Workshop Manual

Audi A6 2005 ➢

6-cylinder TDI engine (2.7 ltr.; 3.0 ltr. 4-valve common rail), mechanics

Engine ID	BMK	BNG	BPP	BSG	ASB				

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List of Workshop Manual Repair Groups

Repair Group

00 - Technical data
10 - Removing and installing engine
13 - Crankshaft group
15 - Cylinder head, valve gear
17 - Lubrication
19 - Cooling
21 - Turbocharging/supercharging
26 - Exhaust system

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

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Contents

00 - Technical data 1
1 Engine number 1
2 Engine data 2
3 Safety precautions 3
4 General repair instructions 5
4.1 Different types of glow plugs for the 6-cylinder 3.0 ltr. TDI engine 5
4.2 Handling ceramic glow plugs 5
4.3 Rules for cleanliness when working on fuel supply system, injection system and turbocharger 6
4.4 Checking for leaks in the fuel system 6
4.5 Foreign particles in engine 6
4.6 Contact corrosion! 6
4.7 Routing and attachment of pipes, hoses and wiring 7
4.8 Installing radiators, condensers and charge air coolers 7
4.9 Checking vacuum system 7

10 - Removing and installing engine 8
1 Removing and installing engine - vehicles with manual gearbox 8
1.1 Removing engine 8
1.2 Separating engine from manual gearbox 26
1.3 Installing engine 30
2 Removing and installing engine - vehicles with multitronic gearbox 36
2.1 Removing engine 36
2.2 Separating engine from multitronic gearbox 53
2.3 Installing engine 58
3 Removing and installing engine - vehicles with automatic gearbox 63
3.1 Removing engine 63
3.2 Separating engine and automatic gearbox 81
3.3 Installing engine 88
4 Securing engine to engine and gearbox support 95
5 Assembly mountings 98
5.1 Assembly mountings - exploded view 98
5.2 Removing and installing engine mounting (left-side) 99
5.3 Removing and installing engine mounting (right-side) 102
5.4 Removing and installing torque reaction support 107

13 - Crankshaft group 108
1 Cylinder block (pulley end) 108
1.1 Poly V-belt drive - exploded view 108
1.2 Removing and installing poly V-belt 111
1.3 Removing and installing tensioner for poly V-belt 114
1.4 Removing and installing idler roller for poly V-belt 115
1.5 Removing and installing vibration damper 116
1.6 Renewing crankshaft oil seal (pulley end) 116
1.7 Removing and installing sealing flange (front) 118
2 Cylinder block (gearbox end) 122
2.1 Dual-mass flywheel on vehicles with manual gearbox - exploded view 122
2.2 Removing and installing dual-mass flywheel 122
2.3 Extracting and driving in needle bearing for dual-mass flywheel 124
2.4 Flywheel and damper unit on vehicles with multitronic gearbox - exploded view 125
2.5 Removing and installing damper unit 125
2.6 Removing and installing flywheel 126

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2.7 Drive plate on vehicles with automatic gearbox - exploded view . . . 127
2.8 Removing and installing drive plate . . . 128
2.9 Renewing crankshaft oil seal (gearbox end) . . . 129
3 Crankshaft . . . 132
3.1 Crankshaft - exploded view . . . 132
3.2 Crankshaft dimensions . . . 134
3.3 Measuring axial clearance . . . 134
3.4 Measuring radial clearance . . . 135
4 Pistons and conrods . . . 136
4.1 Pistons and conrods - exploded view . . . 136
4.2 Checking piston projection at TDC . . . 139
4.3 Piston and cylinder dimensions . . . 141
4.4 Checking radial clearance of conrod bearings . . . 141

15 - Cylinder head, valve gear . . . 142
1 Chain drive . . . 142
1.1 Timing chain covers - exploded view . . . 142
1.2 Removing and installing timing chain covers . . . 143
1.3 Camshaft timing chain - exploded view . . . 148
1.4 Removing camshaft timing chain from camshafts . . . 151
1.5 Removing and installing camshaft timing chains . . . 160
1.6 Drive chain for valve gear - exploded view . . . 168
1.7 Removing and installing drive chain for valve gear . . . 170
1.8 Drive chain for oil pump and balance shaft - exploded view . . . 171
1.9 Removing and installing drive chain for oil pump and balance shaft . . . 173
1.10 Balance shaft - exploded view . . . 177
1.11 Removing and installing balance shaft . . . 177
2 Handling ceramic glow plugs . . . 181
3 Cylinder head . . . 182
3.1 Cylinder head - exploded view . . . 182
3.2 Cylinder head cover - exploded view . . . 185
3.3 Removing and installing cylinder head cover . . . 188
3.4 Removing cylinder head - vehicles up to 10.2005 . . . 193
3.5 Removing cylinder head - vehicles from 10.2005 onwards . . . 196
3.6 Installing cylinder head . . . 200
3.7 Checking compression . . . 204
4 Valve gear . . . 207
4.1 Valve gear - exploded view . . . 207
4.2 Measuring axial clearance of camshafts . . . 209
4.3 Measuring radial clearance of camshafts . . . 210
4.4 Renewing camshaft oil seal . . . 210
4.5 Removing and installing camshafts - cylinder head (left-side) . . . 213
4.6 Removing and installing camshafts - cylinder head (right-side) . . . 219
4.7 Renewing valve stem oil seals with cylinder head installed . . . 225
4.8 Renewing valve stem oil seals with cylinder head removed . . . 230
4.9 Checking hydraulic valve compensation elements . . . 233
4.10 Valve dimensions . . . 234
4.11 Machining valve seats . . . 234
4.12 Checking valve guides . . . 234
4.13 Checking valves . . . 235

17 - Lubrication . . . 236
1 Oil pump, sump (bottom section), sump (top section) . . . 236
1.1 Oil pump, sump (bottom section) - exploded view . . . 236
1.2 Removing and installing sump (bottom section) . . . 237

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1.3 Removing and installing oil pump . . . 239
1.4 Sump (top section) - exploded view . . . 240
1.5 Removing and installing sump (top section) . . . 242
2 Engine oil cooler, oil filter housing, oil pressure switch . . . 245
2.1 Engine oil cooler, pressure control valve and oil filter housing - exploded view . . . 245
2.2 Removing and installing engine oil cooler . . . 246
2.3 Removing and installing oil filter housing . . . 247
2.4 Removing and installing pressure control valve for crankcase breather system . . . 251
2.5 Removing and installing mounting plate for engine oil cooler, pressure control valve and oil filter housing . . . 252
2.6 Removing and installing oil pressure switch F1 . . . 253
2.7 Checking oil pressure . . . 254
2.8 Engine oil . . . 255
2.9 Checking oil level . . . 255

19 - Cooling . . . 256
1 Cooling system . . . 256
1.1 Draining and filling cooling system . . . 256
2 Coolant pump, thermostat, coolant pipes . . . 264
2.1 Coolant pump and thermostat - exploded view . . . 264
2.2 Removing and installing coolant pump . . . 264
2.3 Removing and installing hose connection with thermostat . . . 266
2.4 Removing and installing coolant temperature sender G62 . . . 267
2.5 Removing and installing coolant pipe (front) . . . 268
2.6 Removing and installing coolant pipe (left-side) . . . 270
2.7 Removing and installing coolant pipe (right-side) . . . 275
2.8 Removing and installing coolant pipe (rear) . . . 282
3 Radiator and radiator fans . . . 286
3.1 Radiator and radiator fans - exploded view . . . 286
3.2 Removing and installing radiator . . . 287
3.3 Removing and installing radiator cowl . . . 292
3.4 Removing and installing radiator fans . . . 295
3.5 Checking cooling system for leaks . . . 295

21 - Turbocharging/supercharging . . . 298
1 Turbocharger . . . 298
1.1 Turbocharger for vehicles with 2.7 ltr. engine up to 12.2005 and 3.0 ltr. engine - exploded view . . . 298
1.2 Removing and installing turbocharger - vehicles with 2.7 ltr. engine up to 12.2005 and 3.0 ltr. engine . . . 300
1.3 Removing and installing turbocharger 1 control unit J724 - vehicles with 2.7 ltr. engine up to 12.2005 and 3.0 ltr. engine . . . 305
1.4 Removing and installing intermediate flange - vehicles with 2.7 ltr. engine up to 12.2005 or 3.0 ltr. engine . . . 314
1.5 Turbocharger for vehicles with 2.7 ltr. engine from 12.2005 onwards - exploded view . . . 314
1.6 Removing and installing turbocharger - vehicles with 2.7 ltr. engine from 12.2005 onwards . . . 317
1.7 Removing and installing turbocharger 1 control unit J724 - vehicles with 2.7 ltr. engine from 12.2005 . . . 322
1.8 Removing and installing intermediate flange - vehicles with 2.7 ltr. engine from 12.2005 onwards . . . 332
2 Charge air cooling . . . 333
2.1 Charge air cooler - exploded view . . . 333
2.2 Removing and installing charge air coolers (left and right) . . . 334
2.3 Removing and installing charge air cooler (centre) . . . 335
2.4 Removing and installing charge pressure sender G31 . . . 336

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26 - Exhaust system 338

1 Silencers - vehicles without particulate filter 338
1.1 Exhaust system - exploded view 338
1.2 Removing and installing starter catalytic converter - vehicles with manual gearbox 341
1.3 Removing and installing starter catalytic converter - vehicles with automatic gearbox 343
1.4 Removing and installing front exhaust pipe with catalytic converter - vehicles with manual gearbox 347
1.5 Removing and installing front exhaust pipe with catalytic converter - vehicles with automatic gearbox 349

2 Silencers - vehicles with particulate filter 352
2.1 Exhaust system - exploded view 352
2.2 Removing and installing starter catalytic converter 355
2.3 Removing and installing front exhaust pipe 359
2.4 Removing and installing particulate filter with catalytic converter 361

3 Y-pipe and rear silencers 364
3.1 Separating Y-pipe and rear silencers 364
3.2 Renewing tailpipe 365
3.3 Stress-free alignment of exhaust system 366
3.4 Aligning tailpipe 367
3.5 Checking exhaust system for leaks 367

4 Exhaust manifolds and intermediate pipes 369
4.1 Exhaust manifolds and intermediate pipes - exploded view 369
4.2 Removing and installing exhaust manifold (left-side) 370
4.3 Removing and installing exhaust manifold (right-side) 373
4.4 Removing and installing intermediate pipe (left-side) 376
4.5 Removing and installing intermediate pipe (right-side) 377

5 Exhaust gas temperature control 379
5.1 Removing and installing exhaust gas temperature sender 1 G235 379
5.2 Removing and installing exhaust gas temperature sender 2 G448 380
5.3 Removing and installing temperature sender before particulate filter G506 382

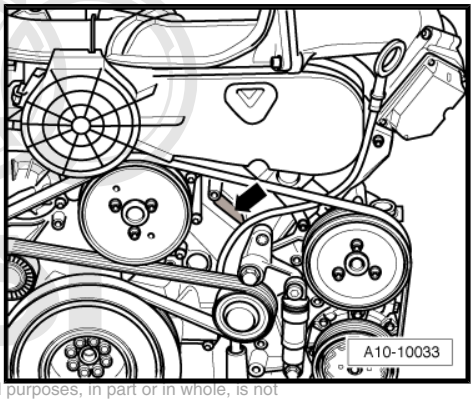
6 Exhaust gas recirculation system 383
6.1 Exhaust gas recirculation system - exploded view 383
6.2 Removing and installing mechanical exhaust gas recirculation valve 385
6.3 Removing and installing exhaust gas recirculation cooler 385

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00 – Technical data

1 Engine number

- The engine number („engine code“ and „serial number“) can be found at the front below the toothed belt for the high-pressure pump (left-side) -arrow-.
- There is also a sticker on the intake manifold showing the „engine code“ and „serial number“.
- The engine code is also included on the vehicle data sticker.



Note

On some versions the engine number is concealed by an idler roller for the poly-V belt. Removing idler roller for poly V-belt *⇒ page 115* *.*

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2 Engine data

Code letters		ASB	BMK	BNG
Capacity	ltr.	2.967	2.967	2.967
Power output	kW at rpm	171/4000	165/4000	155/4000
Torque	Nm at rpm	450/1400 … 3250	450/1500 … 3250	450/1400 … 3250
Bore	∅ in mm	83.0	83.0	83.0
Stroke	mm	91.4	91.4	91.4
Compression ratio		17.5	17.5	17.5
CN	at least	51	51	51
Firing order		1-4-3-6-2-5	1-4-3-6-2-5	1-4-3-6-2-5
Exhaust gas recirculation		yes	yes	yes
Turbocharging/supercharging		Turbocharger	Turbocharger	Turbocharger
Catalytic converter		yes	yes	yes
Charge air cooling		yes	yes	yes
Lambda control		1 Lambda probe	1 Lambda probe	1 Lambda probe

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Code letters		BPP	BSG	
Capacity	ltr.	2.698	2.698	
Power output	kW at rpm	132/4000	120/4000	
Torque	Nm at rpm	380/1500 … 3200	380/1500 … 3200	
Bore	∅ in mm	83.0	83.0	
Stroke	mm	83.1	83.1	
Compression ratio		17.5	17.5	
CN	at least	51	51	
Firing order		1-4-3-6-2-5	1-4-3-6-2-5	
Exhaust gas recirculation		yes	yes	
Turbocharging/supercharging		Turbocharger	Turbocharger	
Catalytic converter		yes	yes	
Charge air cooling		yes	yes	
Lambda control		1 Lambda probe	1 Lambda probe	

Note

Special instructions for handling ceramic glow plugs
⇒ page 5 and ⇒ Rep. gr. 28 .

3 Safety precautions

When working on the fuel system note the following warnings:

WARNING

- *The fuel system is pressurised. Before opening the system place a clean cloth around the connection. Then release pressure by carefully loosening the connection.*
- *Wear protective gloves.*
- *Wear safety goggles.*

Observe the following points to prevent personal injuries and damage to the injection and glow plug system:

- Always switch off the ignition before connecting or disconnecting tester cables or electrical wiring for the injection or glow plug system.
- Always switch off ignition before washing engine.
- Faults are stored in engine control unit if electrical connectors have been unplugged:

– Connect vehicle diagnostic, testing and information system - VAS 5051B- .

– Start „Vehicle self-diagnosis“ mode.

– Interrogate fault memory.

Caution

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

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

– Disconnect battery ⇒ Rep. gr. 27 .

When working on the cooling system note the following warnings:

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WARNING

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

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

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

WARNING

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

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

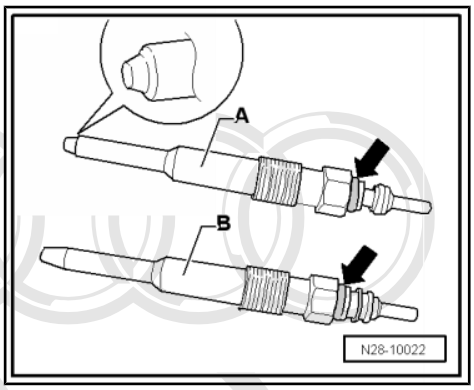
- *The use of test equipment while driving causes distraction.*
- *There is an increased risk of injury if test equipment is not secured.*
- *Test equipment must always be secured on the rear seat with a strap and operated from the rear seat by a second person.*

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4 General repair instructions

4.1 Different types of glow plugs for the 6-cylinder 3.0 ltr. TDI engine

- The 6-cylinder 2.7 ltr. TDI engine in the Audi A6 is fitted exclusively with metal glow plugs:
- Up to autumn 2004, two different types of glow plugs are fitted in the Audi A6 with 6-cylinder 3.0 ltr. TDI engine; from autumn 2004 onwards, these engines are fitted exclusively with metal glow plugs. Distinguishing features:



A - Ceramic glow plugs are colour-coded with a „white seal“ -arrow- and have a chamfered shoulder at the tip.

B - Metal glow plugs are colour-coded with a „red seal“ -arrow-.

The metal glow plugs do not require any special handling procedures.

4.2 Handling ceramic glow plugs

Important: Note the following points regarding ceramic glow plugs:

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Caution

- *Due to the special properties of the material used, ceramic glow plugs are easily damaged and require extra care when handling and removing/installing. Always observe the special instructions when removing and installing ceramic glow plugs ⇒ Rep. gr. 28 .*
- *Transport and store only in original packaging or packed separately in bubble wrap.*
- *Do not remove new ceramic glow plugs from packaging until they are ready to be fitted.*
- *Ceramic glow plugs are sensitive to knocks and bending. For this reason, ceramic glow plugs which have been dropped (even from a height of only about 2 cm) must not be installed, even if no damage is apparent (hair-line cracks may not be visible).*
- *Always install a new ceramic glow plug if you are not sure the old one is in perfect condition.*
- *Damaged glow plugs (e.g. heater pin of the glow plug is damaged) will invariably cause engine damage.*
- *If the heater pin of the glow plug is damaged, the fragments must be removed from the combustion chamber before starting the engine for the first time, otherwise this will invariably cause mechanical damage (piston seizure).*
- *The software of the engine control unit is specifically adapted to either the ceramic or the metal glow plugs, so it is important to install the correct type.*
- *Mixed installation of ceramic glow plugs and metal glow plugs on the same engine is not permissible.*

4.3 Rules for cleanliness when working on fuel supply system, injection system and turbocharger

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

- Carefully clean connection points and the surrounding area with engine cleaner or brake cleaner and dry thoroughly before opening.
- Plug open lines and connections with suitable protective caps immediately.
- Place parts that have been removed on a clean surface and cover them over. Do not use fluffy cloths.
- Only install clean components; replacement parts should only be unpacked immediately prior to installation. Do not use parts that have been previously unpacked and stored away loose (e.g. in toolboxes, etc.).
- When the system is open: Do not work with compressed air. Do not move the vehicle unless absolutely necessary.
- Protect unplugged electrical connectors against dirt and moisture and make sure connections are dry when attaching.

4.4 Checking for leaks in the fuel system

– Start the engine and let it run at medium speed for a few minutes.

– Switch off ignition.

– Check the entire fuel system for leaks.

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

– Then carry out a road test with at least one full-power acceleration.

– Then check high-pressure part of fuel system again for leakage.

4.5 Foreign particles in engine

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

4.6 Contact corrosion!

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

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

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

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

Note the following:

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

4.7 Routing and attachment of pipes, hoses and wiring

Mark hydraulic lines, vacuum lines and electrical wiring before removal so they can be re-installed in the original positions and correctly connected. Make sketches or take photographs if necessary.

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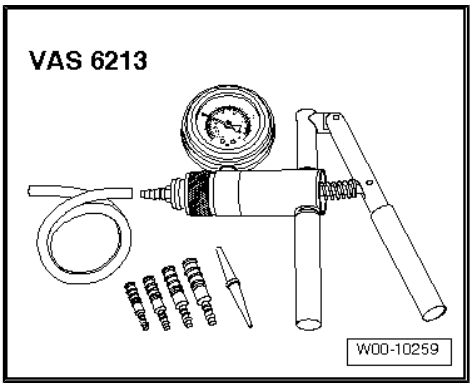
4.8 Installing radiators, condensers and charge air coolers

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

4.9 Checking vacuum system

Special tools and workshop equipment required

- Hand vacuum pump -VAS 6213-



Procedure

– Check all vacuum lines in the complete vacuum system for:

- Cracks
- Traces of animal bites
- Kinked or crushed lines
- Lines porous or leaking

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

– If a fault is stored in the memory, check the vacuum lines leading to the corresponding component and also check the remaining vacuum lines in the system.

– If it is not possible to build up pressure with the hand vacuum pump -VAS 6213- or if the pressure drops again immediately, check the hand vacuum pump and connecting hoses for leaks.

10 – Removing and installing engine

1 Removing and installing engine - vehicles with manual gearbox

Note

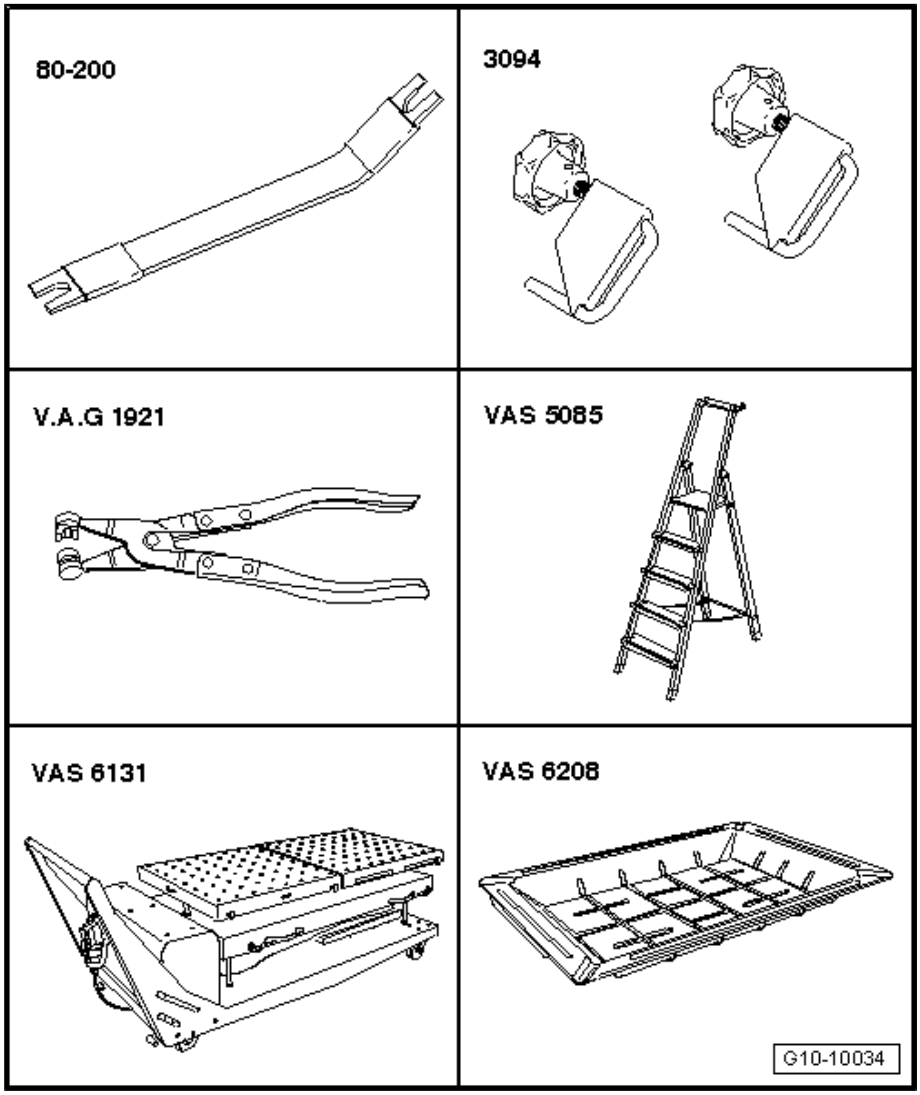
- *The engine is removed from underneath together with the gearbox and subframe (with lock carrier installed).*
- *Renew all cable ties which are released or cut open when removing the engine. Refit in the same position when installing the engine.*
- *Collect drained coolant in a clean container for re-use or disposal.*

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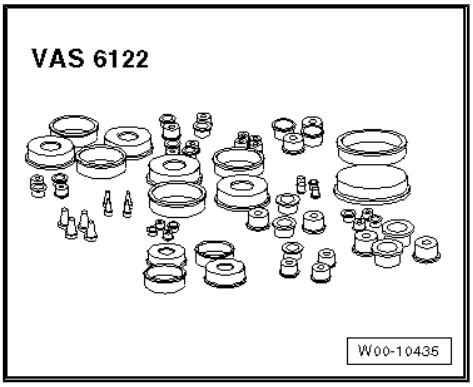
1.1 Removing engine

Special tools and workshop equipment required

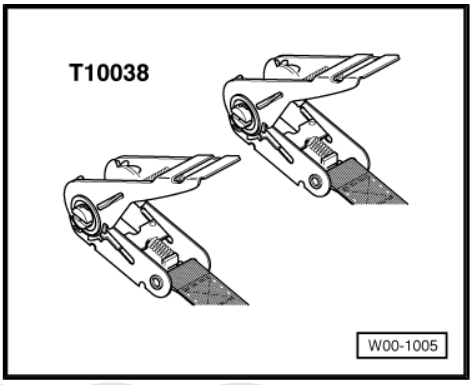
- Removal lever -80 - 200-
- Hose clamps for hoses up to 25 mm -3094-
- Hose clip pliers -VAS 6362- instead of -V.A.G 1921- shown in illustration
- Stepladder -VAS 5085-
- Scissor-type assembly platform -VAS 6131 A- with support set for Audi -VAS 6131/10-
- Drip tray for workshop hoist -VAS 6208-



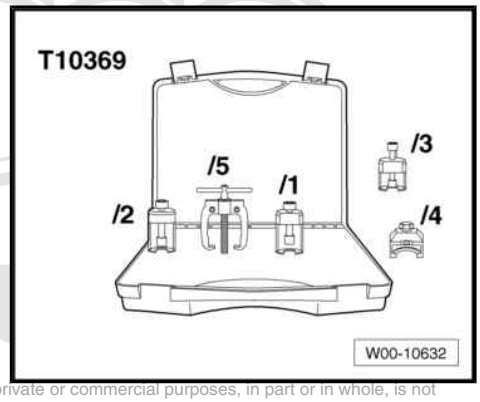
- Engine bung set -VAS 6122-



- Tensioning strap -T10038-



- Tool set for wiper arms -T10369-



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Procedure

WARNING

Before removing the engine secure the vehicle against tipping over. To do so, the luggage compartment must be empty.

– Discharge refrigerant system ⇒ Air conditioner with refrigerant R134a .

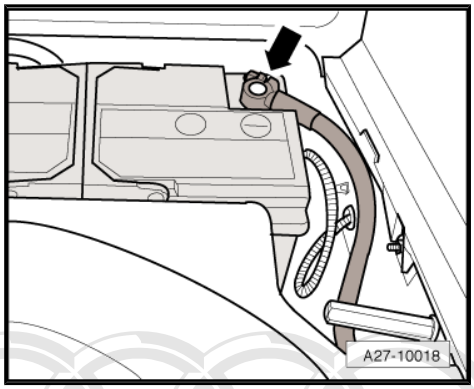
Caution

Observe notes on procedure for disconnecting the battery.

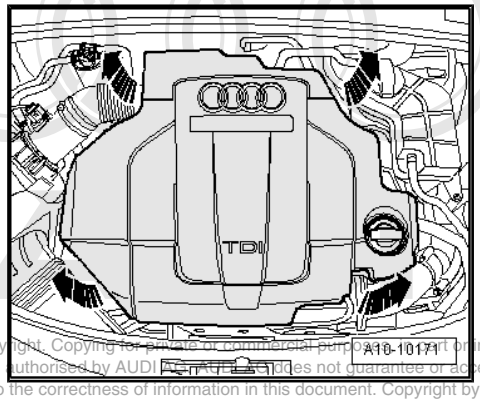
Note

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

– With ignition switched off, disconnect battery earth cable -arrow- ⇒ Rep. gr. 27 .



– Carefully pull engine cover panel off four retaining pins one after the other -arrows-.



WARNING

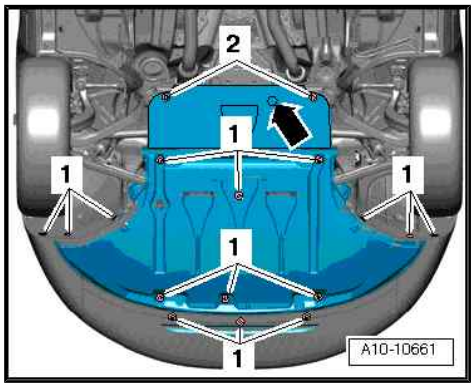
Hot steam or hot coolant can escape when expansion tank is opened; cover filler cap with cloth and open carefully.

– Open filler cap on coolant expansion tank.

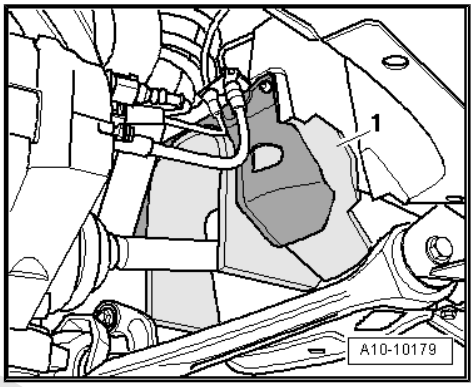
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– Remove both front wheels.

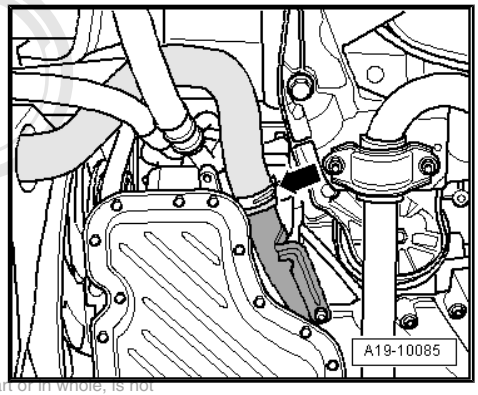
– Release fasteners marked -1, 2- and -arrow- (if fitted) and remove front and rear noise insulation.



– Remove noise insulation -1- in wheel housing (left and right).

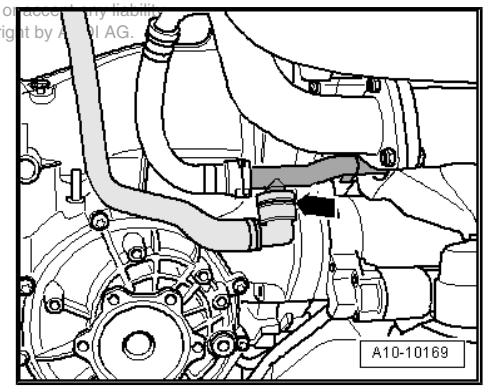


– Place drip tray for workshop hoist -VAS 6208- under engine.
– Disconnect coolant hose -arrow- from coolant pipe (left-side) and drain off coolant.

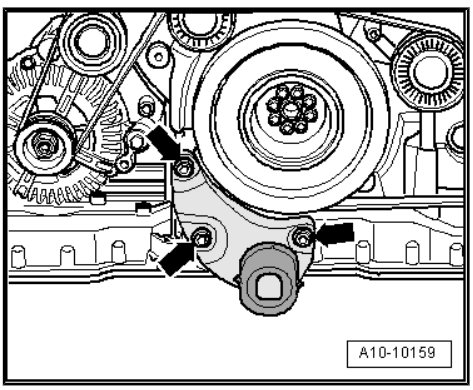


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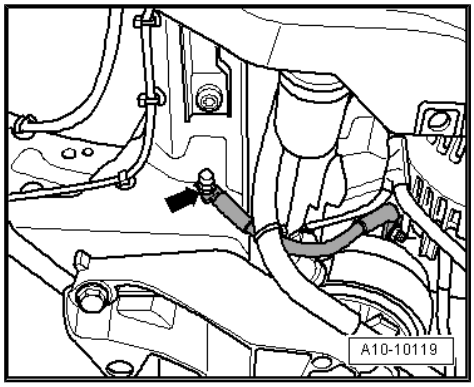
– Lift retaining clip to disconnect coolant hose -arrow- from coolant pipe (right-side) and drain off remaining coolant.



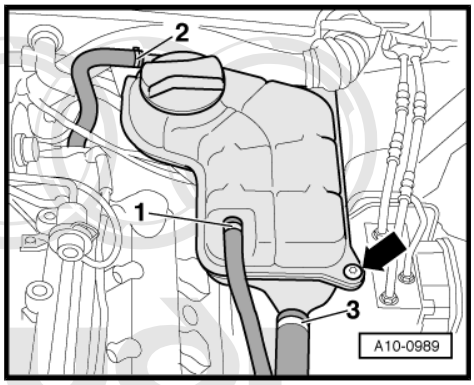
– Unscrew bolts -arrows- and remove torque reaction support from engine.



– Unbolt earth cable -arrow- at longitudinal member (right-side).

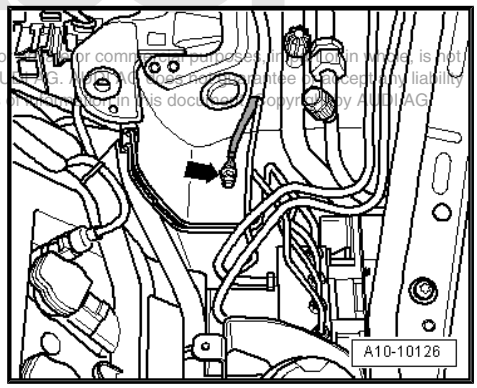


– Detach coolant hoses -1 … 3- at coolant expansion tank.
– Unbolt coolant expansion tank -arrow-.
– Detach electrical connector at coolant shortage indicator switch -F66- on coolant expansion tank (bottom).

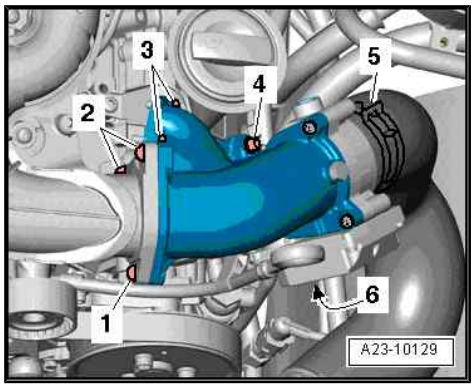


– Unbolt earth cable -arrow- at suspension turret (left-side).

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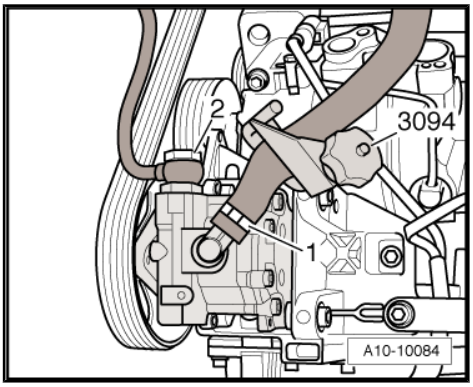


– Disconnect air intake hose -5- from throttle valve module - J338- .
– Unplug electrical connector -6- at throttle valve module - J338- .
– Remove bolts -1 ... 4-.



Note

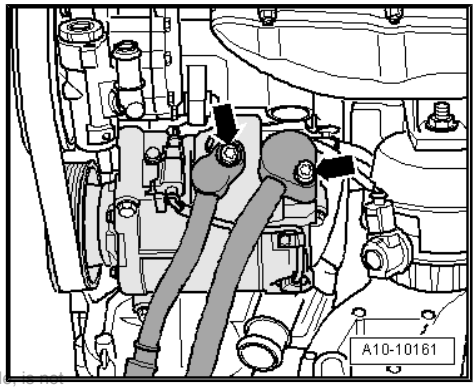
Lay a cloth under the hydraulic lines to catch any escaping hydraulic fluid.



- Disconnect hydraulic pressure line -2- from power steering pump and lay aside on top of longitudinal member.
- Clamp off hydraulic hose for power steering pump using a hose clamp -3094- .
- Disconnect hydraulic hose -1- from power steering pump.
- Seal off open pipes/lines and connections with clean plugs from engine bung set -VAS 6122- .

Note

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



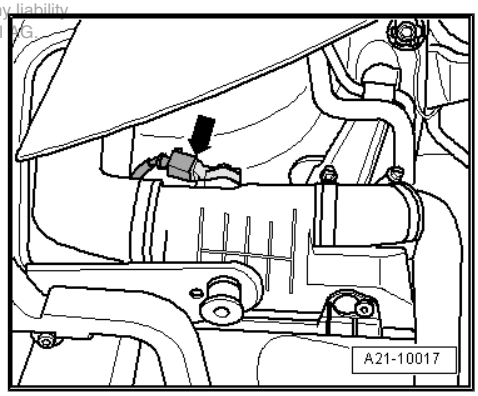
- Detach refrigerant lines -arrows- from air conditioner compressor.
- Seal off open pipes/lines and connections with clean plugs from engine bung set -VAS 6122- .

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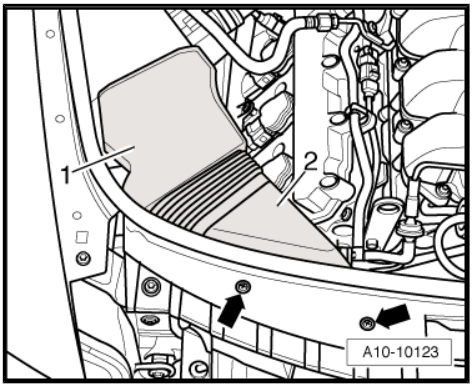
- Unplug electrical connector -arrow- for charge pressure sender -G31- at charge air cooler (left-side).

Note

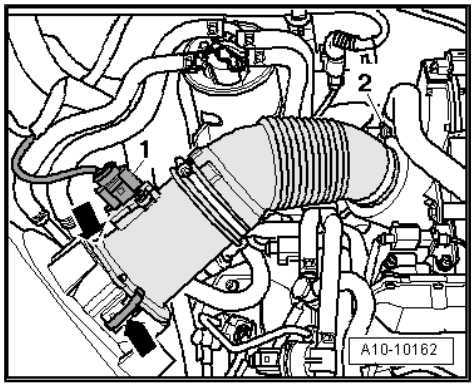
Shown in illustration with headlight removed.



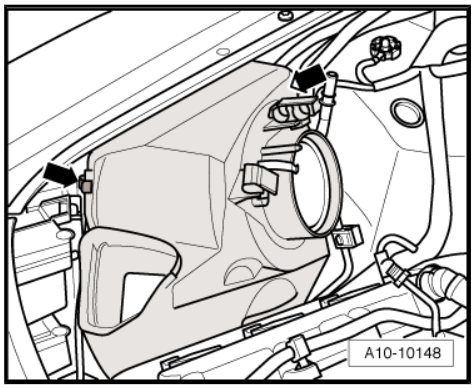
- Remove bolts -arrows-.
- Remove air ducts -1- and -2-.



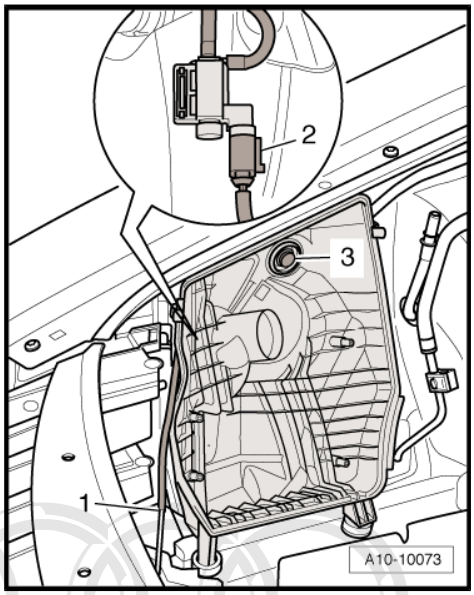
– Unplug electrical connector -1- at air mass meter -G70- .
– Remove air intake hose. To do so, release hose clip -2- and clamps -arrows-.



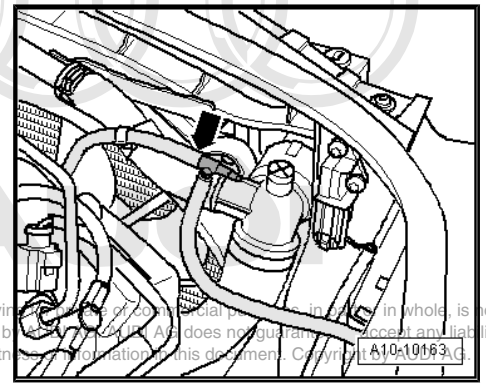
– Release clamps -arrows- and detach air cleaner (top section).



– Disconnect vacuum pipe -1-.
– Pull out pin of fastener -3-.
– Remove air cleaner (bottom section) and unplug electrical connector -2- on reverse side at air filter bypass flap valve -N275- .

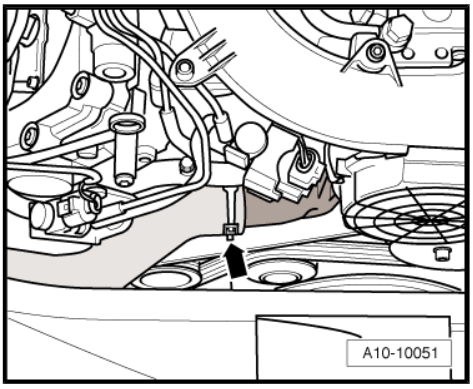


– Disconnect vacuum hose from T-piece -arrow-.

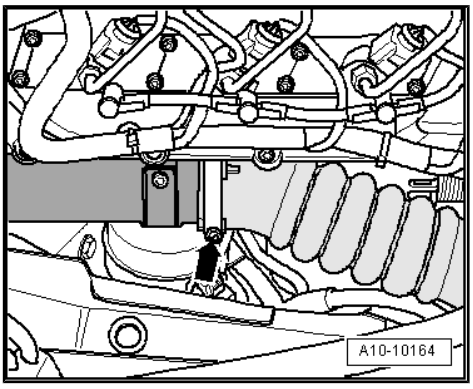


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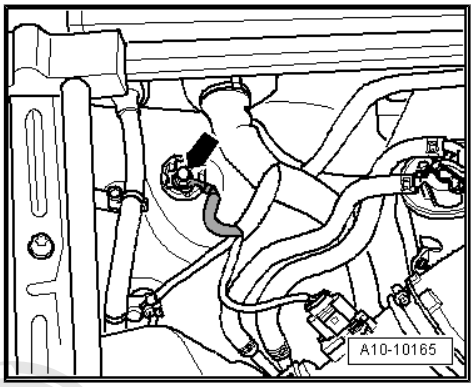
– Disconnect coolant hose -arrow- from hose connection on thermostat.



– Disconnect air intake hose -arrow- from air pipe.

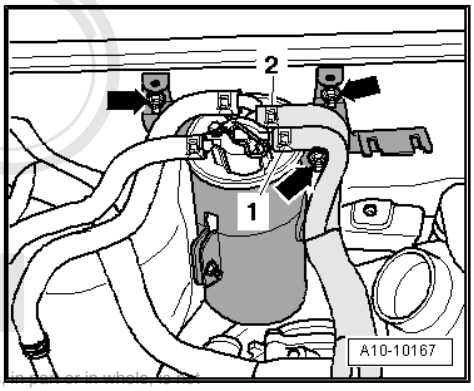


– Disconnect earth cable -arrow- at suspension turret (right-side).



Caution

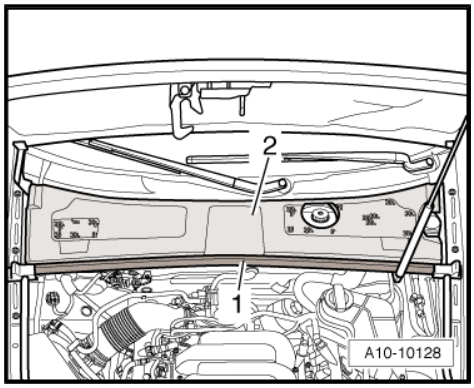
Rules for cleanliness when working on the injection system ***⇒ page 6*** .



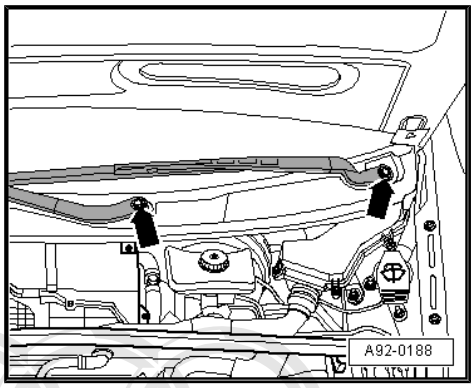
– Disconnect fuel return hose -1- and fuel supply hose -2- from fuel filter.
– Seal off open pipes/lines and connections with clean plugs from engine bung set -VAS 6122- .
– Move electrical wire and coolant hose clear from bracket.
– Remove bracket with fuel filter from plenum chamber partition panel -arrows-.
– Place fuel filter with bracket to one side.

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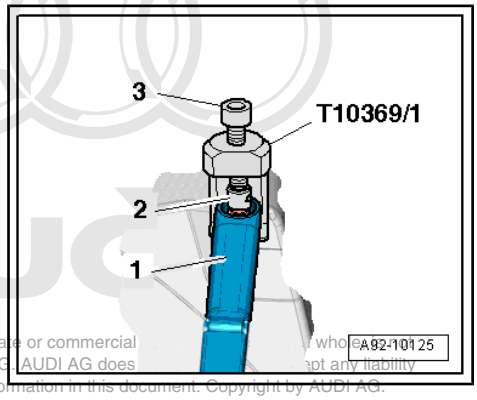
– Pull off rubber seal -1- and remove plenum chamber cover -2-.



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



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

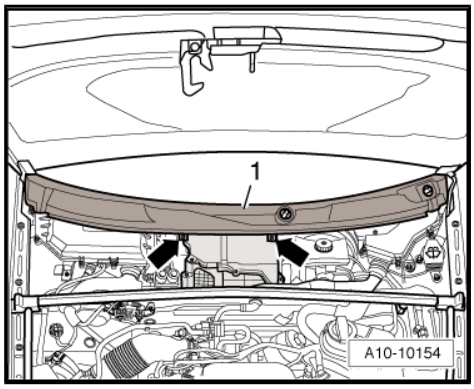


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– Unscrew bolts -arrows- for cowl panel trim -1-.

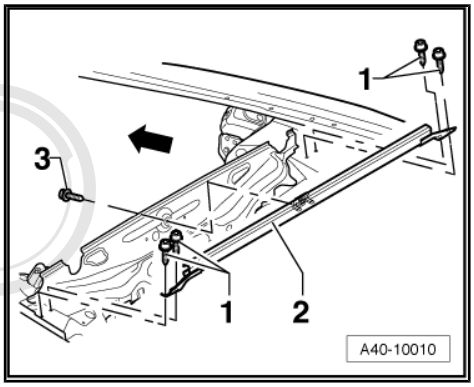
Caution

To avoid cracking the cowl panel trim -1- during removal, apply a small amount of soap solution to the joint between the windscreen and the cowl panel trim and pull the trim vertically up out of the windscreen surround, starting from the edge of the windscreen.



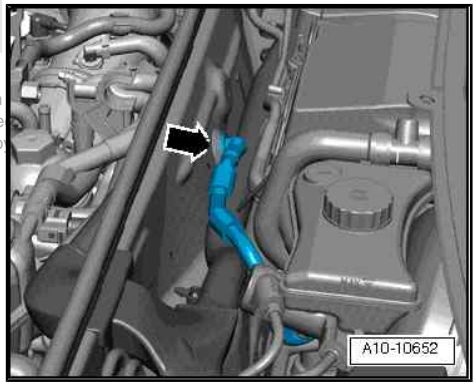
– Pull cowl panel trim off windscreen.

– If fitted, unscrew bolts -1- and -3- and remove body brace -2-.

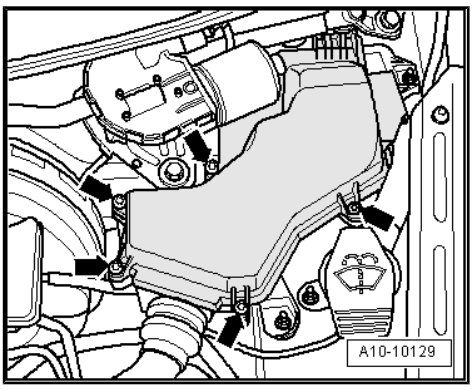


– Detach vacuum hose -arrow- going to brake servo at plenum chamber partition panel.

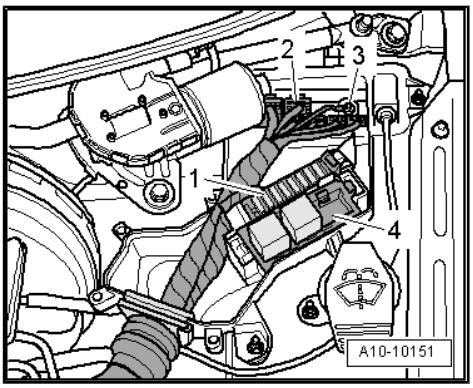
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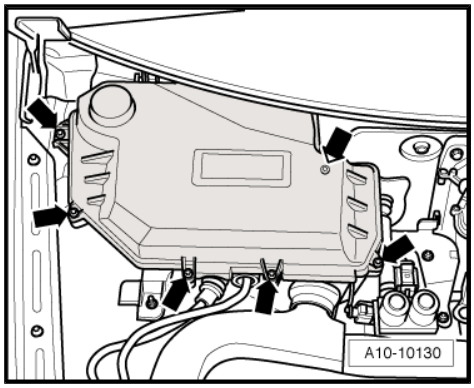
– Unscrew bolts -arrows- and take off cover for electronics box in engine compartment (left-side).



– Release retainers and lift off fuse holder -1-; then lift off 3-position relay carrier -4-.
– Unscrew electrical wiring -3-.
– Unplug all connectors -2- at rear of connector console.
– Disengage engine wiring harness at electronics box and move it clear.



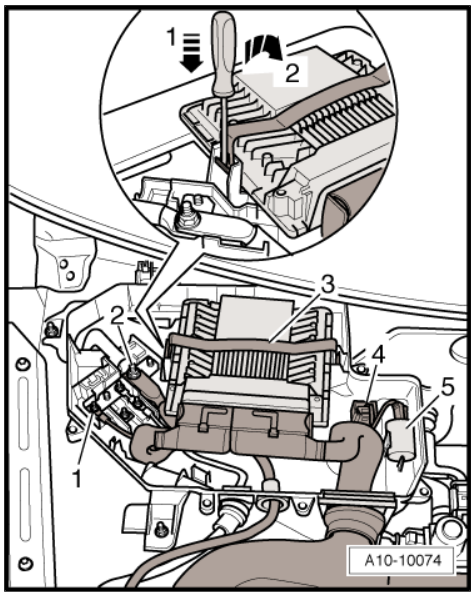
– Unscrew bolts -arrows- and take off cover for electronics box in engine compartment (right-side).



WARNING

The pump valve unit for heating system (left in front of electronics box) gets very hot – risk of burns!

– Carefully lever out the retaining strap -3- using a screwdriver -arrows 1 and 2- and remove the engine control unit from the electronics box.

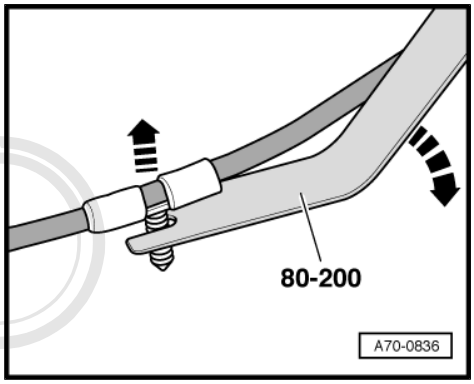


Note

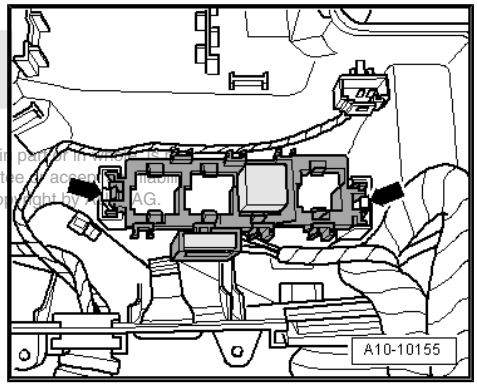
The engine control unit remains connected to the wiring harness.

– Unclip suppressor capacitor -5- and take out of retainer in electronics box.
– Unplug electrical connector -4- at rear of connector console.
– Unscrew electrical wiring connections -1- and -2-.

– Release electrical wiring up to the alternator using removal lever -80 - 200- .

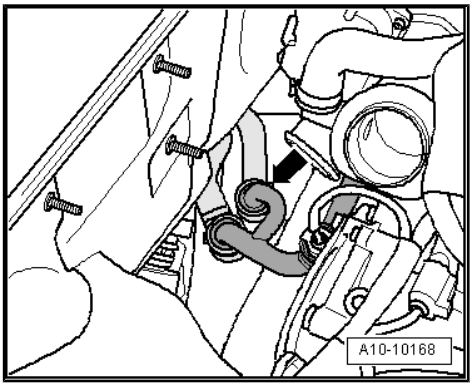


– Release retainers -arrows- and pull relay carrier off electronics box in engine compartment (right-side).
– Place both wiring harnesses on top of engine and secure the engine control unit to prevent it falling.



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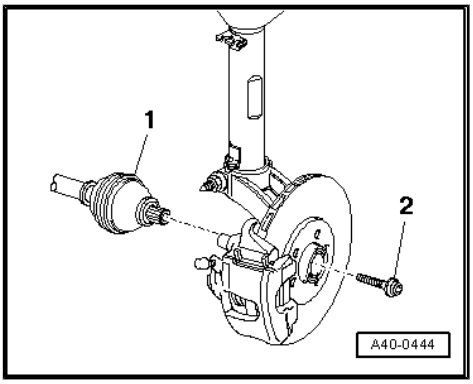
– Disconnect coolant hose -arrow- leading to heat exchanger for heater at rear of engine.



– Have a 2nd mechanic press the brake pedal.

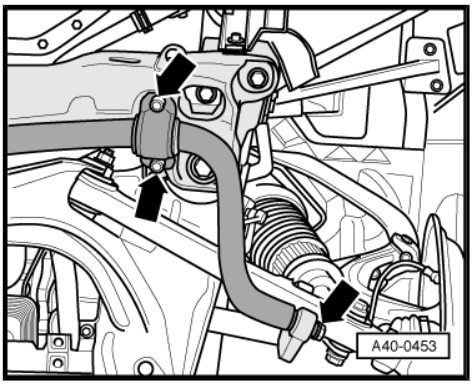
Caution

When slackening the flange bolt securing the drive shaft, the wheel bearing must not be under load (vehicle must not be standing on its wheels).

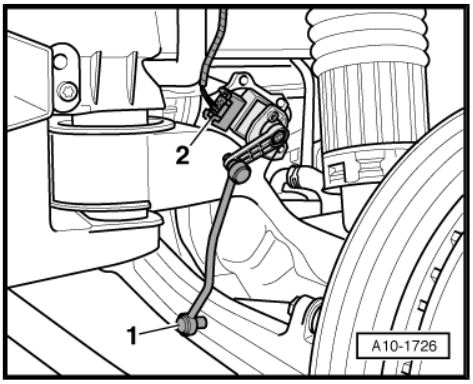


– Unscrew flange bolt -2- from drive shaft -1- (left and right).

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



– If fitted, unplug electrical connector -2- at vehicle level sender.
– Detach coupling rod -1- at track control link.

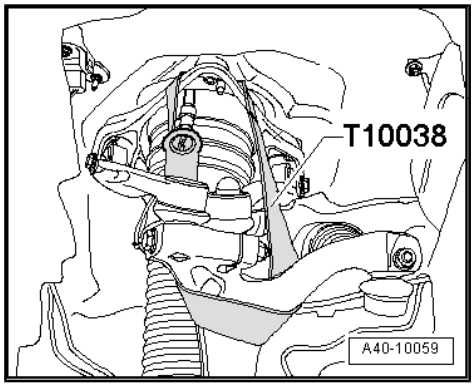


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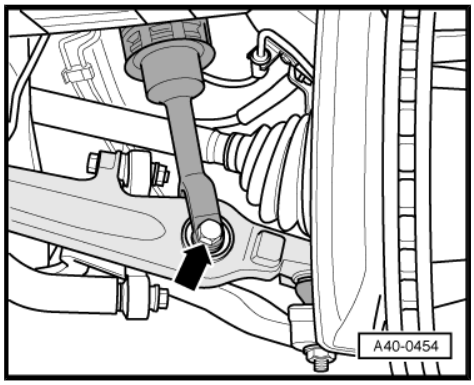
Caution

The weight of the wheel bearing housings must be supported in order to prevent damage to the joints of the upper links.

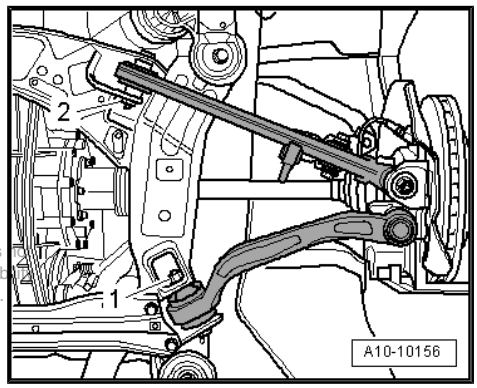
– Tie up wheel bearing housing using tensioning strap -T10038- as illustrated.



– Unbolt suspension strut from track control link -arrow-.



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

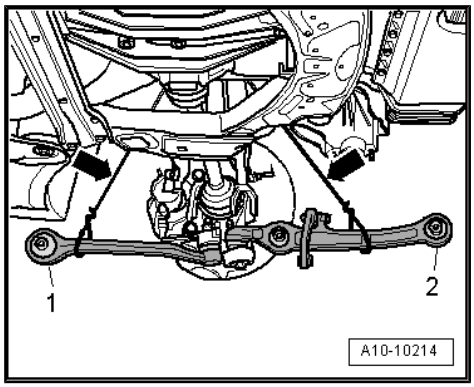


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– Pivot guide link -1- and track control link -2- outwards.

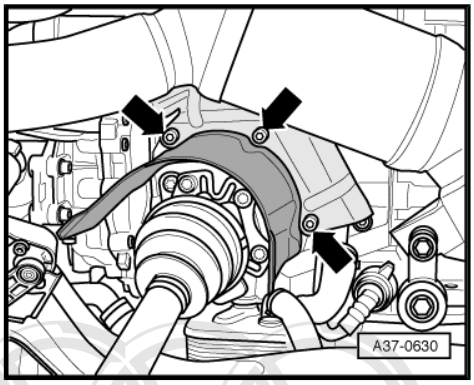
Caution

The guide link and track control link must not be allowed to hang down without support. Tie up both the guide link and track control link to wheel bearing housing as illustrated -arrow-.

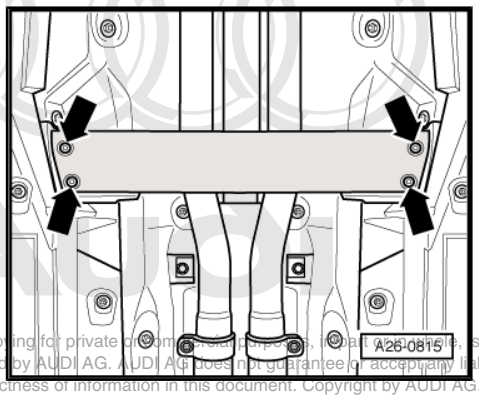


– Repeat procedure on other side of vehicle.

– Unbolt heat shield for drive shaft -arrows-.
– Unbolt drive shaft from flange shaft on gearbox.
– Pivot wheel bearing housing outwards and remove drive shaft, taking care not to damage brake hose.
– Repeat procedure on other side of vehicle.



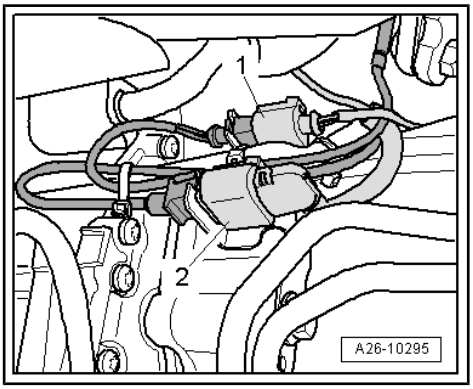
– Remove front cross piece -arrows-.



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Vehicles with particulate filter:

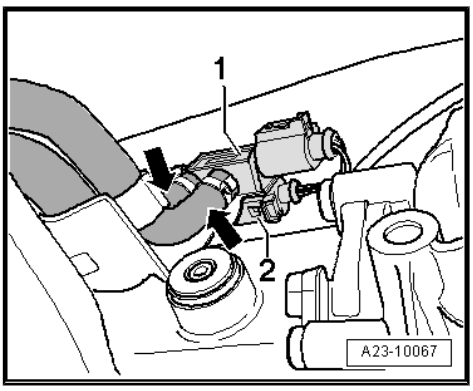
– Unplug electrical connector -1- for exhaust gas temperature sender 2 -G448- at front of gearbox (left-side) and move electrical wiring clear.



Note

Disregard -item 2-.

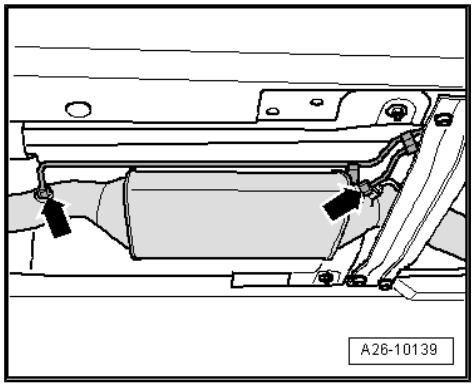
– Unplug electrical connector for temperature sender before particulate filter -G506- -item 2- and move wiring clear.



Note

Ignore items marked -1- and -arrows-.

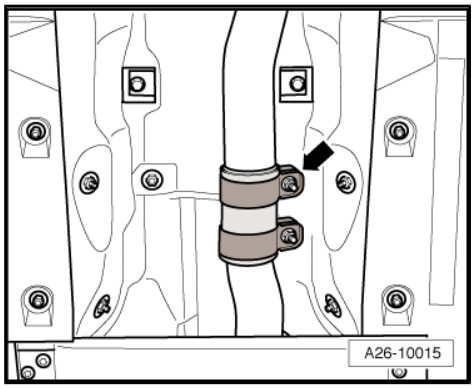
– Unscrew pressure pipes -arrows- from particulate filter.



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All vehicles:

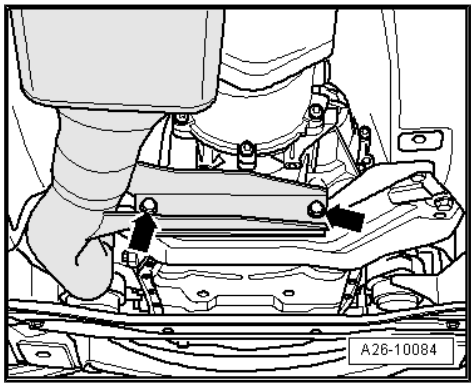
– Disconnect exhaust system at clamp -arrow-.



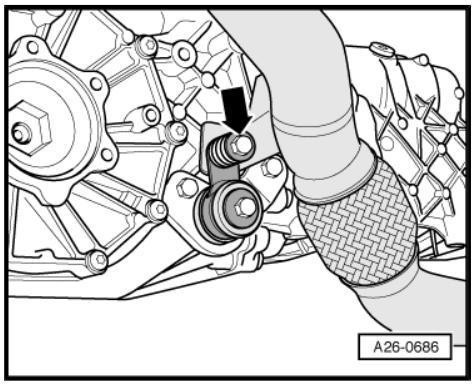
Note

To avoid any damage, the flexible joint in the front exhaust pipe must not be bent more than 10°.

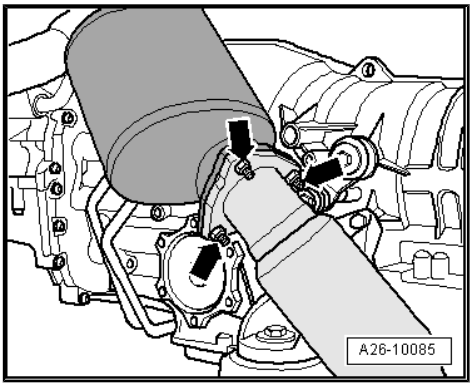
– Remove bolts -arrows- at centre bracket for front exhaust pipe.



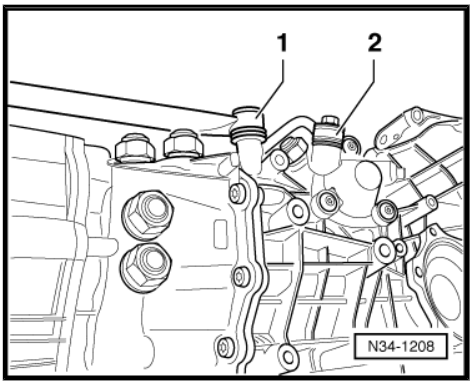
– Remove bolt -arrow- on bracket for front exhaust pipe.



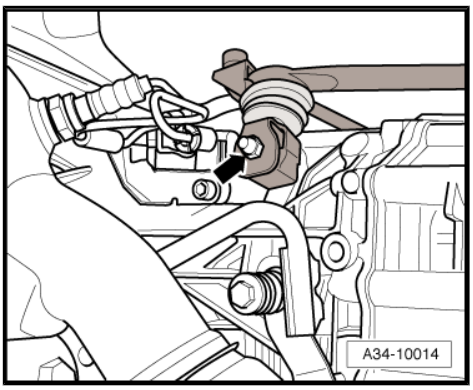
– Remove nuts -arrows- and take out front exhaust pipe with catalytic converter/particulate filter.



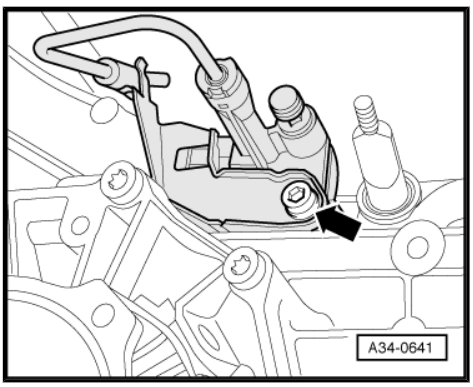
– Unbolt push rod -1- and connecting rod for selector rod -2-.



– Remove nut -arrow- and detach gearbox selector lever from selector shaft.



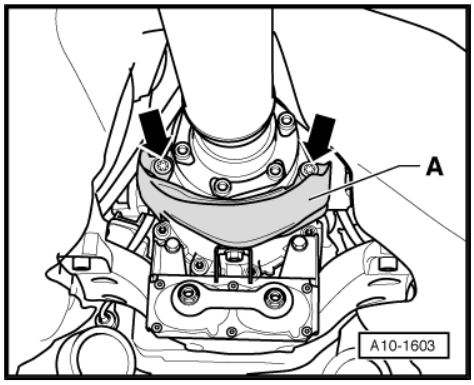
– Remove clutch slave cylinder -arrow-. Do not open pipes.



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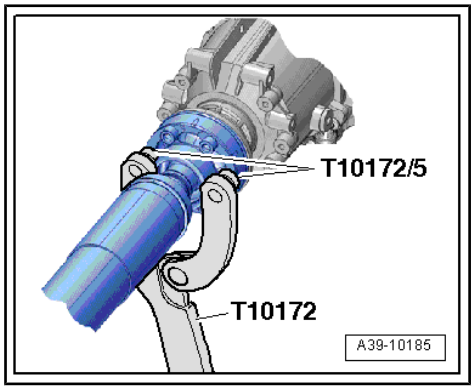
Vehicles with four-wheel drive:

– Remove bolts -arrows- and detach heat shield -A- for propshaft.

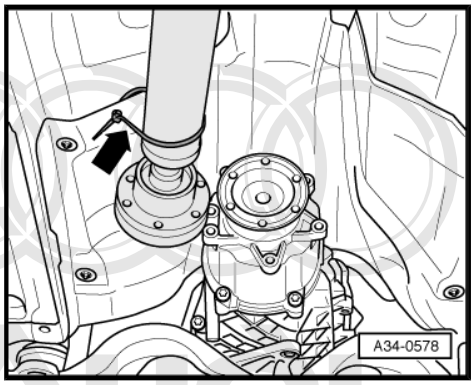


– Remove bolts connecting propshaft to gearbox (use counterhold tool -T10172- with -T10172/5-).

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



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

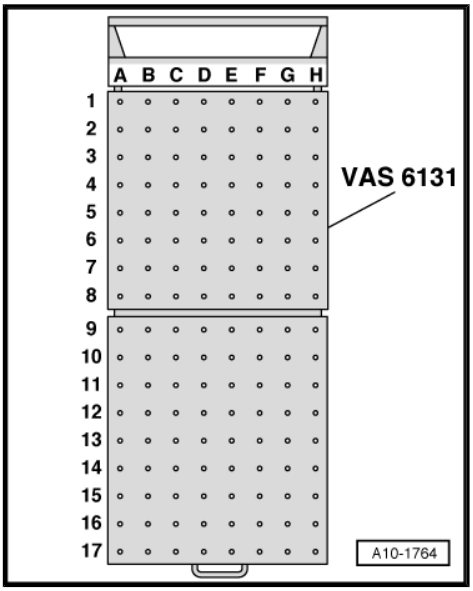


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Set up the scissor-type assembly platform as follows:

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

Platform coordinates	Parts from support set for Audi -VAS 6131/10-			
B3	/10-1	/10-4	/10-5	/10-11
F3	/10-1	/10-4	/10-5	/10-11
B10	/10-1	/10-2	/10-5	/10-8
G10	/10-1	/10-2	/10-5	/10-8
E13	/10-1	/10-3	/10-5	/10-6
C15	/10-1	/10-3	/10-5	/10-6



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

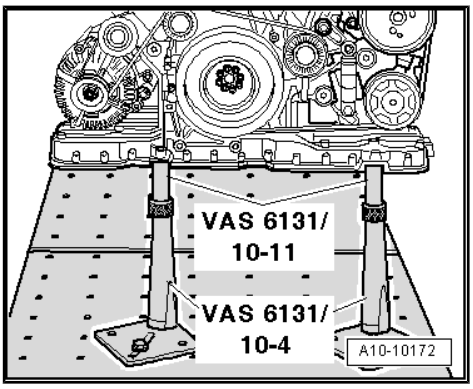
– Adjust the scissor-type assembly platform -VAS 6131 A- so that it is horizontal.

• Take note of spirit level (bubble gauge).

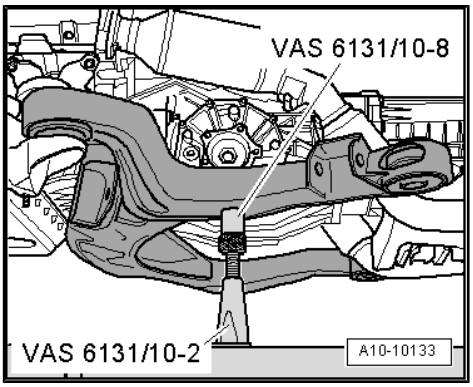
– Place scissor-type assembly platform -VAS 6131 A- under engine/gearbox assembly.

– Position support elements from -VAS 6131/10- at front of engine, as shown in illustration.

– Make sure that threaded spindles are screwed in completely.

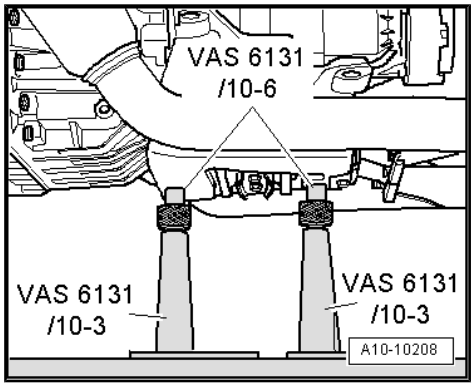


– Position support elements from -VAS 6131/10- at left and right of subframe, as shown in the illustration.

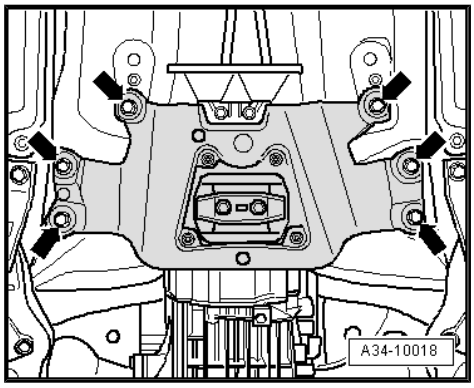


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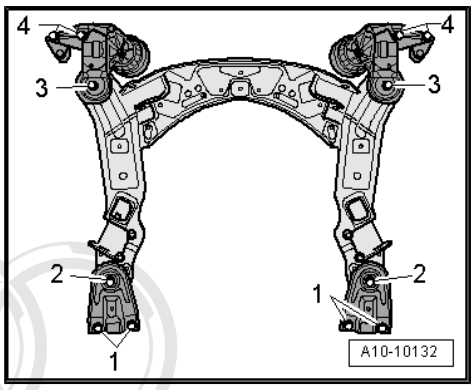
– Position support elements from -VAS 6131/10- at rear of tunnel cross member, as shown in the illustration.
– Turn all spindles for the support elements upwards until all locating lugs make contact with the mounting points.
– Tighten base plates for support elements to 20 Nm on scissor-type assembly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



– Remove bolts -arrows- at tunnel cross member.



– Remove bolts -1-.
– Mark the installation position of the subframe and the two consoles for engine mountings on the longitudinal members with a felt-tip pen.
– Unscrew bolts -2-, -3- and -4- in a diagonal sequence and in stages.



Note

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

– Lower engine/gearbox assembly gradually.
– Tie clutch slave cylinder together with selector linkage up to body.
– Pull out scissor-type assembly platform -VAS 6131 A- from under the vehicle.

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1.2 Separating engine from manual gearbox

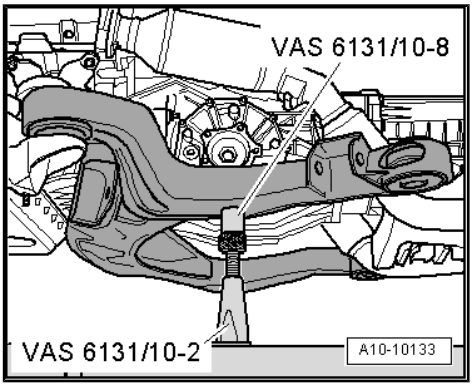
Special tools and workshop equipment required

- Support set for Audi -VAS 6131/10- , supplementary set -VAS 6131/11- and -VAS 6131/12-

Procedure

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

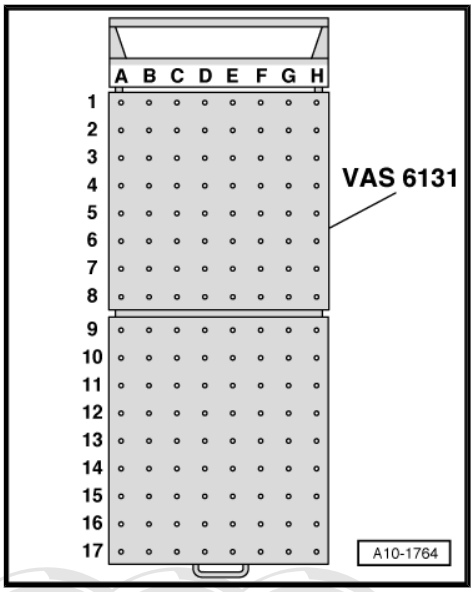
– Screw down spindles of support elements from -VAS 6131/10- (left and right) at subframe as far as possible.
– Remove locating lugs from spindles.
– Remove subframe to the side.
– Unscrew the two base plates for support elements (for subframe) on scissor-type assembly platform -VAS 6131 A- .



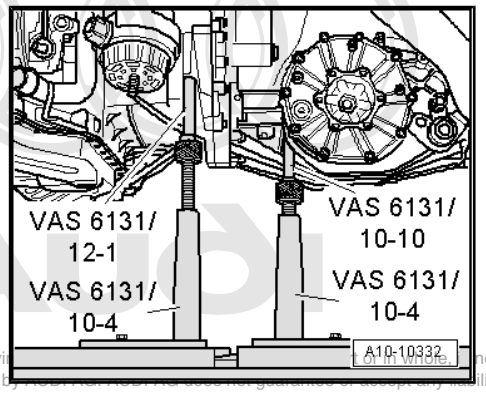
– Set up scissor-type assembly platform -VAS 6131 A- with support set for Audi -VAS 6131/10- , support set -VAS 6131/11- and supplementary set -VAS 6131/12- as follows:

Platform coordinates	Parts of support set for Audi -VAS 6131/10- , support set -VAS 6131/11- and supplementary set -VAS 6131/12-			
B3 1)	/10-1	/10-4	/10-5	/10-11
F3 1)	/10-1	/10-4	/10-5	/10-11
B7	/10-1	/10-4	/10-5	/12-1
F7	/10-1	/10-4	/10-5	/10-12
C10	/10-1	/10-4	/10-5	/10-10
F10	/10-1	/10-4	/10-5	/11-3
E13 1)	/10-1	/10-3	/10-5	/10-6
C15 1)	/10-1	/10-3	/10-5	/10-6

• 1) Support elements remain unchanged.

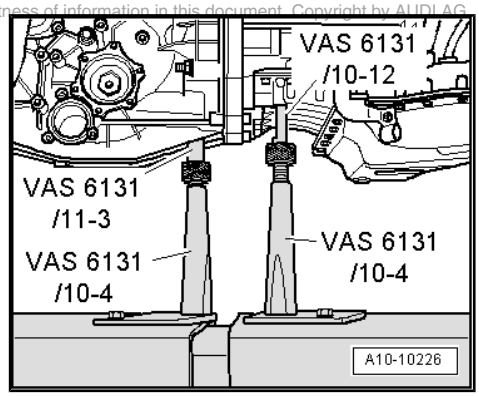


– Position support elements from -VAS 6131/10- and -VAS 6131/12- on left side of engine/gearbox assembly, as shown in illustration.

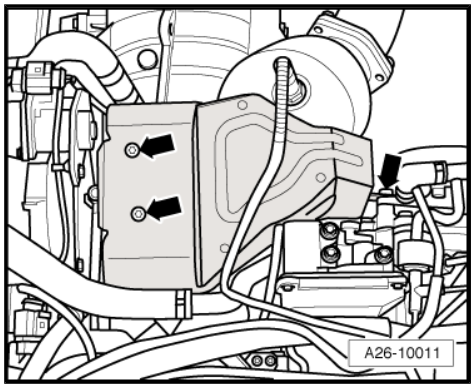


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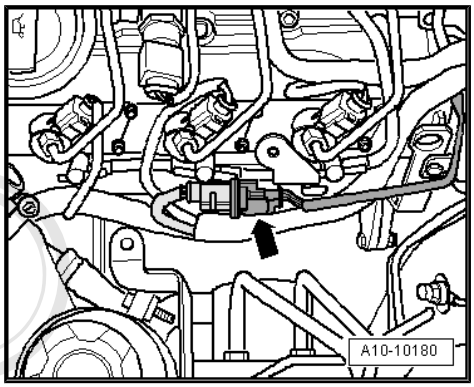
– Place support elements from -VAS 6131/10- and -VAS 6131/11- at right of engine/gearbox assembly, as shown in illustration.
– Turn spindles for the support elements upwards until all locating lugs make contact with the mounting points.
– Tighten base plates for support elements to 20 Nm on scissor-type assembly platform -VAS 6131 A- .



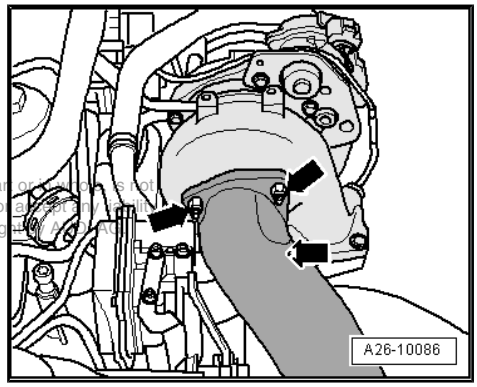
– Remove heat shield for turbocharger -arrows-.



– If fitted: unplug electrical connector -arrow- for Lambda probe -G39- and move wiring clear.



– Unscrew nuts -arrows- at starter catalytic converter/turbocharger.



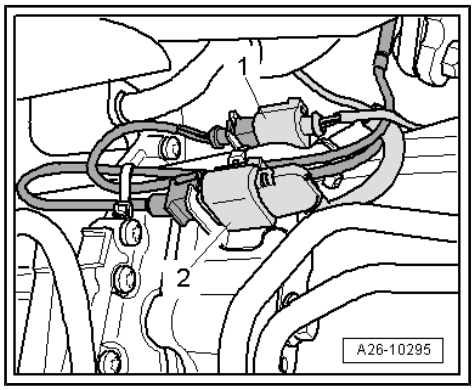
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– Detach electrical connectors from bracket at front left of gearbox and unplug:

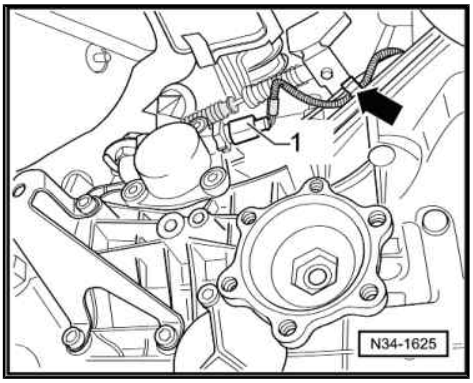
1 - For exhaust gas temperature sender 3 -G495-

2 - For engine speed sender -G28-

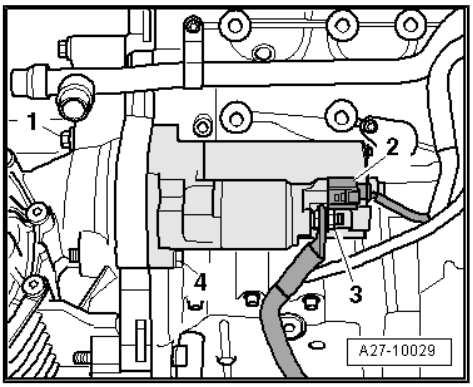
– Move clear electrical wiring.



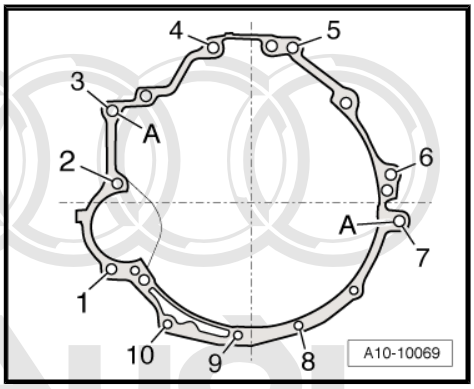
– Unplug electrical connector -1- for reversing light switch -F4- and move wiring -arrow- clear.



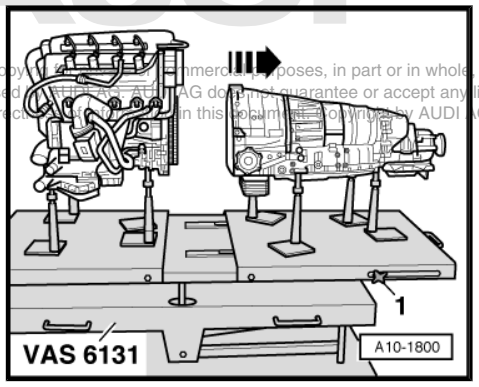
– Detach electrical wires -2- and -3- at starter.
– Unscrew bolt -1- and nut -4- and remove starter.



– Remove engine/gearbox securing bolts -3 ... 10-.



– Loosen clamping bolts -1- on sides of scissor-type assembly platform -VAS 6131 A- and pull rear section of platform together with gearbox towards rear -arrow-.



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1.3 Installing engine

Note

- *Renew self-locking nuts and bolts when performing assembly work.*
- *Renew bolts which are tightened to a specified angle as well as seals, gaskets and O-rings.*
- *Hose connections and hoses for charge air system must be free of oil and grease before assembly.*
- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*
- *To ensure that the charge air hoses can be properly secured at their connections, spray rust remover onto the worm thread of used hose clips before installing.*
- *Fit all cable ties in the original positions when installing.*

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– Install engine mounting with engine supports ⇒ page 98 .

– When fitting a new clutch plate together with a used pressure plate (self-adjusting clutch), the adjuster ring in the pressure plate has to be reset by turning it back as far as it will go. If this is not done, the pressure plate will operate with reduced clamping force, causing clutch slip ⇒ Rep. gr. 30 .

Note

- *If the clutch plate is not being replaced, it is not necessary to reset the adjuster ring.*
- *New SAC pressure plates are already pre-set accordingly, and do not have to be reset.*

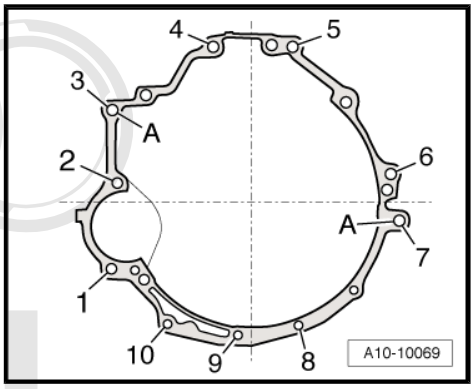
– Clean input shaft splines and (in the case of used clutch plates) the hub splines. Remove corrosion and apply only a very thin coating of grease for clutch plate splines -G 000 100- to the splines. Do not lubricate guide sleeve.

– Check that the clutch plate is properly centralised (only necessary if you have carried out other work on the clutch).

– Check clutch release bearing for wear and make sure that plastic ring is securely seated; renew clutch release bearing if necessary ⇒ Rep. gr. 30 .

– A needle bearing must be fitted in the crankshaft on vehicles with manual gearbox; install needle bearing if not already fitted ⇒ page 124 .

– Check whether dowel sleeves -A- for centring engine and gearbox are fitted in cylinder block; install missing dowel sleeves.
– Press intermediate plate between engine and gearbox onto dowel sleeves.
– Bolt gearbox to engine.



Note

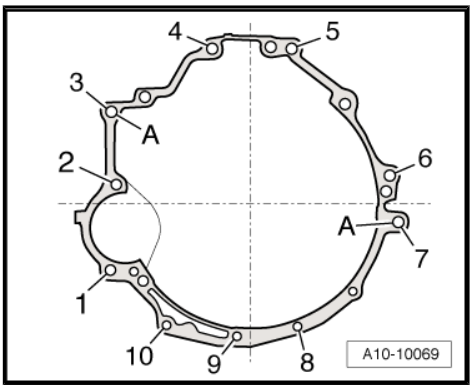
- *Tightening torques apply only to lightly greased, oiled, phosphated or black-finished nuts and bolts.*
- *Additional lubricants such as engine or gearbox oil may be used, but do not use lubricants containing graphite.*
- *Do not use degreased parts.*
- *Tolerance for tightening torques: ± 15 %.*

Audi
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Securing engine to gearbox

Item	Bolt	Nm
1, 2	M12x135	65 1)
3, 4, 5	M12x105	65
6, 7	M12x120	65
8, 9, 10	M10x80	45
A	Dowel sleeves for centralising	

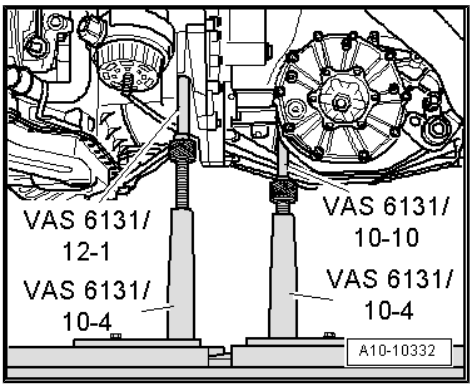
• 1) Property class 10.9.



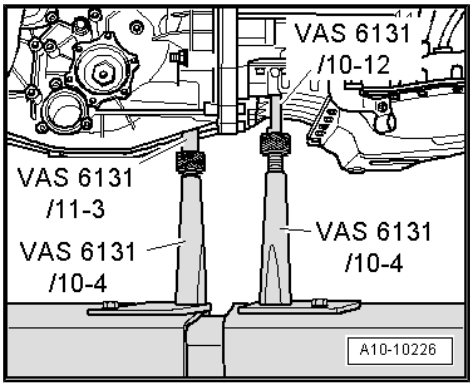
Perform further installation in reverse order, paying attention to the following:

– Install starter catalytic converter: vehicles without particulate filter ⇒ page 341 , vehicles with particulate filter ⇒ page 355 .

– Screw down spindles of support elements on left side of engine/gearbox assembly.
– Unscrew both base plates for support elements (left-side) at scissor-type assembly platform -VAS 6131 A- .



– Screw down spindles of support elements on right side of engine/gearbox assembly.
– Unscrew both base plates for support elements (right-side) at scissor-type assembly platform -VAS 6131 A- .



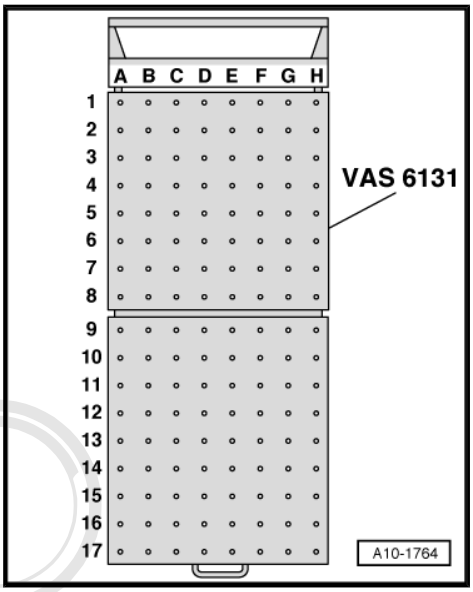
Note

The mounting points for engine (front) and tunnel cross member remain unchanged.

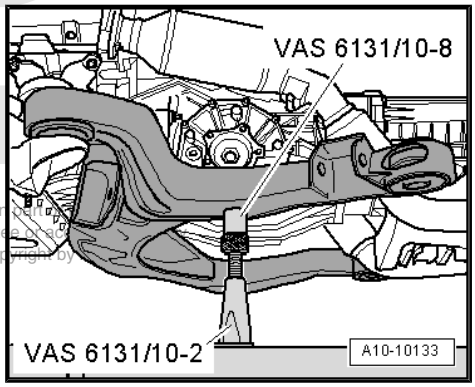
– Set up scissor-type assembly platform -VAS 6131 A- with support set for Audi -VAS 6131/10- as follows:

Platform coordinates	Parts from support set for Audi -VAS 6131/10-			
B3 1)	/10-1	/10-4	/10-5	/10-11
F3 1)	/10-1	/10-4	/10-5	/10-11
B10	/10-1	/10-2	/10-5	/10-8 2)
G10	/10-1	/10-2	/10-5	/10-8 2)
E13 1)	/10-1	/10-3	/10-5	/10-6
C15 1)	/10-1	/10-3	/10-5	/10-6

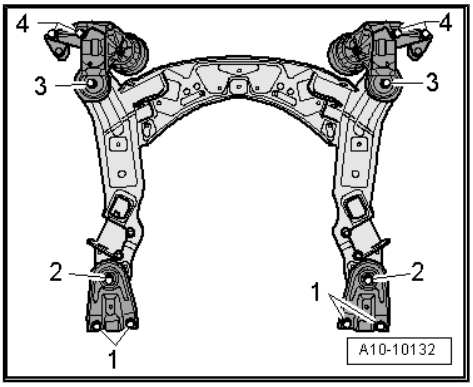
- 1) Support elements remain unchanged.
- 2) Secure support elements only after installing the subframe.



– Fit subframe onto the two support elements -VAS 6131/10-8- .
– Screw up the spindles for support elements on both sides.
– Tighten base plates for support elements to 20 Nm on scissor-type assembly platform -VAS 6131 A- .



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– Carefully guide engine/gearbox assembly together with subframe into the body from below using scissor-type assembly platform -VAS 6131 A- .
– Adjust the subframe and consoles for engine mountings according to the markings made on the longitudinal members during removal.
– Only tighten bolts for subframe and consoles for engine mountings to the specified torque (do not turn further); tighten bolts only after performing wheel alignment check.

1 - 55 Nm

2 - 115 Nm

3 - 115 Nm

4 - 75 Nm

WARNING

The vehicle must not be driven at this stage.

– Fit tunnel cross piece ⇒ Rep. gr. 40 .
– Install clutch slave cylinder ⇒ Rep. gr. 30 .
– Fit selector linkage to gearbox ⇒ Rep. gr. 34 .
– Vehicles with four-wheel drive: install propshaft ⇒ Rep. gr. 39 , ⇒ Rep. gr. 39 , ⇒ Rep. gr. 39 .
– Install front exhaust pipe with catalytic converter ⇒ page 347 or install particulate filter with catalytic converter ⇒ page 361 .
– Align exhaust system so it is free of stress ⇒ page 366 .
– Install cross piece (front) ⇒ Rep. gr. 50 .
– Install drive shafts ⇒ Rep. gr. 40 .
– Install guide links, track control links, anti-roll bar and suspension struts ⇒ Rep. gr. 40 .
– Secure hydraulic pressure line at power steering pump ⇒ Rep. gr. 48 .
– Install refrigerant lines ⇒ Rep. gr. 87 .
– Install torque reaction support ⇒ page 107 .
– Electrical connections and routing ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.
– Observe notes on procedures required after connecting battery ⇒ Rep. gr. 27 .

Caution

Do not use a battery charger to boost starting. There is danger of damaging the vehicle's control units.

– Install and adjust wiper arms ⇒ Rep. gr. 92 .
– Install body brace ⇒ Rep. gr. 40 .
– Check oil level ⇒ Maintenance ; Booklet 405 .

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

Note

The power steering pump must not be run when dry.

– Connect coolant hose with plug-in connector to coolant pipe ⇒ page 287 .

– Fill cooling system ⇒ page 259 .

Note

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

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

– Adjust subframe and the two consoles for engine mountings ⇒ Rep. gr. 40 .

– Perform wheel alignment check ⇒ Rep. gr. 44 .

WARNING

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

– Check fuel system for leaks ⇒ page 6 .

Tightening torques

Note

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

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Component		Nm
Bolts/nuts	M6	9
	M8	20
	M10	40
	M12	65
Except for the following:		
Terminal B+ to starter		16
Drive shaft heat shield to gearbox		23
Intake connection with	Intake manifold	9
intake manifold flap to:	Connecting pipe for exhaust gas recirculation	9
Hose clips (9 mm wide)		3
Hose clips (13 mm wide)		5.5

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2 Removing and installing engine - vehicles with multitronic gearbox

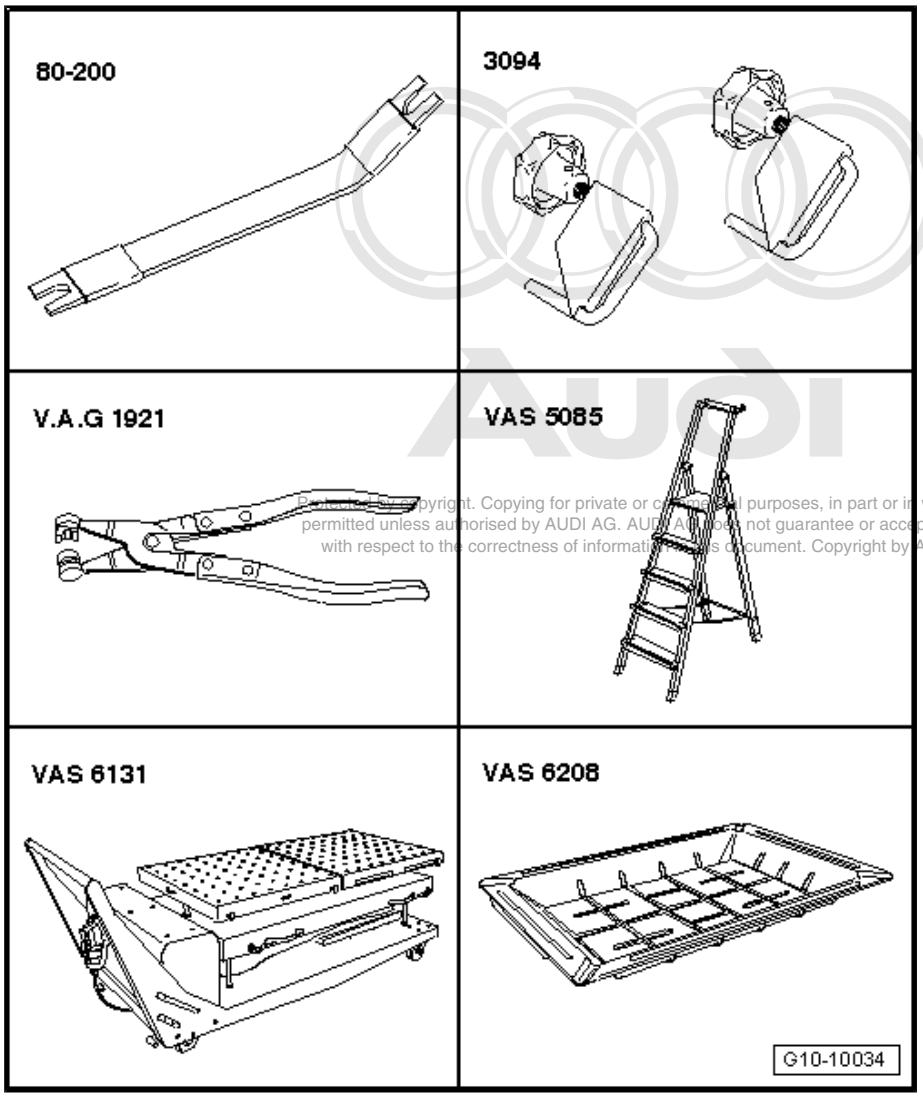
Note

- *The engine is removed from underneath together with the gearbox and subframe (with lock carrier installed).*
- *All cable ties which are released or cut open when removing must be fitted in the same position when installing.*
- *Collect drained coolant in a clean container for re-use or disposal.*

2.1 Removing engine

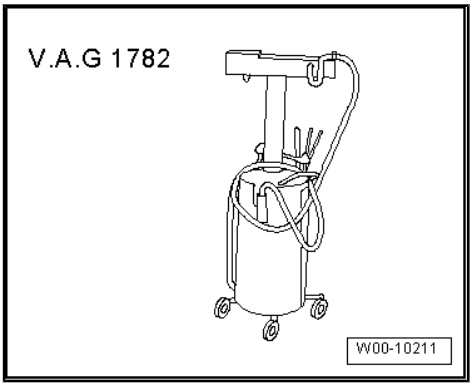
Special tools and workshop equipment required

- Removal lever -80 - 200-
- Hose clamps for hoses up to 25 mm -3094-
- Hose clip pliers -VAS 6362- instead of -V.A.G 1921- shown in illustration
- Stepladder -VAS 5085-
- Scissor-type assembly platform -VAS 6131 A- with support set for Audi - VAS 6131/10- and supplementary set -VAS 6131/11-
- Drip tray for workshop hoist -VAS 6208-

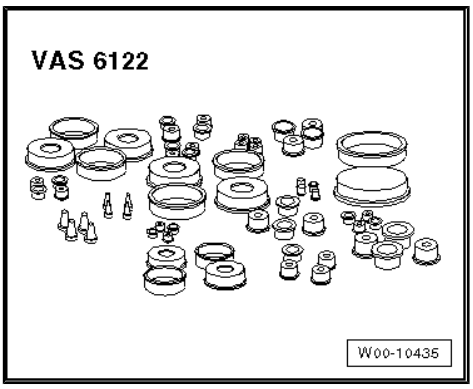


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- Used oil collection and extraction unit -V.A.G 1782-

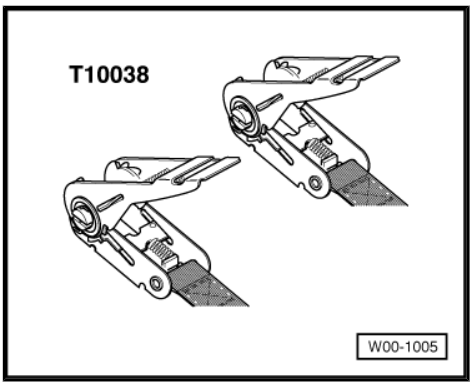


- Engine bung set -VAS 6122-

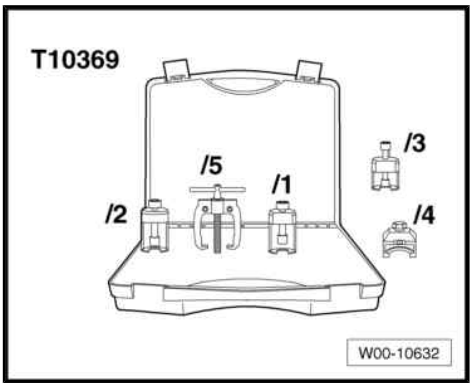


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- Tensioning strap -T10038-



- Puller -T10369-



Procedure

WARNING

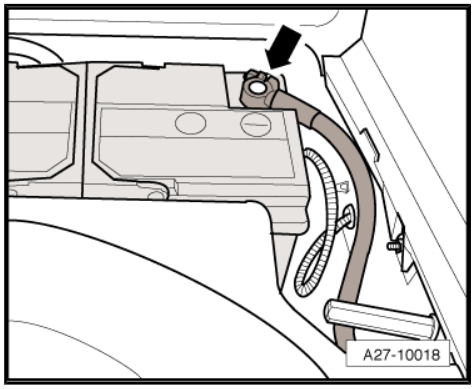
Before removing the engine secure the vehicle against tipping over. To do so, the luggage compartment must be empty.

Caution

Observe notes on procedure for disconnecting the battery.

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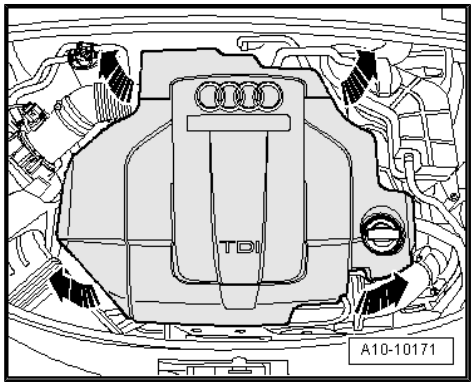
– With ignition switched off, disconnect battery earth cable -arrow- ⇒ Rep. gr. 27 .



– Carefully pull engine cover panel off four retaining pins one after the other -arrows-.

WARNING

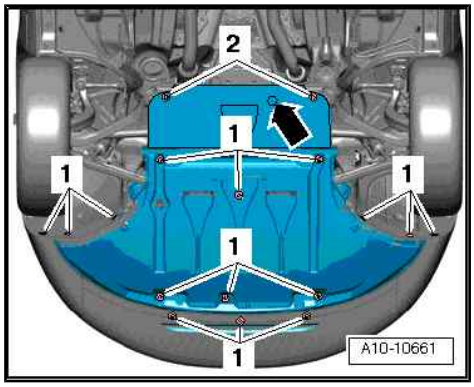
Hot steam or hot coolant can escape when expansion tank is opened; cover filler cap with cloth and open carefully.



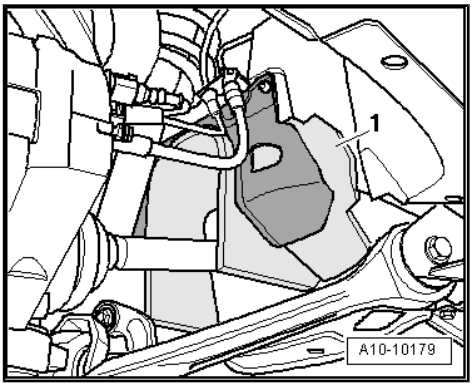
– Open filler cap on coolant expansion tank.

– Remove both front wheels.

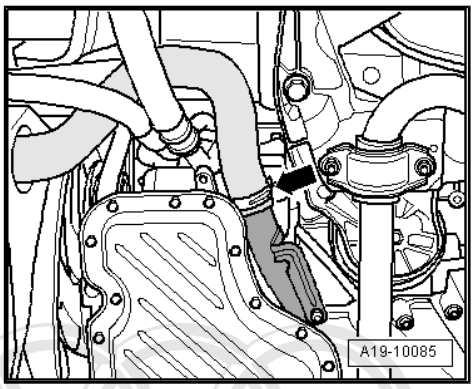
– Release fasteners marked -1, 2- and -arrow- (if fitted) and remove front and rear noise insulation.



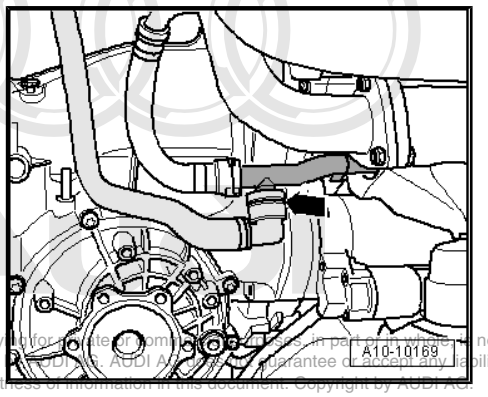
– Remove noise insulation -1- in wheel housing (left and right).



– Place drip tray for workshop hoist -VAS 6208- under engine.
– Disconnect coolant hose -arrow- from coolant pipe (left-side) and drain off coolant.

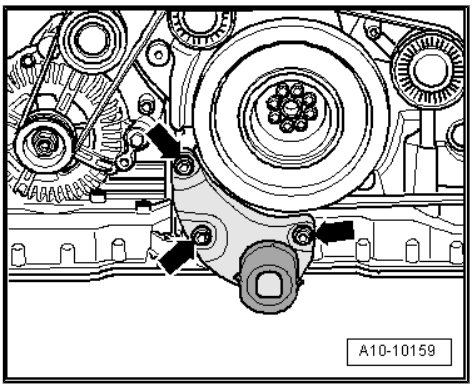


– Lift retaining clip to disconnect coolant hose -arrow- from coolant pipe (right-side) and drain off remaining coolant.



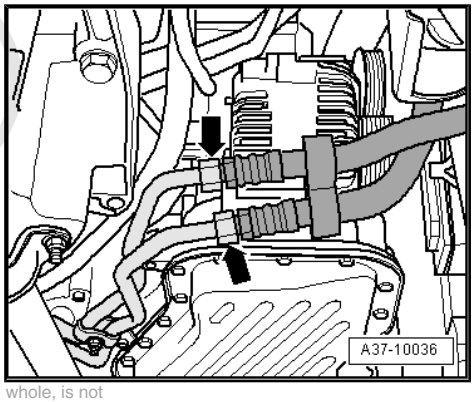
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– Unscrew bolts -arrows- and remove torque reaction support from engine.



Note

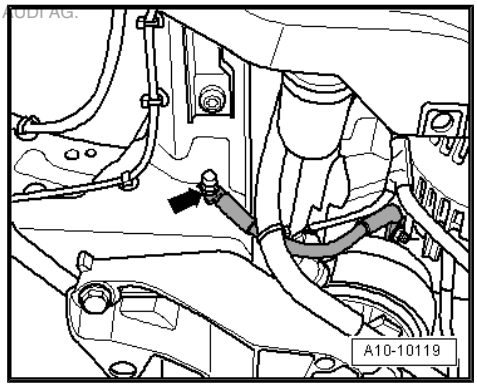
Observe rules for cleanliness when working on automatic gearbox ⇒ Rep. gr. 00 .



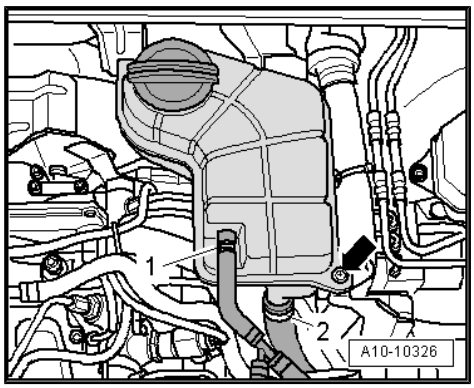
- Place used oil collection and extraction unit -V.A.G 1782- under engine.
- Disconnect ATF lines -arrows- at connections on right side of engine.
- Seal off open pipes/lines and connections with clean plugs from engine bung set -VAS 6122-.

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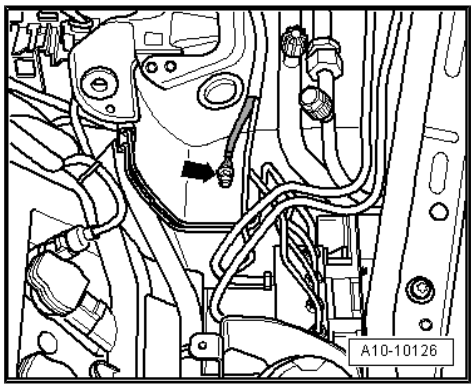
- Unbolt earth cable -arrow- at longitudinal member (right-side).



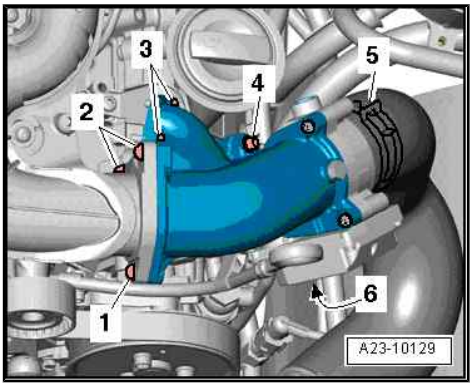
- Detach coolant hose -2- at expansion tank.
- Unbolt coolant expansion tank -arrow-.
- Detach electrical connector at coolant shortage indicator switch -F66- on coolant expansion tank (bottom).
- Lay aside coolant expansion tank with coolant hoses -1- and -3- connected.



- Unbolt earth cable -arrow- at suspension turret (left-side).



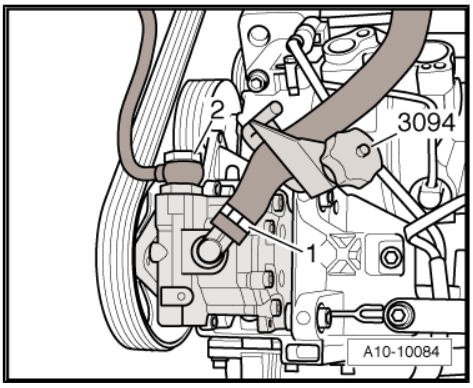
– Disconnect air intake hose -5- from throttle valve module - J338- .
– Unplug electrical connector -6- at throttle valve module - J338- .
– Remove bolts -1 ... 4-.



Note

Lay a cloth under the hydraulic lines to catch any escaping hydraulic fluid.

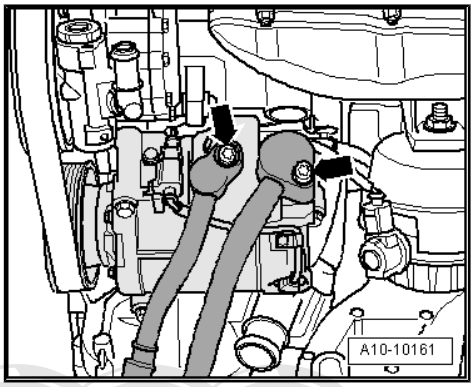
– Disconnect hydraulic pressure line -2- from power steering pump and lay aside on top of longitudinal member.
– Clamp off hydraulic hose for power steering pump using a hose clamp -3094- .
– Disconnect hydraulic hose -1- from power steering pump.
– Seal off open pipes/lines and connections with clean plugs from engine bung set -VAS 6122- .



Note

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

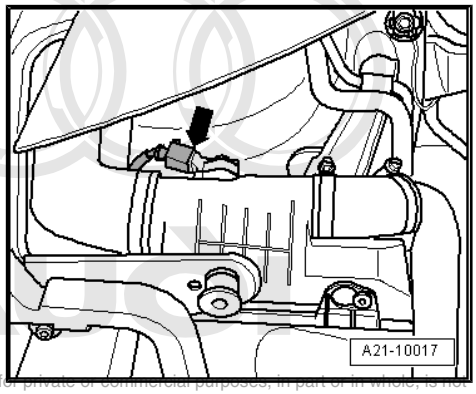
– Remove bolts -arrows- and disconnect refrigerant lines from A/C compressor.
– Seal off open pipes/lines and connections with clean plugs from engine bung set -VAS 6122- .



– Unplug electrical connector -arrow- for charge pressure sender -G31- at charge air cooler (left-side).

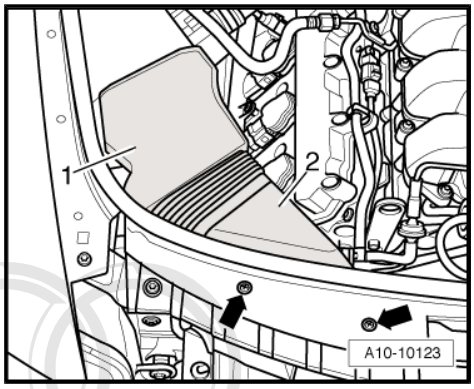
Note

Shown in illustration with headlight removed.

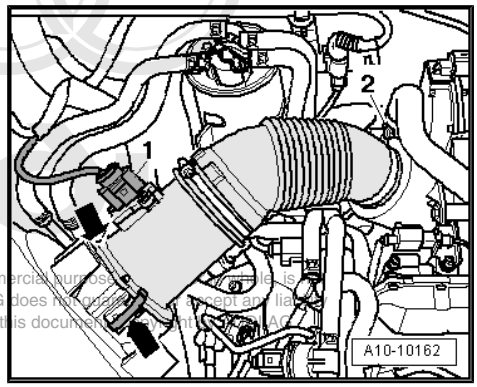


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– Remove bolts -arrows-.
– Remove air ducts -1- and -2-.

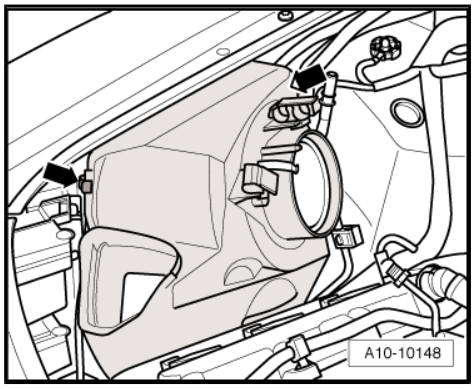


– Unplug electrical connector -1- at air mass meter -G70- .
– Remove air intake hose. To do so, release hose clip -2- and clamps -arrows-.

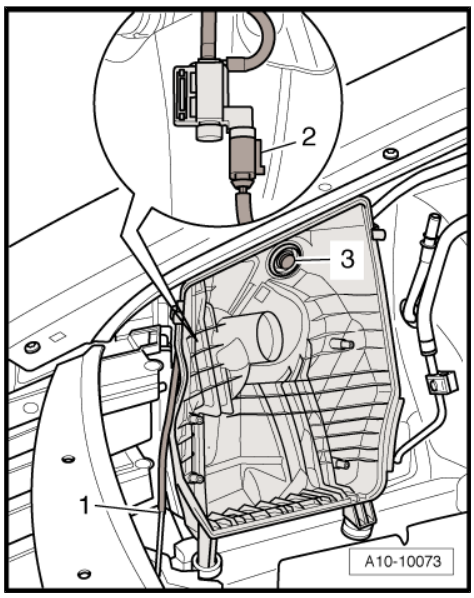


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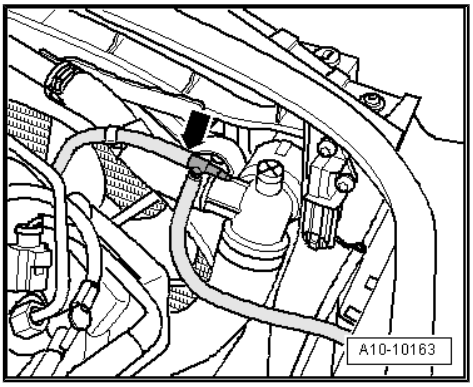
– Release clamps -arrows- and detach air cleaner (top section).



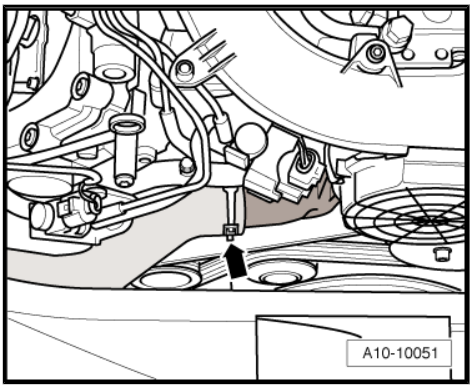
– Disconnect vacuum pipe -1-.
– Pull out pin of fastener -3-.
– Remove air cleaner (bottom section) and unplug electrical connector -2- on reverse side at air filter bypass flap valve - N275- .



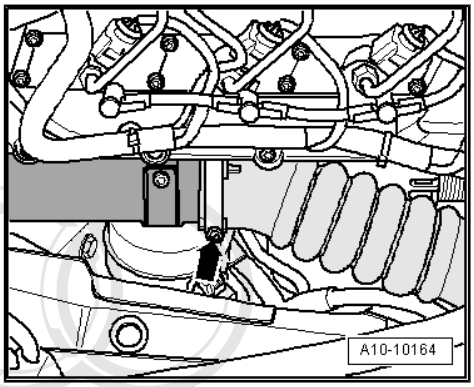
– Disconnect vacuum hose from T-piece -arrow-.



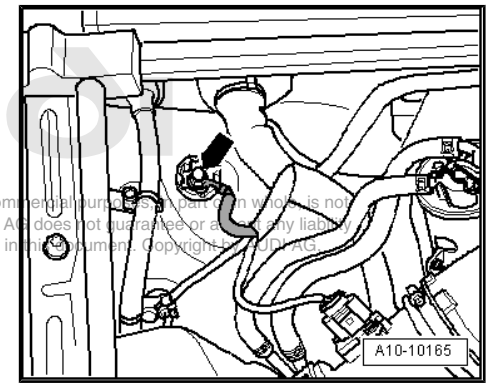
– Disconnect coolant hose -arrow- from hose connection on thermostat.



– Disconnect air intake hose -arrow- from air pipe.

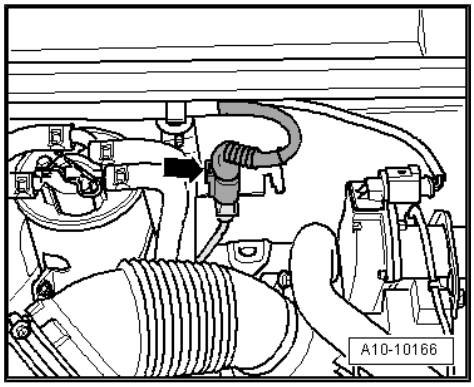


– Disconnect earth cable -arrow- at suspension turret (right-side).



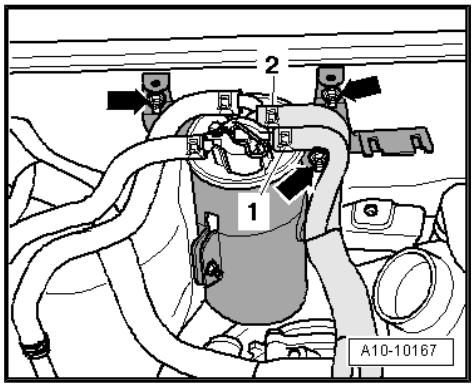
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– If fitted, detach electrical connector for engine speed sender - G28- from bracket on bulkhead.



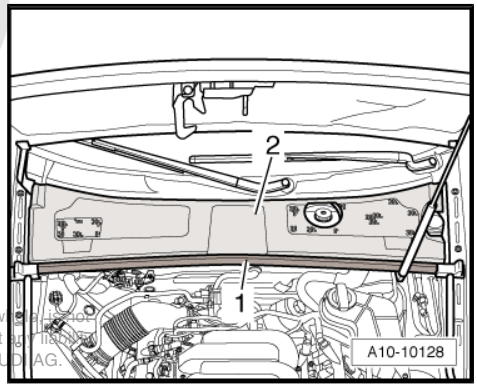
Caution

Rules for cleanliness when working on the injection system ***⇒ page 6*** ***.***



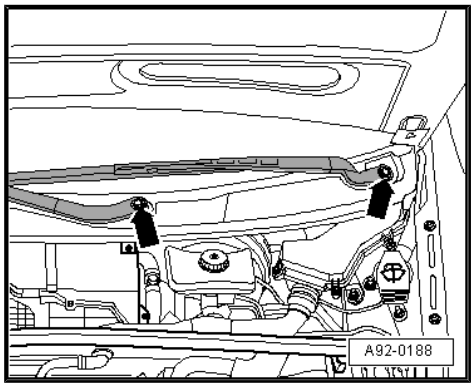
– Disconnect fuel return hose -1- and fuel supply hose -2- from fuel filter.
– Seal off open pipes/lines and connections with clean plugs from engine bung set -VAS 6122- .
– Remove bracket with fuel filter from plenum chamber partition panel -arrows-.
– Place fuel filter with bracket to one side.

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

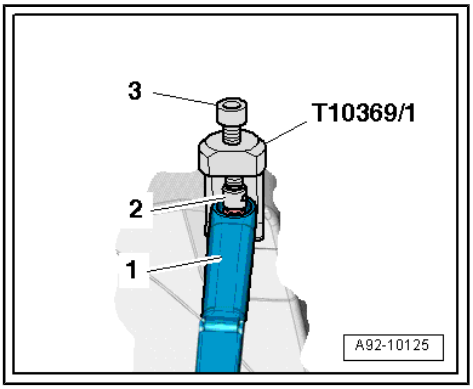


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– Lever off caps on windscreen wiper arms with a screwdriver.
– Loosen hexagon nuts -arrows- several turns.



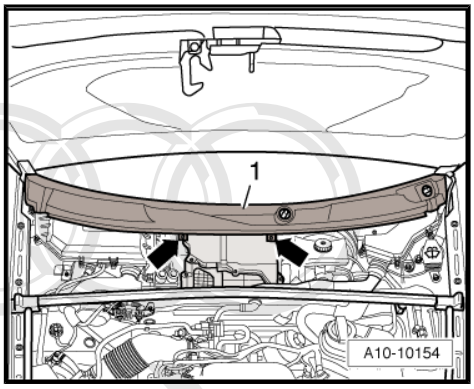
– Apply puller -T10369/1- to wiper arm -1- as shown in illustration.
– Apply thrust piece -2- onto wiper shaft.
– Turn bolt -3- in clockwise direction until wiper arm is pulled off wiper shaft.
– Remove nuts and detach windscreen wiper arms.



– Unscrew bolts -arrows- for cowl panel trim -1-.

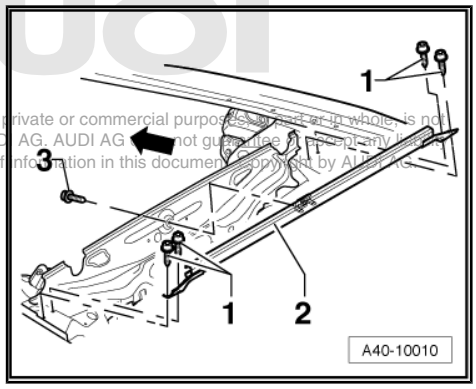
Caution

To avoid cracking the cowl panel trim -1- during removal, apply a small amount of soap solution to the joint between the windscreen and the cowl panel trim and pull the trim vertically up out of the windscreen surround, starting from the edge of the windscreen.



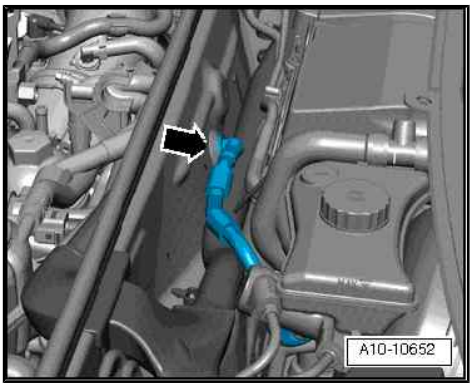
– Pull cowl panel trim off windscreen.

– If fitted, unscrew bolts -1- and -3- and remove body brace -2-.

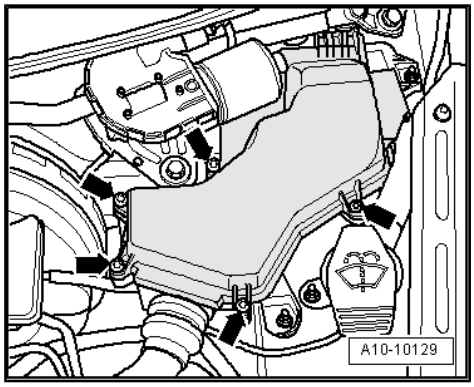


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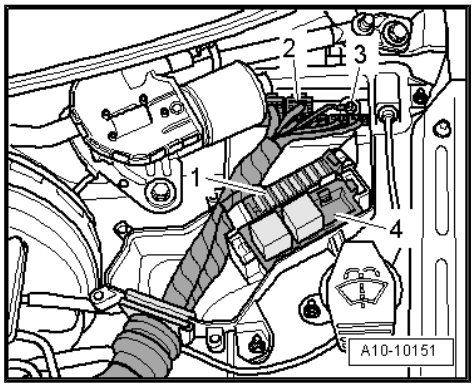
– Detach vacuum hose -arrow- going to brake servo at plenum chamber partition panel.



– Unscrew bolts -arrows- and take off cover for electronics box in engine compartment (left-side).



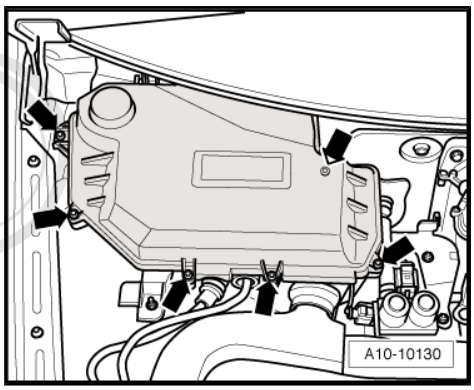
– Release retainers and lift off fuse holder -1-; then lift off 3-position relay carrier -4-.
– Unscrew electrical wiring -3-.
– Unplug all connectors -2- at rear of connector console.
– Disengage engine wiring harness at electronics box and move it clear.



– Unscrew bolts -arrows- and take off cover for electronics box in engine compartment (right-side).

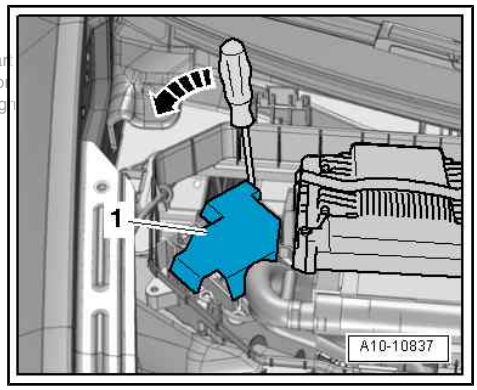
WARNING

The pump valve unit for heating system (left in front of electronics box) gets very hot – risk of burns!

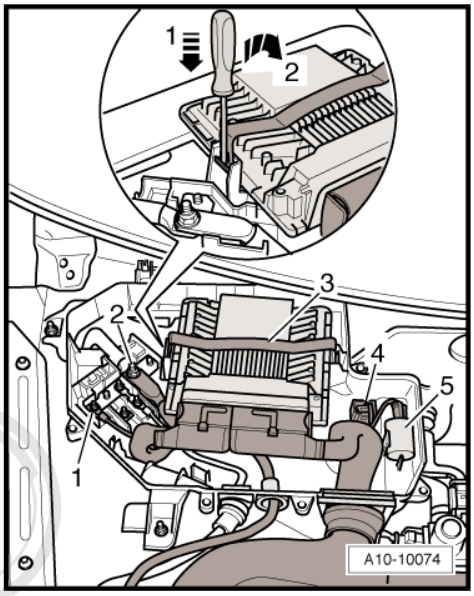


– Open cover -1- with screwdriver -arrow- and detach.

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– Carefully lever out the retaining strap -3- using a screwdriver -arrows 1 and 2- and remove the engine control unit from the electronics box.

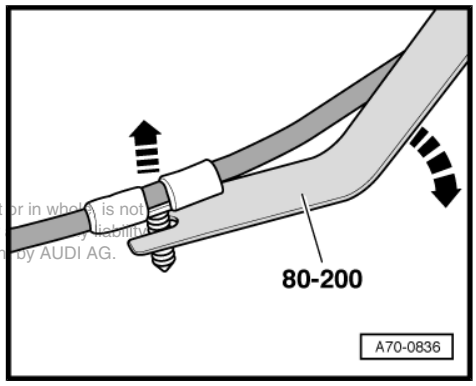


Note

The engine control unit remains connected to the wiring harness.

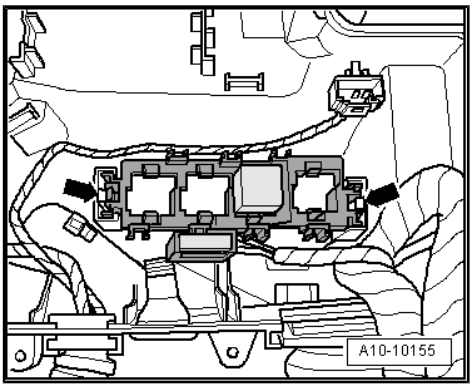
– Unclip suppressor capacitor -5- and take out of retainer in electronics box.
– Unplug electrical connector -4- at rear of connector console.
– Unscrew electrical wiring connections -1- and -2-.

– Release electrical wiring up to the alternator using removal lever -80 - 200- .

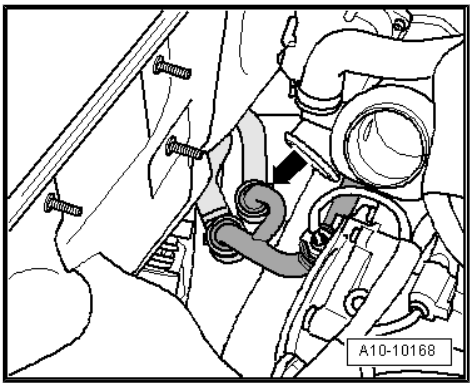


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– Release retainers -arrows- and pull relay carrier off electronics box in engine compartment (right-side).
– Place both wiring harnesses on top of engine and secure the engine control unit to prevent it falling.



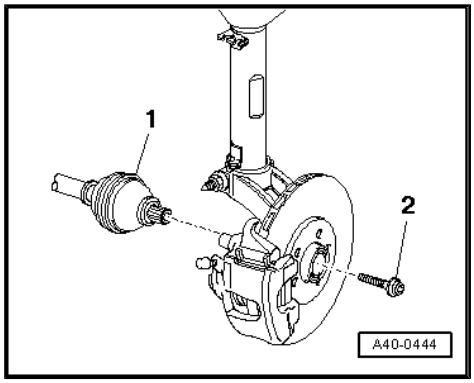
– Disconnect coolant hose -arrow- leading to heat exchanger for heater at rear of engine.



– Have a 2nd mechanic press the brake pedal.

Caution

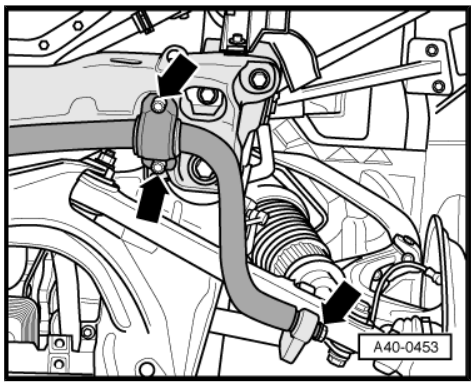
When slackening the flange bolt securing the drive shaft, the wheel bearing must not be under load (vehicle must not be standing on its wheels).



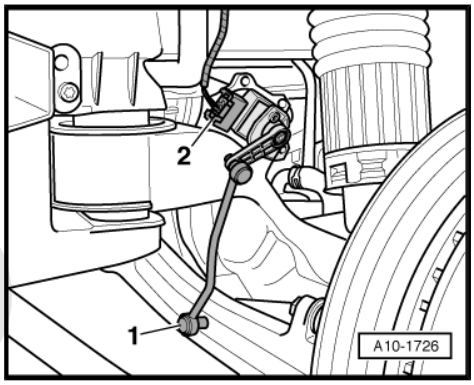
– Unscrew flange bolt -2- from drive shaft -1- (left and right).

– Unscrew bolts (left and right) -arrows- evenly.

– Take out anti-roll bar.

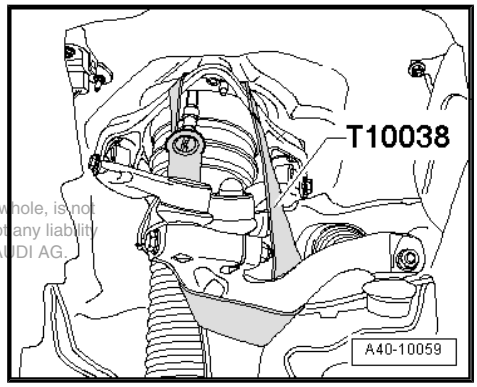


– If fitted, unplug electrical connector -2- at vehicle level sender.



Caution

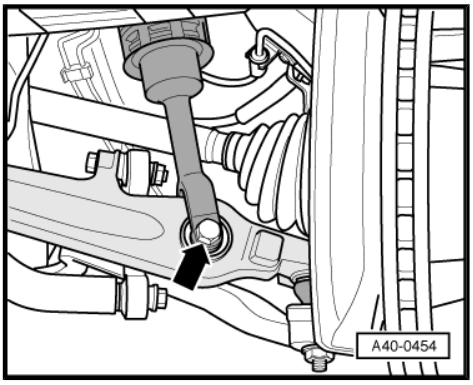
The weight of the wheel bearing housings must be supported in order to prevent damage to the joints of the upper links.



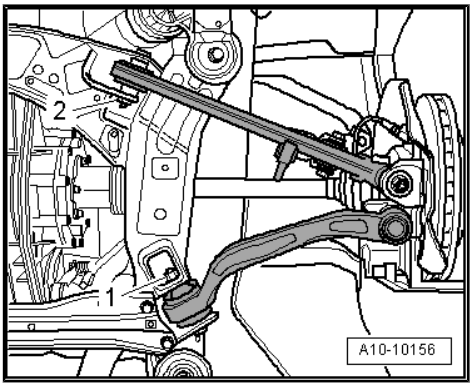
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– Tie up wheel bearing housing using tensioning strap -T10038- as illustrated.

– Unbolt suspension strut from track control link -arrow-.



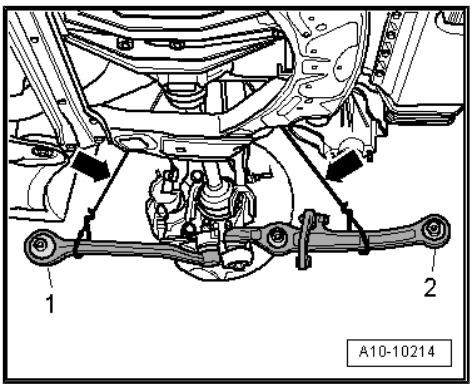
– Unbolt guide link -1- and track control link -2- at subframe.



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

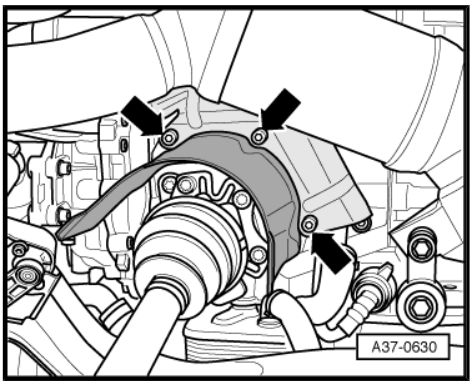
Caution

The guide link and track control link must not be allowed to hang down without support. Tie up both the guide link and track control link to wheel bearing housing as illustrated -arrow-.



– Unbolt heat shield for drive shaft -arrows-.

– Remove bolts -arrows- and detach heat shield for drive shaft (left-side).



– Unbolt drive shaft from flange shaft on gearbox.

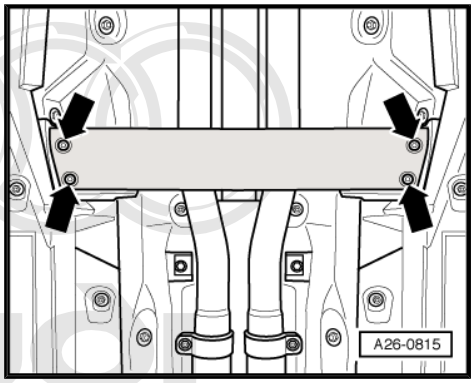
– Pivot wheel bearing housing outwards and remove drive shaft, taking care not to damage brake hose.

– Perform the same work steps on the other side of the vehicle.

– Repeat procedure on other side of vehicle.

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– Remove front cross piece -arrows-.

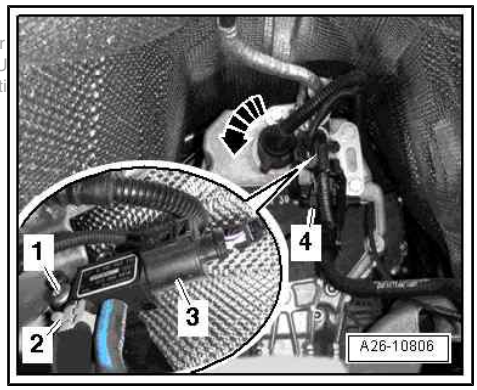


Vehicles with particulate filter:

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– Unplug electrical connectors -3- for exhaust gas pressure sensor 1 -G450- and -4- for exhaust gas temperature sender 4 -G648- at rear of gearbox.

– Remove bolt -1- and move clear exhaust gas pressure sensor 1 -G450- .

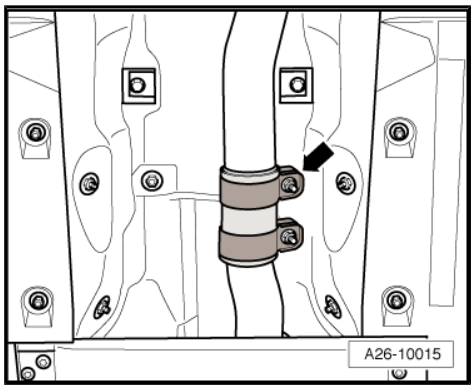


Note

Disregard -item 2- and -arrow-.

All vehicles:

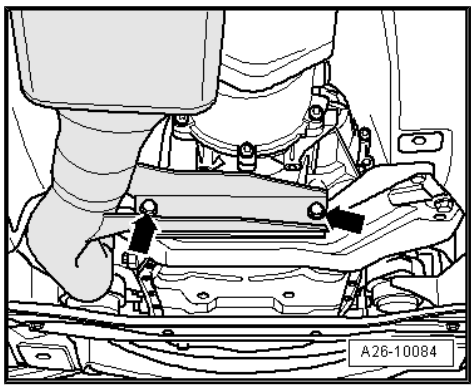
– Disconnect exhaust system at clamp -arrow-.



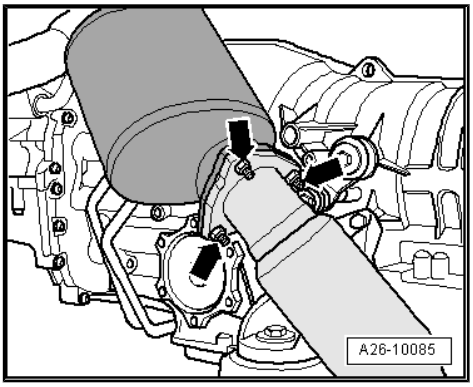
Note

To avoid any damage, the flexible joint in the front exhaust pipe must not be bent more than 10°.

– Remove bolts -arrows- at centre bracket for front exhaust pipe.



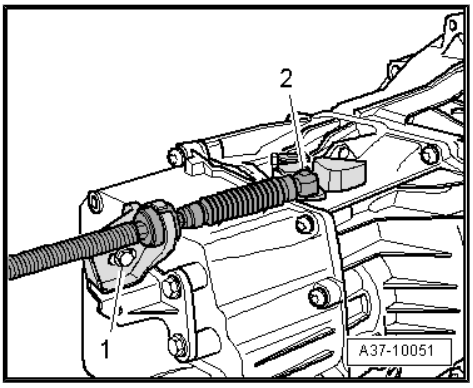
– Remove nuts -arrows- and take out front exhaust pipe with catalytic converter/particulate filter.



Note

Mark installation position of support bracket for selector lever cable.

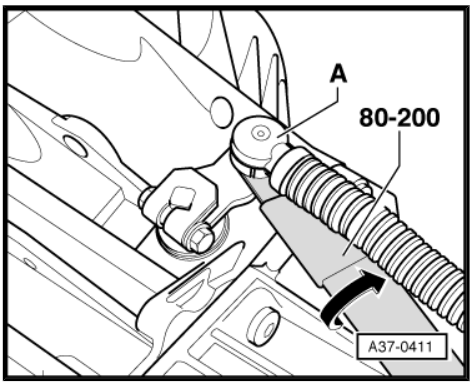
– Remove bolt -1- for cable support bracket.



Note

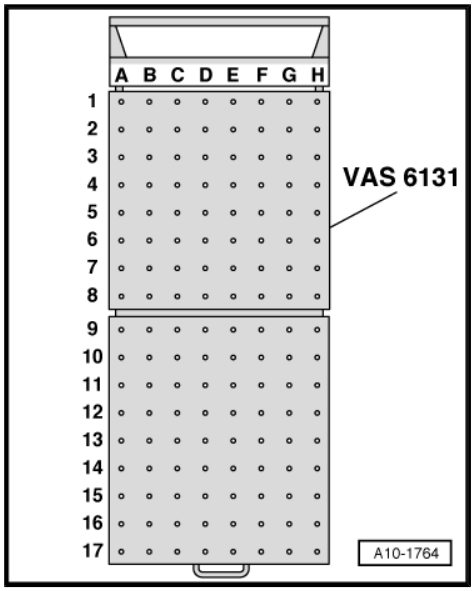
Disregard -item 2-.

– Pry ball socket -A- of selector lever cable off gearbox selector lever in direction of -arrow- using removal lever -80 - 200- .



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Set up the scissor-type assembly platform as follows:



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

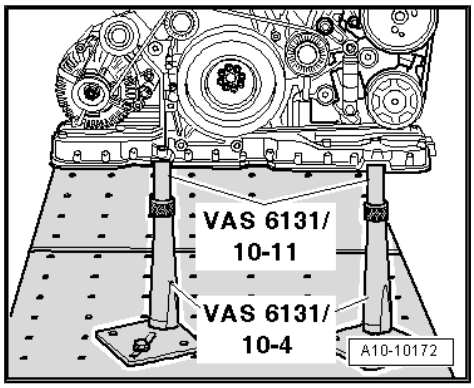
Platform coordinates	Parts of support set for Audi -VAS 6131/10- and supplementary set -VAS 6131/11-			
B3	/10-1	/10-4	/10-5	/10-11
F3	/10-1	/10-4	/10-5	/10-11
B10	/10-1	/10-2	/10-5	/10-8
G10	/10-1	/10-2	/10-5	/10-8
C14	/10-1	/10-3	/10-5	/10-12
F14	/10-1	/10-3	/10-5	/11-2

– Initially hand-tighten the support elements on the scissor-type assembly platform.

– Position scissor-type assembly platform -VAS 6131 A- horizontally.

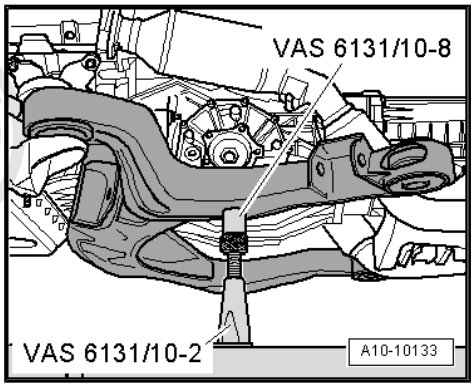
• Take note of spirit level (bubble gauge).

– Position scissor-type assembly platform -VAS 6131 A- below engine/gearbox assembly.



– Position the support elements from -VAS 6131/10- at front of engine, as shown in illustration.

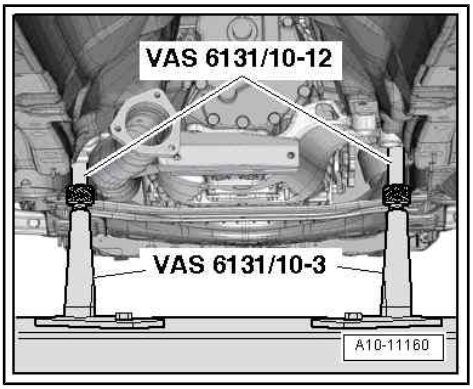
– Make sure that threaded spindles are screwed in completely.



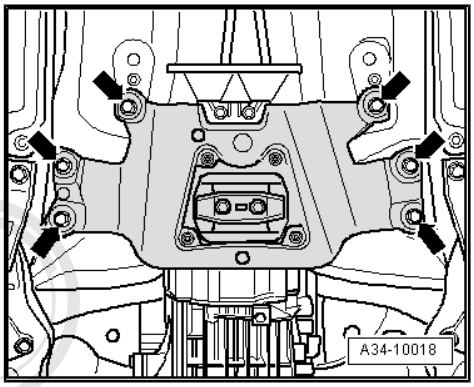
– Position the support elements from -VAS 6131/10- at left and right of subframe, as shown in illustration.

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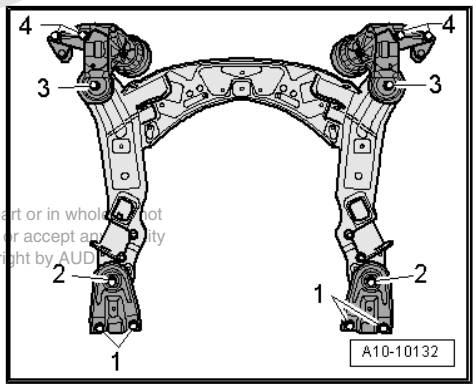
– Position the support elements from -VAS 6131/10- and -VAS 6131/11- at rear of tunnel cross member, as shown in illustration.
– Turn all spindles for support elements upwards until all locating lugs make contact with mounting points.
– Tighten base plates for support elements to 20 Nm on scissor-type assembly platform -VAS 6131 A- .



– Remove bolts -arrows- for tunnel cross member.



– Remove bolts -1-.
– Mark installation position of subframe and both consoles for engine mountings on longitudinal members with felt-tip pen.
– Remove bolts -2, 3, 4- in diagonal sequence and in stages.



Note

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

– Lower engine/gearbox assembly gradually.
– Pull out scissor-type assembly platform -VAS 6131 A- from under the vehicle.

2.2 Separating engine from multitronic gearbox

Special tools and workshop equipment required

- Support set for Audi -VAS 6131/10- , supplementary set -VAS 6131/11- and -VAS 6131/12-
- Gearbox support -VAS 6131/14-

Setting up gearbox support -VAS 6131/14- :

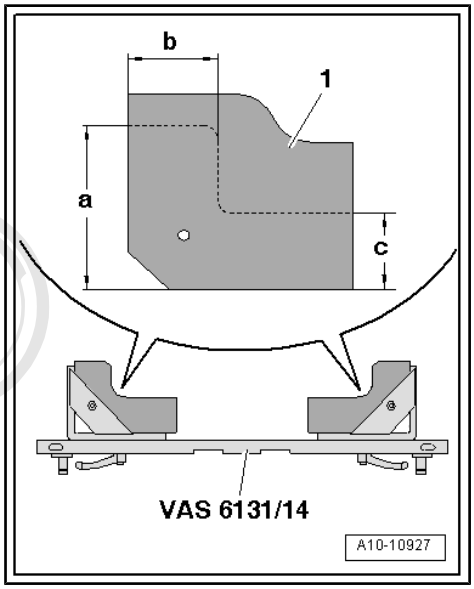
– Cut foam plastic insert according to the dimensions given.

• Distance -a- = 20 mm.

• Distance -b- = 55 mm.

• Distance -c- = 55 mm.

– Order new foam plastic insert.



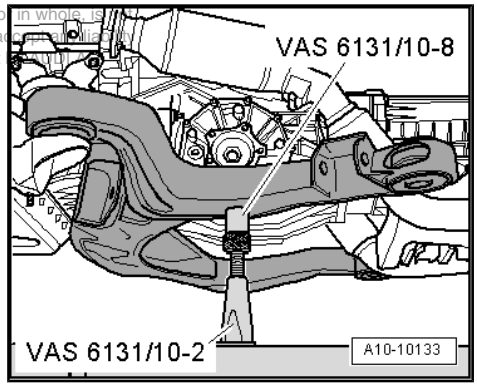
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Procedure

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

– Screw down spindles of support elements from -VAS 6131/10- (left and right) at subframe as far as possible.

– Remove locating lugs from spindles.

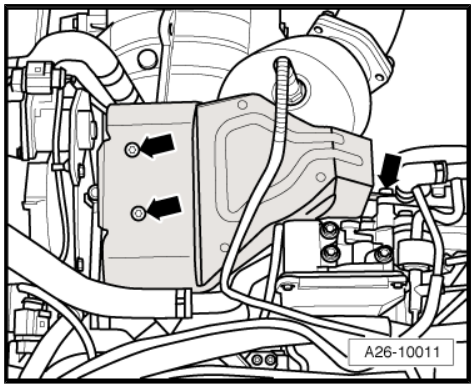


Note

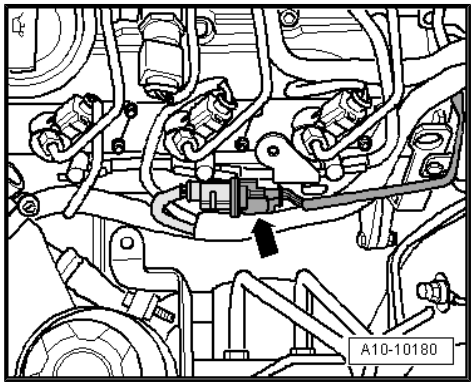
A second mechanic is required for removing the subframe.

– Take out subframe to the side.

– Remove heat shield for turbocharger -arrows-.



– If fitted: unplug electrical connector -arrow- for Lambda probe -G39- and move wiring clear.

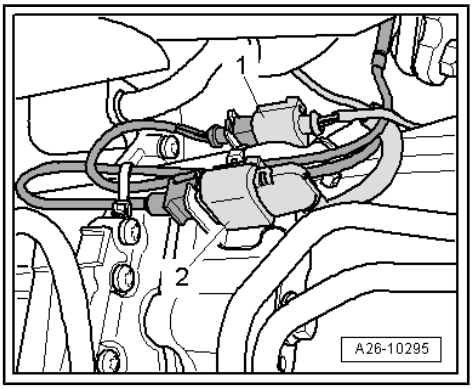


– Detach electrical connectors from bracket at front left of gearbox and unplug:

1 - For exhaust gas temperature sender 3 -G495-

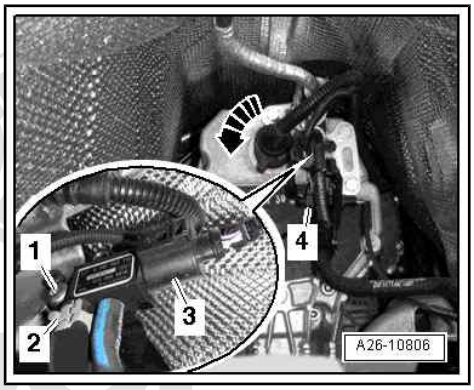
2 - For engine speed sender -G28-

– Move clear electrical wiring.



Caution

Risk of irreparable damage to gearbox control unit (mechatronic unit) because of static discharge. Do NOT touch connector contacts in gearbox connector with your hands.



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

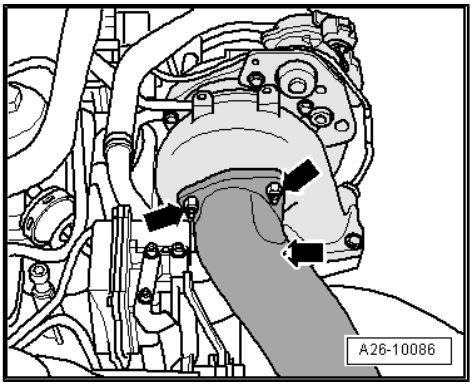
– Turn retainer catch anti-clockwise -arrow- and unplug electrical connector at rear of gearbox.

Note

Disregard items marked -1 ... 4-.

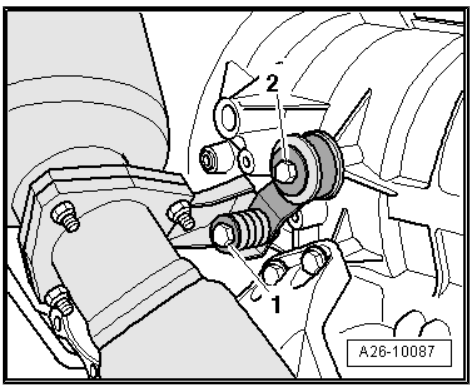
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– Unscrew nuts -arrows- at starter catalytic converter/turbocharger.



– Remove bolt -1- on bracket for starter catalytic converter.

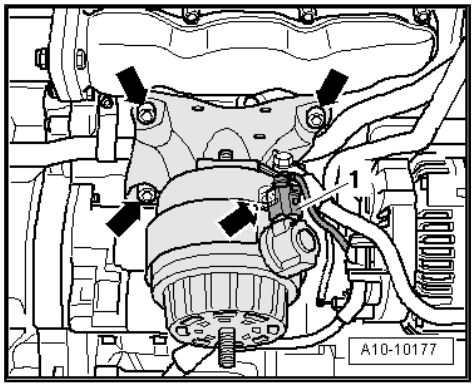
– Detach starter catalytic converter.



Note

Disregard -item 2-.

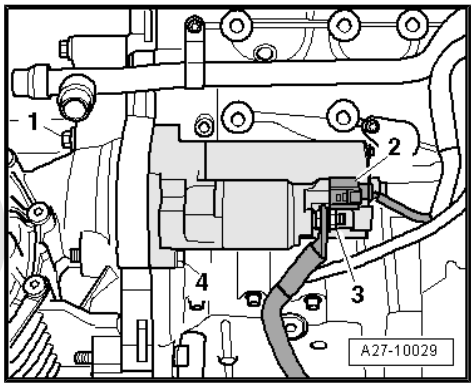
– Unplug electrical connector -1- for right electrohydraulic engine mounting solenoid valve -N145- .
– Move clear electrical wiring at console for engine mounting.
– Unscrew bolts -arrows- and remove engine support (right-side).



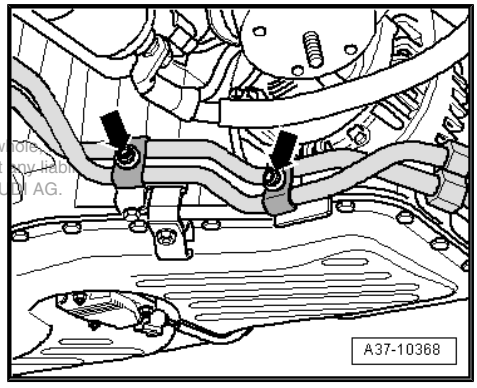
Note

For illustration purposes, the installation position is shown without console for engine mounting.

– Remove nut -3- for battery positive cable.
– Unplug electrical connector -2-.
– Remove bolts -1- and -4- and take off starter.



– Remove bolts -arrows- on bracket for ATF lines.

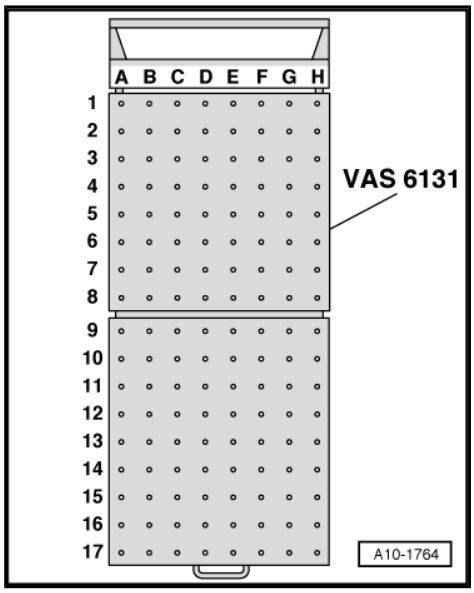


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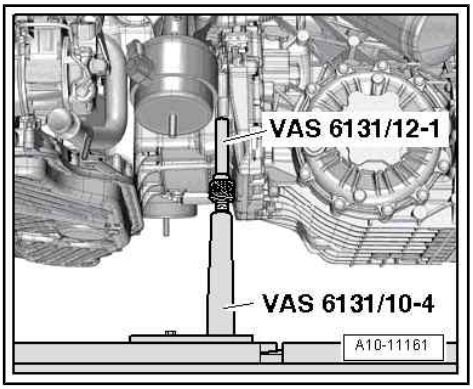
– Set up scissor-type assembly platform -VAS 6131 A- with support set for Audi -VAS 6131/10- and gearbox support -VAS 6131/14- as follows:

Platform coordinates	Parts of support set for Audi -VAS 6131/10- , support set -VAS 6131/11- and supplementary set -VAS 6131/12-			
B3 1)	/10-1	/10-4	/10-5	/10-11
F3 1)	/10-1	/10-4	/10-5	/10-11
B7	/10-1	/10-4	/10-5	/12-1
F7	/10-1	/10-4	/10-5	/11-2
G10	/10-1	/10-2	/10-5	/14
C11	/10-1	/10-2	/10-5	
G14 1)	/10-1	/10-4	/10-5	/10-12
D15 1)	/10-1	/10-4	/10-5	/11-2

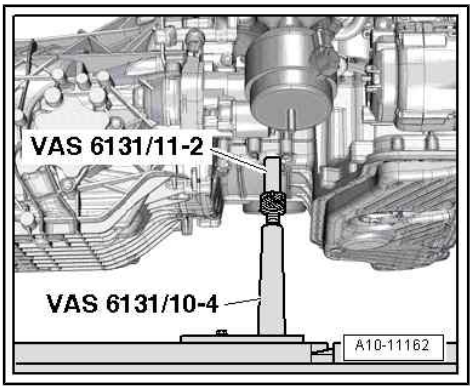
• 1) Support elements remain unchanged.



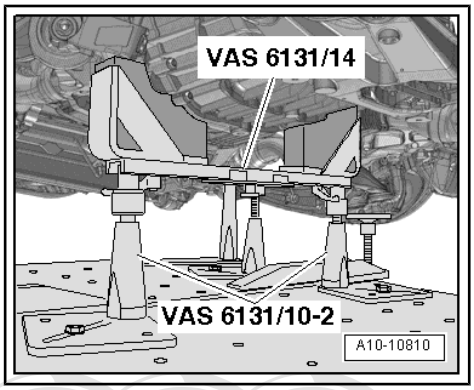
– Position the support elements from -VAS 6131/10- at left of engine, as shown in illustration.



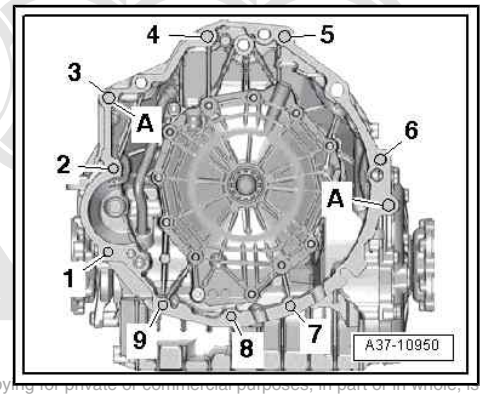
– Position the support elements from -VAS 6131/10- at right of engine, as shown in illustration.
– Turn spindles for support elements upwards until all locating lugs make contact with mounting points.



– Position support elements from -VAS 6131/10- and gearbox support -VAS 6131/14- at front of gearbox, as illustrated.
– Screw spindles on both sides upwards until gearbox support -VAS 6131/14- makes full contact with gearbox.
– Tighten base plates for support elements to 20 Nm on scissor-type assembly platform -VAS 6131 A- .

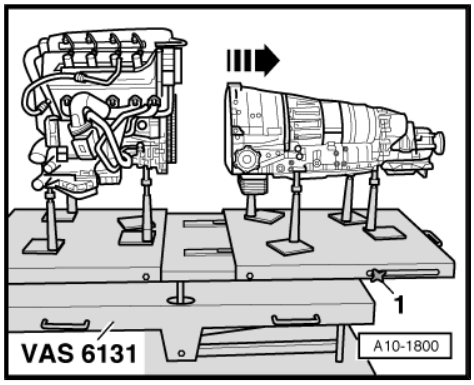


– Remove bolts -3 ... 9- securing gearbox to engine.



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– Loosen clamping bolts -1- on sides of scissor-type assembly platform -VAS 6131 A- and pull rear section of platform together with gearbox towards rear -arrow-.



2.3 Installing engine

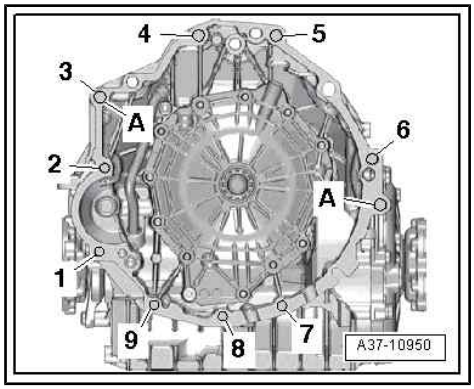
Note

- *Renew self-locking nuts and bolts when performing assembly work.*
- *Renew bolts which are tightened to a specified angle as well as seals and gaskets.*
- *Hose connections and hoses for charge air system must be free of oil and grease before assembly.*
- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*
- *To ensure that the charge air hoses can be properly secured at their connections, spray rust remover onto the worm thread of used hose clips before installing.*
- *Fit all cable ties in the original positions when installing.*
- *Reinstall heat insulation sleeves in the same locations when assembling.*

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– Install engine mounting with engine supports ⇒ page 98 .

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



– Bring gearbox into position on engine and tighten bolts -3 … 9-.

– Secure ATF lines ⇒ Rep. gr. 37 .

– Install starter ⇒ Rep. gr. 27 .

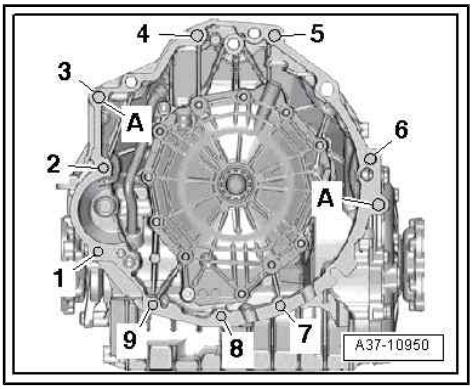
Note

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

Securing engine to gearbox

Item	Bolt	Nm
1 [1)]	M10x80	65
2 [1)]	M10x90	65
3, 4	M12x95	65
5	M12x110	65
6	M12x125	65
7, 8, 9	M10x70	45
A	Dowel sleeves for centralising	

• [1)] Also secures starter; property class 10.9

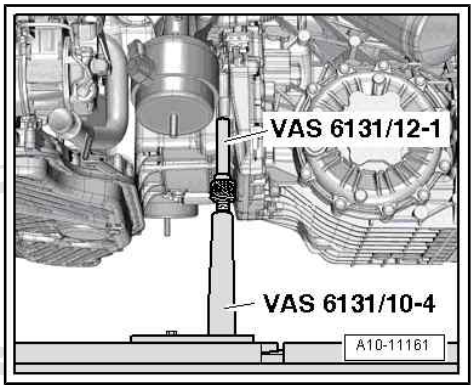


Installation is carried out in the reverse order; note the following:

– Install starter catalytic converter: vehicles without particulate filter ⇒ page 343 , vehicles with particulate filter ⇒ page 355 .

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

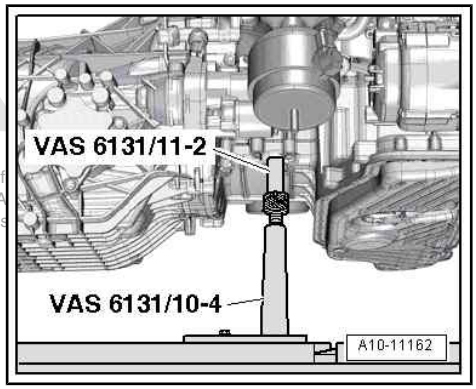
– Unscrew base plate for support element (left-side) from scissor-type assembly platform -VAS 6131 A- .



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

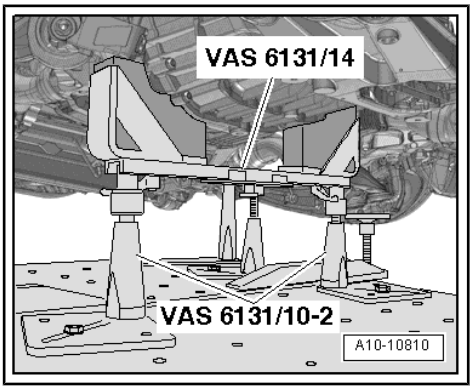
– Unscrew base plate for support element (right-side) from scissor-type assembly platform -VAS 6131 A- .

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– Screw down spindles of support elements on front of gearbox.

– Unscrew base plates for support elements from scissor-type assembly platform -VAS 6131 A- .



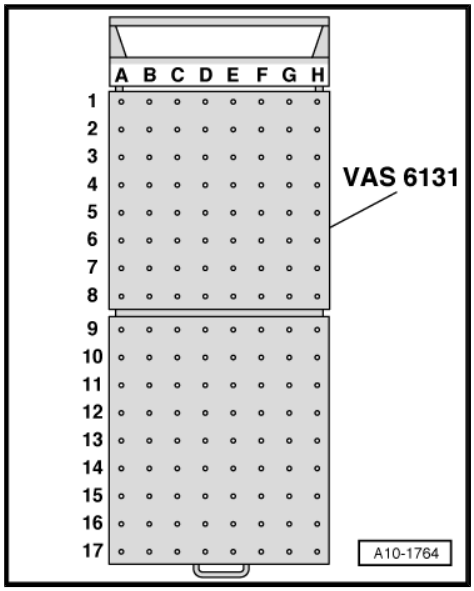
Note

The mounting points for engine (front), gearbox and tunnel cross member remain unchanged.

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

Platform coordinates	Parts from support set for Audi -VAS 6131/10-			
B3 1)	/10-1	/10-4	/10-5	/10-11
F3 1)	/10-1	/10-4	/10-5	/10-11
B10	/10-1	/10-2	/10-5	/10-8 2)
G10	/10-1	/10-2	/10-5	/10-8 2)
C14 1)	/10-1	/10-3	/10-5	/10-12
F14 1)	/10-1	/10-3	/10-5	/11-2

- 1) Support elements remain unchanged.
- 2) Secure support elements only after installing the subframe.



Note

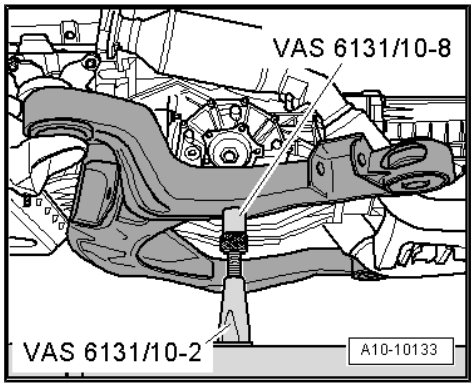
A second mechanic is required for positioning the subframe on the support elements.

– Fit subframe on both support elements -VAS 6131/10-8- .

– Screw up spindles of support elements on both sides.

– Tighten base plates for support elements to 20 Nm on scissor-type assembly platform -VAS 6131 A- .

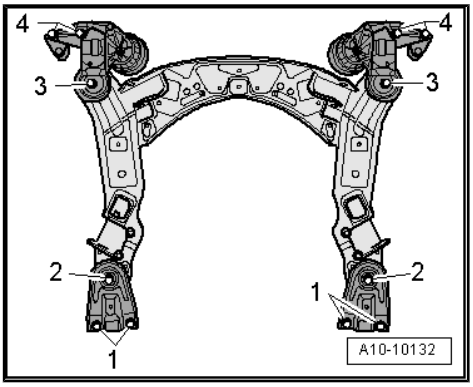
– Carefully guide engine/gearbox assembly together with subframe into the body from below using scissor-type assembly platform -VAS 6131 A- .



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– Adjust the subframe and consoles for engine mountings according to the markings made on the longitudinal members during removal.
– Only tighten bolts for subframe and consoles for engine mountings to the specified torque (do not turn further); tighten bolts only after performing wheel alignment check.

1 - 55 Nm
2 - 115 Nm
3 - 115 Nm
4 - 75 Nm



WARNING

The vehicle must not be driven at this stage.

– Fit tunnel cross piece ⇒ Rep. gr. 40 .
– Install selector lever cable and check adjustment if necessary ⇒ Rep. gr. 37 .
– Install front exhaust pipe with catalytic converter ⇒ page 349 or install particulate filter with catalytic converter ⇒ page 361 .
– Align exhaust system so it is free of stress ⇒ page 366 .
– Install cross piece (front) ⇒ Rep. gr. 50 .
– Install drive shafts ⇒ Rep. gr. 40 .
– Install guide links, track control links, anti-roll bar and suspension struts ⇒ Rep. gr. 40 .
– Secure hydraulic pressure line at power steering pump ⇒ Rep. gr. 48 .
– Install refrigerant lines ⇒ Rep. gr. 87 .
– Install torque reaction support ⇒ page 107 .
– Electrical connections and routing ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.
– Observe notes on procedures required after connecting battery ⇒ Rep. gr. 27 .

Caution

Do not use a battery charger to boost starting. There is danger of damaging the vehicle's control units.

– Install and adjust wiper arms ⇒ Rep. gr. 92 .
– Install body brace ⇒ Rep. gr. 40 .
– Check oil level ⇒ Maintenance ; Booklet 405 .
– Fill cooling system ⇒ page 259 .

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Note

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

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

– Top up power steering fluid and bleed steering system ⇒ Rep. gr. 48 .

– Check ATF level ⇒ Rep. gr. 37 .

– Adjust subframe and the two consoles for engine mountings ⇒ Rep. gr. 40 .

– Perform wheel alignment check ⇒ Rep. gr. 44 .

WARNING

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

– Check fuel system for leaks ⇒ page 6 .

Tightening torques

Note

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

Component		Nm
Bolts/nuts	M6	9
	M8	20
	M10	40
	M12	65
Except for the following:		
Terminal B+ to starter		16
Drive shaft heat shield to gearbox		23
Intake connecting pipe to:	Intake manifold	9
	Connecting pipe for exhaust gas recirculation	9
Hose clips (9 mm wide)		3
Hose clips (13 mm wide)		5.5

• 1) Renew bolt(s).

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3 Removing and installing engine - vehicles with automatic gearbox

Note

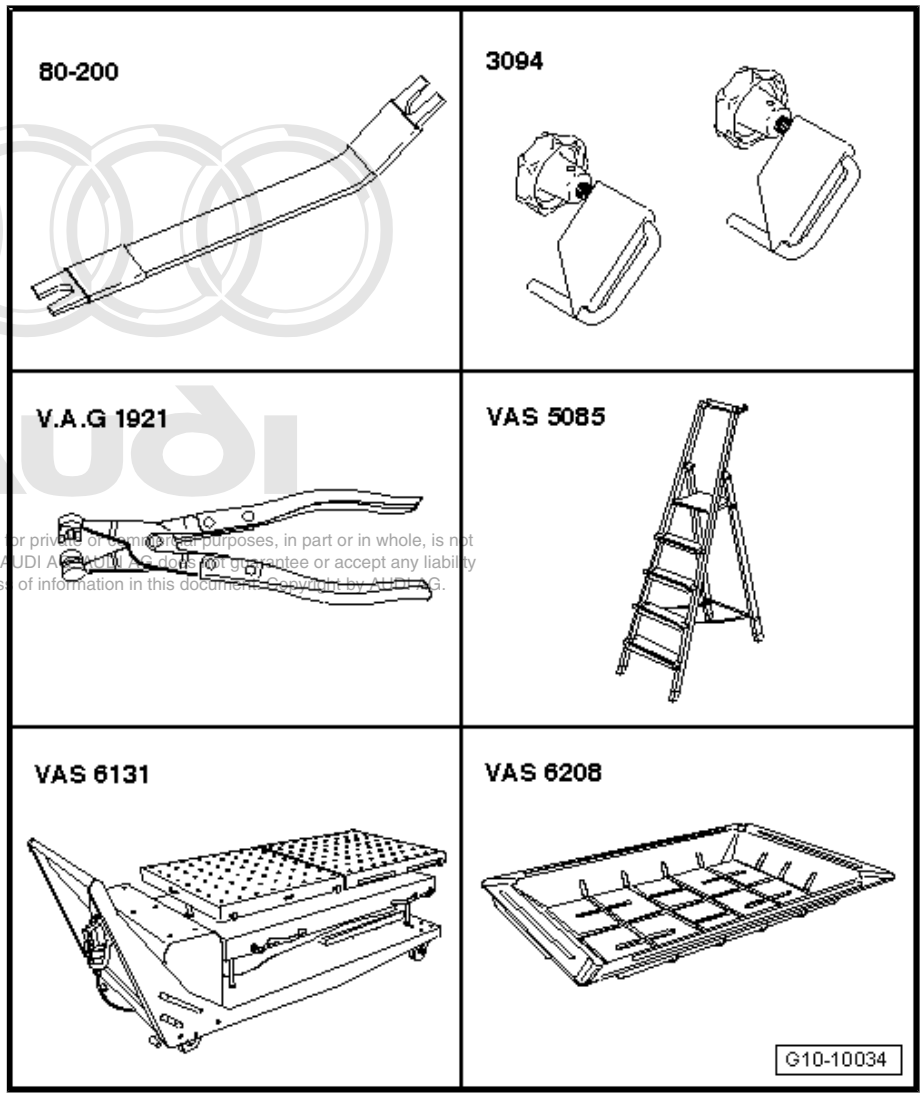
- *The engine is removed from underneath together with the gearbox and subframe (with lock carrier installed).*
- *All cable ties which are released or cut open when removing must be fitted in the same position when installing.*
- *Collect drained coolant in a clean container for re-use or disposal.*

3.1 Removing engine

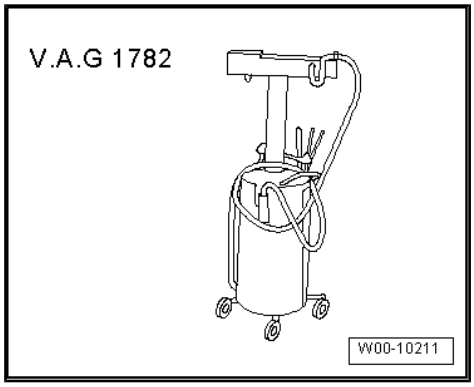
Special tools and workshop equipment required

- Removal lever -80 - 200-
- Hose clamps for hoses up to 25 mm -3094-
- Hose clip pliers -VAS 6362- instead of -V.A.G 1921- shown in illustration
- Stepladder -VAS 5085-
- Scissor-type assembly platform -VAS 6131 A- with support set for Audi -VAS 6131/10-
- Drip tray for workshop hoist -VAS 6208-

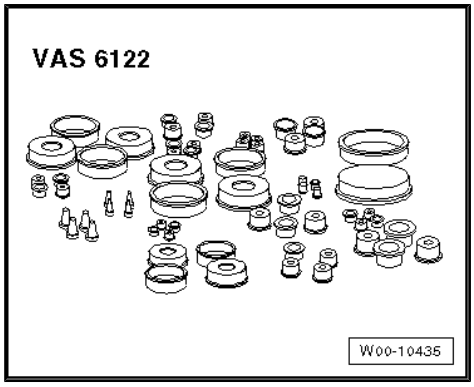
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- Used oil collection and extraction unit -V.A.G 1782-

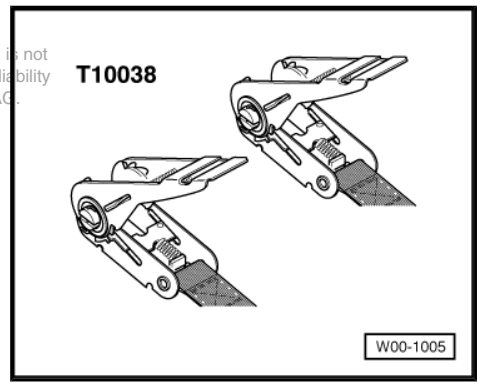


- Engine bung set -VAS 6122-

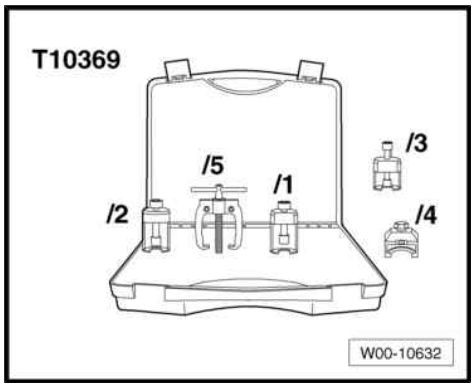


- Tensioning strap -T10038-

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- Puller -T10369-



Procedure

WARNING

Before removing the engine secure the vehicle against tipping over. To do so, the luggage compartment must be empty.

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

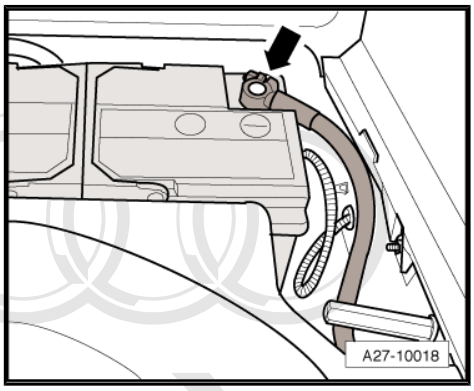
Caution

Observe notes on procedure for disconnecting the battery.

Note

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

– With ignition switched off, disconnect battery earth cable -arrow- ⇒ Rep. gr. 27 .

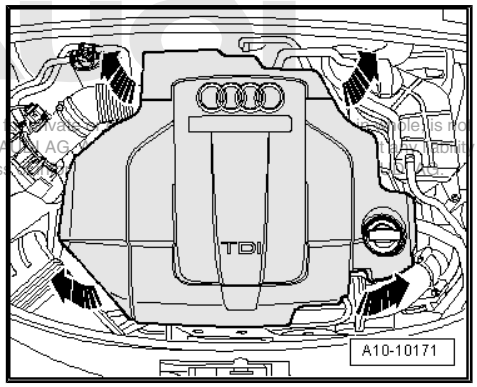


– Carefully pull engine cover panel off four retaining pins one after the other -arrows-.

WARNING

Hot steam or hot coolant can escape when expansion tank is opened; cover filler cap with cloth and open carefully.

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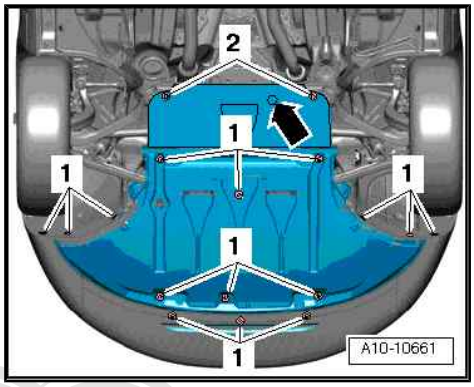
– Open filler cap on coolant expansion tank.

– Remove both front wheels.

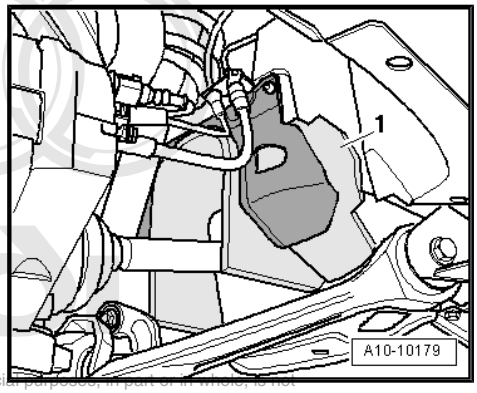
Note

Secure brake discs with wheel bolts.

– Release fasteners marked -1, 2- and -arrow- (if fitted) and remove front and rear noise insulation.



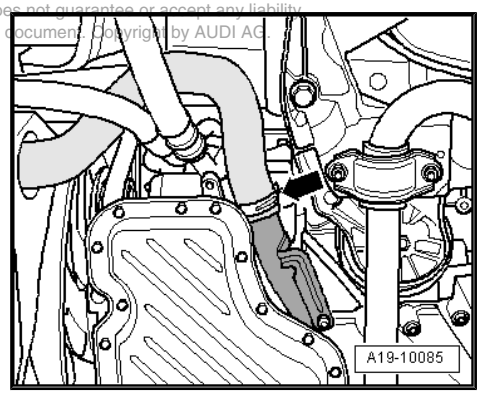
– Remove noise insulation -1- in wheel housing (left and right).



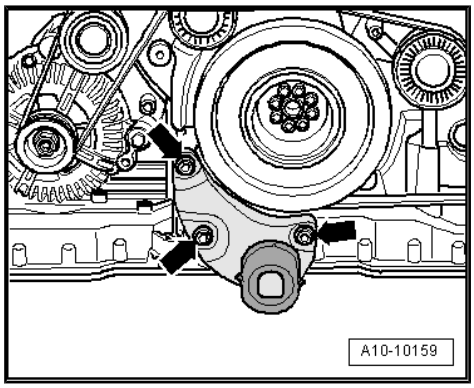
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– Place drip tray for workshop hoist -VAS 6208- under engine.

– Disconnect coolant hose -arrow- from coolant pipe (left-side) and drain off coolant.



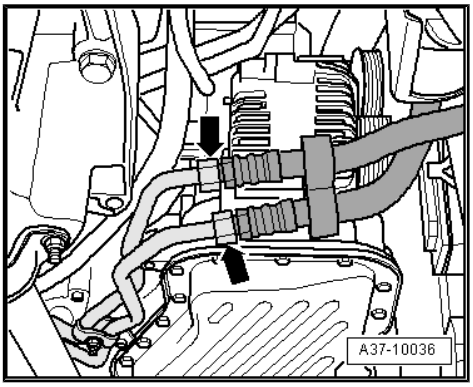
– Unscrew bolts -arrows- and remove torque reaction support from engine.



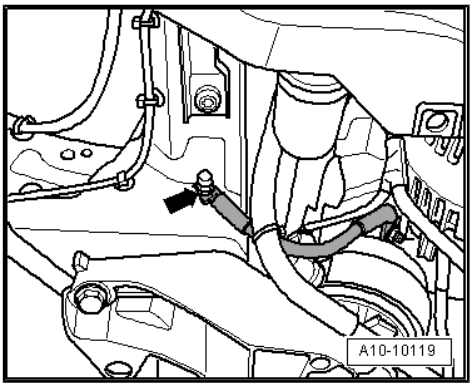
Note

Observe rules for cleanliness when working on automatic gearbox ⇒ Rep. gr. 00 .

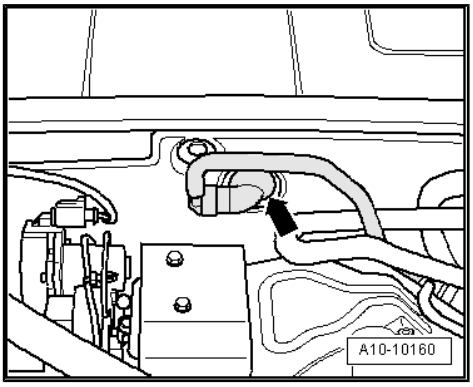
– Place used oil collection and extraction unit -V.A.G 1782- under engine.
– Disconnect ATF lines -arrows- at connections on right side of engine.
– Seal off open pipes/lines and connections with clean plugs from engine bung set -VAS 6122- .



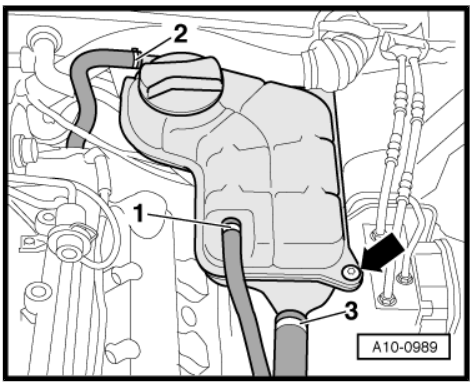
– Unbolt earth cable -arrow- at longitudinal member (right-side).



– Detach vacuum hose -arrow- going to brake servo at plenum chamber partition panel.

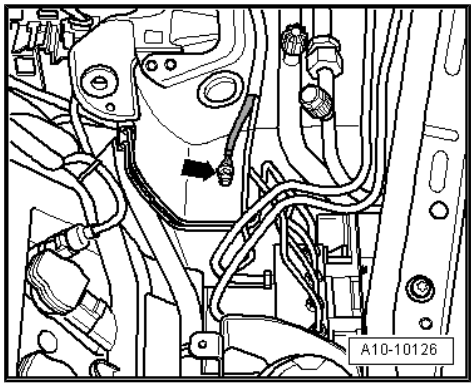


– Detach coolant hose -2- at expansion tank.
– Unbolt coolant expansion tank -arrow-.
– Detach electrical connector at coolant shortage indicator switch -F66- on coolant expansion tank (bottom).
– Lay aside coolant expansion tank with coolant hoses -1- and -3- connected.

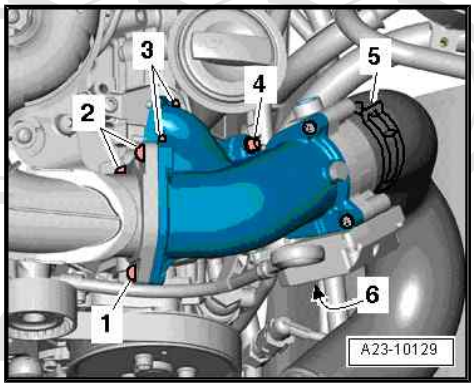


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– Unbolt earth cable -arrow- at suspension turret (left-side).



– Disconnect air intake hose -5- from throttle valve module - J338- .
– Unplug electrical connector -6- at throttle valve module - J338- .
– Remove bolts -1 ... 4-.

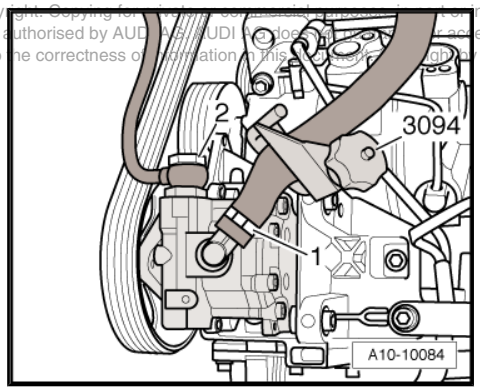


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Note

Lay a cloth under the hydraulic lines to catch any escaping hydraulic fluid.

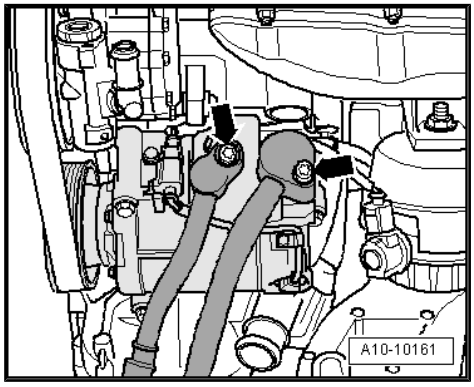
– Disconnect hydraulic pressure line -2- from power steering pump and lay aside on top of longitudinal member.
– Clamp off hydraulic hose for power steering pump using a hose clamp -3094- .
– Disconnect hydraulic hose -1- from power steering pump.
– Seal off open pipes/lines and connections with clean plugs from engine bung set -VAS 6122- .



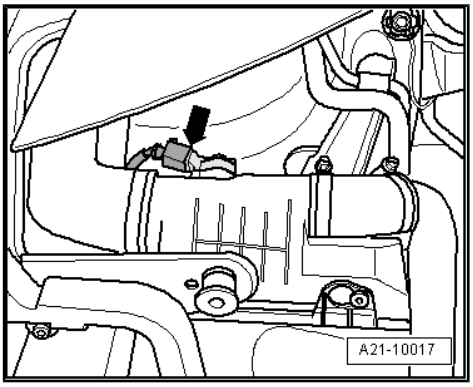
Note

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

– Detach refrigerant lines -arrows- from air conditioner compressor.
– Seal off open pipes/lines and connections with clean plugs from engine bung set -VAS 6122- .



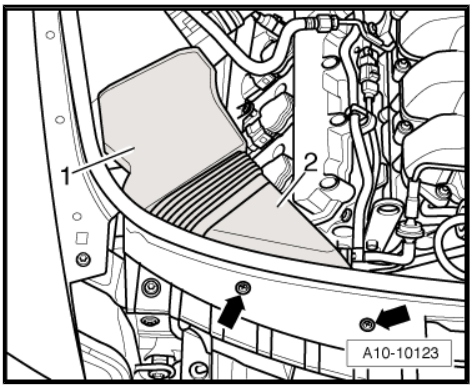
– Unplug electrical connector -arrow- for charge pressure sender -G31- at charge air cooler (left-side).



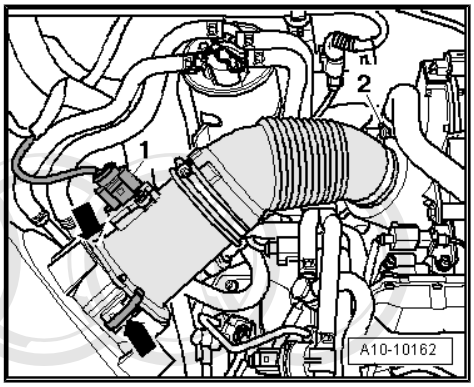
Note

Shown in illustration with headlight removed.

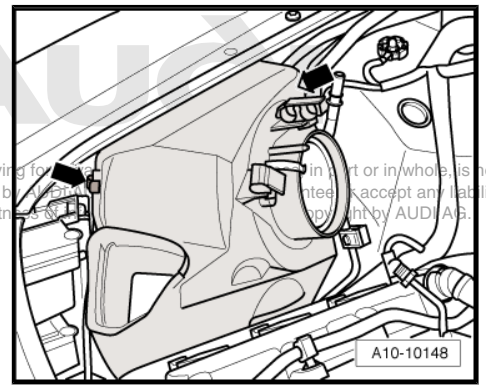
– Remove bolts -arrows-.
– Remove air ducts -1- and -2-.



– Unplug electrical connector -1- at air mass meter -G70- .
– Remove air intake hose. To do so, release hose clip -2- and clamps -arrows-.

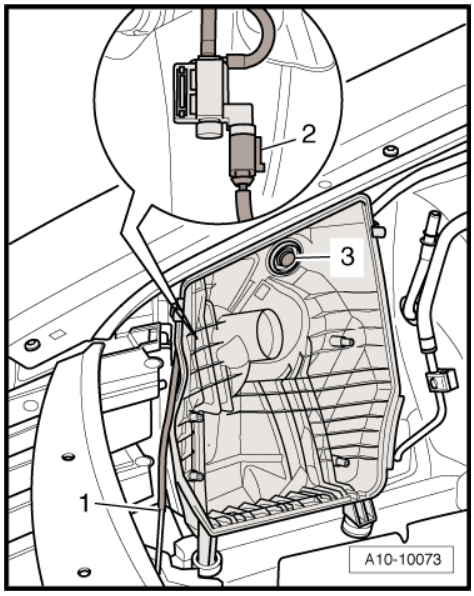


– Release clamps -arrows- and detach air cleaner (top section).

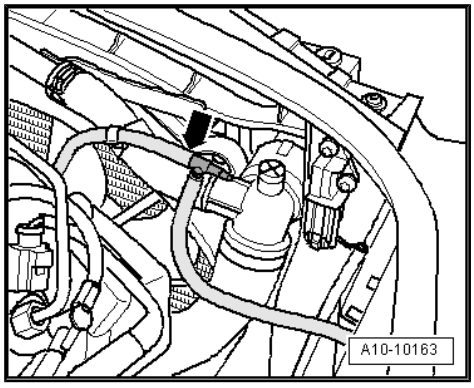


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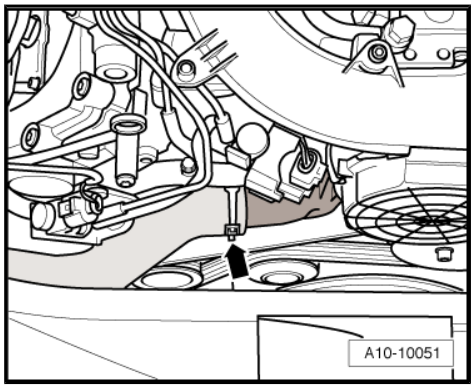
– Disconnect vacuum pipe -1-.
– Pull out pin of fastener -3-.
– Remove air cleaner (bottom section) and unplug electrical connector -2- on reverse side at air filter bypass flap valve - N275- .



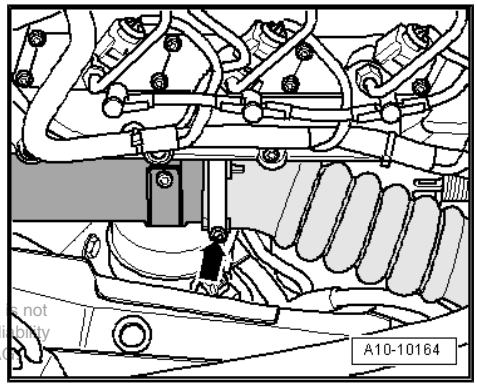
– Disconnect vacuum hose from T-piece -arrow-.



– Disconnect coolant hose -arrow- from hose connection on thermostat.

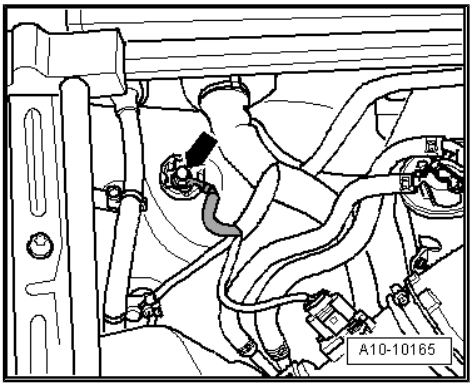


– Disconnect air intake hose -arrow- from air pipe.

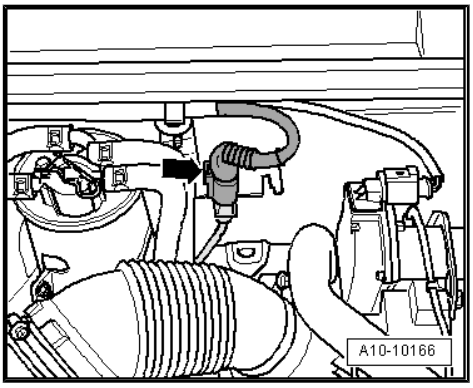


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– Disconnect earth cable -arrow- at suspension turret (right-side).

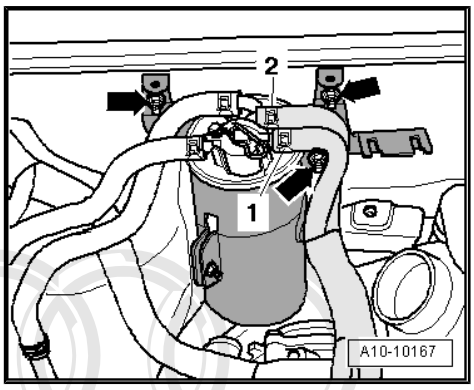


– If fitted, detach electrical connector for engine speed sender -G28- from bracket on plenum chamber partition panel.



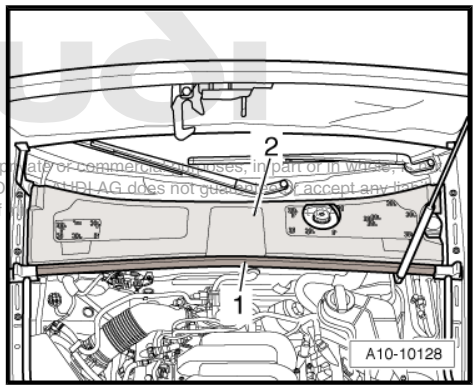
Caution

Rules for cleanliness when working on the injection system *⇒ page 6* *.*



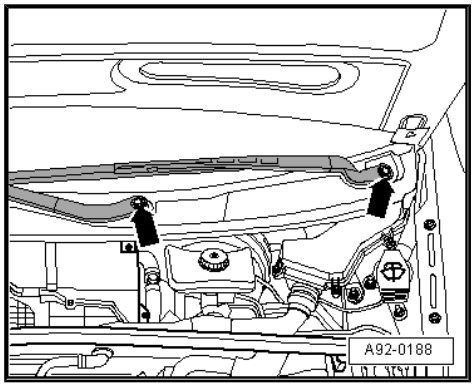
– Disconnect fuel return hose -1- and fuel supply hose -2- from fuel filter.
– Seal off open pipes/lines and connections with clean plugs from engine bung set -VAS 6122- .
– Remove bracket with fuel filter from plenum chamber partition panel -arrows-.
– Place fuel filter with bracket to one side.

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

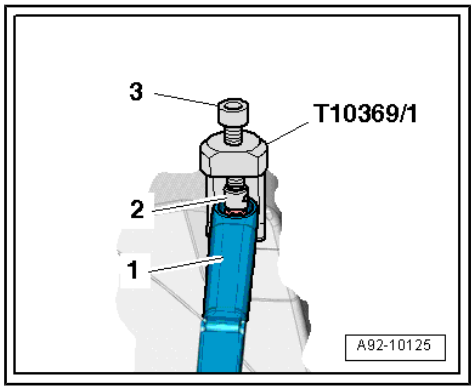


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– Lever off caps on windscreen wiper arms with a screwdriver.
– Loosen hexagon nuts -arrows- several turns.



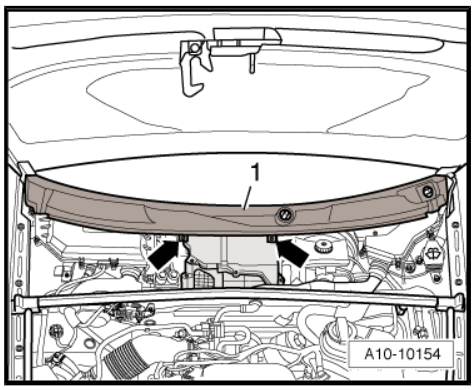
– Apply puller -T10369/1- to wiper arm -1-, as shown in illustration.
– Apply thrust piece -2- onto wiper shaft.
– Turn bolt -3- in clockwise direction until wiper arm is pulled off wiper shaft.
– Remove nuts and detach windscreen wiper arms.



– Unscrew bolts -arrows- for cowl panel trim -1-.

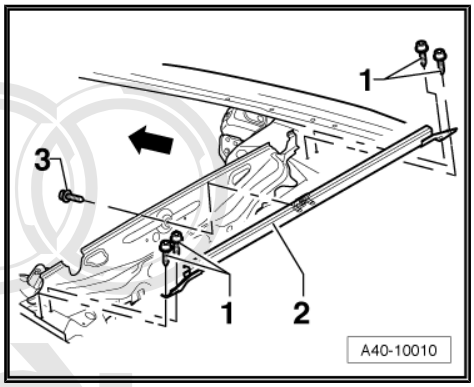
Caution

To avoid cracking the cowl panel trim -1- during removal, apply a small amount of soap solution to the joint between the windscreen and the cowl panel trim and pull the trim vertically up out of the windscreen surround, starting from the edge of the windscreen.



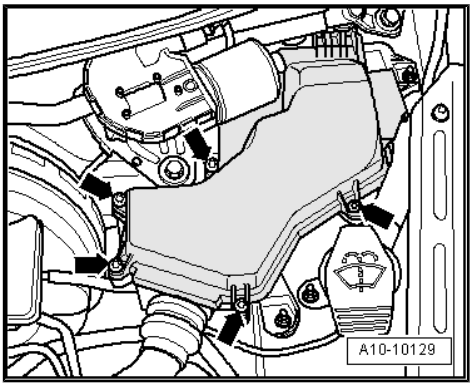
– Pull cowl panel trim off windscreen.

– If fitted, unscrew bolts -1- and -3- and remove body brace -2-.

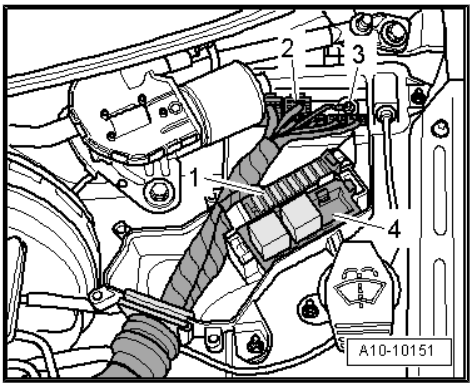


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– Unscrew bolts -arrows- and take off cover for electronics box in engine compartment (left-side).



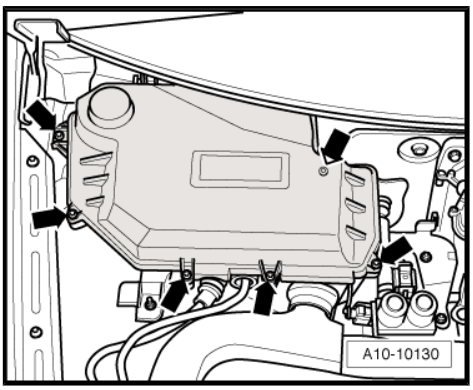
– Release retainers and lift off fuse holder -1-; then lift off 3-position relay carrier -4-.
– Unscrew electrical wiring -3-.
– Unplug all connectors -2- at rear of connector console.
– Disengage engine wiring harness at electronics box and move it clear.



– Unscrew bolts -arrows- and take off cover for electronics box in engine compartment (right-side).

WARNING

The pump valve unit for heating system (left in front of electronics box) gets very hot – risk of burns!



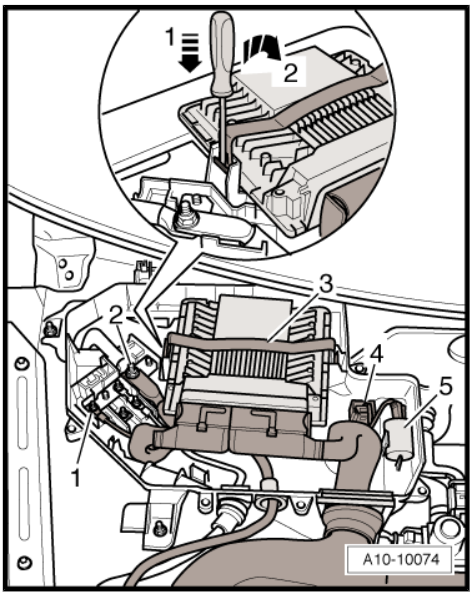
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– Carefully lever out the retaining strap -3- using a screwdriver -arrows 1 and 2- and remove the engine control unit from the electronics box.

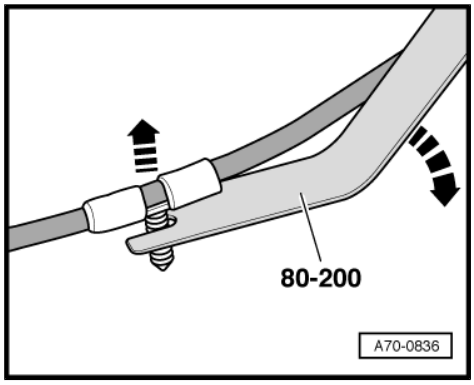
Note

The engine control unit remains connected to the wiring harness.

– Unclip suppressor capacitor -5- and take out of retainer in electronics box.
– Unplug electrical connector -4- at rear of connector console.
– Unscrew electrical wiring connections -1- and -2-.

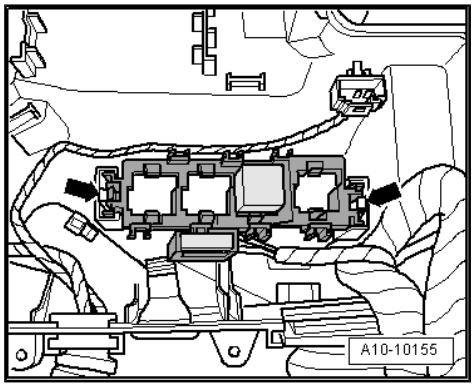


– Release electrical wiring up to the alternator using removal lever -80 - 200- .

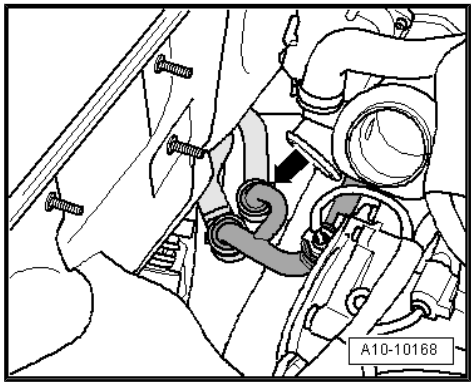


– Release retainers -arrows- and pull relay carrier off electronics box in engine compartment (right-side).

– Place both wiring harnesses on top of engine and secure the engine control unit to prevent it falling.



– Disconnect coolant hose -arrow- leading to heat exchanger for heater at rear of engine.

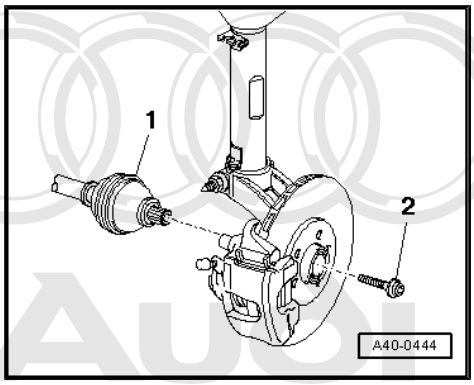


– Have a 2nd mechanic press the brake pedal.

Caution

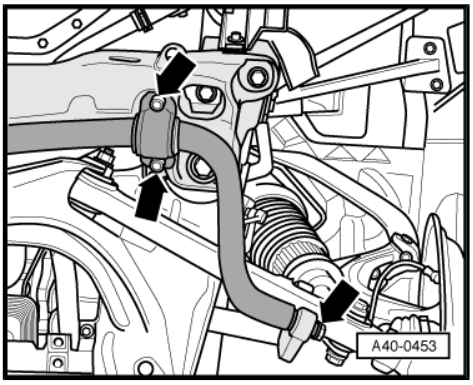
When slackening the flange bolt securing the drive shaft, the wheel bearing must not be under load (vehicle must not be standing on its wheels).

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

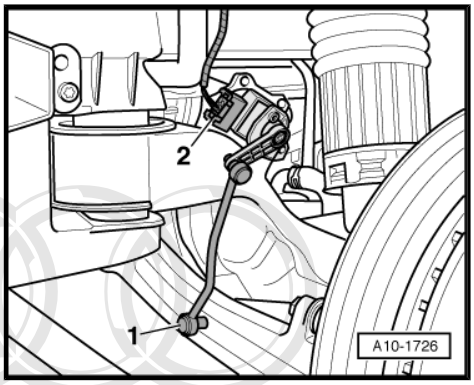


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– Unscrew bolts (left and right) -arrows- evenly.
– Take out anti-roll bar.



– Unplug electrical connector -2- at vehicle level sender.
– Detach coupling rod -1- at track control link.

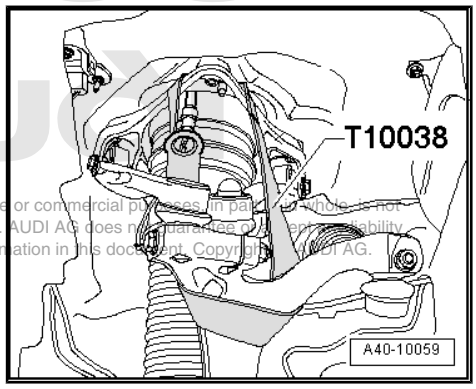


Caution

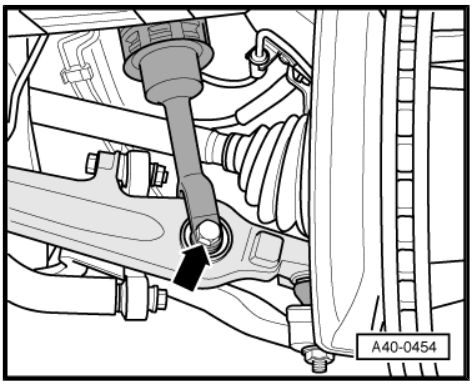
The weight of the wheel bearing housings must be supported in order to prevent damage to the joints of the upper links.

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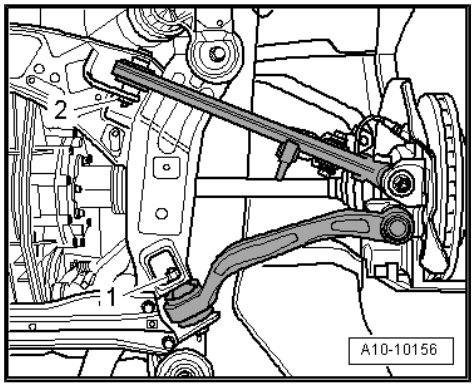
– Tie up wheel bearing housing using tensioning strap -T10038- as illustrated.



– Unbolt suspension strut from track control link -arrow-.



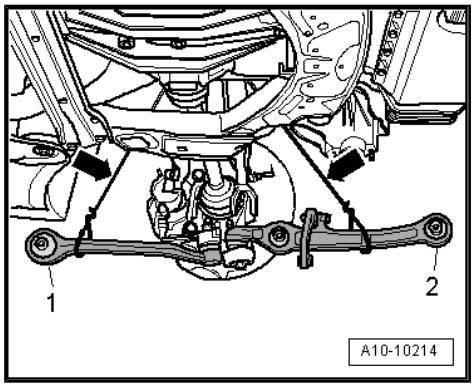
– Unbolt guide link -1- and track control link -2- at subframe.



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

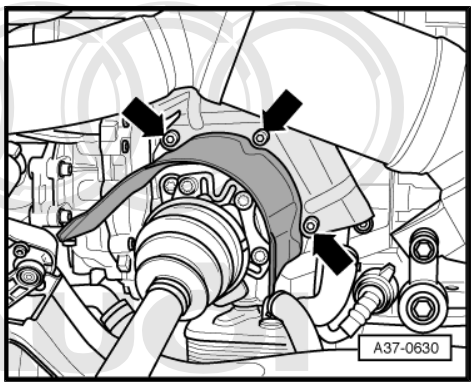
Caution

The guide link and track control link must not be allowed to hang down without support. Tie up both the guide link and track control link to wheel bearing housing as illustrated -arrow-.



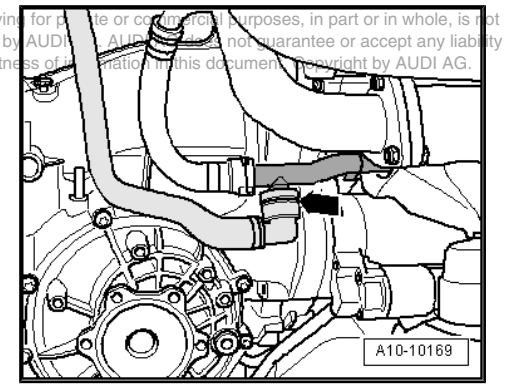
– Repeat procedure on other side of vehicle.

– Unbolt heat shield for drive shaft (left-side) -arrows-.
– Unbolt drive shaft from flange shaft on gearbox.
– Pivot wheel bearing housing outwards and remove drive shaft.
– Repeat procedure on other side of vehicle.

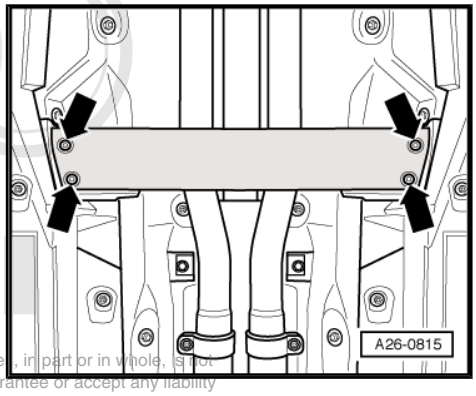


– Place drip tray for workshop hoist -VAS 6208- under engine.
– Lift retaining clip and detach coolant hose -arrow- from coolant pipe (right-side).

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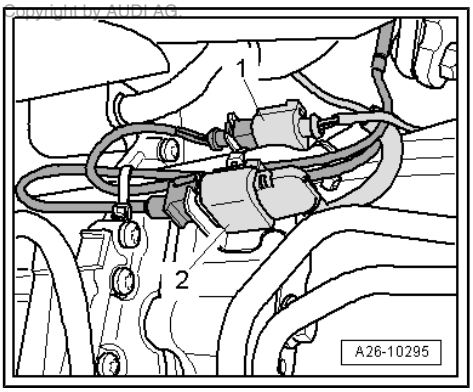
– Remove front cross piece -arrows-.



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Vehicles with particulate filter:

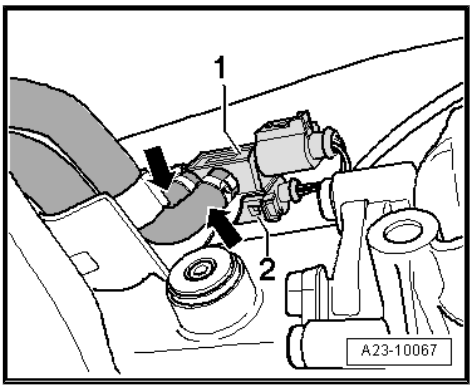
– Unplug electrical connector -1- for exhaust gas temperature sender 2 -G448- at front of gearbox (left-side) and move electrical wiring clear.



Note

Disregard -item 2-.

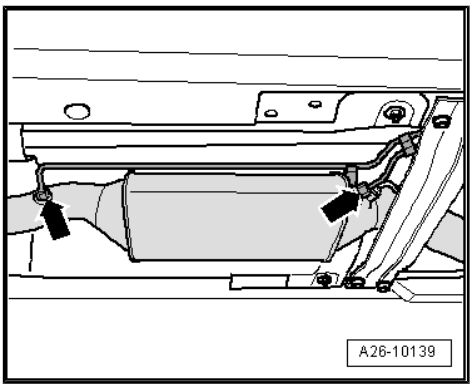
– Unplug electrical connector for temperature sender before particulate filter -G506- -item 2- and move wiring clear.



Note

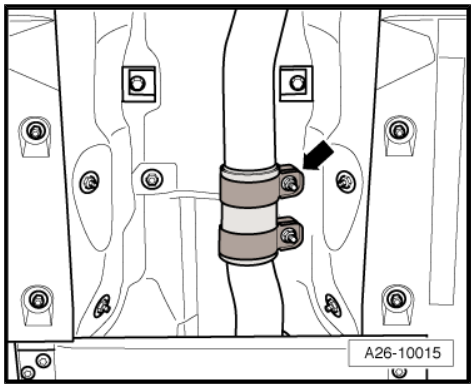
Ignore items marked -1- and -arrows-.

– Unscrew pressure pipes -arrows- from particulate filter.



All vehicles:

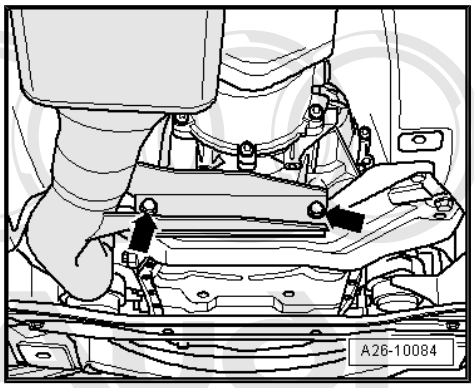
– Disconnect exhaust system at clamp -arrow-.



Note

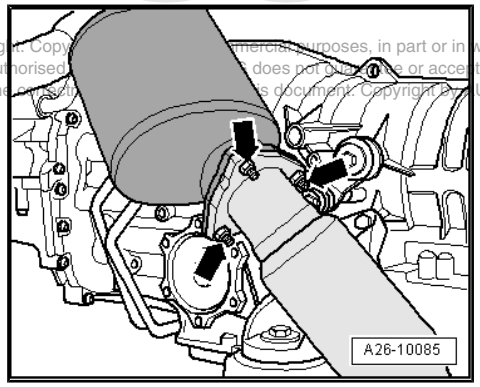
To avoid any damage, the flexible joint in the front exhaust pipe must not be bent more than 10°.

– Remove bolts -arrows- at centre bracket for front exhaust pipe.



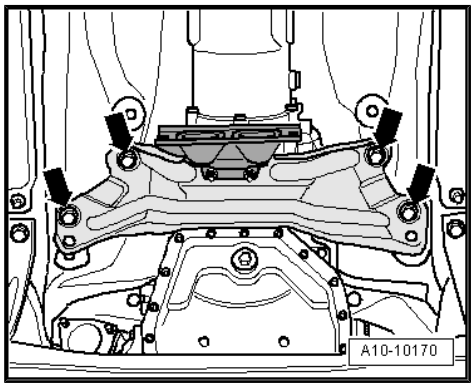
– Remove nuts -arrows- and take out front exhaust pipe with catalytic converter/particulate filter.

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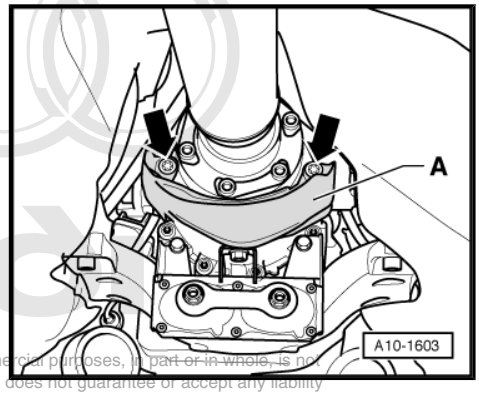


– Remove bolts -arrows- at tunnel cross member.

– Detach tunnel cross member with centre bracket for front exhaust pipe.



– Unscrew heat shield -A- for propshaft -arrows-.
– Unscrew bolts at gearbox/propshaft flange.
– Push propshaft back towards rear final drive. The constant velocity joints can be moved axially.
– Tie up propshaft to body.

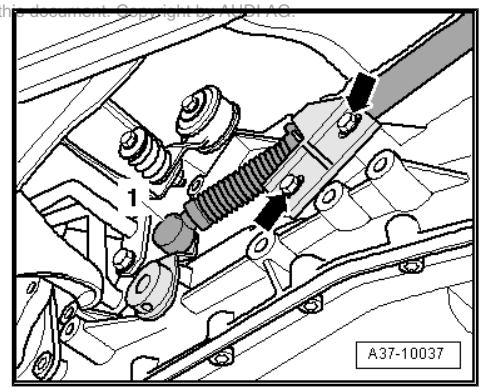


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Note

Mark installation position of support bracket for selector lever cable with a felt-tip pen.

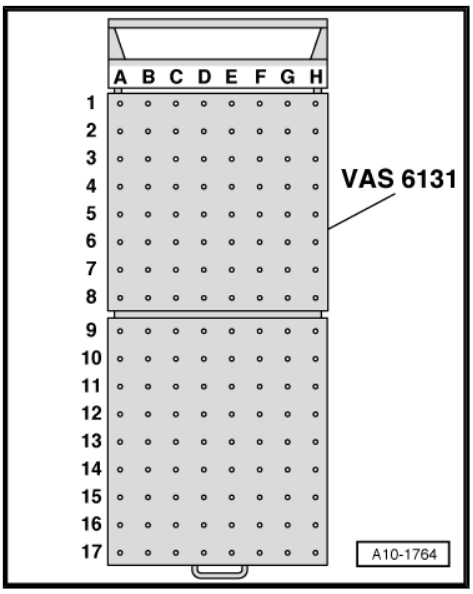
– Push ball socket -1- of selector lever cable off gearbox selector lever.
– Unbolt cable support bracket from gearbox -arrows-.
– Move selector lever cable clear.



Set up the scissor-type assembly platform as follows:

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

Platform coordinates	Parts from support set for Audi -VAS 6131/10-			
B3	/10-1	/10-4	/10-5	/10-11
F3	/10-1	/10-4	/10-5	/10-11
B10	/10-1	/10-2	/10-5	/10-8
G10	/10-1	/10-2	/10-5	/10-8
G14	/10-1	/10-4	/10-5	/10-12
D15	/10-1	/10-4	/10-5	/10-13

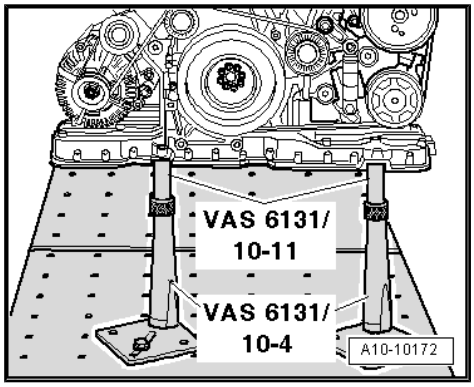


– Initially tighten the support elements on the assembly platform only hand-tight.
– Adjust the scissor-type assembly platform -VAS 6131 A- so that it is horizontal.

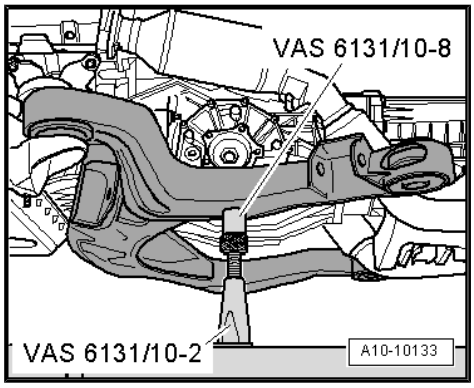
• Take note of spirit level (bubble gauge).

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

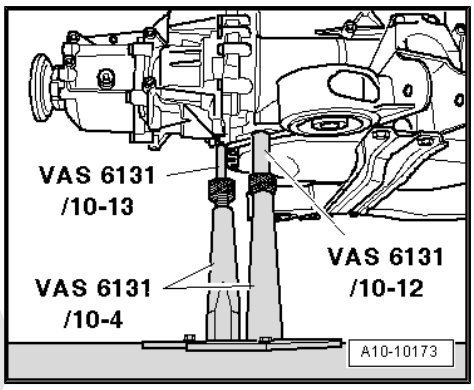
– Position support elements from -VAS 6131/10- at front of engine, as shown in illustration.
– Make sure that threaded spindles are screwed in completely.



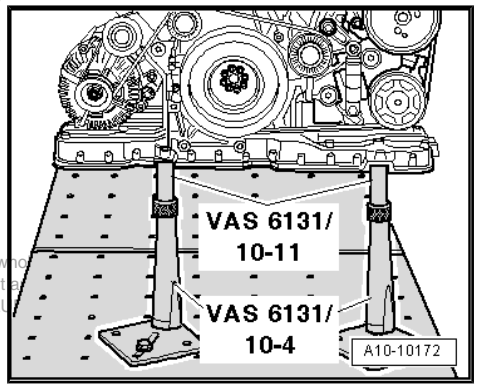
– Position support elements from -VAS 6131/10- at left and right of subframe, as shown in the illustration.



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

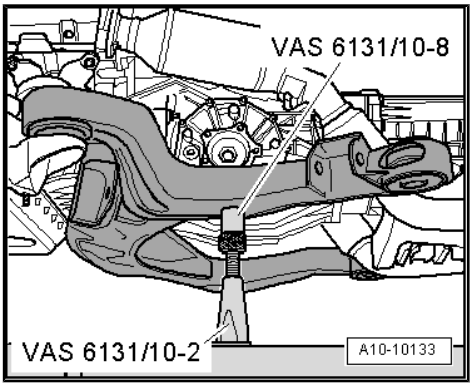


– Screw two front spindles (at engine) 8 turns upwards.

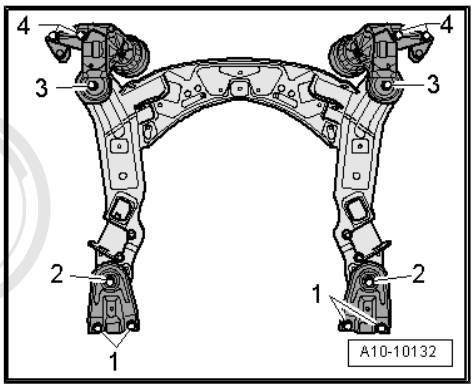


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– Screw two rear spindles (at subframe) 4 turns upwards.



– Remove bolts -1-.
– Mark the installation position of the subframe and the two consoles for engine mountings on the longitudinal members with a felt-tip pen.
– Unscrew bolts -2-, -3- and -4- in a diagonal sequence and in stages.



Note

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

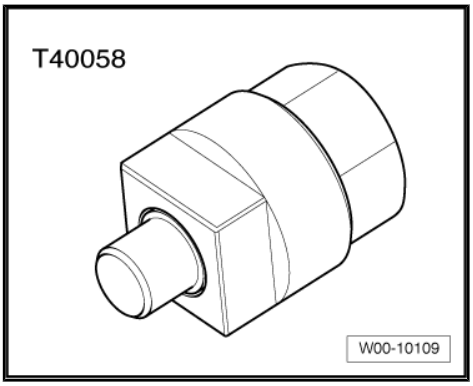
– Lower engine/gearbox assembly gradually.
– Pull out scissor-type assembly platform -VAS 6131 A- from under the vehicle.

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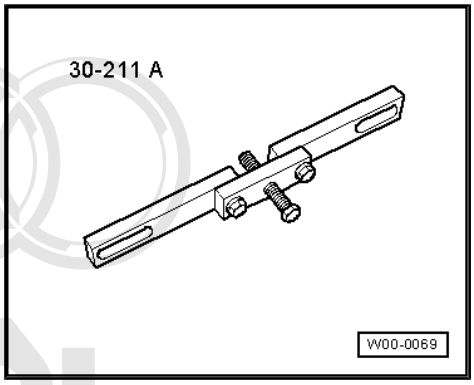
3.2 Separating engine and automatic gearbox

Special tools and workshop equipment required

- Support set for Audi -VAS 6131/10- , supplementary set -VAS 6131/11- and -VAS 6131/12-
- Adapter -T40058-



♦ Support bridge -30 - 211 A-

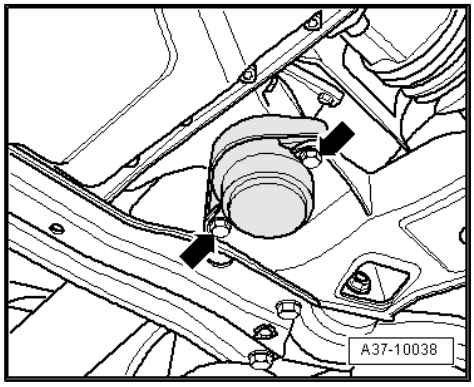


Procedure

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

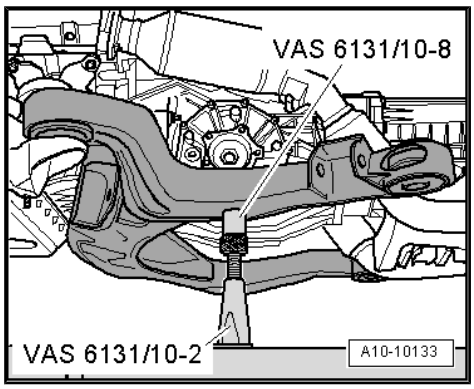
– Remove bolts -arrows- for gearbox mountings (left and right).



– Screw down spindles of support elements from -VAS 6131/10- (left and right) at subframe as far as possible.

– Remove locating lugs from spindles.

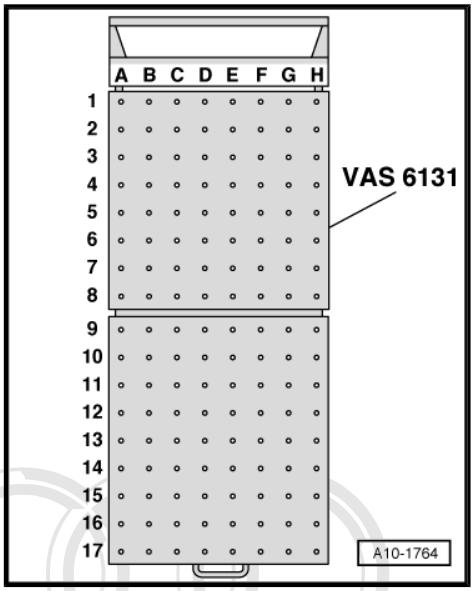
– Remove subframe to the side.



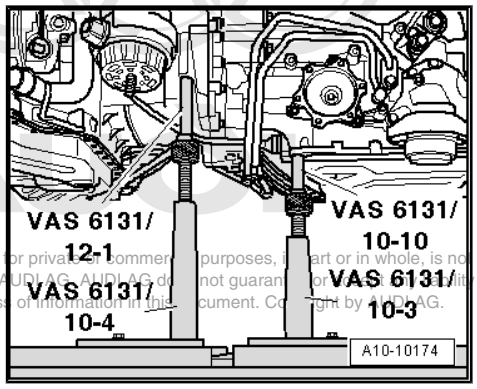
– Set up scissor-type assembly platform -VAS 6131 A- with support set for Audi -VAS 6131/10- , support set -VAS 6131/11- and supplementary set -VAS 6131/12- as follows:

Platform coordinates	Parts of support set for Audi -VAS 6131/10- , support set -VAS 6131/11- and supplementary set -VAS 6131/12-			
B3 1)	/10-1	/10-4	/10-5	/10-11
F3 1)	/10-1	/10-4	/10-5	/10-11
B7	/10-1	/10-4	/10-5	/12-1
F7	/10-1	/10-4	/10-5	/11-2
B10	/10-1	/10-3	/10-5	/10-10
G10	/10-1	/10-3	/10-5	/11-3
G14 1)	/10-1	/10-4	/10-5	/10-12
D15 1)	/10-1	/10-4	/10-5	/10-13

• 1) Support elements remain unchanged.

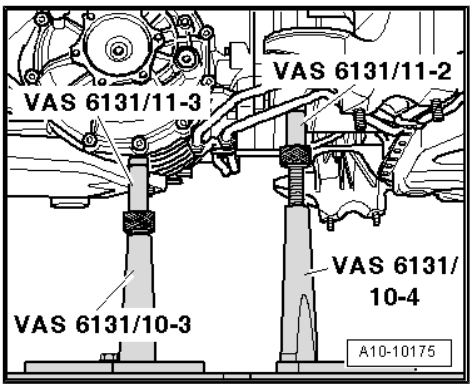


– Position support elements from -VAS 6131/10- and -VAS 6131/12- on left side of engine/gearbox assembly, as shown in illustration.

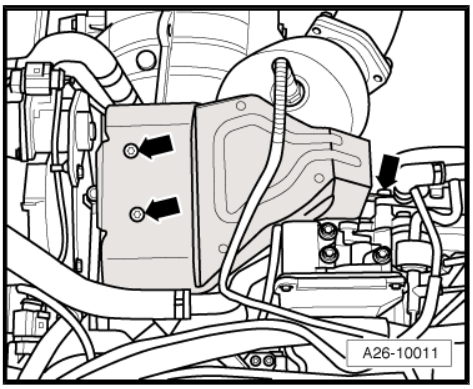


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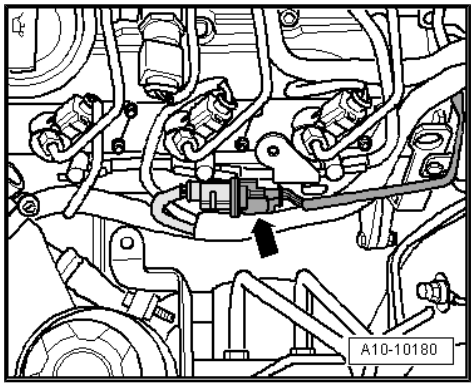
– Place support elements from -VAS 6131/10- and -VAS 6131/11- at right of engine/gearbox assembly, as shown in illustration.
– Turn spindles for the support elements upwards until all locating lugs make contact with the mounting points.
– Tighten base plates for support elements to 20 Nm on scissor-type assembly platform -VAS 6131 A- .



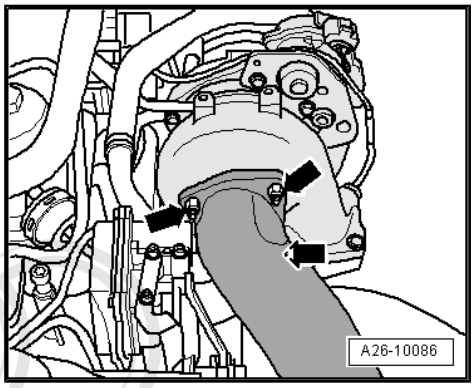
– Remove heat shield for turbocharger -arrows-.



– If fitted: unplug electrical connector -arrow- for Lambda probe -G39- and move wiring clear.



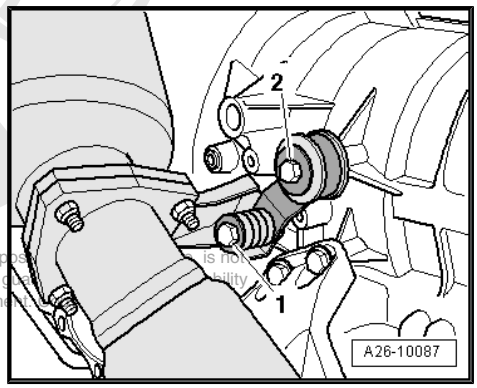
– Unscrew nuts -arrows- at starter catalytic converter/turbo-charger.



– Remove bolt -1- on bracket for starter catalytic converter.
– Detach starter catalytic converter.

Note

Disregard -item 2-.

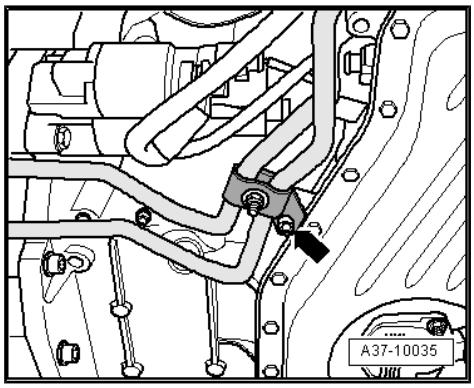


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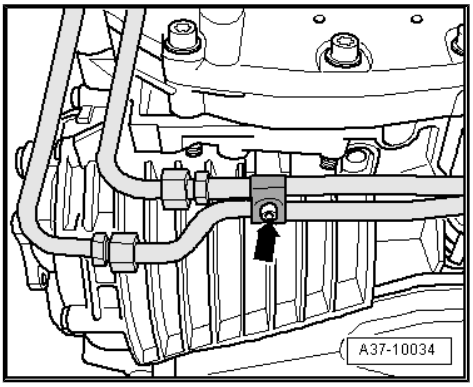
Note

Observe rules for cleanliness when working on automatic gearbox ⇒ Rep. gr. 00 .

– Unbolt bracket -arrow- for ATF lines at sump (top section).



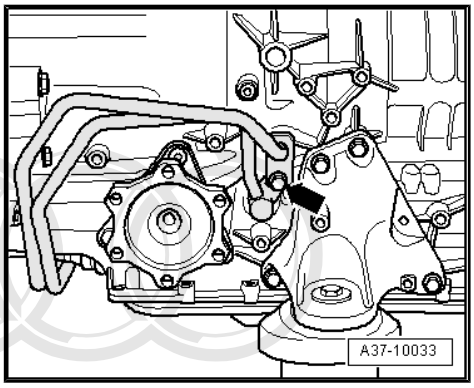
– Unbolt bracket -arrow- for ATF lines at gearbox (bottom).



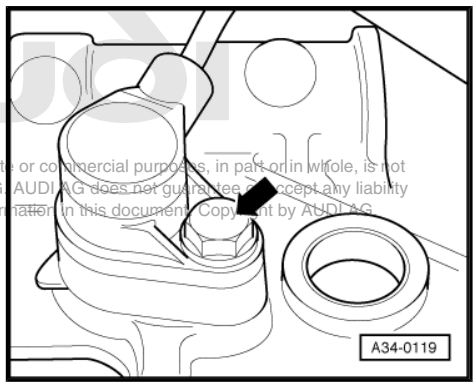
Note

Lay a cloth under the ATF lines to catch escaping ATF fluid.

– Remove bolt -arrow-.
– Detach ATF lines from gearbox.
– Seal off open pipes/lines and connections with clean plugs from engine bung set -VAS 6122- .



– Unbolt engine speed sender -G28- from gearbox -arrow-.

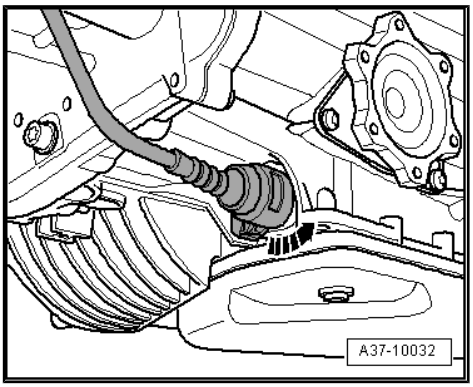


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Caution

Risk of irreparable damage to gearbox control unit (mechatronic unit) because of static discharge. Do NOT touch connector contacts in gearbox connector with your hands.

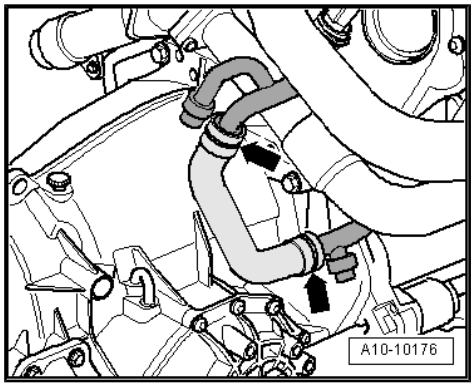
– Turn retainer catch anti-clockwise -arrow- and unplug electrical connector at gearbox.



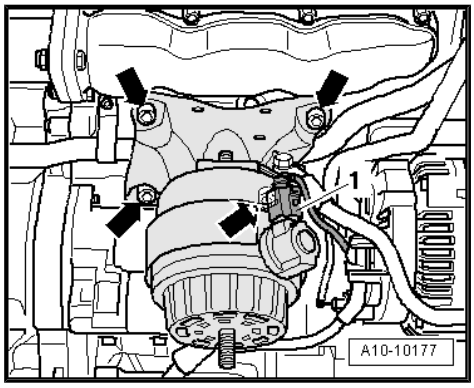
Note

Lay a cloth under the connection to catch escaping coolant.

– Detach coolant hose at the connections indicated -arrows-.



– Unplug electrical connector -1- at engine mounting (right-side).
– Move wiring clear at console for engine mounting.
– Remove bolts -arrows- and detach engine support (right-side).

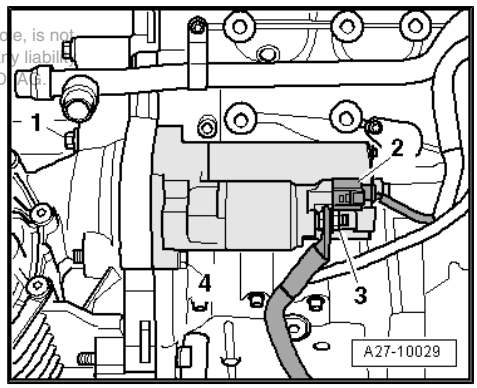


Note

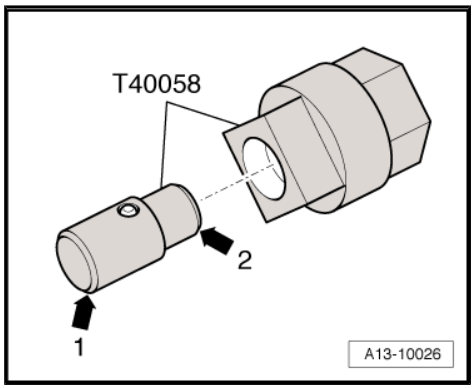
Shown in illustration without console for engine mounting.

– Detach electrical wires -2- and -3- at starter.
– Remove bolts -1- and -4- and detach starter.

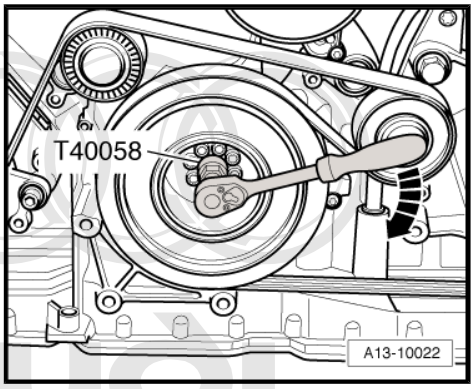
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– Insert guide pin of adapter -T40058- with the larger-diameter section -arrow 1- pointing towards the engine. The smaller-diameter section -arrow 2- faces the adapter.



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

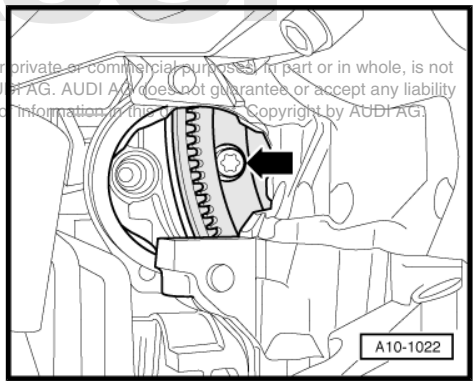


Note

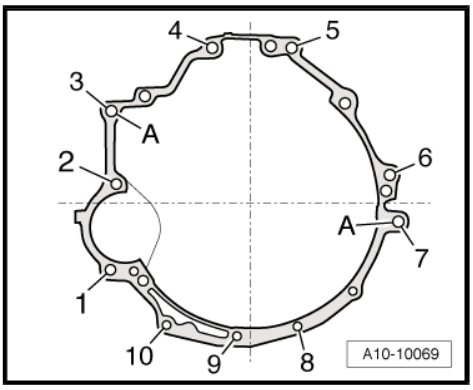
Disregard -arrow-.

– Unscrew the three bolts -arrows- for torque converter, working through opening of removed starter (turn crankshaft 1/3 turn each time).

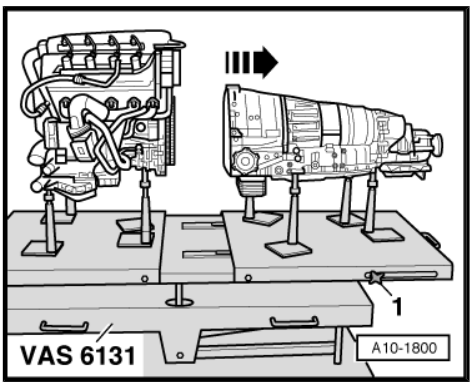
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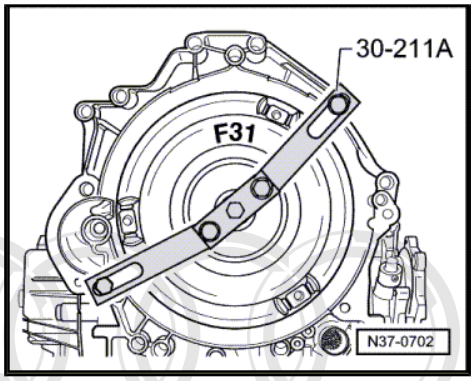
– Remove engine/gearbox securing bolts -3 ... 10-.



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



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



3.3 Installing engine

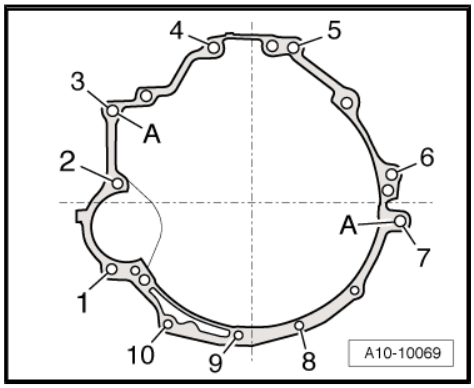
Note

- *Renew self-locking nuts and bolts when performing assembly work.*
- *Renew bolts which are tightened to a specified angle as well as seals and gaskets.*
- *Hose connections and hoses for charge air system must be free of oil and grease before assembly.*
- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*
- *To ensure that the charge air hoses can be properly secured at their connections, spray rust remover onto the worm thread of used hose clips before installing.*
- *Fit all cable ties in the original positions when installing.*
- *Reinstall heat insulation sleeves in the same locations when assembling.*

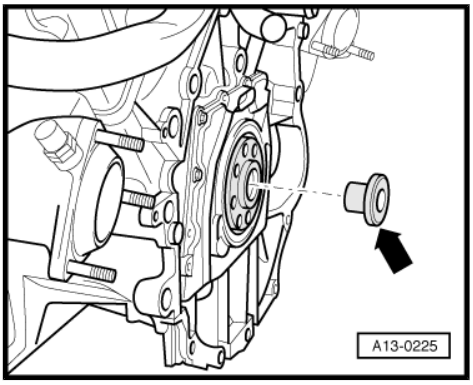
Audi
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– Install engine mounting with engine supports ⇒ page 98 .

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

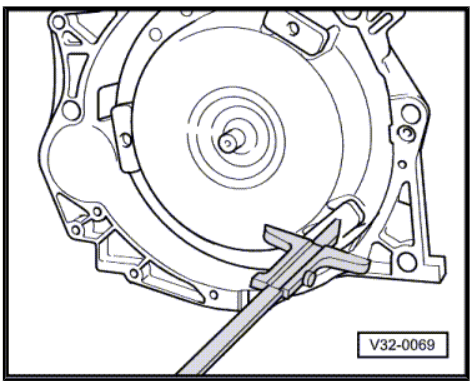


– Before installing an exchange engine in a vehicle with automatic gearbox, check whether the centralising bush -arrow- for the torque converter is fitted at the rear of the crankshaft.



Checking installation depth of torque converter

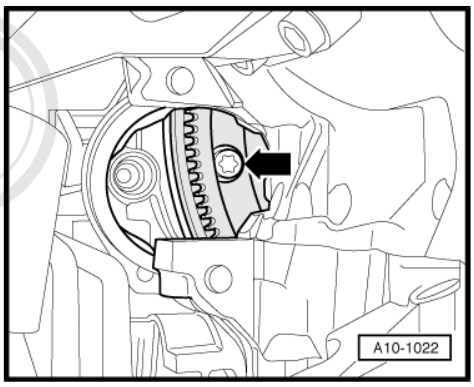
If the torque converter has been correctly installed, the distance between the contact surfaces at the threaded holes in the torque converter and the contact surface on the torque converter bell housing (with automatic gearbox 09L) is at least 19 mm.



Caution

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

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



– To secure torque converter on drive plate, use only new ribbed bolts of the correct type (same as original equipment) as specified in ⇒ Electronic parts catalogue .

– Bolt gearbox to engine.

Caution

Before and during tightening of bolts on engine/gearbox flange, continually check that the torque converter behind the drive plate can be turned. If the converter cannot be turned, it must be assumed that it has not been installed correctly and the drive lugs of the ATF pump and consequently the gearbox will be damaged when the bolts are finally tightened.

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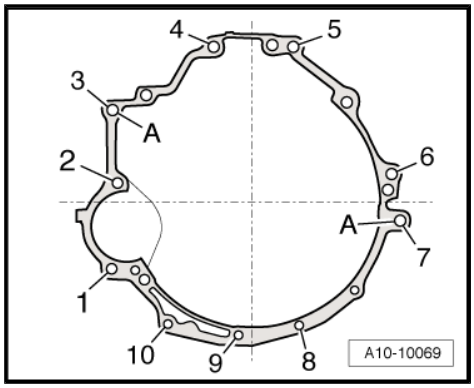
Note

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

Securing engine to gearbox

Item	Bolt	Nm
1	M10x80	65 1)
2	M10x100	65 1)
3	M12x100	65
4, 5	M12x110	65
6, 7	M12x120	65
8, 9, 10	M10x80	45
A	Dowel sleeves for centralising	

• 1) Property class 10.9.



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

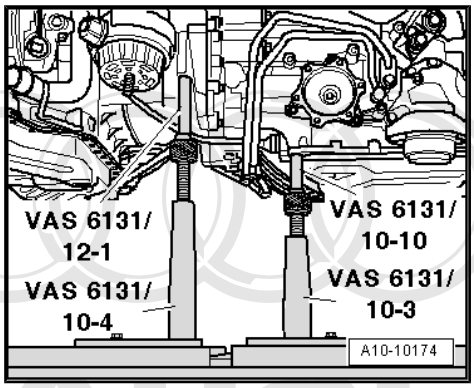
– Secure ATF lines ⇒ Rep. gr. 37 .

– Install starter catalytic converter: vehicles without particulate filter ⇒ page 343 , vehicles with particulate filter ⇒ page 355 .

– Prior to assembly, always use a thread tap to remove remaining locking fluid from the tapped holes in the flange shaft for the propshaft on the gearbox.

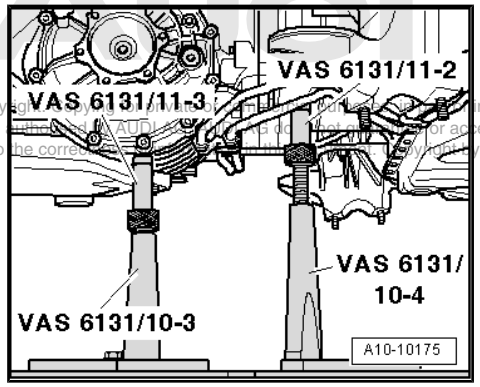
– Screw down spindles of support elements on left side of engine/gearbox assembly.

– Unscrew both base plates for support elements (left-side) at scissor-type assembly platform -VAS 6131 A- .



– Screw down spindles of support elements on right side of engine/gearbox assembly.

– Unscrew both base plates for support elements (right-side) at scissor-type assembly platform -VAS 6131 A- .



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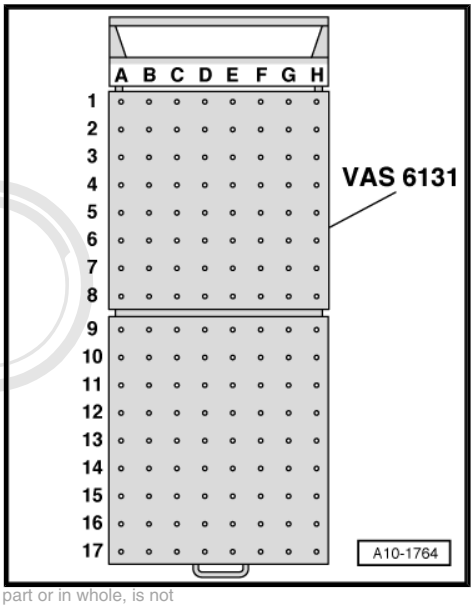
Note

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

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

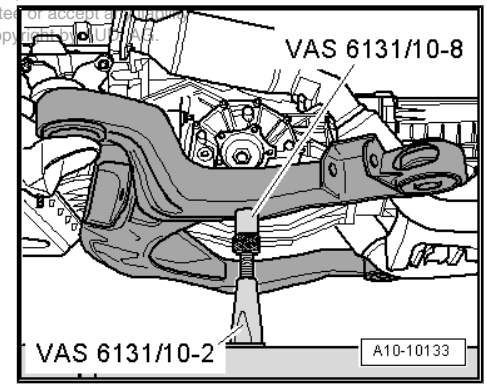
Platform coordinates	Parts from support set for Audi -VAS 6131/10-			
B3 1)	/10-1	/10-4	/10-5	/10-11
F3 1)	/10-1	/10-4	/10-5	/10-11
B10	/10-1	/10-2	/10-5	/10-8 2)
G10	/10-1	/10-2	/10-5	/10-8 2)
G14 1)	/10-1	/10-4	/10-5	/10-12
D15 1)	/10-1	/10-4	/10-5	/10-13

- 1) Support elements remain unchanged.
- 2) Secure support elements only after installing the subframe.



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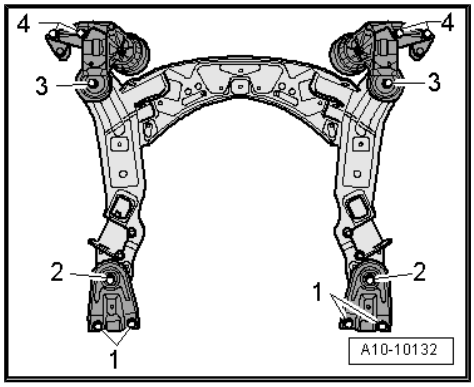
– Fit subframe onto the two support elements -VAS 6131/10-8- .
– Screw up the spindles for support elements on both sides.
– Tighten base plates for support elements to 20 Nm on scissor-type assembly platform -VAS 6131 A- .
– Install gearbox mounting ⇒ Rep. gr. 37 .



– Carefully guide engine/gearbox assembly together with subframe into the body from below using scissor-type assembly platform -VAS 6131 A- .
– Adjust the subframe and consoles for engine mountings according to the markings made on the longitudinal members during removal.
– Only tighten bolts for subframe and consoles for engine mountings to the specified torque (do not turn further); tighten bolts only after performing wheel alignment check.

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1 - 55 Nm
2 - 115 Nm
3 - 115 Nm
4 - 75 Nm



WARNING

The vehicle must not be driven at this stage.

– Fit tunnel cross piece ⇒ Rep. gr. 40 .
– Install selector lever cable and check adjustment if necessary ⇒ Rep. gr. 37 .
– Install propshaft ⇒ Rear final drive 01R; Rep. gr. 39 , ⇒ Rear final drive 0AR; Rep. gr. 39 , ⇒ Rear final drive 08V; Rep. gr. 39 .
– Install front exhaust pipe with catalytic converter ⇒ page 349 or install particulate filter with catalytic converter ⇒ page 361 .
– Align exhaust system so it is free of stress ⇒ page 366 .
– Install cross piece (front) ⇒ Rep. gr. 50 .
– Install drive shafts ⇒ Rep. gr. 40 .
– Install guide links, track control links, anti-roll bar and suspension struts ⇒ Rep. gr. 40 .
– Secure hydraulic pressure line at power steering pump ⇒ Rep. gr. 48 .
– Install refrigerant lines ⇒ Rep. gr. 87 .
– Install torque reaction support ⇒ page 107 .
– Electrical connections and routing ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.
– Observe notes on procedures required after connecting battery ⇒ Rep. gr. 27 .

Caution

Do not use a battery charger to boost starting. There is danger of damaging the vehicle's control units.

– Install and adjust wiper arms ⇒ Rep. gr. 92 .
– Install body brace ⇒ Rep. gr. 40 .
– Check oil level ⇒ Maintenance ; Booklet 405 .

– Connect coolant hose with plug-in connector to coolant pipe ⇒ page 287 .

– Fill cooling system ⇒ page 259 .

Note

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

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

– Top up power steering fluid and bleed steering system ⇒ Rep. gr. 48 .

– Check ATF level ⇒ Rep. gr. 37 .

– Adjust subframe and the two consoles for engine mountings ⇒ Rep. gr. 40 .

– Perform wheel alignment check ⇒ Rep. gr. 44 .

WARNING

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

– Check fuel system for leaks ⇒ page 6 .

Tightening torques

Note

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

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Component		Nm
Bolts/nuts	M6	9
	M8	20
	M10	40
	M12	65
Except for the following:		
Drive plate to torque converter		85 1)
Terminal B+ to starter		16
Drive shaft heat shield to gearbox		23
Intake connecting pipe to:	Intake manifold	9
	Connecting pipe for exhaust gas recirculation	9
Hose clips (9 mm wide)		3
Hose clips (13 mm wide)		5.5

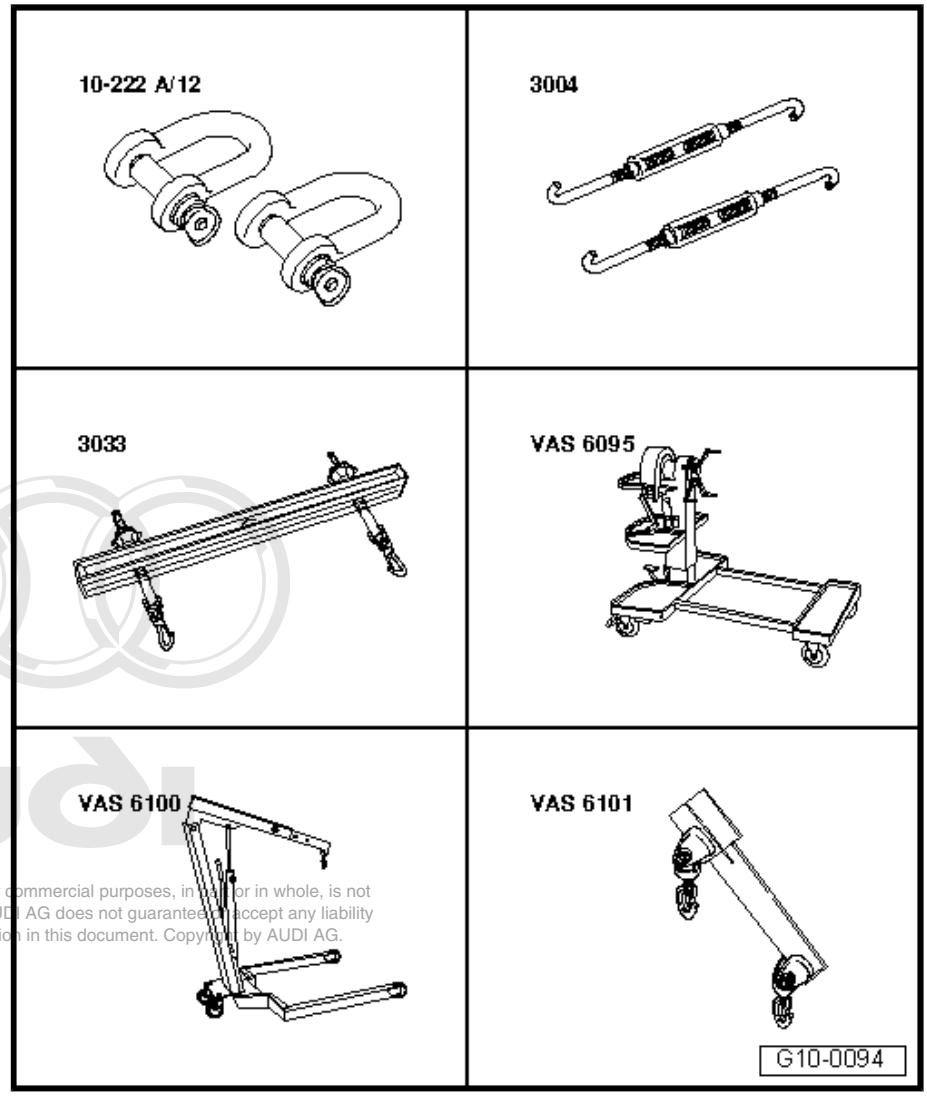
- 1) Renew bolt(s).

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4 Securing engine to engine and gearbox support

Special tools and workshop equipment required

- Shackle -10 - 222 A /12-
- Hook -3004-
- Lifting tackle -3033-
- Engine and gearbox support -VAS 6095- with bracket for V6 TDI engine -VAS 6095/1-4-
- Workshop hoist - VAS 6100-
- Lift arm extension (workshop hoist) -VAS 6101-



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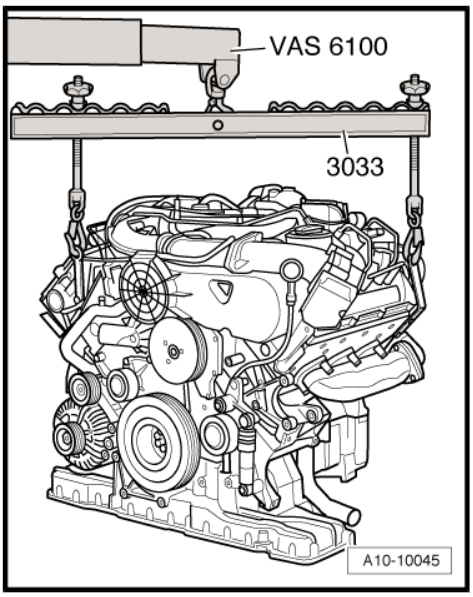
Procedure

- Engine separated from gearbox: vehicles with manual gearbox ⇒ page 26 ; vehicles with multitronic gearbox ⇒ page 53 ; vehicles with automatic gearbox ⇒ page 81 .

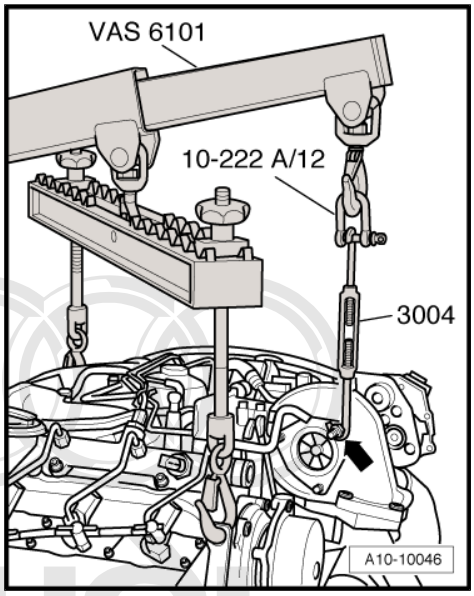
Note

Only for scissor-type assembly platform -VAS 6131- : for better accessibility with workshop hoist -VAS 6100- it is advisable to remove the sliding bar from the scissor-type assembly platform.

– Attach lifting tackle -3033- to workshop hoist -VAS 6100- as shown in the illustration.

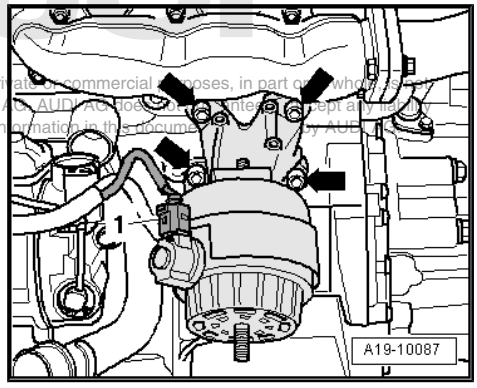


– Screw a nut -arrow- about 4 turns onto stud on turbocharger.
– Attach lift arm extension -VAS 6101- to workshop hoist -VAS 6100- .
– Connect lift arm extension -VAS 6101- to shackle -10 - 222 A / 12- and engage hook -3004- on stud.
– Tension hook -3004- so that engine is taken up horizontally.
– Lift engine off the support elements on scissor-type assembly platform -VAS 6131 A- .



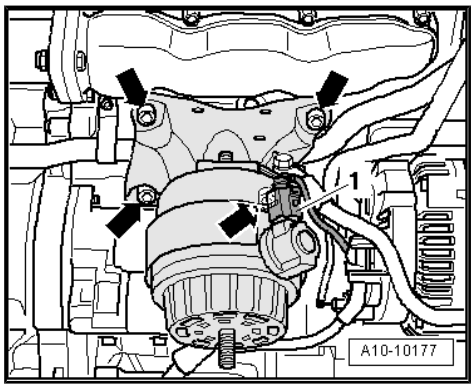
– Unplug electrical connector -1- at engine mounting (left-side).
– Remove bolts -arrows- and detach engine support (left-side).

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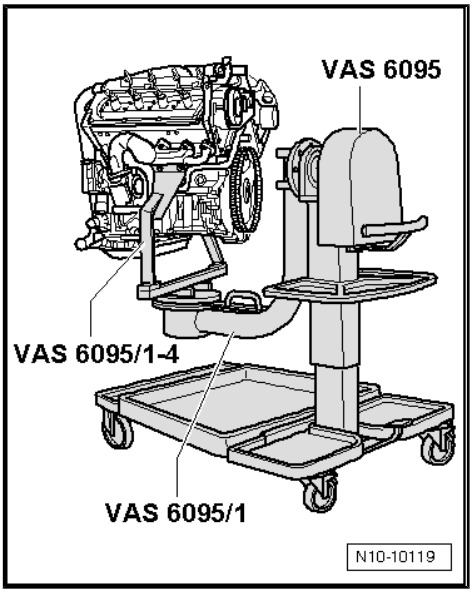
Vehicles with manual gearbox:

– Unplug electrical connector -1- at engine mounting (right-side).
– Move wiring clear at console for engine mounting.
– Remove bolts -arrows- and detach engine support (right-side).



All vehicles:

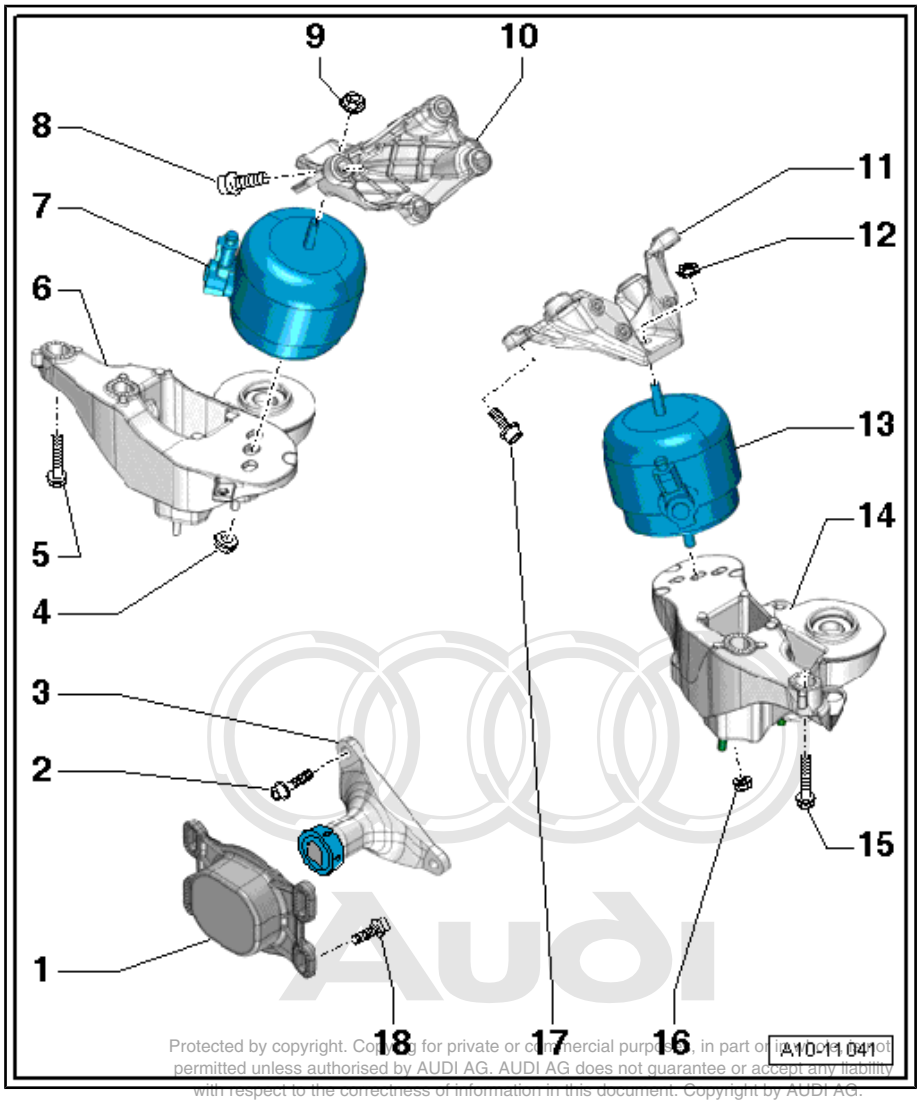
– Using support bracket for V6 TDI engine -VAS 6095/1-4- , secure engine to engine and gearbox support -VAS 6095- (40 Nm) as shown in the illustration.



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5 Assembly mountings

5.1 Assembly mountings - exploded view



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1 - Stop for torque reaction support

- ❑ Installation instructions ⇒ „5.4 Removing and installing torque reaction support“, page 107

2 - 40 Nm

3 - Torque reaction support

- ❑ Removing and installing ⇒ page 107

4 - 40 Nm

5 - Bolt

- ❑ Tightening torque ⇒ Rep. gr. 40

6 - Console for engine mounting (right-side)

7 - Engine mounting (right-side)

- ❑ With right electrohydraulic engine mounting solenoid valve -N145-
- ❑ Removing and installing ⇒ page 102

8 - 40 Nm

9 - 40 Nm

10 - Engine support (right-side)

- ❑ Removing and installing ⇒ „5.3 Removing and installing engine mounting (right-side)“, page 102

11 - Engine support (left-side)

- ❑ Removing and installing ⇒ „5.2 Removing and installing engine mounting (left-side)“, page 99

12 - 40 Nm

13 - Engine mounting (left-side)

- ❑ With left electrohydraulic engine mounting solenoid valve -N144-
- ❑ Removing and installing ⇒ page 99

14 - Console for engine mounting (left-side)

15 - Bolt

- ❑ Tightening torque ⇒ Rep. gr. 40

16 - 40 Nm

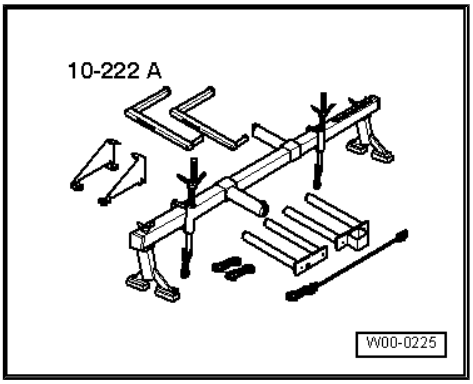
17 - 40 Nm

18 - 40 Nm

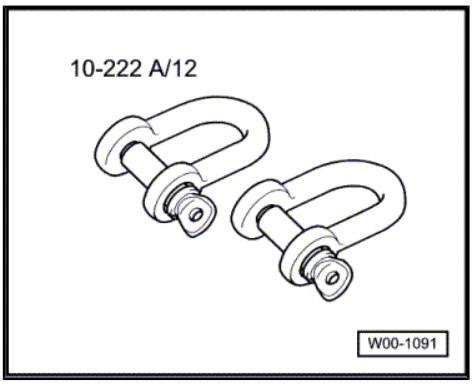
5.2 Removing and installing engine mounting (left-side)

Special tools and workshop equipment required

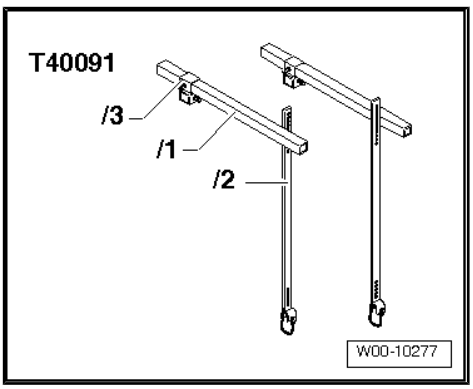
- Support bracket -10 - 222 A-



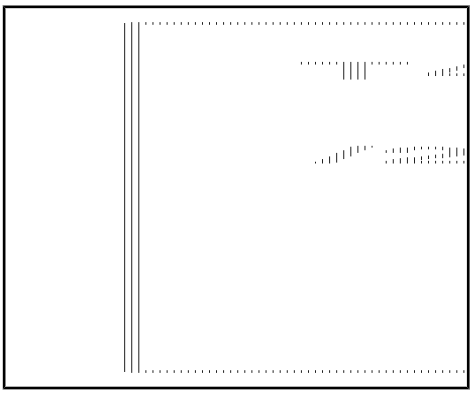
- Shackle -10 - 222 A /12-



- Engine support bracket (basic set) -T40091-



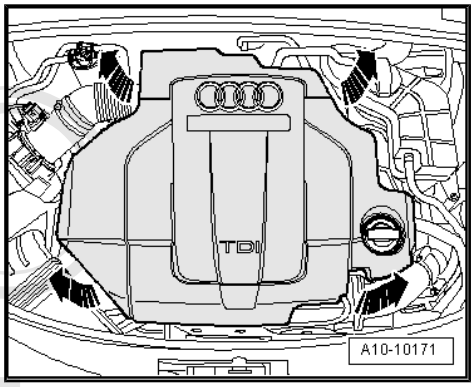
- Engine support bracket (supplementary set) -T40093-



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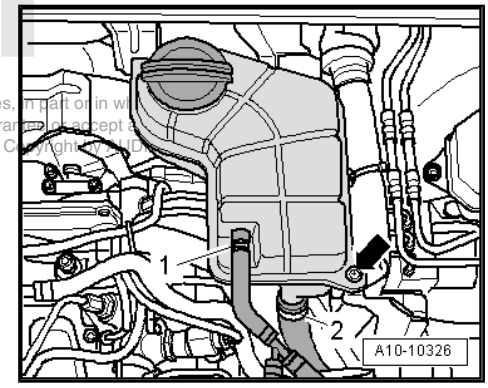
Removing

– Carefully pull engine cover panel off four retaining pins one after the other -arrows-.



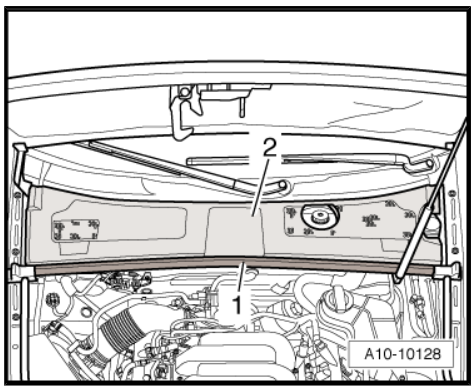
– Remove bolt -arrow-.

– Unplug electrical connector for coolant shortage indicator switch -F66- at bottom of expansion tank and move expansion tank to one side with coolant hoses -1- and -2- attached.



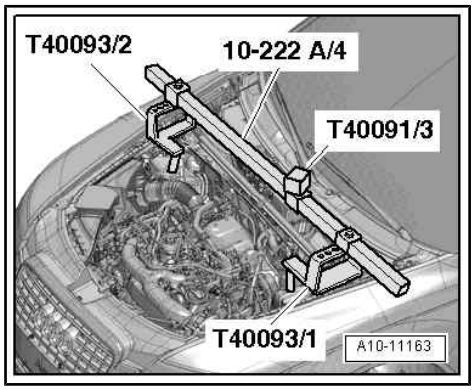
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– Pull off seal -1- and remove plenum chamber cover -2-.

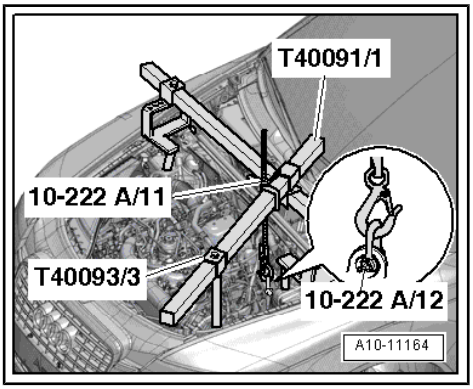


– Set up adapter -10 - 222 A /4- with connecting piece -T40091/3- and supports -T40093/1- and -T40093/2- on suspension turrets as illustrated.

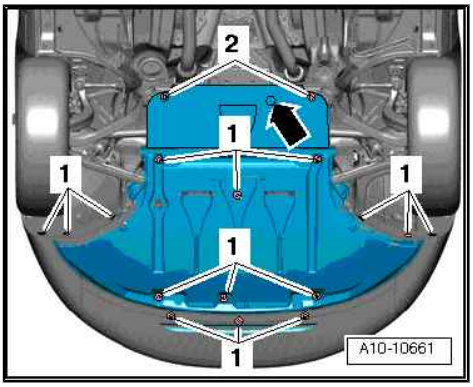
• Supports are marked for left and right side of vehicle.



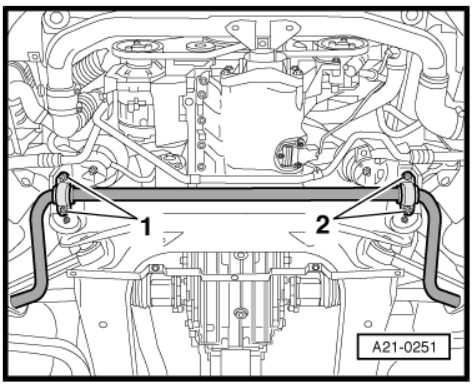
– Attach further components of support bracket -10 - 222 A- , -T40091- and -T40093- as shown in illustration. Position support -T40093/3- onto flange of longitudinal member (left-side).
– Engage hook -10 - 222 A /10- at engine lifting eye (left and right).
– Additionally attach shackle -10 - 222 A /12- at engine lifting eye (left-side).
– Take up weight of engine with spindle.



– Remove front and rear noise insulation ⇒ Rep. gr. 50 .



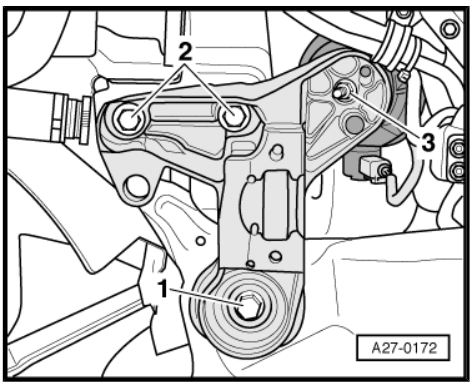
– Remove bolts -1- and -2- for anti-roll bar mounting on both sides and slightly lower anti-roll bar.



– Remove nut -3-.
– Remove bolts -1- and -2- and take off console for engine mounting (left-side).

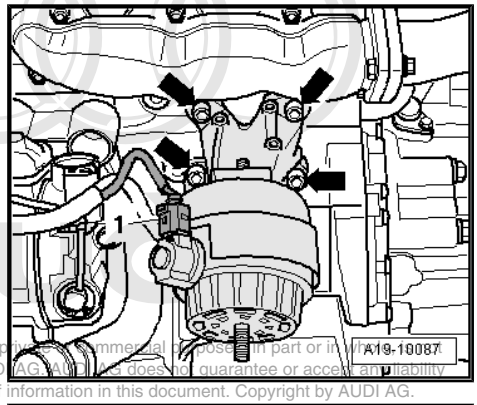
Note

The procedure is illustrated for the console for engine mounting (right-side).



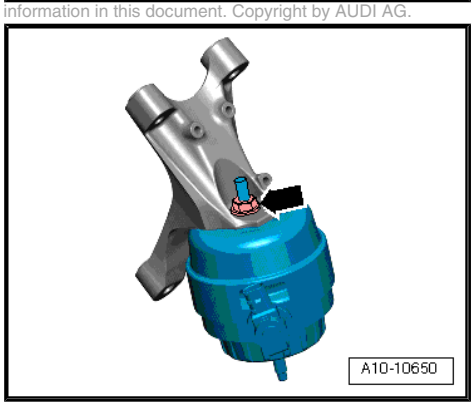
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– Unplug electrical connector -1- on left electrohydraulic engine mounting solenoid valve -N144- .
– Remove bolts -arrows- and detach engine support with engine mounting.



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– Remove nut -arrow- and detach engine mounting from engine support.



Installing

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

Note

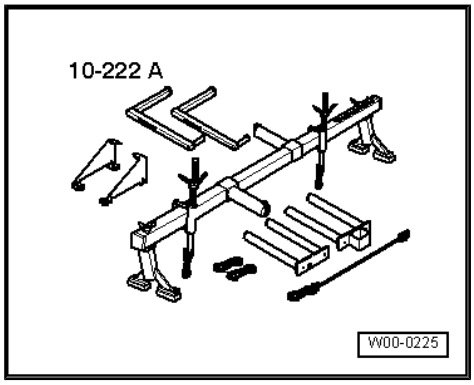
- *Renew the bolts tightened with specified tightening angle.*
- *Fit all cable ties in the original positions when installing.*

– Install subframe and anti-roll bar ⇒ Rep. gr. 40 .
– On vehicles with auxiliary heater: install exhaust silencer with corrugated exhaust pipes ⇒ Rep. gr. 82 .
– Install front wheel housing liner ⇒ Rep. gr. 66 .
• Tightening torques ⇒ page 98

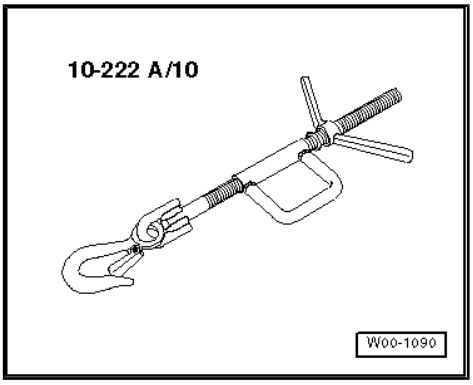
5.3 Removing and installing engine mounting (right-side)

Special tools and workshop equipment required

- Support bracket -10 - 222 A-

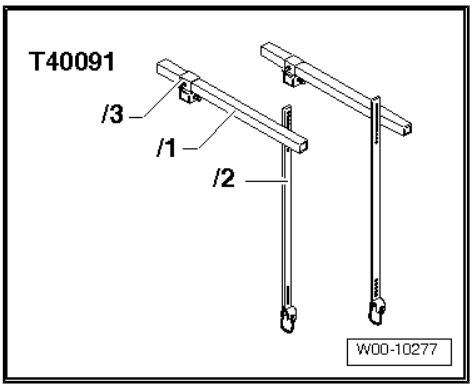


- Hook -10 - 222 A /10-

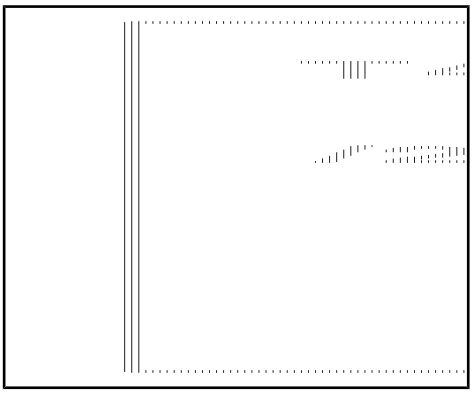


- Engine support bracket (basic set) -T40091-

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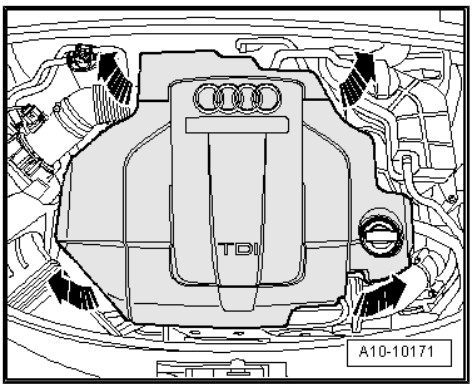
- Engine support bracket (supplementary set) -T40093-



Removing

– Carefully pull engine cover panel off four retaining pins one after the other -arrows-.

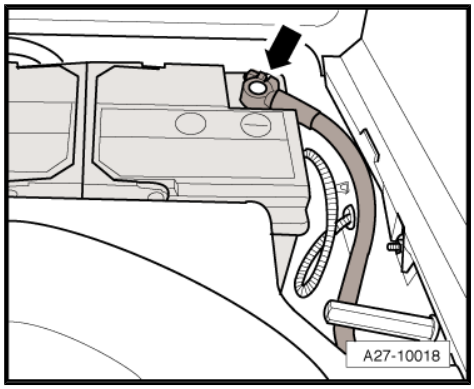
– Remove air cleaner housing ⇒ Rep. gr. 23 .



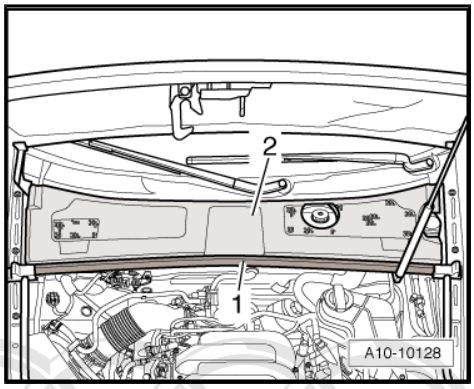
Caution

Observe notes on procedure for disconnecting the battery.

– With ignition switched off, disconnect battery earth cable -arrow- ⇒ Rep. gr. 27 .

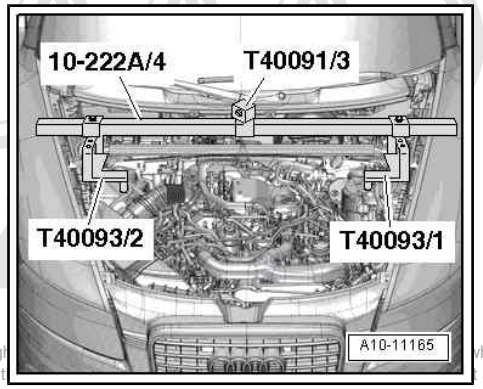


– Pull off seal -1- and remove plenum chamber cover -2-.



– Set up adapter -10 - 222 A /4- with connecting piece -T40091/3- and supports -T40093/1- and -T40093/2- on suspension turrets.

• Supports are marked for left and right side of vehicle.

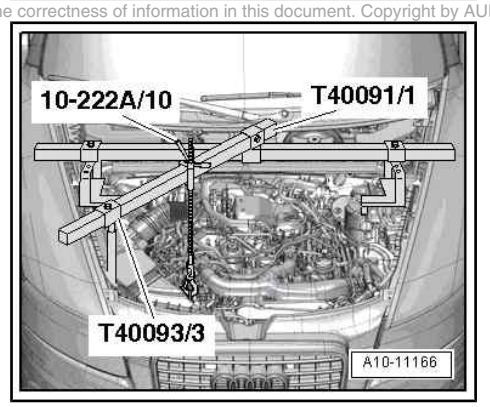


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– Attach further components of support bracket -10 - 222 A- , -T40091- and -T40093- as shown in illustration. Position support -T40093/3- onto flange of longitudinal member.

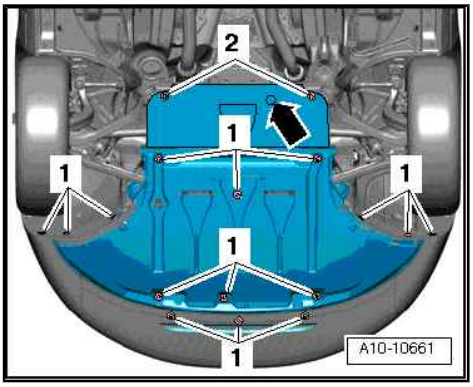
– Engage hook -10 - 222 A /10- at engine lifting eye (left-side).

– Take up weight of engine with spindle.

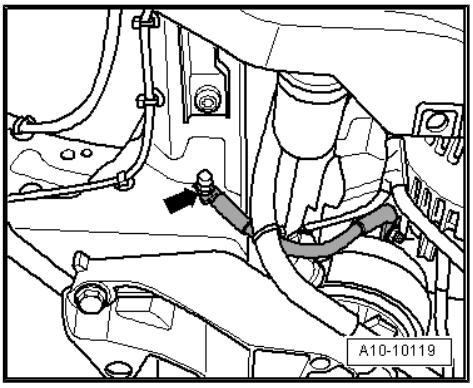


– Remove front right wheel.

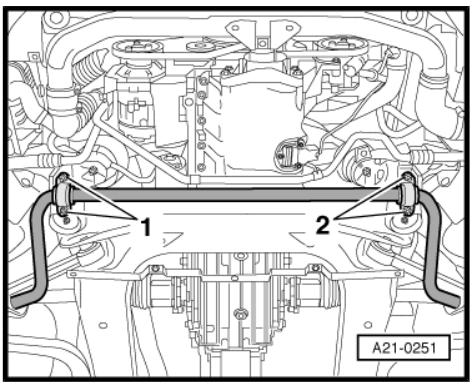
– Release fasteners marked -1, 2- and -arrow- (if fitted) and remove front and rear noise insulation.



– Unscrew nut -arrow- on longitudinal member (right-side) and move earth cable clear.

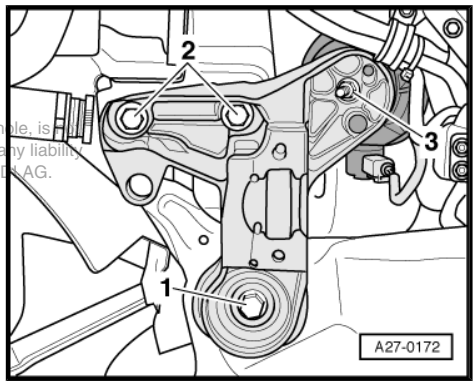


– Remove nuts -1- and -2- for anti-roll bar mounting on both sides and slightly lower anti-roll bar.



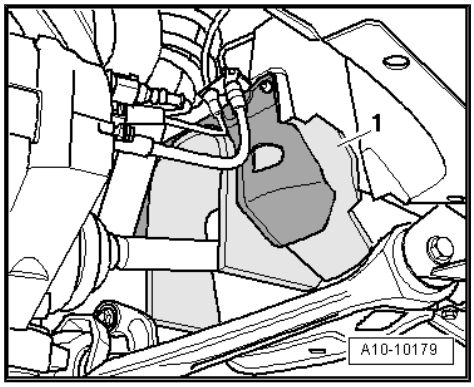
– Remove nut -3-.

– Remove bolts -1- and -2- and take off console for engine mounting (right-side).

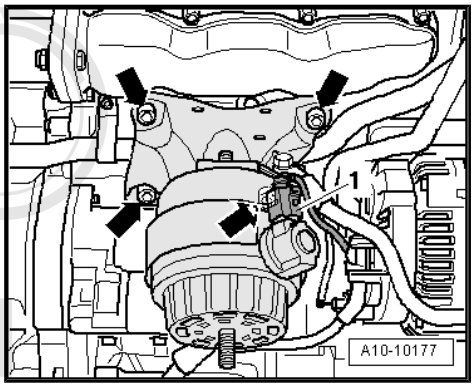


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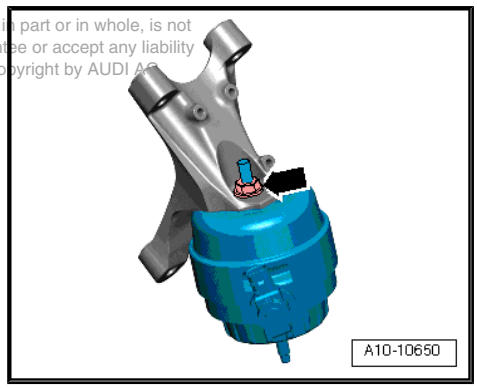
– Remove cover -1- for drive shaft in wheel housing (right-side).



– Unplug electrical connector -1- on right electrohydraulic engine mounting solenoid valve -N145- .
– Remove bolts -arrows- and detach engine support with engine mounting.



– Remove nut -arrow- and detach engine mounting from engine support.



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Installing

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

Note

- *Renew the bolts tightened with specified tightening angle.*
- *Fit all cable ties in the original positions when installing.*

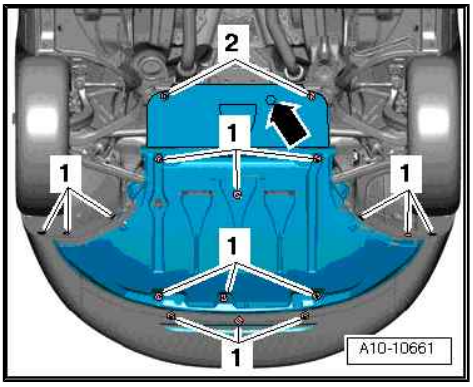
– Install subframe and anti-roll bar ⇒ Rep. gr. 40 .
– Install cover for drive shaft ⇒ Rep. gr. 66 .
– Fit front wheel ⇒ Rep. gr. 44 .
– Install air cleaner housing ⇒ Rep. gr. 23 .
– Observe notes on procedure for connecting the battery ⇒ Rep. gr. 27 .

• Tightening torques ⇒ page 98

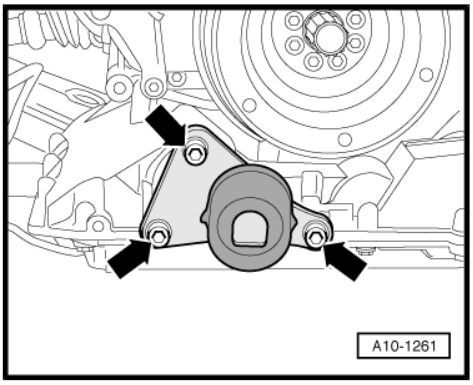
5.4 Removing and installing torque reaction support

Removing

– Remove front and rear noise insulation ⇒ Rep. gr. 50 .



– Unscrew bolts -arrows- and detach torque reaction support from engine.



Installing

• Tightening torques ⇒ page 98

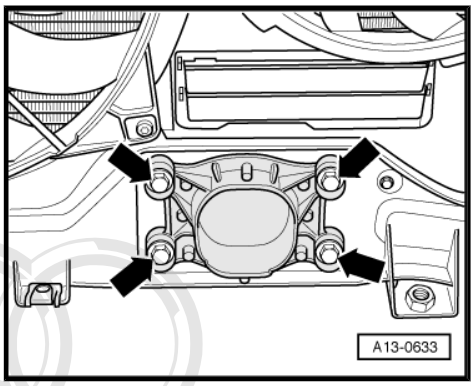
Installation is carried out in the reverse order; note the following:

– Loosen bolts -arrows-.

– Allow stop for torque reaction support to rest on rubber buffer for torque reaction support under its own weight, and tighten bolts.

– Install noise insulation panels ⇒ Rep. gr. 50 .

• Tightening torques ⇒ page 98

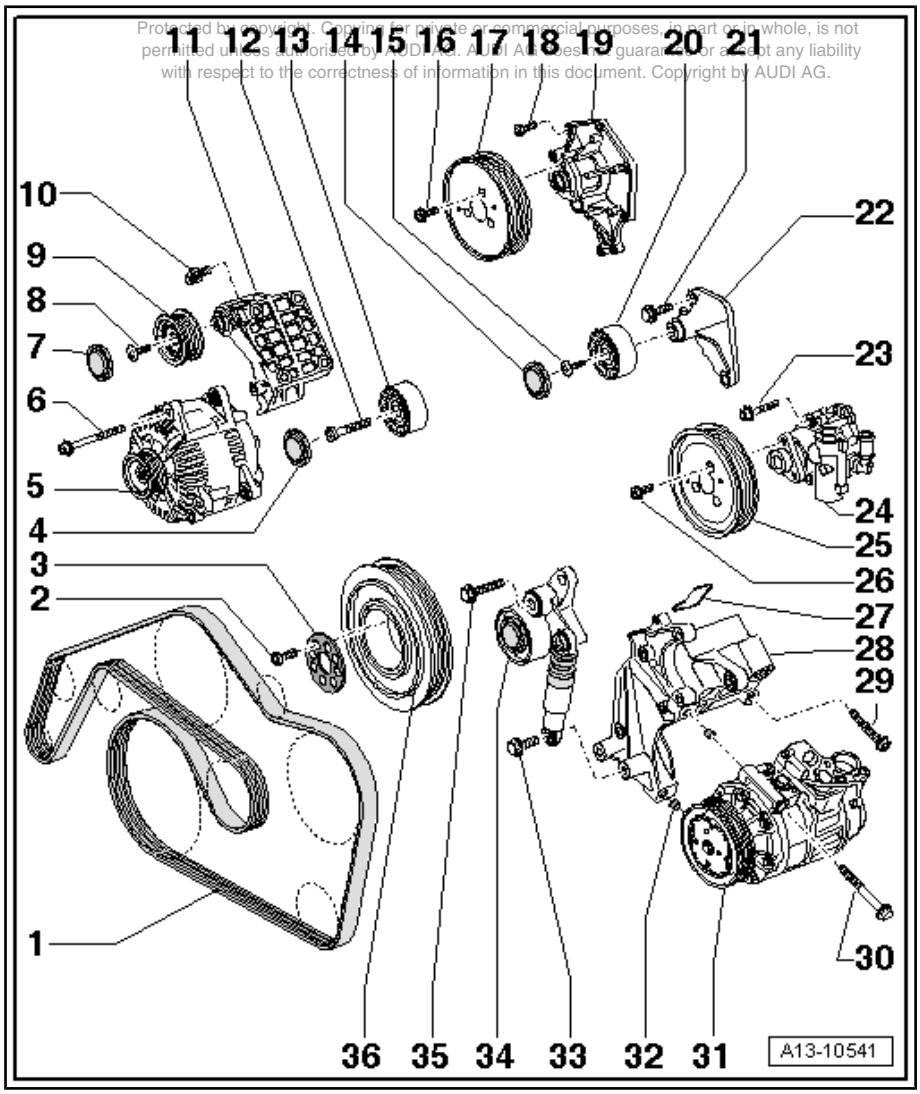


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13 – Crankshaft group

1 Cylinder block (pulley end)

1.1 Poly V-belt drive - exploded view



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1 - Poly V-belt

- ❑ Before removing, mark direction of rotation with chalk or felt-tip pen. If the belt runs in the opposite direction when it is refitted, this can cause breakage.
- ❑ Removing and installing ⇒ page 111
- ❑ Check for wear
- ❑ When installing, make sure it is properly seated on pulleys.

2 - 20 Nm + turn 90° further

- ❑ Property class 10.9
- ❑ Renew

3 - Shim

- ❑ Renew
- ❑ Must be fitted on all vehicles, even if no shim was fitted previously

4 - Cover for idler roller

5 - Alternator

- ❑ Removing and installing ⇒ Rep. gr. 27
- ❑ To facilitate attachment of alternator, knock back threaded bushes for alternator securing bolt slightly

6 - 23 Nm

7 - Cover for idler roller

8 - 23 Nm

- ❑ Property class 10.9

9 - Idler roller for poly V-belt

- ❑ Note installation position

10 - Bolt

- ❑ Tightening torque and sequence ⇒ page 111

11 - Bracket for alternator and idler roller

12 - 23 Nm

- ❑ Property class 10.9

13 - Idler roller for poly V-belt

- ❑ Note installation position

14 - Cover for idler roller

- ❑ On vehicles with additional idler roller

15 - 23 Nm

- ❑ Property class 10.9
- ❑ On vehicles with additional idler roller

16 - 23 Nm

17 - Poly V-belt pulley for coolant pump

- ❑ Counterhold with pin wrench -3212- when loosening and tightening ⇒ page 111 .
- ❑ Installation position: marking „vorne“ (front) faces in direction of travel.

18 - 9 Nm

19 - Coolant pump

- ❑ Removing and installing ⇒ page 264

20 - Idler roller for poly V-belt

- ❑ Only applicable on new versions:
- ❑ Removing and installing ⇒ page 115

21 - 23 Nm

- ❑ On vehicles with additional idler roller

22 - Bracket for idler roller

- ❑ On vehicles with additional idler roller

23 - 23 Nm

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24 - Power steering pump

- ❑ Removing and installing ⇒ Rep. gr. 48

25 - Poly V-belt pulley for power steering pump

- ❑ Counterhold with pin wrench -3212- when loosening and tightening ⇒ page 111 .
- ❑ Installation position: marking „vorne“ (front) faces in direction of travel.

26 - 22 Nm

27 - Seal

- ❑ Renew

28 - Bracket for ancillaries

29 - 40 Nm

30 - 25 Nm

31 - Air conditioner compressor

- ❑ Do not unscrew or disconnect refrigerant hoses or pipes.
- ❑ Removing and installing ⇒ Rep. gr. 87
- ❑ When installing check dowel sleeves -item 32-

32 - Dowel sleeve

- ❑ 2x
- ❑ Check for correct seating in bracket

33 - 23 Nm

34 - Poly V-belt tensioner

> **Caution**
> *Depending on the vehicle version, an M10 or an M11 thread may have been used for the securing thread in the crankcase for the tensioner. It is very important to use the correct bolt and tensioner for the crankcase ⇒ Electronic parts catalogue .*

- ❑ Removing and installing ⇒ page 114

35 - Bolt

> **Caution**
> *Different threads in crankcase.*
>
> *Before installation, check whether thread is M10 or M11 version.*
>
> *Use appropriate bolt size. Risk of damage to engine.*
>
> *It is very important that the correct bolt and tensioner for the crankcase is used ⇒ Electronic parts catalogue .*

- ❑ Bolt with M10 thread: 50 Nm + turn 90° further
- ❑ Bolt with M11 thread: 60 Nm + turn 90° further
- ❑ Renew

36 - Vibration damper

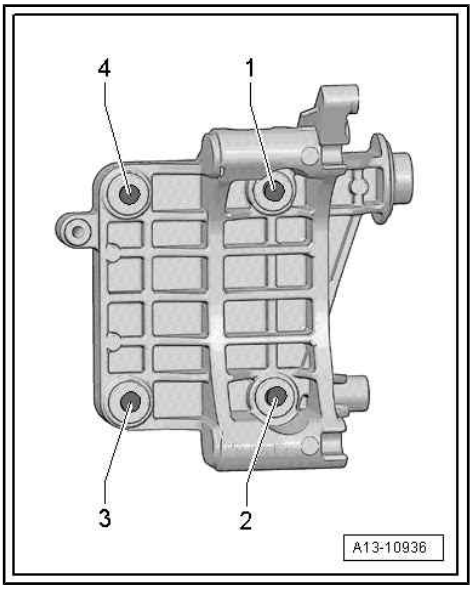
- ❑ With poly V-belt pulley
- ❑ Removing and installing ⇒ page 116

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Bracket for alternator and idler roller - tightening torque and sequence

– Fit bolts in the sequence -1 ... 4-.

– Tighten bolts in the sequence -1 ... 4- to 40 Nm.

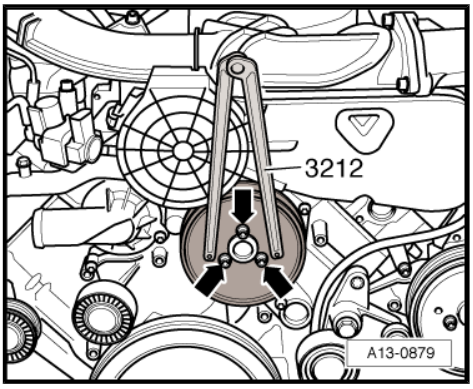


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Loosening poly V-belt pulley for coolant pump

- Poly V-belt removed.

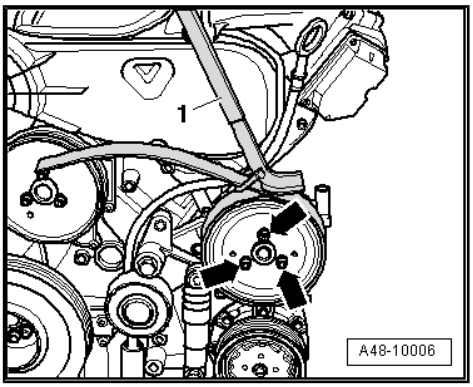
– Counterhold using pin wrench -3212- when loosening bolts -arrows- on poly V-belt pulley for coolant pump.



Loosening poly V-belt pulley for power steering pump

- Poly V-belt removed.

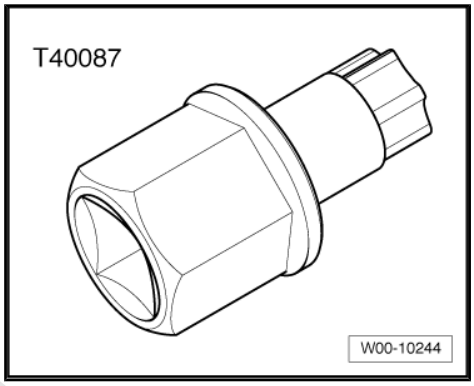
– Counterhold using strap wrench when loosening bolts -arrows- on poly V-belt pulley for power steering pump.



1.2 Removing and installing poly V-belt

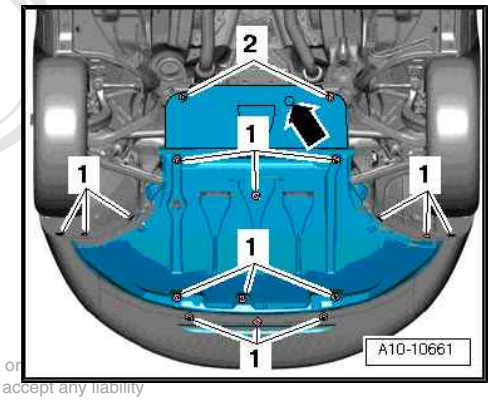
Special tools and workshop equipment required

♦ Socket Torx T 60 -T40087-



Removing

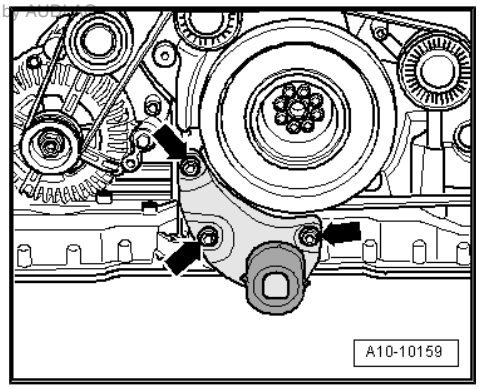
– Release fasteners marked -1, 2- and -arrow- (if fitted) and remove front and rear noise insulation.



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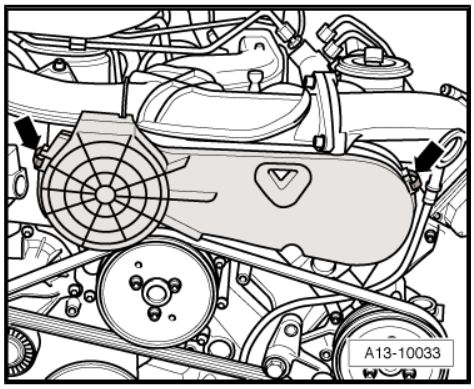
– Unscrew bolts -arrows- and remove torque reaction support from engine.

– Remove intake manifold (top section) ⇒ Rep. gr. 23 .

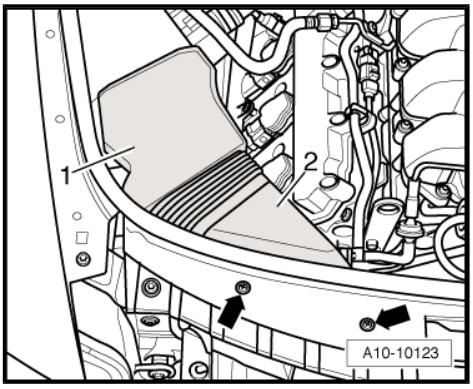


– Loosen clamps -arrows-.

– Pivot toothed belt cover forward and disengage retaining pegs on bottom side of toothed belt cover.



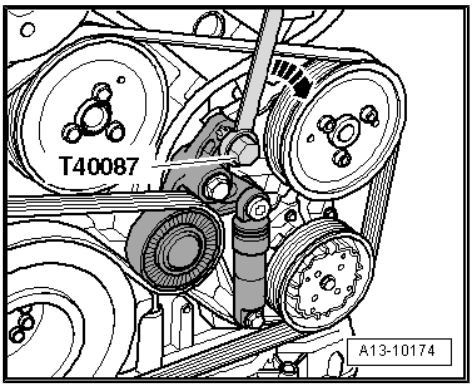
– Remove bolts -arrows-.
– Remove air ducts -1- and -2-.



Note

Before removing, mark direction of rotation of poly V-belt with chalk or felt-tip pen. If the belt runs in the opposite direction when it is refitted, this can cause breakage.

– Slacken poly V-belt by swivelling tensioner in direction of -arrow-, using socket Torx T 60 -T40087- and a long, straight-handled ring spanner or open-end spanner.
– Remove poly V-belt.



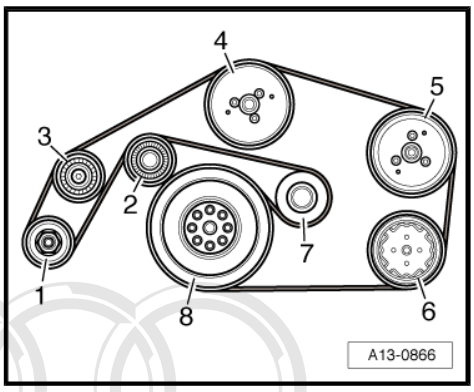
Installing

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

– Fit poly V-belt on pulleys.

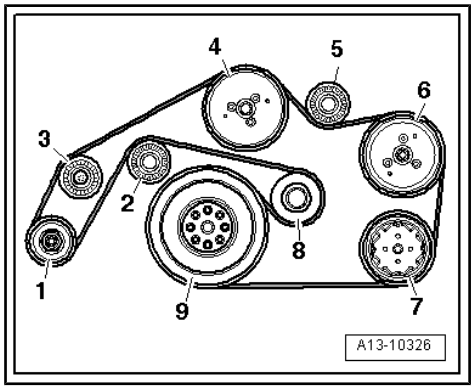
Vehicles without additional idler roller:

1 - Alternator
2 - Idler roller
3 - Idler roller
4 - Coolant pump
5 - Power steering pump
6 - Air conditioner compressor
7 - Poly V-belt tensioner
8 - Vibration damper



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Vehicles with additional idler roller:



1 - Alternator
2 - Idler roller
3 - Idler roller
4 - Coolant pump
5 - Idler roller
6 - Power steering pump
7 - Air conditioner compressor
8 - Poly V-belt tensioner
9 - Vibration damper

All vehicles:

Note

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

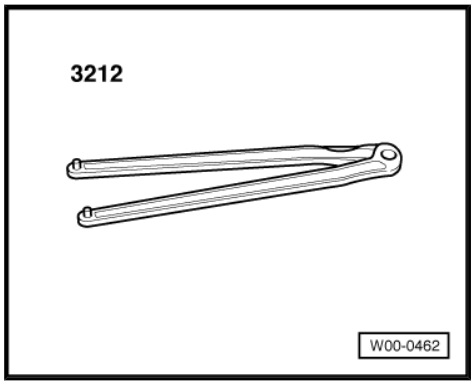
– Install intake manifold (top section) ⇒ Rep. gr. 23 .
– Install torque reaction support ⇒ page 107 .
– Start engine and check that belt runs properly.

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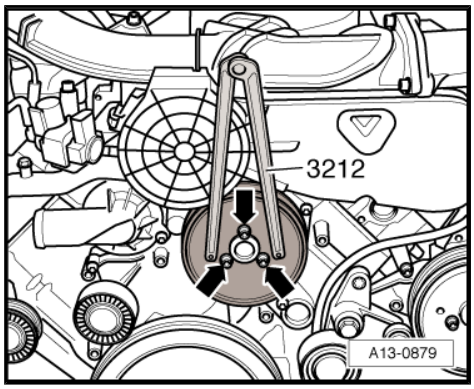
1.3 Removing and installing tensioner for poly V-belt

Special tools and workshop equipment required

♦ Pin wrench -3212-

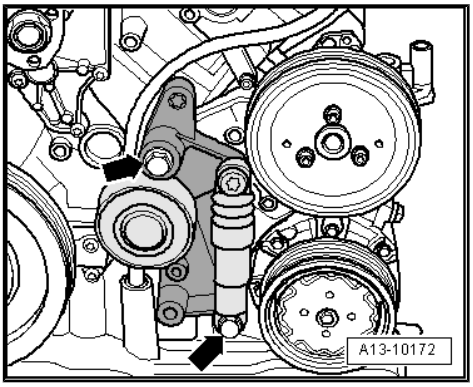


Removing



– Remove intake manifold (top section) ⇒ Rep. gr. 23 .
– Remove poly V-belt ⇒ page 111 .
– Unbolt coolant pump pulley -arrows- (counterhold with pin wrench -3212-).

– Remove bolts -arrows-.
– Detach poly V-belt tensioner.



Installing

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

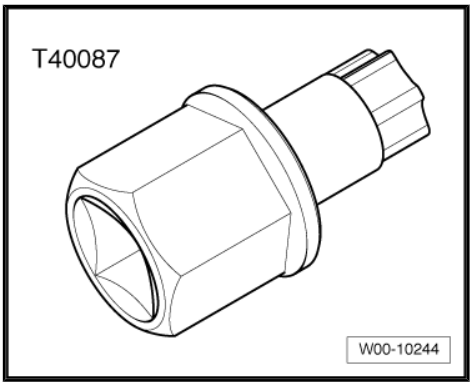
– Install poly V-belt ⇒ page 111 .
– Install intake manifold (top section) ⇒ Rep. gr. 23 .

• Tightening torques ⇒ page 108

1.4 Removing and installing idler roller for poly V-belt

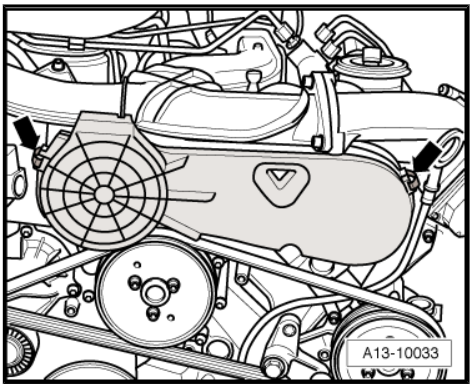
Special tools and workshop equipment required

♦ Socket Torx T 60 -T40087-



Removing

– Remove intake manifold (top section) ⇒ Rep. gr. 23 .
– Loosen clamps -arrows-.
– Pivot toothed belt cover forward and disengage retaining pegs on bottom side of toothed belt cover.

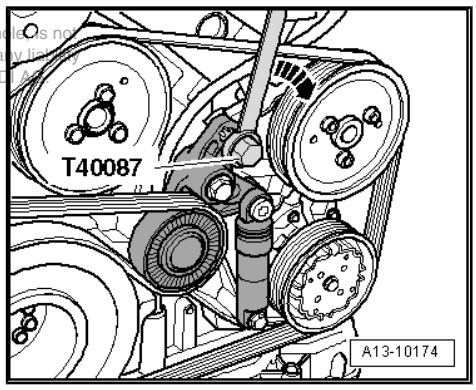


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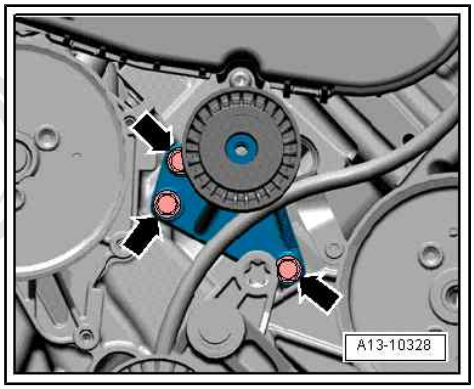
Note

Before removing, mark direction of rotation of poly V-belt with chalk or felt-tip pen. If the belt runs in the opposite direction when it is refitted, this can cause breakage.

– Slacken poly V-belt by swivelling tensioner in direction of -arrow-, using socket Torx T 60 -T40087- and a long, straight-handled ring spanner or open-end spanner.
– Remove poly V-belt from tensioning roller.



– Unscrew bolts -arrows- and detach idler roller from front sealing flange.



Installing

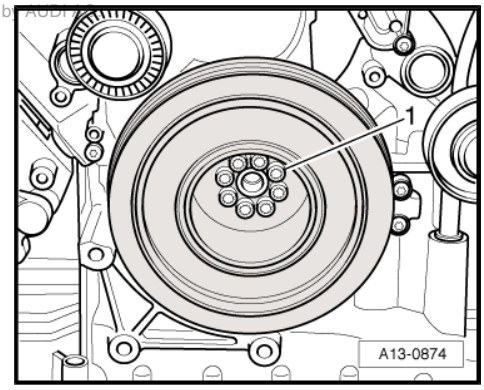
Installation is carried out in the reverse order; note the following:

– Install poly V-belt ⇒ page 111 .
– Install intake manifold (top section) ⇒ Rep. gr. 23 .
• Tightening torque ⇒ page 108

1.5 Removing and installing vibration damper

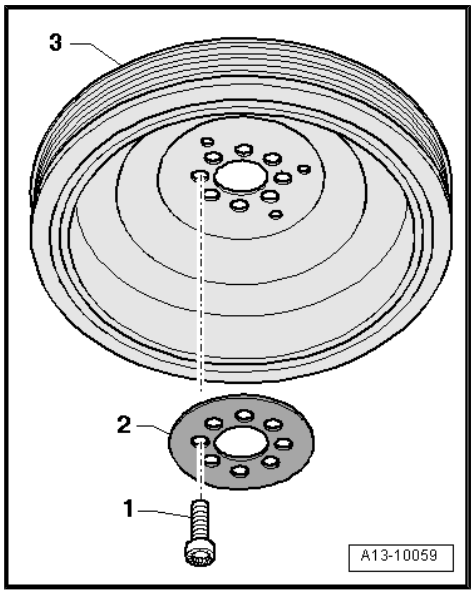
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Removing



– Remove poly V-belt ⇒ page 111 .
– Remove bolts -1-.
– Remove vibration damper.

Installing



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

Note

♦ *Renew bolts -1- for vibration damper.*
♦ *The vibration damper has a fixed installation position and can only be fixed in this position.*

– Install vibration damper -3- with new shim -2-.

Caution

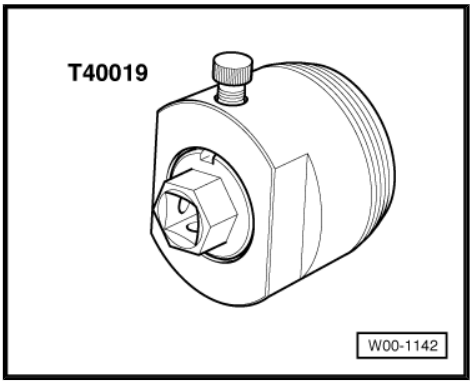
The shim must be installed on all vehicles, even if no shim was fitted previously.

– Install poly V-belt ⇒ page 111 .
– Install intake manifold (top section) ⇒ Rep. gr. 23 .
• Tightening torque ⇒ page 108

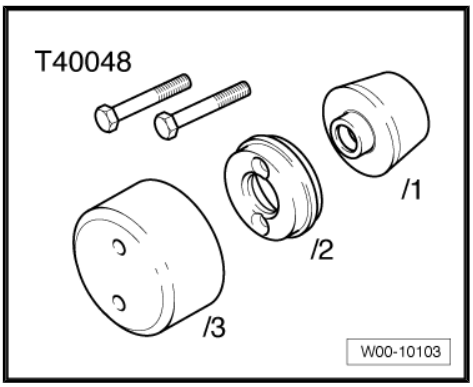
1.6 Renewing crankshaft oil seal (pulley end)

Special tools and workshop equipment required

♦ Oil seal extractor -T40019-



♦ Assembly appliance -T40048- with -T40048/4-



Procedure

– Remove poly V-belt ⇒ page 111 .

– Remove vibration damper ⇒ page 116 .

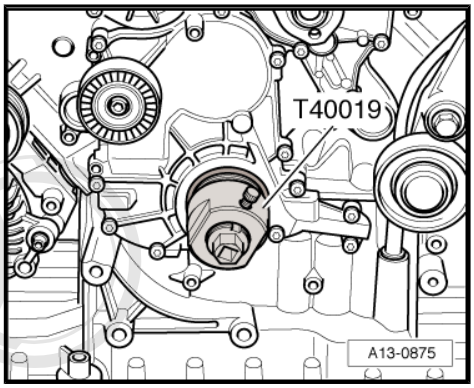
– Adjust the inner part of oil seal extractor -T40019- so it is flush with the outer part and lock in position with knurled screw.

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

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

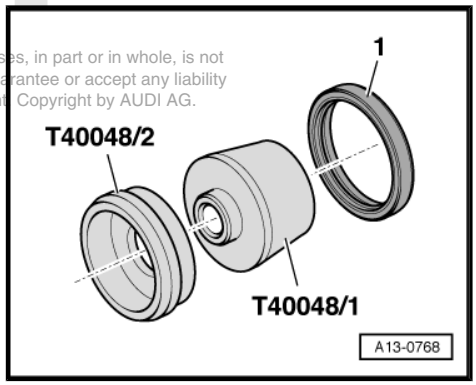
– Clamp flats of oil seal extractor in vice. Remove oil seal with pliers.

– Clean contact surface and sealing surface.



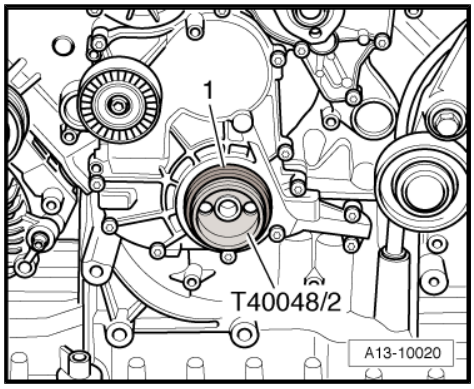
– Fit assembly aid -T40048/1- onto assembly sleeve -T40048/2- and slide oil seal -1- onto assembly sleeve.

– Take off assembly aid.



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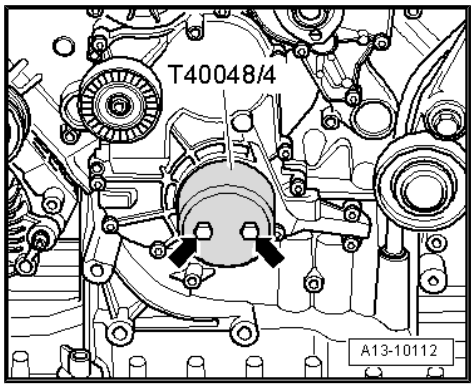
– Fit assembly sleeve -T40048/2- on crankshaft and push oil seal -1- into sealing flange (front).



Note

Leave assembly sleeve -T40048/2- in position on crankshaft for pressing in seal.

– Apply press sleeve -T40048/4- (installation depth 5 mm) to crankshaft using two M8×55 mm bolts -arrows-.



– Screw in bolts hand-tight to start with.

– Tighten bolts alternately, $^{1}/_{2}$ turn at a time, to press in oil seal onto stop.

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

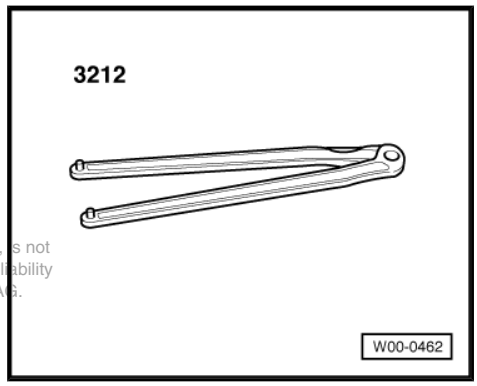
– Install vibration damper ⇒ page 116 .

– Install poly V-belt ⇒ page 111 .

1.7 Removing and installing sealing flange (front)

Special tools and workshop equipment required

♦ Pin wrench -3212-



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♦ Electric drill with plastic brush attachment

♦ Safety goggles

♦ Sealant ⇒ Electronic parts catalogue

Removing

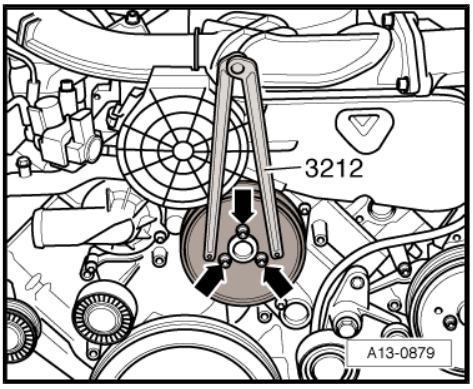
– Drain off coolant ⇒ page 256 .

– Remove poly V-belt ⇒ page 111 .

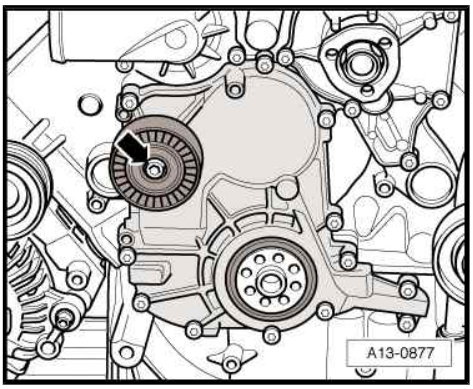
– Remove toothed belt for high-pressure pump ⇒ Rep. gr. 23 .

– Remove coolant pipe (right-side) ⇒ page 275 .

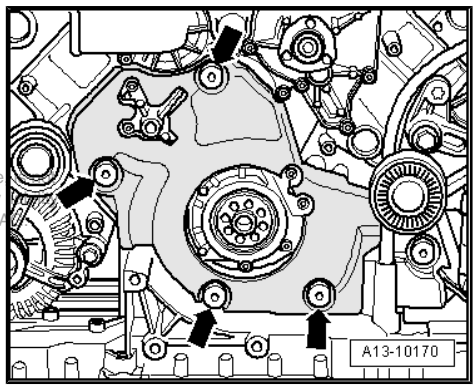
– Unbolt coolant pump pulley -arrows- (counterhold with pin wrench -3212-).
– Remove vibration damper ⇒ page 116 .



– Pry off cover from idler roller for poly V-belt.
– Unscrew bolt -arrow- and detach idler roller from front sealing flange.

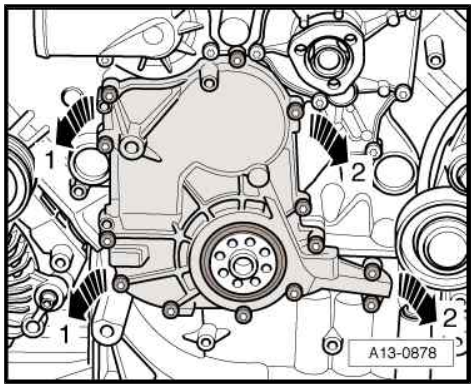


– Detach noise insulation panel from sealing flange (front) -arrows-.



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– Remove bolts.
– Pull off front sealing flange (right-side first -arrow 1-, then left-side -arrow 2-).
– Drive out oil seal with sealing flange removed.



Installing

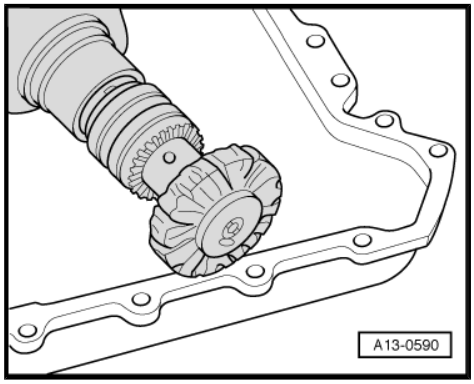
Note

- *Renew gaskets, seals and O-rings.*
- *Hose connections and hoses for charge air system must be free of oil and grease before assembly.*
- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*
- *To ensure that the charge air hoses can be properly secured at their connections, spray rust remover onto the worm thread of used hose clips before installing.*

– Remove old sealant from grooves in sealing flange and from sealing surfaces.

WARNING

Wear safety goggles.

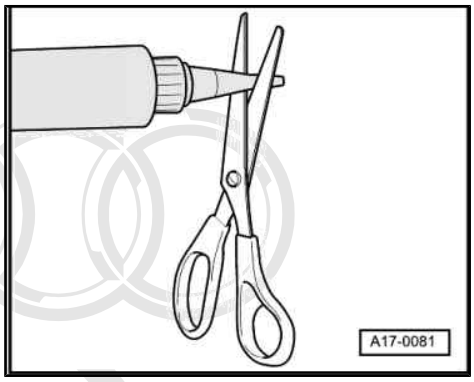


– Remove remaining sealant from sealing flange and cylinder block/sump (top section) with rotating plastic brush or similar.
– Clean sealing surfaces; they must be free of oil and grease.

Note

Note the use-by date of the sealant.

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

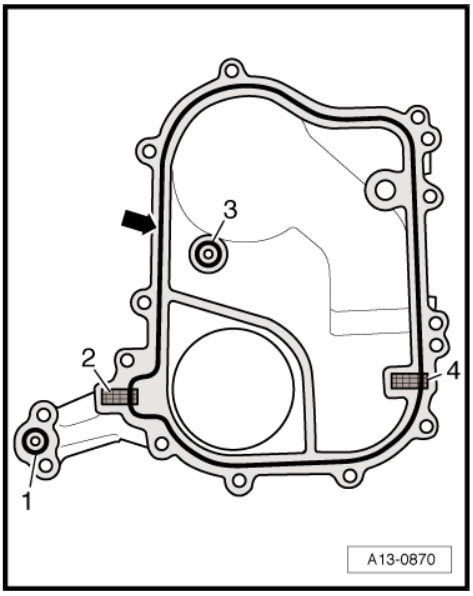


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– Install sealing elements -2- and -4- and O-rings -1- and -3-.

– Apply bead of sealant -arrow- onto clean sealing surface of front sealing flange as illustrated.

• The bead of sealant must project 1.5 … 2.0 mm above the sealing surface.

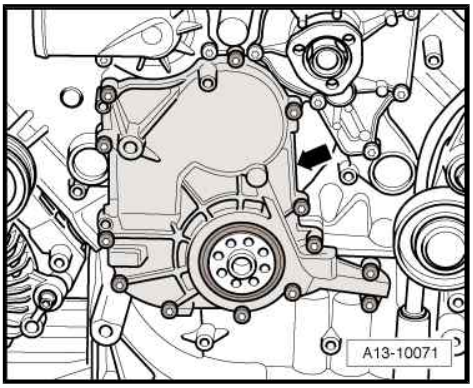


Note

♦ *The sealant bead must not be thicker than specified, otherwise excess sealant could enter the sump and clog the strainer in the oil pump.*

♦ *The front sealing flange must be installed within 5 minutes after applying sealant.*

– Tighten bolts securing front sealing flange -arrow- in diagonal sequence and in stages.



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

– Install crankshaft oil seal (pulley end) ⇒ page 116 .

– Install vibration damper ⇒ page 116 .

– Install poly V-belt ⇒ page 111 .

– Install coolant pipe (right-side) ⇒ page 275 .

– Install toothed belt for high-pressure pump ⇒ Rep. gr. 23 .

Tightening torques

Component	Nm
Front sealing flange to cylinder block	9
Noise insulation to engine	9
Idler roller to sealing flange	23
Poly V-belt pulley to coolant pump	23

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2 Cylinder block (gearbox end)

2.1 Dual-mass flywheel on vehicles with manual gearbox - exploded view

Note

Servicing clutch ⇒ Rep. gr. 30

1 - Dual-mass flywheel
- ❑ Removing and installing ⇒ page 122

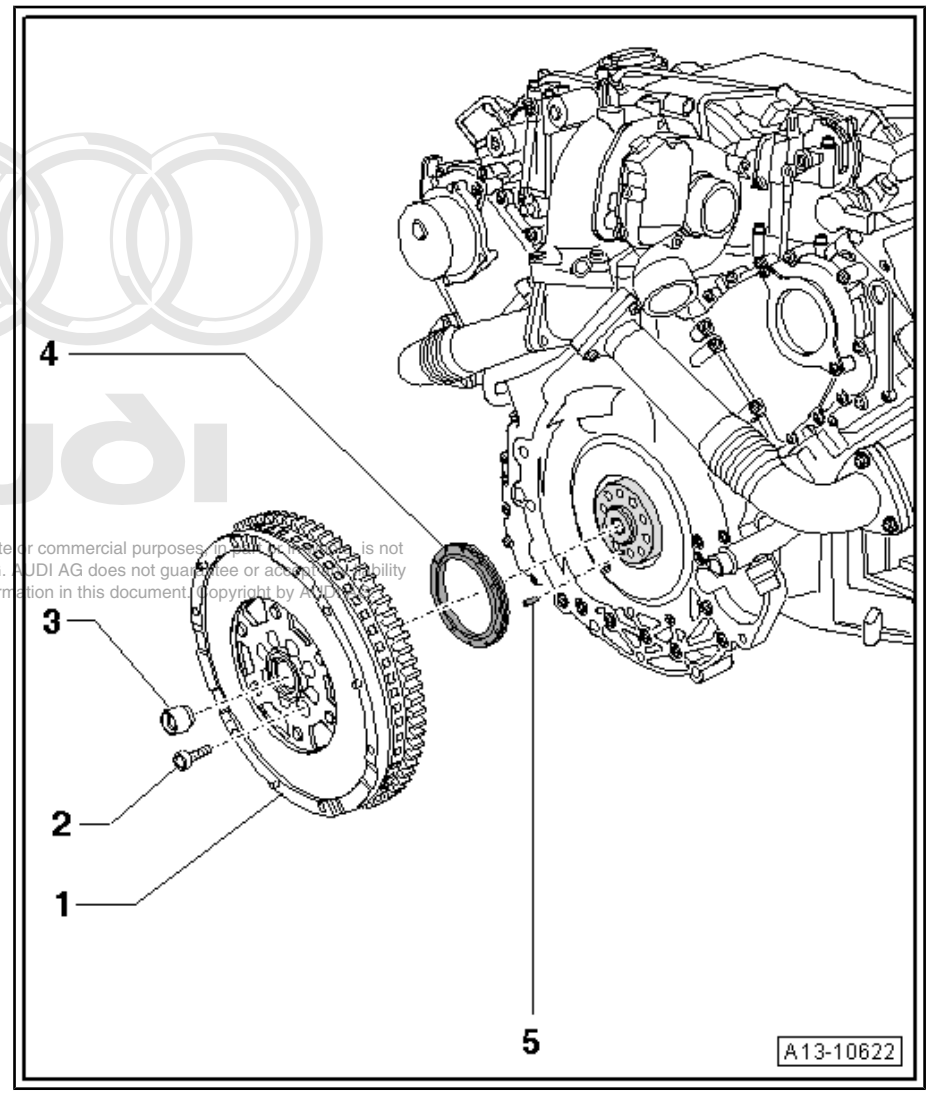
2 - 60 Nm + turn 90° further
- ❑ Renew

3 - Needle bearing
- ❑ Extracting and driving in ⇒ page 124

4 - Crankshaft oil seal (gearbox end)
- ❑ Renewing ⇒ page 129

5 - Dowel pin
- ❑ Allocation ⇒ Electronic parts catalogue

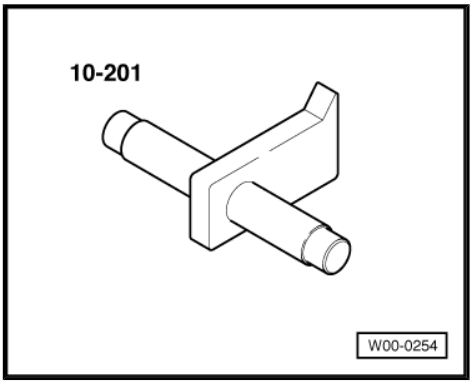
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2.2 Removing and installing dual-mass flywheel

Special tools and workshop equipment required

♦ Counterhold tool -10 - 201-

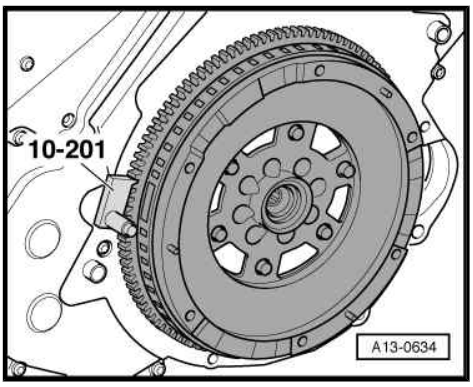


Removing

- Gearbox removed ⇒ Rep. gr. 34 .

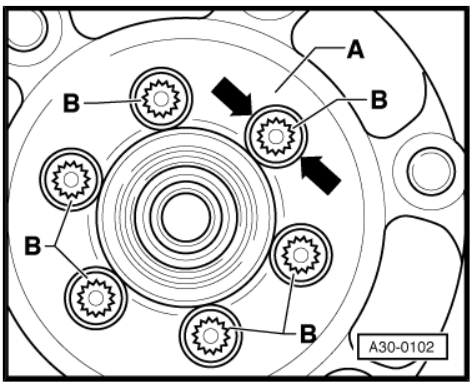
– Remove clutch pressure plate ⇒ Rep. gr. 30 .

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



Note

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



– Rotate the dual-mass flywheel -A- so that the bolts align with the holes -arrows-.

– When unscrewing the bolts, make sure that the bolt heads do not come into contact with the dual-mass flywheel; the flywheel will otherwise be damaged as the bolts are screwed out.

Installing

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

Note

A needle bearing is fitted in the dual-mass flywheel; knock in the needle bearing when fitting a new flywheel *⇒ page 124* .

– Use new securing bolts.

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

– Install clutch pressure plate ⇒ Rep. gr. 30 .

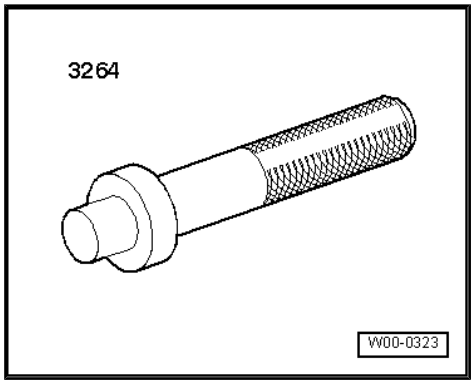
• Tightening torque ⇒ page 122

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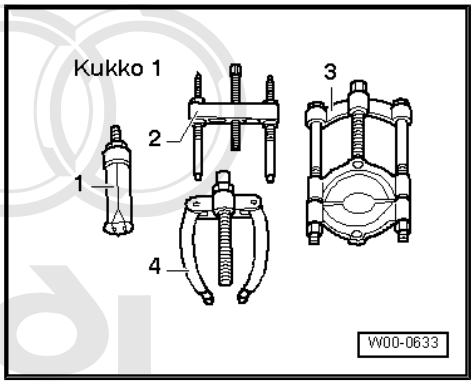
2.3 Extracting and driving in needle bearing for dual-mass flywheel

Special tools and workshop equipment required

- Punch -3264-



- -1- Internal puller Kukko 21/1



- -4- Counter-support Kukko 22/1

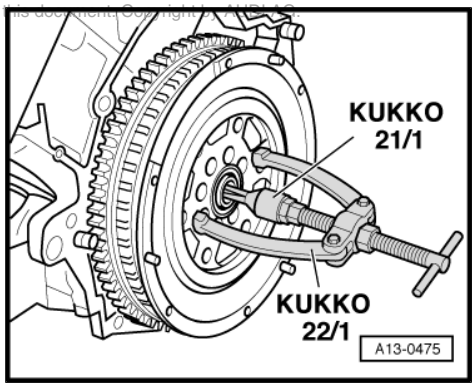
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Procedure

- Gearbox removed ⇒ Rep. gr. 34 .

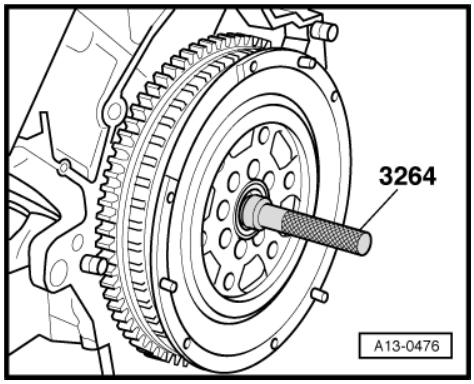
– Remove clutch pressure plate ⇒ Rep. gr. 30 .

– Remove needle bearing using internal puller Kukko 21/1 and counter-support Kukko 22/1.



– Drive needle bearing into dual-mass flywheel as far as the stop using punch -3264- .

– Install clutch pressure plate ⇒ Rep. gr. 30 .



2.4 Flywheel and damper unit on vehicles with multitronic gearbox - exploded view

1 - Damper unit

- ❑ Removing and installing ⇒ page 125

2 - 22 Nm

- ❑ Screw in by hand until they make contact and tighten in diagonal sequence

3 - Flywheel

- ❑ Removing and installing ⇒ page 126

4 - Crankshaft oil seal (gearbox end)

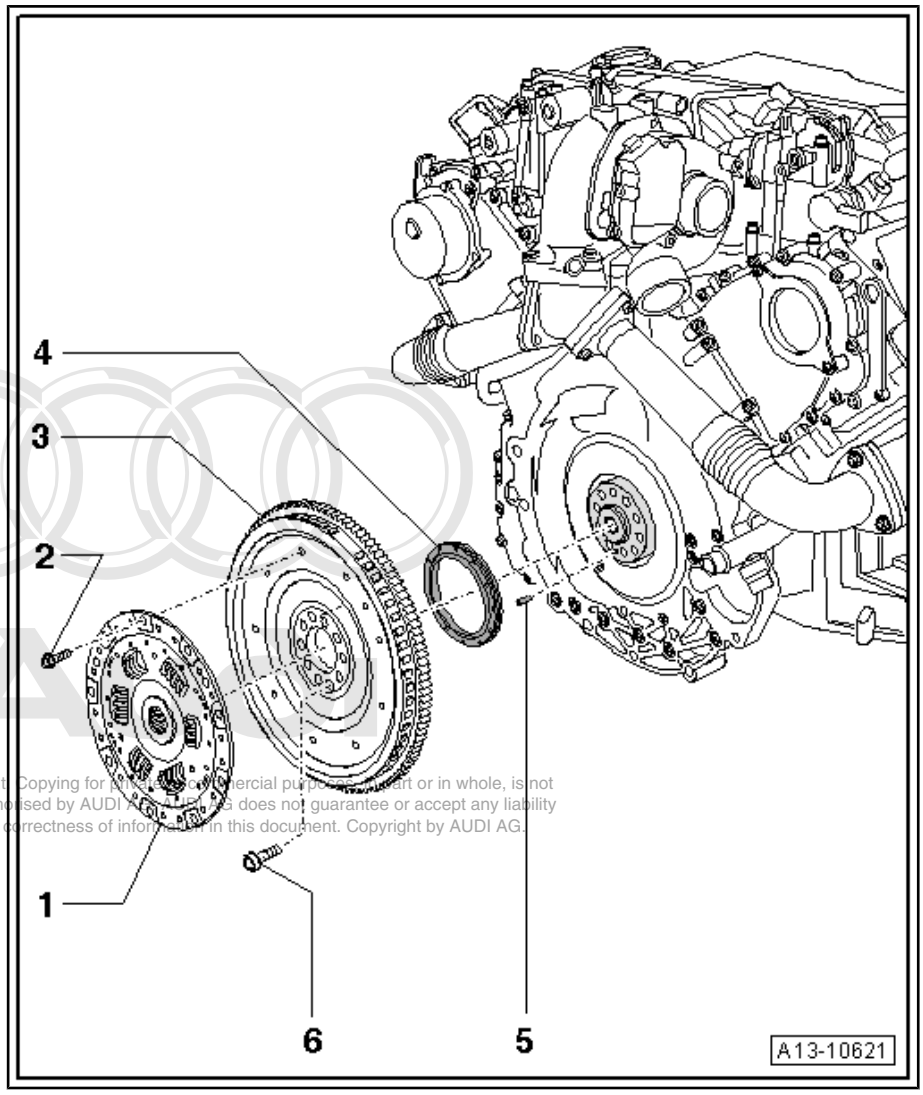
- ❑ Renewing ⇒ page 129

5 - Dowel pin

- ❑ Allocation ⇒ Electronic parts catalogue

6 - 60 Nm + turn 90° further

- ❑ Renew

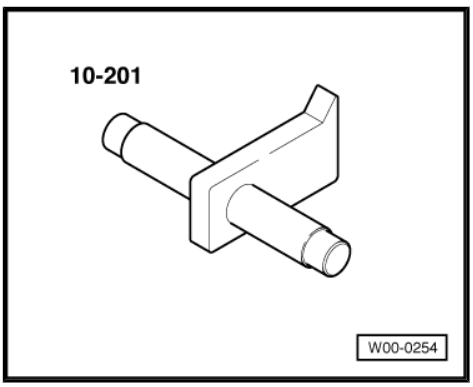


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2.5 Removing and installing damper unit

Special tools and workshop equipment required

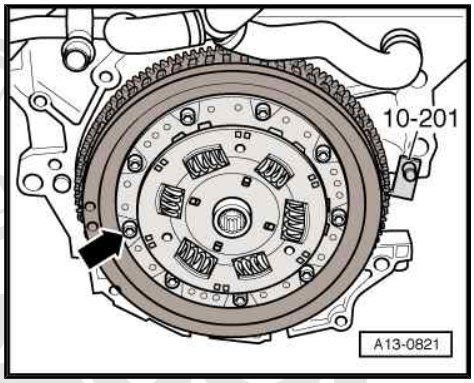
- ♦ Counterhold tool -10 - 201-



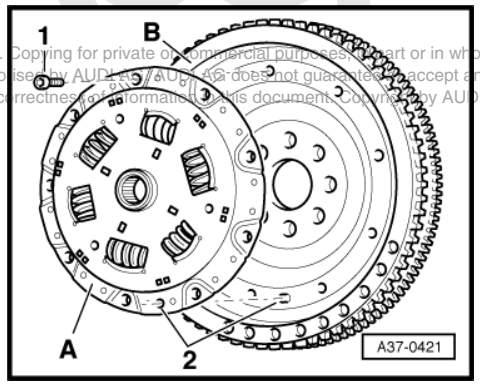
Removing

- Gearbox removed ⇒ Rep. gr. 37 .

– Insert counterhold tool -10 - 201- to slacken bolts -arrow-.



– Remove bolts -1- and detach damper unit -A- from flywheel -B-.



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Installing

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

Note

Allocate damper unit according to gearbox code ⇒ Electronic parts catalogue .

– Fit counterhold tool -10 - 201- the other way round to tighten bolts.

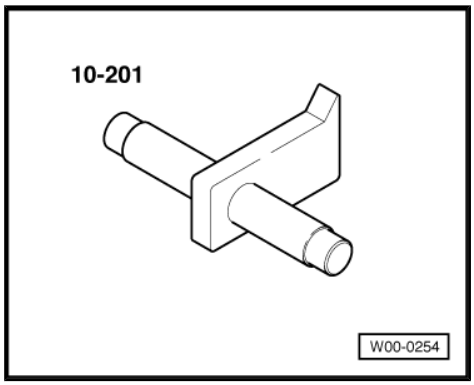
– Align damper unit -A- on flywheel -B-.

- The installation markings -2- must align.
- Tightening torque ⇒ page 125

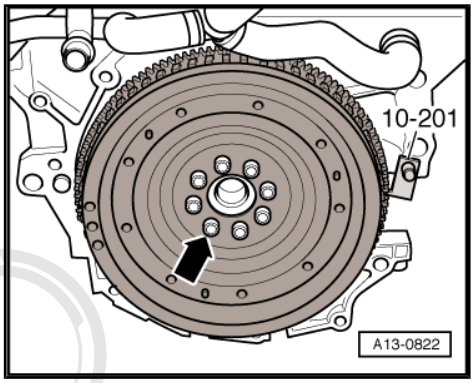
2.6 Removing and installing flywheel

Special tools and workshop equipment required

♦ Counterhold tool -10 - 201-



Removing



- Gearbox removed ⇒ Rep. gr. 37 .
- – Remove damper unit ⇒ page 125 .
- – Insert counterhold tool -10 - 201- to slacken bolts.
- – Remove bolts -arrow- and remove flywheel.

Installing

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

Note

Renew bolts for flywheel.

- – Pay attention to dowel pin when installing flywheel.
- – Fit counterhold tool -10 - 201- the other way round to tighten bolts.
- – Install damper unit ⇒ page 125 .
- Tightening torque ⇒ page 125

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2.7 Drive plate on vehicles with automatic gearbox - exploded view

1 - Drive plate

- ❑ Removing and installing ⇒ page 128
- ❑ After renewing the drive plate on vehicles up to approx. 01.2006, the pin assignment for the engine speed sender - G28- must be altered accordingly ⇒ page 129

2 - Washer

- ❑ Thickness 1.5 mm

3 - 30 Nm + turn 90° further

- ❑ Renew

4 - Dowel sleeve

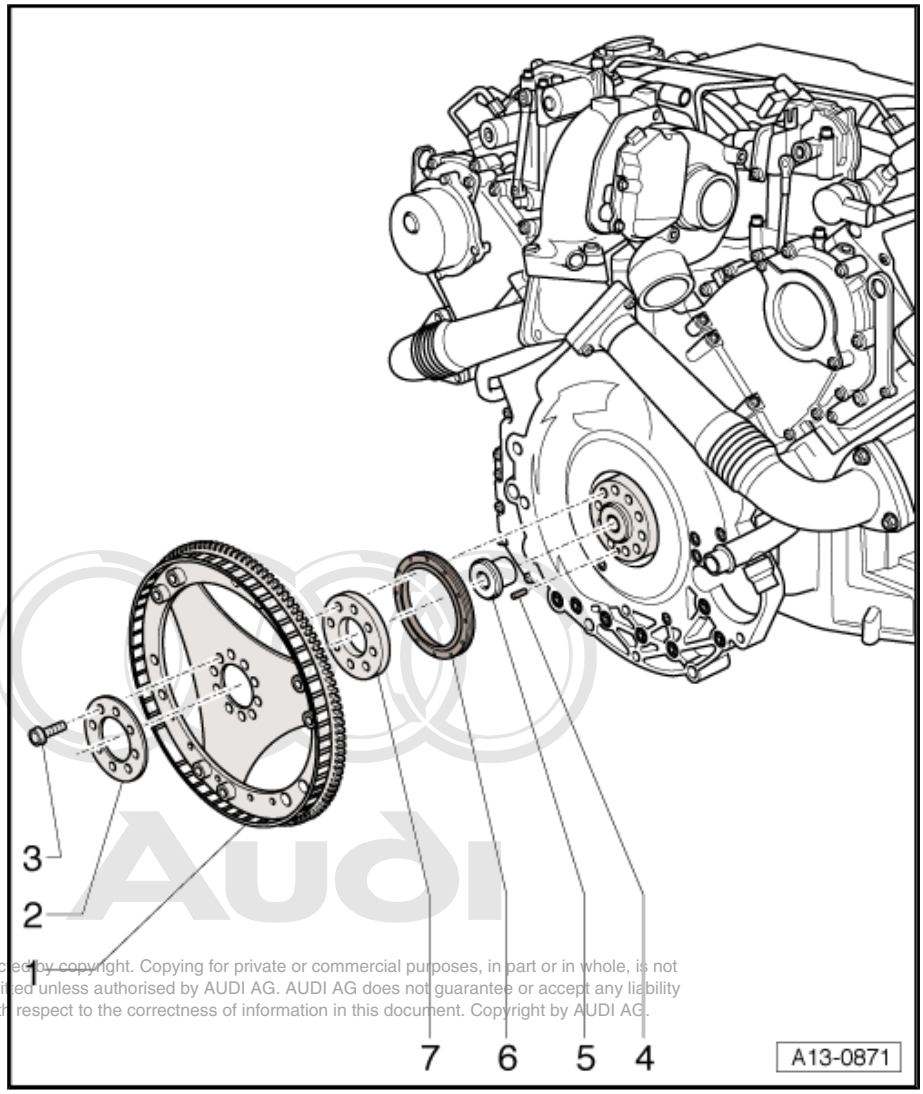
5 - Centring sleeve for torque converter

6 - Crankshaft oil seal (gearbox end)

- ❑ Removing and installing ⇒ page 129

7 - Shim

- ❑ Thickness 1.5 mm

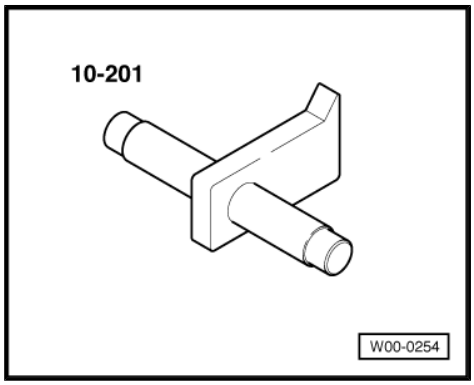


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2.8 Removing and installing drive plate

Special tools and workshop equipment required

- ♦ Counterhold tool -10 - 201-



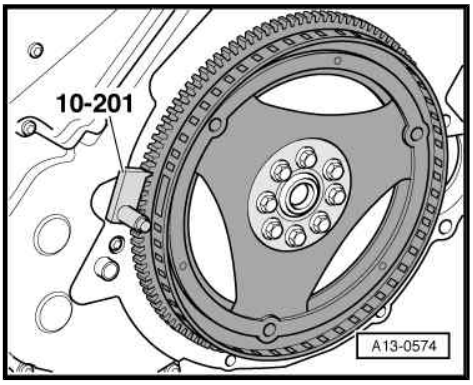
Removing

- Engine/gearbox removed.

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

– Unbolt drive plate.

– Take out shim located behind.



Installing

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

– Fit shim (1.5 mm) onto crankshaft.

– Install drive plate with washer (1.5 mm).

– Use new securing bolts.

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

Vehicles up to approx. 01.2006:

If the drive plate -059 105 323 AG- has to be replaced, only the drive plate -059 105 323 AL- is available as a replacement part. When this new drive plate has been installed, the pin assignment of the electrical connector for the engine speed sender -G28- must be altered as follows:

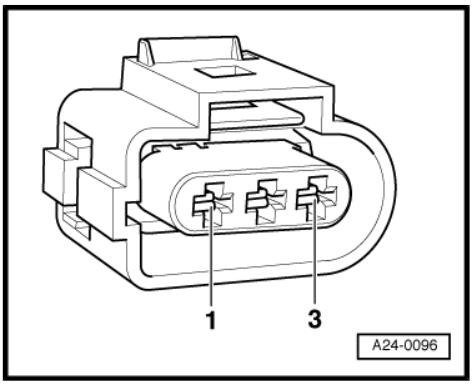
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♦ Pin assignment (old) for engine speed sender -G28- in combination with drive plate -059 105 323 AG-

1 - Black

2 - Grey

3 - Blue

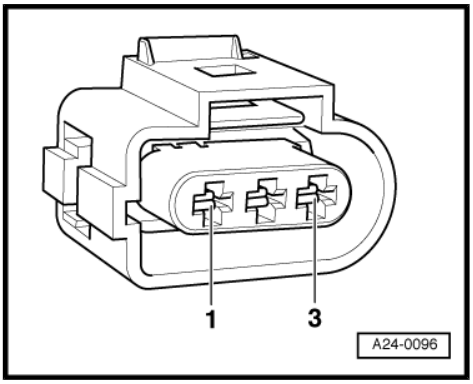


♦ Pin assignment (new) for engine speed sender -G28- in combination with drive plate -059 105 323 AL-

1 - Black

2 - Blue

3 - Grey

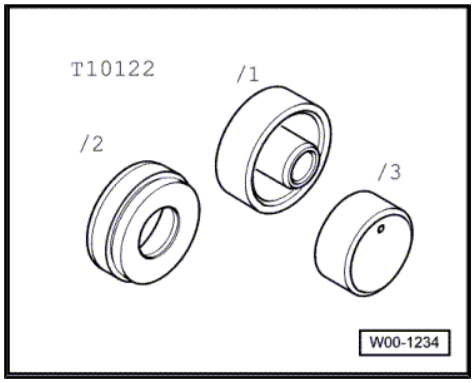


- Tightening torque ⇒ page 127

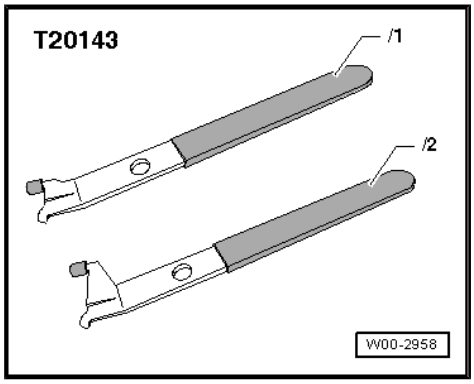
2.9 Renewing crankshaft oil seal (gearbox end)

Special tools and workshop equipment required

♦ Fitting tool -T10122-



♦ Extractor tool -T20143-



Procedure

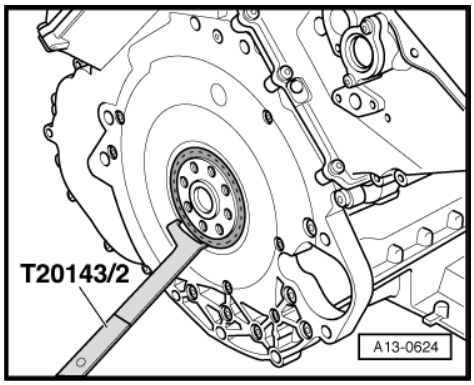
- Engine/gearbox removed.

– Remove dual-mass flywheel on vehicles with manual gearbox ⇒ page 122 .

– Remove flywheel on vehicles with multitronic gearbox ⇒ page 126 .

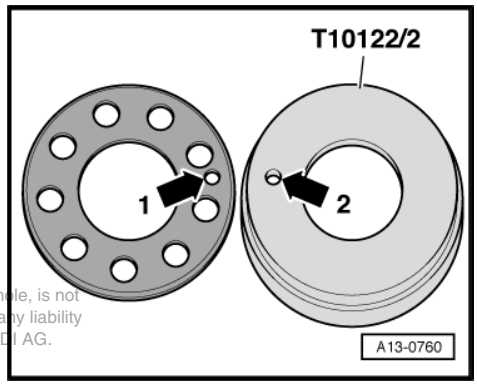
– Remove drive plate on vehicles with automatic gearbox ⇒ page 128 .

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



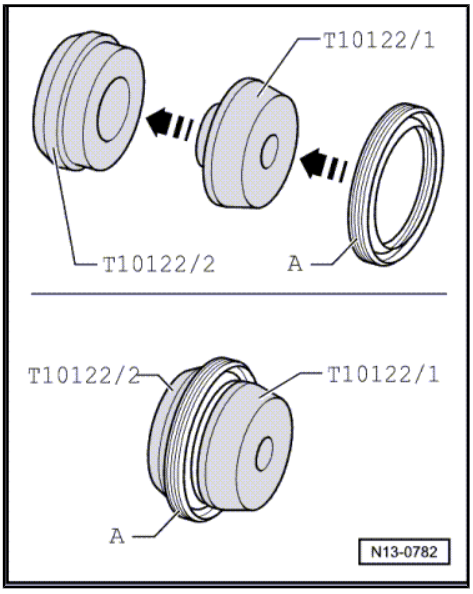
– Modify assembly sleeve -T10122/2- by drilling an 8 mm ∅ hole -arrow 2- for the dowel sleeve.

– Use hole -arrow 1- in washer as a drilling template.



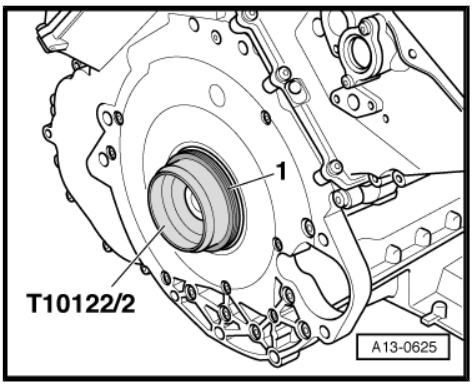
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– Clean running surface and sealing surface.
– Fit assembly aid -T10122/1- onto assembly sleeve -T10122/2- and slide oil seal -A- onto assembly sleeve.
– Take off assembly aid.

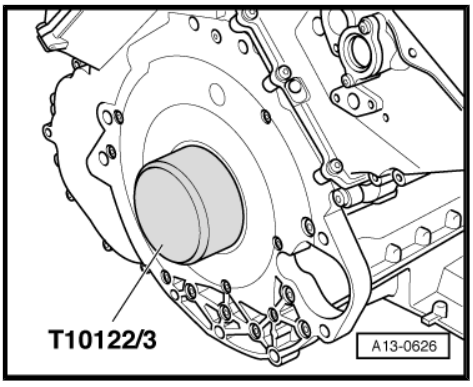


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– Fit assembly sleeve with oil seal onto crankshaft.



– Press in oil seal with thrust sleeve -T10122/3- evenly so that it is flush all round.
– Install dual-mass flywheel on vehicles with manual gearbox ⇒ page 122 .
– Install flywheel on vehicles with multitronic gearbox ⇒ page 126 .
– Install drive plate on vehicles with automatic gearbox ⇒ page 128 .

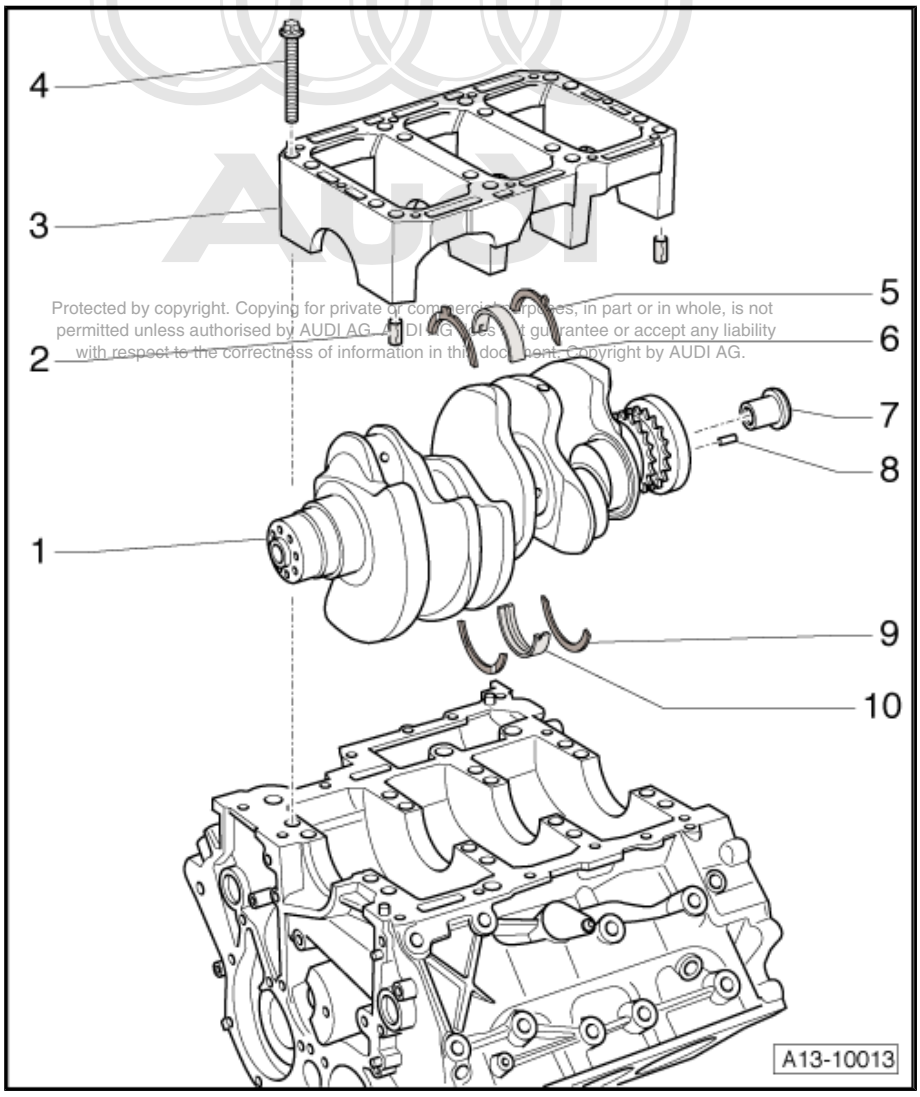


3 Crankshaft

Note

When performing assembly work, secure engine to engine and gearbox support -VAS 6095- ⇒ page 95 .

3.1 Crankshaft - exploded view



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1 - Crankshaft

- ❑ Measuring axial clearance ⇒ page 134
- ❑ Measuring radial clearance ⇒ page 135
- ❑ Do not rotate the crankshaft when checking the radial clearance
- ❑ Crankshaft dimensions ⇒ page 134

2 - Dowel sleeve

- ❑ 2x
- ❑ Insert in cylinder block

3 - Retaining frame

- ❑ Installing ⇒ page 133

4 - Bolt

- ❑ Renew
- ❑ Tightening sequence ⇒ page 133

5 - Thrust washer

- ❑ Only fitted on 3rd crankshaft bearing
- ❑ Oil grooves face outwards
- ❑ Note location
- ❑ Measuring axial clearance of crankshaft ⇒ page 134

6 - Bearing shell

- ❑ For retaining frame
- ❑ Do not interchange used bearing shells (mark positions)
- ❑ Bearing shells worn down to the base layer must be renewed
- ❑ Install new bearing shells for retaining frame with correct coloured markings ⇒ page 134

7 - Centring sleeve for torque converter

- ❑ For vehicles with automatic gearbox ⇒ page 134

8 - Dowel pin

- ❑ Check that pin is firmly seated in crankshaft

9 - Thrust washer

- ❑ Only fitted on 3rd crankshaft bearing
- ❑ Oil grooves face outwards

- ❑ Note location
- ❑ Measuring axial clearance of crankshaft ⇒ page 134

10 - Bearing shell

- ❑ For cylinder block (with oil groove)
- ❑ Do not interchange used bearing shells (mark positions)
- ❑ Bearing shells worn down to the base layer must be renewed
- ❑ Install new bearing shells for the cylinder block with the correct coloured markings ⇒ page 133

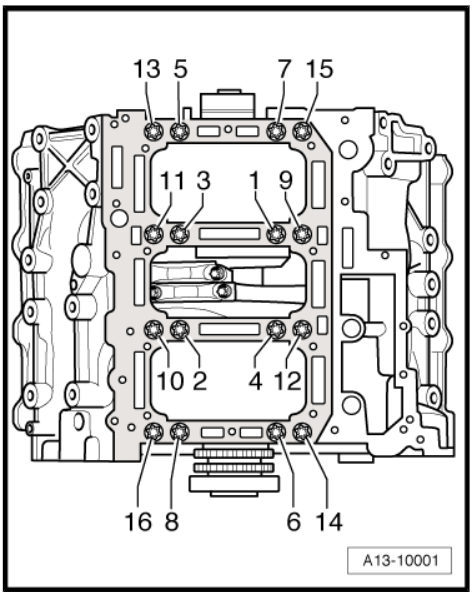
Installing retaining frame

– Renew bolts -1 … 16-.

– Fit both dowel sleeves into cylinder block.

– Tighten securing bolts for retaining frame in the following sequence:

1. Tighten bolts -1 ... 16- to 30 Nm with torque wrench.
2. Tighten bolts -1 ... 16- to 50 Nm with torque wrench.
3. Turn bolts -1 ... 16- 90° further using a rigid wrench.



Matching crankshaft bearing shells to bearings in cylinder block

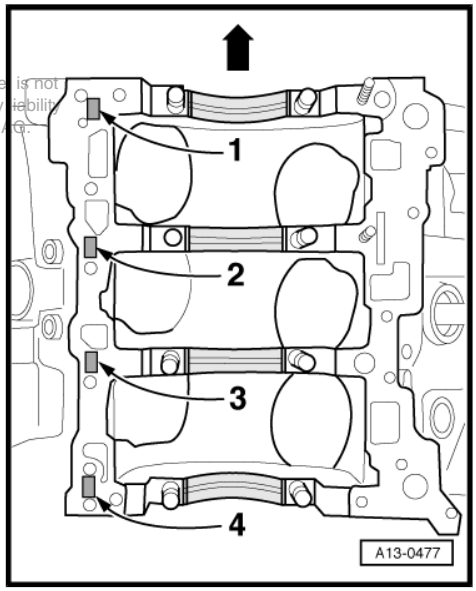
Bearing shells of the correct thickness are matched to the bearings in the cylinder block at the factory. Coloured dots on the bearing shells are used to identify the bearing shell thickness.

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- The -arrow- points to pulley end.

The allocation of the bearing shells to the cylinder block is identified by a code letter next to the relevant bearing.

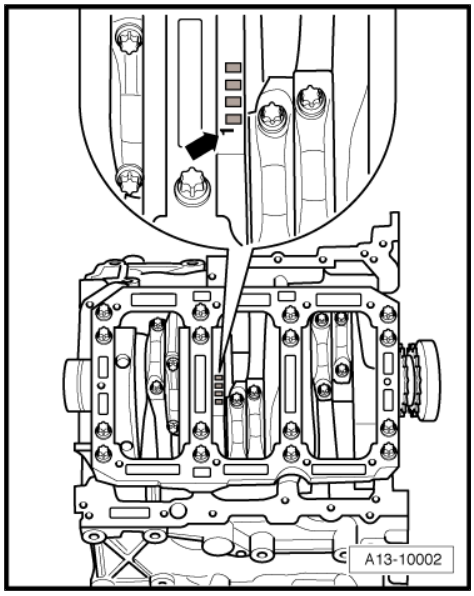
Letter on cylinder block	Colour coding of bearing
R =	Red
G =	Yellow
B =	Blue



Matching crankshaft bearing shells to bearings in retaining frame

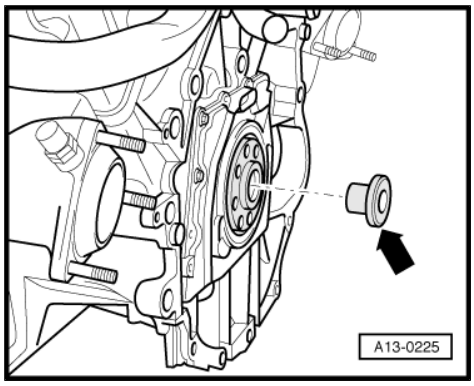
- Bearing shells of the correct thickness are assigned to the bearing caps at the factory. Coloured dots on the bearing shells are used to identify the bearing shell thickness.
- The correct allocation of bearing shells to crankshaft is indicated by a sequence of letters on the crankshaft web. The number „1“ -arrow- preceding the sequence of letters indicates the colour code for bearing 1.

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



Centring sleeve for torque converter

– On vehicles with automatic gearbox, check that centring sleeve -arrow- is fitted in rear of crankshaft. Drive in centring sleeve if necessary.



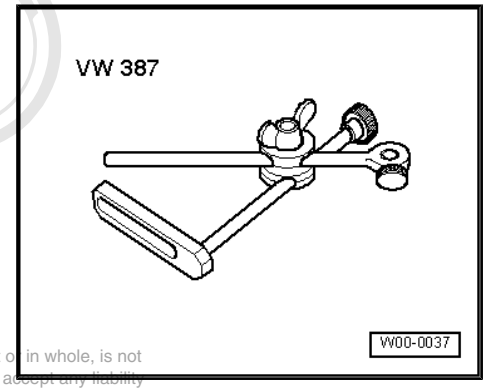
3.2 Crankshaft dimensions

Honing dimension	Crankshaft bearing journal Ø mm	Crankshaft conrod journal Ø mm
Basic dimension	65.000 – 0.022 – 0.042	60.000 – 0.022 – 0.042

3.3 Measuring axial clearance

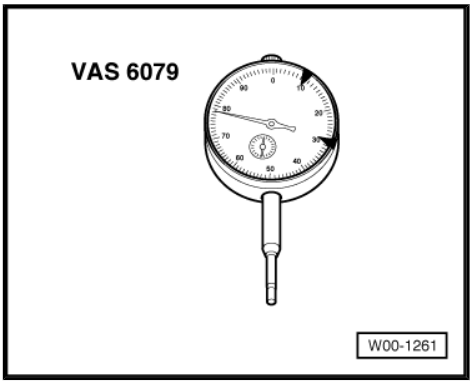
Special tools and workshop equipment required

- Universal dial gauge bracket -VW 387-



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♦ Dial gauge -VAS 6079-

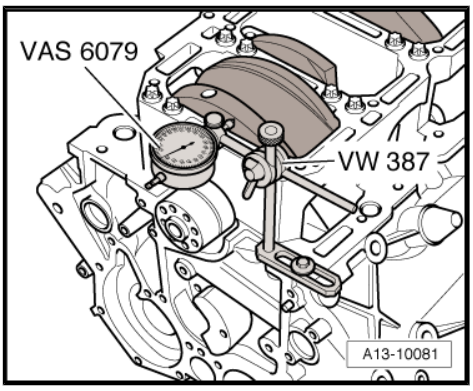


Procedure

– Bolt dial gauge with universal dial gauge bracket -VW 387- onto cylinder block and apply gauge against crank web.

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

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



Axial clearance:

- New: 0.090 ... 0.215 mm.
- Wear limit: 0.280 mm.

3.4 Measuring radial clearance

Special tools and workshop equipment required

♦ Plastigage

Procedure

Note

♦ *Do not interchange used bearings.*

♦ *Bearing shells worn down to the base layer must be renewed.*

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– Remove retaining frame and clean bearing journals.

– Place a length of Plastigage corresponding to the width of the bearing on the bearing journal or bearing shell.

- The Plastigage must be positioned in the centre of the bearing shell

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

– Remove retaining frame once more.

– Compare width of Plastigage with measurement scale:

Radial clearance:

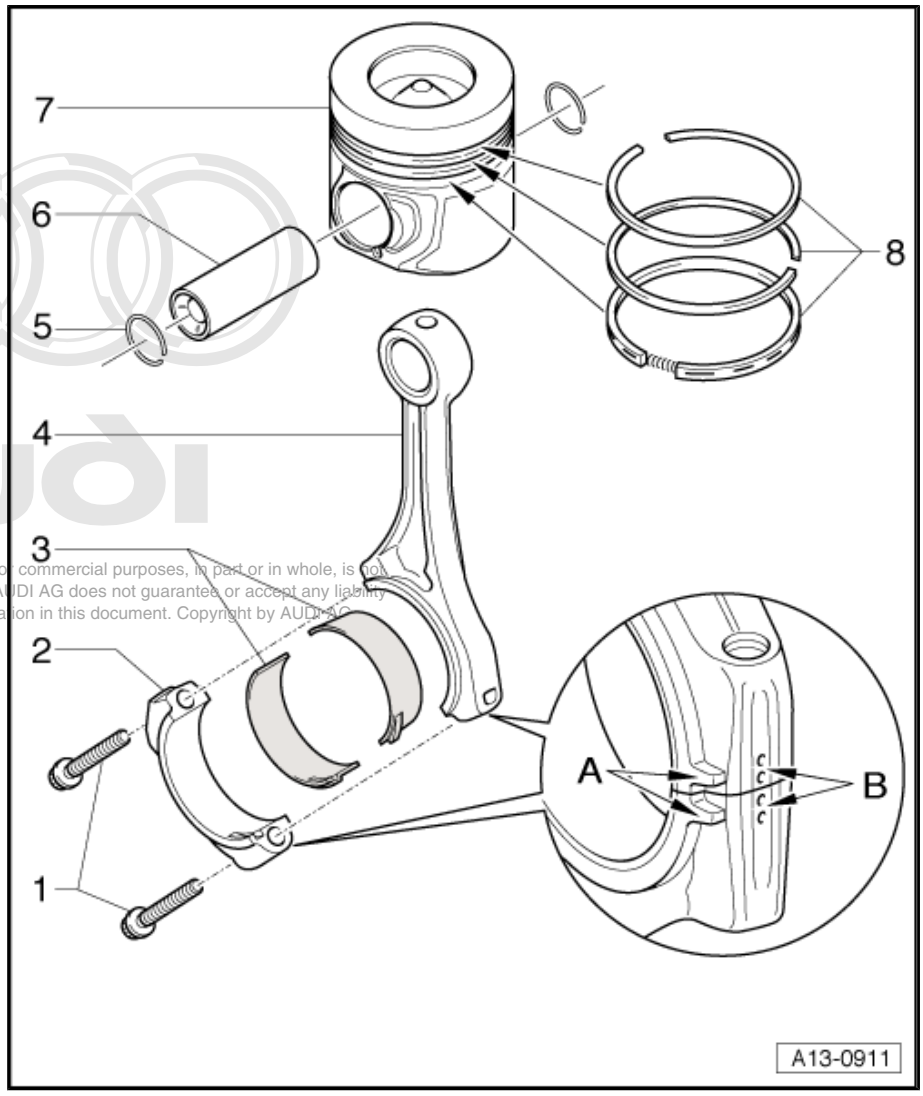
- New: 0.018 ... 0.045 mm.
- Wear limit: 0.10 mm.

4 Pistons and conrods

Note

Oil spray jet for piston cooling ⇒ page 137 .

4.1 Pistons and conrods - exploded view



1 - Conrod bolt, 30 Nm + turn 90° further

- ❑ Renew
- ❑ Lubricate threads and contact surface

2 - Conrod bearing cap

- ❑ Do not interchange
- ❑ Mark cylinder allocation with a coloured pen -B- ⇒ page 138
- ❑ Installation position: Note position of lugs on casting -A-

3 - Bearing shells

- ❑ Note installation position
- ❑ Do not interchange used bearing shells (mark positions)
- ❑ Bearing shells worn down to the base layer must be renewed

4 - Conrod

- ❑ Only renew as a complete set
- ❑ Mark cylinder allocation with a coloured pen -B- ⇒ page 138
- ❑ Installation position: Note position of lugs on casting -A-
- ❑ Axial clearance for each conrod pair (when new): 0.20 … 0.44 mm
- ❑ Measuring radial clearance ⇒ page 141

5 - Circlip

6 - Piston pin

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

7 - Piston

- ❑ With combustion chamber
- ❑ Mark installation position and cylinder number ⇒ page 138
- ❑ Checking ⇒ page 138
- ❑ Install using piston ring clamp
- ❑ If cracking is visible on piston skirt, renew piston

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- ❑ Piston and cylinder dimensions ⇒ page 141
- ❑ Checking piston projection at TDC ⇒ page 139
- ❑ Checking cylinder bore ⇒ page 138

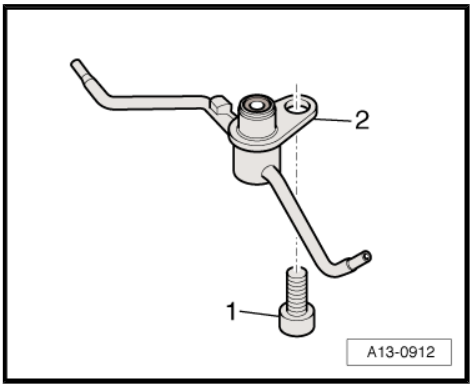
8 - Piston rings

- ❑ Offset gaps by 120°
- ❑ Use piston ring pliers to remove and install
- ❑ „TOP“ must face towards piston crown
- ❑ Checking ring gap ⇒ page 137
- ❑ Checking ring-to-groove clearance ⇒ page 137

Oil spray jet for piston cooling

1 - Bolt, 9 Nm

2 - Oil spray jet with spray nozzle valve for piston cooling



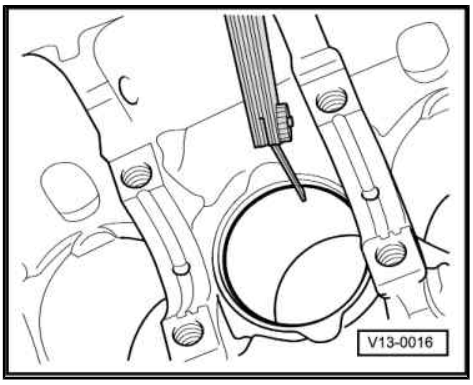
Note

- ♦ *Take care not to bend oil spray jets.*
- ♦ *Always renew bent oil spray jets.*

Checking piston ring gap

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

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

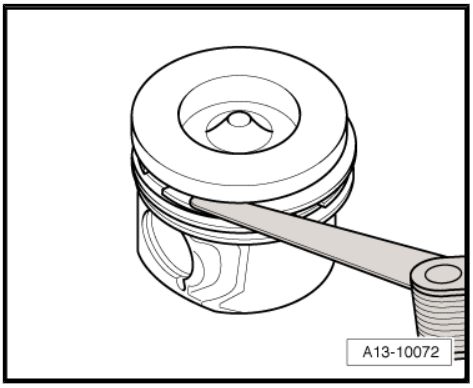


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Piston ring	new mm	Wear limit mm
1st compression ring	0.25 … 0.38	0.80
2nd compression ring	0.70 … 0.90	1.30
Oil scraper ring	0.40 (maximum)	0.70

Checking ring-to-groove clearance

– Clean groove in piston before checking clearance.



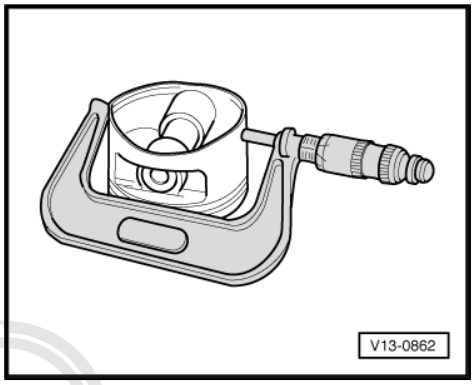
Piston ring	new mm	Wear limit mm
1st compression ring	0.120 … 0.160	0.175
2nd compression ring	0.020 … 0.090	0.115
Oil scraper ring	0.020… 0.090	0.115

Checking piston

– Using a micrometer (75 ... 100 mm), measure approx. 10 mm from the lower edge, perpendicular to the piston pin axis.

• Maximum deviation from nominal dimension: 0.05 mm.

Nominal dimension
⇒ „4.3 Piston and cylinder dimensions“, page 141 .

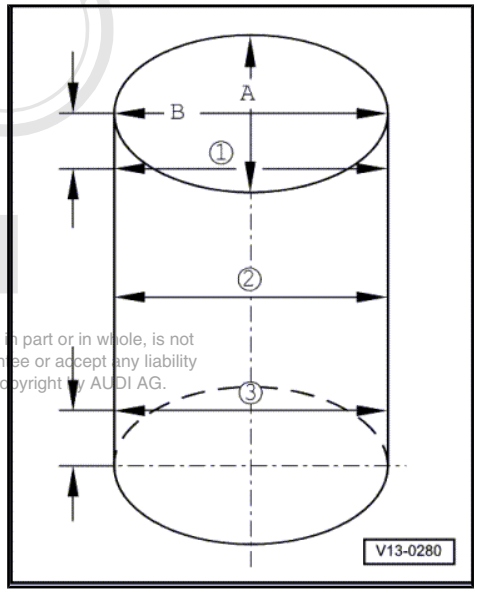


Checking cylinder bore

– Use 50 ... 100 mm internal dial gauge to take measurements at 3 points in transverse direction -A- and longitudinal direction -B-.

• Maximum deviation from nominal dimension: 0.08 mm.

Nominal dimension
⇒ „4.3 Piston and cylinder dimensions“, page 141 .



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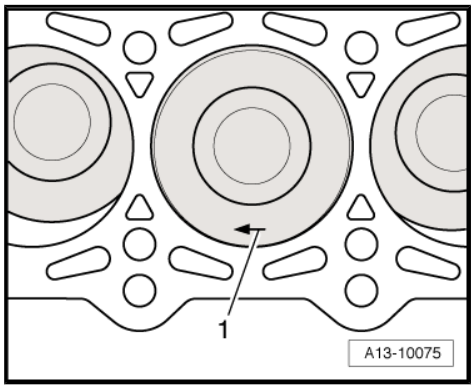
Installation position of pistons

• Installation position: Arrow -item 1- on piston crown points to pulley end.

Note

♦ *If used pistons are being re-installed, use chalk or waterproof felt-tip pen to mark installation position and cylinder number on piston crown.*

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



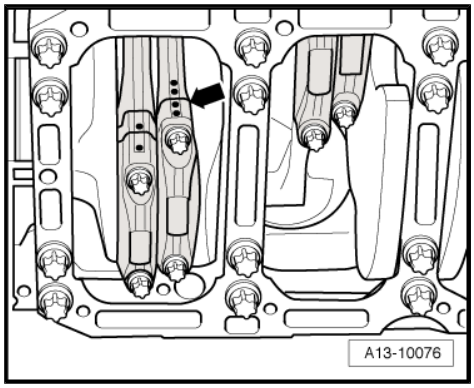
Marking conrods

– Before removing, mark mating positions of conrods and con-rod bearing caps with coloured pen -arrow-.

Note

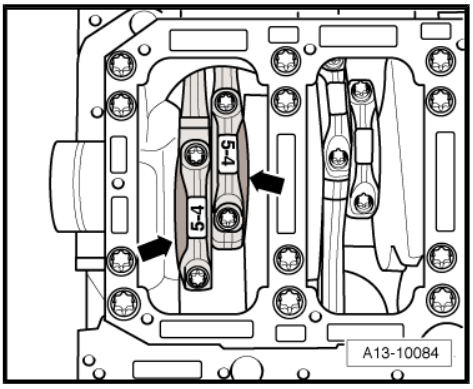
♦ *Only renew conrods as a complete set.*

♦ *Do not interchange conrod bearings.*



Conrod installation position

The larger contact shoulder on the conrod -arrows- faces towards the adjacent crankshaft bearing.



Note

Illustration shows front pair of conrods.

4.2 Checking piston projection at TDC

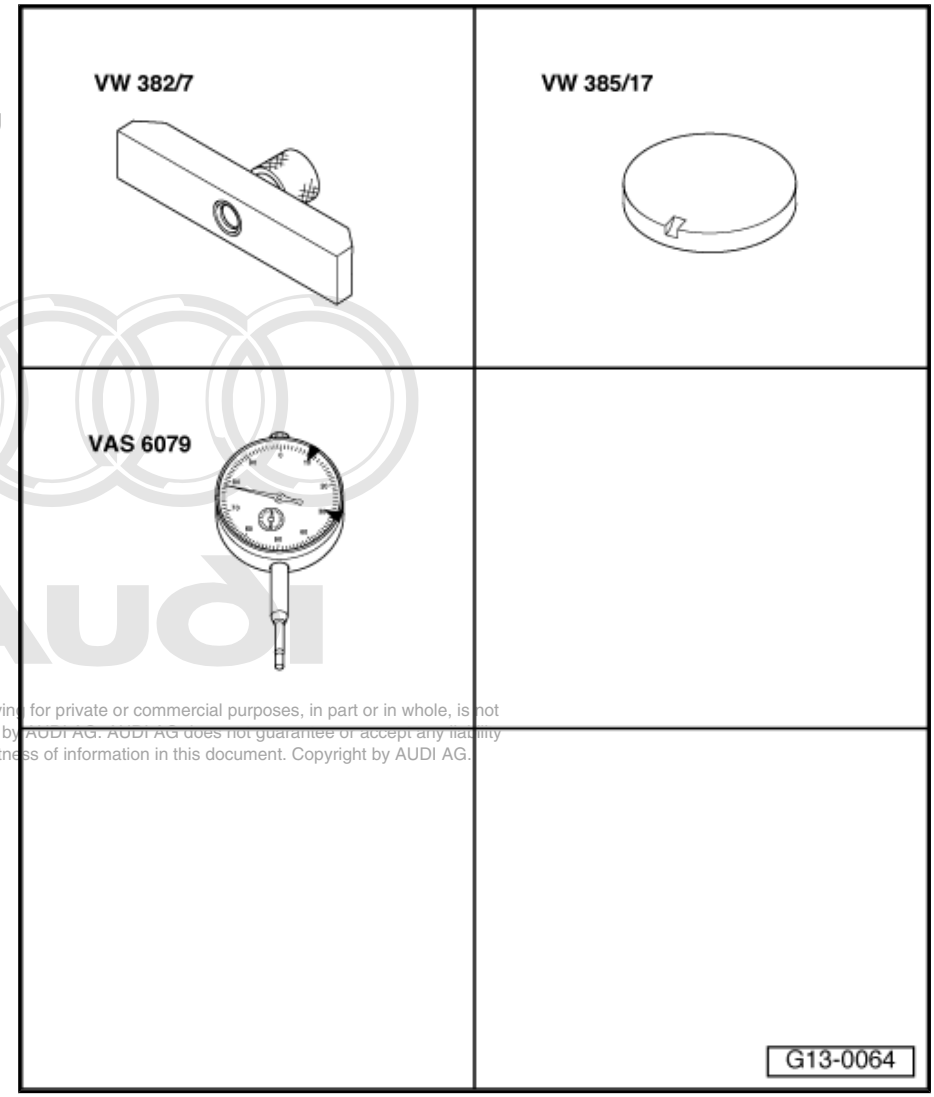
Note

- *Piston projection at TDC must be measured when installing new pistons or a short engine. Depending upon piston projection, install the corresponding cylinder head gasket according to the table below:*
- *If the measured values for piston projection are not the same for all pistons, use the highest value to determine the correct gasket size.*
- *The cylinder head gasket must be determined separately for each cylinder bank.*

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Special tools and workshop equipment required

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



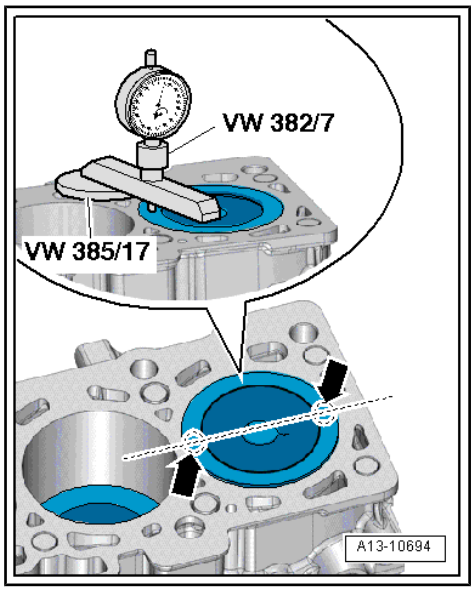
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Procedure

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

– Measure projection at each piston at both locations marked with -arrows- (seen in longitudinal direction of engine: at front and rear of piston).

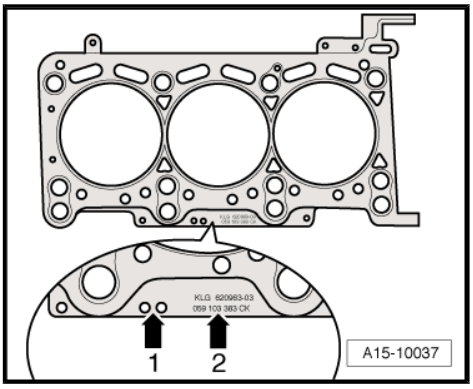
Piston projection above top surface of cylinder block	Identification (No. of holes)
0.39 … 0.49 mm	1
0.49 … 0.54 mm	2
0.54 … 0.65 mm	3



Identification of cylinder head gasket

1 - Holes

2 - Part No.



Note

The gaskets for the left and right cylinder heads have different shapes and cannot be interchanged.

4.3 Piston and cylinder dimensions

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Honing dimension	Piston Ø mm	Cylinder bore Ø mm
Basic dimension	82.939 … 82.951 1)	83.006 … 83.014
Repair oversize	82.979 … 82.991 1)	83.046 … 83.054

• 1) Dimensions not including coating (thickness 0.02 mm). The coating will wear down in service.

4.4 Checking radial clearance of conrod bearings

Special tools and workshop equipment required

♦ Plastigage

Note

♦ *Do not interchange used bearings.*

♦ *Bearing shells worn down to the base layer must be renewed.*

Procedure

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

– Place a length of Plastigage corresponding to the width of the bearing on the bearing journal or bearing shell.

– Fit conrod bearing cap and tighten to 30 Nm. Do not rotate crankshaft.

– Remove conrod bearing cap once more.

– Compare width of Plastigage with measurement scale:

Radial clearance

• New: 0.015 ... 0.062 mm.

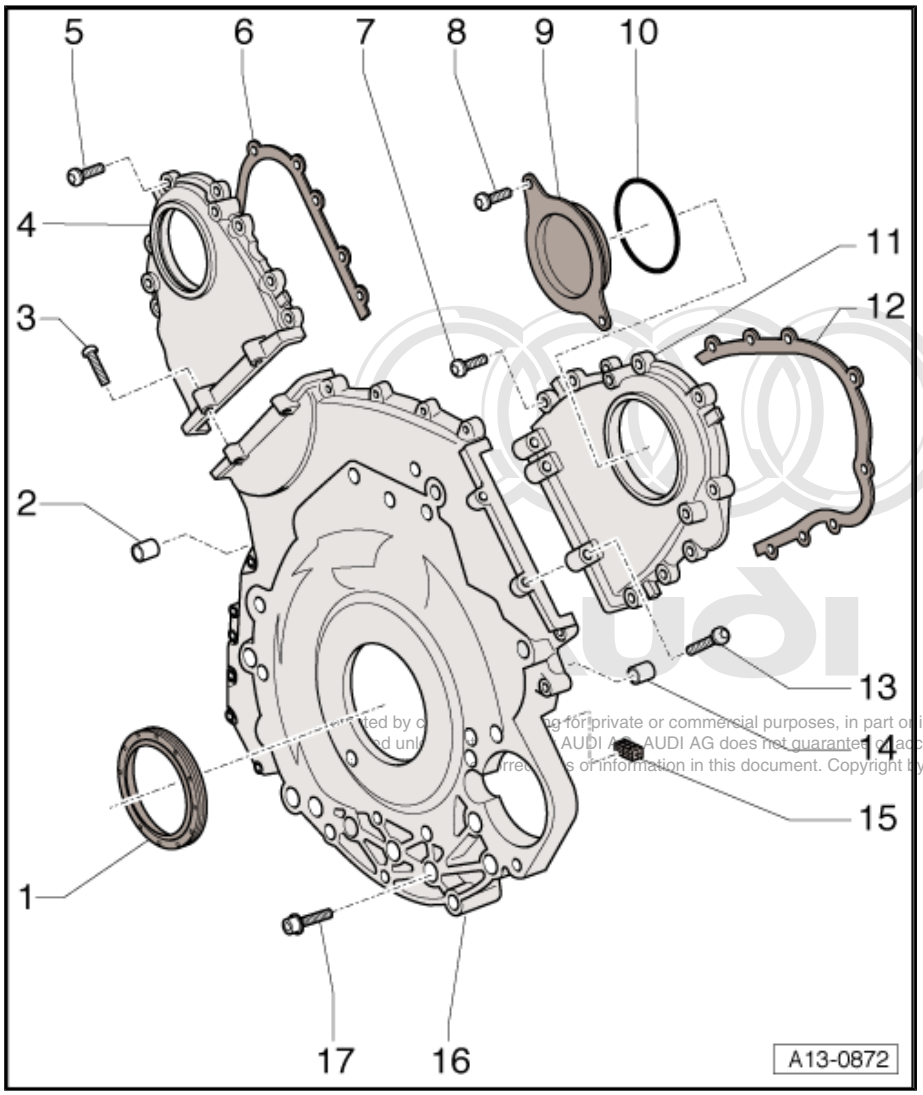
• Wear limit: 0.12 mm.

– Renew conrod bolts.

15 – Cylinder head, valve gear

1 Chain drive

1.1 Timing chain covers - exploded view



1 - Crankshaft oil seal (gearbox end)
- ❑ Removing and installing ⇒ page 129

2 - Dowel sleeve
- ❑ 2x

3 - Bolt
- ❑ Renew
- ❑ Note correct sequence when tightening ⇒ page 148

4 - Timing chain cover (left-side)
- ❑ Removing and installing ⇒ page 143

5 - Bolt
- ❑ Renew
- ❑ Note correct sequence when tightening ⇒ page 148

6 - Gasket
- ❑ Renew

7 - Bolt
- ❑ Renew
- ❑ Note correct sequence when tightening ⇒ page 148

8 - 9 Nm

9 - Cover plate

10 - O-ring
- ❑ Renew

11 - Timing chain cover (right-side)
- ❑ Removing and installing ⇒ page 143

12 - Gasket
- ❑ Renew

13 - Bolt
- ❑ Renew
- ❑ Note correct sequence when tightening ⇒ page 148

14 - Dowel sleeve
- ❑ 2x

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15 - Sealing element

- ❑ 2x

16 - Timing chain cover (bottom)

- ❑ Removing and installing ⇒ page 143

17 - M6 = 9 Nm; M8 = 23 Nm

- ❑ Note correct sequence when tightening ⇒ page 146

1.2 Removing and installing timing chain covers

Special tools and workshop equipment required

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

Removing

- Gearbox removed ⇒ Rep. gr. 34 or ⇒ Rep. gr. 37 .
- Engine oil drained ⇒ Maintenance ; Booklet 405 .

Note

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

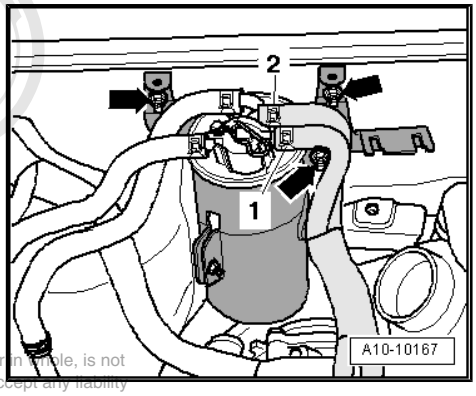
– Remove dual-mass flywheel on vehicles with manual gearbox ⇒ page 122 .

– Remove flywheel on vehicles with multitronic gearbox ⇒ page 126 .

– Remove drive plate on vehicles with automatic gearbox ⇒ page 128 .

Caution

Rules for cleanliness when working on the injection system ⇒ page 6 .



– Disconnect fuel return hose -1- and fuel supply hose -2- from fuel filter.

– Remove bracket with fuel filter from plenum chamber partition panel -arrows-.

– Place fuel filter with bracket to one side.

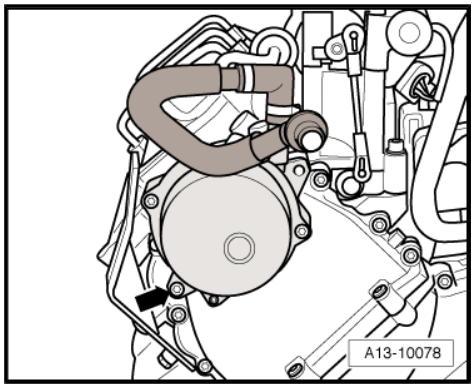
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– Remove coolant pipe (rear) ⇒ page 282 .

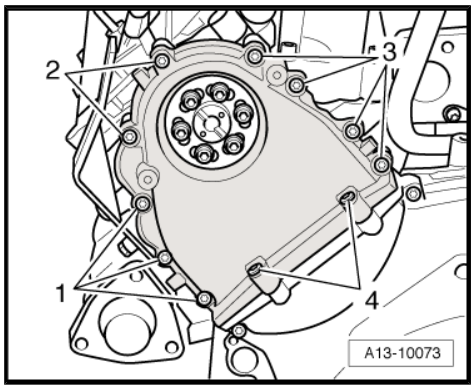
– Remove turbocharger ⇒ page 300 .

– Remove intermediate pipe: left-side ⇒ page 376 , right-side ⇒ page 377 .

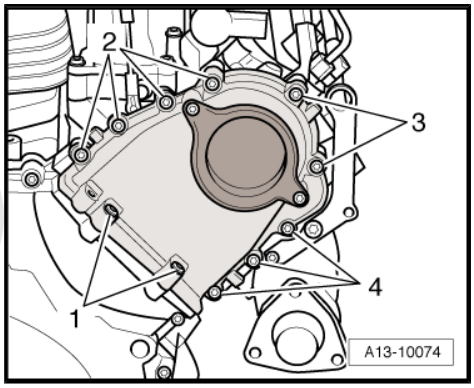
– Unscrew bolt -arrow- and detach vacuum pump for brake servo.



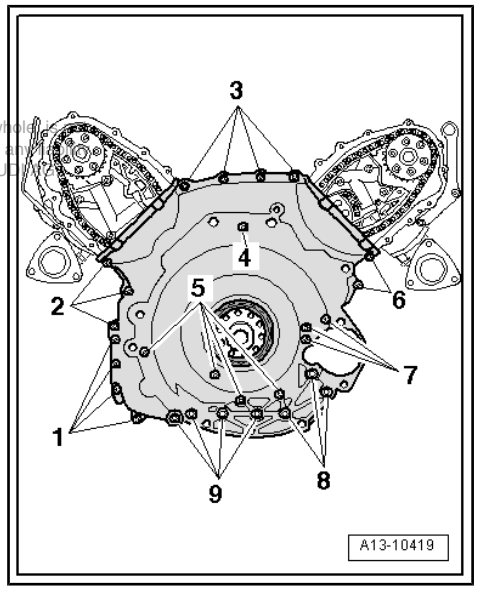
– Remove bolts -1 ... 4- and detach timing chain cover (left-side).



– Remove bolts -1 ... 4- and detach timing chain cover (right-side).



– Remove bolts -1 … 9- and remove timing chain cover (bottom).
– Press out crankshaft oil seal (rear) from timing chain cover (bottom).



Installing

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Note

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

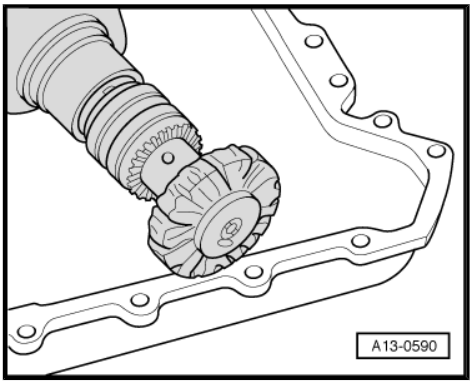
– Remove old sealant from grooves in timing chain covers and from sealing surfaces.

WARNING

Wear safety goggles.

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

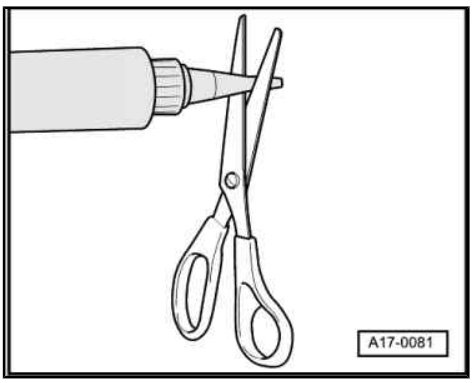
– Clean sealing surfaces; they must be free of oil and grease.



Note

Note the use-by date of the sealant.

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



Note

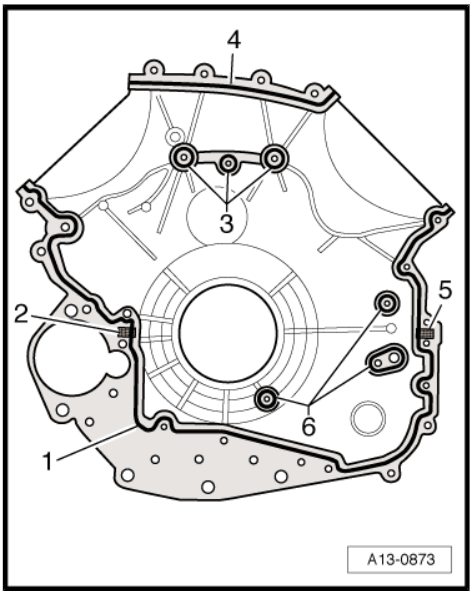
- *The sealant beads must not be thicker than specified, otherwise excess sealant could enter the sump and clog the strainer in the oil pump.*
- *The timing chain covers must be installed within 5 minutes after applying sealant.*

– Insert sealing elements -2- and -5-

– Apply beads of sealant -1- and -4- onto clean sealing surfaces of timing chain cover (bottom) as illustrated.

- The grooves on the sealing surfaces must be completely filled with sealant.
- The bead of sealant must project 1.5 … 2.0 mm above the sealing surface.
- The beads of sealant around drillings -3- and -6- must be 1.5 … 2.0 mm thick.

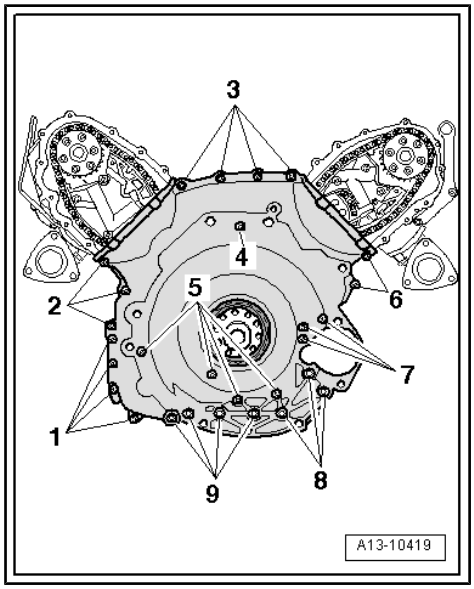
– Check whether the two dowel sleeves are fitted in the cylinder block; install if necessary.



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– Fit timing chain cover (bottom) and tighten bolts as follows:

Stage	Tighten
I	– Tighten bolts -1 … 9- to 5 Nm in diagonal sequence starting from inside and working outwards.
II	– Tighten bolts -1 … 7- to 9 Nm in diagonal sequence starting from inside and working outwards.
III	– Tighten bolts -8- and -9- to 23 Nm.

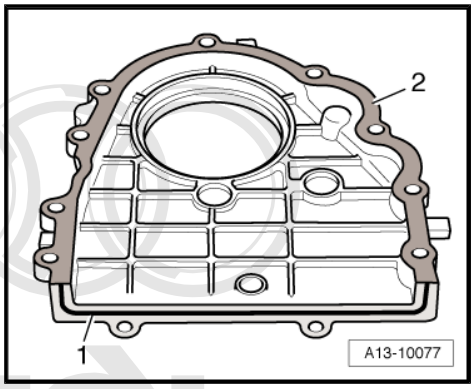


Timing chain cover (left-side)

– Apply bead of sealant onto clean sealing surface of timing chain cover (left-side) as illustrated.

- The groove -1- on the sealing surface must be completely filled with sealant.
- The bead of sealant must project 1.5 … 2.0 mm above the sealing surface.

– Fit gasket -2-.



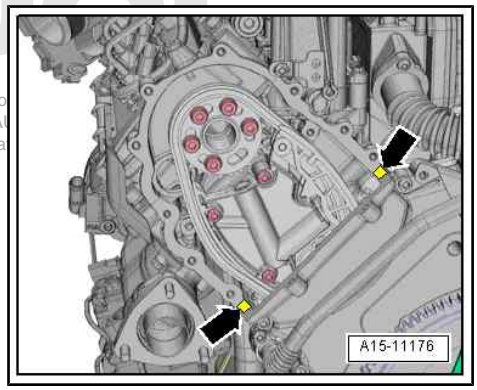
– Apply a bead of sealant (∅ 3 mm) at each joint between cylinder head and timing chain cover (bottom) -arrow-, as shown in illustration.

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Caution

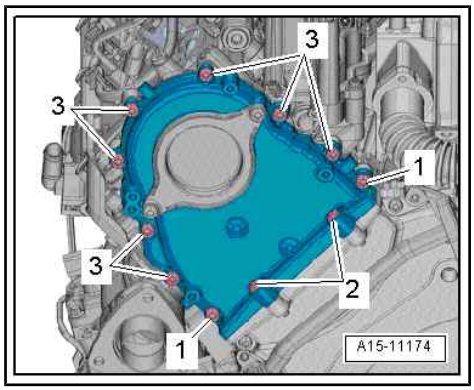
Make sure lubrication system is not clogged by excess sealant.

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

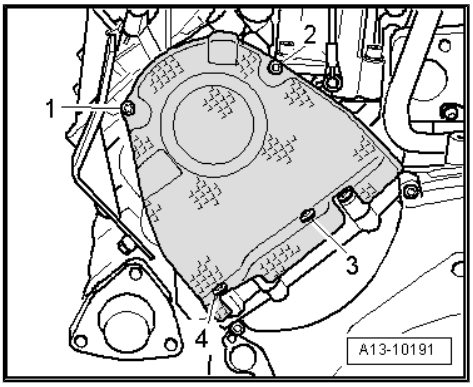


– Fit timing chain cover (left-side) and tighten bolts as follows:

Stage	Bolts	Tightening torque
1.	-1-	3 Nm
2.	-2-	9 Nm
3.	-1-	9 Nm
4.	-3-	9 Nm in diagonal sequence



– Secure heat shield with bolts -1 … 4-.

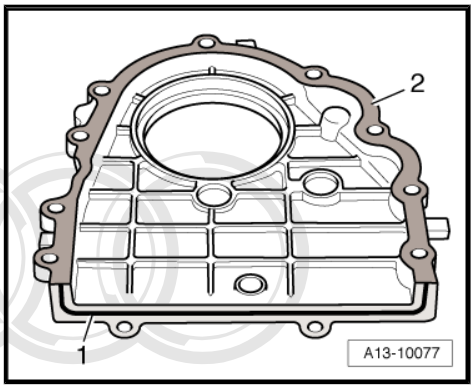


Timing chain cover (right-side)

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

- The groove -1- on the sealing surface must be completely filled with sealant.
- The bead of sealant must project 1.5 … 2.0 mm above the sealing surface.

– Fit gasket -2-.

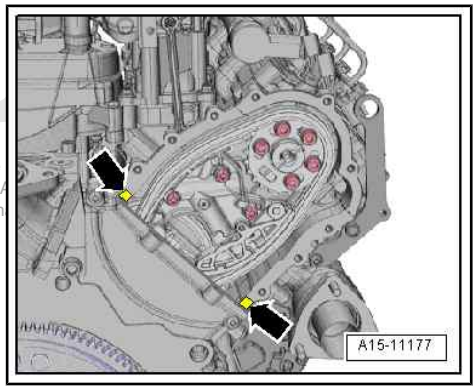


– Apply a bead of sealant (∅ 3 mm) at each joint between cylinder head and timing chain cover (bottom) -arrow-, as shown in illustration.

Caution

Make sure lubrication system is not clogged by excess sealant.

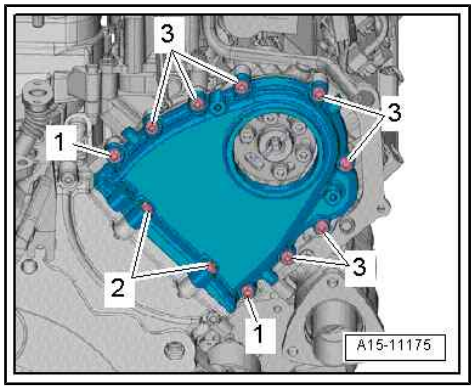
- ***The sealant bead must not be thicker than specified.***



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– Fit timing chain cover (right) and tighten bolts as follows:

Stage	Bolts	Tightening torque
1.	-1-	3 Nm
2.	-2-	9 Nm
3.	-1-	9 Nm
4.	-3-	9 Nm in diagonal sequence



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

– Install intermediate pipe: left-side ⇒ page 376 , right-side ⇒ page 377 .
– Install turbocharger ⇒ page 300 .
– Install coolant pipe (rear) ⇒ page 282 .
– Install vacuum pump ⇒ Rep. gr. 47 .
– Install starter catalytic converter: vehicles with automatic gearbox ⇒ page 343 .
– Install starter catalytic converter: vehicles with manual gearbox ⇒ page 341 .
– Install crankshaft oil seal (gearbox end) ⇒ page 129 .
– Install dual-mass flywheel (vehicles with manual gearbox) ⇒ page 122 .
– Install flywheel (on a vehicle with multitronic gearbox ⇒ page 126).
– Install drive plate (vehicles with automatic gearbox) ⇒ page 128 .
– Fill up with engine oil and check oil level ⇒ Maintenance ; Booklet 803 or ⇒ Maintenance ; Booklet 805 .

Tightening torques

Component		Nm
Timing chain cover (bottom) to engine	M6	9
	M8	23

1.3 Camshaft timing chain - exploded view

Camshaft timing chain (left-side)

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1 - 5 Nm + turn 90° further

- ❑ Renew

2 - Thrust washer for drive sprocket

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

4 - 5 Nm + turn 90° further

- ❑ Renew

5 - Chain tensioner for timing chain (left-side)

6 - Chain sprocket for inlet camshaft

- ❑ Side with lettering faces towards gearbox

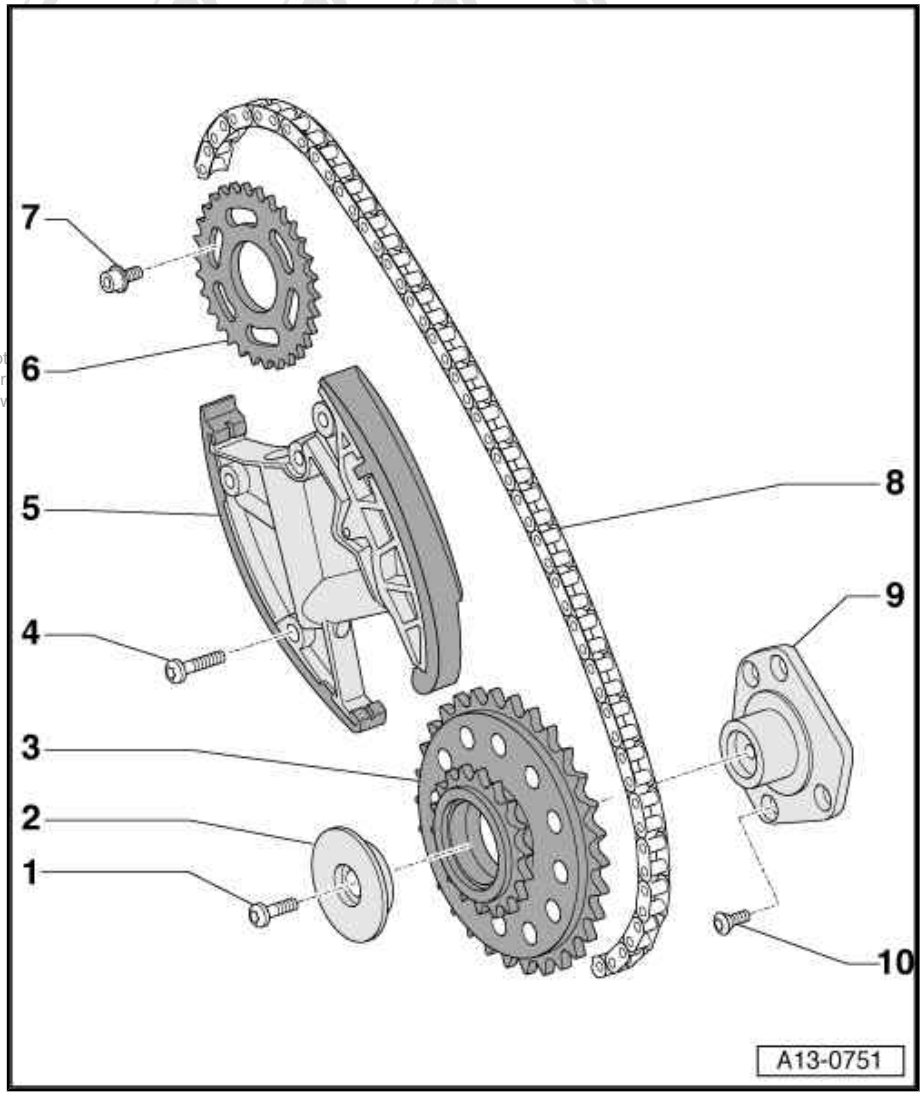
7 - 23 Nm

8 - Camshaft timing chain (left-side)

- ❑ Before removing, mark running direction with paint
- ❑ Removing and installing ⇒ page 160
- ❑ Removing from camshafts ⇒ page 151

9 - Bearing bracket for drive sprocket

10 - 9 Nm



Camshaft timing chain (right-side)

1 - 45 Nm

2 - Bearing mounting for drive sprocket

3 - Camshaft timing chain (right-side)

- ❑ Before removing, mark running direction with paint
- ❑ Removing and installing ⇒ page 160
- ❑ Removing from camshafts ⇒ page 151

4 - Chain sprocket for inlet camshaft

- ❑ Side with lettering faces towards gearbox

5 - 23 Nm

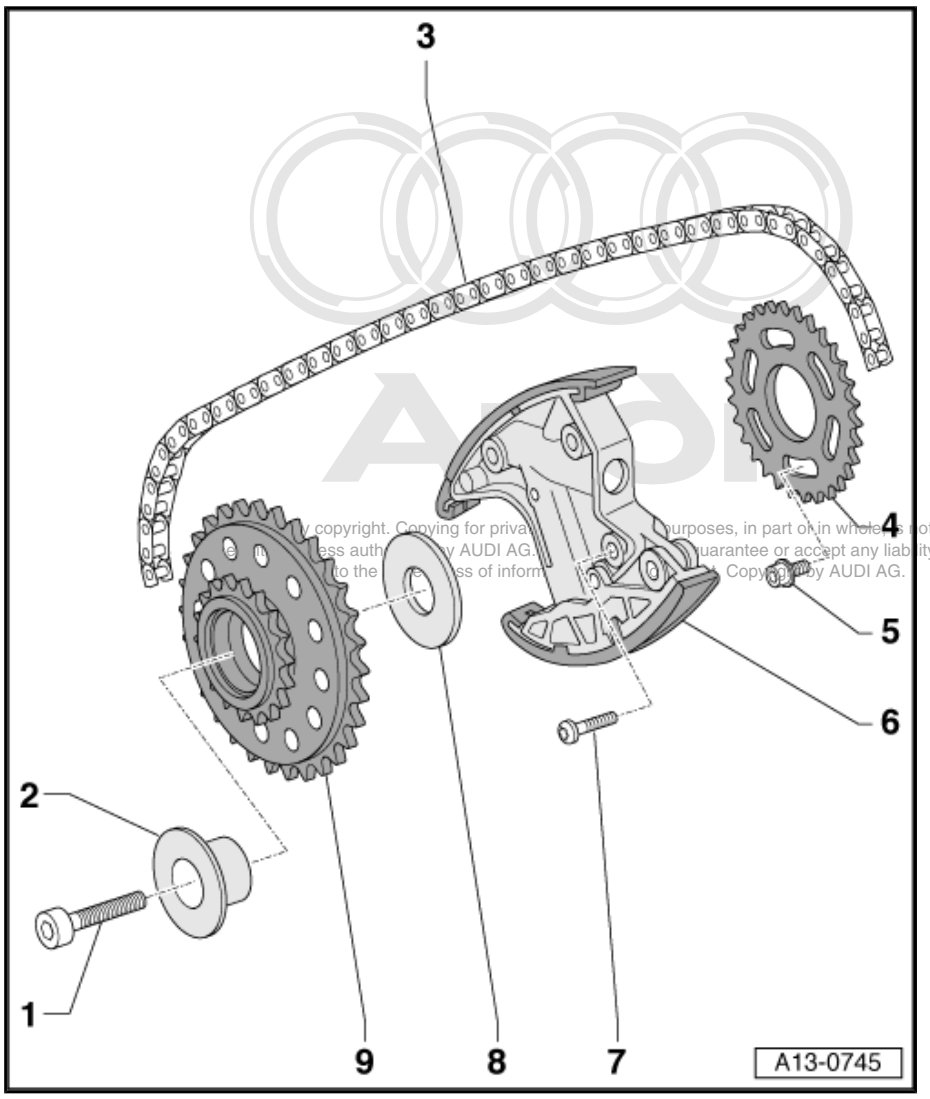
6 - Chain tensioner for timing chain (right-side)

7 - 5 Nm + turn 90° further

- ❑ Renew

8 - Thrust washer for drive sprocket

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

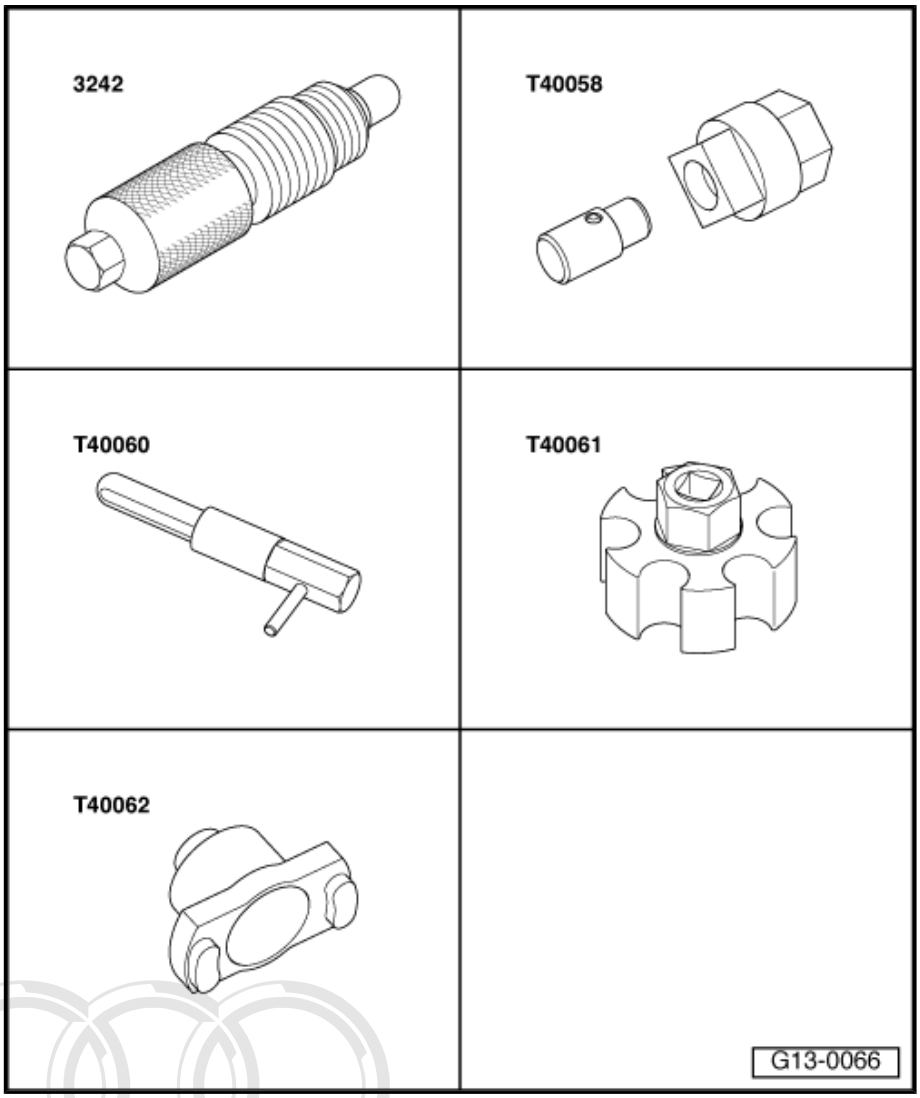


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1.4 Removing camshaft timing chain from camshafts

Special tools and workshop equipment required

- Locking pin -3242-
- Adapter -T40058-
- 2x Adjustment pin -T40060-
- Adapter -T40061-
- Adapter -T40062-
- Drill bit 3.3 mm ∅ (2x)



Note

When working on one cylinder head only, it is not necessary to remove the timing chain cover on the opposite cylinder head as well. In this case it is only necessary to remove the vacuum pump for brake servo or the sealing cap because the timing chain on this cylinder head stays in place.

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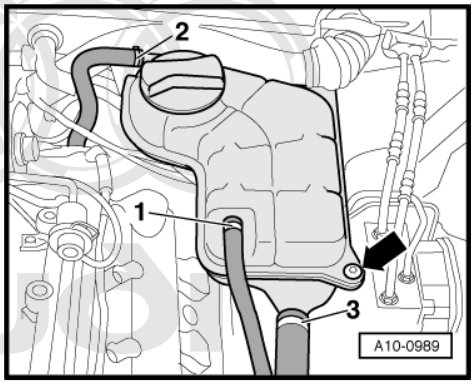
Removing

- Engine and gearbox in vehicle

– Drain off coolant ⇒ page 256 .

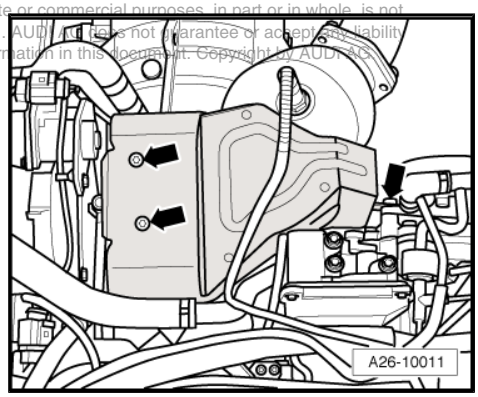
– Remove coolant pipe (rear) ⇒ page 282 .

– Unbolt coolant expansion tank -arrow-.
– Detach electrical connector at coolant shortage indicator switch -F66- on coolant expansion tank (bottom).
– Lay aside coolant expansion tank with coolant hoses -1 … 3- connected.

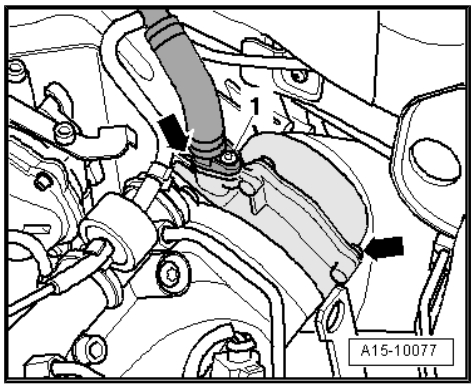


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– Remove heat shield for turbocharger -arrows-.



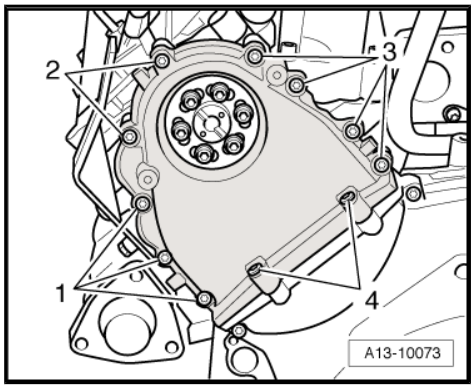
– Unscrew bolt -1- and pull out vacuum hose at vacuum pump for brake servo together with hose connection.
– Unscrew bolts -arrows- and detach vacuum pump for brake servo.



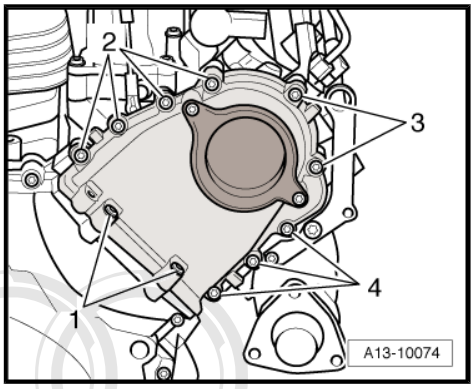
Note

For illustration purposes, the following work on the timing chains is shown from the rear with the engine removed

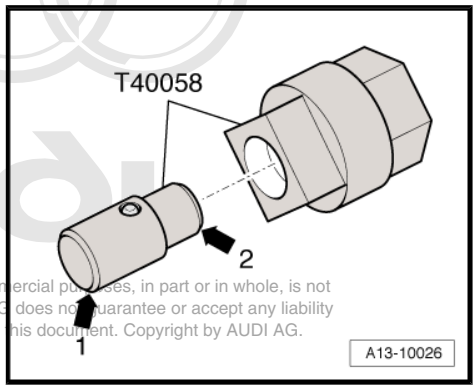
– Remove bolts -1 ... 4- and detach timing chain cover (left-side).



– Remove bolts -1 ... 4- and detach timing chain cover (right-side).

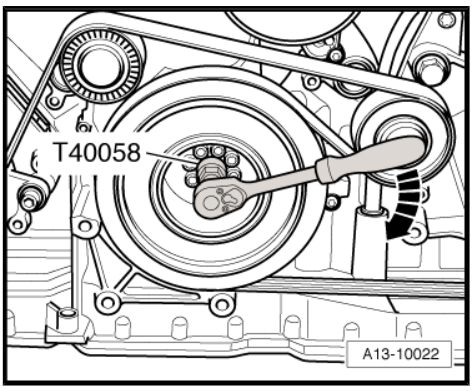


– Insert guide pin of adapter -T40058- with the larger-diameter section -arrow 1- pointing towards the engine. The smaller-diameter section -arrow 2- faces the adapter.



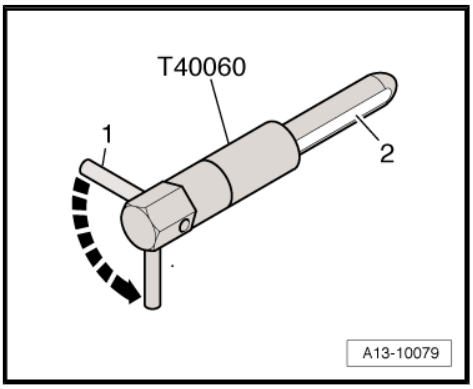
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– Using adapter -T40058- turn the crankshaft in the normal direction of rotation -arrow- to TDC.



Note

- *The adjustment pin -T40060- has a flat -2- which makes it easier to insert when the locating bores in the camshaft and cylinder head are not exactly in line.*
- *The adjustment pin is inserted initially so that the side pin -1- is perpendicular to the imaginary line between the adjustment pin and the centre of the camshaft.*
- *To obtain the correct TDC position, the side pin -1- must then be turned 90° -arrow- so it is in line with the imaginary line between the adjustment pin and the centre of the camshaft.*

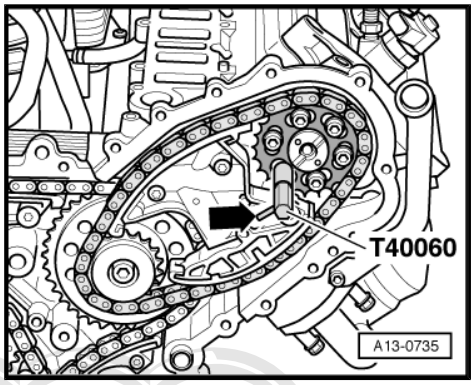


– Check that camshafts on both cylinder heads are positioned at TDC.

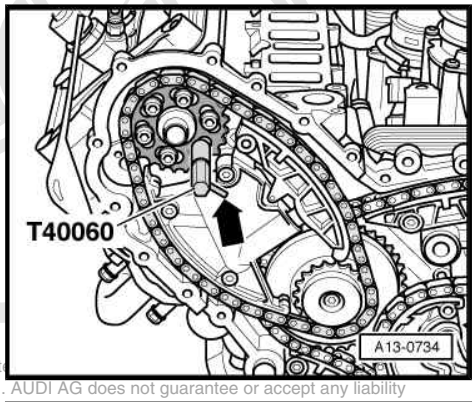
• It should be possible to lock camshafts with adjustment pin -T40060- .

• The side pin -arrow- in each adjustment pin -T40060- must be in line with the imaginary line between the adjustment pin and the centre of the camshaft.

Cylinder bank 1 (right-side):



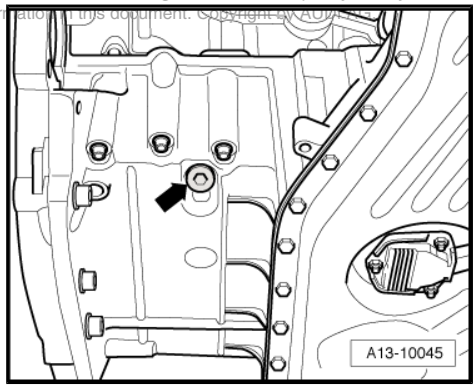
Cylinder bank 2 (left-side):



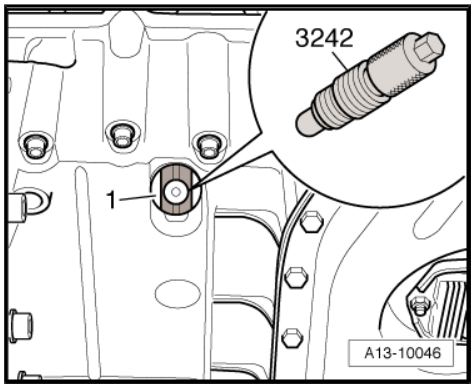
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– Lay a cloth beneath sump (top section) to catch engine oil.

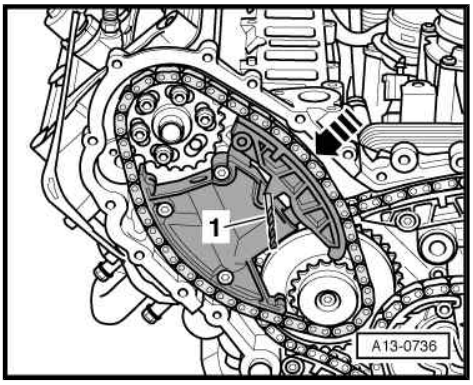
– Unscrew plug -arrow- from sump (top section).



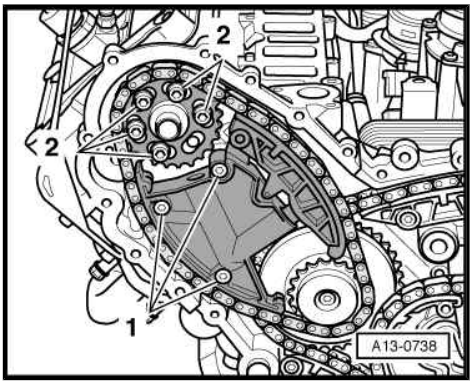
– Screw locking pin -3242- into bore (20 Nm); if necessary, turn crankshaft -1- backwards and forwards slightly to fully centralise locking pin.



– Wrap insulating tape around tip and shaft of 3.3 mm ∅ drill bit to avoid cuts.
– Press guide rail of chain tensioner for timing chain (left-side) in direction of -arrow- and lock chain tensioner by inserting 3.3 mm ∅ drill bit -item 1-.



– Unscrew bolts -1- from chain tensioner and -2- from camshaft sprocket.
– Remove camshaft sprocket and chain tensioner (left-side)

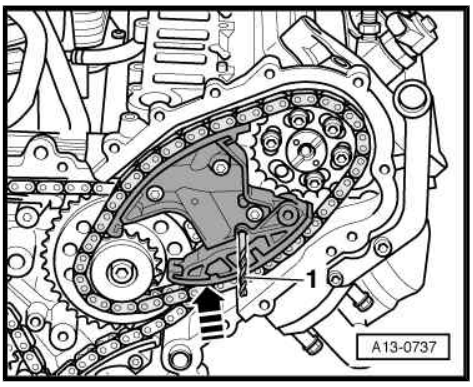


Note

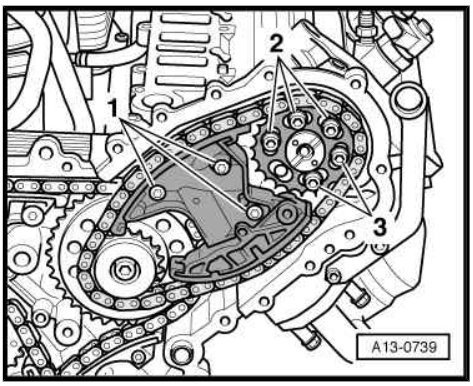
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Cover chain tensioner opening with a cloth or similar to stop small parts dropping in.

– Wrap insulating tape around tip and shaft of 3.3 mm ∅ drill bit to avoid cuts.
– Press guide rail of chain tensioner for timing chain (right-side) in direction of -arrow- and lock chain tensioner by inserting 3.3 mm ∅ drill bit -item 1-.



– Remove bolts -1- for chain tensioner and bolts -2- and -3- for camshaft chain sprocket.
– Remove camshaft sprocket and chain tensioner (right-side).

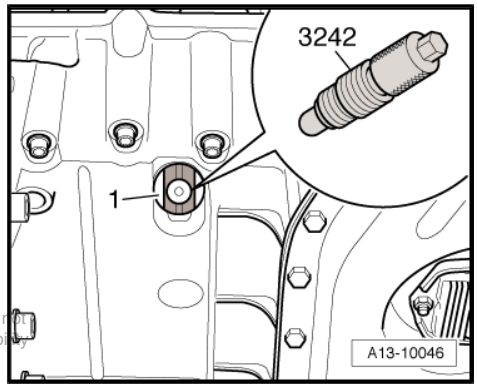


Note

Cover chain tensioner opening with a cloth or similar to stop small parts dropping in.

Installing

- Crankshaft -1- locked in TDC position with locking pin -3242- .



Note

- *Renew gaskets, seals and O-rings.*
- *Renew the bolts tightened with specified tightening angle.*

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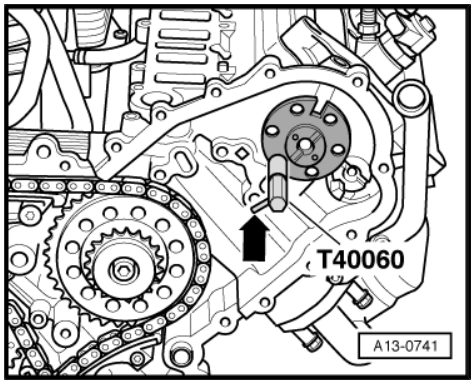
Caution

The crankshaft must not be at TDC at any cylinder when the camshafts are turned. Otherwise, there is a risk of damage to valves and piston crowns.

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

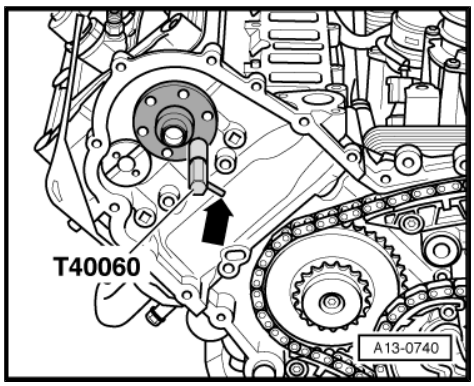
- It should be possible to lock camshafts with adjustment pin -T40060- .
- The side pin -arrow- in each adjustment pin -T40060- must be in line with the imaginary line between the adjustment pin and the centre of the camshaft.

Cylinder bank 1 (right-side):



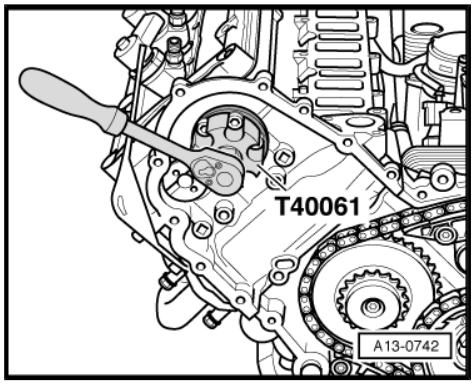
Cylinder bank 2 (left-side):

– Remove adjustment pin -T40060- from both camshafts.



Note

If the adjustment pins cannot be inserted in the camshafts, the camshafts can be turned slightly using adapter -T40061- . To do so, screw securing bolts for camshaft sprocket into camshaft.



Caution

The crankshaft must not be at TDC at any cylinder when the camshafts are turned. Otherwise, there is a risk of damage to valves and piston crowns.

– Install timing chain (left-side) with camshaft sprocket and chain tensioner.

• The elongated holes in the sprocket must be aligned centrally over the tapped holes in the camshaft.

– Tighten bolts -1- for chain tensioner.

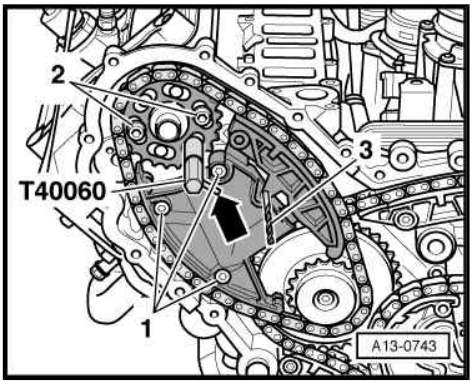
– Screw in two bolts -2- for sprocket, but do not tighten bolts.

• It should just be possible to turn the sprocket on the camshaft without axial movement.

– Lock camshaft (left-side) with adjustment pin -T40060- .

• The side pin -arrow- on the adjustment pin -T40060- must be in line with the imaginary line between the adjustment pin and the centre of the camshaft.

– Pull drill bit -3- from locating hole, this releases the chain tensioner (left-side).



Audi
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– Install timing chain (right-side) with camshaft sprocket and chain tensioner.

• The elongated holes in the sprocket must be aligned centrally over the tapped holes in the camshaft.

– Tighten bolts -1- for chain tensioner.

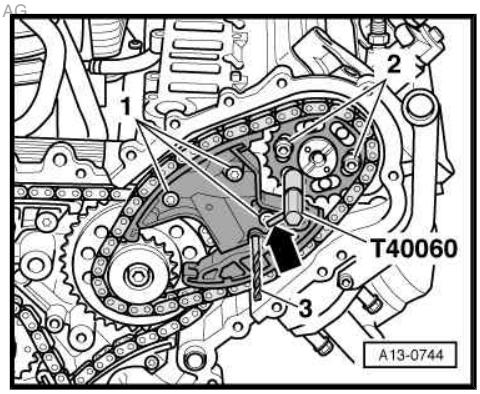
– Screw in two bolts -2- for sprocket, but do not tighten bolts.

• It should just be possible to turn the sprocket on the camshaft without axial movement.

– Lock camshaft (right-side) with adjustment pin -T40060- .

• The side pin -arrow- on the adjustment pin -T40060- must be in line with the imaginary line between the adjustment pin and the centre of the camshaft.

– Pull drill bit -3- out of locating hole; this releases the chain tensioner (right-side).

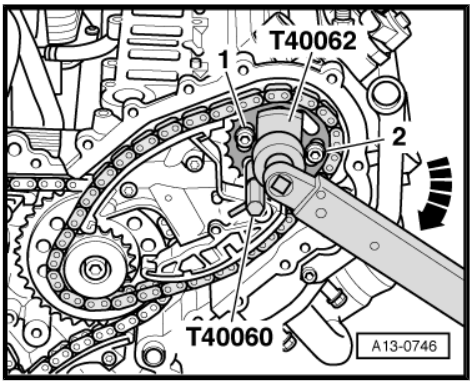


– Using a torque wrench and adapter -T40062- , apply a torque of 30 Nm to camshaft sprocket (right-side) in the direction indicated (-arrow-). Maintain this torque for the following step.

– Tighten bolts -1- and -2-.

– Take off adapter -T40062- and pull out adjustment pin -T40060- .

– Tighten remaining bolts for sprocket (right-side).

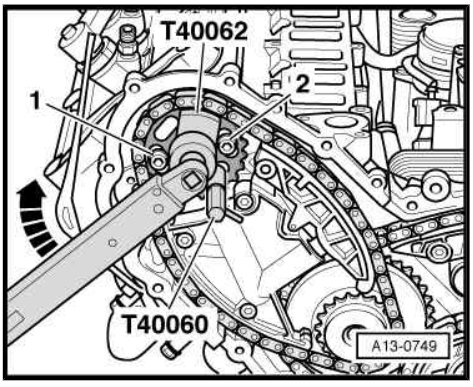


– Using a torque wrench and adapter -T40062- , apply a torque of 15 Nm to camshaft sprocket (left-side) in the direction indicated (-arrow-). Maintain this torque for the following step.

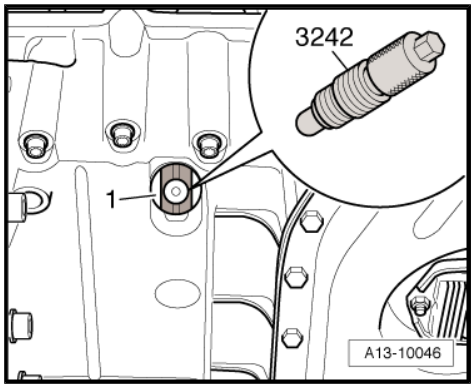
– Tighten bolts -1- and -2-.

– Take off adapter -T40062- and pull out adjustment pin -T40060- .

– Tighten remaining bolts for sprocket (left-side).

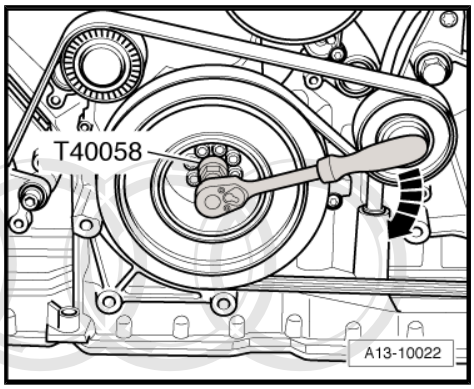


– Remove locking pin -3242- .

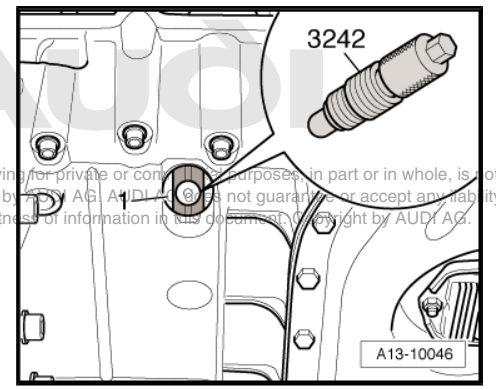


Checking valve timing

– Turn crankshaft two rotations in normal direction of rotation -arrow- until the crankshaft is just before TDC again.



– While turning in this direction, lock crankshaft -1- with locking pin -3242- . Tighten locking pin to 20 Nm.



Caution

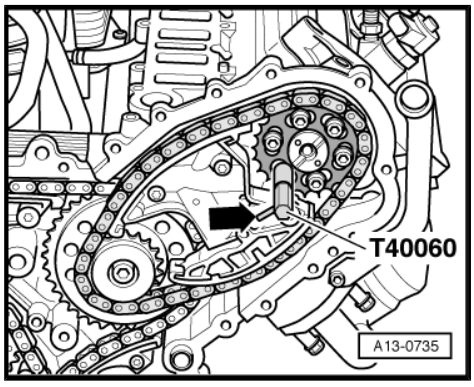
If crankshaft has been turned past „TDC" position, turn crankshaft two further rotations until it is again positioned just before „TDC". Then turn further in the same direction and lock crankshaft with locking pin -3242- .

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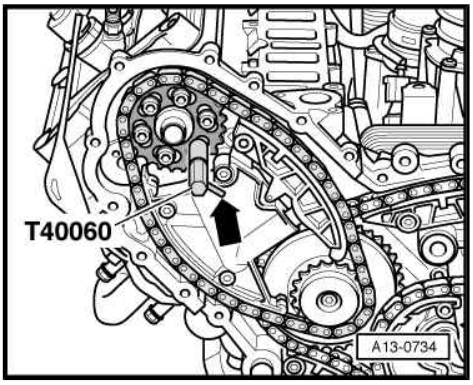
– Check that it is now possible to lock the camshafts with adjustment pin -T40060- .

- The side pin -arrow- in each adjustment pin -T40060- must be in line with the imaginary line between the adjustment pin and the centre of the camshaft.

Cylinder bank 1 (right-side):



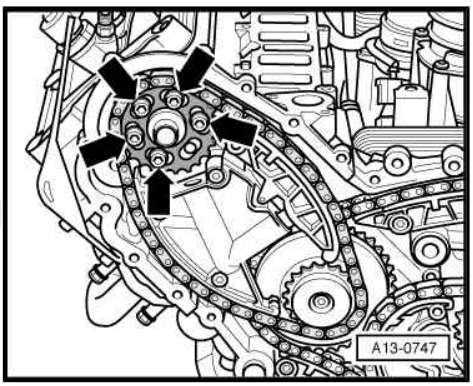
Cylinder bank 2 (left-side):



Adjusting valve timing

If the adjustment pin cannot be inserted in one of the camshafts:

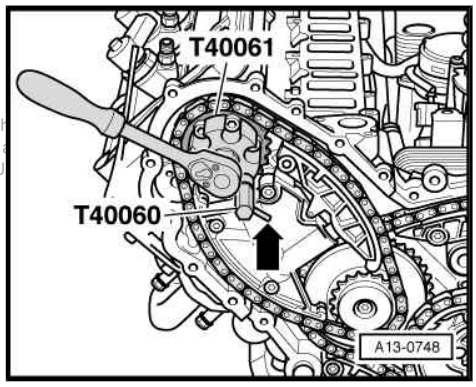
– Loosen all bolts -arrows- on the relevant sprocket approx. 1 turn.



– Apply adapter -T40061- to the heads of the loosened bolts.

– Turn camshaft slightly backwards and forwards with adapter -T40061- until adjustment pin -T40060- can be inserted.

• The side pin -arrow- on the adjustment pin -T40060- must be in line with the imaginary line between the adjustment pin and the centre of the camshaft.



– With adapter -T40061- and adjustment pin -T40060- still in position, tighten bolts on sprocket to approx: 5 Nm.

– Remove adjustment pin -T40060- and adapter -T40061- .

– Tighten bolts on sprocket to final torque.

– Repeat this procedure on the other cylinder bank if necessary.

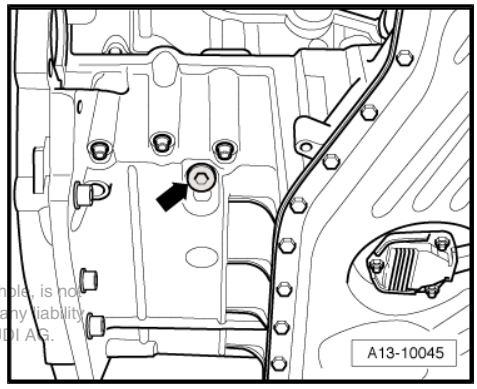
– Remove locking pin -3242- .

– Check valve timing once again ⇒ page 158 .

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

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– Screw plug -arrow- for TDC mark into top section of sump with a new seal.
– Install timing chain covers ⇒ page 144 .
– Install coolant pipe (rear) ⇒ page 282 .
– Install vacuum pump for brake servo ⇒ Rep. gr. 47 .
– Fill cooling system ⇒ page 259 .



Tightening torques

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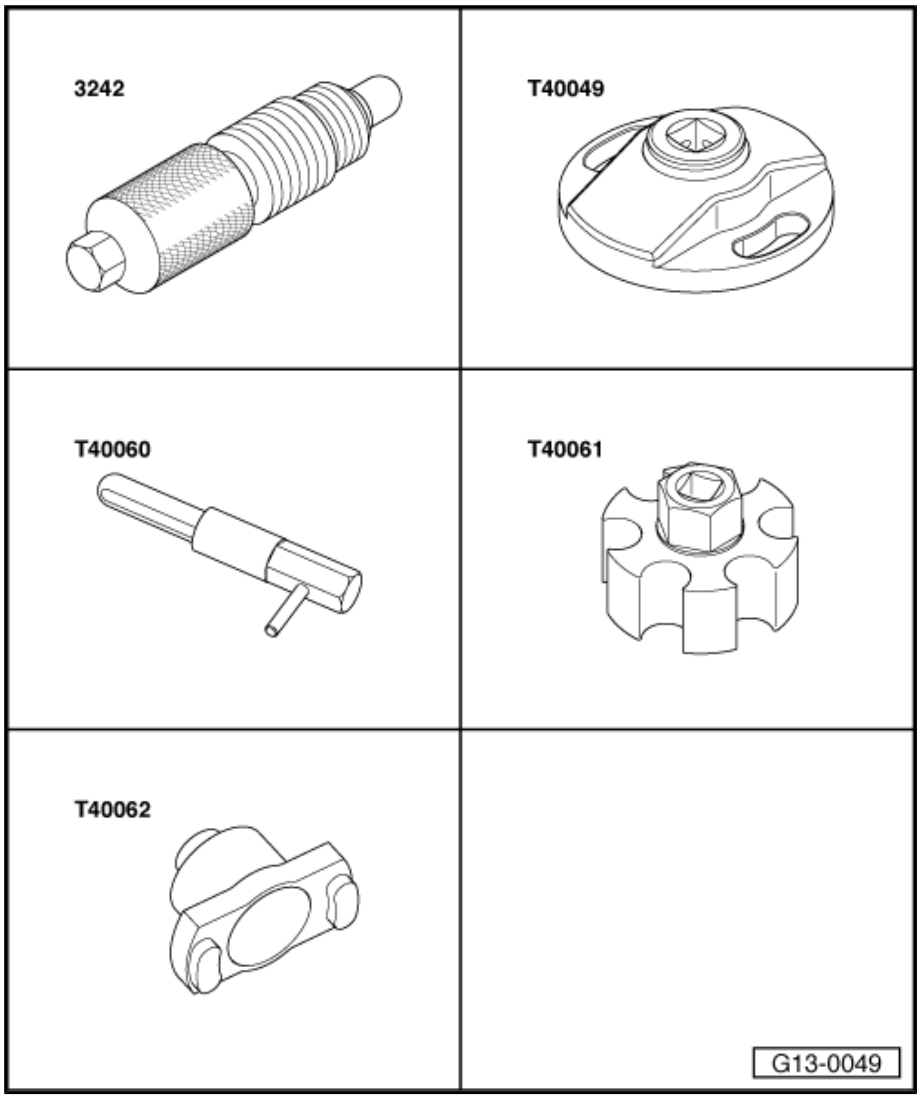
Component	Nm
Chain tensioner to cylinder head	5 +90° 1)2)
Camshaft sprocket to camshaft	23
Screw plug in top section of sump	35

- 1) Renew bolts.
- 2) 90° = one quarter turn.

1.5 Removing and installing camshaft timing chains

Special tools and workshop equipment required

- Locking pin -3242-
- Special wrench -T40049-
- 2x Adjustment pin -T40060-
- Adapter -T40061-
- Adapter -T40062-
- Drill bit 3.3 mm ∅ (2x)



Removing

- Gearbox removed ⇒ Rep. gr. 34 or ⇒ Rep. gr. 37 .

Caution

The crankshaft and camshafts must only be turned with the chain drive mechanism fully installed. Otherwise the valves may strike the pistons, causing damage to valves and piston crowns.

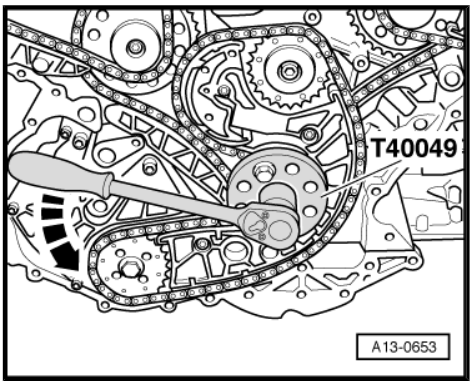
– Remove dual-mass flywheel on vehicles with manual gearbox ⇒ page 122 .

– Remove flywheel on vehicles with multitronic gearbox ⇒ page 126 .

– Remove drive plate on vehicles with automatic gearbox ⇒ page 128 .

– Remove timing chain covers ⇒ page 143 .

– Attach special wrench -T40049- to rear of crankshaft: on vehicles with automatic gearbox secure wrench with two old drive plate bolts; on vehicles with manual gearbox or multitronic gearbox use two bolts M10x19 to secure wrench.



Caution

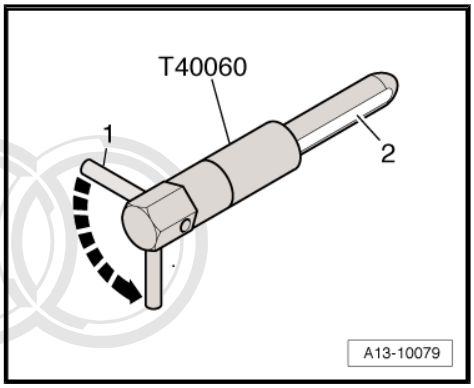
Do not use bolts for dual-mass flywheel or flywheel to secure wrench -T40049- ; these bolts are too long and can damage the camshaft timing chains when they are screwed in.

Note

Disregard -arrow-.

Note

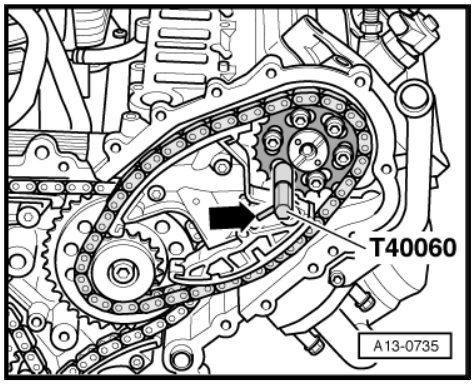
- *The adjustment pin -T40060- has a flat -2- which makes it easier to insert when the locating bores in the camshaft and cylinder head are not exactly in line.*
- *The adjustment pin is inserted initially so that the side pin -1- is perpendicular to the imaginary line between the adjustment pin and the centre of the camshaft.*
- *To obtain the correct TDC position, the side pin -1- must then be turned 90° -arrow- so it is in line with the imaginary line between the adjustment pin and the centre of the camshaft.*



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Caution

Do not rotate crankshaft in opposite direction of engine rotation.



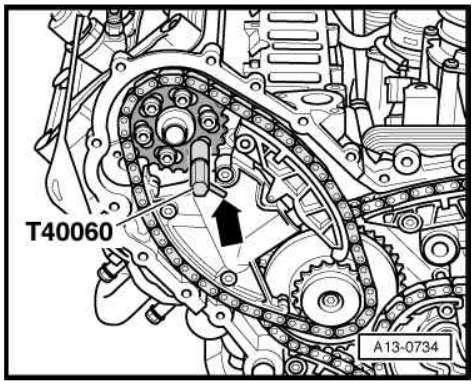
– Turn crankshaft in normal direction of rotation to TDC position:

- It should be possible to lock camshafts with adjustment pin - T40060- .
- The side pin -arrow- in each adjustment pin -T40060- must be in line with the imaginary line between the adjustment pin and the centre of the camshaft.

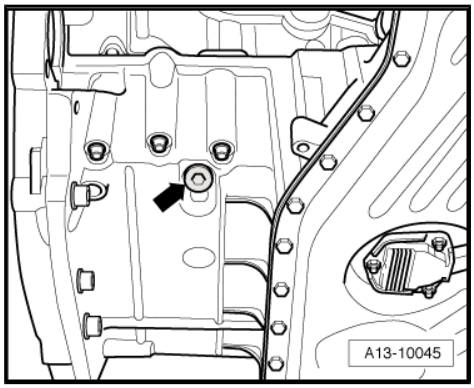
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Cylinder bank 1 (right-side):

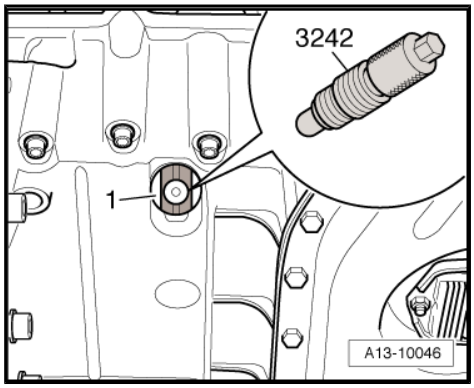
Cylinder bank 2 (left-side):



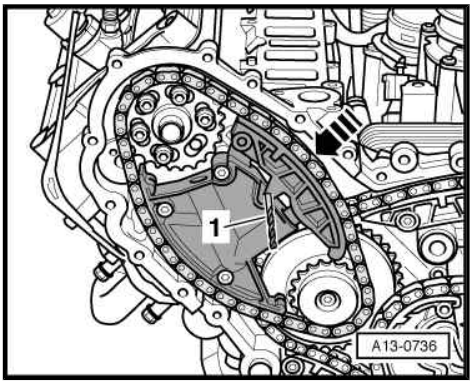
– Unscrew plug -arrow- from sump (top section).



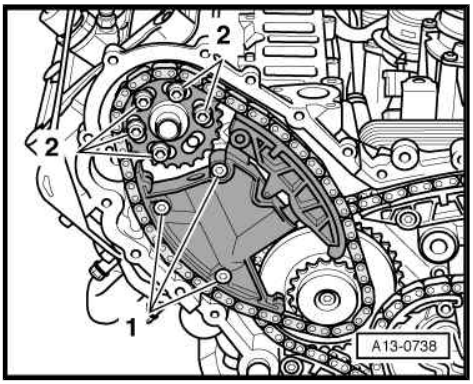
– Screw locking pin -3242- into bore (20 Nm); if necessary, turn crankshaft -1- backwards and forwards slightly to fully centralise locking pin.



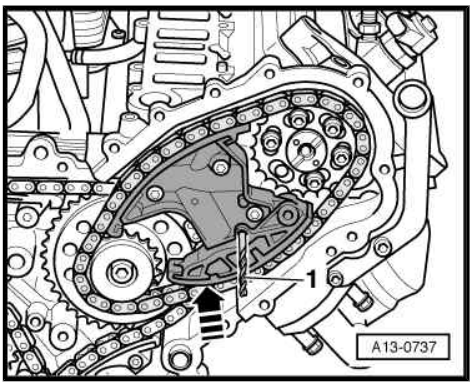
– Wrap insulating tape around tip and shaft of 3.3 mm ∅ drill bit to avoid cuts.
– Press guide rail of chain tensioner for timing chain (left-side) in direction of -arrow- and lock chain tensioner by inserting 3.3 mm ∅ drill bit -item 1-.
– Mark running direction of timing chain (left-side) with paint.
– Remove adjustment pin -T40060- from both camshafts.



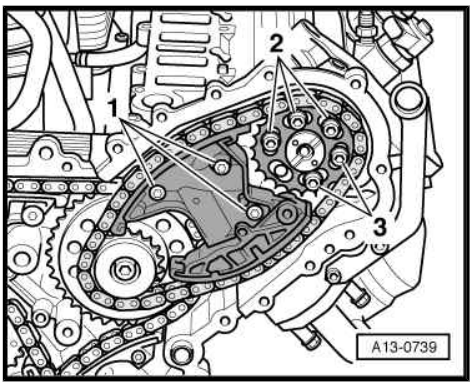
– Unscrew bolts -1- from chain tensioner and -2- from camshaft sprocket.
– Take off camshaft sprocket, chain tensioner and timing chain (left-side).



– Wrap insulating tape around tip and shaft of 3.3 mm ∅ drill bit to avoid cuts.
– Press guide rail of chain tensioner for timing chain (right-side) in direction of -arrow- and lock chain tensioner by inserting 3.3 mm ∅ drill bit -item 1-.
– Mark running direction of timing chain (right-side) with paint.



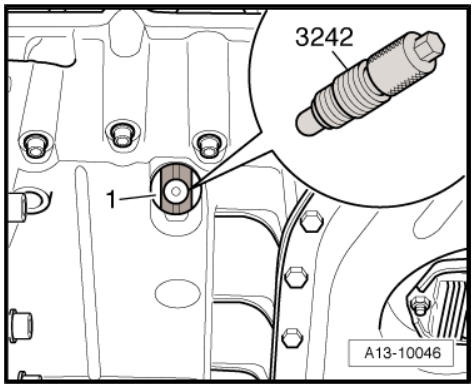
– Remove bolts -1- for chain tensioner and bolts -2- and -3- for camshaft chain sprocket.
– Take off camshaft sprocket, chain tensioner and timing chain (right-side).



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Installing

- Crankshaft -1- locked in TDC position with locking pin -3242- .
- Drive chain for valve gear installed ⇒ page 170



Note

- *Renew seal.*
- *Renew the bolts tightened with specified tightening angle.*

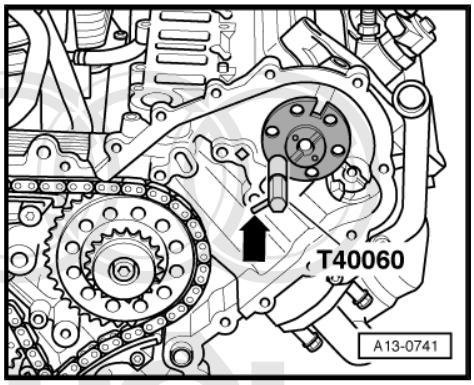
Caution

The crankshaft must not be at TDC at any cylinder when the camshafts are turned. Otherwise, there is a risk of damage to valves and piston crowns.

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

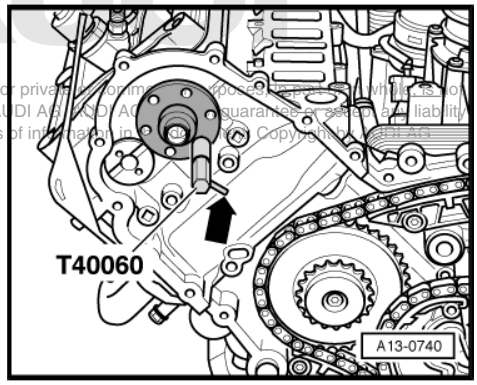
- It should be possible to lock camshafts with adjustment pin -T40060- .
- The side pin -arrow- in each adjustment pin -T40060- must be in line with the imaginary line between the adjustment pin and the centre of the camshaft.

Cylinder bank 1 (right-side):



Cylinder bank 2 (left-side):

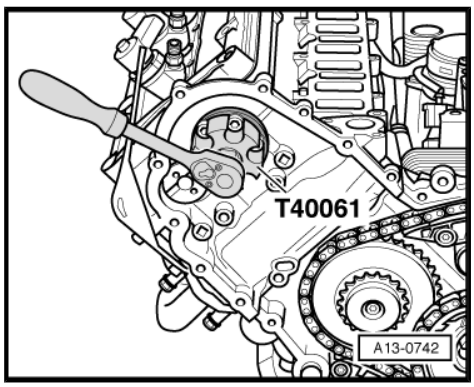
– Remove adjustment pin -T40060- from both camshafts.



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Note

If the adjustment pins cannot be inserted in the camshafts, the camshafts can be turned slightly using adapter -T40061- . To do so, screw securing bolts for camshaft sprocket into camshaft.



Caution

The crankshaft must not be at TDC at any cylinder when the camshafts are turned. Otherwise, there is a risk of damage to valves and piston crowns.

– Install timing chain (left-side) with camshaft sprocket and chain tensioner.

• The elongated holes in the sprocket must be aligned centrally over the tapped holes in the camshaft.

– Tighten bolts -1- for chain tensioner.

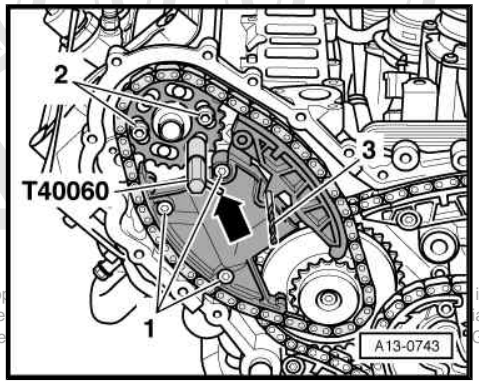
– Screw in two bolts -2- for sprocket, but do not tighten bolts.

• It should just be possible to turn the sprocket on the camshaft without axial movement.

– Lock camshaft (left-side) with adjustment pin -T40060-

• The side pin -arrow- on the adjustment pin -T40060- must be in line with the imaginary line between the adjustment pin and the centre of the camshaft.

– Pull drill bit -3- from locating hole, this releases the chain tensioner (left-side).



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– Install timing chain (right-side) with camshaft sprocket and chain tensioner.

• The elongated holes in the sprocket must be aligned centrally over the tapped holes in the camshaft.

– Tighten bolts -1- for chain tensioner.

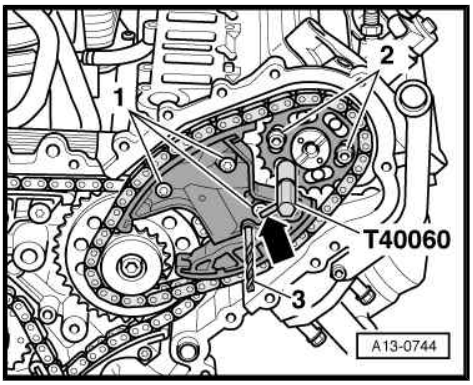
– Screw in two bolts -2- for sprocket, but do not tighten bolts.

• It should just be possible to turn the sprocket on the camshaft without axial movement.

– Lock camshaft (right-side) with adjustment pin -T40060- .

• The side pin -arrow- on the adjustment pin -T40060- must be in line with the imaginary line between the adjustment pin and the centre of the camshaft.

– Pull drill bit -3- out of locating hole; this releases the chain tensioner (right-side).

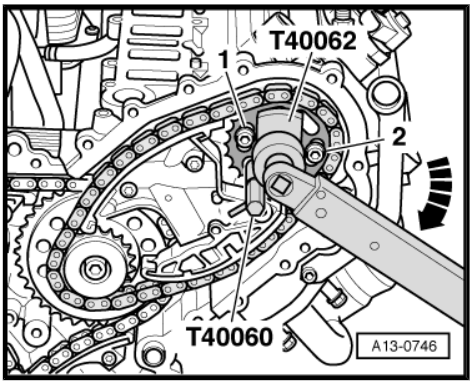


– Using a torque wrench and adapter -T40062- , apply a torque of 30 Nm to camshaft sprocket (right-side) in the direction indicated (-arrow-). Maintain this torque for the following step.

– Tighten bolts -1- and -2-.

– Take off adapter -T40062- and pull out adjustment pin -T40060- .

– Tighten remaining bolts for sprocket (right-side).

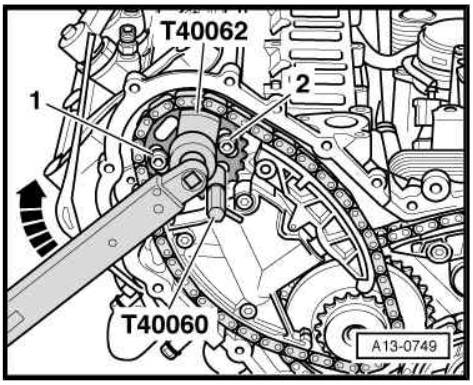


– Using a torque wrench and adapter -T40062- , apply a torque of 15 Nm to camshaft sprocket (left-side) in the direction indicated (-arrow-). Maintain this torque for the following step.

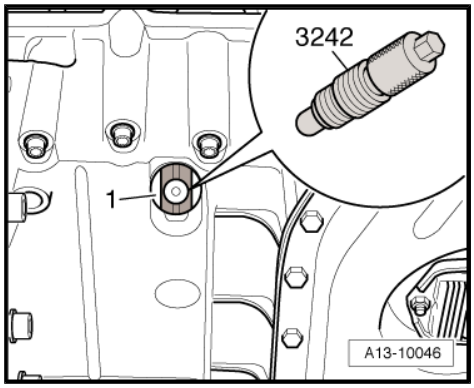
– Tighten bolts -1- and -2-.

– Take off adapter -T40062- and pull out adjustment pin -T40060- .

– Tighten remaining bolts for sprocket (left-side).



– Remove locking pin -3242- .



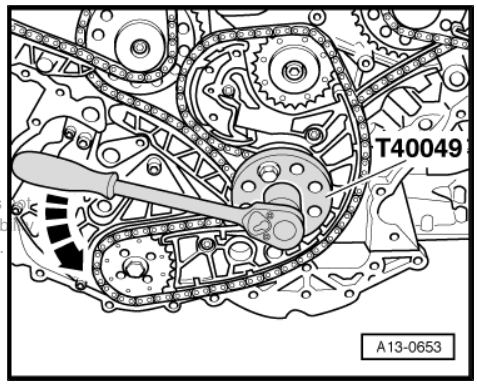
Checking valve timing

Caution

Do not rotate crankshaft in opposite direction of engine rotation.

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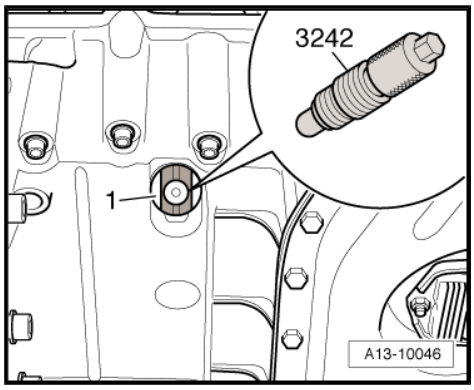
– Using special wrench -T40049- , turn crankshaft two rotations in normal direction of rotation -arrow- until crankshaft is just before TDC again.



– While turning in this direction, lock crankshaft -1- with locking pin -3242- . Tighten locking pin to 20 Nm.

Caution

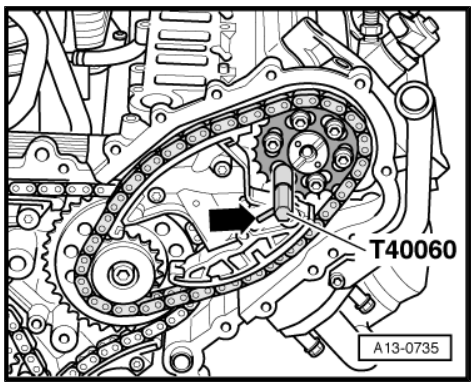
If crankshaft has been turned past „TDC“ position, turn crankshaft two further rotations until it is again positioned just before „TDC“. Then turn further in the same direction and lock crankshaft with locking pin -3242- .



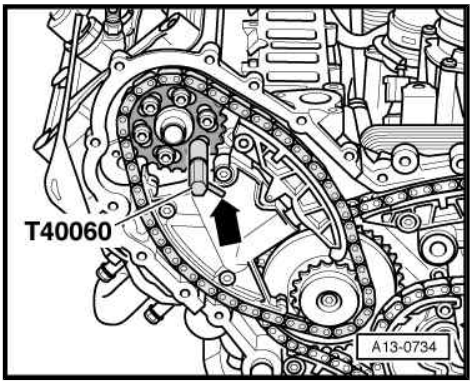
– Check that it is now possible to lock the camshafts with adjustment pin -T40060- .

- The side pin -arrow- in each adjustment pin -T40060- must be in line with the imaginary line between the adjustment pin and the centre of the camshaft.

Cylinder bank 1 (right-side):



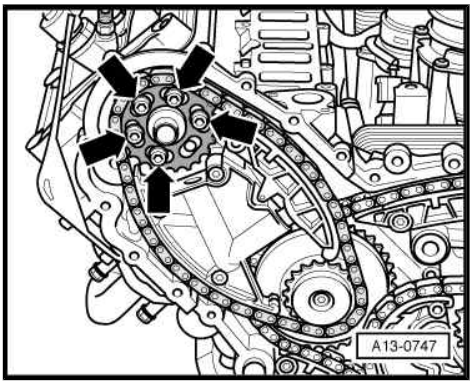
Cylinder bank 2 (left-side):



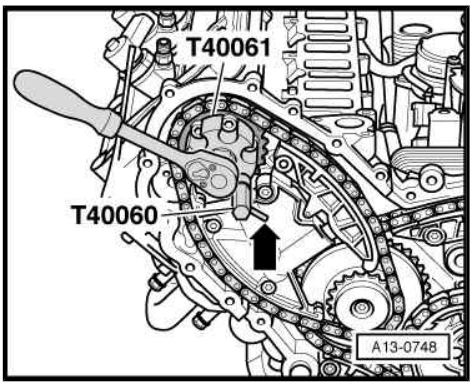
Adjusting valve timing

If the adjustment pin cannot be inserted in one of the camshafts:

– Loosen all bolts -arrows- on the relevant sprocket approx. 1 turn.



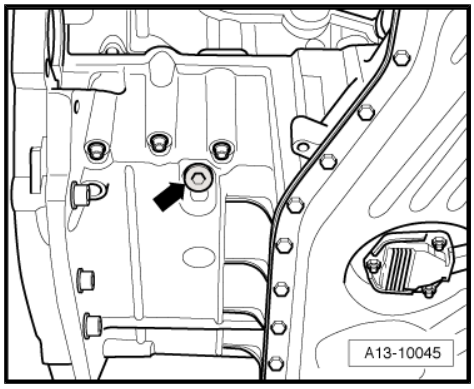
– Apply adapter -T40061- to the heads of the loosened bolts.
– Turn camshaft slightly backwards and forwards with adapter -T40061- until adjustment pin -T40060- can be inserted.
• The side pin -arrow- on the adjustment pin -T40060- must be in line with the imaginary line between the adjustment pin and the centre of the camshaft.
– With adapter -T40061- and adjustment pin -T40060- still in position, tighten bolts on sprocket to approx: 5 Nm.
– Remove adjustment pin -T40060- and adapter -T40061- .
– Tighten bolts on sprocket to final torque.
– Repeat this procedure on the other cylinder bank if necessary.
– Remove locking pin -3242-.
– Check valve timing once again ⇒ page 166 .



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

- Screw plug -arrow- for TDC mark into top section of sump with a new seal.
- Install timing chain covers ⇒ page 144 .
- Install dual-mass flywheel on vehicles with manual gearbox ⇒ page 122 .
- Install flywheel on vehicles with multitronic gearbox ⇒ page 126 .
- Install drive plate on vehicles with automatic gearbox ⇒ page 128 .
- Fill up with engine oil and check oil level ⇒ Maintenance ; Booklet 405 .



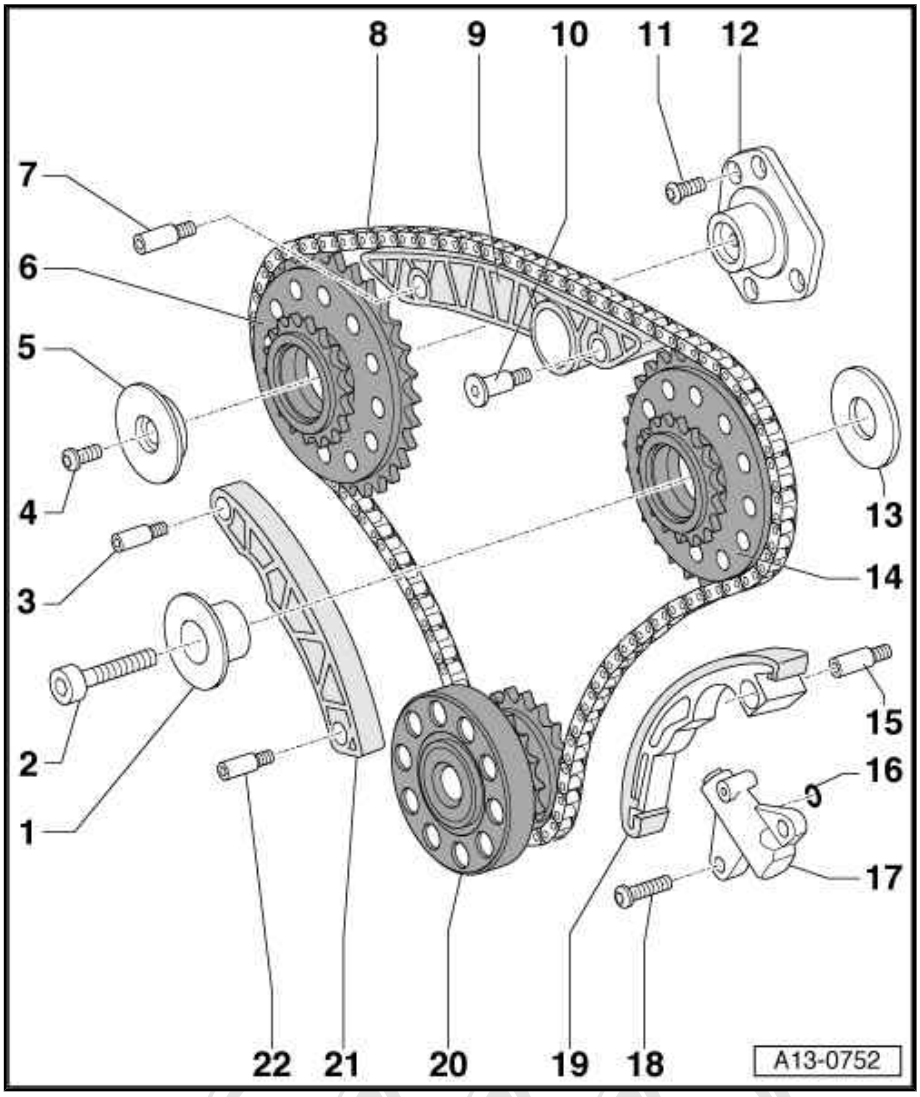
Tightening torques

Component	Nm
Chain tensioner to cylinder head	5 + 90° 1)2)
Camshaft sprocket to camshaft	23
Screw plug in top section of sump	35

- 1) Renew bolts.
- 2) 90° = one quarter turn.

1.6 Drive chain for valve gear - exploded view

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1 - Bearing mounting for drive sprocket

2 - 45 Nm

3 - Mounting pin, 12 Nm

- ❑ Apply locking fluid when installing; refer to ⇒ Electronic parts catalogue

4 - 5 Nm + turn 90° further

- ❑ Renew

5 - Thrust washer for drive sprocket

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

7 - Mounting pin, 12 Nm

- ❑ Apply locking fluid when installing; refer to ⇒ Electronic parts catalogue

8 - Drive chain for valve gear

- ❑ Before removing, mark running direction with paint
- ❑ Removing and installing ⇒ page 170

9 - Guide rail

10 - Mounting pin, 12 Nm

- ❑ Apply locking fluid when installing; refer to ⇒ Electronic parts catalogue

11 - 9 Nm

12 - Bearing bracket for drive sprocket

13 - Thrust washer

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

15 - Mounting pin, 12 Nm

- ❑ Apply locking fluid when installing; refer to ⇒ Electronic parts catalogue

16 - O-ring

- ❑ Renew

17 - Chain tensioner

18 - 12 Nm

19 - Guide rail for chain tensioner

20 - Crankshaft

21 - Guide rail

- ❑ Note installation position

22 - Mounting pin, 9 Nm

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1.7 Removing and installing drive chain for valve gear

Special tools and workshop equipment required

- Drill bit, ∅ 3.3 mm

Removing

- Gearbox removed ⇒ Rep. gr. 34 or ⇒ Rep. gr. 37 .

– Remove dual-mass flywheel on vehicles with manual gearbox ⇒ page 122 .

– Remove flywheel on vehicles with multitronic gearbox ⇒ page 126 .

– Remove drive plate on vehicles with automatic gearbox ⇒ page 128 .

– Remove timing chain covers ⇒ page 143 .

– Remove camshaft timing chains ⇒ page 160 .

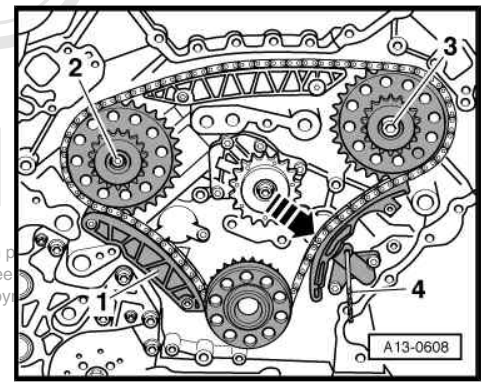
– Remove chain for oil pump and balance shaft ⇒ page 173 .

– Wrap insulating tape around tip and shaft of 3.3 mm ∅ drill bit to avoid cuts.

– Press guide rail of chain tensioner for drive chain in direction of -arrow- and lock chain tensioner by inserting 3.3 mm ∅ drill bit -item 4-.

– Mark running direction of chain with paint.

– Remove bolts -2- and -3- and detach chain sprockets together with drive chain and guide rail -1-.

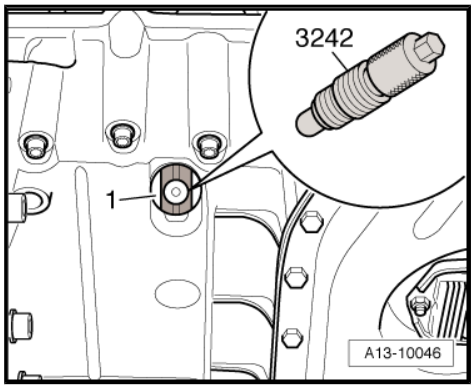


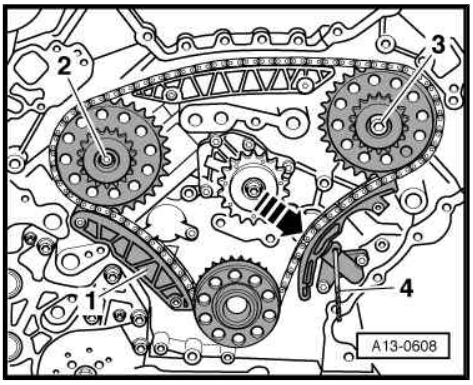
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Installing

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

- Crankshaft -1- locked in TDC position with locking pin -3242- .





- First install sprocket for camshaft timing chain (left-side) -2-.
- Install guide rail -1- with drive chain fitted.
- Now install sprocket for camshaft timing chain (right-side) -3-.
- Push guide rail of chain tensioner for drive chain in direction of -arrow- and pull drill bit -4- out of chain tensioner.
- Install chain for oil pump and balance shaft ⇒ page 173
- Install camshaft timing chains ⇒ page 160 .
- Install timing chain covers ⇒ page 144 .
- Install dual-mass flywheel on vehicles with manual gearbox ⇒ page 122 .
- Install flywheel on vehicles with multitronic gearbox ⇒ page 126 .
- Install drive plate on vehicles with automatic gearbox ⇒ page 128 .
- Fill up with engine oil and check oil level ⇒ Maintenance ; Booklet 405 .

Tightening torques

Component	Nm
Drive chain sprocket (left-side) to bearing bracket	5 + 90° 1)2)
Drive chain sprocket (right-side) to cylinder block	45

- 1) Renew bolts.
- 2) 90° = one quarter turn.

1.8 Drive chain for oil pump and balance shaft - exploded view

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1 - 9 Nm

2 - Chain tensioner

- ❑ With guide rail

3 - Thrust washer

4 - Compression spring

5 - 23 Nm

6 - Chain sprocket for balance shaft

- ❑ Side with lettering faces towards gearbox

7 - Chain for oil pump and balance shaft

- ❑ Before removing, mark running direction with paint
- ❑ Removing and installing ⇒ page 173

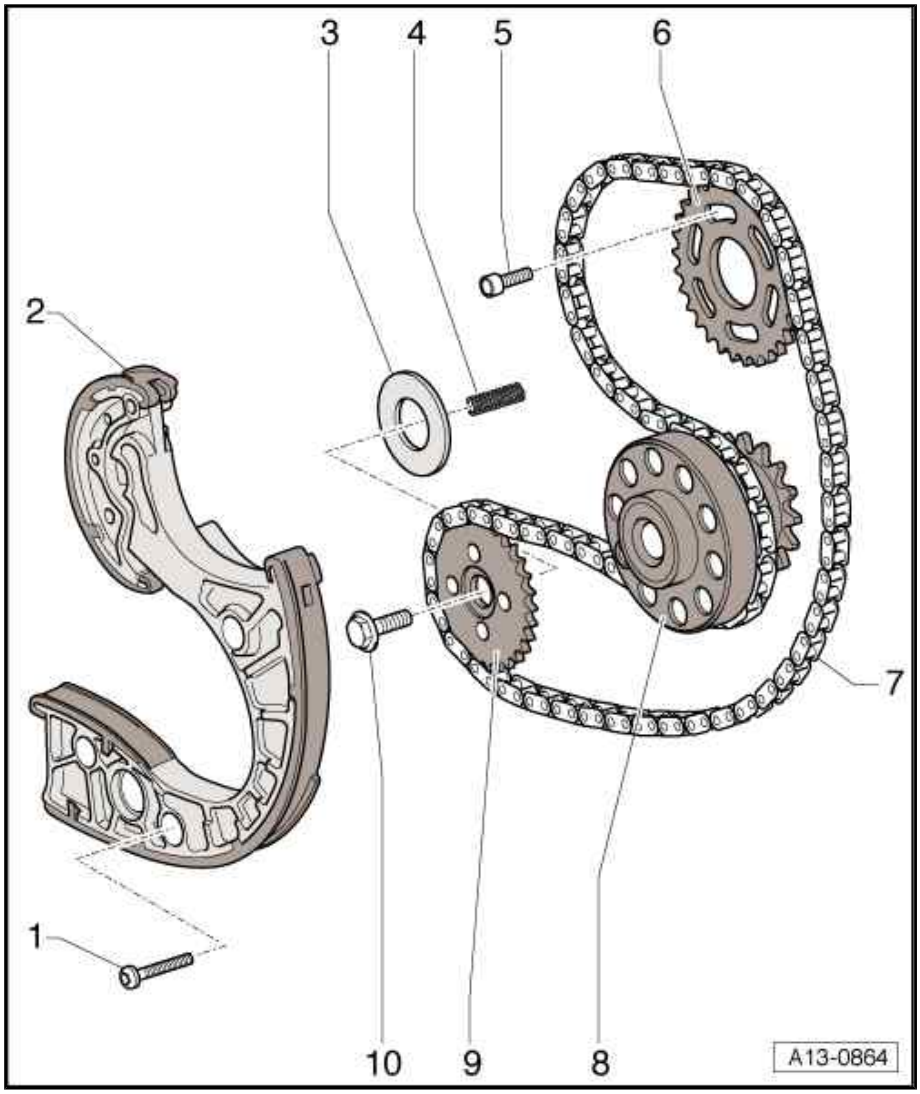
8 - Crankshaft

9 - Chain sprocket for oil pump

- ❑ Installation position: Side with lettering faces engine

10 - 62 Nm

- ❑ If bolt cannot be tightened to torque, remove sump (bottom section) with baffle plate and counterhold oil pump drive shaft using an open-end spanner.

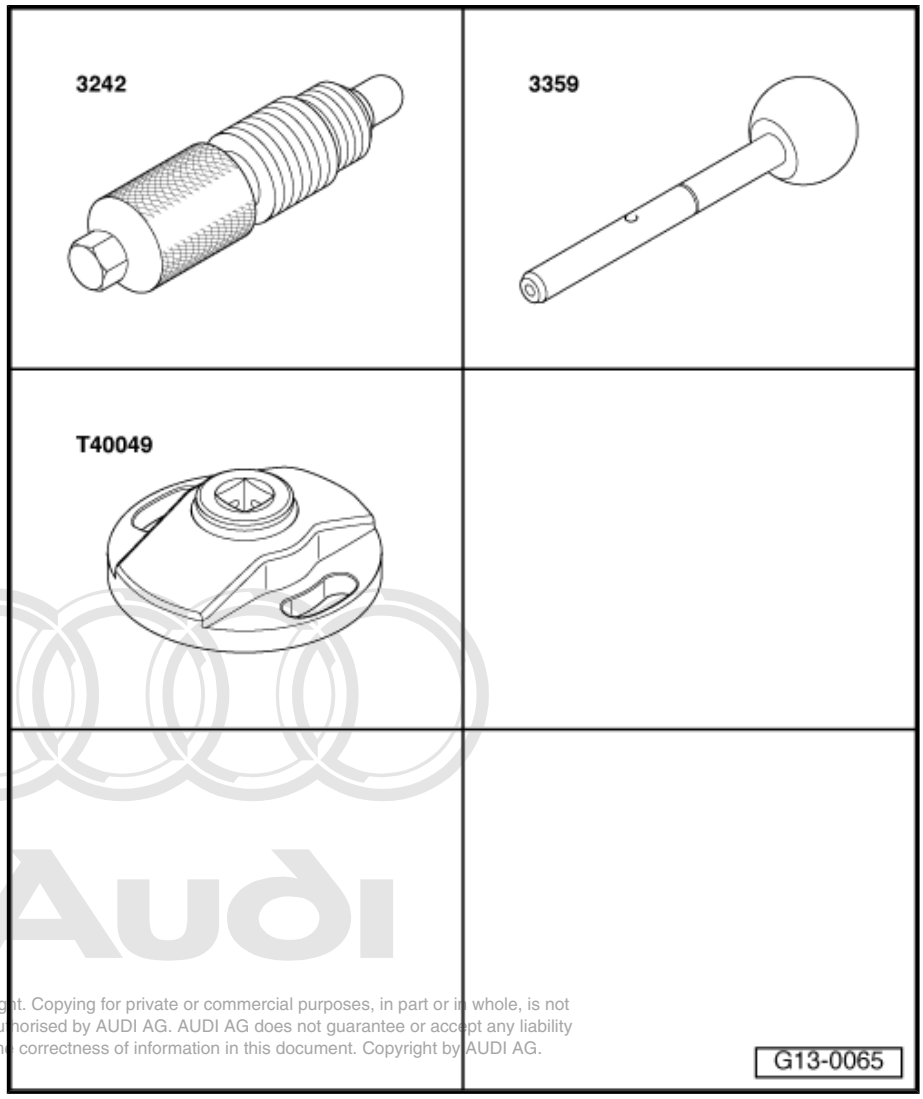


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1.9 Removing and installing drive chain for oil pump and balance shaft

Special tools and workshop equipment required

- Locking pin -3242-
- Diesel injection pump locking pin -3359-
- Special wrench -T40049-
- Drill bit, ∅ 3.3 mm



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Removing

- Gearbox removed ⇒ Rep. gr. 34 or ⇒ Rep. gr. 37 .

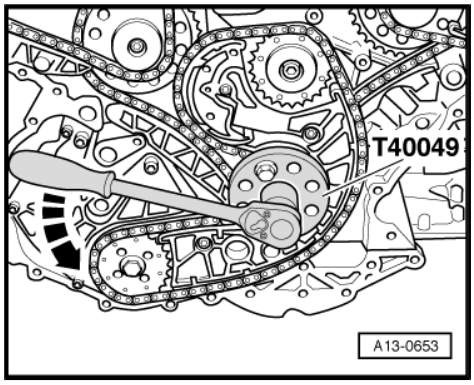
– Remove dual-mass flywheel on vehicles with manual gearbox ⇒ page 122 .

– Remove flywheel on vehicles with multitronic gearbox ⇒ page 126 .

– Remove drive plate on vehicles with automatic gearbox ⇒ page 128 .

– Remove timing chain covers ⇒ page 143 .

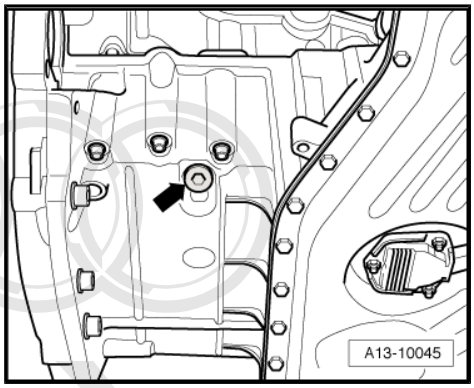
– Attach special wrench -T40049- to rear of crankshaft: on vehicles with automatic gearbox secure wrench with two old drive plate bolts; on vehicles with manual gearbox or multitronic gearbox use two bolts M10x19 to secure wrench.



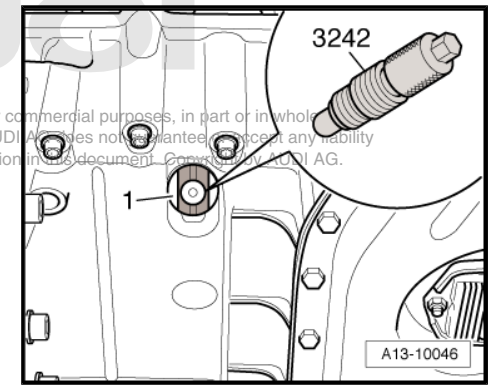
Caution

Do not use bolts for dual-mass flywheel or flywheel to secure wrench -T40049- ; these bolts are too long and can damage the camshaft timing chains when they are screwed in.

– Lay a cloth beneath sump (top section) to catch engine oil.
– Unscrew plug -arrow- from sump (top section).

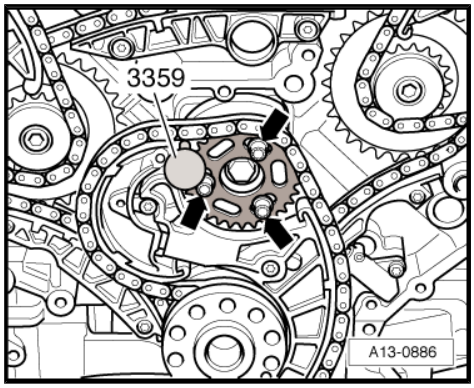


– Screw locking pin -3242- into bore (20 Nm); if necessary, turn crankshaft -1- backwards and forwards slightly to fully centralise locking pin.

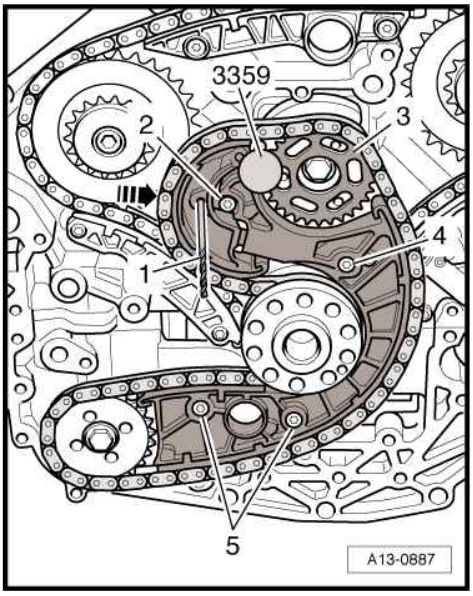


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– Mark running direction of chain for oil pump and balance shaft with paint.
– Lock balance shaft with diesel injection pump locking pin -3359- and loosen bolts -arrows- for balance shaft sprocket.

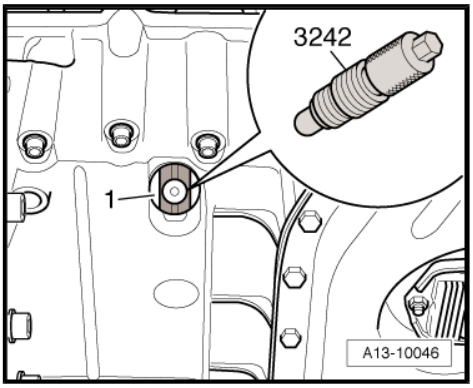


– Wrap insulating tape around tip and shaft of 3.3 mm ∅ drill bit to avoid cuts.
– Press guide rail of chain tensioner in direction of -arrow- and lock chain tensioner by inserting 3.3 mm ∅ drill bit -item 1-.
– Remove bolts -2-, -4- and -5- and take out chain tensioner, balance shaft sprocket -3- and chain.

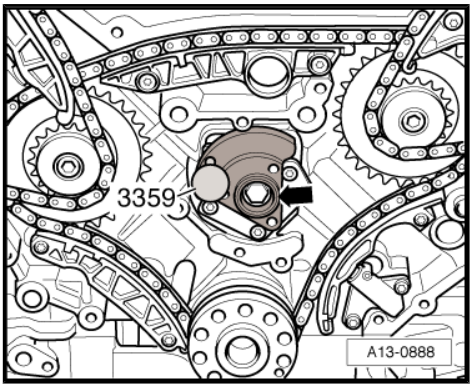


Installing

• Crankshaft -1- locked in TDC position with locking pin -3242- .



– Lock balance shaft -arrow- with diesel injection pump locking pin -3359-

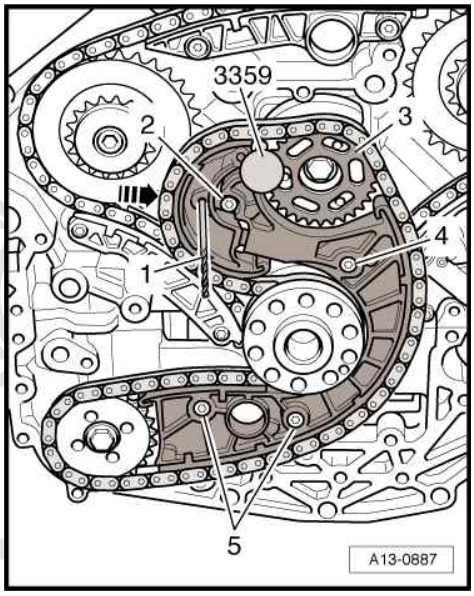


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– Install chain tensioner with chain and balance shaft sprocket.

• The elongated holes in the sprocket -3- must be aligned centrally over the tapped holes in the balance shaft.

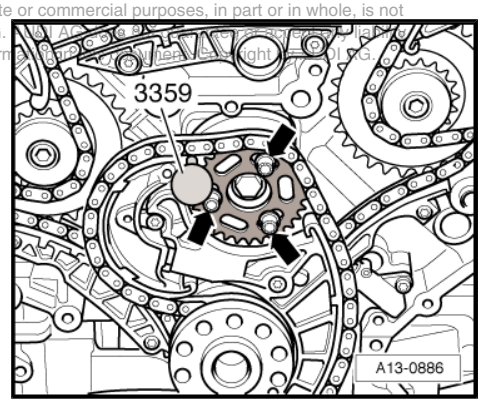
– Tighten bolts -2-, -4- and -5- for chain tensioner.



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with respect to the correctness of inform

– Screw in bolts -arrows- for chain sprocket, but do not tighten.

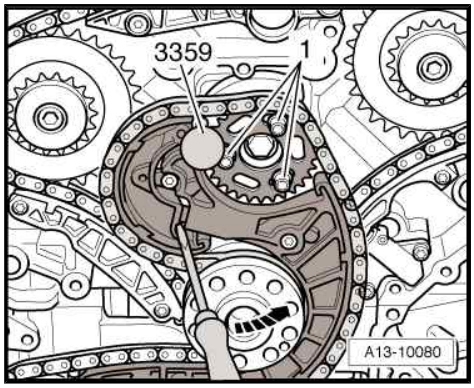
• It should just be possible to turn the sprocket on the balance shaft without axial movement.



– Pull drill bit out of locating hole to release chain tensioner.

– Press against guide rail of chain tensioner in direction of -arrow- using a screwdriver, and at the same time tighten bolts -1- securing chain sprocket.

– Pull diesel injection pump locking pin -3359- out of balance shaft.



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

– Install timing chain covers ⇒ page 144 .

– Install dual-mass flywheel on vehicles with manual gearbox ⇒ page 122 .

– Install flywheel on vehicles with multitronic gearbox ⇒ page 126 .

– Install drive plate on vehicles with automatic gearbox ⇒ page 128 .

– Fill up with engine oil and check oil level ⇒ Maintenance ; Booklet 405 .

Tightening torques

Component	Nm
Chain tensioner to cylinder block	9
Chain sprocket for balance shaft to balance weight	23

1.10 Balance shaft - exploded view

1 - Sleeve bearing

2 - 60 Nm

- ❑ Counterhold with diesel injection pump locking pin -3359- when loosening and tightening

3 - Balance weight (timing chain end)

4 - 9 Nm

5 - Bearing plate

6 - Balance weight (pulley end)

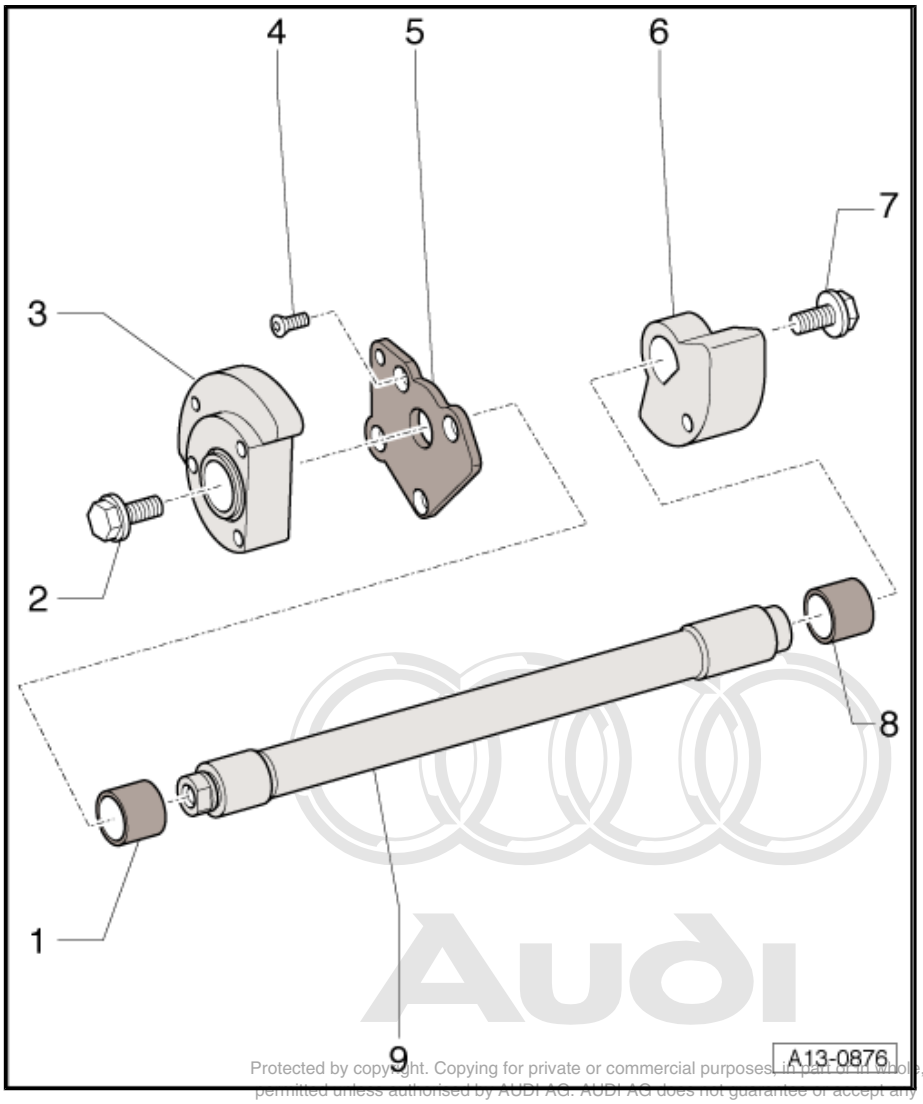
7 - 60 Nm

- ❑ Counterhold with diesel injection pump locking pin -3359- when loosening and tightening

8 - Sleeve bearing

9 - Balance shaft

- ❑ Removing and installing ⇒ page 177

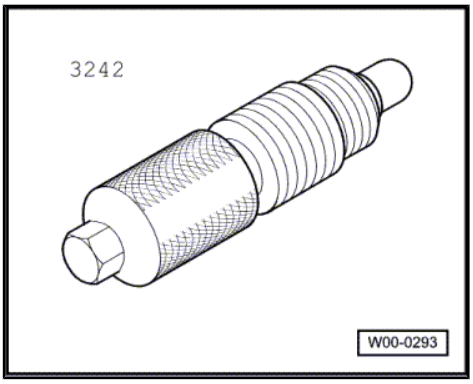


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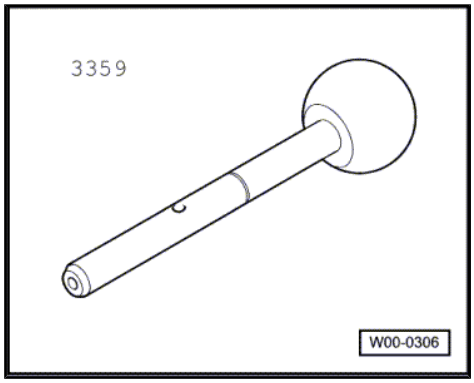
1.11 Removing and installing balance shaft

Special tools and workshop equipment required

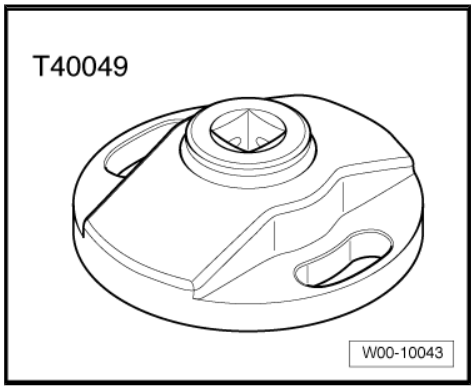
- ♦ Locking pin -3242-



♦ Diesel injection pump locking pin -3359-



♦ Special wrench -T40049-



Removing

- Engine separated from gearbox, engine secured to engine and gearbox support ⇒ page 95 .
- Engine oil drained ⇒ Maintenance ; Booklet 404

– Remove sealing flange (front) ⇒ page 118 .

– Remove dual-mass flywheel on vehicles with manual gearbox ⇒ page 122 .

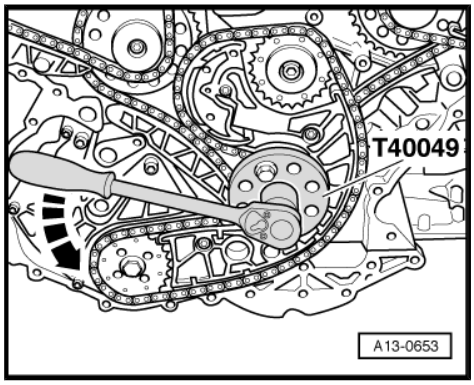
– Remove flywheel on vehicles with multitronic gearbox ⇒ page 126 .

– Remove drive plate on vehicles with automatic gearbox ⇒ page 128 .

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– Remove timing chain covers ⇒ page 143 .

– Attach special wrench -T40049- to rear of crankshaft: on vehicles with automatic gearbox secure wrench with two old drive plate bolts; on vehicles with manual gearbox or multitronic gearbox use two bolts M10x19 to secure wrench.



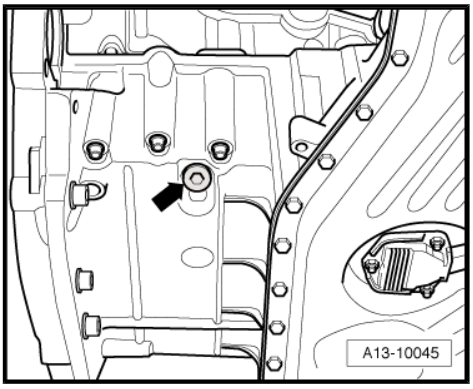
Caution

Do not use bolts for dual-mass flywheel or flywheel to secure wrench -T40049- ; these bolts are too long and can damage the camshaft timing chains when they are screwed in.

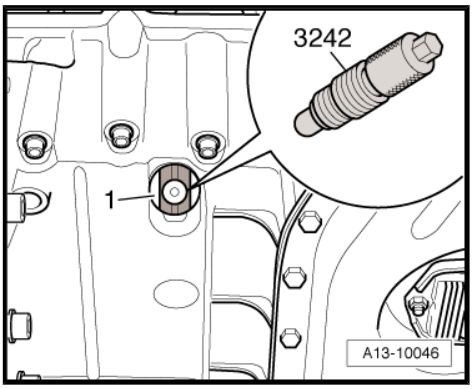
Note

Disregard -arrow-.

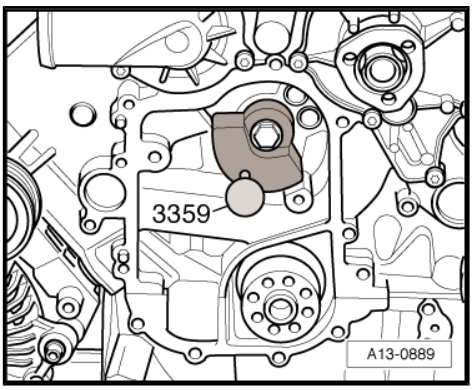
– Unscrew plug -arrow- from sump (top section).



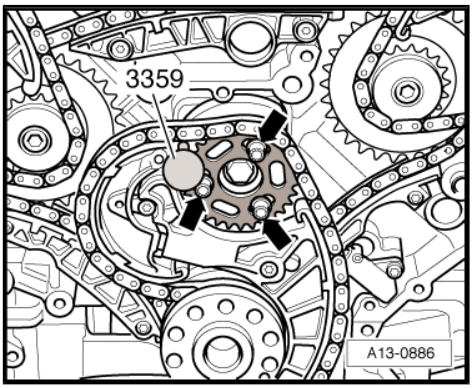
– Screw locking pin -3242- into bore (20 Nm); if necessary, turn crankshaft -1- backwards and forwards slightly to fully centralise locking pin.



– Lock balance shaft at front of engine with diesel injection pump locking pin -3359-
– Unscrew bolt and detach balance weight from balance shaft.

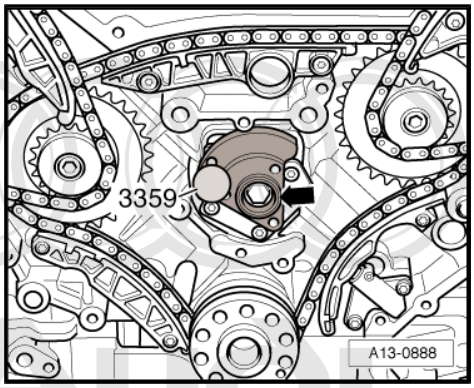


– Lock balance shaft at rear of engine with diesel injection pump locking pin -3359-
– Unscrew bolts -arrows- and detach chain sprocket from balance weight.

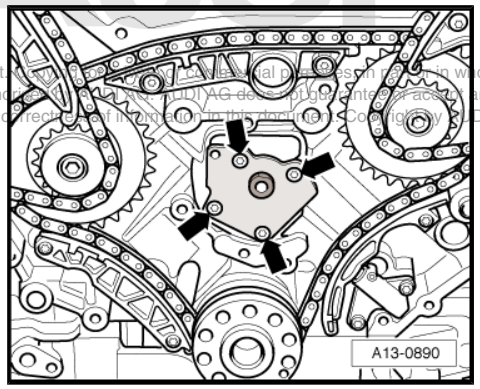


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– Unscrew bolt -arrow- and detach balance weight from balance shaft.



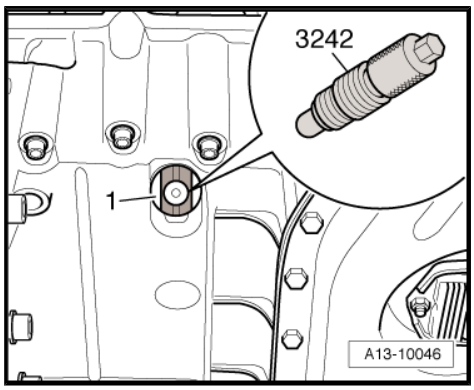
– Unscrew bolts -arrows- and detach bearing plate for balance shaft.
– Pull balance shaft out of cylinder block.



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Installing

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



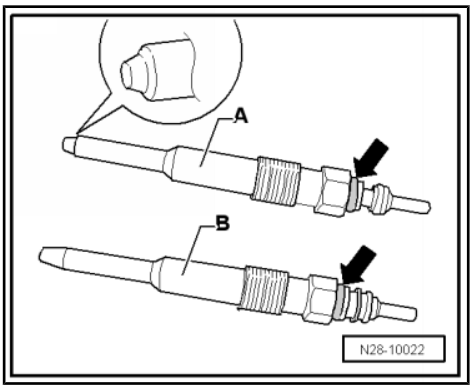
- Crankshaft -1- locked in TDC position with locking pin -3242- .

– Install chain for oil pump and balance shaft ⇒ page 173
– Install timing chain covers ⇒ page 144 .
– Install dual-mass flywheel on vehicles with manual gearbox ⇒ page 122 .
– Install flywheel on vehicles with multitronic gearbox ⇒ page 126 .
– Install drive plate on vehicles with automatic gearbox ⇒ page 128 .
– Install sealing flange (front) ⇒ page 118 .
– After installing engine, fill up with engine oil and check oil level ⇒ Maintenance ; Booklet 405 .

Tightening torques

Component	Nm
Cover to cylinder block	9
Balance weight to balance shaft	60

2 Handling ceramic glow plugs



- The 6-cylinder 2.7 ltr. TDI engine in the Audi A6 is fitted exclusively with metal glow plugs.
- Up to autumn 2004, two different types of glow plugs are fitted in the Audi A6 with 6-cylinder 3.0 ltr. TDI engine; from autumn 2004 onwards, these engines are fitted exclusively with metal glow plugs. Distinguishing features:

A - Ceramic glow plugs are colour-coded with a „white seal“ -arrow- and have a chamfered shoulder at the tip.

B - Metal glow plugs are colour-coded with a „red seal“ -arrow-.

The metal glow plugs do not require any special handling procedures.

Important: Note the following points regarding ceramic glow plugs:

Caution

- *Due to the special properties of the material used, ceramic glow plugs are easily damaged and require extra care when handling and removing/installing. Always observe the special instructions when removing and installing ceramic glow plugs ⇒ Rep. gr. 28 .*
- *Transport and store only in original packaging or packed separately in bubble wrap.*
- *Do not remove new ceramic glow plugs from packaging until they are ready to be fitted.*
- *Ceramic glow plugs are sensitive to knocks and bending. For this reason, ceramic glow plugs which have been dropped (even from a height of only about 2 cm) must not be installed, even if no damage is apparent (hair-line cracks may not be visible).*
- *Always install a new ceramic glow plug if you are not sure the old one is in perfect condition.*
- *Damaged glow plugs (e.g. heater pin of the glow plug is damaged) will invariably cause engine damage.*
- *If the heater pin of the glow plug is damaged, the fragments must be removed from the combustion chamber before starting the engine for the first time, otherwise this will invariably cause mechanical damage (piston seizure).*
- *The software of the engine control unit is specifically adapted to either the ceramic or the metal glow plugs, so it is important to install the correct type.*
- *Mixed installation of ceramic glow plugs and metal glow plugs on the same engine is not permissible.*

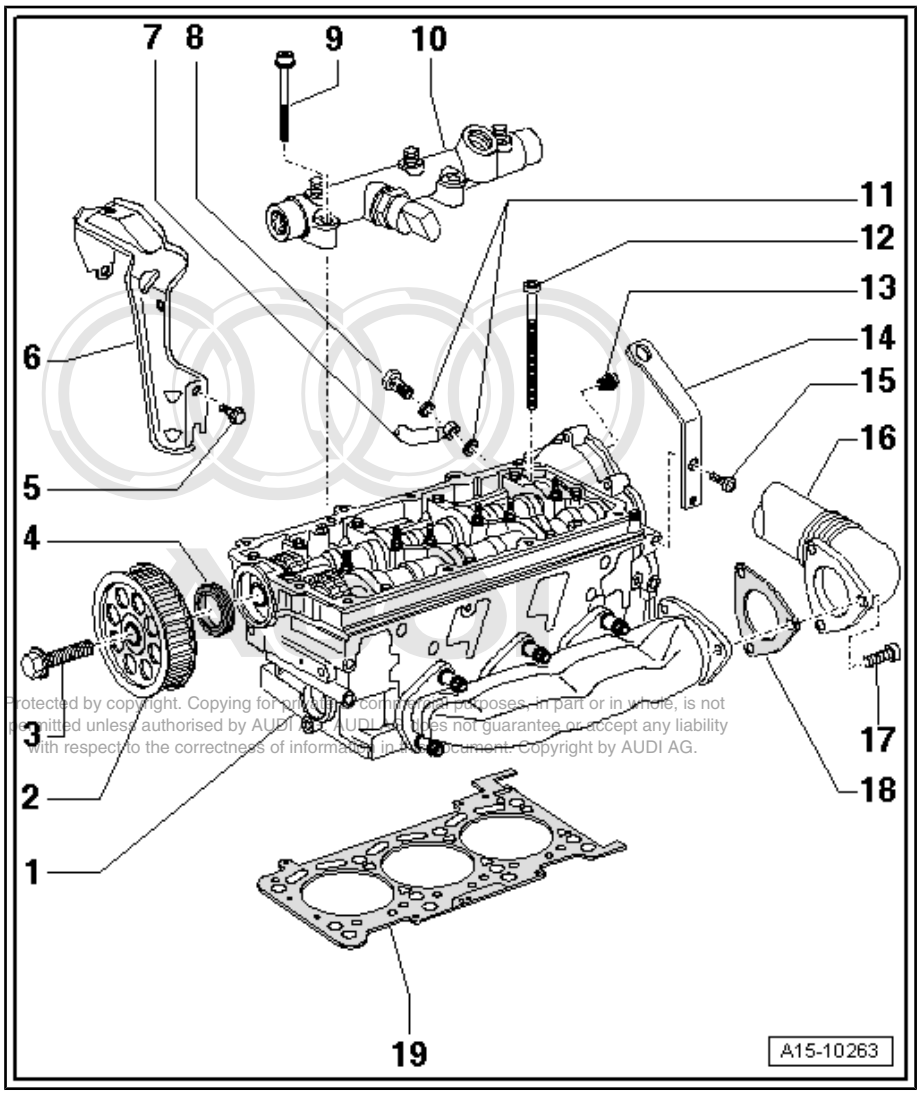
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3 Cylinder head

3.1 Cylinder head - exploded view

Note

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



1 - Cylinder head

Caution

Vehicles with ceramic glow plugs: The ceramic glow plugs fitted in this engine are very easily damaged and project slightly beyond the cylinder head gasket surface, so do NOT lay the cylinder head down on the gasket side while the glow plugs are still installed.

Handling ceramic glow plugs ⇒ page 181 .

- ❑ Removing: vehicles up to 10.2005 ⇒ page 193 ; vehicles from 10.2005 onwards ⇒ page 196
- ❑ Checking for distortion ⇒ page 184
- ❑ Cylinder heads must not be machined on diesel engines
- ❑ Installing ⇒ page 200
- ❑ If renewed, change coolant and engine oil

2 - Toothed belt drive sprocket

- ❑ Use counterhold tool -3036- when loosening and tightening central bolt ⇒ page 183
- ❑ Pulling off: vehicles up to 12.2005 ⇒ page 184 ; vehicles from 12.2005 onwards ⇒ page 184

3 - 75 Nm

- ❑ Use counterhold tool -3036- when loosening and tightening ⇒ page 183

4 - Oil seal for toothed belt sprocket for high-pressure pump

- ❑ Renewing ⇒ page 210

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5 - 9 Nm

6 - Bracket for intake connecting pipe

7 - Coolant pipe/hose

8 - Banjo bolt, 15.5 Nm

9 - 23 Nm

10 - High-pressure reservoir

- ❑ Observe rules for cleanliness ⇒ page 6
- ❑ Do not attempt to bend high-pressure pipes to a different shape
- ❑ Tightening high-pressure pipe connections at high-pressure reservoir ⇒ page 187

11 - Seals

- ❑ Renew

12 - Cylinder head bolt

- ❑ Renew
- ❑ Observe sequence when loosening: vehicles up to 10.2005 ⇒ page 196 , vehicles from 10.2005 onwards ⇒ page 199
- ❑ Note correct sequence when tightening ⇒ page 204

13 - Oil retention valve

- ❑ Tighten to 25 Nm

14 - Lifting eye

15 - M6: 9 Nm; M8: 23 Nm

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16 - Intermediate pipe (left-side)

- ❑ Removing and installing ⇒ page 376

17 - 30 Nm + turn 90° further

- ❑ Type of connection differs depending on version ⇒ page 185

18 - Gasket

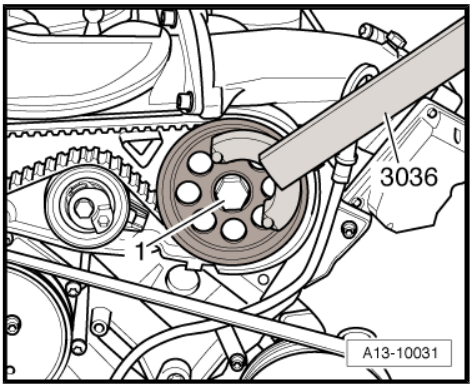
- ❑ Renew

19 - Cylinder head gasket

- ❑ Renewing: vehicles up to 10.2005 ⇒ page 193 ; vehicles from 10.2005 onwards ⇒ page 196
- ❑ Identification ⇒ page 184
- ❑ Installation position: Part No. towards cylinder head
- ❑ If renewed, change coolant and engine oil

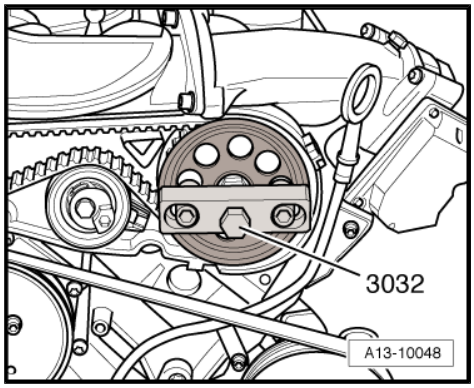
Loosening and tightening central bolt for toothed belt drive sprocket

– Use counterhold tool -3036- when loosening and tightening central bolt -1-.



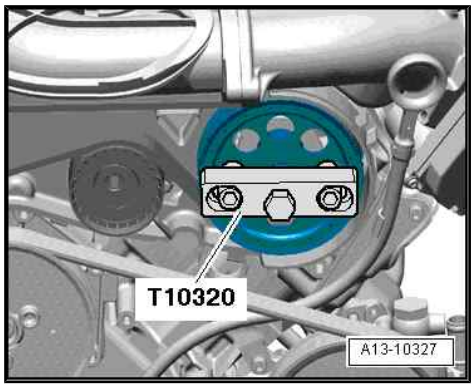
Pulling off toothed belt drive sprocket (versions up to 12.2005)

– Use puller -3032- to pull off toothed belt drive sprocket.



Pulling off toothed belt drive sprocket (versions from 12.2005 onwards)

– Use puller -T10320- to pull off toothed belt drive sprocket.

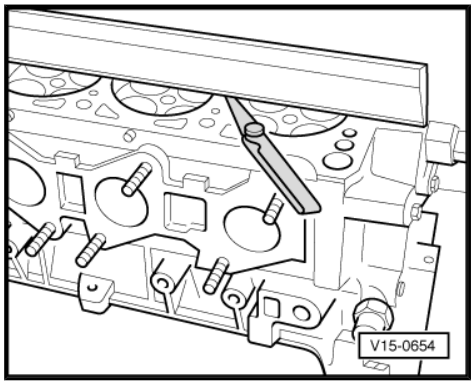


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Checking cylinder head for distortion

– Use straight edge and feeler gauge to measure for distortion at several points.

• Maximum permissible distortion: 0.1 mm.



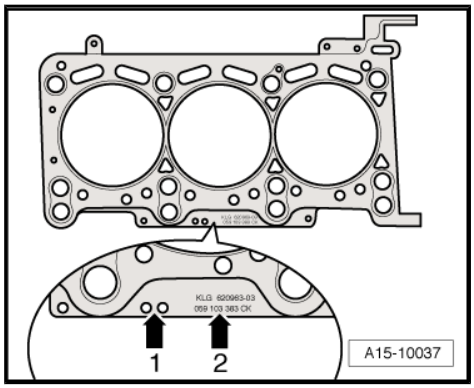
Identification of cylinder head gasket

1 - Holes

2 - Part No.

Note

The gaskets for the left and right cylinder heads have different shapes and cannot be interchanged.



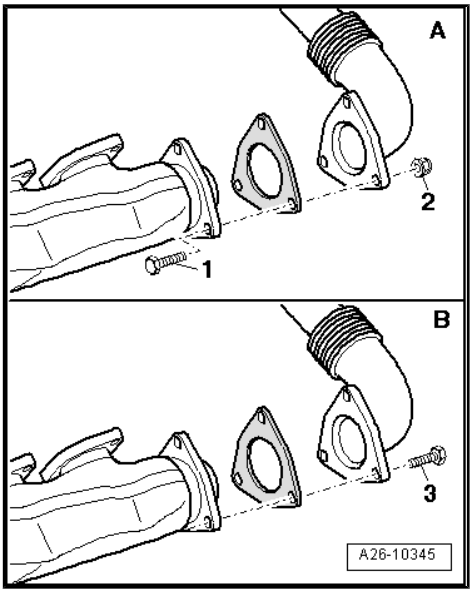
Securing intermediate pipe to exhaust manifold

A - Exhaust manifold (sheet metal version)

- Fitted with bolts -1- and nuts -2-.
- Renew bolts and nuts.
- Coat with high-temperature paste; for high-temperature paste refer to ⇒ Electronic parts catalogue .

B - Exhaust manifold (cast version)

- Fitted with bolts -3-.
- Renew bolts.
- Coat with high-temperature paste; for high-temperature paste refer to ⇒ Electronic parts catalogue .

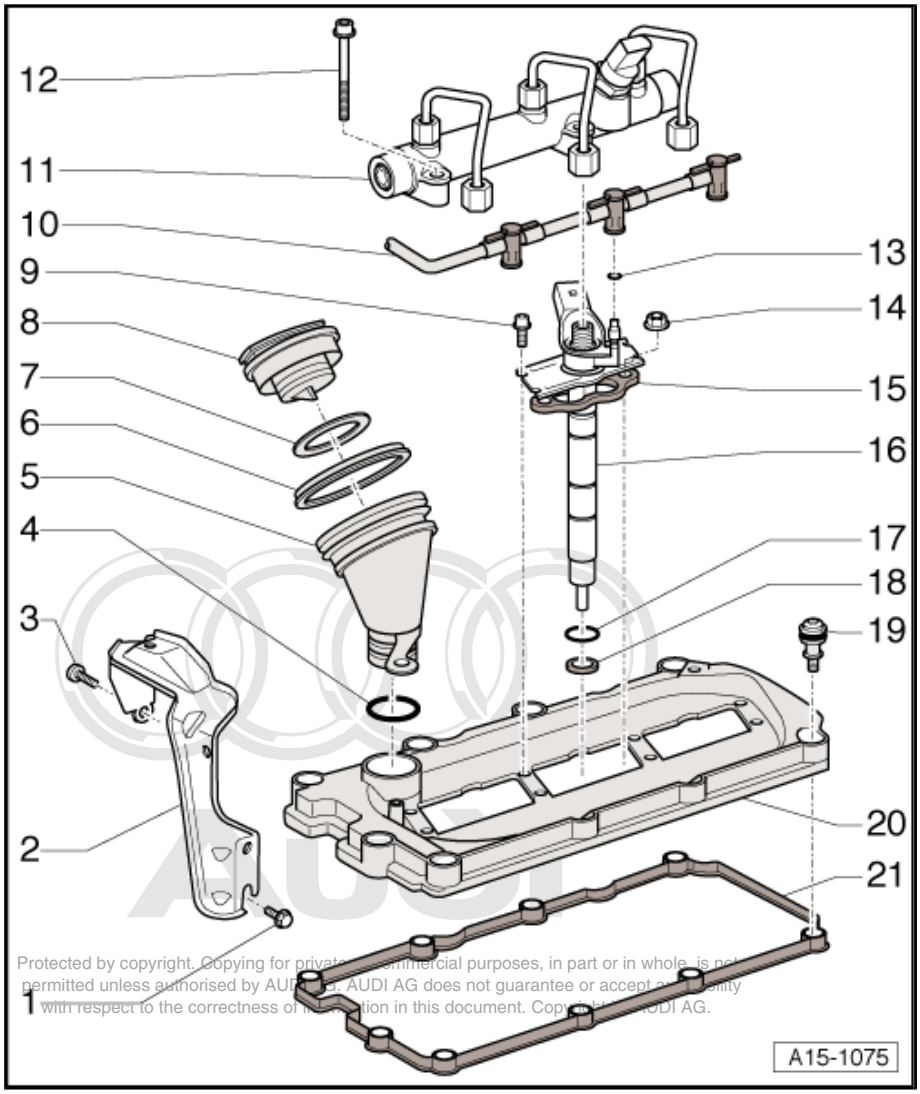


3.2 Cylinder head cover - exploded view

Note

Diagram shows cylinder head cover on cylinder bank 2 (left-side).

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1 - 9 Nm

2 - Bracket for intake connecting pipe

3 - 9 Nm

4 - O-ring

- ❑ Renew

5 - Oil filler neck

- ❑ To remove: Lift tab, turn oil filler neck anti-clockwise and take out

6 - Seal

7 - Seal

- ❑ Renew if damaged or leaking

8 - Filler cap

9 - 5 Nm

10 - Fuel return line

- ❑ Observe rules for cleanliness ⇒ page 6

11 - High-pressure reservoir

- ❑ With high-pressure pipes
- ❑ Observe rules for cleanliness ⇒ page 6
- ❑ Tightening high-pressure pipe connections at high-pressure reservoir: vehicles up to 10.2005 ⇒ page 187 ; vehicles from 10.2005 onwards ⇒ page 187
- ❑ Tightening high-pressure pipe connections at injectors ⇒ page 187
- ❑ Do not attempt to bend high-pressure pipes to a different shape

12 - 23 Nm

13 - O-ring

- ❑ Renew

14 - 9 Nm

- ❑ Tighten alternately in stages

15 - Clamping piece

- ❑ Must be renewed if injector is renewed

16 - Injector

- ❑ Observe rules for cleanliness ⇒ page 6
- ❑ Removing and installing ⇒ „3.3 Removing and installing cylinder head cover“, page 188
- ❑ When an injector is renewed, also renew the high-pressure pipe and clamping piece at the same time

17 - O-ring

- ❑ Renew

18 - Copper seal

- ❑ Renew

19 - Special bolt, 9 Nm

- ❑ Renew if damaged or leaking

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❑ Tighten in stages and in diagonal sequence

20 - Cylinder head cover

❑ Removing and installing ⇒ page 188

21 - Gasket for cylinder head cover

❑ Renew if damaged or leaking

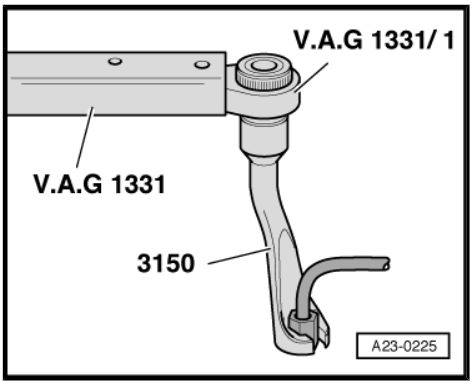
Tightening high-pressure pipe connections at high-pressure reservoir - vehicles up to 10.2005

– Tighten union nuts on high-pressure pipes hand-tight initially.

– Ensure that high-pressure pipes are not under tension.

– To tighten unions of high-pressure pipes, use torque wrench -V.A.G 1331- with ratchet -V.A.G 1331/1- and socket, 14 mm -3150- .

• Tightening torque: 25 Nm.



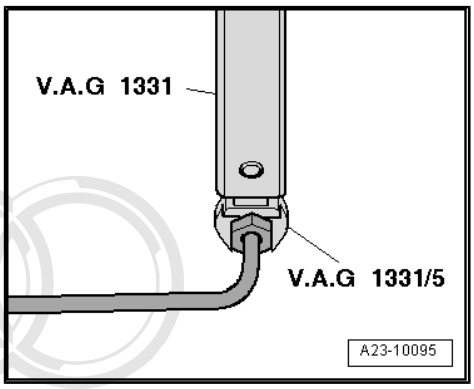
Tightening high-pressure pipe connections at high-pressure reservoir - vehicles from 10.2005 onwards

– Tighten union nuts on high-pressure pipes hand-tight initially.

– Ensure that high-pressure pipes are not under tension.

– To tighten unions of high-pressure pipes, use torque wrench -V.A.G 1331- and tool insert, AF 19 -V.A.G 1331/5- .

• Tightening torque: 25 Nm.



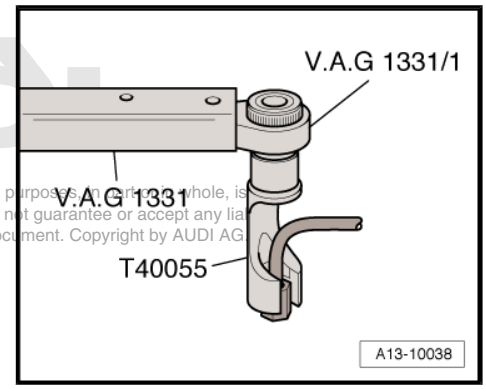
Tightening high-pressure pipes at injectors

– Tighten union nuts on high-pressure pipes hand-tight initially.

– Ensure that high-pressure pipes are not under tension.

– To tighten unions of high-pressure pipes, use torque wrench -V.A.G 1331- with ratchet -V.A.G 1331/1- and socket -T40055- .

• Tightening torque: 25 Nm.

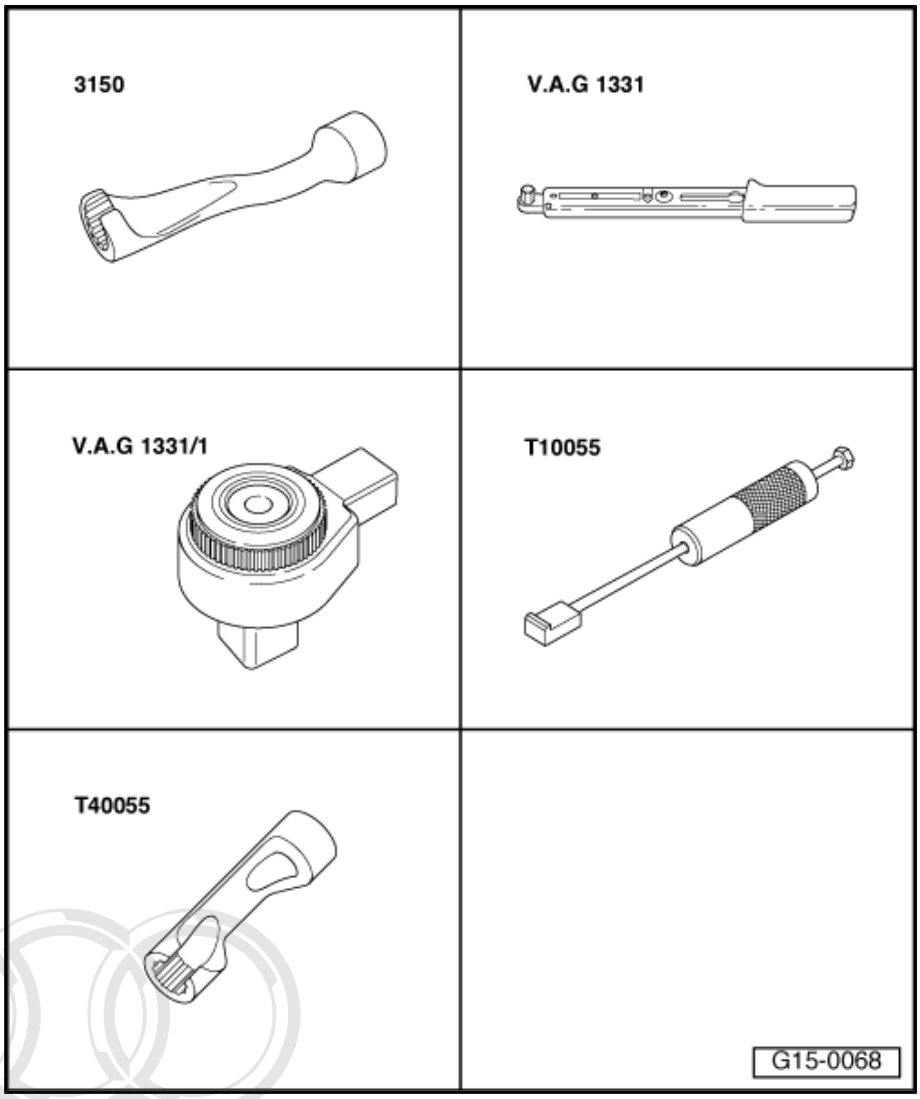


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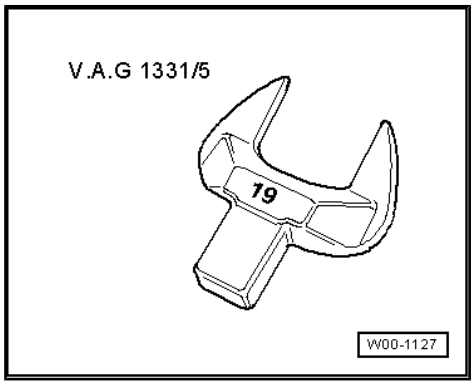
3.3 Removing and installing cylinder head cover

Special tools and workshop equipment required

- Socket, 14 mm -3150- for vehicles up to 10.2005
- Torque wrench - V.A.G 1331-
- Ratchet -V.A.G 1331/1-
- Puller -T10055- with -T10055/1-
- Socket -T40055-



- Tool insert, AF 19 -V.A.G 1331/5- for vehicles from 10.2005 onwards



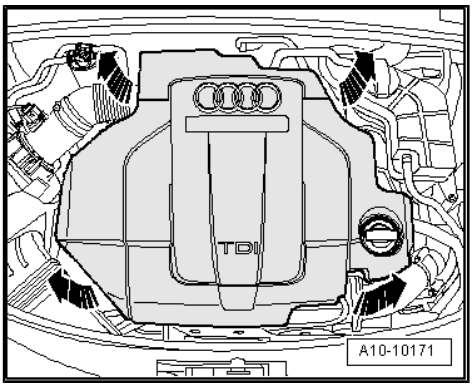
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Removing

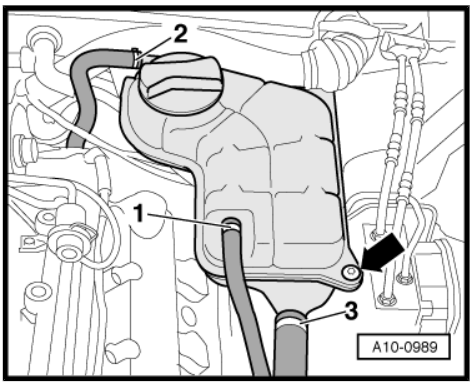
Note

The following description shows the removal and installation of the left cylinder head cover. The procedure for the other side is the same, except that some steps are not required.

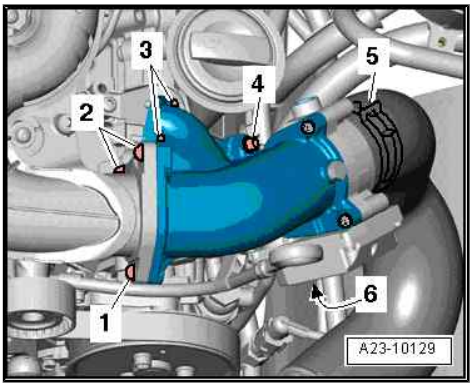
– Carefully pull engine cover panel off four retaining pins one after the other -arrows-.



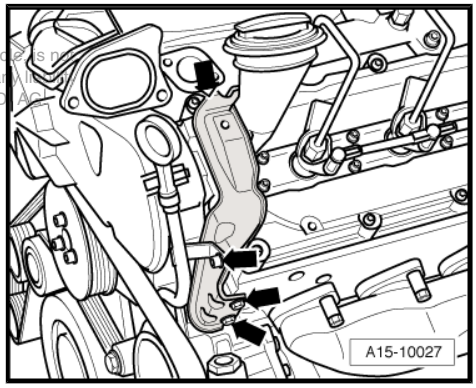
– Unbolt coolant expansion tank -arrow-.
– Detach electrical connector at coolant shortage indicator switch -F66- on coolant expansion tank (bottom).
– Lay aside coolant expansion tank with coolant hoses -1 … 3- connected.



– Disconnect air intake hose -5- from throttle valve module -J338- .
– Unplug electrical connector -6- at throttle valve module -J338- .
– Remove bolts -1 ... 4-.

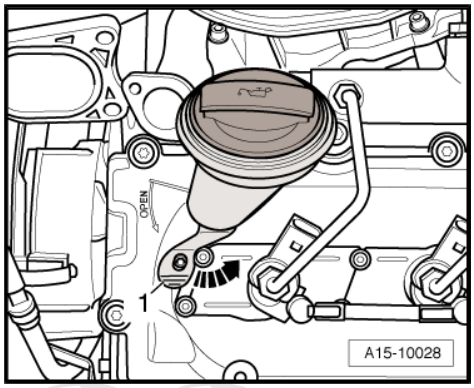


– Unbolt bracket for intake connecting pipe from cylinder head -arrows-.



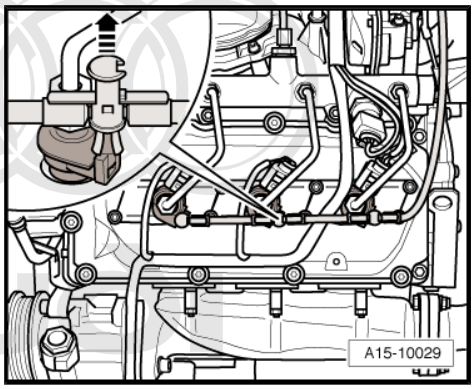
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– Remove oil filler neck. To do so, lift tab -1- and turn oil filler neck anti-clockwise -arrow-.



Caution

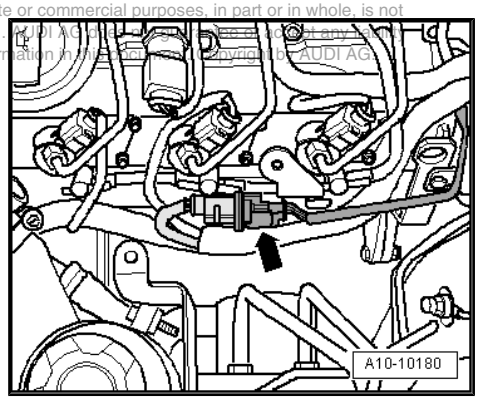
Observe rules for cleanliness when working on the injection system ⇒ page 6 .



– Pull release pins upwards -arrow- and pull return line connections off injectors.

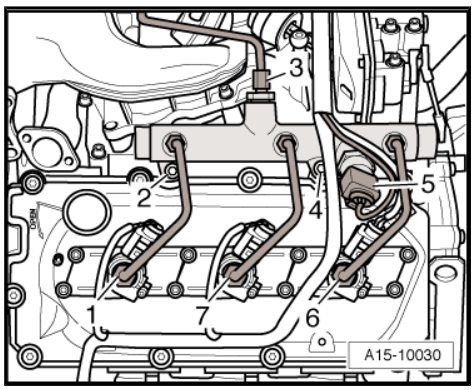
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– Remove connector -arrow- for Lambda probe -G39- from retainer.
– Unplug electrical connector and move wiring clear.
– Detach bracket for electrical connector for Lambda probe -G39- from cylinder head cover.



Vehicles up to 10.2005:

– Unplug electrical connectors -5- at high-pressure reservoir and injectors.
– Move electrical wiring harness clear at high-pressure reservoir.
– Loosen union nuts for high-pressure pipes -1-, -6- and -7- using socket -T40055- .
– Loosen union nut for high-pressure pipe -3- at high-pressure reservoir.
– Remove bolts -2- and -4- and detach high-pressure reservoir.

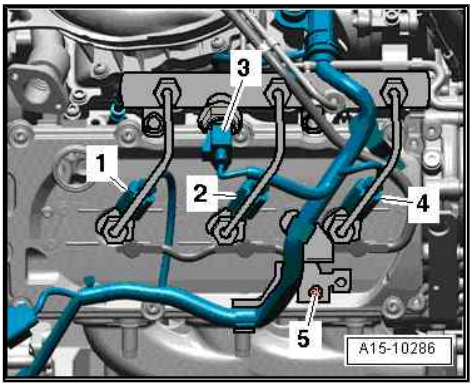


Vehicles from 10.2005 onwards:

– Unbolt bracket -5- for wiring harness at cylinder head cover.

– Unplug electrical connectors -1 ... 4- at high-pressure reservoir and injectors.

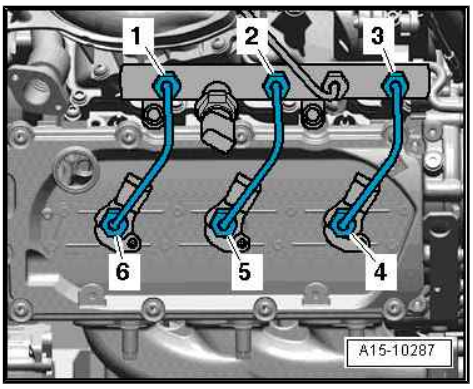
– Move electrical wiring harness clear.



– Mark high-pressure pipes to ensure they are re-connected to the same injectors.

– Loosen union nuts for high-pressure pipes -1 ... 6- using tool insert, AF 19 -V.A.G 1331/5- and socket -T40055- .

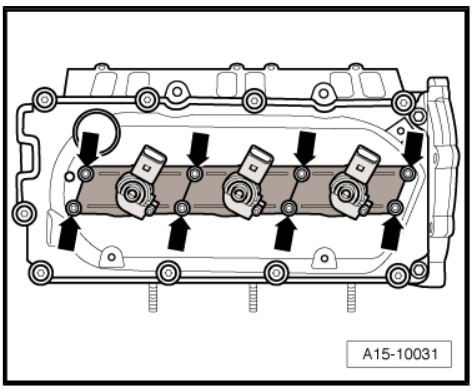
– Detach high-pressure pipes.



All vehicles:

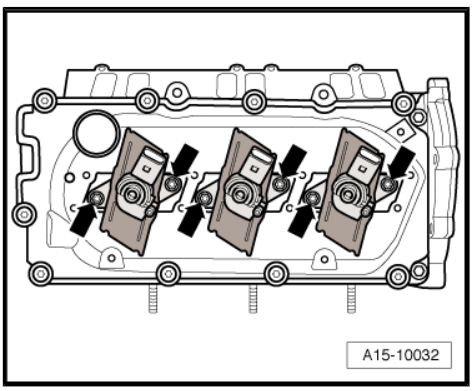
– Unbolt covers for injectors -arrows-.

– Pull covers upwards and turn them $^{1}/_{4}$ turn (90°).

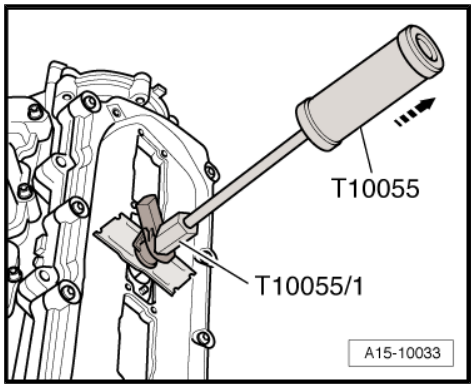


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– Unbolt injectors -arrows-.



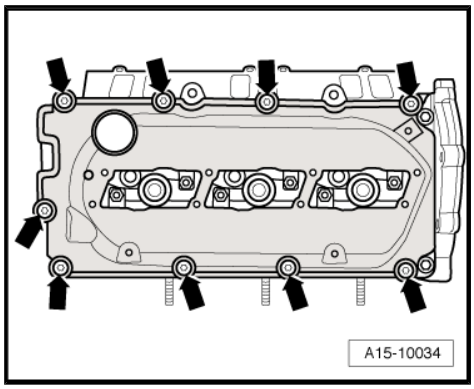
– Pull out injectors using puller -T10055- with -T10055/1- .



Caution

- *Mark cylinder numbers on injector units.*
- *Used injectors must always be re-installed on the same cylinder.*

– Loosen cylinder head cover bolts -arrows- in diagonal sequence.



– Remove bolts and take off cylinder head cover.

Installing

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

Note

- *Renew gaskets and bolts for cylinder head cover if damaged.*
- *Renew gaskets, seals and O-rings.*
- *Hose connections and hoses for charge air system must be free of oil and grease before assembly.*
- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*
- *To ensure that the charge air hoses can be properly secured at their connections, spray rust remover onto the worm thread of used hose clips before installing.*

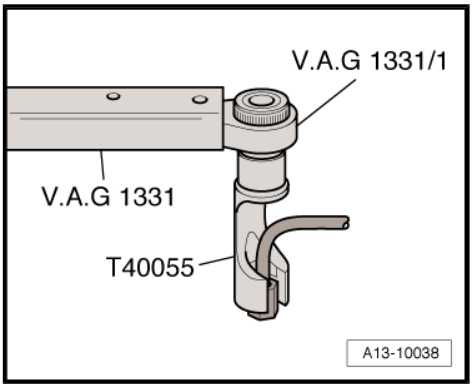
– Tighten cylinder head cover bolts diagonally and in stages.

Instructions for installing injectors:

- Before installation, make sure the injectors and their surroundings are clean. If necessary use a clean cloth to wipe out the injector slot, taking care not to cause damage (do not use sharp-edged tools).
- Always install new seals and gaskets. Lubricate all seals and gaskets lightly with engine oil or assembly oil before installing.
- The injectors must be completely undamaged. To remove the old copper seal from the injector, clamp the seal carefully in a vice so that it is just held between the jaws without turning. Then carefully pull and twist the injector out of the copper seal by hand.
- When an injector is renewed, also renew the high-pressure pipe and clamping piece at the same time.
- Used injectors and high-pressure pipes may only be re-installed on the same cylinder.

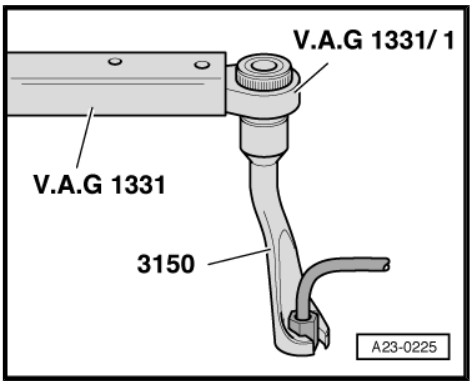
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– Install injectors.
– Tighten union nuts on high-pressure pipes hand-tight initially.
– Ensure that high-pressure pipes are not under tension.
– To tighten unions of high-pressure pipes, use torque wrench -V.A.G 1331- with ratchet -V.A.G 1331/1- and socket -T40055- .



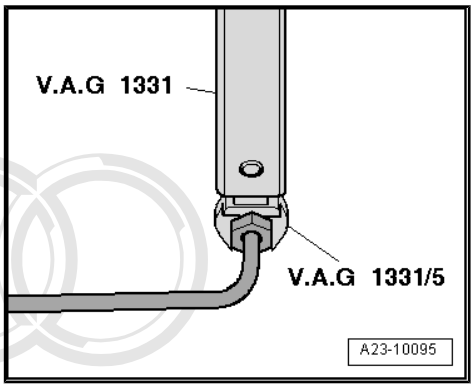
Vehicles up to 10.2005:

– To tighten unions of high-pressure pipes at high-pressure reservoir, use torque wrench -V.A.G 1331- with ratchet -V.A.G 1331/1- and socket, 14 mm -3150- .



Vehicles from 10.2005 onwards:

– To tighten unions of high-pressure pipes, use torque wrench -V.A.G 1331- and tool insert, AF 19 -V.A.G 1331/5- .



All vehicles:

– Check fuel system for leaks ⇒ page 6 .

Tightening torques

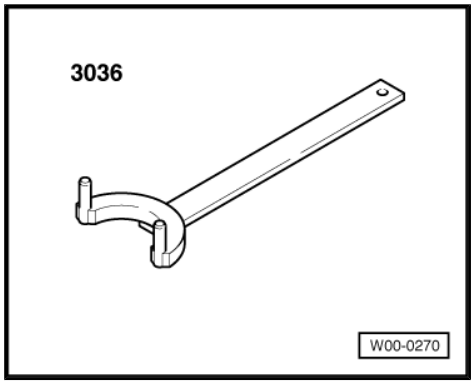
Component		Nm
Cylinder head cover to cylinder head		9
Injector in cylinder head		9
Cover for injector to cylinder head		5
High-pressure reservoir to cylinder head		23
High-pressure pipes		25
Bracket for intake connecting pipe to cylinder head		9
Intake connecting pipe	Intake manifold	9
to:	Bracket	9
Hose clips (13 mm wide)		5.5

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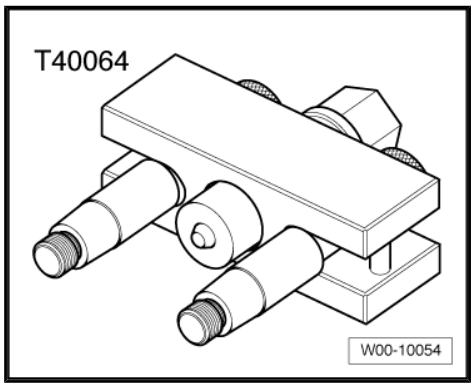
3.4 Removing cylinder head - vehicles up to 10.2005

Special tools and workshop equipment required

♦ Counterhold tool -3036-

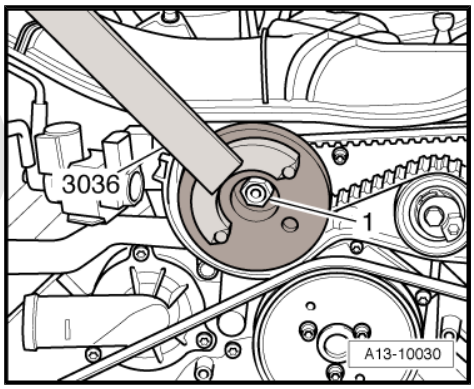


♦ Puller -T40064-

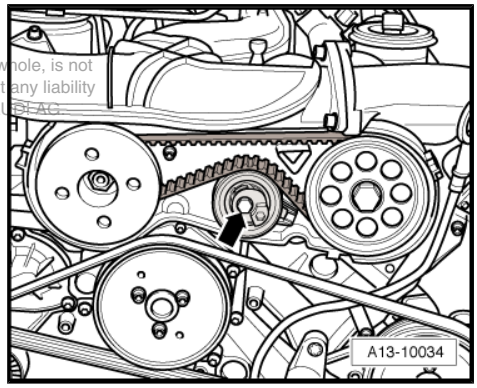


Removing

– Drain off coolant ⇒ page 256 .
– Remove timing chain from camshaft ⇒ page 151 on relevant cylinder bank.
– Remove intermediate pipe: left-side ⇒ page 376 , right-side ⇒ page 377 .
– Remove toothed belt for high-pressure pump ⇒ Rep. gr. 23 .
– Loosen central nut -1- for high-pressure pump shaft using counterhold tool -3036- .
– Remove damper weight.

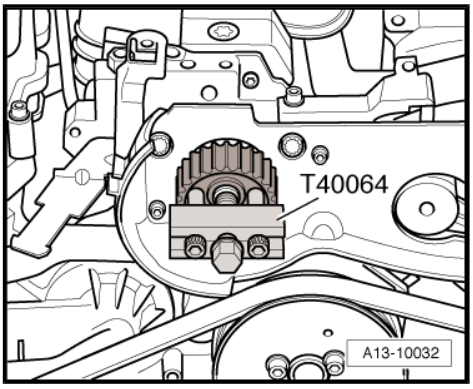


– Remove tensioning roller for toothed belt for high-pressure pump -arrow-.

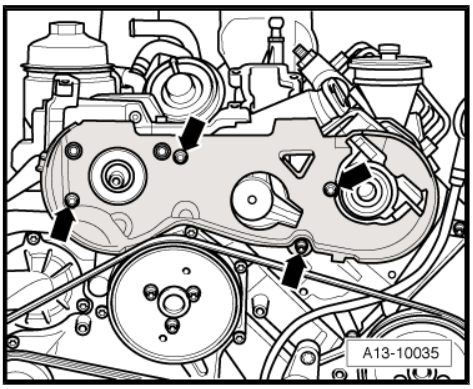


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– Use puller -T40064- to pull off belt sprocket for high-pressure pump.

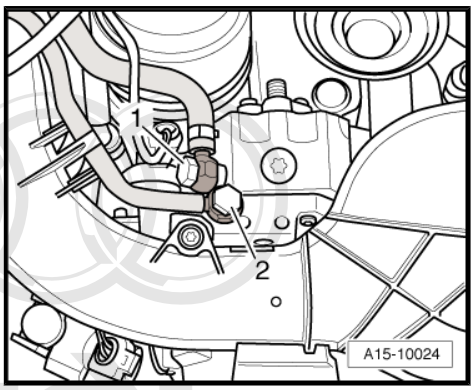


– Remove bolts -arrows- and detach toothed belt cover (rear).



Cylinder head (right-side):

– Disconnect fuel supply line -2- and fuel return line -1- from high-pressure pump and move lines clear to the side.



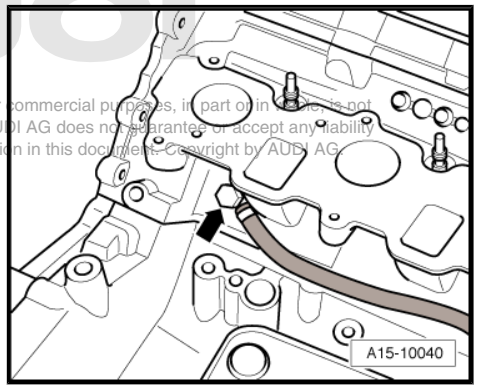
Continuation for both sides:

– Remove intake manifold (top section) ⇒ Rep. gr. 23 .

– Remove bottom section of intake manifold (left or right) ⇒ Rep. gr. 23 .

– Remove cylinder head cover (left or right) ⇒ page 188 .

– Disconnect coolant line -arrow- (left or right).

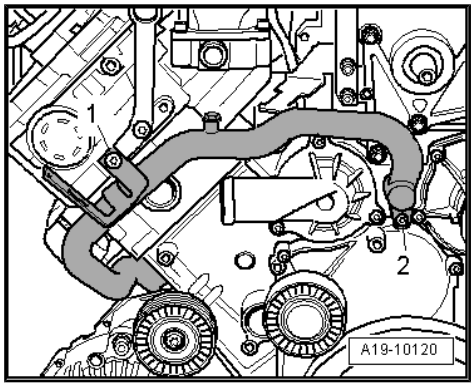


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Cylinder head (right-side):

– Remove bolts -1- and -2-.

– Pull coolant pipe (right-side) forwards out of cylinder block and detach coolant pipe.

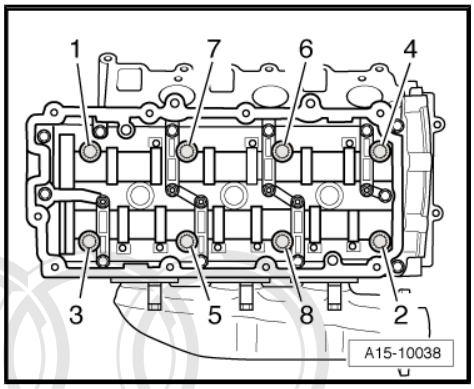


Continuation for both sides:

– Loosen cylinder head bolts in the sequence shown.

– Unscrew bolts completely and take off cylinder head carefully.

– Lay cylinder head aside on a clean surface with the combustion chamber side facing upwards.



Caution

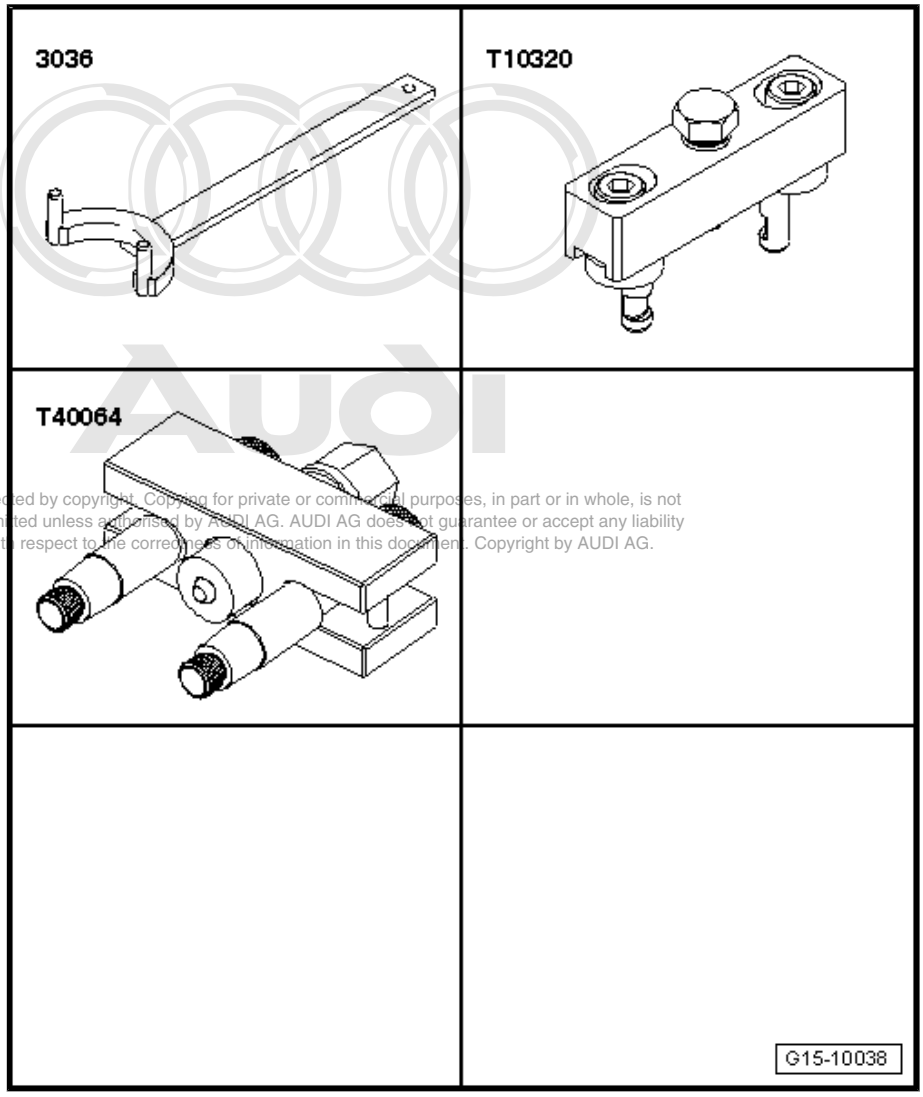
- *Vehicles with steel glow plugs: After removal, do NOT lay the cylinder head down on the gasket side while the glow plugs are still installed because the glow plugs project slightly beyond the cylinder head gasket surface.*
- *Vehicles with ceramic glow plugs: The ceramic glow plugs fitted in this engine are very easily damaged and project slightly beyond the cylinder head gasket surface, so do NOT lay the cylinder head down on the gasket side when it is removed and while the glow plugs are still installed.*
- *Handling ceramic glow plugs ⇒ page 181 .*

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3.5 Removing cylinder head - vehicles from 10.2005 onwards

Special tools and workshop equipment required

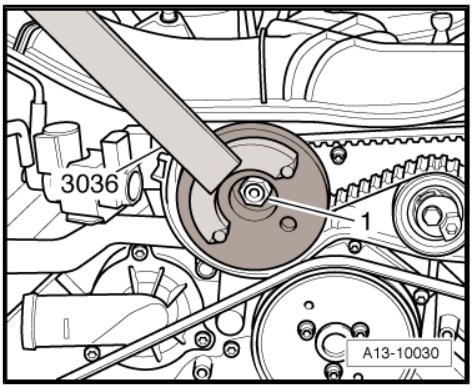
- Counterhold tool -3036-
- Puller -T10320-
- Puller -T40064-



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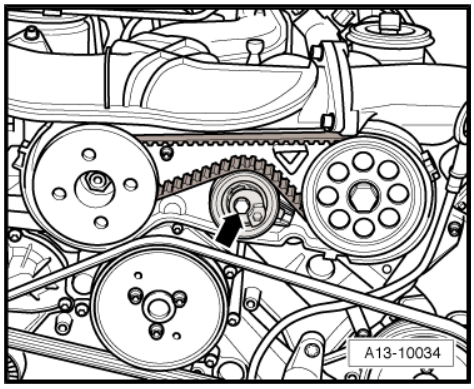
Removing

– Drain off coolant ⇒ page 256 .
– Remove toothed belt for high-pressure pump ⇒ Rep. gr. 23 .
– Loosen central nut -1- for high-pressure pump shaft using counterhold tool -3036- .
– Remove damper weight.



Vehicles up to 12.2005:

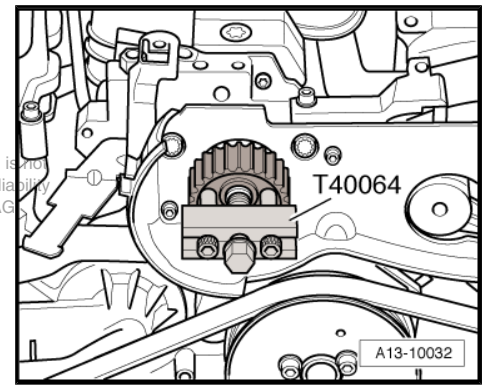
– Remove tensioning roller for toothed belt for high-pressure pump -arrow-.



All vehicles:

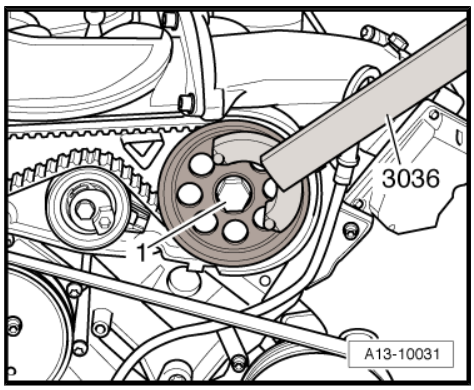
– Use puller -T40064- to pull off belt sprocket for high-pressure pump.

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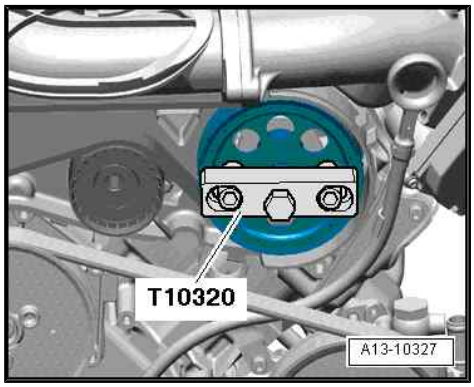


Vehicles from 12.2005 onwards:

– Loosen central bolt -1- for toothed belt drive sprocket approx. 2 turns using counterhold tool -3036- .

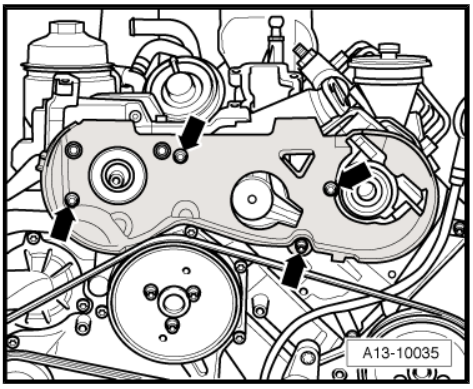


– Use puller -T10320- to pull off toothed belt drive sprocket.



All vehicles:

– Remove bolts -arrows- and detach toothed belt cover (rear).



Cylinder head (right-side):

– Disconnect fuel supply line -2- and fuel return line -1- from high-pressure pump and move lines clear to the side.

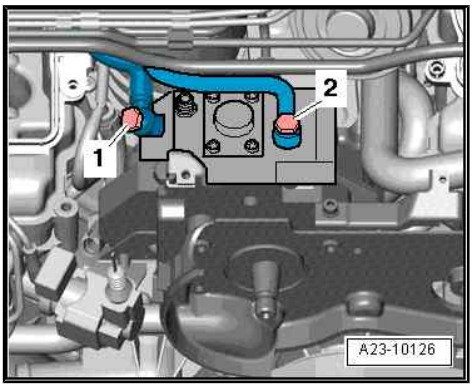
Continuation for both sides:

– Remove bottom section of intake manifold (left or right) ⇒ Rep. gr. 23 .

– Remove timing chain from camshaft ⇒ page 151 on relevant cylinder bank.

– Remove intermediate pipe: left-side ⇒ page 376 , right-side ⇒ page 377 .

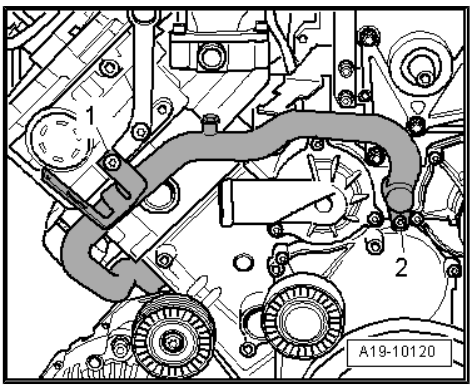
– Remove cylinder head cover (left or right) ⇒ page 188 .



Cylinder head (right-side):

– Remove bolts -1- and -2-.

– Pull coolant pipe (right-side) forwards out of cylinder block and detach coolant pipe.

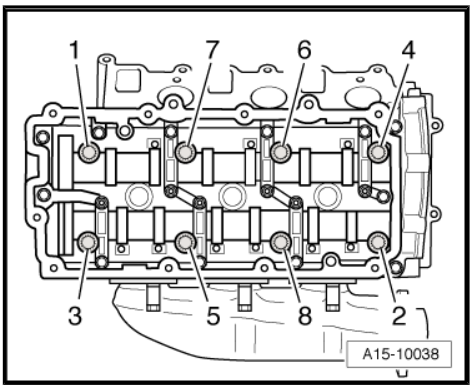


Continuation for both sides:

– Loosen cylinder head bolts in the sequence shown.

– Remove bolts and carefully detach cylinder head.

– Lay cylinder head aside on a clean surface with the combustion chamber side facing upwards.



Caution

After removal, the cylinder head must not be put down on the gasket side with the glow plugs still installed, because the glow plugs project beyond the gasket surface.

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3.6 Installing cylinder head

Note

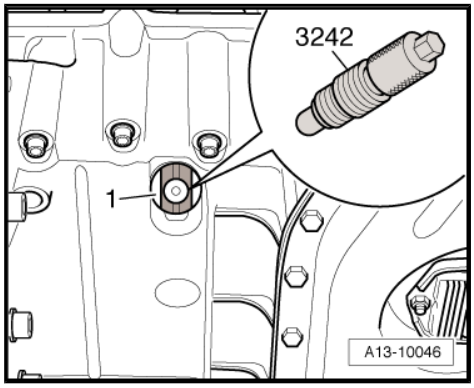
- *The cylinder heads of diesel engines must not be machined.*
- *Renew the cylinder head bolts.*
- *Renew self-locking nuts and bolts when performing assembly work.*
- *Renew bolts which are tightened to a specified angle as well as seals and gaskets.*
- *If repairing, carefully remove any remaining gasket material from the cylinder head and cylinder block. Ensure that no long scores or scratches are made on the surfaces.*
- *Carefully remove any remaining emery and abrasive material.*
- *No oil or coolant must be allowed to remain in the blind holes for the cylinder head bolts in the cylinder block.*
- *Do not remove new cylinder head gasket from packaging until it is ready to be fitted.*
- *Handle cylinder head gasket very carefully. Damage to the silicone coating or the indented area will lead to leaks.*
- *The plastic protectors fitted to protect the open valves should not be removed until the cylinder head is ready to be fitted.*
- *When installing an exchange cylinder head with fitted camshafts, oil the contact surfaces between the roller rocker fingers and cams.*
- *After working on the valve gear, turn the engine carefully at least 2 rotations to ensure that none of the valves make contact when the starter is operated.*
- *Hose connections and hoses for charge air system must be free of oil and grease before assembly.*
- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*
- *To ensure that the charge air hoses can be properly secured at their connections, spray rust remover onto the worm thread of used hose clips before installing.*
- *After fitting a new cylinder head or cylinder head gasket, change the engine oil and the coolant in the entire cooling system.*

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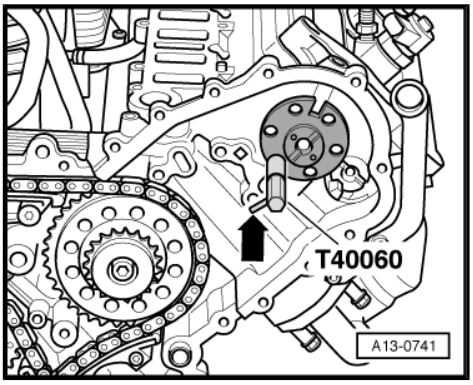
Installation is carried out in the reverse order; note the following:

– Set crankshaft and camshafts to TDC before fitting cylinder head:

• Locking pin -3242- must be screwed in with crankshaft at TDC position -1-.



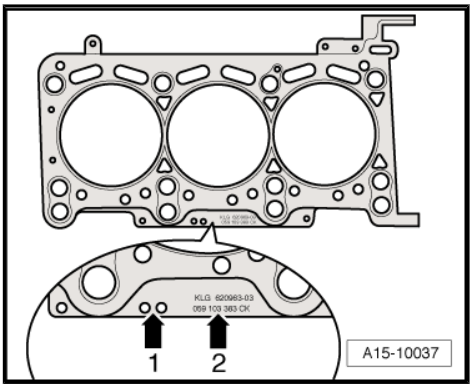
- The camshafts on both cylinder heads must be locked with adjustment pins -T40060- .
- The side pin -arrow- in each adjustment pin -T40060- must be in line with the imaginary line between the adjustment pin and the centre of the camshaft.



– Note identification markings on cylinder head gasket:

1 - Holes

2 - Part No.



Note

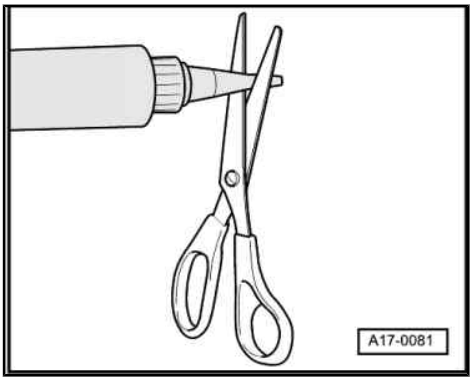
- *If the cylinder head gasket or cylinder head have been replaced, select the new cylinder head gasket according to the number of holes on the old gasket.*
- *If parts of the crankshaft drive have been renewed, the new cylinder head gasket must be selected by measuring the piston projection at TDC ⇒ page 139 .*
- *The gaskets for the left and right cylinder heads have different shapes and cannot be interchanged.*

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

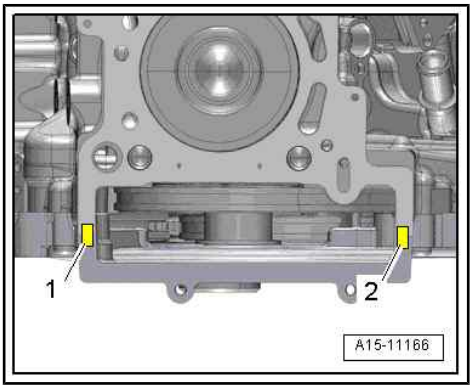
Note

- *Note the use-by date of the sealant.*
- *Cut off nozzle of tube at front marking (nozzle ∅ approx. 5 mm).*
- *After applying sealant, components must be installed and secured within 15 minutes.*



Cylinder head (left-side):

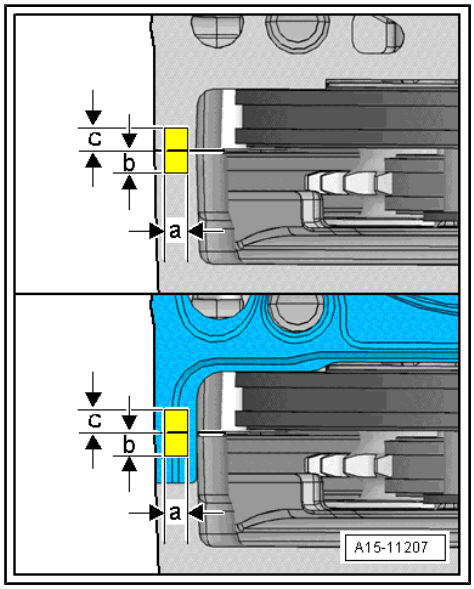
– Apply sealant beads -1- and -2- onto clean sealing surface of cylinder block and timing chain cover (bottom) as illustrated.



– Apply sealant according to dimensions given.

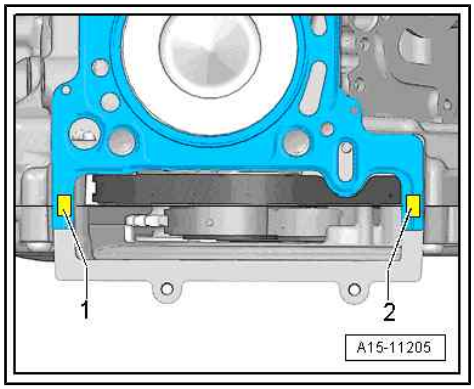
- a = 7 mm
- b = 7 mm
- c = 7 mm

– Place cylinder head gasket in position.

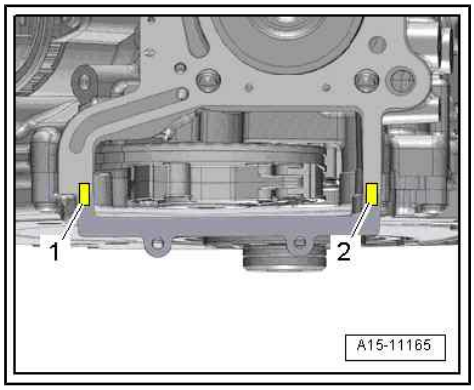


– Apply sealant beads -1- and -2- onto cylinder head gasket as shown in illustration.

Cylinder head (right-side):



– Apply sealant beads -1- and -2- onto clean sealing surface of cylinder block and timing chain cover (bottom) as illustrated.

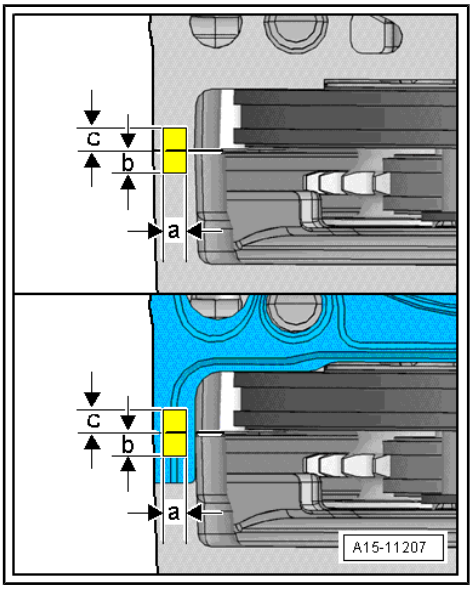


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– Apply sealant according to dimensions given.

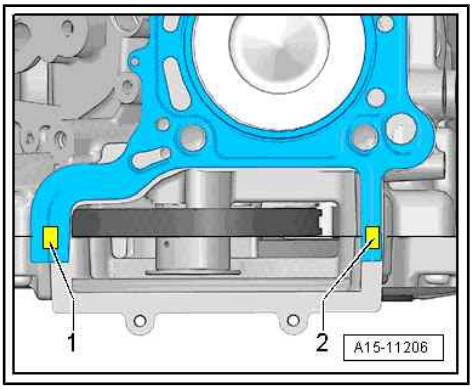
- a = 7 mm
- b = 7 mm
- c = 7 mm

– Place cylinder head gasket in position.



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– Apply sealant beads -1- and -2- onto cylinder head gasket as shown in illustration.

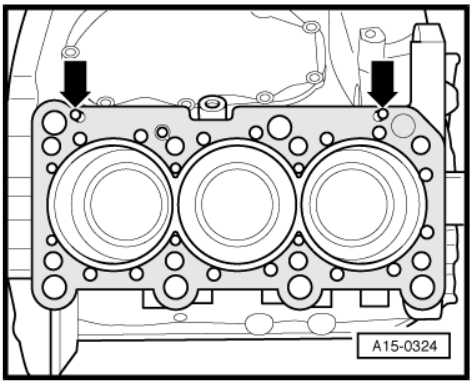


Continuation for both sides:

- Pay attention to dowel sleeves -arrows- in cylinder block.
- Check installation position of cylinder head gasket: the word „oben“ (top) or the Part No. should face towards the cylinder head.

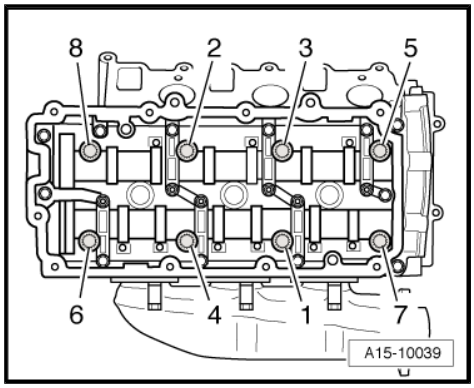
– Fit cylinder head.

– Insert new cylinder head bolts and tighten hand-tight.



– Tighten cylinder head bolts as follows in the sequence shown:

1. Tighten with torque wrench to 35 Nm.
2. Tighten with torque wrench to 60 Nm.
3. Use rigid wrench to turn 90° further.
4. Use rigid wrench to turn 90° further.



Note

Cylinder head bolts do not have to be torqued down again later after repair work.

– Install camshaft timing chain ⇒ page 156 .
– Install cylinder head cover (left or right) ⇒ page 188 .

Cylinder head (left-side):

– Install toothed belt for high-pressure pump ⇒ Rep. gr. 23 .

Continuation for both sides:

– Install intermediate pipe: left-side ⇒ page 376 , right-side ⇒ page 377 .
– Install bottom section of intake manifold (left or right) ⇒ Rep. gr. 23 .
– Install intake manifold (top section) ⇒ Rep. gr. 23 .
– Change engine oil ⇒ Maintenance ; Booklet 405 .
– Fill cooling system with fresh coolant ⇒ page 259 .
– Check fuel system for leaks ⇒ page 6 .

Tightening torques

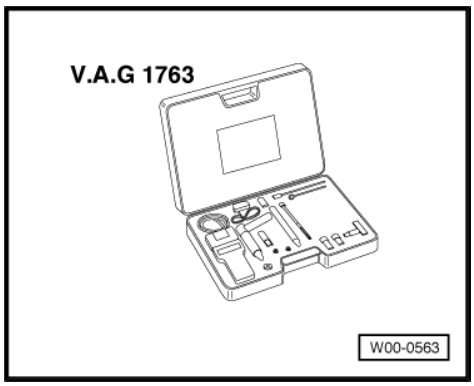
Component	Nm
Coolant line to cylinder head	15.5
Coolant pipe (right-side) to cylinder head	9
Toothed belt cover (rear) to engine	9
Fuel supply and return lines to high-pressure pump	25

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3.7 Checking compression

Special tools and workshop equipment required

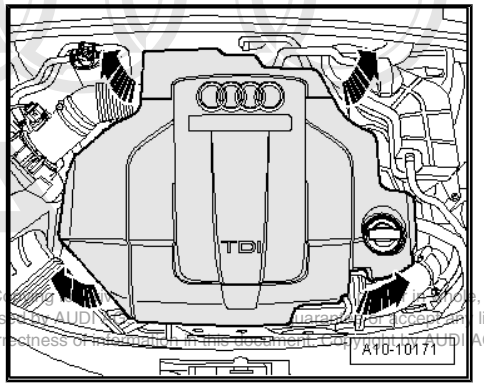
♦ Compression tester -V.A.G 1763- with adapter -V.A.G 1763/8-



Procedure

- Engine oil temperature approx. 80 °C.
- Battery voltage at least 12.5 V

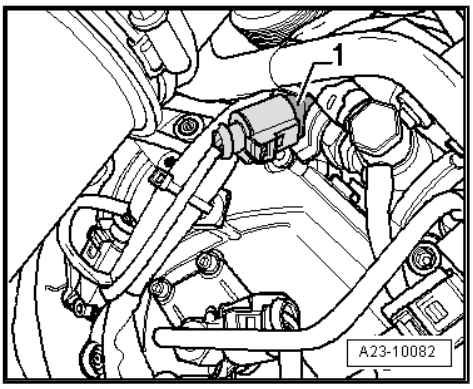
– Carefully pull engine cover panel off four retaining pins one after the other -arrows-.



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– Unplug electrical connector at fuel pressure regulating valve - N276- -item 1- at right-side fuel rail (cylinder bank 1).

– Briefly start engine to relieve fuel pressure in rail.

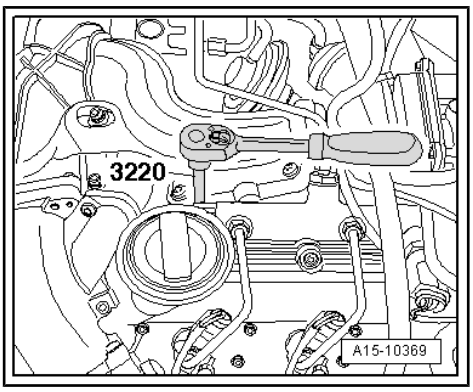


– Detach electrical connectors at glow plugs.

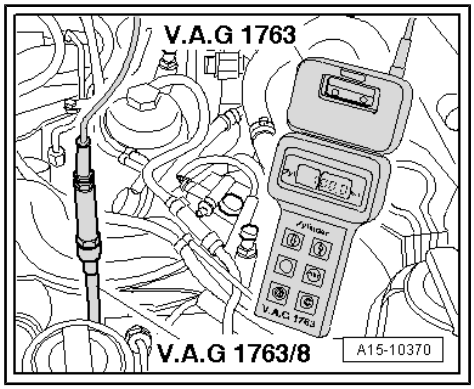
Caution

It is very important to observe all notes on removing the glow plugs ⇒ Rep. gr. 28 .

– Remove all glow plugs ⇒ Rep. gr. 28 .



– Screw in adapter -V.A.G 1763/8- in place of glow plugs and connect compression tester -V.A.G 1763- .



Note

Using the compression tester ⇒ Operating instructions .

– Have a 2nd mechanic operate starter until tester shows no further pressure increase.

Compression pressure	bar
When new	28 … 33
Wear limit	21
Difference between cylinders	5 (maximum)

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

– Install glow plugs ⇒ Rep. gr. 28 .

– When finished, interrogate and erase fault memory for engine control unit, as faults are stored when connectors are unplugged ⇒ Vehicle diagnostic tester.

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4 Valve gear

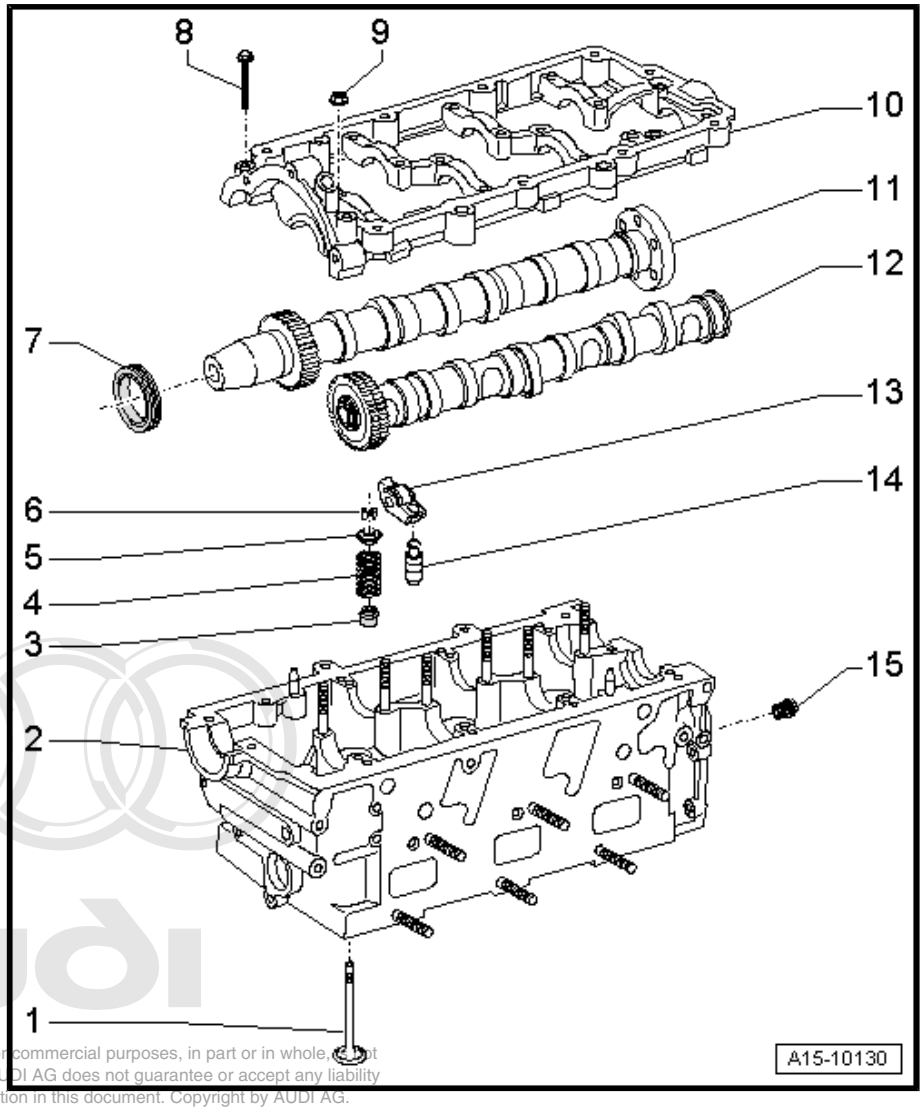
Note

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

4.1 Valve gear - exploded view

Note

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



1 - Valve

- ❑ Do not machine, only grinding-in is permitted
- ❑ Mark installation position for re-installation
- ❑ Checking ⇒ page 235
- ❑ Valve dimensions ⇒ page 234
- ❑ Checking valve guides ⇒ page 234

2 - Cylinder head

- ❑ See note ⇒ page 207
- ❑ Checking valve guides ⇒ page 234
- ❑ Machining valve seats ⇒ page 234

3 - Valve stem oil seal

- ❑ Renewing: with cylinder head installed ⇒ page 225 , with cylinder head removed ⇒ page 230

4 - Valve spring

5 - Valve spring plate

6 - Valve cotters

7 - Camshaft oil seal

- ❑ Renewing ⇒ page 210

8 - Bolt

- ❑ Retaining frame on cylinder head (left-side) - tightening torque and sequence ⇒ page 208
- ❑ Retaining frame on cylinder head (right-side) - tightening torque and sequence ⇒ page 209

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9 - Nut

- ❑ Retaining frame on cylinder head (left-side) - tightening torque and sequence ⇒ page 208
- ❑ Retaining frame on cylinder head (right-side) - tightening torque and sequence ⇒ page 209

10 - Retaining frame

- ❑ With integrated camshaft bearings
- ❑ Removing and installing: cylinder head (left-side) ⇒ page 213 , cylinder head (right-side) ⇒ page 219

11 - Inlet camshaft

- ❑ Removing and installing: cylinder head (left-side) ⇒ page 213 , cylinder head (right-side) ⇒ page 219
- ❑ Checking axial clearance ⇒ page 209
- ❑ Check radial clearance with Plastigage (roller rocker fingers removed)
- ❑ Radial clearance (new): 0.035 ... 0.085 mm
- ❑ Radial clearance: wear limit: 0.1 mm
- ❑ Runout: max. 0.01 mm

12 - Exhaust camshaft

- ❑ Removing and installing: cylinder head (left-side) ⇒ page 213 , cylinder head (right-side) ⇒ page 219
- ❑ Checking axial clearance ⇒ page 209
- ❑ Check radial clearance with Plastigage (roller rocker fingers removed)
- ❑ Radial clearance (new): 0.035 ... 0.085 mm
- ❑ Radial clearance: wear limit: 0.1 mm
- ❑ Runout: max. 0.01 mm

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13 - Roller rocker finger

- ❑ Mark installation position with a coloured pen
- ❑ Do not interchange
- ❑ Check roller bearings for ease of movement
- ❑ Lubricate contact surfaces before installing

14 - Hydraulic valve compensation element

- ❑ Mark installation position with a coloured pen
- ❑ Checking ⇒ page 233
- ❑ Lubricate contact surfaces before installing

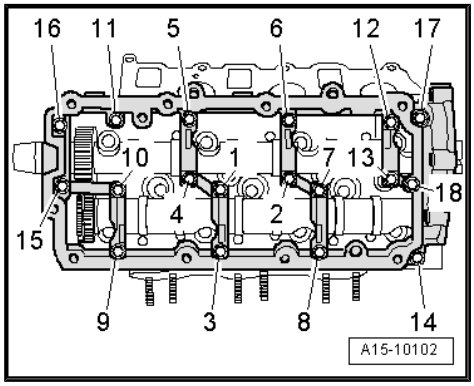
15 - Pressure limiting valve, 25 Nm

- ❑ Not applicable to more recent versions

Retaining frame on cylinder head (left-side) - tightening torque and sequence

– Tighten bolts and nuts in 2 stages in the sequence shown:

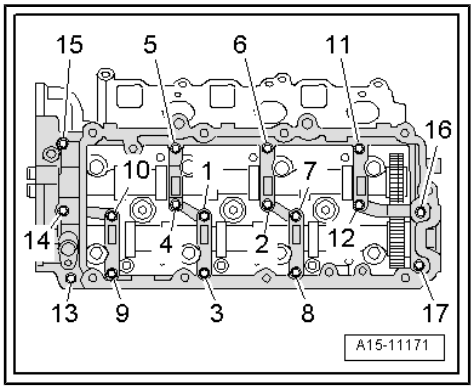
Stage	Bolts/nuts	Tightening torque
1.	-1 … 18-	Screw in by hand until they make contact • The retaining frame should make contact with the cylinder head over the full surface
2.	-1 … 18-	9 Nm



Retaining frame on cylinder head (right-side) - tightening torque and sequence

– Tighten bolts and nuts in 2 stages in the sequence shown:

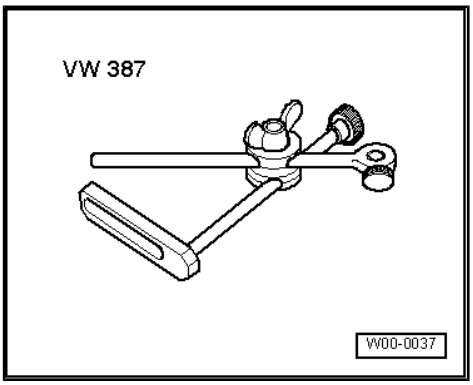
Stage	Bolts/nuts	Tightening torque
1.	-1 … 17-	Screw in by hand until they make contact • The retaining frame should make contact with the cylinder head over the full surface
2.	-1 … 17-	9 Nm



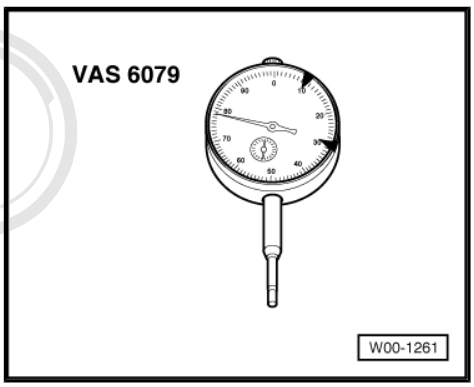
4.2 Measuring axial clearance of camshafts

Special tools and workshop equipment required

♦ Universal dial gauge bracket -VW 387-



♦ Dial gauge -VAS 6079-



Procedure

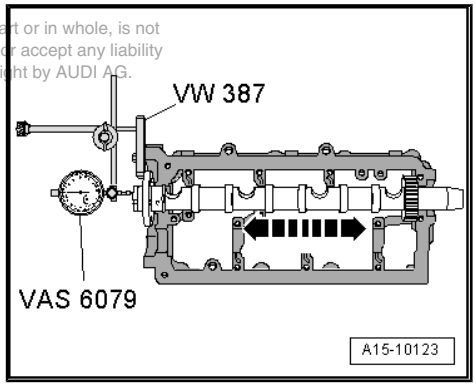
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– Remove retaining frame ⇒ „4.5 Removing and installing camshafts - cylinder head (left-side)“, page 213 .

– Secure dial gauge -VAS 6079- with universal dial gauge bracket -VW 387- to retaining frame as shown in illustrations.

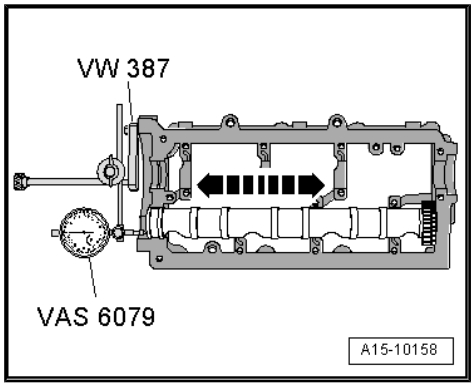
Inlet camshaft:

- Specification: 0.03 … 0.08 mm.
- Wear limit: 0.12 mm.



Exhaust camshaft:

- Specification: 0.03 … 0.08 mm
- Wear limit: 0.12 mm.



4.3 Measuring radial clearance of camshafts

Special tools and workshop equipment required

♦ Plastigage

Procedure

– Remove roller rocker fingers
⇒ „4.5 Removing and installing camshafts - cylinder head (left-side)“, page 213.

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– Clean bearings and bearing journals.

– Place a length of Plastigage corresponding to the width of the bearing on the bearing journal or bearing shell to be measured.

- The Plastigage must be positioned in the centre of the bearing.

– Re-insert camshafts, fit retaining frame and tighten
⇒ page 207 without rotating camshafts.

– Remove retaining frame and camshafts again.

– Compare width of Plastigage with measurement scale.

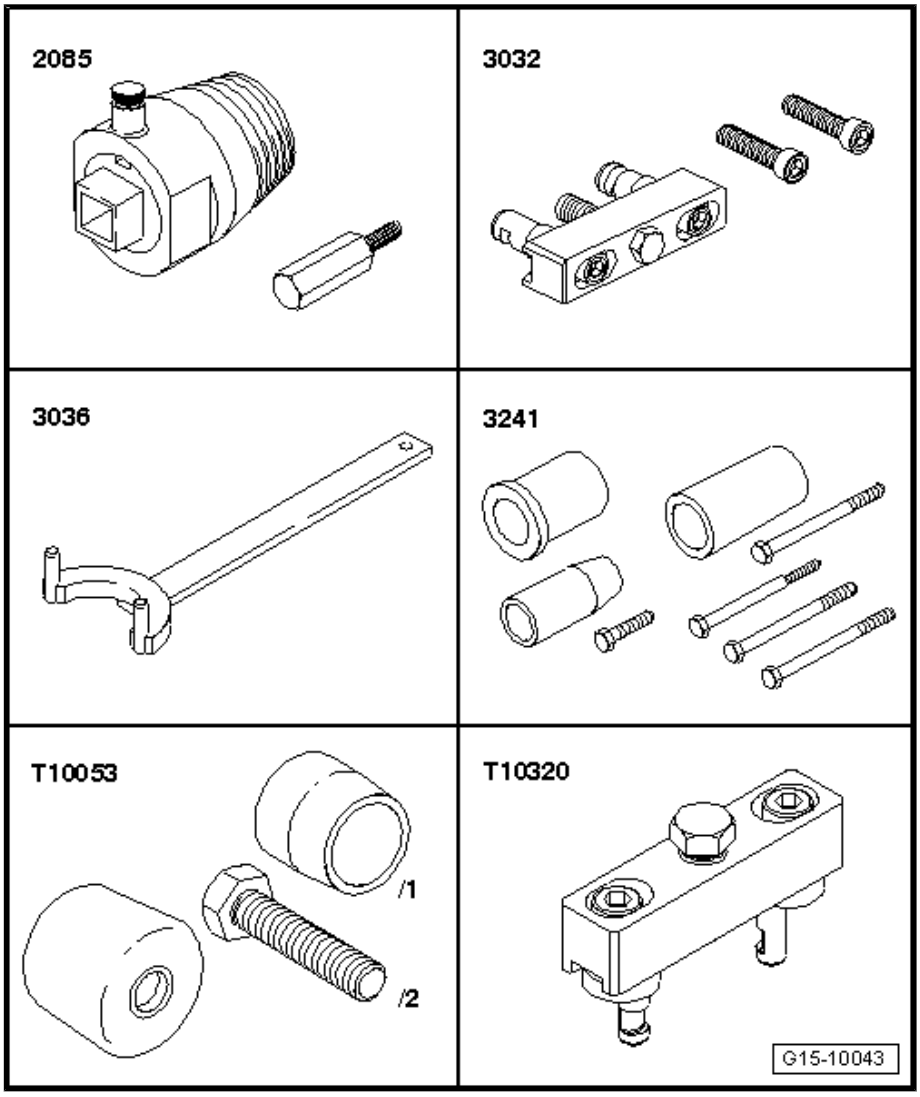
Radial clearance:

- New: 0.035 ... 0.085 mm
- Wear limit: 0.100 mm

4.4 Renewing camshaft oil seal

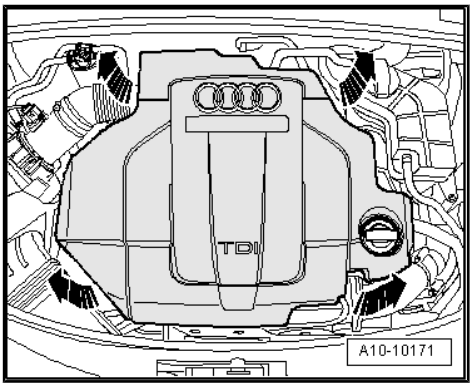
Special tools and workshop equipment required

- Oil seal extractor -2085-
- Puller -3032- for vehicles up to 12.2005
- Counterhold tool -3036-
- Hexagon bolt M10 x 1.25 x 40, (from fitting sleeves -3241-)
- Assembly tool -T10053-
- Puller -T10320- for vehicles from 12.2005



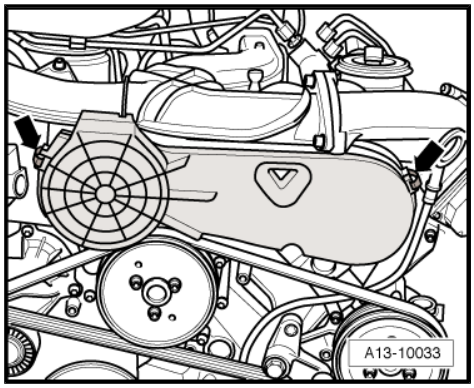
Procedure

– Carefully pull engine cover panel off four retaining pins one after the other -arrows-.

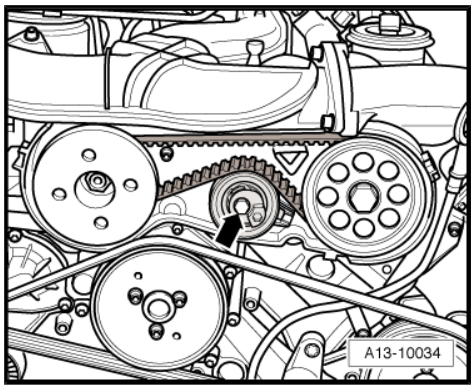


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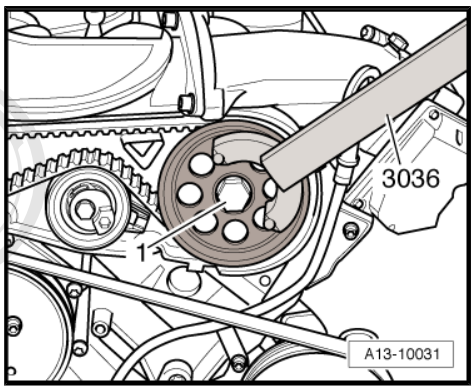
– Loosen clamps -arrows-.
– Pivot toothed belt cover forward and disengage retaining pegs on bottom side of toothed belt cover.
– Remove intake manifold (top section) ⇒ Rep. gr. 23 .



– Loosen bolt -arrow- for tensioning roller approx. 2 turns.

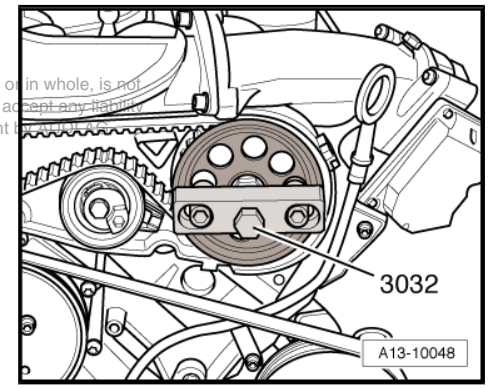


– Loosen central bolt -1- for toothed belt drive sprocket approx. 2 turns using counterhold tool -3036- .



Vehicles up to 12.2005:

– Use puller -3032- to pull off toothed belt drive sprocket.



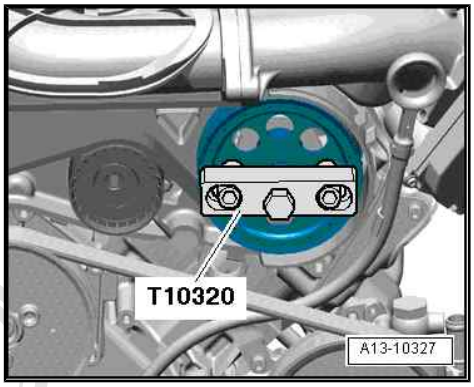
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Vehicles from 12.2005 onwards:

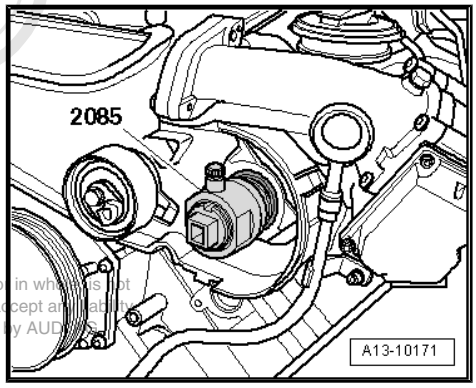
– Use puller -T10320- to pull off toothed belt drive sprocket.

All vehicles:

– Take off toothed belt drive sprocket together with toothed belt.

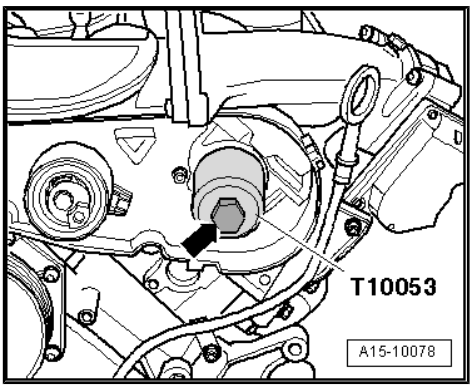


– Unscrew inner section of oil seal extractor -2085- three turns out of outer section and lock inner section with knurled screw.
– Lubricate threaded head of oil seal extractor, place it in position and screw it into oil seal as far as possible (applying firm pressure).
– Loosen knurled screw and turn inner section against camshaft until oil seal is pulled out.
– Clamp flats of oil seal extractor in vice and use pliers to remove oil seal.
– Clean running surface and sealing surface.



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– Press in new oil seal as far as stop using press sleeve from -T10053- and hexagon bolt M10 x 1.25 x 40 -arrow-, (from fitting sleeves -3241-).



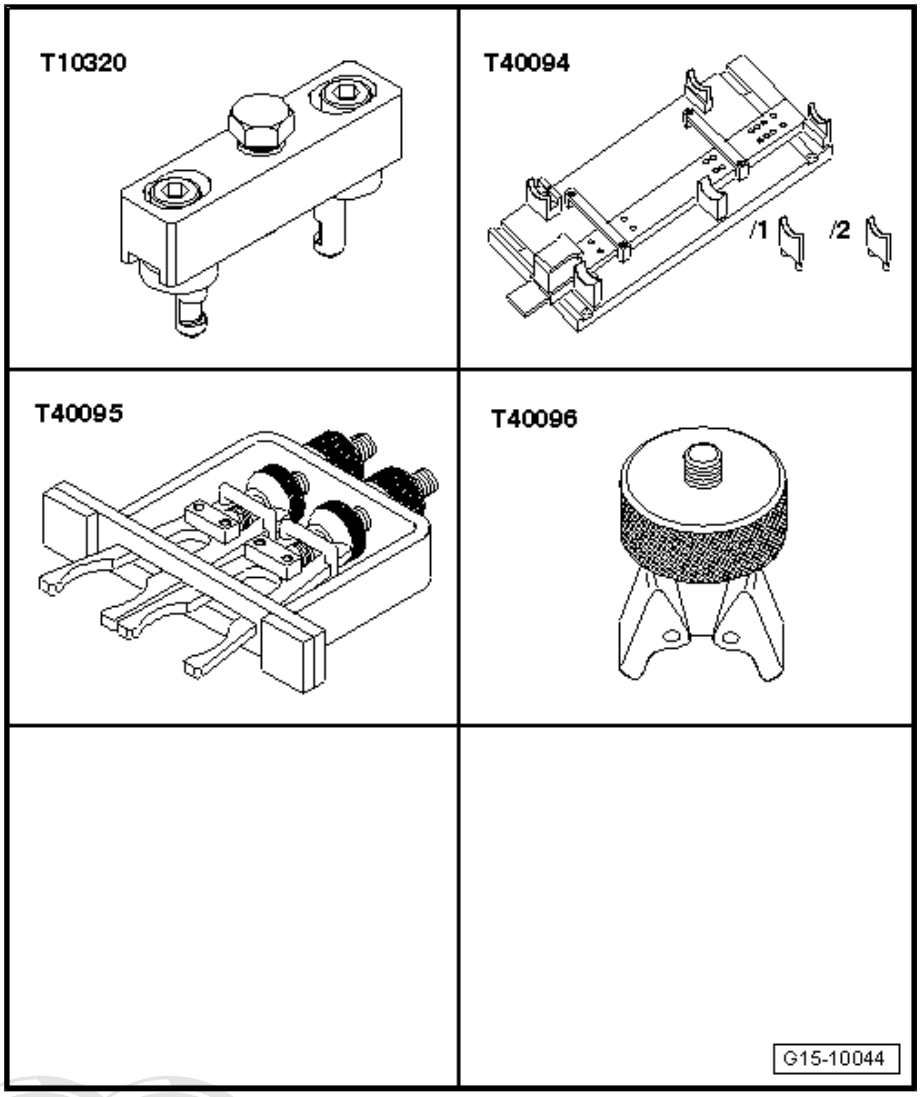
Installation is carried out in the reverse order; note the following:

– Install toothed belt for high-pressure pump ⇒ Rep. gr. 23 .
– Install intake manifold (top section) ⇒ Rep. gr. 23 .

4.5 Removing and installing camshafts - cylinder head (left-side)

Special tools and workshop equipment required

- Puller -T10320- for vehicles from 12.2005
- Camshaft fitting tool - T40094-
- Camshaft fitting tool - T40095-
- Camshaft fitting tool - T40096-
- Electric drill with plastic brush attachment
- Safety goggles
- Sealant ⇒ Electronic parts catalogue



Removing

– Remove timing chain from camshaft ⇒ page 151 on relevant cylinder bank.

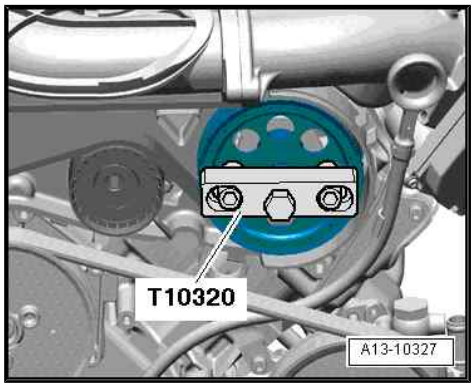
– Remove intake manifold (top section) ⇒ Rep. gr. 23 .

– Remove toothed belt for high-pressure pump ⇒ Rep. gr. 23 .

Vehicles from 12.2005 onwards:

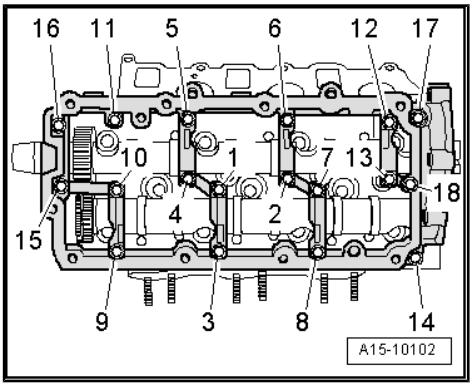
– Use puller -T10320- to pull off toothed belt drive sprocket.

– Remove cylinder head cover (left or right) ⇒ page 188 .



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– Unscrew retaining frame bolts and nuts in the sequence -18 ... 1-.



Note

Make sure you do not damage roller rocker fingers and compensation elements when removing camshafts.

– Carefully remove retaining frame and camshafts.

Installing

Caution

The camshafts MUST be installed using the camshaft fitting tool -T40094- as described in the following, as the thrust bearings in the retaining frame would otherwise be destroyed. The cylinder head would then have to be renewed.

WARNING

Wear safety goggles.

– Remove remaining sealant from cylinder head and retaining frame using rotating plastic brush or similar.

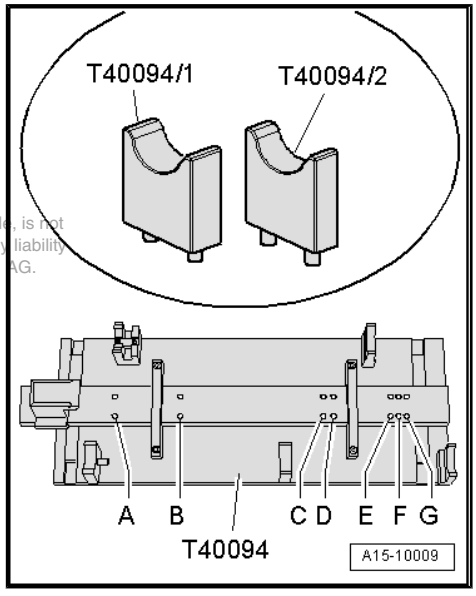
Caution

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

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

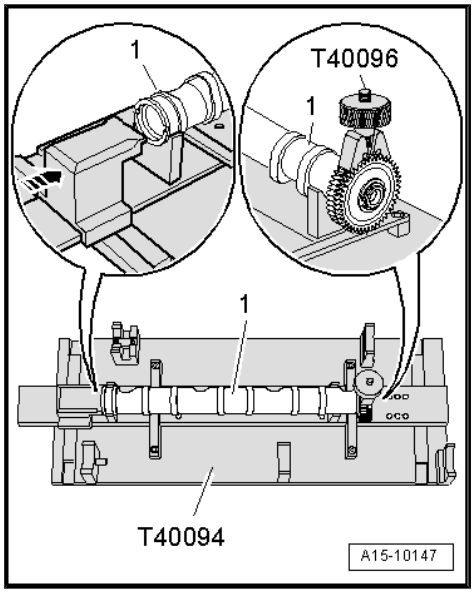
Set up camshaft fitting tool -T40094- as follows:

– Insert support -T40094/2- in position -A-.
– Insert support -T40094/1- in position -D-.

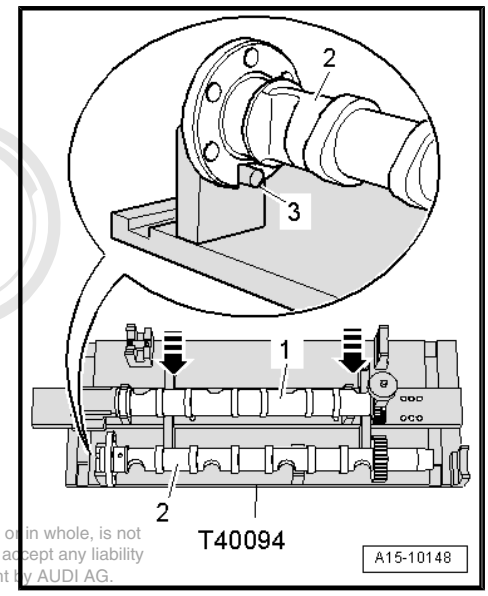


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– Place exhaust camshaft -1- in supports -T40094/1- and -T40094/2- .
– Turn exhaust camshaft in such a way that it can be locked in „TDC“ position using locking device -arrow-.
– Place camshaft fitting tool -T40096- on teeth of exhaust camshaft in such a way that the two arms of the tool engage on the two halves of the gear (one in each half, as shown in illustration).
– Tighten the clamping tool using the knurled wheel so that the faces of the gear teeth are in alignment.

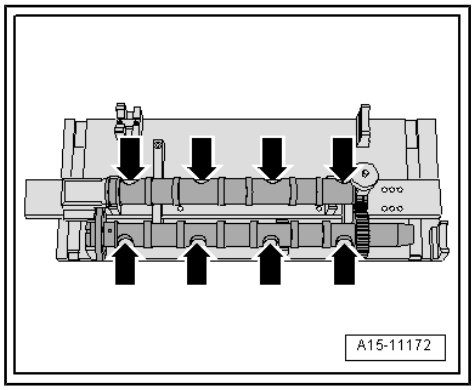


– Place inlet camshaft -2- in camshaft fitting tool -T40094- .
• The locating pin -3- must engage in the slot on the inlet camshaft.
– Slide exhaust camshaft -1- towards inlet camshaft -arrows- until gear teeth engage.



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– Check that camshafts are in correct position:
• Recesses -arrows- on both camshafts must point outwards.

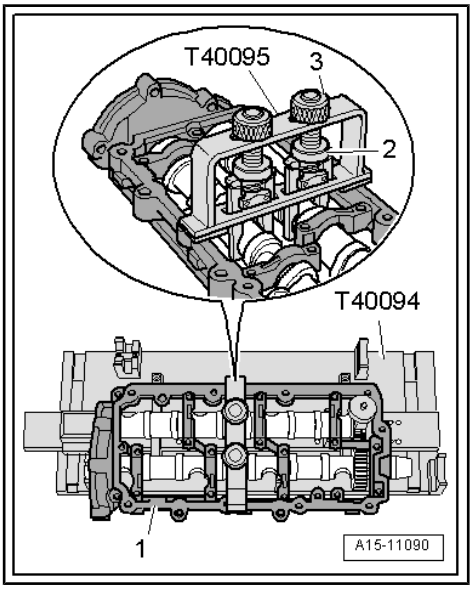


– Fit retaining frame -1- on both camshafts.

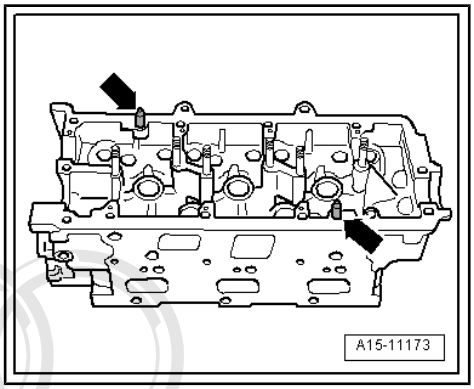
• All camshaft bearings must be seated on the camshafts.

– Attach camshaft fitting tool -T40095- to camshafts (align arms of bracket as required and tighten knurled nuts -2-).

– Apply tension to camshafts by tightening the knurled nuts -3- upwards.



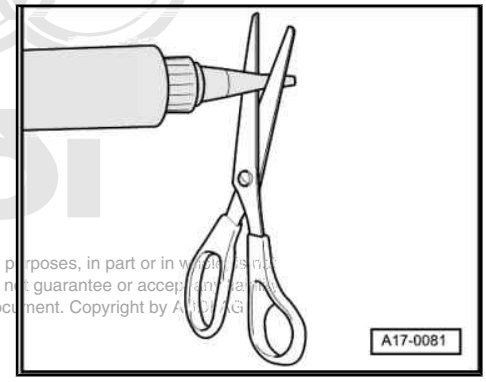
– Check if dowel pins -arrows- are fitted in cylinder head. Install missing dowel pins.



Note

Note the use-by date of the sealant.

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



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Note

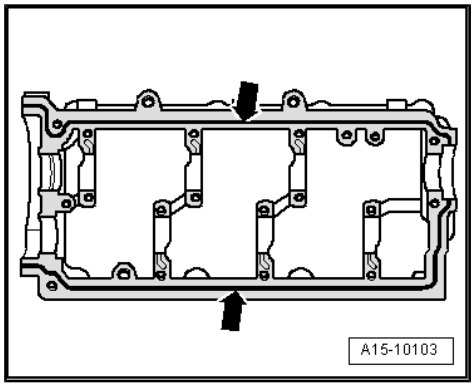
For illustration purposes, the retaining frame is shown without the camshafts.

– Turn retaining frame upside down.

Caution

Make sure lubrication system is not clogged by excess sealant.

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



– Apply beads of sealant -arrows- onto clean sealing surfaces of retaining frame as shown in illustration.

- The grooves on the sealing surface must be completely filled with sealant.
- The beads of sealant must project 1.5 … 2.0 mm above the sealing surface.

Note

The retaining frame must be installed within 5 minutes after applying the sealant.

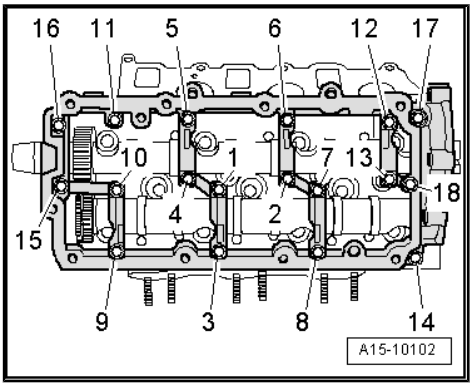
Caution

Risk of damage to engine.

- ***Ensure that all roller rocker fingers contact the valve ends and compensation elements correctly.***

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– Fit retaining frame together with both camshafts and camshaft fitting tool -T40095- onto cylinder head.
– Tighten bolts for retaining frame ⇒ page 208 .
– Remove camshaft fitting tool -T40095- and -T40096- .



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

Note

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

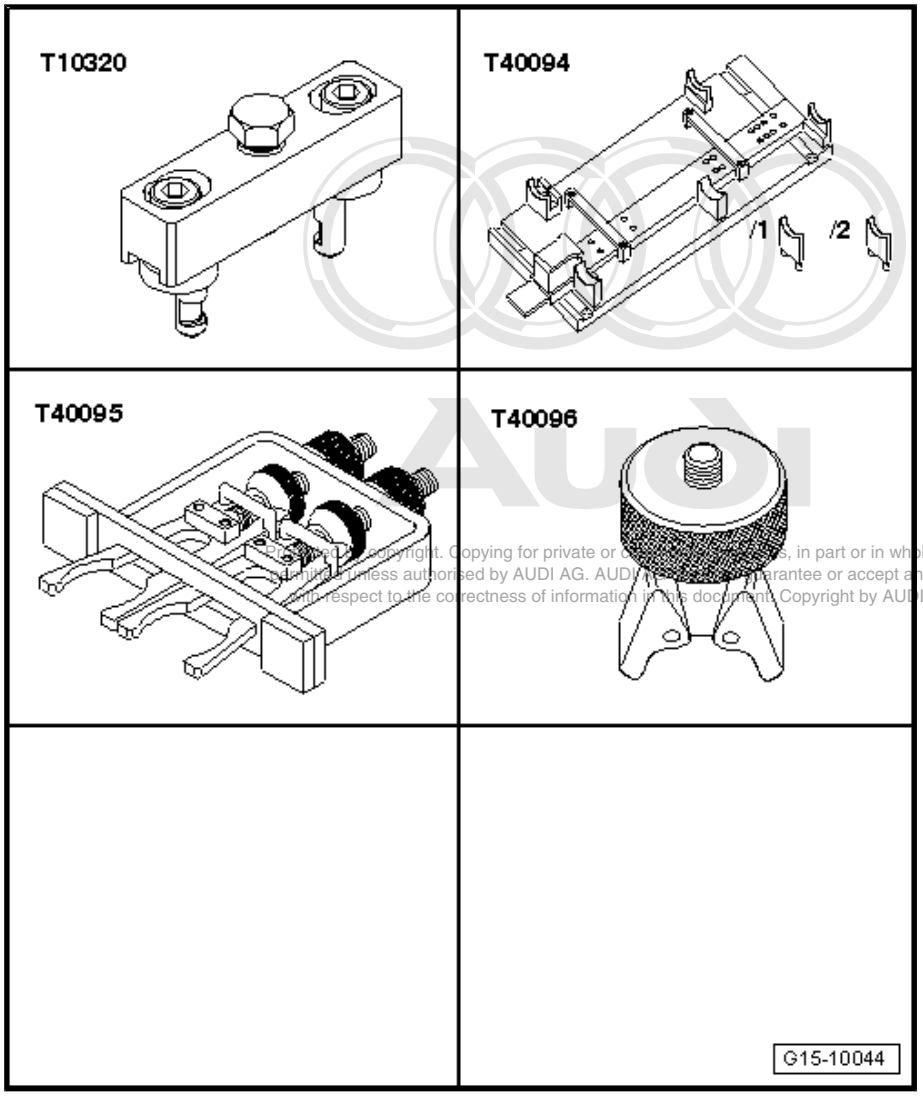
– Install cylinder head cover (left-side) ⇒ page 188 .
– Renew camshaft oil seal ⇒ page 210 .
– Install toothed belt for high-pressure pump ⇒ Rep. gr. 23 .
– Install intake manifold (top section) ⇒ Rep. gr. 23 .
– Install camshaft timing chains ⇒ page 156 .

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4.6 Removing and installing camshafts - cylinder head (right-side)

Special tools and workshop equipment required

- Puller -T10320- for vehicles from 12.2005
- Camshaft fitting tool - T40094-
- Camshaft fitting tool - T40095-
- Camshaft fitting tool - T40096-
- Electric drill with plastic brush attachment
- Safety goggles
- Sealant ⇒ Electronic parts catalogue



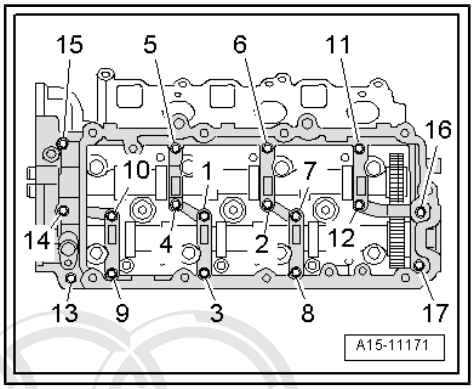
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Removing

– Remove timing chain from camshaft ⇒ page 151 on relevant cylinder bank.

– Remove cylinder head cover (right-side) ⇒ page 188 .

– Unscrew retaining frame bolts and nuts in the sequence -17 ... 1-.



Note

Make sure you do not damage roller rocker fingers and compensation elements when removing camshafts.

– Carefully remove retaining frame and camshafts.

Installing

Caution

The camshafts MUST be installed using the camshaft fitting tool -T40094- as described in the following, as the thrust bearings in the retaining frame would otherwise be destroyed. The cylinder head would then have to be renewed.

WARNING

Wear safety goggles.

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– Remove remaining sealant from cylinder head and retaining frame using rotating plastic brush or similar.

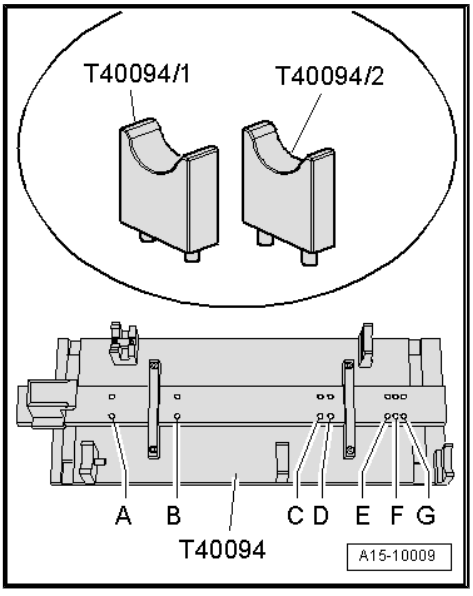
Caution

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

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

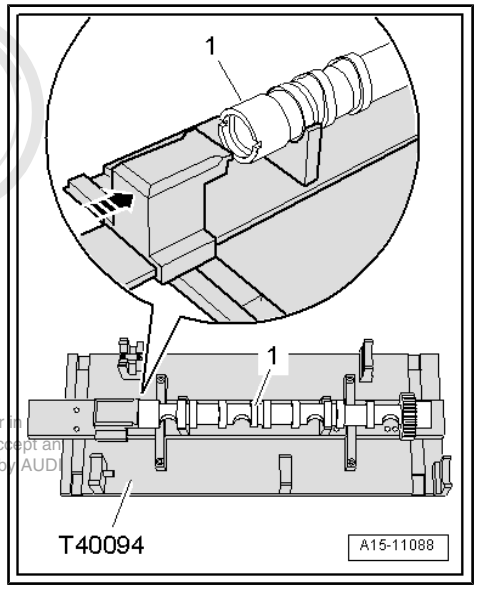
Set up camshaft fitting tool -T40094- as follows:

– Insert support -T40094/2- in position -B-.
– Insert support -T40094/1- in position -C-.



– Place exhaust camshaft -1- in supports -T40094/1- and -T40094/2- .

– Turn exhaust camshaft in such a way that it can be locked in „TDC“ position using locking device -arrow-.



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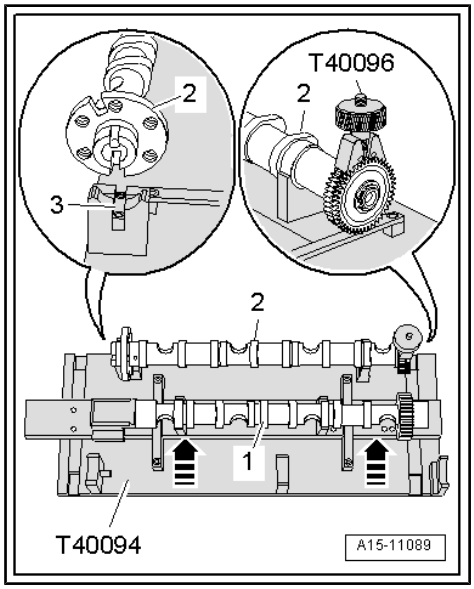
– Place inlet camshaft -2- in camshaft fitting tool -T40094- .

• The locating bar -3- must engage in the groove on the inlet camshaft.

– Place camshaft fitting tool -T40096- on teeth of inlet camshaft in such a way that the two arms of the tool engage on the two halves of the gear (one in each half, as shown in illustration).

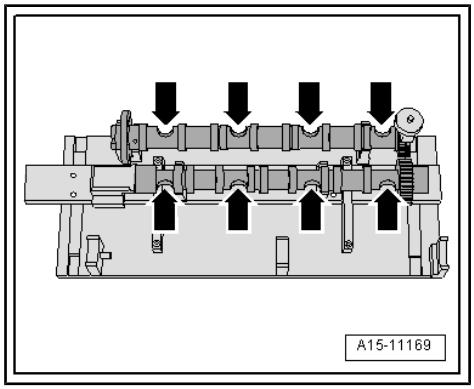
– Tighten the clamping tool using the knurled wheel so that the faces of the gear teeth are in alignment.

– Slide exhaust camshaft -1- towards inlet camshaft -arrows- until gear teeth engage.



– Check that camshafts are in correct position:

• Recesses -arrows- on both camshafts must point outwards.

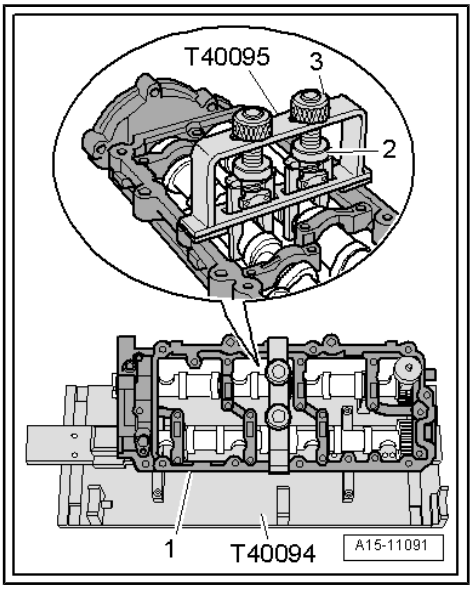


– Fit retaining frame -1- on both camshafts.

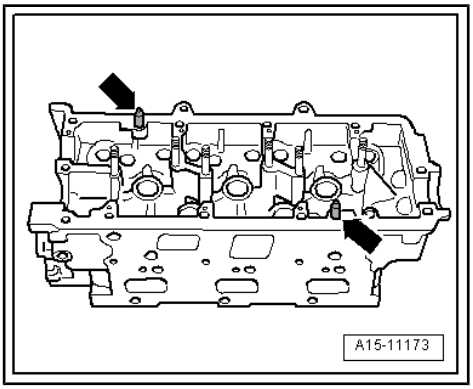
• All camshaft bearings must be seated on the camshafts.

– Attach camshaft fitting tool -T40095- to camshafts (align arms of bracket as required and tighten knurled nuts -2-).

– Apply tension to camshafts by tightening the knurled nuts -3- upwards.



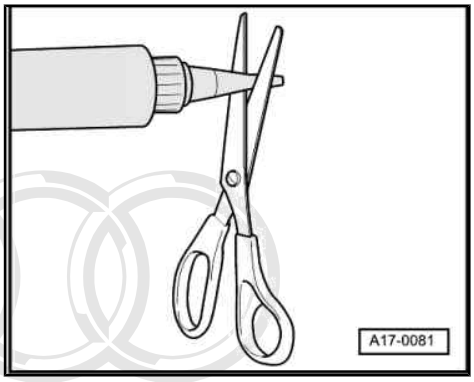
– Check if dowel pins -arrows- are fitted in cylinder head. Install missing dowel pins.



Note

Note the use-by date of the sealant.

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



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Note

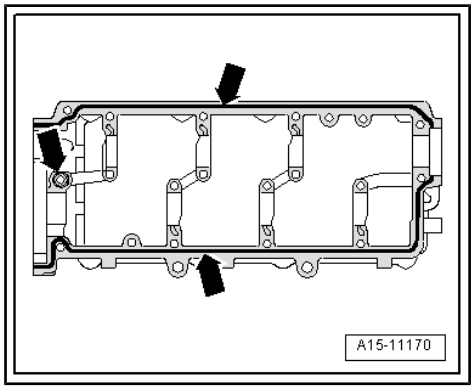
For illustration purposes, the retaining frame is shown without the camshafts.

– Turn retaining frame upside down.

Caution

Make sure lubrication system is not clogged by excess sealant.

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



– Apply beads of sealant -arrows- onto clean sealing surfaces of retaining frame as shown in illustration.

- The grooves on the sealing surface must be completely filled with sealant.
- The beads of sealant must project 1.5 … 2.0 mm above the sealing surface.

Note

The retaining frame must be installed within 5 minutes after applying the sealant.

Caution

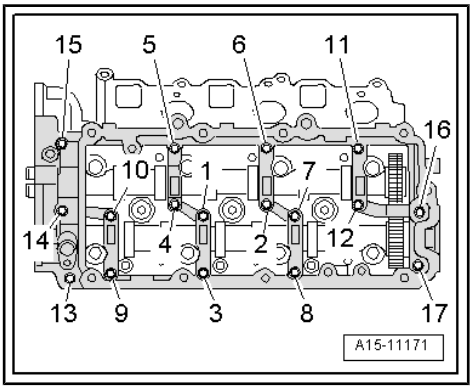
Risk of damage to engine.

- ***Ensure that all roller rocker fingers contact the valve ends and compensation elements correctly.***

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– Fit retaining frame together with both camshafts and camshaft fitting tool -T40095- onto cylinder head.
– Tighten bolts for retaining frame ⇒ page 209 .
– Remove camshaft fitting tool -T40095- and -T40096- .

Perform further installation in reverse order, paying attention to the following:



Note

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

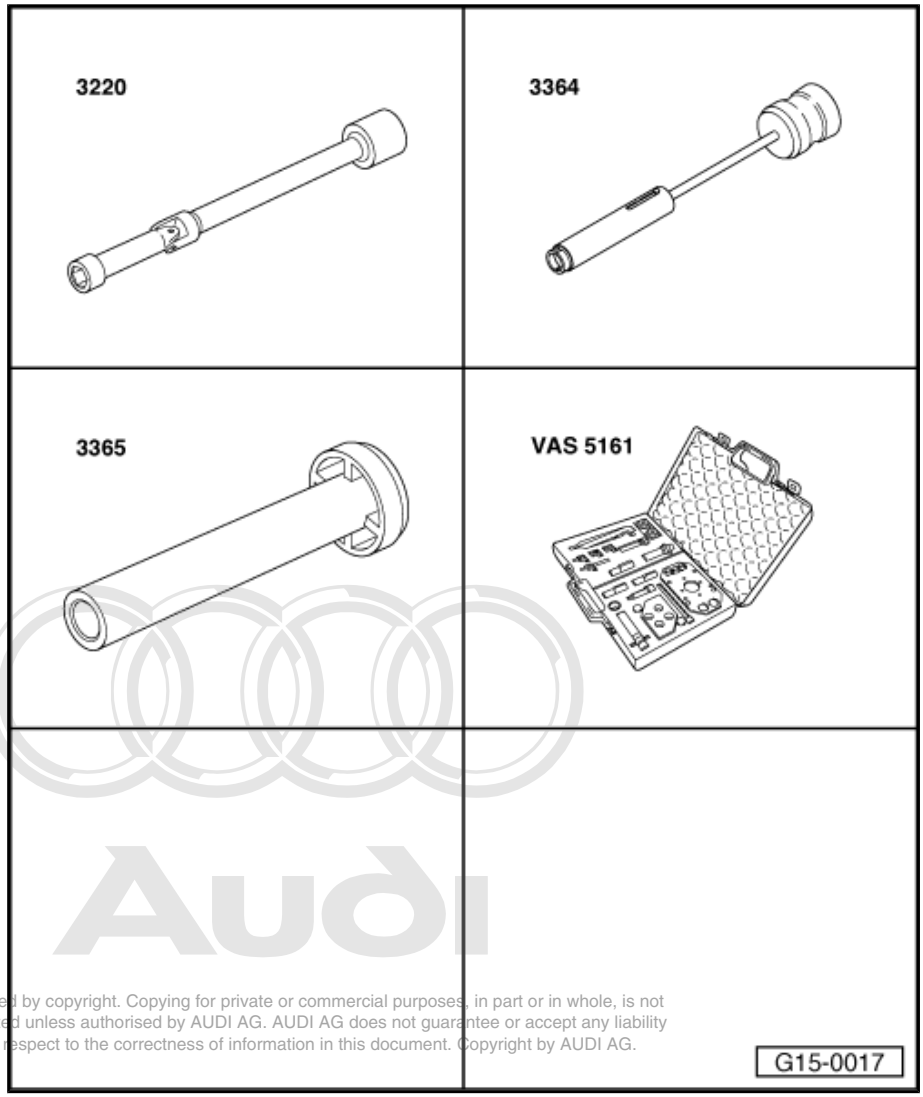
– Install cylinder head cover (left or right) ⇒ page 188 .
– Renew sealing cap (front) on cylinder head.
– Using a suitable drift, knock in new sealing cap (core plug) until flush.
– Install camshaft timing chains ⇒ page 156 .

4.7 Renewing valve stem oil seals with cylinder head installed

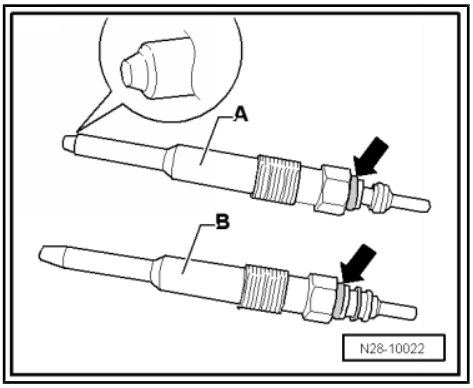
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Special tools and workshop equipment required

- U/J extension and socket, 10 mm -3220-
- Valve stem seal puller -3364-
- Valve stem seal fitting tool -3365-
- Removal and installation device for valve cotters -VAS 5161- with knurled spacer ring -VAS 5161/23-1- and guide plate -VAS 5161/23-



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Procedure

- The 6-cylinder 2.7 ltr. TDI engine in the Audi A6 is fitted exclusively with metal glow plugs:
- Up to autumn 2004, two different types of glow plugs are fitted in the Audi A6 with 6-cylinder 3.0 ltr. TDI engine; from autumn 2004 onwards, these engines are fitted exclusively with metal glow plugs. Distinguishing features:

A - Ceramic glow plugs are colour-coded with a „white seal“ -arrow- and have a chamfered shoulder at the tip.

B - Metal glow plugs are colour-coded with a „red seal“ -arrow-.

The metal glow plugs do not require any special handling procedures.

Vehicles with ceramic glow plugs:

Caution

- *Due to the special properties of the material used, ceramic glow plugs are easily damaged and require extra care when handling and removing/installing. Always observe the special instructions when removing and installing ceramic glow plugs ⇒ Rep. gr. 28 .*
- *Transport and store only in original packaging or packed separately in bubble wrap.*
- *Do not remove new ceramic glow plugs from packaging until they are ready to be fitted.*
- *Ceramic glow plugs are sensitive to knocks and bending. For this reason, ceramic glow plugs which have been dropped (even from a height of only about 2 cm) must not be installed, even if no damage is apparent (hair-line cracks may not be visible).*
- *Always install a new ceramic glow plug if you are not sure the old one is in perfect condition.*
- *Damaged glow plugs (e.g. heater pin of the glow plug is damaged) will invariably cause engine damage.*
- *If the heater pin of the glow plug is damaged, the fragments must be removed from the combustion chamber before starting the engine for the first time, otherwise this will invariably cause mechanical damage (piston seizure).*
- *The software of the engine control unit is specifically adapted to either the ceramic or the metal glow plugs, so it is important to install the correct type.*
- *Mixed installation of ceramic glow plugs and metal glow plugs on the same engine is not permissible.*

Vehicles with metal glow plugs:

– Remove all glow plugs using U/J extension and socket, 10 mm -3220-.

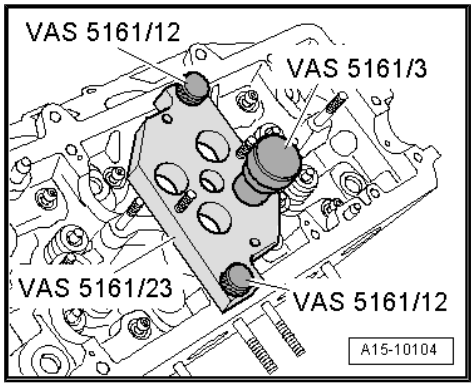
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All vehicles:

– Remove camshafts: cylinder head (left-side) ⇒ page 213 , cylinder head (right-side) ⇒ page 219 .

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

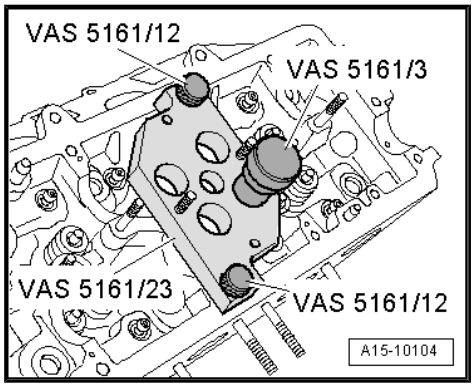
– Remove roller rocker fingers together with hydraulic compensation elements and put down on a clean surface.



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

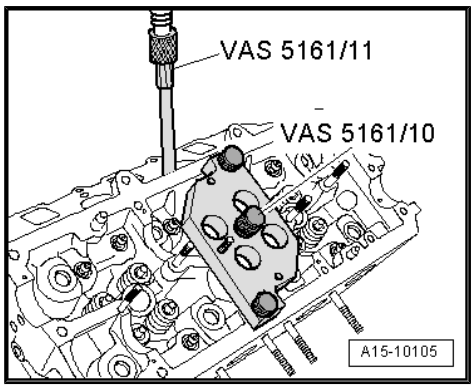
– Secure guide plate with knurled screws -VAS 5161/12- .

– Insert drift -VAS 5161/3- into guide plate and use plastic-headed hammer to release sticking valve cotters.



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

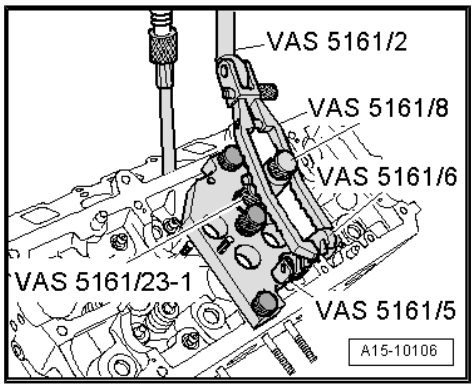
– Screw adapter -VAS 5161/11- hand-tight into corresponding glow plug thread.



– Screw snap-in device -VAS 5161/6- with engaging fork -VAS 5161/5- into guide plate.

– Slide knurled spacer ring -VAS 5161/23-1- onto assembly cartridge -VAS 5161/8- .

– Connect adapter to compressed air line using a commercially available connection piece, and apply constant air pressure.



• Minimum pressure: 6 bar

– Attach pressure fork -VAS 5161/2- to snap-in device and push assembly cartridge down.

– At the same time, turn knurled screw of assembly cartridge clockwise until tips engage in valve cotters.

– Move knurled screw back and forth slightly; the valve cotters are thus forced apart and taken up by the assembly cartridge.

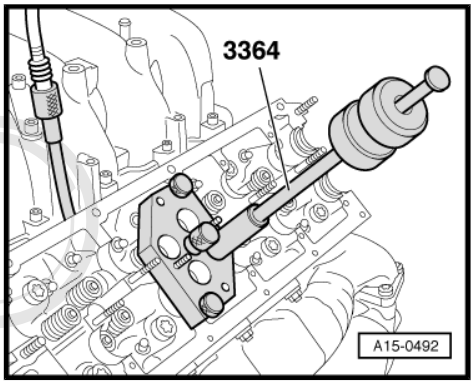
– Release pressure fork.

– Take off assembly cartridge with knurled spacer ring.

– Detach valve spring with valve spring plate.

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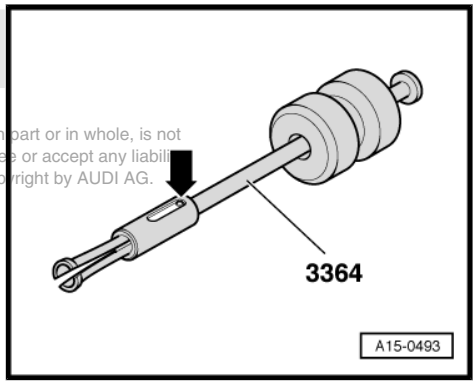
– Pull off valve stem oil seal with valve stem seal puller -3364- .



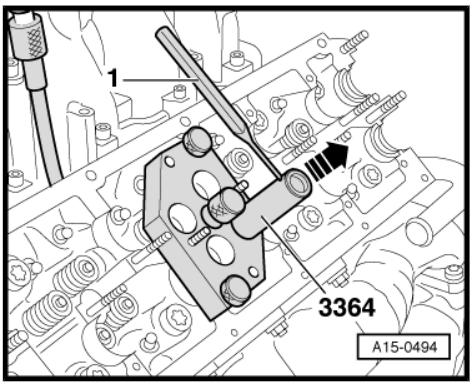
If the puller cannot be used on some of the valve stem oil seals due to the confined space, proceed as follows:

– Knock out pin -arrow- of puller using a drift and remove impact extractor attachment.

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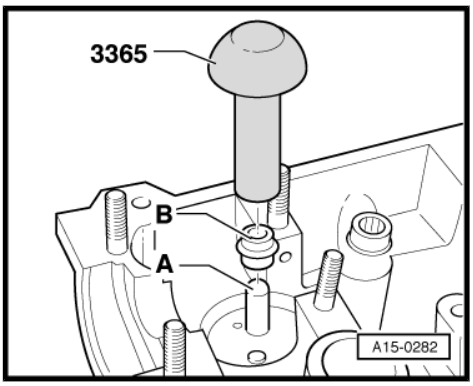
– Apply bottom section of puller -3364- to valve stem oil seal.
– Secure puller with a punch or roll-pin drift -1-, as shown in illustration.
– Apply assembly lever to puller and pull out valve stem oil seal -arrow-.



Caution

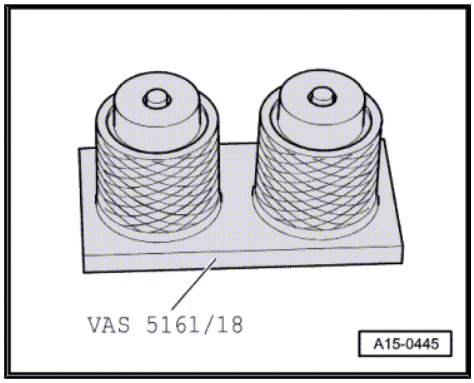
Make sure valve stem oil seals are not damaged when installing.

- ***New valve stem oil seals -B- are supplied with plastic sleeve; fit plastic sleeve -A- onto valve stem.***



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

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

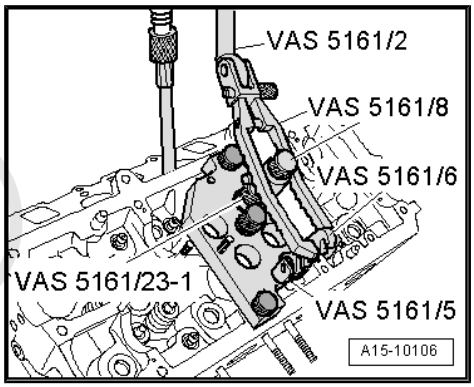


- Larger diameter of valve cotters faces upwards.

– Insert valve spring and valve spring plate.

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

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



– Press down pressure fork and pull knurled screw upwards while turning screw in both directions - this will insert the valve cotters.

– Release the pressure fork with knurled screw still in pulled position.

– Repeat procedure for each valve.

Assembling

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

– Install camshafts: cylinder head (left-side) ⇒ page 213 , cylinder head (right-side) ⇒ page 219 .

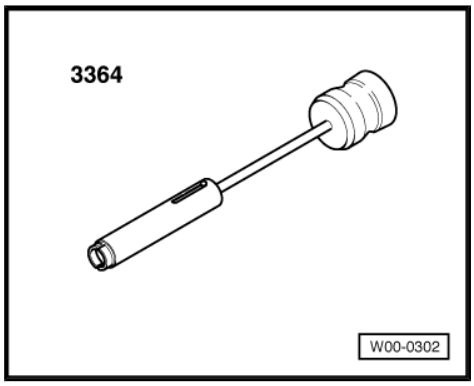
– Install glow plugs ⇒ Rep. gr. 28 .

4.8 Renewing valve stem oil seals with cylinder head removed

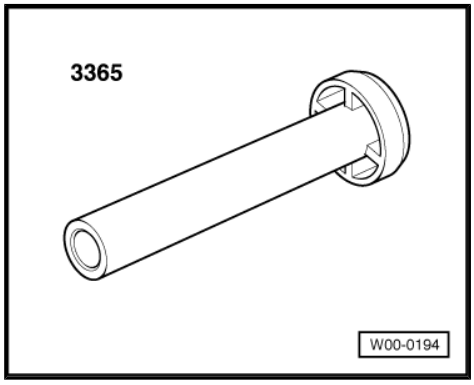
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Special tools and workshop equipment required

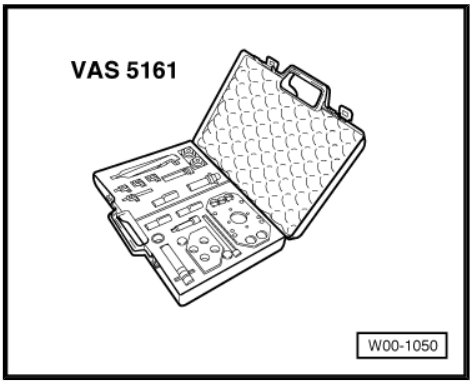
♦ Valve stem seal puller -3364-



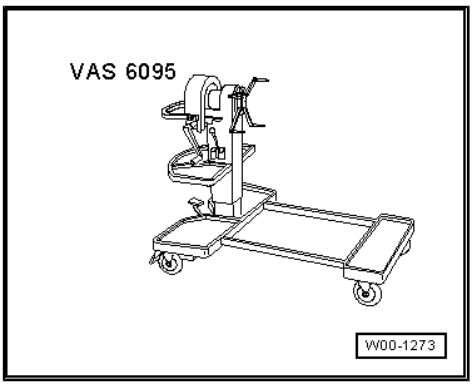
♦ Valve stem seal fitting tool -3365-



- Removal and installation device for valve cotters -VAS 5161- with knurled spacer ring -VAS 5161/23-1- and guide plate -VAS 5161/23-



- Engine and gearbox support -VAS 6095-



- Cylinder head tensioning device -VAS 6419-

Procedure

– Remove camshafts: cylinder head (left-side) ⇒ page 213 , cylinder head (right-side) ⇒ page 219 .

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

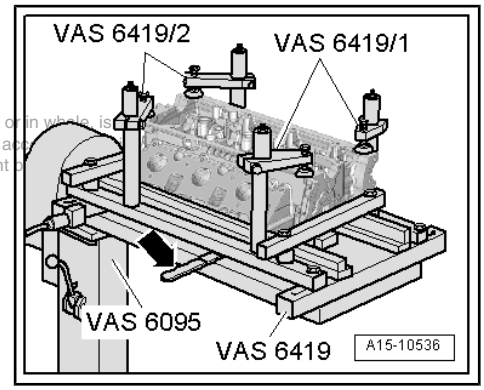
– Remove roller rocker fingers together with hydraulic compensation elements and put down on a clean surface.

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

– Secure cylinder head in cylinder head tensioning device -VAS 6419- , as illustrated.

– Connect cylinder head tensioning device to compressed air.

– Using lever -arrow-, slide air pad under combustion chamber where valve stem oil seals are to be removed.

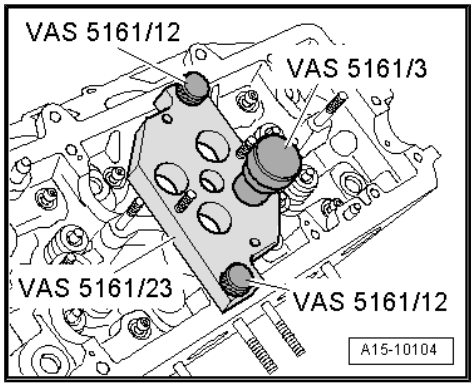


– Apply just enough compressed air to bring air pad into contact with valve heads.

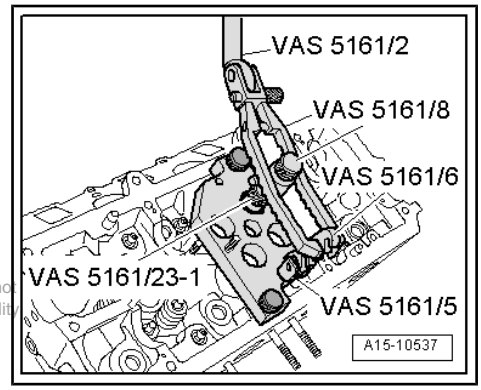
– Mark fitting location of roller rocker fingers for re-installation and remove.

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– Fit guide plate -VAS 5161/23- onto cylinder head.
– Secure guide plate with knurled screws -VAS 5161/12- .
– Insert drift -VAS 5161/3- into guide plate and use plastic-headed hammer to release sticking valve cotters.

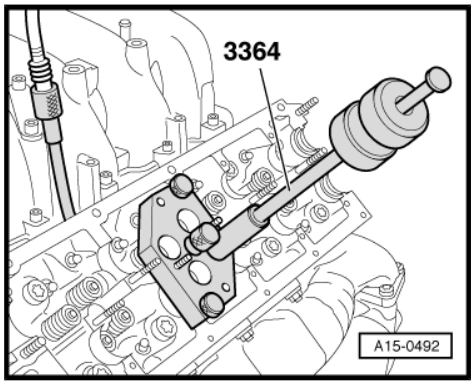


– Screw snap-in device -VAS 5161/6- with engaging fork -VAS 5161/5- into guide plate.
– Slide knurled spacer ring -VAS 5161/23-1- onto assembly cartridge -VAS 5161/8- .
– Attach pressure fork -VAS 5161/2- to snap-in device and push assembly cartridge down.
– At the same time, turn knurled screw of assembly cartridge clockwise until tips engage in valve cotters.
– Move knurled screw back and forth slightly; the valve cotters are thus forced apart and taken up by the assembly cartridge.
– Release pressure fork.
– Take off assembly cartridge with knurled spacer ring.
– Detach valve spring with valve spring plate.



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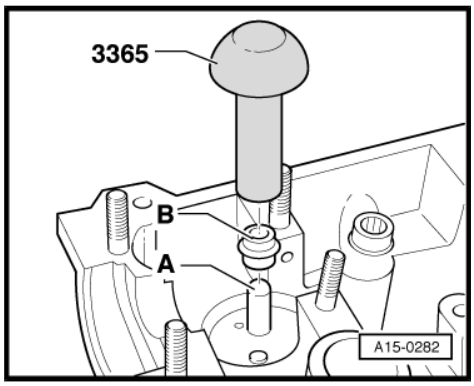
– Pull off valve stem oil seal with valve stem seal puller -3364- .



Caution

Make sure valve stem oil seals are not damaged when installing.

- *New valve stem oil seals -B- are supplied with plastic sleeve; fit plastic sleeve -A- onto valve stem.*



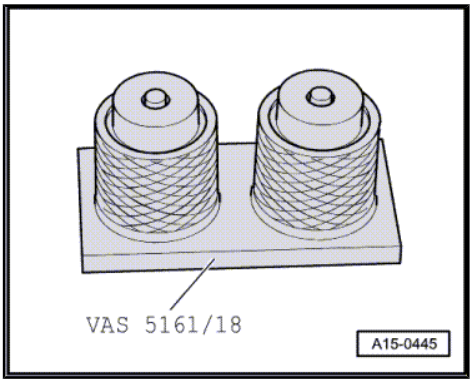
– Lightly oil sealing lip of valve stem oil seal.
– Slide valve stem oil seal onto plastic sleeve.
– Carefully press valve stem oil seal onto valve guide using valve stem seal fitting tool -3365- .
– Take off plastic sleeve.

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

- Larger diameter of valve cotters faces upwards.

– Insert valve spring and valve spring plate.

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

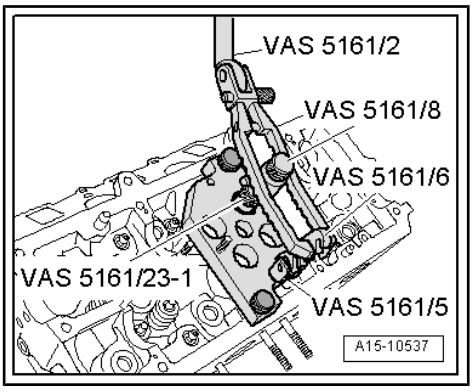


– Insert assembly cartridge in guide plate -VAS 5161/23- again.

– Press down pressure fork and pull knurled screw upwards while turning screw in both directions - this will insert the valve cotters.

– Release the pressure fork with knurled screw still in pulled position.

– Repeat procedure for each valve.



Assembling

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

– Install camshafts: cylinder head (left-side) ⇒ page 213 , cylinder head (right-side) ⇒ page 219 .

4.9 Checking hydraulic valve compensation elements

Special tools and workshop equipment required

♦ Feeler gauge

Note

♦ *Hydraulic valve compensation elements cannot be serviced.*

♦ *Irregular valve noises when starting engine are normal.*

Procedure

– Start engine and run until coolant temperature reaches approx. 80 °C.

– Increase engine speed to approx. 2500 rpm for 2 minutes (perform road test if necessary).

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

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– Remove cylinder head cover (left or right) ⇒ page 188 .

– Rotate crankshaft until cam of hydraulic compensation element to be checked faces upwards. The procedure is:

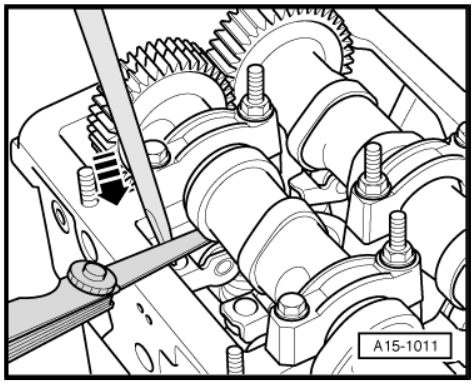
♦ Vehicles with manual gearbox: push vehicle forwards with 4th gear engaged and ignition switched off.

♦ Vehicles with automatic gearbox: remove noise insulation and rotate crankshaft in clockwise direction via central bolt for vibration damper.

– Determine clearance between cam and roller rocker finger.
– Press roller rocker finger down -arrow- using a screwdriver.

If it is possible to insert a feeler gauge of 0.20 mm between camshaft and roller rocker finger:

– Renew hydraulic compensation element
⇒ „4.5 Removing and installing camshafts - cylinder head (left-side)“, page 213 .

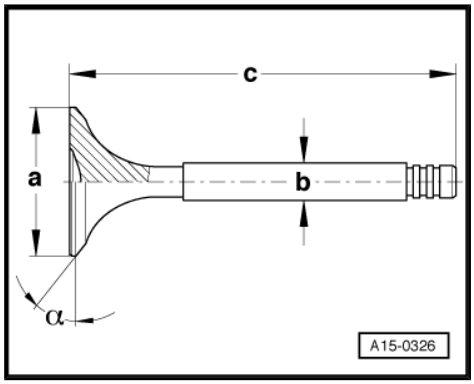


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4.10 Valve dimensions

Note

Inlet and exhaust valves must not be machined. Only grinding-in is permitted.



Dimension		Inlet valve	Exhaust valve
∅ a	mm	28.60 … 28.80	26.70 … 26.90
∅ b	mm	5.968 … 5.982	5.958 … 5.972
c	mm	97.25 … 97.45	97.35 … 97.55
α	∠°	45	45

WARNING

- *Care must be taken when disposing of old sodium-cooled exhaust valves.*
- *The valves must be sawn in two with a metal saw between the centre of the stem and valve head. When doing so, the valves must not come into contact with water. After preparing the valves, throw a maximum of ten into a bucket of water. Then step away immediately, since a chemical reaction will occur in which the sodium filling burns.*
- *After performing these steps the valves can be disposed of in the normal way.*

4.11 Machining valve seats

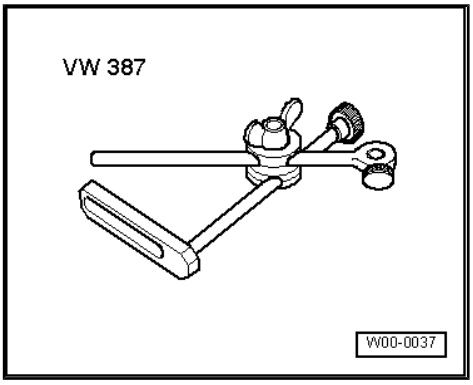
Note

Valve seats may not be machined due to the very small tolerances.

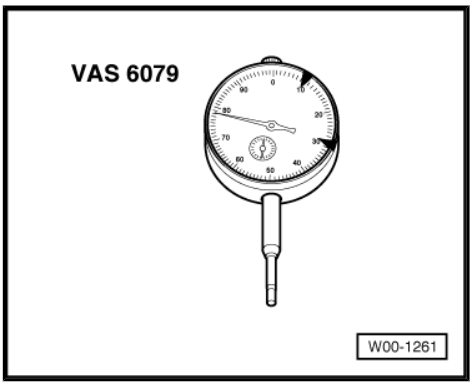
4.12 Checking valve guides

Special tools and workshop equipment required

♦ Universal dial gauge bracket -VW 387-



♦ Dial gauge -VAS 6079-

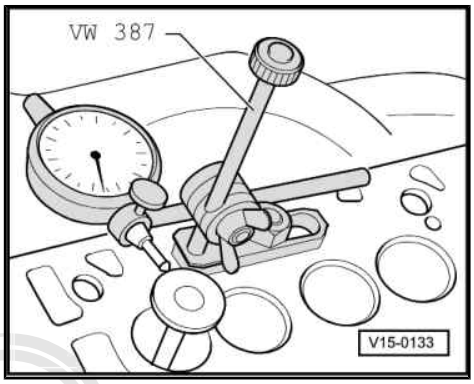


Procedure

– Insert valve into guide. Valve stem end must be flush with guide. Only insert inlet valve into inlet guide and exhaust valve into exhaust guide, as the stem diameters are different.

– Measure the amount of sideways play.

• Wear limit for inlet and exhaust valve guide: max. 1.0 mm



Note

♦ *If the wear limit is exceeded, repeat the measurement with new valves. Renew cylinder head if wear limit is still exceeded. Valve guides cannot be renewed.*

♦ *If the valve has to be renewed as part of a repair, use a new valve for the measurement.*

4.13 Checking valves

– Visually inspect for scoring on valve stem and on seating surface.

If scoring is clearly visible:

– Renew the relevant valve.

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17 – Lubrication

1 Oil pump, sump (bottom section), sump (top section)

Note

- *If large quantities of metal shavings or particles are found in the engine oil when repairing the engine, the oil passages must be cleaned carefully, and the engine oil cooler must be renewed in order to prevent further damage occurring later.*
- *The oil level must not be above max. mark on dipstick – danger of damage to catalytic converter.*
- *Refer to ⇒ Maintenance tables for engine oil capacity, oil specifications and viscosity grades.*
- *Oil spray jet for piston cooling ⇒ page 137 .*
- *Pressure limiting valves ⇒ page 237 .*

1.1 Oil pump, sump (bottom section) - exploded view

1 - 8 Nm + turn 90° further
- ❑ Renew
- ❑ Tighten in stages and in diagonal sequence

2 - 8 Nm + turn 90° further
- ❑ Self-locking
- ❑ Renew

3 - Baffle plate

4 - Oil pump
- ❑ Do not dismantle
- ❑ With pressure relief valve for cold condition (11 bar) and pressure control valve (3.5 bar)
- ❑ Removing and installing ⇒ page 239

5 - 23 Nm

6 - Dowel sleeves

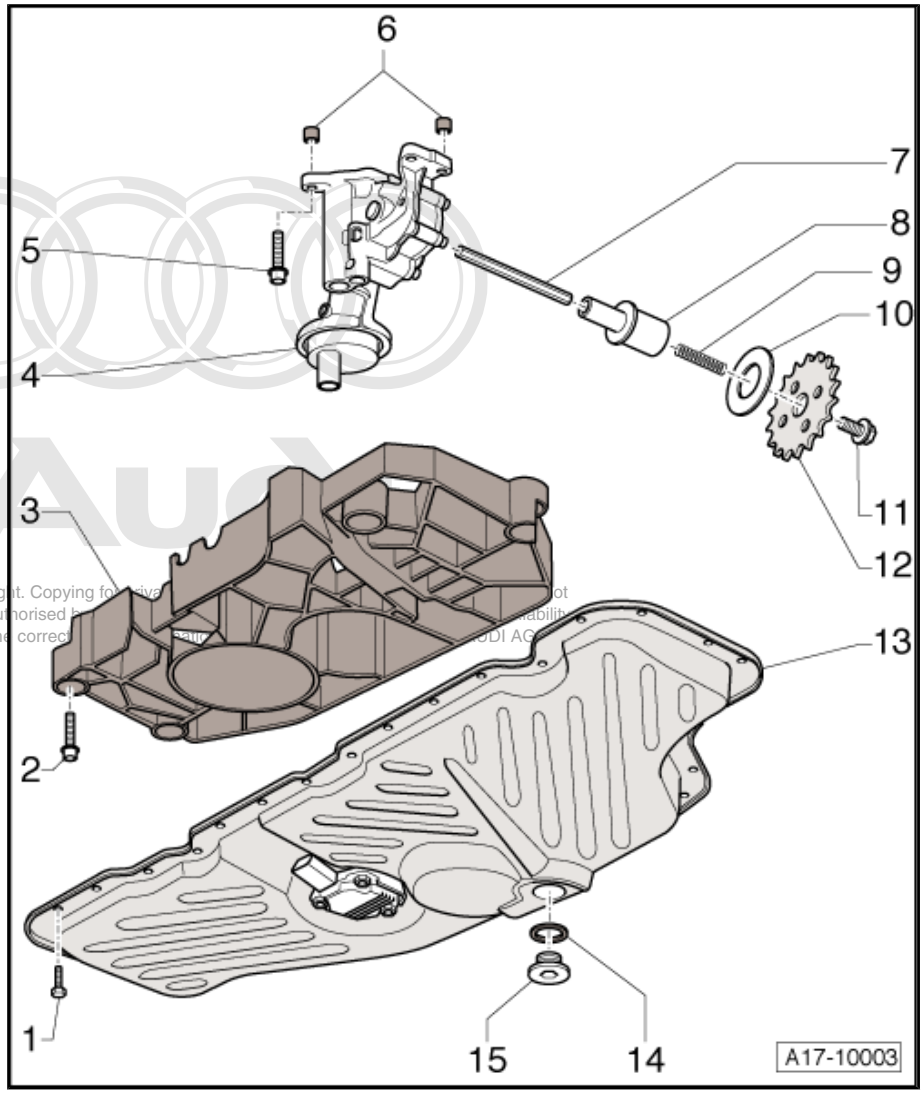
7 - Oil pump drive shaft

8 - Coupling

9 - Compression spring

10 - Thrust washer

11 - 64 Nm
- ❑ Property class 10.9
- ❑ To loosen, use pin wrench -3212- to counterhold chain sprocket
- ❑ If bolt cannot be tightened to torque, remove



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sump (bottom section)
with baffle plate and counterhold oil pump drive shaft using an open-end spanner.

12 - Chain sprocket for oil pump

- ❑ Installation position: Side with lettering faces engine

13 - Sump (bottom section)

- ❑ Removing and installing ⇒ page 237
- ❑ With oil level and oil temperature sender -G266-
- ❑ Removing and installing oil level and oil temperature sender -G266- ⇒ page 237

14 - Seal

- ❑ Renew

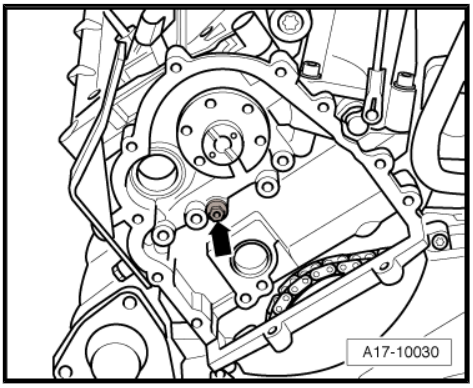
15 - Oil drain plug

- ❑ M14 - 30 Nm
- ❑ M24 - 50 Nm

Pressure limiting valves

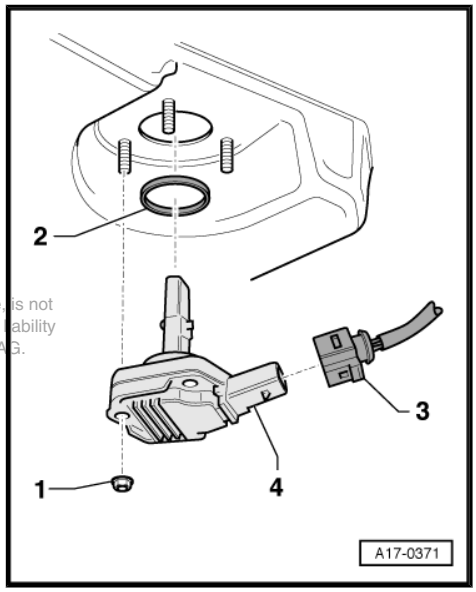
The pressure limiting valves -arrow- are located at the rear end of the cylinder heads (left and right). They are no longer installed on recent versions and can no longer be supplied as replacement parts.

- Tightening torque: 25 Nm.



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

1 - Nut, 9 Nm
2 - Seal; renew
3 - Electrical connector
4 - Oil level and oil temperature sender -G266-



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1.2 Removing and installing sump (bottom section)

Special tools and workshop equipment required

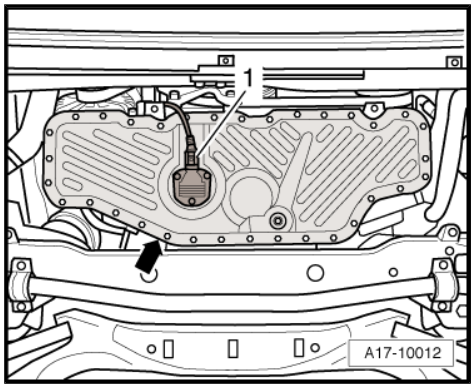
- ♦ Electric drill with plastic brush attachment
- ♦ Safety goggles
- ♦ Sealant ⇒ Electronic parts catalogue

Removing

- Engine oil drained ⇒ Maintenance ; Booklet 405

– Unplug electrical connector at oil level and oil temperature sender -G266- -item 1-.

– Unbolt sump (bottom section) -arrow-.



Installing

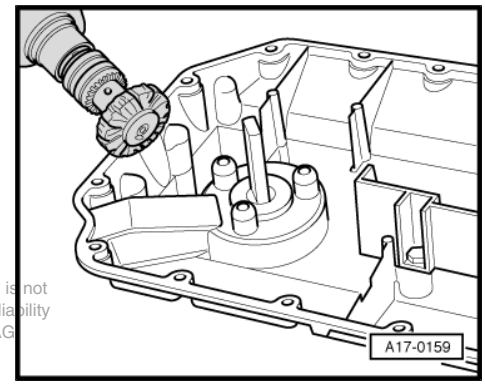
Note

Renew seals.

WARNING

Wear safety goggles.

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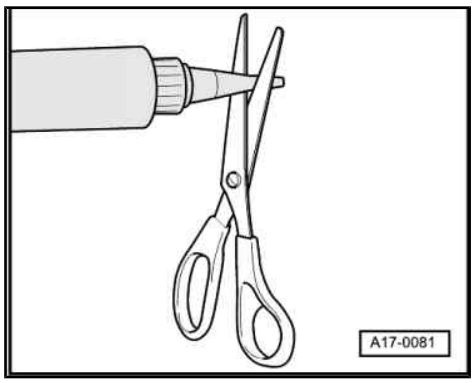
– Remove sealant residue from bottom and top sections of sump with rotating plastic brush or similar.

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

Note

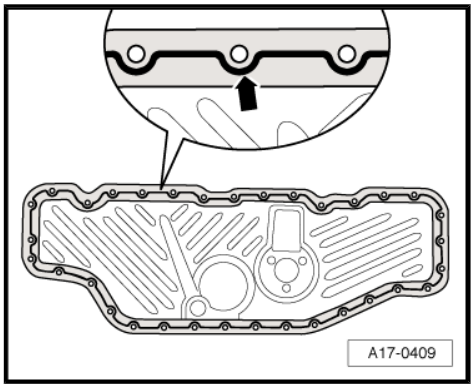
Note the use-by date of the sealant.

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



– Apply bead of sealant -arrow- onto clean sealing surface of sump (bottom section) as illustrated.

• Width of sealant bead: 2 mm.



Note

♦ *The sealant bead must not be thicker than specified, otherwise excess sealant could enter the sump and clog the strainer in the oil pump.*

♦ *The sump (bottom section) must be installed within 5 minutes after applying sealant.*

– Fit sump (bottom section) and tighten all bolts initially to 5 Nm in diagonal sequence.

– Tighten bolts on sump (bottom section) in diagonal sequence.

– Fill up with engine oil and check oil level ⇒ Maintenance ; Booklet 405 .

Tightening torques

Component		Nm
Sump (bottom section) to sump (top section)		8 +90° 1)2)
Oil drain plug	M14	30
	M24	50

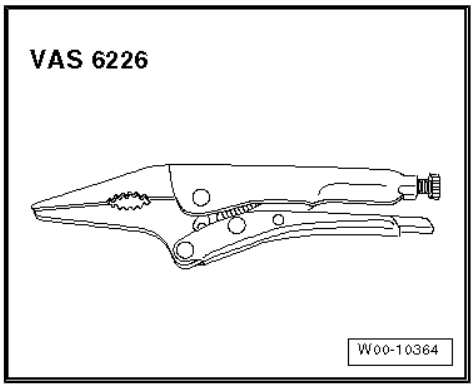
• 1) Renew bolts.

• 2) 90° = one quarter turn.

1.3 Removing and installing oil pump

Special tools and workshop equipment required

♦ Long-nose grip pliers -VAS 6226-



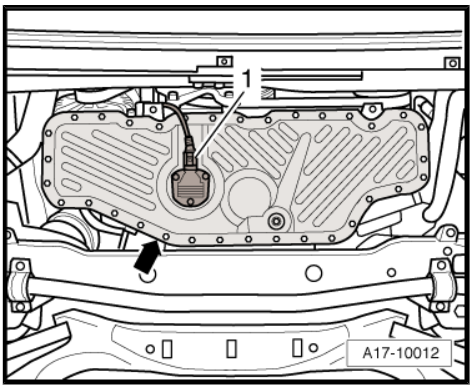
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Removing

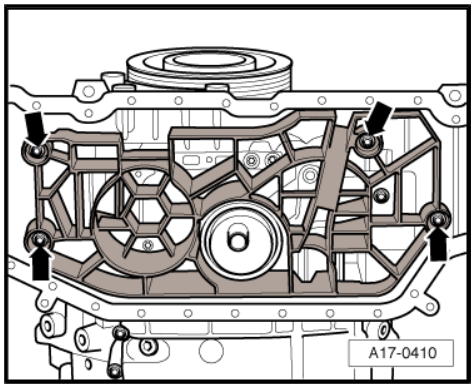
• Engine oil drained ⇒ Maintenance ; Booklet 405

– Unplug electrical connector at oil level and oil temperature sender -G266- -item 1-.

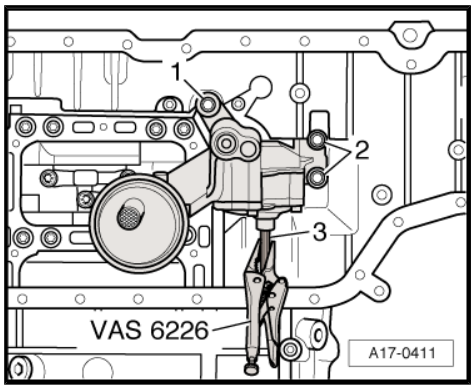
– Unbolt sump (bottom section) -arrow-.



– Detach baffle plate -arrows-.



– Unscrew bolts -1- and -2-.
– Hold oil pump drive shaft -3- firmly with long-nose grip pliers - VAS 6226- and push shaft back against spring pressure.
– Take out oil pump.



Note

Oil pump drive shaft remains in position.

Installing

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

Note

Renew seals and O-rings.

– Check that the two dowel sleeves are fitted in the oil pump; install if necessary.
– Install sump (bottom section) ⇒ page 238 .
– Fill up with engine oil and check oil level ⇒ Maintenance ; Booklet 405 .

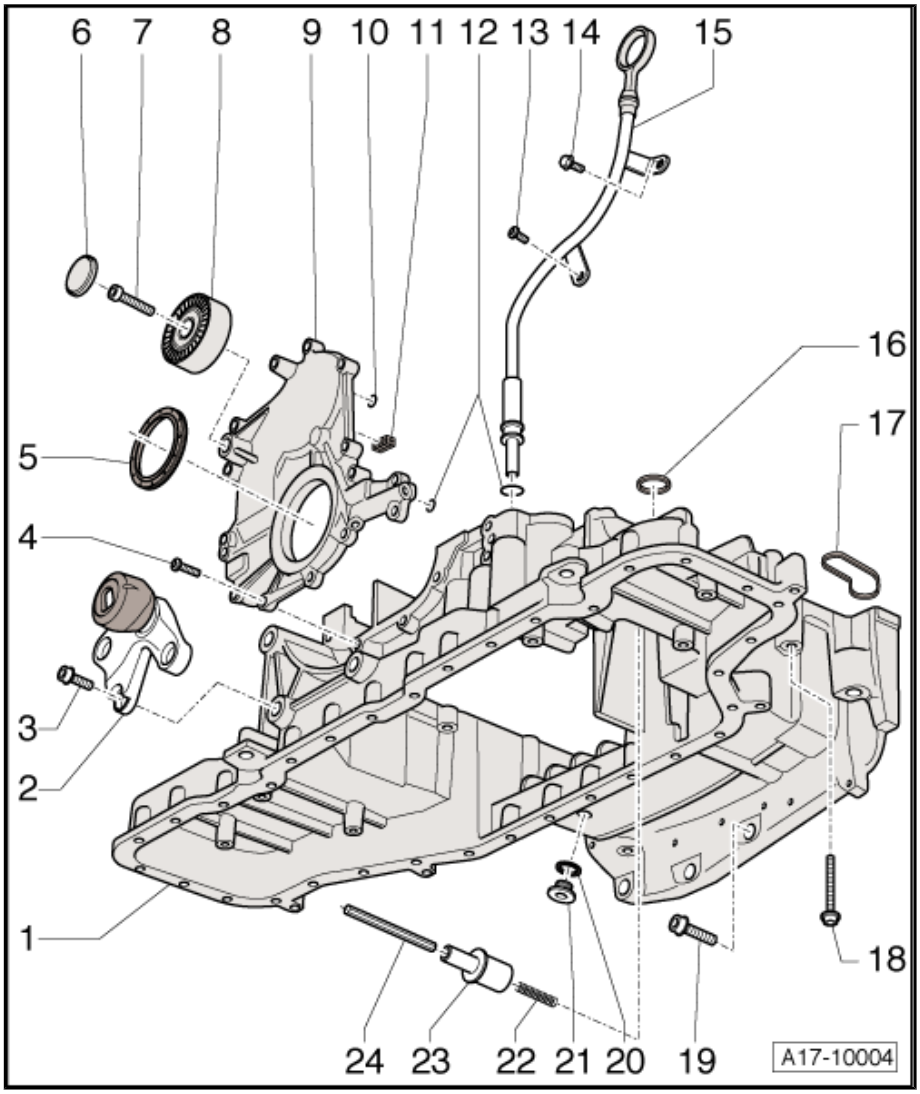
Tightening torques

Component	Nm
Oil pump to sump (top section)	23
Baffle plate to sump (top section)	8 +90° 1)2)

- 1) Renew bolts.
- 2) 90° = one quarter turn.

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1.4 Sump (top section) - exploded view



1 - Sump (top section)

- ❑ Removing and installing ⇒ page 242
- ❑ Fitting location of dowel sleeves ⇒ page 242

2 - Torque reaction support

3 - 40 Nm

4 - 9 Nm

- ❑ Tighten in stages and in diagonal sequence

5 - Oil seal for crankshaft (pulley end)

- ❑ Renewing ⇒ page 116

6 - Cover

7 - 23 Nm

8 - Idler roller for poly V-belt

- ❑ Note installation position

9 - Sealing flange (front)

- ❑ Removing and installing ⇒ page 118

10 - O-ring

- ❑ Renew

11 - Sealing element

- ❑ 2x

12 - O-rings

- ❑ Renew

13 - 9 Nm

14 - 9 Nm

15 - Guide tube for oil dipstick

16 - Seal

- ❑ Renew

17 - Seal

- ❑ Renew

18 - 15 Nm

- ❑ Tighten in stages and in diagonal sequence

19 - 45 Nm

20 - Seal

- ❑ Renew

21 - Plug for TDC drilling, 35 Nm

22 - Compression spring

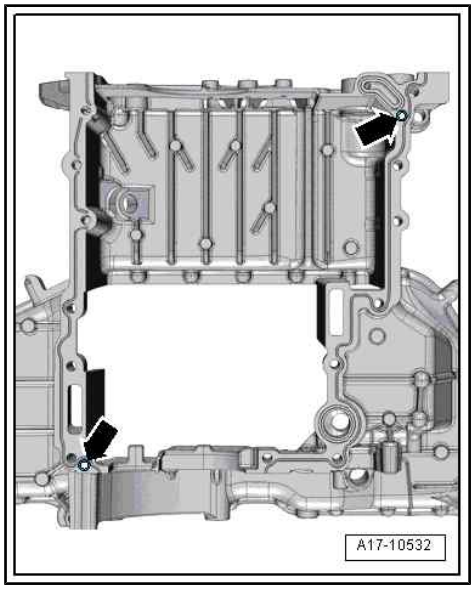
23 - Coupling

24 - Oil pump drive shaft

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Fitting location of dowel sleeves for sump (top section)

– Check whether dowel sleeves -arrows- for centring in sump (top section) are fitted; insert missing dowel sleeves.



1.5 Removing and installing sump (top section)

Special tools and workshop equipment required

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

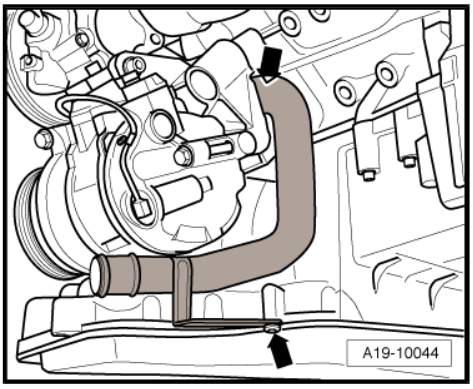
Removing

- Engine removed and secured to engine and gearbox support ⇒ page 95
- Engine oil drained ⇒ Maintenance ; Booklet 405

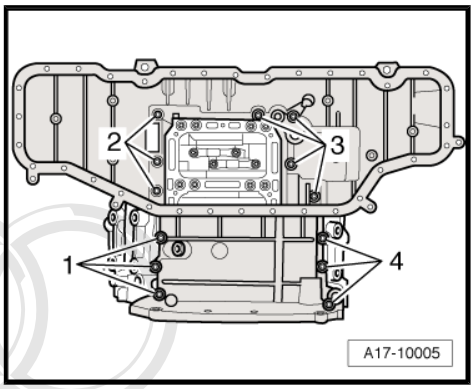
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– Remove dual-mass flywheel on vehicles with manual gearbox ⇒ page 122 .
– Remove flywheel on vehicles with multitronic gearbox ⇒ page 126 .
– Remove drive plate on vehicles with automatic gearbox ⇒ page 128 .
– Remove timing chain covers ⇒ page 143 .
– Remove chain for oil pump and balance shaft ⇒ page 173 .
– Remove sealing flange (front) ⇒ page 118 .
– Remove sump (bottom section) ⇒ page 237 .
– Remove oil pump ⇒ page 239 .

– Remove bolts -arrows- and take off coolant pipe (left-side).



– Remove bolts -1 … 4- for sump (top section).
– Carefully press sump (top section) off bonded joint and off dowel pins on cylinder block.

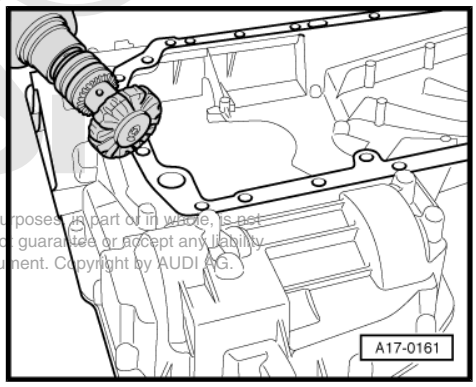


Installing

Note

Renew gaskets, seals and O-rings.

– Remove old sealant from grooves on sump (top section) and from sealing surfaces.



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WARNING

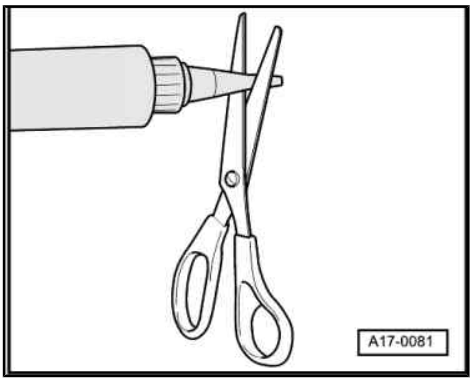
Wear safety goggles.

– Remove sealant residue from sump (top section) and cylinder block with rotating plastic brush or similar.
– Clean sealing surfaces; they must be free of oil and grease.

Note

Note the use-by date of the sealant.

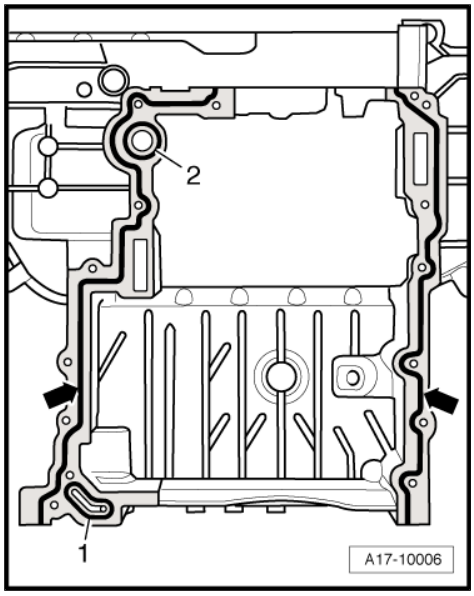
– Cut off tube nozzle at front marking (diameter of nozzle approx. 1.5 mm).



– Install seals -1- and -2- in top section of sump.

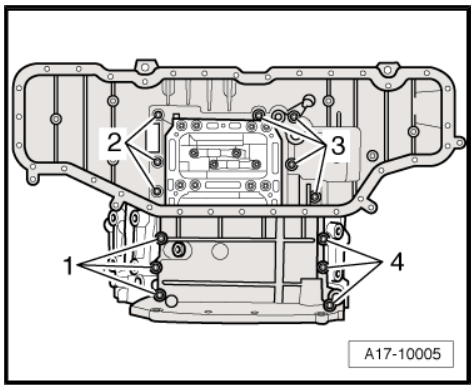
– Apply beads of sealant -arrows- onto clean sealing surface of sump (top section) as illustrated.

- The grooves -arrows- on the sealing surfaces must be completely filled with sealant.
- The beads of sealant must project 1.5 … 2.0 mm above the sealing surface.



Note

- *The sealant beads must not be thicker than specified, otherwise excess sealant could enter the sump and clog the strainer in the oil pump.*
- *The sump (top section) must be installed within 5 minutes after applying sealant.*



– Fit sump (top section), paying attention to dowel sleeves ⇒ page 242 , and tighten bolts -1 ... 4- in diagonal sequence initially to 5 Nm.

– Tighten bolts -1 ... 4- in diagonal sequence.

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

– Install oil pump ⇒ page 239 .

– Install sump (bottom section) ⇒ page 238 .

– Install sealing flange (front) ⇒ page 118 .

– Install chain for oil pump and balance shaft ⇒ page 173

– Install timing chain covers ⇒ page 144 .

– Install dual-mass flywheel on vehicles with manual gearbox ⇒ page 122 .

– Install flywheel on vehicles with multitronic gearbox ⇒ page 126 .

– Install drive plate on vehicles with automatic gearbox ⇒ page 128 .

– After installing engine, fill up with engine oil and check oil level ⇒ Maintenance ; Booklet 405 .

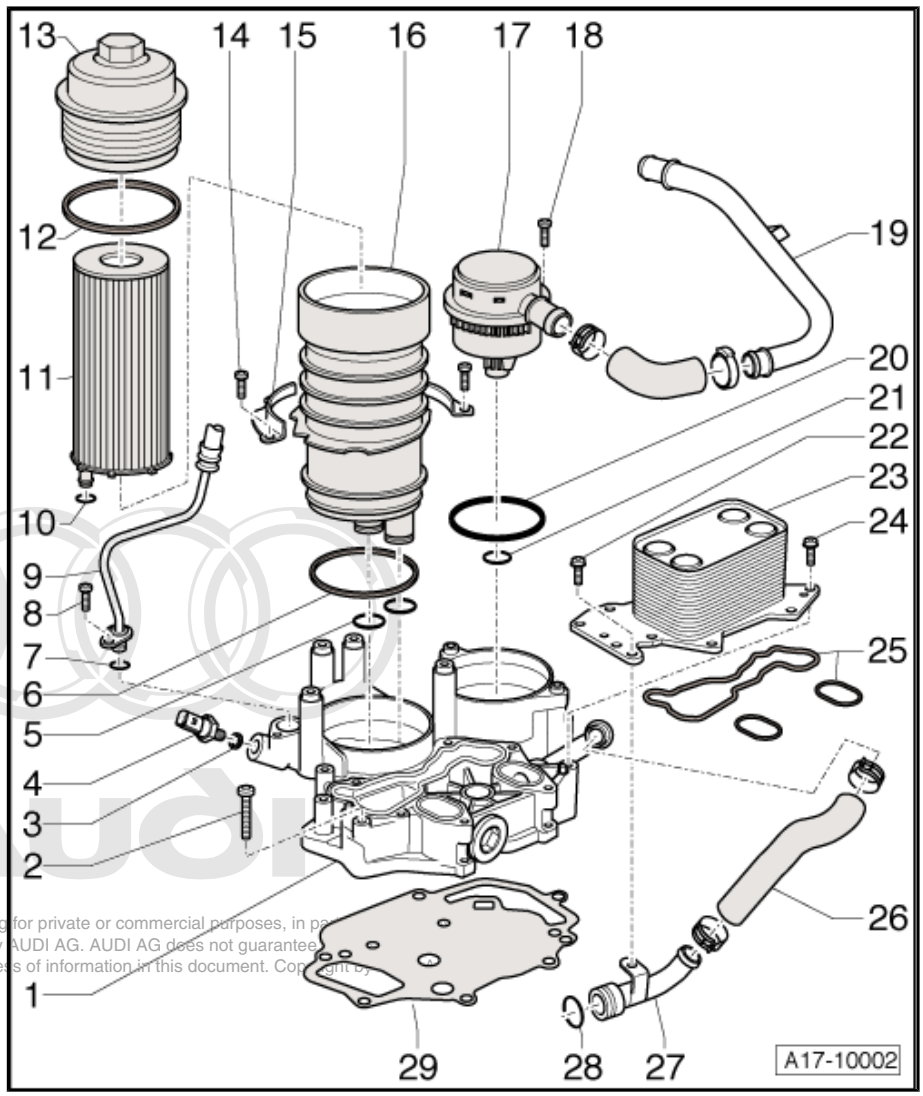
Tightening torques

Component		Nm
Sump (top section) to cylinder block		15
Coolant pipe to:	Sump (top section)	9
	Bracket for air conditioner compressor	9

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2 Engine oil cooler, oil filter housing, oil pressure switch

2.1 Engine oil cooler, pressure control valve and oil filter housing - exploded view



1 - Mounting plate

- ❑ For engine oil cooler, pressure control valve of crankcase breather system, oil filter housing
- ❑ Removing and installing ⇒ page 252

2 - 9 Nm

3 - Seal

- ❑ Renew

4 - Oil pressure switch - F1- , 0.9 bar

- ❑ Grey insulation
- ❑ Checking ⇒ page 254
- ❑ Removing and installing ⇒ page 253

5 - O-rings

- ❑ Renew

6 - Seal

- ❑ Renew

7 - O-ring

- ❑ Renew

8 - 9 Nm

9 - Oil supply line

- ❑ To turbocharger

10 - O-ring

- ❑ Renew

11 - Oil filter element

- ❑ Removing and installing ⇒ Maintenance ; Booklet 405

12 - Seal

- ❑ Renew

13 - Sealing cap, 35 Nm

14 - 9 Nm

15 - Retaining clip

16 - Oil filter housing

- ❑ Removing and installing ⇒ page 247
- ❑ With oil filter bypass valve, 2.0 … 3.0 bar (pressure differential upstream/downstream of filter)

17 - Pressure control valve for crankcase breather system

- ❑ Removing and installing ⇒ page 251

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18 - 9 Nm

19 - Crankcase breather pipe

20 - O-ring

- ❑ Renew

21 - O-ring

- ❑ Renew

22 - 9 Nm

23 - Engine oil cooler

- ❑ See note ⇒ page 236
- ❑ Removing and installing ⇒ page 246
- ❑ With engine oil cooler bypass valve, 2.0 … 3.0 bar (pressure differential upstream/downstream of engine oil cooler)

24 - 9 Nm

25 - Seals

- ❑ Renew

26 - Coolant hose

27 - Coolant pipe

28 - O-ring

- ❑ Renew

29 - Gasket

- ❑ Renew

2.2 Removing and installing engine oil cooler

Removing

– Drain off coolant ⇒ page 256 .

– Remove intake manifold (top section) ⇒ Rep. gr. 23 .

– Remove bottom section of intake manifold (left and right) ⇒ Rep. gr. 23 .

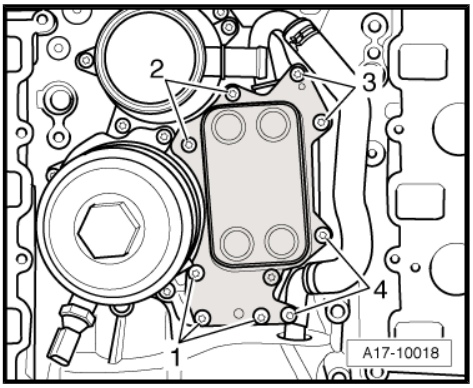
– Remove toothed belt for high-pressure pump ⇒ Rep. gr. 23 .

– Remove high-pressure pump ⇒ Rep. gr. 23 .

– Remove exhaust gas recirculation cooler ⇒ page 385 .

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– Spread out rags round engine oil cooler to catch escaping oil.
– Remove bolts -1 … 4- and detach engine oil cooler.



Installing

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

Note

Renew seals and O-ring for top coolant pipe.

– Install exhaust gas recirculation cooler ⇒ page 385 .
– Install high-pressure pump ⇒ Rep. gr. 23 .
– Install toothed belt for high-pressure pump ⇒ Rep. gr. 23 .
– Install bottom section of intake manifold (left and right) ⇒ Rep. gr. 23 .
– Install intake manifold (top section) ⇒ Rep. gr. 23 .
– Fill up with engine oil and check oil level ⇒ Maintenance ; Booklet 405 .
– Fill cooling system ⇒ page 259 .

Tightening torques

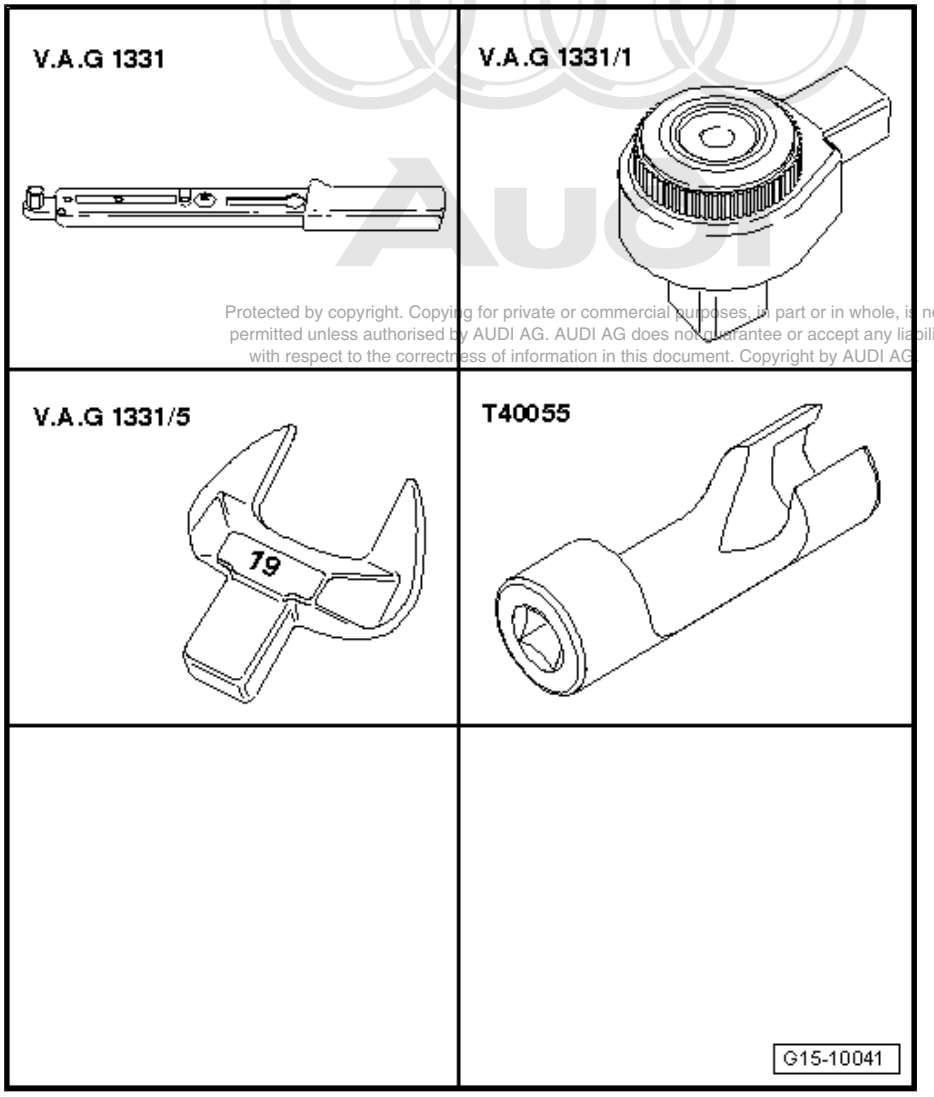
Component	Nm
Engine oil cooler to mounting plate	9
Coolant pipe (top) to engine oil cooler	9

2.3 Removing and installing oil filter housing

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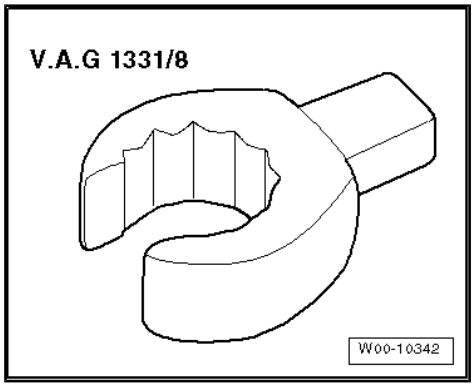
Special tools and workshop equipment required

- Torque wrench -V.A.G 1331-
- Ratchet -V.A.G 1331/1-
- Tool insert, AF 19 -V.A.G 1331/5- for vehicles from 10.2005 onwards
- Socket -T40055- for vehicles from 10.2005 onwards

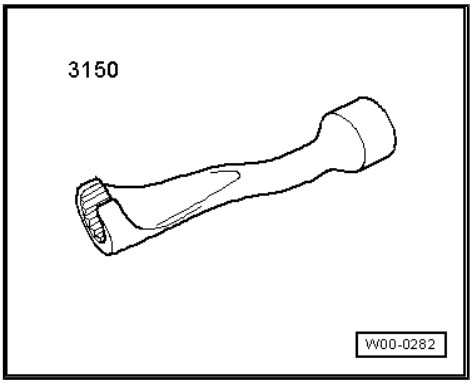


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- Socket insert AF 14, flared ring spanner -V.A.G 1331/8- for vehicles up to 10.2005

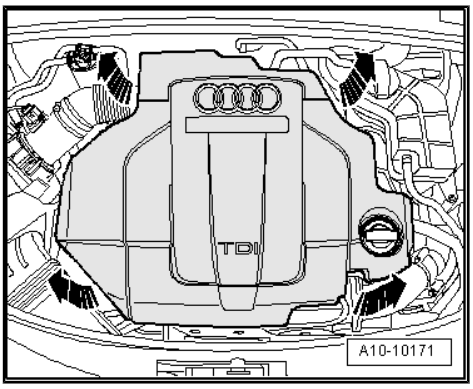


♦ Socket, 14 mm -3150- for vehicles up to 10.2005



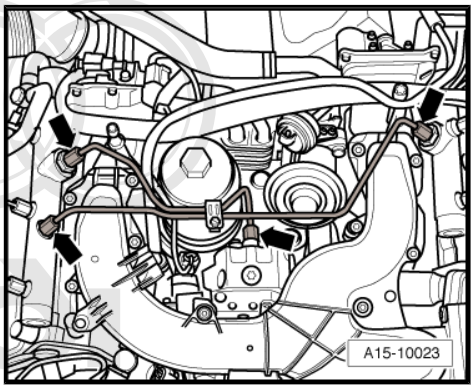
Removing

– Carefully pull engine cover panel off four retaining pins one after the other -arrows-.



Vehicles up to 10.2005:

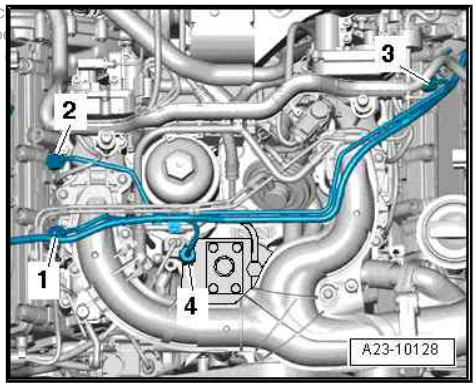
– Unscrew union nuts -arrows- and detach high-pressure pipes.



Vehicles from 10.2005 onwards:

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– Unscrew union nuts -1 ... 4- and detach high-pressure pipes.

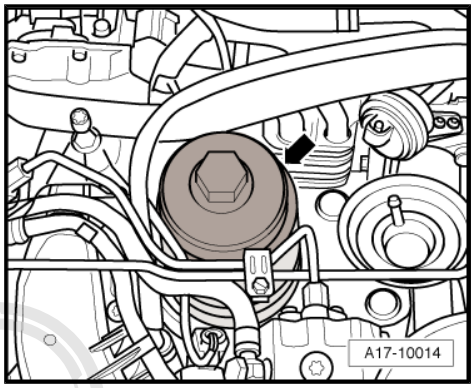


All vehicles:

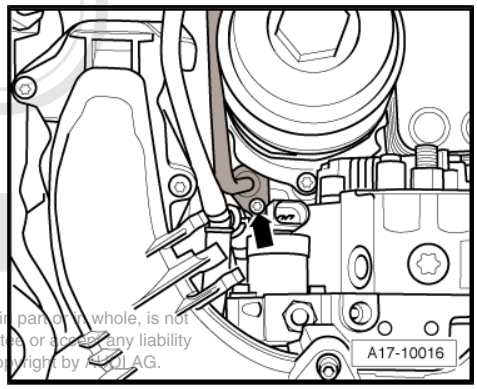
– Remove intake manifold (top section) ⇒ Rep. gr. 23 .

– Loosen sealing cap -arrow- using 32 mm socket. Take off sealing cap together with oil filter element.

– Pull oil filter element off sealing cap.



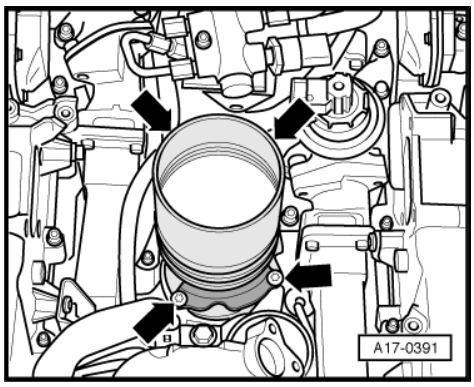
– Disconnect oil supply line -arrow- from mounting plate.



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– Unbolt retaining clip -arrows-.

– Spread out rags round oil filter housing to catch escaping oil.



– Tie two cable ties -2- and -3- into loops and secure them in upper groove on oil filter housing with a third cable tie -1-.

– Lift off oil filter housing with cable ties -arrow-.

Installing

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

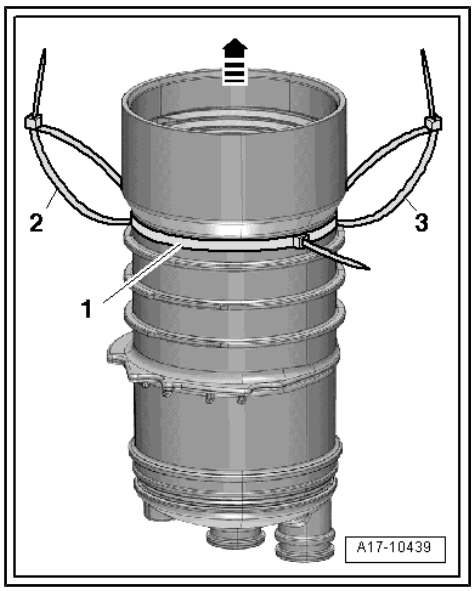
Note

Renew gaskets, seals and O-rings.

– Install intake manifold (top section) ⇒ Rep. gr. 23 .

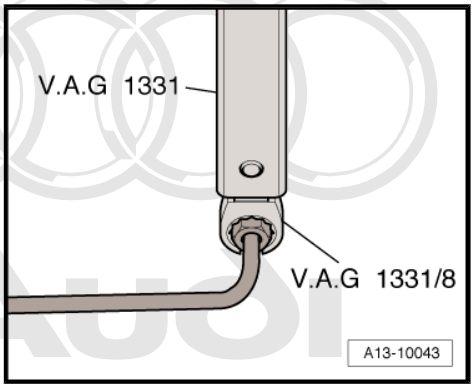
– Tighten union nuts on high-pressure pipes hand-tight initially.

– Ensure that high-pressure pipes are not under tension.



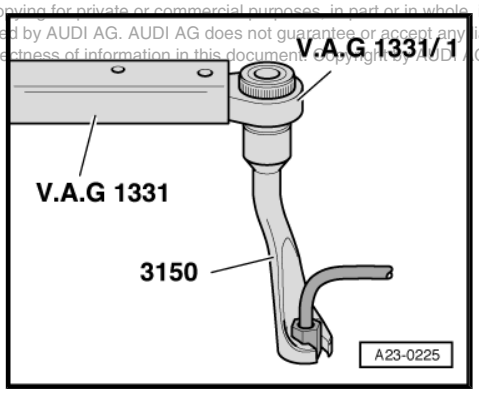
Vehicles up to 10.2005:

– To tighten union of high-pressure pipe at high-pressure pump, use torque wrench -V.A.G 1331- with socket insert AF 14, flared ring spanner -V.A.G 1331/8- .



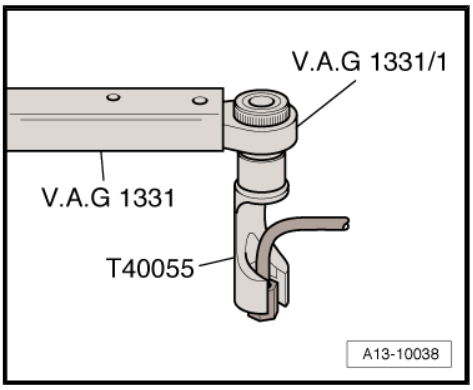
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– To tighten unions of high-pressure pipes, use torque wrench -V.A.G 1331- with ratchet -V.A.G 1331/1- and socket, 14 mm -3150- .

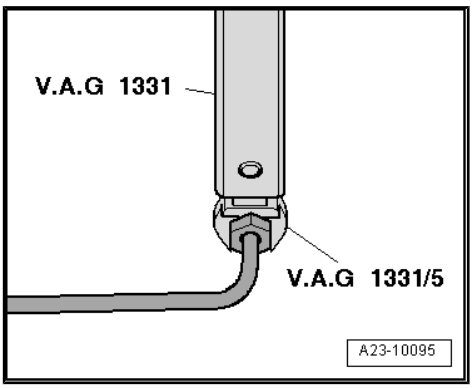


Vehicles from 10.2005 onwards:

– To tighten union of high-pressure pipe at high-pressure pump, use torque wrench -V.A.G 1331- with ratchet -V.A.G 1331/1- and socket -T40055- , 17 mm.



– To tighten unions of high-pressure pipes, use torque wrench -V.A.G 1331- and tool insert, AF 19 -V.A.G 1331/5- .



All vehicles:

– Check oil level ⇒ Maintenance ; Booklet 405 .

– Check fuel system for leaks ⇒ Rep. gr. 23 .

Tightening torques

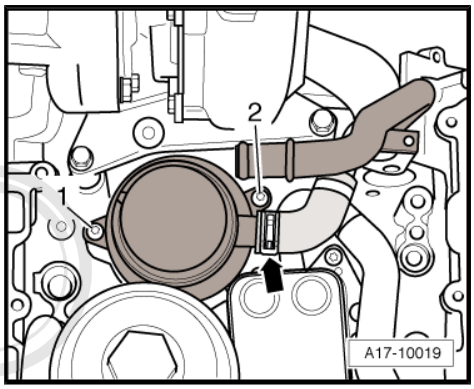
Component	Nm
Oil filter housing to mounting plate	9
Oil supply line to mounting plate	9
Sealing cap on oil filter housing	35
High-pressure pipes	25

2.4 Removing and installing pressure control valve for crankcase breather system

Removing

– Drain off coolant ⇒ page 256 .

– Remove intake manifold (top section) ⇒ Rep. gr. 23 .
– Remove bottom section of intake manifold (left and right) ⇒ Rep. gr. 23 .
– Remove exhaust gas recirculation cooler ⇒ page 385 .
– Detach hose -arrow- from pressure control valve for crankcase breather system.
– Remove bolts -1- and -2-.
– Take out pressure control valve for crankcase breather system.



Installing

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

Note

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

– Install exhaust gas recirculation cooler ⇒ page 385 .
– Install bottom section of intake manifold (left and right) ⇒ Rep. gr. 23 .
– Install intake manifold (top section) ⇒ Rep. gr. 23 .
– Fill cooling system ⇒ page 259 .

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Tightening torque

Component	Nm
Pressure control valve for crankcase breather system to mounting plate	9

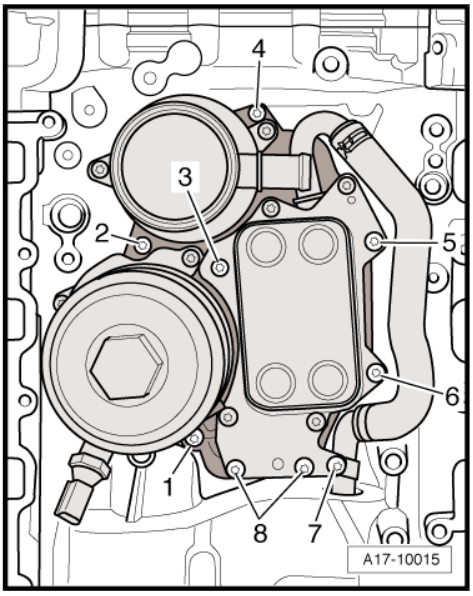
2.5 Removing and installing mounting plate for engine oil cooler, pressure control valve and oil filter housing

Removing

– Drain off coolant ⇒ page 256 .
– Remove intake manifold (top section) ⇒ Rep. gr. 23 .
– Remove bottom section of intake manifold (left and right) ⇒ Rep. gr. 23 .
– Remove toothed belt for high-pressure pump ⇒ Rep. gr. 23 .
– Remove high-pressure pump ⇒ Rep. gr. 23 .
– Remove exhaust gas recirculation cooler ⇒ page 385 .

– Remove bolts -1 ... 8-.

– Take out mounting plate with engine oil cooler, pressure control valve and oil filter housing.



Installing

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

Note

Renew gaskets, seals and O-rings.

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– Tighten bolts securing mounting plate from the inside outwards.

– Install exhaust gas recirculation cooler ⇒ page 385 .

– Install high-pressure pump ⇒ Rep. gr. 23 .

– Install toothed belt for high-pressure pump ⇒ Rep. gr. 23 .

– Install bottom section of intake manifold (left and right) ⇒ Rep. gr. 23 .

– Install intake manifold (top section) ⇒ Rep. gr. 23 .

– Fill up with engine oil and check oil level ⇒ Maintenance ; Booklet 405 .

– Fill cooling system ⇒ page 259 .

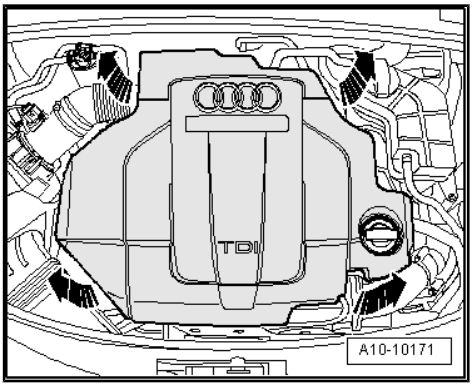
Tightening torque

Component	Nm
Mounting plate to cylinder block	9

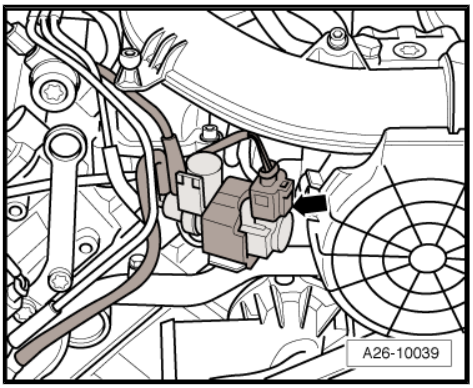
2.6 Removing and installing oil pressure switch -F1-

Removing

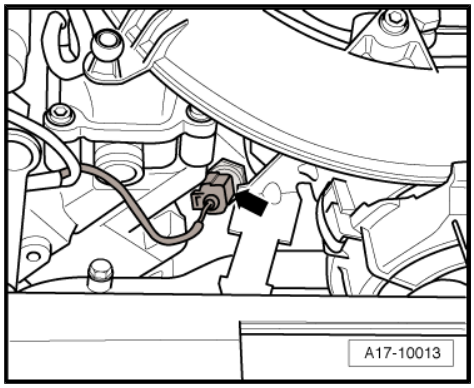
– Carefully pull engine cover panel off four retaining pins one after the other -arrows-.



– Detach exhaust gas recirculation valve -N18- -arrow- from retainer.



– Unplug electrical connector -arrow-.
– Unscrew oil pressure switch -F1- .



Installing

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

Note

Renew seal.

Tightening torque

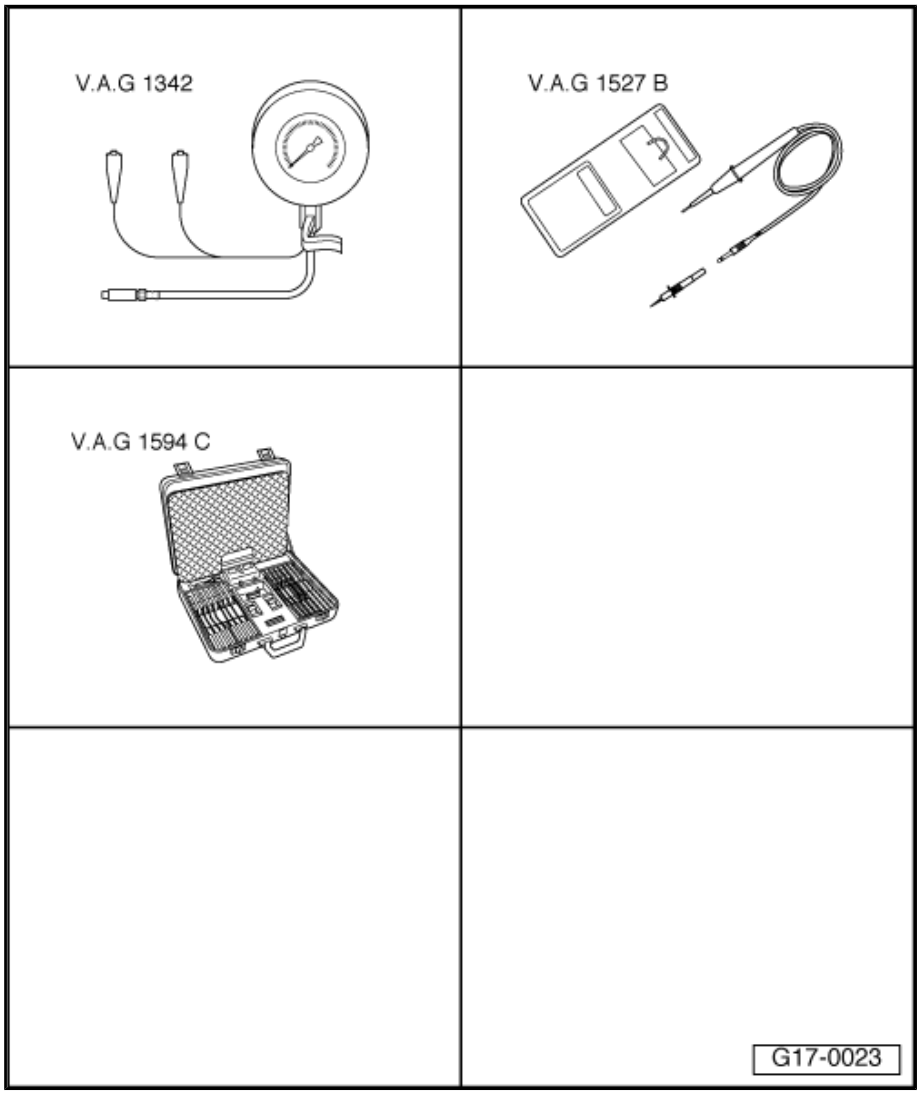
Component	Nm
Oil pressure switch -F1- to engine	20

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2.7 Checking oil pressure

Special tools and workshop equipment required

- Oil pressure tester -V.A.G 1342-
- Voltage tester -V.A.G 1527B-
- Auxiliary measuring set -V.A.G 1594C-



Test conditions

- Oil level OK
- Engine oil temperature approx. 80 °C.

Preparation for test

– Remove oil pressure switch -F1- ⇒ page 253 .

– Connect oil pressure tester -V.A.G 1342- to threaded hole for oil pressure switch.

– Screw oil pressure switch -2- into oil pressure tester -V.A.G 1342- .

Checking oil pressure switch

– Connect brown wire -1- of oil pressure tester to earth (–).

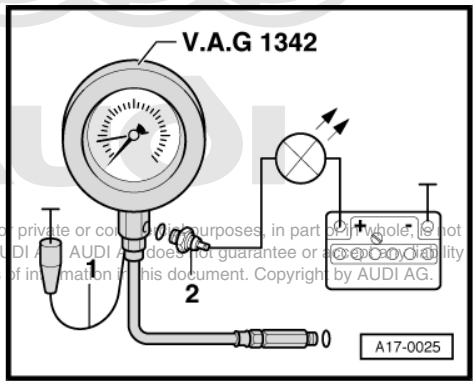
– Connect voltage tester -V.A.G 1527B- with test leads from auxiliary measuring set -V.A.G 1594C- to oil pressure switch and battery positive (+).

• LED should not light up.

If LED lights up now:

– Renew oil pressure switch.

– Start engine.



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Note

Observe tester and LED while starting, as switching point of oil pressure switch may already be exceeded when starting.

• LED should light up at 0.7 ... 1.1 bar.

If LED does not light up:

– Renew oil pressure switch.

Checking oil pressure

– Start engine.

• Minimum oil pressure at idling speed: 1.8 bar

• Minimum oil pressure at 2000 rpm: 4.0 bar

Assembling

– Install oil pressure switch ⇒ page 253 .

2.8 Engine oil

Refer to ⇒ Maintenance tables for engine oil capacity, oil specifications and viscosity grades.

2.9 Checking oil level

Check oil level ⇒ Maintenance ; Booklet 405 .

19 – Cooling

1 Cooling system

WARNING

Hot steam or hot coolant can escape when expansion tank is opened; cover filler cap with cloth and open carefully.

Note

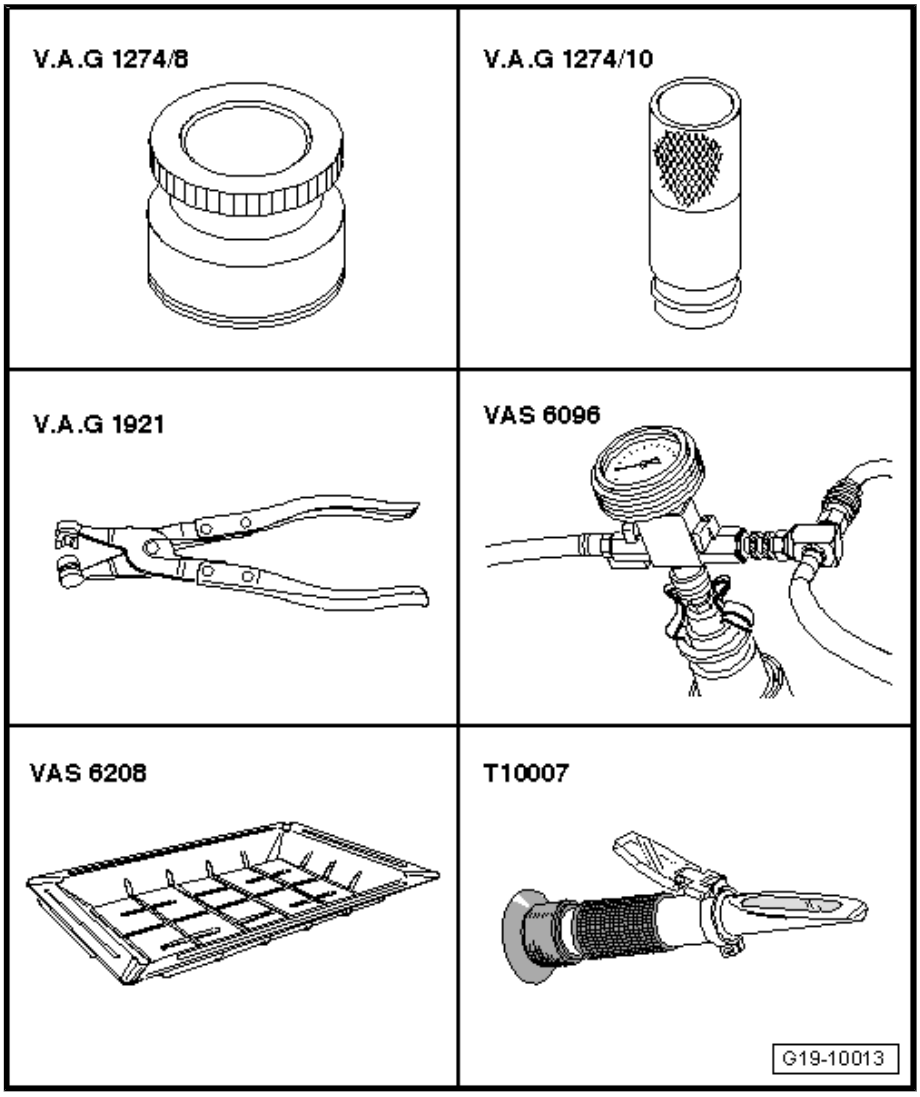
- *The cooling system is under pressure when the engine is hot. If necessary, relieve pressure before commencing repair work.*
- *The arrow markings on coolant pipes and on ends of hoses must align.*
- *The hose clips must be positioned at the white markings on the coolant hoses.*

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1.1 Draining and filling cooling system

Special tools and workshop equipment required

- Adapter for cooling system tester -V.A.G 1274/8-
- Pipe for cooling system tester -V.A.G 1274/10-
- Hose clip pliers -VAS 6362- instead of -V.A.G 1921- shown in illustration
- Cooling system charge unit -VAS 6096-
- Drip tray for workshop hoist -VAS 6208-
- Refractometer -T10007-



Draining

Note

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

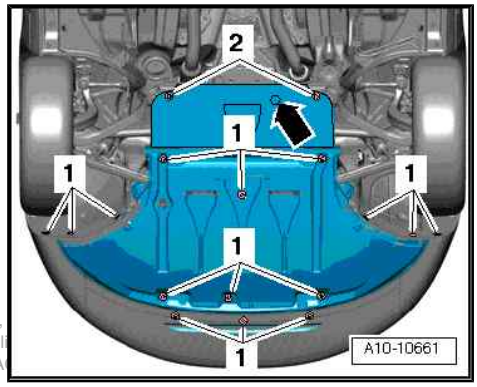
WARNING

Hot steam or hot coolant can escape when expansion tank is opened; cover filler cap with cloth and open carefully.

– Open filler cap on coolant expansion tank.

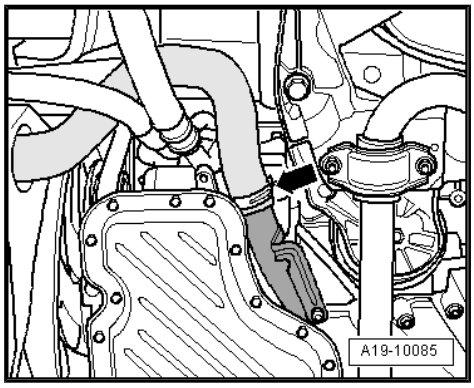
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– Release fasteners marked -1, 2- and -arrow- (if fitted) and remove front and rear noise insulation.

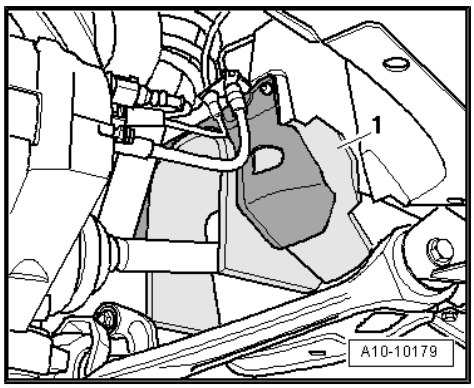


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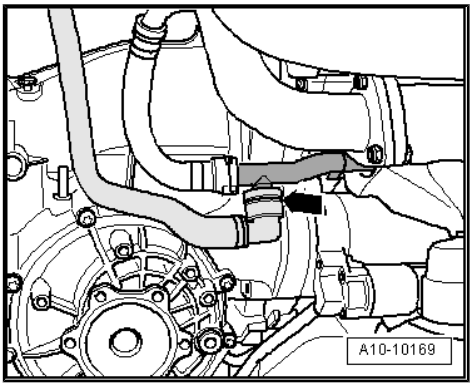
– Place drip tray for workshop hoist -VAS 6208- under engine.
– Disconnect coolant hose -arrow- from coolant pipe (left-side) and drain off coolant.



– Remove noise insulation -1- in wheel housing (right-side).



– Lift retaining clip and detach coolant hose -arrow- from coolant pipe (right-side). Drain remaining coolant.



Filling

- Ignition off.

Note

- *The cooling system is filled all year round with a mixture of water and coolant additive. Mixture ratio ⇒ page 259*
- *Use only the coolant additive listed in the ⇒ Electronic parts catalogue . Other coolant additives could seriously impair in particular the anti-corrosion properties. The resulting damage could lead to loss of coolant and consequently to serious engine damage.*
- *The specified coolant (based on recommended mixture ratio) ⇒ page 259 prevents frost and corrosion damage and stops scaling. Such additives also raise the boiling point of the coolant. For these reasons the cooling system must be filled all year round with the correct coolant additive.*
- *Because of its high boiling point, the coolant improves engine reliability under heavy loads, particularly in countries with tropical climates.*
- *Frost protection is required down to about –25 °C (in countries with arctic climate: down to about –35 °C).*
- *The coolant concentration must not be reduced by adding water even in warmer seasons and in warmer countries. The coolant concentration must be at least 40 %.*
- *If greater frost protection is required for reasons of climate, the coolant concentration can be increased up to a maximum of 60% (this gives frost protection down to about –40 °C). Otherwise frost protection decreases again and cooling efficiency also becomes worse.*
- *Use only clean tap water for mixing coolant.*
- *If radiator, heat exchanger, cylinder head, cylinder head gasket or cylinder block have been renewed, do not re-use old coolant.*
- *Contaminated or dirty coolant must not be used again.*
- *To check anti-freeze protection in cooling system, use refractometer -T10007- .*

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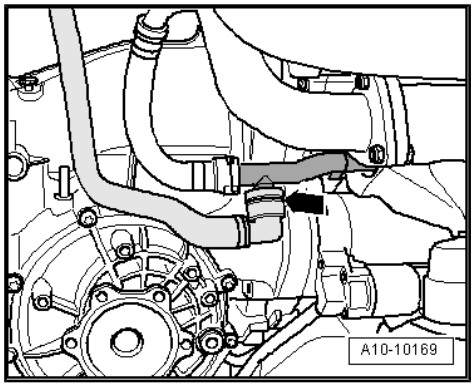
Recommended mixture ratio for coolant

- Coolant additive (40 %) and water (60 %) for frost protection to –25 °C
- Coolant additive (50 %) and water (50 %) for frost protection to –35 °C
- Coolant additive (60 %) and water (40 %) for frost protection to –40 °C

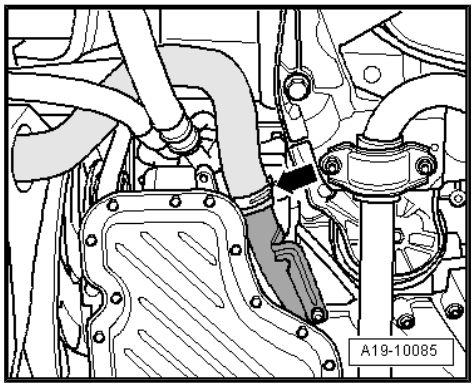
- Coolant ⇒ Electronic parts catalogue

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

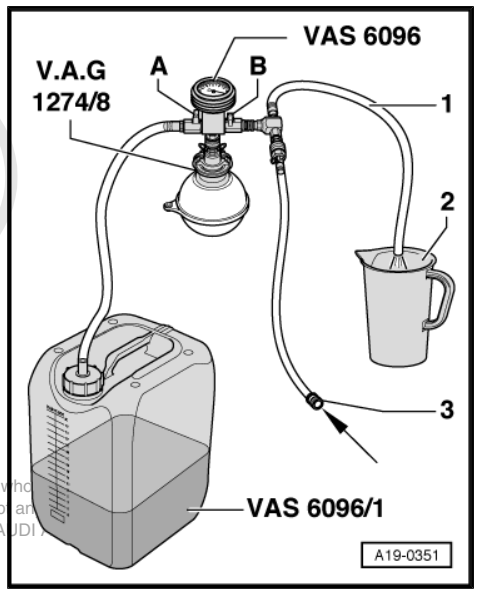
– Connect coolant hose -arrow- with plug-in connector to coolant pipe (right-side) ⇒ page 287 .



– Connect coolant hose -arrow- at coolant pipe (left-side).

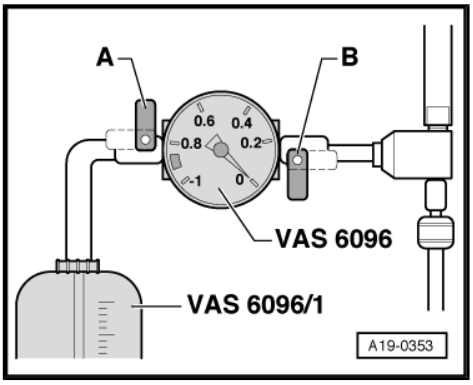


– Fill reservoir of -VAS 6096- with at least 12 litres of premixed coolant (according to recommended ratio ⇒ page 259).
– Screw adapter -V.A.G 1274/8- onto coolant expansion tank.
– Attach cooling system charge unit -VAS 6096- to adapter -V.A.G 1274/8- .
– Run vent hose -1- into a small container -2-. (The vented air draws along a small amount of coolant, which should be collected.)
– Close the two valves -A- and -B- by setting lever at right angle to direction of flow.
– Connect hose -3- to compressed air.
• Pressure: 6 ... 10 bar.



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– Open valve -B- by setting lever in direction of flow.



The suction jet pump generates a partial vacuum in the cooling system.

- The needle on the gauge should move into the green zone.

– Also briefly open valve -A- (turn lever in direction of flow) so that hose on charge unit reservoir -VAS 6096- can fill with coolant.

– Close valve -A- again.

– Leave valve -B- open for another 2 minutes.

- The suction jet pump will continue generating a vacuum in the cooling system.
- The needle on the gauge should remain in the green zone.

– Close valve -B-.

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

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

If the vacuum level drops, there is a leak in the cooling system.

– Detach compressed air hose.

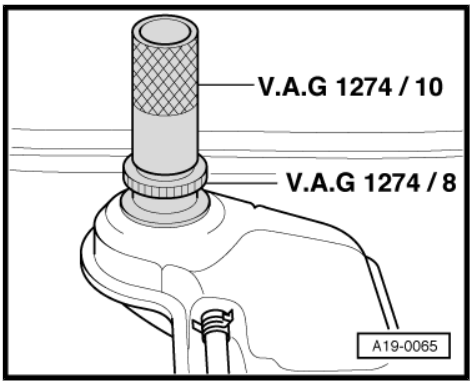
– Open valve -A-.

The vacuum in the cooling system causes the coolant to be drawn out of the reservoir for cooling system charge unit -VAS 6096- ; the cooling system is then filled.

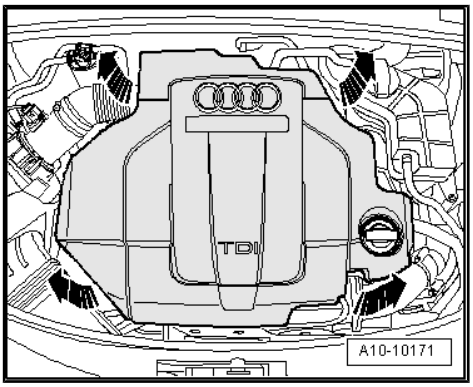
– Detach cooling system charge unit -VAS 6096- from expansion tank.

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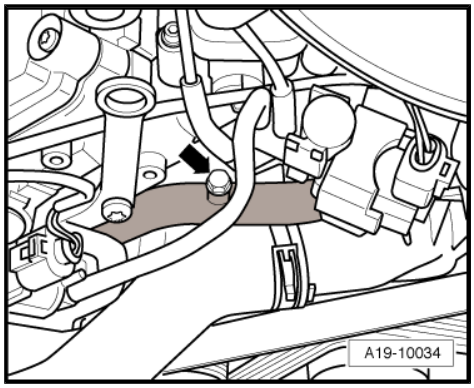
– Fit pipe -V.A.G 1274/10- onto adapter -V.A.G 1274/8-.



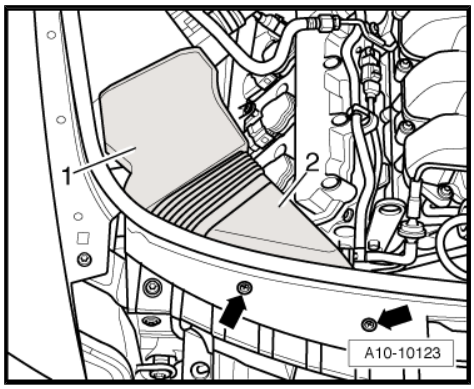
– Carefully pull engine cover panel off four retaining pins one after the other -arrows-.



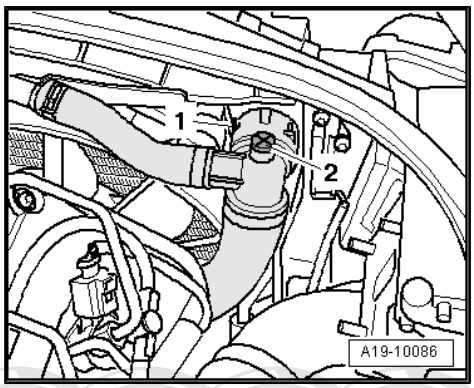
– Unscrew bleeder screw -arrow- at front of engine.
– Fill up with coolant until it comes out at bleeder hole with no air bubbles.
– Close bleeder screw.



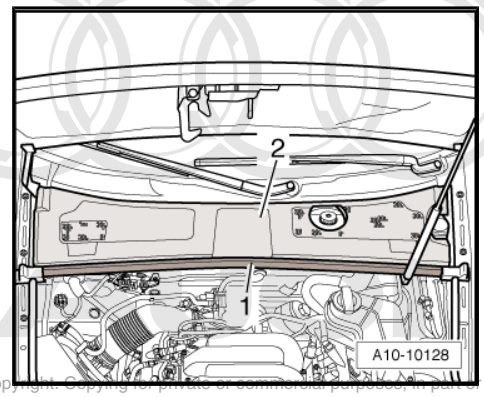
– Remove bolts -arrows-.
– Remove air ducts -1- and -2-.



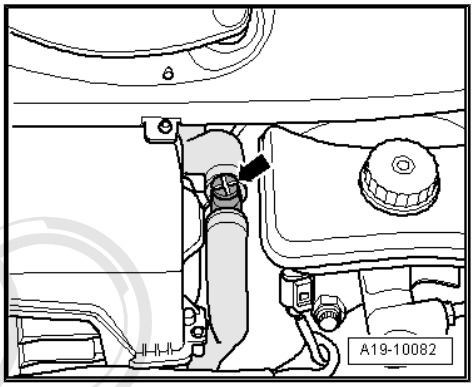
– Unscrew bleeder screw -2- on coolant hose -1- (top right) and fill up with coolant until it comes out at bleeder screw.
– Close bleeder screw.



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



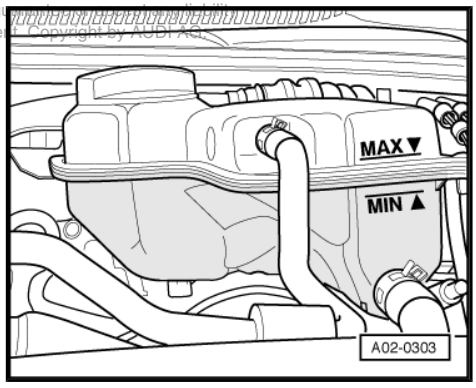
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– Open bleeder screw -arrow-.
– Fill up with coolant until it flows out at bleeder hole in coolant hose.
– Close bleeder screw.
– On vehicles with auxiliary heater, switch heater on (for about 30 seconds) and then off again.
– Tighten filler cap on expansion tank.
– Start engine.
– Set temperature to „HI“ in all zones.
– Switch off air conditioner compressor (press ECON button).
– Run the engine for 3 minutes at 2000 rpm.
– Allow the engine to run at idling speed until the two large coolant hoses at main radiator become warm.
– Run the engine for 1 minute at 2000 rpm.
– Switch off ignition and allow engine to cool down.

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– Check coolant level.



- The coolant level must be at the MAX marking when the engine is cold.
- The coolant level can be above the MAX marking when the engine is warm.

Tightening torque

Component	Nm
Bleeder screw to coolant pipe	8

2 Coolant pump, thermostat, coolant pipes

2.1 Coolant pump and thermostat - exploded view

1 - 23 Nm

2 - 9 Nm

3 - Coolant hose

- ❑ To radiator (top right)

4 - Hose connection with thermostat

- ❑ Removing and installing ⇒ page 266

5 - Seal

- ❑ Renew

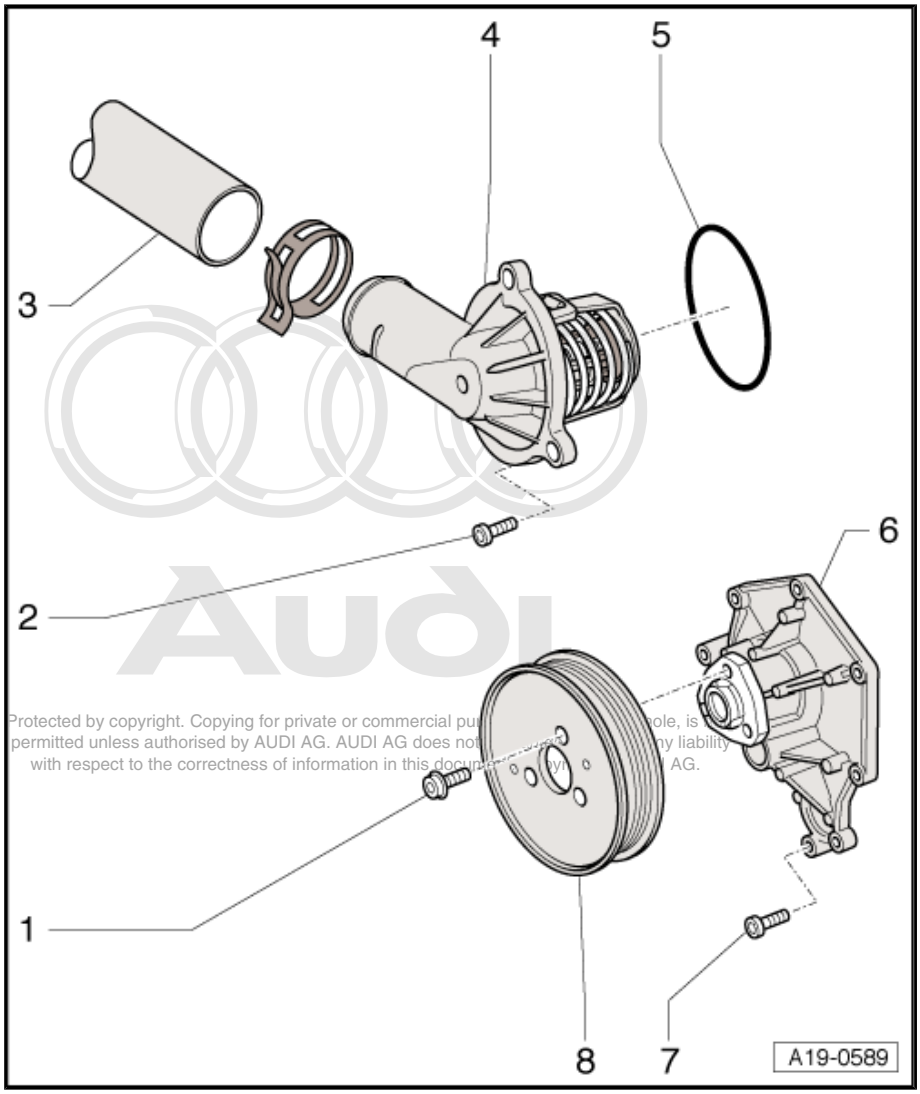
6 - Coolant pump

- ❑ Removing and installing ⇒ page 264

7 - 9 Nm

8 - Poly V-belt pulley for coolant pump

- ❑ Installation position: marking „vorne“ (front) faces in direction of travel.



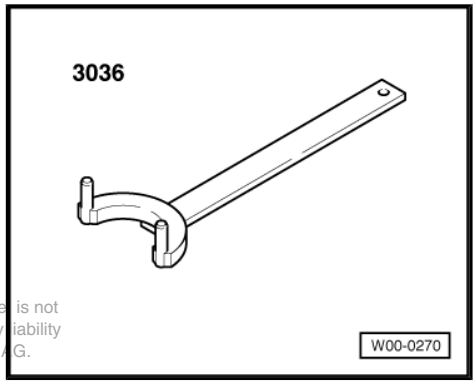
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2.2 Removing and installing coolant pump

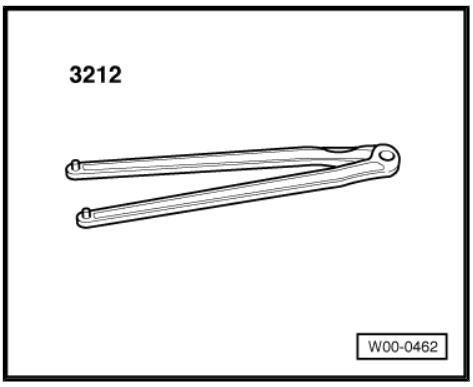
Special tools and workshop equipment required

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♦ Counterhold tool -3036-



♦ Pin wrench -3212-



Removing

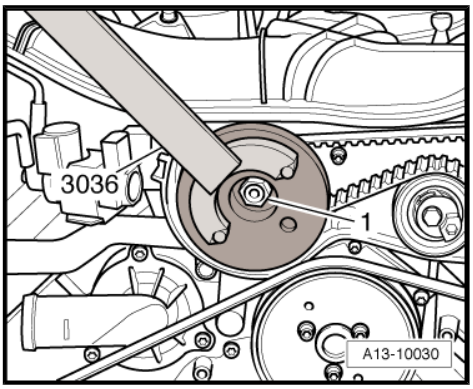
– Drain off coolant ⇒ page 256 .

– Remove intake manifold (top section) ⇒ Rep. gr. 23 .

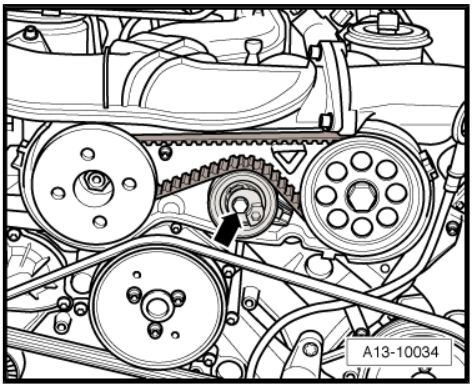
– Remove poly V-belt ⇒ page 111 .

– Loosen central nut -1- for high-pressure pump shaft using counterhold tool -3036- .

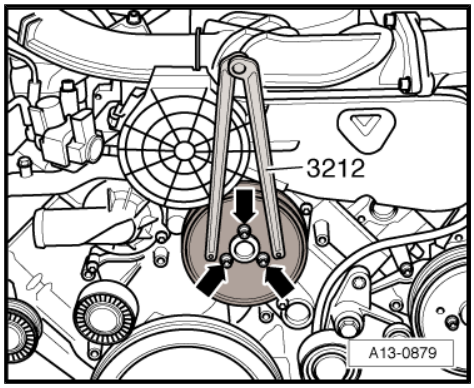
– Remove damper weight.



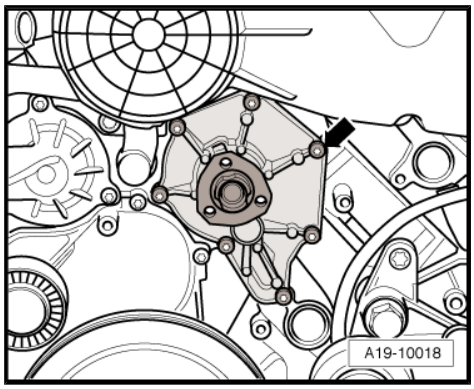
– Loosen bolt -arrow- for toothed belt tensioning roller approx. 2 turns and remove toothed belt from toothed belt sprocket for high-pressure pump.



– Unbolt coolant pump pulley -arrows- (counterhold with pin wrench -3212-).



– Unscrew bolts and take out coolant pump -arrow-.



Installing

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

– Clean sealing surface.

– Install toothed belt for high-pressure pump ⇒ Rep. gr. 23 .

– Install poly V-belt ⇒ page 111 .

– Install intake manifold (top section) ⇒ Rep. gr. 23 .

– Fill cooling system ⇒ page 259 .

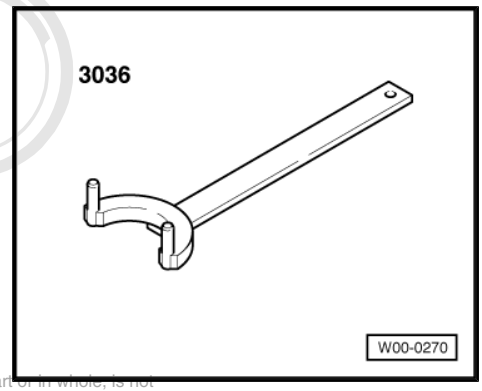
Tightening torques

Component	Nm
Coolant pump to cylinder block	9
Poly V-belt pulley to coolant pump	23
Damper weight to high-pressure pump	70

2.3 Removing and installing hose connection with thermostat

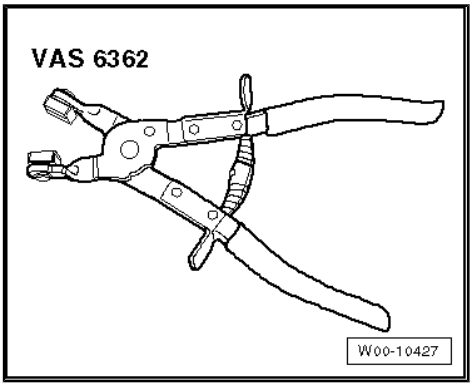
Special tools and workshop equipment required

♦ Counterhold tool -3036-



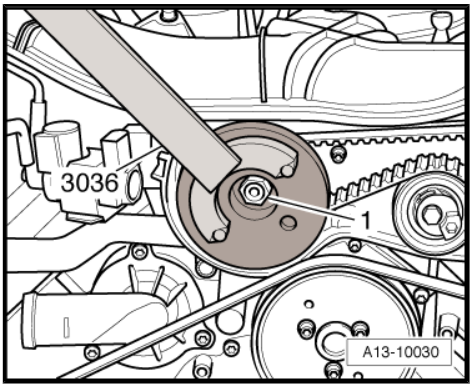
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♦ Hose clip pliers -VAS 6362-

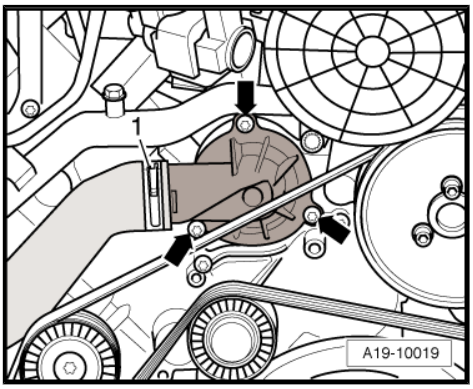


Removing

– Drain off coolant ⇒ page 256 .
– Remove intake manifold (top section) ⇒ Rep. gr. 23 .
– Remove poly V-belt ⇒ page 111 .
– Loosen central nut -1- for high-pressure pump shaft using counterhold tool -3036- .
– Remove damper weight.



– Disconnect coolant hose -1-.
– Unscrew bolts -arrows- and take out hose connection with thermostat.



Installing

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

Note

Renew O-ring.

– Clean sealing surface.
– Install poly V-belt ⇒ page 111 .
– Install intake manifold (top section) ⇒ Rep. gr. 23 .
– Fill cooling system ⇒ page 259 .

Tightening torques

Component	Nm
Hose connection with thermostat to engine	9
Damper weight to high-pressure pump	70

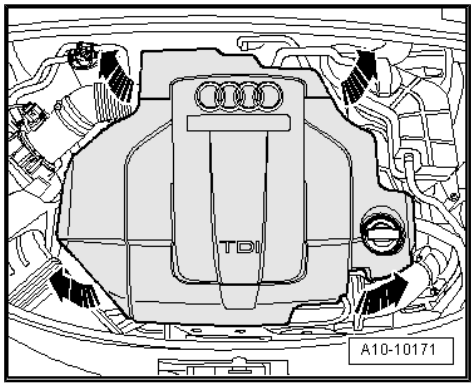
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2.4 Removing and installing coolant temperature sender -G62-

Removing

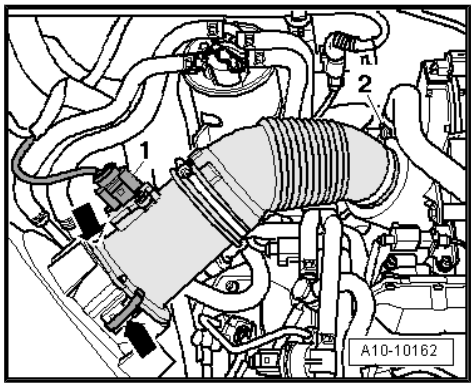
– Drain off coolant ⇒ page 256 .

– Carefully pull engine cover panel off four retaining pins one after the other -arrows-.



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

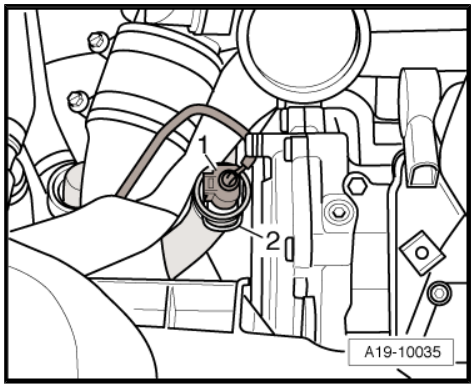
– Remove air intake hose. To do so, release hose clip -2- and clamps -arrows-.



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– Unplug electrical connector -1- at coolant temperature sender -G62- .

– Detach retaining clip -2- and remove coolant temperature sender -G62- .



Installing

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

Note

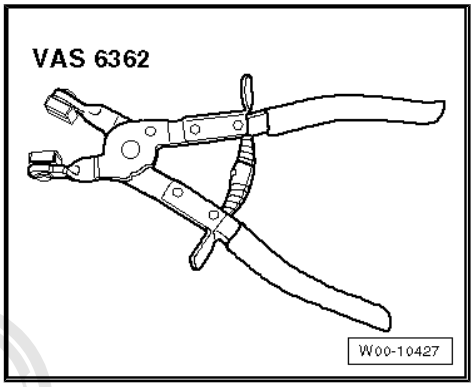
- *Renew O-ring.*
- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*
- *To ensure that the air hoses can be properly secured at their connections, spray rust remover onto the worm thread of used hose clips before installing.*

– Fill cooling system ⇒ page 259 .

2.5 Removing and installing coolant pipe (front)

Special tools and workshop equipment required

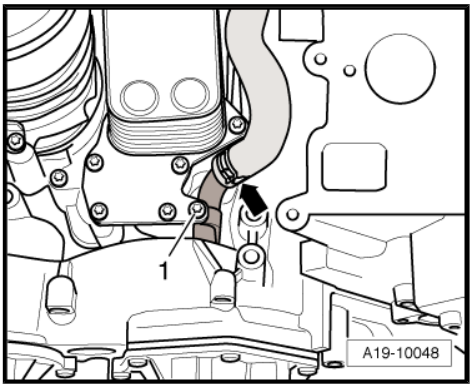
♦ Hose clip pliers -VAS 6362-



Removing

– Drain off coolant ⇒ page 256 .
– Remove intake manifold (top section) ⇒ Rep. gr. 23 .
– Remove bottom section of intake manifold (left-side) ⇒ Rep. gr. 23 .
– Remove poly V-belt ⇒ page 111 .
– Remove toothed belt for high-pressure pump ⇒ Rep. gr. 23 .
– Remove high-pressure pump ⇒ Rep. gr. 23 .
– Remove mechanical exhaust gas recirculation valve ⇒ page 385 .
– Disconnect coolant hose -arrow-.
– Unscrew bolt -1- and pull coolant pipe (top) out of cylinder block.

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Installing

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

Note

Renew O-ring.

– Before installing, clean and smoothen sealing surface for O-ring.
– Lubricate new O-ring with coolant additive and slide onto coolant pipe.
– Install mechanical exhaust gas recirculation valve ⇒ page 385 .
– Install high-pressure pump ⇒ Rep. gr. 23 .
– Install toothed belt for high-pressure pump ⇒ Rep. gr. 23 .
– Install poly V-belt ⇒ page 111 .
– Install bottom section of intake manifold (left-side) ⇒ Rep. gr. 23 .
– Install intake manifold (top section) ⇒ Rep. gr. 23 .
– Fill cooling system ⇒ page 259 .

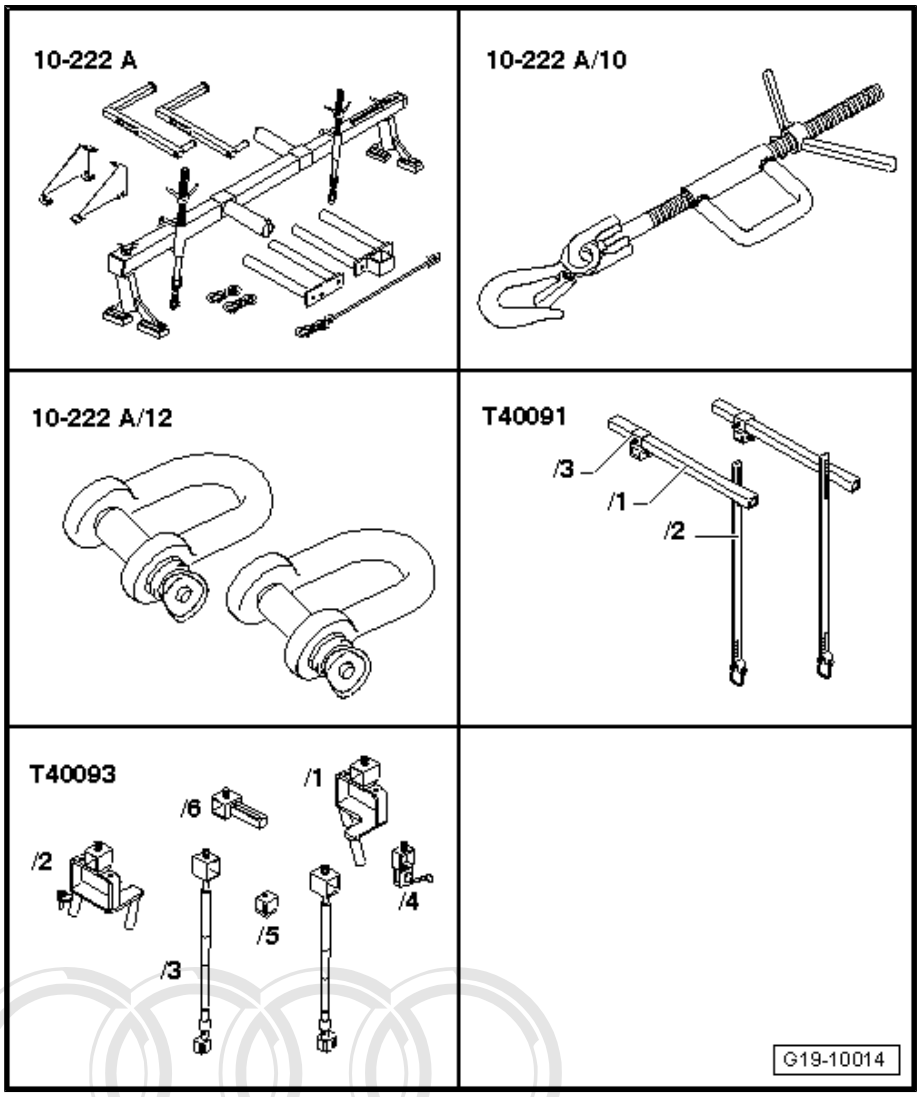
Tightening torque

Component	Nm
Front coolant pipe to engine oil cooler	9

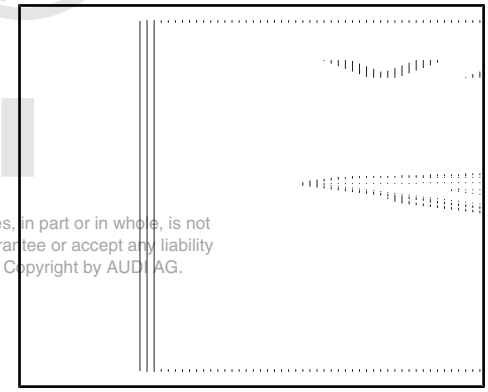
2.6 Removing and installing coolant pipe (left-side)

Special tools and workshop equipment required

- Support bracket -10 - 222 A-
- Hook -10 - 222 A /10-
- Shackle -10 - 222 A /12-
- Engine support bracket (basic set) -T40091-
- Engine support bracket (supplementary set) -T40093-

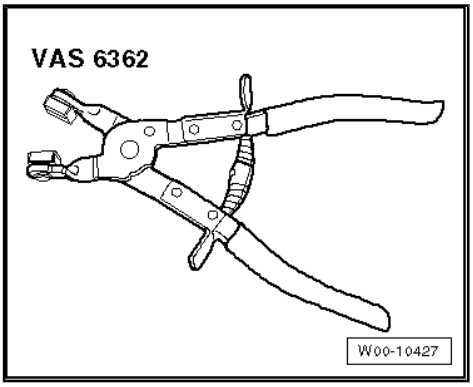


- Drip tray for workshop hoist -VAS 6208-



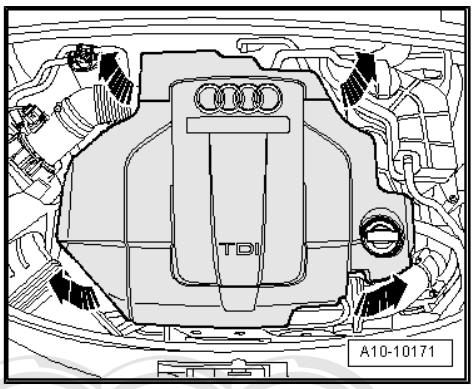
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♦ Hose clip pliers -VAS 6362-



Removing

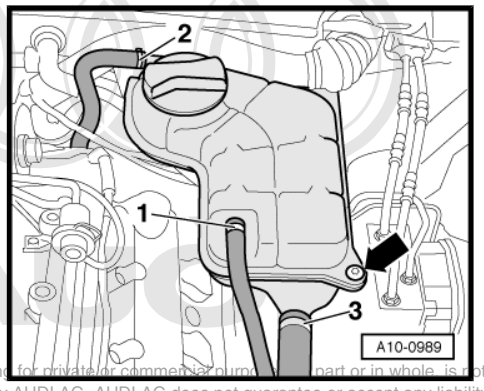
– Carefully pull engine cover panel off four retaining pins one after the other -arrows-.



– Unbolt coolant expansion tank -arrow-.

– Detach electrical connector at coolant shortage indicator switch -F66- on coolant expansion tank (bottom).

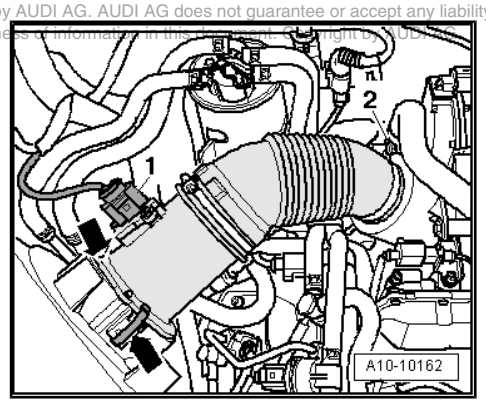
– Lay aside coolant expansion tank with coolant hoses -1 … 3- connected.



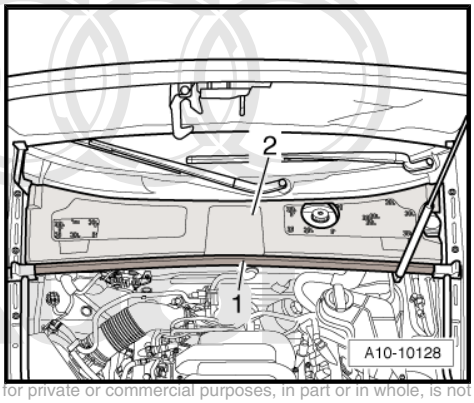
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– Unplug electrical connector -1- at air mass meter -G70-.

– Remove air intake hose. To do so, release hose clip -2- and clamps -arrows-.



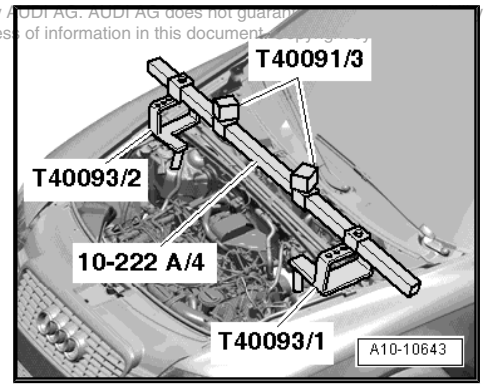
– Pull off rubber seal -1- and remove plenum chamber cover -2-.



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– Attach adapter -10 - 222 A /4- with connecting pieces -T40091/3- and supports -T40093/1- and -T40093/2- onto the suspension turrets.

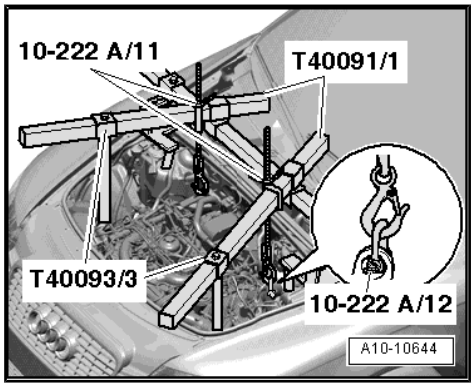
• Supports are marked for left and right side of vehicle.



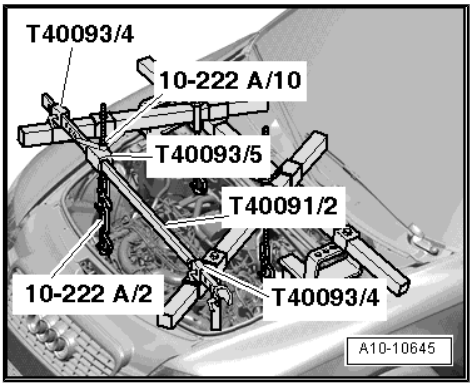
– Set up further components of support bracket as shown in illustration. Position supports -T40093/3- onto flanges of longitudinal members.

– Attach hooks on spindles -10 - 222 A /11- to engine lifting eye (left and right).

– Additionally attach shackle -10 - 222 A /12- on engine lifting eye (on left-side only).



– Push support -T40091/2- with sliding support -T40093/5- and the two connecting pieces -T40093/4- onto square-section pipes -T40091/1- .
– Fit hook -10 - 222 A /2- to hook -10 - 222 A /10- and engage hook -10 - 222 A /2- on engine lifting eye (front right).



WARNING

Secure support -T40091/2- with pins and split pins of connecting pieces -T40093/4- .

– Take up weight of engine by tightening spindles evenly.

WARNING

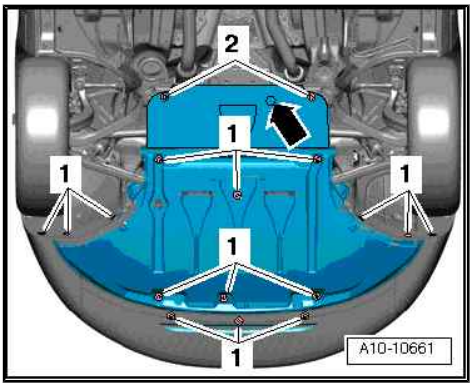
Hot steam or hot coolant can escape when expansion tank is opened; cover filler cap with cloth and open carefully.

– Open filler cap on coolant expansion tank.
– Remove front left wheel.

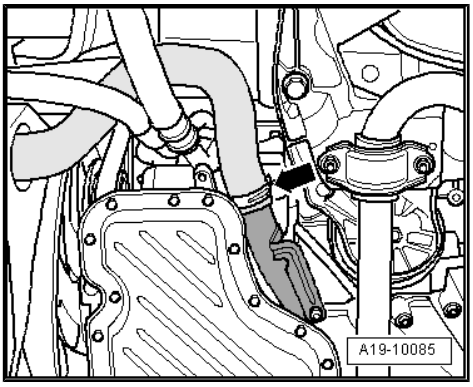
Note

Secure brake disc with one wheel bolt.

– Release fasteners marked -1, 2- and -arrow- (if fitted) and remove front and rear noise insulation.

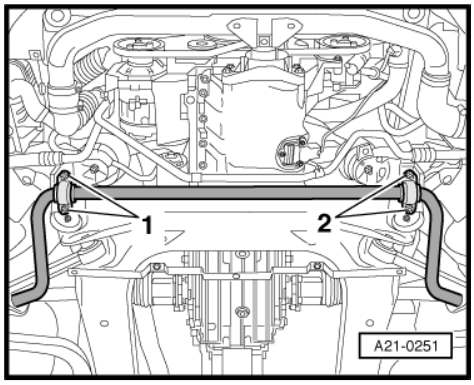


– Place drip tray for workshop hoist -VAS 6208- under engine.
– Disconnect coolant hose -arrow- from coolant pipe (left-side) and drain off coolant.

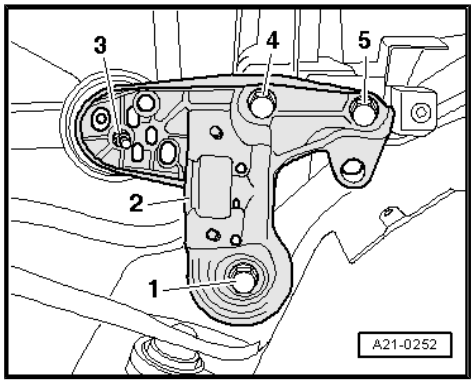


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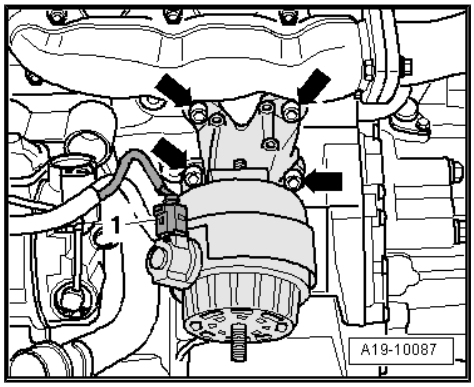
– Unbolt anti-roll bar mountings (left and right) -1- and -2-.



– Unscrew nut -3- at bottom of engine mounting (left-side).
– Unscrew bolts -4- and -5- on console for engine mounting (left-side).
– Unscrew front bolt -1- for subframe (left-side) and detach console for engine mounting -2- (left-side).

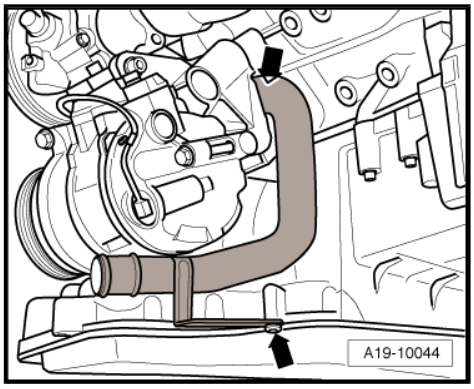


– Unplug electrical connector -1- at engine mounting (left-side).
– Remove bolts -arrows- and detach engine support (left-side).



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– Remove bolts -arrows- and take off coolant pipe (left-side).



Installing

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

Note

- *Renew O-rings.*
- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*
- *To ensure that the air hoses can be properly secured at their connections, spray rust remover onto the worm thread of used hose clips before installing.*

– Before installing, clean and smoothen sealing surface for O-ring.

– Lubricate new O-ring with coolant additive and slide onto coolant pipe.

– Install engine mounting with engine support ⇒ page 98 .

– Install console for engine mounting with new bolts ⇒ Rep. gr. 40 .

– Install anti-roll bar mountings with new nuts ⇒ Rep. gr. 40 .

– Fill cooling system ⇒ page 259 .

Tightening torque

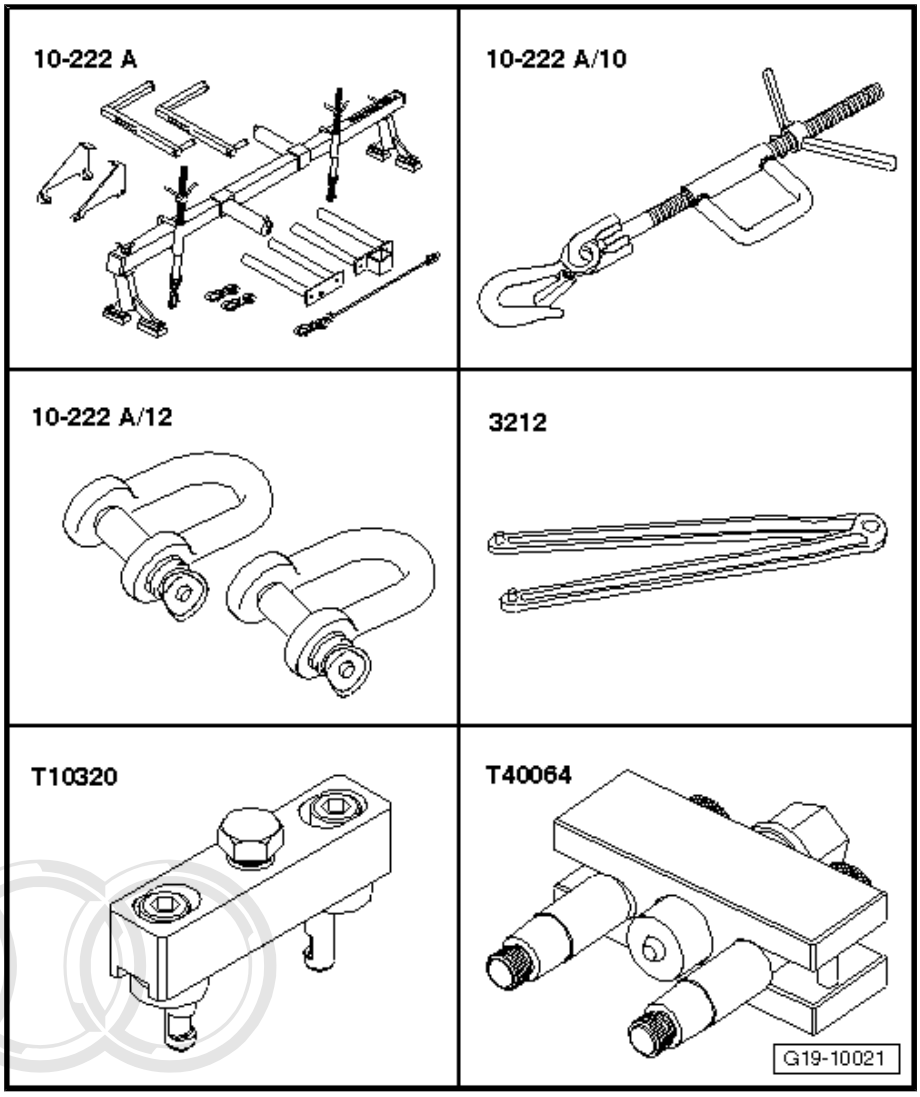
Component	Nm
Coolant pipe (left-side) to top section of sump and bracket for ancillaries	9

2.7 Removing and installing coolant pipe (right-side)

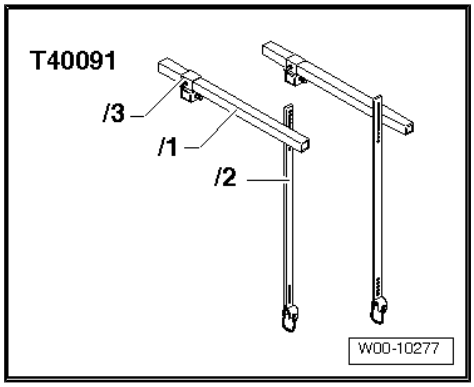
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Special tools and workshop equipment required

- Support bracket -10 - 222 A-
- Hook -10 - 222 A /10-
- Shackle -10 - 222 A /12-
- Pin wrench -3212-
- Puller -T10320- for vehicles from 12.2005
- Puller -T40064-

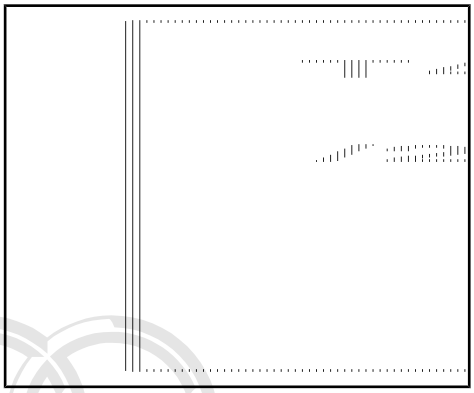


- Engine support bracket (basic set) -T40091-



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♦ Engine support bracket (supplementary set) -T40093-



Removing

Note

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

WARNING

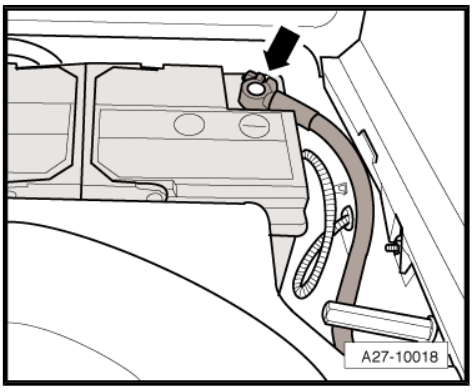
Observe notes on procedure for disconnecting the battery.

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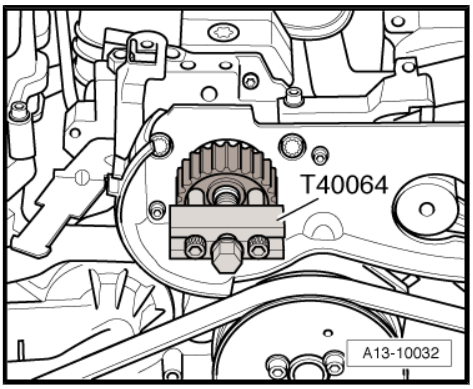
Note

To make sure you can still move the front wheels when the battery has been disconnected, only disconnect the battery with the ignition key inserted.

– With ignition switched off, disconnect battery earth cable -arrow- ⇒ Rep. gr. 27 .
– Drain off coolant ⇒ page 256 .
– Remove poly V-belt ⇒ page 111 .
– Remove toothed belt for high-pressure pump ⇒ Rep. gr. 23 .

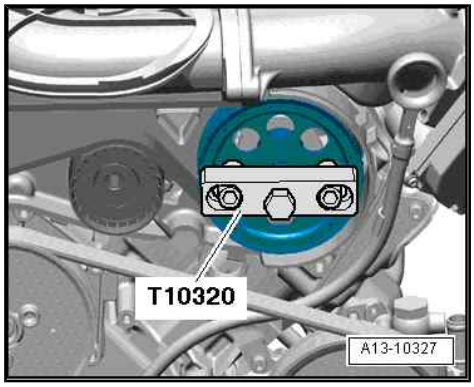


– Use puller -T40064- to pull off belt sprocket for high-pressure pump.



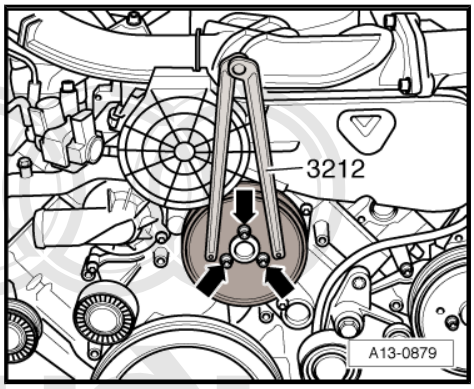
Vehicles from 12.2005 onwards:

– Use puller -T10320- to pull off toothed belt drive sprocket.

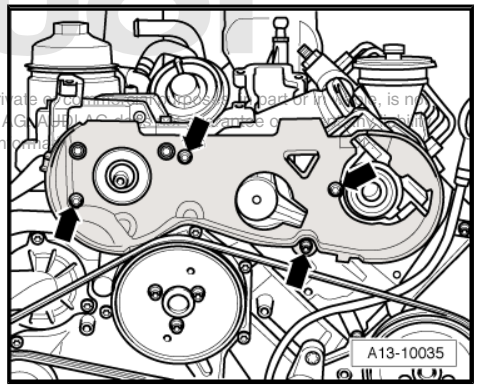


All vehicles:

– Unbolt coolant pump pulley -arrows- (counterhold with pin wrench -3212-).



– Remove bolts -arrows- and detach toothed belt cover (rear).

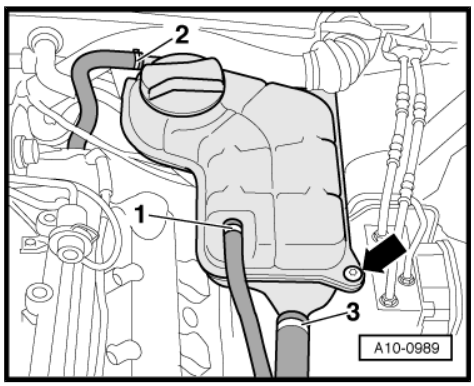


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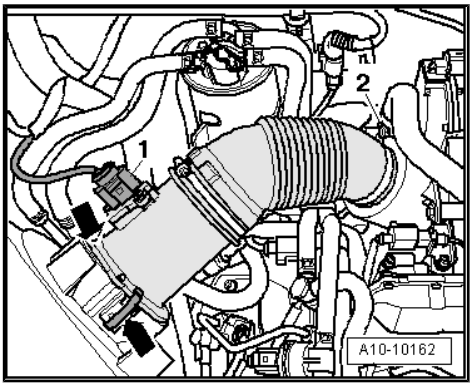
– Unbolt coolant expansion tank -arrow-.

– Detach electrical connector at coolant shortage indicator switch -F66- on coolant expansion tank (bottom).

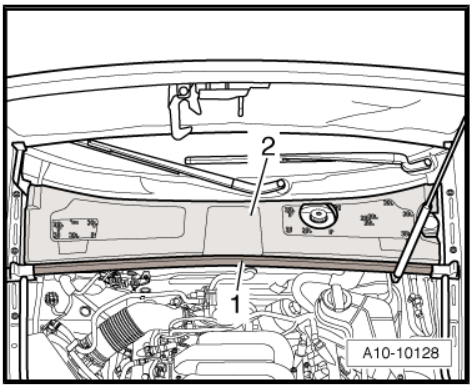
– Lay aside coolant expansion tank with coolant hoses -1 … 3- connected.



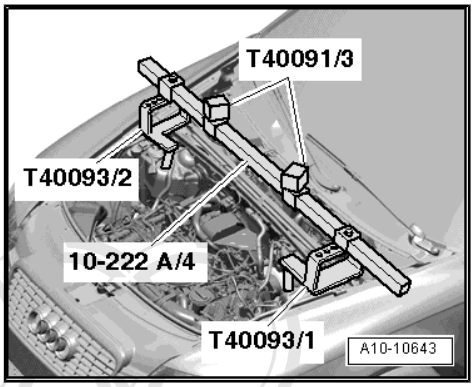
– Unplug electrical connector -1- at air mass meter -G70- .
– Remove air intake hose. To do so, release hose clip -2- and clamps -arrows-.



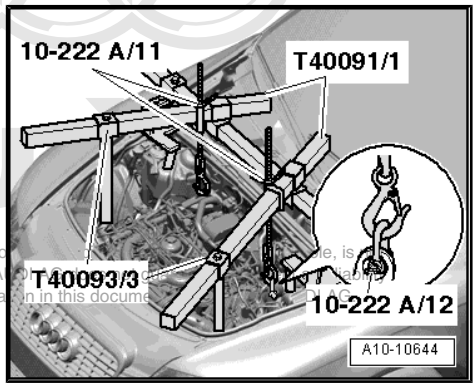
– Pull off rubber seal -1- and remove plenum chamber cover -2-.



– Attach adapter -10 - 222 A /4- with connecting pieces -T40091/3- and supports -T40093/1- and -T40093/2- onto the suspension turrets.
• Supports are marked for left and right side of vehicle.

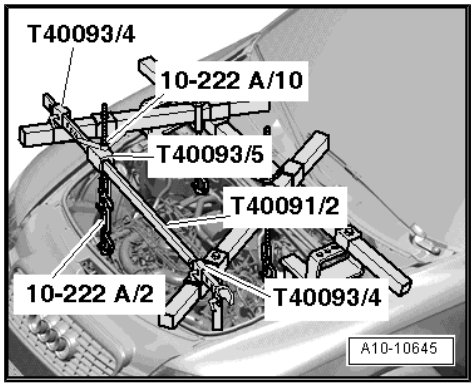


– Set up further components of support bracket as shown in illustration. Position supports -T40093/3- onto flanges of longitudinal members.
– Attach hooks on spindles -10 - 222 A /11- to engine lifting eye (left and right).
– Additionally attach shackle -10 - 222 A /12- on engine lifting eye (on left-side only).



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– Push support -T40091/2- with sliding support -T40093/5- and the two connecting pieces -T40093/4- onto square-section pipes -T40091/1- .
– Fit hook -10 - 222 A /2- to hook -10 - 222 A /10- and engage hook -10 - 222 A /2- on engine lifting eye (front right).



WARNING

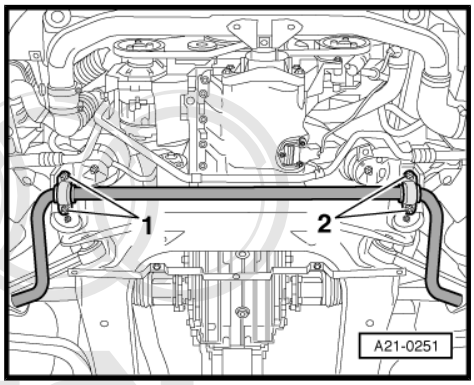
Secure support -T40091/2- with pins and split pins of connecting pieces -T40093/4- .

– Take up weight of engine by tightening spindles evenly.
– Remove front right wheel.

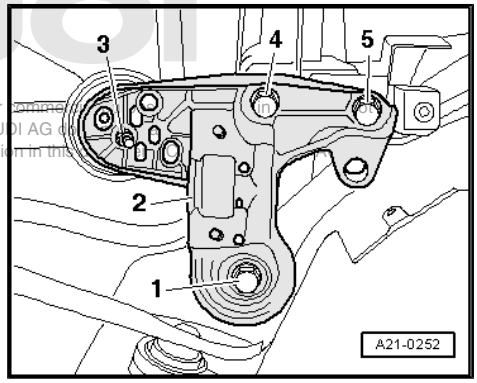
Note

Secure brake disc with one wheel bolt.

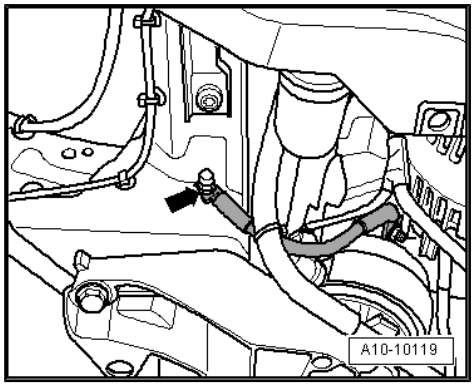
– Unbolt anti-roll bar mountings (left and right) -1- and -2-.



– Unscrew nut -3- at bottom of engine mounting (right-side).
– Unscrew bolts -4- and -5- on console for engine mounting (right-side).
– Unscrew front bolt -1- (right-side) for subframe and detach console for engine mounting -2- (right-side).

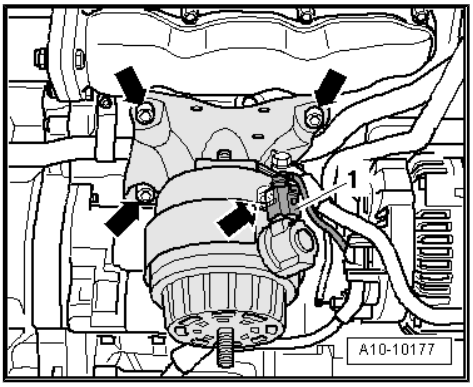


– Unbolt earth cable -arrow- at longitudinal member (right-side).

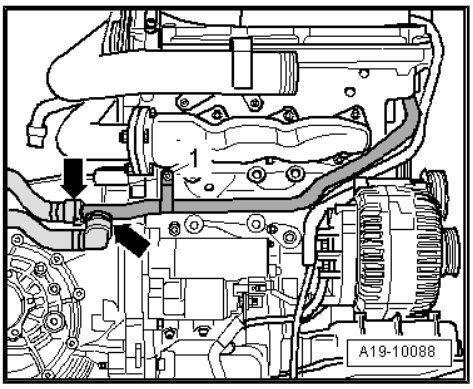


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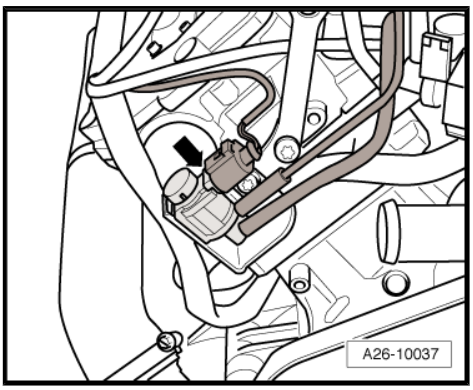
– Unplug electrical connector -1- at engine mounting (right-side).
– Remove bolts -arrows- and detach engine support (right-side).



– Move electrical wiring clear of coolant pipe (right-side).
– Remove bolt -1-.
– Lift retaining clip and detach coolant hoses -arrows- from coolant pipe (right-side).

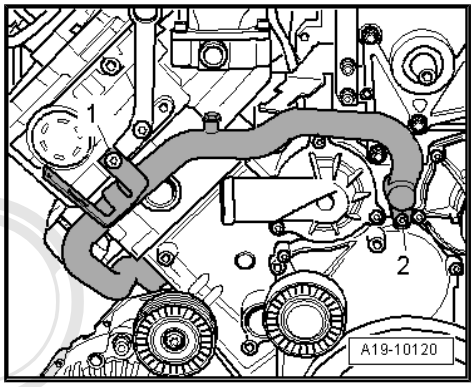


– Pull change-over valve for exhaust gas recirculation cooler - N345- -arrow- off bracket.



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– Remove bolts -1- and -2-.
– Pull coolant pipe (right-side) forwards out of cylinder block and detach coolant pipe.



Installing

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

Note

- *Renew O-rings.*
- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*
- *Fit all cable ties in the original positions when installing.*
- *To ensure that the air hoses can be properly secured at their connections, spray rust remover onto the worm thread of used hose clips before installing.*

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– Before installing, clean and smoothen sealing surface for O-ring.
– Lubricate new O-ring with coolant additive and slide onto coolant pipe.
– Connect coolant hoses with plug-in connector to coolant pipe ⇒ page 287 .
– Install console for engine mounting with new bolts ⇒ Rep. gr. 40 .
– Install engine mounting with engine support ⇒ page 98 .
– Install anti-roll bar mountings with new nuts ⇒ Rep. gr. 40 .
– Install toothed belt for high-pressure pump ⇒ Rep. gr. 23 .
– Install poly V-belt ⇒ page 111 .
– Install intake manifold (top section) ⇒ Rep. gr. 23 .
– Fill cooling system ⇒ page 259 .

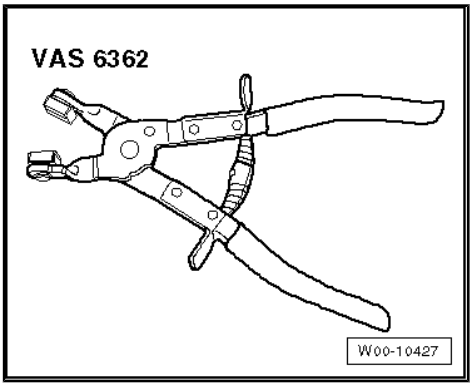
Tightening torques

Component	Nm
Coolant pipe (right-side) to engine	9
Toothed belt cover to engine	9

2.8 Removing and installing coolant pipe (rear)

Special tools and workshop equipment required

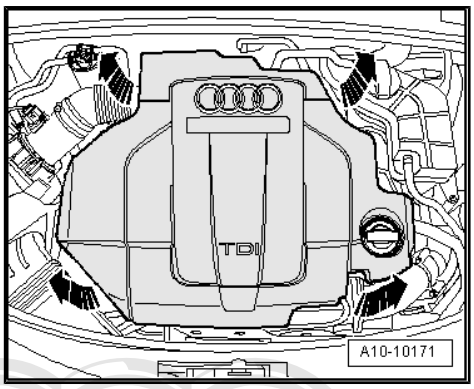
♦ Hose clip pliers -VAS 6362-



Removing

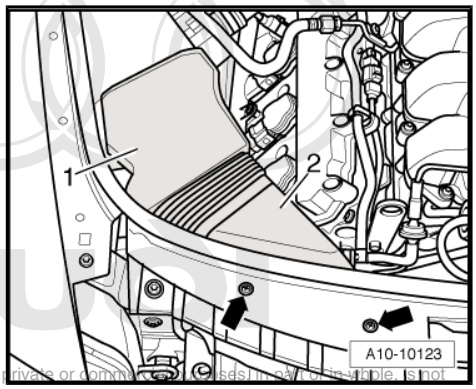
– Drain off coolant ⇒ page 256 .

– Carefully pull engine cover panel off four retaining pins one after the other -arrows-.



– Remove bolts -arrows-.

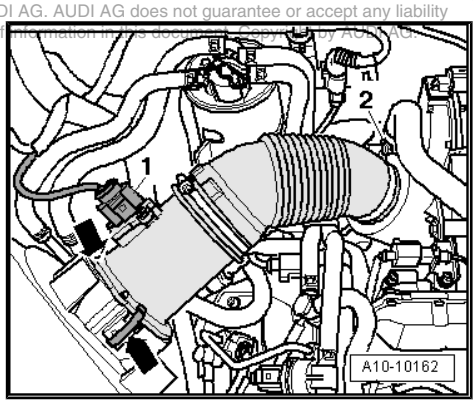
– Remove air ducts -1- and -2-.



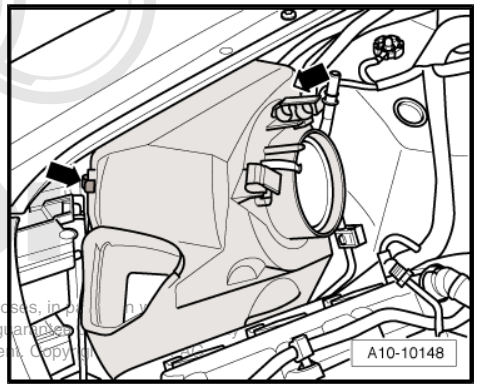
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– Unplug electrical connector -1- at air mass meter -G70- .

– Remove air intake hose. To do so, release hose clip -2- and clamps -arrows-.

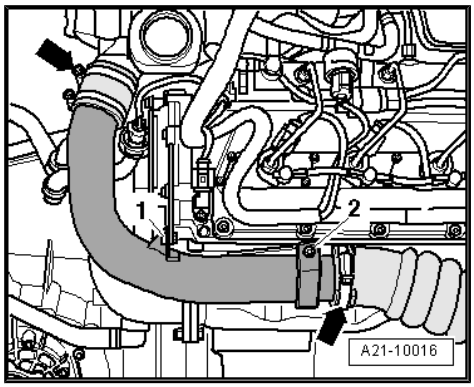


– Release clamps -arrows- and detach air cleaner (top section).

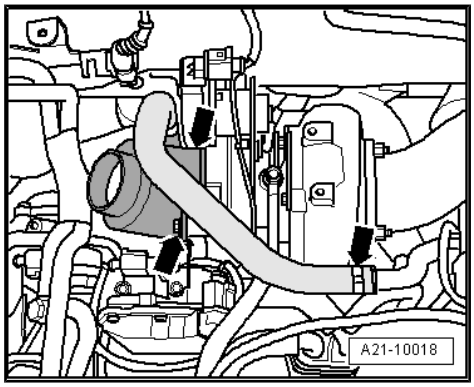


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– Unscrew bolts -1- and -2- and disconnect air pipe from hoses -arrow-.



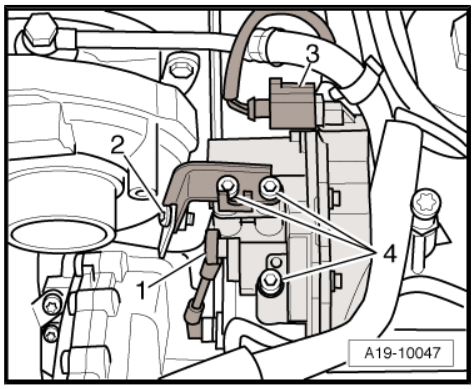
– Remove intake connecting piece together with crankcase breather hose -arrows-.
– Remove electrical connector for exhaust gas temperature sender 1 -G235- from bracket.



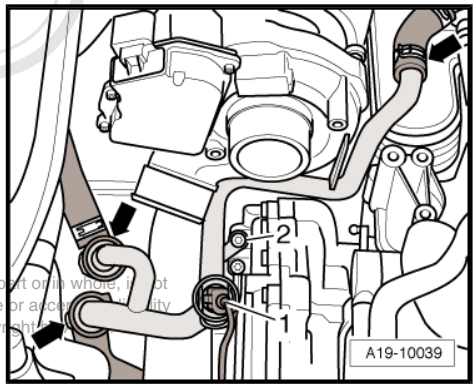
– Detach electrical connector -3- at intake manifold flap motor -V157- .
– Remove bolts -2- and -4- and move intake manifold flap motor -V157- clear to the side (with connecting rod installed).

Note

In order to prevent damage to the intake manifold flap motor -V157- , the connecting rod -1- is not detached.



– Unplug electrical connector -1- at coolant temperature sender -G62- .
– Remove bolt -2-.
– Disconnect coolant hoses -arrows- and take out coolant pipe (rear).



Installing

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

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Note

- *Renew O-rings.*
- *Hose connections and hoses for charge air system must be free of oil and grease before assembly.*
- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*
- *To ensure that the charge air hoses can be properly secured at their connections, spray rust remover onto the worm thread of used hose clips before installing.*

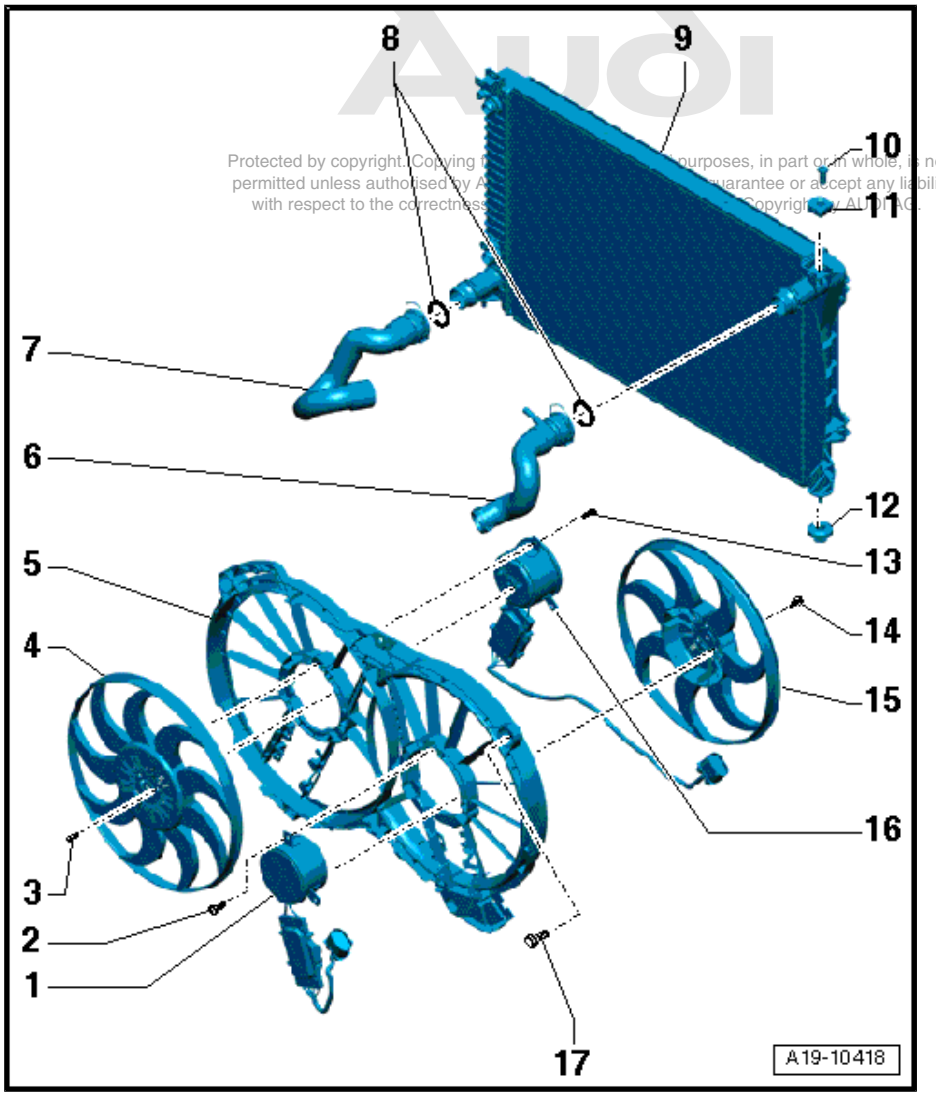
– Fill cooling system ⇒ page 259 .

Tightening torques

Component		Nm
Coolant pipe to cylinder head		9
Bracket to cylinder head		9
Intake manifold flap motor -V157- to intake manifold (bottom section)		9
Air intake connecting piece to turbocharger		9
Air pipe	Bracket	9
(right-side) to:	Engine lifting eye	23
Hose clips (9 mm wide)		3
Hose clips (13 mm wide)		5.5

3 Radiator and radiator fans

3.1 Radiator and radiator fans - exploded view



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1 - Radiator fan 2 -V177-
- ❑ With radiator fan control unit 2 -J671-
- ❑ Removing and installing ⇒ page 295

2 - Bolt
- ❑ 5 Nm

3 - Bolt
- ❑ 3.5 Nm

4 - Fan wheel
- ❑ Not supplied separately

5 - Radiator cowl
- ❑ Removing and installing ⇒ page 292

6 - Coolant hose
- ❑ Lift retaining clip to detach
- ❑ Connecting to radiator ⇒ page 287

7 - Coolant hose
- ❑ Lift retaining clip to detach
- ❑ Connecting to radiator ⇒ page 287

8 - O-rings
- ❑ Renew

9 - Radiator
- ❑ Removing and installing ⇒ page 287
- ❑ If renewed, change coolant in entire system

10 - Retaining pin

11 - Rubber buffer
- ❑ Use screwdriver to release and pull off

12 - Rubber bush

13 - Bolt
- ❑ 4.5 Nm

14 - Bolt
- ❑ 3.5 Nm

15 - Fan wheel
- ❑ Not supplied separately

16 - Radiator fan -V7-
- ❑ With radiator fan control unit -J293-

❑ Removing and installing ⇒ page 295

17 - Bolt

❑ 2 Nm

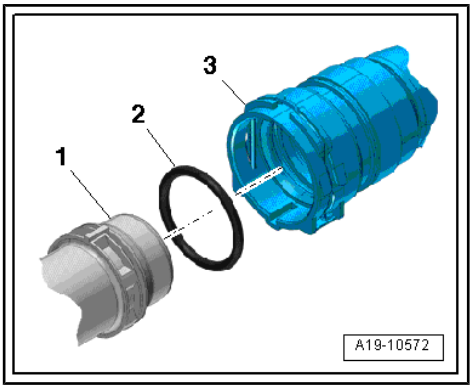
Connecting coolant hose with plug-in connector

– Remove old O-ring -2- from coolant hose -3-.

– Lubricate new O-ring with coolant additive and fit O-ring in coolant hose.

– Press coolant hose onto radiator -1- or coolant pipe until it engages with a click.

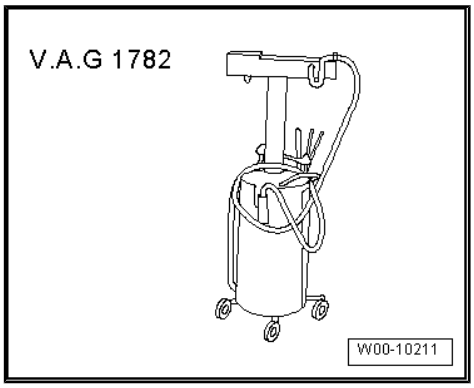
– Press coolant hose in again and then pull to check that plug-in connector is correctly engaged.



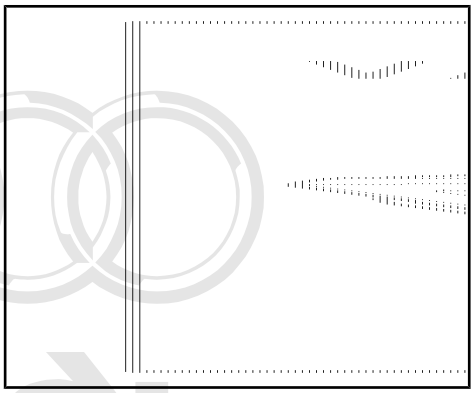
3.2 Removing and installing radiator

Special tools and workshop equipment required

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

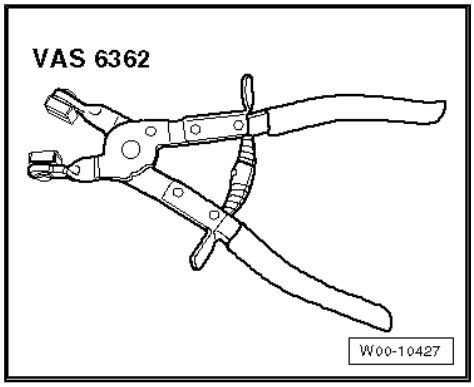


♦ Drip tray for workshop hoist -VAS 6208-

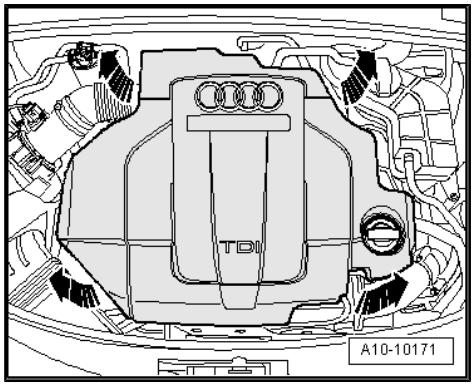


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♦ Hose clip pliers -VAS 6362-



Removing



Note

If there are slight impressions on the fins, refer to ⇒ page 7 .

– Carefully pull engine cover panel off four retaining pins one after the other -arrows-.

WARNING

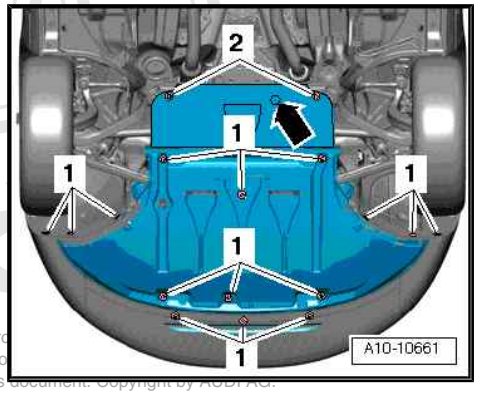
Hot steam or hot coolant can escape when expansion tank is opened; cover filler cap with cloth and open carefully.

– Open filler cap on coolant expansion tank.
– Remove both front wheels.

Note

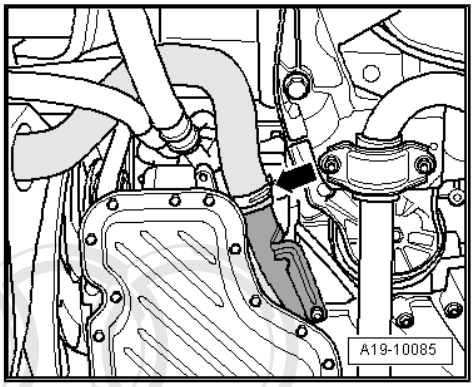
Secure brake discs with wheel bolts.

– Release fasteners -1- and remove front noise insulation panel.
– Remove front wheel housing liners (right and left) ⇒ Rep. gr. 66 .
– Remove bumper cover (front) ⇒ Rep. gr. 63 .

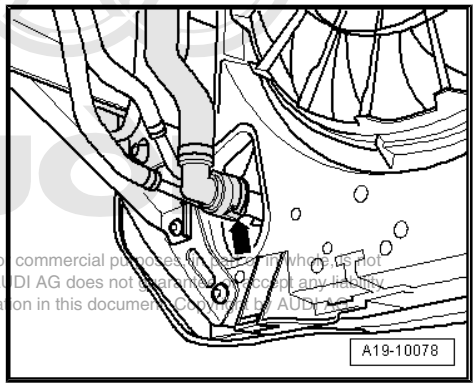


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– Place drip tray for workshop hoist -VAS 6208- under engine.
– Disconnect coolant hose -arrow- from coolant pipe (left-side) and drain off coolant.

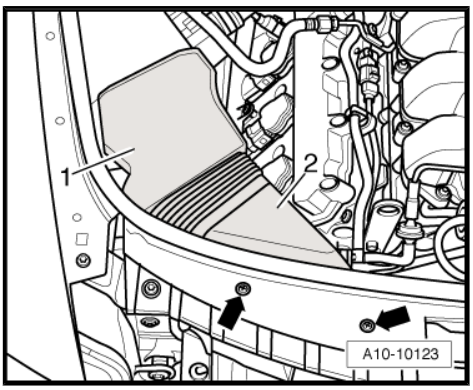


– Disconnect coolant hose -arrow- (bottom left) from radiator (lift retaining clip).



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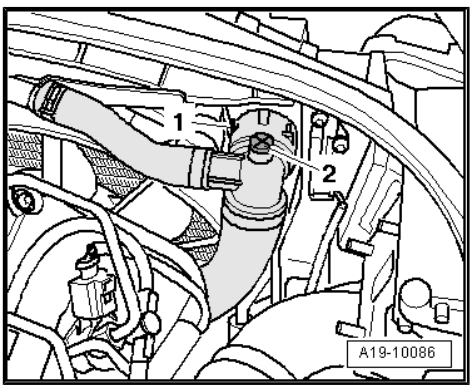
– Remove bolts -arrows-.
– Remove air ducts -1- and -2-.



– Disconnect coolant hose -1- (top right) from radiator (pull out retaining clip).

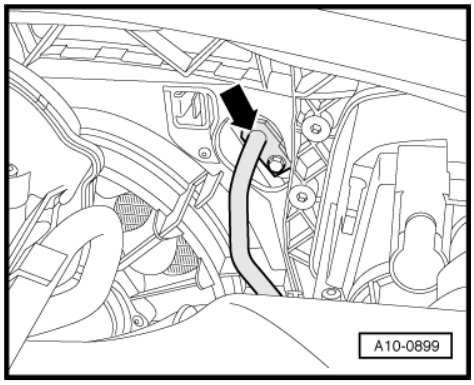
Note

Disregard -item 2-.

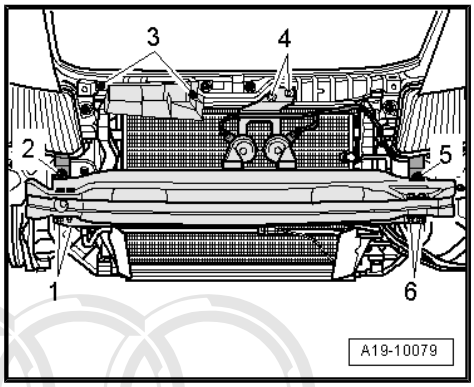


Note

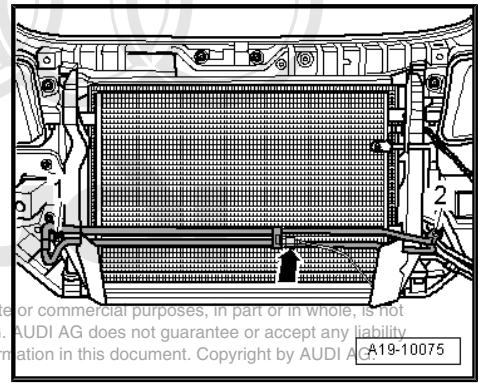
Observe rules for cleanliness when working on automatic gearbox ⇒ Rep. gr. 00 .



- Place used oil collection and extraction unit -V.A.G 1782- underneath.
- Detach ATF lines (top -arrow- and bottom) from radiator: ⇒ Rep. gr. 37 .
- Tie ATF lines up onto longitudinal member to prevent fluid escaping.

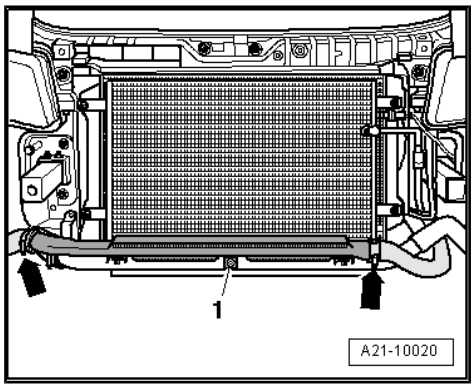


- Unscrew bolts -3- and detach air duct.
- Unscrew bolts -4- and remove bracket for horns; electrical wiring remains attached.
- Unbolt brackets -2- and -5- for headlights.
- Unscrew nuts -1- and -6- and remove bumper.



- Unclip ambient temperature sensor -G17- -arrow- from bracket.
- Unscrew bolts -1- and -2- for power steering cooling pipe; the hydraulic hoses remain attached.
- Detach air ducts (left and right) from radiator.

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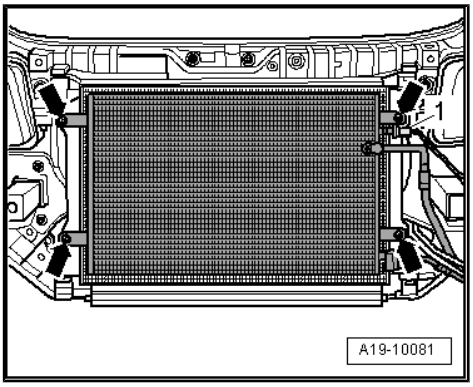


- Remove bolt -1-.
- Detach charge air cooler (centre) from air intake hoses -arrows-.

Caution

The air conditioner refrigerant circuit must not be opened.

– Unplug electrical connector -1-.
– Remove bolts -arrows-.

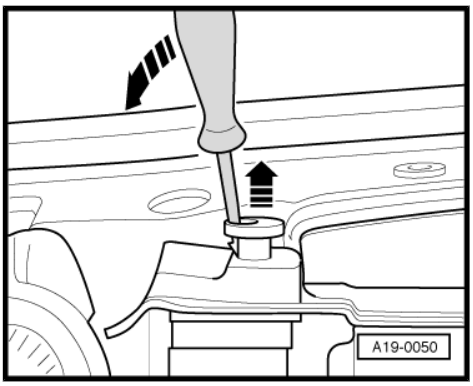


Note

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

– Pivot condenser downwards with pipes/hoses attached.

– Release two retaining pins for radiator and pull out upwards -arrows-.
– Swivel radiator forwards and lift off.



Installing

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

Note

- *Hose connections and hoses for charge air system must be free of oil and grease before assembly.*
- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*
- *To ensure that the charge air hoses can be properly secured at their connections, spray rust remover onto the worm thread of used hose clips before installing.*

– Secure ATF lines ⇒ Rep. gr. 37 .
– Install bumper and bumper cover (front) ⇒ Rep. gr. 63 .
– Install front wheel housing liners (right and left) ⇒ Rep. gr. 66 .
– Install charge air cooler (centre) ⇒ page 335 .
– Connect coolant hose with plug-in connector to radiator ⇒ page 287 .
– Fill cooling system ⇒ page 259 .

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Note

The coolant in the entire system must be changed if the radiator is renewed.

– Check ATF level ⇒ Rep. gr. 37 .

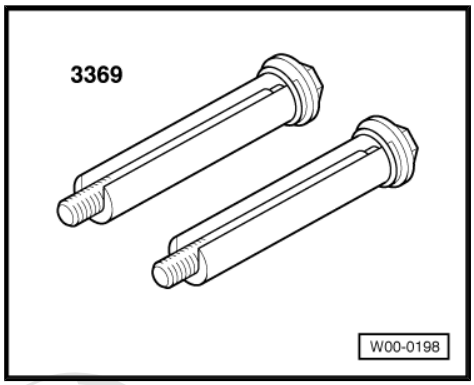
Tightening torques

Component	Nm
Condenser to lock carrier	6
Power steering cooling pipe to condenser	9
Bracket for horns to lock carrier	8
Hose clips (9 mm wide)	3
Hose clips (13 mm wide)	5.5

3.3 Removing and installing radiator cowl

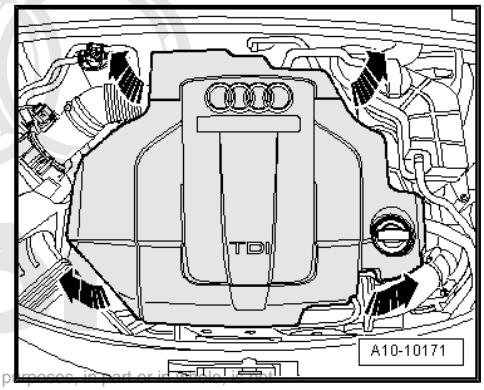
Special tools and workshop equipment required

- Front-end service sleeves -3369-



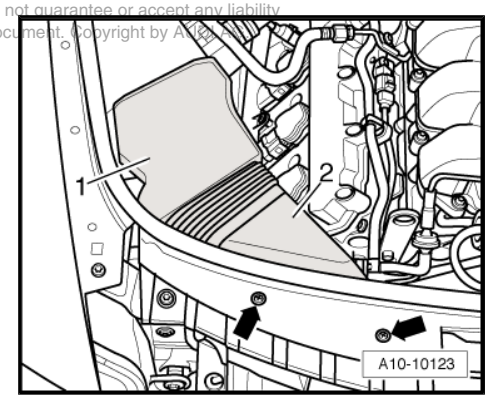
Removing

– Carefully pull engine cover panel off four retaining pins one after the other -arrows-.



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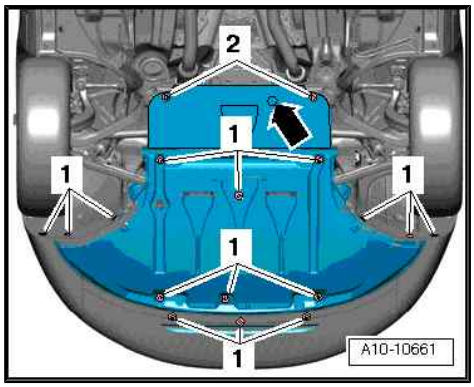
– Remove bolts -arrows-.
– Remove air ducts -1- and -2-.
– Remove both front wheels.



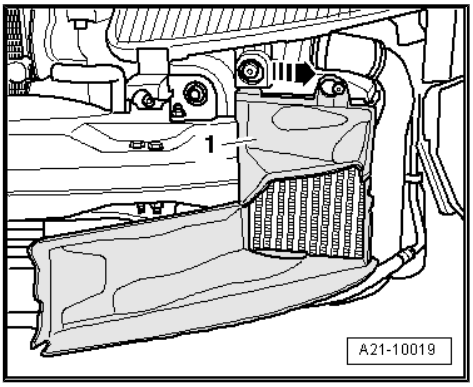
Note

Secure brake discs with wheel bolts.

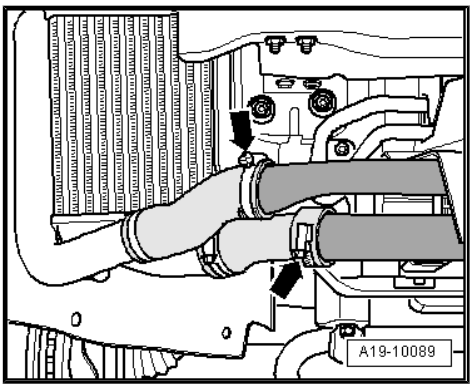
– Release fasteners -1- and remove front noise insulation panel.
– Remove front wheel housing liners (right and left) ⇒ Rep. gr. 66 .
– Remove bumper cover (front) ⇒ Rep. gr. 63 .
– Remove headlights (left and right) ⇒ Rep. gr. 94 .



– Pull off air ducts -1- at charge air coolers (left and right) in direction of -arrow-.

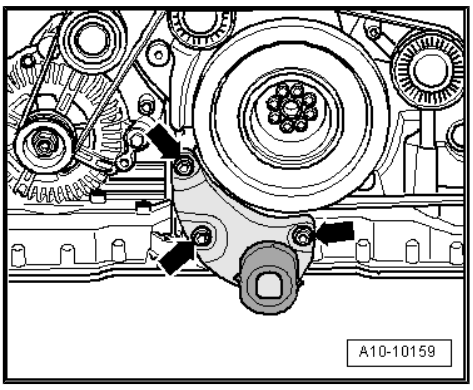


– On right side of vehicle, disconnect two air intake hoses at the connections indicated -arrows-.

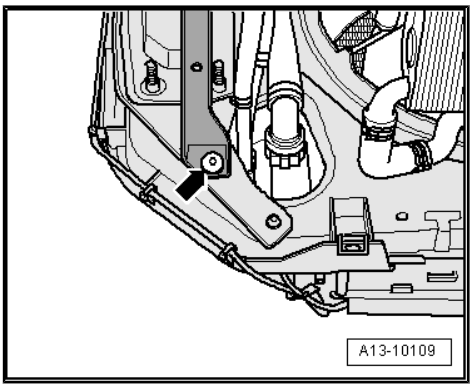


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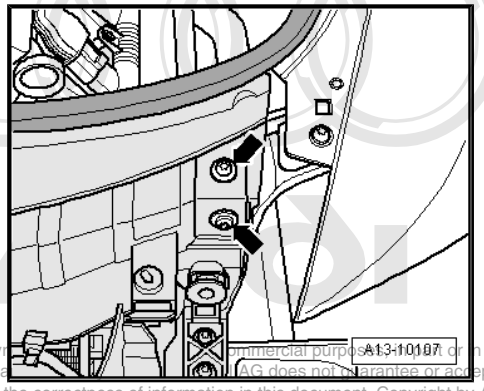
– Unscrew bolts -arrows- and remove torque reaction support from engine.



– Remove one bolt -arrow- on each side at bottom of lock carrier.

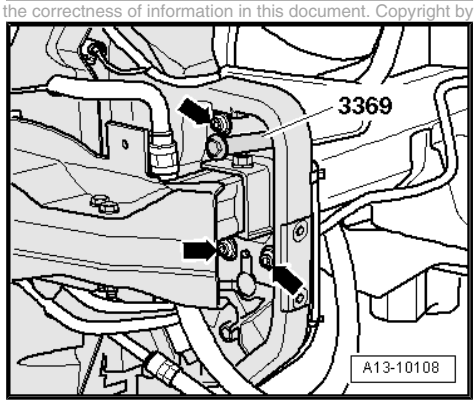


– Pull off bonnet seal at both wing panels.
– Remove two bolts -arrows- on each side at top of lock carrier.

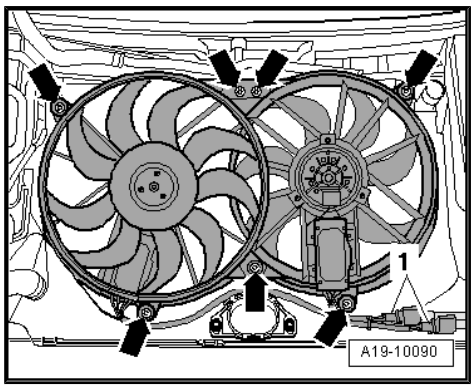


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– Screw in front-end service sleeves -3369- (left and right) at holes for lock carrier securing bolts, after removing corresponding bolts.
– Remove remaining bolts (left and right) -arrows-.
– Carefully pull the lock carrier forward.



– Unplug electrical connectors -1- going to radiator fan.
– Unscrew bolts -arrows- and lift out radiator cowl.



Installing

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

Note

- *Hose connections and hoses for charge air system must be free of oil and grease before assembly.*
- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*
- *To ensure that the charge air hoses can be properly secured at their connections, spray rust remover onto the worm thread of used hose clips before installing.*

– Install lock carrier with attachments ⇒ Rep. gr. 50 .
– Install torque reaction support ⇒ page 107 .
– Install headlights ⇒ Rep. gr. 94 .
– Install bumper cover (front) ⇒ Rep. gr. 63 .
– Check headlight adjustment ⇒ Maintenance ; Booklet 405 .

Tightening torques

Component		Nm
Radiator cowl to	M6	11
Lock carrier	Panel bolt	2
Hose clips (9 mm wide)		3
Hose clips (13 mm wide)		5.5

3.4 Removing and installing radiator fans

Removing

Note

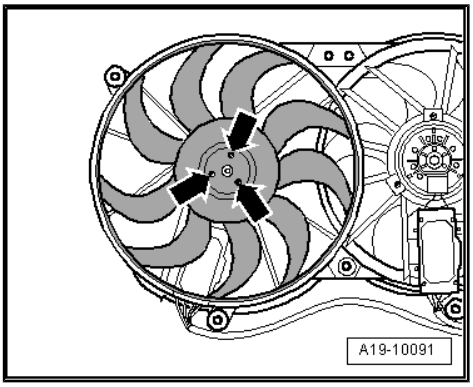
All cable ties which are released or cut open when removing must be fitted in the same position when installing.

– Remove radiator cowl ⇒ page 292 .

Radiator fan (left-side):

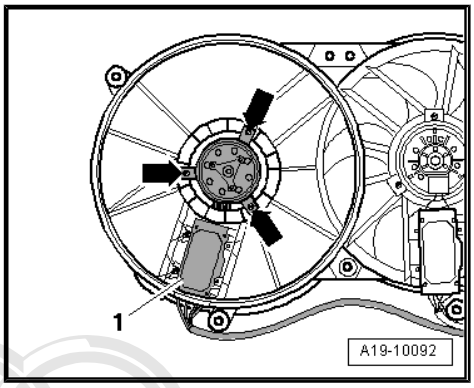
– Remove bolts -arrows-.

– Take off fan.



– Remove bolts -arrows-.

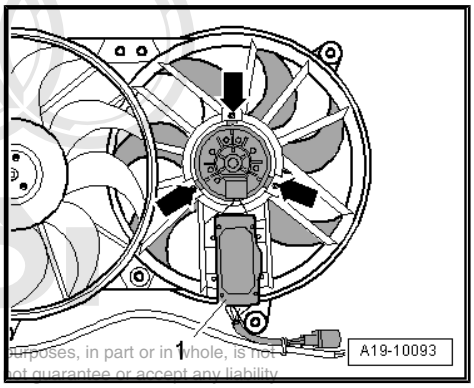
– Unclip control unit -1- from radiator cowl and take off radiator fan with control unit.



Radiator fan (right-side):

– Remove bolts -arrows-.

– Unclip control unit -1- from radiator cowl and take off radiator fan with control unit.



Installing

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

Note

Fit all cable ties in the original positions when installing.

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– Install radiator cowl ⇒ page 292 .

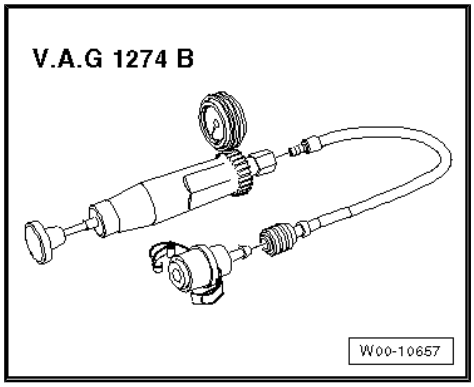
Tightening torque

Component	Nm
Radiator fan to radiator cowl	4.5

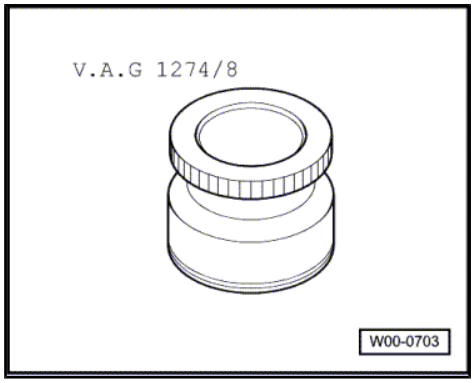
3.5 Checking cooling system for leaks

Special tools and workshop equipment required

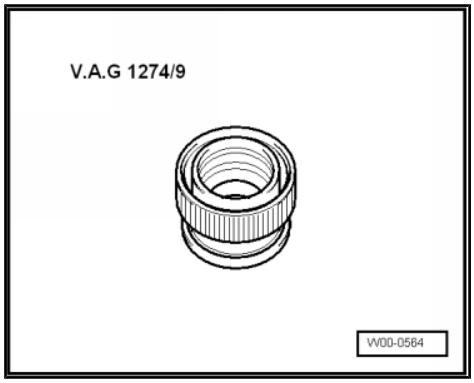
♦ Cooling system tester -V.A.G 1274 B-



♦ Adapter for cooling system tester -V.A.G 1274/8-



♦ Adapter for cooling system tester -V.A.G 1274/9-



Procedure

- Engine must be warm.

WARNING

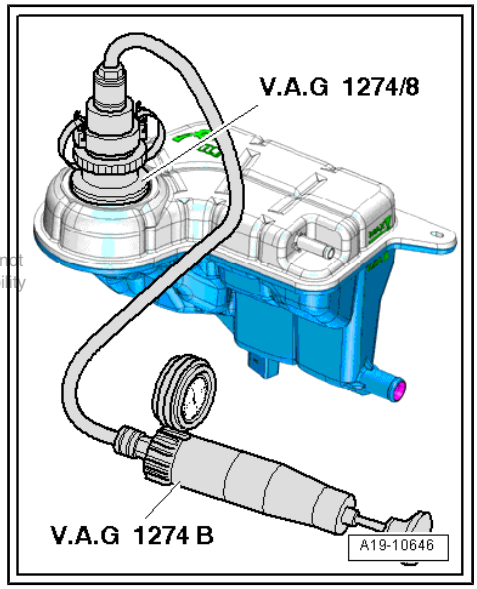
Hot steam or hot coolant can escape when expansion tank is opened; cover filler cap with cloth and open carefully.

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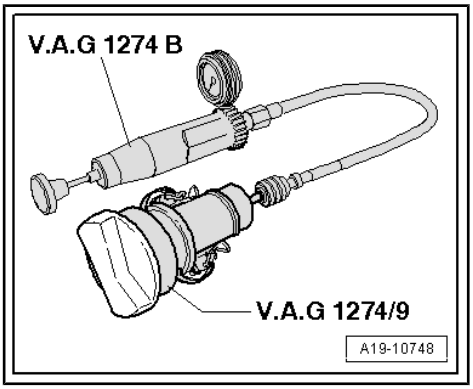
– Open filler cap on coolant expansion tank.
– Attach cooling system tester -V.A.G 1274 B- with adapter -V.A.G 1274/8- to coolant expansion tank.
– Use hand pump on cooling system tester to create a pressure of approx. 1.0 bar.

If the pressure drops:

– Trace leak and repair.



Checking pressure relief valve in filler cap



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

– Use hand pump on cooling system tester to create pressure.

• The pressure relief valve should open at a pressure of 1.4 ... 1.6 bar.

If the pressure relief valve does not open as described:

– Renew filler cap.

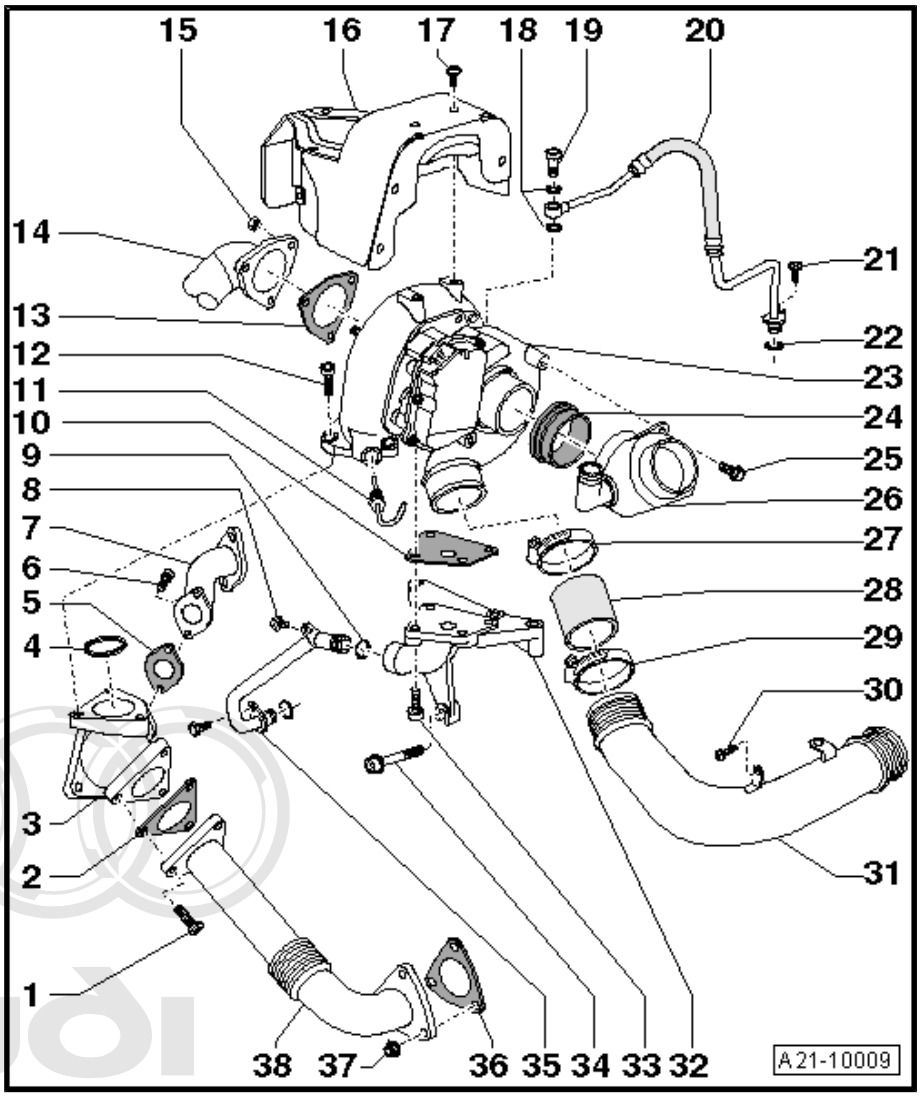
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21 – Turbocharging/supercharging

1 Turbocharger

– Observe rules for cleanliness ⇒ page 6 .

1.1 Turbocharger for vehicles with 2.7 ltr. engine up to 12.2005 and 3.0 ltr. engine - exploded view



1 - 30 Nm + turn 90° further

- ❑ Renew
- ❑ Coat with high-temperature paste; for high-temperature paste refer to ⇒ Electronic parts catalogue

2 - Gasket

- ❑ Renew

3 - Intermediate flange

- ❑ Removing and installing ⇒ page 314

4 - Seal

- ❑ Renew

5 - Gasket

- ❑ Renew

6 - 9 Nm

- ❑ Coat with high-temperature paste; for high-temperature paste refer to ⇒ Electronic parts catalogue

7 - Connecting pipe to changeover flap for exhaust gas recirculation cooler

8 - 9 Nm

9 - O-ring

- ❑ Renew

10 - Gasket

- ❑ Renew

11 - Exhaust gas temperature sender 1 -G235-

- ❑ 3.0 ltr. engine only
- ❑ Removing and installing ⇒ page 379
- ❑ Coat with high-temperature paste; for high-temperature paste refer to ⇒ Electronic parts catalogue

12 - 30 Nm + turn 90° further

- ❑ Renew
- ❑ Coat with high-temperature paste; for high-temperature paste refer to ⇒ Electronic parts catalogue

13 - Gasket

- ❑ Renew

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14 - Starter catalytic converter

- ❑ Removing and installing: vehicles with manual gearbox ⇒ page 341 ; vehicles with automatic gearbox ⇒ page 343

15 - 23 Nm

- ❑ Coat with high-temperature paste; for high-temperature paste refer to ⇒ Electronic parts catalogue

16 - Heat shield for turbocharger

17 - 9 Nm

18 - Seals

- ❑ Renew

19 - Banjo bolt, 15 Nm

20 - Oil supply line

- ❑ From cylinder block

21 - 9 Nm

22 - O-ring

- ❑ Renew

23 - Turbocharger

- ❑ With turbocharger 1 control unit -J724-
- ❑ Removing and installing turbocharger ⇒ page 300
- ❑ Removing and installing turbocharger 1 control unit -J724- ⇒ page 305

24 - Seal

- ❑ Renew if damaged

25 - 9 Nm

26 - Connecting piece for air intake hose

- ❑ From air mass meter -G70- to turbocharger
- ❑ Must be free of oil and grease when installing

27 - Retaining clip, 5.5 Nm

- ❑ Reinforced

28 - Air hose

- ❑ From turbocharger to air pipe (right-side)
- ❑ Must be free of oil and grease when installing

29 - Retaining clip, 5.5 Nm

- ❑ Reinforced

30 - 9 Nm

31 - Air pipe (right-side)

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32 - Bracket for turbocharger

33 - 20 Nm

- ❑ Coat with high-temperature paste; for high-temperature paste refer to ⇒ Electronic parts catalogue

34 - 25 Nm

35 - Oil return line

- ❑ To cylinder block

36 - Gasket

- ❑ Renew

37 - 30 Nm + turn 90° further

- ❑ Type of connection differs depending on version ⇒ page 300

38 - Intermediate pipe

❑ Removing and installing: left-side ⇒ page 376 , right-side ⇒ page 377

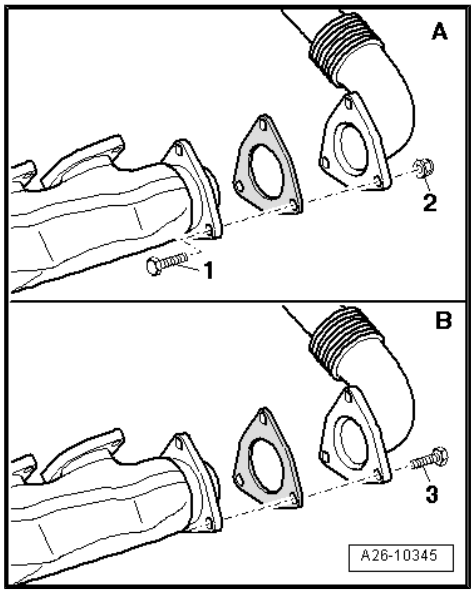
Securing intermediate pipe to exhaust manifold

A - Exhaust manifold (sheet metal version)

- Fitted with bolts -1- and nuts -2-.
- Renew bolts and nuts.
- Coat with high-temperature paste; for high-temperature paste refer to ⇒ Electronic parts catalogue .

B - Exhaust manifold (cast version)

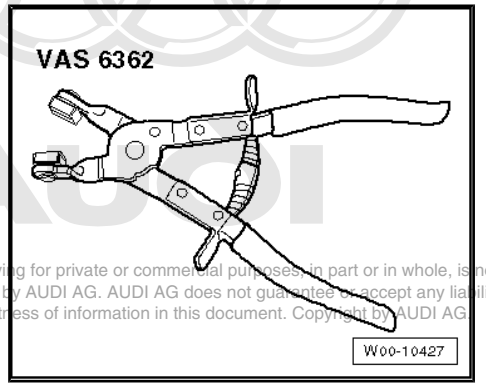
- Fitted with bolts -3-.
- Renew bolts.
- Coat with high-temperature paste; for high-temperature paste refer to ⇒ Electronic parts catalogue .



1.2 Removing and installing turbocharger - vehicles with 2.7 ltr. engine up to 12.2005 and 3.0 ltr. engine

Special tools and workshop equipment required

♦ Hose clip pliers -VAS 6362-



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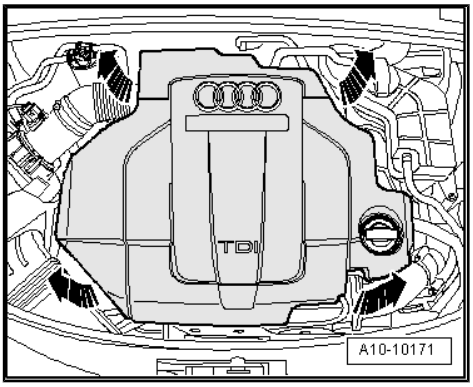
Removing

Caution

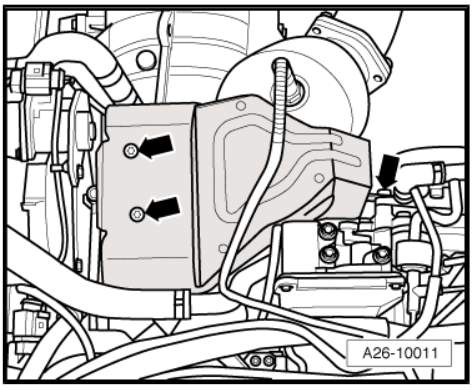
If the turbocharger has suffered mechanical damage (e.g. damaged compressor wheel), it is not sufficient merely to fit a new turbocharger. The following work must be performed in order to avoid further damage:

- *Check air cleaner housing, air filter element and air hoses for dirt and foreign particles.*
- *Check the entire charge air system (including the charge air cooler) for foreign matter.*
- *If foreign matter is found in the charge air system, clean all relevant ducts and hoses and renew charge air cooler if necessary.*

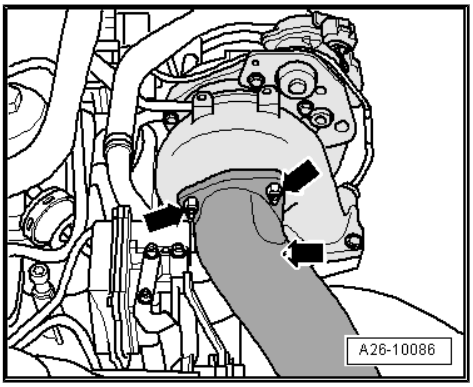
– Open filler cap on coolant expansion tank briefly to release residual pressure in cooling system.
– Carefully pull engine cover panel off four retaining pins one after the other -arrows-.



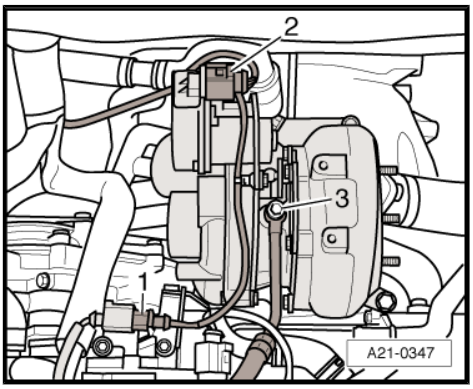
– Remove heat shield for turbocharger -arrows-.



– Unscrew nuts -arrows- securing starter catalytic converter to turbocharger and move starter catalytic converter to the side.

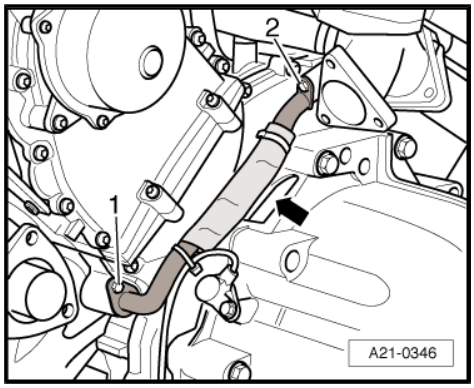


– Unplug electrical connectors -1- and -2-.
– Remove banjo bolt -3- and disconnect oil supply line from turbocharger.



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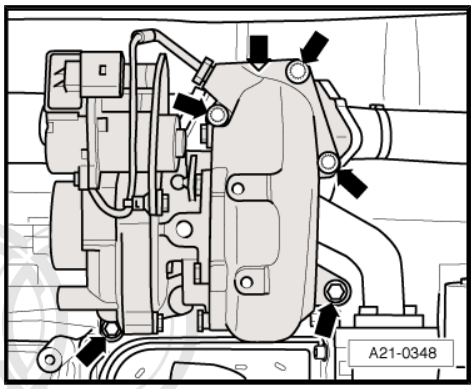
– Cover opening -arrow- in gearbox to prevent small parts from dropping in.
– Remove bolt -2- and detach oil return line from turbocharger.



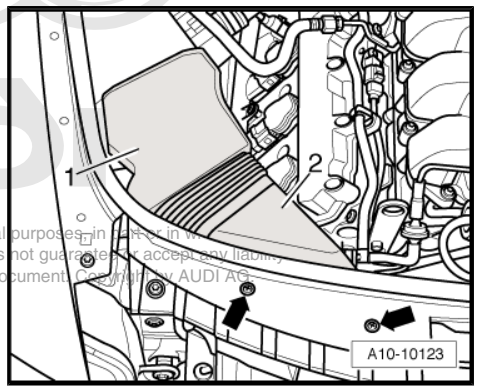
Note

- *Shown in illustration with intermediate pipe removed.*
- *Disregard -item 1-.*

– Remove bolts -arrows-.

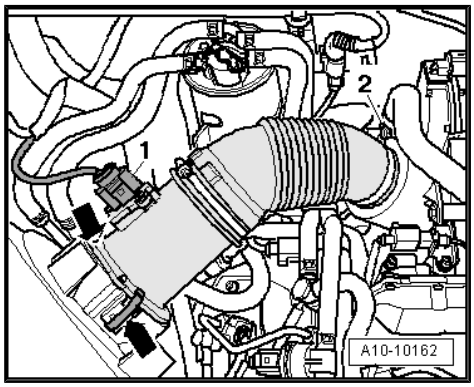


– Remove bolts -arrows-.
– Remove air ducts -1- and -2-.

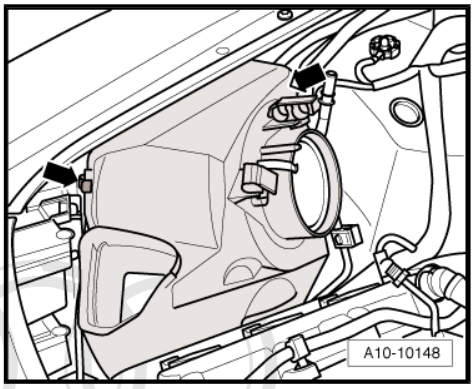


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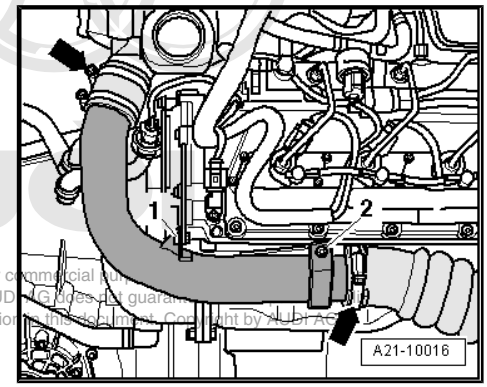
– Unplug electrical connector -1- at air mass meter -G70- .
– Remove air intake hose. To do so, release hose clip -2- and clamps -arrows-.



– Release clamps -arrows- and detach air cleaner (top section).

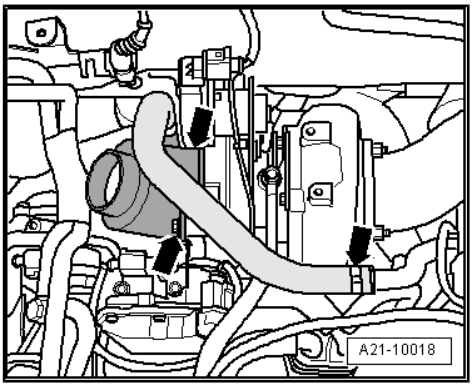


– Unscrew bolts -1- and -2- and disconnect air pipe from hoses.

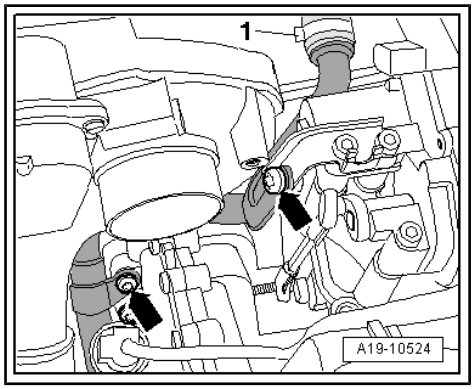


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– If fitted, unbolt air intake connection -left arrows- and move it aside with air intake hose connected -right arrow-.



– Remove bolts -arrows-.



Note

Place a cloth underneath to catch escaping coolant.

– Detach coolant hose -1-.
– Push turbocharger slightly towards the rear and pivot rear coolant pipe towards the right.
– Detach turbocharger.

Installing

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

Note

- *Renew gaskets, seals and O-rings.*
- *Fill turbocharger with engine oil at connection for oil supply line.*
- *Hose connections and hoses for charge air system must be free of oil and grease before assembly.*
- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*
- *To ensure that the charge air hoses can be properly secured at their connections, spray rust remover onto the worm thread of used hose clips before installing.*
- *After installing turbocharger, allow engine to idle for approx. 1 minute and do not rev up immediately to ensure turbocharger is supplied with oil.*

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Vehicles without particulate filter:

– Install starter catalytic converter: vehicles with manual gearbox ⇒ page 341 ; vehicles with automatic gearbox ⇒ page 343 .

Vehicles with particulate filter:

– Install starter catalytic converter ⇒ page 355 .

All vehicles:

– Install coolant pipe (rear) ⇒ page 282 .
– Fill cooling system ⇒ page 259 .

Tightening torques

Component		Nm
Turbocharger to:	Intermediate flange	30 +90° 1)2)3)
	Engine	25
Oil return line to intermediate flange:		9
Oil supply line to turbocharger		15

- 1) Renew bolts.
- 2) 90° = one quarter turn.
- 3) Coat with high-temperature paste; for high-temperature paste refer to ⇒ Electronic parts catalogue

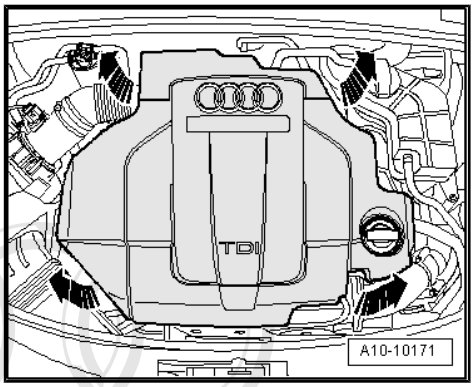
1.3 Removing and installing turbocharger 1 control unit -J724- - vehicles with 2.7 ltr. engine up to 12.2005 and 3.0 ltr. engine

Special tools and workshop equipment required

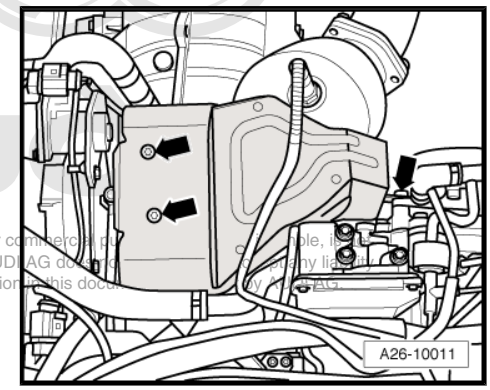
- Tester -VAS 6395-
- Connection lead -VAS 6395/4-2-
- Open-end spanner, 10 mm (90 mm long) -VAS 6395/4-3-

Removing

– Carefully pull engine cover panel off four retaining pins one after the other -arrows-.



– Remove bolts -arrows- and detach heat shield for turbocharger.

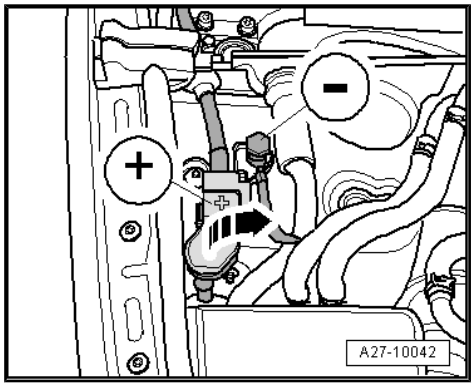


Note

The bottom bolt -right arrow- does not have to be completely removed.

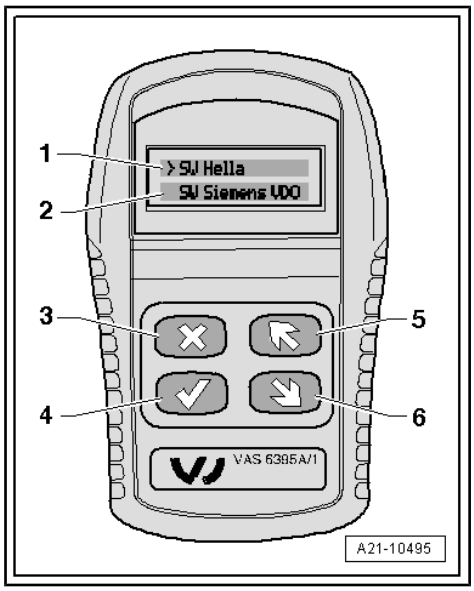
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– Open cover -arrow- above positive terminal.
– Connect tester -VAS 6395- with connection lead -VAS 6395/4-2- to positive terminal „+“ and negative terminal „–“.



Procedure for tester for E-positioner -VAS 6395A/1- :

– Select software version with buttons [↑] -item 5- and [↓] -item 6-.
– To confirm software version, press [V] button -item 4-.



Note

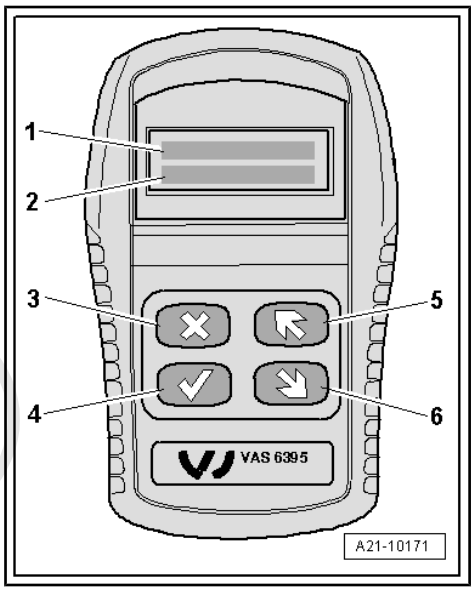
In this example, software version Hella -item 1- is selected.

Procedure for tester for E-positioner -VAS 6395/1- :

Caution

Risk of damage to turbocharger 1 control unit -J724- .

- ***Before continuing, check whether the correct software version is loaded in the tester -VAS 6395/1- . To do so, proceed as follows:***



Display on -VAS 6395/1- (2 seconds after connecting to power supply) if correct software version is loaded:

1 - >TEST

2 - LEARN

Note

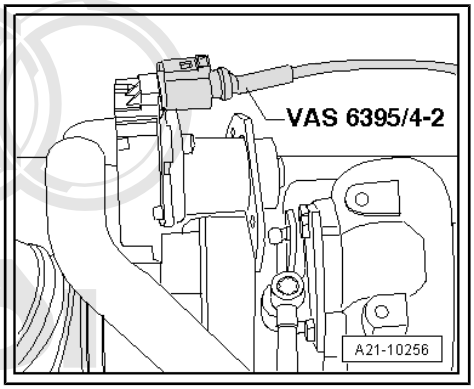
- *If the following appears on the display, an incorrect software version has been loaded:*
- *1. START*
- *2. NEXT [>]*
- *If this is the case, download the correct software version from the „Audi ServiceNet“ under „Workshop Equipment“.*

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Continued for both testers for E-positioner :

– Unplug electrical connector for turbocharger 1 control unit -J724- .

– Connect connection lead -VAS 6395/4-2- to turbocharger 1 control unit -J724- and to tester -VAS 6395- .



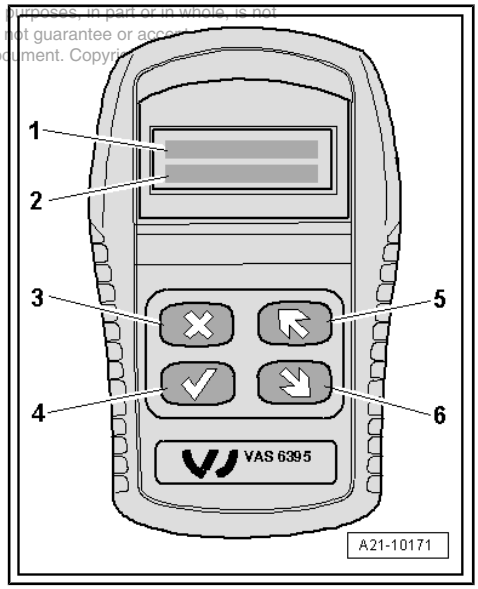
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Display on -VAS 6395/1- :

1 - >TEST

2 - LEARN

– To continue, press [V] button -item 4-.

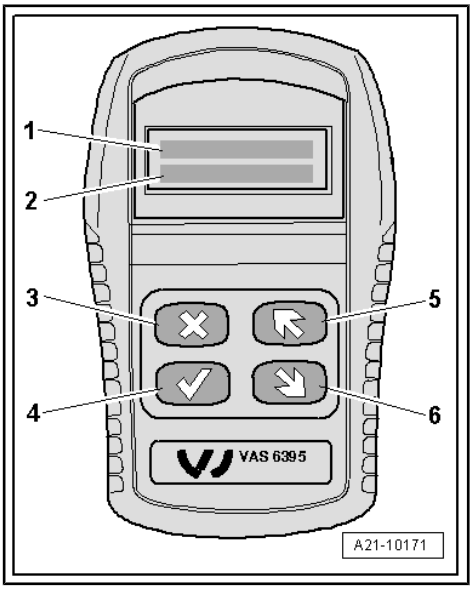


Display on -VAS 6395- :

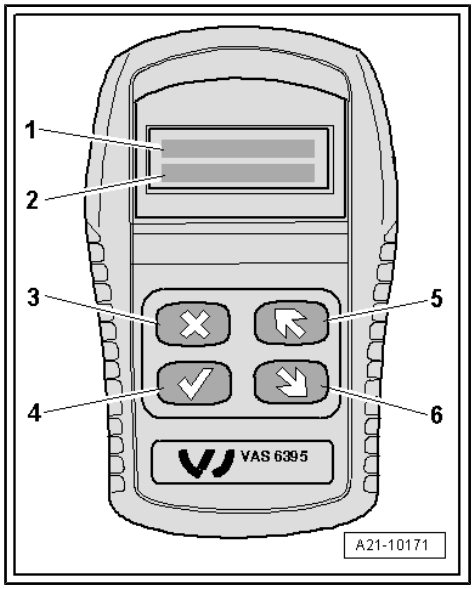
1 - CHECK

2 - S: XX % I: XX %

• The tester -VAS 6395- runs through the adjustment range of the turbocharger 1 control unit -J724- and checks the feedback of the positions.



Display on -VAS 6395- if turbocharger 1 control unit -J724- is OK:



1 - ACTUATOR OK

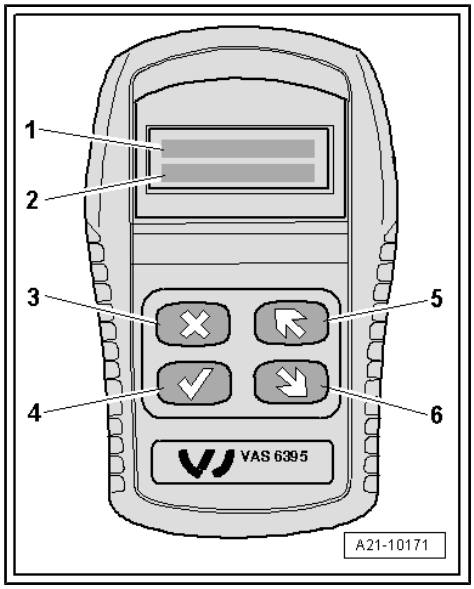
- The test is completed.

– Unplug electrical connectors for tester -VAS 6395- .

Assemble in reverse order.

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Display on -VAS 6395- if turbocharger 1 control unit -J724- is not OK:

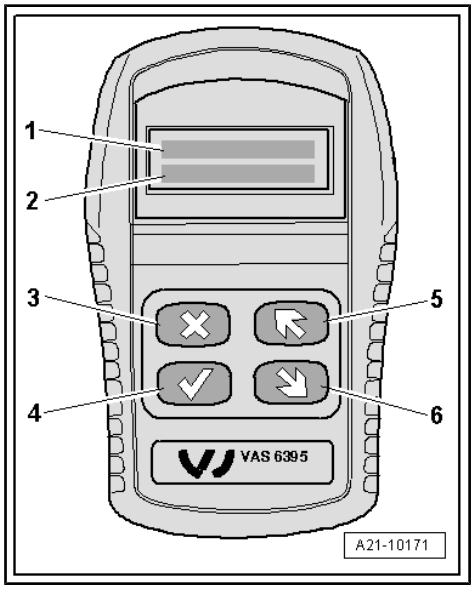


1 - PROBLEM

- Renew turbocharger 1 control unit -J724- .

– To do so, proceed as follows:

– To continue, press V button -item 4-.



Display on -VAS 6395- :

1 - >TEST

2 - LEARN

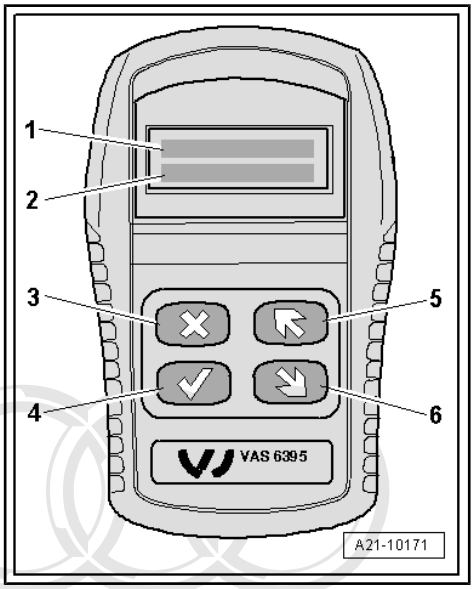
– Press ↓ button -item 6-.

Display on -VAS 6395- :

1 - TEST

2 - >LEARN

– To continue, press [V] button -item 4-.

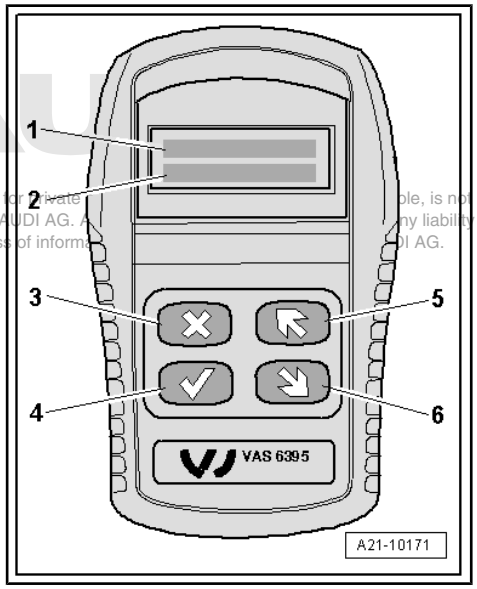


Display on -VAS 6395- :

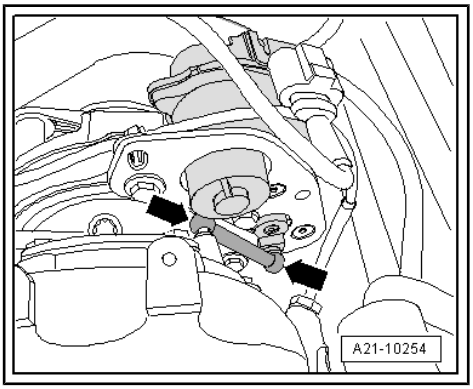
1 - STEP 1

– By pressing buttons [↑] -item 5- and [↓] -item 6-, adjust turbocharger 1 control unit -J724- so that coupling rod can be accessed easily for removal.

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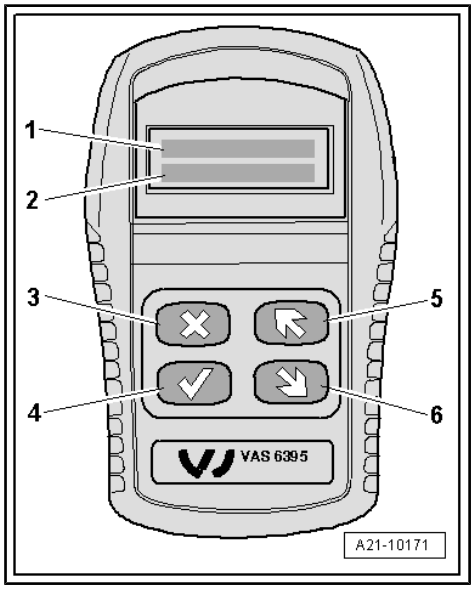
– Unclip coupling rod -arrows- and dispose of it.



– To continue, press [V] button -item 4-.

Display on -VAS 6395- :

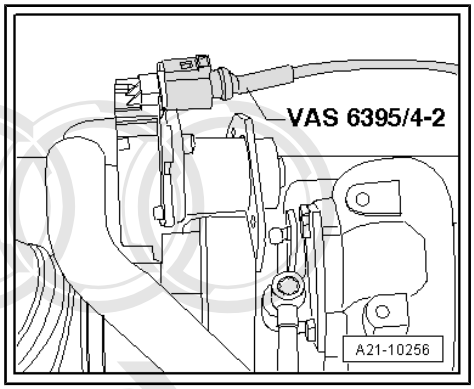
1 - STEP 2



– Disconnect connection lead -VAS 6395/4-2- from turbocharger 1 control unit -J724- .

Caution

Power supply for tester -VAS 6395/1- must remain connected.



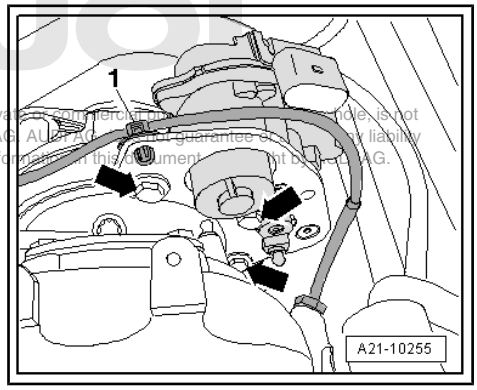
– Unclip retaining clip -1- for electrical wire.

– Remove bolts -arrows-; use open-end spanner, 10 mm (90 mm long) -VAS 6395/4-3- for bolts at centre and bottom.

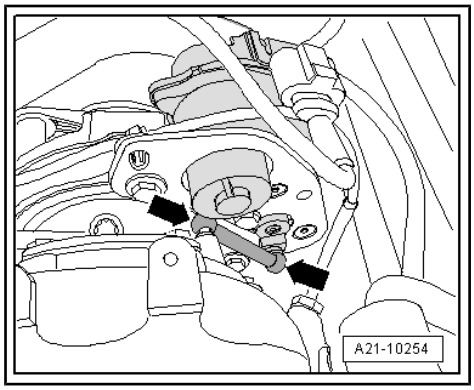
– Remove old turbocharger 1 control unit -J724- and dispose of it.

– Install new turbocharger 1 control unit -J724- in reverse order of removal, tighten bolts -arrows- only hand-tight.

• Turbocharger 1 control unit -J724- must rest on retaining plate so there is no play; it must still be possible to move control unit by hand.

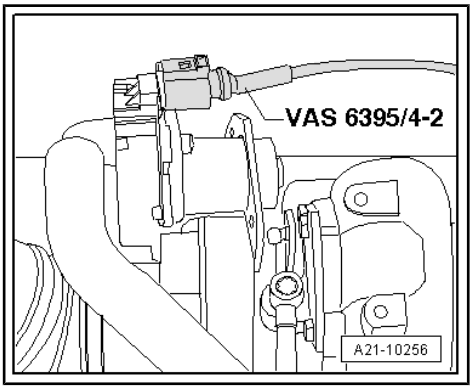


– Clip on new coupling rod -arrows-.



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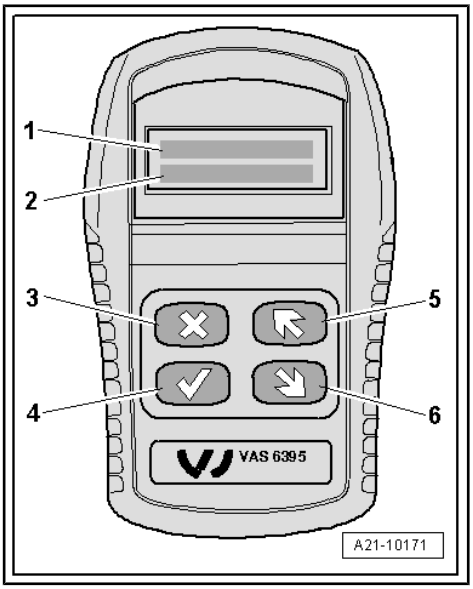
– Connect connection lead -VAS 6395/4-2- to turbocharger 1 control unit -J724- .



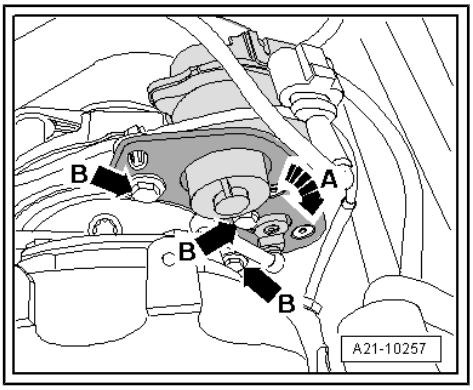
– To continue, press V button -item 4-.

Display on -VAS 6395- :

1 - STEP 3



– Press turbocharger 1 control unit -J724- downwards and towards rear using moderate pressure -arrow A-, at the same time tighten bolts -arrows B- to 10 Nm using open-end spanner, 10 mm (90 mm long) -VAS 6395/4-3- for centre and bottom bolts.



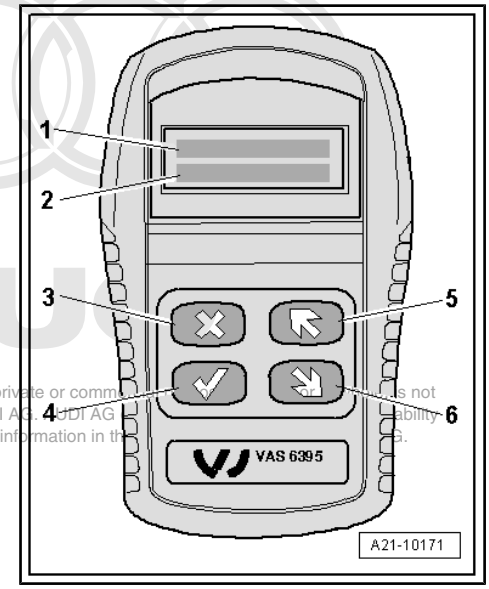
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– To continue, press [v] button -item 4-.

Display on -VAS 6395- :

1 - WARNING

2 - LEARNING



Caution

- *Now check correct installation of turbocharger 1 control unit -J724- ; from the next step of the programme onwards (confirmed by the [v] button -item 4-) the turbocharger 1 control unit -J724- learns the limit positions of the adjustment travel once only. If the limit positions are not stored correctly due to an incorrect installation position, the learning procedure of turbocharger 1 control unit -J724- cannot be repeated and the control unit must be renewed.*
- *If you are not certain that the installation position is correct, you can terminate the procedure by pressing the [x] button -item 3- and the start the procedure again.*

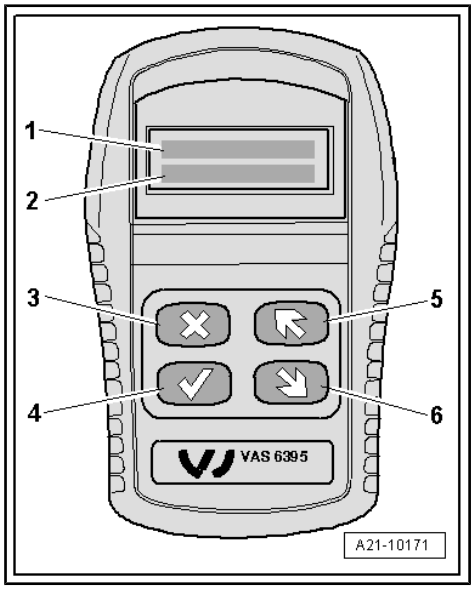
– To confirm that the new turbocharger 1 control unit -J724- has been correctly installed, press [v] button -item 4-.

Display on -VAS 6395- :

1 - TEST 1

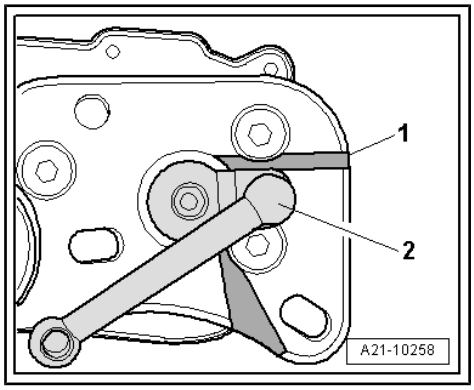
2 - S: 80.0 % I: XX %

- Specification: I = 80 %, successful learning is confirmed by the display „LEARNING“ in display zone -1-.



– At the same time, check position of adjustment lever at turbocharger 1 control unit -J724- :

- The edge of adjustment lever -2- must be within marking -1-.



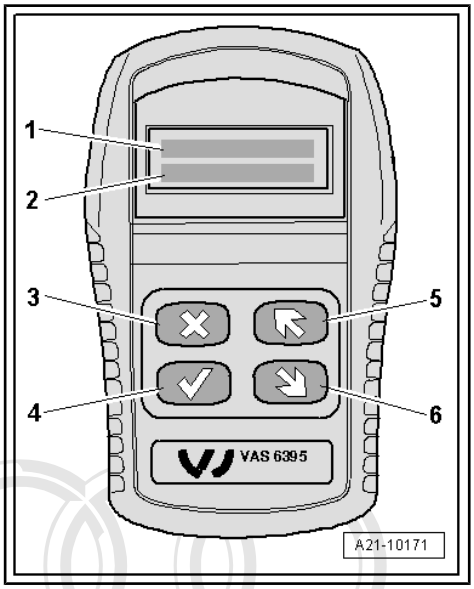
– To continue, press V button -item 4-.

Display on -VAS 6395- :

1 - TEST 2

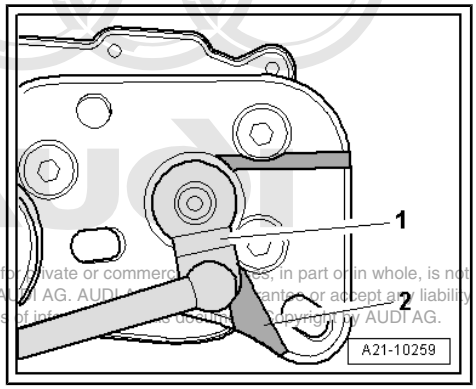
2 - S: 16.0 % I: XX %

• Specification: I = 16 %, successful learning is confirmed by the display „LEARNING“ in display zone -1-.



– At the same time, check position of adjustment lever at turbocharger 1 control unit -J724- :

• The edge of adjustment lever -1- must be within marking -2-.



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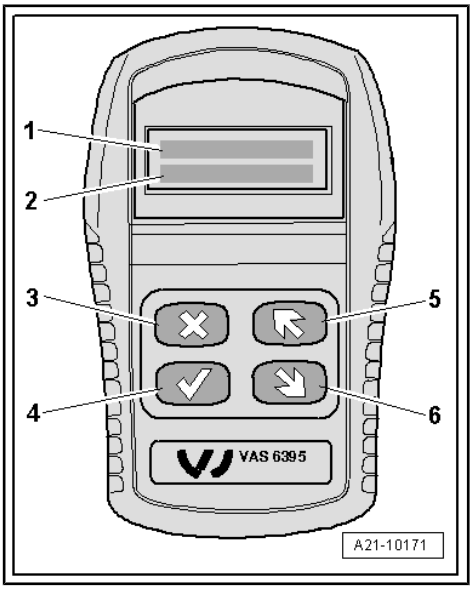
– To continue, press V button -item 4-.

Display on -VAS 6395- :

1 - TEST 3

2 - S: 55.0 % I: XX %

• Check of centre position is now performed.



– To continue, press V button -item 4-.

Display on -VAS 6395- :

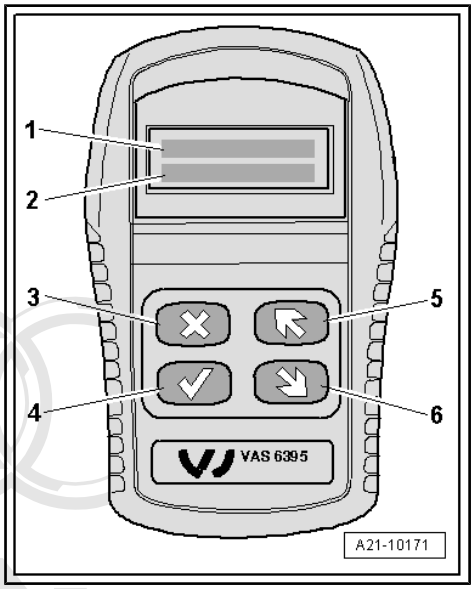
1 - OK

– To confirm, press V button -item 4-.

• Adjustment is completed.

– Unplug electrical connectors for tester -VAS 6395- .

Assemble in reverse order.



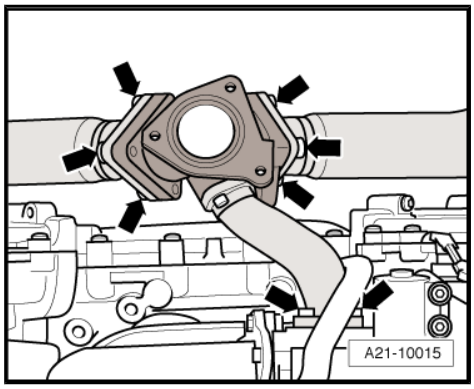
1.4 Removing and installing intermediate flange - vehicles with 2.7 ltr. engine up to 12.2005 or 3.0 ltr. engine

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Removing

– Remove turbocharger ⇒ page 300 .

– Unscrew bolts -arrows- and detach intermediate flange with connecting pipe for exhaust gas recirculation.



Installing

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

Note

Renew seals and gaskets.

– Install turbocharger ⇒ page 300 .

Tightening torques

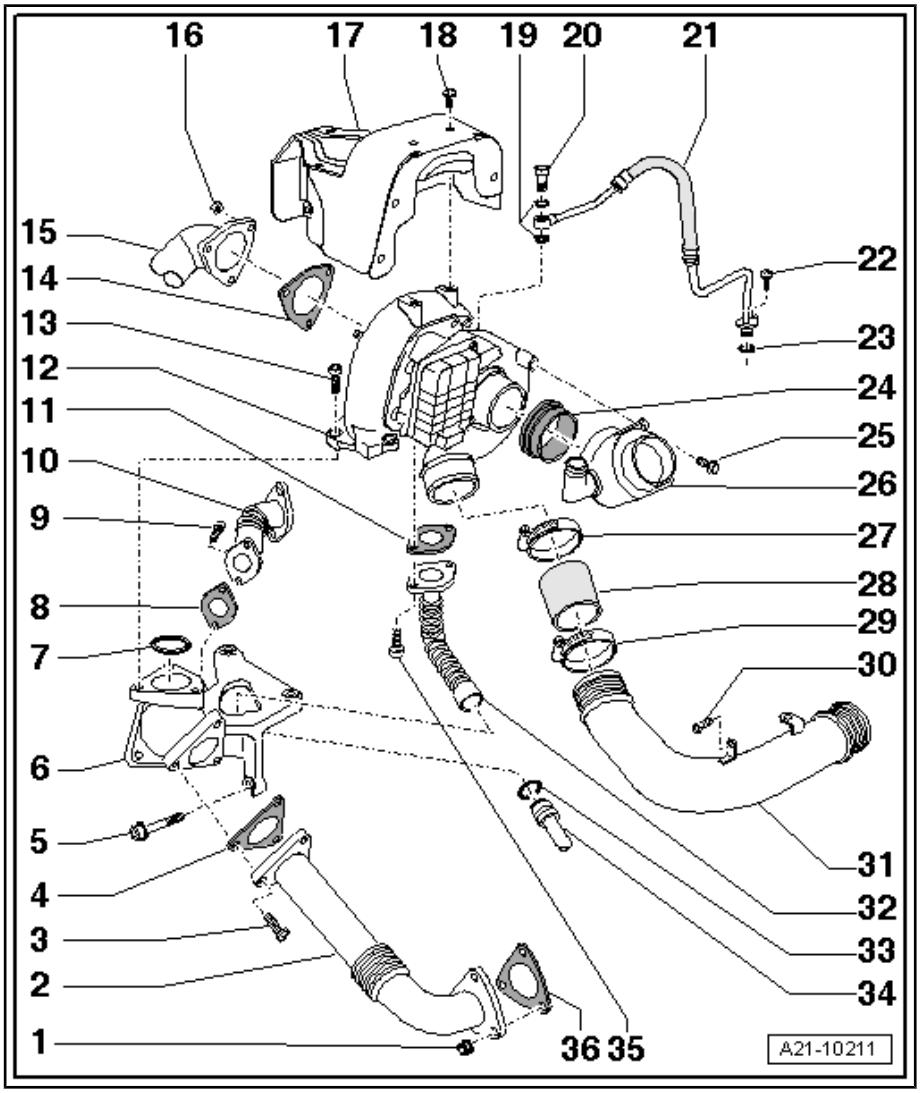
Component		Nm
EGR connecting pipe to:	Intermediate flange	9 1)
	Change-over flap for exhaust gas recirculation cooler	25
Intermediate pipe to intermediate flange		30 +90° 1)2)3)

• 1) Coat with high-temperature paste; for high-temperature paste refer to ⇒ Electronic parts catalogue

• 2) Renew bolts.

• 3) 90° = one quarter turn.

1.5 Turbocharger for vehicles with 2.7 ltr. engine from 12.2005 onwards - exploded view



1 - 30 Nm + turn 90° further

- ❑ Type of connection differs depending on version ⇒ page 317

2 - Intermediate pipe

- ❑ Removing and installing: left-side ⇒ page 376 , right-side ⇒ page 377

3 - 30 Nm + turn 90° further

- ❑ Renew
- ❑ Coat with high-temperature paste; for high-temperature paste refer to ⇒ Electronic parts catalogue

4 - Gasket

- ❑ Renew

5 - 25 Nm

6 - Intermediate flange

- ❑ Removing and installing ⇒ page 332

7 - Seal

- ❑ Renew

8 - Gasket

- ❑ Renew

9 - 9 Nm

- ❑ Coat with high-temperature paste; for high-temperature paste refer to ⇒ Electronic parts catalogue

10 - Connecting pipe to change-over flap for exhaust gas recirculation cooler

11 - Gasket

- ❑ Renew

12 - Turbocharger

- ❑ With turbocharger 1 control unit -J724-
- ❑ Removing and installing turbocharger ⇒ page 317
- ❑ Removing and installing turbocharger 1 control unit -J724- ⇒ page 322

13 - 30 Nm + turn 90° further

- ❑ Renew
- ❑ Coat with high-temperature paste; for high-temperature paste refer to ⇒ Electronic parts catalogue

14 - Gasket

- ❑ Renew

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15 - Starter catalytic converter

- ❑ Removing and installing: vehicles without particulate filter ⇒ page 343 , vehicles with particulate filter ⇒ page 355 ⇒ page 355 .

16 - 23 Nm

- ❑ Coat with high-temperature paste; for high-temperature paste refer to ⇒ Electronic parts catalogue

17 - Heat shield for turbocharger

18 - 9 Nm

19 - Seals

- ❑ Renew

20 - Banjo bolt, 15 Nm

21 - Oil supply line

- ❑ From cylinder block

22 - 9 Nm

23 - O-ring

- ❑ Renew

24 - Seal

- ❑ Renew if damaged

25 - 9 Nm

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26 - Connecting piece for air intake hose

- ❑ From air mass meter -G70- to turbocharger

27 - Hose clip, 5.5 Nm

- ❑ Reinforced

28 - Air hose

- ❑ From turbocharger to air pipe (right-side)
- ❑ Must be free of oil and grease when installing

29 - Hose clip, 5.5 Nm

- ❑ Reinforced

30 - 9 Nm

31 - Air pipe (right-side)

32 - Top section of oil return line

From turbocharger

33 - O-ring

- ❑ Renew

34 - Bottom section of oil return line

- ❑ To cylinder block

35 - 9 Nm

- ❑ Coat with high-temperature paste; for high-temperature paste refer to ⇒ Electronic parts catalogue

36 - Gasket

- ❑ Renew

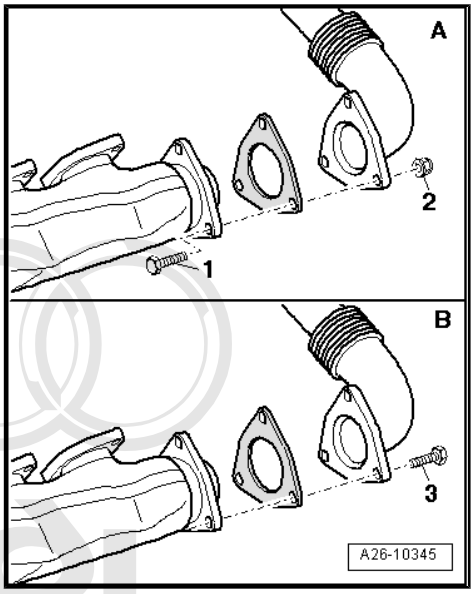
Securing intermediate pipe to exhaust manifold

A - Exhaust manifold (sheet metal version)

- Fitted with bolts -1- and nuts -2-.
- Renew bolts and nuts.
- Coat with high-temperature paste; for high-temperature paste refer to ⇒ Electronic parts catalogue .

B - Exhaust manifold (cast version)

- Fitted with bolts -3-.
- Renew bolts.
- Coat with high-temperature paste; for high-temperature paste refer to ⇒ Electronic parts catalogue .



1.6 Removing and installing turbocharger - vehicles with 2.7 ltr. engine from 12.2005 onwards

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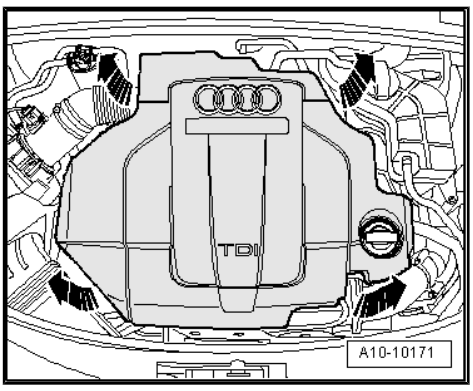
Removing

Caution

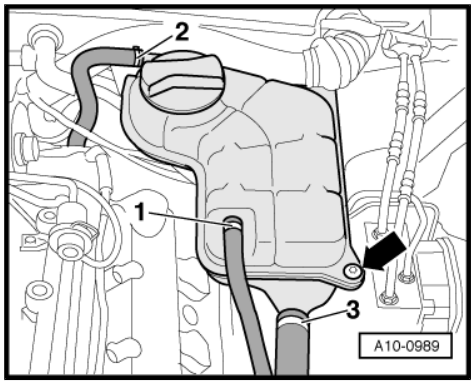
If the turbocharger has suffered mechanical damage (e.g. damaged compressor wheel), it is not sufficient merely to fit a new turbocharger. The following work must be performed in order to avoid further damage:

- *Check air cleaner housing, air filter element and air hoses for dirt and foreign particles.*
- *Check the entire charge air system (including the charge air cooler) for foreign matter.*
- *If foreign matter is found in the charge air system, clean all relevant ducts and hoses and renew charge air cooler if necessary.*

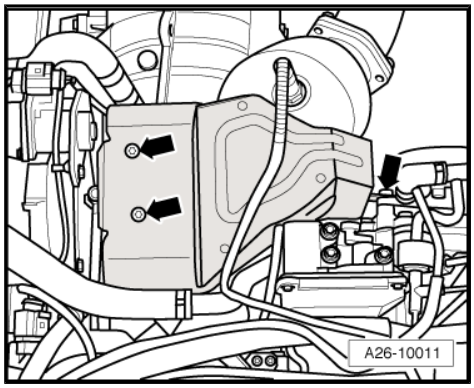
– Carefully pull engine cover panel off four retaining pins one after the other -arrows-.



– Unbolt coolant expansion tank -arrow-.
– Detach electrical connector at coolant shortage indicator switch -F66- on coolant expansion tank (bottom).
– Lay aside coolant expansion tank with coolant hoses -1 … 3- connected.

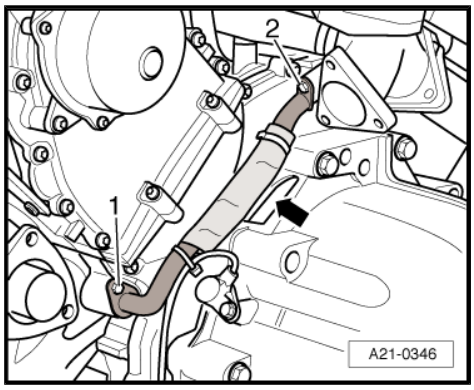


– Remove heat shield for turbocharger -arrows-.



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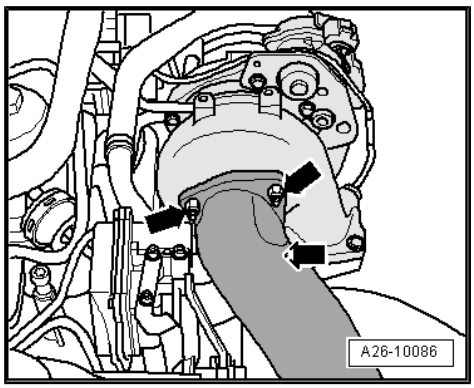
– Cover opening -arrow- in gearbox to prevent small parts from dropping in.



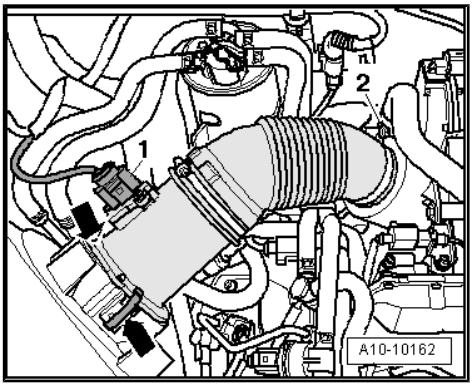
Note

- *Shown in illustration with intermediate pipe removed.*
- *Disregard items -1- and -2-.*

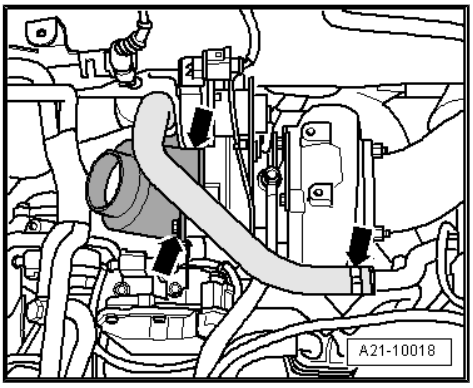
– Move electrical wiring to Lambda probe clear.
– Unscrew nuts -arrows- securing starter catalytic converter to turbocharger and pull starter catalytic converter to the side.



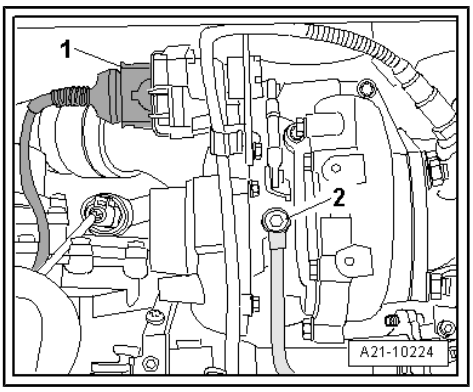
– Unplug electrical connector -1- at air mass meter -G70- .
– Remove air intake hose. To do so, release hose clip -2- and clamps -arrows-.



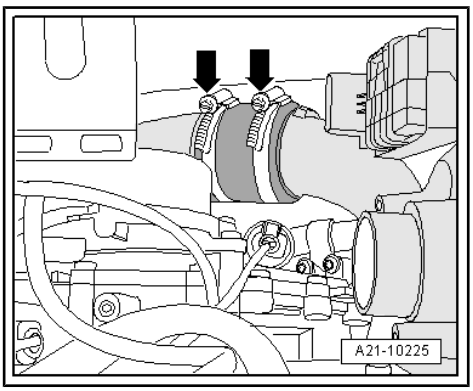
– Unbolt air intake connection -left arrows- and move it aside with air intake hose connected -right arrow-.



– Unplug electrical connector-1- at turbocharger 1 control motor -V280- .
– Unscrew oil supply line -2- from turbocharger.

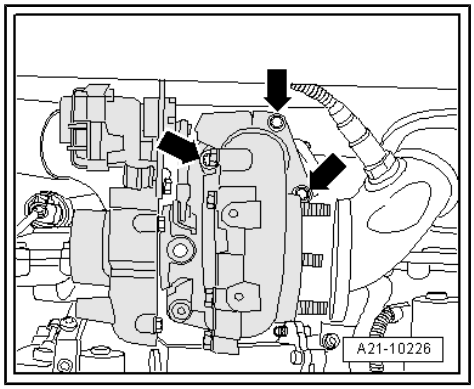


– Release hose clips -arrows- securing connecting hose between turbocharger and air intake pipe and push to one side.
– Push connecting hose onto hose connection on turbocharger.



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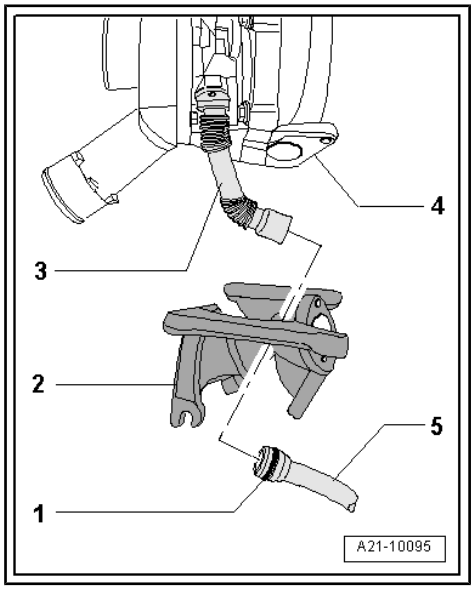
– Remove bolts -arrows-.



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Caution

- ***The top section of the oil return line -3- is secured to the turbocharger and must be detached carefully from the bottom section of the oil return line -5-.***
- ***To avoid bending the two pipes of the oil return line, move the turbocharger -4- slightly backwards and forwards while pulling it off upwards and towards one side.***



1 - O-ring

2 - Intermediate flange

Note

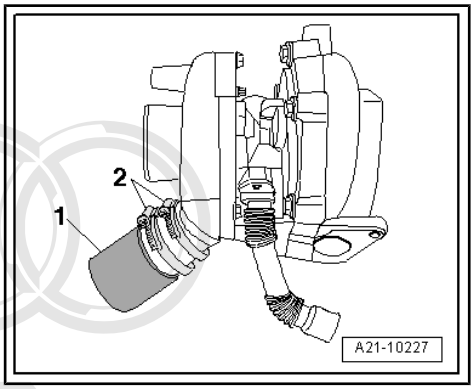
After removing the turbocharger, do not put it down so it rests on the upper section of the oil return line.

Installing

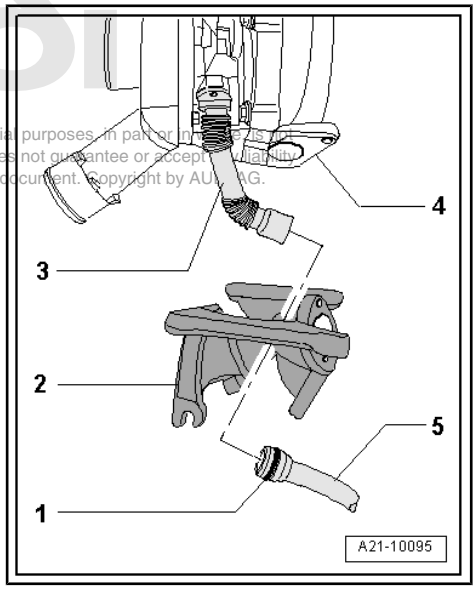
Note

- *Renew gaskets, seals and O-rings.*
- *Fill turbocharger with engine oil at connection for oil supply line.*
- *Hose connections and hoses for charge air system must be free of oil and grease before assembly.*
- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*
- *To ensure that the charge air hoses can be properly secured at their connections, spray rust remover onto the worm thread of used hose clips before installing.*
- *Fit all heat insulation sleeves in the original position when installing.*
- *After installing turbocharger, allow engine to idle for approx. 1 minute and do not rev up immediately to ensure turbocharger is supplied with oil.*

– Prepare turbocharger for installation by fitting connecting hose -1- and two hose clips -2- onto hose connection on turbocharger.



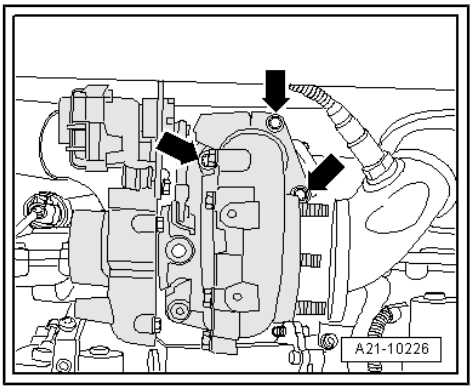
– Fit new O-ring -1- on bottom section of oil return line -5-.
– Lightly lubricate O-ring and internal sealing surface of top section of oil return line -3- with oil.
– When fitting turbocharger -4-, guide top section of oil return line -3- through intermediate flange -2- and towards bottom section of oil return line -5-.
– Carefully push top section of oil return line onto bottom section of oil return line.



Caution

Take care not to damage O-ring.

– Secure turbocharger with bolts -arrows-.



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

– Install starter catalytic converter: vehicles without particulate filter ⇒ page 343 , vehicles with particulate filter ⇒ page 355 .
– Install fuel filter ⇒ Rep. gr. 20 .

Tightening torques

Component		Nm
Turbocharger to intermediate flange		30 +90° 1)2)3)
Oil supply line to turbocharger		15
Hose clips	Width 9 mm	3
	Width 13 mm	5.5

- 1) Renew bolts.
- 2) Coat with high-temperature paste; for high-temperature paste refer to ⇒ Electronic parts catalogue
- 3) 90° = one quarter turn.

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1.7 Removing and installing turbocharger 1 control unit -J724- - vehicles with 2.7 ltr. engine from 12.2005

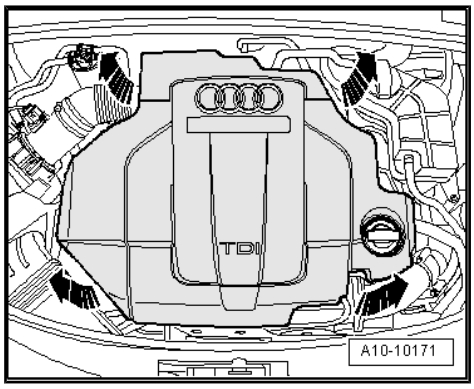
Special tools and workshop equipment required

- Tester -VAS 6395-
- Connection lead -VAS 6395/2-
- Stop plate -VAS 6395/3-

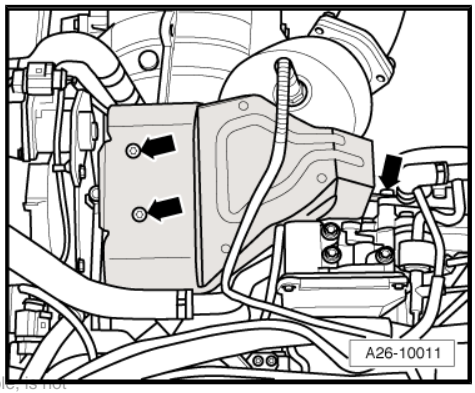
Removing

Proceed as follows:

– Carefully pull engine cover panel off four retaining pins one after the other -arrows-.



– Remove bolts -arrows- and detach heat shield for turbocharger.



Note

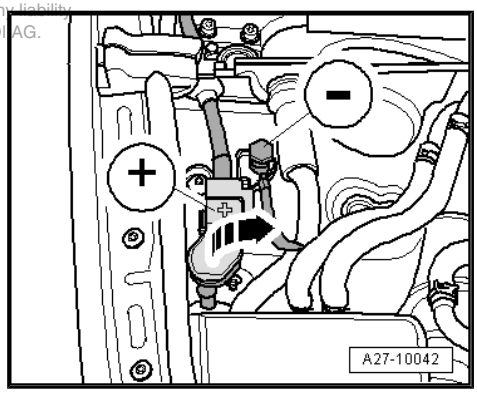
The bottom bolt -right arrow- does not have to be completely removed.

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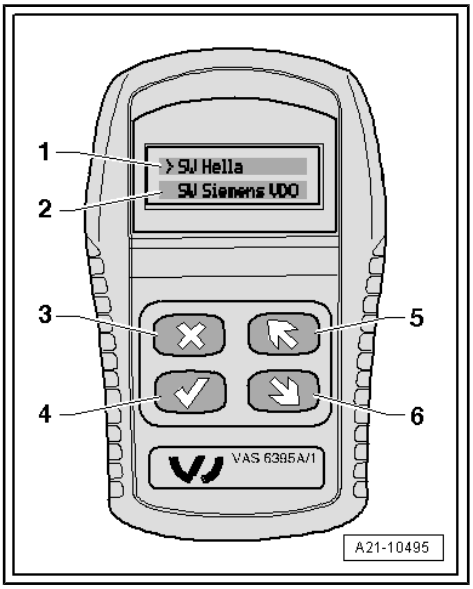
– Open cover -arrow- above positive terminal.

– Connect tester -VAS 6395- with connection lead -VAS 6395/2- to positive terminal „+“ and negative terminal „–“.

Procedure for tester for E-positioner -VAS 6395A/1- :



– Select software version with buttons [↑] -item 5- and [↓] -item 6-.
– To confirm software version, press [V] button -item 4-.



Note

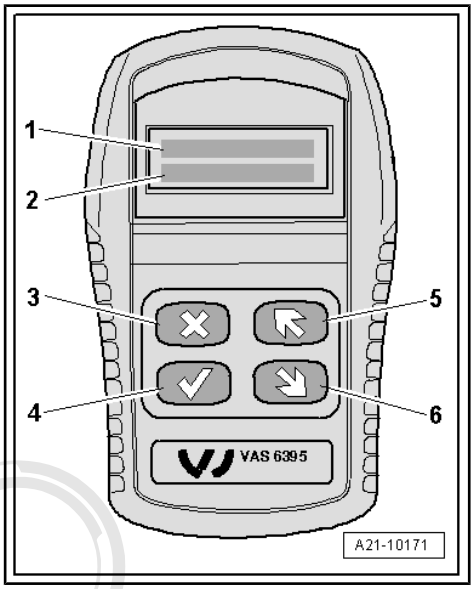
In this example, software version Hella -item 1- is selected.

Procedure for tester for E-positioner -VAS 6395/1- :

Caution

Risk of damage to turbocharger 1 control unit -J724- .

- ***Before continuing, check whether the correct software version is loaded in the tester -VAS 6395/1- . To do so, proceed as follows:***



Display on -VAS 6395/1- (2 seconds after connecting to power supply) if correct software version is loaded:

1 - > 1. START

2 - 2. NEXT [>]

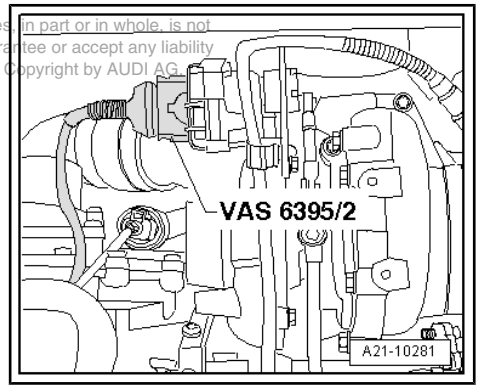
Note

- *If the following appears on the display, an incorrect software version has been loaded:*
- *1. >TEST*
- *2. LEARN*
- *If this is the case, download the correct software version from the „Audi ServiceNet“ under „Workshop Equipment“.*

Continued for both testers for E-positioner :

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– Unplug electrical connector for turbocharger 1 control unit -J724- .
– Connect connection lead -VAS 6395/2- to turbocharger 1 control unit -J724- and to tester -VAS 6395- .



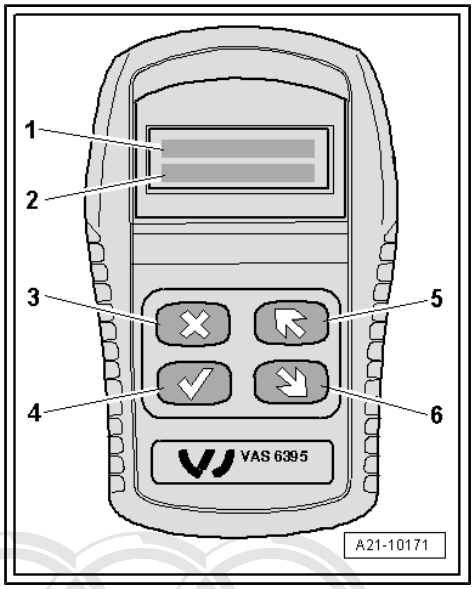
Display on -VAS 6395- :

1 - > 1. START

2 - 2. NEXT [>]

– To continue, press V button -item 4-.

• The tester -VAS 6395- runs through the adjustment range of the turbocharger 1 control unit -J724- and checks that the end positions are reached; display indicates „CHECK“.



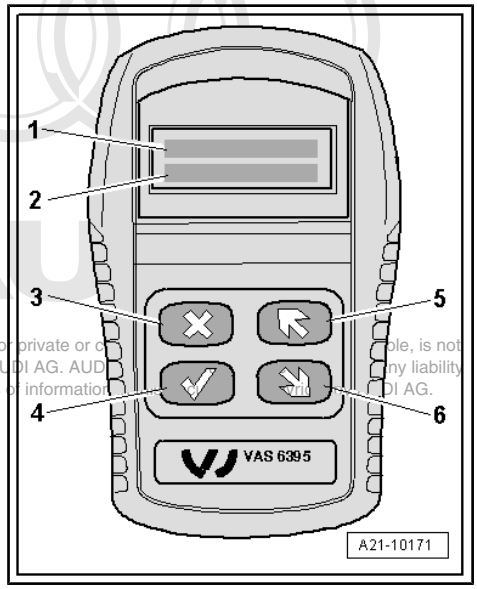
Display on -VAS 6395- :

1 -

2 - [OK]

Note

- *If the display indicates „[OK]“, the adjustment range of the turbocharger 1 control unit -J724- is stored.*
- *If the display shows „FAULT [OK]“, tap gently several times on the housing of turbocharger 1 control unit -J724- with the handle of a screwdriver and repeat the check by pressing V button -item 4-.*



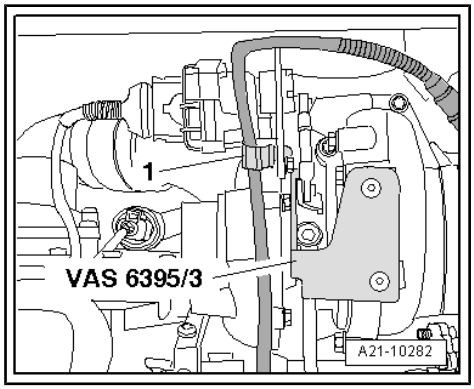
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– Unclip retaining clip -1- and move electrical wire clear.

– Secure stop plate -VAS 6395/3- with bolts for heat shield. Tightening torque: 8 Nm.

Caution

The stop plate -VAS 6395/3- must not be loosened until the work sequence has been completed.

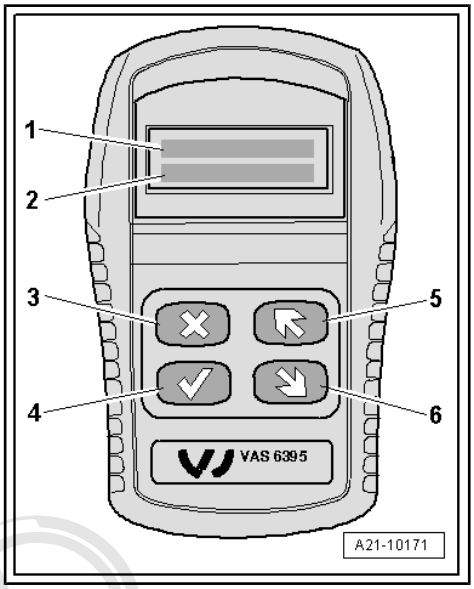


– To continue, press [V] button -item 4-.

• The turbocharger 1 control unit -J724- moves back and forth between the stops several times to determine the voltage value.

• Then the turbocharger 1 control unit -J724- moves into installation position.

– While the voltage value is being determined, keep tapping gently on the housing of turbocharger 1 control unit -J724- until the display indicates the following:



Display on -VAS 6395- :

1 - X.XXX V

2 - [↑][↓][OK]

– Note voltage value.

• Specification: 3.3 ... 3.7 V

Note

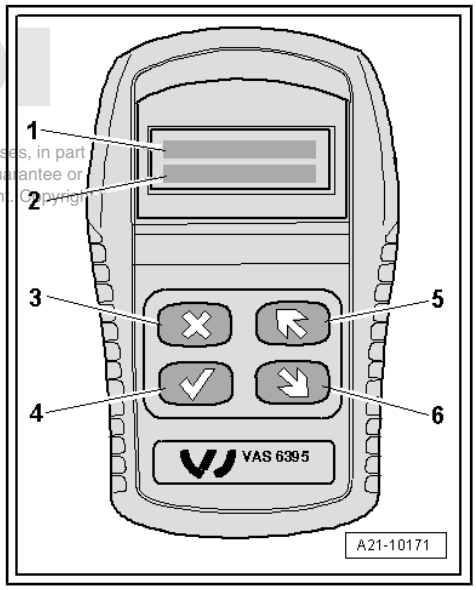
If the display indicates „FAULT [OK]“ or the voltage is less than 3.3 V or greater than 3.7 V, unplug tester -VAS 6395- and repeat the complete procedure ⇒ page 323 .

Display on -VAS 6395- :

1 - X.XXX V

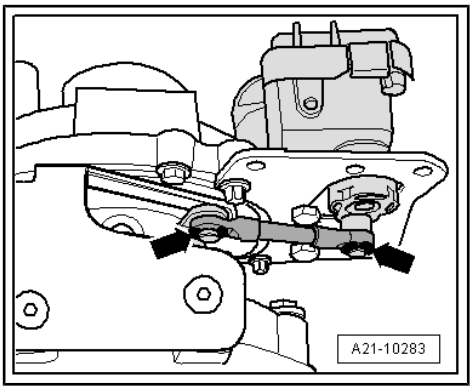
2 - [↑][↓][OK]

– By pressing buttons [↑] -item 5- and [↓] -item 6-, adjust turbocharger 1 control unit -J724- so that coupling rod can be accessed easily for removal.



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– Unclip circlips -arrows- and dispose of them, detach coupling rod.

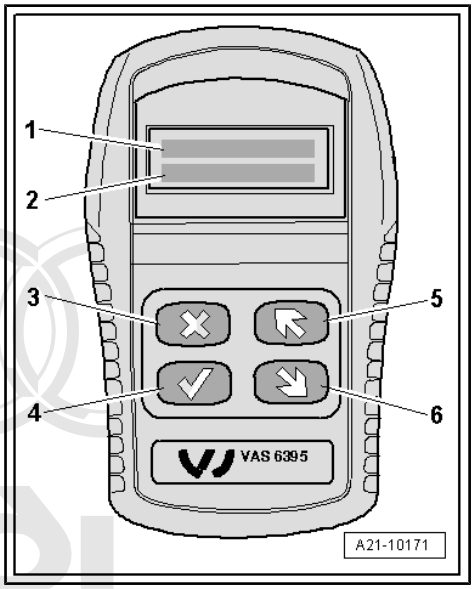


Display on -VAS 6395- :

1 - X.XXX V

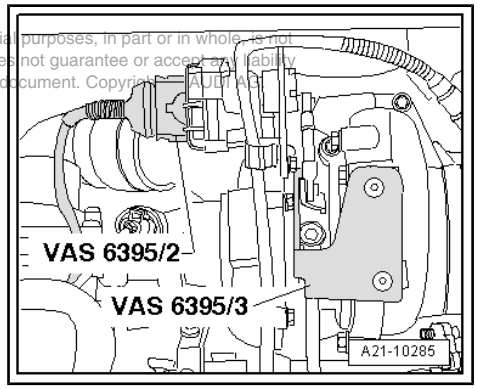
2 - [↑][↓][OK]

– By pressing buttons [↑] -item 5- and [↓] -item 6-, adjust turbocharger 1 control unit -J724- so that bolts for -J724- can be accessed easily.



– Disconnect connection lead -VAS 6395/2- from turbocharger 1 control unit -J724- .

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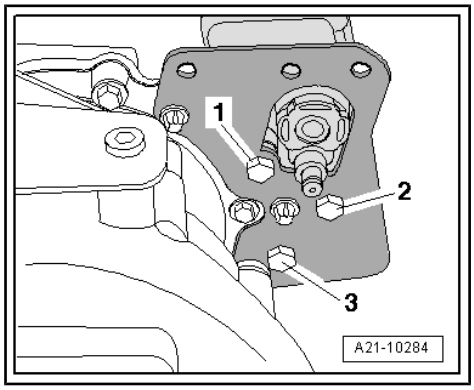


Caution

Power supply for tester -VAS 6395- must remain connected.

– Remove bolts -1, 2, 3- and dispose of them.

– Remove old turbocharger 1 control unit -J724- and dispose of it.



Caution

Check that the three insulating washers are fitted between turbocharger 1 control unit -J724- and the bracket.

– Install new turbocharger 1 control unit -J724- in reverse sequence of removal.

– Fit new bolts as follows:

1 - M6x15 with tapered shank

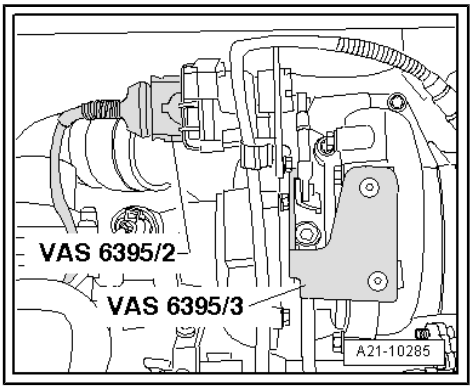
2 - M6x15 with tapered shank

3 - M6x15

– Initially hand-tighten bolts.

• Turbocharger 1 control unit -J724- must rest on retaining plate so there is no play; it must still be possible to move control unit by hand.

– Connect connection lead -VAS 6395/2- to new turbocharger 1 control unit -J724- .



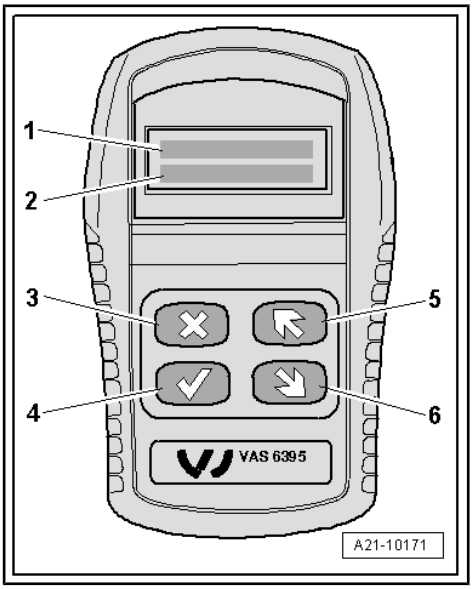
– To continue, press V button -item 4-.

Display on -VAS 6395- :

1 - > 1. START

2 - 2. NEXT [>]

– Select menu item „NEXT“ with ↓ button -item 6-.

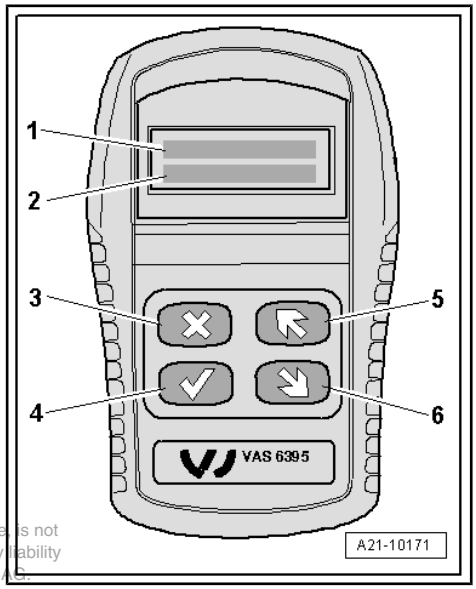


– To continue, press V button -item 4-.

Display on -VAS 6395- :

1 - X.XXX V

2 - [OK]



Note

- *If the display indicates „CHECK“, the adjustment range of the new turbocharger 1 control unit -J724- must be checked* *⇒ page 330* .
- *If the display indicates „FAULT“, the new turbocharger 1 control unit -J724- must be renewed for a second time.*

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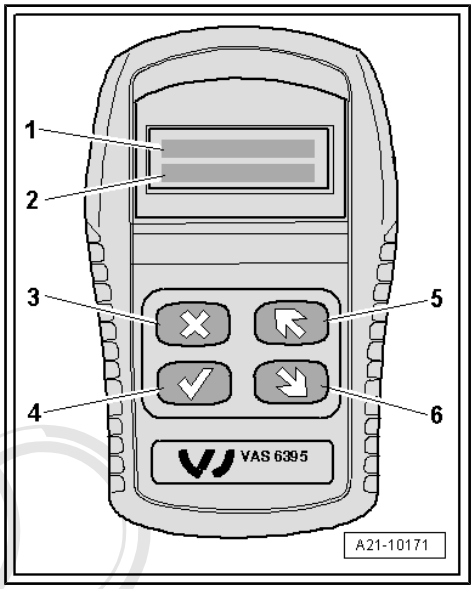
– To continue, press V button -item 4-.

• Turbocharger 1 control unit -J724- runs through the adjustment range.

Display on -VAS 6395- :

1 -

2 - [OK]



– To continue, press V button -item 4-.

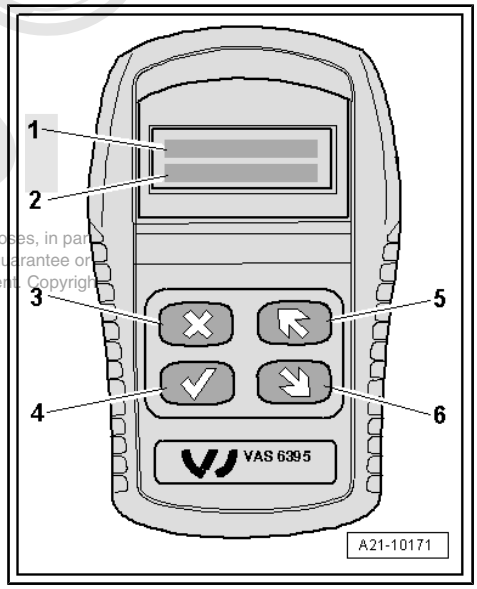
Display on -VAS 6395- :

1 - X.XXX V

2 - [OK]

• Turbocharger 1 control unit -J724- moves into installation position.

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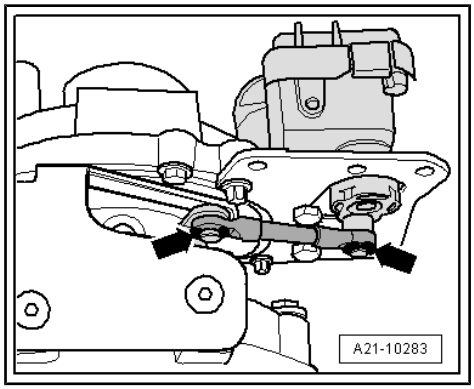


– Insert coupling rod.

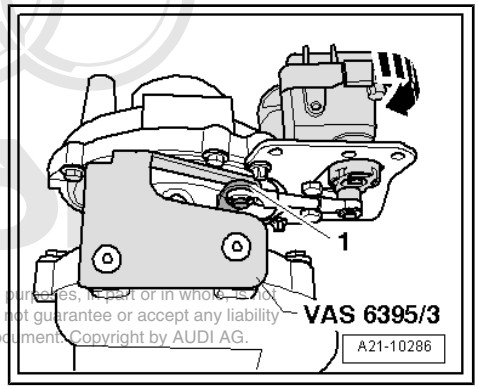
• Installation position: The thicker eyelet is fitted onto the shaft of turbocharger 1 control unit -J724- .

– Fit circlips -arrows-.

• The circlips must engage audibly.

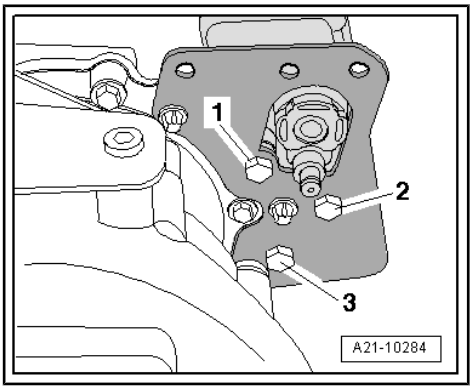


– Press turbocharger 1 control unit -J724- towards the rear without applying force -arrow- until lever -1- rests lightly on stop plate -VAS 6395/3- .
– Hold -J724- in this position.



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– Tighten bolts -1, 2, 3- to 5 Nm.

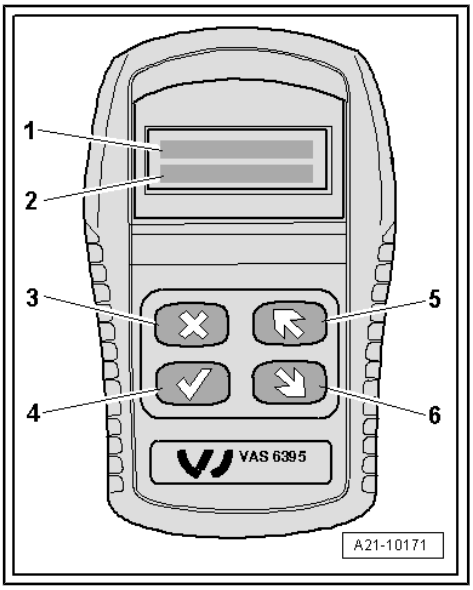


– To continue, press V button -item 4-.
• Turbocharger 1 control unit -J724- moves back and forth between the stops several times and is adjusted to the voltage value determined with the first measurement.

Display on -VAS 6395/1- :

1 - X.XXX V (voltage determined with first measurement)

2 - [OK]



Note

♦ *If [OK] is indicated on display, terminate adjustment* *⇒ page 331* .

♦ *If „CHECK“ is indicated on display, proceed as follows.*

Procedure if display indicates „CHECK“:

Display on -VAS 6395- :

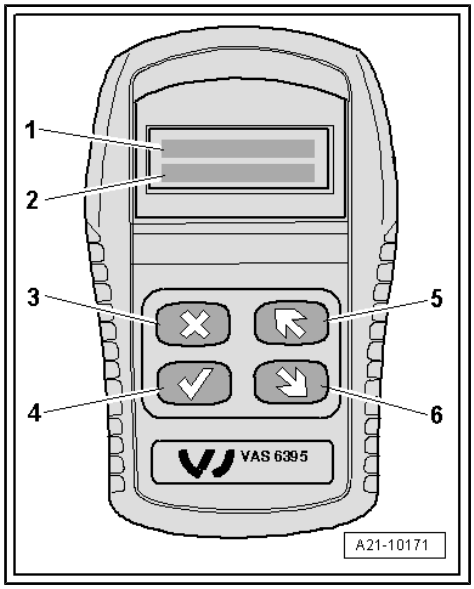
1 - [<<<]

2 - CHECK

Or

1 - [>>>]

2 - CHECK

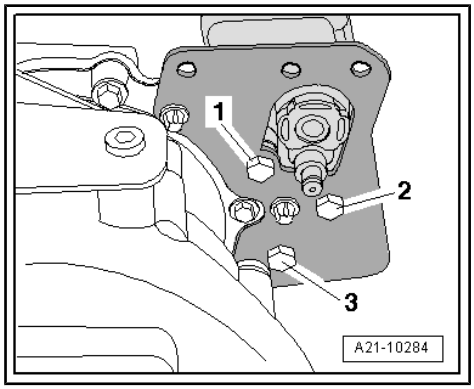


– Loosen bolts -1, 2, 3- until turbocharger 1 control unit -J724- can just be moved by applying light force in the direction stated:

• If display indicates [<<<], move -J724- slightly in direction of travel.

• If display indicates [>>>], move -J724- slightly towards rear of vehicle.

– Tighten bolts -1, 2, 3- to 5 Nm.



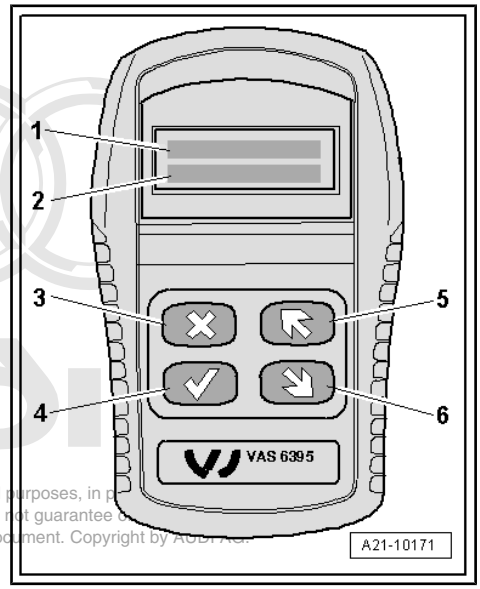
– To continue, press V button -item 4-.

• Turbocharger 1 control unit -J724- again moves back and forth between the stops several times and is adjusted to the voltage value determined with the first measurement.

Display on -VAS 6395- :

1 - X.XXX V (voltage determined with first measurement)

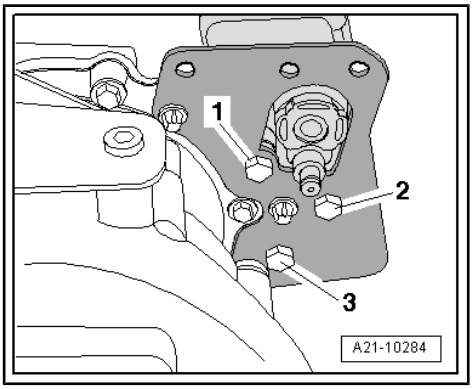
2 - [OK]



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Terminating adjustment:

– Tighten bolts -1, 2, 3- to 10 Nm.

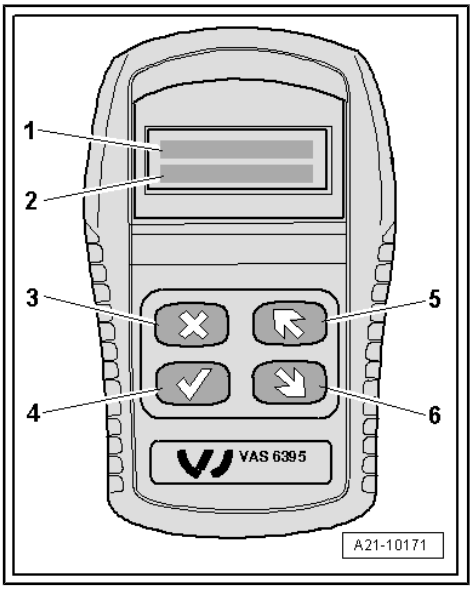


– To continue, press V button -item 4-.

Display on -VAS 6395- :

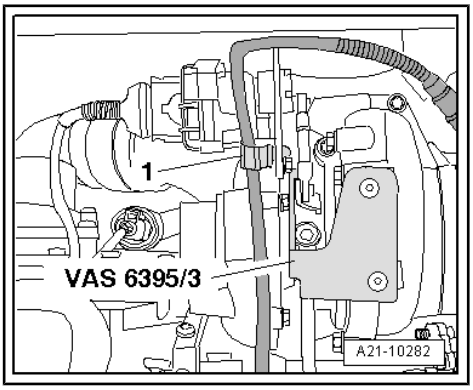
1 - > 1. X.XXX V

2 - 2. [OK]



– Remove stop plate -VAS 6395/3- .

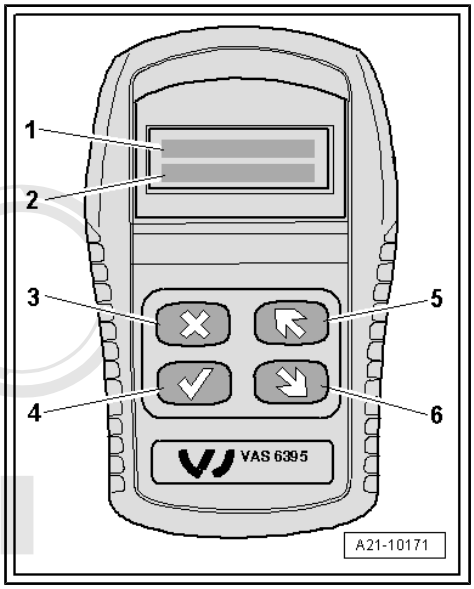
– Secure electrical wiring with retaining clip -1-.



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– To continue, press [V] button -item 4-.

• Turbocharger 1 control unit -J724- moves to end positions.



Note

If the display indicates „FAULT“, the new turbocharger 1 control unit -J724- must be renewed ⇒ page 326 .

Display on -VAS 6395/1- :

1 -

2 - [OK]

• Adjustment is completed.

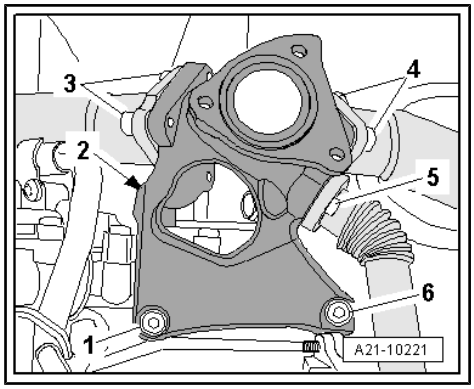
– Unplug electrical connectors for tester -VAS 6395- .

Assemble in reverse order.

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1.8 Removing and installing intermediate flange - vehicles with 2.7 ltr. engine from 12.2005 onwards

Removing



– Remove starter catalytic converter: vehicles without particulate filter ⇒ page 343 ; vehicles with particulate filter ⇒ page 355 .

– Remove turbocharger ⇒ page 300 .

– Remove bolts -3- (3x), -4- (3x), -5- (2x) and -1, 2 and 6- and take off intermediate flange.

Installing

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

Note

Renew seals and gaskets.

– Install turbocharger ⇒ page 300 .

– Install starter catalytic converter: vehicles without particulate filter ⇒ page 343 , vehicles with particulate filter ⇒ page 355 .

Tightening torques

Component	Nm
EGR connecting pipe to intermediate flange	9 1)
Intermediate pipe to intermediate flange	30 +90° 1)2)3)
Intermediate flange to cylinder head	25

• 1) Coat with high-temperature paste; for high-temperature paste refer to ⇒ Electronic parts catalogue

• 2) Renew bolts.

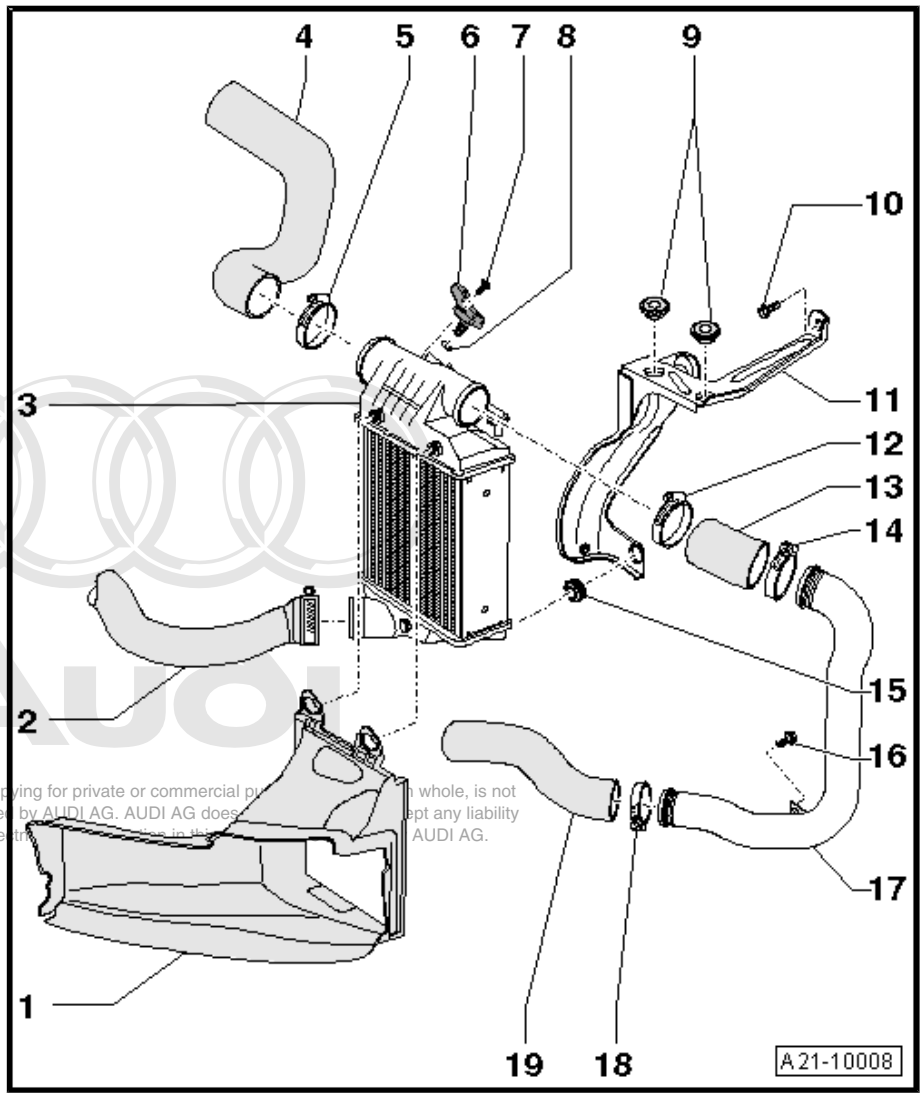
• 3) 90° = one quarter turn.

2 Charge air cooling

2.1 Charge air cooler - exploded view

Note

Illustration shows left-side charge air cooler.



1 - Front air duct

2 - Air hose

- ❑ To charge air cooler (centre)
- ❑ Must be free of oil and grease when installing

3 - Charge air cooler

- ❑ Removing and installing ⇒ page 334

4 - Air hose

- ❑ Between charge air cooler and throttle valve module -J338-
- ❑ Must be free of oil and grease when installing

5 - Hose clip, 5.5 Nm

- ❑ Reinforced

6 - Charge pressure sender -G31-

- ❑ Removing and installing ⇒ page 336

7 - 5 Nm

8 - O-ring

- ❑ Renew

9 - Mounting for charge air cooler

- ❑ 2x

10 - 22 Nm

11 - Bracket

12 - Hose clip, 5.5 Nm

- ❑ Reinforced

13 - Connecting hose

- ❑ Must be free of oil and grease when installing

14 - Rubber grommet

15 - Hose clip, 5.5 Nm

- ❑ Reinforced

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16 - 5 Nm

17 - Air pipe

18 - Hose clip, 5.5 Nm

- ❑ Reinforced

19 - Air hose

- ❑ To charge air cooler (right-side)
- ❑ Must be free of oil and grease when installing

2.2 Removing and installing charge air coolers (left and right)

Removing

Note

- *If there are slight impressions on the fins, refer to ⇒ page 7 .*
- *The following description shows the removal and installation of the left-side charge air cooler. The procedure for the right-side charge air cooler is the same.*

– Remove both front wheels.

Note

Secure brake discs with wheel bolts.

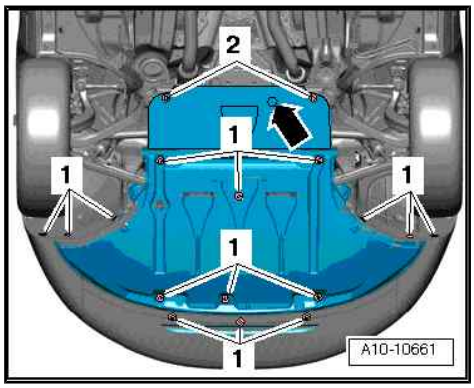
– Release fasteners marked -1, 2- and -arrow- (if fitted) and remove front and rear noise insulation.

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

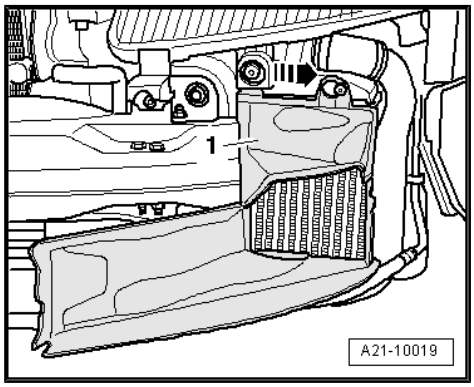
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– Remove bumper cover (front) ⇒ Rep. gr. 63 .

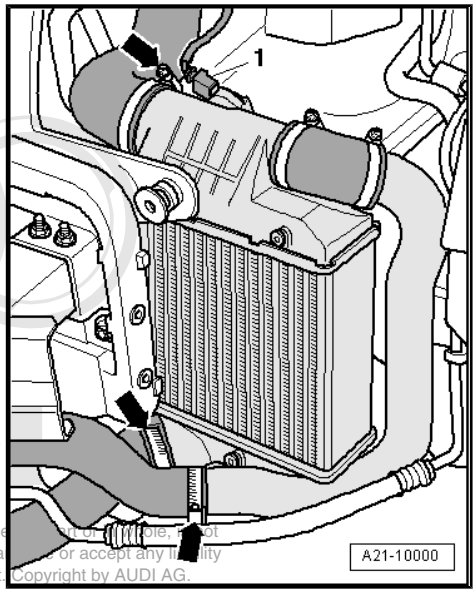
– Remove left headlight ⇒ Rep. gr. 94 .



– Pull off air duct -1- for charge air cooler in direction of -arrow-.



– Unplug electrical connector -1- going to charge pressure sender -G31- .
– Open hose clips -arrows- and disconnect air intake hoses.
– Detach charge air cooler by pulling upwards.



Installing

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

Note

- *Hose connections and hoses for charge air system must be free of oil and grease before assembly.*
- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*
- *To ensure that the charge air hoses can be properly secured at their connections, spray rust remover onto the worm thread of used hose clips before installing.*

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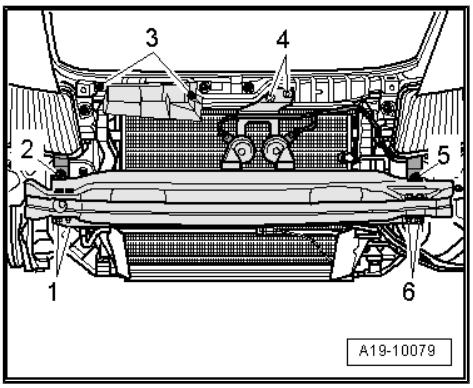
– Install headlight ⇒ Rep. gr. 94 .
– Install bumper cover (front) ⇒ Rep. gr. 63 .
– Install front left wheel housing liner ⇒ Rep. gr. 66 .
– Check headlight adjustment ⇒ Maintenance ; Booklet 405 .

Tightening torque

Component	Nm
Hose clips (13 mm wide)	5.5

2.3 Removing and installing charge air cooler (centre)

Removing



Note

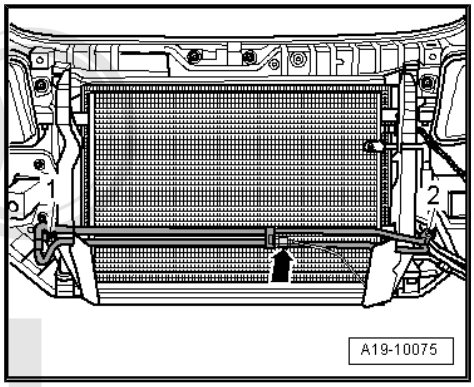
If there are slight impressions on the fins, refer to ⇒ page 7 .

– Remove bumper cover (front) ⇒ Rep. gr. 63 .
– Unscrew brackets -2- and -5- for headlights.
– Unscrew nuts -1- and -6- and remove bumper.

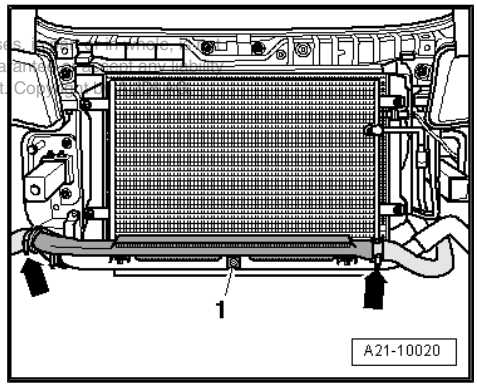
Note

Disregard items -3- and -4-.

– Unclip ambient temperature sensor -G17- -arrow- from bracket.
– Unscrew bolts -1- and -2- for power steering cooling pipe; the hydraulic hoses remain attached.
– Detach air ducts (left and right) from radiator.



– Remove bolt -1-.
– Detach charge air cooler (centre) from air intake hoses -arrows-.



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Installing

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

Note

- *Hose connections and hoses for charge air system must be free of oil and grease before assembly.*
- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*
- *To ensure that the charge air hoses can be properly secured at their connections, spray rust remover onto the worm thread of used hose clips before installing.*

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

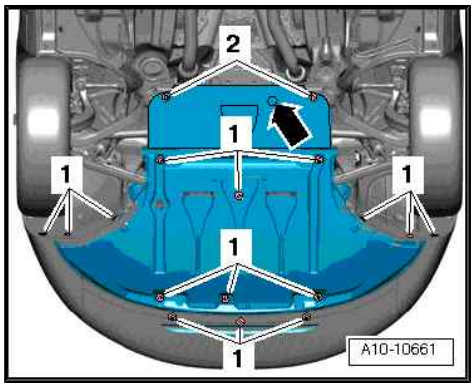
Tightening torques

Component	Nm
Charge air cooler (centre) to air pipe	9
Power steering cooling pipe to condenser	9

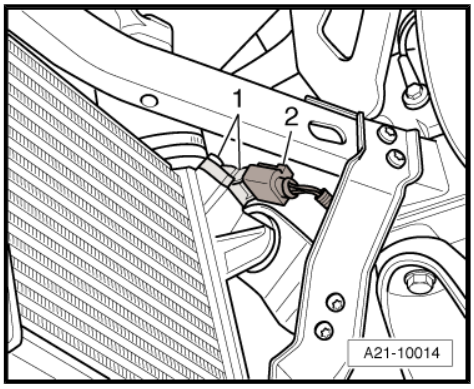
2.4 Removing and installing charge pressure sender -G31-

Removing

– Release fasteners marked -1, 2- and -arrow- (if fitted) and remove front and rear noise insulation.
– Remove front left wheel housing liner ⇒ Rep. gr. 66 .



– Unplug electrical connector -2- at charge pressure sender -G31- .
– Remove bolts -1- and pull charge pressure sender -G31- out of charge air cooler.



Installing

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

Note

Renew O-ring.

– Install front left wheel housing liner ⇒ Rep. gr. 66 .

Tightening torque

Component	Nm
Charge pressure sender -G31- to charge air cooler	5

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26 – Exhaust system

1 Silencers - vehicles without particulate filter

Note

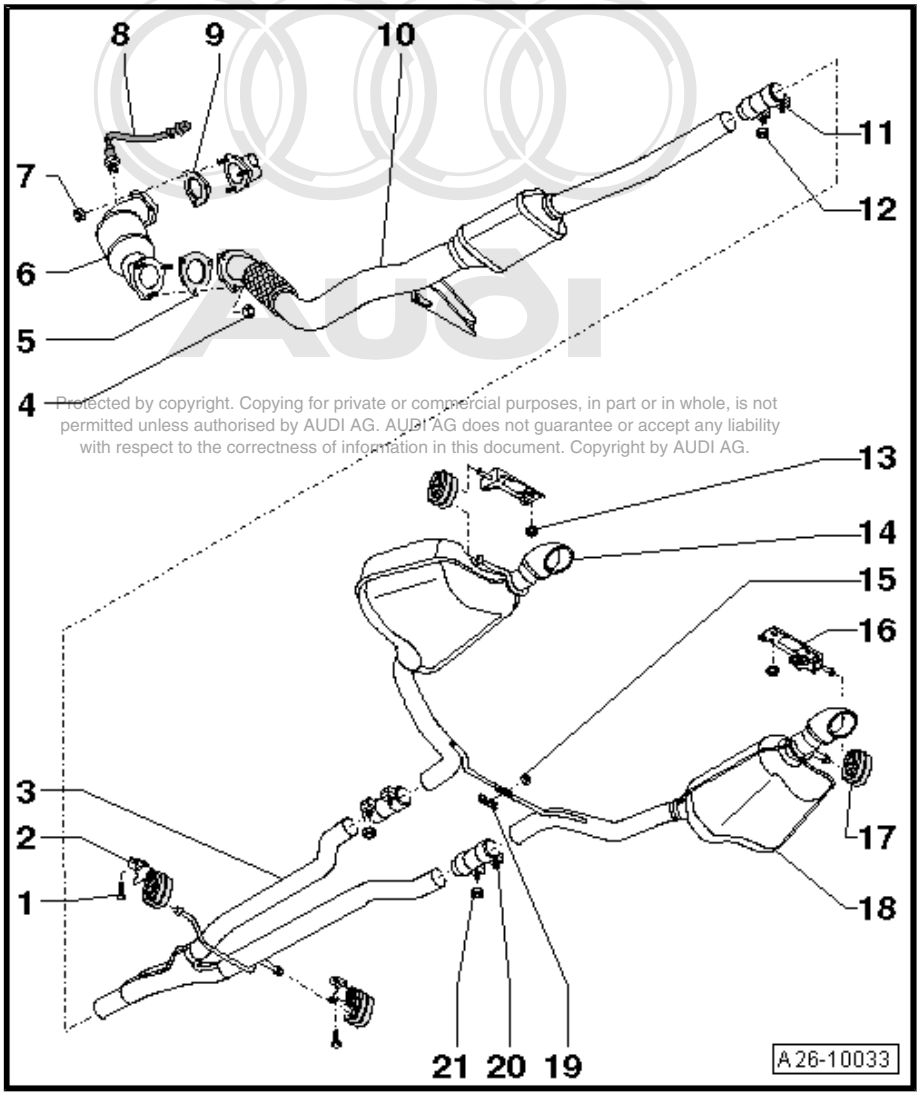
- *Renew gaskets and self-locking nuts.*
- *After working on the exhaust system, ensure that the system is not under stress and that it has sufficient clearance from the body. If necessary, loosen clamps and align silencers and exhaust pipes so that sufficient clearance is maintained to the body at all points and the mountings are evenly loaded.*
- *To avoid any damage, the flexible joint in the front exhaust pipe must not be bent more than 10°.*

1.1 Exhaust system - exploded view

Note

The illustration shows the exhaust system for vehicles with four-wheel drive.

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1 - 23 Nm

2 - Rubber mounting

- ❑ Renew if damaged
- ❑ Check preload ⇒ „3.3 Stress-free alignment of exhaust system“, page 366

3 - Y-pipe

- ❑ Combined in one unit with rear silencers as original equipment. Can be renewed individually for repair purposes
- ❑ Cutting point ⇒ page 365
- ❑ Align exhaust system so it is free of stress ⇒ page 366

4 - 23 Nm

- ❑ Renew

5 - Gasket

- ❑ Renew

6 - Starter catalytic converter

- ❑ Removing and installing: vehicles with manual gearbox ⇒ page 341 ; vehicles with automatic gearbox ⇒ page 343
- ❑ Align exhaust system so it is free of stress ⇒ page 366

7 - 27 Nm

- ❑ Renew
- ❑ Coat with high-temperature paste; for high-temperature paste refer to ⇒ Electronic parts catalogue

8 - Lambda probe -G39-

- ❑ Not on 2.7 ltr. engine without particulate filter
- ❑ The threads on the new Lambda probes are coated with a special assembly paste.
- ❑ If re-installing old Lambda probe, coat thread with high-temperature paste: Refer to ⇒ Electronic parts catalogue for high-temperature paste
- ❑ The assembly paste/high-temperature paste must not get into the slots on the probe body.
- ❑ Removing and installing ⇒ Rep. gr. 23

9 - Gasket

- ❑ Renew

10 - Front exhaust pipe with catalytic converter

- ❑ With flexible joint
- ❑ Removing and installing: vehicles with manual gearbox ⇒ page 347 ; vehicles with automatic gearbox ⇒ page 349
- ❑ Protect against knocks and impact
- ❑ Do not bend flexible joint more than 10° – otherwise it can be damaged
- ❑ Components of mountings ⇒ page 341 and ⇒ page 341
- ❑ Align exhaust system so it is free of stress ⇒ page 366

11 - Clamp (front)

- ❑ Installation position ⇒ page 340
- ❑ Before tightening, align exhaust system so it is free of stress ⇒ page 366
- ❑ Tighten bolt connections evenly

12 - 23 Nm

13 - 23 Nm

14 - Rear silencer with tailpipe

- ❑ For left side of vehicle
- ❑ Combined as one unit with centre silencer as original equipment
- ❑ Centre silencer, rear silencer and tailpipe can be renewed separately as required
- ❑ Cutting point: centre silencer / rear silencer ⇒ page 365
- ❑ Cutting point: rear silencer / tailpipe ⇒ page 365
- ❑ Align exhaust system so it is free of stress ⇒ page 366

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15 - 25 Nm

- ❑ Renew

16 - Mounting

17 - Rubber mounting

- ❑ Renew if damaged
- ❑ Check preload ⇒ „3.3 Stress-free alignment of exhaust system“, page 366

18 - Rear silencer with tailpipe

- ❑ For right side of vehicle
- ❑ Combined as one unit with centre silencer as original equipment
- ❑ Centre silencer, rear silencer and tailpipe can be renewed separately as required
- ❑ Cutting point: centre silencer / rear silencer ⇒ page 365
- ❑ Cutting point: rear silencer / tailpipe ⇒ page 365
- ❑ Align exhaust system so it is free of stress ⇒ page 366

19 - Retainer

20 - Clamp (rear)

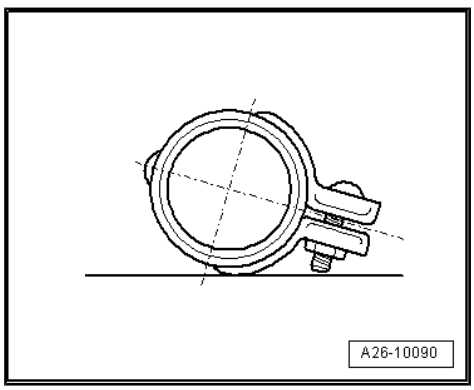
- ❑ For separate replacement of Y-pipe and rear silencers
- ❑ Before tightening, align exhaust system so it is free of stress ⇒ page 366
- ❑ Installation position ⇒ page 341
- ❑ Tighten bolt connections evenly

21 - 23 Nm

Installation position of front clamp

– Install clamp so that ends of bolts do not protrude beyond bottom of clamp.

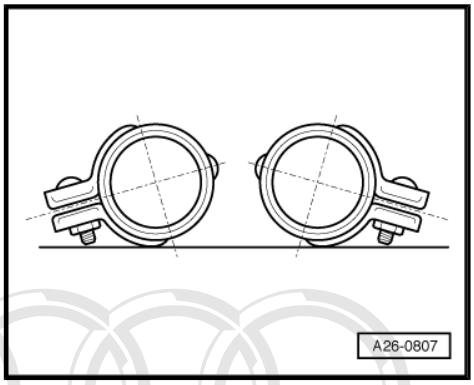
• Bolt connection faces to right.



Installation position of rear clamps

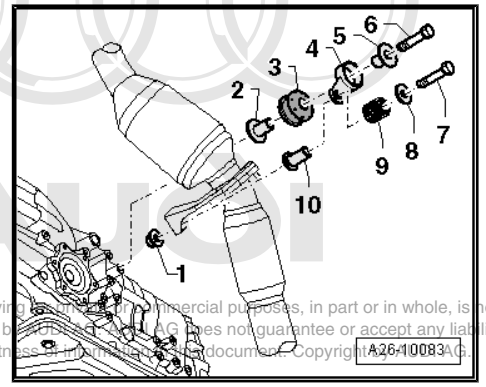
– Install clamps so that the bolt ends do not protrude beyond bottom of clamp.

• Bolt connections face outwards.



Components of mountings for starter catalytic converter

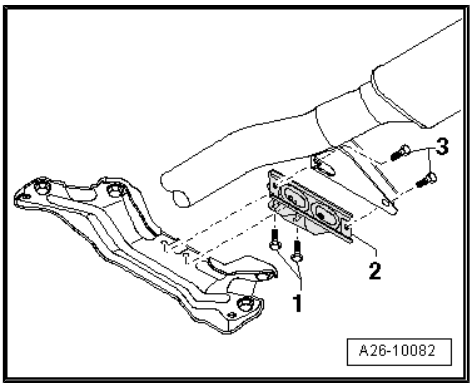
1 - Bolt, 23 Nm
2 - Spacer sleeve
3 - Buffer
4 - Bracket
5 - Spacer sleeve
6 - Bolt, 23 Nm
7 - Bolt
8 - Washer
9 - Compression spring
10 - Spacer sleeve



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Components of centre bracket for front exhaust pipe

1 - Bolt, 23 Nm
2 - Bracket
3 - Bolt, 23 Nm



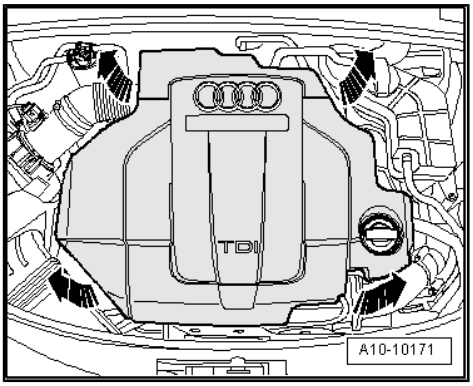
1.2 Removing and installing starter catalytic converter - vehicles with manual gearbox

Removing

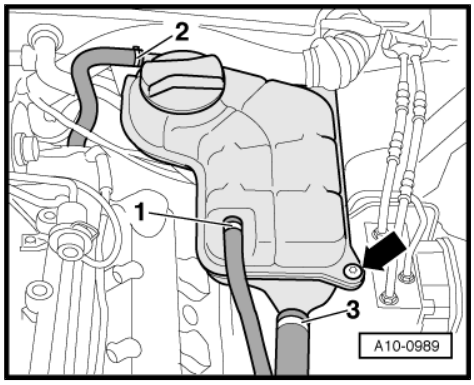
Note

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

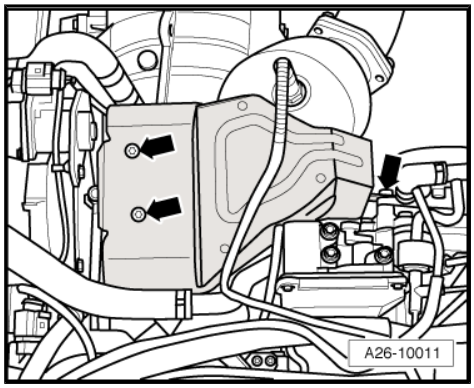
– Carefully pull engine cover panel off four retaining pins one after the other -arrows-.



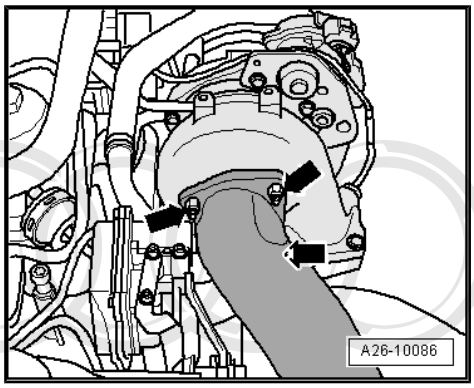
– Unbolt coolant expansion tank -arrow-.
– Detach electrical connector at coolant shortage indicator switch -F66- on coolant expansion tank (bottom).
– Lay aside coolant expansion tank with coolant hoses -1 … 3- connected.



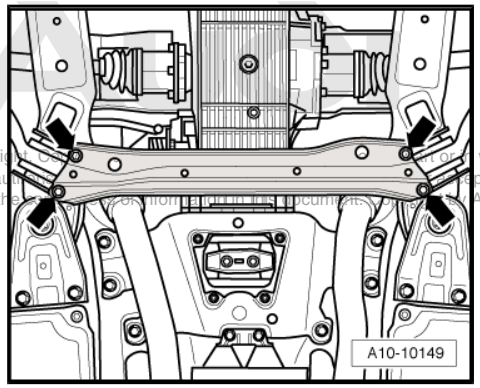
– Remove heat shield for turbocharger -arrows-.



– Unscrew nuts -arrows- and detach starter catalytic converter from turbocharger.

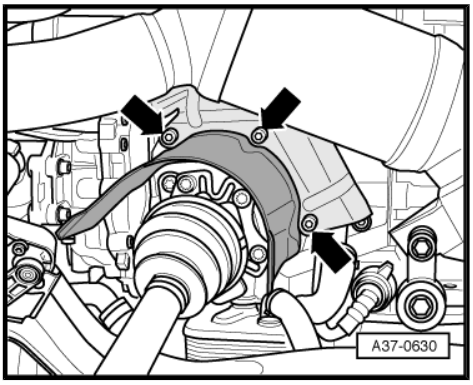


– Unbolt cross piece from subframe -arrows-.
– Remove front exhaust pipe together with catalytic converter ⇒ page 347 .



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– Unbolt heat shield above drive shaft (left-side) from gearbox -arrows-.



– Detach starter catalytic converter.

Installing

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

Note

- *Renew gaskets and self-locking nuts.*
- *Fit all cable ties in the original positions when installing.*

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– Install cross piece on subframe ⇒ Rep. gr. 40 .

– Install front exhaust pipe together with catalytic converter ⇒ page 347 .

– Align exhaust system so it is free of stress ⇒ page 366 .

Tightening torques

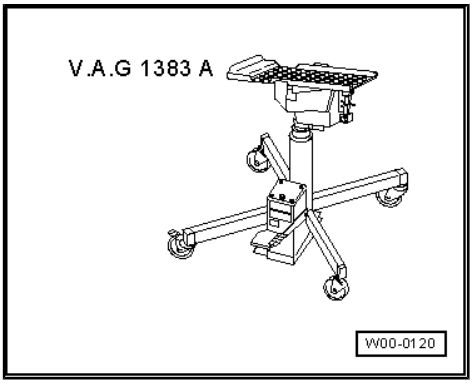
Component	Nm
Starter catalytic converter to turbocharger	27 1)2)
Heat shield to turbocharger	9
Drive shaft heat shield to gearbox	23

- 1) Renew nuts.
- 2) Coat with high-temperature paste; for high-temperature paste refer to ⇒ Electronic parts catalogue

1.3 Removing and installing starter catalytic converter - vehicles with automatic gearbox

Special tools and workshop equipment required

- Engine and gearbox jack -V.A.G 1383 A-

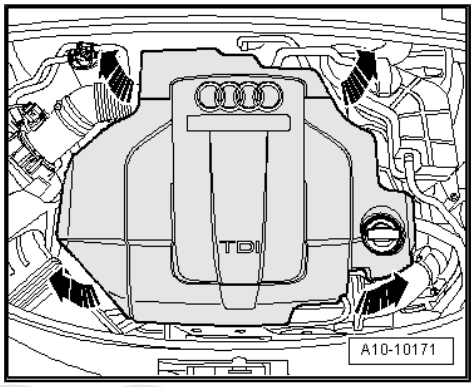


Removing

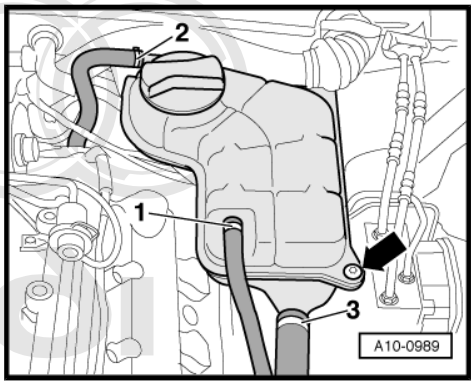
Note

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

– Carefully pull engine cover panel off four retaining pins one after the other -arrows-.

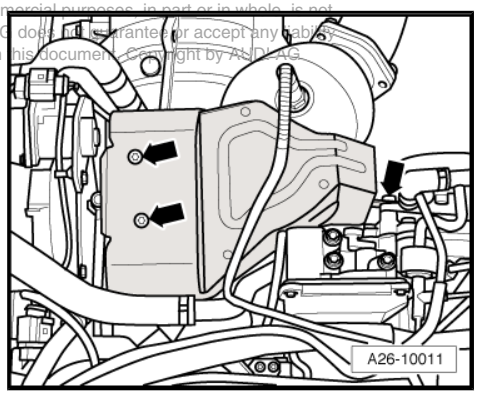


– Unbolt coolant expansion tank -arrow-.
– Detach electrical connector at coolant shortage indicator switch -F66- on coolant expansion tank (bottom).
– Lay aside coolant expansion tank with coolant hoses -1 … 3- connected.

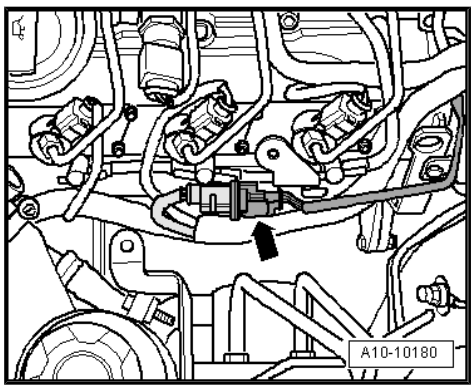


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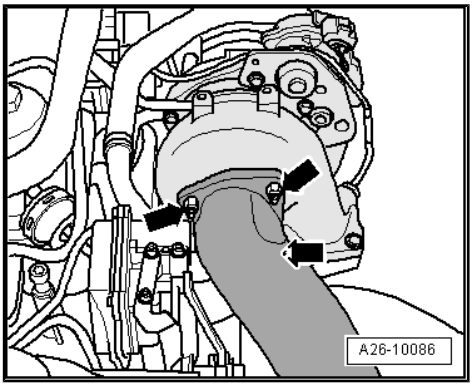
– Remove heat shield for turbocharger -arrows-.



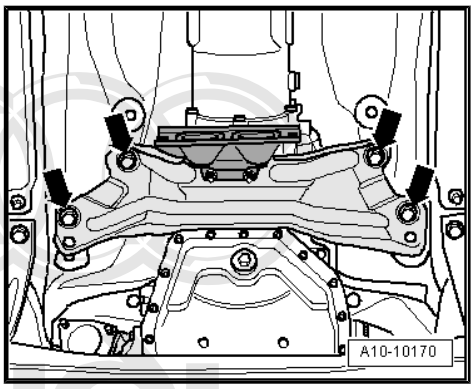
– Unplug electrical connector -arrow- for Lambda probe -G39- and move wiring clear downwards.



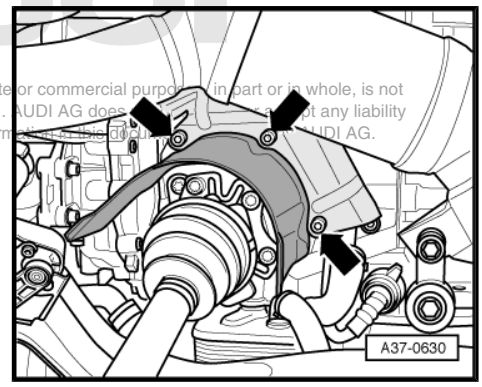
– Unscrew nuts -arrows- and detach starter catalytic converter from turbocharger.
– Remove front exhaust pipe together with catalytic converter ⇒ page 349 .



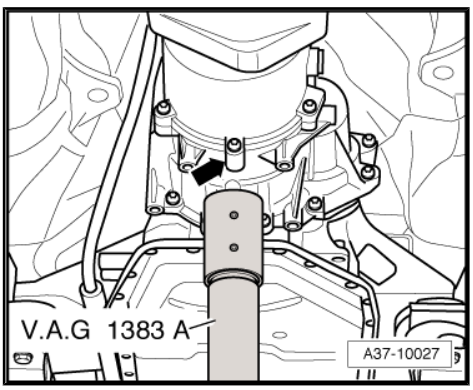
– Remove bolts -arrows- at tunnel cross member.
– Detach tunnel cross member.



– Unbolt heat shield above drive shaft (left-side) from gearbox -arrows-.

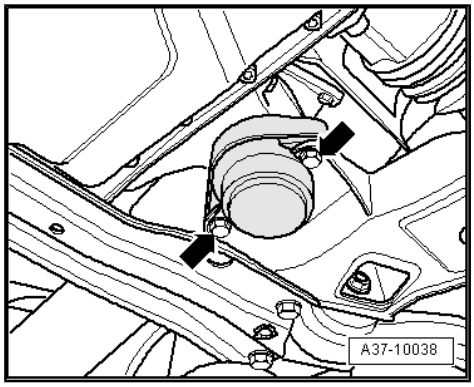


– Apply lifting column of engine and gearbox jack -V.A.G 1383 A- at centre of gearbox housing casting -arrow- and support gearbox from below.

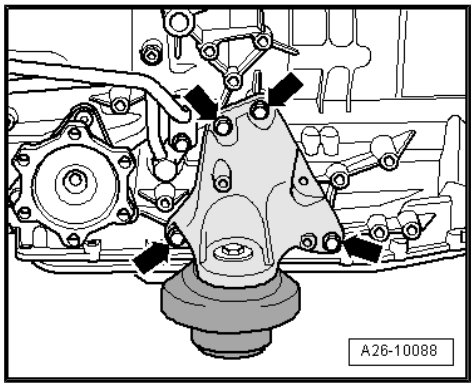


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– Unscrew bolts -arrows- below gearbox mounting (left-side).



– If fitted, remove bolts -arrows- and detach gearbox support with gearbox mounting.



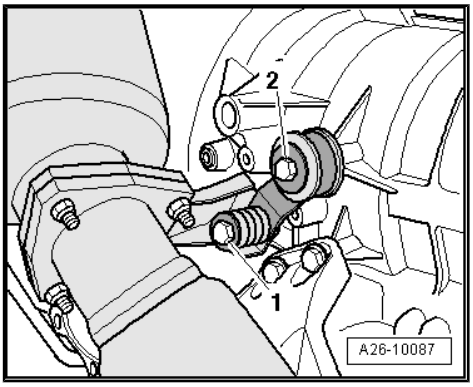
Note

Shown in illustration with gearbox removed.

– Lower gearbox slightly using engine and gearbox jack -V.A.G 1383 A- .

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– Remove bolt -1- on bracket for starter catalytic converter.



Note

Disregard -item 2-.

– Detach starter catalytic converter.

Installing

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

Note

- *Renew gaskets and self-locking nuts.*
- *Fit all cable ties in the original positions when installing.*

– Install gearbox support with gearbox mounting ⇒ Rep. gr. 37 .

– Fit tunnel cross piece ⇒ Rep. gr. 40 .

– Install front exhaust pipe together with catalytic converter ⇒ page 349 .

– Align exhaust system so it is free of stress ⇒ page 366 .

Tightening torques

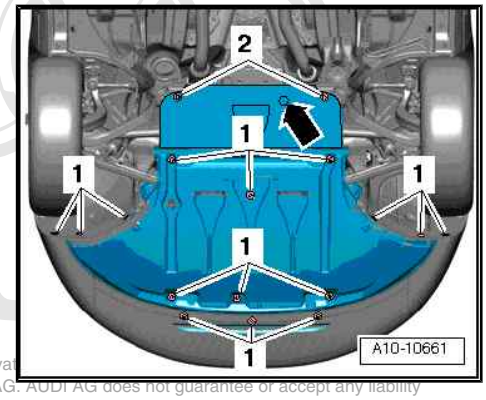
Component	Nm
Starter catalytic converter to bracket	23
Starter catalytic converter to turbocharger	27 1)2)
Heat shield to turbocharger	9
Drive shaft heat shield to gearbox	23

- 1) Renew nuts.
- 2) Coat with high-temperature paste; for high-temperature paste refer to ⇒ Electronic parts catalogue

1.4 Removing and installing front exhaust pipe with catalytic converter - vehicles with manual gearbox

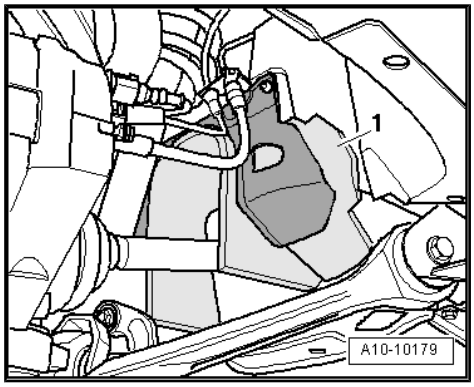
Removing

– Release fasteners marked -1, 2- and -arrow- (if fitted) and remove front and rear noise insulation.

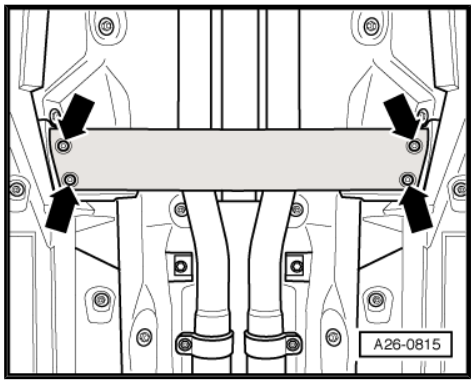


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– Remove noise insulation -1- in wheel housing (left-side).



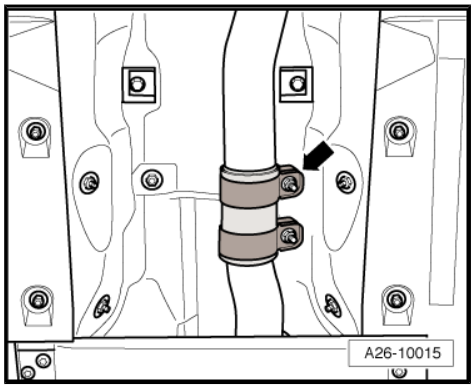
– Remove front cross piece -arrows-.



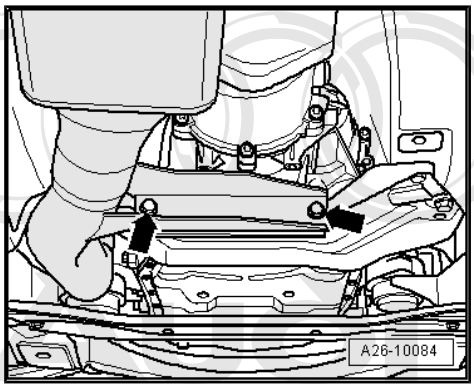
Note

To avoid any damage, the flexible joint in the front exhaust pipe must not be bent more than 10°.

– Disconnect exhaust system at clamp -arrow-.

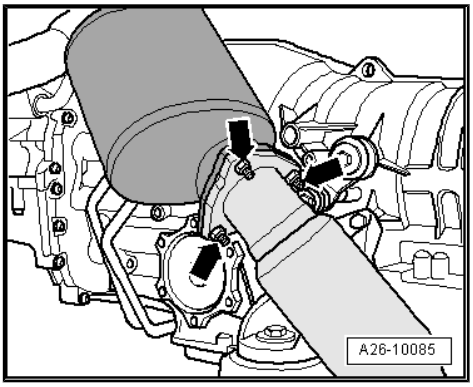


– Remove bolts -arrows- at centre bracket for front exhaust pipe.



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– Unscrew nuts -arrows- and take out front exhaust pipe with catalytic converter.



Installing

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

Note

Renew gaskets and self-locking nuts.

– Install cross piece (front) ⇒ Rep. gr. 50 .

– Align exhaust system so it is free of stress ⇒ page 366 .

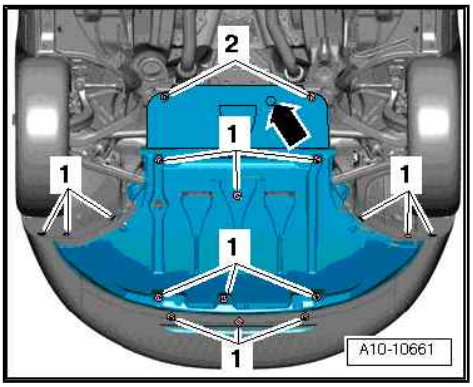
Tightening torques

Component	Nm
Front exhaust pipe to starter catalytic converter	23 1)
Front exhaust pipe to bracket	23
Front exhaust pipe to centre bracket	23
• 1) Renew nuts/bolts.	

1.5 Removing and installing front exhaust pipe with catalytic converter - vehicles with automatic gearbox

Removing

– Remove front left wheel.

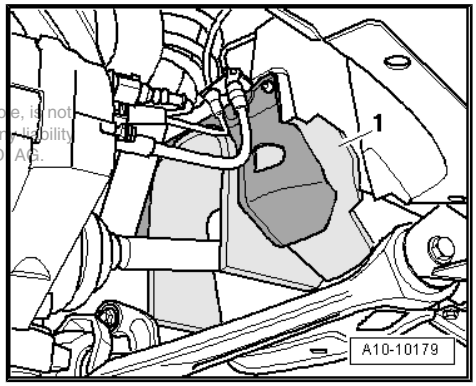


Note

Secure brake disc with one wheel bolt.

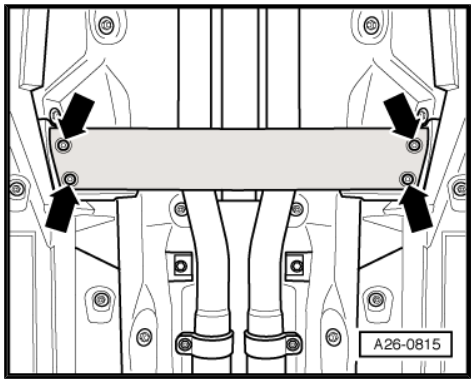
– Release fasteners marked -1, 2- and -arrow- (if fitted) and remove front and rear noise insulation.

– Remove noise insulation -1- in wheel housing (left-side).



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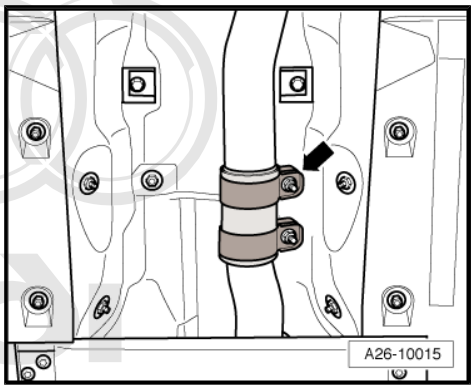
– Remove front cross piece -arrows-.



Note

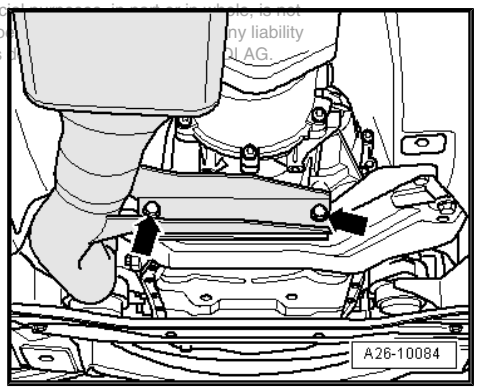
To avoid any damage, the flexible joint in the front exhaust pipe must not be bent more than 10°.

– Disconnect exhaust system at clamp -arrow-.

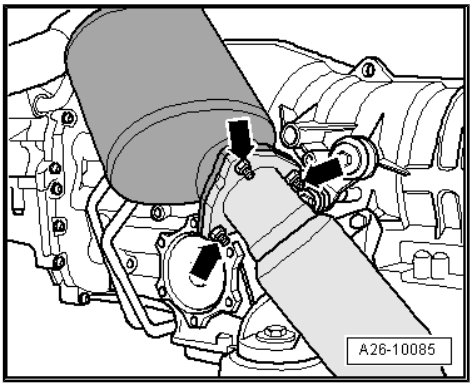


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– Remove bolts -arrows- at centre bracket for front exhaust pipe.



– Unscrew nuts -arrows- and take out front exhaust pipe with catalytic converter.



Installing

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

Note

Renew gaskets and self-locking nuts.

– Install cross piece (front) ⇒ Rep. gr. 50 .

– Align exhaust system so it is free of stress ⇒ page 366 .

Tightening torques

Component	Nm
Front exhaust pipe to starter catalytic converter	23 1)
Front exhaust pipe to centre bracket	23
• 1) Renew nuts/bolts.	

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2 Silencers - vehicles with particulate filter

Note

- *Renew gaskets and self-locking nuts.*
- *After working on the exhaust system, ensure that the system is not under stress and that it has sufficient clearance from the body. If necessary, loosen clamps and align silencers and exhaust pipes so that sufficient clearance is maintained to the body at all points and the mountings are evenly loaded.*
- *To avoid any damage, the flexible joint in the front exhaust pipe must not be bent more than 10°.*

2.1 Exhaust system - exploded view

Note

The illustration shows the exhaust system for vehicles with four-wheel drive.

1 - 23 Nm

2 - Rubber mounting

- ❑ Renew if damaged
- ❑ Check preload
  ⇒ „3.3 Stress-free alignment of exhaust system“, page 366

3 - Y-pipe

- ❑ Combined in one unit with rear silencers as original equipment. Can be renewed individually for repair purposes
- ❑ Cutting point
  ⇒ page 365
- ❑ Align exhaust system so it is free of stress
  ⇒ page 366

4 - 23 Nm

- ❑ Renew

5 - Exhaust gas temperature sender 2 -G448-

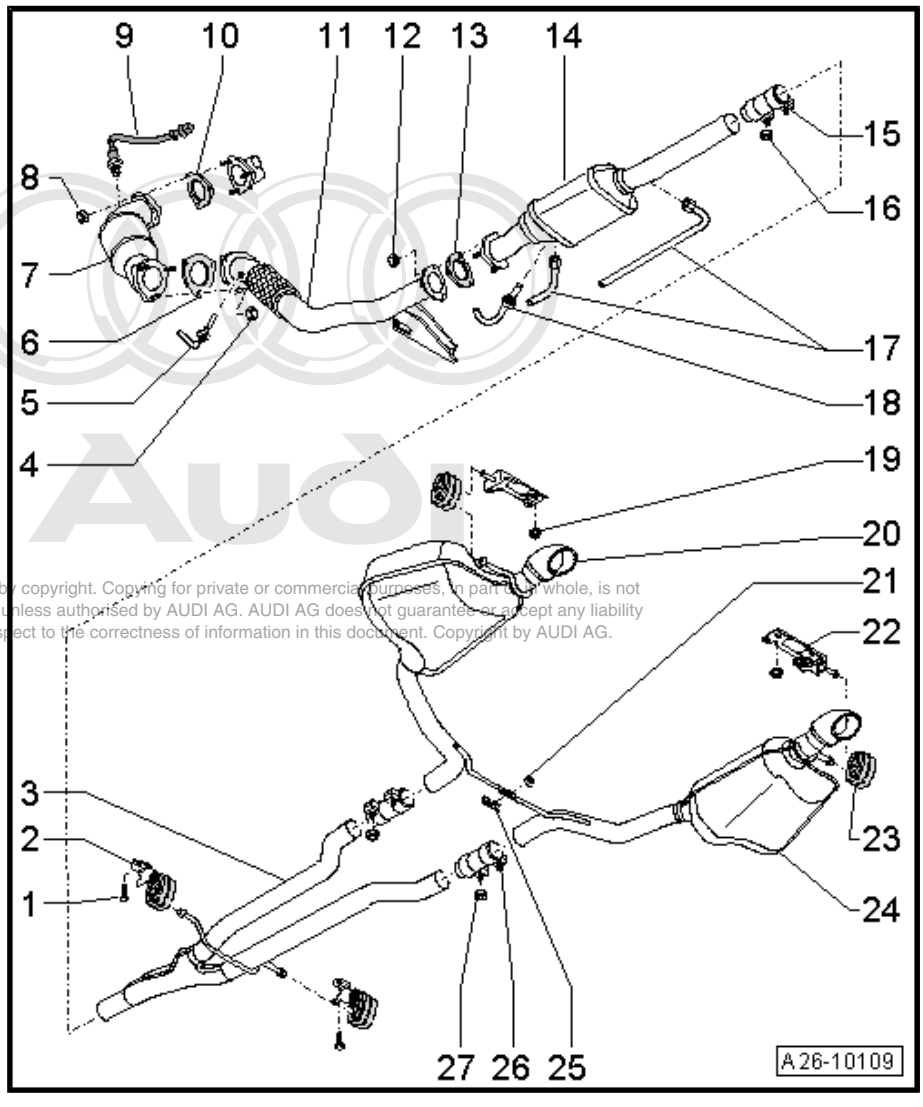
- ❑ Removing and installing
  ⇒ page 380

6 - Gasket

- ❑ Renew

7 - Starter catalytic converter

- ❑ Removing and installing
  ⇒ page 355
- ❑ Stress-free alignment of exhaust system



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8 - 27 Nm

- ❑ Renew
- ❑ Coat with high-temperature paste; for high-temperature paste refer to ⇒ Electronic parts catalogue

9 - Lambda probe -G39-

- ❑ The threads on the new Lambda probes are coated with a special assembly paste.
- ❑ If re-installing old Lambda probe, coat thread with high-temperature paste: Refer to ⇒ Electronic parts catalogue for high-temperature paste
- ❑ The assembly paste/high-temperature paste must not get into the slots on the probe body.
- ❑ Removing and installing ⇒ Rep. gr. 23

10 - Gasket

- ❑ Renew

11 - Front exhaust pipe

- ❑ With flexible joint
- ❑ Removing and installing ⇒ page 359
- ❑ Protect against knocks and impact
- ❑ Do not bend flexible joint more than 10° – otherwise it can be damaged
- ❑ Components of mountings ⇒ page 355 and ⇒ page 355
- ❑ Align exhaust system so it is free of stress ⇒ page 366

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12 - 23 Nm

- ❑ Renew

13 - Gasket

- ❑ Renew

14 - Diesel particulate filter with catalytic converter

- ❑ Removing and installing ⇒ page 361
- ❑ After renewing particulate filter perform adaption in „Guided Fault Finding“ ⇒ Vehicle diagnostic tester.

15 - Clamp (front)

- ❑ Installation position ⇒ page 354
- ❑ Before tightening, align exhaust system so it is free of stress ⇒ page 366
- ❑ Tighten bolt connections evenly

16 - 23 Nm

17 - Pressure pipes

- ❑ Tighten union nuts to 45 Nm.

18 - Temperature sender before particulate filter -G506-

- ❑ Removing and installing ⇒ page 382
- ❑ Coat thread with high-temperature paste; for high-temperature paste refer to ⇒ Electronic parts catalogue

19 - 23 Nm

20 - Rear silencer with tailpipe

- ❑ For left side of vehicle
- ❑ Combined as one unit with centre silencer as original equipment
- ❑ Centre silencer, rear silencer and tailpipe can be renewed separately as required
- ❑ Cutting point: centre silencer / rear silencer ⇒ page 365
- ❑ Cutting point: rear silencer / tailpipe ⇒ page 365
- ❑ Align exhaust system so it is free of stress ⇒ page 366

21 - 25 Nm

- ❑ Renew

22 - Mounting

23 - Rubber mounting

- ❑ Renew if damaged
- ❑ Check preload ⇒ „3.3 Stress-free alignment of exhaust system“, page 366

24 - Rear silencer with tailpipe

- ❑ For right side of vehicle
- ❑ Combined as one unit with centre silencer as original equipment
- ❑ Centre silencer, rear silencer and tailpipe can be renewed separately as required
- ❑ Cutting point: centre silencer / rear silencer ⇒ page 365
- ❑ Cutting point: rear silencer / tailpipe ⇒ page 365
- ❑ Align exhaust system so it is free of stress ⇒ page 366

25 - Retainer

26 - Clamp (rear)

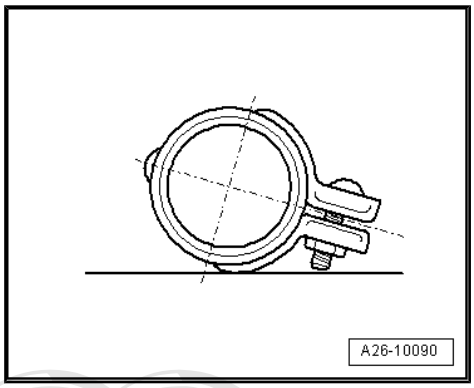
- ❑ For separate replacement of Y-pipe and rear silencers
- ❑ Before tightening, align exhaust system so it is free of stress ⇒ page 366
- ❑ Installation position ⇒ page 354
- ❑ Tighten bolt connections evenly

27 - 23 Nm

Installation position of front clamp

– Install clamp so that ends of bolts do not protrude beyond bottom of clamp.

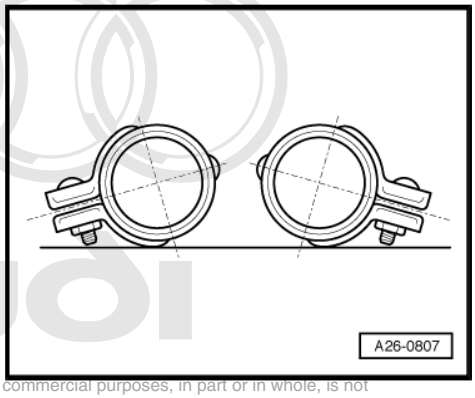
• Bolt connection faces to right.



Installation position of rear clamps

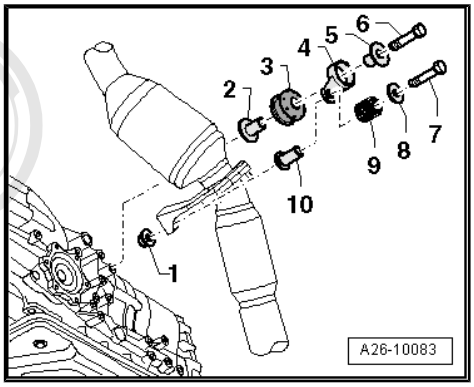
– Install clamps so that the bolt ends do not protrude beyond bottom of clamp.

• Bolt connections face outwards.



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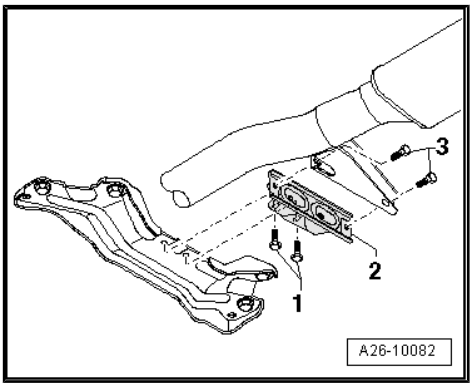
Components of mountings for starter catalytic converter



1 - Bolt, 23 Nm
2 - Spacer sleeve
3 - Buffer
4 - Bracket
5 - Spacer sleeve
6 - Bolt, 23 Nm
7 - Bolt
8 - Washer
9 - Compression spring
10 - Spacer sleeve

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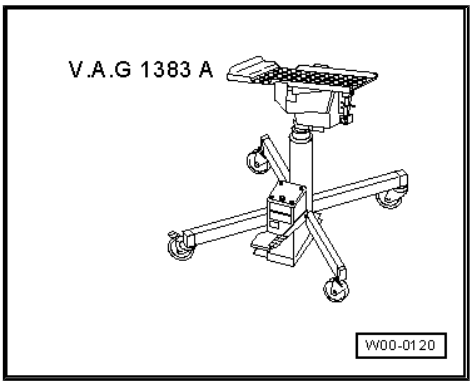
Components of centre bracket for front exhaust pipe



1 - Bolt, 23 Nm
2 - Bracket
3 - Bolt, 23 Nm

2.2 Removing and installing starter catalytic converter

Special tools and workshop equipment required



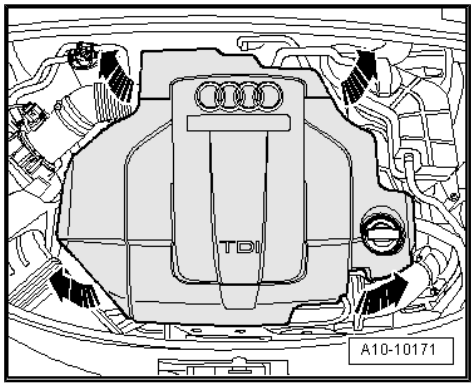
- Engine and gearbox jack -V.A.G 1383 A-

Removing

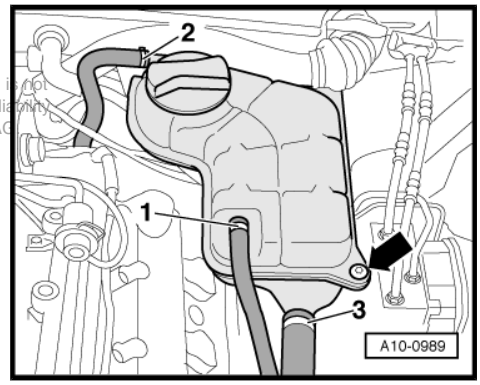
Note

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

– Carefully pull engine cover panel off four retaining pins one after the other -arrows-.

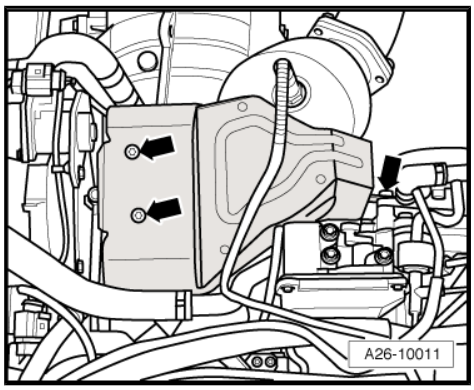


– Unbolt coolant expansion tank -arrow-.
– Detach electrical connector at coolant shortage indicator switch -F66- on coolant expansion tank (bottom).
– Lay aside coolant expansion tank with coolant hoses -1 … 3- connected.

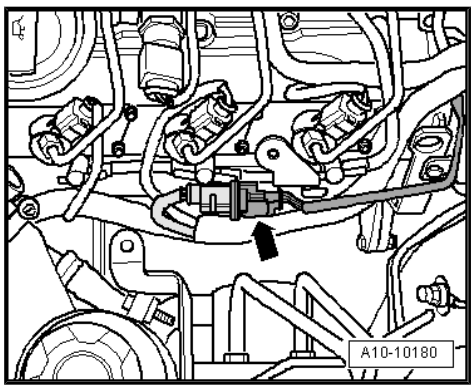


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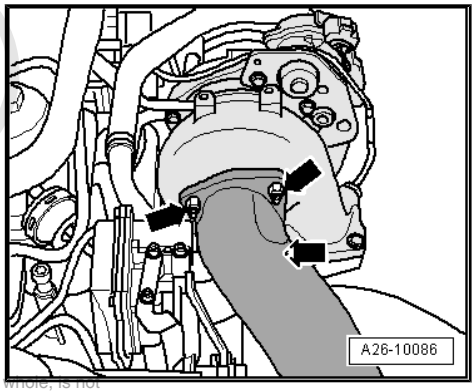
– Remove heat shield for turbocharger -arrows-.



– Unplug electrical connector -arrow- for Lambda probe -G39- and move wiring clear downwards.

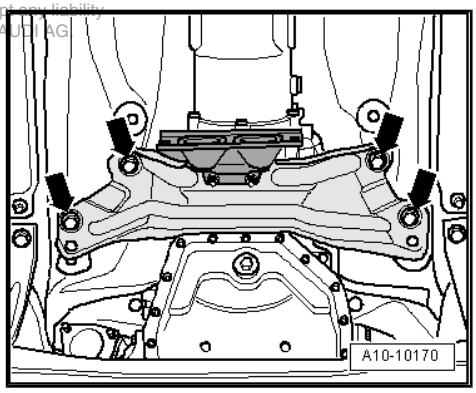


– Unscrew nuts -arrows- and detach starter catalytic converter from turbocharger.
– Remove front exhaust pipe ⇒ page 359 .

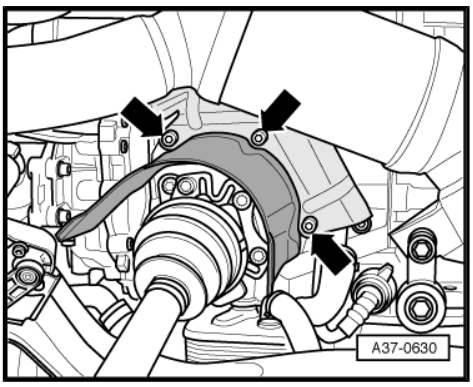


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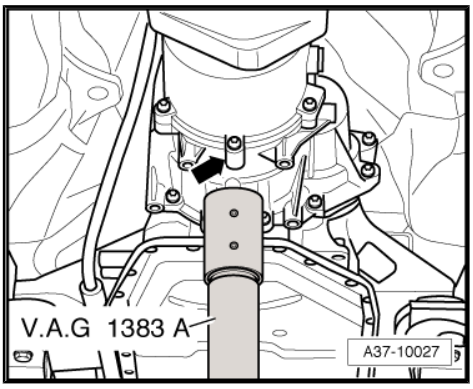
– Remove bolts -arrows- at tunnel cross member.
– Detach tunnel cross member.



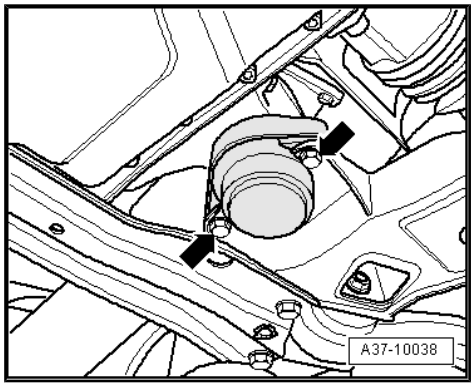
– Unbolt heat shield above drive shaft (left-side) from gearbox -arrows-.



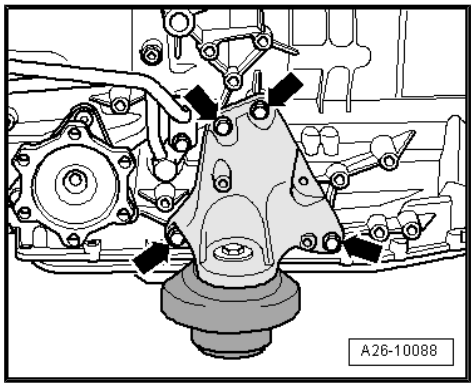
– Apply lifting column of engine and gearbox jack -V.A.G 1383 A- at centre of gearbox housing casting -arrow- and support gearbox from below.



– Unscrew bolts -arrows- below gearbox mounting (left-side).



– Remove bolts -arrows-.
– Remove gearbox support with gearbox mounting.



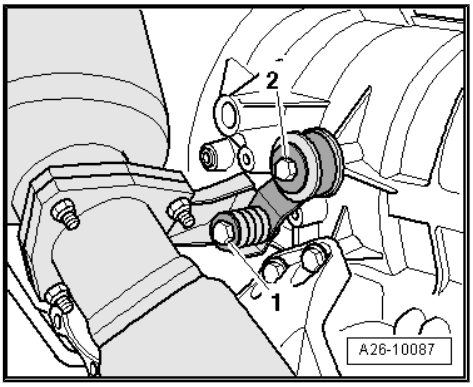
Note

Shown in illustration with gearbox removed.

– Lower gearbox slightly using engine and gearbox jack -V.A.G 1383 A- .

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– Remove bolt -1- on bracket for starter catalytic converter.



Note

Disregard -item 2-.

– Detach starter catalytic converter.

Installing

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

Note

- *Renew gaskets and self-locking nuts.*
- *Fit all cable ties in the original positions when installing.*

– Install gearbox support with gearbox mounting ⇒ Rep. gr. 37 .
– Fit tunnel cross piece ⇒ Rep. gr. 40 .
– Install front exhaust pipe ⇒ page 359 .
– Align exhaust system so it is free of stress ⇒ page 366 .

Tightening torques

Component	Nm
Starter catalytic converter to bracket	23
Starter catalytic converter to turbocharger	27 1)2)
Heat shield to turbocharger	9
Drive shaft heat shield to gearbox	23

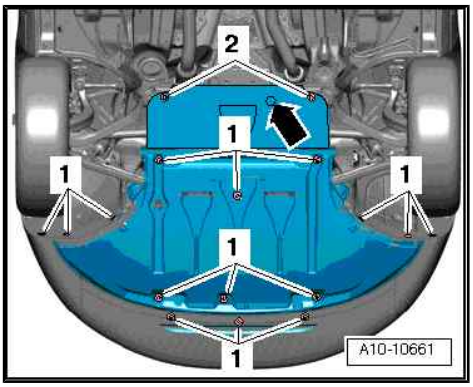
- 1) Renew nuts.
- 2) Coat with high-temperature paste; for high-temperature paste refer to ⇒ Electronic parts catalogue

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2.3 Removing and installing front exhaust pipe

Removing

– Remove front left wheel.

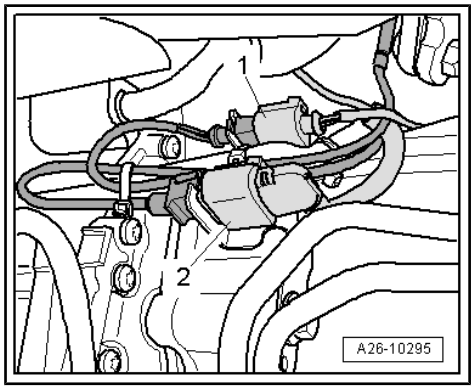


Note

Secure brake disc with one wheel bolt.

– Release fasteners marked -1, 2- and -arrow- (if fitted) and remove front and rear noise insulation.

– Unplug electrical connector -1- for exhaust gas temperature sender 2 -G448- at front of gearbox (left-side) and move electrical wiring clear.

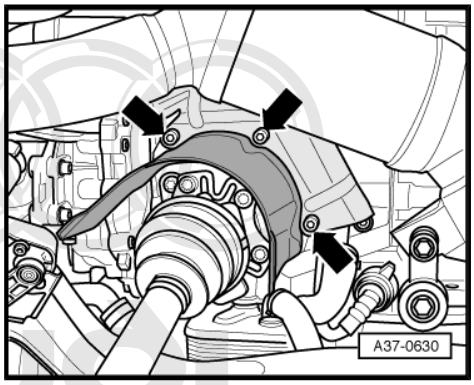


Note

Disregard -item 2-.

– Move wiring clear.

– Unbolt heat shield above drive shaft (left-side) from gearbox -arrows-.

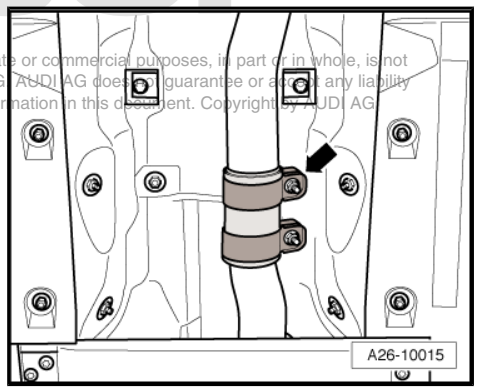


Note

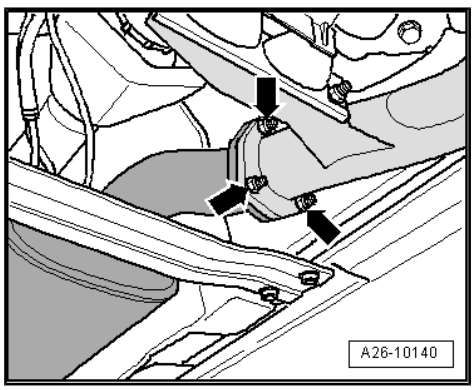
To avoid any damage, the flexible joint in the front exhaust pipe must not be bent more than 10°.

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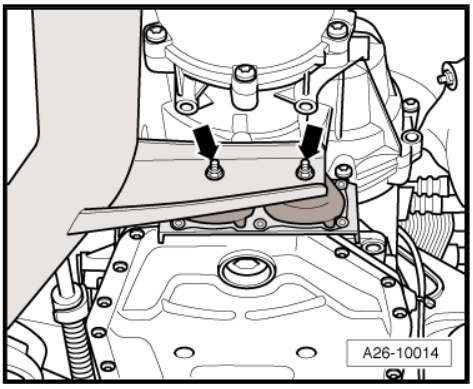
– Disconnect exhaust system at clamp -arrow- and push clamp forwards.



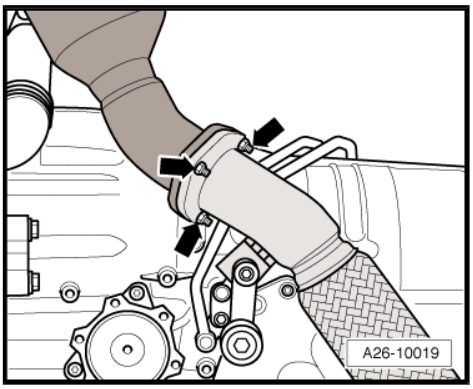
– Unscrew nuts -arrows-.
– Place the particulate filter onto cross piece.



– Remove nuts -arrows- at centre bracket for front exhaust pipe.



– Unscrew nuts -arrows- and remove front exhaust pipe.



Installing

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

Note

Renew gaskets and self-locking nuts.

– Align exhaust system so it is free of stress ⇒ page 366 .

Tightening torques

Component		Nm
Front exhaust pipe to starter catalytic converter		23 1)
Bracket for front exhaust pipe to:	Gearbox support	23
	Front exhaust pipe	23
Front exhaust pipe to centre bracket		23
Front exhaust pipe to particulate filter		23 1)
Drive shaft heat shield to gearbox		23

• 1) Renew nuts/bolts.

2.4 Removing and installing particulate filter with catalytic converter

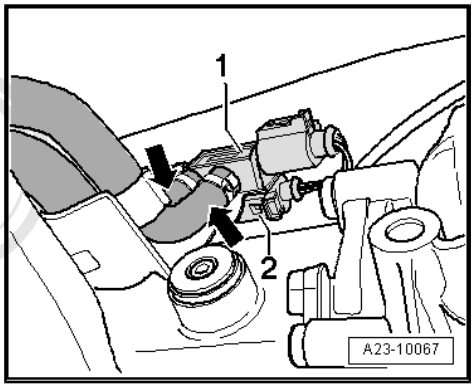
Removing

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Note

- *Fit all heat insulation sleeves in the original position when installing.*
- *All cable ties which are released or cut open when removing must be fitted in the same position when installing.*

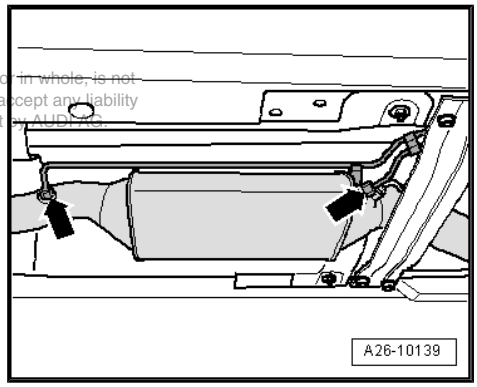
– Disengage the electrical connector -2- from retainer at gearbox (right-side).
– Unplug electrical connector and move wiring clear.



Note

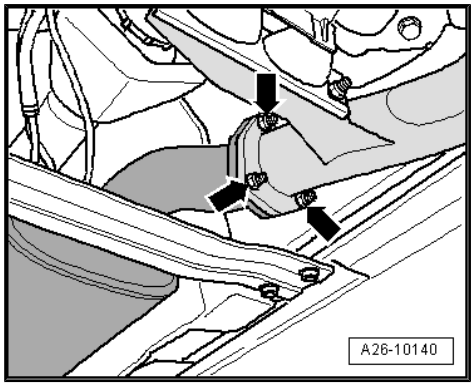
Ignore items marked -1- and -arrows-.

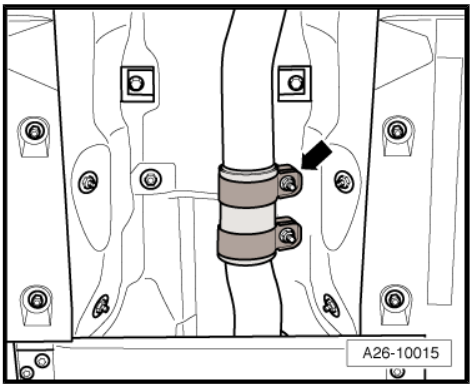
– Unscrew pressure pipes -arrows- from particulate filter.



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– Unscrew nuts -arrows-.





Note

To avoid any damage, the flexible joint in the front exhaust pipe must not be bent more than 10°.

– Disconnect exhaust system at clamp -arrow-.
– Detach particulate filter with catalytic converter.

Installing

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

Note

- *Reinstall heat insulation sleeves in the same locations when assembling.*
- *Fit all cable ties in the original positions when installing.*

– Align exhaust system so it is free of stress ⇒ page 366 .
– After renewing particulate filter perform adaption in „Guided Fault Finding“ ⇒ Vehicle diagnostic tester.

Tightening torques

Component	Nm
Particulate filter with catalytic convertor to front exhaust pipe	23 1)
Pressure pipes to particulate filter	45

• 1) Renew nuts.

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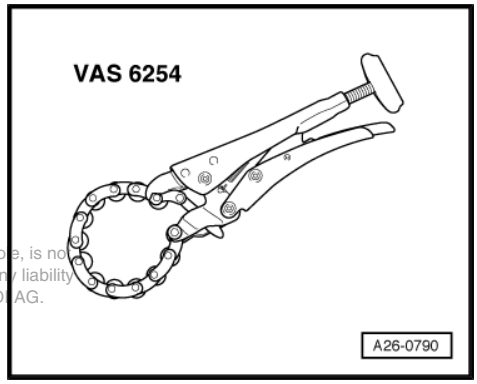
3 Y-pipe and rear silencers

3.1 Separating Y-pipe and rear silencers

- The connecting pipe can be cut through at the point marked in order to renew the Y-pipe or rear silencer(s) separately.
- The cutting point is marked by an indentation on the circumference of the exhaust pipe.

Special tools and workshop equipment required

- Chain pipe cutter -VAS 6254-

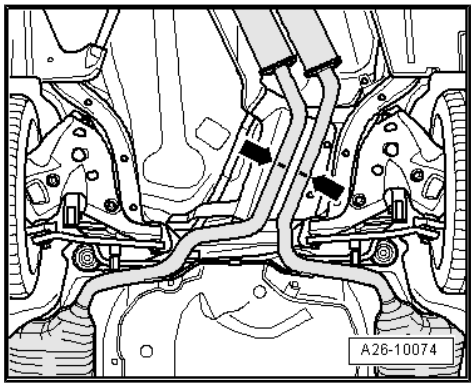


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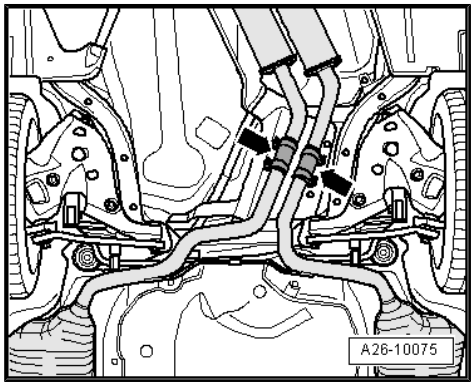
Procedure

Vehicles with front-wheel drive:

– Cut through exhaust pipes at right angles at position marked -arrow- using chain pipe cutter -VAS 6254-

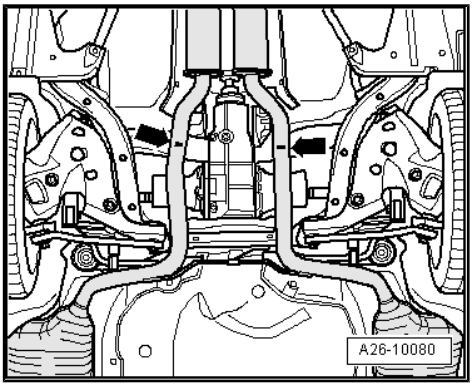


– When installing, position centre of clamps -arrows- over cutting location.



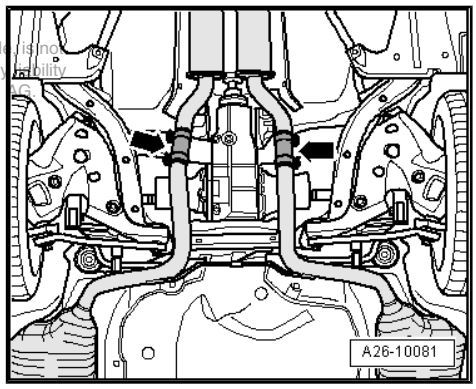
Vehicles with four-wheel drive:

– Cut through exhaust pipes at a right angle at cutting point -arrows- using chain pipe cutter -VAS 6254- .



– When reassembling, position the clamps -arrows- centrally over the cutting points.

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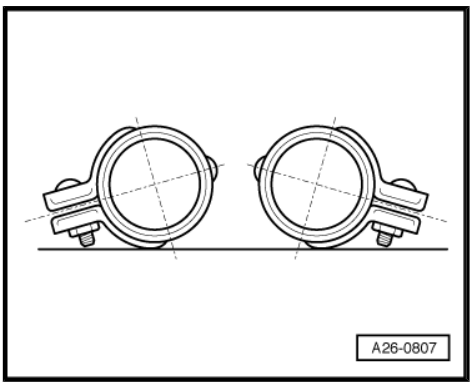


All vehicles:

– Fit clamps so that ends of bolts do not protrude beyond bottom of clamp.

• Bolt connections face outwards.

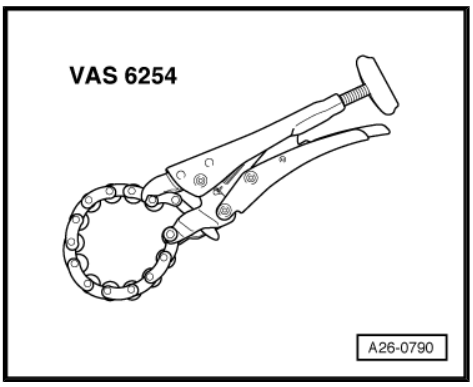
– Align exhaust system so it is free of stress ⇒ page 366 .



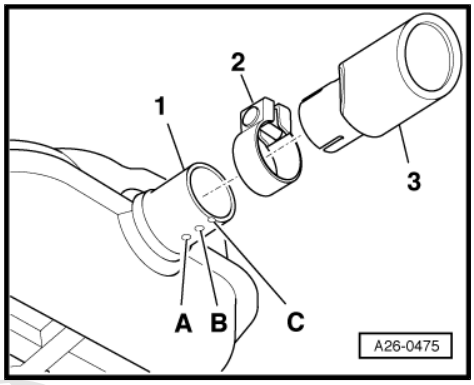
3.2 Renewing tailpipe

Special tools and workshop equipment required

♦ Chain pipe cutter -VAS 6254-



Procedure



- Cut through old tailpipe -1- at a right angle at cutting point -C- using chain pipe cutter -VAS 6254- .
- Push on new tailpipe -3- as far as marking -A-. Slot on tailpipe should align with marking -B-.
- Fit clip -2-.

Tightening torque

Component	Nm
Clamp	25

3.3 Stress-free alignment of exhaust system

Procedure

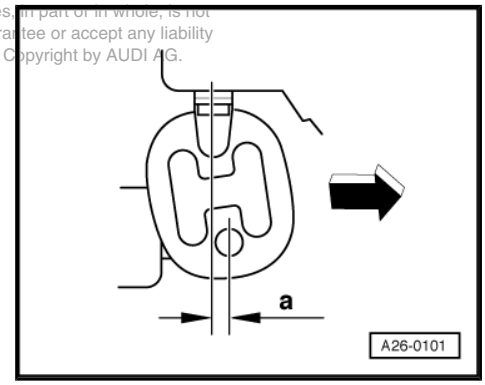
Note

The exhaust system must be aligned when it is cool.

Vehicles without clamps between Y-pipe and rear silencer

- Loosen bolt connections of front clamp ⇒ Item 15 (page 353) .
- Push exhaust system towards front of vehicle -arrow- so that rear rubber mountings for rear silencers are preloaded by -a- = 5 ... 9 mm.
- Tighten clamp evenly to 23 Nm.
- Align tailpipes ⇒ page 367 .

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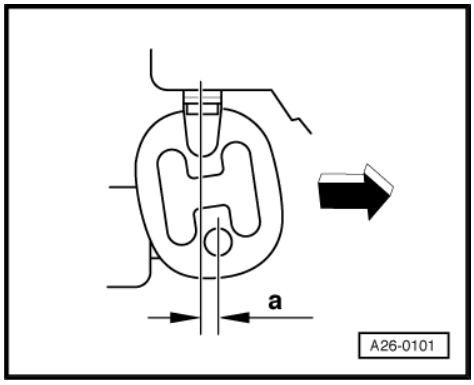


Vehicles with clamps between Y-pipe and rear silencer

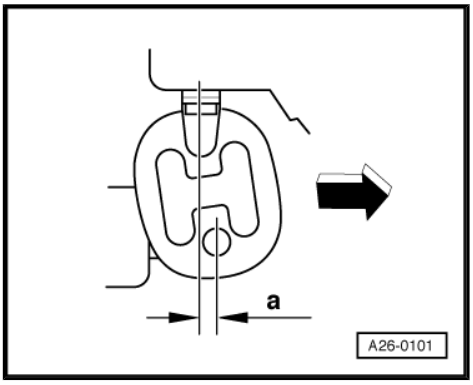
Note

On a vehicle with clamps fitted between Y-pipe and rear silencer, it is also necessary to align the Y-pipe.

- Loosen bolts on clamps ⇒ Item 15 (page 353) and ⇒ Item 26 (page 354) .
- Push front section of exhaust system towards front of vehicle -arrow-, so that mountings for Y-pipe are preloaded by -a- = 5 ... 9 mm.
- Tighten bolts on front clamp ⇒ Item 15 (page 353) evenly to 23 Nm.



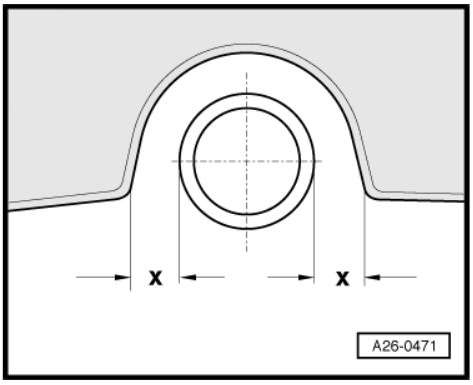
– Push rear section of exhaust system towards front of vehicle -arrow-, so that mountings (rear) for rear silencers are preloaded by -a- = 5 ... 9 mm.
– Align rear silencers so they are horizontal.
– Tighten bolts on rear clamps ⇒ Item 26 (page 354) evenly to 23 Nm.
– Align tailpipes ⇒ page 367 .



3.4 Aligning tailpipe

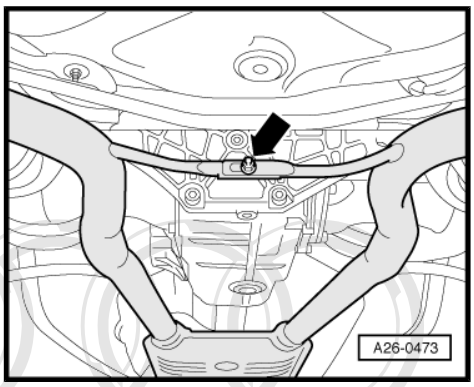
Procedure

– Check clearance between tailpipes and bumper on both sides.
• Dimension -x- (left-side) = dimension -x- (right-side)

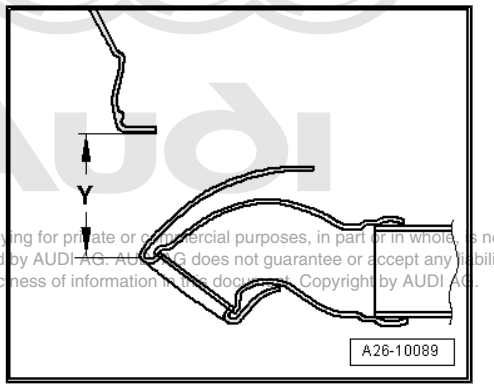


If necessary, correct dimension -x- as follows:

– Slacken bolt connection -arrow- on brace between exhaust pipes.
– Adjust the distance between the rear silencers.
– Tighten bolt connection to 25 Nm.



– Check clearance -y- between tailpipes and bumper:
• Dimension -y- = 37 ... 43 mm.
– If necessary, check whether the exhaust system is aligned free of stress ⇒ page 366 .



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3.5 Checking exhaust system for leaks

– Start engine and run at idling speed.
– Plug tailpipe (e. g. with rags or stopper) and leave plugged until the check is complete.

– Listen for leaks at joints between cylinder head/exhaust manifold, exhaust manifold/intermediate pipe, intermediate pipe/intermediate flange, intermediate flange/turbocharger, etc.
– Repair any leaks that are found.

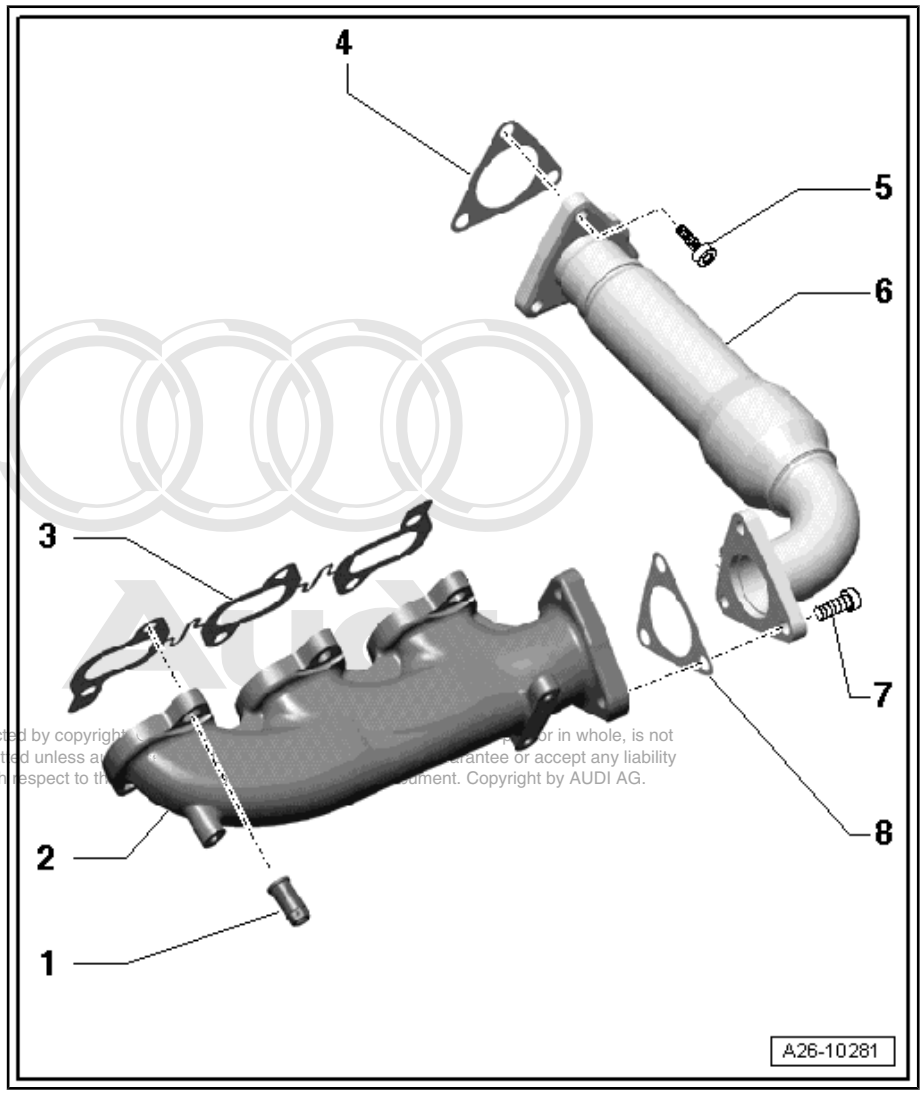
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4 Exhaust manifolds and intermediate pipes

4.1 Exhaust manifolds and intermediate pipes - exploded view

Note

Illustration shows exhaust manifold of cylinder bank 2 (left-side) with intermediate pipe.



1 - 25 Nm
- ❑ Renew
- ❑ Coat with high-temperature paste; for high-temperature paste refer to ⇒ Electronic parts catalogue

2 - Exhaust manifold
- ❑ Removing and installing: left-side ⇒ page 370 , right-side ⇒ page 373

3 - Gasket
- ❑ Renew

4 - Gasket
- ❑ Renew

5 - 30 Nm + turn 90° further
- ❑ Renew
- ❑ Coat with high-temperature paste; for high-temperature paste refer to ⇒ Electronic parts catalogue

6 - Intermediate pipe
- ❑ Removing and installing: left-side ⇒ page 376 , right-side ⇒ page 377

7 - 30 Nm + turn 90° further
- ❑ Type of connection differs depending on version ⇒ page 370

8 - Gasket
- ❑ Renew

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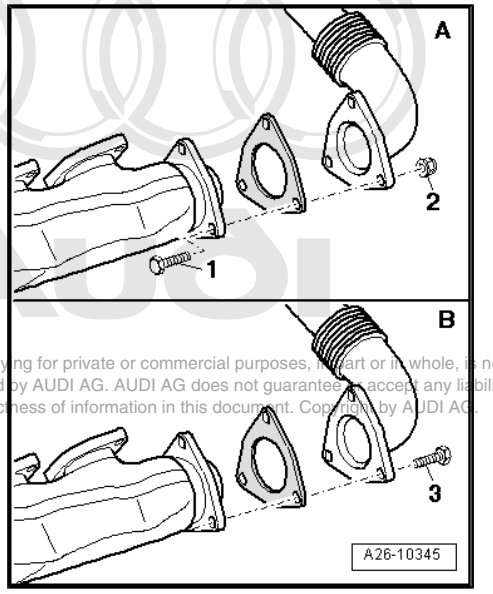
Securing intermediate pipe to exhaust manifold

A - Exhaust manifold (sheet metal version)

- Fitted with bolts -1- and nuts -2-.
- Renew bolts and nuts.
- Coat with high-temperature paste; for high-temperature paste refer to ⇒ Electronic parts catalogue .

B - Exhaust manifold (cast version)

- Fitted with bolts -3-.
- Renew bolts.
- Coat with high-temperature paste; for high-temperature paste refer to ⇒ Electronic parts catalogue .



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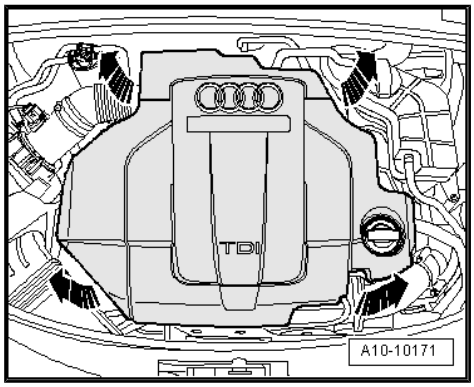
4.2 Removing and installing exhaust manifold (left-side)

Removing

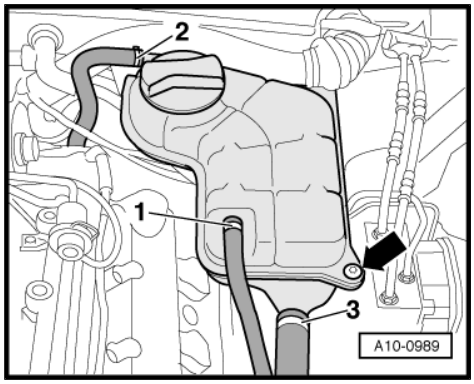
Note

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

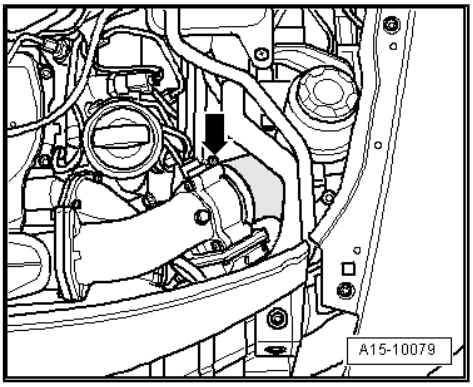
– Carefully pull engine cover panel off four retaining pins one after the other -arrows-.



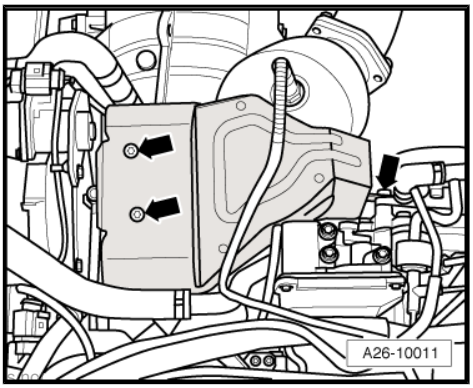
– Unbolt coolant expansion tank -arrow-.
– Detach electrical connector at coolant shortage indicator switch -F66- on coolant expansion tank (bottom).
– Lay aside coolant expansion tank with coolant hoses -1 … 3- connected.



– Disconnect air intake hose from intake connecting pipe -arrow-.

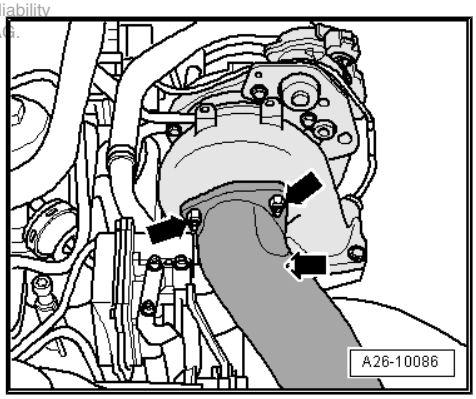


– Remove heat shield for turbocharger -arrows-.



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– Unscrew nuts -arrows- at starter catalytic converter and detach starter catalytic converter from turbocharger.

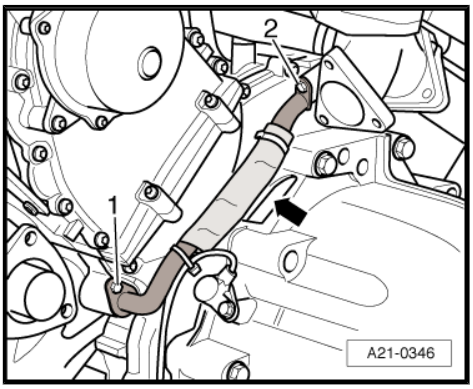


– Cover opening -arrow- in gearbox to prevent small parts from dropping in.

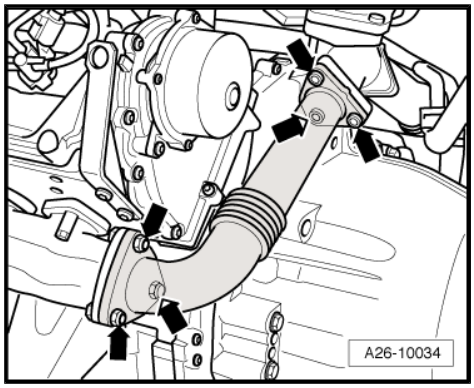
– Unscrew bolts -1- and -2- and detach oil return line.

Note

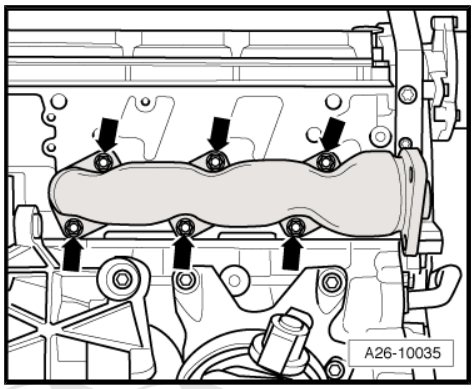
Shown in illustration with engine removed and intermediate pipe detached.



– Unscrew nuts and bolts -arrows- and detach intermediate pipe.



– Unbolt exhaust manifold -arrows-.



Installing

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

Note

- *Renew gaskets, O-rings and self-locking nuts.*
- *Hose connections and hoses for charge air system must be free of oil and grease before assembly.*
- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*
- *To ensure that the charge air hoses can be properly secured at their connections, spray rust remover onto the worm thread of used hose clips before installing.*
- *Fit all cable ties in the original positions when installing.*

Tightening torques

Component		Nm
Exhaust manifold to cylinder head		25 1)2)
Intermediate pipe to:	Exhaust manifold	30 +90° 1)2)3)
	Intermediate flange	30 +90° 1)2)3)
Oil return line to:	Cylinder block	9
	Intermediate flange	9
Starter catalytic converter to turbocharger		23 1)2)
Heat shield to turbocharger		9
Hose clips (13 mm wide)		5.5

- 1) Renew bolts/nuts.
- 2) Coat with high-temperature paste; for high-temperature paste refer to ⇒ Electronic parts catalogue
- 3) 90° = one quarter turn.

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4.3 Removing and installing exhaust manifold (right-side)

Removing

Note

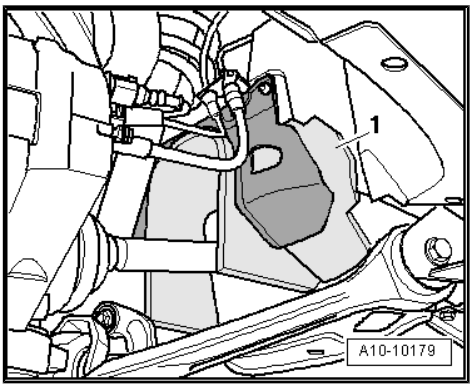
All cable ties which are released or cut open when removing must be fitted in the same position when installing.

– Remove front right wheel.

Note

Secure brake disc with one wheel bolt.

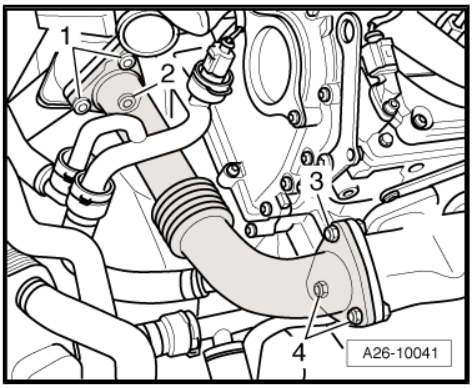
– Remove noise insulation in wheel housing (right-side) -arrows-.
– Unbolt drive shaft (right-side) from gearbox flange.



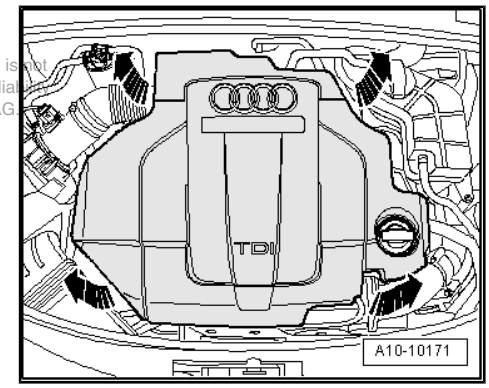
– Unscrew bolts and nuts -2- and -4- (accessible from below) securing intermediate pipe.

Note

Shown in illustration with engine removed.

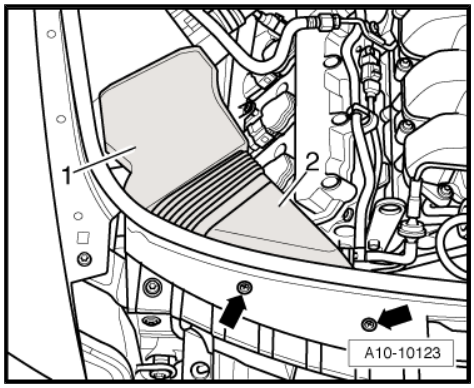


– Carefully pull engine cover panel off four retaining pins one after the other -arrows-.

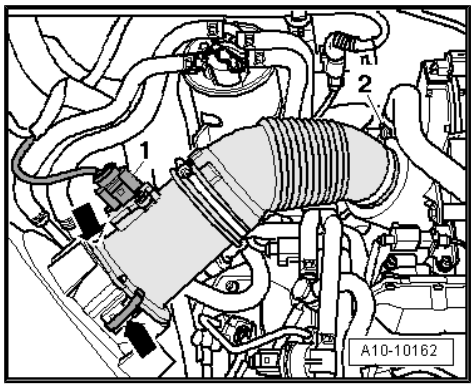


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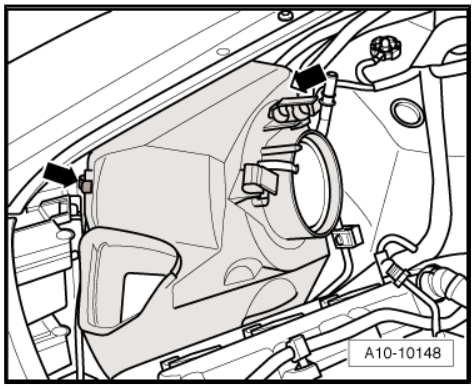
– Remove bolts -arrows-.
– Remove air ducts -1- and -2-.



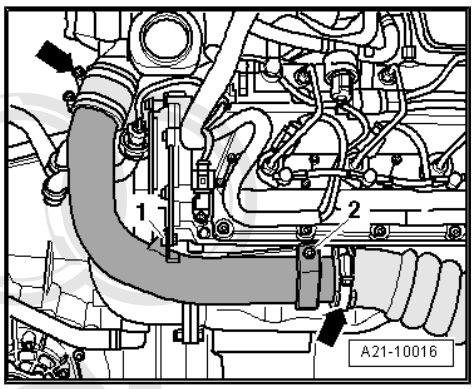
– Unplug electrical connector -1- at air mass meter -G70- .
– Remove air intake hose. To do so, release hose clip -2- and clamps -arrows-.



– Release clamps -arrows- and detach air cleaner (top section).

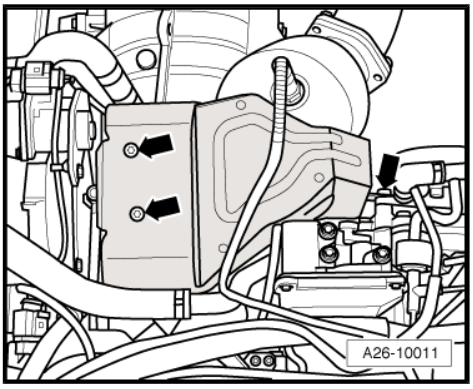


– Unscrew bolts -1- and -2- and disconnect air pipe from hoses.



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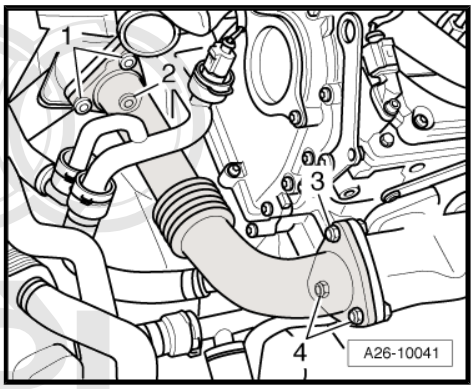
– Remove heat shield for turbocharger -arrows-.



– Unscrew bolts and nuts -1- and -3- (accessible from above).

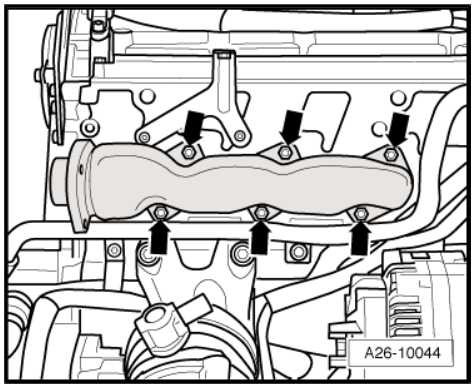
Note

Shown in illustration with engine removed.



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– Unbolt exhaust manifold -arrows- and take out together with intermediate pipe.



Installing

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

Note

- *Renew gaskets and self-locking nuts.*
- *Hose connections and hoses for charge air system must be free of oil and grease before assembly.*
- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*
- *To ensure that the charge air hoses can be properly secured at their connections, spray rust remover onto the worm thread of used hose clips before installing.*
- *Fit all cable ties in the original positions when installing.*

– Install drive shaft (right-side) ⇒ Rep. gr. 40 .

Tightening torques

Component		Nm
Exhaust manifold to cylinder head		25 1)2)
Intermediate pipe to:	Exhaust manifold	30 +90° 1)2)3)
	Intermediate flange	30 +90° 1)2)3)
Heat shield to turbocharger		9
Air pipe to:	Bracket	9
	Engine lifting eye	9
Bracket for electrical connector to cylinder head cover		9
Hose clips (9 mm wide)		3
Hose clips (13 mm wide)		5.5

- 1) Renew bolts.
- 2) Coat with high-temperature paste; for high-temperature paste refer to ⇒ Electronic parts catalogue
- 3) 90° = one quarter turn.

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4.4 Removing and installing intermediate pipe (left-side)

Removing

Note

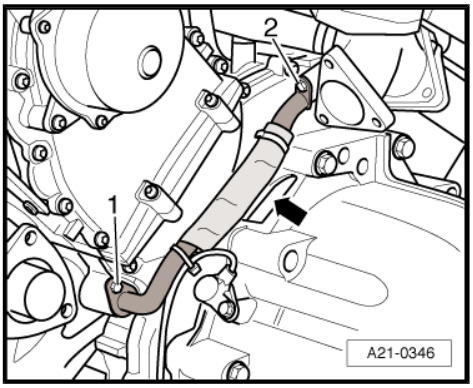
All cable ties which are released or cut open when removing must be fitted in the same position when installing.

– Remove starter catalytic converter: vehicles without particulate filter ⇒ page 341 ; vehicles with particulate filter ⇒ page 355 .

– Cover opening -arrow- in gearbox to prevent small parts from dropping in.
– Unscrew bolts -1- and -2- and detach oil return line.

Note

Shown in illustration with engine removed and intermediate pipe detached.

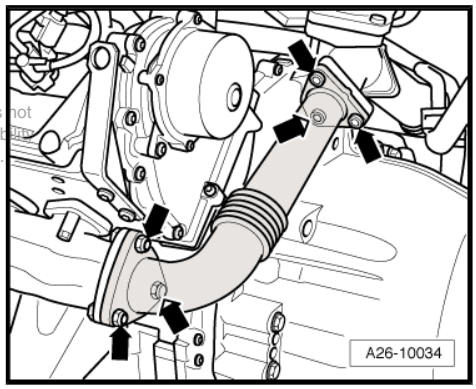


– Unbolt intermediate pipe -arrows-.

Installing

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

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Note

- *Renew gaskets, O-rings and self-locking nuts.*
- *Fit all cable ties in the original positions when installing.*

– Install starter catalytic converter: vehicles without particulate filter ⇒ page 341 , vehicles with particulate filter ⇒ page 355 .

Tightening torques

Component		Nm
Intermediate pipe to:	Exhaust manifold	30 +90° 1)2)3)
	Intermediate flange	30 +90° 1)2)3)
Oil return line to:	Cylinder block	9
	Intermediate flange	9
Heat shield to turbocharger		9

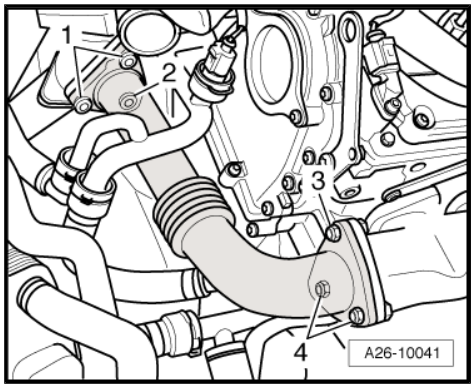
- 1) Renew bolts/nuts.
- 2) Coat with high-temperature paste; for high-temperature paste refer to ⇒ Electronic parts catalogue
- 3) 90° = one quarter turn.

4.5 Removing and installing intermediate pipe (right-side)

Removing

– Drain off coolant ⇒ page 256 .
– Remove coolant pipe (rear) ⇒ page 282 .

– Unscrew bolts -1- and -2- and nuts -3- and -4- and take off intermediate pipe.



Note

Shown in illustration with engine removed.

Installing

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

Note

Renew seals and gaskets.

– Install coolant pipe (rear) ⇒ page 282 .
– Fill cooling system ⇒ page 259 .

Tightening torques

Component		Nm
Intermediate pipe to:	Exhaust manifold	30 +90° 1)2)3)
	Intermediate flange	30 +90° 1)2)3)

- 1) Renew bolts.
- 2) Coat with high-temperature paste; for high-temperature paste refer to ⇒ Electronic parts catalogue
- 3) 90° = one quarter turn.

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5 Exhaust gas temperature control

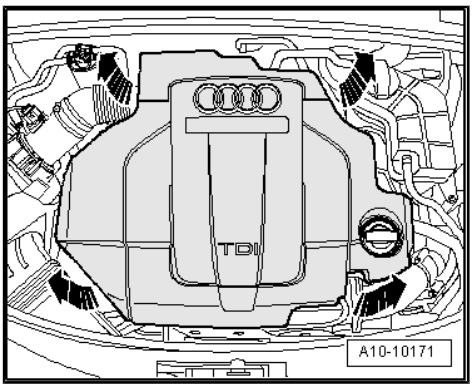
5.1 Removing and installing exhaust gas temperature sender 1 -G235-

Removing

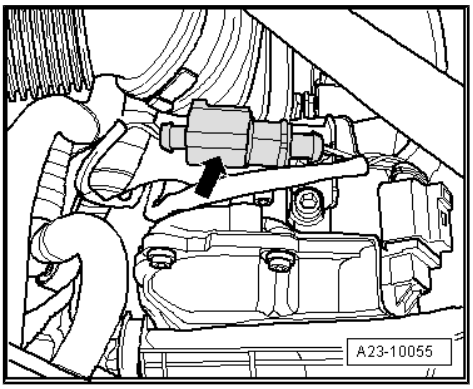
Note

- *Exhaust gas temperature sender 1 -G235- is only installed on vehicles with 3.0 ltr. engine.*
- *All cable ties which are released or cut open when removing must be fitted in the same position when installing.*

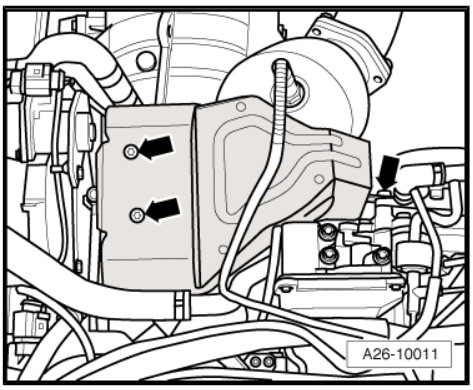
– Carefully pull engine cover panel off four retaining pins one after the other -arrows-.



– Unplug electrical connector -arrow- for exhaust gas temperature sender 1 -G235- and move wiring clear.

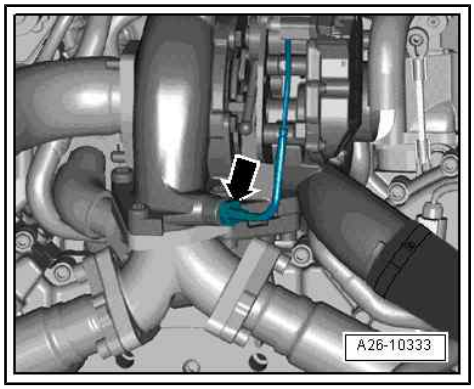


– Remove heat shield for turbocharger -arrows-.



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– Unscrew exhaust gas temperature sender 1 -G235- -arrow-.



Note

Shown from rear with engine removed for illustration purposes.

Installing

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

Note

Fit all cable ties in the original positions when installing.

- Installation position: connection for exhaust gas temperature sender 1 -G235- faces upwards.

Tightening torques

Component		Nm
Exhaust gas temperature sender 1 -G235- to turbocharger		45 1)
Heat shield to:	Turbocharger	9
	Cylinder head	9
• 1) Coat with high-temperature paste; for high-temperature paste refer to ⇒ Electronic parts catalogue		

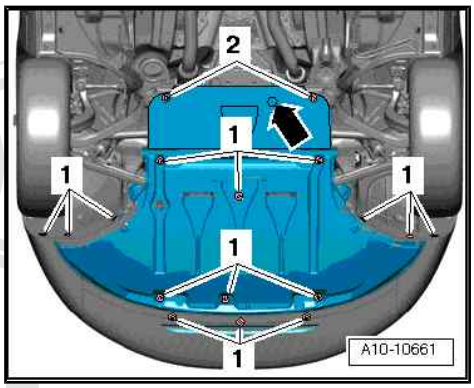
5.2 Removing and installing exhaust gas temperature sender 2 -G448-

Removing

Note

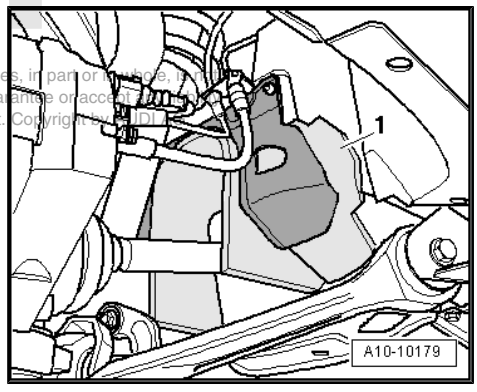
All cable ties which are released or cut open when removing must be fitted in the same position when installing.

– Release fasteners marked -2- and -arrow- (if fitted) and remove rear noise insulation panel.



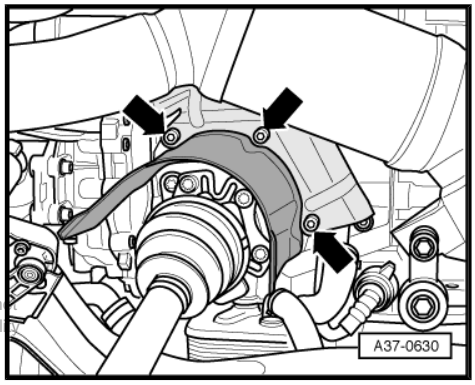
– Remove front left wheel.

– Remove noise insulation -1- in wheel housing (left-side).



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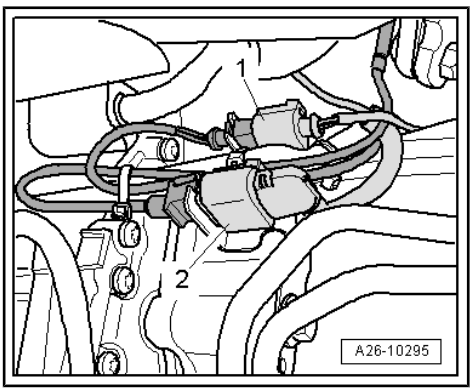
– Unbolt heat shield for drive shaft -arrows-.
– Unbolt drive shaft from flange shaft on gearbox.
– Pivot wheel bearing housing outwards and remove drive shaft, taking care not to damage brake hose.



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– Unplug electrical connector -1- at exhaust gas temperature sender 2 -G448- and move electrical wiring clear.

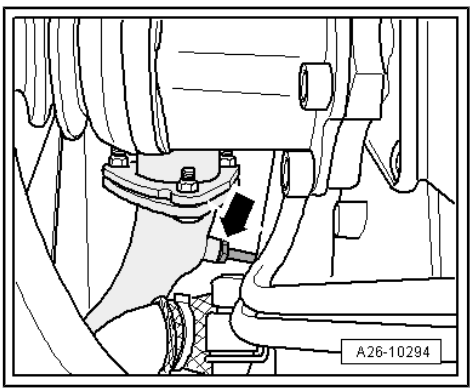
• Fitting location: at front of gearbox (left-side).



Note

Disregard -item 2-.

– Unscrew exhaust gas temperature sender 2 -G448- -arrow-.



Installing

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

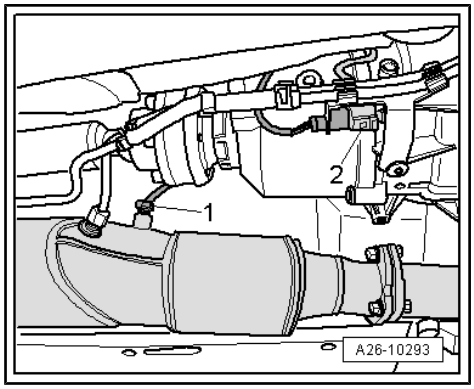
Note

Fit all cable ties in the original positions when installing.

Tightening torque

Component	Nm
Exhaust gas temperature sender 2 -G448- on front exhaust pipe	45 1)
• 1) Grease thread with high-temperature paste; refer to ⇒ Electronic parts catalogue for high-temperature paste	

5.3 Removing and installing temperature sender before particulate filter -G506-



Removing

– Unplug electrical connector -2- at temperature sender before particulate filter -G506- (located on gearbox, right-side in direction of travel).

– Unscrew temperature sender before particulate filter -G506- -item 1-.

Installing

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

Note

Fit all cable ties in the original positions when installing.

Tightening torque

Component	Nm
Temperature sender before particulate filter -G506- to particulate filter	45 1)
• 1) Grease thread with high-temperature paste; refer to ⇒ Electronic parts catalogue for high-temperature paste	

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6 Exhaust gas recirculation system

Exhaust gas recirculation system

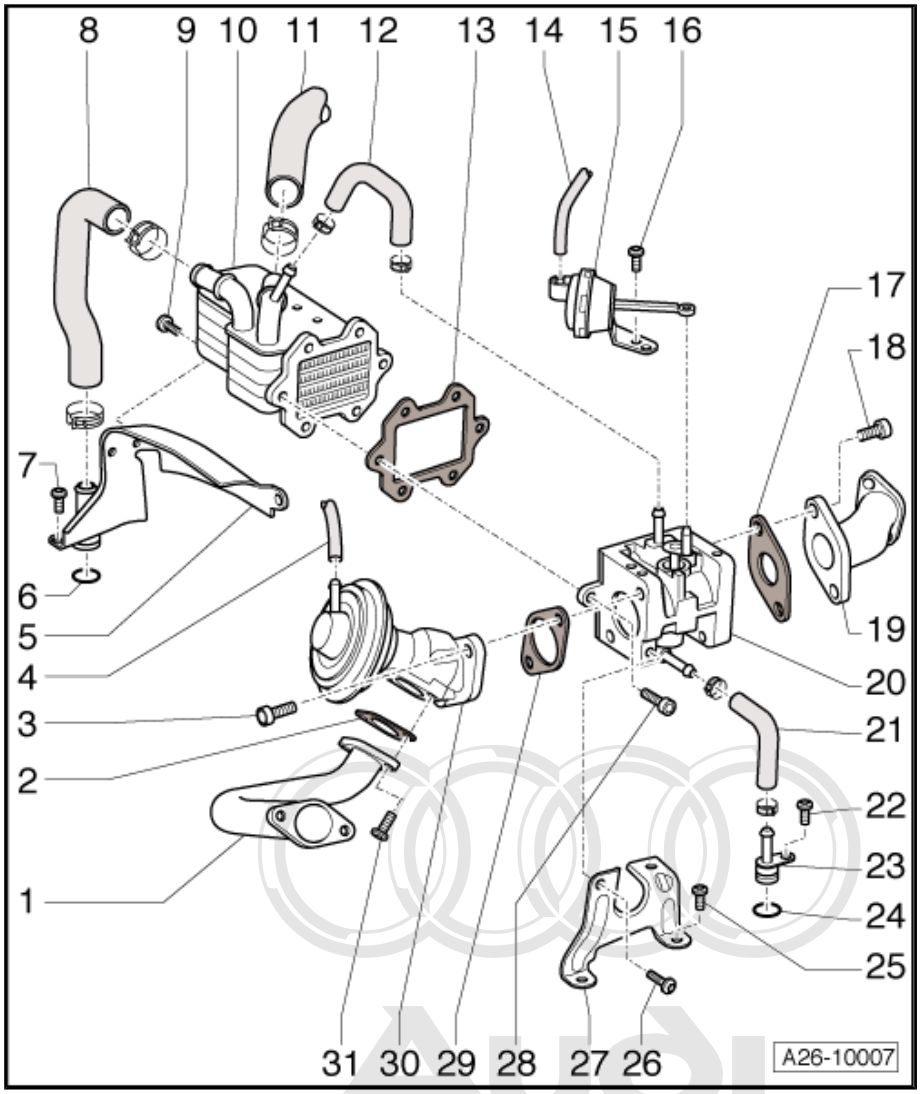
- To improve exhaust emission values, exhaust gas is recirculated to the combustion chambers, thus reducing the combustion chamber temperature.
- The exhaust gas recirculation system is activated by the diesel direct injection system control unit -J248- via the exhaust gas recirculation valve -N18- and the mechanical exhaust gas recirculation valve.
- The tapered plunger in the mechanical exhaust gas recirculation valve varies the opening cross section according to valve travel.
- Pulsed actuation makes it possible to obtain any required valve position.
- The exhaust gas recirculation is switched off after approx. 2 minutes at idling speed.
- Restart engine or briefly increase engine speed above 1500 rpm when longer checks are necessary. Then repeat measurement.

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Cooling system for exhaust gas recirculation system

- To further improve the exhaust emission values, the exhaust gas recirculation system is equipped with a cooler that is connected into the engine cooling system.
- Under certain operating conditions, the flow of exhaust gas that is recirculated to the combustion chamber is routed via this cooler. The exhaust gas temperature is thereby reduced, further lowering the combustion temperature and improving the exhaust emission values.
- The engine control unit determines when the recirculated exhaust gas is routed via the cooler. The control unit actuates a vacuum unit via the exhaust gas recirculation cooler change-over valve -N345- , and the vacuum unit in turn operates the change-over flap for the exhaust gas recirculation cooler.

6.1 Exhaust gas recirculation system - exploded view



1 - Connecting pipe for exhaust gas recirculation

2 - Gasket

- ❑ Renew

3 - 25 Nm

4 - Vacuum hose

5 - Bracket for exhaust gas recirculation cooler

- ❑ With connection for coolant hose

6 - O-ring

- ❑ Renew

7 - 9 Nm

8 - Coolant hose

9 - 9 Nm

10 - Exhaust gas recirculation cooler

- ❑ Removing and installing ⇒ page 385

11 - Coolant hose

12 - Coolant hose

13 - Gasket

- ❑ Renew

14 - Vacuum hose

- ❑ From exhaust gas recirculation cooler change-over valve -N345-

15 - Vacuum unit for exhaust gas recirculation cooler change-over

16 - 4 Nm

17 - Gasket

- ❑ Renew

18 - 25 Nm

19 - Connecting pipe for exhaust gas recirculation

20 - Change-over flap for exhaust gas recirculation cooler

21 - Coolant hose

22 - 9 Nm

23 - Connection for coolant hose

24 - O-ring

- ❑ Renew

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25 - 9 Nm

26 - 9 Nm

27 - Bracket for change-over flap for exhaust gas recirculation cooler

28 - 9 Nm

29 - Gasket

- ❑ Renew

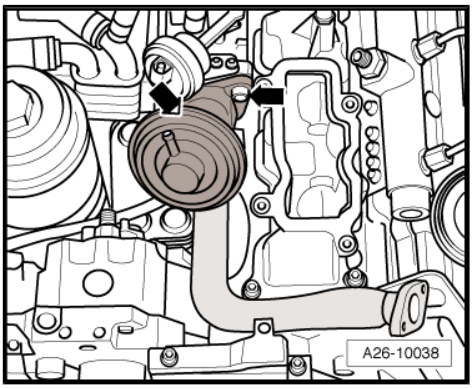
30 - Mechanical exhaust gas recirculation valve

- ❑ Removing and installing ⇒ page 385

31 - 9 Nm

6.2 Removing and installing mechanical exhaust gas recirculation valve

Removing



– Remove intake manifold (top section) ⇒ Rep. gr. 23 .

– Detach vacuum hose at mechanical exhaust gas recirculation valve.

– Remove bolts -arrows- and take off mechanical exhaust gas recirculation valve with connecting pipe.

Installing

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

Note

Renew seals and gaskets.

– Install intake manifold (top section) ⇒ Rep. gr. 23 .

Tightening torques

Component	Nm
Mechanical exhaust gas recirculation valve to connecting flange	25
Connecting pipe to mechanical exhaust gas recirculation valve	9

6.3 Removing and installing exhaust gas recirculation cooler

Removing

– Drain off coolant ⇒ page 256 .

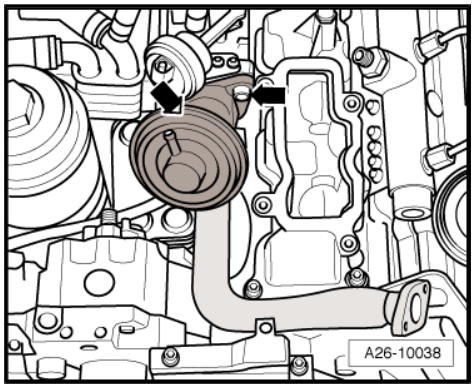
– Remove intake manifold (top section) ⇒ Rep. gr. 23 .

– Remove bottom section of intake manifold (left and right) ⇒ Rep. gr. 23 .

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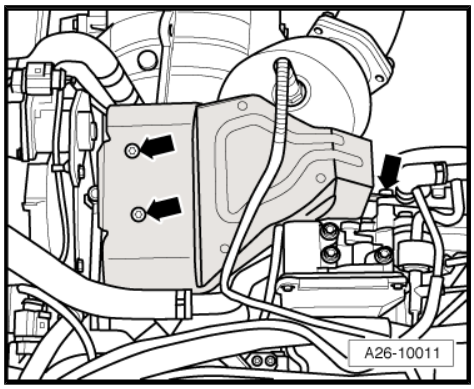
Vehicles up to 08.2004:

– Remove bolts -arrows- and take off mechanical exhaust gas recirculation valve with connecting pipe.



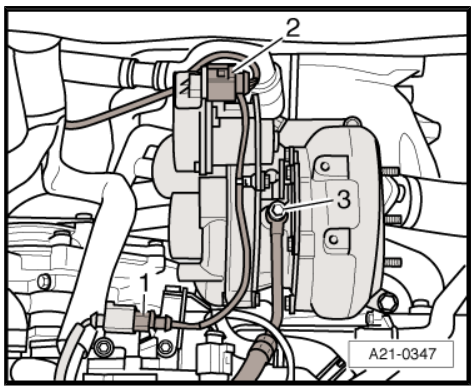
All vehicles:

– Remove heat shield for turbocharger -arrows-.



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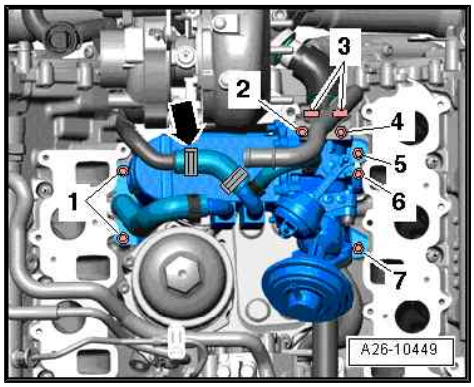
– Remove banjo bolt -3- and disconnect oil supply line from turbocharger.



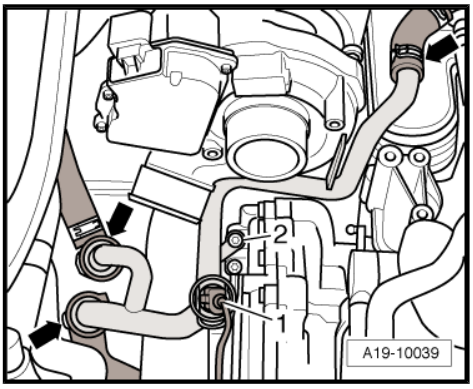
Note

Disregard items -1- and -2-.

– Detach hose -arrow-.
– Remove bolts -1 ... 7-.



– Remove bolt -2- and push coolant pipe (rear) slightly to the side.



Note

Ignore items marked -1- and -arrows-.

– Lift off cooler for exhaust gas recirculation (left-side) from cylinder block.

Installing

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

Note

- *Renew gaskets, seals and O-rings.*
- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*

– Install mechanical exhaust gas recirculation valve ⇒ page 385 .

– Install bottom section of intake manifold (left and right) ⇒ Rep. gr. 23 .

– Install intake manifold (top section) ⇒ Rep. gr. 23 .

– Fill cooling system ⇒ page 259 .

Tightening torques

Component		Nm
Exhaust gas recirculation cooler to cylinder block		9
Connecting pipe to exhaust gas recirculation cooler		25
Coolant pipe (rear) to cylinder head		9
Crankcase breather pipe to change-over flap for exhaust gas recirculation cooler		9
Heat shield to:	Turbocharger	9
	Cylinder head	9

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