



## Workshop Manual Amarok 2011 ➤

4-cylinder diesel engine (2.0 l engine, common rail)

Engine ID	CDC A	CDB A	CNE A	CSH A	CNF A	CNF B			
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Edition 04.2013





## List of Workshop Manual Repair Groups

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





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4-cylinder diesel engine (2.0 l engine, common rail) - Edition 04.2013

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## 00 – Technical data

### 1 Identification

(VRL005497; Edition 04.2013)

⇒ **"1.1 Engine number, engine data", page 1**

#### 1.1 Engine number, engine data

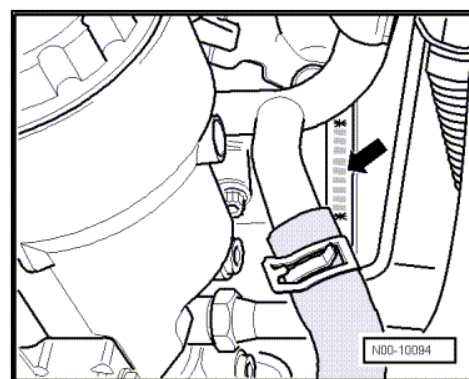
New four digit engine codes have been introduced since model year 2008. The first 3 digits refer to the mechanical configuration of the engine. They are stamped onto the engine. The fourth digit denotes the power output of the engine and depends on the engine control unit. The four digit engine code 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		CDCA	CDBA	CNFA
Manufactured	from to	01.10 ▶		
Emissions fulfil		EU 3 standard EU 4 standard EU 5 standard	EU 3 standard EU 4 standard EU 5 standard	EU 3 standard EU 4 standard EU 5 standard
Capacity	l	2.0	2.0	2.0
Output	kW at rpm	120/4000	90/3750	90/3750
Torque	Nm at rpm	400/ 1500 - 2000	340/ 1750 - 2250	340/ 1600 - 2000
Capacity	cm <sup>3</sup>	1968	1968	1968
Bore	Ø mm	81.0	81.0	81.0
Stroke	mm	95.5	95.5	95.5
Valves per cylinder		4	4	4
Compression ratio		16.5	16.5	16.0
Fuel	accord- ing to	DIN EN 590	DIN EN 590	DIN EN 590
Firing order		1-3-4-2	1-3-4-2	1-3-4-2
Balancer shaft module		no	no	no
Catalytic converter		yes	yes	yes
Exhaust gas recirculation		yes	yes	yes
Turbocharging/supercharg- ing		yes	yes	yes
Charge air cooler		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





Engine code	CDCA	CDBA	CNFA
Particulate filter	No; on vehicles compliant with EU 3 and EU 4 standards.	No; on vehicles compliant with EU 3 and EU 4 standards.	No; on vehicles compliant with EU 3 and EU 4 standards.
Selective catalytic reduction (SCR system)	no	no	no

1) Present in the case of engines compliant with EU 5 standard and/or in conjunction with dual clutch gearboxes.

Engine codes	CNEA	CSHA	CNFB
Manufactured from to	01.10 ►		
Emissions fulfil	EU 4 standard EU 5 standard	EU 4 standard EU 5 standard	EU 4 standard EU 5 standard
Capacity l	2.0	2.0	2.0
Output kW at rpm	132/4000	132/4000	103/3500
Torque Nm at rpm	400/ 1500 - 2250	420/ 1750	340/ 1600 - 2250
Capacity cm <sup>3</sup>	1968	1968	1968
Bore Ø mm	81.0	81.0	81.0
Stroke mm	95.5	95.5	95.5
Valves per cylinder	4	4	4
Compression ratio	16.5	16.0	16.0
Fuel according to	DIN EN 590	DIN EN 590	DIN EN 590
Firing order	1-3-4-2	1-3-4-2	1-3-4-2
Balancer shaft module	no	yes	no
Catalytic converter	yes	yes	yes
Exhaust gas recirculation	yes	yes	yes
Turbocharging/supercharging	yes	yes	yes
Charge air cooler	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
Particulate filter	No; on vehicles compliant with EU 3 and EU 4 standards.	No; on vehicles compliant with EU 3 and EU 4 standards.	No; on vehicles compliant with EU 3 and EU 4 standards.
Selective catalytic reduction (SCR system)	no	no	no

2) Present in the case of engines compliant with EU 5 standard and/or in conjunction with dual clutch gearboxes.





## 2 Safety instructions

⇒ **"2.1 Safety precautions when working on fuel supply system", page 3**

⇒ **"2.2 Safety precautions when working on injection system", page 4**

⇒ **"2.3 Safety precautions when working on charge air system", page 5**

⇒ **"2.4 Safety precautions when working on cooling system", page 5**

⇒ **"2.5 Safety precautions during road tests in which testing and measuring equipment is used", page 6**

### 2.1 Safety precautions when working on fuel supply 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.*
- ◆ *Fuel and fuel lines in fuel system can become very hot (danger of scalding)!*
- ◆ *The fuel system is also under pressure! Before opening the system, place cloths around the connections. Then carefully loosen connection 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:

- ◆ Even before work commences, the extraction hose of an activated fume extraction system has to be placed in the vicinity of the assembly opening of the fuel tank to extract any escaping fumes. If no exhaust gas extraction system is available, a radial fan with a displacement greater than 15 m<sup>3</sup>/h can be used providing that motor is not in air flow.
- ◆ Prevent skin contact with fuel! Wear fuel-resistant gloves!





## 2.2 Safety precautions when working on injection 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.*
- ◆ *The engine must not be run when the fuel return line is disconnected, this is because the coupling chamber will be emptied due to the lack of the counterpressure.*



### Note

*Diesel direct injection system control unit is equipped with an event memory. Read event memory before and after making repairs or adjustments ⇒ Vehicle diagnostic tester.*

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

- ◆ Test and measuring instruments must always be secured to rear seat and operated by a second person from this location.
- ◆ 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.

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

- ◆ The ignition must be switched off before connecting or disconnecting preglow and injection system wiring as well as test equipment leads.
- ◆ Before disconnecting battery, obtain radio code for radios with anti-theft coding.
- ◆ Disconnecting and connecting the battery must only be done with the ignition switched off, as otherwise the control unit for diesel direct injection system could become damaged.





## 2.3 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 2nd 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.

## 2.4 Safety precautions when working 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:*

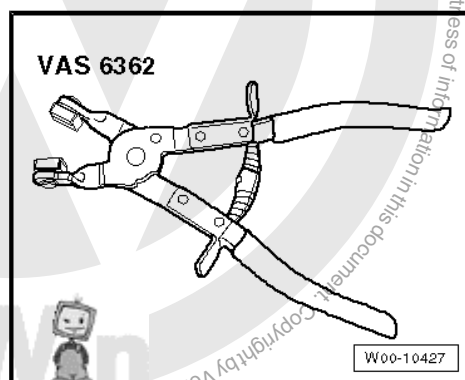
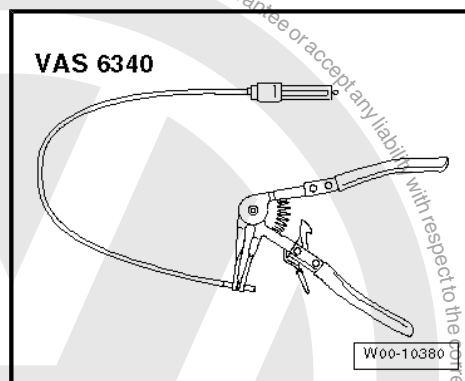
- ◆ *Route all the various lines (e.g. for fuel, hydraulics, activated charcoal filter system, coolant and refrigerant, brake fluid and vacuum) and electrical wiring in their original positions.*
- ◆ *To avoid damage to lines, ensure sufficient clearance from all moving or hot components.*





#### 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.*
- ◆ *When installing or removing spring-type clips, we recommend using spring-type clip pliers - VAS 6340- or ... hose clip pliers - VAS 6362- recommended.*
- ◆ *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.*
- ◆ *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.*



## 2.5 Safety precautions during road tests in which testing and measuring equipment is used

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

- ◆ **Test and measuring instruments must always be secured to the rear seat and operated by a second person from this location.**
- ◆ **Operating from the front passenger seat may result in an accident caused by releasing the front passenger air bag which can cause injuries to the person sitting there.**





### 3 Repair instructions

⇒ [“3.1 General notes on the lubrication system”, page 7](#)

⇒ [“3.2 General notes on fuel system”, page 7](#)

⇒ [“3.3 Rules for cleanliness when working on fuel supply system/injection system”, page 8](#)

⇒ [“3.4 Rules for cleanliness when working on charge air system”, page 8](#)

⇒ [“3.5 Instructions for working on fuel system”, page 9](#)

⇒ [“3.6 To avoid any risk of injuries to persons and/or the destruction of the injection and glow plug system, the following must be noted”, page 10](#)

⇒ [“3.7 Instructions for hose connections with screw-type clips”, page 11](#)

#### 3.1 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 passages,
- ◆ Renew oil spray jets,
- ◆ Renew engine oil cooler,
- ◆ Renew oil filter element.

#### 3.2 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:*

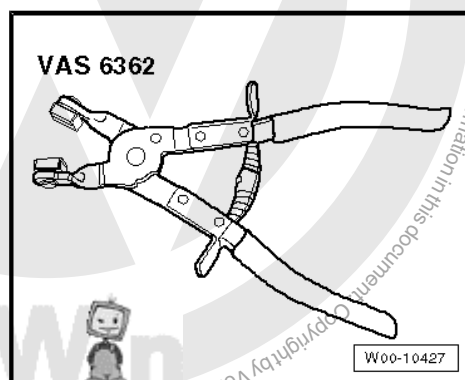
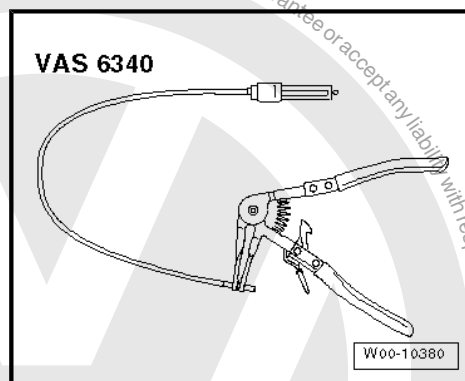
- ◆ Route all the various lines (e.g. for fuel, hydraulics, activated charcoal filter system, coolant and refrigerant, brake fluid and vacuum) and electrical wiring in their original positions.
- ◆ Ensure that there is sufficient clearance to all moving or hot components.





#### 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*
- ◆ *... hose clip pliers - VAS 6362- recommended.*
- ◆ *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.*



### 3.3 Rules for cleanliness when working on fuel supply system/injection 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 or similar).
- ◆ When system is open, do not work with compressed air if this can be avoided. Do not move vehicle unless absolutely necessary.
- ◆ 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.

### 3.4 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 system is open: do not work with compressed air if this can be avoided. Do not move vehicle unless absolutely necessary.

### 3.5 Instructions for working on fuel system

**To prevent the high-pressure fuel 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 fuel high-pressure pump are removed or renewed, initial fuel filling must be carried out.
- ◆ If a fuel pump, fuel line (between fuel tank and fuel high-pressure pump) or fuel filter is removed or renewed
- ◆ Fuel system must be bled before starting engine for first time.
- ◆ If the high-pressure fuel pump is removed or renewed, the fuel system must be bled before engine is started for the first time.
- ◆ Initial fuel filling procedure ⇒ [page 316](#) .
- Clean tools and workbench etc. before working on injection system.
- Thoroughly clean all unions and surrounding areas before disconnecting.
- When removing components, plug all open connections immediately with suitable clean sealing caps.
- Do not remove sealing caps from components until immediately prior to installation. Place removed components in new sealable plastic bags (if available, use original packaging of new components).
- 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).
- Clean sealing surface of injector in cylinder head and injector bore.
- Only cleaning set - VAS 6811- may be used for cleaning sealing surface of 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- .





- The following components and seals/O-rings must always be renewed when the injectors are removed and installed: "copper seal", "O-ring for injector bore", "O-ring for injector return connection", "injector return connection clip"
- The following components and seals/O-rings must always be renewed when an injector is renewed: "copper seal", "O-ring for injector shaft" and "O-ring for injector return connection" "injector return clip"
- Always fit new copper seals for the injectors. Check all new O-rings for damage before installing. O-rings must be moist when installed (assembly oil or clean engine oil). Use assembly tool to install the "O-ring for injector return connection".
- Take care not to damage the injectors when removing the old copper seals.
- Align high-pressure lines free from tension. First tighten all unions hand-tight and then tighten to torque.
- Never attempt to reshape high-pressure fuel lines.
- When working on any part 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.
- Disassembling individual common rail components is not permitted.
- The components should be replaced as complete units if faulty.
- Never attempt to bleed the common rail system by loosening high-pressure components after starting the engine.
- Do not carry out any installation work on common rail system whilst engine is running.
- In particular, do not open or release high-pressure lines and electrical connectors.
- All cable ties which were opened or cut open during removal must be replaced with new ties in same position during installation.
- When the fuel system is open: do not work with compressed air if this can be avoided. Do not move vehicle unless absolutely necessary.
- 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.

### **3.6 To avoid any risk of injuries to persons and/or the destruction of the injection and glow plug system, the following must be noted**

- ◆ Persons wearing a pacemaker should not lean over the engine compartment while the engine is running, as the injectors use high voltage pulses.
- ◆ No fuel lines may be opened while the engine is running.
- ◆ Always switch off the ignition before connecting or disconnecting injection and glow plug system wiring or tester cables.
- ◆ Always switch off ignition before cleaning engine.
- ◆ The battery should only be disconnected and reconnected with ignition switched off.





- ◆ Certain tests may lead to a fault being detected by the control unit and stored. Therefore, after completing all checks and repairs, the fault memory must be read and if necessary cleared.

### 3.7 Instructions for hose connections with screw-type clips



#### Caution

*The screw-type clips on the charge air lines must always be tightened to 5.5 Nm. If the torque is too low or too high, the charge air hose may slip off the charge air pipe during vehicle operation.*

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

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



#### Caution

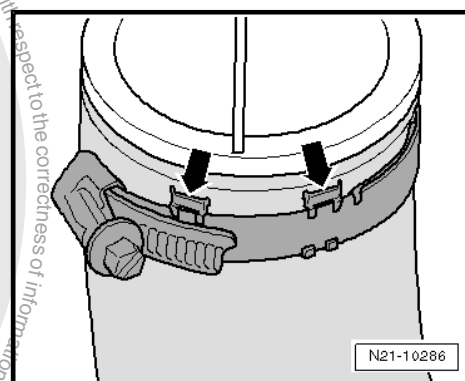
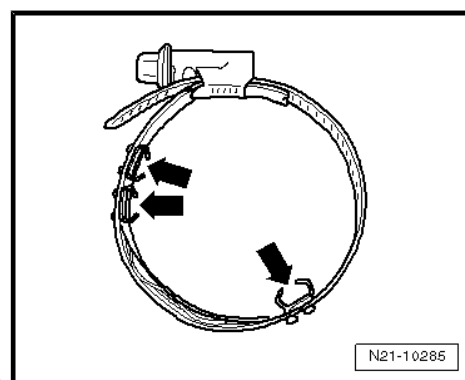
- *Do not loosen these screw-type clips and pull back over the delivery hose. Risk of damage to the hose!*
- *If a clip has been removed, it must be renewed together with the hose.*

Screw-type clips with "locking hooks" -arrows- may only be loosened. Loosen bolt of screw-type clips sufficiently to remove 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.







## 10 – Removing and installing engine

### 1 Removing and installing engine

⇒ [“1.1 Removing engine”, page 12](#)

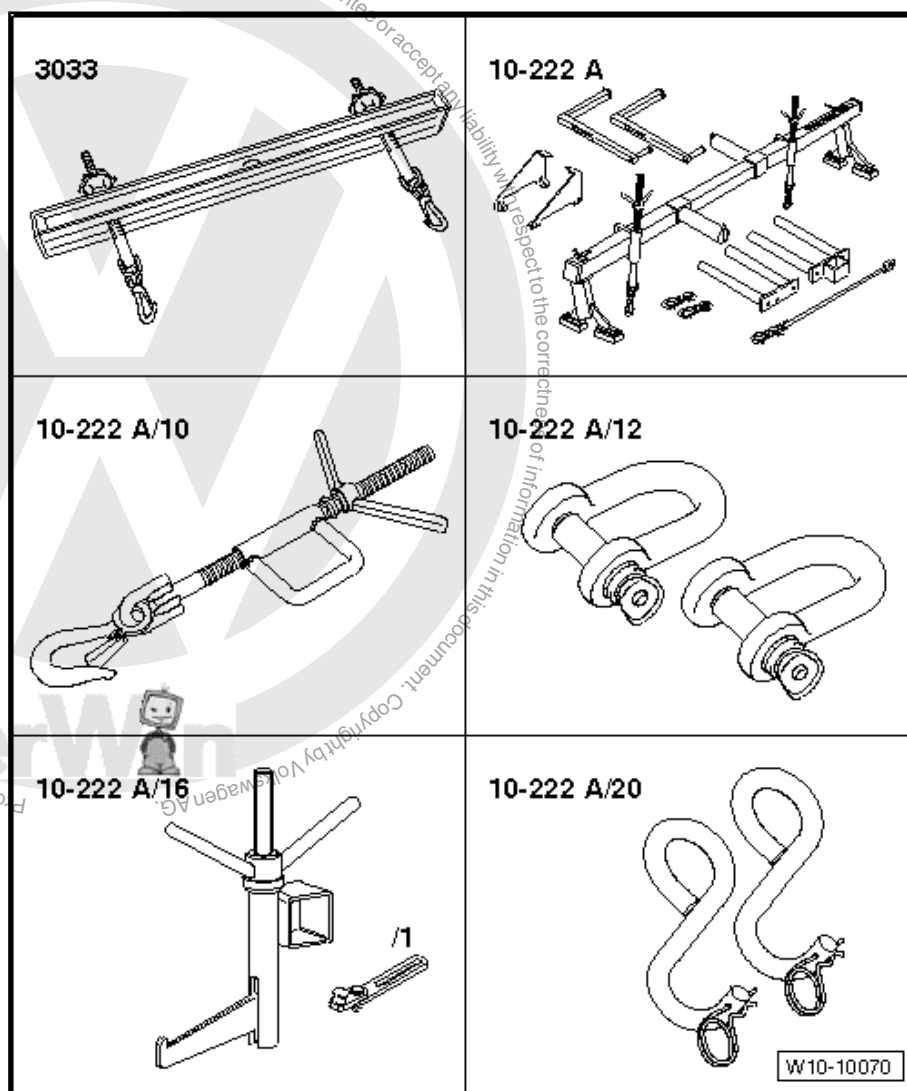
⇒ [“1.2 Securing engine on engine and gearbox support VAS 6095”, page 26](#)

⇒ [“1.3 Installing engine”, page 27](#)

#### 1.1 Removing engine

##### Special tools and workshop equipment required

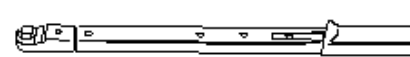
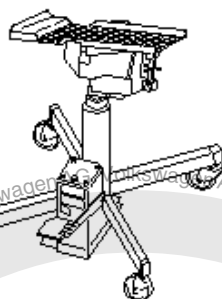
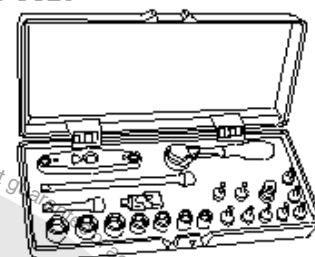
- ◆ Lifting tackle - 3033-
- ◆ Support bracket - 10 - 222 A-
- ◆ Hook - 10 - 222 A /10-
- ◆ Shackle - 10 - 222 A /12-
- ◆ Adapter - 10 - 222 A /16-
- ◆ Adapter - 10 - 222 A /20-  
qty. 2







- ◆ Torque wrench - V.A.G 1331-
- ◆ Torque wrench - V.A.G 1332-
- ◆ Engine and gearbox jack - V.A.G 1383 A-
- ◆ Socket set 1/4", 22-piece - VAS 5528-
- ◆ Workshop hoist - VAS 6100-
- ◆ Engine bung set - VAS 6122-

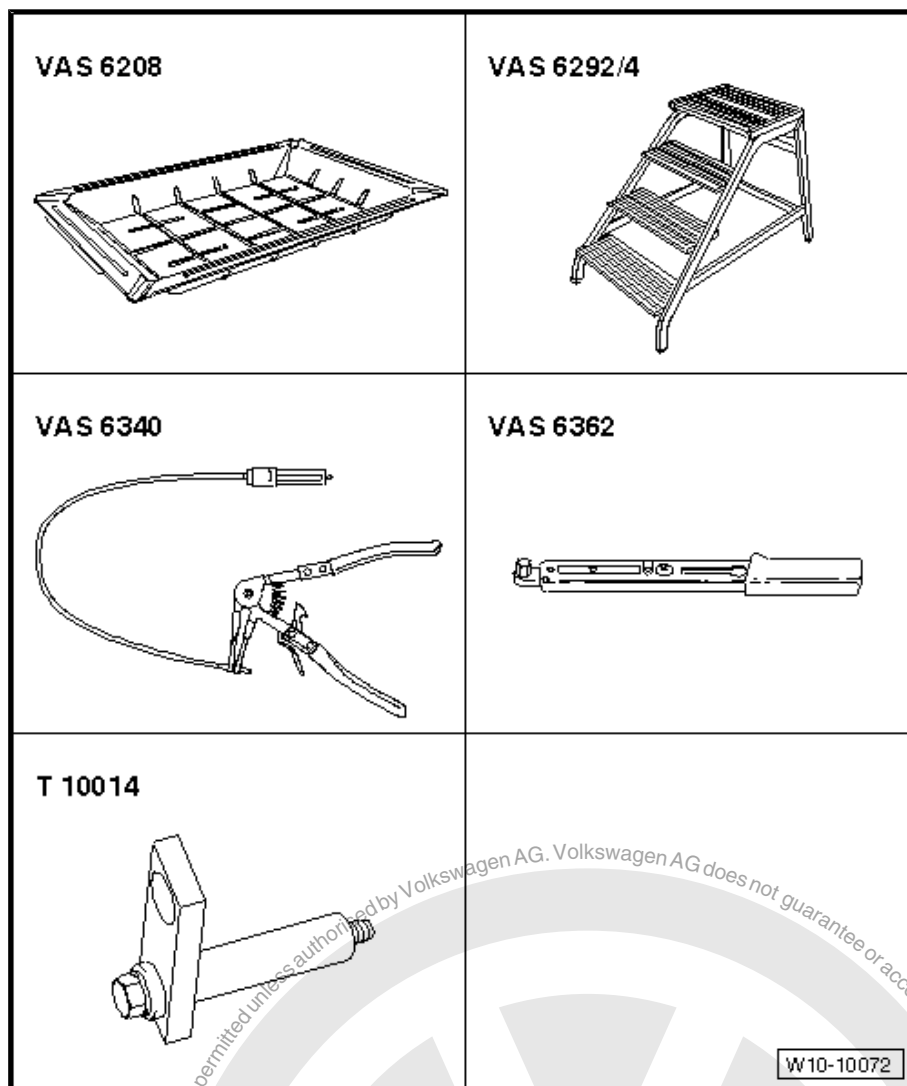
**V.A.G 1331****V.A.G 1332****V.A.G 1383****VAS 5528****VAS 6100****VAS 6122**

W10-10071





- ◆ Drip tray for workshop hoist - VAS 6208-
- ◆ Step - VAS 6292/4-
- ◆ Hose clip pliers - VAS 6340-
- ◆ Hose clip pliers - VAS 6362-
- ◆ Bracket - T10014-
- ◆ High-temperature grease - G 052 133 A2-
- ◆ Cable ties
- ◆ Wooden block 10 x 30 x 10 cm



#### Procedure:



#### Note

- ◆ *Before carrying out further work, remove the battery. Check whether a coded radio is fitted. Obtain anti-theft coding beforehand if necessary.*
- ◆ *The engine is removed upwards.*
- ◆ *The gearbox remains installed.*
- ◆ *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- .*
- ◆ *Collect drained coolant in a clean container for re-use or disposal.*

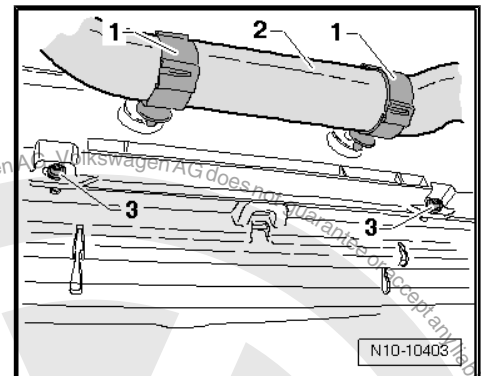


**Caution**

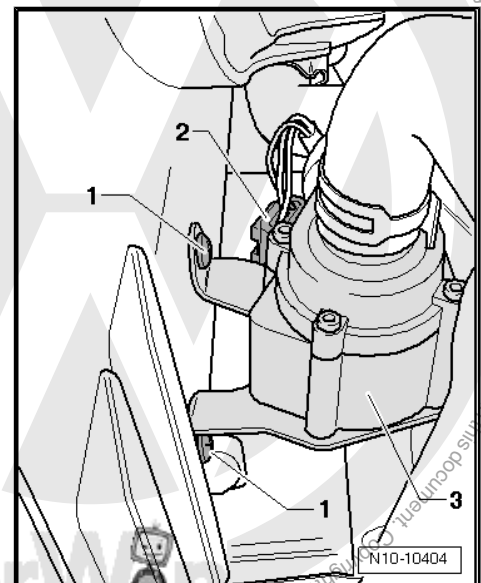
*When doing any repair work, especially in the engine compartment, pay attention to the following due to the cramped conditions:*

- ◆ *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.*
- ◆ *Cut through cable ties carefully and install new ones in the same position.*

- Remove bonnet ⇒ General body repairs, exterior; Rep. gr. 55 ; Bonnet .
- Remove starter ⇒ Electrical system; Rep. gr. 27 ; Removing and installing starter .
- Remove front left wheel housing liner ⇒ General body repairs, exterior; Rep. gr. 50 ; Wheel housing liner .
- Remove underbody guard, if fitted ⇒ General body repairs, exterior; Rep. gr. 66 ; Underbody guard .
- Drain coolant ⇒ [page 182](#) .
- Detach coolant hose -2- with both brackets -1-.
- Unscrew bolts -3-.



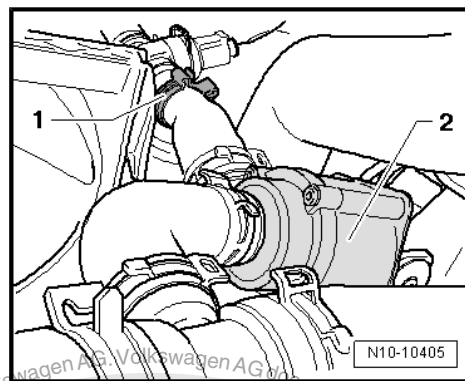
- Release connector -2- on circulation pump - V55- -3- and pull off.
- Unscrew bolts -1-.



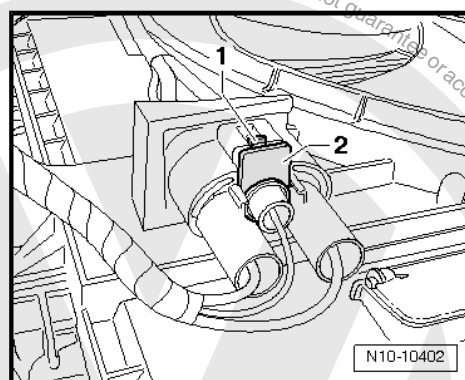




- Detach circulation pump - V55- -2- from bracket with hoses attached.



- Pull latch -1- back.
- Press retaining lever -2- down and pull connector off.

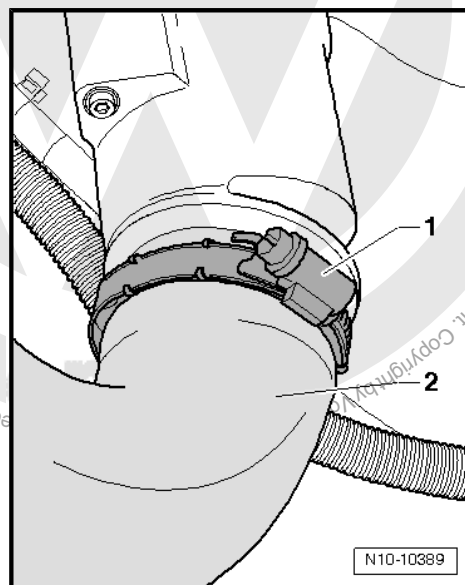


- Open clip -1- and remove hose -2- from turbocharger.



#### WARNING

- ◆ *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, place cloths around the connections. Then carefully loosen connection to release the pressure!*
- ◆ *Wear eye and hand protection when performing any type of repair work on the fuel system!*







- Separate fuel lines -1-, -2- and -3-.

Vehicles with air conditioning system:



#### Note

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

To facilitate removing and installing engine without opening refrigerant circuit:

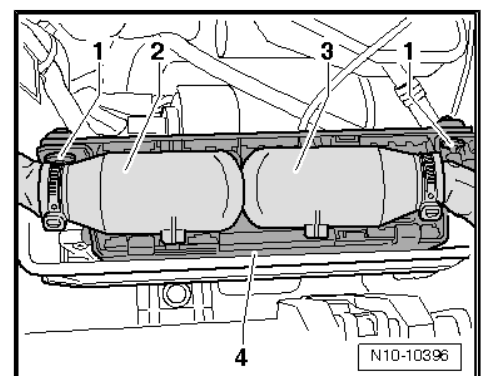
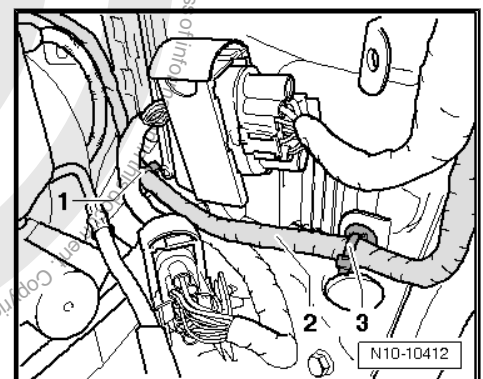
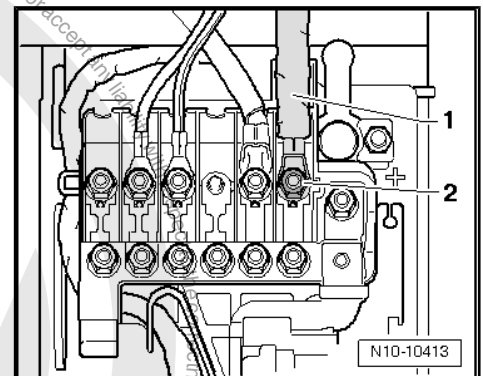
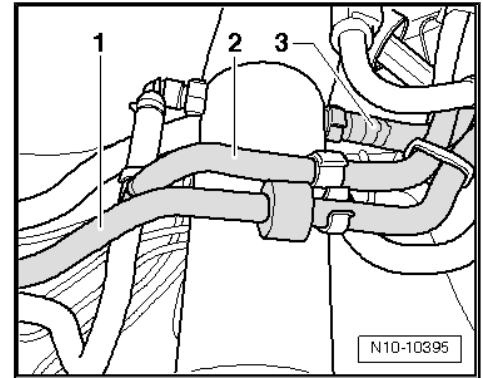
- Secure air conditioner compressor to body so that the refrigerant lines and hoses are not under tension.
- Remove AC compressor with hoses connected and secure to body ⇒ Heating, air conditioning system; Rep. gr. 87 ; Removing and installing air conditioner compressor .

#### Continuation for all vehicles

- Remove front exhaust pipe ⇒ [page 374](#).
- Remove cover from fuse box above battery.
- Unscrew nut -2- of battery positive cable -1-.

- Unhook clips -1- and -3-.
- Lay wiring harness -2- to one side.

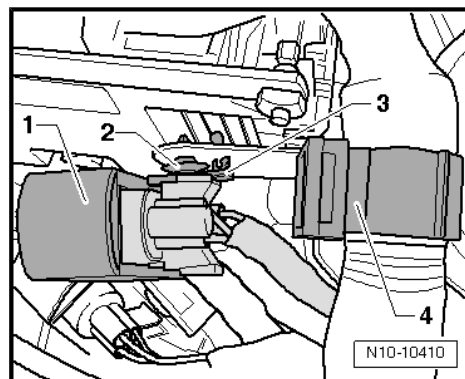
- Release and pull off connectors -2- and -3-.
- Remove shear bolts -1- and remove bow -4-.



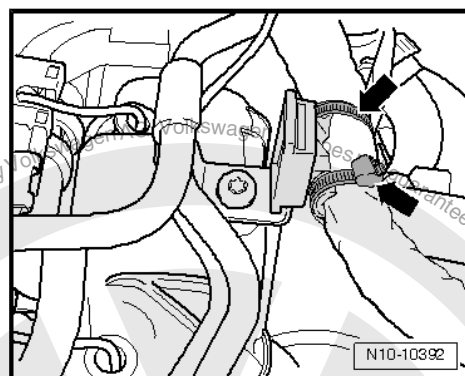




- Unhook clips -2- and -3-.
- Release and pull off connector -1-.
- Open retainer -4- and detach wiring harness.



- Carefully cut through cable ties -arrows-.
- Lay wiring harness on engine and secure.



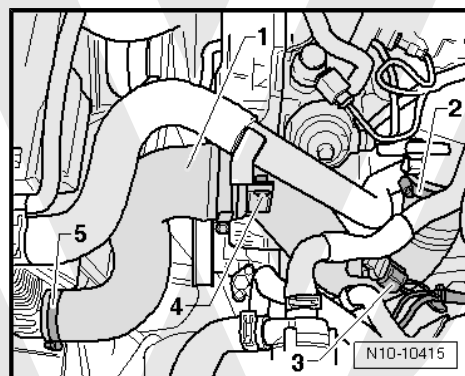
- Release and pull off connector -3-.
- Remove bolt -4-.



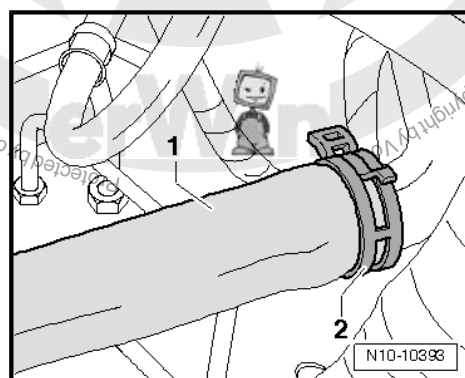
#### Caution

- **Do not loosen screw-type clips and pull back over pressure hose. Risk of damage to the delivery hose!**

**Removing screw-type clips ➔ [page 11](#) .**



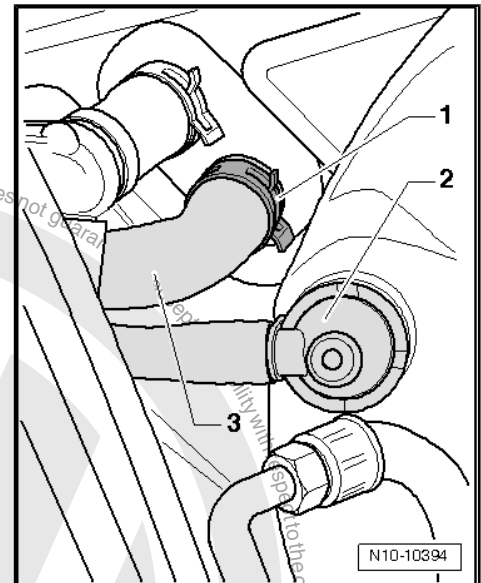
- Remove hose/pipe -1- completely. To do this, loosen clips -2- and -5- sufficiently to enable hose/pipe -1- to be pulled off.
- Open clip -2- and remove coolant hose -1-. Guide coolant hose downwards and allow coolant to drain.



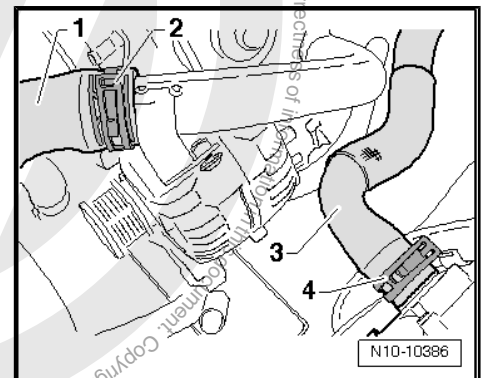




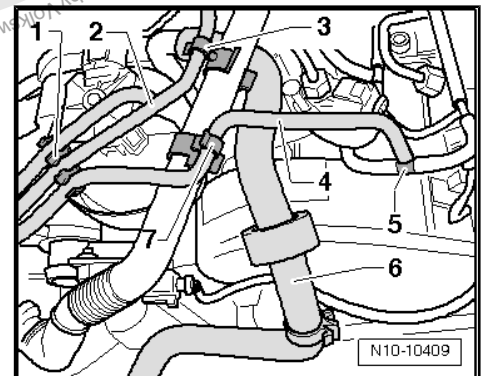
- Pull line -2- out of brake servo.
- Open clip -1- and remove coolant hose -3-.



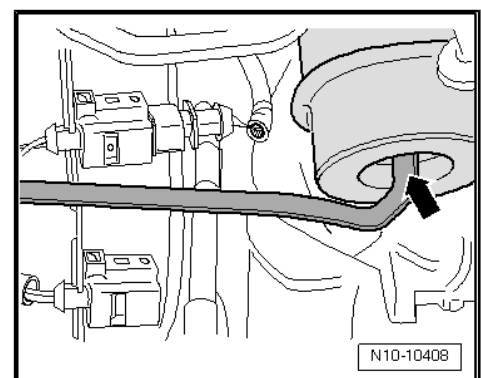
- Open clips -2- and -4- and remove coolant hoses -1- and -3-.
- Remove vane pump with hoses connected, and secure it to vehicle body ⇒ Running gear, axles, steering; Rep. gr. 48 ; Hydraulic power steering .



- Pull off hose -2- from turbocharger.
- Open clip -3- and remove coolant hose -6-.
- Pull hose -4- off union -5- and detach from clip -7-.
- Lay clip -1- aside with lines.



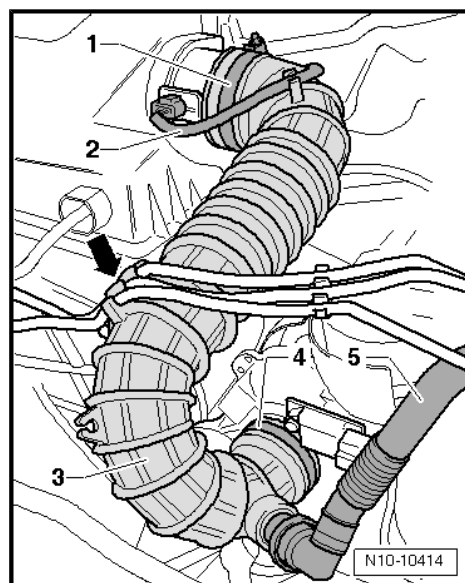
- Pull off hose -arrow- from turbocharger.



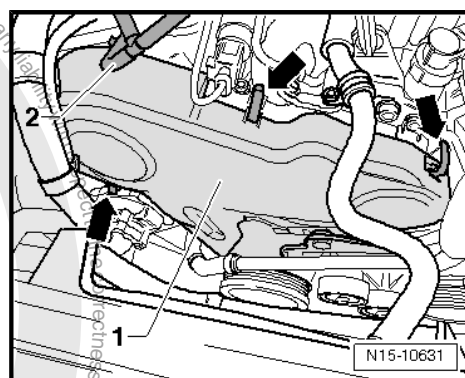




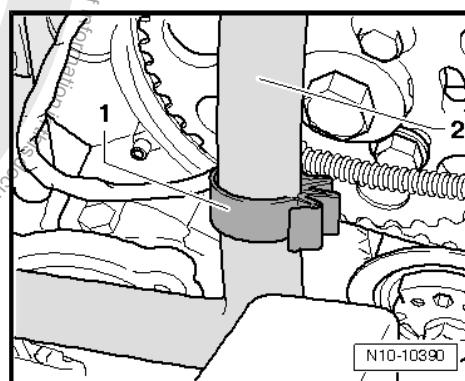
- Detach hoses from intake hose -3- bracket -arrow-.
- Remove pipe -5- from cylinder head cover.
- Release and pull off wiring harness connector -2-. Detach wiring harness -2- from intake hose retainer -3-.
- Open clips -1- and -4- and remove intake hose -3-.



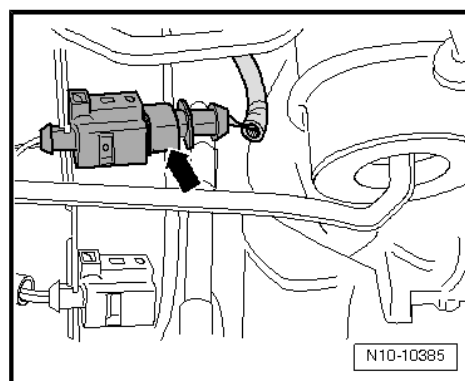
- Detach vacuum hose -2- from toothed belt guard -1-.
- Open clips -arrows- and remove toothed belt guard -1-.



- Open bracket -1- and detach coolant hose -2-.



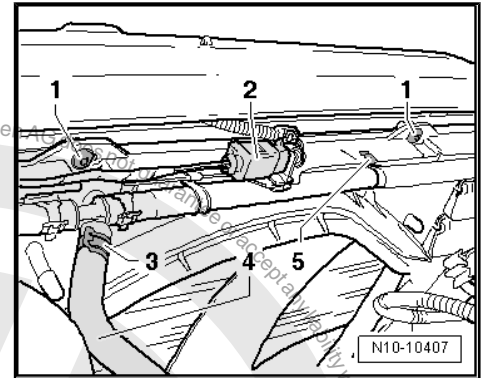
- Release connector -arrow- and pull off from exhaust temperature sender 1 - G235-. Free wiring harness from fittings and secure it to engine.



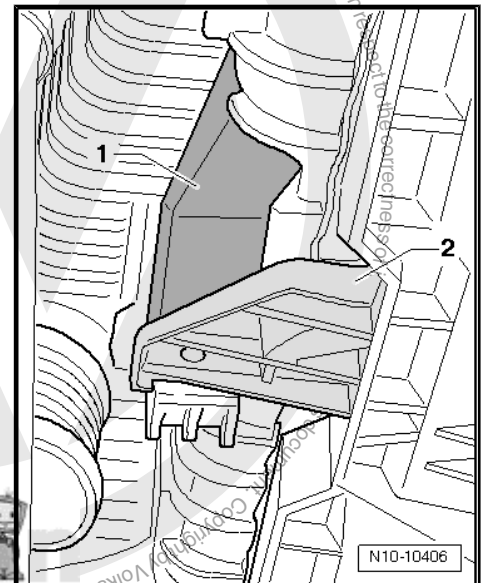




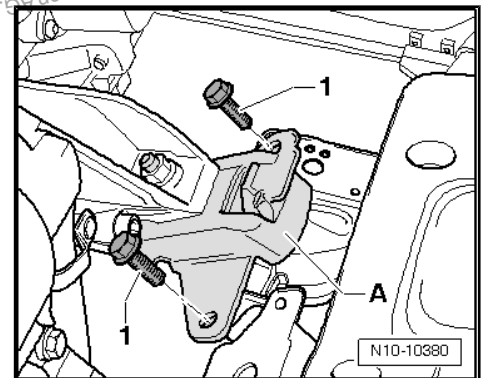
- Release connector -2-.
- Open clip -3- and remove coolant hose -4-.
- Pull all clips -5- off radiator cowl.
- Remove bolts -1-.



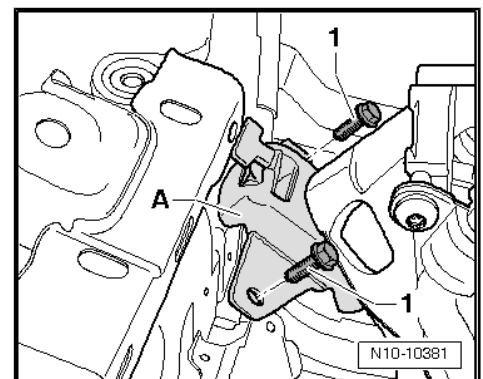
- Release cowl -2- at left and right. To do this, press retaining lever -1- forwards using a screwdriver, and raise radiator cowl -2- slightly.
- Remove radiator cowl -2- with assistance of a 2nd mechanic.



- Unscrew bolts -1- from left engine mounting -A-.



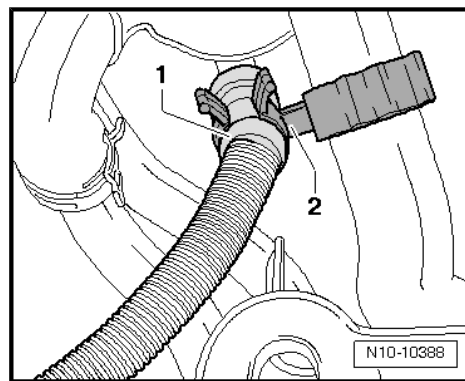
- Unscrew bolts -1- from right engine mounting -A-.



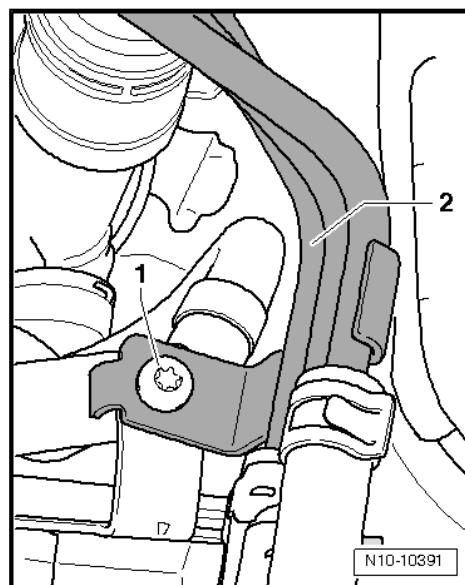




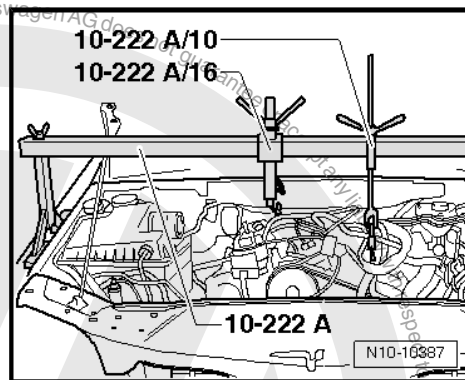
- Detach gearbox breather line -1- from clip -2- (on coolant hose on rear right of engine).



- Unscrew bolt -1- for fuel lines -2- from bracket through wheel housing.
- Install support bracket - 10 - 222 A- .



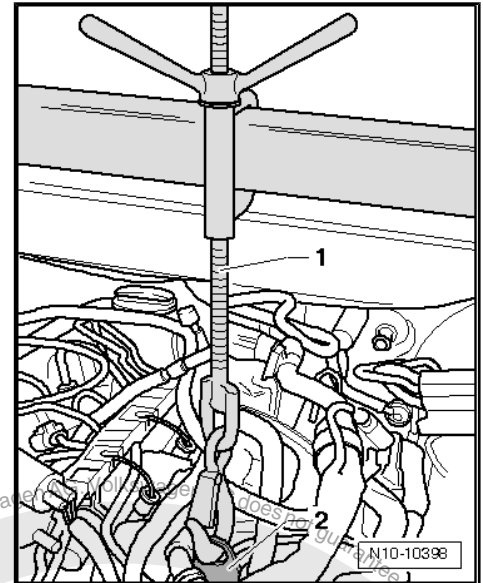
- Secure adapter - 10 - 222 A /16- and hook - 10 - 222 A /10- to support bracket - 10 - 222 A- .







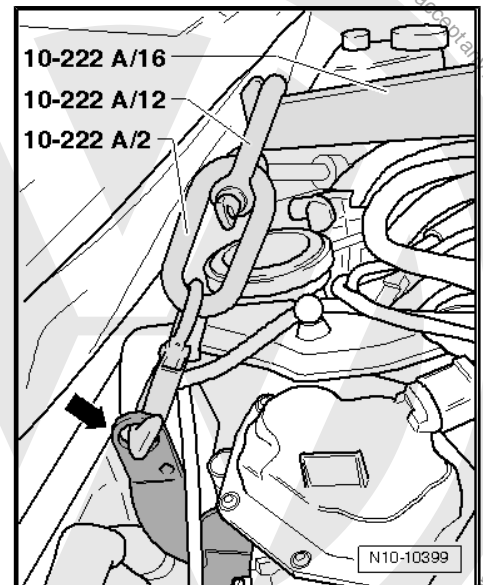
- Engage hook - 10 - 222 A /10- in transport eye.



- Engage hook - 10 - 222 A /2- in transport eye -arrow-.
- Engage shackle - 10 - 222 A /12- with hook - 10 - 222 A /2- on adapter - 10 - 222 A /16- .
- Raise engine until left engine mounting is raised approx. 15 mm and right engine mounting approx. 35 mm.

**Note**

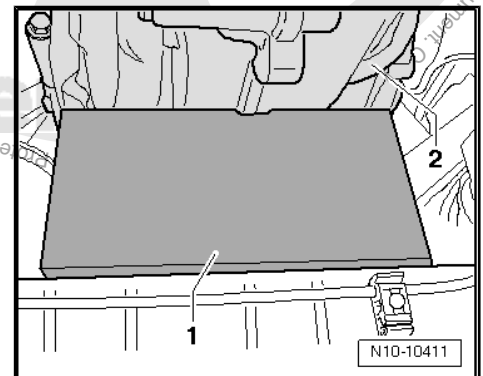
Raise engine only sufficiently to allow a square timber to be inserted between chassis and gearbox.



- Insert square timber -1-.
- Lower engine using support bracket - 10 - 222 A- until gearbox -2- rests completely on square timber -1- and support bracket - 10 - 222 A- is relieved.

**Caution**

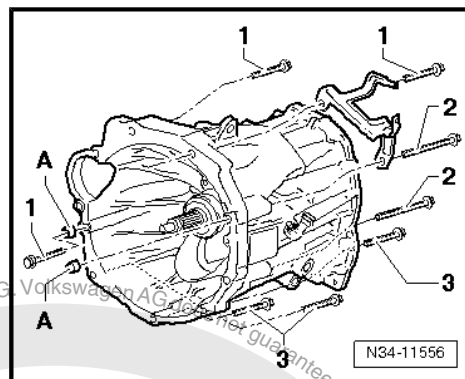
- Do not unscrew the two upper bolts -1-.



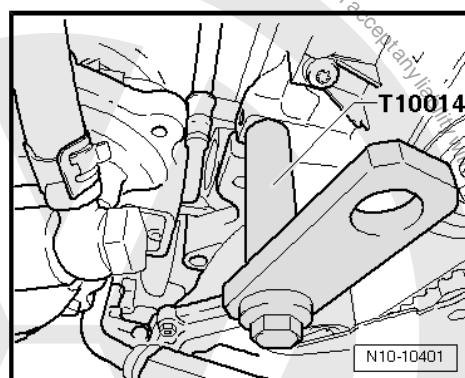




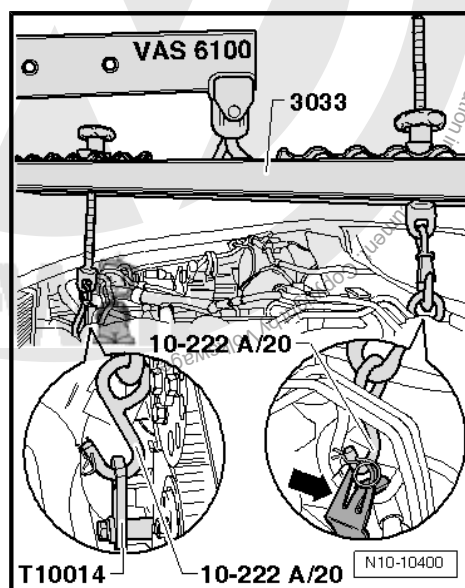
- Remove bolts -2- and -3-.
- Only unscrew bolt -1- beneath starter.
- Unscrew all connecting bolts for lower and centre engine/ gearbox. The two upper bolts initially remain screwed in.
- Remove support bracket - 10 - 222 A- .



- Install retainer - T10014- to front right of engine.



- Engage lifting tackle - 3033- on workshop hoist - VAS 6100- and attach to engine.
- Engage adapter - 10 - 222 A /20- in lifting tackle - 3033- and retainer - T10014- and secure with retaining clip.
- Engage adapter - 10 - 222 A /20- in lifting tackle - 3033- and transport eye -arrow- and secure with retaining clip.



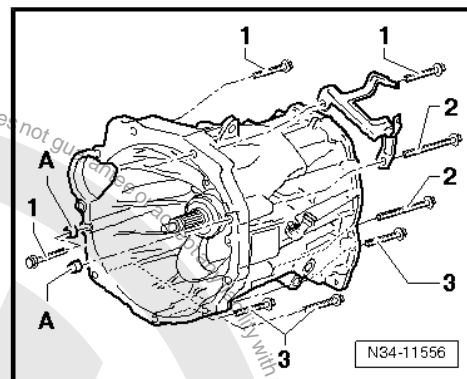




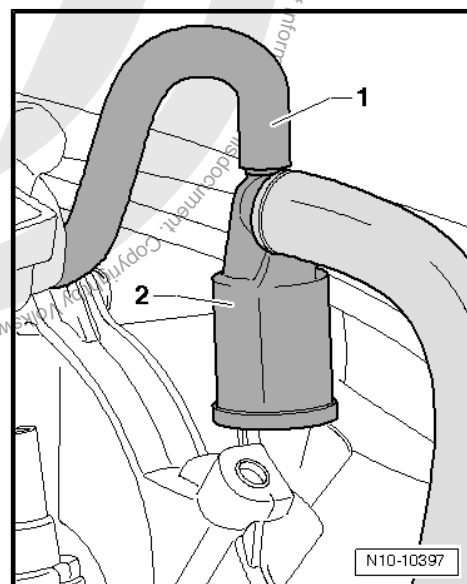
- Unscrew the two upper bolts -1-.
- If necessary, disconnect all connecting, coolant, vacuum and intake hoses that have to be disconnected from the engine in order to remove it.
- Carefully pull engine from gearbox in longitudinal direction. Do not damage needle bearing in the crankshaft whilst doing this.

**Caution**

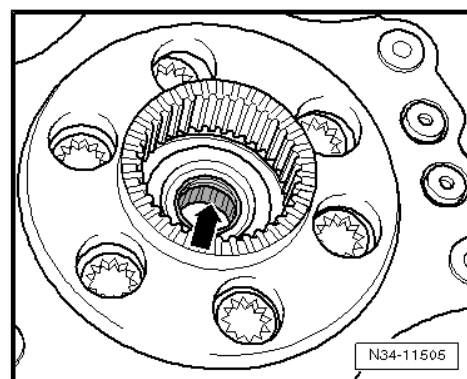
- ◆ **Only a few millimetres of space are available between plenum chamber and radiator/lock carrier for removing and installing the engine. The engine must therefore be guided carefully when raising and lowering.**
- ◆ **Raise and lower the engine slowly with the assistance of a second mechanic.**
- ◆ **The workshop hoist - VAS 6100- must also be guided carefully when raising and lowering the engine.**



- When raising and lowering engine, make sure that neither vacuum hose -1- nor union -2- on vacuum pump are damaged.
- Guide vacuum hose -1-, union -2- and vacuum pump past plenum chamber when raising and lowering.
- When raising and lowering engine, make sure that rollers of belt drive and turbocharger do not damage radiator.
- When raising and lowering engine, pay attention to lines and hoses to prevent these from being damaged.



- Check needle bearing -arrow- in crankshaft. If it is damaged or has turned blue, it must be renewed ⇒ [page 76](#) .
- If it is not damaged, lightly grease with high-temperature grease - G 052 133 A2- .
- Slightly grease the journal (not the teeth) of the gears as well.



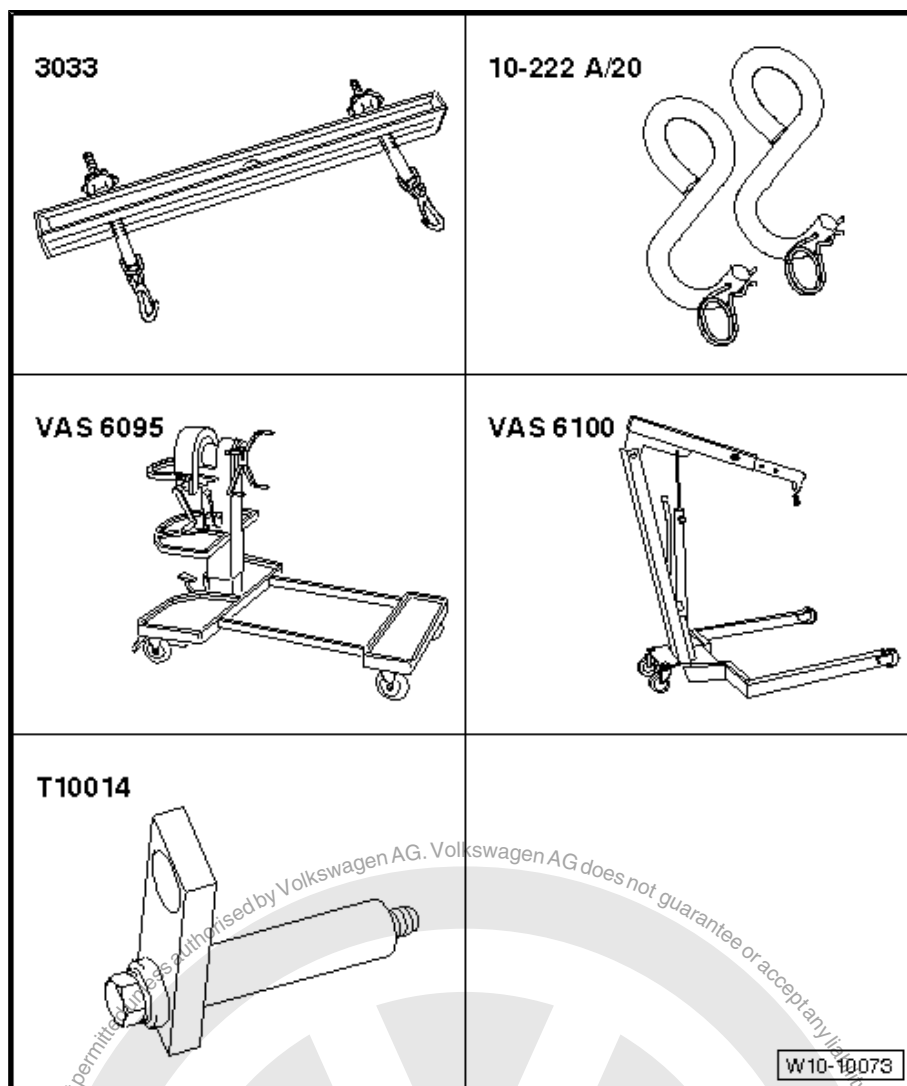




## 1.2 Securing engine on engine and gearbox support - VAS 6095-

### Special tools and workshop equipment required

- ◆ Lifting tackle - 3033-
- ◆ Adapter - 10 - 222 A /20-
- ◆ Engine and gearbox support - VAS 6095-
- ◆ Workshop hoist - VAS 6100-
- ◆ Bracket - T10014-



### Procedure:

Secure engine to engine and gearbox support - VAS 6095- to carry out repairs.

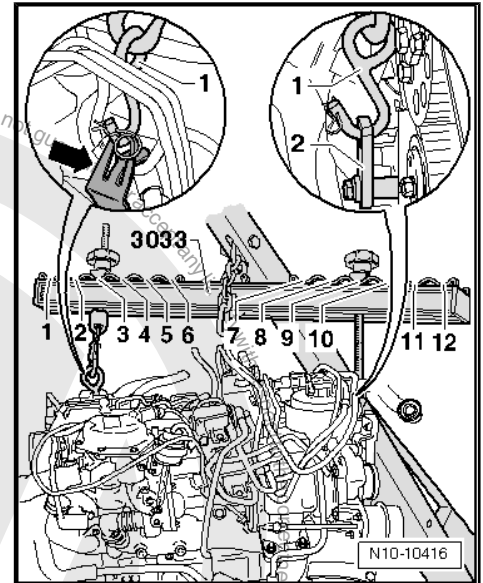




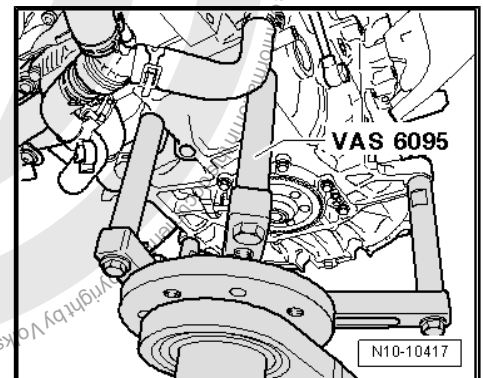
- Engage lifting tackle - 3033- with both adapters - 10 - 222 A / 20 - -1- and retainer - T10014- -1- on engine.

Flywheel end: position 3.

Belt drive end: position 9



- Secure engine in engine and gearbox support - VAS 6095- .



### 1.3 Installing engine

#### Special tools and workshop equipment required

- ◆ vehicle diagnostic tester

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



#### Caution

- ◆ *Only a few millimetres of space are available between plenum chamber and radiator/lock carrier for removing and installing the engine. The engine must therefore be guided carefully when raising and lowering.*
- ◆ *Raise and lower the engine slowly with the assistance of a second mechanic.*
- ◆ *The workshop hoist - VAS 6100- must also be guided carefully when raising and lowering the engine.*



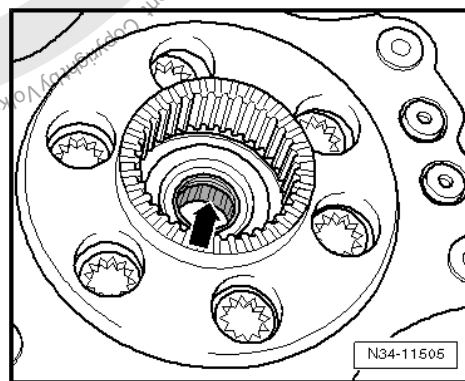
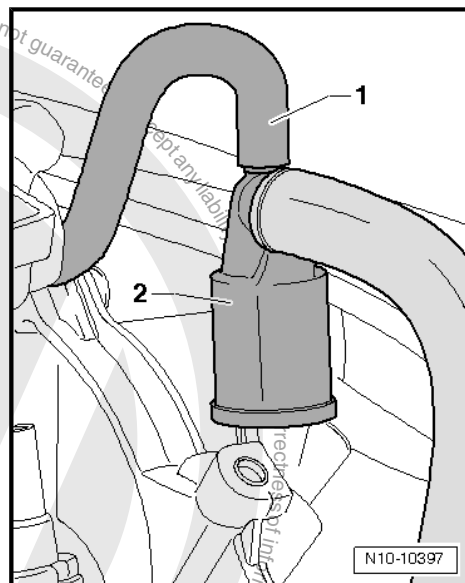


- When raising and lowering engine, make sure that neither vacuum hose -1- nor union -2- on vacuum pump are damaged.
- Guide vacuum hose -1-, union -2- and vacuum pump past pleum chamber when raising and lowering.
- When raising and lowering engine, make sure that rollers of belt drive and turbocharger do not damage radiator.
- When raising and lowering engine, pay attention to lines and hoses to prevent these from being damaged.
- Check whether dowel sleeves for centering engine/gearbox are in cylinder block and install if necessary (gearbox removed).
- Check clutch release bearing for wear and, if necessary, replace (gearbox removed).

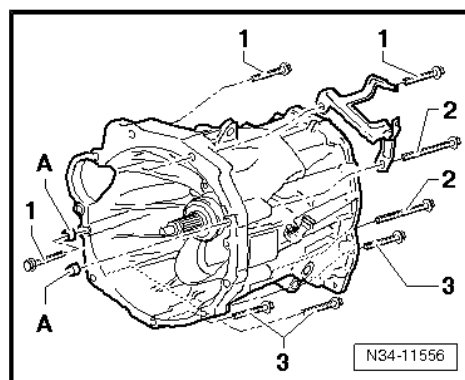


**Caution**

- ***Bring engine and gearbox together in longitudinal direction, not at an incline.***
- ***When bringing engine and gearbox together, make sure that needle bearing -arrow- is not damaged.***



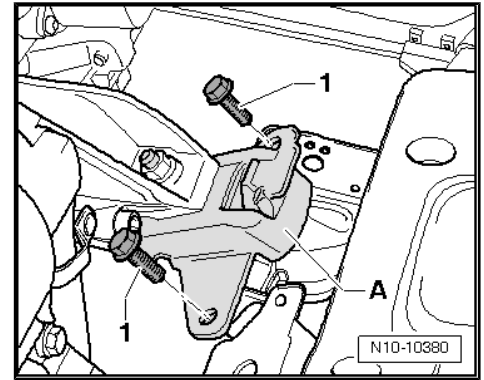
- First tighten the two upper bolts -1-.







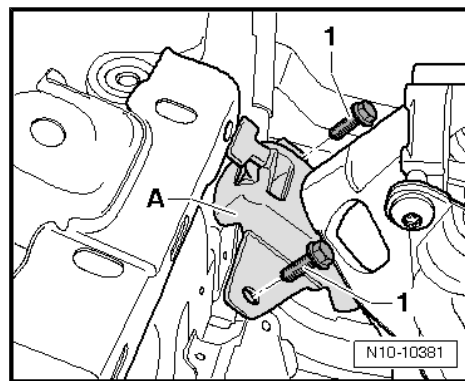
- Tighten new bolts -1- for left engine mounting -A-.







- Tighten new bolts -1- for right engine mounting -A-.
- Install front exhaust pipe ⇒ [page 374](#) .
- Install air conditioner compressor ⇒ Heating, air conditioning; Rep. gr. 87 .
- Install vane pump ⇒ Running gear, axles, steering; Rep. gr. 48 ; Hydraulic power steering .
- Install underbody guard, if fitted previously ⇒ General body repairs, exterior; Rep. gr. 66 ; Underbody guard .
- Install front left wheel housing liner ⇒ General body repairs, exterior; Rep. gr. 50 ; Wheel housing liner .
- Install starter ⇒ Electrical system; Rep. gr. 27 ; Removing and installing starter .
- Install bonnet ⇒ General body repairs, exterior; Rep. gr. 55 ; Bonnet .



**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 components of the fuel system between the fuel tank and the high-pressure pump are removed or renewed, it is necessary for the fuel system to be bled. To do this, perform the "Bleeding fuel system" function using the ⇒ Vehicle diagnostic tester ⇒ [page 316](#) .
- ◆ This process takes 130 seconds. Fuel pumps are actuated a total of 3 times in the process. The process must not be terminated prematurely.
- Check oil level ⇒ [page 147](#) .



#### Note

- ◆ *Only reuse drained coolant if neither cylinder head nor cylinder block have been renewed.*
- ◆ *Soiled coolant must not be reused.*
- Replenish coolant ⇒ [page 182](#) .
- Carry out road test and read event memory ⇒ Vehicle diagnostic tester.

#### Specified torques

- ◆ ⇒ ["2.1 Removing and installing assembly mountings", page 31](#)
- ◆ ⇒ ["2.2 Assembly overview - emission control \(catalytic converter\)", page 379](#)
- ◆ ⇒ ["2.1 Assembly overview - emission control \(diesel particulate filter\)", page 377](#)



## 2 Assembly mountings

⇒ "2.1 Removing and installing assembly mountings", page 31

### 2.1 Removing and installing assembly mountings

#### Left and right engine support to crankcase



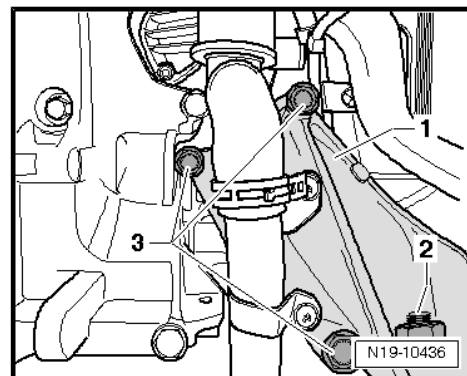
#### Caution

- *Nut -2- must not be loosened.*
- *If nut -2- is loosened, engine mounting must subsequently be renewed.*
- ◆ *Engine mounting connection to engine support may only be loosened if engine mounting is to be renewed.*

- Secure engine support -1- to crankcase with bolts -3-.
- Bolts -3- must always be renewed.

#### Specified torque

Component	Specified torque
Bolts -3-	50 Nm +180°

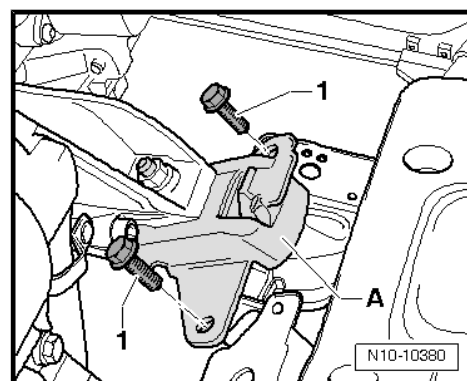


#### Left engine mounting to frame

- Secure engine mounting -A- to frame with bolts -1-.
- Bolts -1- must always be renewed.

#### Specified torque

Component	Specified torque
Bolts -1-	50 Nm + 90°

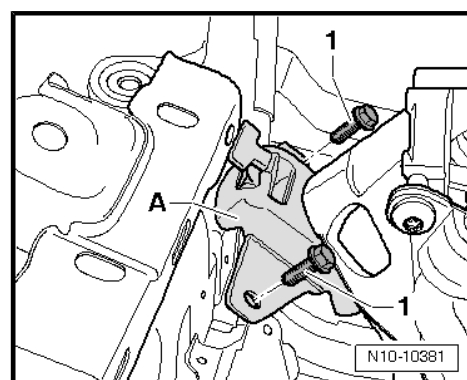


#### Right engine mounting to frame

- Secure engine mounting -A- to frame with bolts -1-.
- Bolts -1- must always be renewed.

#### Specified torque

Component	Specified torque
Bolts -1-	50 Nm + 90°



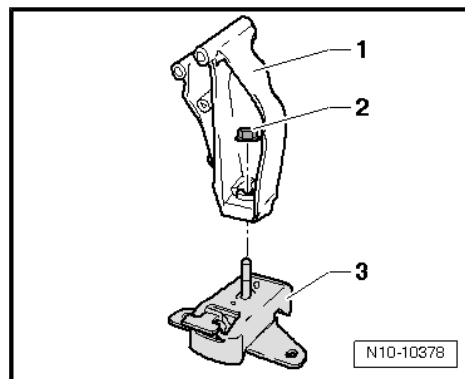


**Left engine mounting to engine support**

- Bolt new engine mounting -3- to engine support -1- with nut -2-.
- Nut -2- must always be renewed.

**Specified torque**

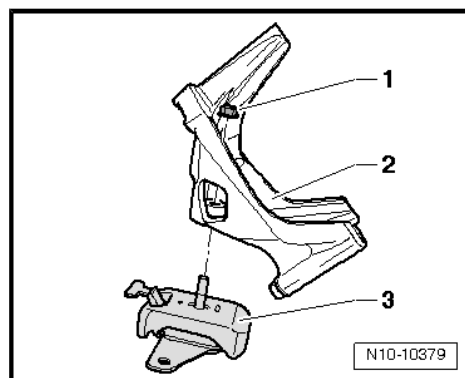
Component	Specified torque
Nut -2-	90 Nm + 90°

**Right engine mounting to engine support**

- Bolt new engine mounting -3- to engine support -2- with nut -1-.
- Nut -1- must always be renewed.

**Specified torque**

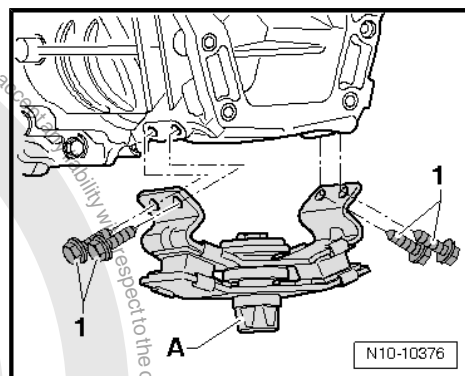
Component	Specified torque
Nut -1-	90 Nm + 90°

**Gearbox mounting to gearbox**

- Secure gearbox mounting -A- to gearbox with bolts -1-.
- Bolts -1- must always be renewed.

**Specified torque**

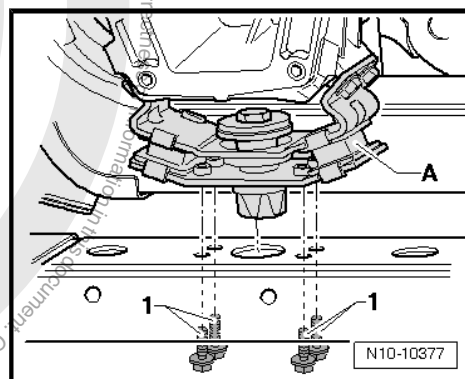
Component	Specified torque
Bolts -1-	50 Nm + 90°

**Gearbox mounting to gearbox cross member**

- Secure gearbox mounting -A- to gearbox cross member with bolts -1-.
- Bolts -1- must always be renewed.

**Specified torque**

Component	Specified torque
Bolts -1-	30 Nm + 90°







## 13 – Crankshaft group





## 1 Cylinder block (pulley end)

⇒ "1.1 Assembly overview - cylinder block", page 34

⇒ "1.2 Assembly overview - sealing flange, belt pulley end", page 36

⇒ "1.3 Assembly overview - poly V-belt drive", page 37

⇒ "1.4 Assembly overview - poly V-belt drive, vehicles without A/C system", page 39

⇒ "1.5 Removing and installing poly V-belt", page 40

⇒ "1.6 Removing and installing tensioner for poly V-belt", page 42

⇒ "1.7 Removing and installing ancillary bracket", page 43

⇒ "1.8 Removing and installing vibration damper", page 44

⇒ "1.9 Renewing crankshaft oil seal - belt pulley end", page 46

⇒ "1.10 Removing and installing sealing flange on pulley end", page 48

### 1.1 Assembly overview - cylinder block

#### 1 - Cylinder block

- ☐ Removing and installing sealing flange on belt pulley end ⇒ [page 48](#).
- ☐ Removing and installing dual-mass flywheel ⇒ [page 55](#).
- ☐ Removing and installing sealing flange on fly-wheel end ⇒ [page 57](#).
- ☐ Removing and installing crankshaft ⇒ [page 73](#).
- ☐ Dismantling and assembling pistons and connecting rods ⇒ [page 66](#).

#### 2 - Guide tube

- ☐ Renew O-ring.

#### 3 - Spreader clip

#### 4 - Gaskets

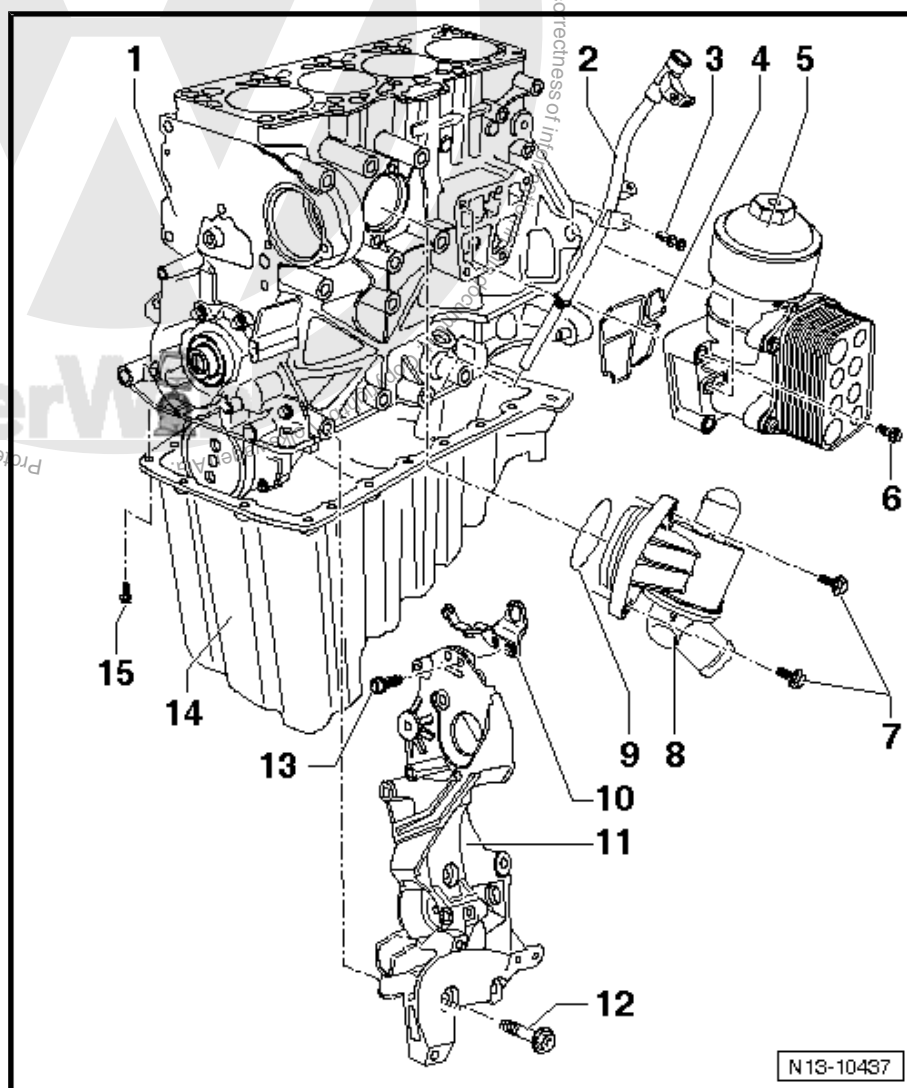
- ☐ Renew after removing

#### 5 - Oil filter bracket

- ☐ Oil filter bracket and engine oil cooler ⇒ [page 151](#).

#### 6 - Bolt

- ☐ Renew after removing
- ☐ First fit upper left and lower right bolts and then tighten all four bolts diagonally.
- ☐ 14 Nm +180°





**7 - Bolt**

- ☐ 13 Nm

**8 - Thermostat (4/2-way valve)**

- ☐ Thermostat is firmly installed in valve.
- ☐ Can only be renewed complete.
- ☐ Removing and installing ⇒ [page 187](#)

**9 - O-ring**

- ☐ Renew after removing

**10 - Lifting eye****11 - Bracket for ancillaries**

- ☐ Observe tightening sequence ⇒ [page 43](#) .
- ☐ Removing and installing ⇒ [page 43](#)

**12 - Bolt**

- ☐ Observe different prescribed torques and tightening sequence ⇒ [page 43](#) .

**13 - Bolt**

- ☐ 25 Nm

**14 - Oil sump**

- ☐ Clean sealing surface before fitting.
- ☐ Install with silicone sealant ⇒ [Electronic Parts Catalogue \(ETKA\)](#) .
- ☐ Removing and installing ⇒ [page 140](#) .

**15 - Bolt**

- ☐ 15 Nm







## 1.2 Assembly overview - sealing flange, belt pulley end

### 1 - Bolt

- ☐ Renew after removing
- ☐ Loosen and tighten with counterhold - 3415-
- ☐ Do not additionally oil the thread and shoulder.
- ☐ 120 Nm + 90°

### 2 - Crankshaft toothed belt pulley

- ☐ Contact surface between toothed belt pulley and crankshaft must be free from oil
- ☐ Fitting possible in one position only.

### 3 - Crankshaft oil seal for belt pulley end

- ☐ Do not additionally oil or grease the oil seal sealing lip.
- ☐ Before installing, remove oil residue from crankshaft journal using a clean cloth.
- ☐ Renewing ⇒ [page 46](#).

### 4 - Sealing flange at belt pulley end

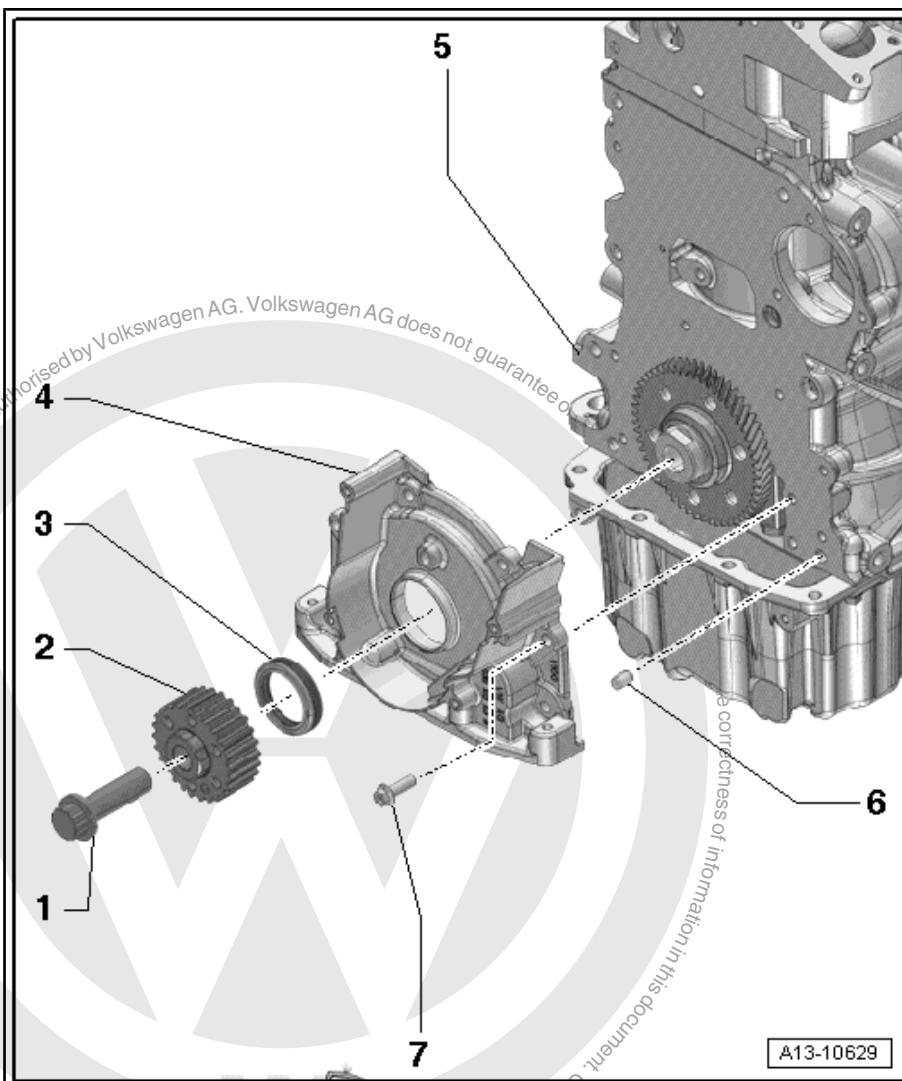
- ☐ Insert with silicone sealant ⇒ Electronic Parts Catalogue (ETKA).
- ☐ Must seat on dowel pins.
- ☐ Removing and installing ⇒ [page 48](#).

### 5 - Cylinder block

### 6 - Dowel pin

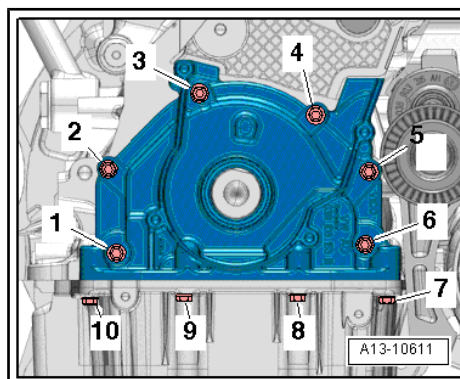
### 7 - Bolt

- ☐ Specified torque and tightening sequence ⇒ [page 36](#).



### 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.







### 1.3 Assembly overview - poly V-belt drive

#### 1 - Poly V-belt

- ☐ Mark direction of rotation before removing.
- ☐ Check for wear.
- ☐ Do not kink.
- ☐ Removing and installing ⇒ [page 40](#)

#### 2 - Bolt

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

#### 3 - Belt pulley and vibration damper

- ☐ Installation position: hole in vibration damper must align over protrusion on crankshaft toothed belt pulley.
- ☐ Can only be installed in one position. Holes are offset.

#### 4 - Bolt

- ☐ 20 Nm

#### 5 - Idler roller

- ☐ For toothed belt

#### 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 prescribed torque and tightening sequence during installation ⇒ [page 38](#)

#### 8 - High-pressure pump

- ☐ Removing and installing ⇒ [page 347](#).

#### 9 - Alternator

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

#### 10 - Bolt

- ☐ When reusing bolt, tighten to 20 Nm plus 90° further.
- ☐ New bolt: 20 Nm + 180°

#### 11 - Centre hex stud

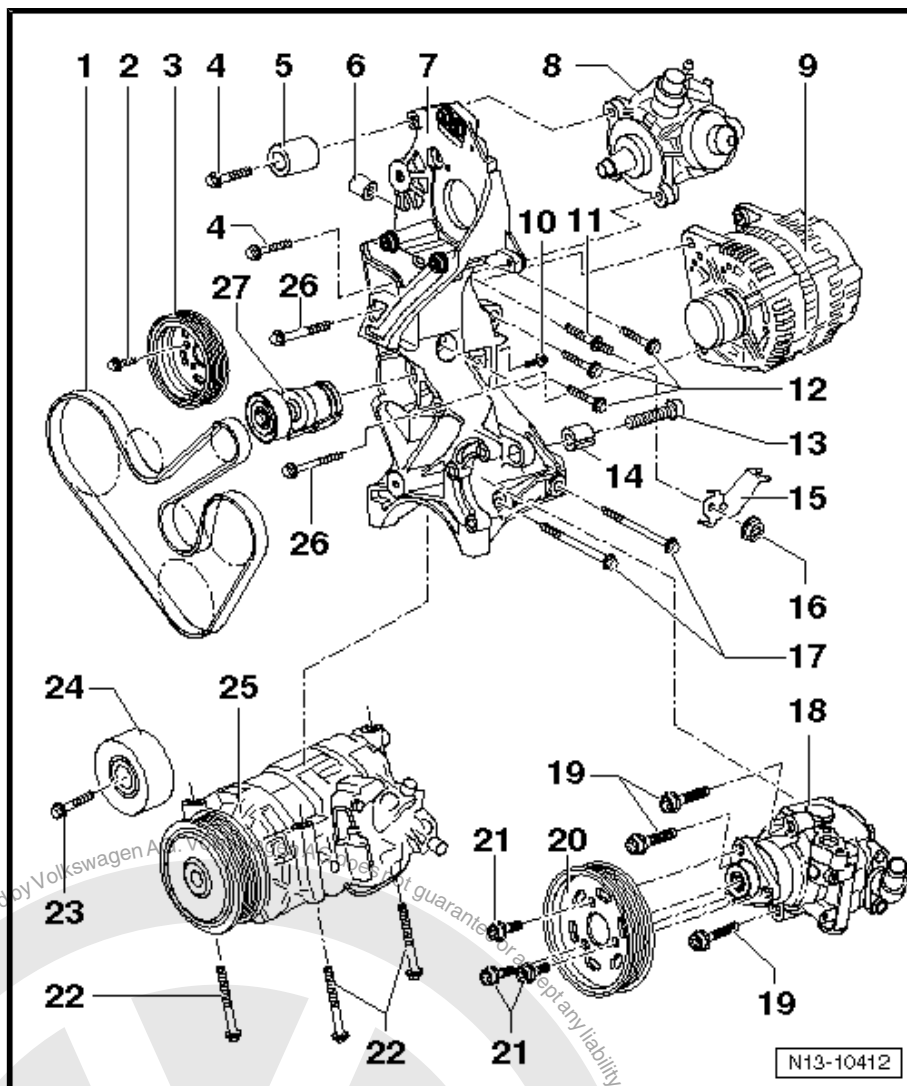
- ☐ Observe tightening sequence ⇒ [page 38](#).
- ☐ 40 Nm + 90°

#### 12 - Bolt

- ☐ Observe tightening sequence ⇒ [page 38](#).
- ☐ 40 Nm + 90°

#### 13 - Bolt

- ☐ 25 Nm







#### 14 - Sleeve

- ☐ Before installing, push vane pump back slightly.

#### 15 - Bracket

#### 16 - Nut

- ☐ For bracket of Hall sender - G40- .
- ☐ 25 Nm

#### 17 - Bolt

- ☐ Observe tightening sequence ⇒ [page 38](#) .
- ☐ 40 Nm +180°

#### 18 - Vane pump

- ☐ Removing and installing ⇒ Running gear, axles and steering; Rep. gr. 48 .

#### 19 - Bolt

- ☐ 25 Nm

#### 20 - Belt pulley

#### 21 - Bolt

- ☐ 25 Nm

#### 22 - Bolt

- ☐ 23 Nm

#### 23 - Bolt

- ☐ Renew after removing
- ☐ 20 Nm + 90°

#### 24 - Idler roller

- ☐ For poly V-belt.

#### 25 - Air conditioner compressor

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

#### 26 - Bolt

- ☐ Prescribed torque ⇒ Electrical system; Rep. gr. 27 .

#### 27 - Poly V-belt tensioning element

- ☐ Swing with ring spanner to slacken ribbed belt ⇒ [page 40](#)

#### Ancillary bracket - specified torques and tightening sequence

- Insert securing bolts for ancillary bracket as follows:

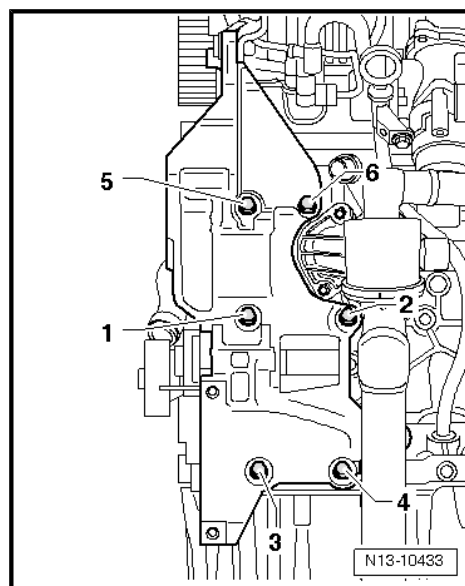
◆ Bolts -1- and -2-

◆ 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.







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

### 1 - Poly V-belt

- ☐ Mark direction of rotation before removing.
- ☐ Check for wear.
- ☐ Do not kink.
- ☐ Removing and installing ⇒ [page 40](#)

### 2 - Bolt

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

### 3 - Belt pulley and vibration damper

- ☐ Installation position: hole in vibration damper must align over protrusion on crankshaft toothed belt pulley.
- ☐ Can only be installed in one position. Holes are offset.

### 4 - Bolt

- ☐ 20 Nm

### 5 - Idler roller

- ☐ For toothed belt

### 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 prescribed torque and tightening sequence during installation ⇒ [page 40](#)

### 8 - High-pressure pump

- ☐ Removing and installing ⇒ [page 347](#) .

### 9 - Alternator

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

### 10 - Bolt

- ☐ Renew after removing
- ☐ 20 Nm +180°

### 11 - Centre hex stud

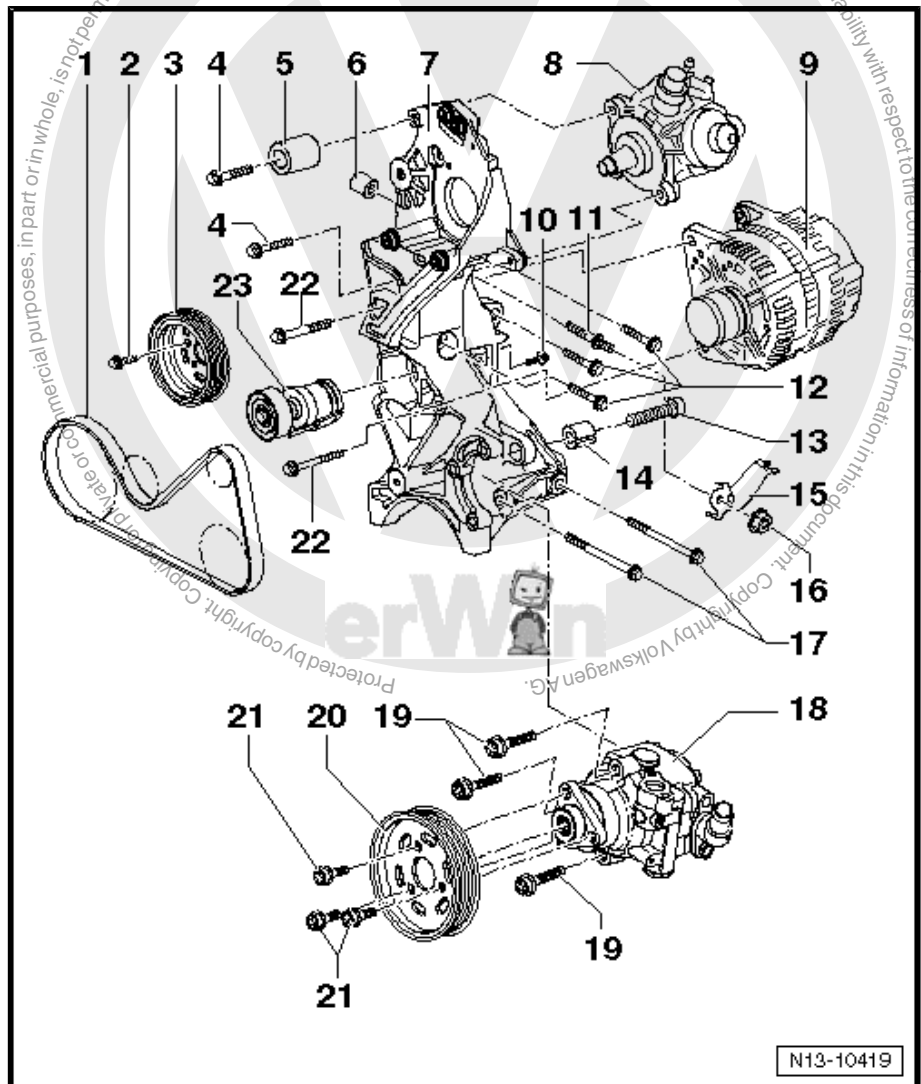
- ☐ Observe tightening sequence ⇒ [page 40](#) .
- ☐ 40 Nm + 90°

### 12 - Bolt

- ☐ Observe tightening sequence ⇒ [page 40](#) .
- ☐ 40 Nm + 90°

### 13 - Bolt

- ☐ 25 Nm







#### 14 - Sleeve

- ☐ Push back slightly before installing vane pump.

#### 15 - Bracket

#### 16 - Nut

- ☐ For bracket of Hall sender - G40- .
- ☐ 25 Nm

#### 17 - Bolt

- ☐ Observe tightening sequence ⇒ [page 40](#) .
- ☐ 40 Nm +180°

#### 18 - Vane pump

- ☐ Removing and installing ⇒ Running gear, axles and steering; Rep. gr. 48 .

#### 19 - Bolt

- ☐ 25 Nm

#### 20 - Belt pulley

#### 21 - Bolt

- ☐ 25 Nm

#### 22 - Bolt

- ☐ Prescribed torque ⇒ Electrical system; Rep. gr. 27 .

#### 23 - Poly V-belt tensioning element

- ☐ Swing with ring spanner to slacken ribbed belt ⇒ [page 40](#)

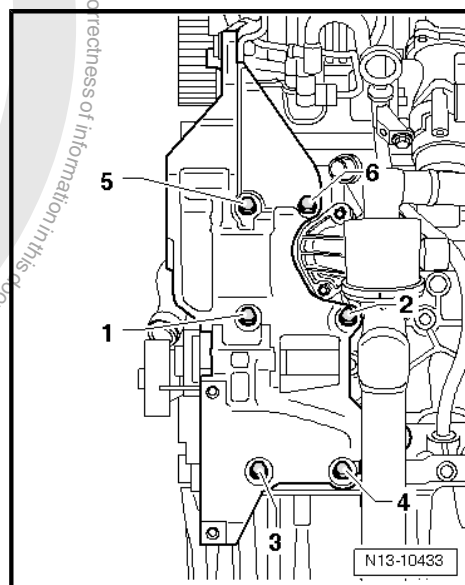
#### Ancillary bracket - specified torques and tightening sequence

– Insert securing bolts for ancillary bracket as follows:

- ◆ 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.



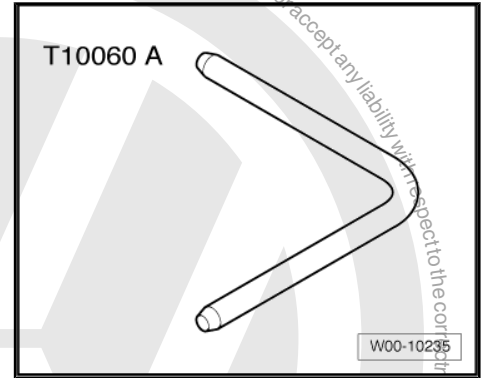
## 1.5 Removing and installing poly V-belt

Special tools and workshop equipment required



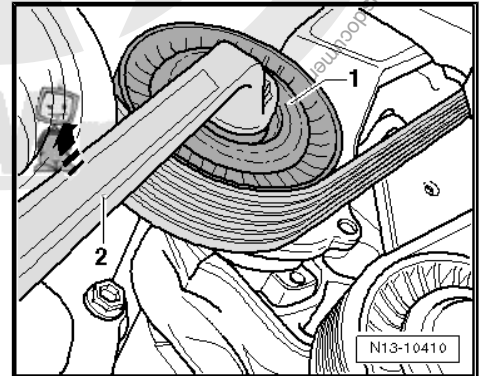


◆ Locking pin - T10060 A-



**Removing**

- Remove underbody guard, if fitted ⇒ General body repairs, exterior; Rep. gr. 66 ; Underbody guard .
- 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:



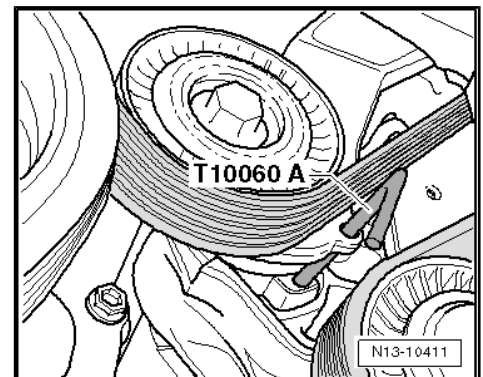
**Note**

- ◆ *Before installing poly V-belt, ensure that all ancillaries (alternator, air conditioner compressor, power steering vane pump) are secured tightly.*
- ◆ *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 belt running.

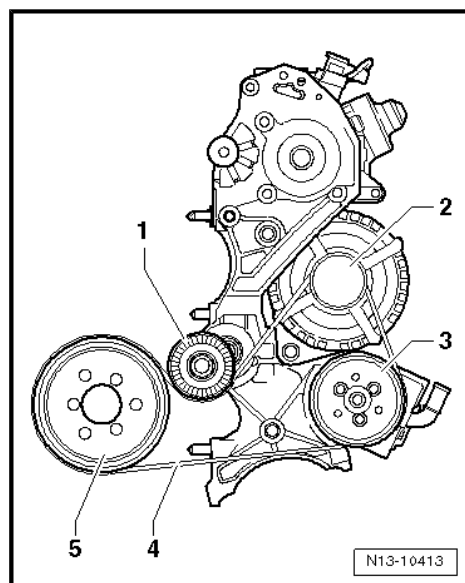






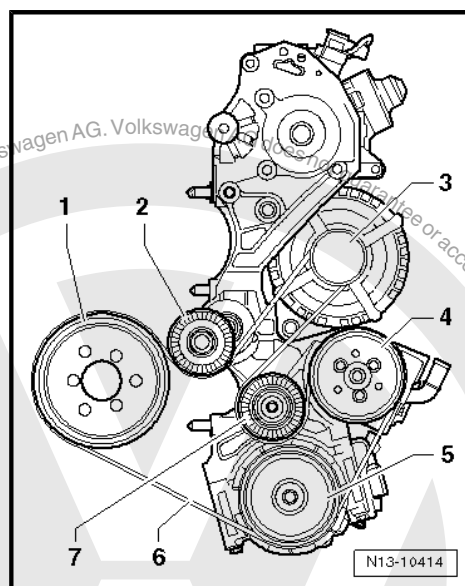
### Belt drive without air conditioner compressor

- 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 - Idler roller



## 1.6 Removing and installing tensioner for poly V-belt

### Removing

- Remove poly V-belt  
⇒ ["1.5 Removing and installing poly V-belt", page 40](#) .
- Disconnect battery ⇒ Electrical system; Rep. gr. 27 .
- Remove alternator ⇒ Electrical system; Rep. gr. 27 .



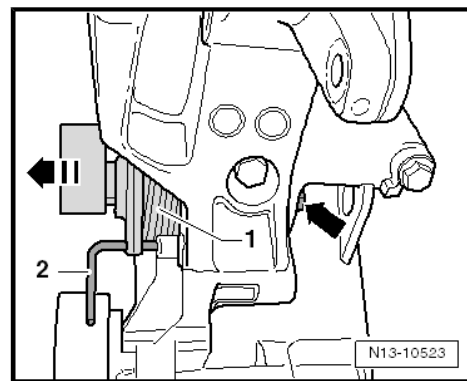


- Remove bolt -arrow- for tensioning element -1- and remove tensioning element in -direction of arrow-.

### Installing

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

- Install alternator ⇒ Electrical system; Rep. gr. 27 .
- Install poly V-belt  
⇒ [“1.5 Removing and installing poly V-belt”, page 40](#) .
- Connect battery ⇒ Electrical system; Rep. gr. 27 .
- Re-learn window lifter, enter radio code, set clock and, if necessary recode control units which have fault entries.



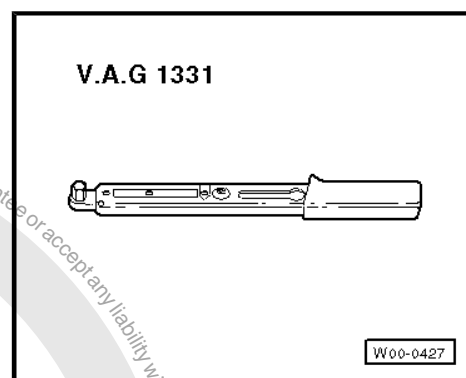
### Specified torques

- ◆ ⇒ [“1.3 Assembly overview - poly V-belt drive”, page 37](#)
- ◆ ⇒ [“1.4 Assembly overview - poly V-belt drive, vehicles without A/C system”, page 39](#)

## 1.7 Removing and installing ancillary bracket

### Special tools and workshop equipment required

- ◆ Torque wrench - V.A.G 1331-



### Removing

- Remove high-pressure pump ⇒ [page 347](#) .
- Remove the generator ⇒ Electrical system; Rep. gr. 27 .



### WARNING

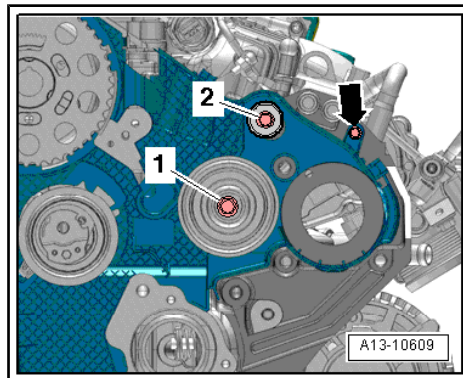
***The air conditioner refrigerant circuit must not be opened.***

- Remove air conditioner compressor ⇒ Heating, air conditioning; Rep. gr. 87
- Secure air conditioner compressor to body so that the refrigerant lines and hoses are not under tension.
- Screw off vane pump for power assisted steering together with connected lines and fasten to body ⇒ Running gear, axles, steering; Rep. gr. 48





- Unscrew deflection rolls -1- and -2- and screw out bolt of toothed belt guard -arrow-.

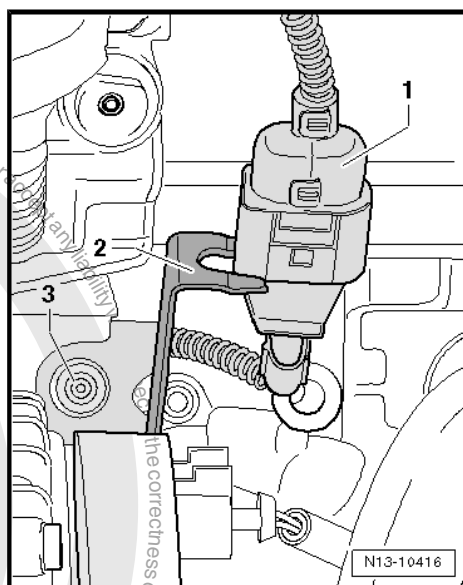


- Pull connector -1- out of bracket -2-.

**Note**

*Nut -3- cannot be seen or felt. A small hand-held mirror is required to unscrew and insert nut -3-.*

- Remove nut -3- and bracket -2-.



- Unscrew bolts -1....6- and remove ancillary bracket.

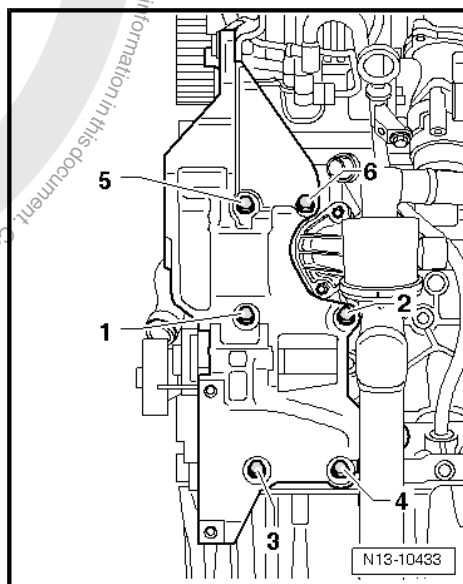
**Installing**

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

- Make sure that the dowel sleeve ⇒ [Item 6 \(page 37\)](#) on the rear of the bracket is in the hole for the bolt. If the dowel sleeve is missing, it must be replaced.
- Installing the generator ⇒ Electrical system; Rep. gr. 27 .
- Installing high-pressure pump ⇒ [page 347](#) .

**Specified torques**

- ♦ ⇒ [“2.1 Assembly overview - toothed belt drive”, page 105](#)
- ♦ ⇒ [“1.3 Assembly overview - poly V-belt drive”, page 37](#)
- ♦ ⇒ [“1.4 Assembly overview - poly V-belt drive, vehicles without A/C system”, page 39](#)



## 1.8 Removing and installing vibration damper

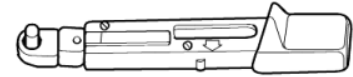
Special tools and workshop equipment required





- ◆ Torque wrench - V.A.G 1410-

V.A.G 1410



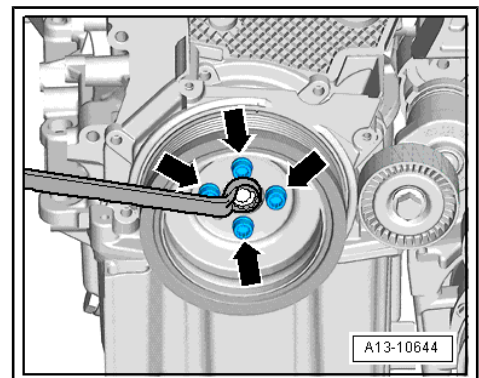
W00-0554

### Removing

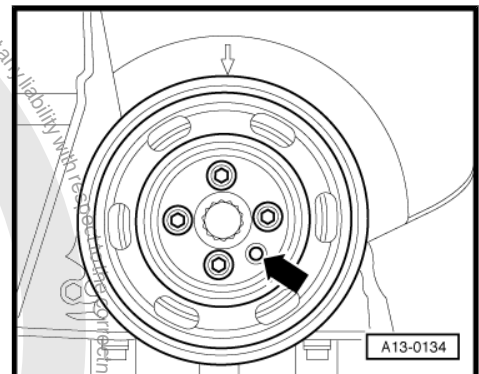
- Remove poly V-belt ➔ [page 40](#) .
- Loosen bolts -arrows- for vibration damper, counterholding on crankshaft toothed belt pulley bolt with a ring spanner.
- Unscrew bolts and remove vibration damper.

### Installing

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



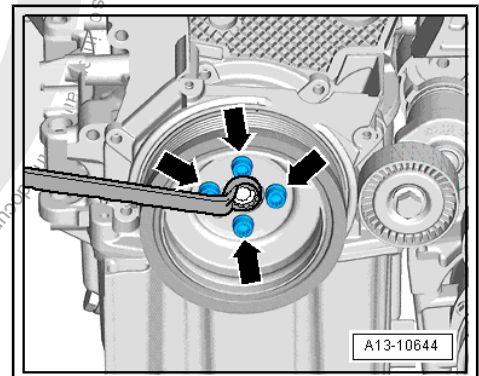
Assembly of the vibration damper is only possible in one position. The vibration damper hole must be positioned over the projection on the toothed belt pulley -arrow-.



- Install vibration damper with new bolts -arrows-.
- Tighten bolts -arrows- for vibration damper, counterhold on crankshaft toothed belt pulley bolt with a ring spanner.

### Specified torques

- ◆ ➔ ["1.3 Assembly overview - poly V-belt drive", page 37](#)
- ◆ ➔ ["1.4 Assembly overview - poly V-belt drive, vehicles without A/C system", page 39](#)



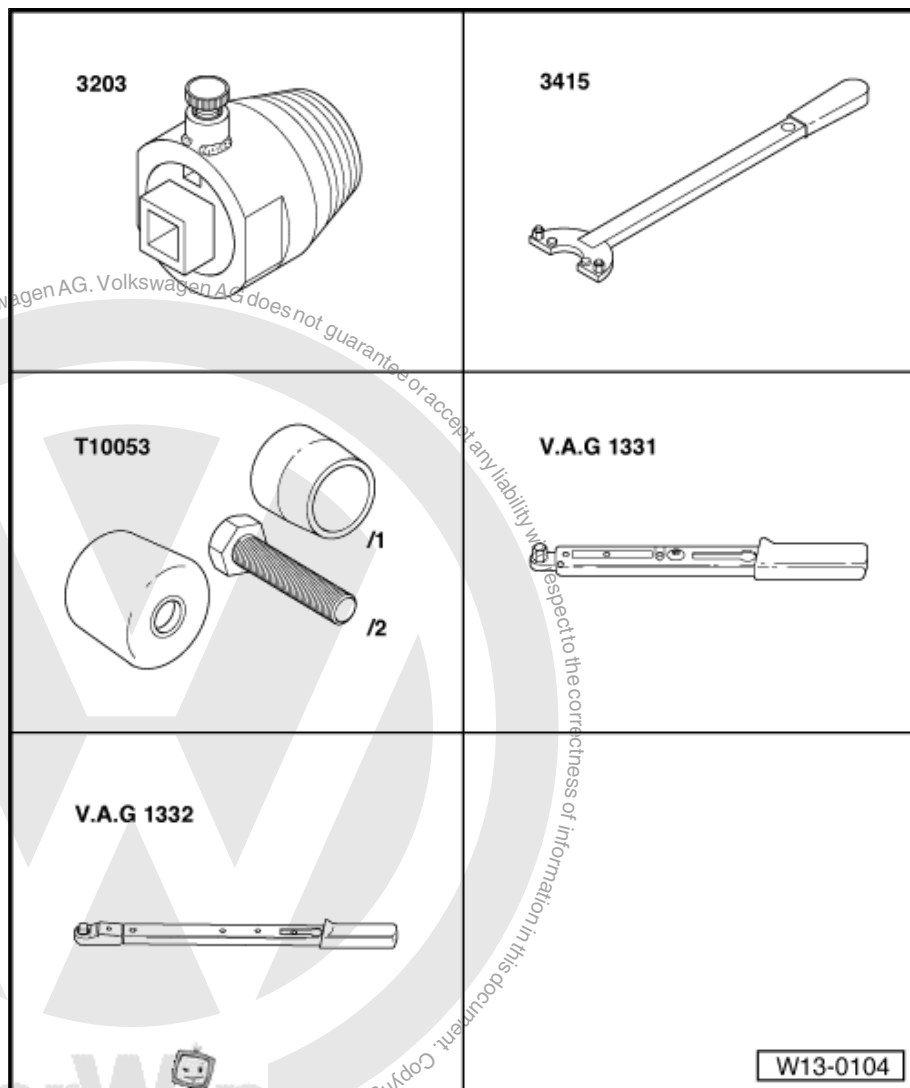




## 1.9 Renewing crankshaft oil seal - belt pulley end

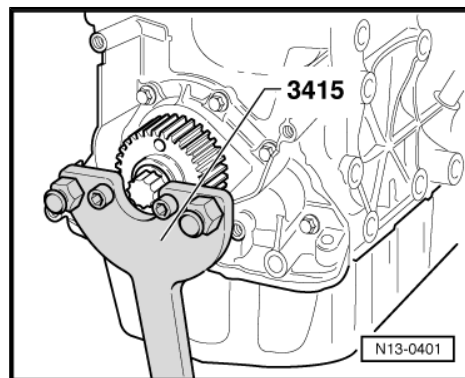
### Special tools and workshop equipment required

- ◆ 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 107](#) .
- Remove crankshaft toothed belt 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 oil 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:



#### Note

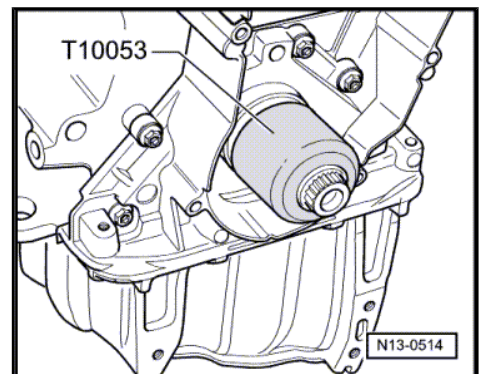
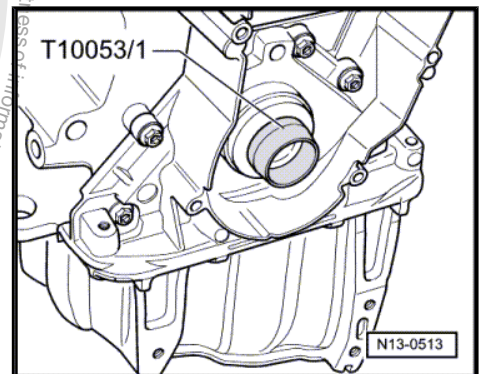
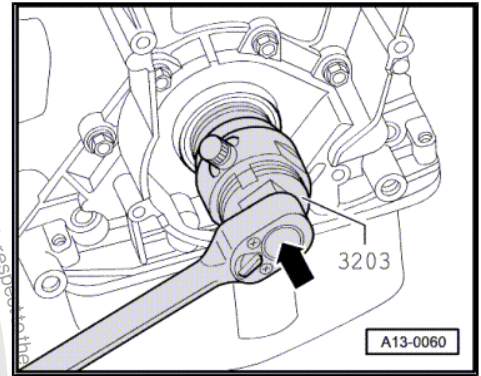
*The oil seal sealing lip must not be additionally oiled or greased.*

- 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.
- Install crankshaft toothed belt pulley.
- Install toothed belt ⇒ [page 107](#) .

### Specified torques

- ◆ ⇒ [“2.1 Assembly overview - toothed belt drive”, page 105](#)
- ◆ ⇒ [“1.3 Assembly overview - poly V-belt drive”, page 37](#)
- ◆ ⇒ [“1.4 Assembly overview - poly V-belt drive, vehicles without A/C system”, page 39](#)



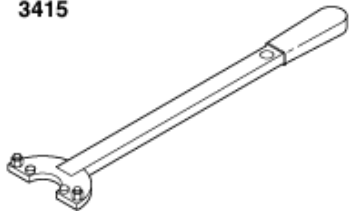
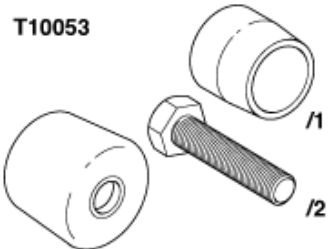


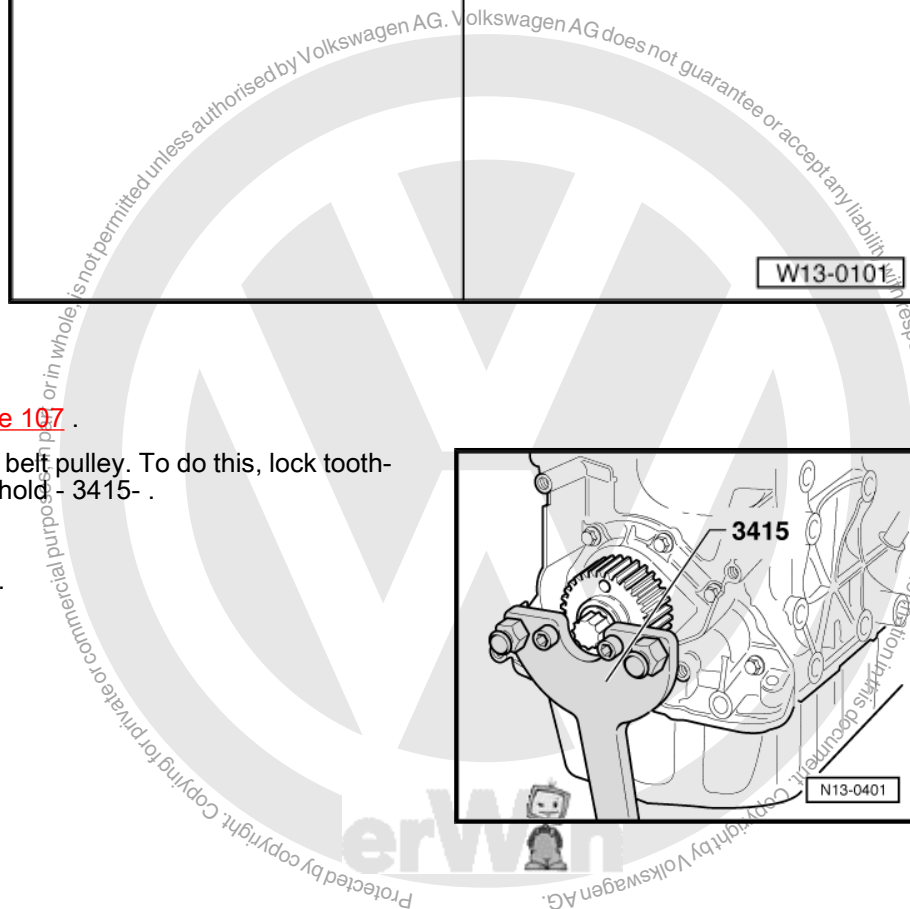




## 1.10 Removing and installing sealing flange on pulley end

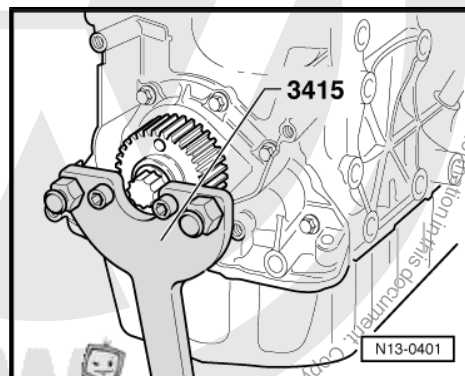
### Special tools and workshop equipment required

- ◆ 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 (ET-KA)

<b>3415</b> 	<b>T10053</b> 
<b>V.A.G 1331</b> 	<b>V.A.G 1332</b> 
 <b>W13-0101</b>	

### Removing

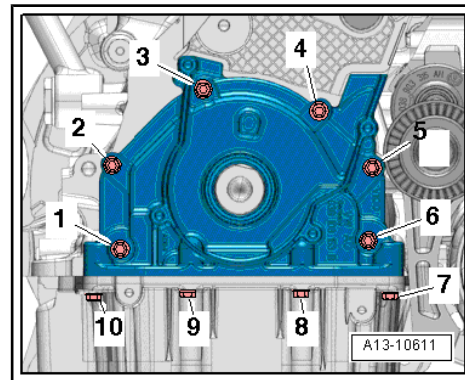
- Remove toothed belt ➔ [page 107](#) .
- Remove crankshaft toothed belt pulley. To do this, lock toothed belt pulley using counterhold - 3415- .
- Drain off engine oil.
- Remove sump ➔ [page 140](#) .







- 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.

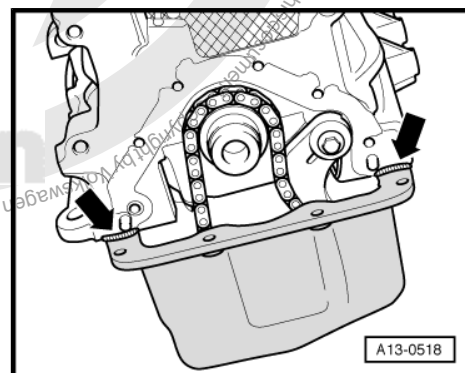
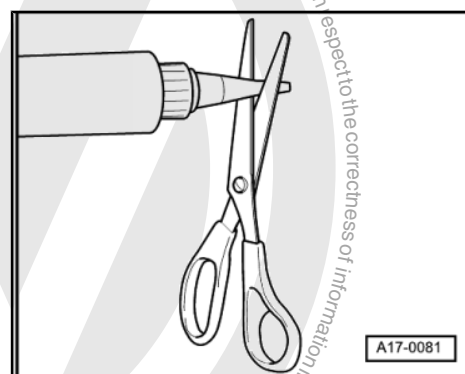
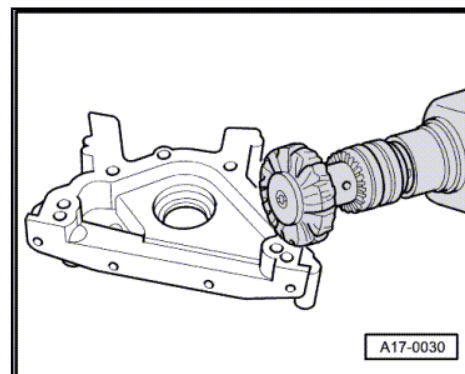
### Installing

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



#### Note

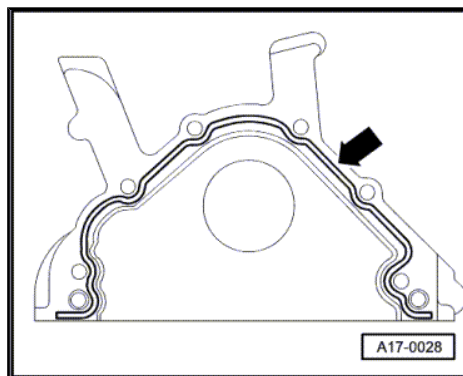
- ◆ *Observe expiry date of sealing compound.*
- ◆ *The sealing flange must be installed within 5 minutes of applying the silicone sealant.*
- ◆ *Sealant bead must be no thicker than 2...3 mm. Excess sealant can find its way into the sump and block the strainer in the suction line and drip on the sealing surface of the crankshaft seal.*
- ◆ *Before applying sealant bead, cover sealing surface of oil seal with a clean cloth.*
- Cut off nozzle on tube at front marking (Ø 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.

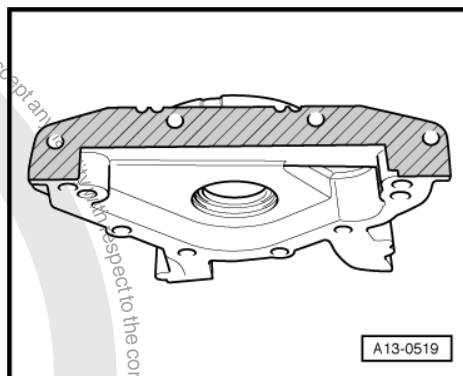


- Thinly coat lower sealing surface -shaded area- on sealing flange with sealant.
- Fit sealing flange immediately and lightly tighten all bolts.



#### 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.
- Tighten sealing flange securing bolts diagonally and alternately.
- Install crankshaft toothed belt pulley.
- Install sump ⇒ [page 140](#) .
- Install toothed belt and adjust the valve timing ⇒ [page 107](#) .



#### Specified torques

- ◆ ⇒ [“2.1 Assembly overview - toothed belt drive”, page 105](#)
- ◆ ⇒ [“1.3 Assembly overview - poly V-belt drive”, page 37](#)
- ◆ ⇒ [“1.4 Assembly overview - poly V-belt drive, vehicles without A/C system”, page 39](#)
- ◆ ⇒ [“1.1 Assembly overview - sump, oil pump”, page 137](#)





## 2 Ancillary drive

⇒ ["2.1 Assembly overview - ancillary drive", page 51](#)

⇒ ["2.2 Retrofitting preparation for ancillary drive", page 51](#)

### 2.1 Assembly overview - ancillary drive

#### 1 - Hub

- ☐ Note marking when installing

#### 2 - Bolt

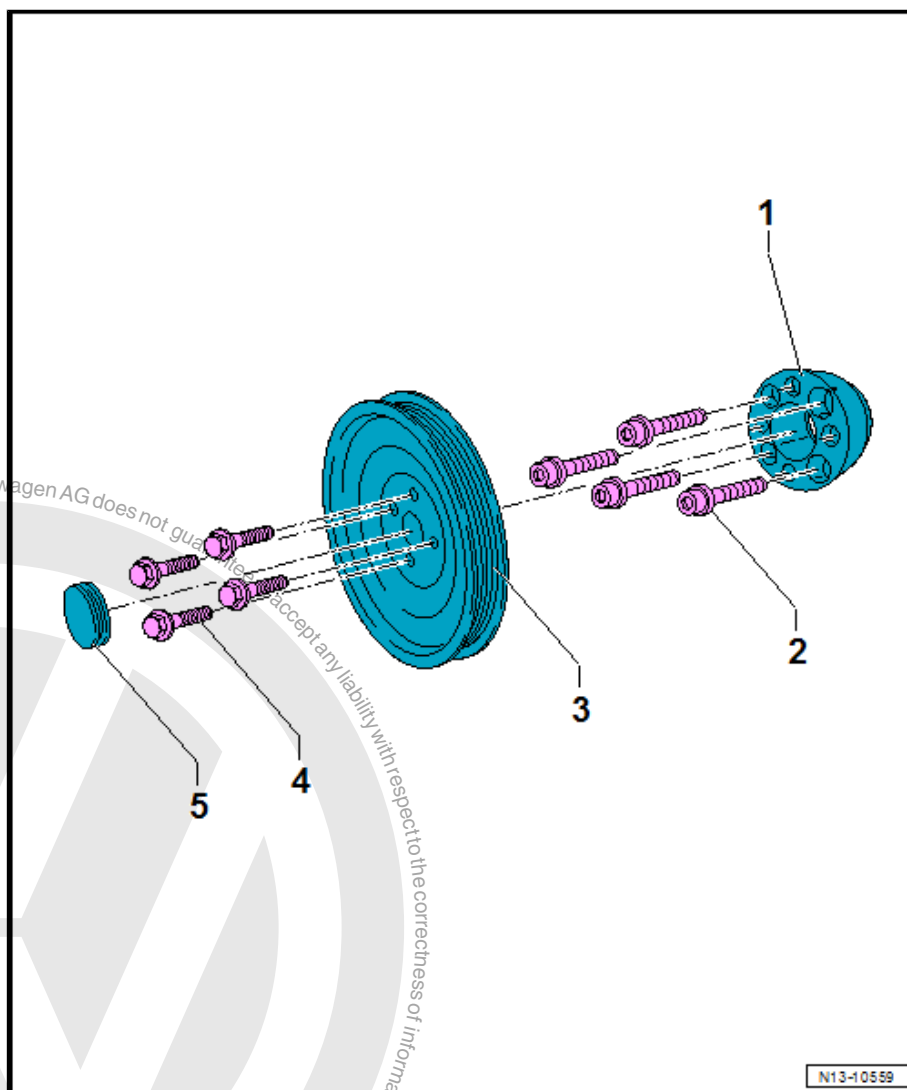
- ☐ Renew after removing
- ☐ 20 Nm + 180°

#### 3 - Belt pulley

#### 4 - Bolt

- ☐ Renew after removing
- ☐ 20 Nm + 90°

#### 5 - Plug



N13-10559

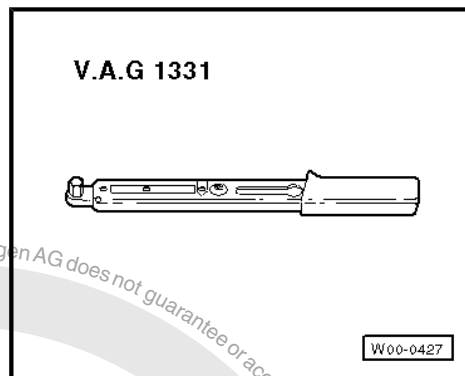
### 2.2 Retrofitting preparation for ancillary drive

Special tools and workshop equipment required





◆ Torque wrench - V.A.G 1331-



**Procedure**

- Remove poly V-belt ➔ [page 40](#) .



**WARNING**

***Always use the original TDC mark for all adjustments to the engine.***



**Note**

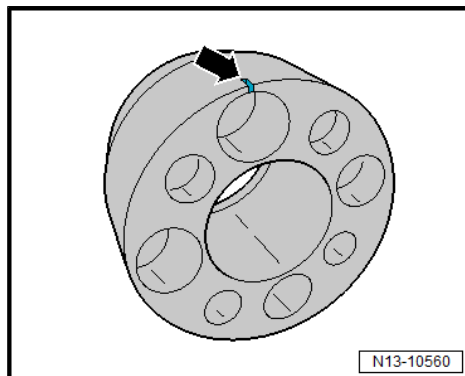
- ◆ *Contact surfaces must be free of oil, wax and grease. To clean them, remove vibration damper.*
- ◆ *Set engine to TDC.*
- Remove vibration damper ➔ [page 44](#) .
- Clean contact surfaces thoroughly



**Note**

*The hub fits in only one position. If incorrectly positioned, the bolt holes will be offset.*

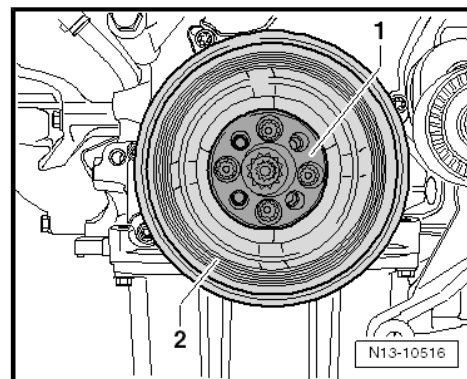
- Set mark on hub -arrow- to “12 o'clock” during assembly because holes in damper and hub align in this position.







- Then secure vibration damper -2- to hub -1- using new bolts.



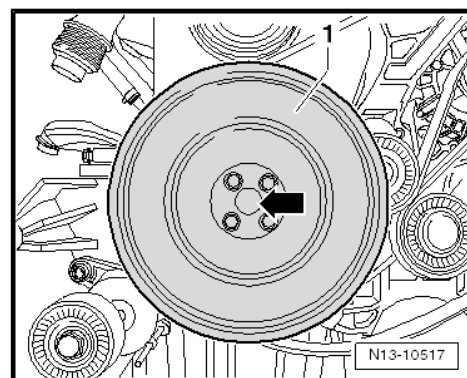
- Set ancillary drive belt pulley -1- on hub using new bolts and tighten.
- Clip plug -arrow- into place.
- Install poly V-belt ⇒ [page 40](#) .

#### Specified torque

- ◆ ⇒ [“2.1 Assembly overview - ancillary drive”, page 51](#)

After completing repair, always:

- Start engine and check that belt runs properly.







### 3 Cylinder block (gearbox end)

⇒ ["3.1 Assembly overview - cylinder block, gearbox end", page 54](#)

⇒ ["3.2 Removing and installing dual-mass flywheel", page 55](#)

⇒ ["3.3 Removing and installing sealing flange on gearbox side", page 57](#)

#### 3.1 Assembly overview - cylinder block, gearbox end

##### 1 - Seal

- ☐ 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.
- ☐ Renew crankshaft oil seal (belt pulley end) ⇒ [page 46](#).

##### 2 - Sealing flange

- ☐ Must sit on dowel sleeves.
- ☐ Insert with silicone sealant ⇒ Electronic Parts Catalogue (ETKA).
- ☐ Removing and installing ⇒ [page 48](#).

##### 3 - Cylinder block

- ☐ Removing and installing crankshaft ⇒ [page 73](#).
- ☐ Dismantling and assembling pistons and con-rods ⇒ [page 66](#).

##### 4 - Bolt

- ☐ Renew after removing
- ☐ 60 Nm + 90°

##### 5 - Dual-mass flywheel

- ☐ To loosen securing bolts, lock using 3067.

##### 6 - Intermediate plate

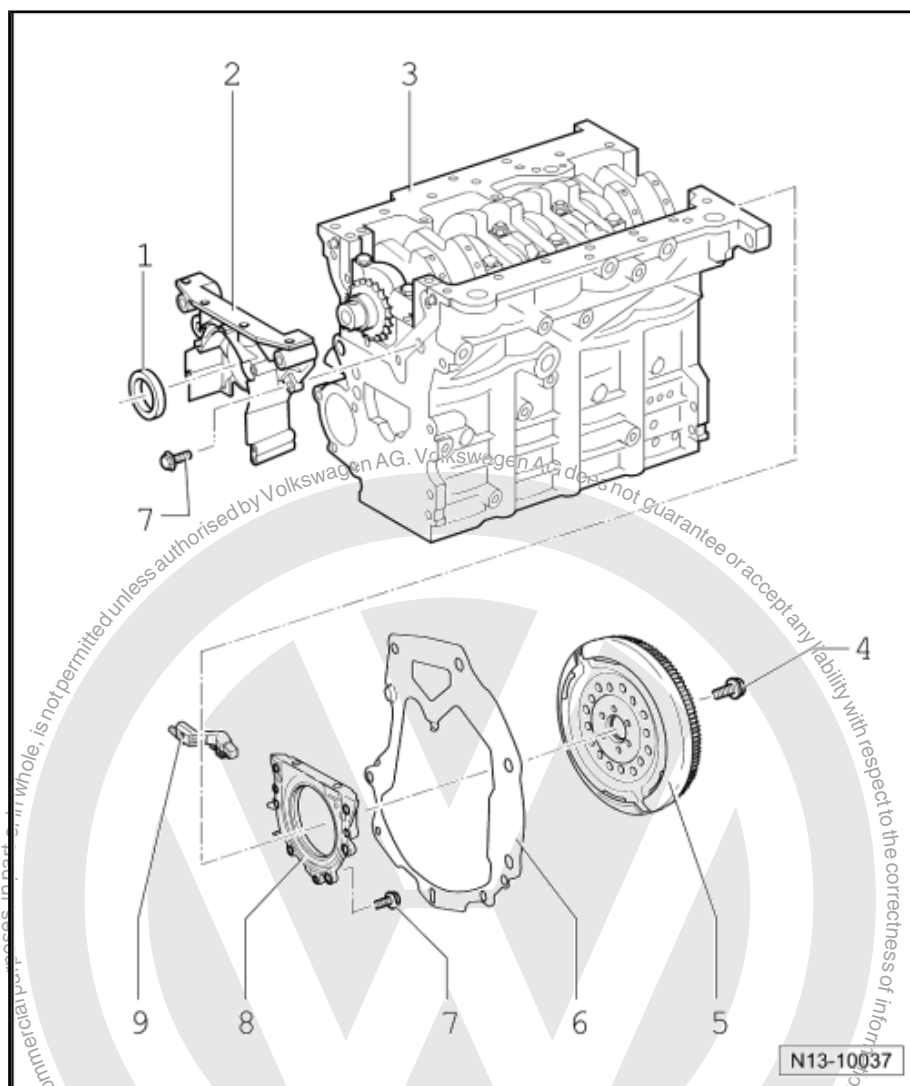
- ☐ Must sit on dowel sleeves.
- ☐ Do not damage or bend when assembling.

##### 7 - Bolt

- ☐ 15 Nm

##### 8 - Sealing flange with oil seal

- ☐ With sender wheel for engine speed.
- ☐ Renew complete unit only.
- ☐ 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.
- ☐ Use support sleeve supplied when installing.







- ❑ Removing and installing ⇒ [page 57](#) .

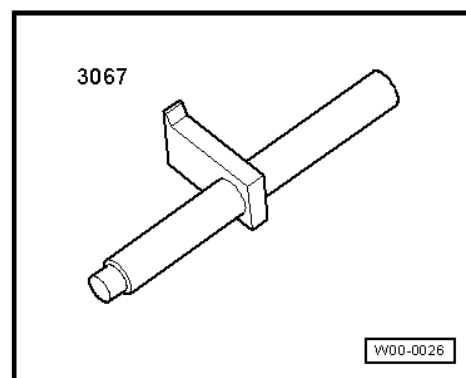
## 9 - Engine speed sender - G28-

- ❑ 5 Nm
- ❑ Removing and installing ⇒ [page 406](#) .

## 3.2 Removing and installing dual-mass flywheel

### Special tools and workshop equipment required

- ◆ Counterhold tool - 3067-



### Removing

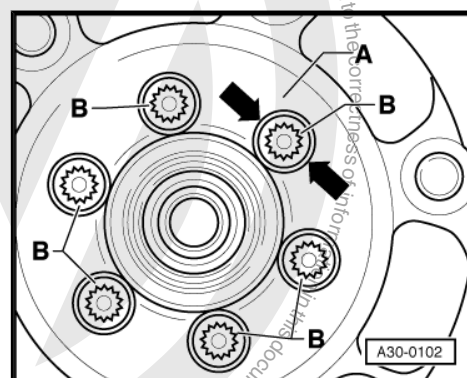
- Remove gearbox ⇒ Power transmission; Rep. gr. 34 ; Removing and installing gearbox .



#### Caution

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

- Mark position of dual-mass flywheel in relation to engine.
- Rotate dual-mass flywheel -A- so that bolts -B- align centrally with the holes -arrows-.
- When unscrewing bolts -B-, ensure that bolt heads do not come into contact with the dual-mass flywheel -arrows-. The flywheel will otherwise be damaged when turning further.



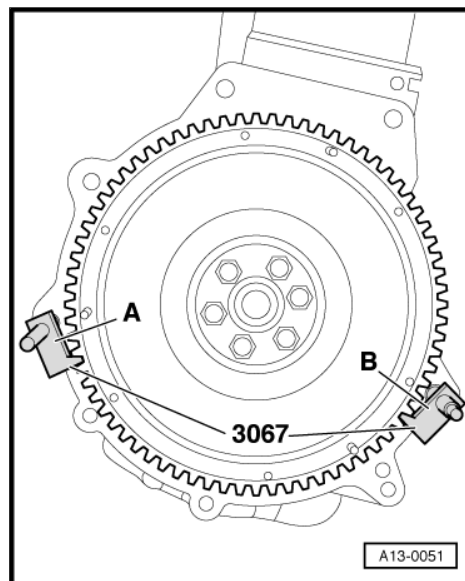




- Insert counterhold - 3067- in hole on cylinder block -B-.
- Unbolt dual-mass flywheel.

### Installing

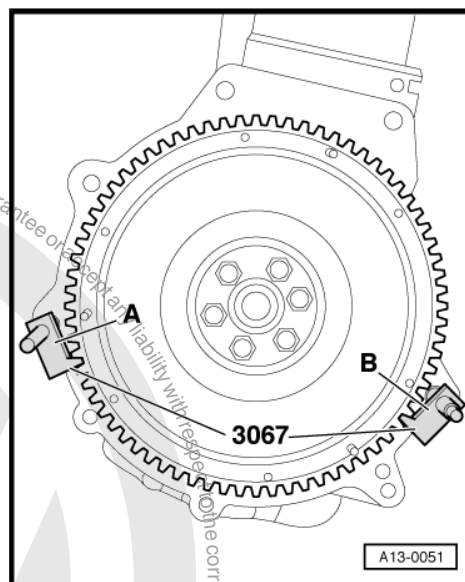
Installation is carried out in the reverse order; note the following:



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

### Specified torques

- ♦ ➔ ["3.1 Assembly overview - cylinder block, gearbox end", page 54](#)



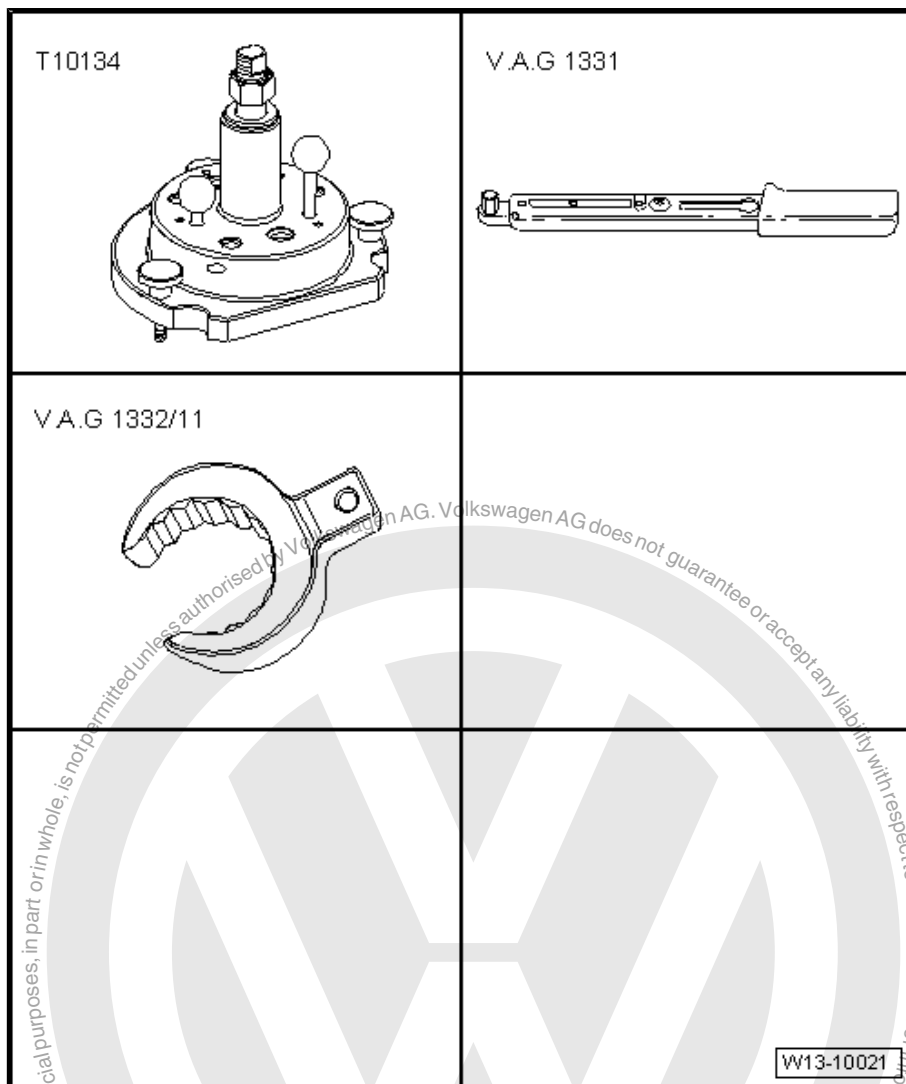




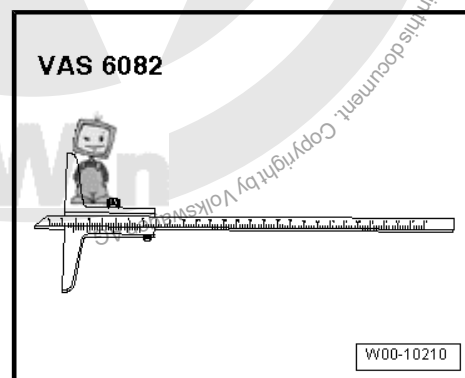
### 3.3 Removing and installing sealing flange on gearbox side

#### 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

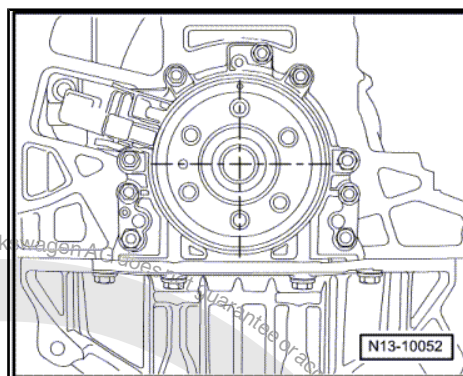


### Note

- ◆ *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 .

## Pressing out sealing flange with sender wheel

- Remove flywheel.
- Remove intermediate plate.
- Turn crankshaft to the TDC for cylinder 1 as shown.
- Remove sump ⇒ [page 140](#) .

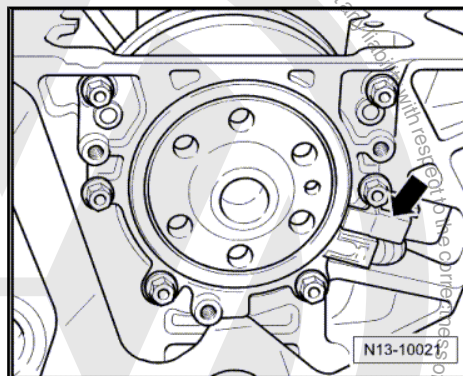


- Remove engine speed sender - G28- -arrow-
- Unscrew bolts of sealing flange.



### Note

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







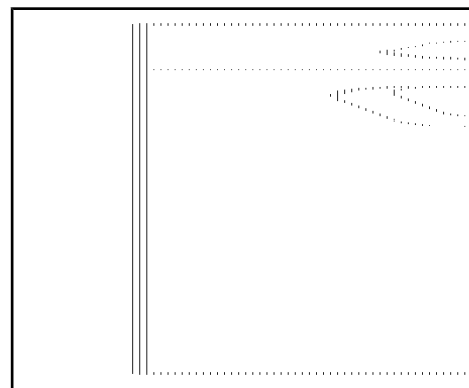
- Screw in 3 M6 x 35 mm bolts into threaded holes of sealing flange -arrows-.
- Screw bolts (max. 180° per bolt) into sealing flange alternately in order to press it and the sender wheel of crankshaft together.

#### Pressing in sealing flange with sender wheel



#### Note

- ◆ Sealing flange with 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.
- ◆ The 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.
- ◆ The assembly device - T10134- is held in its position relative to the crankshaft by a guide pin inserted into a hole in the crankshaft.

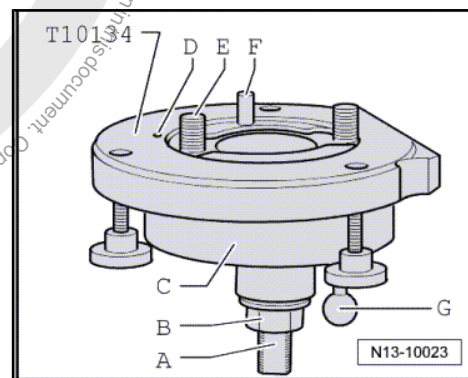
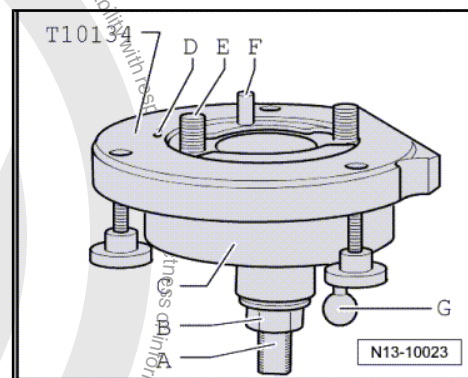


#### Assembly tool - T10134-

- 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 - Fit seal with sender wheel on assembly tool - T10134-

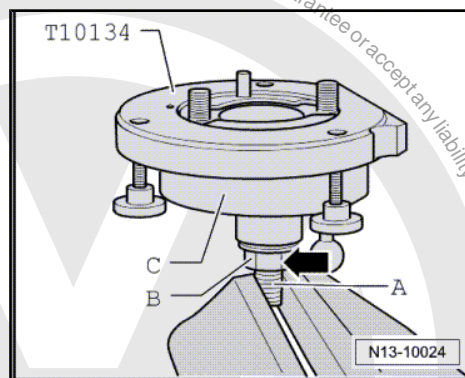
- Screw on nut -B- until just before it touches the clamping surface -A- of the threaded spindle.







- 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.

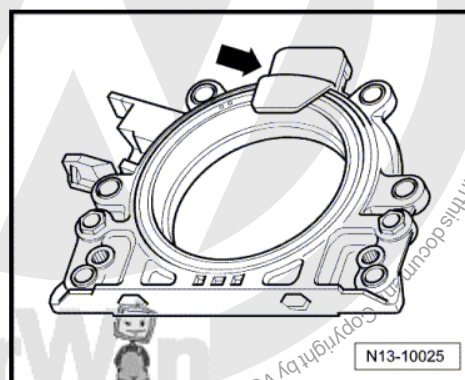


- Remove safety clip -arrow- of the new sealing flange.

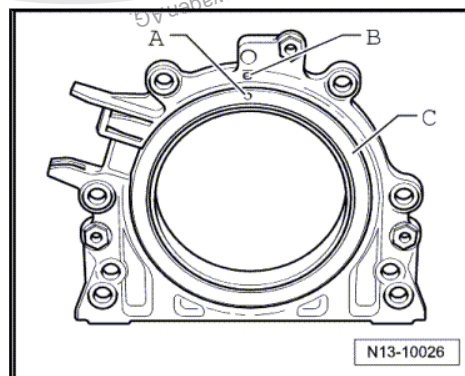


**Note**

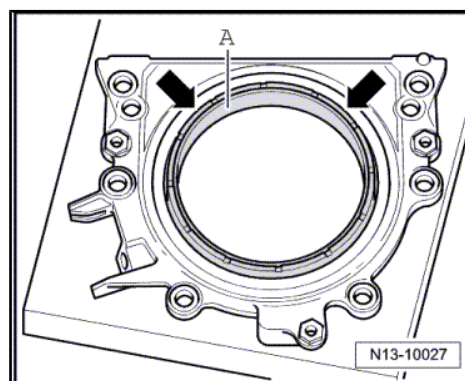
*The sender wheel must not be taken out of the sealing flange or twisted.*



- 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.



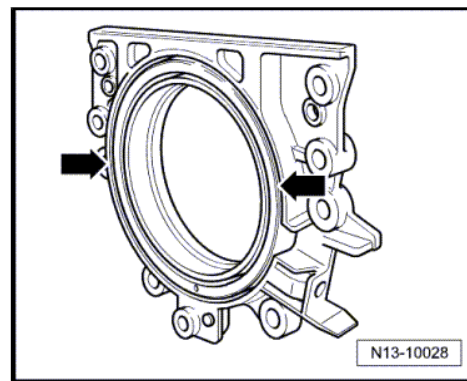
- Push sealing lip support ring -A- downwards in direction of arrow until it lies on flat surface.







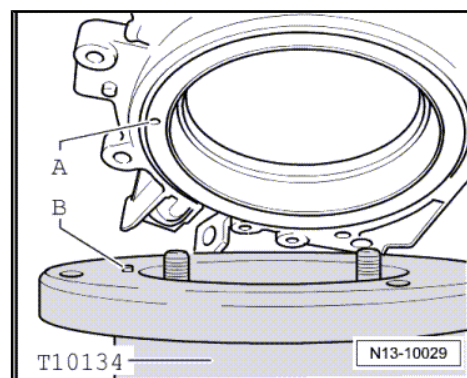
- Upper edge of sender wheel and front edge of sealing flange must align -arrows-.



- 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**

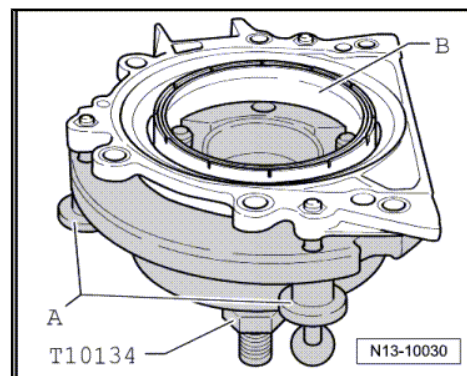
Ensure sealing flange lies flat on assembly tool.



- 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.

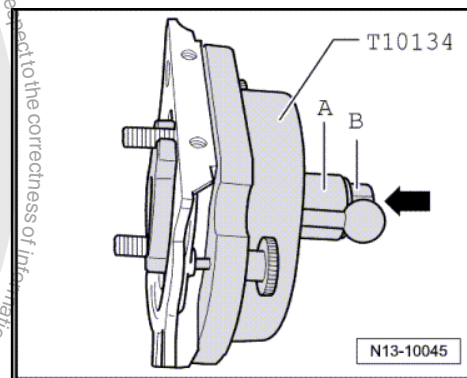
**Note**

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



### B - Fit 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.





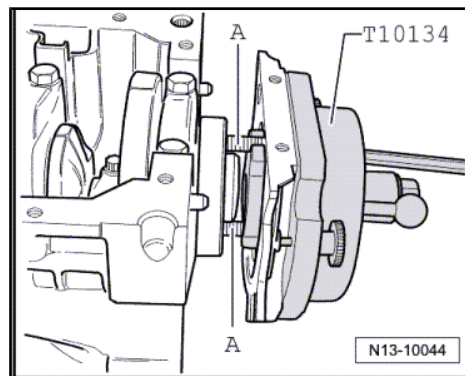


- Secure assembly tool - T10134- to crankshaft flange with hexagon socket head bolts -A-.



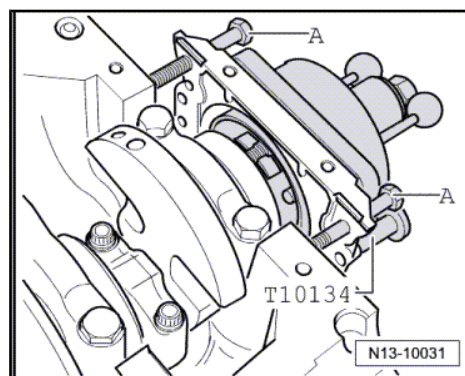
**Note**

*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**



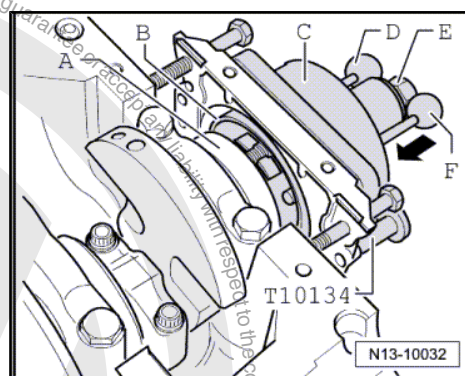
- Push assembly housing -C- by hand in direction of arrow until sealing lip support ring -B- touches crankshaft flange -A-.
- Push guide pin for diesel engines (black knob) -D- into hole in crankshaft. This ensures that the sender wheel reaches its final installation position.



**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
Tighten nut of assembly tool - T10134-	35 Nm

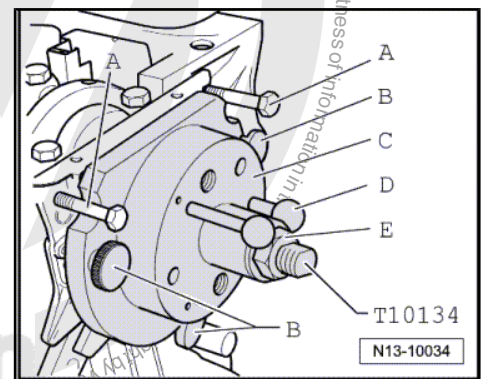
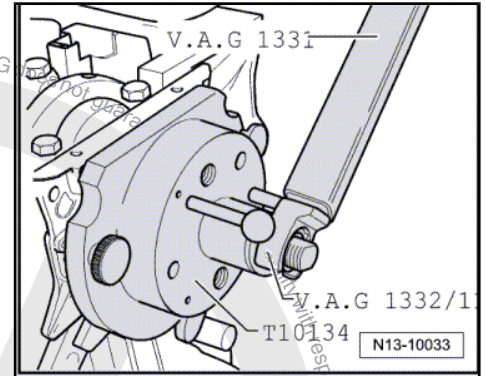


#### Note

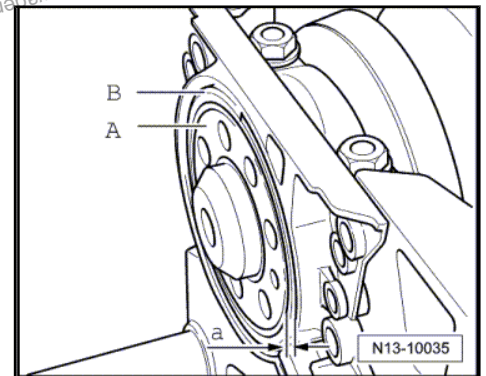
*After hexagon nut is tightened to 35 Nm, a small air gap must still be present between cylinder block and sealing flange.*

#### 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-.



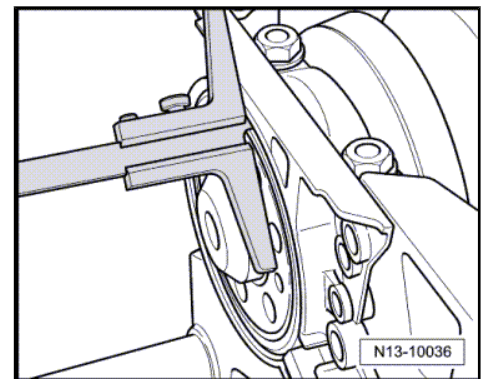
- Place caliper gauge on crankshaft flange.
- Measured distance -a- between crankshaft flange and sender wheel.

If dimension -a- is too small:

- Re-press sender wheel ⇒ [page 64](#) .

If dimension -a- is achieved:

- Tighten new sealing flange securing bolts diagonally and alternately.

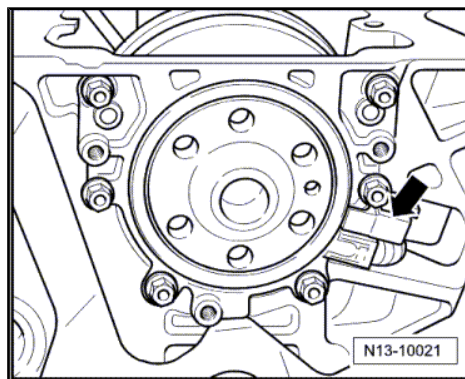




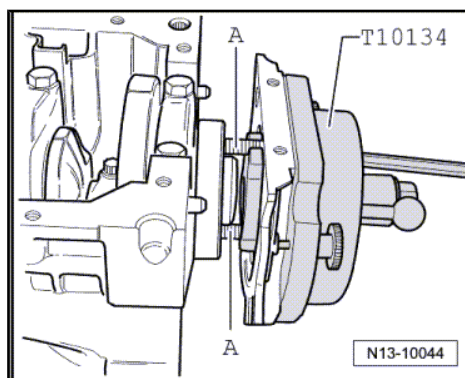


- Install engine speed sender - G28- -arrow- and tighten securing bolt.
- Install sump ⇒ [page 140](#) .
- Install intermediate plate.
- Install flywheel with new bolts.

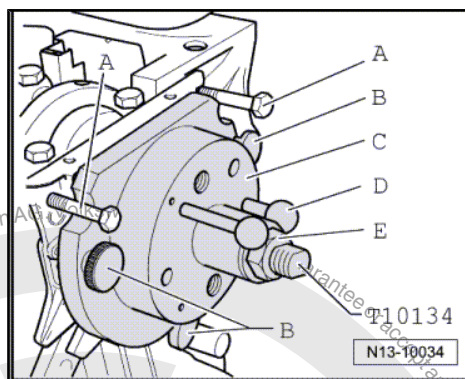
#### F - Re-pressing sender wheel



- 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
Tighten nut of assembly tool - T10134-	40 Nm

- Check the sender wheel installation position on crankshaft again ⇒ [page 63](#)

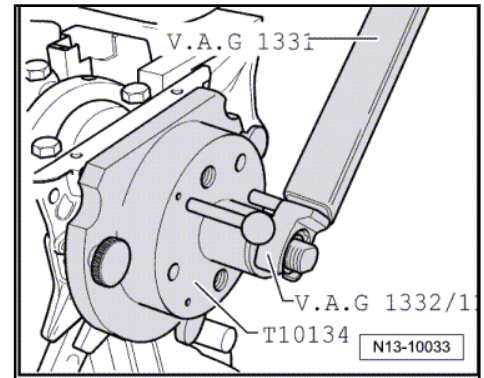
If dimension -a- is too small again:

- Tighten nut of assembly tool - T10134- as follows:

#### Specified torque

Component	Specified torque
Tighten nut of assembly tool - T10134-	45 Nm

- Check the sender wheel installation position on crankshaft again ⇒ [page 63](#)







## 4 Pistons and conrods

⇒ [“4.1 Assembly overview - pistons and conrods”, page 66](#)

⇒ [“4.2 Checking piston and cylinder bore”, page 68](#)

⇒ [“4.3 Piston and cylinder dimensions”, page 69](#)

⇒ [“4.4 Measuring piston projection at TDC”, page 70](#)

⇒ [“4.5 Checking radial clearance of conrods”, page 71](#)

⇒ [“4.6 Bearing shells - installation position”, page 71](#)

⇒ [“4.7 Separating new conrod”, page 72](#)

### 4.1 Assembly overview - pistons and conrods

#### 1 - Piston rings

- ☐ Offset gaps by 120°.
- ☐ Use piston ring pliers to remove and install.
- ☐ “TOP” faces towards piston crown.
- ☐ Checking ring gap  
⇒ [page 67](#).
- ☐ Checking ring-to-groove clearance ⇒ [page 68](#).

#### 2 - Piston

- ☐ With combustion chamber.
- ☐ Mark installation position and cylinder number.
- ☐ Installation position and allocation of piston to cylinder ⇒ [page 68](#).
- ☐ Arrow on piston crown points to belt pulley end.
- ☐ Checking ⇒ [page 68](#).
- ☐ Install using piston ring clamp.
- ☐ If piston skirt is cracked, renew piston.
- ☐ Checking piston projection at TDC  
⇒ [page 70](#).

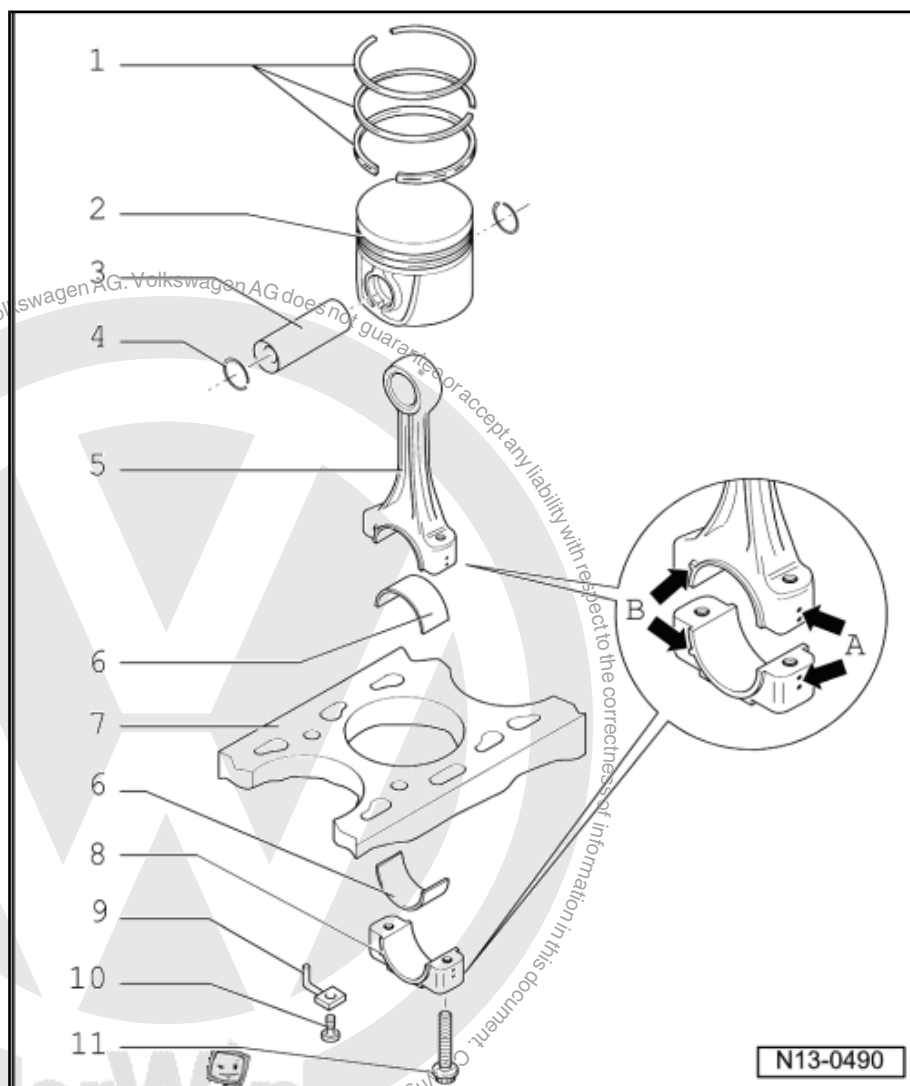
#### 3 - Piston pin

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

#### 4 - Circlip

#### 5 - Conrod

- ☐ Mark cylinder allocation -A- with coloured pen.
- ☐ Installation position: Marking -B- faces towards pulley end.
- ☐ With industrially cracked conrod cap.
- ☐ Measuring radial clearance ⇒ [page 71](#)







## 6 - Bearing shell

- ☐ Note installation position ➔ [page 71](#) .
- ☐ Note version: Upper bearing shell (towards piston) is made of a more wear resistant material. Identification: Black line on bearing surface in area of joint.
- ☐ Do not interchange used bearing shells.
- ☐ Insert bearing shells centrally.
- ☐ Check for secure seating.
- ☐ Axial clearance, wear limit: 0.37 mm
- ☐ Check radial clearance with Plastigage; wear limit: 0.08 mm.
- ☐ Do not rotate crankshaft when checking radial clearance.

## 7 - Cylinder block

- ☐ Checking cylinder bores ➔ [page 69](#) .
- ☐ Piston and cylinder dimensions ➔ [page 69](#) .

## 8 - Conrod bearing cap

- ☐ Note installation position.

## 9 - Oil spray jet

- ☐ For piston cooling.

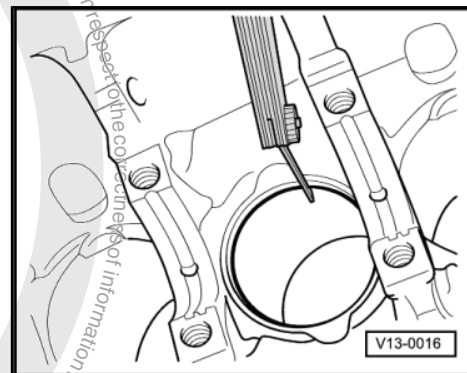
## 10 - Bolt

- ☐ Insert without sealant.
- ☐ 25 Nm

## 11 - Conrod bolt

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

## Checking piston ring gap



## Special tools and workshop equipment required

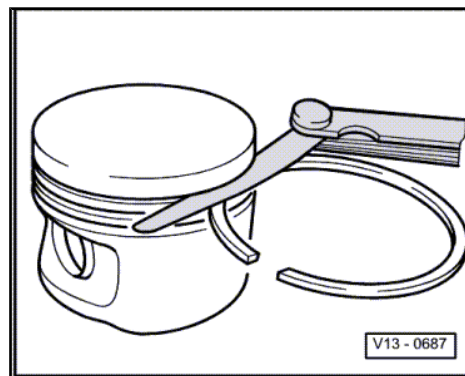
- ◆ Feeler gauges
- Push piston ring at right angle from above down into lower cylinder bore to approx. 15 mm from bottom end of cylinder

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





## Checking ring-to-groove clearance



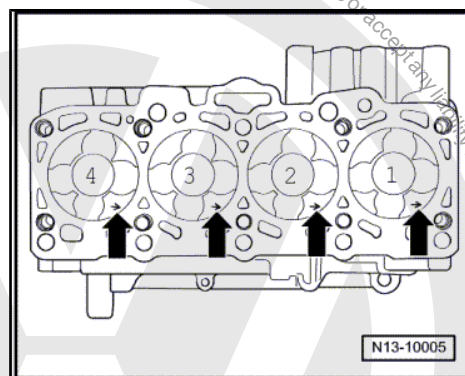
### Special tools and workshop equipment required

- ◆ Feeler gauges
- Clean annular groove before check.

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

### Installation position and allocation of piston to cylinder

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



## 4.2 Checking piston and cylinder bore

### Checking piston

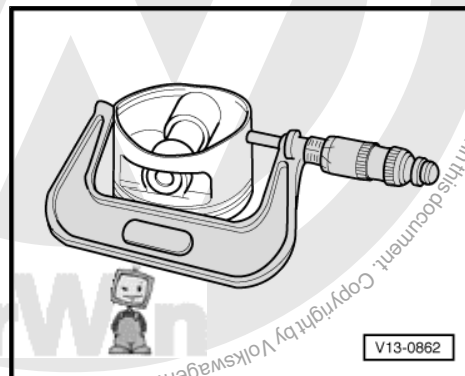
- Using a micrometer (75 ... 100 mm), measure approx. 15 mm from the lower edge, perpendicular to the piston pin axis.
- Maximum deviation from nominal dimension: 0.04 mm

Nominal dimension ➔ [page 69](#)



#### Note

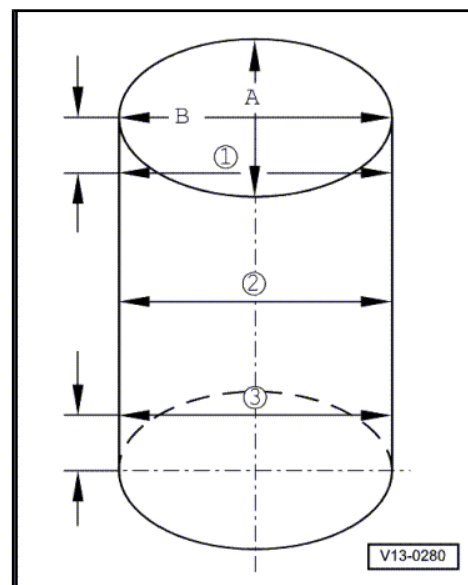
*Piston must be renewed if piston shaft reveals cracking.*







## 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 6095- , as measurements may be incorrect.*

## 4.3 Piston and cylinder dimensions

		Piston Ø	Cylinder bore Ø
Basic dimension	mm	80.96	81.01

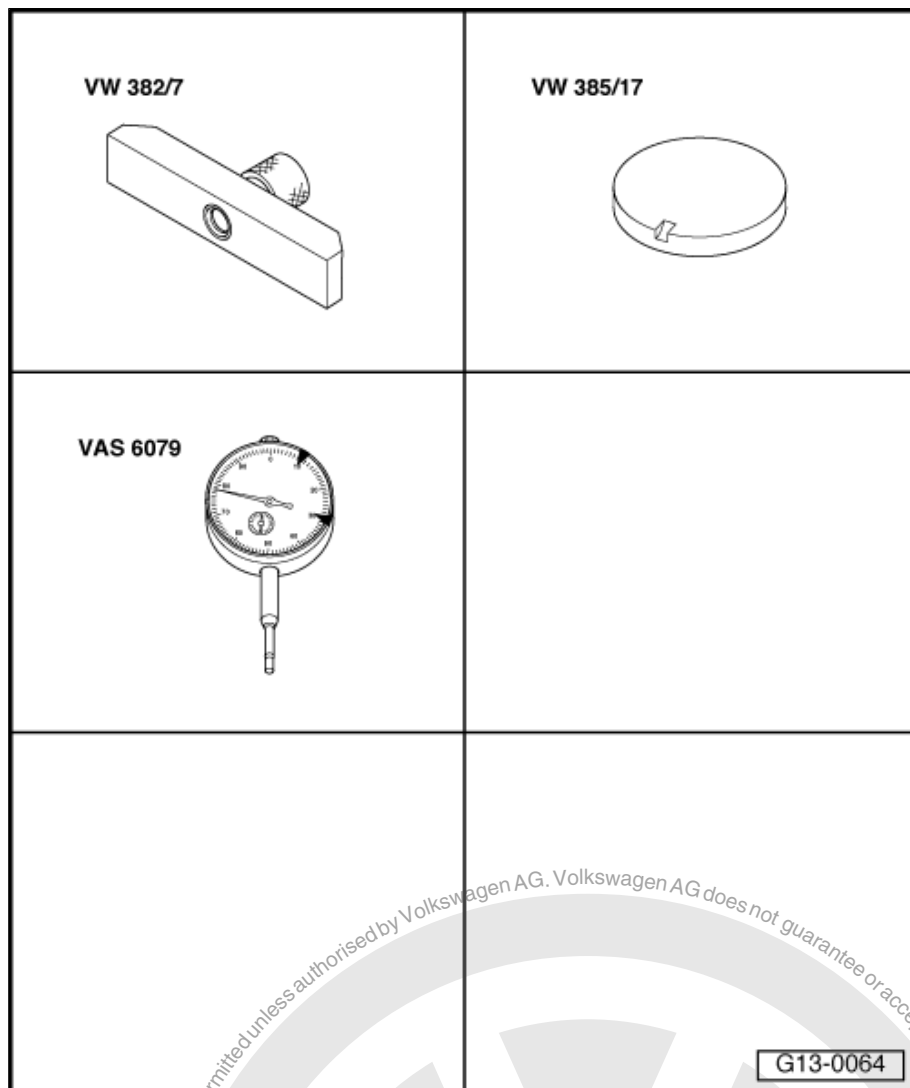




## 4.4 Measuring piston projection at TDC

### Special tools and workshop equipment required

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



### Test procedure

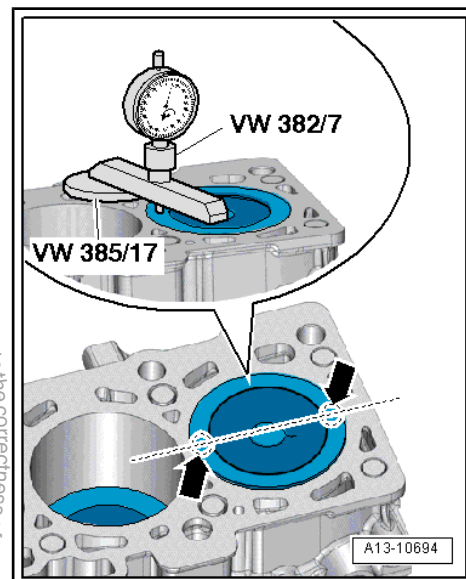
- ◆ The piston projection in the genuine part must be measured on all pistons when installing new pistons or a short engine.
- ◆ If you have measured the piston projection and it is not same for all pistons, use the highest value to determine the correct gasket size.
- ◆ Depending on piston projection, fit the appropriate cylinder head gasket according to following table.
- ◆ Turn crankshaft clockwise to measure.
- 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 the projection of each piston at the two points marked with -arrows- (at the rear side and front side of the piston seen in the longitudinal direction of the engine).
- Install the appropriate cylinder head gasket depending upon piston projection, according to following table:

Piston projection	Identification Holes/notches
0.91 mm ... 1.00 mm	1
1.01 mm ... 1.10 mm	2
1.11 mm ... 1.20 mm	3



## 4.5 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 turning further angle and without rotating crankshaft.
- Remove conrod bearing cap again.
- Compare width of Plastigage with the measurement scale.

Radial clearance:

- Wear limit: 0.08 mm
- Renew conrod bolts.

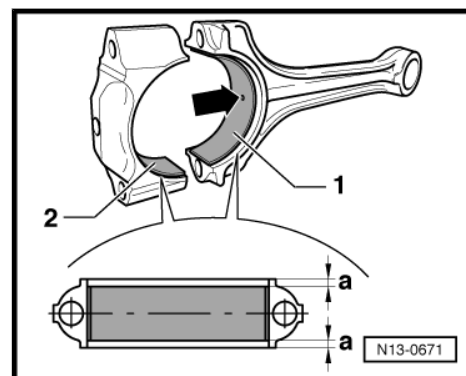
## 4.6 Bearing shells - installation position

Bearing shell -1- with oil hole -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.







## 4.7 Separating new conrod

### Procedure:

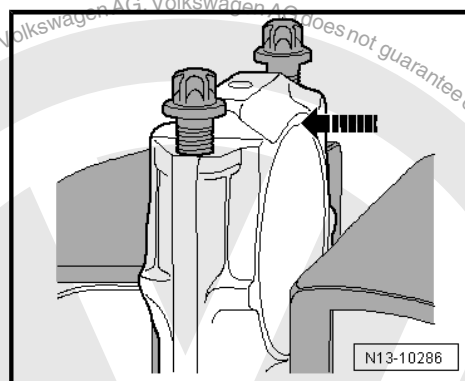
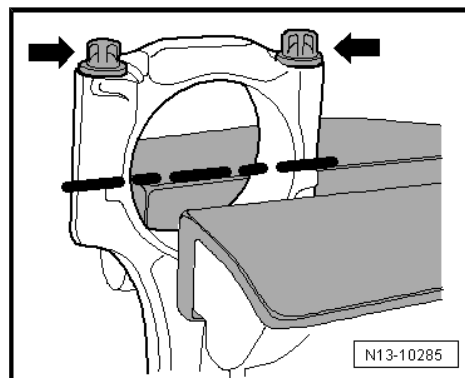
On new conrods it is possible that the breaking point is not fully separated. Proceed as follows if the conrod bearing cap cannot be removed by hand:

- Mark allocation of conrod to cylinder.
- Lightly clamp the conrod in a vice using aluminum 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 Crankshaft

⇒ ["5.1 Assembly overview - crankshaft", page 73](#)

⇒ ["5.2 Crankshaft dimensions", page 74](#)

⇒ ["5.3 Measuring axial clearance of crankshaft", page 74](#)

⇒ ["5.4 Measuring radial clearance of crankshaft", page 75](#)

⇒ ["5.5 Renewing needle bearing in crankshaft", page 76](#)

### 5.1 Assembly overview - crankshaft

#### 1 - Bearing shells 1, 2, 4 and 5

- ☐ For bearing cap without oil groove.
- ☐ For cylinder block with oil groove.
- ☐ 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 - Bearing shell 3

- ☐ For bearing cap without oil groove.
- ☐ For cylinder block with oil groove.

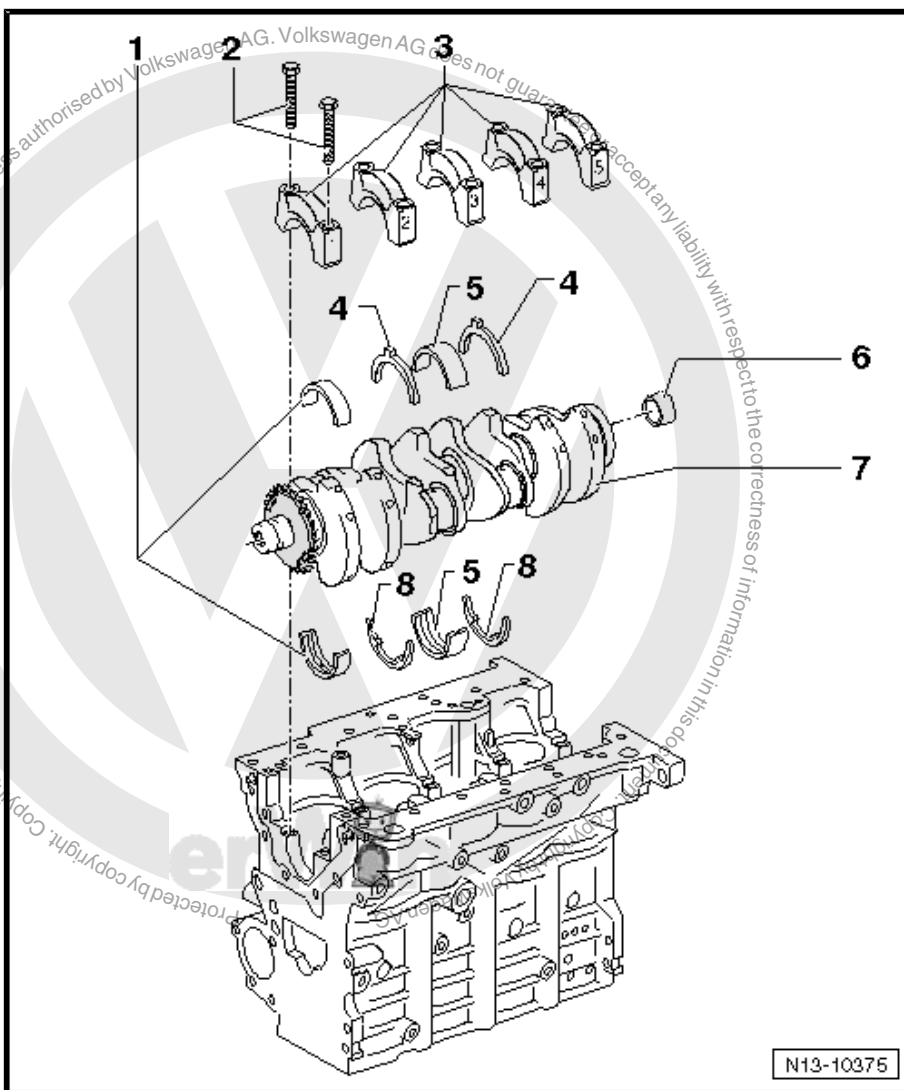
- ☐ Do not interchange used bearing shells (mark).

#### 6 - Needle bearing

- ☐ Removing and installing ⇒ [page 76](#) .

#### 7 - Crankshaft

- ☐ With toothed belt pulley for oil pump drive. Toothed belt pulley is not available as separate part.
- ☐ Axial clearance new: 0.07...0.17 mm; wear limit: 0.37 mm
- ☐ Measure radial clearance with Plastigage , new: 0.03...0.08 mm; wear limit: 0.17 mm
- ☐ Do not rotate crankshaft when checking radial clearance.
- ☐ Crankshaft dimensions ⇒ [page 74](#) .



N13-10375





## 8 - Thrust washer

- For cylinder block, bearing 3

## 5.2 Crankshaft dimensions

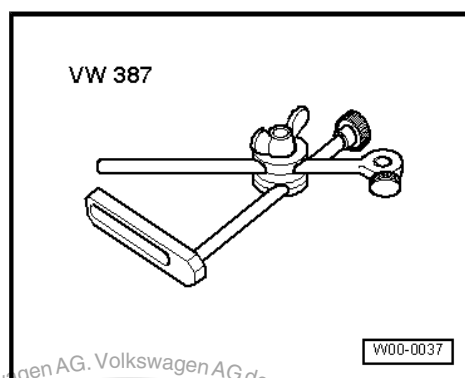
(Dimensions in mm)

	Main journal Ø		Conrod journal Ø	
Basic dimension	54.00	-0.022 -0.042	50.90	-0.022 -0.042

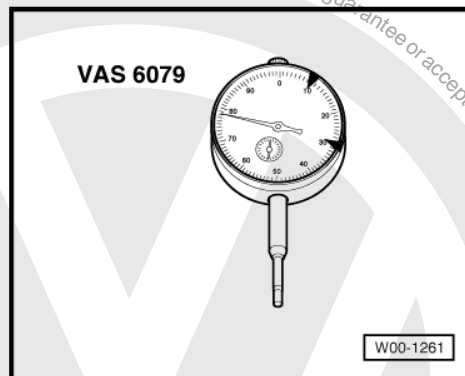
## 5.3 Measuring axial clearance of crankshaft

Special tools and workshop equipment required

- ◆ Universal dial gauge bracket - VW 387-



- ◆ Dial gauge - VAS 6079-

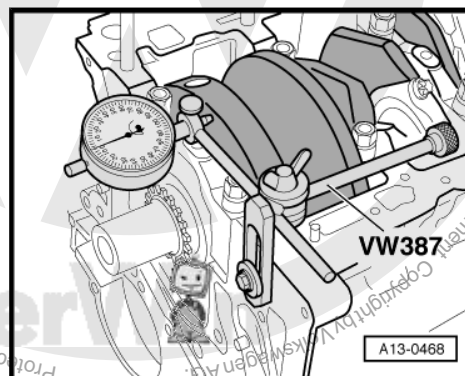


### Procedure

- Fit dial gauge - VAS 6079- with universal dial gauge holder - VW 387- to cylinder block as shown in the 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







## 5.4 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.

### Specified torque

Component	Specified torque
Bearing cap	30 Nm

- 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

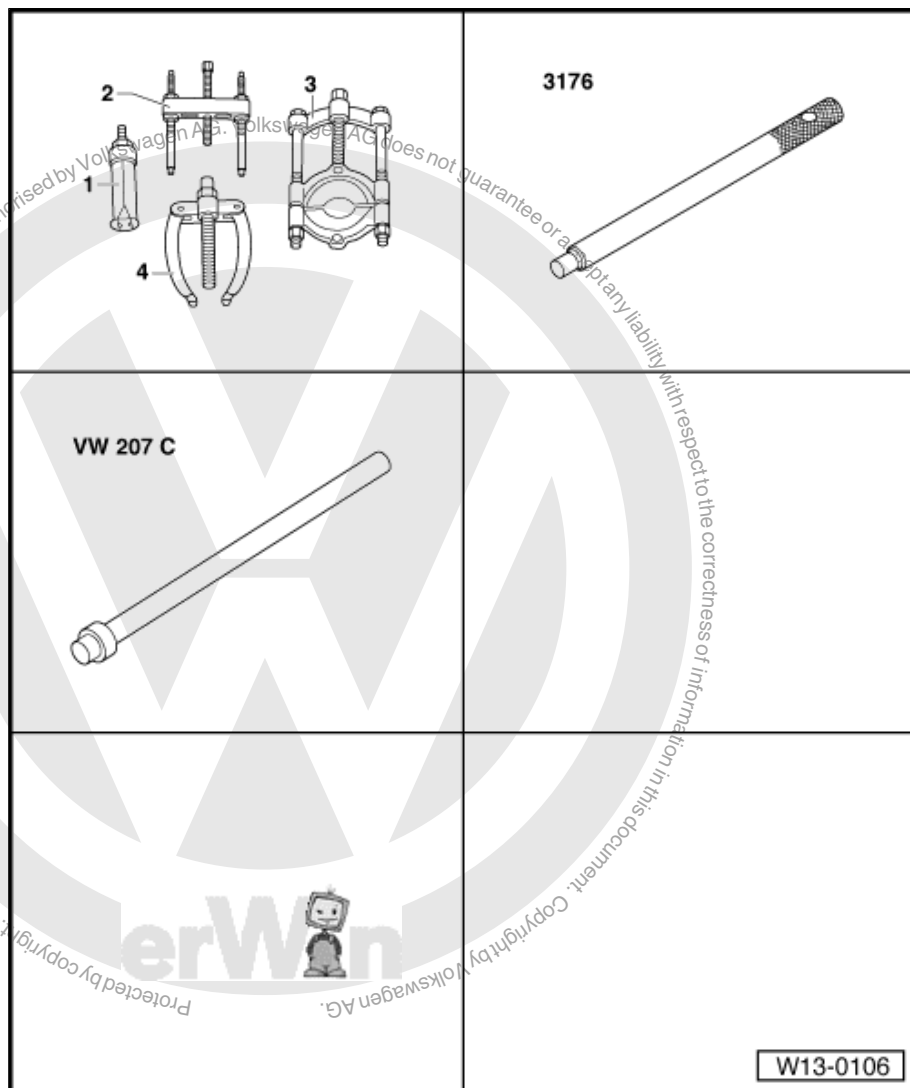




## 5.5 Renewing needle bearing in crankshaft

### 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

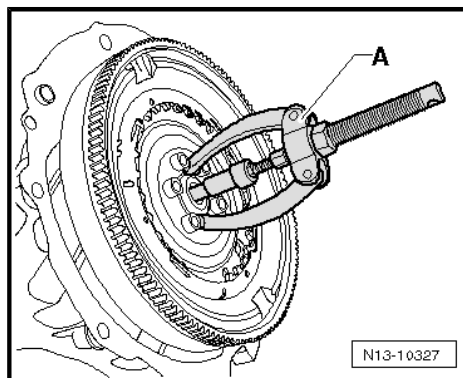
- Gearbox is separated from engine.
- Pull needle bearing out using commercially available internal puller, e.g. KUKKO 21/2 and KUKKO 22/1, -A-.

### Installing



#### Note

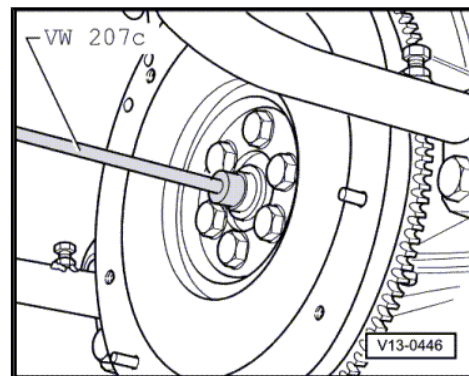
*The lettering on the needle bearing must be visible when installed.*



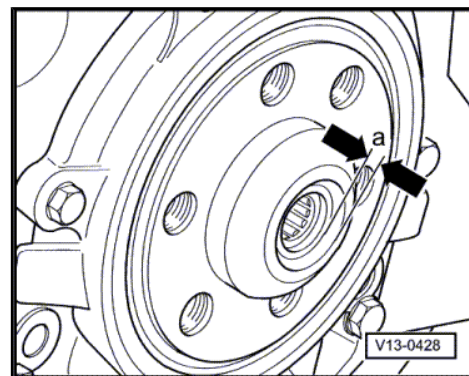




- Drive in needle bearing using drift - VW 207 C- or centring mandrel - 3176- .
- Drive needle bearing in carefully.
- Constantly measure insertion depth when driving in.
- Renew bearing, if driving depth is too deep.



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







## 15 – Cylinder head, valve gear

### 1 Cylinder head

⇒ [“1.1 Assembly overview - cylinder head”, page 78](#)

⇒ [“1.2 Assembly overview - cylinder head cover”, page 81](#)

⇒ [“1.3 Removing and installing cylinder head”, page 85](#)

⇒ [“1.4 Removing and installing cylinder head cover”, page 93](#)

⇒ [“1.5 Removing and installing injector seals”, page 99](#)

⇒ [“1.6 Removing and installing vacuum pump”, page 102](#)

⇒ [“1.7 Checking compression”, page 103](#)

#### 1.1 Assembly overview - cylinder head



##### Note

- ◆ *The plastic packing pieces for protecting the open valves must not be removed until immediately before fitting cylinder head.*
- ◆ *If the cylinder head is replaced, all the coolant in the system must also be renewed.*





## 1 - Cylinder head

- ☐ After renewing, renew entire coolant.
- ☐ Check for distortion  
⇒ [page 80](#).
- ☐ Removing and installing  
⇒ [page 85](#).

## 2 - Washer

## 3 - Cylinder head bolt

- ☐ Renew after removing
- ☐ Before installing, place washers in cylinder head  
⇒ [Item 2 \(page 79\)](#).
- ☐ Observe sequence when loosening and tightening ⇒ [page 80](#).

## 4 - Oil pressure switch - F1-

- ☐ Identification: green
- ☐ 0.5 bar
- ☐ If seal is leaking, nip open and renew.
- ☐ Checking ⇒ [page 156](#).
- ☐ Removing and installing  
⇒ [page 154](#).
- ☐ 22 Nm

## 5 - Centre hex stud

- ☐ 25 Nm

## 6 - Lifting eye

## 7 - Glow plug

- ☐ 18 Nm

## 8 - Gasket

- ☐ Renew after removing

## 9 - Vacuum pump



### DANGER!

*The vacuum pump may, under no circumstances, be dismantled as the vacuum part could otherwise malfunction. This would result in the failure of the brake servo.*

- ☐ Removing and installing ⇒ [page 102](#).

## 10 - Bolt

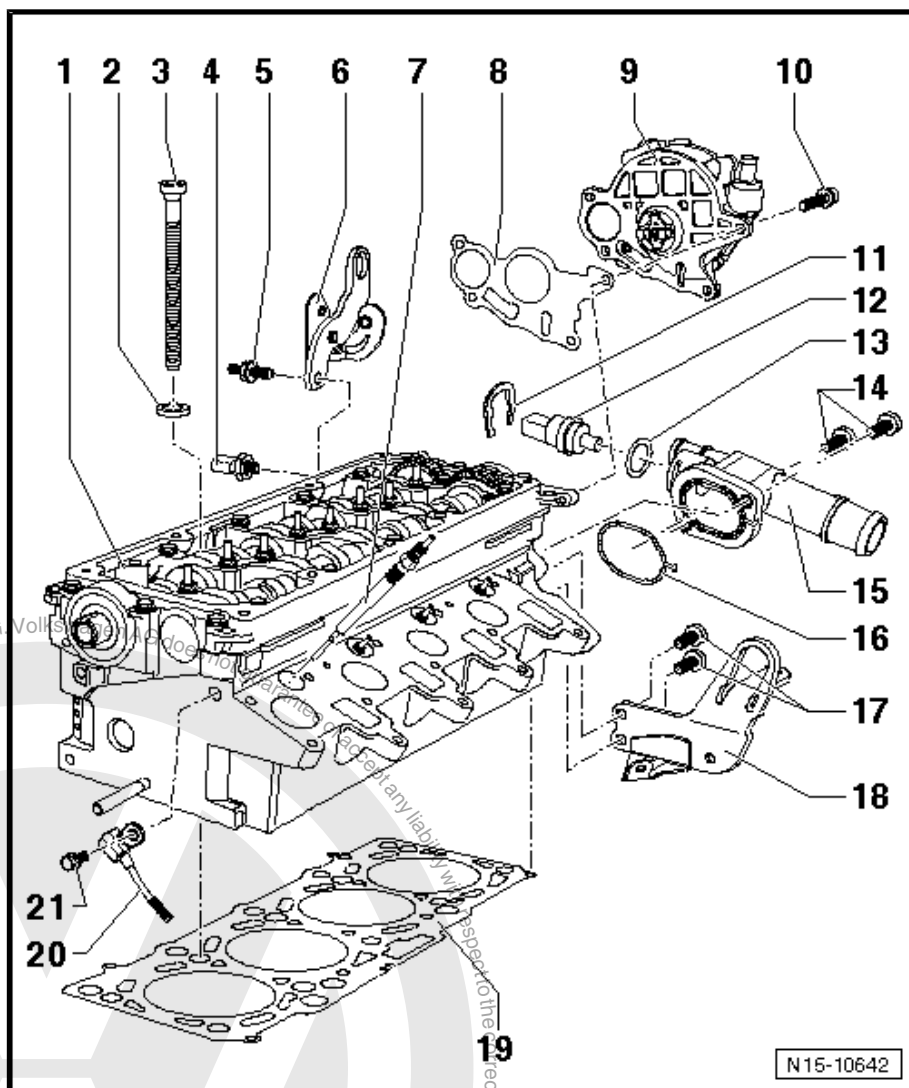
- ☐ 10 Nm

## 11 - Clip

## 12 - Coolant temperature sender - G62-

## 13 - Seal

- ☐ Renew after removing







**14 - Bolt**

- ☐ 10 Nm

**15 - Coolant hose connection**

**16 - Gasket**

- ☐ Renew after removing

**17 - Bolt**

- ☐ 25 Nm

**18 - Lifting eye**

**19 - Cylinder head gasket**

- ☐ Renew after removing
- ☐ Note marking ⇒ [page 81](#) .

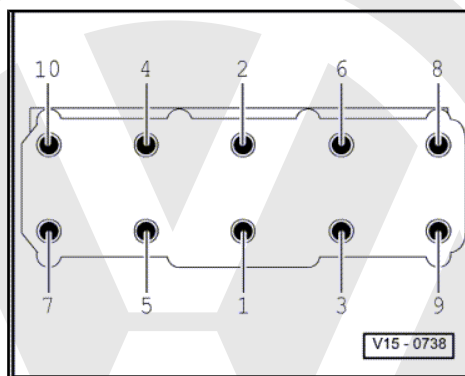
**20 - Hall sender - G40-**

- ☐ For camshaft position.
- ☐ Removing and installing ⇒ [page 407](#) .

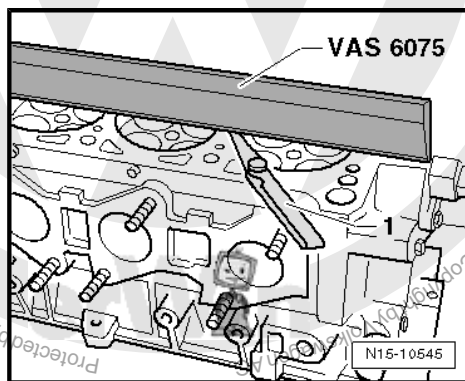
**21 - Bolt**

- ☐ 10 Nm

**Observe tightening sequence of cylinder head bolts.**



**Checking cylinder head for distortion**



**Special tools and workshop equipment required**

- ◆ Straightedge 500 mm - VAS 6075-
- ◆ Feeler gauge -1-

Max. permissible distortion: 0.1 mm.



**Note**

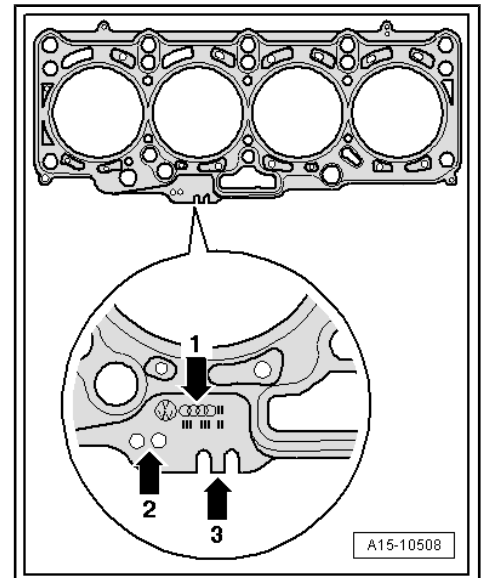
*Reworking diesel cylinder heads is not permissible.*

**Cylinder head gasket identification**

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

**Note**

- ◆ *Different thicknesses of cylinder head gasket are fitted depending on the piston projection. When renewing gasket, install new gasket with same identification.*
- ◆ *Piston projection in genuine part must be determined when installing new pistons or a short engine ⇒ [page 70](#).*



## 1.2 Assembly overview - cylinder head cover

### 1 - High-pressure accumulator (fuel rail)

- ☐ Do not attempt to re-shape high-pressure lines.
- ☐ Observe rules for cleanliness ⇒ [page 7](#).
- ☐ Removing and installing high-pressure lines ⇒ [page 338](#).

### 2 - Bolt

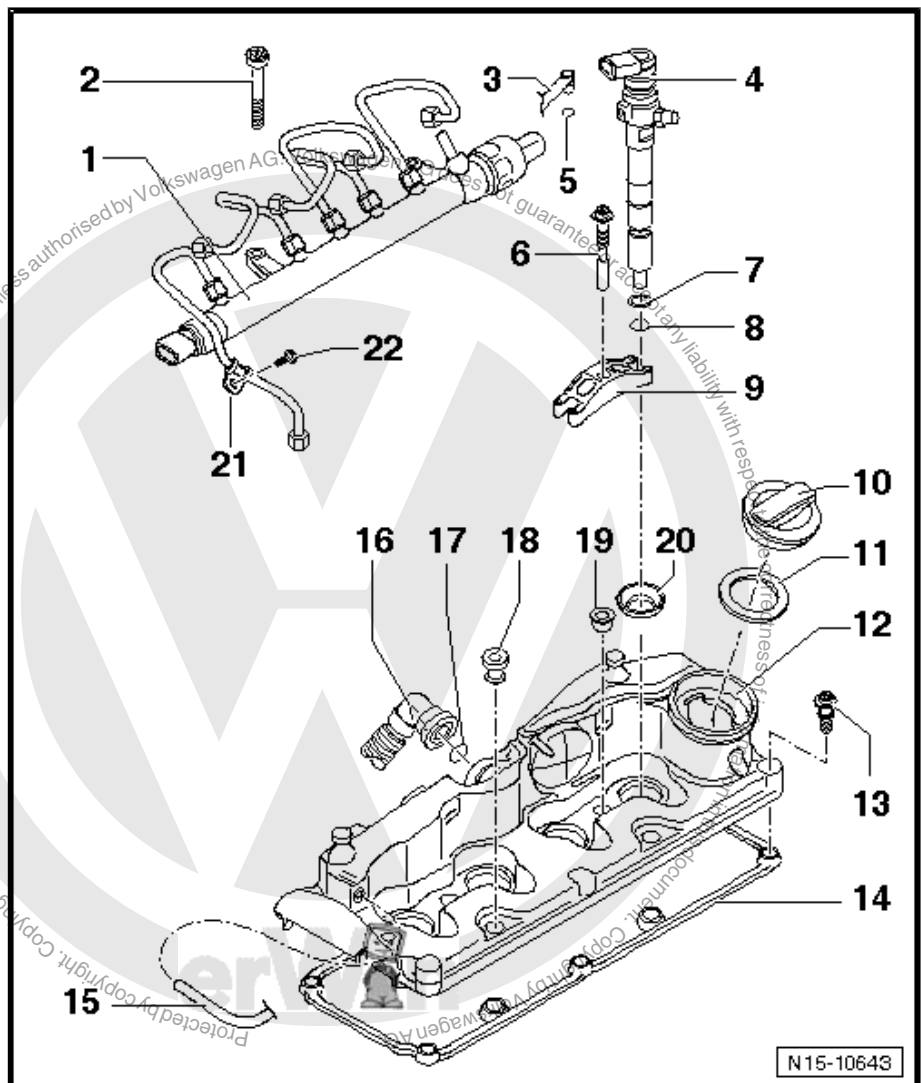
- ☐ 22 Nm

### 3 - Fuel return line

- ☐ Cannot be renewed separately
- ☐ To fuel tank.
- ☐ The fuel return line must not be kinked, damaged or blocked.
- ☐ The fuel return lines must not be dismantled.
- ☐ Removing ⇒ [page 83](#)
- ☐ Checking catches ⇒ [page 83](#).
- ☐ Fitting ⇒ [page 83](#)
- ☐ Lock ⇒ [page 84](#)

### 4 - Injector

- ☐ If the injectors are to be re-installed, they must always be re-fitted on the same cylinder.
- ☐ Before re-using "high-pressure line", perform







visual check of taper  
seals for damage, e.g. transverse scores or corrosion. Always renew pipe if damaged.

- ☐ Removing and installing ⇒ [page 327](#) .

#### 5 - O-ring

- ☐ Renew after removing

#### 6 - Bolt

- ☐ Renew after removing
- ☐ 8 Nm +180°

#### 7 - O-ring

- ☐ Renew after removing

#### 8 - Seal

- ☐ Renew after removing

#### 9 - Clamping plate

#### 10 - Cap

#### 11 - Gasket

#### 12 - Cylinder head cover

- ☐ Removing and installing ⇒ [page 93](#) .

#### 13 - Bolt

- ☐ Renew seal if damaged
- ☐ Tightening sequence ⇒ [page 84](#) .
- ☐ 10 Nm

#### 14 - Gasket

- ☐ Renew if damaged or leaking.

#### 15 - Vacuum hose

#### 16 - Pipe assembly

- ☐ For crankcase ventilation.
- ☐ Press release buttons to remove.

#### 17 - O-ring

- ☐ Renew if damaged or leaking.

#### 18 - Grommet

#### 19 - Sealing bush for high-pressure accumulator (fuel rail)

- ☐ Renew if damaged or leaking.

#### 20 - Injector seal

- ☐ Renew if damaged or leaking ⇒ [page 99](#) .

#### 21 - Bracket

#### 22 - Bolt

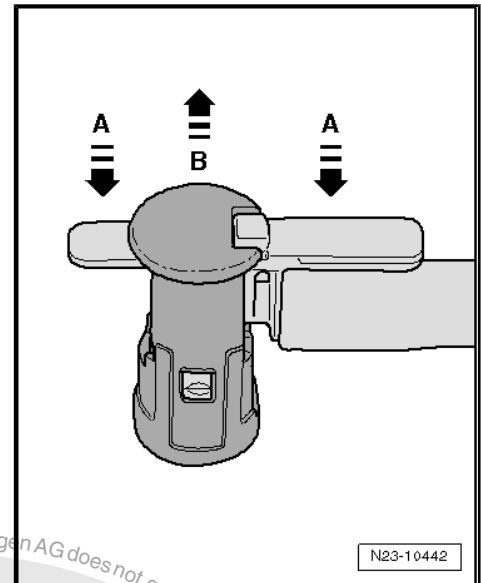
- ☐ 10 Nm





### Disconnecting fuel return lines

- With engine switched off, carefully pull return line connections off at piezo injectors. To do this, press the two clips downwards -arrow A- and, at the same time, pull the release bolt upwards -arrow B-.

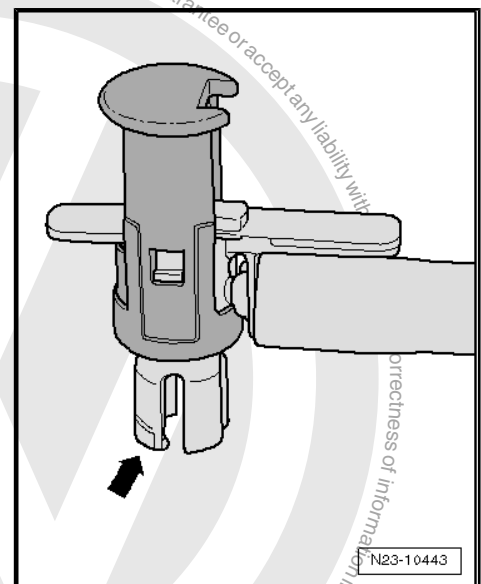


### Check catches



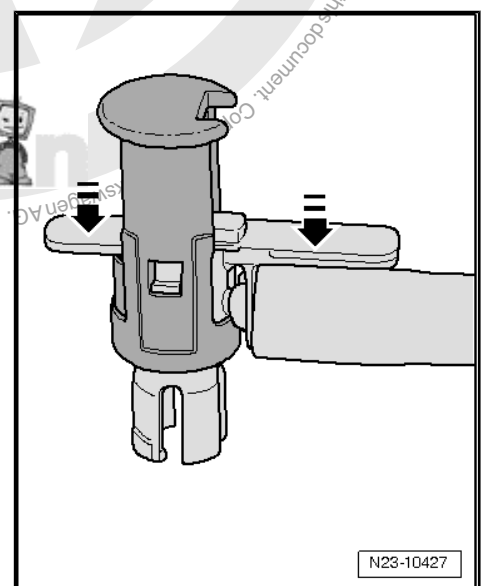
#### Caution

- Carefully pull fuel return lines upwards when disconnecting as the 4 catches -arrow- can fracture.
- After disconnecting, check the 4 catches -arrow- to see whether they are fractured or have broken off.
- Always replace damaged fuel return lines.
- A damaged fuel return line that becomes loose when engine is running causes damage to piezo injector. The piezo injector must then be replaced.



### Fit fuel return line

- Apply a thin coating of diesel fuel to the new O-rings on the return-line connections.
- Connect fuel return line and press the two clips downwards as far as they will go -arrows-.

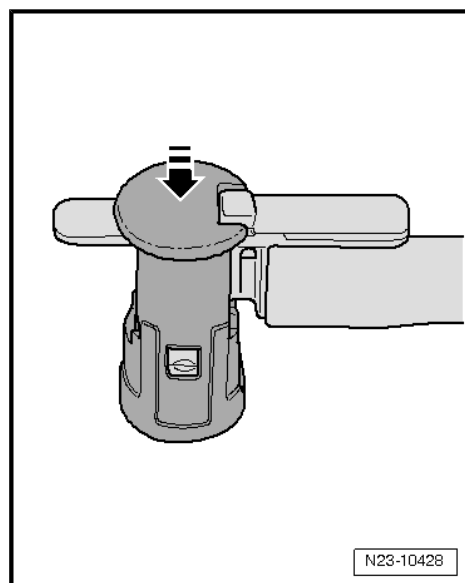






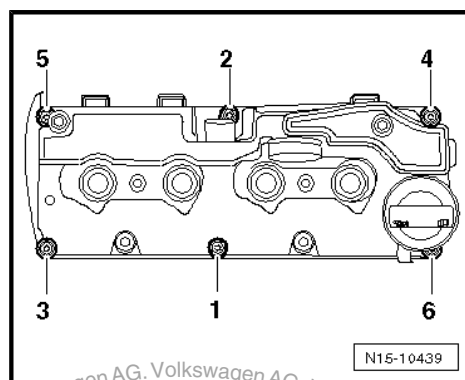
### Lock fuel return line

- After fuel return line has been pushed on completely, press the locking bolt downwards -arrow-.



### Tightening sequence for cylinder head cover

- Hand-tighten cylinder head cover in the sequence -1 ... 6-.
- Tighten bolts in the sequence -1 ... 6-.



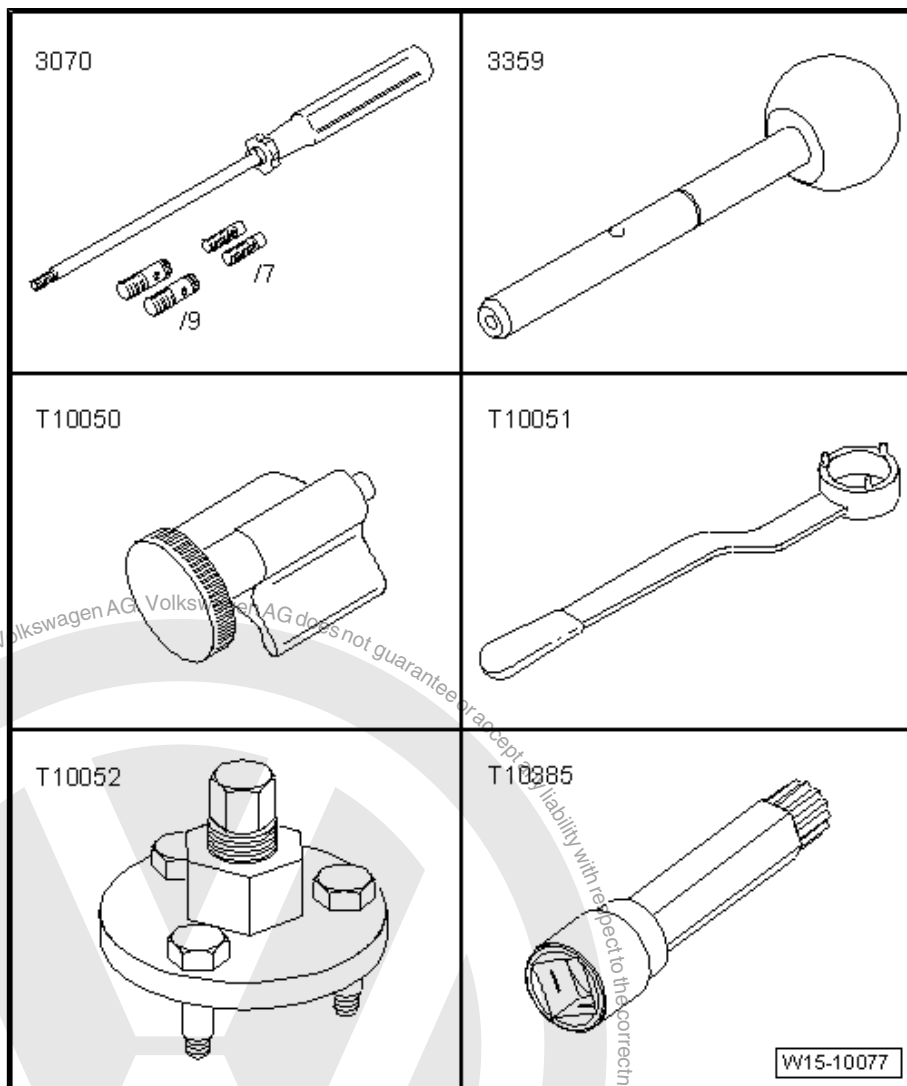




### 1.3 Removing and installing cylinder head

#### 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-
- ◆ Vehicle diagnostic tester

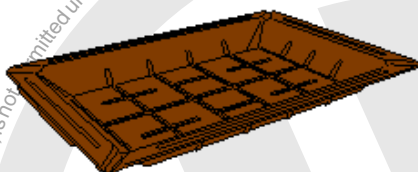
**V.A.G. 1331**



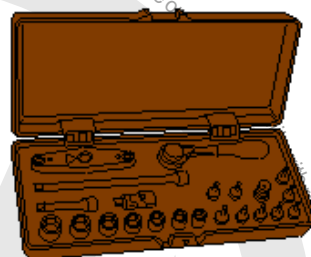
**V.A.G. 1332**



**VA S 6208**



**VA S 5528**



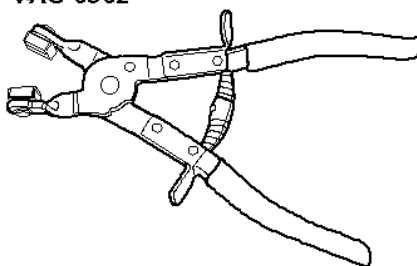
**VA S 6122**



W15-10128

- ◆ Hose clip pliers - VAS 6362-

**VAS 6362**



W00-10427



**Note**

- ◆ Before carrying out further work, disconnect battery earth strap. Check whether a coded radio is fitted. Obtain anti-theft coding first if necessary.
- ◆ 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:**

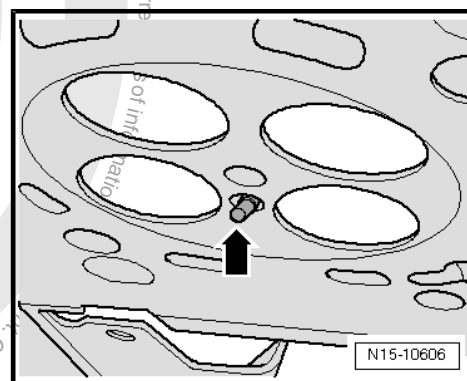
- ◆ Route all the various lines (e.g. for fuel, hydraulics, activated charcoal filter system, coolant and refrigerant, brake fluid and vacuum) and electrical wiring in their original positions.
- ◆ To avoid damage to lines, ensure sufficient clearance from all moving or hot components.

**Note**

Glow plugs -arrows- project out of cylinder head. After removal, the cylinder head must not be placed on the glow plugs. If necessary, remove glow plugs ⇒ [page 405](#) .

**Removing**

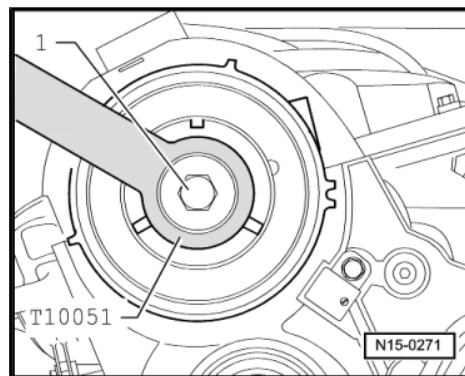
- Remove underbody guard, if fitted ⇒ General body repairs, exterior; Rep. gr. 66 ; Underbody guard .
- Disconnect battery earth strap with ignition switched off ⇒ Electrical system; Rep. gr. 27 ; Disconnecting and reconnecting battery .
- Drain coolant ⇒ [page 182](#) .
- Remove toothed belt ⇒ [page 107](#) .
- Remove camshaft pulley from hub.
- Remove camshaft hub. To do this, pull camshaft hub off using puller - T10052- .



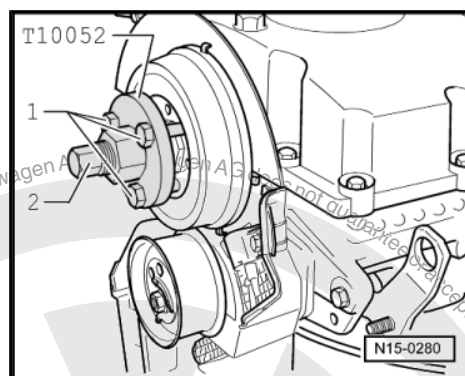




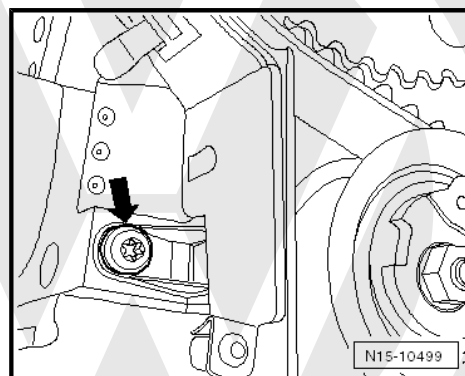
- Counterhold hub with counter-hold tool - T10051- and release hub bolt -1-.
- Unscrew hub bolt approx. 2 turns.



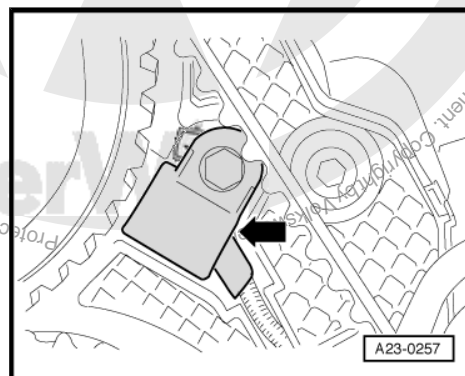
- Position puller - T10052- and align with hub holes.
- Tighten bolts -1-.
- Apply tension to hub by evenly tightening puller -2- until hub separates from taper of camshaft. Hold puller with 30 mm spanner whilst doing this.
- Remove hub from taper of camshaft.



- Unscrew bolt -arrow- from toothed belt guard.



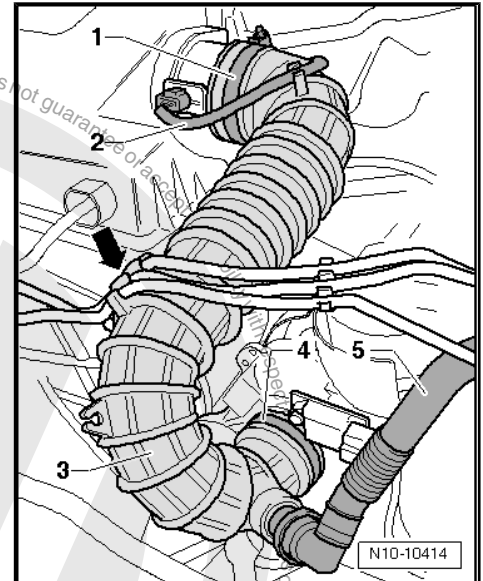
- Screw off Hall sender - G40- -arrow-.
- Release and pull off connector -1-.



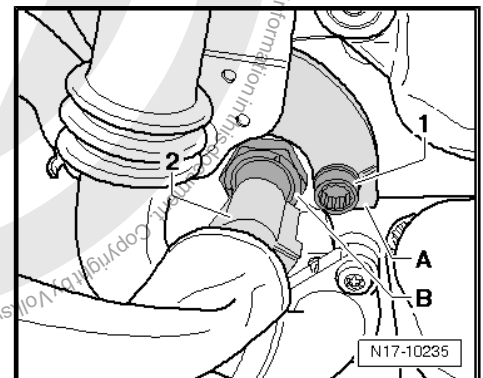




- Detach hoses from intake hose -3- bracket -arrow-.
- Remove pipe -5- from cylinder head cover.
- Release and pull off wiring harness connector -2-. Detach wiring harness -2- from intake hose retainer -3-.
- Open clips -1- and -4- and remove intake hose -3-.
- Remove air filter with attachments ⇒ [page 370](#) .
- Remove particulate filter ⇒ [page 381](#) .
- Remove turbocharger ⇒ [page 267](#) .



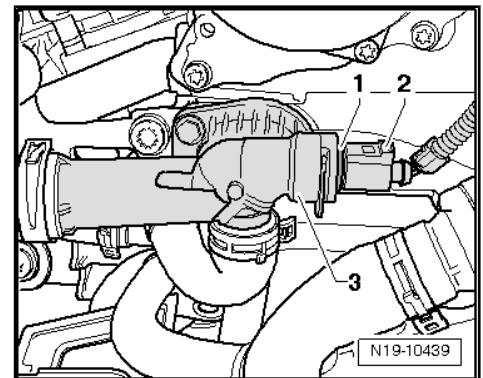
- Unclip connector -2- on oil pressure switch - F1- .



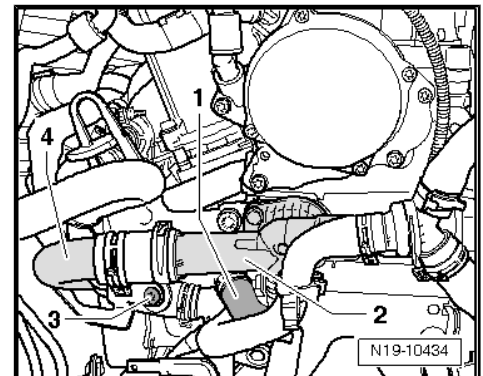
- Disconnect connector -2- at coolant temperature sender - G62- -1-.

**Note**

*Components for coolant temperature sender - G62- are difficult to see. A small hand-held mirror is required to unscrew and insert coolant temperature sender - G62- .*



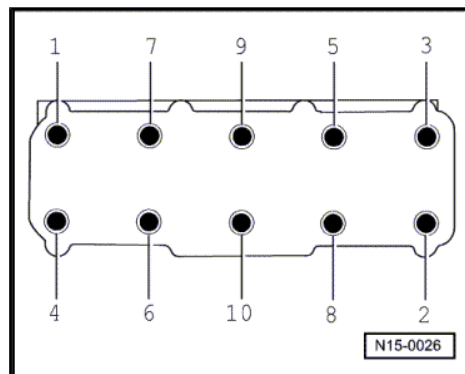
- Loosen clamp for coolant hose -1- and pull off coolant hose -1-.
- Loosen clamp for coolant pipe -4- and pull coolant pipe -4- out at union -2-.
- Remove cylinder head cover ⇒ [page 93](#) .
- Remove intake manifold ⇒ [page 354](#) .
- Remove/pull off all necessary coolant hoses, vacuum lines and plug-in electrical connectors.





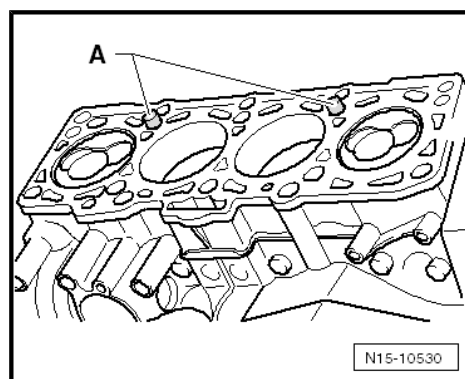


- Comply with specified sequence when undoing cylinder head bolts.



#### Note

- ◆ A second mechanic is required to remove and install the cylinder head.
- ◆ Before removing cylinder head, remove toothed belt tensioner from stud. Make sure that toothed belt tensioner does not fall to the floor.
- ◆ 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

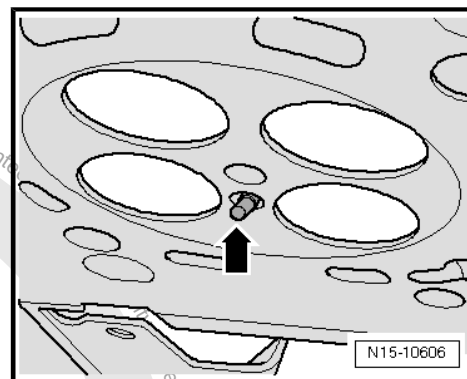
**Risk of damage to glow plug pins -arrow- when cylinder head is being lowered.**

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



**Caution****Avoid 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****Avoid 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.*

**Avoid damage to open valves.**

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

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

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

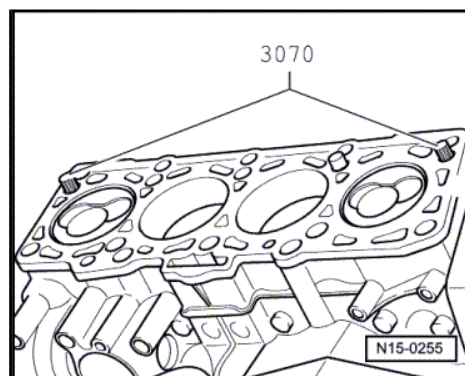




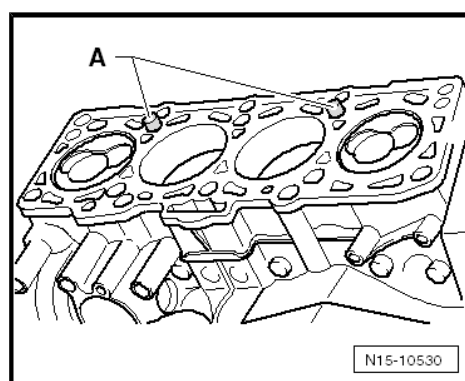
## Note

- ◆ *Proceed with extreme caution. The assistance of a second mechanic is vital.*
- ◆ *Always renew cylinder head bolts.*
- ◆ *Renew 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 182](#) and the engine oil must be changed.*

- 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 to stop by hand.
- Unscrew guide pins -3070/9- through bolt holes in cylinder head and screw remaining cylinder head bolts in to stop by hand.







### Cylinder head bolt tightening sequence

- Tighten cylinder head in 4 stages in sequence shown as follows:

1 - Tighten initially with torque wrench:

Stage I = 35 Nm

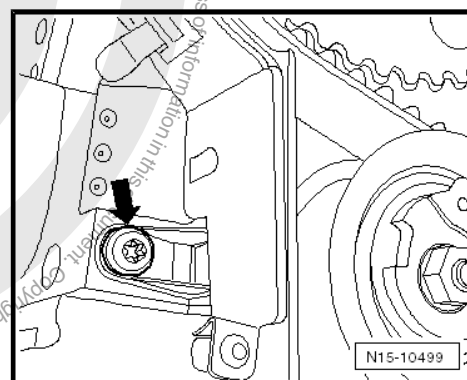
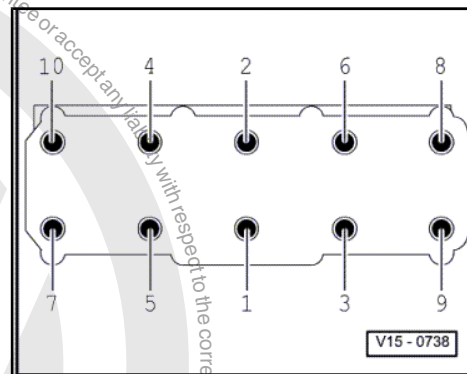
Stage II = 60 Nm

2 - Turn further with rigid spanner:

Stage III = 1/4 turn (90°)

Stage IV = 1/4 turn (90°)

- Secure bolt -arrow- of toothed belt guard.
- Install hub and camshaft pulley.
- Install toothed belt ➔ [page 107](#) .
- Installing turbocharger ➔ [page 267](#) .
- Install particulate filter ➔ [page 381](#) .
- Install cylinder head cover ➔ [page 93](#) .
- Install intake manifold ➔ [page 354](#) .
- Reconnect battery earth strap with ignition switched off ➔ Electrical system; Rep. gr. 27 ; Disconnecting and reconnecting battery .



**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 components of the fuel system between the fuel tank and the high-pressure pump are removed or renewed, it is necessary for the fuel system to be bled. To do this, perform the "Bleeding fuel system" function using the ➔ Vehicle diagnostic tester ➔ [page 316](#) .
- ◆ This process takes 130 seconds. Fuel pumps are actuated a total of 3 times in this case. The process must not be terminated prematurely.
- Carry out road test and read all event memories.

### Specified torques

- ◆ ➔ ["1.1 Assembly overview - cylinder head", page 78](#)
- ◆ ➔ ["1.2 Assembly overview - cylinder head cover", page 81](#)
- ◆ ➔ ["2.1 Assembly overview - toothed belt drive", page 105](#)
- ◆ ➔ ["2.1 Assembly overview - emission control \(diesel particulate filter\)", page 377](#)

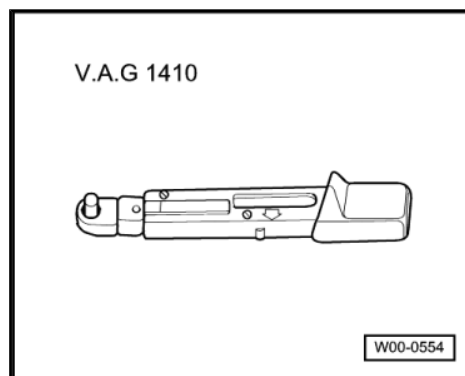
## 1.4 Removing and installing cylinder head cover

Special tools and workshop equipment required

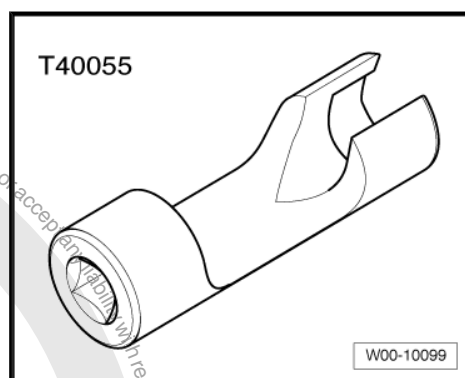




◆ Torque wrench - V.A.G 1410-



◆ Socket - T40055-

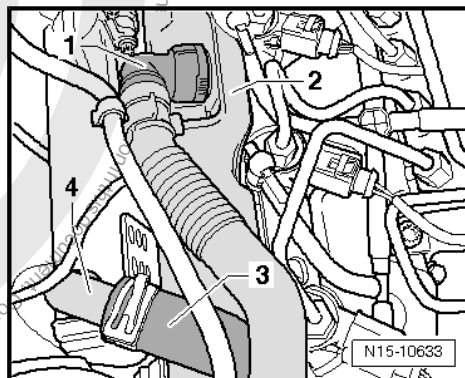


**Removing**

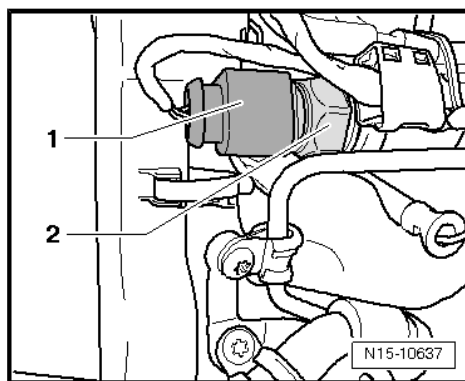
Observe safety precautions ⇒ [page 3](#) .

Observe rules for cleanliness ⇒ [page 7](#) .

- Unclip crankcase breather -1- from cylinder head cover -2-.
- Remove coolant hose -3- from exhaust gas recirculation cooler connection -4-.



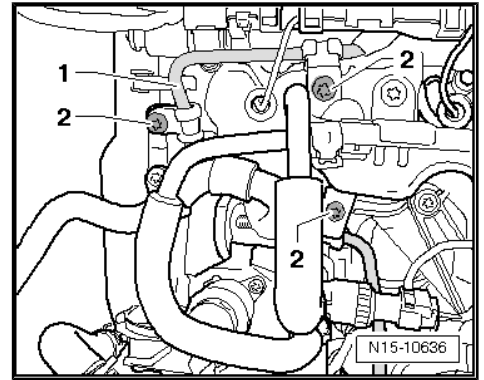
- Pull connector -2- off fuel pressure sender - G247- -1-.



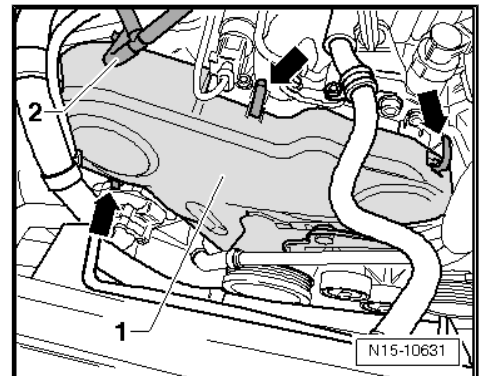




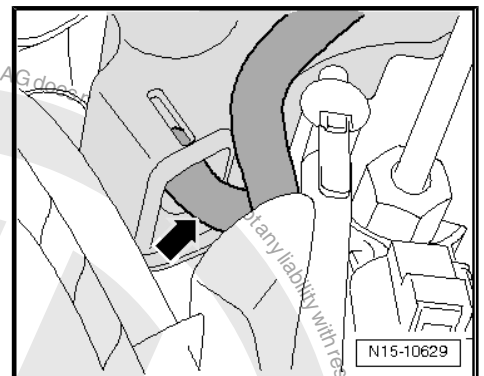
- Unscrew bolts -2- for fuel line -1-.



- Remove vacuum hose -2- from toothed belt guard -1-.
- Open clips -arrows- and remove toothed belt guard -1-.



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

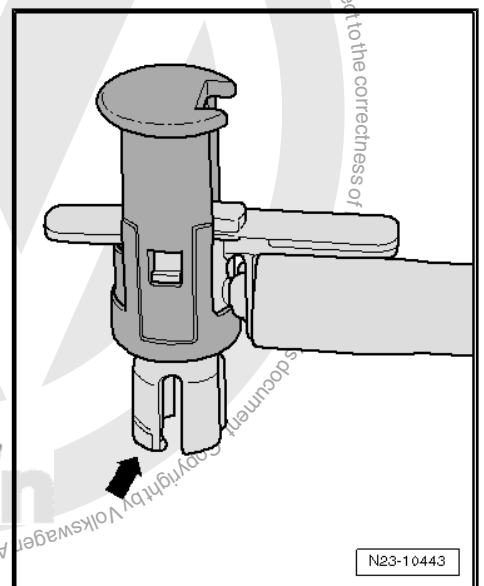


#### Disconnecting fuel return lines



#### Caution

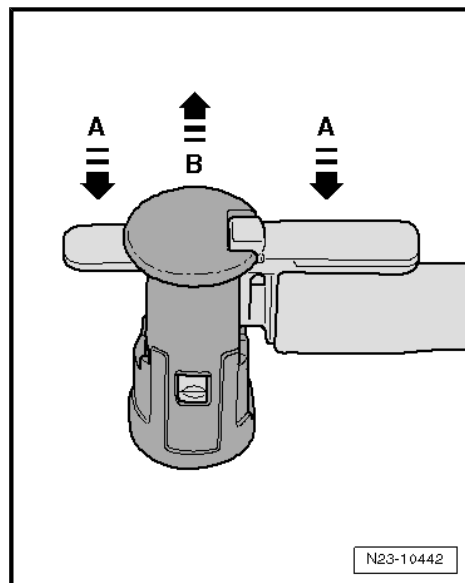
- *Carefully pull fuel return lines upwards when disconnecting as the 4 catches -arrow- can fracture.*
- *After disconnecting, check the 4 catches -arrow- to see whether they are fractured or have broken off.*
- *Always replace damaged fuel return lines.*
- *A damaged fuel return line that becomes loose when engine is running causes damage to piezo injector. The piezo injector must then be replaced.*



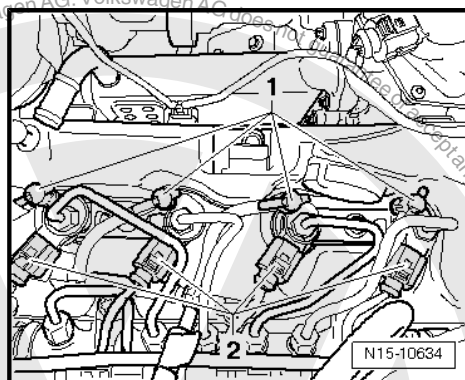




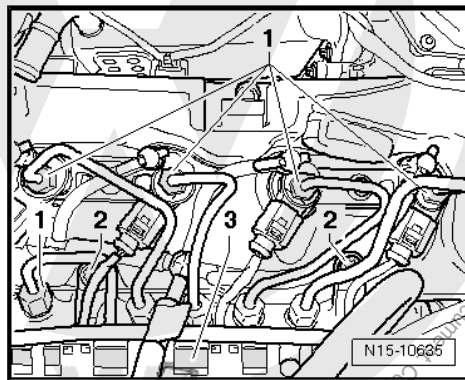
- With engine switched off, carefully pull return line connections off at piezo injectors. To do this, press the two clips downwards -arrow A- and, at the same time, pull the release bolt upwards -arrow B-.



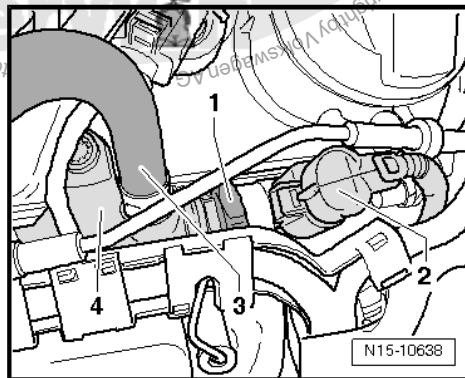
- Pull all fuel return lines -1- off piezo injectors.
- Release connectors -2- and pull them off piezo injectors.



- Unscrew union nuts -1- from piezo injectors.
- Ensure cleanliness. No dirt must be allowed to get into the disconnected fuel return lines or the open connections on the piezo injectors.
- Unscrew bolts -2- from high-pressure accumulator (fuel rail).
- Pull cable guide -3- from high-pressure accumulator (fuel rail).



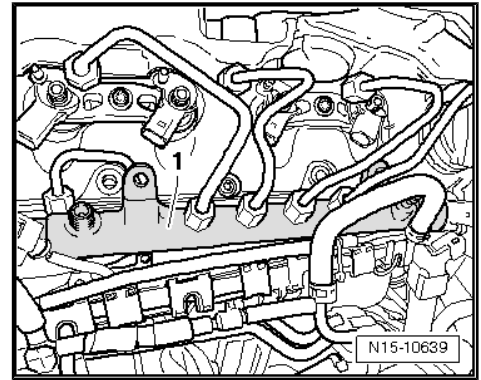
- Unclip connector -2- and pull off from fuel pressure regulating valve - N276- -1-.
- Pull fuel hose -3- from high-pressure accumulator (fuel rail) -4-.







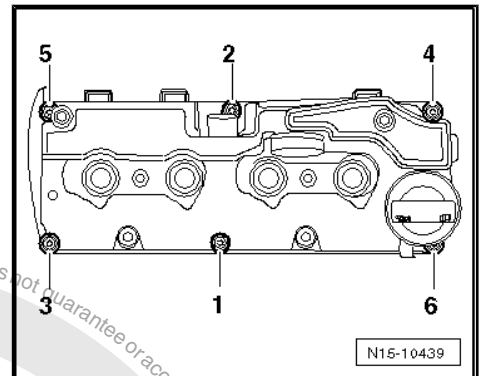
- Remove high-pressure accumulator (fuel rail) -1-. Guide high-pressure accumulator (fuel rail) past fuel return line and fuel lines.
- Ensure cleanliness. No dirt may get into the injector holes on the cylinder head cover.
- Remove injectors ⇒ [page 327](#) .



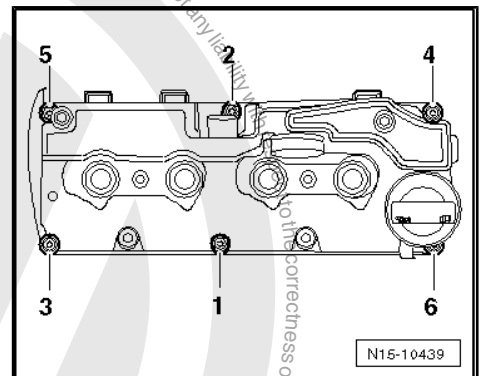
- Unscrew cylinder head cover bolts in the sequence -6 ... 1- and remove cylinder head cover.

### Installing

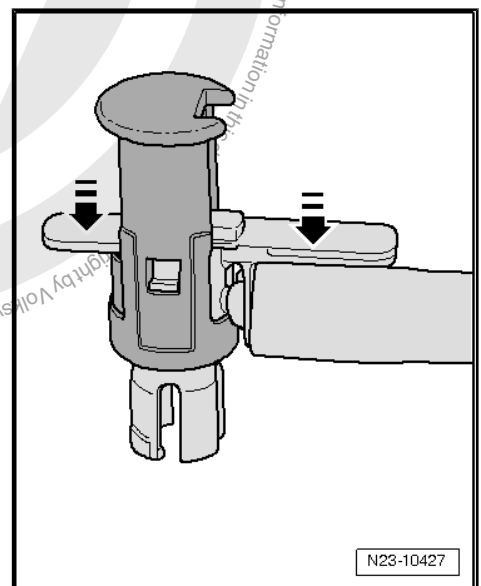
Installation is carried out in the reverse order; note the following:



- Hand-tighten cylinder head cover in the sequence -1 ... 6-.
- Tighten bolts in the sequence -1 ... 6-.
- Apply a thin coating of diesel fuel to the new O-rings on the return-line connections.



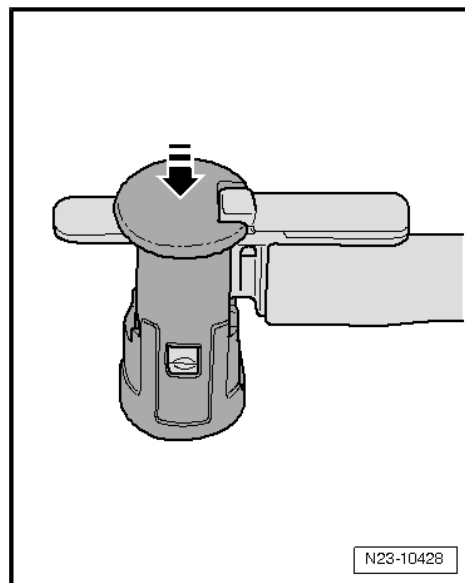
- Connect fuel return line and press the two clips downwards as far as they will go -arrows-.







- After fuel return line has been pushed on completely, press the locking bolt downwards -arrow-.



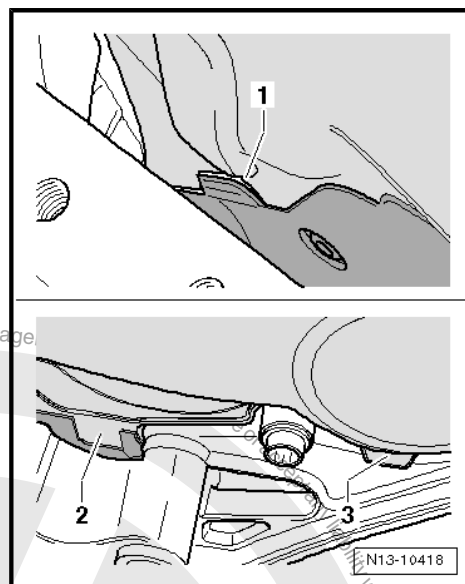
- First, fit top part of toothed belt guard to middle -1- of toothed belt guard from the rear.
- Then, fit toothed belt guard to middle -2- and -3- of toothed belt guard at the top.

**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 components of the fuel system between the fuel tank and the high-pressure pump are removed or renewed, it is necessary for the fuel system to be bled. To do this, perform the "Bleeding fuel system" function using the ⇒ Vehicle diagnostic tester ⇒ [page 316](#).
- ◆ This process takes 130 seconds. Fuel pumps are actuated a total of 3 times in the process. The process must not be terminated prematurely.

#### Specified torques

- ◆ ⇒ ["1.2 Assembly overview - cylinder head cover", page 81](#)



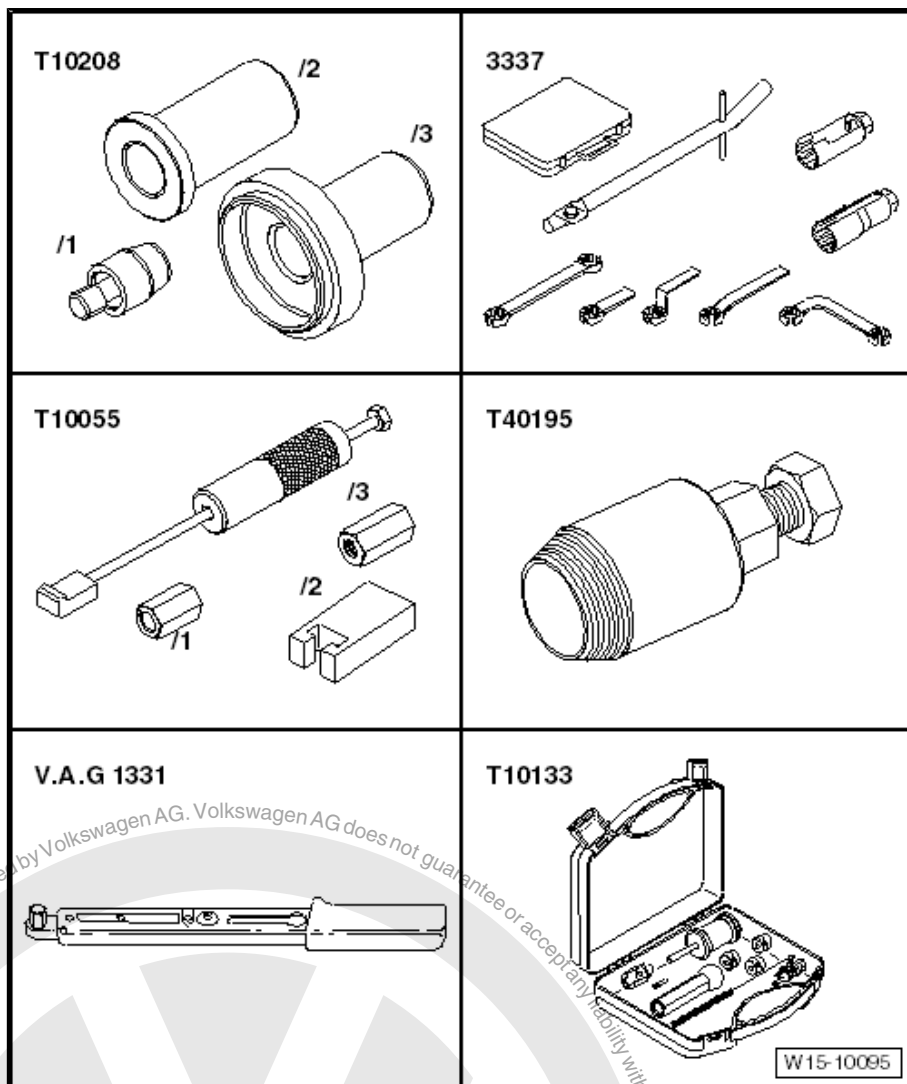




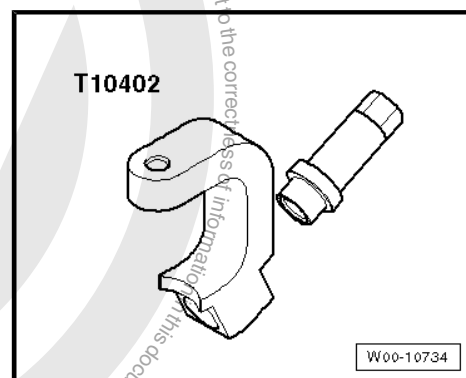
## 1.5 Removing and installing injector seals

### Special tools and workshop equipment required

- ◆ Lambda probe open ring spanner set - 3337-
- ◆ Tool set - T10055-
- ◆ Assembly tool - T10208/2-
- ◆ Torque wrench - V.A.G 1331-
- ◆ Tool set - T10133-
- ◆ Oil seal extractor - T 40195-



- ◆ Injector remover - T40402-



### Removing

Observe safety precautions [⇒ page 4](#).





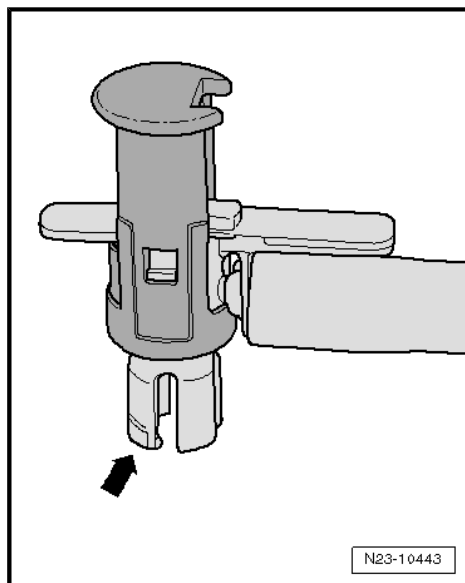
Observe rules for cleanliness ⇒ [page 8](#) .

### Disconnecting fuel return lines



#### Caution

- *Carefully pull fuel return lines upwards when disconnecting as the 4 catches -arrow- can fracture.*
- *After disconnecting, check the 4 catches -arrow- to see whether they are fractured or have broken off.*
- *Always replace damaged fuel return lines.*
- *A damaged fuel return line that becomes loose when engine is running causes damage to piezo injectors. The piezo injector must then be replaced.*



N23-10443

- With engine switched off, carefully pull return line connections off at piezo injectors. To do this, press the two clips downwards -arrow A- and, at the same time, pull the release bolt upwards -arrow B-.
- Remove only piezo injectors of which injector seal is to be renewed.
- Remove noise insulation at injectors.

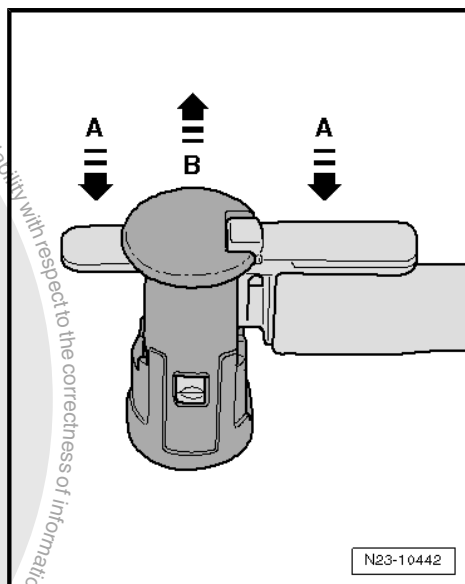


#### Caution

*You must therefore proceed very carefully in order to avoid unnecessary assembly work or further damage.*

*Ensure cleanliness. No dirt may get into the injector holes on the cylinder head cover.*

*First remove leaked oil or fuel with workshop equipment.*



N23-10442





- Position puller - T10055- with puller - T10402- -1- and -2- as shown and pull piezo injectors out upwards by tapping with head of sliding hammer.
- Screw oil seal extractor - T40195- forcibly as far as possible into seal by hand.

Pull injector seal out upwards by tapping using oil seal extractor - T40195- , adapter - T101333/2- and slide hammer - T10133/3- .

- After removal, check whether the spring washer is still on the old seal.

If not, check that spring washer does not remain in injector shaft.

### Installing

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



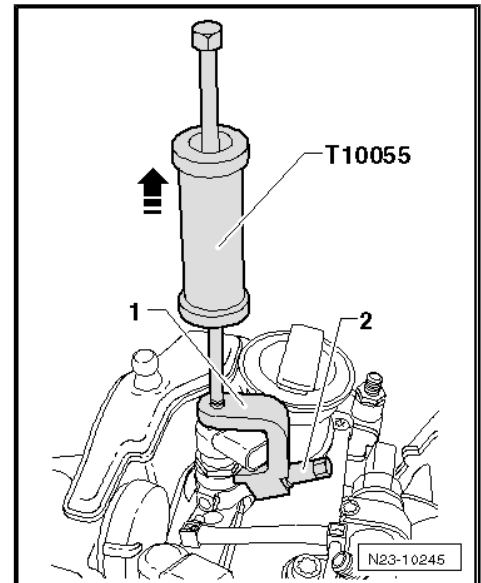
#### Caution

***You must therefore proceed very carefully in order to avoid unnecessary assembly work or further damage.***

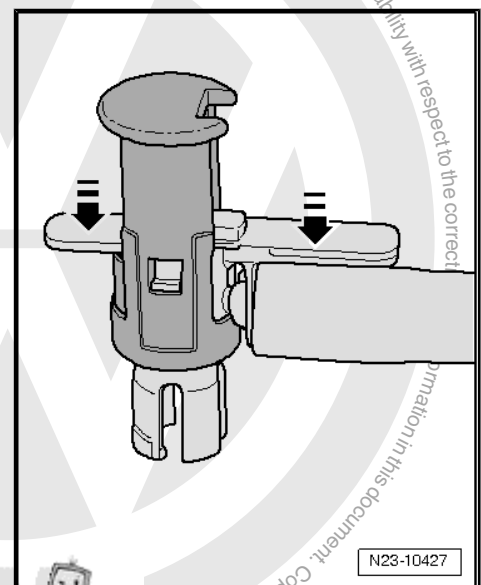
***Remember that the cylinder head cover is made of plastic.***

***A plastic cylinder head cover is damaged easily during repairs.***

***Check cylinder head cover for damage.***



- Initially position new injector seal by hand.
- Then carefully push new injector seal in to stop using assembly tool - T10208/2- .
- Apply a thin coating of diesel fuel to the new O-rings on the return-line connections.
- Connect fuel return line and press the two clips downwards as far as they will go -arrows-.



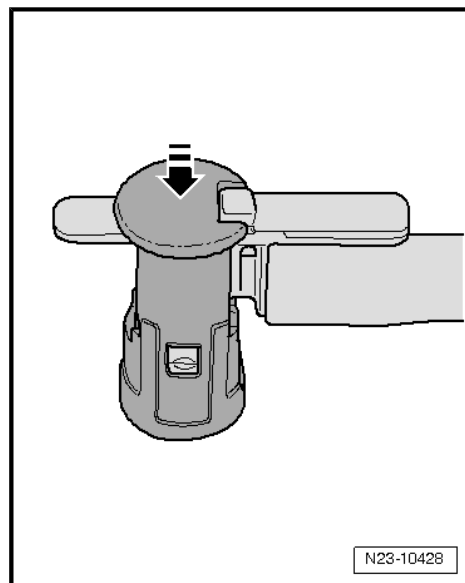




- After fuel return line has been pushed on completely, press the locking bolt downwards -arrow-.

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:

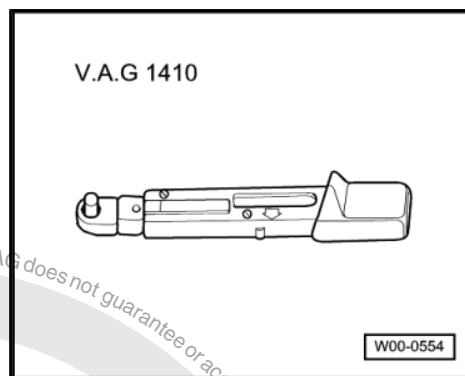
- ◆ If components of the fuel system between the fuel tank and the high-pressure pump are removed or renewed, it is necessary for the fuel system to be bled. To do this, perform the "Bleeding fuel system" function using the ⇒ Vehicle diagnostic tester ⇒ [page 316](#) .
- ◆ This process takes 130 seconds. Fuel pumps are actuated a total of 3 times in the process. The process must not be terminated prematurely.



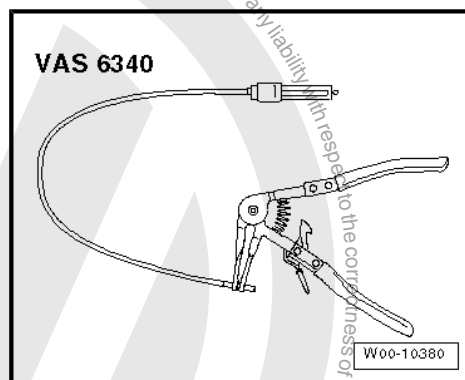
## 1.6 Removing and installing vacuum pump

Special tools and workshop equipment required

- ◆ Torque wrench - V.A.G 1410-



- ◆ Hose clip pliers - VAS 6340-



**DANGER!**

*The vacuum pump may, under no circumstances, be dismantled as the vacuum part could otherwise malfunction. This would result in the failure of the brake servo.*





## Removing

- Place cloths under vacuum pump -1-.
- Pull vacuum line -2- off vacuum pump -1-.
- Unscrew bolts -arrows- for vacuum pump -1-.
- Remove vacuum pump -1- from cylinder head.

## Installing

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



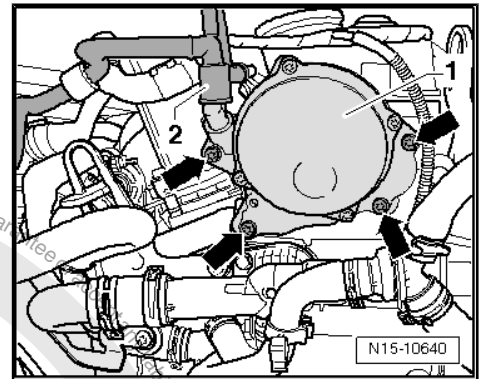
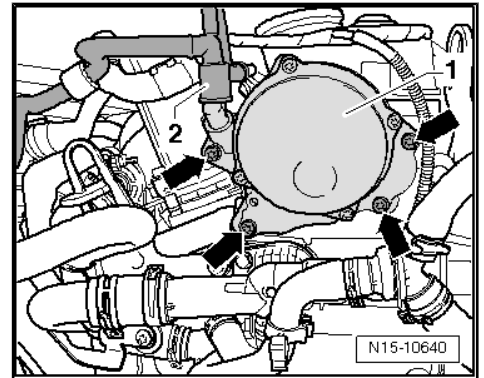
### Note

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

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

## Specified torques

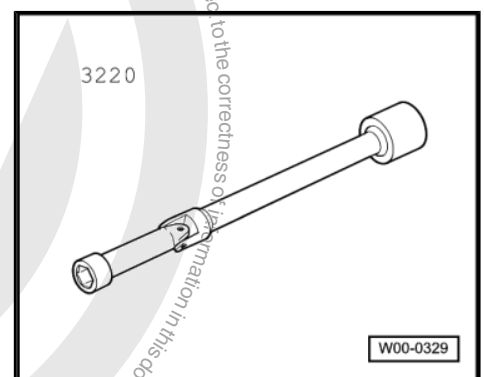
- ◆ ⇒ [“1.1 Assembly overview - cylinder head”](#), page 78



## 1.7 Checking compression

### Special tools and workshop equipment required

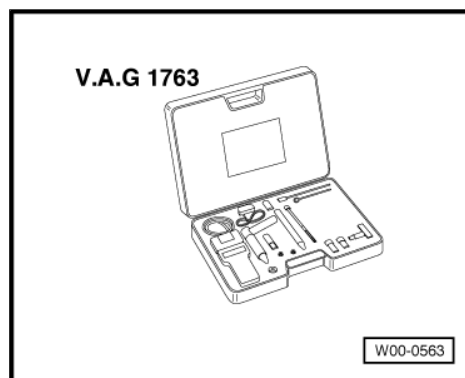
- ◆ Jointed spanner - 3220-







- ◆ 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

##### Procedure:

- Pull connectors off the injectors.
- Remove glow plug from relevant cylinder using U/J extension and 10 mm socket - 3220- ➔ [page 405](#) .
- 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:

New: 25...31 bar

Wear limit: 19 bar

Maximum permissible difference between all cylinders: 5 bar

- Install glow plugs with U/J extension and 10 mm socket - 3220- ➔ [page 405](#) .
- Read engine control unit event memory ➔ Vehicle diagnostic tester.





## 2 Toothed belt drive

⇒ "2.1 Assembly overview - toothed belt drive", page 105

⇒ "2.2 Removing and installing toothed belt", page 107

### 2.1 Assembly overview - toothed belt drive

#### 1 - Toothed belt

- ☐ Mark direction of rotation before removing.
- ☐ Check for wear.
- ☐ Do not kink.
- ☐ Removing and installing  
⇒ [page 107](#).

#### 2 - Bolt

- ☐ Renew after removing
- ☐ Use counterhold tool - 3415- to loosen and tighten.
- ☐ Do not additionally oil or grease the threads and shoulder.
- ☐ Turning further can be done in several stages.
- ☐ 120 Nm + 90°

#### 3 - Crankshaft toothed belt pulley

#### 4 - Nut

- ☐ 20 Nm

#### 5 - Idler roller

#### 6 - Nut

- ☐ 20 Nm + 45°

#### 7 - Tensioning roller

#### 8 - Bolt

- ☐ 20 Nm + 45°

#### 9 - Camshaft pulley

#### 10 - Bolt

- ☐ 20 Nm

#### 11 - Bolt

- ☐ 100 Nm

#### 12 - Hub

- ☐ Use counterhold tool - T10051- to loosen and tighten.
- ☐ To remove, use puller - T10052- .
- ☐ Removing and installing ⇒ [page 85](#).

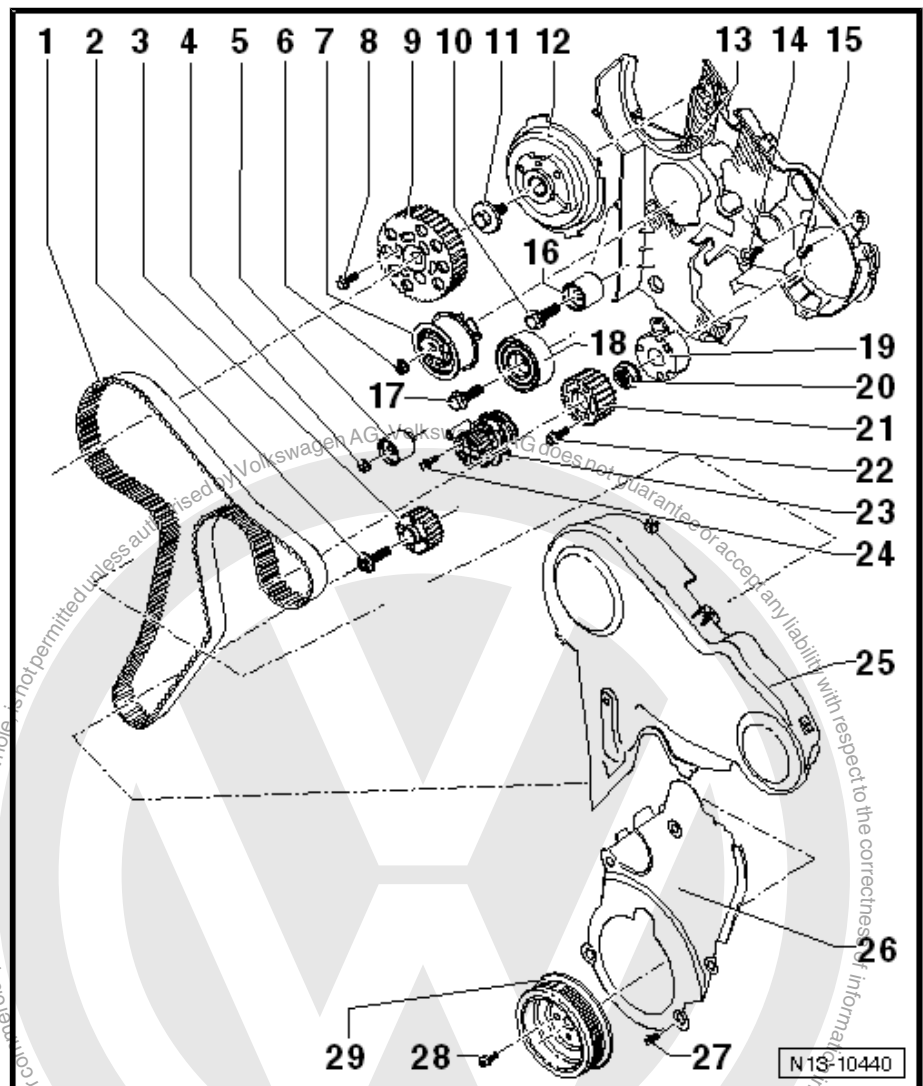
#### 13 - Rear toothed belt guard

#### 14 - Bolt

- ☐ 20 Nm

#### 15 - Bolt

- ☐ Renew after removing







- ☐ 10 Nm

#### 16 - Idler roller

#### 17 - Bolt

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

#### 18 - Idler roller

#### 19 - Hub

- ☐ Use counterhold tool - T10051- to loosen and tighten.
- ☐ To remove, use puller - T40064-.
- ☐ Removing and installing ⇒ [page 347](#) .

#### 20 - Nut

- ☐ 95 Nm

#### 21 - Toothed belt pulley on high-pressure pump

#### 22 - Bolt

- ☐ Renew after removing
- ☐ 23 Nm

#### 23 - Coolant pump

- ☐ Removing and installing ⇒ [page 187](#)

#### 24 - Bolt

- ☐ 15 Nm

#### 25 - Toothed belt guard upper part

#### 26 - Toothed belt guard lower part

#### 27 - Bolt

- ☐ Renew after removing
- ☐ 10 Nm

#### 28 - Bolt

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

#### 29 - Belt pulley and vibration damper

- ☐ Assembly through offset holes only possible in one position
- ☐ Removing and installing ⇒ [page 44](#)

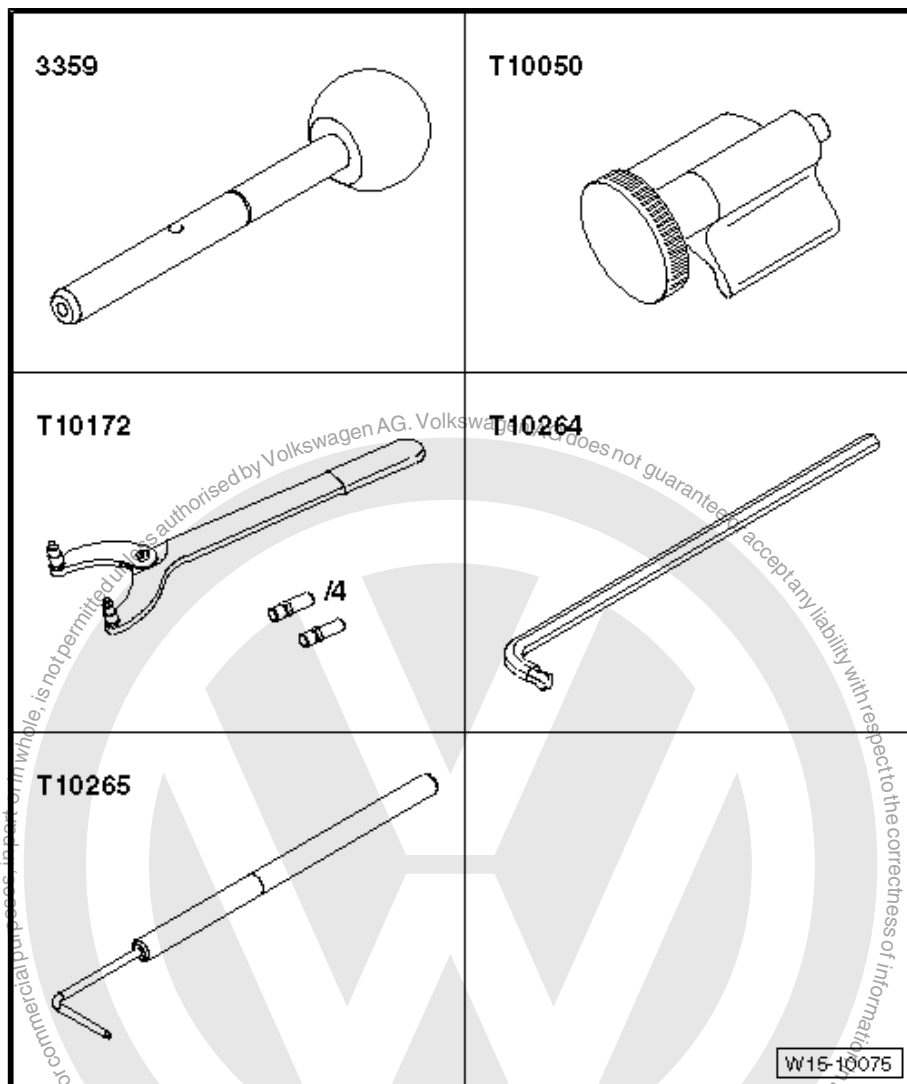




## 2.2 Removing and installing toothed belt

### Special tools and workshop equipment required

- ◆ Locking pin - 3359-
- ◆ Crankshaft stop - T10050-
- ◆ Counterhold tool - T10172-
- ◆ Special wrench, long reach - T10264-
- ◆ Locking tool - T10265-



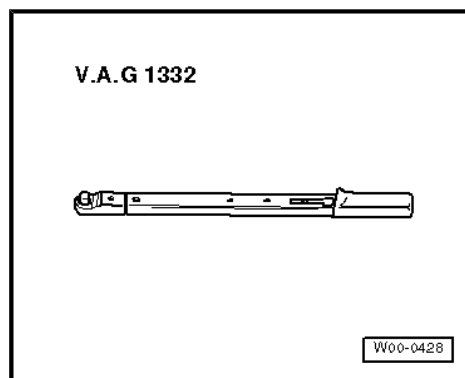
- ◆ Torque wrench (5...50 Nm) - V.A.G 1331-







- ◆ Torque wrench (40...200 Nm) - V.A.G 1332-



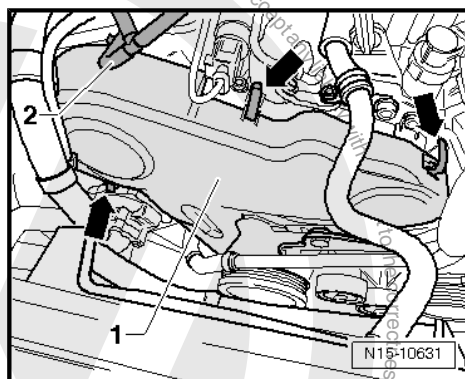
## Removing



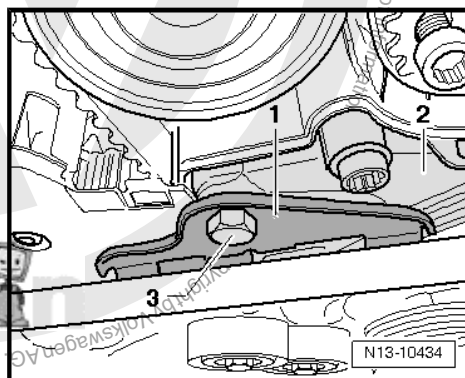
### Note

*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.*

- Remove underbody guard, if fitted ⇒ General body repairs, exterior; Rep. gr. 66 ; Underbody guard
- Remove poly V-belt ⇒ [page 40](#) .
- Detach vacuum hose -2- from upper toothed belt guard -1-.
- Open clips -arrows- and remove toothed belt guard -1-.



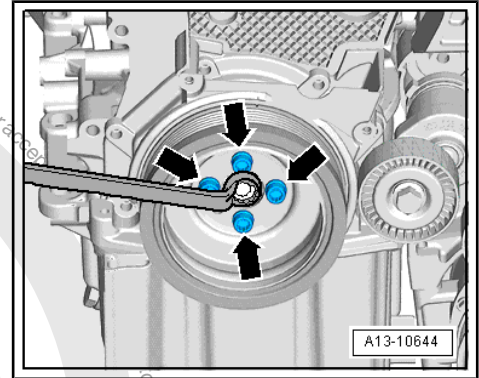
- Unscrew bolt -3- for bracket -1-.



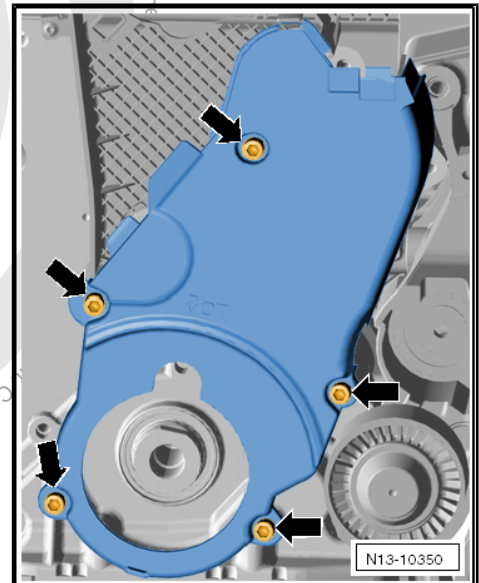




- Unscrew bolts -arrows-. Counterhold at central bolt to do this.
- Relax poly V-belt tensioning element.



- Remove lower toothed belt guard. To do this, unscrew bolts -arrows-.

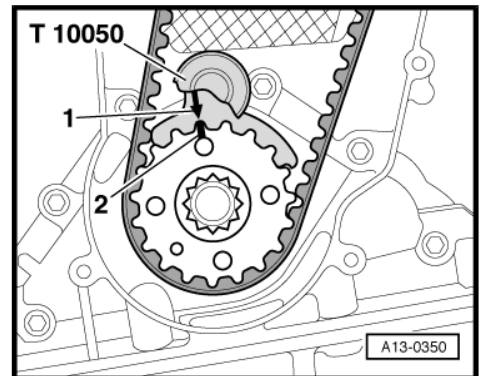


- Turn engine to TDC and lock crankshaft toothed belt pulley in position with crankshaft stop - T10050-. To do this, push the crankshaft stop into the teeth of the toothed belt pulley from the latter's face side. The toothed segment of the camshaft must be at the »12 o'clock position«.



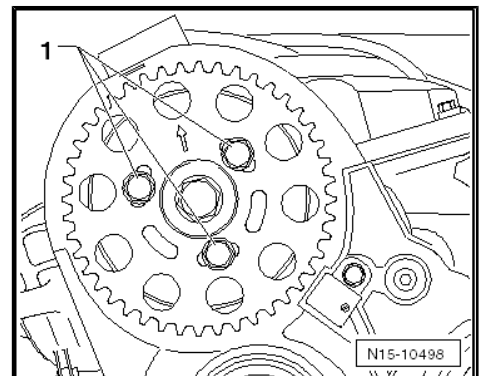
#### Note

The markings on the crankshaft toothed belt pulley -2- and the crankshaft stop - T10050- -1- must align. At the same time, the pin of the crankshaft stop - T10050- must engage in the drilling in the sealing flange.



The arrow on the camshaft pulley must be at almost »12 o'clock«.

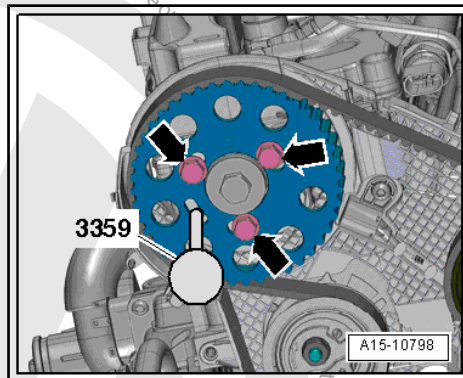
- Mark direction of rotation of toothed belt.



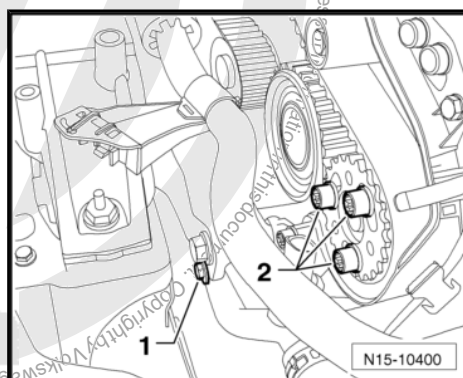




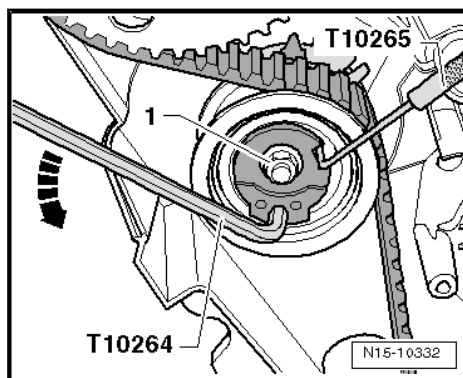
- Lock the camshaft hub with locking pin - 3359- . To do this, insert locking pin through outer free elongated hole into hole in cylinder head.
- Loosen bolts -arrows- approx. 90°.



- Loosen bolts -2- approx. 90° for high-pressure pump toothed belt pulley using bit XZN 10 - T10385- .



- Loosen belt tensioner securing nut -1-.
- Turn eccentric of tensioning roller anti-clockwise -arrow- using socket - T10264- , until the tensioning roller can be locked with locking tool - T10265- .







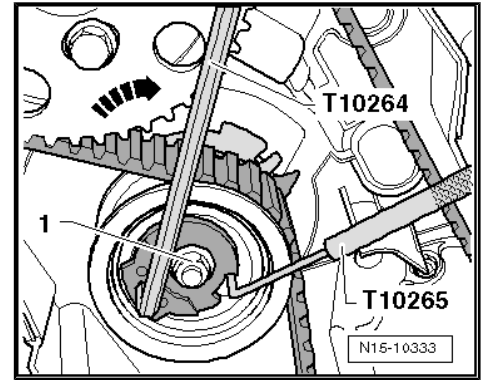
- Now turn tensioning roller eccentric clockwise -arrow- onto stop and tighten securing nut -1- hand-tight.
- First remove toothed belt from camshaft pulley and then from the other pulleys.

### Installing

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

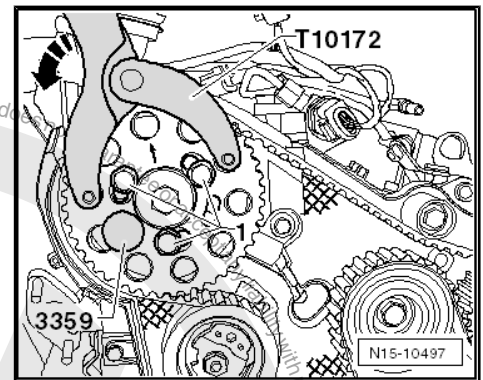
### Prerequisites

- Ignition switched off.
- Engine must be cold.
- Tensioning roller must be locked with locking tool - T10265- and secured at right stop.
- Crankshaft locked in position with crankshaft stop - T10050- .



### Note

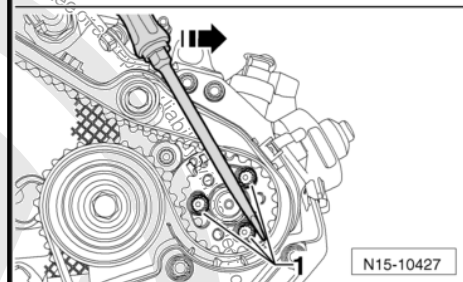
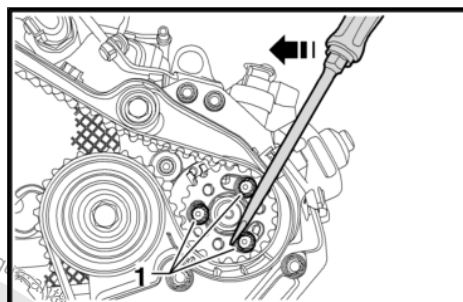
- ◆ *Whenever adjustment work is done on toothed belts, it must be performed only when the engine is cold, as the indicator position on the tensioning element varies depending on the engine temperature.*
- ◆ *Renew securing bolts for camshaft pulley and high-pressure pump pulley.*
- ◆ *If necessary, turn camshaft hub until it can be secured in position with counter-hold tool - T10172- and adapters - T10172/4- . To do this, hand-tighten at least one securing bolt -1-.*
- Lock the camshaft hub with locking pin - 3359- . To do this, insert locking pin through outer free elongated hole into hole in cylinder head.
- Loosen the hand-tightened bolts again.



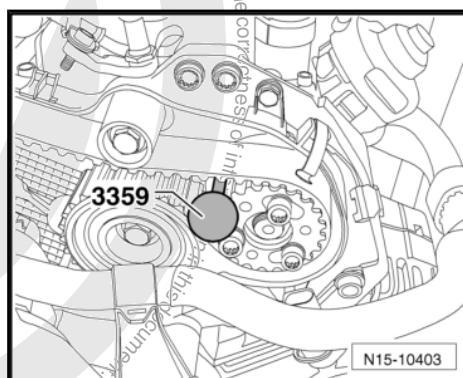




- Turn hub of high-pressure pump at bolt heads with screwdriver until it can be secured in position with diesel injection pump locking pin - 3359- .

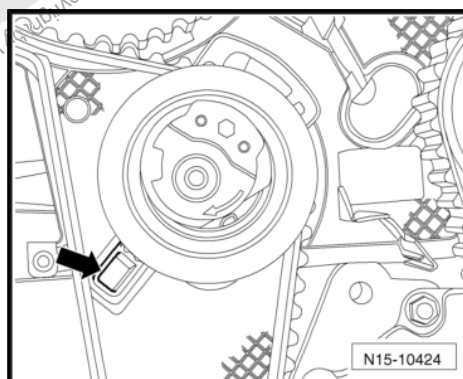


- Lock high-pressure pump hub with diesel injection pump locking pin - 3359- . To do this, push locking pin into adjustment hole outside toothed belt pulley.
- Turn camshaft pulley and toothed belt pulley of high-pressure pump in their elongated holes clockwise to stop.
- Fit toothed belt to crankshaft toothed belt pulley, tensioning roller, camshaft pulley, toothed belt pulley of coolant pump and toothed belt pulley of high-pressure pump.
- Finally, place toothed belt onto idler roller.
- Undo the fastening nuts of the tensioning roller and pull out locking tool - T10265-



#### Note

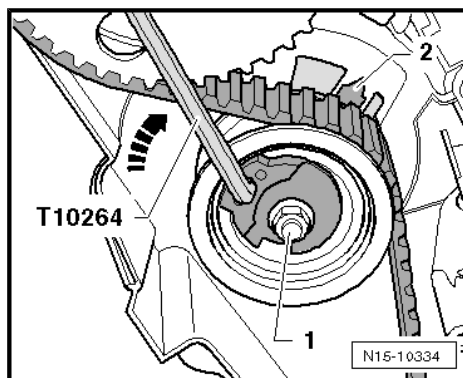
Ensure that belt tensioner seats correctly in rear toothed belt guard -arrow-.



- Carefully turn belt tensioner eccentric clockwise using angle driver - T10264- until indicator -2- is slightly above middle of gap in base plate. The base plate corrects itself when pre-tension is applied.

Ensure that securing nut -1- does not turn as well.

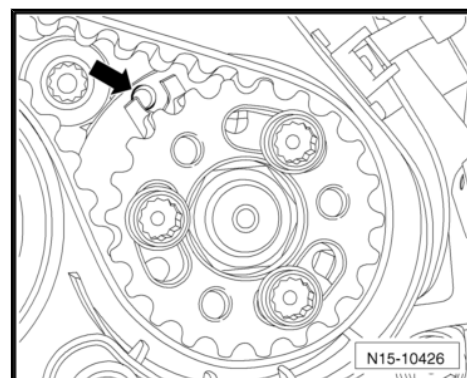
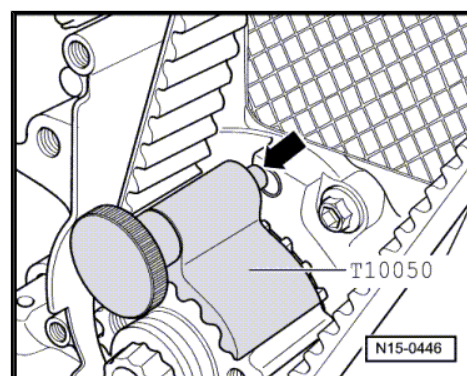
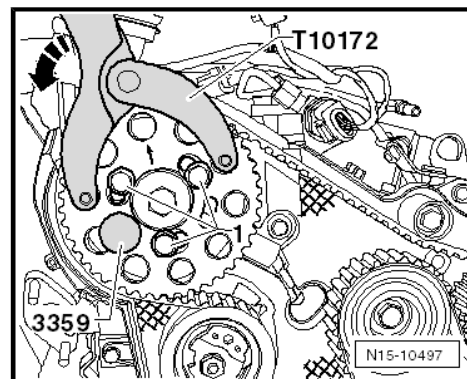
- Hold tensioning roller in this position and tighten securing nut of tensioning roller.







- Fit counterhold - T10172- as shown. Press counter-hold tool - T10172- in direction of arrow and keep camshaft pulley in pretensioning position.
- In this position, tighten securing bolts -1- of camshaft pulley and those of toothed belt pulley for high-pressure pump.
- Remove diesel injection pump locking pin - 3359- and crankshaft stop - T10050- .
- Turn crankshaft at least two full rotations in engine direction of rotation and set to slightly before TDC No. 1 cylinder.
- Place crankshaft stop - T10050- on the crankshaft toothed belt pulley again.
- Now turn crankshaft in engine direction of rotation until crankshaft stop pin -arrow- engages in sealing flange whilst turning.



#### Note

*During the following checking procedure, only the camshaft and crankshaft must be secured in position. It is very difficult to find the securing position of the high-pressure pump hub again. However, a slight deviation -arrow- does not influence the engine operation.*

- Check whether:
  - ◆ Camshaft hub can be locked with locking pin - 3359- .
  - ◆ Tensioning roller indicator is centred or maximum 5 mm to right of base plate notch.

If camshaft hub cannot be locked:

Pull crankshaft stop - T10050- back until pin uncovers hole.

- Twist crankshaft out at little above 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 secured in position.
- After locking, loosen securing nuts of crankshaft toothed belt pulley.

If pin of crankshaft stop - T10050- is standing on left next to hole:

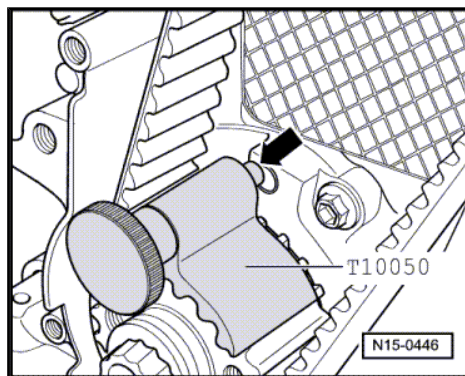




- Turn crankshaft in engine direction of rotation until crankshaft stop pin engages in sealing flange whilst turning.
- Tighten securing bolts of camshaft toothed belt pulley.

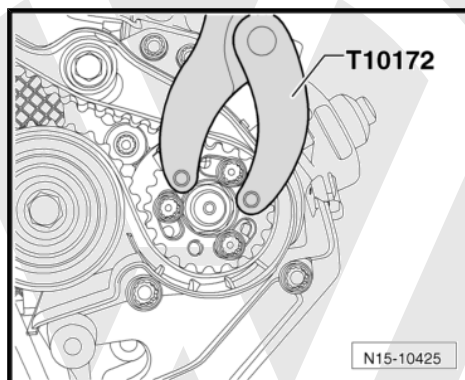
**If pin of crankshaft stop - T10050- is standing on right next to hole:**

- Turn crankshaft a little in direction opposite to engine direction of rotation.
- Turn crankshaft in engine direction of rotation until crankshaft stop pin arrow engages in sealing flange whilst turning.
- Tighten securing bolts of camshaft toothed belt pulley.

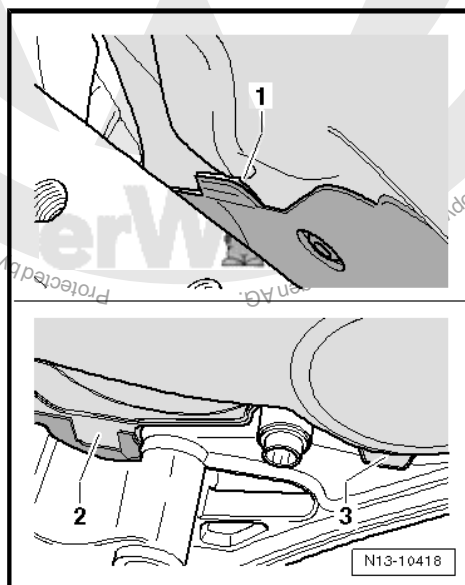


#### Continuation

- Remove locking pin - 3359- and crankshaft stop - T10050- .
- Turn crankshaft at least 2 rotations in engine direction of rotation and set again to TDC no. 1 cylinder.
- Repeat measurement.
- 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 toothed belt guard - lower part.
- Install vibration damper/belt pulley.



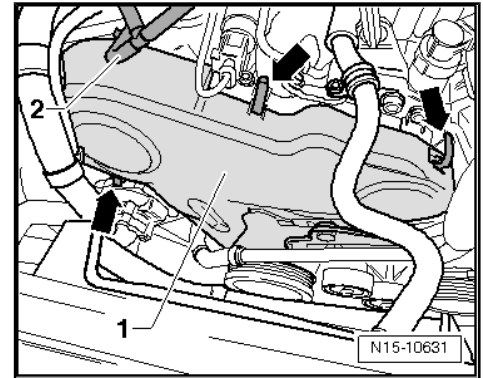
- First, fit top part of toothed belt guard to middle -1- of toothed belt guard from the rear.
- Then, fit toothed belt guard to middle -2- and -3- of toothed belt guard at the top.







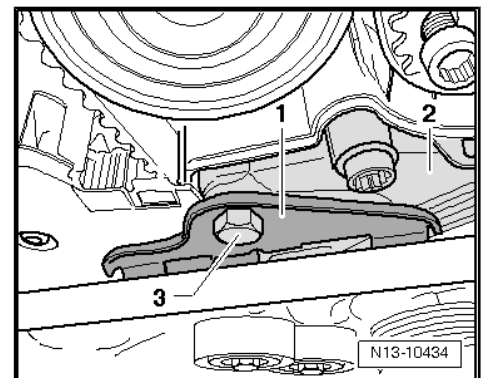
- Secure toothed belt guard -3- with clips -arrows-.
- Clip vacuum hose -2- into upper toothed belt guard -1-.



- Tighten bolt -3- for bracket -1-.
- Install poly V-belt ⇒ [page 40](#) .
- Install underbody guard, if fitted previously ⇒ General body repairs, exterior; Rep. gr. 66 ; Underbody guard .

### Specified torques

- ♦ ⇒ ["2.1 Assembly overview - toothed belt drive", page 105](#)







### 3 Fresh air supply system, belt drive

⇒ "3.1 Assembly overview - fresh air supply system", page 116

⇒ "3.2 Removing and installing blower for fresh air supply system", page 117

⇒ "3.3 Removing and installing air filter housing for fresh air supply system", page 117

⇒ "3.4 Removing and installing bracket for fresh air supply system", page 118

#### 3.1 Assembly overview - fresh air supply system

**1 - Heat shield**

- For air filter housing.

**2 - Bolt**

- 6 Nm

**3 - Air filter bracket**

- Removing and installing  
⇒ page 118 .

**4 - Bolt**

- 6 Nm

**5 - Hose**

**6 - Spring-type clip**

**7 - Hose clip**

**8 - Blower**

- Removing and installing  
⇒ page 117 .

**9 - Bracket**

**10 - Bolt**

- 6 Nm

**11 - Rubber sleeve**

- Qty. 2.
- To air filter
- To toothed belt guard

**12 - Nut**

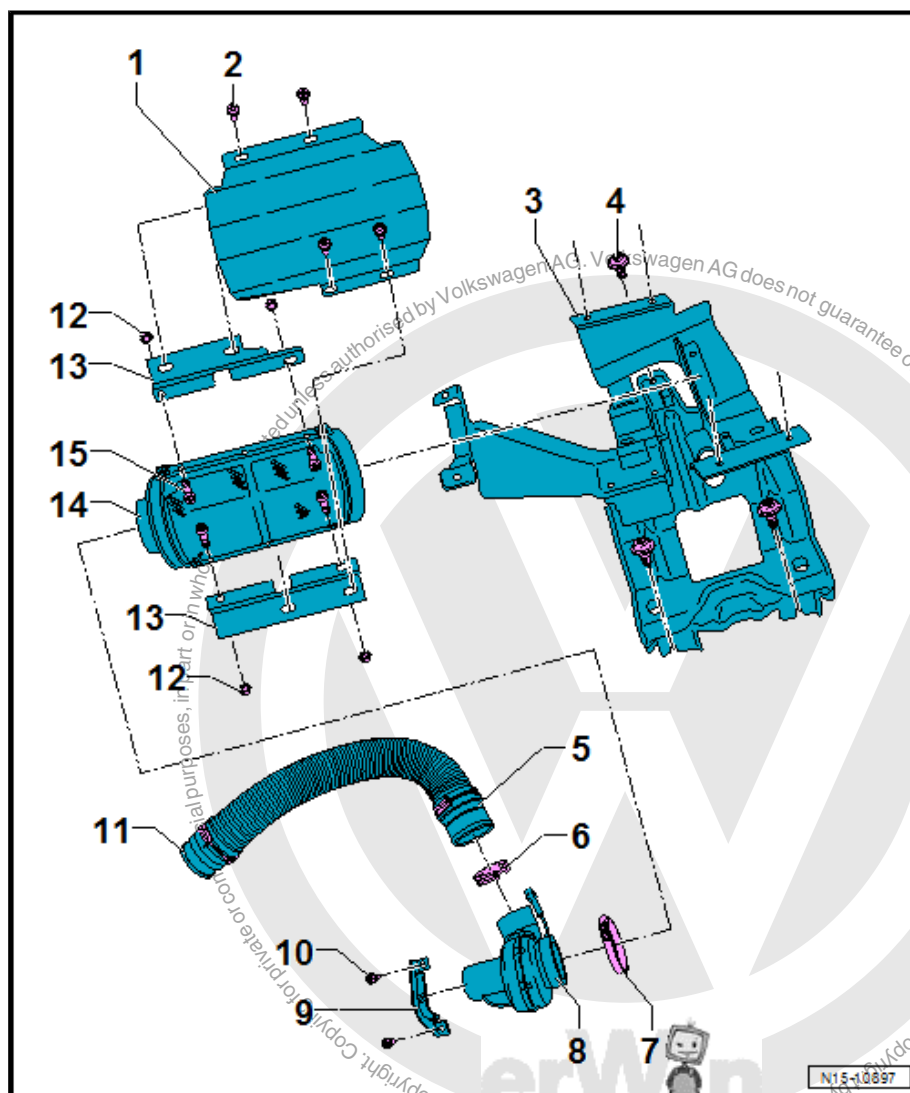
**13 - Bracket**

**14 - Air filter housing**

- Removing and installing  
⇒ page 117 .
- ⇒ ETKA (Electronic  
Parts Catalogue)

**15 - Bolt**

- 6 Nm



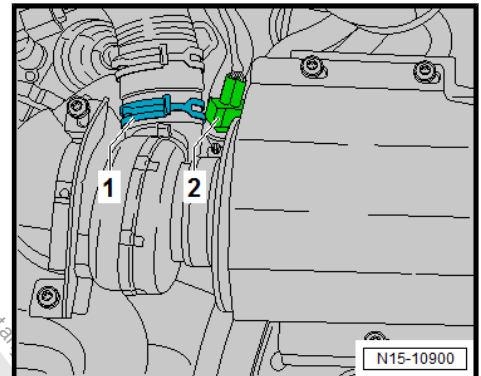




### 3.2 Removing and installing blower for fresh air supply system

#### Removing

- Disconnect electrical connector -2-. Release clip -1- and detach hose.

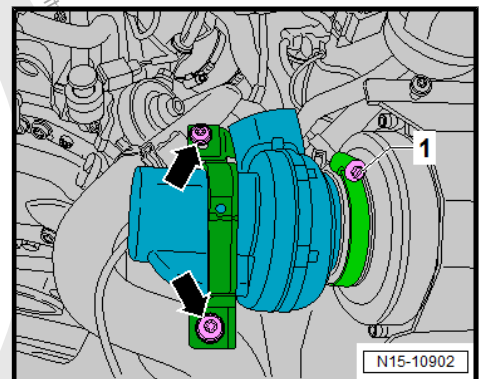


- Loosen screw-type clip -1- and then remove bolts -arrows- from bracket.
- Remove blower for fresh air supply system

#### Installing

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

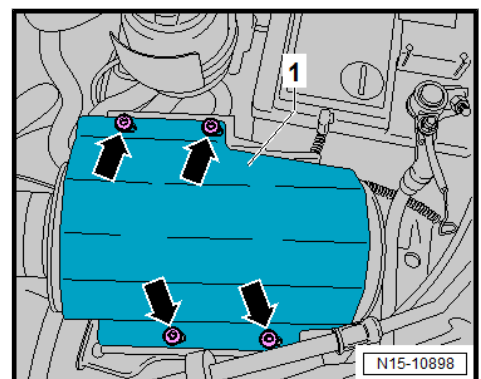
- ♦ => ["3.1 Assembly overview - fresh air supply system", page 116](#)



### 3.3 Removing and installing air filter housing for fresh air supply system

#### Removing

- Unscrew bolts -arrows- and remove heat shield -1-.





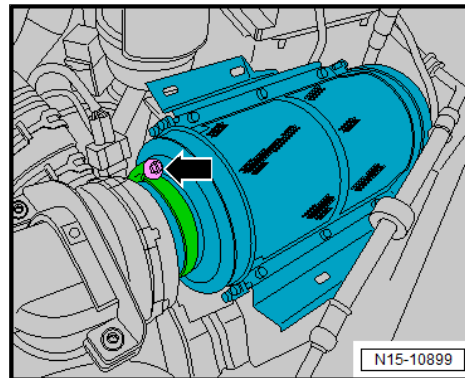


- Loosen screw-type clip -arrow-, and remove air filter housing.

#### Installing

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

- ♦ ⇒ [“3.1 Assembly overview - fresh air supply system”, page 116](#)



### 3.4 Removing and installing bracket for fresh air supply system

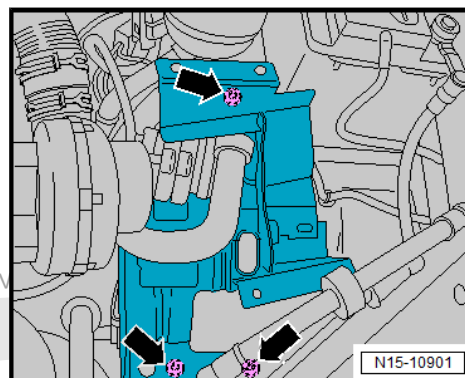
#### Removing

- Remove air filter housing ⇒ [page 117](#) .
- Detach blower for fresh air supply system ⇒ [page 117](#) .
- Release wiring harness.
- Remove bolts -arrows- and remove bracket.

#### Installing

Install in reverse order. In the process, note the following:

- ♦ ⇒ [“3.1 Assembly overview - fresh air supply system”, page 116](#)







## 4 Valve gear

- ⇒ ["4.1 Assembly overview - valve gear", page 119](#)
- ⇒ ["4.2 Measuring axial clearance of camshaft", page 121](#)
- ⇒ ["4.3 Measuring radial clearance of camshafts", page 122](#)
- ⇒ ["4.4 Removing and installing camshafts", page 123](#)
- ⇒ ["4.5 Removing and installing camshaft oil seal", page 129](#)
- ⇒ ["4.6 Checking hydraulic compensation element", page 131](#)
- ⇒ ["4.7 Renewing valve stem seals", page 132](#)

### 4.1 Assembly overview - valve gear



#### Note

- ◆ *Cylinder heads with cracks between the valve seats may be used without reducing engine life, provided the cracks are small and not more than 0,5 mm wide.*
- ◆ *The plastic packing pieces for protecting the open valves must not be removed until immediately before fitting cylinder head.*
- ◆ *When cylinder head is renewed, the coolant must be completely renewed as well.*





#### 1 - Seal

- ☐ Do not additionally oil or grease the oil seal sealing lip.
- ☐ Before installing, remove residual oil from camshaft journal using a clean cloth.
- ☐ To install, mask off groove on camshaft taper (e.g. using Sellotape)
- ☐ Removing and installing ⇒ [page 129](#).

#### 2 - Bolt

- ☐ Observe sequence when loosening and tightening ⇒ [page 121](#).
- ☐ 10 Nm

#### 3 - Retaining frame

- ☐ Seal with silicone sealant ⇒ Electronic Parts Catalogue (ETKA).

#### 4 - Exhaust camshaft

- ☐ Removing and installing ⇒ [page 123](#).

#### 5 - Inlet camshaft

- ☐ Removing and installing ⇒ [page 123](#).

#### 6 - Roller rocker finger

- ☐ Mark installation position.
- ☐ Do not interchange.
- ☐ Check roller bearing for ease of movement.
- ☐ Oil contact surface.

#### 7 - Hydraulic compensation element

- ☐ Mark installation position.
- ☐ Lubricate contact surfaces before installing.

#### 8 - Valve

- ☐ Do not rework. Only lapping in is permitted.
- ☐ Mark installation position for re-installation.
- ☐ Valve dimensions ⇒ [page 136](#)
- ☐ Checking valve guides ⇒ [page 135](#).

#### 9 - Cylinder head

#### 10 - Valve stem seal

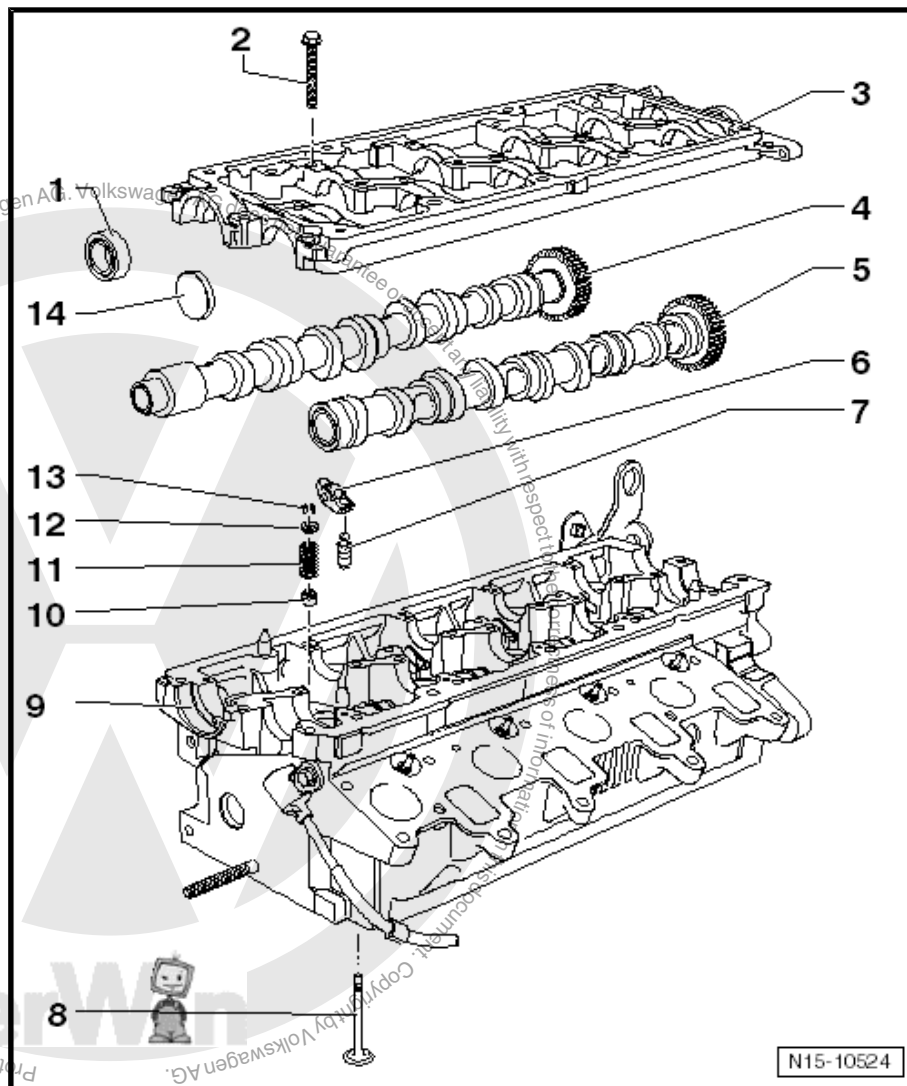
#### 11 - Valve spring

#### 12 - Valve spring plate

#### 13 - Valve cotter

#### 14 - Cap

- ☐ Renew after removing







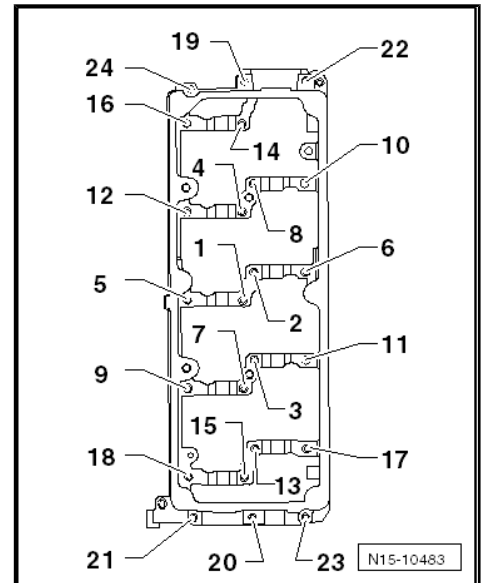
### Retaining frame - tightening sequence

#### Undoing the frame

- Unscrew bolts of support frame in sequence -24...1-.

#### Tightening

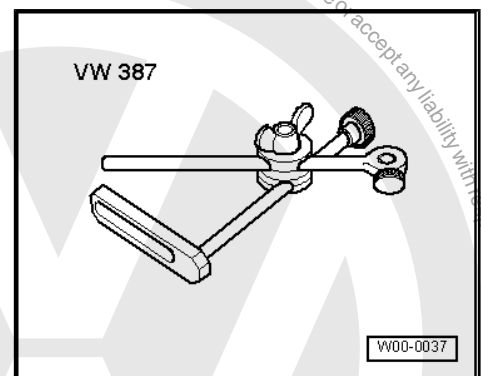
- First, tighten bolts of support frame hand-tight in sequence -1....24-.
- Tighten retaining frame bolts in sequence -1...24-.



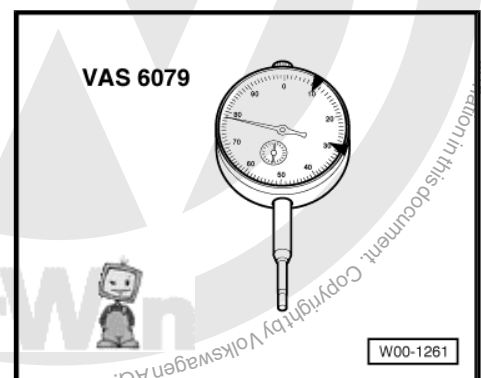
## 4.2 Measuring axial clearance of camshaft

### Special tools and workshop equipment required

- ◆ Universal dial gauge bracket - VW 387-



- ◆ Dial gauge - VAS 6079-



### Procedure

- Remove retaining frame ➔ [page 121](#) .

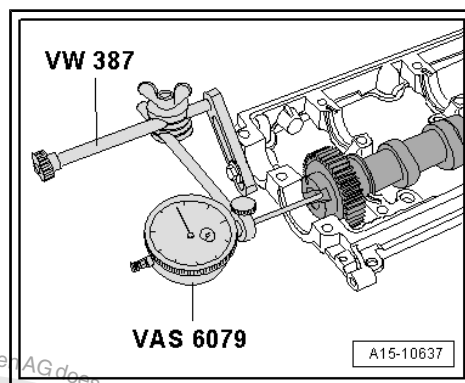




- Fasten dial gauge - VAS 6079- to cylinder head with universal dial gauge bracket - VW 387- as shown in the illustration.
- Press camshaft against dial gauge by hand.
- Set dial gauge to "0".
- Press camshaft away from dial gauge and read off value:

Axial clearance of inlet and outlet camshafts:

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



### 4.3 Measuring radial clearance of camshafts

#### Special tools and workshop equipment required

- ◆ Plastigage

#### Procedure

- Remove roller rocker finger.
- 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 without rotating camshafts  
⇒ [page 121](#).
- Remove retainer frame.
- Compare width of Plastigage with the measurement scale.

Radial clearance: 0.035 ... 0.085 mm.

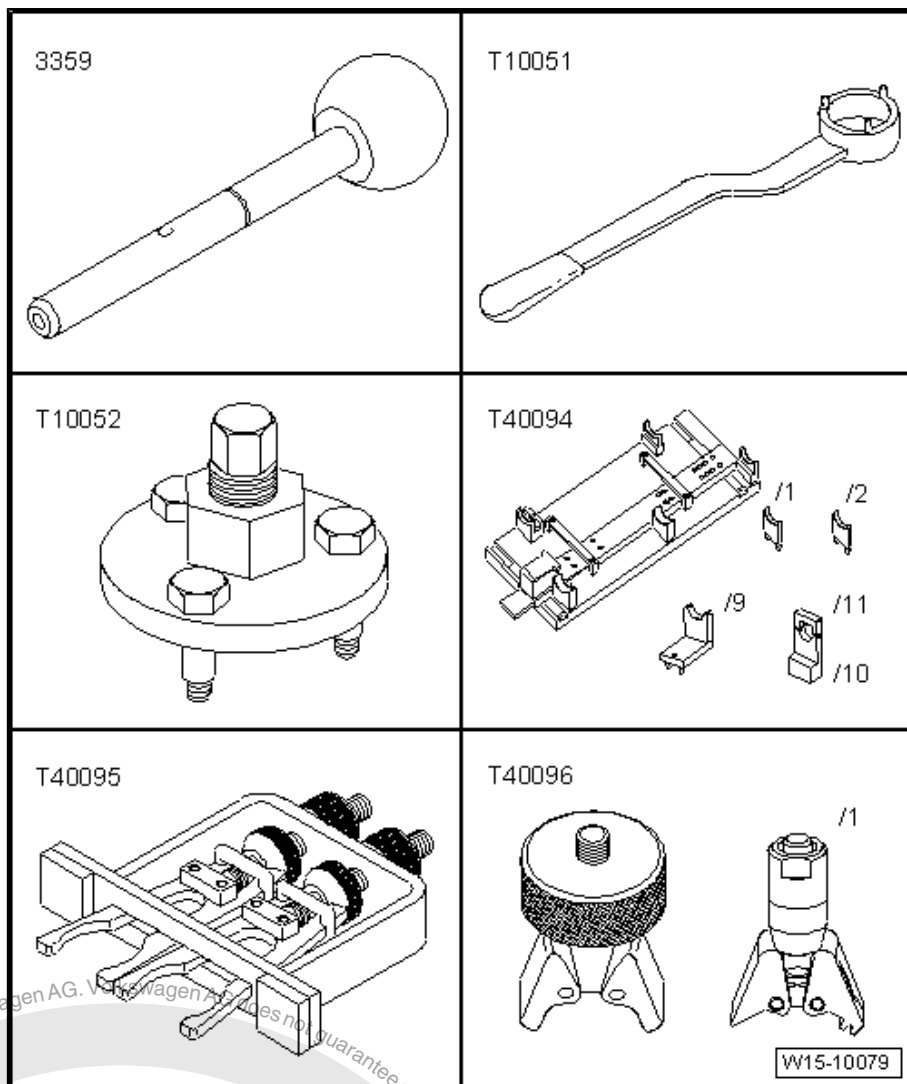




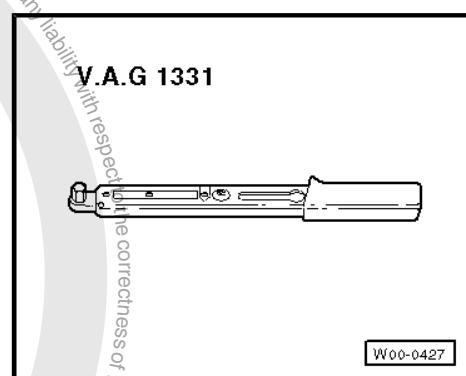
## 4.4 Removing and installing camshafts

### 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-



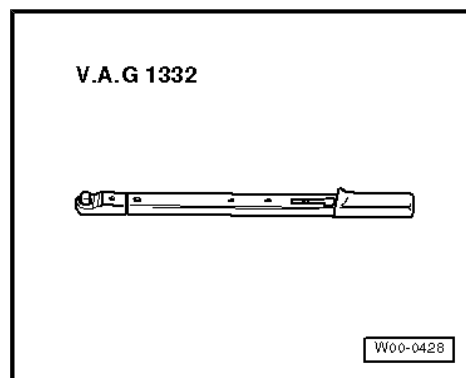
- ◆ Torque wrench - V.A.G 1331/-







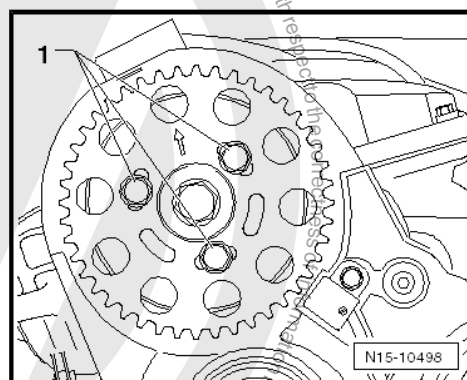
- ◆ Torque wrench - V.A.G 1332/-



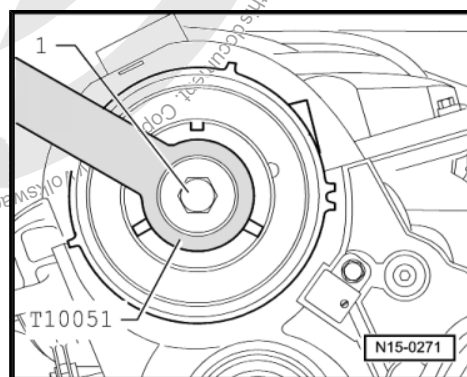
- ◆ Silicone adhesive sealant ⇒ Electronic Parts Catalogue (ET-KA)

### Removing

- Remove fuel filter ⇒ [page 239](#) .
- Removed toothed belt from camshaft and high-pressure pump ⇒ [page 107](#) .
- Remove cylinder head cover ⇒ [page 93](#) .
- Unscrew and remove bolts -arrows- for toothed belt and camshaft.
- Remove camshaft pulley 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.

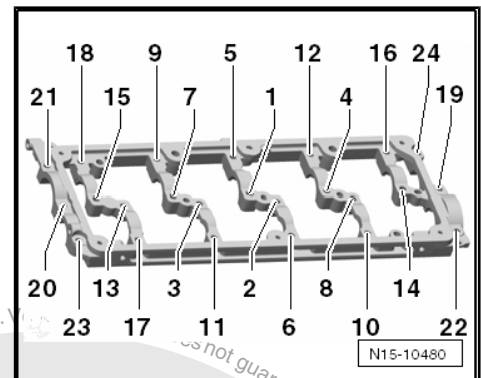
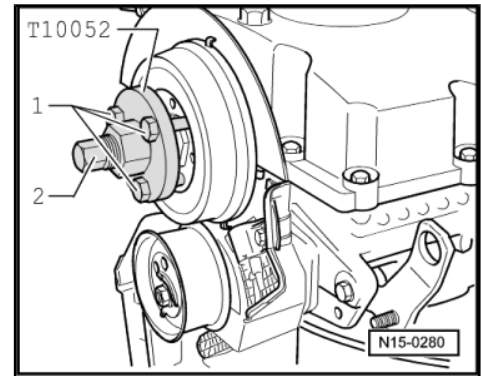
- Remove hub from taper of camshaft.
- Remove vacuum pump ⇒ [page 102](#) .
- Unscrew retaining frame securing bolts in sequence -24...1-.
- Remove retaining frame.
- Carefully remove camshafts.

**Installing**

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

**Note**

Seal contact surface between retaining frame and cylinder head using silicone adhesive sealant ⇒ *Electronic Parts Catalogue (ETKA)* .

**Caution**

**Camshafts may only be installed with 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.**

**Make sure that no sealant residues get into the cylinder head or the bearings.**

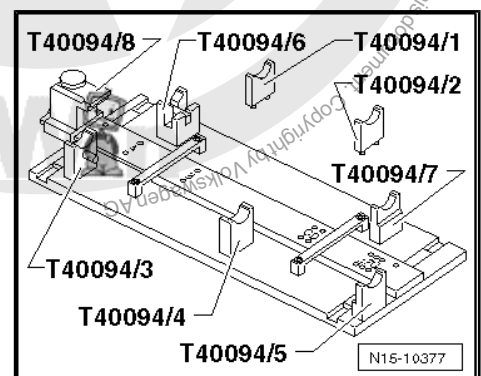
- Remove remaining sealant and from cylinder block and retaining frame using, for example, a rotating plastic brush.
- Clean sealing surfaces. They must be free of oil and grease.
- Oil running surfaces of both camshafts.

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

- Remove supports -T40094/3-, -T40094/4- and -T40094/5- from base plate (bolted from underneath).

**Note**

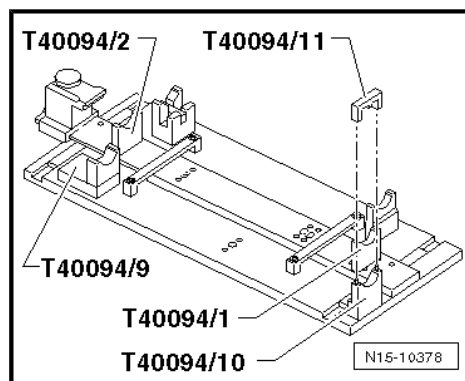
If the supports of the camshaft fitting tool - T40094- are not yet marked, mark the removed supports, e.g. with number stamps, so they can be fitted in the original positions later.



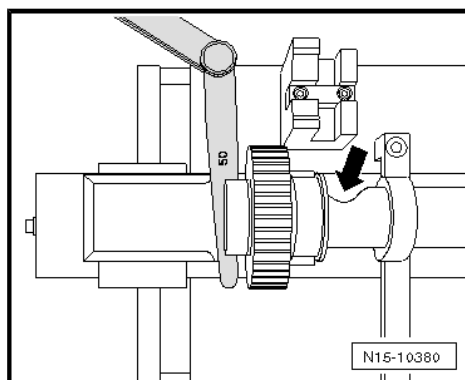




- Install supports -T40094/9- and -T40094/10- instead at vacant outer positions.
- Place support -T40094/2- at position "A" and support -T40094/1- at position "F".
- First insert inlet camshaft as shown. Ensure that indentation -arrow- for cylinder head bolt faces »outwards«.



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



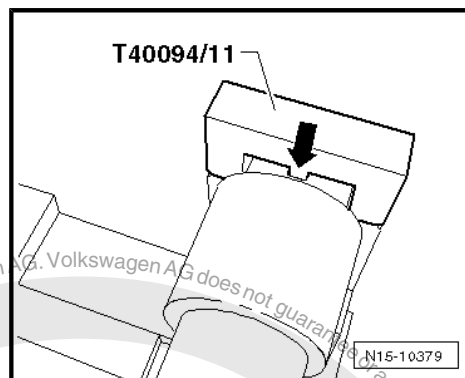
- Insert exhaust camshaft and lock via groove -arrow- with -cover T40094/11-.
- Position clamping tool - T40096/1- on exhaust camshaft pulleys.



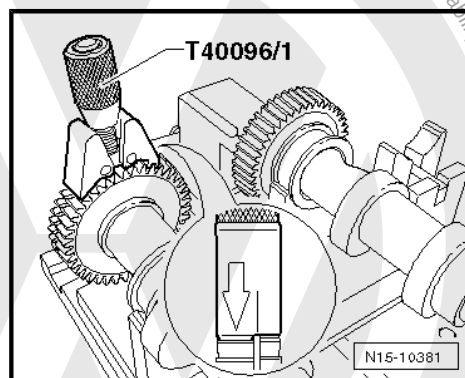
#### Caution

**The exhaust camshaft tensioning roller has been discontinued  
⇒ Electronic Parts Catalogue (ETKA) .**

**In the case of exhaust camshafts with tensioning roller, ensure  
that the clamping jaw marked with an arrow is seated on the  
wider gear.**



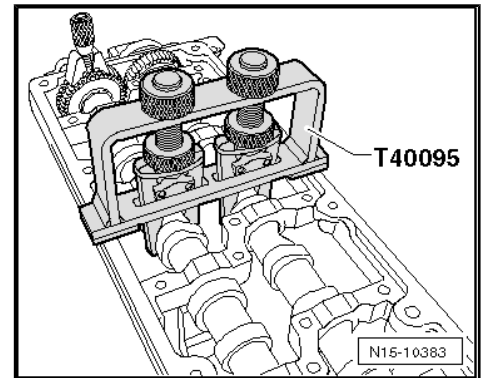
- Tension camshaft fitting tool - T40096/1- with knurled wheel until teeth flanks align. If necessary, use a 13 mm open-ended spanner to assist.
- Slide exhaust camshaft towards inlet camshaft until teeth engage.
- Place retaining frame on camshafts.
- All camshaft bearings must be seated on the camshafts.



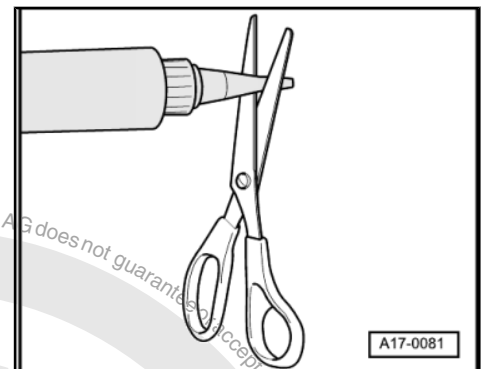




- Position camshaft fitting tool - T40095- as shown, thereby fixing camshafts in position in retaining frame.
- Remove cover - T40094/11- .
- Pull support - T40094/8- out of inlet camshaft groove.



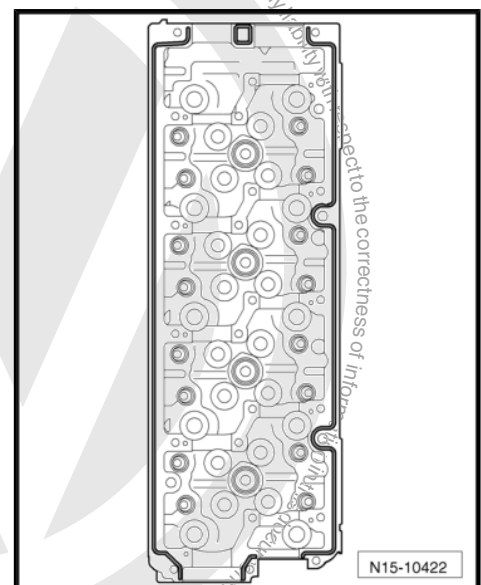
- Cut off nozzle on tube at front marking ( $\varnothing$  of nozzle approx. 2 mm).
- Apply beads of sealant (approx. 2...3 mm wide) -arrows- onto clean sealing surfaces of cylinder head as illustrated.



### Note

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

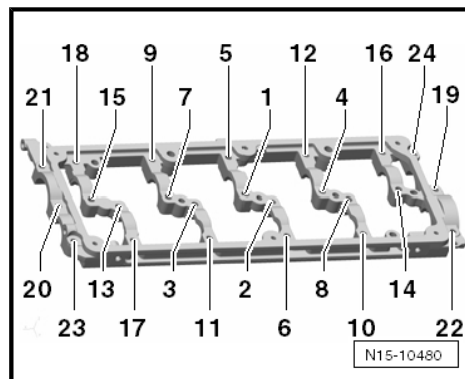
- Install new cap ⇒ [Item 14 \(page 120\)](#) flush on cylinder head.
- Remove camshafts from camshaft fitting tool - T40095- together with retaining frame and camshaft fitting tool - T40094- .
- Carefully insert camshafts and retaining frame into cylinder head.



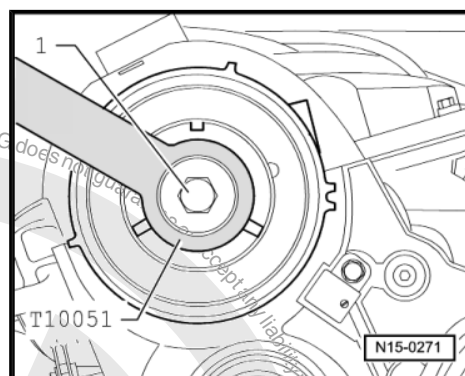




- First tighten securing bolts of retaining frame hand-tight in sequence -1....24-.
- The retaining frame should make contact with the cylinder head over the complete surface.
- Tighten retaining frame bolts to final torque in the sequence -1...24-.
- Remove camshaft fitting tool - T40095- and clamping tool - T40096/1- .
- Renew camshaft seal ⇒ [page 129](#) .

**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.

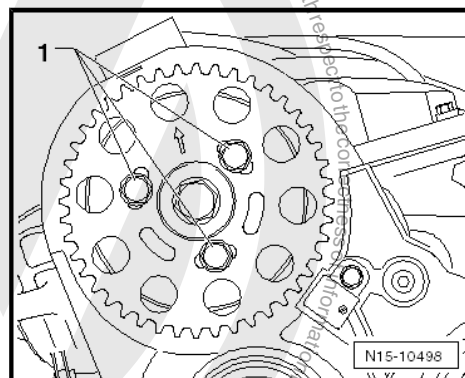


- Push camshaft pulley onto hub.

**Note**

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

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



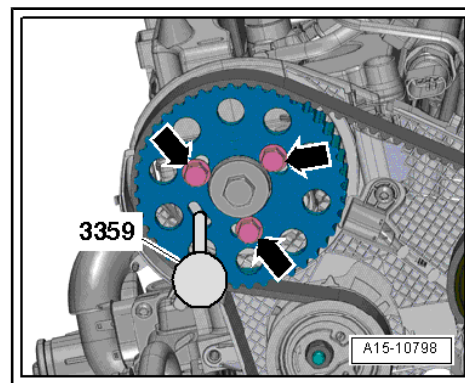




- Lock hub with diesel injection pump locking pin - 3359- .
- Install toothed belt and adjust valve timing ⇒ [page 107](#) .
- Install vacuum pump ⇒ [page 102](#) .
- Install cylinder head cover ⇒ [page 93](#) .
- Install fuel filter.

#### Specified torques

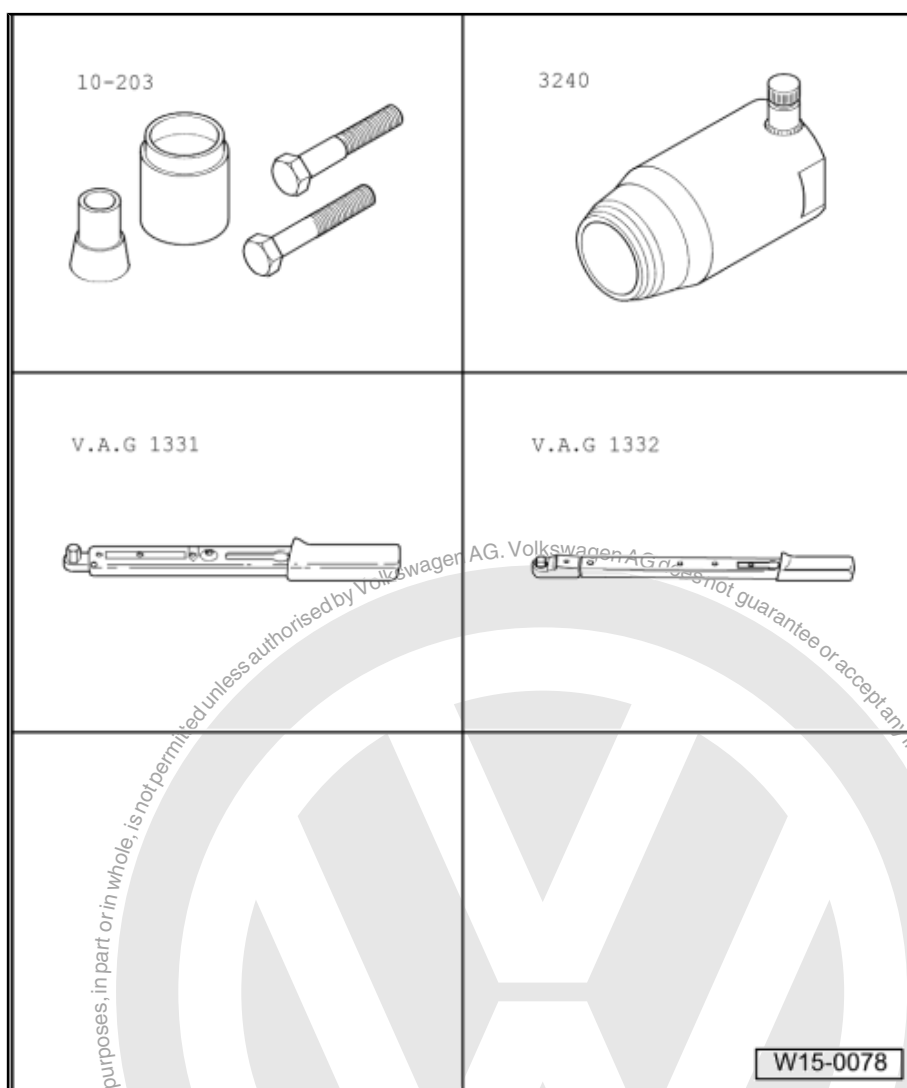
- ◆ ⇒ [“4.1 Assembly overview - valve gear”, page 119](#)
- ◆ ⇒ [“1.2 Assembly overview - cylinder head cover”, page 81](#)
- ◆ ⇒ [“2.1 Assembly overview - toothed belt drive”, page 105](#)



## 4.5 Removing and installing camshaft oil seal

#### Special tools and workshop equipment required

- ◆ Fitting tool - 10 - 203-
- ◆ Oil seal extractor - 3240-
- ◆ Torque wrench - V.A.G 1331-
- ◆ Torque wrench - V.A.G 1332-
- ◆ Bolt M12 x 1.5 x 65



#### Removing

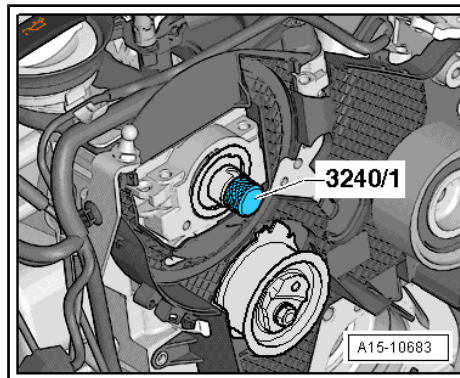
- Removed toothed belt from camshaft and high-pressure pump ⇒ [page 107](#) .
- Remove camshaft pulley and hub ⇒ [page 123](#)



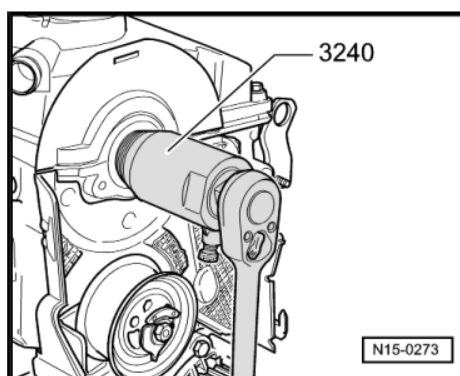




- Insert thrust piece - 3240/1- into camshaft.



- Unscrew inner part of oil seal extractor - 3240- 2 turns (approx. 3 mm) from the outer part and lock in position with the knurled screw.
- Lubricate threaded head of oil seal extractor, place it in position and, exerting firm pressure, screw it into oil seal as far as possible.
- Loosen knurled screw and turn inner part against camshaft until oil seal is pulled out.



### Installing

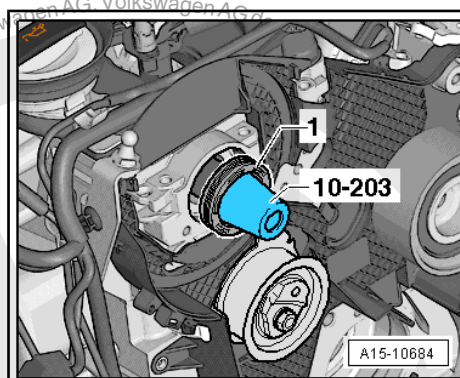
Installation is carried out in the reverse order; note the following:



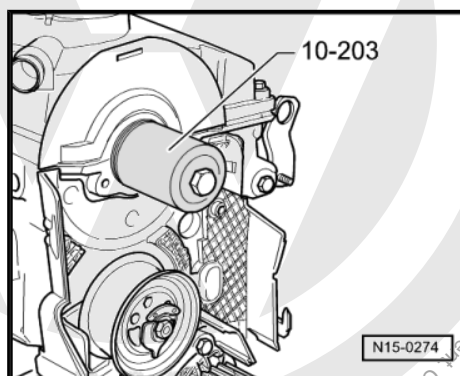
### Note

*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 - 3240- onto camshaft as shown in illustration.
- Carefully slide oil seal -1- over guide sleeve onto camshaft.
- Carefully place seal onto camshaft.



- Press in oil seal with press piece of fitting tool - 10 - 203- and bolt M12 × 1.5 x 65 as far as stop.
- Install camshaft pulley and hub ⇒ [page 107](#) .
- Install toothed belt and adjust the valve timing ⇒ [page 107](#) .



### Specified torques

- ♦ ⇒ [“1.2 Assembly overview - cylinder head cover”, page 81](#)
- ♦ ⇒ [“2.1 Assembly overview - toothed belt drive”, page 105](#)





## 4.6 Checking hydraulic compensation element

### Special tools and workshop equipment required

- ◆ Feeler gauges

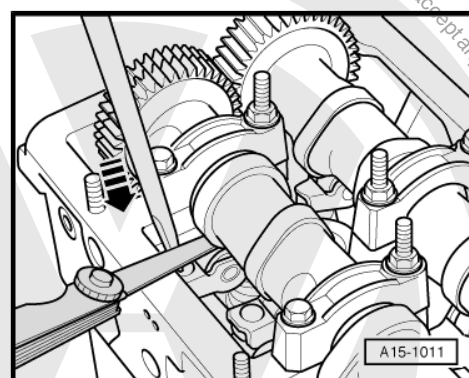


#### Note

- ◆ *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 93](#) .
- 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.



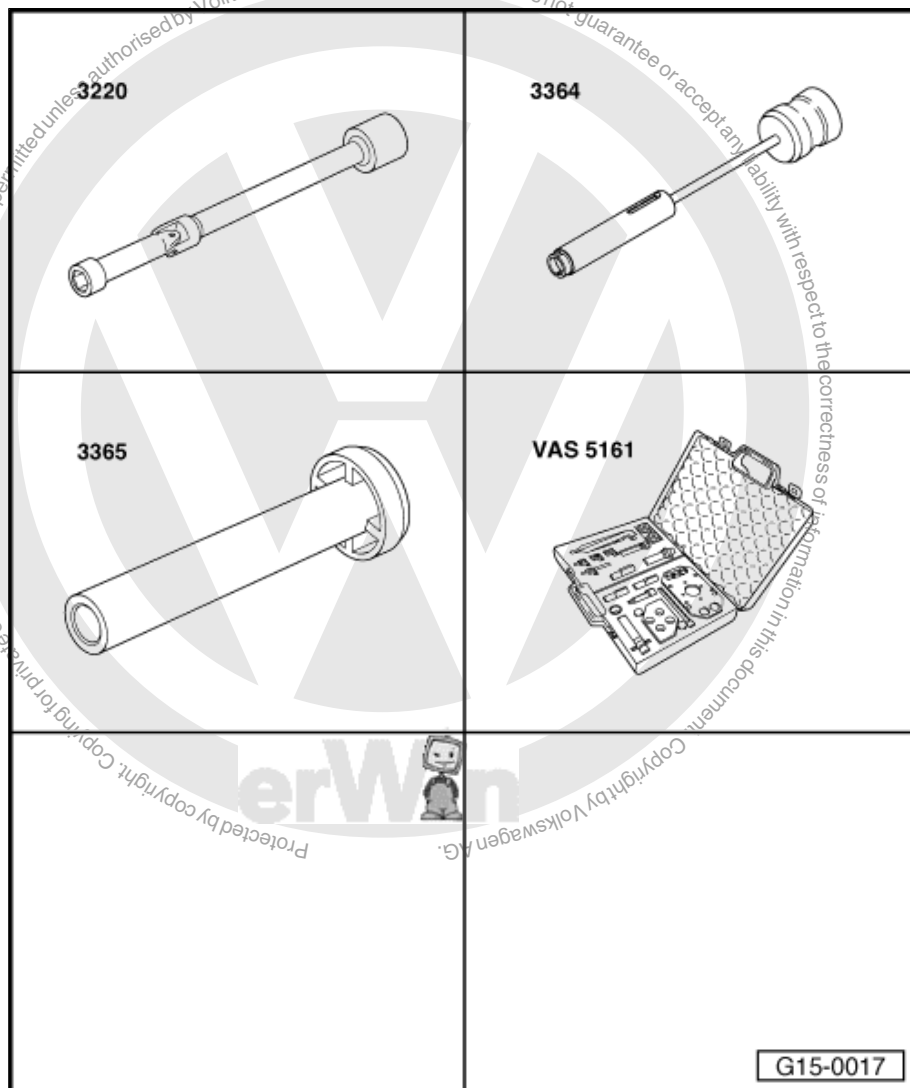




## 4.7 Renewing valve stem seals

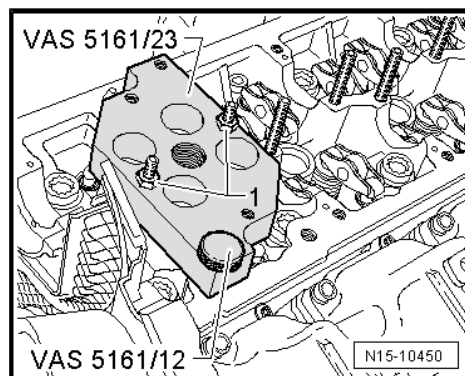
### Special tools and workshop equipment required

- ◆ 10 mm jointed spanner - 3220-
- ◆ Valve stem seal puller - 3364-
- ◆ Valve stem seal fitting tool - 3365-
- ◆ Removal and installation device for valve cotters - VAS 5161 A- with guide plate - VAS 5161/23- and spacer ring - VAS 5161/23-1-



### Procedure

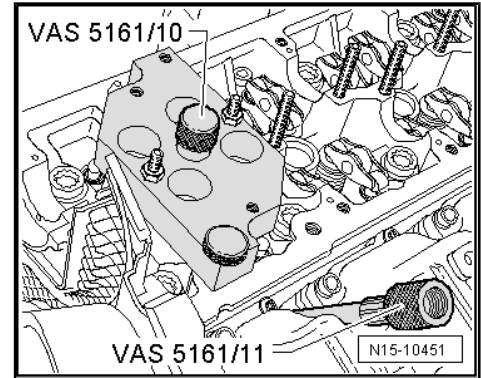
- Remove all glow plugs using jointed spanner - 3220- .  
⇒ [page 405](#)
- Remove camshafts ⇒ [page 123](#) .
- Place guide plate - VAS 5161/23- onto cylinder head.
- Secure guide plate on intake manifold side with knurled screw - VAS 5161/12- and tighten it hand-tight to studs using M6 collarless nuts -1-.
- Screw sealing bolts - VAS 5161/10- into the guide plate.



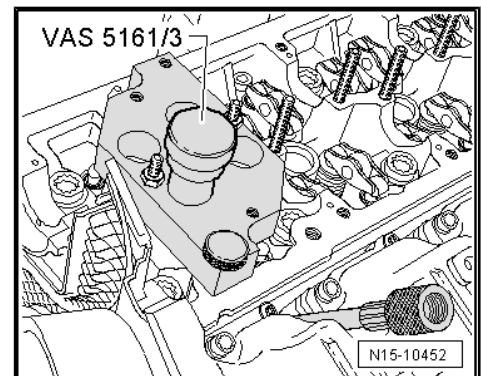




- Screw adapter - VAS 5161/11- hand-tight into the relevant glow plug thread.



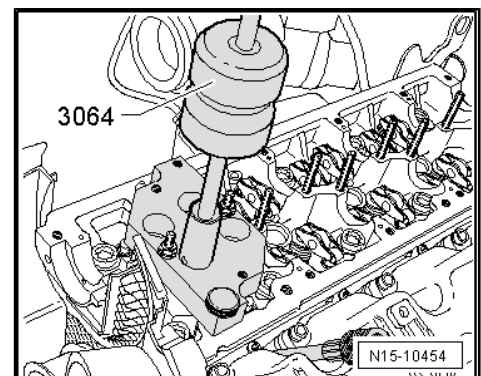
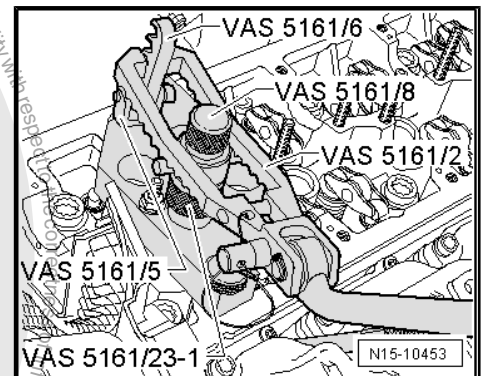
- Insert punch - VAS 5161/3- in the guide plate and use a plastic hammer to knock loose the firmly seated valve cotter.



- Screw attachment fork - VAS 5161/5- with ratchet piece - VAS 5161/6- into guide plate .

Push spacer ring - VAS 5161/23-1- onto the assembly cartridge - VAS 5161/8- .

- Connect adapter - VAS 5161/11- to compressed air supply, using a standard commercially available union and apply pressure continuously.
  - Minimum pressure: 6 bar
- Attach pressure fork - VAS 5161/2- to ratchet piece and press assembly cartridge downwards.
- At the same time, turn knurled screw of assembly cartridge clockwise until tips engage in valve cotter.
- Move knurled screw backwards and forwards slightly. This causes the valve cotter to be pressed apart and taken into the assembly cartridge.
- Release pressure fork.
- Remove assembly cartridge with spacer ring, valve plate and valve spring.
- Pull off valve stem seals using valve stem seal puller - 3364- .

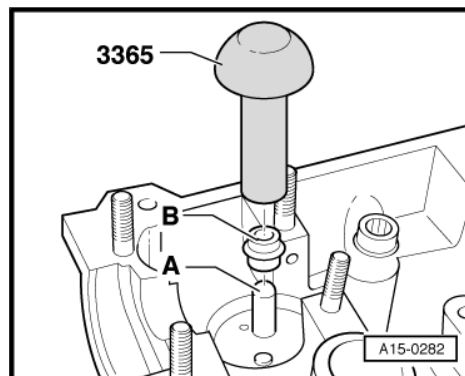




**Note**

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

- Fit plastic sleeve -A- onto valve stem to prevent damage to new valve stem oil seal -B-.
- 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- .
- If necessary, use a plastic head hammer to tap lightly on fitting tool until valve stem oil seal is fitted to stop.
- Remove plastic sleeve.
- Insert valve spring and valve plate into cylinder head.
- If valve cotters have been removed from assembly cartridge , they need to be put into insertion device - VAS 5161/18- first.

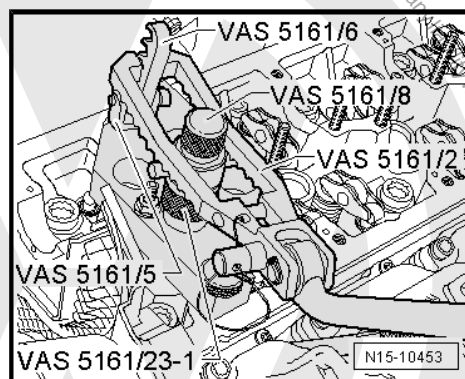
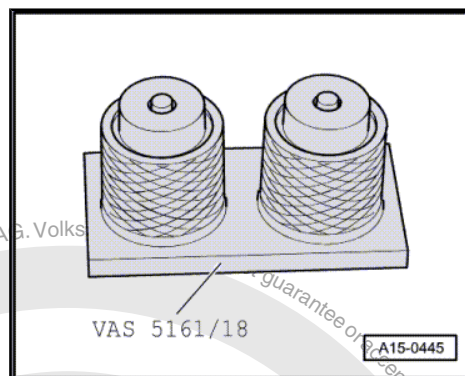
**Note**

Larger diameter of valve cotters face upwards.

- Press assembly cartridge onto insertion device from above and pick up valve cotters.
- Insert assembly cartridge - VAS 5161/8- into guide plate again.
- Press pressure fork downwards and pull knurled screw upwards, turning it clockwise and anticlockwise. This action will install the valve cotters.
- Reduce pressure on pressure fork whilst pulling on knurled screw.

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

- Install glow plugs ➔ [page 405](#) .
- Install camshafts ➔ [page 123](#) .

**Note**

- ♦ Engine is not to be rotated for approx. 30 minutes after installing camshafts. The hydraulic compensation elements must settle (otherwise valves will strike pistons).
- ♦ After working on the valve gear, turn the engine carefully at least 2 rotations to ensure that none of the valves make contact when the starter is operated.





## 5 Inlet and exhaust valves

⇒ ["5.1 Reworking valve seats", page 135](#)

⇒ ["5.2 Checking valve guides", page 135](#)

⇒ ["5.3 Valve dimensions", page 136](#)

### 5.1 Reworking valve seats



#### Note

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

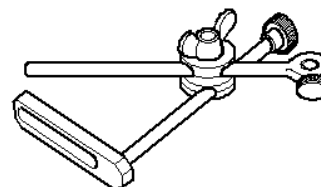
### 5.2 Checking valve guides

#### Special tools and workshop equipment required

- ◆ Universal dial gauge bracket - VW 387-

- ◆ Dial gauge - VAS 6079-

VW 387



W00-0037

VAS 6079

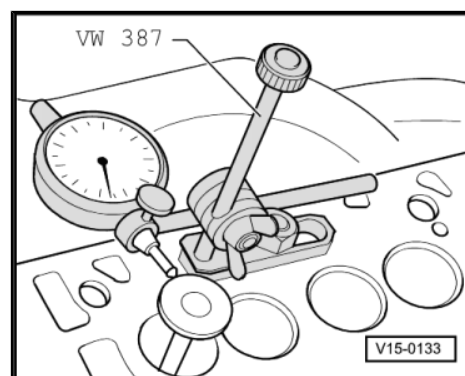


W00-1261

#### Test procedure

- Insert new valve in guide. The end of the valve stem must be flush with the guide. On account of differing stem diameters, only use inlet valve in inlet guide and exhaust valve in exhaust guide.
- Determine rock. Wear limit: max. 1.3 mm
- Cylinder head must be renewed if rock exceeds wear limit.

VW 387



V15-0133





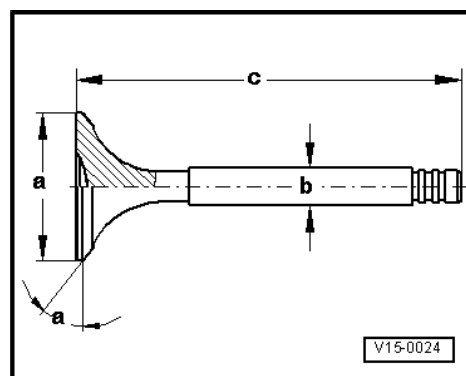
## 5.3 Valve dimensions



### Note

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

Dimension		Inlet valve	Exhaust valve
Ø a	mm	26.60	26.00
Ø b	mm	5.940	5.940
c	mm	99.30	99.10
α	°	45	45







## 17 – Lubrication

### 1 Sump, oil pump

⇒ [“1.1 Assembly overview - sump, oil pump”, page 137](#)

⇒ [“1.2 Removing and installing oil sump”, page 140](#)

⇒ [“1.3 Removing and installing oil pump”, page 146](#)

⇒ [“1.4 Removing and installing oil pump, vehicles with balancer shaft module”, page 146](#)

⇒ [“1.5 Checking engine oil level”, page 147](#)

⇒ [“1.6 Removing and installing oil level and oil temperature sender G266”, page 147](#)

⇒ [“1.7 Removing and installing dipstick tube”, page 148](#)

#### 1.1 Assembly overview - sump, oil pump



##### Note

*Renew cover in sump every time it is removed ⇒ ETKA (electronic parts catalogue)*



**1 - Bolt**

- ☐ 15 Nm

**2 - Sealing flange**

- ☐ With seal.
- ☐ Must seat on dowel sleeves.
- ☐ Insert with silicone sealant → Electronic Parts Catalogue (ETKA) .
- ☐ 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.
- ☐ Removing and installing ⇒ [page 48](#) .

**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 147](#) .

**6 - Guide tube****7 - Clip****8 - Dowel sleeves****9 - O-ring**

- ☐ Renew after removing

**10 - Bolt**

- ☐ 15 Nm

**11 - Oil pump with pressed-on toothed belt pulley**

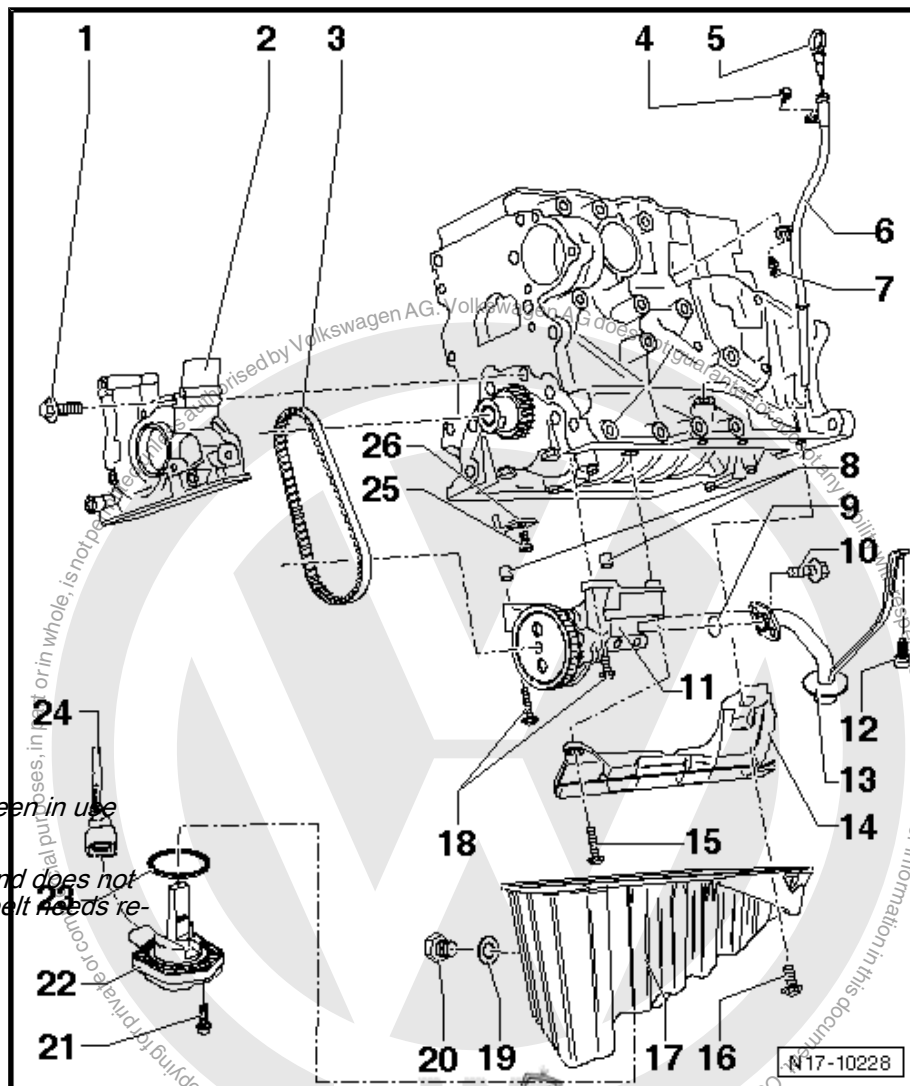
- ☐ With 12 bar pressure relief valve
- ☐ Before installing, check that both dowel sleeves for centring oil pump on cylinder block are fitted.

If toothed belt or oil pump have to be removed:

- ◆ Check oil pump for free movement
- ◆ It must be possible to turn toothed belt pulley easily
- ◆ Replace if tight/binding.

**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**

- ☐ Clean sealing surface before fitting.
- ☐ Install with silicone sealant ⇒ Electronic Parts Catalogue (ETKA) .

**Note**

*Renew cover in sump every time it is removed ⇒ ETKA (electronic parts catalogue)*

- ☐ Removing and installing ⇒ [page 140](#) .

**18 - Bolt**

- ☐ 15 Nm

**19 - Seal**

- ☐ Renew after removing

**20 - Oil drain plug**

- ☐ Renew after removing
- ☐ 30 Nm

**21 - Bolt**

- ☐ Only for vehicles compliant with emission standard EU 5.
- ☐ 10 Nm

**22 - Oil level and oil temperature sender - G266-**

- ☐ Only for vehicles compliant with emission standard EU 5.
- ☐ Black 3-pin connector
- ☐ Removing and installing ⇒ [page 147](#) .

**23 - Seal**

- ☐ Only for vehicles compliant with emission standard EU 5.
- ☐ Renew after removing

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

- ☐ Only for vehicles compliant with emission standard EU 5.

**25 - Bolt**

- ☐ Insert without sealant.
- ☐ 27 Nm

**26 - Oil spray jet**

- ☐ For piston cooling.

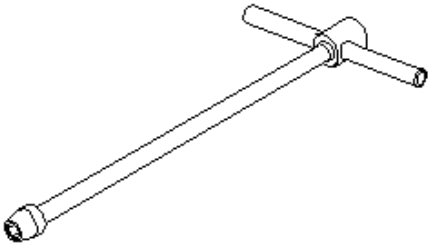
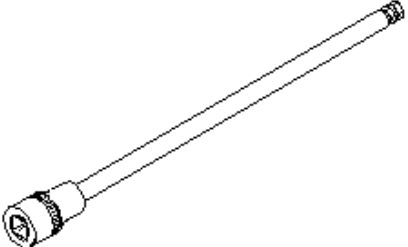

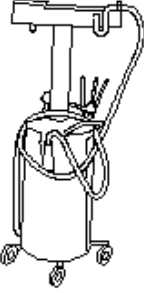
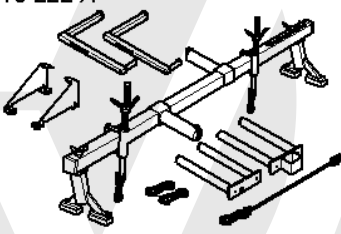




## 1.2 Removing and installing oil sump

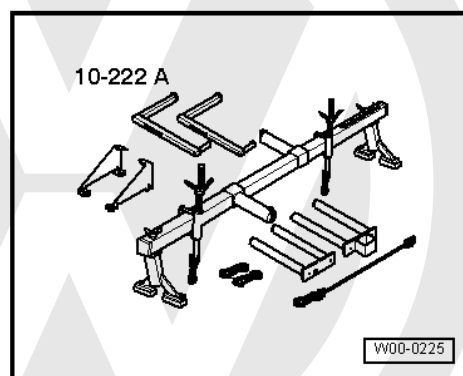
### Special tools and workshop equipment required

- ◆ 10 mm jointed spanner - VAS 3185-
- ◆ Special wrench, long reach - T10058-
- ◆ Torque wrench (5...50 Nm) - V.A.G 1331-
- ◆ Used oil collection and extraction unit - V.A.G 1782-

3185 	T10058 
V.A.G 1331 	V.A.G 1782 
	 WV17-40009

### Special tools and workshop equipment required

- ◆ Support bracket - 10 - 222 A-



Silicone sealant ⇒ Electronic Parts Catalogue (ETKA)

Hand drill with plastic brush

Eye protection

Flat scraper





## Removing

- Remove underbody guard, if fitted ⇒ General body repairs, exterior; Rep. gr. 66 ; Underbody guard .
- Drain coolant ⇒ [page 182](#) .
- Place used oil collection and extraction unit - V.A.G 1782- under engine and drain engine oil.



### Note

- ◆ *Observe environmental regulations for disposal.*
- ◆ *The following procedures are for the left side of the vehicle. This procedure also applies for the right side of the vehicle.*

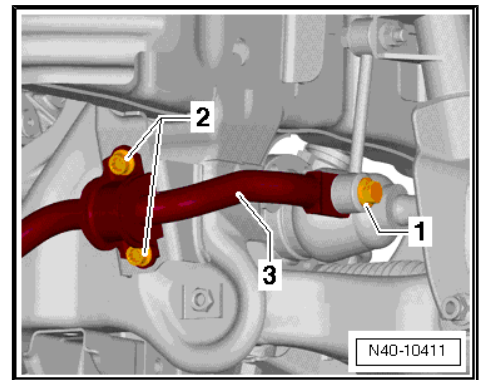
- Remove bolt -1- and pull it out from anti-roll bar -3-.
- Remove bolts -2-.
- Remove anti-roll bar -3- to side.

### Vehicles with four-wheel drive:

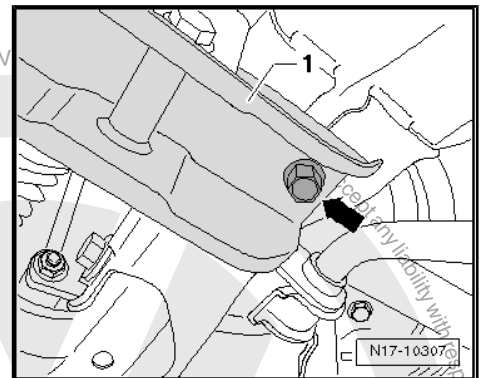


### Note

*When removing sump on a vehicle with four-wheel drive, bracket for final drive must be removed to allow drive shaft to be pulled downwards slightly. This is necessary to allow the sump to be taken out later over the shaft.*

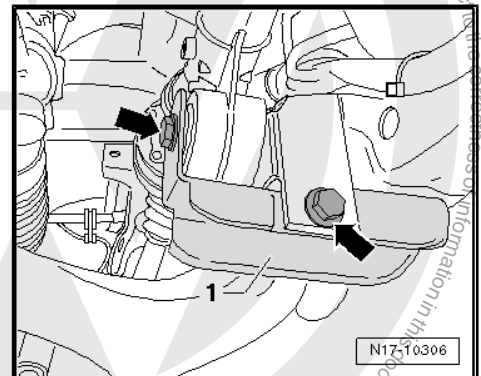


- Unscrew bolt -arrow- from bracket -1-.



- Unscrew bolts -arrows- and remove bracket -1- for final drive.
- Pull final drive downwards slightly.

### Continuation for all vehicles:







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



**Note**

*The securing bolts for the assembly mountings may only be removed if the engine is supported with support bracket - 10-222 A- !*

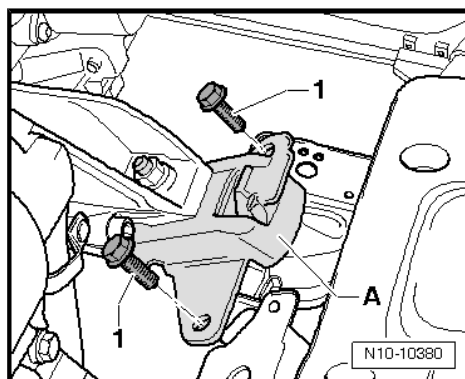
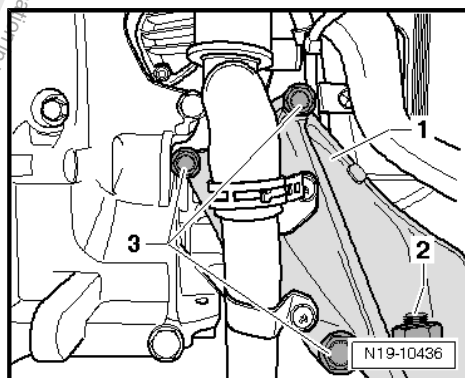
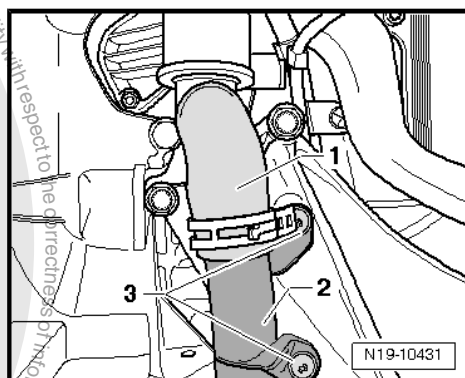
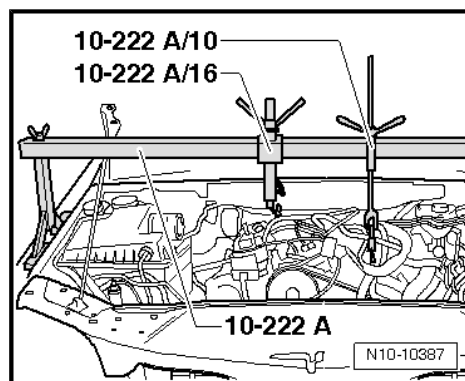
- Unscrew bolts -3- for coolant pipe -2- at left assembly mounting and remove coolant pipe -2- from coolant hose -1-.

- Unscrew bolts -3- for engine support -1- on left and right -1-.



**Caution**

- **Nut -2- must not be loosened.**
- **If nut -2- is loosened, engine mounting must subsequently be renewed.**
- ◆ **Engine mounting connection to engine support may only be loosened if engine mounting is to be renewed.**



- Unscrew bolts -1- from left engine mounting -A-.





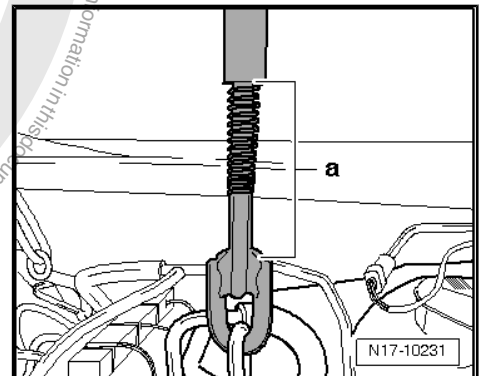
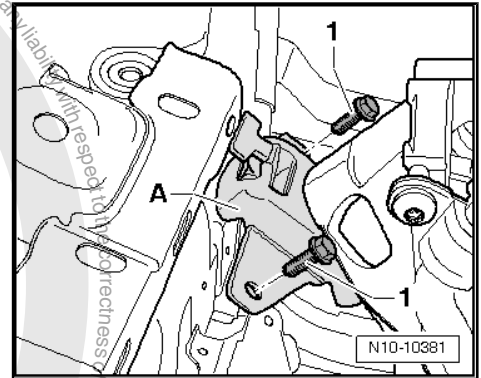
- Unscrew bolts -1- from right engine mounting -A-.



**Note**

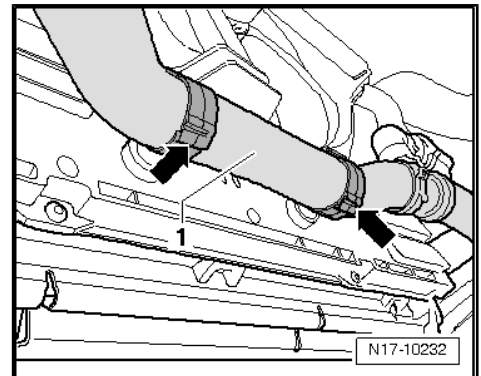
*Before lifting engine on vehicles with an air conditioner, pull electrical connection off air condition compressor otherwise it may be damaged.*

- Pull electrical connections off air conditioner compressor.
- Raise engine by 90 - 100 mm with support bracket - 10 - 222 A- and spindle - 10 - 222 A/10- -a-.
- Remove front anti-roll bar with coupling rods ⇒ Rep. gr. 40



- Unclip coolant hose -1- from brackets -arrows- on bottom of radiator and tie coolant hose -1- up slightly.

**For vehicles compliant with emission standard EU 5.**



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

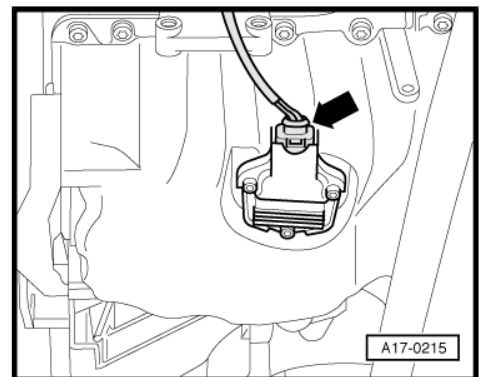
**Continuation for all vehicles**

- Turn crankshaft until recesses in dual-mass flywheel are visible for unscrewing sump bolts.



**Note**

*In vehicles without recesses in dual-mass flywheel, dual-mass flywheel must be removed ⇒ [page 54](#) .*





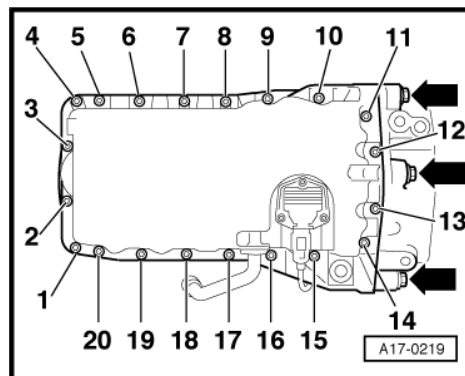


- Remove connecting bolts for sump and gearbox.
- Diagonally unscrew bolts of oil sump.
- Loosen sump with light blows of a rubber headed hammer if necessary.
- Remove sump.
- Remove sealant remaining on crankcase with flat scraper.



#### 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.

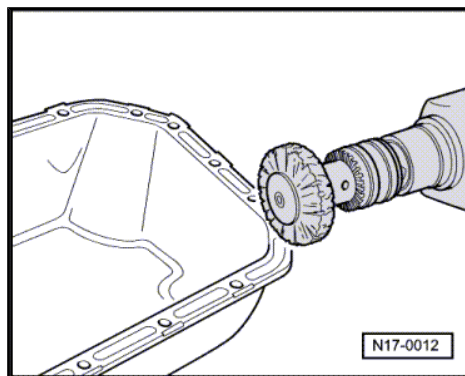
#### Installing

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

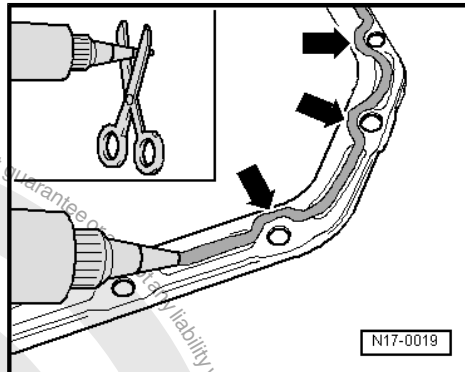


#### Note

- ◆ *Observe expiry date of sealing compound.*
- ◆ *Sump must be installed within 5 minutes of applying silicone sealing compound.*



- Cut off nozzle on tube at front marking ( $\varnothing$  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 bead along inner side of bolt holes -arrows-.



#### Caution

***Danger of blocking lubrication system with excess sealant.***

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



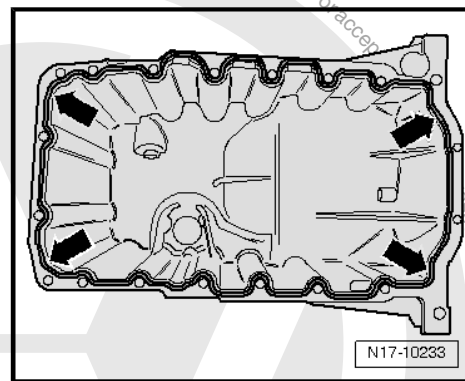


- Apply bead of sealant onto clean sealing surface of sump as illustrated.
- Thickness of sealant bead: 2...3 mm.



#### 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.
- Tighten sump bolts.
- Tighten bolts between sump and gearbox.
- Secure anti-roll bar to subframe. Use new bolts. Tighten bolts when vehicle is standing on its wheels in an unloaded condition or when vehicle is raised and wheels are also in the empty weight position ⇒ front suspension; Rep. gr. 40 .



#### Note

- ◆ Renew cover in sump every time it is removed ⇒ ETKA (electronic parts catalogue)
- ◆ Let sealing compound dry for approx. 30 minutes after installing oil sump. Only then fill with engine oil.
- Install bracket on vehicles with four-wheel drive
- Carefully guide engine into engine mounting with support bracket - 10 - 222 A- and secure engine to engine mounting ⇒ [page 31](#) .

#### Specified torques

- ◆ ⇒ ["1.1 Assembly overview - sump, oil pump", page 137](#)

Component	Specified torque
Anti-roll bar to coupling rod	110 Nm
Bolts between sump and gearbox.	40 Nm





## 1.3 Removing and installing oil pump

### Removing

- Remove sump ⇒ [page 140](#) .
- Unscrew bolts -arrows- for oil pump -1- and baffle plate -2-.
- Remove baffle plate.
- Detach oil pump -1- from toothed belt.

### 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 sluggish oil pump.*
- ◆ *Renew damaged toothed belt.*
- ◆ *The toothed belt can sag after long use, this is not a fault.*
- Check toothed belt for oil pump.
- Fit oil pump with toothed belt pulley into toothed belt and tighten along with baffle.
- Install sump ⇒ [page 140](#) .
- Replenish engine oil and check oil level ⇒ [page 147](#) .

### Specified torques

- ◆ ⇒ [“1.1 Assembly overview - sump, oil pump”, page 137](#)

## 1.4 Removing and installing oil pump, vehicles with balancer shaft module

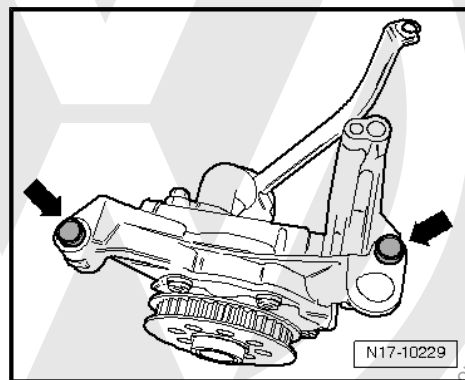
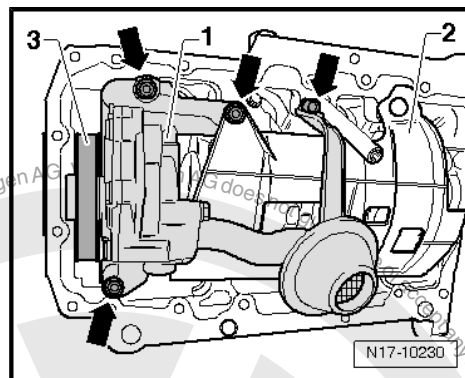
### Removing

- Remove sump ⇒ [page 140](#) .



#### Caution

***Bolt on intermediate gear wheel must not be loosened.***







- Remove circlip -1- with circlip pliers.
- Use a commercially available magnet to pull drive shaft -2- out of oil pump -arrow-.
- Unscrew bolt -4- and detach suction line from oil pump.
- Remove bolts -3- and -5- and remove oil pump.

### Installing

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



#### Note

- ◆ *Renew O-ring.*
- ◆ *Renew damaged or over-tensioned circlip.*
- ◆ *Circlip must lie in base of groove.*
- Ensure both dowel sleeves are in place before installing oil pump.
- Install sump ⇒ [page 140](#) .

### Specified torques

- ◆ ⇒ [“1.1 Assembly overview - sump, oil pump”, page 137](#)

## 1.5 Checking engine oil level

### Oil capacities:

With oil filter change: 7.0 l

Without oil filter change: 6.7 l

### Engine oil specifications:

⇒ Maintenance ; Booklet 11

### 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

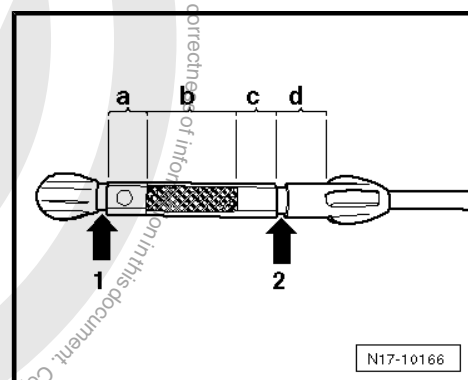
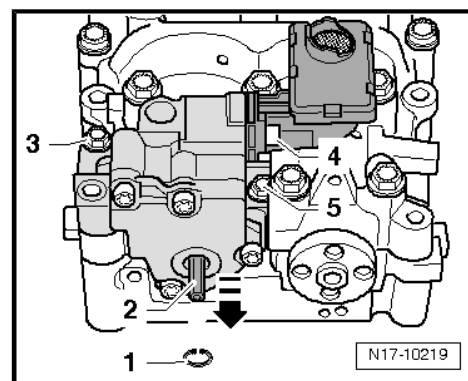
c - Oil level in max. mark area: Do not replenish engine oil!

d - The oil level may be in this area as a result of particular driving conditions.

## 1.6 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-.

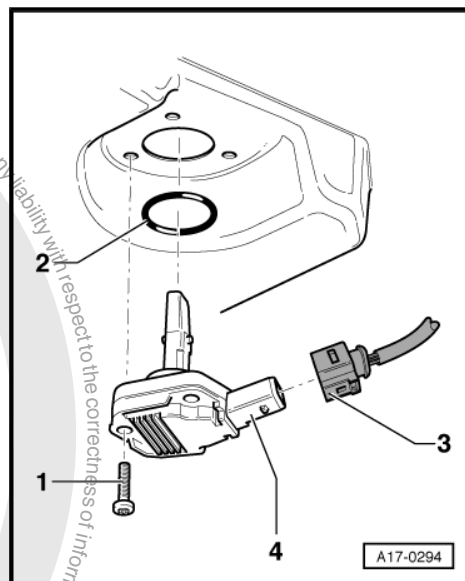
### Installing

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

- Renew self-locking bolts -1- and seal -2-.
- Replenish engine oil and check oil level ⇒ [page 147](#) .

### Specified torques

♦ ⇒ ["1.1 Assembly overview - sump, oil pump", page 137](#)



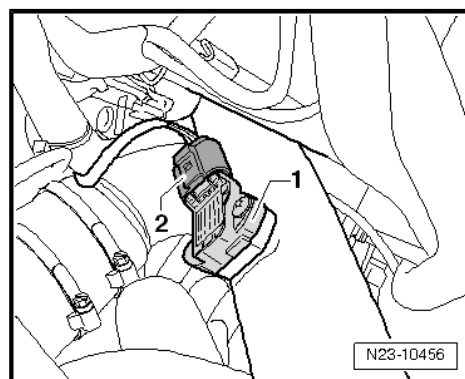
## 1.7 Removing and installing dipstick tube

### Removing

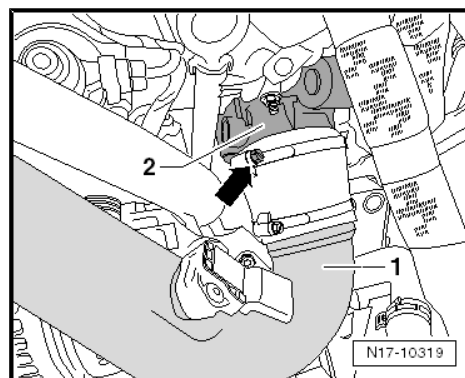
Observe general notes on the lubrication system ⇒ [page 7](#)

Observe rules for cleanliness when working on charge air system  
⇒ [page 8](#)

- Release and pull off connector -1- for intake air temperature sender - G42- together with charge air pressure sender - G31- -1-.



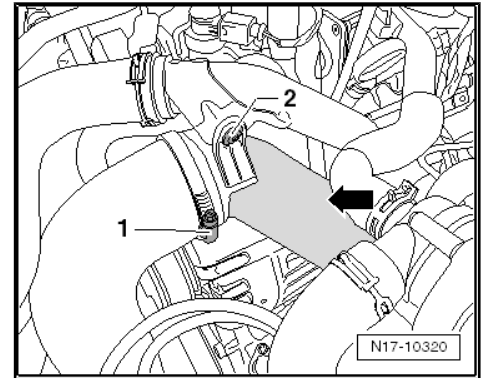
- Remove charge air pipe. Loosen clip -arrow- and pull hose connection with charge air pipe -1- off throttle valve module - J338- -2-.



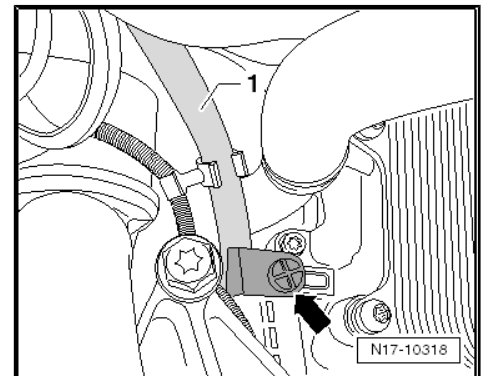




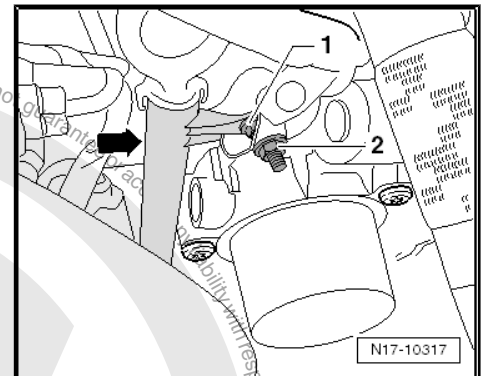
- Loosen clip -1- and pull charge air hose off charge air pipe. Then remove bolt -2- and remove pipe -arrow-.



- Loosen lower attachment -arrow- for dipstick tube. Unclip wiring harness retainer from engine speed sender - G28- on tube -1-.



- Remove nut -2-. Move wiring harness retainer aside. Then remove bolt -1- and remove dipstick tube -arrow- upwards.



### Installing

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



#### Note

*Always renew O-ring on dipstick tube every time tube is removed.*

### Specified torques

- ◆ ⇒ ["1.1 Assembly overview - sump, oil pump", page 137](#)





## 2 Oil filter, oil pressure switch

⇒ [“2.1 Assembly overview - oil filter housing with engine oil cooler”, page 150](#)

⇒ [“2.2 Removing and installing oil filter housing with engine oil cooler”, page 151](#)

⇒ [“2.3 Removing and installing oil pressure switch F1”, page 154](#)

⇒ [“2.4 Checking oil pressure switch F1”, page 156](#)

⇒ [“2.5 Checking oil pressure”, page 157](#)

⇒ [“2.6 Measure oil consumption”, page 157](#)

### 2.1 Assembly overview - oil filter housing with engine oil cooler



#### WARNING

*Do not lubricate rubber seals (11 and 14) with oil. Oil would make the coolant seals 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 7](#)

#### 6 - Guide tube

- ☐ Renew O-ring.

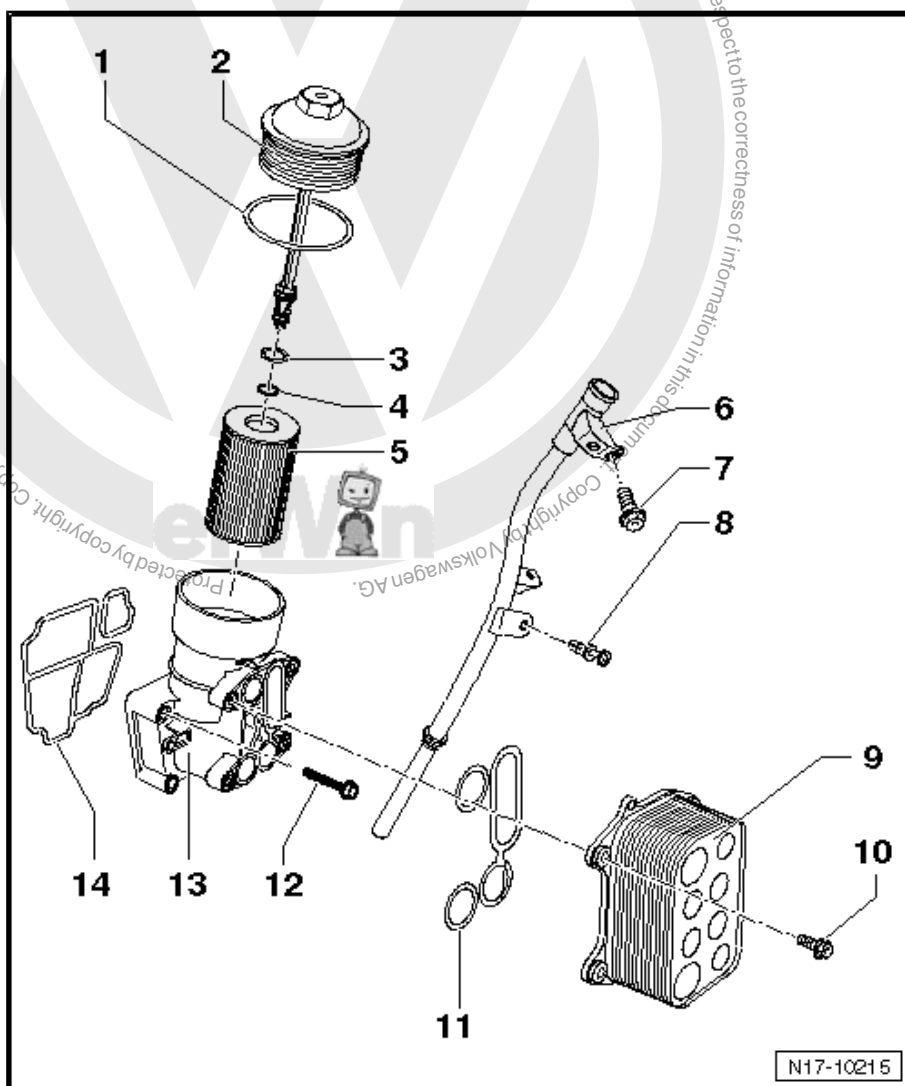
#### 7 - Bolt

- ☐ 10 Nm

#### 8 - Spreader clip

#### 9 - Engine oil cooler

- ☐ Observe general notes on the lubrication system ⇒ [page 7](#)
- ☐ Ensure clearance to adjacent components.
- ☐ Coolant hose schematic diagram ⇒ [page 175](#).
- ☐ Checking engine oil cooler for leaks ⇒ [page 159](#)
- ☐ Removing and installing engine oil cooler







⇒ [page 151](#) .

#### 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 torques and installation sequence ⇒ [page 151](#) .

#### 13 - Oil filter bracket

- ☐ Ensure clearance to adjacent components.
- ☐ Removing and installing oil filter bracket ⇒ [page 151](#) .

#### 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

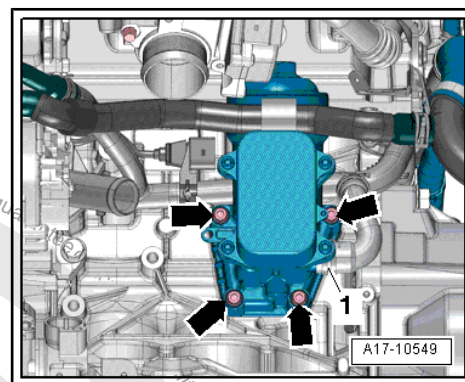


#### Note

*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 with engine oil cooler



#### WARNING

**Do not lubricate rubber seals (8 and 11) with oil. Oil would make the coolant seals swell up.**

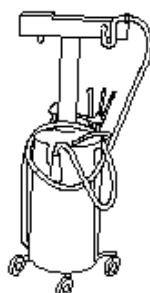




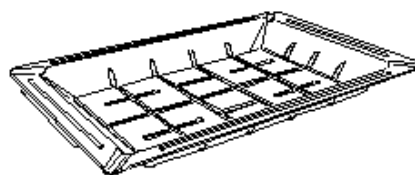
### Special tools and workshop equipment required

- ◆ 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-

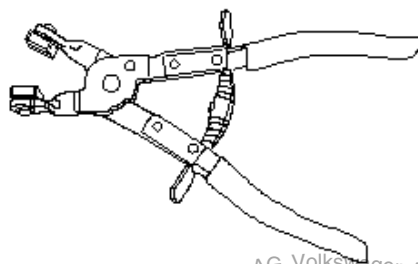
V.A.G. 1782



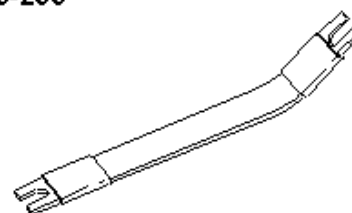
VAS 6208



VAS 6362



80-200



W17-10015

### Removing

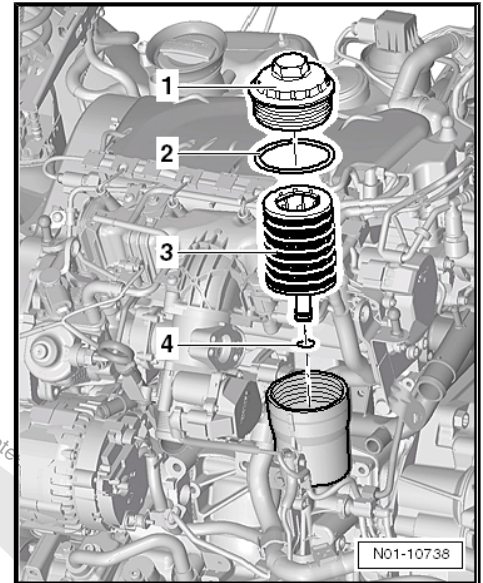
- Remove underbody guard, if fitted ⇒ General body repairs, exterior; Rep. gr. 66 Underbody guard .
- Drain coolant ⇒ [page 182](#) .



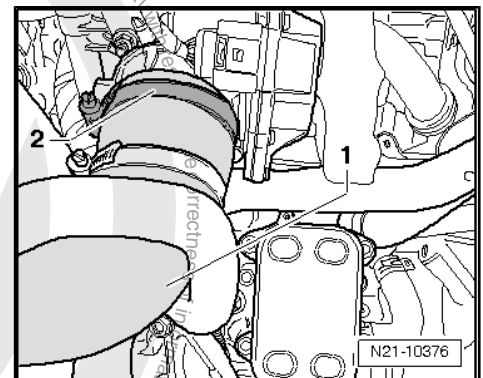


- Remove oil filter element.

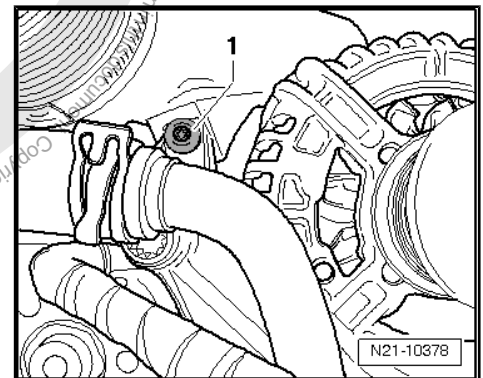
Observe instructions for hose connections with screw-type clips  
 ⇒ [page 11](#) .



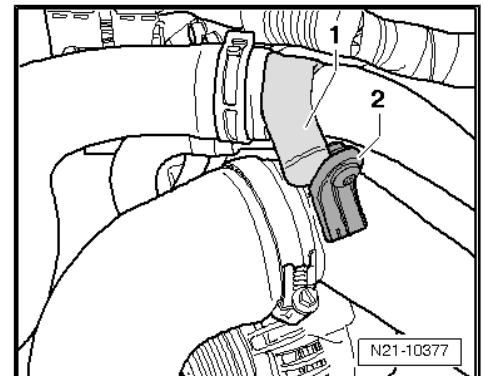
- Loosen screw-type clip -2- and pull charge air pipe -1- off from throttle valve module - J338- with throttle valve potentiometer - G69- and intake manifold flap motor - V157- .



- Unscrew securing bolt -1- for charge air pipe.



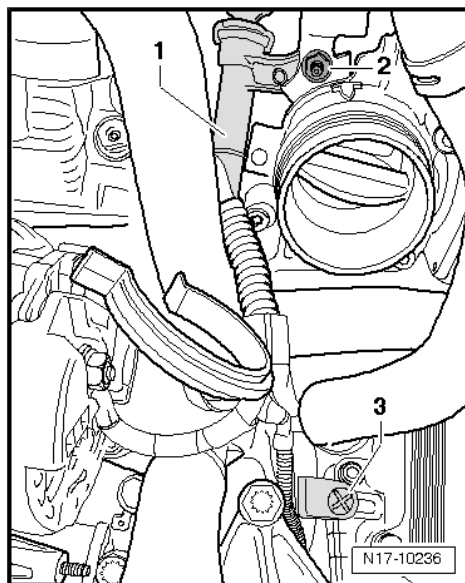
- Unscrew securing bolt from charge air pipe bracket -2- on coolant pipe -1-.



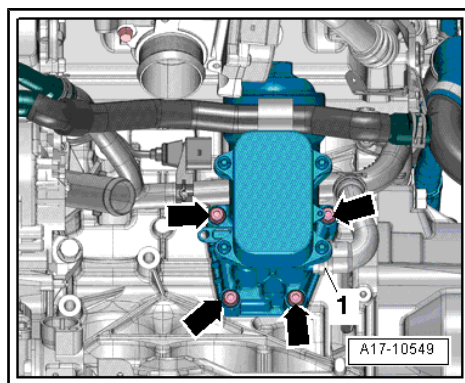




- Pull oil dipstick out of guide tube -1- a little and undo bolt -2-.
- Press off expanding clip -3- using removal lever - 80 - 200- .
- Pull oil dipstick guide tube off cylinder block upwards and push to side.



- Place drip tray for workshop crane - VAS 6208- under point of separation.
- Remove coolant hose, loosen hose clip -1- for this.
- Place used oil collection and extraction unit - V.A.G 1782- under engine.
- Unscrew bolts -arrows- and remove oil filter bracket with engine oil cooler.



### Installing

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



### Note

- ◆ *Renew gaskets, seals and O-rings.*
- ◆ *Hose unions and air intake pipes/hoses must be free of oil and grease when installing.*
- Filling with coolant ⇒ [page 182](#)

### Specified torques

- ◆ ⇒ [“2.1 Assembly overview - oil filter housing with engine oil cooler”, page 150](#)

## 2.3 Removing and installing oil pressure switch - F1-

Special tools and workshop equipment required





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

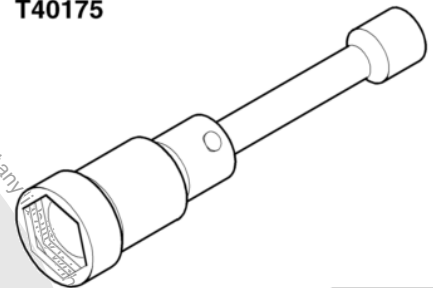
V.A.G 1331



W00-0427

- ◆ Jointed wrench 24 mm - T40175-

T40175



W00-10633

### Removing

- Unscrew securing bolt -1- from right engine mounting -A- and remove engine mounting.
- Unclip connector -2- on oil pressure switch - F1- .
- Unscrew oil pressure switch - F1- -B- from cylinder head using articulated wrench, 24 mm - T40175- .



### Note

Collect escaping engine oil with cloths.

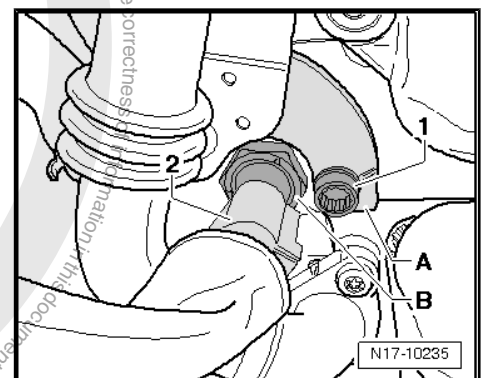
### Installing

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

- Tighten oil pressure switch - F1- .

### Specified torques

- ◆ ⇒ ["1.1 Assembly overview - cylinder head", page 78](#)



N17-10235

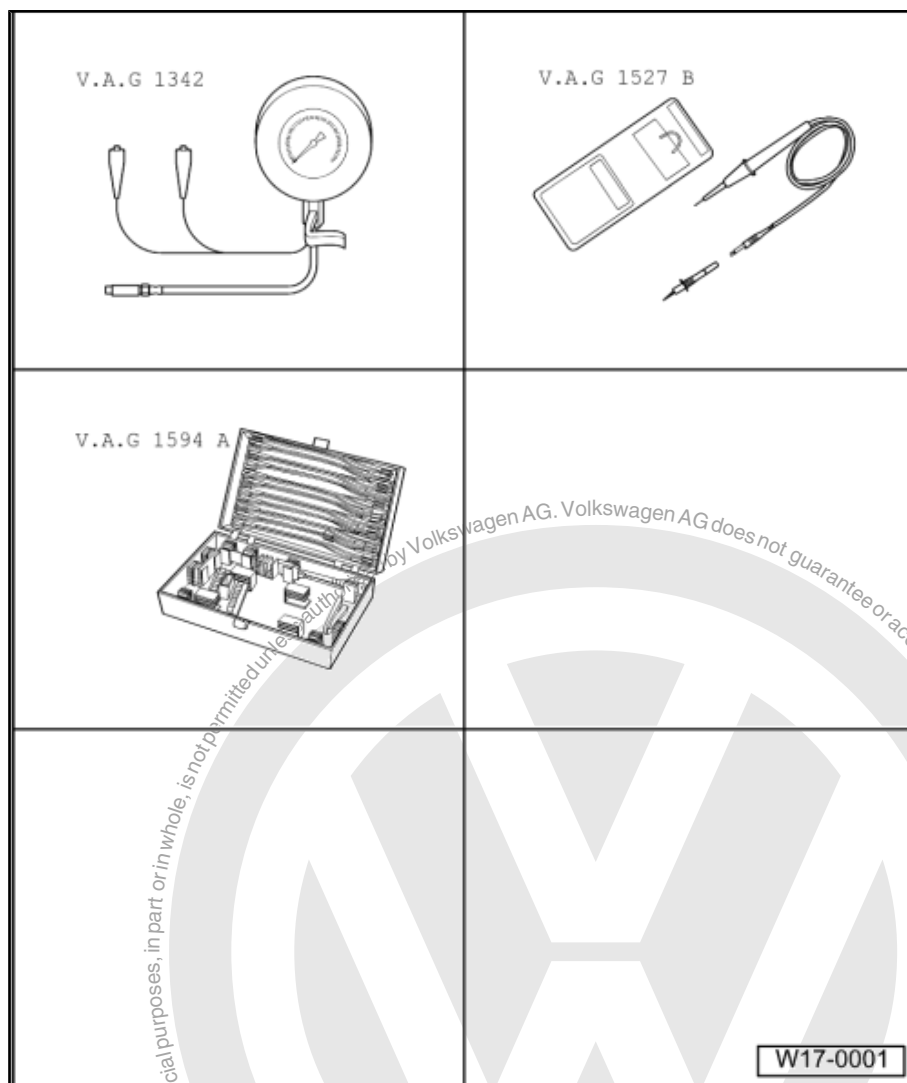




## 2.4 Checking oil pressure switch - F1-

### 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



### Test prerequisites

- Oil level OK, checking ⇒ [page 147](#)
- Engine oil temperature at least 80 °C (radiator fan must have run once)

### Test procedure



#### Note

*Functional check and repair of the optical and acoustic oil pressure warning: ⇒ Current flow diagrams, Electrical fault finding and Fitting locations*

- Pull connector off oil pressure switch - F1- .





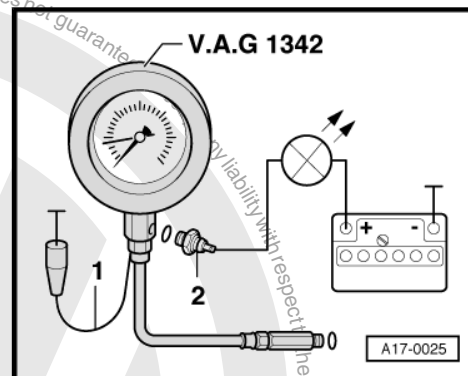
- Remove oil pressure switch - F1- -2- and screw into oil pressure tester - V.A.G 1342- .
- Screw tester into oil filter bracket in place of oil pressure switch .
- Connect brown wire -1- of tester to earth (-).
- Connect voltage tester - V.A.G 1527 B- to battery positive (+) and oil pressure switch using cables from auxiliary test set - V.A.G 1594 C- .
- LED must not light up.

If the LED lights up:

- Replace oil pressure switch - F1-

If LED does not light up:

- Start engine and increase revolutions slowly.
- From 0.30...0.60 bar the LED must light up, otherwise renew oil pressure switch - F1- .



## 2.5 Checking oil pressure

### Prerequisite

- Oil pressure tester - V.A.G 1342- is connected ⇒ [page 156](#).

### Test procedure

- Increase engine speed further.
- Oil pressure at idling speed: at least 0.6 bar (vehicles compliant with EU 4 standard: 1.2 - 2.1 bar).
- Oil pressure at 2,000 rpm: at least 1.0 bar (vehicles compliant with EU 4 standard: 1.6 - 2.1 bar).
- Oil pressure at 3,700 rpm in the case of vehicles compliant with EU 4 standard: 3.0 - 4.0 bar.
- At higher engine speeds, the oil pressure must not exceed 5.0 bar.



### Note

*In the case of vehicles compliant with the EU 4 standard, the oil pressure at 2,000 rpm can be between 3.0 and 4.0 bar during the first 1000 km.*

If specification is not attained:

- Renew oil pump if necessary ⇒ [page 146](#) .



### Note

*Mechanical damage, e.g. to bearings, could also be the cause for oil pressure being too low.*

## 2.6 Measure oil consumption

### Special tools and workshop equipment required

- ◆ Vehicle diagnostic tester

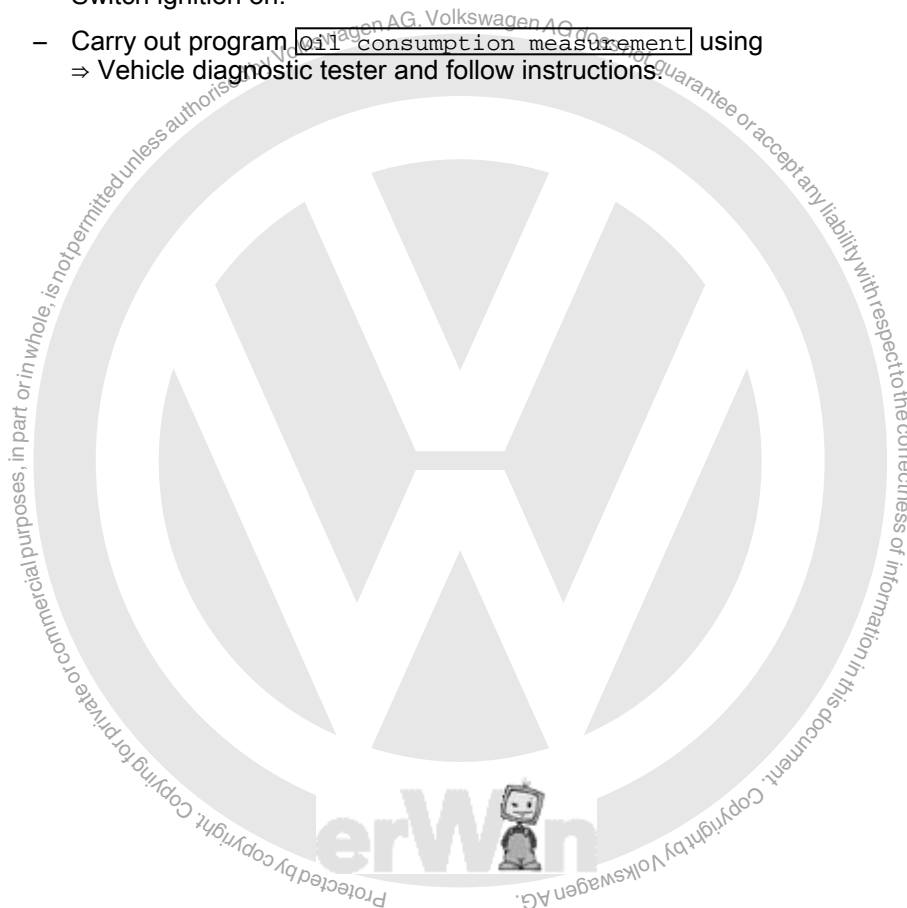
### Procedure

- Pull handbrake on.





- Manual gearbox: gear stick in neutral.
- Automatic gearbox: move selector lever to position "N".
- Connect ⇒ Vehicle diagnostic tester.
- Switch ignition on.
- Carry out program Oil consumption measurement using  
⇒ Vehicle diagnostic tester and follow instructions.







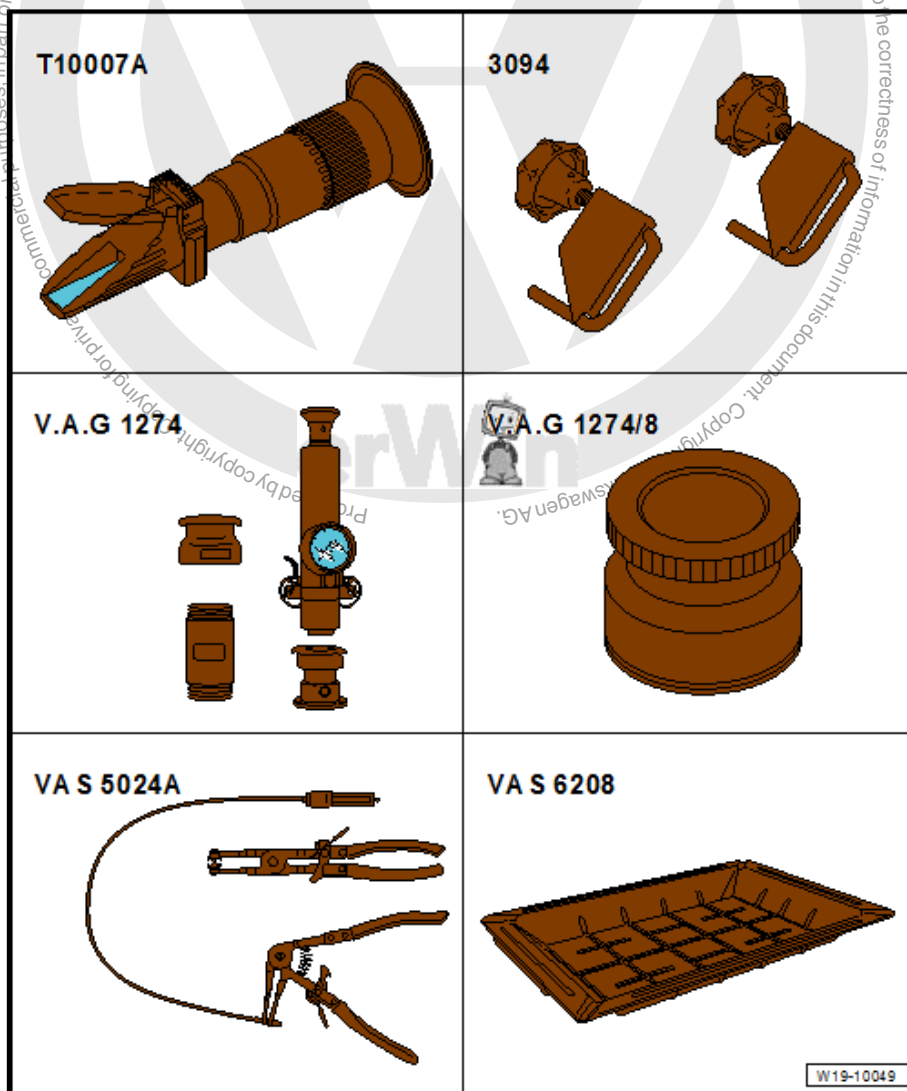
### 3 Engine oil cooler

⇒ ["3.1 Checking engine oil cooler for leaks", page 159](#)

#### 3.1 Checking engine oil cooler for leaks

##### Special tools and workshop equipment required

- ◆ Refractometer - T10007 A-
- ◆ Hose clamps up to 25 mm - 3094-
- ◆ Cooling system tester - V.A.G 1274-
- ◆ Adapter for cooling system tester - V.A.G 1274/8-
- ◆ Spring-type clip pliers - VAS 5024 A-
- ◆ Drip tray - V.A.G 1306- or drip tray - VAS 6208-







◆ Torque wrench - V.A.G 1331-

**Prerequisites:**

- Engine cold

**Test procedure**

- Remove underbody guard, if fitted ⇒ General body repairs, exterior; Rep. gr. 66 ; Underbody guard .
- Drain coolant ⇒ [page 182](#) .
- Loosen hose clip on engine oil cooler with spring-type clip pliers - VAS 5024- .
- Remove engine oil cooler with housing ⇒ [page 151](#) .



**Note**

- ◆ Collect escaping coolant with drip tray - VAS 6208- .
- ◆ Collect leaking engine oil with an absorbent cleaning cloth, if necessary.
- ◆ Do not damage engine oil cooler housing when securing with screw clamp.

**Checking when removed**

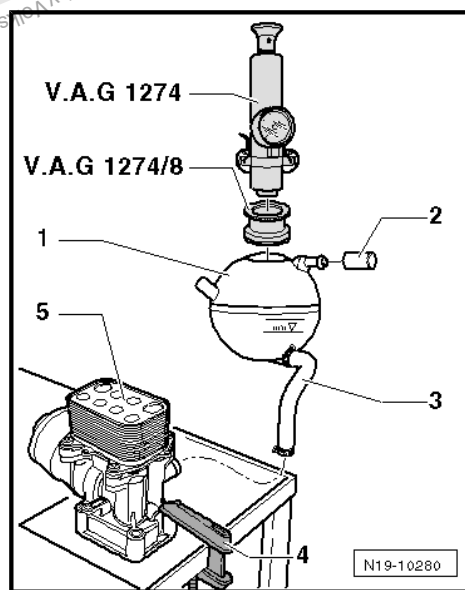
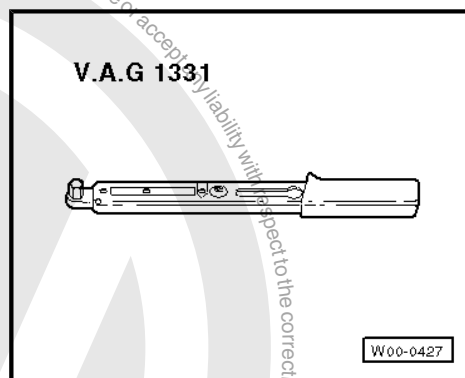
- Secure housing with the old gasket on a suitable, flat, clean surface using a suitable screw clamp -4-.
- Fit plug -2- to venting connection of expansion tank -1-.
- Fit coolant hose -3- to engine oil cooler -5- and to expansion tank -1-.
- Fill expansion tank up to "max." mark.
- Fit cooling system tester - V.A.G 1274- with adapter for cooling system tester - V.A.G 1274/8- on coolant expansion tank-1-.
- Using hand pump on tester, build up a pressure of approx. 1.6 bar.
- Observe pressure drop on pressure gauge. A pressure drop within 10 minutes is not permitted.

**If pressure drops:**

- Renew engine oil cooler ⇒ [page 151](#) .

Install in reverse order. In the process, note the following:

- Renew seal for housing.
- Install underbody guard, if fitted previously ⇒ General body repairs, exterior; Rep. gr. 66 ; Underbody guard .
- Check coolant level and, if necessary, replenish ⇒ [page 182](#) .
- Check engine oil level and, if necessary, replenish ⇒ [page 147](#) .







## 4 Balancer shaft module

⇒ ["4.1 Assembly overview - balancer shaft module", page 161](#)

⇒ ["4.2 Removing balancer shaft module", page 163](#)

⇒ ["4.3 Installing a new balancer shaft module", page 165](#)

⇒ ["4.4 Installing a previously used balancer shaft module again", page 168](#)

### 4.1 Assembly overview - balancer shaft module

#### 1 - Oil sump

- ☐ Tightening sequence  
⇒ [page 163](#) .
- ☐ Removing and installing  
⇒ [page 140](#) .

#### 2 - Bolt

- ☐ 10 Nm

#### 3 - Suction hose

- ☐ Clean strainer if soiled.

#### 4 - Bolt

- ☐ 10 Nm

#### 5 - O-ring

- ☐ Renew after removing

#### 6 - Oil pump

- ☐ Before installing, check that both dowel sleeves for centring oil pump on balancer shaft module are fitted.

#### 7 - Drive shaft for oil pump

#### 8 - Circlip

- ☐ Must lie in base of groove.
- ☐ Renew damaged or over-tensioned circlip.

#### 9 - Spur gear for balancer shaft

#### 10 - Bolt

- ☐ Renew after removing
- ☐ 20 Nm + 90°

#### 11 - Hub

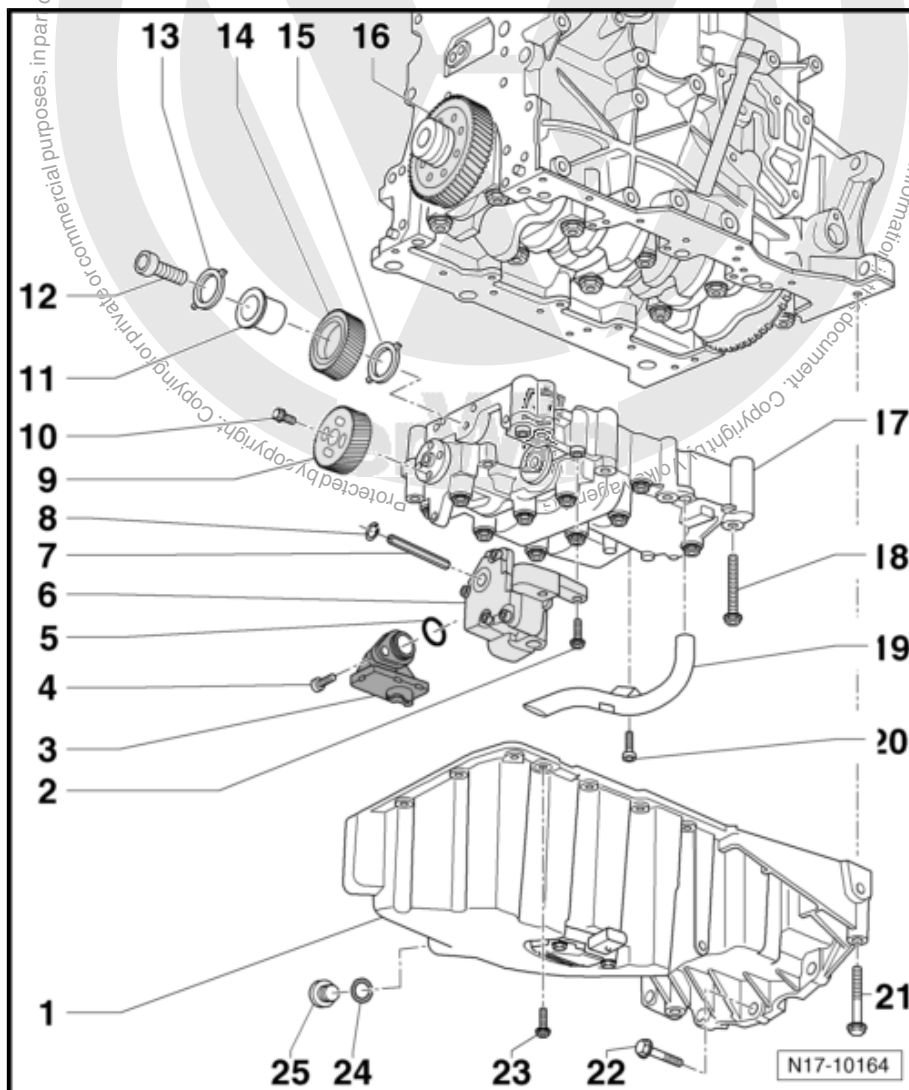
- ☐ Renew after removing
- ☐ For intermediate gear wheel.

#### 12 - Bolt

- ☐ Renew after removing
- ☐ 90 Nm + 90°

#### 13 - Thrust washer

- ☐ Renew after removing
- ☐ For intermediate gear wheel.
- ☐ Note installation position ⇒ [page 163](#) .

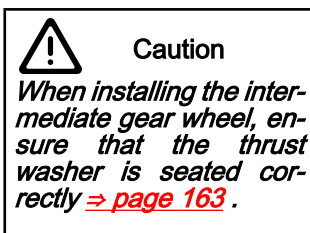






#### 14 - Intermediate gear wheel

- ☐ Renew after removing
- ☐ The new intermediate gear wheel has coating which wears down until the correct tooth backlash is attained.



- ☐ Installation position: Part number must be visible.
- ☐ Installing => [page 165](#).

#### 15 - Thrust washer

- ☐ Renew after removing
- ☐ For intermediate gear wheel.
- ☐ Note installation position => [page 163](#).
- ☐ If necessary, attach to housing with grease when installing intermediate gear wheel.

#### 16 - Spur gear for crankshaft

#### 17 - Balancer shaft module

- ☐ Removing => [page 163](#)
- ☐ Installing new balancer shaft module => [page 165](#).
- ☐ Reinstalling previously run balancer shaft module => [page 168](#).
- ☐ Before installing, check that the two dowel sleeves for centring balancer shaft module on cylinder block are fitted.

#### 18 - Bolt

- ☐ Renew after removing
- ☐ Note tightening sequence: installing new balancer shaft module => [page 165](#), reinstalling previously run balancer shaft module => [page 168](#).
- ☐ M7 = 13 Nm + 90°
- ☐ M8 = 20 Nm + 90°

#### 19 - Oil extraction pipe

#### 20 - Bolt

- ☐ 10 Nm

#### 21 - Bolt

- ☐ 40 Nm

#### 22 - Bolt

- ☐ 45 Nm

#### 23 - Bolt

- ☐ Tighten in stages and in diagonal sequence.
- ☐ Initial tightening torque: 5 Nm
- ☐ 15 Nm

#### 24 - Seal

- ☐ Permanently attached to drain plug.

#### 25 - Oil drain plug

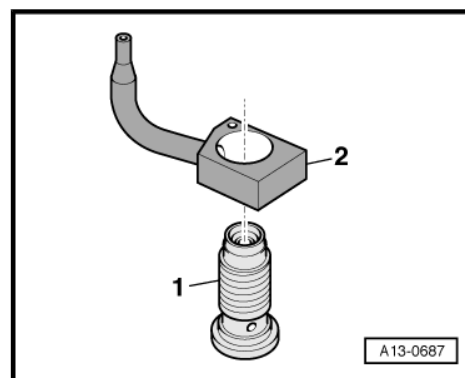
- ☐ Renew after removing
- ☐ With seal.
- ☐ 30 Nm





### Oil spray jet and pressure relief valve

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

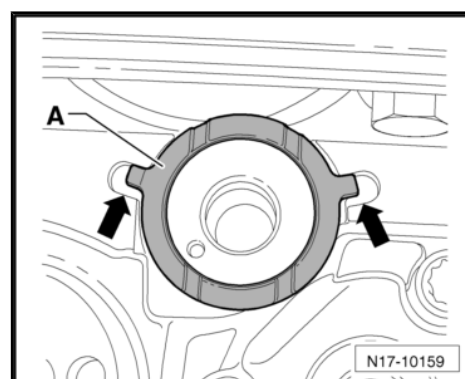


### Thrust washer installation position



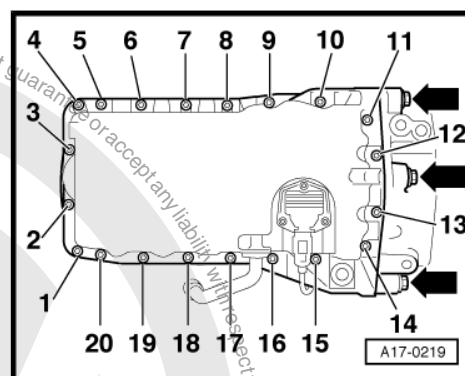
#### Caution

*When installing intermediate gear wheel, make sure that thrust washer -A- does not slip out of balancer shaft module indentations -arrows- and subsequently become jammed. If necessary, fix in place with grease on balancer shaft module.*



### Sump - tightening sequence

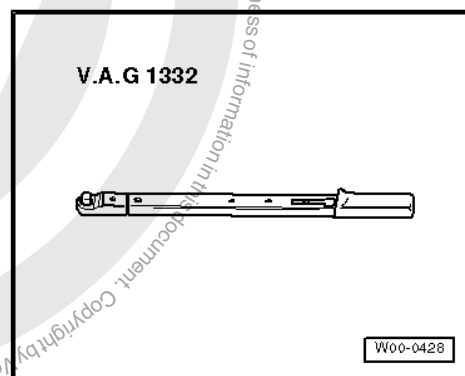
- Renew bolts for oil sump.
- Tighten bolts in diagonal sequence in 3 stages as follows:
  1. Initially tighten bolts 1 ... 20- diagonally.
  2. Tighten bolts -arrows- securing sump to gearbox.
  3. Tighten bolts 1 ... 20- diagonally in stages.



## 4.2 Removing balancer shaft module

### Special tools and workshop equipment required

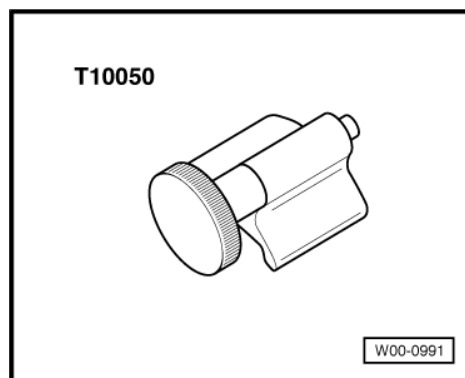
- ◆ Torque wrench - V.A.G 1332-







- ◆ Crankshaft stop - T10050- for engines with round crankshaft toothed belt pulley



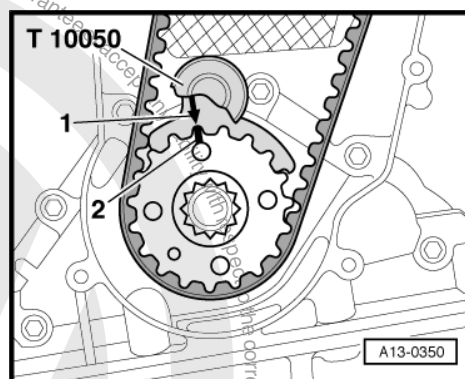
### Removing

- Pull oil dipstick out.
- Remove sump ⇒ [page 140](#) .
- Remove vibration damper ⇒ [page 44](#) .
- Rotate crankshaft to TDC and lock in position with crankshaft stop - T10050- .

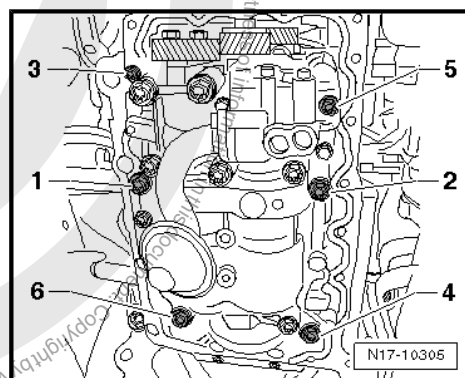


### Note

*The markings on the crankshaft toothed belt pulley -2- and the crankshaft stop -T10050- -1- must align. At the same time, the pin of the crankshaft stop - T10050- must engage in the drilling in the sealing flange.*



- Unscrew bolts in sequence -6 ... 1- and remove balancer shaft module together with oil pump.



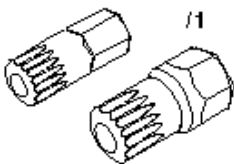
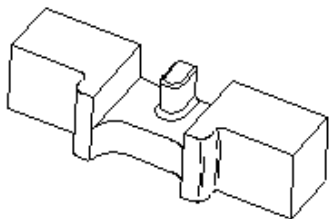
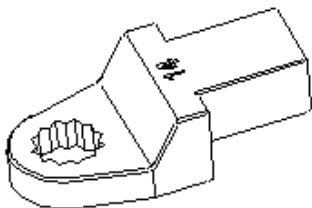


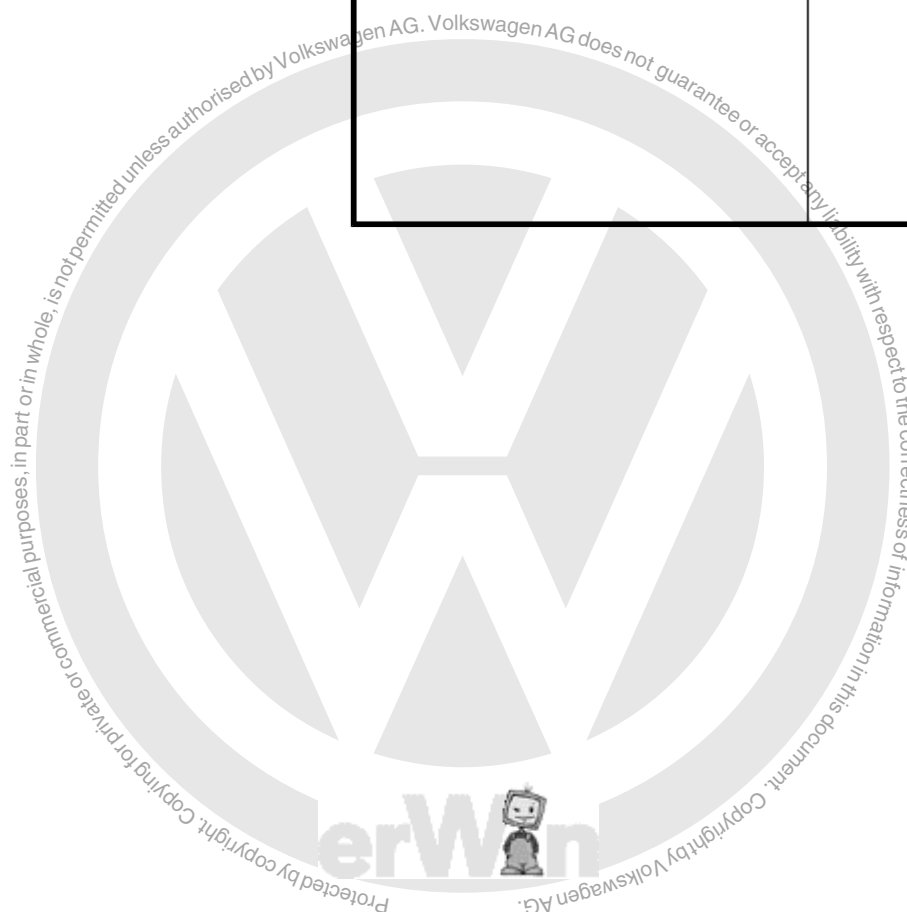


## 4.3 Installing a new balancer shaft module

### Special tools and workshop equipment required

- ◆ Bits - T10099-
- ◆ Locking device - T10255-
- ◆ 14 mm tool insert - T10393-

<p><b>T10099</b></p> 	<p><b>T10255</b></p> 
<p><b>T10393</b></p> 	
	<p>W17-10014</p>







#### Note

- ◆ *The spur gear drive of the balancer shaft module must be installed with correct tooth backlash.*
  - ◆ *A coating is applied to the new intermediate gear wheel to set the correct tooth backlash.*
  - ◆ *Intermediate gear wheels that have a white point are partly coated around the circumference. Intermediate gear wheels without a white spot are fully coated around the circumference.*
  - ◆ *The coating is quickly worn away, as a result of which the tooth backlash is set.*
  - ◆ *For this reason a new balancer shaft module must always be installed with a new intermediate gear wheel with special coating.*
  - ◆ *A white spot is positioned only on partly coated intermediate gear wheel to ensure correct installation position.*
  - ◆ *For intermediate gear wheels with coating around the complete circumference the installation position is not relevant.*
  - ◆ *Bolts that are firmly tightened at a specified angle must be renewed.*
- Crankshaft locked in position with crankshaft stop, T10050-



#### Caution

*The threaded connection of the intermediate gear wheel must be loosened to position the balancer shaft module. When doing this, do not loosen the bolt fully to prevent that the thrust washer does not slip behind the intermediate gear wheel. Thrust washer installation position ⇒ [page 163](#)*



#### Note

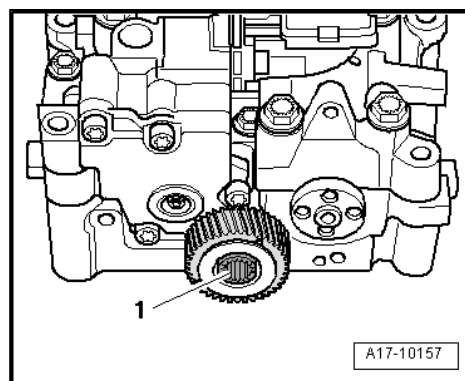
*For illustration purposes the following procedure is described with sealing flange removed.*

- Before positioning balancer shaft module on cylinder block, loosen bolt -1- for intermediate gear wheel approx. 45°.
- Check to see whether both dowel sleeves are in place to correctly position balancer shaft module on cylinder block.
- Place balancer shaft module on cylinder block.



#### Note

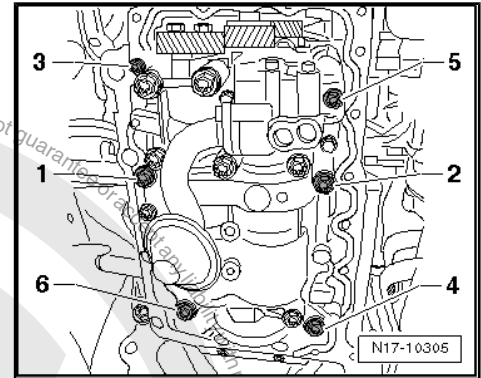
*Take care not to damage coating on intermediate gear wheel.*



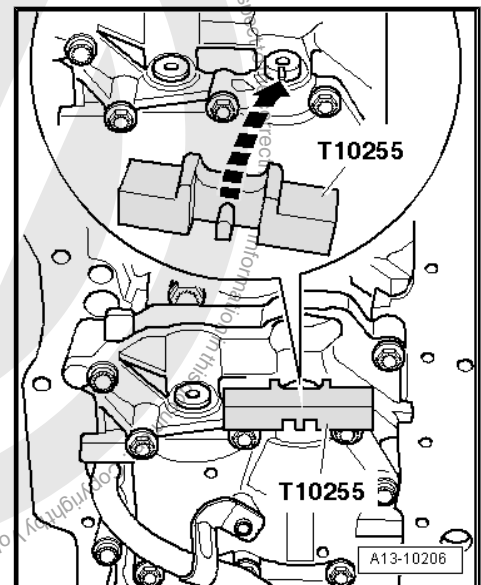




- Fit bolts in sequence -1 ... 6- and hand-tighten at first.
- Tighten bolts of balancer shaft module as follows:
  1. Initially tighten bolts in the sequence -1 ... 6- to 6 Nm.
  2. Tighten bolts -3- and -5- to 13 Nm.
  3. Turn bolts -3- and -5- 90° further with rigid spanner.
  4. Tighten bolts -1 ... 2-, -4- and -6- to 20 Nm.
  5. Turn bolts -1 ... 2-, -4- and -6- 90° further with rigid spanner.



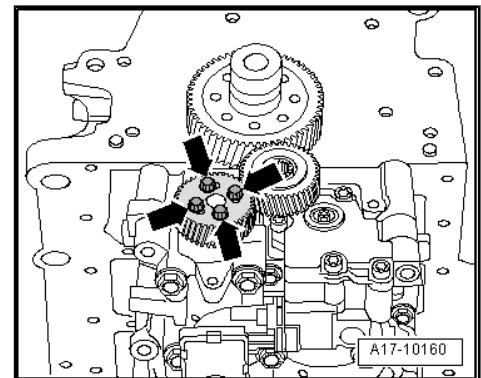
- Lock balancer shaft with locking device - T10255-. To do this, turn balancer shaft if necessary.
- Locking tool pin must engage in groove in balancer shaft when doing this.



- Carefully fit gear wheel of balancer shaft onto balancer shaft. While doing this, press intermediate wheel to one side slightly.

**Note**

- ◆ Ensure threaded holes in balancer shaft are central within elongated holes of balancer shaft gear wheel.
- ◆ If elongated holes in balancer shaft gear wheel cannot be aligned with the threaded holes, the balancer shaft gear wheel must be turned further by a corresponding number of teeth and must be mounted again.



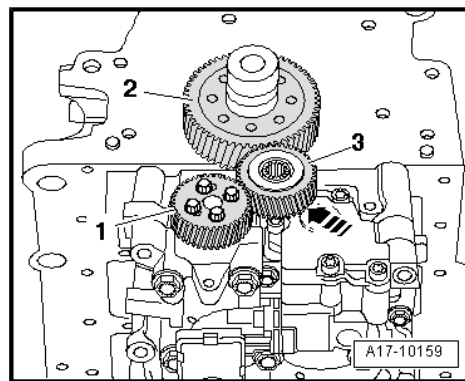
- Securely tighten balancer shaft gear wheel -arrows-.
- Remove locking tool - T10255- .





The following 3 procedures must be performed simultaneously (2nd mechanic required):

- Press intermediate gear wheel -3- forcefully (with assistance of a wooden rod if necessary) in -direction of arrow- into teeth of drive gear wheel -2- and balancer shaft gear wheel -1- (meshing together).
- When doing so, turn the balancer shaft gear wheel -1- slightly in an anticlockwise direction.
- Firmly tighten bolt for intermediate gear wheel using bit - T10099- and 14 mm tool insert - T10393-  
⇒ [Item 13 \(page 161\)](#) .
- Remove crankshaft stop - T10050- .



### Note

*No backlash may be perceptible after installing intermediate gear wheel. This can be checked by hand using light force.*

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

- Install sump ⇒ [page 140](#) .
- Install belt pulley/vibration damper (replace securing bolts)  
⇒ [page 44](#)
- Install poly V-belt ⇒ [page 40](#) .

### Specified torques

- ◆ ⇒ [“1.1 Assembly overview - sump, oil pump”, page 137](#)
- ◆ ⇒ [“2.1 Assembly overview - toothed belt drive”, page 105](#)

## 4.4 Installing a previously used balancer shaft module again



### Caution

*If the bolt for the intermediate wheel has been removed, a new intermediate wheel with coating must be installed and the hub ⇒ [Item 11 \(page 161\)](#) including bolt ⇒ [Item 12 \(page 161\)](#) and thrust washer must be renewed. This also applies to replacement of the drive gear wheel on the crankshaft and to removal of the crankshaft. Otherwise, the tooth backlash will be incorrect. Procedure when installing ⇒ [page 165](#) .*



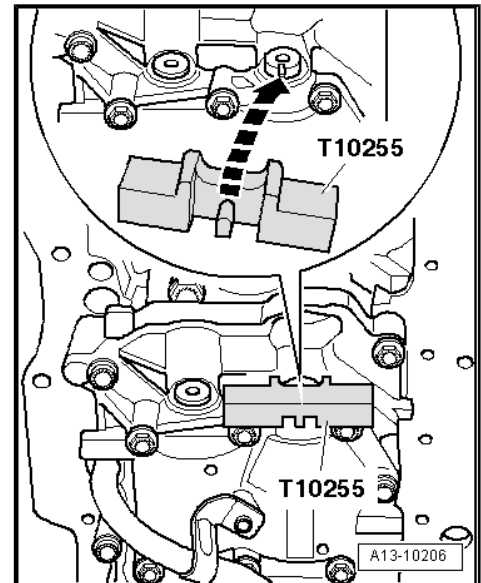
### Note

- ◆ *If the previously used balancer shaft module is to be reinstalled and neither has the drive gear wheel on crankshaft been renewed nor has the crankshaft been removed, proceed as follows. The intermediate gear wheel must also not have been loosened.*
- ◆ *Renew bolts tightened through an additional specified angle.*

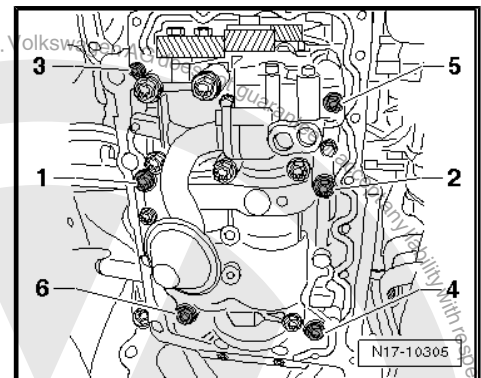




- Lock balancer shaft with locking device - T10255- . To do this, turn balancer shaft if necessary.
- Locking tool pin must engage in groove in balancer shaft when doing this.
- Check to see whether both dowel sleeves are in place to correctly position balancer shaft module on cylinder block.
- Place balancer shaft module on cylinder block.
- The intermediate gear wheel must mesh in the crankshaft drive gear wheel when the balancer shaft is locked.
- The intermediate gear wheel must have a slight tooth backlash.



- Fit bolts in sequence -1 ... 6- and hand-tighten at first.
- Tighten bolts of balancer shaft module as follows:
  1. Initially tighten bolts in the sequence -1 ... 6- to 6 Nm.
  2. Tighten bolts -3- and -5- to 13 Nm.
  3. Turn bolts -3- and -5- 90° further with rigid spanner.
  4. Tighten bolts -1 ... 2-, -4- and -6- to 20 Nm.
  5. Turn bolts -1 ... 2-, -4- and -8- 90° further with rigid spanner.
- Remove crankshaft stop - T10050- .



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

- Install sump ⇒ [page 140](#) .
- Install belt pulley/vibration damper (replace securing bolts) ⇒ [page 44](#)

#### Specified torques

- ◆ ⇒ ["1.1 Assembly overview - sump, oil pump", page 137](#)
- ◆ ⇒ ["2.1 Assembly overview - toothed belt drive", page 105](#)





## 5 Oil circuit

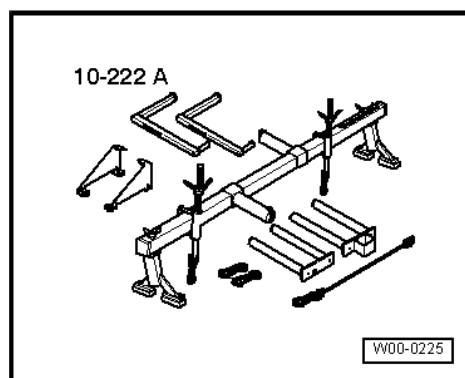
⇒ "5.1 Removing and installing oil supply line to turbocharger, 120 kW and 132 kW engines", page 170

⇒ "5.2 Removing and installing oil pressure line to turbocharger - 90 kW and 103 kW engine", page 172

### 5.1 Removing and installing oil supply line to turbocharger, 120 kW and 132 kW engines

Special tools and workshop equipment required

- ◆ Support bracket - 10 - 222 A-



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

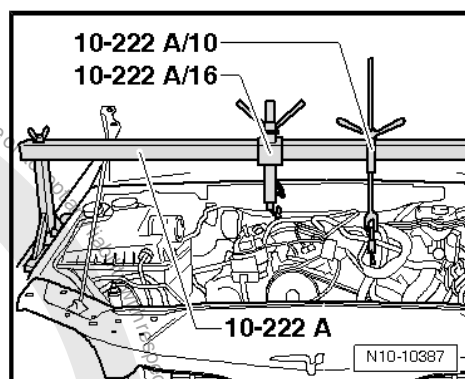


#### Note

*The securing bolts for the assembly mountings may only be removed if the engine is supported with support bracket - 10-222 A- !*

#### Removing

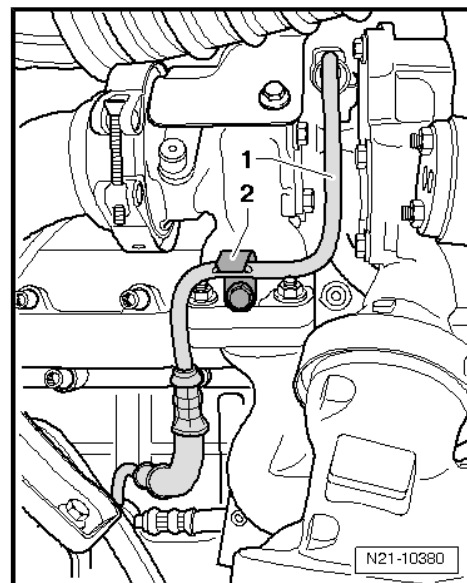
- Remove air filter housing ⇒ [page 370](#) .
- Remove starter ⇒ Electrical system; Rep. gr. 27 ; Removing and installing starter .
- Remove right engine support ⇒ [page 31](#) .



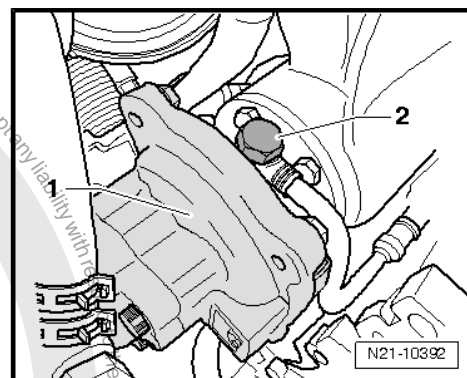




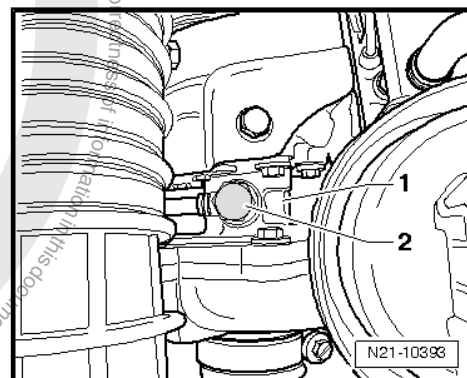
- Unbolt bracket -2- for oil supply line -1- from turbocharger.



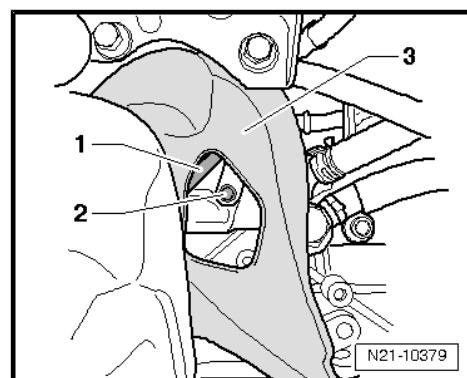
- Loosen banjo bolt -2- for oil supply line on upper turbocharger -1-.



- Loosen banjo bolt -2- for oil supply line on lower turbocharger -1-.



- Unscrew bolt -2- for oil supply line bracket -4- through opening on assembly mounting -3-.







- 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:

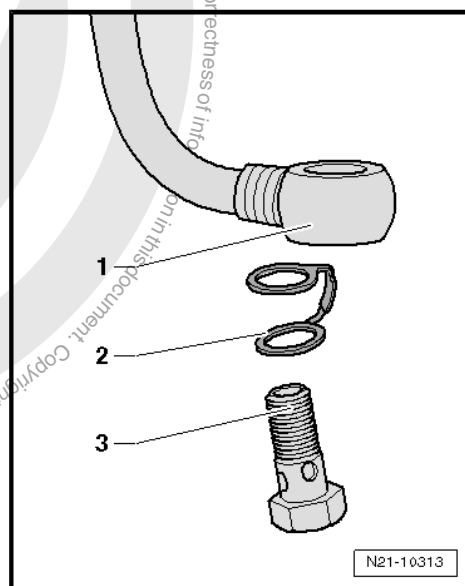
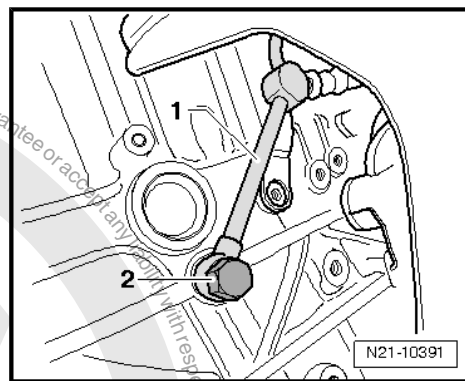
**Note**

*Procedure must be adhered to, this ensures that the oil supply line is installed stress-free.*

- 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 31](#) .
- Install charge air pipe ⇒ [page 250](#) .
- Install air filter housing ⇒ [page 368](#) .

**Specified torques**

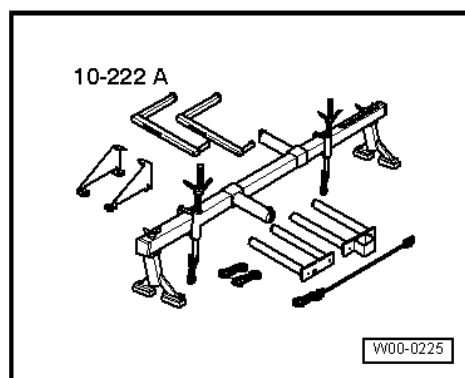
- ♦ ⇒ ["2.1 Removing and installing assembly mountings", page 31](#)
- ♦ ⇒ ["1.1 Assembly overview - charge air system", page 250](#)
- ♦ ⇒ ["7.1 Assembly overview - air filter", page 368](#)
- ♦ ⇒ ["2.1 Assembly overview - turbocharger, 120 kW and 132 kW engines", page 260](#)



## 5.2 Removing and installing oil pressure line to turbocharger - 90 kW and 103 kW engine

**Special tools and workshop equipment required**

- ♦ Support bracket - 10 - 222 A-







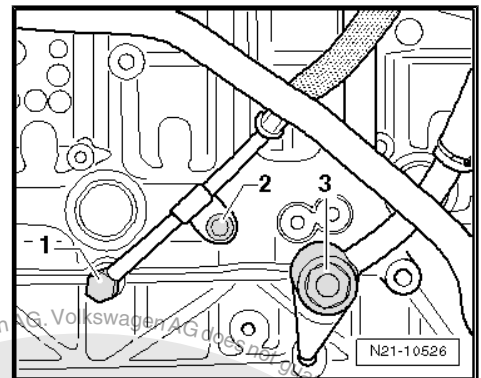
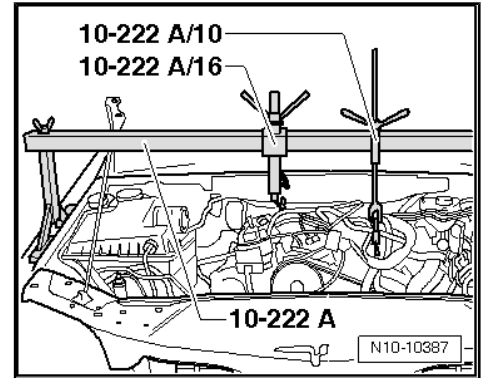
- Position engine with support bracket - 10 - 222 A- as shown and take up weight of engine in installation position.

**Note**

*The securing bolts for the assembly mountings may only be removed if the engine is supported with support bracket - 10-222 A- !*

**Removing**

- Remove air filter housing ⇒ [page 370](#) .
- Remove starter ⇒ Electrical system; Rep. gr. 27 ; Removing and installing starter .
- Remove right engine support ⇒ [page 31](#) .
- Remove securing bolt -2-.
- Remove banjo bolts -1 and 3-.
- Collect escaping oil with a cloth.



- Remove bolts -1- and remove oil pressure line.
- Collect escaping oil with a cloth.

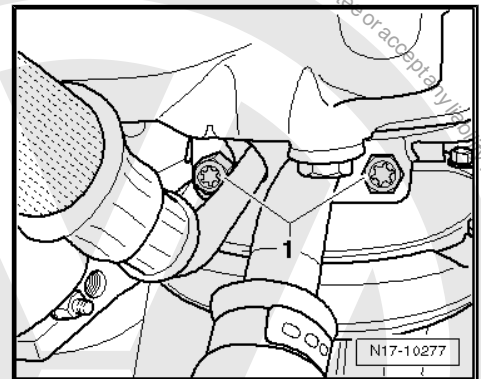
**Installing**

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

**Note**

*Procedure must be adhered to, this ensures that the oil pressure line is installed stress-free.*

- Renew seals, gaskets and self-locking nuts.



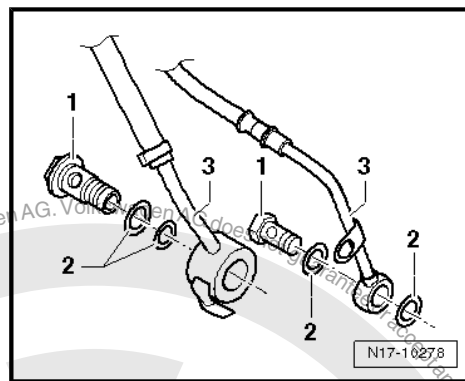




- Fit new seals -2- onto the respective line connection -3- and secure by screwing in the corresponding banjo bolt -1-.
- Install starter ⇒ Electrical system; Rep. gr. 27 ; Removing and installing starter .
- Install right engine support ⇒ [page 31](#) .
- Install charge air pipe ⇒ [page 250](#) .
- Install air filter housing ⇒ [page 368](#) .

#### Specified torques

- ♦ ⇒ [“2.1 Removing and installing assembly mountings”, page 31](#)
- ♦ ⇒ [“1.1 Assembly overview - charge air system”, page 250](#)
- ♦ ⇒ [“7.1 Assembly overview - air filter”, page 368](#)
- ♦ ⇒ [“2.2 Assembly overview - turbocharger, 90 kW and 103 kW engines”, page 264](#)







## 19 – Cooling

### 1 Cooling system, coolant

⇒ [“1.1 Coolant hose schematic diagram”, page 175](#)

⇒ [“1.2 Assembly overview - coolant hoses”, page 178](#)

⇒ [“1.3 Checking cooling system for leaks”, page 180](#)

⇒ [“1.4 Draining and filling coolant”, page 182](#)

#### 1.1 Coolant hose schematic diagram

##### 1.1.1 Coolant hose schematic diagram for vehicles with supplementary heater, engine codes CDCA and CDBA

1 - Expansion tank

2 - Heat exchanger for heater unit

3 - Union on rear of cylinder head

- ☐ With coolant temperature sender - G62-

4 - Cylinder head

5 - Engine oil cooler

6 - 4/2-way valve

- ☐ With thermostat.
- ☐ Can only be renewed complete.
- ☐ Removing and installing ⇒ [page 191](#).

7 - Circulation pump - V55-

- ☐ Assembly overview ⇒ [page 189](#).
- ☐ Removing and installing ⇒ [page 200](#).

8 - Auxiliary heater

- ☐ Depending on equipment.

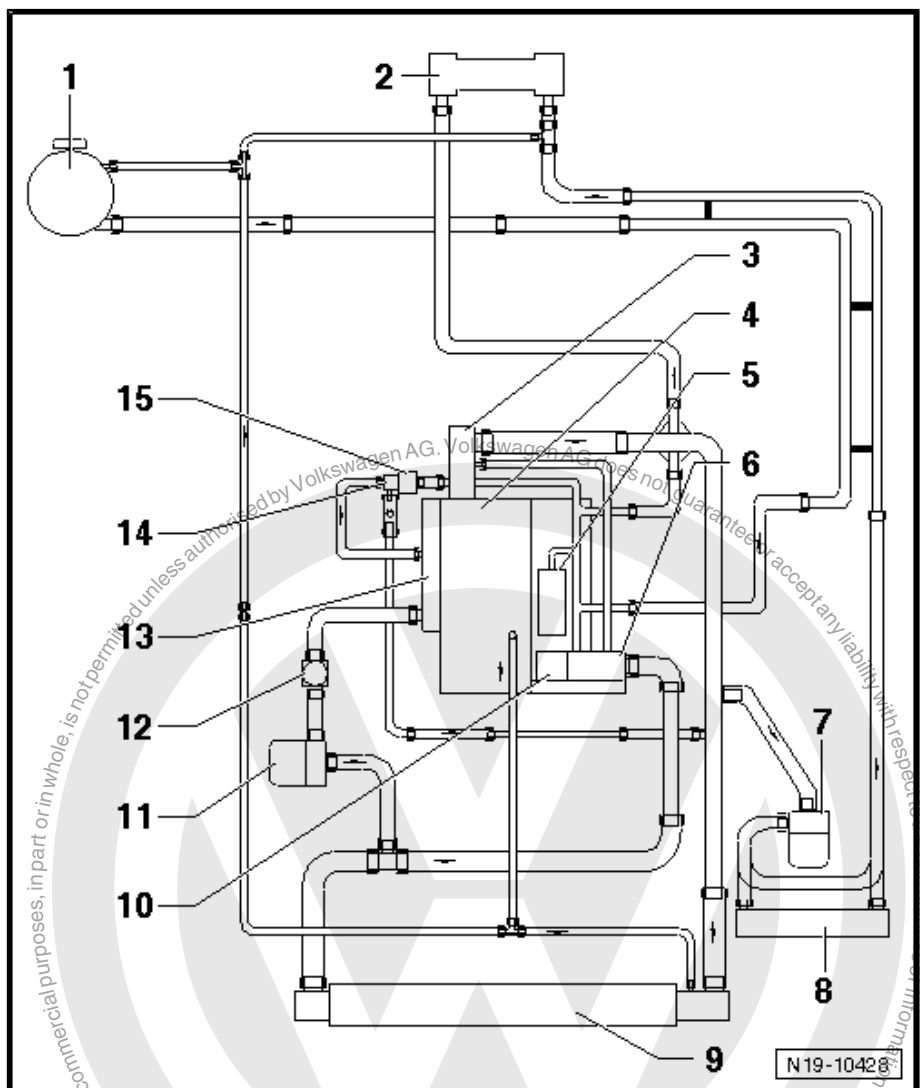
9 - Radiator

- ☐ Renew coolant after replacing.
- ☐ Removing and installing ⇒ [page 204](#).

10 - Coolant pump

11 - Continued coolant circulation pump - V51-

- ☐ Removing and installing ⇒ [page 198](#).







- 12 - Continued coolant circulation pump - V51-
- 13 - Radiator outlet coolant temperature sender - G83-
- 14 - Exhaust gas recirculation cooler
  - ☐ Removing and installing ⇒ [page 392](#) .
- 15 - Thermostat (Y-piece)
- 16 - Coolant temperature sender - G62-

### 1.1.2 Coolant hose schematic diagram, vehicles with auxiliary heater, engine codes CSHA and CNEA (emission standards EU 4 and EU 5)

- 1 - Expansion tank
- 2 - Heat exchanger for heater unit
- 3 - Union on rear of cylinder head

- ☐ With coolant temperature sender - G62-

- 4 - Cylinder head
- 5 - Engine oil cooler

- 6 - 4/2-way valve
  - ☐ With thermostat.
  - ☐ Can only be renewed complete.

- 7 - Circulation pump - V55-

- 8 - Coolant pump

- 9 - Auxiliary heater
  - ☐ Depending on equipment.

- 10 - 2-way valve for coolant shut-off valve - N147-

- 11 - Radiator
  - ☐ Renew coolant after replacing

- 12 - Exhaust gas recirculation cooler changeover valve - N345-

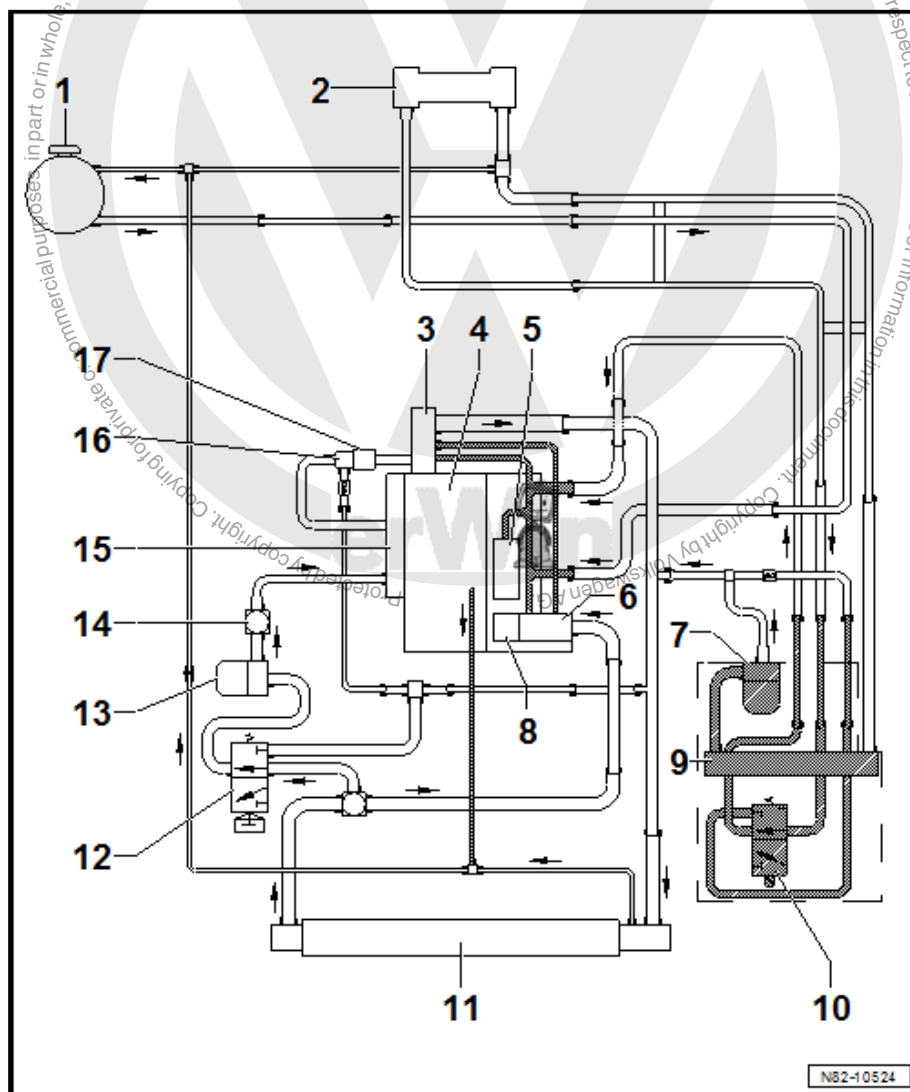
- 13 - Continued coolant circulation pump - V51-

- 14 - Radiator outlet coolant temperature sender - G83-

- 15 - Exhaust gas recirculation cooler

- 16 - Thermostat (Y-piece)

- 17 - Coolant temperature sender - G62-







### 1.1.3 Coolant hose schematic diagram, vehicles with auxiliary heater, engine codes CDBA and CNFA (emission standards EU 3, EU 4 and EU 5)

1 - Expansion tank

2 - Heat exchanger for heater unit

3 - Union on rear of cylinder head

- ☐ With coolant temperature sender - G62-

4 - Cylinder head

5 - Engine oil cooler

6 - Circulation pump - V55-

7 - 4/2-way valve

- ☐ With thermostat.
- ☐ Can only be renewed complete.

8 - Coolant pump

9 - Auxiliary heater

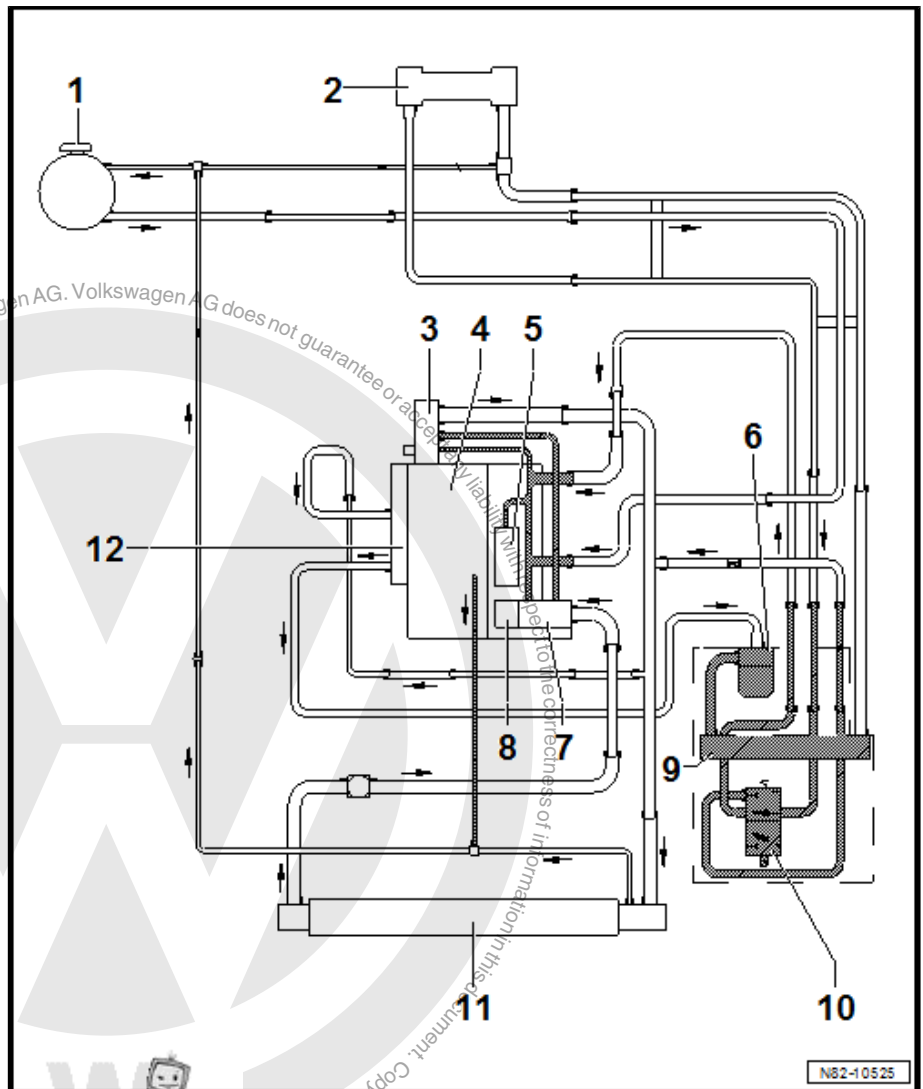
- ☐ Depending on equipment.

10 - 2-way valve for coolant shut-off valve - N147-

11 - Radiator

- ☐ Renew coolant after replacing

12 - Exhaust gas recirculation cooler







## 1.2 Assembly overview - coolant hoses

### 1 - Expansion tank

- ☐ Checking cooling system for leaks with cooling system tester - V.A.G 1274- and adapter - V.A.G 1274/8- ➔ [page 180](#) .
- ☐ With coolant temperature display sender - G32- .

### 2 - Spring-type clip

- ☐ Hose clip pliers - VAS 6340- or hose clip pliers - VAS 6362- are recommended for installation of spring-type clips.

### 3 - Coolant line

- ☐ Coolant hose schematic diagram ➔ [page 175](#) .

### 4 - Retaining clip

### 5 - T piece

- ☐ To heat exchanger

### 6 - Connection

- ☐ Removing and installing with coolant temperature sender - G62- ➔ [page 196](#)

### 7 - Y-thermostat

### 8 - Coolant pipe

### 9 - Coolant line

- ☐ Coolant hose schematic diagram ➔ [page 175](#) .

### 10 - Bolt

- ☐ 9 Nm

### 11 - Ball thermostat (4/2-way valve)

- ☐ Thermostat is installed in valve.
- ☐ Renew completely.
- ☐ Removing and installing ➔ [page 191](#) .

### 12 - O-ring

- ☐ Renew if damaged or leaking.

### 13 - Coolant pipe

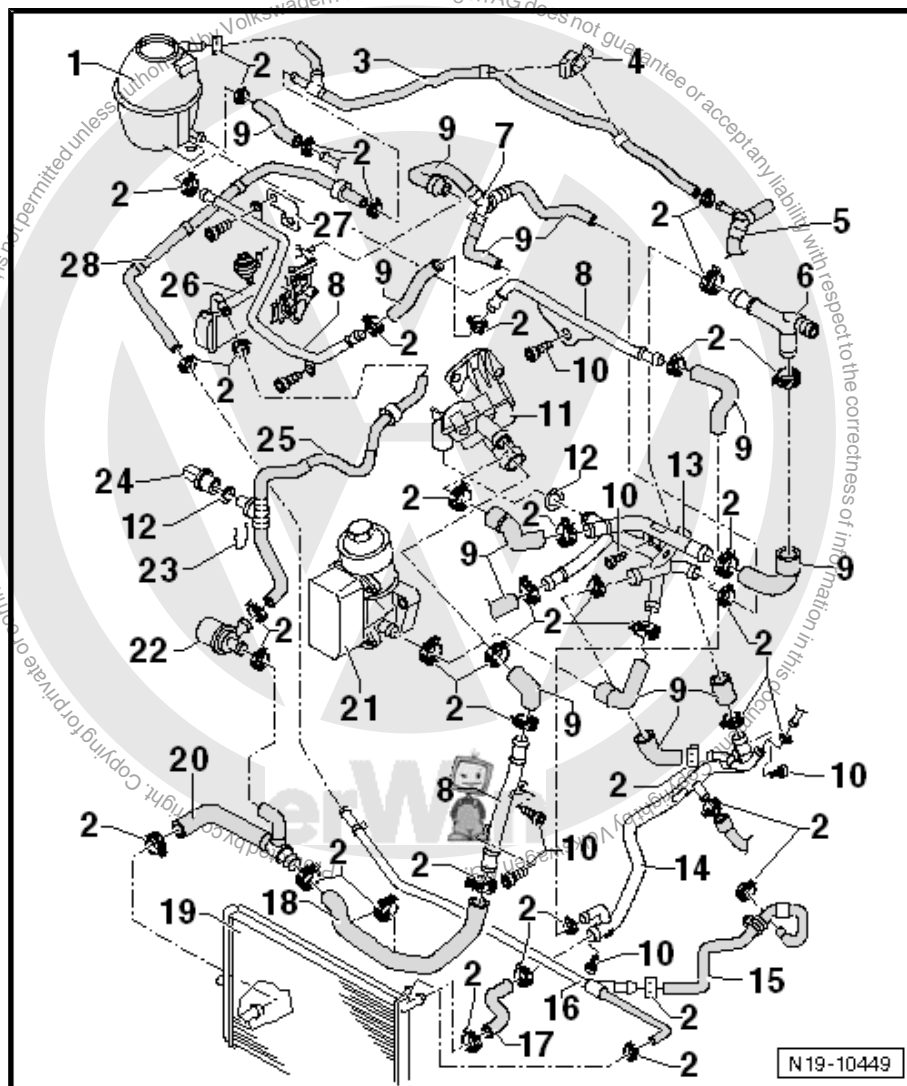
### 14 - Coolant pipe

### 15 - Coolant line

- ☐ Coolant hose schematic diagram ➔ [page 175](#) .

### 16 - Coolant line

- ☐ Coolant hose schematic diagram ➔ [page 175](#) .
- ☐ Secured to top of radiator.





**17 - Upper coolant hose**

- ☐ Coolant hose schematic diagram ➔ [page 175](#) .

**18 - Coolant hose**

- ☐ Coolant hose schematic diagram ➔ [page 175](#) .

**19 - Radiator**

- ☐ Renew coolant after replacing
- ☐ Removing and installing ➔ [page 204](#) .

**20 - Coolant hose at bottom with T piece**

- ☐ Coolant hose schematic diagram ➔ [page 175](#) .

**21 - Engine oil cooler****22 - Continued coolant circulation pump - V51-**

- ☐ Removing and installing ➔ [page 198](#) .

**23 - Retaining clip****24 - Radiator outlet coolant temperature sender - G83-**

- ☐ Removing and installing ➔ [page 197](#) .

**25 - Coolant line**

- ☐ Coolant hose schematic diagram ➔ [page 175](#) .

**26 - Exhaust gas recirculation cooler**

- ☐ Removing and installing ➔ [page 392](#) .

**27 - Bracket****28 - Coolant line**

- ☐ Coolant hose schematic diagram ➔ [page 175](#) .



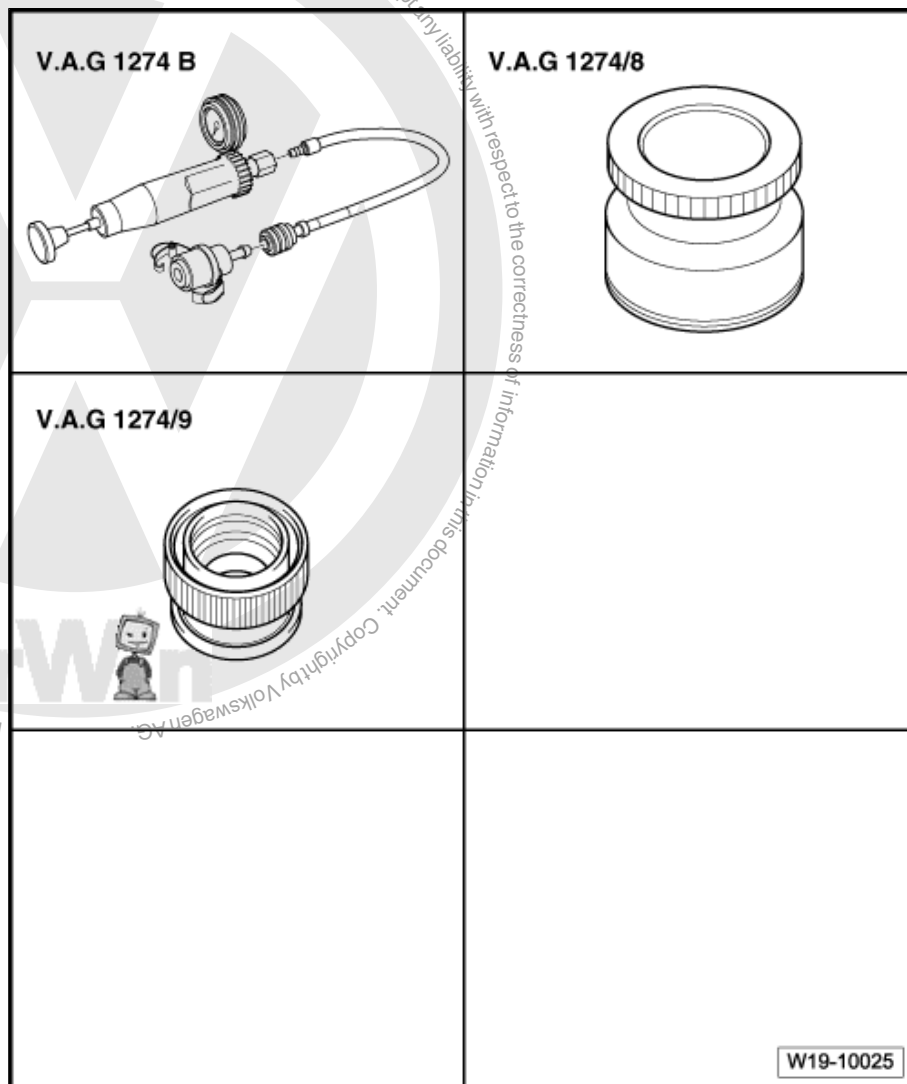




## 1.3 Checking cooling system for leaks

### 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-



### Test prerequisite

- Engine is at operating temperature
- Perform leakage test of cooling system using cooling system tester - V.A.G 1274- and adapters adapter - V.A.G 1274/8- and adapter - V.A.G 1274/9- .

### Test sequence:



#### WARNING

*Hot steam may escape when expansion tank is opened. Place cloth over cap and open with caution.*

- Open filler cap on coolant expansion tank.
- Screw adapter for cooling system tester - V.A.G 1274/8- into coolant expansion tank.
- Clamp connector - V.A.G 1274 B/1- into adapter for cooling system tester - V.A.G 1274/8- .





- Join connection piece - V.A.G 1274 B/1- to cooling system tester - V.A.G 1274 B- using connecting hose supplied.
- 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.

**Check pressure relief valve in filler cap**

- Screw cap into adapter for cooling system tester - V.A.G 1274/9- .
- Clamp connector - V.A.G 1274 B/1- into adapter for cooling system tester - V.A.G 1274/9- .
- Join connection piece - V.A.G 1274 B/1- to cooling system tester - V.A.G 1274 B- using connecting hose supplied.
- Using hand pump on cooling system tester, build up a pressure of approx. 1.6 bar.

The pressure relief valve must not open.

If the pressure relief valve opens prematurely:

- Renew cap.
- Increase pressure to over 1.6 bar.

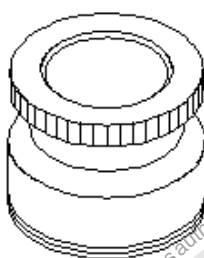
The pressure relief valve must open.

If the pressure relief valve does not open:

- Renew cap.



- ◆ 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-



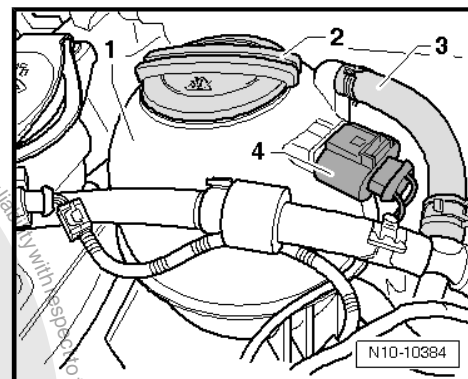
W19-10042

***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 underbody guard, if fitted ⇒ General body repairs, exterior; Rep. gr. 66 ; Underbody guard .



Remove spring-type clip -2- and pull lower coolant hose -1- off radiator -3-.



#### Note

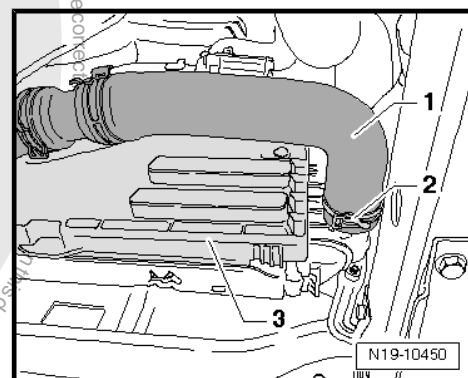
Observe environmental regulations for disposal.

#### Filling



#### Caution

**Only distilled water may be used for mixing with coolant additives. The use of distilled water ensures optimum protection against corrosion.**





**Note**

- ◆ Use only coolant additives which conform 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 due to 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.
- ◆ Frost protection must be guaranteed down to about -25 °C (in countries with Arctic climates, down to about -36 °C).
- ◆ The coolant concentration must not be reduced by adding water even in warmer seasons and in warmer countries. The coolant additive concentration must be at least 40 %.
- ◆ If a stronger anti-freeze mixture is necessary due to harsher weather conditions, the coolant additive content can be increased. But only to 60 %, or the antifreeze protection will be reduced again and the cooling effect will be impaired.
- ◆ ONLY refractometer - T10007 A- may be used for determining current anti-freeze density.
- ◆ Read anti-freeze figures from respective scale for type of anti-freeze added.
- ◆ Do not reuse old coolant.

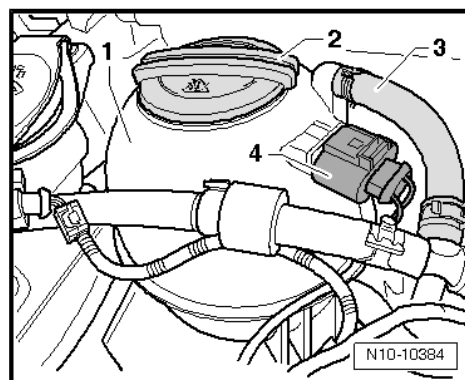
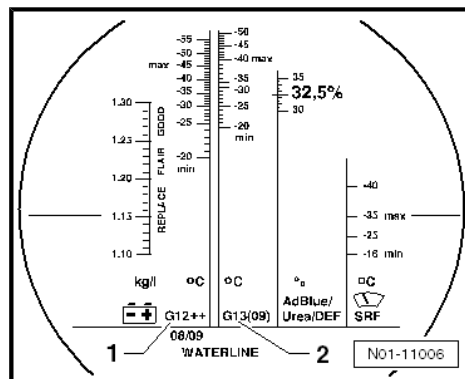
**Recommended mixture ratios:**

Frost protection to	Coolant additive portion	Coolant additive <sup>3)</sup>	Distilled water <sup>3)</sup>
-25 °C	40 %	5.0 l	7.5 l
-36 °C	50 %	6.25 l	6.25 l

3) The quantity of coolant can vary depending upon vehicle equipment.

**Procedure:**

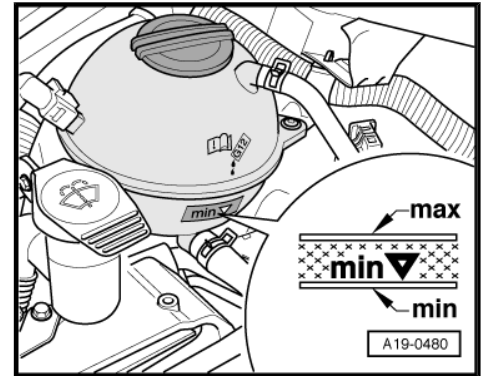
- Unscrew cap -2- from expansion tank -1-.
- Pull off coolant hose -3- on expansion tank -1-.
- Fill expansion tank -1- to capacity and reconnect coolant hose -3-.
- Seal expansion tank -1- with cap -2-.
- Install underbody guard, if fitted previously ⇒ General body repairs, exterior; Rep. gr. 66 ; Underbody guard .
- Start engine and keep engine speed at approx. 2000 rpm until radiator fan starts up.







- Check coolant level and top up if necessary. When engine is at normal operating temperature, the coolant level must be at the upper mark; when engine is cold, in the middle of the shaded field.







Amarok 2011 ►

4-cylinder diesel engine (2.0 l engine, common rail) - Edition 04.2013

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## 2 Coolant pump, regulation of cooling system

⇒ [“2.1 Assembly overview - coolant pump/ball thermostat \(4/2-way valve\)”, page 187](#)

⇒ [“2.2 Assembly overview - Continued coolant circulation pump V51”, page 188](#)

⇒ [“2.3 Assembly overview - circulation pump V55”, page 189](#)

⇒ [“2.4 Removing and installing coolant pump”, page 190](#)

⇒ [“2.5 Removing and installing 4/2-way valve with thermostat”, page 191](#)

⇒ [“2.6 Removing and installing coolant temperature sender G62”, page 196](#)

⇒ [“2.7 Removing and installing coolant temperature sender at radiator outlet G83”, page 197](#)

⇒ [“2.8 Removing and installing continued coolant circulation pump V51”, page 198](#)

⇒ [“2.9 Removing and installing Y-thermostat”, page 199](#)

⇒ [“2.10 Removing and installing recirculation pump V55”, page 200](#)

### 2.1 Assembly overview - coolant pump/ball thermostat (4/2-way valve)

#### 1 - Cylinder block

#### 2 - O-ring

- ☐ Renew after removing

#### 3 - Bolt

- ☐ 15 Nm

#### 4 - Ball thermostat (4/2-way valve)

- ☐ Removing and installing  
⇒ [page 191](#).

#### 5 - O-ring

- ☐ Renew after removing

#### 6 - Coolant pump

- ☐ Removing and installing  
⇒ [page 190](#).

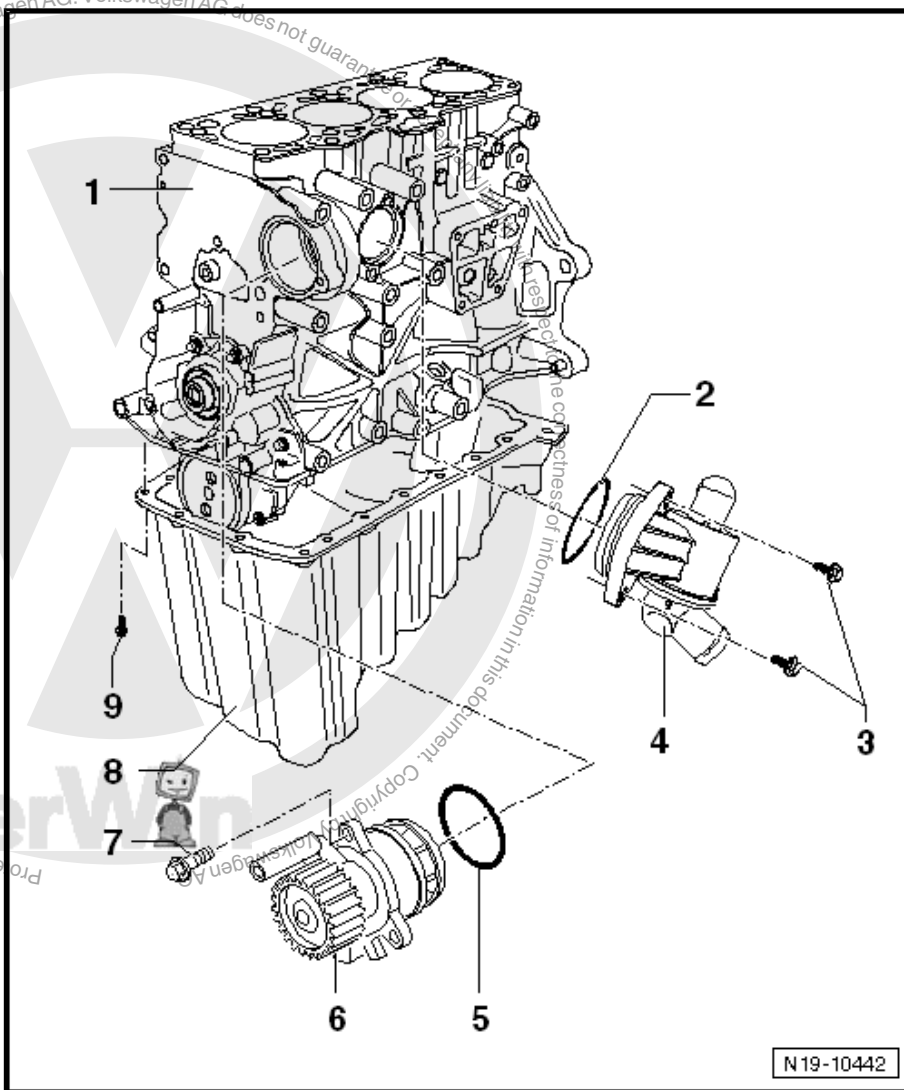
#### 7 - Bolt

- ☐ 15 Nm

#### 8 - Oil sump

#### 9 - Bolt

- ☐ 15 Nm



N19-10442





## 2.2 Assembly overview - Continued coolant circulation pump - V51-

### 1 - Coolant hose

- ❑ Return flow to exhaust gas recirculation cooler

### 2 - Spring-type clip

### 3 - Bolt

- ❑ 4.5 Nm

### 4 - Bolt

- ❑ 1.2 Nm

### 5 - Bracket

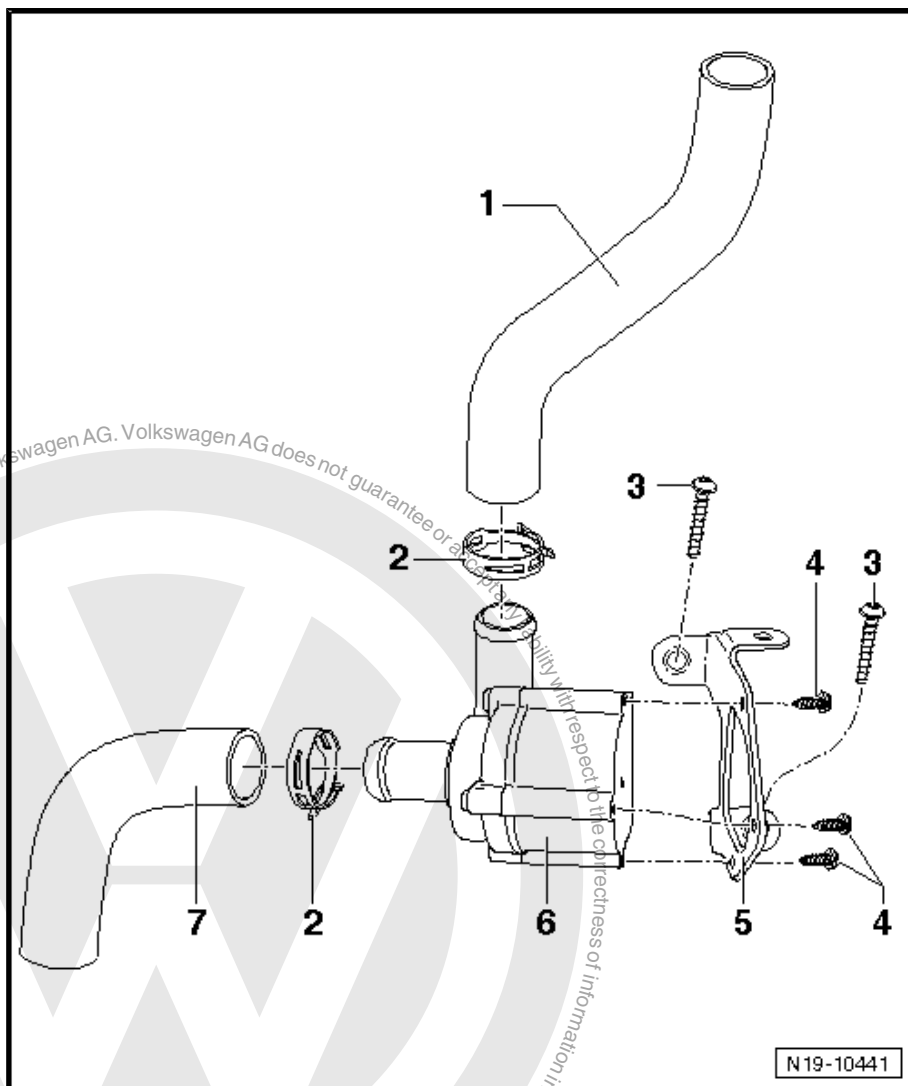
- ❑ For continued coolant circulation pump - V51- .
- ❑ For continued coolant circulation pump - V51- wiring harness.

### 6 - Continued coolant circulation pump - V51-

- ❑ Removing and installing  
⇒ [page 198](#) .

### 7 - Coolant hose

- ❑ Feed line from radiator







## 2.3 Assembly overview - circulation pump - V55-

### 1 - Bracket

- ☐ Secured on left wheel housing

### 2 - Bolt

- ☐ 8 Nm

### 3 - Rubber bush

### 4 - Circulation pump - V55-

- ☐ Removing and installing  
⇒ [page 200](#) .

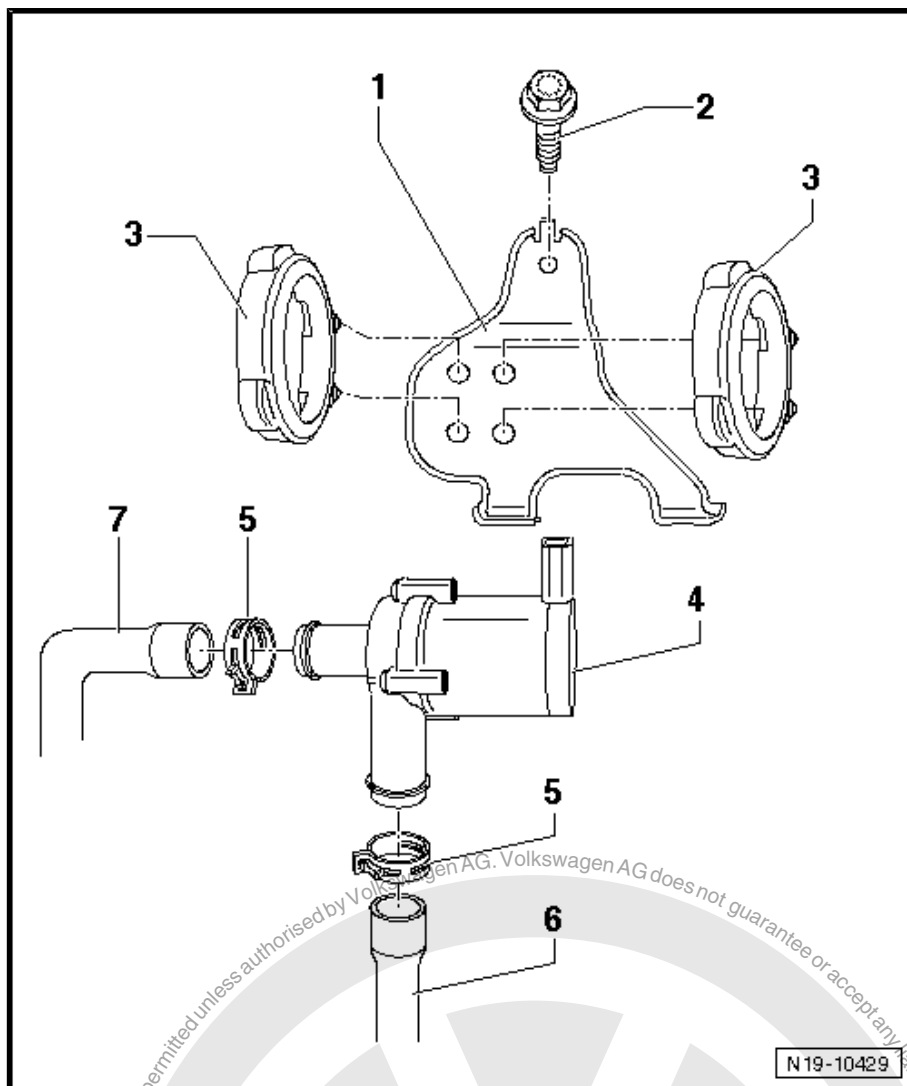
### 5 - Spring-type clip

### 6 - Coolant hose

- ☐ To heater cooler.

### 7 - Coolant hose

- ☐ From cylinder head



N 19-10429

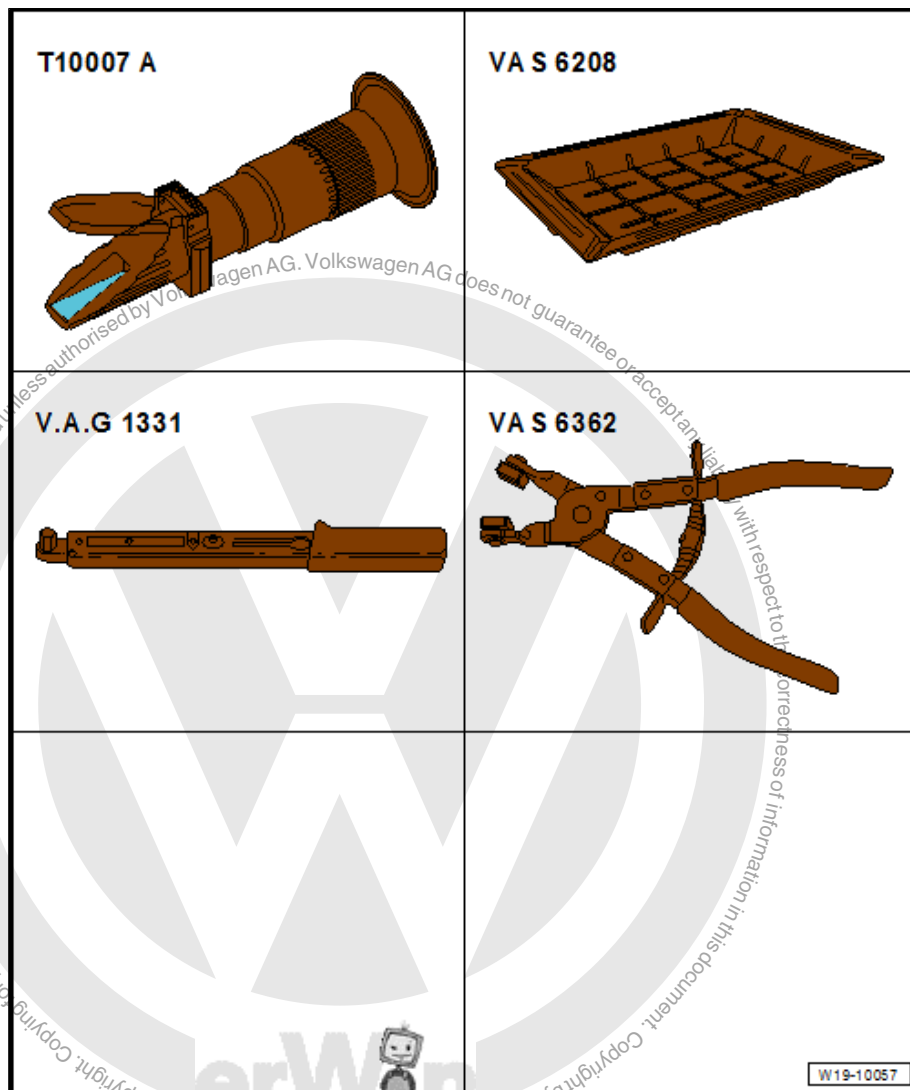




## 2.4 Removing and installing coolant pump

### Special tools and workshop equipment required

- ◆ Refractometer - T10007 A-
- ◆ Drip tray for workshop hoist - VAS 6208-
- ◆ Torque wrench - V.A.G 1331-
- ◆ Spring-type clip pliers - VAS 6362-



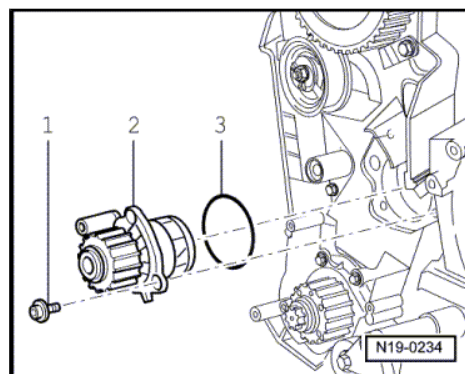
### Removing

- Remove underbody guard, if fitted ⇒ General body repairs, exterior; Rep. gr. 66 ; Underbody guard .
- Drain coolant ⇒ [page 182](#) .
- Remove toothed belt ⇒ [page 107](#) .
- Unscrew securing bolts -1- of coolant pump -2- and carefully remove coolant pump.

### Installing

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

- Always renew gaskets, seals and O-rings.







- Moisten new O-ring -3- with coolant.
- Insert coolant pump -2- into cylinder block and tighten securing bolts -1-.

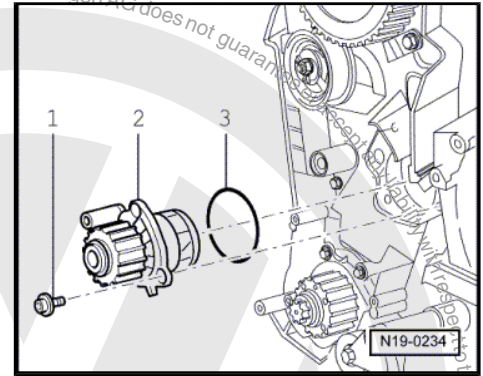
**Note**

*Coolant pump sealing plug faces downwards.*

- Install toothed belt ⇒ [page 107](#)
- Replenish coolant ⇒ [page 182](#).
- Install underbody guard, if fitted previously ⇒ General body repairs, exterior; Rep. gr. 66 Underbody guard .

**Specified torques**

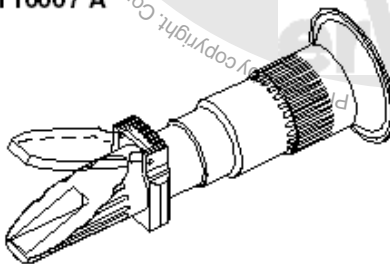
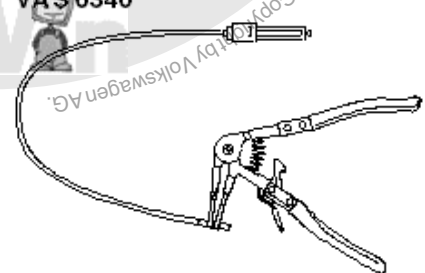
- ◆ ⇒ [“2.1 Assembly overview - coolant pump/ball thermostat \(4/2-way valve\)”, page 187](#)
- ◆ ⇒ [“2.1 Assembly overview - toothed belt drive”, page 105](#)



## 2.5 Removing and installing 4/2-way valve with thermostat

### Special tools and workshop equipment required

- ◆ Refractometer - T10007 A-
- ◆ Torque wrench (5...50 Nm) - V.A.G 1331-
- ◆ Hose clip pliers - VAS 6340-

**T10007 A****VAS 6340****V.A.G 1331**

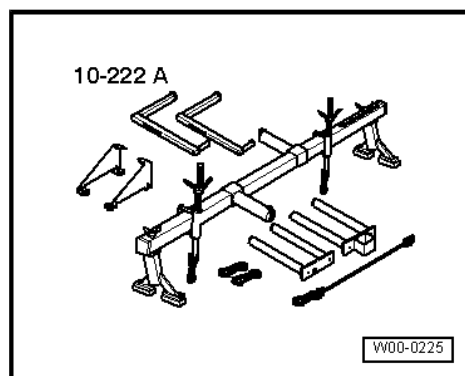
W19-10043





### Special tools and workshop equipment required

- ◆ Support bracket - 10 - 222 A-



### Removing

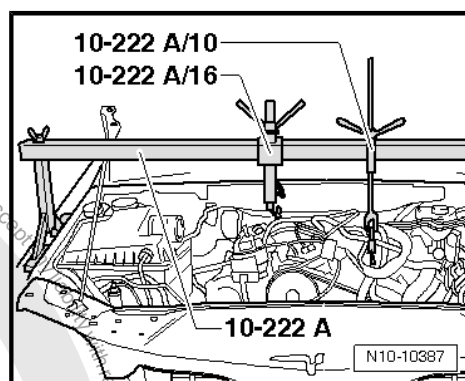
- Remove underbody guard, if fitted ⇒ General body repairs, exterior; Rep. gr. 66 ; Underbody guard .



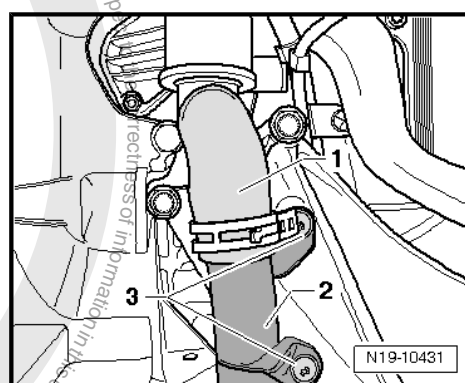
#### Note

*Thermostat is located within the 4/2-way valve and cannot be replaced individually.*

- Position engine with support bracket - 10 - 222 A- as shown and take up weight of engine in installation position.
- Disconnect battery ⇒ Electrical system; Rep. gr. 27 .
- Drain coolant ⇒ [page 182](#) .



- Unscrew securing bolts -3- for coolant pipe -2-.
- Remove coolant hose -1- at 4/2-way valve and lay aside.



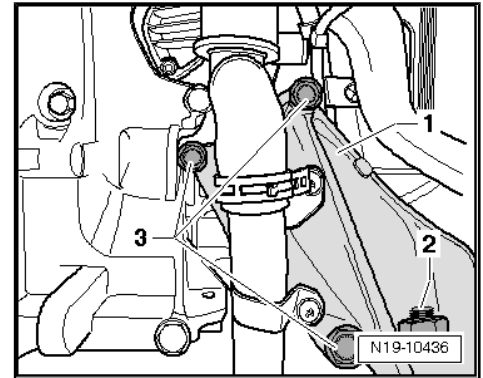




- Unscrew bolts -3- for left engine support -1-.

**Caution**

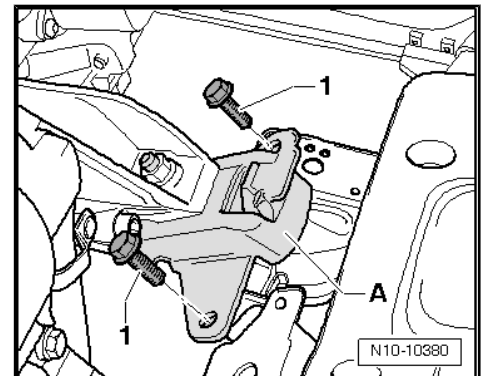
- **Nut -2- must not be loosened.**
- **If nut -2- is loosened, engine mounting must subsequently be renewed.**
- ◆ **Engine mounting connection to engine support may only be loosened if engine mounting is to be renewed.**



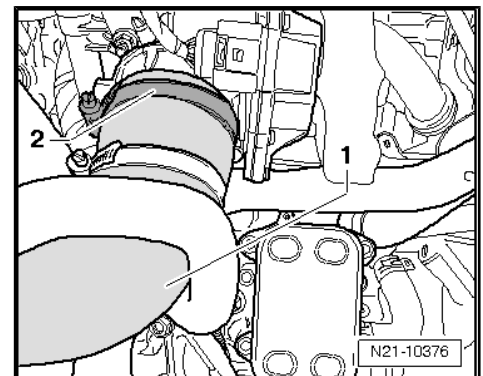
- Unscrew bolts -1- from left engine mounting -A-.

**Note**

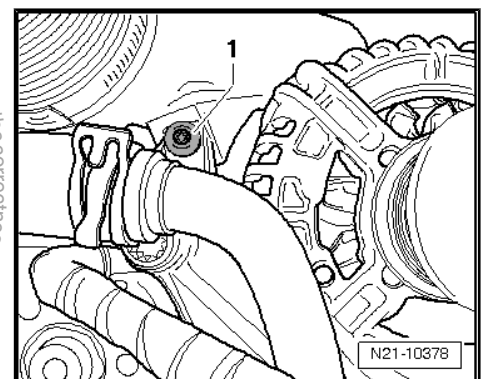
*Coolant pipe is still installed in illustration!*



- Loosen screw-type clip -2- and pull charge air pipe -1- off from throttle valve module - J338- with throttle valve potentiometer - G69- and intake manifold flap motor - V157- .



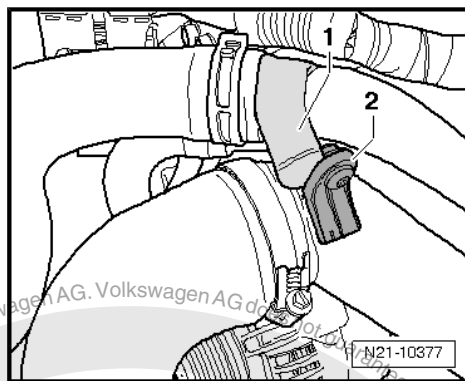
- Unscrew securing bolt -1- for charge air pipe.



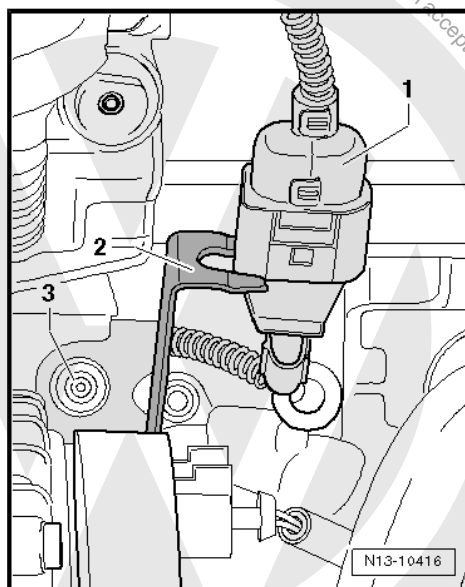




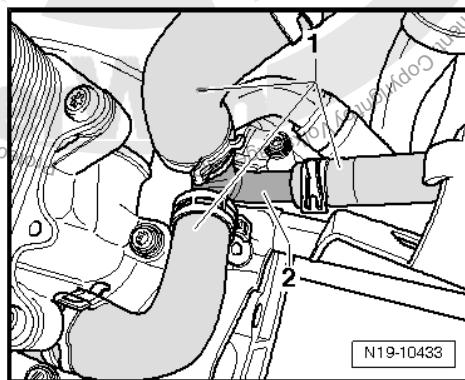
- Unscrew securing bolt from charge air pipe bracket -2- on coolant pipe -1-.
- Remove throttle valve module - J338- with throttle valve potentiometer - G69- and intake manifold flap motor - V157- ➔ [page 357](#) .



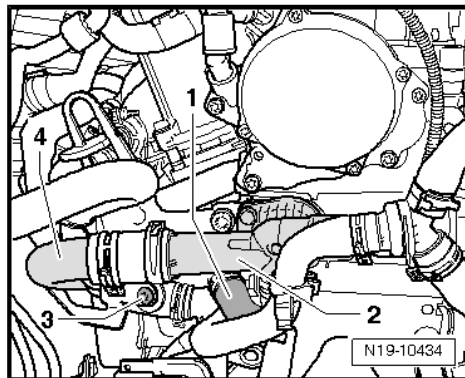
- Detach connector -1- for Hall sender - G40- .
- Remove alternator ➔ Electrical system; Rep. gr. 27 ; Removing and installing alternator .



- Remove coolant hoses -1- at coolant pipe branch-off -2-.
- Remove oil filter bracket ➔ [page 151](#) .



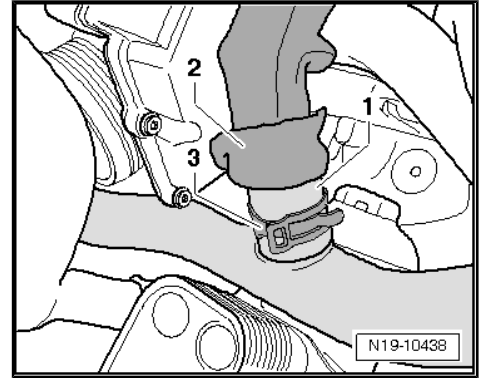
- Loosen clamp for coolant hose -1- and pull off coolant hose -1-.
- Loosen clamp for coolant pipe -4- and pull coolant pipe -4- out at union -2-.
- Unscrew securing bolt -3- for coolant pipe bracket.







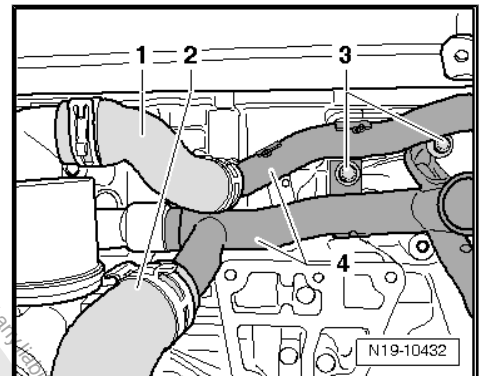
- Pull heat shield -2- up slightly from coolant hose -1-.
- Loosen clamp -3- and pull coolant hose -1- off.



- Unscrew bolts -3- for coolant pipes -4- at cylinder block.

**Note**

*Separate all electrical cables required to remove 4/2-way valve and lay aside.*



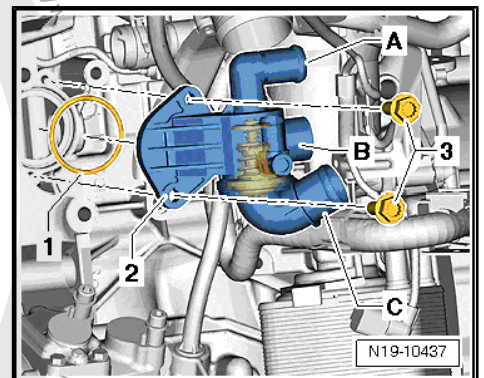
- Pull coolant hoses off unions -A and C-.
- Pull coolant pipe out of connection -B-.
- Unscrew securing bolts -3- for 4/2-way valve -2-.
- Pull valve out of cylinder block and then to the left to separate connection -C- from coolant pipe.

**Installing**

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

**Note**

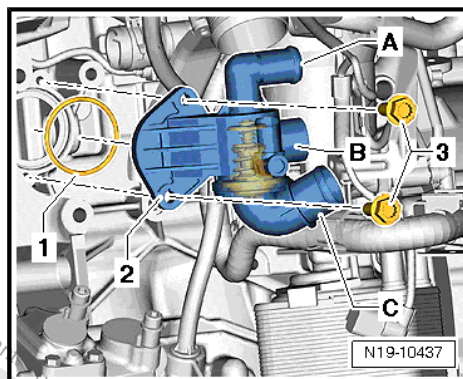
*Renew gaskets and seals.*







- First position 4/2-way valve with connection -B- on coolant pipe.
- Install 4/2-way valve.
- Screw in and tighten securing bolts -3-.
- Connect coolant hoses as follows:
  - ◆ -A-: Bypass line to cylinder head
  - ◆ -C-: Radiator return line
- Fill cooling system ⇒ [page 182](#).
- Install throttle valve module - J338- with throttle valve potentiometer - G69- and intake manifold flap motor - V157-
- Install alternator ⇒ Starter, current supply, CCS; Rep. gr. 27 ; Removing and installing alternator .
- Install underbody guard, if fitted previously ⇒ General body repairs, exterior; Rep. gr. 66 ; Underbody guard .



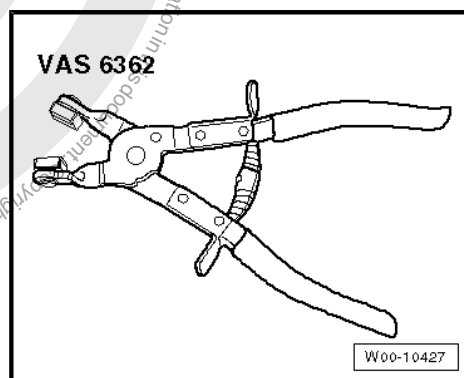
#### Specified torques

- ◆ ⇒ [“2.1 Assembly overview - coolant pump/ball thermostat \(4/2-way valve\)”, page 187](#)
- ◆ ⇒ [“5.1 Assembly overview - intake manifold”, page 354](#)

## 2.6 Removing and installing coolant temperature sender - G62-

#### Special tools and workshop equipment required

- ◆ Hose clip pliers - VAS 6362-



#### Removing

- Briefly open filler cap for coolant expansion tank in order to reduce pressure in cooling system.
- Remove underbody guard, if fitted ⇒ General body repairs, exterior; Rep. gr. 66 ; Underbody guard .
- Drain coolant ⇒ [page 182](#) .



#### Note

*Place several cloths under the screw connection to absorb escaping coolant.*





- Disconnect connector -2- at coolant temperature sender - G62- -1-.

### Note

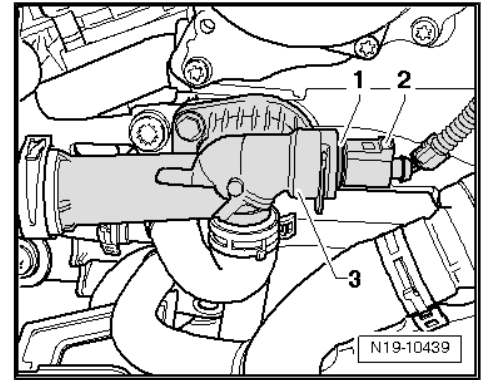
*Components for coolant temperature sender - G62- are difficult to see. A small hand-held mirror is required to unscrew and insert coolant temperature sender - G62- .*

- Pull off retaining clip and pull coolant temperature sender - G62- -1- out of union -3-.

### Installing

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

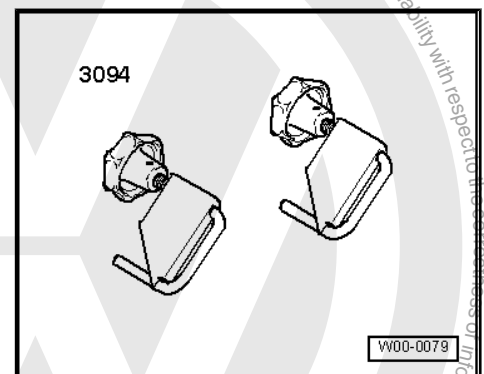
- Install coolant temperature sender - G62- with new O-ring only.
- Replenish coolant ⇒ [page 182](#) .
- Install underbody guard, if fitted previously ⇒ General body repairs, exterior; Rep. gr. 66 ; Underbody guard .



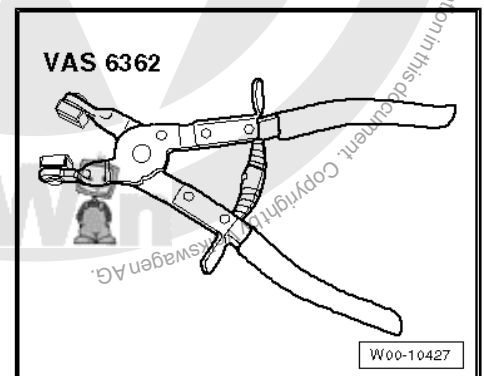
## 2.7 Removing and installing coolant temperature sender at radiator outlet - G83-

### Special tools and workshop equipment required

- ◆ Hose clamps up to 25 mm - 3094-



- ◆ Hose clip pliers - VAS 6362-



### Removing

- Briefly open filler cap for coolant expansion tank in order to reduce pressure in cooling system.
- Place several cloths under the screw connection to absorb escaping coolant.



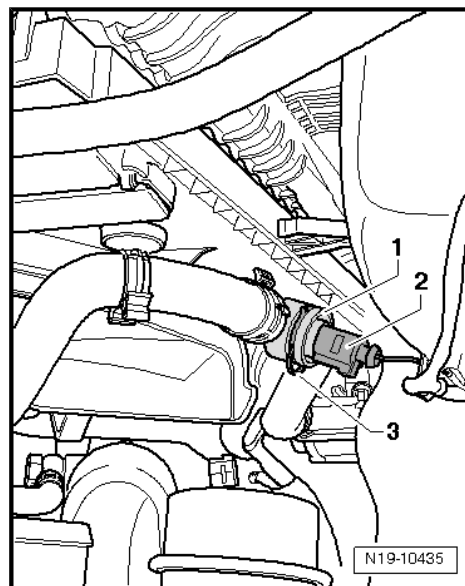


- Detach connector -2- from radiator outlet coolant temperature sender - G83- -1-.
- Pinch off coolant hoses with hose clamps, up to 25 mm dia. - 3094- .
- Pull off retaining clip -3- and pull radiator outlet coolant temperature sender - G83- out of union.

#### Installing

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

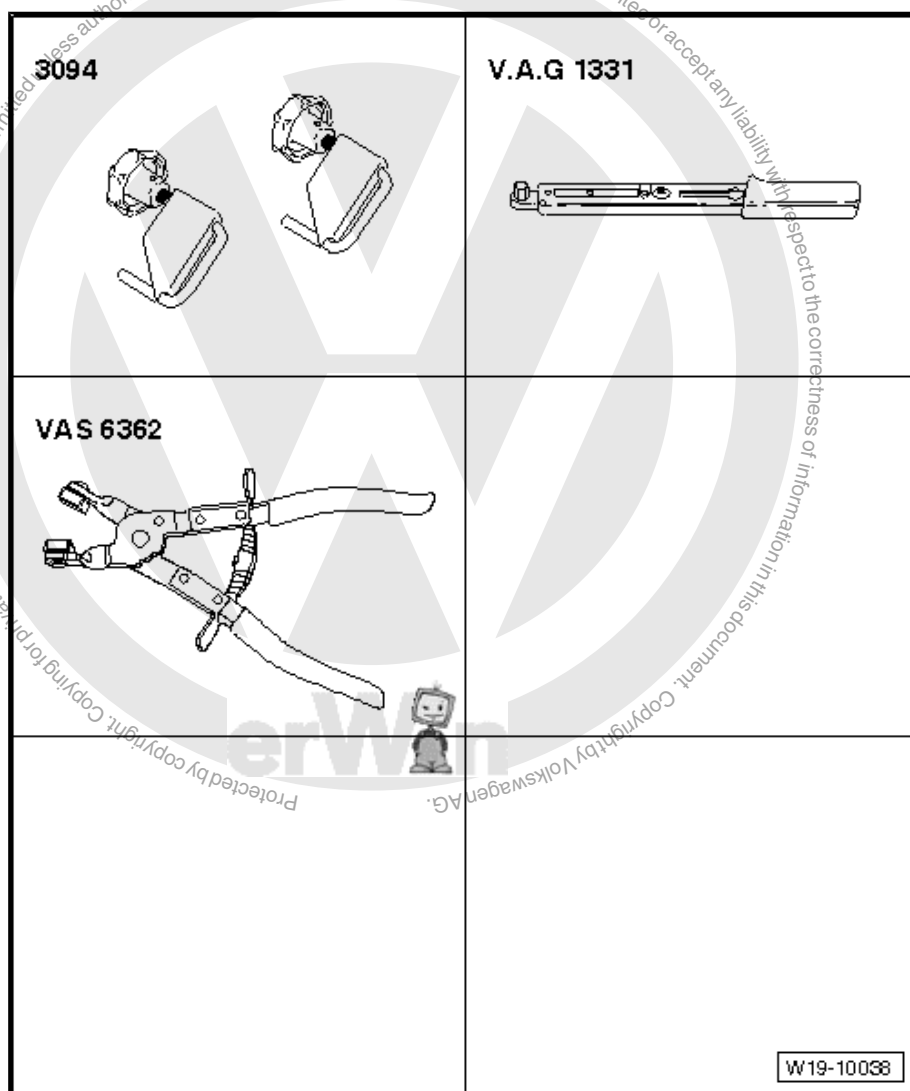
- Check coolant level ➔ [page 182](#) .



## 2.8 Removing and installing continued coolant circulation pump - V51-

#### Special tools and workshop equipment required

- ◆ Hose clamps up to 25 mm - 3094-
- ◆ Torque wrench (5...50 Nm) - V.A.G 1331-
- ◆ Hose clip pliers - VAS 6362-

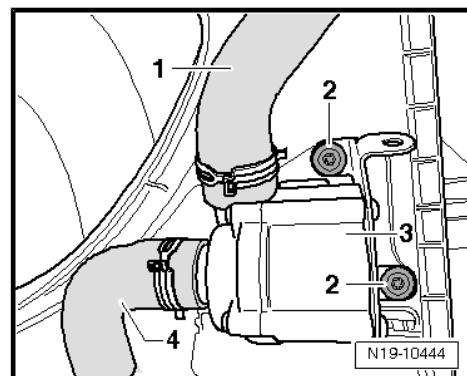






## Removing

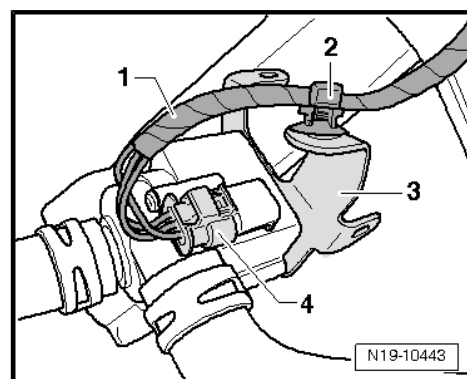
- Remove underbody guard, if fitted ⇒ General body repairs, exterior; Rep. gr. 66 ; Underbody guard .
- Pinch off coolant hoses -1 and 4- with hose clamps, up to 25 mm dia. - 3094- .
- Remove coolant hoses -1 and 4- from continued coolant circulation pump - V51- . To do this, loosen spring-type clips.
- Collect escaping coolant with a cloth.
- Unscrew bolts -2- and remove continued coolant circulation pump - V51- .



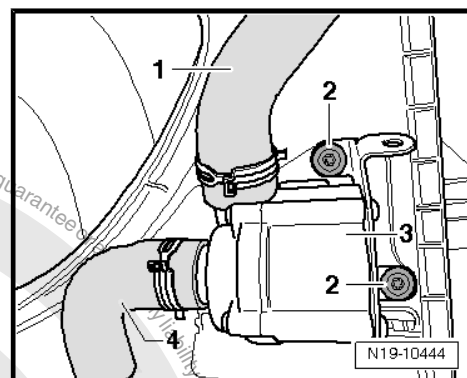
- Loosen clip -2- for wiring harness -1- at bracket -3-.
- Disconnect connector -4- at continued circulation coolant pump - V51- .

## Installing

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



- Install continued coolant circulation pump - V51- -3- and secure with bolts -2-.
- Tighten bolts -2-.
- Secure coolant hoses -1 and 4- to continued coolant circulation pump - V51- -3- using spring-type clips.
- Clip connector onto continued circulation coolant pump - V51- and secure wiring harness to bracket.
- Install underbody guard, if fitted previously ⇒ General body repairs, exterior; Rep. gr. 66 ; Underbody guard .
- Check coolant level ⇒ [page 182](#) .



## Specified torques

- ♦ ⇒ [“2.2 Assembly overview - Continued coolant circulation pump V51”](#), [page 188](#)

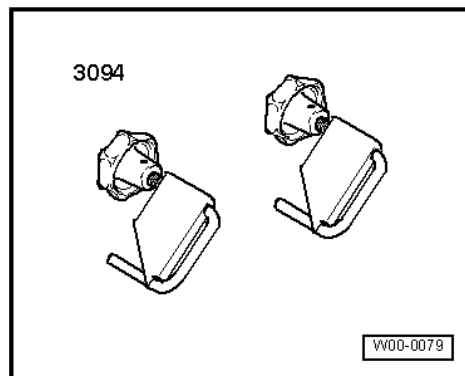
## 2.9 Removing and installing Y-thermostat

Special tools and workshop equipment required

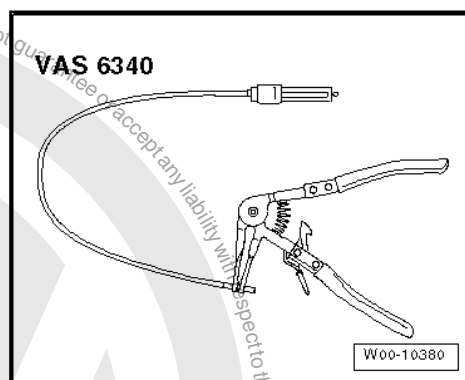




- ◆ Hose clamps up to 25 mm - 3094-



- ◆ Hose clip pliers - VAS 6340-



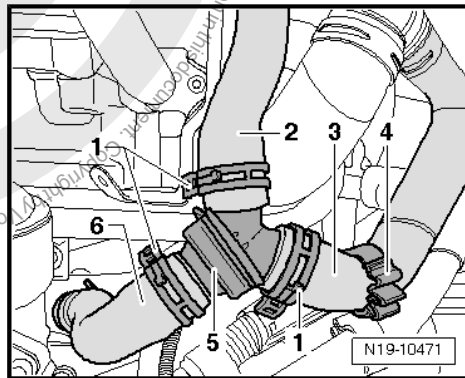
### Removing

- Briefly open filler cap for coolant expansion tank in order to reduce pressure in cooling system.
- Remove underbody guard, if fitted ⇒ Rep. gr. 66 .
- Detach coolant hoses with clamps up to 25 mm - 3094- .
- Remove spring-type clip -1- with hose clip pliers - VAS 6340- .
- Open retainer -4-.
- Disconnect coolant hoses -2-, -3- and -6- from Y-thermostat.

### Installing

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

- Check coolant level ⇒ [page 182](#) .



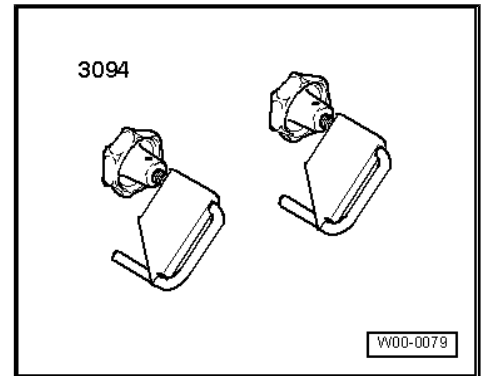
## 2.10 Removing and installing recirculation pump - V55-

Special tools and workshop equipment required

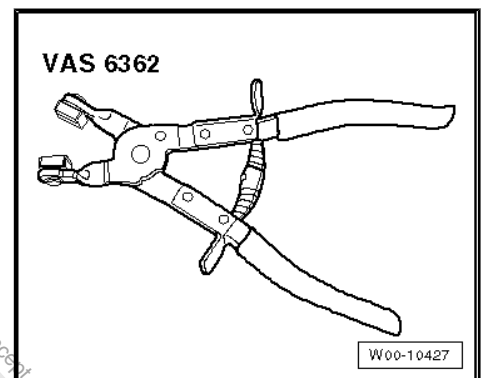




- ◆ Hose clamps up to 25 mm - 3094-



- ◆ Hose clip pliers - VAS 6362-



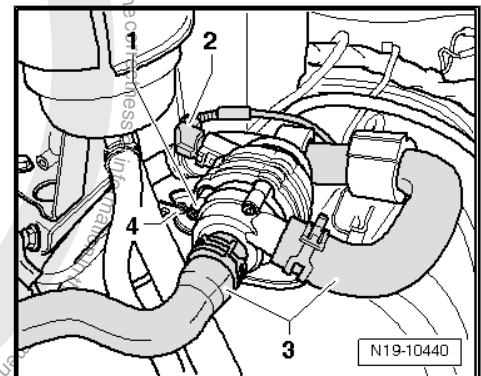
### Removing

- Briefly open filler cap for coolant expansion tank in order to reduce pressure in cooling system.
- Place several cloths under circulation pump - V55- to absorb escaping coolant.
- Separate connector -2- at circulation pump - V55- -1-.
- Pinch off coolant hoses -3- with hose clamps, up to 25 mm dia. -3094- at union.
- Release clamps with hose clip pliers - VAS 6362- .
- Unscrew bolt -4- and remove circulation pump - V55- -1- with bracket.

### Installing

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

- Check coolant level [⇒ page 182](#) .







### 3 Radiator, radiator fan

⇒ ["3.1 Assembly overview - radiator/ radiator fan V7", page 202](#)

⇒ ["3.2 Assembly overview - radiator cowl and radiator fan V7", page 204](#)

⇒ ["3.3 Removing and installing radiator", page 204](#)

⇒ ["3.4 Removing and installing radiator cowl with radiator fan V7", page 207](#)

#### 3.1 Assembly overview - radiator/ radiator fan - V7-

##### 1 - Radiator upper mounting

##### 2 - Radiator

- ☐ Renew coolant after replacing
- ☐ Removing and installing ⇒ [page 204](#) .

##### 3 - Charge air cooler

##### 4 - Upper cowl

##### 5 - Condenser

##### 6 - Cap

- ☐ Check using cooling system tester - V.A.G 1274- and adapter for cooling system tester - V.A.G 1274/9- .
- ☐ Test pressure 1.4...1.6 bar

##### 7 - Connector

##### 8 - Bolt

- ☐ 5 Nm

##### 9 - Expansion tank

- ☐ Checking cooling system for leaks with cooling system tester - V.A.G 1274- and adapter - V.A.G 1274/8- ⇒ [page 180](#) .
- ☐ With coolant temperature display sender - G32- .

##### 10 - Bolt

- ☐ 5 Nm

##### 11 - Radiator cowl with radiator fan - V7-

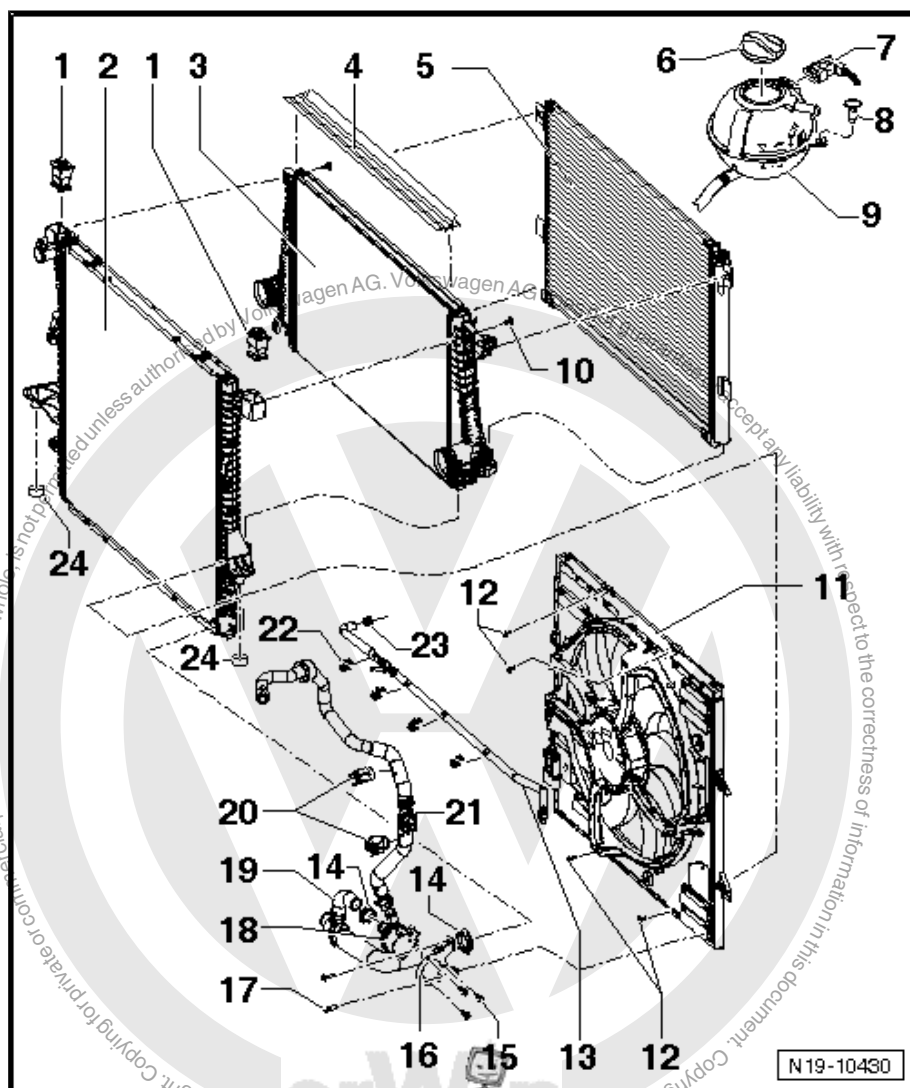
- ☐ Removing and installing ⇒ [page 207](#) .

##### 12 - Bolt

- ☐ 4 Nm

##### 13 - Breather line

- ☐ Coolant hose schematic diagram ⇒ [page 175](#) .
- ☐ Secured to top of radiator.





**14 - Spring-type clip**

- ☐ Hose clip pliers - VAS 6340- or hose clip pliers - VAS 6362- are recommended for installation of spring-type clips.

**15 - Bolt**

- ☐ 1.2 Nm

**16 - Bracket**

- ☐ For continued coolant circulation pump - V51- .

**17 - Bolt**

- ☐ 4.5 Nm

**18 - Continued coolant circulation pump - V51-****19 - Coolant hose**

- ☐ Coolant hose schematic diagram ➔ [page 175](#) .

**20 - Bracket****21 - Radiator outlet coolant temperature sender - G83-**

- ☐ Coolant hose schematic diagram ➔ [page 175](#) .

**22 - Bracket****23 - Spring-type clip****24 - Radiator lower mounting**





## 3.2 Assembly overview - radiator cowl and radiator fan - V7-

1 - Radiator

2 - Radiator fan

3 - Bolt

□ 5 Nm

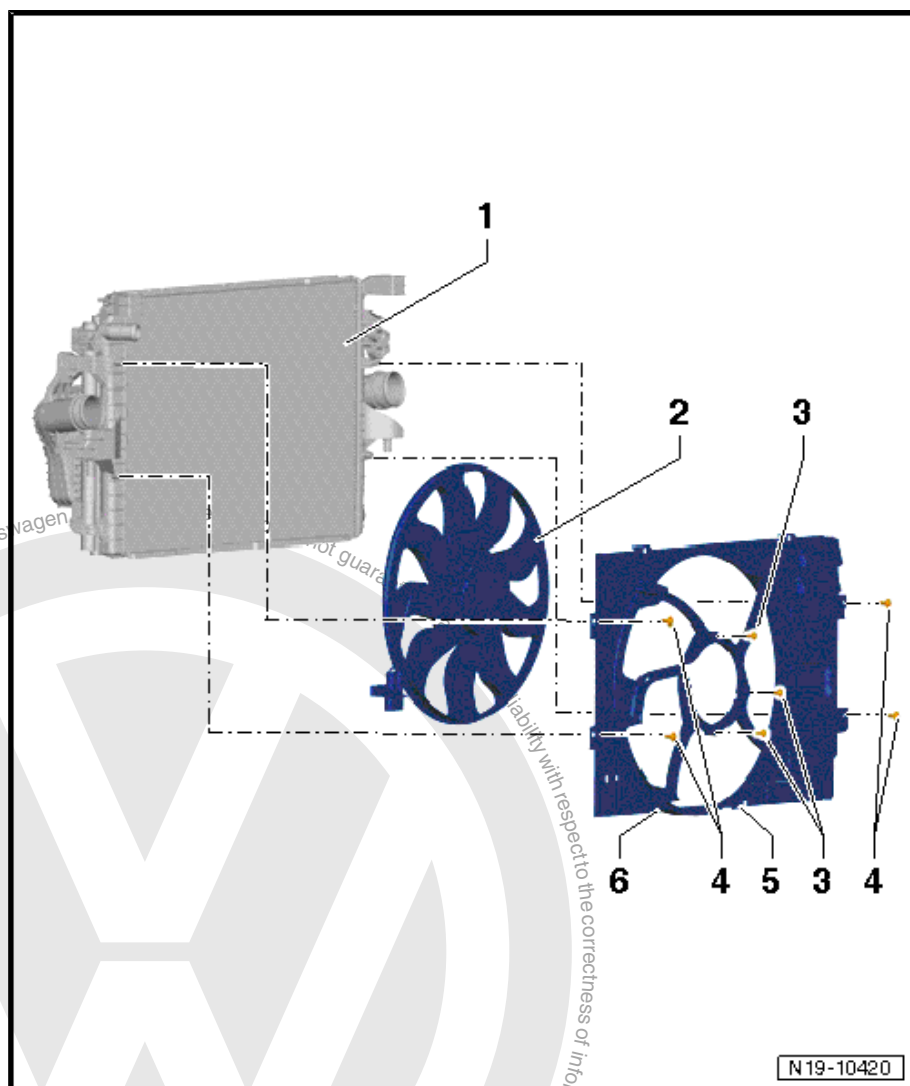
4 - Bolt

□ 5 Nm

5 - Locking lug

□ Must be engaged in radiator.

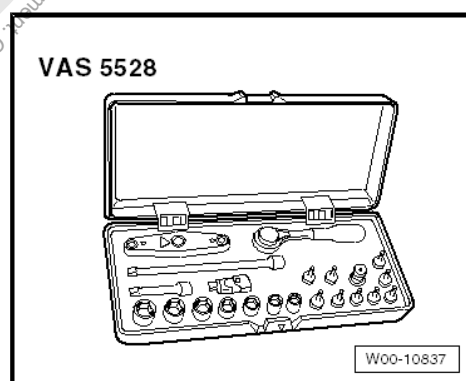
6 - Radiator cowl



## 3.3 Removing and installing radiator

Special tools and workshop equipment required

- ◆ Socket set 1/4", 22-piece - VAS 5528-





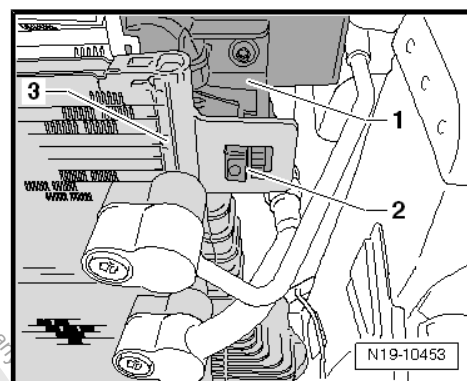
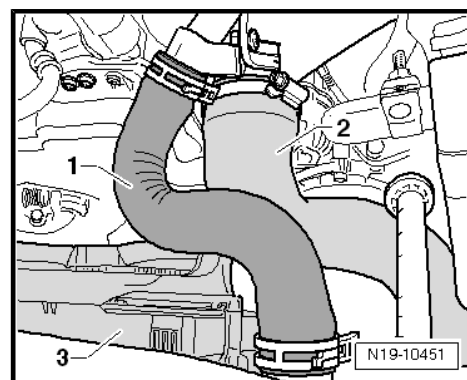
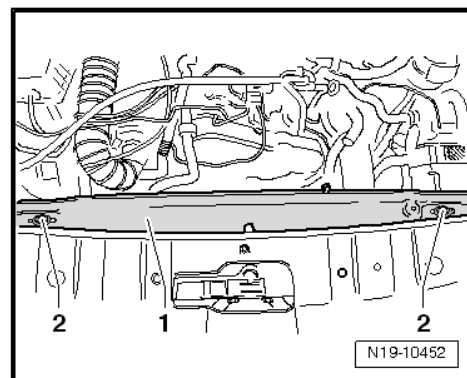


## Removing

- Remove bolts -2- for securing radiator to lock carrier -1-.
- Remove lock carrier ⇒ General body repairs, exterior; Rep. gr. 66 ; Lock carrier .
- Drain coolant ⇒ [page 182](#) .
- Remove radiator cowl ⇒ [page 207](#) .

Observe instructions for hose connections with screw-type clips ⇒ [page 11](#) .

- If fresh air supply system is present, partially remove ⇒ [page 116](#) .
- Remove coolant hose -1- at radiator -3- and remove connecting hose -2-.
- Remove right connecting hose leading to turbocharger from charge air cooler and place to one side.
- Remove air duct mounting ⇒ [Item 23 \(page 369\)](#) .



- Unclip left radiator fastening -2- at condenser -3-.
- Unclip right radiator fastening as well and pull condenser -3- off radiator -1-.



### Caution

- **Do not bend or stretch the refrigerant lines excessively.**
- **During further removal work, make sure that the refrigerant lines are not bent or stretched excessively.**

- Support condenser, e.g. with cable ties.
- Do not bend or stretch the refrigerant lines excessively.
- Carefully remove radiator upwards together with charge air cooler. When doing so, take the radiator -2- past the refrigerant lines.

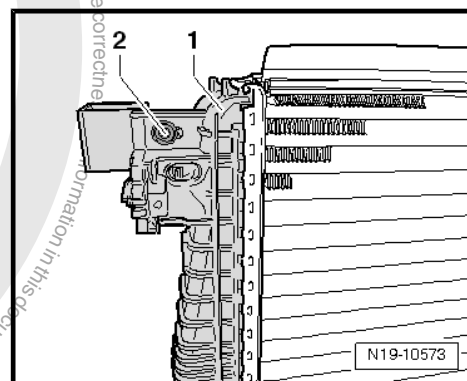


### Note

- ◆ If the radiator -1- is to be replaced, undo bolts of charge air cooler and remove it from radiator.
- ◆ Undo and remove bolt -2- on right and left (not shown in illustration) at radiator.

## Installing

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



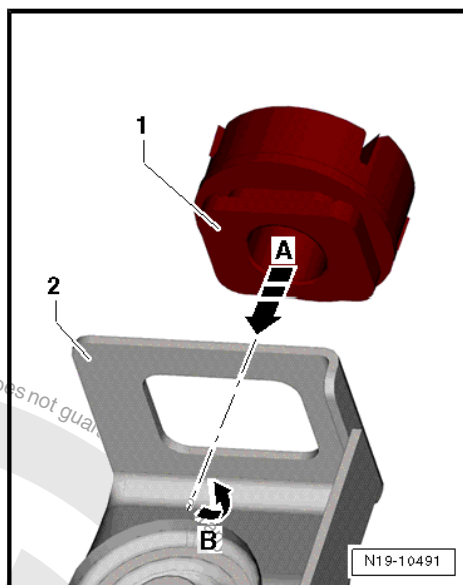
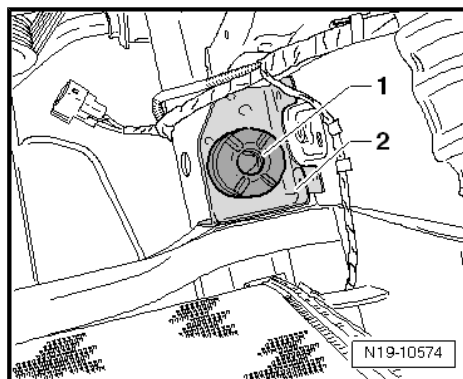




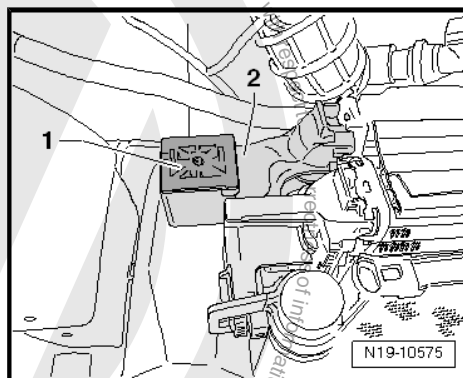
### Note

*Before installing radiator, check that radiator mountings -1- are correctly seated on front part of car -2- and, if necessary, reposition:*

- Insert radiator mounting into lock carrier -2- at bottom -1-, doing so transversely to the direction of travel, and then turn it 90°.



- Insert top radiator mountings -1- on right and left into the mounting on radiator -2- appropriately.

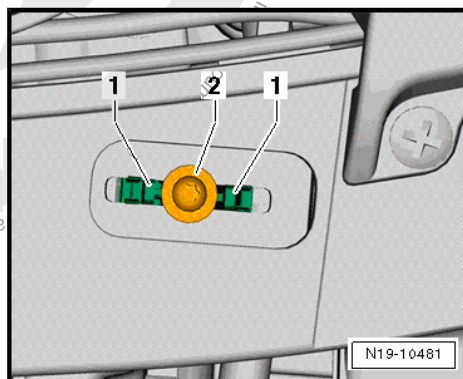


- When installing the radiator, make sure that the catches -1- of the radiator mounting on the left and right at the top have engaged completely in the lock carrier.



### Caution

*The screw-type clips on the charge air lines must always be tightened to 5.5 Nm. If the torque is too low or too high, the charge air hose may slip off the charge air pipe during vehicle operation.*





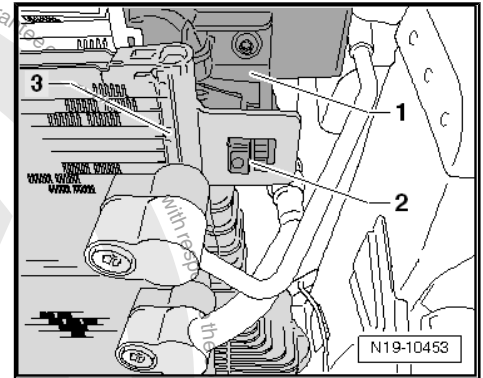


- Fit condenser -3- on radiator -1- on left and right so that it engages securely in the catches -2-.



**Caution**

- *Do not bend or stretch the refrigerant lines excessively.*



- Install radiator cowl ⇒ [page 207](#) .
- Filling with coolant ⇒ [page 182](#)
- Install lock carrier ⇒ General body repairs, exterior; Rep. gr. 50 ; Lock carrier .

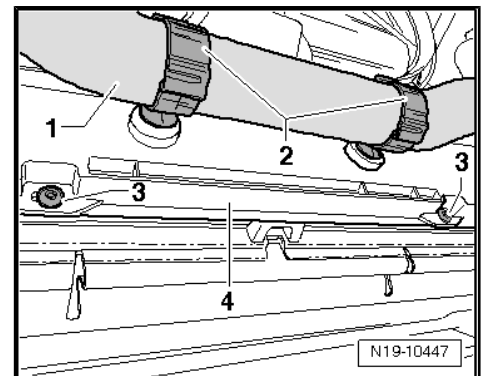
**Specified torques**

- ◆ ⇒ ["3.1 Assembly overview - radiator/ radiator fan V7 "](#), [page 202](#)
- ◆ ⇒ ["3.2 Assembly overview - radiator cowl and radiator fan V7 "](#), [page 204](#)

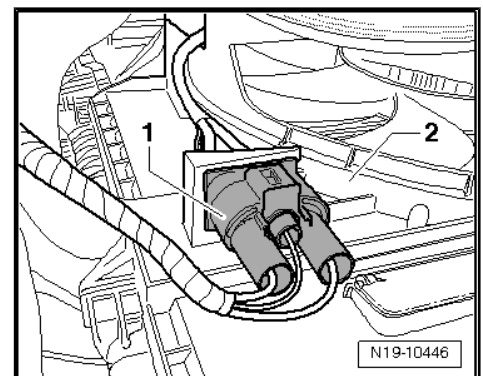
### 3.4 Removing and installing radiator cowl with radiator fan - V7-

**Removing**

- Remove underbody guard, if fitted ⇒ General body repairs, exterior; Rep. gr. 66 ; Underbody guard .
- Unclip coolant hose -1- from brackets -2-.
- Unscrew securing bolts -3- for radiator cowl -4-.



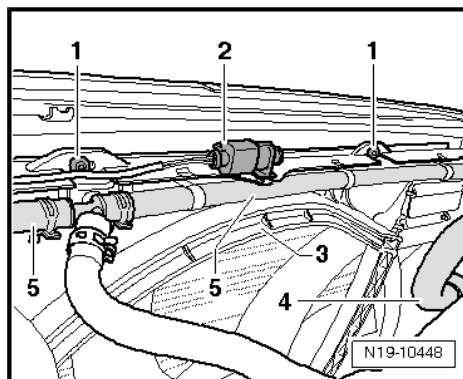
- Disconnect connector -1- from radiator cowl -2-.



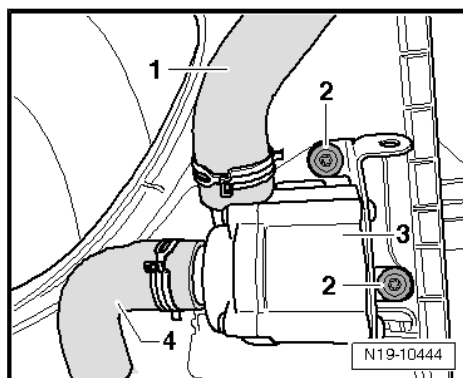




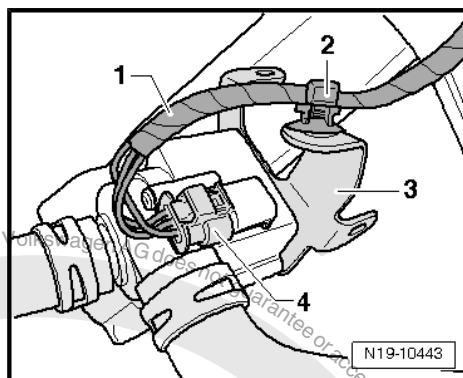
- Unscrew securing bolts -1- for radiator cowl -3-.
- Completely unclip bleeder hose -5- from radiator cowl -3-, and lay it to one side.
- Unclip and unscrew coolant hose -4- with radiator outlet coolant temperature sender - G83- and continued coolant circulation pump - V51- -3- from radiator cowl.



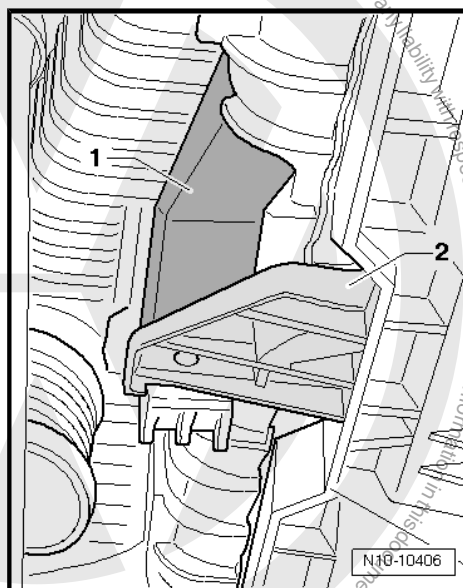
- Unscrew bolts -2- and remove continued coolant circulation pump - V51- with hoses.



- Loosen clip -2- for wiring harness -1- at bracket -3-.
- Disconnect connector -4- at continued circulation coolant pump - V51- .



- Release radiator cowl -2- at left and right. To do this, press retaining lever -1- forwards using a screwdriver, and raise radiator cowl -2- slightly.
- Remove radiator cowl upwards, together with radiator fan.







- Unscrew bolts -arrows- and remove radiator fan -1-

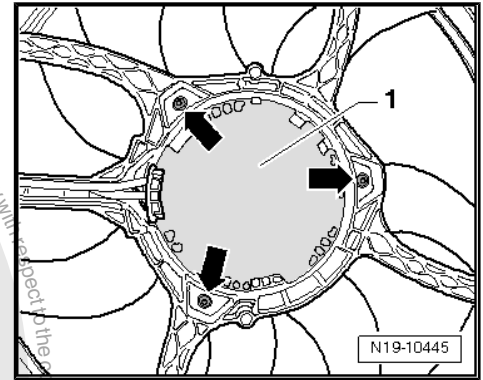
### Installing

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

- Install underbody guard, if fitted previously ⇒ General body repairs, exterior; Rep. gr. 66 ; Underbody guard .

### Specified torques

- ◆ ⇒ ["3.2 Assembly overview - radiator cowl and radiator fan V7"](#)  
page 204







## 20 – Fuel supply system

### 1 Procedure when filling with incorrect fuel

⇒ [“1.1 Procedure when filling with incorrect fuel”, page 210](#)

⇒ [“1.2 Engine is not running”, page 210](#)

⇒ [“1.3 Engine is running”, page 211](#)

#### 1.1 Procedure when filling with incorrect fuel



##### Caution

*Irreparable damage to high-pressure components, especially the high-pressure pump, due to lack of lubrication though diesel can occur when filling fuel tank with incorrect fuel. Damage due to seizure and metal particles can be expected. These metal particles will probably cause further damage to pressure regulating valves and injectors.*

Here are the solutions for two different cases of filling with incorrect fuel:

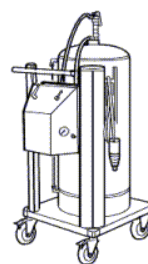
- ◆ 1. 1st case: filling with incorrect fuel was detected BEFORE starting the engine and the engine was NOT started  
⇒ [page 210](#).
- ◆ 2. 2nd case: filling with incorrect fuel was detected AFTER starting the engine. Impurities or incorrect type of fuel has entered the fuel system and has reached the high-pressure system ⇒ [page 211](#).

#### 1.2 Engine is not running

##### Special tools and workshop equipment required

- ◆ Fuel extractor - VAS 5190-

VAS 5190



W00-1107

- ◆ Hose - VAS 6550/1-
- ◆ Vehicle diagnostic tester

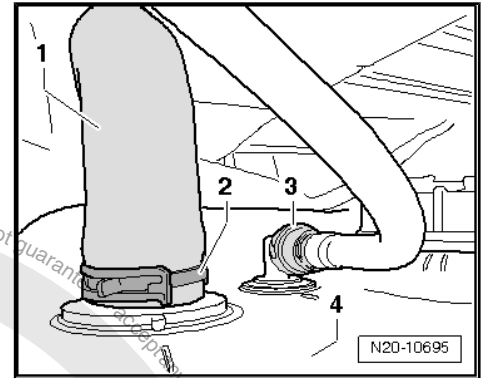
##### Procedure

- Do not switch ignition on.
- Raise vehicle.

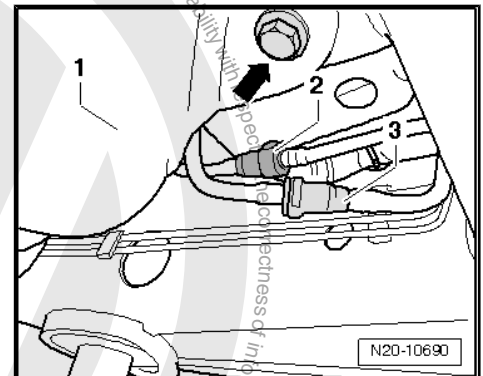




- Thoroughly clean area around filler neck -1- on fuel tank -4-.
- Loosen clamp -2- for connecting hose -1- of filler neck on fuel tank -4- and pull connecting hose off.
- Extract fuel with fuel extractor - VAS 5190- via the opening.
- Re-attach connecting hose -1- of filler neck to fuel tank, using clamp -2-.



- Press the circlip to release the fuel line and then detach the fuel supply line -3-.
- Connect pressure gauge pipe -VAS 6550/1- to the fuel supply line -3-.
- Guide open end of line into a suitable container.
- Connect ⇒ Vehicle diagnostic tester and carry out "Check electric fuel pump(s)".



#### Note

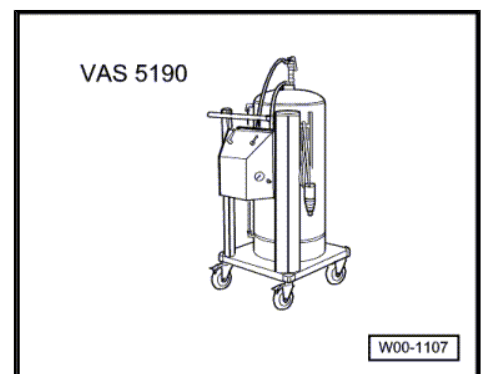
*Fuel pump is now activated for 30 seconds.*

- Repeat this procedure until fuel tank is completely empty.
- Fill fuel tank with 5 litres of diesel fuel. Then, carry out "Guided Fault Finding, Checking electrical fuel pump(s)" again to empty the tank.
- Reconnect fuel supply line.
- Fill fuel tank completely with diesel fuel.
- Perform road test.

## 1.3 Engine is running

### Special tools and workshop equipment required

- ◆ Fuel extractor - VAS 5190-



- ◆ Hose - VAS 6550/1-
- ◆ Vehicle diagnostic tester

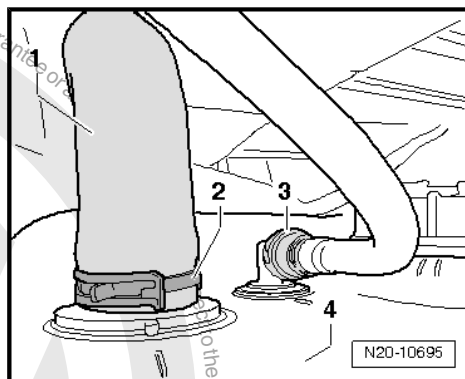
### Procedure

- Do not switch ignition on.
- Raise vehicle.

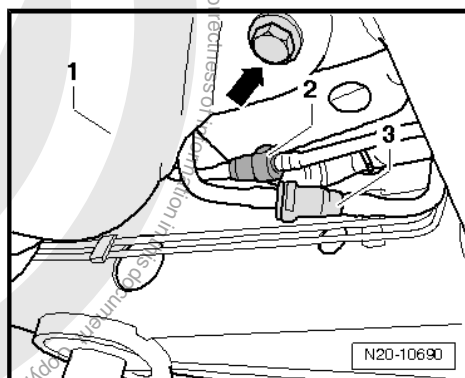




- Thoroughly clean area around filler neck -1- on fuel tank -4-.
- Loosen clamp -2- for connecting hose -1- of filler neck on fuel tank -4- and pull connecting hose off.
- Extract fuel with fuel extractor - VAS 5190- via the opening.



- Press the circlip to release the fuel line and then detach the fuel supply line -3-.
- Connect pressure gauge pipe -VAS 6550/1- to the fuel supply line -3-.
- Guide open end of line into a suitable container.
- Connect ➔ Vehicle diagnostic tester and carry out "Check electric fuel pump(s)".



#### Note

*Fuel pump is now activated for 30 seconds.*

- Repeat this procedure until fuel tank is completely empty.
- Remove fuel delivery unit ➔ [page 236](#) .
- Check fuel tank for dirt and filings.
- If necessary, clean fuel tank.
- Replace fuel delivery unit and install fuel tank ➔ [page 229](#) .
- Fill fuel tank with 5 litres of diesel fuel.
- Renew fuel filter ➔ [page 239](#) .
- Renew following high-pressure components:
  - ◆ High-pressure pump ➔ [page 347](#) .
  - ◆ High-pressure lines ➔ [page 338](#) .
  - ◆ High-pressure accumulator (fuel rail) including fuel pressure regulating valve - N276- and fuel pressure sender - G247- ➔ [page 340](#) .
  - ◆ Injectors ➔ [page 327](#) .
  - ◆ Fuel return lines (overflow oil lines).
- Reconnect fuel supply line.
- Fill fuel tank completely with diesel fuel.
- Fill/bleed fuel system ➔ [page 316](#) .
- Perform road test.





## 2 Checking low-pressure fuel system

⇒ [“2.1 Checking fuel low-pressure at high-pressure pump”, page 213](#)

⇒ [“2.2 Checking flow rate at high-pressure pump”, page 215](#)

⇒ [“2.3 Checking fuel low-pressure ahead of fuel filter”, page 218](#)

⇒ [“2.4 Checking flow rate ahead of fuel filter”, page 222](#)

### 2.1 Checking fuel low-pressure at high-pressure pump



#### Note

◆ The adapter lines/leads 1 to 4 listed below are not required for the test.

◆ Hose - VAS 6551/1-

◆ Hose - VAS 6551/2-

◆ Test lead - VAS 6551/3-

◆ Test lead - VAS 6551/4-



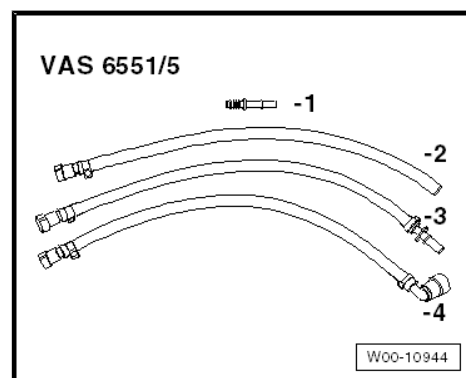
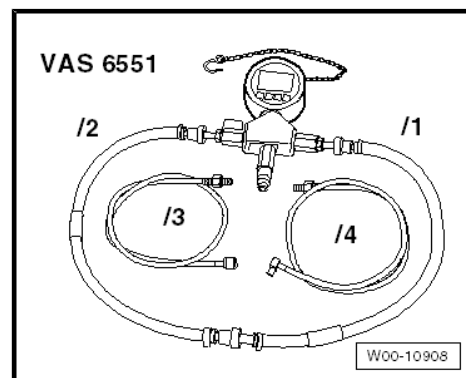
#### Note

To perform test, use ⇒ Vehicle diagnostic tester in conjunction with test instrument box - VAS 6356-.

#### Special tools and workshop equipment required

◆ Pressure gauge - VAS 6551-

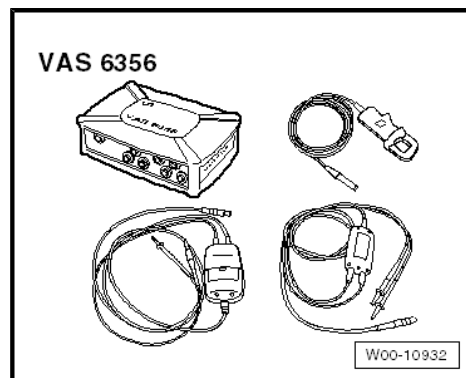
◆ Adapter set - VAS 6551/5-







- ◆ Vehicle diagnostic tester
- ◆ Laptop, vehicle diagnosis (remote head) - VAS 6150 A-
- ◆ Instrument box - VAS 6356-



### Test prerequisites

- Fuses must be OK.
- Battery voltage at least 12 V
- Ignition switched off
- There must be at least 10 l of fuel in the fuel tank.
- All electrical consumers, e.g. lights and rear window heating, must be switched off.
- The fuel lines must not be kinked or damaged.



#### WARNING

*Fuel supply lines are under pressure! Wear eye protection and protective clothing to avoid eye injuries and skin contact. Before loosening hose connections, wrap a cloth around the connection. Then release pressure by carefully pulling hose off connection.*

### Procedure



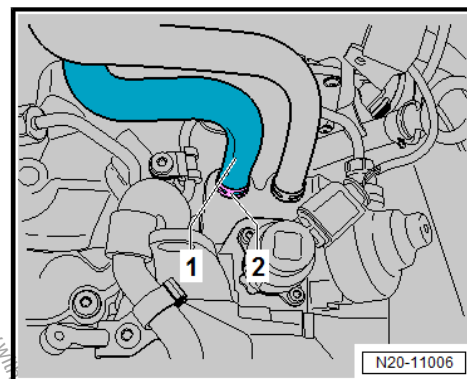
#### WARNING

- ◆ *Read rules for cleanliness and the instructions for working on the fuel system ⇒ **page 8**.*
- ◆ *Always follow these rules for cleanliness and instructions before starting work and while working on the fuel system.*
- ◆ *Wrap a clean cloth around the connection before opening the fuel system, then carefully loosen the connection to release the pressure.*

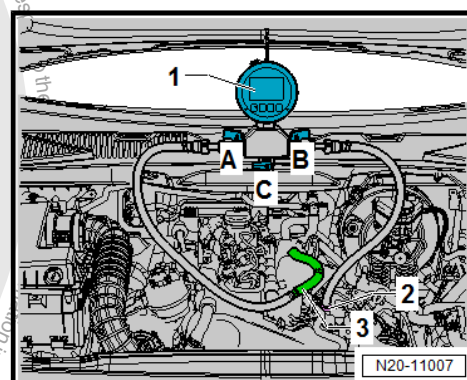




- Loosen spring-type clip -2- of fuel supply line -1-.
- Pull fuel supply line -1- off high-pressure pump.
- Collect escaping fuel with a cleaning cloth.



- Connect pressure tester - VAS 6551- -1- with hoses from adapter set - VAS 6551/5- .
- Connect hose -VAS 6551/2- as well as connection fitting -VAS 6551/5-1- from adapter set - VAS 6551/5- to fuel supply line -3- and connection -A - of pressure tester - VAS 6551- .
- Open shut-off tap -A-.
- Connect hose »-2« from adapter set - VAS 6551/5- to open connection on high-pressure pump -2- and connection -B- of pressure tester - VAS 6551- .
- Close shut-off taps -B- and -C-.
- Switch on pressure tester - VAS 6551- by pressing **on/off** pushbutton.
- Carefully open shut-off tap -B-.
- Connect ➤ Vehicle diagnostic tester to test instrument box - VAS 6356- .
- Activate fuel pump using guided function "Fuel pump activation".
- The fuel pump is activated.
- Specification:  $\geq 3.5$  bar.



If the specified value is not reached: check fuel low-pressure ahead of fuel filter ➔ [page 218](#) .

- ◆ If the pressure ahead of fuel filter is "OK":
- ◆ Renew fuel filter ➔ [page 239](#) .

## 2.2 Checking flow rate at high-pressure pump



### Note

- ◆ The adapter lines/leads 1 to 4 listed below are not required for the test.
- ◆ Hose - VAS 6551/1-
- ◆ Hose - VAS 6551/2-
- ◆ Test lead - VAS 6551/3-
- ◆ Test lead - VAS 6551/4-



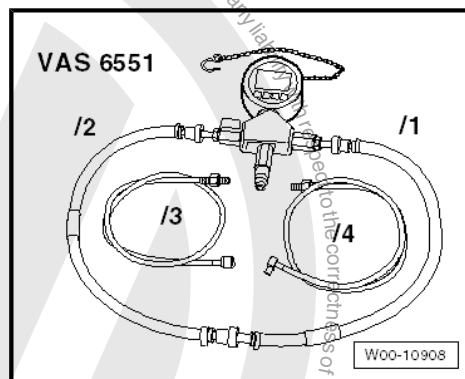


## Note

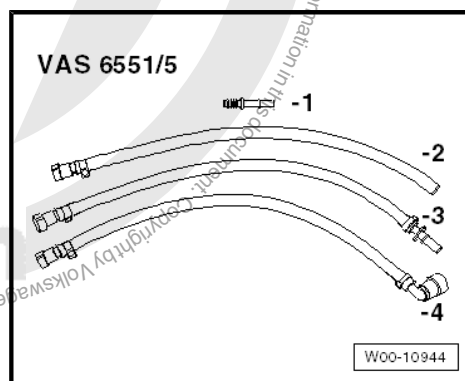
To perform test, → Vehicle diagnostic tester may be used in conjunction with test instrument box - VAS 6356-.

## Special tools and workshop equipment required

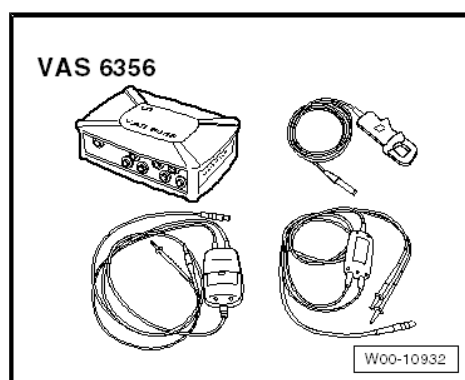
- ◆ Pressure gauge - VAS 6551-



- ◆ Adapter set - VAS 6551/5-



- ◆ Vehicle diagnostic tester
- ◆ Laptop, vehicle diagnosis (remote head) - VAS 6150 A-
- ◆ Instrument box - VAS 6356-



- ◆ Transparent measuring beaker  $\geq 1.5$  litre

## Test prerequisites

- Fuses must be OK.
- Battery voltage at least 12 V
- Ignition switched off
- There must be at least 10 l of fuel in the fuel tank.





- All electrical consumers, e.g. lights and rear window heating, must be switched off.
- The fuel lines must not be kinked or damaged.

**WARNING**

*Fuel supply lines are under pressure! Wear eye protection and protective clothing to avoid eye injuries and skin contact. Before loosening hose connections, wrap a cloth around the connection. Then release pressure by carefully pulling hose off connection.*

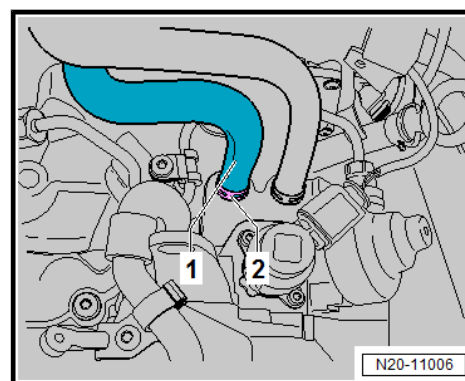
**Procedure****WARNING**

- ◆ *Read rules for cleanliness and the instructions for working on the fuel system ⇒ [page 8](#).*
- ◆ *Always follow these rules for cleanliness and instructions before starting work and while working on the fuel system.*
- ◆ *Wrap a clean cloth around the connection before opening the fuel system, then carefully loosen the connection to release the pressure.*

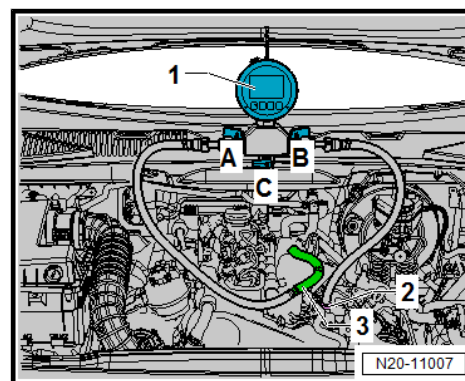
**Note**

*Collect escaping fuel with a cleaning cloth.*

- Loosen spring-type clip -2- of fuel supply line -1-.
- Pull fuel supply line -1- off high-pressure pump.



- Connect pressure tester - VAS 6551- -1- with hoses from adapter set - VAS 6551/5- .
- Connect hose -VAS 6551/2- as well as connection fitting -VAS 6551/5-1- from adapter set - VAS 6551/5- to fuel supply line -3- and connection -A- of pressure tester - VAS 6551- .
- Open shut-off tap -A- of pressure tester - VAS 6551- .
- Close shut-off tap -C- of pressure tester - VAS 6551- .





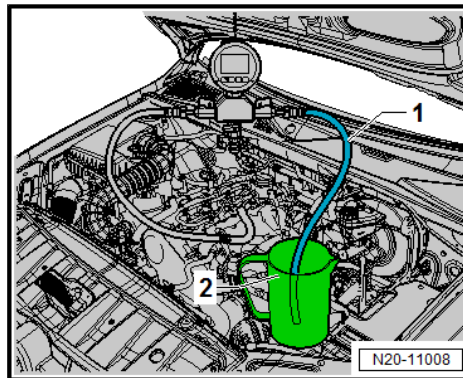


- Connect hose »-2« -1- from adapter set - VAS 6551/5- to connection -B- of pressure tester - VAS 6551- .
- Hold open end of hose into measuring beaker -2-.
- Close shut-off tap -B-.
- Switch on pressure tester - VAS 6551- by pressing on/off pushbutton.



#### Note

*A 2nd mechanic is needed to check the flow rate in the vehicle.*



- Connect ⇒ Vehicle diagnostic tester to test instrument box - VAS 6356- .
- Activate fuel pump using guided function "Fuel pump activation".
- The fuel pump is activated.
- Carefully open shut-off tap -B- until specified value of 3.5 bar is displayed on pressure tester - VAS 6551- .
- Empty measuring beaker.
- Hold hose -2- -1- from adapter set - VAS 6551/5- in measuring beaker -2- again.
- Activate fuel pump using guided function "Fuel pump activation".
- The fuel pump is activated.

Specification: ≥ 550 ml

## 2.3 Checking fuel low-pressure ahead of fuel filter



#### Note

- ♦ *The adapter lines/leads 1 to 4 listed below are not required for the test.*
- ♦ *Hose - VAS 6551/1-*
- ♦ *Hose - VAS 6551/2-*
- ♦ *Test lead - VAS 6551/3-*
- ♦ *Test lead - VAS 6551/4-*



#### Note

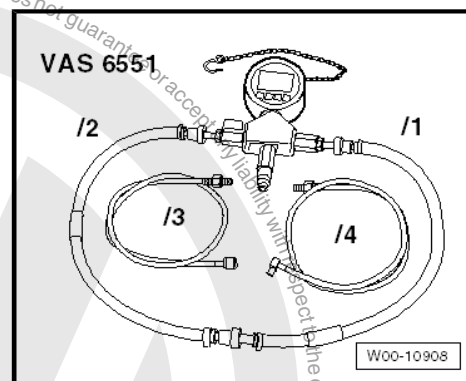
*To perform test, use ⇒ Vehicle diagnostic tester in conjunction with test instrument box - VAS 6356- .*

**Special tools and workshop equipment required**

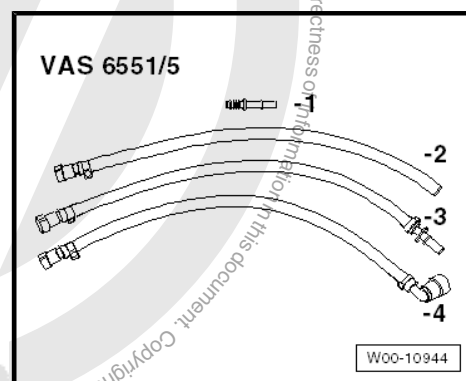




◆ Pressure gauge - VAS 6551-



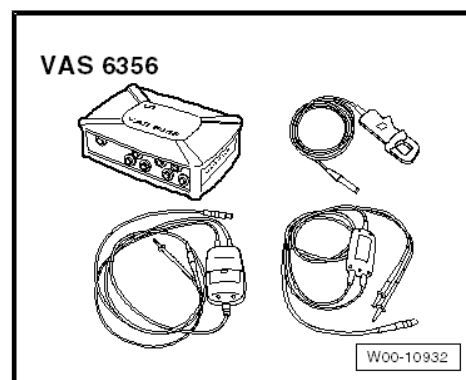
◆ Adapter set - VAS 6551/5-



◆ Vehicle diagnostic tester

◆ Laptop, vehicle diagnosis (remote head) - VAS 6150 A-

◆ Instrument box - VAS 6356-



**Test prerequisites**

- Fuses must be OK.
- Battery voltage at least 12 V
- Ignition switched off
- There must be at least 10 l of fuel in the fuel tank.
- All electrical consumers, e.g. lights and rear window heating, must be switched off.
- The fuel lines must not be kinked or damaged.





#### WARNING

*Fuel supply lines are under pressure! Wear eye protection and protective clothing to avoid eye injuries and skin contact. Before loosening hose connections, wrap a cloth around the connection. Then release pressure by carefully pulling hose off connection.*

#### Procedure



#### WARNING

- ◆ *Read rules for cleanliness and the instructions for working on the fuel system ➔ [page 8](#).*
- ◆ *Always follow these rules for cleanliness and instructions before starting work and while working on the fuel system.*
- ◆ *Wrap a clean cloth around the connection before opening the fuel system, then carefully loosen the connection to release the pressure.*

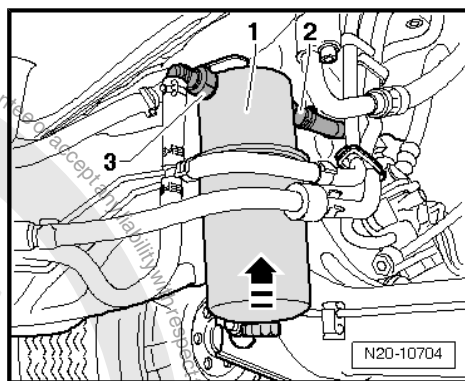
- Separate quick-release coupling of "black" fuel supply line -3- from fuel filter -1-.



#### Note

*To do this, press locking mechanism on quick-release coupling.*

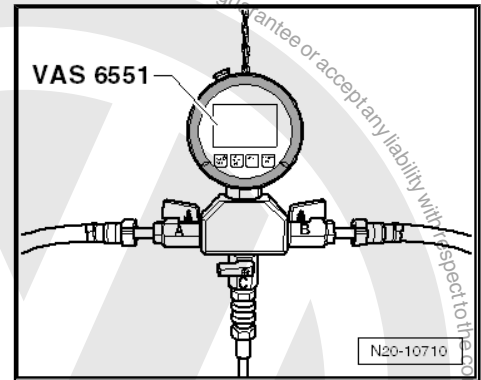
- Collect escaping fuel with a cleaning cloth.







- Connect hose »-3« from adapter set - VAS 6551/5- to open fuel line (from fuel tank) and connection -A- of pressure tester - VAS 6551- .
- Open shut-off tap -A- of pressure tester - VAS 6551- .
- Connect hose »-4« from adapter set - VAS 6551/5- to open connection on fuel filter and connection -B- of pressure tester - VAS 6551- .
- Open shut-off tap -B- of pressure tester - VAS 6551- .
- Close shut-off tap -C- of pressure tester - VAS 6551- .
- Switch on pressure tester - VAS 6551- by pressing  pushbutton.
- Connect ⇒ Vehicle diagnostic tester or laptop, vehicle diagnosis (remote head) - VAS 6150 A- to test instrument box - VAS 6356-
- Activate fuel pump using guided function "Fuel pump activation".
- The fuel pump is activated.
- Specification:  $\geq 3.5$  bar.



**i Note**

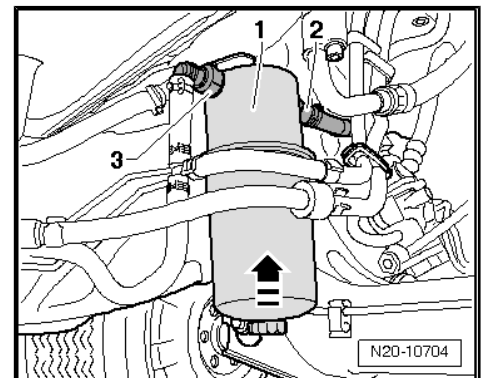
- ◆ *If the specification has been reached and the fuel low-pressure on the high-pressure pump has not been checked yet, the fuel low-pressure downstream of fuel filter must be checked.*
- ◆ *If the fuel low-pressure on the high-pressure pump has already been checked and the specification has not been reached, re-new fuel filter ⇒ [page 239](#) .*

- Connect fuel supply line -3- to connection on fuel filter -1-.
- Separate quick-release coupling of fuel supply line -2- from fuel filter -1-.

**i Note**

*To do this, press locking mechanism on quick-release coupling.*

- Collect escaping fuel with a cleaning cloth.



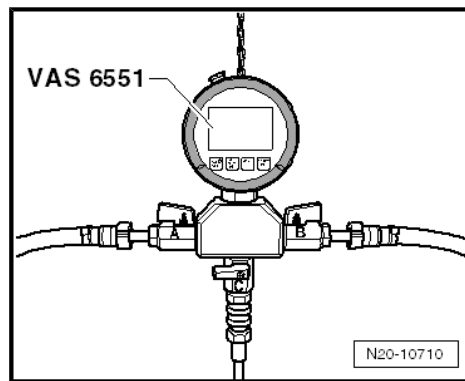




- Connect hose »-4« from adapter set - VAS 6551/5- to open connection on fuel filter and connection -A- of pressure tester - VAS 6551- .
- Open shut-off tap -A- of pressure tester - VAS 6551- .
- Connect hose »-3« from adapter set - VAS 6551/5- to open fuel supply line leading to high-pressure pump -B- of pressure tester - VAS 6551- .
- Open shut-off tap -B- of pressure tester - VAS 6551- .
- Close shut-off tap -C- of pressure tester - VAS 6551- .
- Switch on pressure tester - VAS 6551- by pressing on/off pushbutton.
- Carefully open shut-off tap -B-.
- Connect ⇒ Vehicle diagnostic tester or laptop, vehicle diagnosis (remote head) - VAS 6150 A- to test instrument box - VAS 6356-
- Activate fuel pump using guided function "Fuel pump activation".
- The fuel pump is activated.
- Specification:  $\geq 3.5$  bar.

If the specified value is not attained:

- ◆ Renew fuel filter ⇒ [page 239](#) .



## 2.4 Checking flow rate ahead of fuel filter



### Note

- ◆ *The adapter lines/leads 1 to 4 listed below are not required for the test.*
- ◆ *Hose - VAS 6551/1-*
- ◆ *Hose - VAS 6551/2-*
- ◆ *Test lead - VAS 6551/3-*
- ◆ *Test lead - VAS 6551/4-*



### Note

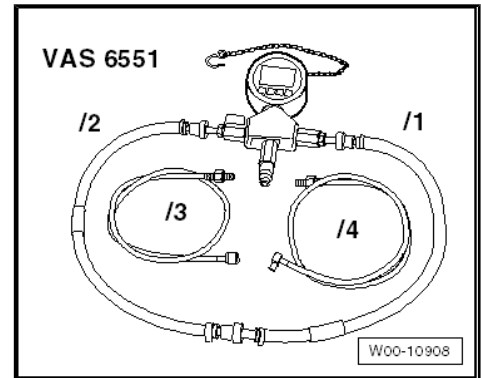
To perform test, ⇒ Vehicle diagnostic tester may be used in conjunction with test instrument box - VAS 6356- .

**Special tools and workshop equipment required**

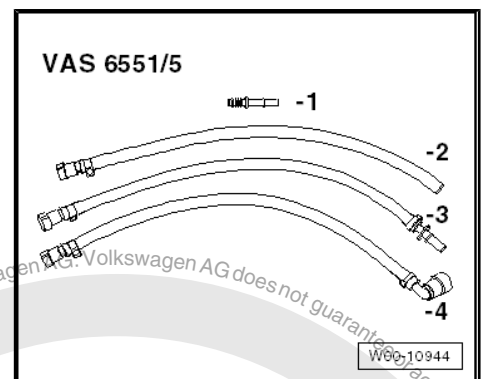




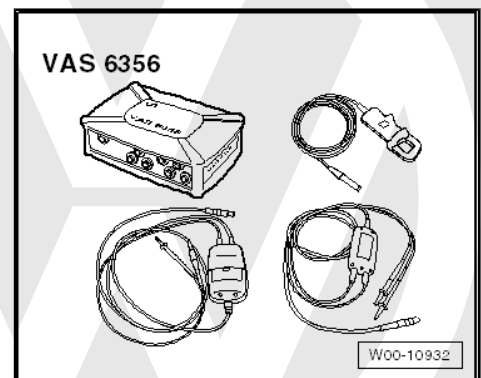
- ◆ Pressure gauge - VAS 6551-



- ◆ Adapter set - VAS 6551/5-



- ◆ Vehicle diagnostic tester
- ◆ Laptop, vehicle diagnosis (remote head) - VAS 6150 A-
- ◆ Instrument box - VAS 6356-



- ◆ Transparent measuring beaker  $\geq 1.5$  litre

#### Test prerequisites

- Fuses must be OK.
- Battery voltage at least 12 V
- Ignition switched off
- There must be at least 10 l of fuel in the fuel tank.
- All electrical consumers, e.g. lights and rear window heating, must be switched off.
- The fuel lines must not be kinked or damaged.





#### WARNING

*Fuel supply lines are under pressure! Wear eye protection and protective clothing to avoid eye injuries and skin contact. Before loosening hose connections, wrap a cloth around the connection. Then release pressure by carefully pulling hose off connection.*

#### Procedure



#### WARNING

- ◆ *Read rules for cleanliness and the instructions for working on the fuel system ➔ [page 8](#).*
- ◆ *Always follow these rules for cleanliness and instructions before starting work and while working on the fuel system.*
- ◆ *Wrap a clean cloth around the connection before opening the fuel system, then carefully loosen the connection to release the pressure.*

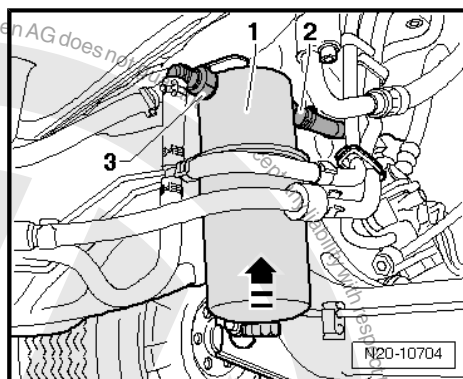
- Disconnect "black" fuel supply line -3- from fuel filter -1-.



#### Note

*To do this, press locking mechanism on hose coupling.*

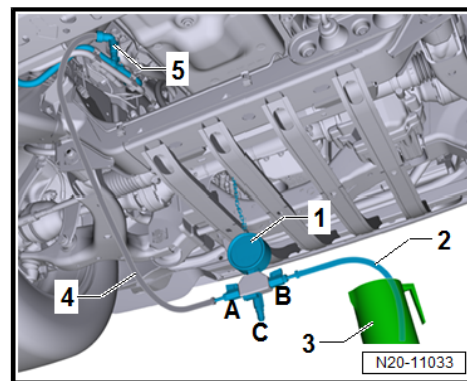
- Collect escaping fuel with a cleaning cloth.







- Connect hose »-3« from adapter set - VAS 6551/5- -4- to fuel supply line (from fuel tank) -5- and connection -A- of pressure tester - VAS 6551- -1-.
- Open shut-off tap -A- of pressure tester - VAS 6551- .
- Close shut-off tap -C- of pressure tester - VAS 6551- .
- Connect hose »-3« from adapter set - VAS 6551/5- -2- to connection -B- of pressure tester - VAS 6551- .
- Hold open end of hose into measuring beaker -3-.
- Close shut-off tap -B- of pressure tester - VAS 6551- .
- Switch on pressure tester - VAS 6551- by pressing  pushbutton.



### Note

*A 2nd mechanic is needed to check the flow rate in the vehicle.*

- Connect ⇒ Vehicle diagnostic tester or laptop, vehicle diagnosis (remote head) - VAS 6150 A- to test instrument box - VAS 6356-
- Activate fuel pump using guided function "Fuel pump activation".
- The fuel pump is activated.
- Carefully open shut-off tap -B- until the specified value of 3.5 bar is displayed on pressure tester - VAS 6551- .
- Empty measuring beaker.
- Hold hose from adapter set - VAS 6551/5- -2- into measuring beaker -3- again.
- Activate fuel pump using guided function "Fuel pump activation".
- The fuel pump is activated.

Specification:  $\geq 550$  ml

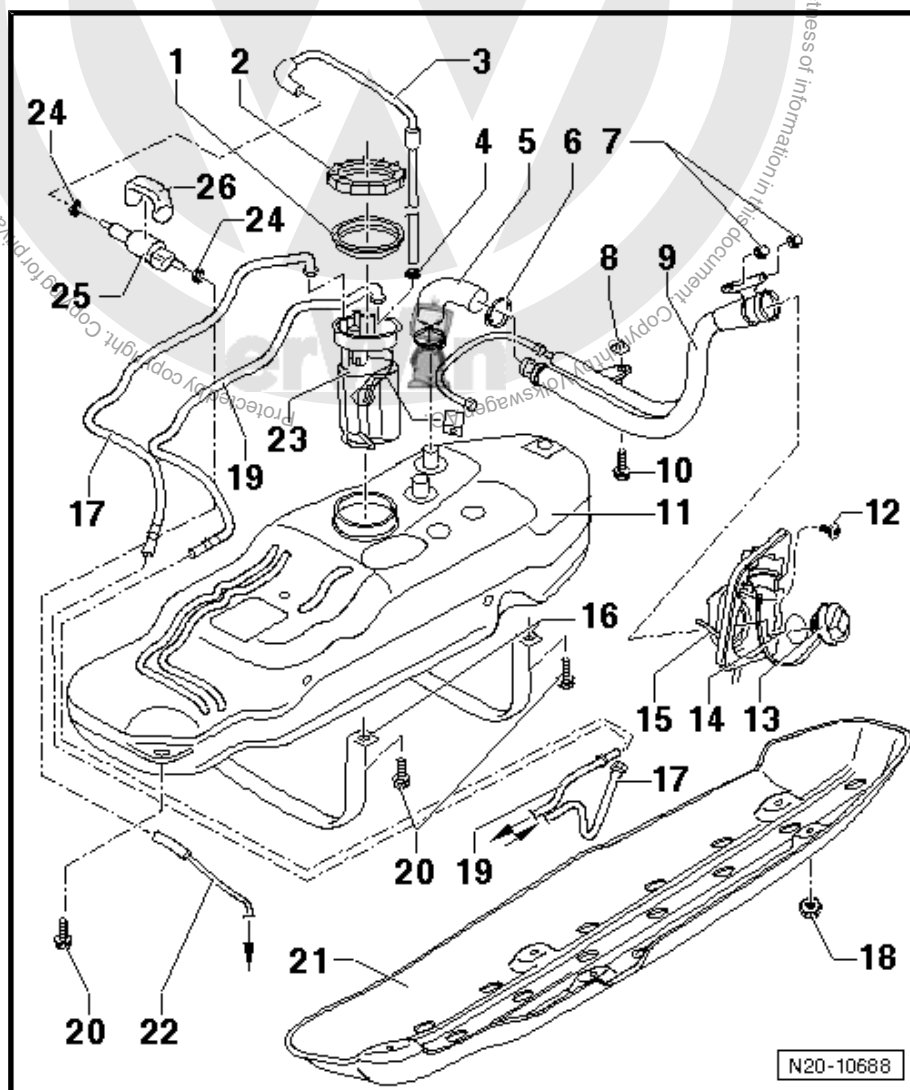




⇒ “3.4 Removing and installing filler neck”, page 232

***The fuel tank must contain at least 5 litres of fuel.***

- ❑ When removing, support using engine and gearbox jack - V.A.G 1383 A- .
- ❑ Drain fuel tank using fuel extractor - VAS 5190-
- ❑ Removing and installing ⇒ **page 229** .





**12 - Bolt**

- ☐ 8 Nm

**13 - Cap****14 - Seal**

- ☐ Renew if damaged.

**15 - Tank flap unit****16 - Securing strap**

- ☐ Note installation position.
- ☐ Check for secure seating.

**17 - Return line**

- ☐ Blue or with blue marking.
- ☐ Clipped onto fuel tank.
- ☐ Check for secure seating.
- ☐ To pull off flange, press release button on connecting piece.

**18 - Nut**

- ☐ 20 Nm

**19 - Supply line**

- ☐ To fuel filter ⇒ [Item 1 \(page 238\)](#) .
- ☐ Clipped onto fuel tank.
- ☐ Check for secure seating.
- ☐ Black
- ☐ To pull off flange, press release button on connecting piece.

**20 - Bolt**

- ☐ 30 Nm

**21 - Protective cover**

- ☐ For bottom of fuel tank.
- ☐ Depending on equipment.

**22 - Supply line**

- ☐ For vehicles with additional heater ⇒ Rep. gr. 82 .
- ☐ Check for secure seating.

**23 - Fuel delivery unit**

- ☐ Note installation position on fuel tank ⇒ [page 228](#) .
- ☐ To remove, first remove fuel tank ⇒ [page 229](#) .
- ☐ Removing and installing fuel gauge sender ⇒ [page 237](#) .

**24 - Spring-type clip**

- ☐ Check for secure seating.

**25 - Metering pump - V54-**

- ☐ For vehicles with additional heater ⇒ Rep. gr. 82 .

**26 - Mounting for metering pump - V54-**

- ☐ For vehicles with additional heater ⇒ Rep. gr. 82 .



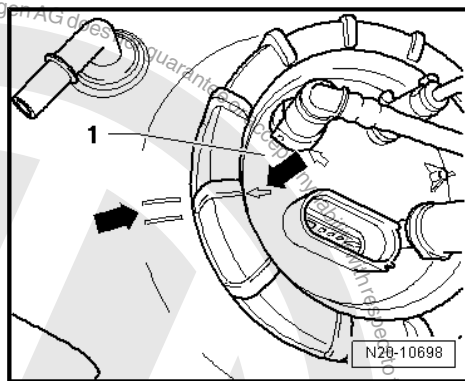
**Installation position of fuel gauge sender**

Arrow on sender flange -1- must align with mark on fuel tank -arrows-.

Connections for blue or blue-marked return line and black supply line are marked with arrows on fuel gauge sender flange.

**Note**

After installing fuel gauge sender, check whether fuel supply and return lines are still clipped onto fuel tank.

**3.2 Assembly overview - fuel lines****1 - Supply line**

- ☐ To high-pressure pump
- ☐ Check for secure seating.

**2 - Return line**

- ☐ From high-pressure pump.
- ☐ Check for secure seating.

**3 - Fuel temperature sender - G81-**

- ☐ Fitting location  
⇒ [page 307](#)

**4 - Bracket****5 - Return line**

- ☐ From the injectors
- ☐ Check for secure seating.

**6 - Return line**

- ☐ Check for secure seating.

**7 - Bracket****8 - Fuel filter with bracket**

- ☐ Can only be renewed complete.
- ☐ Removing and installing  
⇒ [page 239](#).

**9 - Quick-release coupling**

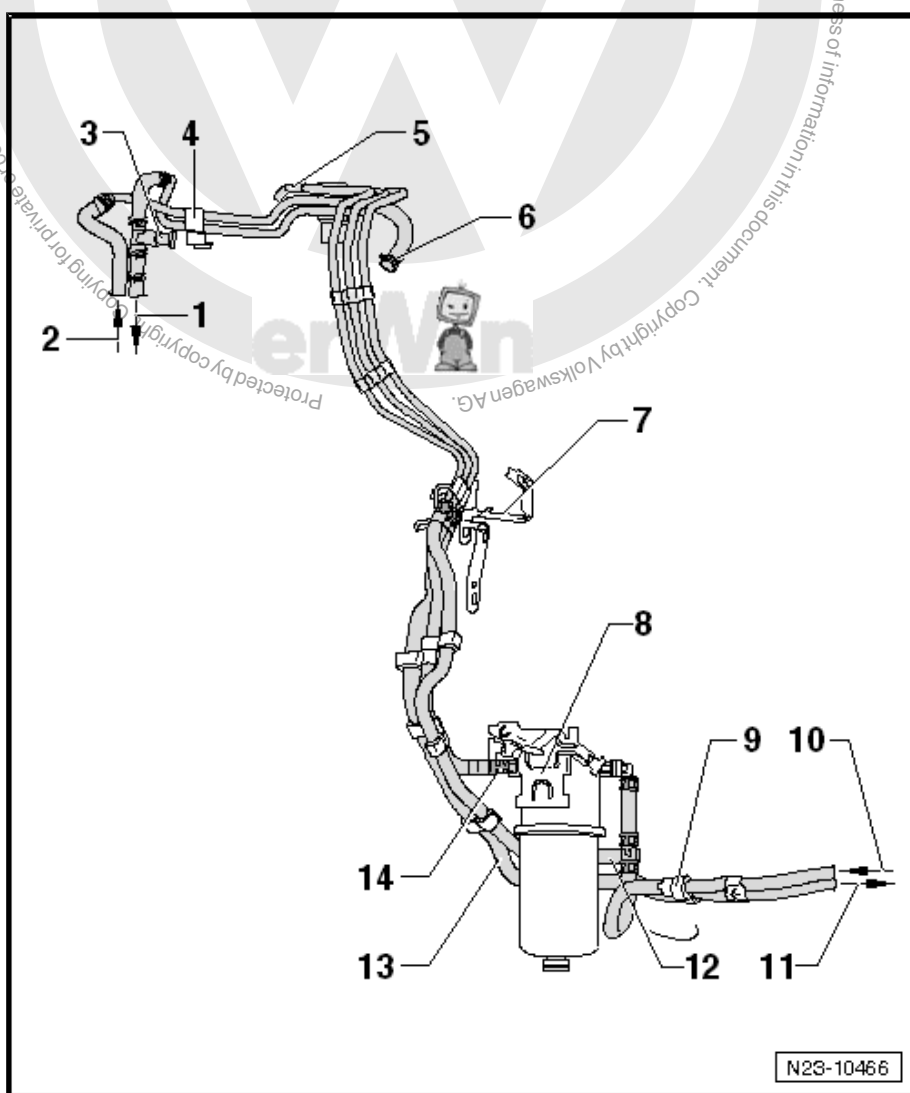
- ☐ Check for secure seating.

**10 - Supply line**

- ☐ From fuel tank.
- ☐ Check for secure seating.

**11 - Return line**

- ☐ To fuel tank.
- ☐ Check for secure seating.





**12 - Return line**

- ☐ Fuel return line from injectors to supply line leading to fuel filter

**13 - Return line**

- ☐ From high-pressure pump.

**14 - Supply line**

- ☐ To high-pressure pump

**3.3 Removing and installing fuel tank****Caution**

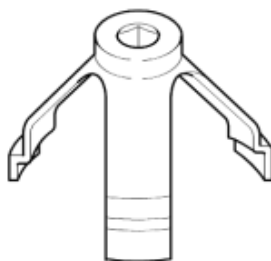
*The fuel pump must not be allowed to run when the fuel tank is empty, as this may cause deflagrations.*

*The fuel tank must contain at least 5 litres of fuel.*

**Special tools and workshop equipment required**

- ◆ Union nut tool - 3217-
- ◆ Torque wrench - V.A.G 1331-
- ◆ Torque wrench - V.A.G 1332-
- ◆ Engine and gearbox jack - V.A.G 1383 A-
- ◆ Fuel extractor - VAS 5190-

3217



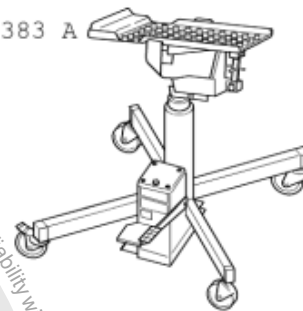
V.A.G 1331



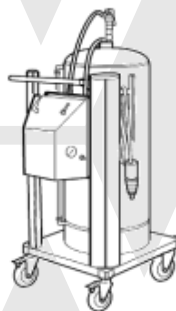
V.A.G 1332



V.A.G 1383 A



VAS 5190



W20-10000





## Removing



### Note

*Fuel tank must be drained. Use the fuel extractor - VAS 5190- to do this.*

- Note safety precautions before starting installation work  
⇒ [page 3](#) .
- Observe rules for cleanliness ⇒ [page 8](#) .



### Note

*Before carrying out further work, disconnect battery earth strap. For this reason, first check whether a coded radio is fitted. Obtain anti-theft coding first if necessary.*

- Thoroughly clean area around filler neck -1- on fuel tank -4-.
- Loosen clamp -2- for connecting hose -1- of filler neck on fuel tank -4- and pull connecting hose off.
- Extract fuel with fuel extractor - VAS 5190- via the opening.

### Vehicles with lower protective cover

- Unbolt protective cover on bottom of fuel tank  
⇒ [Item 21 \(page 227\)](#) .

### Continuation for all vehicles:

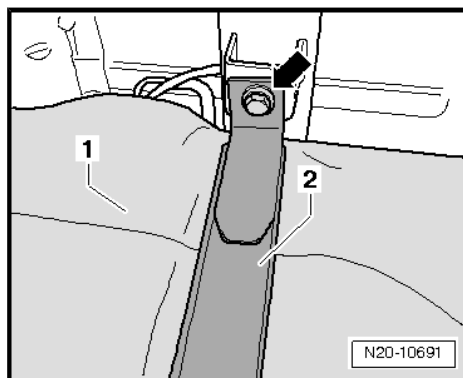
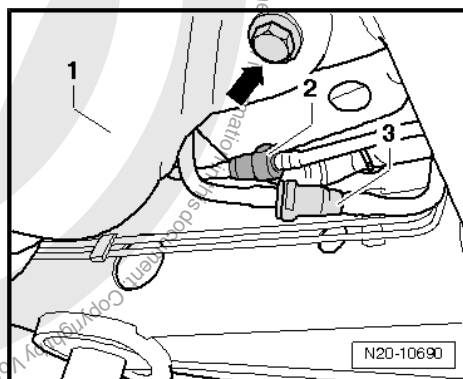
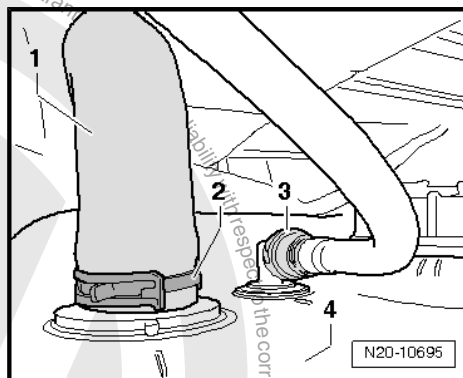
- Support fuel tank with engine and gearbox jack - V.A.G 1383 A- .
- Disconnect supply line -3- and return line -2-.



### Note

*Press in buttons on hose couplings to do this.*

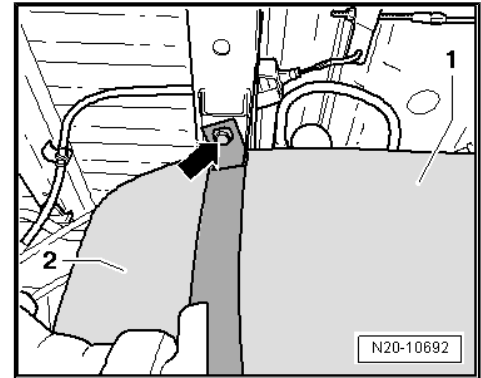
- Unscrew bolt -arrow- for securing fuel tank -1- on left cross member.
- Loosen securing straps in succession:
- Unscrew bolt -arrow- for front securing strap -2- for fuel tank -1-.





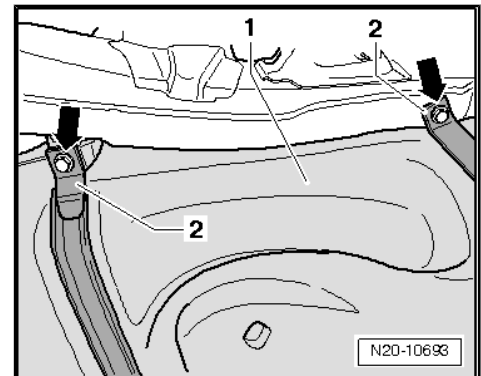


- Unscrew bolt -arrow- for rear securing strap -2- for fuel tank -1-.



- Unscrew bolts -arrows- for securing straps -2- for fuel tank -1-.

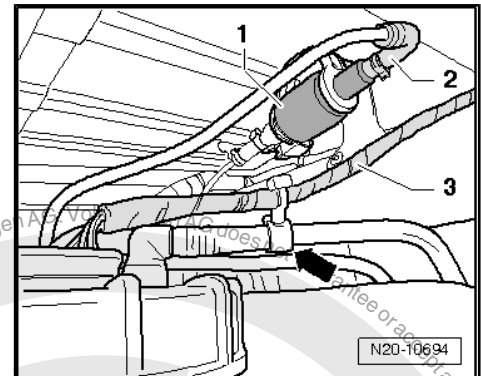
**Vehicles with additional heater:**



- Pull fuel line -2- off at metering pump - V54- -1-.

**Continuation for all vehicles:**

- Unclip wiring harness -3- at supply line -arrow-.
- Only lower fuel tank with engine and gearbox jack - V.A.G 1383 A- until filler neck and breather line can be removed.

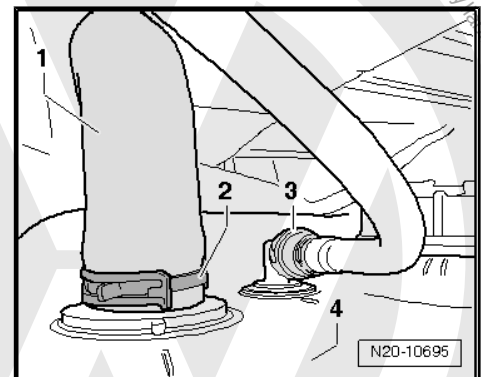


- Loosen clamp -2- for connecting hose -1- of filler neck on fuel tank -4- and pull connecting hose off.
- Unclip breather line -3- on fuel tank -4-.



**Note**

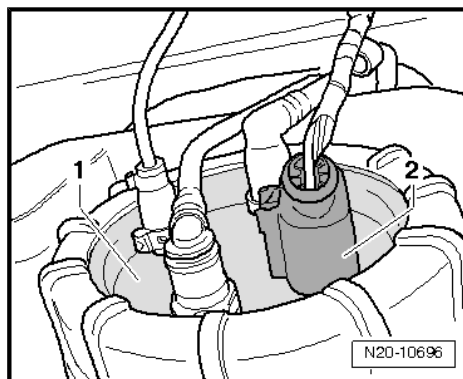
*Immediately seal all openings on fuel tank with clean cloths.*







- Continue lowering fuel tank with engine and gearbox jack - V.A.G 1383 A- until connector -2- can be pulled off fuel delivery unit -1-.
- Press in securing clip to release fuel lines.



- Unclip fuel lines -2 and 3- from fuel delivery unit -1-.
- Carefully lower fuel tank.

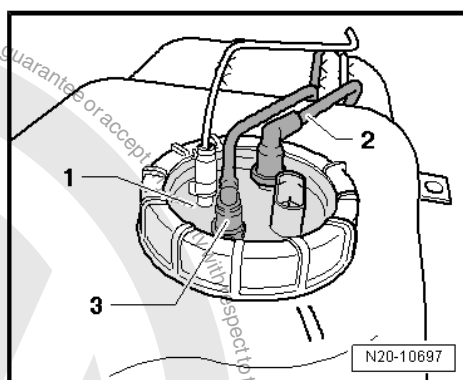
**Installing**

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

**Caution**

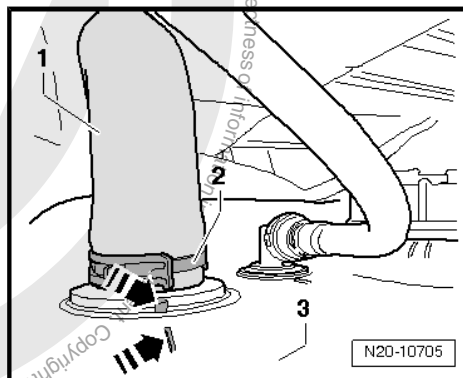
*The fuel pump must not be allowed to run when the fuel tank is empty, as this may cause deflagrations.*

*The fuel tank must contain at least 5 litres of fuel.*



Push hose -1- of filler neck onto connection on fuel tank -3-.

Position clamp -2- at assembly markings -arrows- using hose clip pliers - VAS 6362- .



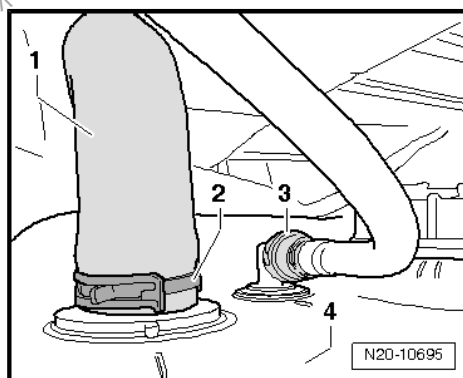
- Push on breather line -3- and engage securely.
- ◆ Connections for breather and fuel lines must engage audibly when reconnected.
- ◆ Clip fuel lines onto fuel tank.
- ◆ Push connector onto fuel pump flange and clip wire onto fuel tank.
- ◆ Ensure that fuel hose connections are tight.

**Vehicles with lower protective cover**

- Bolt protective cover to bottom of fuel tank .

**Specified torques**

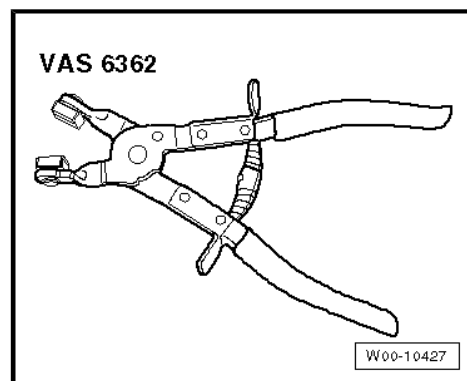
- ◆ ➔ [“3.1 Assembly overview - fuel tank”, page 226](#)

**3.4 Removing and installing filler neck****Special tools and workshop equipment required**

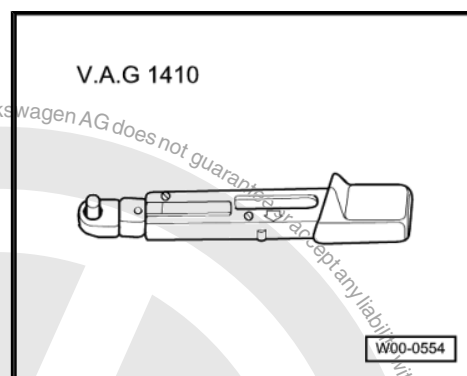




- ◆ Hose clip pliers - VAS 6362-

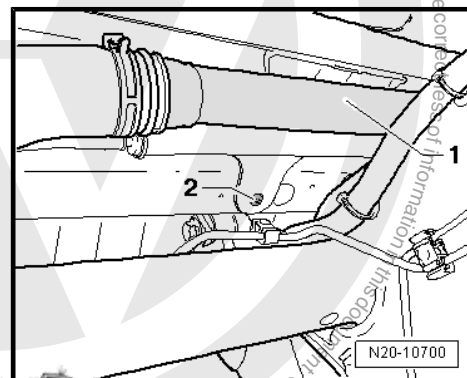


- ◆ Torque wrench - V.A.G 1410-

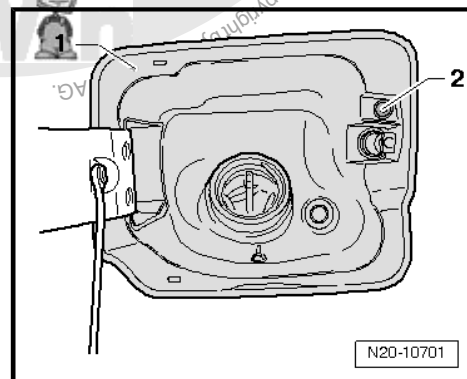


### Removing

- Remove fuel tank ⇒ [page 229](#) .
- Unscrew bolt -2- for filler neck -1- on underbody.
- Open tank flap and clean inside tank flap unit thoroughly.
- Unscrew cap.



- Unscrew bolt -2- from tank flap unit.
- Unclip tank flap unit and remove completely.







- Unscrew nuts -2- from filler neck -1- at top of tank flap unit cut-out.
- Remove filler neck -1- from below; filler neck must be turned when doing this.

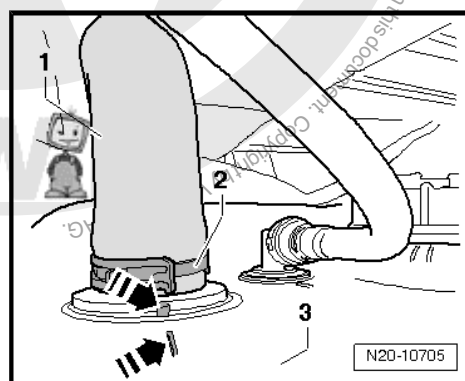
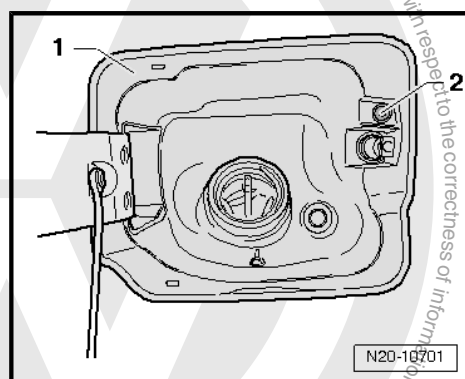
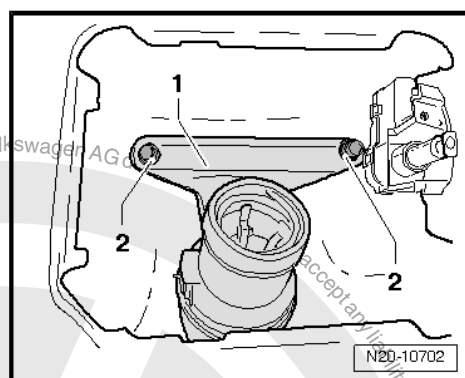
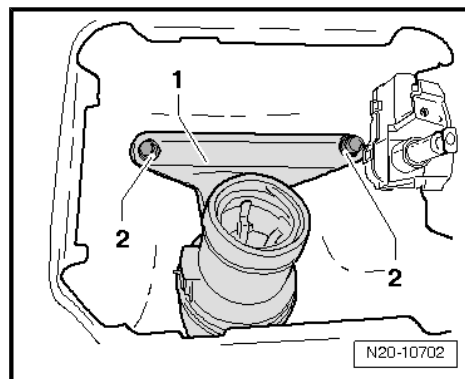
### Installing

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

- Thread filler neck -1- in through wheel housing and position at top of tank flap unit cut-out with nuts -2-.
- Tighten nuts -2-.
- Renew speed nut in cross member on underbody  
⇒ [Item 8 \(page 226\)](#) .

- Tighten bolt -2-.
- Installing fuel tank:

- Push hose -1- of filler neck onto connection on fuel tank -3-.
- Position clamp -2- at assembly markings -arrows- using hose clip pliers - VAS 6362- .



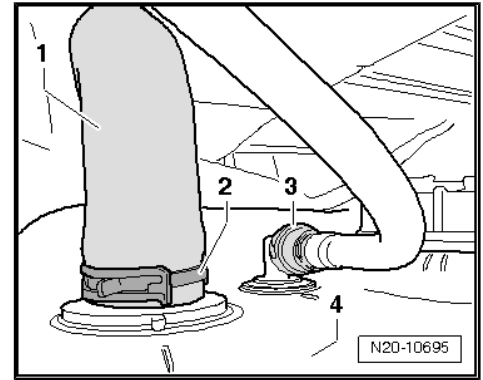




- Push on breather line -3- and engage securely.
- ◆ Connections for breather and fuel lines must engage audibly when reconnected.
- ◆ Clip fuel lines onto fuel tank.
- ◆ Push connector onto fuel pump flange and clip wire onto fuel tank.
- ◆ Ensure that fuel hose connections are tight.

#### Specified torques

- ◆ ⇒ [“3.1 Assembly overview - fuel tank”, page 226](#)







## 4 Fuel delivery unit, fuel gauge sender

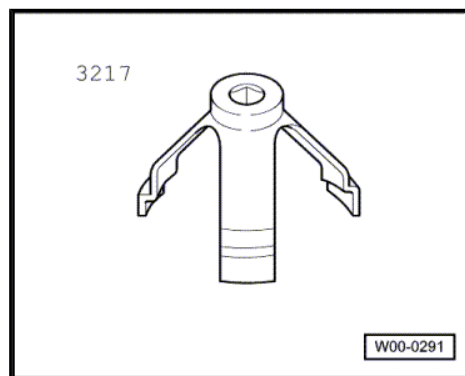
⇒ "4.1 Removing and installing fuel delivery unit", page 236

⇒ "4.2 Removing and installing fuel gauge sender G", page 237

### 4.1 Removing and installing fuel delivery unit

Special tools and workshop equipment required

- ◆ Union nut tool - 3217-



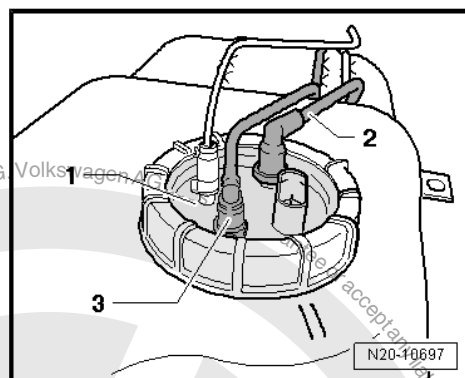
#### Removing

- Remove fuel tank ⇒ page 229 .
- Unclip fuel lines -2 and 3- from fuel delivery unit -1-.

Vehicles with additional heater:

- Pull fuel line for metering pump - V54- off at fuel delivery unit.

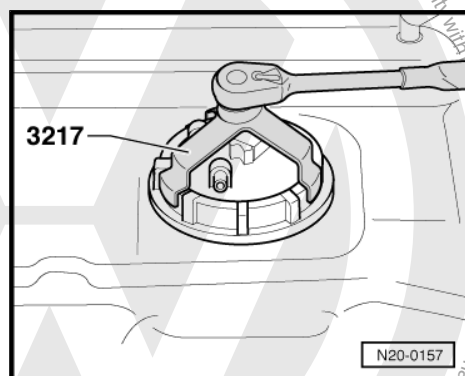
Continuation for all vehicles:



- Unscrew union nut with union nut tool - 3217- .
- Take fuel delivery unit out of the fuel tank.

#### Installing

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



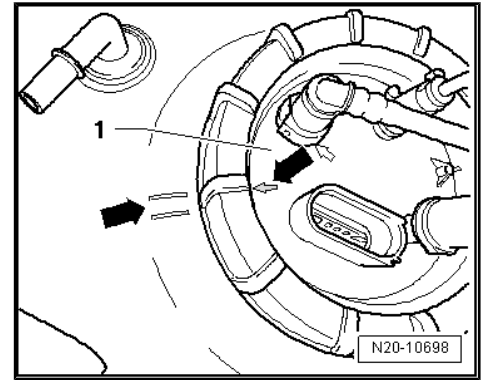




- Install fuel delivery unit so that mark on flange of fuel delivery unit -1- is aligned with mark on fuel tank -arrows-.

#### Specified torques

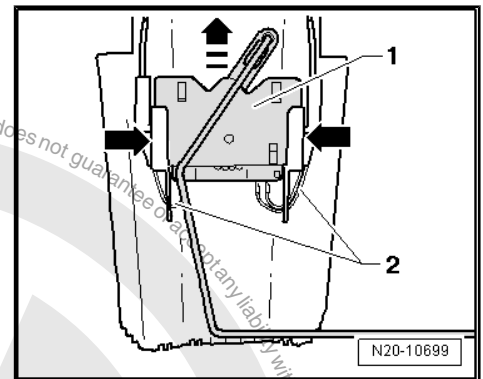
- ◆ ⇒ [“3.1 Assembly overview - fuel tank”, page 226](#)



## 4.2 Removing and installing fuel gauge sender - G-

### Removing

- Remove fuel tank ⇒ [page 229](#) .
- Remove fuel delivery unit ⇒ [page 236](#) .
- Free lines -2- and unclip fuel gauge sender - G- to side -arrows-.



- Remove fuel gauge sender - G- -1- in -direction of arrow-.
- Release connectors on fuel gauge sender - G- .

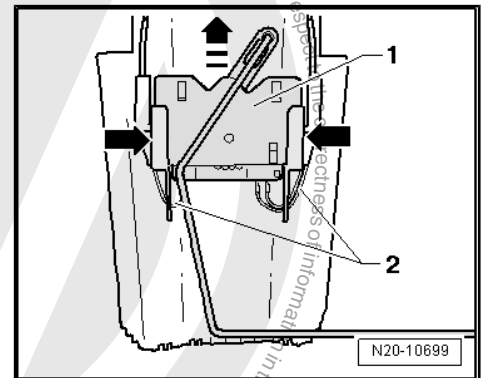
### Installing

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

- Insert fuel gauge sender - G- into guides on fuel pump and press downwards until it engages.

### Specified torques

- ◆ ⇒ [“3.1 Assembly overview - fuel tank”, page 226](#)







## 5 Fuel filter

⇒ "5.1 Assembly overview - fuel filter", page 238

⇒ "5.2 Removing and installing fuel filter", page 239

⇒ "5.3 Checking fuel filter", page 239

### 5.1 Assembly overview - fuel filter

#### 1 - Supply line

- ☐ From fuel tank
- ☐ Check for secure seating.

#### 2 - Supply line

- ☐ To high-pressure pump
- ☐ Check for secure seating.

#### 3 - Fuel filter

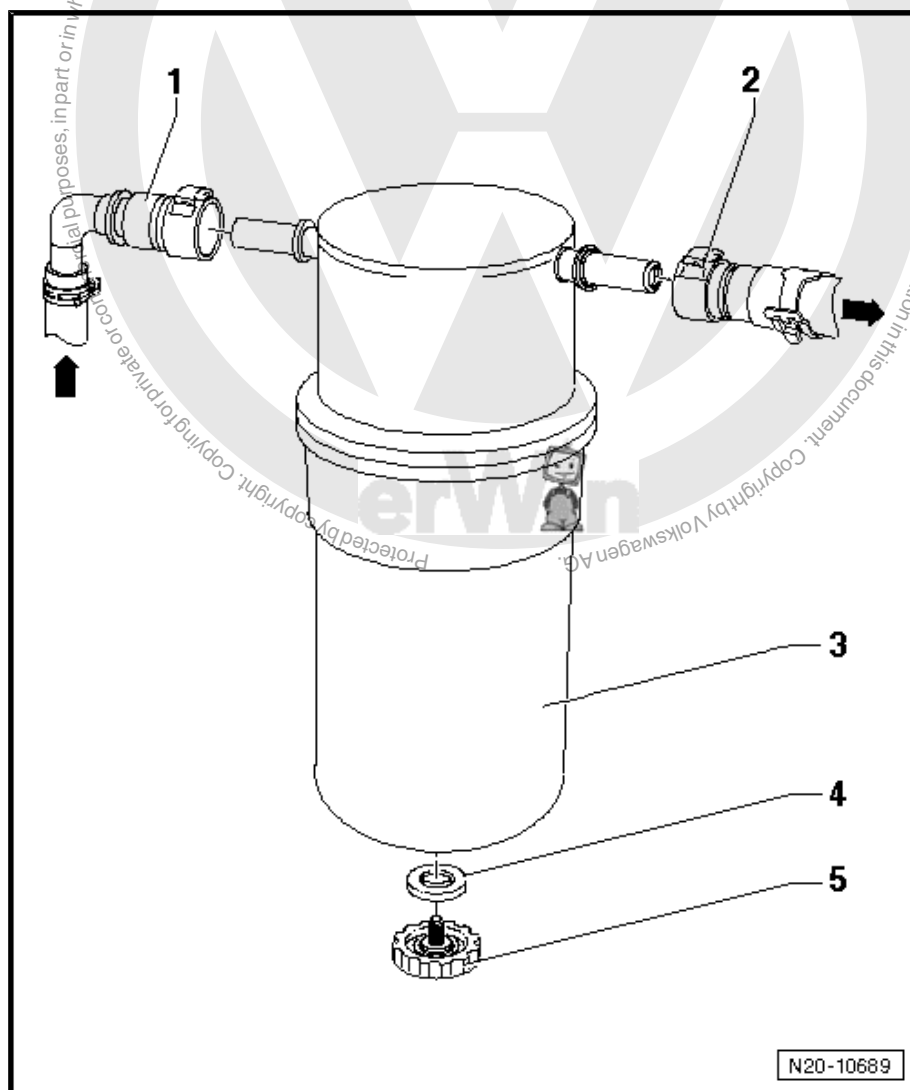
- ☐ Can only be renewed complete.
- ☐ Removing and installing ⇒ [page 239](#).
- ☐ Checking ⇒ [page 239](#).

#### 4 - Gasket

- ☐ Renew if damaged.

#### 5 - Water drain screw

- ☐ Loosen and allow approx. 100 cm<sup>3</sup> fluid to drain







## 5.2 Removing and installing fuel filter

### Removing and installing fuel filter

#### Removing

- Unclip fuel lines -2 and 3- from fuel filter -1- and pull fuel filter out of bracket in -direction of arrow-.

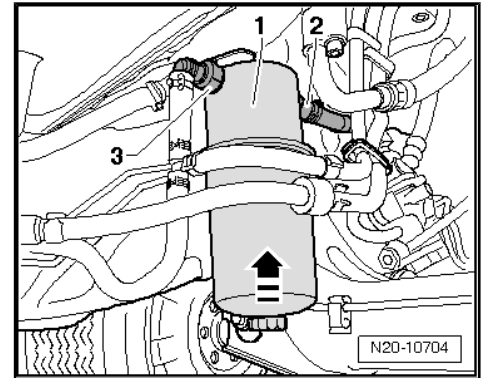


#### Note

*Press in buttons on hose couplings to do this.*

#### Installing

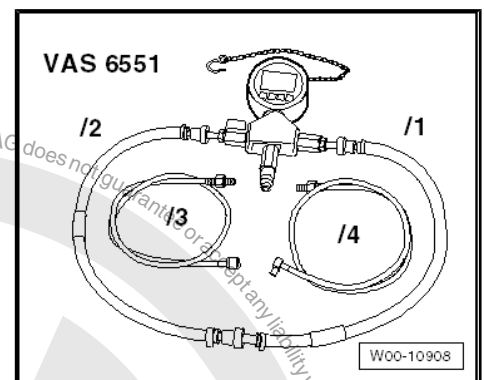
Install in reverse order.



## 5.3 Checking fuel filter

### Special tools and workshop equipment required

- ◆ Pressure tester - VAS 6551-



- ◆ Hose - VAS 6551/3-

- ◆ Hose - VAS 6551/4-

#### Test prerequisites

- Fuses must be OK.
- Battery voltage at least 12 V
- Ignition switched off
- There must be at least 10 l of fuel in the fuel tank.
- All electrical consumers, e.g. lights and rear window heating, must be switched off.



#### WARNING

**Fuel supply lines are under pressure! Wear eye protection and protective clothing to avoid eye injuries and skin contact. Before loosening hose connections, wrap a cloth around the connection. Then release pressure by carefully pulling hose off connection.**





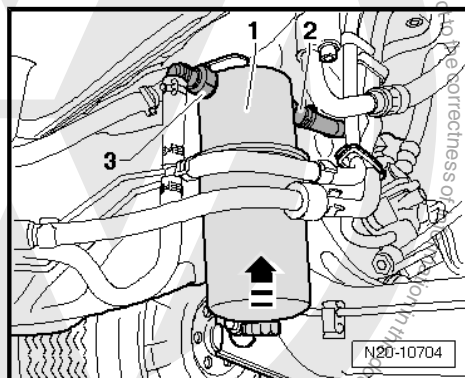
## Procedure



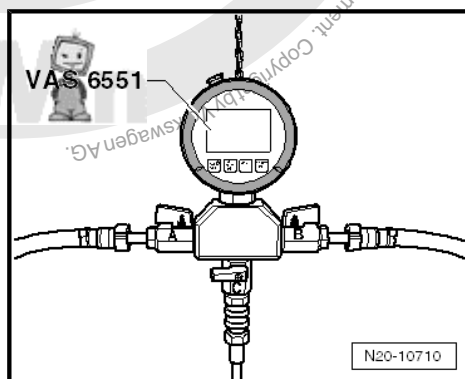
### WARNING

- ◆ **Always read rules for cleanliness and instructions for working on fuel system ➔ page 8.**
- ◆ **Always follow these rules for cleanliness and instructions before starting work and while working on the fuel system.**
- ◆ **Wrap a clean cloth around the connection before opening the fuel system, then carefully loosen the connection to release the pressure.**

- Pull fuel supply line -2- off fuel filter.
- Collect escaping fuel with a cleaning cloth.



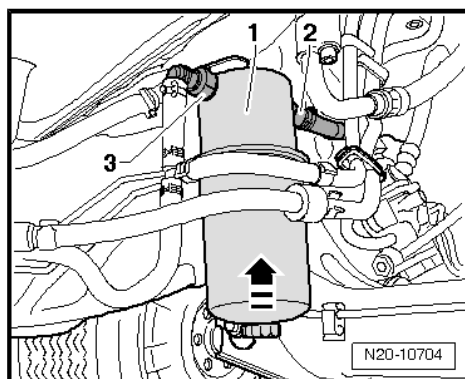
- Connect connection -A- of pressure tester - VAS 6551- with line -VAS 6551/3- to open end of fuel filter.
- Connect connection -B- of pressure tester - VAS 6551- together with line -VAS 6551/4- to open line of high-pressure pump.
- Switch on pressure tester - VAS 6551- by pressing **On/Off** button.
- Close shut-off tap “C” of pressure tester - VAS 6551- .
- Carefully open shut-off valves -A- and -B-.
- Start engine.
- Take specification reading: at least 3.5 bar on pressure tester - VAS 6551-



If the specified value is attained, the fuel system is OK.

If the specified value is not attained:

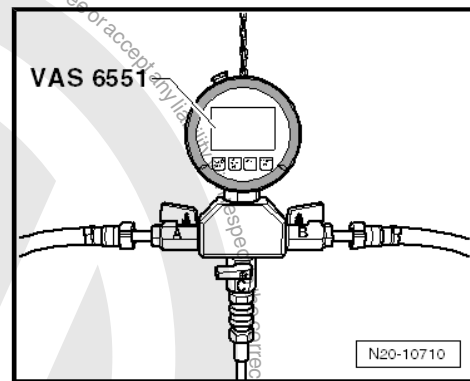
- Connect fuel supply line -2- to fuel filter again.
- Pull fuel supply line -3- off fuel filter.
- Collect escaping fuel with a cleaning cloth.







- Connect connection -A- of pressure tester - VAS 6551- with line -VAS 6551/3- to open end of fuel filter.
- Connect connection -B- of pressure tester - VAS 6551- together with line -VAS 6551/4- to open line of fuel tank.
- Switch on pressure tester - VAS 6551- by pressing  button.
- Close shut-off tap "C" of pressure tester - VAS 6551- .
- Carefully open shut-off valves -A- and -B-.
- Start engine.
- Take specification reading: at least 3.5 bar on pressure tester - VAS 6551-



If specification is attained:

- Renew fuel filter.

If the specified value is not attained:

- Check fuel pump ➔ [page 242](#) .







## 6 Fuel pump

⇒ "6.1 Checking fuel delivery rate of fuel pump (fuel low pressure)", page 242

⇒ "6.2 Checking voltage supply of fuel pump (fuel low pressure)", page 245

### 6.1 Checking fuel delivery rate of fuel pump (fuel low pressure)

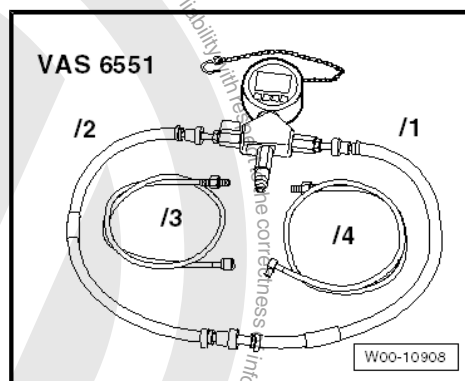


#### Note

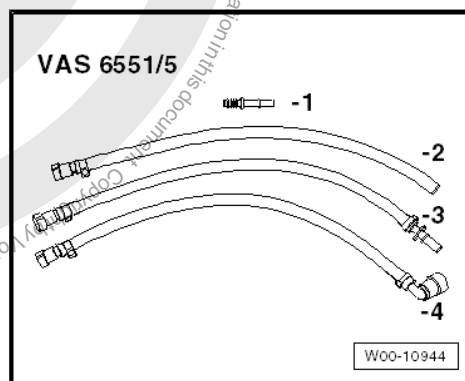
- ◆ Hose - VAS 6551/1-
- ◆ Hose - VAS 6551/2-
- ◆ Test lead - VAS 6551/3-
- ◆ Test lead - VAS 6551/4-
- ◆ Adapter lines/leads 1-4 are not required for test

#### Special tools and workshop equipment required

- ◆ Pressure tester - VAS 6551-



- ◆ Adapter set - VAS 6551/5-



- ◆ Vehicle diagnostic tester
- ◆ Test instrument adapter/DSO (5-pin) - VAS 5565-

#### Test prerequisites

- Fuses must be OK.
- Battery voltage at least 12 V
- Ignition switched off
- There must be at least 10 l of fuel in the fuel tank.





- All electrical consumers, e.g. lights and rear window heating, must be switched off.
- Low-pressure fuel system checked ➔ [page 213](#) .
- Fuel filter checked ➔ [page 239](#) .
- Ensure that fuel lines are not blocked.

**WARNING**

***Fuel supply lines are under pressure! Wear eye protection and protective clothing to avoid eye injuries and skin contact. Before loosening hose connections, wrap a cloth around the connection. Then release pressure by carefully pulling hose off connection.***

**Procedure****WARNING**

- ◆ ***Read rules for cleanliness and the instructions for working on the fuel system ➔ [page 8](#) .***
- ◆ ***Always follow these rules for cleanliness and instructions before starting work and while working on the fuel system.***
- ◆ ***Wrap a clean cloth around the connection before opening the fuel system, then carefully loosen the connection to release the pressure.***

**Note**

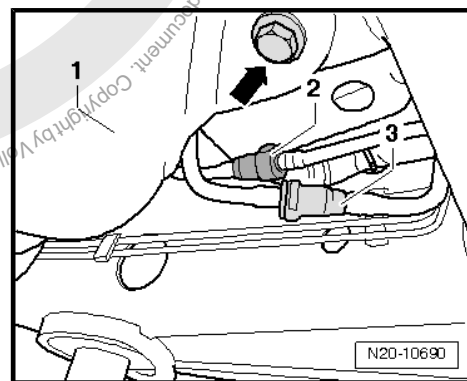
*A 2nd mechanic is needed to check the fuel delivery rate in the vehicle.*

- Disconnect “black” fuel supply line -3-.

**Note**

*To do this, press catches on hose couplings.*

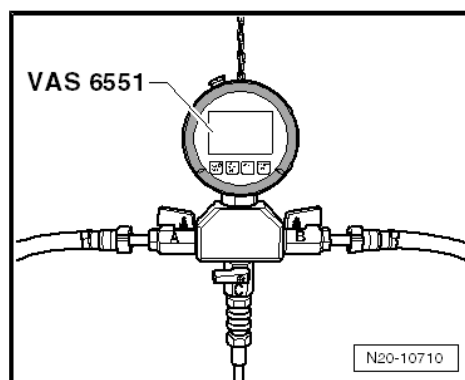
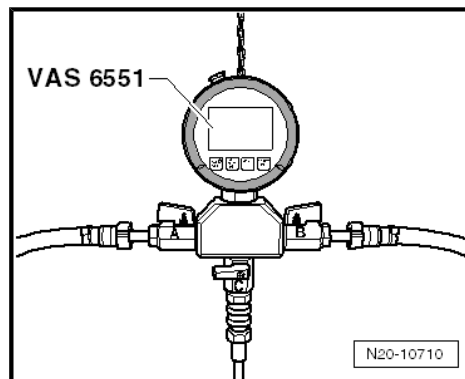
- Collect escaping fuel with a cleaning cloth.







- Connect pressure tester - VAS 6551- to open ends of fuel supply line -3- using lines/hoses from adapter set - VAS 6551/5- .
- Connect connection -A- of pressure tester - VAS 6551- to end of fuel supply line from fuel tank using lines/hoses from adapter set - VAS 6551/5- and open shut-off tap -A-.
- Connect connection -B- of pressure tester - VAS 6551- to end of fuel line to fuel tank using lines/hoses from adapter set - VAS 6551/5- .
- Close shut-off tap -B- of pressure tester - VAS 6551- .
- Put the line leading from connection -C- into a  $\geq 3$  litre measuring container -3- and hold there.
- Close shut-off tap -C- of pressure tester - VAS 6551- .
- Switch on pressure tester - VAS 6551- by pressing **on/off** pushbutton.
- Connect test instrument/DSO adapter (5-pin) - VAS 5565- to fuel delivery unit.
- Switch ignition on.
- Connect  $\Rightarrow$  Vehicle diagnostic tester and carry out "Check electric fuel pump(s)".



#### Note

*Fuel pump is now activated for 30 seconds.*

- Carefully open shut-off valve -C- completely.
- Slowly close the shut-off tap -C- again while reading the pressure shown on the pressure tester - VAS 6551- . Set specified value  $5 \pm 0.2$  bar by closing the shut-off tap carefully.
- Drain measuring container.

Repeat function "Checking electric fuel pump(s)".



**Note**

- ◆ Amount of fuel delivered by fuel pump depends on voltage at fuel delivery unit.
- ◆ Therefore, also connect multimeter - V.A.G 1526- to outputs -1 and 5- of test instrument/DSO adapter 5-pin - VAS 5565-.

**Test prerequisites**

- At RT = room temperature or a fuel temperature of  $T = (20 \pm 5) ^\circ\text{C}$ .
- At a pressure of  $5 \pm 0.2$  bar at flange output
- During the checking process, there must be voltages of 11 to 15 volts at the fuel pump. Measured at the flange connector of the delivery unit.
- If these voltages are not achieved, the fuel pump must be subjected to a voltage test ➔ [page 245](#).
- Carry out in the guided function "Checking electronic fuel pump(s)"

\*) Amount of fuel delivered in ml/30 s.

\*\*) Voltage across fuel delivery unit (V) with engine at a standstill and with pump running.

**Example:**

During the test, a voltage of 12.0 volts, for example, is measured at the fuel delivery unit.

The minimum amount of fuel delivered is therefore 1100 ml/30 s.

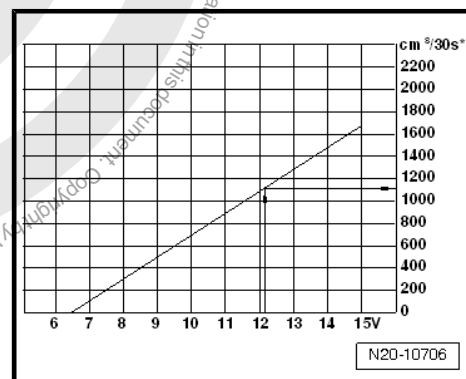
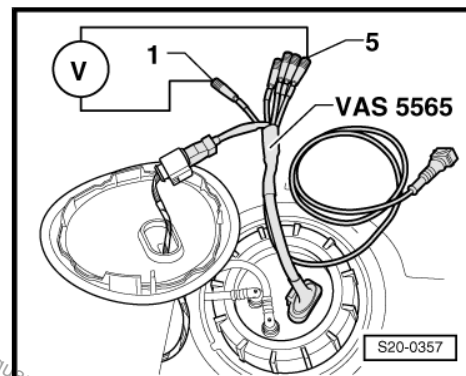
If the required amount of delivered fuel is achieved, or if more is measured: Fuel pump ok.

If the amount of fuel to be delivered by the fuel pump is not achieved, the following faults have occurred:

- ◆ Visual inspection of fuel delivery unit for dirt.
- ◆ If voltages in the range of 11 to 15 volts were not achieved during the testing process, check the voltage supply.

**Note**

Check fuel system for leaks.



## 6.2 Checking voltage supply of fuel pump (fuel low pressure)

Special tools and workshop equipment required

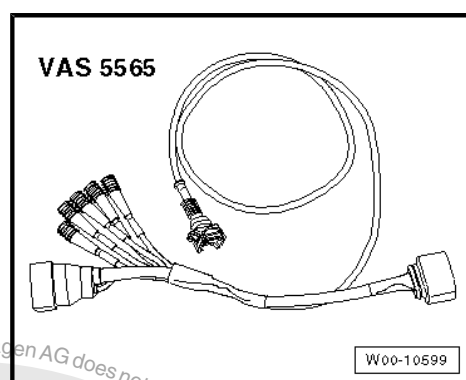




- ◆ Hand-held multimeter - V.A.G 1526D-



- ◆ Test instrument adapter/DSO (5-pin) - VAS 5565-



- ◆ Vehicle diagnostic tester

#### Test prerequisites

- Fuses must be OK.
- Battery voltage must be at least 12 V, if necessary connect a battery charger.
- All electrical consumers, e.g. lights and rear window heating, must be switched off.
- Visual check of cables OK.

#### Procedure:



#### Note

*The fuel tank has to be lowered in order to be able to remove the connector from the flange of the fuel pump unit ➔ [page 229](#)*





- Detach connector -2- from fuel delivery unit -1-.
- Connect test instrument adapter/DSO (5-pin) - VAS 5565- between connector and flange.
- Connect hand-held multimeter - V.A.G 1526D- to contacts of adapter.
- Connect ⇒ Vehicle diagnostic tester and carry out "Check electric fuel pump(s)".

**Note**

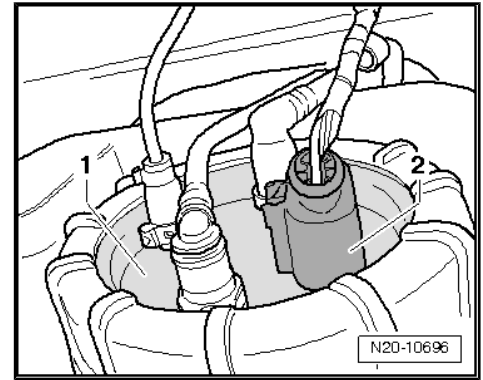
*Fuel pump is now activated for 30 seconds.*

- Read voltage value on hand-held multimeter - V.A.G 1526D- : specification = battery voltage (- 0.5 V OK).

If a voltage of 11 to 15 volts is not measured:

- Check cables/wires for breakage and short-circuiting.

Voltage supply OK.







## 7 Accelerator mechanism

⇒ **"7.1 Function", page 248**

⇒ **"7.2 Assembly overview - accelerator mechanism", page 249**

### 7.1 Function

With the EPC system, the throttle valve is not operated by a cable from the accelerator. There is no mechanical connection between the accelerator and the throttle valve.

Position of accelerator is transmitted to engine control unit by two accelerator position senders (variable resistors together in one housing) connected to accelerator.

Position of accelerator (driver's requirement) is a main input value for engine control unit.

Throttle valve is actuated by an electric motor (throttle valve positioner) in throttle valve module over full range of engine speeds and load conditions.

Throttle valve is operated by throttle valve positioner which is controlled by engine control unit.

When the engine is not running and the ignition is switched on, the engine control unit moves the throttle valve exactly as prescribed by the accelerator position sender. This means that when the accelerator is depressed half way, the throttle valve positioner opens the throttle valve to the same extent. The throttle valve is then approx. half open.

When the engine is running (under load), the engine control unit can open or close the throttle valve independently of the accelerator position sender.

This means that the throttle valve can already be completely open even though the accelerator is only depressed half way. This has the advantage of preventing throttling losses at the throttle valve.

After evaluating the torque requirements of the various components (e.g. air conditioning system, automatic gearbox, ABS/ESP, etc.), the engine control unit calculates the optimal throttle valve opening angle for the respective situation.

This also results in significantly improved consumption and exhaust emission values under certain load conditions.

"EPC" is a system comprising all components which contribute to determining, controlling or monitoring the position of the throttle valve (e.g. accelerator position sender, throttle valve control module, EPC warning lamp, engine control unit).





## 7.2 Assembly overview - accelerator mechanism

### 1 - Bearing bracket

- ☐ Removing and installing: ⇒ Rep. gr. 46 .

### 2 - Connector

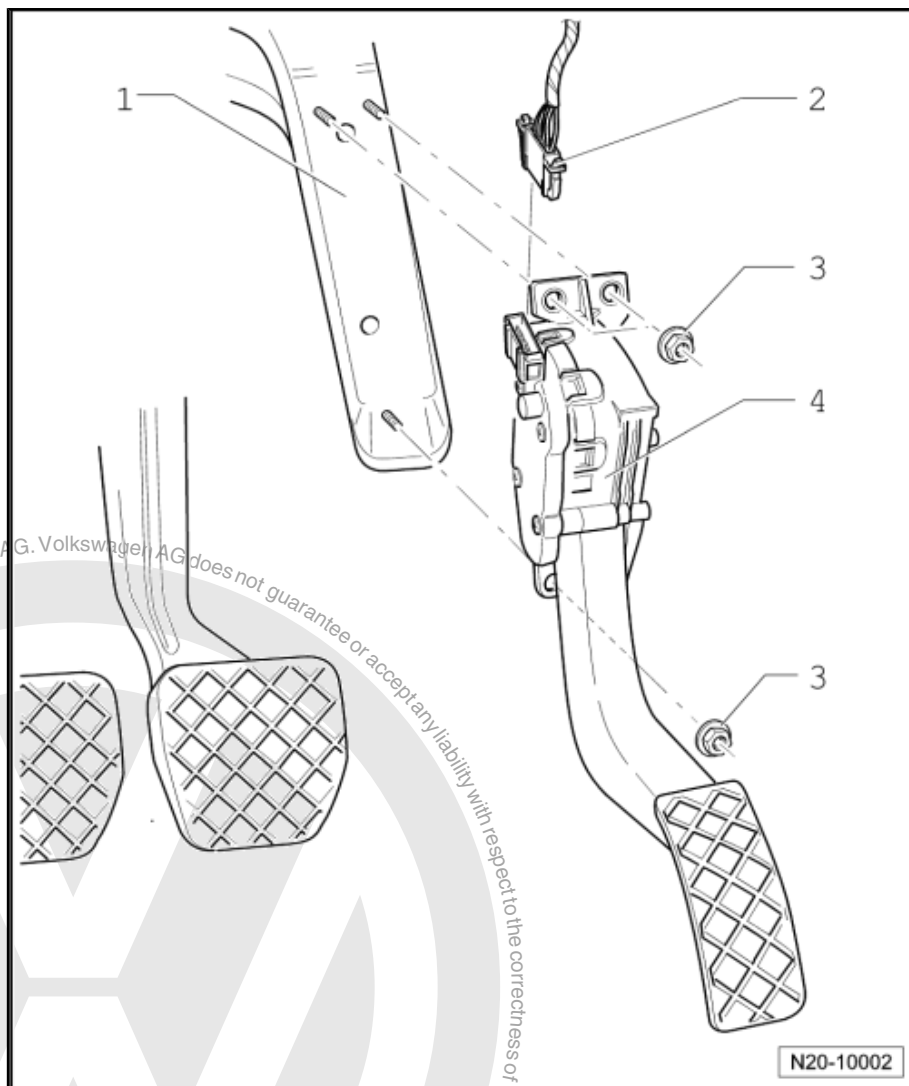
- ☐ 6-pin

### 3 - Nut

- ☐ 9 Nm

### 4 - Accelerator position sender - G79-

- ☐ Not adjustable.
- ☐ The accelerator position sender - G79- transmits the driver's input to the engine control unit
- ☐ Remove footwell cover to remove sender.







## 21 – Turbocharging/supercharging

### 1 Charge air system

⇒ [“1.1 Assembly overview - charge air system”, page 250](#)

⇒ [“1.2 Removing and installing charge air cooler”, page 251](#)

⇒ [“1.3 Removing and installing intake air temperature sender G42 with charge air pressure sender G31”, page 254](#)

⇒ [“1.4 Removing and installing exhaust gas flap valve N220”, page 255](#)

⇒ [“1.5 Checking charge air system for leaks”, page 256](#)

#### 1.1 Assembly overview - charge air system



##### Caution

*The screw-type clips on the charge air lines must always be tightened to 5.5 Nm. If the torque is too low or too high, the charge air hose may slip off the charge air pipe during vehicle operation.*

*Assembly of hose connections ⇒ [page 11](#).*





### 1 - Clamp

- ☐ Follow installation instructions ⇒ [page 11](#) .

### 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 - Connecting hose

- ☐ Note installation position ⇒ [page 251](#) .

### 6 - Connecting hose

- ☐ Note installation position ⇒ [page 251](#) .

### 7 - Charge air cooler

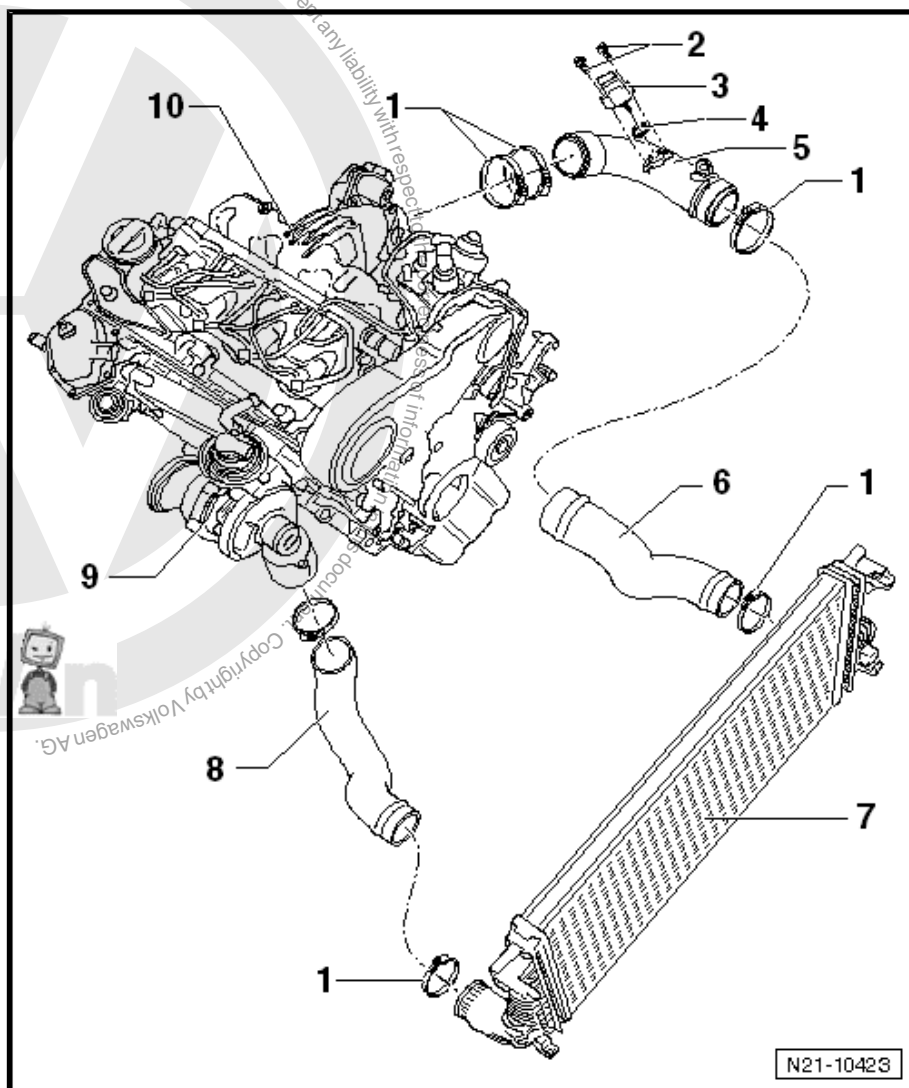
- ☐ Removing and installing ⇒ [page 251](#) .

### 8 - Connecting hose

- ☐ Note installation position ⇒ [page 251](#) .

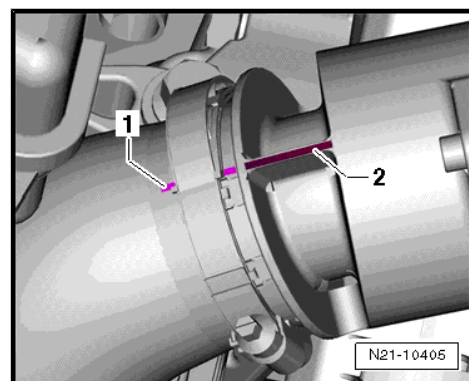
### 9 - Turbocharger

### 10 - Intake manifold



### Installation position of connecting hoses

- Install connecting hose in such a way that marking -1- on connecting hose is aligned with marking -2- on respective union.



## 1.2 Removing and installing charge air cooler

Special tools and workshop equipment required





◆ Torque wrench - V.A.G 1410-

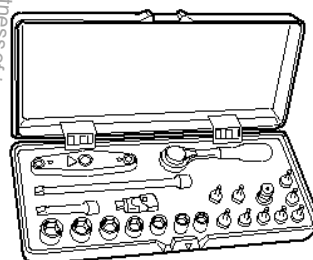
V.A.G 1410



W00-0554

◆ Socket set 1/4", 22-piece - VAS 5528-

VAS 5528



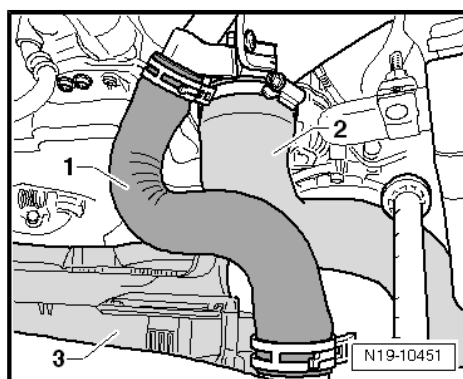
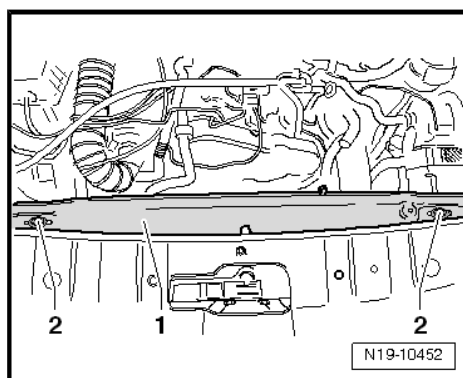
W00-10837

## Removing

- Remove bolts -2- for securing radiator to lock carrier -1-.
- Remove lock carrier ⇒ General body repairs, exterior; Rep. gr. 66 ; Lock carrier .
- Drain coolant ⇒ [page 182](#) .
- Remove radiator cowl ⇒ [page 207](#) .

Observe instructions for hose connections with screw-type clips ⇒ [page 11](#) .

- If fresh air supply system is present, partially remove ⇒ [page 116](#) .
- Remove coolant hose -1- and connecting hose -2-.
- Remove right connecting hose leading to turbocharger from chair air cooler and place to one side.
- Remove air duct mounting ⇒ [Item 23 \(page 369\)](#) .
- Squeeze left catch -2- and pull condenser -3- forwards a little.



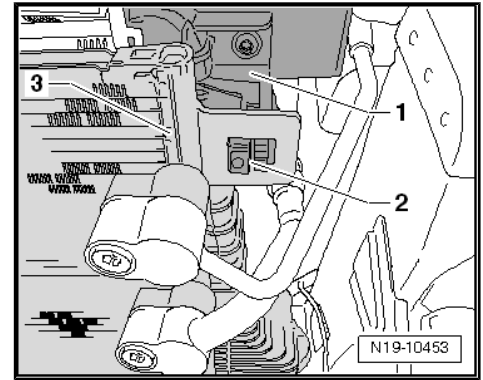




- Unclip right catch as well and pull condenser -3- off radiator -1-.

**Caution**

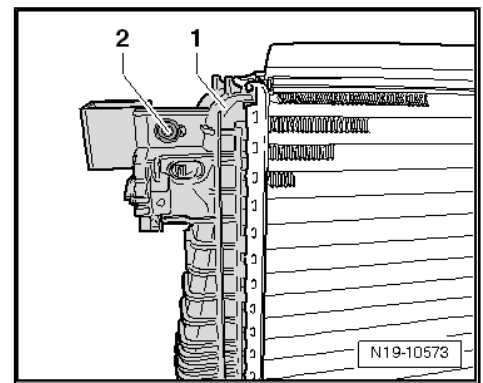
- *Do not bend or stretch the refrigerant lines excessively.*
- *During further removal work, make sure that the refrigerant lines are not bent or stretched excessively.*



- Support condenser, e.g. with cable ties.
- Do not bend or stretch the refrigerant lines excessively.
- Carefully remove radiator upwards together with charge air cooler. When doing so, take the radiator -2- past the refrigerant lines.

**Note**

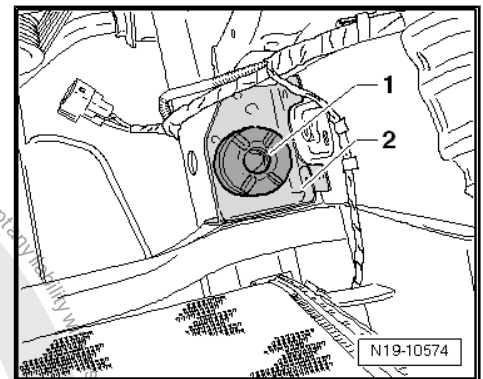
- ◆ *If the radiator -1- is to be replaced, undo bolts of charge air cooler and remove it from radiator.*
- ◆ *Undo and remove bolt -2- on right and left (not shown in illustration) at radiator.*

**Installing**

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

**Note**

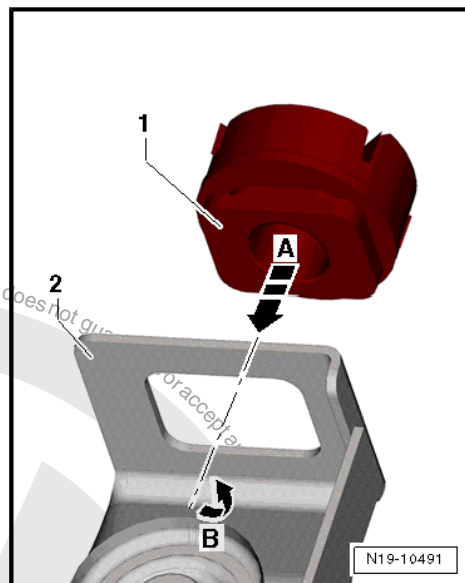
*Before installing radiator, check that radiator mountings -1- are correctly seated on front part of car -2- and, if necessary, reposition:*



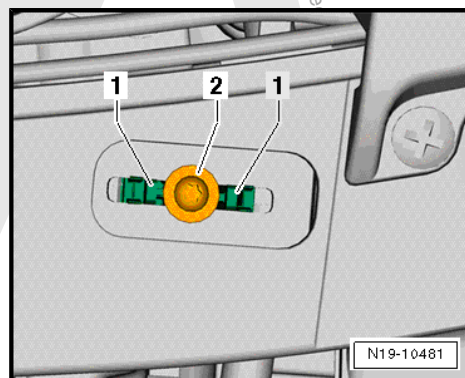




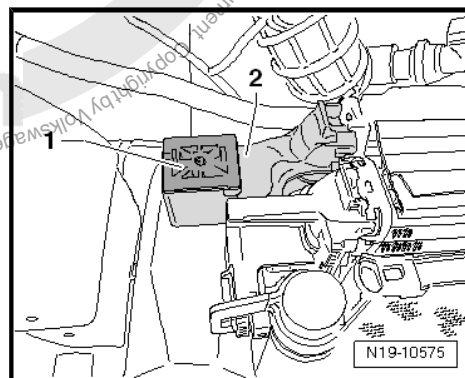
- Insert radiator mounting into lock carrier -2- at bottom -1-, doing so transversely to the direction of travel, and then turn it 90°.



- When installing the radiator, make sure that the catches -1- of the radiator mounting on the left and right at the top have engaged completely in the lock carrier.



- Insert top radiator mountings -1- on right and left into the mounting on radiator -2- appropriately.
- Install radiator cowl ➔ [page 207](#) .
- Filling with coolant ➔ [page 182](#)
- Install lock carrier ➔ General body repairs, exterior; Rep. gr. 50 ; Lock carrier .



Assembly of hose connections ➔ [page 11](#) .

#### Specified torques

- ♦ ➔ ["1.1 Assembly overview - charge air system", page 250](#)
- ♦ ➔ ["3.1 Assembly overview - radiator/ radiator fan V7 ", page 202](#)
- ♦ ➔ ["3.2 Assembly overview - radiator cowl and radiator fan V7 ", page 204](#)

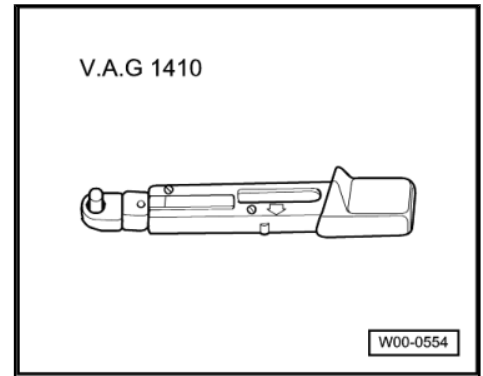
### 1.3 Removing and installing intake air temperature sender - G42- with charge air pressure sender - G31-

Special tools and workshop equipment required



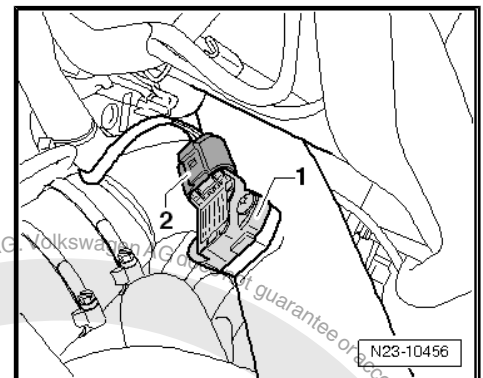


- ◆ Torque wrench - V.A.G 1410-



### Removing

- Release and pull off connector -1- for intake air temperature sender - G42- together with charge air pressure sender - G31- -1-.
- Undo and remove bolts for intake air temperature sender - G42- and charge air pressure sender - G31- -1-.
- Pull intake air temperature sender - G42- together with charge air pressure sender - G31- -1- out of union.



### Installing

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

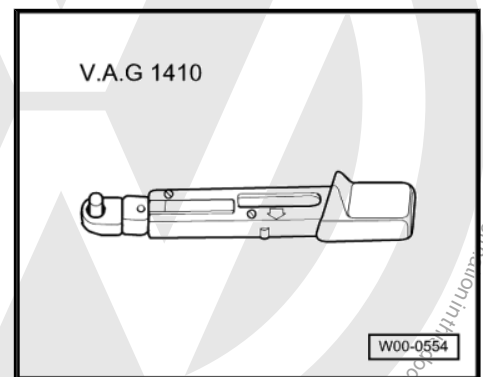
### Specified torques

- ◆ ⇒ ["1.1 Assembly overview - charge air system", page 250](#)

## 1.4 Removing and installing exhaust gas flap valve - N220-

### Special tools and workshop equipment required

- ◆ Torque wrench - V.A.G 1410-



- ◆ Socket set 1/4", 22-piece - VAS 5528-







## Removing

- Pull connector -3- and vacuum lines and pull off fuel pressure regulating valve - N220- -1-.
- Remove spreader rivet -2- and exhaust gas flap valve - N220- -1-.

## Installing

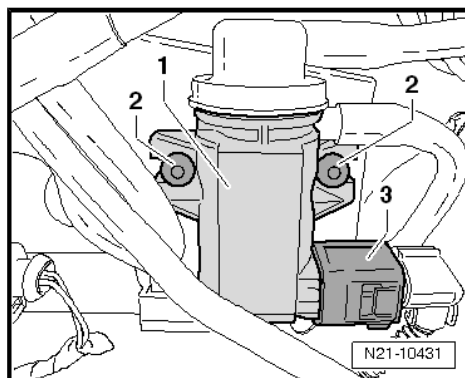
Installation is carried out in the reverse order; note the following:



### Caution

*Do not kink, twist or crush the vacuum lines when routing. This may cause breakdowns.*

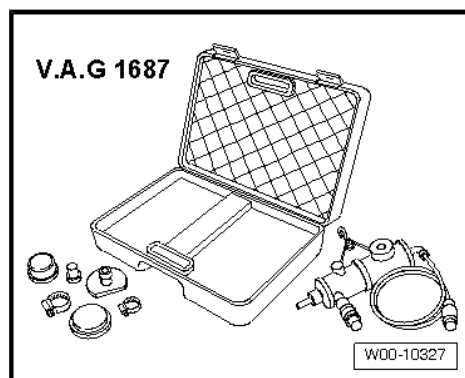
*Connect all hoses to stop or at least 10 mm on the relevant connection piece.*



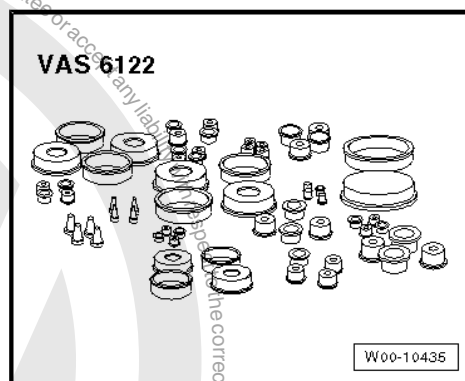
## 1.5 Checking charge air system for leaks

### 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-

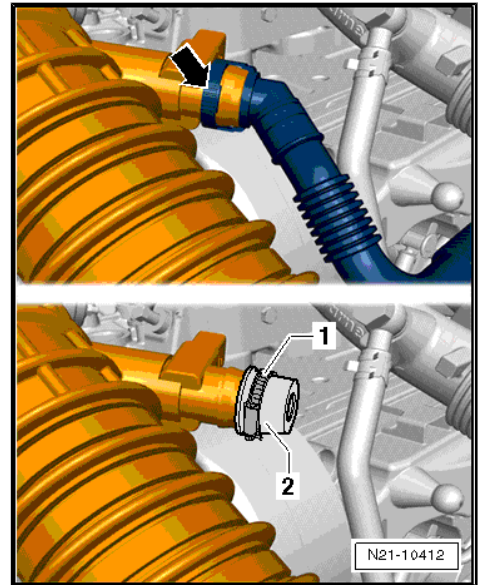






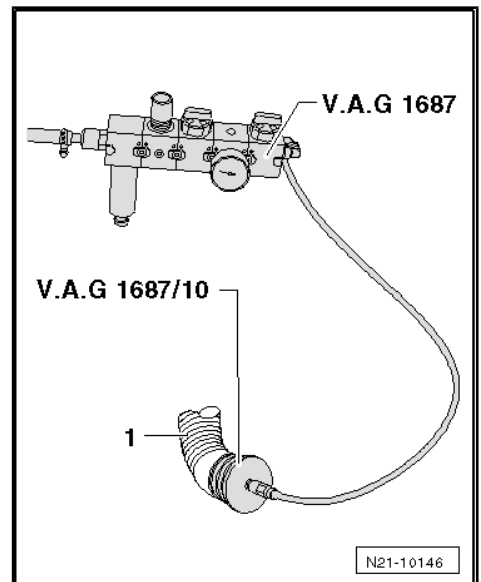
## Procedure

- Remove connecting pipe -arrow-.
- Seal union with a bung -2- (diameter 28 mm) from the engine bung set - VAS 6122- and secure 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:

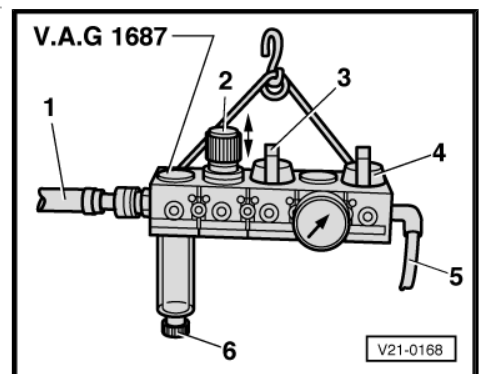


- Unscrew pressure control valve -2- completely and close valves -3- and -4-.



### Note

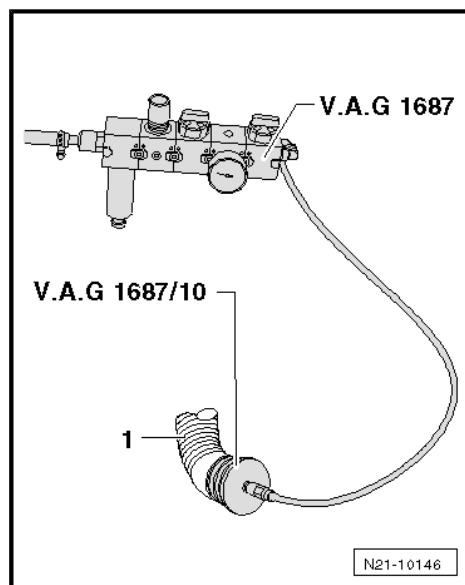
To turn the pressure regulating valve -2- the knob must be pulled upwards.







- 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.

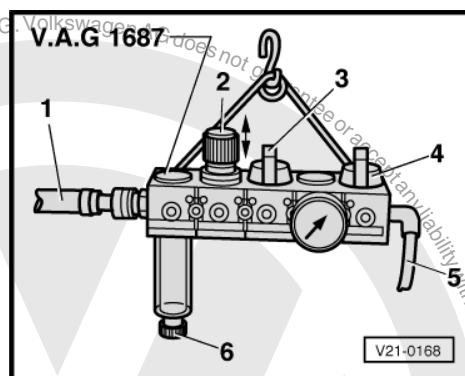
**Note**

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 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
- ♦ Depressurise test circuit by detaching coupling from adapter - V.A.G 1687/10- before removing adapter.









## 2 Turbocharger

⇒ [“2.1 Assembly overview - turbocharger, 120 kW and 132 kW engines”, page 260](#)

⇒ [“2.2 Assembly overview - turbocharger, 90 kW and 103 kW engines”, page 264](#)

⇒ [“2.3 Removing and installing turbocharger - 120 kW and 132 kW engines”, page 267](#)

⇒ [“2.4 Removing and installing turbocharger - 90 kW and 103 kW engines”, page 272](#)

⇒ [“2.5 Removing and installing charge pressure sender 2 G447”, page 277](#)

⇒ [“2.6 Removing and installing regulating flap potentiometer G584 and vacuum unit for turbocharger, 120 kW engine”, page 278](#)

⇒ [“2.7 Removing and installing regulating flap potentiometer G584 and vacuum unit for turbocharger, 132 kW engine”, page 290](#)

⇒ [“2.8 Removing and installing charge pressure control solenoid valve N75”, page 300](#)

### 2.1 Assembly overview - turbocharger, 120 kW and 132 kW engines



#### 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 with engine oil through union.
- ◆ After installing turbocharger, allow engine to run at idling speed for about 1 minute to ensure that oil is supplied to turbocharger.

1 - Heat shield

2 - Bolt

- 9 Nm

3 - Vacuum unit

- Removing and installing  
⇒ [page 321](#).

4 - Regulating flap potentiometer - G584-

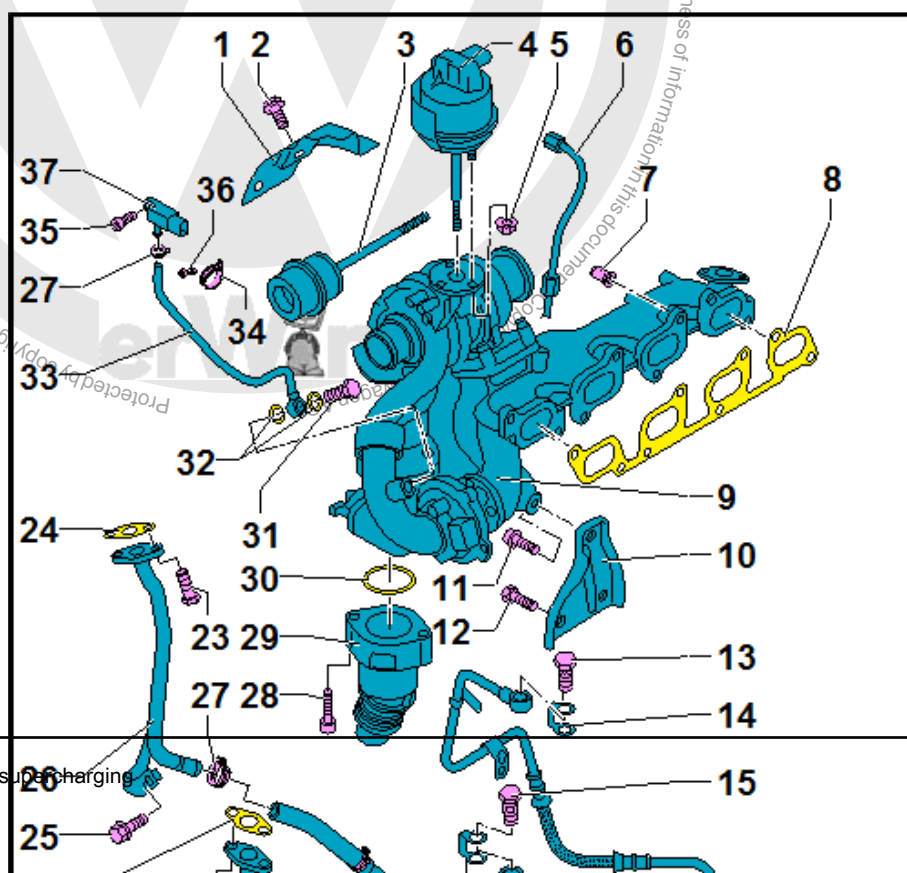
- Removing and installing  
⇒ [page 278](#).

5 - Nut

- 9 Nm

6 - Exhaust gas temperature sender 1 - G235-

- Grease thread of sender using high-temperature paste ⇒ Electronic Parts Catalogue (ET-KA).







- ☐ Sender must not be bent when removing and installing.
- ☐ Sender must not contact any other component when installed.
- ☐ Black connector
- ☐ 45 Nm

## 7 - Nut

- ☐ Renew after removing
- Tightening sequence ⇒ [page 263](#) .
- Installation sequence:
  - ◆ Bolts ⇒ [Item 11 \(page 261\)](#) and ⇒ [Item 12 \(page 261\)](#) must be loosened at bracket.
  - ◆ Fit turbocharger on studs on cylinder head.
  - ◆ Tighten turbocharger bolts ⇒ [Item 9 \(page 261\)](#) in specified sequence.
  - ◆ First, tighten bolt by hand. Then, tighten ⇒ [Item 11 \(page 261\)](#) and ⇒ [Item 12 \(page 261\)](#) . After that, tighten bolts to specified torque.
    - ☐ 25 Nm

## 8 - Gasket

- ☐ Renew after removing

## 9 - Exhaust manifold with turbocharger

- ☐ Renew complete only.
- ☐ Before removing, connecting pipes must be removed ⇒ [page 250](#) .
- ☐ Always renew oil return line when it has been removed or opened in area of hose connection.
- ☐ Check oil supply lines for damage before installing them ⇒ [Item 16 \(page 261\)](#) .
- ☐ Note tightening sequence and installation procedure ⇒ [page 263](#) .
- ☐ When turbocharger and connecting pipes are being assembled, it is essential that the correct repair kit ⇒ ETKA (Electronic Parts Catalogue) is used.
- ☐ Installation position of connecting hose at turbocharger ⇒ [page 263](#)
- ☐ Removing and installing ⇒ [page 267](#) .

## 10 - Bracket

### 11 - Bolt

- ☐ Renew after removing
- ☐ Observe tightening sequence and procedure ⇒ [page 263](#) .
- ☐ 40 Nm

### 12 - Bolt

- ☐ 40 Nm

### 13 - Banjo bolt

- ☐ 30 Nm

### 14 - Double seal

- ☐ Renew after removing
- ☐ Remember that there are various sizes

### 15 - Banjo bolt

- ☐ 24 Nm

### 16 - Oil supply line

- ☐ To remove oil supply line completely, engine support and 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 170](#).*

### 17 - Banjo bolt

- ☐ 60 Nm

### 18 - Seal

- ☐ Renew after removing

### 19 - Bolt

- ☐ 25 Nm

### 20 - Seal

- ☐ Renew after removing

### 21 - Banjo bolt

- ☐ For oil return line
- ☐ 60 Nm

### 22 - Oil return line

- ☐ Oil return line must always be renewed after removing turbocharger.

### 23 - Bolt

- ☐ 11 Nm

### 24 - Gasket

- ☐ Renew after removing

### 25 - Bolt

- ☐ 15 Nm

### 26 - Oil return line

- ☐ Oil return line must be renewed after removing turbocharger.

### 27 - Clip

### 28 - Bolt

- ☐ 9 Nm

### 29 - Pulsation damper

### 30 - O-ring

- ☐ Not available as replacement part.
- ☐ Included in [Item 29 \(page 262\)](#).

### 31 - Banjo bolt

- ☐ 30 Nm

### 32 - Seal

- ☐ Renew after removing



**33 - Line to charge pressure sender 2 - G447-****34 - Retaining clamp****35 - Bolt**

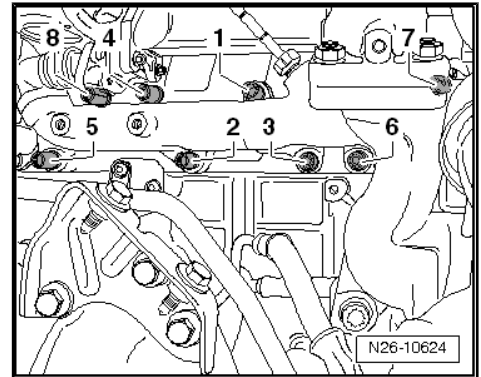
□ 3 Nm

**36 - Bolt**

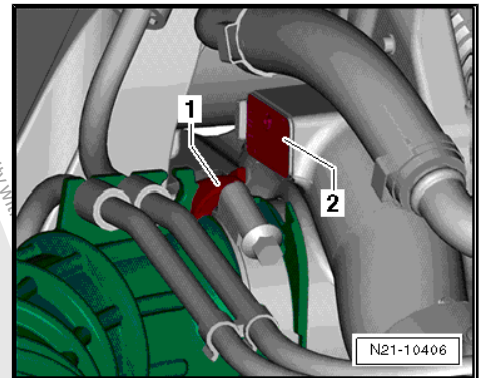
□ 9 Nm

**37 - 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 7 \(page 261\)](#) 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 11 \(page 261\)](#) .

**Installation position of connecting hose at turbocharger**

- Fit connecting hose in such a way that the "rib" -1- of the connecting hose is aligned with the middle of the nameplate -2-.







## 2.2 Assembly overview - turbocharger, 90 kW and 103 kW engines



### 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 with engine oil through union.
- ◆ 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 only.
- ☐ Connecting pipes must be removed before removing ⇒ [page 250](#).
- ☐ Check oil pressure lines for damage before installing them.
- ☐ Note tightening sequence and installation procedure ⇒ [page 263](#)
- ☐ When turbocharger and connecting pipes are being assembled, it is essential that the correct repair set ⇒ ETKA (Electronic Parts Catalogue) is used.
- ☐ Installation position of connecting hose at turbocharger ⇒ [page 264](#)
- ☐ Removing and installing ⇒ [page 272](#).

### 2 - Bolt

- ☐ No replacement part available

### 3 - Position sender for charge pressure positioner - G581-

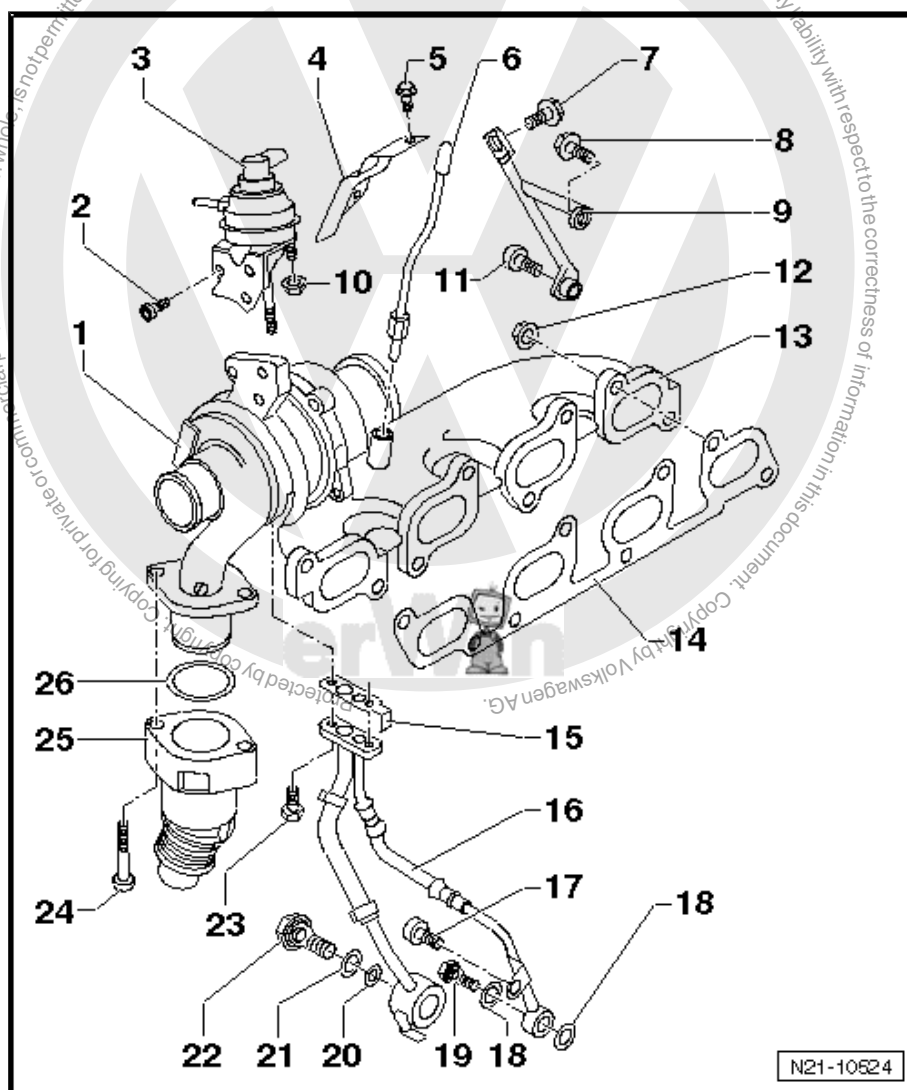
### 4 - Heat shield

### 5 - Bolt

- ☐ 9 Nm

### 6 - Exhaust gas temperature sender 1 - G235-

- ☐ Grease thread of sender using high-temperature paste ⇒ Electronic Parts Catalogue (ETKA).
- ☐ 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.
- ☐ Black connector
- ☐ 45 Nm





**7 - Bolt**

- ☐ M10 x 35

**8 - Bolt**

- ☐ M10 x 18

**9 - Support****10 - Nut**

- ☐ No replacement part available

**11 - Bolt**

- ☐ M10 x 30

**12 - Nut**

- ☐ Renew after removing

- Installation sequence:

- ◆ Position turbocharger on studs on cylinder head.
- ◆ First tighten nut finger-tight, then tighten nut to prescribed torque ⇒ [page 266](#) .
- ◆ Tighten turbocharger bolts ⇒ [page 266](#) in specified sequence.

- ☐ 25 Nm

**13 - Exhaust manifold with turbocharger**

- ☐ Renew complete only.
- ☐ Tightening sequence ⇒ [page 266](#) .

**14 - Gasket**

- ☐ Renew after removing

**15 - Gasket**

- ☐ Renew after removing

**16 - Oil pressure line**

- ☐ Supply and return.
- ☐ Oil pressure line must be renewed after removing turbocharger.

**Note**

- ◆ *Risk of damage when removing and installing turbocharger.*
- ◆ *Always renew oil pressure line after removing.*
- ◆ *Check oil pressure line for damage (kinks in hose) after installing turbocharger.*
- ◆ *Removing and installing*  
⇒ [page 170](#) .

**17 - Bolt****18 - Seal**

- ☐ Renew after removing

**19 - Banjo bolt**

- ☐ 32 Nm

**20 - Seal**

- ☐ Renew after removing

**21 - O-ring**

- ☐ Renew after removing





## 22 - Banjo bolt

- ❑ 60 Nm

## 23 - Bolt

- ❑ M6 x 16

## 24 - Bolt

- ❑ No replacement part available

## 25 - Connection

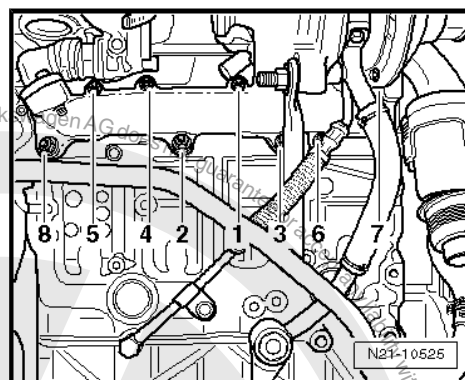
- ❑ No replacement part available

## 26 - Gasket

- ❑ No replacement part available

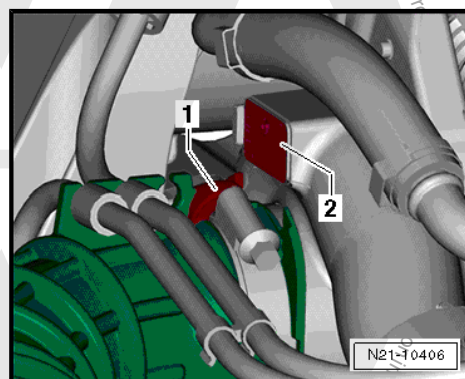
### Tightening sequence and installation procedure

- ◆ Position exhaust manifold together with turbocharger on studs on cylinder head.
- ◆ Tighten nut ➔ [Item 12 \(page 265\)](#) finger-tight on stud.
- ◆ Tighten nuts -1- to -8- to 25 Nm in specified sequence. Then tighten nuts to 25 Nm again in specified sequence.



### Installation position of connecting hose at turbocharger

- Fit connecting hose in such a way that the "rib" -1- of the connecting hose is aligned with the middle of the nameplate -2-.







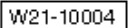




## 2.3 Removing and installing turbocharger - 120 kW and 132 kW engines

### 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-

<b>V.A.G 1331</b> 	<b>V.A.G 1332</b> 
<b>V.A.G 1410</b> 	<b>VAS 6122</b> 
	



### 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.*

"Biturbo" is removed upwards.

Before the "biturbo" can be removed, the following parts must be removed:





- ◆ Exhaust pipe with catalytic converter
- ◆ Air filter with attachments

### Removing

Observe rules for cleanliness ⇒ [page 8](#) .

Observe instructions for hose connections with screw-type clips  
⇒ [page 11](#) .

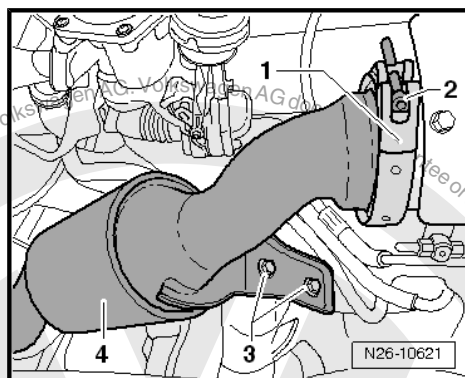


### Note

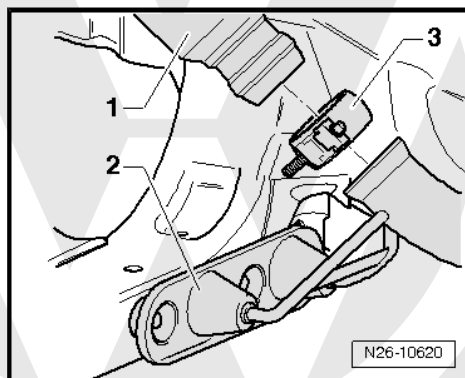
- ◆ *After lines and hoses have been removed, the open connections are to be sealed immediately with a plug from the engine bung set - VAS 6122- .*

- ◆ *Only use clean plugs.*

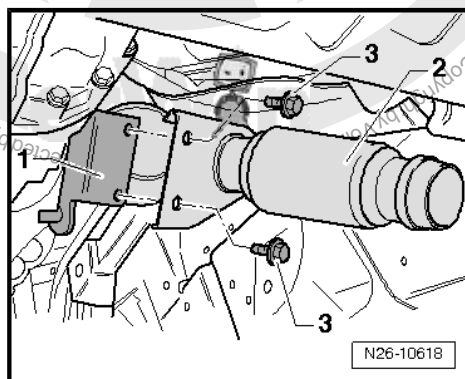
- Remove air filter with attachments ⇒ [page 368](#)
- Remove connecting pipe ⇒ [page 250](#)
- Loosen bolt -2- in screw-type clip -1- for front exhaust pipe -4- at turbocharger.
- Unscrew and remove bolts -3- in bracket for front exhaust pipe -4-.



- Loosen screw-type clip -3- for front exhaust pipe -1-.



- Undo and remove bolts -3- for front exhaust pipe -2- at bracket -1-.
- Carefully remove front exhaust pipe upwards out of the engine compartment.



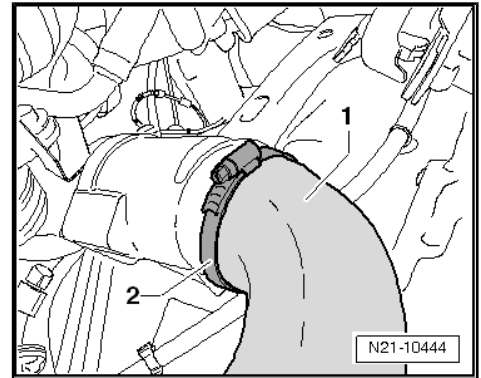




- Loosen screw-type clip -2- for connecting hose -1- and detach connecting hose from pulsation damper.

**i Note**

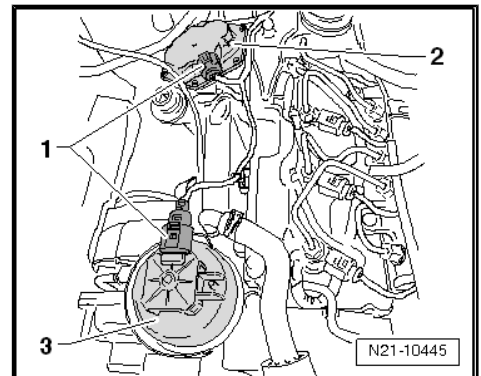
Seal opening in turbocharger with clean cloths or similar.



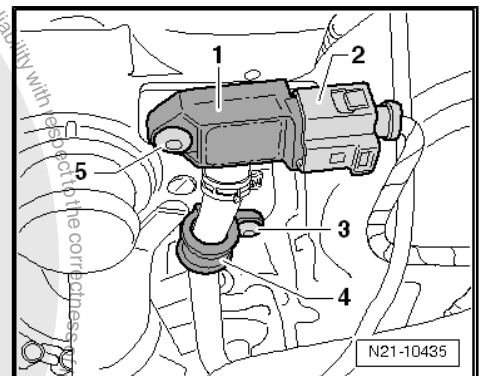
- Pull connector -1- off regulating flap potentiometer - G584- -3- and lay to side. There is no need to disconnect connector -1- on exhaust gas recirculation valve - N18- -2-.

**i Note**

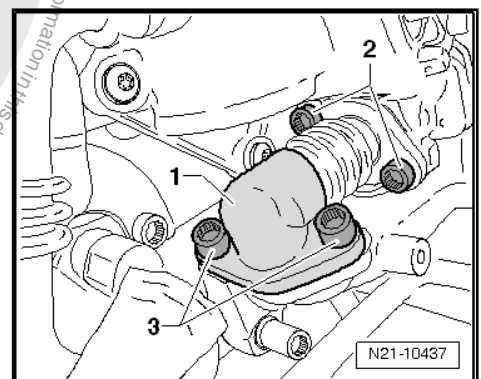
The described procedure does not apply to vehicles compliant with the emission standard EU 5 as sensor is secured permanently to vehicle.



- Detach connector -2- from charge air pressure sender 2 - G447- -1-.



- Remove bolts -2 and 3- for pipe -1- from exhaust gas recirculation cooler.
- Remove pipe from exhaust gas recirculation cooler.
- Remove oil supply line from turbocharger ⇒ [page 170](#).



**Caution**

- Avoid damage to oil supply line. Observe notes.
- When doing this, ensure that no pressure is exerted on the rod.
- Do not hold onto the rod when removing the turbocharger.
- When carrying the turbocharger, always hold it by the pipes and not by the rods.

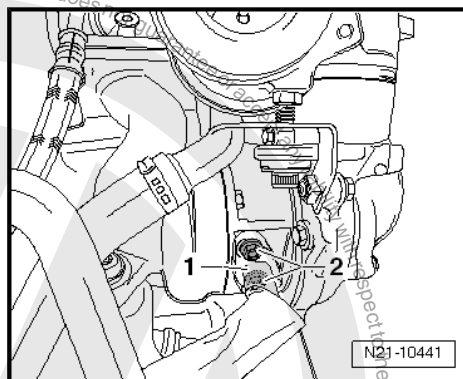
Bent rods impair the functioning of the turbocharger.

- Loosen clamp ⇒ [Item 27 \(page 262\)](#) and disconnect oil return line.

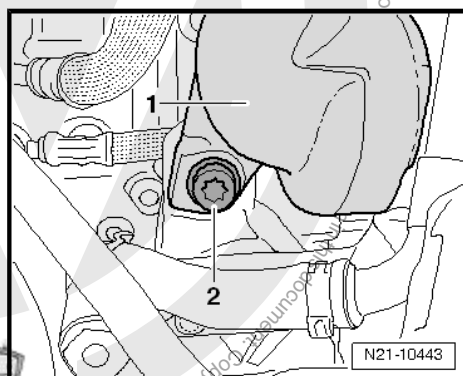




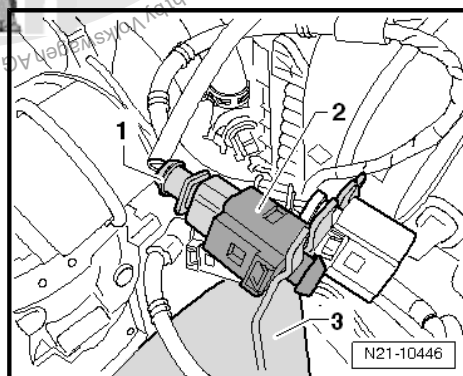
- Undo and remove bolts -2- for oil return line at bottom of turbocharger -1-.



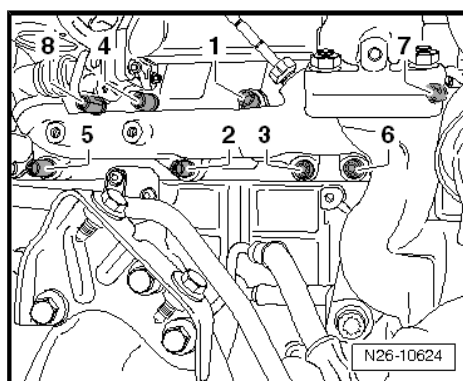
- Undo and remove bolt -2- for turbocharger -1- at lower bracket.



- Release and detach connector -1- of exhaust gas temperature sender 1 - G235- on front right wheel housing -3- at the coupling point -2-. Then, free wiring harness from fittings and lay it to one side.



- Undo and remove bolts -1- to -8- for exhaust manifold with turbocharger.
- Remove turbocharger with exhaust manifold upwards.





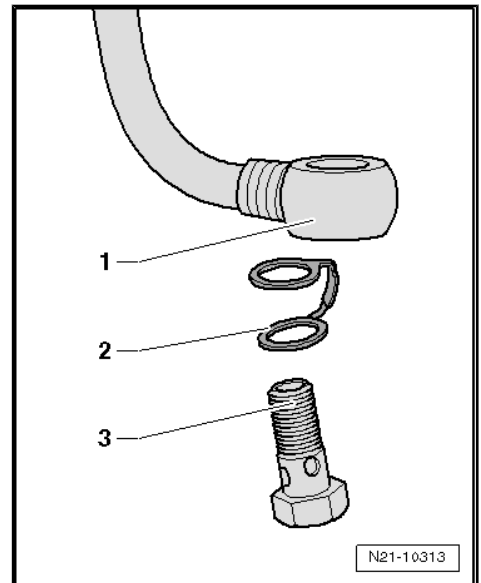
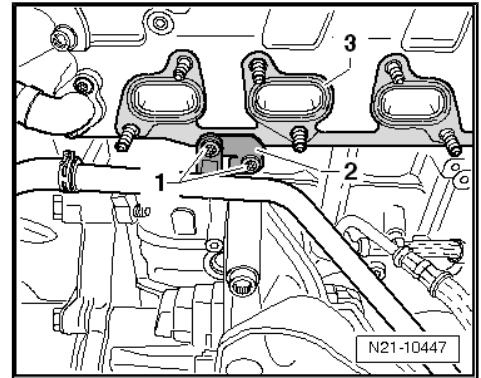


- Undo and remove bolts -1- in bracket for coolant pipe -2- and remove exhaust manifold gasket -3-.

### Installing

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

- 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 \(page 261\)](#).
- Install connecting pipes [⇒ page 250](#).

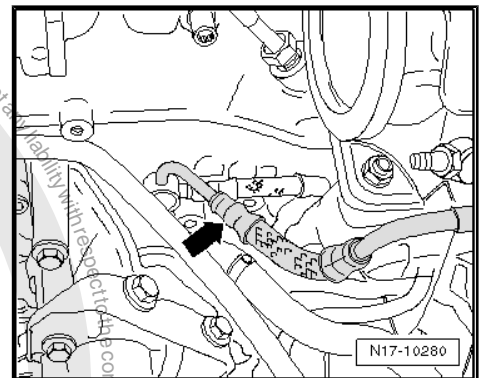


### Caution

- **Note tightening sequence and procedure when bolting turbocharger on [⇒ page 263](#).**

### Specified torques

- ◆ [⇒ "2.1 Removing and installing assembly mountings", page 31](#)
- ◆ [⇒ "2.1 Assembly overview - turbocharger, 120 kW and 132 kW engines", page 260](#)
- ◆ [⇒ "7.1 Assembly overview - air filter", page 368](#)
- ◆ [⇒ "2.1 Assembly overview - emission control \(diesel particulate filter\)", page 377](#)





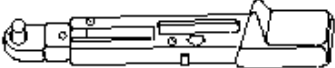





## 2.4 Removing and installing turbocharger - 90 kW and 103 kW engines

### 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-

<b>V.A.G 1331</b> 	<b>V.A.G 1332</b> 
<b>V.A.G 1410</b> 	<b>VAS 6122</b> 
<div style="text-align: right;">W21-10004</div>	



### 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.**

"Turbocharger" is removed upwards.

For removal of the "turbocharger", the following parts must first be removed:





- ◆ Exhaust pipe with catalytic converter

- ◆ Air filter with attachments

### Removing

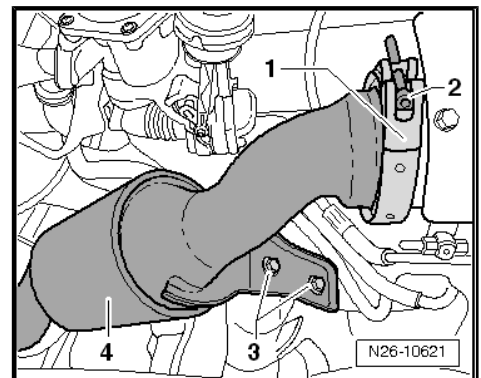
Observe rules for cleanliness ⇒ [page 8](#) .

Observe instructions for hose connections with screw-type clips  
⇒ [page 11](#) .

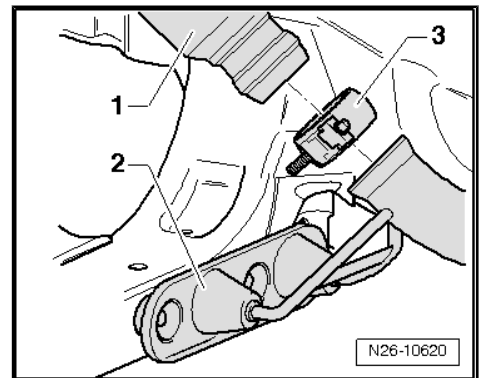


### Note

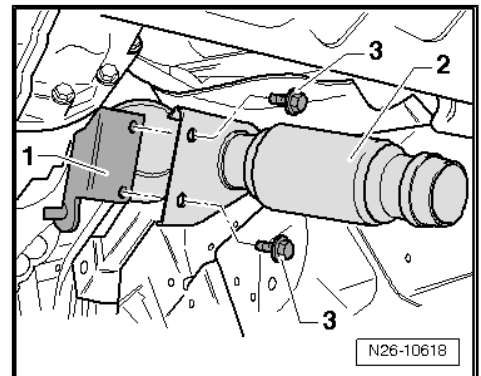
- ◆ *After lines and hoses have been removed, the open connections are to be sealed immediately with a plug from the engine bung set - VAS 6122- .*
- ◆ *Only use clean plugs.*
- Remove air filter with attachments ⇒ [page 368](#)
- Remove connecting pipe ⇒ [page 250](#)
- Loosen bolt -2- in screw-type clip -1- for front exhaust pipe -4- at turbocharger.
- Unscrew and remove bolts -3- in bracket for front exhaust pipe -4-.



- Loosen screw-type clip -3- for front exhaust pipe -1-.



- Undo and remove bolts -3- for front exhaust pipe -2- at bracket -1-.
- Carefully remove front exhaust pipe upwards out of the engine compartment.





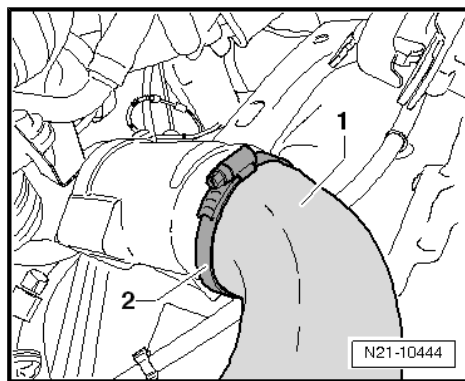


- Loosen screw-type clip -2- for connecting hose -1- and detach connecting hose from pulsation damper.



**Note**

*Seal opening in turbocharger with clean cloths or similar.*

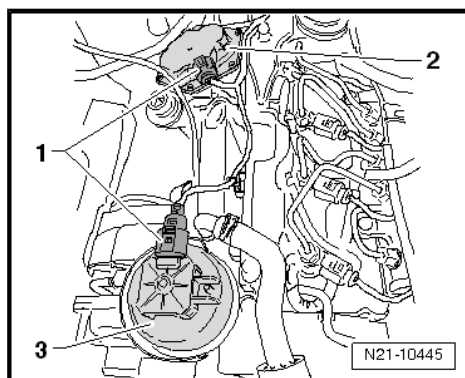


- Pull connector -1- off position sender for charge pressure positioner - G581- -3- and lay to side. There is no need to disconnect connector -1- on exhaust gas recirculation valve - N18- -2-.

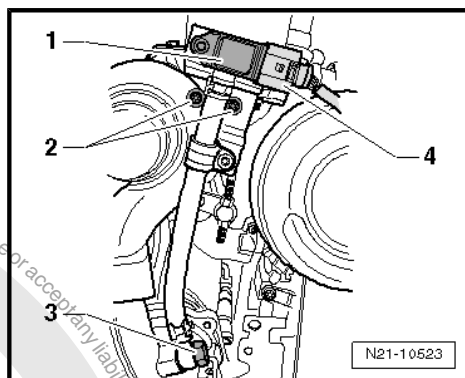


**Note**

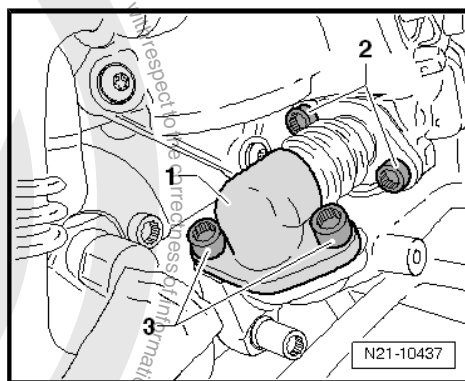
*The described procedure does not apply to vehicles compliant with the emission standard EU 5 as sensor is secured permanently to vehicle.*



- Detach connector -4- from charge air pressure sender 2 - G447- -1-.



- Remove bolts -2 and 3- for pipe -1- from exhaust gas recirculation cooler.
- Remove pipe from exhaust gas recirculation cooler.



**Caution**

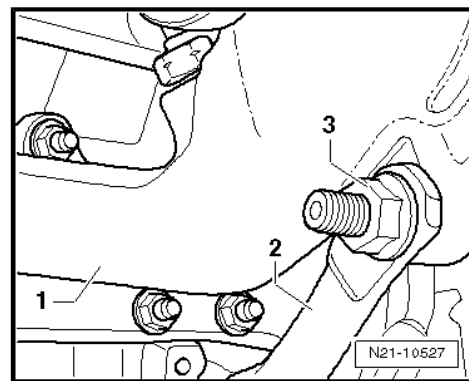
- **Avoid damage to oil pressure line. Observe notes.**
- **When doing this, ensure that no pressure is exerted on the rod.**
- **Do not hold onto the rod when removing the turbocharger.**
- **When carrying the turbocharger, always hold it by the pipes and not by the rods.**

**Bent rods impair the functioning of the turbocharger.**

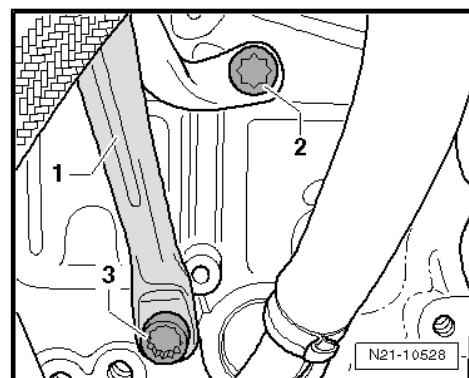




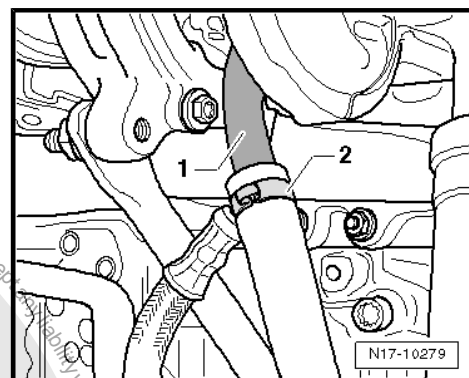
- Unscrew nut -3- for support -2- of turbocharger -1-.



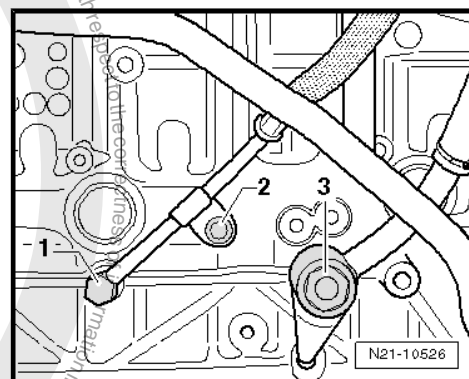
- Remove securing bolts -2 and 3- for support -1-.



- Loosen clamp -2- on oil pressure line pipe -1- and separate oil pressure line.



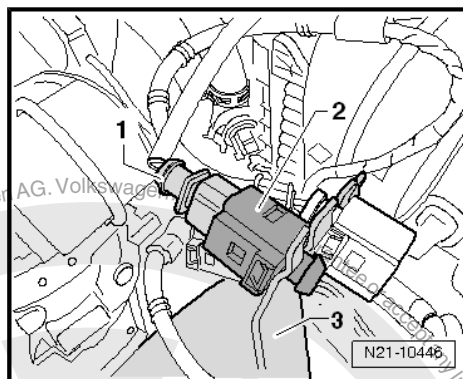
- Remove securing bolt and banjo bolt -1 and 2-.



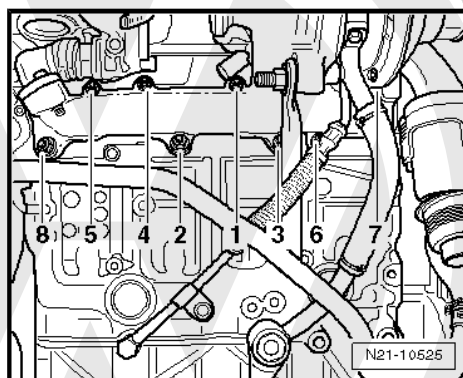




- Release and detach connector -1- of exhaust gas temperature sender 1 - G235- on front right wheel housing -3- at the coupling point -2-. Then, free wiring harness from fittings and lay it to one side.



- Remove nuts -1- to -8- for exhaust manifold with turbocharger.
- Remove turbocharger with exhaust manifold and oil line upwards.

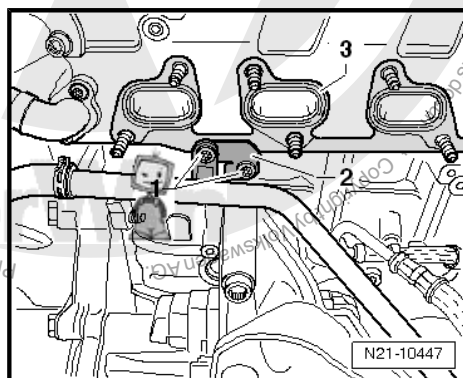


- Undo and remove bolts -1- in bracket for coolant pipe -2- and remove exhaust manifold gasket -3-.

#### Installing

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

- Renew all gaskets, O-rings and self-locking nuts.
- Install turbocharger with new oil pressure line.

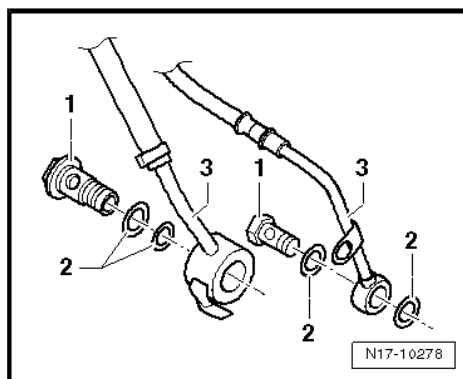


- Fit new seals -2- onto the respective line connection -3- and secure by screwing in the corresponding banjo bolt -1-.
- Install connecting pipes ➔ [page 250](#) .



#### Caution

- **Note tightening sequence and procedure when bolting turbocharger on ➔ [Item 12 \(page 265\)](#) .**



#### Specified torques

- ♦ ➔ [“2.1 Removing and installing assembly mountings”, page 31](#)
- ♦ ➔ [“2.2 Assembly overview - turbocharger, 90 kW and 103 kW engines”, page 264](#)
- ♦ ➔ [“7.1 Assembly overview - air filter”, page 368](#)
- ♦ ➔ [“2.1 Assembly overview - emission control \(diesel particulate filter\)”, page 377](#)





## 2.5 Removing and installing charge pressure sender 2 - G447-



### Note

- ◆ On vehicles without particulate filter, the charge pressure sender 2 - G447- can only be renewed together with bracket, as one unit ⇒ *Electronic parts catalogue (ETKA)* .
- ◆ Charge air pressure sender 2 - G447- is integrated into turbo-charger and cannot be replaced on vehicles with a particulate filter.

### Special tools and workshop equipment required

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

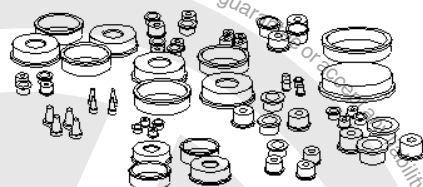
V.A.G 1331



W00-0427

- ◆ Engine bung set - VAS 6122-

VAS 6122



W00-10435

### Removing



### Note

- ◆ Due to risk of breakage, sensor is replaced complete with bracket and hose.
- ◆ The described procedure does not apply to vehicles compliant with the emission standard EU 5 as sensor is secured permanently to vehicle.



### 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.

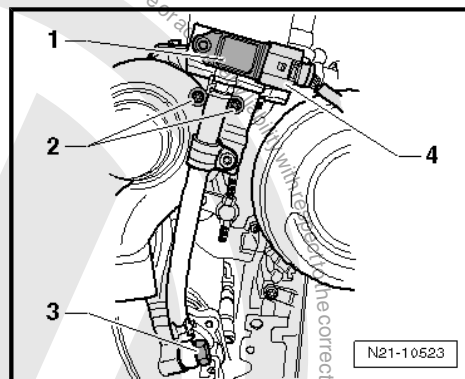




- Release and pull connector -4- off charge air pressure sender 2 - G447- -1-.
- Unscrew bolts -2- on bracket for charge air pressure sender 2 - G447- .
- Remove banjo bolt -3- from turbocharger and remove charge air pressure sender 2 - G447- complete.

#### Installing

Install in reverse order.

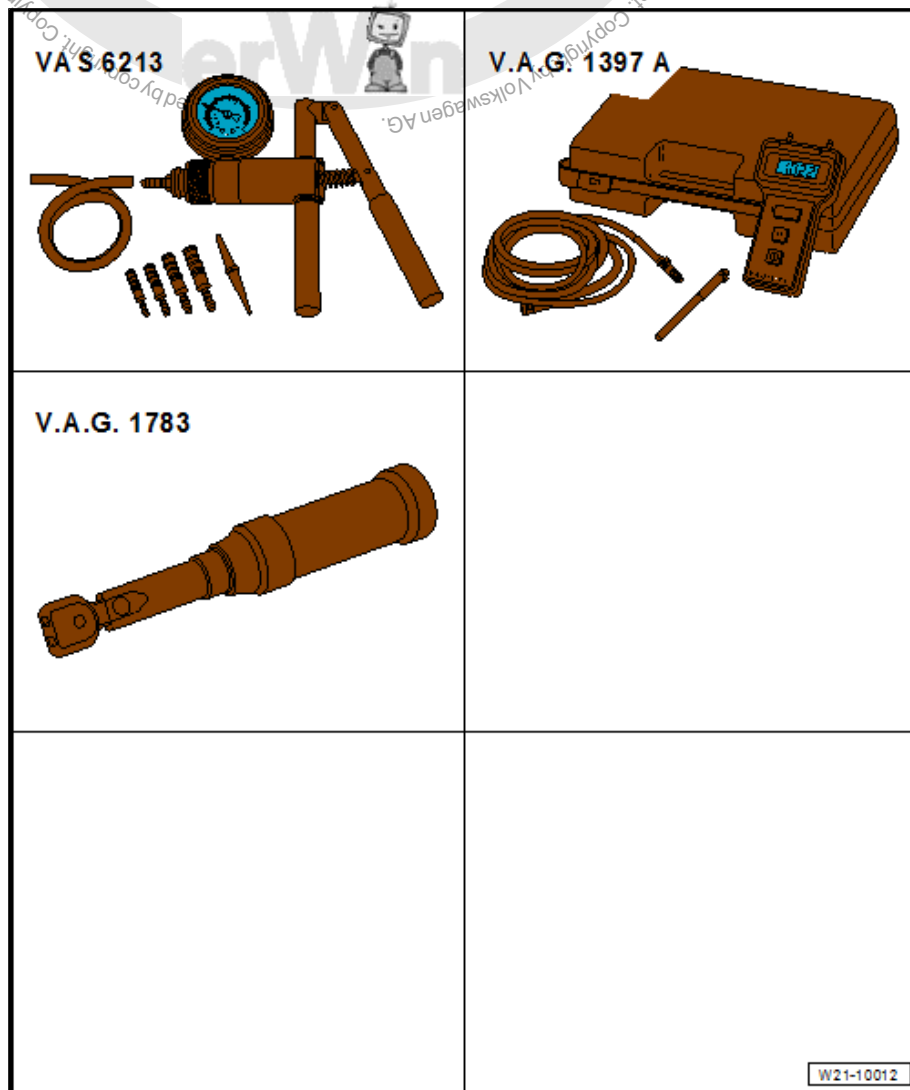


## 2.6 Removing and installing regulating flap potentiometer - G584- and vacuum unit for turbocharger, 120 kW engine

### 2.6.1 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-
- ◆ Vehicle diagnostic tester



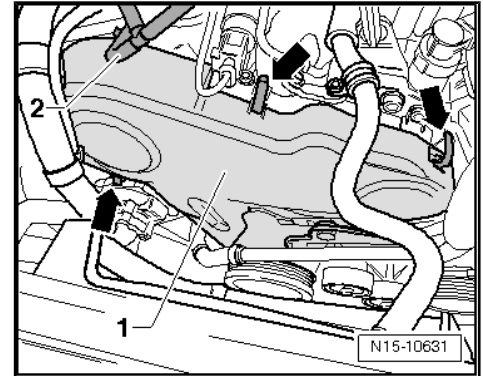


**Note**

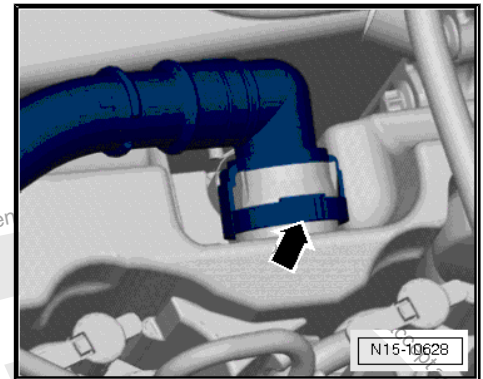
A spare-parts kit → ETKA (electronic parts catalogue) is available for replacing the regulating flap potentiometer - G584- .

**Removing**

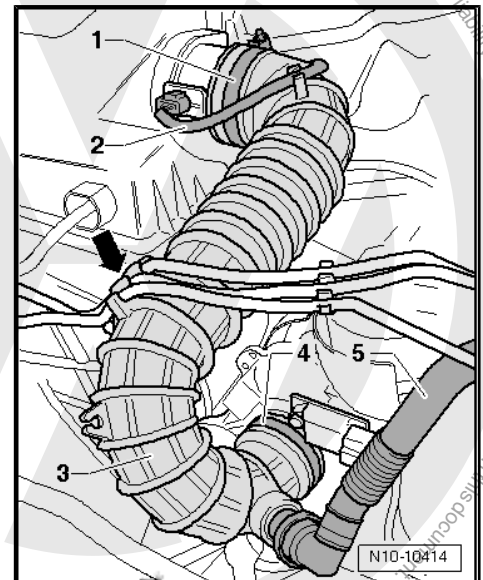
- Detach vacuum hose -2- from upper toothed belt guard -1-.



- Remove pipe -arrow- from cylinder head cover.



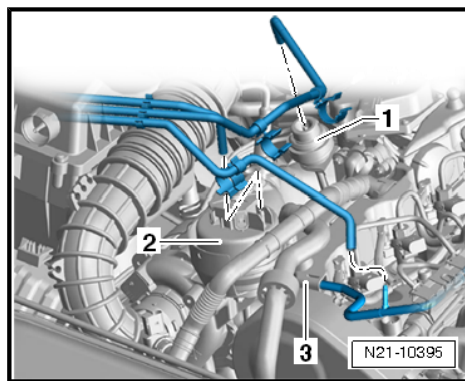
- Detach hoses from connecting hose -3- bracket -arrow-.
- Release and pull off wiring harness connector -2-. Detach wiring harness -2- from connecting hose retainer -3-.
- Open clips -1- and -4-.
- Remove connecting hose -3-.





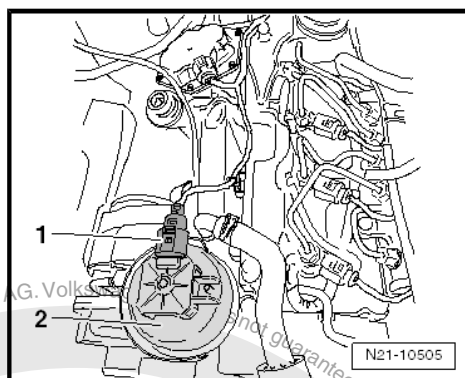


- Pull hose off regulating flap potentiometer - G584- -2-.

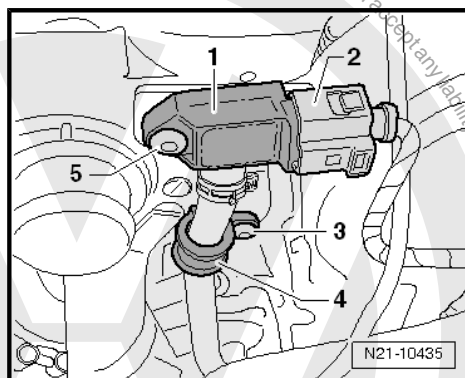


- Unclip connector -1- from regulating flap potentiometer - G584- -2-.

**Only for vehicles with charge air pressure sender 2 - G447- on turbocharger.**



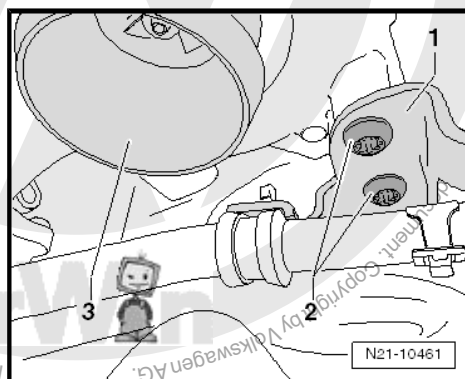
- Detach connector -2- from charge air pressure sender 2 - G447- -1-.



- Undo and remove bolts -2- securing bracket for charge air pressure sender 2 - G447- -1- and place charge air pressure sender 2 - G447- to one side.

**Continuation for all vehicles**

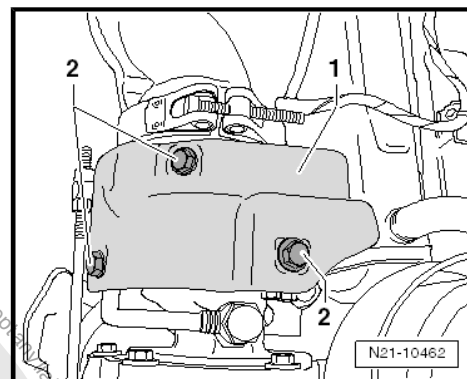
- Seal opening -3- of turbocharger with a suitable cover.



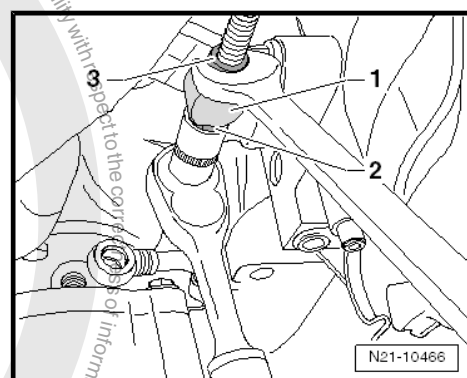




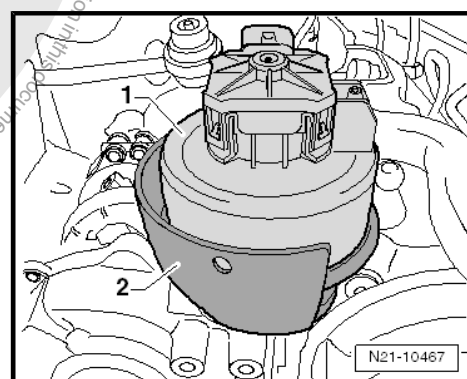
- Undo and remove bolts -2- securing heat shield -1- and remove heat shield.



- Undo and completely remove nut -2- securing control rod.
- Counterhold lock nut -3- with open-end spanner.



- Working from below, undo and remove nuts securing regulating flap potentiometer - G584- -1- together with bracket -2- to mounting of turbocharger (2 nuts).
- Remove regulating flap potentiometer - G584- upwards together with bracket.



### Installing

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



#### Caution

**Use only new bolts and nuts from the spare-parts kit if the regulating flap potentiometer - G584- is being replaced completely!**

### New part

- If necessary, remove lower nut securing the control rod of the new regulating flap potentiometer - G584- .



#### Note

*Lock nut must have been screwed onto control rod.*

### Old part

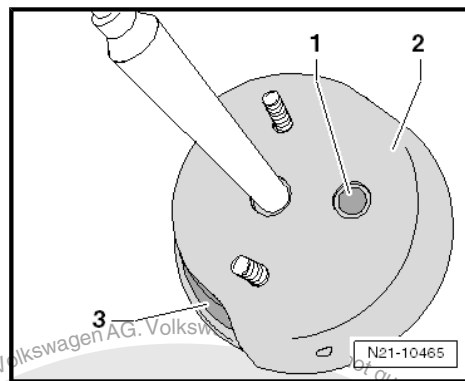
- Remove lock nut from control rod and carefully remove the sealing paint from the control rod completely.
- Screw new lock nut from spare-parts kit onto control rod again.

**Continuation for all**

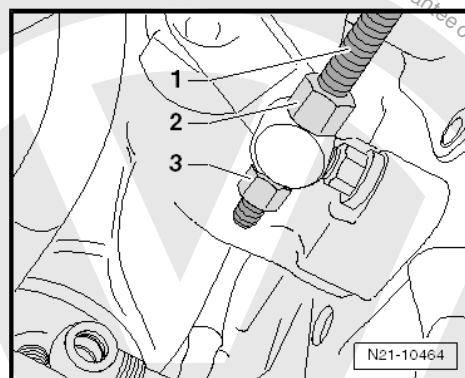




- Carefully clean touching surfaces of regulating flap potentiometer - G584- -3- and bracket -2-.
- Carefully clean mounting for regulating flap potentiometer - G584- on turbocharger.
- Insert regulating flap potentiometer - G584- -3- in such a way that the location marker -1- fits into the hole in the bracket -2-.



- Install regulating flap potentiometer - G584- and guide control rod -1- through adjusting lever on turbocharger as shown in the illustration.

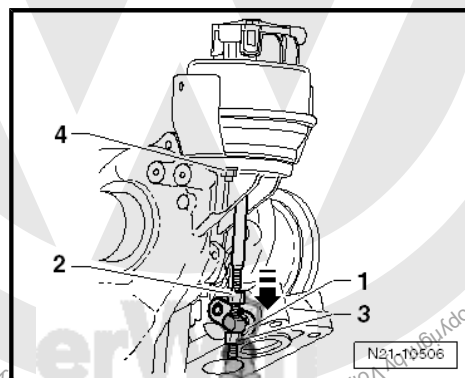


- Fit regulating flap potentiometer - G584- on the turbocharger mounting with new nuts from the spare-parts kit -4- and tighten nuts to 8 Nm.
- Screw nuts -2- onto control rod by hand in direction of vacuum unit.



**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.

#### Selecting operating mode:


- Press button on display for "Vehicle self-diagnosis".

#### Selecting vehicle system:

- Press button "01 - Engine electronics" on display.

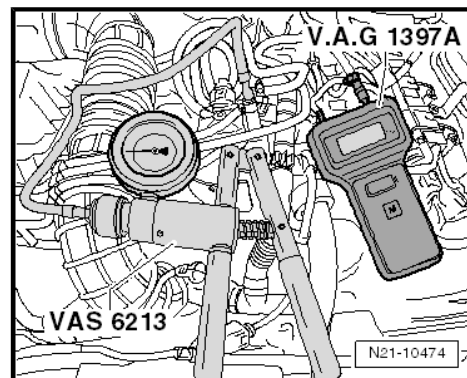
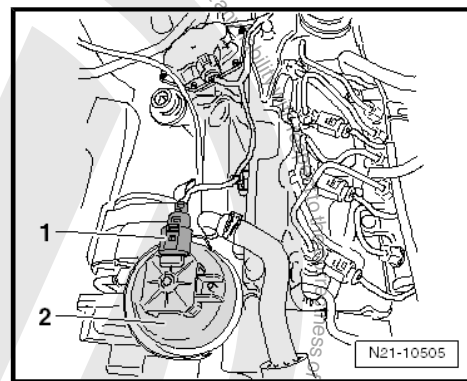
The display indicates the control unit identification and the coding of the engine control unit.

#### Selecting diagnostic function:

- Press button for "011 - Measured values" on the display.
- The display shows the individual components.
- Select "Bypass Valve, Turbocharger, High Pressure Turbine Input, Input Voltage" and confirm entry with .
- 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 on turbocharger tester - V.A.G 1397A- and move sliding switch on device to position II.

- Apply a vacuum of  $500 \pm 50$  mbar to regulating flap potentiometer - G584- .

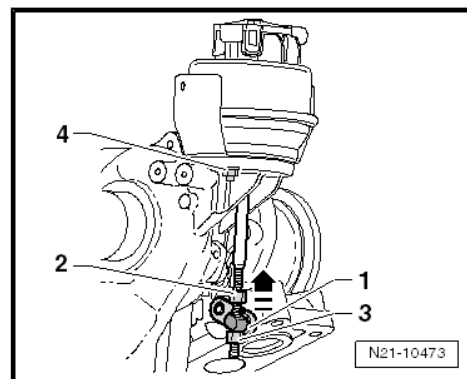


- Move flap lever -1- on turbocharger in -direction of arrow- to "Closed" position and hold it there.
- Screw securing nut -3- in direction of vacuum unit until it contacts flap lever -1-.
- Continue turning securing nut -3- until a voltage of  $0.75 \text{ volt} \pm 0.02 \text{ volt}$  of regulating flap potentiometer - G584- is reached.
- Tighten lock nut -2- to 8 Nm.



#### Note

Make sure that control rod -1- does not turn by counterholding on nut -2-.



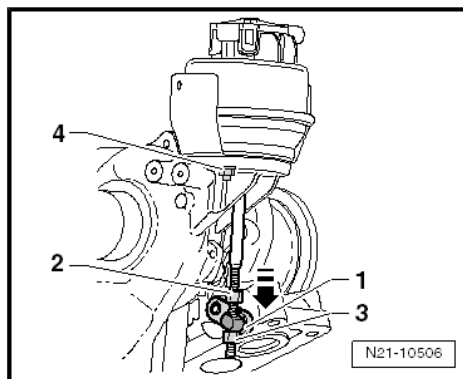




Slowly reduce vacuum. Flap lever -1- now moves in -direction of arrow- "Open".

- Apply a vacuum of  $500 \pm 50$  mbar to regulating flap potentiometer - G584- again.
- Check voltage setting ( $0.75 \text{ volt} \pm 0.02 \text{ volt}$ ) of regulating flap potentiometer - G584- and, if necessary, reset.

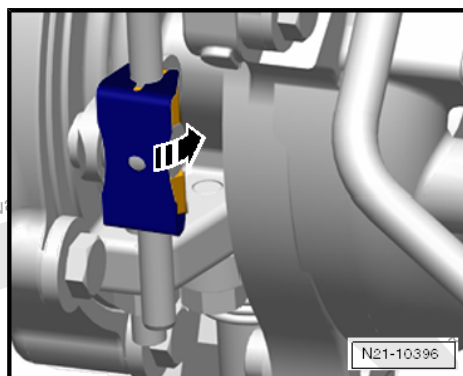
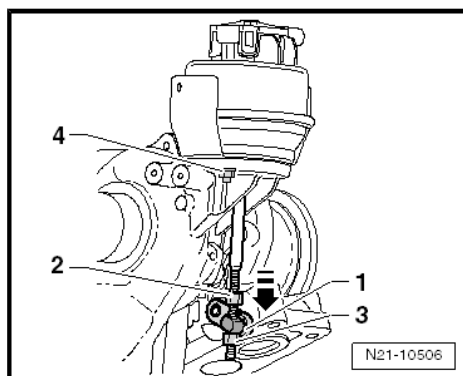
Slowly reduce vacuum.



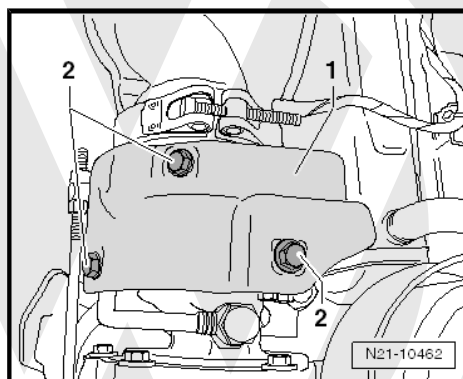
#### Note

*Flap lever -1- must now be resting against the stop. If the flap lever is not resting against the stop, the setting procedure must be repeated until the setting 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-.



- Tighten securing bolts -2- for heat shield -1-.





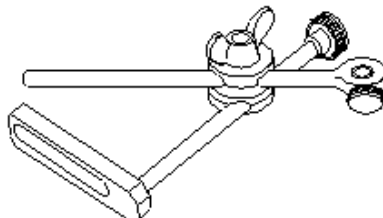


## 2.6.2 Removing and installing vacuum unit for turbocharger

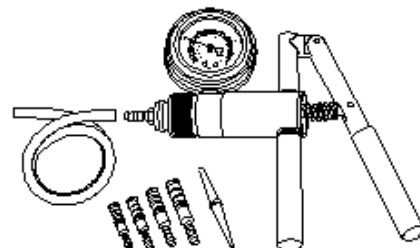
### Special tools and workshop equipment required

- ◆ 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-

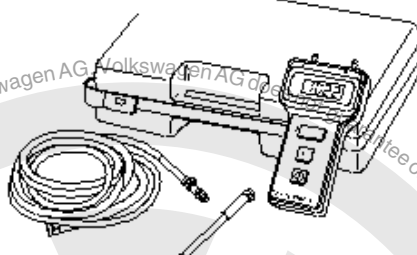
VW 387



VAS 6213



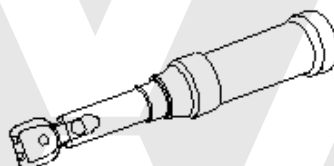
V.A.G. 1397 A



VAS 6341



V.A.G. 1783



W21-10008

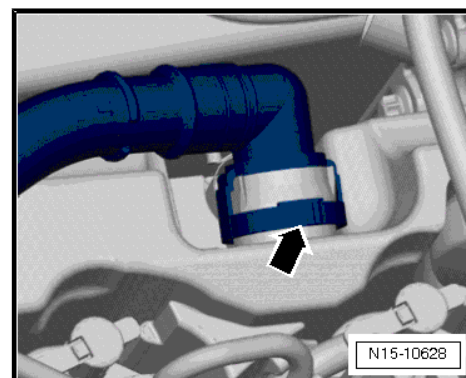


### Note

A spare-parts kit ⇒ ETKA (electronic parts catalogue) is available for replacing the vacuum unit.

### Removing

- Remove pipe -arrow- from cylinder head cover.

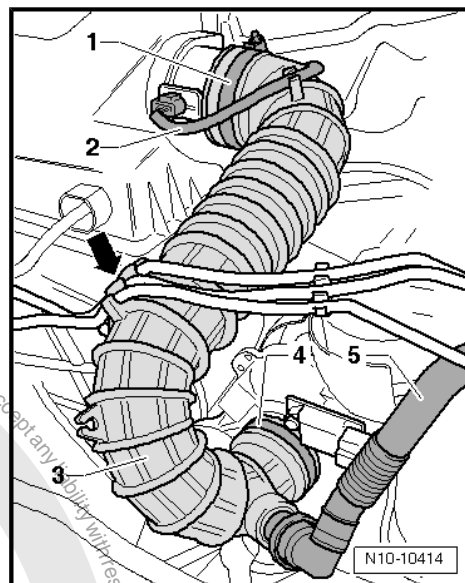


N15-10628

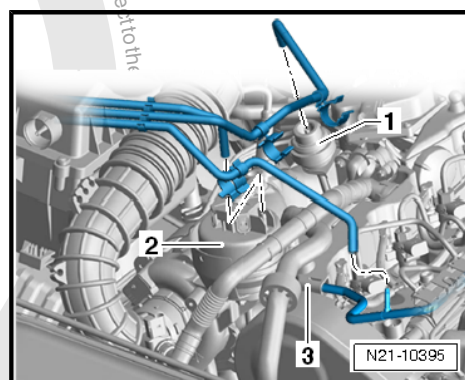




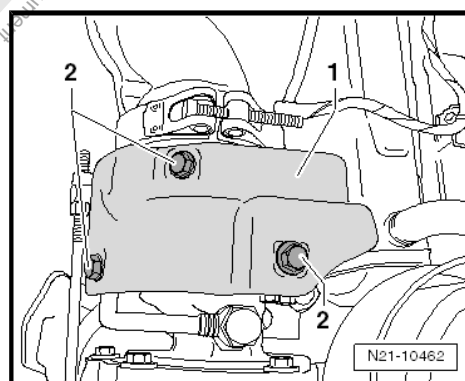
- Detach vacuum hoses from connecting hose -3- bracket -arrow-.
- Release and pull off wiring harness connector -2-. Detach wiring harness -2- from connecting hose retainer -3-.
- Open clips -1- and -4-.
- Remove connecting hose -3-.



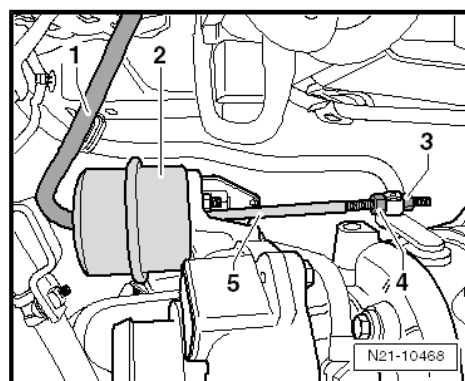
- Pull hose off regulating flap potentiometer - G584- -2-.



- Undo and remove bolts -2- securing heat shield -1-.



- Pull hose -1- off vacuum unit -2-.
- Undo and completely remove lower nut -3- of control rod -5-.







- Undo nuts of vacuum unit -1- and remove vacuum unit -2-.

### Installing

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



#### Caution

**Only use new nuts from the spare-parts kit!**

- Carefully cleaning touching surfaces of vacuum unit.
- If necessary, remove lower securing nut -3- of the control rod from the new vacuum unit -2-.
- Install new vacuum unit -2- and push control rod -5- through adjusting lever on turbocharger as shown in illustration.



#### Note

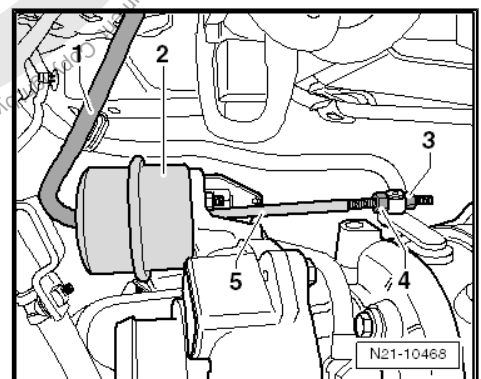
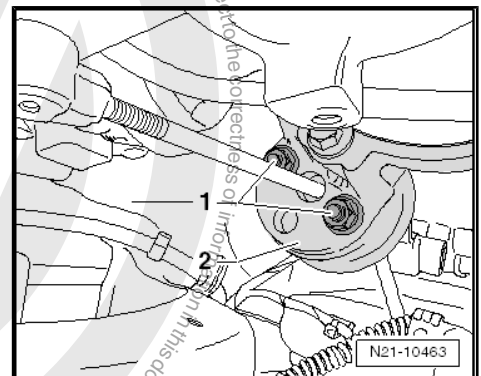
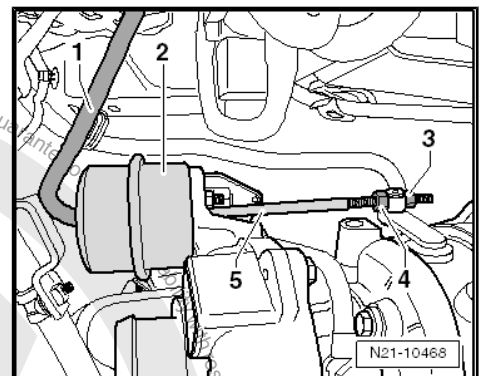
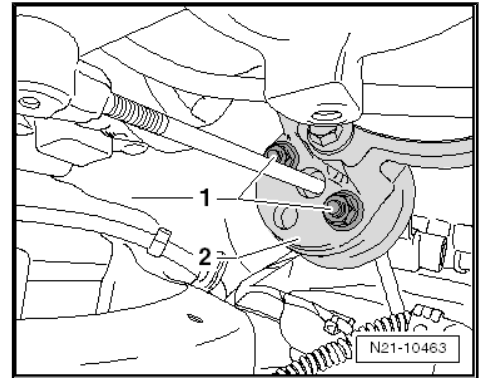
*Location marker on vacuum unit must fit into mounting on turbocharger.*

- Fit vacuum unit -2- in place and fit nuts -1-, tighten nuts to 8 Nm.
- Screw nuts -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.*







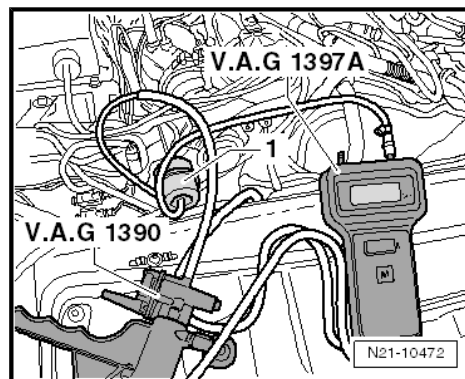
- Connect turbocharger tester - V.A.G 1397A- -2- and hand vacuum pump - VAS 6213- or hand vacuum pump - V.A.G. 1390- -3- to vacuum connection of vacuum unit -1- using a T-piece to do so.

Switch turbocharger tester - V.A.G 1397A- on and move sliding switch on device to position II.

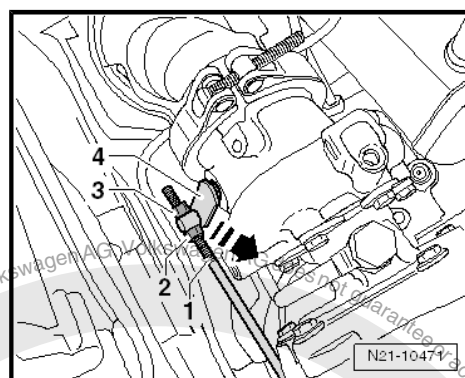
- Apply a vacuum of  $390 \pm 10$  mbar to vacuum unit.

**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.

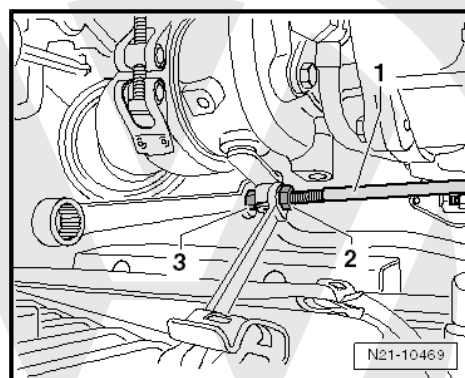


- Screw nut -3- in direction of vacuum unit until it is touching the flap lever, while applying a tightening torque of 8 Nm to the lock nut -2- at the same time.

**Note**

*Make sure that control rod -1- does not turn by counterholding on the nut -3-.*

- Reduce vacuum again and apply a vacuum of  $390 \pm 10$  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.



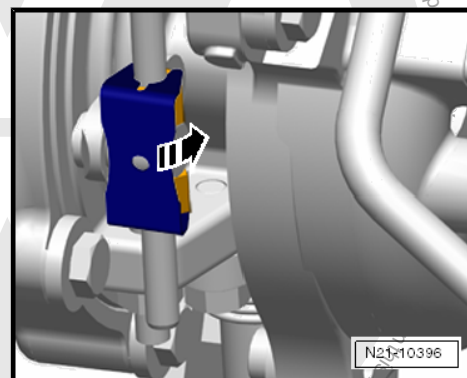
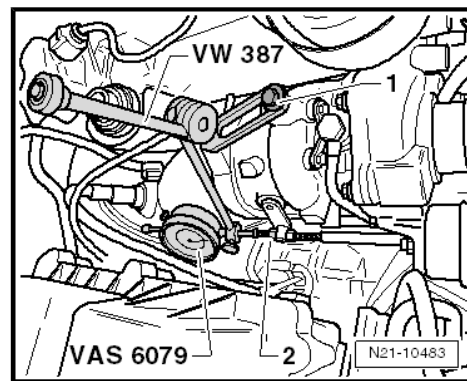


- Secure dial gauge - VAS 6079- together with universal dial gauge bracket - VW 387- to turbocharger with a suitable bolt -1- (as shown in illustration) and move gauge to end of control rod -2-.

**Note**

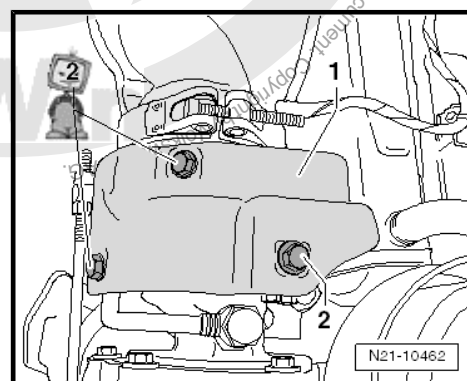
*The dial gauge rod and the control rod of the vacuum unit must be in line with each other.*

- Operate hand vacuum pump - VAS 6213- until the turbocharger tester - V.A.G 1397A- indicates  $390 \pm 10$  mbar.
- Set dial gauge, 0-30 mm - VAS 6341/1- to 0.
- Operate hand vacuum pump - VAS 6213- until turbocharger tester - V.A.G 1397A- indicates  $410 \pm 10$  mbar.
- Read value on dial gauge - VAS 6079- .
- Make sure that value on dial gauge - VAS 6079- does not change.
- If the value has changed, correct the setting of the vacuum unit and repeat the measurement until the setting agrees with the specified values.
- Secure securing nut and lock nut with sealing paint from the spare-parts kit.
- Press retaining clip from spare-parts kit onto control rod and turn  $90^\circ$  in the -direction of the arrow-.



- Tighten bolts -2- securing heat shield -1- to 9 Nm.

Further assembly is carried out in the reverse order of removal.





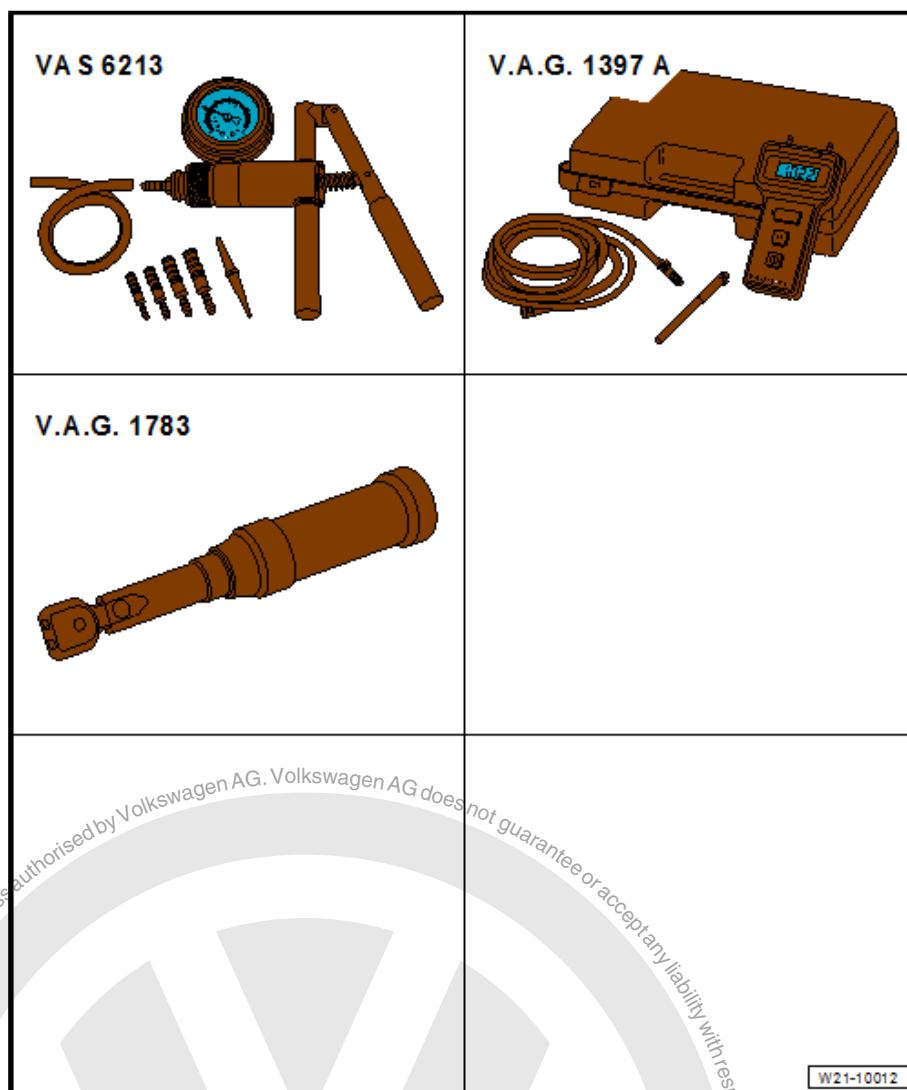


## 2.7 Removing and installing regulating flap potentiometer - G584- and vacuum unit for turbocharger, 132 kW engine

### 2.7.1 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-
- ♦ Vehicle diagnostic tester



#### Note

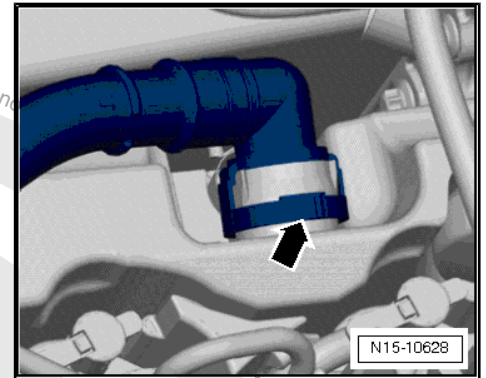
A replacement-parts kit for replacing the regulating flap potentiometer - G584- is available in the ⇒ ETKA (electronic parts catalogue) .



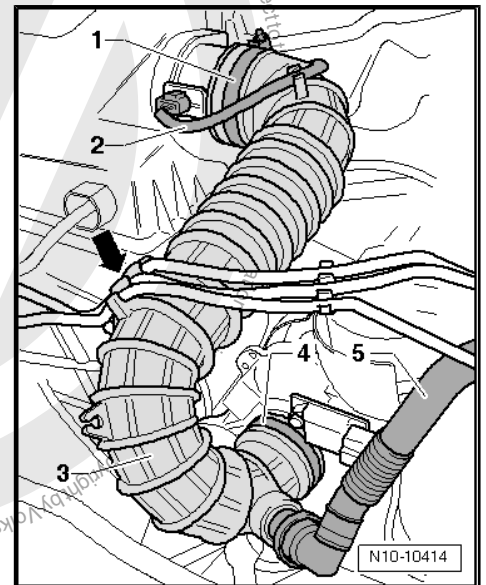


## Removing

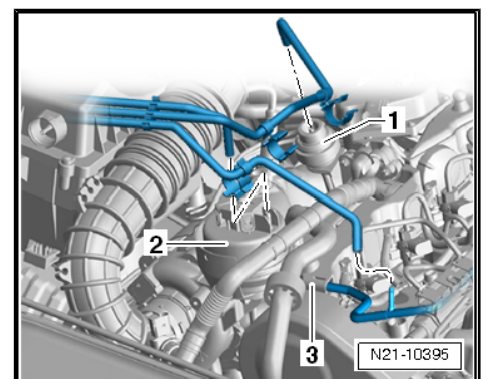
- Remove pipe -arrow- from cylinder head cover.



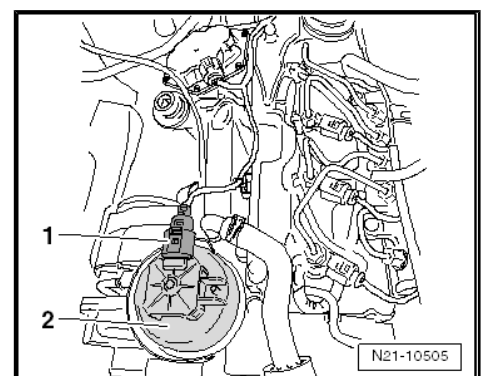
- Detach hoses from retainer -arrow- on connecting hose -3-.
- Release and pull off wiring harness connector -2-. Detach wiring harness -2- from connecting hose retainer -3-.
- Open clips -1- and -4-.
- Remove connecting hose -3-.



- Pull hose off regulating flap potentiometer - G584- -2-.



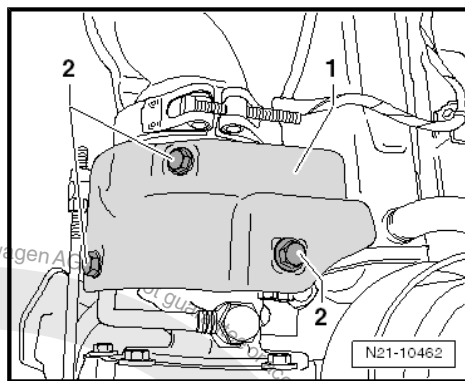
- Unclip connector -1- from regulating flap potentiometer - G584- -2-.



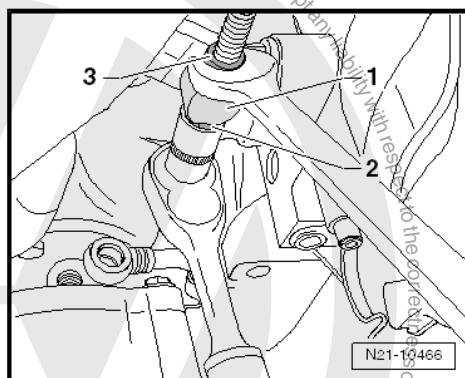




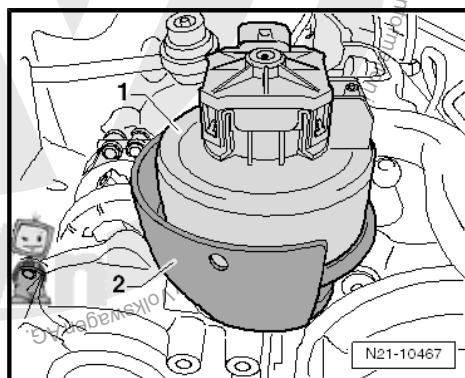
- Undo and remove bolts -2- securing heat shield -1- and remove heat shield.
- Lever off retaining clamp.



- Loosen and completely unscrew securing nut -2- for control rod.
- Counterhold lock nut -3- with open-end spanner.



- Working from below, unbolt regulating flap potentiometer - G584- -1- together with bracket -2- from mounting of turbo-charger (3 nuts).
- Remove regulating flap potentiometer - G584- upwards together with bracket.



### Installing

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



#### 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

*The lock nut must be screwed onto control rod.*

### Old part

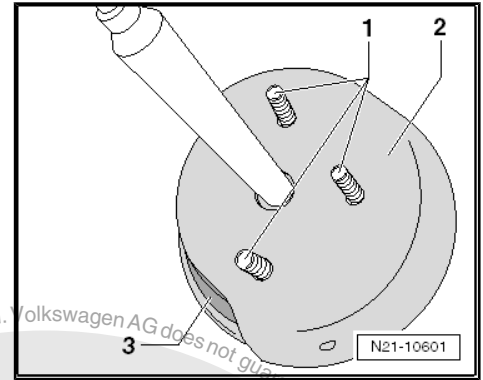
- Unscrew lock nut from control rod and carefully remove sealing paint from control rod completely.
- Screw new lock nut from replacement-parts kit onto control rod.

### Continuation for all

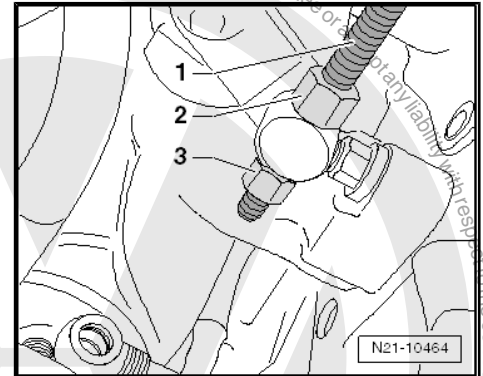




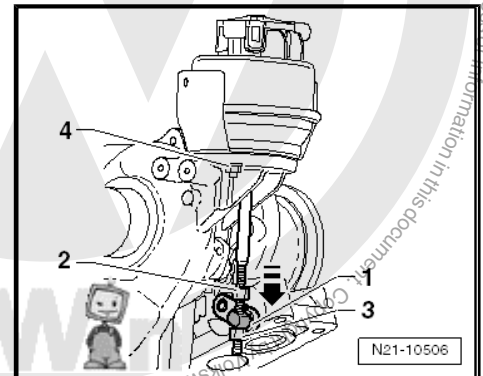
- Carefully clean contact surfaces of regulating flap potentiometer - G584- -3- and bracket -2-.
- Carefully clean mounting for regulating flap potentiometer - G584- on turbocharger.



- 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 to 8 Nm.
- 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.

#### Selecting operating mode:


- Press button on display for “Vehicle self-diagnosis”.

#### Selecting vehicle system:

- Press button “01 - Engine electronics” on display.

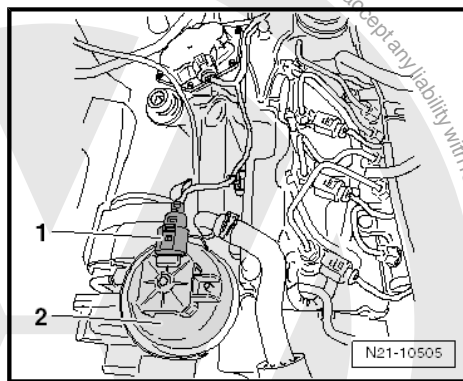
The display indicates the control unit identification and the coding of the engine control unit.

#### Selecting diagnostic function:

- Press button for “011 - Measured values” on the display.
- The display shows the individual components.
- Select “Bypass Valve, Turbocharger, High Pressure Turbine Input, Input Voltage” and confirm entry with .
- 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 on turbocharger tester - V.A.G 1397A- and move sliding switch on device to position II.

- Apply a vacuum of  $500 \pm 50$  mbar to regulating flap potentiometer - G584- .

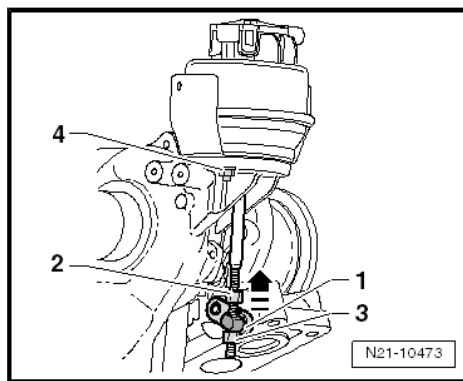
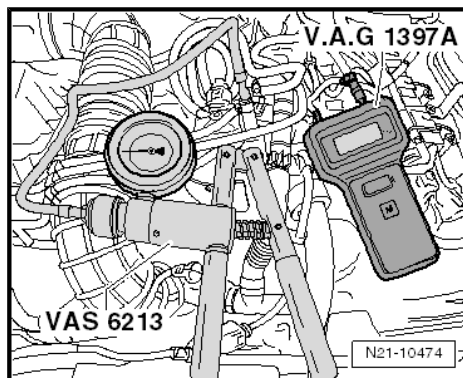


- Move flap lever -1- on turbocharger in -direction of arrow- to “Closed” position and hold it there.
- Screw securing nut -3- in direction of vacuum unit until it contacts flap lever -1-.
- Continue turning securing nut -3- until a voltage of  $0.75 \text{ volt} \pm 0.02 \text{ volt}$  of regulating flap potentiometer - G584- is reached.
- Tighten lock nut -2- to 8 Nm.



#### Note

Make sure that control rod -1- does not turn by counterholding on nut -2-.







Slowly reduce vacuum. Flap lever -1- now moves in -direction of arrow- "Open".

- Apply a vacuum of  $500 \pm 50$  mbar to regulating flap potentiometer - G584- again.
- Check voltage setting ( $0.75 \text{ volt} \pm 0.02 \text{ volt}$ ) of regulating flap potentiometer - G584- and, if necessary, reset.

Slowly reduce vacuum.



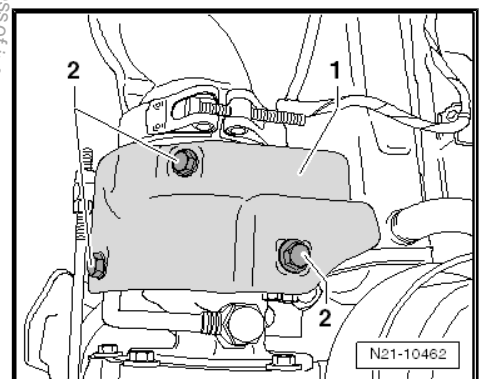
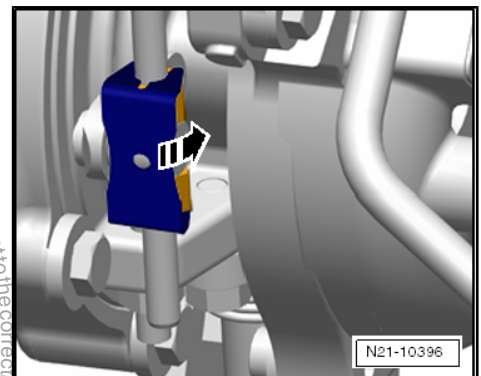
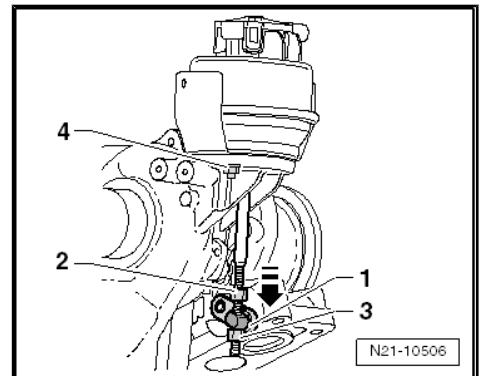
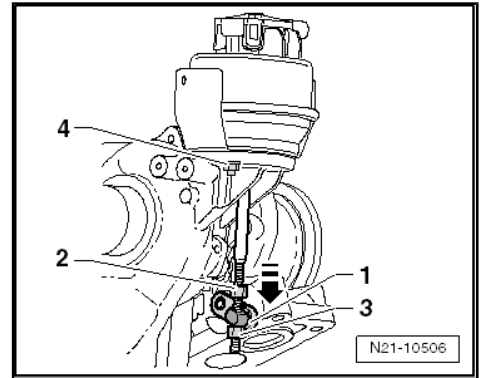
#### Note

*Flap lever -1- must now be resting against the stop. If the flap lever is not resting against the stop, the setting procedure must be repeated until the setting 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-.

- Tighten securing bolts -2- for heat shield -1-.

Further assembly is carried out in the reverse order of removal.



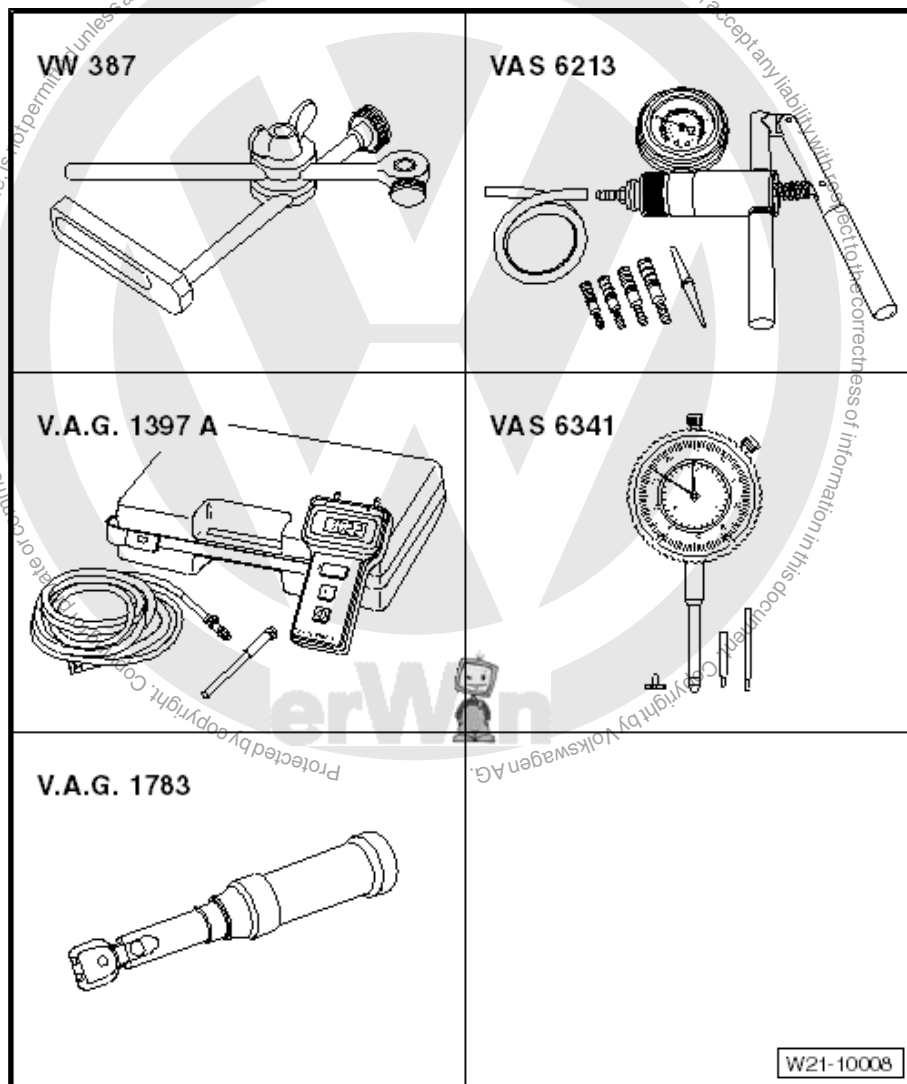




## 2.7.2 Removing and installing vacuum unit for turbocharger

### 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-

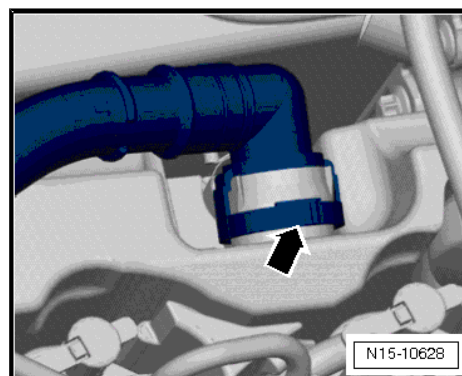


### Note

A replacement-parts kit for replacing the vacuum unit is available in the ⇒ ETKA (electronic parts catalogue) .

### Removing

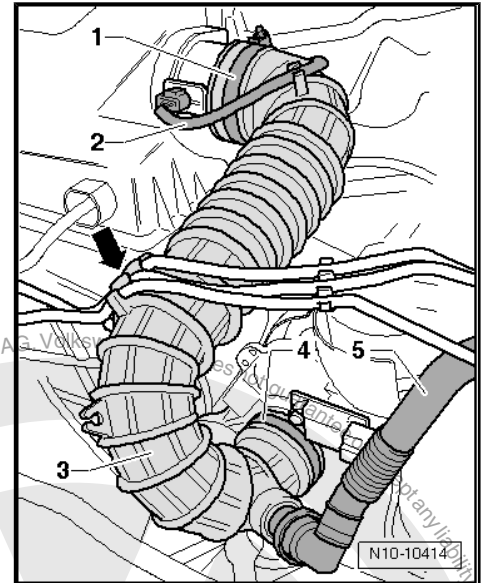
- Remove pipe -arrow- from cylinder head cover.



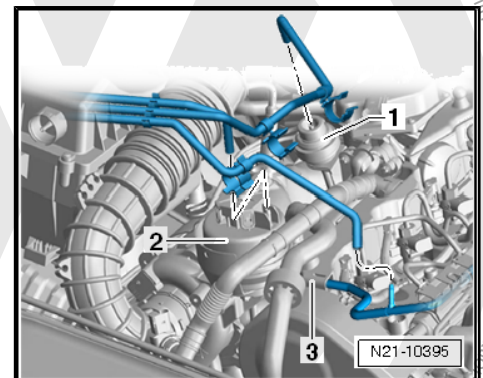




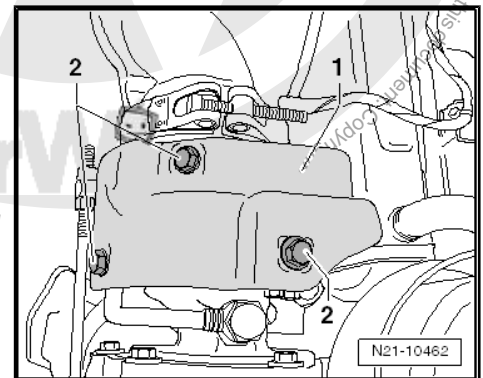
- Detach vacuum hoses from retainer -arrow- on connecting hose -3-.
- Release and pull off wiring harness connector -2-. Detach wiring harness -2- from connecting hose retainer -3-.
- Open clips -1- and -4-.
- Remove connecting hose -3-.



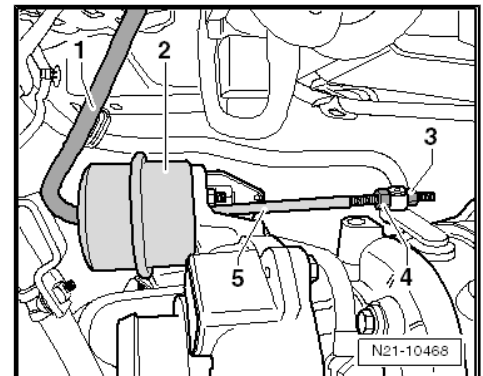
- Pull hose off regulating flap potentiometer - G584- -2-.



- Undo and remove bolts -2- securing heat shield -1-.



- Pull hose -1- off vacuum unit -2-.
- Loosen and completely unscrew lower securing nut -3- of control rod -5-.







- Unscrew 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, unscrew 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.*

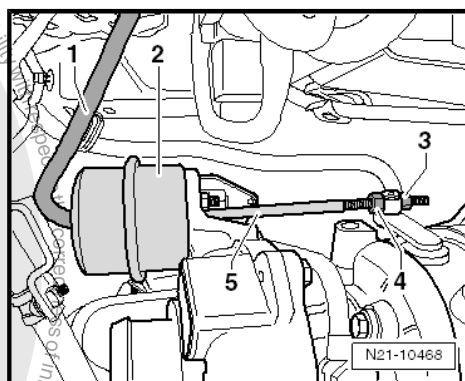
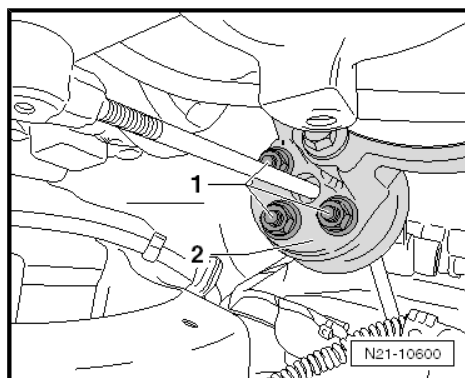
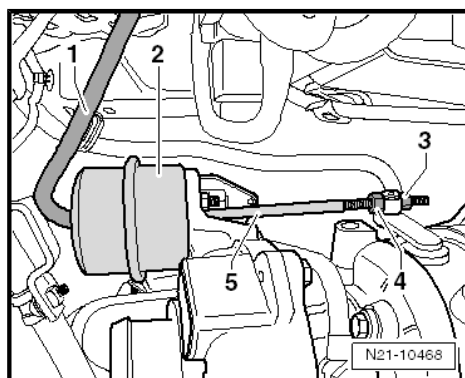
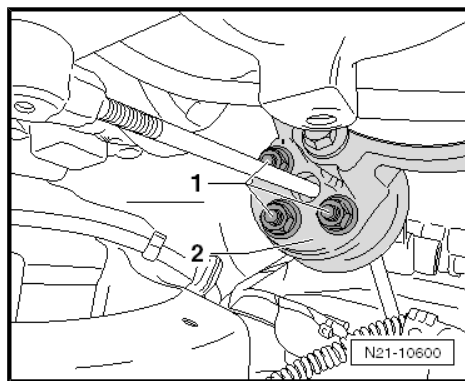
- Fit vacuum unit -2- in place and fit nuts -1-, tighten nuts to 8 Nm.

- 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.

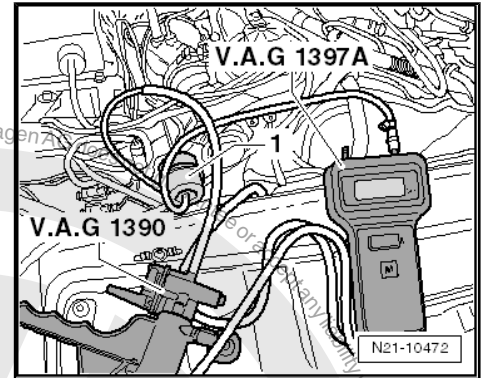
Switch turbocharger tester - V.A.G 1397A- on and move sliding switch on device to position II.

- Apply a vacuum of  $390 \pm 10$  mbar to vacuum unit.

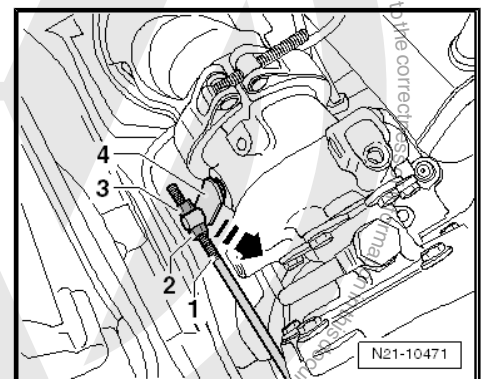


### Caution

*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.



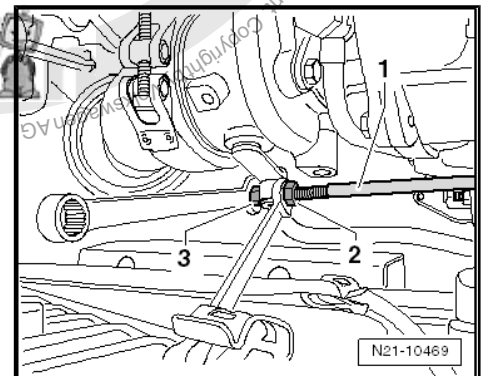
- Screw nut -3- in direction of vacuum unit until it is touching the flap lever, while applying a tightening torque of 8 Nm to the lock nut -2- at the same time.



### Note

*The control rod -1- must not turn. Therefore, counterhold on securing nut -3-.*

- Reduce vacuum again and apply a vacuum of  $390 \pm 10$  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-.



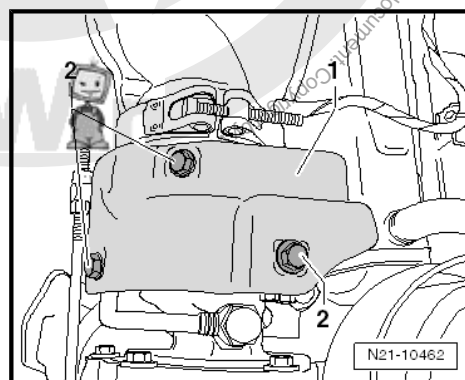
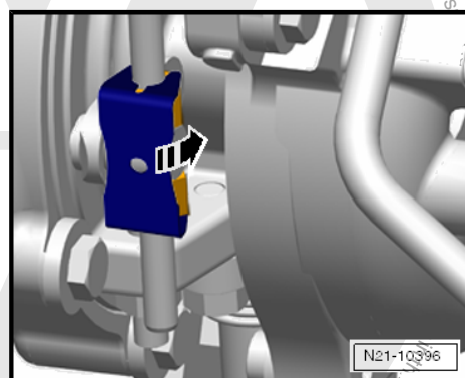
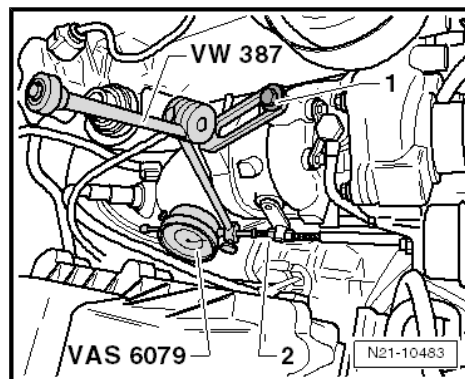
#### Note

*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  $390 \pm 10$  mbar.
- Set dial gauge, 0-30 mm - VAS 6341/1- to 0.
- Operate hand vacuum pump - VAS 6213- until turbocharger tester - V.A.G 1397A- indicates  $410 \pm 10$  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 complies 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-.

- Tighten securing bolts -2- for heat shield -1-.

Further assembly is carried out in the reverse order of removal.



## 2.8 Removing and installing charge pressure control solenoid valve - N75-

Special tools and workshop equipment required





- ◆ Torque wrench - V.A.G 1410-

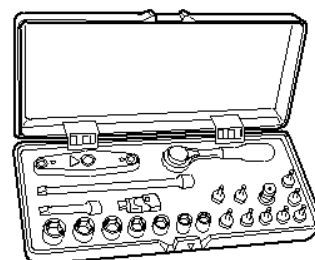
V.A.G 1410



W00-0554

- ◆ Socket set 1/4", 22-piece - VAS 5528-

VAS 5528



W00-10837

## Removing

- Pull connector -2- and vacuum lines off charge pressure control solenoid valve - N75- -1-.
- Remove spreader rivet -3- and charge pressure control solenoid valve - N75- -1-.

## Installing

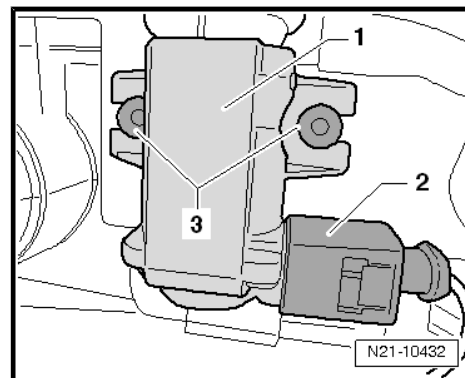
Installation is carried out in the reverse order; note the following:



### 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.***



N21-10482





## 23 – Mixture preparation - injection

### 1 Injection system

⇒ [“1.1 Schematic overview - fuel system”, page 302](#)

⇒ [“1.2 Fitting location overview - injection system”, page 304](#)

⇒ [“1.3 Assembly overview - fuel system”, page 311](#)

⇒ [“1.4 Checking fuel system for leaks”, page 316](#)

⇒ [“1.5 Filling/bleeding fuel system”, page 316](#)

#### 1.1 Schematic overview - fuel system



##### WARNING

- ◆ *Read through the rules for cleanliness and the instructions for working on the 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 fuel tank and the high-pressure pump are removed or renewed, the fuel system must be filled to be bled ⇒ [page 316](#). (It is important not to allow the high-pressure pump to run while still empty.)*

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 components of the fuel system between the fuel tank and the high-pressure pump are removed or renewed, it is necessary for the fuel system to be bled. To do this, perform the “Bleeding fuel system” function using the ⇒ Vehicle diagnostic tester ⇒ [page 316](#).
- ◆ This process takes 130 seconds. Fuel pumps are actuated a total of 3 times in this case. The process must not be terminated prematurely.





### 1 - Fuel tank

- ☐ With fuel system pressurisation pump - G6-

### 2 - Fuel filter

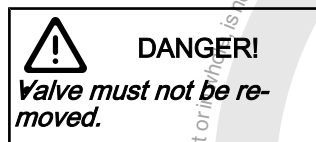
- ☐ With pre-heating valve.
- ☐ Assembly overview - fuel filter ⇒ [page 238](#).
- ☐ Removing and installing ⇒ [page 239](#).

### 3 - Fuel temperature sender - G81-

### 4 - High-pressure pump

- ☐ Removing and installing ⇒ [page 347](#).

### 5 - Fuel metering valve - N290-



- ☐ Valve is not available as separate part.

### 6 - Fuel pressure regulating valve - N276-

- ☐ Removing and installing ⇒ [page 362](#).

### 7 - High-pressure accumulator (fuel rail)

### 8 - Fuel pressure sender - G247-

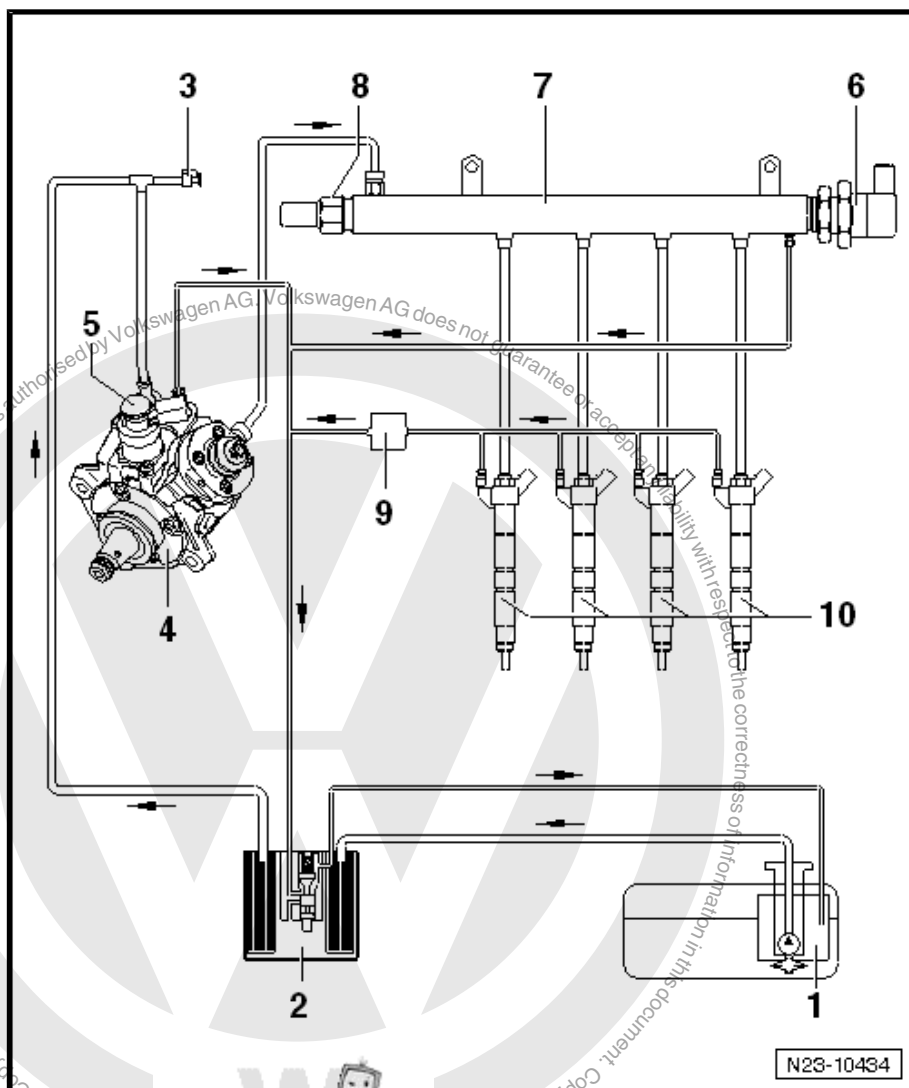
- ☐ Removing and installing ⇒ [page 365](#).

### 9 - Restrictor

- ☐ Cannot be renewed separately

### 10 - Injectors

- ☐ Injector, cylinder 1 - N30-
- ☐ Injector, cylinder 2 - N31-
- ☐ Injector, cylinder 3 - N32-
- ☐ Injector, cylinder 4 - N33-
- ☐ Removing and installing ⇒ [page 327](#).



N23-10434





## 1.2 Fitting location overview - injection system

### 1 - Intake manifold pressure sender - G71-

- ☐ Fitting location  
⇒ [page 307](#)

### 2 - Air mass meter - G70-

- ☐ Fitting location  
⇒ [page 307](#)

### 3 - Regulating flap potentiometer - G584-

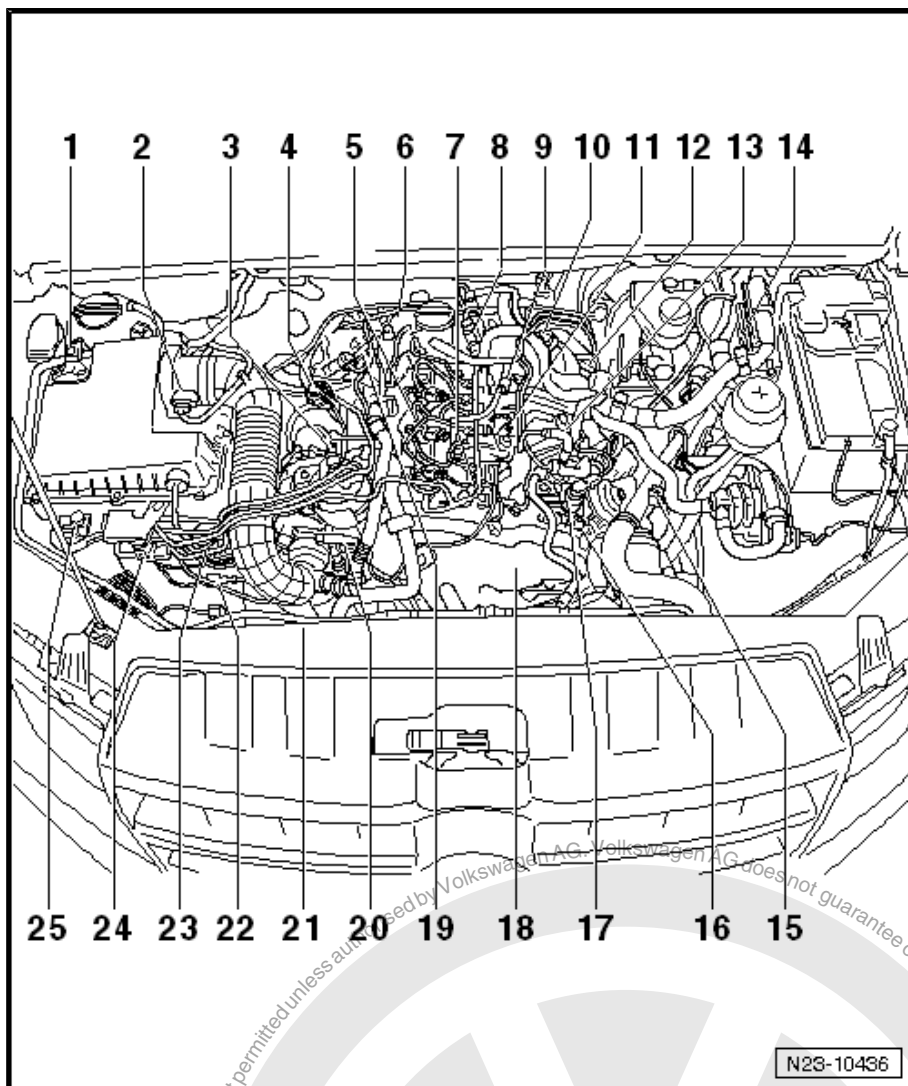
- ☐ "Position sender for charge pressure positioner" in vehicles with single turbo engine - G581- .
- ☐ Fitting location  
⇒ [page 308](#)

### 4 - Vacuum unit for exhaust flap

- ☐ In vehicles with "biturbo engine" only.
- ☐ Fitting location  
⇒ [page 308](#)

### 5 - Injectors

- ☐ Injector, cylinder 1 - N30-
- ☐ Injector, cylinder 2 - N31-
- ☐ Injector, cylinder 3 - N32-
- ☐ Injector, cylinder 4 - N33-
- ☐ Fitting location







⇒ [page 307](#)

- ☐ Removing and installing  
⇒ [page 327](#) .

#### 6 - Coolant temperature sender - G62-

- ☐ Fitting location ⇒ [page 304](#)
- ☐ Removing and installing ⇒ [page 196](#) .

#### 7 - Fuel pressure sender - G247-

- ☐ Fitting location ⇒ [page 307](#)

#### 8 - Fuel pressure regulating valve - N276-

- ☐ Fitting location ⇒ [page 307](#)

#### 10 - Engine speed sender - G28-

- ☐ Fitting location ⇒ [page 310](#)
- ☐ Removing and installing ⇒ [page 406](#) .

#### 11 - Glow plugs

- ☐ Glow plug 1 - Q10-
- ☐ Glow plug 2 - Q11-
- ☐ Glow plug 3 - Q12-
- ☐ Glow plug 4 - Q13-
- ☐ Fitting location ⇒ [page 307](#)
- ☐ Removing and installing ⇒ [page 405](#) .

#### 12 - Throttle valve module - J338- with throttle valve potentiometer - G69- and intake manifold flap motor - V157-

- ☐ Fitting location ⇒ [page 307](#)

#### 13 - Fuel temperature sender - G81-

- ☐ Fitting location ⇒ [page 307](#)

#### 14 - Engine control unit - J623-

- ☐ Fitting location ⇒ [page 306](#)
- ☐ Removing and installing ⇒ [page 372](#) .

#### 15 - Intake air temperature sender - G42- with charge air pressure sender - G31-

- ☐ Fitting location ⇒ [page 308](#)

#### 16 - High-pressure pump

- ☐ Fitting location ⇒ [page 307](#)

#### 17 - Fuel metering valve - N290-

- ☐ Fitting location ⇒ [page 307](#)

#### 18 - Hall sender - G40-

- ☐ Fitting location ⇒ [page 309](#)
- ☐ Removing and installing ⇒ [page 407](#) .

#### 19 - Exhaust gas recirculation valve - N18- with exhaust gas recirculation potentiometer - G212-

- ☐ Fitting location ⇒ [page 307](#)

#### 20 - Charge pressure sender 2 - G447-

- ☐ Adaptation must be carried out after renewing.
- ☐ Removing and installing ⇒ [page 277](#) .
- ☐ Fitting location ⇒ [page 308](#)

#### 21 - Radiator outlet coolant temperature sender - G83-

- ☐ Fitting location ⇒ [page 311](#)





## 22 - Coupling point

- ☐ For exhaust gas temperature sender 1 - G235- ➔ [Item 6 \(page 260\)](#) (black connector) at coupling point of air filter
- ☐ For exhaust gas temperature sender 3 - G495- ➔ [Item 5 \(page 377\)](#) (brown connector) at coupling point of air filter
- ☐ For exhaust gas temperature sender 4 - G648- ➔ [Item 6 \(page 377\)](#) (orange connector) at coupling point of air filter

## 23 - Charge pressure control solenoid valve - N75-

- ☐ Fitting location ➔ [page 309](#)

## 24 - Exhaust gas flap valve - N220-

- ☐ Fitting location ➔ [page 309](#)

## 25 - Exhaust gas recirculation cooler changeover valve - N345-

- ☐ Fitting location ➔ [page 309](#)

## A - Brake light switch on brake master cylinder - F-

- ☐ Fitting location ➔ [page 310](#)

## B - Clutch pedal switch - F36-

- ☐ Fitting location ➔ [page 310](#)

## C - Accelerator position sender - G79-

- ☐ Fitting location ➔ [page 249](#)

## D - Exhaust temperature sender 1 - G235- or exhaust temperature sender 2 - G448-

- ☐ Installed in exhaust manifold/turbocharger.

## E - Exhaust gas temperature sender 3 - G495-

- ☐ Fitting location ➔ [Item 5 \(page 377\)](#)

## F - Exhaust gas temperature sender 4 - G648-

- ☐ Fitting location ➔ [Item 6 \(page 377\)](#)

## G - Lambda probe - G39-

- ☐ Fitting location ➔ [Item 3 \(page 377\)](#)

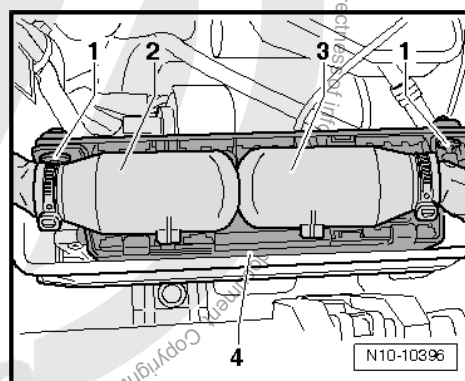
## H - Particulate filter

- ☐ Fitting location ➔ [page 377](#)

## Engine control unit - J623-

Location: in engine compartment on left.

- 1 - Securing bolts/shear bolts
- 2 - 60-pin connector - T60-
- 3 - 94-pin connector - T94-
- 4 - Engine control unit - J623-

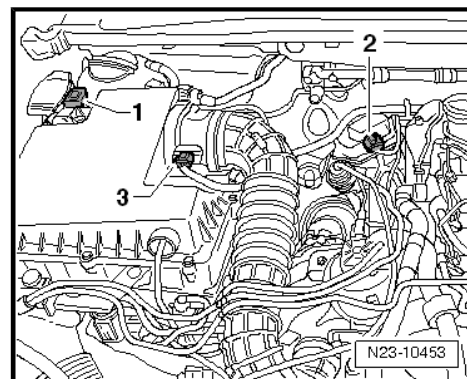






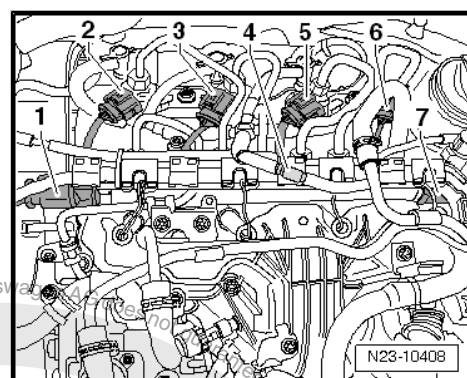
### Mounting locations on right on top of engine

- 1 - Intake manifold pressure sender - G71-
- 2 - Exhaust gas recirculation valve - N18- with exhaust gas recirculation potentiometer - G212-
- 3 - Air mass meter - G70-



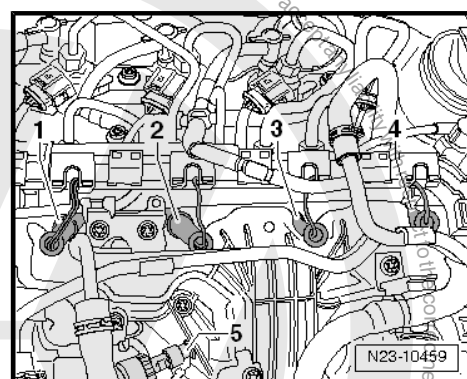
### Mounting locations on top of engine

- 1 - Fuel pressure sender - G247-
- 2 - Injector, cylinder 1 - N30-
- 3 - Injector, cylinder 2 - N31-
- 4 - Injector, cylinder 3 - N32-
- 5 - Injector, cylinder 4 - N33-
- 6 - Fuel pressure regulating valve - N276-



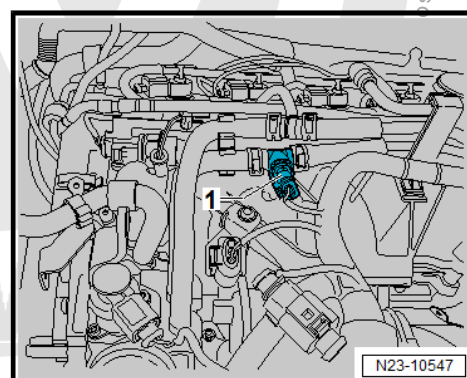
### Mounting locations on top of engine (continued)

- 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 top of engine (continued)

- 1 - Fuel temperature sender - G81-

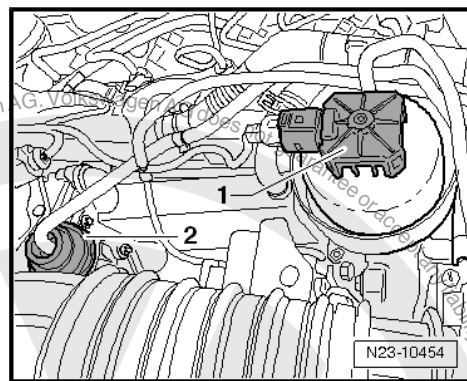






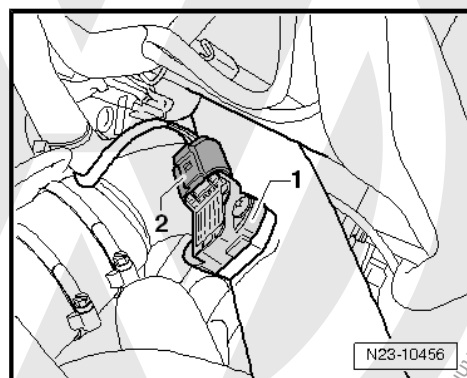
### Components on top of turbocharger

- 1 - Regulating flap potentiometer - G584-
- 2 - "Position sender for charge pressure positioner" in vehicles with single turbo engine - G581- .
- 3 - Vacuum unit for exhaust flap



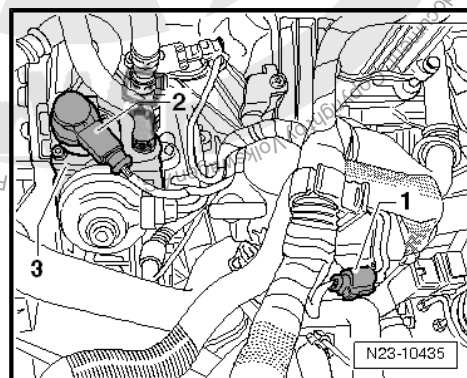
### Intake air temperature sender - G42- with charge air pressure sender - G31-

- 1 - Intake air temperature sender - G42- with charge air pressure sender - G31-
- 2 - Connector

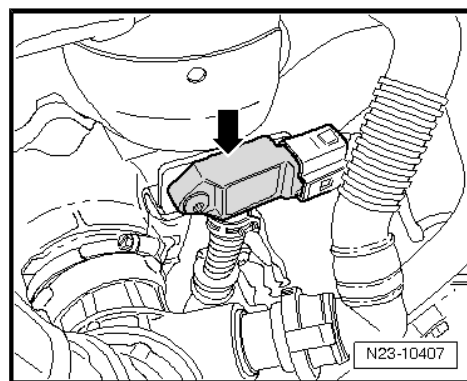


### Mounting locations on top of engine on left

- 1 - Throttle valve module - J338- with throttle valve potentiometer - G69- and intake manifold flap motor - V157-
- 2 - Fuel metering valve - N290-
- 3 - High-pressure pump



### Charge pressure sender 2 - G447- -arrow-

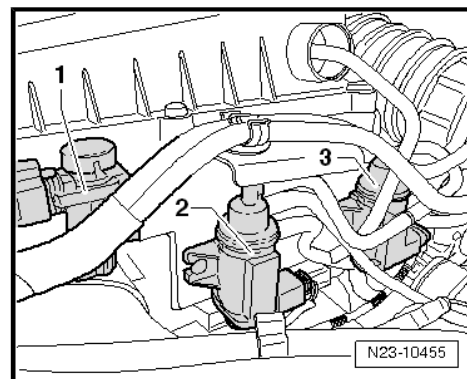




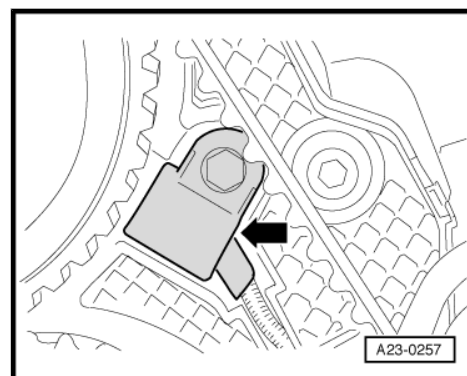


### Solenoid valves at air filter

- ◆ Changeover valve for exhaust gas recirculation cooler - N345- -1-
- ◆ Exhaust gas flap valve - N220- -2-
- ◆ Charge pressure control solenoid valve - N75- -3-

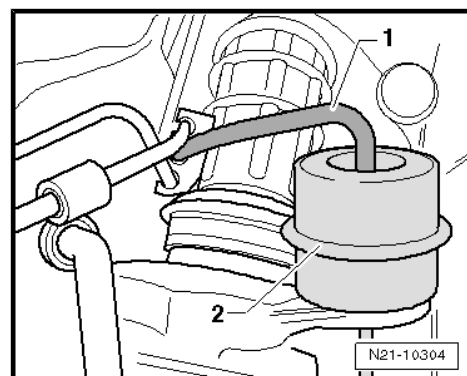


### Hall sender - G40-



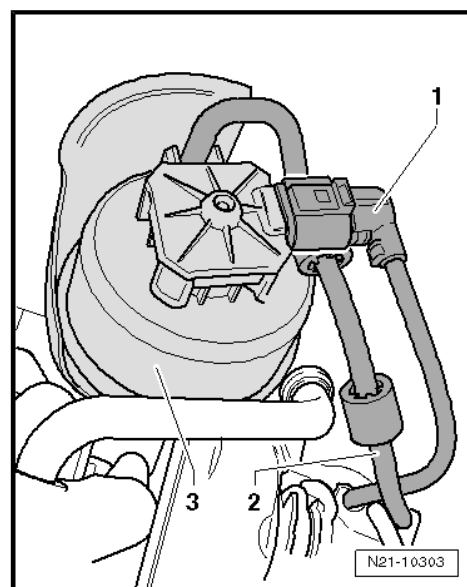
### Vacuum unit for exhaust flap

- 1 - Vacuum hose
- 2 - Vacuum unit for exhaust flap



### Regulating flap potentiometer - G584-

- 1 - Electrical line connection
- 2 - Vacuum hose
- 3 - Vacuum unit for wastegate

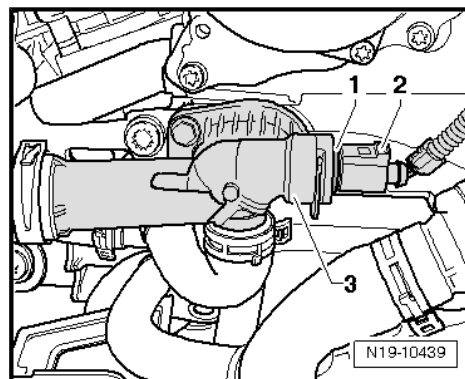






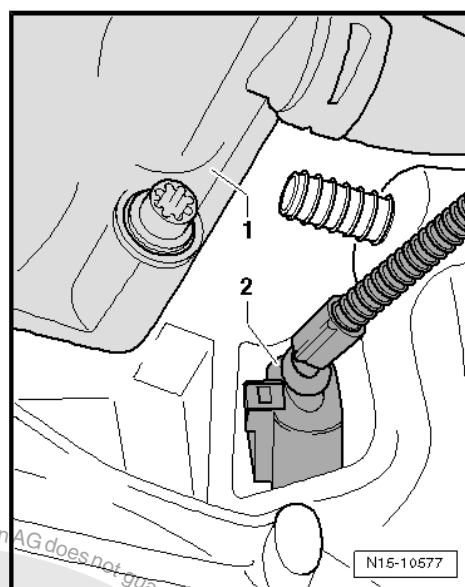
### Coolant temperature sender G62

- 1 - Coolant temperature sender - G62-
- 2 - Electrical line connection
- 3 - Connection



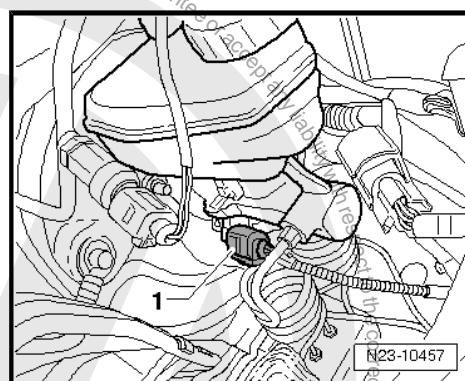
### Engine speed sender - G28-

Installation location of engine speed sender - G28- -2- below the oil filter holder -1-.



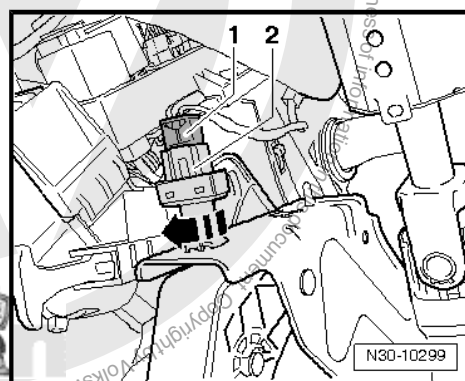
### Brake light switch on brake master cylinder - F-

Brake light switch - F- with brake pedal switch - F47- -1- is fitted underneath the brake master cylinder.



### Clutch pedal switch - F36-

- 1 - Connector
- 2 - Clutch pedal switch - F36-

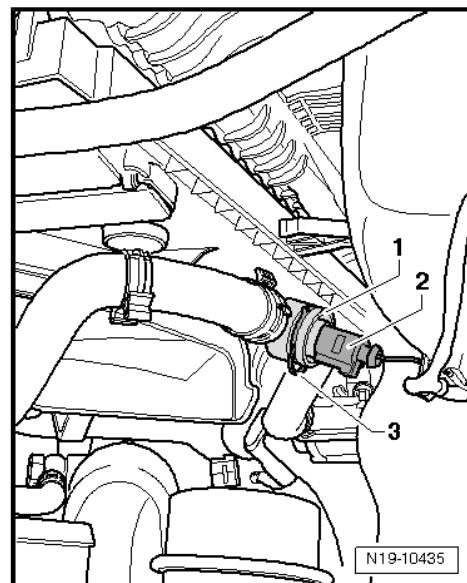






### Radiator outlet coolant temperature sender - G83-

Coolant temperature sender at radiator outlet - G83- : Installed at the bottom on the left in front of the radiator.



## 1.3 Assembly overview - fuel system



### WARNING

- ◆ *Read through the rules for cleanliness and the instructions for working on the 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 pump are removed or renewed, the fuel system must be filled to be bled ⇒ [page 316](#). (It is important not to allow the high-pressure pump to run while still empty.)*
- ◆ *The engine must not be run when the fuel return line is disconnected, this is because the coupling chamber will be emptied due to the lack of the counterpressure.*

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 components of fuel system between fuel tank and high-pressure pump are unbolted, removed or renewed, "Bleeding fuel system" function must be carried out to bleed fuel system 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.





- ## 2 - Supply line

- ### 3 - Bolt

- ☐ 10 Nm

#### 4 - Hose

- ❑ Connection to return lines of the injectors

## 5 - Hose

- Around high-pressure accumulator (fuel rail)

**6 - Return line**

- ❑ To fuel tank.

**7 - Supply line**

- ❑ To high-pressure pump

### 8 - Return line

-  To fuel filter

### 9 - High-pressure line

- ❑ Between high-pressure accumulator (common rail) and injectors
- ❑ Install so that component is not stressed.
- ❑ Removing and installing ⇒ page 338.



- ◆ *The high-pressure lines may be re-used after the following checks:*
- ◆ *Check taper seat of high-pressure line for deformation and cracks.*
- ◆ *The line hole must not be deformed, constricted or damaged.*
- ◆ *Corroded lines should no longer be used.*

- 30 Nm

## 10 - Clamp

- ❑ For high-pressure line  $\Rightarrow$  Item 26 (page 314)

## 11 - Bolt

- 10 Nm





## 12 - High-pressure accumulator (fuel rail)

- ☐ Removing and installing ⇒ [page 340](#) .

## 13 - Seal

- ☐ Renew after removing

## 14 - Fuel pressure regulating valve - N276-

- ☐ Cannot be re-installed.
- ☐ 80 Nm
- ☐ Removing and installing ⇒ [page 362](#) .

## 15 - O-ring

- ☐ Renew after removing

## 16 - Injectors (piezo injectors or solenoid valves)

- ☐ Do not interchange!
- ☐ When removing and installing, always renew the following components and seals/O-rings: "copper seal" ⇒ [Item 17 \(page 313\)](#) and ⇒ [Item 19 \(page 313\)](#) , "O-ring for injector bore", ⇒ [Item 15 \(page 313\)](#) , "O-ring for injector return connection" ⇒ [Item 15 \(page 313\)](#) and "bolt for clamping plate" ⇒ [Item 21 \(page 313\)](#) .
- ☐ Before re-using high-pressure lines ⇒ [Item 9 \(page 312\)](#) , perform visual check of taper seals for damage, e.g. transverse scores or corrosion. Always renew if damaged.
- ☐ If piezo injectors, high-pressure lines ⇒ [Item 9 \(page 312\)](#) and clamping plates ⇒ [Item 20 \(page 313\)](#) which were removed are to be reinstalled, they must always be re-fitted in their original positions (i.e. on the same cylinder).
- ☐ Removing and installing ⇒ [page 327](#) .

## 17 - Copper washer

- ☐ Renew after removing

## 18 - O-ring

- ☐ Renew after removing

## 19 - Copper washer

- ☐ Renew after removing

## 20 - Clamping plates

- ☐ Reusable.

## 21 - Bolt

- ☐ Renew after removing
- ☐ 8 Nm +180°

## 22 - Fuel return line

- ☐ To fuel tank.
- ☐ The fuel return line must not be kinked, damaged or blocked.
- ☐ The fuel return lines must not be dismantled.
- ☐ Release ⇒ [page 315](#)
- ☐ Check locks ⇒ [page 315](#)
- ☐ Attach ⇒ [page 315](#)
- ☐ Lock ⇒ [page 316](#)

## 23 - Restrictor

- ☐ Cannot be renewed separately

## 24 - Fuel pressure sender - G247-

- ☐ 100 Nm
- ☐ Removing and installing ⇒ [page 365](#) .

## 25 - Bolt

- ☐ 22 Nm





## 26 - High-pressure line

- ☐ Secured with 3 clamps ➔ [Item 10 \(page 312\)](#)
- ☐ Between high-pressure pump and high-pressure accumulator (fuel rail)



### Note

- ◆ *The high-pressure lines may be re-used after the following checks:*
- ◆ *Check taper seat of high-pressure line for deformation and cracks.*
- ◆ *The line hole must not be deformed, constricted or damaged.*
- ◆ *Corroded lines should no longer be used.*

- ☐ 30 Nm

## 27 - High-pressure fuel pump

- ☐ With fuel metering valve - N290- (must not be opened).
- ☐ After renewing, initial fuel filling must be carried out (never allow the pump to run while it is still empty) ➔ [page 316](#) .
- ☐ Removing and installing ➔ [page 347](#) .

## 28 - Bolt

- ☐ Renew after removing
- ☐ 20 Nm +180°

## 29 - Bolt

- ☐ Renew after removing
- ☐ 20 Nm +45°

## 30 - Bolt

- ☐ Renew after removing
- ☐ 23 Nm

## 31 - Hub

- ☐ With sender ring.
- ☐ Use counterhold tool - T10051- to loosen and tighten.
- ☐ To remove, use puller - T40064- .
- ☐ Removing and installing ➔ [page 347](#) .

## 32 - Nut

- ☐ 95 Nm

## 33 - Toothed belt pulley on high-pressure pump

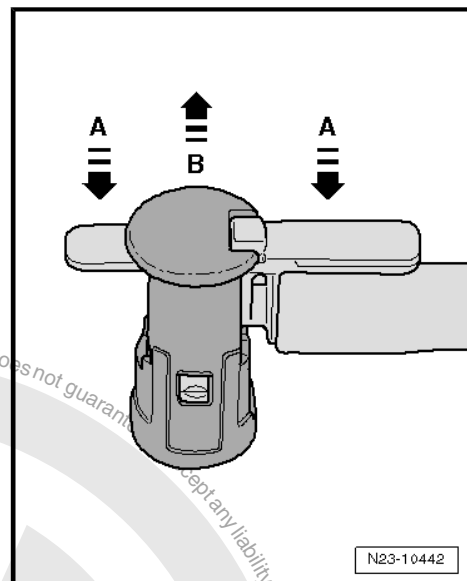
## 34 - Fuel temperature sender - G81-





### Release fuel return line

- With engine switched off, carefully pull return line connections off at piezo injectors. To do this, press the two clips downwards -arrow A- and, at the same time, pull the release bolt upwards -arrow B-.

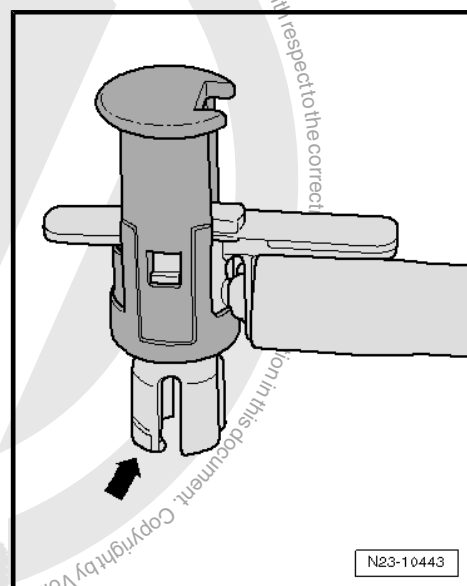


### Check locks



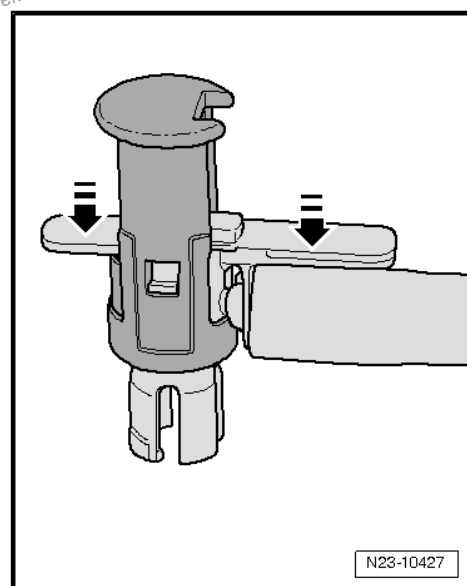
#### Caution

- Carefully pull fuel return lines upwards when disconnecting as the 4 catches -arrow- can fracture.*
- After disconnecting, check the 4 catches -arrow- to see whether they are fractured or have broken off.*
- Always replace damaged fuel return lines.*
- A damaged fuel return line that becomes loose when engine is running causes damage to piezo injectors. The piezo injector must then be replaced.*
- The engine must not be run when the fuel return line is disconnected, this is because the coupling chamber will be emptied due to the lack of the counterpressure.*



### Fit fuel return line

- Apply a thin coating of diesel fuel to the new O-rings on the return-line connections.
- Connect fuel return line and press the two clips downwards as far as they will go -arrows-.

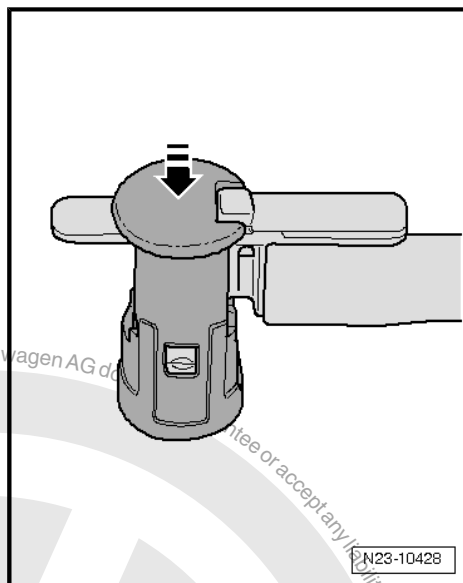






### Lock fuel return line

- After fuel return line has been pushed on completely, press the locking bolt downwards -arrow-.



## 1.4 Checking fuel system for leaks



### DANGER!

- ♦ *Observe safety precautions when working on the injection system ➔ [page 4](#) .*
- ♦ *Observe rules for cleanliness ➔ [page 8](#) .*

*Follow these instructions before starting work and while working on system.*

- 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, 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, erase event memory and then continue road test.*

- Then check high-pressure section again for leaks.

## 1.5 Filling/bleeding fuel system



### Caution

*After new or removed parts such as the fuel filter or fuel lines have been fitted, the high-pressure pump must be filled with fuel before the engine is started for the first time. Avoid allowing the high-pressure pump to run dry under all circumstances.*



**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 function "Bleed fuel system".

**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.
- Check fuel system for leaks.
- Read event memory and, if necessary, delete 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 the engine and erase the fault memory. Then continue road test.*
- ◆ *Then check high-pressure part of fuel system again for leakage.*
- Read event memory again.





## 2 Vacuum system

⇒ "2.1 Schematic diagram - vacuum system", page 318

⇒ "2.2 Testing vacuum system for leaks", page 321

⇒ "2.2.1 Checking vacuum hoses leading to non-return valve, solenoid valves N220 and N75 changeover valve N345", page 322

⇒ "2.2.2 Checking vacuum hose leading to changeover valve for exhaust gas recirculation cooler N345", page 324

⇒ "2.2.3 Checking vacuum hose to vacuum unit on turbocharger", page 324

⇒ "2.2.4 Checking vacuum hose to vacuum unit on exhaust gas recirculation cooler", page 325

### 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 - Exhaust gas recirculation cooler changeover valve - N345-

- ☐ Checking ⇒ [page 401](#) .

## 2 - Bracket

- ☐ Attach bracket to bottom of air filter housing  
⇒ [page 320](#)

## 3 - Bolt

- ☐ 1 Nm

## 4 - Connection to air filter

## 5 - Vacuum unit

- ☐ Vacuum unit is installed on exhaust gas recirculation cooler. Both parts can only be renewed together.
- ☐ Connection of vacuum hose to vacuum unit  
⇒ [page 320](#)

## 6 - T-piece

- ☐ Installed between brake servo and vacuum pump.
- ☐ Connection of vacuum hose to T-piece  
⇒ [page 320](#)

## 7 - Regulating flap potentiometer - G584-

- ☐ With vacuum unit with potentiometer
- ☐ On turbocharger.
- ☐ Connection of vacuum hose to regulating flap ⇒ [page 320](#)
- ☐ Checking ⇒ [page 401](#) .
- ☐ Removing and installing ⇒ [page 278](#) .

## 8 - Vacuum line

- ☐ Fastened with cable ties

## 9 - Cylinder head cover

- ☐ Vacuum reservoir is installed in cylinder head cover. Both parts can only be renewed together.
- ☐ Connection of vacuum hose to cylinder head cover ⇒ [page 320](#)

## 10 - Exhaust gas flap valve - N220-

- ☐ Checking ⇒ [page 255](#) .
- ☐ 6 Nm

## 11 - To vacuum unit on turbocharger

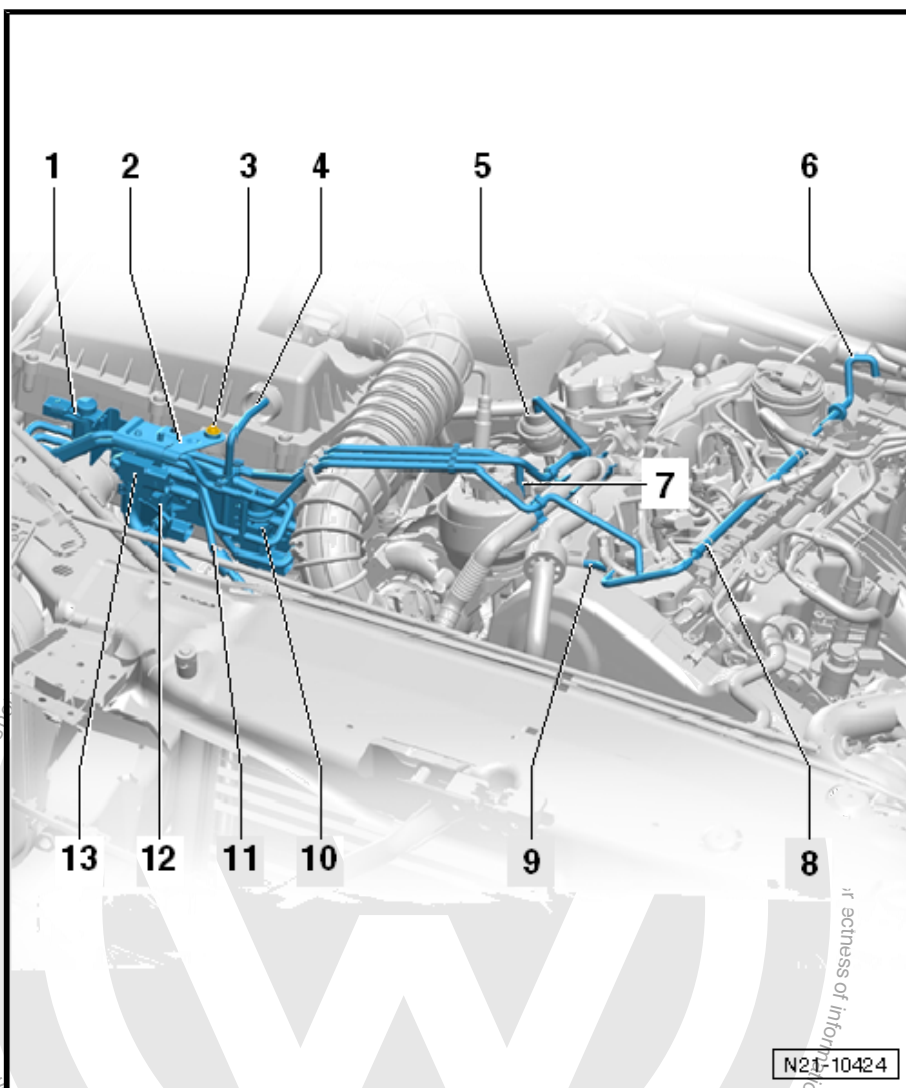
- ☐ Vacuum unit not available as a separate part.

## 12 - Charge pressure control solenoid valve - N75-

- ☐ With individual air filter.
- ☐ Checking ⇒ [page 322](#) .
- ☐ 6 Nm

## 13 - Charge pressure sender 2 - G447-

- ☐ Old fitting location ⇒ [page 321](#)



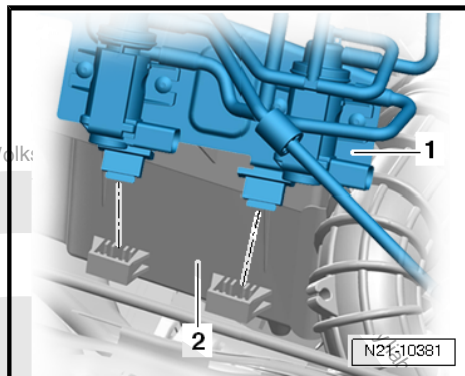




- ❑ New fitting location: fastened to solenoid valve bracket

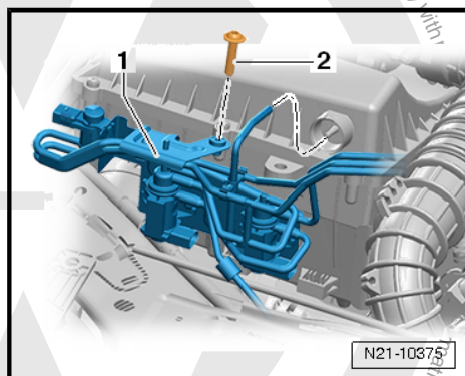
### Secure bracket to bottom of air filter housing

- Insert bracket together with valves -1- at bottom into mountings on air filter housing -2-.



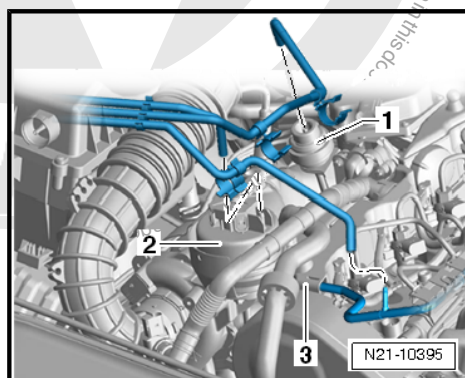
### Secure bracket to top of air filter housing

- Fit and tighten bolt holding bracket with valves -1- to top of air filter housing -2-.



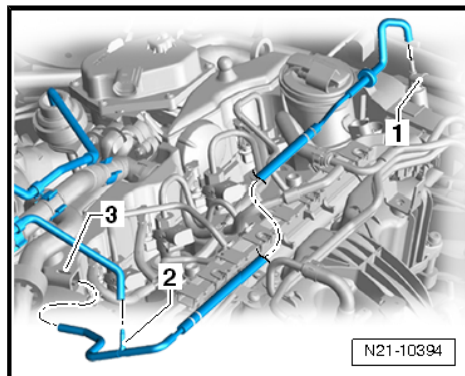
### Installation of vacuum lines on engine on right-hand side

- 1 - Connect vacuum hose to vacuum unit of cooler for waste gas recirculation.
- 2 - Connect vacuum hose to regulating flap potentiometer - G584- .
- 3 - Connect vacuum hose of recirculation valve leading to cylinder head cover.



### Installation of vacuum lines on engine on left-hand side

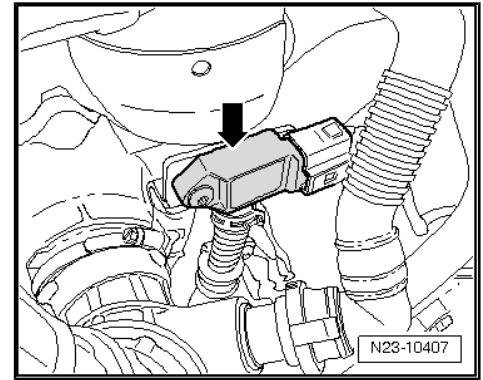
- 1 - Connect vacuum hose to junction piece on vacuum pump.
- 2 - Connect vacuum hose of recirculation valve leading to junction piece.
- 3 - Connect vacuum hose of junction piece leading to cylinder head cover.







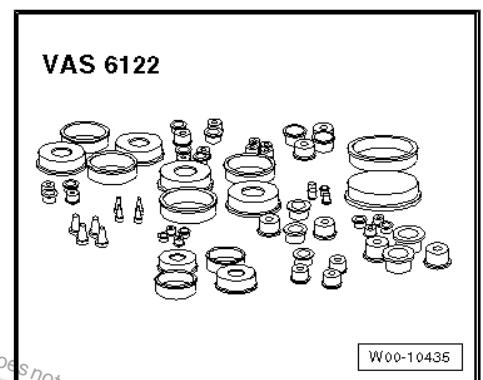
Charge pressure sender 2 - G447- -arrow-



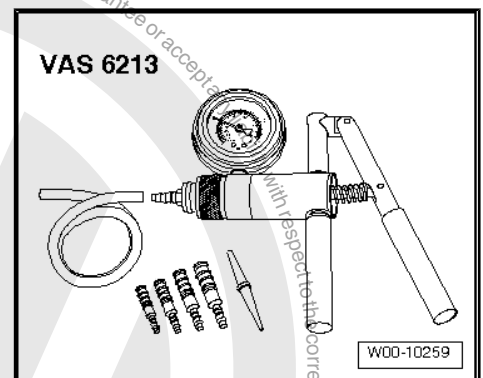
## 2.2 Testing vacuum system for leaks

Special tools and workshop equipment required

- ◆ Engine bung set - VAS 6122-



- ◆ Hand vacuum pump - VAS 6213-



### 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.**

Checking vacuum hoses to non-return valve, exhaust gas flap valve - N220- , charge pressure control solenoid valve - N75- changeover valve for exhaust gas recirculation cooler - N345- and vacuum reservoir ➔ [page 322](#)

Checking vacuum hose to regulating flap potentiometer - G584- ➔ [page 324](#)

Checking vacuum hose to vacuum unit on turbocharger ➔ [page 324](#)





Checking vacuum hose to vacuum unit on exhaust gas recirculation cooler ➔ [page 325](#)

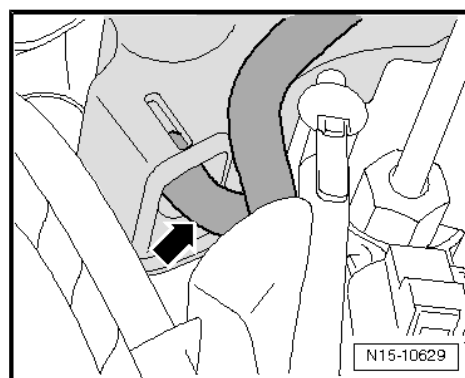
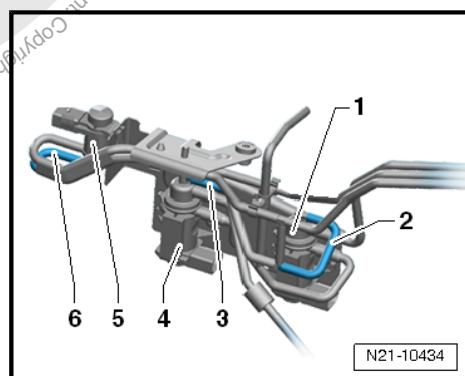
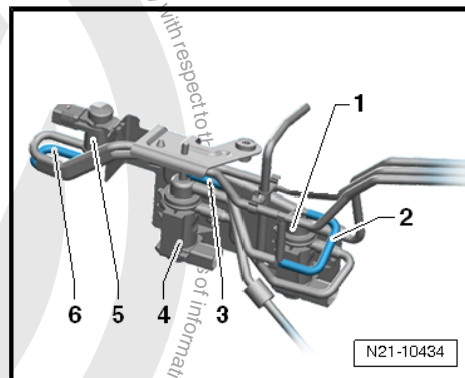
## 2.2.1 Checking vacuum hoses leading to non-return valve, solenoid valves -N220- and -N75- changeover valve -N345-

### Test procedure

- Pull vacuum hose -3- off at outer connection of exhaust gas flap valve - N220- -4-.
- Pull vacuum hose -2- off at outer connection of charge pressure control solenoid valve - N75- -1-.
- Pull vacuum hose -6- off at outer connection of changeover valve for exhaust gas recirculation cooler - N345- -5-.
- Connect hand vacuum pump - VAS 6213- to the 3 valves one after the other and then generate a vacuum of 0.6 bar.
- Observe pressure gauge of hand vacuum pump - VAS 6213- for approx. 30 seconds.
- Vacuum must not drop.

If vacuum drops:

- Replace valve if it does not seal properly.
- Seal vacuum hoses -2, 3 and 6- with clean bungs from engine bung set - VAS 6122-.
- Seal connecting piece -2- with a clean bung from engine bung set - VAS 6122-.
- Pull vacuum hose -arrow- off vacuum reservoir. Seal opening of vacuum hose with clean bung from engine bung set - VAS 6122-.



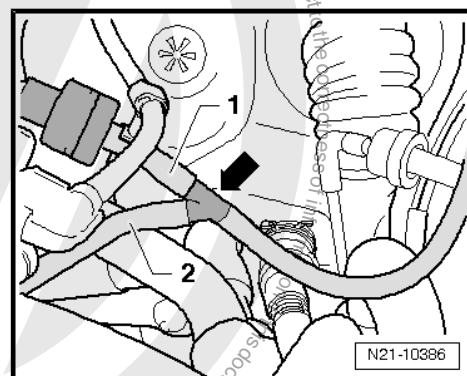
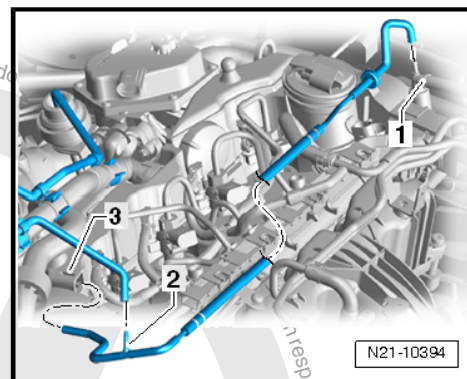




- Pull vacuum hose off T-piece -2-.
- Connect hand vacuum pump - VAS 6213- to removed vacuum hose and generate a vacuum of 0.6 bar.
- Observe pressure gauge of hand vacuum pump - VAS 6213- for approx. 30 seconds.
- Vacuum must not drop.

If vacuum drops:

- Locate damage or leaking vacuum hose connection. To do this, pull individual vacuum hoses off from relevant connection and check for leak to connected component.
- Pull off vacuum hoses -1- and -2- at connector -arrow- and check non-return valve and vacuum hose to exhaust gas recirculation cooler changeover valve - N345-.
- Locate damage or leaking vacuum hose connection.
- Renew non-return valve or leaking vacuum hose.
- Reconnect all vacuum hoses to valves and to union -arrow-.



- Pull vacuum hose -arrow- off vacuum reservoir. Seal opening of vacuum hose with clean bung from engine bung set - VAS 6122-.
- Connect hand vacuum pump - VAS 6213- to removed vacuum hose and generate a vacuum of 0.6 bar.
- Observe pressure gauge of hand vacuum pump - VAS 6213- for approx. 30 seconds.
- Vacuum must not drop.

If vacuum drops:

- Replace vacuum hose if it leaks -1-.

If pressure does not drop:

- Connect hand vacuum pump - VAS 6213- to vacuum reservoir and generate a vacuum of 0.6 bar.
- Observe pressure gauge of hand vacuum pump - VAS 6213- for approx. 30 seconds.
- Vacuum must not drop.

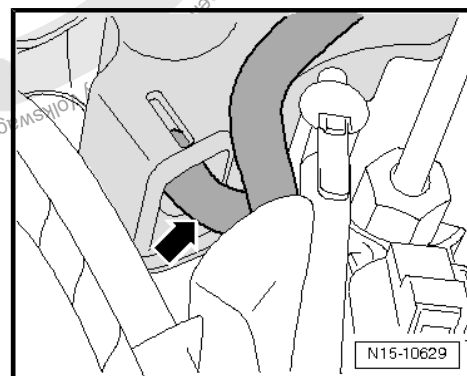
If vacuum drops:

- Replace cylinder head cover if it leaks ➔ [page 93](#).

If pressure does not drop:

- Check following vacuum hoses:

- ◆ Vacuum hose to regulating flap potentiometer - G584- ➔ [page 324](#)
- ◆ Vacuum hose to vacuum unit on turbocharger ➔ [page 324](#)
- ◆ Vacuum hose to vacuum unit on exhaust gas recirculation cooler ➔ [page 325](#)







## 2.2.2 Checking vacuum hose leading to changeover valve for exhaust gas recirculation cooler - N345-

### Test procedure

- Vacuum hoses to non-return valve, exhaust flap valve - N220- , charge pressure control solenoid valve - N75- , exhaust gas recirculation cooler changeover valve - N345- and vacuum reservoir must first have been checked for leaks  
⇒ [page 322](#) .

- Pull vacuum hose off at middle connection of exhaust gas flap valve - N220- .
- Connect hand vacuum pump - VAS 6213- to removed vacuum hose and generate a vacuum of 0.6 bar.
- Observe pressure gauge of hand vacuum pump - VAS 6213- for approx. 30 seconds.
- Vacuum must not drop.

If vacuum drops:

- Pull vacuum hose -arrow- off regulating flap potentiometer - G584- . Seal opening of vacuum hose with clean bung from engine bung set - VAS 6122- .
- Connect hand vacuum pump - VAS 6213- to pulled-off vacuum reservoir and generate a vacuum of 0.6 bar.
- Observe pressure gauge of hand vacuum pump - VAS 6213- for approx. 30 seconds.
- Vacuum must not drop.

If vacuum drops:

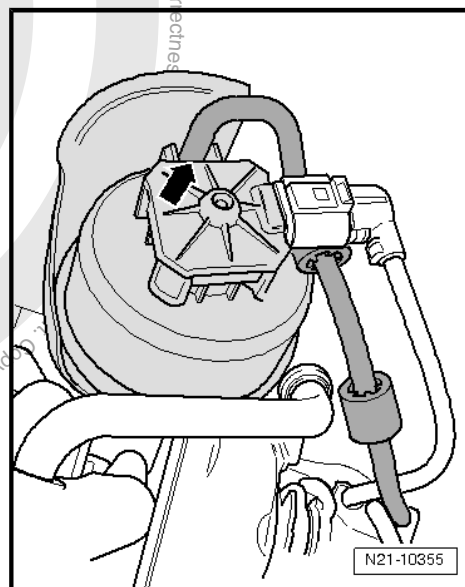
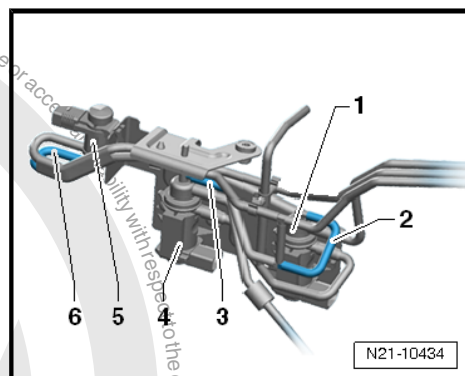
- Renew leaking vacuum hose.

If pressure does not drop:

- Connect hand vacuum pump - VAS 6213- to potentiometer for regulating flap - G584- and generate a vacuum of 0.6 bar.
- Observe pressure gauge of hand vacuum pump - VAS 6213- for approx. 30 seconds.
- Vacuum must not drop.

If vacuum drops:

- Replace turbocharger ⇒ [page 267](#) .



## 2.2.3 Checking vacuum hose to vacuum unit on turbocharger

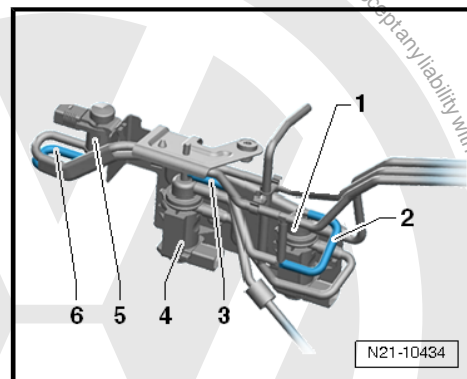
### Test procedure

- Vacuum hoses to non-return valve, exhaust flap valve - N220- , charge pressure control solenoid valve - N75- , exhaust gas recirculation cooler changeover valve - N345- and vacuum reservoir must first have been checked for leaks  
⇒ [page 322](#) .





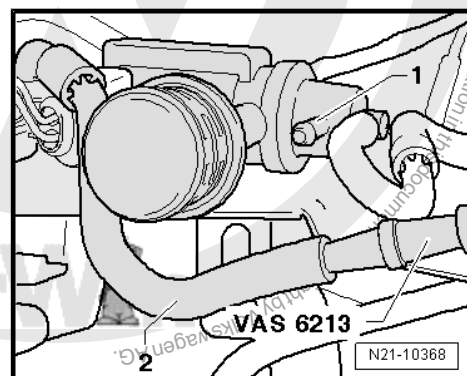
- Pull vacuum hose off at middle connection of charge pressure control solenoid valve - N75- -1-.



- Connect hand vacuum pump - VAS 6213- to removed vacuum hose -2- and generate a vacuum of 0.6 bar.
- Observe pressure gauge of hand vacuum pump - VAS 6213- for approx. 30 seconds.
- Vacuum must not drop.

If vacuum drops:

- Remove underbody guard, if fitted ⇒ Rep. gr. 66 .



- Pull vacuum hose -1- from vacuum unit -2-. Seal opening of vacuum hose with clean bung from engine bung set - VAS 6122- .
- Connect hand vacuum pump - VAS 6213- to pulled-off vacuum reservoir and generate a vacuum of 0.6 bar.
- Observe pressure gauge of hand vacuum pump - VAS 6213- for approx. 30 seconds.
- Vacuum must not drop.

If vacuum drops:

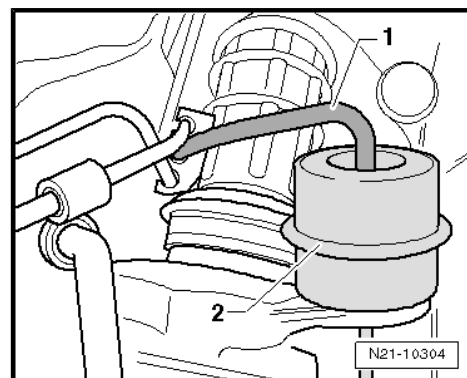
- Renew leaking vacuum hose.

If pressure does not drop:

- Connect hand vacuum pump - VAS 6213- to vacuum unit and generate a vacuum of 0.6 bar.
- Observe pressure gauge of hand vacuum pump - VAS 6213- for approx. 30 seconds.
- Vacuum must not drop.

If vacuum drops:

- Replace turbocharger ⇒ [page 267](#) .



## 2.2.4 Checking vacuum hose to vacuum unit on exhaust gas recirculation cooler

### Test procedure

- Vacuum hoses to non-return valve, exhaust flap valve - N220- , charge pressure control solenoid valve - N75- , exhaust gas recirculation cooler changeover valve - N345- and vacuum reservoir must first have been checked for leaks ⇒ [page 322](#) .





- Pull vacuum hose off at central connection of changeover valve for exhaust gas recirculation cooler - N345- -5-.
- Connect hand vacuum pump - VAS 6213- to removed vacuum hose and generate a vacuum of 0.6 bar.
- Observe pressure gauge of hand vacuum pump - VAS 6213- for approx. 30 seconds.

- Vacuum must not drop.

If vacuum drops:

- Bring lock carrier into service position ⇒ General body repairs; Rep. gr. 50 ; Body - front; Lock carrier service position .

- Pull off vacuum hose -arrow 2-. Seal opening of vacuum hose with clean bung from engine bung set - VAS 6122- .
- Connect hand vacuum pump - VAS 6213- to pulled-off vacuum reservoir and generate a vacuum of 0.6 bar.
- Observe pressure gauge of hand vacuum pump - VAS 6213- for approx. 30 seconds.

- Vacuum must not drop.

If vacuum drops:

- Renew leaking vacuum hose.

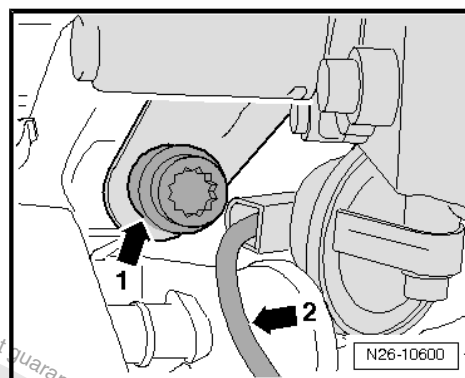
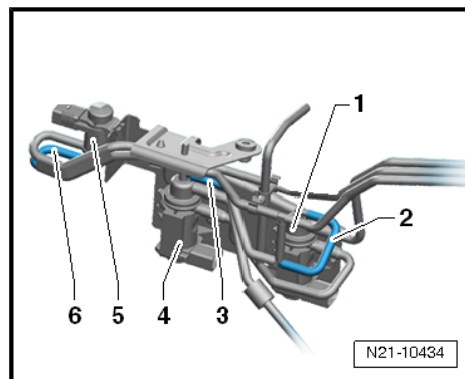
If pressure does not drop:

- Connect hand vacuum pump - VAS 6213- to vacuum unit and generate a vacuum of 0.6 bar.
- Observe pressure gauge of hand vacuum pump - VAS 6213- for approx. 30 seconds.

- Vacuum must not drop.

If vacuum drops:

- Replace exhaust gas recirculation cooler ⇒ [page 251](#) .







### 3 Injectors and high-pressure accumulator (rail)

⇒ [“3.1 Overview of injectors”, page 327](#)

⇒ [“3.2 Injector delivery calibration”, page 327](#)

⇒ [“3.3 Removing and installing injectors \(piezo injectors\)”, page 328](#)

⇒ [“3.4 Removing and installing injectors \(solenoid valves\)”, page 332](#)

⇒ [“3.5 Removing and installing high-pressure lines”, page 338](#)

⇒ [“3.6 Removing and installing high-pressure accumulator \(rail\)”, page 340](#)

⇒ [“3.7 Checking return flow rate of injectors with engine running”, page 343](#)

#### 3.1 Overview of injectors

Engine codes	Solenoid valves with restrictor	Piezo injectors with pressure retention valve
CDBA, CDCA		X
CNEA, CNFA, CSHA	X	

#### 3.2 Injector delivery calibration

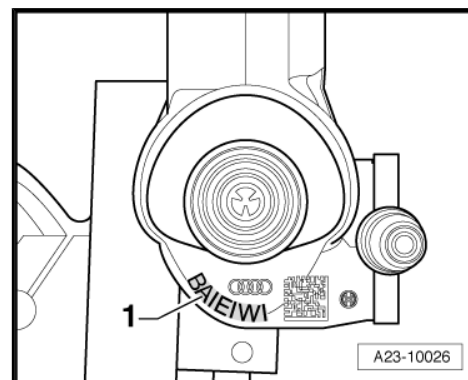
Special tools and workshop equipment required

- ◆ Vehicle diagnostic tester

Check “injector delivery calibration” adaptation

The function “injector delivery calibration” serves to correct the injection rates for each cylinder of a common rail system individually across the entire map range.

The 7-digit adaptation values -1- (details in illustration are only an example) are marked separately on each piezo injector. They may consist of letters and/or numbers (ASCII code).





**Table of characters for reading the characters on the injector.**

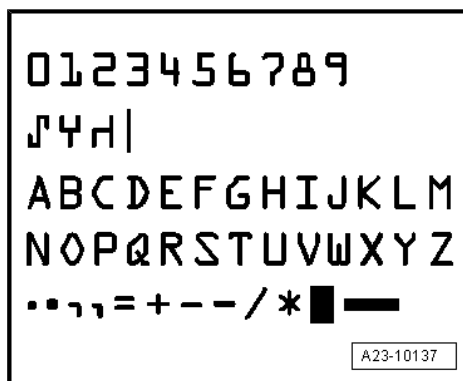
When a new injector is installed, the adaptation value for the new injector must be written to the engine control unit.

When the engine control unit is renewed, the "injector delivery calibration values" must be written into the new engine control unit.

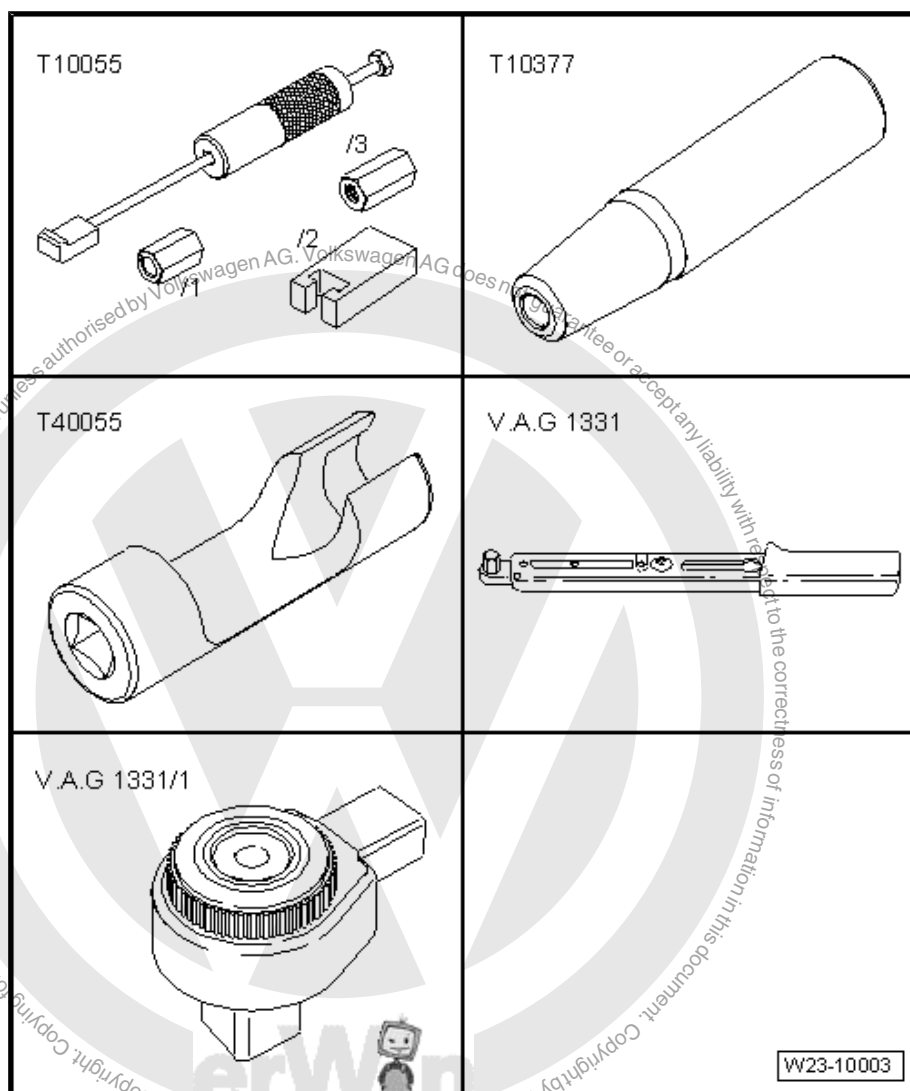
The work procedure for the adaptation is described in ⇒ Vehicle diagnostic tester.

Also check that the "injector delivery calibration" values are correctly entered for all the other injectors. Do NOT attempt to re-enter these calibration values if the correct values are already stored in the engine control unit.

Select "Adapt injector delivery calibration" ⇒ Vehicle diagnostic tester.

**3.3 Removing and installing injectors (piezo injectors)****Special tools and workshop equipment required**

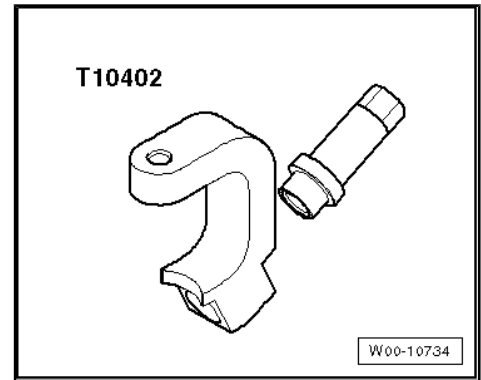
- ◆ Puller - T10055-
- ◆ Assembly sleeve - T10377-
- ◆ Socket - T40055-
- ◆ Torque wrench (5...50 Nm) - V.A.G 1331-
- ◆ Ratchet - V.A.G 1331/1-







◆ Puller - T10402-

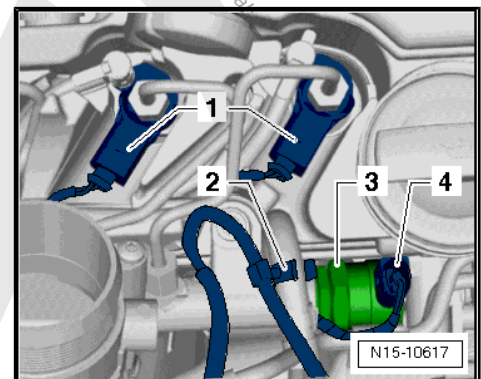


**Caution**

- *Do not interchange removed piezo injectors.*
- *When a new piezo injector is installed, the adaptation value for the new injector must be entered in the engine control unit ➔ Vehicle diagnostic tester.*

**Removing**

- Pull off connector -1- at piezo injector to be removed.

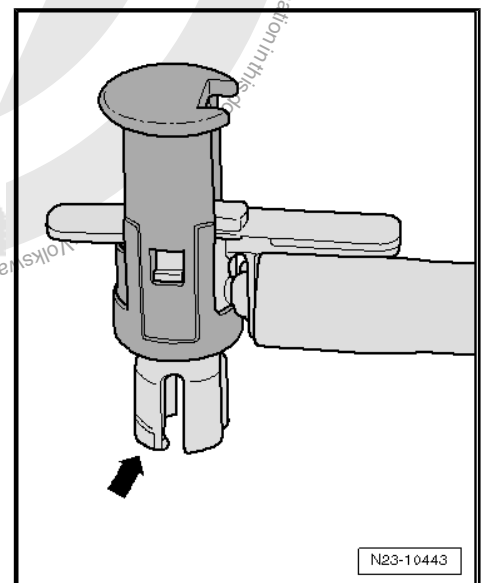


**Disconnecting fuel return lines**



**Caution**

- *Carefully pull fuel return lines upwards when disconnecting as the 4 catches -arrow- can fracture.*
- *After disconnecting, check the 4 catches -arrow- to see whether they are fractured or have broken off.*
- *Always replace damaged fuel return lines.*
- *A damaged fuel return line that becomes loose when engine is running causes damage to piezo injectors. The piezo injector must then be replaced.*
- *The engine must not be run when the fuel return line is disconnected, this is because the coupling chamber will be emptied due to the lack of the counterpressure.*







- With engine switched off, carefully pull return line connections off at piezo injectors. To do this, press the two clips downwards -arrow A- and, at the same time, pull the release bolt upwards -arrow B-.

**Note**

Ensure cleanliness. It must be assured that no dirt gets into the disconnected fuel return lines or the open connections of the piezo injectors.

- Unscrew high-pressure line ➔ [Item 9 \(page 312\)](#) between high-pressure accumulator (fuel rail) and injectors to be removed.
- Remove bolts ➔ [Item 21 \(page 313\)](#) of the injectors to be removed.

- Place puller - T10055- with adapter - T10055/1- in position as shown and pull injector out downwards with tapping movements.

**Installing**

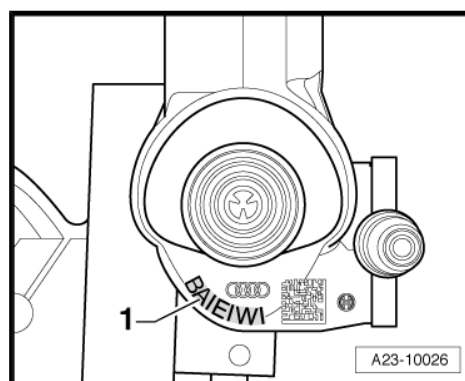
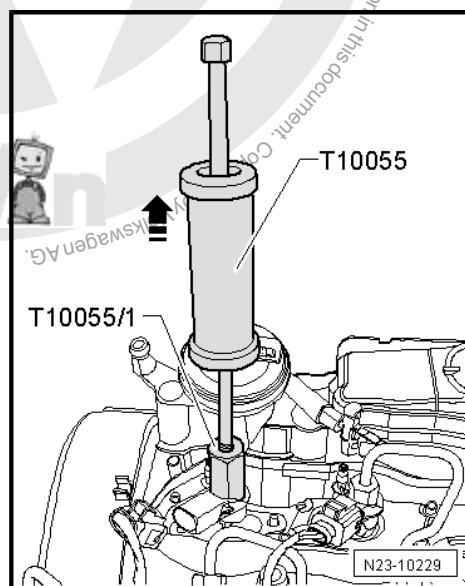
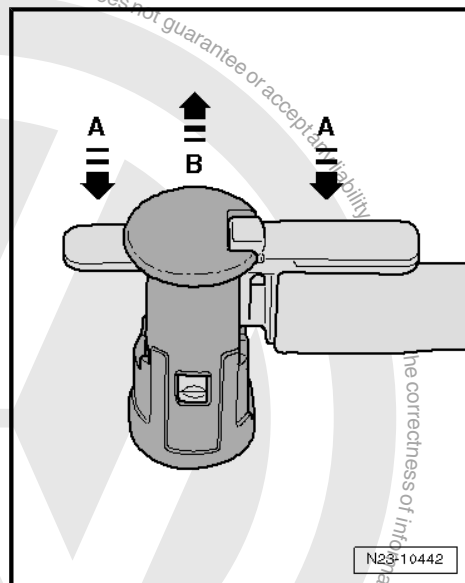
Installation is carried out in the reverse order; note the following:

- The 7-digit adaptation values -1- (details in illustration are only an example) are marked separately on each piezo injector. Read off and note down this value before installing new piezo injector.

**Important instructions for installation of piezo injectors:**

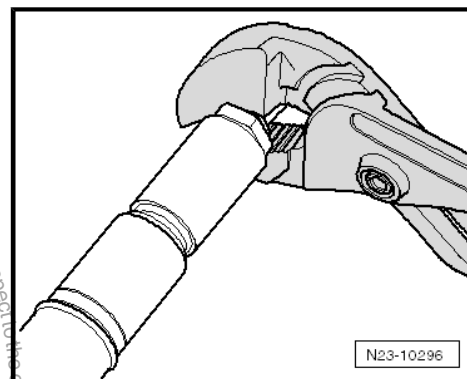
- When removing and installing, always renew the following components and seals/O-rings: "copper seal", "O-ring for injector bore", "O-ring for injector return connection".
- Used piezo injectors may only be re-installed on the cylinder they were removed from.
- Make sure that the piezo injector and the installation area are clean before installing.
- Piezo injector must not be damaged in any way.
- Lubricate all O-rings with diesel before installing.

If a used piezo injector is being re-installed:

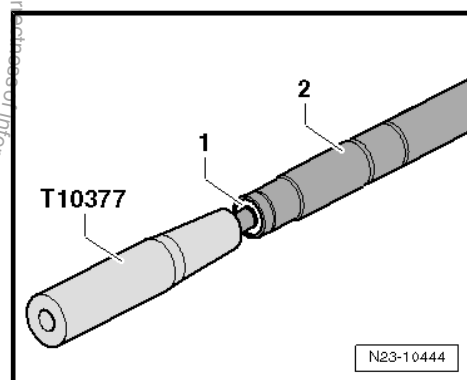




- To remove the old copper seal from the piezo injector, carefully clamp the copper seal in a pair of pliers so the copper seal is just prevented from spinning. Then carefully pull and twist the piezo injector out of the copper seal by hand.
- Clean piezo injector tip and sealing surface.



- Fit new copper seal -1- on piezo injector -2- with help of assembly sleeve - T10377-. Use "narrow" side of assembly sleeve - T10377- for this.
- Carefully slide new O-ring over fuel return connection to avoid damaging O-ring.
- Clean sealing surface of injector in cylinder head and injector shaft.

**WARNING**

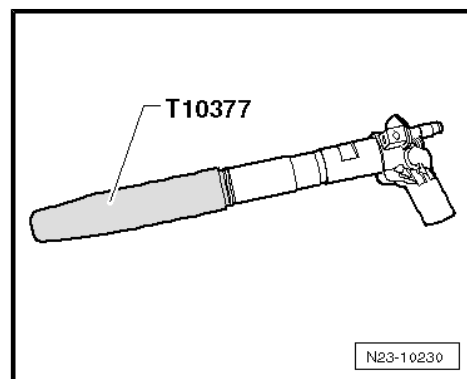
**Only cleaning set - VAS 6811- may be used for cleaning sealing surface of injector bore.**

**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 seal for injector shaft. Use assembly sleeve - T10377- to do this.
- Push clamping plate onto piezo injectors.

Piezo injectors are installed "dry". Therefore, do not install with any fluid to facilitate assembly.

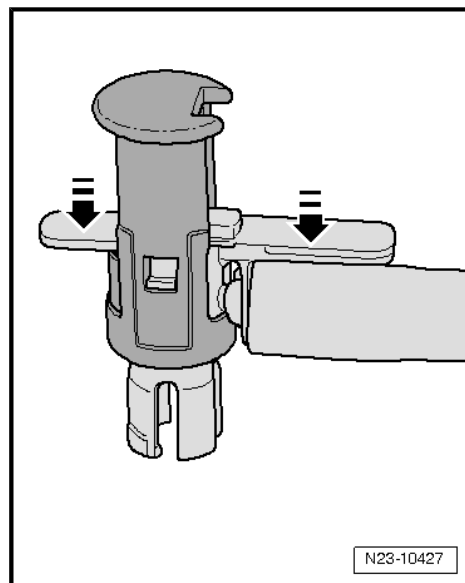
- Insert piezo injectors with clamping plate into injector bores without exerting excessive force.
- Check O-rings for damage. Replace damaged O-rings.
- Apply a thin coating of diesel fuel to the new O-rings on the return-line connections.







- Connect fuel return line and press the two clips downwards as far as they will go -arrows-.



- After fuel return line has been pushed on completely, press the locking bolt downwards -arrow-.
- Install high-pressure lines ➔ [page 338](#).

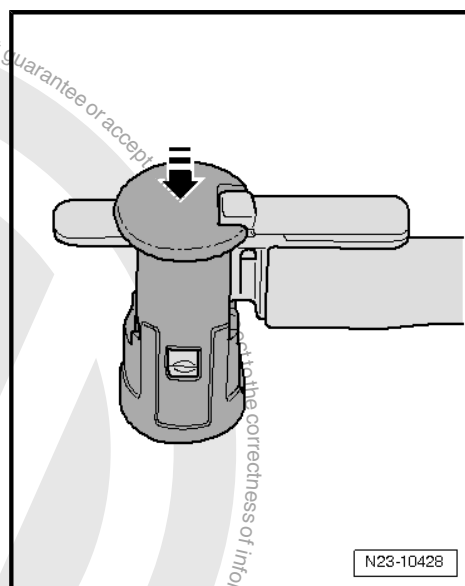


#### Note

After renewing one or more injectors, the "injector delivery calibration" values for the new injectors must be written into the engine control unit with ➔ Vehicle diagnostic tester ➔ [page 327](#).

#### Specified torques

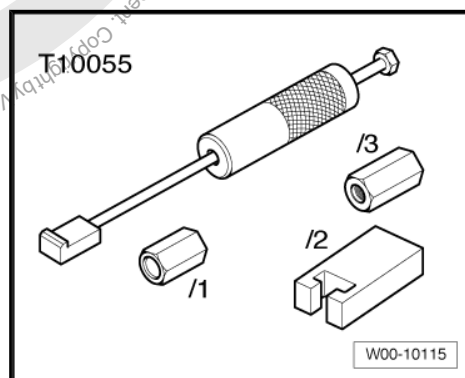
- ♦ ➔ ["1.3 Assembly overview - fuel system", page 311](#)



### 3.4 Removing and installing injectors (solenoid valves)

#### Special tools and workshop equipment required

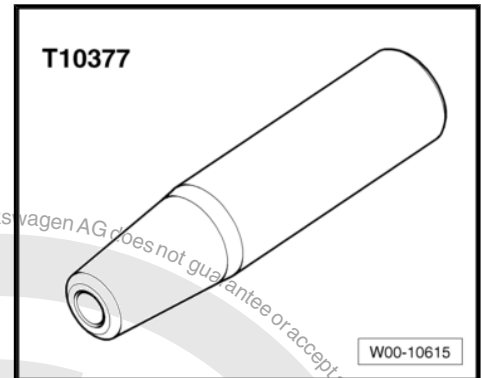
- ♦ Puller - T10055-







◆ Assembly sleeve - T10377-



◆ Puller -T10415-

Removing



**WARNING**

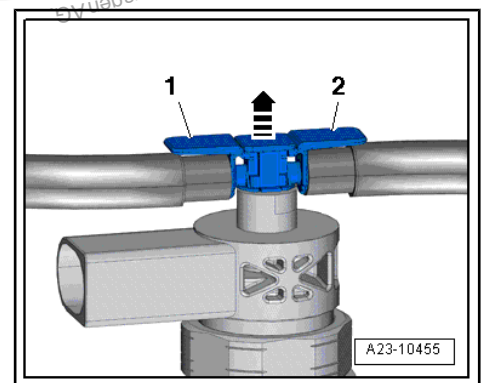
- ◆ *Read rules for cleanliness and the instructions for working on the fuel system ⇒ [page 8](#) .*
- ◆ *Always follow these rules for cleanliness and instructions before starting work and while working on the fuel system.*



**Caution**

- ◆ *Mark allocation of injectors to cylinders. They must always be re-installed on the same cylinders.*
- ◆ *Observe rules for cleanliness when working on the injection system.*
- ◆ *The open connections must be sealed with a suitable cap.*

- Pull return line connections off injectors. To do this, press the catches -1- and -2- downwards and, at the same time, pull the release pin upwards -arrow-.







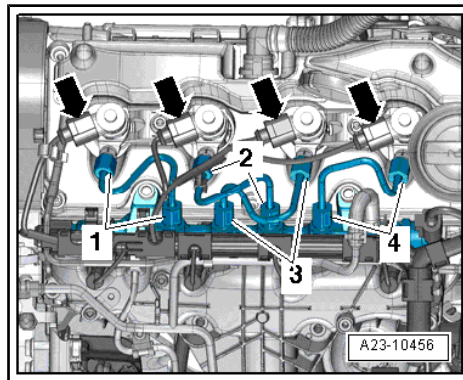
- Detach connectors -arrows- from injectors.



**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- and pull injector out upwards using tapping movements.

**Note**

*Pull injector out using rotary movements in order not to damage sealing lip.*

- Place the removed injectors on a clean cloth.

**Installing new injectors**

When a fitting a new injector, the following must be replaced:

- ◆ Copper seal
- ◆ O-ring 3 for shaft of injector
- ◆ O-ring for fuel return connection

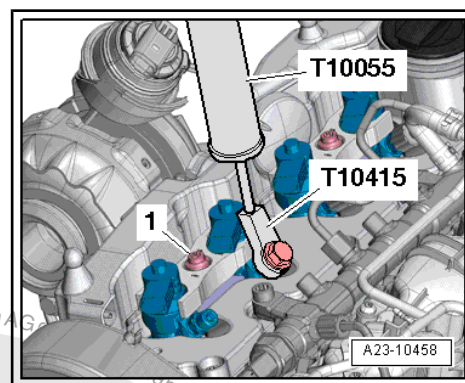
**Note**

- ◆ *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 line hole must not be deformed, constricted or damaged.*
- ◆ *Corroded lines should no longer be used.*

**Installing used injectors**

When a used injector is re-fitted, the following must be replaced:

- ◆ Copper seal
- ◆ O-ring 3 for shaft of injector
- ◆ O-ring for fuel return connection
- Spray tip of injector with an 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 the old copper seal from the injector, clamp the seal carefully in a vice so that it is just held between the 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.
- Clean sealing surface of injector in cylinder head and injector shaft.







**WARNING**

*Only cleaning set - VAS 6811- may be used for cleaning sealing surface of 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-.*







- Replace O-ring for shaft of injector. Use assembly sleeve - T10377- to do this.
- Install injectors.

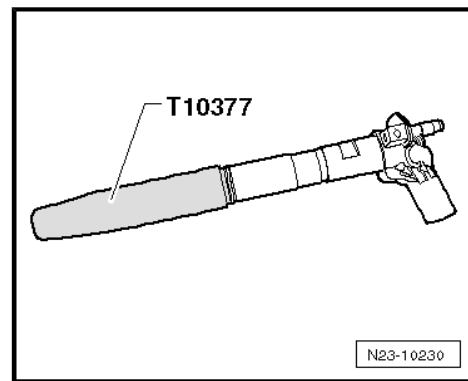
**Note**

*If any of the seals for injectors in cylinder head cover are damaged, replace the affected seal.*

- Tighten union nuts of high-pressure lines hand-tight. Check they are seated without stress.
- Tighten high-pressure lines to specified torque.
- 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 316](#).

Renew the affected component if leakage still occurs after tightening to the correct torque.

**Note**

*The return lines can only be renewed complete.*

Then, road-test the vehicle for more than 20 km. Accelerate with full throttle at least once. Then check high-pressure part 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. Stop engine and delete event memory ⇒ Vehicle diagnostic tester. Then continue the road test.*

**Specified torques**

- ◆ ⇒ ["1.3 Assembly overview - fuel system", page 311](#)

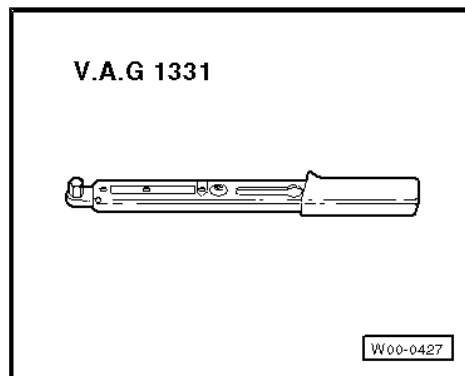




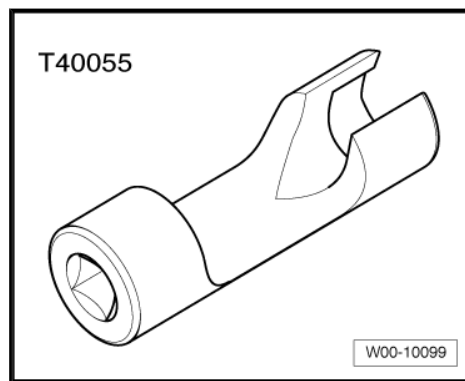
### 3.5 Removing and installing high-pressure lines

#### Special tools and workshop equipment required

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



- ◆ Socket - T40055-



#### Removing



#### Caution

- ◆ *Mark high-pressure lines to indicate which ones belong to which cylinders. They must always be re-installed on the same cylinders.*
- ◆ *Open connections must be sealed immediately with a suitable cap.*
- ◆ *Do not crush or damage fuel return lines during removal or installation.*
- ◆ *The engine must not be run when the fuel return line is disconnected, this is because the coupling chamber will be emptied due to the lack of the counterpressure.*

- 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 the injection lines which were previously fitted are to be used again, the points listed under ➔ **Item 9 (page 312)** must be checked again. Apart from that the procedure is identical.*

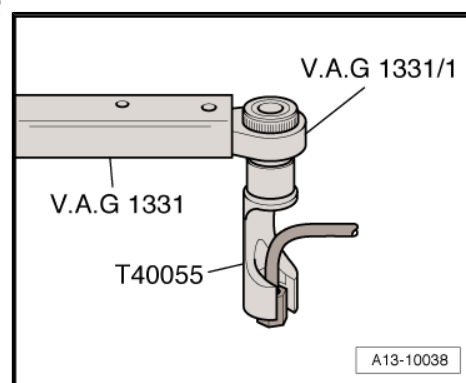
### Installing individual injection lines (cylinders 1...4, between high-pressure accumulator (fuel rail) and injector)

- 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 high-pressure accumulator (fuel rail) bolts again, if necessary. Specified torque ➔ **Item 11 (page 312)**.
- Tighten union nuts of all new injection lines using torque wrench (5...50 Nm) - V.A.G 1331- and socket bit - T40055- . Specified torque ➔ **Item 9 (page 312)**.

### Installing fuel line between high-pressure pump and high-pressure accumulator (fuel rail) or complete wiring harness

**Note**

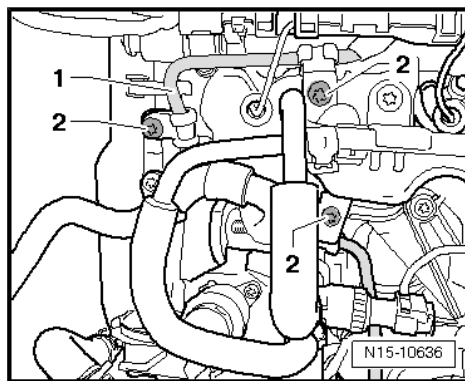
- ◆ *If high-pressure lines are used again, bear in mind the markings you have already made on them.*
- ◆ *High-pressure lines may be re-used after the following checks:*
- ◆ *Check taper seat of respective high-pressure line for deformation and cracks.*
- ◆ *Line hole must not be deformed, constricted 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 wiring harness needs to be installed, adopt the same procedure for all 4 injection lines.



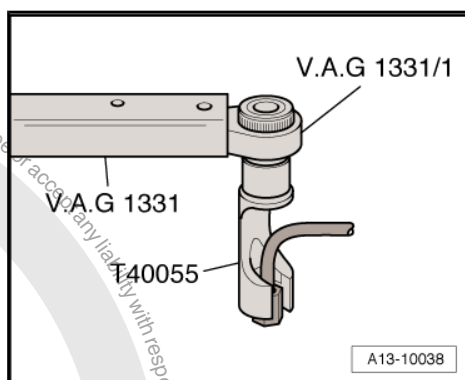




- Fit all fastening clips to the fuel line. Make sure they are aligned correctly.
- Screw in the screws -2- of the clips approx. 3 turns of the screw.
- Tighten high-pressure accumulator (fuel rail) bolts again. Specified torque ⇒ [Item 11 \(page 312\)](#) .
- Tighten clamp on top of intake manifold.



- Tighten union nuts of all new injection lines using torque wrench (5...50 Nm) - V.A.G 1331- and socket bit - T40055- . Specified torque ⇒ [Item 9 \(page 312\)](#) .
- Then, tighten 2 remaining securing bolts.
- Press return line connections carefully over the seals and onto the injectors and check seal for damage. You should hear them click into place. Then press the release pin downwards carefully.
- Filling fuel system ⇒ [page 316](#) .



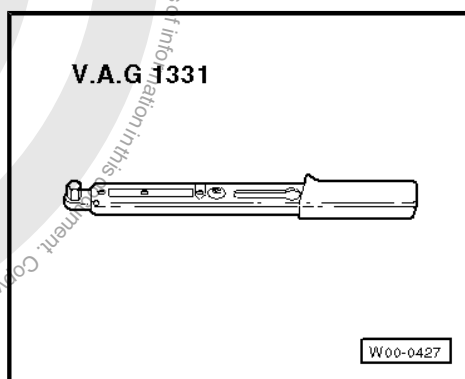
#### Specified torques

- ♦ ⇒ ["1.3 Assembly overview - fuel system", page 311](#)

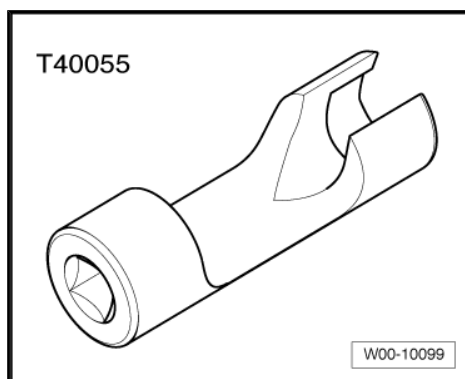
### 3.6 Removing and installing high-pressure accumulator (rail)

#### Special tools and workshop equipment required

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



- ♦ Socket - T40055-

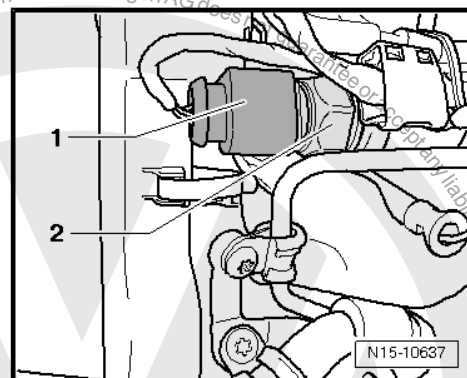




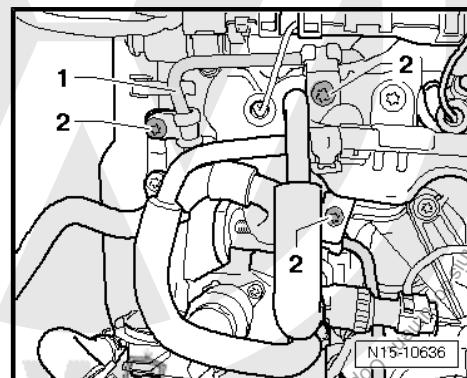


## Removing

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



- Unscrew bolts -2- for fuel line -1-.

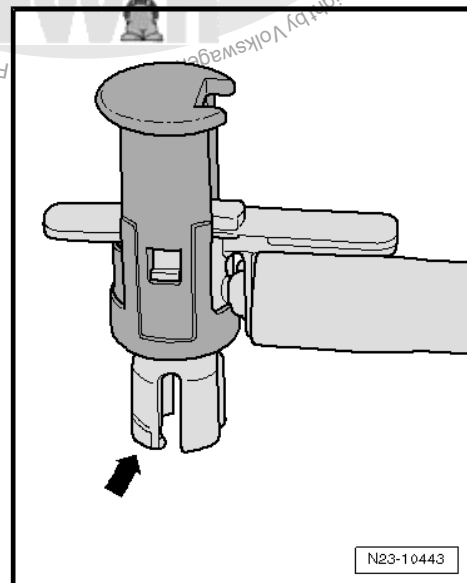


## Disconnecting fuel return lines



### Caution

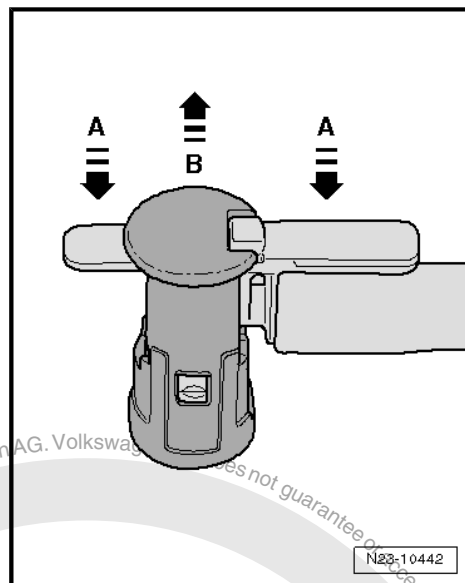
- *Carefully pull fuel return lines upwards when disconnecting as the 4 catches -arrow- can fracture.*
- *After disconnecting, check the 4 catches -arrow- to see whether they are fractured or have broken off.*
- *Always replace damaged fuel return lines.*
- *A damaged fuel return line that becomes loose when engine is running causes damage to piezo injectors. The piezo injector must then be replaced.*
- *The engine must not be run when the fuel return line is disconnected, this is because the coupling chamber will be emptied due to the lack of the counterpressure.*



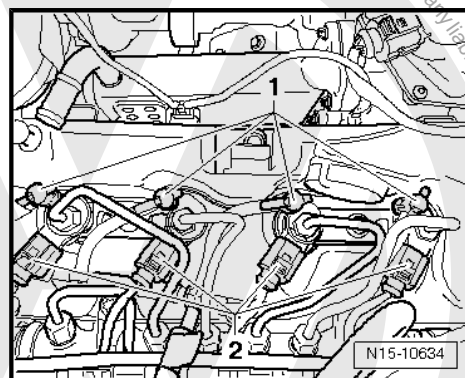




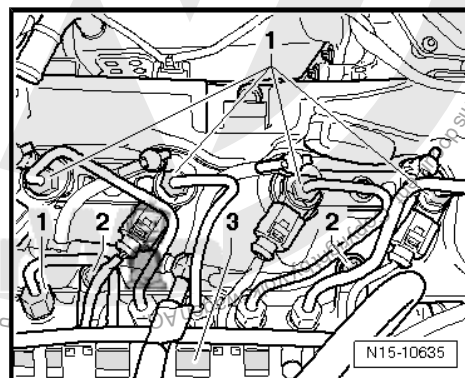
- With engine switched off, carefully pull return line connections off at piezo injectors. To do this, press the two clips downwards -arrow A- and, at the same time, pull the release bolt upwards -arrow B-.



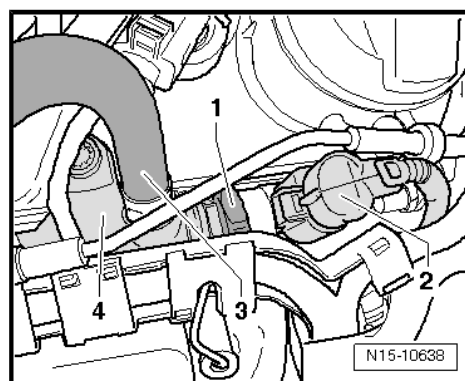
- Pull all fuel return lines -1- off piezo injectors.
- Release connectors -2- and pull them off piezo injectors.



- Unscrew union nuts -1- from piezo injectors.
- Ensure cleanliness. No dirt must be allowed to get into the disconnected fuel return lines or the open connections on the piezo injectors.
- Unscrew bolts -2- from high-pressure accumulator (fuel rail).
- Pull cable guide -3- from high-pressure accumulator (fuel rail).



- Unclip connector -2- and pull off from fuel pressure regulating valve - N276- -1-.
- Pull fuel hose -3- from high-pressure accumulator (fuel rail) -4-.







- Remove high-pressure accumulator (fuel rail) 1. Guide high-pressure accumulator (fuel rail) past fuel return line and fuel lines.
- Ensure cleanliness. No dirt may get into the injector holes on the cylinder head cover.

### Installing

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

- Install high-pressure lines (without tension).
- Observe instructions for installing high-pressure lines  
⇒ [page 338](#).
- The fuel system must first be filled with fuel before the engine is started ⇒ [page 316](#).

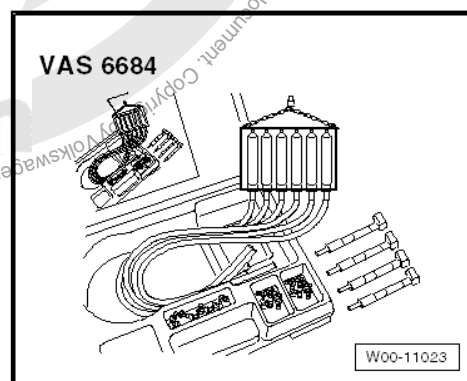
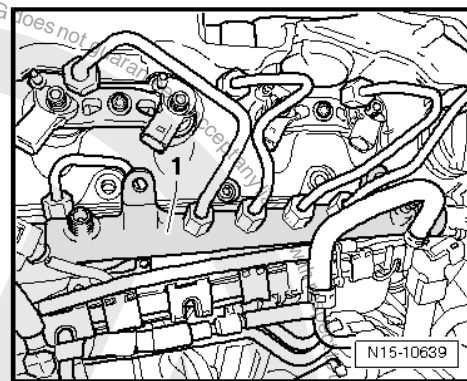
### Specified torques

- ◆ ⇒ [“1.3 Assembly overview - fuel system”, page 311](#)

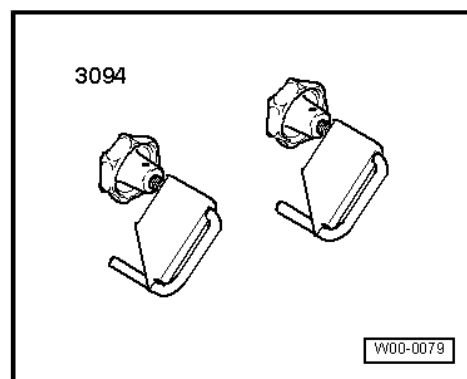
## 3.7 Checking return flow rate of injectors with engine running

### Special tools and workshop equipment required

- ◆ Return flow meter - VAS 6684-



- ◆ Hose clamps, up to Ø 25 mm - 3094-



### WARNING

*Wear eye protection and protective clothing to avoid eye injuries and skin contact. Before loosening hose connections, wrap a cloth around the connection. Then release pressure by carefully pulling hose off connection.*





## Procedure



### WARNING

- ◆ *Read rules for cleanliness and the instructions for working on the fuel system ⇒ **page 8**.*
- ◆ *Always follow these rules for cleanliness and instructions before starting work and while working on the fuel system.*
- ◆ *Wrap a clean cloth around the connection before opening the fuel system, then carefully loosen the connection to release the pressure.*



### Note

- ◆ *Adhere strictly to the rules for cleanliness; no dirt must be allowed to get into the disconnected return lines and the open return line connections.*
- ◆ *Clean all return line connections with commercially available degreaser before removing them.*
- ◆ *Dry all cleaned parts.*



### Note

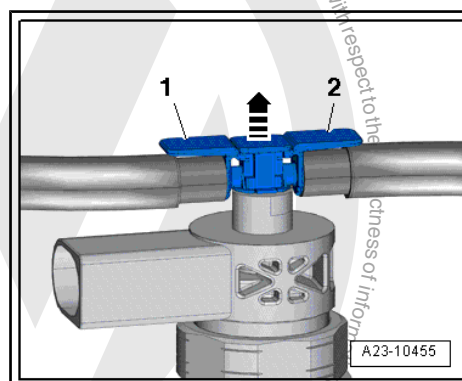
- ◆ *The test sequence is described for the solenoid valves with restrictor. The test sequence for piezo injectors with pressure retention valve is the same.*
- ◆ *For checking the return flow rate of the solenoid valves the "transparent" hoses of the return flow meter - VAS 6684- are required.*



### Note

*The hoses of the return flow meter - VAS 6684- must be of the same length.*

- Carefully pull return line connections off injectors. To do this, press tabs -1- and -2- downwards and simultaneously pull release pin -arrow- upwards.





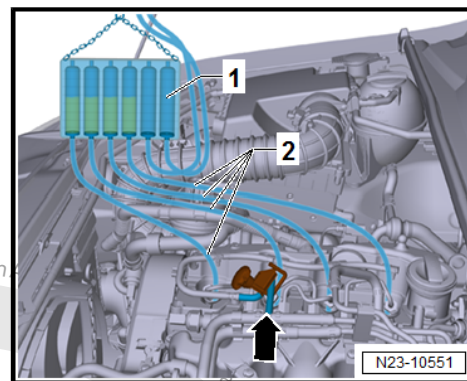


- Clamp off fuel return hose -arrow- using hose clamp up to 25 mm - 3094- .
- Connect the "transparent" hoses -2- of return flow meter - VAS 6684- -1- to the return line connections of all 4 injectors.

**Caution**

***Risk of damage to injectors when return lines are pulled off.***

- ◆ ***Do NOT press the accelerator during this test; the engine must only run at idling speed.***
- ◆ ***If one of the inspection glasses is about to overflow, terminate the measurement.***



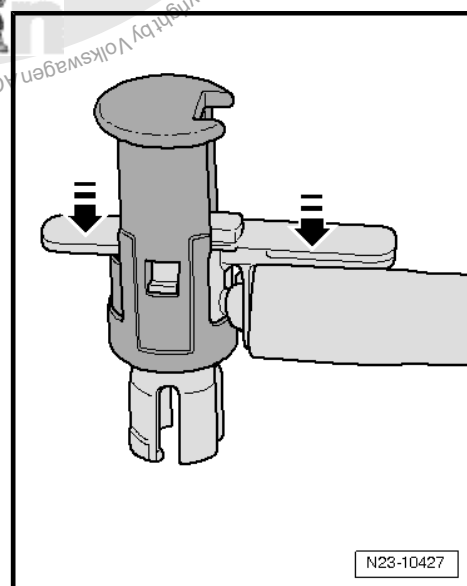
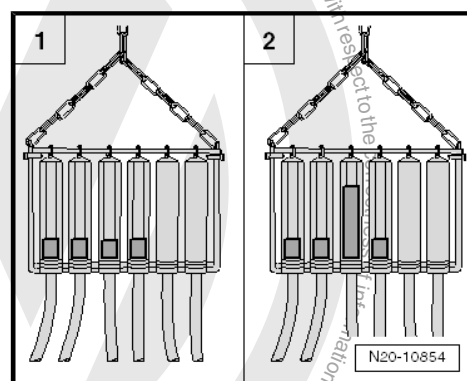
- Start engine and allow to idle for 3.5 minutes.
- When the engine is warm and running at idling speed the return flow rates at each of the 4 injectors must not differ by more than a small amount -1-.
- If the return flow rate of one injector is significantly higher than the return flow rate of the other injectors -2-, renew the respective injector, => [page 328](#) or => [page 332](#) .

**Installing**

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

**Note**

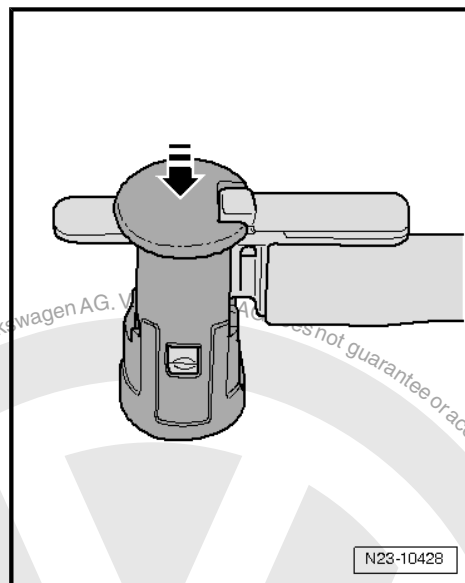
- ◆ ***The O-rings of all return line connections must be renewed.***
- ◆ ***Lubricate O-rings with engine oil or assembly oil before installing.***
- Carefully fit return lines onto injectors and press down tabs on side -arrows- until they engage audibly.







- Then carefully press the release pin downwards -arrow-.
- Check fuel system for leaks ⇒ [page 316](#) .







## 4 High-pressure pump

⇒ "4.1 Removing and installing high-pressure pump", page 347

⇒ "4.2 Checking high-pressure pump", page 350

### 4.1 Removing and installing high-pressure pump

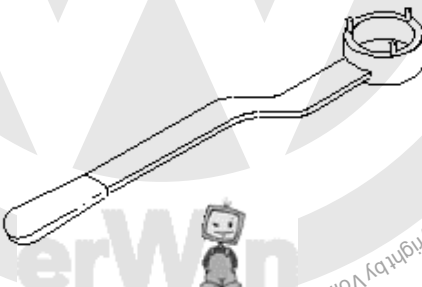
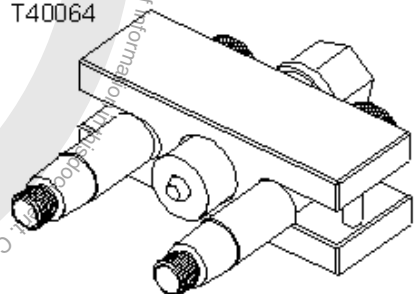
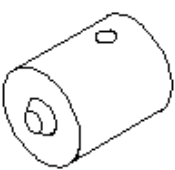



#### Caution

- ◆ *Risk of irreparable damage to high-pressure pump if allowed to run dry.*
- ◆ *The high pressure pump must be filled with fuel before the engine is started the 1st time ⇒ **page 316**. (It is important not to allow the high-pressure pump to run while still empty.)*

#### Special tools and workshop equipment required

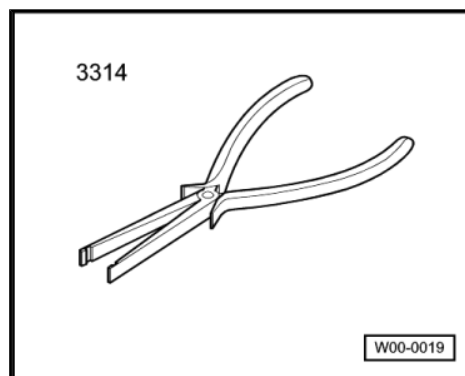
- ◆ Counterhold tool - T10051-
- ◆ Puller - T40064-
- ◆ Thrust piece - T40064/1-
- ◆ Torque wrench (5...50 Nm)  
- V.A.G 1331-

<p>T10051</p> 	<p>T40064</p> 
<p>T40064/1</p> 	<p>V.A.G 1331</p> 
	<p>W23-10004</p>



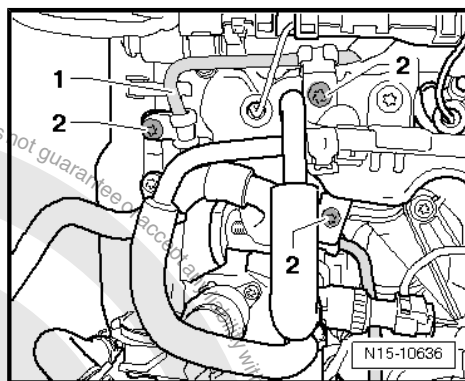


◆ Pliers - 3314-

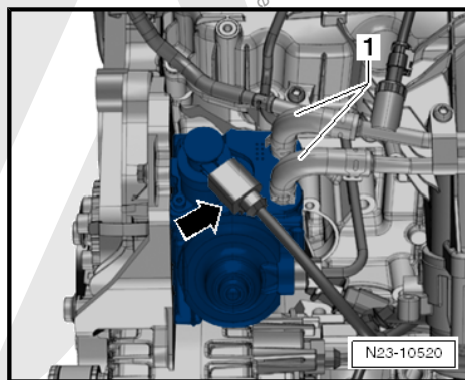


### Removing

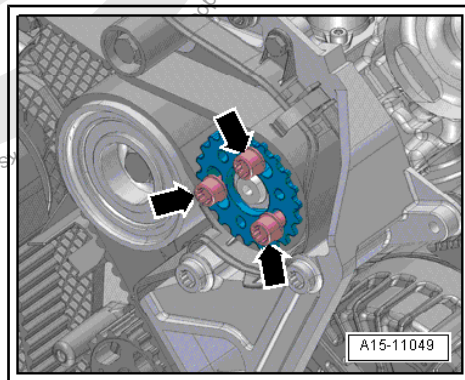
- If fresh air supply system is present, partially remove  
⇒ [page 116](#) .
- Removing toothed belt from camshaft and high-pressure pump ⇒ [page 107](#) .
- Undo and remove bolts -2- for high-pressure line -1-.
- Remove union nuts and remove high-pressure line -1-.
- Place removed high-pressure line -1- on a clean surface.



- Detach connector -arrow- from fuel metering valve - N290- .
- Loosen clips from fuel hoses -1- and pull fuel hoses off high-pressure pump.



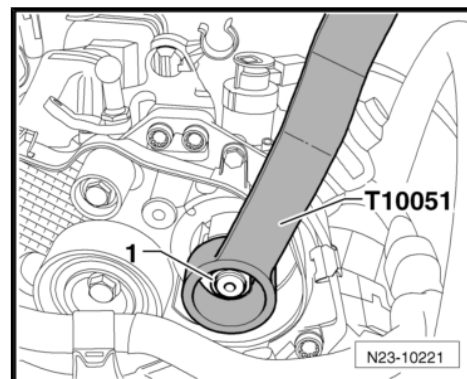
- Unscrew bolts -arrows- for high-pressure pump toothed belt pulley.
- Remove pulley from high-pressure pump.



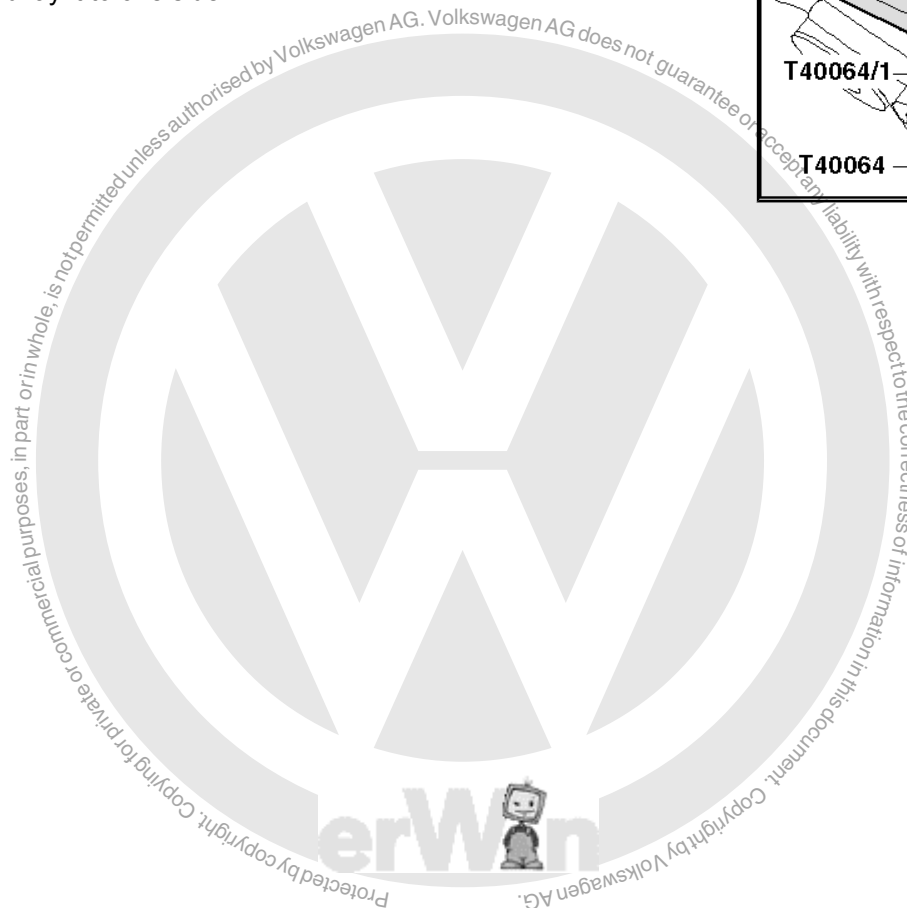
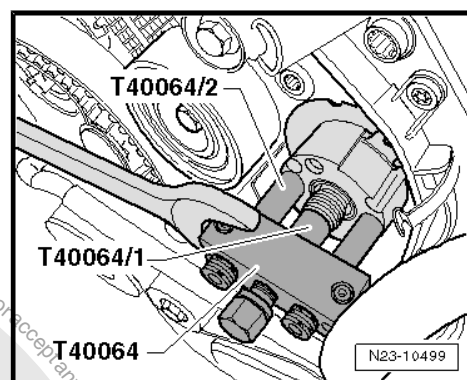




- Hold hub of high-pressure pump with counterhold - T10051- and undo nut -1-.



- Position puller - T40064- with thrust piece - T40064/1- and pin - T40064/2- as shown and pull hub off high-pressure pump. If necessary, use a 24 mm open-ended spanner as a counterhold.
- Free wiring harness above high-pressure pump from fittings, and lay it to one side.







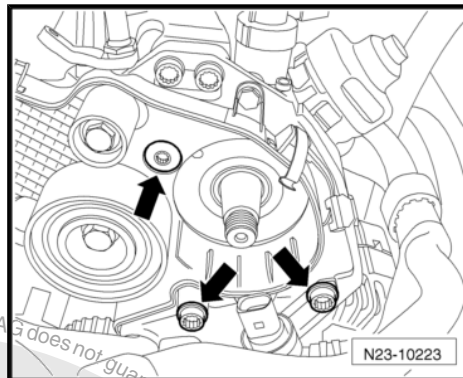
- Unscrew bolts -arrows- of high-pressure pump.
- Remove high-pressure pump.

**Installing**

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

**Caution**

*After new or removed parts such as the fuel filter or fuel lines have been fitted, the high-pressure pump must be filled with fuel before the engine is started for the first time. Avoid allowing the high-pressure pump to run dry under all circumstances.*



- ◆ If components of the fuel system between the fuel tank and the high-pressure pump are removed or renewed, it is necessary for the fuel system to be bled. To do this, perform the "Bleeding fuel system" function using the ⇒ Vehicle diagnostic tester ⇒ [page 316](#).
- ◆ This process takes 130 seconds. Fuel pumps are actuated a total of 3 times in the process. The process must not be terminated prematurely.
- Install toothed belt ⇒ [page 107](#).
- Install high-pressure lines ⇒ [page 338](#).

**Note**

- ◆ *High-pressure lines may be re-used after the following checks:*
- ◆ *Check taper seat of high-pressure line for deformation and cracks.*
- ◆ *Line hole must not be deformed, constricted or damaged.*
- ◆ *Corroded lines should no longer be used.*

**Specified torques**

- ◆ ⇒ ["1.3 Assembly overview - fuel system", page 311](#)
- ◆ ⇒ ["2.1 Assembly overview - toothed belt drive", page 105](#)

**4.2 Checking high-pressure pump****Special tools and workshop equipment required**

- ◆ Torque wrench - V.A.G 1331-

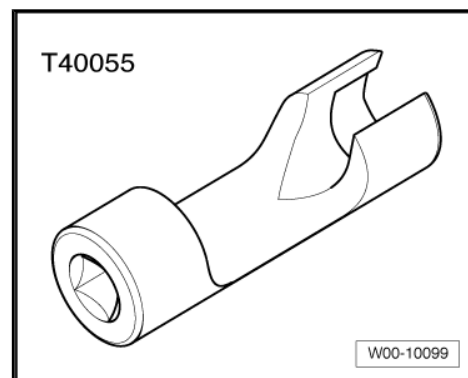
**V.A.G 1331**

W00-0427

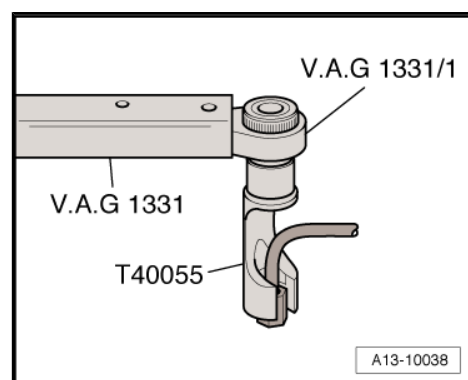




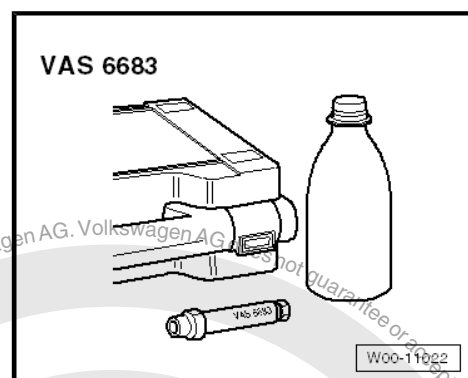
- ◆ Socket - T40055-



- ◆ Ratchet - V.A.G 1331/1-



- ◆ High-pressure pump tester - VAS 6683-



# **WARNING**

***Wear eye protection and protective clothing to avoid eye injuries and skin contact. Before loosening hose connections, wrap a cloth around the connection. Then release pressure by carefully pulling hose off connection.***





## Procedure



### WARNING

- ◆ *Read rules for cleanliness and the instructions for working on the fuel system ⇒ **page 8**.*
- ◆ *Always follow these rules for cleanliness and instructions before starting work and while working on the fuel system.*
- ◆ *Wrap a clean cloth around the connection before opening the fuel system, then carefully loosen the connection to release the pressure.*



### Note

- ◆ *Adhere strictly to rules of cleanliness. No dirt must be allowed to get into the union nut and the disconnected high-pressure line.*
- ◆ *Clean all high-pressure connections with commercially available degreaser before removing them.*
- ◆ *Dry all cleaned parts.*

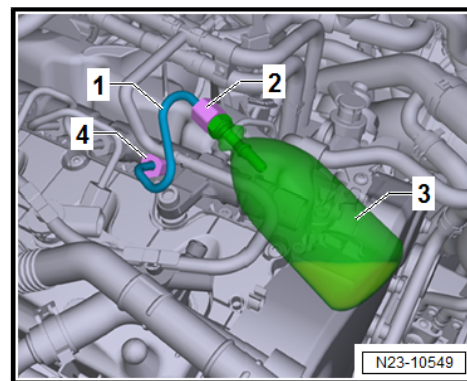
## Specified torques

Component	Nm
High-pressure line on injector	30
High-pressure line on fuel rail	30





- Unscrew union nut -2- of high-pressure line -1- from cylinder 1.
- Loosen union nut -4- of high-pressure line -1- from fuel rail by 2 turns.
- Connect high-pressure pump tester - VAS 6683- -3- to union nut -2- of open high-pressure line, screw on nut "to stop" and tighten it by hand.
- Screw union nut -4- of high-pressure line -1- "to stop" onto fuel rail and tighten by hand.
- Using torque wrench - V.A.G 1331- , ratchet - V.A.G 1331/1- and socket - T40055- , tighten union nuts -2- and -4- to specified torque of 30 Nm.
- Disconnect the 4 connectors of the injectors.
- Start engine.
- Fuel must be supplied to the high-pressure pump tester - VAS 6683- .

**Note**

*If there is fuel in the high-pressure pump tester - VAS 6683- , the high-pressure pump is "OK".*

**Installing**

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

**Note**

- ◆ *The high-pressure line may be re-used after the following checks:*
- ◆ *Check taper seat of high-pressure line for deformation and cracks.*
- ◆ *The line hole must not be deformed, constricted or damaged.*
- ◆ *Corroded lines should no longer be used.*
- Using torque wrench - V.A.G 1331- , ratchet - V.A.G 1331/1- and socket - T40055- , tighten high-pressure line to specified torque of 30 Nm.





## 5 Intake manifold

⇒ ["5.1 Assembly overview - intake manifold", page 354](#)

⇒ ["5.2 Removing and installing intake manifold", page 354](#)

⇒ ["5.3 Removing and installing throttle valve module J338 with throttle valve potentiometer G69 and intake manifold flap motor V157", page 357](#)

### 5.1 Assembly overview - intake manifold

1 - Oil dipstick

2 - Seal

☐ Renew if damaged.

3 - Gasket

☐ Renew if damaged.

4 - Bolt

☐ 8 Nm

5 - Intake manifold

☐ Removing and installing  
⇒ [page 354](#).

6 - Gasket

☐ Renew if damaged.

7 - Bolt

☐ 20 Nm

8 - Pipe

☐ To cylinder head

9 - Clamp

☐ 5 Nm

10 - Connection

11 - Bolt

☐ 8 Nm

12 - Seal

☐ Renew if damaged.

13 - Throttle valve module -  
J338- with throttle valve poten-  
tiometer - G69- and intake  
manifold flap motor - V157-

☐ Removing and installing  
⇒ [page 357](#).

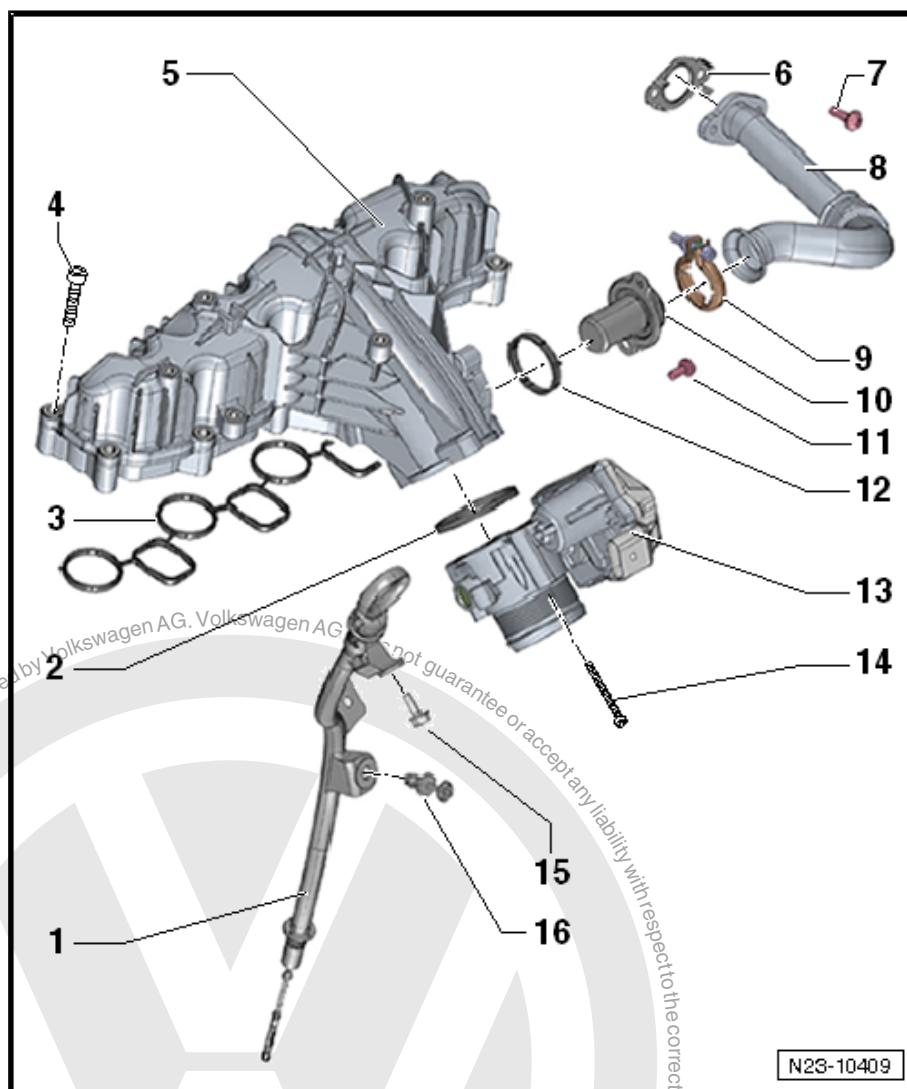
14 - Bolt

☐ 8 Nm

15 - Bolt

☐ 9 Nm

16 - Clip



N23-10409

### 5.2 Removing and installing intake manifold

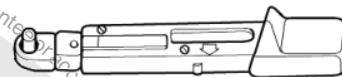
Special tools and workshop equipment required





- ◆ Torque wrench - V.A.G 1410-

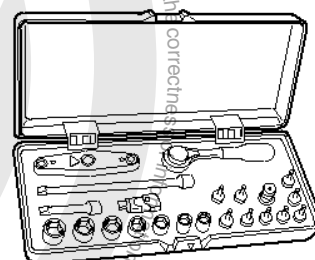
V.A.G 1410



W00-0554

- ◆ Socket set, 22 piece - VAS 5528-

VAS 5528



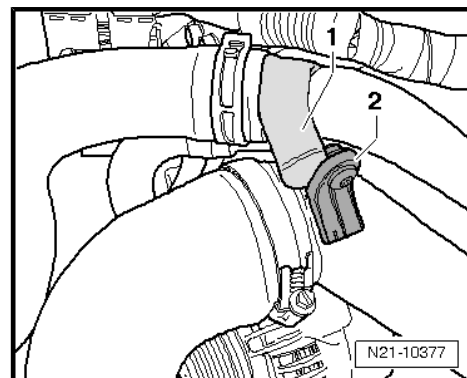
W00-10837

### Special tools and workshop equipment required

- ◆ XZN 8 bit - T40159- or Torx T 30 bit - T10405-

### Removing

- Remove high-pressure accumulator (fuel rail) ⇒ [page 340](#)
- Pull connector off glow plugs ⇒ [page 405](#) .
- Free fuel lines and engine wiring harness above intake manifold from fittings, and lay them to one side.
- Undo and remove bolts from charge air pipe bracket -2- at coolant pipe -1-.

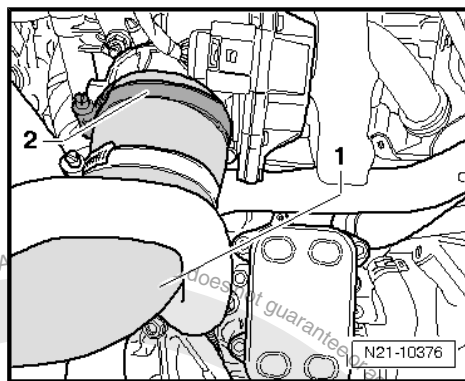


N21-10377





- Loosen screw-type clip -2- and pull charge air pipe -1- off throttle valve control module - J338- together with throttle valve potentiometer - G69- and intake manifold flap motor - V157- .

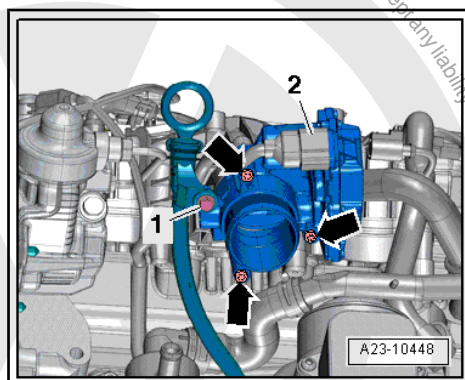


- Pull connector -2- off throttle valve module - J338- together with throttle valve potentiometer - G69- and intake manifold flap motor - V157- .

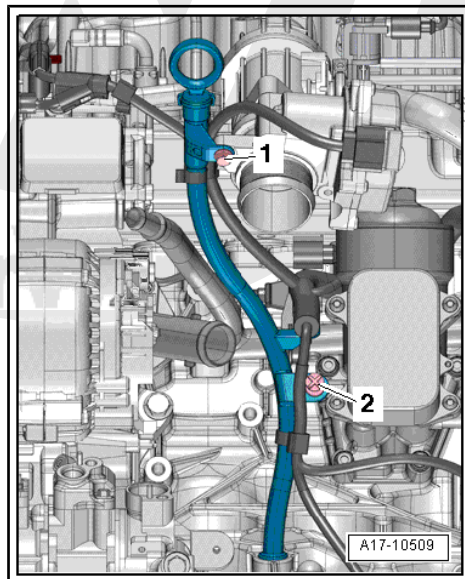


#### Note

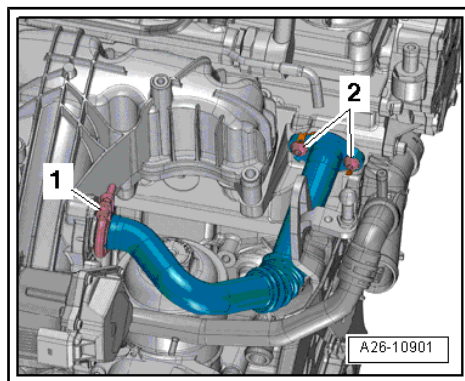
*Bolt -1- for oil dipstick has already been removed!*



- Continue releasing oil dipstick by forcing off the spreader clip with removal lever - 80 - 200- .



- Loosen clip -1- and remove screws -2-.
- Remove connecting pipe.







- Undo and remove bolts holding intake manifold in place -arrows- in diagonal sequence from the outside to the inside with XZN 8 bit - T40159- or Torx T30 bit - T10405- .
- Carefully remove intake manifold upwards.

### Installing

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



#### Note

*Renew all gaskets and seals.*

- Tighten bolts holding intake manifold in place -arrows- in diagonal sequence from the inside to the outside with XZN 8 bit - T40159- or Torx T30 bit - T10405- .
- Observe instructions for installing high-pressure lines [⇒ page 338](#) .
- Install high-pressure lines (without tension).
- The fuel system must first be filled with fuel before the engine is started [⇒ page 316](#) .

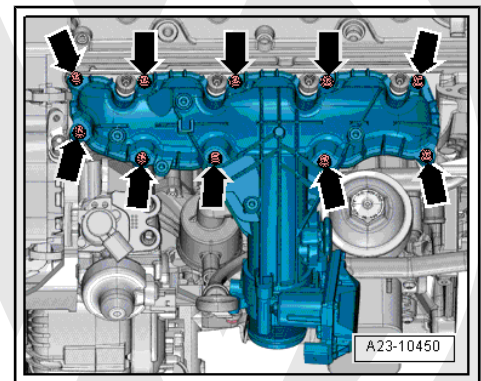
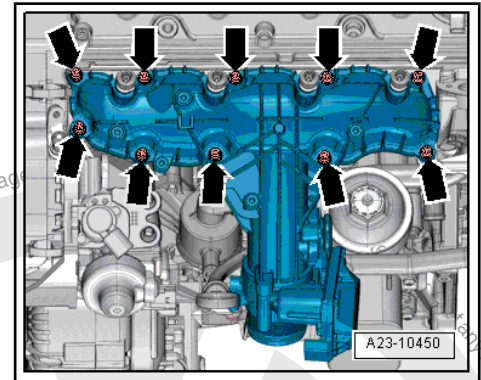
### Specified torques

- ◆ [⇒ “5.1 Assembly overview - intake manifold”, page 354](#)
- ◆ [⇒ “1.3 Assembly overview - fuel system”, page 311](#)

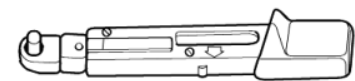
## 5.3 Removing and installing throttle valve module - J338- with throttle valve potentiometer - G69- and intake manifold flap motor - V157-

### Special tools and workshop equipment required

- ◆ Torque wrench - V.A.G 1410-



V.A.G 1410



W00-0554

### Removing

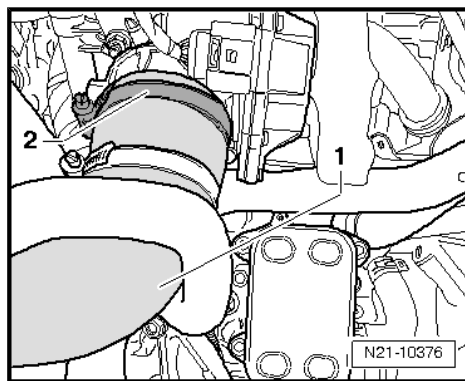
Observe rules for cleanliness [⇒ page 8](#) .

Removing screw-type clips [⇒ page 11](#) .

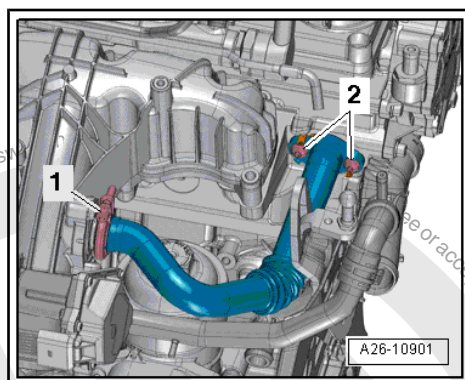




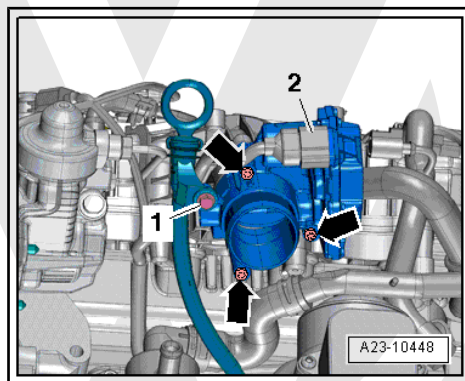
- Loosen screw-type clip -2- and pull charge air pipe -1- off from throttle valve module - J338- with throttle valve potentiometer - G69- and intake manifold flap motor - V157- .



- Loosen clamp -1- and detach connecting pipe.



- Pull connector -2- off throttle valve module - J338- together with throttle valve potentiometer - G69- and intake manifold flap motor - V157- .
- Undo bolts -arrows- and remove throttle valve module - J338- together with throttle valve potentiometer - G69- and intake manifold flap motor - V157- -4-.



### Installing

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

### Specified torques

- ♦ ⇒ ["5.1 Assembly overview - intake manifold" page 354](#)





## 6 Senders and sensors

⇒ ["6.1 Removing and installing air mass meter G70", page 359](#)

⇒ ["6.2 Removing and installing exhaust pressure sensor 1 G450", page 360](#)

⇒ ["6.3 Removing and installing fuel pressure regulating valve N276", page 362](#)

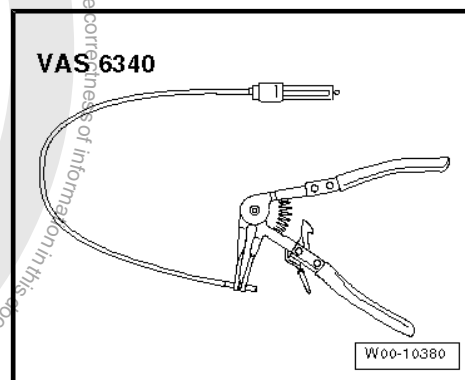
⇒ ["6.4 Checking fuel pressure regulating valve N276", page 364](#)

⇒ ["6.5 Removing and installing fuel pressure sender G247", page 365](#)

### 6.1 Removing and installing air mass meter - G70-

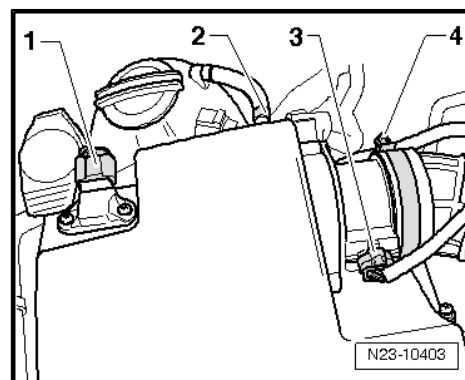
#### Special tools and workshop equipment required

- ◆ Hose clip pliers - VAS 6340-



#### Removing

- Pull off connector -3- for air mass meter - G70- .
- Loosen screw-type clip -4- and remove intake hose from air mass meter - G70- .







- Unscrew bolts -arrows- from air mass meter - G70- and carefully pull air mass meter - G70- 1- out of air filter housing guide.

### 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 observe the following notes and instructions.



### Note

- ♦ *If the air filter element is very dirty or wet, dirt or water could reach the air mass meter - G70- and affect the air mass value. This would lead to loss of power, since a smaller injection quantity is calculated.*
- ♦ *Always use genuine part for air filter element.*
- ♦ *Use a lubricant (silicon) to amount the air intake hose.*
- Check for salt residues, dirt and leaves in air mass meter - G70- and air intake hose (pure air side).
- Check intake channel for contamination as far as air filter element. If contamination is found, remove salt residues, dirt and leaves from top and bottom part of air filter housing by rinsing out or using a vacuum cleaner if necessary.

### Specified torques

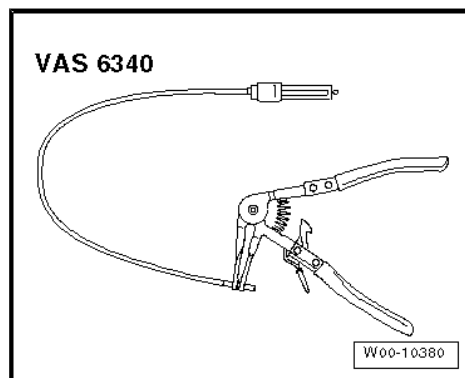
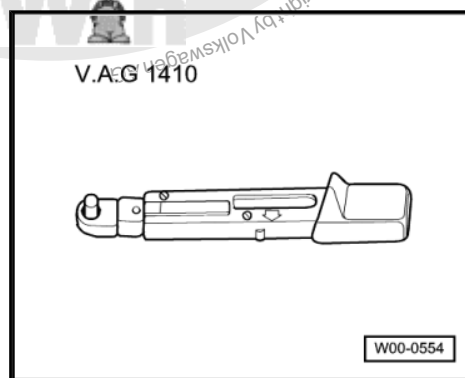
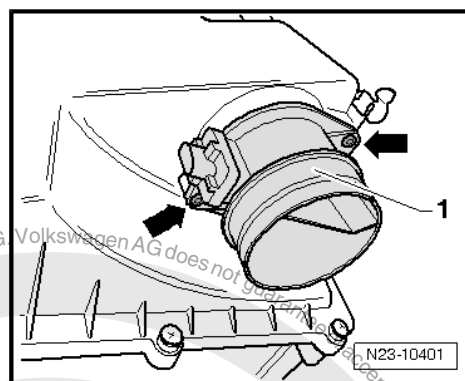
- ♦ ⇒ [“7.1 Assembly overview - air filter”](#), page 368

## 6.2 Removing and installing exhaust pressure sensor 1 - G450-

### Special tools and workshop equipment required

- ♦ Torque wrench - V.A.G 1410-

- ♦ Hose clip pliers - VAS 6340-







## Removing



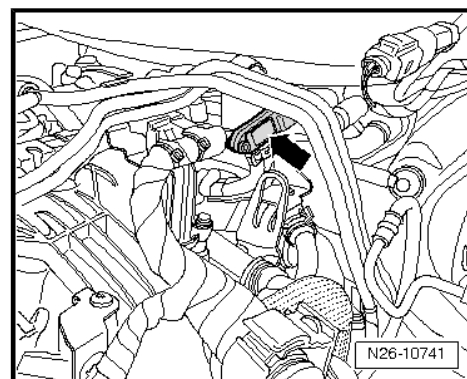
### Note

Some connectors are difficult to see. A small hand-held mirror is required to unscrew and insert the threaded connection.

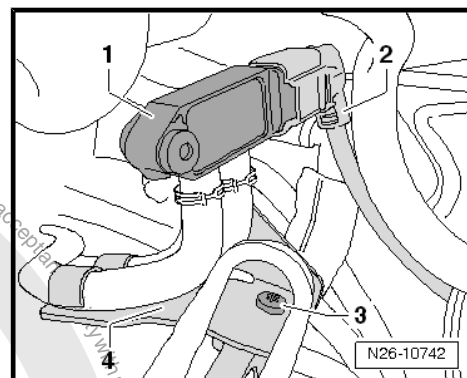


### Note

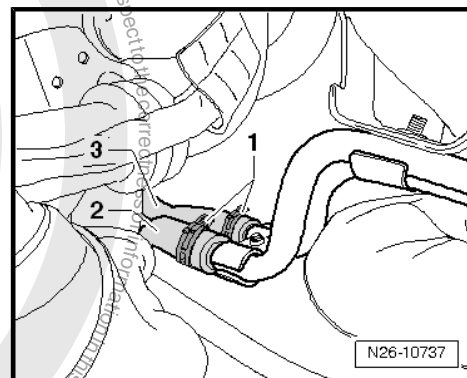
Exhaust pressure sensor 1 - G450- -arrow- is located on rear left engine bracket.



- Release connector -2- and pull off from exhaust gas pressure sensor 1 - G450- -1-.
- Undo and remove bolt -3- in bracket -4- and detach exhaust gas pressure sensor 1 - G450- -1-.



- Open spring-type clips -1- and pull hoses off -2 and 3-.







- Undo and remove bolt -2- on line retainer -1- and detach line retainer -1- from vacuum pump -3-.
- Completely remove exhaust gas pressure sensor 1 - G450- .

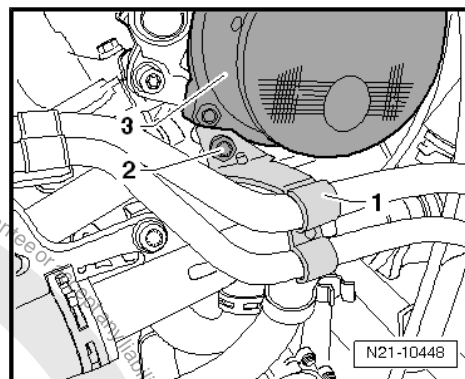
### Installing

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



#### Note

*If exhaust pressure sensor 1 - G450- is renewed, then adaptation must be carried out using ⇒ Vehicle diagnostic tester.*



### Specified torques

- ♦ ⇒ [“2.1 Assembly overview - emission control \(diesel particulate filter\)”](#), page 377

## 6.3 Removing and installing fuel pressure regulating valve - N276-

The fuel pressure regulating valve 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, the regulating valve will open. 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 the fuel high pressure circuit, the regulating valve will close. The valve seals the high pressure side against the low pressure side in this way.

### Procedure



#### Note

*Fuel pressure regulating valve - N276- must be renewed each time after removing.*



#### Caution

***Read through the rules for cleanliness and the instructions for working on the fuel system ⇒ [page 7](#).***

***Follow these instructions before starting work and while working on the fuel system.***

- 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 (fuel rail).



#### Note

*Clean carefully; cleaning solvent must not enter the electrical connector.*

- Dry fuel pressure regulating valve - N276- .

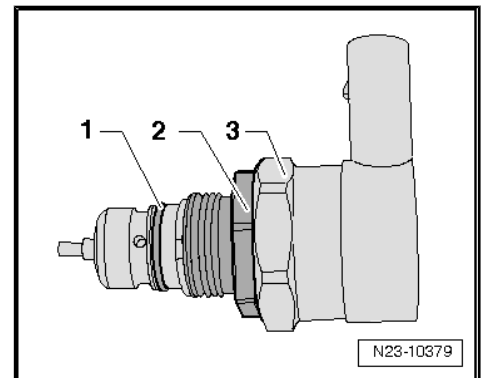




- Remove high-pressure accumulator (fuel rail) ➔ [page 340](#) .
- Clamp high-pressure accumulator (fuel rail) in a vice with protective jaws.
- Counterhold at 36 mm hexagon -3- and loosen 30 mm union nut -2-. Then unscrew regulating valve by hand.
- Use suction device to extract dirt from high-pressure accumulator bore (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****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.*
- ◆ *Check that sealing surfaces (deformable sealing lip) and threads on fuel pressure regulating valve - N276- are undamaged.*
- ◆ *Check the sealing surface of the high-pressure accumulator hole as well.*
- ◆ *Thread on fuel pressure regulating valve - N276- must be free of oil and grease.*





- Renew seal -1-.
- Tighten union nut -2- by hand.



#### Note

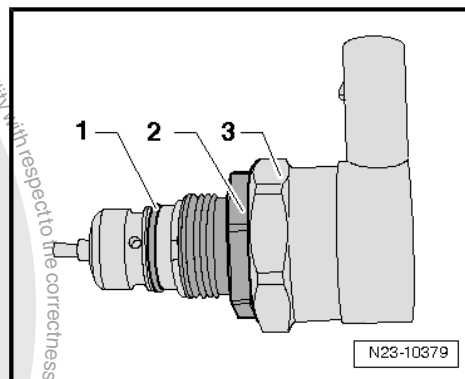
Connector connection piece must point vertically upwards.

- Align fuel pressure regulating valve - N276- so that connector connection piece points vertically upwards.
- Counterhold at housing hexagon -3- and tighten union nut -2-.

Bleeding fuel system ➔ [page 316](#) .

After mounting, leave engine running at moderate speed for a few minutes and then switch off again.

- Check fuel system for leaks.
- Read event memory again.
- Then test drive the vehicle, accelerating to full throttle at least once. Check high pressure part of fuel system again for leaks.
- Read event memory again.



#### Specified torques

- ♦ ➔ ["1.3 Assembly overview - fuel system", page 311](#)

## 6.4 Checking fuel pressure regulating valve - N276-

#### Special tools and workshop equipment required

- ♦ Transparent measuring beaker  $\geq 500$  ml



#### WARNING

*Wear eye protection and protective clothing to avoid eye injuries and skin contact. Before loosening hose connections, wrap a cloth around the connection. Then release pressure by carefully pulling hose off connection.*

#### Procedure



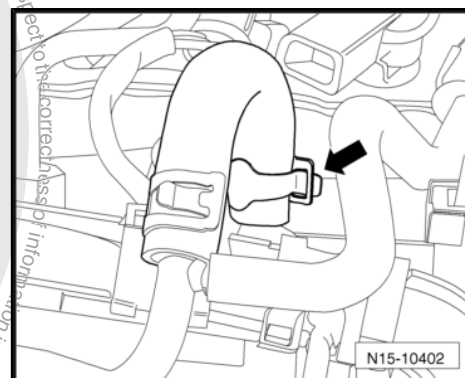
#### WARNING

- ♦ *Read rules for cleanliness and the instructions for working on the fuel system ➔ [page 8](#) .*
- ♦ *Always follow these rules for cleanliness and instructions before starting work and while working on the fuel system.*
- ♦ *Wrap a clean cloth around the connection before opening the fuel system, then carefully loosen the connection to release the pressure.*

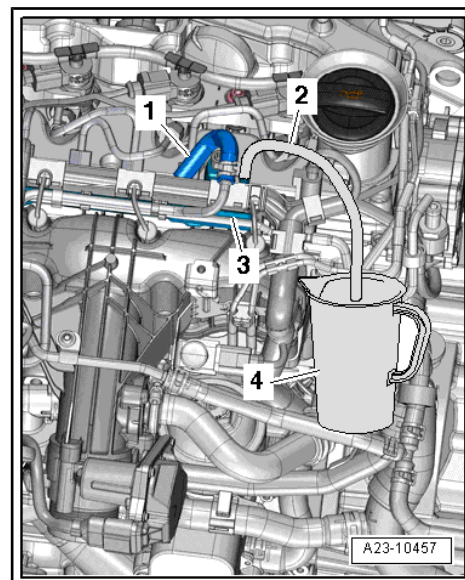


**Note**

- ◆ *Adhere strictly to the rules for cleanliness; no dirt must be allowed to get into the disconnected return line and the open return line connection.*
- ◆ *Clean all return line connections with commercially available degreaser before removing them.*
- ◆ *Dry all cleaned parts.*
- Release spring-type clip -arrow- and pull fuel return hose off fuel rail.



- Seal the open fuel return hose -1- with a clean sealing plug
- Connect an auxiliary hose -2- to return connection of fuel rail -3-.
- Hold auxiliary hose in measuring beaker -4- to measure return flow rate.
- Start engine and run at idling speed for 30 seconds.

**Note**

*The fuel in the auxiliary hose is disregarded for determining the return flow rate.*

- Specified amount in 30 seconds: 90 ... 110 ml

If the specification is not attained, the fuel pressure regulating valve - N276- is defective and must be renewed ➔ [page 364](#) .

**Installing**

- Installation is performed in the reverse sequence.

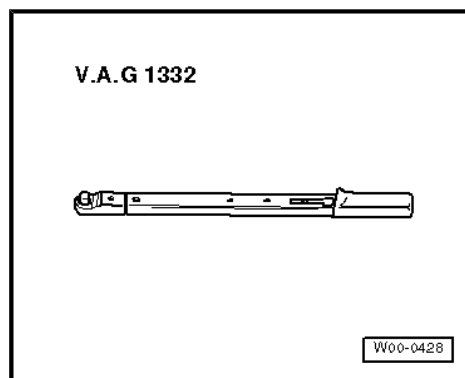
## 6.5 Removing and installing fuel pressure sender - G247-

Special tools and workshop equipment required





- ◆ Torque wrench (40...200 Nm) - V.A.G 1332-



Fuel pressure sender - G247- is located in high-pressure accumulator. It measures the fuel pressure and sends a voltage signal to the control unit for direct diesel injection system - J248- .

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.

### Removing



#### Caution

***Read through the rules for cleanliness and the instructions for working on the fuel system ⇒ [page 7](#) .***

***Follow these instructions before starting work and while working on the fuel system.***

- 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 (fuel rail).



#### Note

***Clean carefully; cleaning solvent must not enter the electrical connector.***

- Dry fuel pressure sender - G247- .

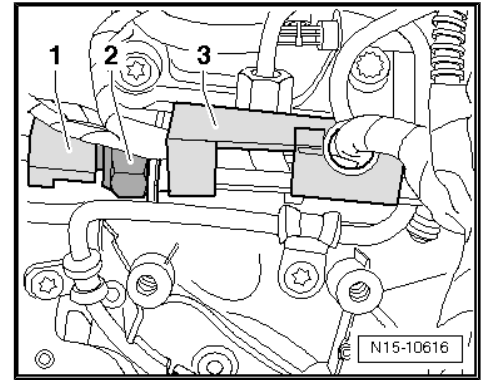




- Release connector -1- from fuel pressure sender - G247- -2- and pull off.
- Unscrew fuel pressure sender - G247- .
- Use suction device to extract dirt from high-pressure accumulator bore (threads and sealing surface). Do not use any mechanical tools to do this.

**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:

**Note**

- ◆ *Check that sealing surfaces (deformable sealing lip) and threads on fuel pressure sender - G247- are undamaged.*
- ◆ *Check the sealing surface of the high-pressure accumulator hole as well.*
- ◆ *Thread of fuel pressure sender - G247- is coated with an anti-friction lacquer. The thread must therefore be free of oil and grease.*
- Tighten fuel pressure sender - G247- by hand.
- Tightening sender.
- Bleeding fuel system ⇒ [page 316](#) .
- After mounting, leave engine running at moderate speed for a few minutes and then switch off again.
- Check fuel system for leaks.
- Read event memory again.
- Then test drive the vehicle, accelerating to full throttle at least once. Check high pressure part of fuel system again for leaks.
- Read event memory again.

**Specified torques**

- ◆ ⇒ ["1.3 Assembly overview - fuel system", page 311](#)





## 7 Air filter

⇒ ["7.1 Assembly overview - air filter", page 368](#)

⇒ ["7.2 Removing and installing air filter", page 370](#)

### 7.1 Assembly overview - air filter

#### 1 - Air duct

- ☐ Check for secure engagement.

#### 2 - Rubber bush

- ☐ Clipped into lower part of air filter.

#### 3 - Air filter lower part

#### 4 - Bolt

- ☐ Rubber bush clipped into lower part of air filter.
- ☐ 8.5 Nm

#### 5 - Water drainage pipe

⇒ [page 370](#)

- ☐ Clipped onto lower part of air filter.
- ☐ Make sure it is mounted in correct position on longitudinal member
- ☐ Clean if soiled

#### 6 - Filter element

- ☐ Renewing air filter: clean and replace filter element ⇒ Maintenance ; Booklet 11
- ☐ Renewing air filter: with saturation indication in dash panel insert ⇒ Maintenance ; Booklet 11

#### 7 - Air filter upper part

#### 8 - Bolt

- ☐ 2 Nm

#### 9 - O-ring

- ☐ Renew if damaged.

#### 10 - Intake manifold pressure sender - G71-

#### 11 - Bolt

- ☐ 1.6 Nm

#### 12 - Bracket

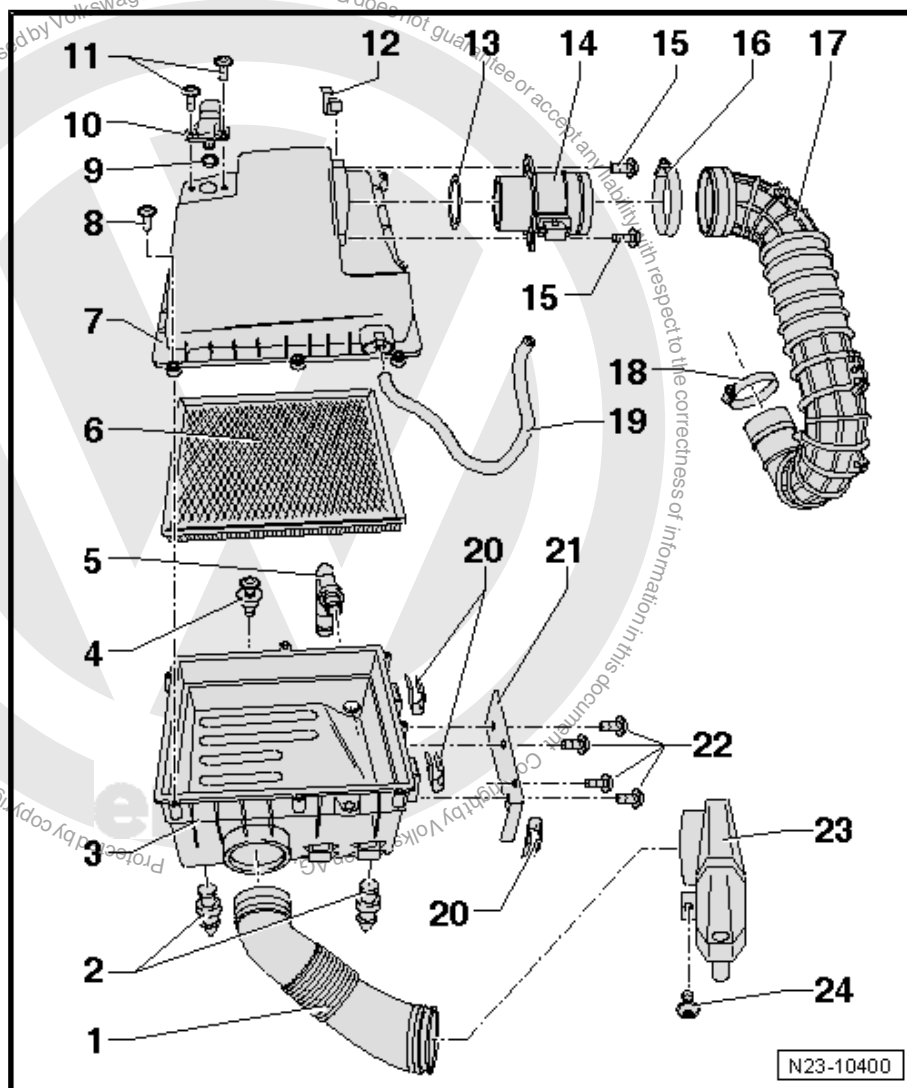
- ☐ For coolant hose mounting.

#### 13 - O-ring

- ☐ Renew if damaged.

#### 14 - Air mass meter - G70-

- ☐ Removing and installing ⇒ [page 359](#) .





**15 - Bolt**

- ☐ 1.6 Nm

**16 - Screw-type clip****Caution**

*The screw-type clips on the charge air lines must always be tightened to 5.5 Nm. If the torque is too low or too high, the charge air hose may slip off the charge air pipe during vehicle operation.*

- ☐ 5.5 Nm

**17 - Intake hose**

- ☐ It is essential that the marks on intake hose be in line with the webs on the turbocharger.
- ☐ Clean oil from ends of hoses before installing.
- ☐ Do not use lubricants containing oil.
- ☐ To turbocharger.
- ☐ With heater element for crankcase breather - N79- and connection for crankcase breather/cylinder head cover connecting pipe.

**18 - Screw-type clip****Caution**

*The screw-type clips on the charge air lines must always be tightened to 5.5 Nm. If the torque is too low or too high, the charge air hose may slip off the charge air pipe during vehicle operation.*

- ☐ 5.5 Nm

**19 - Vacuum hose****20 - Bracket**

- ☐ For wiring harness.

**21 - Heat shield****22 - Bolt**

- ☐ 2 Nm

**23 - Mounting for air duct**

- ☐ Secured to lock carrier.
- ☐ Check for secure engagement.

**24 - Bolt**

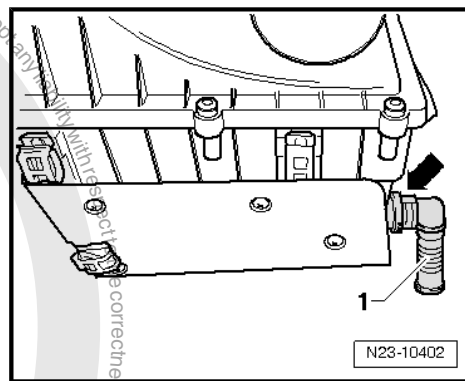
- ☐ 8.5 Nm





### Water drainage pipe on lower part of air filter

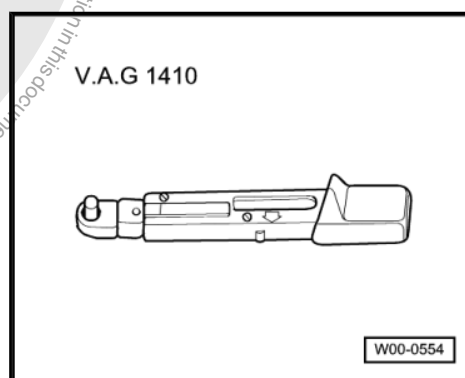
- Water drainage pipe -1- is clipped into lower part of air filter -arrow-.



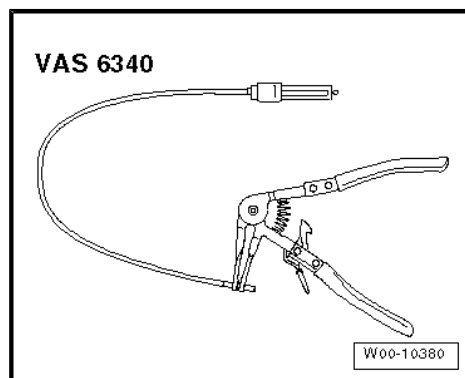
## 7.2 Removing and installing air filter

### Special tools and workshop equipment required

- ◆ Torque wrench - V.A.G 1410-

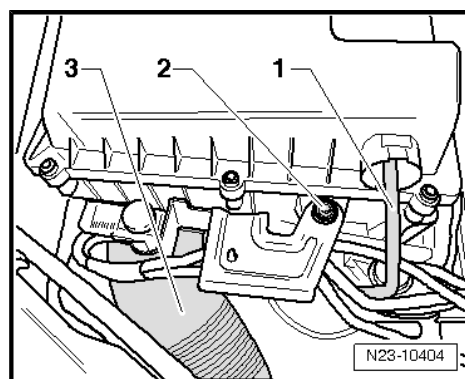


- ◆ Hose clip pliers - VAS 6340-



### Removing

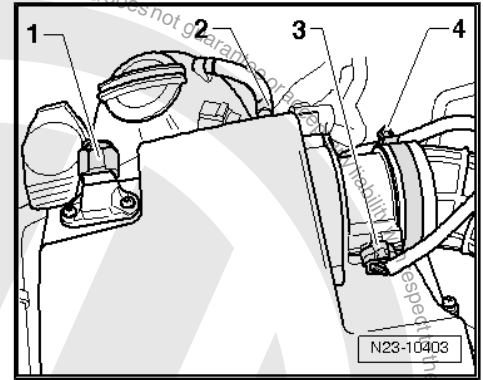
- Pull vacuum hose -1- off upper part of air filter.
- Remove cowling -3- from lower part of air filter and unscrew securing bolt -2- for bracket.







- Pull off connector -1- for intake manifold pressure sender - G71- .
- Unclip coolant hose -2- from bracket on upper part of air filter.
- Pull off connector -3- for air mass meter - G70- .
- Loosen screw-type clip -4- and remove intake hose from air mass meter - G70- .
- Open screwed-attached clip -2- and pull intake pipe -4- off the air filter container.
- Unclip wiring harness from brackets on air filter housing.



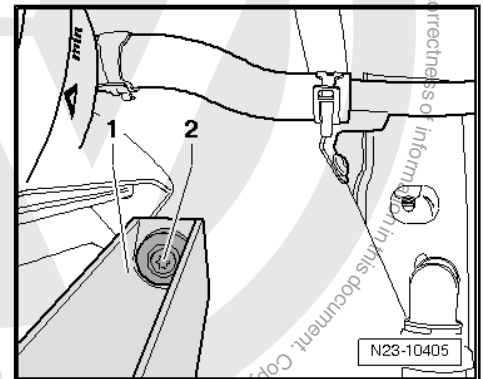
- Unscrew securing bolt -2- ⇒ [Item 4 \(page 368\)](#) for air filter housing -1- in area of coolant expansion tank.
- Pull air filter out of mountings.

### Installing

Install in reverse order. In the process, note the following:

### Specified torques

- ♦ ⇒ ["7.1 Assembly overview - air filter", page 368](#)







## 8 Engine control unit

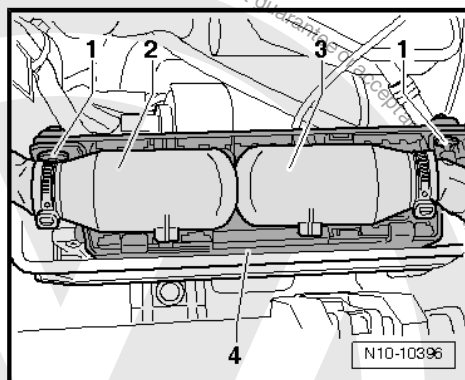
⇒ ["8.1 Removing and installing engine control unit", page 372](#)

⇒ ["8.2 Renewing engine control unit", page 372](#)

### 8.1 Removing and installing engine control unit

#### Removing

- Switch off ignition.
- Disconnect battery ⇒ Electrical system; Rep. gr. 27 .
- If fitted, remove shear-head bolts -1- using a suitable tool and remove retaining bar -4-.
- Release and pull off connectors -2- and -3-.
- Pull engine control unit out of its bracket.



#### Installing

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



#### Note

Use new shear-head bolts.

### 8.2 Renewing engine control unit



#### Note

The diesel direct injection system control unit is equipped with an event memory. Read event memory before and after making repairs or adjustments ⇒ Vehicle diagnostic tester.



#### Caution

- When the engine control unit is renewed, the "injector delivery calibration values" must be written into the new engine control unit ⇒ [page 327](#) .

#### Removing

- Before removing engine control unit, read identification and coding of present control unit ⇒ Vehicle diagnostic tester.
- Remove engine control unit ⇒ [page 372](#) .





- Remove shear-head bolts -2- using a suitable tool and remove bracket -1-.

### Installing

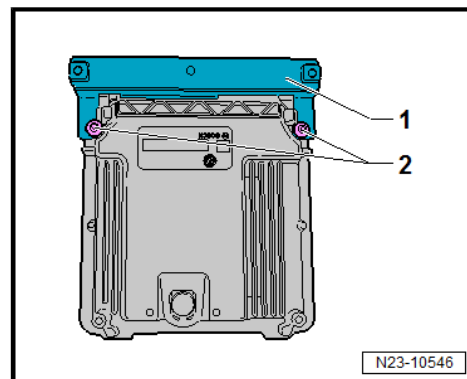
Installation is carried out in the reverse order, note the following:



#### Note

Use new shear-head bolts.

- Install engine control unit ⇒ [page 372](#) .
- Check previous coding and code new control unit ⇒ Vehicle diagnostic tester.







## 26 – Exhaust system

### 1 Exhaust pipes, silencers

⇒ “1.1 Assembly overview - silencers”, page 374

⇒ “1.2 Checking exhaust system for leaks”, page 375

⇒ “1.3 Aligning exhaust system free of stress”, page 375

#### 1.1 Assembly overview - silencers

##### 1 - Screw-type clip

- ☐ Note installation position.
- ☐ 35 Nm

##### 2 - Rubber mounting

- ☐ Note installation position ⇒ [page 375](#).

##### 3 - Front silencer

- ☐ Removing:
  - Remove front propshaft.
  - Remove gearbox support and gearbox mountings ⇒ [page 31](#).
  - Detach front/rear silencers at separating point.
  - Undo bolts holding hanger ⇒ [Item 6 \(page 374\)](#) on gearbox cross member.

- Detach front silencer from rubber mounting ⇒ [Item 2 \(page 374\)](#) and completely remove front silencer.

##### 4 - Rear silencer

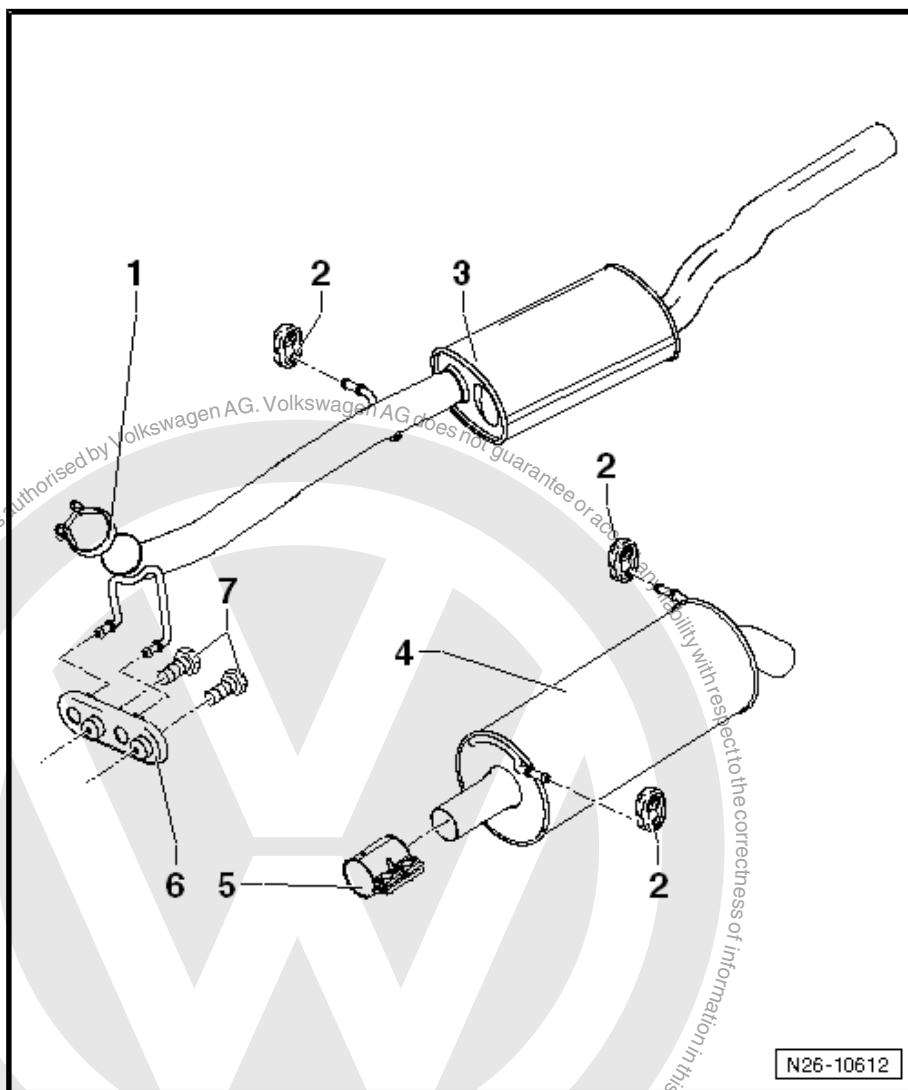
- ☐ Removing:
  - Detach front and rear silencers at separating point.
  - Detach rear silencer from rubber mounting ⇒ [Item 2 \(page 374\)](#) and completely remove rear silencer.

##### 5 - Double clamp

- ☐ Note installation position.
- ☐ Installation of double clamp ⇒ [page 375](#)
- ☐ 31 Nm

##### 6 - Mounting

- ☐ Fasten mounting on gearbox cross member ⇒ [page 375](#)





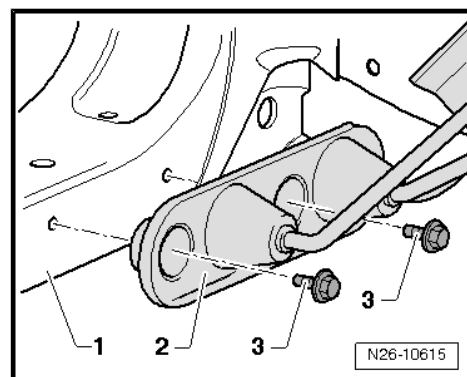


## 7 - Bolt

- 20 Nm

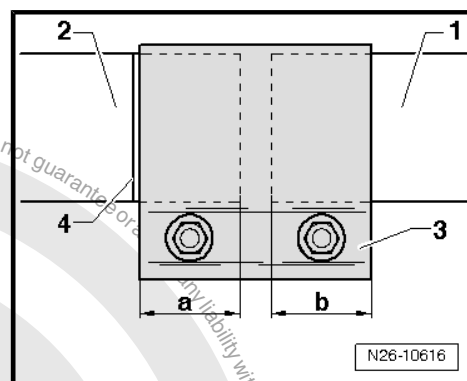
### Fasten mounting on gearbox cross member

- Secure mounting -2- to gearbox cross member -1- with bolts -3-.



### Installation of double clamp

- Mark the distances 39 mm -a- and b- at end of pipe of front silencer -2- and beginning of pipe of rear silencer -1- - 4-.
- Insert front silencer -2- and rear silencer -1- into double clamp -3- up to dimensions -a- and b-.
- Align screw-type connection of double clamp -3- horizontally and lightly tighten bolts.
- Align front silencer -2- and rear silencer -1- horizontally, and tighten bolts -3- for double clamp.



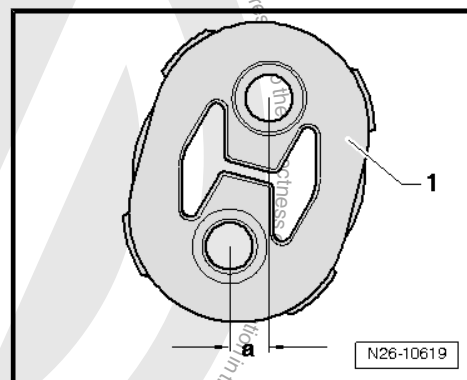
### Installation location of rubber mounting

- Align rubber mounting -1- in such a way that the distance -a- is 8 mm.



#### Note

Check entire installation location of exhaust system.



## 1.2 Checking exhaust system for leaks

- 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, and between turbocharger and front exhaust pipe to make sure there are no leaks.
- Rectify any leaks that are found.

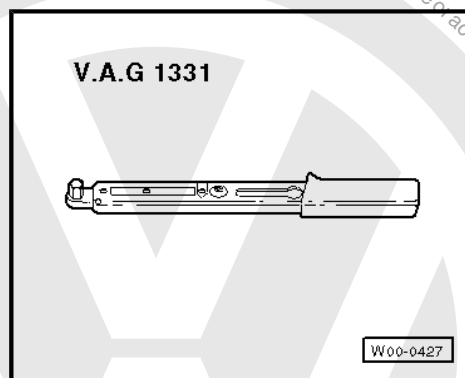
## 1.3 Aligning exhaust system free of stress

Special tools and workshop equipment required





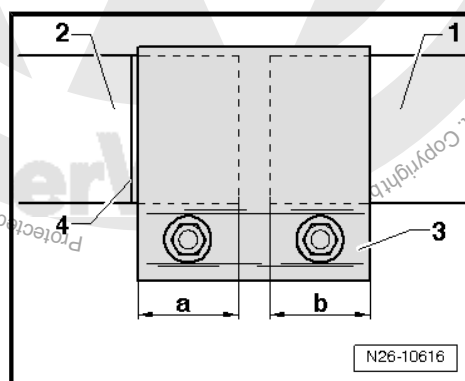
- ◆ Torque wrench (5...50 Nm) - V.A.G 1331-



- Exhaust system must be aligned when cold.

#### Procedure

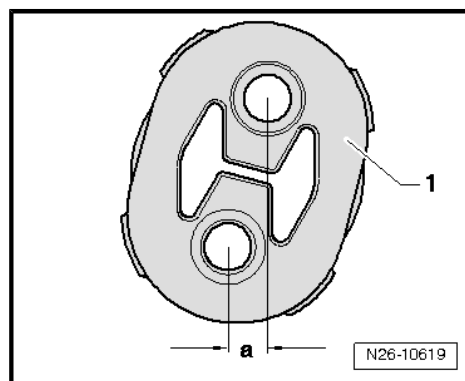
- Loosen bolts of double clamp -3-.
- Tighten bolts hand tight.
- Align exhaust system until the marking- 4- is visible.



- Align bolts of double clamp -3- horizontally.
- Align rubber mountings -1- for front silencer -2- and rear silencer -1- in such a way that dimension -a- is 8 mm.
- Tighten bolts for double clamp -3-.

#### Specified torques

- ◆ ⇒ ["1.1 Assembly overview - silencers", page 374](#)







## 2 Cleansing exhaust emissions

⇒ [“2.1 Assembly overview - emission control \(diesel particulate filter\)”, page 377](#)

⇒ [“2.2 Assembly overview - emission control \(catalytic converter\)”, page 379](#)

⇒ [“2.3 Removing and installing particulate filter”, page 381](#)

⇒ [“2.4 Removing and installing catalytic converter”, page 387](#)

### 2.1 Assembly overview - emission control (diesel particulate filter)

#### 1 - Screw-type clip

- ☐ Always renew after removing
- ☐ Fit screw-type clip by hand
- ☐ When installing, first fit screw-type clip on turbocharger for exhaust pipe.
- ☐ 8 Nm

#### 2 - Gasket

- ☐ Renew after removing
- ☐ Note installation position.

#### 3 - Lambda probe - G39-

- ☐ Grease only thread. The high-temperature paste ⇒ Electronic parts catalogue (ETKA) must not get into the slots on the probe body.
- ☐ 50 Nm

#### 4 - Control line with union nut

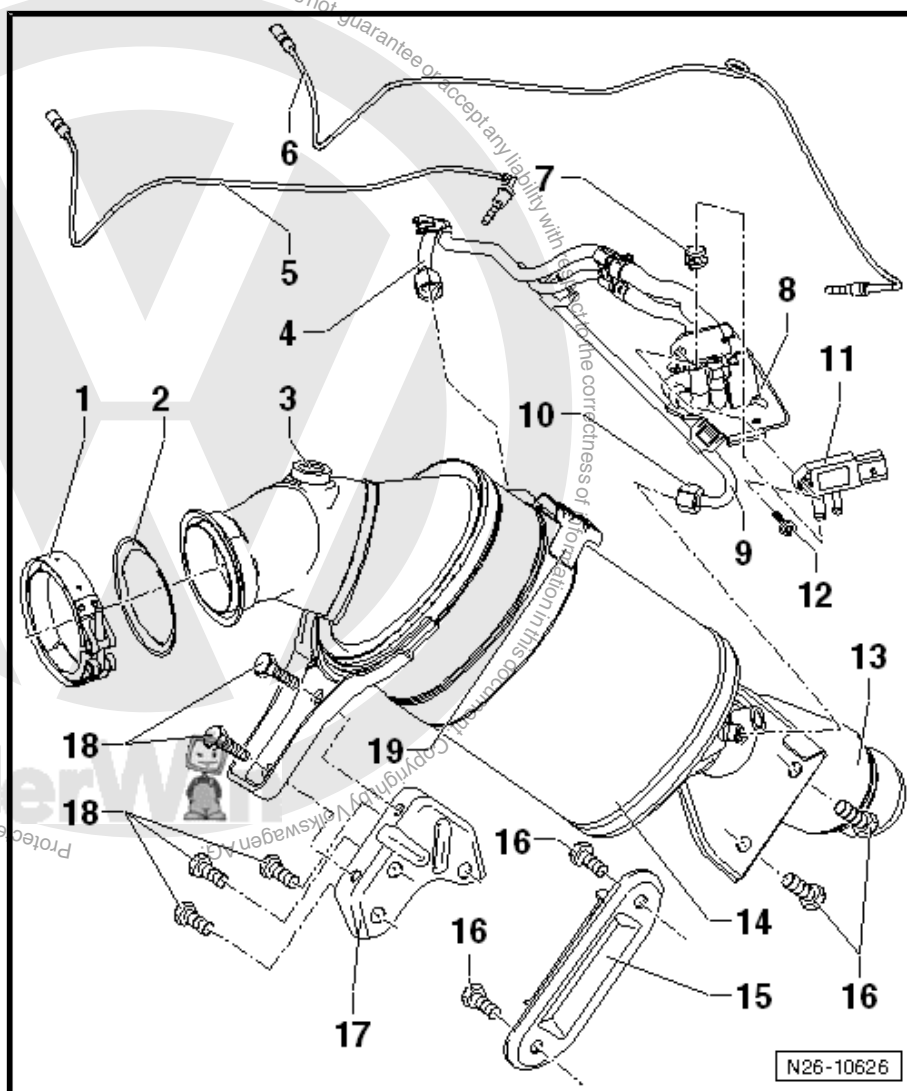
- ☐ 20 Nm

#### 5 - Exhaust gas temperature sender 3 - G495-

- ☐ Grease thread of sender using high-temperature paste ⇒ Electronic Parts Catalogue (ETKA) .
- ☐ Connector (brown) at coupling point of air filter
- ☐ 45 Nm

#### 6 - Exhaust gas temperature sender 4 - G648-

- ☐ Grease thread of sender using high-temperature paste ⇒ Electronic Parts Catalogue (ETKA) .
- ☐ Connector (orange) at coupling point of air filter
- ☐ 45 Nm







**7 - Bracket with control lines**

**8 - Clip**

**9 - Control pipe**

**10 - Union nut**

- ☐ 20 Nm

**11 - Exhaust gas pressure sensor 1 - G450-**

- ☐ Adaptation is necessary after this component has been renewed ⇒ Vehicle diagnostic tester.
- ☐ Removing and installing ⇒ [page 360](#) .

**12 - Bolt**

- ☐ 5 Nm

**13 - Front exhaust pipe**

- ☐ Take into account the fact that there are different types ⇒ ETKA (electronic parts catalogue)
- ☐ Handle carefully to avoid damage.
- Transport shock-free.
- Do not kink flexible hose.
- Do not stretch flexible hose.
- ☐ Removing and installing ⇒ [page 381](#) .

**14 - Particulate filter**

- Assembly sequence must be adhered to during installation to ensure stress-free installation.
- ♦ Position particulate filter with new gasket ⇒ [Item 2 \(page 377\)](#) and new screw-type clip ⇒ [Item 1 \(page 377\)](#) .
- ♦ Tighten screw-type clip ⇒ [Item 1 \(page 377\)](#) .
- ☐ Removing and installing ⇒ [page 381](#) .

**15 - Bracket**

- ☐ Secured to gearbox on right
- ☐ Attaching bracket to gearbox ⇒ [page 380](#)

**16 - Bolt**

- ☐ 20 Nm

**17 - Bracket**

- ☐ Fastened to engine support on right
- ☐ Metal type
- ☐ Fasten to bracket on engine support ⇒ [page 380](#)

**18 - Bolt**

- ☐ 20 Nm

**19 - Mounting**





## 2.2 Assembly overview - emission control (catalytic converter)



### Note

- ◆ After working on the exhaust system, ensure that the system is not under stress and that there is sufficient clearance to the bodywork. Loosen double clamp and clip if necessary. Align silencer and exhaust pipe so that sufficient clearance is maintained to the bodywork and the support rings are evenly loaded.
- ◆ Renew self-locking nuts.

### 1 - Screw-type clip

- ☐ Always renew after removing
- ☐ Fit screw-type clip by hand
- ☐ When installing, first fasten the screw-type clip for the exhaust pipe on turbocharger
- ☐ 8 Nm

### 2 - Gasket

- ☐ Renew after removing
- ☐ Note installation position.

### 3 - Front exhaust pipe with catalytic converter

- ☐ Take into account the fact that there are different types ⇒ ETKA (electronic parts catalogue)
- ☐ Handle carefully to avoid damage.
- ☐ When installing, first fasten the top screw-type clip for the exhaust pipe on turbocharger
- Transport shock-free.
- Do not kink flexible hose.
- Do not stretch flexible hose.
- ☐ Removing and installing ⇒ [page 387](#).

### 4 - Bolt

- ☐ 20 Nm

### 5 - Bracket

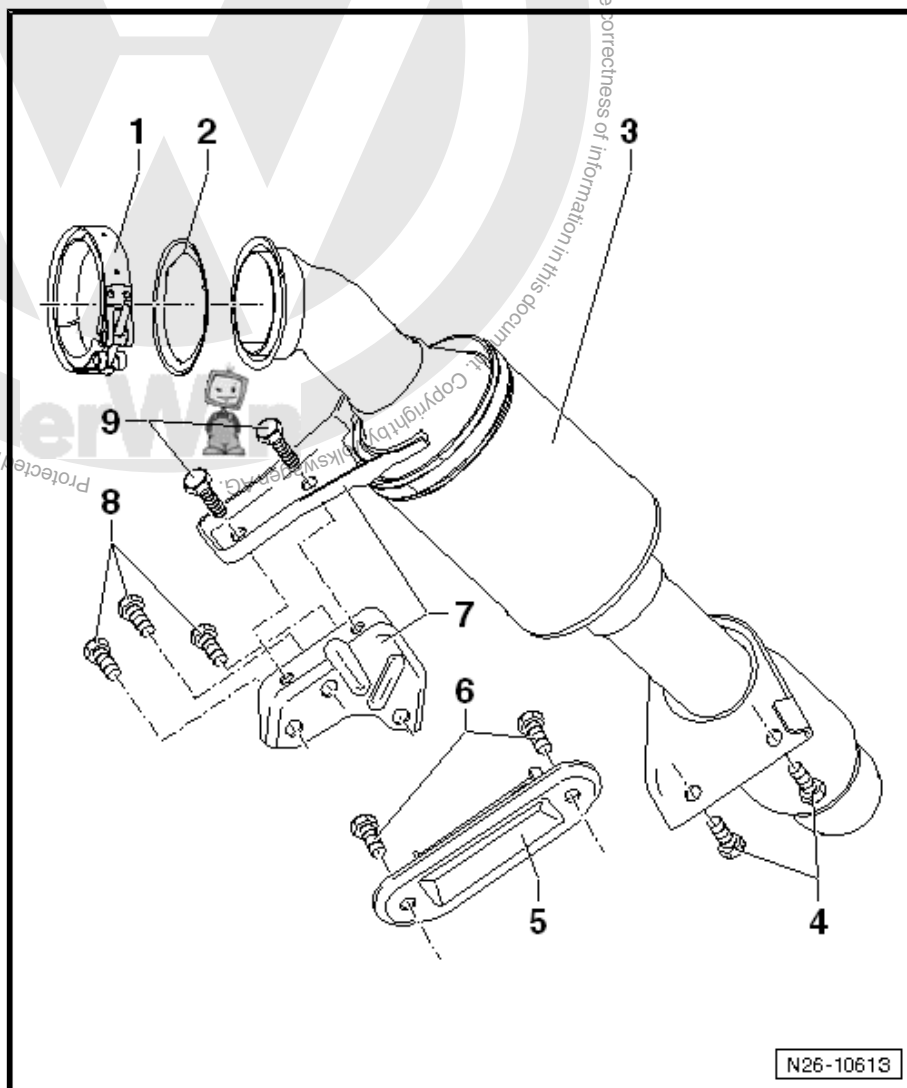
- ☐ Secured to gearbox on right
- ☐ Attaching bracket to gearbox ⇒ [page 380](#)

### 6 - Bolt

- ☐ 20 Nm

### 7 - Bracket

- ☐ Fastened to engine support on right
- ☐ Metal type
- ☐ Attaching bracket to engine support ⇒ [page 380](#)







**8 - Bolt**

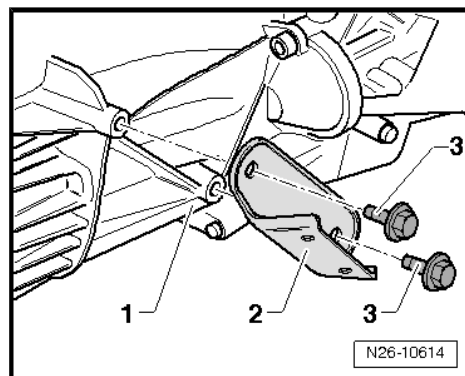
- 20 Nm

**9 - Bolt**

- 20 Nm

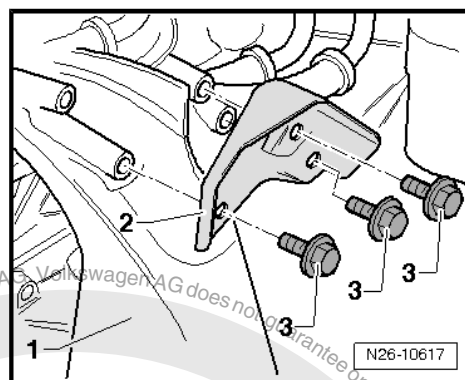
**Fasten to bracket on gearbox**

- Secure bracket -2- to gearbox -1- with bolts -3-.



**Fasten bracket to engine support**

- Secure bracket -2- to engine support -1- with bolts -3-.




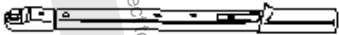
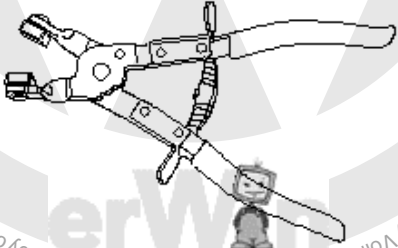




## 2.3 Removing and installing particulate filter

### Special tools and workshop equipment required

- ◆ Torque wrench (5...50 Nm) - V.A.G 1331-
- ◆ Torque wrench (40...200 Nm) - V.A.G 1332-
- ◆ Hose clip pliers - VAS 6362-

<p><b>V.A.G 1331</b></p> 	<p><b>V.A.G 1332</b></p> 
<p><b>VAS 6362</b></p> 	
	<p>W26-10006</p>





## Removing



### WARNING

*Risk of burns.*

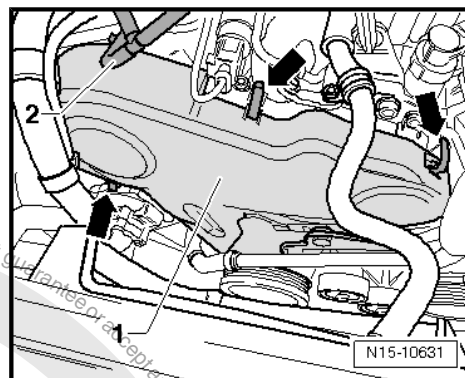
*Parts of the exhaust system may be hot.*

*Allow exhaust system to cool before removing.*

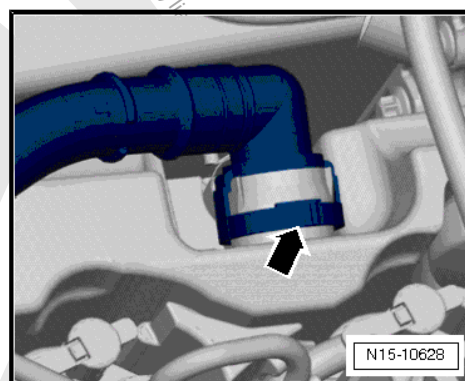
*When doing any repair work, especially in the engine compartment, pay attention to the following due to the cramped conditions:*

- ◆ *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 install new ones in the same position.*

- Detach vacuum hose -2- from upper toothed belt guard -1-.
- Open clips -arrows- and remove toothed belt guard -1-.



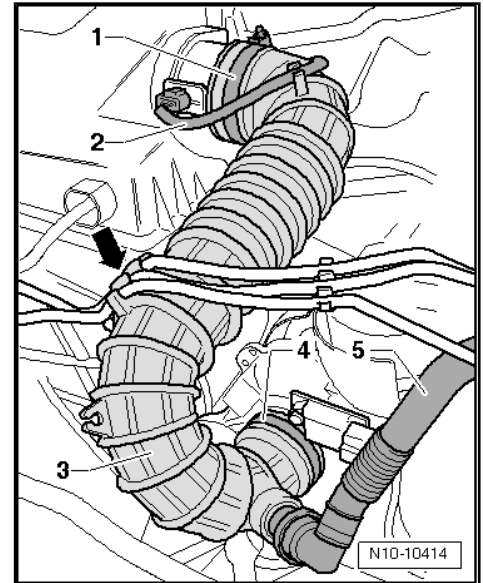
- Remove pipe -arrow- from cylinder head cover.



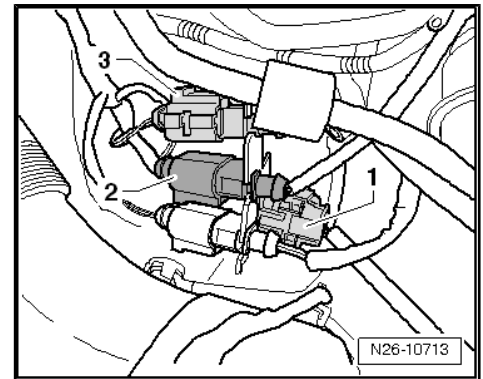




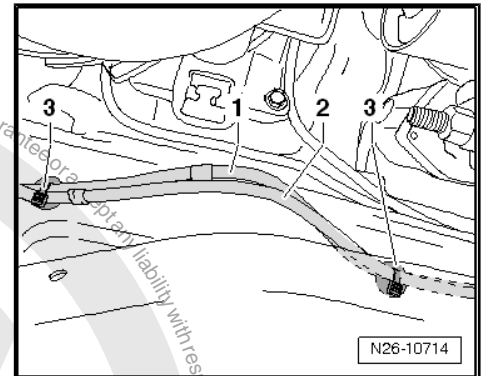
- Detach hoses from intake hose -3- bracket -arrow-.
- Release and pull off wiring harness connector -2-. Detach wiring harness -2- from intake hose -3-.
- Open clips -1- and -4- and remove intake hose -3- together with pipe -5-.
- Remove air filter ⇒ [page 368](#) .



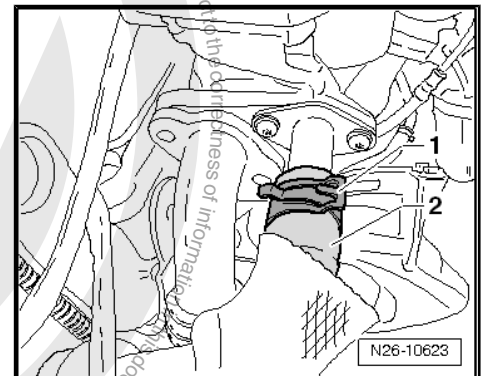
- Disconnect connectors -1, 2 and 3- for exhaust gas temperature sender 1 - G235- (black connector), exhaust gas temperature sender 3 - G495- (brown connector) and exhaust gas temperature sender 4 - G648- (orange connector) at coupling point (in front of air filter).



- Loosen cable ties -3-, free lines -1 and 2- from fittings, and lay them to one side.



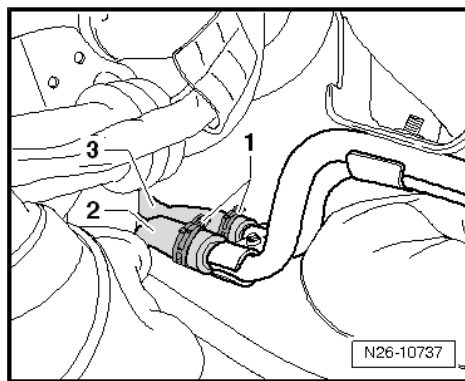
- Clamp off coolant hose -2- with hose clamps up to 25 mm - 3094- .
- Open spring-type clip -1- for coolant hose -2- and pull coolant hose off.







- Open spring-type clips -1- and pull hoses -2 and 3- off control lines for particulate filter.

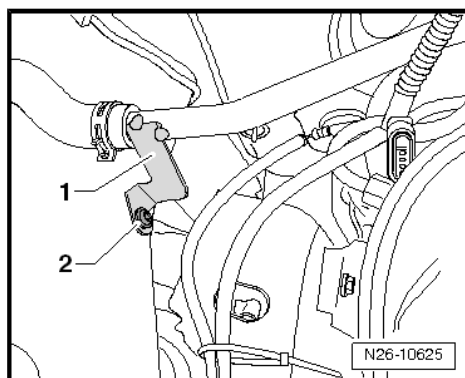


- Undo and remove bolt -2- for coolant pipe -1- at wheel housing and tie on coolant hose somewhere at a slightly higher point.

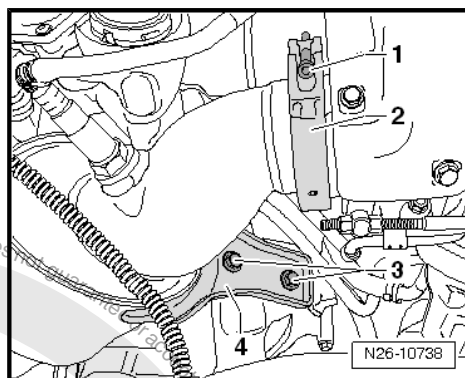


**Note**

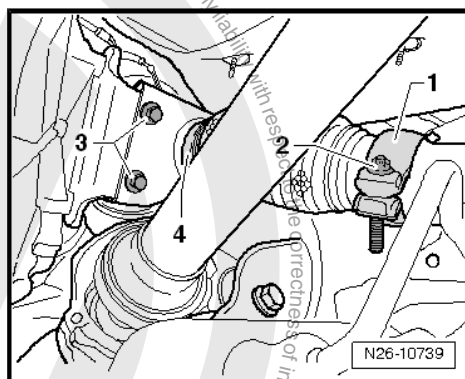
*Do not bend coolant pipe.*



- Undo screw -1- of screw-type clamp -2- between particulate filter and turbocharger and remove clamp -2-.
- Undo and remove bolts -3- for particulate filter bracket -4-.



- Undo screw -1- of clamp -2-.
- Undo and remove bolts -3- for exhaust pipe bracket -4-.







- When removing particulate filter, push -1- the coolant pipe -2- a little to one side.
- Carefully remove particulate filter -1- upwards out of the engine compartment.

### Installing

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



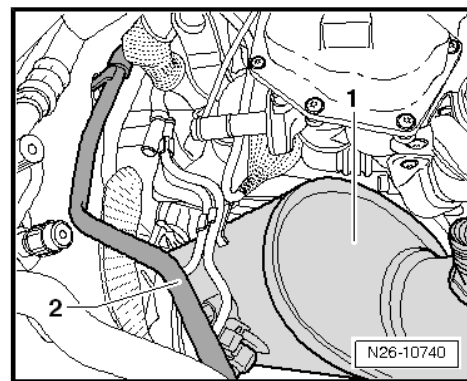
#### Caution

***Ensure particulate filter is not stressed when installed.***

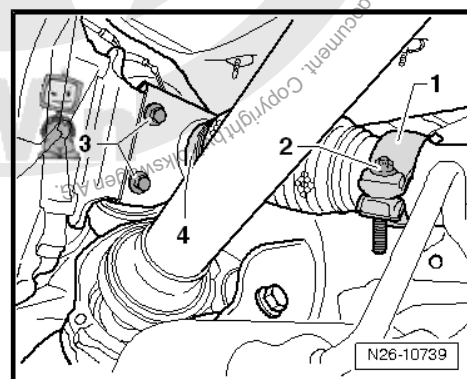
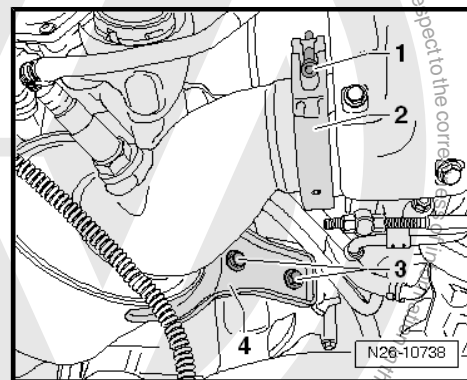
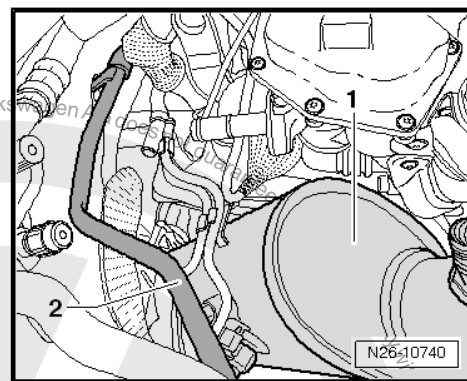
***The particulate filter could be damaged.***

***Follow installation sequence.***

***Use new clips and gaskets.***



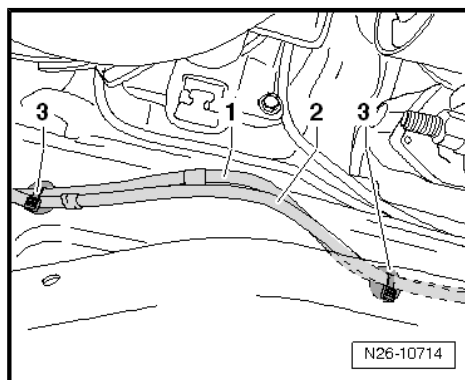
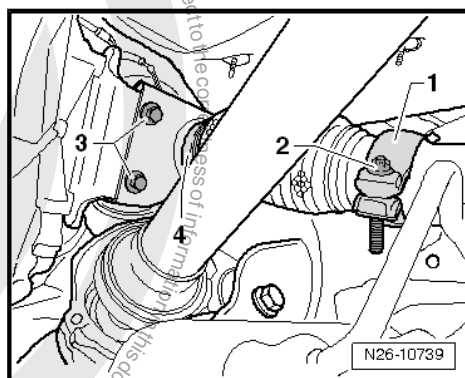
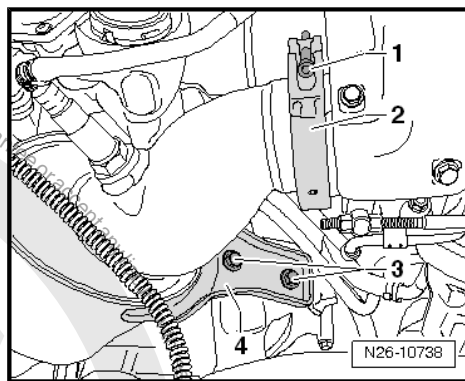
- Assembly sequence for installation of particulate filter must be adhered to during installation to ensure stress-free installation.







- ◆ When installing particulate filter, push -1- the coolant pipe -2- a little to one side.
- ◆ Install particulate filter -1- carefully.
- ◆ Screw in bolts -3- for particulate filter bracket -4- a few turns.
- ◆ Position particulate filter with new gasket  
⇒ [Item 2 \(page 377\)](#) and new screw-type clip  
⇒ [Item 1 \(page 377\)](#).
- ◆ Fit exhaust pipe bracket -4- and tighten bolts -3- hand-tight.
- ◆ Fit clamp -2- and tighten screw -1- slightly.
- ◆ Tighten screw -1- for screw-type clip ⇒ [Item 1 \(page 377\)](#) -2-.
- ◆ Tighten bolts ⇒ [Item 18 \(page 378\)](#) -3-.
- ◆ Tighten bolts ⇒ [Item 18 \(page 378\)](#) -3-.
- ◆ Tighten screw -1- for clamp -2-.
- Fasten lines -1 and 2- with new cable ties -3-.



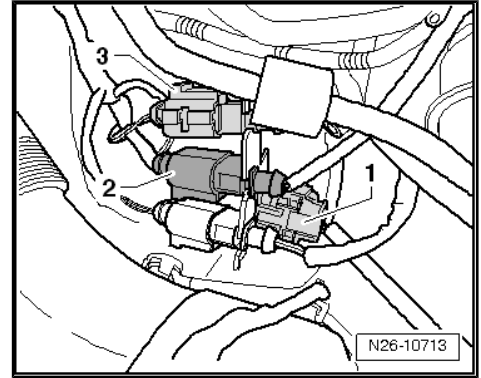




- Connect connectors -1, 2 and 3- for exhaust gas temperature sender 1 - G235- (black connector), exhaust gas temperature sender 3 - G495- (brown connector) and exhaust gas temperature sender 4 - G648- (orange connector) at coupling point (in front of air filter), and make sure they engage securely.
- Install air filter ⇒ [page 368](#)

**Note**

*If a new particulate filter was installed, connect ⇒ Vehicle diagnostic tester and carry out "Ash mass comparison".*

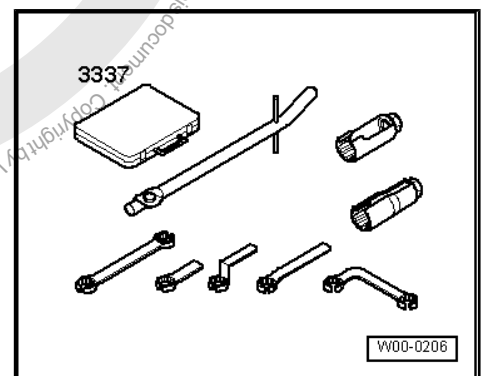
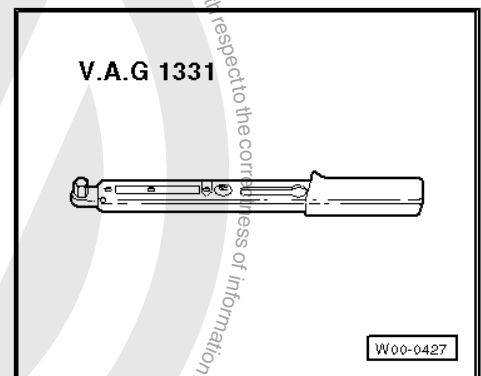
**Specified torques**

- ◆ ⇒ ["2.1 Assembly overview - emission control \(diesel particulate filter\)", page 377](#)
- ◆ ⇒ ["7.1 Assembly overview - air filter", page 368](#)

## 2.4 Removing and installing catalytic converter

**Special tools and workshop equipment required**

- ◆ Torque wrench (5...50 Nm) - V.A.G 1331-
- ◆ Lambda probe open ring spanner set - 3337-

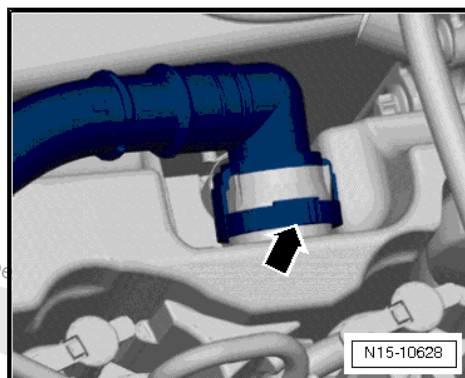




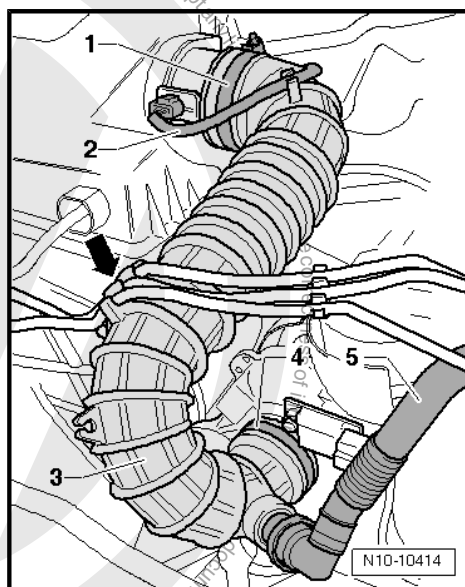


## Removing

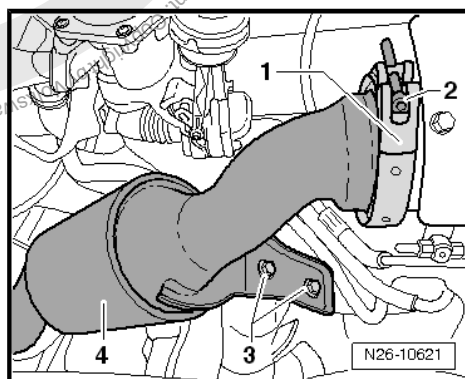
- Remove pipe -arrow- from cylinder head cover.



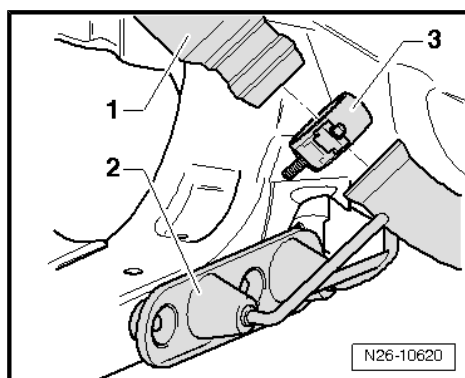
- Detach hoses from intake hose -3- bracket -arrow-.
- Release and pull off wiring harness connector -2-. Detach wiring harness -2- from intake hose retainer -3-.
- Open clips -1- and -4- and remove intake hose -3- together with pipe -5-.
- Remove air filter [page 368](#)
- Pull vacuum hose -2- off vacuum unit of exhaust gas recirculation cooler and vacuum hose -1- off regulating flap potentiometer - G584-



- Loosen screw -2- for clamp -1- between exhaust pipe -4- and turbocharger.



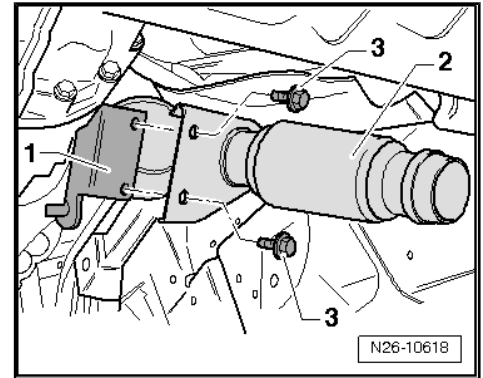
- Loosen clamp -3- on exhaust pipe -1- and pull exhaust pipe -1- off a little.



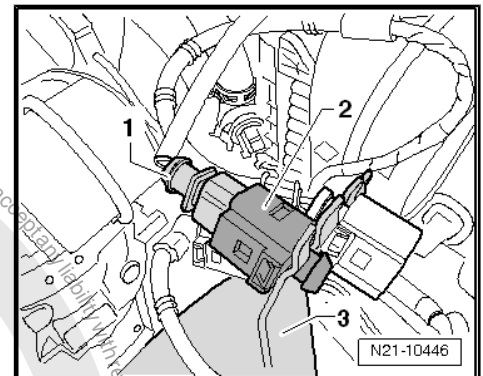




- Undo and remove bolts -3- holding exhaust pipe -2- on gear-box bracket -1-.



- Release and detach connector -1- of exhaust gas temperature sender 1 - G235- on front right wheel housing -3- at the coupling point -2-. Then, free wiring harness from fittings and lay it to one side.
- Carefully remove front exhaust pipe upwards out of the engine compartment.



### Installing

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

- Use new clips and gaskets.
- Install front exhaust pipe and first fasten the top screw-type clamp for the exhaust pipe on turbocharger
- Secure front exhaust pipe with all brackets, and fit screw-type clip ⇒ [Item 1 \(page 374\)](#) at bottom.
- Install air filter ⇒ [page 368](#)

### Specified torques

- ◆ ⇒ [2.2 Assembly overview - emission control \(catalytic converter\)", page 379](#)
- ◆ ⇒ [7.1 Assembly overview - air filter", page 368](#)





### 3 Exhaust gas recirculation

⇒ ["3.1 Assembly overview - exhaust gas recirculation", page 390](#)

⇒ ["3.2 Assembly overview - exhaust gas recirculation, 132 kW engine", page 391](#)

⇒ ["3.3 Removing and installing exhaust gas recirculation cooler", page 392](#)

⇒ ["3.4 Removing and installing exhaust gas recirculation cooler, 132 kW engine", page 398](#)

⇒ ["3.5 Removing and installing exhaust gas recirculation valve N18, 132 kW engine", page 400](#)

⇒ ["3.6 Removing and installing changeover valve for exhaust gas recirculation cooler N345", page 401](#)

⇒ ["3.7 Checking exhaust gas recirculation cooler for leaks", page 402](#)

#### 3.1 Assembly overview - exhaust gas recirculation

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

2 - Vacuum unit for exhaust flap

3 - Exhaust gas recirculation cooler

- ❑ Removing and installing  
⇒ [page 392](#) .

4 - Connection

- ❑ Coolant hose schematic diagram ⇒ [page 175](#) .

5 - Bolt



#### Note

*For better accessibility and to ensure the correct torque for the bolts of the exhaust gas recirculation cooler on the turbocharger side, hexagon bolts with part number »N 107 188 01« can be used.*

- ❑ First, fit bolts on turbocharger side and screw them in hand-tight.

- ❑ 8 Nm

6 - Gasket

- ❑ Renew after removing

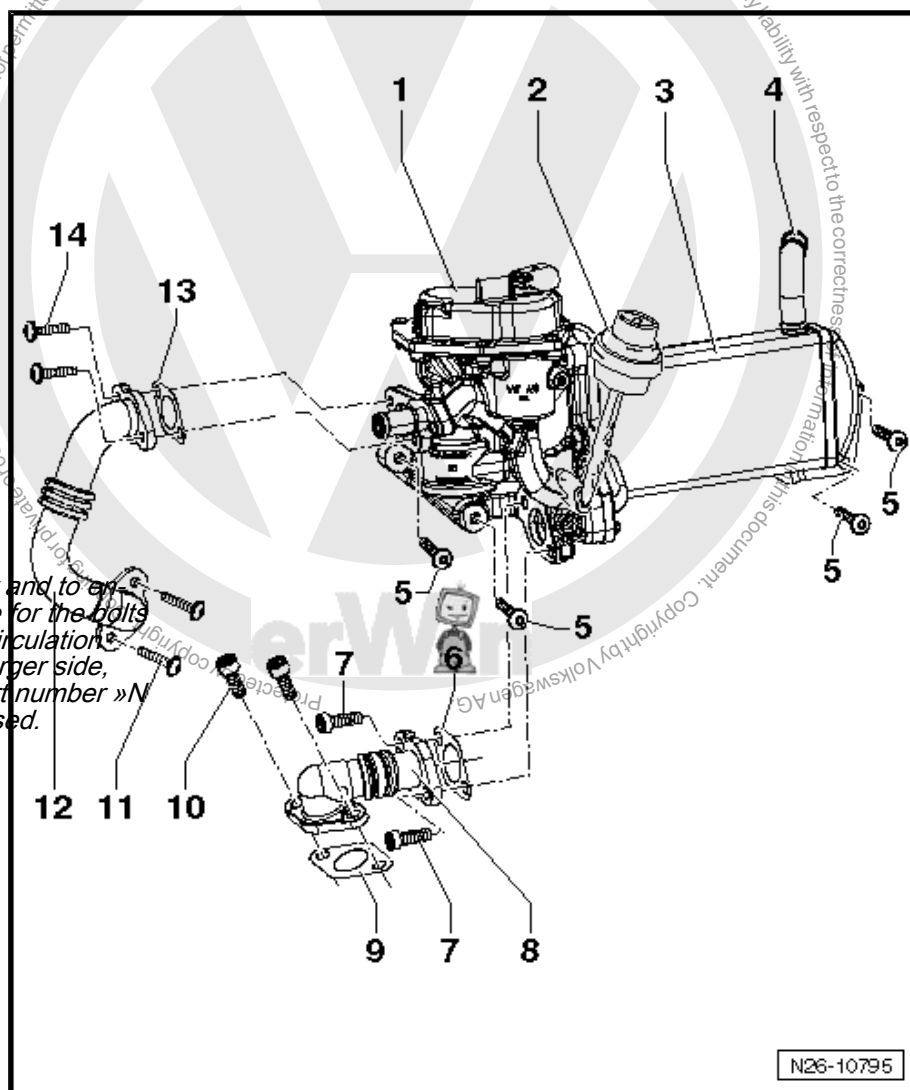
7 - Bolt

- ❑ 20 Nm

8 - Lower pipe

9 - Gasket

- ❑ Renew after removing



N26-10795



**10 - Bolt**

- ☐ 20 Nm

**11 - Bolt**

- ☐ 8 Nm

**12 - Upper pipe****13 - Gasket**

- ☐ Renew after removing

**14 - Bolt**

- ☐ Renew after removing
- ☐ 8 Nm

### 3.2 Assembly overview - exhaust gas recirculation, 132 kW engine

**1 - Exhaust gas recirculation cooler**

- ☐ Removing and installing  
⇒ [page 398](#) .

**2 - Bracket**

- ☐ For exhaust gas recirculation cooler.

**3 - Bolt**

- ☐ Renew after removing
- ☐ 8 Nm

**4 - Gasket****5 - Connecting pipe**

- ☐ To exhaust gas recirculation valve - N18-

**6 - Exhaust gas recirculation valve - N18-**

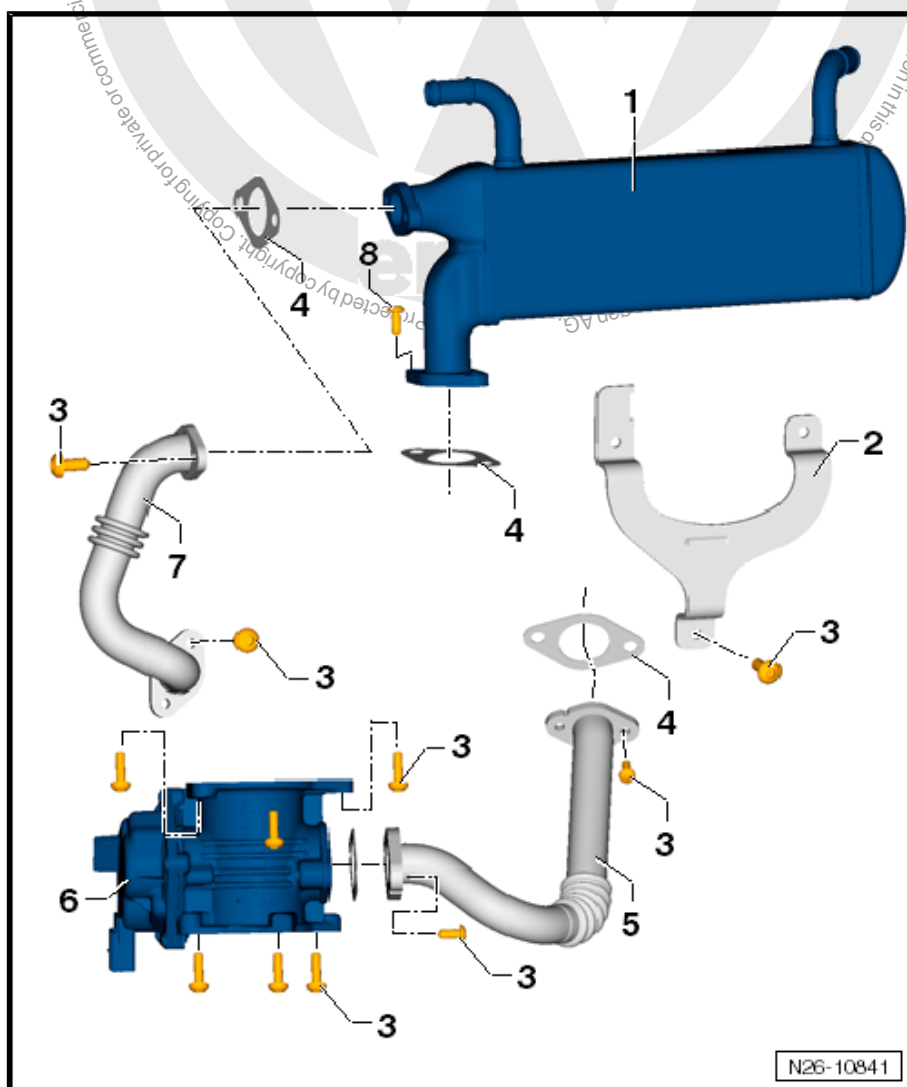
- ☐ Removing and installing  
⇒ [page 400](#) .

**7 - Connecting pipe**

- ☐ From exhaust gas recirculation cooler

**8 - Bolt**

- ☐ 20 Nm



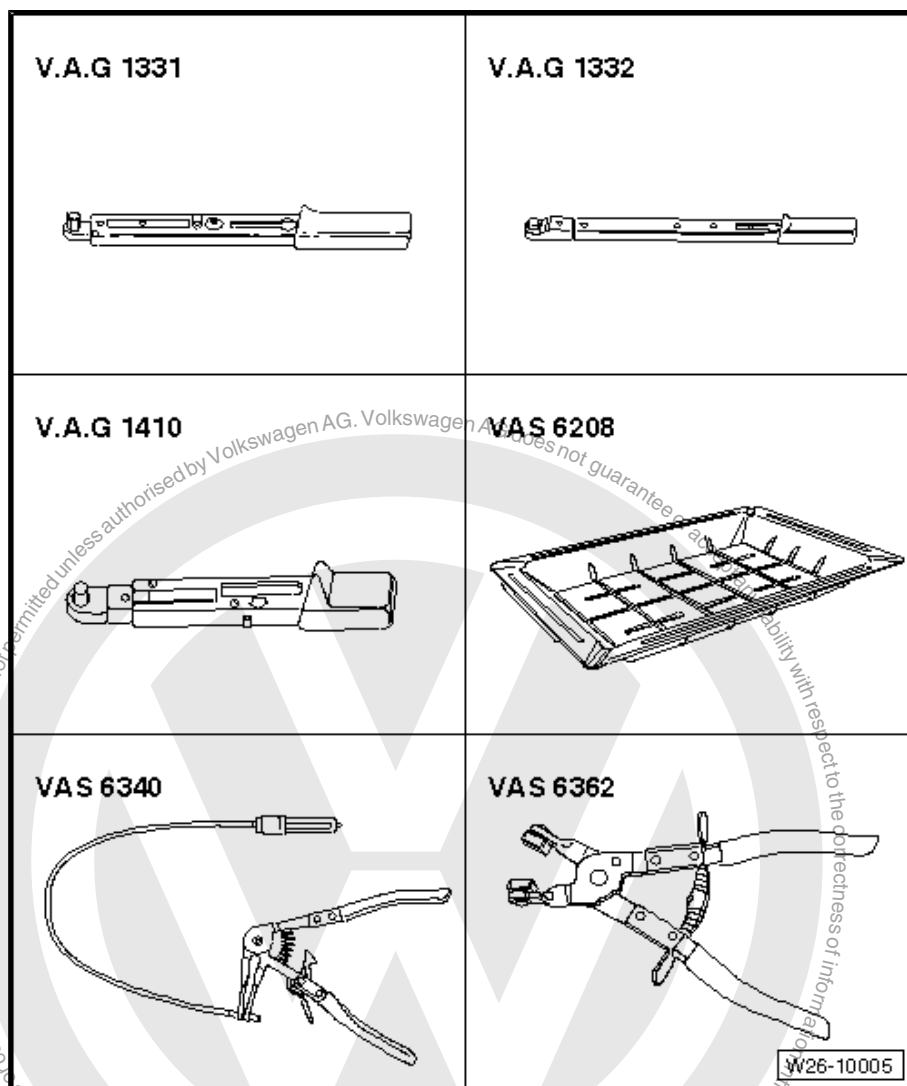




### 3.3 Removing and installing exhaust gas recirculation cooler

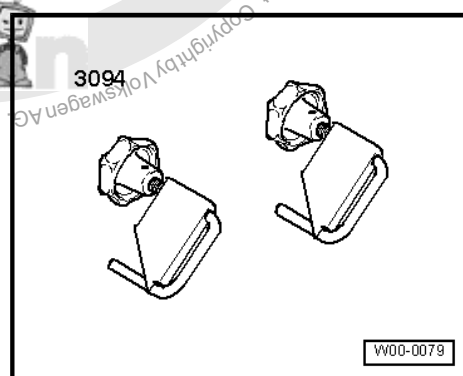
#### Special tools and workshop equipment required

- ◆ Torque wrench (5...50 Nm) - V.A.G 1331-
- ◆ Torque wrench (40...200 Nm) - V.A.G 1332-
- ◆ Torque wrench - V.A.G 1410-
- ◆ Drip tray for workshop hoist - VAS 6208-
- ◆ Hose clip pliers - VAS 6340-
- ◆ Hose clip pliers - VAS 6362-



#### Special tools and workshop equipment required

- ◆ Hose clamps up to 25 mm - 3094-



- ◆ Small hand-held mirror
- ◆ Flexible magnet





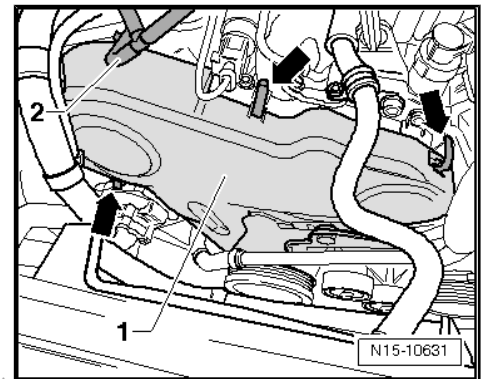
## Removing



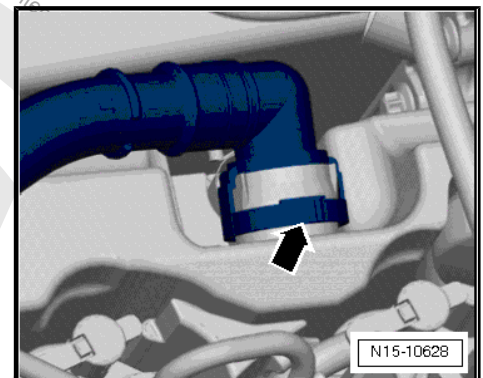
### Note

- ◆ Exhaust gas recirculation cooler is removed upwards. Contaminated areas must be cleaned thoroughly after installing.
- ◆ To facilitate removal of the exhaust gas recirculation cooler, remove the air filter housing and the exhaust pipe.
- ◆ For better accessibility and to ensure the correct torque for the bolts of the exhaust gas recirculation cooler, hexagon bolts with part number »N 107 188 01« can be used.
- ◆ Some connectors are difficult to see. A small hand-held mirror is required to unscrew and insert the threaded connection.
- ◆ Note different bolt lengths for pipes.
- ◆ Renew gaskets and seals.

- Detach vacuum hose -2- from upper toothed belt guard -1-.
- Open clips -arrows- and remove toothed belt guard -1-.



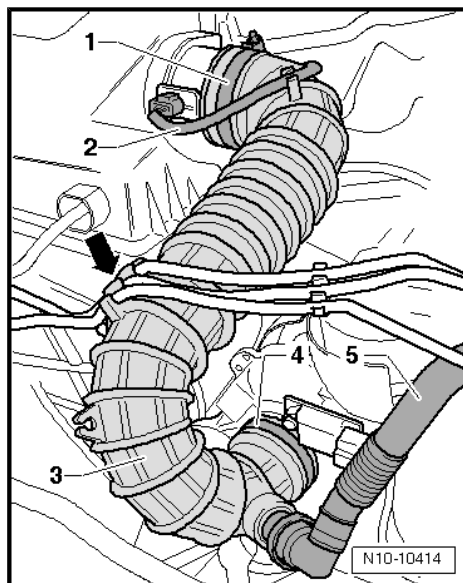
- Remove pipe -arrow- from cylinder head cover.



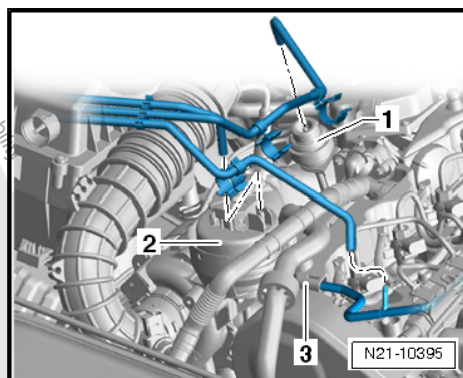




- Detach hoses from intake hose -3- bracket -arrow-.
- Release and pull off wiring harness connector -2-. Detach wiring harness -2- from intake hose retainer -3-.
- Open clips -1- and -4- and remove intake hose -3- together with pipe -5-.
- Remove air filter ⇒ [page 368](#)

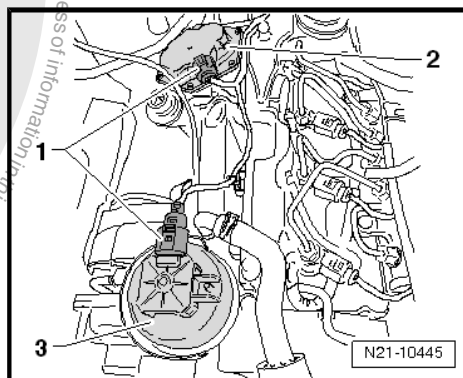


- Pull vacuum hose off vacuum unit of exhaust gas recirculation cooler -1- and vacuum hose from regulating flap potentiometer - G584- -2-.



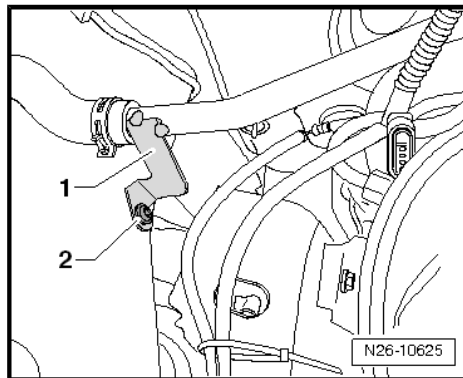
- Detach connectors -1- from exhaust gas recirculation valve - N18- -2- and regulating flap for potentiometer - G584- -3-.

#### Vehicles with particulate filter



- Undo and remove bolt -2- for coolant pipe -1- at wheel housing and tie on coolant hose somewhere at a slightly higher point.
- Remove particulate filter ⇒ [page 381](#) .

#### Vehicles with engines compliant with EU 4 and EU 3 standards

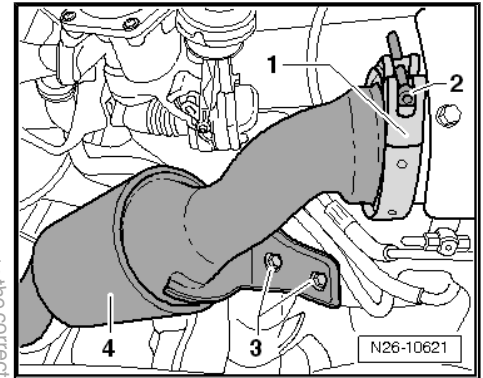




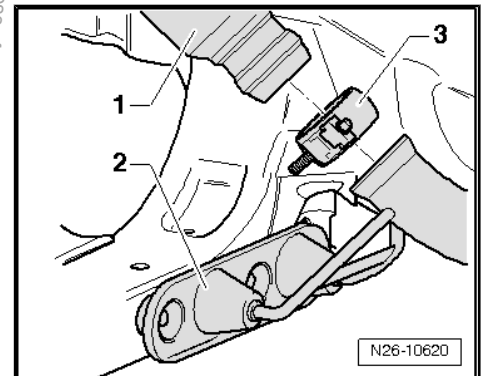


- Loosen bolt -2- in screw-type clip -1- for front exhaust pipe -4- at turbocharger.

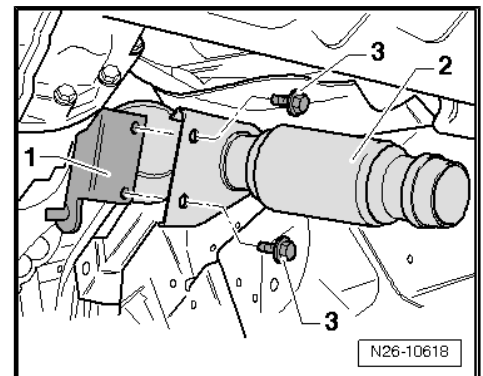
Unscrew and remove bolts -3- in bracket for front exhaust pipe -4-.



- Loosen screw-type clip -3- for front exhaust pipe -1-.



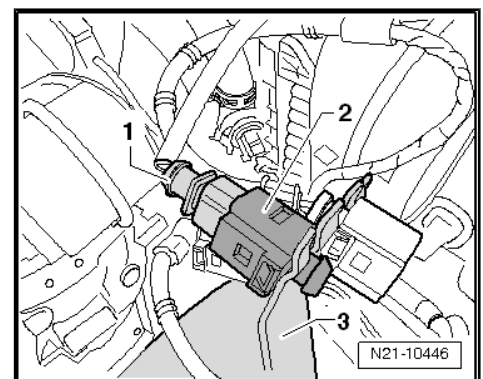
- Undo and remove bolts -3- for front exhaust pipe -2- at bracket -1-.



- Release and detach connector -1- of exhaust gas temperature sender 1 - G235- on front right wheel housing -3- at the coupling point -2-. Then, free wiring harness from fittings and lay it to one side.

- Carefully remove front exhaust pipe upwards out of the engine compartment.

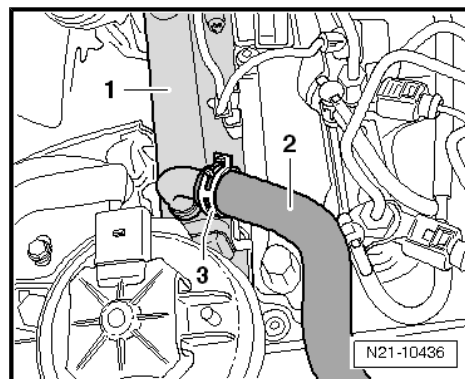
**Continuation for all vehicles**







- Clamp off coolant hose -2- with hose clamps up to 25 mm - 3094- .
- Loosen spring-type clip -3- and remove coolant hose -2- at exhaust gas recirculation cooler -1-.

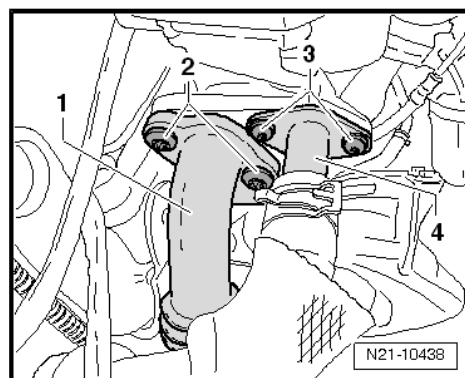


- Undo and remove bolts -2- for pipe -1- and remove pipe from exhaust gas recirculation cooler.

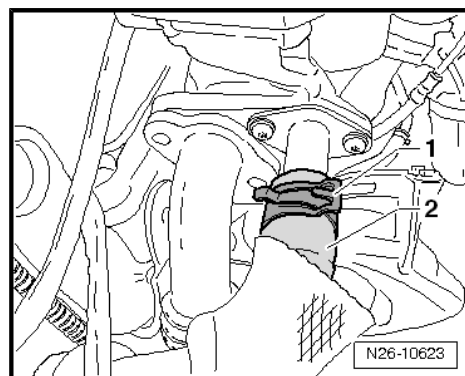


**Note**

*The bolts -3- for the pipe -4- are not undone.*



- Clamp off coolant hose -2- with hose clamps up to 25 mm - 3094- .
- Open spring-type clip -1- for coolant hose -2- and pull coolant hose off.

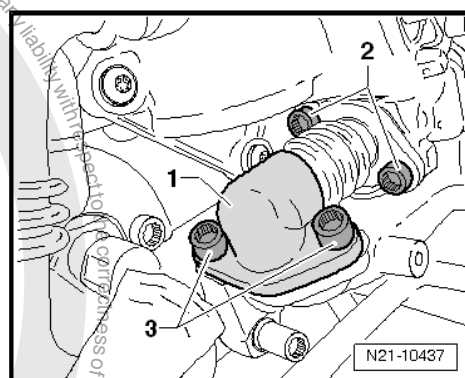


- Undo and remove bolts -2- and -3- for pipe -1- and remove pipe.



**Note**

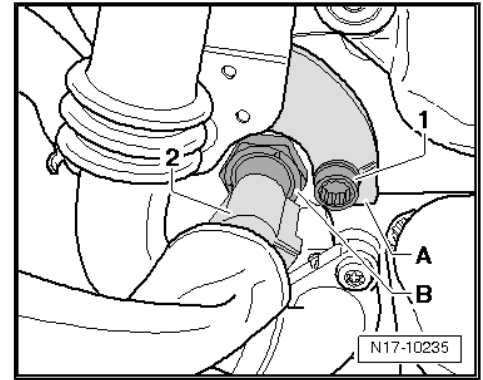
*Bear in mind the differences between the types of bolt!*



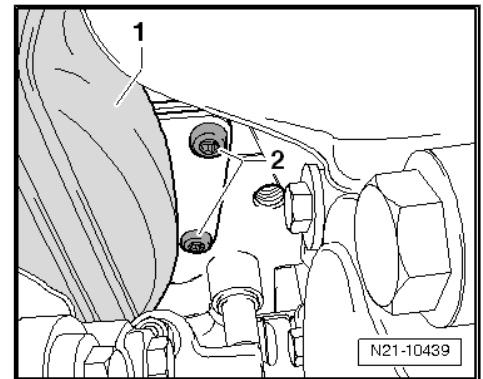




- Unclip connector -2- on oil pressure switch - F1- .



- Undo and remove bolts -2- at exhaust gas recirculation cooler -1-.

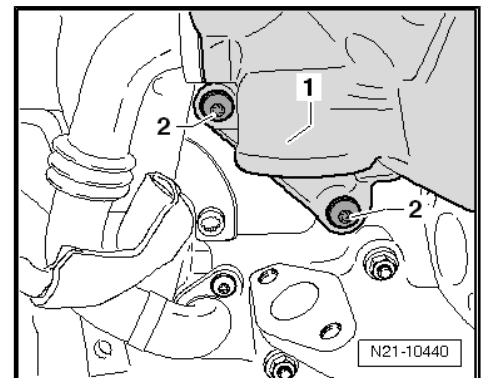


- Undo and remove bolts -2- at exhaust gas recirculation cooler -1-.
- Carefully remove exhaust gas recirculation cooler upwards.
- Clean contaminated areas thoroughly.

### Installing

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

- Renew gaskets and seals.



### Note

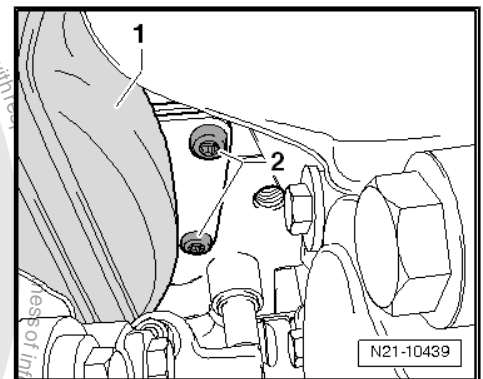
For better accessibility and to ensure the correct torque for the bolts -2- of the exhaust gas recirculation cooler on the turbo-charger side, hexagon bolts with part number N 107 188 01 can be used.

- Replace both bolts -2- at exhaust gas recirculation cooler on right with hexagon bolts (part number »N 107 188 01«), and tighten hexagon bolts.



### Note

- ◆ Note different bolt lengths for pipes.
- ◆ Only screw pipe bolts in loosely at first, then tighten.



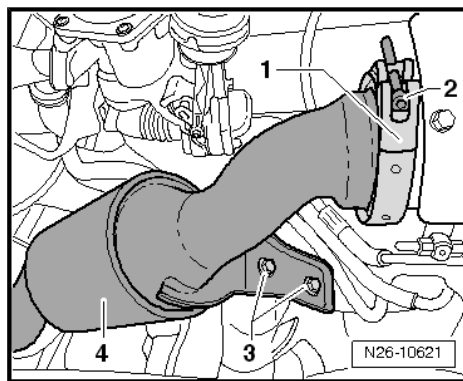




- Replace screw-type clamp -1- for front exhaust pipe -4-.
- Replenish coolant ⇒ [page 182](#) .

#### Specified torques

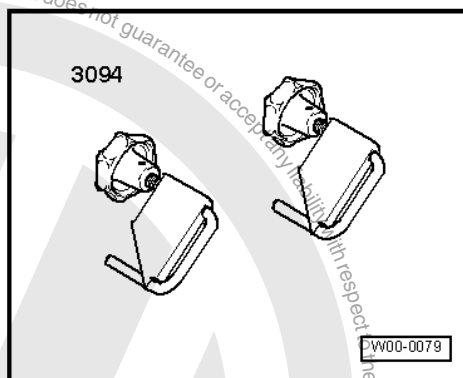
- ♦ ⇒ ["3.1 Assembly overview - exhaust gas recirculation", page 390](#)
- ♦ ⇒ ["2.1 Assembly overview - emission control \(diesel particulate filter\)", page 377](#)
- ♦ ⇒ ["2.2 Assembly overview - emission control \(catalytic converter\)", page 379](#)



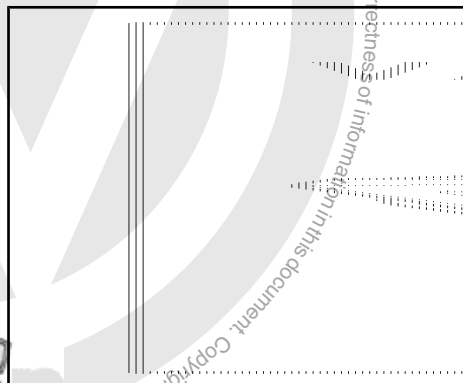
### 3.4 Removing and installing exhaust gas recirculation cooler, 132 kW engine

#### Special tools and workshop equipment required

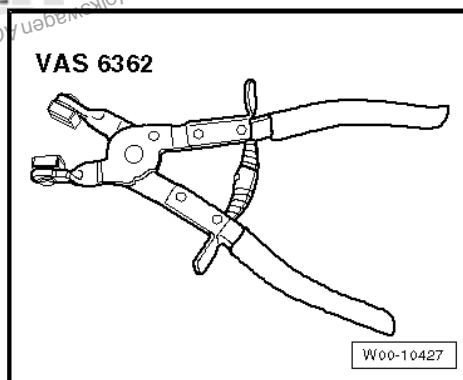
- ♦ Hose clamps up to 25 mm - 3094-



- ♦ Drip tray for workshop hoist - VAS 6208-



- ♦ Hose clip pliers - VAS 6362-



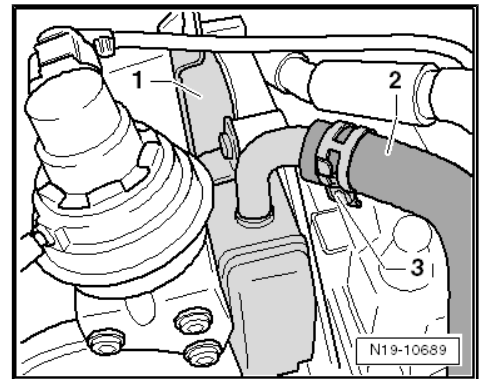


**Note**

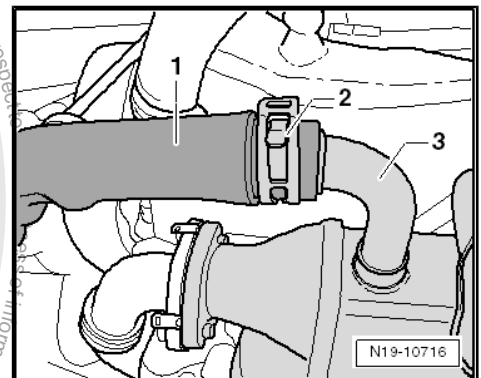
- ◆ *The exhaust gas recirculation cooler is removed upwards. Contaminated areas must be cleaned thoroughly after installing.*
- ◆ *Renew gaskets and seals.*

**Removing**

- Clamp off coolant hose -2- leading to input to exhaust gas recirculation cooler -1- with hose clamps up to 25 mm - 3094- .
- Loosen clamp -3- and pull coolant hose -2- off exhaust gas recirculation cooler -1-.

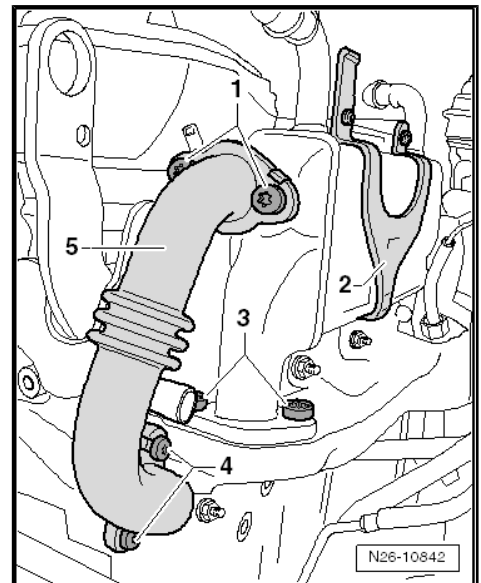


- Clamp off coolant hose -1- coming from output of exhaust gas recirculation cooler -3- with hose clamps up to 25 mm - 3094- .
- Loosen clamp -2- and pull coolant hose -1- off output of exhaust gas recirculation cooler -3-.



Undo and remove bolts -1 and 4- and remove connecting pipe -5-.

- Unscrew bolts -3-.







- Unscrew bolts -arrows- and remove bracket -1- of exhaust gas recirculation cooler.
- Carefully remove exhaust gas recirculation cooler upwards.

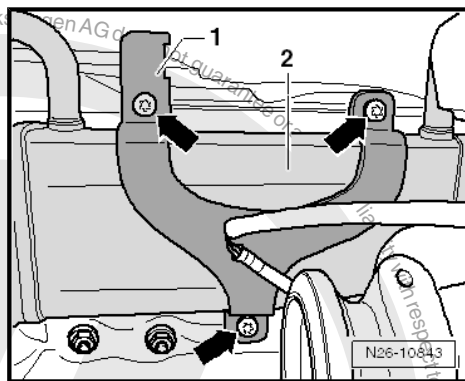
### Installing

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



#### Note

First, screw in all pipe bolts loosely and then tighten them to specified torque.



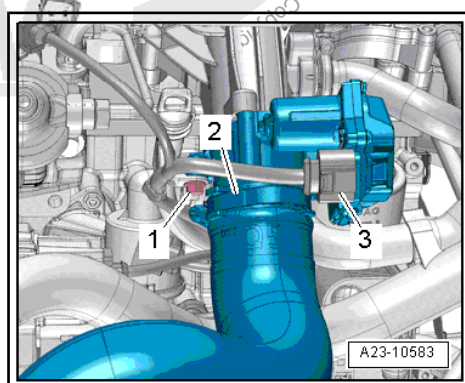
### Specified torques

- ♦ ⇒ ["3.2 Assembly overview - exhaust gas recirculation, 132 kW engine", page 391](#)

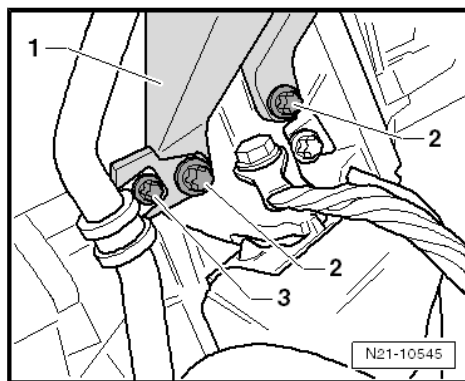
## 3.5 Removing and installing exhaust gas recirculation valve - N18- , 132 kW engine

### Removing

- Loosen clip -2- and pull pressure hose off throttle valve control module - J338- .
- Remove bolt -1- for dipstick guide tube
- Detach connector -3- from throttle valve control module - J338- .



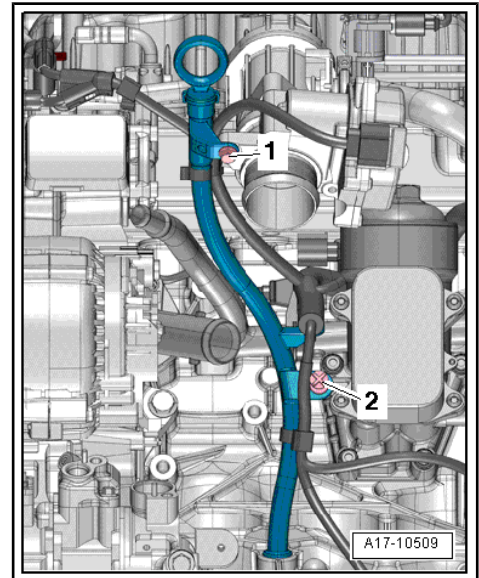
- Undo and remove bolts -2 and 3- and remove pressure pipe -1-.



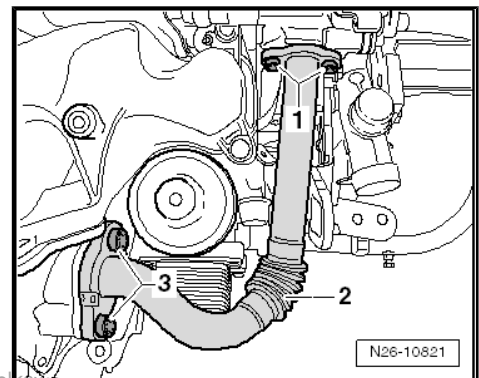




- Release oil dipstick again. To this, force expanding clip -2- off, using removal lever - 80 - 200- .
- Remove throttle valve module - J338- → [page 357](#) .
- Undo and remove bolts -1 and 3- from connecting pipe -2-.



- Remove connecting pipe -2-.



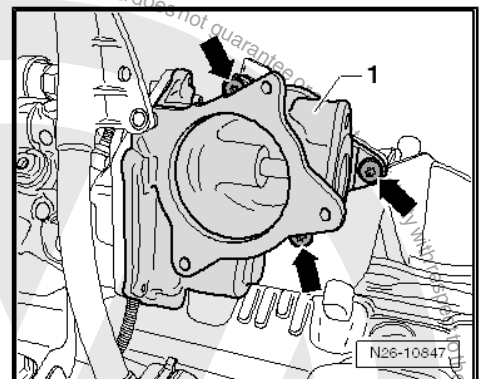
- Undo and remove bolts -arrows- and remove exhaust gas recirculation valve - N18- -1- from intake manifold.

### Installing

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

### Specified torques

- ◆ ⇒ [“3.2 Assembly overview - exhaust gas recirculation, 132 kW engine”, page 391](#)
- ◆ ⇒ [“5.1 Assembly overview - intake manifold”, page 354](#)



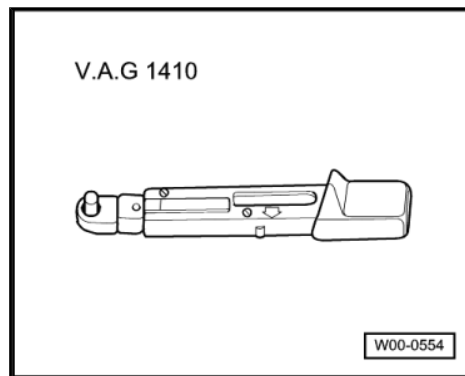
## 3.6 Removing and installing changeover valve for exhaust gas recirculation cooler - N345-

Special tools and workshop equipment required

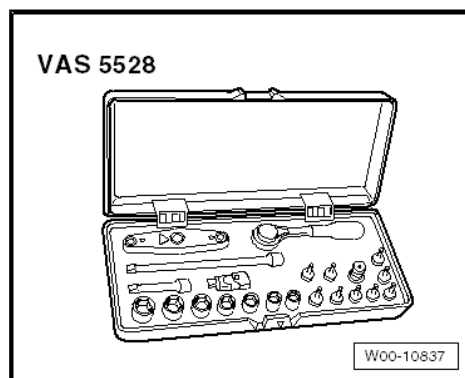




- ◆ Torque wrench - V.A.G 1410-



- ◆ Socket set 1/4", 22-piece - VAS 5528-



### Removing

- Pull connector -3- and vacuum lines and pull off changeover valve for exhaust gas recirculation cooler - N345- -1-.
- Unclip locking lug for changeover valve for exhaust gas recirculation cooler - N345- -1- and remove changeover valve for exhaust gas recirculation cooler - N345- .

### Installing

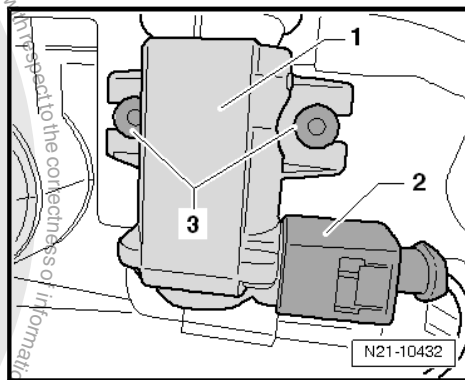
Installation is carried out in the reverse order; note the following:



#### 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.**



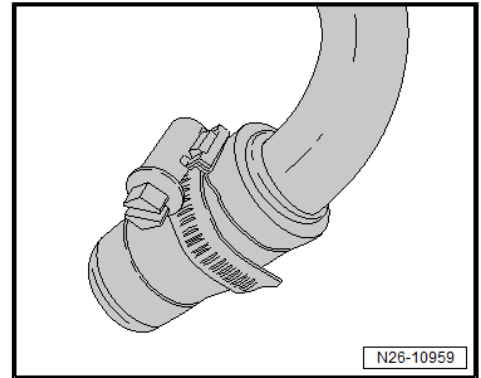
## 3.7 Checking exhaust gas recirculation cooler for leaks

- Exhaust gas recirculation cooler is removed ➤ [page 398](#) .

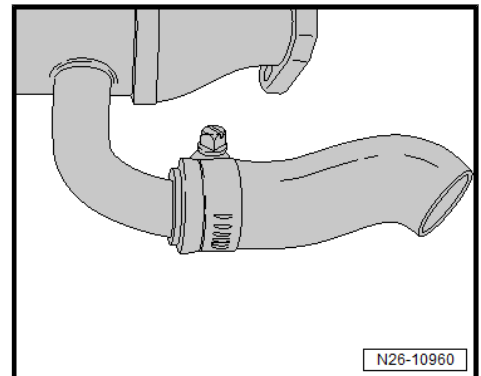




- The cooler connection which will be immersed in the water must be sealed watertight.



- Using a clamp, secure a hose to the cooler connection at which compressed air is supplied.

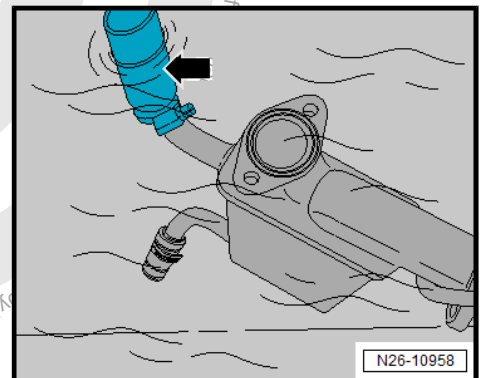
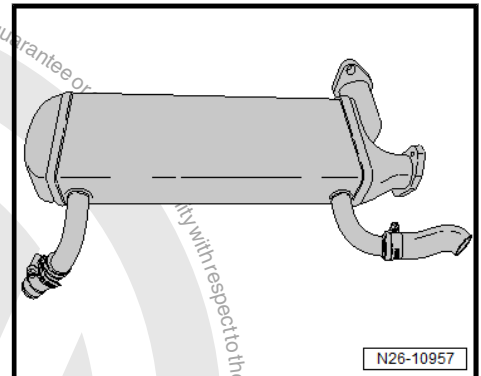


The exhaust gas recirculation cooler is now ready to be immersed in the water.



#### Note

- ◆ Supply compressed air at connection where coolant is supplied.
  - ◆ The cooler should remain immersed in the water for at least 30 minutes in order to obtain a significant result.
  - ◆ Using a commercially available immersion heater, heat water to approx. 60-80 °C.
  - ◆ Perform the pressure test with the cooler in vertical position.
  - ◆ The pressure must not exceed 3 bar.
- Immerse cooler in water as shown in illustration. Hose -arrow- must protrude from water in order to perform pressure test.







## 28 – Glow plug system

### 1 Glow plug system

⇒ [“1.1 Checking glow plug system”, page 404](#)

⇒ [“1.2 Removing and installing glow plugs”, page 405](#)

⇒ [“1.3 Removing and installing engine speed sender G28”, page 406](#)

⇒ [“1.4 Removing and installing Hall sender G40”, page 407](#)

#### 1.1 Checking glow plug system

##### Procedure

Automatic glow period control unit - J179- -A- is located in front left of engine compartment -arrow- beneath headlight.

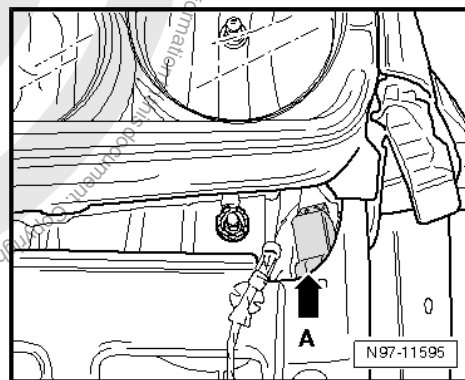
Glow plug system is activated via automatic glow period control unit - J179- . The automatic glow period control unit - J179- is capable of self-diagnosis.

A fault entry is stored in the engine control unit if a fault occurs in the glow plug system.

The procedure for checking 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.



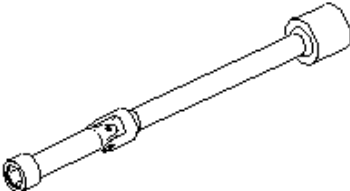
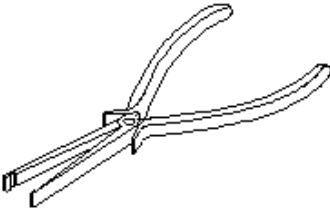
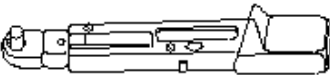




## 1.2 Removing and installing glow plugs

### Special tools and workshop equipment required

- ◆ Jointed wrench 10 mm - 3220-
- ◆ Pliers - 3314-
- ◆ Torque wrench - V.A.G 1410-

<b>3220</b> 	<b>3314</b> 
<b>V.A.G 1410</b> 	
	<div style="border: 1px solid black; padding: 2px;">W28-10003</div>

### Removing

- Switch off ignition.



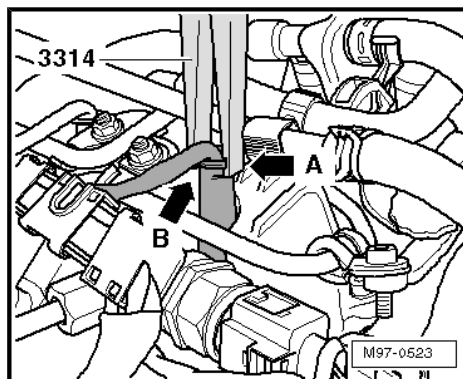
#### Caution

***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.***

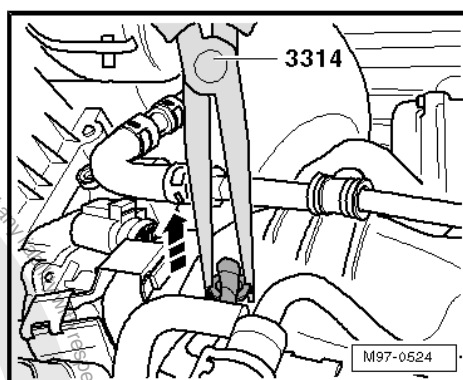




- Position pliers - 3314- with groove -arrow A- on support sleeve shoulder -arrow B-.



- 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 assured that no dirt falls into the cylinder.

**Note**

- 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 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:

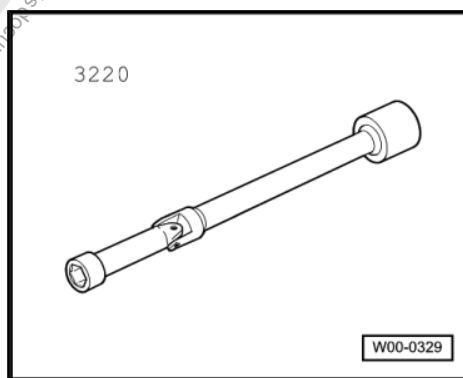
- To tighten the glow plugs use special tool U/J extension and socket, 10 mm - 3220- with a suitable torque wrench.
- Tighten glow plugs.
- Fit glow plug connectors to the respective glow plugs and ensure they are firmly seated.
- Delete event memory of engine control unit.

**Specified torques**

- ⇒ ["1.1 Assembly overview - cylinder head", page 78](#)

### 1.3 Removing and installing engine speed sender - G28-

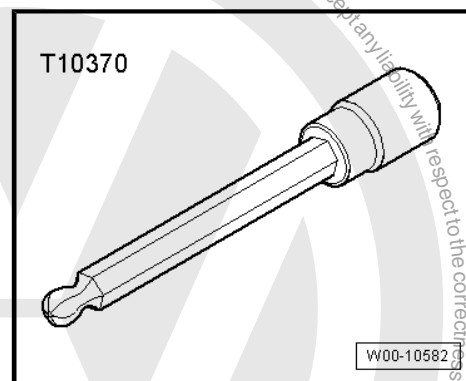
Special tools and workshop equipment required







- ◆ Hexagon key extension, 4 mm - T10370-



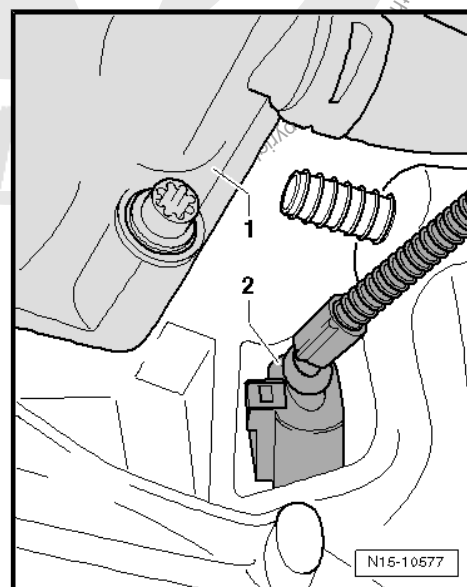
### Removing

- Remove underbody guard, if fitted ⇒ General body repairs, exterior; Rep. gr. 66 ; Underbody guard .
- Pull the connector -2- off the engine speed sender - G28- below the oil filter holder -1-.



### Note

To release electrical connector without assembly tool - T10118-, press connector on engine speed sender - G28- in with a screwdriver and at the same time raise release tab with a thin wire hook.



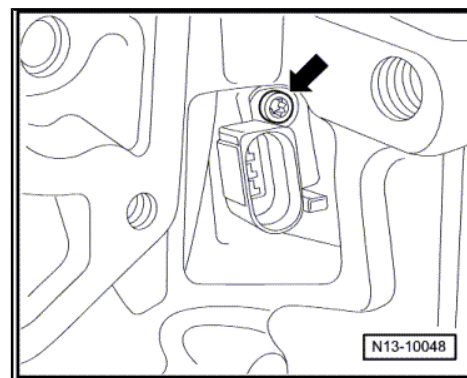
- Loosen securing bolt -arrow- with socket AF 4 mm - T10370- and remove speed sender.

### Installing

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

### Specified torques

- ◆ ⇒ [“3.1 Assembly overview - cylinder block, gearbox end”, page 54](#)



## 1.4 Removing and installing Hall sender - G40-

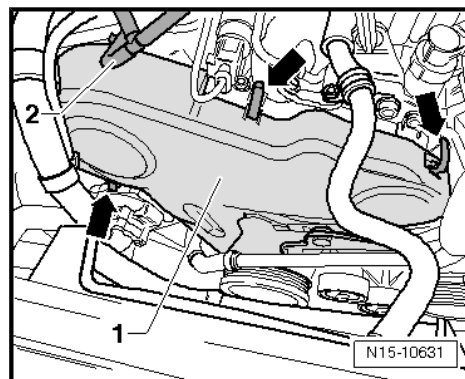
### Removing

- Remove poly V-belt ⇒ [page 40](#) .

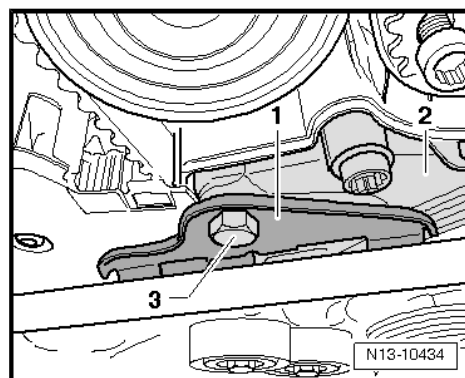




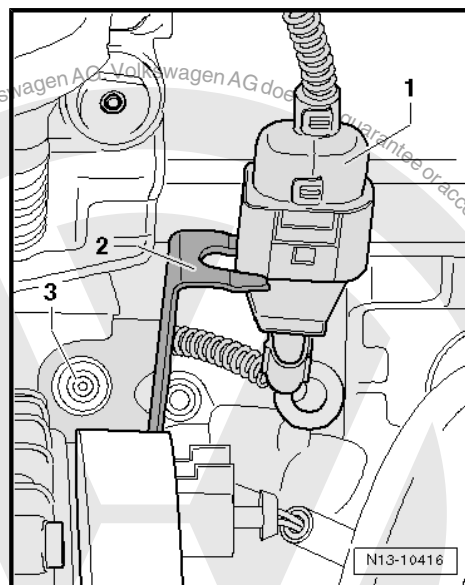
- Detach vacuum hose -2- from upper toothed belt guard -1-.
- Open clips -arrows- and remove toothed belt guard -1-.



- Unscrew bolt -3- for bracket -1-.



- Detach connector -1- for Hall sender - G40- .
- Remove vibration damper ➤ [page 44](#) .

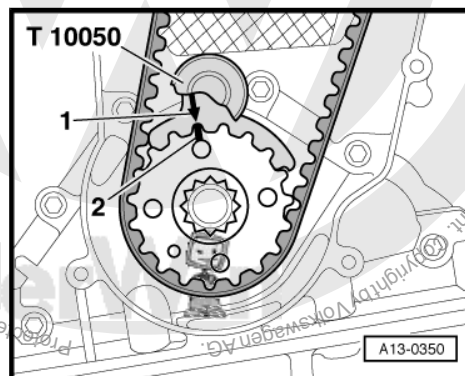


- Turn engine to TDC and lock crankshaft toothed belt pulley in position with crankshaft stop - T10050- . To do this, push the crankshaft stop into the teeth of the toothed belt pulley from the latter's face side. The toothed segment of the camshaft must be at the »12 o'clock position«.



#### Note

Markings on crankshaft toothed belt pulley -2- and crankshaft stop - T10050- -1- must align. At the same time, the pin of the crankshaft stop - T10050- must engage in the drilling in the sealing flange.

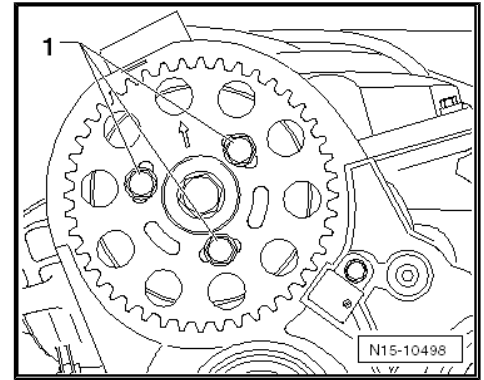




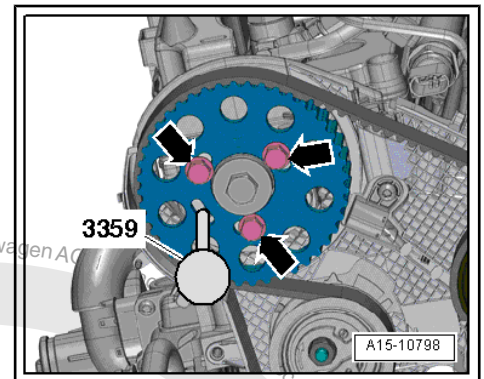


Arrow on camshaft pulley must be at almost »12 o'clock«.

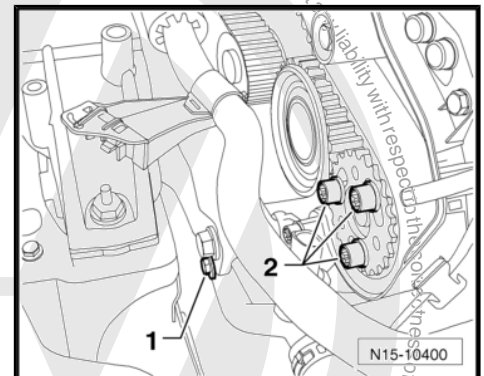
- Mark direction of rotation of toothed belt.



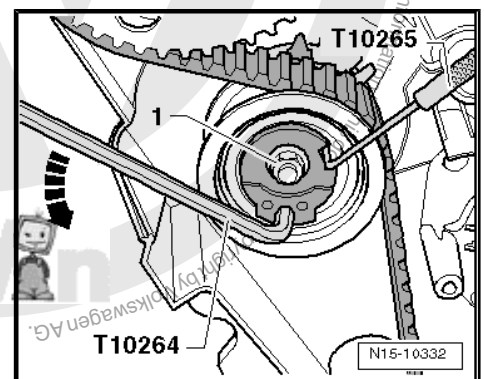
- Lock the camshaft hub with locking pin - 3359- . To do this, insert locking pin through outer free elongated hole into hole in cylinder head.
- Loosen bolts -arrows- approx. 90° for camshaft toothed belt pulley.



- Remove bolts of toothed belt pulley of high-pressure pump -2-.
- Loosen belt tensioner nut -1-.



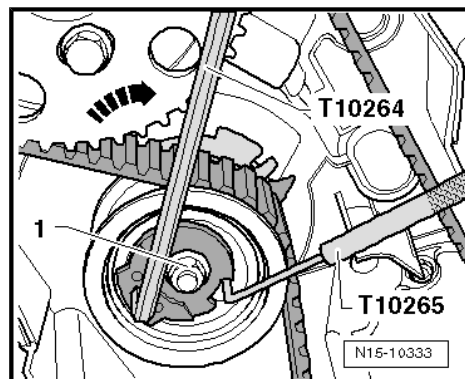
- Turn eccentric of tensioning roller anti-clockwise -arrow- using socket - T10264- , until the tensioning roller can be locked with locking tool - T10265- .



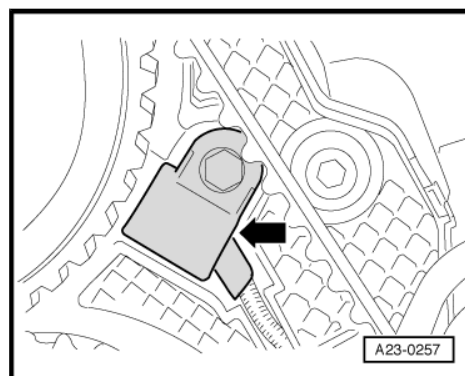




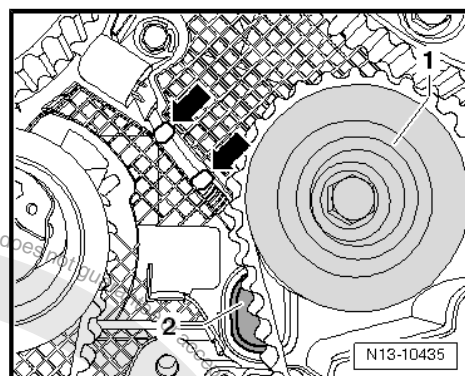
- Now turn tensioning roller eccentric clockwise -arrow- onto stop and tighten securing nut -1- hand-tight.
- Remove toothed belt from idler roller and high-pressure pump.



- Screw off Hall sender - G40- -arrow-.



- Remove guide roller -1- ➔ [Item 18 \(page 106\)](#) .
- Using a screwdriver, remove webs -arrows- and detach wiring harness
- Remove cover -2- of repair aperture -arrows-.
- Unscrew Hall sender - G40- from cylinder head.

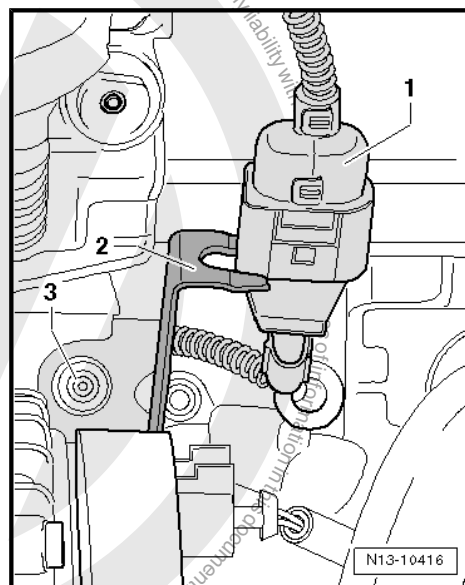


- Pull wiring harness -1- out of retainer -2- and separate.
- Pull wiring harness together with Hall sender - G40- out completely in direction of normal travel (forwards).

### Installing

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

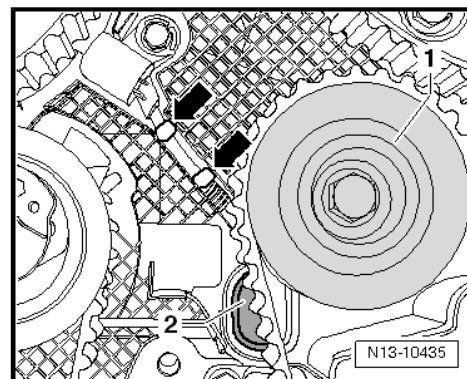
- Seal repair aperture in toothed belt guard with rubber plugs as specified in ➔ Electronic Parts Catalogue (ETKA) .



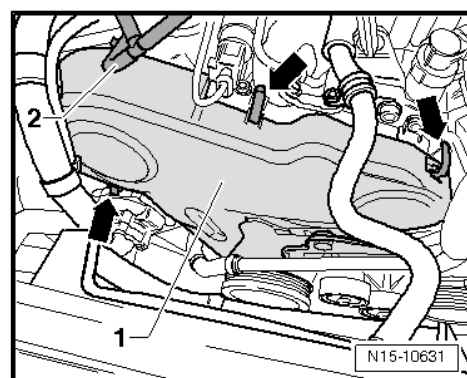




- Install guide roller -1- ⇒ [Item 18 \(page 106\)](#) .
- Fit toothed belt and adjust the valve timing ⇒ [page 107](#) .



- Install upper toothed belt guard -3- and secure with clips -arrows-.
- Clip vacuum hose -2- into toothed belt guard -1-.



- Tighten bolt -3- for coolant pipe bracket -1-.
- Install poly V-belt ⇒ [page 40](#) .

#### Specified torques

- ◆ ⇒ ["1.1 Assembly overview - cylinder head", page 78](#)
- ◆ ⇒ ["2.1 Assembly overview - toothed belt drive", page 105](#)

