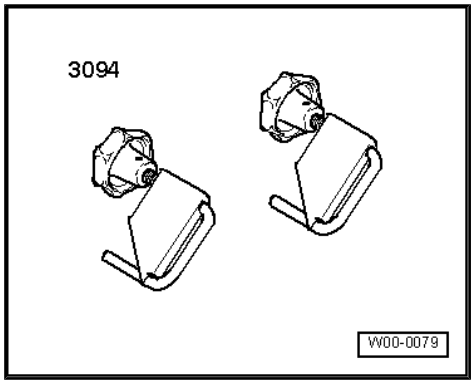
– Renew defective injectors ⇒ page 280



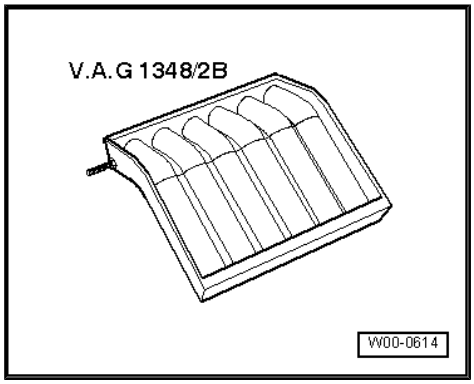
5.6 Checking return flow rate of injectors with engine running

Special tools and workshop equipment required

♦ Hose clamps up to 25 mm - 3094-



♦ Measuring instrument - V.A.G 1348/2 B- for measuring amount



♦ 4 lengths of hose must be made up in the workshop to fit on return line connections on injectors.

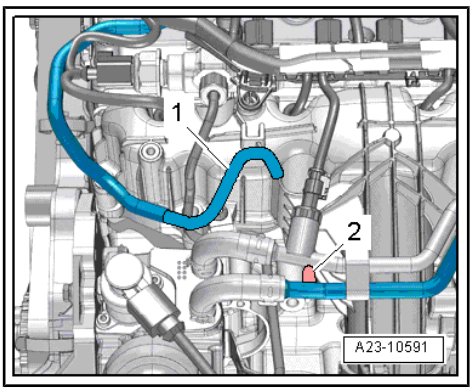
Checking return flow rate of all injectors:

Caution

Danger of functional impairment due to contamination/soiling!

♦ ***Note***
⇒ "3.2 Rules for cleanliness and instructions for working on fuel system", page 7 .

– Remove air filter housing ⇒ page 277 .
– If necessary, remove oil filler hose or oil filler neck.
– Detach hose connection from fuel return line.
– Use a clean plug -2- to seal open return connection.
– Hold fuel return hose -1- (added an extension to it if necessary) in measuring vessel to measure total return flow.
– Start engine and allow to idle for 2 minutes.
• Specified amount in 2 minutes: 0 ml to 50 ml
– If the specified amount is achieved, increase the engine speed to between 2000 and 2500 rpm for approx. 2 minutes and then check the amount of fuel returned.
• Specified amount in 2 minutes: less than 250 ml



Note

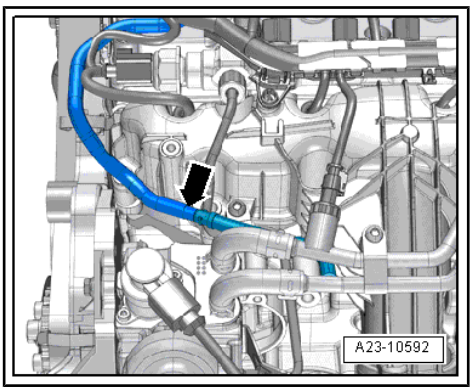
1000 ml is 1 litre.

If more fuel is returned than the specified amount, one or more injectors are defective. Checking return flow rate of each individual injector.

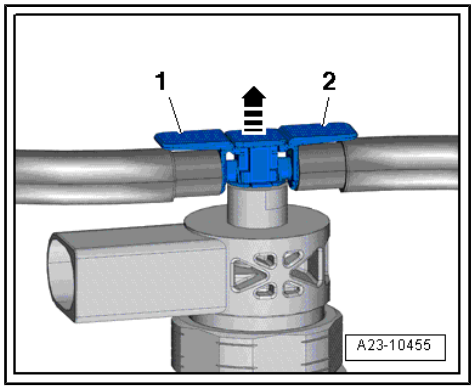
Checking return flow rate of individual injector:

Each injector normally has a relatively low return flow rate. If the return flow rate at one injector is relatively high (compared to the other injectors), that injector is probably defective.

– Clean all return line connections (e.g. with standard commercially available cold cleaning solvent) before removing them.
– Dry all cleaned parts.
– Clamp off coolant return hose -arrow- with hose clips up to 25 mm - 3094- .



– Pull return line connections off injectors by counterholding slightly on catches -1 und 2- and pulling release pin upwards -arrow-.



Note

Ensure cleanliness. No dirt must be allowed to get into the disconnected fuel return lines or the open connections on the injectors.

– Fit hose lines onto return line connections of all 4 injectors.

– Insert the 4 hose lines into the measuring instrument - V.A.G 1348/2 B- .

– Start engine and allow to idle for several minutes:

Caution

Risk of damage to injectors after return lines have been pulled off!

- ***Do not accelerate the engine during the test. Engine must be idling all the time.***

– When the engine is warm and running at idling speed the return flow rates at each of the 4 return lines must not differ by more than a small amount.

– If one injector has a significantly higher return flow rate than the others it must be renewed ⇒ page 280 .

Installing fuel return lines

Note

Lubricate all seals with engine oil or assembly oil before installing.

– Renew O-rings of all return line connections.

– Carefully press connections of return lines onto injectors. The catch should engage audibly. Then press release pin down carefully.

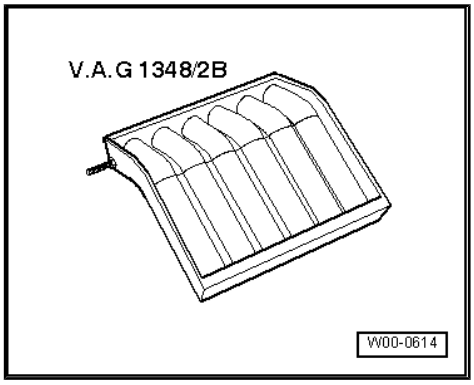
– Checking fuel system for leaks ⇒ page 268 .

5.7 Checking return flow rate of injectors at starter speed

If the engine cannot be started, the return flow rate of the injectors can also be checked at starter motor speed.

Special tools and workshop equipment required

- Measuring instrument - V.A.G 1348/2 B- for measuring amount



- 4 lengths of hose must be made up in the workshop to fit on return line connections on injectors.

Caution

Danger of functional impairment due to contamination/soiling!

- ***Note***
  ⇒ "3.2 Rules for cleanliness and instructions for working on fuel system", page 7 .

– Remove air filter housing ⇒ page 277 .

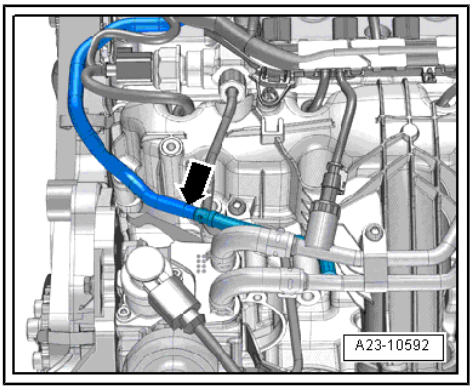
– If necessary, remove oil filler hose or oil filler neck.

Each injector normally has a relatively low return flow rate. If the return flow rate at one injector is relatively high compared to the return flow rate of the other injectors, that injector is probably defective.

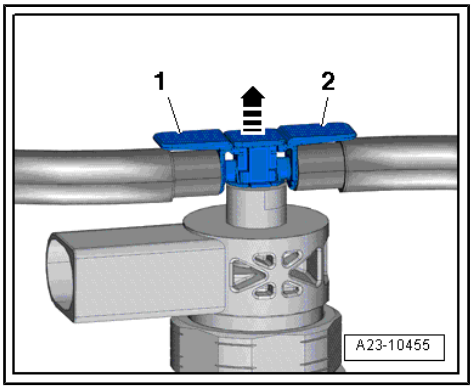
– Clean all return line connections (e.g. with standard commercially available cold cleaning solvent) before removing them.

– Dry all cleaned parts.

– Clamp off coolant return hose -arrow- with hose clips up to 25 mm - 3094- .



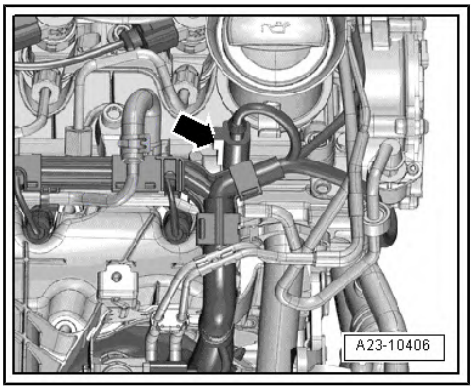
– Pull return line connections off injectors by counterholding slightly on catches -1 and 2- and pulling release pin upwards -arrow-.



Note

Ensure cleanliness. No dirt must be allowed to get into the disconnected fuel return lines or the open connections on the injectors.

– Detach connector -arrow- from fuel pressure regulating valve - N276- .



Note

This prevents the fuel from being injected during the attempt at starting.

– Fit hose lines onto return line connections of all 4 injectors.
– Insert the 4 hose lines into the measuring instrument - V.A.G 1348/2 B- .
– Activate starter 3 times,(pausing for around 20 seconds after each starting attempt to ensure that starter does not overheat).
• Return flow rate specification: 0 ml
– If fuel escapes from an injector, that injector has to be renewed.
– Reattach connector of fuel pressure regulating valve - N276- .

Installing fuel return lines

Note

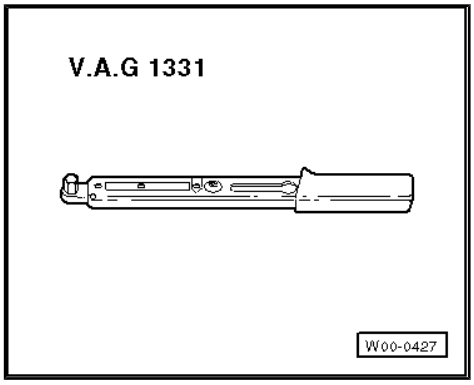
Lubricate all seals with engine oil or assembly oil before installing.

– Renew O-rings of all return line connections.
– Carefully press connections of return lines onto injectors. You should hear them click into place. Then carefully press the release pin downwards.
– Checking fuel system for leaks ⇒ page 268 .
– Delete event memory entry with an ⇒ Vehicle diagnostic tester.

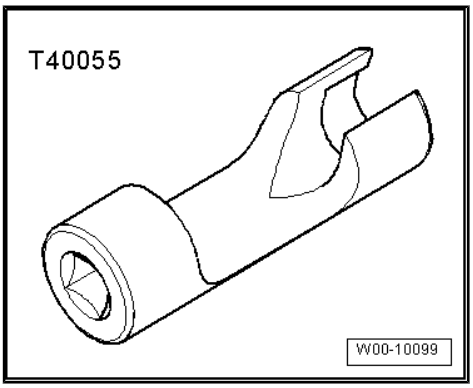
5.8 Removing and installing fuel rail

Special tools and workshop equipment required

- Torque wrench (5…50 Nm) - V.A.G 1331-



- Socket - T40055-



Removing

– Remove air filter housing ⇒ page 277 .

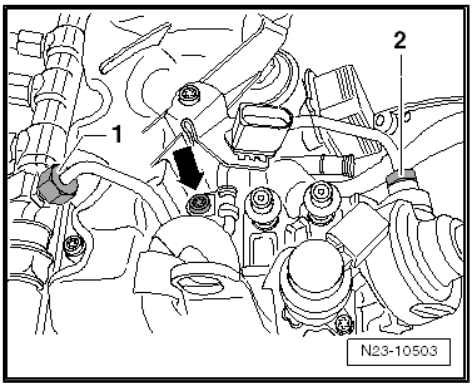
– If necessary, remove oil filler hose or oil filler neck.

WARNING

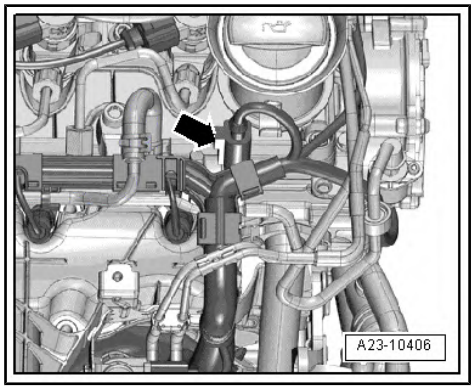
- *Always read rules for cleanliness and instructions for working on fuel system ⇒ page 7 .*
- *Always follow these rules for cleanliness and instructions before starting work and while working on the fuel system.*

– Undo and remove bolt -arrow- from retainer of high-pressure line.

– Unscrew union nuts -1 and 2-, and remove high-pressure line.



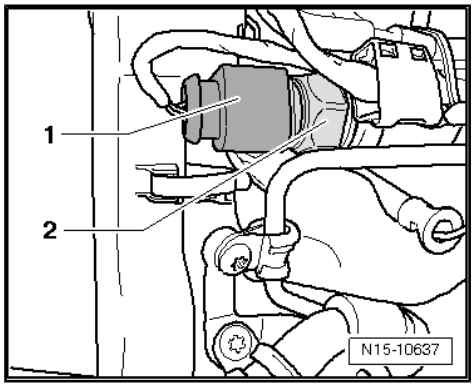
– Detach connector -arrow- from fuel pressure regulating valve - N276- .



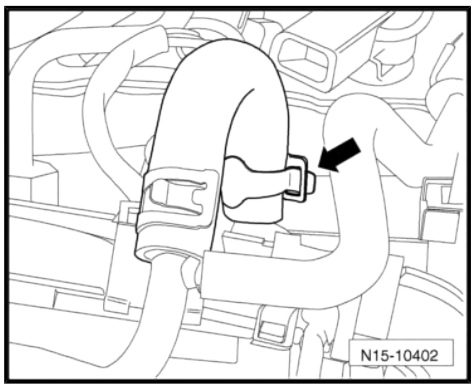
– Pull connector -2- off fuel pressure sender - G247- -1-.

Caution

When releasing high-pressure line, counterhold high-pressure connection using an open-ended spanner. Leaks occur if high-pressure connection is released.



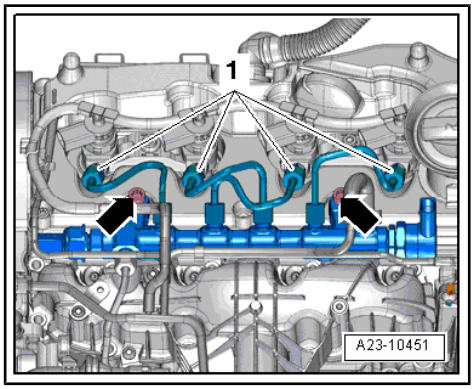
– Remove fuel return hose from high pressure accumulator (fuel rail). To do this, release hose clip -arrow-.
– Remove line guide from high-pressure accumulator (fuel rail) and place to one side.



– Undo union nuts of 4 high-pressure lines -1-.

– Unscrew bolts -arrows- and remove high-pressure accumulator (fuel rail).

– Seal open fuel rail holes using a clean bung.



Installing

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

WARNING

For vehicles with solenoids, the learnt values from the fuel system must be reset following the renewal of the fuel pressure regulating valve - N276- ⇒ Vehicle diagnostic tester.

– Install high-pressure lines (without tension).

Note

- *Observe cylinder specific markings when reusing high-pressure lines.*
- *The high-pressure lines may be re-used after the following checks:*
- *Check taper seat of respective high-pressure line for deformation and cracks.*
- *The inside of the line must not be deformed, constricted or damaged.*
- *Corroded lines should no longer be used.*

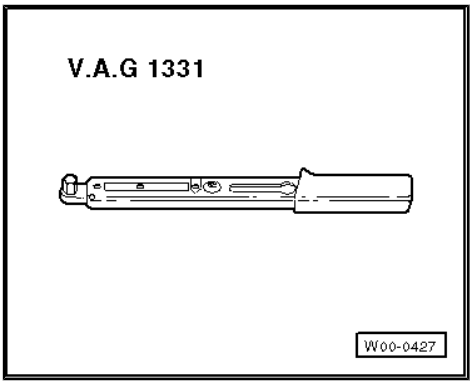
Specified torques

- ⇒ “5.1 Assembly overview - injectors”, page 278

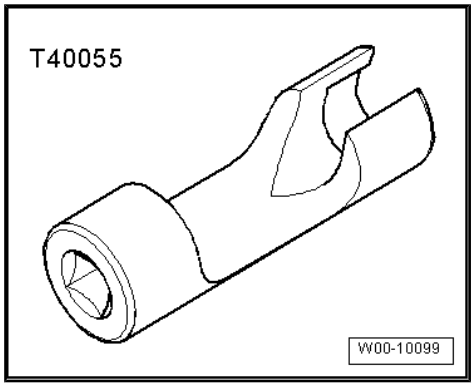
5.9 Removing and installing high-pressure lines

Special tools and workshop equipment required

- Torque wrench (5…50 Nm) - V.A.G 1331-



- Socket - T40055-



Removing

– Remove air filter housing ⇒ page 277 .

– If necessary, remove oil filler hose or oil filler neck.

Caution

- *Mark high-pressure lines to indicate which ones belong to which cylinders. Injectors must always be re-installed on the same cylinders.*
- *The open connections must be sealed immediately with a suitable cap.*
- *Do not crush or damage fuel return lines during removal or installation.*

– Use socket - T40055- to unscrew high-pressure line between high-pressure accumulator (fuel rail) and injectors to be removed.

Installing

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

Caution

To position injection lines more easily and stress-free, loosen and shift high-pressure accumulator (fuel rail) slightly if necessary. The lines must never be bent or tensioned. Tension would otherwise cause the respective line to break in the long-term.

Note

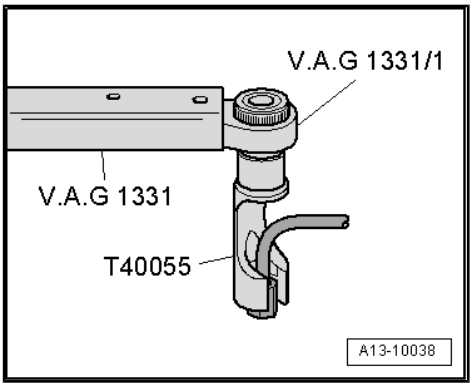
This section describes how to install new injection lines. If already fitted injection lines are to be used again, the following things must be checked. Apart from that the procedure is identical.

- Visual inspection of taper seats for damaged such as transverse scores, cracks, corrosion.

Installing individual injection lines (cylinders 1...4, between high-pressure accumulator (fuel rail) and injector)

– Remove new injection line from its packaging. Remove sealing plug and position line between high-pressure accumulator (fuel rail) and injector (without laying down).

– First, tighten the union nuts of the injection line hand-tight without a tool. Ensure that line is correctly seated.
– Proceed in the same way with other injection lines.
– Tighten union nuts of all new injection lines using torque wrench (5...50 Nm) - V.A.G 1331- and socket bit - T40055- .



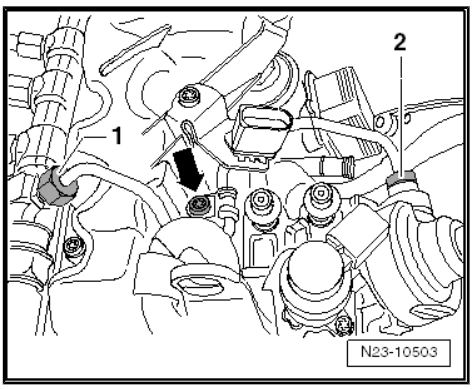
Installing fuel line between high-pressure pump and high-pressure accumulator (fuel rail) or complete set of lines

Note

- *If high-pressure lines are used again, bear in mind the markings you have already made on them.*
- *The high-pressure lines can be re-used after the following checks:*
- *Check taper seat of respective high-pressure line for deformation and cracks.*
- *The inside of the line must not be deformed, constricted or damaged.*
- *Corroded lines should no longer be used.*

– Install high-pressure lines (without tension).
– If you have not yet done so, loosen the bolts of the high-pressure accumulator (fuel rail) to allow it to be moved.
– Then remove the packaging from the fuel line between high-pressure pump and high-pressure accumulator (fuel rail). Remove sealing plug and position the line without laying down again.
– First, tighten the union nuts of the injection line hand-tight without a tool. Ensure that line is correctly seated.
– If a complete set needs to be installed, adopt the same procedure for all 4 injection lines.

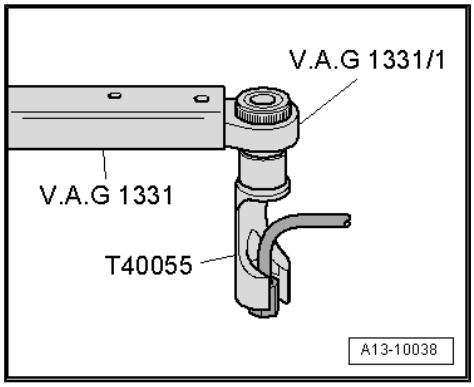
– Screw in bolt -arrows- around 3 turns of the thread.
– Tighten clamp on top of intake manifold -arrow-.



Note

Make sure that the clamp is correctly fitted!

– Tighten union nuts of all new injection lines using torque wrench (5...50 Nm) - V.A.G 1331- and socket bit - T40055- .
– Press return line connections carefully onto injector (check seal for damage). You should hear them click into place. Then carefully press the release pin downwards.
– Bleed fuel system ⇒ Vehicle diagnostic tester `Test electric fuel pump`.

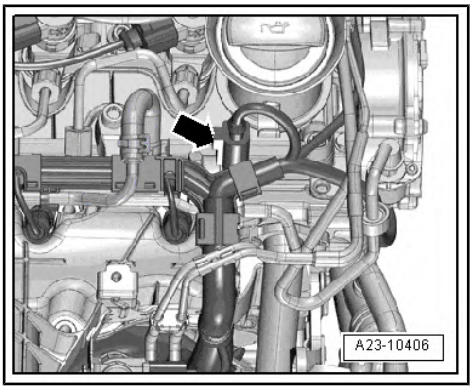


Specified torques

- ⇒ “5.1 Assembly overview - injectors”, page 278
-
-

6 Senders and sensors

6.1 Removing and installing fuel pressure regulating valve - N276-



Fuel pressure regulating valve - N276- -arrow- is located in the high-pressure accumulator. The valves ensure that pressure is constant in the high pressure accumulator and in the injector lines (fuel high pressure circuit).

If pressure is too high in the fuel high-pressure circuit, fuel pressure regulating valve - N276- opens. A small amount of fuel from the high pressure accumulator will thereby make its way back to the fuel tank via the return line.

If pressure is too low in fuel high-pressure circuit, fuel pressure regulating valve - N276- closes. The valve seals the high pressure side against the low pressure side in this way.

Note

Fuel pressure regulating valve - N276- must be renewed each time after removing.

Removing

WARNING

- *Note*
  ⇒ “3.2 Rules for cleanliness and instructions for working on fuel system”, page 7 .

– Removing high-pressure accumulator ⇒ page 292 .

– Clamp high-pressure accumulator in a vice with protective jaws.

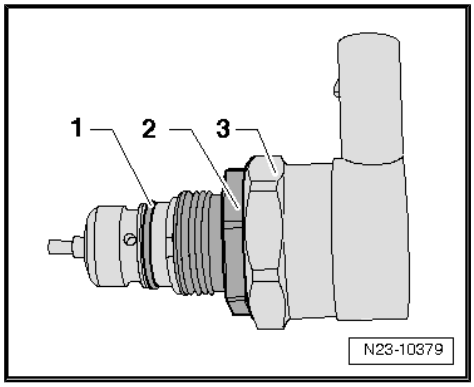
– Before removal, clean area around thread for fuel pressure regulating valve - N276- using commercial cold cleaning solution etc. (no dirt must enter bore of fuel rail).

Note

Clean carefully; cleaning solvent must not enter the electrical connector.

– Dry the fuel pressure regulating valve - N276- .

– Counterhold at 36 mm hexagon -3- and loosen 30 mm union nut -2-. Then unscrew regulating valve by hand.
– Use suction device to extract dirt from high-pressure accumulator hole (threads and sealing surface). Do not use any mechanical tools to do this.



Note

Seal off high-pressure accumulator hole immediately with a suitable plug to prevent dirt from entering.

Installing

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

WARNING

For vehicles with solenoids, the learnt values from the fuel system must be reset following the renewal of the fuel pressure regulating valve - N276- ⇒ Vehicle diagnostic tester.

Note

- *The fuel pressure regulating valve - N276- has a deformable sealing lip and no separate seal; it can therefore be used only once.*
- *Make sure that sealing surfaces (deformable sealing lip) and threads on new fuel pressure regulating valve - N276- are undamaged.*
- *Check sealing surface at fuel rail bore.*
- *Start of thread and deformable sealing lip of fuel pressure regulating valve - N276- must be moistened with diesel.*

– Tighten union nut by hand.
– Align new fuel pressure regulating valve so that connecting line is free of tension after connector is attached.
– Hold regulating valve in this position with an open-end spanner on housing hexagon or use a wrench (e.g. water pump wrench).
– Use a suitable torque wrench with an open-end insert (30 mm) to tighten union nut.
– Install high-pressure accumulator ⇒ page 292 .
– After mounting, leave engine running at moderate speed for a few minutes and then switch off again.
– Checking fuel system for leaks ⇒ page 268
– Read event memory ⇒ Vehicle diagnostic tester.
– Road-test vehicle accelerating with full throttle at least once, then check high-pressure system for leaks again.
– Read event memory again ⇒ Vehicle diagnostic tester.

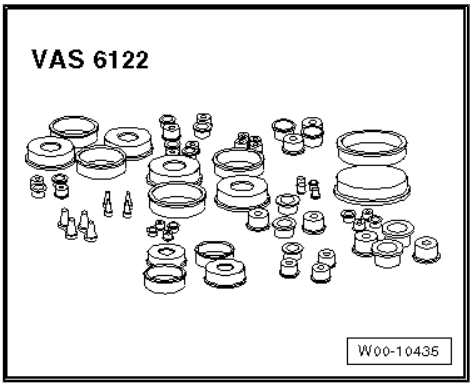
Specified torques

- ⇒ “5.1 Assembly overview - injectors”, page 278

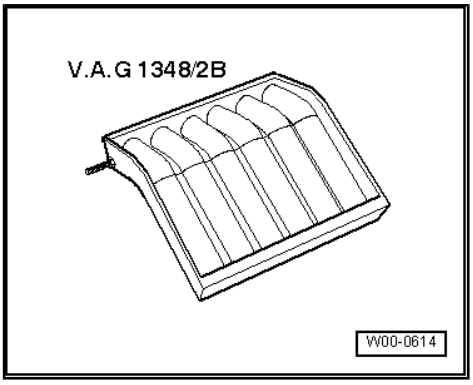
6.2 Checking fuel pressure regulating valve - N276-

Special tools and workshop equipment required

- Engine bung set - VAS 6122-



- Measuring instrument - V.A.G 1348/2B-



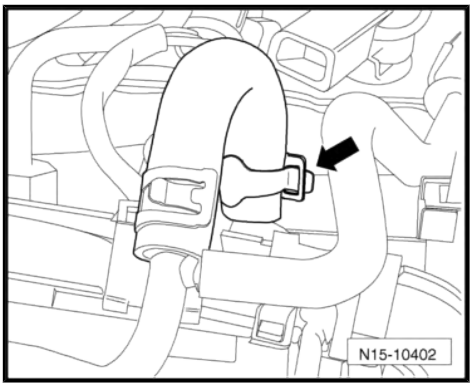
- Measuring container, fuel-resistant

WARNING

- *Note*
  ⇒ "3.2 Rules for cleanliness and instructions for working on fuel system", page 7 .

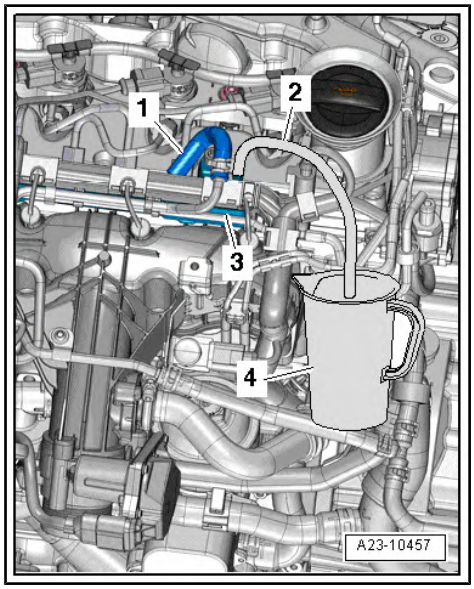
– Remove fuel return hose from fuel rail. To do this, release hose clip -arrow-.

– Seal open fuel return hose using a bung from engine bung set - VAS 6122- .



– Connect auxiliary hose -2- to fuel rail return connection -3-.
– Hold auxiliary hose in measuring container -4- or meter - V.A.G 1348/2B- to measure return flow rate.
– Start engine and run at idling speed for 30 seconds.
• Specified amount in 30 seconds: 90 ... 110 ml

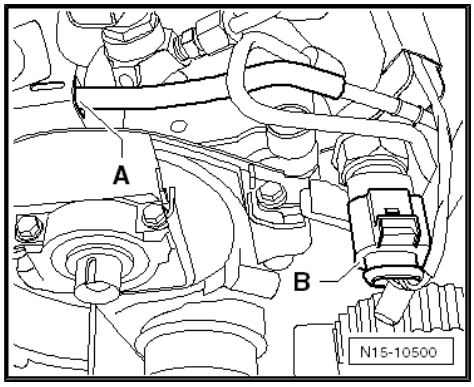
If the specification is not attained, the fuel pressure regulating valve - N276- is defective.



6.3 Removing and installing fuel pressure sender - G247-

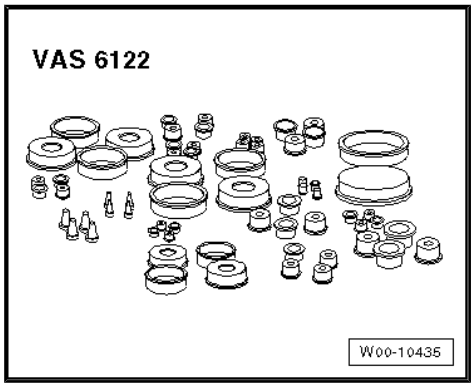
Fuel pressure sender - G247- -item B- is located in fuel rail. It measures the current fuel pressure in the high-pressure system and transmits a voltage signal to the engine control unit - J623- .

In the event of sender failure, pressure regulation is controlled using a map from the engine control unit. In back-up function, the maximum engine speed is limited to approx. 3000 rpm.



Special tools and workshop equipment required

♦ Engine bung set - VAS 6122-



Removing

WARNING

♦ *Note*
⇒ "3.2 Rules for cleanliness and instructions for working on fuel system", page 7 .

– Clean threaded area around the regulating valve with commercially available degreaser, for example, before removing

it. Under no circumstances may dirt enter the hole of the high pressure accumulator.

Note

Clean carefully; cleaning solvent must not enter the electrical connector.

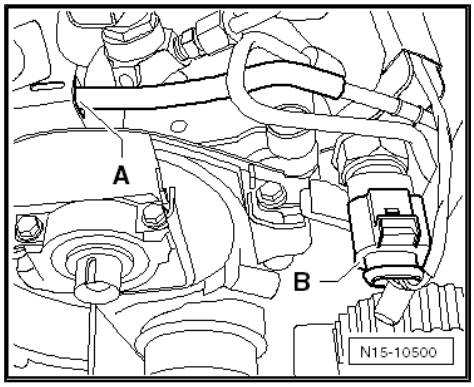
– Dry fuel pressure sender - G247- .

– Detach connector -B- from fuel pressure sender - G247- .

– Unscrew fuel pressure sender - G247- .

– Use suction device to extract dirt from high-pressure accumulator hole (threads and sealing surface). Do not use any mechanical tools to do this.

– Seal open fuel rail bore using a bung from engine bung set - VAS 6122- .



Installing

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

Note

- *Fuel pressure sender - G247- has a deformable sealing lip, not a seal, for sealing purposes.*
- *Check that sealing surfaces (deformable sealing lip) and threads on fuel pressure sender - G247- are undamaged. Re-using fuel pressure sender - G247- if possible if it has been tested OK.*
- *Also check sealing surface at bore of fuel rail.*
- *Start of thread and deformable sealing lip of fuel pressure regulating valve - N276- must be moistened with diesel.*

– After installing fuel pressure sender - G247- , bleed fuel system using ⇒ Vehicle diagnostic tester.

Note

The high-pressure connections must “not” be opened for bleeding.

– Read out event memory and, if necessary, delete it ⇒ Vehicle diagnostic tester

– Switch off ignition.

– Check fuel system carefully for leaks ⇒ page 268 .

– Renew the affected component if leakage still occurs after tightening to the correct torque.

– Road-test the vehicle. Accelerate with full throttle at least once, then check the fuel system again for leaks.

Note

If there is any air left in the fuel system, the engine may switch to the backup mode ('emergency running' mode) during the road test. Switch off engine and delete event memory. Then continue road test.

– After road test, read out event memory again ⇒ Vehicle diagnostic tester.

Specified torques

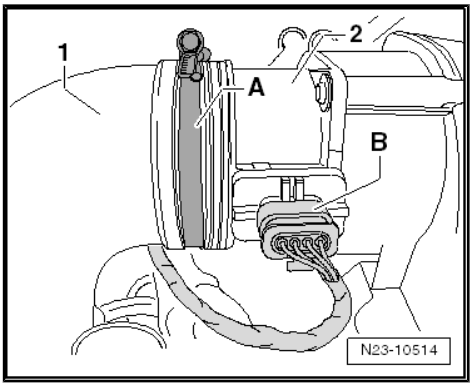
- ⇒ “5.1 Assembly overview - injectors”, page 278

6.4 Removing and installing air mass meter - G70-

Removing

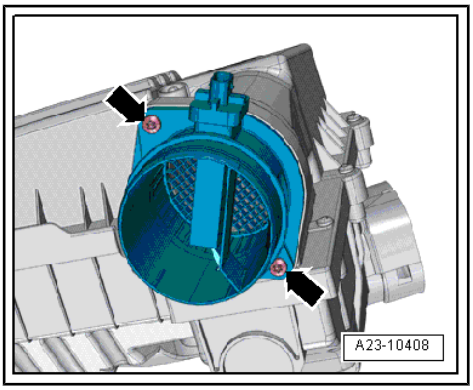
– Loosen clip -A- of intake hose -1- and pull hose off air mass meter - G70- -2-.

– Detach connector -B- from air mass meter - G70- -2-.



– Remove bolts -arrows-.

– Carefully pull air mass meter - G70- out of guide on air filter housing.



Installing

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

To ensure the proper function of the air mass meter - G70- it is important to adhere to the following work sequences.

Note

- *If the air filter element is very dirty or wet, particles of dirt or water may reach the air mass meter and falsify the measured 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.*
- *Always renew seal if damaged (infiltrating air).*
- *Use a silicone-free lubricant to install the air hose and seal.*
- *Hose unions and air intake pipes/hoses must be free of oil and grease when installing.*
- *Secure all hose connections with hose clips corresponding to the series equipment ⇒ Electronic Parts Catalogue .*

– Check for salt residue, dirt and leaves in air mass meter and air hose (clean air side).

– Check intake channel for contamination as far as air filter element. If contamination is found, remove salt residue, dirt and leaves from top and bottom part of air filter housing (rinse out or use vacuum cleaner if necessary).

Specified torques

- ⇒ “4.1 Assembly overview - air filter housing”, page 276

7 Engine control unit

⇒ “7.1 Removing and installing engine control unit J623 ”, page 306

⇒ “7.2 Removing and installing engine control unit J623 with protective housing”, page 306

7.1 Removing and installing engine control unit - J623-

Note

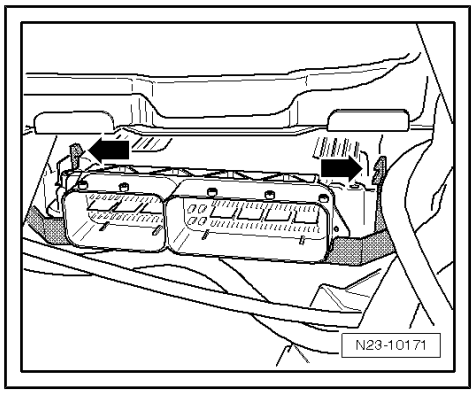
- *If the engine control unit is to be renewed, connect ⇒ Vehicle diagnostic tester, and carry out “Renew engine control unit”.*
- *When renewing the engine control unit - J623- , make sure to set the maximum speed governor (if provided) again ⇒ Vehicle diagnostic tester.*

Removing

– Switch off ignition.

– Release the two connectors from engine control unit - J623- and pull them off.

– Release engine control unit - J623- -arrows- and pull out of guide.



Installing

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

– Push engine control unit - J623- into holder and lock in place.

Note

- *Make sure that the engine control unit - J623- is correctly seated in the holder as it can otherwise become loose and possibly cause damage.*
- *If the engine control unit is to be renewed, connect ⇒ Vehicle diagnostic tester, and carry out “Renew engine control unit”.*
- *When renewing the engine control unit - J623- , make sure to set the maximum speed governor (if provided) again ⇒ Vehicle diagnostic tester.*

7.2 Removing and installing engine control unit - J623- with protective housing

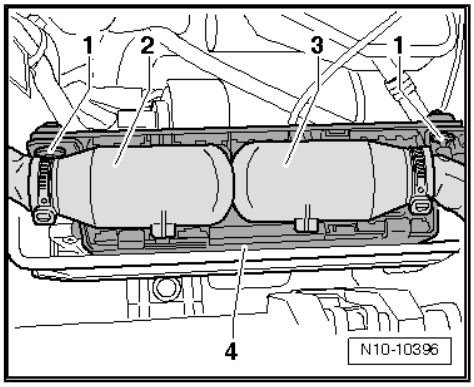
Note

- *If the engine control unit is to be renewed, connect ⇒ Vehicle diagnostic tester, and carry out “Renew engine control unit”.*
- *When renewing the engine control unit - J623- , make sure to set the maximum speed governor (if provided) again ⇒ Vehicle diagnostic tester.*

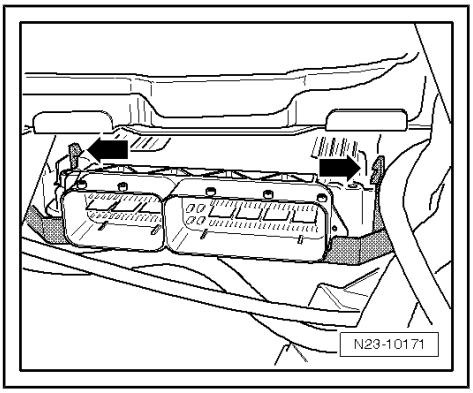
Removing

– Switch off ignition.

– Remove shear bolts -1- and remove bow -4-.
– Release and pull off connectors -2- and -3-.



– Release engine control unit - J623- -arrows- and pull out of guide.



Installing

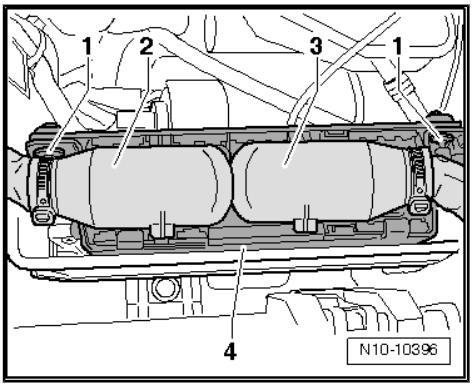
Installation is carried out in the reverse order; note the following:

– Push engine control unit - J623- into holder and lock in place.

Note

- *Make sure that the engine control unit - J623- is correctly seated in the holder as it can otherwise become loose and possibly cause damage.*
- *If the engine control unit is to be renewed, connect ⇒ Vehicle diagnostic tester, and carry out "Renew engine control unit".*
- *When renewing the engine control unit - J623- , make sure to set the maximum speed governor (if provided) again ⇒ Vehicle diagnostic tester.*

– Insert and lock connectors -2- and -3-.
– Fit bow -4- and new shear bolts -1-.



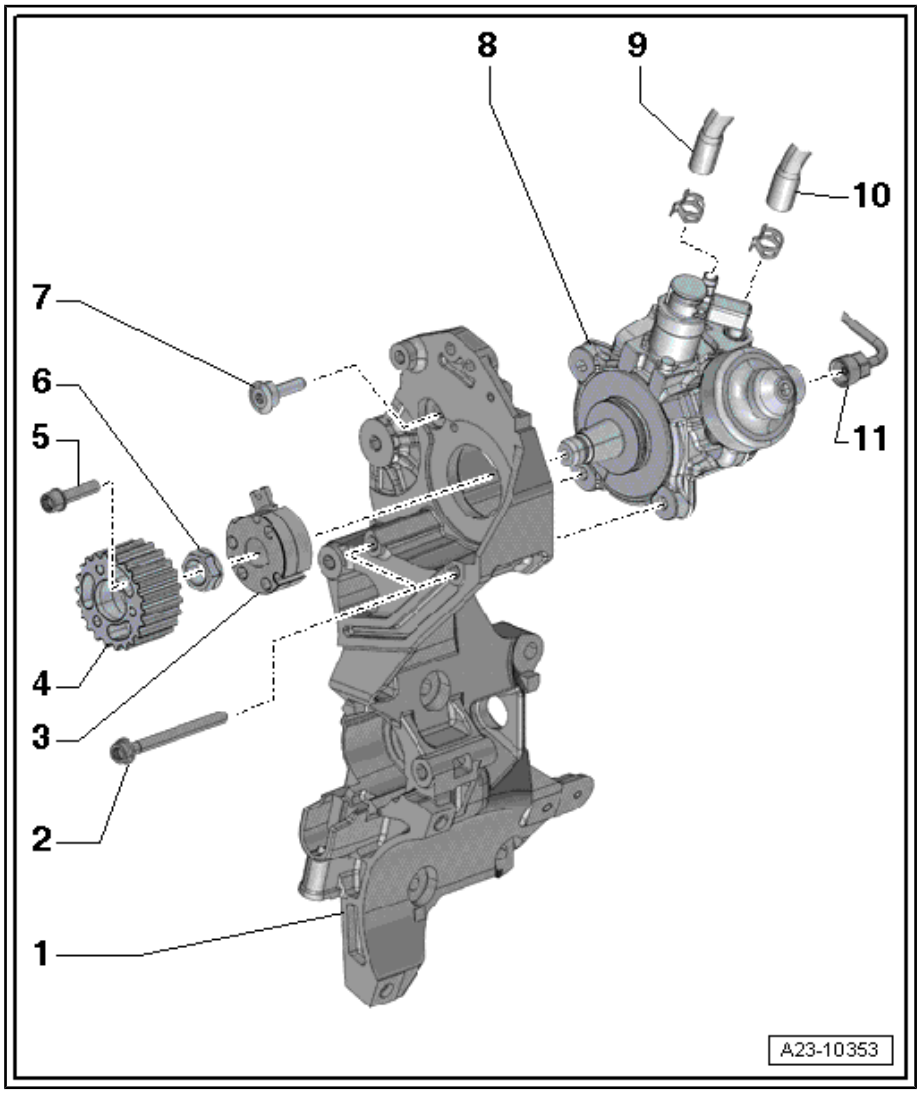
8 High-pressure pump

⇒ “8.1 Assembly overview - high-pressure pump”, page 308

⇒ “8.2 Removing and installing high-pressure pump”, page 309

⇒ “8.3 Initial fuel filling after installation of the high-pressure pump”, page 312

8.1 Assembly overview - high-pressure pump



1 - Bracket for ancillaries

- ❑ Removing and installing ⇒ page 50 .

2 - Bolt

- ❑ Renew after removing.
- ❑ 20 Nm +180°

3 - Hub

- ❑ Use counter-hold tool - T10051- to loosen and tighten.
- ❑ To remove, use puller - T40064- .

4 - High-pressure pump toothed belt pulley

5 - Bolts

- ❑ Renew after removing.
- ❑ 23 Nm

6 - Nut

- ❑ 95 Nm

7 - Bolt

- ❑ Renew after removing.
- ❑ 20 Nm +45°

8 - High-pressure pump

- ❑ Removing and installing ⇒ page 309 .
- ❑ With fuel metering valve - N290- (do not open).
- ❑ After renewing, initial fuel filling must be carried out (never allow pump to run dry) ⇒ page 312 .
- ❑ After replacement of the high-pressure pump or fuel pressure regulating valve - N276- , the learnt values have to be re-adapted ⇒ Vehicle diagnostic tester.

9 - Fuel supply hose

10 - Fuel return hose

11 - High-pressure line

- ❑ 25 Nm

Note

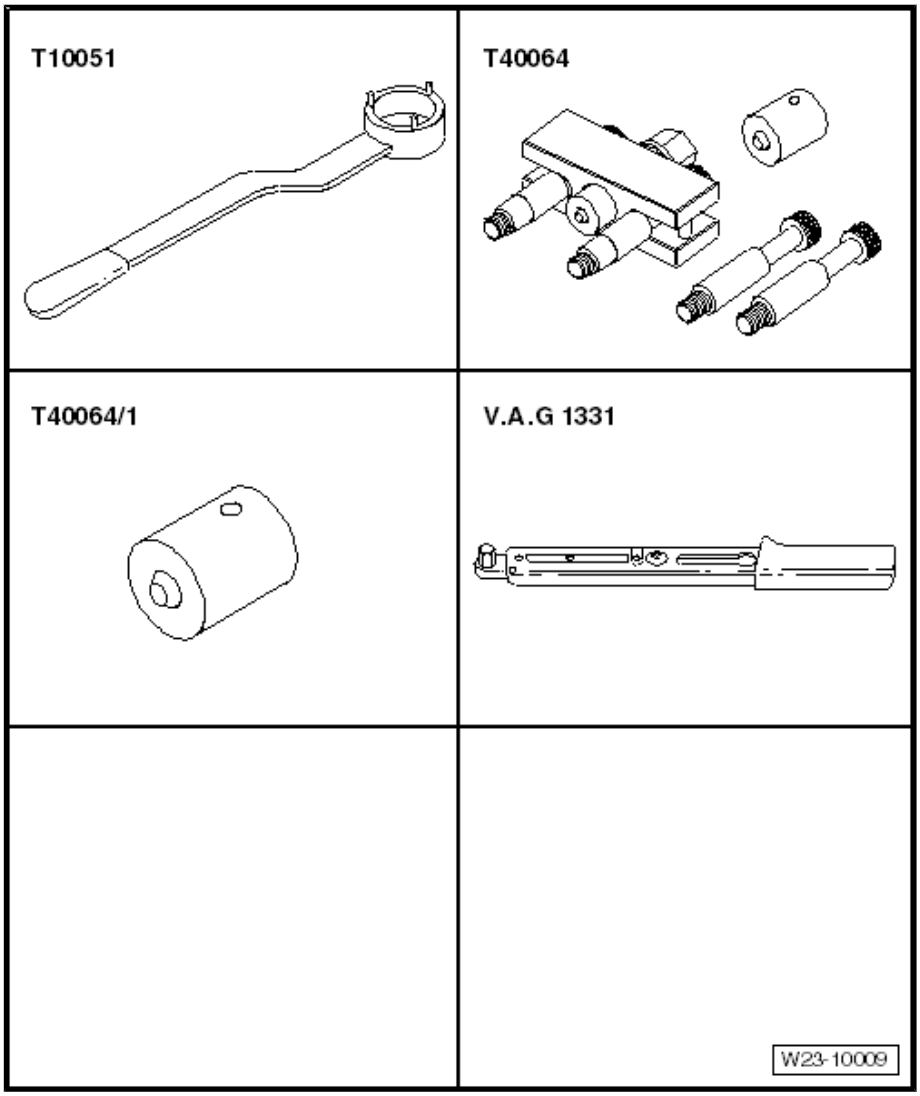
- *The high-pressure lines may be re-used after the following checks:*
- *Check taper seat for deformation and cracks.*
- *The inside of the line must not be deformed, constricted or damaged.*
- *Corroded lines should no longer be used.*

❑ Install so that component is not under tension.
❑ Lubricate thread of union nuts with clean engine oil.

8.2 Removing and installing high-pressure pump

Special tools and workshop equipment required

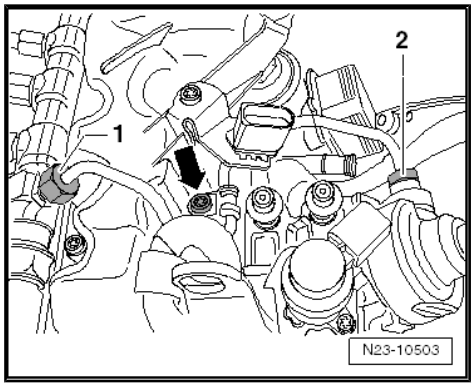
- Counterhold tool - T10051-
- Puller - T40064- with T40064/1
- Torque wrench - V.A.G 1331-



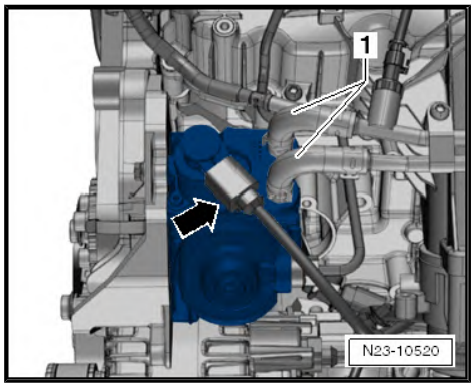
Removing

– Remove exhaust gas recirculation valve - N18- ⇒ page 361 .

– Remove toothed belt from camshaft and high-pressure pump ⇒ page 112 .
– Loosen union nuts -1 and 2-.
– Remove bolt -arrow-.
– Unclip connector of Hall sender - G40- from retainer.
– Remove high-pressure line.



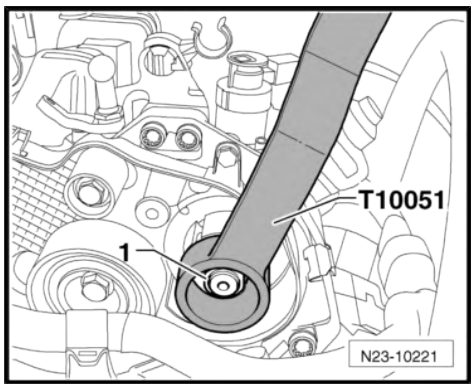
– Disconnect electrical connector -arrow-.
– Loosen clamps, and pull off fuel hoses -1-.
– Unscrew bolts ⇒ Item 5 (page 308) for high-pressure pump pulley using bit XZN 10 - T10385- .



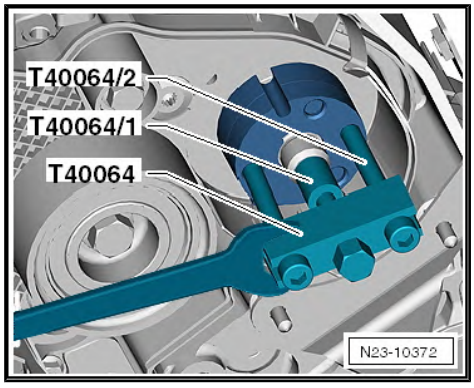
– Unscrew nut -1- from hub of high-pressure pump. To do this, counterhold with counterhold - T10051- .

Note

To fit the counterhold tool - T10051- , loosen the coolant pipe.

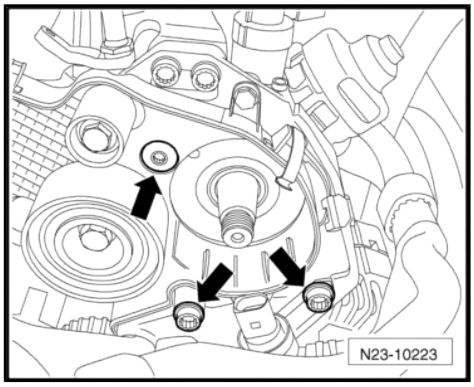


– Position puller - T40064- with thrust piece - T40064/1- and pin - T40064/2- as shown and pull hub off high-pressure pump. If necessary, counterhold with an open jaw spanner (24 mm).



– Remove bolts -arrows-.

– Carefully remove high-pressure pump.



Installing

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

Caution

Danger of functional impairment due to contamination/soiling!

- *Note ⇒ page 7 .*

To prevent the high-pressure fuel pump from running while it is empty (very tight tolerances) and to ensure that the engine starts quickly after parts have been renewed, it is important to observe the following:

- *If fuel system components between fuel tank and high-pressure pump are removed or renewed, initial fuel filling must be carried out.*
- *If a fuel pump, fuel line (between fuel tank and high-pressure pump) or the fuel filter is removed or renewed, fuel system bleeding must be carried out using ⇒ Vehicle diagnostic tester before first starting engine.*
- *If the high-pressure pump is removed or renewed, the fuel system must be bled using ⇒ Vehicle diagnostic tester before engine is started for the first time.*

Initial fuel filling procedure ⇒ page 312 .

Caution

- *The high-pressure pump must first be filled with fuel before the engine is started. The high-pressure pump must not be allowed to run while still empty.*
- *Risk of irreparable damage to high-pressure pump if allowed to run dry.*
- *Initial fuel filling ⇒ page 312 .*

Specified torques

- ⇒ “2.1 Assembly overview - toothed belt”, page 110
- ⇒ “4.1 Assembly overview - exhaust gas recirculation”, page 360
- ⇒ “3.1 Assembly overview - intake manifold”, page 271
- ⇒ “8.1 Assembly overview - high-pressure pump”, page 308

8.3 Initial fuel filling after installation of the high-pressure pump

Caution

Risk of irreparable damage to high-pressure pump if allowed to run dry.

- *The high-pressure pump must first be filled with fuel before the engine is started. The high-pressure pump must not be allowed to run while still empty.*

Note

- *When installing the high-pressure pump, it is essential to ensure that no dirt enters the fuel system.*
- *Only remove sealing plugs immediately prior to installation of fuel lines.*
- *There must be sufficient fuel in the tank.*

Proceed as follows to fill high-pressure pump with fuel.

– Switch ignition on.

– Connect ⇒ Vehicle diagnostic tester and carry out “Test electric fuel pump”.

Note

This process takes 130 seconds. Fuel pumps are actuated a total of 3 times in this case. The process must not be terminated prematurely.

– Then, start the engine.

– After filling fuel system, leave engine running at moderate speed for a few minutes and then switch off again.

– Checking fuel system for leaks ⇒ page 268

– Read out event memory and, if necessary, delete the event memory entry.

– Then, road-test the vehicle for more than 20 km. Accelerate with full throttle at least once.

Note

- *If there is any air left in the fuel system, the engine may switch to the backup mode ('emergency running' mode) during the road test. Switch off engine and delete event memory. Then continue road test.*
- *Then check high-pressure section of fuel system again for leakage.*

– Read event memory again.

9 Lambda probe

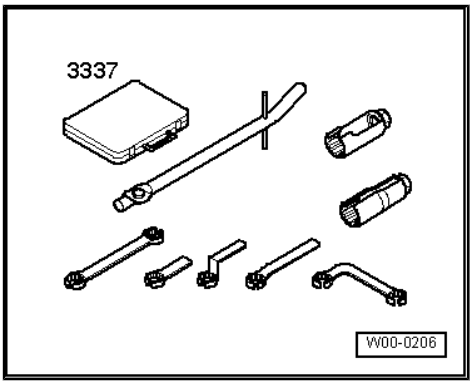
⇒ “9.1 Removing and installing Lambda probe”, page 313

⇒ “9.2 Removing and installing lambda probe (Crafter 4MOTION with Achleitner all-wheel drive)”, page 314

9.1 Removing and installing Lambda probe

Special tools and workshop equipment required

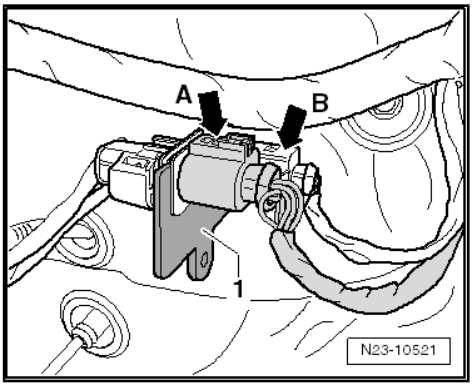
- Lambda probe open ring spanner set - 3337-



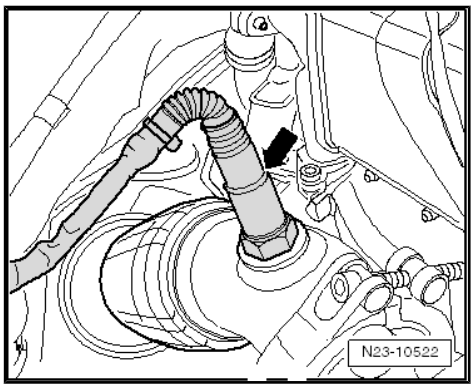
Removing

– Detach connector -arrow A- for Lambda probe - G39- .

– Pull connector -arrow A- out of holder -1- and expose wiring harness of Lambda probe - G39- .



– Unscrew Lambda probe - G39- -arrow-, using tool from Lambda probe open ring spanner set - 3337- .



Installing

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

Note

- *New Lambda probes are coated with an assembly paste. The paste must not get into the slots on the Lambda probe body.*
- *In the case of a used Lambda probe grease only the thread with high-temperature paste. This paste must not get into the slots on the Lambda probe body. High-temperature paste ⇒ Electronic Parts Catalogue .*
- *When installing, the Lambda probe's electrical wiring connection must always be re-attached in the same locations to prevent the Lambda probe cable from coming into contact with the exhaust pipe.*

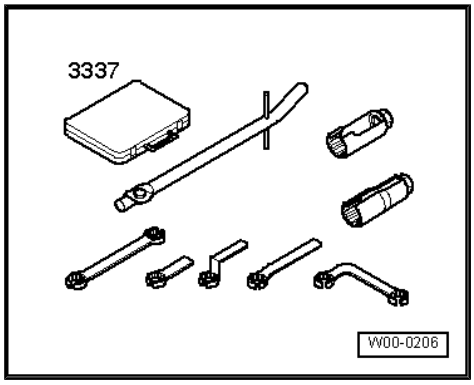
Specified torques

- ⇒ “2.1 Assembly overview - emission control”, page 329

9.2 Removing and installing lambda probe (Crafter 4MOTION with Achleitner all-wheel drive)

Special tools and workshop equipment required

- Lambda probe open ring spanner set - 3337-

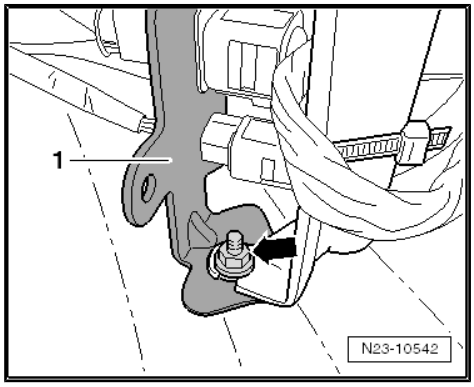


Removing

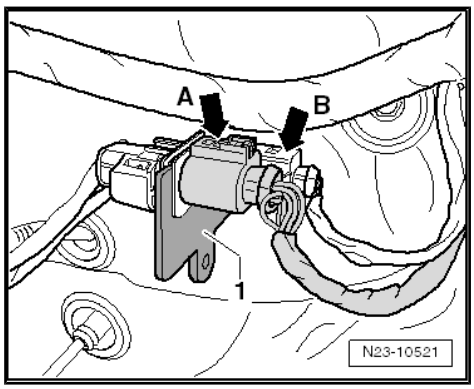
Note

The retainer for the Lambda probe wiring harness is bolted to plenum chamber bulkhead behind the air supply assembly. For the process, pull assembly slightly off plenum chamber bulkhead to separate connector.

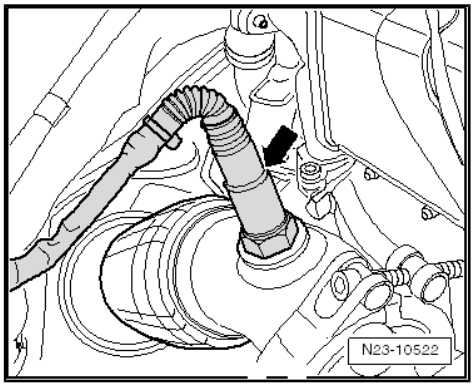
– Remove nut -arrow- of air supply assembly on plenum chamber bulkhead and pull assembly forwards slightly.



– Pull retainer -1- out of guide. Detach connector -arrow A- for Lambda probe - G39- .
– Free Lambda probe - G39- wiring harness.



– Unscrew Lambda probe - G39- -arrow-, using tool from Lambda probe open ring spanner set - 3337- .



Installing

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

Note

- *New Lambda probes are coated with an assembly paste. The paste must not get into the slots on the Lambda probe body.*
- *In the case of a used Lambda probe grease only the thread with high-temperature paste. This paste must not get into the slots on the Lambda probe body. High-temperature paste ⇒ Electronic Parts Catalogue .*
- *When installing, the Lambda probe's electrical wiring connection must always be re-attached in the same locations to prevent the Lambda probe cable from coming into contact with the exhaust pipe.*

Specified torques

- ⇒ “2.1 Assembly overview - emission control”, page 329

26 – Exhaust system

1 Exhaust pipes, silencers

1.1 Assembly overview - silencers

1 - Clamp

2 - Seal

3 - Particulate filter

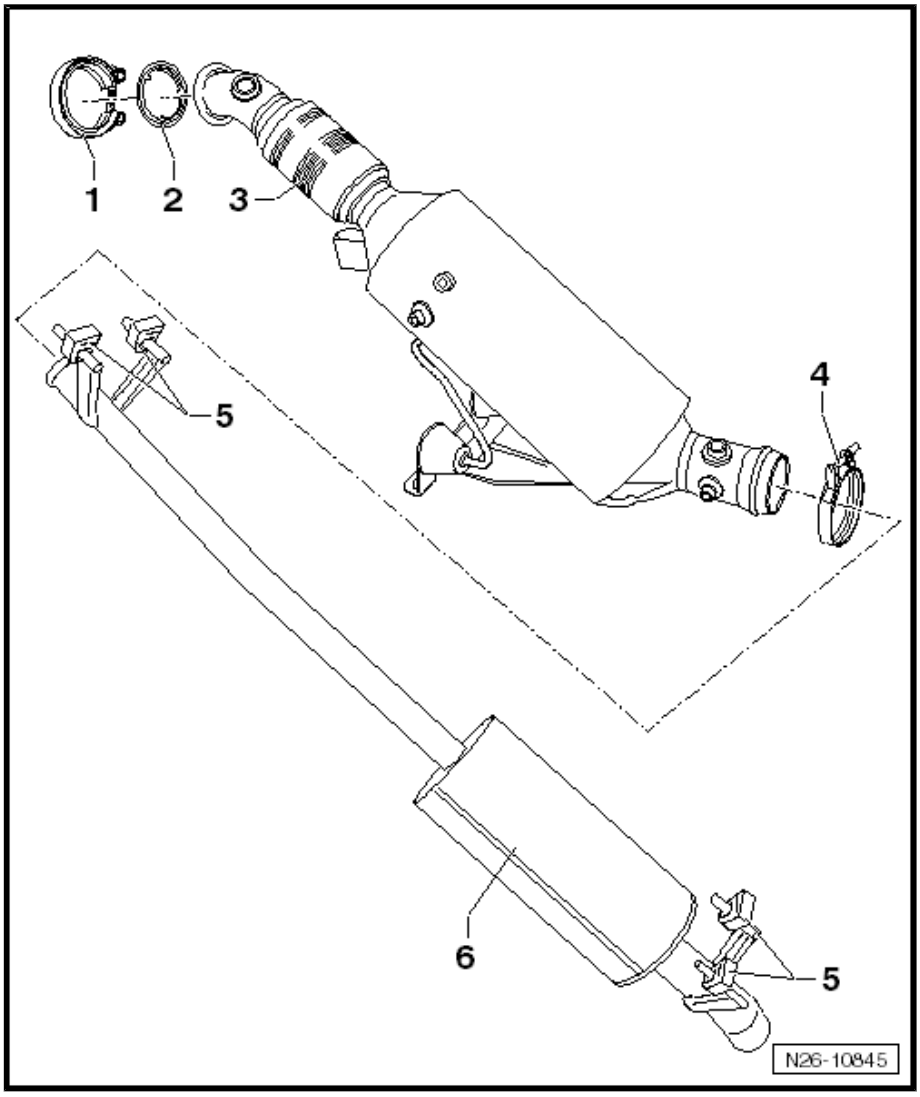
- ❑ Assembly overview ⇒ page 329 .
- ❑ Removing and installing ⇒ page 330 .

4 - Clamp

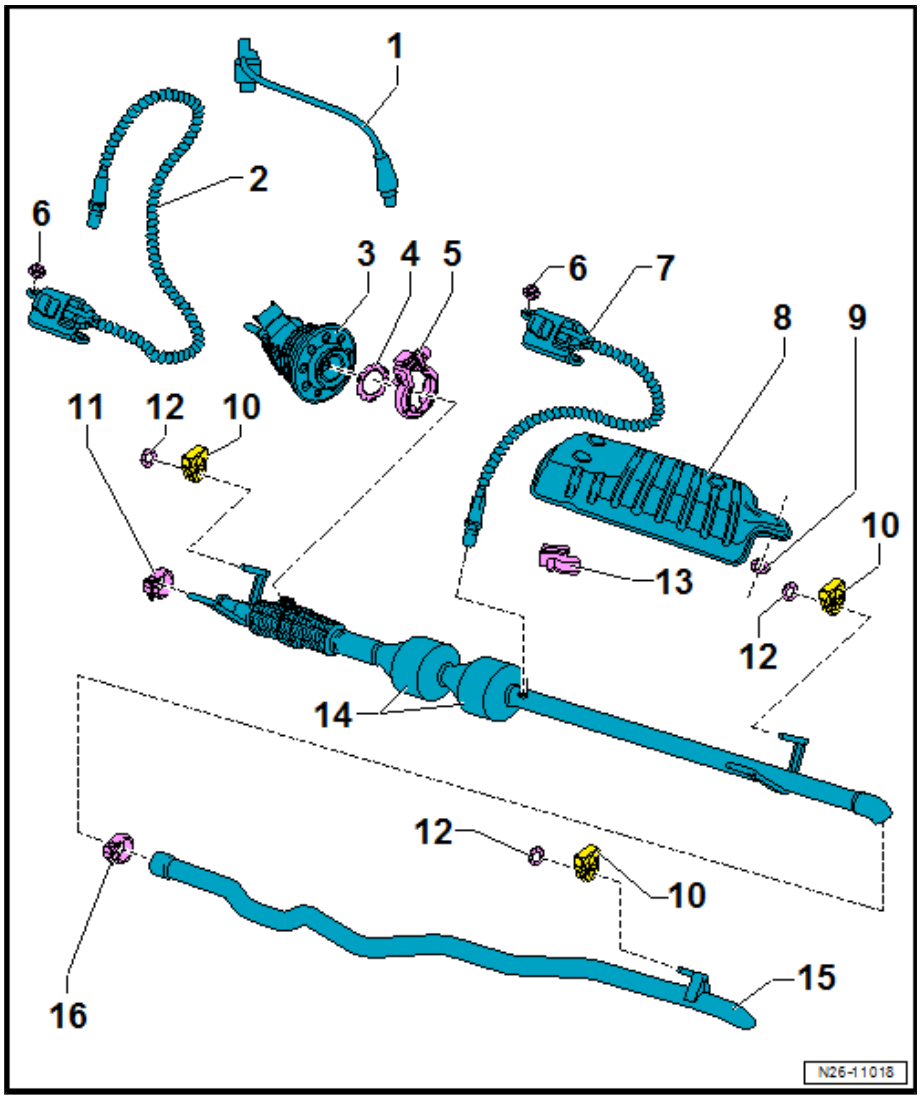
5 - Retaining rubbers

6 - Rear silencer

- ❑ Removing and installing ⇒ page 321 .



1.2 Assembly overview – SCR catalytic converters (vehicles compliant with EU 6 standard)



1 - Exhaust gas temperature sender 2 - G448-

- ❑ Fitting location: screwed into particulate filter on its front edge
- ❑ Removing and installing ⇒ page 357 .
- ❑ Coat thread with high-temperature paste as per ⇒ Electronic Parts Catalogue (ETKA)
- ❑ 45 Nm

2 - NOx sender - G295- with control unit for NOx sender - J583-

- ❑ Fitting location: screwed into exhaust pipe ahead of particulate filter
- ❑ Removing and installing ⇒ page 353 .
- ❑ 45 Nm

3 - Injector for reduction agent - N474-

- ❑ Removing and installing ⇒ page 347 .

4 - Seal

- ❑ Renew after removing

5 - Clamp

- ❑ Renew after removing
- ❑ 5 Nm

6 - Nut

- ❑ 3.5 Nm

7 - NOx sender 2 - G687- with control unit for NOx sender 2 - J881-

- ❑ Fitting location: screwed into exhaust pipe behind SCR catalytic converters
- ❑ Removing and installing ⇒ page 355 .
- ❑ To remove, remove heat shield ⇒ Item 8 (page 318)
- ❑ 45 Nm

8 - Heat shield

9 - Speed nut

- ❑ Qty. 4; for securing the heat shield
- ❑ Renew after removing

10 - Retaining ring

- ❑ Renew if damaged.
- ❑ Push up to stop on silencer

11 - Clamp

- ❑ Renew after removing
- ❑ 35 Nm

12 - Speed nut
- ❑ Renew after removing

13 - Retaining clip
- ❑ For line of NOx sender 2 - G687-

14 - Reduction catalytic converters
- ❑ Removing and installing ⇒ page 321 .
- ❑ Illustration shows short version of exhaust system
- ❑ The long version of exhaust system has an additional exhaust pipe ⇒ Item 15 (page 319)
- ❑ To remove, remove heat shield ⇒ Item 8 (page 318) and NOx sender 2 - G687- with control unit for NOx sender 2 - J881- ⇒ Item 7 (page 318)

15 - Exhaust pipe
- ❑ Only vehicles with long exhaust system

16 - Clamp
- ❑ Only vehicles with long exhaust system
- ❑ 23 Nm

1.3 Assembly overview - short silencer, Crafter 4MOTION with Achleitner four-wheel drive

1 - Rubber bracket
- ❑ Renew if damaged.

2 - Exhaust pipe

3 - Clamp

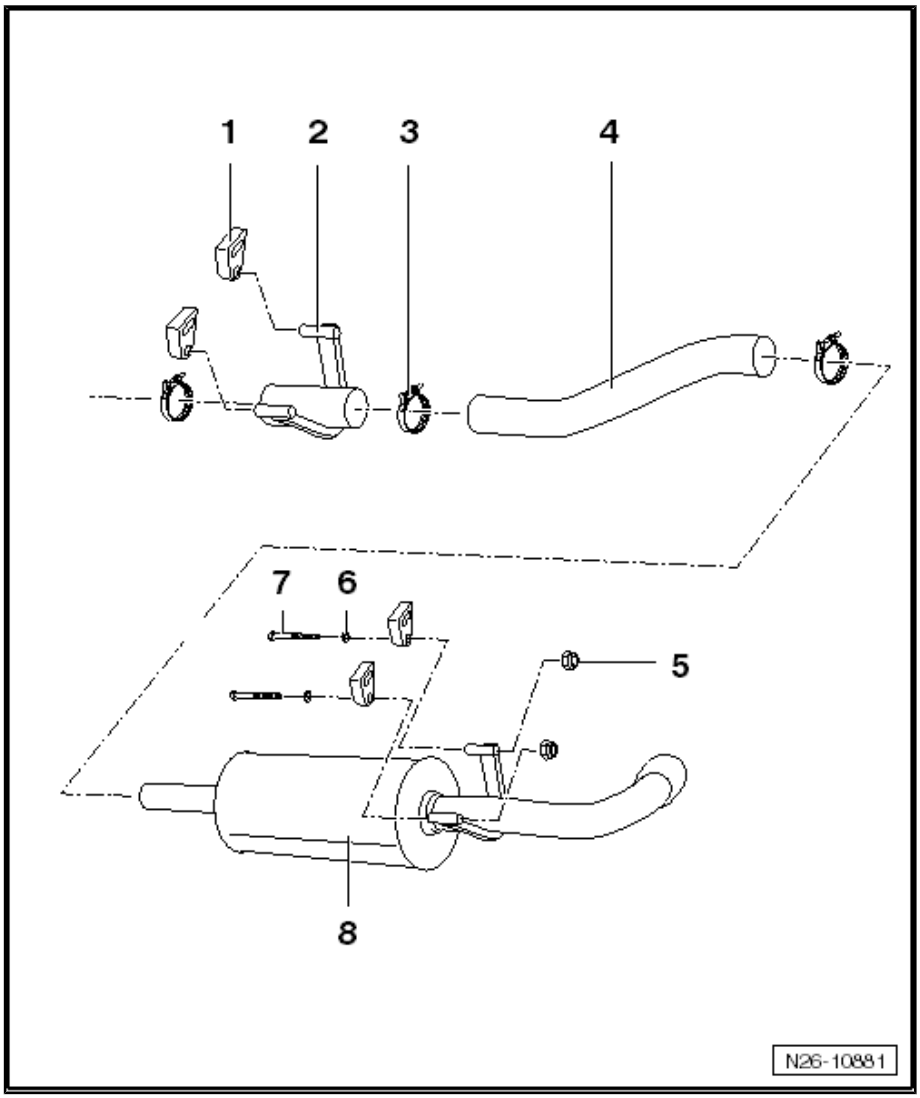
4 - Front exhaust pipe

5 - Hexagon nut
- ❑ Renew after removing.
- ❑ 60 Nm

6 - Washer

7 - Bolt
- ❑ Renew after removing.
- ❑ M12 × 1.5 × 100

8 - Rear silencer
- ❑ Removing and installing ⇒ page 323 .
- ❑ Shortening exhaust pipe and holder ⇒ page 325 .



1.4 Assembly overview - long silencer, Crafter 4MOTION with Achleitner four-wheel drive

1 - Rubber bracket
- ❑ Renew if damaged.

2 - Exhaust pipe

3 - Clamp

4 - Front exhaust pipe

5 - Nut
- ❑ Renew after removing.
- ❑ 60 Nm

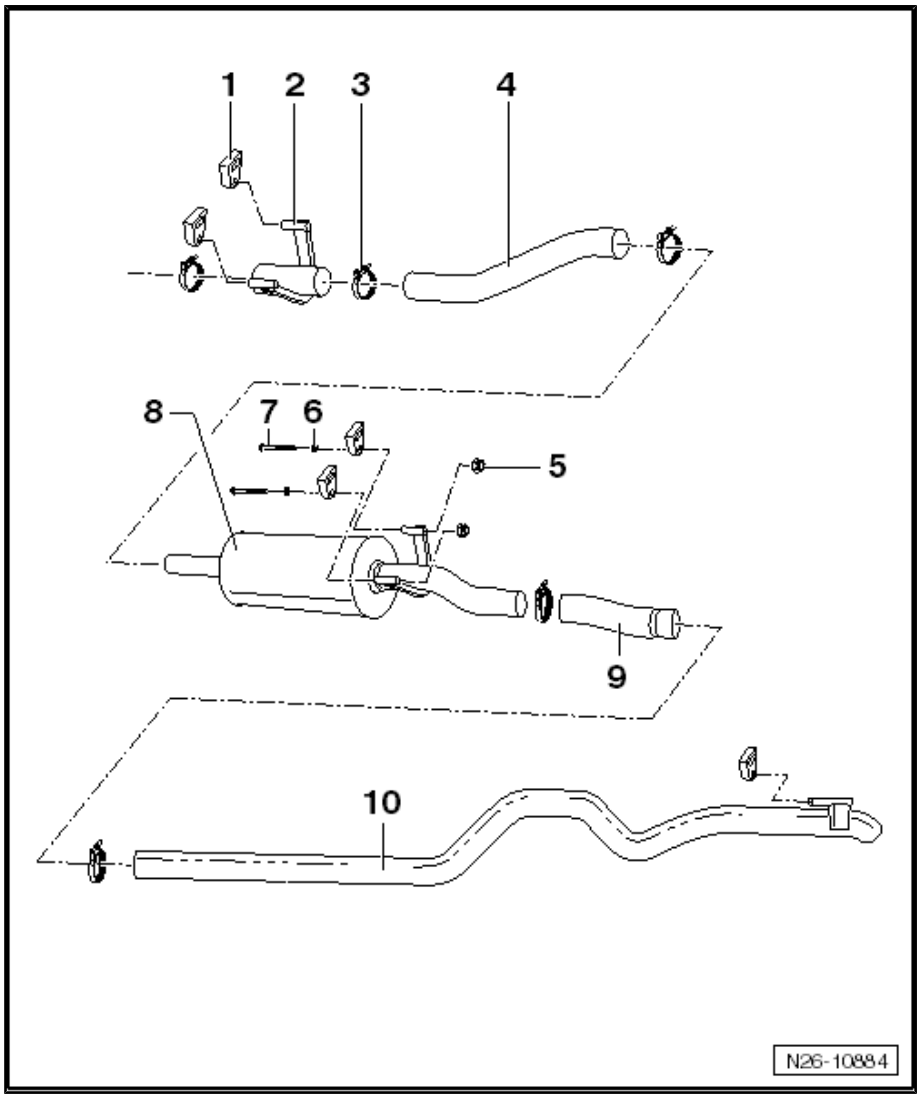
6 - Washer

7 - Bolt
- ❑ Renew after removing.
- ❑ M12 × 1.5 × 100

8 - Silencer
- ❑ Removing and installing ⇒ page 323 .
- ❑ Shortening exhaust pipe and holder ⇒ page 325 .

9 - Exhaust pipe
- ❑ With long exhaust system only.

10 - Exhaust tailpipe
- ❑ Shorten as required.
- ❑ Shortening exhaust pipe ⇒ page 325 .
- ❑ With long exhaust system only.



1.5 Checking exhaust system for leaks

Procedure

– Start engine and run at idling speed.

– Seal end exhaust pipes with cloths or plugs, for example, for the duration of the leakage test.

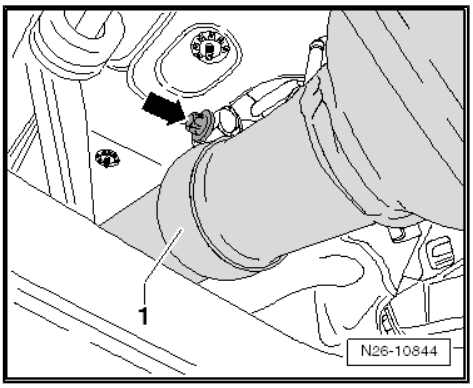
– Check (by listening) points of connection between exhaust manifold and cylinder head, between turbocharger and exhaust manifold, between particulate filter and turbocharger etc. to make sure there are no leaks.

– Rectify any leaks that are found.

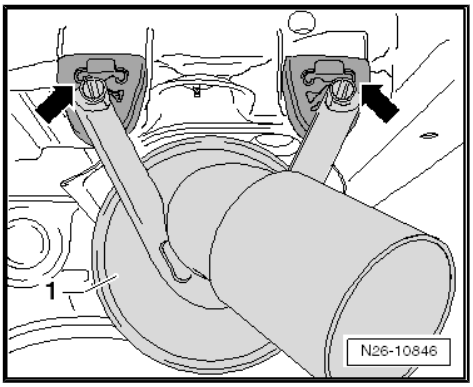
1.6 Removing and installing rear silencer

Removing

– Loosen bolt -arrow- and push clamp -1- onto exhaust pipe.



– Pull rear silencer -1- towards the rear out of holders -arrows- and remove towards the rear.



Installing

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

Note

Make sure that the clamp is correctly fitted.

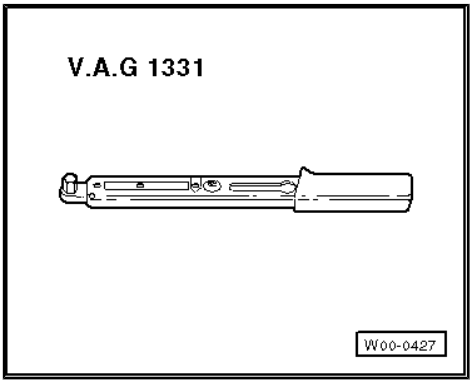
Specified torques

♦ ⇒ “1.1 Assembly overview - silencers”, page 316

1.7 Removing and installing SCR catalytic converters (vehicles compliant with EU 6 standard)

Special tools and workshop equipment required

♦ Torque wrench (5…50 Nm) - V.A.G 1331-



Removing:

WARNING

Risk of burns.

Parts of the exhaust system may be hot.

Allow exhaust system to cool before removing.

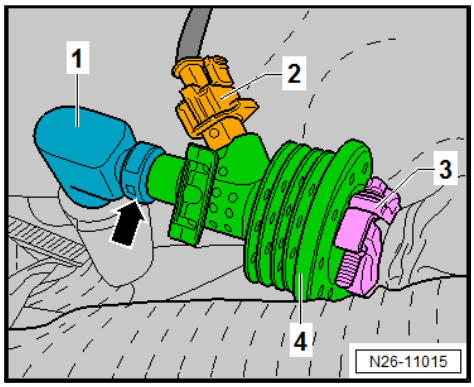
When doing any repair work, especially in the engine compartment, pay attention to the following due to the cramped conditions:

- *Route all the various lines (e.g. for fuel, hydraulics, activated charcoal filter system, coolant and refrigerant, brake fluid and vacuum) and electrical wiring in their original positions.*
- *To avoid damage to lines, ensure sufficient clearance from all moving or hot components.*
- *Cut through cable ties carefully and reinstall them in the same position.*

– Pull NOx sender 2 - G687- with control unit for NOx sender 2 - J881- off connector and therefore separating from line.

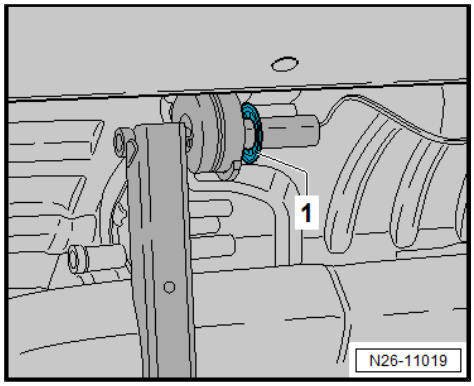
– Push connection of delivery line -1- as far as stop onto injector for reducing agent - N474- -4-; then press securing clips -arrow-, and pull off connection. Seal open connections to prevent ingress of dirt.

– Release and disconnect connector -2-.

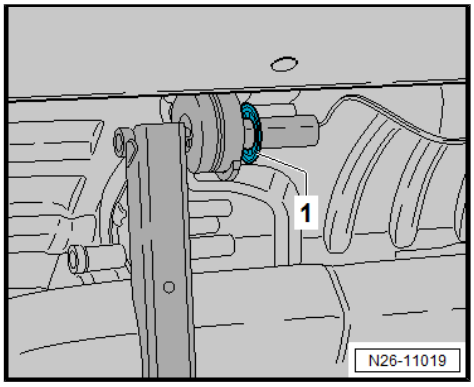


– Pull speed nut -1- off rear mounting for SCR catalytic converters.

Only vehicles with long exhaust system:



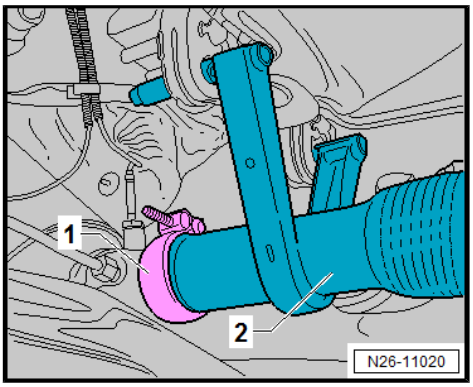
– Pull speed nut -1- off rear exhaust pipe mounting ⇒ Item 15 (page 319) .



Continuation for all vehicles:

– Open and remove clip -1-.

– Pull exhaust system together with SCR catalytic converters -2- towards rear out of mountings to remove.



Installing:

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

Note

- *Make sure that the clamps are seated correctly.*
- *Always renew clamps, seals and speed nuts.*
- *After working on the exhaust system, ensure that the system is not under tension and that there is sufficient clearance to the bodywork. If necessary, loosen clamps, and align the front exhaust pipe so that sufficient clearance is maintained to the bodywork and the mountings are evenly loaded.*
- *Checking exhaust system for leaks ⇒ page 320 .*

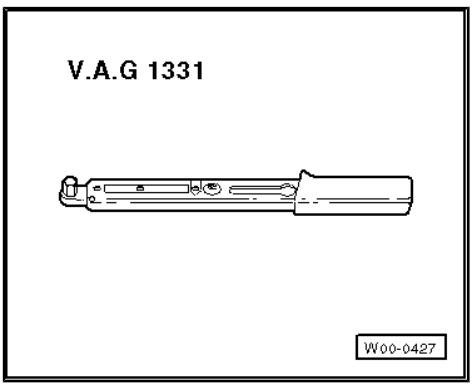
Specified torques:

- ⇒ “1.2 Assembly overview – SCR catalytic converters (vehicles compliant with EU 6 standard)”, page 318

1.8 Removing and installing rear silencer, Crafter 4MOTION with Achleitner four-wheel drive

Special tools and workshop equipment required

- Torque wrench (5…50 Nm) - V.A.G 1331-



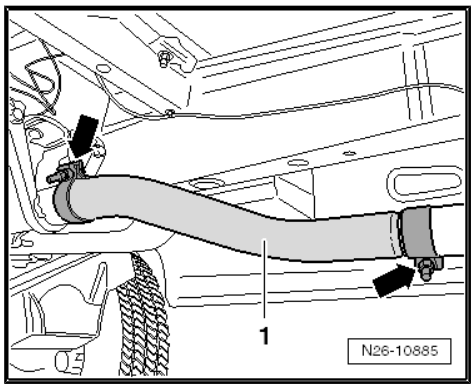
Removing

Note

- *The front exhaust pipe does not need to be removed.*
- *Loosen front clamp also, to align exhaust system free of stress.*

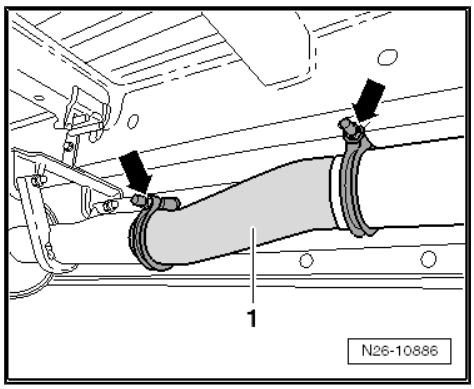
– Loosen clamps -arrows- of front exhaust pipe -1-.

Vehicles with long exhaust system

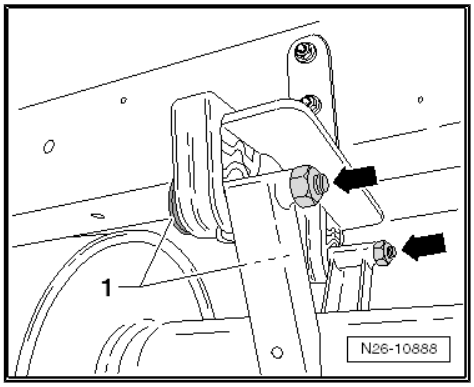


– Loosen clamps -arrows- of front exhaust pipe -1-.

Continuation for all vehicles



– Remove nuts -arrows- and remove bolts -1- of holder, then remove silencer.



Installing

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

Note

- *Make sure that the clamp is correctly fitted.*
- *After working on the exhaust system, ensure that the system is not under stress and that there is sufficient clearance to the bodywork. If necessary, loosen clamps and align silencer and front exhaust pipe so that sufficient clearance is maintained to the bodywork and the mountings are evenly loaded.*
- *Renew self-locking nuts.*
- *Align exhaust system free of stress* ⇒ *page 327* .
- *Checking exhaust system for leaks* ⇒ *page 320* .

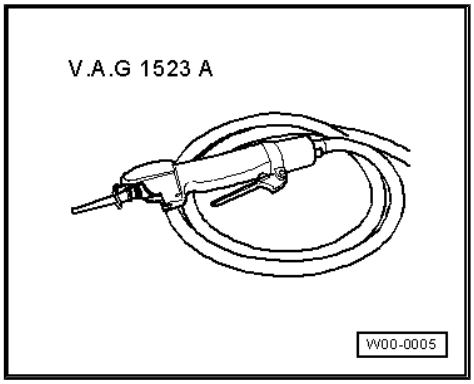
Specified torques

- ⇒ “1.3 Assembly overview - short silencer, Crafter 4MOTION with Achleitner four-wheel drive”, page 319
- ⇒ “1.4 Assembly overview - long silencer, Crafter 4MOTION with Achleitner four-wheel drive”, page 320

1.9 Shortening exhaust pipe and bracket, Crafter 4MOTION with Achleitner four-wheel drive

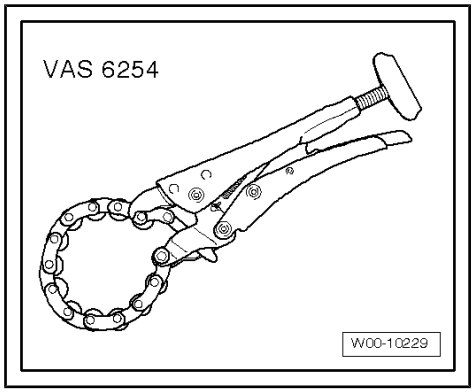
Special tools and workshop equipment required

- Pneumatic sabre saw - V.A.G 1523A-



or

- Chain-type pipe cutter - VAS 6254-
- Eye protection



Note

Pipes and holder must be cut to length, depending on model and exhaust system.

WARNING

To avoid injury from metal shavings, wear eye protection and protective clothing.

Procedure

WARNING

Risk of burns.

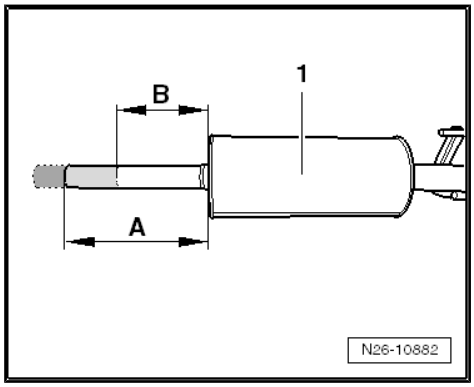
Parts of the exhaust system may be hot.

Allow exhaust system to cool before removing.

Note

The pipe and silencer must be shortened at front on all vehicles.

– Coupling point -a- = 300 mm on exhaust pipe; for vehicles with double cab: -b- = 530 mm.
– Cut through exhaust pipe at coupling point at right angle to pipe using e.g. chain pipe cutter - VAS 6254- .



Note

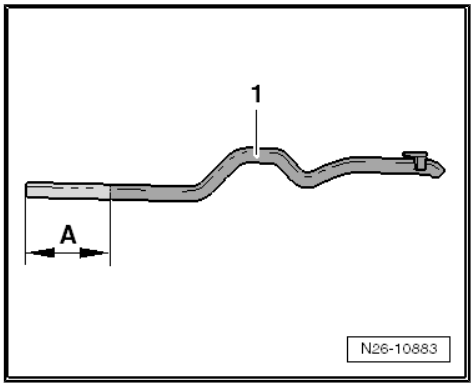
- *A pipe is installed between silencer and particulate filter ⇒ Electronic Parts Catalogue .*
- *Pipe may only be installed on vehicle, to align complete exhaust system free of stress.*

– Align exhaust system free of stress.

Models with long exhaust system, there may be a requirement to shorten rear exhaust pipe.

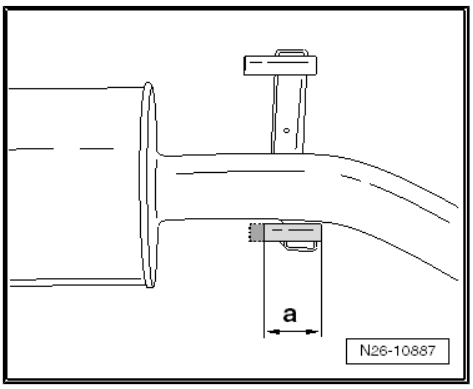
– Coupling point -A- = 90 mm.

Shortening holder:



– Shorten holder on silencer to dimension -a- = 70 mm.

– Checking exhaust system for leaks ⇒ page 320 .



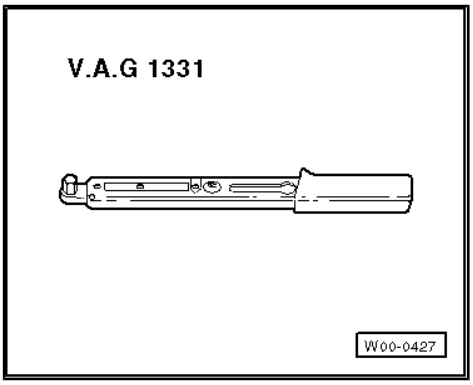
Note

- *After working on the exhaust system, ensure that the system is not under stress and that there is sufficient clearance to the bodywork. If necessary, loosen clamps and align silencer and front exhaust pipe so that sufficient clearance is maintained to the bodywork and the mountings are evenly loaded.*
- *Renew self-locking nuts.*
- *Align exhaust system free of stress ⇒ page 327 .*

1.10 Aligning exhaust system free of stress, Crafter 4MOTION with Achleitner four-wheel drive

Special tools and workshop equipment required

- Torque wrench (5…50 Nm) - V.A.G 1331-

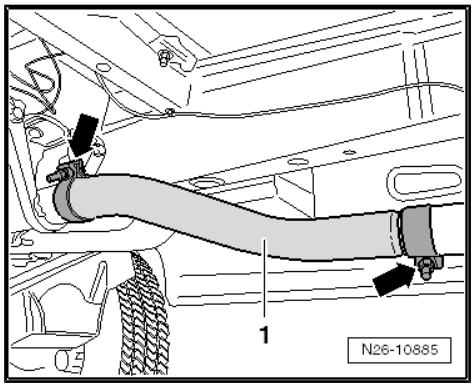


- The exhaust system must be aligned when cold.

Procedure:

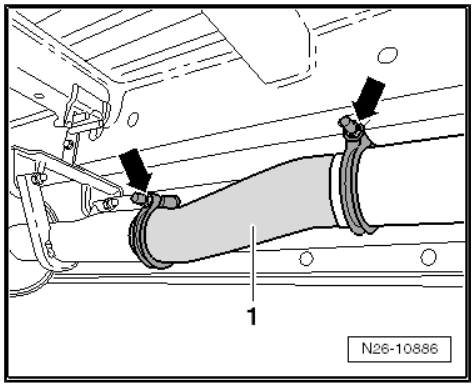
– Undo threaded connections of front clamps -arrows-.

– Then align exhaust system so that it does not make contact with other components and that it sits free of stress.



Vehicles with long exhaust system:

– Additionally align rear exhaust pipe, loosen clamps -arrows- and align exhaust system.



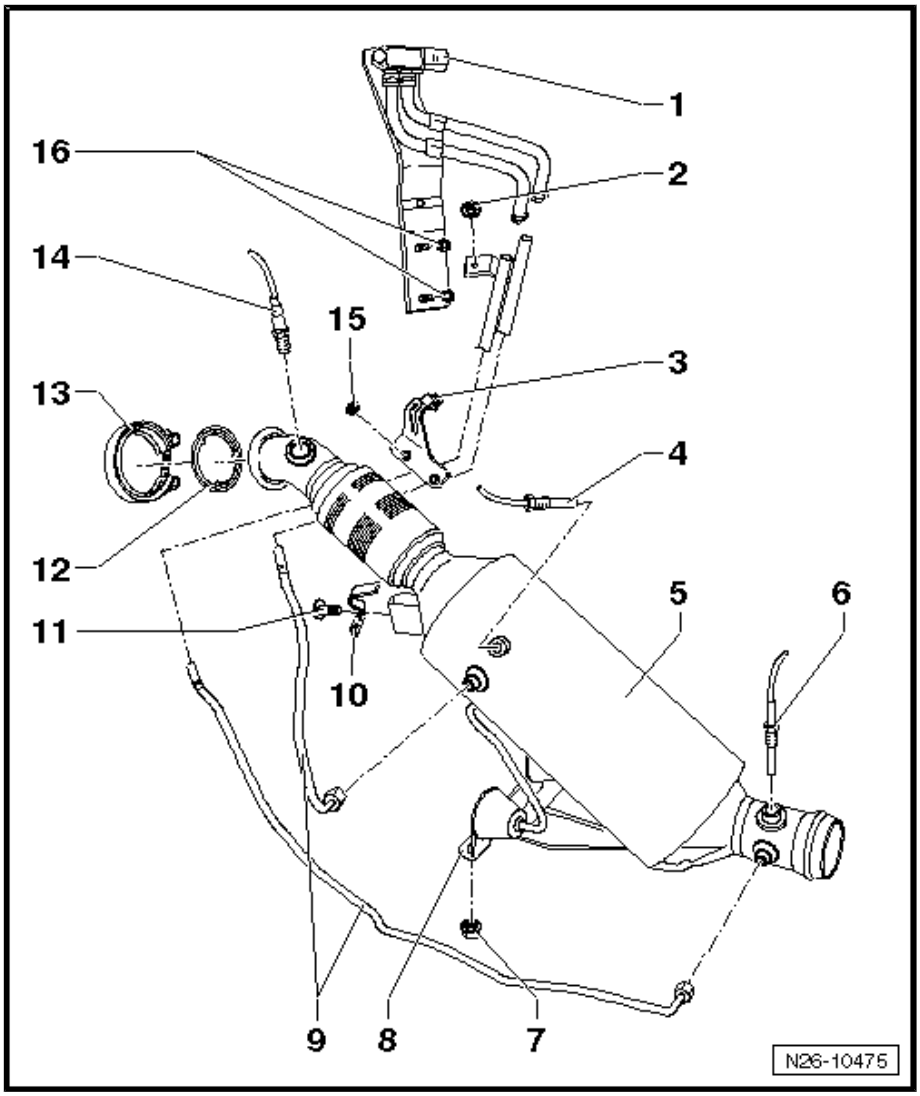
2 Emission control

⇒ “2.1 Assembly overview - emission control”, page 329

⇒ “2.2 Removing and installing particulate filter”, page 330

⇒ “2.3 Removing and installing particulate filter, Crafter 4MOTION with Achleitner four-wheel drive”, page 333

2.1 Assembly overview - emission control



1 - Exhaust gas pressure sensor 1 - G450-

> **WARNING**
> *After renewing, carry out “Adapt G450 exhaust gas pressure sensor 1” ⇒ Vehicle diagnostic tester.*

2 - Nut

- ❑ 6 Nm

3 - Bracket

4 - Exhaust gas temperature sender 3 - G495-

- ❑ Coat with high-temperature paste ⇒ Electronic Parts Catalogue .
- ❑ 45 Nm

5 - Particulate filter

- ❑ Do not bend the de-coupling element of the particulate filter more than 10°, otherwise it could be damaged!
- ❑ Removing and installing ⇒ page 330 .

6 - Exhaust gas temperature sender 4 - G648-

- ❑ Remove and install using tool set - T10395A- .
- ❑ Coat with high-temperature paste ⇒ Electronic Parts Catalogue .
- ❑ 45 Nm

7 - Nut

- ❑ 23 Nm

8 - Mounting

- ❑ Renew if damaged.

9 - Control pipe

- ❑ 45 Nm

10 - Retaining clip

11 - Bolt

- ❑ 9 Nm

12 - Gasket

- ❑ Renew after removing.
- ❑ Note installation position.

13 - Clamp

- ❑ 7 Nm

14 - Lambda probe - G39-

- ❑ Removing and installing ⇒ page 313 .
- ❑ Grease only thread with high-temperature paste. High-temperature paste must not get into the slots on the probe body.
- ❑ 55 Nm

15 - Nut

- ❑ 6 Nm

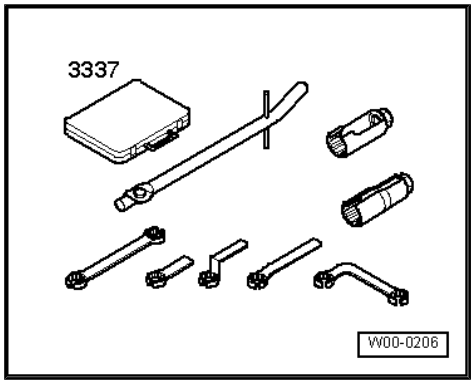
16 - Nut

- ❑ 4 Nm

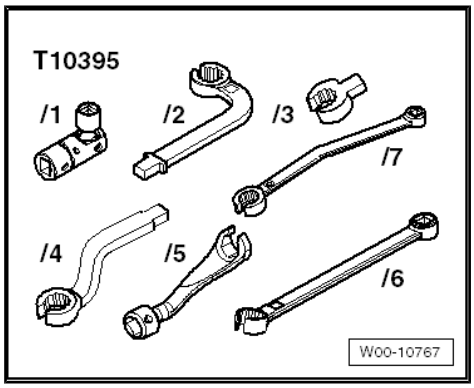
2.2 Removing and installing particulate filter

Special tools and workshop equipment required

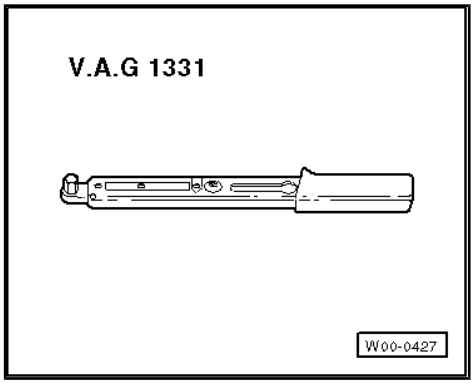
- ♦ Lambda probe open ring spanner set - 3337-



- ♦ Tool set, 17 mm - T10395-



- Torque wrench - V.A.G 1331-



Removing

– Remove air filter and intake hose leading to turbocharger ⇒ page 277 .

WARNING

Risk of burns.

Parts of the exhaust system may be hot.

Allow exhaust system to cool before removing.

When doing any repair work, especially in the engine compartment, pay attention to the following due to the cramped conditions:

- *Route all the various lines (e.g. for fuel, hydraulics, activated charcoal filter system, coolant and refrigerant, brake fluid and vacuum) and electrical wiring in their original positions.*
- *To avoid damage to lines, ensure sufficient clearance from all moving or hot components.*
- *Cut through cable ties carefully and reinstall them in the same position.*

Only for vehicles with EU 6 standard-compliant engines:

Note

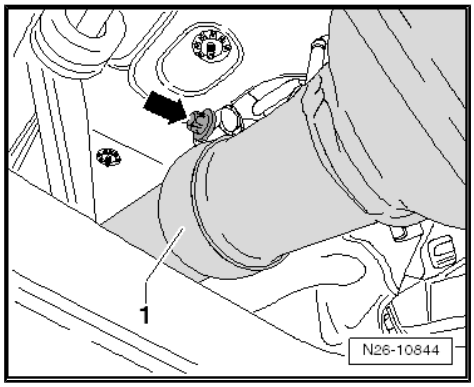
- *Vehicles equipped with EU6 standard-compliant engines and SCR system have 2 additional senders integrated in the particulate filter.*
- *If the particulate filter is to be removed and then reinstalled, the senders need to be detached just far enough (according to the description) to be able to remove them together with the particulate filter.*
- *If the particulate filter is to be renewed, the senders need to be removed completely from the particulate filter.*

– Remove exhaust temperature sender 2 - G448- ⇒ page 357 .

– Remove NOx sender - G295- together with control unit for NOx sender - J583- ⇒ page 353 .

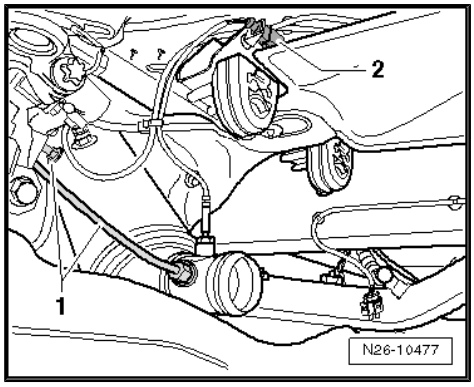
Continuation for all vehicles:

– Loosen bolt -arrow- of clamp -1- and detach rear silencer from particulate filter.



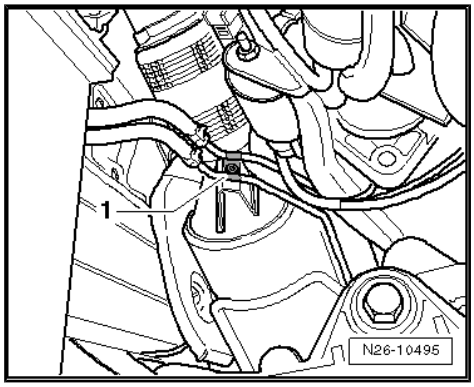
– Detach connector -2- from exhaust temperature sender 3 - G495- and exhaust temperature sender 4 - G648- and expose wiring harnesses.

– Unscrew control lines -1- from particulate filter.

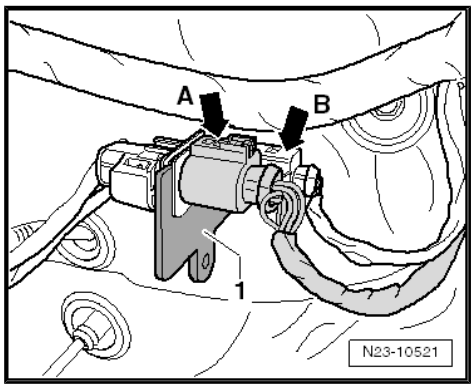


– Unscrew bracket of control lines -1- and move control lines to one side.

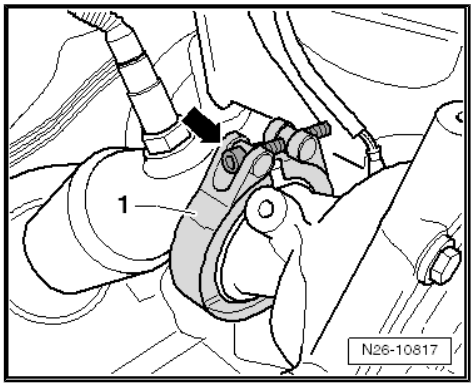
– Undo and remove bolts -arrows- from particulate filter mounting -1-.



– Disconnect connector -arrow A- from Lambda probe - G39- and lay wiring harness to one side.



– Loosen bolt -arrow- and remove clamp -1-.



Caution

Do not bend the de-coupling element of the particulate filter more than 10°, otherwise it could be damaged.

– Take particulate filter out upwards.

Installing

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

Only for vehicles with EU 6 standard-compliant engines:

– Installing exhaust temperature sender 2 - G448- ⇒ page 357 .

– Install NOx sender - G295- with control unit for NOx sender - J583- ⇒ page 353 .

WARNING

After renewing particulate filter, carry out adaptation ⇒ Vehicle diagnostic tester because otherwise the function of the new particulate filter is not assured.

Note

- *Make sure clamp and particulate filter are correctly seated.*
- *After working on the exhaust system, ensure that the system is not under stress and that there is sufficient clearance to the bodywork. If necessary, loosen clamps and align silencer and front exhaust pipe so that sufficient clearance is maintained to the bodywork and the mountings are evenly loaded.*
- *Renew self-locking nuts.*
- *Align exhaust system free of stress ⇒ page 327 .*

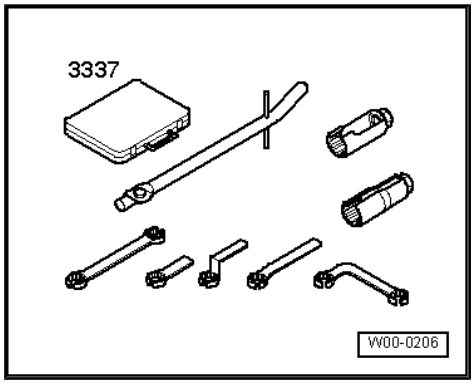
Specified torques

- ⇒ “1.1 Assembly overview - silencers”, page 316
- ⇒ “2.1 Assembly overview - emission control”, page 329
- Only for vehicles with EU 6 standard-compliant engines: ⇒ “1.2 Assembly overview – SCR catalytic converters (vehicles compliant with EU 6 standard)”, page 318
- ⇒ “4.1 Assembly overview - air filter housing”, page 276

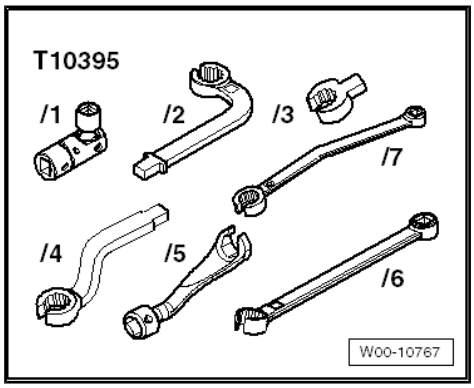
2.3 Removing and installing particulate filter, Crafter 4MOTION with Achleitner four-wheel drive

Special tools and workshop equipment required

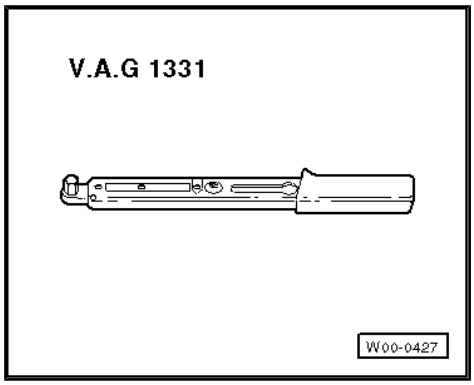
♦ Lambda probe open ring spanner set - 3337-



♦ Tool set, 17 mm - T10395-



♦ Torque wrench - V.A.G 1331-



Removing

– Remove air filter and intake hose leading to turbocharger ⇒ page 277 .

– Remove air compressor - V534- and accumulator (Crafter 4MOTION with Achleitner all-wheel drive) ⇒ Rear axle and rear final drive; Rep. gr. 39 .

WARNING

Risk of burns.

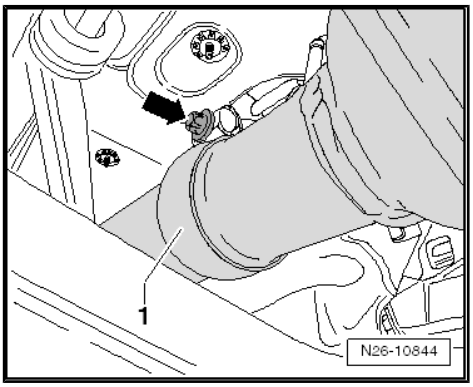
Parts of the exhaust system may be hot.

Allow exhaust system to cool before removing.

When doing any repair work, especially in the engine compartment, pay attention to the following due to the cramped conditions:

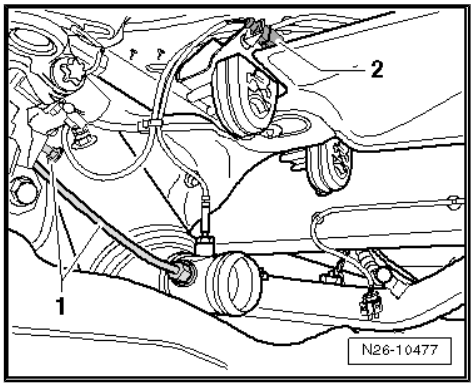
- *Route all the various lines (e.g. for fuel, hydraulics, activated charcoal filter system, coolant and refrigerant, brake fluid and vacuum) and electrical wiring in their original positions.*
- *To avoid damage to lines, ensure sufficient clearance from all moving or hot components.*
- *Cut through cable ties carefully and reinstall them in the same position.*

– Loosen bolt -arrow- of clamp -1- and detach rear silencer from particulate filter.



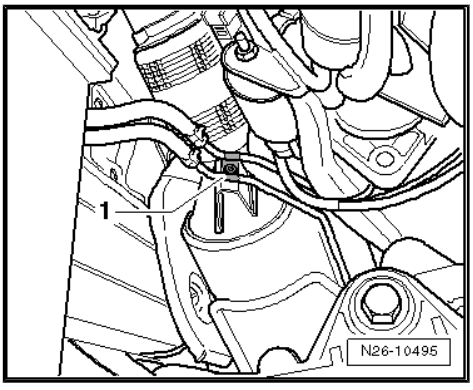
– Detach connector -2- from exhaust temperature sender 3 - G495- and exhaust temperature sender 4 - G648- and expose wiring harnesses.

– Unscrew control lines -1- from particulate filter.

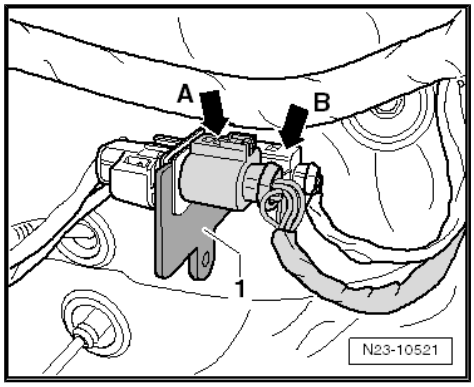


– Unscrew bracket of control lines -1- and move control lines to one side.

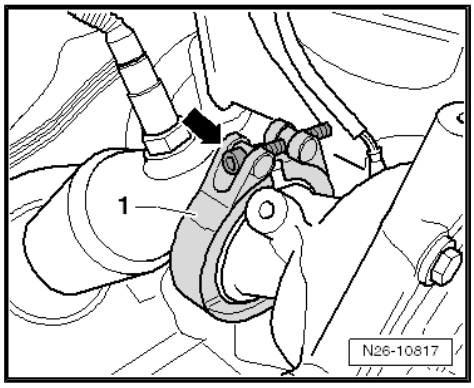
– Undo and remove bolts -arrows- from particulate filter mounting -1-.



– Disconnect connector -arrow A- from Lambda probe - G39- and lay wiring harness to one side.



– Loosen bolt -arrow- and remove clamp -1-.



Caution

Do not bend the de-coupling element of the particulate filter more than 10°, otherwise it could be damaged.

– Take particulate filter out upwards.

Installing

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

WARNING

After renewing particulate filter, carry out adaptation ⇒ Vehicle diagnostic tester because otherwise the function of the new particulate filter is not assured.

Note

- *Make sure clamp and particulate filter are correctly seated.*
- *After working on the exhaust system, ensure that the system is not under stress and that there is sufficient clearance to the bodywork. If necessary, loosen clamps and align silencer and front exhaust pipe so that sufficient clearance is maintained to the bodywork and the mountings are evenly loaded.*
- *Renew self-locking nuts.*
- *Align exhaust system free of stress ⇒ page 327 .*

Specified torques

- ⇒ “2.1 Assembly overview - emission control”, page 329
- ⇒ “1.3 Assembly overview - short silencer, Crafter 4MOTION with Achleitner four-wheel drive”, page 319
- ⇒ “1.4 Assembly overview - long silencer, Crafter 4MOTION with Achleitner four-wheel drive”, page 320
- Air supply unit and differential lock; Assembly overview - air compressor ⇒ Air compressor/accumulator; Rep. gr. 39 ; Assembly overview - air compressor
- ⇒ “4.1 Assembly overview - air filter housing”, page 276

3 SCR system (selective catalytic reduction)

3.1 AdBlue® technology

On vehicles with AdBlue® technology, a special urea solution (AdBlue®) is injected into the exhaust system ahead of the catalytic converter in order to reduce nitrogen oxide emissions.

The “NO_X reducing agent AUS 32” (AdBlue®) is stored in a separate tank of the vehicle. As of a certain remaining range, a reminder to refill AdBlue® is displayed in the dash panel insert. AdBlue® consumption depends on the individual driving style.

If the AdBlue® tank is empty, no engine start is possible.

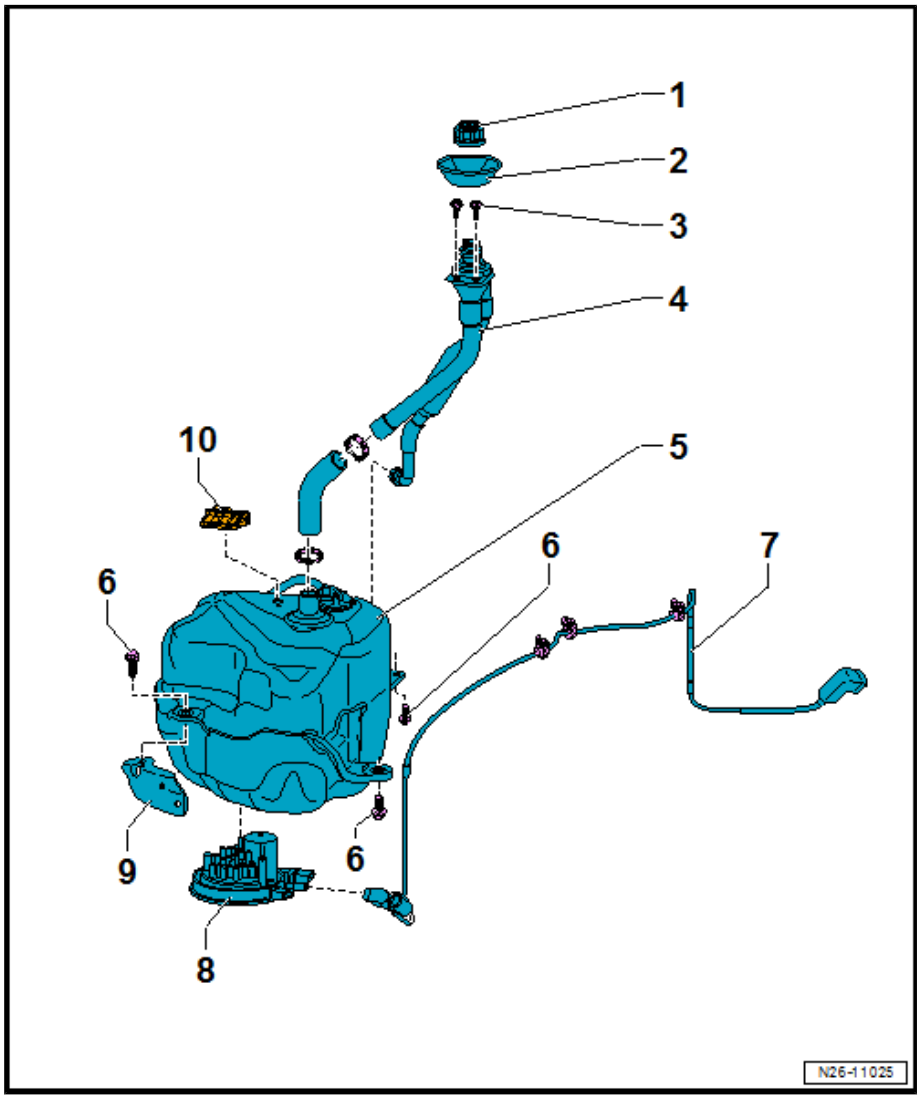
Note

- *The design and function of AdBlue® technology is described in ⇒ Self-study programme No. 424 ; Selective Catalytic Reduction .*
- *Additional information ⇒ Operating instructions .*
- *To keep the following description as short as possible, the “NO_X reduction agent AUS 32” (AdBlue®) will be referred to as "reduction agent".*

WARNING

- *The reduction agent can irritate skin, eyes and respiratory organs.*
- *After skin contact with this agent, wash immediately with plenty of water.*
- *If necessary, call a doctor.*

3.2 Assembly overview - tank for reducing agent



1 - Cap

2 - Drip cup

3 - Securing bolts, M6x20

- ❑ 9 Nm

4 - Filler neck with moulded hose

- ❑ Removing and installing ⇒ page 341 .

5 - Tank for reduction agent

- ❑ Emptying ⇒ page 339 .
- ❑ Removing and installing ⇒ page 342 .

6 - Securing bolts for reducing agent tank

- ❑ Bolt with washer, M8x25, for securing tank to vehicle jack console: 28 Nm
- ❑ Hexagon bolt with washer, M8x25, for securing tank to bracket: 28 Nm
- ❑ Hexagon bolt with flange, M12x32, for securing tank to longitudinal member: 75 Nm

7 - Reduction agent supply line

- ❑ Removing and installing ⇒ page 345 .

8 - Delivery module

- ❑ Fitting location: welded into the bottom of the tank for reducing agent
- ❑ With pump for reduction agent - V437- .
- ❑ Removing and installing pump for reducing agent - V437- ⇒ page 349
- ❑ 3 bolts (Torx T30) for securing pump for reducing agent to delivery module: 6 Nm
- ❑ With heater for reduction agent tank - Z102- .
- ❑ With sender for reduction agent tank - G697-
- ❑ With evaluation unit for reducing agent level - G698-
- ❑ With temperature sender for reduction agent - G685-

9 - Bracket

- ❑ For reducing agent tank

10 - Control unit for reduction agent heater - J891-

- ❑ Fitting location: engaged in tank for reducing agent at top
- ❑ Removing and installing ⇒ page 352 .

3.3 Emptying tank for reduction agent

WARNING

Danger of skin irritation due to reducing agent.

- *Do not allow reducing agent to come into contact with skin or eyes! Always wear protective gloves and safety goggles.*
- *If reducing agent gets onto the skin, wash with soap and water.*
- *If reducing agent gets into the eyes, rinse with water for several minutes.*
- *Do not breathe in or swallow reducing agent!*
- *If you have swallowed reducing agent, rinse out your mouth, drink a lot of water and immediately go to the medical office or inform a doctor.*

Caution

Observe safety precautions when working on the SCR system ⇒ page 3 .

Observe rules for cleanliness when working on the SCR system ⇒ page 9 .

Note

- *Capacity of reducing agent tank ⇒ Maintenance ; Booklet 1.2 .*
- *To keep the following description as short as possible, the "NO_X reduction agent AUS 32" (AdBlue®) will be referred to as "reduction agent".*

Special tools and workshop equipment required

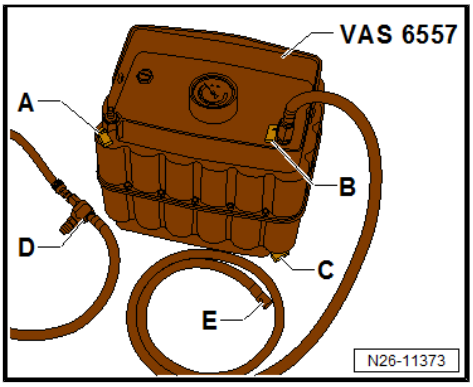
- Vacuum box - VAS 6557-

Emptying

– Unscrew cap from filler neck of reducing agent tank in engine compartment.

Prepare vacuum box - VAS 6557- as follows:

– Close shut-off taps -A-, -B- and -C-.



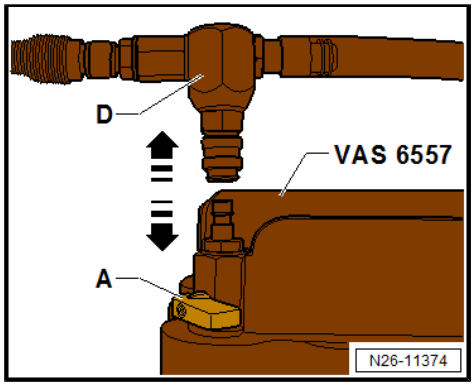
– Connect coupling -D- with connection to shut-off tap -A- and pressurise compressed air hose with compressed air.

– Open shut-off tap -A-.

Now a vacuum is created in vacuum box - VAS 6557- .

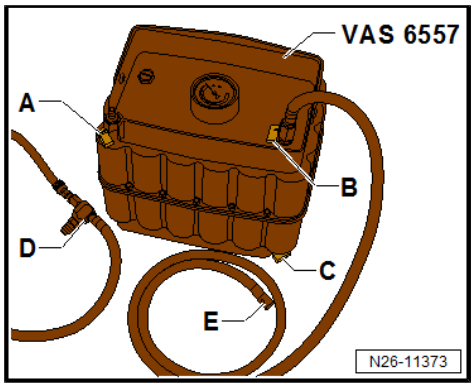
– Close shut-off valve -A- as soon as the pressure gauge registers a pressure of 0.8 bar.

– Interrupt compressed air supply at compressed air hose, and disconnect coupling -D- from connection on shut-off tap -A-.



– Position SCR vacuum box - VAS 6557- in engine compartment, in immediate vicinity of filler neck.

– Guide end of hose -E- into filler neck and as far as possible towards bottom of tank for reducing agent, and open shut-off tap -B-.



Note

- *The reducing agent is then drawn from the tank and into the SCR vacuum box - VAS 6557- by the vacuum.*
- *The capacity of the SCR vacuum box - VAS 6557- is approx. 7 litres. Repeat the process if the reducing agent tank contains more than 7 litres of the reducing agent.*
- *Due to the length of the SCR vacuum box - VAS 6557- extraction hose, only a part of the entire tank content can be extracted.*
- *To fully empty the tank without removing it, pull the moulded hose of the filler neck off the upper part of the tank, and guide the SCR vacuum box - VAS 6557- extraction hose directly into the tank* ⇒ page 341 .
- *A tank which has been partially emptied can also be removed.*

– To empty vacuum box - VAS 6557- , hold connection on shut-off tap -C- over suitable container and open shut-off taps -A- and -C-.

Caution

Never reuse extracted reduction agent.

For information on storage and disposal, see ⇒ Service net → Environment → Workshop disposal .

Request country-specific information concerning storage and disposal from your importer.

– Flush out vacuum box - VAS 6557- carefully using water when work sequence is complete.

Filling:

– Fill reducing agent tank ⇒ Maintenance ; Booklet 1.2 .

3.4 Removing and installing filler neck for reducing agent

WARNING

Danger of skin irritation due to reducing agent.

- *Do not allow reducing agent to come into contact with skin or eyes! Always wear protective gloves and safety goggles.*
- *If reducing agent gets onto the skin, wash with soap and water.*
- *If reducing agent gets into the eyes, rinse with water for several minutes.*
- *Do not breathe in or swallow reducing agent!*
- *If you have swallowed reducing agent, rinse out your mouth, drink a lot of water and immediately go to the medical office or inform a doctor.*

Caution

Observe safety precautions when working on the SCR system *⇒ page 3* *.*

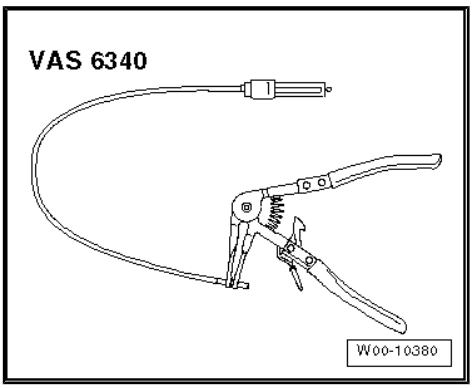
Observe rules for cleanliness when working on the SCR system *⇒ page 9* *.*

Note

To keep the following description as short as possible, the "NO_X reduction agent AUS 32" (AdBlue®) will be referred to as "reduction agent".

Special tools and workshop equipment required

- Hose clip pliers - VAS 6340-



Removing:

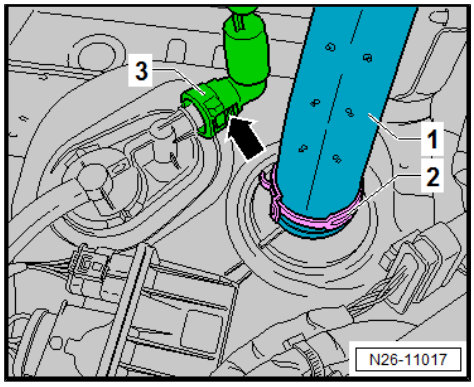
Caution

Immediately seal all open lines and connections using suitable plugs to prevent ingress of dirt. The smallest particle of dirt can cause extensive damage to the system.

– Emptying tank for reduction agent ⇒ page 339 .

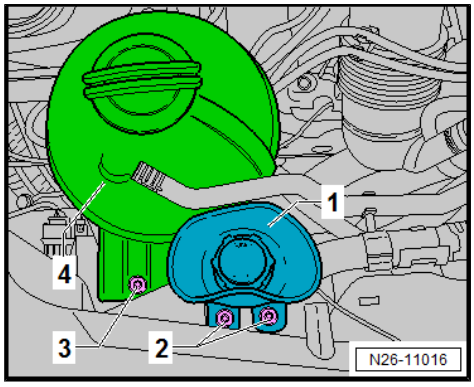
– Push connection -3- as far as stop onto coupling point; then press catch -arrow-, and pull off connection. Seal open connections to prevent ingress of dirt.

– Open spring-type clip -2-, and pull moulded hose of filler neck -1- off tank for reducing agent.



– Unscrew securing bolt -3-, and lay coolant expansion tank -4- to one side (lines remain connected).

– Unscrew securing bolts -2-, and remove filler neck -1- upwards from vehicle.



Installing:

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

Specified torques:

♦ ⇒ “3.2 Assembly overview - tank for reducing agent”, page 338

– Fill reducing agent tank ⇒ Maintenance ; Booklet 1.2 .

3.5 Removing and installing tank for reduction agent

WARNING

Danger of skin irritation due to reducing agent.

- *Do not allow reducing agent to come into contact with skin or eyes! Always wear protective gloves and safety goggles.*
- *If reducing agent gets onto the skin, wash with soap and water.*
- *If reducing agent gets into the eyes, rinse with water for several minutes.*
- *Do not breathe in or swallow reducing agent!*
- *If you have swallowed reducing agent, rinse out your mouth, drink a lot of water and immediately go to the medical office or inform a doctor.*

Caution

Observe safety precautions when working on the SCR system ⇒ page 3 .

Observe rules for cleanliness when working on the SCR system ⇒ page 9 .

Note

To keep the following description as short as possible, the "NO_X reduction agent AUS 32" (AdBlue®) will be referred to as "reduction agent".

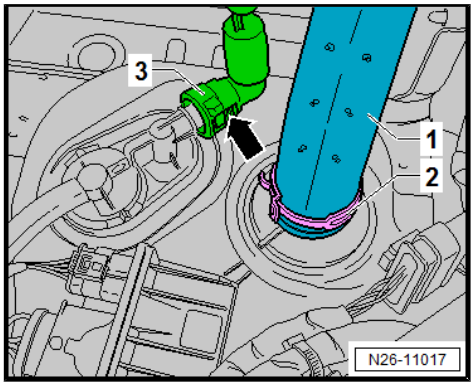
Removing:

Caution

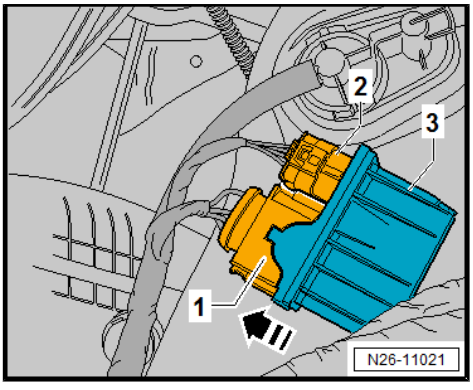
Immediately seal all open lines and connections using suitable plugs to prevent ingress of dirt. The smallest particle of dirt can cause extensive damage to the system.

Protect disconnected connectors against wetting from reducing agent by suitable means, e.g. a plastic bag and cable ties. Electrical connections may be damaged due to the high penetration ability along with subsequent crystallisation of the reducing agent.

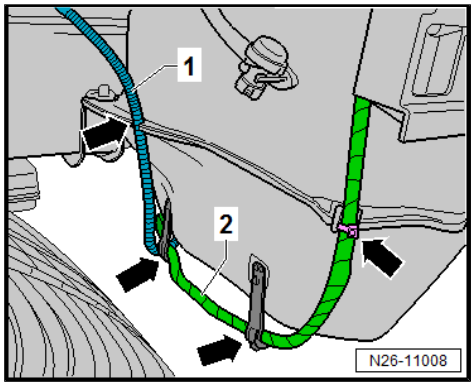
– Emptying tank for reduction agent ⇒ page 339 .
– Remove front bumper cover ⇒ General body repairs, exterior; Rep. gr. 63 ; Front bumper; Removing and installing front bumper cover on vehicles as of 2012 .
– Push connection -3- as far as stop onto coupling point; then press catch -arrow-, and pull off connection. Seal open connections to prevent ingress of dirt.
– Open spring-type clip -2-, and pull moulded hose of filler neck -1- off tank for reducing agent.



– Pull control unit for reducing-agent heater - J891- -3- towards rear (-arrow-) off catch on reducing agent tank, and lay it to one side ensuring that lines -1- and -2- remain connected.

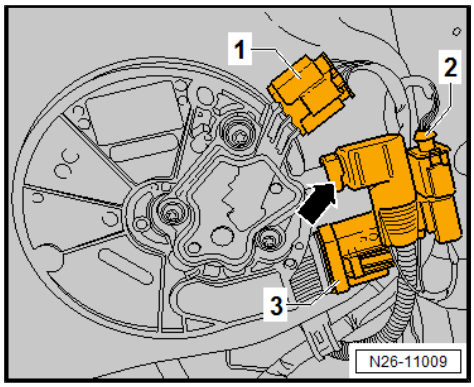


– Disconnect reducing agent supply line -1- and wiring harness -2- from tank by releasing securing clamps -arrows-.

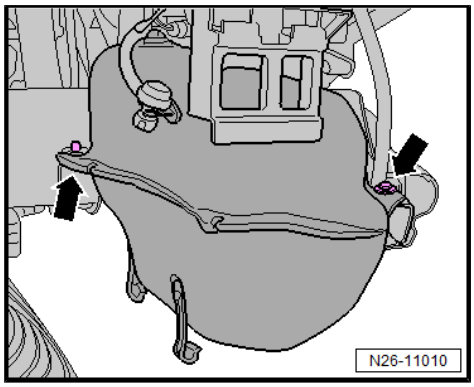


– Push hydraulic connection of delivery line -2- as far as stop onto delivery module; then press securing clips -arrows-, and pull off connection. Seal open connections to prevent ingress of dirt.

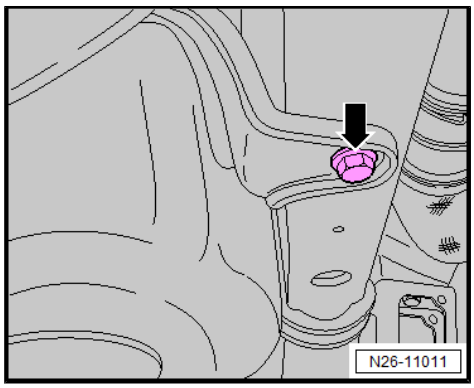
– Release and disconnect connectors -1- and -3-.



– Unscrew securing bolts -arrows-.



– Unscrew securing bolt from longitudinal member -arrow-, and remove tank for reducing agent downwards.



Installing:

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

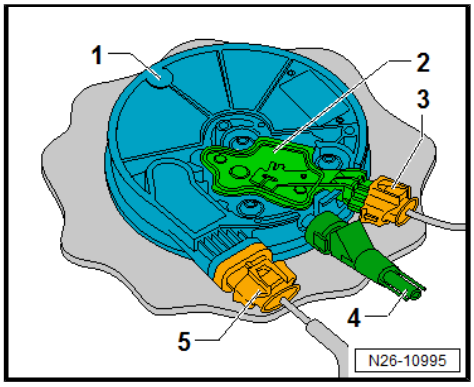
– Install tank for reducing agent, and connect filler neck.

– Fit control unit for reducing-agent heater - J891- , and engage it.

– Pull protective cap off hydraulic connection of pressure line; then connect hydraulic connector -4-, and make sure it is securely engaged.
– Fit and engage connectors -3- and -5-.
– Fill reducing agent tank ⇒ Maintenance ; Booklet 1.2 .

Specified torques:

- ⇒ “3.2 Assembly overview - tank for reducing agent”, page 338



3.6 Removing and installing reduction agent supply line

WARNING

Danger of skin irritation due to reducing agent.

- *Do not allow reducing agent to come into contact with skin or eyes! Always wear protective gloves and safety goggles.*
- *If reducing agent gets onto the skin, wash with soap and water.*
- *If reducing agent gets into the eyes, rinse with water for several minutes.*
- *Do not breathe in or swallow reducing agent!*
- *If you have swallowed reducing agent, rinse out your mouth, drink a lot of water and immediately go to the medical office or inform a doctor.*

Caution

Observe safety precautions when working on the SCR system ⇒ page 3 .

Observe rules for cleanliness when working on the SCR system ⇒ page 9 .

Note

To keep the following description as short as possible, the “NO_X reduction agent AUS 32” (AdBlue®) will be referred to as "reduction agent".

Removing:

Caution

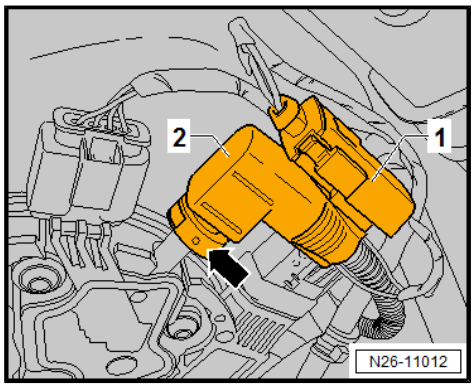
Immediately seal all open lines and connections using suitable plugs to prevent ingress of dirt. The smallest particle of dirt can cause extensive damage to the system.

Protect disconnected connectors against wetting from reducing agent by suitable means, e.g. a plastic bag and cable ties. Electrical connections may be damaged due to the high penetration ability along with subsequent crystallisation of the reducing agent.

– Remove front right wheel housing liner ⇒ General body repairs, exterior; Rep. gr. 66 ; Wheel housing liner; Removing and installing front wheel housing liner .

– Release and disconnect connector -1-.

– Push hydraulic connection of delivery line -2- as far as stop onto delivery module; then press securing clips -arrows-, and pull off connection. Seal open connections to prevent ingress of dirt.

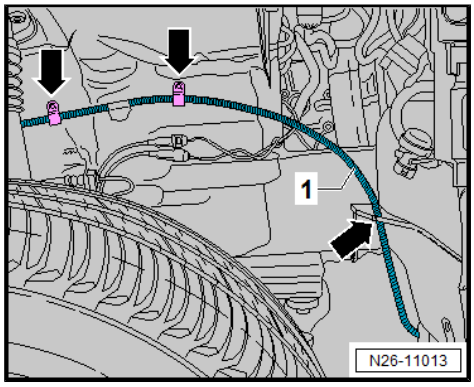


Caution

Risk of damage to the delivery line.

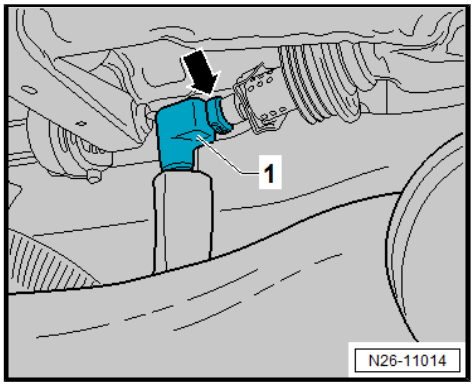
- *The delivery line is equipped with a heater element over its complete length.*
- *If the delivery line is kinked, twisted or stretched during the installation or removal process, the heater element may become damaged.*
- *For this reason, make sure not to kink, twist or stretch the delivery line when removing or installing it.*

– Release delivery line -1- along its entire length from retainers -arrows- on tank and vehicle body.



– Push hydraulic connection of delivery line -1- as far as stop onto injector for reducing agent - N474- ; then press securing clips -arrow-, and pull off connection. Seal open connections to prevent ingress of dirt.

– Carefully expose delivery line and remove.



Installing:

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

– Remove plug and connect delivery line to injector for reduction agent - N474- .

– Clip delivery line into retainers along its entire length.

– Remove sealing plug; fit delivery line onto hydraulic connection on delivery module, and engage it.

– Fit connectors of delivery line, and engage them.

– Install front right wheel housing liner ⇒ General body repairs, exterior; Rep. gr. 66 ; Wheel housing liner; Removing and installing front wheel housing liner .

Specified torques:

- ⇒ “3.2 Assembly overview - tank for reducing agent”, page 338

3.7 Removing and installing injector for reduction agent - N474-

WARNING

Danger of skin irritation due to reducing agent.

- *Do not allow reducing agent to come into contact with skin or eyes! Always wear protective gloves and safety goggles.*
- *If reducing agent gets onto the skin, wash with soap and water.*
- *If reducing agent gets into the eyes, rinse with water for several minutes.*
- *Do not breathe in or swallow reducing agent!*
- *If you have swallowed reducing agent, rinse out your mouth, drink a lot of water and immediately go to the medical office or inform a doctor.*

Caution

Observe safety precautions when working on the SCR system ⇒ page 3 .

Observe rules for cleanliness when working on the SCR system ⇒ page 9 .

Note

To keep the following description as short as possible, the "NO_X reduction agent AUS 32" (AdBlue®) will be referred to as "reduction agent".

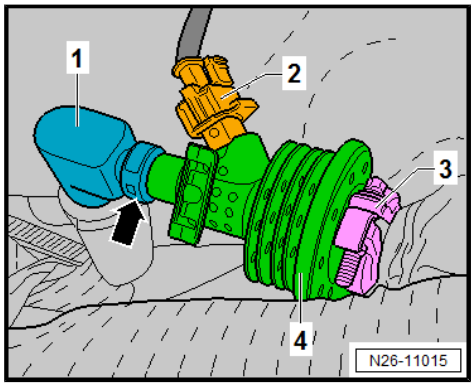
Removing:

Caution

Immediately seal all open lines and connections using suitable plugs to prevent ingress of dirt. The smallest particle of dirt can cause extensive damage to the system.

Protect disconnected connectors against wetting from reducing agent by suitable means, e.g. a plastic bag and cable ties. Electrical connections may be damaged due to the high penetration ability along with subsequent crystallisation of the reducing agent.

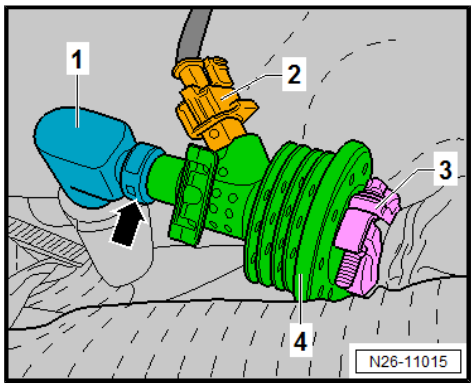
– Push hydraulic connection of delivery line -1- as far as stop onto injector for reducing agent - N474- -4-; then press securing clips -arrow-, and pull off connection. Seal open connections to prevent ingress of dirt.
– Release and disconnect connector -2-.
– Remove clamp -3-, and remove injector for reducing agent - N474- -4-.



Installing:

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

– Connect injector for reducing agent - N474- -4- with new sealing washer to SCR catalytic converter observing lugs (electrical connector -2- faces upwards).
– Place new securing clamp -3- over connection, and press it until it engages. The injector for reducing agent - N474- is then fixed in position.
– Start securing clamp bolt -3-, and tighten it to 5 Nm ⇒ page 318 .
– First, fit and engage connector -2-.
– Then, fit and engage hydraulic connector of delivery line -1-.



3.8 Removing and installing pump for reducing agent - V437-

WARNING

Danger of skin irritation due to reducing agent.

- *Do not allow reducing agent to come into contact with skin or eyes! Always wear protective gloves and safety goggles.*
- *If reducing agent gets onto the skin, wash with soap and water.*
- *If reducing agent gets into the eyes, rinse with water for several minutes.*
- *Do not breathe in or swallow reducing agent!*
- *If you have swallowed reducing agent, rinse out your mouth, drink a lot of water and immediately go to the medical office or inform a doctor.*

Caution

Observe safety precautions when working on the SCR system ⇒ page 3 .

Observe rules for cleanliness when working on the SCR system ⇒ page 9 .

Note

To keep the following description as short as possible, the "NO_X reduction agent AUS 32" (AdBlue®) will be referred to as "reduction agent".

Removing:

– Emptying tank for reduction agent ⇒ page 339 .

– Remove reduction agent tank ⇒ page 342 .

Caution

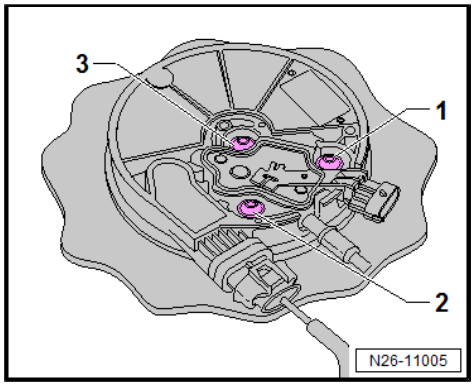
Immediately seal all open lines and connections using suitable plugs to prevent ingress of dirt. The smallest particle of dirt can cause extensive damage to the system.

Protect disconnected connectors against wetting from reducing agent by suitable means, e.g. a plastic bag and cable ties. Electrical connections may be damaged due to the high penetration ability along with subsequent crystallisation of the reducing agent.

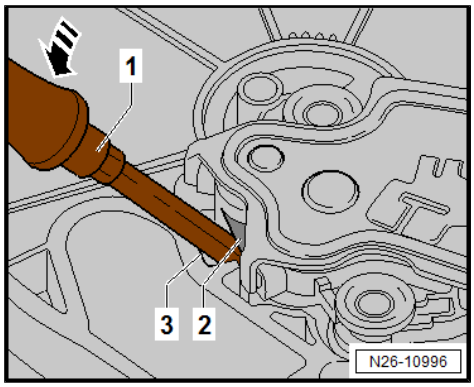
The hydraulic connections of the pump for reducing agent must not be cleaned using compressed air.

– Thoroughly clean and dry tank for reducing agent in area of delivery module to prevent ingress of dirt during removal and installation processes.

– Unscrew securing bolts -1-, -2- and -3- (Torx T30).



– Fit suitable screwdriver with flat, 8 mm wide blade -1- under edge -2- of pump for reducing agent, and support it at web -3-.



Caution

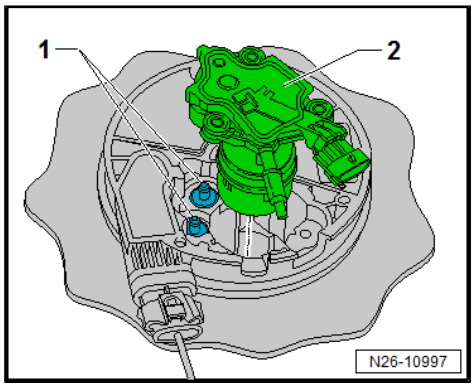
The web -3- must not be deformed plastically when levering out the pump for reducing agent.

If the web -3- is plastically deformed when levering out the pump for reducing agent, the adjacent resin seal may become damaged or leaky.

Lever pump for reducing agent upwards in a straight line out of delivery module, making sure not to apply excessive force.

– Swivel flat-bladed screwdriver -1- in direction of -arrow- to lever pump for reducing agent in a straight line upwards out of delivery module.

– Remove pump for reducing agent -2- in a straight line upwards from delivery module.



Note

If any seals remained on the internal hydraulic sealing points -1- after the removal of the pump for reducing agent, remove the seals.

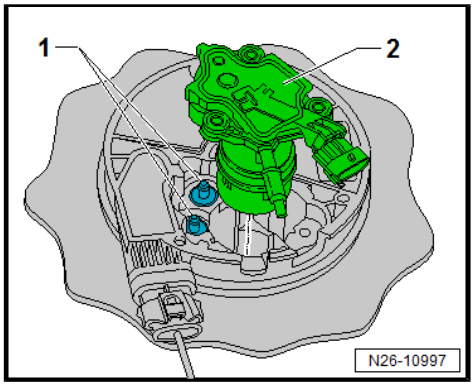
Installing:

Install in the reverse order of removal. When doing this, note the following:

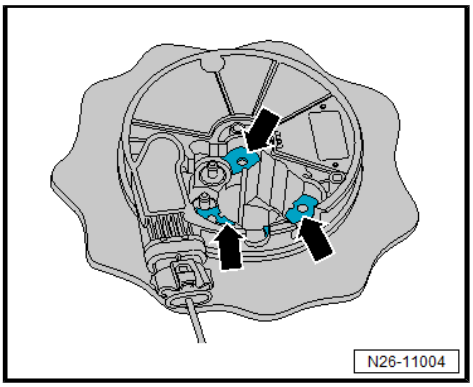
Note

Before installing the pump for reducing agent, clean the sealing points and contact surfaces of the pump in the delivery module with water and a lint-free cloth to remove crystallised AdBlue residue and dirt.

– Thoroughly clean internal hydraulic sealing points -1- to remove AdBlue residue and dirt, and dry them afterwards.



– Thoroughly clean contact surfaces of pump in fuel delivery module -arrows- to remove AdBlue residue and dirt, and dry them afterwards.



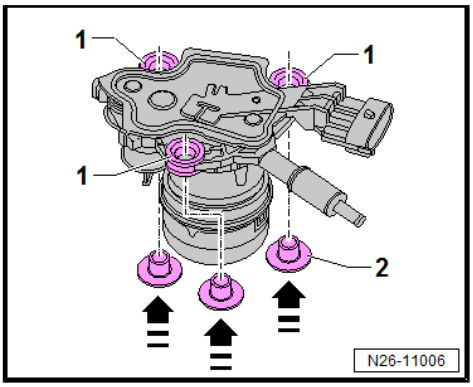
– Push rubber dampers -1- into mountings on new pump for reducing agent.

Caution

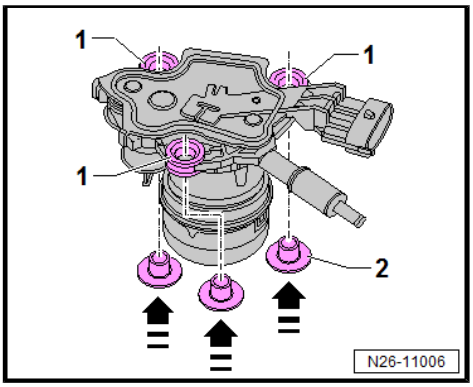
Risk of malfunction due to improper installation of the spacer sleeves.

The pump will not function properly if the spacer sleeves are inserted into the rubber dampers from above.

Please make sure to insert the three spacer sleeves into the rubber dampers from below.

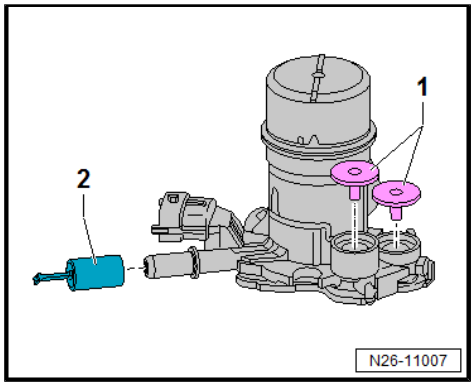


– Insert spacer sleeves -2- into rubber dampers from below, as shown in illustration.

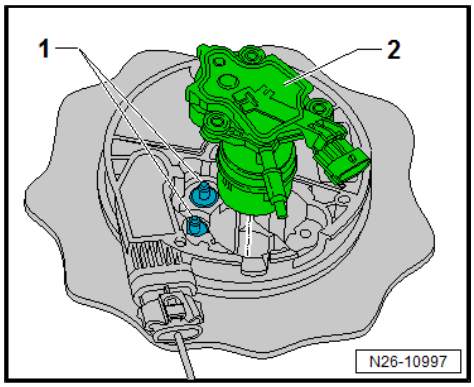


– Pull out two sealing plugs -1-, and use distilled water as assembly aid for coating seals located underneath.

Do not remove protective cap -2- from hydraulic connection of pressure line.



– Insert pump for reducing agent -2- in a straight line into delivery module ensuring that the seals are properly fitted onto internal hydraulic sealing points -1-.
– Push pump for reducing agent -2- into delivery module until the surface of pump housing does not project above the end face of delivery module by more than 1 mm.



Caution

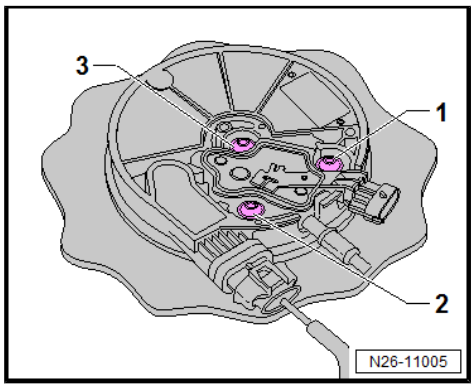
Risk of damage to the securing thread of the delivery module.

- ***Uncontrolled screwing-in of the bolts for securing the pump to the delivery module may cause damage to the plastic thread in the delivery module.***
- ***Proceed very carefully, and make sure not to cross-thread when screwing in the securing bolts.***
- ***Also, observe the specified tightening sequence and specified torques.***

– First, screw in securing bolts -1-, -2- and -3- completely; then tighten them to 6 Nm in the same sequence.
– To compensate for the settling, wait at least 2 minutes before tightening securing bolts -1-, -2- and -3- again to 6 Nm in same sequence.
– Install reduction agent tank ⇒ page 342 .
– Fill reducing agent tank ⇒ Maintenance ; Booklet 1.2 .

Specified torques:

- ⇒ “3.2 Assembly overview - tank for reducing agent”, page 338



3.9 Removing and installing control unit for reducing-agent heater - J891-

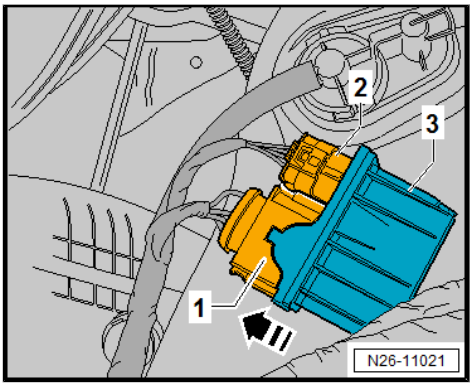
Note

The control unit for reducing-agent heater - J891- is engaged in a bracket at top of the tank for reducing agent.

Removing:

– Pull control unit for reducing-agent heater - J891- -3- towards rear (-arrow-) off tank for reducing agent.

– Release and disconnect connectors -1- and -2-.

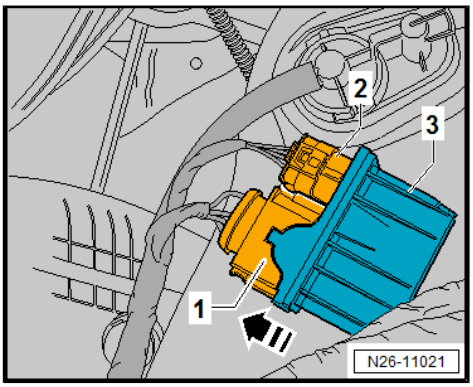


Installing:

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

– First, fit and engage connectors -1- and -2-.

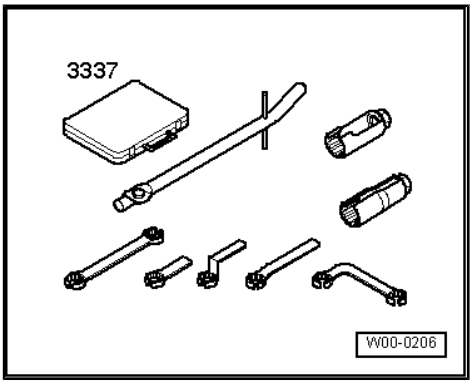
– Then, push control unit for reducing-agent heater - J891- -3- onto bracket on tank for reducing agent, and engage it there.



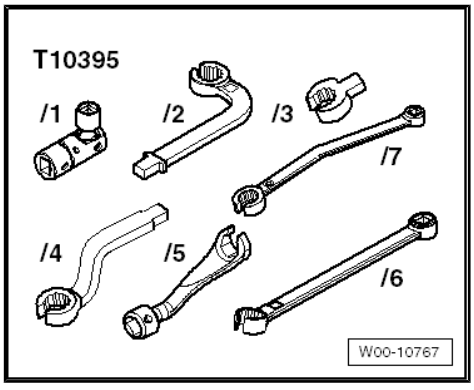
3.10 Removing and installing NOx sender - G295- / control unit for NOx sender - J583-

Special tools and workshop equipment required

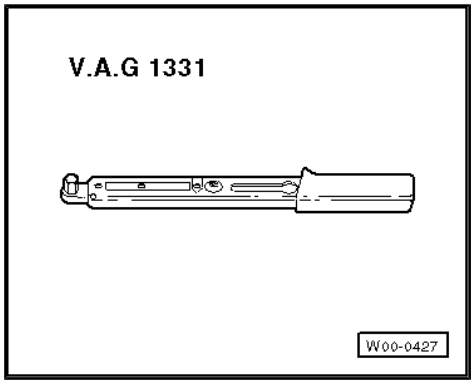
♦ Lambda probe open ring spanner set - 3337-



♦ Tool set, 17 mm - T10395-



- Torque wrench - V.A.G 1331-



Note

- *The NOx sender - G295- is screwed into the exhaust pipe ahead of the particulate filter.*
- *Since the sender line cannot be disconnected from the control unit, the NOx sender - G295- needs to be removed together with the control unit for NOx sender - J583- .*

Removing:

WARNING

Risk of burns.

Parts of the exhaust system may be hot.

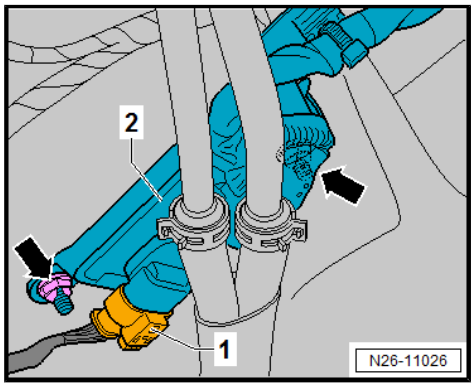
Allow exhaust system to cool before removing.

When doing any repair work, especially in the engine compartment, pay attention to the following due to the cramped conditions:

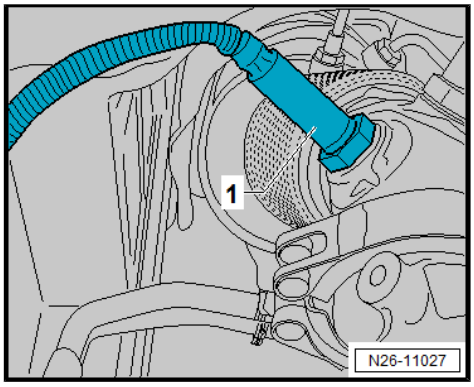
- ***Route all the various lines (e.g. for fuel, hydraulics, activated charcoal filter system, coolant and refrigerant, brake fluid and vacuum) and electrical wiring in their original positions.***
- ***To avoid damage to lines, ensure sufficient clearance from all moving or hot components.***
- ***Cut through cable ties carefully and reinstall them in the same position.***

– Release and disconnect connector -1-.

– Unscrew securing nuts -arrows-, and remove control unit for NOx sender - J583- -2- from studs.



– Unscrew NOx sender - G295- -1- from particulate filter, and remove sender.



Installing:

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

– First, screw in NOx sender - G295- , and tighten it to specified torque.

– Then, bolt control unit for NOx sender - J583- to vehicle body.

Note

Fit all cable ties at the same positions at which they were detached or cut open during removal.

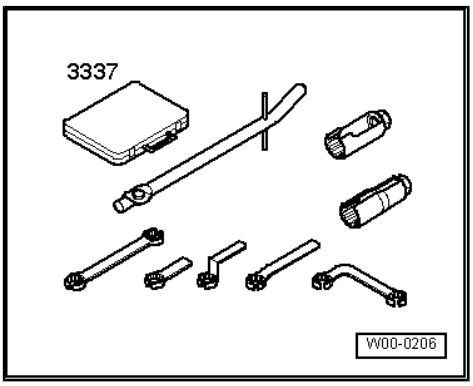
Specified torques:

♦ ⇒ “1.2 Assembly overview – SCR catalytic converters (vehicles compliant with EU 6 standard)”, page 318

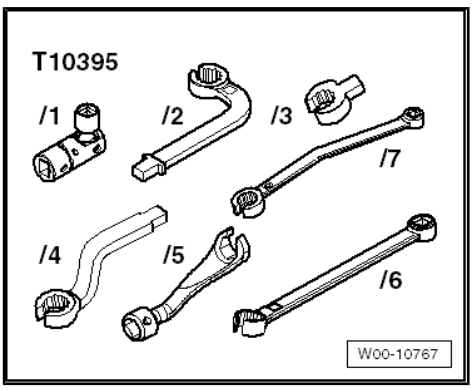
3.11 Removing and installing NOx sender 2 - G687- / control unit for NOx sender 2 - J881-

Special tools and workshop equipment required

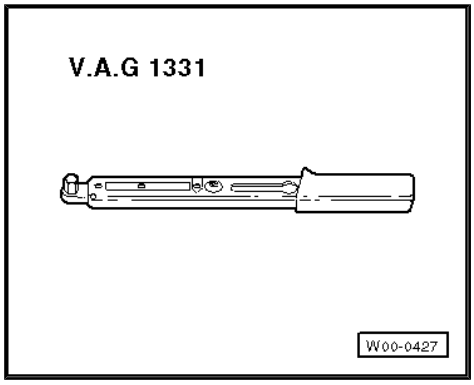
♦ Lambda probe open ring spanner set - 3337-



♦ Tool set, 17 mm - T10395-



- Torque wrench - V.A.G 1331-



Note

- *The NOx sender 2 - G687- is screwed into the exhaust pipe behind the SCR catalytic converters.*
- *Since the sender line cannot be disconnected from the control unit, the NOx sender 2 - G687- needs to be removed together with the control unit for NOx sender 2 - J881- .*

WARNING

Risk of burns.

Parts of the exhaust system may be hot.

Allow exhaust system to cool before removing.

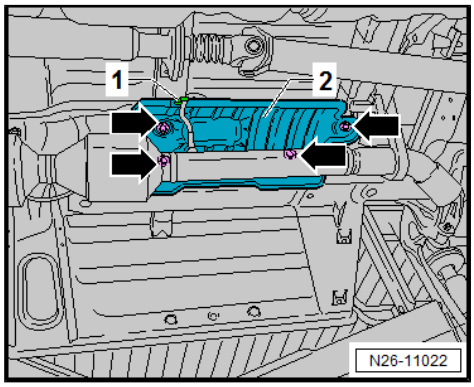
When doing any repair work, especially in the engine compartment, pay attention to the following due to the cramped conditions:

- ***Route all the various lines (e.g. for fuel, hydraulics, activated charcoal filter system, coolant and refrigerant, brake fluid and vacuum) and electrical wiring in their original positions.***
- ***To avoid damage to lines, ensure sufficient clearance from all moving or hot components.***
- ***Cut through cable ties carefully and reinstall them in the same position.***

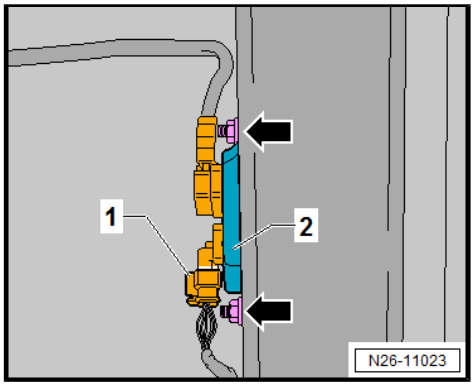
Removing:

– Pull line retainer -1- off heat shield.

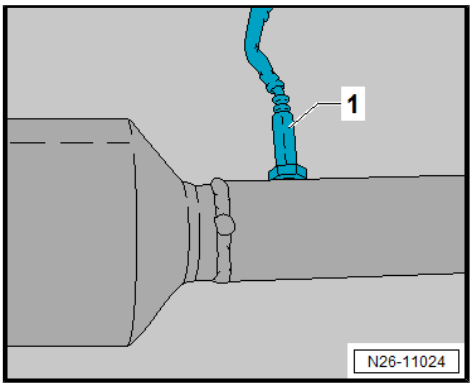
– Unscrew speed nuts -arrows-, and remove heat shield -2- from studs.



– Release and disconnect connector -1- from control unit for NOx sender 2 - J881- -2-.
– Unscrew securing nuts -arrows-, and remove control unit for NOx sender 2 - J881- -2- from studs.



– Unscrew NOx sender 2 - G687- -1-, and remove it along with control unit for NOx sender 2 - J881- .



Installing:

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

– First, screw in NOx sender 2 - G687- , and tighten it to specified torque.
– Then, bolt control unit for NOx sender 2 - J881- to vehicle body.

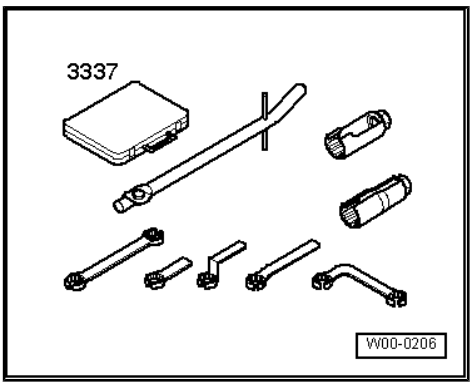
Specified torques:

♦ ⇒ “1.2 Assembly overview – SCR catalytic converters (vehicles compliant with EU 6 standard)”, page 318

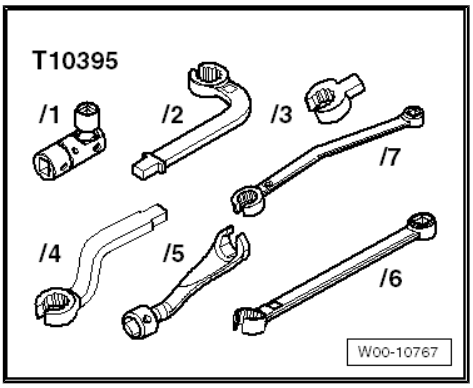
3.12 Removing and installing exhaust gas temperature sender 2 - G448-

Special tools and workshop equipment required

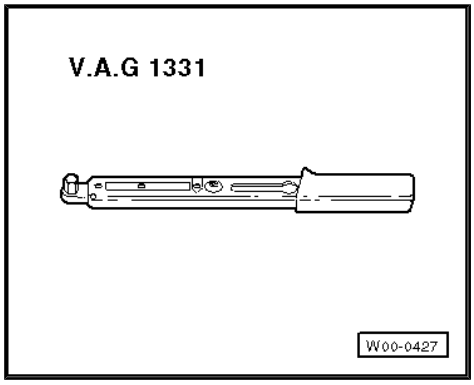
♦ Lambda probe open ring spanner set - 3337-



♦ Tool set, 17 mm - T10395-



- Torque wrench - V.A.G 1331-



Note

The exhaust gas temperature sender 2 - G448- is screwed into particulate filter on its front edge.

Removing:

WARNING

Risk of burns.

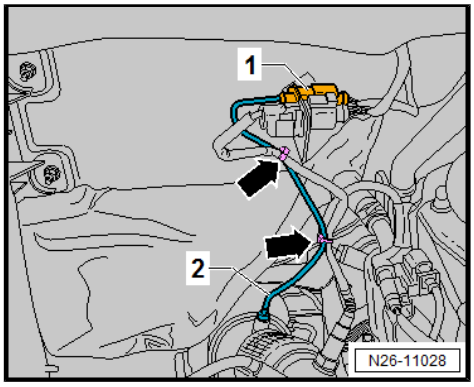
Parts of the exhaust system may be hot.

Allow exhaust system to cool before removing.

When doing any repair work, especially in the engine compartment, pay attention to the following due to the cramped conditions:

- ***Route all the various lines (e.g. for fuel, hydraulics, activated charcoal filter system, coolant and refrigerant, brake fluid and vacuum) and electrical wiring in their original positions.***
- ***To avoid damage to lines, ensure sufficient clearance from all moving or hot components.***
- ***Cut through cable ties carefully and reinstall them in the same position.***

– Pull connector -1- upwards out of retainer.
– Release and disconnect connector -1-.
– Open cable ties -arrows-, and move clear the line.
– Unscrew exhaust temperature sender 2 - G448- -2- from particulate filter.



Installing:

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

– Before installing, coat thread of exhaust gas temperature sender 2 - G448- with high-temperature paste as per ⇒ Electronic Parts Catalogue (ETKA) .

Note

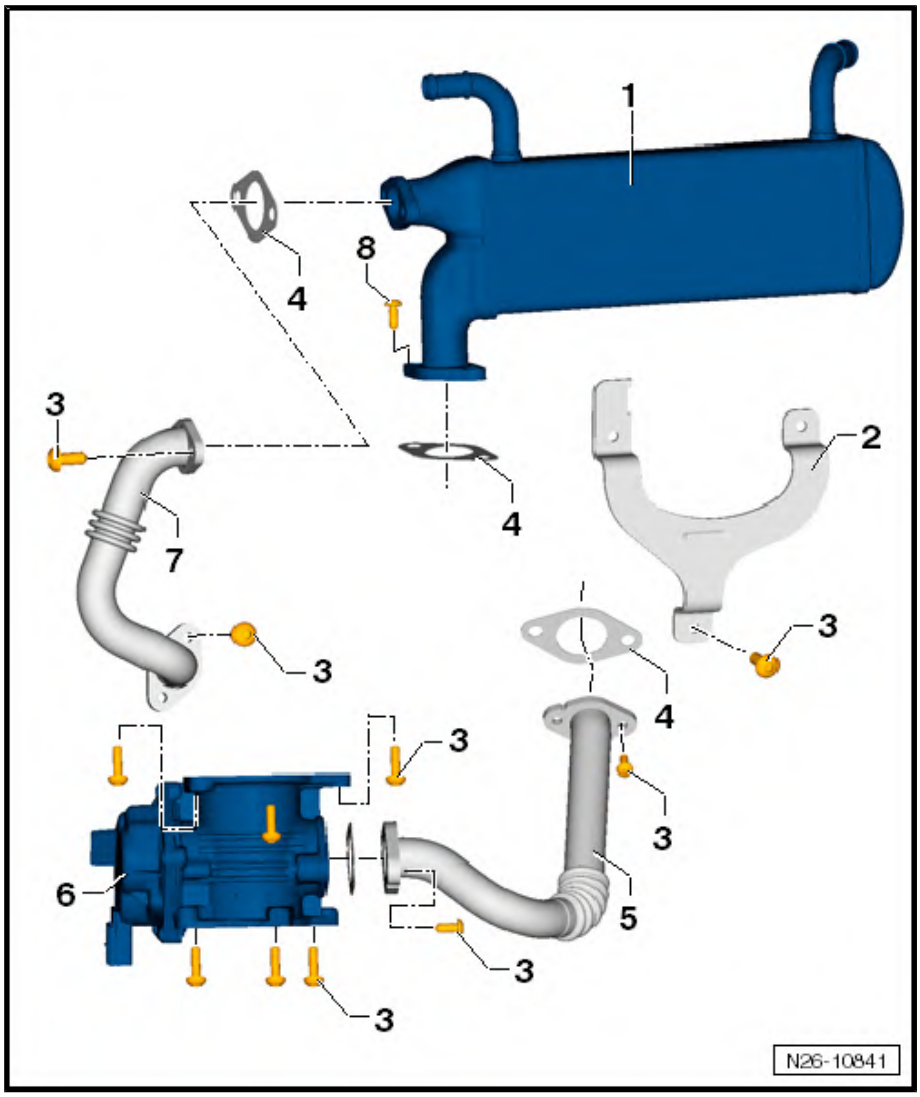
Fit all cable ties at the same positions at which they were detached or cut open during removal.

Specified torques:

◆ ⇒ “1.2 Assembly overview – SCR catalytic converters (vehicles compliant with EU 6 standard)”, page 318

4 Exhaust gas recirculation

4.1 Assembly overview - exhaust gas recirculation



1 - Exhaust gas recirculation cooler

- ❑ Checking for leaks ⇒ page 364 .
- ❑ Removing and installing ⇒ page 361 .
- ❑ On vehicles with EU6 standard-compliant engines: with additional exhaust gas recirculation temperature sensor - G98-
- ❑ Removing and installing exhaust gas recirculation temperature sensor - G98- ⇒ page 368 .
- ❑ Specified torque for exhaust gas recirculation temperature sensor - G98- : 60 Nm

2 - Bracket

3 - Bolt

- ❑ Renew after removing.
- ❑ 8 Nm

4 - Gasket

- ❑ Renew after removing

5 - Connecting pipe

- ❑ Renew after removing

6 - Exhaust gas recirculation valve - N18-

- ❑ Removing and installing ⇒ page 361 .

7 - Connecting pipe

- ❑ Renew after removing

8 - Bolt

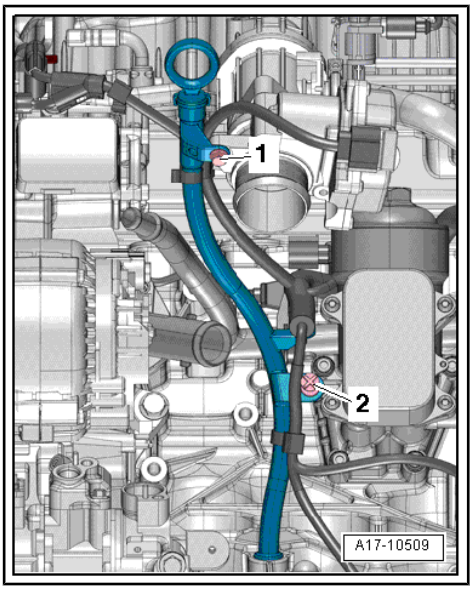
- ❑ 20 Nm

4.2 Removing and installing exhaust gas recirculation valve - N18-

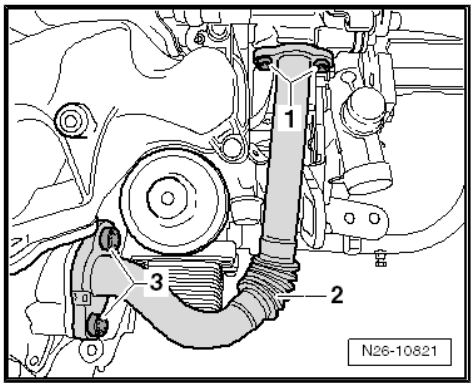
Removing

– Remove throttle valve module - J338- ⇒ page 275 .

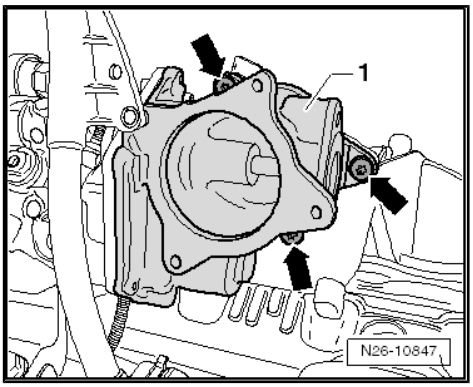
– Loosen upper -1- and lower -2- securing elements on oil dipstick. Press off spreader clip -2- using removal lever - 80 - 200- if necessary (depending on type).



– Unscrew securing bolts -1 and 3-, and remove connecting pipe -2-.



– Unscrew securing bolts -arrows-, and remove exhaust gas recirculation valve - N18- -1- from intake manifold.



Installing

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

Note

Renew connecting pipes after each removal.

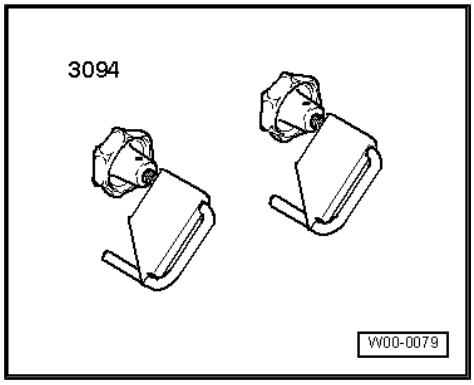
Specified torques

- ⇒ “4.1 Assembly overview - exhaust gas recirculation”, page 360
- ⇒ “3.1 Assembly overview - intake manifold”, page 271

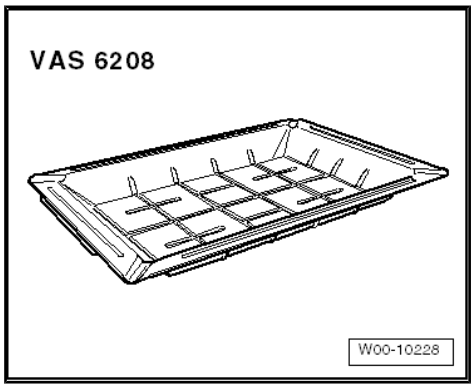
4.3 Removing and installing exhaust gas recirculation cooler

Special tools and workshop equipment required

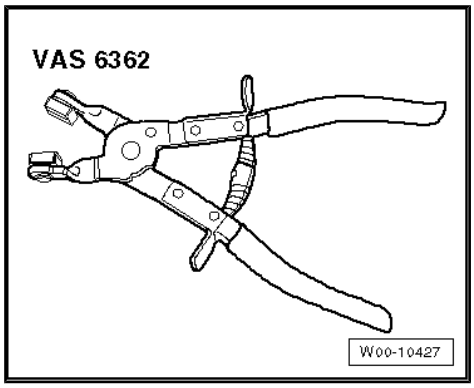
- Hose clamps up to 25 mm - 3094-



- Drip tray for workshop hoist - VAS 6208-



- Hose clip pliers - VAS 6362-



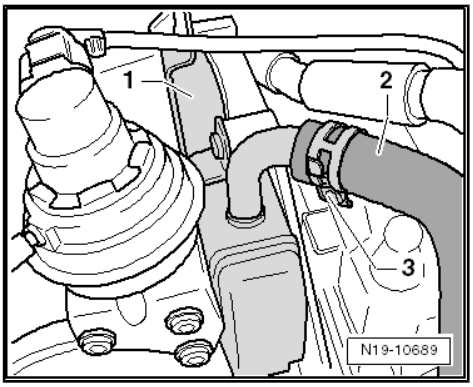
Note

- *The exhaust gas recirculation cooler is removed upwards. Contaminated areas must be cleaned thoroughly after installing.*
- *Renew gaskets and seals.*

Removing

– Clamp off coolant hose -2- leading to the entrance to the exhaust gas recirculation cooler -1- with hose clips up to 25 mm - 3094- .

– Loosen clamp -3- and pull coolant hose -2- off exhaust gas recirculation cooler -1-.



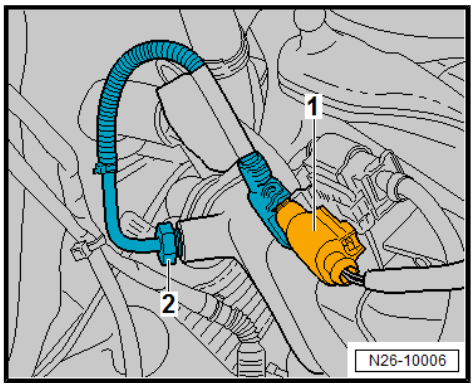
Only for vehicles with EU 6 standard-compliant engines:

Note

- *On vehicles with EU6 standard-compliant engines there is an additional exhaust gas recirculation temperature sensor - G98- integrated in the exhaust gas recirculation cooler.*
- *If the exhaust gas recirculation cooler is to be removed and then reinstalled, the exhaust gas recirculation temperature sensor - G98- needs to be detached just far enough (according to the description) to be able to remove it together with the exhaust gas recirculation cooler.*
- *If the exhaust gas recirculation cooler is to be renewed, the exhaust gas recirculation temperature sensor - G98- needs to be removed completely from the exhaust gas recirculation cooler.*

– Pull connector -1- out of retainer, release it, and then disconnect.

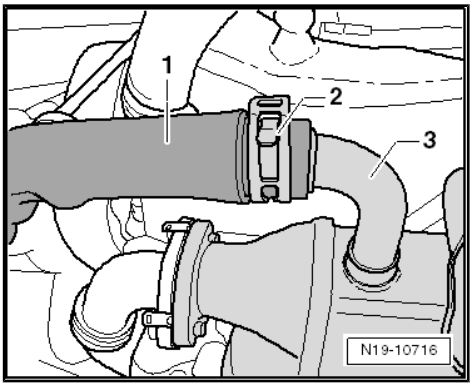
– When renewing exhaust gas recirculation cooler, remove exhaust gas recirculation temperature sensor - G98- -2- ⇒ page 368 .



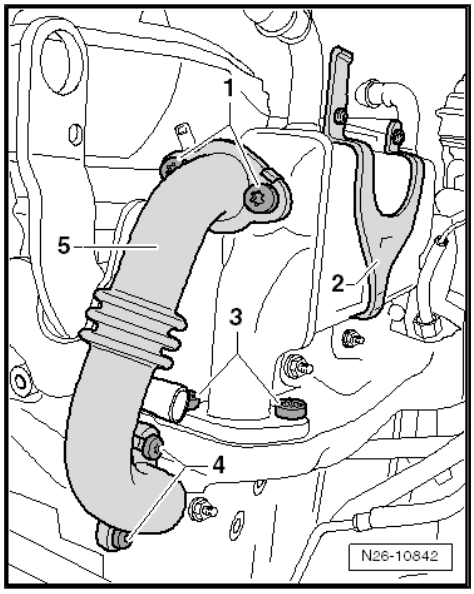
Continuation for all vehicles:

– Clamp off coolant hose -1- coming from exit of exhaust gas recirculation cooler -3- with hose clips up to 25 mm - 3094- .

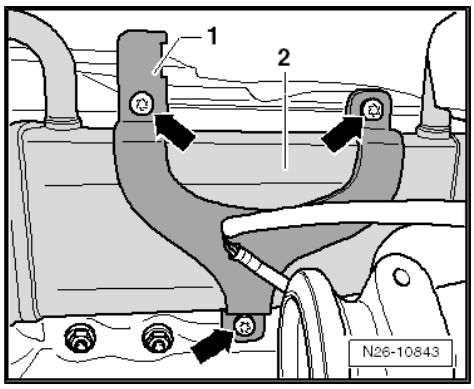
– Loosen clamp -2- and pull coolant hose -1- off exit of exhaust gas recirculation cooler -3-.



– Unscrew bolts -1 and 4-, and remove connecting pipe -5-.
– Undo and remove bolts -3-.



– Unscrew bolts -arrows- and remove bracket -1- of exhaust gas recirculation cooler.
– Carefully remove exhaust gas recirculation cooler upwards.



Installing

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

Note

- *Renew connecting pipes after each removal.*
- *First start all pipe bolts by hand then tighten them to specified torque.*

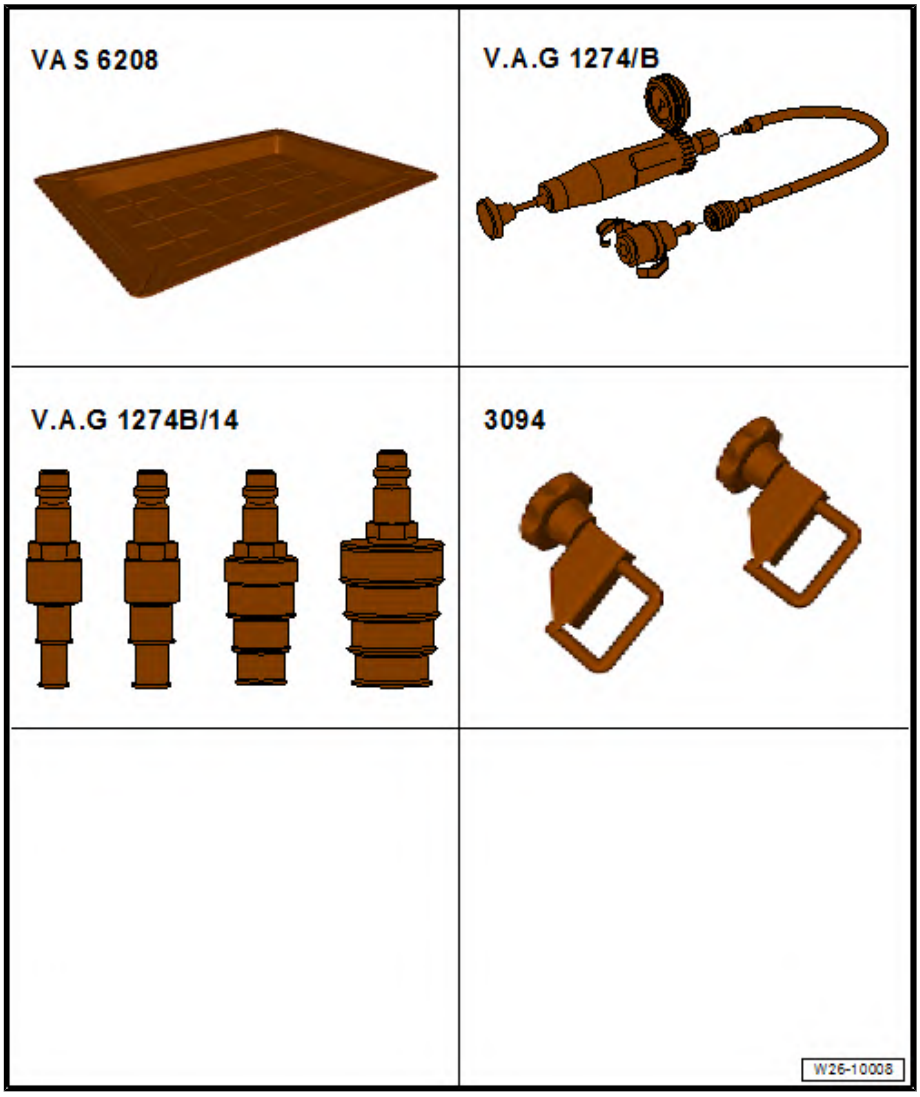
Specified torques

- ⇒ “4.1 Assembly overview - exhaust gas recirculation”, page 360

4.4 Checking exhaust gas recirculation cooler for leaks

Special tools and workshop equipment required

- Drip tray for workshop hoist - VAS 6208-
- Cooling system tester - V.A.G 1274 B-
- Adapter - V.A.G 1274B/14-
- Hose clamps up to 25 mm - 3094-



The following instructions apply for checking the exhaust gas recirculation cooler while installed.

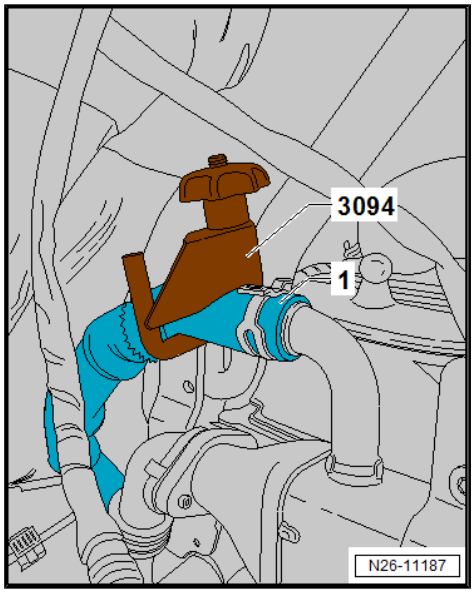
WARNING

When the engine is warm, the cooling system is under pressure.

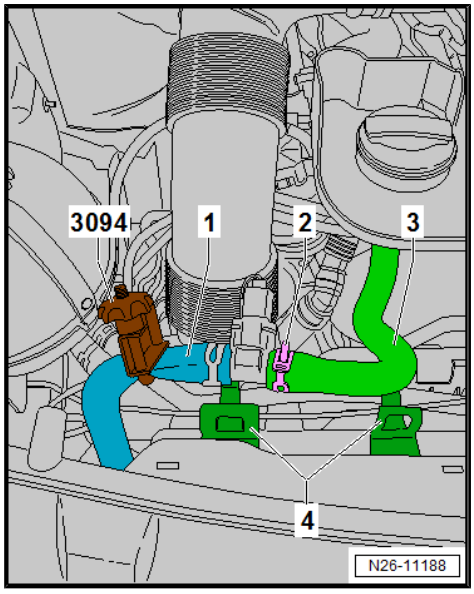
Hot steam/hot coolant can escape - risk of scalding.

Cover filler cap on expansion tank with a cloth and open carefully to dissipate pressure.

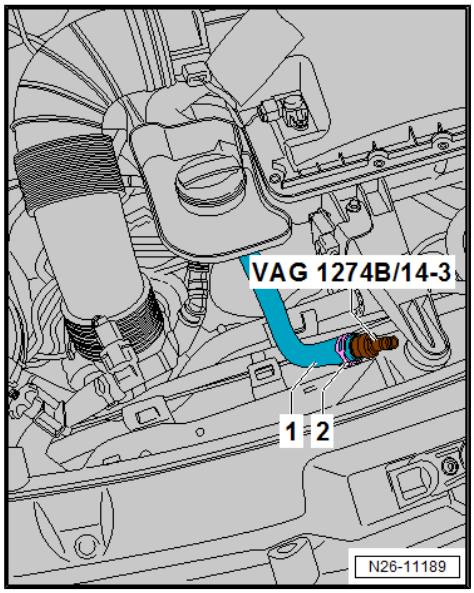
– Clamp off coolant hose -1- leading from exhaust gas recirculation cooler with hose clamps, up to 25 mm - 3094- .



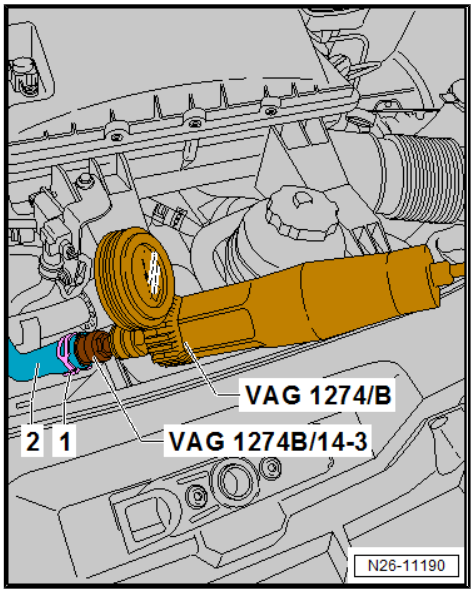
– Remove coolant hose -3- from retainer -4-.
– Clamp off coolant hose -1- leading to exhaust gas recirculation cooler with hose clamps, up to 25 mm - 3094- .
– Loosen clip -2-.
– Pull off coolant hose -3-.



– Connect adapter - V.A.G 1274B/14-3- to coolant hose -1-.
– Secure coolant hose -1- again using clamp -2-.



– Connect cooling system tester - V.A.G 1274 B- to adapter - V.A.G 1274B/14-3- .
– Using cooling system tester - V.A.G 1274 B- , generate a pressure of 2.0 bar.



Note

Check hose clip -1- of coolant hose -2- for firm seating.

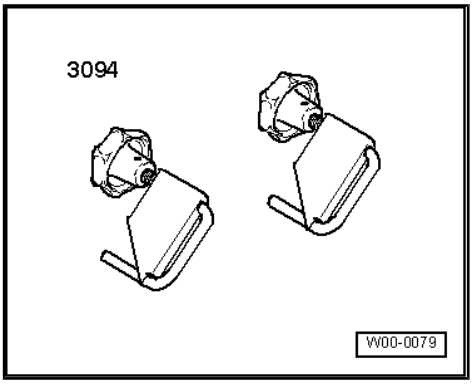
– Check all hose connections for leaks.
- The pressure must not drop by more than 0.2 bar within 10 minutes.
- When the pressure drops by more than 0.2 bar, build-up pressure again to 1.5 bar, and repeat the test again.
- If the exhaust gas recirculation cooler leaks, renew exhaust gas recirculation cooler.
- The channels to the valves must free of coolant remnants.

– Filling coolant and bleeding cooling system ⇒ page 179 .

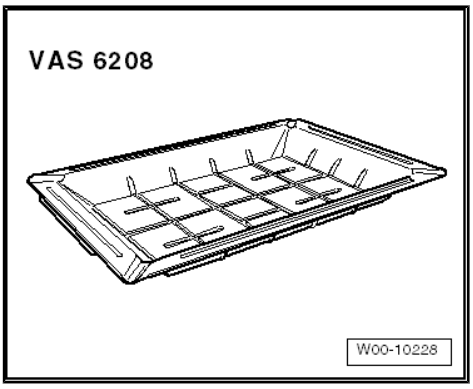
4.5 Removing and installing pump for exhaust gas recirculation cooler - V400-

Special tools and workshop equipment required

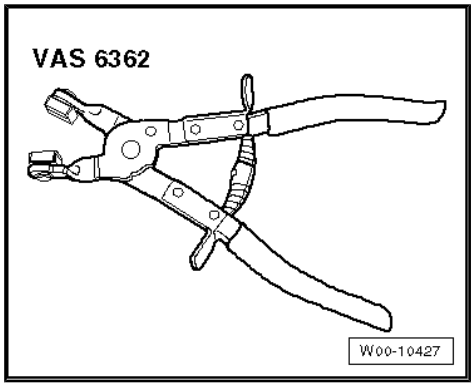
♦ Hose clamps up to 25 mm - 3094-



♦ Drip tray for workshop hoist - VAS 6208-



♦ Hose clip pliers - VAS 6362-

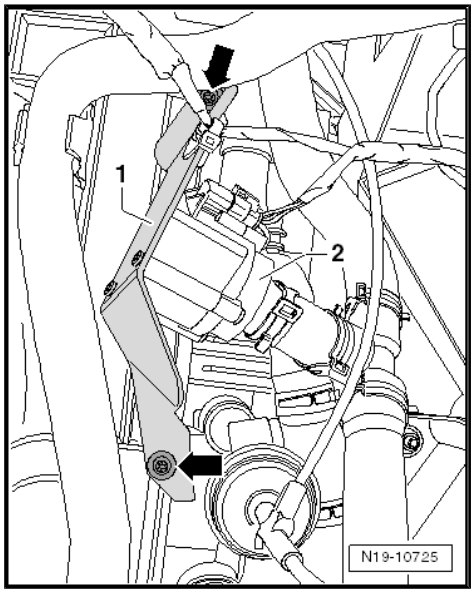


Removing

– Clamp off coolant hoses leading to pump for exhaust gas recirculation cooler - V400- with hose clips up to 25 mm - 3094- .

– Loose hose clips from pump for exhaust gas recirculation cooler - V400- and pull coolant hoses off.

– Remove bolts -arrows-. Remove pump for exhaust gas recirculation cooler - V400- with retainer -1-



Installing

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

– Check coolant level and top up if necessary ⇒ page 179 .

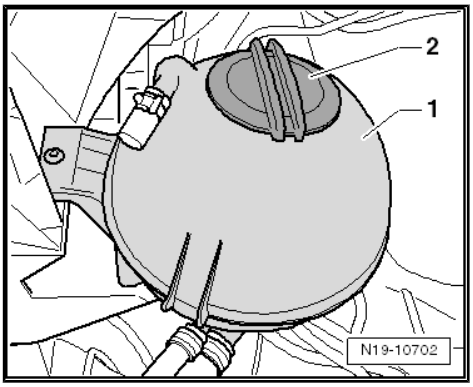
4.6 Removing and installing exhaust gas recirculation temperature sensor - G98-

Note

On vehicles with EU6 standard-compliant engines the exhaust gas recirculation temperature sensor - G98- is screwed directly into the exhaust gas recirculation cooler.

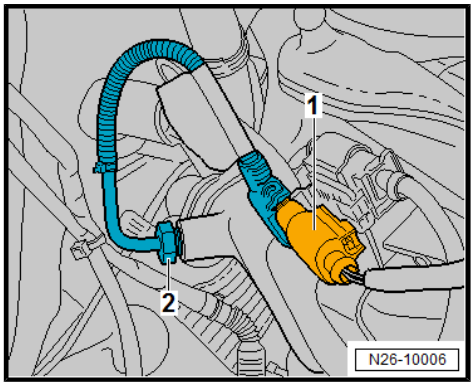
Removing

– Briefly open filler cap -2- for coolant expansion tank -1- in order to reduce pressure in cooling system.



– Pull connector -1- out of retainer, release it, and then disconnect.

– Unscrew exhaust gas recirculation temperature sensor - G98- -2- from exhaust gas recirculation cooler.



Installing

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

Specified torques

♦ ⇒ “4.1 Assembly overview - exhaust gas recirculation”, page 360

– Check coolant and top up if necessary ⇒ page 179 .

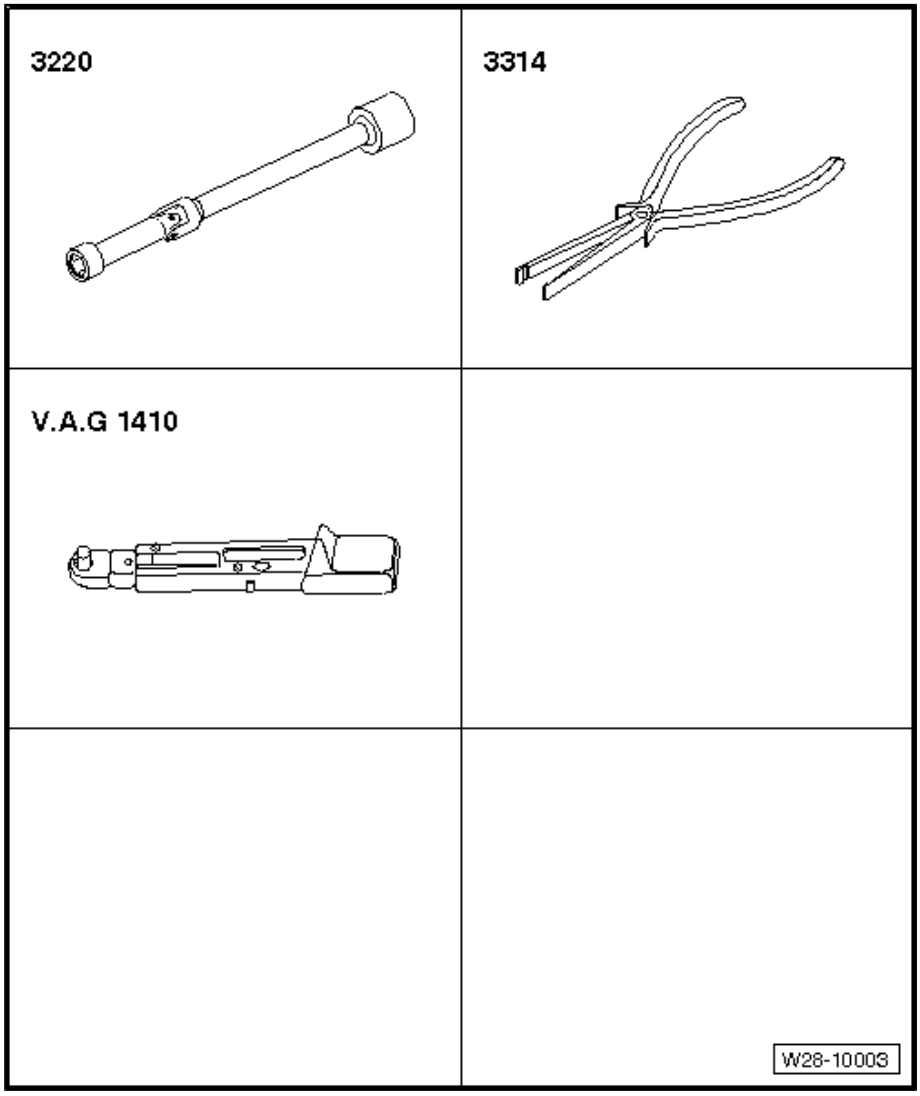
28 – Glow plug system

1 Glow plug system

1.1 Removing and installing glow plug

Special tools and workshop equipment required

- Jointed wrench 10 mm - 3220-
- Pliers - 3314-
- Torque wrench - V.A.G 1410-



Removing

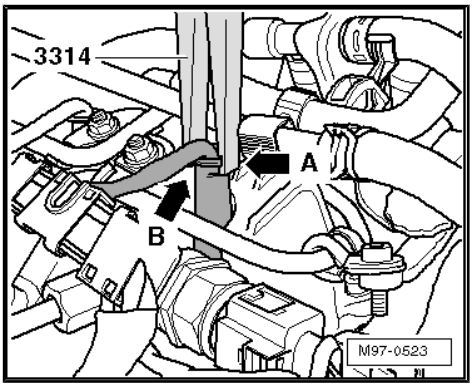
– Remove air filter housing ⇒ page 277 .

– Switch off ignition.

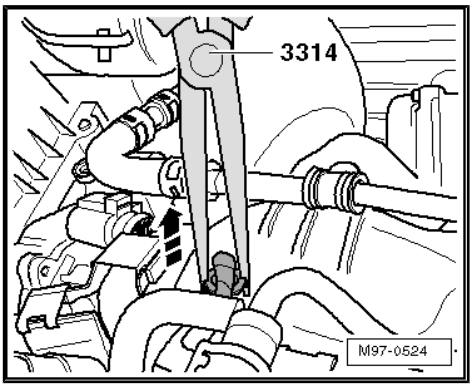
Caution

Make sure that no wiring connections are damaged when disconnecting the connectors. Otherwise the whole wiring harness will need to be renewed. Do not compress the pliers - 3314- to firmly to separate the connectors, otherwise the support sleeve may be damaged.

– Position pliers - 3314- with groove -arrow A- on support sleeve shoulder -arrow B-.



– Carefully pull connector off glow pin plug -in direction of arrow-.



Note

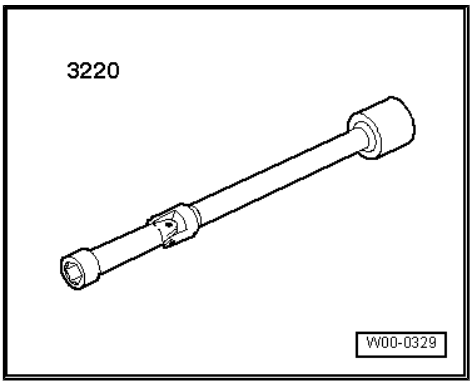
Detach all the necessary electrical connectors to ensure that the wiring harness is not damaged.

– Clean glow pin plug opening in cylinder head. It must be ensured that no dirt falls into the cylinder when this is being done.

Cleaning procedure:

- Use a vacuum cleaner to remove coarse dirt.
- Spray brake cleaner or suitable cleaning agent into glow pin plug opening, let it work in briefly, and blow out with compressed air.
- Then use an oil-soaked cloth to clean the glow pin plug opening.

– To loosen glow plugs, use special tool U/J extension and 10 mm socket - 3220-



Installing

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

– To tighten glow plugs, use special tool U/J extension with 10 mm socket - 3220- .

– Fit glow plug connectors to the respective glow plugs and ensure they are firmly seated.

– Install air filter housing ⇒ page 277 .

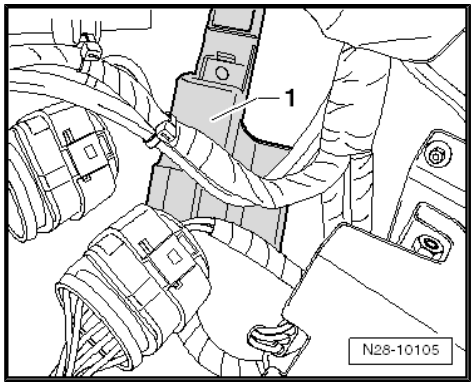
– Delete engine control unit event memory.

Specified torque

Component	Specified torque
Glow plug	17 Nm

1.2 Checking glow plug system

The automatic glow period control unit - J179- is located under the engine control unit on the left in the engine compartment.



1 - Automatic glow period control unit - J179-

The glow plug system is controlled by means of an automatic glow period control unit - J179- The automatic glow period control unit - J179- is capable of self-diagnosis.

A fault entry is stored in the engine control unit if a fault occurs in the glow plug system.

The test for the glow plug system is described in ⇒ Vehicle diagnostic tester.

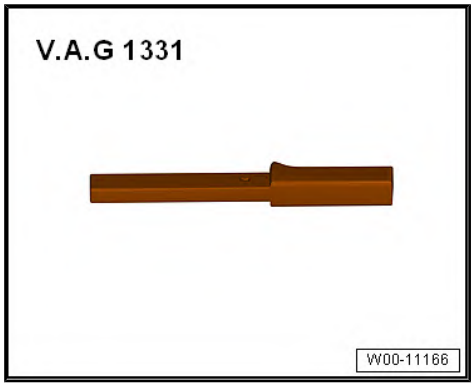
For faster starting, the vehicle is equipped with electronically controlled glow plugs and a separate glow period control unit.

Each glow plug is activated and diagnosed separately.

1.3 Removing and installing Hall sender - G40-

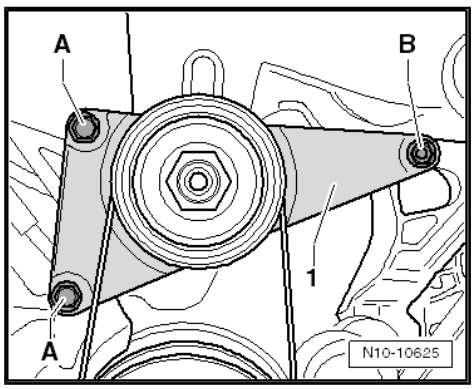
Special tools and workshop equipment required

- Torque wrench - V.A.G 1331-



Removing

– Remove air filter housing ⇒ page 277 .
– Remove cowling ⇒ page 207 .
– Remove viscous fan ⇒ page 205 .
– Remove poly V-belt ⇒ page 43 .
– Unscrew bolts -A and B-, and remove bracket -1- for viscous fan.

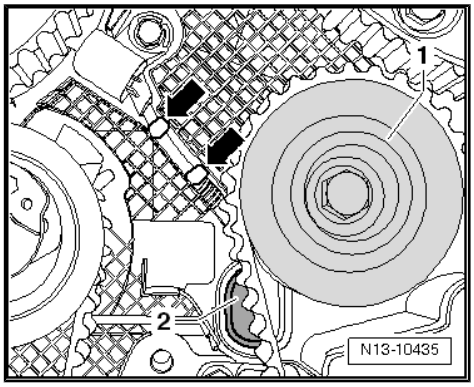


– Remove vibration damper ⇒ page 49 .
– Remove toothed belt from idler pulley and high-pressure pump ⇒ page 112 .

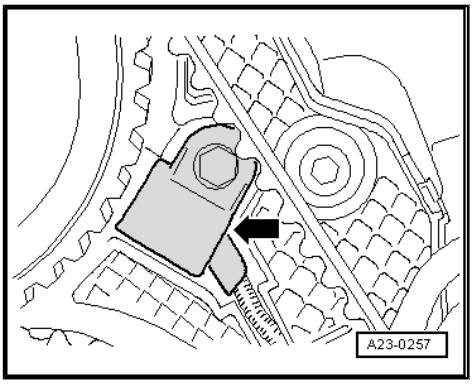
Note

- *The toothed belt need not be removed completely.*
- *The lower toothed belt guard does not need to be removed.*

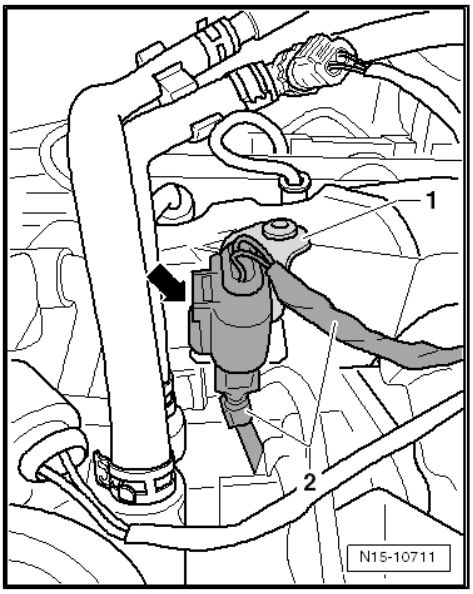
– Unbolt idler pulley -1-.
– Remove web plates -arrows- with a screwdriver and release wiring harness.
– Remove cover -2- of repair aperture.



– Screw off Hall sender - G40- -arrow-.



– Withdraw wiring harness -2- from bracket -1-.
– Disconnect electrical connector -arrow-.
– Pull wiring harness together with Hall sender - G40- through repair aperture to remove.



Installing

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

– Seal repair aperture in toothed belt guard with rubber plugs as specified in ⇒ ETKA (Electronic Parts Catalogue) .

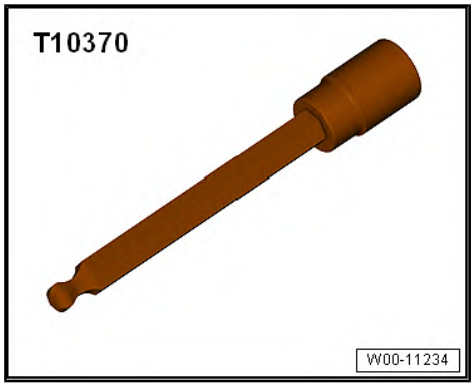
Specified torques

♦ ⇒ “1.1 Assembly overview - cylinder head”, page 87

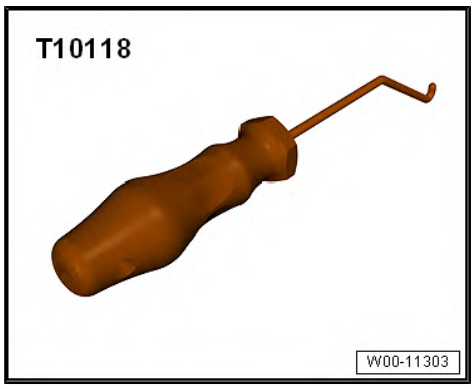
1.4 Removing and installing engine speed sender - G28-

Special tools and workshop equipment required

♦ Bit AF 4 mm - T10370-



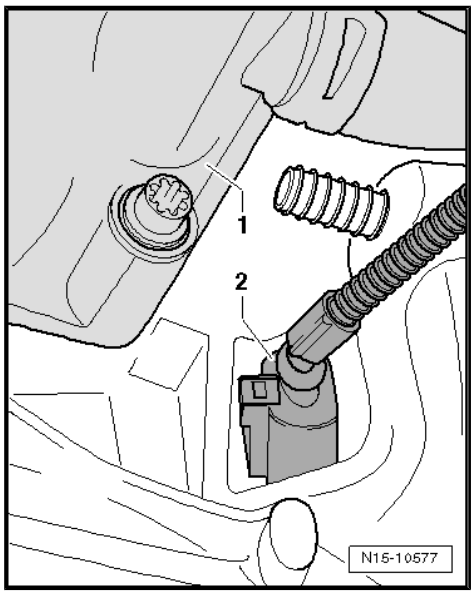
♦ Assembly tool - T10118-



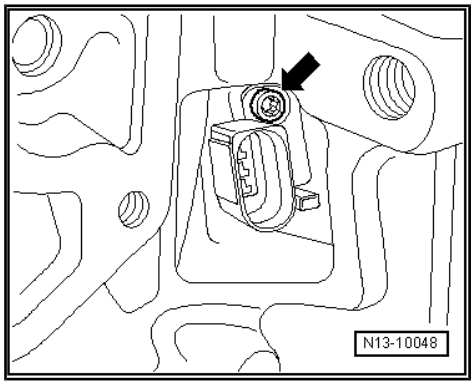
Removing

– If fitted, remove noise insulation ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Removing and installing noise insulation .

– Disconnect connector -2- for engine speed sender - G28- below oil filter housing -1-. Use assembly tool - T10118- for this as necessary.



– Loosen bolt -arrow- using bit AF 4 mm - T10370- and remove speed sender.



Installing

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

Specified torque

- ⇒ “2.1 Assembly overview - cylinder block, gearbox end”, page 58