Workshop Manual

Transporter 2016 ➤

4-cylinder injection engine (2.0 l direct injection engine, turbocharger)									
Engine ID	CJKA	CJKB							

Edition 06.2018

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.

Contents

00 – Technical data

1 Safety information

(VRL011702; Edition 06.2018)

1.1 Safety regulations for working on fuel supply

Risk of injury from highly pressurised fuel.

The fuel system is pressurised. Injury from fuel spray possible.

Before opening the fuel system:

– Wear protective goggles.

– Wear protective gloves.

– To release pressure, wrap a clean cloth around the connection and carefully loosen the connection.

Danger of fire caused by escaping fuel

When the battery is connected and the driver door opens, the door contact switch activates the fuel pump. Escaping fuel can ignite and cause a fire.

– Disconnect voltage supply to fuel pump before opening the fuel system.

1.2 Safety measures when working on vehicles with a start/stop system

Risk of injury due to unexpected motor start

If the vehicle’s start/stop system is activated, the engine can start unexpectedly. A message in the dash panel insert indicates whether the start/stop system is activated.

– Deactivate start/stop system by switching off the ignition.

1.3 Safety precautions when using testers and measuring instruments during a road test

Risk of injury caused by unsecured testing and measuring instruments

When the front passenger airbag is triggered in an accident, insufficiently secured testing and measuring instruments become dangerous projectiles.

– Secure testing and measuring instruments on the rear seat.

or

– Have a second person operate the test and measuring equipment on the rear seat.

1.4 Safety precautions when working on the cooling system

Danger of scalding by hot coolant

On a warm engine, the cooling system is under high pressure. Danger of scalding by steam and hot coolant.

– Wear protective gloves.

– Wear protective goggles.

– Reduce excess pressure by covering cap of coolant expansion tank with cloths and opening it carefully.

1.5 Safety precautions when working on ignition system

Risk of injury due to electric shock

The ignition system is under high voltage when the engine is running. Touching the ignition system may result in an electric shock.

– Do not touch or disconnect ignition cables when the engine is running or being turned at starter speed.

Risk of damage to components

Connecting or disconnecting electric cables or washing the engine while it is running may damage components.

– Switch off the ignition before connecting or disconnecting electric cables.

– Switch off the ignition before washing the engine.

1.6 Safety precautions when working on exhaust system

Risk of poisoning due to chemical substances

Exhaust gas temperature senders may contain chemical substances. There is a risk of poisoning or injuries to respiratory system.

– Never open an exhaust gas temperature sender by cutting, sawing or any other means.

Risk of injury due to hot condensate and particles in the exhaust system.

The exhaust system could contain hot condensate and/or particles. There is a risk of injury to the eyes, skin and respiratory system, as well as poisoning.

– Always wear protective gloves and eye protection when cutting the exhaust system.

– When cutting, use an extraction system or otherwise ensure sufficient ventilation.

2 Identification

⇒ “2.1 Engine number/engine data”, page 4

2.1 Engine number/engine data

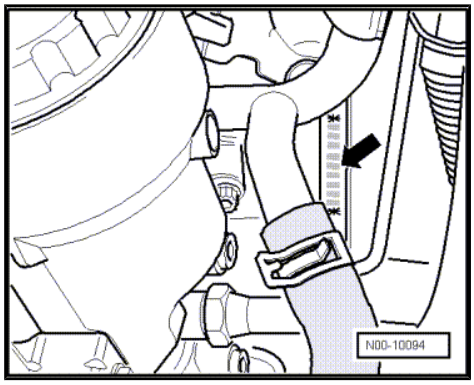
The engine number (engine code and serial number) is located at the front on the joint -arrow- between engine and gearbox.

In addition, a sticker is attached to the top of the toothed belt guard -arrow- showing the engine code.

The engine codes have four characters.

The first 3 characters stand for the engine's cubic capacity and mechanical structure. They are stamped into the cylinder block together with the serial number.

The fourth character denotes the engine's performance and torque rating and depends on the engine control unit.



Note

Fitting locations of vehicle data sticker ⇒ Maintenance ; Booklet 20.1 ; General; Vehicle data sticker .

Codes		CJKA	CJKB
Displacement	l	2.0	2.0
Power	kW at rpm	150 kW at 4200 to 6000 rpm	110 kW at 3750 to 6000 rpm
Torque	Nm at rpm	350 Nm at 1500 to 4000 rpm	280 Nm at 1500 to 3750 rpm
Displacement	cm^3	1984	1984
Bore	∅ mm	82.5	82.5
Stroke	mm	92.8	92.8
Valves per cylinder		4	4
Compression ratio		9.6:1	9.8:1
Fuel:	acc. to	DIN EN 228	DIN EN 228
Firing order		1-3-4-2	1-3-4-2
Catalytic converter		Yes	Yes
Exhaust gas recirculation		No	No
Charging		Yes	Yes
Knock control		Yes	Yes
Camshaft timing adjustment		Yes	Yes
Secondary air injection		No	No

1) If petrol with a RON rating of less than 95 is used, reduced power output and torque must be expected.

3 Repair instructions

3.1 Rules for cleanliness

Even slight soiling can cause faults. You must therefore comply with the following cleanliness rules when working on the fuel supply system, injectors or the turbocharger:

- Carefully clean connection points and the surrounding area, and dry thoroughly before opening.
- Seal open pipes and connections immediately with clean plugs for example from the engine bung set - VAS 6122- .
- Place removed parts on a clean surface and cover them over. Use lint-free cloths only.
- If repair work cannot be performed immediately, carefully cover or seal components.
- Install only clean parts; do not remove new parts from packaging until immediately before installing. Do not use parts that have been stored outside of their packaging (e.g. in tool boxes).
- If system is open, do not work with compressed air. Do not move the vehicle.
- Protect disconnected electrical connectors from dirt and water, and reconnect them only when dry.
- The components must be clean and dry.

3.2 General information

- The engine control unit has a self-diagnosis capability. Before carrying out repairs and for fault finding, first read event memory. Also the vacuum hoses and connections must be checked (unmetered air).
- For trouble-free operation of electrical components, a voltage of at least 11.5 volts is necessary.
- Do not use sealants containing silicone. Particles of silicone drawn into the engine will not be burnt in the engine and damage the Lambda probe.
- Vehicles are fitted with a crash fuel shut-off circuit. It reduces the danger of a fire in a crash as the fuel pump is switched off via the fuel pump relay.
- The system also improves the starting characteristics of the engine. When the driver door is opened, the fuel pump is activated for 2 seconds in order to build up pressure in the fuel system, observe safety precautions ⇒ page 1 .

3.3 General repair instructions

- Clean tools and workbench etc. before working on injection system.
- The injectors and locations are to be checked before installation by means of a visual inspection for damage and dirt. It must be ensured that the injector bore is clean. If necessary, clean the injector shaft using a clean cloth. Take care not to cause any damage (do not use any sharp tools!).
- If high-pressure lines are not renewed, they must be labelled on removal. High-pressure fuel lines must always be re-installed in their original positions (i.e. on the same cylinder).
- Take care not to damage the injectors when removing the old copper seals.
- Check all new O-rings for damage before installing. Lubricate O-rings with engine oil or assembly oil before installing.
- Align high-pressure lines so that they are not subjected to stress . First tighten all unions hand-tight and then tighten to torque.
- Never attempt to reshape high-pressure fuel lines.
- When working on any parts of the high-pressure fuel system, tools may only be used for loosening and tightening pipe unions. All other components must always be removed and installed by hand without using tools or other equipment.
- Press the fuel return lines onto the injectors by hand from above so that they engage audibly on each injector (do not press in the release pins when doing this). Then, press the release pin downwards. Pull fuel return lines upwards by hand to check that they are firmly attached and are not leaking.
- Disassembling individual common rail components is not permitted. The components should be replaced as complete units if faulty.
- Do not carry out any installation work on common rail system whilst engine is running.
- Never attempt to bleed the common rail system by loosening high-pressure components after starting the engine.
- All cable ties which were opened or cut during removal must be renewed at the same locations.
- Fuel hoses in engine compartment must be secured only with spring-type clips. The use of crimp-type or screw-type clips is not permissible.

3.4 Foreign objects in engine

- To prevent the ingress of foreign bodies during work on the engine, seal all openings.
- Seal openings with suitable bungs from engine bung set - VAS 6122- .

3.5 Contact corrosion

Contact corrosion can occur if non-approved fasteners are used on the vehicle (bolts, nuts, washers etc.).

For this reason, only connecting elements with a special surface coating have been fitted.

In addition, rubber, plastic and adhesives are made of non-conductive materials.

If there is any doubt about the suitability of parts, a general rule is to use new parts ⇒ Electronic Parts Catalogue (ETKA) .

3.6 Routing and attachment of lines

Risk of damage to lines

Lines may become damaged by moving or hot components.

– Route lines in their original positions.

– Ensure there is sufficient clearance to moving or hot components.

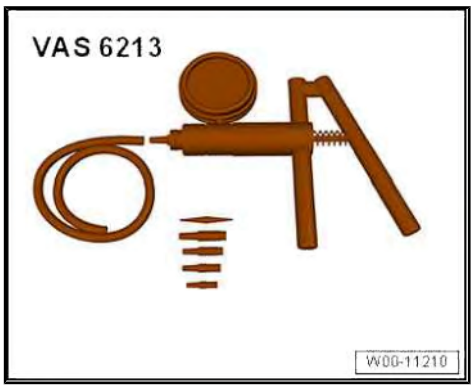
3.7 Fitting radiator and condensers

Even if installed correctly, the radiator, the condenser and the charge air cooler may have small dents in their fins. This does not mean that these components have been damaged. It is not permissible to renew radiators, charge air coolers or condensers only because of such minor dents.

3.8 Checking vacuum system

Special tools and workshop equipment required

♦ Hand operated vacuum pump - VAS 6213-



Sequence of operations

– Check all vacuum lines throughout entire vacuum system for:

♦ Cracks

♦ Marten bites

♦ Crushing

♦ Porous areas and other leaks

– Check vacuum line to solenoid valve and from solenoid valve to relevant component.

– If a fault has been entered in the event memory, make sure to check not only all vacuum lines leading to the specified component, but also those leading to other components.

– If pressure cannot be built-up using hand vacuum pump - VAS 6213- or pressure immediately drops again, check hand vacuum pump and connecting hoses for leaks.

10 – Removing and installing engine

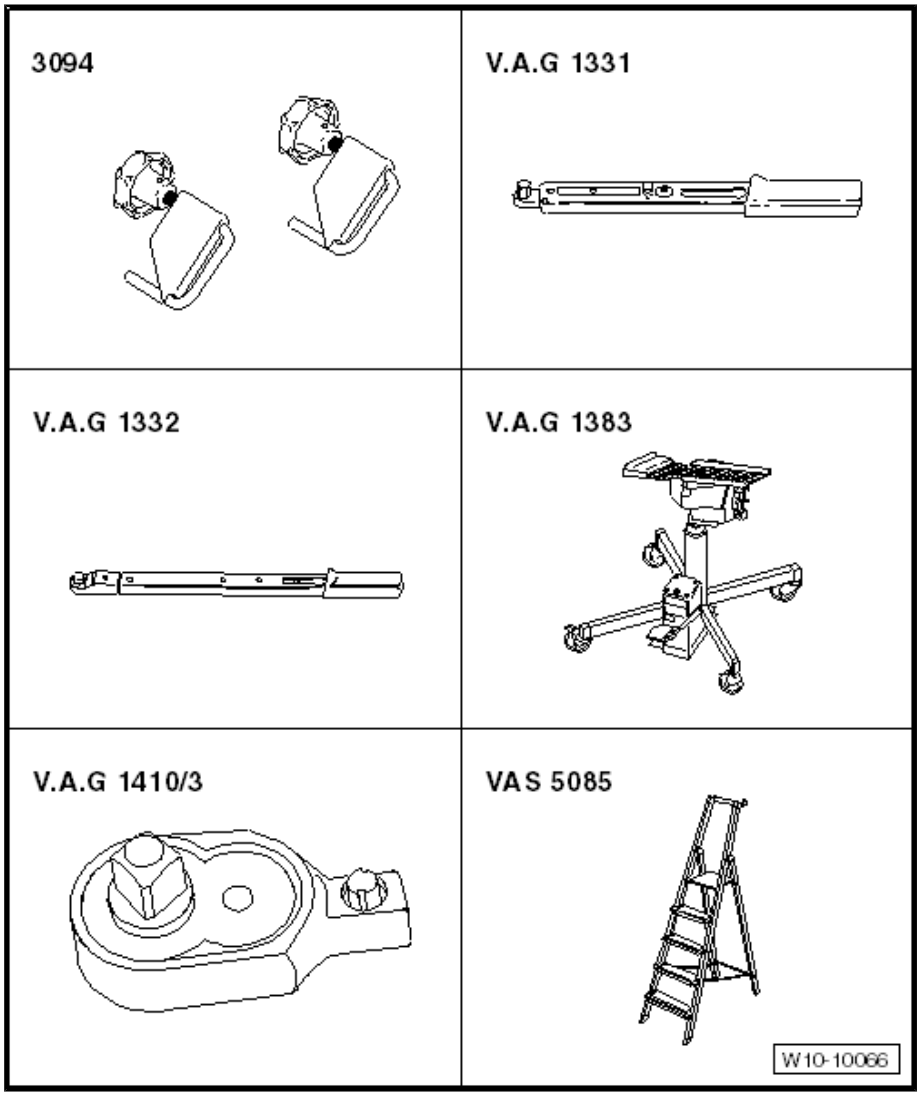
1 Removing and installing engine

⇒ “1.1 Removing engine”, page 8

⇒ “1.2 Securing engine on engine and gearbox support”, page 18

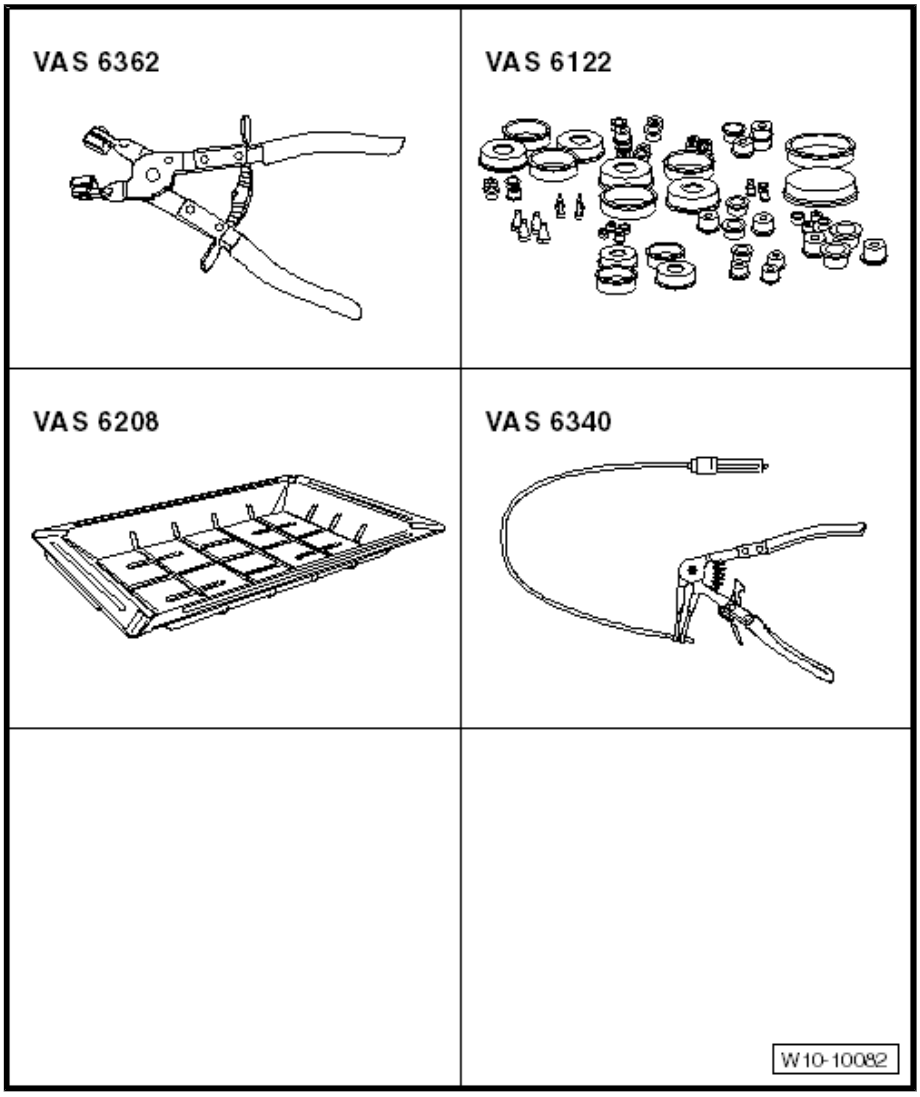
⇒ “1.3 Installing engine”, page 19

1.1 Removing engine



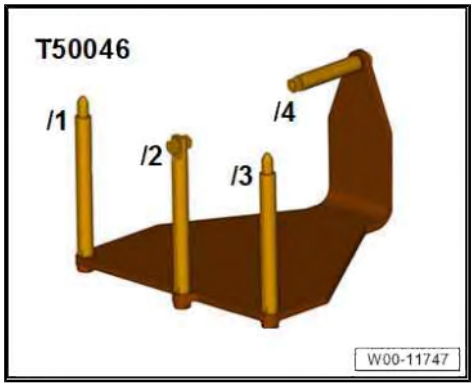
- Hose clamps to 25 mm - 3094-
- Torque wrench - V.A.G 1331-
- Torque wrench - V.A.G 1332-
- Engine and gearbox jack - V.A.G 1383 A-
- Ratchet attachment - V.A.G 1410/3-
- Stepladder - VAS 5085-

Special tools and workshop equipment required



- Engine bung set - VAS 6122-
- Drip tray for workshop hoist - VAS 6208-
- Hose clamp pliers - VAS 6340-
- Spring-type clip pliers - VAS 6362-

Engine support - T50046-



Removing

Note

- *The engine is removed downwards together with the gearbox.*
- *Seal open lines and unions with clean plugs from engine bung set - VAS 6122- .*

– Remove battery tray ⇒ Electrical system; Rep. gr. 27 ; Battery; Removing and installing battery tray .

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

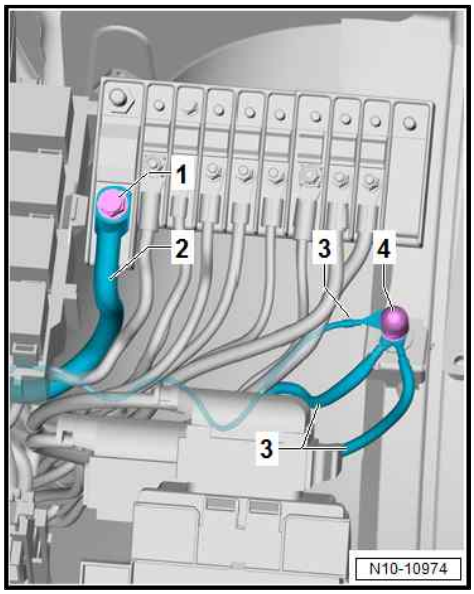
– Move to service position ⇒ General body repairs, exterior; Rep. gr. 50 ; Lock carrier; Moving to and back from service position .

– Remove left headlight ⇒ Electrical system; Rep. gr. 94 ; Headlights; Removing and installing headlights .

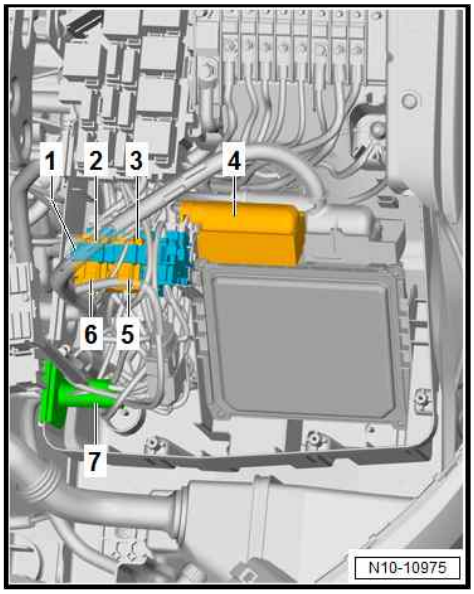
– Remove upper part of electronics box ⇒ Electrical system; Rep. gr. 97 ; Removing and installing fuse holders, relay carriers and electronics boxes .

– Unscrew nuts -1- and -4-.

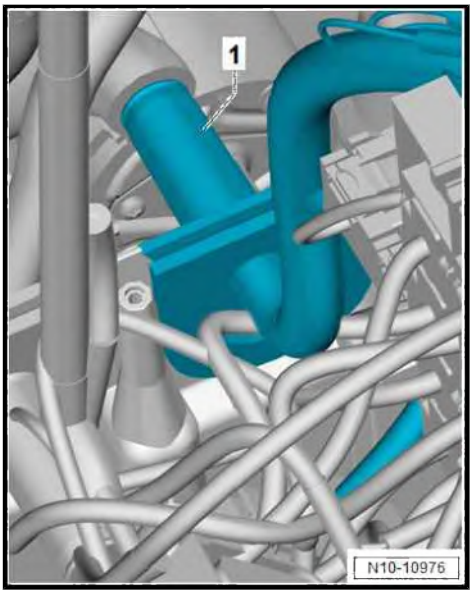
– Remove wiring harness -2- and -3-.



– Disconnect connector -4-.
– Unplug electrical connectors -2, 3, 5, 6-.
– Open retainer -1-.
– Remove wiring harness together with seal -7- from electronics box.



– Remove wiring harness together with seal -1- from electronics box.
– Lay wiring harness on engine and secure.
– Drain coolant ⇒ page 163 .
– Remove subframe together with steering rack ⇒ Running gear, axles, steering; Rep. gr. 40 ; Subframe; Removing and installing subframe with steering rack .
– Remove right and left drive shaft ⇒ Running gear, axles, steering; Rep. gr. 40 ; Drive shaft; Removing and installing drive shaft .
– Remove downstream catalytic converter ⇒ page 245 .



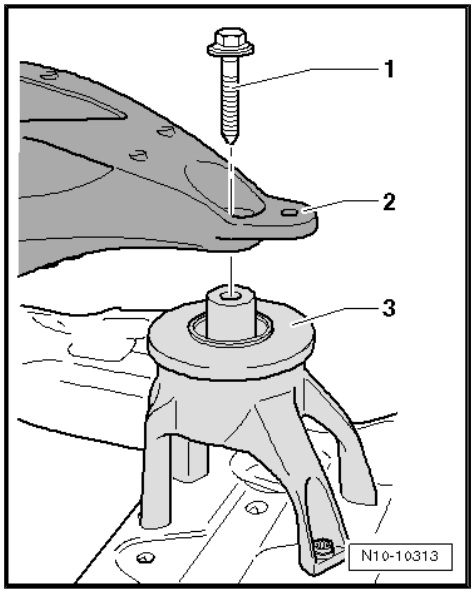
Vehicles with air conditioner:

– Remove air conditioner compressor from bracket with lines still attached, and secure it on vehicle ⇒ Heating, air conditioning; Rep. gr. 87 ; Air conditioner compressor; Removing air conditioner compressor from and installing on bracket .

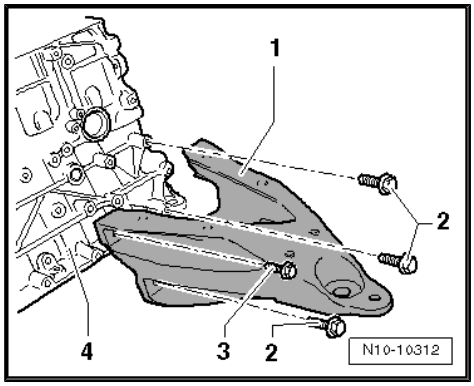
Continued for all vehicles

– Remove power steering vane pump with lines still attached, and secure it to body ⇒ Running gear, axles, steering; Rep. gr. 48 ; Hydraulic power steering, Removing and installing vane pump .

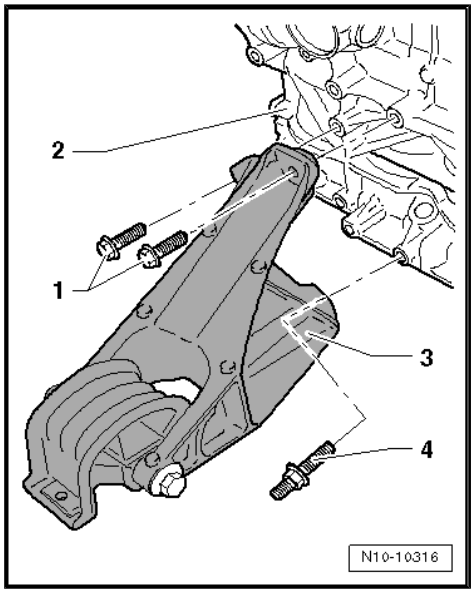
– Unscrew bolt -1-.



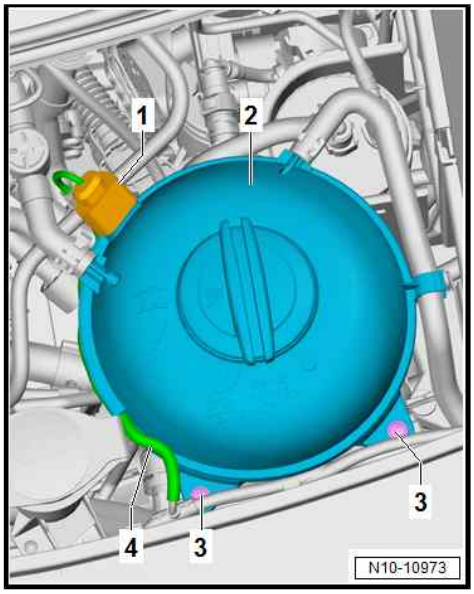
– Unscrew bolts -2- and -3-.
– Remove rear engine support -1- from cylinder block -4-.



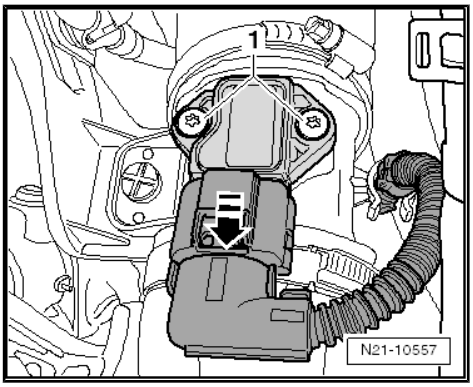
– Unscrew bolts -1- and -4-.
– Remove front engine support -3- from cylinder block -2-.



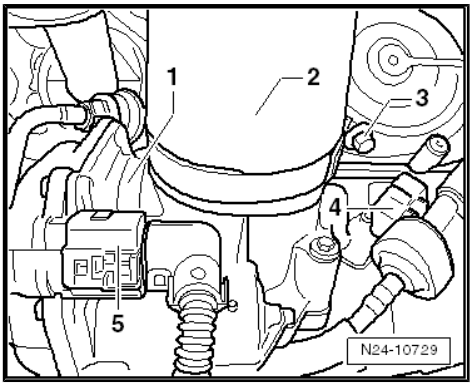
– Separate connector -1-.
– Move clear wiring harness -4-.
– Unscrew bolts -3- and move coolant expansion tank -2- to one side.



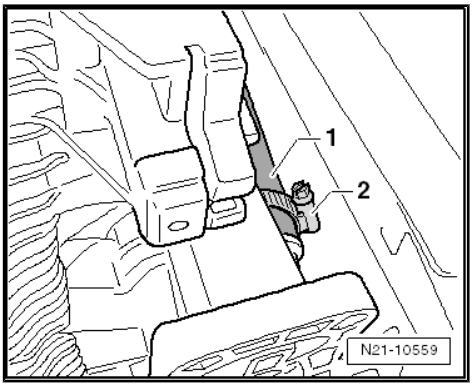
– Separate electrical connector in direction of -arrow-.



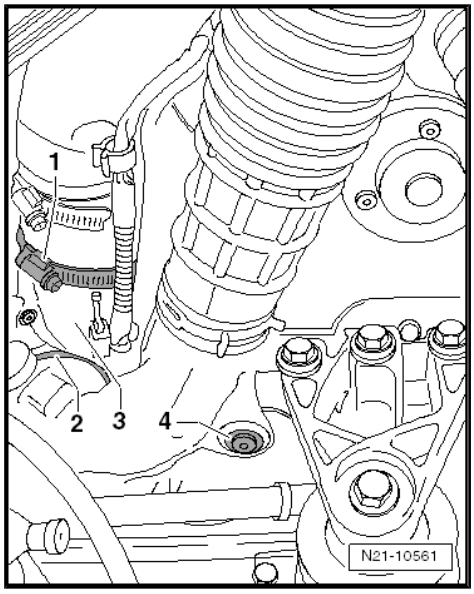
– Loosen screw-type clip -3-.
– Pull off pressure hose -2- from throttle valve module - J338- -1- to charge air cooler.



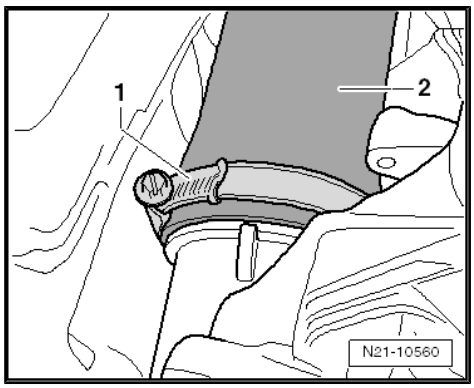
– Loosen screw-type clip -2-.
– Remove pressure hose -1-.
– Remove air filter ⇒ page 216 .
– Detach electrical connector from intake hose.



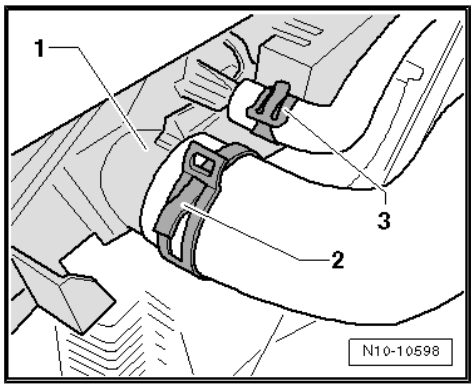
– Unscrew bolt -4-.
– Loosen screw-type clips -1- and -2-.
– Pull off pressure hoses from turbocharger -3-.



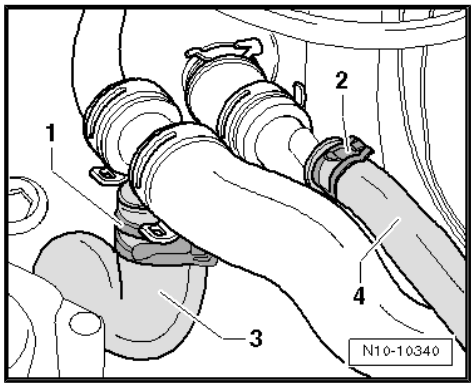
– Loosen screw-type clip -1-.
– Pull pressure hose on right -2- towards the rear and off the charge air cooler.
– Remove pressure hoses.



– Loosen hose clips -2- and -3- and pull off coolant hoses from radiator -1-.



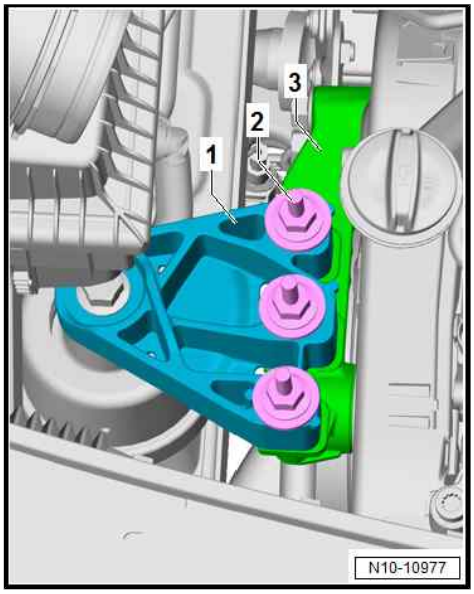
– Open hose clips -1- and -2-.
– Pull coolant hoses -3- and -4- off heat exchanger.



Note

Bolts -2- are only loosened. They are unscrewed later.

– Loosen bolts -2- a maximum of 2 turns.



– Detach electrical connector -3- of Lambda probe - G39- .

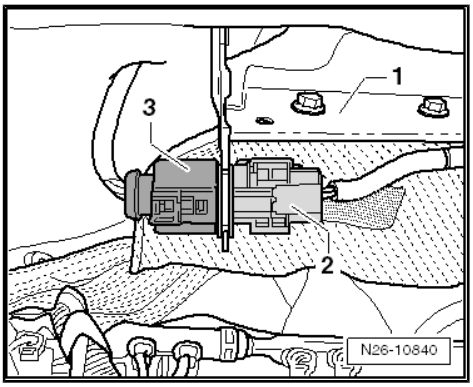
– Unclip wiring harness -2- for Lambda probe - G39- from bracket -1-.

CAUTION

The fuel system is pressurised.

Danger of injury caused by fuel spray.

- **Wear protective goggles.**
- **Wear protective gloves.**
- **To release pressure, wrap a clean cloth around the connection and carefully loosen the connection.**

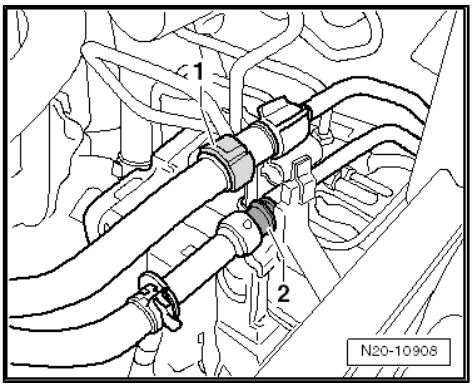


– Disconnect fuel lines -1- and -2- in engine compartment.

– Pull the vacuum line off the brake servo.

Vehicles with dual clutch gearbox:

– Remove selector lever cable from gearbox ⇒ Rep. gr. 34 ; Selector mechanism; Removing and installing selector lever cable .

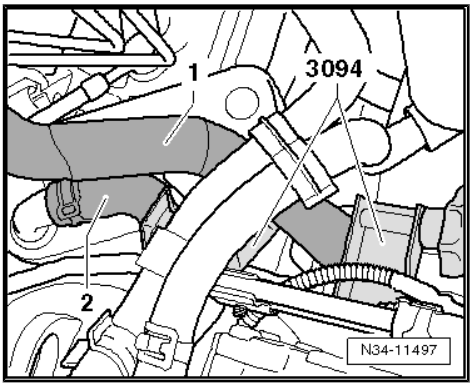


– Clamp off coolant hoses -1- and -2- using hose clamps to 25 mm - 3094- and disconnect hoses from gear oil cooler.

Vehicles with manual gearbox:

– Remove selector mechanism from gearbox ⇒ Rep. gr. 34 ; Selector mechanism; Removing and installing selector mechanism .

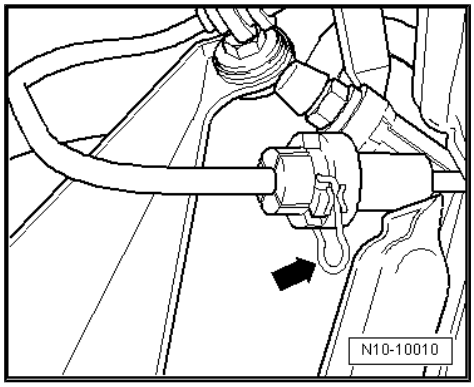
– Detach gear selector cable.



– Pull out clip -arrow-.

– Separate slave cylinder of hydraulic clutch at electrical connector.

– Seal line at slave cylinder with clean plugs from engine bung set - VAS 6122- .



Vehicles with all-wheel drive:

– Remove transfer box ⇒ Rep. gr. 39 ; Transfer box; Removing and installing transfer box .

Continued for all vehicles

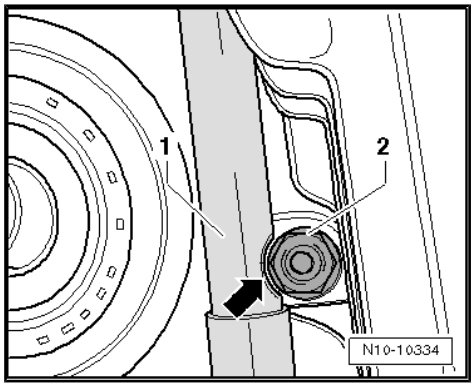
Note

Depending on equipment, it can be necessary to detach or disconnect other connection, coolant, vacuum and intake hoses.

Note

Stud - T50046/1- is required to separate engine and gearbox after removing.

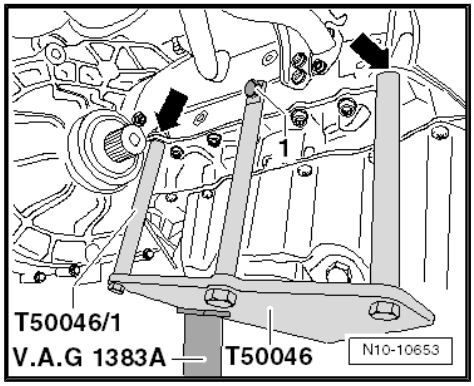
– Attach stud - T50046/1- -1- with recess -arrow- to engine in such a way that bolt -2- connecting engine and gearbox can be unscrewed.



– Introduce engine bracket - T50046- with mounting bolt placed in the holes -arrows- in the cylinder block.

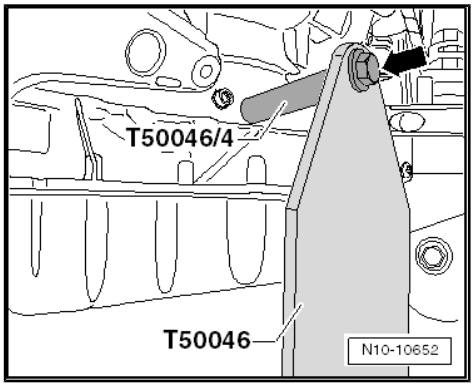
– Tighten stud - T50046/1- on engine bracket - T50046- .

– Tighten bolt -1-.

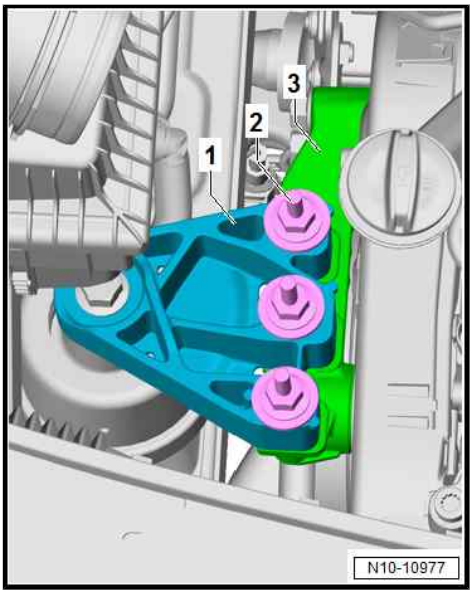


– Tighten engine bracket - T50046- to front of cylinder block with bolt -arrow- and spacer sleeve - T50046/4- .

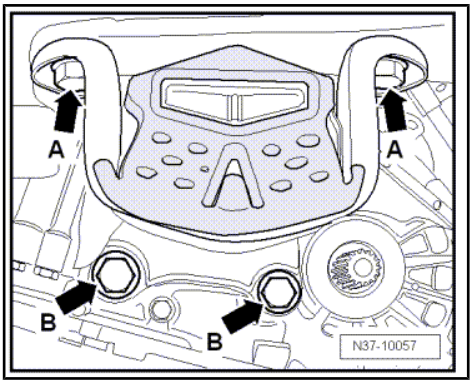
– Insert engine bracket - T50046- in engine and gearbox jack - V.A.G 1383 A- and raise engine and gearbox slightly.



– Unscrew bolts -2-.



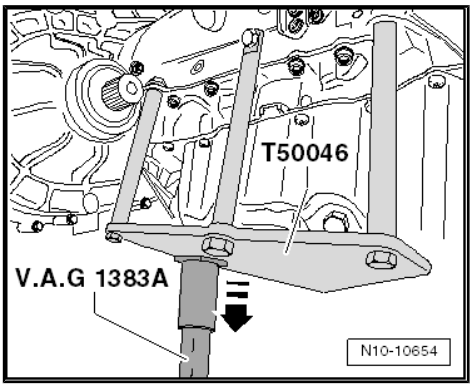
– Only unscrew bolts -arrows A- of left assembly mounting.



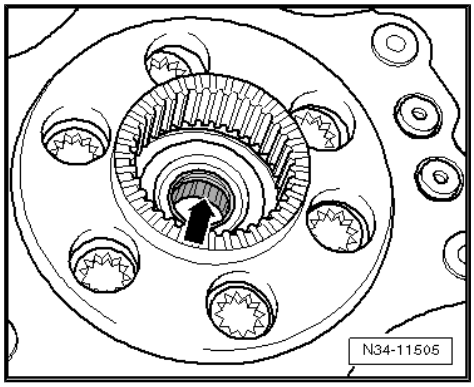
– Carefully lower engine and gearbox using engine and gearbox jack - V.A.G 1383 A- in direction of -arrow-.

– Carefully lower engine with gearbox, making sure that none of the connecting, coolant, vacuum and intake hoses are damaged when doing so.

Vehicles with dual clutch gearbox:



– Check needle bearing -arrow- in crankshaft. If it is damaged or has turned blue, it must be renewed ⇒ page 55 .
– Lightly lubricate needle bearings with high-temperature grease - G 052 133 A2- .
– End of gearbox shaft (but not splines) also must be lightly greased.

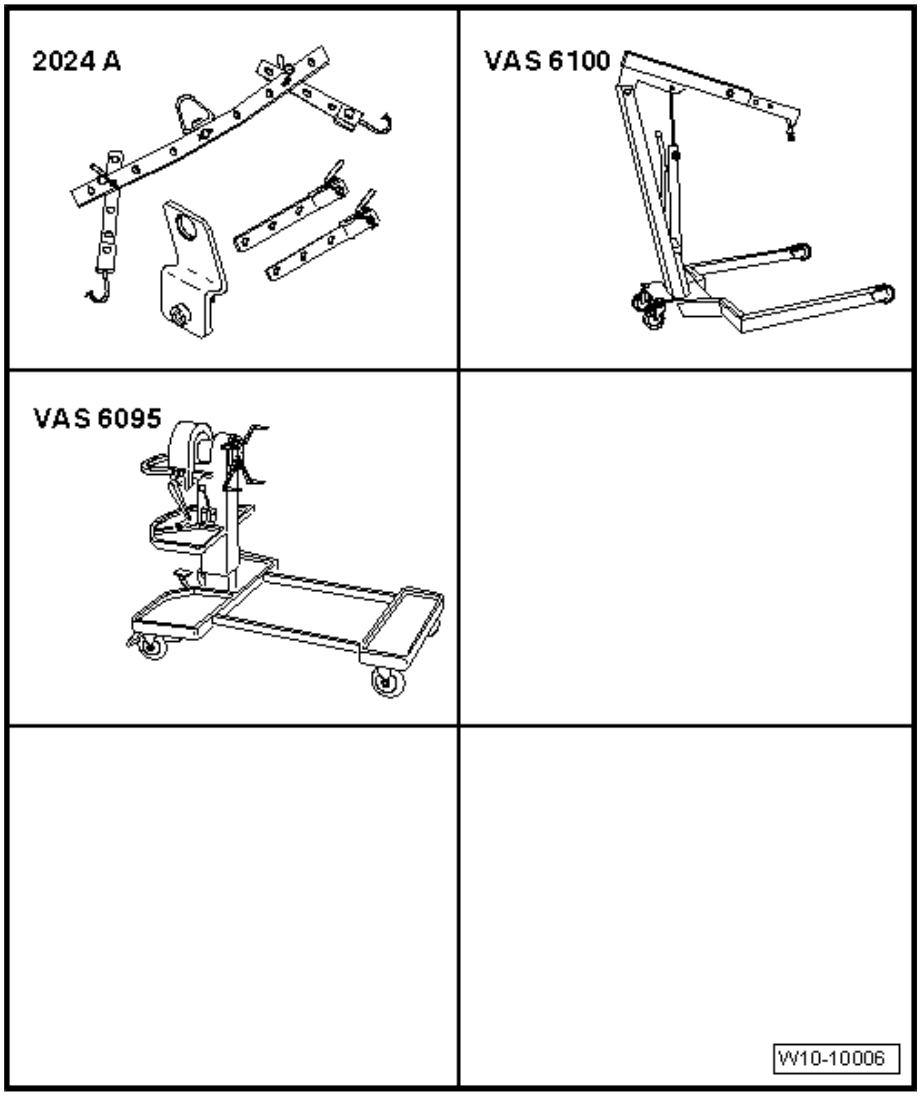


Specified torques

Component	Specified torque
Bolt securing spacer sleeve - T50046/4-	50 Nm
Stud - T50046/1- on engine bracket	50 Nm
Bolt securing engine bracket to cylinder block	50 Nm

1.2 Securing engine on engine and gearbox support

Special tools and workshop equipment required

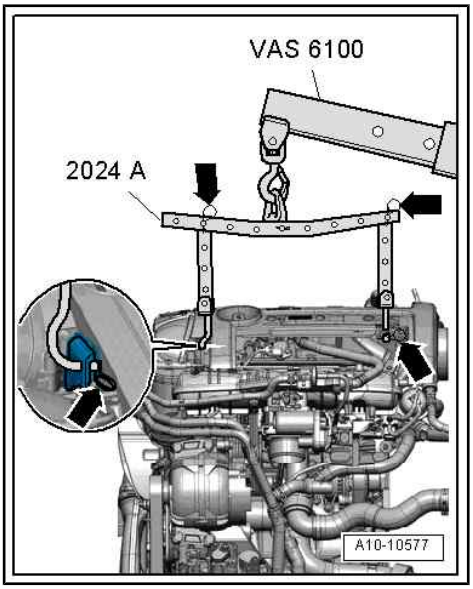


- Lifting tackle - 2024 A-
- Workshop hoist - VAS 6100-
- Engine and gearbox support - VAS 6095-

Sequence of operations

- Engine removed and mounted on engine support - T10359- .
- Gearbox detached from engine

– Attach lifting tackle - 2024 A- as follows and lift out using workshop hoist - VAS 6100- .

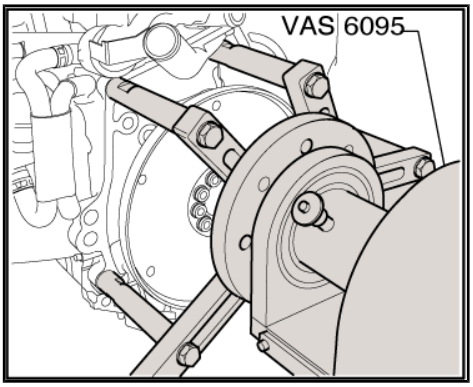


Note

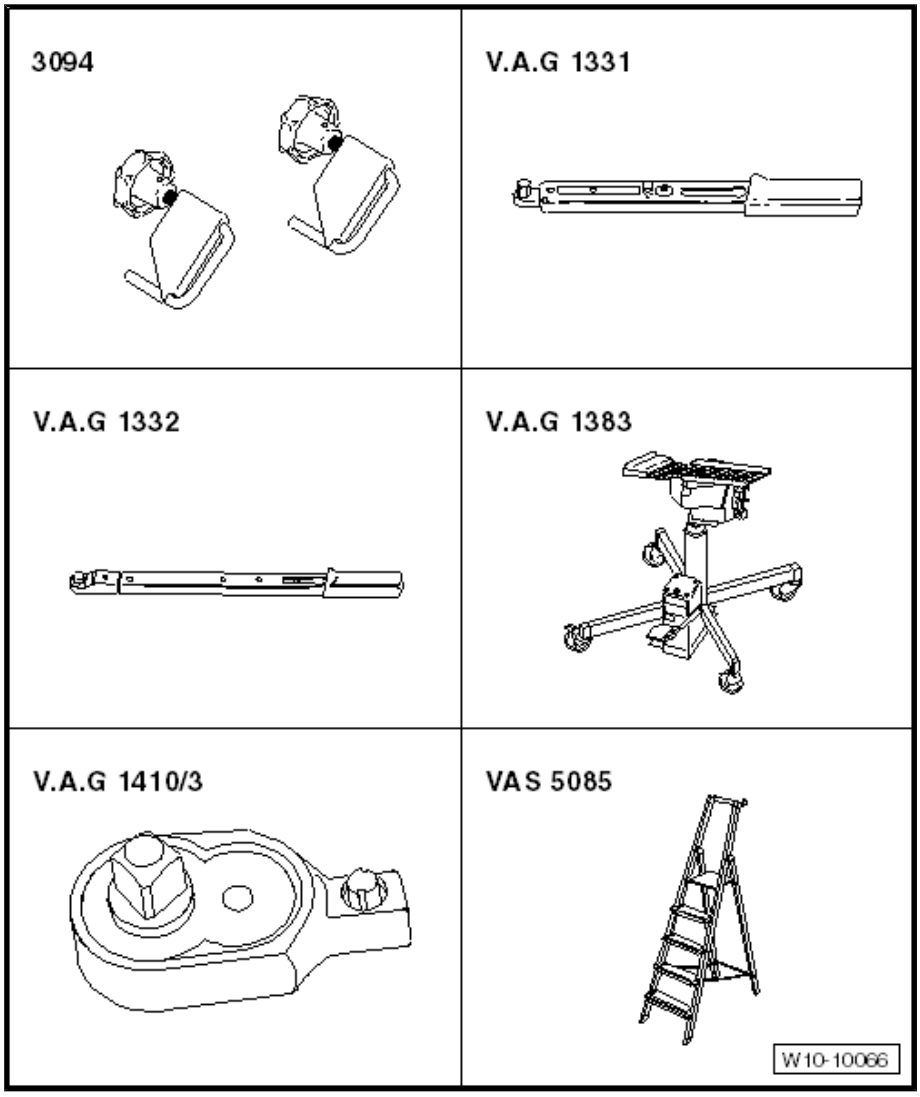
Use securing pins arrows on hooks and locking pins to avoid damage to engine.

– Using workshop hoist - VAS 6100- , lift engine off engine and gearbox jack - V.A.G 1383 A- .

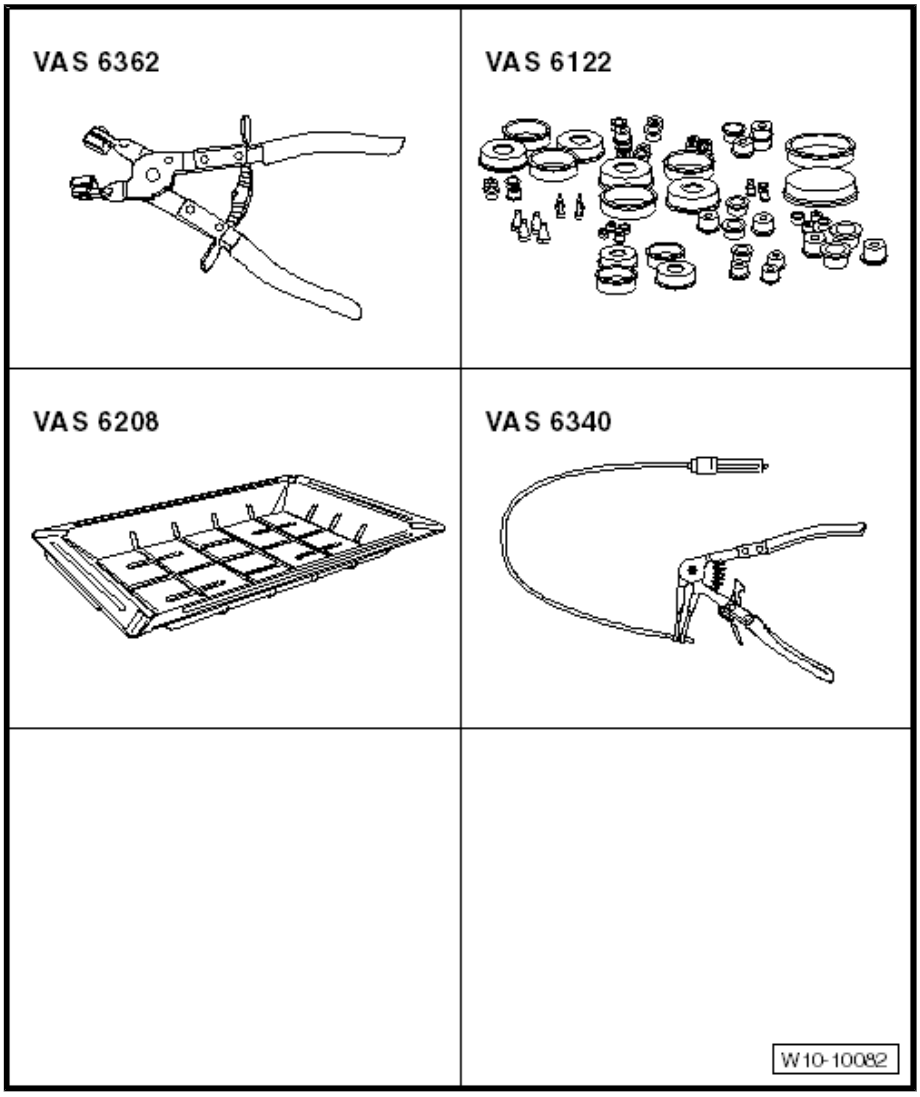
– Firmly bolt gearbox end of engine to the engine and gearbox bracket - VAS 6095- as shown in the picture.



1.3 Installing engine

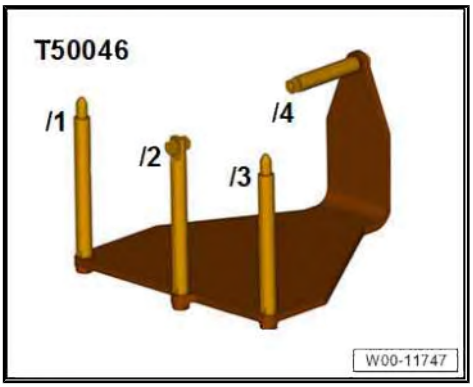


- Hose clamps to 25 mm - 3094-
- Torque wrench - V.A.G 1331-
- Torque wrench - V.A.G 1332-
- Engine and gearbox jack - V.A.G 1383 A-
- Ratchet attachment - V.A.G 1410/3-
- Stepladder - VAS 5085-



- Engine bung set - VAS 6122-
- Drip tray for workshop hoist - VAS 6208-
- Hose clamp pliers - VAS 6340-
- Spring-type clip pliers - VAS 6362-

Engine support - T50046-

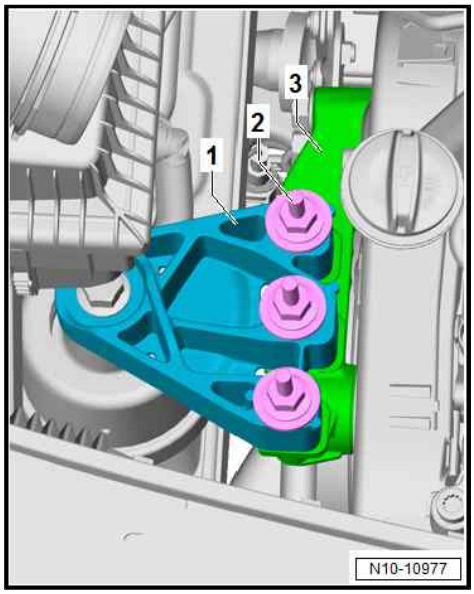


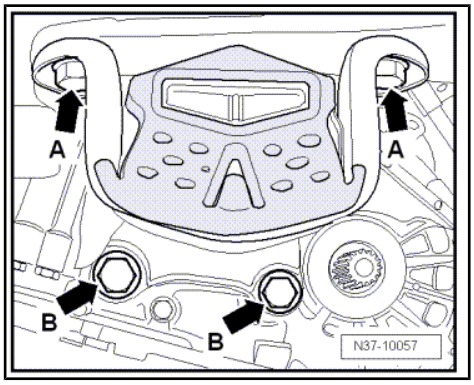
- Vehicle diagnostic tester

Installing

Install in reverse order of removal, observing the following:

– Check clutch release bearing for wear and, if necessary, replace (gearbox removed).
– Lightly grease input shaft splines with grease - G 000 100- (gearbox removed).
– Check whether dowel sleeves for centring engine and gearbox are in cylinder block; install if necessary (gearbox removed).
– Install engine with engine bracket - T50046- .
– Tighten new bolts -2-.





– Tighten new bolts -arrows A- to body.

– Install drive shafts ⇒ Running gear, axles, steering; Rep. gr. 40 ; Drive shaft; Removing and installing drive shaft .

– Install catalytic converter ⇒ page 243 .

Vehicles with manual gearbox:

– Join line with electrical connector to hydraulic clutch slave cylinder ⇒ Rep. gr. 30 ; Clutch mechanism; Removing and installing clutch master cylinder .

– Install selector mechanism ⇒ Rep. gr. 34 ; Selector mechanism; Removing and installing selector mechanism .

– Install gear selector cable.

– Adjust selector mechanism ⇒ Rep. gr. 34 ; Selector mechanism; Adjusting selector mechanism .

Vehicles with dual clutch gearbox:

– Mount and adjust selector lever cable of gearbox ⇒ Rep. gr. 34 ; Selector mechanism; Removing and installing selector mechanism .

Continued for all vehicles

– If fitted, install air conditioner compressor ⇒ Heating, air conditioning; Rep. gr. 87 ; Air conditioner compressor; Removing and installing air conditioner compressor .

– Install front engine support ⇒ page 46 .

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

– Add coolant ⇒ page 163 .

– Carry out road test and read all event memories ⇒ Vehicle diagnostic tester.

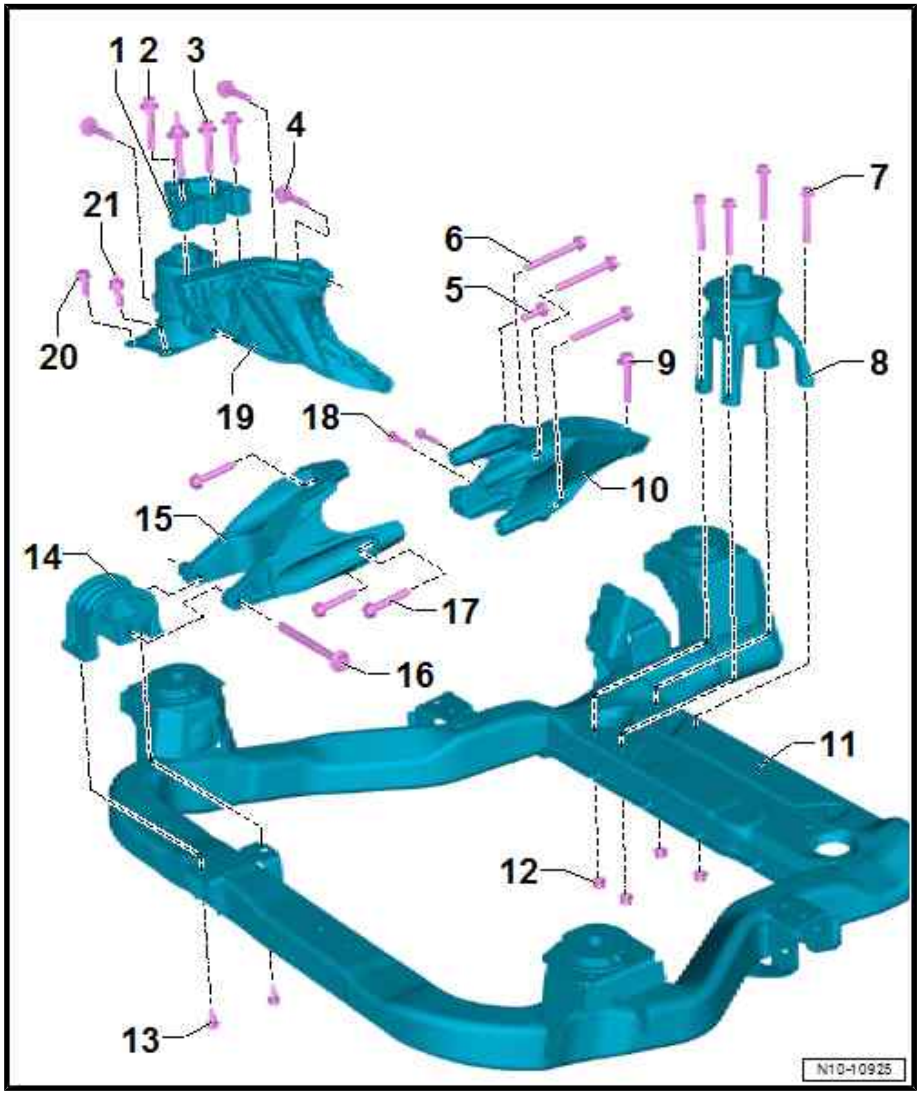
Specified torques

- ⇒ “2.1 Assembly overview - assembly mountings”, page 24
- ⇒ “4.1 Assembly overview - air filter housing”, page 215

Component		Specified torque
Nuts and bolts	M6	10 Nm
	M8	20 Nm
	M10	45 Nm
	M12	60 Nm
Bolts for coolant expansion tank		3.5 Nm

2 Assembly mountings

2.1 Assembly overview - assembly mountings



1 - engine mounts
- ❑ Right
- ❑ Removing and installing ⇒ page 28

2 - Bolt
- ❑ Renew after removal
- ❑ 90 Nm +90°

3 - Bolts
- ❑ Qty. 3
- ❑ Renew after removal
- ❑ 50 Nm +90°

4 - Bolts
- ❑ Qty. 3
- ❑ Renew after removal
- ❑ 40 Nm +180°

5 - Bolt
- ❑ Renew after removal
- ❑ 50 Nm +90°

6 - Bolts
- ❑ Qty. 3
- ❑ Renew after removal
- ❑ 50 Nm +90°

7 - Bolts
- ❑ Qty. 4
- ❑ Renew after removal
- ❑ 20 Nm +180°

8 - Engine mounting
- ❑ Removing and installing ⇒ page 26

9 - Bolt
- ❑ Renew after removal
- ❑ 50 Nm +90°

10 - Engine support
- ❑ Removing and installing ⇒ page 47

11 - Subframe

12 - Nuts
- ❑ Qty. 4

13 - Bolts

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

14 - Engine mounting

- ❑ 20 Nm +90°
- ❑ Removing and installing ⇒ page 26

15 - Engine support

- ❑ Removing and installing ⇒ page 46

16 - Bolt

- ❑ Renew after removal
- ❑ 90 Nm +120°

17 - Bolts

- ❑ Qty. 3
- ❑ Renew after removal
- ❑ 50 Nm +90°

18 - Bolts

- ❑ Qty. 2
- ❑ Renew after removal
- ❑ 50 Nm +90°

19 - Engine support

- ❑ Removing and installing ⇒ page 48

20 - Bolt

- ❑ Qty. 2
- ❑ Renew after removal
- ❑ 50 Nm +90°

21 - Bolt

- ❑ Qty. 1
- ❑ Renew after removal
- ❑ 50 Nm +90°

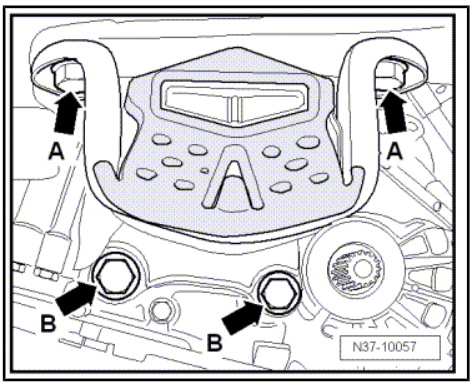
Gearbox mounting

– Bolt gearbox mounting to longitudinal member using bolts -A-.

– Bolt gearbox mounting to gearbox using bolts -B-.

Specified torques

Component	Specified torque
Bolts -A- and -B-	50 Nm +90°



2.2 Removing and installing engine mounting

⇒ “2.2.1 Removing and installing front engine mountings”, page 26

⇒ “2.2.2 Removing and installing rear engine mountings”, page 26

⇒ “2.2.3 Removing and installing right engine mounting”, page 27

2.2.1 Removing and installing front engine mountings

Special tools and workshop equipment required

- Torque wrench - V.A.G 1332-

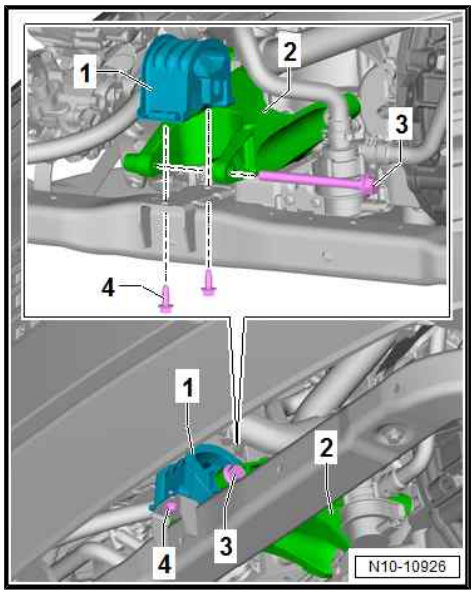
Removing

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

– Unscrew bolt -3- from bracket -2-.

– Unscrew bolts -4-.

– Remove engine mounting -1-.



Installing

Install in reverse order of removal, observing the following:

Note

Bolt -3- is the last to be tightened for all work, as this is used to achieve vertical tolerance compensation.

Specified torques

- ⇒ “2.1 Assembly overview - assembly mountings”, page 24

2.2.2 Removing and installing rear engine mountings

Special tools and workshop equipment required

♦ Torque wrench - V.A.G 1332-

Removing

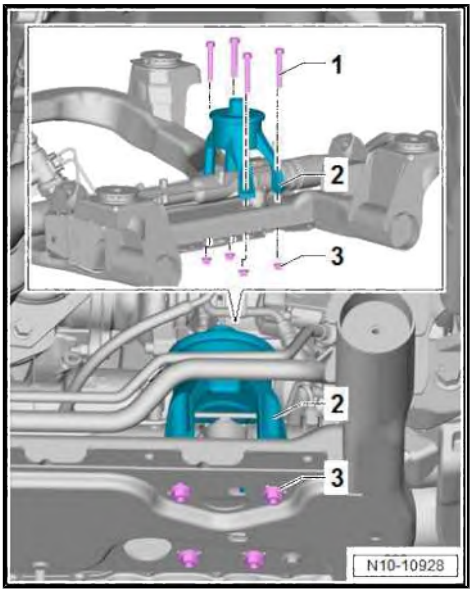
– If fitted, remove noise insulation ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Removing and installing noise insulation .

– Remove engine support ⇒ page 47 .

– Remove nut -3-.

– Remove bolts -1-.

– Remove engine mounting -2-.



Installing

Install in reverse order of removal, observing the following:

Specified torques

♦ ⇒ “2.1 Assembly overview - assembly mountings”, page 24

2.2.3 Removing and installing right engine mounting

Special tools and workshop equipment required

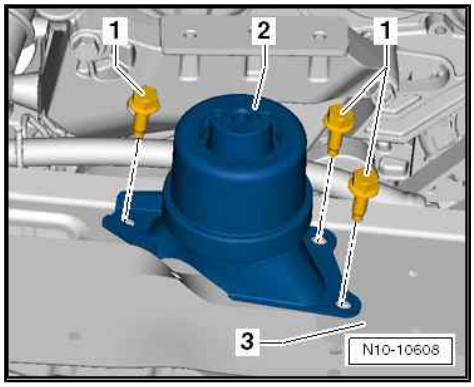
♦ Torque wrench - V.A.G 1332-

Removing

– Remove engine mounting ⇒ page 28 .

– If fitted, unscrew earth wire.

– Unscrew bolts -1-.
– Remove engine mounting -2-.



Installing

Install in reverse order of removal, observing the following:

Specified torques

♦ ⇒ “2.1 Assembly overview - assembly mountings”, page 24

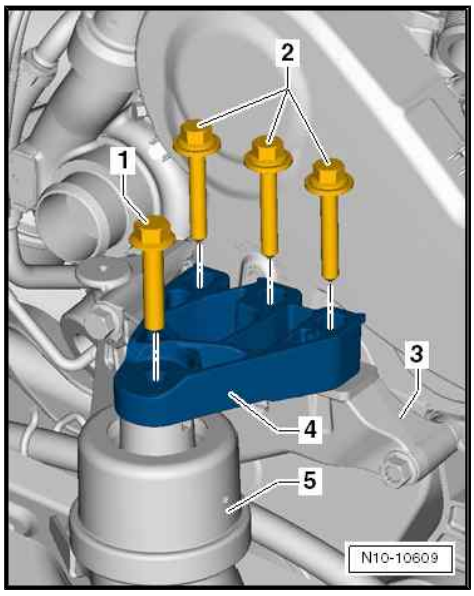
2.3 Removing and installing engine mounting

Special tools and workshop equipment required

♦ Torque wrench - V.A.G 1332-

Removing

– Remove air filter housing ⇒ page 216 .
– Release clamp ⇒ Item 15 (page 215) , and remove intake hose ⇒ Item 14 (page 215) .
– Release clamp ⇒ Item 3 (page 201) , and remove pressure hose ⇒ Item 4 (page 201) .
– Support engine in its installation position ⇒ page 30 .
– Unscrew bolts -1- and -2-.
– Remove engine carrier -4-.



Installing

Install in reverse order of removal, observing the following:

Specified torques

♦ ⇒ “2.1 Assembly overview - assembly mountings”, page 24

2.4 Removing and installing gearbox mounting

⇒ “2.4.1 Removing and installing gearbox mounting, vehicles with manual gearbox”, page 29

⇒ “2.4.2 Removing and installing gearbox mounting, vehicles with dual clutch gearbox”, page 29

2.4.1 Removing and installing gearbox mounting, vehicles with manual gearbox

Special tools and workshop equipment required

- Torque wrench - V.A.G 1332-

Removing

– Support engine in its installation position ⇒ page 30 .

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

– Unscrew bolts -1-.

Note

To gain access to the upper bolts, lower the engine slightly if necessary.

– Unscrew bolts -2-.

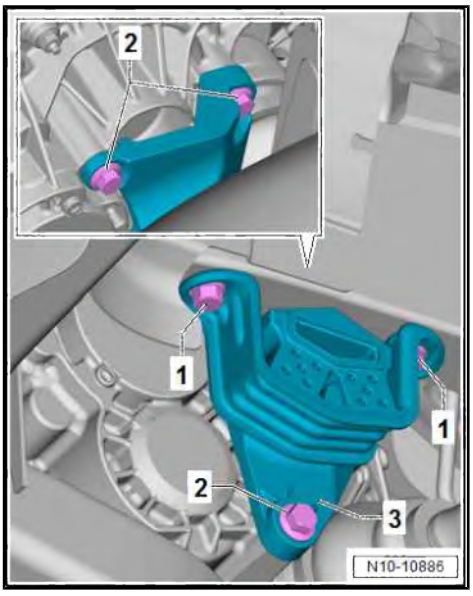
– Remove gearbox mounting -1-.

Installing

Install in reverse order of removal, observing the following:

Specified torques

- ⇒ “2.1 Assembly overview - assembly mountings”, page 24



2.4.2 Removing and installing gearbox mounting, vehicles with dual clutch gearbox

Special tools and workshop equipment required

♦ Torque wrench - V.A.G 1332-

Removing

– Support engine in its installation position ⇒ page 30 .

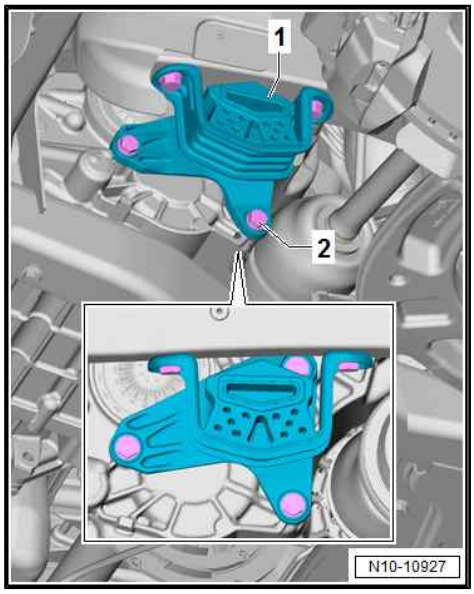
– If fitted, remove noise insulation ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Removing and installing noise insulation .

– Unscrew bolts -2-.

Note

To gain access to the upper bolt, lower the engine slightly if necessary.

– Remove gearbox mounting -1-.



Installing

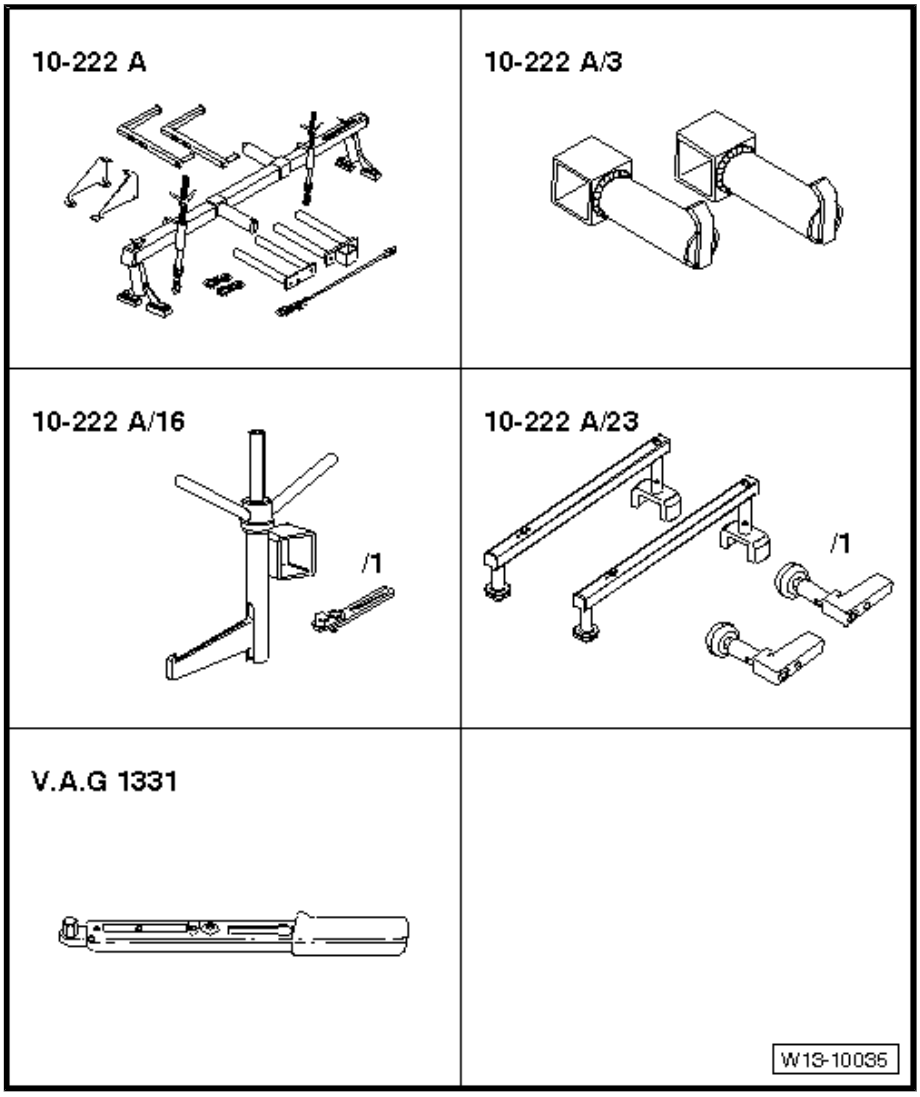
Install in reverse order of removal, observing the following:

Specified torques

♦ ⇒ “2.1 Assembly overview - assembly mountings”, page 24

2.5 Supporting engine in installation position

Special tools and workshop equipment required



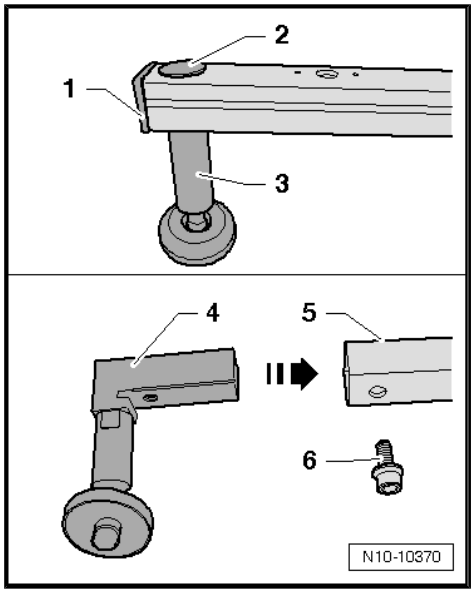
- Support - 10 - 222 A-
- Adapter - 10 - 222 A /3-
- Adapter - 10 - 222 A /16-
- Adapter - 10 - 222 A /23- with adapter - 10 - 222 A /23-1-

Sequence of operations

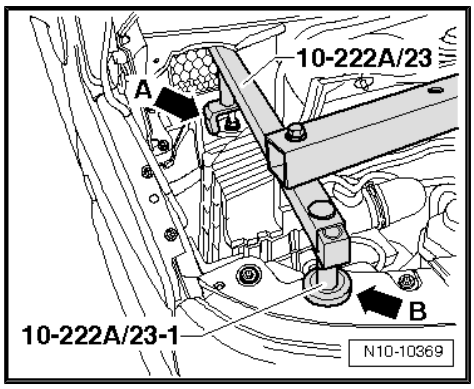
– Remove plenum chamber bulkhead on left and right ⇒ General body repairs, exterior; Rep. gr. 50 ; Plenum chamber bulkhead; Removing and installing plenum chamber bulkhead .

– If necessary, equip adapter - 10 - 222 A /23- with adapter - 10 - 222 A /23-1- .

– Remove cap -1-.
– Remove cap -2-, and unscrew support bolt -3- located beneath it.
– Insert adapter - 10 - 222 A /23-1- -4- into adapter - 10 - 222 A /23- -5-.
– Insert bolt -6- from underneath in adapter - 10 - 222 A /23- and tighten.



– Fit support bracket - 10 - 222 A- with adapter - 10 - 222 A /23- and adapter - 10 - 222 A /23-1- as shown and take up weight of engine in installation position.



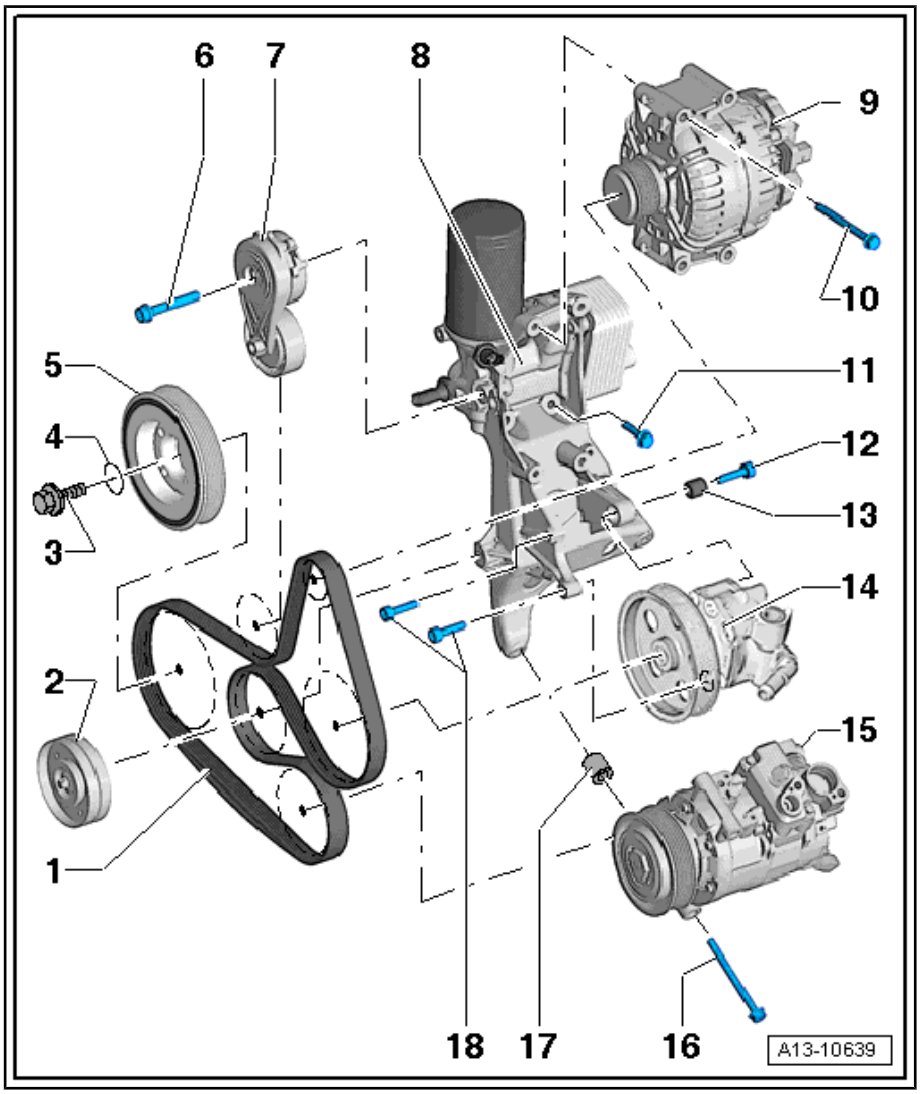
Specified torques

Component	Specified torque
Bolt -6-	40 Nm

13 – Crankshaft group

1 Cylinder block (pulley end)

1.1 Assembly overview - poly V-belt drive



1 - Poly V-belt

- ❑ Removing and installing ⇒ page 35
- ❑ Check for wear
- ❑ Do not kink
- ❑ When installing, make sure it is properly seated on belt pulleys.
- ❑ Poly V-belt routing ⇒ page 35

2 - Idler roller

- ❑ 20 Nm

3 - Bolt

- ❑ Renew after removal
- ❑ 150 Nm +90°

4 - O-ring

- ❑ Renew after removal

5 - Vibration damper

- ❑ With poly V-belt pulley
- ❑ Removing and installing ⇒ page 37

6 - Bolt

- ❑ 40 Nm

7 - Tensioning device for poly V-belt

- ❑ Removing and installing ⇒ page 36

8 - Ancillary bracket

- ❑ With oil filter and engine oil cooler
- ❑ Removing and installing ancillary bracket ⇒ page 43 .
- ❑ Removing and installing engine oil cooler ⇒ page 156

9 - Alternator

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

10 - Bolts

- ❑ Qty. 4
- ❑ Specified torque ⇒ Electrical system; Rep. gr. 27 ; Alternator; Assembly overview - alternator

11 - Bolts

- ❑ Qty. 5
- ❑ Observe tightening sequence ⇒ page 34
- ❑ 20 Nm +90°

12 - Bolt

- ❑ Specified torque ⇒ Running gear, axles, steering; Rep. gr. 48 ; Hydraulic power-assisted steering; Assembly overview - vane pump

13 - Sleeve

14 - Vane pump

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

15 - Air conditioner compressor

- ❑ Removing and installing ⇒ Heating, air conditioning system; Rep. gr. 87 ; Air conditioner compressor; Removing and installing air conditioner compressor from and to bracket

16 - Bolts

- ❑ Qty. 3
- ❑ Specified torque ⇒ Heating, air conditioning; Rep. gr. 87 ; Air conditioner compressor; Assembly overview - drive unit of air conditioner compressor .

17 - Dowel sleeves

- ❑ Qty. 2
- ❑ For air conditioner compressor.

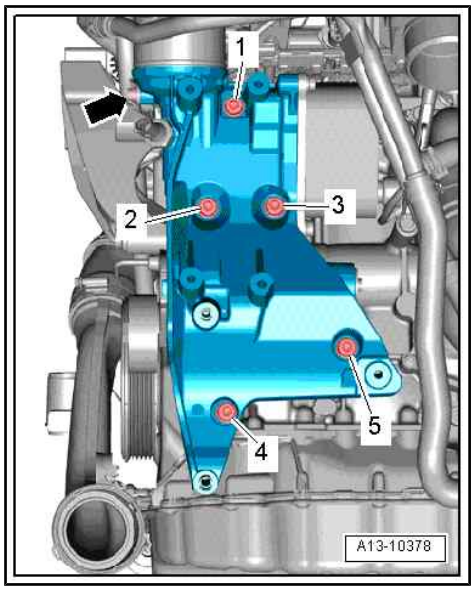
18 - Bolts

- ❑ Qty. 2
- ❑ Specified torque ⇒ Running gear, axles, steering; Rep. gr. 48 ; Hydraulic power-assisted steering; Assembly overview - vane pump

Bracket for ancillaries - tightening sequence

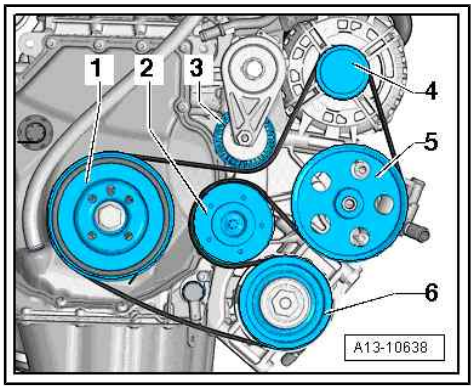
– Fit ancillary bracket (start bolt -4- first).

– Tighten bolts in the sequence -1 … 5-.



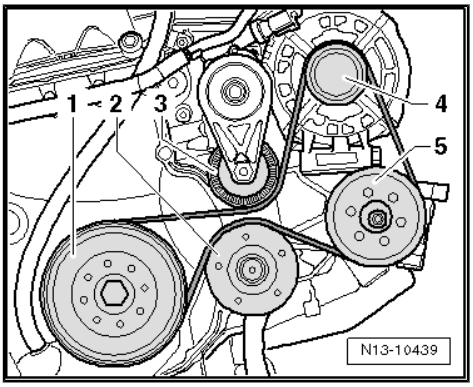
Poly V-belt route with air conditioning system

1 - Vibration damper
2 - Idler roller
3 - Poly V-belt tensioning element
4 - Alternator
5 - Vane pump
6 - Air conditioner compressor



Poly V-belt route without air conditioner

1 - Vibration damper
2 - Idler roller
3 - Poly V-belt tensioning element
4 - Alternator
5 - Vane pump



1.2 Removing and installing poly-V belt

Special tools and workshop equipment required

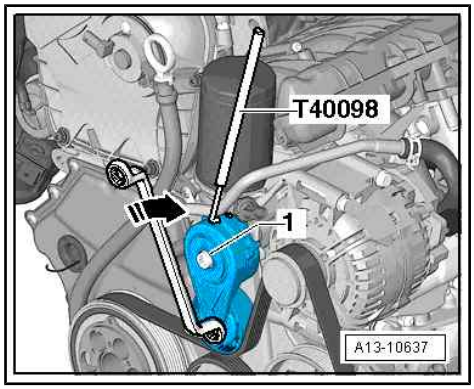
♦ Locking tool - T40098-

Removing

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

– Before removing the poly V-belt, use a piece of chalk or a felt pen to mark the running direction.

– To slacken poly V-belt turn tensioning device in direction of -arrow-.
– Lock tensioning device with locking tool - T40098- .
– Remove poly V-belt.



Installing

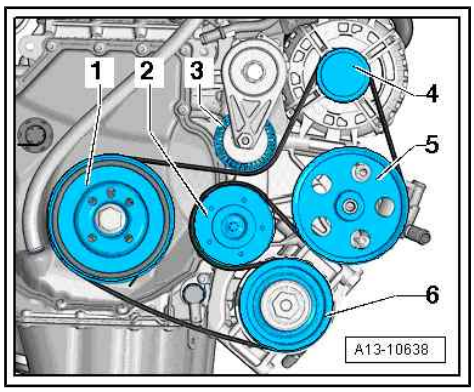
Install in reverse order of removal, observing the following:

Note

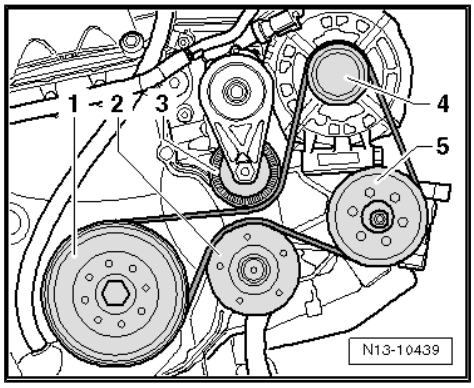
Alternator and air conditioner compressor must be firmly mounted before poly V-belt is installed.

– Fit poly V-belt as shown in figure.

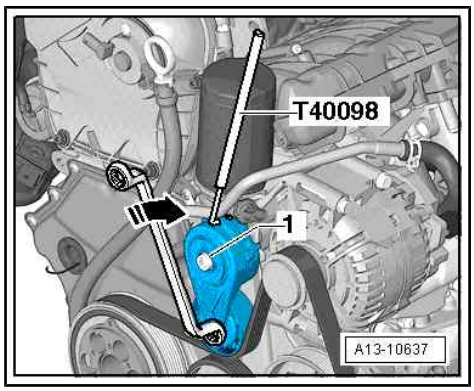
Vehicles with air conditioning system



Vehicles without air conditioning system



– Turn tensioning device in -direction of arrow- and withdraw locking tool - T40098- .
– Release tensioner.
– Check that poly V-belt is properly seated.
– Start engine and check that poly V-belt runs properly.



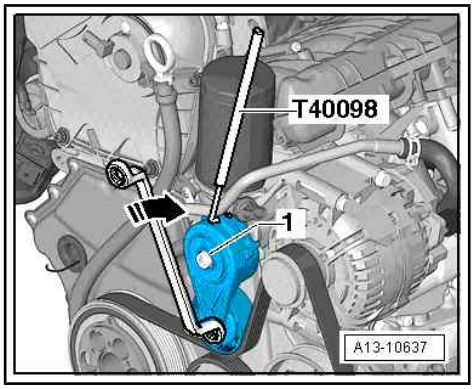
1.3 Removing and installing tensioner for poly V-belt

Special tools and workshop equipment required

♦ Locking tool - T40098-

Removing

– If fitted, remove noise insulation ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Removing and installing noise insulation .
– Before removing the poly V-belt, use a piece of chalk or a felt pen to mark the running direction.
– To slacken poly V-belt turn tensioning device in direction of -arrow-.
– Lock tensioning device with locking tool - T40098- .
– Remove poly V-belt from tensioning device.
– Remove bolt -1- and take off tensioning device for poly V-belt from bracket for ancillaries.



Installing

Install in reverse order of removal, observing the following:

Specified torques

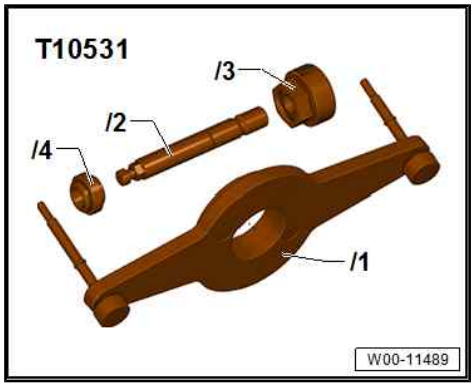
♦ ⇒ “1.1 Assembly overview - poly V-belt drive”, page 33

1.4 Removing and installing vibration damper

Special tools and workshop equipment required

♦ Counter-hold tool - T10355-

- Assembly tool - T10531-

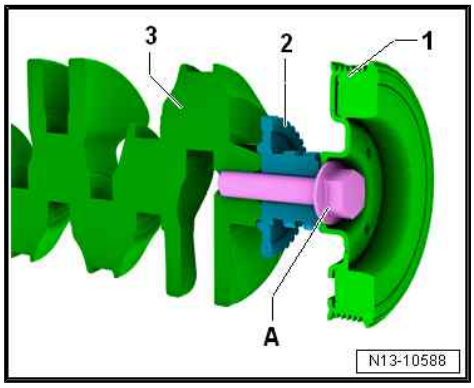


Components of assembly tool - T10531- :

- Support - T10531/1-
- Clamping pin - T10531/2-
- Turning over tool - T10531/3-
- Flange nut - T10531/4-

Note

The vibration damper bolt -A- is used to secure the vibration damper -1- and the timing sprocket -2- on the crankshaft -3-. Before unscrewing the bolt, lock the timing sprocket in position relative to the crankshaft as described below.



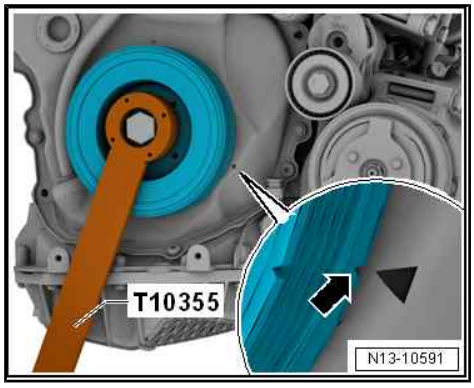
Removing

– Remove poly V-belt ⇒ page 35 .

– Relieve tension from tensioning device, and pull out locking tool - T40098- from poly V-belt tensioning device.

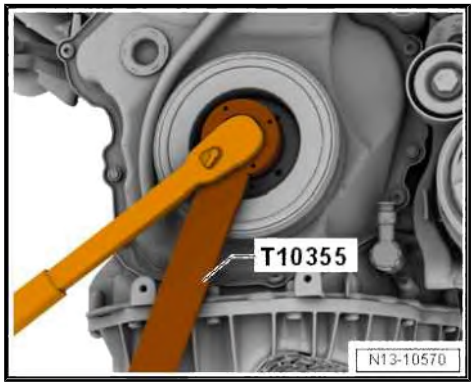
– Turn vibration damper to TDC position -arrow- using counterhold tool - T10355- .

- Notch on vibration damper must align with arrow marking on lower cover for timing chains
- Marking on cover is located at »4 o'clock position«

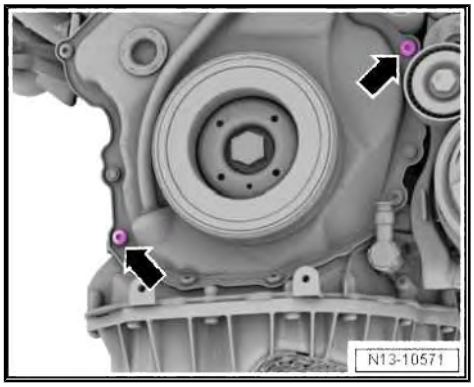


– Use counterhold tool - T10355- to loosen bolt for vibration damper by approx. half a turn.

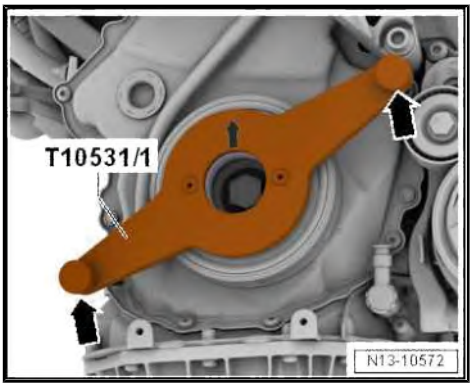
– If vibration damper was turned while loosening bolt, reset TDC position.



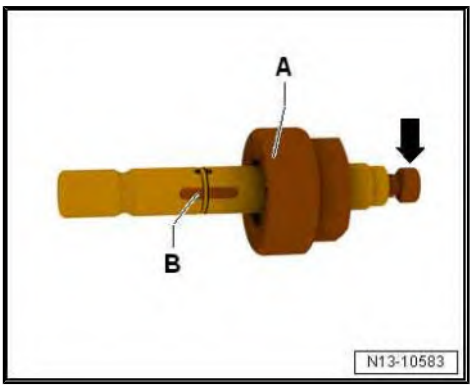
– Unscrew bolts -arrows-.



– Fit support - T10531/1- to vibration damper and tighten knurled screws -arrows- by hand.
– Unscrew vibration damper bolt completely.



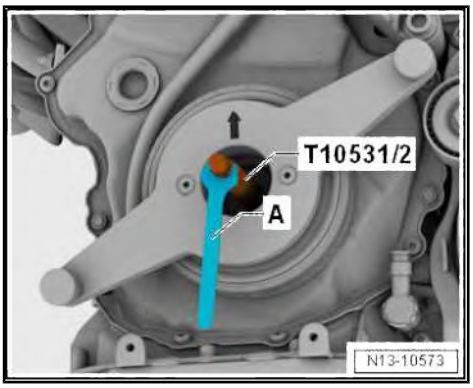
– Check if turning over tool - T10531/3- -A- slides easily over clamping pieces -B-.
– If necessary, turn tensioning bolt -arrow-.



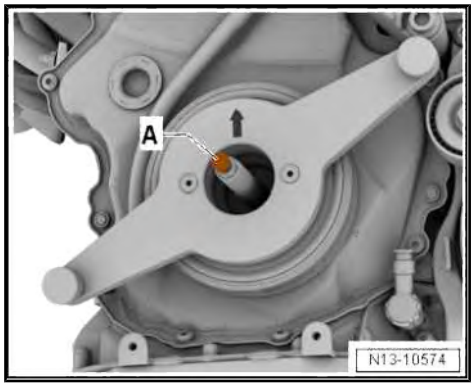
Note

Now, do not turn the tensioning bolt any more, or the clamping pin - T10531/2- will be jammed when it is screwed into the crankshaft.

– Screw clamping pin - T10531/2- into crankshaft, and tighten it hand-tight with a 12 mm open-end spanner -A-.

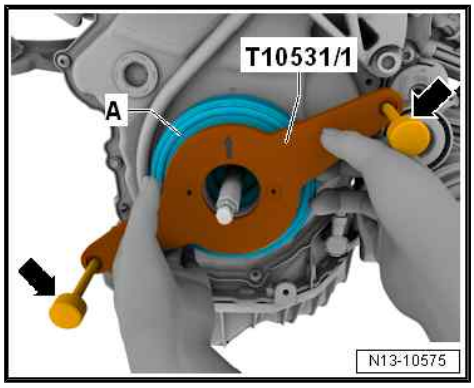


– Tighten tensioning bolt -A- hand-tight.



– Unscrew knurled screws -arrows-.
– Remove support - T10531/1- and vibration damper -A-.

Turning crankshaft without vibration damper

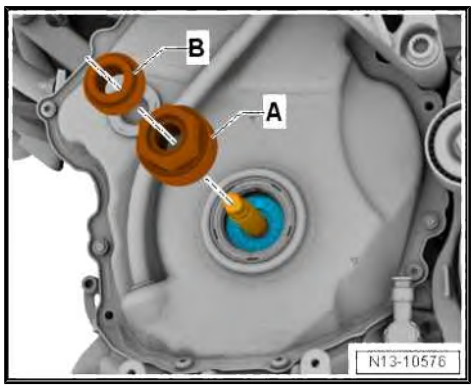


– Fit turning over tool - T10531/3- -A- on clamping pin. Note teeth of sprocket when doing so.

Note

In TDC position the flat section of the tool faces upwards.

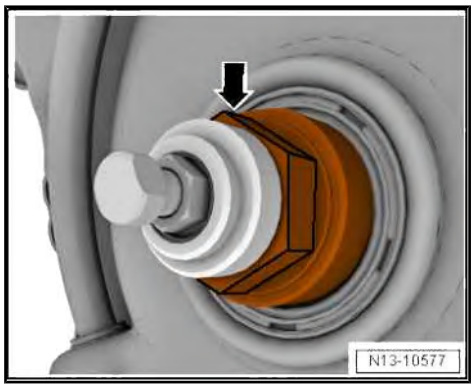
– Tighten turning over tool - T10531/3- with flange nut - T10531/4- -B-.



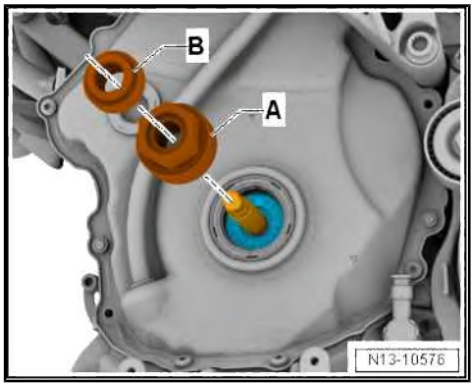
– Turn crankshaft at hexagon -arrow-.

Installing

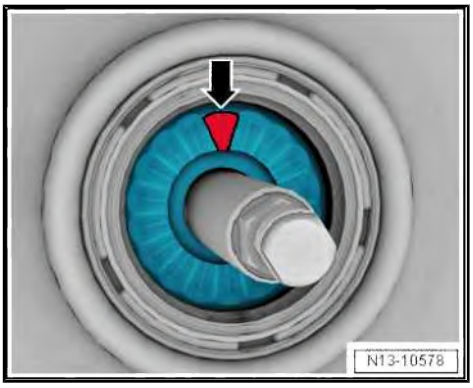
Install in reverse order of removal, observing the following:



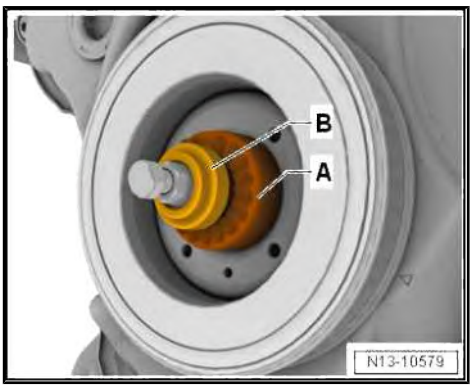
– Remove flange nut - T10531/4- -B- and turning over tool - T10531/3- -A- from clamping pin.



– Fit vibration damper in TDC position. Pay attention to teeth of chain sprocket -arrow- while doing so.



– Fit turning over tool - T10531/3- -A- on clamping pin.



Note

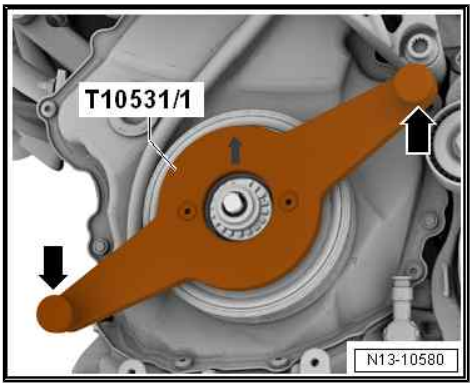
The hexagon faces the vibration damper.

– Screw on flange nut - T10531/4- -B-, moving vibration damper back and forth slightly when doing so.

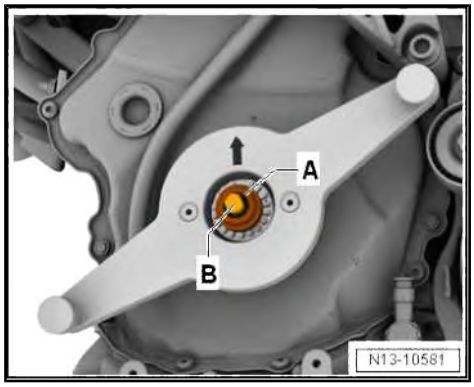
Note

To check whether the vibration damper is correctly located in the teeth: Tighten the flange nut until the vibration damper can no longer be turned.

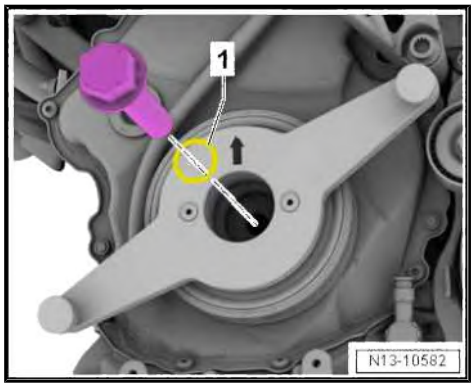
– Fit support - T10531/1- to vibration damper and tighten knurled screws -arrows- by hand.



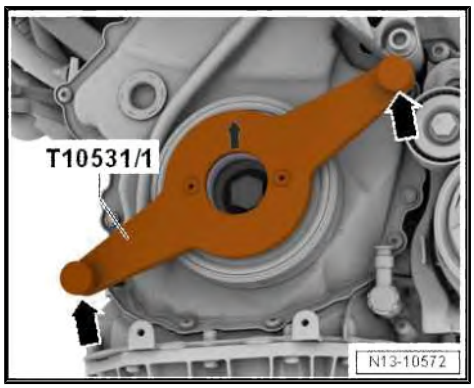
– Unscrew flange nut - T10531/4- -A-.
– Loosen tensioning bolt -B-.
– Unscrew clamping pin - T10531/2- and remove with turning over tool - T10531/3- .



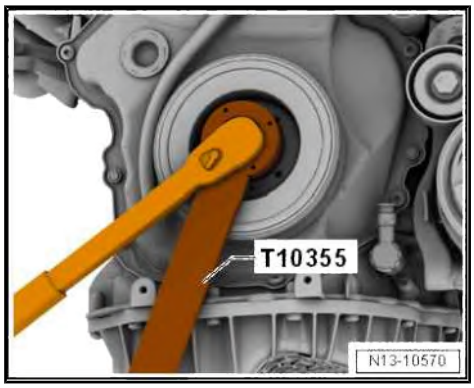
– Screw in new vibration damper bolt with lubricated O-ring -1- by hand.



– Unscrew knurled screws -arrows-, and remove support - T10531/1- .



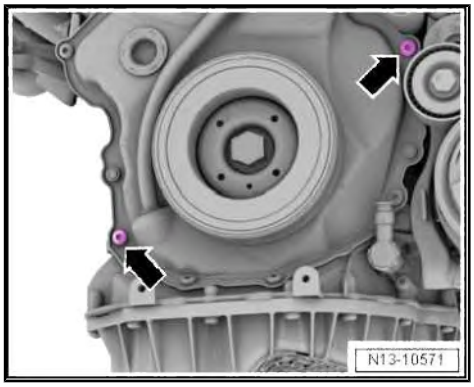
– Tighten bolt for vibration damper using counter-hold tool - T10355- .



– Screw in new bolts -arrows-.

Specified torques

♦ ⇒ “1.1 Assembly overview - poly V-belt drive”, page 33



1.5 Removing and installing bracket for ancillaries

Special tools and workshop equipment required

♦ Drip tray for workshop hoist - VAS 6208-

Removing

– Drain coolant ⇒ page 163 .

– Remove poly V-belt ⇒ page 35 .

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

Vehicles with air conditioning system

CAUTION

Risk of freezing injury caused by refrigerant.

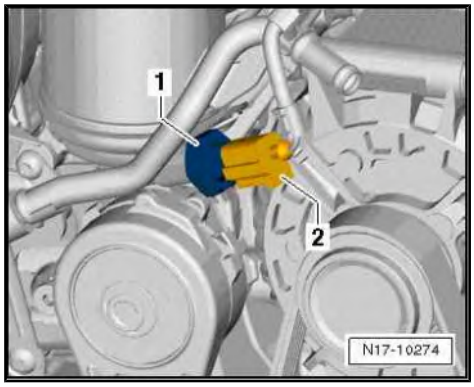
– Do not open refrigerant circuit of air conditioning system.

– Remove air conditioner compressor with refrigerant lines connected and tie up ⇒ Heating, air conditioning; Rep. gr. 87 ; Air conditioner compressor; Removing and installing air conditioner compressor from/on bracket .

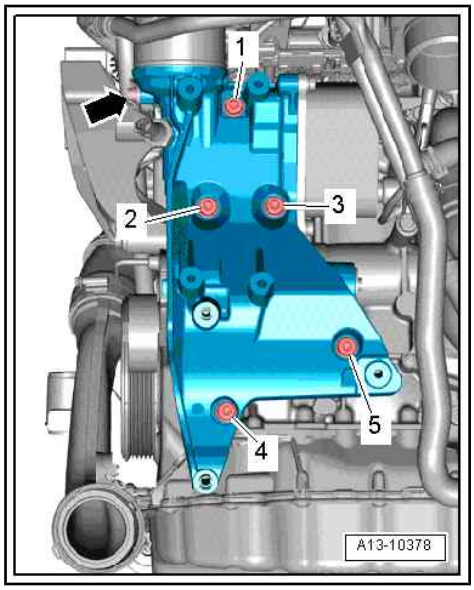
Continued for all vehicles

– Remove vane pump and tie up on longitudinal member with hydraulic lines still attached ⇒ Running gear, axles, steering; Rep. gr. 48 ; Hydraulic power-assisted steering; Removing and installing vane pump .

– Separate electrical connector -2- from oil pressure switch - F22- -1-.



– Remove bolt -arrow- for dipstick guide tube.
– Unscrew bolts -1 … 5- and detach bracket for ancillary units from coolant pump housing.



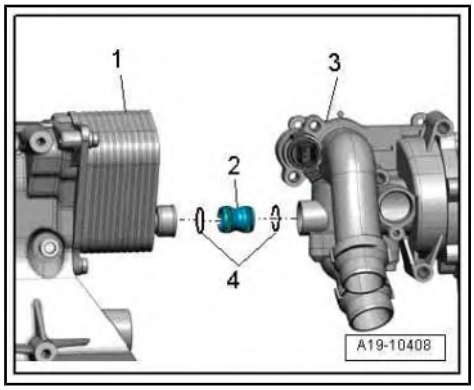
Installing

Install in reverse order of removal, observing the following:

Note

- *Renew bolts that are tightened with specified further tightening angle.*
- *Renew O-rings and seals.*

– Coat O-ring -4- with coolant and install on connection -2-.
– Insert connection -2- into coolant pump housing -3-.
– Push ancillary bracket -1- on connection.
– Start bolts and tighten ⇒ page 34 .
– Install vane pump ⇒ Running gear, axles, steering; Rep. gr. 48 ; Hydraulic power-assisted steering; Removing and installing vane pump .
– If fitted, install air conditioner compressor ⇒ Heating, air conditioning; Rep. gr. 87 ; Removing and installing air conditioner compressor .
– Install alternator ⇒ Electrical system; Rep. gr. 27 ; Alternator; Removing and installing alternator .
– Install poly V-belt ⇒ page 35 .
– Add coolant ⇒ page 163 .
– If present, install noise insulation ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Removing and installing noise insulation .



Specified torques

- ⇒ “1.1 Assembly overview - poly V-belt drive”, page 33

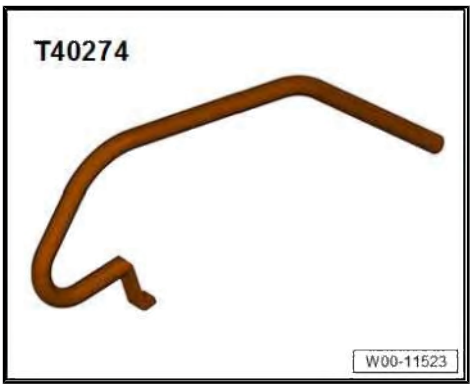
1.6 Renewing crankshaft oil seal - belt pulley end

Special tools and workshop equipment required

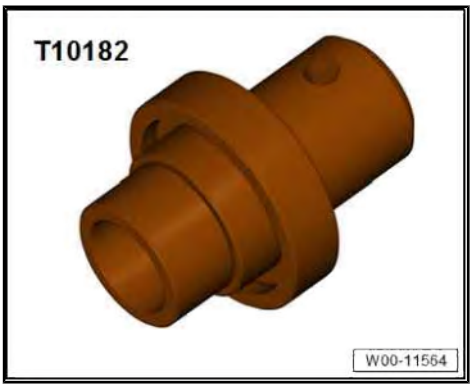
- Thrust piece - T10354-

- Thrust piece - T10368-

- Extractor hook - T40274-



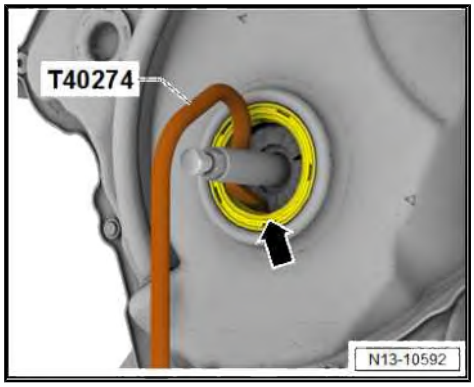
- Thrust piece - T10182-



Removing

– Remove vibration damper ⇒ page 37 .

– Pull out oil seal using puller hooks - T40274- .

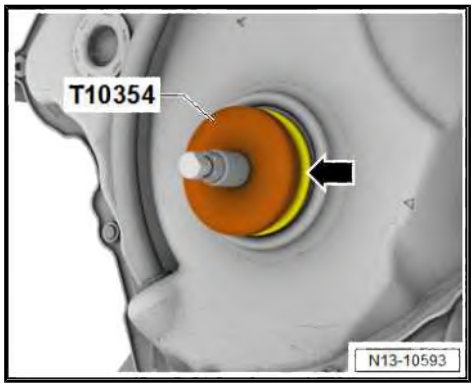


Installing

Install in reverse order of removal, observing the following:

– Clean contact surface and sealing surface.

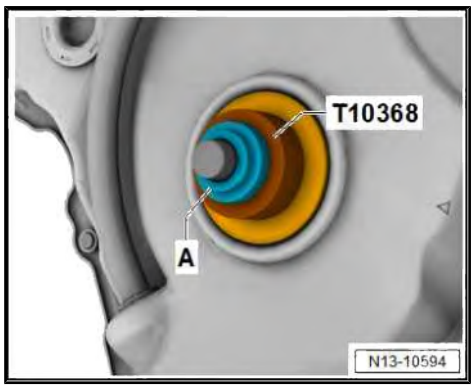
– Fit oil seal -arrow- with press piece - T10354- .



– Attach additional thrust piece - T10368- and tighten flange nut -A-.

– Install oil seal onto stop using thrust piece - T10182- .

– Install vibration damper ⇒ page 37 .



1.7 Removing and installing engine support

⇒ “1.7.1 Removing and installing front engine support”, page 46

⇒ “1.7.2 Removing and installing rear engine support”, page 47

⇒ “1.7.3 Removing and installing right engine support”, page 48

1.7.1 Removing and installing front engine support

Special tools and workshop equipment required

♦ Torque wrench - V.A.G 1332-

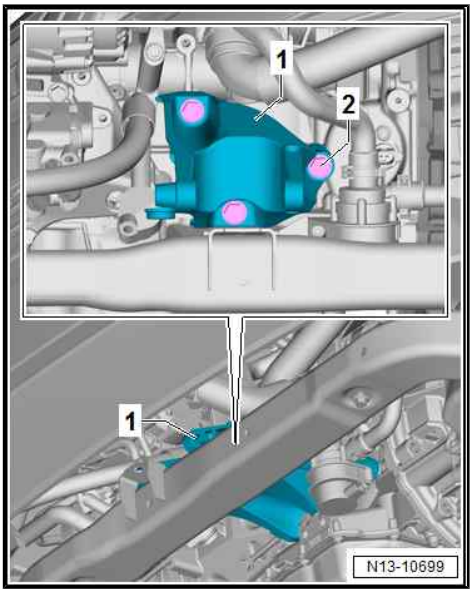
Removing

– Move to service position ⇒ General body repairs, exterior; Rep. gr. 50 ; Lock carrier; Moving to and back from service position .

– Remove front engine mounting ⇒ page 26 .

– Unscrew bolts -2-.

– Remove engine support -1-.



Installing

Install in reverse order of removal, observing the following:

Specified torques

♦ ⇒ “2.1 Assembly overview - assembly mountings”, page 24

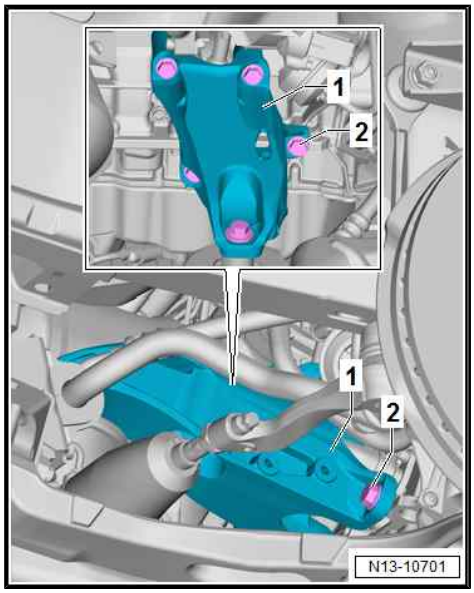
1.7.2 Removing and installing rear engine support

Special tools and workshop equipment required

♦ Torque wrench - V.A.G 1332-

Removing

– Remove rear engine mounting ⇒ page 26 .
– Unscrew bolts -2-.
– Remove engine support -1-.



Installing

Install in reverse order of removal, observing the following:

Specified torques

◆ ⇒ “2.1 Assembly overview - assembly mountings”, page 24

1.7.3 Removing and installing right engine support

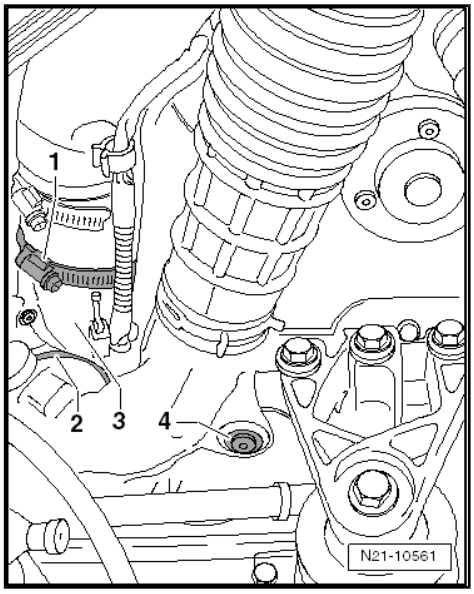
Special tools and workshop equipment required

◆ Torque wrench - V.A.G 1332-

Removing

– Remove engine mounting ⇒ page 28 .
– If fitted, remove noise insulation ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Removing and installing noise insulation .

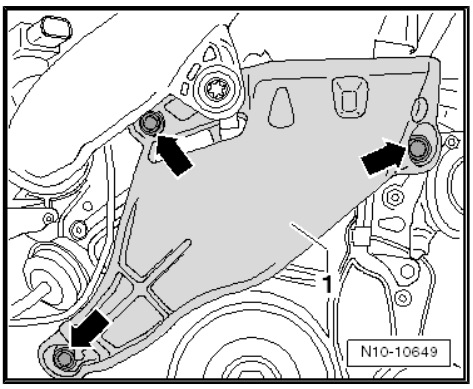
– Unscrew bolt -4-.



– Unscrew bolts -arrows-.
– Remove engine support -1-.

Installing

Install in reverse order of removal, observing the following:

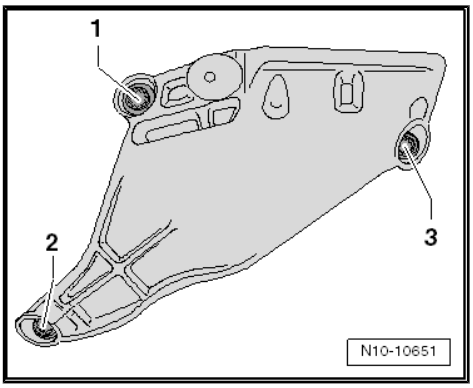


Engine support tightening sequence

– Initially, screw in bolts hand-tight in the sequence -1 … 3-.
– Then tighten bolts as per tightening sequence.
– Install engine mounting ⇒ page 28 .

Specified torques

♦ ⇒ “2.1 Assembly overview - assembly mountings”, page 24



2 Cylinder block, gearbox end

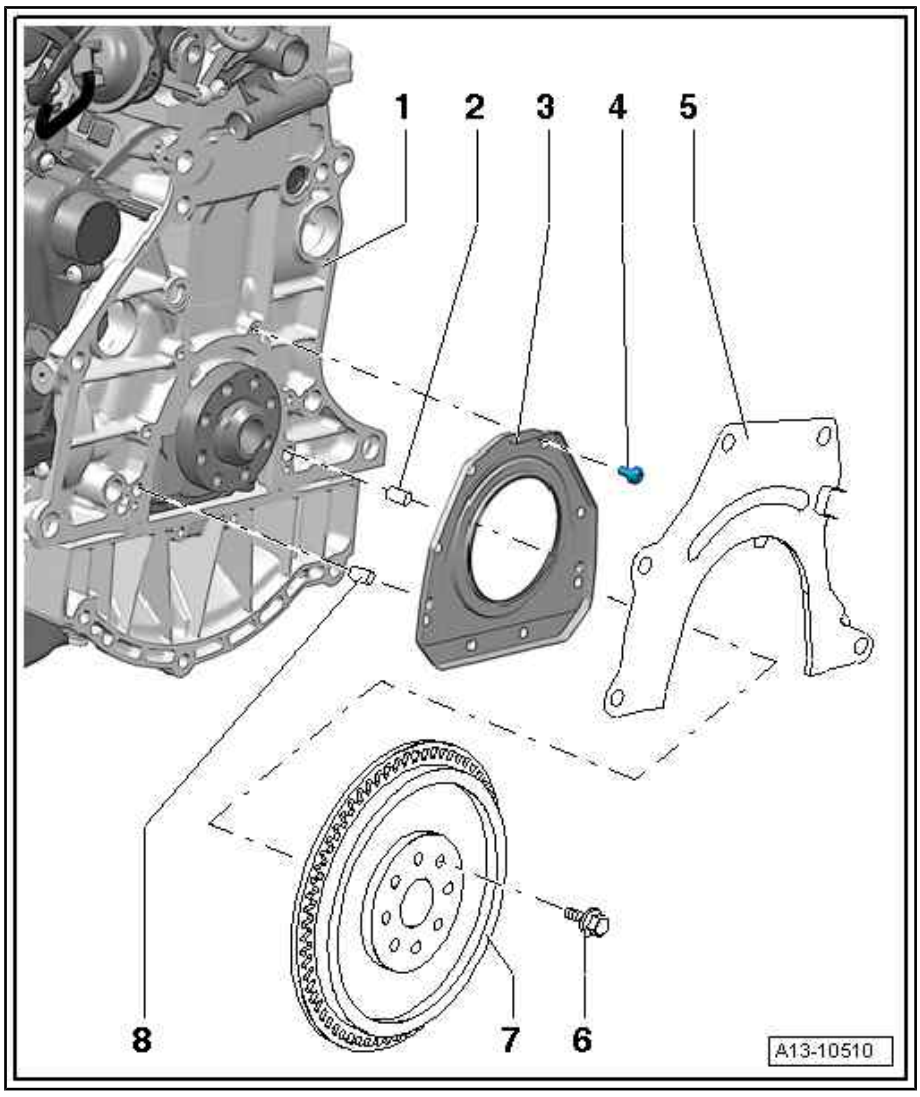
⇒ “2.1 Assembly overview - flywheel”, page 50

⇒ “2.2 Removing and installing flywheel”, page 51

⇒ “2.3 Removing and installing sealing flange on gearbox side”, page 53

⇒ “2.4 Renewing needle bearing in drive plate”, page 55

2.1 Assembly overview - flywheel



1 - Cylinder block

2 - Dowel pin

- ❑ Not installed

3 - Sealing flange on gearbox side

- ❑ With seal
- ❑ Renew only as complete unit
- ❑ Removing and installing ⇒ page 53

4 - Bolts

- ❑ Qty. 8
- ❑ Observe tightening sequence ⇒ page 51
- ❑ 9 Nm

5 - Adapter

- ❑ Must seat on dowel sleeves.
- ❑ Do not damage or bend when assembling.
- ❑ Is fitted onto sealing flange ⇒ page 51

6 - Bolts

- ❑ Qty. 8
- ❑ Renew after removal
- ❑ 60 Nm +90°

7 - Flywheel

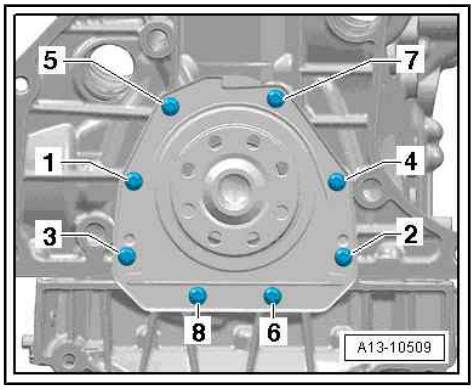
- ❑ Can only be installed in one position, holes are offset.
- ❑ Removing and installing ⇒ page 51

8 - Dowel pin

- ❑ Not installed

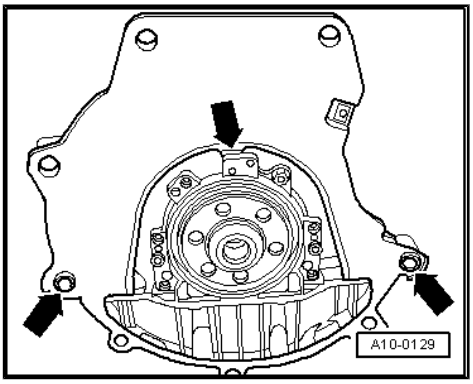
Sealing flange at gearbox end - tightening sequence

– Tighten bolts -1 … 8- in the sequence shown:



Install intermediate plate.

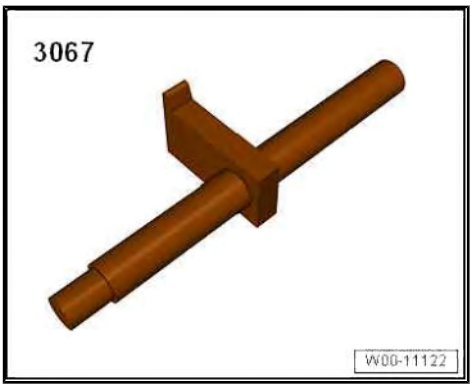
– Engage intermediate plate on sealing flange, and press onto dowel sleeves -arrows-.



2.2 Removing and installing flywheel

Special tools and workshop equipment required

♦ Counter-hold tool - 3067-



♦ Torque wrench - V.A.G 1332-

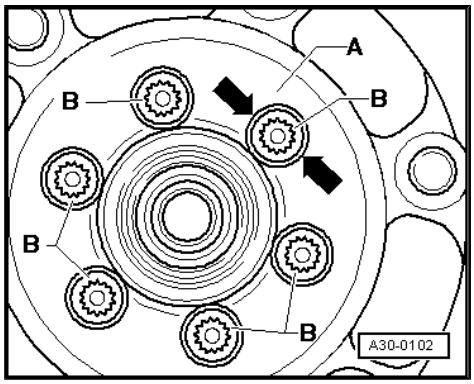
Removing

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

Note

To avoid damaging the flywheel when removing, the bolts -B- must not be removed with an impact driver or similar. It is only permissible to remove the bolts by hand.

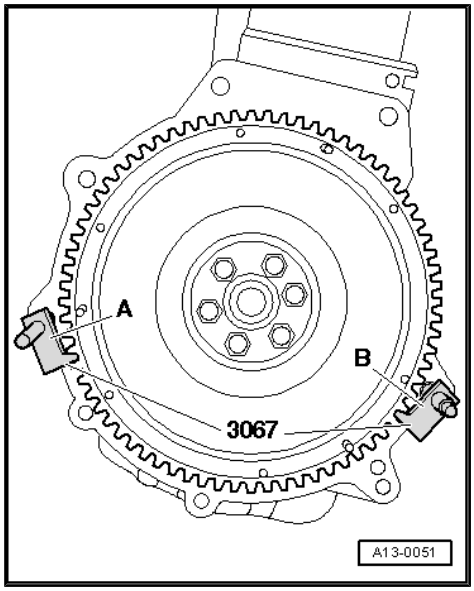
– Mark position of flywheel in relation to engine.
– Rotate dual-mass flywheel -A- so that bolts -B- align centrally with the holes -arrows-.
– When unscrewing bolts -B-, ensure that bolt heads do not come into contact with the dual-mass flywheel -arrows-. The flywheel will otherwise be damaged when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



– Insert counterhold - 3067- in hole on cylinder block -B-.
– Unscrew flywheel.

Installing

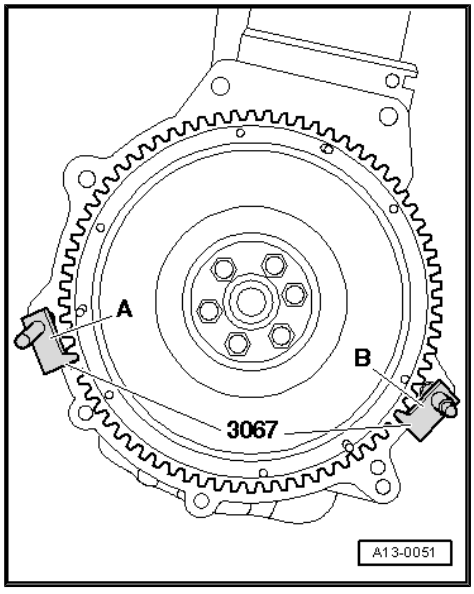
Install in reverse order of removal, observing the following:



– Insert counter hold - 3067- in hole on cylinder block -A-.

Specified torques

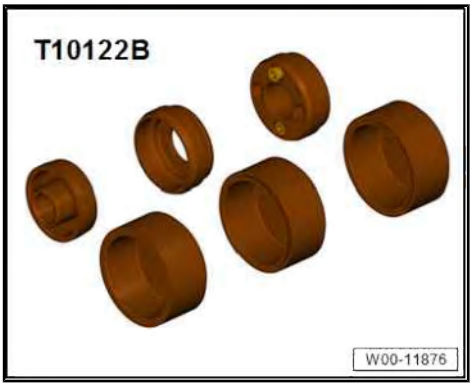
◆ ⇒ “2.1 Assembly overview - flywheel”, page 50



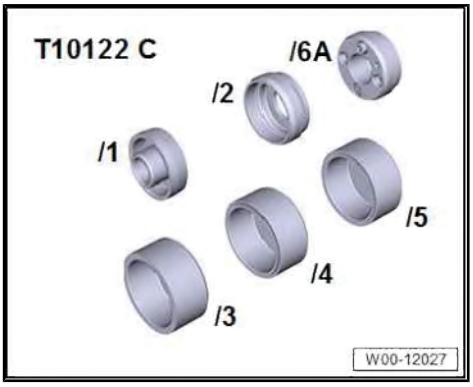
2.3 Removing and installing sealing flange on gearbox side

Special tools and workshop equipment required

- Guide piece - T10122/6- or guide piece - T10122/6A- from fitting tool - T10122B- or fitting tool - T10122C-



- Assembly aid - T10122/1- from fitting tool - T10122B- or fitting tool - T10122C-

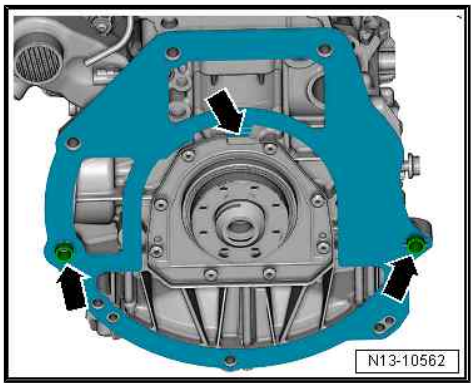


- Hand drill with plastic brush attachment
- Safety goggles
- Sealant ⇒ Electronic parts catalogue (ETKA)

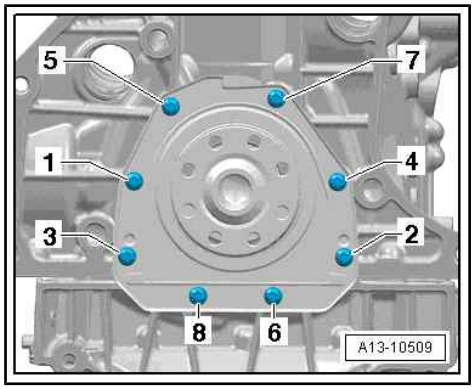
Removing

– Remove flywheel or drive plate ⇒ page 51 .

– Detach intermediate plate from sealing flange and dowel pins -arrows-.



– Unscrew bolts -1 to 8-.
– Remove sealing flange.



Installing

Install in reverse order of removal, observing the following:

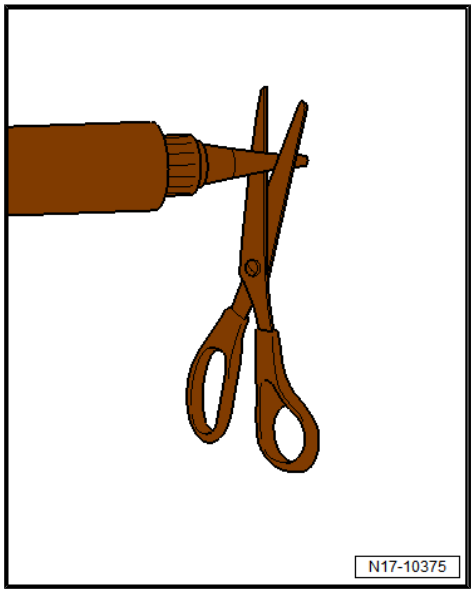
– In order to prevent the lubrication system from being soiled, cover the open section of the sump with a clean cloth.

CAUTION

Risk of eye injury caused by sealant residue.

– Wear protective goggles.

– Remove sealant residue.
– Clean sealing surfaces.



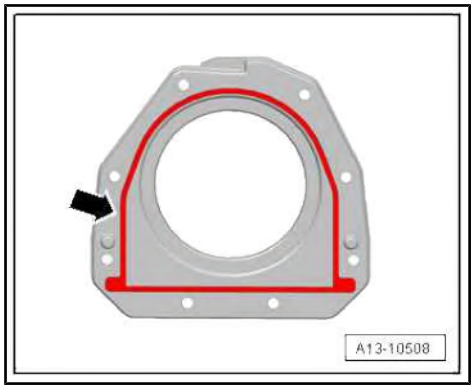
Note

Observe use-by date of silicone sealant.

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

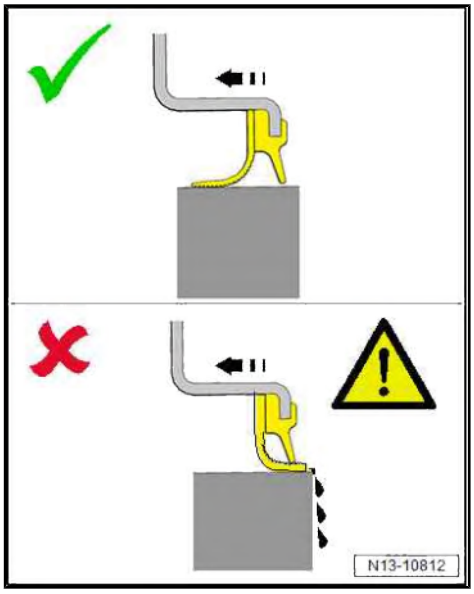
– Apply silicone sealant -arrow- to clean sealing surface of sealing flange.

• Thickness of sealant bead: 2 to 3 mm

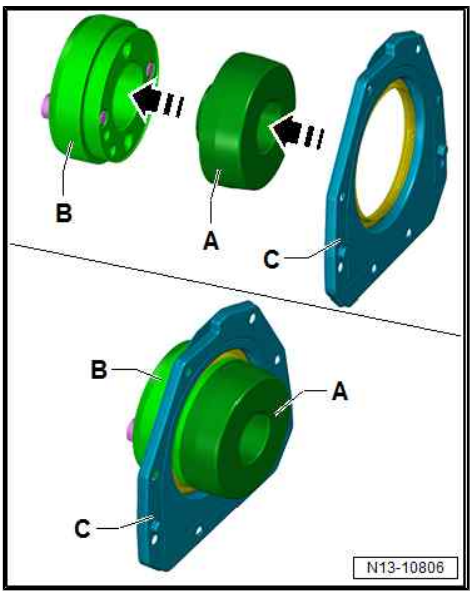


Note

- *Check sealing flange; it must be free of kinks and damage.*
- *The sealing lip must face engine following installation. Otherwise, oil leaks may occur.*
- *Install the sealing flange within 5 minutes after application of the silicone sealant.*



– Check guide - T10122/6- -B-; it must be clean and free of sharp edges.
– Attach assembly aid - T10122/1- -A- to guide - T10122/6- -B-.
– Push sealing flange -C-, with outer side leading, onto guide piece - T10122/6- -B-.
– Remove assembly aid -A-.

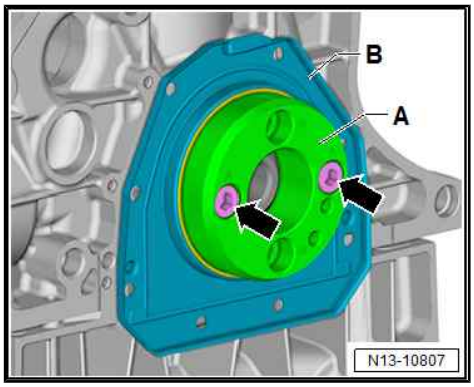


– Put guide -A- with sealing flange -B- onto crankshaft journal.

Note

It is not necessary to tighten the bolts -arrows-.

– Push sealing flange -B- over guide -A- onto crankshaft journal.
– Remove guide -A-.
– Tighten bolts; observe tightening sequence ⇒ page 51 .
• After installing the sealing flange, wait about 30 minutes for the sealant to dry. Only then fill with engine oil.

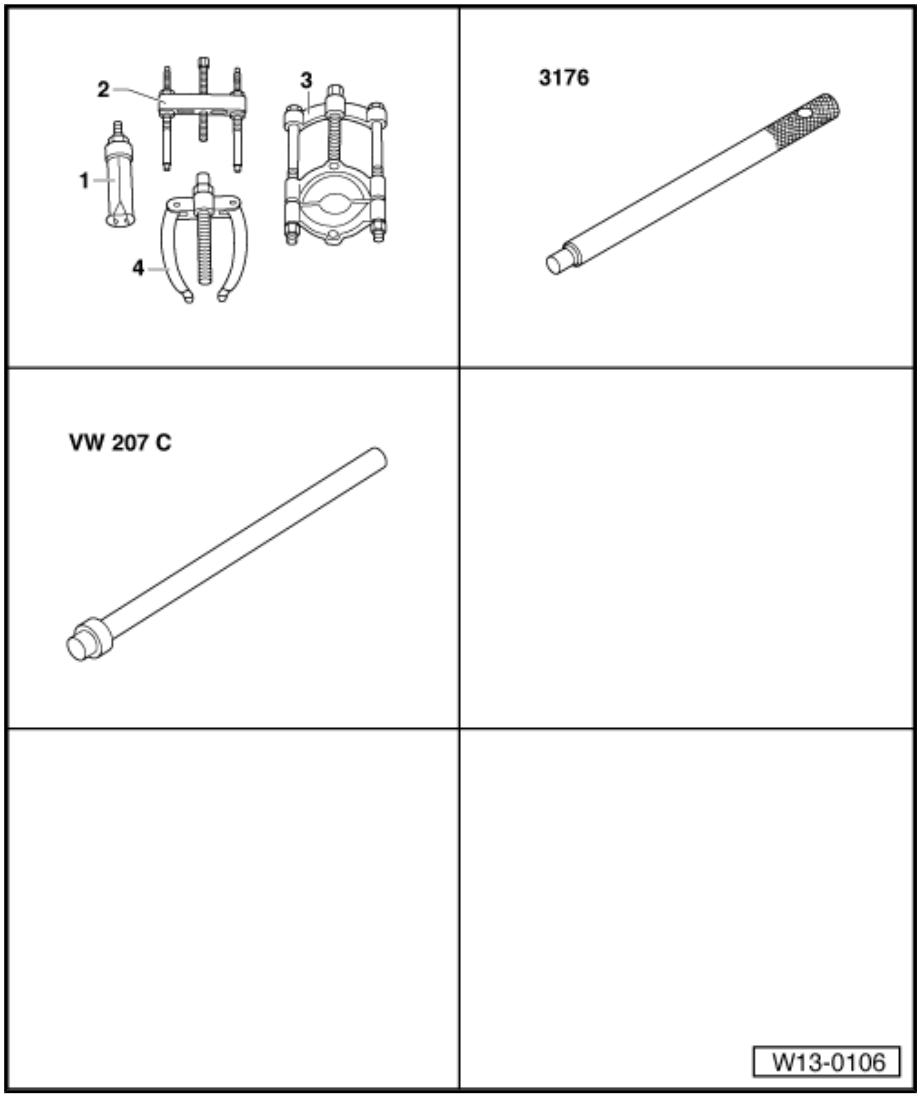


Specified torques

- ⇒ “2.1 Assembly overview - flywheel”, page 50

2.4 Renewing needle bearing in drive plate

Special tools and workshop equipment required

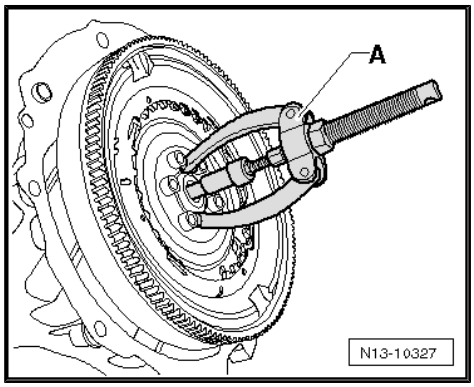


- Counter support, e.g. KUKKO 22-1 - VAS 251 621-
- Internal puller e.g. KUKKO 21-2 - VAS 251 605-
- Centring mandrel - 3176-
- Drift - VW 207 C-

Removing

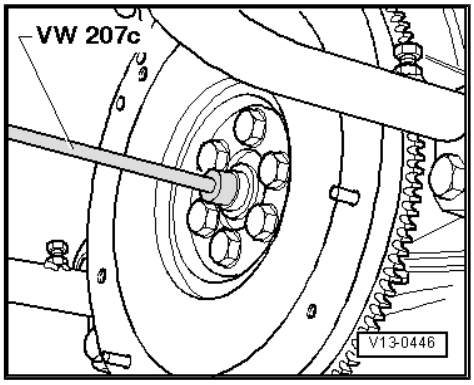
- Gearbox is separated from engine.

– Pull out needle bearing using internal puller, e.g. KUKKO 21-2 - VAS 251 605- and counter support e.g. KUKKO 22-1 - VAS 251 621- -A-.



Installing

Install in reverse order of removal, observing the following:

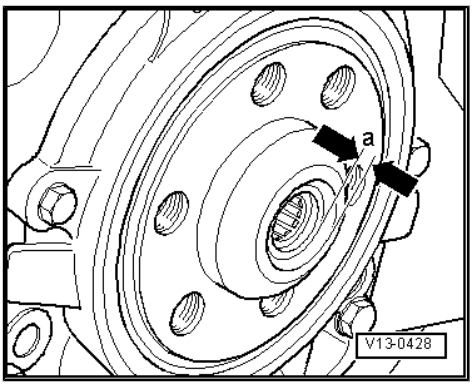


Note

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

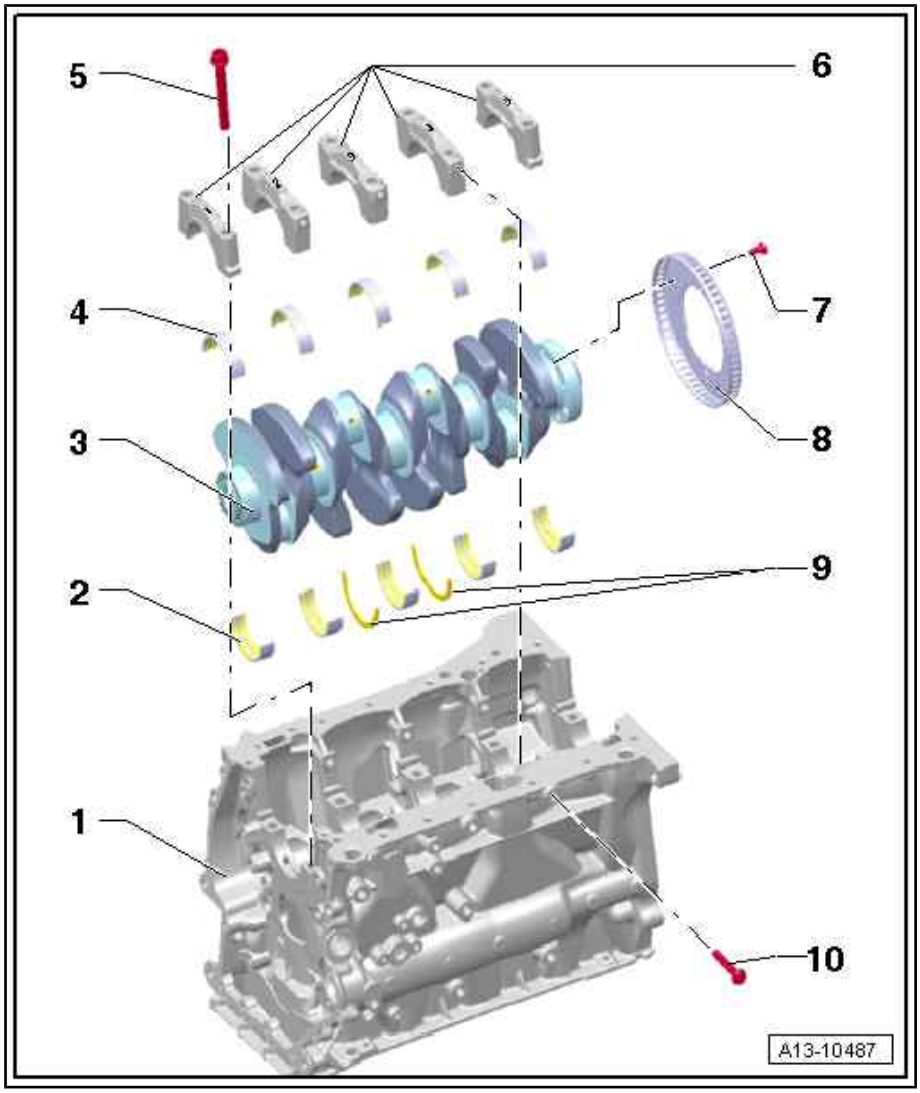
- Drive in needle bearing using drift - VW 207 C- or centring mandrel - 3176- .
- Drive needle bearing in carefully.
- Constantly measure insertion depth when driving in.
- Renew bearing if driven in too deep.

Installation depth dimension a = 1.5 to 1.8 mm.



3 Crankshaft

3.1 Assembly overview - crankshaft



1 - Cylinder block

2 - Bearing shells for cylinder block

- ❑ Qty. 5
- ❑ With oil groove.
- ❑ Do not interchange used bearing shells (mark).
- ❑ Marking of crankshaft bearing shells ⇒ page 61

3 - Crankshaft

- ❑ After removing, place down in such a way that sender wheel does not rest on surface and become damaged
- ❑ If crankshaft is renewed, bearing shells must be reassigned to bearing cap ⇒ page 61
- ❑ Axial clearance ⇒ page 59
- ❑ Radial clearance ⇒ page 60
- ❑ Do not rotate crankshaft when checking radial clearance.
- ❑ Crankshaft dimensions ⇒ page 59 .

4 - Bearing bushes

- ❑ Qty. 5
- ❑ Without oil groove.
- ❑ Do not interchange used bearing shells (mark).
- ❑ Marking of crankshaft bearing shells (classification) ⇒ page 61

5 - Bolts

- ❑ Qty. 10
- ❑ Renew after removal
- ❑ Tightening sequence ⇒ page 59

6 - Bearing cap

- ❑ Qty. 5

- ❑ Bearing cap 1: belt pulley end.
- ❑ The bearing shell retaining lugs in cylinder block and bearing caps must be aligned with each other

7 - Bolt

- ❑ Qty. 3
- ❑ Renew after removal
- ❑ Sender wheel must be renewed if bolts are loosened ⇒ page 62
- ❑ 10 Nm +90°

8 - Sender wheel

- ❑ For engine speed sender - G28-
- ❑ Can only be installed in one position (holes are offset).
- ❑ Sender wheel must be renewed if bolts are loosened
- ❑ Removing and installing ⇒ page 62

9 - Thrust washers

- ❑ Qty. 2
- ❑ For bearing 3

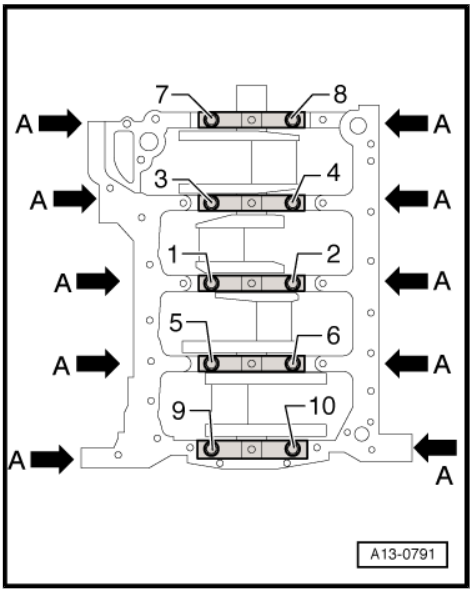
10 - Bolt

- ❑ Renew after removal
- ❑ Tightening sequence ⇒ page 59

Crankshaft tightening sequence

– Tighten crankshaft bolts in the sequence -1 … 5- as follows.

1. Tighten bolts -1 to 10- and -arrows- by hand.
2. Pre-tighten bolts -1 to 10- to 65 Nm.
3. Turn bolts -1 to 10- 90° further using a rigid wrench.
4. Pre-tighten bolts -arrows- to 20 Nm.
5. Turn bolts -arrows- 90° further using a rigid wrench.



3.2 Crankshaft dimensions

(Dimensions in mm)

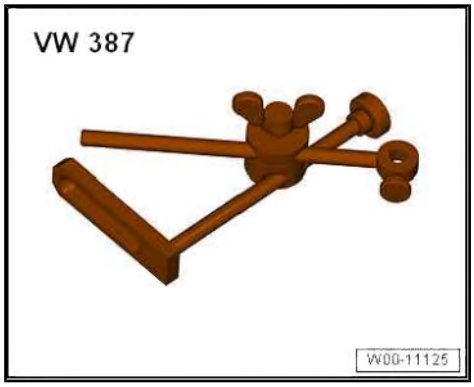
Honing dimension 1)	Main journal Ø	Conrod journal Ø
Basic dimension	58.00	47.80

1) No provision has yet been made to recondition worn crankshafts.

3.3 Measuring axial clearance of crankshaft

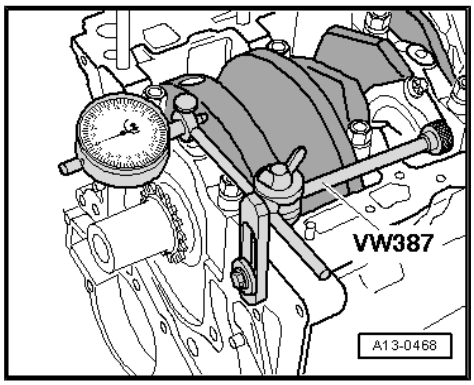
Special tools and workshop equipment required

- Universal dial gauge holder - VW 387-



- Dial gauge - VAS 6079-

Sequence of operations



– Screw dial gauge - VAS 6079- with universal dial gauge holder - VW 387- onto cylinder block and set against crank web.
– Press crankshaft against dial gauge by hand and set gauge to “0”.
– Push crankshaft away from dial gauge and read off value.

Axial clearance:

- New: 0.07 … 0.23 mm
- Wear limit: 0.30 mm

3.4 Measuring radial clearance of crankshaft

Special tools and workshop equipment required

- Plastigage

Sequence of operations

Note

- *Mark used bearings for re-installation but not on bearing surface.*
- *If the bearing shells have worn down to the 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 be in the middle of the bearing shell

– Fit bearing cap and tighten.
– Do not rotate crankshaft.
– Remove bearing cap again.
– Compare width of Plastigage with the measurement scale.

Radial clearance:

- New: 0.017 … 0.037 mm
- Wear limit: 0.15 mm

3.5 Allocation of main bearing shells

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

Which bearing shell is to be inserted at each place in the cylinder block (upper bearing shell) is marked by letters on the lower sealing surface or on the front side of cylinder block.

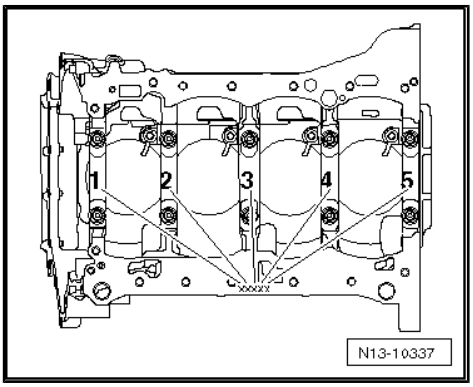
Which bearing shell is to be inserted at each place in bearing cap (lower bearing shell) is marked by letters on the crankshaft.

The first letter is allocated to bearing cap 1, the second to bearing cap 2, etc.

Marking on bearing shell for cylinder block:

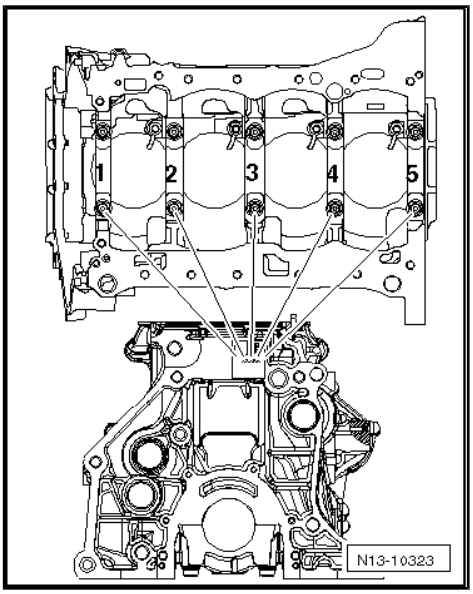
Note

The marking on the cylinder block can be found engraved either in the sump sealing surface or in the front end (gearbox side) of the cylinder block.



Identification on cylinder block is allocated to upper bearing shell (bearing shell for cylinder block).

– Note letters and identify colour code to be installed based on table.

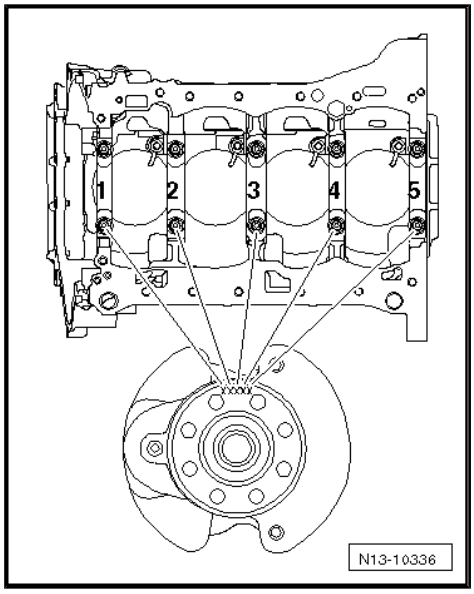


Marking on bearing shell for bearing cap:

Identification on crankshaft is allocated to lower bearing shell (bearing shell for bearing cap).

– Note letters and identify colour code to be installed based on table.

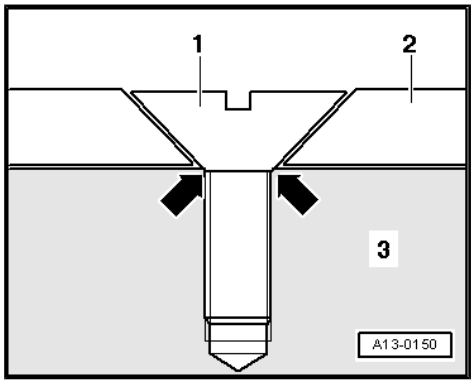
S	=	black
R	=	red
G	=	yellow
B	=	blue
W	=	white



3.6 Removing and installing sender wheel

Removing

– Remove engine ⇒ page 8 .
– Remove sealing flange on gearbox side ⇒ page 53 .
– Remove upper part of sump ⇒ page 147 .
– Remove balancer shaft timing chain ⇒ page 116 .
– Unscrew conrod bearing cap.
– Remove crankshaft bearing cap.
– Remove crankshaft and unscrew sender wheel.
– Always renew sender wheel -2- each time bolts -1- are loosened.



Note

- *The second time the bolts are tightened, the contact points in the sender wheel for the countersunk heads are deformed so much that the bolt heads seat on the crankshaft -3-, -arrows- and the sender wheel is loose under the bolts.*
- *Sender wheel can only be installed in one position. The holes are offset.*

Installing

Install in reverse order of removal, observing the following:

Specified torques

- ⇒ “3.1 Assembly overview - crankshaft”, page 58

4 Balancer shaft

⇒ “4.1 Assembly overview - balance shaft”, page 63

⇒ “4.2 Removing and installing balance shaft”, page 64

4.1 Assembly overview - balance shaft

1 - Bolt
- ❑ Renew after removal
- ❑ 9 Nm

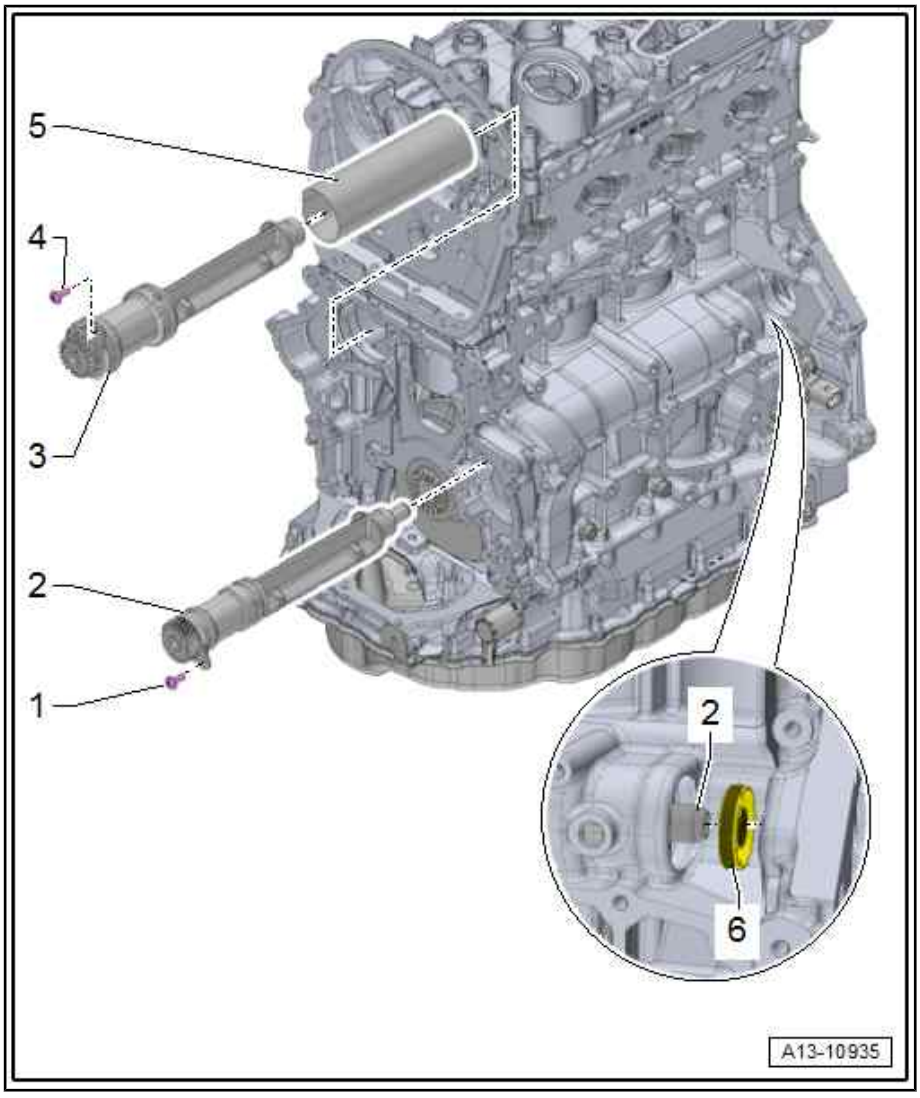
2 - Balancer shaft
- ❑ Inlet side
- ❑ Renew after removal
- ❑ Lubricate bearing with engine oil
- ❑ Removing and installing ⇒ page 64

3 - Balancer shaft
- ❑ Exhaust side
- ❑ Must always be re-newed if removed
- ❑ Lubricate bearing with engine oil
- ❑ Removing and installing ⇒ page 67

4 - Bolt
- ❑ Renew after removal
- ❑ 9 Nm

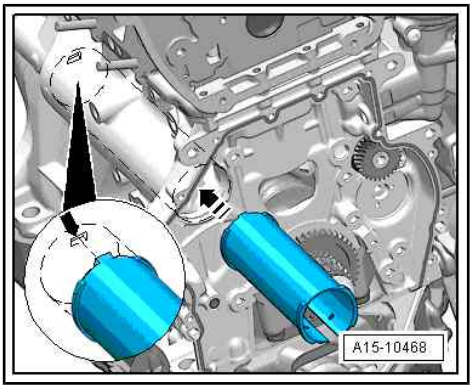
5 - Tube for balancer shaft
- ❑ Fitting position ⇒ page 63

6 - Seal for balance shaft, inlet side
- ❑ Removing and installing ⇒ page 70



Tube for balancer shaft - installation position

- Lug on tube for balance shaft must engage in slot -arrow-.



4.2 Removing and installing balance shaft

⇒ “4.2.1 Renewing balancer shaft for inlet camshaft”, page 64

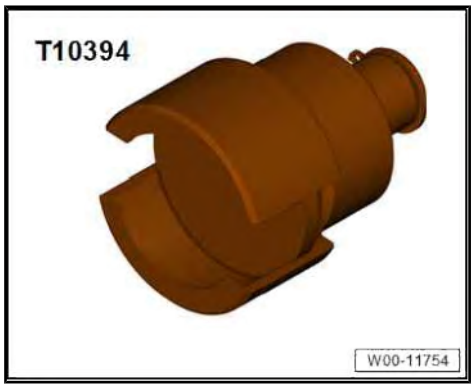
⇒ “4.2.2 Renewing balancer shaft for exhaust camshaft”, page 67

⇒ “4.2.3 Renewing oil seal for balance shaft (inlet side)”, page 70

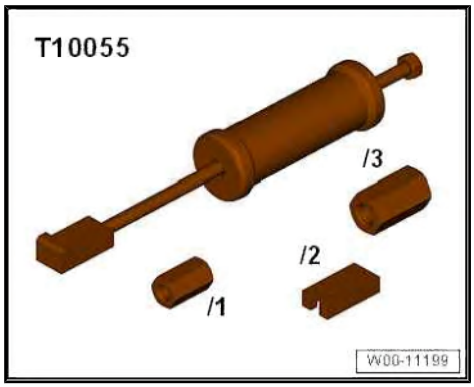
4.2.1 Renewing balancer shaft for inlet camshaft

Special tools and workshop equipment required

- Puller - T10394-



- Puller - T10055-



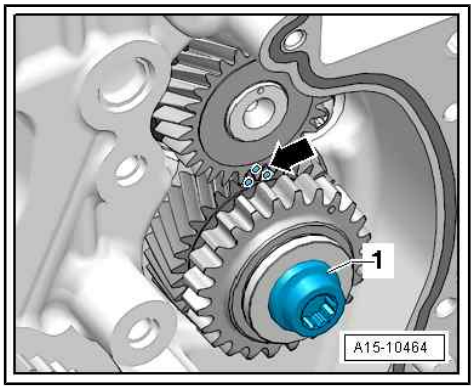
Removing

Note

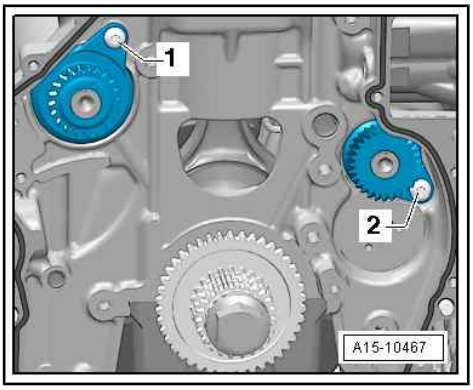
The balancer shaft for the inlet camshaft must always be renewed after removing.

- Remove drive sprocket and toothed belt for coolant pump ⇒ page 180 .
- Remove camshaft timing chain ⇒ page 104 .
- Remove balancer shaft timing chain ⇒ page 116 .
- Lower engine with support bracket - 10 - 222 A- slightly until balance shaft is accessible.

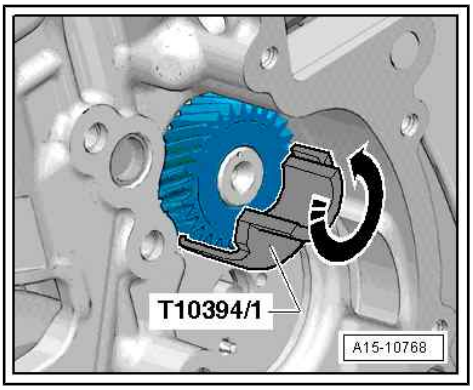
– Remove intermediate shaft sprocket -1-.



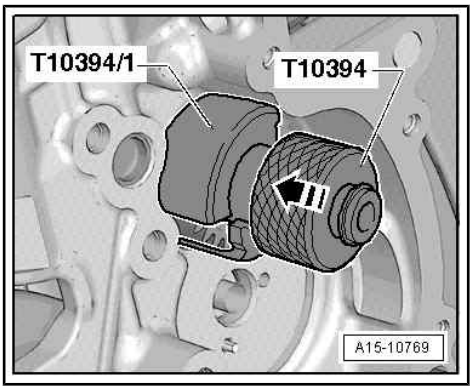
– Unscrew bolt -2- for balance shaft of inlet camshaft.



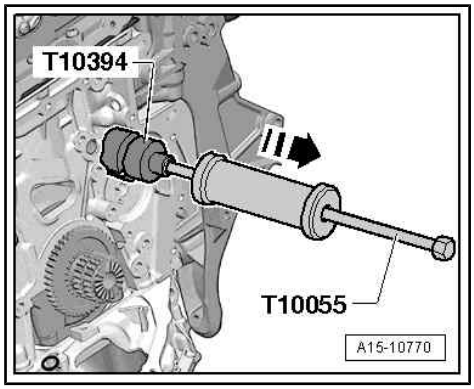
– Insert shell half - T10394/1- from puller - T10394- and turns upwards in direction of arrow.



– Insert puller - T10394- and push locking collar in -direction of arrow-.



– Screw puller - T10055- into puller - T10394- and force out balance shaft in -direction of arrow-.



Installing

Install in reverse order of removal, observing the following:

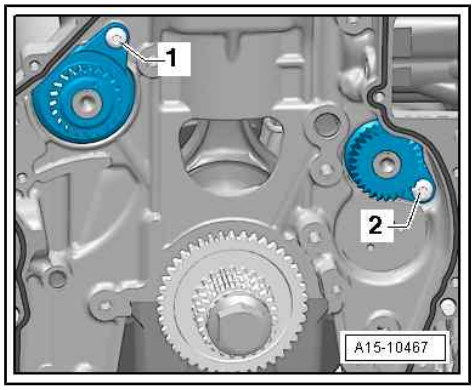
Note

Due to the small amount of play between the balancer shaft and cylinder block, the balancer shaft may need to be installed chilled. Check whether the balancer shaft can be fitted into the cylinder block without exerting force. If this is not the case, the balancer shaft must be chilled before installing.

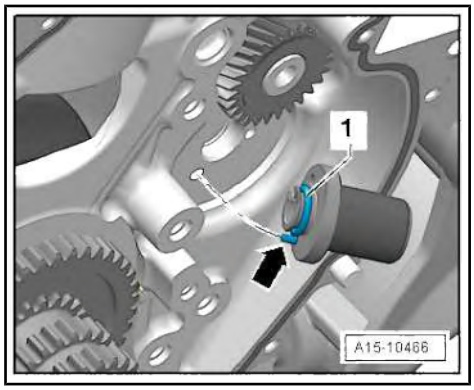
– If necessary, place new balance shaft in freezer compartment for 30 minutes or spray with commercially available cooling spray.

– Lubricate balancer shaft bearing with engine oil.

– Install new balance shaft for inlet camshaft and tighten bolt -2-.



– Renew O-ring -1- and lubricate with engine oil.



Note

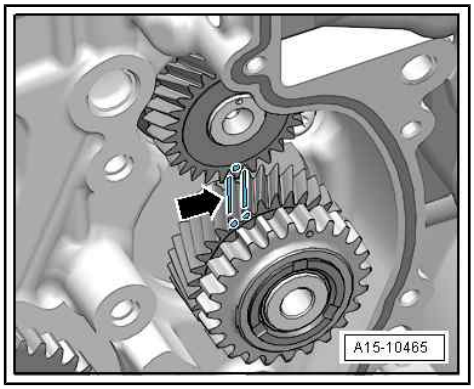
Dowel pin -arrow- for bearing mounting must engage in bore in cylinder block.

– Coat bearing mounting with engine oil and insert.

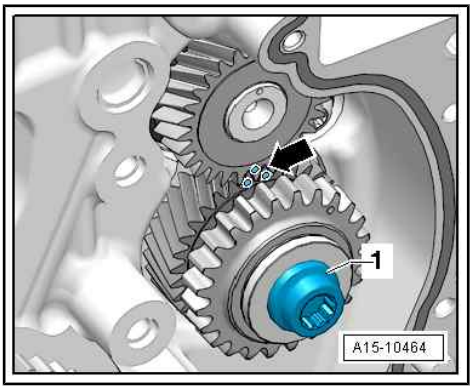
Note

- *The intermediate shaft sprocket must be replaced. Otherwise no tooth backlash is set, engine damage.*
- *The new intermediate shaft sprocket is coated with a solid film lubricant that wears off after a short period and thus automatically sets the tooth backlash.*

– Mark faces of gear teeth of intermediate shaft sprocket with paint -arrows-.
– Insert intermediate shaft sprocket; marking on balancer shaft must be positioned between markings on faces of gear teeth.



– Tighten bolt -1- for intermediate shaft sprocket: tightening sequence ⇒ page 102 .
– Check markings on intermediate shaft sprocket/balancer shaft -arrow-.
– Install balance shaft timing chain ⇒ page 116 .
– Install camshaft timing chain ⇒ page 104 .
– Install timing chain cover (bottom) ⇒ page 96 .
– Install timing chain cover (top) ⇒ page 96 .
– Install engine mounting ⇒ page 28 .
– Install plenum chamber bulkhead on left and right ⇒ General body repairs, exterior; Rep. gr. 50 ; Plenum chamber bulkhead; Removing and installing plenum chamber bulkhead .
– Install tensioner for poly V-belt ⇒ page 36 .
– Install poly V-belt ⇒ page 35 .
– Renew oil seal for coolant pump drive ⇒ page 175 .
– Install drive sprocket and toothed belt for coolant pump ⇒ page 180 .
– If present, install noise insulation ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Removing and installing noise insulation .



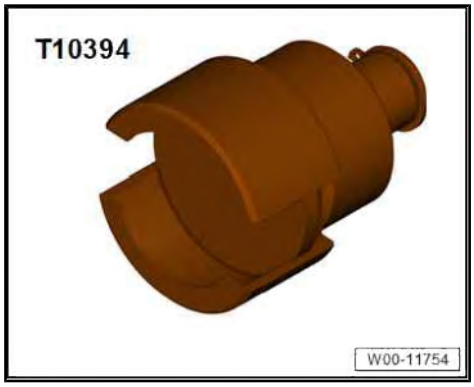
Specified torques

- ⇒ “2.1 Assembly overview - assembly mountings”, page 24
- ⇒ “3.1 Assembly overview - drive chain for balance shaft”, page 100
- ⇒ “1.1 Assembly overview - poly V-belt drive”, page 33
- ⇒ “2.1 Assembly overview - coolant pump, thermostat”, page 171
- ⇒ “2.1 Assembly overview - cover for timing chain”, page 94

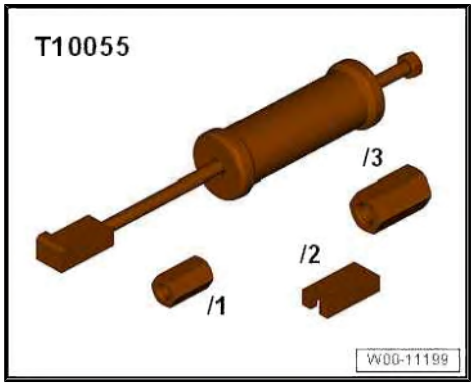
4.2.2 Renewing balancer shaft for exhaust camshaft

Special tools and workshop equipment required

♦ Puller - T10394-



♦ Puller - T10055-

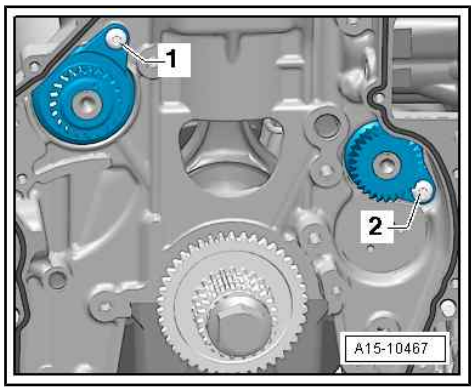


Removing

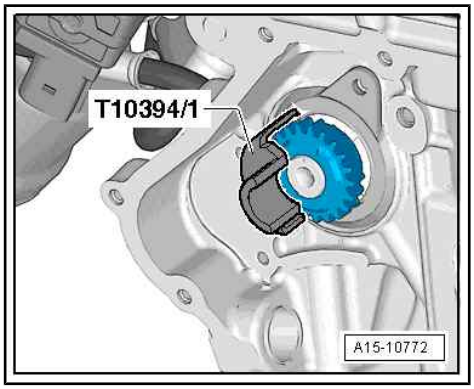
Note

The balancer shaft for the inlet camshaft must always be renewed after removing.

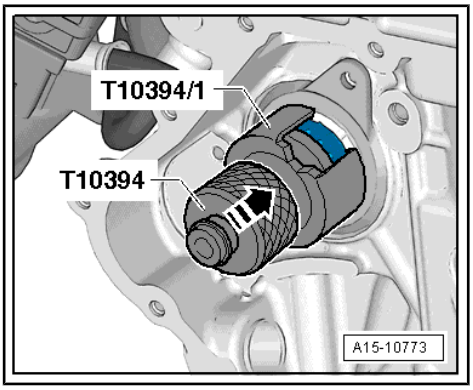
– Remove camshaft timing chain ⇒ page 104 .
– Remove balancer shaft timing chain ⇒ page 116 .
– Lower the engine with the support bracket - 10 - 222 A- slightly until the balance shaft is accessible.
– Unscrew bolt -1- for balance shaft of exhaust camshaft.



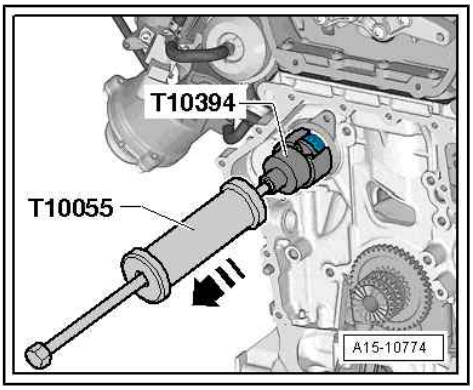
– Insert shell half -T10394/1- from puller - T10394- .



– Insert puller - T10394- and push locking collar in -direction of arrow-.



– Screw puller - T10055- into puller - T10394- and force out balance shaft.



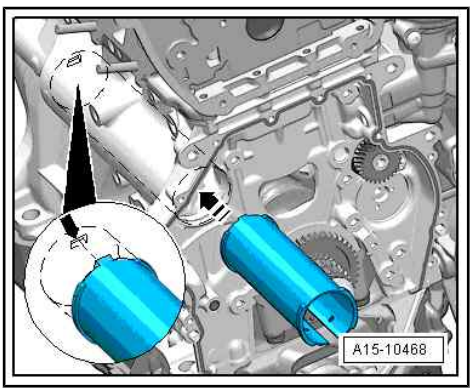
Installing

Install in reverse order of removal, observing the following:

Note

Due to the small amount of play between the balancer shaft and cylinder block, the balancer shaft may need to be installed chilled. Check whether the balancer shaft can be fitted into the cylinder block without exerting force. If this is not the case, the balancer shaft must be chilled before installing.

– Install tube for balance shaft in direction of -arrow-.



Note

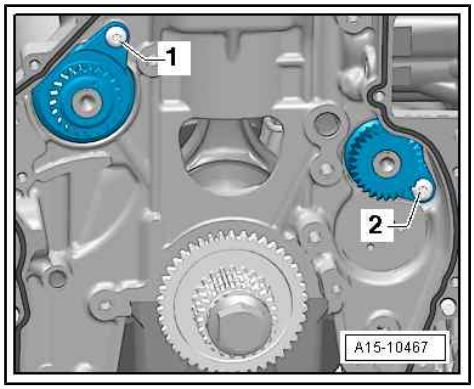
Lug -arrow- must engage in slot.

– If necessary, place new balance shaft in freezer compartment for 30 minutes or spray with commercially available cooling spray.

– Lubricate balancer shaft bearing with engine oil.

– Install balancer shaft for exhaust camshaft.

– Before tightening bolt -1-, check that balance shaft rests flat against crankcase.



Note

If the balancer shaft does not rest flat, the pipe for balancer shaft must be inserted again.

– Install balance shaft timing chain ⇒ page 116 .

– Install camshaft timing chain ⇒ page 104 .

– Install timing chain cover (bottom) ⇒ page 96 .

– Install timing chain cover (top) ⇒ page 96 .

– Install engine mounting ⇒ page 28 .

– Install plenum chamber bulkhead on left and right ⇒ General body repairs, exterior; Rep. gr. 50 ; Plenum chamber bulkhead; Removing and installing plenum chamber bulkhead .

– Install tensioner for poly V-belt ⇒ page 36 .

– Install poly V-belt ⇒ page 35 .

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

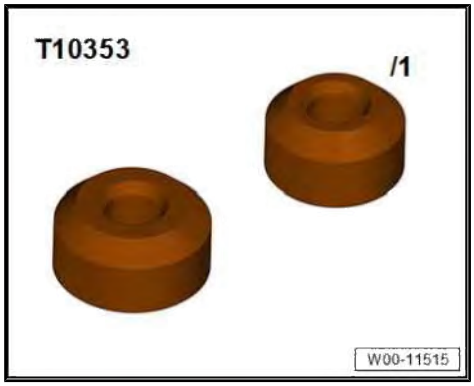
Specified torques

- ⇒ “2.1 Assembly overview - assembly mountings”, page 24
- ⇒ “3.1 Assembly overview - drive chain for balance shaft”, page 100
- ⇒ “1.1 Assembly overview - poly V-belt drive”, page 33
- ⇒ “2.1 Assembly overview - cover for timing chain”, page 94

4.2.3 Renewing oil seal for balance shaft (inlet side)

Special tools and workshop equipment required

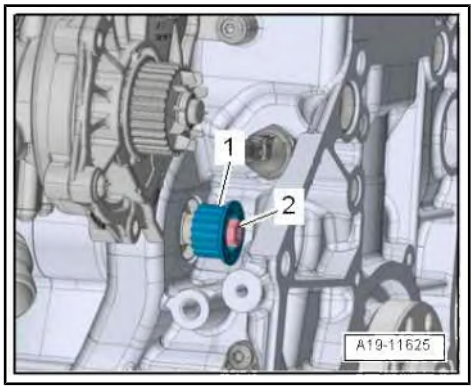
- Thrust piece - T10353-



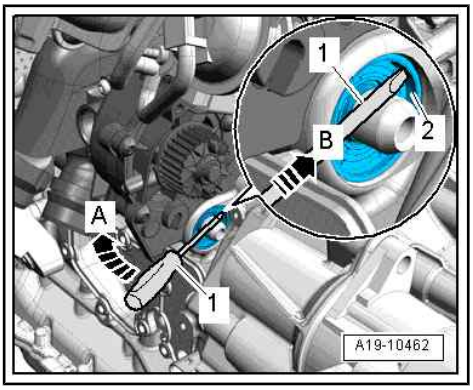
Removing

– Remove toothed belt for coolant pump ⇒ page 180 .

– Unscrew bolt -2-.
– Detach drive sprocket -1- for toothed belt for coolant pump.



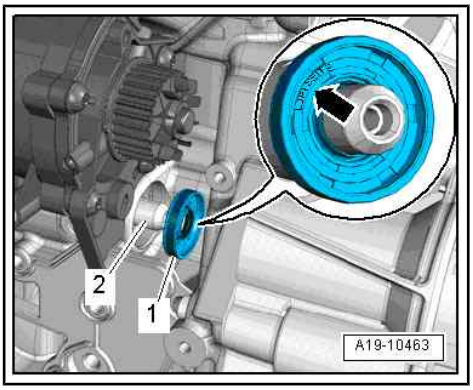
– Press screwdriver -1- firmly onto section -2- of oil seal -arrow B-.
– Lever out seal using screwdriver -1- in direction of -arrow A-.
– Clean contact surface and sealing surface.



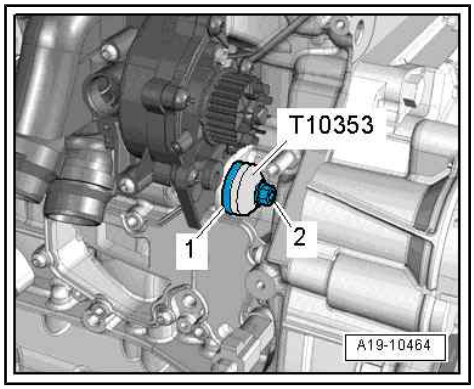
– Lubricate sealing surface of balance shaft -2- with gear oil.
– Fit seal -1- onto balance shaft.

Note

Inscription -arrow- must be readable from above.



– Apply thrust piece - T10353- to oil seal -1- and press into cylinder block as far as possible using bolt -2- (take care not to cant oil seal).



Note

- *Risk of damage to thread.*
- *The drive sprocket bolt has a left-hand thread.*

Installing

Install in reverse order of removal, observing the following:

– Fit toothed belt for coolant pump ⇒ page 180 .

– Install small coolant pipe.

Note

Never reuse old coolant.

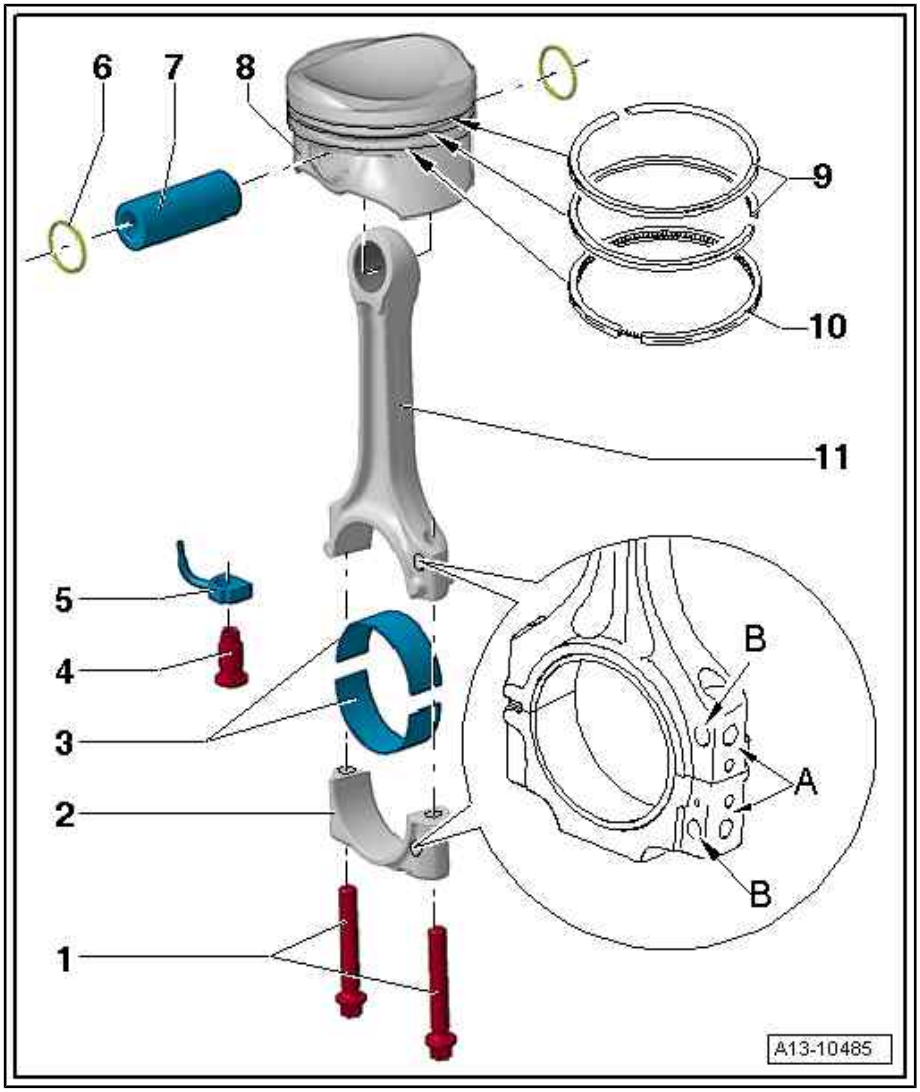
– Add coolant ⇒ page 163 .

Specified torques

- ⇒ “2.1 Assembly overview - coolant pump, thermostat”, page 171

5 Pistons and conrods

5.1 Assembly overview - pistons and conrods



1 - Conrod bolts

- ❑ Qty. 2
- ❑ Renew after removal
- ❑ Oil threads and contact surface
- ❑ Use old bolt for measuring radial clearance.
- ❑ To measure radial clearance, tighten to 30 Nm but not further.
- ❑ 45 Nm +90°

2 - Conrod bearing cap

- ❑ Observe installation position
- ❑ Due to industrial cracking, the caps only fit in one position and only on the appropriate conrod
- ❑ Mark with cylinder number -A-.
- ❑ Installation position: Marking -B- faces towards pulley end.

3 - Bearing bushes

- ❑ Qty. 2
- ❑ Fitting position ⇒ page 74
- ❑ Do not interchange used bearing shells (mark).
- ❑ Axial clearance, new: 0.10 … 0.35 mm, wear limit: 0.40 mm
- ❑ Measure radial clearance using Plastigage; new: 0.02 … 0.06 mm; wear limit: 0.09 mm. Do not rotate crankshaft when checking radial clearance.

4 - Pressure relief valve

- ❑ 27 Nm

5 - Oil spray jet

- ❑ For piston cooling

6 - Retaining rings

- ❑ Qty. 2

7 - Piston pin

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

8 - Piston

- ❑ Checking ⇒ page 76
- ❑ Mark installation position and cylinder number.
- ❑ Arrow on piston crown points to belt pulley end.
- ❑ Install using piston ring clamp.
- ❑ Piston and cylinder dimensions ⇒ page 76 .
- ❑ Checking cylinder bores ⇒ page 77 .

9 - Compression rings

- ❑ Qty. 2
- ❑ Offset gaps by 120°
- ❑ Use piston ring pliers to remove and install.
- ❑ “TOP” or “R” marking must face upwards towards piston crown.
- ❑ Checking ring gap ⇒ page 76 .
- ❑ Checking ring-to-groove clearance ⇒ page 77 .

10 - Oil scraper ring

- ❑ Two-piece design.
- ❑ Offset gap of top steel element of piston ring by 120° to next compression ring
- ❑ Offset gaps of individual parts of oil scraper ring
- ❑ Checking ring gap ⇒ page 76 .
- ❑ Ring-to-groove clearance not measurable.

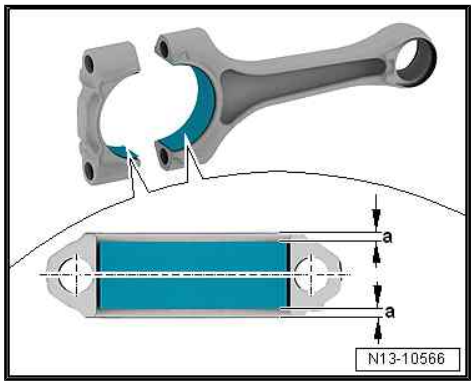
11 - Connecting rod

- ❑ Renew as set only.
- ❑ Mark with cylinder number -A-.
- ❑ Installation position: Marking -B- faces towards pulley end.
- ❑ Separate new conrod ⇒ page 77

Bearing shells - installation position

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

Distance -a- must be identical on both sides.



5.2 Removing and installing pistons

Special tools and workshop equipment required

♦ Drift - VW 222 A-

♦ Piston ring clamp, commercially available

Removing

– Secured engine on engine and gearbox support - VAS 6095- ⇒ page 18

– Remove cylinder head ⇒ page 82 .

– Remove upper part of sump ⇒ page 147 .

– Mark piston installation position and corresponding cylinder number.

– Mark conrod installation position and corresponding cylinder number ⇒ Item 11 (page 74) .

– Remove conrod bearing cap and withdraw piston and conrod upwards.

Note

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

– Remove retaining ring from piston pin eye.

– Drive out piston pin using drift - VW 222 A- .

Installing

Install in reverse order of removal, observing the following:

Note

♦ *Renew bolts that are tightened with specified further tightening angle.*

♦ *Arrow on piston crown points to belt pulley end.*

♦ *Offset piston ring gaps by 120°.*

– Oil running surfaces of bearing shells.

– Install piston with commercially available piston ring clamp, noting installation position ⇒ Item 8 (page 74) .

– Install conrod bearing cap, noting installation position ⇒ Item 2 (page 73) .

– Install cylinder head ⇒ page 82 .

– Install upper part of sump ⇒ page 147 .

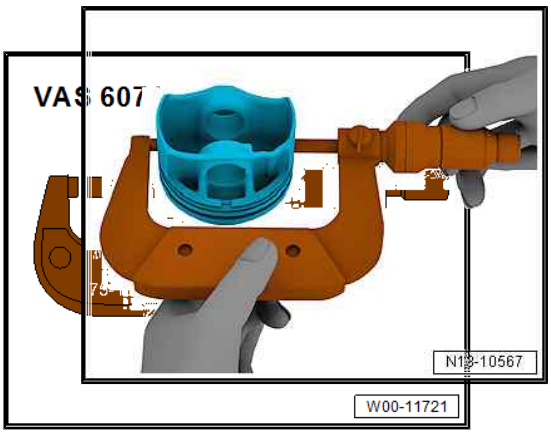
Specified torques

- ⇒ “5.1 Assembly overview - pistons and conrods”, page 73
- ⇒ “1.1 Assembly overview - cylinder head”, page 79

5.3 Checking pistons and cylinder bores

Special tools and workshop equipment required

- External micrometre 75 - 100 mm - VAS 6071-



- Feeler gauge, commercially available

Checking piston

– Measure approx. 15 mm from lower edge, offset 90° from piston pin axis with a 75 … 100 mm external micrometer.

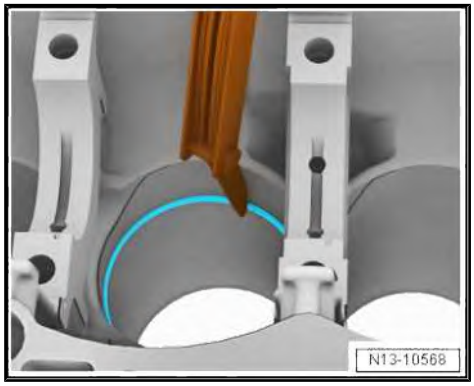
- Difference between actual and nominal diameter max. 0.04 mm.

	Piston ∅	Cylinder bore ∅
Basic dimension mm	82.465[1)]	82.51

• [1)] Dimensions without graphite coating (thickness 0.02 mm). The graphite coating will wear down.

Checking piston ring gap

– Push piston ring at right angles to cylinder wall from above down to approx. 15 mm from bottom end of cylinder. Push in using a piston without rings.

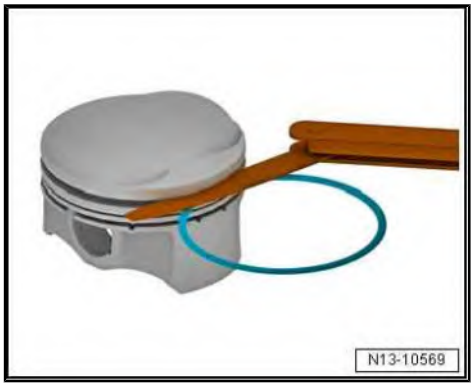


Piston ring dimensions in mm	New	Wear limit
compression ring	0.20 … 0.40	0.80
Oil scraper ring	0.25 … 0.50	0.80

Checking ring-to-groove clearance

– Clean annular groove of piston before check.

Piston ring dimensions in mm	New	Wear limit
1st compression ring	0.06 … 0.09	0.20
2nd compression ring	0.03 … 0.06	0.15
Oil scraper rings	Cannot be measured	



Checking cylinder bores

– Using cylinder gauge - VAS 6078- take measurements at 3 positions diagonally in lateral direction -A- and longitudinal direction -B-.

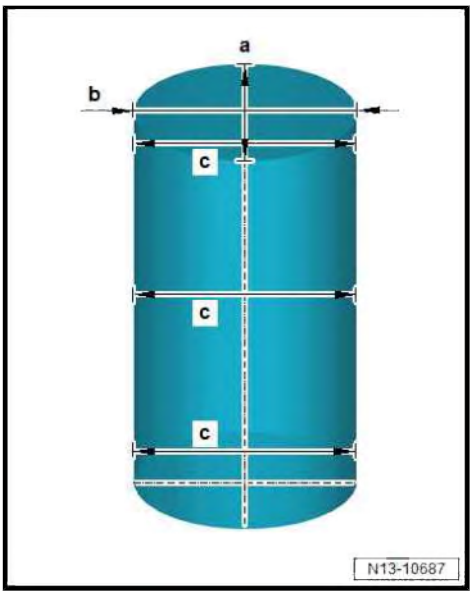
NOTICE

Risk of damage to the surface of the cylinder bore caused by incorrect machining.

– Do not machine cylinder bore (reboring, honing, grinding) with workshop equipment.

– Using a cylinder gauge - VAS 6078- , take measurements at 3 positions diagonally in the lateral direction -A- and in the longitudinal direction -B-.

♦ Difference between actual and nominal diameter max. 0.08 mm.



	Cylinder bore ∅
Basic dimension	82.51 mm

Note

Do not measure cylinder bores when cylinder block is mounted on engine and gearbox support - VAS 6095- , as measurements may be incorrect.

5.4 Separating new conrod

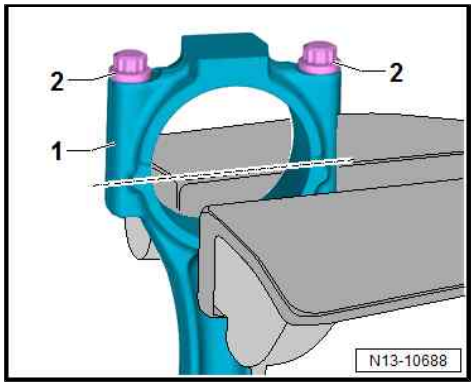
Sequence of operations

Note

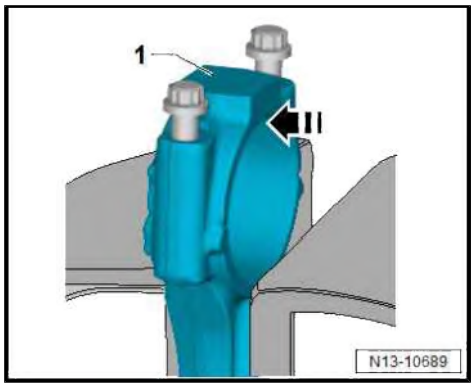
♦ *To avoid damage, only clamp the conrod lightly in a vice and use protective jaw covers.*

♦ *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:*

– Clamp conrod -1- below dashed line.
– Unscrew bolts -2- approx. 5 turns.



– Using a plastic hammer, carefully knock against conrod bearing cap -1- in direction of -arrow- until it is loose.



5.5 Checking radial clearance of conrods

Special tools and workshop equipment required

♦ Plastigage

Sequence of operations

– 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:

• New: 0.02 … 0.06 mm
• Wear limit: 0.09 mm

– Renew conrod bolts.

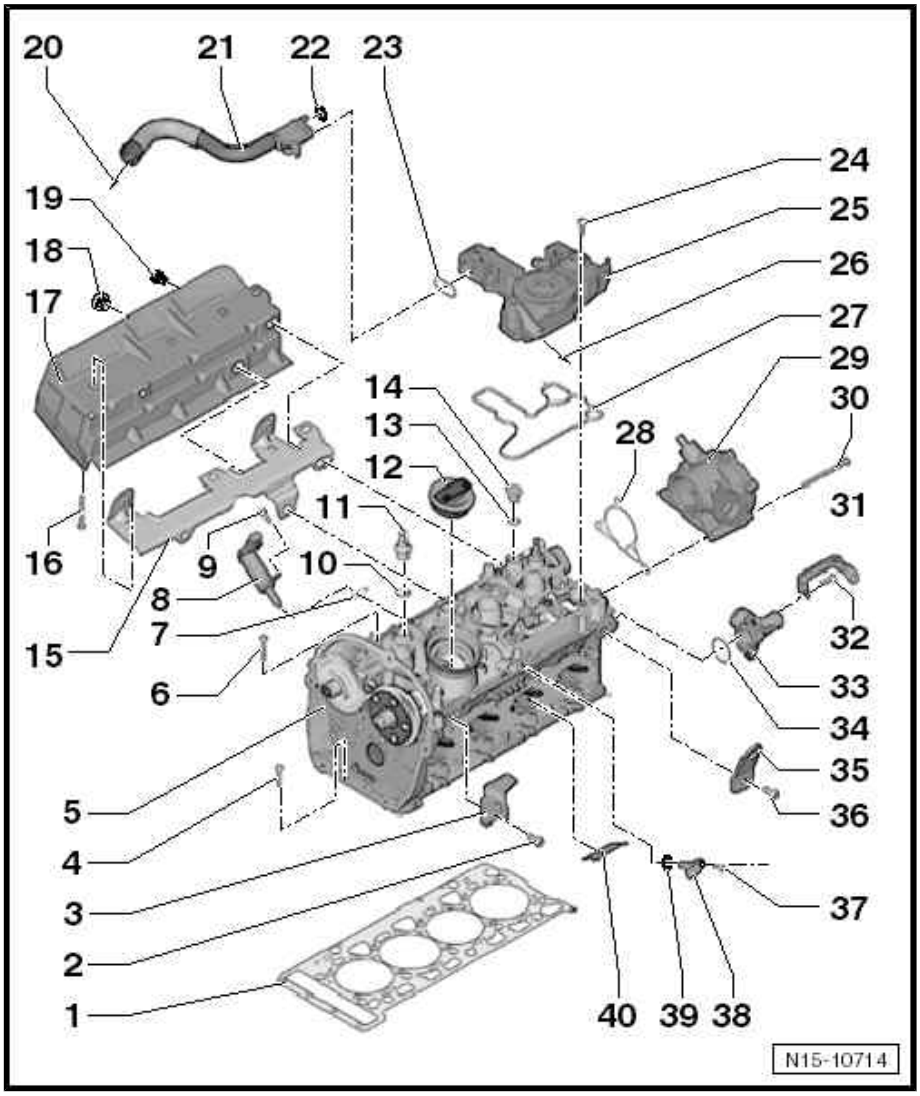
Specified torques

Component	Specified torque
Conrod bearing cap bolts	45 Nm +90°

15 – Cylinder head, valve gear

1 Cylinder head

1.1 Assembly overview - cylinder head



1 - Cylinder head gasket

- ❑ Renew after removal
- ❑ Observe installation position: Part number to cylinder head

2 - Bolt

- ❑ 25 Nm

3 - Engine lifting eye

4 - Bolts

- ❑ Qty. 4
- ❑ Renew after removal
- ❑ Note procedure when loosening ⇒ page 82 .
- ❑ Note procedure when tightening ⇒ page 82 .

5 - Cylinder head

- ❑ Check for distortion ⇒ page 81 .
- ❑ Removing and installing ⇒ page 82

6 - Cylinder head bolts

- ❑ Renew after removal
- ❑ Qty. 10
- ❑ Observe specified torques and tightening sequence ⇒ page 82

7 - O-ring

- ❑ Moisten with engine oil.
- ❑ Check for damage
- ❑ Not a replacement part, provided together with actuator for camshaft adjustment

8 - Actuator for camshaft adjustment -F366- / -F373-

- ❑ Qty. 8
- ❑ Removing and installing ⇒ page 133

9 - Bolts

- ❑ Qty. 8
- ❑ 5 Nm

10 - O-rings
- ❑ Qty. 2
- ❑ Renew after removal
- ❑ Lubricate with engine oil

11 - Plug
- ❑ Qty. 2
- ❑ With ball head for engine cover panel
- ❑ 5 Nm

12 - Cap
- ❑ With seal

13 - O-rings
- ❑ Qty. 2
- ❑ Renew after removal
- ❑ Lubricate with engine oil

14 - Plug
- ❑ Qty. 3

15 - Bracket

16 - Bolts
- ❑ Qty. 10
- ❑ 9 Nm

17 - Heat shield

18 - Bolt
- ❑ 20 Nm

19 - Bolt
- ❑ 20 Nm

20 - To intake manifold/turbocharger

21 - Breather pipe

22 - O-ring
- ❑ No replacement part

23 - Seal
- ❑ No replacement part

24 - Bolts
- ❑ Qty. 10
- ❑ Observe tightening sequence ⇒ page 81
- ❑ 11 Nm

25 - Crankcase ventilation
- ❑ Removing and installing ⇒ page 157

26 - To intake manifold

27 - Seal
- ❑ No replacement part

28 - Seal
- ❑ Renew if damaged

29 - Vacuum pump
- ❑ Removing and installing ⇒ page 93

30 - Bolt

- ❑ 9 Nm

31 - Retaining plate

32 - Bolt

- ❑ 9 Nm

33 - Union

34 - O-ring

- ❑ Renew after removal
- ❑ Moisten with coolant

35 - Engine lifting eye

36 - Bolt

- ❑ 25 Nm

37 - Bolt

- ❑ 9 Nm

38 - Hall sender - G40-

- ❑ Removing and installing ⇒ page 250

39 - O-ring

- ❑ Renew after removal
- ❑ Lubricate with engine oil

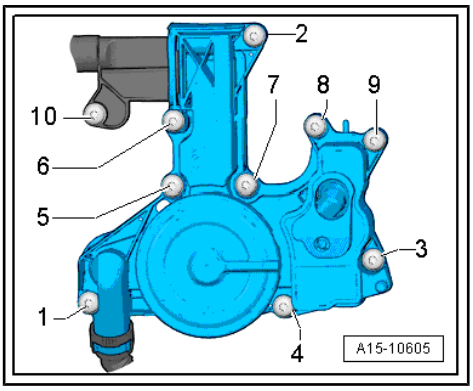
40 - Partition

Crankcase breather system - tightening torque

Note

- ♦ *The bolts are self-tapping. When renewing cylinder head, only genuine bolts may be used since cylinder head is supplied without thread to attach crankcase breather system.*
- ♦ *It is not permissible to tap threads with a thread tap.*

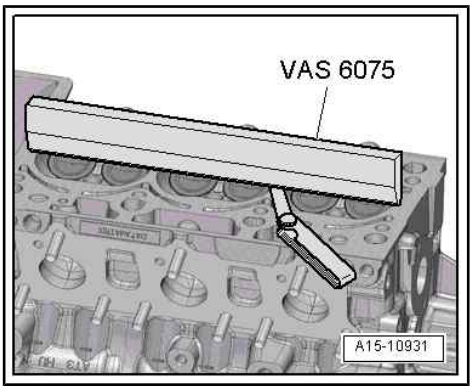
– Tighten bolts for crankcase breather in the sequence -1 … 10-.



Checking cylinder head for distortion

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

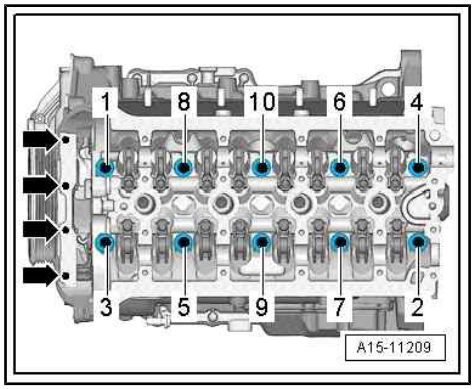
- ♦ Max. permissible distortion: 0.05 mm



Loosening cylinder head bolts

– Unscrew bolts -arrows-.

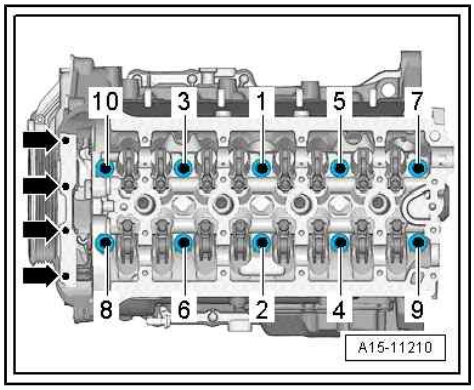
– Slacken cylinder head bolts in the sequence -1 to 10-.



Tightening sequence for cylinder head

– Tighten cylinder head bolts in the sequence -1 … 10- as follows.

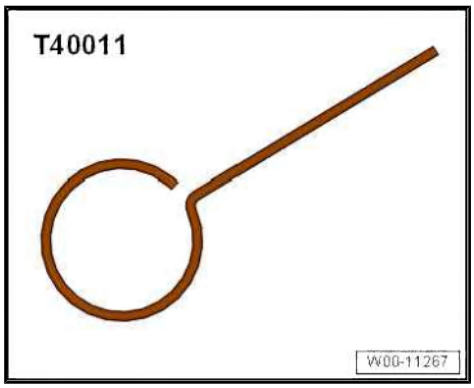
1. Using a torque wrench, pre-tighten bolts with strength rating of 10.9 to 40 Nm, pre-tighten bolts with strength rating of 12.9 to 50 Nm.
2. Use fixed wrench to turn 90° further.
3. Use fixed wrench to turn 90° further.
4. Pre-tighten bolts -arrows- to 8 Nm.
5. Turn bolts -arrows- 90° further using a rigid wrench.



1.2 Removing and installing cylinder head

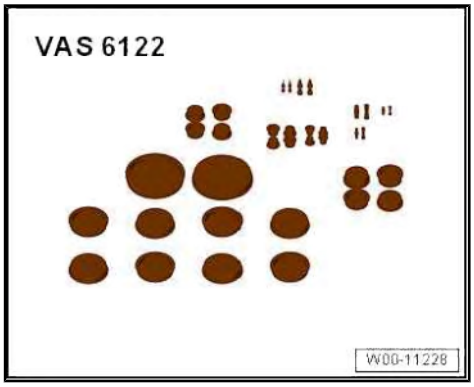
Special tools and workshop equipment required

♦ Pin - T40011-



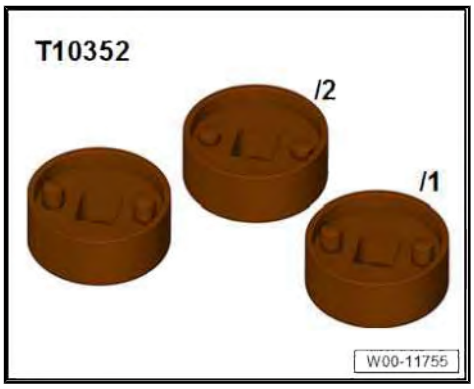
♦ Puller - T40039-

- Engine bung set - VAS 6122-



- Counter-hold tool - T10355-

- Removal tool - T10352- and removal tool - T10352/1-



- Contour blade set - VAS 852 005- (not illustrated) or commercially available CERAN surface scraper

Removing

Note

- *Fit the cable ties in the original position when installing.*
- *Always seal open channels of the intake connecting pipe and exhaust system with suitable plugs, for example from the engine bung set - VAS 6122- .*

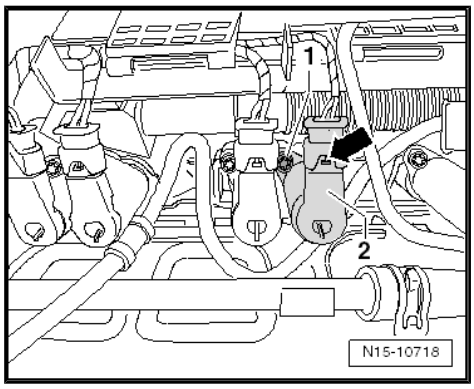
CAUTION

On a warm engine, the cooling system is under high pressure. Danger of scalding by steam and hot coolant.

Skin and other parts of the body may be scalded.

- **Wear protective gloves.**
- **Wear protective goggles.**
- **Reduce excess pressure by covering cap of coolant expansion tank with cloths and opening it carefully.**

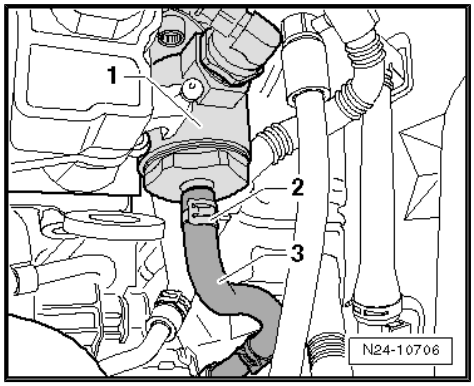
- Drain coolant ⇒ page 163 .
- Remove turbocharger ⇒ page 196 .
- Release brake servo vacuum line.
- Remove coolant hose on cylinder head.
- Completely remove pressure hose from the throttle valve control module - J338- to the charge-air cooler.
- Disconnect electrical connector -arrow- of actuators -F366- / -F373- .



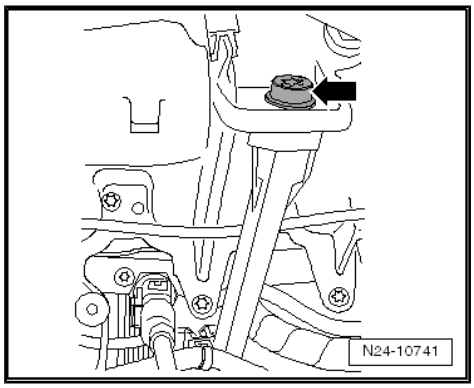
Note

Disregard positions -1- and -2-.

- Remove ignition coils ⇒ page 248 .
- Unscrew spark plugs using spark plug socket and extension - 3122 B- .
- Remove oil separator ⇒ page 157 .

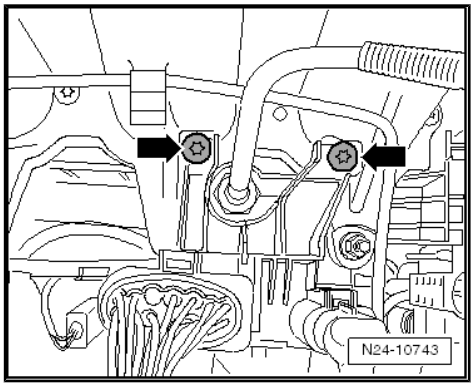


- Detach hose clip -2- for fuel supply line -3-.
- Pull fuel supply line -3- off high-pressure pump -1-.
- Detach fuel lines for activated charcoal filter solenoid valve 1 - N80- .
- Unclip fuel lines from guide and lay aside.
- Detach electrical connectors from intake air temperature sender - G42- , solenoid valve 1 for activated charcoal filter - N80- , throttle valve control module - J338- and Hall sender - G40- .
- Unclip wiring harness from intake manifold and place to one side.

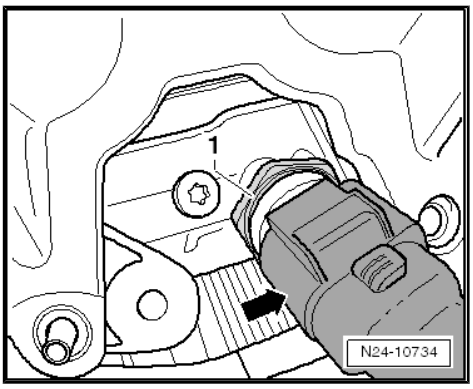


- Unscrew bolt -arrow- on intake manifold support.

– Unscrew bolts -arrows- from intake manifold.
– Lay bracket aside.

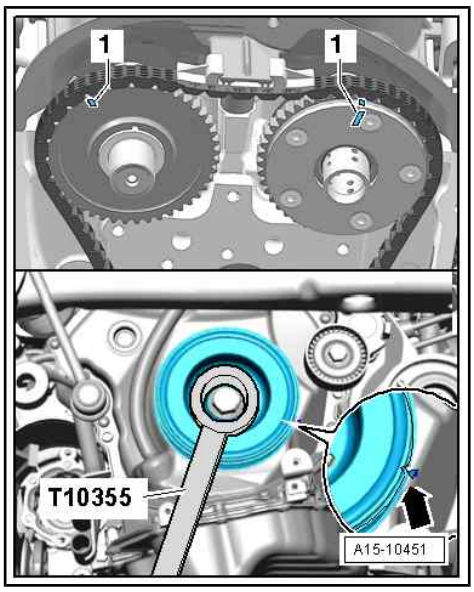


– Release and separate electrical connector -arrow- from fuel pressure sender - G247- using assembly tool - T10118- .
– Remove timing chain cover (top) ⇒ page 96 .



– Turn vibration damper to TDC position -arrow- using counter-hold - T10355- .

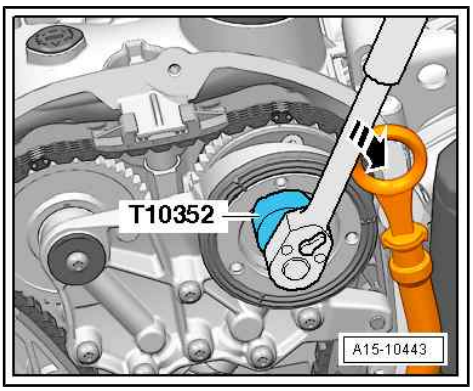
- Notch on vibration damper must align with arrow marking on bottom cover for timing chains
- Markings -1- on camshafts must face upwards.



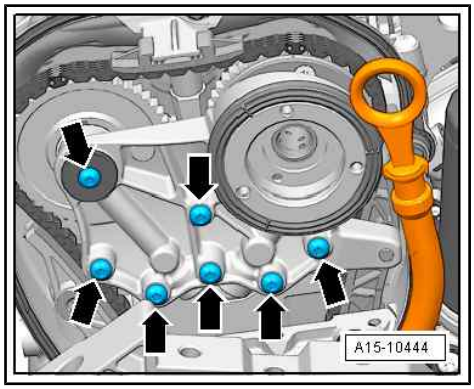
– Depending on model, remove regulating valve using removal tool - T10352- or removal tool - T10352/1- in -direction of arrow-.

Note

The timing valve has a left-hand thread.

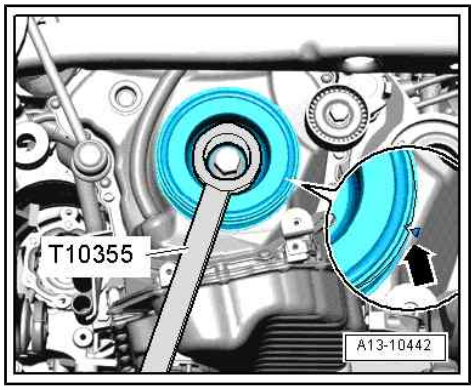


– Unscrew bolts -arrows-.
– Remove bearing saddle.
– Remove right engine support ⇒ page 48 .

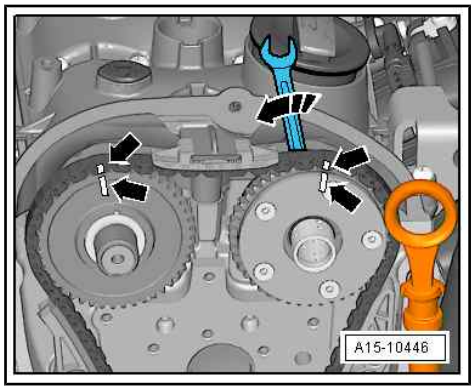


– Turn vibration damper to TDC position -arrow- using counter-hold - T10355- .

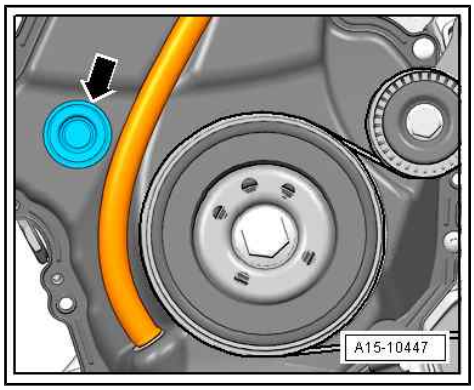
• Notch on vibration damper must align with arrow marking on lower cover for timing chains



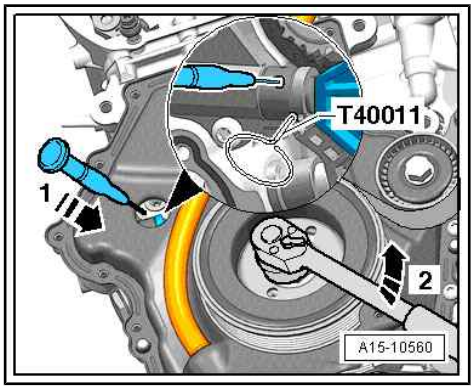
– Use a waterproof pen to mark drive chain/chain sprockets -arrows-.



– Remove sealing plug -arrow-.



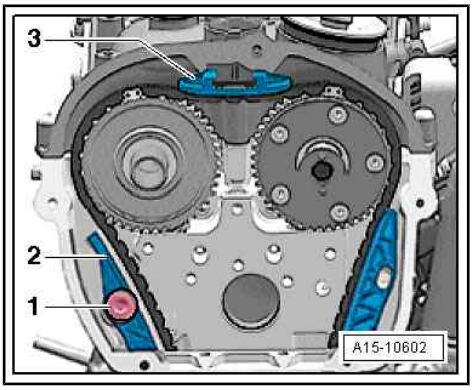
– Insert scriber or suitable screwdriver in hole of chain tensioner in direction of -arrow 1- and lift locking element for chain tensioner.
– Turn crankshaft in opposite direction to normal rotation -arrow 2- and lock in place using locking pin - T40011- .



Note

Inlet camshaft will move in direction of engine rotation.

– Unscrew bolt -1-.
– Guide tensioning rail -2- downwards.
– Remove upper guide rail -3-. Release catch with a screwdriver and push guide rail off towards the front of vehicle.
– Remove camshaft timing chain from camshaft sprockets.



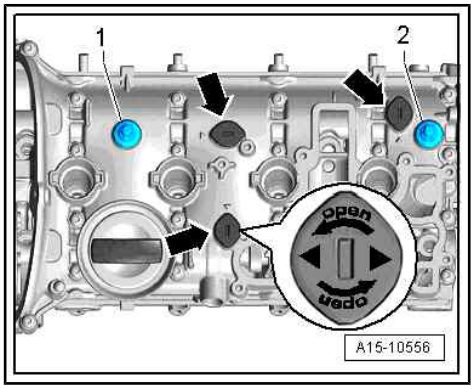
Note

- *Avoid damage to valves and piston crowns.*
- *Do not turn the crankshaft after the camshaft timing chain has been removed from the cylinder head.*

– Install right engine support ⇒ page 48 .

Cylinder head cover version 1

– Turn sealing plugs -arrows- 90° anti-clockwise -arrow- and remove.
– Unscrew ball head -1- and -2-.
– Remove filler cap.

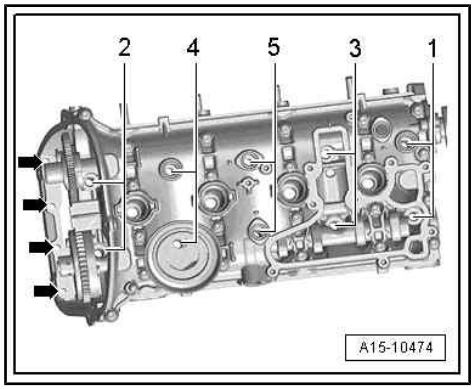


Note

To be able to unscrew the cylinder head bolts, turn camshafts using spanner, if necessary.

– Unscrew bolts -arrows-.

– Unscrew cylinder head bolts in the sequence -1 … 5- with special wrench, long reach - T10070- with exception of 2 bolts.



Cylinder head cover version 2

Note

On cylinder head cover version 2, not all cylinder head bolts are accessible.

– Remove cylinder head cover ⇒ page 122 .

Continued for all vehicles

Note

- *Make sure all hoses/pipes and wiring are removed.*
- *Ensure tensioning rail and guide rail are not damaged when lifting off cylinder head.*

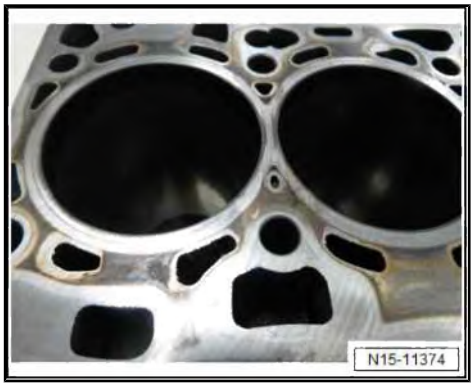
– Move to service position ⇒ General body repairs, exterior; Rep. gr. 50 ; Lock carrier; Moving to and back from service position .

– Remove cylinder head.

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

Installing

Install in reverse order of removal, observing the following:



Note

- *Do not use sandpaper, grinding wheels, abrasive or scour pads or any other sanding or abrasive media.*
- *Sealing surface (see photo) must not project.*
- *Discolouration (dark spots, see photo) need not be removed.*
- *When removing the sealant residue, make sure no loose particles get into the open channels of the engine.*
- *Ensure that all adjacent workspaces are clean, and that none of the above mentioned sanding or abrasive media are used.*
- *Using unauthorised sanding or abrasive media may lead to secondary damage such as, for example, damage to the turbocharger or the conrod bearings.*

CAUTION

Risk of eye injury caused by sealant residue.

– Wear protective goggles.

– Do not use any other means rather than the contour blade set - VAS 852 005- or a commercially available CERAN surface scraper to remove the sealant residue from the cylinder head and cylinder block.

- The sealing surfaces must not be damaged.
- There must be no oil or coolant in the bolt pockets.
- Do not remove new cylinder head gasket from packaging until it is ready to be fitted.
- If a new cylinder head is installed, contact surfaces between roller rocker fingers and running surface of cam must be oiled.

– Remove any loose remains using a lint-free cloth.

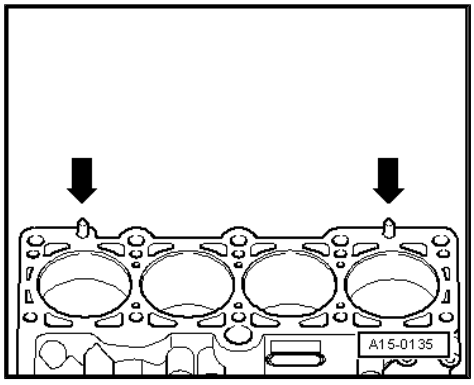
Note

- *Handle the cylinder head gasket very carefully to prevent damage to the silicone coating or the indented area of the gasket.*
- *After fitting a new cylinder head or cylinder head gasket, the engine oil and coolant must be changed.*

– Position cylinder head gasket.

♦ Note centring pins in cylinder block -arrows-.

♦ Check installation position of cylinder head gasket. Characteristic: the part number should be legible from the inlet side.



Note

When turning crankshaft, make sure that no components are damaged by timing chain.

– If crankshaft has been turned in the meantime, set piston of No. 1 cylinder to TDC, and turn crankshaft back slightly.

– Fit cylinder head.

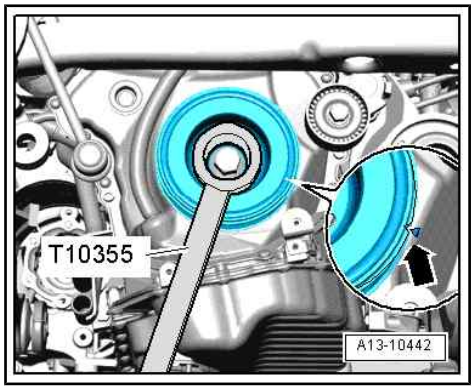
Note

To enable insertion of the cylinder head bolts, the inlet camshaft must be turned with a wrench.

– Tighten cylinder head bolts in prescribed sequence ⇒ page 82 .

– Turn vibration damper to TDC position -arrow- using counterhold - T10355- .

• Notch on vibration damper must align with arrow marking on bottom cover for timing chains



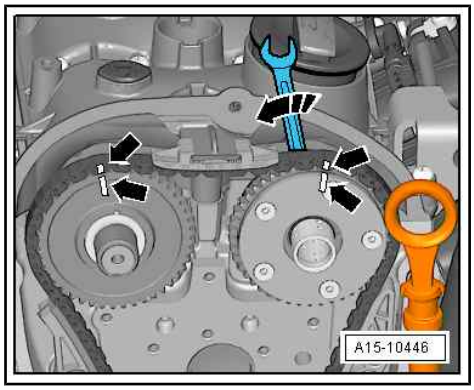
Note

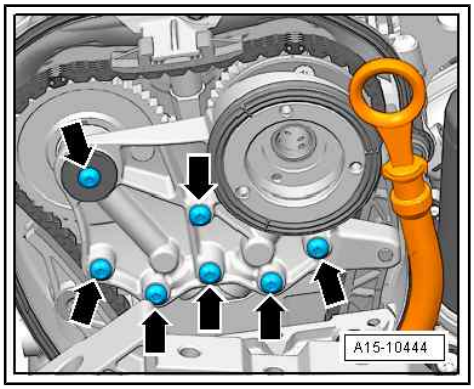
The timing chain links with markings must be positioned at the markings on the chain sprockets.

– Fit camshaft timing chain.

– Drive chain/sprocket markings must align -arrows-.

– Use open-jaw spanner to turn inlet camshaft in direction of -arrow- and fit timing chain.





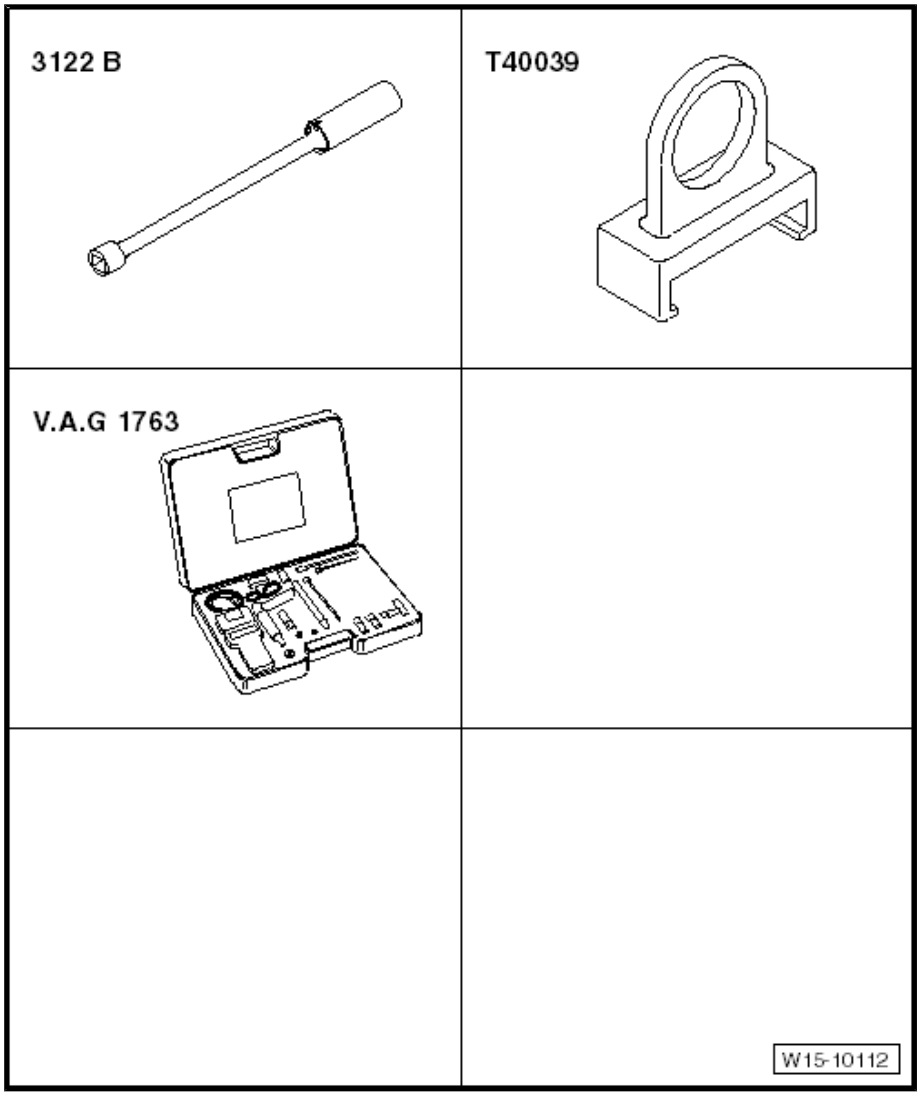
– Attach bearing saddle and screw in bolts -arrows- hand-tight.
– Remove locking pin - T40011- .
– Tighten bolts -arrows- for bearing saddle.
– Install regulating valve.
– Reset service position ⇒ General body repairs, exterior; Rep. gr. 50 ; Lock carrier; Moving to and back from service position .
– Install timing chain cover (top) ⇒ page 96 .
– Add coolant ⇒ page 163 .
– Install turbocharger ⇒ page 196 .
– If present, install noise insulation ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Removing and installing noise insulation .

Specified torques

- ⇒ “1.1 Assembly overview - cylinder head”, page 79
- ⇒ “4.1 Assembly overview - valve gear”, page 120
- ⇒ “1.1 Assembly overview - turbocharger”, page 193
- ⇒ “2.1 Assembly overview - cover for timing chain”, page 94

1.3 Checking compression

Special tools and workshop equipment required



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

Test sequence

Note

- *Engine oil temperature: at least 30°C*
- *Battery voltage: at least 12.7 V*

– Removing ignition coils with output stages ⇒ page 248 .

– Unscrew spark plugs using spark plug socket and extension - 3122 B- .

– Check compression using compression tester - V.A.G 1763- and adapter - V.A.G 1763/6- .

Note

Using compression tester ⇒ operating instructions .

– Operate starter until tester shows no further pressure increase.

Compression pressures:

New bar pressure	Wear limit bar pressure	Difference between cylinders bar pressure
11.0 … 14.0	7.0	max. 3.0

– Install spark plugs ⇒ Maintenance ; Booklet 20.1 .

– Install ignition coils with output stages ⇒ page 248 .

Note

Faults will have been stored in the memory owing to connectors being separated. Read and, if necessary, clear the event memory after the test.

– Read engine control unit event memory using ⇒ Vehicle diagnostic tester.

Specified torques

◆ ⇒ “1.1 Assembly overview - ignition system”, page 247

1.4 Removing and installing vacuum pump

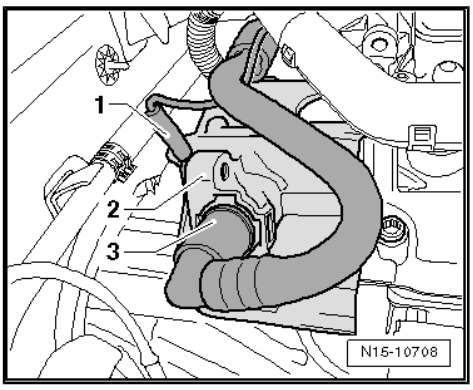
Removing

– Remove high-pressure pump with »roller tappet« ⇒ page 231 .

– Unscrew earth wire -1-.

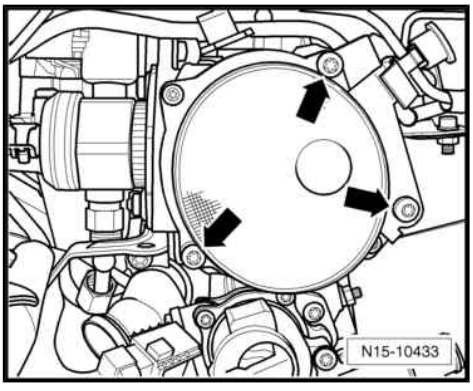
– Remove vacuum hose -3- from vacuum pump -2.-

– Detach bracket from vacuum pump -2- and place aside.



– Unscrew bolts -arrows-.

– Remove vacuum pump.



Note

Dismantling of the vacuum pump is not permitted.

Installing

Install in reverse order of removal, observing the following:

– Clean sealing surfaces.

Specified torques

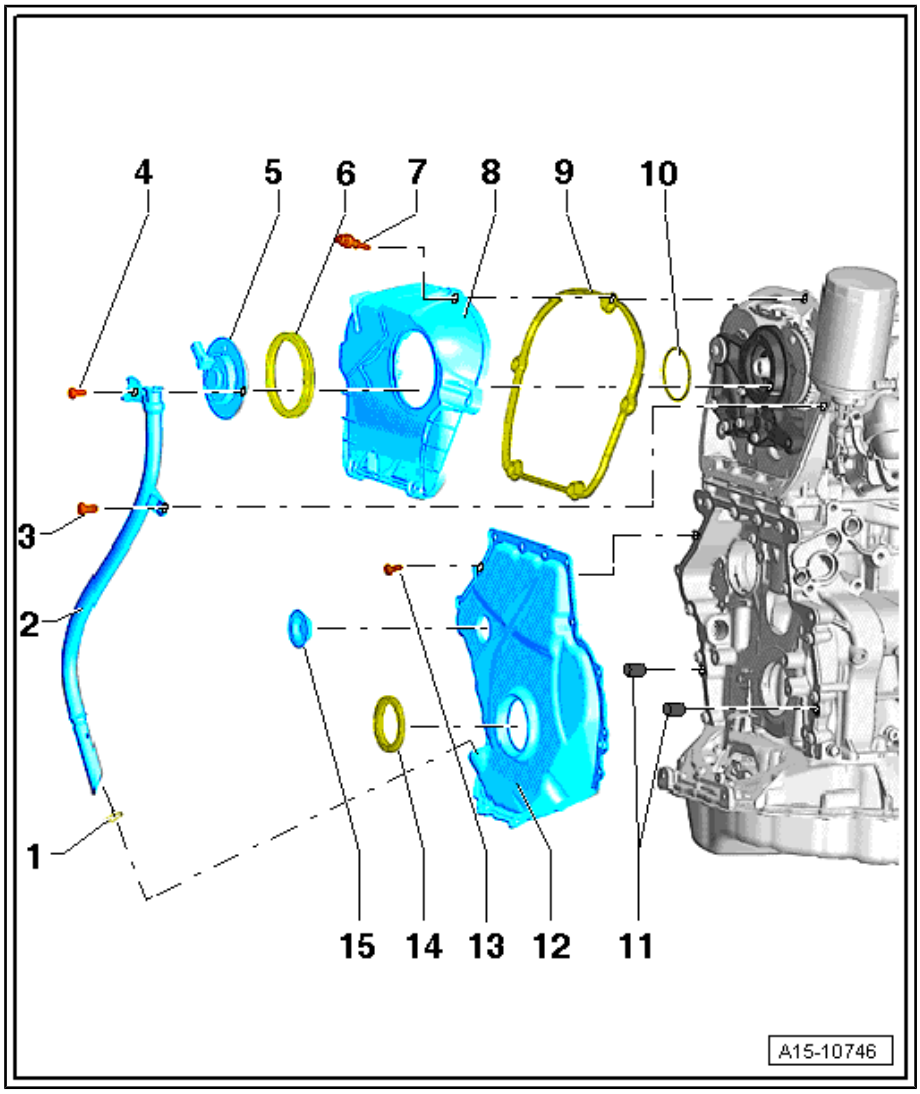
◆ ⇒ “1.1 Assembly overview - cylinder head”, page 79

2 Cover for timing chain

⇒ “2.1 Assembly overview - cover for timing chain”, page 94

⇒ “2.2 Removing and installing timing chain cover”, page 96

2.1 Assembly overview - cover for timing chain



1 - O-ring
- ❑ Renew after removal
- ❑ Lubricate before assembling.

2 - Dipstick guide tube

3 - Bolt
- ❑ 9 Nm

4 - Bolt
- ❑ 9 Nm

5 - Inlet camshaft control valve 1 - N205-
- ❑ Removing and installing ⇒ page 133

6 - Seal
- ❑ Lubricate before assembling.
- ❑ Renew if damaged

7 - Bolts
- ❑ Qty. 5
- ❑ Observe tightening sequence ⇒ page 95
- ❑ 9 Nm

8 - Timing chain cover (top)
- ❑ Removing and installing ⇒ page 96

9 - Seal
- ❑ Renew if damaged

10 - O-ring
- ❑ Renew after removal
- ❑ Lubricate before assembling.

11 - Dowel pins
- ❑ Qty. 2
- ❑ For centring cover

12 - Lower timing chain cover
- ❑ If the cover was bent, renew it
- ❑ Removing and installing ⇒ page 96

13 - Bolts
- ❑ Qty. 8
- ❑ Renew after removal
- ❑ Tightening sequence ⇒ page 95

14 - Oil seal
- ❑ For vibration damper

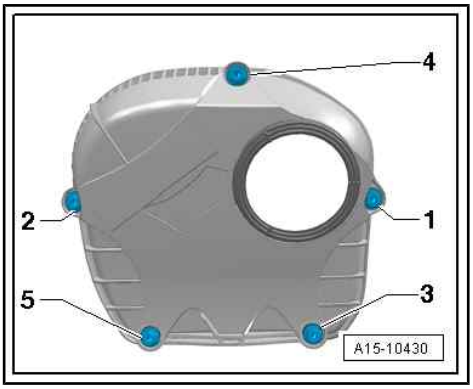
❑ Removing and installing ⇒ page 45

15 - Plug

❑ Renew after removal

Timing chain cover (top), tightening sequence

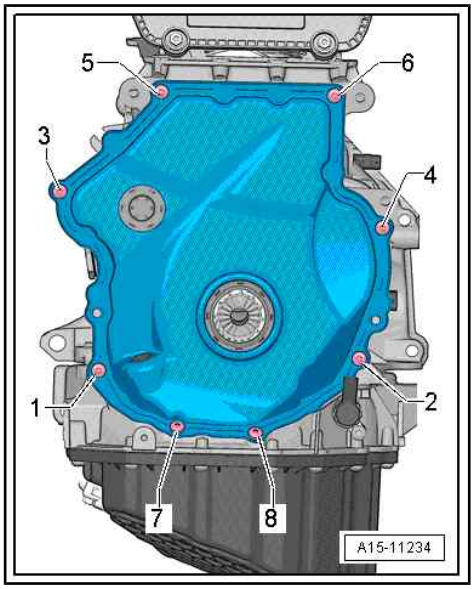
– Tighten bolts -1 … 5- in the sequence shown.



Timing chain cover (bottom), tightening sequence

Note

Do not tighten bolts -1- and -4- with turning further angle until after the vibration damper has been installed. The bolts must be unscrewed again for installing the vibration damper. Note the different torques for steel bolts and aluminium bolts!



Stage	Steel bolts	Specified torque/turning further angle for steel bolts
1.	-1 … 8-	8 Nm
2.	-1 … 8-	45°

Stage	Aluminium bolts	Specified torque/turning further angle for aluminium bolts
1.	-1 … 8-	4 Nm
2.	-1 … 8-	45°

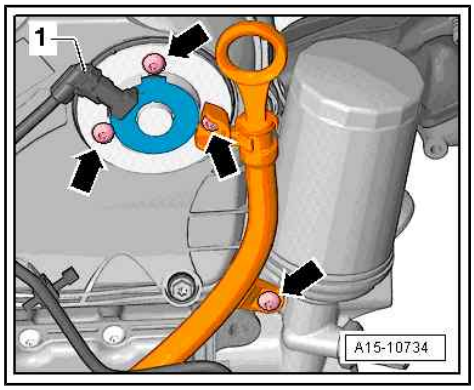
2.2 Removing and installing timing chain cover

⇒ “2.2.1 Removing and installing upper timing chain cover”, page 96

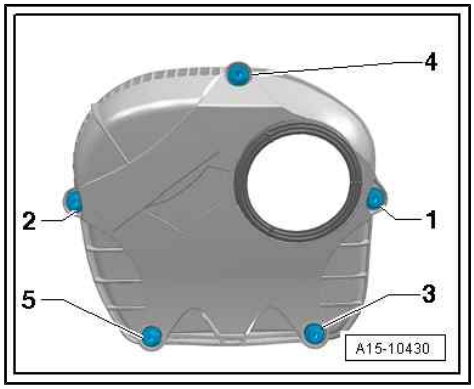
⇒ “2.2.2 Removing and installing timing chain cover (bottom)”, page 96

2.2.1 Removing and installing upper timing chain cover

Removing



– Remove air filter housing ⇒ page 216 .
– Separate electrical connector -1- from camshaft control valve 1 - N205- .
– Unscrew bolts -arrows-.
– Remove camshaft control valve 1 - N205- .



– Remove bolts -1 … 5-.
– Remove upper timing chain cover.

Installing

Install in reverse order of removal, observing the following:

Note

Renew O-ring.

– Lubricate seal and O-ring with engine oil.

Specified torques

♦ ⇒ “2.1 Assembly overview - cover for timing chain”, page 94

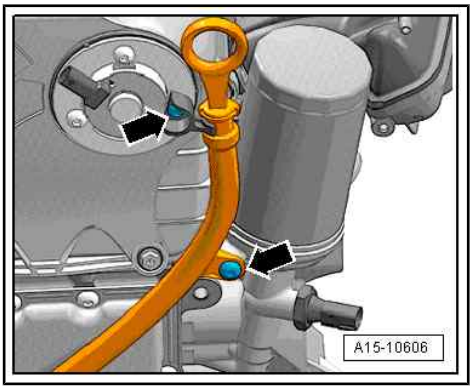
2.2.2 Removing and installing timing chain cover (bottom)

Special tools and workshop equipment required

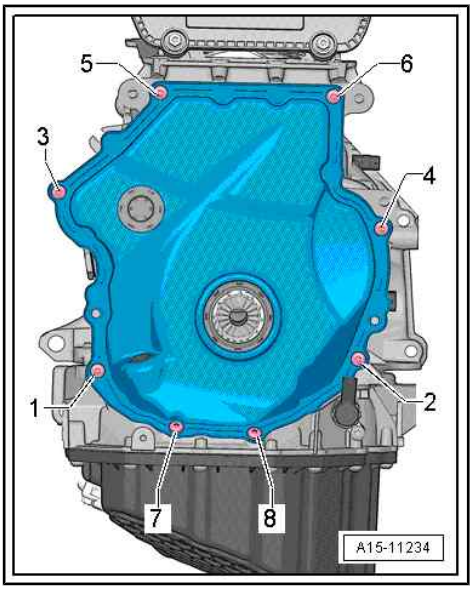
♦ Counter-hold tool - T10355-

Removing

– Remove air filter housing ⇒ page 216 .
– Remove tensioner for poly V-belt ⇒ page 36 .
– Remove engine support ⇒ page 46 .
– Remove vibration damper ⇒ page 37 .
– Remove guide roller ⇒ Item 2 (page 33) .
– Unscrew bolts -arrows-.
– Pull dipstick guide tube out of the timing chain cover.



– Remove bolts -1 … 8-.
– Lever off lower timing chain cover, starting at points -1- and -2-.



Note

To avoid deformation, do not lever between the bolt holes.

Installing

Install in reverse order of removal, observing the following:

Note

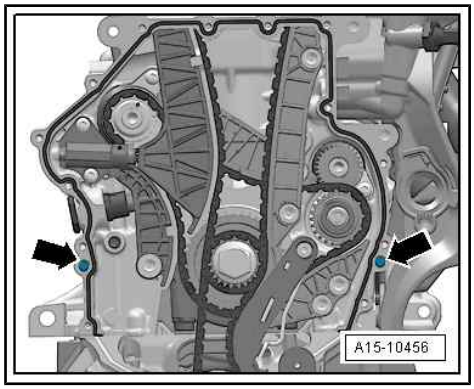
- *If the cover was bent, renew it.*
- *Silicone sealant ⇒ Electronic parts catalogue (ETKA) .*
- *The cover must be installed within 5 minutes after applying the silicone sealant.*
- *Renew bolts that are tightened with specified further tightening angle.*
- *Gaskets, oil seals and self-locking nuts must be renewed*
- *Danger of soiling lubrication system. Cover open parts of engine.*

CAUTION

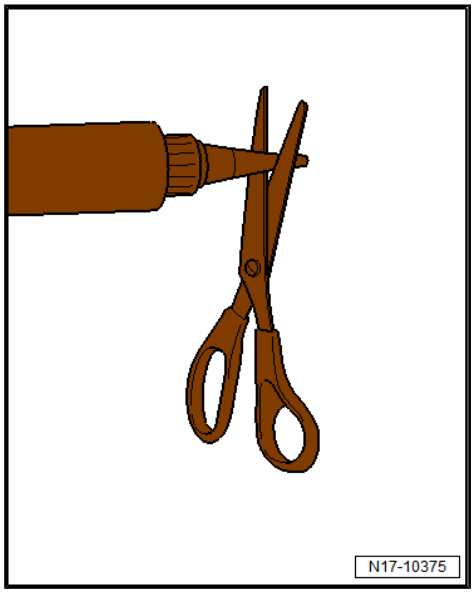
Risk of eye injury caused by sealant residue.
– Wear protective goggles.

– Remove sealant residues from cylinder block with a flat scraper.
– Remove any oil and grease from sealing surfaces.

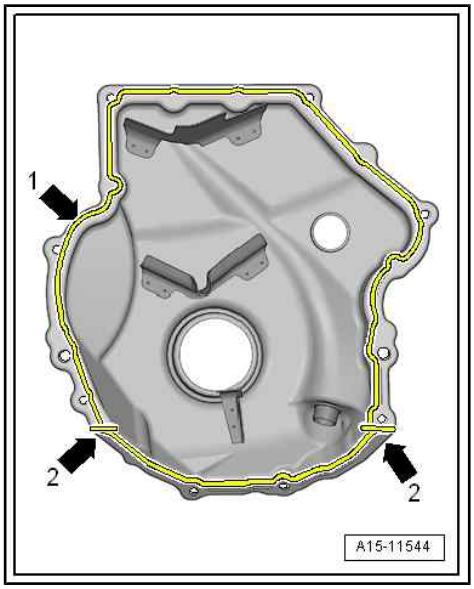
– Check that both dowel pins for centring the cover -arrows- are fitted.



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



– Apply silicone sealant to clean sealing surface -arrow 1- and to edges -arrows 2- of cover.



Note

- *The cover must be installed within 5 minutes after applying the silicone sealant.*
- *After fitting cover, let sealant dry for approx. 30 minutes. Only then fill with engine oil.*
- *The bead of sealant must not be thicker than specified, otherwise excess sealant can enter the sump and obstruct the strainer in the oil intake pipe.*

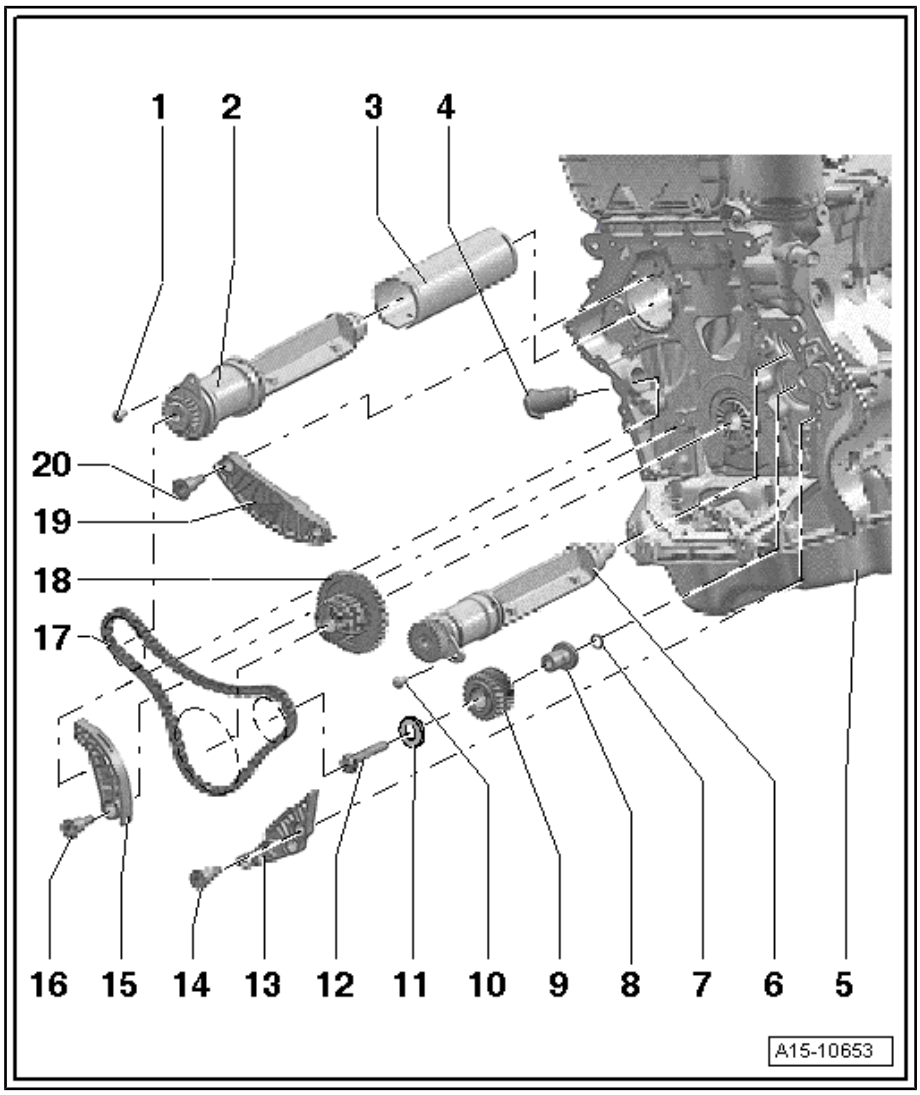
– Install cover immediately and tighten bolts ⇒ page 95 .
– Install vibration damper ⇒ page 37 .
– Install tensioner for poly V-belt ⇒ page 36 .
– Install poly V-belt ⇒ page 35 .
– Installing engine support ⇒ page 46 .
– Install air filter housing ⇒ page 216 .
– If present, install noise insulation ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Removing and installing noise insulation .

Specified torques

- ⇒ “2.1 Assembly overview - cover for timing chain”, page 94
- ⇒ “1.1 Assembly overview - poly V-belt drive”, page 33
- ⇒ “4.1 Assembly overview - air filter housing”, page 215
- ⇒ “2.1 Assembly overview - assembly mountings”, page 24

3 Chain drive

3.1 Assembly overview - drive chain for balance shaft



1 - Bolt
- ❑ Renew after removal
- ❑ 9 Nm

2 - Balancer shaft
- ❑ Exhaust side
- ❑ Must always be renewed if removed
- ❑ Lubricate bearing with engine oil

3 - Tube for balancer shaft
- ❑ Fitting position ⇒ page 101

4 - Chain tensioner
- ❑ 65 Nm

5 - Cylinder block

6 - Balancer shaft
- ❑ Inlet side
- ❑ Must always be renewed if removed
- ❑ Lubricate bearing with engine oil

7 - O-ring
- ❑ Lubricate with engine oil

8 - Bearing mounting
- ❑ Lubricate with engine oil
- ❑ Fitting position ⇒ page 101

9 - Intermediate shaft sprocket
- ❑ For balancer shaft.
- ❑ If bolt ⇒ Item 12 (page 100) has been loosened, intermediate shaft sprocket will need to be renewed.

10 - Bolt
- ❑ Renew after removal
- ❑ 9 Nm

11 - Washer

12 - Bolt
- ❑ If bolt has been loosened, intermediate shaft sprocket ⇒ Item 9 (page 100) will need to be renewed.

❑ Tightening sequence ⇒ page 102

13 - Slide rail

❑ For timing chain

14 - Guide pin

❑ 20 Nm

15 - Tensioning rail

❑ For timing chain

16 - Guide pin

❑ 20 Nm

17 - Timing chain

18 - Sprocket

❑ Fitting position ⇒ page 102

19 - Slide rail

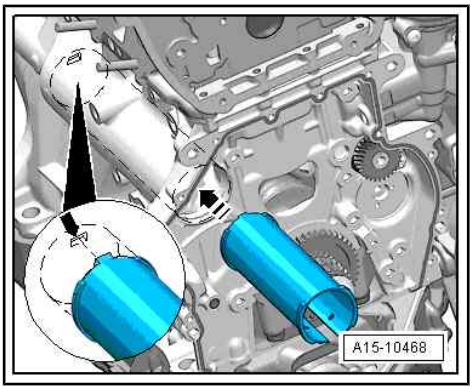
❑ For balancer shaft timing chain

20 - Guide pin

❑ 20 Nm

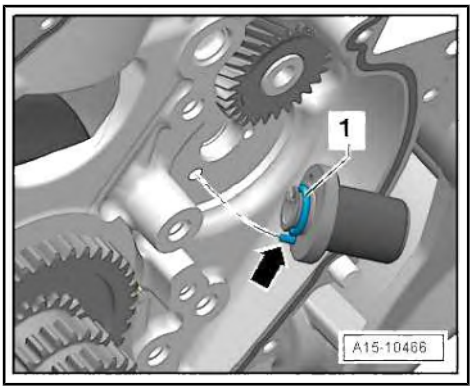
Tube for balancer shaft - installation position

- Lug on tube for balance shaft must engage in slot -arrow-.

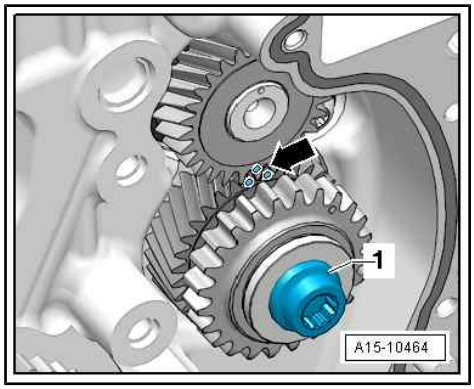


Bearing mounting - installation position

- Renew O-ring -1- and lubricate with oil
- Dowel pin -arrow- for bearing mounting must engage in bore in cylinder block
- Lubricate bearing mounting.



Intermediate shaft sprocket - tightening sequence



Note

- *The intermediate shaft sprocket must be replaced. Otherwise no tooth backlash is set.*
- *The new intermediate shaft sprocket is coated with a solid film lubricant that wears off after a short period and thus the tooth backlash is automatically set.*

– Tighten as follows using new bolt.

1. Pre-tighten to 10 Nm using torque wrench.
2. Turn intermediate shaft sprocket.

There must be no play in intermediate shaft sprocket; otherwise loosen bolt and tighten again.

3. Tighten to 25 Nm using torque wrench.
4. Use fixed wrench to turn 90° further.

3.2 Assembly overview - camshaft timing chains

1 - Bolts
- ❑ Qty. 2
- ❑ 9 Nm

2 - Chain tensioner
- ❑ Is spring-loaded
- ❑ Depending on version, secure with locking pin - T40011- or locking tool - T40267- .

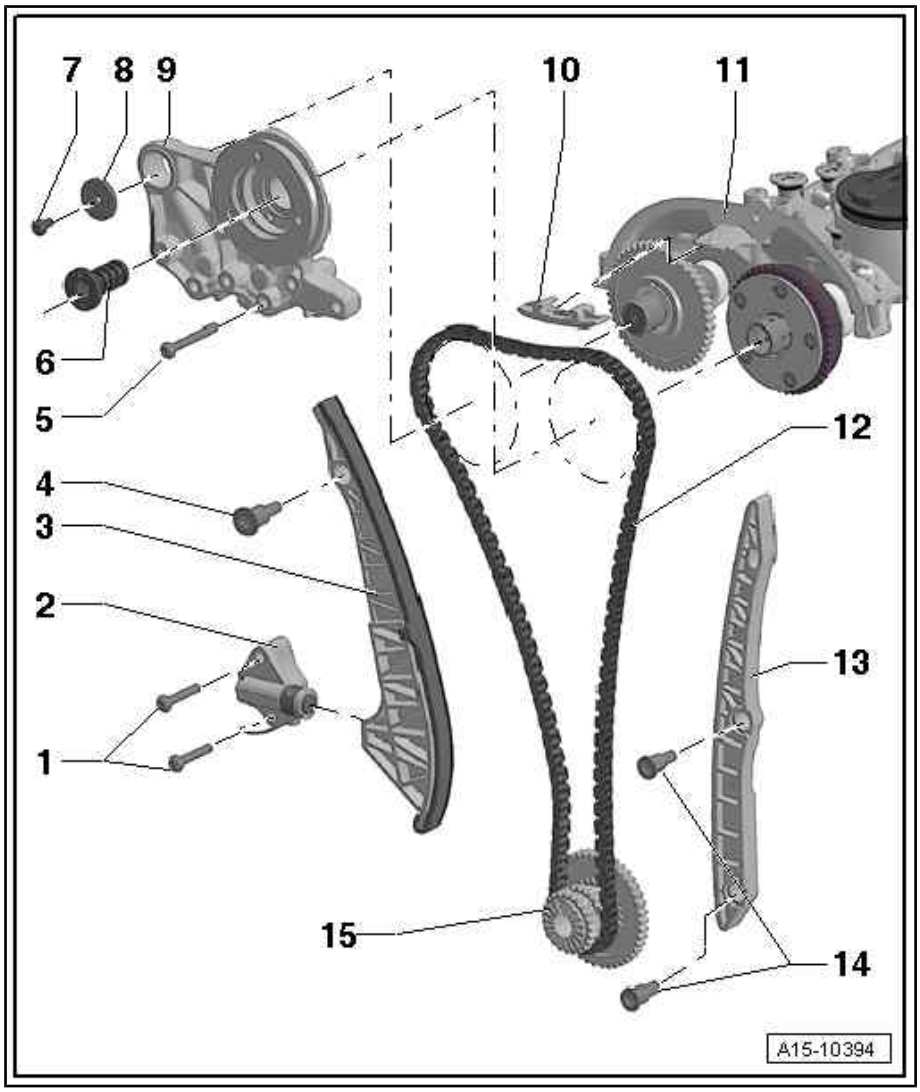
3 - Tensioning rail for timing chain
- ❑ Removing and installing ⇒ page 104

4 - Guide pin
- ❑ 20 Nm

5 - Bolts
- ❑ Qty. 6
- ❑ 9 Nm

6 - Regulating valve
- ❑ Left-hand thread
- ❑ Depending on model, remove using removal tool - T10352- or removal tool - T10352/1- .
- ❑ 35 Nm

7 - Bolt
- ❑ Renew after removal
- ❑ 20 Nm +90°



8 - Washer

9 - Bearing saddle

- ❑ Removing and installing ⇒ page 104

10 - Guide rail for camshaft timing chain

11 - Camshaft case

12 - Camshaft timing chain

- ❑ Before removing, mark running direction with paint
- ❑ Removing and installing ⇒ page 104

13 - Guide rail for camshaft timing chain

- ❑ Removing and installing ⇒ page 104

14 - Guide pin

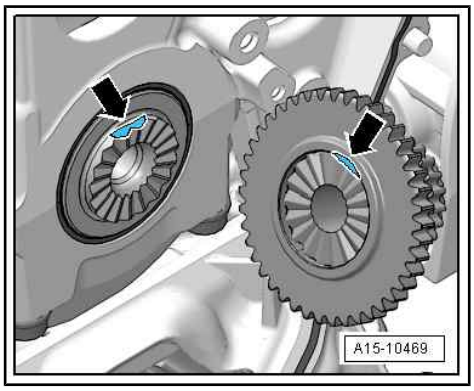
- ❑ 20 Nm

15 - Sprocket

- ❑ Crankshaft
- ❑ Fitting position ⇒ page 103

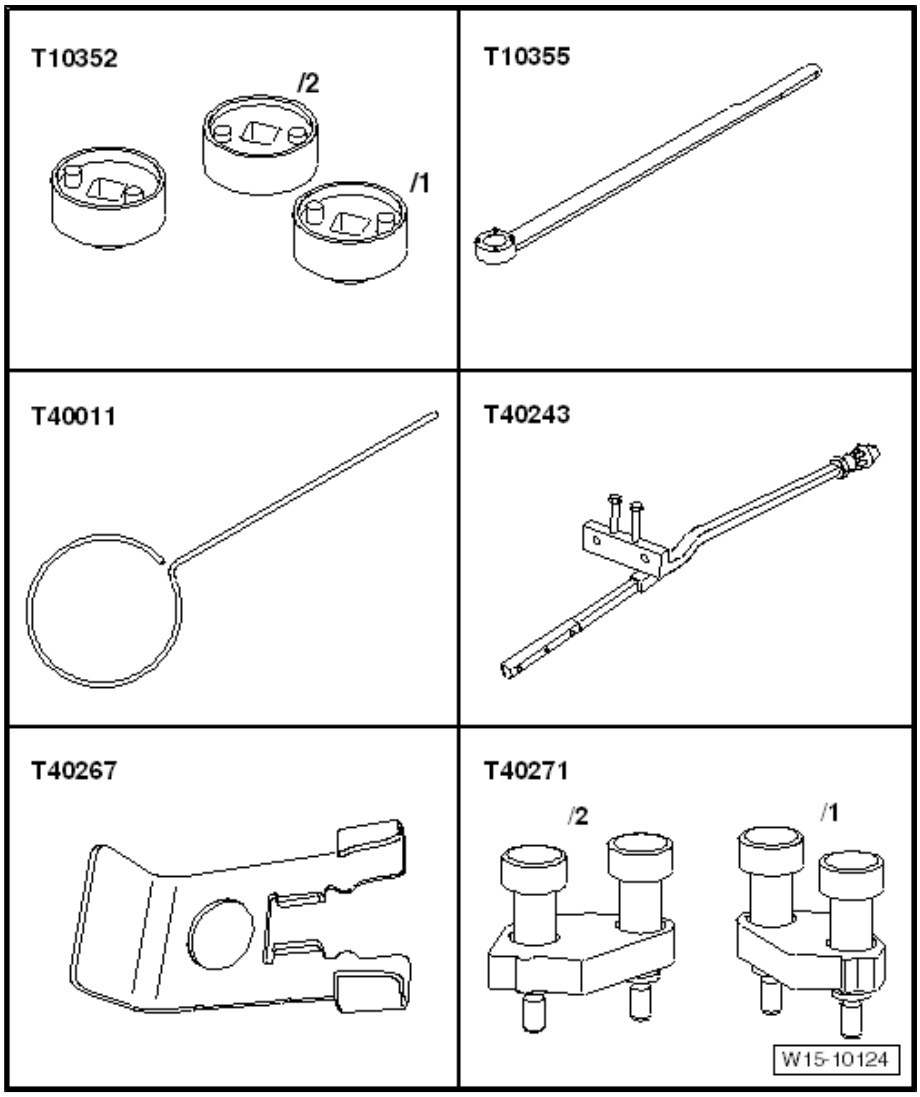
Crankshaft chain sprocket - installation position

- The two sections -arrows- must be aligned



3.3 Removing and installing camshaft timing chain

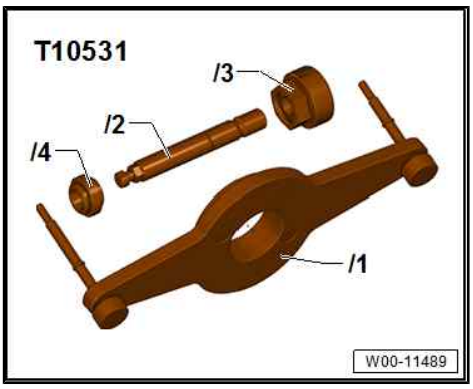
Special tools and workshop equipment required



- Assembly tool - T10352/2-
- Counter-hold tool - T10355-
- Pin - T40011-
- Assembly lever - T40243-
- Locking tool - T40267-
- Camshaft clamp - T40271-

- Assembly tool - T40266-

- Assembly tool - T10531-



Components of assembly tool - T10531- :

- Support - T10531/1-
- Clamping pin - T10531/2-
- Turning over tool - T10531/3-
- Flange nut - T10531/4-

Removing

– Support engine in its installation position ⇒ page 30 .

– Remove engine support ⇒ page 46 .

– Remove timing chain cover (top) ⇒ page 96 .

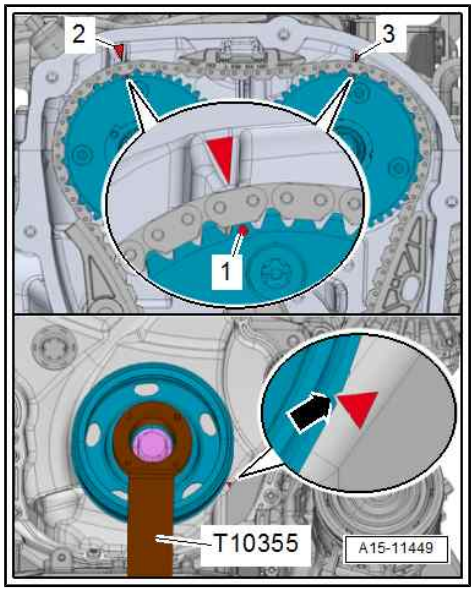
– Remove noise insulation ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Removing and installing noise insulation .

– Remove front part of right wheel housing liner ⇒ General body repairs, exterior; Rep. gr. 66 ; Wheel housing liner; Removing and installing front wheel housing liner .

– Turn vibration damper to “TDC position” using counter-hold - T10355- .

- The markings -1- on the camshaft sprockets must be aligned with markings -2- and -3-.
- The notch on the vibration damper must align with the marking on the lower timing chain cover -arrow-

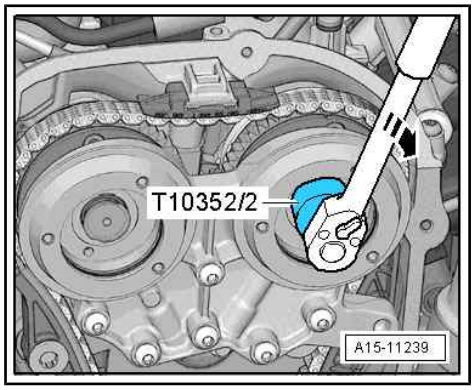
– Remove lower timing chain cover ⇒ page 96 .



Note

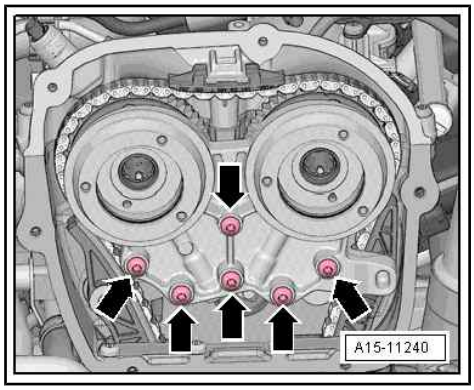
The timing valves have left-hand threads.

– Turn assembly tool - T10352/2- in -direction of arrow- to remove left and right timing valves.

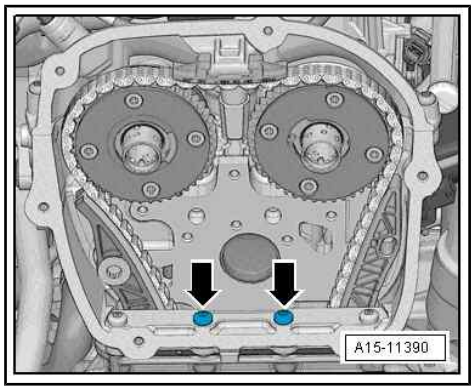


– Unscrew bolts -arrows-.

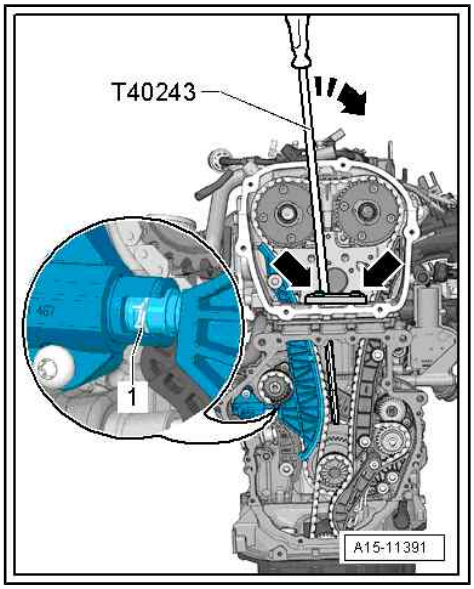
– Remove bearing saddle.



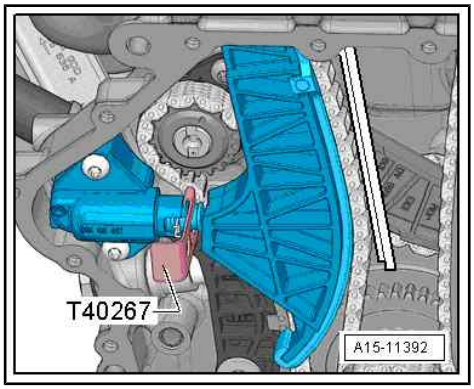
– Unscrew bolts -arrows-.



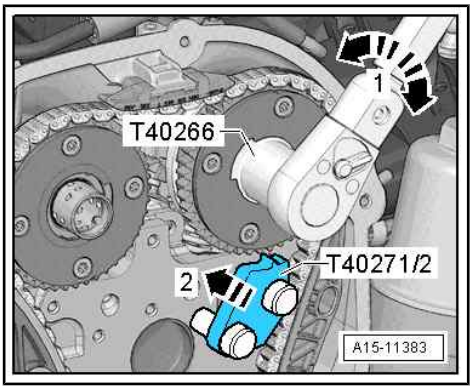
– Screw in lever - T40243- -arrows-.
– Press together retaining ring -1- of chain tensioner and hold it in that position.
– Slowly push lever - T40243- in -direction of arrow-, and hold it in that position.



– Secure chain tensioner with locking pin - T40267- .
– Remove lever - T40243- .



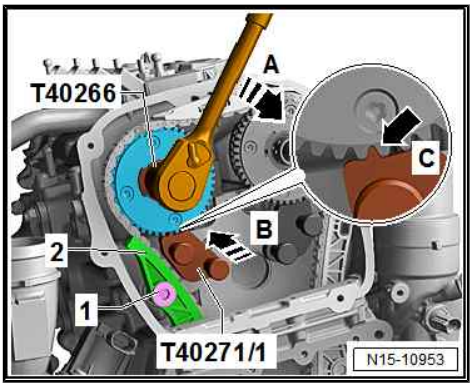
– Screw camshaft clamp - T40271/2- onto cylinder head, and insert it in teeth of chain sprocket (direction of arrow -2-).
– If necessary, turn inlet camshaft using assembly tool - T40266- -arrow 1-.



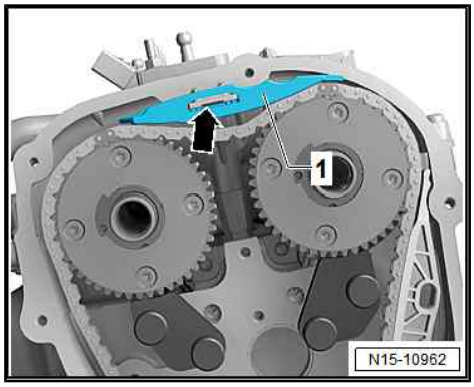
– Bolt camshaft clamp - T40271/1- to cylinder head.

A second mechanic is required for the following work step.

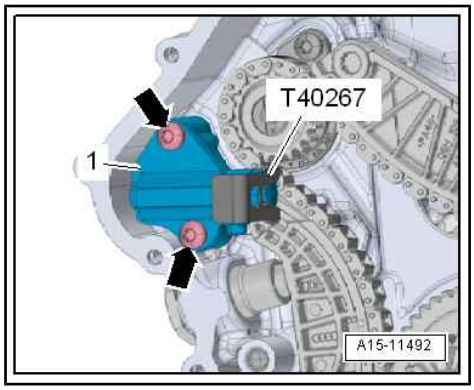
– Using assembly tool - T40266- , locate exhaust camshaft in direction of arrow -A-.
– Remove bolt -1- and guide tensioning rail -2- downwards.
– Turn exhaust camshaft clockwise -A- until camshaft clamp - T40271/1- can be inserted in teeth of chain sprocket -C-.



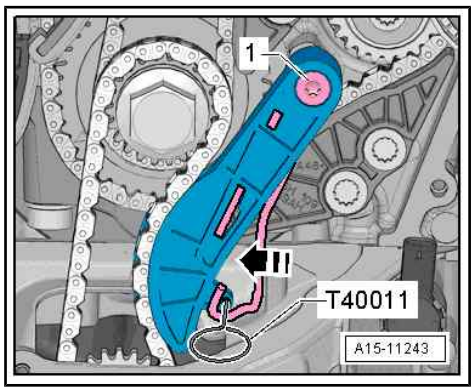
– Remove guide rail -1-. Release catch -arrow- using a screwdriver, and push guide rail off forwards.



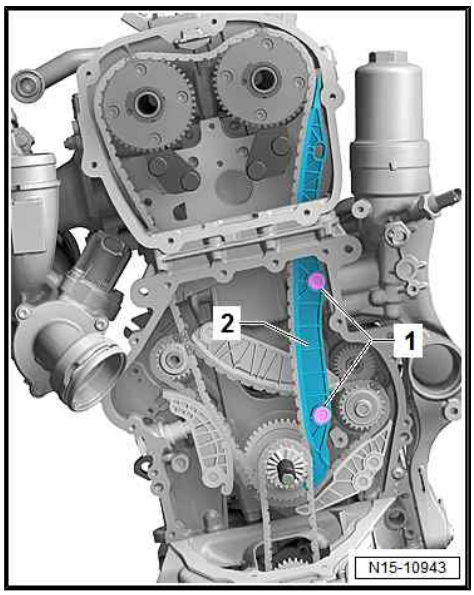
– Unscrew bolts -arrows-.
– Remove chain tensioner -1-.



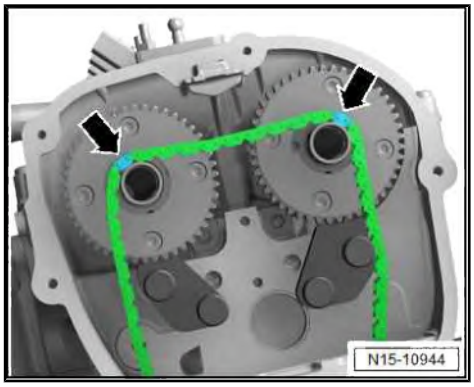
– Press tensioning bar of oil pump chain tensioner in direction of -arrow- and lock it with locking pin - T40011- .
– Unscrew bolt -1-, and remove chain tensioner.



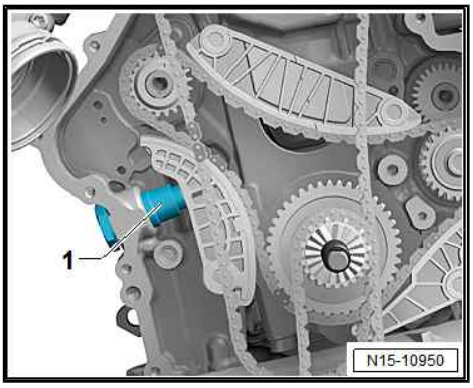
– Unscrew bolts -1-.
– Remove guide rail -2-.



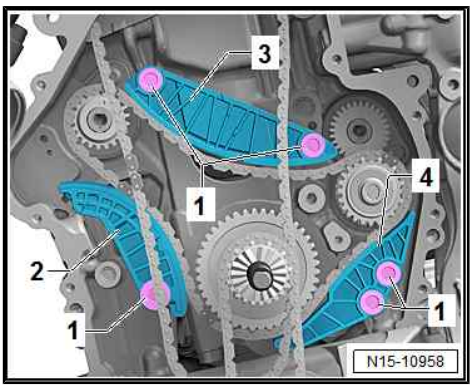
– Remove camshaft timing chain from camshaft sprockets and fit onto journals -arrows- of camshafts.



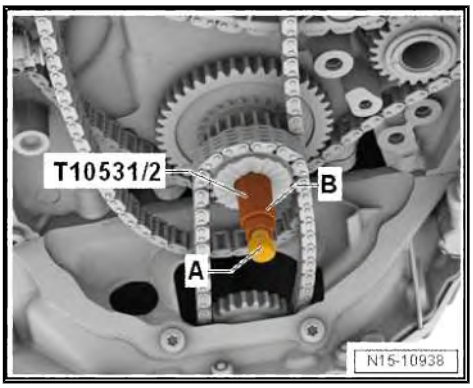
– Remove chain tensioner -1- for balance shaft timing chain.



– Unscrew bolts -1-.
– Remove tensioning rail -2-.
– Remove guide rails -3- and -4-.



– Loosen tensioning bolt -A-.
– Unscrew clamping pin -B-.
– Remove triple chain sprocket. To do this, remove timing chain for oil pump drive.
– Remove camshaft timing chain and drive chain for balance shaft.

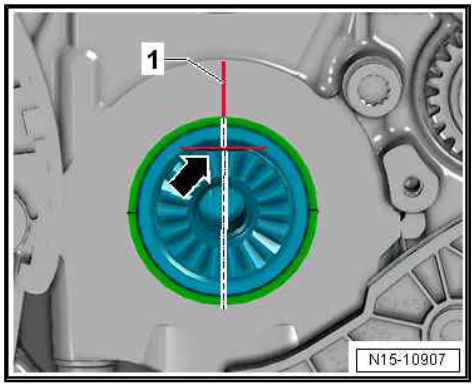


Installing

Install in reverse order of removal, observing the following:

– Check if crankshaft is positioned at TDC. The flat section on crankshaft -arrow- must be in horizontal position.

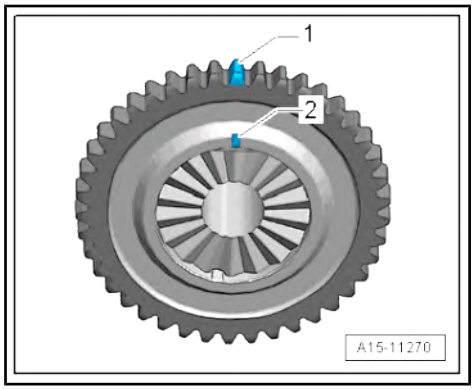
– Using a permanent marker, mark the cylinder block -1- as shown.



– Mark tooth -1- of triple chain sprocket which is aligned with marking -2- using a permanent felt tip marker.

Note

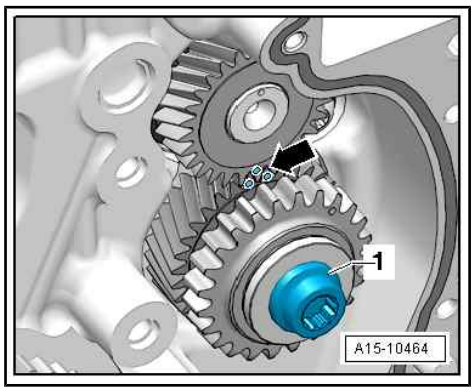
The markings -arrow- on idler gear and balance shaft are difficult to see.



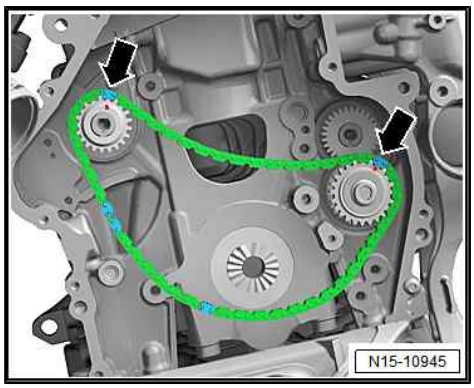
– Turn idler gear and balance shaft to markings -arrow-.

Note

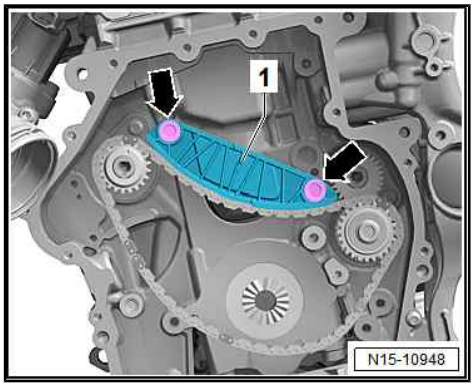
Do not loosen bolt -1-.



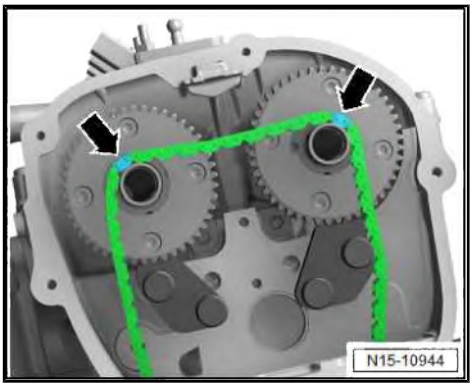
– Fit drive chain for balance shafts and position coloured chain links -arrows- at markings on chain sprockets.



– Install guide rail -1-.
– Tighten bolts -arrows-.



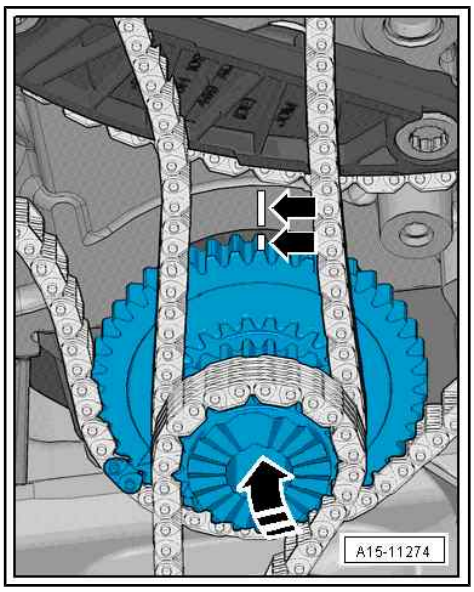
– Fit camshaft timing chain onto camshaft journals with coloured markings -arrows- properly aligned.



– Fit timing chain for oil pump drive onto triple chain sprocket.
– Swing triple sprocket towards engine (-direction of arrow-), and fit it onto crankshaft.

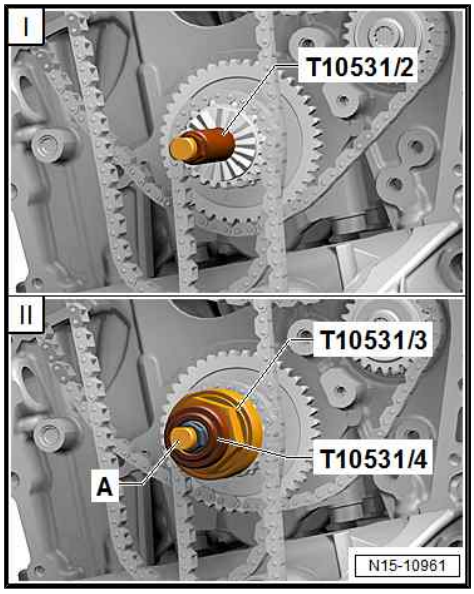
Note

The markings -arrows- must align.

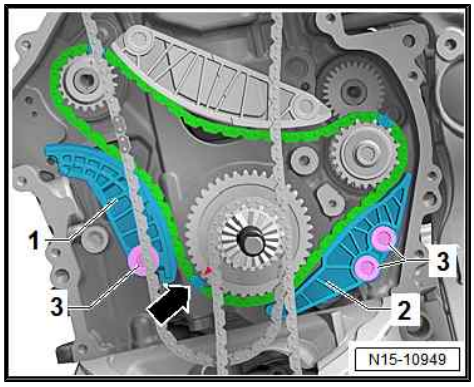


I - Screw clamping pin - T10531/2- into crankshaft, and tighten it by hand.

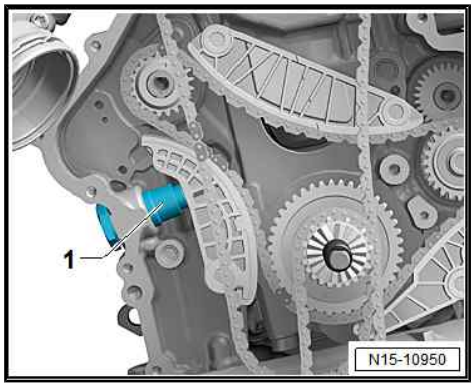
II - Fit turning over tool - T10531/3- . Screw on flange nut - T10531/4- by hand. Slightly move turning over tool back and forth with a 32 mm open-end spanner. While doing so, retighten flange nut until the chain sprocket is securely seated on the crankshaft splines. Now tighten tensioning bolt -A-.



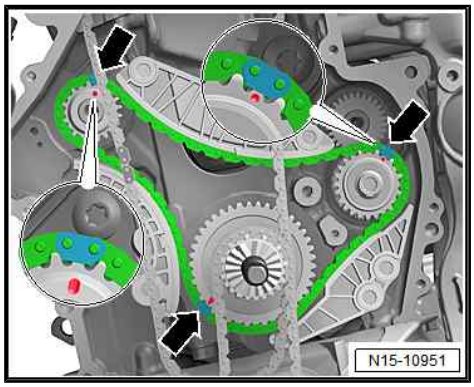
– Position link of drive chain for balance shafts with coloured marking -arrow- at marking of triple sprocket.
– Install tensioning rail -1-.
– Install guide rail -2-.
– Tighten bolts -3-.



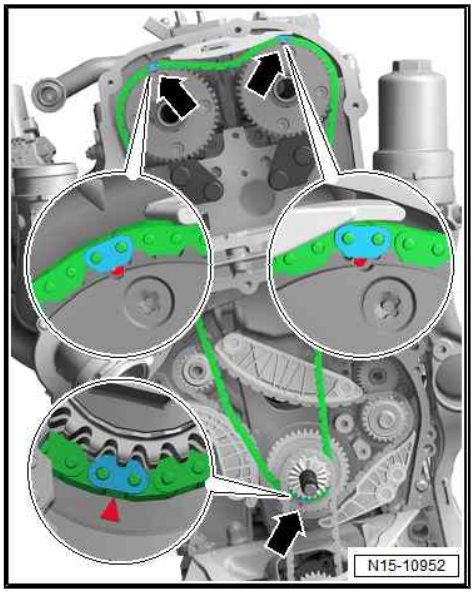
– Install chain tensioner -1-.



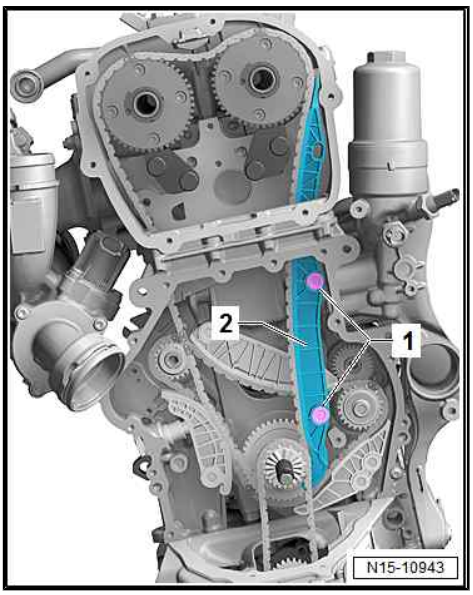
– Make sure that adjustment has been carried out correctly: chain links with coloured markings -arrows- must be positioned at markings on chain sprockets.
– Fit camshaft timing chain on inlet camshaft, exhaust camshaft and crankshaft.



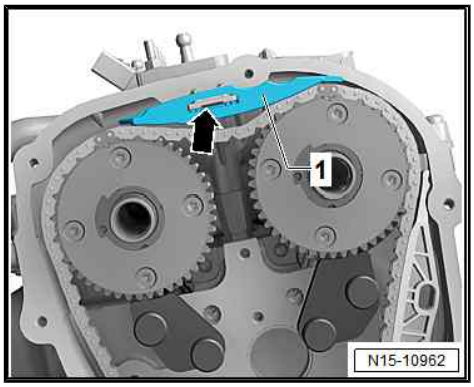
– Position chain links with coloured markings -arrows- at the markings on chain sprockets.



– Install guide rail -2-.
– Tighten bolts -1-.



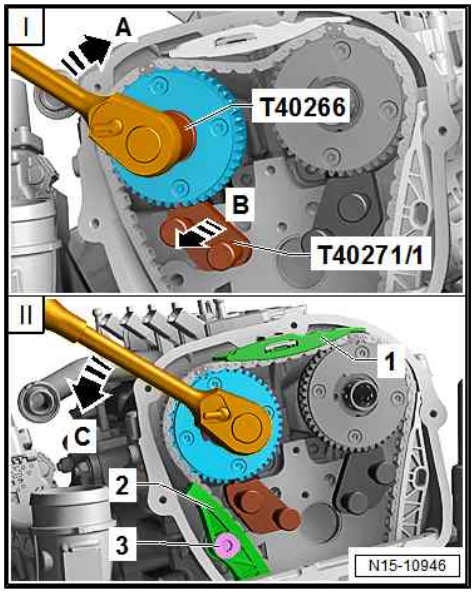
– Install upper guide rail -1-.



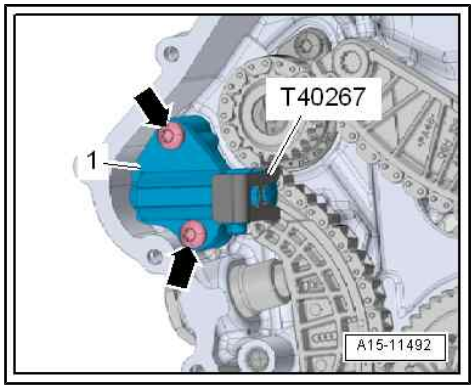
A second mechanic is required for the following work step.

I - Turn exhaust camshaft in -direction of arrow A- using assembly tool - T40266- , and remove camshaft clamp - T40271/1- from between teeth of chain sprocket -B-.

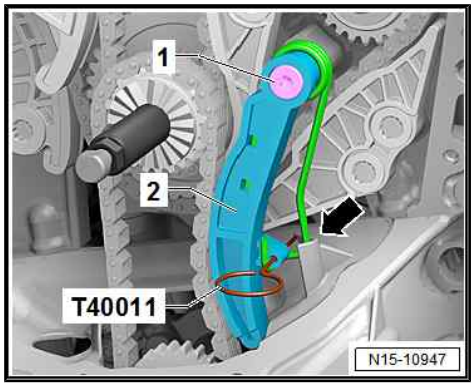
II - Release tension from camshaft in -direction of arrow C- until timing chain rests against guide rail -1-. Hold camshaft in this position, install tensioning rail -2-, and tighten bolt -3-.



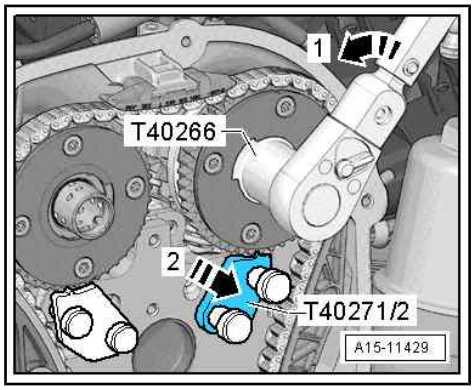
– Install chain tensioner -1-.
– Tighten bolts -arrows-.



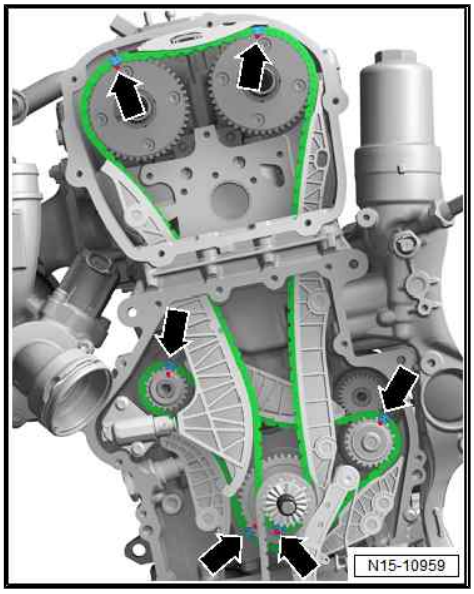
– Install chain tensioner -2-.
– The retaining clip -arrow- must be seated in recess in top section of sump.
– Tighten bolt -1-.
– Remove locking pin - T40011- .



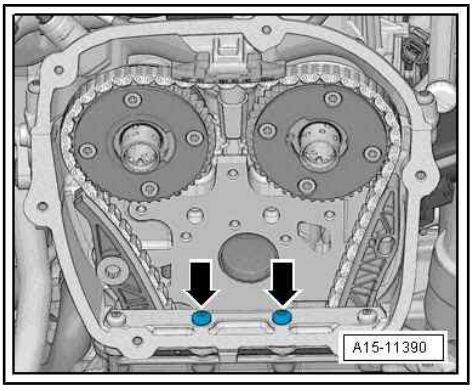
– Using assembly tool - T40266- , turn inlet camshaft in -direction of arrow 1- until camshaft clamp - T40271/2- can be removed from between teeth of chain sprocket -2-.
– Relieve tension from camshaft.
– Remove camshaft clamp - T40271/1- and -T40271/2- .



– Make sure that adjustment has been carried out correctly: chain links with coloured markings -arrows- must be positioned at markings on chain sprockets.



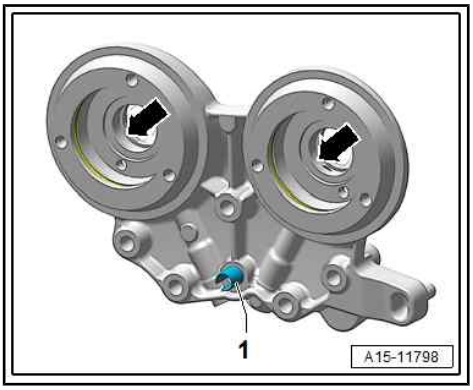
– Tighten bolts -arrows-.



– Moisten holes -arrows- with engine oil.

Note

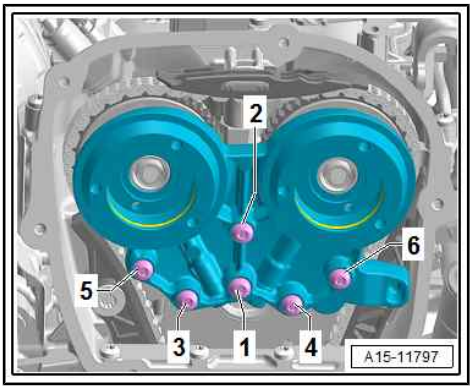
Clamping sleeve -1- is not fitted on all bearing saddles.



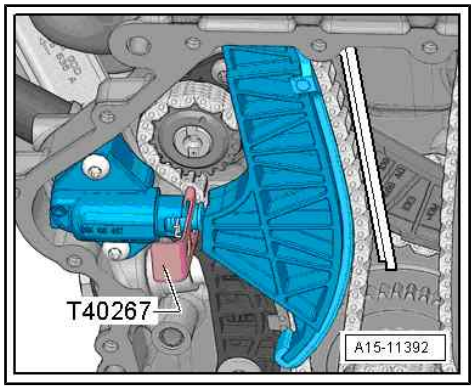
– Fit bearing saddle taking care not to cant it.
– Screw in bolts -1 to 6- by hand.

Note

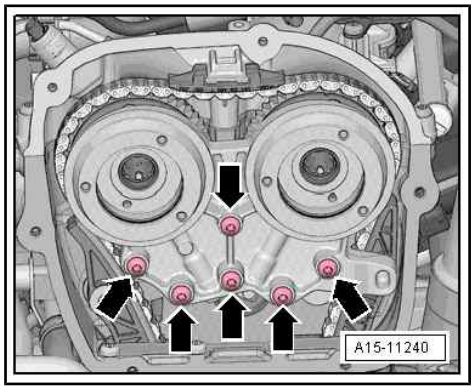
If a spring pin is installed, it is pulled into the cylinder head together with bolt -1-.



– Remove locking tool - T40267- .



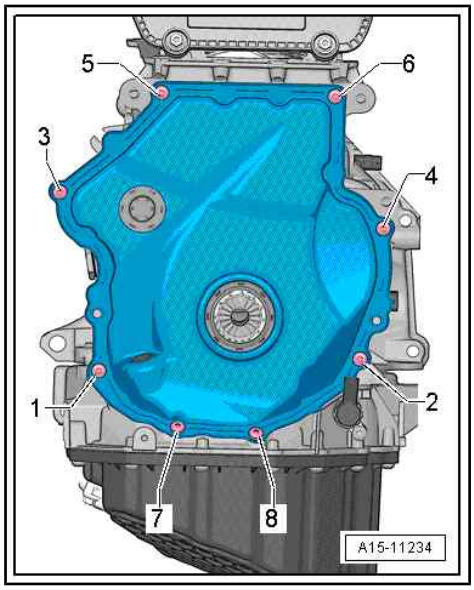
– Tighten bolts -arrows-.
– Install control valve.
– Turn engine two times in engine direction of rotation.



Note

Due to the ratio, the coloured chain links no longer align with the markings after the engine has been turned.

– Remove turning over tool, and install lower timing chain cover ⇒ page 96 .



Note

Do not tighten bolts -1- and -4- with turning further angle until after the vibration damper has been installed. The bolts must be unscrewed again for installing the vibration damper.

– Install vibration damper ⇒ page 37 .
– Install timing chain cover (top) ⇒ page 96 .
– Install tensioner for poly V-belt ⇒ page 36 .
– Install poly V-belt ⇒ page 35 .
– After working on the chain drive, adapt learnt values in engine control unit ⇒ Vehicle diagnostic tester.

Specified torques

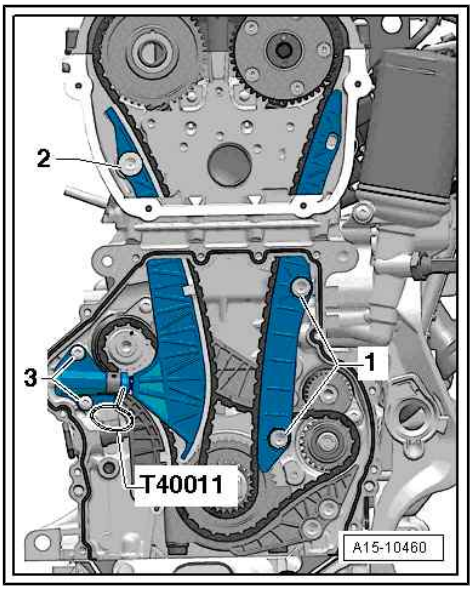
- ⇒ “2.1 Assembly overview - cover for timing chain”, page 94
- ⇒ “3.2 Assembly overview - camshaft timing chains”, page 102
- Assembly overview - noise insulation ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Assembly overview - noise insulation

3.4 Removing and installing drive chain for balance shaft

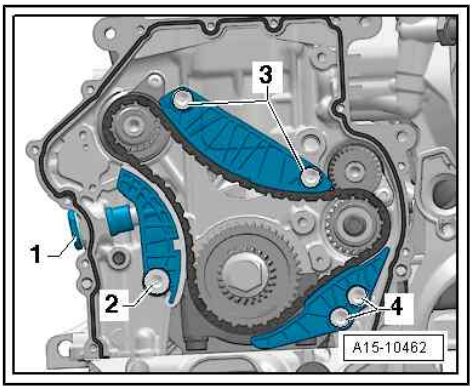
Removing

– Remove timing chain cover (top) ⇒ page 96 .

– If fitted, remove noise insulation ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Removing and installing noise insulation .
– Remove lower timing chain cover ⇒ page 96 .
– Remove camshaft timing chain ⇒ page 104 .
– Remove guide rail for camshaft timing chain -1-.
– Remove chain tensioner for camshaft timing chain -3-.



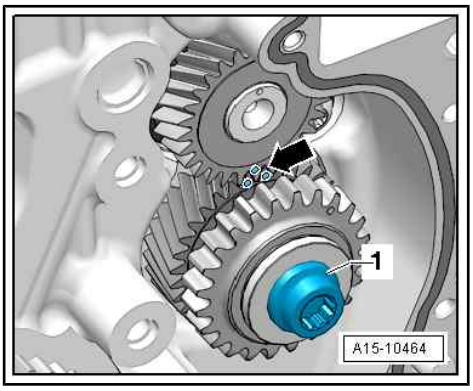
– Remove chain tensioner for balancer shaft timing chain -1-.
– Remove tensioning rail -2-.
– Remove guide rail -3-.
– Remove guide rail -4-.
– Remove timing chain.



Installing

Install in reverse order of removal, observing the following:

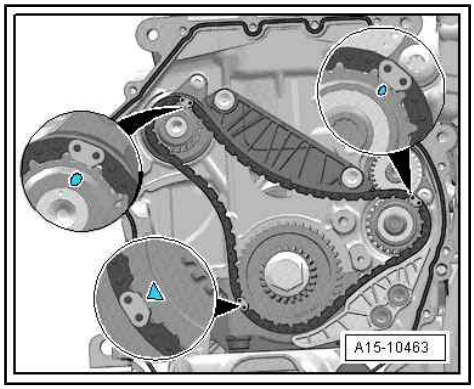
– Turn intermediate shaft sprocket/balancer shaft to markings -arrows-.



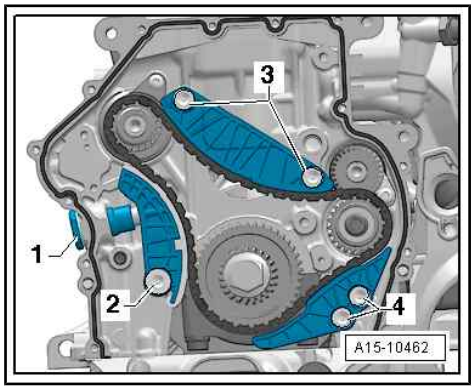
Note

Timing chain links with coloured markings must be positioned at markings on chain sprockets.

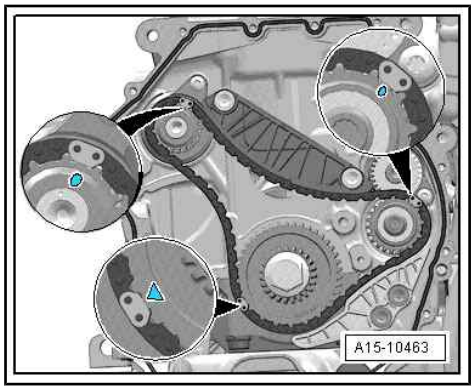
– Fit timing chain. The timing chain links with coloured markings must be positioned at the markings on the chain sprockets.



– Fit guide rail for timing chain and tighten bolts -4-.
– Fit guide rail for timing chain and tighten bolts -3-.
– Fit tensioning rail for timing chain and tighten bolt -2-.
– Install chain tensioner of timing chain -1- with locking fluid ⇒ Electronic parts catalogue (ETKA) .



– Check adjustment again.
– Install camshaft timing chain ⇒ page 104 .
– Install timing chain cover (bottom) ⇒ page 96 .
– Install timing chain cover (top) ⇒ page 96 .
– Install tensioner for poly V-belt ⇒ page 36 .
– Install poly V-belt ⇒ page 35 .
– If present, install noise insulation ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Removing and installing noise insulation .

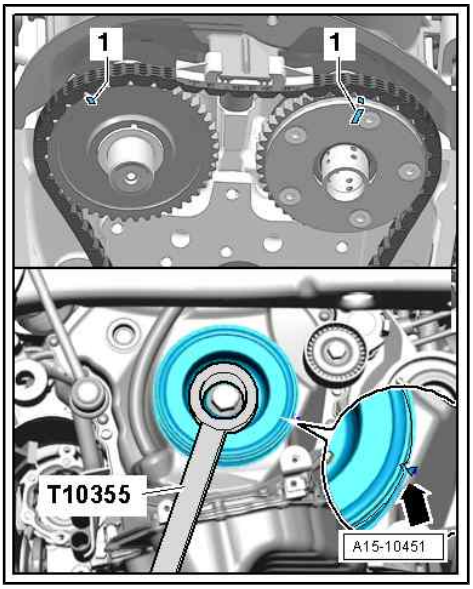


Specified torques

- ⇒ “3.2 Assembly overview - camshaft timing chains”, page 102
- ⇒ “3.1 Assembly overview - drive chain for balance shaft”, page 100
- ⇒ “2.1 Assembly overview - cover for timing chain”, page 94

3.5 Checking valve timing

– Remove timing chain cover (top) ⇒ page 96 .



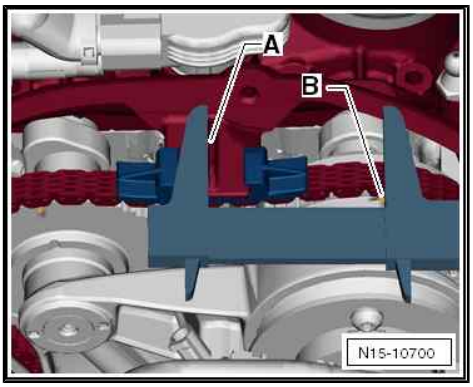
Note

Use a ratchet spanner with a 24 mm socket to turn the vibration damper. Always turn the vibration damper in the engine's direction of rotation to the "TDC" position. Do not correct TDC position by turning the damper in the other direction.

- Notch on vibration damper must align with arrow marking on bottom cover for timing chains (use a mirror)
- Markings -1- on camshafts must face upwards.

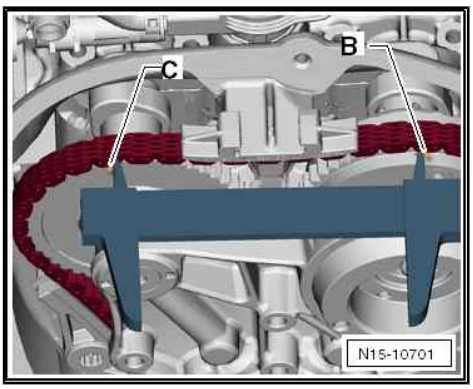
– Measure the distance from the outer edge of web -A- to marking -B- on the inlet camshaft.

- Specification: 61 to 64 mm



– If the specified value is achieved, measure the distance between the marking on the inlet camshaft -B- and the marking on the exhaust camshaft -C-.

- Specification: 124 to 126 mm

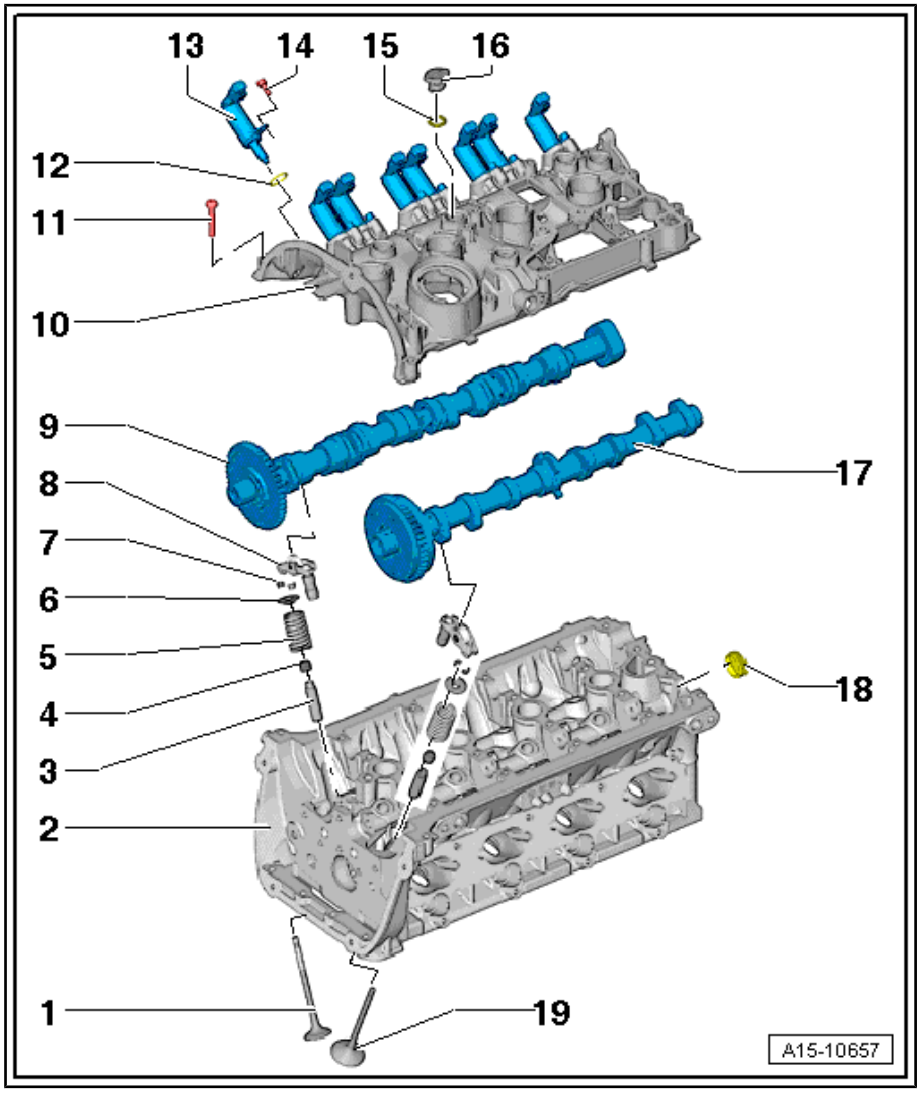


Note

An offset of one tooth results in a deviation of approx. 6 mm from the specified value. If an offset is found, the timing chain must be re-fitted.

4 Valve gear

4.1 Assembly overview - valve gear



1 - Exhaust valves

- ❑ Qty. 8
- ❑ Do not rework; only lapping in is permitted
- ❑ Valve dimensions ⇒ page 144

2 - Cylinder head

- ❑ Removing and installing ⇒ page 82

3 - Valve guides

- ❑ Qty. 16
- ❑ Checking valve guides ⇒ page 143

4 - Valve stem seal

- ❑ Qty. 16

5 - Valve springs

- ❑ Qty. 16

6 - Valve spring plate

- ❑ Qty. 16

7 - Valve cotters

- ❑ Qty. 32

8 - Hydraulic compensation element

- ❑ Qty. 8
- ❑ Do not interchange
- ❑ Oil contact surface

9 - Exhaust camshaft

- ❑ Check radial clearance with Plastigage (roller rocker fingers removed).
- ❑ Radial clearance: 0.024 to 0.066 mm.
- ❑ Runout: max. 0.04 mm
- ❑ Removing and installing ⇒ page 122

10 - Cylinder head cover

- ❑ With integrated camshaft bearings.
- ❑ Clean sealing surface; reworking not permitted.

- ❑ Completely remove sealant residue

11 - Bolts

- ❑ Qty. 22
- ❑ Renew after removal
- ❑ Loosening ⇒ page 121
- ❑ Observe tightening sequence ⇒ page 122
- ❑ 8 Nm +90°

12 - O-rings

- ❑ Qty. 8
- ❑ Moisten with engine oil.
- ❑ Check for damage
- ❑ Not a replacement part, provided together with actuator for camshaft adjustment

13 - Actuator for camshaft adjustment -F366- / -F373-

- ❑ Qty. 8
- ❑ Removing and installing ⇒ page 133

14 - Bolts

- ❑ Qty. 8
- ❑ 5 Nm

15 - O-rings

- ❑ Qty. 3
- ❑ Renew after removal
- ❑ Lubricate with engine oil

16 - Plug

- ❑ Qty. 3

17 - Inlet camshaft

- ❑ Check radial clearance with Plastigage (roller rocker fingers removed).
- ❑ Radial clearance: 0.024 to 0.066 mm.
- ❑ Runout: max. 0.04 mm
- ❑ Removing and installing ⇒ page 122

18 - Cap

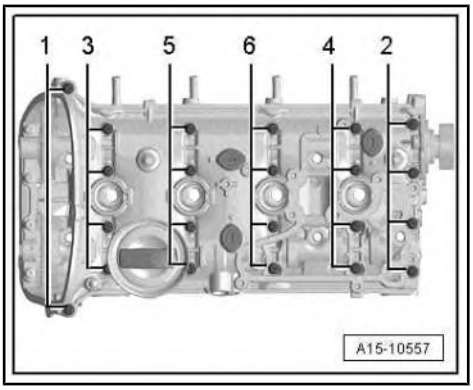
- ❑ Renew after removal
- ❑ Removing: with cylinder head cover installed, pierce one side of cap with awl and lever cap off

19 - Inlet valve

- ❑ Qty. 8
- ❑ Do not rework; only lapping in is permitted
- ❑ Valve dimensions ⇒ page 144

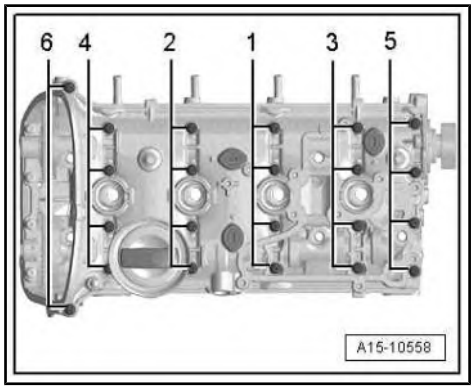
Cylinder head cover - release

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

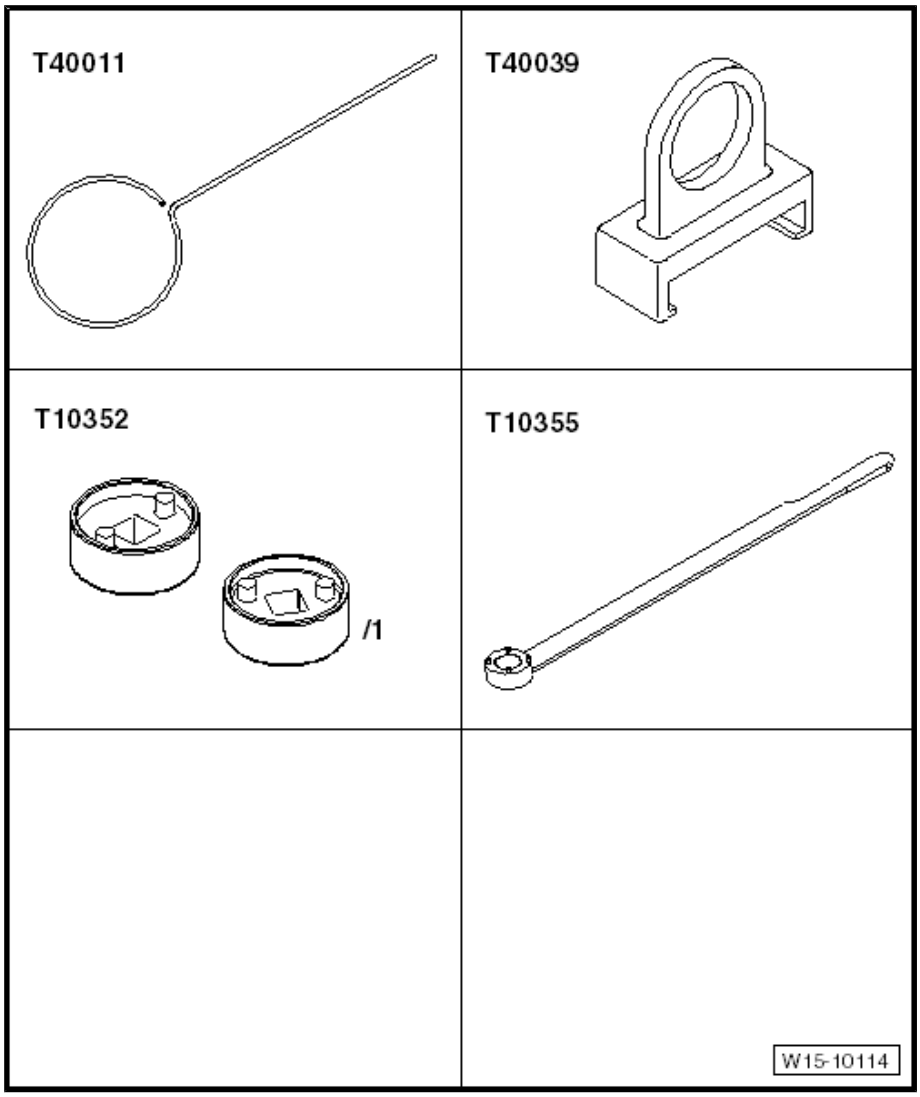


Tightening sequence for cylinder head cover

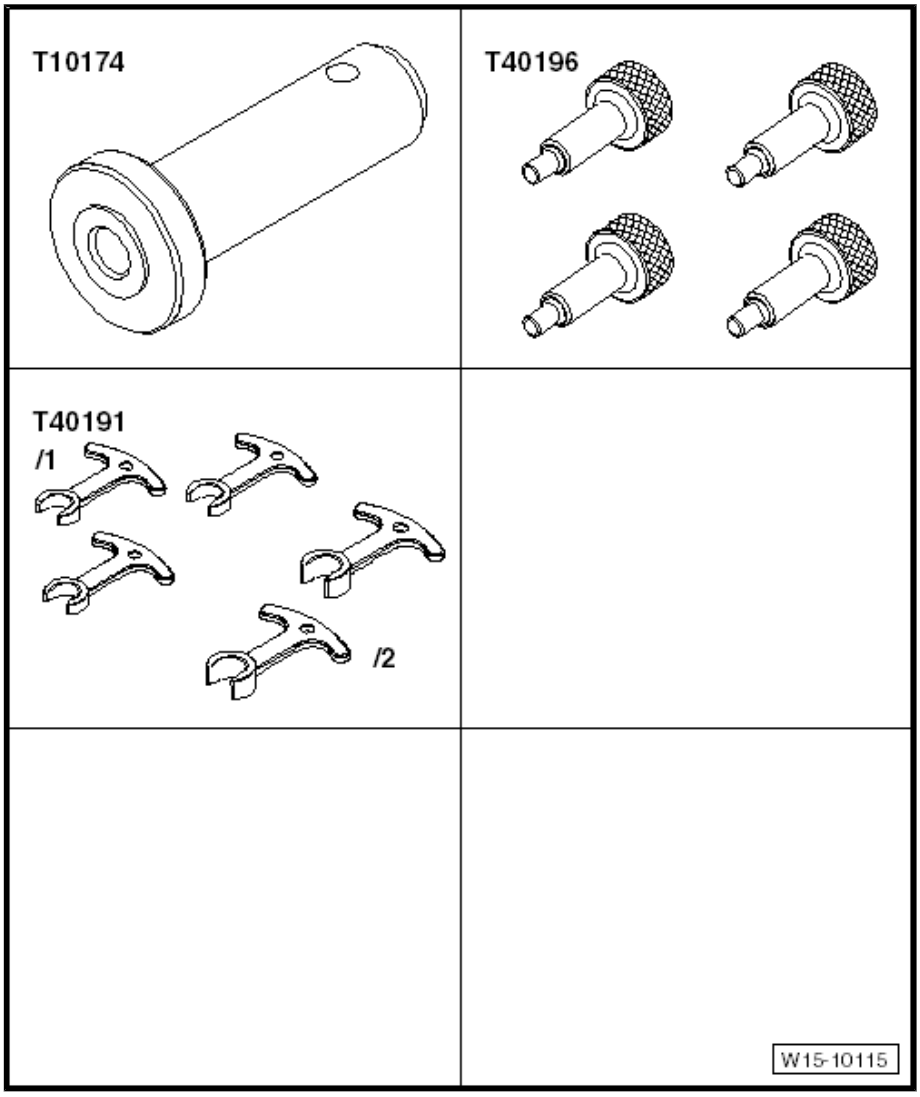
– Tighten bolts in the sequence -1 … 6-.



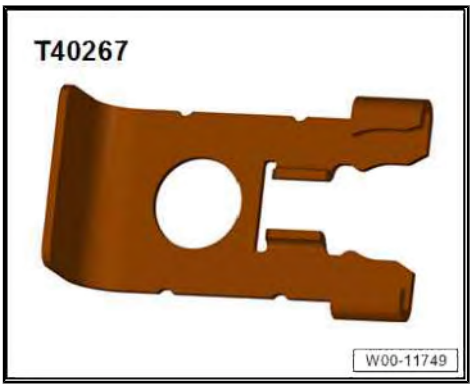
4.2 Removing and installing camshaft



- Puller - T40039-
- Pin - T40011-
- Removal tool - T10352/1-
- Counter-hold tool - T10355-



- Thrust piece - T10174-
- Assembly pin - T40196-
- Spacers - T40191-
- Locking tool - T40267-

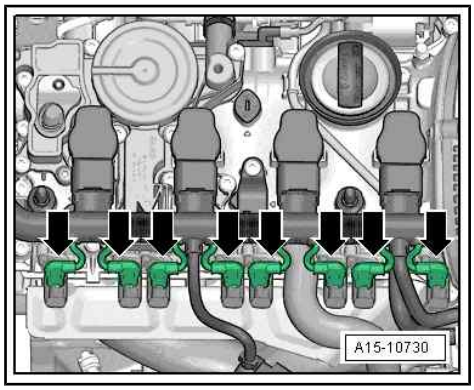


Removing

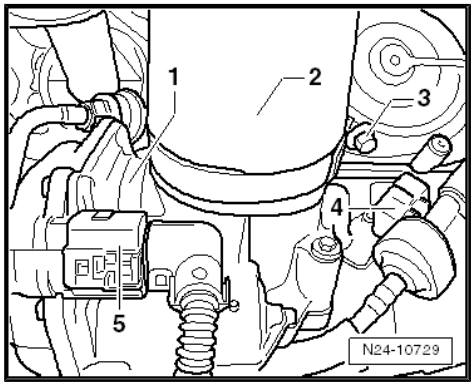
Note

- *Sealing surfaces at bottom of cylinder head cover and top of cylinder head must not be machined.*
- *Camshaft bearings are integrated into cylinder head and cylinder head cover. Camshaft timing chain must be relieved of tension before you remove cylinder head cover.*
- *Renew sealing cap if cylinder head cover has been detached.*
- *Fit the cable ties in the original position when installing.*

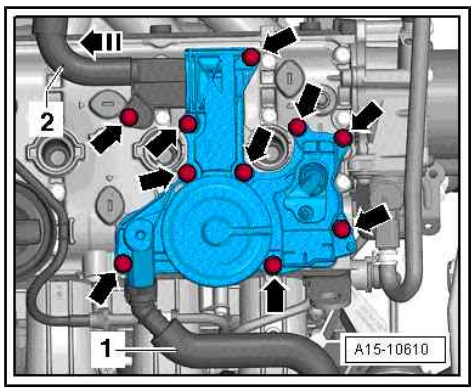
– Remove timing chain cover (top) ⇒ page 96 .
– Remove pressure hose leading from charge air cooler to turbocharger.
– Separate electrical connectors -arrows-.
– Remove ignition coils ⇒ page 248 .
– Remove actuators -F366- / -F373- ⇒ page 133 .



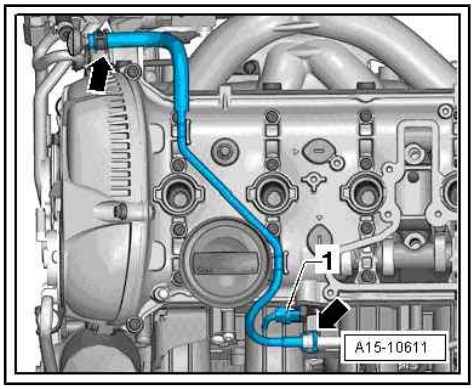
– Loosen clamp -3-.
– Pull hose -2- off throttle valve module - J338- -1-.
– Loosen clip on other side where hose is and remove hose.



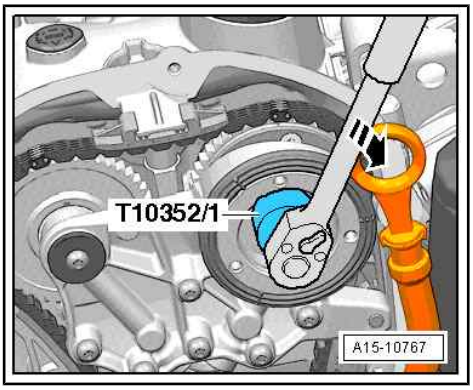
– Disconnect crankcase breather hose -1-.
– Unscrew bolts -arrows-.
– Pull off hose -2- in direction of -arrow-.
– Remove crankcase breather.



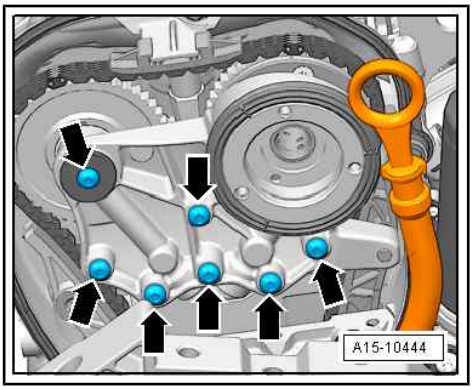
– Disconnect line -arrows-.
– Disconnect connector -1-.



– Remove regulating valve using removal tool - T10352/1- in direction of -arrow-.



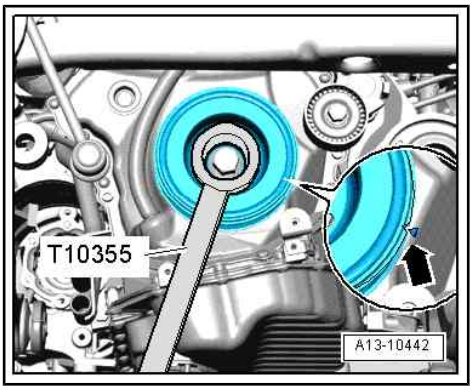
– Unscrew bolts -arrows-.
– Remove bearing saddle.
– If fitted, remove noise insulation ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Removing and installing noise insulation .



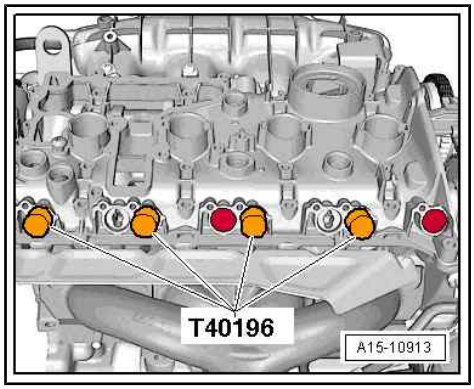
– Turn vibration damper to TDC position -arrow- using counterhold - T10355- .

Note

Notch on vibration damper must align with arrow marking on cover for timing chains (bottom).



– Insert drifts - T40196- .



Note

Only insert drifts - T40196- in points marked in illustration.

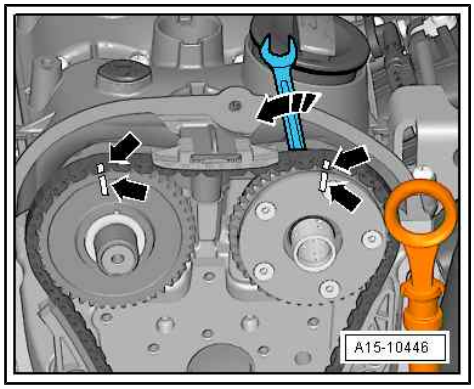
– Turn crankshaft 2 times in direction of engine's rotation.

Note

Engine must be at “TDC” again.

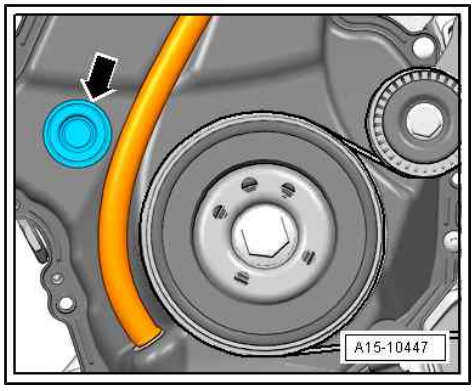
– Remove drifts - T40196- .

– Use a waterproof pen to mark drive chain at marks on chain sprockets -arrows-.



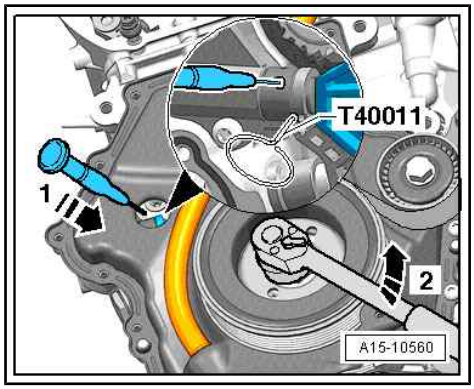
Up to 29/04/2013

– Remove sealing plug -arrow-.



– Insert scriber or suitable screwdriver in hole of chain tensioner in direction of -arrow 1- and lift locking element for chain tensioner.

– Turn crankshaft in opposite direction to normal rotation -arrow 2- and lock in place using locking pin - T40011- .

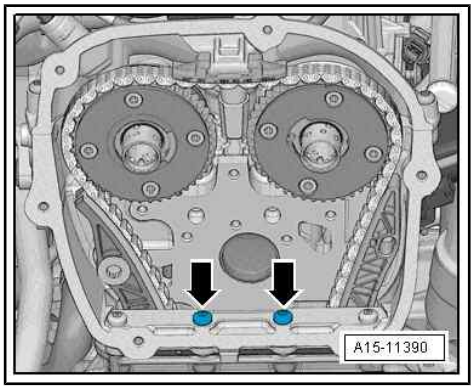


Note

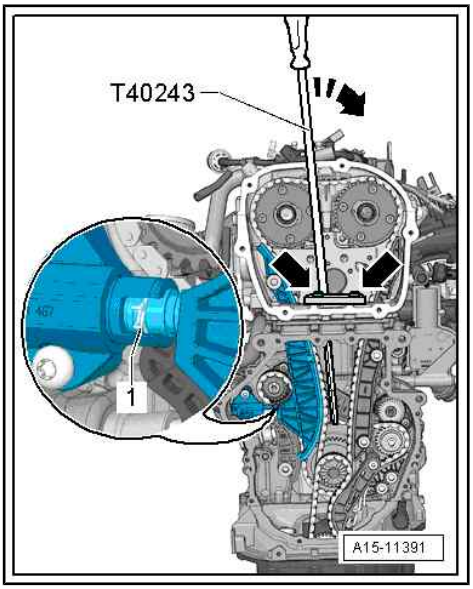
Inlet camshaft will move in direction of engine rotation.

As of 29/04/2013

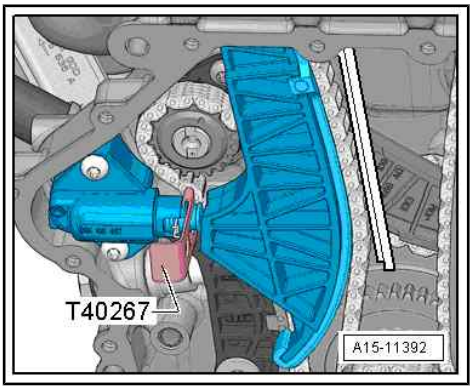
– Unscrew bolts -arrows-.



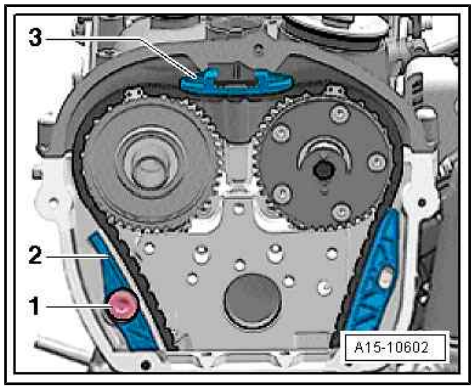
– Remove lower timing chain cover ⇒ page 96 .
– Screw in lever - T40243- -arrows-.
– Press together retaining ring -1- of chain tensioner and hold it in that position.
– Slowly push lever - T40243- in -direction of arrow-, and hold it in that position.



– Secure chain tensioner with locking pin - T40267- .
– Remove lever - T40243- .



Continued for all vehicles



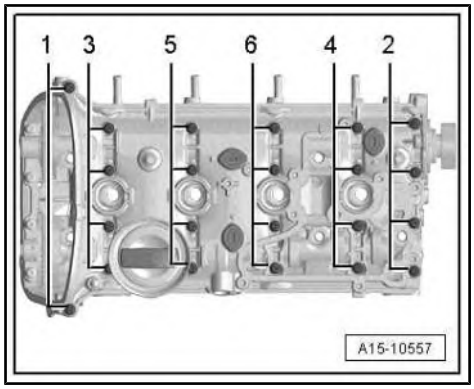
– Unscrew bolt -1-.
– Guide tensioning rail -2- downwards.
– Remove upper guide rail -3-. Release catch with a screwdriver and push guide rail off towards the front of vehicle.
– Remove camshaft timing chain from camshaft sprockets.

Note

- *Risk of damage to valves and piston crowns!*
- *Do not turn the crankshaft after the camshaft timing chain has been removed from the cylinder head.*

– Remove high-pressure pump ⇒ page 231 .
– Remove vacuum pump ⇒ page 93 .

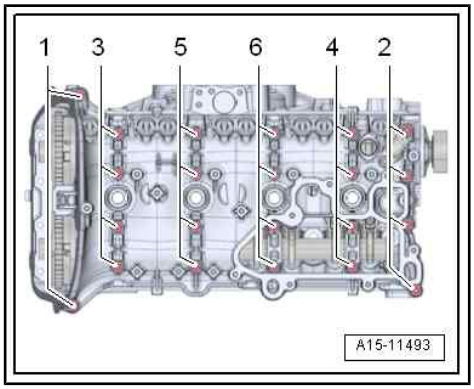
Cylinder head cover version 1



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

Cylinder head cover version 2

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



Continued for all vehicles

– Remove cylinder head cover.

– Detach camshafts.

Installing

Install in reverse order of removal, observing the following:

Note

- *The sealing surfaces must be free of oil and grease.*
- *Pistons must not be positioned at TDC.*
- *Ensure that all roller rocker fingers are properly seated on valve stem ends.*

– Remove sealant remaining on cylinder head with flat scraper.

CAUTION

Risk of eye injury caused by sealant residue.

– Wear protective goggles.

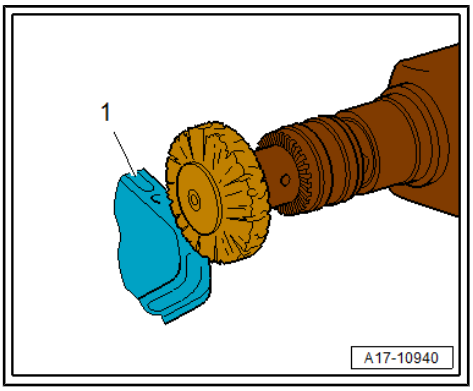
Note

- *Danger of lubrication system and bearings becoming soiled!*
- *Cover open parts of engine.*

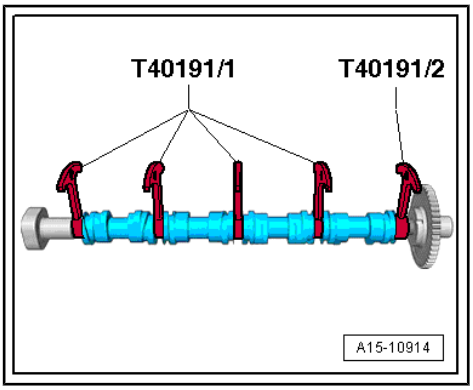
– Remove sealant left in groove of cylinder head cover and on sealing surfaces, e.g. using a rotating plastic brush.

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

– Oil running surfaces of both camshafts.



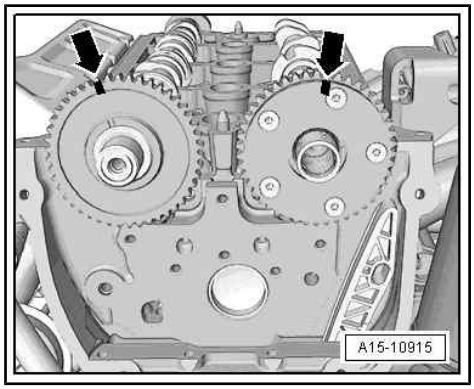
– Lock camshaft using spacers - T40191- , pushing sliding pieces into correct position as necessary.



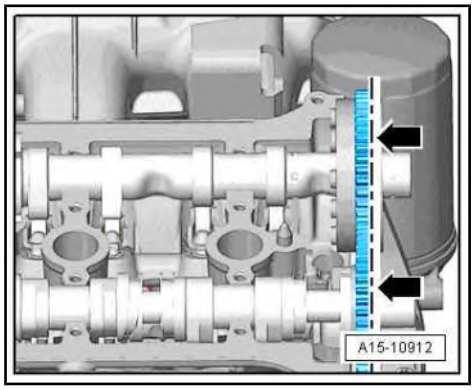
Note

If available, use second set of spacers - T40191/2- or reuse - T40191/1- .

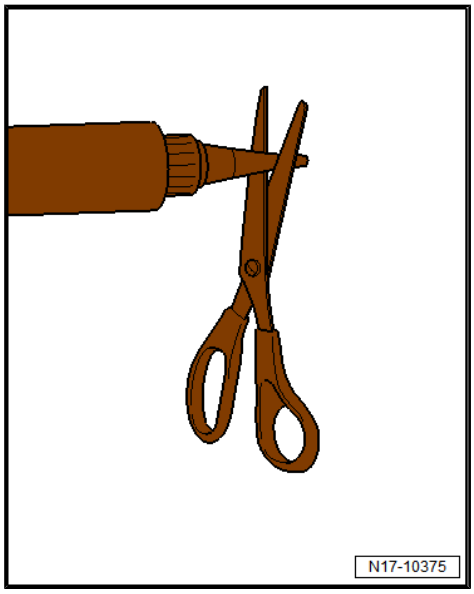
– Insert camshafts into cylinder head.
– Markings -arrows- must be located as shown in illustration.



– Check alignment -arrows- of camshafts.

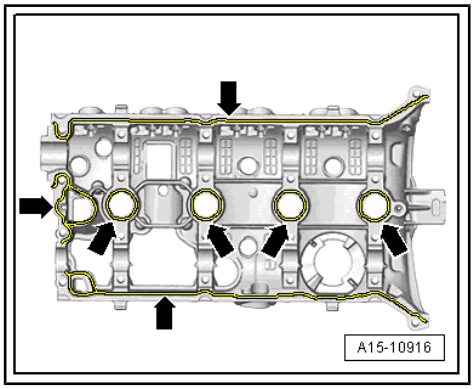


– Cut off nozzle on tube at front marking (∅ of nozzle approx. 2 mm).



– Apply silicone sealant -arrows- onto clean sealing surface of cylinder head cover.

♦ Thickness of sealant bead: 2 to 3 mm.



Note

♦ *The cylinder head cover must be installed within 5 minutes after applying the silicone sealant.*

♦ *The bead of sealant must not be thicker than specified, otherwise excess sealant can enter the sump and obstruct the strainer in the oil intake pipe.*

♦ *Observe use-by-date of sealant.*

– Fit cylinder head cover onto cylinder head.

– Renew bolts for cylinder head cover.

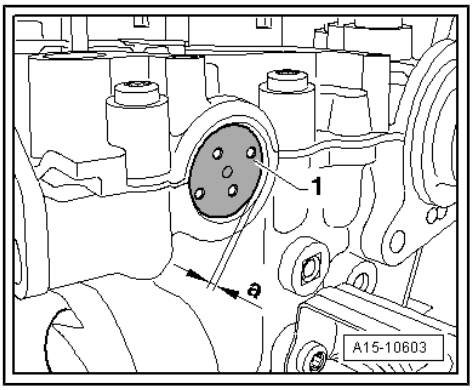
– Tighten bolts in several stages, tightening sequence ⇒ page 120 .

Note

Install cylinder head cover, making sure not to cant it.

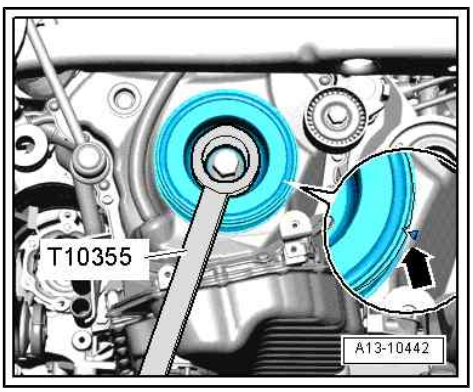
– Use thrust piece - T10174- to drive in sealing cap -1- without sealant.

-a-: 1 … 2 mm



– Turn vibration damper to TDC position -arrow- using counterhold - T10355- .

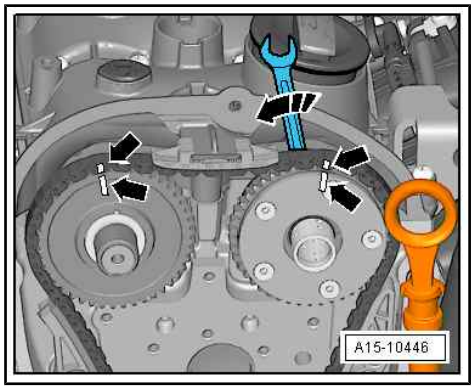
• Notch on vibration damper must align with arrow marking on bottom cover for timing chains



Note

The timing chain links with markings must be positioned at the markings on the chain sprockets.

– Fit camshaft timing chain.

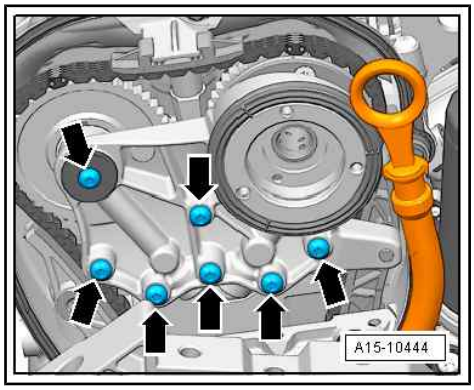


Note

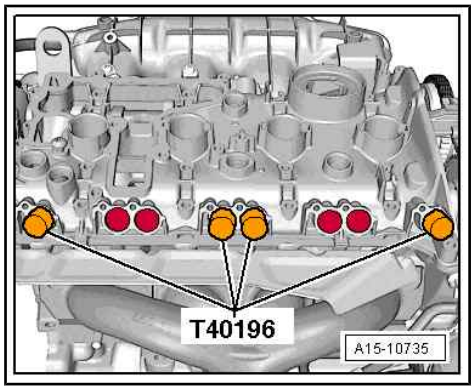
The drive chain/sprocket markings must align -arrows-.

– Use open-jaw spanner to turn inlet camshaft in direction of -arrow- and fit timing chain.

– Attach bearing saddle and screw in bolts -arrows- hand-tight.
– Remove locking pin - T40011- .
– Tighten bolts -arrows-.
– Install regulating valve.



– Insert drifts - T40196- .
– Turn crankshaft 4 times in direction of engine's rotation.
– Remove drifts - T40196- .
– Install timing chain cover (top) ⇒ page 96 .
– Install vacuum pump ⇒ page 93 .
– Installing high-pressure pump ⇒ page 231 .
– Install air filter housing ⇒ page 216 .
– If present, install noise insulation ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Removing and installing noise insulation .



Specified torques

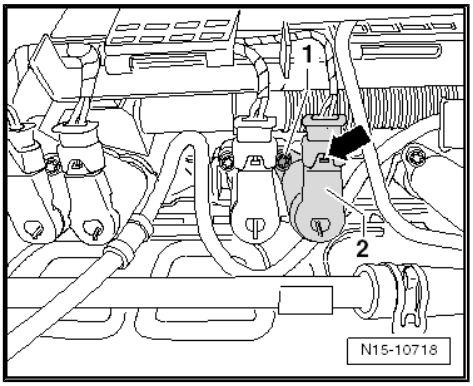
- ⇒ “4.1 Assembly overview - valve gear”, page 120
- ⇒ “2.1 Assembly overview - cover for timing chain”, page 94
- ⇒ “4.1 Assembly overview - air filter housing”, page 215

4.3 Removing and installing camshaft adjuster

⇒ “4.3.1 Removing and installing actuator for camshaft adjustment F366 / F373 ”, page 133

4.3.1 Removing and installing actuator for camshaft adjustment -F366- / -F373-

Removing



– Disconnect connector -arrow- from respective actuator for camshaft adjustment -F366- / -F373- -2-.
– Unscrew bolt -1-.
– Carefully pull out actuator for camshaft adjustment -F366- / -F373- which is to be removed.

Installing

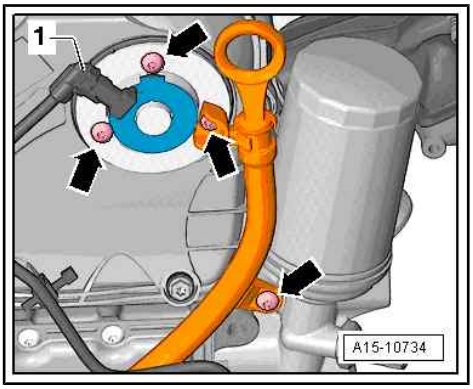
Install in reverse order of removal, observing the following:

Specified torques

◆ ⇒ “1.1 Assembly overview - cylinder head”, page 79

4.4 Removing and installing camshaft control valve 1 - N205-

Removing



– Separate electrical connector from camshaft control valve 1 - N205- -1-.
– Unscrew bolts -arrows-.
– Remove camshaft control valve 1 - N205- .

Installing

Install in reverse order of removal, observing the following:

Note

◆ *Renew O-ring after each removal.*
◆ *Lubricate seal and O-ring with engine oil.*

Specified torques

◆ ⇒ “2.1 Assembly overview - cover for timing chain”, page 94

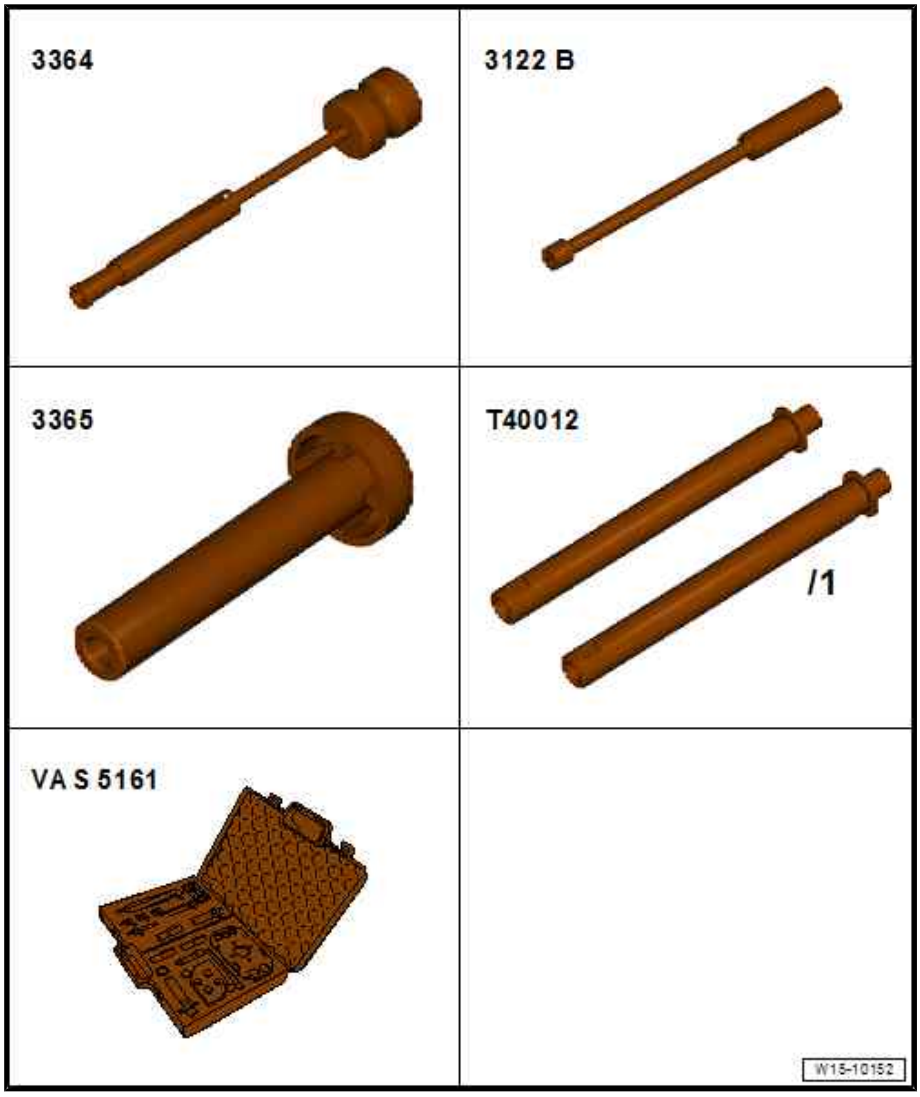
4.5 Removing and installing valve stem seals

⇒ “4.5.1 Renewing valve stem seals with cylinder head installed”, page 133

⇒ “4.5.2 Renewing valve stem seals with cylinder head removed”, page 137

4.5.1 Renewing valve stem seals with cylinder head installed

Special tools and workshop equipment required



- Spark plug socket - 3122 B-
- Valve stem seal puller - 3364-
- Valve stem seal fitting tool - 3365-
- Adapter - T40012-
- Torque wrench - V.A.G 1331-
- Dismantling and assembling device for valve cotters - VAS 5161-
- Guide plate for 2.0 l and 3.0 l FSI engine - VAS 5161/19B-

Removing

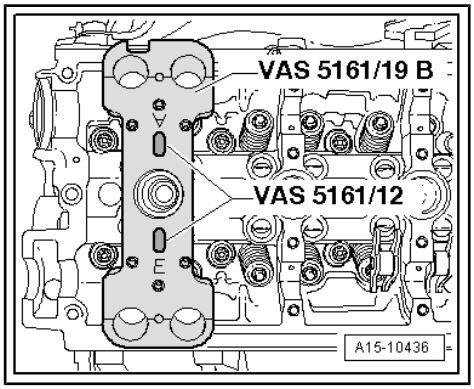
– Remove camshafts ⇒ page 122 .

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

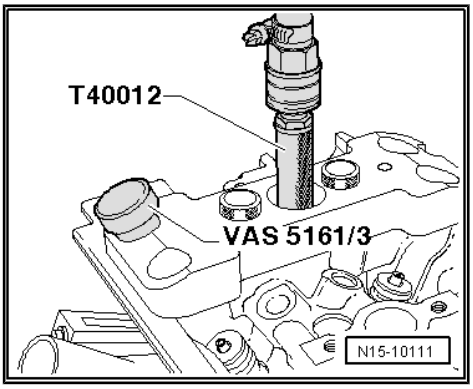
– Remove roller rocker fingers together with hydraulic compensation elements and place down on a clean surface.

– Unscrew spark plugs using spark plug socket and extension - 3122 B- .

– Secure guide plate for 2.0 l and 3.0 l FSI engine - VAS 5161/19B- with knurled screws - VAS 5161/12- on cylinder head.
– Set piston of respective cylinder to “bottom dead centre”.

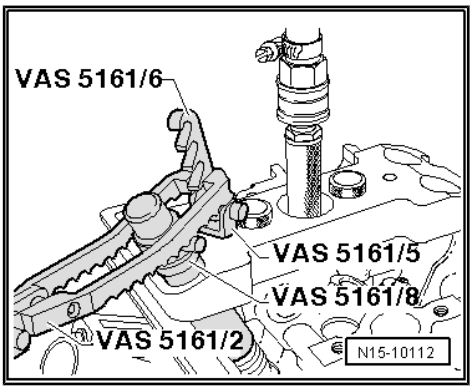


– Screw adapter - T40012- into spark plug thread.
– Connect compressed air with pressure rating of at least 6 bar.
– Strike tight valve cotters with drift - VAS 5161/3- and a plastic hammer.



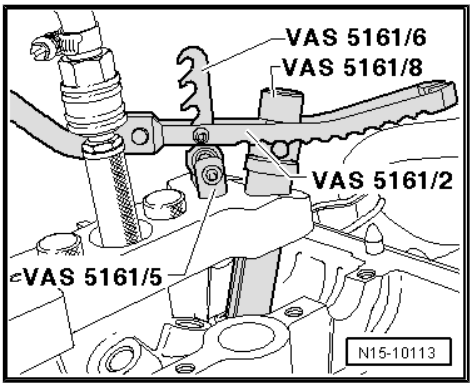
For inlet side

– Screw retainer - VAS 5161/6- with guide fork - VAS 5161/5- into centre thread of guide plate for 2.0 l and 3.0 l FSI engine - VAS 5161/19B- .
– Insert assembly cartridge - VAS 5161/8- into guide plate for 2.0 l and 3.0 l FSI engine - VAS 5161/19B- .
– Attach pressure fork - VAS 5161/2- to retainer - VAS 5161/6- .

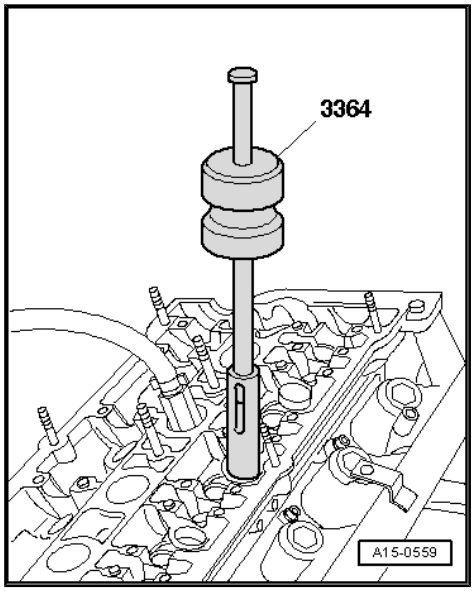


For exhaust side

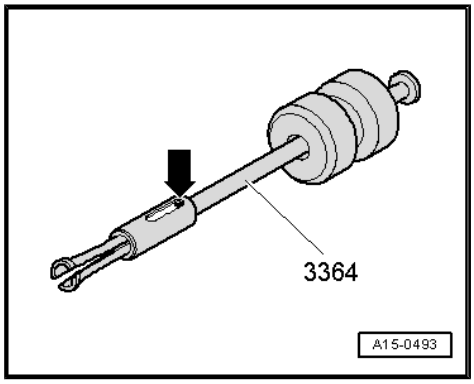
– Screw retainer - VAS 5161/6- with guide fork - VAS 5161/5- into outer threads of guide plate for 2.0 l and 3.0 l FSI engine - VAS 5161/19B- .
– Press installation cartridge - VAS 5161/8- down and turn knurled screw of installation cartridge - VAS 5161/8- to right until tips engage in valve cotters.
– Move knurled screw back and forth slightly to press apart valve cotters and capture them in the assembly cartridge.
– Release pressure fork - VAS 5161/2- .
– Remove installation cartridge - VAS 5161/8- .



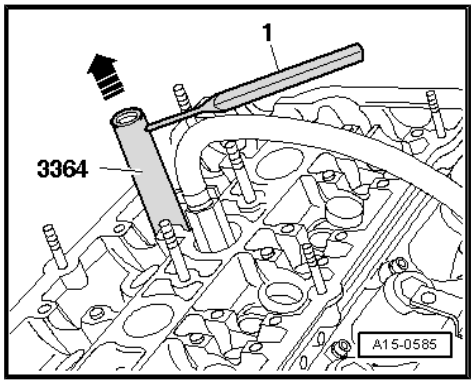
– Pull off valve stem seals using valve stem seal puller - 3364- .



– If valve stem seal puller - 3364- cannot be used on account of restricted space, knock out pin -arrow- with a punch and remove the impact extractor attachment.



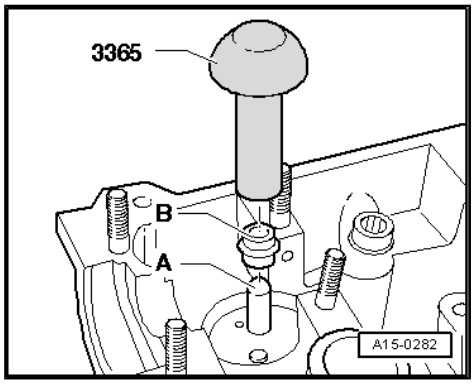
– Place lower part of valve stem seal puller - 3364- onto valve stem seal.
– Insert punch -1- into bore in lower part of puller.
– Place installation lever on puller and pull out valve stem seal -arrow-.



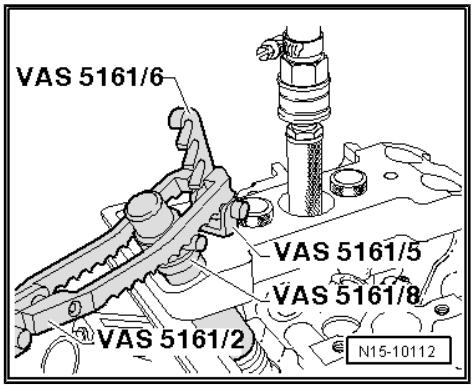
Installing

Install in reverse order of removal, observing the following:

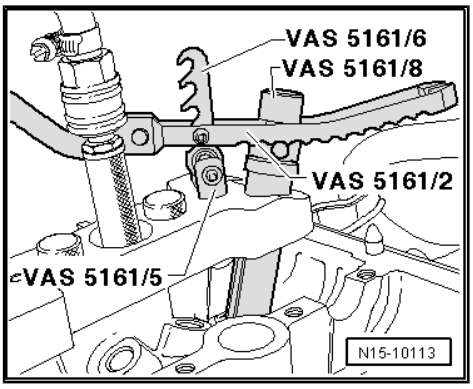
– To prevent damage to new valve stem seals -B-, attach plastic sleeve -A- to valve stem.
– Lubricate sealing lip of valve stem seal -B-, place it in the valve stem seal fitting tool - 3365- and push carefully onto valve guide.
– Remove plastic sleeve -A-.
– Insert valve spring and valve spring plate.
– Install removal and installation device for valve cotters - VAS 5161- as shown.



Inlet side

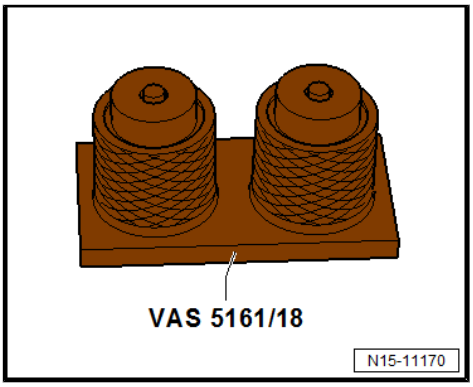


Exhaust side



Note

- *If the valve cotters have been removed from the installation cartridge, they must first be inserted into the insertion device - VAS 5161/18- .*
- *Press assembly cartridge -VAS 5161/8- onto insertion device from above and pick up valve cotters.*



– Press installation cartridge - VAS 5161/8- down with pressure fork - VAS 5161/2- , and turn installation cartridge knurled screw back and forth whilst pulling upwards.

– Relieve pressure fork - VAS 5161/2- whilst pulling on knurled screw.

– Remove removal and installation device - VAS 5161- .

– Install camshafts.

4.5.2 Renewing valve stem seals with cylinder head removed

Special tools and workshop equipment required

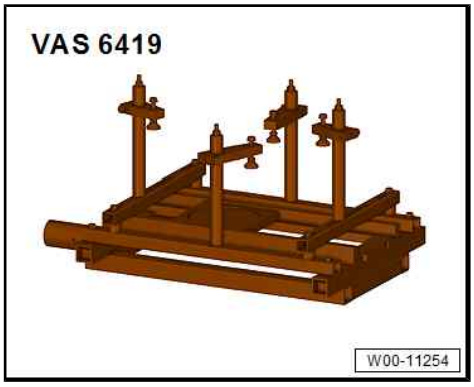
- Valve stem seal puller - 3364-

- Valve stem seal fitting tool - 3365-

- Dismantling and assembling device for valve cotters - VAS 5161 A-

- Engine and gearbox support - VAS 6095A-

♦ Cylinder head tensioning device - VAS 6419-



Removing

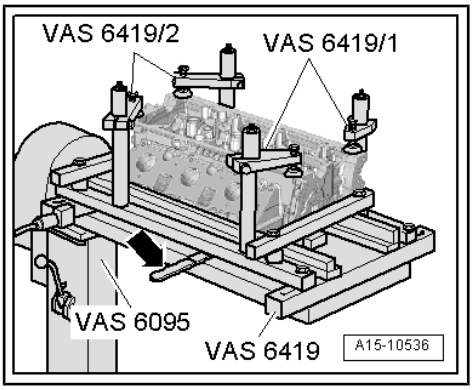
– Remove cylinder head ⇒ page 82 .

– Remove camshafts ⇒ page 122 .

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

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

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



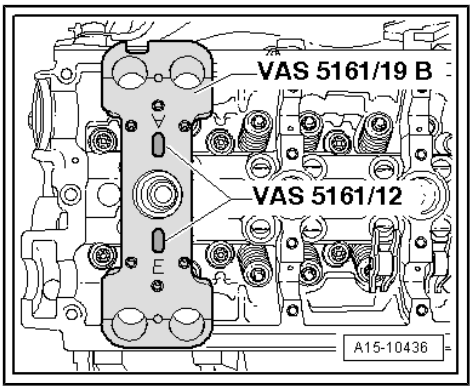
– Secure cylinder head on cylinder head clamping device.

– Connect cylinder head tensioning device to compressed air.

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

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

– Secure guide plate for 2.0 l and 3.0 l FSI engine - VAS 5161/19B- with knurled screws - VAS 5161/12- to cylinder head as shown.



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

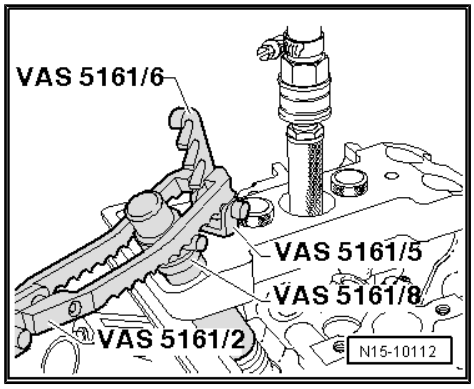
– Insert drift -VAS 5161/3- into guide plate and use a plastic hammer to knock loose the firmly seated valve cotters.

For inlet side

– Screw retainer - VAS 5161/6- with guide fork - VAS 5161/5- into centre thread of guide plate for 2.0 l and 3.0 l FSI engine - VAS 5161/19B- .

– Insert assembly cartridge - VAS 5161/8- into guide plate for 2.0 l and 3.0 l FSI engine - VAS 5161/19B- .

– Attach pressure fork - VAS 5161/2- to retainer - VAS 5161/6- .



For exhaust side

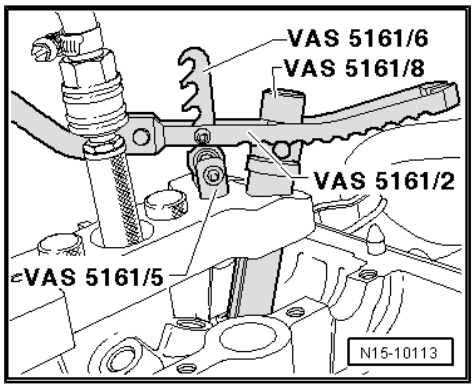
– Screw retainer - VAS 5161/6- with guide fork - VAS 5161/5- into outer threads of guide plate for 2.0 l and 3.0 l FSI engine - VAS 5161/19B- .

– Press installation cartridge - VAS 5161/8- down and turn knurled screw of installation cartridge - VAS 5161/8- to right until tips engage in valve cotters.

– Move knurled screw back and forth slightly to press apart valve cotters and capture them in the assembly cartridge.

– Release pressure fork - VAS 5161/2- .

– Remove installation cartridge - VAS 5161/8- .



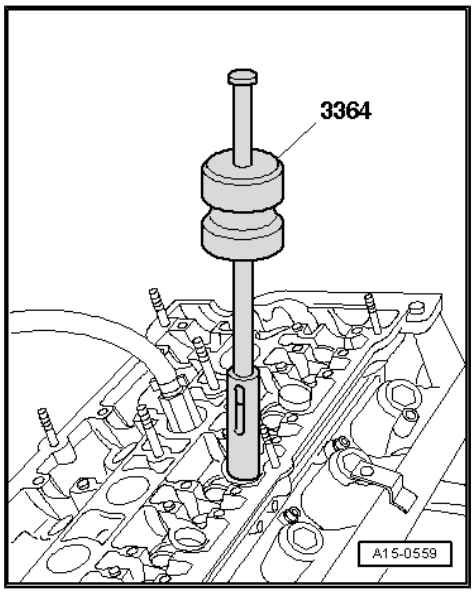
– Pull off valve stem seals using valve stem seal puller - 3364- .

Installing

Install in reverse order of removal, observing the following:

Note

- *Risk of damage when valve stem seals are being installed!*
- *Place plastic sleeve -A-, enclosed with new valve stem seals -B-, onto valve stem.*



– Lightly oil sealing lip of valve stem seal -B-.

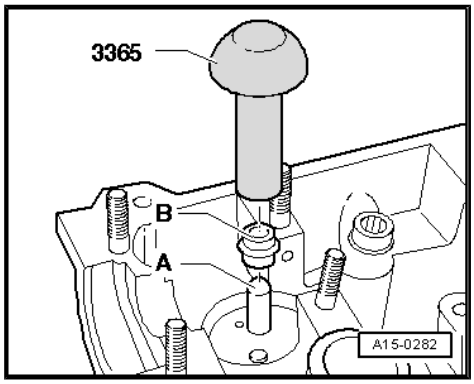
– Push valve stem seal -B- onto plastic sleeve -A-.

– Carefully press valve stem seal -B- onto valve guide using valve stem seal fitting tool - 3365- .

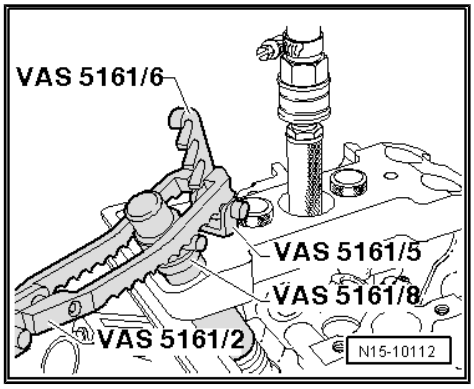
– Remove plastic sleeve -A-.

– Insert valve spring and valve spring plate.

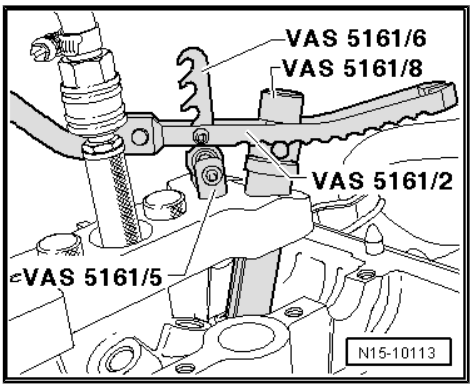
– Assemble removal and installation device for valve cotters - VAS 5161- .



Inlet side

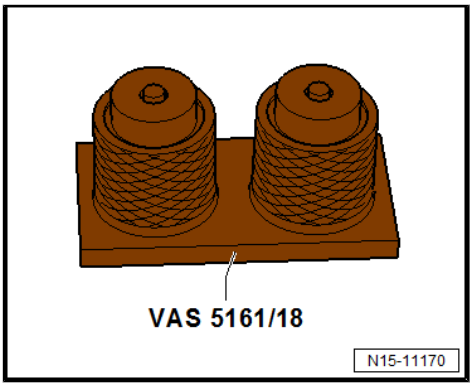


Exhaust side



Note

- *If the valve cotters have been removed from the installation cartridge, they must first be inserted into the insertion device - VAS 5161/18- .*
- *Press assembly cartridge -VAS 5161/8- onto insertion device from above and pick up valve cotters.*



– Press installation cartridge - VAS 5161/8- down with pressure fork - VAS 5161/2- , and turn installation cartridge knurled screw back and forth whilst pulling upwards.

– Relieve pressure fork - VAS 5161/2- whilst pulling on knurled screw.

– Remove removal and installation device for valve cotters - VAS 5161- .

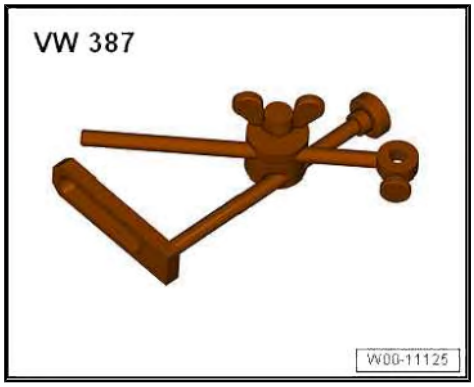
– Install camshafts ⇒ page 122 .

– Install cylinder head ⇒ page 82 .

4.6 Measuring axial play of camshaft

Special tools and workshop equipment required

- Universal dial gauge holder - VW 387-

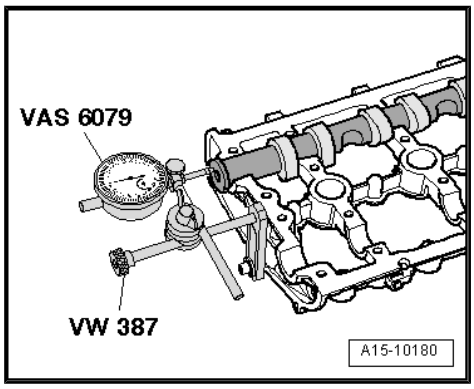


- Dial gauge - VAS 6079-

Test sequence

– Take measurements with retaining frame removed.
– Fit camshaft to be tested in retaining frame.
– Attach dial gauge - VAS 6079- with universal dial gauge holder - VW 387- to cylinder head.
– Press camshaft against dial gauge by hand.
– Set dial gauge to “0”.
– Press camshaft away from dial gauge and read off value:

• Axial clearance: 0.05 to 0.17 mm



5 Inlet and exhaust valves

⇒ “5.1 Checking valve guides”, page 143

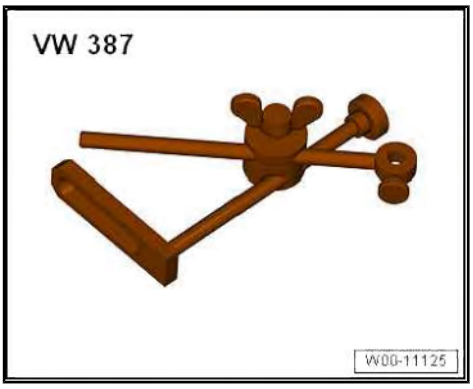
⇒ “5.2 Checking valves”, page 144

⇒ “5.3 Valve dimensions”, page 144

5.1 Checking valve guides

Special tools and workshop equipment required

- Universal dial gauge holder - VW 387-

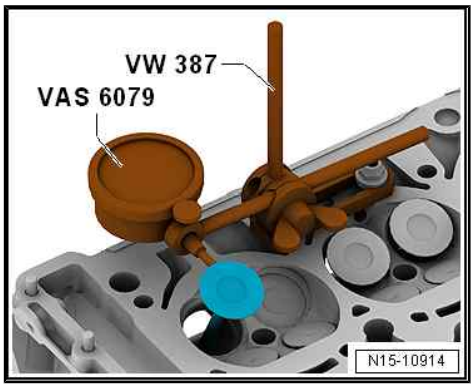


- Dial gauge - VAS 6079-

Test sequence

– Insert valve in guide. Valve stem end must be flush with guide. On account of differing stem diameters, only use inlet valve in inlet guide and exhaust valve in exhaust guide.

– Determine rock.



Wear limit

Inlet valve guide	Exhaust valve guide
0.80 mm	0.80 mm

Note

- *If the wear limit is exceeded, repeat the measurement with new valves. If the wear limit is exceeded again, renew the cylinder head.*
- *If the valve is to be renewed as part of a repair, use a new valve for the calculation.*

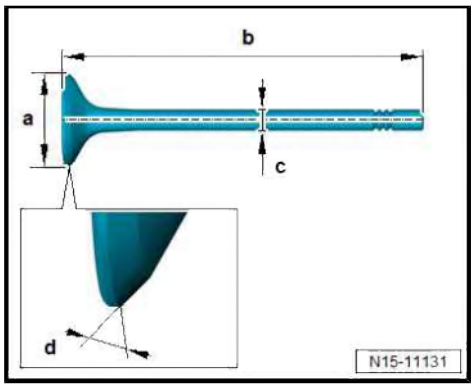
5.2 Checking valves

– Check for scoring on valve stems and valve seat surfaces.

– Exchange valve if significant scoring can be seen.

5.3 Valve dimensions

Valve dimensions



Note

Never rework the inlet and exhaust valves. Only lapping-in is permitted.

Dimension		Inlet valve	Outlet valve
∅ a	mm	33.85 ± 0.10	28.0 ± 0.1
b	mm	104.0 ± 0.2	101.9 ± 0.2
Diameter c	mm	5.98 ± 0.01	5.96 ± 0.01
d	∠°	45	45

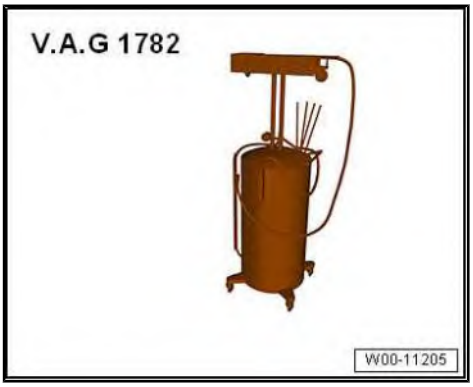
17 – Lubrication

1 Sump, oil pump

1.1 Removing and installing sump

Special tools and workshop equipment required

- Used oil collector and extractor - V.A.G 1782-



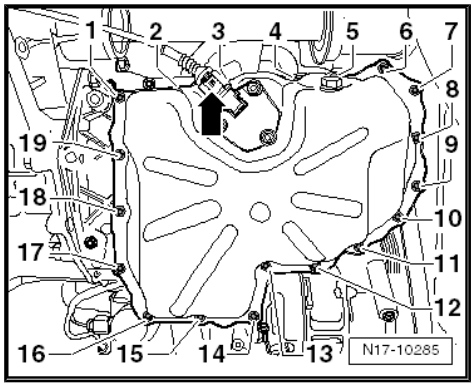
- Hand drill with plastic brush
- Safety goggles
- Silicone sealant ⇒ Electronic parts catalogue (ETKA)

Removing

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

– Drain engine oil ⇒ Maintenance ; Booklet 20.1 .

– Separate electrical connector from oil level and oil temperature sender - G266- .
– Unscrew bolts -1 … 19-.
– Remove sump; if necessary, loosen using light blows with a rubber-headed hammer.



Installing

Install in reverse order of removal, observing the following:

Note

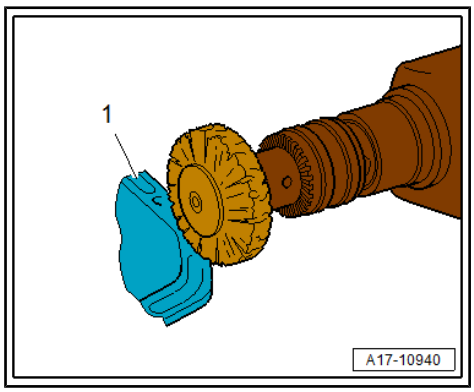
- *Observe use-by date of silicone sealant.*
- *The bead of sealant must not be thicker than specified, otherwise excess sealant can enter the sump and obstruct the strainer in the oil intake pipe.*
- *The sump must be installed within 5 minutes of applying silicone sealing compound.*
- *Let sealing compound dry for approx. 30 minutes after installing oil sump. Only then fill with engine oil.*

CAUTION

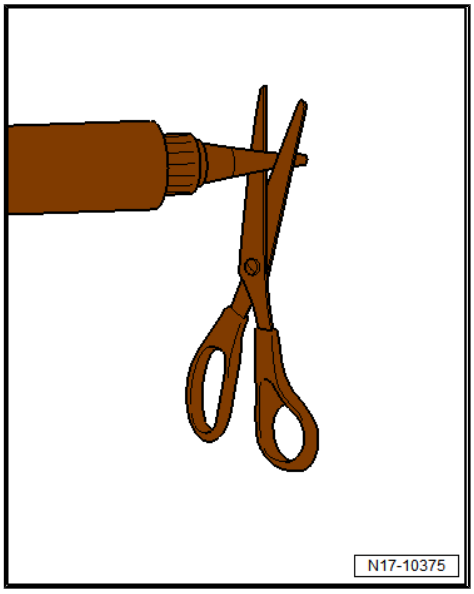
Risk of eye injury caused by sealant residue.
– Wear protective goggles.

– Remove sealant residues from sump upper part with a flat scraper.

– Remove sealant residue from sump (bottom section) using a rotating plastic brush, for example.



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



Note

Thickness of sealant bead: 2 to 3 mm.

– Apply silicone sealant ⇒ Electronic parts catalogue (ETKA) to clean sealing surface of sump (bottom section).

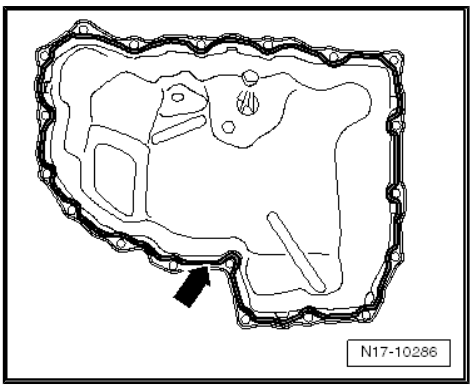
– Fit bottom section of sump immediately and tighten bolts -1 … 19- in 3 stages as follows:

1 - Tighten bolts by hand.

2 - Tighten bolts to 8 Nm.

3 - Turn bolts 45° further.

– Fill with engine oil ⇒ Maintenance ; Booklet 20.1 .

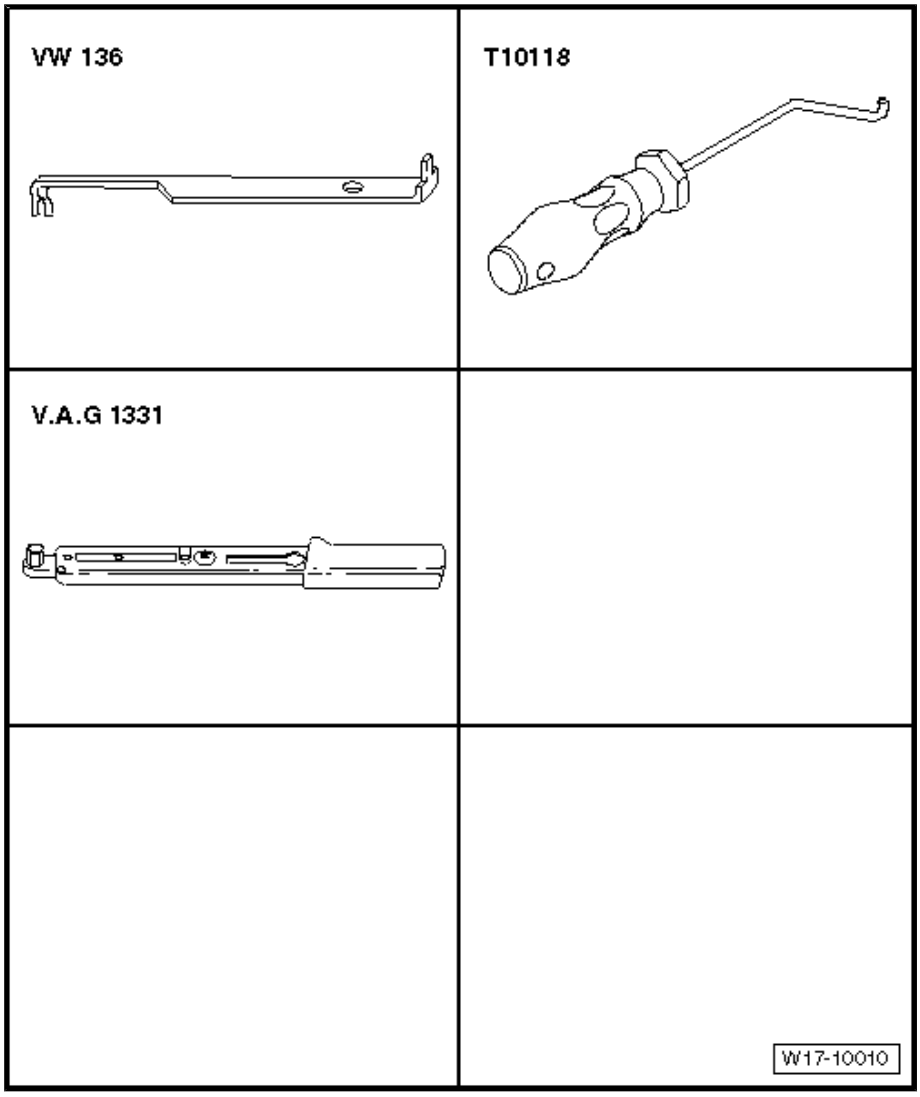


Specified torques

Component	Specified torque
Bolt	8 Nm +45°

1.2 Removing and installing upper part of sump

Special tools and workshop equipment required



- Assembly tool - T10118-
- Brake lining wear gauge - VW 136-
- Torque wrench - V.A.G 1331-
- Silicone sealant - D 174 003 A2-

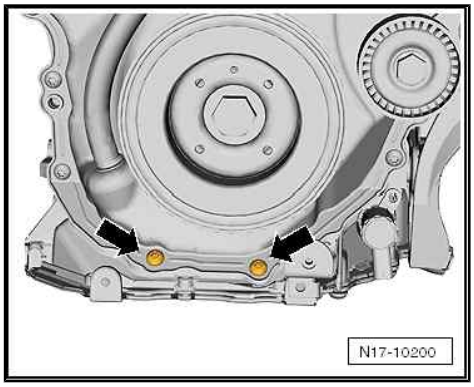
Removing

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

– Remove oil pump ⇒ page 152 .

– Remove sealing flange on gearbox side ⇒ page 53 .

– Unscrew bolts -arrows-.

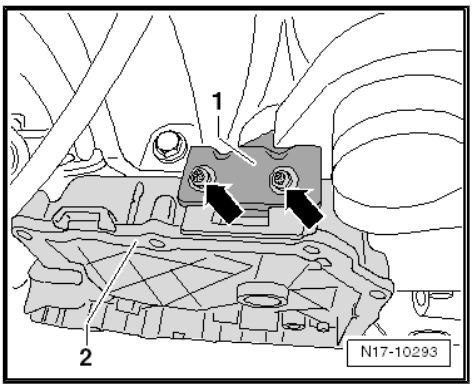


Note

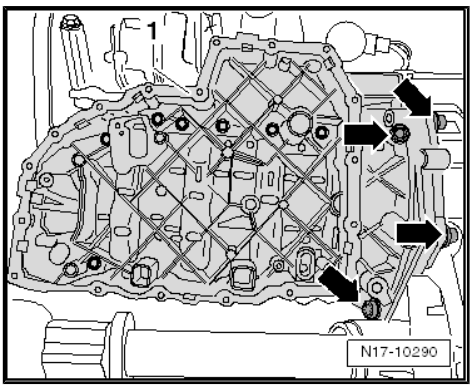
- *Danger of injury! When removing upper part of sump, spring of chain tensioner for oil pump drive jumps from upper part of sump to lower timing chain cover.*
- *When removing upper part of sump, do not grip between upper part of sump and lower timing chain cover.*

– Unscrew bolts -arrows-.

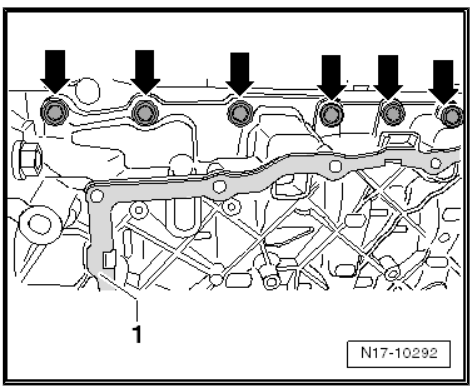
– Detach bracket of continued coolant circulation pump - V51- -1- from sump upper part -2-.



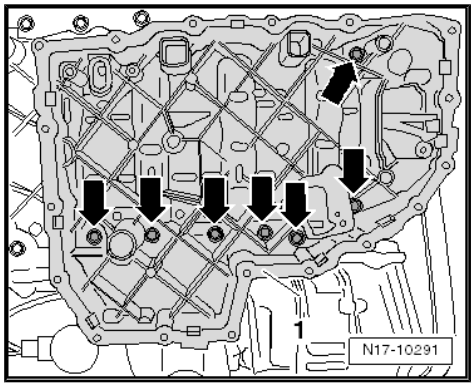
– Remove bolts -arrows- from the upper part -1- of the gearbox sump.



– Undo and remove bolts -arrows- from the outside of the oil sump upper part -1-.



– Unscrew bolts -arrows- securing top section of sump -1-.
– Carefully remove top section of sump.



Note

Lever off upper part of sump on gearbox side first. When levering off, exercise caution to ensure the timing chain cover is not bent in the process.

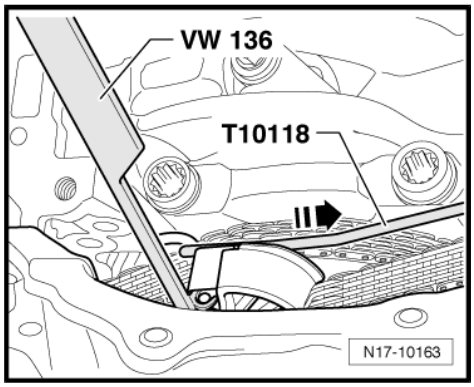
Installing

Install in reverse order of removal, observing the following:

Note

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

– Use assembly tool - T10118- to pull spring of chain tensioner for oil pump drive in direction of guide rail -arrow-.
– Insert brake lining wear gauge - VW 136- in hole of guide rail.



Note

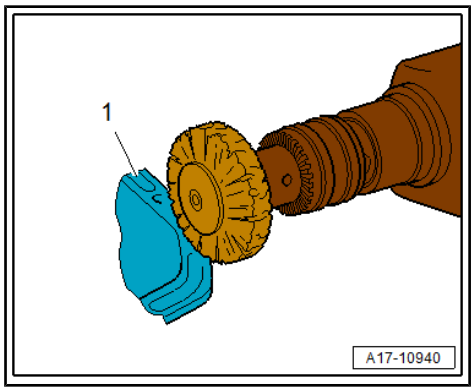
The spring is secured in this way.

– Remove sealant residues from cylinder block with a flat scraper.

CAUTION

Risk of eye injury caused by sealant residue.
– Wear protective goggles.

– Remove remaining sealant on sump (top section) and lower timing chain cover e.g. using rotating plastic brush.

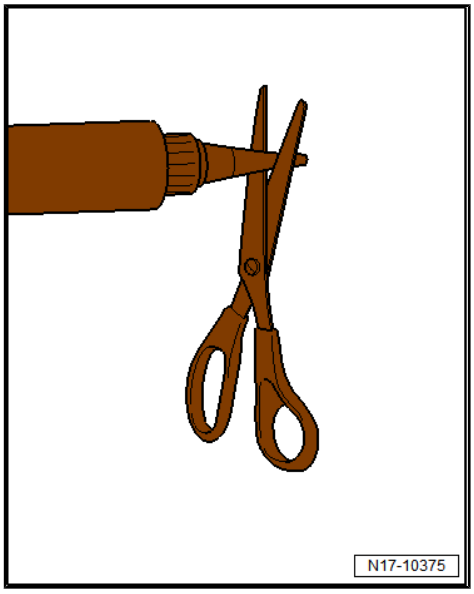


Note

Check timing chain cover for deformation. To do this, fit sump upper part first without sealant and check gap between cover and sump upper part. Renew cover if deformation is found which cannot be corrected. Renew cover once sump upper part has been installed.

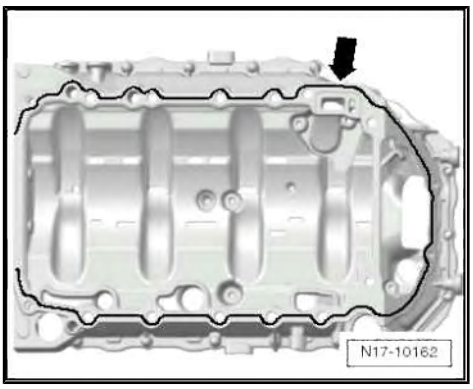
– Clean sealing surfaces until they are all oil- and grease-free.
– Check oil galleries in sump upper part and crankcase for soiling.

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



– Apply silicone sealant - D 174 003 A2- -arrow- to clean sealing surface of sump (top section).

• Thickness of sealant bead: 2 to 3 mm



Note

♦ *The sump upper part must be installed within 5 minutes of applying silicone sealing compound.*

♦ *The bead of sealant must not be thicker than specified, otherwise excess sealant can enter the sump and obstruct the strainer in the oil intake pipe.*

• Top section of sump and crankcase must be flush on gearbox side

– Fit sump upper part immediately and tighten bolts in 3 stages as follows:

1 - Tighten bolts by hand.

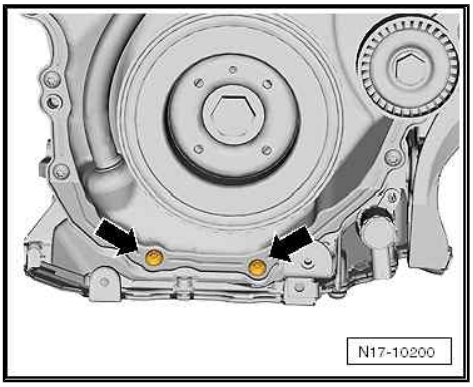
2 - Tighten bolts to 15 Nm.

3 - Turn bolts 90° further.

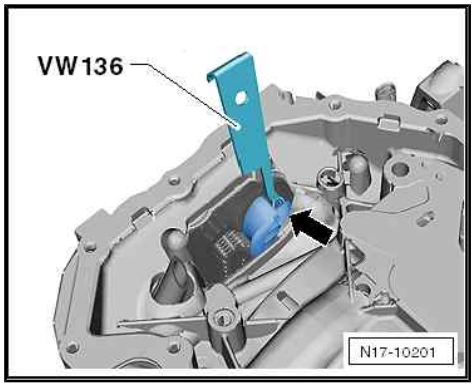
– Tighten bolts -arrows- in 2 stages:

– 1. Tighten bolts to 8 Nm.

– 2. Turn bolts 45° further.



– Pull brake lining wear gauge - VW 136- out of guide rail -arrow-.



Note

Spring now jumps back to installation position.

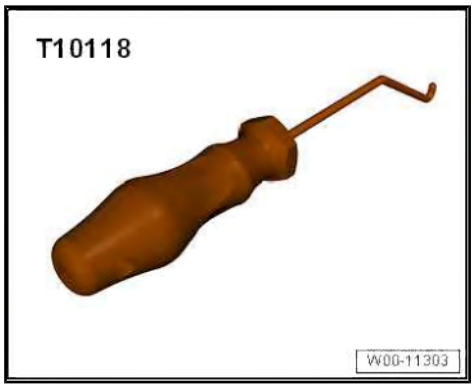
Specified torques

Component	Specified torque
Bolt securing top section of sump	15 Nm +90°
Bolts -arrows-	8 Nm +45°

1.3 Removing and installing oil pump

Special tools and workshop equipment required

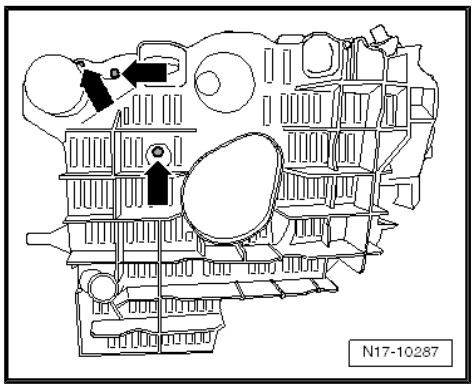
- Assembly tool - T10118-



Removing

– Remove sump (bottom section) ⇒ page 145 .

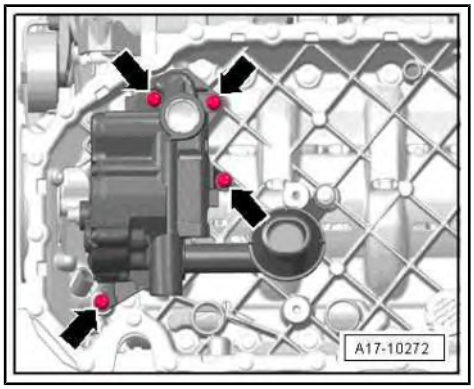
– Remove baffle plate -arrows-.



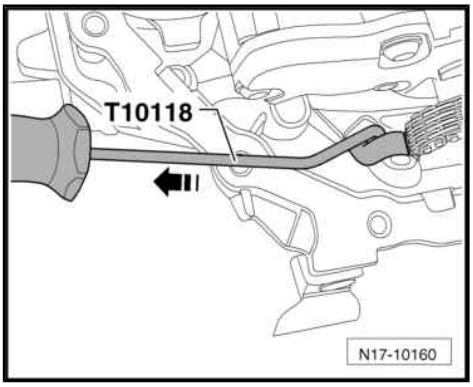
Note

The following procedure must be carried out in a single operation. This requires a second mechanic.

– Unscrew bolts -arrows-.
– Remove oil pump.



– Pull back chain tensioner using assembly tool - T10118- in direction of -arrow- and have oil pump removed by a second mechanic.



Installing

Install in reverse order of removal, observing the following:

– Before installing oil pump, check strainer in oil suction pipe and oil galleries in upper part of sump for soiling.
– Check that both centring sleeves for centring oil pump are present.
– Renew baffle plate.

Note

On the baffle plate are plastic ribs that are permanently deformed during tightening. The plastic rips ensure that the baffle plate rests without play and does not rattle. For this reason, the baffle plate should always be replaced.

Specified torques

Component	Specified torque
Bolts for oil pump	9 Nm
Bolts for baffle plate	9 Nm

1.4 Engine oil:

Engine oil specification and oil capacities

Capacities and specifications ⇒ Maintenance ; Booklet 20.1 ; Descriptions of work; Engine oil: capacities and specifications .

Note

- *The oil level must remain below the max. mark - danger of damage to catalytic converter!*
- *Check oil level ⇒ Maintenance ; Booklet 20.1 ; Descriptions of work; Oil level: check .*

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

Removing

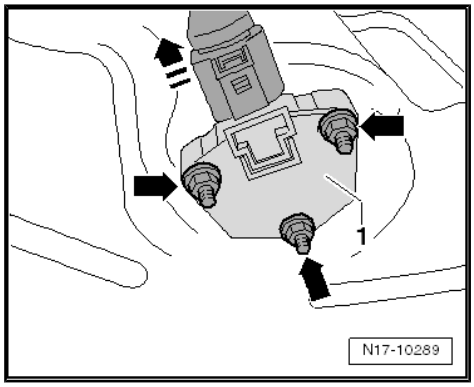
– If fitted, remove noise insulation ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Removing and installing noise insulation .

– Drain engine oil ⇒ Maintenance ; Booklet 20.1 .

– Separate electrical connector from oil level and oil temperature sender - G266- -1- in direction of -arrow-.

– Unscrew nuts -arrows-.

– Remove oil level and oil temperature sender - G266- -1-.



Installing

Install in reverse order of removal, observing the following:

Specified torques

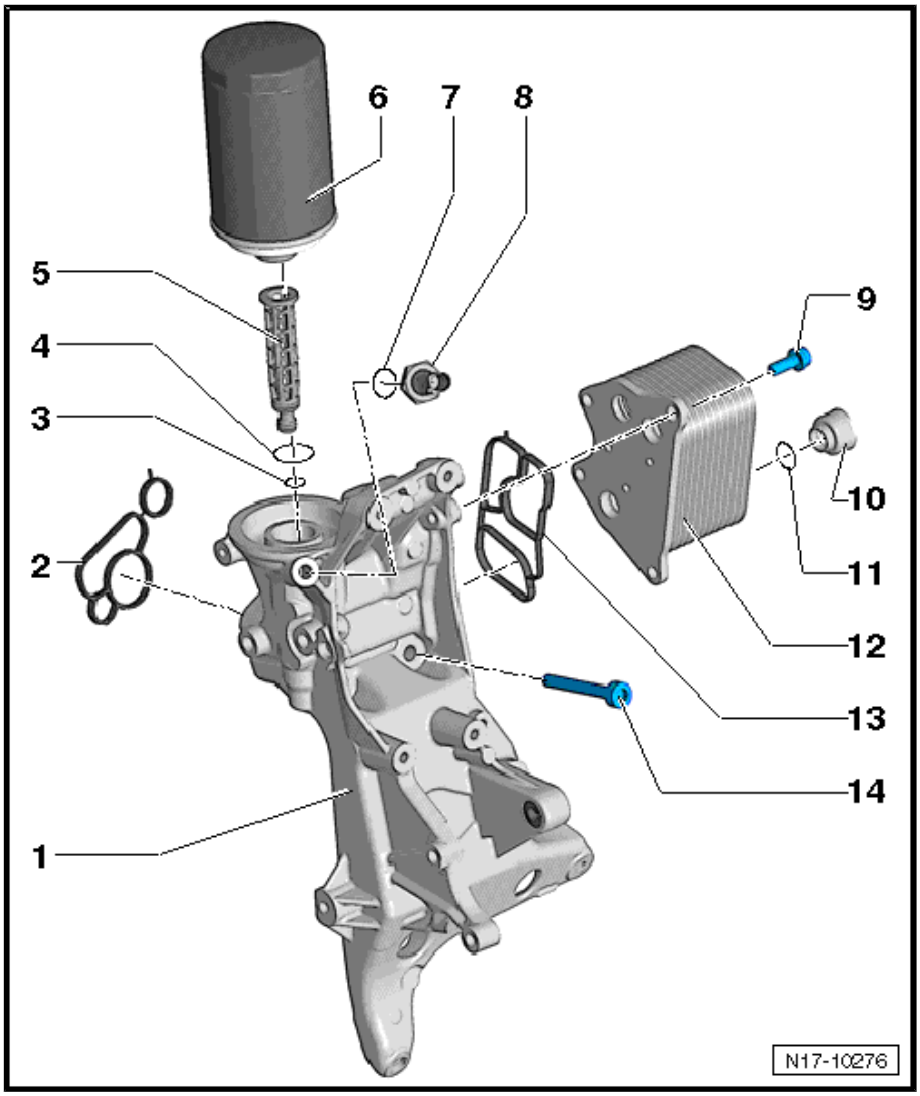
Component	Specified torque
Nuts	9 Nm

2 Engine oil cooler

⇒ "2.1 Assembly overview - engine oil cooler", page 155

⇒ "2.2 Removing and installing engine oil cooler", page 156

2.1 Assembly overview - engine oil cooler



1 - Ancillary bracket
- ❑ Removing and installing ⇒ page 43

2 - Seal
- ❑ Renew after removal

3 - O-ring
- ❑ Not replacement part. Include in items supplied with valve unit

4 - O-ring
- ❑ Not replacement part. Include in items supplied with valve unit

5 - Valve unit
- ❑ With O-rings

6 - Oil filter
- ❑ Remove and install with oil filter tool - 3417- .
- ❑ Removing and installing ⇒ Maintenance ; Booklet 20.1

7 - Seal
- ❑ Renew after removal

8 - Oil pressure switch - F22-
- ❑ Removing and installing ⇒ page 158
- ❑ Checking ⇒ Vehicle diagnostic tester
- ❑ 20 Nm

9 - Bolts
- ❑ Qty. 4
- ❑ 23 Nm

10 - Union

11 - Seal
- ❑ Renew after removal
- ❑ Moisten with coolant additive.

12 - Engine oil cooler
- ❑ Ensure clearance to adjacent components.
- ❑ Observe notes ⇒ page 156
- ❑ Removing and installing ⇒ page 156

13 - Seal
- ❑ Renew after removal

14 - Bolts

- ❑ Qty. 5
- ❑ Observe tightening sequence ⇒ page 34

2.2 Removing and installing engine oil cooler

Special tools and workshop equipment required

- ♦ Drip tray for workshop hoist - VAS 6208-

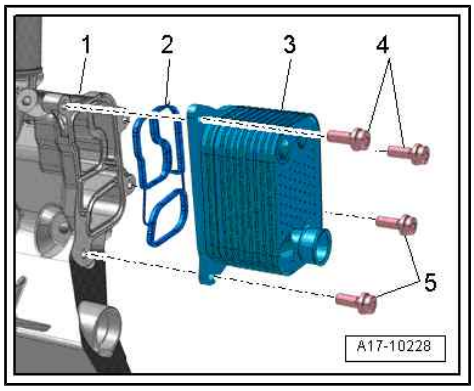
Removing

– Drain coolant ⇒ page 163 .

– Remove bracket for ancillaries ⇒ page 43 .

– Unscrew bolts -4- and -5-.

– Remove engine oil cooler -3- with seal -2-.



Installing

Install in reverse order of removal, observing the following:

Note

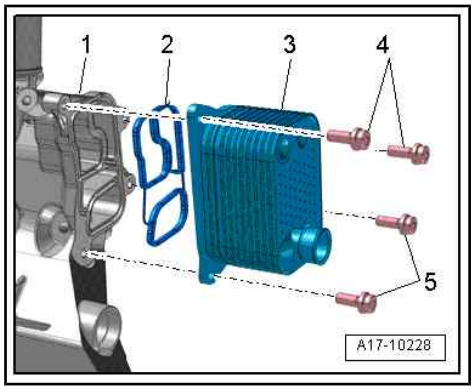
- ♦ *Renew gaskets and seals after each removal.*
- ♦ *Restore the factory standard by securing all of the hose connections with hose clips appropriately ⇒ Electronic parts catalogue (ETKA) .*

– Install engine oil cooler -3- with new seal -2-.

– Install bracket for ancillaries ⇒ page 43 .

– Add coolant ⇒ page 163 .

– Replenish engine oil and check oil level ⇒ Maintenance ; Booklet 20.1 ; Descriptions of work; Engine oil: draining or extracting; Renewing oil filter and replenishing engine oil .



Specified torques

- ♦ ⇒ “2.1 Assembly overview - engine oil cooler”, page 155

3 Crankcase ventilation

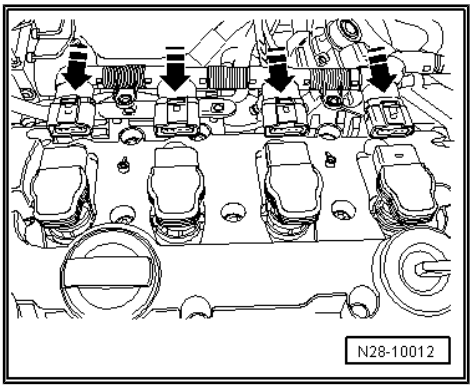
⇒ “3.1 Removing and installing oil separator”, page 157

3.1 Removing and installing oil separator

Removing

– Detach clamp from pressure hose for throttle valve module - J338- . Pull off pressure hose from throttle valve module - J338- and lay aside.

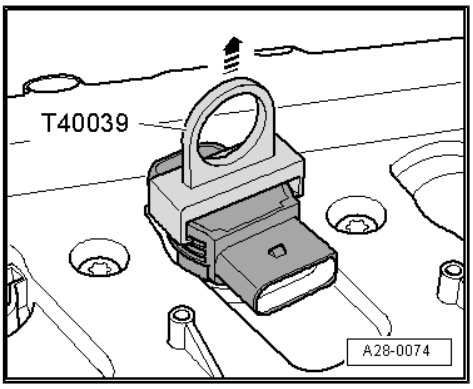
– Separate electrical connectors -arrows-, detaching them all from the ignition coils at the same time.



Note

Only the ignition coils of the third and fourth cylinders have to be pulled out.

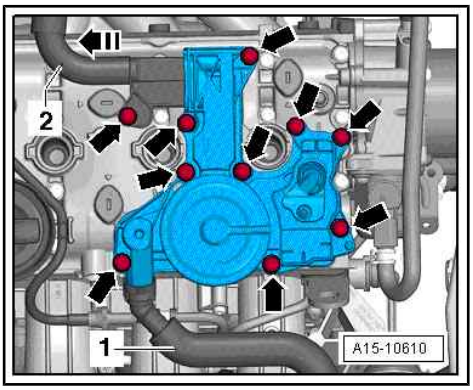
– Pull out ignition coils using puller - T40039- in direction of -arrow-.



– Pull off hose -1-.

– Unscrew bolts -arrows-.

– Remove oil separator and pull off from hose -2- for crankcase breather in direction of -arrow-.



Installing

Install in reverse order of removal, observing the following:

Note

- *Renew bolts that are tightened with specified further tightening angle.*
- *Renew gaskets, oil seals and self-locking nuts.*

Specified torques

- ⇒ “1.1 Assembly overview - cylinder head”, page 79

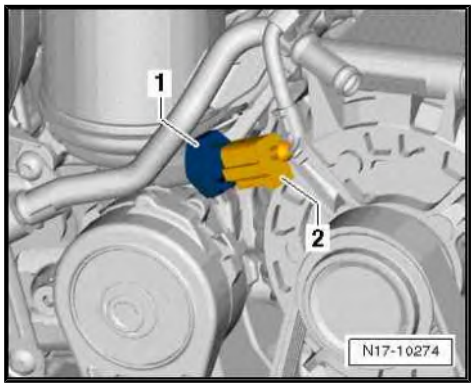
4 Oil filter, oil pressure switch

⇒ “4.1 Removing and installing oil pressure switch F22 ”, page 158

⇒ “4.2 Checking oil pressure”, page 158

4.1 Removing and installing oil pressure switch - F22-

Removing



Note

Place a cloth underneath bracket for ancillaries to catch any escaping engine oil.

– Separate electrical connector -2- on oil pressure switch - F22- -1-.

– Unscrew oil pressure switch - F22- -2-.

Installing

Install in reverse order of removal, observing the following:

Note

- *Renew seal.*
- *Insert new oil pressure switch - F22- immediately in bore to avoid loss of oil.*

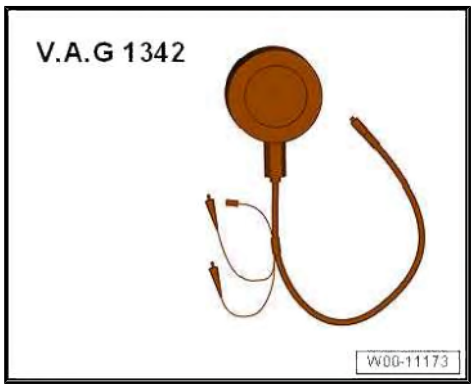
Specified torques

- ⇒ “2.1 Assembly overview - engine oil cooler”, page 155

4.2 Checking oil pressure

Special tools and workshop equipment required

- Oil pressure tester - V.A.G 1342-



Conditions for testing

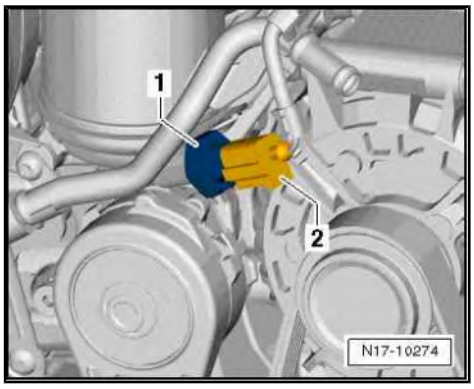
- Oil level OK.
- Engine oil temperature at least 80°C (radiator fan must have run once)

Test sequence

Note

Place a cloth underneath bracket for ancillaries to catch any escaping engine oil.

– Disconnect connector -2-.
– Unscrew oil pressure switch - F22- -1-.
– Screw oil pressure tester - V.A.G 1342- into oil filter bracket in place of oil pressure switch -1-.
– Start engine.
• Oil pressure at idling speed: 1.2 … 2.1 bar
• Oil pressure at 2000 rpm: 1.6 … 2.1 bar
• Oil pressure at 3700 rpm: 3.0 … 4.0 bar



Note

During the first 1000 km, the oil pressure at 2000 rpm can be between 3.0 and 4.0 bar.

Assembling

– Install oil pressure switch.

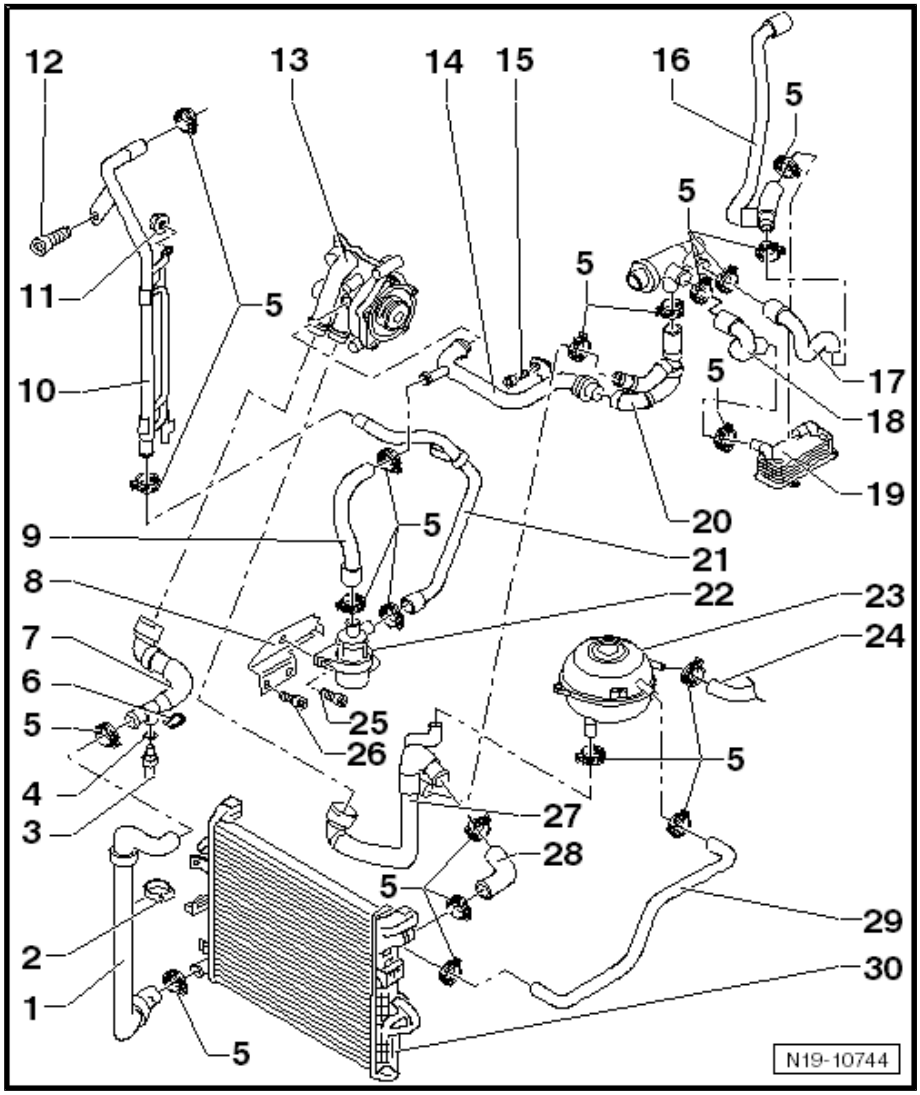
Specified torques

◆ ⇒ “2.1 Assembly overview - engine oil cooler”, page 155

19 – Cooling

1 Cooling system/coolant

1.1 Fitting location overview - cooling system



1 - Coolant hose

- ❑ Return

2 - Fastener

3 - Radiator outlet coolant temperature sender - G83-

- ❑ Removing and installing ⇒ page 183

4 - Seal

5 - Spring-type clip

6 - Retaining spring

7 - Coolant hose

- ❑ Return

8 - Bracket for continued coolant circulation pump - V51-

9 - Coolant hose

10 - Coolant pipe

11 - Nut

- ❑ 8 Nm

12 - Bolt

- ❑ 8 Nm

13 - Coolant pump

- ❑ Removing and installing ⇒ page 172

14 - Coolant pipe

15 - Oval hexagon socket head bolt

- ❑ 9 Nm

16 - Coolant hose

17 - Coolant hose

18 - Coolant hose

19 - Gear oil cooler

- ❑ On vehicles with dual clutch gearbox only.

20 - Coolant hose

21 - Coolant hose

22 - Continued coolant circulation pump - V51-

- ❑ Removing and installing ⇒ page 177

23 - Coolant expansion tank

24 - Coolant hose

25 - Bolt

- ❑ M6 x 22

26 - Bolt

- ❑ M6 x 12

27 - Coolant hose

- ❑ Supply

28 - Coolant hose

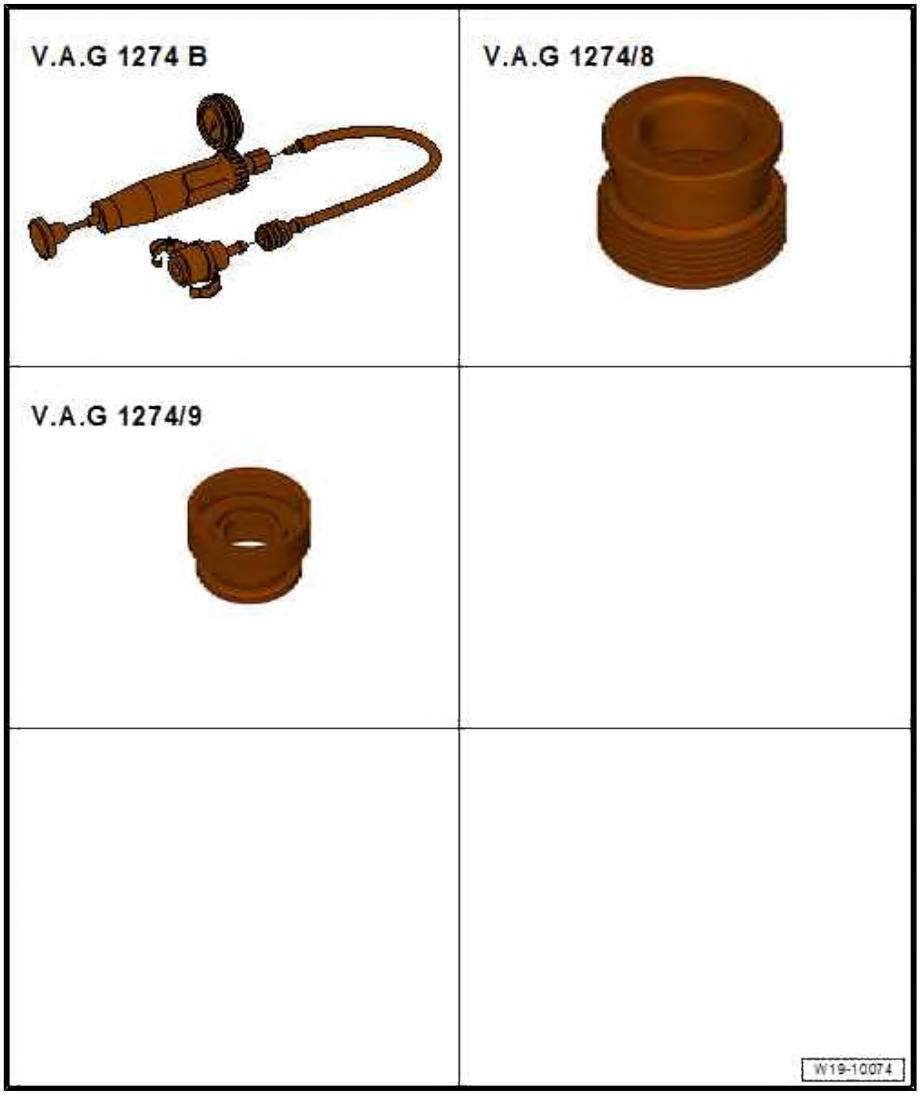
29 - Coolant hose

30 - Radiator/cooler

- ❑ Removing and installing ⇒ page 186

1.2 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-

Prerequisites for check

- Engine at operating temperature.
- Perform cooling system leak test using cooling system tester - V.A.G 1274- , adapter for cooling system tester - V.A.G 1274/8- and adapter for cooling system tester - V.A.G 1274/9-

Test sequence

CAUTION

On a warm engine, the cooling system is under high pressure. Danger of scalding by steam and hot coolant.

Skin and other parts of the body may be scalded.

– Wear protective gloves.

– Wear protective goggles.

– Reduce excess pressure by covering cap of coolant expansion tank with cloths and opening it carefully.

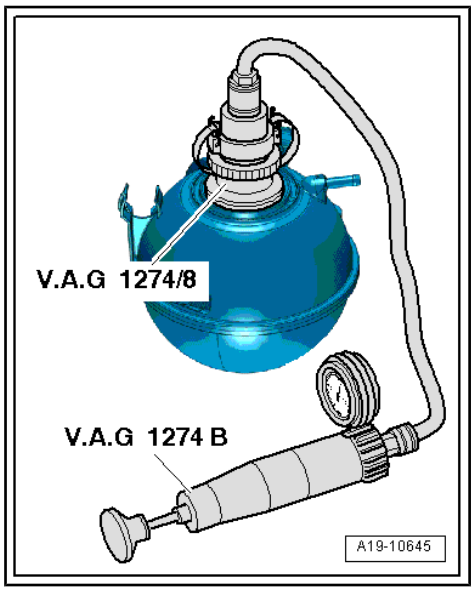
– Open filler cap on coolant expansion tank.

– 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- .

– Connect connector - V.A.G 1274 B/1- to cooling system tester - V.A.G 1274 B- using supplied hose.

– Using hand pump of tester, build up a pressure of approx. 1.0 bar.



Note

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 the pressure drops:

– Find leaks and rectify.

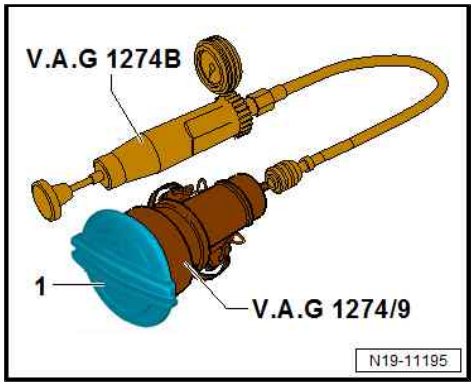
Check pressure relief valve in cap.

– Fit cooling system tester - V.A.G 1274 B- with adapter - V.A.G 1274/9- to filler cap -1-.

– Build up pressure using hand pump of cooling system tester.

- The pressure relief valve must open at a pressure of 1.4 to 1.6 bar.

– Renew filler cap, if pressure relief valve does not open as described.



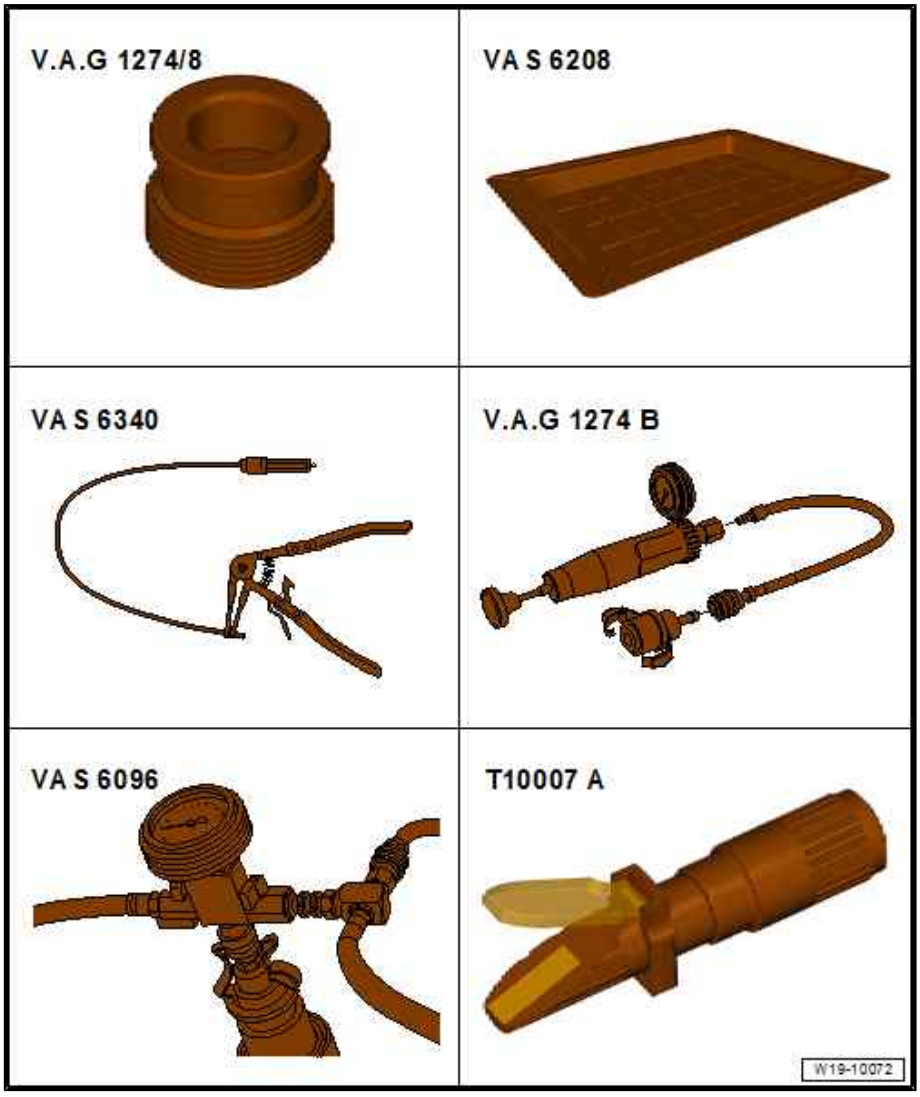
1.3 Draining and adding coolant

⇒ “1.3.1 Draining and adding coolant”, page 163

⇒ “1.3.2 Charging the cooling system in the case of emergency”, page 168

1.3.1 Draining and adding coolant

Special tools and workshop equipment required



- Adapter for cooling system tester - V.A.G 1274/8-
- Drip tray for workshop hoist - VAS 6208-
- Hose clamp pliers - VAS 6340-
- Cooling system tester - V.A.G 1274 B-
- Coolant system charge unit - VAS 6096-
- Refractometer - T10007 A-

Draining

CAUTION

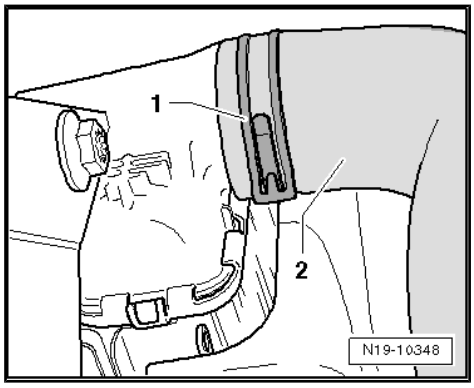
On a warm engine, the cooling system is under high pressure. Danger of scalding by steam and hot coolant.

Skin and other parts of the body may be scalded.

- **Wear protective gloves.**
- **Wear protective goggles.**
- **Reduce excess pressure by covering cap of coolant expansion tank with cloths and opening it carefully.**

– Open filler cap on coolant expansion tank.

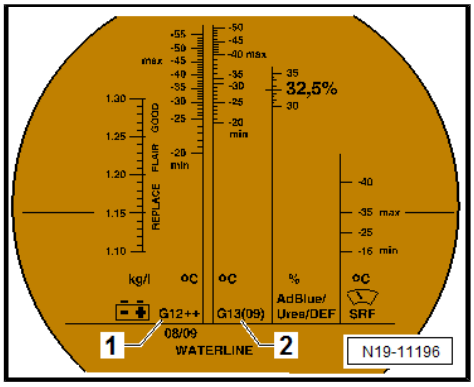
– Remove spring-type clip -1- and pull coolant hose downwards off radiator -2-.



Note

Please observe disposal instructions!

Filling



Note

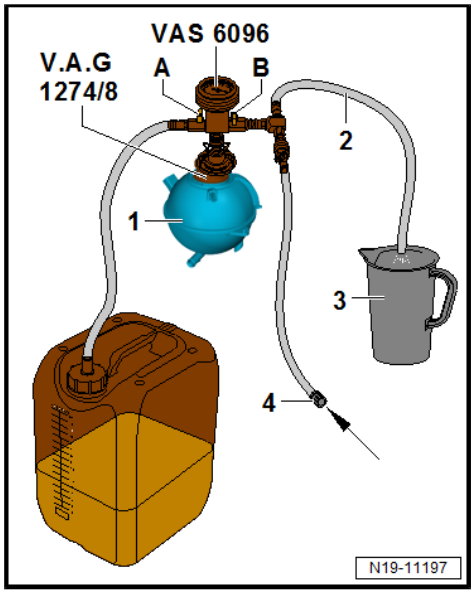
- *Use only distilled water for mixing coolant additives. The use of distilled water ensures optimum protection against corrosion.*
- *The water used for mixing has a major influence on the effectiveness of the coolant. Since water quality differs from country to country and even region to region, it is necessary to set a standard for the quality of water to be used. Distilled water fulfils all requirements. Therefore, always use only distilled water when mixing coolant for topping up or renewing coolant.*
- *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.*
- *Mixed in the proper proportions, coolant inhibits frost and corrosion damage as well as scaling. Such additives also raise the boiling point of the coolant. For this reason, the cooling system must be filled all-year-round with coolant additives.*
- *Because of its high boiling point, the coolant improves engine reliability under heavy loads, particularly in countries with tropical climates.*
- *The refractometer - T10007A- must be used to determine the current anti-freeze value.*
- *Frost protection must be guaranteed down to -25°C as a minimum and, in countries with arctic conditions, down to approx. -36°C. Increasing the frost protection is permissible only if climatic conditions require stronger frost protection. It may, however, be increased only to a maximum of -48°C. Otherwise, the cooling effect will be impaired.*
- *Do not reduce the coolant concentration by adding water even in warmer seasons and in warmer countries. Frost protection must be guaranteed down to at least -25°C.*
- *Read off anti-freeze figures for respective replenished coolant additives.*
- *The temperature read off the refractometer - T10007A- corresponds the »ice flocculation point«. Flakes of ice may start forming in the coolant below this temperature.*
- *Never reuse old coolant.*
- *Use only a water/coolant additive mixture as a slip agent for coolant hoses.*

Coolant mixture ratio

- Coolant additive (40 %) and distilled water (60 %) for frost protection to -25 °C
- Coolant additive (50%) and distilled water (50%) for frost protection to -36 °C
- Coolant additive ⇒ Electronic parts catalogue (ETKA)

– Reconnect coolant hoses, and secure them with clamps.

– Fill tank of cooling system charge unit - VAS 6096- with at least 8 litres of pre-mixed coolant in correct mixture ratio.



Note

The quantity may vary depending on the equipment level.

– Screw adapter for cooling system tester - V.A.G 1274/8- onto coolant expansion tank -1-.
– Install cooling system charge unit - VAS 6096- on adapter - V.A.G 1274/8- .
– Feed vent hose -2- into a small container -3-.

Note

Exhaust air takes a slight quantity of coolant along with it; this should be collected.

– Close valves -A- and -B- (turn lever transverse to direction of flow to do this).
– Connect hose -4- to compressed air.
• Pressure: 6 to 10 bar.

– Open valve -B-; turn lever in direction of flow to do this.

• In cooling system, vacuum is generated by suction jet pump; needle of gauge must move into green area.

– In addition, open valve -A- briefly by turning lever in direction of flow until expansion tank hose of cooling system charge unit - VAS 6096- fills with coolant.

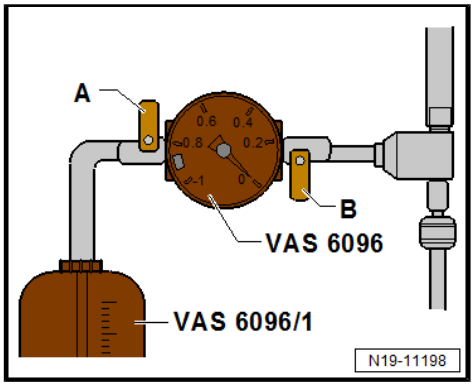
– Close valve -A- again.

– Leave valve -B- open for a further 2 minutes.

• Vacuum continues to be generated in the cooling system by the suction jet pump; the needle of gauge must remain in green range.

– Close valve -B-.

• The needle on the gauge should stop in the green zone. The vacuum level in the cooling system is then sufficient for subsequent filling.



Note

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

♦ *If vacuum drops, cooling system must be checked for leaks.*

– Pull off compressed air hose.

– Open valve -A-.

• The vacuum in the cooling system causes coolant to be extracted from coolant expansion tank of cooling system charge unit - VAS 6096- and the cooling system to be filled.

– Remove cooling system charge unit - VAS 6096- from coolant expansion tank.

– Fill coolant up to max. mark.

– Close coolant expansion tank.

– If fitted, switch off air conditioning system.

– Start engine and maintain engine speed at approx. 2000 rpm for about 3 minutes.

– Then run engine at idling speed until radiator fan cuts in.

CAUTION

On a warm engine, the cooling system is under high pressure. Danger of scalding by steam and hot coolant.

Skin and other parts of the body may be scalded.

– Wear protective gloves.

– Wear protective goggles.

– Reduce excess pressure by covering cap of coolant expansion tank with cloths and opening it carefully.

– Check coolant level and top up as needed.

• The coolant level must be at the max. marking when the engine is warm.

• When the engine is cold, the coolant level must be between min. and max. marking.

1.3.2 Charging the cooling system in the case of emergency

Note

- *The following steps only apply in the case of a breakdown.*
- *Here, the cooling system is charged without using the cooling system charge unit - VAS 6096- .*
- *Charging in the case of an emergency is only permissible to keep the vehicle mobile and does not replace the proper charging procedure according to the repair manual.*
- *After an emergency charging, the vehicle should be brought to a workshop as soon as possible where the cooling system should be filled properly in accordance with the repair manual.*

Sequence of operations

CAUTION

On a warm engine, the cooling system is under high pressure. Danger of scalding by steam and hot coolant.

Skin and other parts of the body may be scalded.

– Wear protective gloves.

– Wear protective goggles.

– Reduce excess pressure by covering cap of coolant expansion tank with cloths and opening it carefully.

– Open filler cap on coolant expansion tank.

Note

- *Use only distilled water for mixing coolant additives. The use of distilled water ensures optimum protection against corrosion.*
- *The water used for mixing has a major influence on the effectiveness of the coolant. Since water quality differs from country to country and even region to region, it is necessary to set a standard for the quality of water to be used. Distilled water fulfils all requirements. Therefore, always use only distilled water when mixing coolant for topping up or renewing coolant.*
- *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.*
- *Mixed in the proper proportions, coolant inhibits frost and corrosion damage as well as scaling. Such additives also raise the boiling point of the coolant. For this reason, the cooling system must be filled all-year-round with coolant additives.*
- *Because of its high boiling point, the coolant improves engine reliability under heavy loads, particularly in countries with tropical climates.*
- *The refractometer - T10007A- must be used to determine the current anti-freeze value.*
- *Frost protection must be guaranteed down to -25°C as a minimum and, in countries with arctic conditions, down to approx. -36°C. Increasing the frost protection is permissible only if climatic conditions require stronger frost protection. It may, however, be increased only to a maximum of -48°C. Otherwise, the cooling effect will be impaired.*
- *Do not reduce the coolant concentration by adding water even in warmer seasons and in warmer countries. Frost protection must be guaranteed down to at least -25°C.*
- *Read off anti-freeze figures for respective replenished coolant additives.*
- *The temperature read off the refractometer - T10007A- corresponds the ice flocculation point. Flakes of ice may start forming in the coolant below this temperature.*
- *Never reuse old coolant.*
- *Use only a water/coolant additive mixture as a slip agent for coolant hoses.*

Coolant mixture ratio

- Coolant additive (40 %) and distilled water (60 %) for frost protection to -25 °C
- Coolant additive (50%) and distilled water (50%) for frost protection to -36 °C
- Coolant additive ⇒ Electronic parts catalogue (ETKA)

– Fill a suitable container with pre-mixed coolant observing the correct mixing ratio.

– Fill the cooling system via the coolant expansion tank up to max. marking.

– Close coolant expansion tank.

– If fitted, switch off air conditioning system.

– Start engine and maintain engine speed at approx. 2000 rpm for about 3 minutes.

– Then run engine at idling speed until radiator fan cuts in.

⚠ CAUTION

On a warm engine, the cooling system is under high pressure. Danger of scalding by steam and hot coolant.

Skin and other parts of the body may be scalded.

– Wear protective gloves.

– Wear protective goggles.

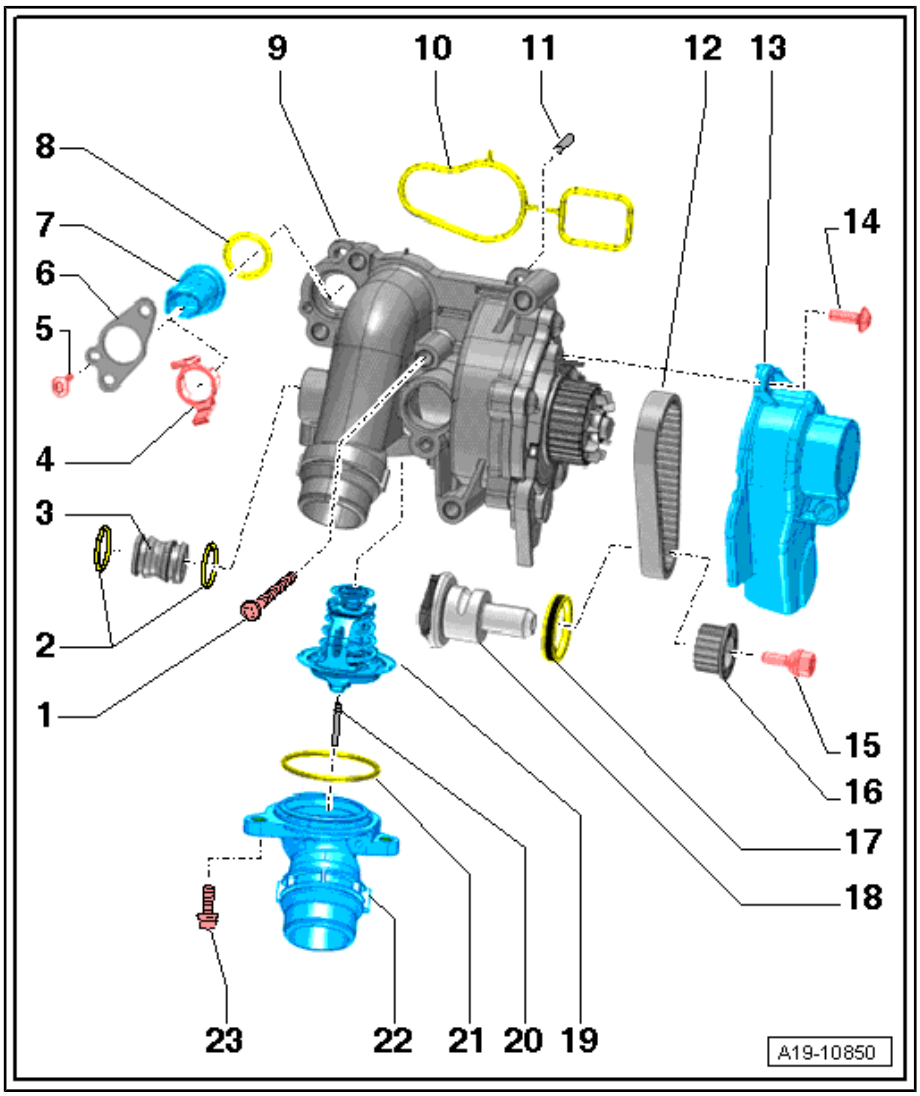
– Reduce excess pressure by covering cap of coolant expansion tank with cloths and opening it carefully.

– Check coolant level and top up as needed.

- The coolant level must be at the max. marking when the engine is warm.
- When the engine is cold, the coolant level must be between min. and max. marking.

2 Coolant pump, regulation of cooling system

2.1 Assembly overview - coolant pump, thermostat



1 - Bolts
- ❑ Qty. 5
- ❑ Observe tightening sequence ⇒ page 172
- ❑ 9 Nm

2 - O-rings
- ❑ Qty. 2
- ❑ Renew after removal

3 - Union

4 - Retaining clip
- ❑ Only for inserted version.
- ❑ Ensure firm seating

5 - Bolt
- ❑ Only for screwed version.
- ❑ 4 Nm

6 - Support plate
- ❑ Only for screwed version.

7 - Radiator outlet coolant - G62-
- ❑ Removing and installing ⇒ page 182

8 - O-ring
- ❑ Renew after removal

9 - Coolant pump
- ❑ New coolant pump: remove protective cap
- ❑ Removing and installing ⇒ page 172

10 - Seal
- ❑ Renew after removal

11 - Centring pins
- ❑ Qty. 2

12 - Toothed belt
- ❑ Removing and installing ⇒ page 180

13 - Toothed belt guard

14 - Bolt
- ❑ 9 Nm

15 - Bolt
- ❑ Renew after removal
- ❑ Left-hand thread
- ❑ 10 Nm +90°

16 - Toothed belt drive sprocket
- ❑ Observe installation position

17 - Oil seal
- ❑ Renew after removal
- ❑ Removing and installing ⇒ page 175

18 - Balancer shaft
- ❑ Removing and installing ⇒ page 64

19 - Thermostat
- ❑ Removing and installing ⇒ page 179

20 - Centring pin

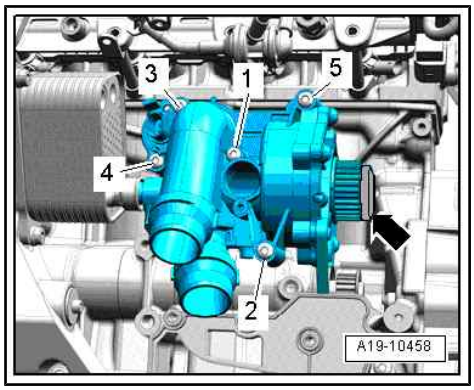
21 - O-ring
- ❑ Renew after removal

22 - Union

23 - Bolt
- ❑ 9 Nm

Coolant pump - tightening sequence

– Tighten bolts for coolant pump in the sequence -1 … 5-.



2.2 Removing and installing coolant pump

⇒ “2.2.1 Removing and installing coolant pump”, page 172

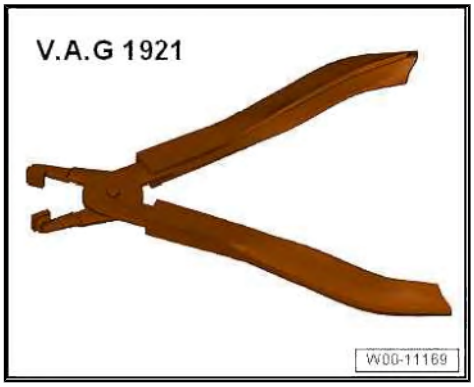
⇒ “2.2.2 Renewing oil seal for coolant pump drive”, page 175

⇒ “2.2.3 Removing and installing continued coolant circulation pump V51 ”, page 177

2.2.1 Removing and installing coolant pump

Special tools and workshop equipment required

♦ Hose clamp pliers - V.A.G 1921-



⚠ CAUTION

On a warm engine, the cooling system is under high pressure. Danger of scalding by steam and hot coolant.

Skin and other parts of the body may be scalded.

- **Wear protective gloves.**
- **Wear protective goggles.**
- **Reduce excess pressure by covering cap of coolant expansion tank with cloths and opening it carefully.**

Removing

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

– Move to service position ⇒ General body repairs, exterior; Rep. gr. 50 ; Lock carrier; Moving to and back from service position .

– Remove toothed belt for coolant pump ⇒ page 180 .

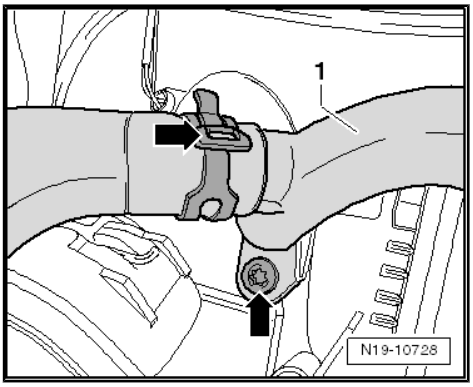
– Drain coolant ⇒ page 163 .

– Loosen clamp -arrow-.

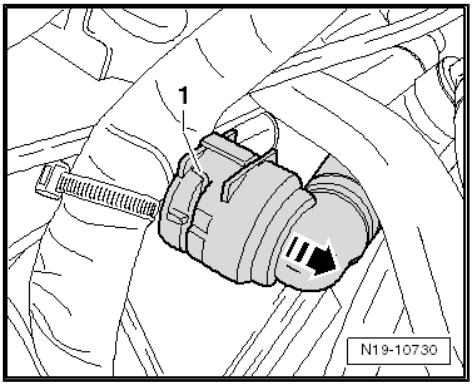
– Pull off hose.

– Unscrew bolt -arrow-.

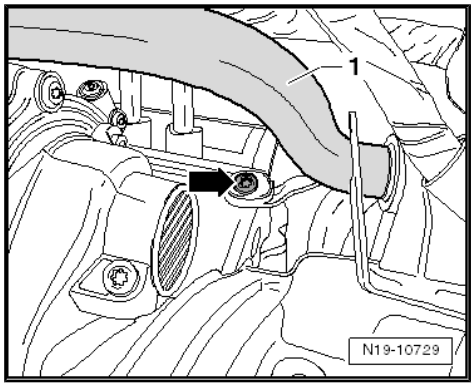
– Remove coolant pipe -1-.



– Lift up clip -1- and pull off water hose from water pipe in direction of arrow.



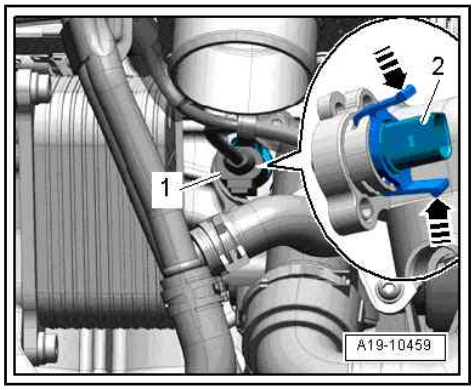
– Unscrew bolt -arrow- from water pipe -1-.
– Remove water pipe -1-.



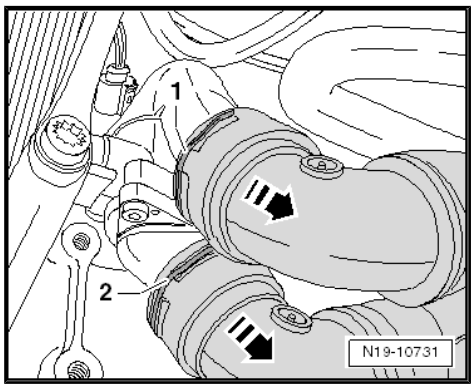
– Disconnect electrical connector -1- at coolant temperature sender - G62- .

Note

Disregard -2- and -arrows-.



– Lift retaining clips -1- and -2-.
– Pull off coolant hoses and lay aside.



– Remove bolts -1 … 5-.
– Detach coolant pump from centring pin and pull off engine oil cooler.

Note

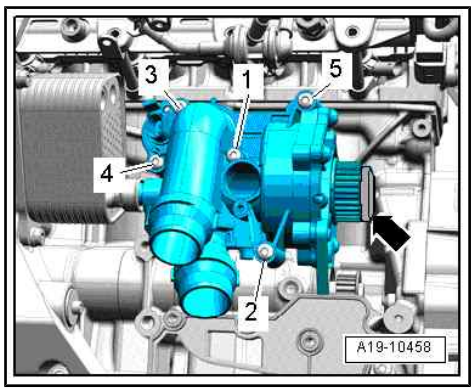
Disregard -arrow-.

Installing

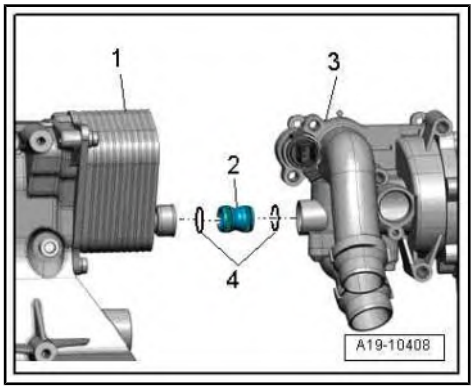
Install in reverse order of removal, observing the following:

Note

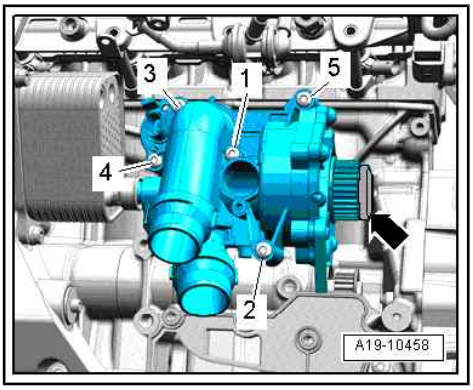
Renew seals and O-rings.



– Coat O-rings -4- with coolant; coolants ⇒ Electronic parts catalogue (ETKA) .
– Check whether the two centring pins are fitted in the cylinder block; install if necessary.
– Fit connecting piece -2- into engine oil cooler -1-.
– Push coolant pump -3- onto connecting piece and centring pin into cylinder block.



– Tighten bolts for coolant pump.



Note

Remove protective cap -arrow- if a new coolant pump has been fitted.

– Fit toothed belt for coolant pump ⇒ page 180 .
– Install coolant pipe.
– Add coolant ⇒ page 163 .

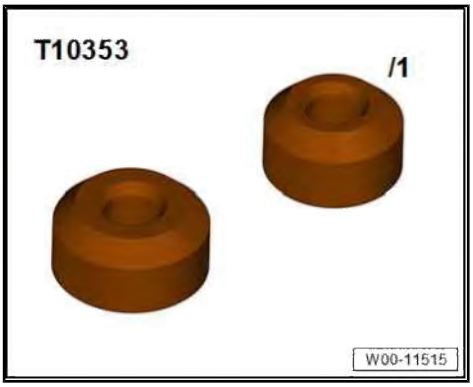
Specified torques

♦ ⇒ “2.1 Assembly overview - coolant pump, thermostat”, page 171

2.2.2 Renewing oil seal for coolant pump drive

Special tools and workshop equipment required

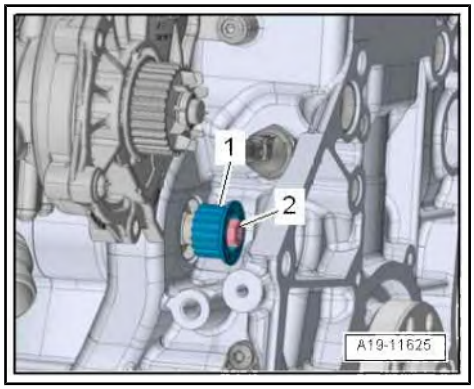
♦ Thrust piece - T10353-



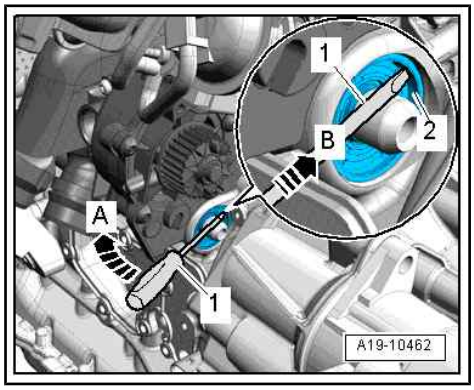
Removing

– Remove toothed belt for coolant pump ⇒ page 180 .

– Unscrew bolt -2-.
– Detach drive sprocket -1- for toothed belt for coolant pump.



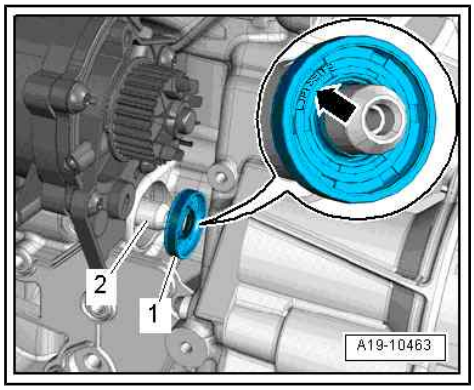
– Press screwdriver -1- firmly onto section -2- of oil seal -arrow B-.
– Lever out seal using screwdriver -1- in direction of -arrow A-.
– Clean contact surface and sealing surface.



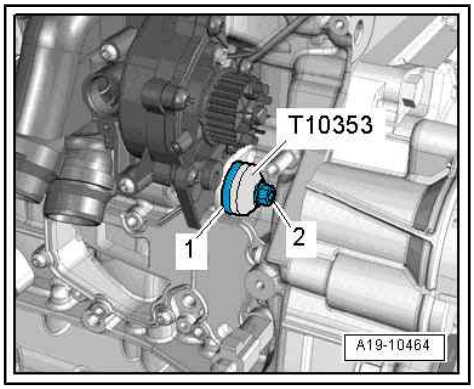
– Lubricate sealing surface of balance shaft -2- with gear oil.
– Fit seal -1- onto balance shaft.

Note

Inscription -arrow- must be readable from above.



– Apply thrust piece - T10353- to oil seal -1- and press into cylinder block as far as possible using bolt -2- (take care not to cant oil seal).



Note

- *Risk of damage to thread.*
- *The drive sprocket bolt has a left-hand thread.*

Installing

Install in reverse order of removal, observing the following:

– Fit toothed belt for coolant pump ⇒ page 180 .

– Install small coolant pipe.

Note

Never reuse old coolant.

– Add coolant ⇒ page 163 .

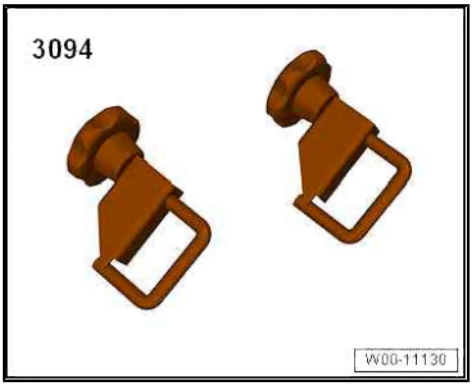
Specified torques

- ⇒ “2.1 Assembly overview - coolant pump, thermostat”, page 171

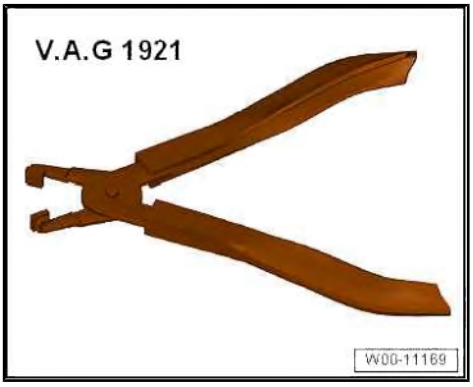
2.2.3 Removing and installing continued coolant circulation pump - V51-

Special tools and workshop equipment required

- Hose clamps to 25 mm - 3094-



- Hose clamp pliers - V.A.G 1921-



- Drip tray for workshop hoist - VAS 6208-

Removing

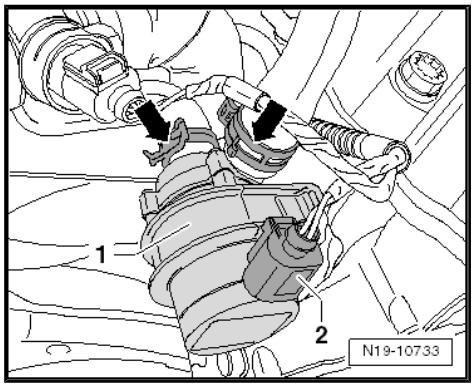
Note

To collect the escaping coolant, place drip tray for workshop hoist - VAS 6208- underneath.

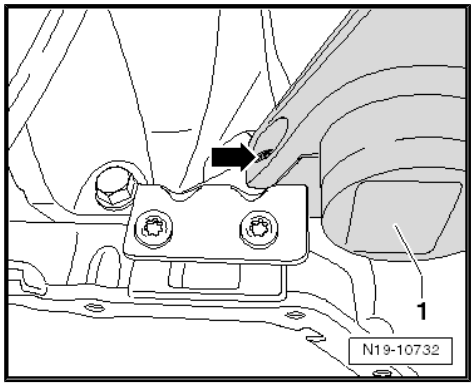
– If fitted, remove noise insulation ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Removing and installing noise insulation .

– Clamp off coolant hoses -arrows- using hose clamps to 25 mm - 3094- and remove.

– Disconnect connector -2-.



– Undo bolt -arrow- and remove coolant circulation pump - V51- -1-.



Installing

Install in reverse order of removal, observing the following:

Note

- *Hose unions and air intake pipes and hoses must be free of oil and grease before installation.*
- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*

– Check coolant level ⇒ page 163 .

Specified torques

Component	Specified torque
Bolt	8 Nm

2.3 Removing and installing thermostat

Removing

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

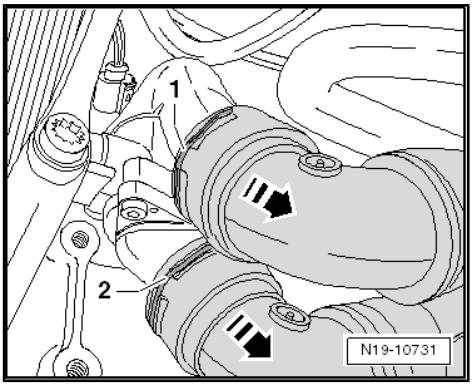
– Move to service position ⇒ General body repairs, exterior; Rep. gr. 50 ; Lock carrier; Moving to and back from service position .

– Drain coolant ⇒ page 163 .

Note

Only the lower water hose has to be removed.

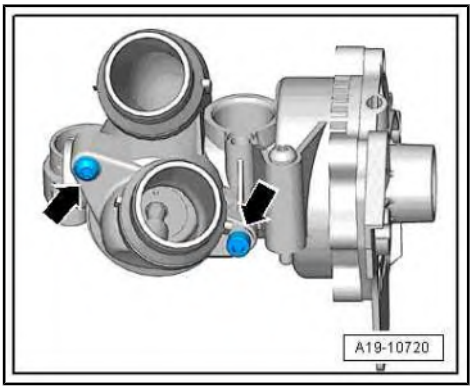
– Lift retaining clip -2- and pull off coolant hose.



– Unscrew bolts -arrows-.

– Remove connection.

– Detach thermostat.



Installing

Install in reverse order of removal, observing the following:

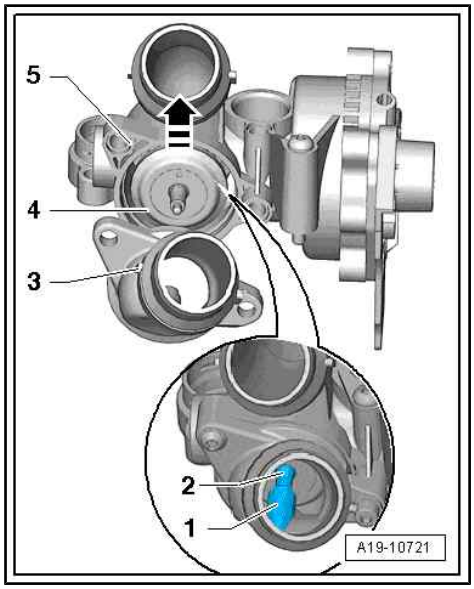
Note

Renew seals and O-rings.

– Clean sealing surface for O-ring.

– Coat O-ring with coolant; coolants ⇒ Electronic parts catalogue (ETKA) .

– Insert thermostat -4- in coolant pump housing -5- and swivel forwards slightly -arrow-.
– Fit connection -3- carefully (insert centralising pin -2- in guide -1-).
– Add coolant ⇒ page 163 .



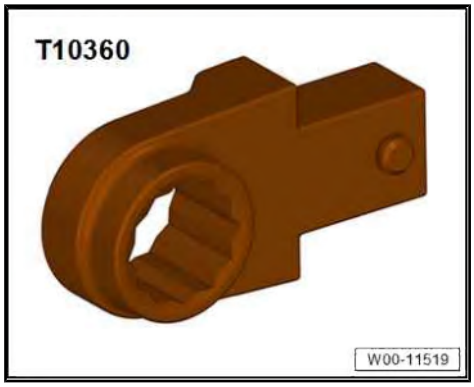
Specified torques

♦ ⇒ “2.1 Assembly overview - coolant pump, thermostat”, page 171

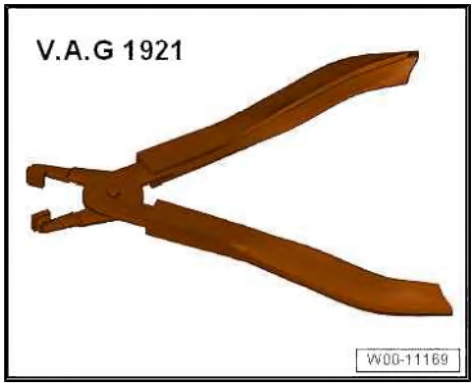
2.4 Removing and installing toothed belt for coolant pump

Special tools and workshop equipment required

♦ Insert tool - T10360-



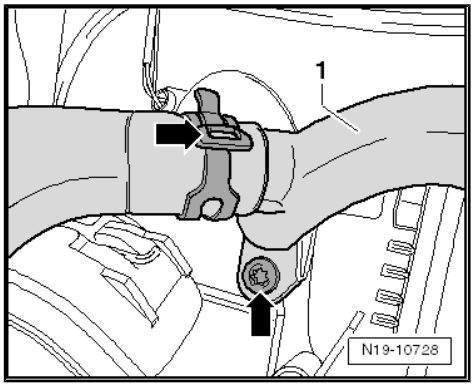
♦ Hose clamp pliers - V.A.G 1921-



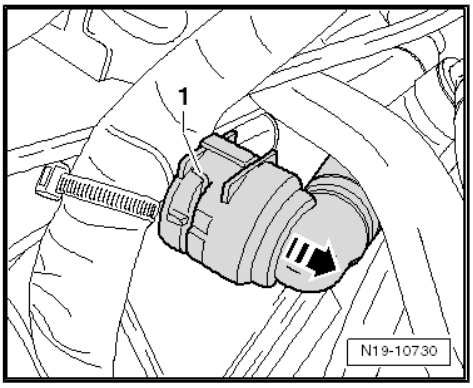
Removing

– If fitted, remove noise insulation ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Removing and installing noise insulation .
– Move to service position ⇒ General body repairs, exterior; Rep. gr. 50 ; Lock carrier; Moving to and back from service position .
– Drain coolant ⇒ page 163 .

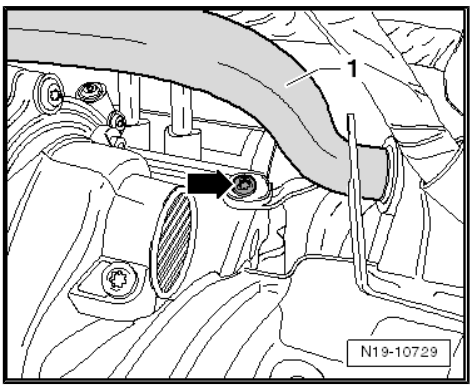
– Loosen clamp -arrow-.
– Pull off hose.
– Unscrew bolt -arrow-.
– Remove coolant pipe -1-.



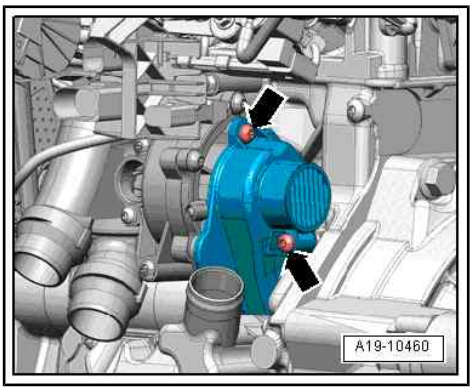
– Lift up clip -1- and pull off water hose from water pipe in direction of arrow.



– Unscrew bolt -arrow- from water pipe -1-.
– Remove water pipe -1-.



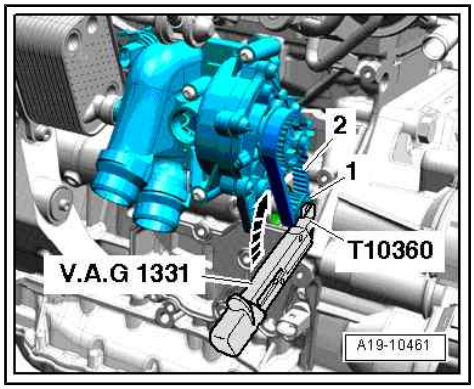
– Unscrew bolts -arrows- and remove toothed belt guard.



Note

The drive sprocket bolt has a left-hand thread.

– Use torque wrench - V.A.G 1331- and socket - T10360- to remove bolt on coolant pump drive sprocket -1- (counterhold at vibration damper.



– Detach drive sprocket -1- and toothed belt -2-.

Installing

Install in reverse order of removal, observing the following:

Note

- *Replace bolt for drive sprocket.*
- *Renew seals and O-rings.*
- *Note installation position of V-belt pulley* ⇒ page 171 .

– Install coolant pipe.

– Add coolant ⇒ page 163 .

Specified torques

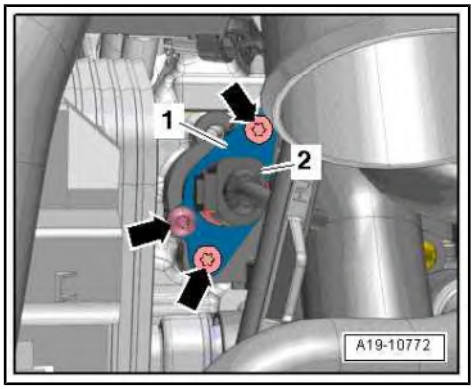
- ⇒ “2.1 Assembly overview - coolant pump, thermostat”, page 171

2.5 Removing and installing coolant temperature sender - G62-

Special tools and workshop equipment required

- Drip tray for workshop hoist - VAS 6208-

Removing



- Engine cold

– Move to service position ⇒ General body repairs, exterior; Rep. gr. 50 ; Lock carrier; Moving to and back from service position .

– Disconnect connector -2-.

– Place drip tray for workshop hoist - VAS 6208- underneath.

– Unscrew bolts -arrows-.

– Detach retaining plate -1-.

– Remove coolant temperature sender - G62- .

Installing

Install in reverse order of removal, observing the following:

Note

- *Renew O-rings after removal.*
- *Insert new coolant temperature sender - G62- immediately into connection to avoid loss of coolant.*

– Add coolant ⇒ page 163 .

Specified torques

- ⇒ “2.1 Assembly overview - coolant pump, thermostat”, page 171

2.6 Removing and installing radiator outlet coolant temperature sender - G83-

Special tools and workshop equipment required

- Drip tray for workshop hoist - VAS 6208-

Removing

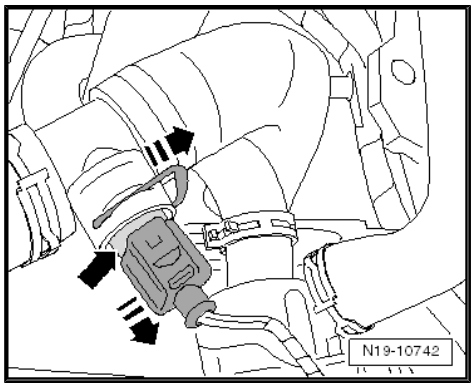
- Engine cold

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

Note

- *To collect the escaping coolant, place drip tray for workshop hoist - VAS 6208- underneath.*
- *Fit new radiator outlet coolant temperature sender - G83- immediately into union to avoid loss of coolant.*

– Separate electrical connector on radiator outlet coolant temperature sender - G83- in direction of -arrow-.
– Pull out securing clip in direction of -arrow-.
– Remove radiator outlet coolant temperature sender - G83- -arrow-.



Installing

Install in reverse order of removal, observing the following:

Note

- *Renew O-rings after removal.*
- *Hose connections and coolant pipes/hoses must be free of oil and grease before installing them.*
- *Restore the factory standard by securing all of the hose connections with hose clips appropriately ⇒ Electronic parts catalogue (ETKA) .*

– If present, install noise insulation ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Removing and installing noise insulation .
– Check coolant level ⇒ page 163 .

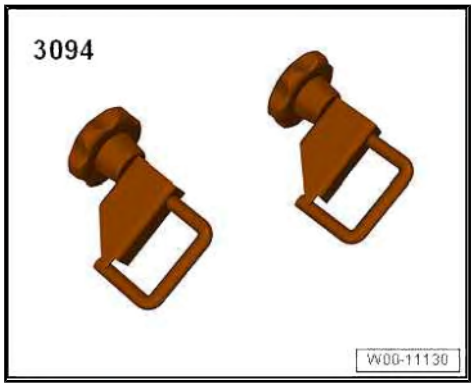
2.7 Removing and installing coolant valves

⇒ “2.7.1 Removing and installing 3/2-way valve”, page 184

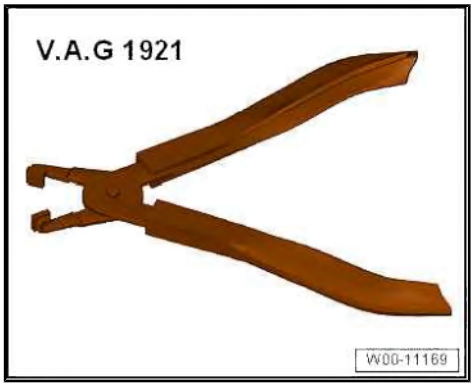
2.7.1 Removing and installing 3/2-way valve

Special tools and workshop equipment required

- Hose clamps to 25 mm - 3094-



- Hose clamp pliers - V.A.G 1921-

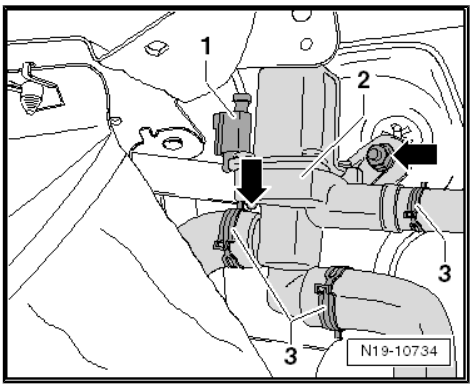


Removing

Note

Place a cloth under water hoses to absorb escaping coolant.

- Release clips -3-.
- Pull off water hoses from 3/2-way valve -2-.
- Separate connector -1-.
- Unscrew nuts -arrows-.
- Remove 3/2-way valve.



Installing

Install in reverse order of removal, observing the following:

Note

- *Hose unions and air intake pipes and hoses must be free of oil and grease before installation.*
- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*

- Check coolant level ⇒ page 163 .

Specified torques

Component	Specified torque
Nut	8 Nm

3 Radiator, radiator fan

3.1 Assembly overview - radiator/radiator fan

1 - Radiator/cooler

- ❑ Removing and installing ⇒ page 186

2 - Radiator fan

- ❑ Removing and installing ⇒ page 191

3 - Bolts

- ❑ Qty. 3
- ❑ 5 Nm

4 - Bolts

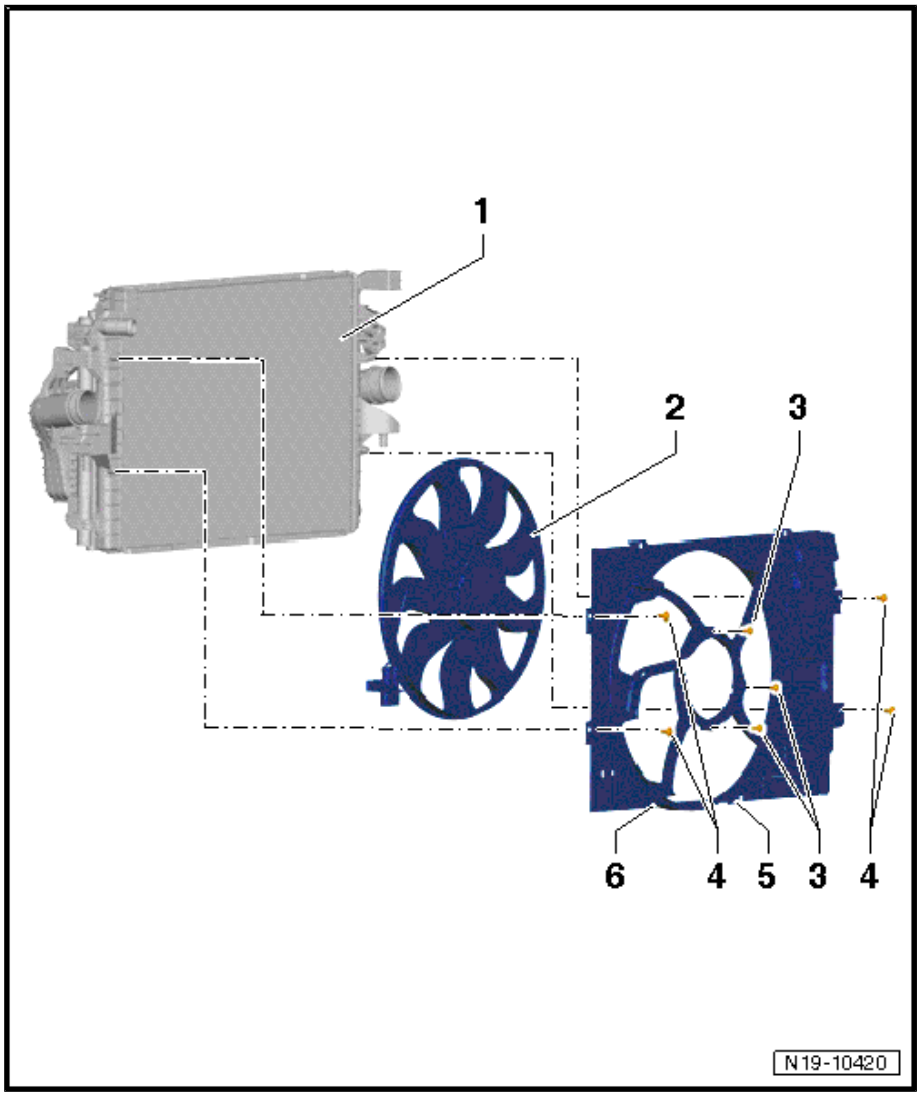
- ❑ Qty. 4
- ❑ 5 Nm

5 - Retainer tab

- ❑ Must be engaged in radiator.

6 - Radiator cowl

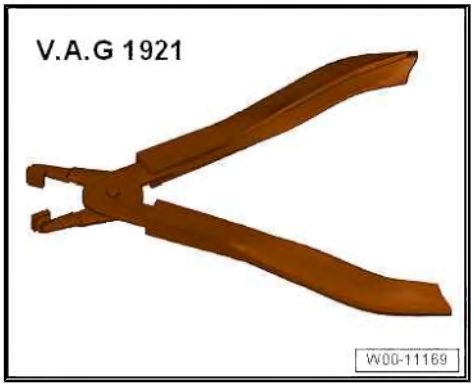
- ❑ Removing and installing ⇒ page 191



3.2 Removing and installing radiator

Special tools and workshop equipment required

♦ Hose clamp pliers - V.A.G 1921-



Removing

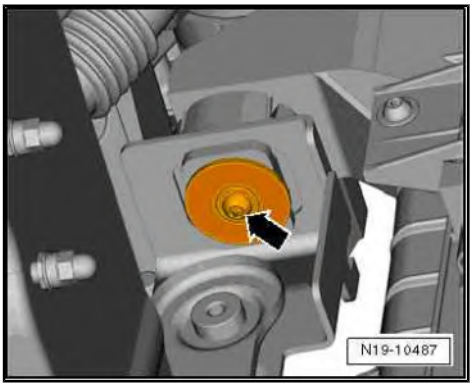
– If fitted, remove noise insulation ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Removing and installing noise insulation .

– Drain coolant ⇒ page 163 .

– Remove front bumper cover ⇒ General body repairs, exterior; Rep. gr. 63 ; Front bumper; Removing and installing bumper cover .

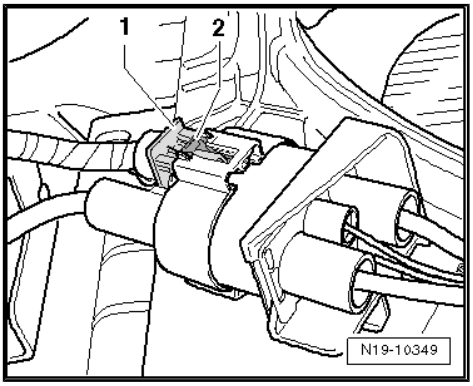
– Remove charge air cooler ⇒ page 202 .

– Unscrew bolt -arrow- from radiator mounting on right and left.

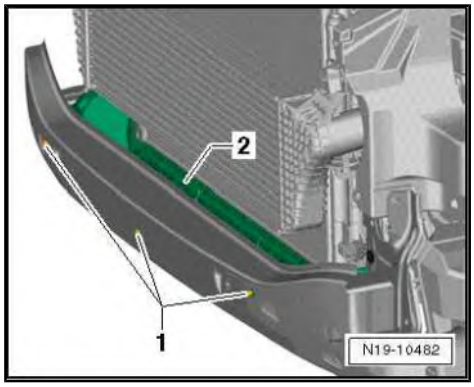


– Pull back securing lever -1- onto stop

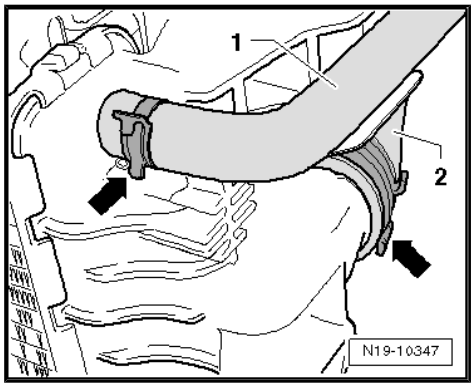
– Press down locking lever -2- and separate electrical connector.



– Remove spreader rivets -1- and remove air duct -2- upwards.



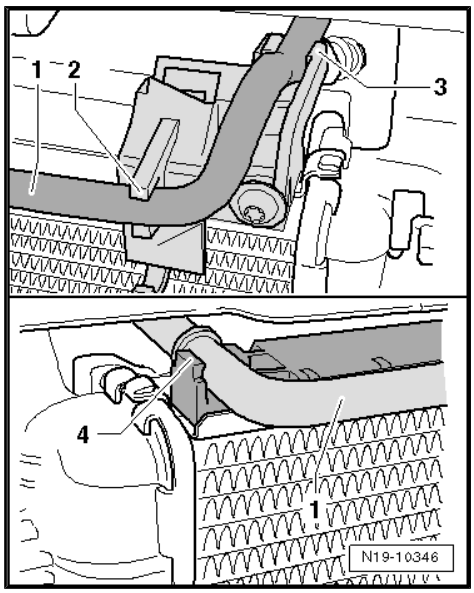
– Open spring-type clips -arrows-.
– Pull off coolant hoses -1- and -2- from radiator.



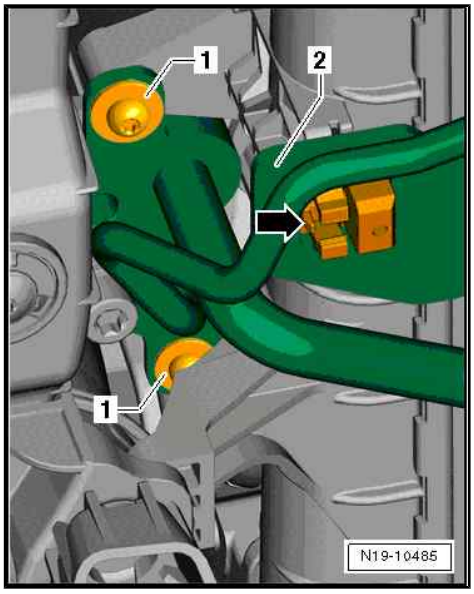
– Pull out power steering pipes -1- from mountings -2 … 4-.

Note

Remove the two holders for the servo steering pipe only if the radiator is to be replaced.



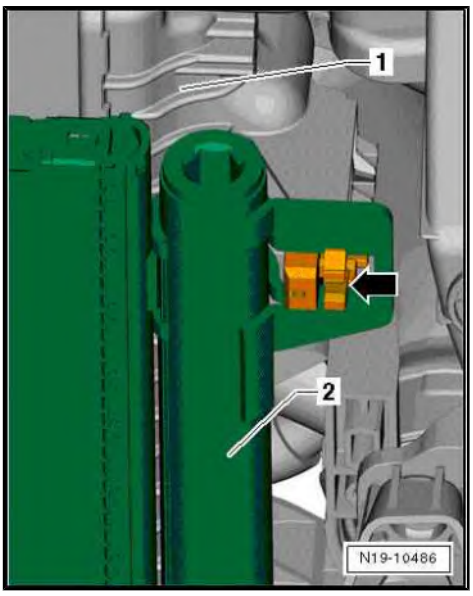
– Unscrew bolts -1-.
– Squeeze catch -arrow- and pull condenser forwards a little.



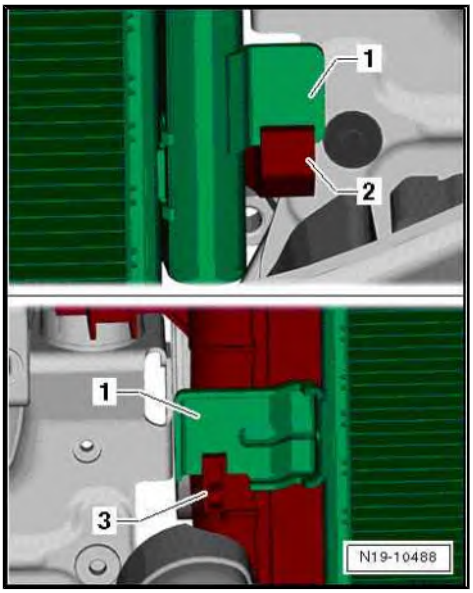
– Squeeze catch -arrow- and pull condenser -2- off radiator -1-.

Note

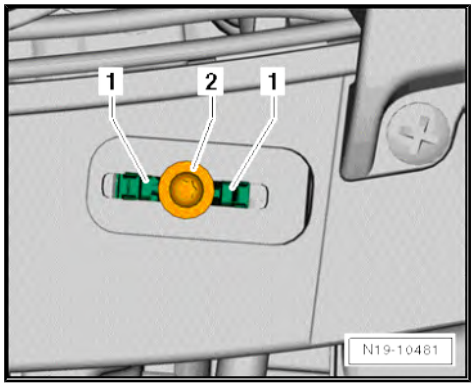
- *Do not bend or stretch the refrigerant lines.*
- *The condenser must be held in the "2 o'clock position" when the radiator is being removed.*
- *A second mechanic is needed to remove the radiator.*



– Lift condenser -1- out of the left holder -2- and right holder -3- and place it on the bumper.



– Unscrew bolt -2- from upper left and right radiator mounting.
– Press right and left catches -1- together.
– Press the two radiator mountings downwards into the radiator.

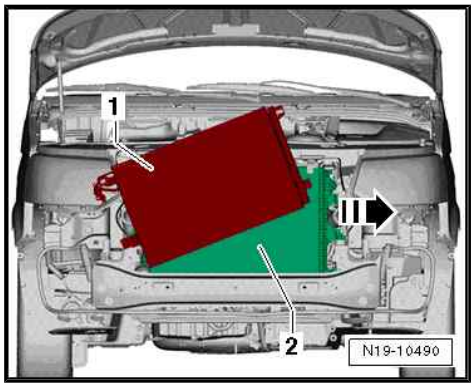


NOTICE

Risk of damage to refrigerant lines from rupture of inner foil.

– **Never bend refrigerant lines to a radius tighter than r = 100 mm.**

– Hold condenser -1- in “2 o'clock position” with aid of second mechanic.
– Carefully remove radiator -2- in left-hand direction, while guiding radiator -2- past refrigerant lines and bumper carrier.



If radiator is to be renewed, remove radiator cowl together with radiator fan - V7- ⇒ page 191 .

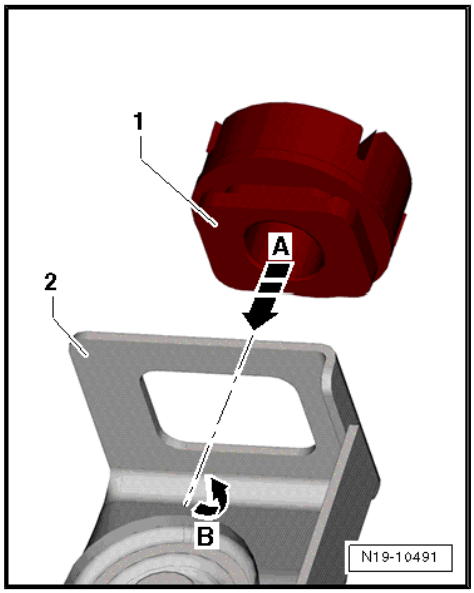
Installing

Install in reverse order of removal, observing the following:

Note

Use only distilled water for mixing coolant additives. The use of distilled water ensures optimum protection against corrosion.

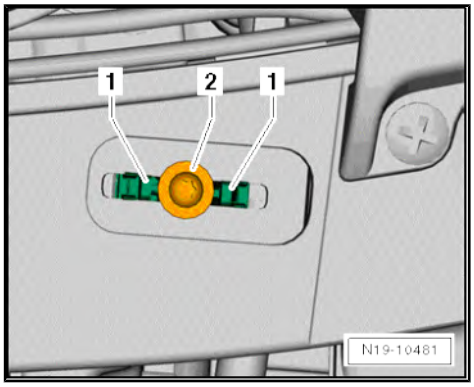
– Insert lower radiator mounting -1- into lock carrier -2- transverse to direction of travel, and then turn it 90°.



– Fasteners -1- of upper left and right radiator mountings must be completely engaged in lock carrier.

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

– Add coolant ⇒ page 163 .



Specified torques

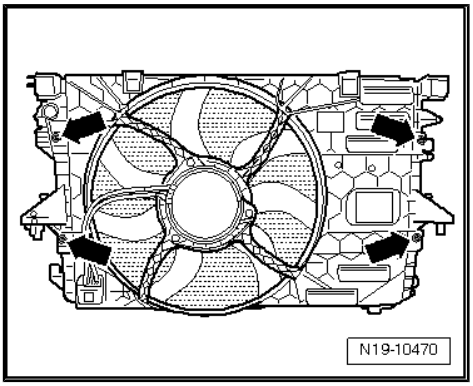
◆ ⇒ “3.1 Assembly overview - radiator/radiator fan”, page 186

3.3 Removing and installing radiator cowl with radiator fan

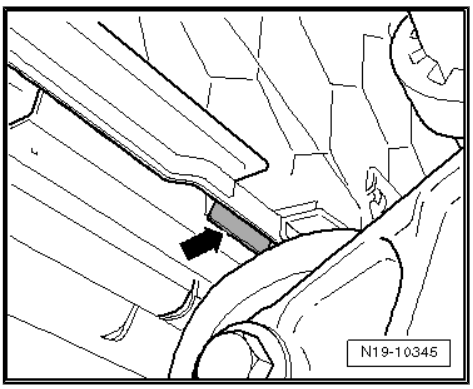
Removing

– Removing radiator ⇒ page 186 .

– Unscrew bolts -arrows- and remove radiator cowl with radiator fan - V7- from radiator.



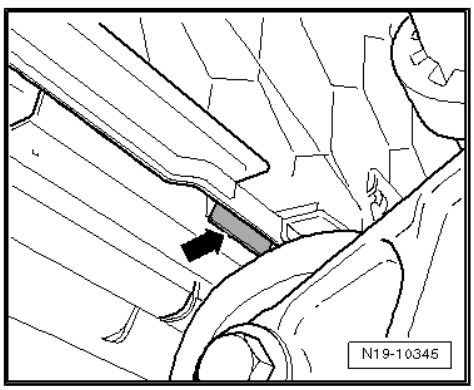
– Push back locking lug -arrow-, and remove radiator cowl together with radiator fan - V7- from radiator.



Installing

Install in reverse order of removal, observing the following:

– Insert radiator cowl with radiator fan - V7- into radiator with locking lug first -arrow-.

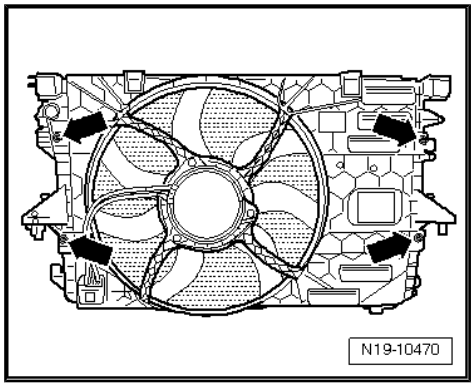


– Tighten bolts -arrows-.

– Installing radiator ⇒ page 186 .

Specified torques

◆ ⇒ “3.1 Assembly overview - radiator/radiator fan”, page 186



21 – Turbocharging/supercharging

1 Exhaust turbocharger

⇒ "1.1 Assembly overview - turbocharger", page 193

⇒ "1.2 Removing and installing turbocharger", page 196

1.1 Assembly overview - turbocharger

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 and bolts.*
- *Before screwing on oil pressure line, fill turbocharger at union with engine oil.*
- *After installing turbocharger, allow engine to run at idling speed for about 1 minute to ensure that oil is supplied to turbocharger.*

1 - Exhaust manifold with turbocharger

- ❑ Renew only as complete unit
- ❑ Renewed together with vacuum unit, exhaust manifold and regulating flap potentiometer - G584-
- ❑ When turbocharger and connecting pipes are being assembled, it is essential that the correct repair set ⇒ Electronic parts catalogue (ETKA) is used
- ❑ Removing and installing ⇒ page 196

2 - Seal

- ❑ Renew after removal

3 - Retaining clip

4 - Bolt

- ❑ M5 x 12
- ❑ 7 Nm

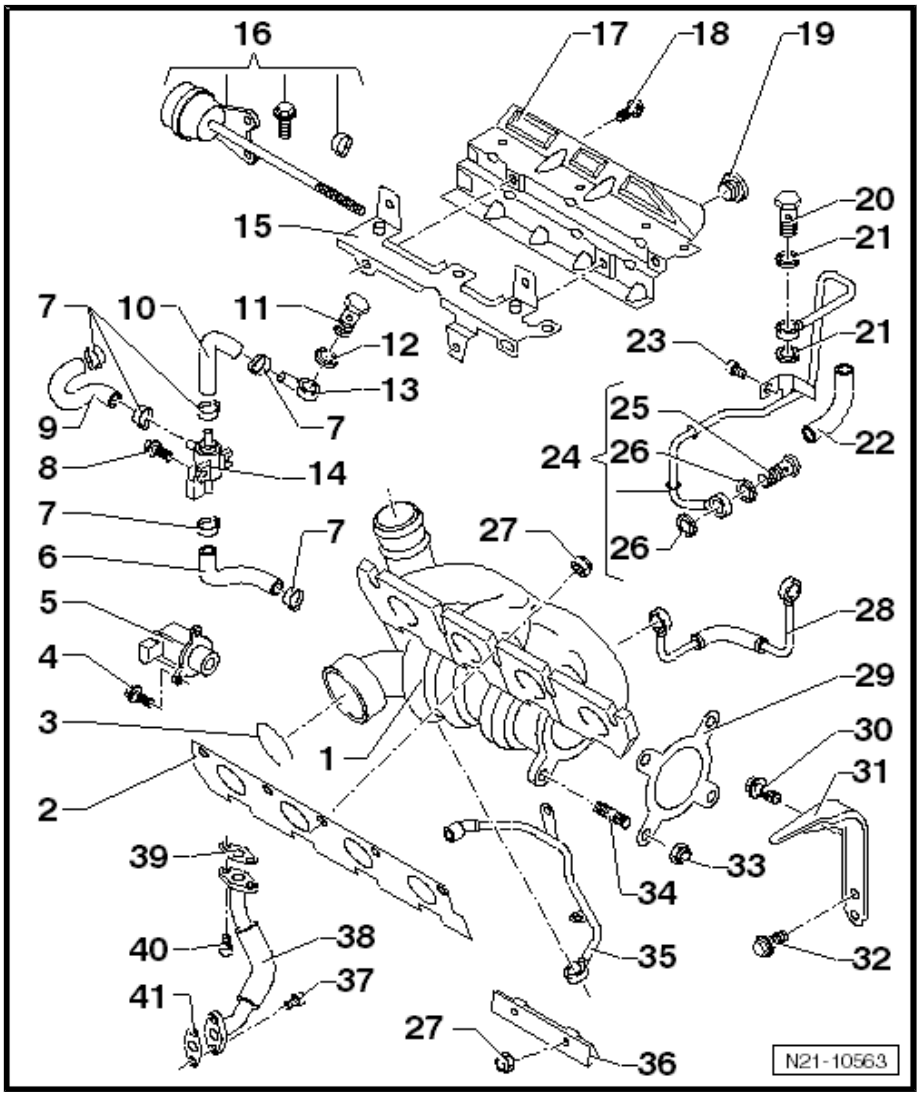
5 - Turbocharger air recirculation valve - N249-

6 - Hose

7 - Clip

8 - Bolt

- ❑ M5 x 12
- ❑ 3 Nm



9 - Hose

10 - Hose

11 - Banjo bolt

- ❑ Not available as replacement part

12 - Seal

- ❑ Not available as replacement part

13 - Connection piece

- ❑ Not available as replacement part

14 - Charge pressure control solenoid valve - N75-

15 - Bracket for cover

16 - Pressure capsule with attachments

- ❑ Not available as replacement part

17 - Splash plate

18 - Bolt

- ❑ M6 x 16

19 - Plug

20 - Banjo bolt

- ❑ 32 Nm

21 - Seal

- ❑ Renew after removal

22 - Thermal protection for oil pipe

23 - Bolt

- ❑ M6 x 15
- ❑ 9 Nm

24 - Oil pipe

Note

- ♦ *Risk of damage when removing and installing turbocharger.*
- ♦ *Check oil pressure line for damage after removing (kinks in hose). Oil pressure line must be renewed if damaged.*

25 - Banjo bolt

- ❑ 32 Nm

26 - Seal

- ❑ Renew after removal

27 - Securing nut

- ❑ Renew after removal
- ❑ Observe tightening sequence and specified torque ⇒ page 200

28 - Coolant pipe

- ❑ Supply line

29 - Seal

- ❑ Renew after removal

30 - Bolt

- ❑ M8 x 35

- ❑ 30 Nm

31 - Support

32 - Bolt

- ❑ M8 x 16
- ❑ 30 Nm

33 - Nut

- ❑ Renew after removal

34 - Stud

- ❑ M10 x 32
- ❑ 24 Nm

35 - Coolant pipe

- ❑ Return

36 - Tensioner

37 - Bolt

- ❑ M6 x 15
- ❑ 9 Nm

38 - Oil pipe

39 - Seal

- ❑ Renew after removal

40 - Bolt

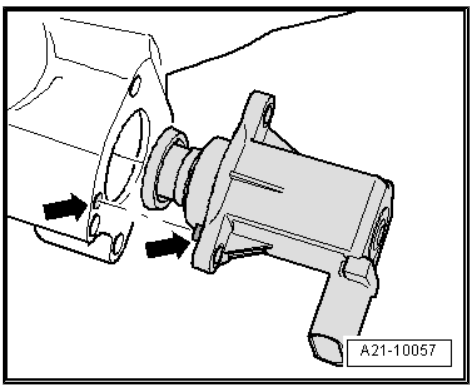
- ❑ M6 x 15
- ❑ 9 Nm

41 - Seal

- ❑ Renew after removal

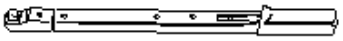
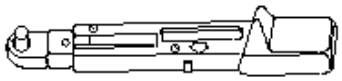
Installation location of turbocharger air recirculation valve - N249-

– Note installation position -arrows-.



1.2 Removing and installing turbocharger

Special tools and workshop equipment required

V.A.G 1331 	V.A.G 1332 
V.A.G 1410 	VAS 6122 
	W21-10004

- Torque wrench - V.A.G 1331-
- Torque wrench - V.A.G 1332-
- Torque wrench - V.A.G 1410-
- Engine bung set - VAS 6122-

Note

- *If a mechanical fault is found on the turbocharger, e.g. a destroyed compressor impeller, just renewing the turbocharger is not enough. To avoid subsequent damage, the following work must be carried out:*
- *Check air filter housing, air filter element and intake hoses for dirt/soiling.*
- *Check the whole charge air path and charge air cooler for foreign objects.*
- *If foreign objects are found in the charge air system, the charged air routing must be cleaned and the charge air cooler must be renewed, if necessary.*

Removing

Note

- *After lines and hoses have been removed, the open connections are to be sealed immediately with a plug from the engine bung set - VAS 6122- .*
- *Only use clean plugs.*

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

– Drain coolant ⇒ page 163 .

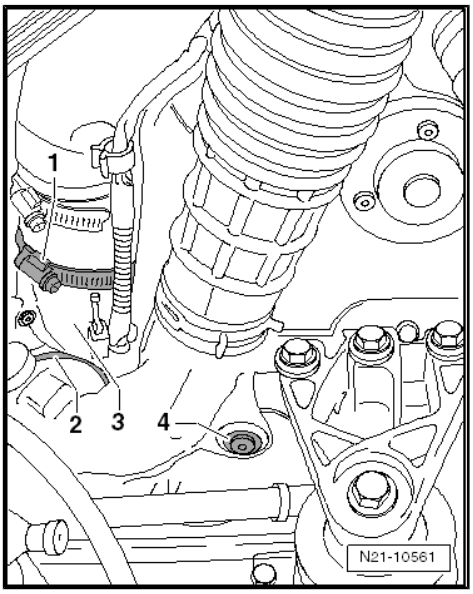
– Remove air filter housing ⇒ page 216 .

– Detach electrical connector from intake hose.

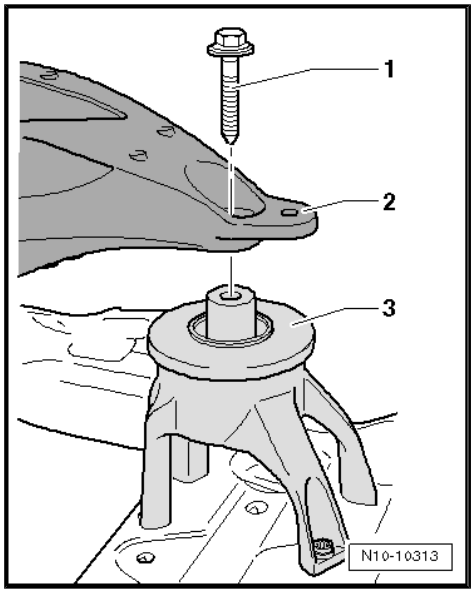
– Unscrew bolt -4-.

– Loosen clamps -1- and -2- and pull off hoses from turbocharger -3-.

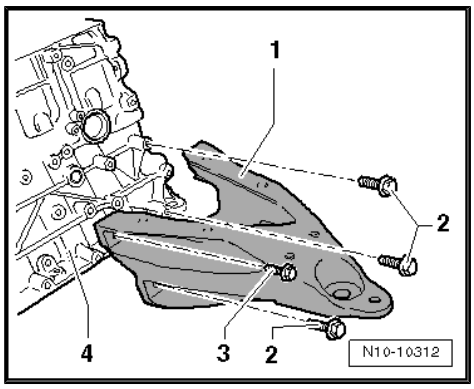
– Remove downstream catalytic converter ⇒ page 245 .



– Unscrew bolt -1- from support mounting -3-.



– Unscrew bolts -2- and -3-.
– Remove engine support -1-.



Note

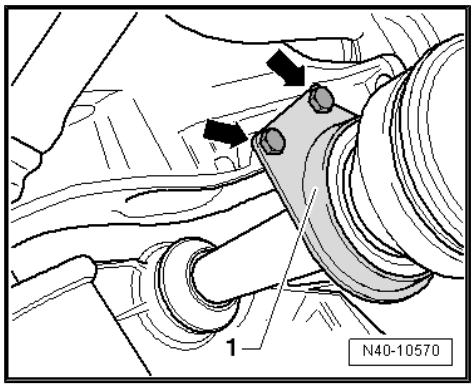
Note different bolt lengths.

Vehicles with all-wheel drive:

– Remove front propshaft ⇒ Rep. gr. 39 ; Propshaft; Removing and installing propshaft .
– Remove bevel box ⇒ Rep. gr. 39 ; Components of bevel box; Removing and installing bevel box .

Vehicles with front-wheel drive:

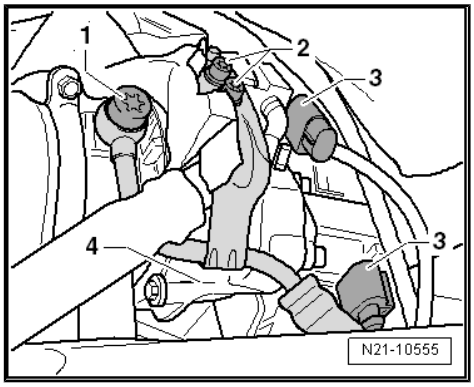
– Unscrew bolts -arrows- and swivel drive shaft support downwards.



Continued for all vehicles:

– Remove starter catalytic converter ⇒ page 243 .

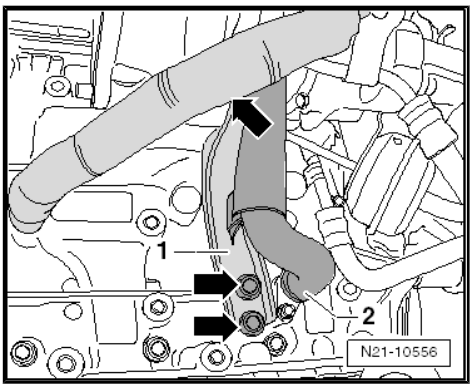
– Detach electrical connectors -3- from turbocharger.
– Detach vacuum hoses from turbocharger.



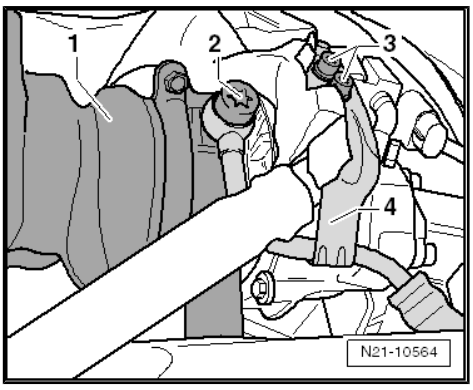
– Unscrew bolts -arrows-.
– Remove pendulum support -1-.
– Loosen clip -2- and pull water hose off.

Note

Avoid damage to oil pressure line and coolant line.



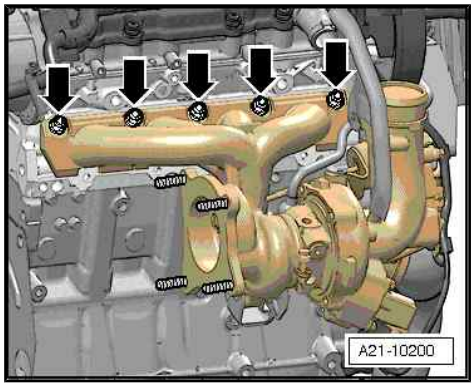
– Unscrew bolts -2- and -3-.
– Release coolant line bracket -4- from turbocharger -1-.
– Remove coolant line from turbocharger and swing aside.
– Detach oil supply line from turbocharger.
– Unscrew oil return line from turbocharger and also swing aside.
– Remove heat shield on turbocharger .



– Unscrew nuts -arrows-.

– Cover anti-roll bar with a cloth or similar to avoid damage to paintwork.

– Remove turbocharger, tilt to rear and remove via subframe and anti-roll bar.



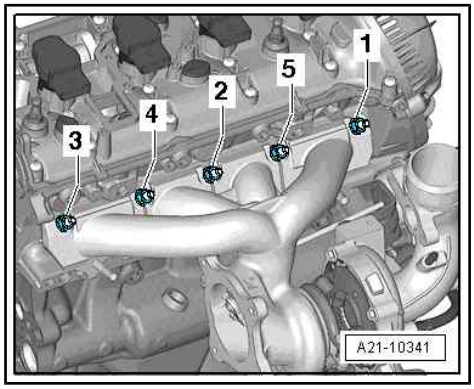
Installing

Install in reverse order of removal, observing the following:

Note

- *Renew seals, gaskets, O-rings and self-locking nuts after removal.*
- *Fill turbocharger with engine oil at oil supply line connection.*
- *Hose connections and hoses for charge air system must be free of oil and grease before assembly.*
- *Restore the factory standard by securing all of the hose connections with hose clips appropriately ⇒ Electronic parts catalogue (ETKA) .*
- *After installing turbocharger, run engine for about 1 minute at idling speed to ensure that oil is supplied to turbocharger.*

Tightening sequence - turbocharger



– Tighten bolts in sequence -1 … 5- in 4 stages as follows:

1. Tighten screws to 5 Nm.
2. Tighten screws to 12 Nm.
3. Tighten screws to 16 Nm.
4. Tighten screws to 25 Nm.

Vehicles with all-wheel drive:

– Install front propshaft ⇒ Rep. gr. 39 ; Propshaft; Removing and installing propshaft .

– Install bevel box ⇒ Rep. gr. 39 ; Components of bevel box; Removing and installing bevel box .

Continued for all vehicles:

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

– Add coolant ⇒ page 163 .

– Check oil level; replenish engine oil if necessary ⇒ Maintenance ; Booklet 20.1 ; Descriptions of work; Engine oil: draining or extracting; Renewing oil filter and replenishing engine oil .

Specified torques

- ⇒ “1.1 Assembly overview - turbocharger”, page 193
- ⇒ “4.1 Assembly overview - air filter housing”, page 215
- ⇒ “2.1 Assembly overview - assembly mountings”, page 24

2 Charge air system

2.1 Assembly overview - charge air system

1 - Charge air cooler
- ❑ Removing and installing ⇒ page 202

2 - Bolts
- ❑ Qty. 2
- ❑ 5 Nm

3 - Clamps
- ❑ Qty. 6

4 - Connection hose
- ❑ Note installation position ⇒ page 202

5 - Connection hose
- ❑ Note installation position ⇒ page 202

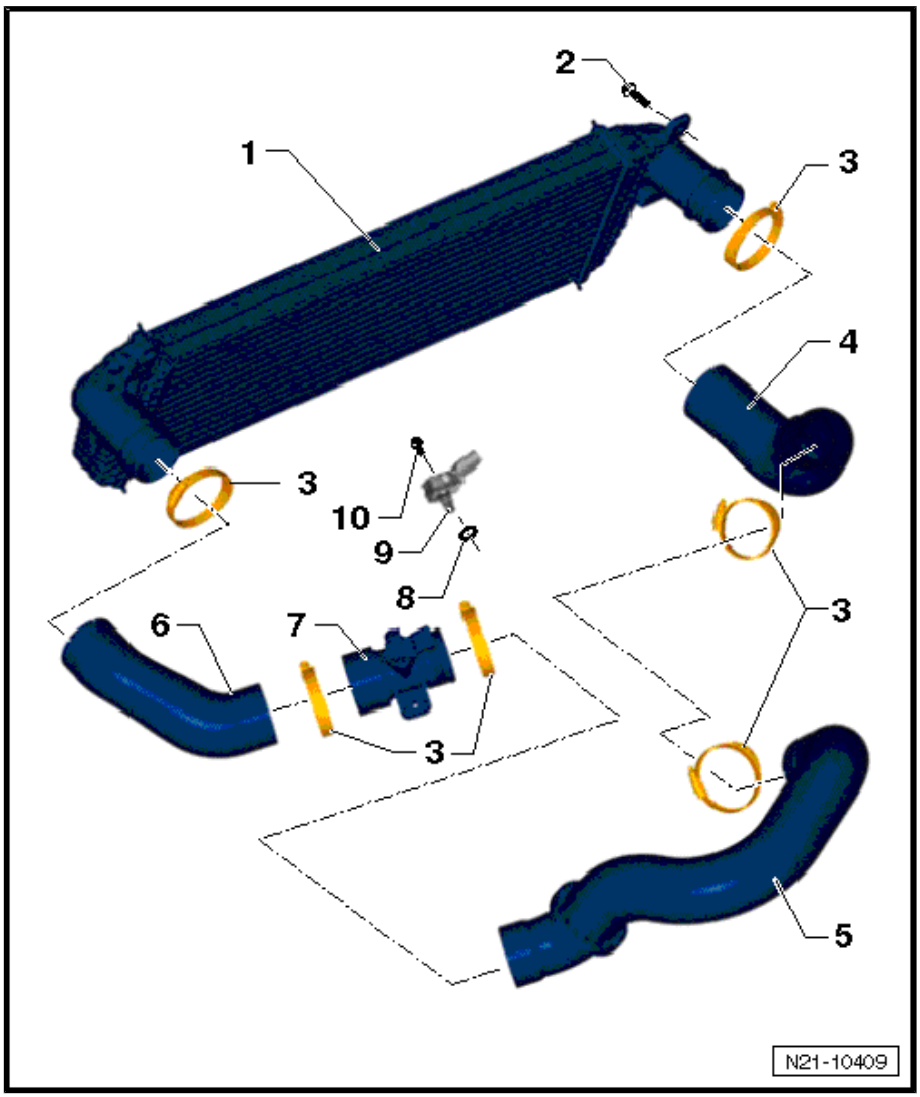
6 - Connection hose
- ❑ Note installation position ⇒ page 202

7 - Union

8 - O-ring
- ❑ Renew if damaged or leaking

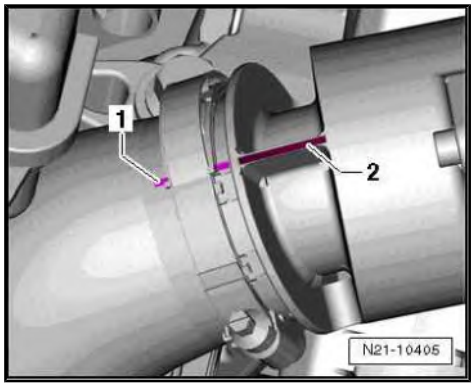
9 - Charge air pressure sender - G31-
- ❑ Removing and installing ⇒ page 203

10 - Bolt
- ❑ 2 Nm



Installation position of connecting hoses

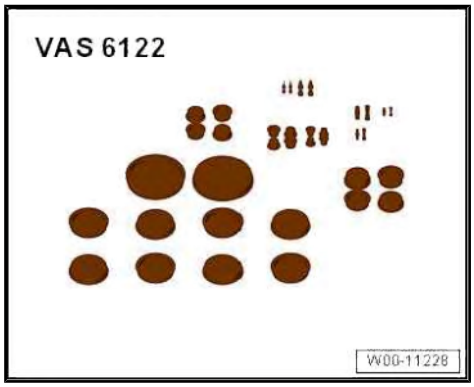
– Install connecting hose in such a way that marking -1- on connecting hose aligns with marking -2- on respective connecting piece.



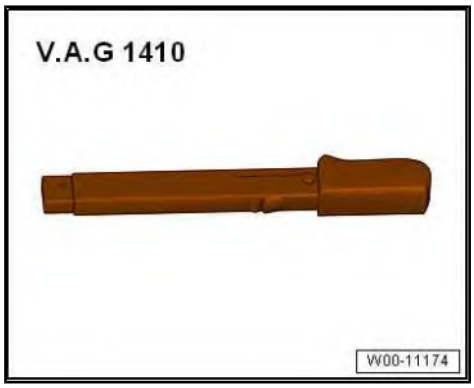
2.2 Removing and installing charge air cooler

Special tools and workshop equipment required

♦ Engine bung set - VAS 6122-



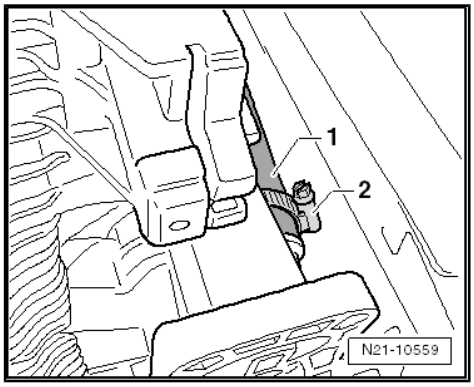
♦ Torque wrench - V.A.G 1410-



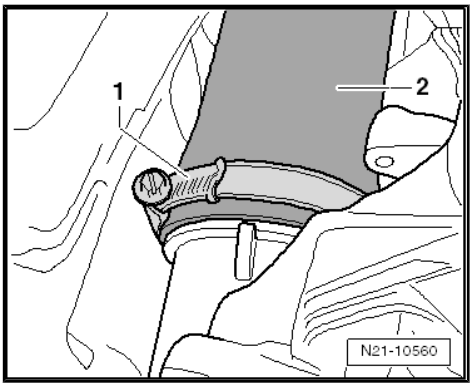
Removing

– Remove front bumper cover ⇒ General body repairs, exterior; Rep. gr. 63 ; Front bumper; Removing and installing bumper cover .

– Loosen clamp -2-.
– Pull pressure hose on left -1- towards the rear and off the charge air cooler.



– Loosen clamp -1-.
– Pull pressure hose on right -2- towards the rear and off the charge air cooler.



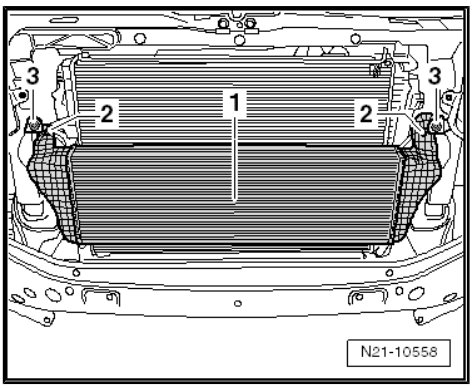
– Unscrew bolts -2- and -3-.
– Remove charge air cooler -1- from mounting on left and right.

Installing

Install in reverse order of removal, observing the following:

Specified torques

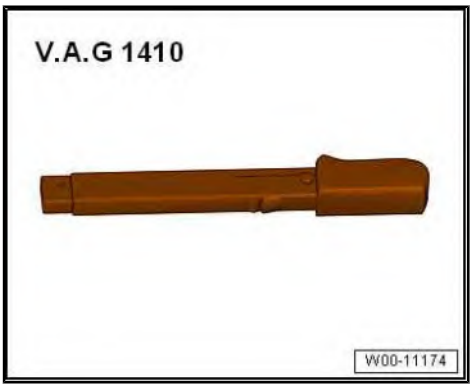
♦ ⇒ “2.1 Assembly overview - charge air system”, page 201



2.3 Removing and installing charge pressure sender - G31-

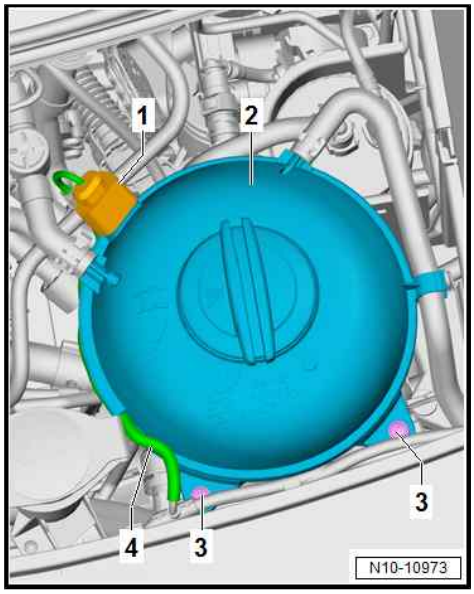
Special tools and workshop equipment required

♦ Torque wrench - V.A.G 1410-



Removing

– Separate connector -1-.
– Move clear wiring harness -4-.
– Unscrew bolts -3- and move coolant expansion tank -2- to one side.



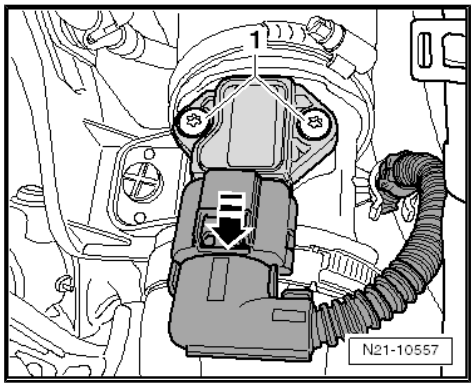
– Separate electrical connector in direction of -arrow-.
– Unscrew bolts -1-.
– Remove charge pressure sender - G31- .

Installing

Install in reverse order of removal, observing the following:

Specified torques

♦ ⇒ “2.1 Assembly overview - charge air system”, page 201

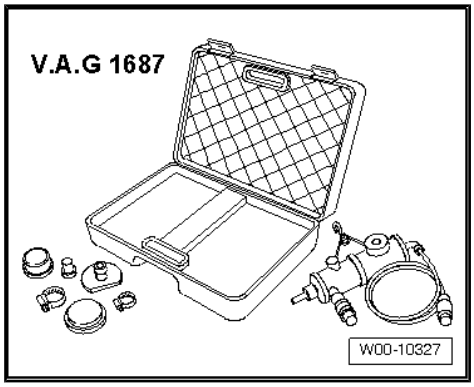


Component	Specified torque
Bolts for coolant expansion tank	⇒ page 23

2.4 Checking charge air system for leaks

Special tools and workshop equipment required

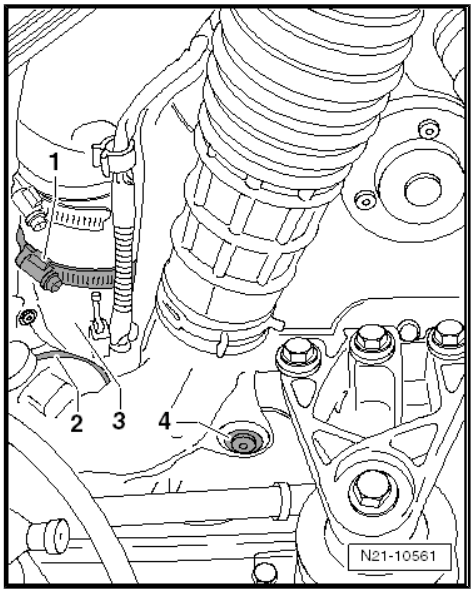
♦ Charge air system tester - V.A.G 1687-



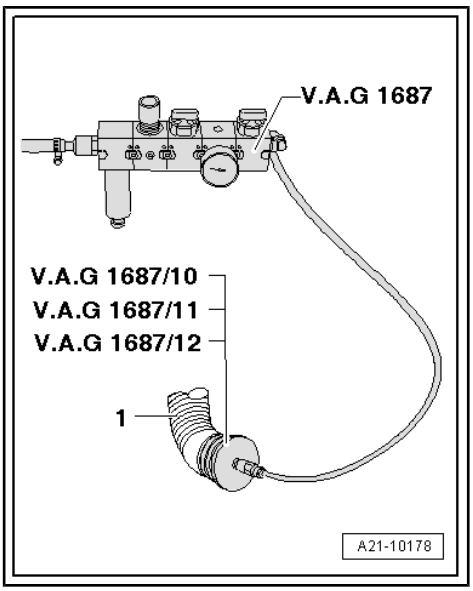
Note

Items 2 and 4 can be disregarded.

– Release hose clip -1- and pull pressure hose off turbocharger -3-.

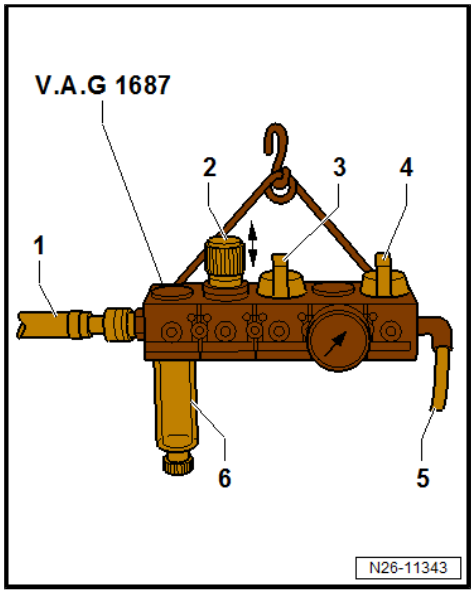


– Depending on hose diameter, insert adapter - 1687/10- , -1687/11- or -1687/12- in air duct -1- and secure with hose clip.
– Connect charge air system tester - V.A.G 1687- as shown in figure.



Prepare charge air system tester - V.A.G 1687- as follows:

– Unscrew pressure control valve -2- completely.



Note

To turn the pressure regulating valve -2- the knob must be pulled upwards.

– Close valves -3- and -4-.

– Apply compressed air -1- to charge air system tester - V.A.G 1687- .

– If there is water in inspection glass, drain via drain screw -6-.

– Open valve -3-.

Note

- *Risk of damage if pressure is set too high!*
- *The pressure must not exceed 0.5 bar.*

– 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 by hearing, touching, with commercially available leak detector spray or using ultrasonic tester - V.A.G 1842- .

Note

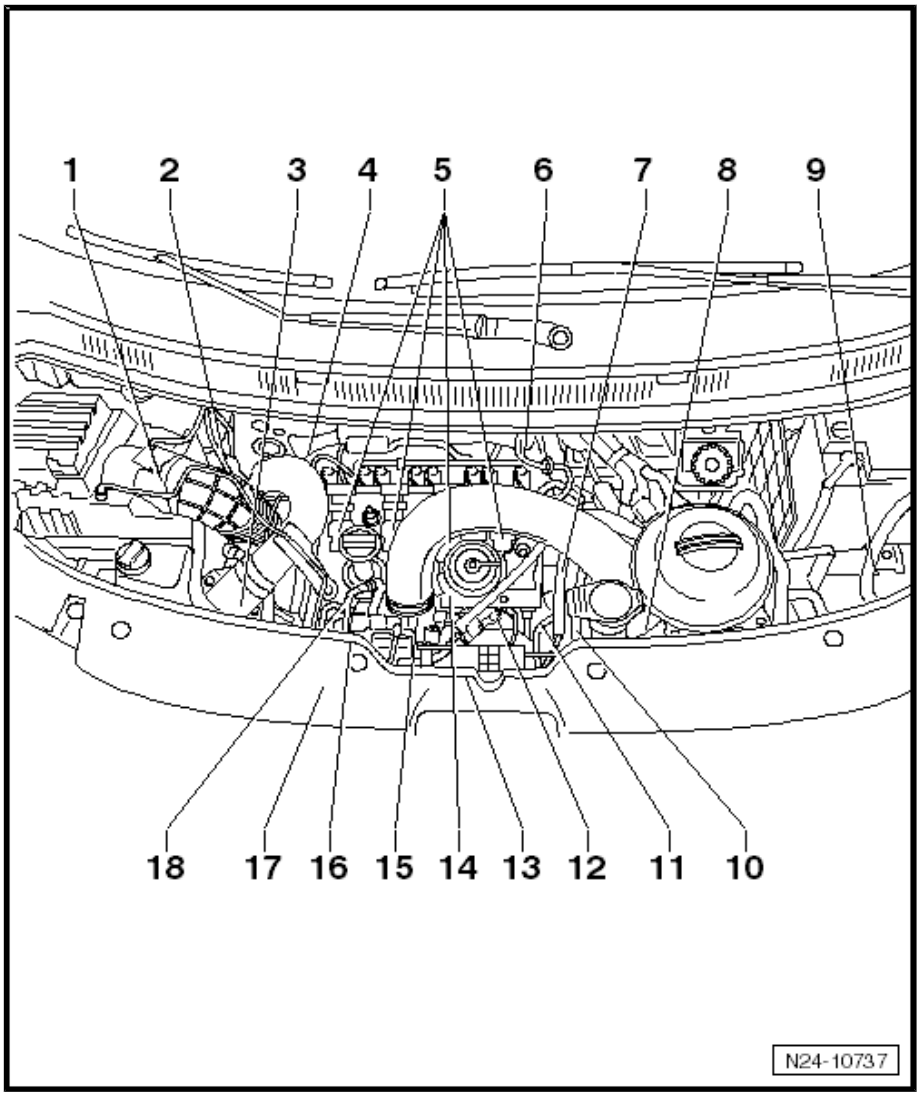
- *A small amount of air escapes through the valves and enters the engine. Therefore a holding pressure test is not possible.*
- *How to use the ultrasonic tester - V.A.G 1842- ⇒ operating instructions*
- *Before removing the adapters, depressurise the test circuit by detaching coupling.*
- *Hose unions and air intake pipes and hoses must be free of oil and grease before installation.*
- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*

24 – Mixture preparation - injection

1 Injection system

⇒ "1.1 Overview of fitting locations - injection system", page 207

1.1 Overview of fitting locations - injection system



1 - Air mass meter - G70-

- ❑ Removing and installing ⇒ page 226

2 - Turbocharger air recirculation valve - N249-

3 - Inlet camshaft control valve 1 - N205-

- ❑ Removing and installing ⇒ page 133

4 - Charge pressure control solenoid valve - N75-

- ❑ Removing and installing ⇒ page 226

5 - Ignition coils with output stages

- ❑ Removing and installing ⇒ page 248

6 - Lambda probe - G39- and Lambda probe heater - Z19-

- ❑ Removing and installing ⇒ page 235

7 - High-pressure pump

- ❑ Removing and installing ⇒ page 231

8 - Intake air temperature sender - G42- with charge air pressure sender - G31-

- ❑ Removing and installing ⇒ page 203

9 - Engine control unit - J623-

- ❑ Removing and installing ⇒ page 228

10 - Fuel pressure regulating valve - N276-

11 - Intake manifold flap potentiometer - G336-

12 - Activated charcoal filter solenoid valve 1 - N80-

13 - Engine speed sender - G28-

- ❑ Removing and installing ⇒ page 250

14 - Knock sensor 1 - G61-

- ❑ Removing and installing ⇒ page 249

15 - Throttle valve module - J338-

- ❑ Throttle valve drive angle sender - G187- and throttle valve drive angle sender 2 - G188-

- ❑ After each removal and installation procedure or after renewing throttle valve module - J338- , it must be re-adapted to engine control unit - J623- .
- ❑ Removing and installing ⇒ page 222

16 - Radiator outlet coolant - G62-

- ❑ Removing and installing ⇒ page 182

17 - Fuel pressure sender - G247-

- ❑ Removing and installing ⇒ page 227

18 - Hall sender - G40-

- ❑ Removing and installing ⇒ page 250

2 Vacuum system

⇒ “2.1 Connection diagram - vacuum system”, page 209

2.1 Connection diagram - vacuum system

1 - Vacuum hose

2 - Air filter

3 - Silencer

4 - Fuel lines

5 - Hose
- ❑ With non-return valve

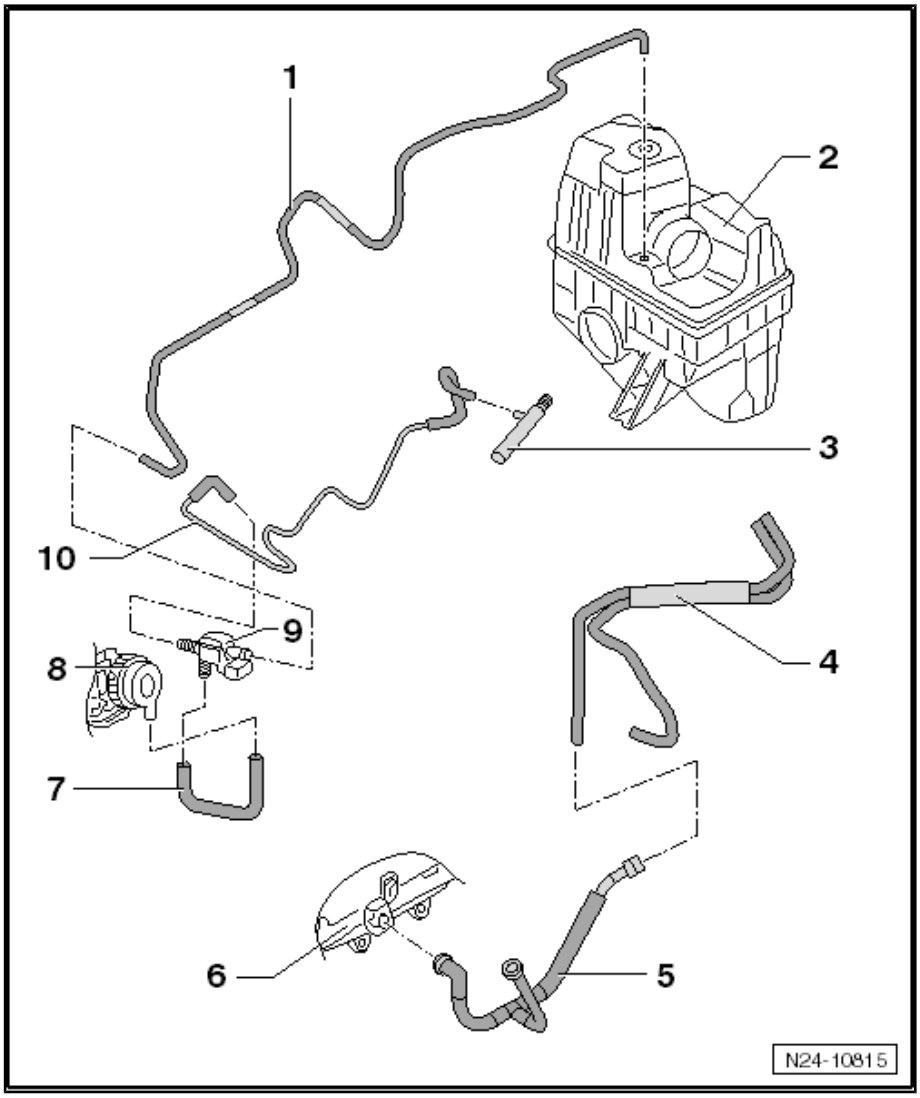
6 - Intake manifold

7 - Vacuum hose

8 - Vacuum unit for fuel rail
- ❑ Removing and installing fuel rail ⇒ page 221 .

9 - Intake manifold flap air flow control valve - N316-

10 - Vacuum hose

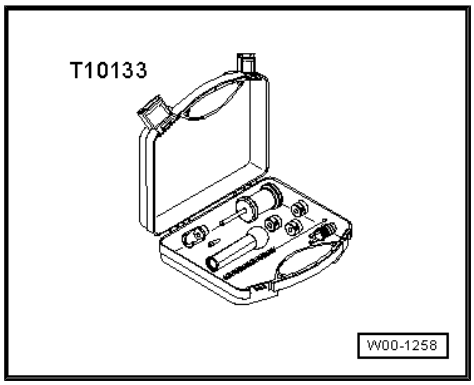


3 Injectors

3.1 Removing and installing injectors

Special tools and workshop equipment required

- Tool kit with puller - T10133-

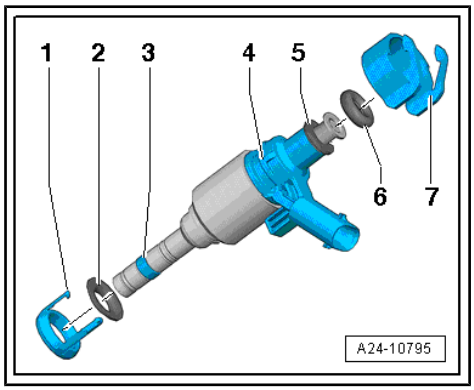


Removing

– Remove intake manifold with fuel rail ⇒ page 219 .

Note

- *Remove injectors if these remain in fuel rail.*
- *Remove injectors if these remain in cylinder head.*



Injector (new version)

1 - Replace intermediate ring

2 - Support bearing

3 - Combustion chamber ring seal (Teflon ring seal), renew; when fitting, do not grease ring or use any other lubricant.

4 - Injection valve

5 - Spacer (renew if damaged)

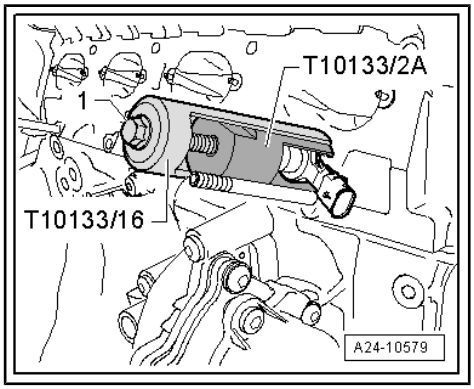
6 - O-ring (renew; to install, lightly lubricate with clean engine oil).

7 - Support ring (via this support ring, the fuel rail exerts force which secures injector in cylinder head)

– Cover open intake ports with a clean cloth.

– Separate electrical connector from injector to be removed.

– Insert puller -T10133/2A- into groove in injector.
– Then position removal tool -T10133/16- and pull injector out by turning bolt -1-.



Note

The combustion chamber seal must always be renewed prior to reinstallation of the injector *⇒ page 211* *.*

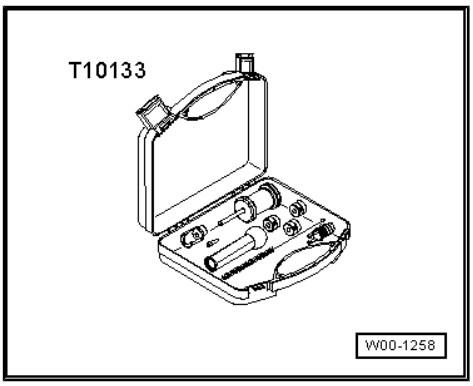
Installing

Install in reverse order of removal.

3.2 Renewing seals on injectors

Special tools and workshop equipment required

- Tool kit with puller - T10133-



Sequence of operations

Note

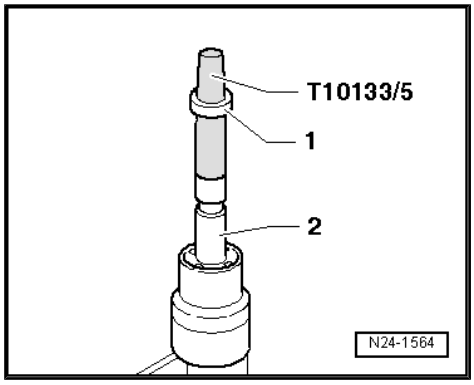
- *The combustion chamber seal must always be renewed prior to reinstallation of the injector*
- *Injector must be renewed if groove is damaged.*

– Carefully remove old Teflon ring using a suitable tool (e.g. cut open ring using razor blade, or prise open ring with small screwdriver and then pull off forwards).
– Before fitting new Teflon ring, clean any combustion residue from annular groove and injector shaft using a clean cloth.

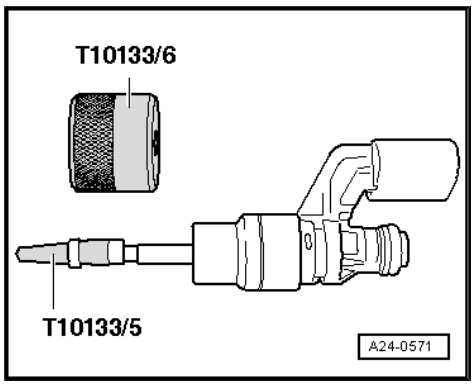
Note

- *The figure shows an injector with an angled connector.*
- *This can be ignored in the subsequent procedure since it is not important when renewing the combustion chamber ring seal.*

– Fit assembly cone -T10133/5- with new Teflon ring -1- on injector -2-.



– Push Teflon ring with assembly sleeve -T10133/6- further on to assembly cone -T10133/5- until Teflon ring engages in seal ring.

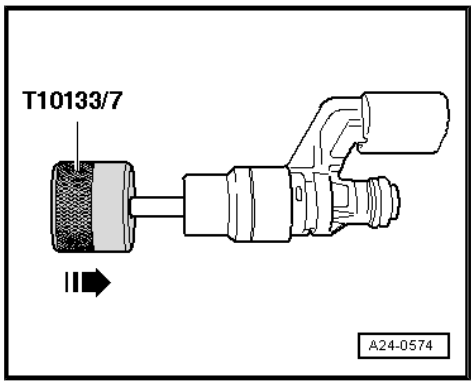


Note

- *Pushing Teflon ring onto injector stretches Teflon ring.*
- *The Teflon ring must therefore be compressed again after it has been fitted.*

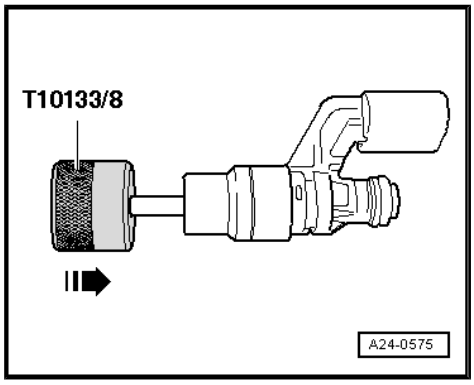
Perform step 1 of calibration (adaption) of Teflon ring using calibration sleeve -T10133/7- .

– Using a twisting movement (approx. 180°) and applying slight pressure, slide calibration sleeve -T10133/7- over injector as far as it will go.
– Twist calibration sleeve -T10133/7- in opposite direction and pull it off.



Perform step 2 of calibration (adaption) of Teflon ring using calibration sleeve -T10133/8- .

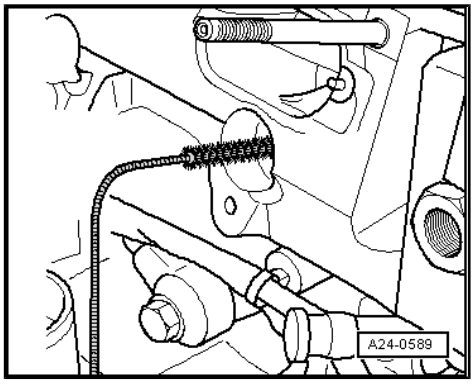
– Using a twisting movement (approx. 180°) and applying slight pressure, slide calibration sleeve -T10133/8- over injector as far as it will go.
– Twist calibration sleeve -T10133/8- in opposite direction and pull it off.
– Renew O-ring on injector.
– Before installing O-ring, lightly moisten it with clean engine oil.



Note

Teflon ring must not be oiled.

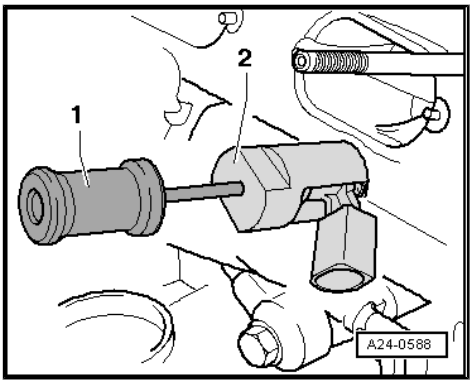
– Before installing injectors, thoroughly clean injector bores in cylinder head with nylon brush provided -T10133/4- .



Note

- *Do not oil or grease the Teflon seal on the injector.*
- *There must be no cleaning fluid or oil in the bores in the cylinder head when installing the injector.*

– Push injector by hand as far as it will go into the hole of the cylinder head (free of oil and grease). Ensure injectors are positioned correctly in cylinder head.



Note

- *It should be possible to insert the injector easily. If necessary, wait until the combustion chamber ring seal has contracted sufficiently.*
- *Ensure injectors are correctly seated and positioned in cylinder head.*
- *If it is not possible to insert the injector by hand, use the puller - T10133/2A- -2- with a hammer - T10133/3- to insert the injector.*

Important: It is essential to comply with the following points:

- Moisten O-rings of high-pressure injectors with clean engine oil to aid insertion into fuel rail
- Renew all gaskets
- Fuel rail must be placed on injectors and evenly pressed in
- Install intake manifold with fuel rail

3.3 Cleaning injectors

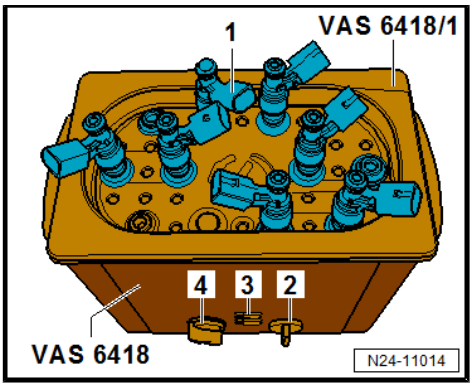
Special tools and workshop equipment required

- Ultrasonic cleaning device - VAS 6418-
- Mounting plate for injection modules - VAS 6418/1-
- Cleaning fluid ⇒ Electronic parts catalogue (ETKA)

Sequence of operations

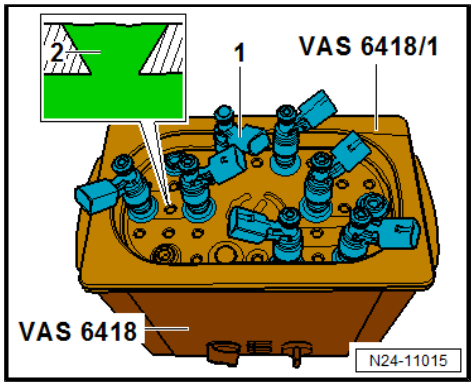
– Remove injectors ⇒ page 210 .

– Insert injectors -1- to stop into mounting plate for injection modules - VAS 6418/1- .

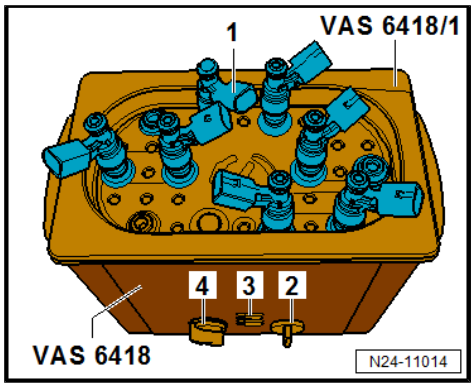


Note

- *The ultrasonic cleaner - VAS 6418- must be filled with cleaning agent to the upper edge of the holes -2-.*
- *Adhere to the safety precautions and the instructions for use of the ultrasonic cleaner - VAS 6418- .*



– Immerse injectors together with mounting plate for injection modules - VAS 6418/1- into cleaning fluid .
– Set rotary knob -2- to a temperature of 50°C.
– Set a cleaning time of 30 minutes with the rotating knob -4-.
– Switch on ultrasonic unit with button -3-.



Note

The time set starts to elapse as soon as a cleaning temperature of 50°C has been attained.

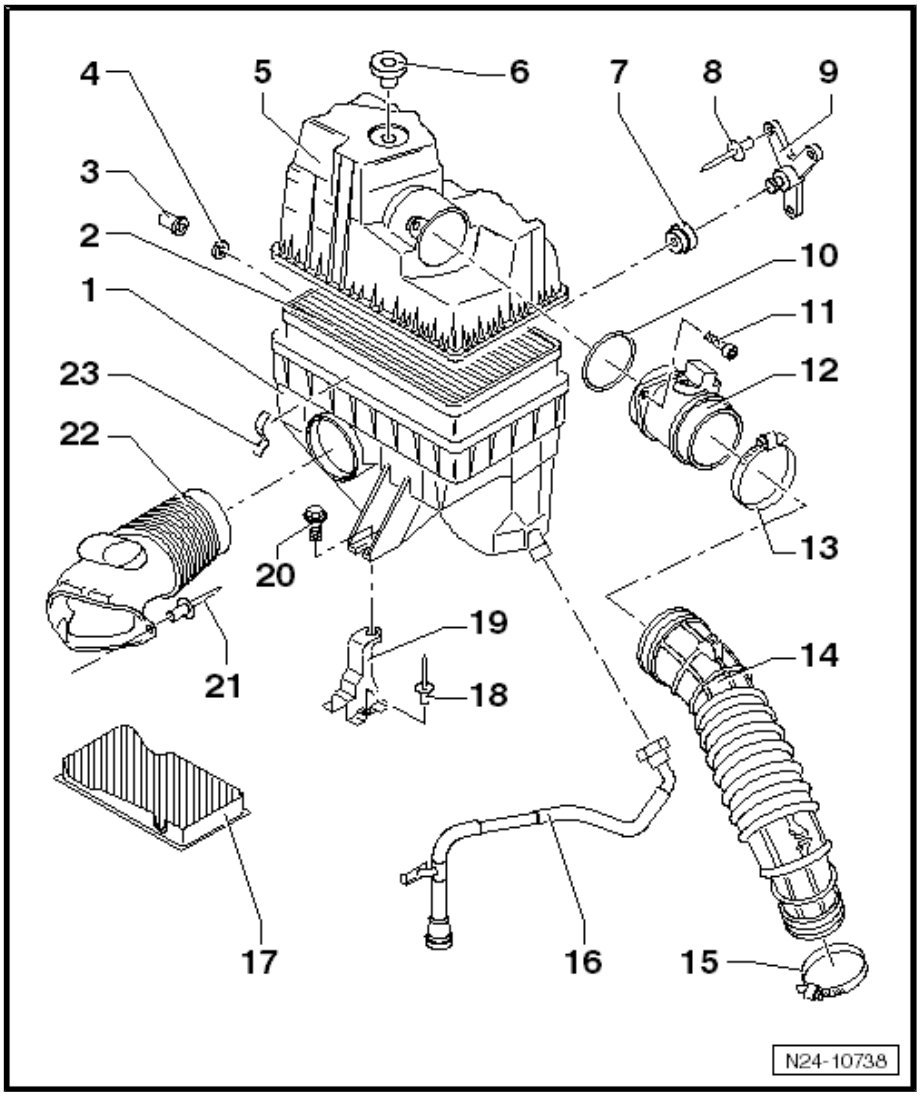
– Each time after cleaning injector, renew combustion chamber ring seal (Teflon ring seal) ⇒ page 211 .
– Then reinstall injectors ⇒ page 210 .

4 Air filter

⇒ "4.1 Assembly overview - air filter housing", page 215

⇒ "4.2 Removing and installing air filter housing", page 216

4.1 Assembly overview - air filter housing



1 - Air filter lower part

- ❑ Removing and installing ⇒ page 216

2 - Air filter element

- ❑ Renew air filter ⇒ Maintenance ; Booklet 20.1 ; Descriptions of work; Air filter: cleaning housing and renewing filter element

3 - Grommet

4 - Plug

5 - Air filter upper part

- ❑ Removing and installing ⇒ page 216

6 - Air filter - maintenance indicator

- ❑ Only for countries with high dust content in the air

7 - Buffer stop

8 - Pop rivet

- ❑ Use blind-rivet gun - VAS 5072- to renew.

9 - Bracket

- ❑ Fitted onto wheel housing

10 - O-ring

- ❑ Renew if damaged

11 - Bolt

- ❑ M6 x 22
- ❑ 3.5 Nm

12 - Air mass meter - G70-

- ❑ Removing and installing ⇒ page 226

13 - Clip

14 - Intake hose

- ❑ Markings on intake hose must be flush with webs on turbocharger (very important)
- ❑ Clean oil from ends of hoses before installing
- ❑ Do not use oil-based lubricants
- ❑ To turbocharger

15 - Clip

16 - Water drain hose

- ❑ Clipped onto lower part of air filter

- ❑ Make sure it is mounted in correct position on longitudinal member
- ❑ Clean if soiled

17 - Grille

18 - Pop rivet

- ❑ Use blind-rivet gun - VAS 5072- to renew.

19 - Bracket

- ❑ Fitted onto longitudinal member

20 - Bolt

- ❑ M6 x 35

21 - Spreader rivet

22 - Air duct

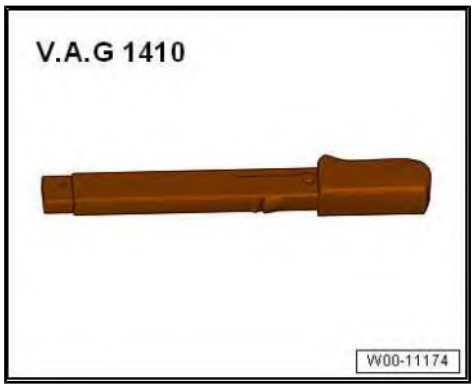
- ❑ Ensure proper engagement.

23 - Sealing clip

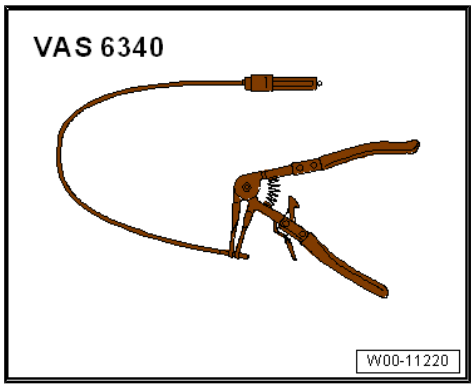
4.2 Removing and installing air filter housing

Special tools and workshop equipment required

- ♦ Torque wrench - V.A.G 1410-



- ♦ Hose clamp pliers - VAS 6340-

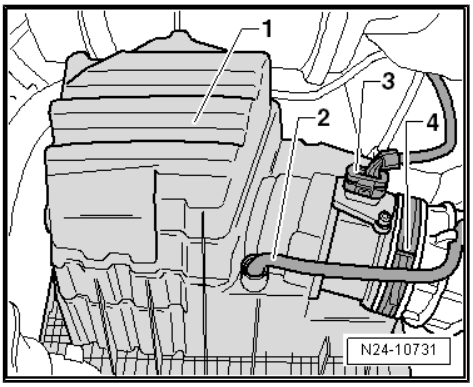


Removing

– Unplug electrical connector -3- from air mass meter - G70- .

– Unclip vacuum hose -2- from retainer and pull it off air filter housing -1-.

– Release clamp -4-, and pull off intake hose.



– Unscrew bolt -1-.

– Release water drain pipe -3-.

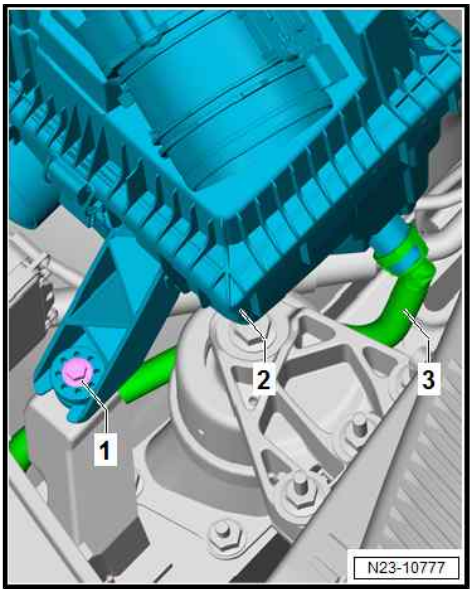
– Carefully pull air filter housing -2- out of guides and remove.

Installing

Install in reverse order of removal, observing the following:

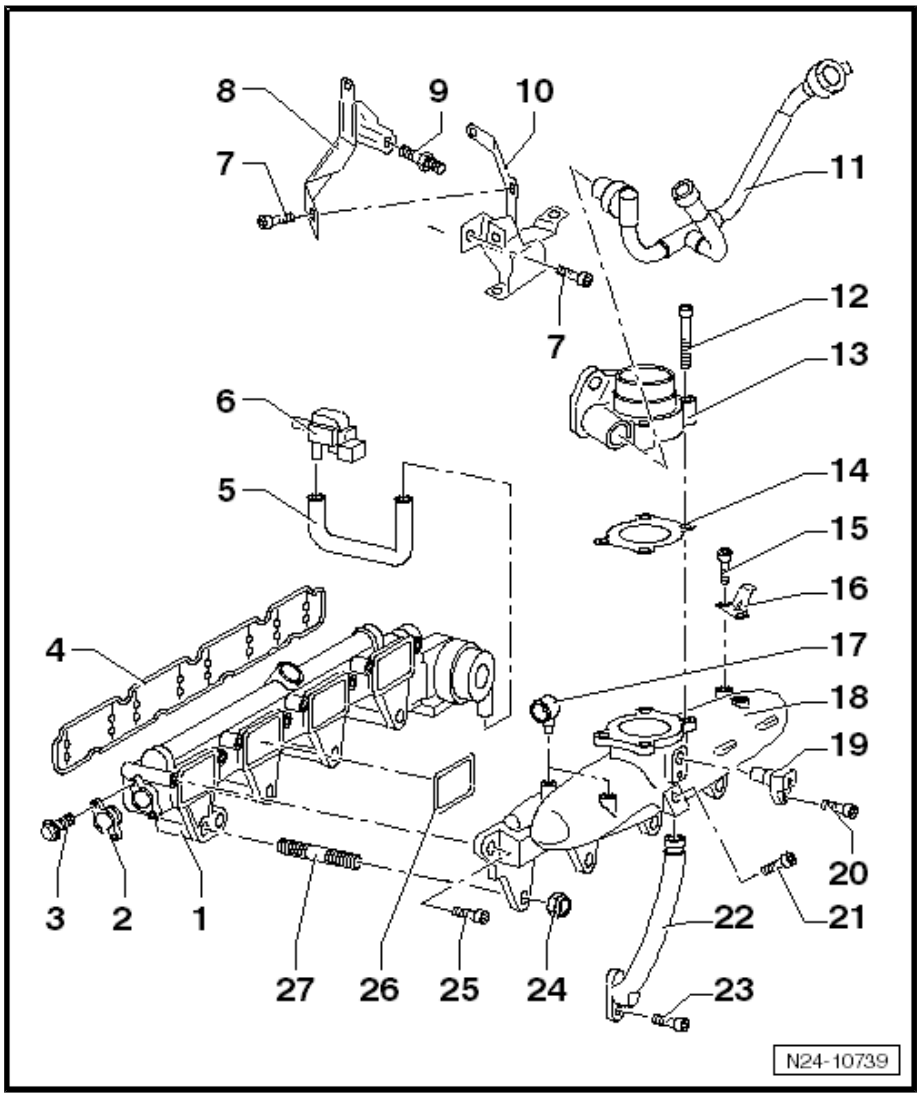
Specified torques

◆ ⇒ “4.1 Assembly overview - air filter housing”, page 215



5 Intake manifold

5.1 Assembly overview - lower part of intake manifold with fuel rail



1 - Fuel distributor

- ❑ Removing and installing ⇒ page 221

2 - Intake manifold flap potentiometer - G336-

3 - Bolts

- ❑ Qty. 2

4 - Seal

- ❑ Renew after removal

5 - Hose

6 - Intake manifold flap air flow control valve - N316-

7 - Bolt

- ❑ 9 Nm

8 - Bracket

9 - Bolt

- ❑ 9 Nm

10 - Bracket

11 - Hose

12 - Bolt

- ❑ 9 Nm

13 - Throttle valve module - J338-

- ❑ Removing and installing ⇒ page 222

14 - Seal

- ❑ Renew after removal

15 - Bolt

- ❑ 9 Nm

16 - Bracket for valve

17 - Attachment

18 - Variable intake manifold

- ❑ Removing and installing ⇒ page 219

19 - Intake air temperature sender - G42-

20 - Bolt

- ❑ 9 Nm

21 - Bolt

- ❑ 20 Nm

22 - Support

23 - Bolt

- ❑ 20 Nm

24 - Nut

- ❑ 9 Nm

25 - Bolt

- ❑ 9 Nm

26 - Seal

- ❑ Renew after removal

27 - Stud

- ❑ 9 Nm

5.2 Removing and installing intake manifold upper part

Removing

Note

- ♦ *The injectors can only be accessed after removal of the intake manifold and fuel rail.*
- ♦ *The combustion chamber ring seal (Teflon) and O-ring must always be renewed.*

– Remove intake manifold and fuel rail ⇒ page 218 .

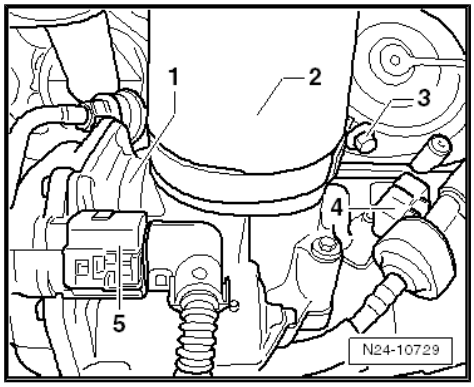
– If fitted, remove noise insulation ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Removing and installing noise insulation .

– Move to service position ⇒ General body repairs, exterior; Rep. gr. 50 ; Lock carrier; Moving to and back from service position .

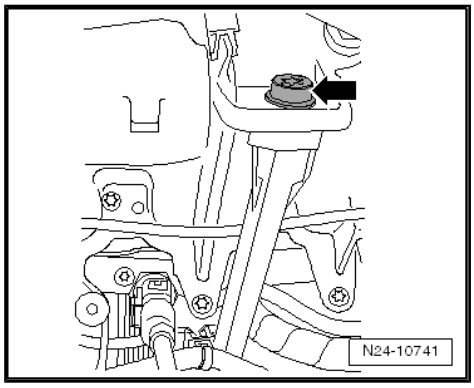
– Detach electrical connectors from intake air temperature sender - G42- , solenoid valve 1 for activated charcoal filter - N80- , throttle valve control module - J338- and Hall sender - G40- .

– Unclip wiring harness from intake manifold and place to one side.

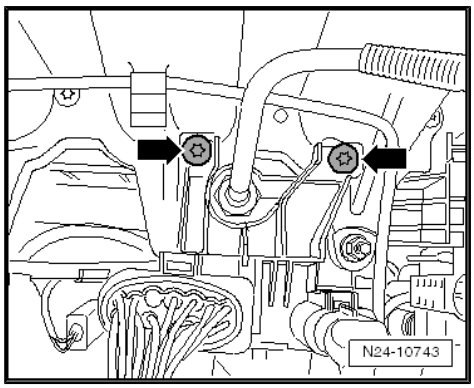
– Detach clamp -3- of pressure hose -2- at throttle valve module - J338- .
– Pull off pressure hose from throttle valve module - J338- and lay aside.
– Detach bracket -4- from solenoid valve 1 for activated charcoal filter - N80- .
– Loosen activated charcoal filter line from intake manifold and lay aside.



– Unscrew bolt -arrow-.



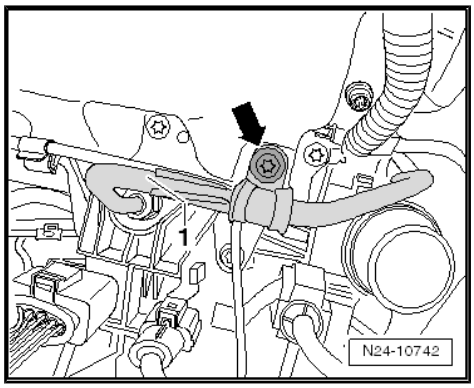
– Unscrew bolts -arrows-.
– Detach bracket.



Note

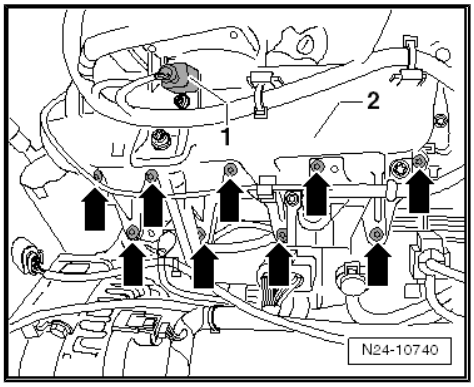
The fuel system must not be under pressure.

– Unscrew bolt -arrow-.
– Loosen union nut of pressure pipe -1-.
– Loosen bracket of pressure pipe at intake manifold.



– Undo and remove bolts -arrows- from intake manifold -2-.

– Carefully pull upper part of intake manifold off lower part of intake manifold.



Note

Seal intake ports with a clean cloth.

Installing

Install in reverse order of removal, observing the following:

Specified torques

◆ ⇒ “5.1 Assembly overview - lower part of intake manifold with fuel rail”, page 218

5.3 Removing and installing lower part of intake manifold

Removing

Note

◆ *The injectors can only be accessed after removal of the intake manifold and fuel rail.*

◆ *The combustion chamber ring seal (Teflon) and O-ring must always be renewed.*

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

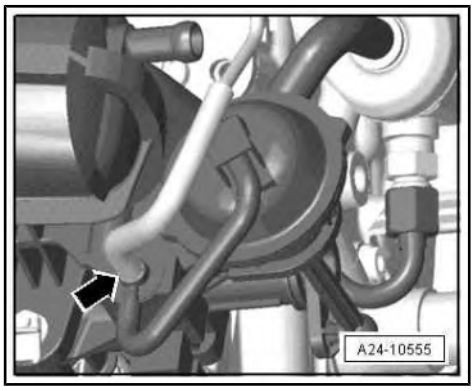
– Move to service position ⇒ General body repairs, exterior; Rep. gr. 50 ; Lock carrier; Moving to and back from service position .

– Remove upper part of intake manifold ⇒ page 219 .

– Pull vacuum line -arrow- off intake manifold flap air flow control valve - N316- and detach electrical connector.

– Unclip crankcase breather hose from oil trap.

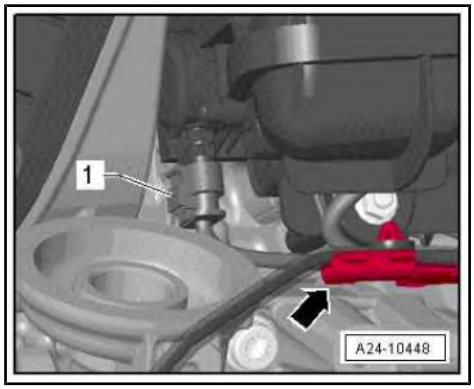
– Remove oil filter ⇒ Item 6 (page 155) .



Note

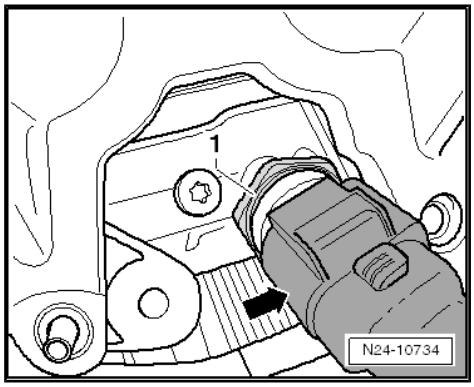
If present, open cable retainer -arrow-, and lay wiring harness to one side.

– Detach electrical connector -1- from intake manifold flap potentiometer - G336- .



– Detach electrical connector -arrow- from fuel pressure sender - G247- -1-.

– Unscrew the two stud bolts and remove lower part of intake manifold.



Note

- *The injectors can remain in the fuel rail.*
- *Seal intake ports with a clean cloth.*

Installing

Install in reverse order of removal, observing the following:

– Push lower part of intake manifold onto stud bolts (left and right) on cylinder head.

Specified torques

- ⇒ “5.1 Assembly overview - lower part of intake manifold with fuel rail”, page 218

5.4 Removing and installing throttle valve module - J338-

⇒ “5.4.1 Removing and installing throttle valve module J338 ”, page 222

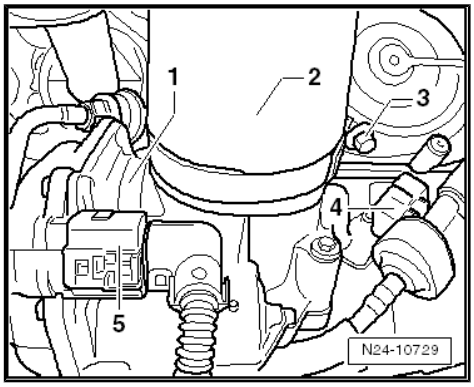
⇒ “5.4.2 Cleaning throttle valve module J338 ”, page 223

5.4.1 Removing and installing throttle valve module - J338-

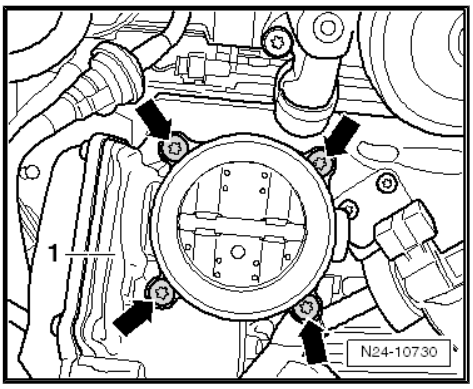
Removing

– Detach electrical connector -5- from throttle valve control module - J338- -1-.

– Detach clamp -3- of pressure hose -2- at throttle valve module - J338- .
– Pull off pressure hose from throttle valve module - J338- .
– Unclip bracket -4- from solenoid valve 1 for activated charcoal filter - N80- .



– Unscrew bolts -arrows- of throttle valve module - J338- .
– Remove throttle valve module - J338- upwards.



Installing

Install in reverse order of removal, observing the following:

– Clean sealing surface for O-ring.
– Renew seal.
– After throttle valve module - J338- has been renewed, it must be readapted to engine control unit - J623- ⇒ Vehicle diagnostic tester.

Specified torques

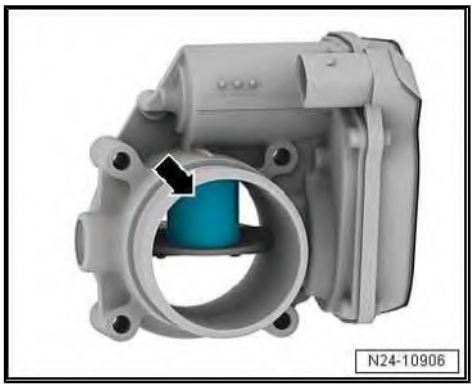
◆ ⇒ "5.1 Assembly overview - lower part of intake manifold with fuel rail", page 218

5.4.2 Cleaning throttle valve module - J338-

Note

◆ *If a new engine control unit - J623- is installed, the throttle valve module - J338- must be adapted.*
◆ *When cleaning the throttle valve nozzle it must not be scratched.*

– Remove throttle valve module - J338- ⇒ page 222 .
– Open throttle valve module - J338- by hand and lock throttle valve module - J338- in open position using a suitable object (e.g. wood or plastic wedge) -arrow-.

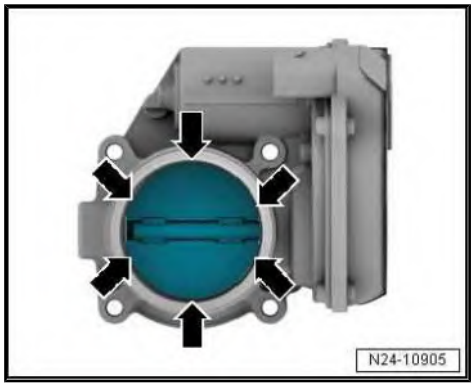


CAUTION

Risk of injury caused by acetone. Acetone is highly flammable and may cause eye and skin irritation.

– Wear protective goggles.
– Wear protective gloves.

– Thoroughly clean throttle valve connection, especially in area -arrows- of closed throttle valve housing - J338- using commercially available acetone compliant with DIN 53247 and a brush.
– Wipe the inside of the throttle valve housing with a lint-free cloth.
– Allow acetone to flash off completely and reinstall cleaned throttle valve module - J338- .
– Delete programmed values, and adapt engine control unit - J623- to throttle valve module - J338- ⇒ Vehicle diagnostic tester.

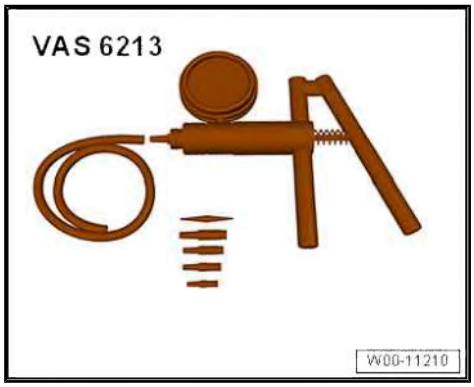


5.5 Checking intake manifold change-over

Perform check only if there is a loss of torque. This means when there is a lack of elasticity or a lack of pulling power.

Special tools and workshop equipment required

♦ Hand operated vacuum pump - VAS 6213-



Prerequisites for check

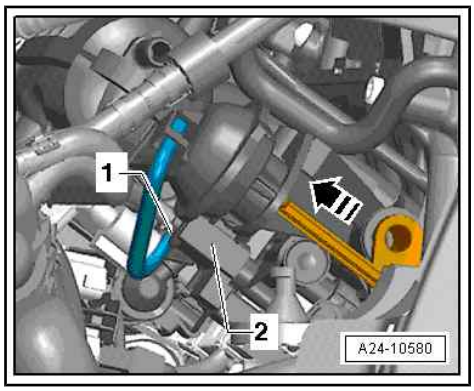
♦ Variable intake manifold valve - N316- checked with ⇒ Vehicle diagnostic tester

If the intake manifold flap valve - N316- is OK, perform the following tests:

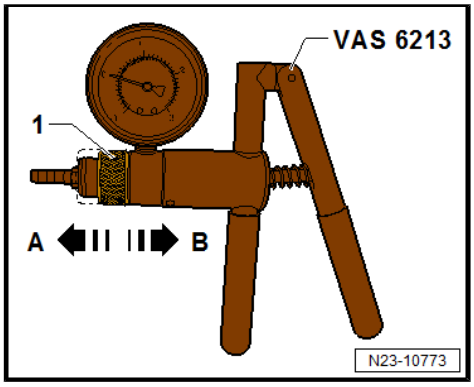
– Start engine and allow to idle.
– Get a second person to abruptly increase engine speed (burst of acceleration).
– Observe vacuum unit for intake manifold changeover.
• Actuator must move -arrow-

If changeover does not operate as indicated:

– Check vacuum system for leaks.
– Check changeover mechanism for ease of movement . To do this, operate rods by hand.
– Check that vacuum lines are connected correctly.
– Check vacuum hoses for porosity.
– Remove vacuum hose -1- leading to actuator for intake manifold flap valve - N316- from intake manifold flap valve - N316- -2-.



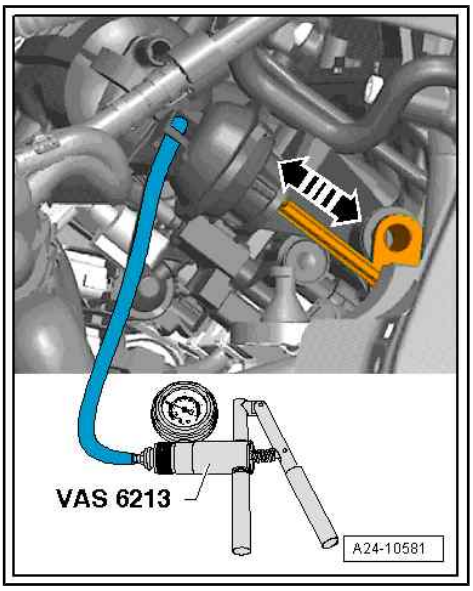
– Move slide ring -1- on hand vacuum pump - VAS 6213- to position -A- for vacuum.



– Connect hand vacuum pump - VAS 6213- to actuator for intake manifold flap valve - N316- .
– Operate hand vacuum pump - VAS 6213- several times.

vacuum unit -arrows- must move.

– If the vacuum unit does not move, renew it.



6 Senders and sensors

⇒ “6.1 Removing and installing air mass meter G70 ”, page 226

⇒ “6.2 Removing and installing fuel pressure sender G247 ”, page 227

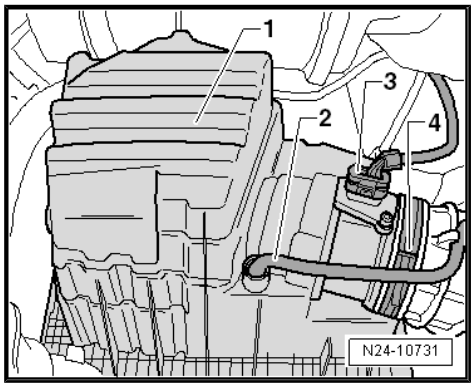
6.1 Removing and installing air mass meter - G70-

Removing

– Unplug electrical connector -3- from air mass meter - G70- .

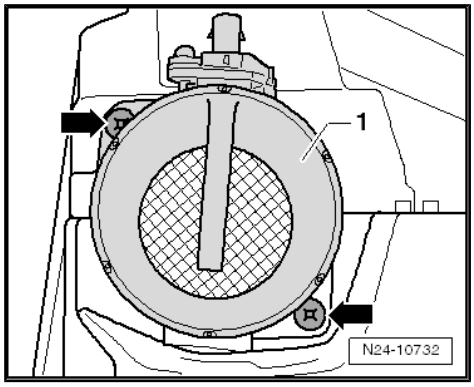
– Pull off vacuum hose -2- and unclip from retainer.

– Loosen clamp -4- and disconnect hose.



– Unscrew bolts -arrows- from air mass meter - G70- -1-.

– Remove air mass meter - G70- from air cleaner housing.



Installing

Install in reverse order of removal, observing the following:

To ensure proper operation of the air mass meter - G70- it is important to observe the following instructions and comply with the procedures described.

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.*
- *Restore the factory standard by securing all of the hose connections with hose clips appropriately ⇒ Electronic parts catalogue (ETKA) .*

– Check air mass meter and intake hose (engine intake side) for salt residue, soiling and leaves.

– Check intake port for dirt as far as the air filter element.

– If contamination is found, remove salt residue, dirt and leaves from top and bottom part of air filter housing (rinse out or use vacuum cleaner if necessary).

– Removing and installing air filter element ⇒ Maintenance ; Booklet 20.1 ; Descriptions of work; Air filter: cleaning housing and renewing filter element

Specified torques

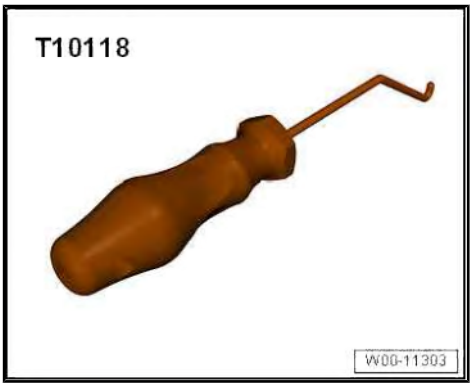
- ⇒ “4.1 Assembly overview - air filter housing”, page 215

6.2 Removing and installing fuel pressure sender - G247-

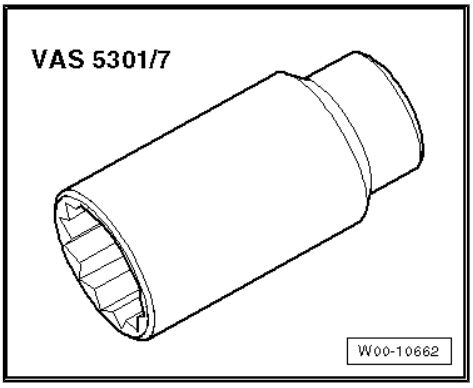
If fuel pressure sender - G247- fails, fuel pressure regulating valve - N276- is switched off, electric fuel pump is fully actuated, and engine is operated with available fuel pressure. This reduces the engine torque drastically.

Special tools and workshop equipment required

- Assembly tool - T10118-



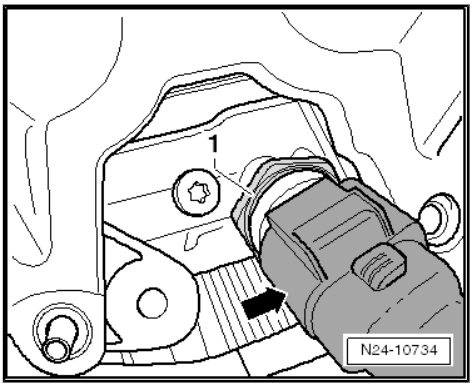
- Double hex socket1/2", 27mm - VAS 5301/7- or commercially available 27 mm socket



Removing

– Separate electrical connector -arrow- from fuel pressure sender - G247- using assembly tool - T10118- .

– Unscrew fuel pressure sender - G247- -1- using double hexagon socket Unscrew 1/2, 27mm - VAS 5301/7- .



Installing

Install in reverse order of removal, observing the following:

Specified torques

Component	Specified torque
Fuel pressure sender - G247-	27 Nm

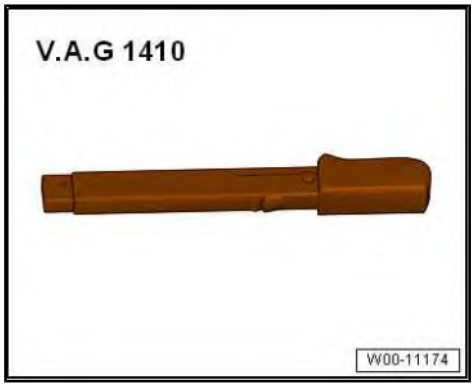
7 Engine control unit

⇒ “7.1 Removing and installing engine (motor) control unit J623 ”, page 228

7.1 Removing and installing engine (motor) control unit - J623-

Special tools and workshop equipment required

- Torque wrench - V.A.G 1410-



Removing

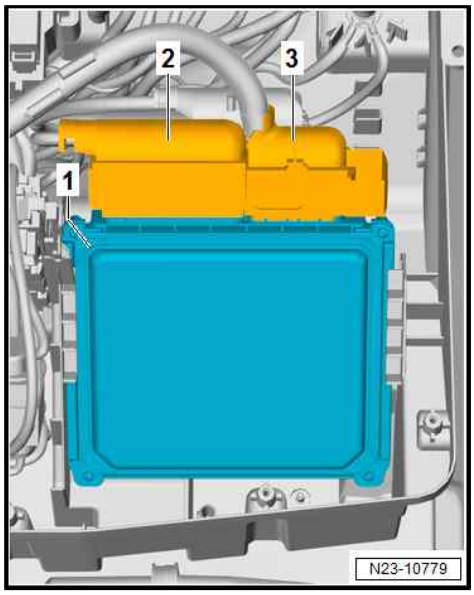
Note

Before removing engine control unit, read the identification of control device and the code of the control unit used up to now ⇒ Vehicle diagnostic tester.

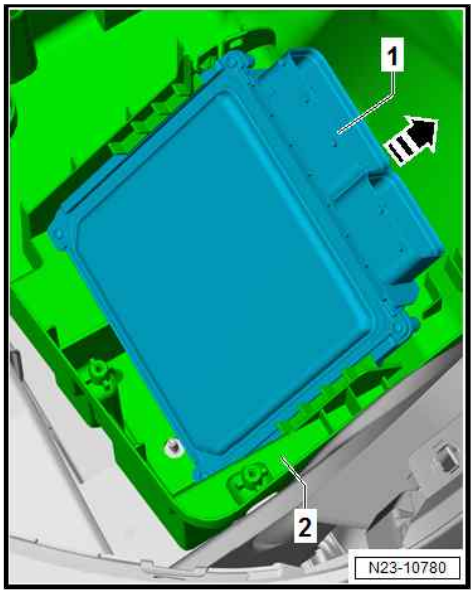
– Remove battery tray ⇒ Electrical system; Rep. gr. 27 ; Battery; Removing and installing battery tray .

– Remove electronics box cover ⇒ Electrical system; Rep. gr. 97 ; Relay carrier, fuse carrier, electronics boxes; Removing and installing electronics box .

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



– Pull engine control unit - J623- -1- in -direction of arrow- out of electronics box -2-.



Installing

Install in reverse order of removal, observing the following:

– Check previous code and code new engine control unit - J623- ⇒ Vehicle diagnostic tester.

Specified torques

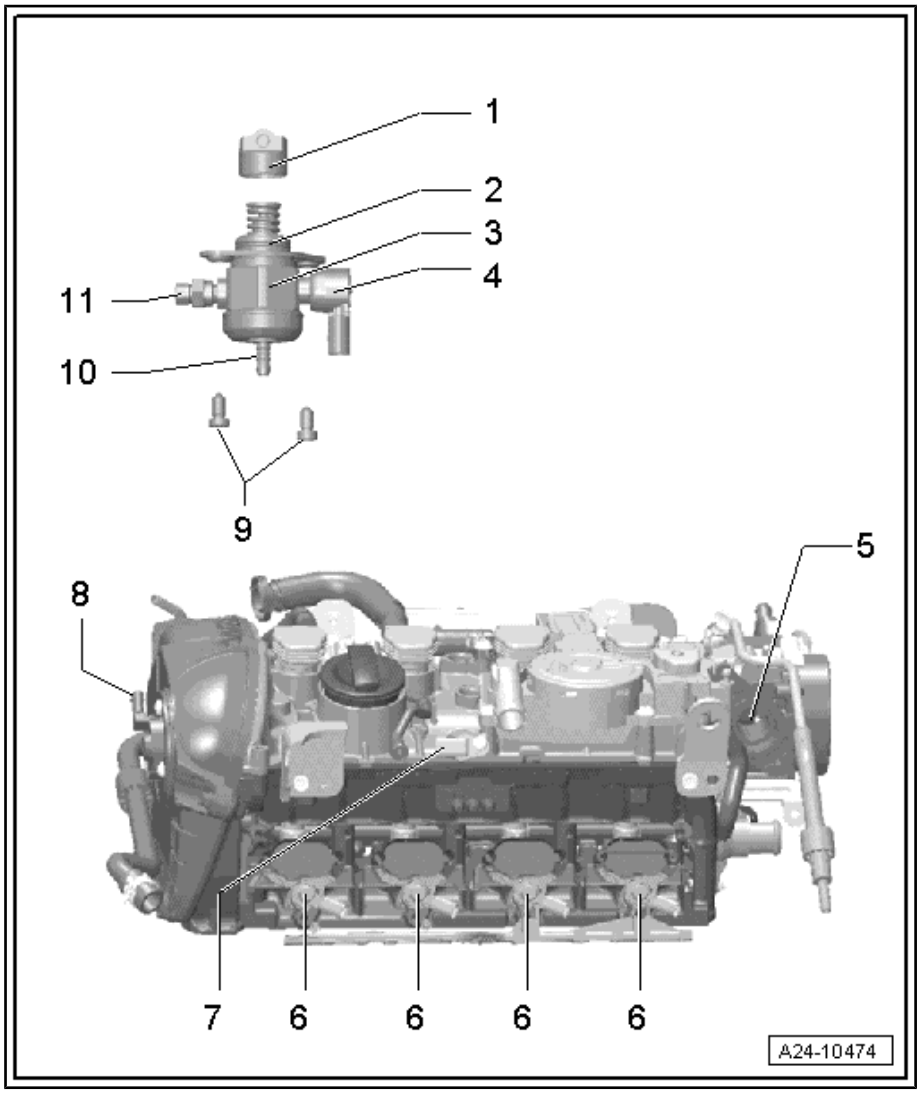
- Assembly overview - battery ⇒ Electrical system; Rep. gr. 27 ; Battery; Assembly overview - battery .
- Overview of fitting locations - relay carrier, fuse carrier, electronics boxes ⇒ Electrical system; Rep. gr. 97 ; Relay carrier, fuse carrier, electronics boxes; Overview of fitting locations - relay carrier, fuse carrier, electronics boxes

8 High-pressure pump

⇒ “8.1 Assembly overview - high-pressure pump”, page 230

⇒ “8.2 Removing and installing high-pressure pump”, page 231

8.1 Assembly overview - high-pressure pump



1 - Roller tappet

- ❑ Can remain inserted in vacuum pump after removal of high-pressure pump

2 - O-ring

- ❑ Renew after removal

3 - High-pressure pump

- ❑ Fuel tank contains electric fuel pump which pumps fuel to mechanical high-pressure pump.
- ❑ When installing the high-pressure pump, ensure that no dirt enters the fuel system
- ❑ The fuel system must be depressurised in order to install the high-pressure pump; relieve fuel pressure.
- ❑ Install fuel lines free of stress.
- ❑ Removing and installing ⇒ page 231

4 - Fuel pressure regulating valve - N276-

5 - Bore in vacuum pump for high-pressure pump

6 - Injectors

- ❑ Renew O-ring and Teflon ring
- ❑ Ensure correct installa-

tion position

- ❑ Removing and installing ⇒ page 210

7 - Hall sender - G40-

- ❑ Removing and installing ⇒ page 250

8 - Inlet camshaft control valve 1 - N205-

- ❑ Removing and installing ⇒ page 133

9 - Bolts

- ❑ Qty. 2
- ❑ Do not cant high-pressure pump
- ❑ Tighten in diagonal sequence by hand and then to 5 Nm
- ❑ Final specified torque 20 Nm

10 - Connecting piece for fuel supply line from fuel tank

11 - Connection for fuel supply line

- ❑ Renew after removal
- ❑ Fuel supply line must be free of tension when installed.
- ❑ Union: 30 Nm
- ❑ Specified specified torque for union nut of fuel pressurisation line: 27 Nm

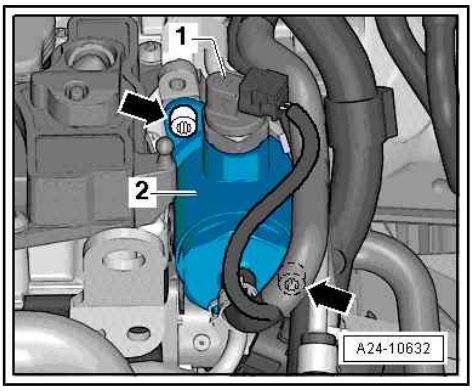
8.2 Removing and installing high-pressure pump

Removing

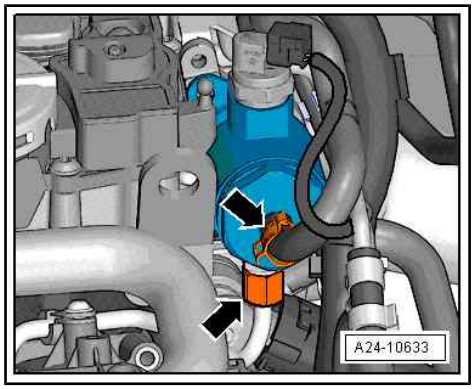
Note

- ♦ *It is only permissible to remove high-pressure pump when engine is cold.*
- ♦ *When installing the high-pressure pump, it is essential to ensure that no dirt enters the fuel system.*
- ♦ *The O-ring must always be renewed.*
- ♦ *Always ensure that high-pressure fuel line is free of tension when installed.*

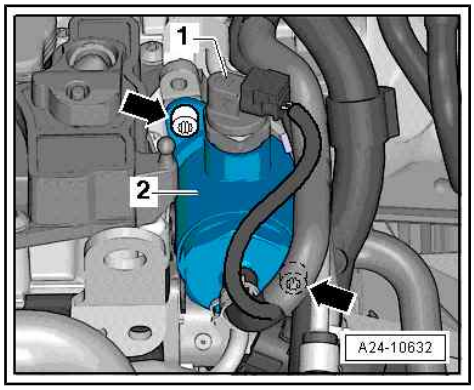
– Disconnect connector from fuel pressure regulating valve - N276- -1-.



– Open both fuel lines -arrows-.



– Unscrew bolts -arrows-.
– Carefully pull out high-pressure pump -2-.
– The roller tappet can remain inserted in vacuum pump in some cases.



Installing

Install in reverse order of removal, observing the following:

Note

The fuel pressure regulating valve - N276- must be adapted if it has been renewed ⇒ Vehicle diagnostic tester.

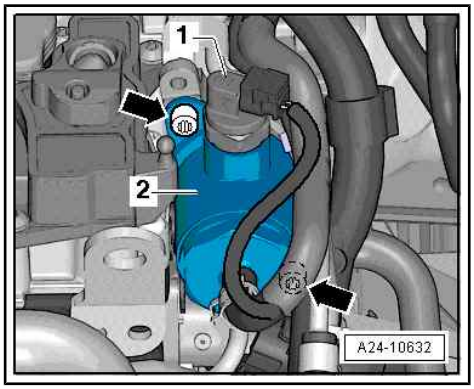
– Renew high-pressure pump O-rings.
– Insert roller tappet in vacuum pump (first check roller tappet for damage).

Note

- *Roller tappet must be at bottom dead centre to enable high-pressure pump to be installed.*
- *If same or a used high-pressure pump is installed, connection for fuel pressurisation line (high-pressure side) must be renewed. See assembly overview - high-pressure pump item 11* *⇒ Item 11 (page 231)*

– Turn crankshaft until roller tappet is at bottom dead centre.
– Insert high-pressure pump into vacuum pump.
– Tighten bolts by hand.
– Renew high-pressure pump connection.
– Tighten union nuts of fuel supply line by hand and align free of stress.

– Re-attach electrical connector of fuel pressure regulating valve - N276- -1-.
– Put back fuse if it has been removed.



Note

Then check entire fuel system for leaks.

Specified torques

◆ ⇒ “8.1 Assembly overview - high-pressure pump”, page 230

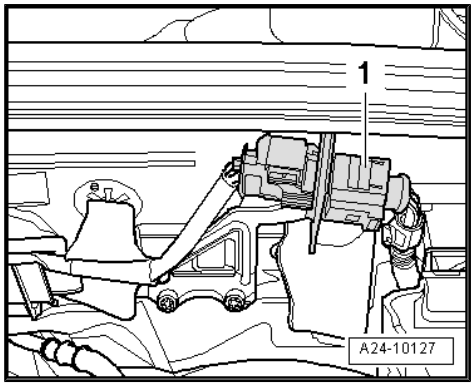
9 Lambda probe

⇒ “9.1 Assembly overview - Lambda probe”, page 234

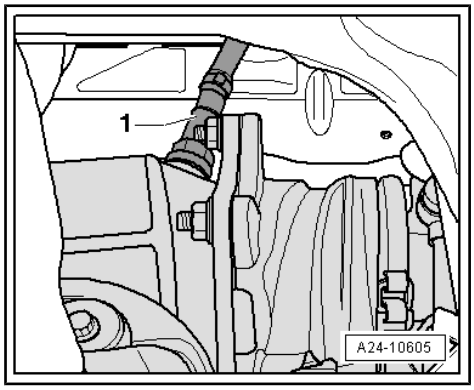
⇒ “9.2 Removing and installing Lambda probe”, page 235

9.1 Assembly overview - Lambda probe

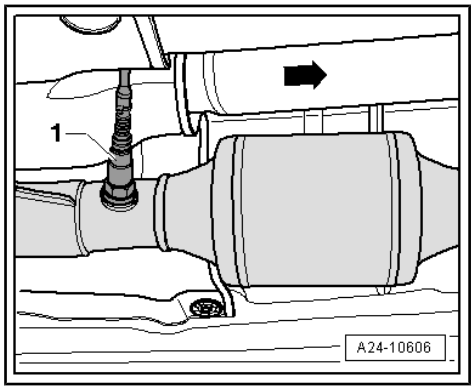
Electrical plug connector -1- for the Lambda probe - G39- and Lambda probe heater - Z19-



Lambda probe - G39- and Lambda probe heater - Z19- -1-



Lambda probe after catalytic converter - G130- and Lambda probe heater 1 after catalytic converter - Z29- -1-



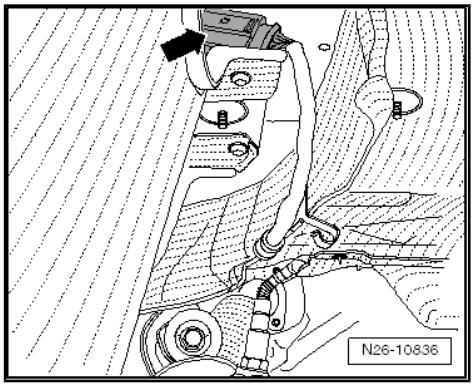
Note

The arrow in the picture shows the direction.

Specified torques

Component	Specified torque
Lambda probe	55 Nm

Electrical plug connector -arrow- for the Lambda probe after the catalytic converter - G130- and Lambda probe heater 1 after catalytic converter - Z29-



Note

- *New lambda probes are coated with an assembly paste. The paste must not get into the slots on the Lambda probe body.*
- *In the case of a used Lambda probe, grease only the thread with high-temperature paste. This paste must not get into the slots on the Lambda probe body. High-temperature paste ⇒ Electronic parts catalogue (ETKA)*
- *When installing, the electrical wiring of the Lambda probe must always be re-attached at the same locations to prevent the Lambda probe wiring from coming into contact with the exhaust pipe.*

– Removing and installing Lambda probe - G39- and Lambda probe heater - Z19- before catalytic converter ⇒ page 235 .

– Removing and installing Lambda probe after catalytic converter - G130- ⇒ page 236 .

9.2 Removing and installing Lambda probe

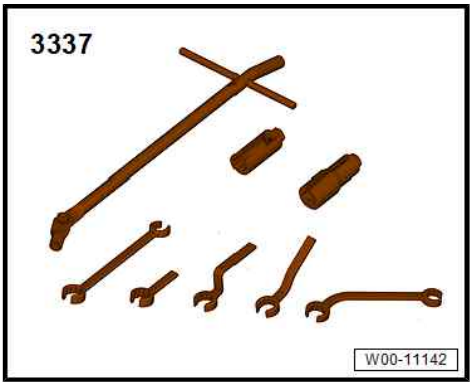
⇒ "9.2.1 Removing and installing Lambda probe G39 before catalytic converter", page 235

⇒ "9.2.2 Removing and installing Lambda probe after catalytic converter G130 ", page 236

9.2.1 Removing and installing Lambda probe - G39- before catalytic converter

Special tools and workshop equipment required

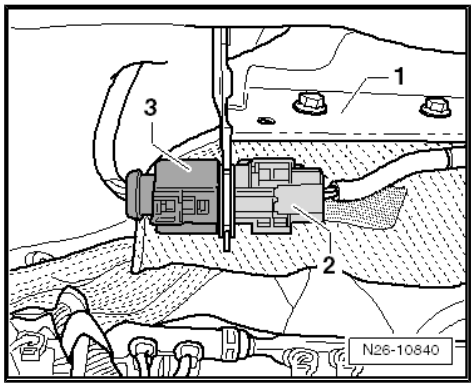
- Lambda probe open ring spanner set - 3337-



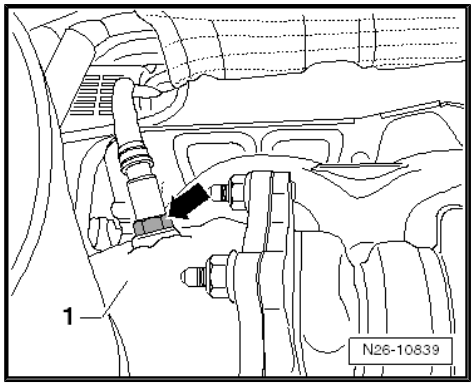
Removing

– Detach electrical connector -3- of Lambda probe - G39- .

– Unclip wiring harness -2- for Lambda probe - G39- from bracket -1-.



– Unscrew Lambda probe - G39- -arrow- from catalytic converter -1-.



Installing

Install in reverse order of removal, observing the following:

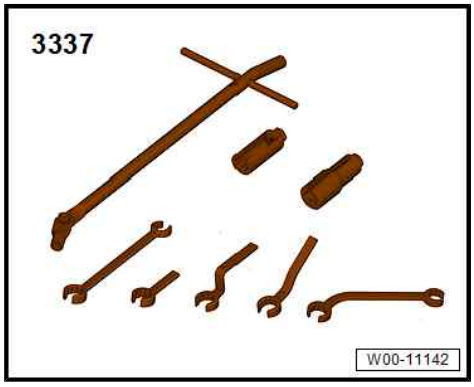
Note

- *New lambda probes are coated with an assembly paste. The paste must not get into the slots on the Lambda probe body.*
- *In the case of a used Lambda probe, grease only the thread with high-temperature paste. This paste must not get into the slots on the Lambda probe body. High-temperature paste ⇒ Electronic parts catalogue (ETKA)*
- *When installing, the electrical wiring of the Lambda probe must always be re-attached at the same locations to prevent the Lambda probe wiring from coming into contact with the exhaust pipe.*

9.2.2 Removing and installing Lambda probe after catalytic converter - G130-

Special tools and workshop equipment required

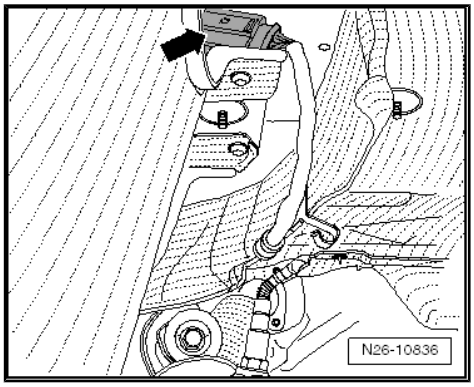
- Lambda probe open ring spanner set - 3337-



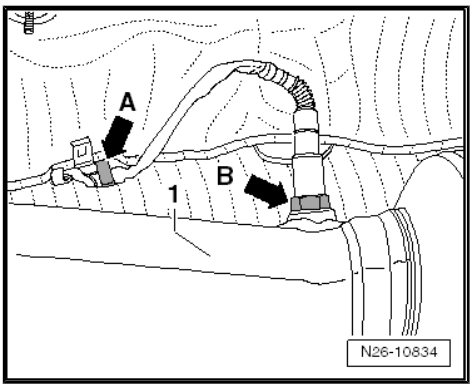
Removing

– Loosen heat shield on underbody sufficiently so that the electrical plug connector of the Lambda probe after the catalytic converter - G130- and Lambda probe heater 1 after the catalytic converter - Z29- is accessible.

– Electrical plug connector -arrow- for the Lambda probe after the catalytic converter - G130- and Lambda probe heater 1 after catalytic converter - Z29-



– Unclip wiring harness for Lambda probe after catalytic converter - G130- and Lambda probe heater 1 after catalytic converter - Z29- -A-.
– Unscrew Lambda probe after catalytic converter - G130- and Lambda probe 1 heater after catalytic converter - Z29- -B- from exhaust pipe -1- using tool from Lambda probe open ring spanner set - 3337- .



Installing

Install in reverse order of removal, observing the following:

Note

- *New lambda probes are coated with an assembly paste. The paste must not get into the slots on the Lambda probe body.*
- *In the case of a used Lambda probe, grease only the thread with high-temperature paste. This paste must not get into the slots on the Lambda probe body. High-temperature paste ⇒ Electronic parts catalogue (ETKA)*
- *When installing, the electrical wiring of the Lambda probe must always be re-attached at the same locations to prevent the Lambda probe wiring from coming into contact with the exhaust pipe.*

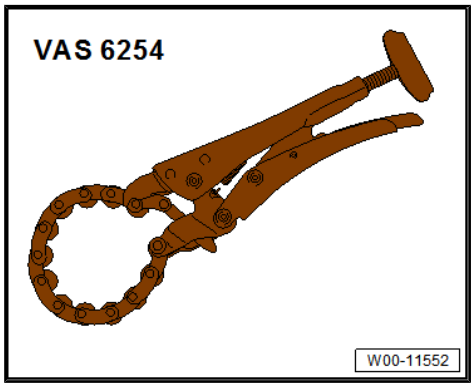
26 – Exhaust system

1 Exhaust pipes and silencers

1.1 Removing and installing centre silencer

Special tools and workshop equipment required

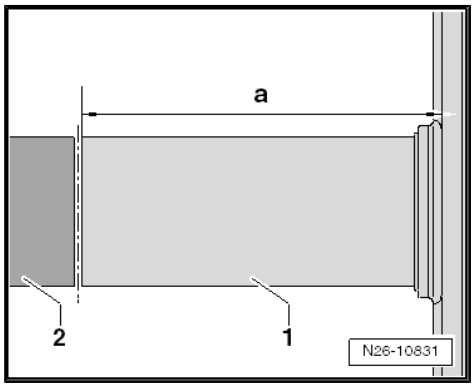
- Chain-type pipe cutter - VAS 6254-



- or body saw - V.A.G 1523A-

Removing

– Mark cutting location -a- = 144 mm on centre silencer exhaust pipe -1-.



CAUTION

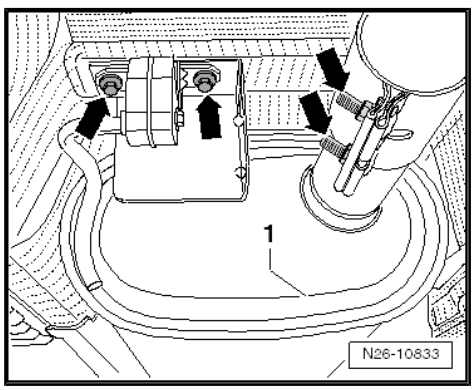
Risk of eye injury caused by flying swarf.
Eye irritation and injury possible.
– Wear protective goggles.

– Cut through exhaust pipe at separating point at right angles using chain-type pipe cutter - VAS 6254- .

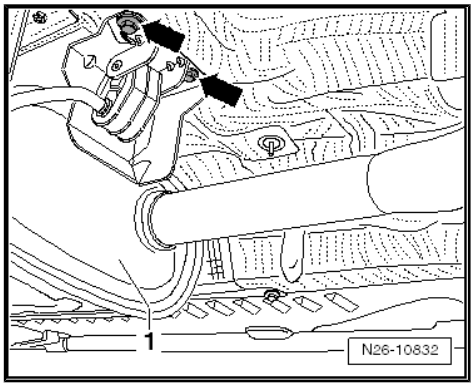
– Loosen nuts -arrows-.

– Remove double clamp.

– Unscrew bolts -arrows- for bracket of centre silencer at front.



– Unscrew bolts -arrows- for bracket of centre silencer at rear and remove centre silencer.



Installing

Install in reverse order of removal, observing the following:

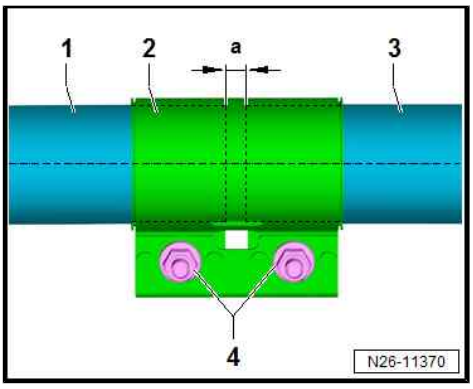
– Align repair double clamp -2- between front silencer -1- and rear silencer -3- when installing.

• The distance “a” must be approx. 5 mm.

– Tighten threaded connections -4- in this position.

Checking exhaust system for leaks ⇒ page 241 .

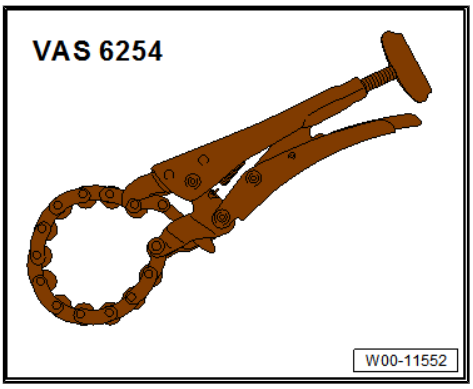
Align exhaust system free of stress ⇒ page 240 .



1.2 Removing and installing rear silencer

Special tools and workshop equipment required

♦ Chain-type pipe cutter - VAS 6254-



♦ or body saw - V.A.G 1523A-

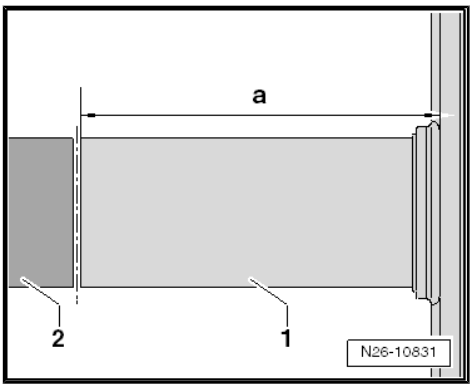
Removing

– Mark cutting location -a- = 144 mm on centre silencer exhaust pipe -1-.

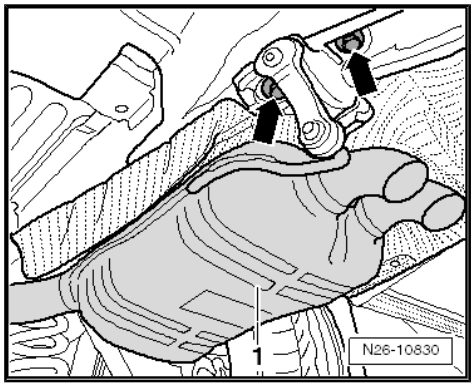
⚠ CAUTION

Risk of eye injury caused by flying swarf.
Eye irritation and injury possible.
– Wear protective goggles.

– Cut through exhaust pipe at right angles using chain-type pipe cutter - VAS 6254- , for example.



– Unscrew bolts -arrows- from bracket for rear silencer and remove rear silencer -1-.



Installing

Install in reverse order of removal, observing the following:

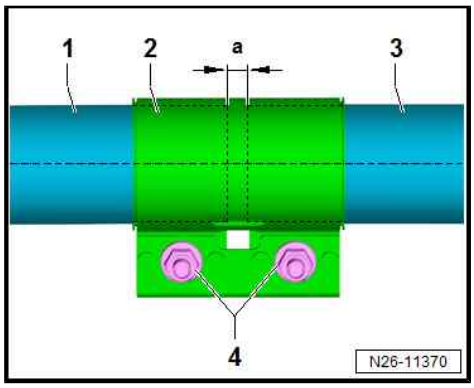
– Align repair double clamp -2- between front silencer -1- and rear silencer -3- when installing.

• The distance “a” must be approx. 5 mm.

– Tighten threaded connections -4- in this position.

Checking exhaust system for leaks ⇒ page 241 .

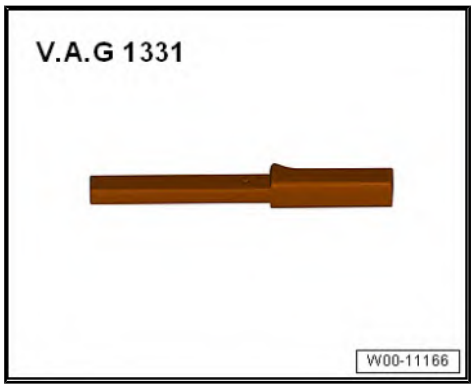
Align exhaust system free of stress ⇒ page 240 .



1.3 Aligning exhaust system free of stress

Special tools and workshop equipment required

♦ Torque wrench - V.A.G 1331-



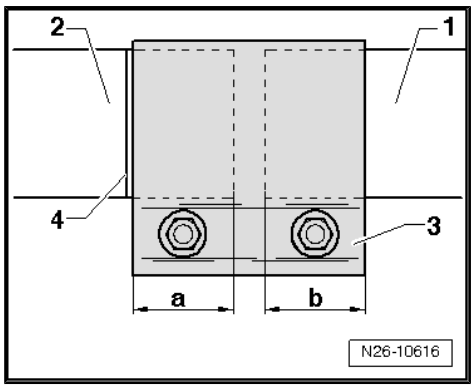
• The exhaust system must be aligned when cold

Sequence of operations

– Loosen bolts of double clamp -3-.

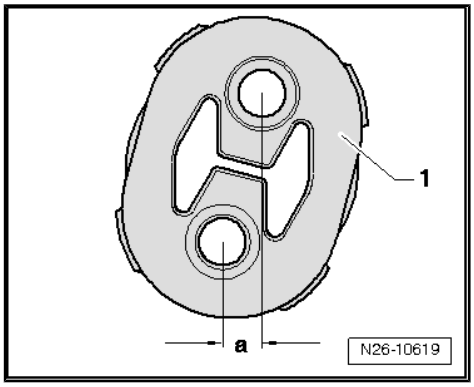
– Tighten bolts by hand.

– 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.



Specified torques

Component	Specified torque
Bolts for double clamp	31 Nm

1.4 Check exhaust system for leaks

Sequence of operations

– Start engine and run it at idling speed.

– Seal exhaust pipe with cloths or plugs, for example, for the duration of the leakage test.

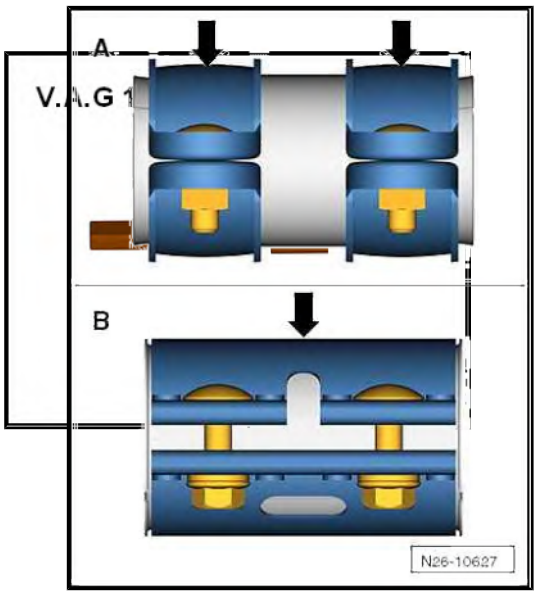
– Check (by listening) points of connection between exhaust manifold and the cylinder head, between turbocharger and front exhaust pipe etc. to make sure there are no leaks.

– Repair any leaks found.

1.5 Installation position of clamp

Special tools and workshop equipment required

♦ Torque wrench - V.A.G 1331-



Specified torque and mounting dimensions of clamping sleeve.

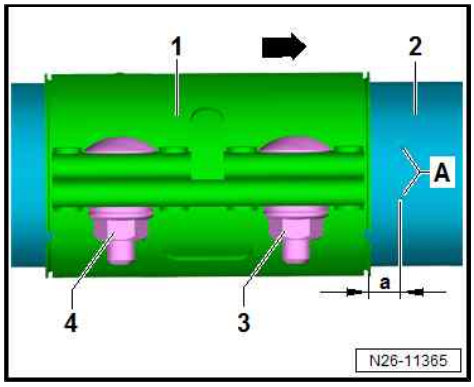
Clamp -A- has 2 individual clips.

Clamp -B- has continuous clip.

Specified torques

Component	Specified torque
Clamp -A-	25 Nm
Clamp -B-	35 Nm

Installation dimension -a- applies to vehicles with marking -A- on front exhaust pipe, 8.5 mm (only for front clamping sleeve).



1 - Clamping sleeve

2 - Front exhaust pipe

3 - Nut

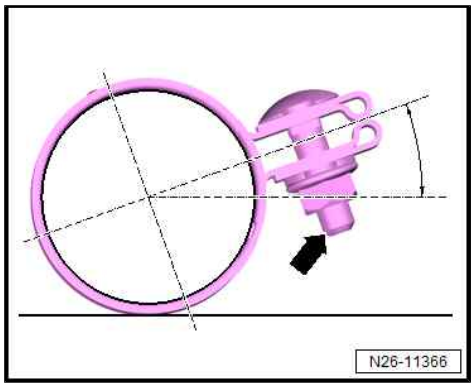
4 - Nut

a - Installation dimension

A - Marking

Installation position of clamp

– Install clamp so that end of bolt -arrow- does not extend beyond lower edge of clamp.



- The threaded connection of the front clamp faces to the right.
- The threaded connection of the rear clamp faces to the rear.

2 Exhaust gas cleaning

⇒ “2.1 Removing and installing catalytic converter”, page 243

2.1 Removing and installing catalytic converter

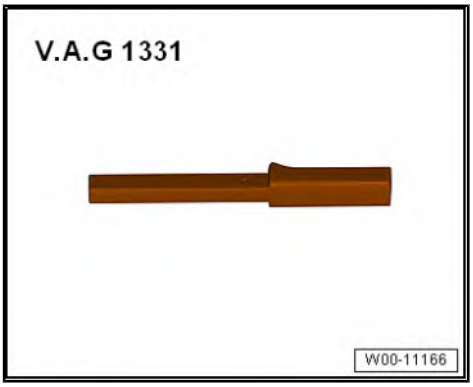
⇒ “2.1.1 Removing and installing starter catalytic converter”, page 243

⇒ “2.1.2 Removing and installing downstream catalytic converter”, page 245

2.1.1 Removing and installing starter catalytic converter

Special tools and workshop equipment required

- Torque wrench - V.A.G 1331-



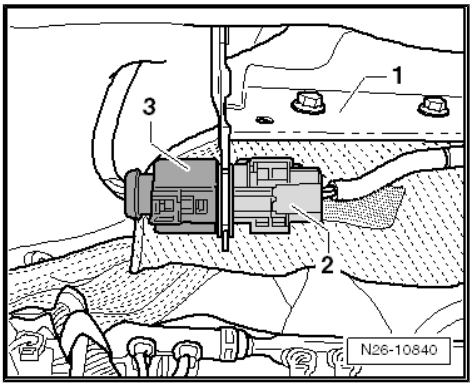
Removing

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

– Detach electrical connector -3- of Lambda probe - G39- .

– Unclip wiring harness for Lambda probe - G39- and remove it from bracket.

– Remove downstream catalytic converter ⇒ page 245 .



Vehicles with all-wheel drive:

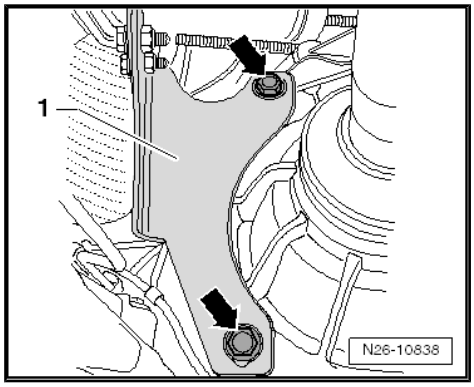
– Remove front propshaft ⇒ Rep. gr. 39 ; Propshaft; Removing and installing propshaft .

– Remove bevel box ⇒ Rep. gr. 34 ; Bevel box; Removing and installing bevel box .

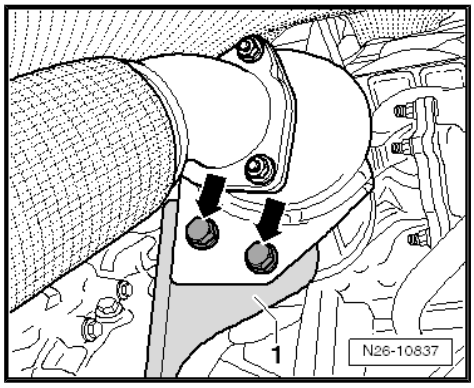
Vehicles with front-wheel drive:

– Unscrew bolts -arrows-.
– Remove bracket for starter catalytic converter -1-.

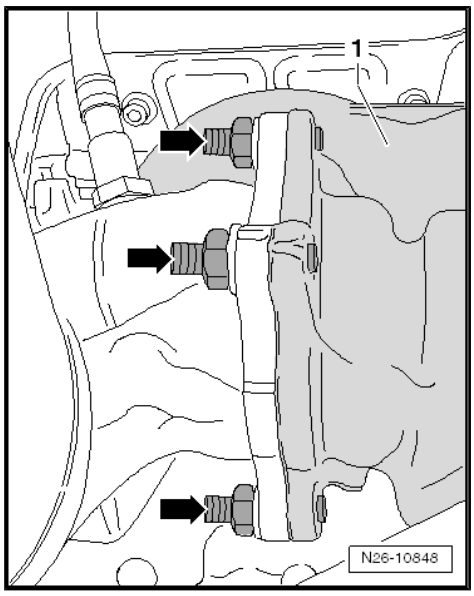
Continued for all vehicles:



– Unscrew bolts -arrows- from catalytic converter.
– Remove bracket on starter catalytic converter -1-.



– Unscrew nuts -arrows- of catalytic converter on turbocharger.
– Remove catalytic converter -1-.



Installing

Install in reverse order of removal, observing the following:

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 clamp 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.*

Checking exhaust system for leaks ⇒ page 241 .

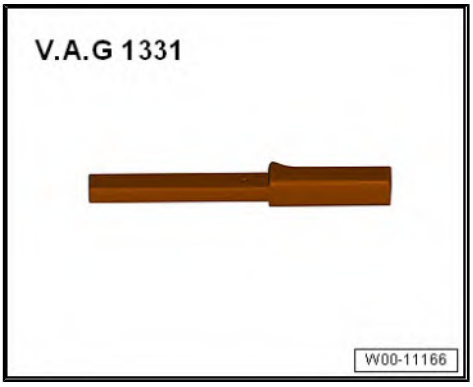
Align exhaust system free of stress ⇒ page 240 .

Specified torques

- ⇒ “1.1 Assembly overview - turbocharger”, page 193

2.1.2 Removing and installing downstream catalytic converter

Torque wrench - V.A.G 1331-

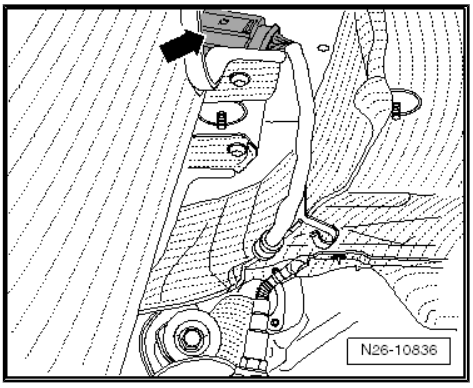


Removing

– Loosen heat shield on underbody sufficiently so that the electrical connector of the Lambda probe after the catalytic converter - G130- is accessible.

– Detach electrical connector -arrow- of Lambda probe after catalytic converter - G130- .

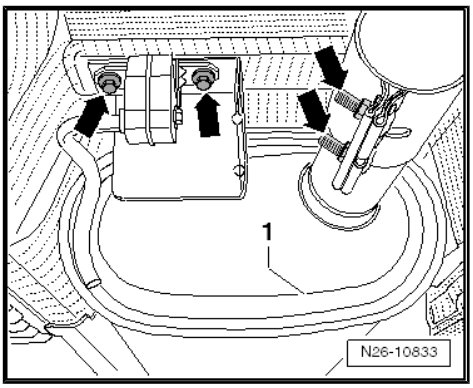
– Unclip wiring harness for Lambda probe after catalytic converter - G130- from underbody.



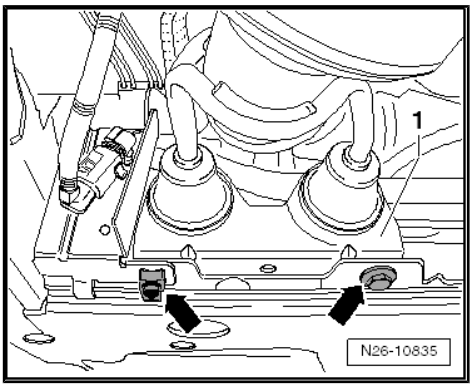
Note

Disregard bolts -arrows- for bracket of centre silencer.

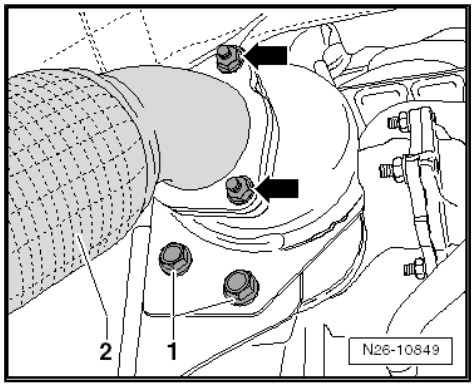
– Unscrew nuts -arrows-.



– Undo bolts -arrows- from bracket for catalytic converter -1-.



– Unscrew nuts -arrows-.
– Remove downstream catalytic converter -2-.



Installing

Install in reverse order of removal, observing the following:

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 clamp 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.*

Checking exhaust system for leaks ⇒ page 241 .

Align exhaust system free of stress ⇒ page 240 .

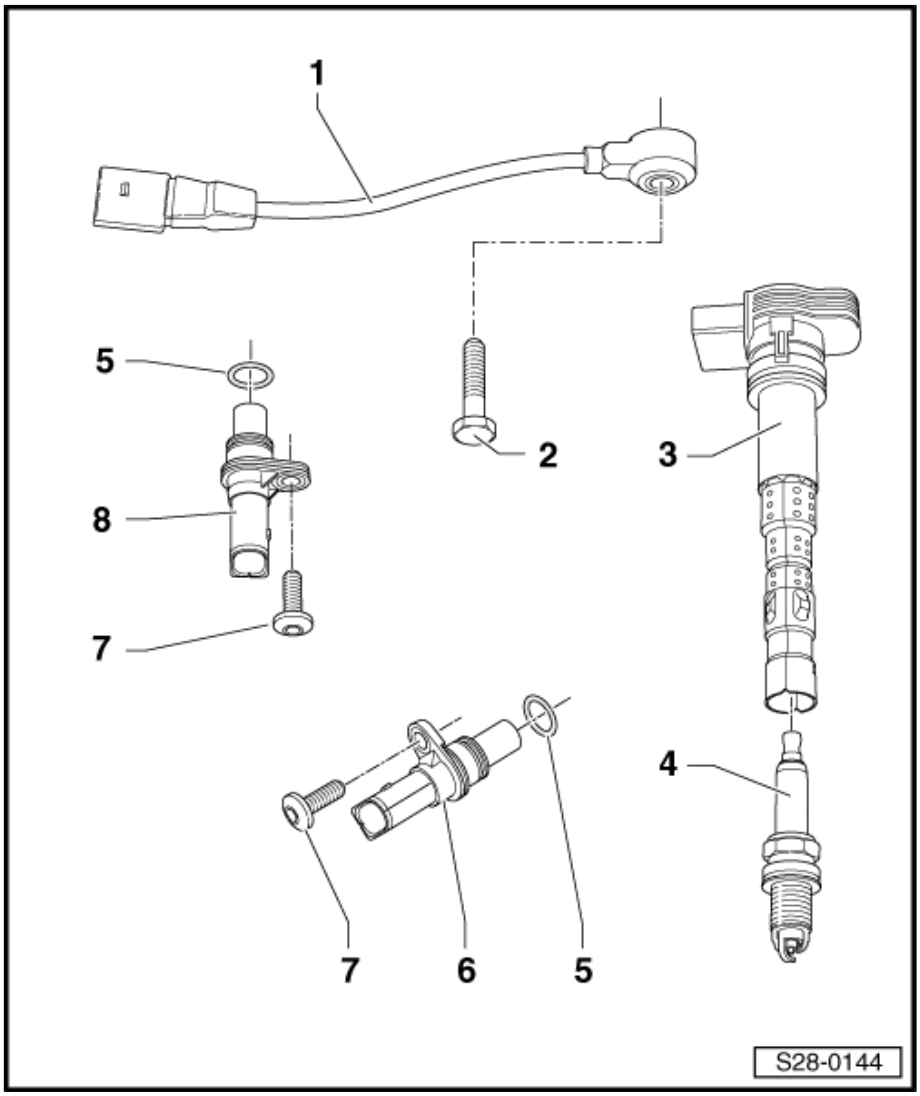
Specified torques

- ⇒ “1.5 Installation position of clamp”, page 241
- ⇒ “1.1 Assembly overview - turbocharger”, page 193

28 – Ignition system

1 Ignition system

1.1 Assembly overview - ignition system



1 - Knock sensor 1 - G61-

- On front of cylinder head under intake manifold
- Removing and installing ⇒ page 249

2 - Bolt

- The specified torque influences the function of the knock sensor.
- 20 Nm

3 - Ignition coils

- Ignition coil 1 with output stage - N70-
- Ignition coil 2 with output stage - N127-
- Ignition coil 3 with output stage - N291-
- Ignition coil 4 with output stage - N292-
- Removing and installing ⇒ page 248

4 - Spark plug

- If a spark plug is to be renewed, regrease ignition coil with final output stage
- Type and electrode gap ⇒ page 251 .
- 25 Nm

5 - O-ring

- Renew after removal

6 - Engine speed sender - G28-

- In cylinder block at front on the bottom left, at an angle beneath the coolant pump ⇒ page 250
- Removing and installing ⇒ page 250

7 - Bolt

- ❑ 10 Nm

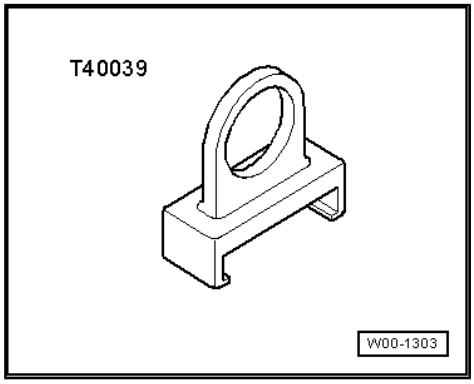
8 - Hall sender - G40-

- ❑ In cylinder head cover at front.
- ❑ Removing and installing ⇒ page 250

1.2 Removing and installing ignition coils with output stage

Special tools and workshop equipment required

- ♦ Puller - T40039-

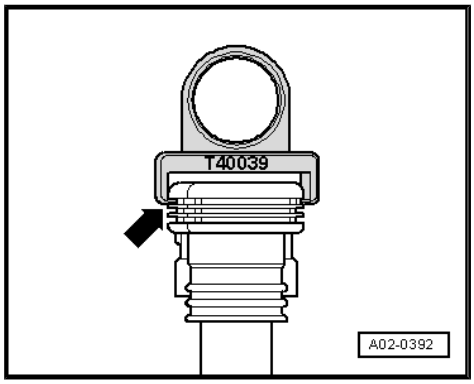


- ♦ Lubricating paste - G 052 141 A2-

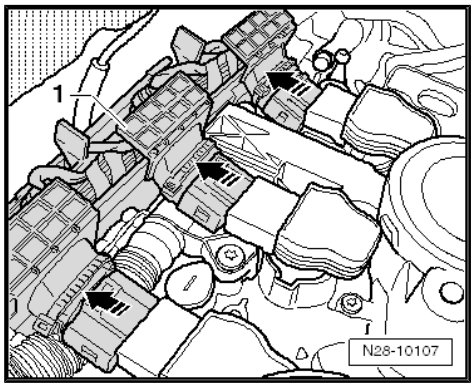
Removing

Note

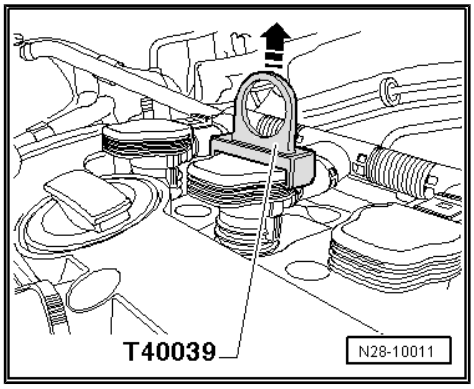
- ♦ *To detach spark plugs, fit puller - T40039- onto uppermost, thick rib -arrow- of ignition coils with final output stages.*
- ♦ *If the lower ribs are used, they could be damaged.*



– Release electrical connectors -1- of ignition coil with output stage and separate in direction of -arrow-.



– Pull all ignition coils out of spark plug recess using puller - T40039- .



Installing

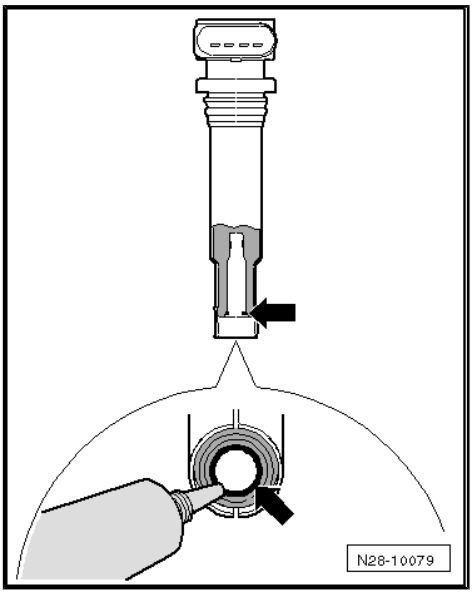
Install in reverse order of removal, observing the following:

Note

- *When fitting new spark plugs, the ignition coil must be re-greased using lubricating paste - G 052 141 A2- This will stop the ignition coil sealing hose from »sticking« to the spark plug.*
- *The lubricating paste must be distributed on the spark plug when inserting on the ignition coil.*
- *New ignition coils with output stage are lubricated when delivered.*

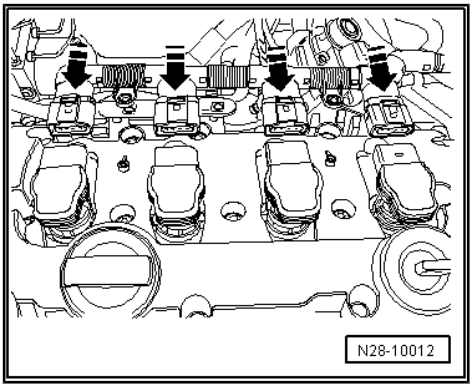
– Apply lubricating paste - G 052 141 A2- around circumference (1 … 2 mm thick) of ignition coil sealing hose -arrow-.

– Insert all ignition coils loosely into spark plug hole.



– Align ignition coils to electrical connectors.

– Fit electrical connectors -arrows-.



Note

Electrical connectors must engage audibly.

– Evenly push ignition coils onto spark plugs by hand.

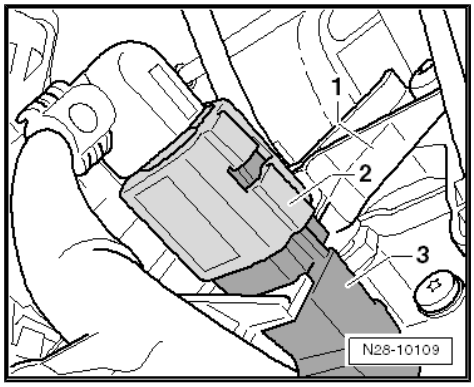
1.3 Removing and installing knock sensor 1 - G61-

Removing

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

– Release electrical connector -2-.

– Detach wiring harness for knock sensor 1 - G61- -3- from retainer -1-.



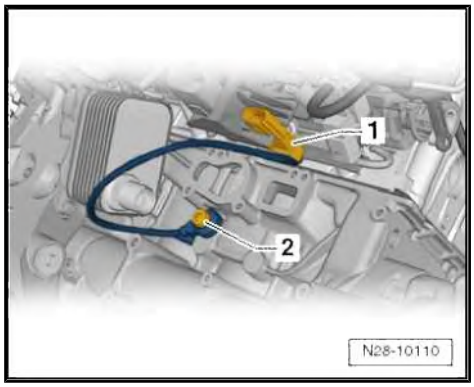
Note

- *The knock sensor I - G61- is located under the intake manifold behind the coolant pump.*
- *To remove, the coolant pump must be removed.*

– Remove coolant pump ⇒ page 172 .

– Unscrew bolt -2-.

– Remove knock sensor 1 - G61- -1-.



Installing

Install in reverse order of removal, observing the following:

Specified torques

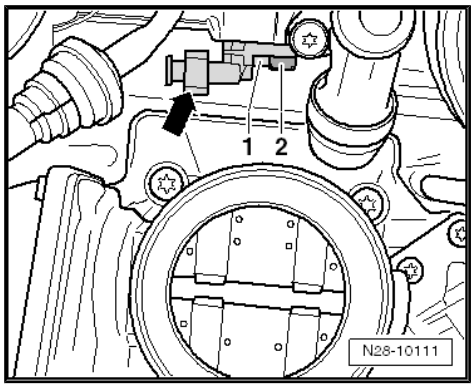
- ⇒ “1.1 Assembly overview - ignition system”, page 247

1.4 Removing and installing Hall sender - G40-

Removing

– Separate electrical connector -arrow- from Hall sender - G40- .

– Undo bolt -arrow- and remove Hall sender - G40- -1-.



Installing

Install in reverse order of removal, observing the following:

Specified torques

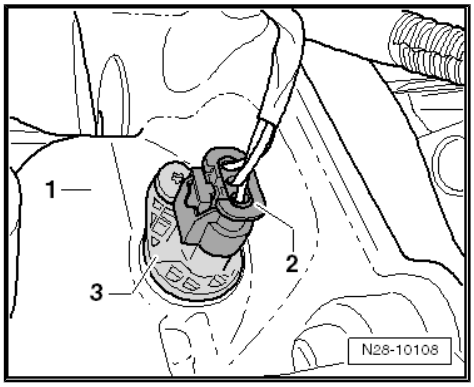
- ⇒ “1.1 Assembly overview - ignition system”, page 247

1.5 Removing and installing engine speed sender - G28-

Removing

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

– Separate electrical connector -2- from engine speed sender - G28- underneath coolant pump.
– Unscrew bolt from engine speed sender - G28- .
– Remove engine speed sender - G28- -3-.



Installing

Install in reverse order of removal, observing the following:

Specified torques

◆ ⇒ “1.1 Assembly overview - ignition system”, page 247

1.6 Test data, spark plugs

Engine code	CJKA, CJKB
Firing order	1-3-4-2
Spark plugs	
VW/Audi	⇒ Electronic parts catalogue (ETKA)
Electrode gap	1.0 to 1.1 mm
Specified torque	25 Nm
Change interval	⇒ Maintenance ; Booklet 20.1 ; Service tables