Repair Manual
Golf 2013 ➤
Golf 2015 ➤

Engine Mechanical, Fuel Injection and Ignition									
Engine ID	CYF B								

Edition 07.2015

List of Workshop Manual Repair Groups

Repair Group

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

Contents

00 – General, Technical Data

1 Identification

(Edition 07.2015)

⇒ "1.1 Engine Number/Engine Specifications", page 1

1.1 Engine Number/Engine Specifications

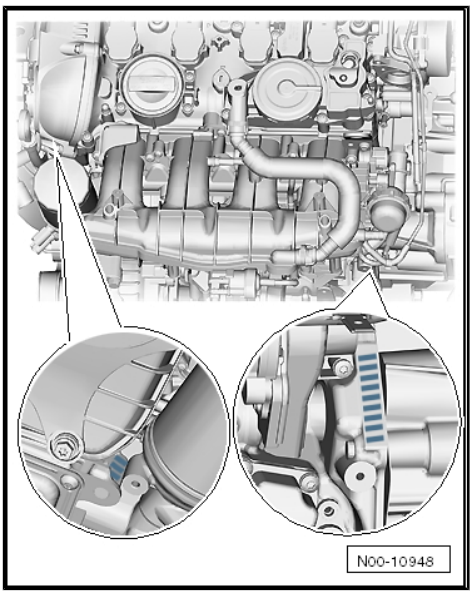
Engine Number

The engine number ("engine codes" and "serial number") are located at the engine/transmission joint.

The engine code is also stamped on the cylinder block behind the oil filter.

There is also a label glued to the timing chain cover with the "engine code" and "serial number".

The first three digits describe the mechanical structure of the engine and are still stamped on the engine. The fourth letter describes the engine torque and output and depends on the engine control module. The four digit engine code is located on the type label and the vehicle data label. It can also be read via the engine control module.



Note

Vehicle data label locations. Refer to ⇒ Maintenance ; Booklet 36.1

Engine Specifications

Codes		CYFB
Displacement	liters	1.984
Output	kW at RPM	215/5400 to 6200
Torque	Nm at RPM	380/1900 to 5300
Bore	Diameter in mm	82.5
Stroke	mm	92.8
Compression ratio		9.3:1
Research Octane Number (RON)		98 1)
Injection system/ignition system		FSI MPI
Exhaust Gas Recirculation (EGR)		no
Exhaust Temperature Regulation		no
Turbocharger, Supercharger		Turbocharger
Knock sensors		yes
Charge air cooler		yes
Oxygen sensor regulation		yes
Variable valve timing		yes
Variable intake manifold		yes
Secondary Air System		no
Valve per cylinder		4
Ignition sequence		1-3-4-2
Cylinder cut-off		no

Codes	CYFB
• 1) Unleaded RON 95 is also permissible, although with reduced power.	

2 Safety Precautions

2.1 Safety Precautions when Working on Fuel Supply System

WARNING

The fuel lines are under pressure.

Fuel poses a risk of injury to the eyes and skin.

Wear protective eyewear and protective clothing to avoid injury and contact with the skin. Place a cleaning cloth around the connection point before loosening hose connections. Carefully open the connection points to release the pressure.

WARNING

There is a risk of injury because the fuel is under very high pressure.

- *The fuel injection system is separated into a high-pressure section (maximum approximately 120 bar (1740 psi)) and a low-pressure section (4 to 7 bar (58 to 101.5 psi)).*
- *Before opening high pressure system, fuel pressure must be reduced to a residual pressure of approximately 6 bar (87 psi). Procedure. Refer to ⇒ “1.2 High Fuel Pressure, Reducing”, page 266 .*

2.2 Safety Precautions, Working on Start/Stop System

WARNING

There is a risk of injury if the engine starts automatically in vehicles with the Start/Stop System.

- *For vehicles with an activated Start/Stop system (recognized by a signal in the instrument cluster), the engine can be started automatically if needed.*
- *Therefore, make sure that the Start/Stop System is deactivated when working on the vehicle (turn off ignition, turn the ignition back on when necessary).*

2.3 Safety Precautions during Road Test with Testing Equipment

WARNING

Distraction and unsecured testing equipment increase the risk of an accident.

- *Operating testing equipment while driving is a distraction.*
- *Testing equipment that is not secure increases the risk of injury.*
- *Always secure testing equipment on the rear seat.*
- *Have a second person operate the testing equipment.*
- *Operate the testing equipment from the rear seat.*
- *Do not operate the testing equipment from the front passenger seat.*
- *The deployment of the front passenger airbag during an accident can cause injury to the person.*

2.4 Ignition System Safety Precautions

To Reduce the Risk of Personal Injury and/or Damage to the Fuel Injection and Ignition System, Observe the Following:

- Individuals with a pacemaker must not stay in the danger area of high voltage systems, for example ignition systems, xenon light.
- Fuel lines must not be opened when the engine is running.
- The ignition must be switched off before connecting or disconnecting fuel injection and ignition system wiring or tester cables.
- If the DTC memory was erased, a new readiness code must be generated.
- Cleaning the engine is only performed with the ignition switched off.
- The battery may only be disconnected and connected when the ignition is switched off, otherwise it could damage the engine control module.
- Remove the four connectors from the ignition coils if the engine is supposed to be driven by the cranking speed so that the engine cannot start (for example, when performing a compression test). Use the Puller - Ignition Coil - T40039- to remove the connectors. Also remove the fuse from the Fuel Pump Control Module - J538- .

2.5 Safety Precautions, Working on Cooling System

WARNING

The coolant system is under pressure when the engine is warm.

Risk of scalding due to hot steam and hot coolant.

Reduce pressure by covering the coolant reservoir cap with a cloth and carefully opening.

Caution

The vehicle could overheat if the cap is installed incorrectly.

- *The cap must be heard engage and felt engage when closing.*

3 Repair Information

3.1 Guidelines for Clean Working Conditions

Note

Even small pieces of debris can lead to faults. Therefore when working on the fuel supply, injection system and turbocharger, pay careful attention to the following rules of cleanliness:

- Before loosening, the connection points and surrounding areas must be cleaned thoroughly with engine or brake cleaner, and then the cleaned area must be dried completely.
- Immediately seal off any open lines and connections with clean plugs, for example, taken from the Engine Bung Set - VAS6122- .
- Place the removed parts on a clean surface and cover them. Only use lint-free cloths!
- Carefully cover or seal opened components if repairs are not performed immediately.
- Install only clean parts: remove the replacement parts from their packaging just before installing them. Do not use parts that have been stored out of their original packaging (for example, in tool boxes).
- If the system is open, do not work with compressed air and do not move the vehicle.
- Make sure no fuel gets onto the fuel hoses. If necessary, the fuel hoses must be cleaned again immediately.
- Protect any disconnected connectors from dirt and moisture, and only connect them when they are completely dry.

3.2 Foreign Objects in Engine

- To prevent foreign objects from entering when working on the engine, open intake and exhaust tract channels must always be sealed off with suitable plugs, for example from the Engine Bung Set - VAS6122- .

Note

If there is mechanical damage to the turbocharger. Refer to ⇒ “1 Turbocharger”, page 243 .

3.3 Contact Corrosion

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

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

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

If there are doubts about whether the parts are suitable, use new parts. Refer to the Parts Catalog.

- Only Original Replacement Parts are recommended. They are tested and compatible with aluminum.
- The use of Volkswagen accessories is recommended.
- Contact corrosion damage is not covered under warranty.

3.4 Wire Routing and Securing

- Mark for example the individual fuel and vacuum lines for the EVAP canister system as well as the electrical wires before disconnecting and/or removing them. This will prevent mixing them up when reconnecting. If necessary, draw sketches or take pictures.
- Because of the small spaces in the engine compartment, make sure there is enough clearance between all moving or hot components to prevent damaging the lines.

3.5 Radiator and Condenser Assembly

When assembled correctly, the radiator, condenser and turbo-charger may have slight impressions on their plates. This is not damage. Do no replace the cooler, condenser or turbocharger because of impressions like that.

3.6 Vacuum System, Checking

Special tools and workshop equipment required

- Hand Vacuum Pump - VAS6213-

Procedure

– Check all vacuum lines in the vacuum system for:

- Cracks
- Damage caused by animals
- Pinching
- Porous locations and other leaks

– Check the vacuum line leading both to and from the solenoid valve to the respective component.

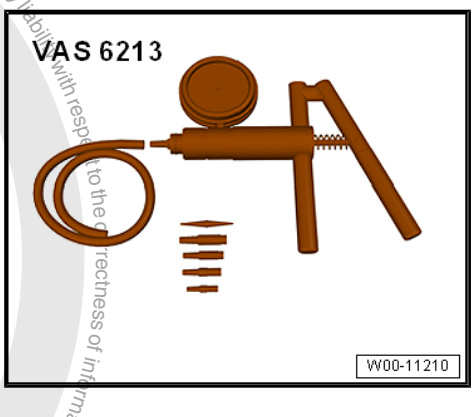
– If there is a DTC memory entry, check all the vacuum lines for the named component, but also all the vacuum lines to the other components.

– If using the Hand Vacuum Pump - VAS6213- does not produce any pressure or if the pressure drops again right away, then check the hand vacuum pump and the connection hoses for leaks.

4 Special Tools

Special tools and workshop equipment required

- Hand Vacuum Pump - VAS6213-



10 – Engine Assembly

1 Engine, Removing and Installing

1.1 Engine, Removing

Special tools and workshop equipment required

- Pry Lever - 80-200-
- Hose Clip Pliers - VAS6362-
- Engine and Gearbox Jack - VAS6931-
- Step Ladder - VAS5085-
- Shop Crane - Drip Tray - VAS6208-
- Engine/Gearbox Jack - Engine Support - T10359 -
- Engine/Gearbox Jack - Pin - T10359/2-
- Adapter - T10359/3-
- Protective Eyewear
- Safety Gloves

Procedure

Note

The engine with transmission is removed downward.

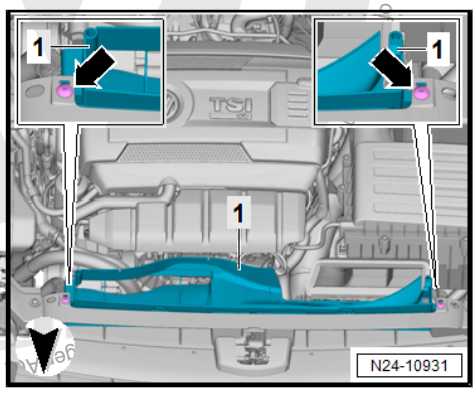
– Remove the engine cover. Refer to ⇒ “3.1 Engine Cover, Removing and Installing”, page 34 .

– Remove the air filter housing with air guide hose. Refer to ⇒ “2.2 Air Filter Housing, Removing and Installing”, page 269 .

– Remove the bolts -arrows-.

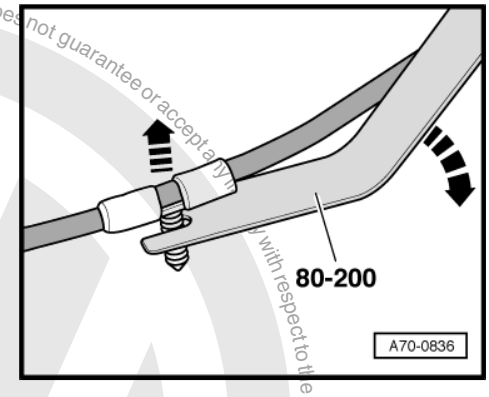
– Unclip and remove the lower section -1- of the air duct.

– Remove the battery tray. Refer to ⇒ Electrical Equipment; Rep. Gr. 27 ; Battery; Battery Tray, Removing and Installing .

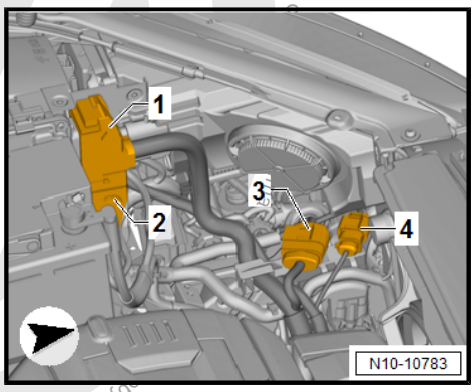


Note

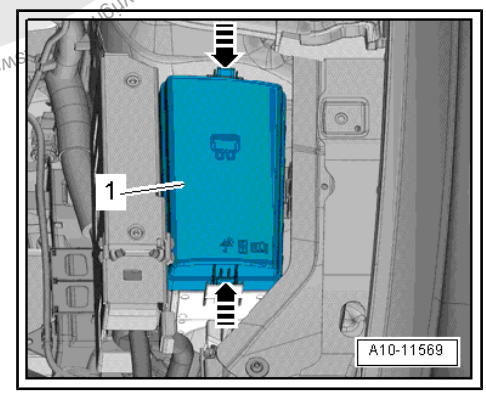
Use the Pry Lever - 80-200- to unclip the spiral clips.



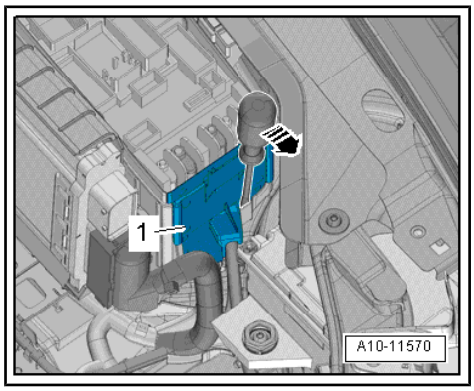
– Disconnect the connectors -1 and 2- from the Engine Control Module - J623-.
– Remove the connectors -3 and 4- from the bracket and disconnect them.
– Free up the wires.



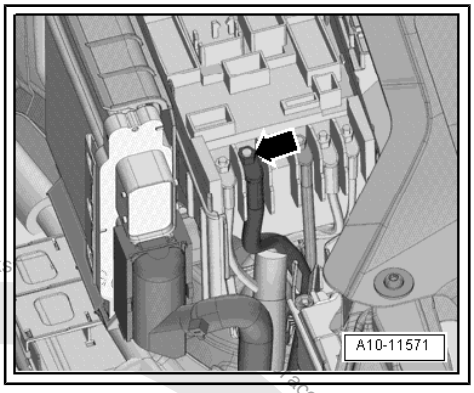
– Release the retainers in direction of -arrows-, and remove the cover -1- from the engine compartment E-box.



– Release the catch with a screwdriver in direction of -arrow-. Remove the cover -1- for the engine compartment E-box upward.



– Remove the nut -arrow-, disconnect and free up the wires.

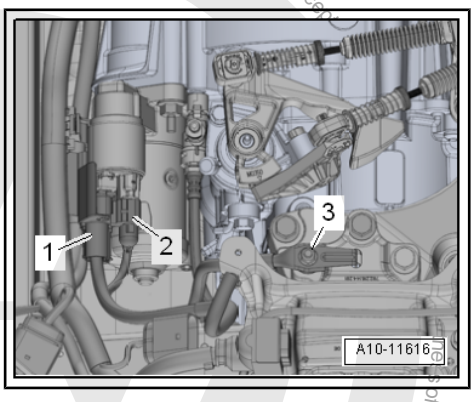


Vehicles with Manual Transmission:

– Disconnect the connector -2-.

– Push the B+ terminal protector -1- back and disconnect the B + wire from the starter solenoid switch.

– Remove the nut -3- and remove the ground wire.



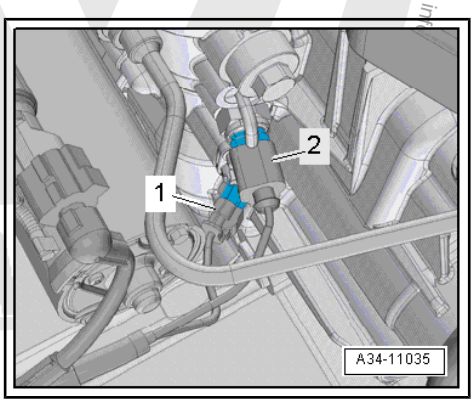
Note

Depending on the version the ground cable is attached to the starter bolt.

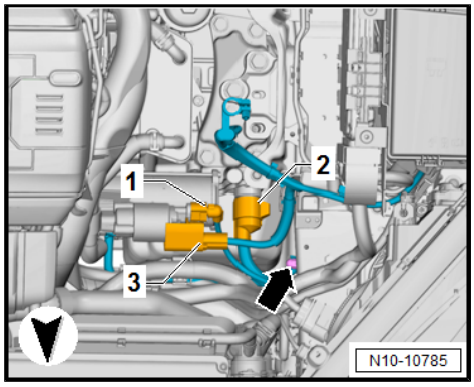
– Disconnect the connectors -1- and 2- on the left front side of the transmission.

– Remove the gearshift and the selector lever cable from the transmission, remove the cable bracket and move it to the side with the cables. Refer to ⇒ Rep. Gr. 34 ; Selector Mechanism; Selector Mechanism, Disassembling and Assembling .

– Loosen the line from the clutch slave cylinder. Refer to ⇒ Manual Transmission; Rep. Gr. 30 ; Clutch Mechanism; Clutch Master and Clutch Slave Cylinder, Checking .



Vehicles with DSG transmission:



– Disconnect the connector -1-.
– Push the B+ terminal protector -3- back and disconnect the B + wire from the starter solenoid switch.
– Loosen the nut -arrow- and remove the ground wire.

Note

Depending on the version the ground cable is attached to the starter bolt.

Caution

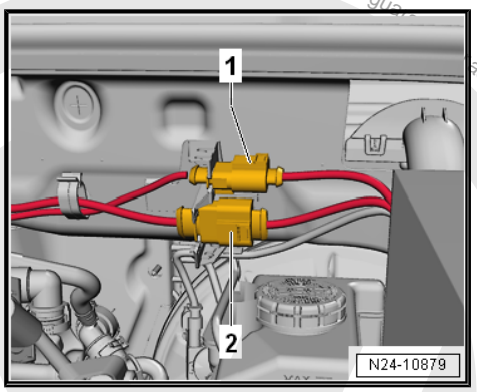
There is a risk of destroying the control module (Mechatronic) with static discharge.

- ***Do not touch connector terminals in the transmission connector with hands.***

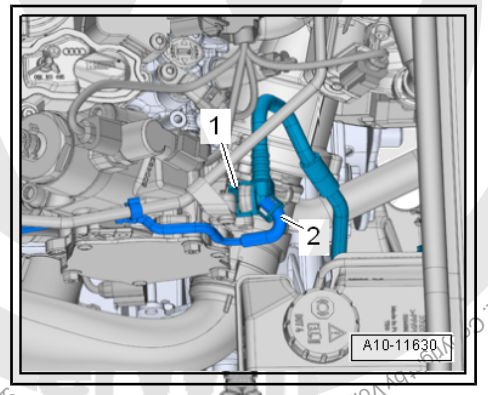
– To discharge static electricity, touch vehicle ground with hand (without gloves).
– Disconnect the connector -2- for the DSG Transmission Mechatronic - J743- by turning the twist lock counter-clockwise.
– Selector lever cable from the transmission and pull it out of the cable bracket. Refer to the ⇒ Rep. Gr. 34 ; Selector Mechanism; Selector Mechanism, Disassembling and Assembling .

Continuation for All:

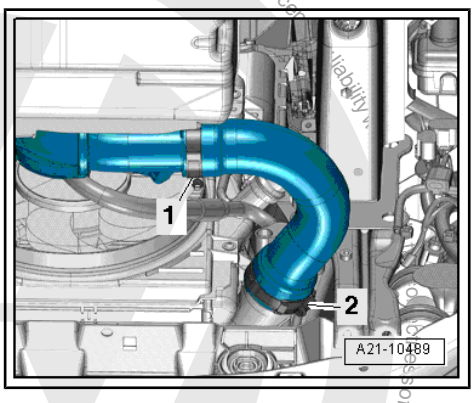
– Remove the connectors -1 and 2- from the bracket and disconnect. Free up the lines.



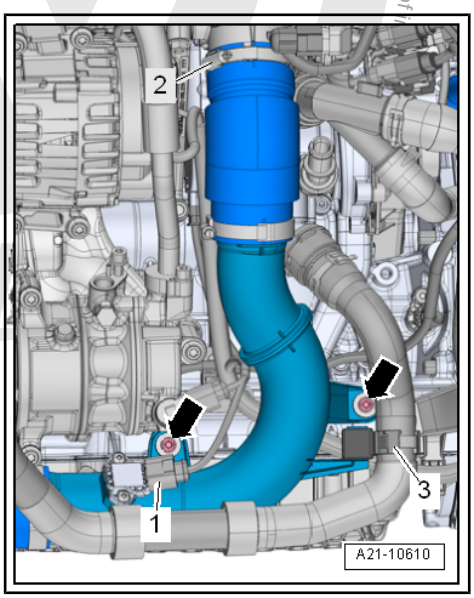
– Disconnect the vacuum hose -2-.
– Press the release buttons on the vacuum hose -1-. Remove the hose from the vacuum pump.
– Remove the fan shroud. Refer to ⇒ “4.6 Fan Shroud, Removing and Installing”, page 237 .



– Open the clamp -1 and 2- and remove the air duct hose.
– Seal the open lines and connections with clean plugs from the Engine Bung Set - VAS6122-

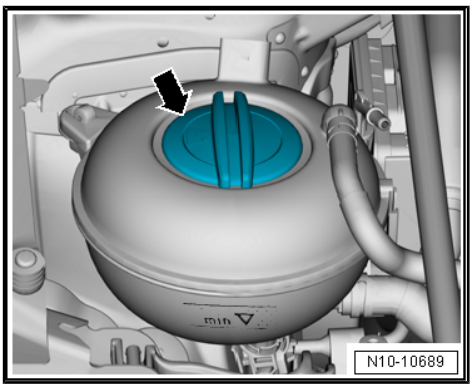


– Free up the coolant hose -3-.
– Remove the bolts -arrows-.
– Loosen the hose clamp -2-.
– Disconnect the connector -1- on the Charge Air Pressure Sensor - G31- .
– Remove the right air guide pipe.
– Remove the front left and right wheel housing liners front section. Refer to ⇒ Body Exterior; Rep. Gr. 66 ; Wheel Housing Liner; Overview - Front Wheel Housing Liner .
– Remove the subframe without the steering gear. Refer to ⇒ Suspension, Wheels, Steering; Rep. Gr. 40 ; Subframe; Subframe without Steering Gear, Removing and Installing .
– Remove the front exhaust pipe with catalytic converter. Refer to
⇒ “2.2 Catalytic Converter, Removing and Installing”, page 319 .



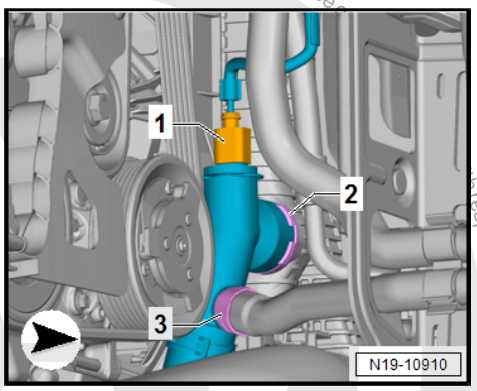
Observe the safety precautions before working on the cooling system. Refer to
⇒ “2.5 Safety Precautions, Working on Cooling System”, page 5 .

– Open the coolant reservoir cap -arrow-.
– Place the Shop Crane - Drip Tray - VAS6208- underneath.
– Disconnect the connector -1-. Lift up the clamp -2- and loosen the hose clamp -3-.



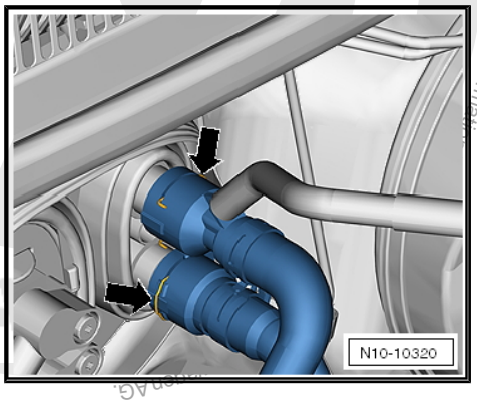
– Pull out the coolant hose and connection and drain the coolant.

– Lift the clamps -arrows-, remove the coolant hoses from the heater heat exchanger.

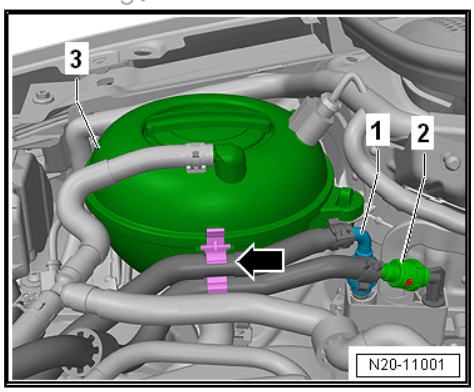


– Hold the coolant hoses downward and drain the coolant.

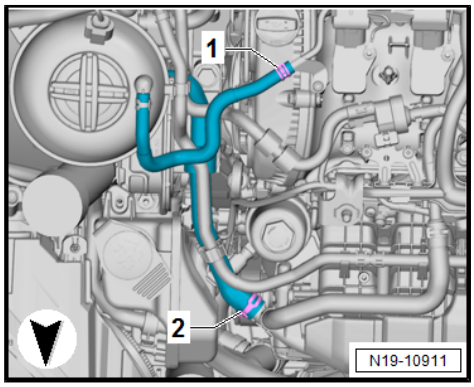
Observe the safety precautions before working on the fuel system. Refer to
⇒ “2.1 Safety Precautions when Working on Fuel Supply System”, page 3 .



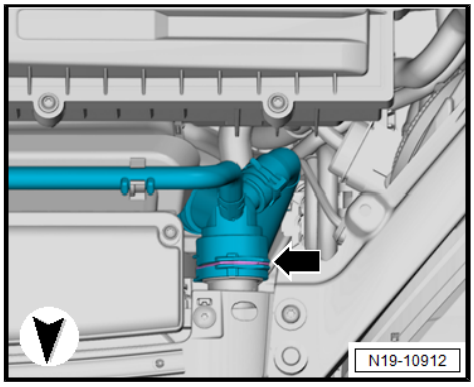
– Disconnect the hose couplings -1 and 2-. Refer to ⇒ Fuel Supply - Gasoline Engines; Rep. Gr. 20 ; Couplings; Couplings, Disconnecting . Loosen the hose clamp from the expansion tank -3-.



– Loosen the hose clamps -1 and 2- and remove the coolant hoses.

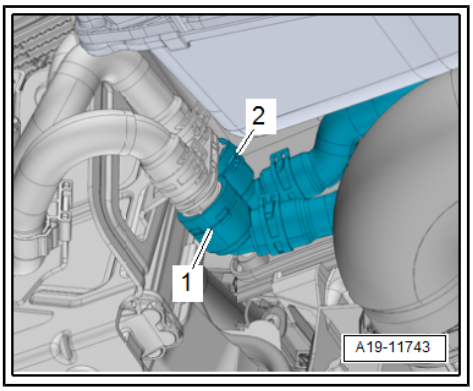


– Lift the clamp -arrow- and remove the upper left coolant hose from the radiator.



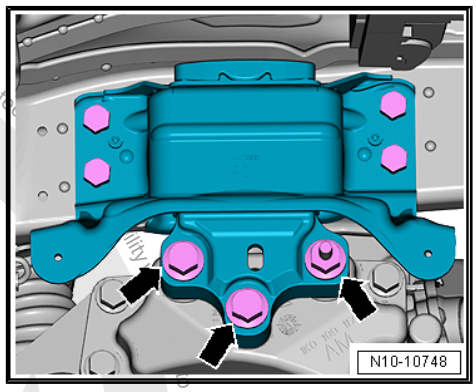
Vehicles with DSG Transmission

– Release the clamps -1 and 2- and remove the coolant hoses from the left front auxiliary cooler.

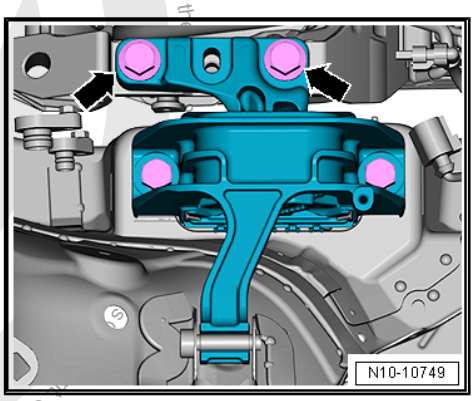


Continuation for All Vehicles

– Remove the bolts -arrows- for the transmission mount about 2 turns.



– Remove the bolts -arrows- for the engine mount about 2 turns.



– Remove the A/C Compressor from the bracket with refrigerant hoses connected and tie up to the right side. Refer to ⇒ Heating, Ventilation and Air Conditioning; Rep. Gr. 87 ; A/C Compressor; A/C Compressor, Removing and Installing on Bracket .

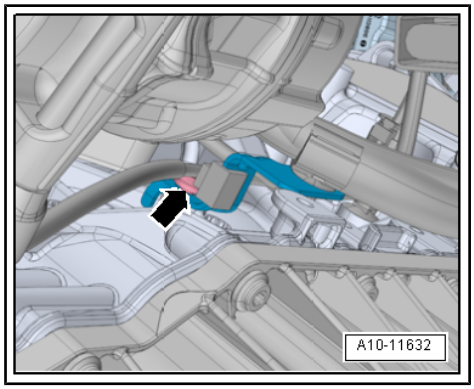
– Remove the left and right drive axles from the flange shafts. Refer to ⇒ Suspension, Wheels, Steering; Rep. Gr. 40 ; Drive Axle; Drive Axle, Removing and Installing .

– Tie up the drive axles to the rear.

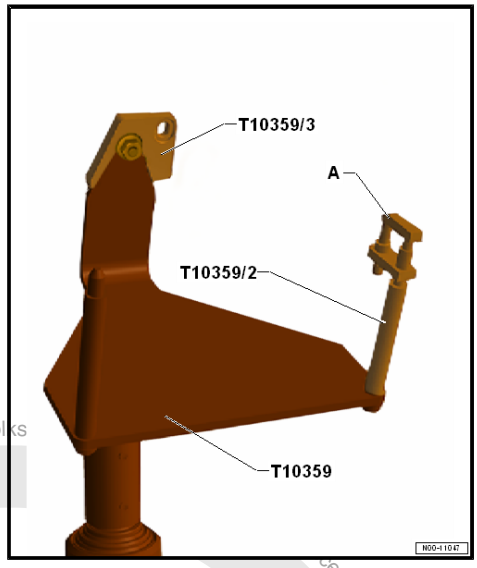
Note

Do not damage the surface protection on the drive axle.

– Remove bolt -arrow-, push the bracket for the wiring harness aside.



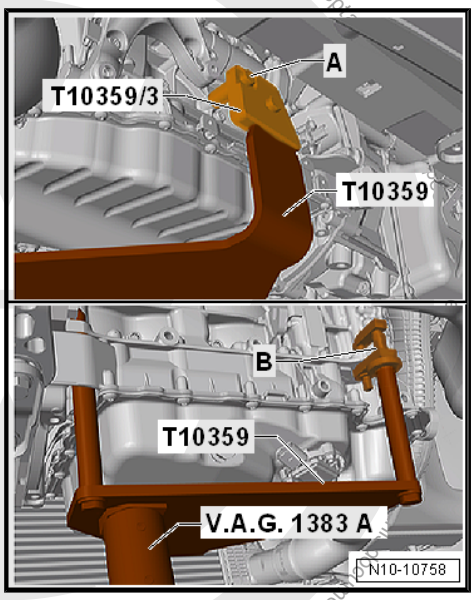
– Install the Adapter - T10359/3- , as shown in the illustration, on the Engine/Gearbox Jack - Engine Support - T10359A- .
– Tighten Engine/Gearbox Jack - Pin - T10359/2- with support element -A- from the Transmission Support - 3282- to the engine bracket.
– Place the Engine/Gearbox Jack - Engine Support - T10359- in the Engine and Gearbox Jack - VAS6931- .



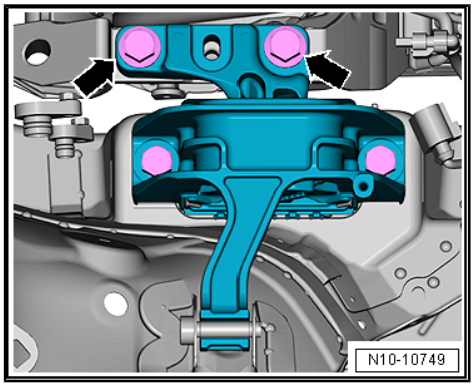
– Install the Engine/Gearbox Jack - Engine Support - T10359- on the cylinder block. Install the bolt -A- with spacer sleeve on the cylinder block.

Component	Tightening Specification
Bolt -A-	20 Nm

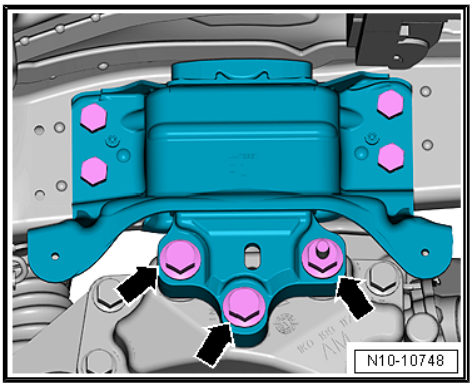
– Secure the engine with the support element -B- and lift the engine with the transmission.



– Remove the engine mount bolts -arrows- completely.



– Remove the transmission mount bolts -arrows- completely.

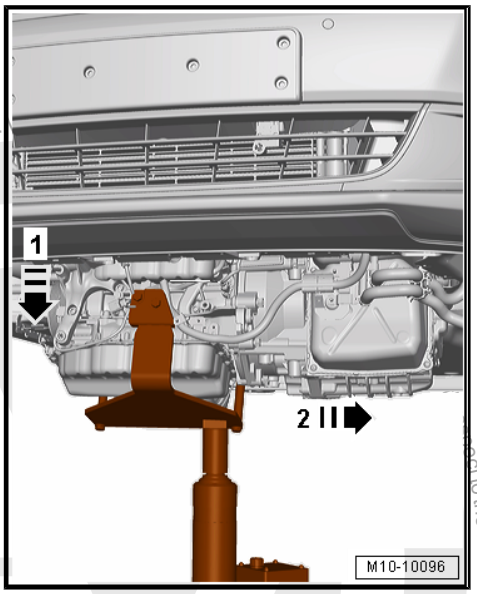


Caution

Risk of damaging the vacuum lines and wires as well as the engine compartment.

- *Make sure all the vacuum lines or wires between the engine, the transmission and the vehicle body are loosened.*
- *Carefully lower and guide the engine/transmission assembly out of the engine compartment.*

– Carefully remove the engine/transmission assembly.



1.2 Engine and Transmission, Separating

⇒ “1.2.1 Engine and Transmission, Separating, Vehicles with Manual Transmission”, page 17

⇒ “1.2.2 Engine and Transmission, Separating, Vehicles with DSG® Transmission”, page 19

1.2.1 Engine and Transmission, Separating, Vehicles with Manual Transmission

Special tools and workshop equipment required

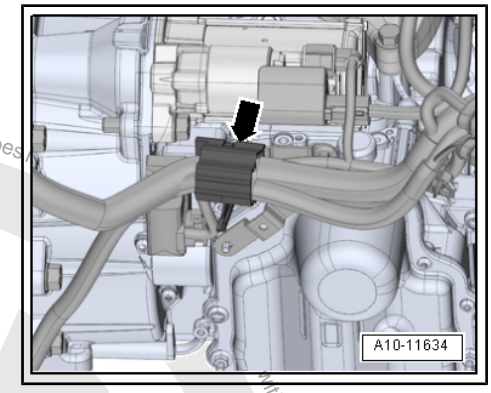
- Shop Crane - VAS6100-
- Transmission Lift Hook - T40013-

♦ Engine Support Bridge - Additional Hooks (2 pc.) - 10-222A/ 2-

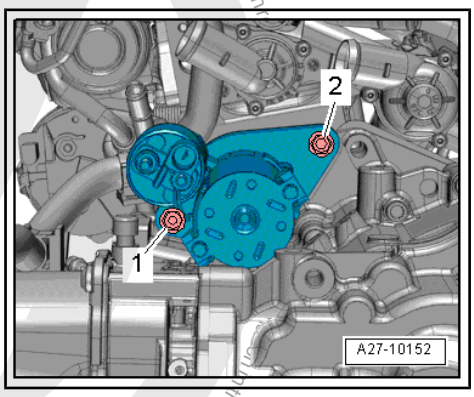
Procedure

- Engine/transmission assembly removed and secured on the Engine/Gearbox Jack - Engine Support - T10359- .

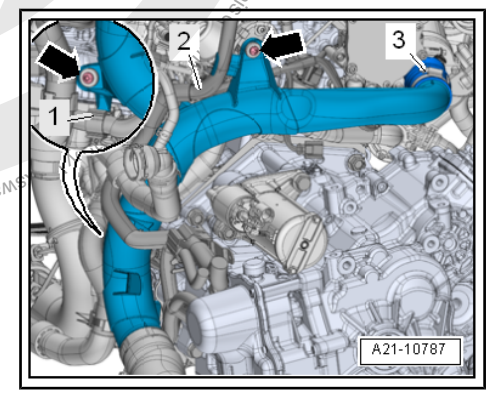
– Free up the wire on the bracket -arrow-.



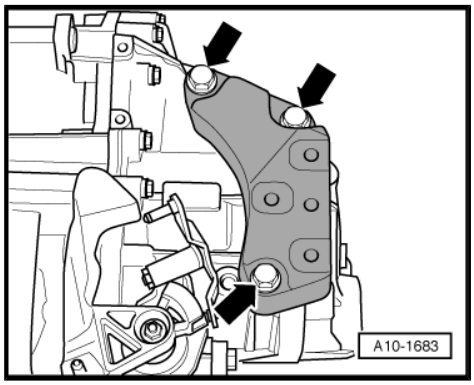
– Remove the bolts -1 and 2- and then remove the starter from the transmission.



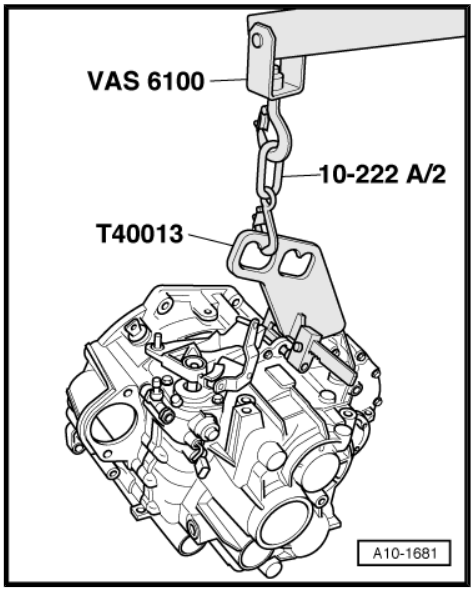
– Free up the wiring harness -1 and 2- from the air guide pipe.
– Loosen the screw-type clamp -3-.
– Remove the bolts -arrows- and remove the air guide pipe.



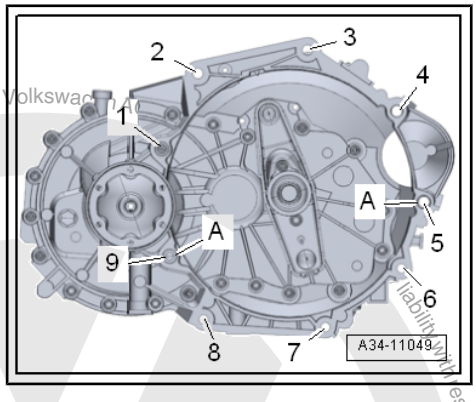
– Remove the bolts -arrows- and remove the transmission support.



– Install the Transmission Lift Hook - T40013- on the transmission and close the locking device.
– Engage the Shop Crane - VAS6100- with Engine Support Bridge - Additional Hooks - 10-222A/2- on the lifting tackle.



– Remove the bolts -1, 2, 3, 6, 7, 8 and 9- connecting the transmission to the engine.



Note

Ignore -4 and 5- and -A-.

– Remove the transmission from the engine.

1.2.2 Engine and Transmission, Separating, Vehicles with DSG® Transmission

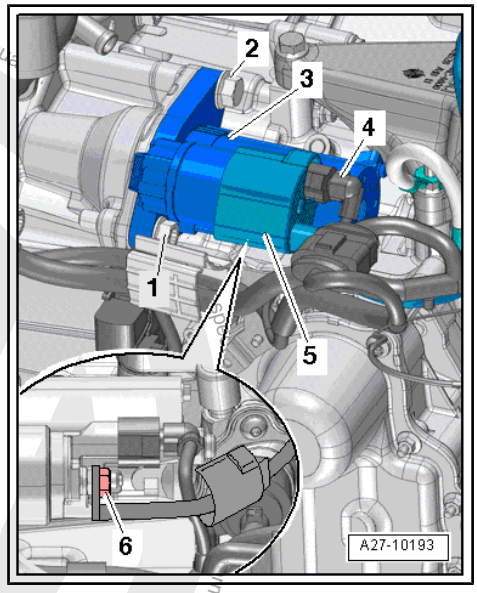
Special tools and workshop equipment required

- Shop Crane - VAS6100-
- Engine Support Bridge - Special Hook (2 pc.) - 10-222A/20-
- Engine Sling - Engine Bracket - 2024A/1-
- Engine Bung Set - VAS6122-

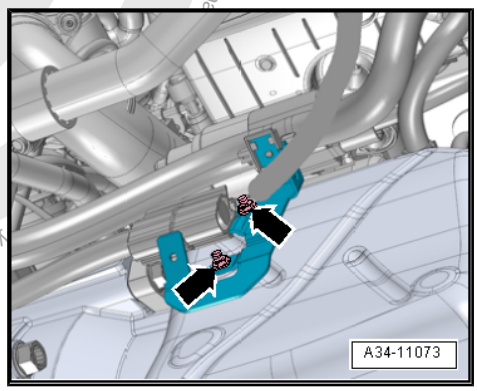
Procedure

- Engine/transmission assembly removed and secured on the Engine/Gearbox Jack - Engine Support - T10359- .

– Remove the starter. Refer to ⇒ Electrical Equipment; Rep. Gr. 27 ; Starter; Starter, Removing and Installing .



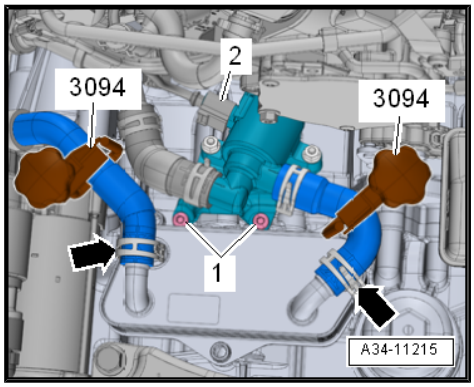
– Remove the nut -arrows-, and remove the front bracket from the transmission fluid pan.



Note

The threaded bolts are welded to the front of the oil pan.

– Disconnect the connector -2-.



Note

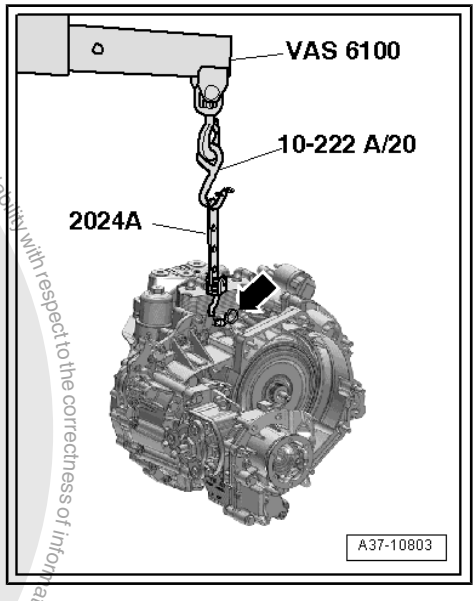
Place a cloth underneath to catch any escaping coolant.

– Loosen the hose clamps -arrows-, remove the coolant hoses from the transmission fluid cooler.

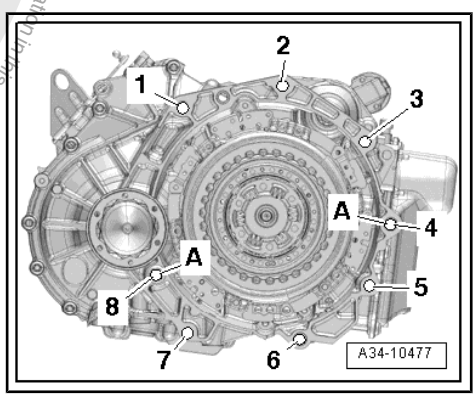
– Remove the bolts -1- and set aside the Transmission Coolant Valve - N488- .

– Seal the open lines and connections with clean plugs from the Engine Bung Set - VAS6122- .

– Attach the Engine Sling - 2024A- hooks to the transmission lifting eyes and secure it with the securing pin -arrow-.
– Hook the Shop Crane - VAS6100- with the Engine Support Bridge - Special Hook - 10-222A/20- on the Engine Sling - Engine Bracket - 2024A/1- .



– Remove the bolts -1 to 8- for the transmission/engine connection.



Note

Ignore -A-.

– Remove the transmission from the engine.

1.3 Engine, Securing to Engine and Transmission Holder

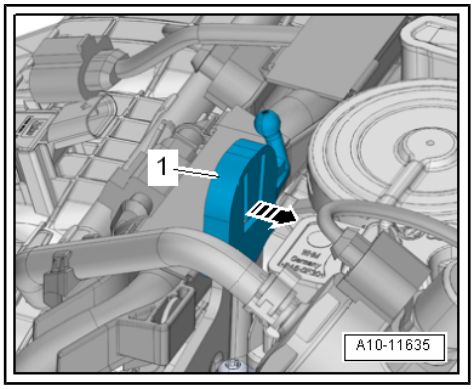
Special tools and workshop equipment required

- Engine Sling - 2024A-
- Shop Crane - VAS6100-
- Engine and Gearbox Bracket - VAS6095A-

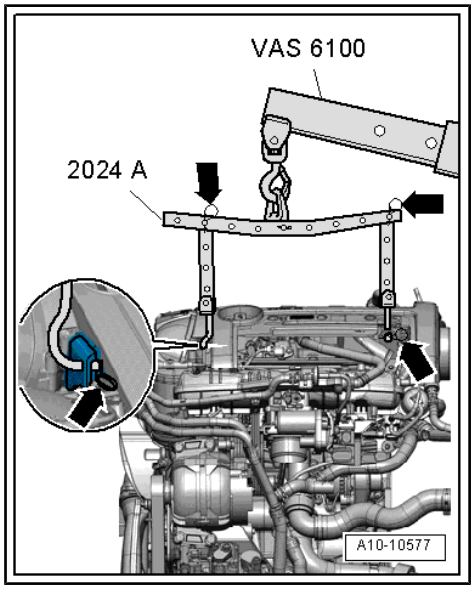
Procedure

- The transmission is separated from the engine. Refer to ⇒ “1.2 Engine and Transmission, Separating”, page 17 .

– Unlock the retaining tab in direction of -arrow- and remove the engine cover mount -1-.



– Hook the Engine Sling - 2024A- to the engine and to the Shop Crane - VAS6100- .



Note

To be aligned to the center of gravity of the engine assembly, the hole rails of the lifting hook must be inserted as shown in the illustration.

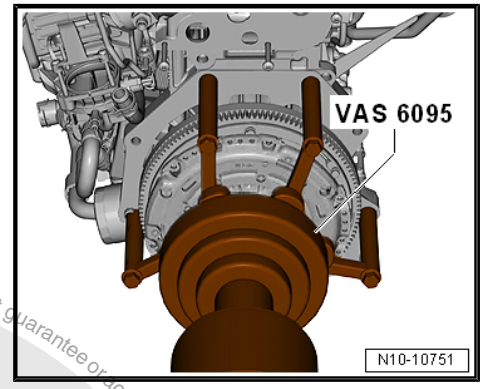
WARNING

Loose engine support bridge components could cause an accident.

- ***Secure the mounting hooks and pins on the engine support bridge using securing pins -arrows-.***

– Lower the engine from the Engine and Gearbox Jack - VAS6931- using the Shop Crane - VAS6100- .

– Remove the transmission alignment sleeve and secure the transmission side of the engine on the Engine And Transmission Holder - VAS6095- .



1.4 Engine, Installing

Procedure

Caution

Note the following whenever working inside the engine compartment due to limited space:

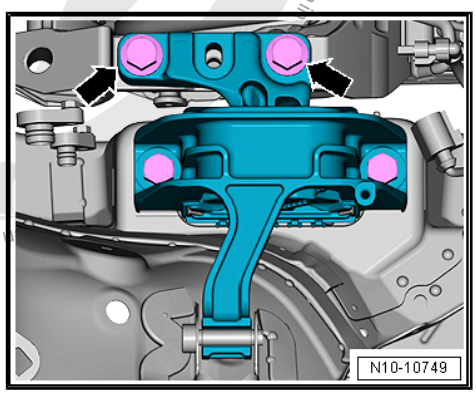
- ***Route all lines and cables in their original locations.***
- ***Make sure that there is sufficient clearance to all moving or hot components.***

Note

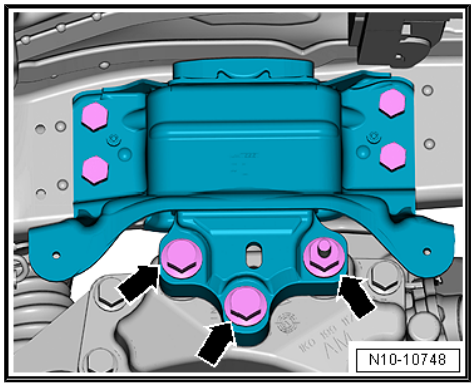
- *Replace the bolts that were tightened with an additional turn.*
- *Replace the self-locking nuts and bolts, sealing rings, seals and O-rings.*
- *The hose connections as well as air duct pipes and hoses must be free of oil and grease before installing.*
- *Secure all hose connections with standard production hose clamps. Refer to the Parts Catalog.*
- *During installation, all cable ties must be installed at the same location.*

– Guide the engine/transmission assembly into the body.

– Install the bolts -arrows- for the engine mount by hand all the way.



– Install the bolts -arrows- for the transmission mount by hand until it is in position.



Note

Only tighten the bolts to the specification when installing the subframe mount. Refer to
⇒ "2.1 Overview - Subframe Mount", page 26 .

– Remove the Engine/Gearbox Jack - Engine Support - T10359- from the engine.

– Install drive axles. Refer to ⇒ Suspension, Wheels, Steering; Rep. Gr. 40 ; Drive Axle; Overview - Drive Axle .

Vehicles with Manual Transmission:

– Install the clutch slave cylinder. Refer to ⇒ Manual Transmission; Rep. Gr. 30 ; Clutch Mechanism; Clutch Master and Clutch Slave Cylinder, Checking .

– Install the cables with the cable bracket. Refer to ⇒ Rep. Gr. 34 ; Selector Mechanism; Selector Mechanism, Removing and Installing .

Vehicles with DSG® Transmission:

– Install and adjust the selector lever cable. Refer to ⇒ Rep. Gr. 34 ; Selector Mechanism; Selector Mechanism, Removing and Installing .

Continuation for All Vehicles:

– Install the A/C compressor. Refer to ⇒ Heating, Ventilation and Air Conditioning; Rep. Gr. 87 ; A/C Compressor; Overview - A/C Compressor Power Unit .

– Install the ribbed belt. Refer to
⇒ "1.2 Ribbed Belt, Removing and Installing", page 41 .

– Install the battery tray. Refer to ⇒ Electrical Equipment; Rep. Gr. 27 ; Battery; Overview - Battery .

– Connections and wiring routing. Refer to ⇒ Electrical Equipment; Rep. Gr. 97 ; Relay Carriers, Fuse Panels and E-Boxes; Component Location Overview - Relay Carriers, Fuse Panels and E-Boxes and ⇒ Wiring diagrams, Troubleshooting & Component locations.

– Install the air filter housing. Refer to
⇒ "2.2 Air Filter Housing, Removing and Installing", page 269 .

– Install the engine cover. Refer to
⇒ "3.1 Engine Cover, Removing and Installing", page 34 .

– Check the oil level.

– Connect the coolant hoses.

– Fill with coolant. Refer to ⇒ page 202 .

Note

Do not reuse coolant.

– Install the subframe. Refer to ⇒ Suspension, Wheels, Steering; Rep. Gr. 40 ; Subframe; Subframe without Steering Gear, Removing and Installing .

– Adjust the subframe mount. Refer to ⇒ “2.7 Subframe Mount, Adjusting”, page 32 .

– Install front wheel housing liners. Refer to ⇒ Body Exterior; Rep. Gr. 66 ; Wheel Housing Liner .

Caution

Risk of destroying the control module through excessive voltage.

- ***Do not use a charger to jump start.***

– The chain lengths must be adapted after replacing the engine. To do this, select `01 - Chain Length Adaptation Diagnosis` in the `Guided Functions`. Refer to Vehicle Diagnostic Tester .

Tightening Specifications

- Refer to ⇒ “2.1 Overview - Subframe Mount”, page 26
- Refer to ⇒ “2.1 Overview - Emissions Control”, page 317
- Refer to ⇒ “1.1 Overview - Muffler”, page 310
- Refer to ⇒ “2.1 Overview - Air Filter Housing”, page 268
- Refer to ⇒ Rep. Gr. 34 ; Transmission, Removing and Installing; Transmission Tightening Specifications .

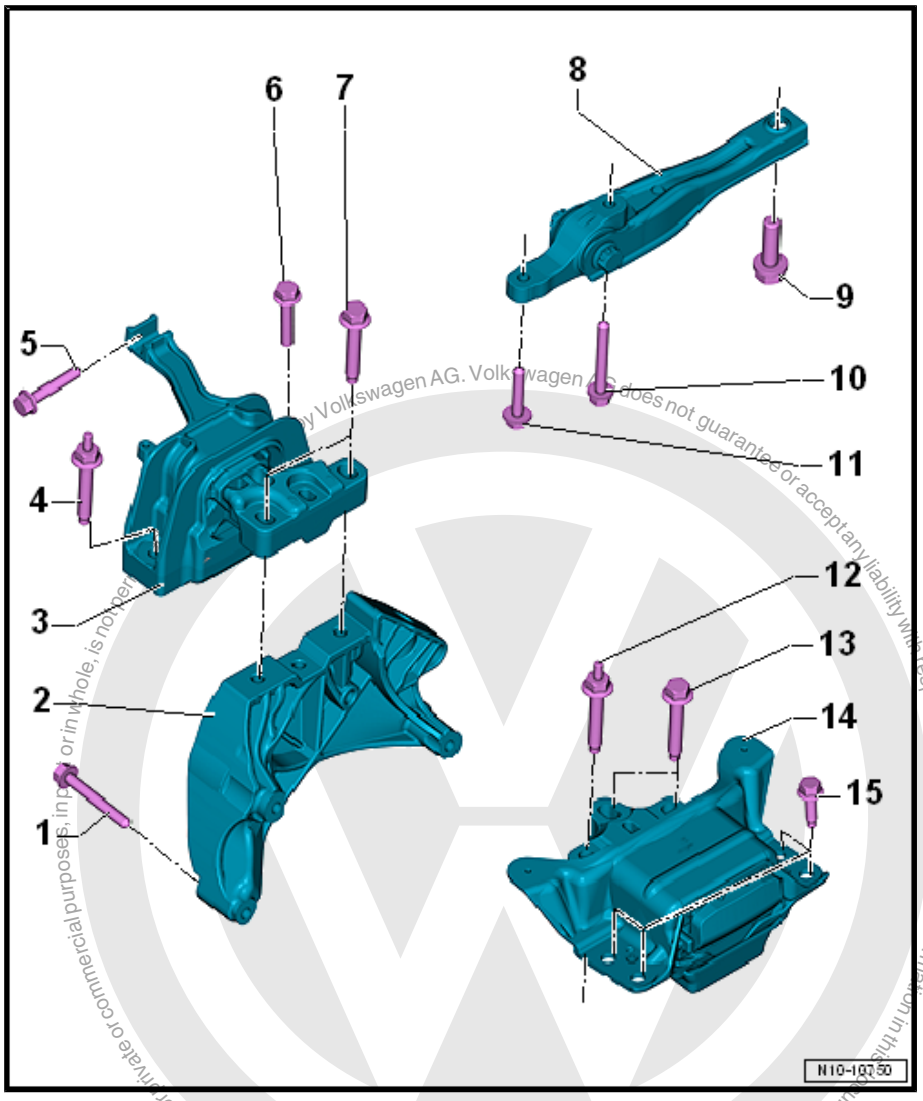
Note

- *The tightening specifications only apply to lightly greased, oiled, phosphated or blackened nuts and bolts.*
- *Additional lubricants, such as engine or transmission oil are permissible, however lubricants containing graphite are not.*
- *Do not use any ungreased parts.*
- *Tightening specification tolerance: ±15%.*

Component		Nm
Bolts and nuts	M6	10
	M7	15
	M8	20
	M10	40
	M12	65

2 Subframe Mount

2.1 Overview - Subframe Mount



1 - Bolt
- ❑ Replace after removing
- ❑ Tightening specification and sequence. Refer to ⇒ Fig. ““Engine Support - Tightening Specification and Sequence”“ , page 50 .

2 - Engine Support
- ❑ Removing and installing. Refer to ⇒ “1.6 Engine Support, Removing and Installing”, page 49 .

3 - Engine Mount
- ❑ With support arm
- ❑ Removing and installing. Refer to ⇒ “2.3 Engine Mount, Removing and Installing”, page 30 .

4 - Bolt
- ❑ 40 Nm +90°
- ❑ Replace after removing

5 - Bolt
- ❑ 20 Nm +90°
- ❑ Replace after removing

6 - Bolt
- ❑ 40 Nm +90°
- ❑ Replace after removing

7 - Bolt
- ❑ 60 Nm +90°
- ❑ Replace after removing

8 - Pendulum Support
- ❑ Removing and installing. Refer to ⇒ “2.5 Pendulum Support, Removing and Installing”, page 32 .

9 - Bolt
- ❑ Replace after removing

- ❑ Tightening specification and sequence. Refer to ⇒ “2.5 Pendulum Support, Removing and Installing”, page 32 .

10 - Bolt

- ❑ Replace after removing
- ❑ Tightening specification and sequence. Refer to ⇒ “2.5 Pendulum Support, Removing and Installing”, page 32 .

11 - Bolt

- ❑ Replace after removing
- ❑ Tightening specification and sequence. Refer to ⇒ “2.5 Pendulum Support, Removing and Installing”, page 32 .

12 - Bolt

- ❑ 60 Nm +90°
- ❑ Replace after removing

13 - Bolt

- ❑ 60 Nm +90°
- ❑ Replace after removing

14 - Transmission Mount

- ❑ With support arm
- ❑ Removing and installing. Refer to ⇒ “2.4 Transmission Mount, Removing and Installing”, page 30 .

15 - Bolt

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

2.2 Engine, Supporting in Installation Position

Special tools and workshop equipment required

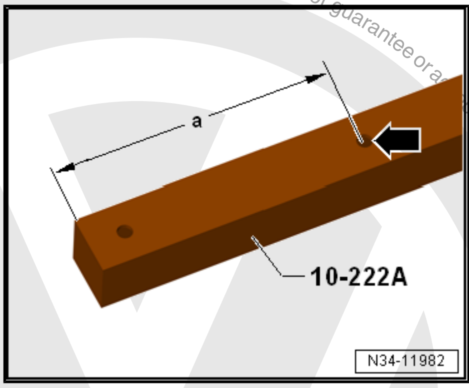
- ♦ Engine Support Bridge - 10-222A-
- ♦ Engine Support Bridge - Engine Support 18 - 10-222A/18-
- ♦ Engine Support Bridge - Engine Support 29 - 10-222A/29-
- ♦ Engine Support - Basic Set Square Pipe - T40091/1- and Engine Support - Movable Joint - T40091/3- from the Engine Support - Basic Set - T40091-
- ♦ Engine Support Brackets - T40093/3- and Engine Support Brackets - T40091/3-6- from the Engine Support - Supplement Kit - T40093A-
- ♦ Engine Support Bridge - Special Hook (2 pc.) - 10-222A/20-

Tool Development

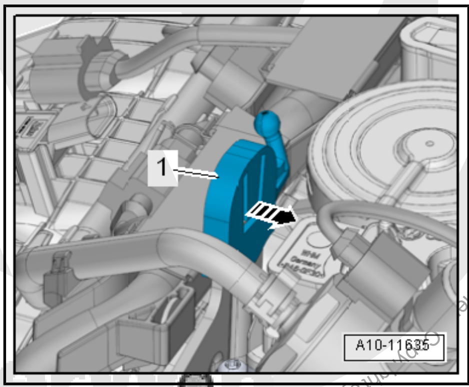
– If the adapter for Engine Support Bridge - Engine Support 4 - 10-222A/4- does not have the indicated holes -arrow- shown they must be added.

- Dimension -a- = 225 mm.
- Hole diameter = 12.5 mm

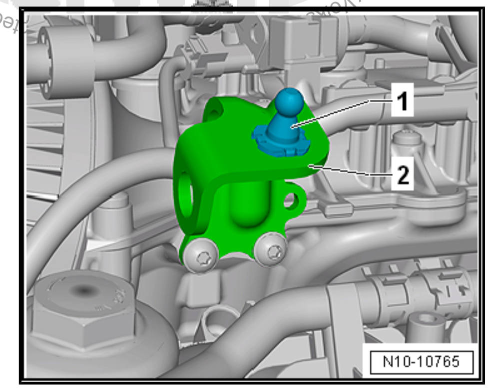
– Remove the engine cover. Refer to ⇒ “3.1 Engine Cover, Removing and Installing”, page 34 .



– Unlock the retaining tab in direction of -arrow- and remove the engine cover mount -1-.



– Unclip the right mount -1- for the engine cover from the bracket -2-.



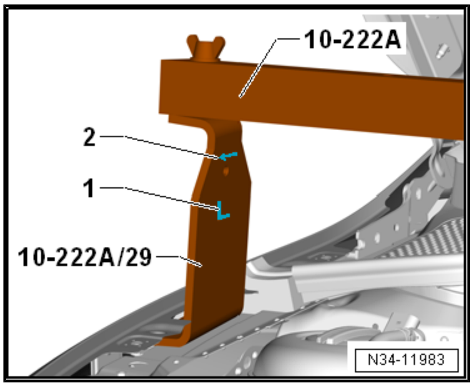
– Place the Engine Support Bridge - Engine Support 29 - 10-222A/29- on both sides of the vehicle between the upper wheel housing longitudinal member and the fender bolting plate underneath.

♦ Installation position:

“L” = -1- Adapter is Installed on the Right Side of the Vehicle (Adapter Secured in the Opening on the Fender).

“R” (Not Illustrated), Adapter is Installed on the Left Side of the Vehicle.

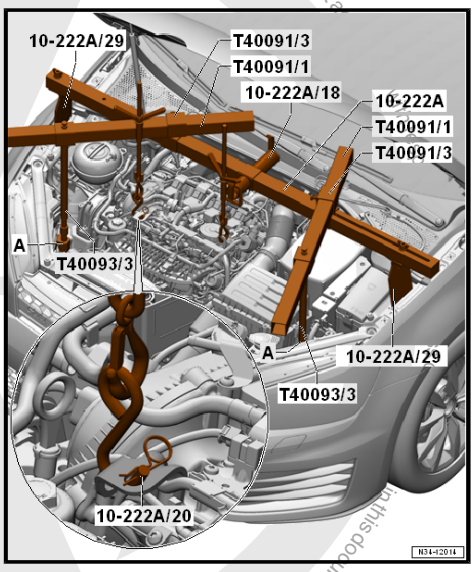
The arrow -2- always points in direction of travel.



– Push the Engine Support Bridge - Engine Support 18 - 10-222A/18- and two Engine Support - Movable Joint - T40091/3- on the Engine Support Bridge - 10-222A- .

– Tighten the Engine Support Bridge - 10-222A- on the Engine Support Bridge - Engine Support 29 - 10-222A/29- .

– Remove the upper section of the washer fluid reservoir. Refer to ⇒ Electrical Equipment; Rep. Gr. 92 ; Windshield Washer System; Windshield Washer Fluid Reservoir, Removing and Installing .



– If equipped, remove the wires from the front area of ridge on both longitudinal members -arrow-. Do not disconnect the wiring harness.

– Place the Engine Support Brackets - T40093/3-6- on both sides of the longitudinal member the right longitudinal member is shown here).

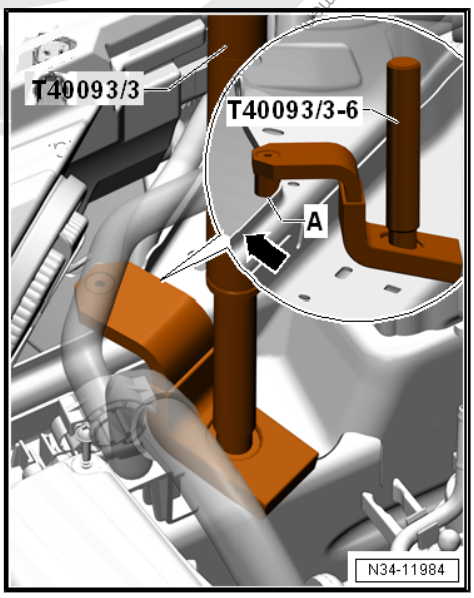
– If necessary carefully unclip the A/C system pipe in the front area. Do not disconnect the wiring harness. Refer to ⇒ Heating, ventilation, and Air Conditioning; Rep. Gr. 87 ; System Overview - Refrigerant Circuit .

• Lock the Engine Support Brackets - T40093/3-6- with the pin -A- behind the edge of the longitudinal member -arrow-.

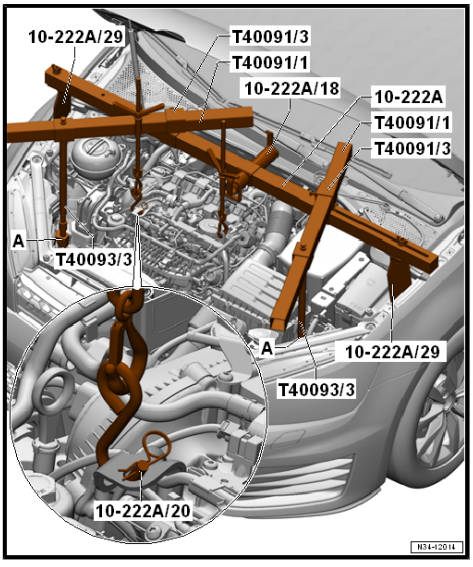
– Install the Engine Support Bracket - T40093/3- .

– Connect the Engine Support Brackets - T40093/3- over the Engine Support - Basic Set - Square Pipe - T40091/1- with the Engine Support Bridge - 10-222A- and tension.

– Engage the Engine Support Brackets - T40093/3- in the engine lifting eye over the Engine Support Bridge - Special Hook (2 pc.) - 10-222A/20- and if necessary over the Engine/Gearbox Support Shackle (2 pc.) - 10-222A/12- .



– Lightly tension the engine/transmission assembly and Extractor via the Engine Support Brackets - T40093/3- .



2.3 Engine Mount, Removing and Installing

Removing

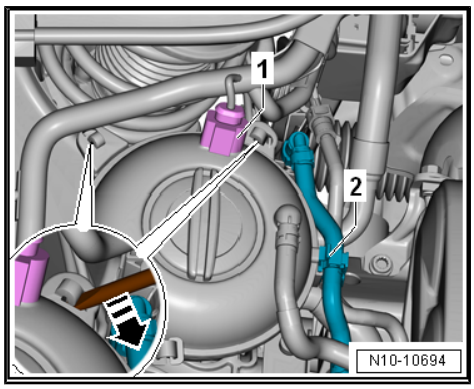
– Disconnect the connector -1-.

– Free up the hoses -2-.

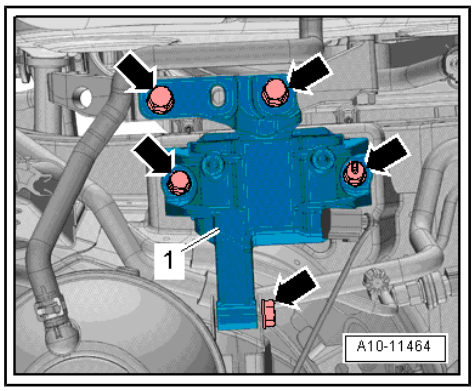
– Release the catches with a screwdriver in direction of -arrow-. Move the coolant expansion tank to the side.

– Support the engine in the installation position. Refer to ⇒ “2.2 Engine, Supporting in Installation Position”, page 27 .

– Slightly pretension the engine/transmission assembly with the spindle, do not lift.



– Remove the bolts -arrows- and engine mount -1-.



Installing

Install in reverse order of removal and note the following:

– Check the adjustment of the subframe mount. Refer to ⇒ “2.6 Subframe Mount, Checking Adjustment”, page 32 .

Tightening Specifications

◆ Refer to ⇒ “2.1 Overview - Subframe Mount”, page 26

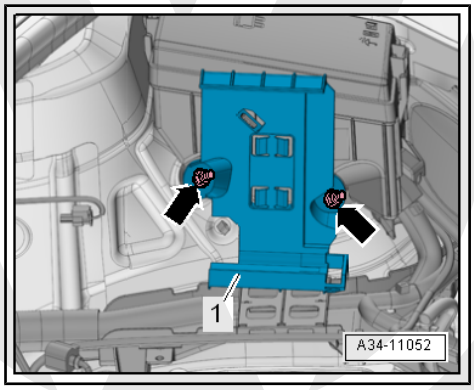
2.4 Transmission Mount, Removing and Installing

Removing

– Remove the battery tray. Refer to ⇒ Electrical Equipment; Rep. Gr. 27 ; Battery; Battery Tray, Removing and Installing .

– Remove the Engine Control Module - J623- from the bracket with the lines still connected. Refer to ⇒ “8.1 Engine Control Module J623 , Removing and Installing”, page 304 .

– Remove the bolts -arrows- and remove the bracket -1-.

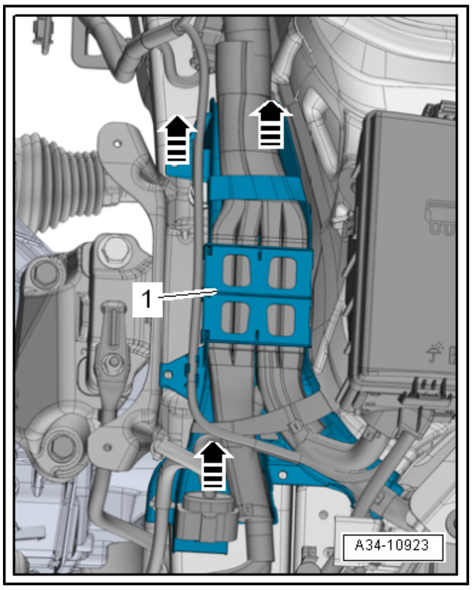


Note

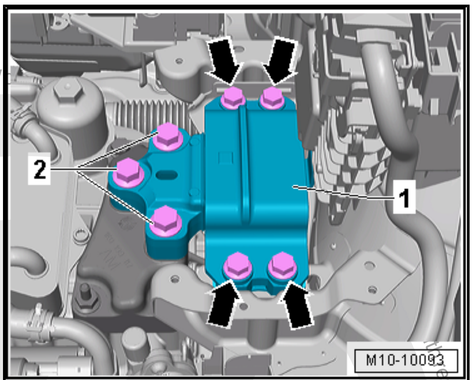
Depending on the version different brackets are installed.

– Unclip the wiring guide -1- upward and move it slightly to the side in direction of -arrows-.

– Support the engine in the installation position. Refer to ⇒ “2.2 Engine, Supporting in Installation Position”, page 27 .



– Remove the bolts -2-, then the bolts -arrows- and remove the transmission mount -1-.



Installing

Install in reverse order of removal and note the following:

Note

Replace the bolts that were tightened with an additional turn.

– Secure the transmission support to the longitudinal member.

Caution

Risk of damaging threads in transmission support by inserting bolts at an angle.

- ***The transmission support and the transmission mount support arm must be absolutely parallel to each other before installing the bolts. Push the transmission up using a floor jack if necessary.***
- ***Only remove the Engine Support Bridge - 10-222A- when bolts for subframe mount are tightened to tightening specification.***

– Pull the transmission up using the spindle on the engine support bridge until the transmission comes into contact with the transmission mount support arm.

– Check the adjustment of the subframe mount. Refer to ⇒ “2.6 Subframe Mount, Checking Adjustment”, page 32 .

– Remove the Engine Support Bridge - 10-222A- from the engine.

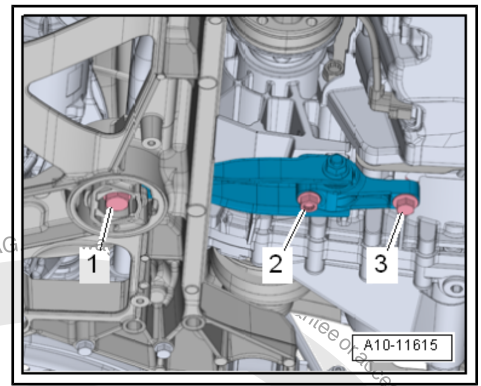
Tightening Specifications

- Refer to ⇒ “2.1 Overview - Subframe Mount”, page 26
- Refer to ⇒ Electrical Equipment; Rep. Gr. 27 ; Battery; Overview - Battery .

2.5 Pendulum Support, Removing and Installing

Removing

– Remove the noise insulation. Refer to ⇒ Body Exterior; Rep. Gr. 66 ; Noise Insulation; Overview - Noise Insulation .



– Remove bolts -1, 2 and 3- and remove pendulum support.

Installing

Install in reverse order of removal and note the following:

Tightening Specifications

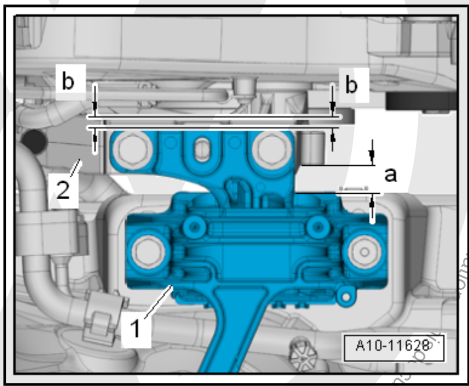
Step	Screws	Tightening Specification/Additional Turn
1.	-2 and 3-	50 Nm
2.	-1-	130 Nm
3.	-1 to 3-	Turn an additional 90°.

♦ Refer to ⇒ Body Exterior; Rep. Gr. 66 ; Noise Insulation; Overview - Noise Insulation .

2.6 Subframe Mount, Checking Adjustment

Procedure

The following dimensions must be attained:



- The clearance between the engine support -2- and the engine mount -1- must be -a- = 10 mm.
- The casting edge on the engine support must be parallel to the support arm.
- Dimension -b- = Dimension -b-.

Note

Distance -a- = 10 mm can be checked for example with a corresponding round stock.

– If the distance measured is too small or too large, adjust the subframe. Refer to ⇒ “2.7 Subframe Mount, Adjusting”, page 32 .

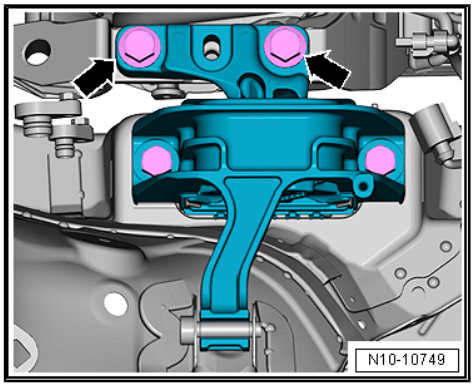
2.7 Subframe Mount, Adjusting

Procedure

– Remove the battery tray. Refer to ⇒ Electrical Equipment; Rep. Gr. 27 ; Battery; Battery Tray, Removing and Installing .

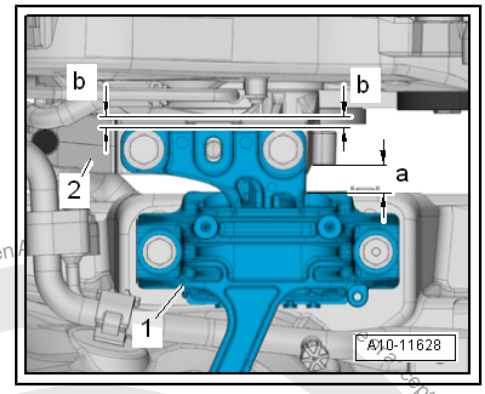
– Support the engine in the installation position. Refer to ⇒ “2.2 Engine, Supporting in Installation Position”, page 27 .

– Remove and replace the bolts -arrows- for the engine mount one after the other (if this was not already done when the engine was installed).
– Install the bolts loosely.



– Slide the engine/transmission assembly with a extractor lever until the following dimensions are set:

• The clearance between the engine support -2- and the engine mount -1- must be -a- = 10 mm.
• The casting edge on the engine support must be parallel to the support arm.
• Dimension -b- = Dimension -b-.

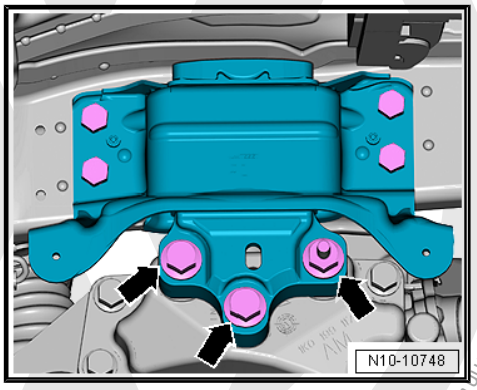


Note

Distance -a- = 10 mm can be checked for example with a corresponding round stock.

– Tighten the bolts on the engine mount.

– Remove and replace the bolts -arrows- for the transmission mount one after the other on the (if this was not already done when the engine was installed).
– Install the bolts loosely.



– Pay attention that on the transmission side the support arm and the transmission mount remain parallel.

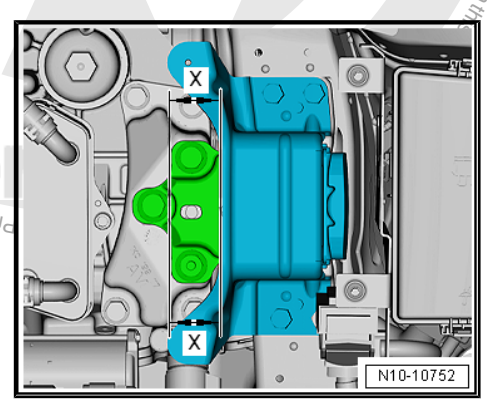
• Dimension -x- = dimension -x-.

– Tighten the transmission support bolts.

Tightening Specifications

♦ Refer to ⇒ “2.1 Overview - Subframe Mount”, page 26

♦ Refer to ⇒ Electrical Equipment; Rep. Gr. 27 ; Battery; Overview - Battery .



3 Engine Cover

⇒ “3.1 Engine Cover, Removing and Installing”, page 34

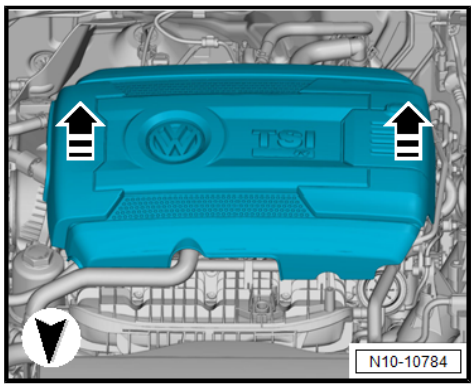
3.1 Engine Cover, Removing and Installing

Removing

Note

Do not pull sharply on the engine cover or pull it to one side.

– Carefully pull the engine cover off the retaining pins one after the other in direction of -arrows-.



Installing

Install in reverse order of removal and note the following:

– To prevent damage to the engine cover, do not hit the engine cover with fist or a tool.

– Position the engine cover while paying attention to the oil filler tube and oil dipstick.

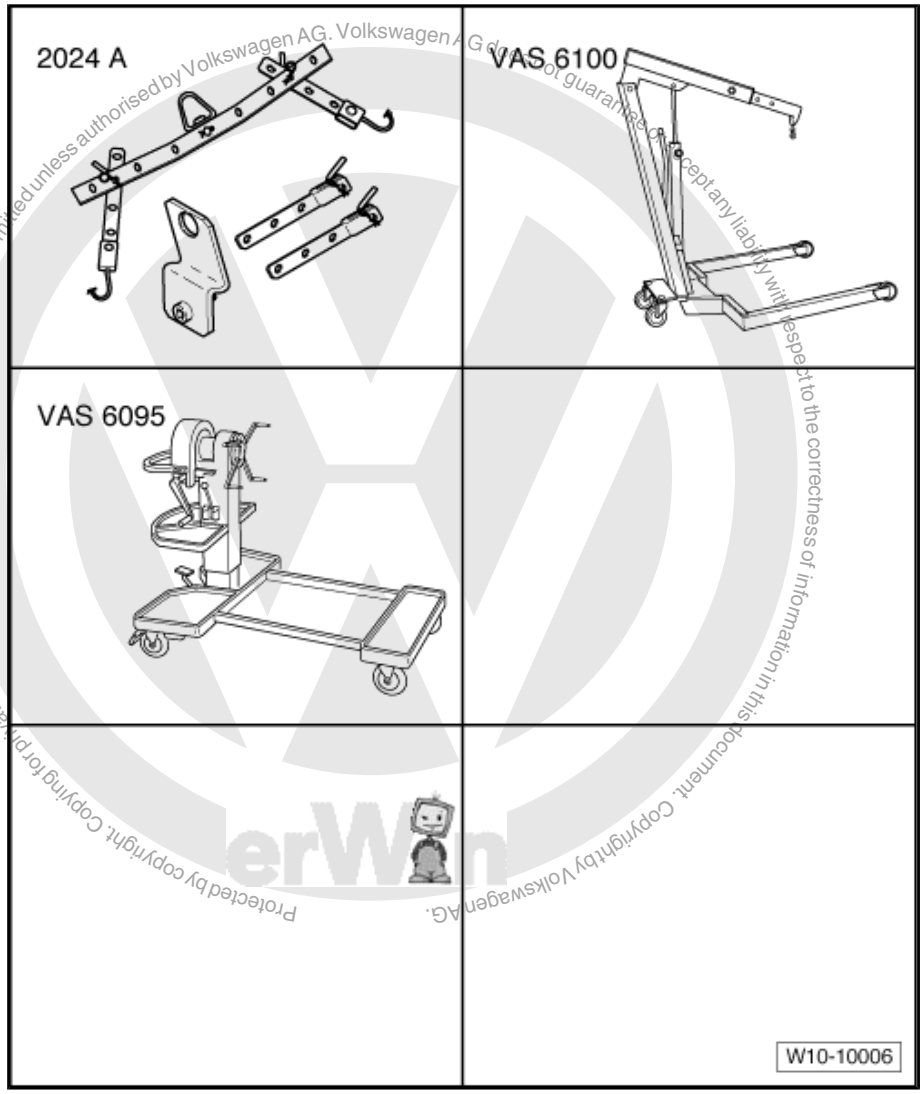
– Press the engine cover into the rubber grommets on the left side first, then into the ones on the right side.

4 Special Tools

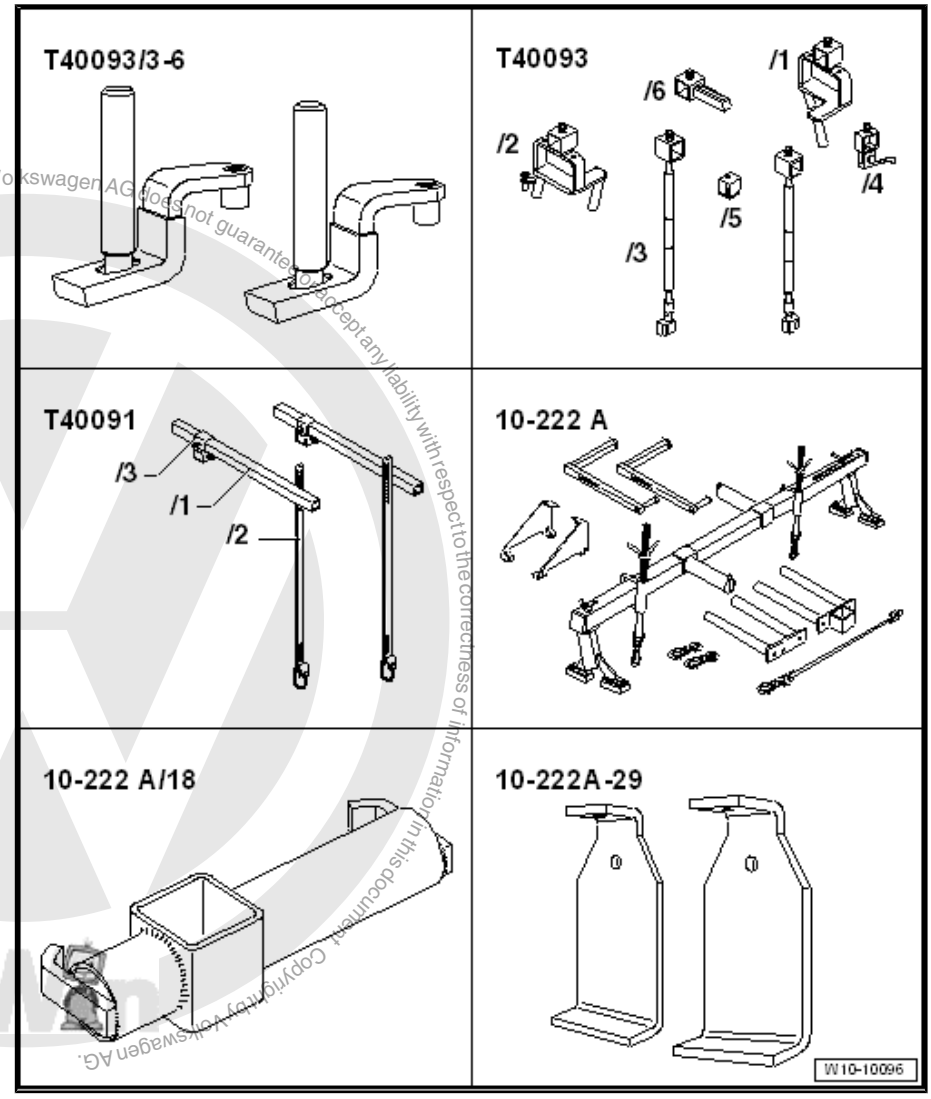
Special tools and workshop equipment required

- Pry Lever - 80-200-
- Hose Clip Pliers - VAS6362-
- Engine and Gearbox Jack - VAS6931-
- Step Ladder - VAS5085-
- Shop Crane - Drip Tray - VAS6208-
- Engine/Gearbox Jack - Engine Support - T10359 -
- Engine/Gearbox Jack - Pin - T10359/2-
- Adapter - T10359/3-
- Protective Eyewear
- Safety Gloves

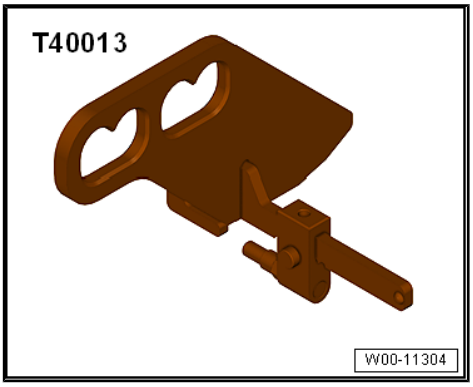
- Engine Sling - 2024A-
- Shop Crane - VAS6100-
- Engine and Gearbox Bracket - VAS6095A-



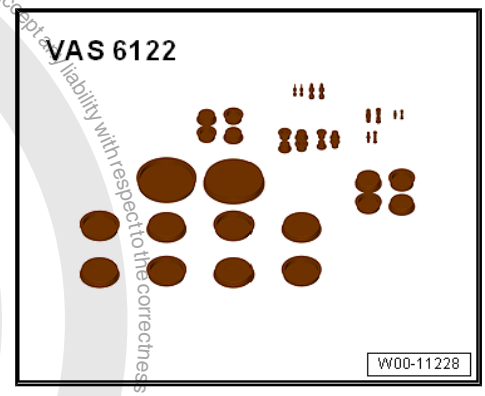
- Engine Support Bridge - 10-222A-
- Engine Support Bridge - Engine Support 18 - 10-222A/18-
- Engine Support Bridge - Engine Support 29 - 10-222A/29-
- Engine Support - Basic Set Square Pipe - T40091/1- and Engine Support - Movable Joint - T40091/3- from the Engine Support - Basic Set - T40091-
- Engine Support Brackets - T40093/3- and Engine Support Brackets - T40091/3-6- from the Engine Support - Supplement Kit - T40093A-



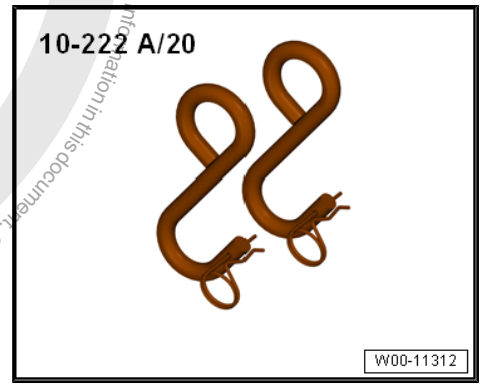
- Transmission Lift Hook - T40013-



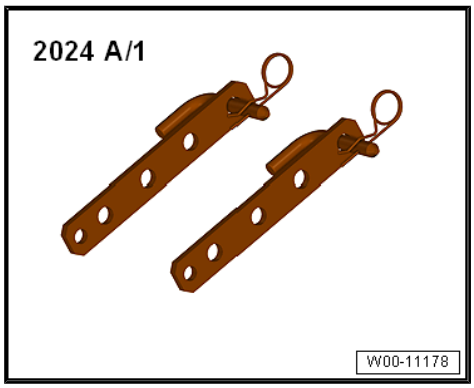
- Engine Bung Set - VAS6122-



- Engine Support Bridge - Special Hook (2 pc.) - 10-222A/20-



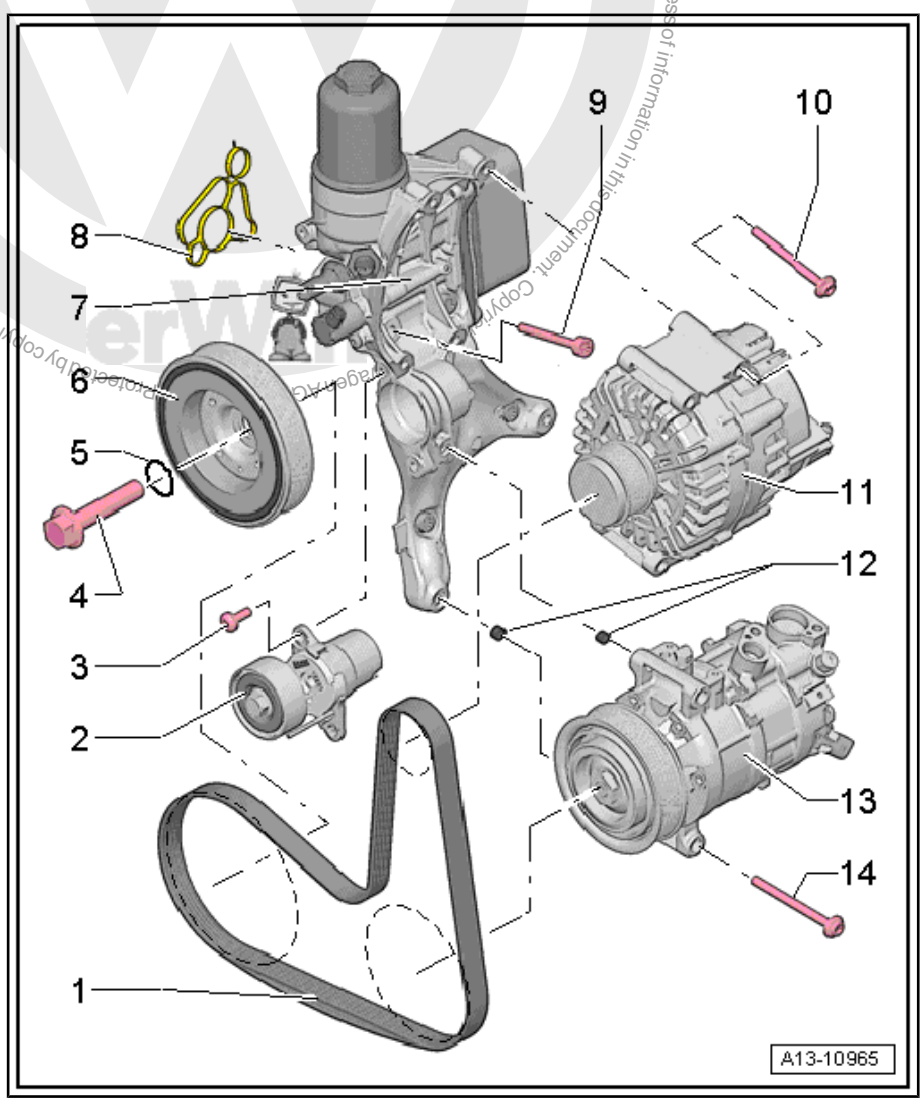
- Engine Sling - Engine Bracket - 2024A/1-



13 – Crankshaft, Cylinder Block

1 Cylinder Block, Belt Pulley Side

1.1 Overview - Cylinder Block, Belt Pulley Side



1 - Ribbed Belt

- ❑ Check for wear
- ❑ Do not kink
- ❑ Ribbed belt routing. Refer to ⇒ Fig. ““Ribbed Belt Routing”“ , page 41
- ❑ Removing and installing. Refer to ⇒ “1.2 Ribbed Belt, Removing and Installing”, page 41 .
- ❑ When installing, make sure it is seated correctly on the belt pulleys

2 - Ribbed Belt Tensioner

- ❑ To release tension on ribbed belt, pivot using a wrench.
- ❑ Secure using the Locking Pin - T10060A-
- ❑ Removing and installing. Refer to ⇒ “1.3 Ribbed Belt Tensioner, Removing and Installing”, page 42 .

3 - Bolt

- ❑ 8 Nm +45°
- ❑ Replace after removing

4 - Bolt

- ❑ 150 Nm +90°
- ❑ Replace after removing
- ❑ Coat the O-ring with oil.
- ❑ Use the Counterhold - Vibration Damper - T10355- to loosen and tighten

5 - O-Ring

- ❑ Not a replacement part; supplied with the bolt

6 - Vibration Damper

- ❑ With ribbed belt pulley
- ❑ Removing and installing. Refer to ⇒ “1.5 Vibration Damper, Removing and Installing”, page 44 .

7 - Sub-Assembly Bracket

- ❑ With oil filter and engine oil cooler
- ❑ Sub-assembly bracket, removing and installing. Refer to ⇒ “1.4 Sub-Assembly Bracket, Removing and Installing”, page 42 .
- ❑ Removing and installing the engine oil cooler. Refer to ⇒ “2.2 Engine Oil Cooler, Removing and Installing”, page 182 .

8 - Seal

- ❑ Replace after removing

9 - Bolt

- ❑ Replace after removing
- ❑ Tightening specification and sequence. Refer to ⇒ Fig. ““Accessory Assembly Bracket - Tightening Specifications and Tightening Sequence”“ , page 40 .

10 - Bolt

- ❑ Tightening specification. Refer to ⇒ Electrical Equipment; Rep. Gr. 27 ; Generator; Overview - Generator .

11 - Generator

- ❑ Overview. Refer to ⇒ Electrical Equipment; Rep. Gr. 27 ; Generator; Overview - Generator .

12 - Alignment Sleeves

- ❑ For the A/C compressor

13 - A/C Compressor

- ❑ Do not remove or disconnect refrigerant lines
- ❑ Overview. Refer to ⇒ Heating, Ventilation and Air Conditioning; Rep. Gr. 87 ; A/C Compressor; Overview - A/C Compressor Power Unit .

14 - Bolt

- ❑ Tightening specification. Refer to ⇒ Heating, Ventilation and Air Conditioning; Rep. Gr. 87 ; A/C Compressor; Overview - A/C Compressor Power Unit .

Accessory Assembly Bracket - Tightening Specifications and Tightening Sequence

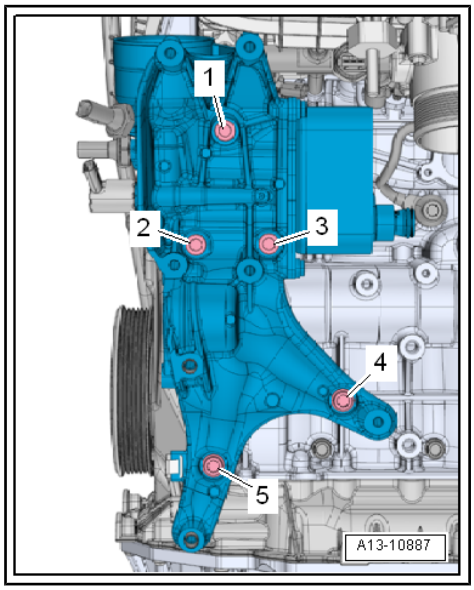
– Mount the accessory assembly bracket and then install the bolt -4- by hand.

Note

Bolts that are tightened with an additional turn must be replaced.

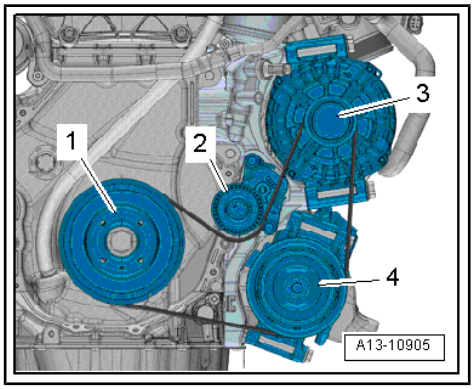
– Tighten bolts in -1 to 5- sequence in three stages as follows:

1. Tighten bolts hand-tight.
2. Tighten the bolts to 20 Nm.
3. Tighten the bolts an additional 90°.



Ribbed Belt Routing

1 - Vibration Damper
2 - Ribbed Belt Tensioner
3 - Generator
4 - A/C Compressor



1.2 Ribbed Belt, Removing and Installing

Special tools and workshop equipment required

- Locking Pin - T10060A-

Removing

– Remove the noise insulation. Refer to ⇒ Body Exterior; Rep. Gr. 66 ; Noise Insulation; Overview - Noise Insulation .

– Remove the windshield washer fluid reservoir. Refer to ⇒ Electrical Equipment; Rep. Gr. 92 ; Windshield Washer System; Windshield Washer Fluid Reservoir, Removing and Installing .

Caution

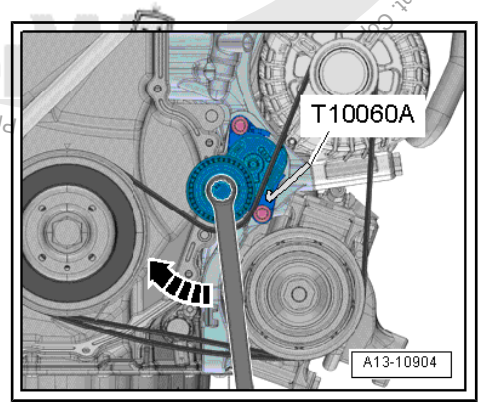
Risk of damage by reversing the running direction on a used ribbed belt.

- ***Before removing the ribbed belt, mark the running direction with chalk or a felt-tip pen for reinstallation.***

– To release the ribbed belt tension, rotate tensioner in the direction of -arrow-.

– Secure the tensioning system using the Locking Pin - T10060A- .

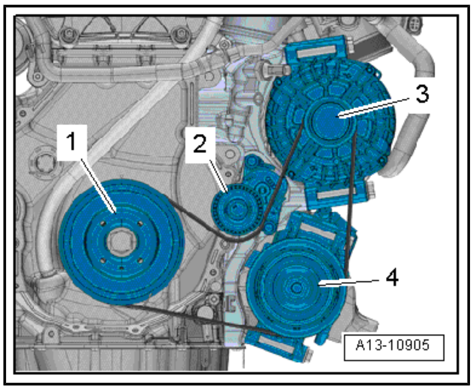
– Remove the ribbed belt.



Installing

Install in reverse order of removal and note the following:

– Position the ribbed belt as illustrated.



1 - Vibration Damper

2 - Ribbed Belt Tensioner

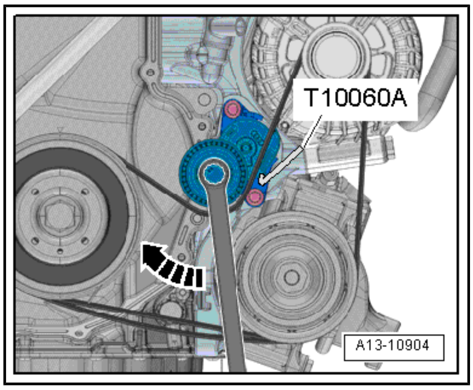
3 - Generator

4 - A/C Compressor

– Turn the tensioning system in the direction of -arrow- and remove the Locking Pin - T10060A- .

– Release the tensioner.

– Check whether the ribbed belt is routed correctly.



– Start engine and check whether ribbed belt runs correctly.

Tightening Specifications

♦ Noise insulation; overview - noise insulation. Refer to ⇒ Body Exterior; Rep. Gr. 66 ; Noise Insulation; Overview - Noise Insulation .

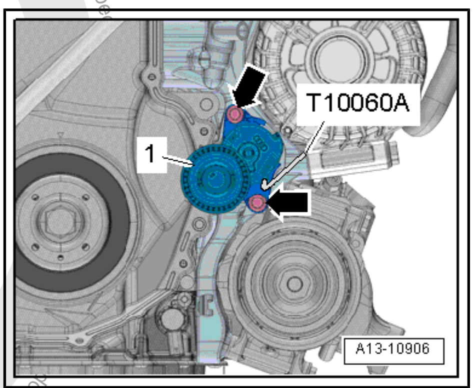
1.3 Ribbed Belt Tensioner, Removing and Installing

Removing

– Remove the ribbed belt. Refer to ⇒ “1.2 Ribbed Belt, Removing and Installing”, page 41 .

– Remove the windshield washer fluid reservoir. Refer to ⇒ Electrical Equipment; Rep. Gr. 92 ; Windshield Washer System; Windshield Washer Fluid Reservoir, Removing and Installing .

– Remove the bolts -arrows- and pull the ribbed belt tensioning damper -1- off the sub-assembly bracket.



Installing

Install in reverse order of removal and note the following:

– Install the ribbed belt. Refer to ⇒ “1.2 Ribbed Belt, Removing and Installing”, page 41 .

Tightening Specifications

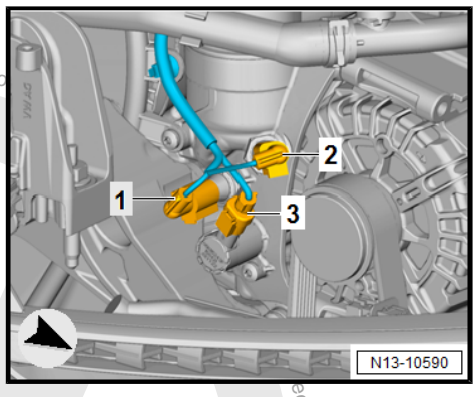
♦ Refer to ⇒ “1.1 Overview - Cylinder Block, Belt Pulley Side”, page 39

1.4 Sub-Assembly Bracket, Removing and Installing

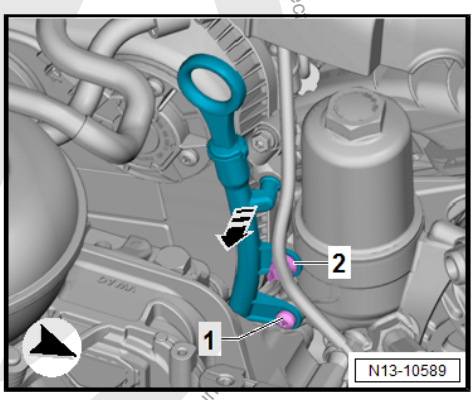
Removing

– Drain the coolant. Refer to ⇒ “1.2 Coolant, Draining and Filling”, page 201 .

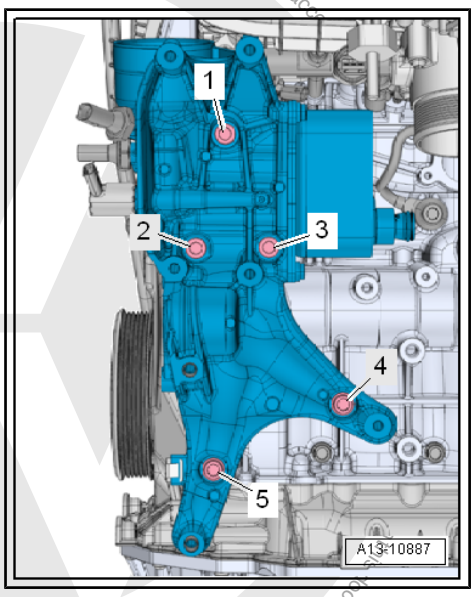
– Remove the generator. Refer to ⇒ Electrical Equipment; Rep. Gr. 27 ; Generator; Generator, Removing and Installing .
– Remove the A/C compressor from the bracket with refrigerant hoses connected and tie up to the right side. Refer to ⇒ Heating, Ventilation and Air Conditioning; Rep. Gr. 87 ; A/C Compressor; A/C Compressor, Removing and Installing on Bracket .
– Disconnect the connectors -1, 2 and 3-.
– Remove the oil filter. Refer to ⇒ Maintenance ; Booklet 36.1 .
– Unclip the wiring harness bracket -2-. Remove the bolt -1- for the oil dipstick tube.



– Unclip the guide tube from the upper cover for the timing chain in the direction of -arrow-.
– Free up the wiring harness.
– Place the Shop Crane - Drip Tray - VAS6208- under the engine.



– Remove the bolts -1 through 5- and pull off the accessory assembly bracket from the coolant pump housing.



Installing

Install in reverse order of removal and note the following:

Note

- *Bolts that are tightened with an additional turn must be replaced.*
- *Replace the O-rings and seals.*

– Coat the new O-rings -4- with coolant.

– Install the connection -2- into the coolant pump housing -3-.

– Slide the engine oil cooler -1- onto the connection and then install and tighten the bolts. Refer to ⇒ Fig. ""Accessory Assembly Bracket - Tightening Specifications and Tightening Sequence"" , page 40 .

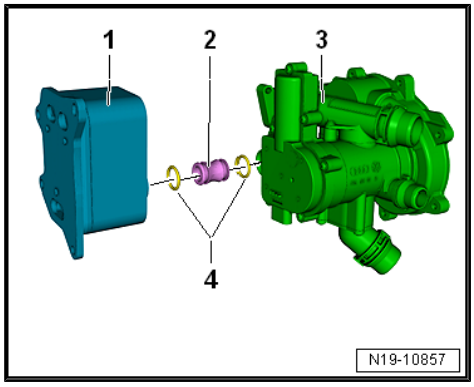
– Install the A/C compressor. Refer to ⇒ Heating, Ventilation and Air Conditioning; Rep. Gr. 87 ; A/C Compressor; Overview - A/C Compressor Power Unit .

– Install the generator. Refer to ⇒ Electrical Equipment; Rep. Gr. 27 ; Generator; Generator, Removing and Installing .

– Install the ribbed belt. Refer to ⇒ "1.2 Ribbed Belt, Removing and Installing", page 41 .

– Fill with coolant. Refer to ⇒ page 202 .

– Install the oil filter and then check the oil level. Refer to ⇒ Maintenance ; Booklet 36.1 .



Tightening Specifications

- Refer to ⇒ "1.1 Overview - Cylinder Block, Belt Pulley Side", page 39
- Refer to ⇒ "1.1 Overview - Timing Chain Cover", page 82
- Refer to ⇒ Electrical Equipment; Rep. Gr. 27 ; Generator; Overview - Generator .

1.5 Vibration Damper, Removing and Installing

Special tools and workshop equipment required

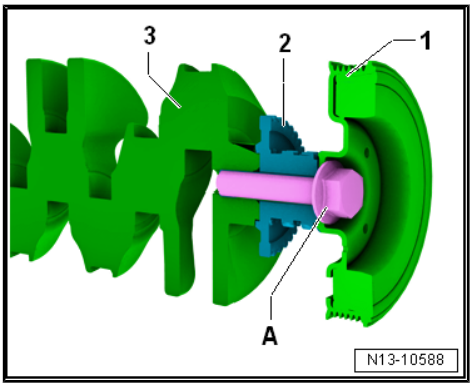
- Counterhold - Vibration Damper - T10355-
- Vibration Damper Assembly Tool - T10531-

Individual components of the Vibration Damper Assembly Tool - T10531- :

- Vibration Damper Assembly Tool - Counterhold Tool - T10531/1-
- Vibration Damper Assembly Tool - Tensioning Pins - T10531/2-
- Vibration Damper Assembly Tool - Turning Over Tool - T10531/3-

♦ Vibration Damper Assembly Tool - Knurled Nut - T10531/4-

The vibration damper bolt -A- connects the vibration damper -1- timing chain sprocket -2- and the crankshaft -3-. Secure the chain sprocket as described as follows to the crankshaft, before removing the vibration damper.



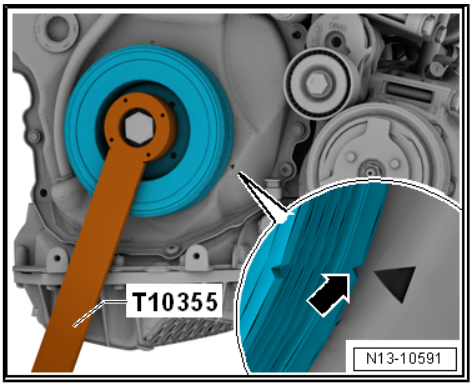
Removing

– Remove the windshield washer fluid reservoir. Refer to ⇒ Electrical Equipment; Rep. Gr. 92 ; Windshield Washer System; Windshield Washer Fluid Reservoir, Removing and Installing .

– Remove the ribbed belt. Refer to ⇒ “1.2 Ribbed Belt, Removing and Installing”, page 41 .

– Remove the Locking Pin - T10060A- from the ribbed belt tensioner.

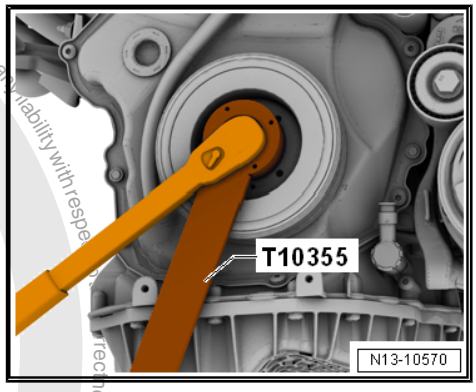
– Turn the vibration damper with the Counterhold - Vibration Damper - T10355- to the TDC point -arrow-.



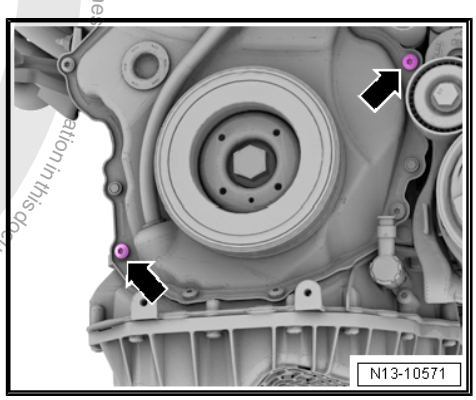
- The notch on the vibration damper must align with the arrow marking on the lower timing chain cover.
- The marking for the cover is located in the »four-o'clock position«.

– Loosen the vibration damper bolt approximately $^1/_2$ turn, to do this use the Counterhold - Vibration Damper - T10355- .

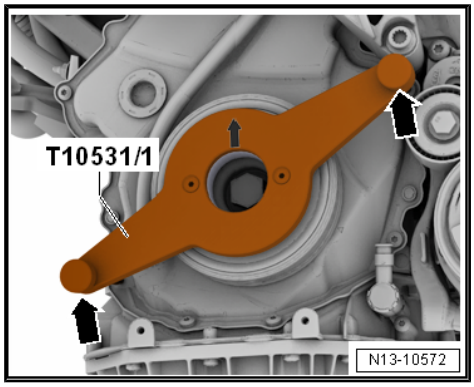
– If the vibration damper was turned, correct to TDC.



– Remove the bolts -arrows- for the timing chain cover. The bolts must be replaced.



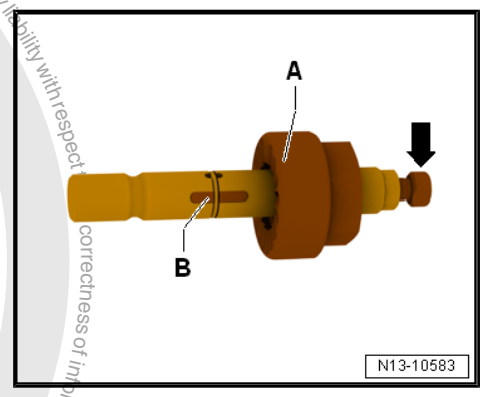
– Place the Vibration Damper Assembly Tool - Counterhold Tool - T10531/1- as shown on the vibration damper and tighten hand-tight using the knurled bolt -arrows-.
– Remove the vibration damper bolt completely.



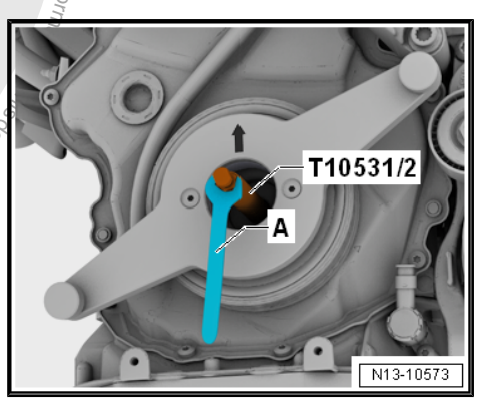
– Check if the Vibration Damper Assembly Tool - Turning Over Tool - T10531/3- -A- can be easily pushed over the clamping piece -B-. If necessary turn the adjusting bolt -arrow-.

Note

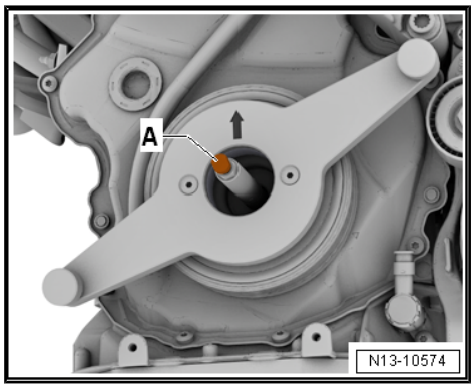
Do not turn the tensioning bolt further, otherwise the Assembly Tool - Tensioning Pins - T10531/2- becomes jammed when installing the crankshaft



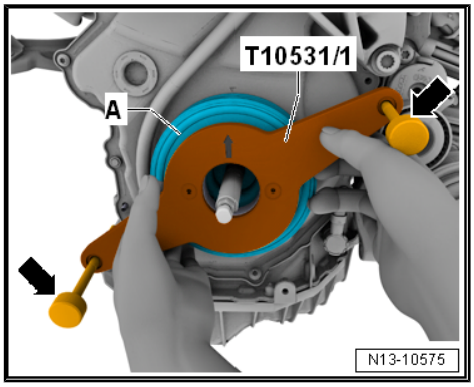
– Install the Vibration Damper Assembly Tool - Tensioning Pins -T10531/2- in the crankshaft and with a 12 mm open end wrench -A- tighten hand-tight.



– Tighten the adjusting bolt -A- hand-tight, to secure the chain sprocket to the crankshaft.

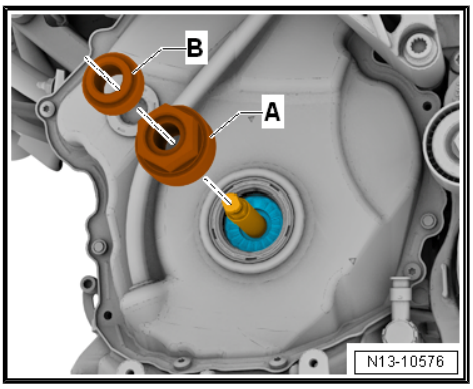


– Remove the knurled bolt -arrows-.
– Remove the Vibration Damper Assembly Tool - Counterhold Tool - T10531/1- and vibration damper -A-.

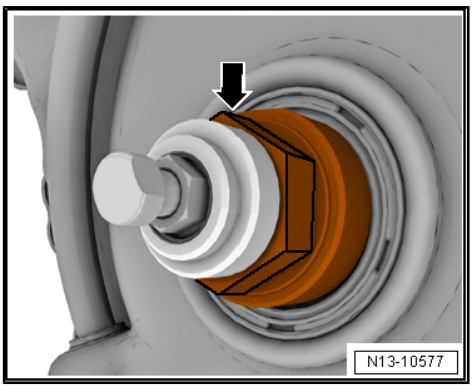


If the Crankshaft Should Be Turned without the Vibration Damper:

– Place the Assembly Tool - Turning Over Tool - T10531/3- -A- on the tensioning pins and while doing so pay attention to the chain sprocket tooth contour. The flat side of the top of the tool sits in TDC.
– Tighten the Assembly Tool - Turning Over Tool - T10531/3- with the Knurled Nut - T10531/4- -B-.



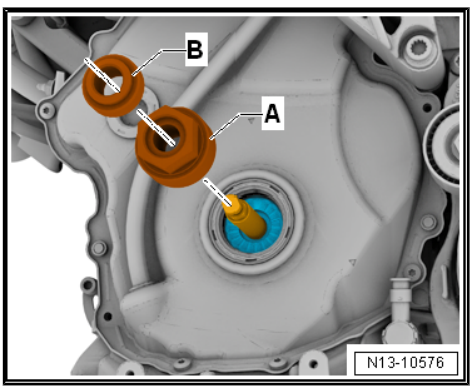
– The crankshaft can now be turned on the hex fitting -arrow-.



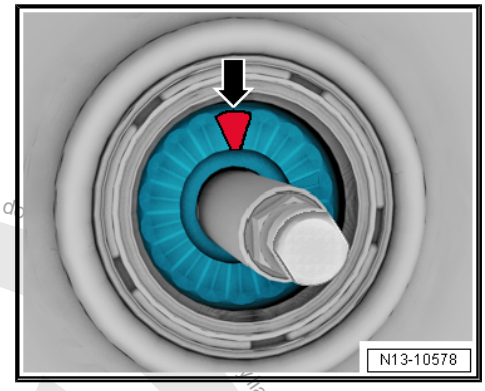
Installing

Install in reverse order of removal and note the following:

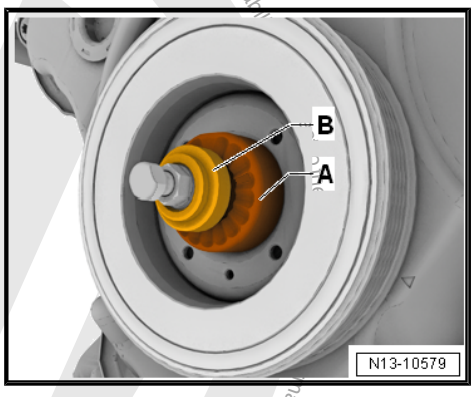
– If necessary remove the Vibration Damper Assembly Tool - Knurled Nut - T10531/4- -B- and the Vibration Damper Assembly Tool - Turning Over Tool - T10531/3- -A- from the tensioning pins.



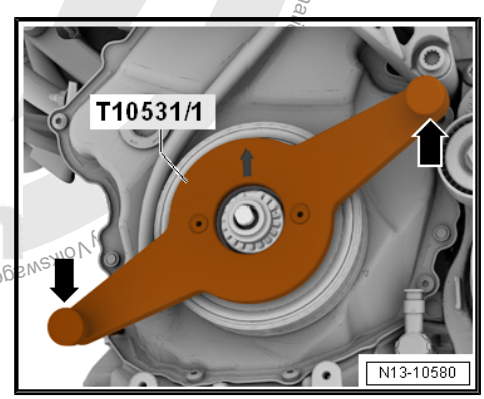
– Secure the vibration damper in TDC, while doing this pay attention to the tooth contour of the chain sprocket -arrow-.
– Place the Vibration Damper Assembly Tool - Turning Over Tool - T10531/3- -A- on the tensioning pins while the hex fitting points to the vibration damper.
– Install the Vibration Damper Assembly Tool - Knurled Nut - T10531/4- -B-, while doing this move the vibration damper slightly back and forth, to check in the vibration damper is seated correctly in the tooth contour.



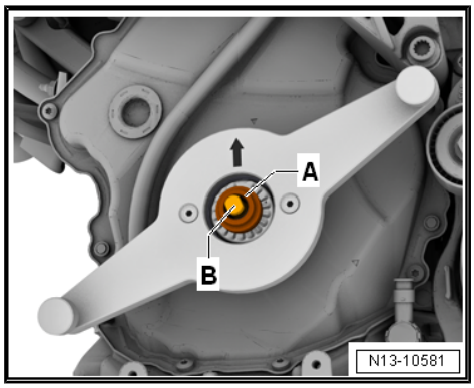
– Tighten the collar nut, until the vibration damper can no longer be turned.



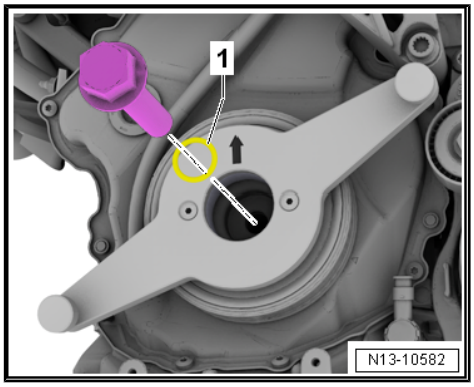
– Place the Vibration Damper Assembly Tool - Counterhold Tool - T10531/1- as shown on the vibration damper and tighten hand-tight using the knurled bolt -arrows-.



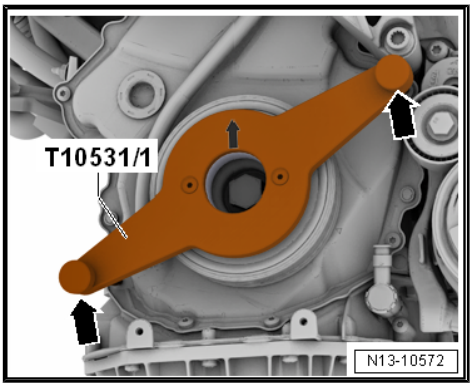
– Remove the Vibration Damper Assembly Tool - Turning Over Tool - T10531/3- -A- and loosen the adjusting bolt -B-.
– Remove the Vibration Damper Assembly Tool - Tensioning Pins - T10531/2- and remove with Vibration Damper Assembly Tool - Turning Over Tool - T10531/3- .



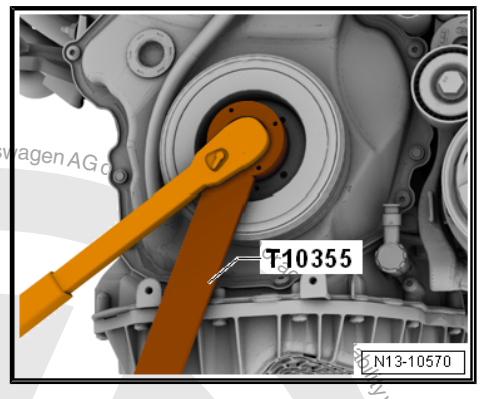
– Install a new vibration damper bolt with an oiled O-ring -1- hand-tight.



– Remove the knurled bolt -arrows- and remove the Vibration Damper Assembly Tool - Counterhold Tool - T10531/1- .



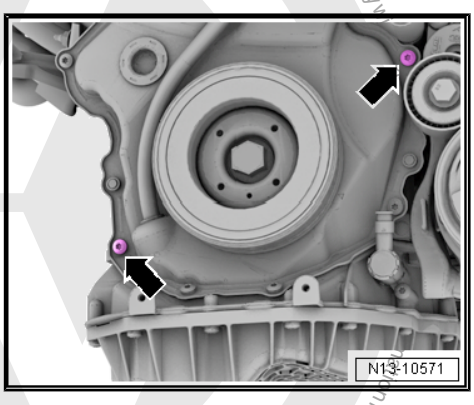
– Tighten vibration damper bolt using the Counterhold - Vibration Damper - T10355- .



– Install new bolts -arrows-.

Tightening Specifications

♦ Refer to
⇒ “1.1 Overview - Cylinder Block, Belt Pulley Side”, page 39



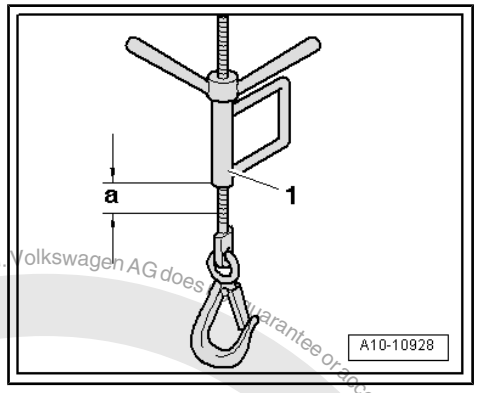
1.6 Engine Support, Removing and Installing

Removing

– Remove the engine mount. Refer to
⇒ “2.3 Engine Mount, Removing and Installing”, page 30 .

– Lift the engine using the Engine Support Bridge - Spindle - 10-222A/11- -1- to dimension -a-.

• Dimension -a- = approximately 30 mm.

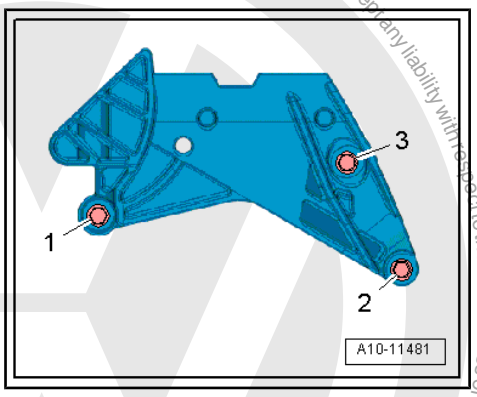


– Remove the bolts -1, 2 and 3- and engine support.

Installing

Install in reverse order of removal and note the following:

– Install the engine mount. Refer to ⇒ “2.3 Engine Mount, Removing and Installing”, page 30 .

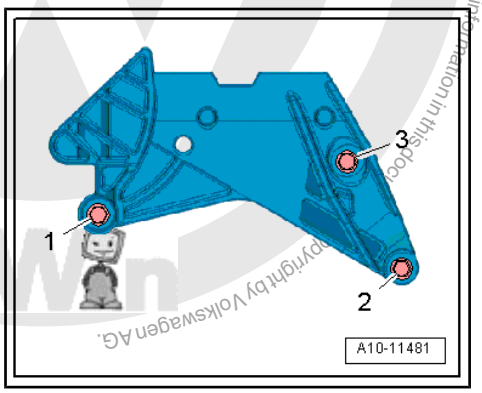


Engine Support - Tightening Specification and Sequence

Note

Replace the bolts.

– Tighten the bolts in steps in the sequence shown:



Step	Bolts	Tightening Specification/Additional Turn
1.	-1 to 3-	7 Nm
2.	-1 to 3-	40 Nm
3.	-1 to 3-	Turn an additional 90°.

1.7 Crankshaft Seal, Replacing, Belt Pulley Side

Special tools and workshop equipment required

♦ Seal Installer - Crankshaft - T10354-

♦ Press Piece - Gearbox - T10375-

♦ Vibration Damper Assembly Tool - Knurled Nut - T10531/4- from the Vibration Damper Assembly Tool - T10531-

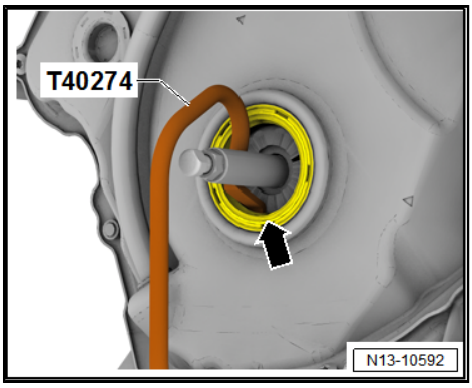
♦ Seal Installer - Crankshaft - T40274-

Removing

– Remove the vibration damper. Refer to ⇒ “1.5 Vibration Damper, Removing and Installing”, page 44 .

• The Vibration Damper Assembly Tool - Tensioning Pins - T10531/2- is installed.

– Remove the seal -arrow- with the Seal Installer - Crankshaft - T40274- .



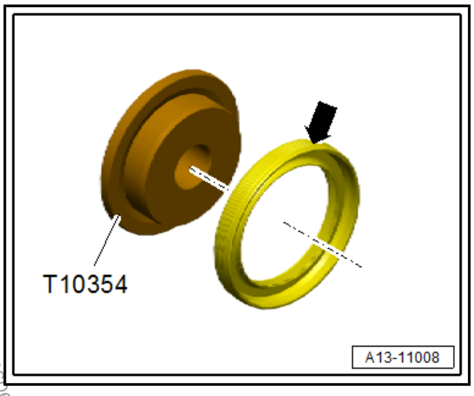
Installing

Install in reverse order of removal and note the following:

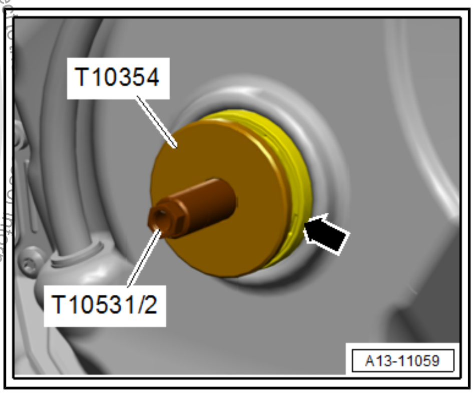
– Clean the contact and sealing surface.

– Push the seal -arrow- on the Seal Installer - Crankshaft - T10354- .

• The closed side of the seal points to the Seal Installer - Crankshaft - T10354- .



– Push the seal -arrow- with the Seal Installer - Crankshaft - T10354- on the Vibration Damper Assembly Tool - Tensioning Pins - T10531/2- and place on the lower timing chain cover.

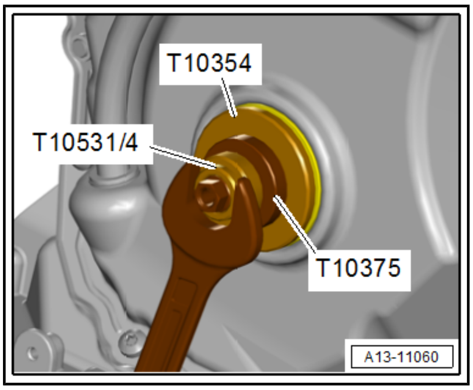


Note

- *Replace the vibration damper bolt.*
- *Replace the O-ring.*

– Additionally attach the Press Piece - Gearbox - T10375- and install the Vibration Damper Assembly Tool - Knurled Nut - T10531/4- .

– Tighten the Vibration Damper Assembly Tool - Knurled Nut - T10531/4- with a 21 mm open end wrench, until the seal is pressed in all the way.



– Install the vibration damper. Refer to ⇒ “1.5 Vibration Damper, Removing and Installing”, page 44 .

Tightening Specifications

- Refer to ⇒ “1.1 Overview - Cylinder Block, Belt Pulley Side”, page 39

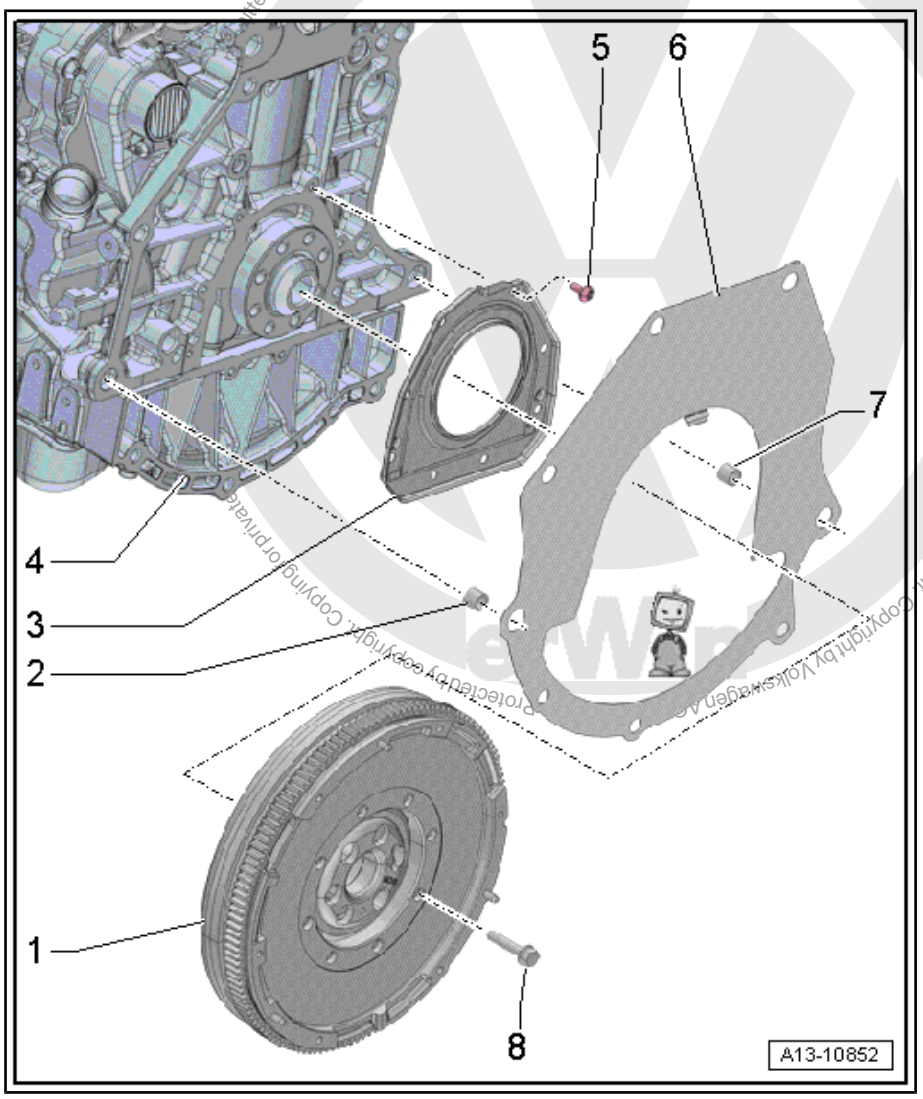
2 Cylinder Block, Transmission Side

⇒ “2.1 Overview - Cylinder Block, Transmission Side”, page 52

⇒ “2.2 Flywheel, Removing and Installing”, page 53

⇒ “2.3 Sealing Flange, Removing and Installing, Transmission Side”, page 54

2.1 Overview - Cylinder Block, Transmission Side



1 - Flywheel

- ❑ Only possible to install in one position - Bores are offset
- ❑ Removing and installing. Refer to ⇒ “2.2 Flywheel, Removing and Installing”, page 53 .

2 - Alignment Sleeve

3 - Sealing Flange, Transmission Side

- ❑ Replace after removing
- ❑ With seal
- ❑ Removing and installing. Refer to ⇒ “2.3 Sealing Flange, Removing and Installing, Transmission Side”, page 54 .
- ❑ Do not oil or grease the sealing lip of seal
- ❑ Before installing, remove oil remains from crankshaft journal with a clean cloth
- ❑ Guide sleeve may only be removed after the sealing flange has been slid onto the crankshaft pin.

4 - Cylinder Block

5 - Screws

- ❑ Tightening specification and sequence. Refer to ⇒ “2.3 Sealing Flange, Removing and Installing, Transmission Side”, page 54 .

6 - Intermediate Plate

- ❑ The illustration does not show the version in the vehicle.
- ❑ Must be located on alignment sleeves
- ❑ Be careful not to damage or bend when installing
- ❑ Is hooked in at sealing flange. Refer to ⇒ Fig. ““Installing the Intermediate Plate”“ , page 53

7 - Alignment Sleeve

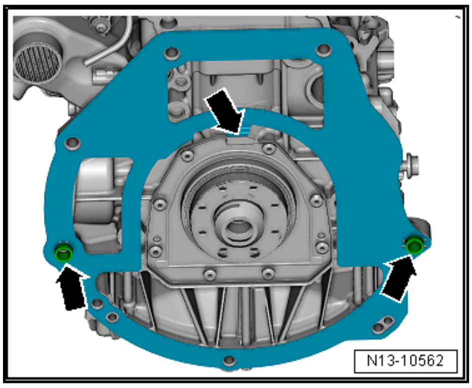
8 - Screws

- ❑ 60 Nm +90°
- ❑ Replace after removing

❑ For the dual-mass flywheel

Installing the Intermediate Plate

– Hook in intermediate plate at sealing flange and push it onto the alignment sleeves -arrows-.



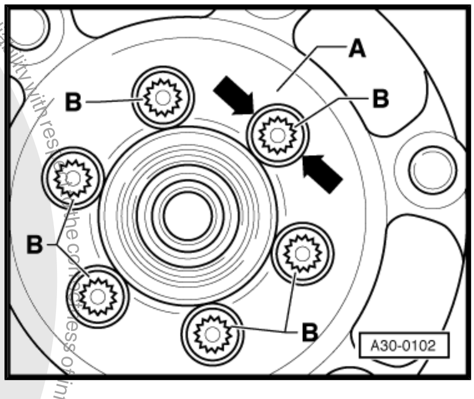
2.2 Flywheel, Removing and Installing

Special tools and workshop equipment required

♦ Flywheel Retainer - 3067-

Removing

• The transmission is removed.



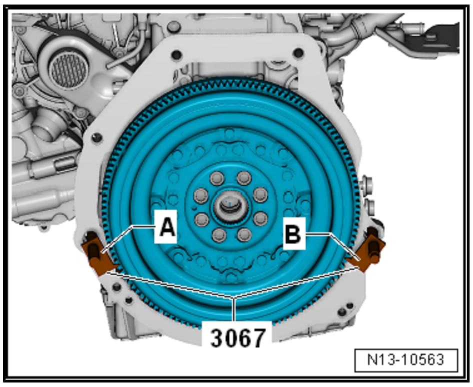
> ⚠ **Caution**
>
> *Risk of destroying the flywheel.*
>
> ♦ *Remove the bolts -B- by hand. Do not use an air-powered or impact wrench.*
>
> ♦ *When removing bolts, ensure bolt head does not come in contact with the flywheel.*
>
> ♦ *Turn the flywheel -A- until the bolts -B- line up with the holes -arrows-.*

– Insert the Flywheel Retainer - 3067- into the hole in the cylinder block -B-.

– Loosen and remove bolts for the flywheel.

Installing

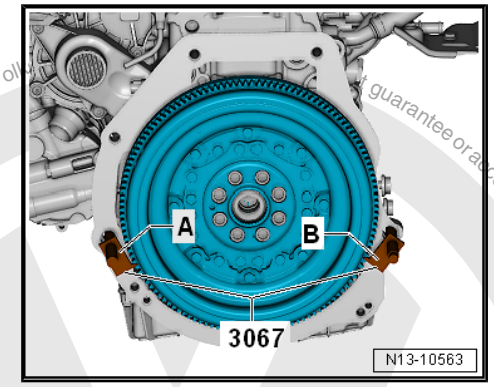
Install in reverse order of removal and note the following:



ℹ **Note**

Replace the bolts that were tightened with an additional turn.

– Insert the Flywheel Retainer - 3067- into the hole in the cylinder block -A-.



Tightening Specifications

♦ Refer to
⇒ “2.1 Overview - Cylinder Block, Transmission Side”, page 52

2.3 Sealing Flange, Removing and Installing, Transmission Side

Special tools and workshop equipment required

♦ Seal Installer - Sealing Flange Guide Sleeve - T20097-

♦ Hand Drill with Plastic Brush Attachment

♦ Protective Eyewear

♦ Sealant. Refer to the Parts Catalog.

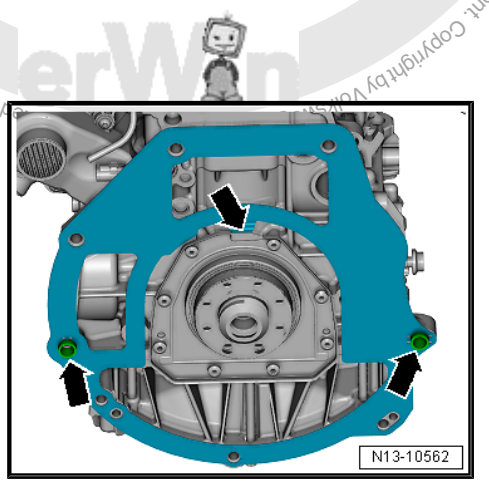
Removing

• The transmission is removed.

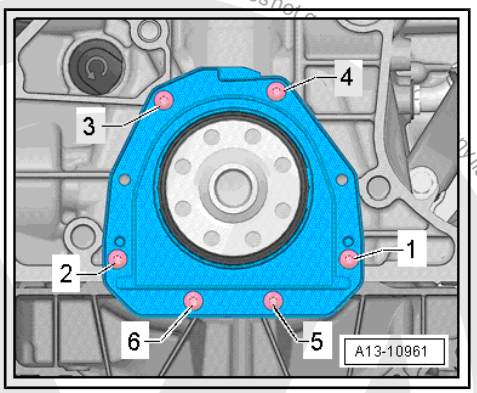
– Remove the flywheel. Refer to
⇒ “2.2 Flywheel, Removing and Installing”, page 53 .

– Disengage the intermediate plate at sealing flange and at the alignment sleeves -arrows-.

– Remove the bolts -1 through 6-.



– Remove the sealing flange.



Installing

Install in reverse order of removal and note the following:

Note

- *Be sure to check the expiration date of the silicone sealant.*
- *The sealing flange must be installed within five minutes after application of silicon sealant.*

Caution

Risk of contaminating the lubrication system with sealant residue.

- ***Lay a clean cloth over open part of oil pan.***

WARNING

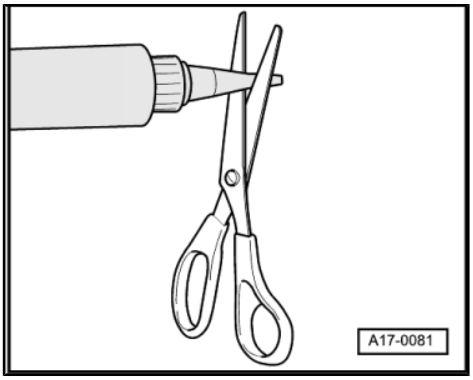
Risk of eye injury.

- ***Wear protective eyewear!***

– Remove the remaining sealant on the cylinder head with a flat-blade scraper or with a rotating plastic brush.

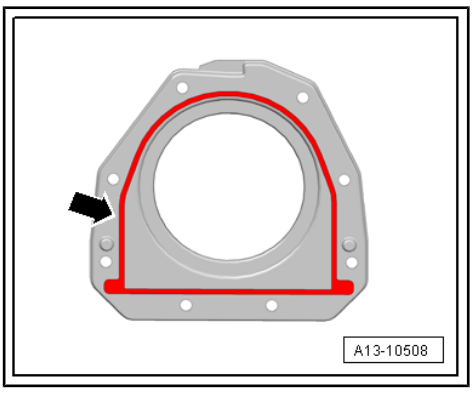
– Clean the sealing surfaces. They must be free of oil and grease.

– Cut the tube nozzle at the front marking (nozzle diameter: approximately 2 mm).



– Apply silicone sealant as illustrated to the clean sealing surface of the sealing flange.

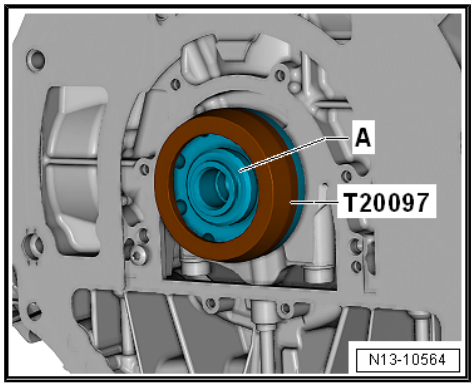
- Sealant bead thickness: 2 to 3 mm.



Note

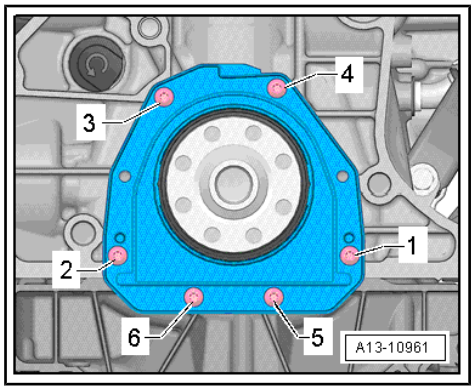
- *The sealing flange must be installed within five minutes after application of silicon sealant.*
- *The sealant bead may not be thicker than specified, otherwise excess sealant could enter the oil pan and clog the oil intake pipe screen.*

– Position the Seal Installer - Sealing Flange Guide Sleeve - T20097- on the crankshaft journal -A-.
– Slide the sealing flange onto the crankshaft pins with the Seal Installer - Sealing Flange Guide Sleeve - T20097- .



– Tighten the new bolts in evenly in the sequence shown:

Step	Bolts	Tightening Specification/Additional Turn
1.	-1 to 6-	Install all the way in by hand.
2.	-1 to 6-	9 Nm



Note

- *Only six bolts are installed, two bolt openings remain open.*
- *After installing sealing flange, the sealant must dry for approximately 30 minutes. Only after then may the engine oil be replenished.*

Tightening Specifications

- Refer to
⇒ “2.1 Overview - Cylinder Block, Transmission Side”, page 52

3 Crankshaft

3.1 Overview - Crankshaft

Note

Secure engine to assembly stand using Engine and Transmission Holder - VAS6095- when performing repair work. Refer to ⇒ “1.3 Engine, Securing to Engine and Transmission Holder”, page 21 .

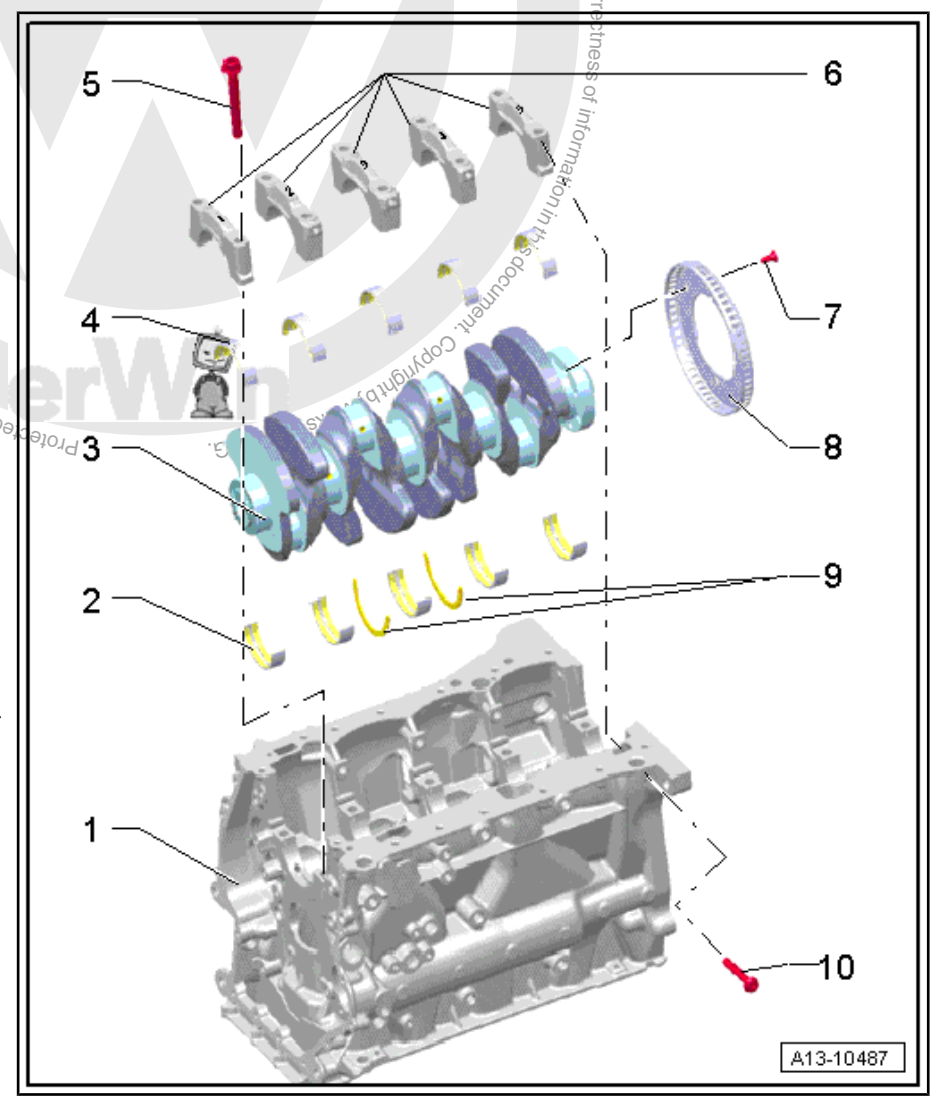
1 - Cylinder Block

2 - Cylinder Block Bearing Shell

- ❑ With oil groove
- ❑ lubricate
- ❑ Do not interchange used bearing shells (label)
- ❑ Crankshaft bearing shells identification (classification). Refer to ⇒ “3.4 Main Bearing Shells Allocation”, page 60 .

3 - Crankshaft

- ❑ After removal, lay aside so that sensor wheel -item 8- ⇒ Item 8 (page 58) is not rested on and becomes damaged
- ❑ If the crankshaft is being replaced, then the bearing shells must be reallocated to the bearing cover. Refer to ⇒ “3.4 Main Bearing Shells Allocation”, page 60 .
- ❑ Axial play. Refer to ⇒ “3.6 Crankshaft, Measuring Axial Clearance”, page 62
- ❑ Radial clearance. Refer to ⇒ “3.7 Crankshaft,



Measuring Radial Clearance", page 62 .

- ❑ Do not turn the crankshaft when measuring radial clearance
- ❑ Crankshaft Dimensions. Refer to ⇒ "3.5 Crankshaft Dimensions", page 61 .

4 - Bearing Shell for Bearing Cap

- ❑ Without oil groove
- ❑ Lubricate
- ❑ Do not interchange used bearing shells (label)
- ❑ Crankshaft bearing shells identification (classification). Refer to ⇒ "3.4 Main Bearing Shells Allocation", page 60 .

5 - Bolt

- ❑ Replace after removing
- ❑ Tightening sequence. Refer to ⇒ Fig. ""Crankshaft - Tightening Sequence"" , page 58

6 - Bearing Cap

- ❑ Bearing cap 1: belt pulley side
- ❑ Retaining tabs of bearing shells and cylinder block/bearing caps must lie above one another

7 - Bolt

- ❑ 10 Nm +90°
- ❑ Replace after removing
- ❑ Replace sensor wheel every time bolts are loosened. Refer to ⇒ "3.2 Sensor Wheel, Removing and Installing", page 59 .

8 - Sensor Wheel

- ❑ For Engine Speed Sensor - G28-
- ❑ Only possible to install in one position - Bores are offset
- ❑ Replace sensor wheel every time bolts are loosened
- ❑ Removing and installing. Refer to ⇒ "3.2 Sensor Wheel, Removing and Installing", page 59.

9 - Thrust Washers

- ❑ For bearing 3
- ❑ Lubricate

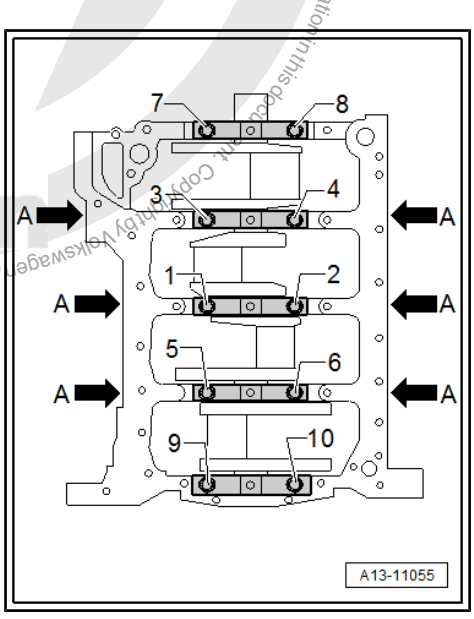
10 - Bolt

- ❑ Replace after removing
- ❑ Tightening sequence. Refer to ⇒ Fig. ""Crankshaft - Tightening Sequence"" , page 58

Crankshaft - Tightening Sequence

– Tighten the crankshaft bolts in the sequence -1 to 5-.

1. Tighten the bolts -1 through 10- -arrows A- by hand.
2. Pre-tighten the bolts -1 through 10- to 65 Nm.
3. Tighten the bolts -1 through 10- a 90° additional turn using a rigid wrench.
4. Tighten the bolts -arrows A- to 20 Nm.
5. Tighten the bolts -arrows A- 90° farther using a rigid wrench.



3.2 Sensor Wheel, Removing and Installing

– Remove the engine.

– Remove the sealing flange on the transmission side. Refer to ⇒ “2.3 Sealing Flange, Removing and Installing, Transmission Side”, page 54 .

– Remove the oil pan upper section. Refer to ⇒ “1.5 Oil Pan Upper Section, Removing and Installing”, page 176 .

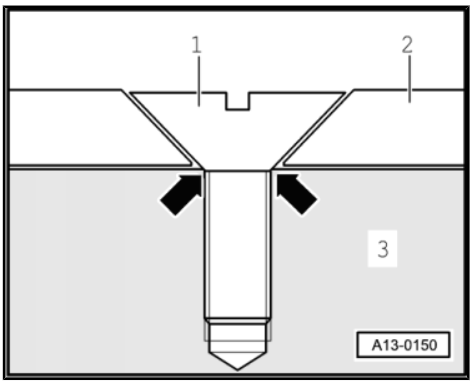
– Remove the balance shaft timing chain. Refer to ⇒ “2.4 Balance Shaft Drive Chain, Removing and Installing”, page 106 .

– Remove the connecting rod bearing cap.

– Remove the crankshaft bearing cap.

– Remove the crankshaft and the sensor wheel.

– Always replace the sensor wheel -2- each time the bolts -1- are loosened.



Note

- *After tightening a second time, the attachment point of the countersunk screws of the sensor wheel are so deformed that the screw heads lie on the crankshaft -3- -arrows- and the sensor wheel is loose underneath the screws.*
- *Installation of the sensor wheel is only possible in one position, the bore holes are shifted.*

Tightening Specifications

- Refer to ⇒ “3.1 Overview - Crankshaft”, page 57

3.3 Crankshaft Needle Bearing, Replacing

Only for Vehicles Equipped with a DSG Transmission

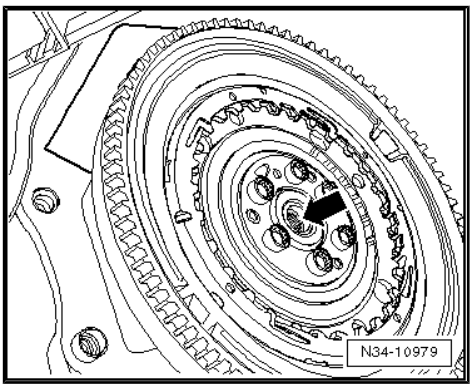
Special tools and workshop equipment required

- Counter-support for example Puller - Kukko Counterstay - 22/1-
- Internal puller, for example Puller - Kukko Internal - 14-19mm - 21/2-
- Bearing Installer - Bearing Press Piece - VW207C-

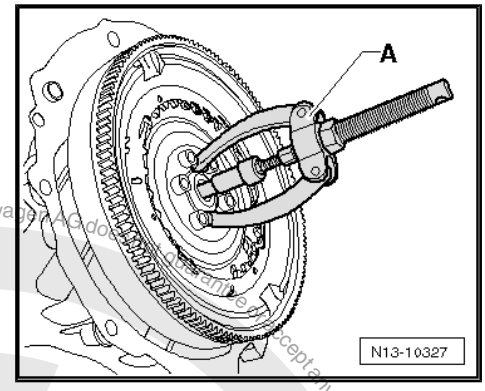
Note

Always replace the needle bearing -arrow- if the engine and the transmission are separated.

Removing:

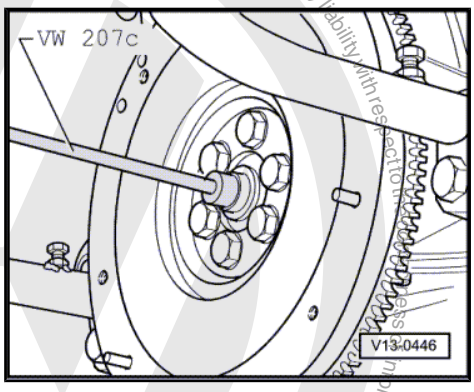


– Remove the needle bearing using a commercially available internal puller, for example Puller - Kukko Internal - 12-16mm - 21/2- and a counter-support, for example Puller - Kukko Counterstay - 22/1- -A-.

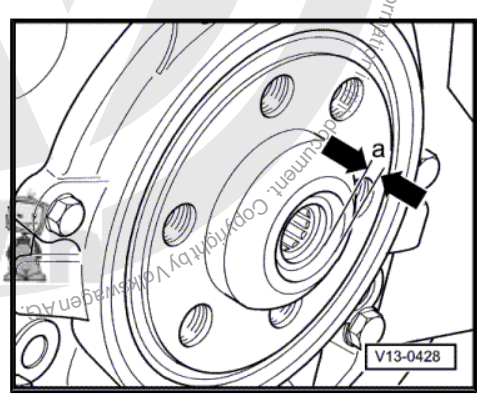


Installing:

– Drive in the needle bearing using Bearing Installer - Bearing Press Piece - VW207C- .



Installation depth -a- = 2.0 mm



3.4 Main Bearing Shells Allocation

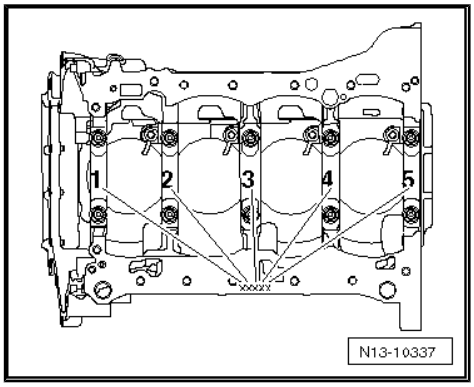
The bearing shells are allocated to the cylinder block with the correct thickness at the factory. Colored dots serve to identify the bearing shell thickness.

The code letters on the lower contact surface or on the top of the cylinder block identify which bearing shell and where it must be mounted on the cylinder block (upper bearing shell).

The code letters on the crankshaft identify which bearing shells and where they must be installed in the bearing cover (lower bearing shell).

The first letter is for bearing cap one, the second for bearing cap two, etc.

Cylinder Block Bearing Shell Identification:

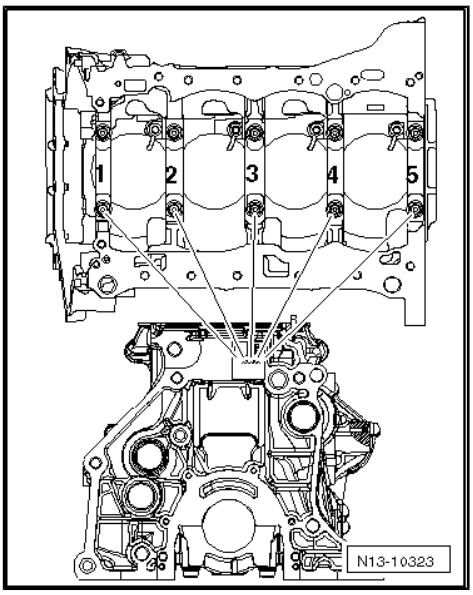


Note

The cylinder block identification may be located either on the oil pan sealing surface or on the top (transmission side) of the cylinder block.

The identification on the cylinder block is for the upper bearing shell (cylinder block bearing shell).

– Note the letters and then match them to the color identification in the table.

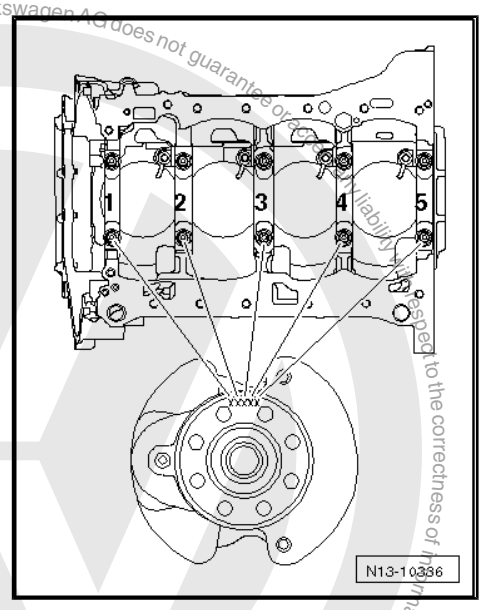


Bearing Cap Bearing Shell Identification:

The identification on the crankshaft is for the lower bearing shell (bearing cap bearing shell)

– Note the letters and then match them to the color identification in the table.

S	=	Black
R	=	Red
G	=	Yellow
B	=	Blue
W	=	White



3.5 Crankshaft Dimensions

(Dimensions in mm)

Reconditioning Dimension [1]	Crankshaft Bearing Pin Diameter	Connecting Rod Bearing Pin Diameter
Standard dimension	58.00	47.80

[1] The preparation of worn crankshafts is not possible at this time.

3.6 Crankshaft, Measuring Axial Clearance

Special tools and workshop equipment required

- Dial Gauge Holder - VW387-
- Dial Gauge - 0-10mm - VAS6079-

Procedure

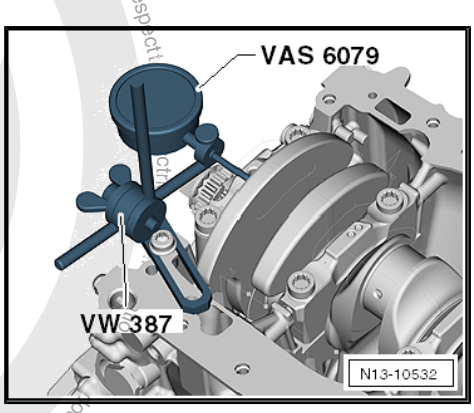
– Attach the Dial Gauge - 0-10mm - VAS6079- with the Dial Gauge Holder - VW387- to the cylinder block and with approximately 2 mm tension, set indicator against crankshaft counterweight.

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

– Remove the crankshaft from the dial gauge and read the measurement.

Axial play:

- New: 0.070 to 0.231 mm.
- Wear limit: 0.30 mm.



3.7 Crankshaft, Measuring Radial Clearance

Special tools and workshop equipment required

- Plastigage®

Procedure

Note

- *Do not interchange used bearings*
- *Bearing shells that are worn down to the nickel layer must be replaced.*

– Remove the crankshaft bearing cap and clean the bearing cap and pins.

– Place the Plastigage® over the entire width of the bearing journal or in the bearing shells.

- Plastigage® must rest in center of bearing shell.

Note

Ignore bolts -arrow A-.

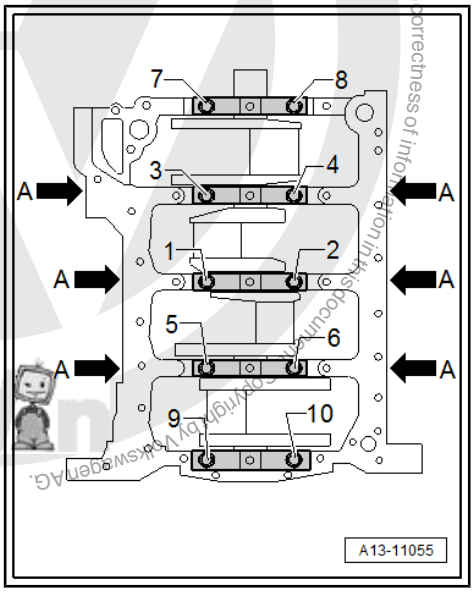
– Position the crankshaft bearing cap and tighten with the old bolts -1 to 10-. Refer to ⇒ Fig. ""Crankshaft - Tightening Sequence"" , page 58 . Do not turn the crankshaft.

– Remove the crankshaft bearing cap again.

– Compare width of Plastigage® with calibrated scale.

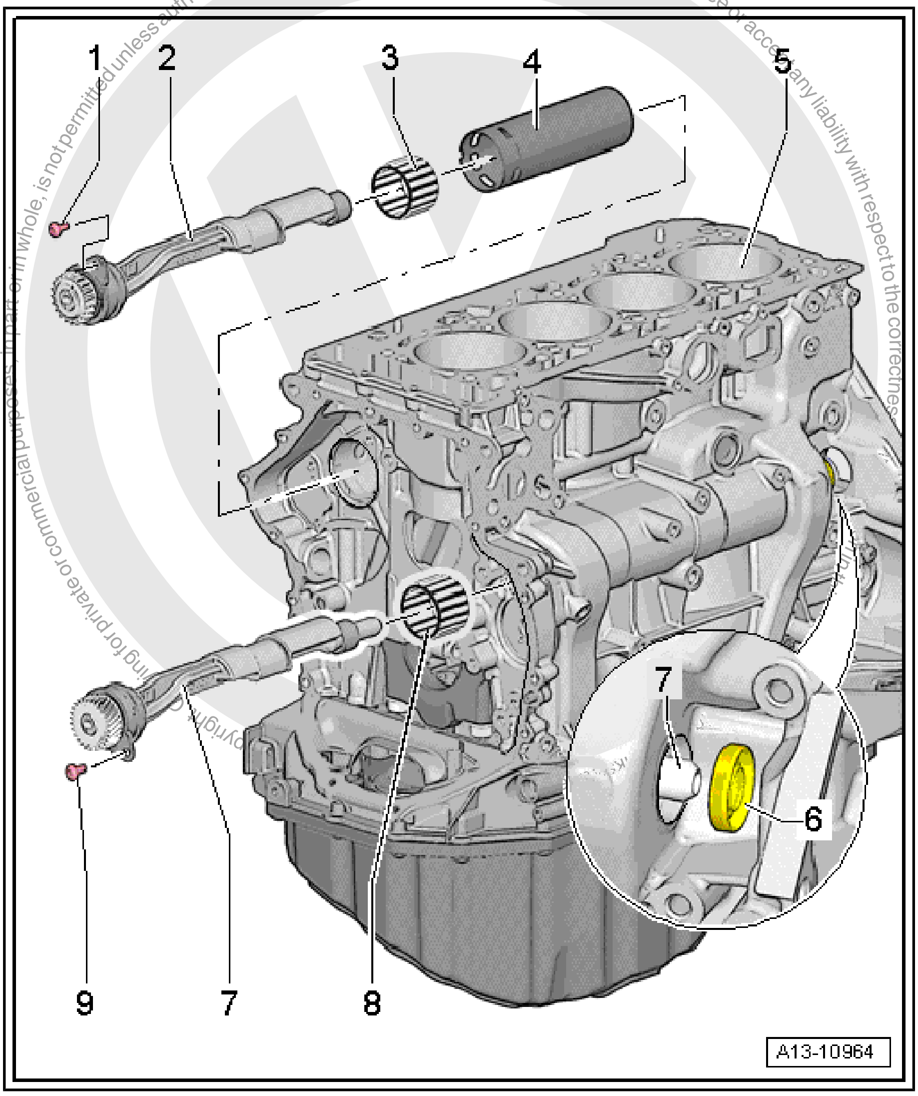
Radial clearance:

- New: 0.017 to 0.037 mm.
- Wear limit: 0.15 mm.



4 Balance Shaft

4.1 Overview - Balance Shaft



1 - Bolt

- ❑ 4 Nm +45°
- ❑ Replace after removing

2 - Balance Shaft

- ❑ Exhaust side
- ❑ Must be replaced after removing
- ❑ Lubricate the bearing with engine oil
- ❑ Replacing. Refer to ⇒ “4.2.2 Exhaust Side Balance Shaft, Removing and Installing”, page 68 .

3 - Needle Bearing Rim

- ❑ No replacement part, part of the balance shaft delivery package

4 - Pipe for the Balance Shaft

- ❑ Installation position. Refer to ⇒ Fig. ““Balance Shaft Pipe - Installed Position”“ , page 65

5 - Cylinder Block

6 - Balance Shaft Seal Intake Side

- ❑ Replacing. Refer to ⇒ “4.3 Balance Shaft Sealing Ring, Replacing, Intake Side”, page 70 .

7 - Balance Shaft

- ❑ Intake side
- ❑ Must be replaced after removing
- ❑ Lubricate the bearing with engine oil
- ❑ Replacing. Refer to ⇒ “4.2.1 Balance Shaft Intake Side, Removing and Installing”, page 65 .

8 - Needle Bearing Rim

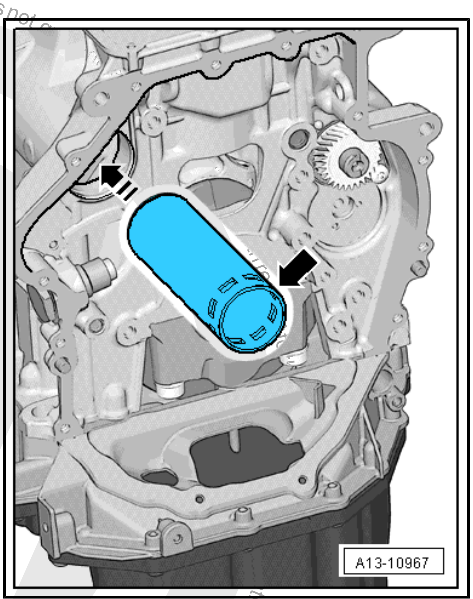
- ❑ No replacement part, part of the balance shaft delivery package

9 - Bolt

- ❑ 4 Nm +45°
- ❑ Replace after removing

Balance Shaft Pipe - Installed Position

The openings -arrow- must face the chain side.



4.2 Balance Shaft, Removing and Installing

⇒ "4.2.1 Balance Shaft Intake Side, Removing and Installing", page 65

⇒ "4.2.2 Exhaust Side Balance Shaft, Removing and Installing", page 68

4.2.1 Balance Shaft Intake Side, Removing and Installing

Removing

- Engine removed.

– Remove the coolant pump toothed belt. Refer to ⇒ "2.4 Coolant Pump Toothed Belt, Removing and Installing", page 213 .

– Remove the upper timing chain cover. Refer to ⇒ "1.2 Upper Timing Chain Cover, Removing and Installing", page 84 .

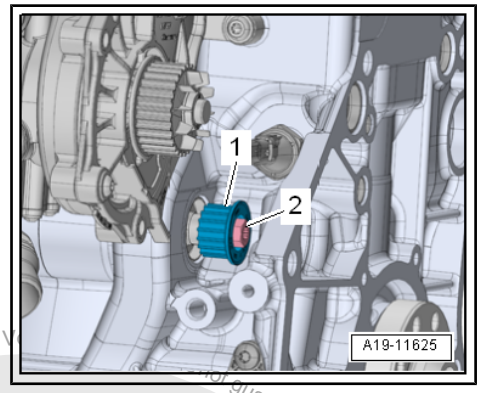
– Remove the lower timing chain cover. Refer to ⇒ "1.3 Lower Timing Chain Cover, Removing and Installing", page 86 .

– Remove the camshaft timing chain. Refer to ⇒ "2.3 Camshaft Timing Chain, Removing and Installing", page 94 .

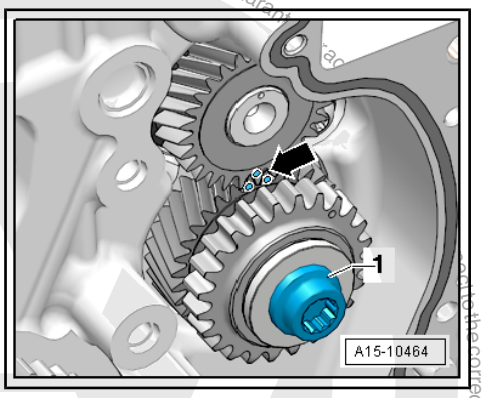
– Remove the balance shaft drive chain. Refer to ⇒ "2.4 Balance Shaft Drive Chain, Removing and Installing", page 106 .

– Remove the bolt -2-.

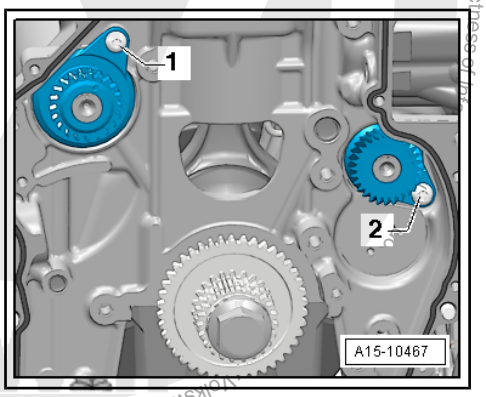
– Remove the drive wheel -1- for the coolant pump toothed belt.



– Remove the intermediate shaft sprocket -1-.

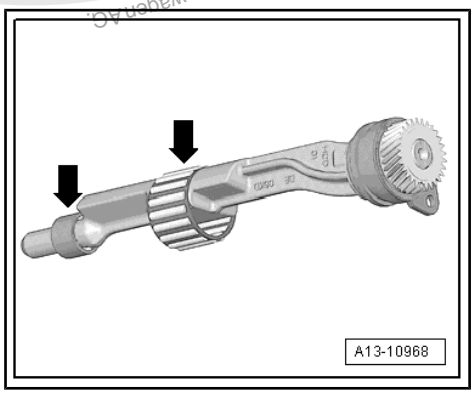


– Remove the bolt -2- for the intake side balance shaft and remove the balance shaft.

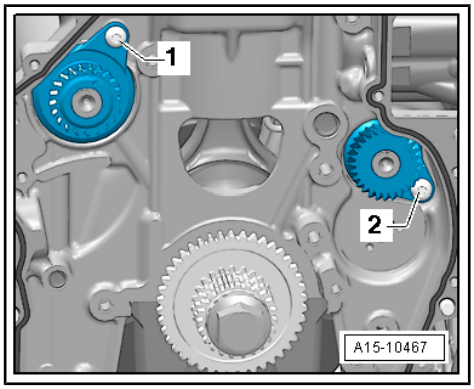


Installing

– Lubricate the balance shaft mountings -arrows- with engine oil.



– Install the intake side balance shaft and tighten the bolt -2-.
– Replace the O-ring -1- and coat with engine oil.

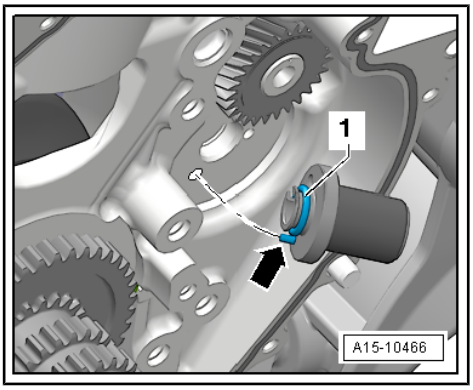


– Coat the mounting pin with engine oil and insert it. The alignment pin -arrow- for the mounting pin must engage in the hole in the cylinder block.

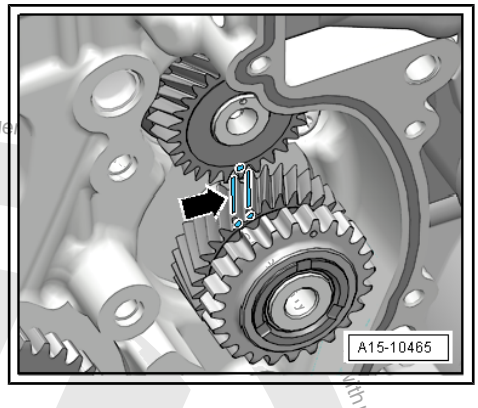
Caution

Always replace the intermediate sprocket. Otherwise the backlash will not adjust itself and it could result in engine damage.

The new intermediate sprocket has an anti-friction coating that wears off after a short period of use, which automatically adjusts the backlash.

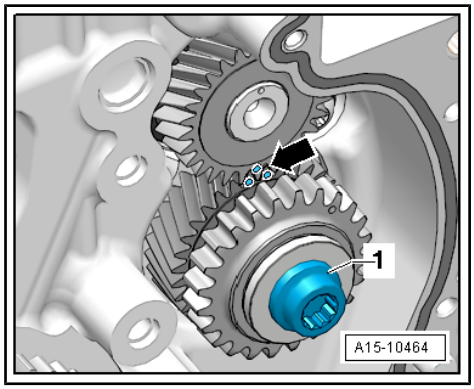


– Mark the tooth flank on the intermediate sprocket -arrow-.
– Install the intermediate sprocket; the marking on the balance shaft must be between the markings on the tooth flanks.



– Tighten the bolt -1- for the intermediate sprocket: tightening sequence. Refer to ⇒ Fig. ""Intermediate Sprocket Tightening Sequence"" , page 94 .

– Check the markings on the intermediate sprocket/balance shaft -arrow-.



Installation is performed in reverse order of removal, while noting the following:

– Install the balance shaft drive chain. Refer to ⇒ "2.4 Balance Shaft Drive Chain, Removing and Installing", page 106 .

– Install the camshaft timing chain. Refer to ⇒ "2.3 Camshaft Timing Chain, Removing and Installing", page 94 .

– Install the lower timing chain cover. Refer to ⇒ "1.3 Lower Timing Chain Cover, Removing and Installing", page 86 .

– Install the upper timing chain cover. Refer to ⇒ "1.2 Upper Timing Chain Cover, Removing and Installing", page 84 .

– Replace the intake side balance shaft seal. Refer to ⇒ "4.3 Balance Shaft Sealing Ring, Replacing, Intake Side", page 70 .

– Install the toothed belt on the coolant pump. Refer to ⇒ "2.4 Coolant Pump Toothed Belt, Removing and Installing", page 213 .

Tightening Specifications

◆ Refer to ⇒ "4.1 Overview - Balance Shaft", page 64

4.2.2 Exhaust Side Balance Shaft, Removing and Installing

Removing

• Engine removed.

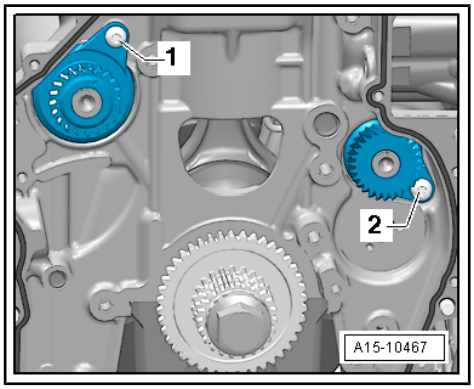
– Remove the upper timing chain cover. Refer to ⇒ "1.2 Upper Timing Chain Cover, Removing and Installing", page 84 .

– Remove the lower timing chain cover. Refer to ⇒ "1.3 Lower Timing Chain Cover, Removing and Installing", page 86 .

– Remove the camshaft timing chain. Refer to ⇒ "2.3 Camshaft Timing Chain, Removing and Installing", page 94 .

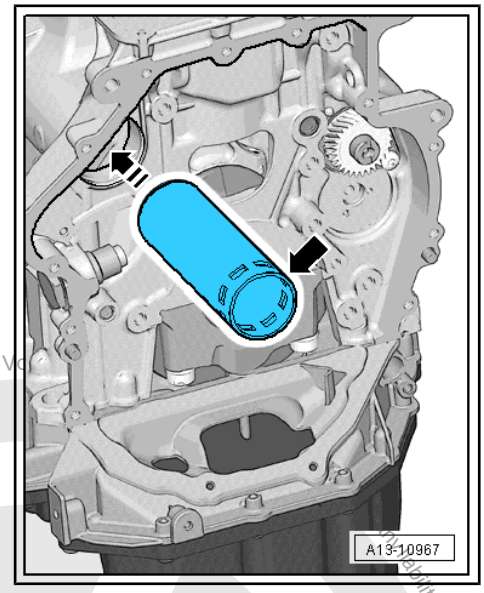
– Remove the balance shaft drive chain. Refer to ⇒ "2.4 Balance Shaft Drive Chain, Removing and Installing", page 106 .

– Remove the bolt -1- for the exhaust side balance shaft and remove the balance shaft.



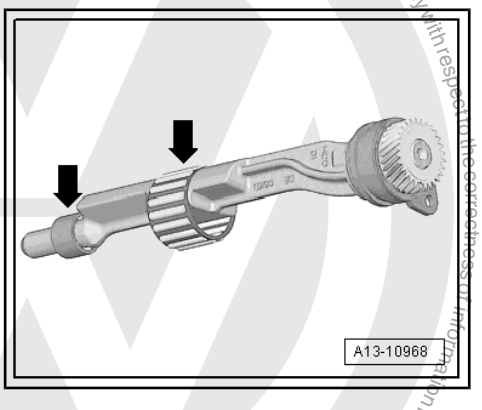
Installing

– Check the installed position for the balance shaft pipe. The openings -arrow- must face the chain side.



– Lubricate the balance shaft mountings -arrows- with engine oil.

– Install the exhaust side balance shaft.

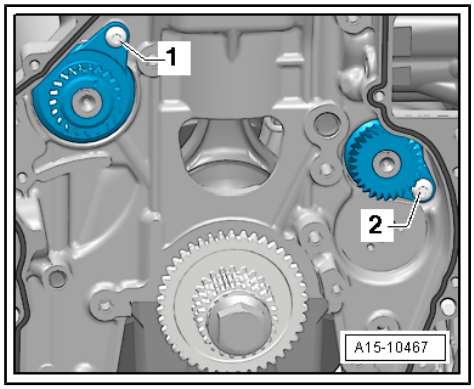


Note

If the balance shaft is not level, then the pipe for the balance shaft must be installed again.

– Make sure the balance shaft lies level on the crankshaft before tightening the bolt -1-.

Installation is performed in reverse order of removal, while noting the following:



- Install the balance shaft drive chain. Refer to ⇒ “2.4 Balance Shaft Drive Chain, Removing and Installing”, page 106 .
- Install the camshaft timing chain. Refer to ⇒ “2.3 Camshaft Timing Chain, Removing and Installing”, page 94 .
- Install the lower timing chain cover. Refer to ⇒ “1.3 Lower Timing Chain Cover, Removing and Installing”, page 86 .
- Install the upper timing chain cover. Refer to ⇒ “1.2 Upper Timing Chain Cover, Removing and Installing”, page 84 .

Tightening Specifications

- Refer to ⇒ “4.1 Overview - Balance Shaft”, page 64

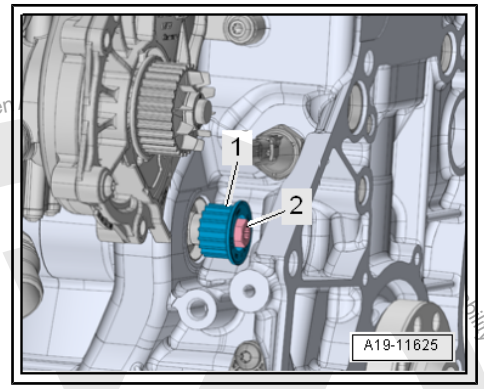
4.3 Balance Shaft Sealing Ring, Replacing, Intake Side

Special tools and workshop equipment required

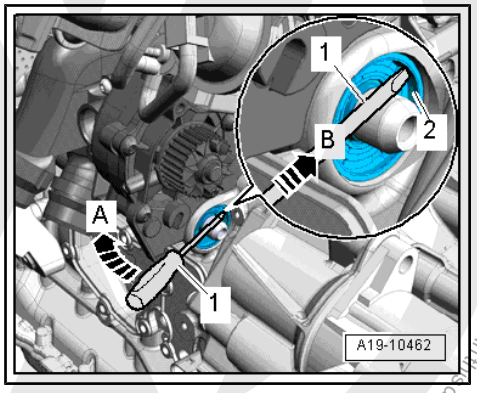
- Seal Installer, Intermediate Shaft - T10353/1-

Procedure

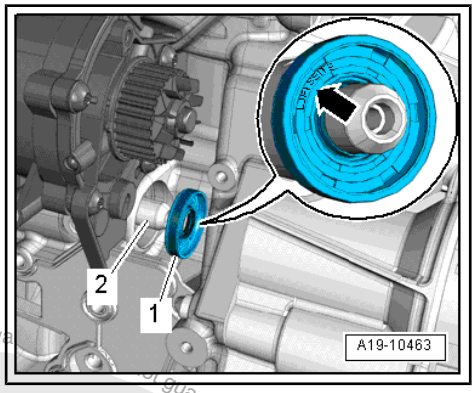
- Remove the coolant pump toothed belt. Refer to ⇒ “2.4 Coolant Pump Toothed Belt, Removing and Installing”, page 213 .
- Remove the bolt -2-.
- Remove the drive wheel -1- for the coolant pump toothed belt.
- Firmly press a screwdriver -1- on the seal surface -2- in direction of -arrow B-.



- Pry out the seal in direction of -arrow A-.
- Clean the contact and sealing surface.
- Coat the sealing surface of the balance shaft -2- with transmission oil.
- Push the shaft seal -1- onto the balance shaft.



- “Luftseite” or (“Outside”) -arrow- must be readable from the outside.



Caution

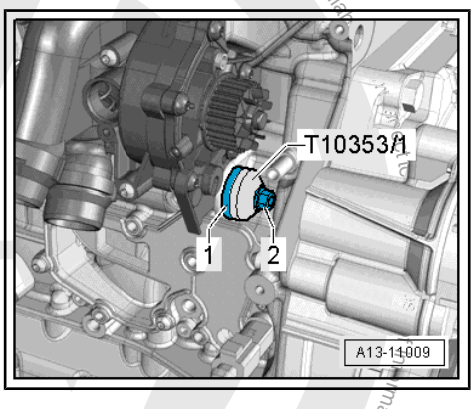
Risk of damaging the threads.

- *The drive gear bolt has a left thread.*

– Mount the Seal Installer, Intermediate Shaft - T10353/1- on the shaft seal -1- and then tighten it all the way into the cylinder block with the screw -2-. Be careful not to tilt the shaft seal when doing this.

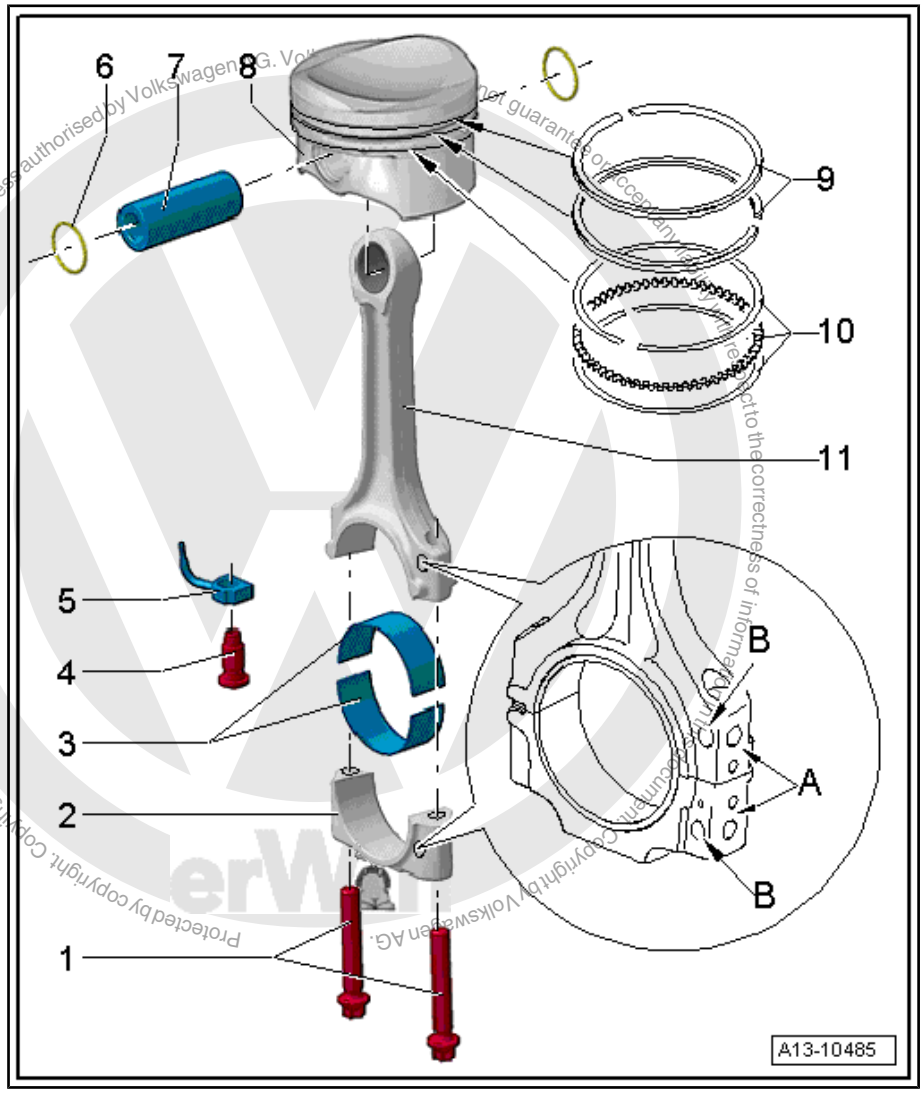
– Install the toothed belt on the coolant pump. Refer to ⇒ “2.4 Coolant Pump Toothed Belt, Removing and Installing”, page 213 .

– Fill with coolant. Refer to ⇒ page 202 .



5 Piston and Connecting Rod

5.1 Overview - Piston and Connecting Rod



1 - Connecting Rod Bolts

- ❑ 45 Nm +90°
- ❑ Replace after removing
- ❑ Lubricate the thread and contact surface.
- ❑ Use the old bolt to measure the radial clearance

2 - Connecting Rod Bearing Cap

- ❑ Note the installation position
- ❑ Due to the separation procedure (cracking) of the connecting rod, the connecting rod bearing cap only fits in one position and only to the corresponding connecting rod.
- ❑ Mark the cylinder to which it belongs -A-
- ❑ Installation position: the markings -B- face the belt pulley side
- ❑ New connecting rod, separating. Refer to ⇒ “5.3 New Connecting Rod, Separating”, page 74 .

3 - Bearing Shells

- ❑ Installation position. Refer to ⇒ Fig. ““Bearing Shell Installation Position”“ , page 73
- ❑ Do not interchange used bearing shells (label)
- ❑ Coat with oil before installing
- ❑ New axial play: 0.10 to 0.35 mm, wear limit: 0.40 mm
- ❑ Measure radial clearance with Plastigage®; new: 0.02 to 0.06 mm, wear limit: 0.09 mm Do not turn the crankshaft when checking the radial clearance.

4 - Relief Valve

- ❑ 27 Nm

5 - Oil Spray Jet

- ❑ For piston cooling

6 - Circlip

- ❑ Replace after removing

7 - Piston Pin

- ❑ Coat with oil before installing

8 - Piston

- ❑ Removing and installing. Refer to ⇒ “5.2 Pistons, Removing and Installing”, page 73 .
- ❑ Mark installed position and cylinder allocation
- ❑ Arrow on piston face points toward belt pulley side
- ❑ Check piston and cylinder bore. Refer to ⇒ “5.4 Pistons and Cylinder Bore, Checking”, page 75 .

9 - Compression Rings

- ❑ Use piston ring pliers (commercially available) for removing and installing
- ❑ Offset gaps by 120°
- ❑ Installed Position: “TOP” “R” mark must face up toward piston crown
- ❑ Checking the ring gap. Refer to ⇒ Fig. ““Checking the Piston Ring Gap”“ , page 76 .
- ❑ Checking the piston ring groove clearance. Refer to ⇒ Fig. ““Piston Ring Groove Clearance, Checking”“ , page 76 .

10 - Oil Scraping Ring

- ❑ Two-part
- ❑ Install offset gaps by 120° to the neighboring compression ring
- ❑ The “TOP” or “R” marking must face toward the piston crown.
- ❑ Checking the ring gap. Refer to ⇒ Fig. ““Checking the Piston Ring Gap”“ , page 76 .
- ❑ Height clearance cannot be measured

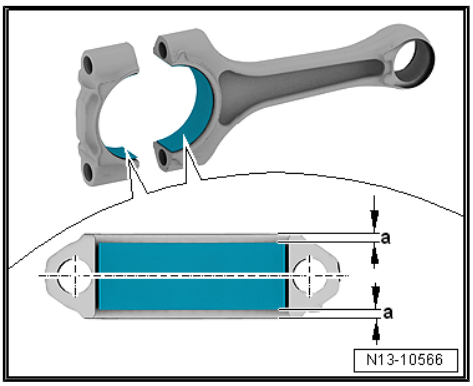
11 - Connecting Rod

- ❑ Always replace as a set
- ❑ Mark the cylinder to which it belongs -A-
- ❑ Installation position: the markings -B- face the belt pulley side
- ❑ New connecting rod, separating. Refer to ⇒ “5.3 New Connecting Rod, Separating”, page 74 .
- ❑ Radial play, measuring. Refer to ⇒ “5.5 Connecting Rods, Checking Radial Clearance”, page 77 .

Bearing Shell Installation Position

– Place the bearing shells centrally into connecting rod and connecting rod bearing cap.

The dimension -a- must be the same at left and right.



5.2 Pistons, Removing and Installing

Special tools and workshop equipment required

- ♦ Pilot Drift - VW222A-
- ♦ Commercially Available Piston Ring Compressor

Removing

– Secure the engine to the Engine and Gearbox Bracket - VAS6095A- . Refer to ⇒ “1.3 Engine, Securing to Engine and Transmission Holder”, page 21 .

– Remove the cylinder head. Refer to ⇒ “3.2 Cylinder Head, Removing and Installing”, page 114 .

– Remove the oil pan upper section. Refer to ⇒ “1.5 Oil Pan Upper Section, Removing and Installing”, page 176 .

– Label the installation position and the cylinder allocation for the piston.

– Mark installation position and connecting rod cylinder -item 11- ⇒ Item 11 (page 73) .

– Remove the connecting rod bearing cap and remove the piston and connecting rod upward.

Note

If difficult to move, heat pistons to approximately 60 °C (140 °F).

– Remove the circlip from the piston pin eye.

– Remove the piston pin using the Pilot Drift - VW222A- .

Installing

Install in reverse order of removal and note the following:

Note

- *Replace the bolts that were tightened with an additional turn.*
- *Arrow on the piston crown points toward belt pulley side.*
- *Piston ring gap offset 120°.*

– Coat the contact surfaces on the bearing shells with oil.

– Install the piston with a commercially available piston ring compressor. Pay attention to the installed position -item 8- ⇒ Item 8 (page 73) .

– Install the connecting rod bearing cap. Pay attention to the installed position -item 2- ⇒ Item 2 (page 72) .

– Install the cylinder head. Refer to ⇒ “3.2 Cylinder Head, Removing and Installing”, page 114 .

– Install the oil pan upper section. Refer to ⇒ “1.5 Oil Pan Upper Section, Removing and Installing”, page 176 .

Tightening Specifications

- Refer to ⇒ “5.1 Overview - Piston and Connecting Rod”, page 72

5.3 New Connecting Rod, Separating

New connecting rods might not be separated at the location where they should be. If the connecting rod bearing cap cannot be removed by hand, proceed as follows:

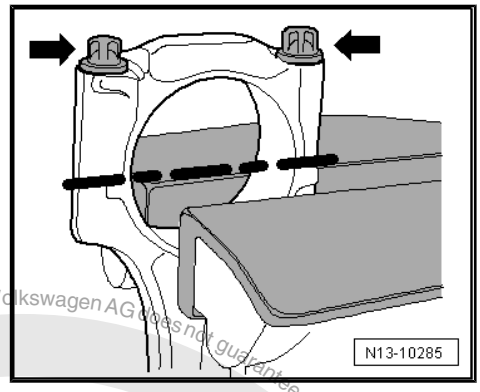
– Mark the cylinder where the connecting rod is allocated to -item 11- ⇒ Item 11 (page 73) .

– Lightly clamp the connecting rod, as shown, in a vise equipped with aluminum protective pads.

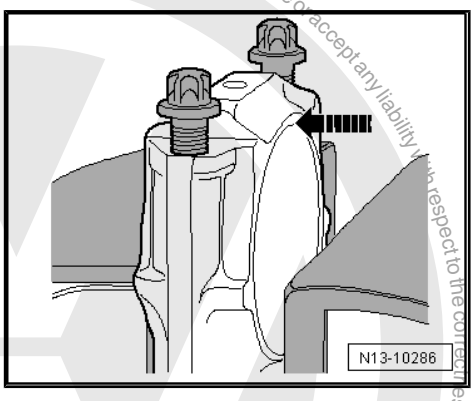
Note

- *Clamp the connecting rod lightly to prevent damaging it.*
- *Clamp the connecting rod below the dotted line.*

– Loosen the bolts -arrows- approximately 5 turns.



– Carefully tap against the connecting rod bearing cap in direction of -arrow- with a plastic hammer until the cap is loose.



5.4 Pistons and Cylinder Bore, Checking

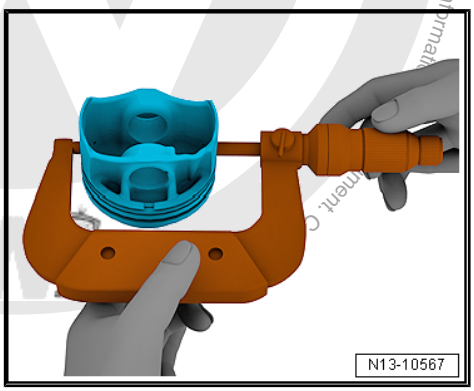
Special tools and workshop equipment required

- Outside Micrometer - 75-100mm - VAS6071-

Pistons, Checking

– Measure approximately 15 mm in from the lower edge at a 90° angle to the piston pin axis using a micrometer.

- Deviation from specified size: maximum 0.04 mm



		Piston Diameter
Standard dimension	mm	82.420 [1]

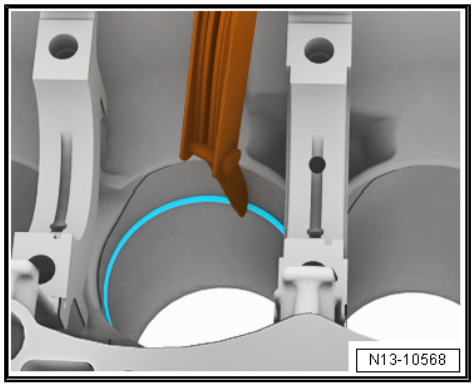
• [1] Measurements without graphite coating (thickness = 0.02 mm). The graphite coating wears off.

Special tools and workshop equipment required

- Feeler Gauge

Checking the Piston Ring Gap

– Push piston ring squarely from above down to approximately 15 mm from bottom end of cylinder. To push in use a piston without rings.



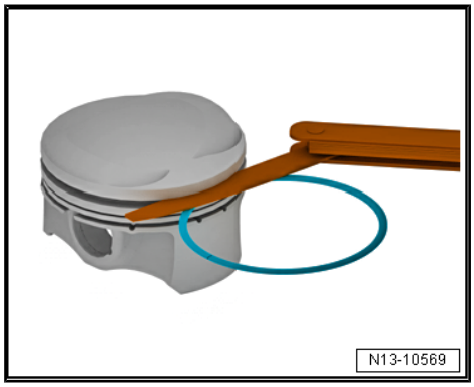
Piston Ring Dimensions in mm	New	Wear Limit
1. Compression ring	0.30 to 0.40	0.80
2. Compression ring	0.40 to 0.50	0.80
Oil Scraping Ring	0.20 to 0.40	0.80

Special tools and workshop equipment required

- Feeler Gauge

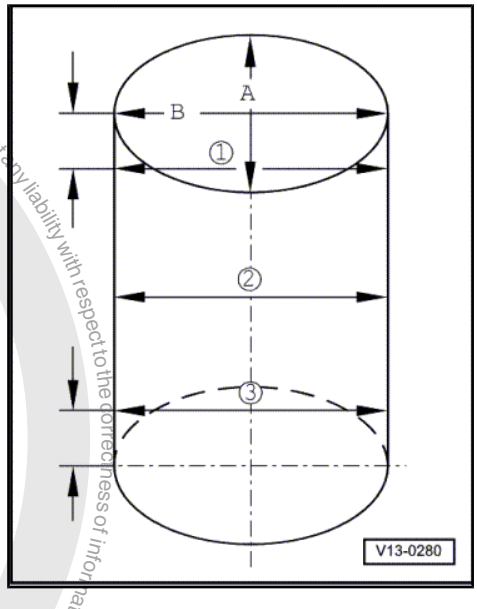
Piston Ring Groove Clearance, Checking

– Clean the piston ring groove before checking.



Piston Ring Dimensions in mm	New	Wear Limit
1. Compression ring	0.06 to 0.09	0.20
2. Compression ring	0.03 to 0.06	0.15
Oil scraping rings	cannot be measured	

Cylinder Bore, Checking



Special tools and workshop equipment required

- Cylinder Dial Bore Gauge - VAS6078-

Caution

Do not drill, hone, grind or rework the cylinder bores with workshop tools. Reworking damages the surface of the cylinder bore.

– Using a Cylinder Dial Bore Gauge - VAS6078- measure in a diagonal sequence at three positions transversely -A- and longitudinally -B-.

♦ Deviation from specified size: maximum 0.08 mm

		Cylinder Bore Diameter
Standard dimension	mm	82.51

Note

The cylinder bore must not be measured when the cylinder block is mounted on the Engine and Transmission Holder - VAS6095- because the measurements may be incorrect.

5.5 Connecting Rods, Checking Radial Clearance

Special tools and workshop equipment required

♦ Plastigage®

Procedure

– Remove the connecting rod bearing cap.

– Clean the bearing cap and pin.

– Place the Plastigage® over the entire width of the bearing journal or into the bearing shells.

– Position the connecting rod bearing cap and tighten the old bolts -item 1- ⇒ Item 1 (page 72) without turning the crankshaft.

– Remove the connecting rod bearing cap again.

– Compare the width of Plastigage® with calibrated scale.

Radial clearance:

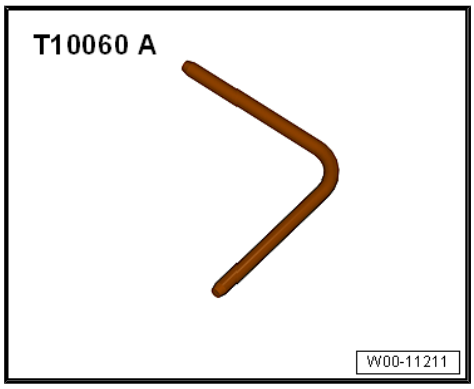
- New: 0.02 to 0.06 mm.
- Wear limit: 0.09 mm.

– Replace the connecting rod bolts.

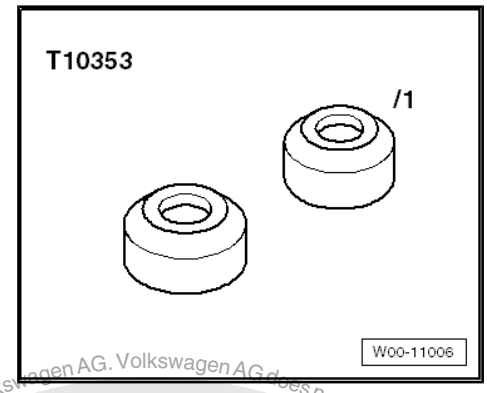
6 Special Tools

Special tools and workshop equipment required

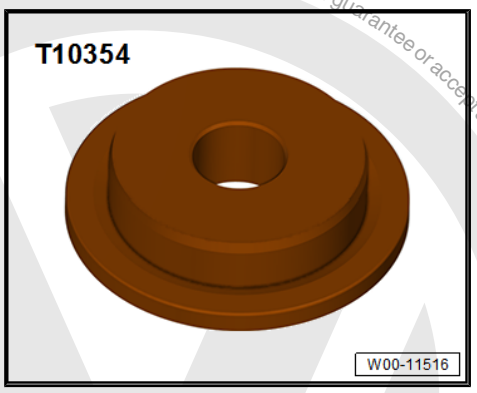
- Locking Pin - T10060A-



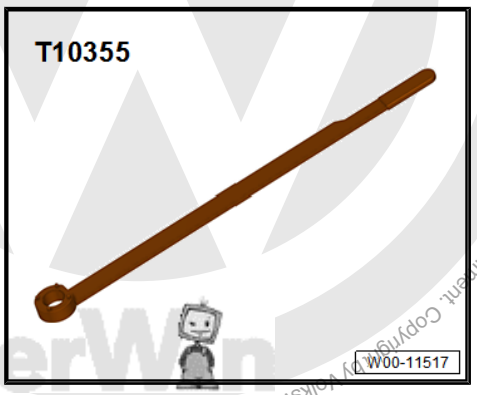
- Seal Installer, Intermediate Shaft - T10353/1-



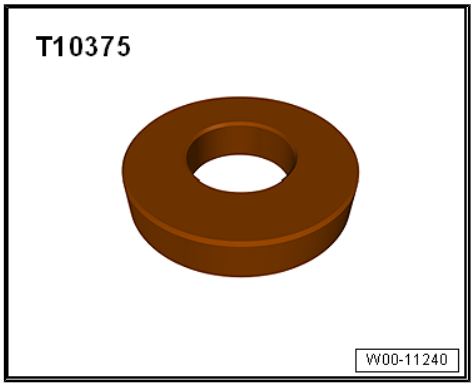
- Seal Installer - Crankshaft - T10354-



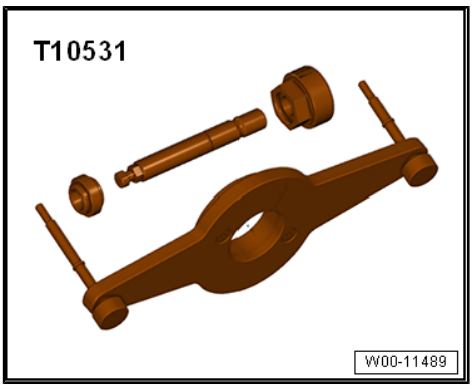
- Counterhold - Vibration Damper - T10355-



- Press Piece - Gearbox - T10375-

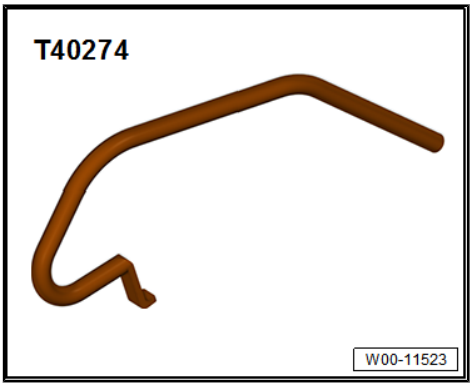


- Vibration Damper Assembly Tool - T10531-

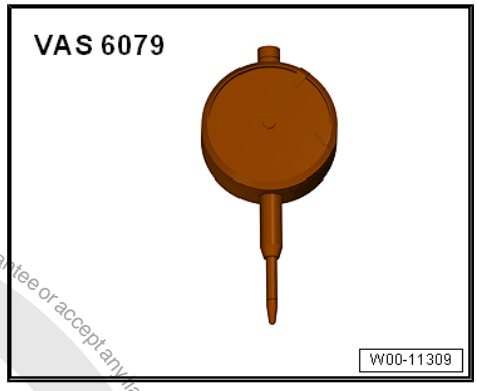


- Seal Installer - Sealing Flange Guide Sleeve - T20097-

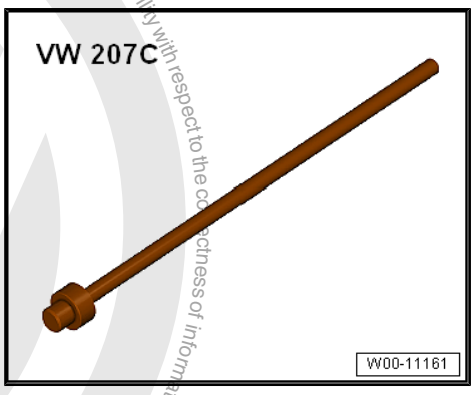
- Seal Installer - Crankshaft - T40274-



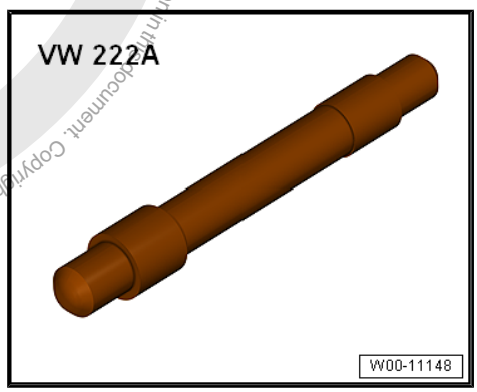
- Dial Gauge - 0-10mm - VAS6079-



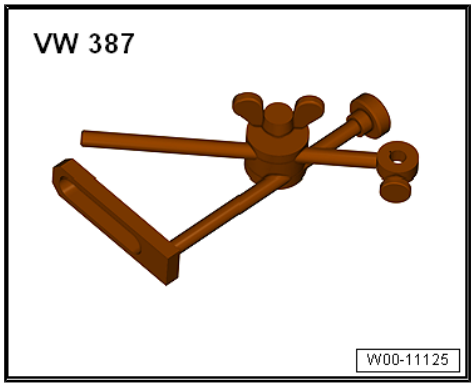
- Bearing Installer - Bearing Press Piece - VW207C-



- Pilot Drift - VW222A-



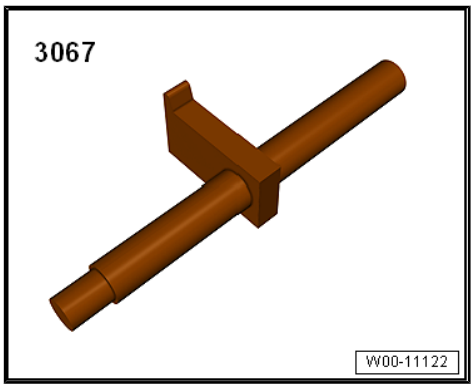
- Dial Gauge Holder - VW387-



- Internal puller, for example Puller - Kukko Internal -14-19mm - 21/2-

- Counter-support for example Puller - Kukko Counterstay - 22/1-

- Flywheel Retainer - 3067-

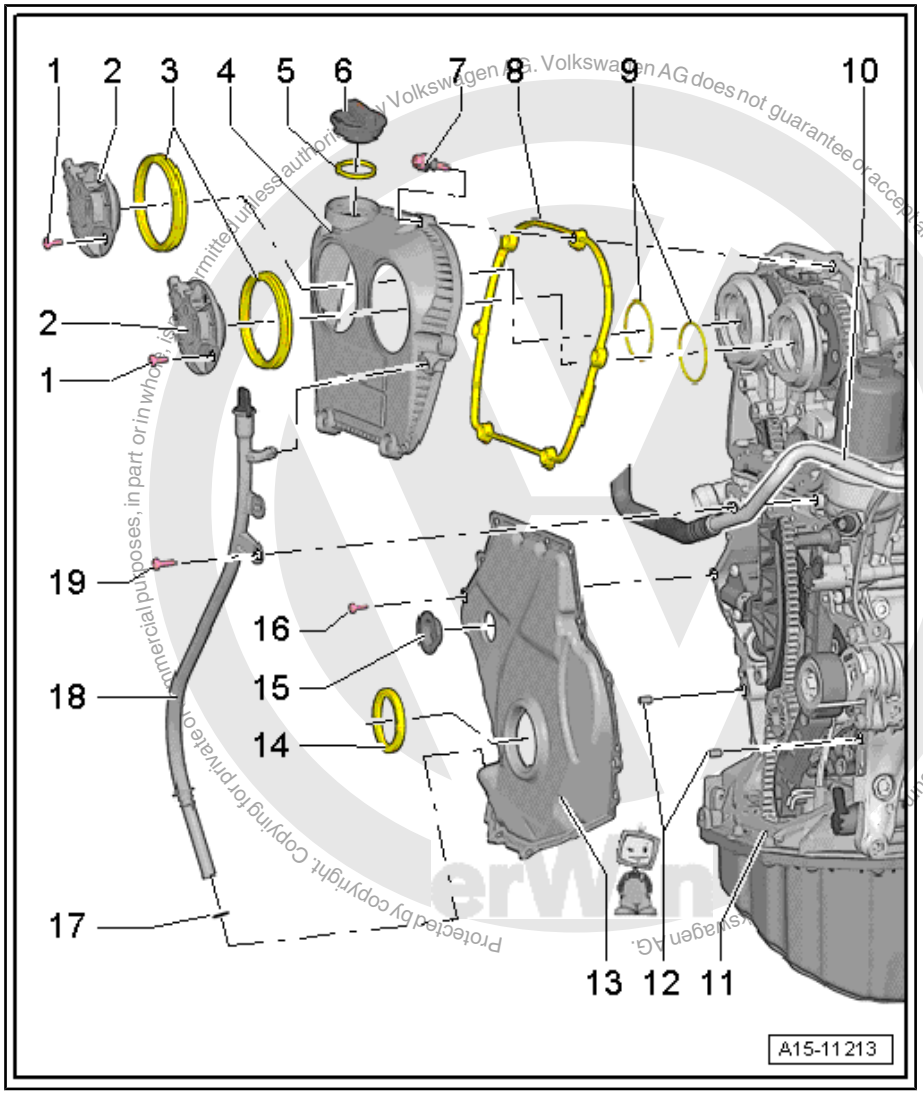


- Not Illustrated:
- Plastigage®
- Outside Micrometer - 75-100mm - VAS6071-

15 – Cylinder Head, Valvetrain

1 Timing Chain Cover

1.1 Overview - Timing Chain Cover



1 - Bolt

- ❑ 4 Nm 45°
- ❑ Replace after removing

2 - Exhaust Camshaft Adjustment Valve 1 - N318-

- ❑ Removing and installing. Refer to ⇒ “4.5 Camshaft Adjustment Valve 1 N205 / Exhaust Camshaft Adjustment Valve 1 N318 , Removing and Installing”, page 160 .

3 - Gaskets

- ❑ To replace the cover must be removed.

4 - Upper Timing Chain Cover

- ❑ Removing and installing. Refer to ⇒ “1.2 Upper Timing Chain Cover, Removing and Installing”, page 84 .

5 - Seal

- ❑ Replace if damaged

6 - Cap

7 - Bolt

- ❑ 9 Nm
- ❑ Note the tightening sequence. Refer to ⇒ Fig. ““Upper Timing Chain Cover - Tightening Sequence”“ , page 83 .

8 - Seal

- ❑ Replace if damaged

9 - O-Ring

- ❑ Replace after removing
- ❑ Coat with engine oil

10 - Not Installed

11 - Engine

12 - Alignment Pins

❑ Centering the cover

13 - Lower Timing Chain Cover

❑ With shaft seal

❑ Removing and installing. Refer to ⇒ “1.3 Lower Timing Chain Cover, Removing and Installing”, page 86 .

14 - Seal

❑ For the vibration damper

❑ Replacing. Refer to ⇒ “1.7 Crankshaft Seal, Replacing, Belt Pulley Side”, page 50 .

15 - Plugs

❑ Replace after removing

16 - Bolt

❑ Replace after removing

❑ Tightening sequence for the cover with 8 bolts. Refer to ⇒ Fig. ““Lower Timing Chain Cover - Tightening Sequence for 8 Bolts”“ , page 84

❑ Tightening sequence for the cover with 15 bolts. Refer to ⇒ Fig. ““Lower Timing Chain Cover - Tightening Sequence for 15 Bolts”“ , page 84

17 - O-Ring

❑ Replace after removing

❑ Coat with oil before assembly

18 - Oil Dipstick Tube

19 - Bolt

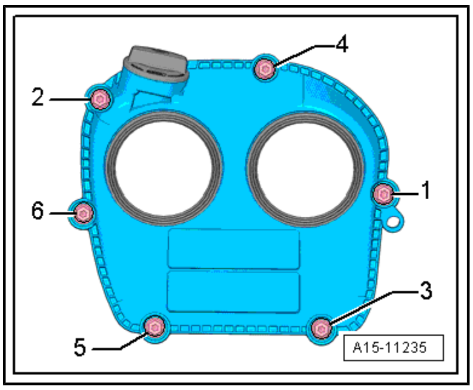
❑ 9 Nm

20 - Camshaft Adjustment Valve 1 - N205-

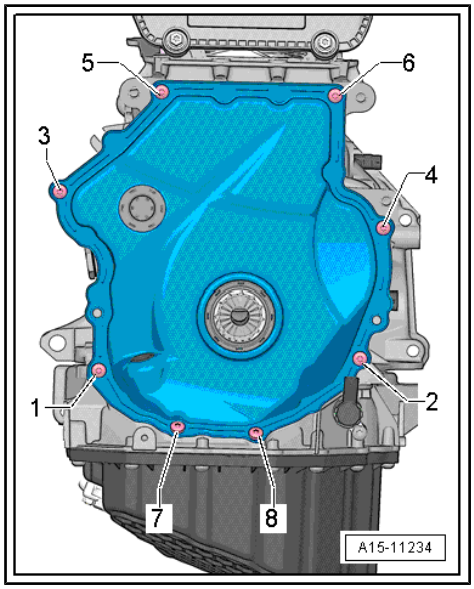
❑ Removing and installing. Refer to ⇒ “4.5 Camshaft Adjustment Valve 1 N205 / Exhaust Camshaft Adjustment Valve 1 N318 , Removing and Installing”, page 160 .

Upper Timing Chain Cover - Tightening Sequence

– Tighten the bolts -1 through 6- in the sequence shown: Use the Torque Wrench 1783 - 2-10Nm - VAG1783- and the Torque Wrench 1783 - Open Jaw -10mm - VAG1783/1- for the bolts -3- and -5-.



Lower Timing Chain Cover - Tightening Sequence for 8 Bolts



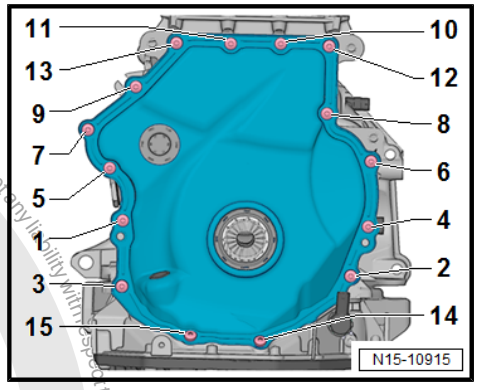
Note

Tighten the bolts -1 and 4- with an additional turn after installing the vibration damper. The bolts must be removed again to install the vibration damper. Note the different tightening specifications for steel bolts and aluminum bolts.

Step	Steel Bolts	Tightening Specification/Additional Turn for Steel Bolts
1.	-1 to 8-	8 Nm
2.	-1 to 8-	45°

Step	Aluminum bolts	Tightening Specification/Additional turn for Aluminum Bolts
1.	-1 to 8-	4 Nm
2.	-1 to 8-	45°

Lower Timing Chain Cover - Tightening Sequence for 15 Bolts



Note

Tighten the bolts -3 and 6- with an additional turn after installing the vibration damper. The bolts must be removed again to install the vibration damper. Note the different tightening specifications for steel bolts and aluminum bolts.

Step	Steel bolts	Tightening Specification/Additional Turn for Steel Bolts
1.	-1 to 15-	8 Nm
2.	-1 to 15-	45°

Step	Aluminum bolts	Tightening Specification/Additional Turn for Aluminum Bolts
1.	-1 to 15-	4 Nm
2.	-1 to 15-	45°

1.2 Upper Timing Chain Cover, Removing and Installing

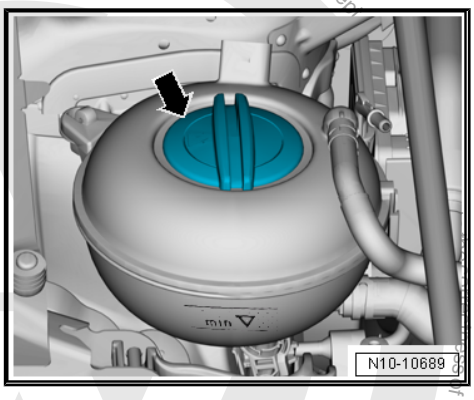
Special tools and workshop equipment required

- Hose Clip Pliers - VAS6362-
- Torque Wrench 1783 - 2-10Nm - VAG1783-
- Torque Wrench 1783 - Open Jaw - 10mm - VAG1783/1-
- Silicone Grease . Refer to the Parts Catalog.

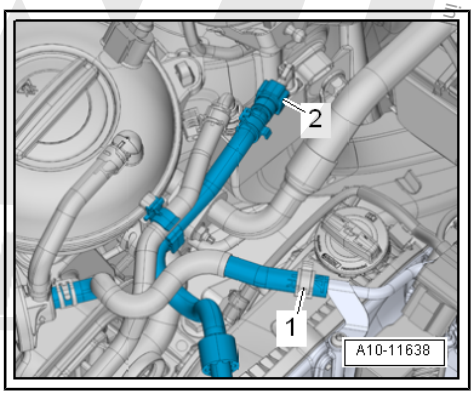
Removing

- The engine is cold.

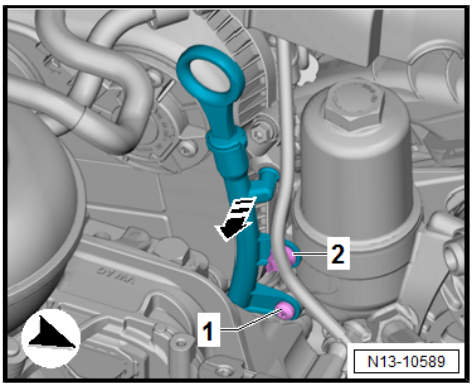
– Briefly open the coolant reservoir cap -arrow- to reduce the residual pressure in the coolant system.
– Remove the engine cover. Refer to ⇒ “3.1 Engine Cover, Removing and Installing”, page 34 .



– Loosen hose clamps -1-, remove coolant hose and push to the right side.
– Press the release button on the EVAP canister hose -2-, remove hose and free it up.
– Remove the Camshaft Adjustment Valve 1 - N205- / Exhaust Camshaft Adjustment Valve 1 - N318- . Refer to ⇒ “4.5 Camshaft Adjustment Valve 1 N205 / Exhaust Camshaft Adjustment Valve 1 N318 , Removing and Installing”, page 160 .
– Unclip the wiring harness bracket -2-.
– Remove the bolt -1- for the oil dipstick tube.



– Unclip the guide tube from the upper cover for the timing chain in the direction of -arrow-.
– Remove the bolts -1 through 6-.
– Remove the upper timing chain cover.



– If necessary, remove bolts -3 and 5-.

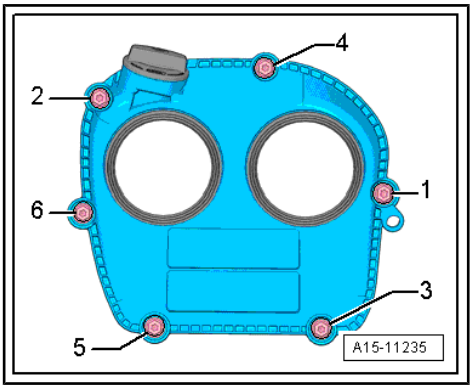
Installing

Install in reverse order of removal and note the following:

Note

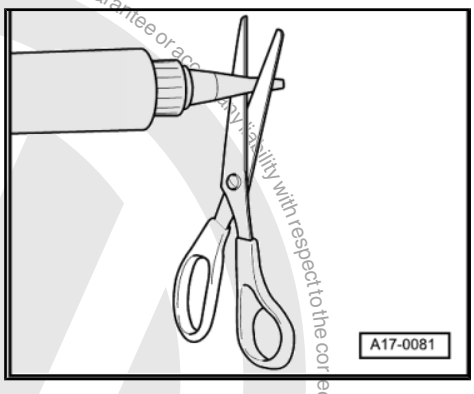
Replace seals.

– Remove sealant residue on the bearing bracket.
– Clean any oil or grease off the sealing surfaces.



Note

Be sure to check the expiration date of the sealant.

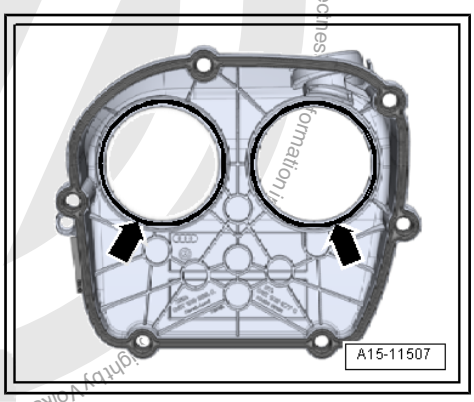


– Cut the tube nozzle at the front marking (nozzle diameter: approximately 1.5 mm).

Caution

Risk of blocking the lubrication system due to excess sealant.

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



– Apply sealant beads -arrows- to the clean seals as shown in the illustration.

- Sealant bead thickness: 2 mm.

Note

Install the upper timing chain cover within five minutes of applying the sealant.

– Install the timing chain upper cover and note the tightening sequence. Refer to ⇒ Fig. ""Upper Timing Chain Cover - Tightening Sequence"" , page 83 .

– Install the Camshaft Adjustment Valve 1 - N205- and Exhaust Camshaft Adjustment Valve 1 - N318- . Refer to ⇒ “4.5 Camshaft Adjustment Valve 1 N205 / Exhaust Camshaft Adjustment Valve 1 N318 , Removing and Installing”, page 160 .

– Install the engine cover. Refer to ⇒ “3.1 Engine Cover, Removing and Installing”, page 34 .

Tightening Specifications

- Refer to ⇒ “1.1 Overview - Timing Chain Cover”, page 82

1.3 Lower Timing Chain Cover, Removing and Installing

Note

The cover may bend during removal depending on the strength of the sealant. Because of this, always replace the cover.

Special tools and workshop equipment required

- Vibration Damper Assembly Tool - T10531-
- Silicone Grease . Refer to the Parts Catalog.

Removing

– Remove right front wheel housing liner. Refer to ⇒ Body Exterior; Rep. Gr. 66 ; Wheel Housing Liner .

– Remove the engine support. Refer to ⇒ “1.6 Engine Support, Removing and Installing”, page 49 .

– Remove the vibration damper. Refer to ⇒ “1.5 Vibration Damper, Removing and Installing”, page 44 .

– Remove the Oil Pressure Regulation Valve -N428- . Refer to ⇒ “4.4 Oil Pressure Regulation Valve N428 , Removing and Installing”, page 188 .

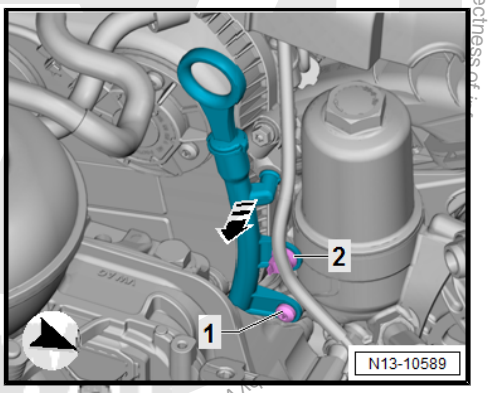
– Remove the ribbed belt tensioner. Refer to ⇒ “1.3 Ribbed Belt Tensioner, Removing and Installing”, page 42 .

– Unclip the wiring harness bracket -2-.

– Remove the bolt -1- for the oil dipstick tube.

– Unclip the guide tube from the upper cover for the timing chain in the direction of -arrow-.

– Remove the guide tube from the timing chain guard.



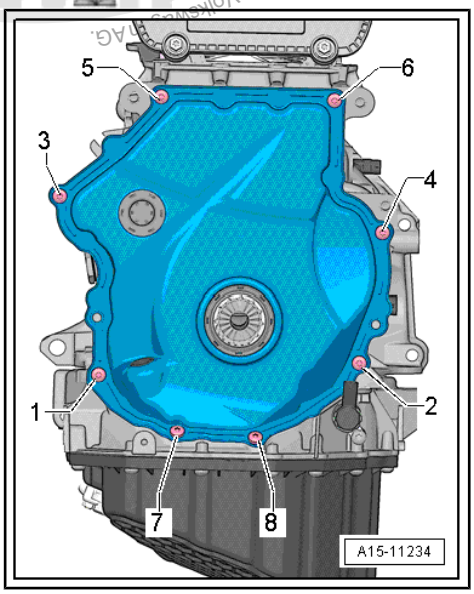
Cover with 8 Bolts

– Remove the bolts -1 through 8-.

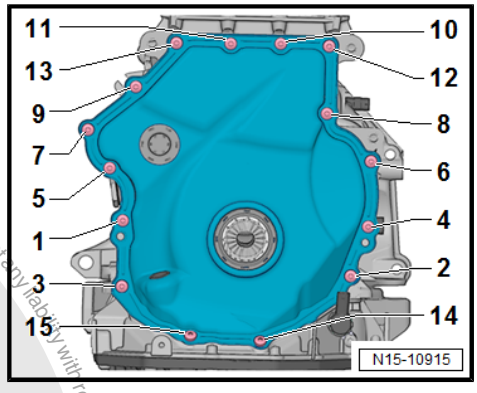
– Pry off the lower timing chain cover.

Cover with 15 Bolts

– Remove the bolts -1 through 15-.



– Pry off the lower timing chain cover.



Installing

Install in reverse order of removal and note the following:

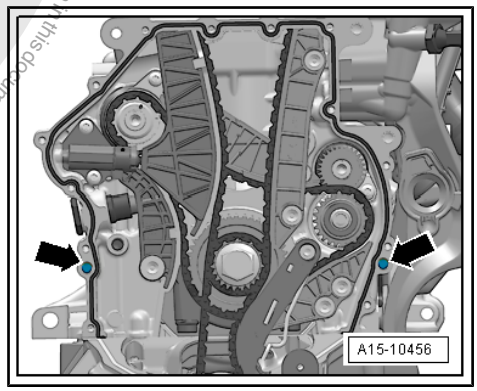
Note

- *Be sure to check the expiration date of the silicone sealant.*
- *Refer to the Parts Catalog for the silicone grease.*
- *The cover must be installed within five minutes after application of silicone sealant.*
- *Bolts that are tightened with an additional turn must be replaced.*
- *Replace sealing ring and O-ring.*
- *Risk of contaminating the lubricating system. Cover open parts of the engine.*

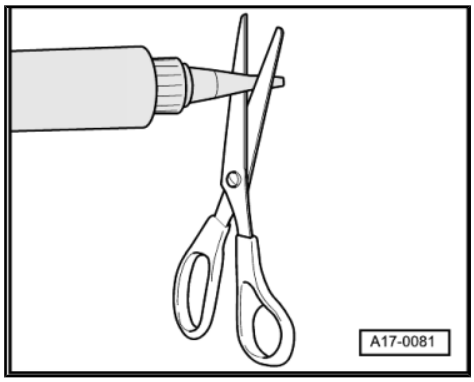
– Remove any sealant residue on the cylinder block using a flat blade scraper.

– Clean any oil or grease off the sealing surfaces.

– Make sure both alignment bushings for centering the cover -arrows- are present.



– Cut the tube nozzle at the front marking (nozzle diameter: approximately 3 mm).



Seal the Cover with 15 Bolts

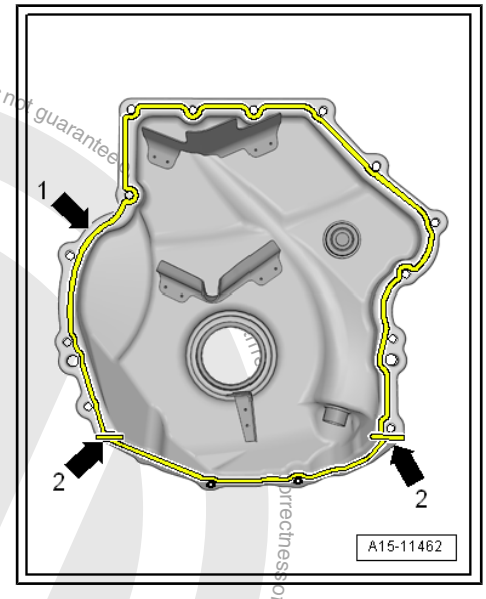
- Sealant bead thickness: 2 to 3 mm.

Note

- *The cover must be installed within five minutes after application of silicone sealant.*
- *The sealant bead may not be thicker than specified, otherwise excess sealant could enter the oil pan and clog the oil intake pipe screen.*
- *After installing cover, allow sealant to dry for approximately 30 minutes. Only after then may the engine oil be replenished.*

– Apply the Silicone Sealant to the clean sealing surface -arrow 1- and on the edges -arrows 2- of the new cover as shown.

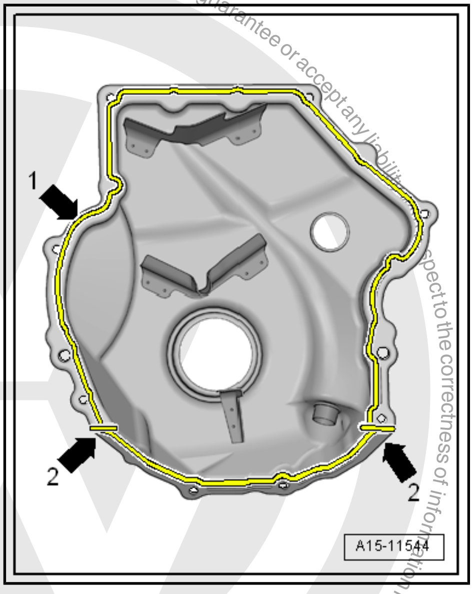
– Mount the cover immediately and tighten the bolts. Tightening sequence. Refer to ⇒ Fig. ""Lower Timing Chain Cover - Tightening Sequence for 15 Bolts"" , page 84 .



Seal the Cover with 8 Bolts

– Apply the Silicone Sealant to the clean sealing surface -arrow 1- and on the edges -arrows 2- of the new cover as shown.

♦ Sealant bead thickness: 2 to 3 mm.



Note

♦ *The cover must be installed within five minutes after application of silicone sealant.*

♦ *The sealant bead may not be thicker than specified, otherwise excess sealant could enter the oil pan and clog the oil intake pipe screen.*

♦ *After installing cover, allow sealant to dry for approximately 30 minutes. Only after then may the engine oil be replenished.*

– Mount the cover immediately and tighten the bolts. Tightening sequence. Refer to ⇒ Fig. ""Lower Timing Chain Cover - Tightening Sequence for 8 Bolts"" , page 84 .

Continuation for All:

– Install the vibration damper. Refer to ⇒ "1.5 Vibration Damper, Removing and Installing", page 44 .

– Install the Oil Pressure Regulation Valve - N428- . Refer to ⇒ "4.4 Oil Pressure Regulation Valve N428 , Removing and Installing", page 188 .

– Install the ribbed belt tensioning damper. Refer to ⇒ "1.4 Sub-Assembly Bracket, Removing and Installing", page 42 .

– Install the ribbed belt. Refer to ⇒ "1.2 Ribbed Belt, Removing and Installing", page 41 .

– Install the right front wheel housing liner. Refer to ⇒ Body Exterior; Rep. Gr. 66 ; Wheel Housing Liner .

– Fill with engine oil and then check the level. Refer to ⇒ Maintenance ; Booklet 36.1 .

Tightening Specifications

♦ Refer to ⇒ "1.1 Overview - Timing Chain Cover", page 82

♦ Refer to ⇒ Fig. ""Engine Support - Tightening Specification and Sequence"" , page 50

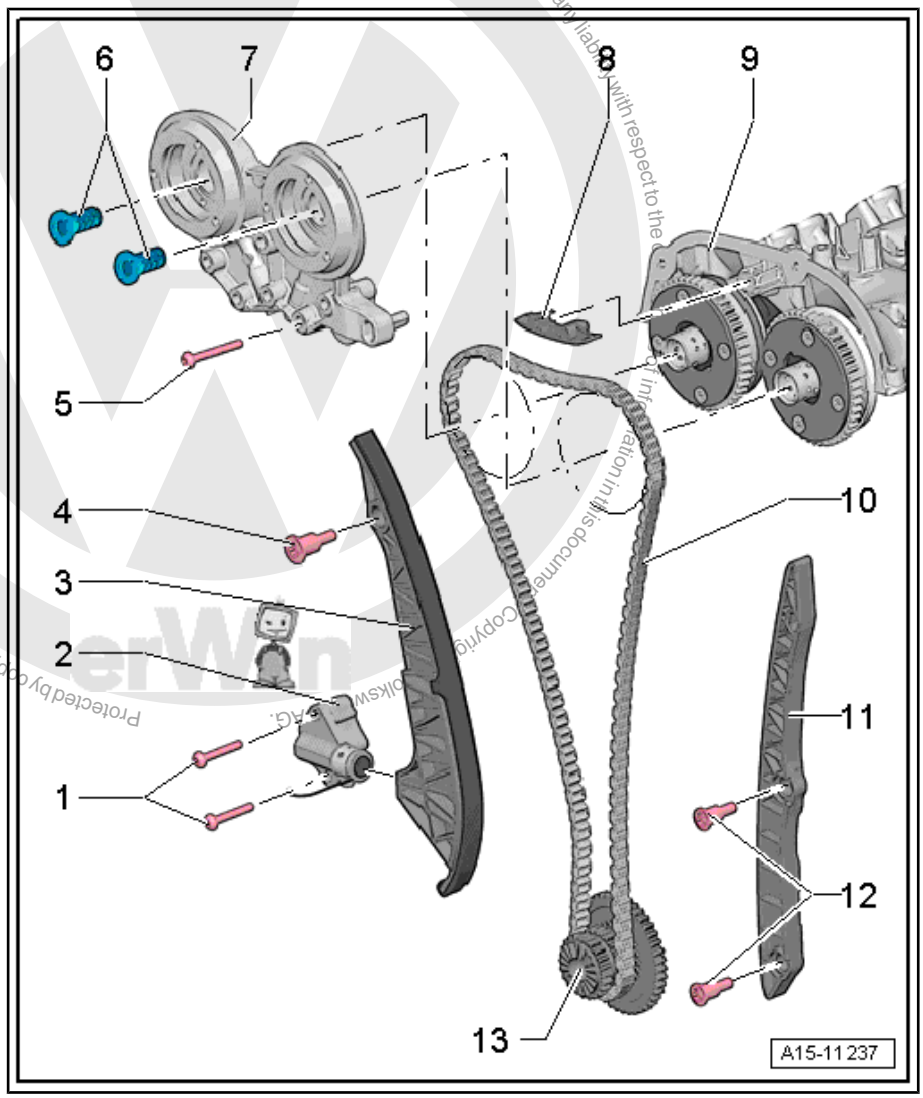
♦ Refer to ⇒ "2.1 Overview - Subframe Mount", page 26

2 Chain Drive

2.1 Overview - Camshaft Timing Chains

Note

Adapt the chain lengths after working on the chain drive. To do this, select `01 - Chain Length Adaptation Diagnosis` *in the* `Guided Functions`*. Refer to Vehicle Diagnostic Tester .*



1 - Bolt
- ❑ 4 Nm +90°
- ❑ Replace after removing

2 - Chain Tensioner
- ❑ Is under tension
- ❑ Secure using Tensioner Locking Tool - T40267- before removing

3 - Timing Chain Tensioning Rail

4 - Guide Pin
- ❑ 20 Nm

5 - Bolt
- ❑ 4 Nm +180°
- ❑ Replace after removing

6 - Regulator Valve
- ❑ 35 Nm
- ❑ Left-hand thread
- ❑ Removing using Assembly Tool - T10352/2-

7 - Bearing Bracket

8 - Camshaft Timing Chain Guide Rail

9 - Camshaft Housing

10 - Camshaft Timing Chain
- ❑ Before removing, mark the running direction with paint

11 - Camshaft Timing Chain Guide Rail

12 - Guide Pin

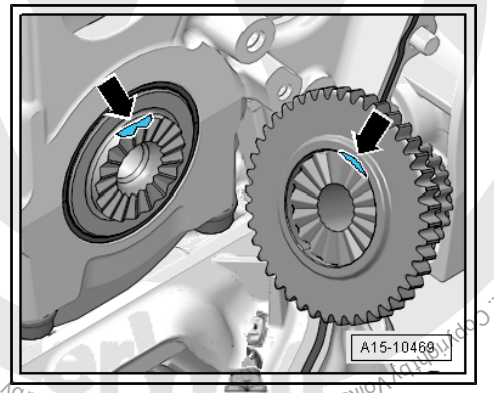
- ❑ 20 Nm

13 - Three Stage Chain Sprocket

- ❑ Crankshaft
- ❑ Installation position. Refer to ⇒ Fig. ""Three Stage Chain Sprocket - Installed Position"" , page 92

Three Stage Chain Sprocket - Installed Position

- Both surfaces -arrows- must align across from each other.



2.2 Overview - Balance Shaft Drive Chain

1 - Guide Pin

- ❑ 20 Nm

2 - Tensioning Rail

- ❑ For the timing chain

3 - Balance Shaft

- ❑ Exhaust side
- ❑ Must be replaced after removing
- ❑ Lubricate the bearing with engine oil
- ❑ Replacing. Refer to ⇒ "4.2.2 Exhaust Side Balance Shaft, Removing and Installing", page 68 .

4 - Guide Pin

- ❑ 20 Nm

5 - Guide Rail

- ❑ For the timing chain

6 - Chain Tensioner

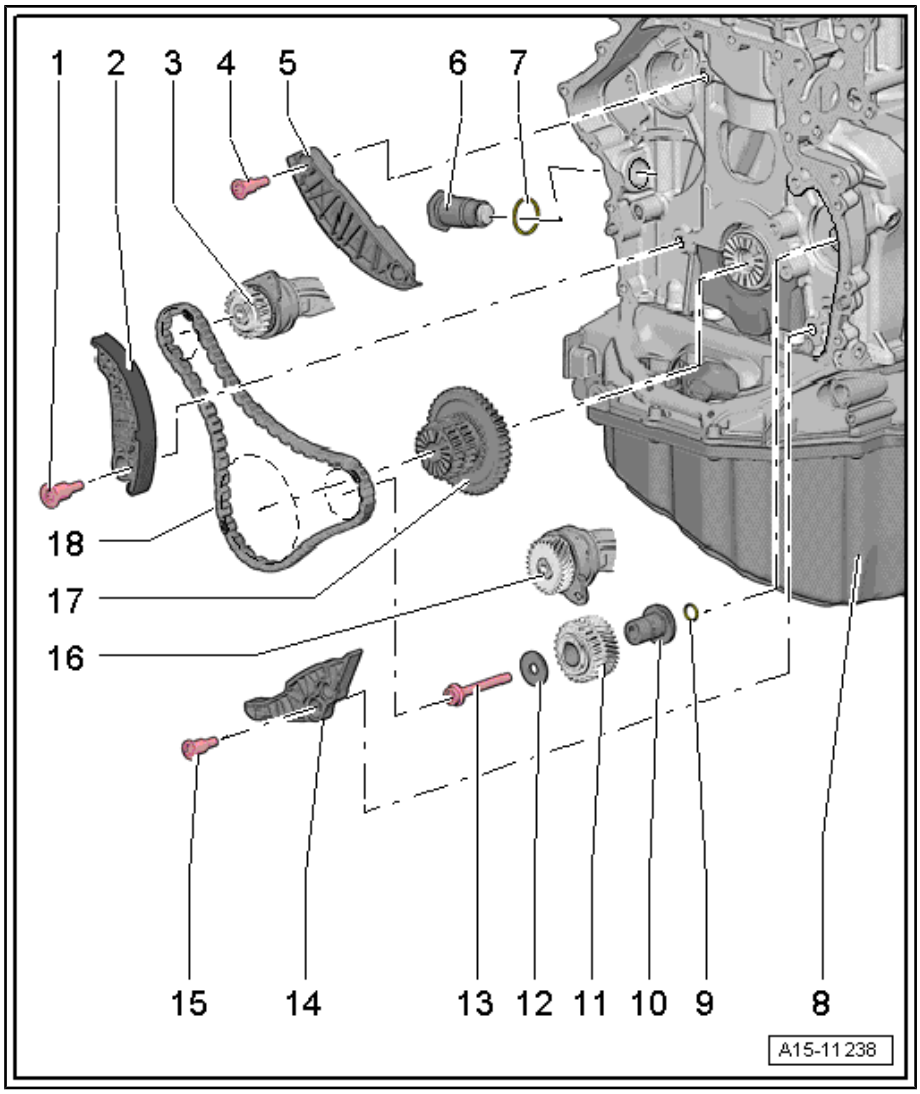
- ❑ 85 Nm
- ❑ Install with locking fluid. Refer to the Parts Catalog.

7 - Seal

8 - Cylinder Block

9 - O-Ring

- ❑ Coat with engine oil



10 - Mounting Pin

- ❑ Lubricate with engine oil
- ❑ Installation position. Refer to ⇒ Fig. ""Mounting Pins - Installation Position"" , page 93

11 - Intermediate Sprocket

- ❑ The intermediate sprocket must be replaced if the bolt -item 13- ⇒ Item 13 (page 93) is loosened.

12 - Thrust Washer

13 - Bolt

- ❑ Replace after removing
- ❑ The intermediate sprocket -item 11- ⇒ Item 11 (page 93) must be replaced if the bolt is loosened.
- ❑ Tightening sequence. Refer to ⇒ Fig. ""Intermediate Sprocket Tightening Sequence"" , page 94

14 - Guide Rail

- ❑ For the balance shaft timing chain

15 - Guide Pin

- ❑ 20 Nm

16 - Balance Shaft

- ❑ Intake side
- ❑ Must be replaced after removing
- ❑ Lubricate the bearing with engine oil
- ❑ Replacing. Refer to ⇒ "4.2.1 Balance Shaft Intake Side, Removing and Installing", page 65 .

17 - Three Stage Chain Sprocket

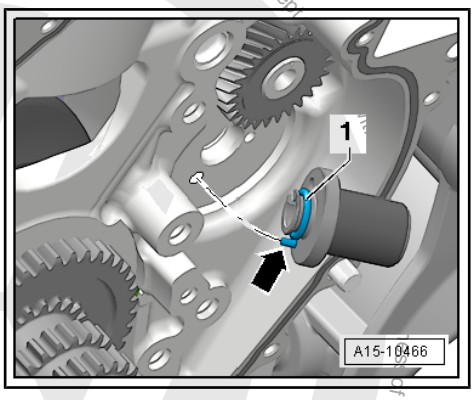
- ❑ Installation position. Refer to ⇒ Fig. ""Three Stage Chain Sprocket - Installed Position"" , page 92

18 - Balance Shaft Drive Chain

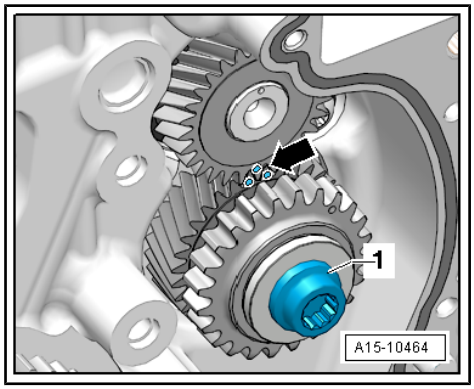
- ❑ Removing. Refer to ⇒ "2.4 Balance Shaft Drive Chain, Removing and Installing", page 106 .

Mounting Pins - Installation Position

- Replace and lubricate the O-ring -1-
- The alignment pin -arrow- for the bearing pins must engage in the hole in the cylinder block.
- Lubricate the bearing pins.



Intermediate Sprocket Tightening Sequence



> **Caution**
>
> *Always replace the intermediate sprocket. Otherwise the backlash will not adjust itself and it could cause damage to the engine.*
>
> *The new intermediate sprocket has an anti-friction coating that wears off after a short period of use, which automatically adjusts the backlash.*

– Tighten with a new bolt as follows:

1. Partially tighten to 10 Nm using a torque wrench.
2. Turn the intermediate sprocket.

The intermediate sprocket must not have any play. If it does, loosen and tighten it back up.

3. Tighten to 25 Nm using a torque wrench.
4. Turn another 90° using a rigid wrench.

2.3 Camshaft Timing Chain, Removing and Installing

Special tools and workshop equipment required

- Central Valve Assembly Tool - T10352-
- Counterhold - Vibration Damper - T10355-
- Locking Pin (3 pc.) - T40011-
- Chain Tensioner Lever - T40243-
- Tensioner Locking Tool - T40267-
- Camshaft Locks - T40271-
- Adapter - T40266-
- Vibration Damper Assembly Tool - T10531-
- Vibration Damper Assembly Tool - T10531- :
- Vibration Damper Assembly Tool - Counterhold Tool - T10531/1-
- Vibration Damper Assembly Tool - Tensioning Pins - T10531/2-
- Vibration Damper Assembly Tool - Turning Over Tool - T10531/3-
- Vibration Damper Assembly Tool - Knurled Nut - T10531/4-

Removing

– Support the engine in the installation position. Refer to ⇒ “2.2 Engine, Supporting in Installation Position”, page 27 .

– Remove the engine mount. Refer to ⇒ “2.3 Engine Mount, Removing and Installing”, page 30 .

– Remove the engine support. Refer to ⇒ “1.6 Engine Support, Removing and Installing”, page 49 .

– Remove the upper timing chain cover. Refer to ⇒ “1.2 Upper Timing Chain Cover, Removing and Installing”, page 84 .

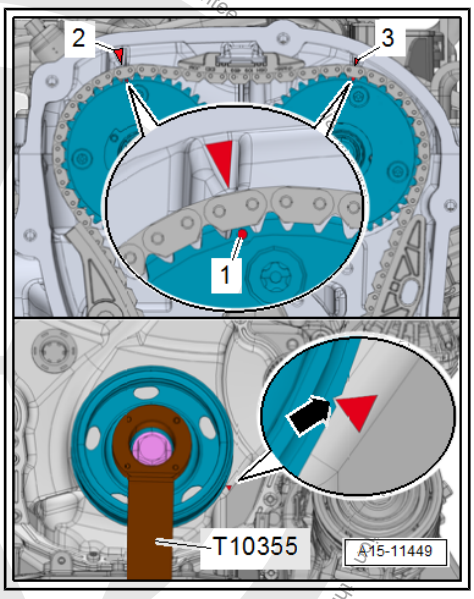
– Remove the windshield washer fluid reservoir. Refer to ⇒ Electrical Equipment; Rep. Gr. 92 ; Windshield Washer System; Windshield Washer Fluid Reservoir, Removing and Installing .

– Remove the noise insulation. Refer to ⇒ Body Exterior; Rep. Gr. 66 ; Noise Insulation; Overview - Noise Insulation .

With Markings on the Cylinder Head.

– Turn the vibration damper with the Counterhold - Vibration Damper - T10355- to the TDC point.

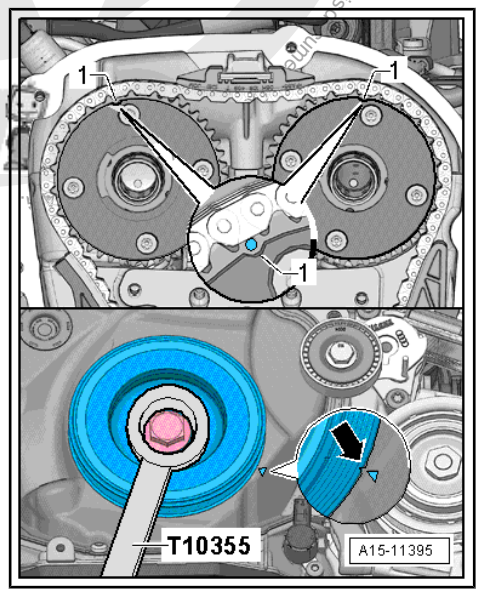
- The markings -1- on the camshaft chain sprockets must be opposite the markings -2 and 3-.
- The notch on the vibration damper and the marking on the lower cover for timing chain -arrow- must be opposite one another.



Without Markings on the Cylinder Head.

– Turn the vibration damper with the Counterhold - Vibration Damper - T10355- to the TDC point.

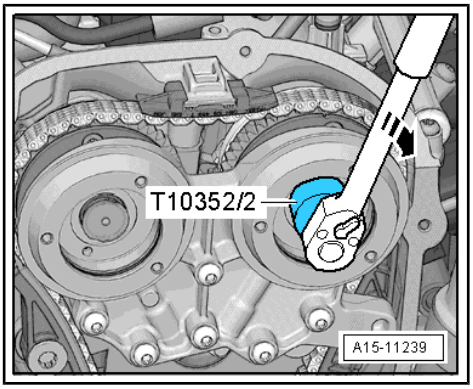
- The markings -1- on the camshaft chain sprockets must point upward.
- The notch on the vibration damper and the marking on the lower cover for timing chain -arrow- must be opposite one another.



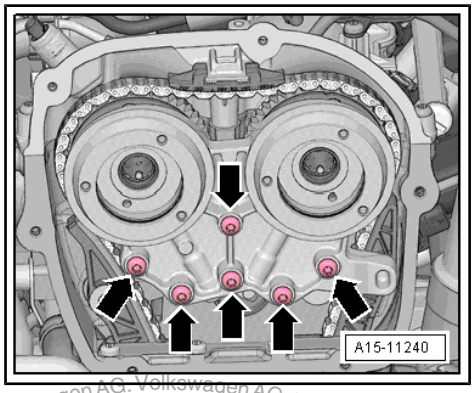
– Remove the left and right control valves using the Assembly Tool - T10352/2- in the direction of -arrow-.

Note

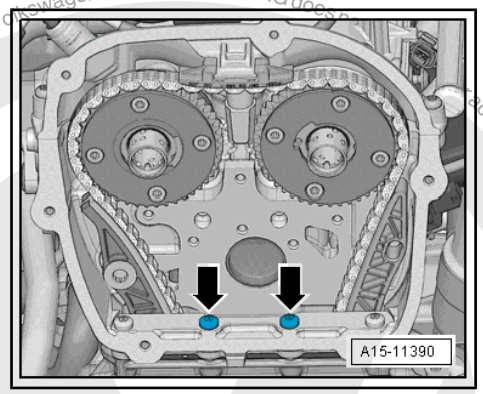
The pilot valve has left-hand threads.



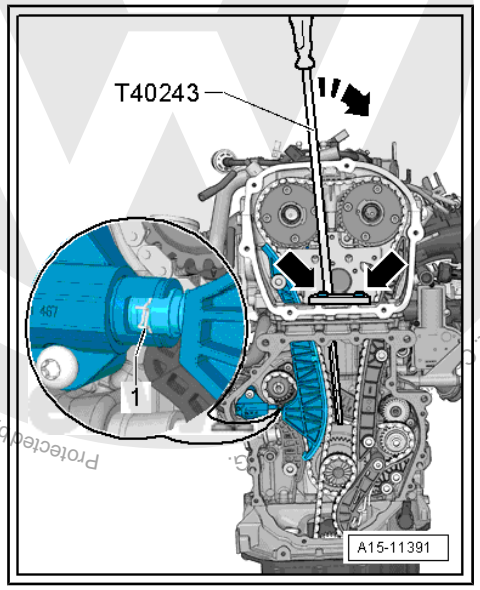
– Remove the bolts -arrows- and remove the bearing bracket.



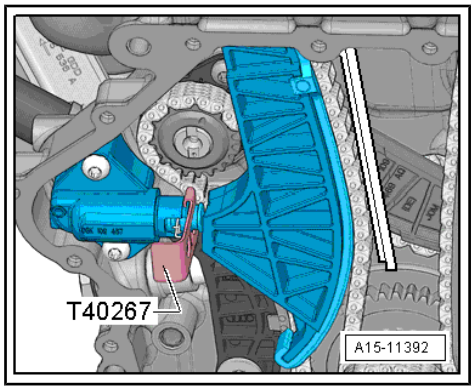
– Remove the bolts -arrows-.
– Install the Chain Tensioner Lever - T40243- -arrows-.
– Press the chain tensioner circlip -1- together and hold it.



– Slowly press and hold the Chain Tensioner Lever - T40243- in the direction of -arrow-.
– Secure the chain tensioner with the Tensioner Locking Tool - T40267- .



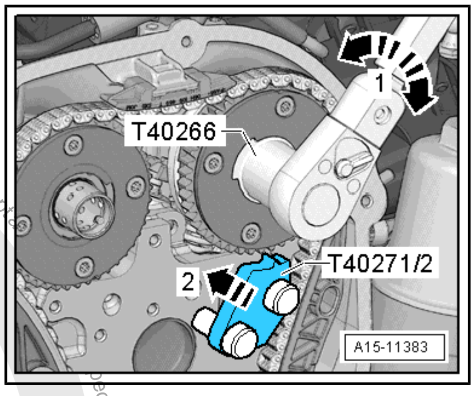
– Remove the Chain Tensioner Lever - T40243- .



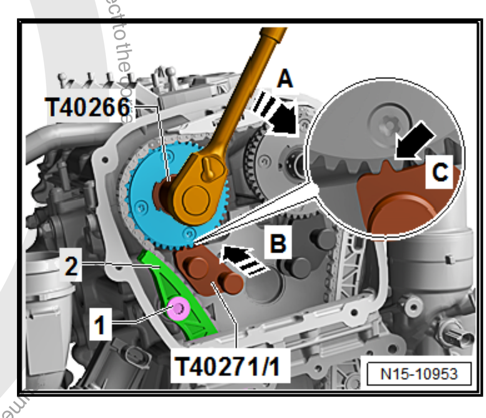
– Bolt the Camshaft Lock - T40271/2- to the cylinder head and push the chain sprocket splines in the direction of -arrow 2-. If necessary, turn the intake camshaft with an Adapter - T40266- in the direction of -arrow 1-.

– Install the Camshaft Lock - Component 1 - T40271/1- on the cylinder head.

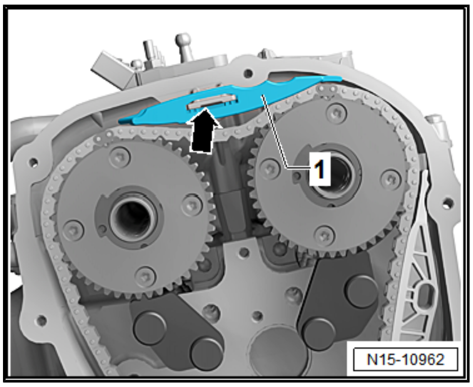
A second technician is needed for the following step.



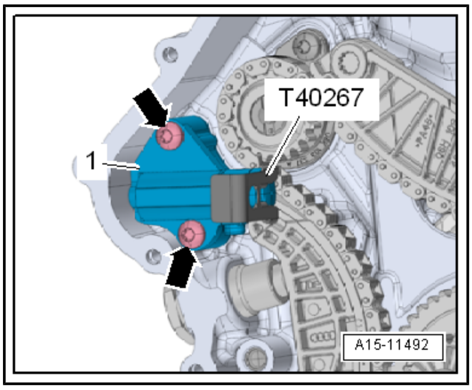
– Hold the exhaust camshaft with the Adapter - T40266- in the direction of the -arrow A-. Remove the bolt -1- and guide the tensioning rail -2- downward. Turn the camshaft clockwise in direction of -arrow A- until the Camshaft Locks - T40271/1- can be pushed in the chain sprocket splines -arrow C-.



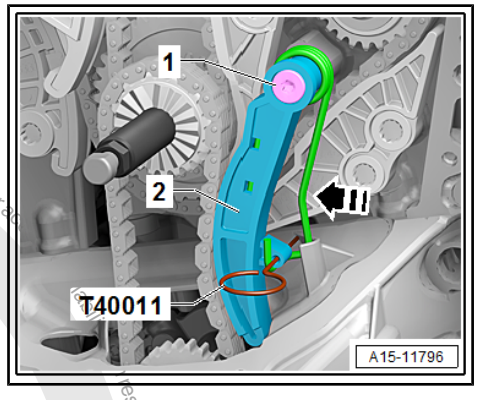
– Remove the guide rail -1- by unlocking the latch -arrow- with a screwdriver and pushing the guide rail forward.



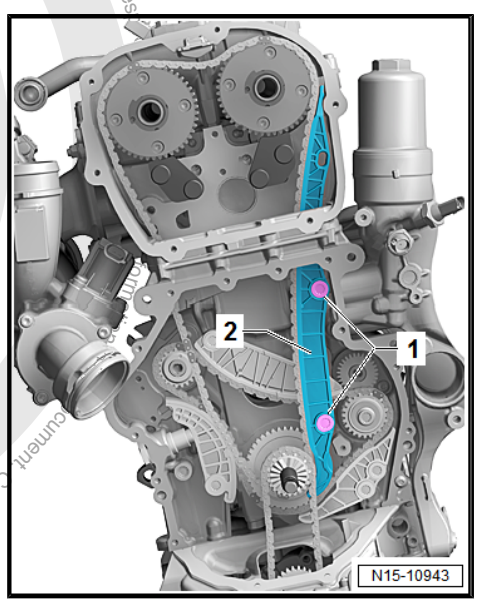
– Remove the bolts -arrows- and remove the chain tensioner -1-.



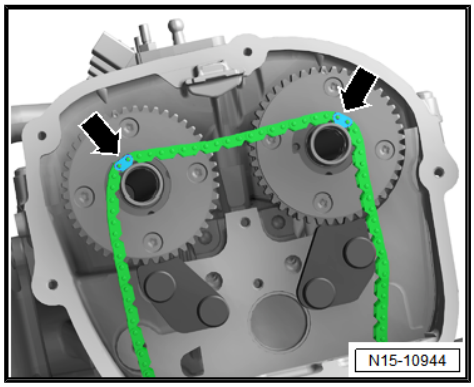
– Press the oil pump chain tensioner bracket in direction of -arrow- and lock with Locking Pin - T40011- .
– Remove the bolt -1-.
– Remove the chain tensioner -2-.



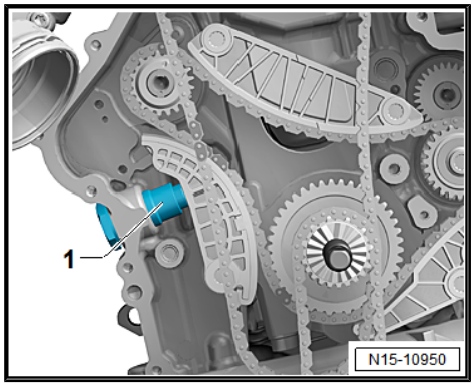
– Remove the bolts -1-.
– Remove the glide rail -2-.



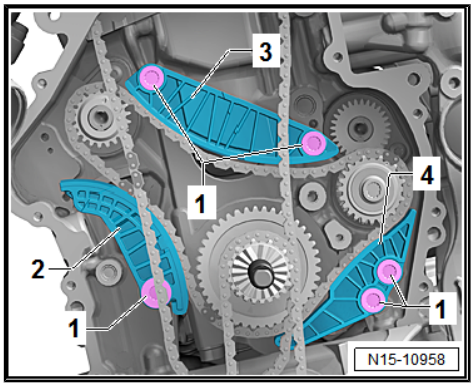
– Remove the camshaft timing chain from the camshaft sprockets and hang it on the camshaft pins -arrows-.



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



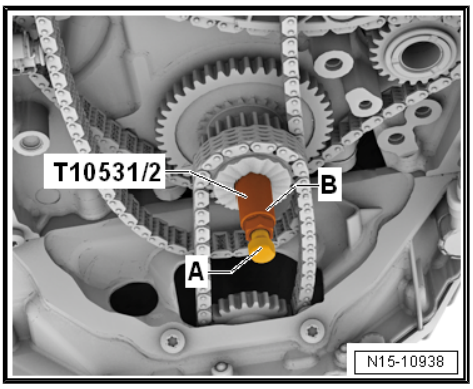
– Remove the bolts -1-.
– Remove the tensioning rail -2- and the glide rails -3 and 4-.
– Loosen the adjusting bolt -A-.
– Remove the adjusting pin -B-.
– Remove the oil pump drive timing chain to remove the three stage chain sprocket.



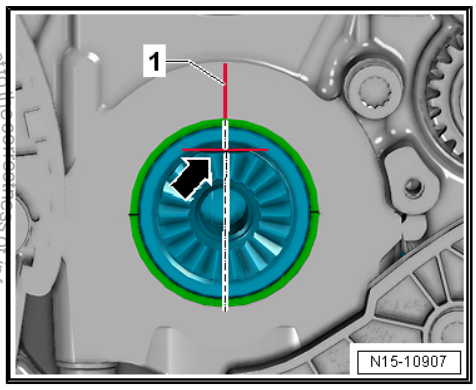
– Remove the camshaft timing chain and drive chain for the balance shaft.

Installing

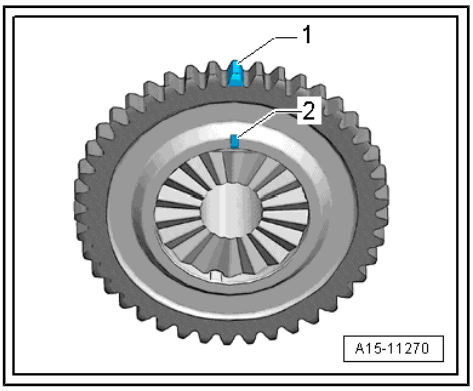
Install in reverse order of removal and note the following:



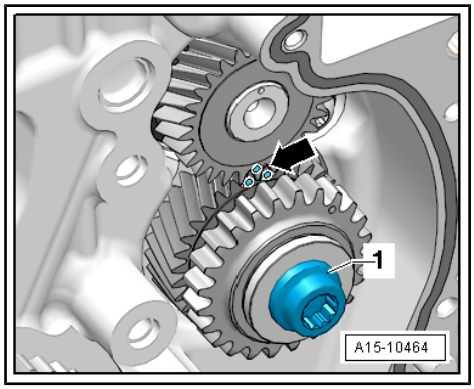
– Check the crankshaft TDC. The flat area on the crankshaft -arrow- must be horizontal.
– Draw the markings on the cylinder block -1-, as shown, with a waterproof marker.



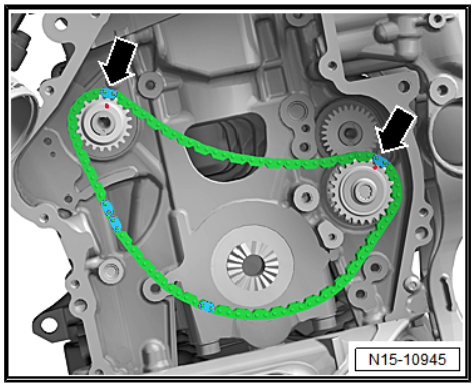
– Draw a marking -2- on the three stage chain sprocket tooth -1- with a waterproof marker.



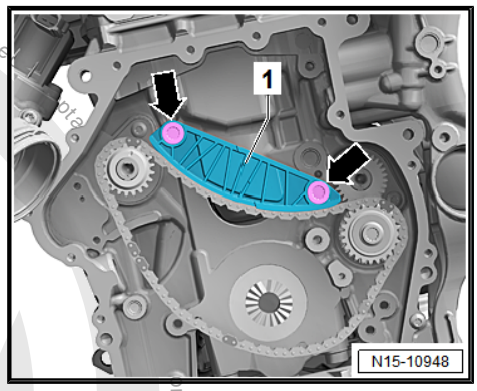
– Turn the intermediate sprocket and balance shaft to the markings -arrow-, do not loosen the bolt -1-. The marks on the intermediate sprocket and the balance shaft are difficult to see.



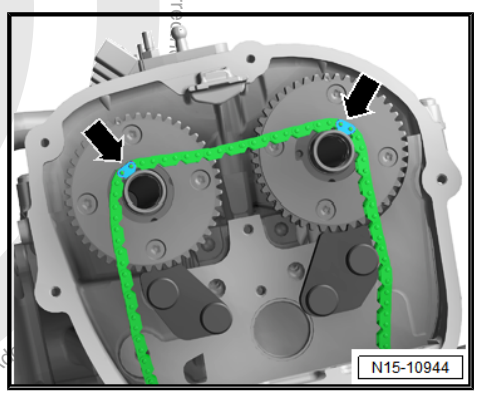
– Lay the balance shaft drive chain, and position the painted links -arrows- on the chain sprocket markings.



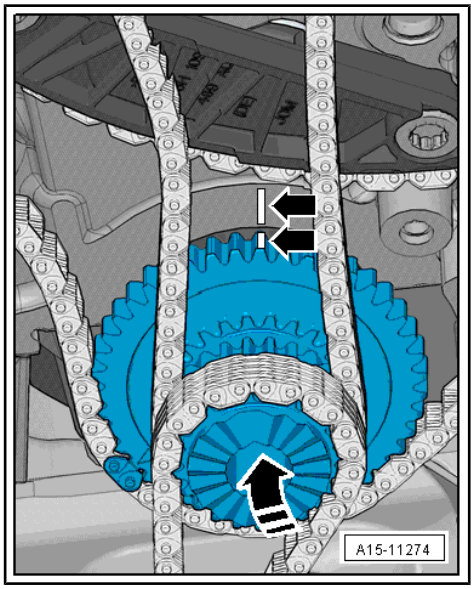
– Install the guide rail -1- and tighten the bolts -arrows-.



– Engage the camshaft timing chain with the painted links -arrows- on the camshaft pins.

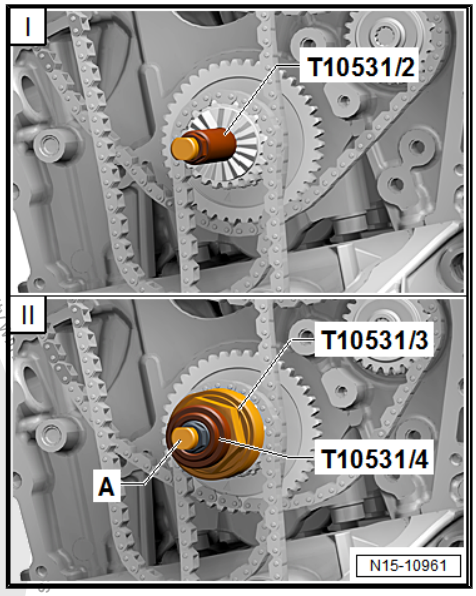


– Lay the oil pump drive timing chain onto the three stage chain sprocket.
– Tilt the three stage chain sprocket in the direction of -arrow- toward the engine and secure it to the crankshaft. The marking -arrows- must be positioned opposite each other.

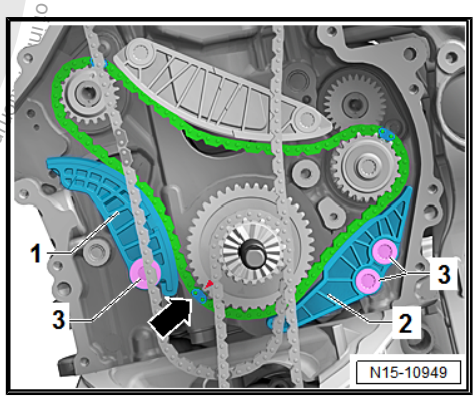


I - Install the Vibration Damper Assembly Tool - Tensioning Pins - T10531/2- in the crankshaft and tighten hand-tight.

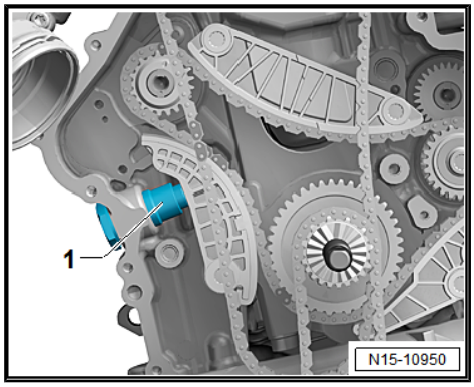
II - Install the Vibration Damper Assembly Tool - Turning Over Tool - T10531/3-. Tighten the Vibration Damper Assembly Tool - Knurled Nut - T10531/4- hand-tight. Using a 32 mm open end wrench move the Vibration Damper Assembly Tool - Turning Over Tool - T10531/3- back and forth slightly while doing this tighten the Vibration Damper Assembly Tool - Knurled Nut - T10531/4- until the chain sprocket is seated securely on the crankshaft splines. Now tighten the adjusting bolt -A-.



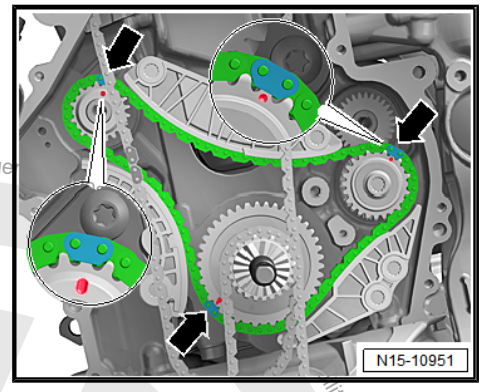
– Position the painted chain link in the balance shaft drive chain -arrow- at the marking on the three stage chain sprocket. Install the tensioning rail -1- and the glide rail -2-. Tighten the bolts -3-.



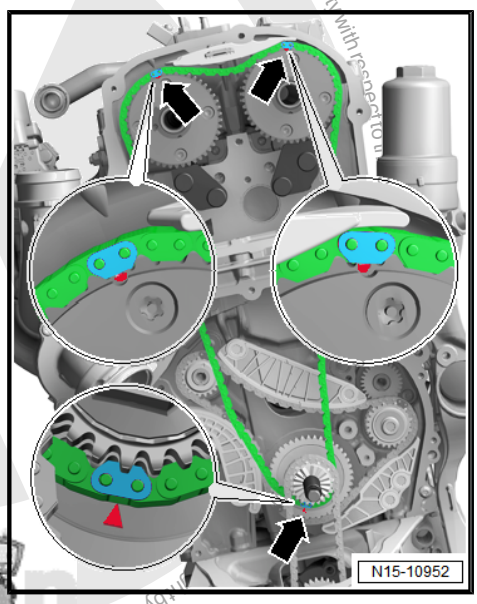
– Install the chain tensioner -1-.



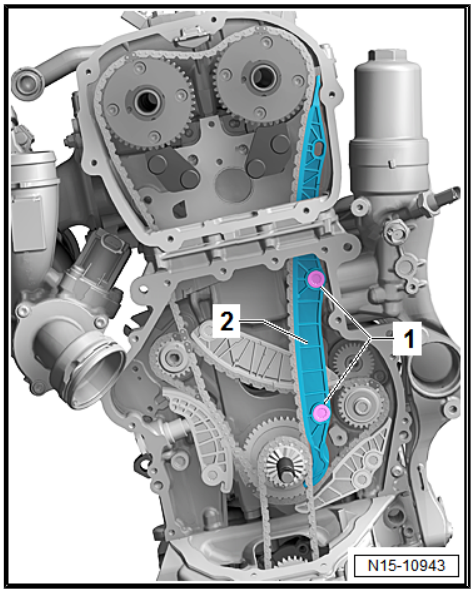
– Check the adjustment again. The painted chain links -arrows- must line up with the markings on the chain sprockets.



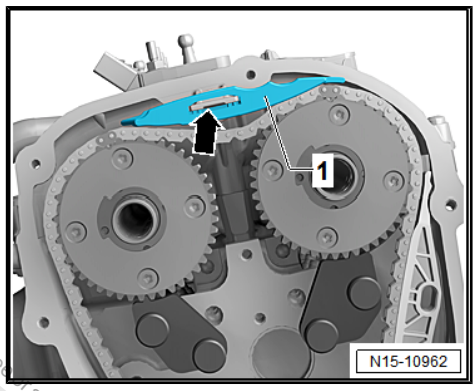
– Place the camshaft timing chain on the intake camshaft, exhaust camshaft and the crankshaft. Position the painted chain links -arrows- on the markings on the chain sprockets.



– Install the guide rail -2- and tighten the bolts -1-.



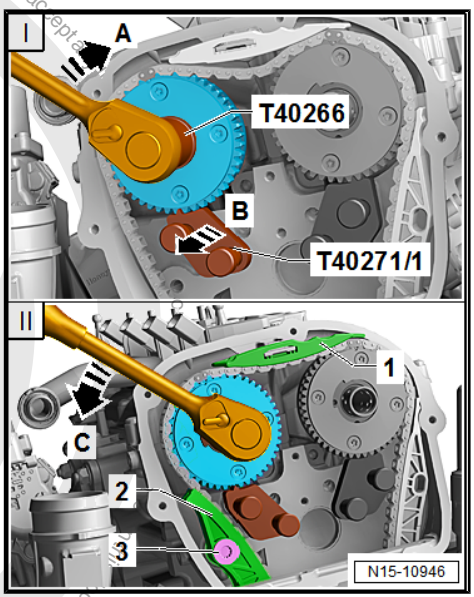
– Install the upper glide rail -1-.



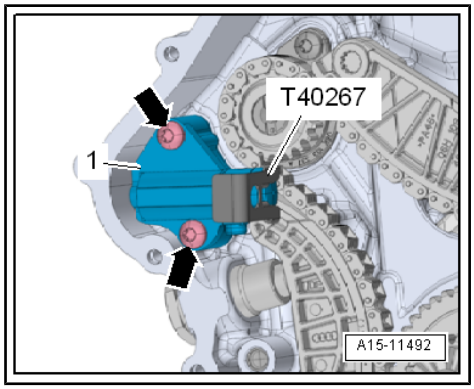
A second technician is needed for the following step.

I - Turn the exhaust camshaft slightly in the direction of the -arrow A- using the Adapter - T40266- and push the Camshaft Lock - T40271/1- out of the chain sprocket splines in direction of -arrow B-.

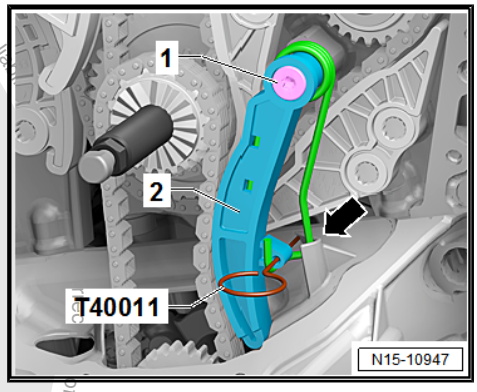
II - Release the camshaft in the direction of -arrow C-, until the timing chain touches the glide rail -1-. Hold the camshaft ion this position, install the tensioning rail -2- and tighten the bolts -3-.



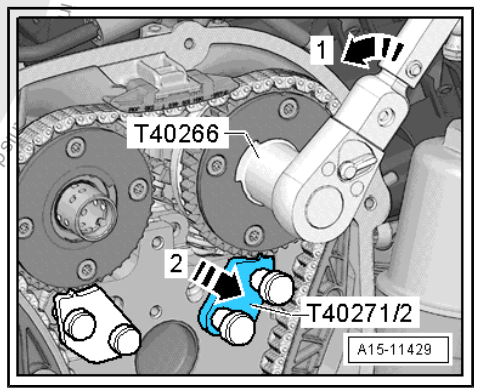
– Install the chain tensioner -1- and tighten the bolts -arrows-.



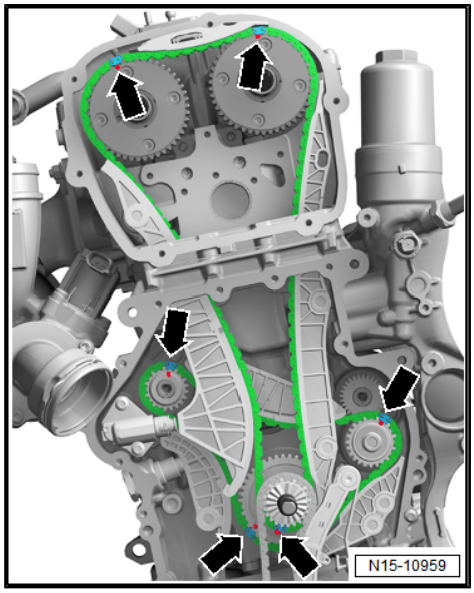
– Install the chain tensioner -2-. The wire clip -arrow- must come in to contact with the oil pan upper section opening. Tighten the bolt -1- and remove the Locking Pin (3 pc.) - T40011- .



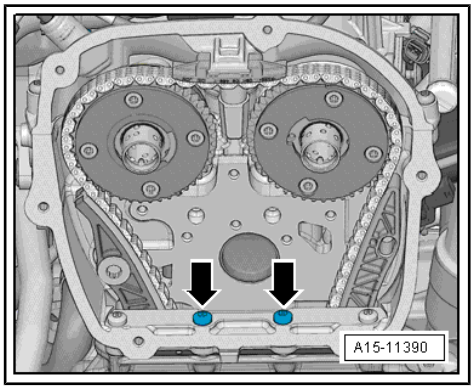
– Turn the intake camshaft with the Adapter - T40266- in the direction of the arrow -1- until the Camshaft Lock - T40271/2- can be pushed out of the chain sprocket splines -2-. Release the camshaft.
– Remove the Camshaft Locks - T40271/1- and Camshaft Locks - T40271/2- .



– Check the adjustment. The painted chain links -arrows- must line up with the markings on the chain sprockets.



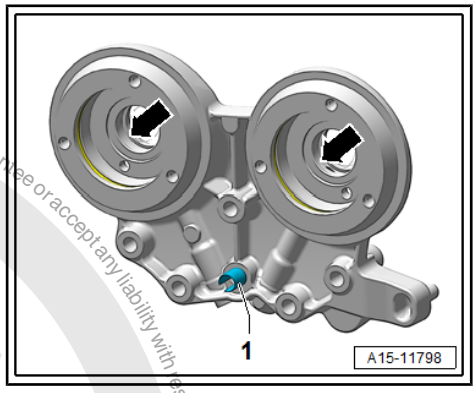
– Install the bolts -arrows- and tighten them.



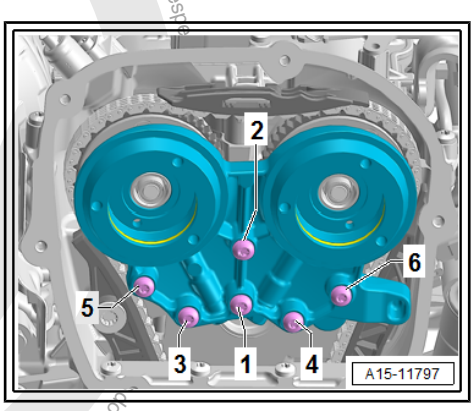
– Lubricate the holes -arrows- with engine oil.

Note

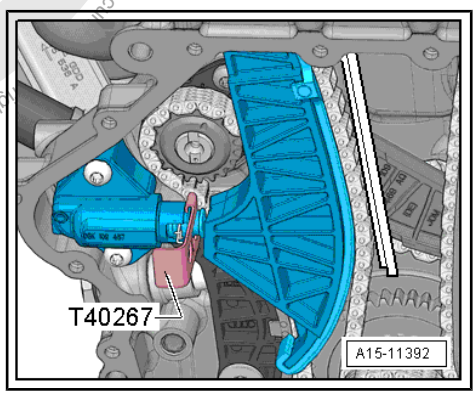
Adapter sleeve -1- is not present on every bearing bracket.

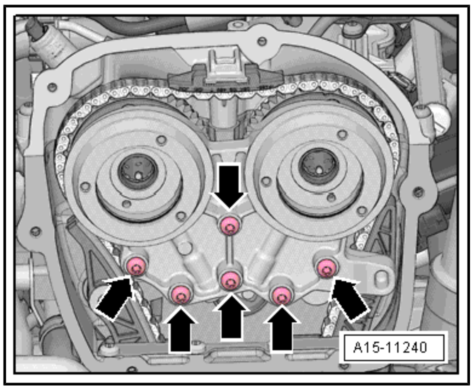


– Attach the bearing mount. Do not tilt it when doing this. Tighten the bolts -1 to 6- hand-tight.
– If an adapter sleeve is installed, this will be moved with the bolt -1- in the cylinder head.



– Remove the Tensioner Locking Tool - T40267- .





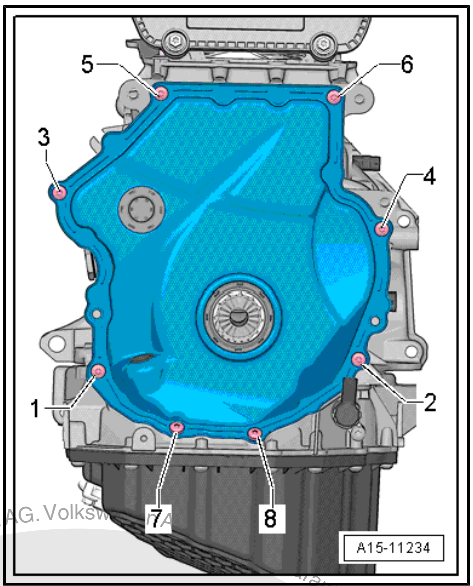
– Tighten the bearing bracket bolts -arrows-.

– Install the control valves -item 6- ⇒ Item 6 (page 91) .

– Let the engine turn a second time in the direction of engine rotation.

Note

Due to the ratio, the painted chain links no longer match up after the engine has been turned.



– Remove the turning over tool and install the lower timing chain cover. Refer to ⇒ “1.3 Lower Timing Chain Cover, Removing and Installing”, page 86 .

Note

Tighten the bolts -1 and 4- with an additional turn after installing the vibration damper. The bolts must be removed again to install the vibration damper.

– Install the vibration damper. Refer to ⇒ “1.5 Vibration Damper, Removing and Installing”, page 44 .

– Install the upper timing chain cover. Refer to ⇒ “1.2 Upper Timing Chain Cover, Removing and Installing”, page 84 .

– Install the ribbed belt tensioning damper. Refer to ⇒ “1.3 Ribbed Belt Tensioner, Removing and Installing”, page 42 .

– Install the ribbed belt. Refer to ⇒ “1.2 Ribbed Belt, Removing and Installing”, page 41 .

– After working on the chain drive the adaptation value in the engine control module must be adapted. Refer to Vehicle Diagnostic Tester .

Tightening Specifications

♦ Refer to ⇒ “2.1 Overview - Camshaft Timing Chains”, page 91

♦ Refer to ⇒ “2.2 Overview - Balance Shaft Drive Chain”, page 92

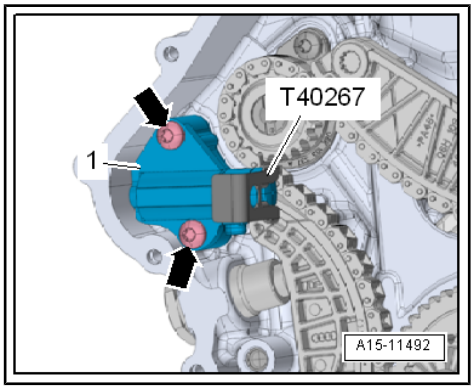
♦ Refer to ⇒ Body Exterior; Rep. Gr. 66 ; Noise Insulation; Overview - Noise Insulation .

2.4 Balance Shaft Drive Chain, Removing and Installing

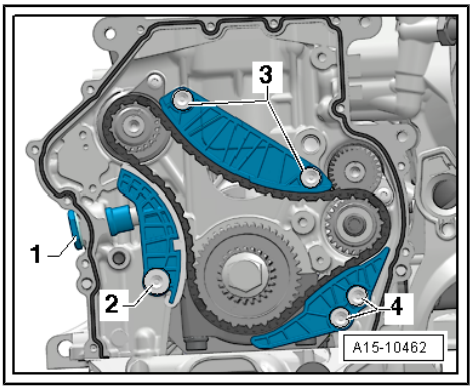
Removing

– Remove the camshaft timing chain. Refer to ⇒ “2.3 Camshaft Timing Chain, Removing and Installing”, page 94 .

– Remove the bolts -arrows- and remove the chain tensioner for the camshaft timing chain -1-.
– Remove the guide rail -3-.

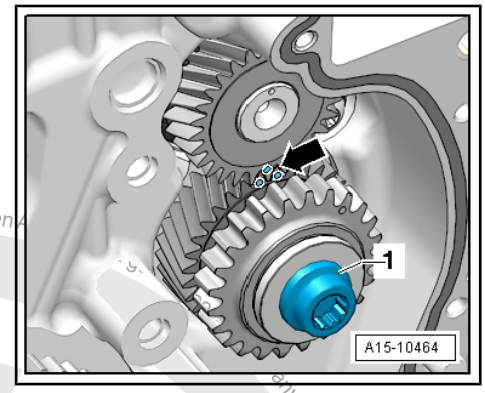


– Remove balance shaft drive chain.



Installing

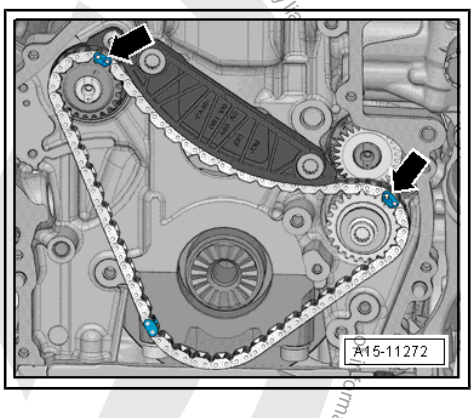
– Turn the intermediate sprocket and balance shaft to the markings -arrow-, do not loosen the bolt -1-.



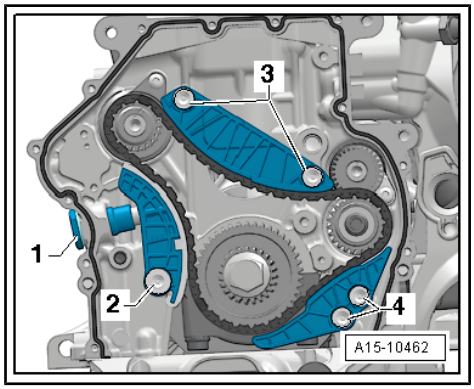
Note

The painted chain links in the balance shaft drive chain must be positioned at the markings on the chain sprockets.

– Lay the balance shaft drive chain, the painted links -arrows- must be positioned with the markings on the chain sprockets.

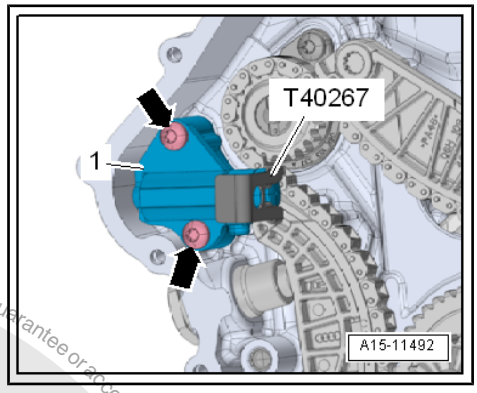


– Install the timing chain guide rail and tighten the bolts -3-.



– Install chain tensioner -1- for camshaft timing chain.

– Install the camshaft timing chain. Refer to ⇒ “2.3 Camshaft Timing Chain, Removing and Installing”, page 94 .



Tightening Specifications

- Refer to ⇒ “2.1 Overview - Camshaft Timing Chains”, page 91
- Refer to ⇒ “2.2 Overview - Balance Shaft Drive Chain”, page 92

2.5 Chain Length, Checking

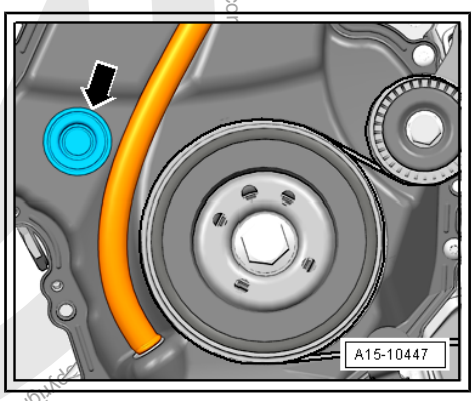
Note

If an elongated camshaft timing chain is suspected based on complaints (for example noises), the timing chain can be checked as described in the following.

– Remove the plug -arrow-. The plugs must be replaced.

– Turn the vibration damper in direction of engine rotation until the chain tensioner piston is extended the maximum distance in the direction of -arrow-.

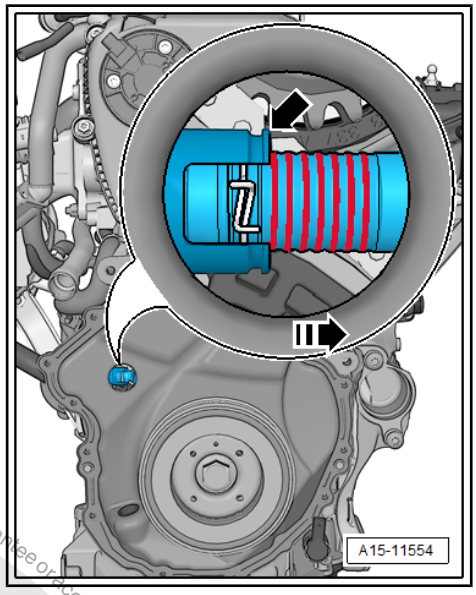
– Count the visible piston splines.



Note

The visible splines are all of the splines that are located to the right of the chain tensioner housing -arrow-.

- If six or fewer splines are visible: the camshaft timing chain does not need to be replaced.
- If seven or more splines are visible: the camshaft timing chain must be replaced. Refer to ⇒ “2.3 Camshaft Timing Chain, Removing and Installing”, page 94 .



2.6 Valve Timing, Checking

Special tools and workshop equipment required

- Dial Gauge Set - VAS6341-
- Dial Gauge Adapter - T10170A-

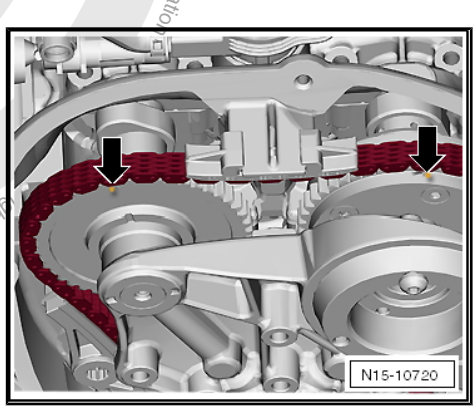
– Remove the upper timing chain cover. Refer to ⇒ “1.2 Upper Timing Chain Cover, Removing and Installing”, page 84 .

– Remove the noise insulation. Refer to ⇒ Body Exterior; Rep. Gr. 66 ; Noise Insulation; Overview - Noise Insulation .

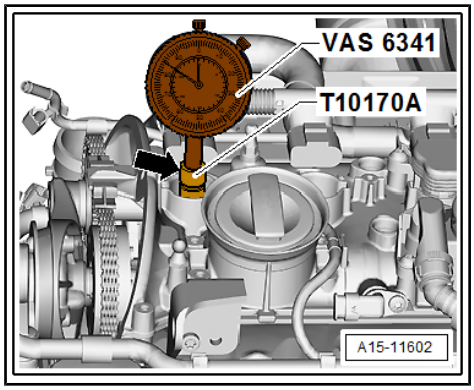
– Remove the windshield washer fluid reservoir. Refer to ⇒ Electrical Equipment; Rep. Gr. 92 ; Windshield Washer System; Windshield Washer Fluid Reservoir, Removing and Installing .

– Turn the crankshaft with the socket SW 24 on the vibration damper in the direction of the engine rotation until the markings -arrows- are almost on top.

– Remove the spark plug from cylinder 1. Refer to ⇒ “1.1 Overview - Ignition System”, page 327 .



– Install the Dial Gauge Adapter - T10170A- all the way into the spark plug thread.
– Insert the Dial Gauge Set - VAS6341- using the Dial Gauge Adapter - T10170A/1- until stop and secure with the locking nut -arrow-.
– Turn the crankshaft slowly in the direction of the engine rotation until the maximum dial reading is reached. When the maximum dial reading is reached (BDC of the meter) position the piston at »TDC«.

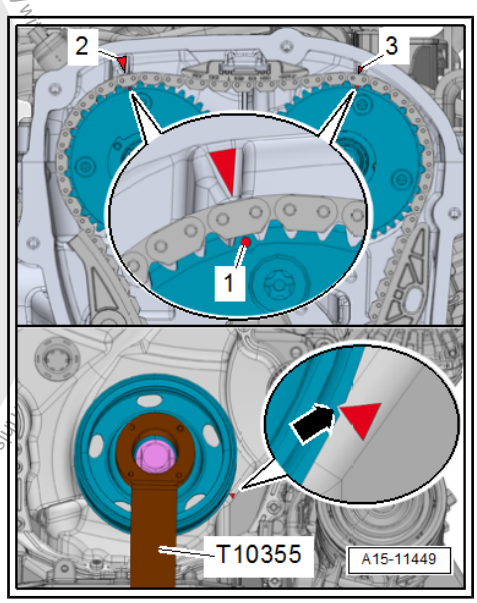


Note

- *Use a ratchet with a 24 mm socket or Counterhold - Vibration Damper - T10355- to turn the vibration damper.*
- *If the crankshaft was turned past "TDC", turn the crankshaft two more turns in the direction of the engine rotation. Do not turn the engine in the opposite direction of the engine rotation.*

With Markings on the Cylinder Head.

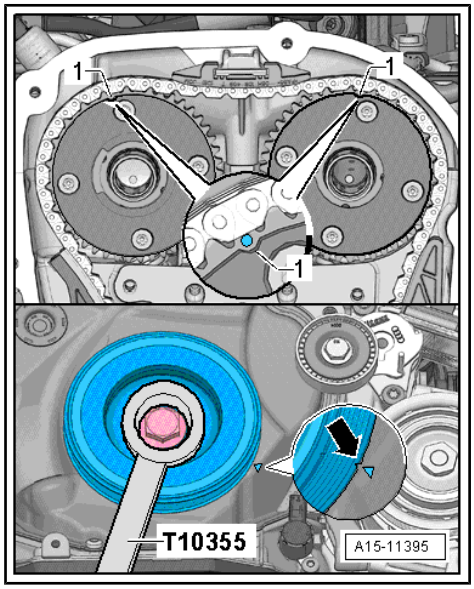
- The notch on the vibration damper must line up with the arrow marking on the lower timing chain cover -arrow-.
- The markings -1- on the camshaft chain sprockets must be opposite the markings -2 and 3- on the cylinder head.



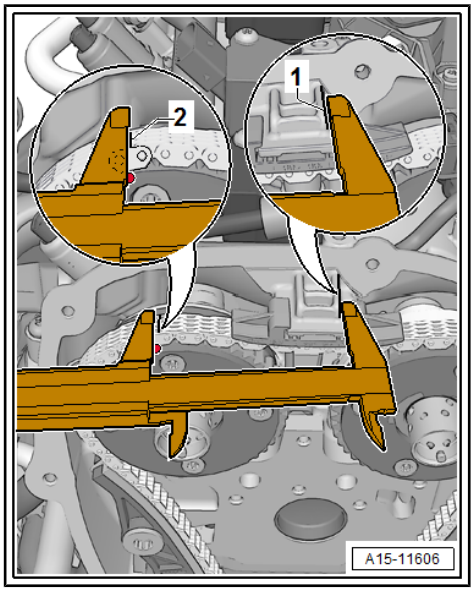
Without Markings on the Cylinder Head.

- The notch on the vibration damper and the marking on the lower cover for timing chain must be opposite one another -arrow-.
- The markings -1- on the camshaft chain sprockets must point upward.

– Measure the distance from the edge -1- to the marking -2- on the exhaust camshaft chain sprocket.

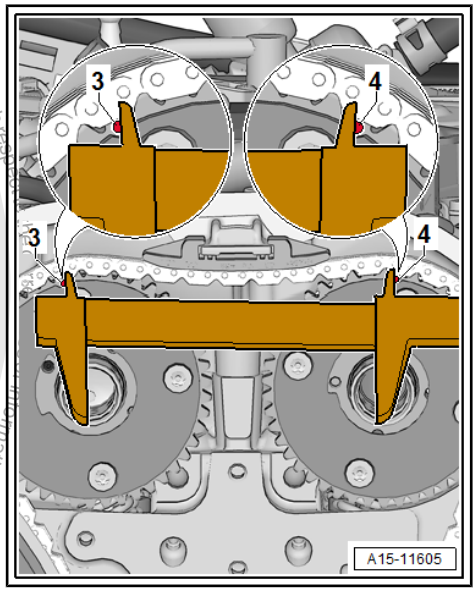


- Specified value: 74 to 77 mm.



– Once the specified value is reached, measure the distance between the marking on the exhaust camshaft chain sprocket -3- and the marking on the intake camshaft chain sprocket -4-.

- Specified value: 124 to 127 mm.



Note

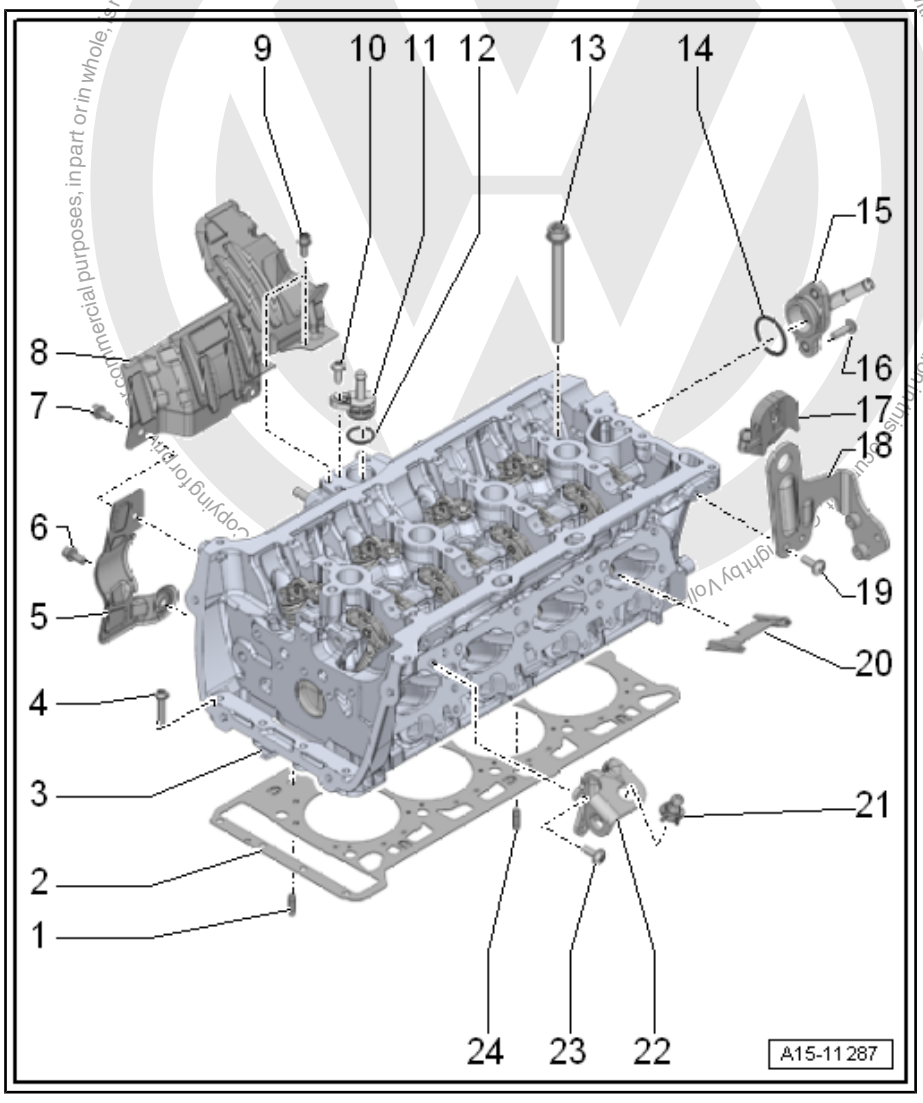
If one tooth has an offset, there will be a deviation of approximately 6 mm from the specified value. Install the timing chain once again if an offset is determined.

3 Cylinder Head

3.1 Overview - Cylinder Head

Note

- *Replace the cylinder head bolts.*
- *Always replace self-locking nuts, bolts which have been tightened to tightening specifications as well as seals and O-rings.*
- *The plastic protectors installed to protect the open valves must only be removed immediately before mounting the cylinder head.*
- *The engine oil and coolant must be changed if the cylinder head or cylinder head seal are replaced.*



1 - Alignment Pin

2 - Cylinder Head Gasket

- ❑ Replace after removing
- ❑ Installed position: the part number faces the cylinder head

3 - Cylinder Head

- ❑ Checking for distortion. Refer to ⇒ Fig. ““Cylinder Head, Checking for Distortion”“ , page 114
- ❑ Removing and installing. Refer to ⇒ “3.2 Cylinder Head, Removing and Installing”, page 114 .

4 - Bolt

- ❑ Replace after removing
- ❑ Follow the procedure when loosening. Refer to ⇒ Fig. ““Loosening the Cylinder Head”“ , page 114
- ❑ Follow the procedure when tightening. Refer to ⇒ Fig. ““Cylinder Head Tightening Sequence”“ , page 114

5 - Heat Shield

6 - Bolt

- ❑ 9 Nm

7 - Bolt

- ❑ 9 Nm

8 - Heat Shield

9 - Bolt

- ❑ 9 Nm

10 - Bolt

- ❑ 9 Nm

11 - Connection

- ❑ For coolant hose

12 - O-Ring

- ❑ Replace after removing
- ❑ Coat with coolant

13 - Cylinder Head Bolts

- ❑ Replace after removing
- ❑ Follow the procedure when loosening. Refer to ⇒ Fig. ""Loosening the Cylinder Head"" , page 114
- ❑ Follow the procedure when tightening. Refer to ⇒ Fig. ""Cylinder Head Tightening Sequence"" , page 114

14 - O-Ring

- ❑ Replace after removing
- ❑ Coat with coolant

15 - Connection

- ❑ For coolant hose

16 - Bolt

- ❑ 9 Nm

17 - Mount

- ❑ For engine cover

18 - Engine Lifting Eye

19 - Bolt

- ❑ 8 Nm +90°
- ❑ Replace after removing

20 - Partition Plate

21 - Ball Pin

- ❑ For engine cover

22 - Engine Lifting Eye

23 - Bolt

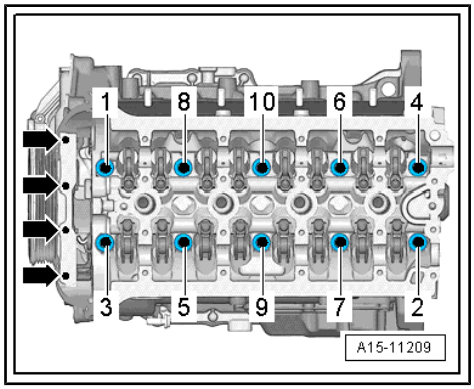
- ❑ 8 Nm +90°
- ❑ Replace after removing

24 - Alignment Pin

Loosening the Cylinder Head

– Remove the bolts -arrows-.

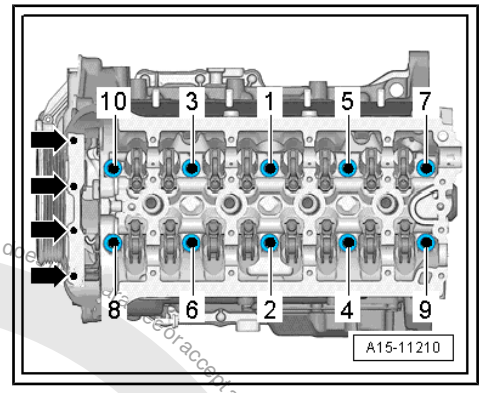
– Loosen the cylinder head bolts in the sequence -1 to 10-.



Cylinder Head Tightening Sequence

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

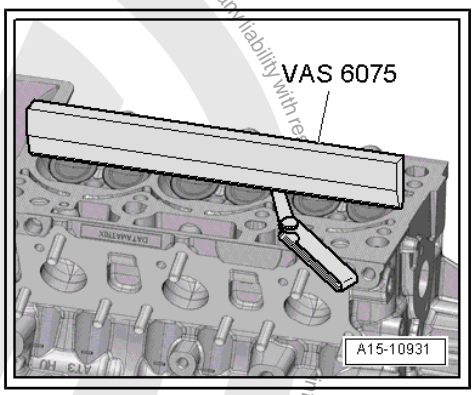
1. Pre-tighten tighten to 40 Nm using a torque wrench.
2. Turn another 90° using a rigid wrench.
3. Turn another 90° using a rigid wrench.
4. Pre-tighten the bolts -arrows- to 4 Nm.
5. Tighten the bolts -arrows- 90° further using a rigid wrench.



Cylinder Head, Checking for Distortion

– Check the cylinder head at several locations for distortion using a Straight Edge - 500mm - VAS6075- and a feeler gauge.

♦ Maximum permissible distortion: 0.05 mm



3.2 Cylinder Head, Removing and Installing

Special tools and workshop equipment required

♦ Engine Bung Set - VAS6122-

♦ Polydrive Bit Drive Socket - T10070-

Removing

Note

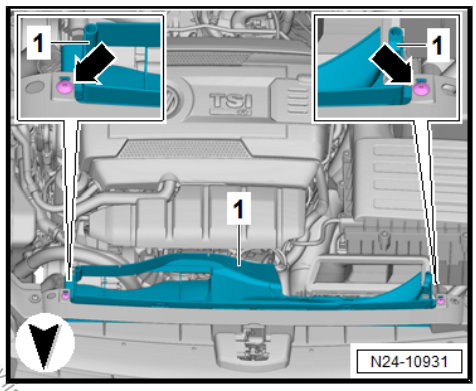
♦ *During installation, all cable ties must be installed at the same location.*

♦ *Always seal off any open channels in the intake and exhaust tract with suitable plugs. For example, from the Engine Bung Set - VAS6122- .*

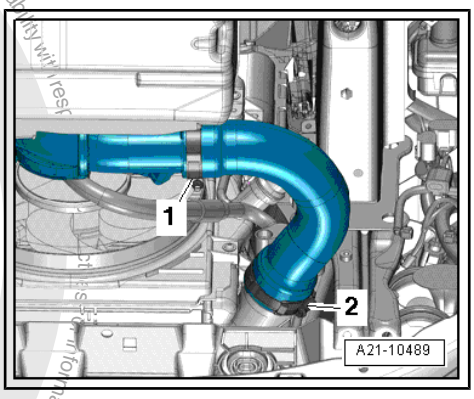
– Drain the coolant. Refer to
⇒ “1.2 Coolant, Draining and Filling”, page 201 .

– Remove the camshafts. Refer to
⇒ “4.2 Camshaft, Removing and Installing”, page 128 .

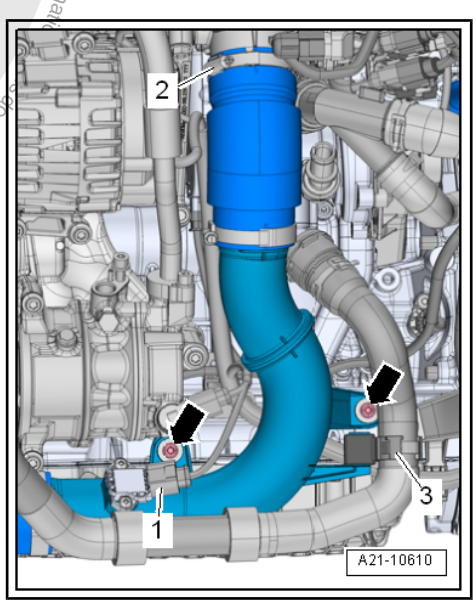
– Remove the front exhaust pipe with catalytic converter. Refer to
⇒ “2.2 Catalytic Converter, Removing and Installing”, page 319 .
– Remove the Oxygen Sensor 1 before Catalytic Converter - GX10- . Refer to
⇒ “7.2 Heated Oxygen Sensor, Removing and Installing”, page 302 .
– Remove the bolts -arrows-.
– Unclip and remove the lower section -1- of the air duct.



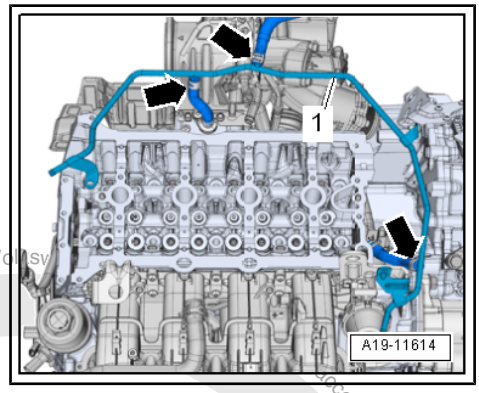
– Loosen the hose clamp -2-, remove the air duct hose from the charge air cooler.
– Seal the open lines and connections with clean plugs from the Engine Bung Set - VAS6122- .
– Loosen the hose clamp -2-.
– Free up the coolant hose -3-.
– Remove the bolts -arrows-.



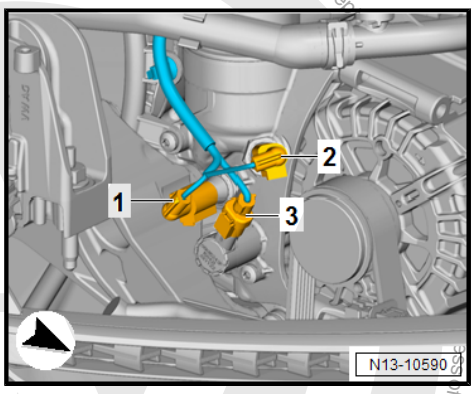
– Disconnect the connector -1- from the Charge Air Pressure Sensor - G31- , and remove the right air guide pipe.
– Loosen the clamps -arrows- and remove the coolant hoses.



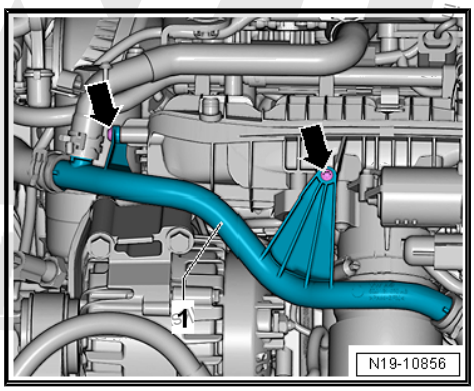
– Swing the coolant line -1- to the side.



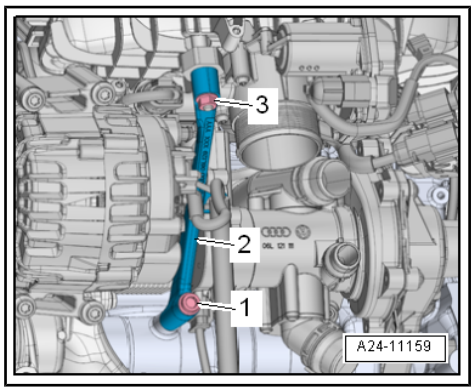
– Disconnect the connectors -1, 2 and 3-.



– Remove the bolts -arrows-.



– Remove the bolt -1- and the nut -3- and then remove the bracket -2- for the intake manifold.



– Disconnect the connectors:

1 - For Throttle Valve Control Module - GX3-

2 - For Intake Manifold Sensor - GX9-

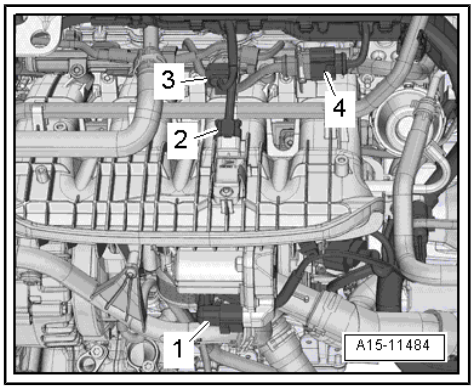
3 - For Fuel Pressure Sensor - G247-

– Remove the connector -4- from the bracket.

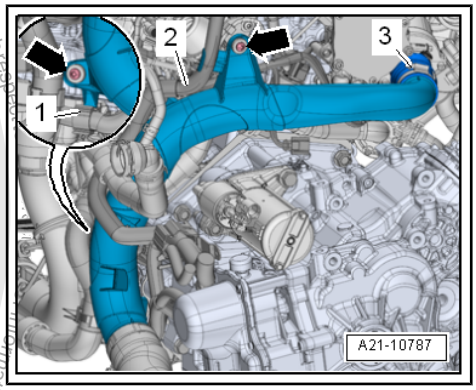
– Free up the wiring harness and push it to the side.

– Free up the wiring harness -1 and 2- from the air guide pipe.

– Loosen the screw-type clamp -3-.

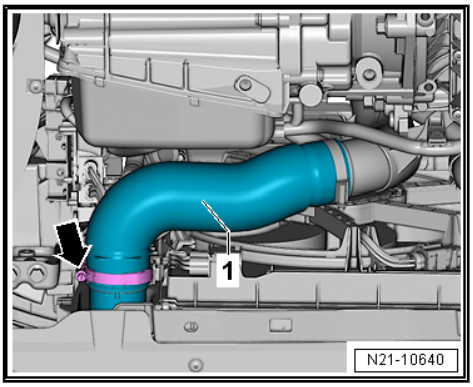


– Remove the bolts -arrows-.

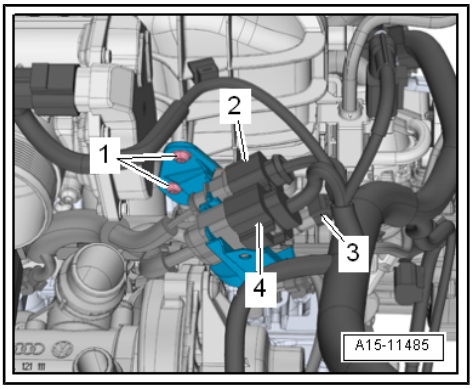


– Loosen the hose clamp -arrow- and remove the charge air hose -1- with the air guide pipe downward.

– Disconnect the connector -3- for Knock Sensor 1 - G61- from the bracket.



– Disconnect the connectors -2 and 4-.



– Disconnect the connectors and free up the wires.

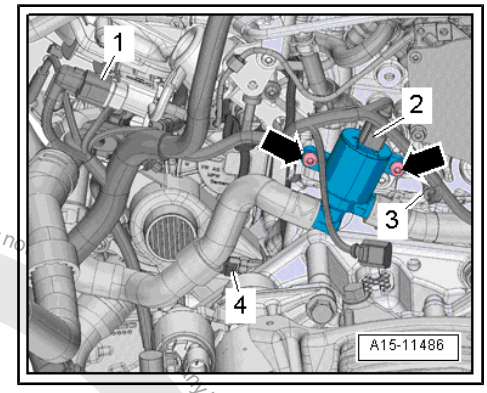
1 - For Intake Manifold Runner Control Valve - N316-

2 - For Coolant Shut-Off Valve - N82-

3 - For Engine Coolant Temperature Sensor - G62-

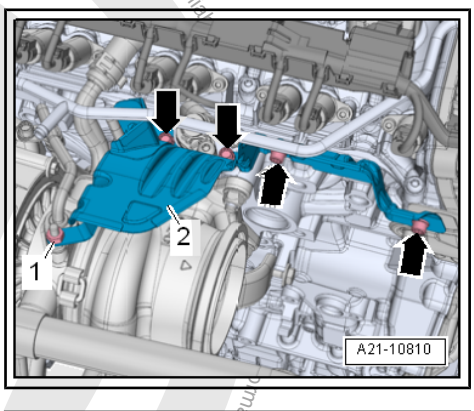
4 - For Oil Pressure Switch, Level 3 - F447-

– Remove the bolts -arrows-.



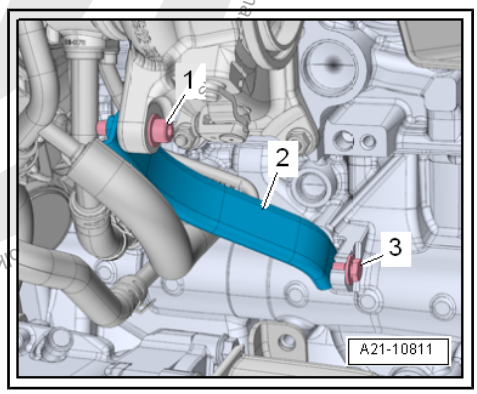
– Remove the bolts -arrows- and nut -1-.

– Remove the heat shield -2-.



– Remove the bolt -1-. Just loosen bolt -3-.

– Remove the turbocharger bracket -2-.

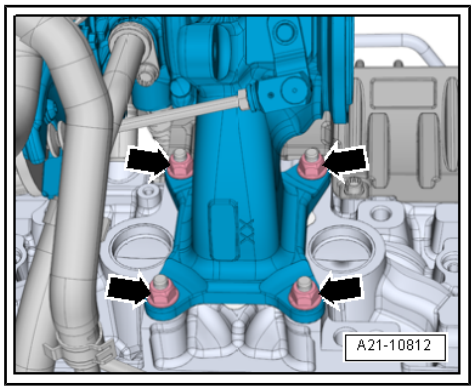


– Remove the nuts -arrows-.

– Remove the turbocharger from the cylinder head and tie up behind.

– Remove the bolts -arrows-.

– Remove the cylinder head bolts with the Polydrive Bit Drive Socket - T10070- in the order -1 through 10-.

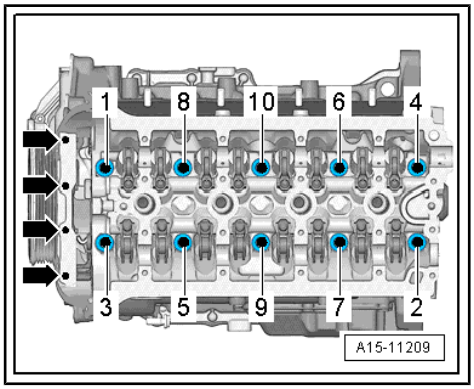


Note

- *Make sure all wires and cables are disconnected.*
- *Pay attention to the tension and guide tracks when lifting the cylinder head.*

– Remove the cylinder head.

– Lay the cylinder head on a soft surface, such as foam.



Installing

Install in reverse order of removal and note the following:

Caution

Risk of damaging the sealing surfaces.

- *Carefully remove the sealant residue from cylinder head and cylinder block.*
- *Make sure that no long grooves or scratches result.*

Risk of damaging the cylinder block.

- *There must be no oil or coolant in the blind holes for the cylinder head bolts in the cylinder block.*

Risk of cylinder head seal leaking.

- *Carefully remove all grinding and sanding residue.*
- *Only unpack the new cylinder head gasket immediately prior to installation.*
- *To prevent cylinder head gasket silicone layer and recessed area from being damaged, always handle the gasket extremely carefully.*

Risk of damaging open valves.

- *If a replacement cylinder is installed, only remove plastic base right before cylinder head is installed to protect open valves.*

Risk of damaging valves and piston crowns after working on valve train.

- *To ensure valves do not strike pistons when starting, carefully rotate engine at least two full revolutions.*

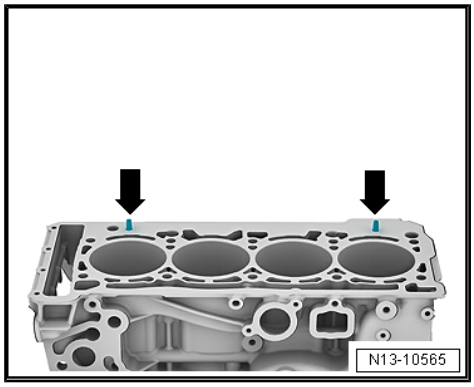
Note

- *Bolts that are tightened with an additional turn must be replaced.*
- *Replace the gaskets, seals and self-locking nuts.*
- *Pay attention to the different sealants for sealing surfaces and bolts for the cylinder head.*
- *If a replacement cylinder head is being installed, the contact surfaces between the hydraulic adjusters, the roller rocker levers and the cam running surfaces must be oiled before the camshafts are installed.*
- *The hose supports, air duct pipes and hoses must be free of oil and grease before installing.*
- *Secure all hose connections with standard production hose clamps. Refer to the Parts Catalog.*
- *In order to be able to securely mount the charge air hoses on their connectors, the screws on the used clamps must be sprayed with a rust remover before installing.*
- *The engine oil and coolant must be changed if the cylinder head or cylinder head seal are replaced.*

– Position the cylinder head gasket.

♦ Pay attention to centering pins in cylinder block -arrows-.

♦ Pay attention to the cylinder head gasket installation position: the part number must be readable from the intake side.



WARNING

When rotating the crankshaft, make sure the timing chain cannot damage any other components.

– If the crankshaft was turned in the meantime: bring the piston for cylinder 1 to the upper TDC and then turn the crankshaft back just a little.

– Position the cylinder head.

– Insert cylinder head bolts and tighten by hand.

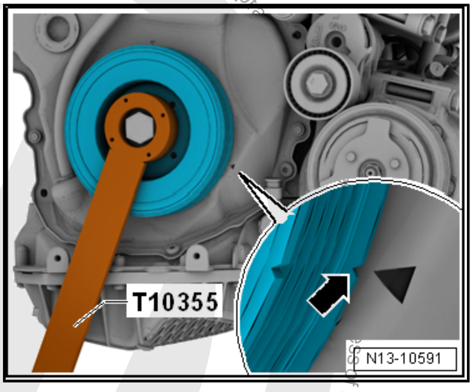
– Cylinder head tightening sequence. Refer to ⇒ Fig. ""Cylinder Head Tightening Sequence"" , page 114 .

Note

It is not necessary to retighten the cylinder head bolts after repairs.

– Turn the vibration damper with the Counterhold - Vibration Damper - T10355- to the TDC point.

- The notch on the vibration damper and the marking on the lower cover for timing chain must be opposite one another -arrow-.



Installation is performed in reverse order of removal, while noting the following:

– Install the camshafts. Refer to ⇒ “4.2 Camshaft, Removing and Installing”, page 128 .

– Replace the engine oil. Refer to ⇒ Maintenance ; Booklet 36.1 .

– Change the coolant. Refer to ⇒ “1.2 Coolant, Draining and Filling”, page 201 .

– Install the front exhaust pipe with the catalytic converter. Refer to ⇒ “2.2 Catalytic Converter, Removing and Installing”, page 319 .

> ⚠ WARNING
>
> *Do not use a charger to jump start. There is the risk that the vehicle control modules could be damaged.*

Tightening Specifications

- Refer to ⇒ “3.1 Overview - Cylinder Head”, page 112
- Refer to ⇒ “3.1 Overview - Intake Manifold”, page 270
- Refer to ⇒ “3.1 Overview - Coolant Pipes”, page 225
- Refer to ⇒ “1.1 Overview - Turbocharger”, page 243
- Refer to ⇒ “1.1 Overview - Muffler”, page 310

3.3 Vacuum Pump, Removing and Installing

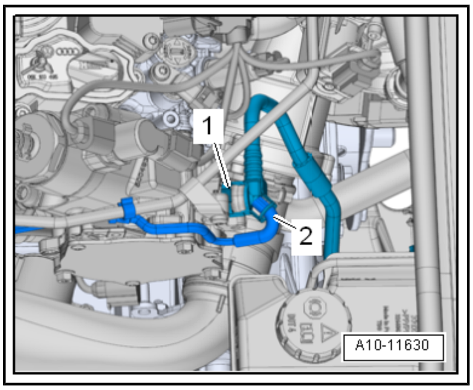
Removing

– Remove the engine cover. Refer to ⇒ “3.1 Engine Cover, Removing and Installing”, page 34 .

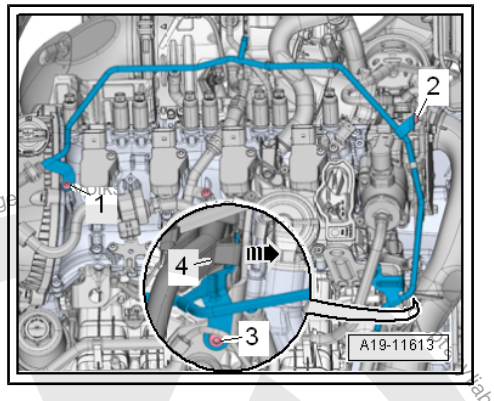
– Remove the air filter housing. Refer to ⇒ “2.2 Air Filter Housing, Removing and Installing”, page 269 .

– Disconnect the vacuum hose -2-.

– Press the release button on the vacuum hose -1-, remove the hose from the vacuum pump.



– Release the retainer in direction of -arrow-, remove the wiring duct upward from the bracket and move it towards the front.



Caution

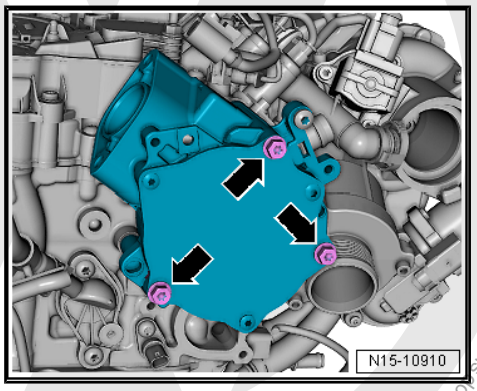
Risk of damaging the coolant line.

- *Do not change the shape of the coolant line.*

– Remove the bolts -1, 2 and 3- and carefully move the coolant line slightly to the side.

– Remove the high pressure pump with the roller tappet. Refer to
⇒ “6.2 High Pressure Pump, Removing and Installing”, page 297 .

– Remove the bolts -arrows- and remove the vacuum pump.



Note

Do not disassemble the vacuum pump.

Installing

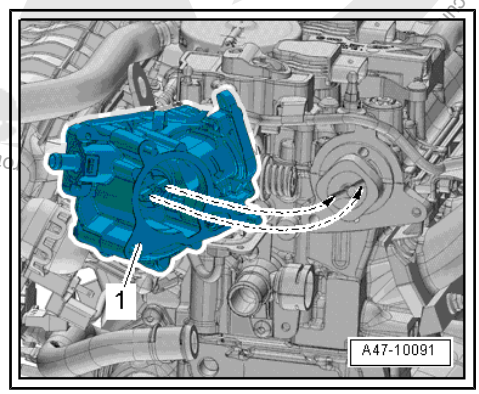
Install in reverse order of removal and note the following:

– Clean the sealing surfaces.

– Turn the vacuum pump coupling plate so that it engages in the camshaft groove when installing the vacuum pump.

– Install new seal on the vacuum pump, stick the two bolts through and install the vacuum pump with new seal on the cylinder head.

– While doing so pay attention that it lays flush on the flange.



Tightening Specifications

- Refer to ⇒ “4.1 Overview - Valvetrain”, page 124

3.4 Compression, Checking

Special tools and workshop equipment required

- Spark Plug Removal Tool - 3122B-
- Compression Tester Kit - VAG1763-
- Compression Tester Kit - Adapter - VAG1381/1-
- Compression Tester Kit - Adapter 5A - VAG1381/5A-

Test Sequence

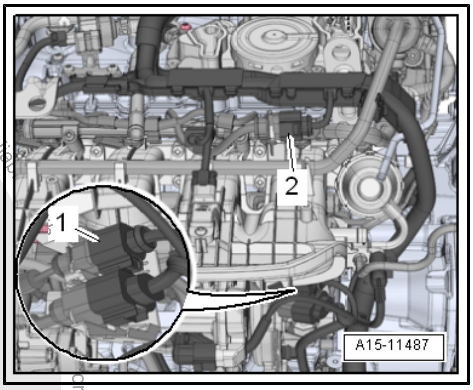
Note

- *Engine oil temperature: minimum 30 °C (86 °F)*
- *Battery voltage at least 12.7 V*

– Remove the engine cover. Refer to ⇒ “3.1 Engine Cover, Removing and Installing”, page 34 .

– Remove the ignition coils. Refer to ⇒ “1.2 Ignition Coils with Power Output Stages, Removing and Installing”, page 328 .

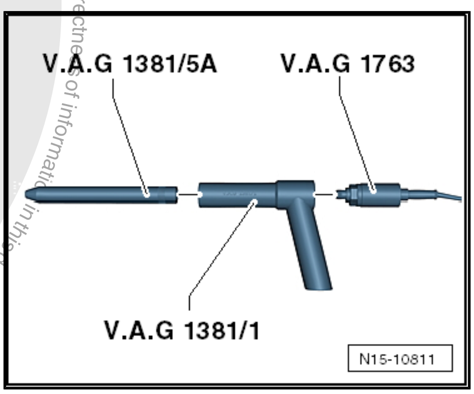
– Disconnect the connectors:



1 - For Cylinder 1 Fuel Injector - N30- to Cylinder 4 Fuel Injector - N33-

2 - For Cylinder 1 Fuel Injector 2 - N532- to Cylinder 4 Fuel Injector 2 - N535-

– Remove the spark plugs with the Spark Plug Removal Tool - 3122B- .



– Check the compression using the Compression Tester Kit - VAG1763- , Compression Tester Kit - Adapter 1 - VAG1381/1- and Compression Tester Kit - Adapter 5A - VAG1381/5A- .

Note

Refer to the Operating Instructions for information on using the tester.

– Operate the starter until the tester no longer indicates a pressure increase.

Compression Pressure	Pressure
New	11.0 to 14.0 bar (160 to 203 psi)
Wear limit	7.0 bar (101.52 psi)
Maximum difference between cylinders	3.0 bar (43.5 psi)

– Install the spark plugs. Refer to ⇒ Maintenance ; Booklet 36.1 .

– Install the ignition coils. Refer to ⇒ “1.2 Ignition Coils with Power Output Stages, Removing and Installing”, page 328 .

Note

By separating the connections, DTCs will be stored. After the test, check the DTC memory and erase, if necessary.

– Delete DTC entries which were generated during testing. Refer to Vehicle Diagnostic Tester .

4 Valvetrain

4.1 Overview - Valvetrain

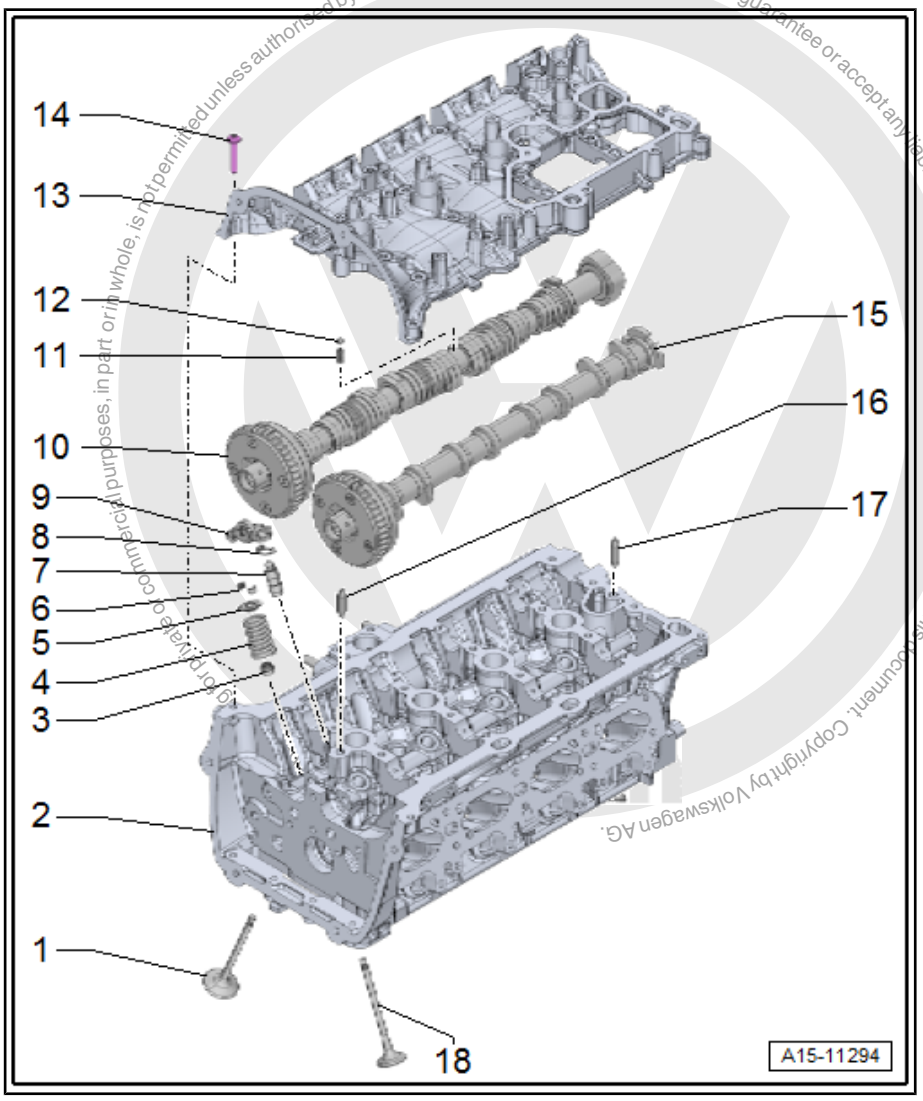
Note

- *The cylinder head and the cylinder head cover must be replaced together.*
- *Do not start the engine for approximately 30 minutes after installing the camshafts. The hydraulic adjusters must seat themselves (otherwise the valves will crash into the pistons).*
- *After working on the valvetrain, carefully rotate the engine by hand at least two full revolutions before starting to be sure that valves do not strike the pistons when starting.*
- *Always replace the gaskets and seals.*

After removing the camshaft, adjust the chain length. Refer to Vehicle Diagnostic Tester .

Part I

Part II. Refer to ⇒ page 126 .



1 - Exhaust Valve

- ❑ Do not rework, only lapping is permitted
- ❑ Valve Dimensions. Refer to ⇒ “5.3 Valve Dimensions”, page 162 .
- ❑ Valve Guides, Checking. Refer to ⇒ “5.1 Valve Guides, Checking”, page 162 .

2 - Cylinder Head

3 - Valve Stem Seal

- ❑ Replacing. Refer to ⇒ “4.4 Valve Stem Seals, Removing and Installing”, page 153 .

4 - Valve Spring

5 - Valve Spring Retainer

6 - Valve Keepers

7 - Hydraulic Adjuster

- ❑ Do not interchange
- ❑ Lubricate contact surface

8 - Clip

- ❑ For hydraulic adjuster

9 - Roller Rocker Lever

- ❑ Mark the installed position for installation later
- ❑ Check the roller bearing for ease of movement
- ❑ Lubricate the running surfaces before installing
- ❑ Removing and installing. Refer to ⇒ “4.2 Camshaft, Removing and Installing”, page 128 .

10 - Exhaust Camshaft

- ❑ Check radial clearance using Plastigage® (roller rocker lever removed)
- ❑ Radial clearance: 0.024 to 0.066 mm
- ❑ Run-out: maximum 0.04 mm
- ❑ Removing and installing. Refer to ⇒ “4.2 Camshaft, Removing and Installing”, page 128 .

11 - Spring

- ❑ No Replacement Part

12 - Ball

- ❑ For sliding bar
- ❑ Installing. Refer to ⇒ “4.3 Sliding Bar Ball, Installing”, page 152 .

13 - Cylinder Head Cover

- ❑ With integrated camshaft bearings
- ❑ Clean sealing surface, reworking is not permitted.
- ❑ Remove old sealant residue.

14 - Bolt

- ❑ Replace after removing
- ❑ Loosening. Refer to ⇒ Fig. ““Loosening the Cylinder Head Cover”“ , page 126

- ❑ Tightening sequence. Refer to ⇒ Fig. ""Cylinder Head Cover Tightening Sequence"" , page 126

15 - Intake Camshaft

- ❑ Check radial clearance using Plastigage® (roller rocker lever removed)
- ❑ Radial clearance: 0.024 to 0.066 mm
- ❑ Run-out: maximum 0.04 mm
- ❑ Removing and installing. Refer to ⇒ "4.2 Camshaft, Removing and Installing", page 128 .

16 - Alignment Pins

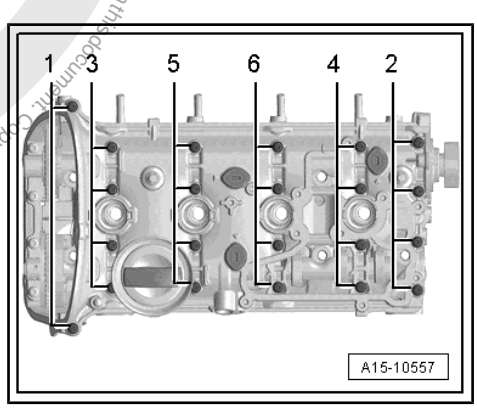
17 - Alignment Pins

18 - Intake Valve

- ❑ Do not rework, only lapping is permitted
- ❑ Valve Dimensions. Refer to ⇒ "5.3 Valve Dimensions", page 162 .
- ❑ Valve Guides, Checking. Refer to ⇒ "5.1 Valve Guides, Checking", page 162 .

Loosening the Cylinder Head Cover

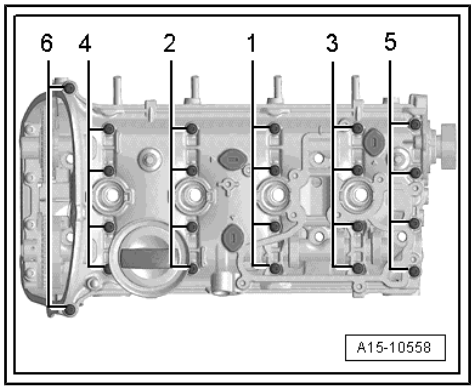
– Loosen the cylinder head cover in the order -1 through 6-.



Cylinder Head Cover Tightening Sequence

– Replace the bolts.

1. Hand-tighten bolts in several steps in -1 to 6- sequence.
2. Tighten the bolts in a -1 to 6- sequence to 8 Nm using a torque wrench.
3. Tighten the bolts an additional 90° using a rigid wrench in the sequence -1 to 6-.

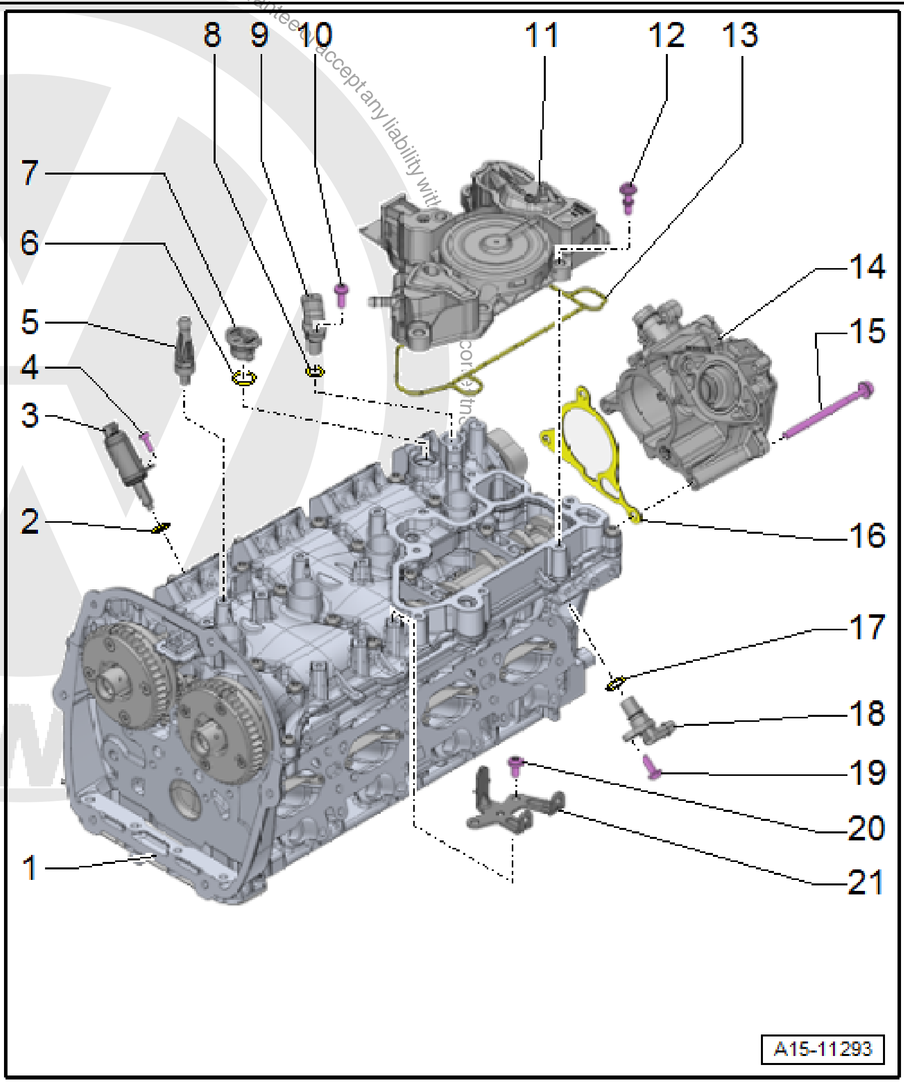


Note

Pay attention that the cylinder head cover is not tilted.

Part II

Part I. Refer to ⇒ page 124 .



1 - Cylinder Head

2 - O-Ring

- ❑ Coat with engine oil
- ❑ Check for damage
- ❑ No replacement part, part of the cam adjustment actuator

3 - Cam Adjustment Actuator 1 - F366- / Cam Adjustment Actuator 8 - F373-

- ❑ Removing and installing. Refer to ⇒ “4.6 Cam Adjustment Actuator 1 F366 / Cam Adjustment Actuator 8 F373 , Removing and Installing”, page 161 .

4 - Bolt

- ❑ 5 Nm

5 - Ball Pin

- ❑ 9 Nm
- ❑ For engine cover

6 - O-Ring

- ❑ Replace after removing
- ❑ Coat with engine oil

7 - Plugs

8 - O-Ring

- ❑ Replace after removing
- ❑ Coat with engine oil

9 - Camshaft Position Sensor 3 - G300-

- ❑ Overview. Refer to ⇒ “1.1 Overview - Ignition System”, page 327 .

10 - Bolt

- ❑ Tightening specification. Refer to ⇒ “1.1 Overview - Ignition System”, page 327 .

11 - Oil Separator

- ❑ Removing and installing. Refer to ⇒ “3.2 Oil Separator, Removing and Installing”, page 185 .

12 - Bolt

- ❑ Tightening specification and sequence. Refer to ⇒ Fig. ““Oil Separator - Tightening Sequence”“ , page 185 .

13 - Seal

- ❑ Replace after removing

14 - Vacuum Pump

- ❑ Removing and installing. Refer to ⇒ “3.3 Vacuum Pump, Removing and Installing”, page 121 .

15 - Bolt

- ❑ 8 Nm +180°

16 - Seal

- ❑ Replace after removing

17 - O-Ring

- ❑ Replace after removing
- ❑ Coat with engine oil

18 - Camshaft Position Sensor - G40-

- ❑ Overview. Refer to ⇒ “1.1 Overview - Ignition System”, page 327 .

19 - Bolt

- ❑ Tightening specification. Refer to ⇒ “1.1 Overview - Ignition System”, page 327 .

20 - Bolt

- ❑ 9 Nm

21 - Bracket

- ❑ For EVAP Canister Purge Regulator Valve 1 - N80-

4.2 Camshaft, Removing and Installing

⇒ “4.2.1 Camshaft Timing Chain Glide Rails, Differentiating Characteristics”, page 128

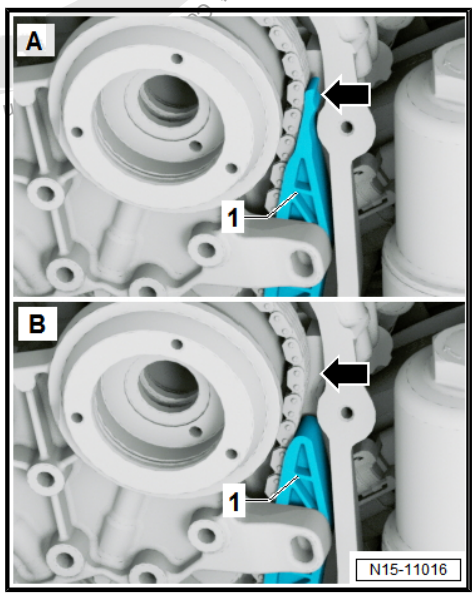
⇒ “4.2.2 Camshaft, Removing and Installing, Version A”, page 128

⇒ “4.2.3 Camshaft, Removing and Installing, Version B”, page 141

4.2.1 Camshaft Timing Chain Glide Rails, Differentiating Characteristics

Depending on the Version, There May Be Different Glide Rails Installed.

- Remove the upper timing chain cover. Refer to ⇒ “1.2 Upper Timing Chain Cover, Removing and Installing”, page 84 .
- Check -arrow- which version of the glide rail -1- is installed.
- Camshaft, Removing and Installing, with Glide Rail Version A. Refer to ⇒ “4.2.2 Camshaft, Removing and Installing, Version A”, page 128 .
- Camshaft, removing and installing, with glide rail version B. Refer to ⇒ “4.2.3 Camshaft, Removing and Installing, Version B”, page 141 .



4.2.2 Camshaft, Removing and Installing, Version A

Special tools and workshop equipment required

- Central Valve Assembly Tool - T10352-
- Counterhold - Vibration Damper - T10355-
- Chain Tensioner Lever - T40243-
- Tensioner Locking Tool - T40267-
- Camshaft Locks - T40271-
- Adapter - T40266-
- Vehicle Diagnostic Tester
- Sealant - D 154 103 A1-

Removing

Note

- *The sealing surfaces of the lower cylinder head cover and on the upper cylinder head must not be reworked.*
- *The camshaft bearings are integrated in the cylinder head or cylinder head cover. The tension must be released from the camshaft timing chain before removing the cylinder head cover.*
- *When installing, secure all cable ties back to same positions.*

– Remove the air filter housing. Refer to ⇒ “2.2 Air Filter Housing, Removing and Installing”, page 269 .

– Remove the upper coolant pipe. Refer to ⇒ “3.3 Coolant Pipe on Upper Engine, Removing and Installing”, page 227 .

– Remove the ignition coils. Refer to ⇒ “1.2 Ignition Coils with Power Output Stages, Removing and Installing”, page 328 .

– Disconnect the connectors:

1 - For Turbocharger Recirculation Valve - N249-

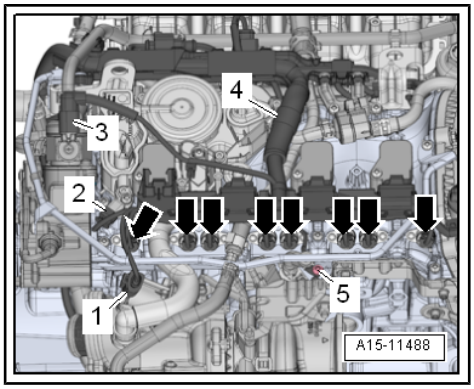
2 - For Camshaft Position Sensor 3 - G300-

3 - For Fuel Pressure Regulator Valve - N276-

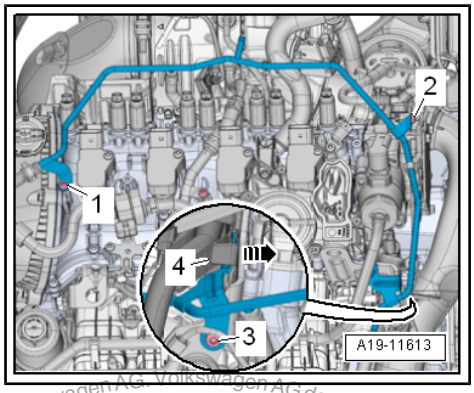
– Disconnect the connectors -arrows- from the cam adjustment actuator.

– Remove the bolt -5- and free up the ground cable.

– Free up the connector from the clip -4- and pivot it forward.



– Release the retainers -arrow-, remove the wiring duct upward from the bracket and move it towards the front.



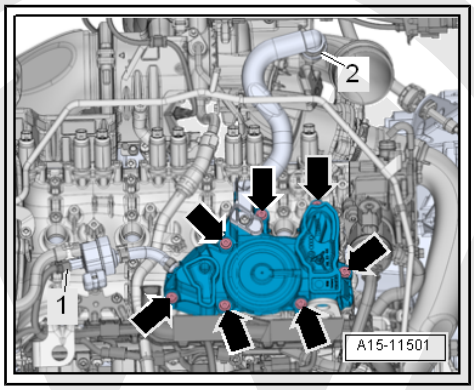
Note

Risk of destroying the coolant pipes through deformation. Never change the coolant pipe bent shape.

– Remove bolts -1, 2 and 3-. Carefully move the coolant line slightly backward.

– Disconnect the connector -1- from the EVAP Canister Purge Regulator Valve 1 - N80- .

– Press the release button on the crankcase ventilation hose -2- and remove the hose.



– Remove the bolts -arrows- and the crankcase ventilation.

– Remove the high pressure pump. Refer to ⇒ “6.2 High Pressure Pump, Removing and Installing”, page 297 .

– Remove the vacuum pump. Refer to ⇒ “3.3 Vacuum Pump, Removing and Installing”, page 121 .

– Support the engine in the installation position. Refer to ⇒ “2.2 Engine, Supporting in Installation Position”, page 27 .

– Remove the engine mount. Refer to ⇒ “2.3 Engine Mount, Removing and Installing”, page 30 .

– Remove the noise insulation. Refer to ⇒ Body Exterior; Rep. Gr. 66 ; Noise Insulation; Overview - Noise Insulation .

– Remove the right wheel housing liner front section. Refer to ⇒ Body Exterior; Rep. Gr. 66 ; Wheel Housing Liner .

– Remove the windshield washer fluid reservoir. Refer to ⇒ Electrical Equipment; Rep. Gr. 92 ; Windshield Washer System; Windshield Washer Fluid Reservoir, Removing and Installing .

– Remove the engine support. Refer to ⇒ “1.6 Engine Support, Removing and Installing”, page 49 .

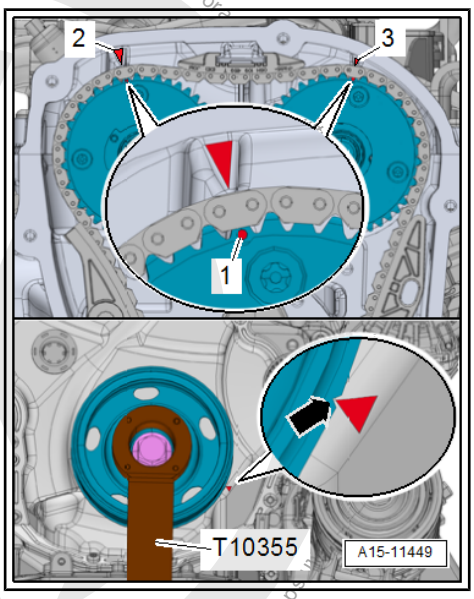
– Remove the upper timing chain cover. Refer to ⇒ “1.2 Upper Timing Chain Cover, Removing and Installing”, page 84 .

– Turn the vibration damper with the Counterhold - Vibration Damper - T10355- to the “TDC point”.

• The markings -1- on the camshaft chain sprockets must be opposite the markings -2 and 3-.

• The notch on the vibration damper and the marking on the lower cover for timing chain -arrow- must be opposite one another.

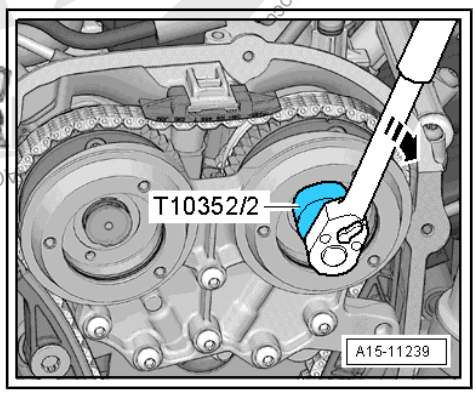
– Remove the lower timing chain cover. Refer to ⇒ “1.3 Lower Timing Chain Cover, Removing and Installing”, page 86 .



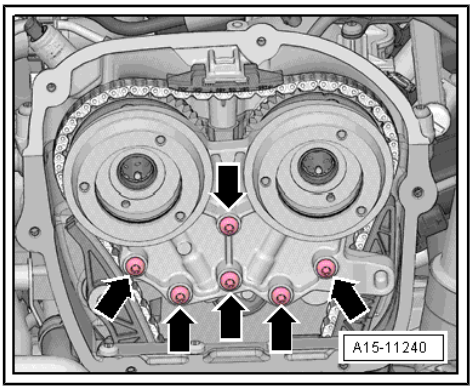
Note

The pilot valve has left-hand threads.

– Remove the left and right control valves using the Assembly Tool - T10352/2- in the direction of -arrow-.



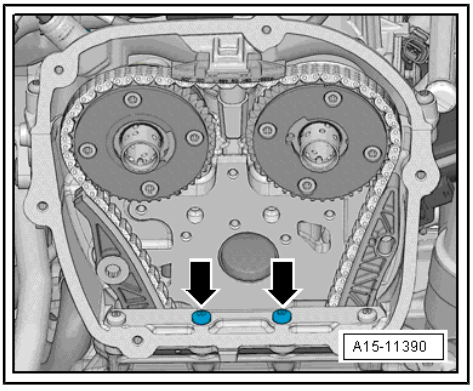
– Remove the bolts -arrows- and remove the bearing bracket.



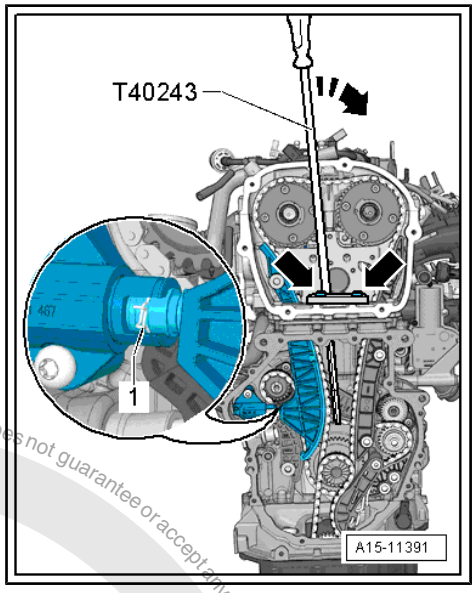
– Remove the bolts -arrows-.

– Install the Chain Tensioner Lever - T40243- -arrows-.

– Press the chain tensioner circlip -1- together and hold it.

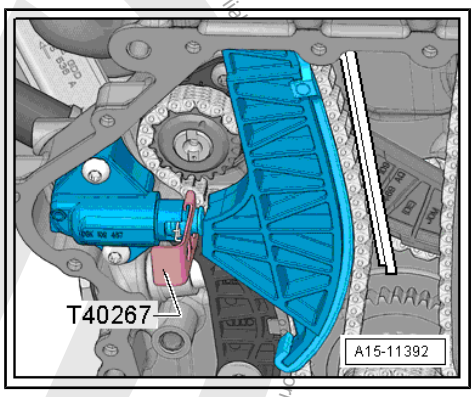


– Slowly press and hold the Chain Tensioner Lever - T40243- in the direction of -arrow-.



– Secure the chain tensioner with the Tensioner Locking Tool - T40267- .

– Remove the Chain Tensioner Lever - T40243- .

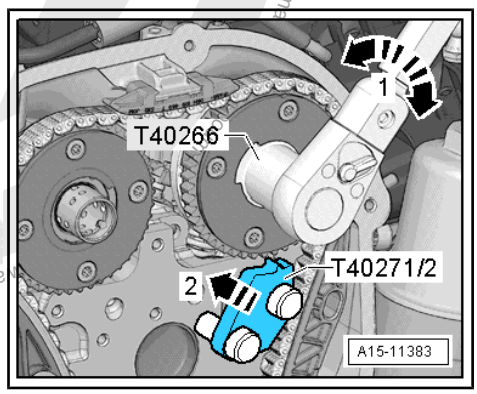


– Bolt the Camshaft Lock - Component 2 - T40271/2- to the cylinder head and slide into the splines on the chain sprocket in the direction of the -arrow 2-. Rotate the intake camshaft with the Adapter - T40266- in direction of -1- if necessary.

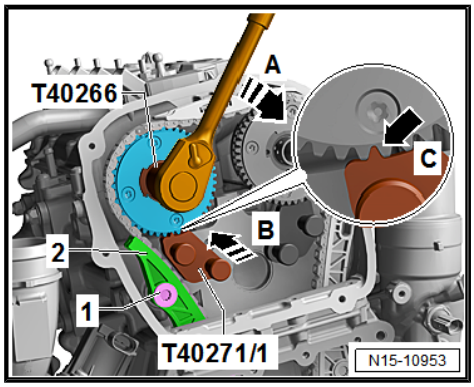
– Install the Camshaft Lock - Component 1 - T40271/1- on the cylinder head.

A second technician is needed for the following step.

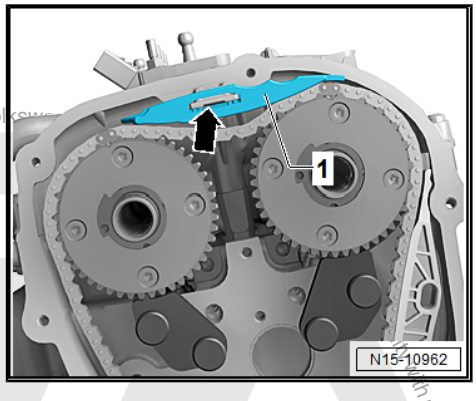
– Hold the exhaust camshaft with the Adapter - T40266- in the direction of the -arrow A-. Remove the bolt -1- and guide the tensioning rail -2- downward. Turn the camshaft further in a clockwise direction -arrow A- until the Camshaft Lock - T40271/1- can slide into the chain sprocket splines in direction of -arrow B-.



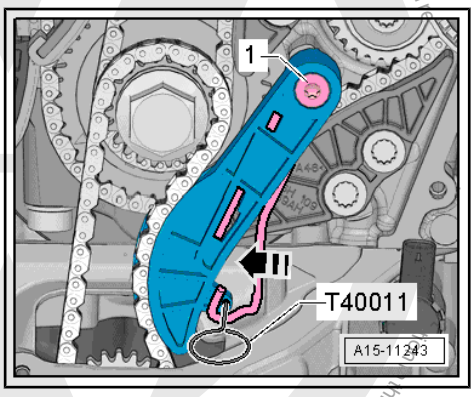
– Check the installation position -C- of the Camshaft Locks - T40271/1- .



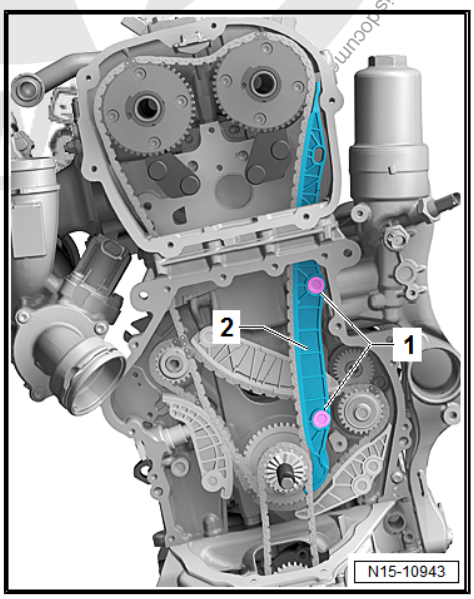
– Remove the guide rail -1-. To do so, release the retainer -arrow- with a screwdriver and push the guide rail off toward the front.



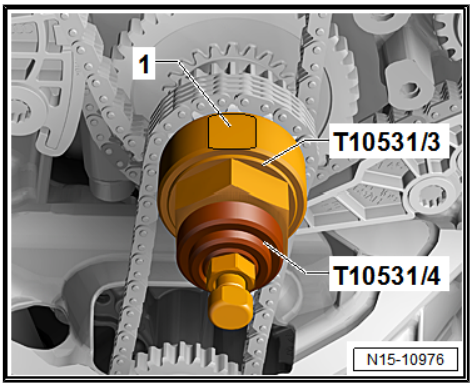
– Press the oil pump chain tensioner bracket in direction of -arrow- and lock with Locking Pin - T40011- .
– Remove the bolt -1- and remove the chain tensioner.



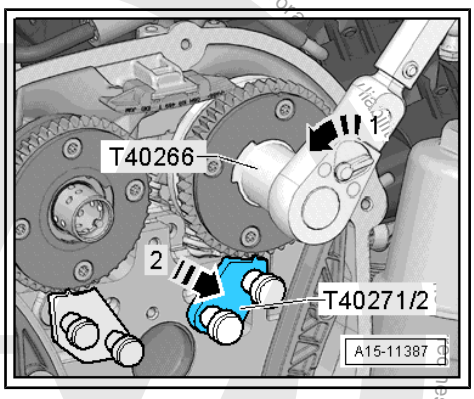
– Remove the bolts -1- and remove the glide rail -2-.
– Remove the camshaft timing chain from the camshaft bearing and guide downward.



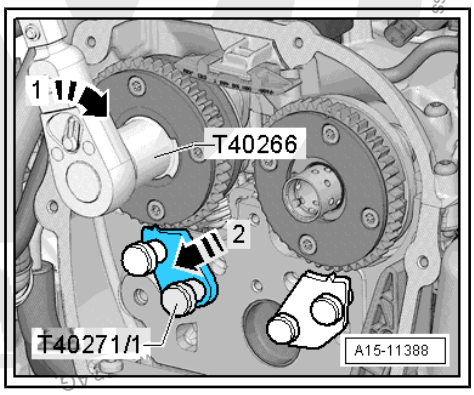
– Install the Assembly Tool - Turning Over Tool - T10531/3- . In the “TDC point” the flat area -1- points upward. Install the Vibration Damper Assembly Tool - Knurled Nut - T10531/4- . Turn the crankshaft with a 32 mm open end wrench counterclockwise out of “TDC”.



– Turn the intake camshaft in the direction of the -arrow 1- using the Adapter - T40266- . Slide the Camshaft Lock - T40271/2- in direction of -arrow 2- out of the chain sprocket splines and bring the camshaft into the rest position.



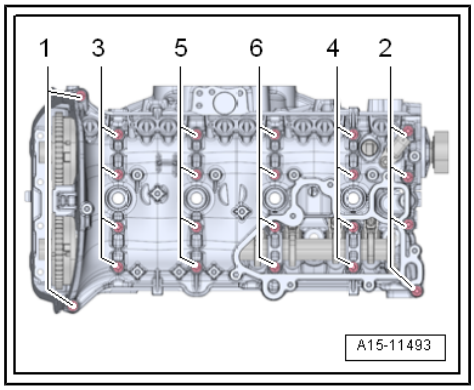
– Turn the exhaust camshaft in the direction of the -arrow 1- using the Adapter - T40266- . Slide the Camshaft Lock - T40271/1- in direction of -arrow 2- out of the chain sprocket splines and bring the camshaft into the rest position.



– Remove the cylinder head cover bolts in -1 to 6- sequence.

– Remove the cylinder head cover.

– Remove the camshaft and cover the open engine components.



Installing

Install in reverse order of removal and note the following:

Note

- *Sealing surfaces must be completely free of oil and grease.*
- *Pay attention that all roller rocker levers rest on the valve stem ends.*

– If the crankshaft was turned in the meantime, bring the piston for cylinder 1 to TDC and then turn the crankshaft back again slightly.

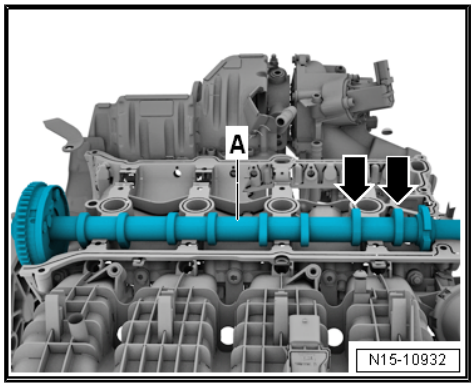
– Remove any sealant residue from the groove on the cylinder head cover as well as on the sealing surfaces.

– Sealing surfaces must be free of oil and grease.

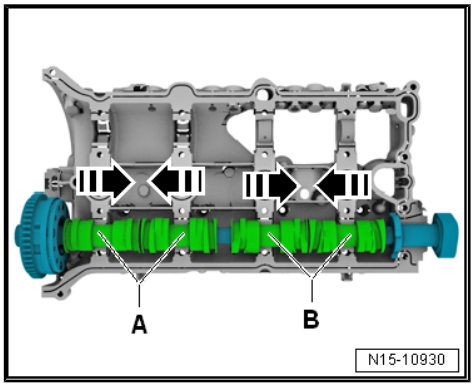
– Lubricate the running surfaces of both camshafts.

– Place the intake camshaft -A- in the cylinder head. Turn the cam lobes of cylinder 4 -arrows- upward.

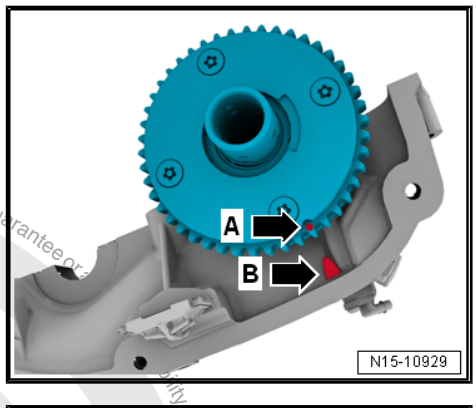
– Check if the valve lifters for the cam adjustment actuators are retracted.



– Place the exhaust camshaft in the cylinder head cover as illustrated. The cam pair -A and B- must be pushed together.



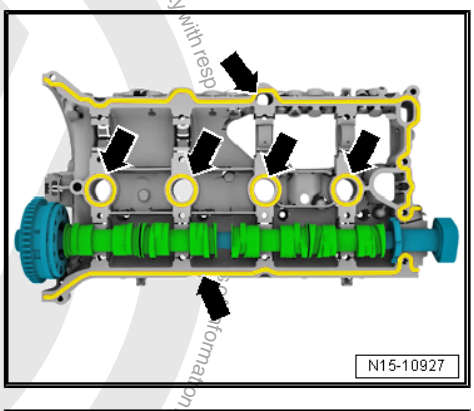
– Turn the exhaust camshaft until the markings -A and B- align.



– Apply the sealant on the clean sealing surface of the cylinder head cover as illustrated -arrows-.

♦ Sealant bead thickness: 2 to 3 mm.

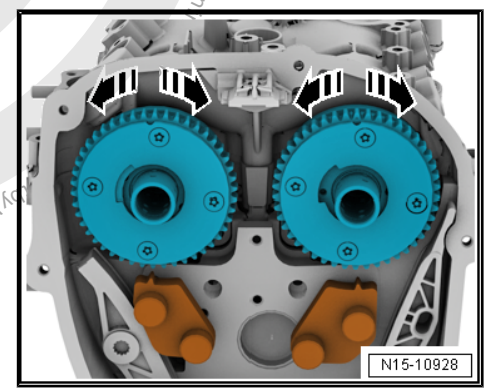
– Secure the camshaft and place the cylinder head cover with the camshaft on the cylinder head.



– Lightly push on the cylinder head cover by hand and while doing so turn the camshaft slightly until the cylinder head cover lays »free of tension« on the cylinder head.

– Replace the cylinder head cover bolts.

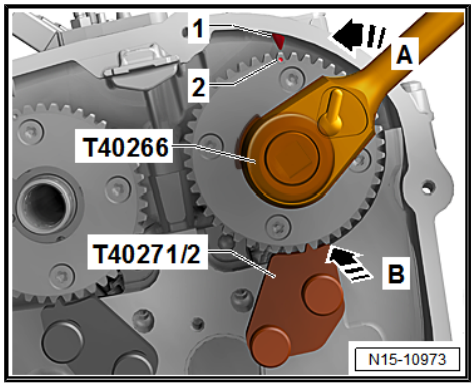
– Tighten the bolts in several steps. Refer to ⇒ Fig. ""Cylinder Head Cover Tightening Sequence"", page 126 .



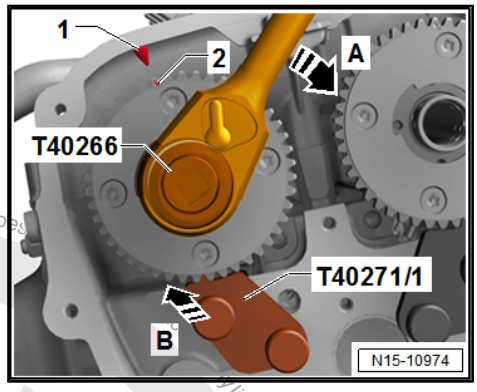
Note

Pay attention that the cylinder head cover is not tilted.

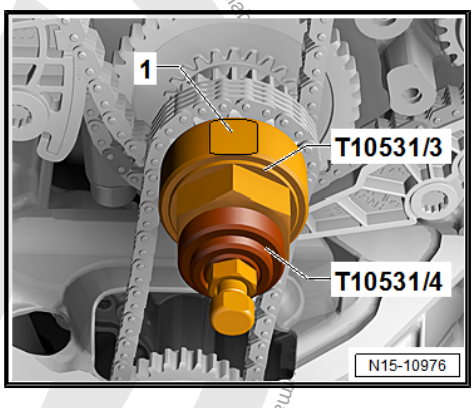
– Turn the intake camshaft with the Adapter - T40266- in the direction of the -arrow A- until the markings -1 and 2- align. Push the Camshaft Lock - T40271/2- in the chain sprocket splines in direction of -arrow B-.



– Turn the exhaust camshaft with the Adapter - T40266- in the direction of the -arrow A- until the markings -1 and 2- align. Push the Camshaft Lock - T40271/1- in the chain sprocket splines in direction of -arrow B-. The mark -2- is offset slightly to the right.

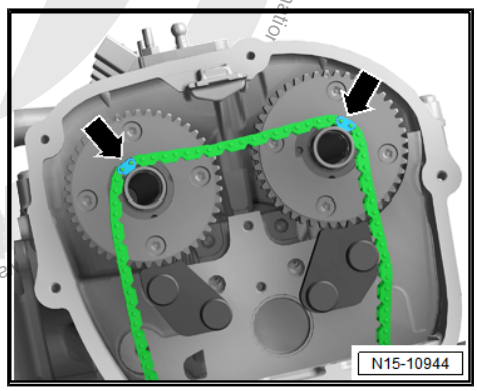


– Turn the crankshaft on the hex fitting to the “TDC point”. In the “TDC point” flat area -1- is upward.

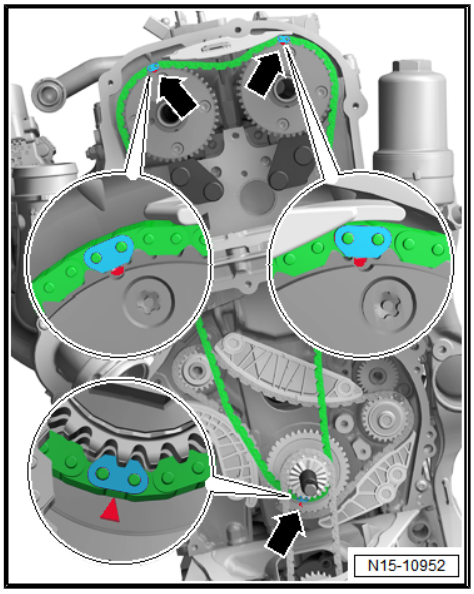


Install the Camshaft Timing Chain

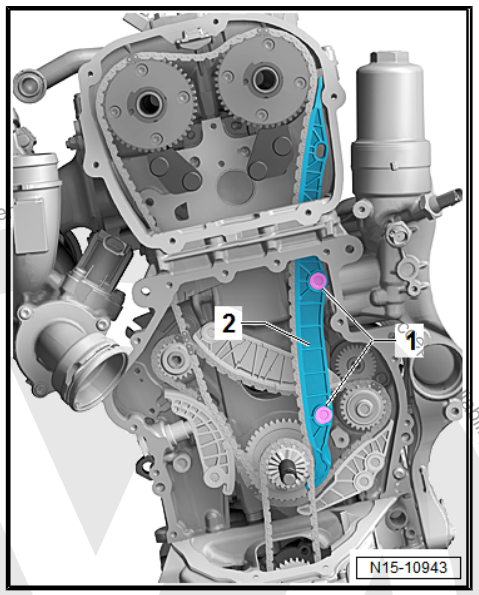
– Engage the camshaft timing chain with the painted links -arrows- on the camshaft pins.



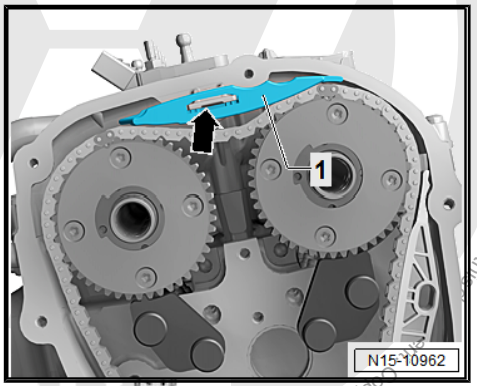
– Place the camshaft timing chain on the intake camshaft, exhaust camshaft and the crankshaft. Position the painted chain links -arrows- on the markings on the chain sprockets.



– Install the guide rail -2- and tighten the bolts -1-.



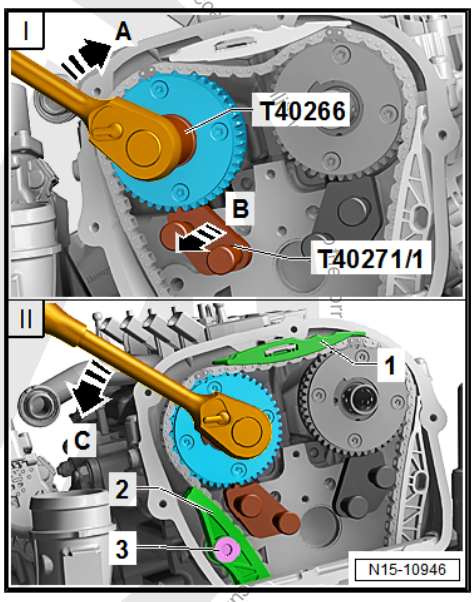
– Install the upper glide rail -1-.



A second technician is needed for the following step.

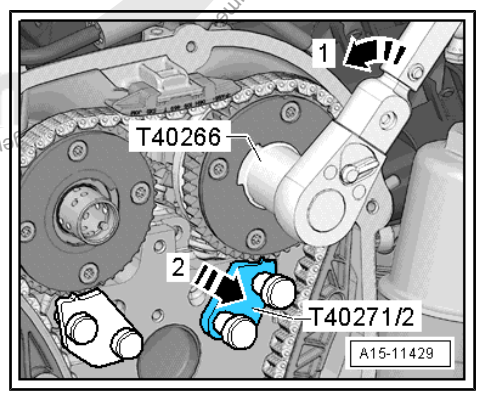
I - Turn the exhaust camshaft slightly in the direction of the -arrow A- using the Adapter - T40266- and push the Camshaft Lock - T40271/1- out of the chain sprocket splines in direction of -arrow B-.

II - Release the camshaft in the direction of -arrow C-, until the timing chain touches the glide rail -1-. Hold the camshaft ion this position, install the tensioning rail -2- and tighten the bolts -3-. Release the camshaft.

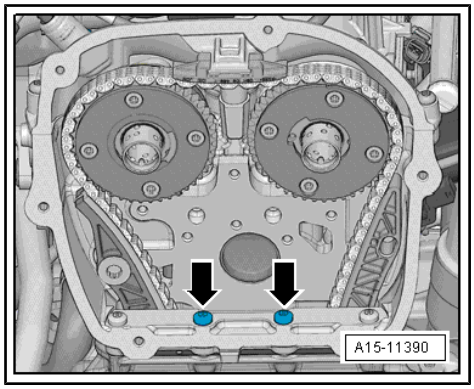


– Turn the intake camshaft with the Adapter - T40266- in the direction of the -arrow 1- until the Camshaft Lock - T40271/2- can be pushed out of the chain sprocket splines in the direction of the -arrow 2-. Release the camshaft.

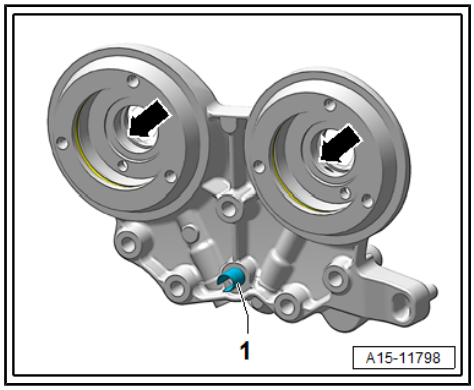
– Remove the Camshaft Locks - T40271/1- and Camshaft Locks - T40271/2- .



– Install the bolts -arrows- and tighten them. Tightening specification. Refer to -item 4- ⇒ Item 4 (page 112) .



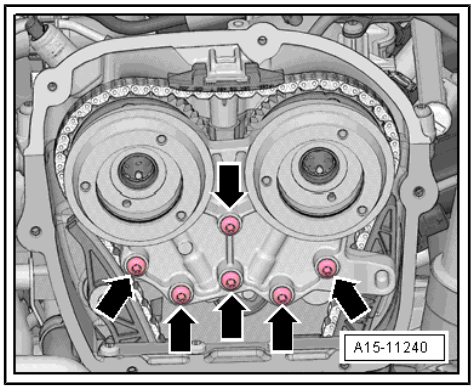
– Lubricate the holes -arrows- with engine oil.



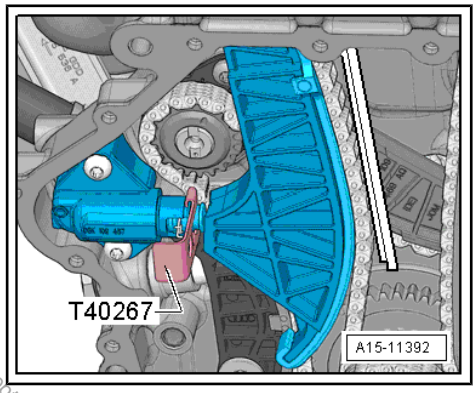
Note

Adapter sleeve -1- is not present on every bearing bracket.

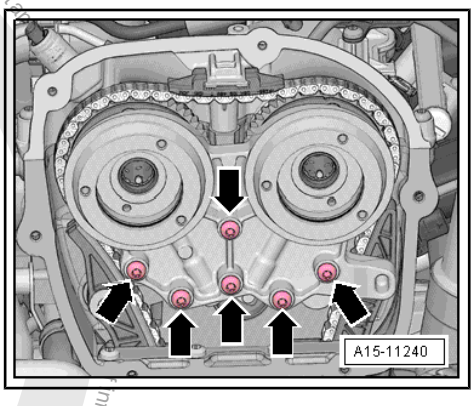
– Attach the bearing mount. Do not tilt it when doing this. Hand-tighten the bolts -arrows-.



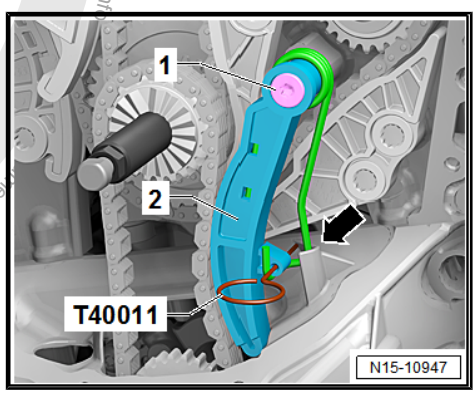
– Remove the Tensioner Locking Tool - T40267- .



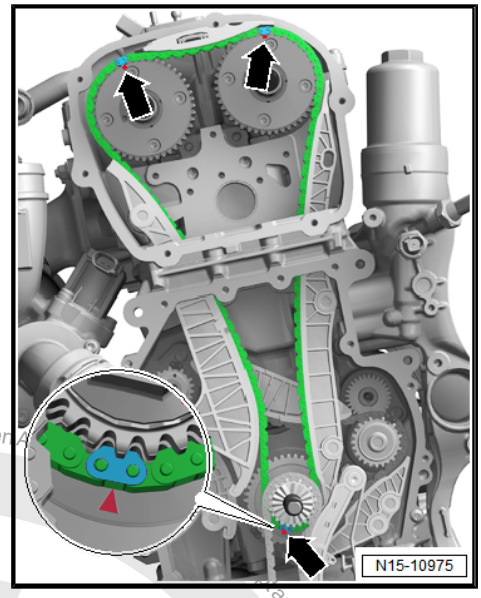
– Tighten the bolts -arrows-. Refer to -item 5- ⇒ Item 5 (page 91) .



– Install the chain tensioner -2-. The wire clip must come in to contact with the oil pan upper section opening -arrow-. Tighten the bolt -1- and remove the Locking Pin (3 pc.) - T40011- .



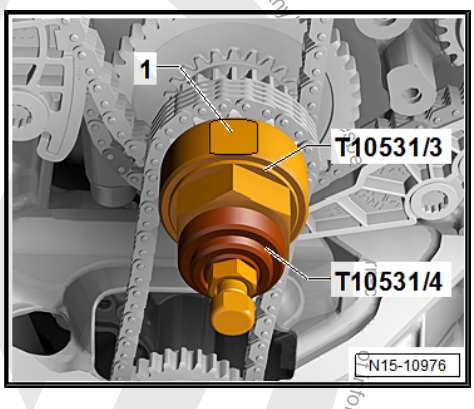
– Check the adjustment. The painted chain links -arrows- must line up with the markings on the chain sprockets.
– Install the control valves -item 6- ⇒ Item 6 (page 91) .
– Let the engine turn a second time in the direction of engine rotation.



Note

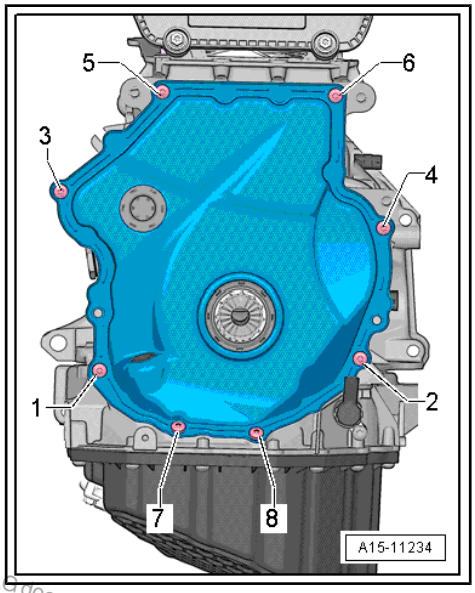
Due to the ratio, the painted chain links no longer match up after the engine has been turned.

– Remove the Vibration Damper Assembly Tool - Knurled Nut - T10531/4- and remove the Vibration Damper Assembly Tool - Turning Over Tool - T10531/3- .
– Install the lower timing chain cover. Refer to ⇒ “1.3 Lower Timing Chain Cover, Removing and Installing”, page 86 .



Note

Tighten the bolts -1 and 4- with an additional turn after installing the vibration damper. The bolts must be removed again to install the vibration damper.



- Install the vibration damper. Refer to ⇒ “1.5 Vibration Damper, Removing and Installing”, page 44 .
- Install the upper timing chain cover. Refer to ⇒ “1.2 Upper Timing Chain Cover, Removing and Installing”, page 84 .
- Install the ribbed belt tensioning damper. Refer to ⇒ “1.3 Ribbed Belt Tensioner, Removing and Installing”, page 42 .
- Install the ribbed belt. Refer to ⇒ “1.2 Ribbed Belt, Removing and Installing”, page 41 .
- Install the vacuum pump. Refer to ⇒ “3.3 Vacuum Pump, Removing and Installing”, page 121 .
- Install the high pressure pump. Refer to ⇒ “6.2 High Pressure Pump, Removing and Installing”, page 297 .
- After working on the chain drive the adaptation value in the engine control module must be adapted. Refer to Vehicle Diagnostic Tester .

Tightening Specifications

- Refer to ⇒ “2.1 Overview - Camshaft Timing Chains”, page 91
- Refer to ⇒ “2.2 Overview - Balance Shaft Drive Chain”, page 92
- Refer to ⇒ “4.1 Overview - Valvetrain”, page 124
- Refer to ⇒ “3.1 Overview - Cylinder Head”, page 112
- Refer to ⇒ “2.1 Overview - Air Filter Housing”, page 268
- Refer to ⇒ “6.1 Overview - High Pressure Pump”, page 296

4.2.3 Camshaft, Removing and Installing, Version B

Special tools and workshop equipment required

- Central Valve Assembly Tool - T10352-
- Counterhold - Vibration Damper - T10355-
- Chain Tensioner Lever - T40243-
- Tensioner Locking Tool - T40267-
- Camshaft Locks - T40271-
- Adapter - T40266-
- Vehicle Diagnostic Tester

Removing

Note

- *During installation, all cable ties must be installed at the same location.*
- *The sealing surfaces of the lower cylinder head cover and on the upper cylinder head must not be reworked.*
- *The camshaft bearings are integrated in the cylinder head or cylinder head cover. Before removing the cylinder head cover, release the tension on the camshaft timing chain.*

– Remove the noise insulation. Refer to ⇒ Body Exterior; Rep. Gr. 66 ; Noise Insulation; Overview - Noise Insulation .

– Remove the windshield washer fluid reservoir. Refer to ⇒ Electrical Equipment; Rep. Gr. 92 ; Windshield Washer System; Windshield Washer Fluid Reservoir, Removing and Installing .

– Remove the air filter housing. Refer to ⇒ “2.2 Air Filter Housing, Removing and Installing”, page 269 .

– Remove the upper timing chain cover. Refer to ⇒ “1.2 Upper Timing Chain Cover, Removing and Installing”, page 84 .

– Remove the upper coolant pipe. Refer to ⇒ “3.3 Coolant Pipe on Upper Engine, Removing and Installing”, page 227 .

– Remove the ignition coils. Refer to ⇒ “1.2 Ignition Coils with Power Output Stages, Removing and Installing”, page 328 .

– Disconnect the connectors:

1 - For Turbocharger Recirculation Valve - N249-

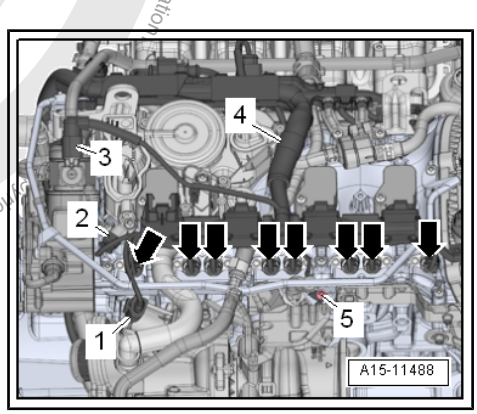
2 - For Camshaft Position Sensor 3 - G300-

3 - For Fuel Pressure Regulator Valve - N276-

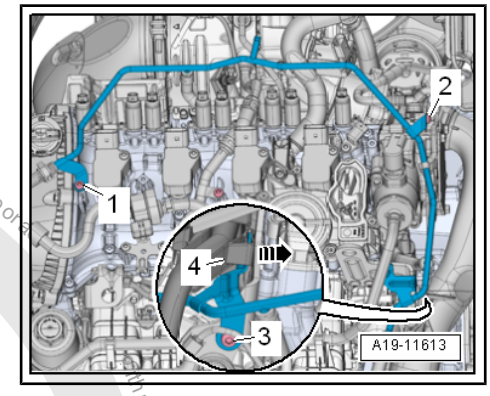
– Disconnect the connectors -arrows- from the cam adjustment actuator.

– Remove the bolt -5- and free up the ground cable.

– Free up the connector from the clip -4- and pivot it forward.



– Release the retainers in direction of -arrow-, remove the wiring duct upward from the bracket and move it towards the front.



Caution

Risk of damaging the coolant line.

- *Do not change the shape of the coolant line.*

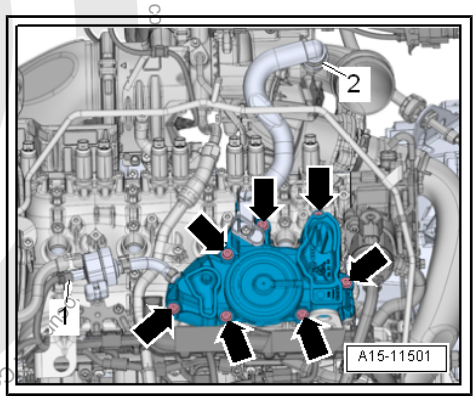
– Remove bolts -1, 2 and 3-. Carefully move the coolant line slightly backward.

– Disconnect the connector -1- from the EVAP Canister Purge Regulator Valve 1 - N80- .

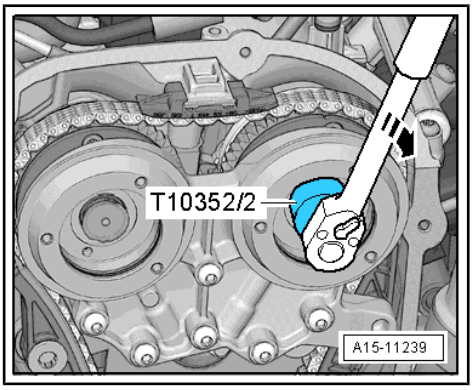
– Press the release button on the crankcase ventilation hose -2- and remove the hose.

– Remove the bolts -arrows- and the crankcase ventilation.

– Remove the cam adjustment actuator. Refer to ⇒ “4.6 Cam Adjustment Actuator 1 F366 / Cam Adjustment Actuator 8 F373 , Removing and Installing”, page 161 .



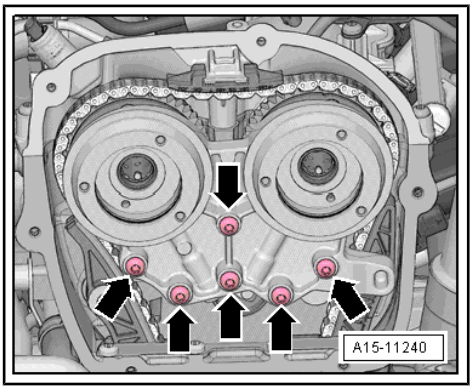
– Remove the left and right regulator valves using the Assembly Tool - T10352/2- in the direction of -arrow-.



Caution

The regulator valves have left-hand thread.

– Remove the bolts -arrows- and remove the bearing bracket.

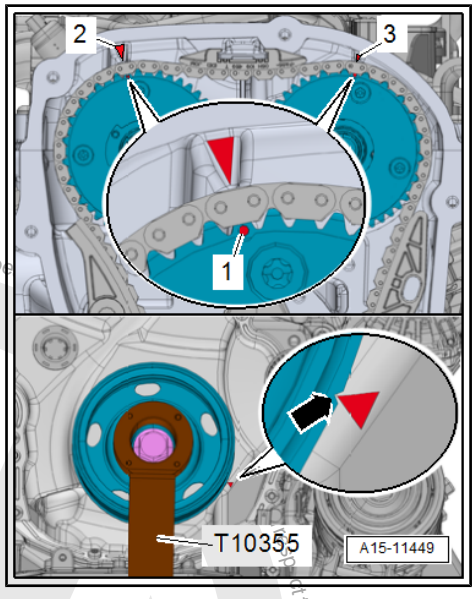


With Markings on the Cylinder Head.

– Turn the vibration damper with the Counterhold - Vibration Damper - T10355- to the TDC point.

• The notch on the vibration damper must line up with the arrow marking on the lower timing chain cover -arrow-.

• The markings -1- on the camshaft chain sprockets must be opposite the markings -2 and 3- on the cylinder head.

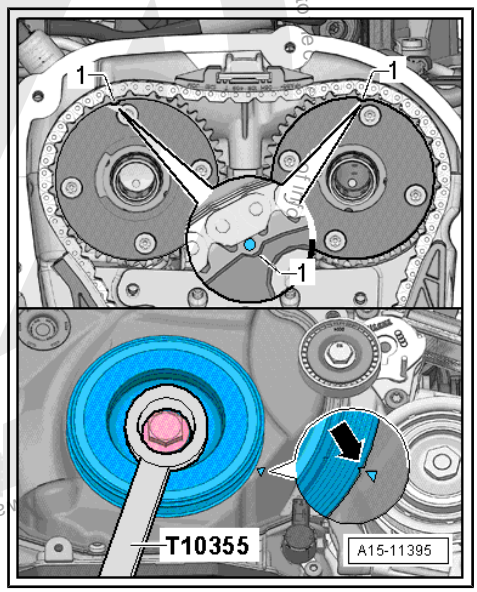


Without Markings on the Cylinder Head.

– Turn the vibration damper with the Counterhold - Vibration Damper - T10355- to the TDC point.

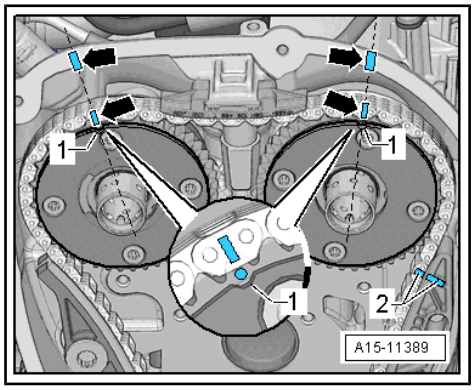
• The notch on the vibration damper and the marking on the lower cover for timing chain must be opposite one another -arrow-.

• The markings -1- on the camshafts must point upward.

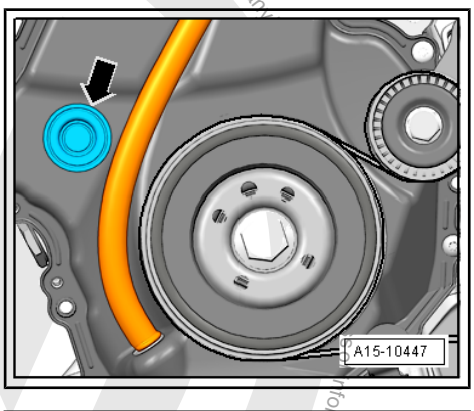


– Mark the camshaft timing chain and the cylinder head -arrows- to match the marking on the chain sprockets -1- with a waterproof marker.

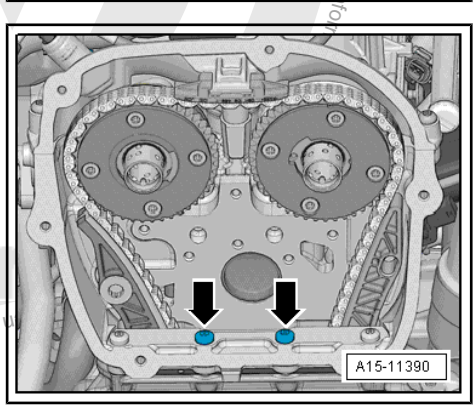
– In addition, mark the camshaft timing chain to the camshaft timing chain guide rail -2- with a waterproof marker.



– Remove the plug -arrow-.



– Remove the bolts -arrows-.
– Install the Chain Tensioner Lever - T40243- -arrows-.

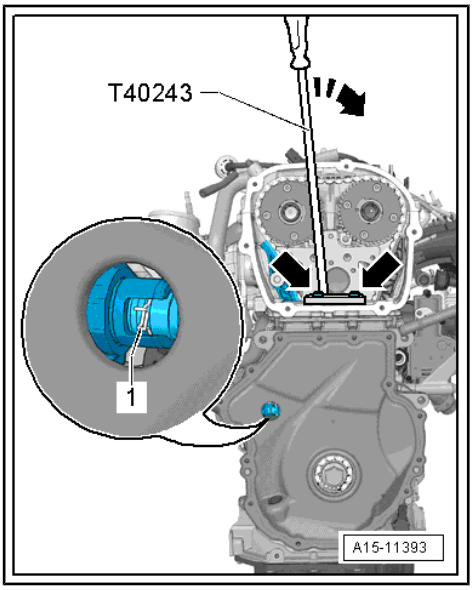


Note

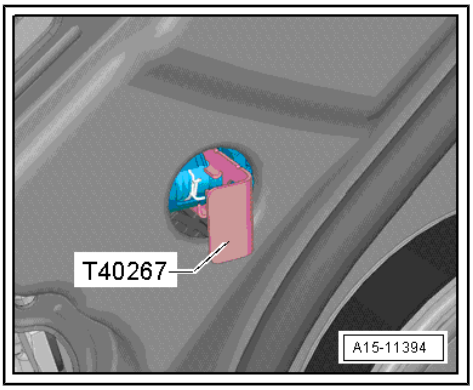
A second technician is needed for the following steps.

– Press the chain tensioner circlip -1- together and hold it.

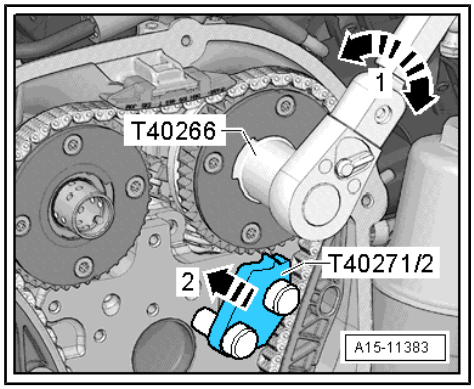
– Slowly press and hold the Chain Tensioner Lever - T40243- in the direction of -arrow-.



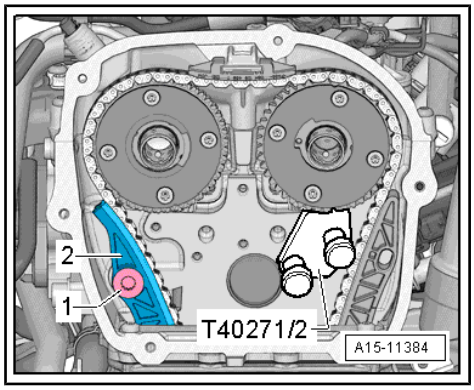
– Secure the chain tensioner with the Tensioner Locking Tool - T40267- .
– Remove the Chain Tensioner Lever - T40243- .



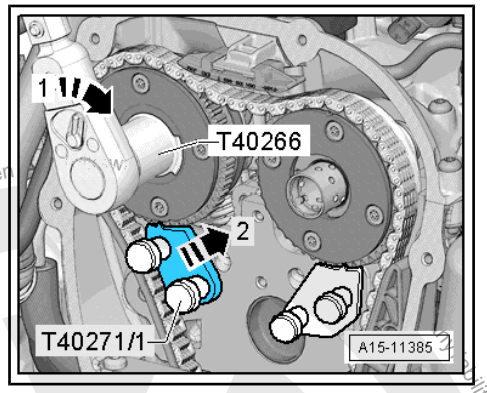
– Bolt the Camshaft Lock - T40271/2- to the cylinder head and push the chain sprocket splines in the direction of -arrow 2-. If necessary, turn the intake camshaft with an Adapter - T40266- in the direction of -arrow 1-.



– Remove the bolt -1- and guide the tensioning rail -2- downward.
– Install the Camshaft Lock - Component 1 - T40271/1- on the cylinder head.



– Turn the exhaust camshaft with the Adapter - T40266- in the direction of -arrow 1- and slide the Camshaft Lock - T40271/1- in the chain sprocket splines in the direction of -arrow 2-.
– Mark the camshaft sprocket to the Camshaft Lock - Component 1 - T40271/1- and the Camshaft Lock - Component 2 - T40271/2- -arrow-.
– Remove the upper guide rail -1- by unlocking the latch with a screwdriver and pushing the guide rail forward.

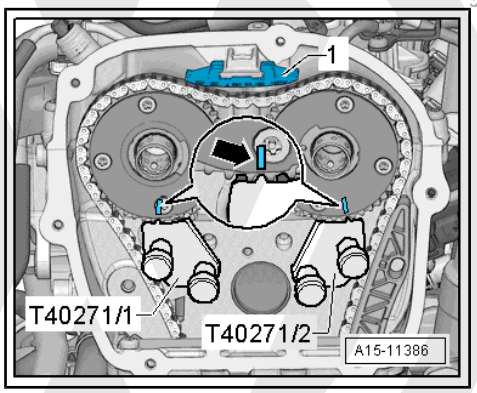


– Remove camshaft timing chain from chain sprockets.

Caution

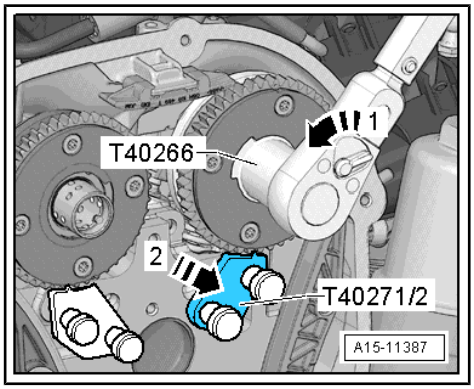
Risk of damaging the valves and piston crowns.

- ***If the camshaft timing chain was removed from the cylinder head, then the crankshaft may not be turned farther.***

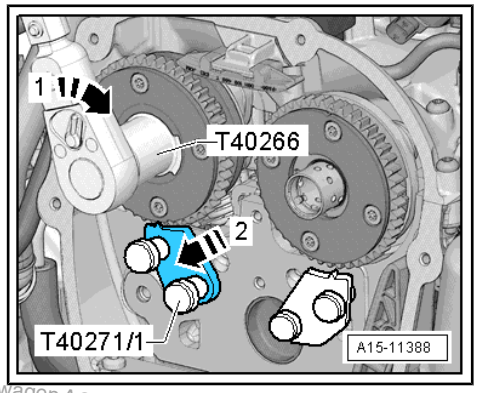


– Turn the vibration damper in the opposite direction of the engine rotation out of “TDC”.

– Use the Adapter - T40266- to turn the intake camshaft in the direction of -arrow 1-, slide out the Camshaft Lock - T40271/2- from the chain sprocket splines in the direction of -arrow 2- and bring the camshaft into the rest position.



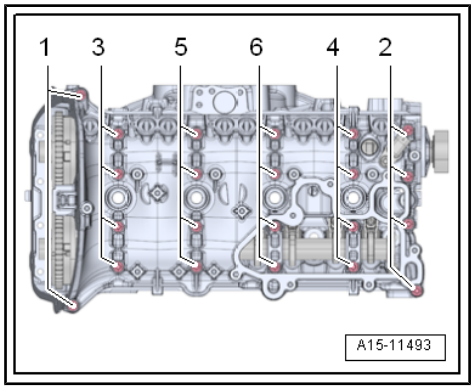
– Use the Adapter - T40266- to turn the exhaust camshaft in the direction of -arrow 1-, slide out the Camshaft Lock - T40271/1- from the chain sprocket splines in the direction of -arrow 2- and bring the camshaft into the rest position.



– Remove the high pressure pump. Refer to ⇒ “6.2 High Pressure Pump, Removing and Installing”, page 297 .

– Remove the vacuum pump. Refer to ⇒ “3.3 Vacuum Pump, Removing and Installing”, page 121 .

– Remove the cylinder head cover bolts in -1 to 6- sequence.
– Remove the cylinder head cover.
– Remove the camshafts.



Caution

Risk of contaminating the lubrication system and the bearing.

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

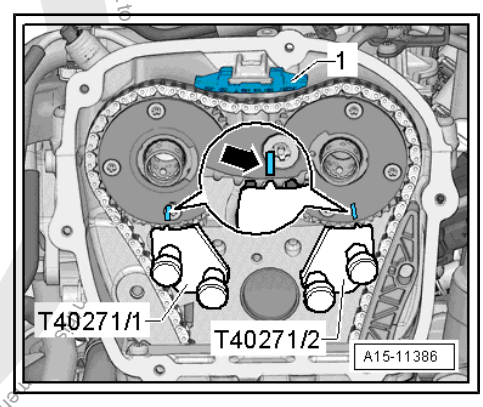
Installing

Install in reverse order of removal and note the following:

Note

- *Sealing surfaces must be completely free of oil and grease.*
- *Pay attention that all roller rocker levers rest on the valve stem ends.*
- *The crankshaft must not be at "TDC".*

– Remove any sealant residue on the cylinder head using the flat-blade scraper.
– If the crankshaft was turned in the meantime: bring the piston for cylinder 1 to the upper TDC and then turn the crankshaft back just a little.
– Remove any sealant residue from the groove on the cylinder head cover as well as on the sealing surfaces.
– Clean the sealing surfaces. They must be free of oil and grease.
– Lubricate the running surfaces of both camshafts.
– If the camshafts are replaced, the markings -arrow- need to be transferred onto the new camshafts.

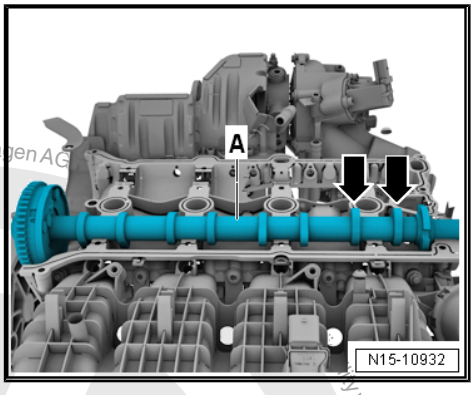


Caution

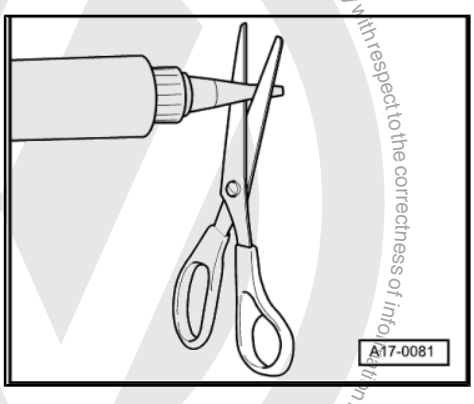
Risk of damaging the valves and piston crowns.

- ***The crankshaft must not be at the TDC point when installing the camshafts.***

– Place the intake camshaft -A- in the cylinder head. Turn the cam lobes of cylinder 4 -arrows- upward.

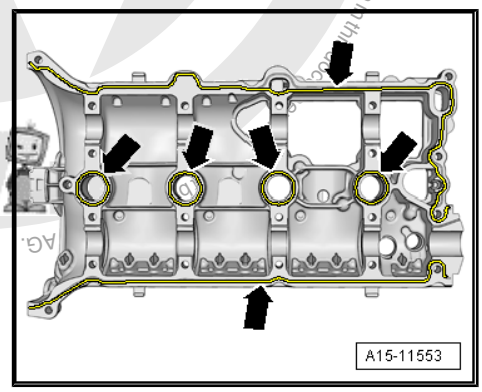


– Cut the tube nozzle at the front marking (nozzle diameter: approximately 2 mm).



– Apply the silicone sealant on the clean sealing surface of the cylinder head cover as illustrated -arrows-.

♦ Sealant bead thickness: 2 to 3 mm.



Note

♦ *The cylinder head cover must be installed within five minutes after application of silicone sealant.*

♦ *The sealant bead may not be thicker than specified, otherwise excess sealant could enter the oil pan and clog the oil intake pipe screen.*

♦ *Be sure to check the expiration date of the sealant.*

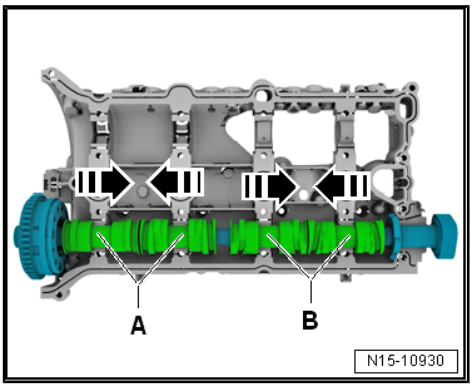
Sealant. Refer to the Parts Catalog.

– Place the exhaust camshaft in the cylinder head cover as illustrated. The cam pair -A and B- must be pushed together.

– Position the cylinder head cover with the camshaft onto the cylinder head.

– Replace the cylinder head cover bolts.

– Tighten the bolts in several steps. Refer to ⇒ Fig. ""Cylinder Head Cover Tightening Sequence"" , page 126 .

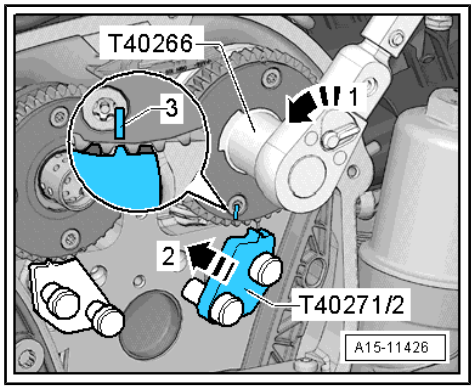


Note

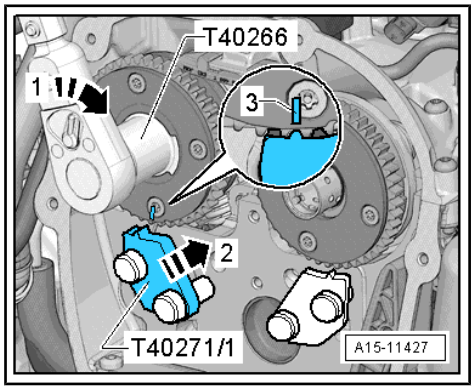
Pay attention that the cylinder head cover is not tilted.

– Turn the intake camshaft in direction of -arrow 1- until the marking -3- aligns with the Camshaft Lock - Component 2 - T40271/2- .

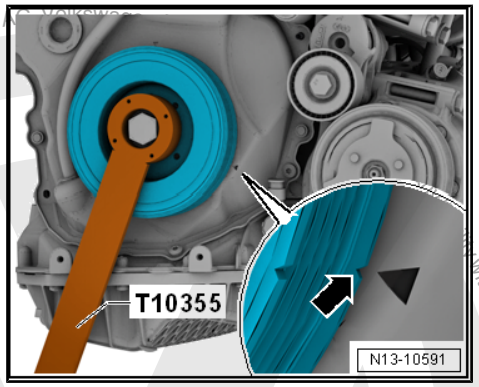
– Slide the Camshaft Lock - Component 2 - T40271/2- into the chain sprocket splines in the direction of -arrow 2-.
– Turn the exhaust camshaft in the direction of -arrow 1- until the marking -3- aligns with the Camshaft Lock - Component 1 - T40271/1- .



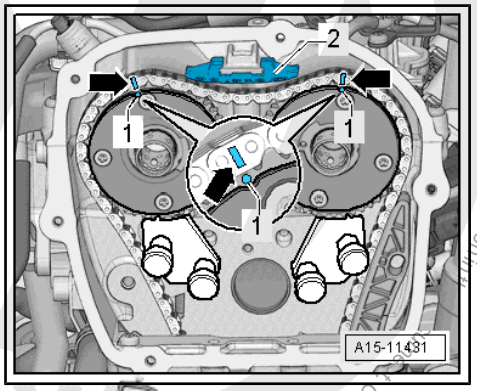
– Slide the Camshaft Lock - Component 1 - T40271/1- into the chain sprocket splines in the direction of -arrow 2-.



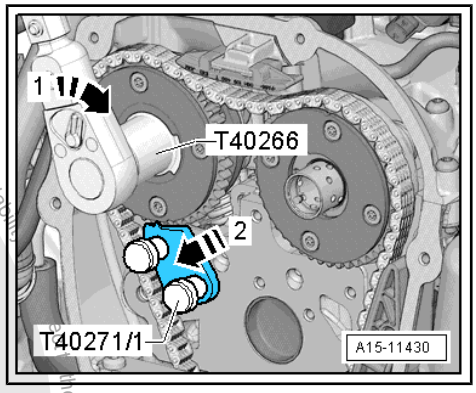
– Turn the vibration damper with the Counterhold - Vibration Damper - T10355- to the TDC point.
• The notch on the vibration damper and the marking on the lower cover for timing chain must be opposite one another -arrow-.
– Mount the camshaft timing chain. Do so by positioning the markings on the chain links -arrows- on the chain sprockets -1-.



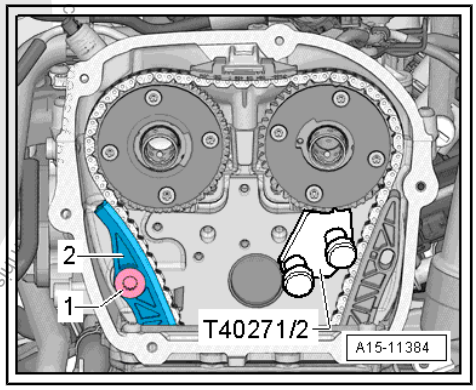
– Install the upper guide rail -2-.



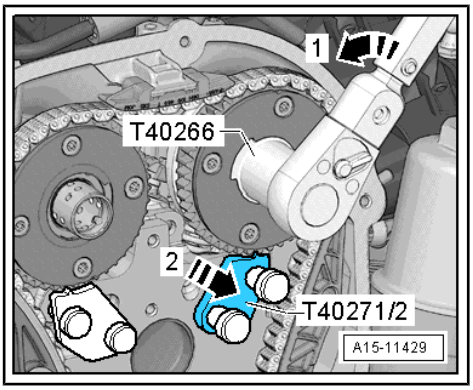
– Turn the exhaust camshaft in the direction of -arrow 1- using the Adapter - T40266- . Slide the Camshaft Lock - T40271/1- out of the chain sprocket splines direction of -arrow 2- and release the camshaft.



– Guide the tensioning rail -2- upward and install the bolt -1-.



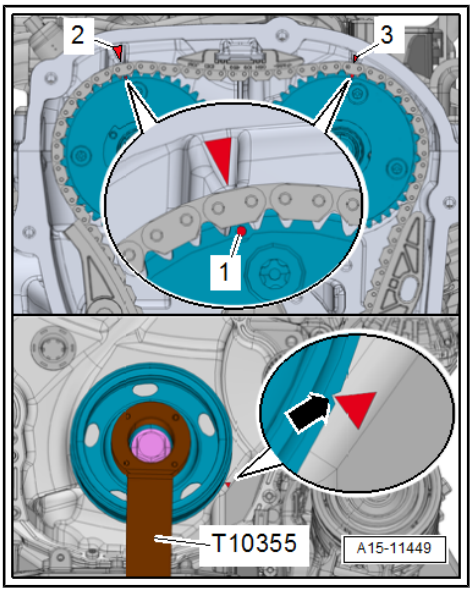
– Use the Adapter - T40266- to turn the intake camshaft in the direction of -arrow 1-, slide out the Camshaft Lock - T40271/2- from the chain sprocket splines in the direction of -arrow 2- and release the camshaft.



Check the Valve Timing, with the Markings on the Cylinder Head

– Turn the vibration damper with the Counterhold - Vibration Damper - T10355- to the TDC point.

- The notch on the vibration damper must line up with the arrow marking on the lower timing chain cover -arrow-.
- The markings -1- on the camshaft chain sprockets must be opposite the markings -2 and 3- on the cylinder head.

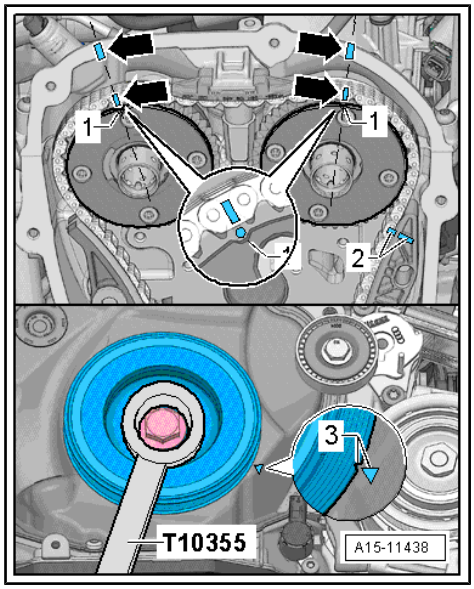


Check the Valve Timing, without the Markings on the Cylinder Head

– Check the valve timing. The camshaft timing chain and cylinder head -arrows- must align with the markings on the chain sprocket.

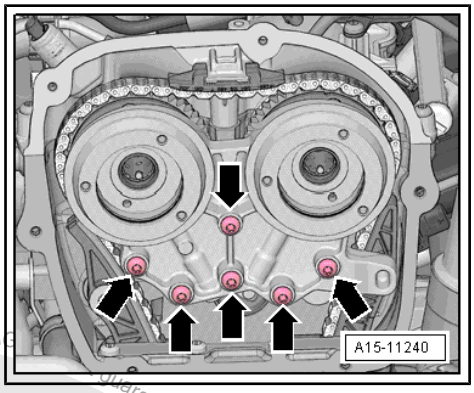
– The markings for the camshaft timing chain and the camshaft timing chain guide rail -2- must align.

– The notch on the vibration damper must be opposite the marking on the lower timing chain cover -3-.



Note

If the self-made markings are no longer visible, check the valve timing. Refer to ⇒ "2.6 Valve Timing, Checking", page 109 .



– Mount the bearing bracket and the bolts -arrows- hand-tight.
– Remove the Tensioner Locking Tool - T40267- .
– Tighten the bolts -arrows-. Refer to ⇒ "2.1 Overview - Camshaft Timing Chains", page 91 .
– Install the regulator valve -item 6- ⇒ Item 6 (page 91) .
– Install the upper timing chain cover. Refer to ⇒ "1.2 Upper Timing Chain Cover, Removing and Installing", page 84 .
– Install the vacuum pump. Refer to ⇒ "3.3 Vacuum Pump, Removing and Installing", page 121 .
– Install the high pressure pump. Refer to ⇒ "6.2 High Pressure Pump, Removing and Installing", page 297 .
– Adapt the chain length. Refer to Vehicle Diagnostic Tester .

Tightening Specifications

- Refer to ⇒ "4.1 Overview - Valvetrain", page 124
- Refer to ⇒ "2.1 Overview - Air Filter Housing", page 268
- Refer to ⇒ "6.1 Overview - High Pressure Pump", page 296

4.3 Sliding Bar Ball, Installing

Special tools and workshop equipment required

- Camshaft Spacer - T40191-

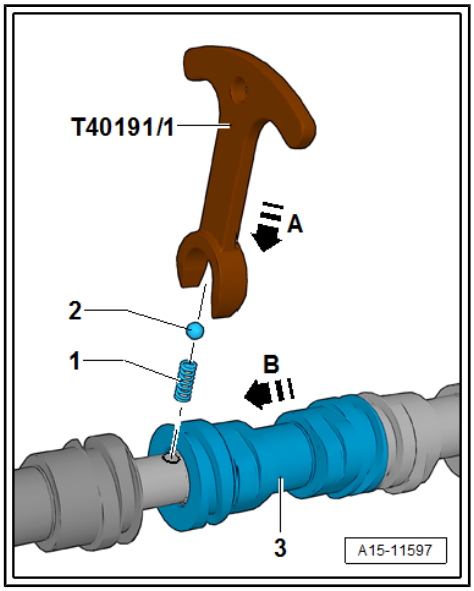
Installing

WARNING

Risk of eye injury from bar ball popping out.

- ***Wear protective eyewear!***

– Insert the spring -1- in the camshaft.
– Place the ball -2- on the spring in the camshaft.
– Push the ball and spring downward in direction of -arrow A- using the Camshaft Spacers - T40191/1- and hold.
– Push the sliding bar -3- in the direction of -arrow B-.



4.4 Valve Stem Seals, Removing and Installing

⇒ “4.4.1 Valve Stem Seals, Removing and Installing, Cylinder Head Installed”, page 153

⇒ “4.4.2 Valve Stem Seals, Removing and Installing, Cylinder Head Removed”, page 157

4.4.1 Valve Stem Seals, Removing and Installing, Cylinder Head Installed

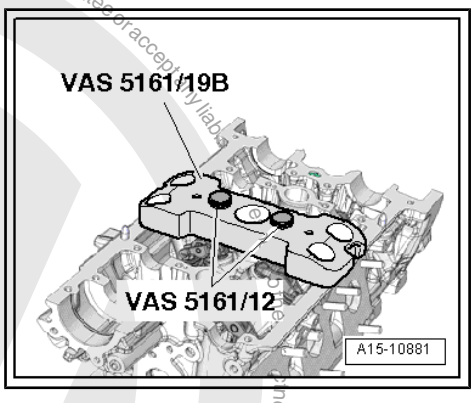
Special tools and workshop equipment required

- Spark Plug Removal Tool - 3122B-
- Puller - Valve Seal - 3364-
- Seal Installer - Valve Stem - 3365-
- Valve Cotter Tool Kit - Adapter - T40012-
- Torque Wrench 1331 5-50Nm - VAG1331-
- Valve Cotter Tool Kit - VAS5161A-
- Valve Cotter Tool Kit - Guide Plate 19B - VAS5161/19B-

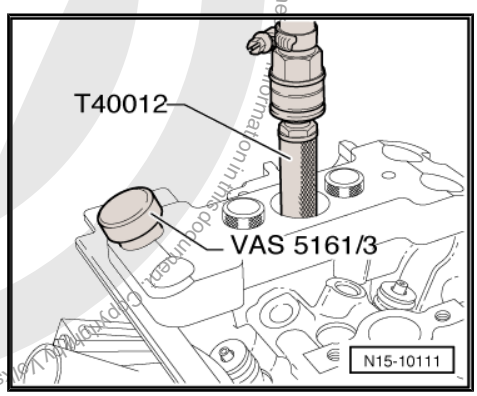
Remove Valve Stem Seals

– Remove the camshafts. Refer to ⇒ “4.2 Camshaft, Removing and Installing”, page 128 .
– Mark the allocation of the roller rocker lever and the hydraulic adjuster so they can be installed again.
– Remove the roller rocker levers with the hydraulic adjuster and place them on a clean surface.
– Remove the spark plugs using a Spark Plug Removal Tool - 3122B- .

– Install the Valve Cotter Tool Kit - Guide Plate 19B - VAS5161/19B- with the Valve Cotter Tool Kit Knurled Thumb Screws M6 - VAS5161/12- as shown on the cylinder head.
– Set the piston for the respective cylinder to bottom dead center.

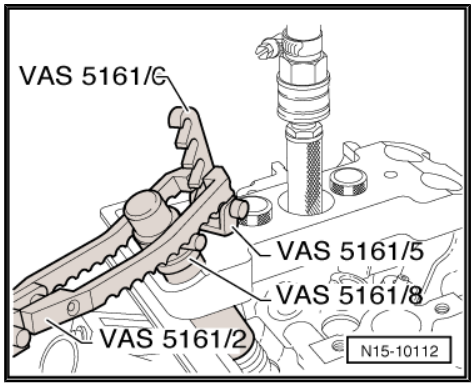


– Install the Valve Cotter Tool Kit - Adapter - T40012- in the spark plug threads.
– Connect compressed air with at least 6 bar (87 psi) pressure.
– Loosen stuck valve retainers using a Punch - VAS5161/3A- and a plastic hammer.



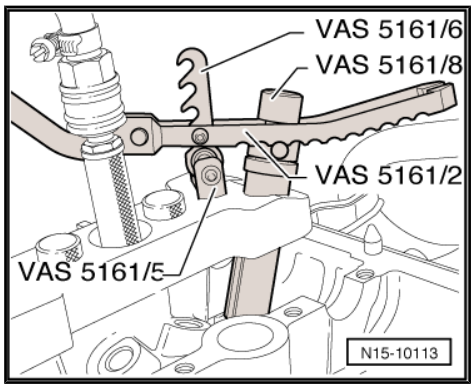
For the Intake Side

– Install the Valve Cotter Tool Kit - Retainer - VAS5161/6- with Valve Cotter Tool Kit - Guide Forks M6/M8 Threaded - VAS5161/5- in the center thread of the Valve Cotter Tool Kit - Guide Plate 19B - VAS5161/19B- .
– Place the Valve Cotter Tool Kit - Assembly Cartridge - VAS5161/8- in the Valve Cotter Tool Kit - Guide Plate 19B - VAS5161/19B- .
– Engage the Pressure Fork With Lever for Assembly Cartridge - VAS5161/2- on the Valve Keeper Tool Kit - Retainer - VAS5161/6- .

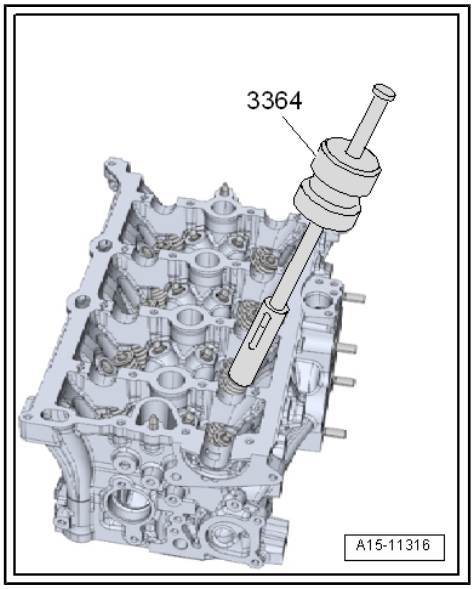


For the Exhaust Side

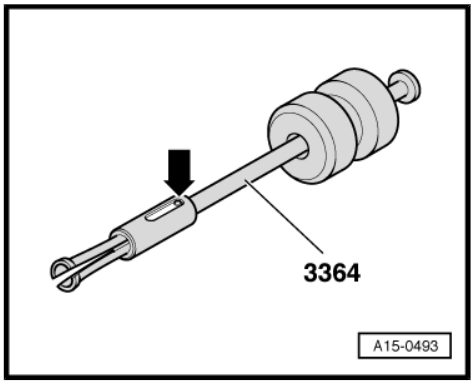
– Install the Valve Cotter Tool Kit - Retainer - VAS5161/6- with Valve Cotter Tool Kit - Guide Forks M6/M8 Threaded - VAS5161/5- in the outer thread of the Valve Cotter Tool Kit - Guide Plate 19B - VAS5161/19B- .
– Press down the Valve Keeper Tool Kit - Assembly Cartridge - VAS5161/8A- and at the same time turn the knurled thumb screw on the Valve Keeper Tool Kit - Assembly Cartridge - VAS5161/8A- to the right until the points engage in the valve keepers.
– Move knurled screw back and forth slightly. Because of this the valve keepers will be pushed apart other and removed in the installation cartridge.
– Release the Pressure Fork With Lever For Assembly Cartridge - VAS5161/2- .
– Remove the Valve Keeper Tool Kit - Assembly Cartridge - VAS5161/8A- .



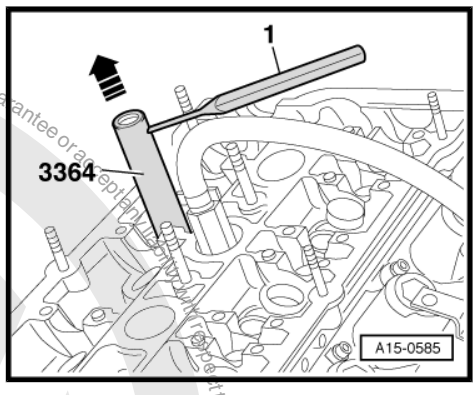
– Remove the valve stem seals using Puller - Valve Seal - 3364- .



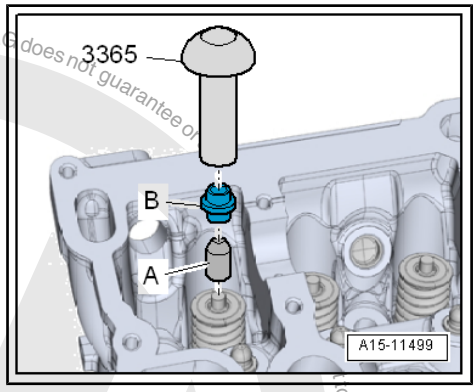
– If the Puller - Valve Seal - 3364- cannot be used because there is not enough space, drive the spring pin -arrow- out using a drift and remove the impact attachment.
– Position the lower section of the Puller - Valve Seal - 3364- on the valve stem seal.
– Place the drift -1- in the hole in the lower section of the removal tool.



– Position the lever on the removal tool and remove the valve stem seal in direction of -arrow-.



Install Valve Stem Seals



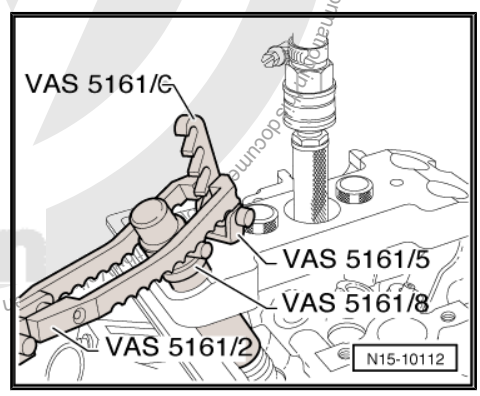
Caution

Risk of damage when installing valve stem seals.

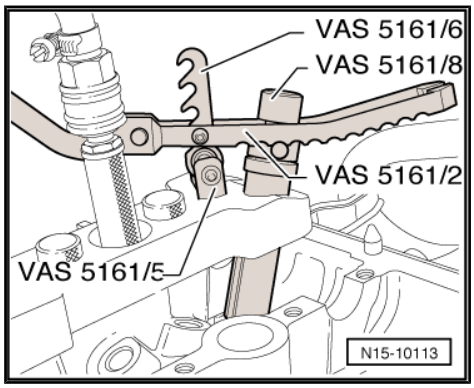
- ***Place the plastic sleeve -A- that is attached to the new valve stem seals -B- on the valve stem.***

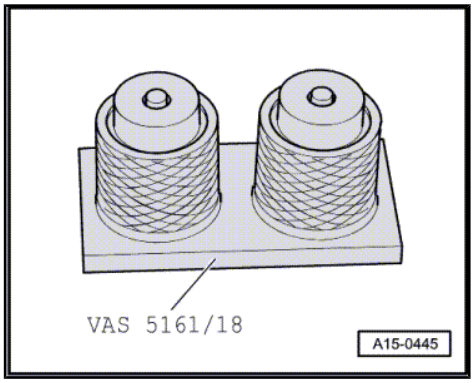
– Lightly oil the valve stem seal sealing lip.
– Slide the valve stem seal onto the plastic sleeve.
– Carefully press the valve stem seal onto the valve guide with the Seal Installer - Valve Stem - 3365- .
– Remove plastic sleeve.
– Insert the valve spring and valve spring retainer.
– Connect the Valve Keeper Tool Kit - VAS5161A- as illustrated.

Intake Side



Exhaust Side





Note

- *If the valve rtainers were removed from the installation cartridge, they must then be inserted into the Valve Cotter Tool Kit - Valve Insertion Device - VAS5161/18- .*
- *Press the Valve Keeper Tool Kit - Assembly Cartridge - VAS5161/8A- onto the insertion device from above and capture the valve retainers.*

– Press the Valve Keeper Tool Kit Assembly Cartridge - VAS5161/8- down with the Valve Keeper Tool Kit Pressure Fork with Lever for Assembly Cartridge - VAS5161/2- and rotate the cartridge knurled thumb screw back and forth while pulling up.

– Release the Pressure Fork with Lever for Assembly Cartridge - VAS5161/2- with the knurled thumb screw pulled.

– Remove the Valve Keeper Tool Kit - VAS5161A- .

Installation is performed in reverse order of removal, while noting the following:

– Install the camshafts. Refer to ⇒ “4.2 Camshaft, Removing and Installing”, page 128 .

4.4.2 Valve Stem Seals, Removing and Installing, Cylinder Head Removed

Special tools and workshop equipment required

- Puller - Valve Seal - 3364-
- Seal Installer - Valve Stem - 3365-
- Valve Keeper Tool Kit - VAS5161A-
- Valve Cotter Tool Kit - Guide Plate 19B - VAS5161/19B-
- Engine and Gearbox Bracket - VAS6095A-
- Cylinder Head Tensioning Device - VAS6419-

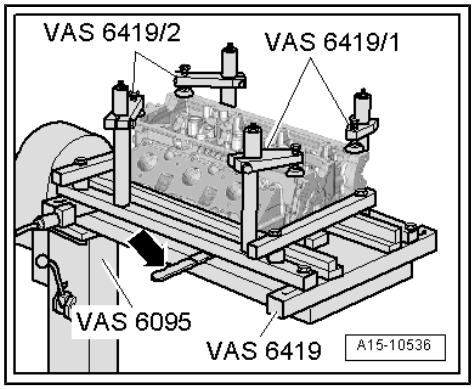
Remove Valve Stem Seals

– Remove the camshafts. Refer to ⇒ “4.2 Camshaft, Removing and Installing”, page 128 .

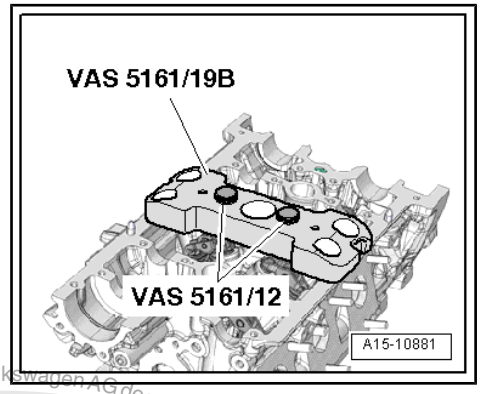
– Mark the allocation of the roller rocker lever and the hydraulic adjuster so they can be installed again.

– Remove the roller rocker levers with the hydraulic adjuster and place them on a clean surface.

– Insert the Cylinder Head Tensioning Device - VAS6419- in the Engine and Gearbox Bracket - VAS6095A- .
– Tension the cylinder head on the cylinder head tensioning device, as shown.
– Connect the cylinder head tensioning device to the compressed air.
– Slide the air cushion with the lever -arrow- under the combustion chambers onto the valve stem seal that will be removed.
– Let enough compressed air flow into the air cushion until it contacts the valve plate.
– Install the Valve Cotter Tool Kit - Guide Plate 19B - VAS5161/19B- with the Valve Cotter Tool Kit Knurled Thumb Screws M6 - VAS5161/12- as shown on the cylinder head.

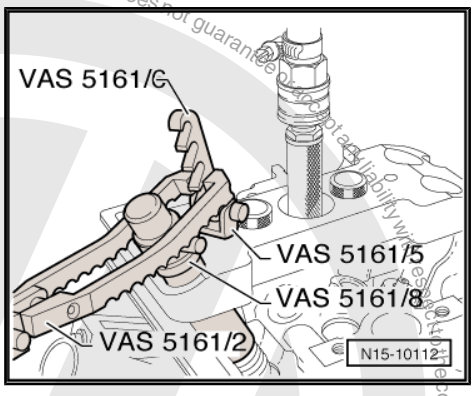


– Insert the Valve Cotter Tool Kit - Punch - VAS5161/3- in the guide plate and loosen the stuck valve retainers with a plastic mallet.



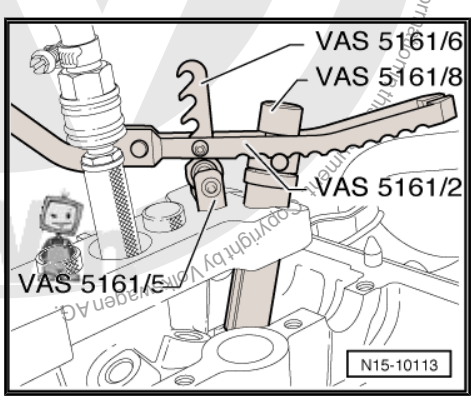
For the Intake Side

– Install the Valve Cotter Tool Kit - Retainer - VAS5161/6- with Valve Cotter Tool Kit - Guide Forks M6/M8 Threaded - VAS5161/5- in the center thread of the Valve Cotter Tool Kit - Guide Plate for FSI Engine - VAS5161/19B- .
– Place the Valve Cotter Tool Kit - Assembly Cartridge - VAS5161/8- in the Valve Cotter Tool Kit - Guide Plate 19B - VAS5161/19B- .
– Engage the Pressure Fork With Lever for Assembly Cartridge - VAS5161/2- on the Retainer - VAS5161/6- .

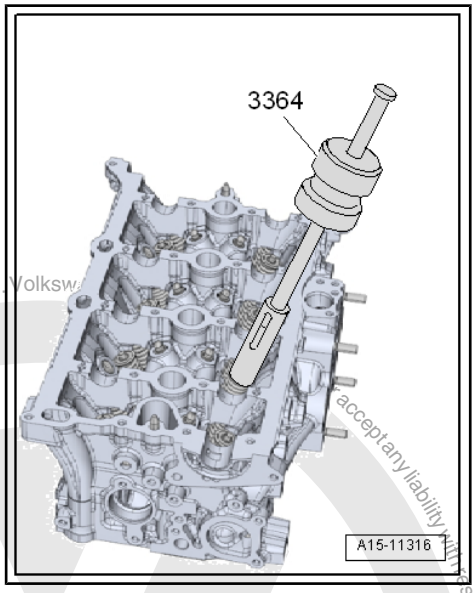


For the Exhaust Side

– Install the Valve Cotter Tool Kit - Retainer - VAS5161/6- with Valve Cotter Tool Kit - Guide Forks M6/M8 Threaded - VAS5161/5- in the outer thread of the Valve Cotter Tool Kit - Guide Plate 19B - VAS5161/19B- .
– Press down the Assembly Cartridge - VAS5161/8A- and at the same time turn the knurled thumb screw on the Assembly Cartridge - VAS5161/8A- to the right until the points engage in the valve retainers.
– Move knurled screw back and forth slightly. Because of this the valve retainers will be pushed apart other and removed in the installation cartridge.
– Release the Pressure Fork With Lever For Assembly Cartridge - VAS5161/2- .
– Remove the Assembly Cartridge - VAS5161/8A- .



– Remove the valve stem seals using Puller - Valve Seal - 3364- .

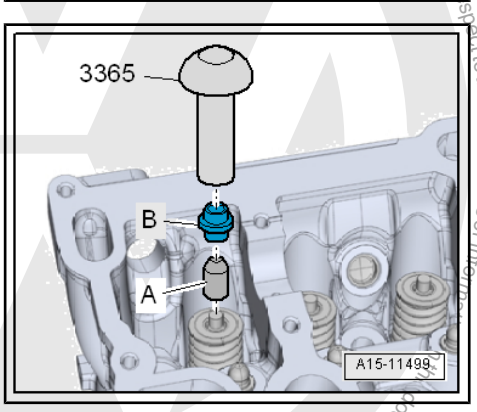


Install Valve Stem Seals

Caution

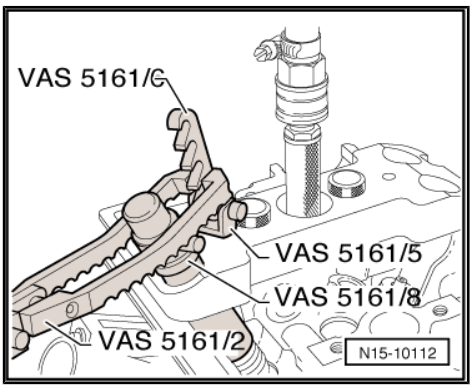
Risk of damage when installing valve stem seals.

- ***Place the plastic sleeve -A- that is attached to the new valve stem seals -B- on the valve stem.***

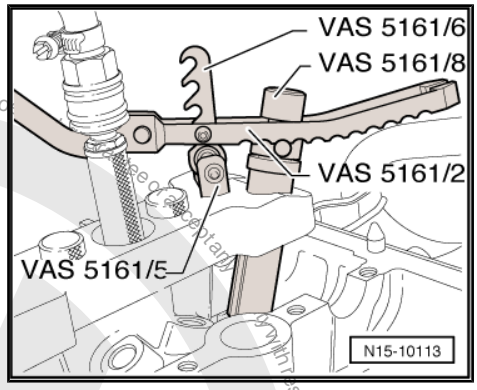


– Lightly oil the valve stem seal sealing lip.
– Slide the valve stem seal onto the plastic sleeve.
– Carefully press the valve stem seal onto the valve guide with the Seal Installer - Valve Stem - 3365- .
– Remove the plastic sleeve.
– Insert the valve spring and valve spring retainer.
– Install the Valve Keeper Tool Kit - VAS5161A- as illustrated.

Intake Side



Exhaust Side



Note

- *If the valve retainers were removed from the installation cartridge, they must then be inserted into the Valve Cotter Tool Kit - Valve Insertion Device - VAS5161/18- .*
- *Press the Valve Cotter Tool Kit - Assembly Cartridge - VAS5161/8A- onto the insertion device from above and capture the valve retainers.*

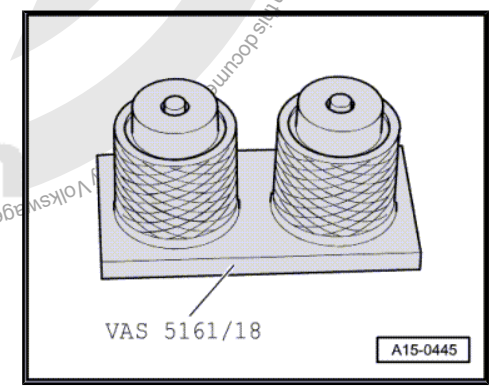
– Press the Valve Keeper Tool Kit Assembly Cartridge - VAS5161/8- down with the Valve Keeper Tool Kit Pressure Fork with Lever for Assembly Cartridge - VAS5161/2- and rotate the cartridge knurled thumb screw back and forth while pulling up.

– Release the Valve Keeper Tool Kit Pressure Fork with Lever for Assembly Cartridge - VAS5161/2- with the knurled thumb screw pulled.

– Remove the Valve Keeper Tool Kit - VAS5161A- .

Installation is performed in reverse order of removal, while noting the following:

– Install the camshafts. Refer to ⇒ “4.2 Camshaft, Removing and Installing”, page 128 .



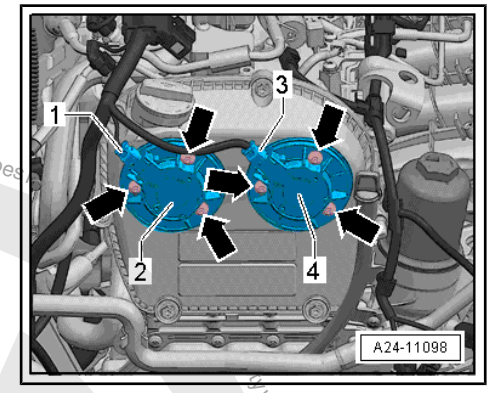
4.5 Camshaft Adjustment Valve 1 - N205- / Exhaust Camshaft Adjustment Valve 1 - N318- , Removing and Installing

Removing

– Disconnect the connectors -1 and 3-.

– Remove the bolts -arrows-.

– Remove the Camshaft Adjustment Valve 1 - N205- -4- and Exhaust Camshaft Adjustment Valve 1 - N318- -2-.



Installing

Install in reverse order of removal and note the following:

Note

Replace seals and O-rings.

– Lubricate seals on the Camshaft Adjustment Valve 1 - N205- / Exhaust Camshaft Adjustment Valve 1 - N318- sealing surfaces with engine oil.

Tightening Specifications

♦ Refer to ⇒ “1.1 Overview - Timing Chain Cover”, page 82

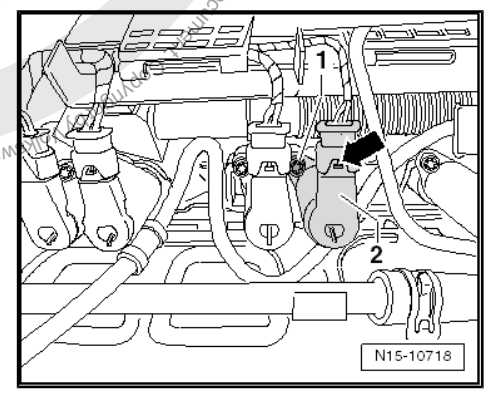
4.6 Cam Adjustment Actuator 1 - F366- / Cam Adjustment Actuator 8 - F373- , Removing and Installing

Removing

– Disconnect the connector -arrow- from the corresponding Cam Adjustment Actuator 1 - F366- / Cam Adjustment Actuator 8 - F373- -2-.

– Remove the bolt -1-.

– Carefully pull out the Cam Adjustment Actuator 1 - F366- / Cam Adjustment Actuator 8 - F373- being removed.



Installing

Install in reverse order of removal and note the following:

Note

♦ *Coat the O-ring with engine oil.*

♦ *Check for damage.*

♦ *No replacement part, part of the cam adjustment actuator*

Tightening Specifications

♦ Refer to ⇒ “4.1 Overview - Valvetrain”, page 124

5 Intake and Exhaust Valves

⇒ “5.1 Valve Guides, Checking”, page 162

⇒ “5.2 Valves, Checking”, page 162

⇒ “5.3 Valve Dimensions”, page 162

5.1 Valve Guides, Checking

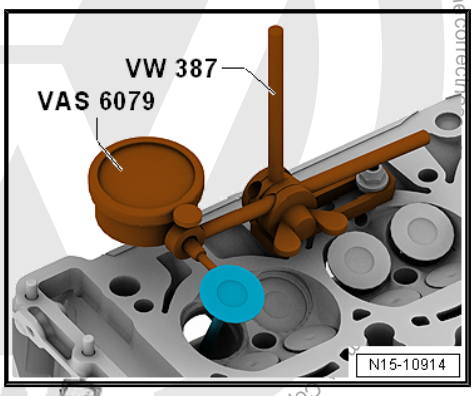
Special tools and workshop equipment required

- Dial Gauge Holder - VW387-
- Dial Gauge - 0-10mm - VAS6079-

Test Sequence

– Insert the valve into guide. The valve stem end must be flush with the guide. Due to differences in valve stem diameter, make sure that only intake valves are used to check intake valve guides, and only exhaust valves are used to check exhaust valve guides.

– Determine the tilting clearance.



Wear Limit

Intake Valve Guide	Exhaust Valve Guide
0.80 mm	0.80 mm

Note

- *If the wear limit is exceeded, measure again using new valves. If the wear limit is still exceeded, replace the cylinder head.*
- *If the valve is to be replaced as part of a repair, use a new valve for the measurement.*

5.2 Valves, Checking

– Check the valves at stem and seating surface for wear grooves.

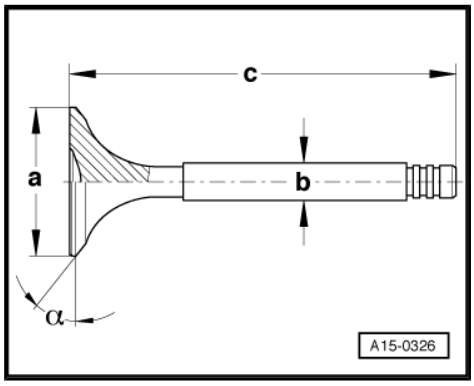
– If there are clear wear grooves, replace the valve.

5.3 Valve Dimensions

Valve Dimensions

Note

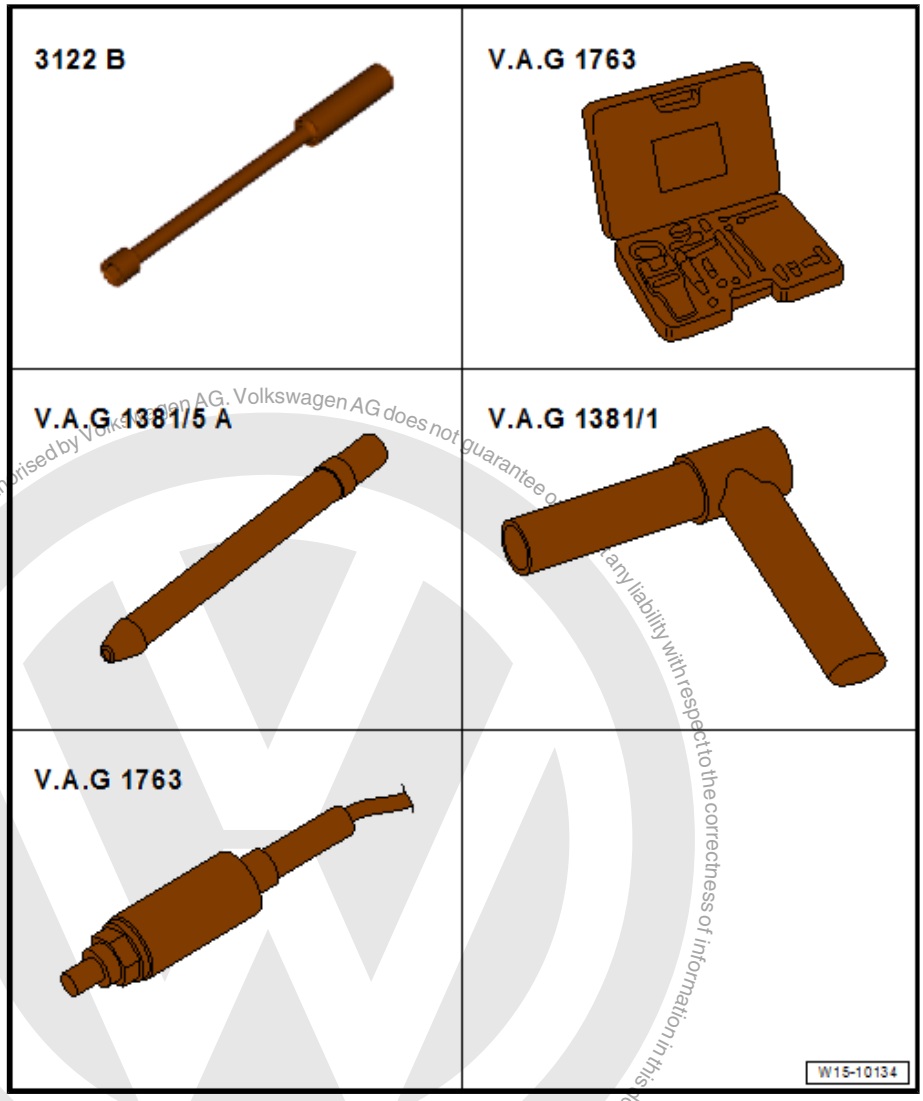
Intake and exhaust valves must not be reworked. Only lapping is permitted.



Dimension		Intake Valve	Exhaust Valve
Diameter a	mm	33.85 ± 0.10	28.0 ± 0.1
Diameter b	mm	5.98 ± 0.01	5.96 ± 0.01
c	mm	104.0 ± 0.2	101.9 ± 0.2
α	∠°	45	45

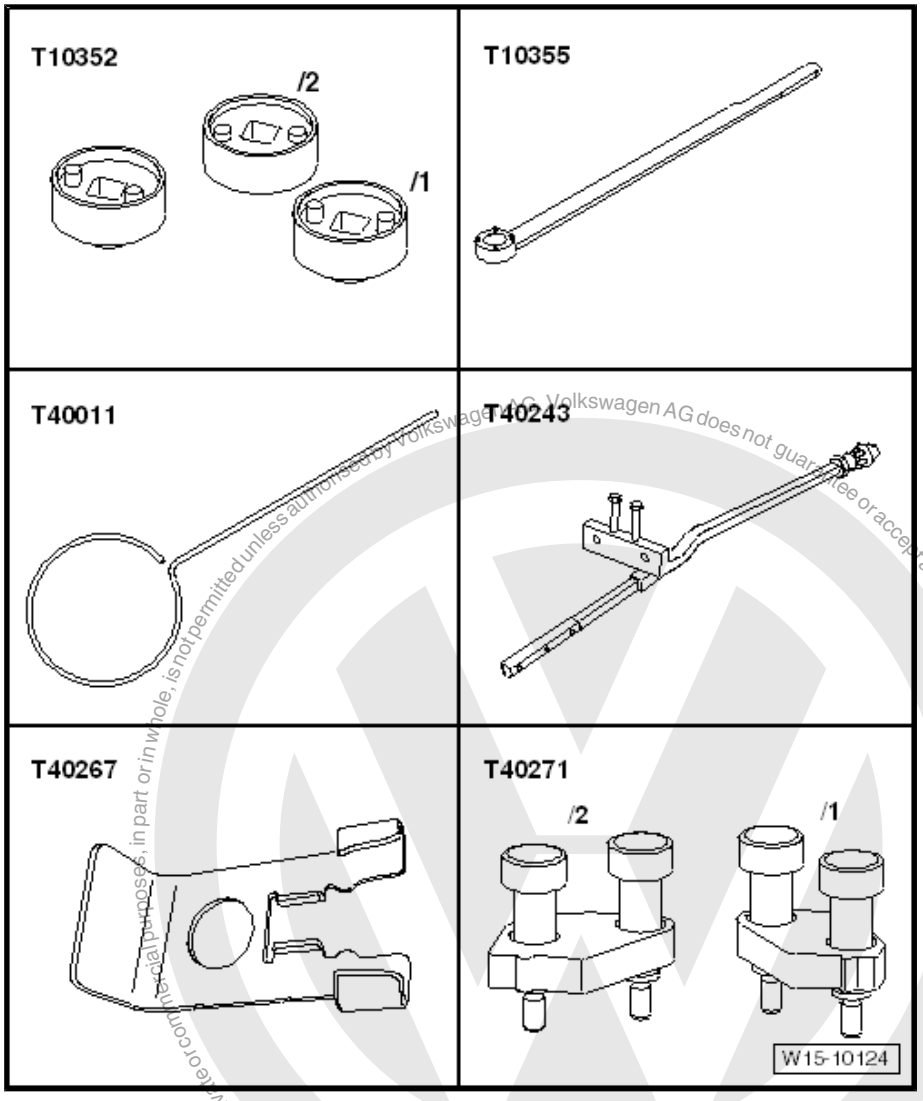
6 Special Tools

- Spark Plug Removal Tool - 3122B-
- Compression Tester Kit - VAG1763-
- Compression Tester Kit - Adapter - VAG1381/1-
- Compression Tester Kit - Adapter 5A - VAG1381/5A-

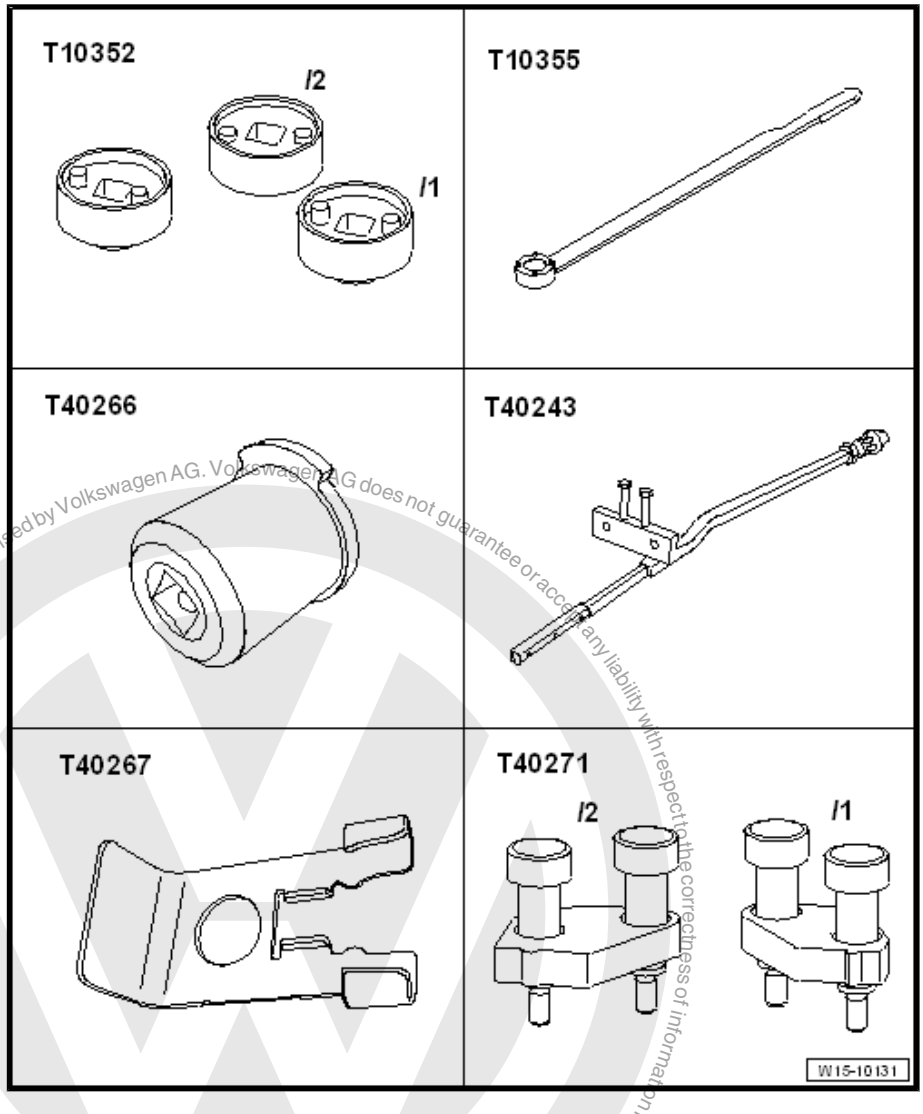


Special tools and workshop equipment required

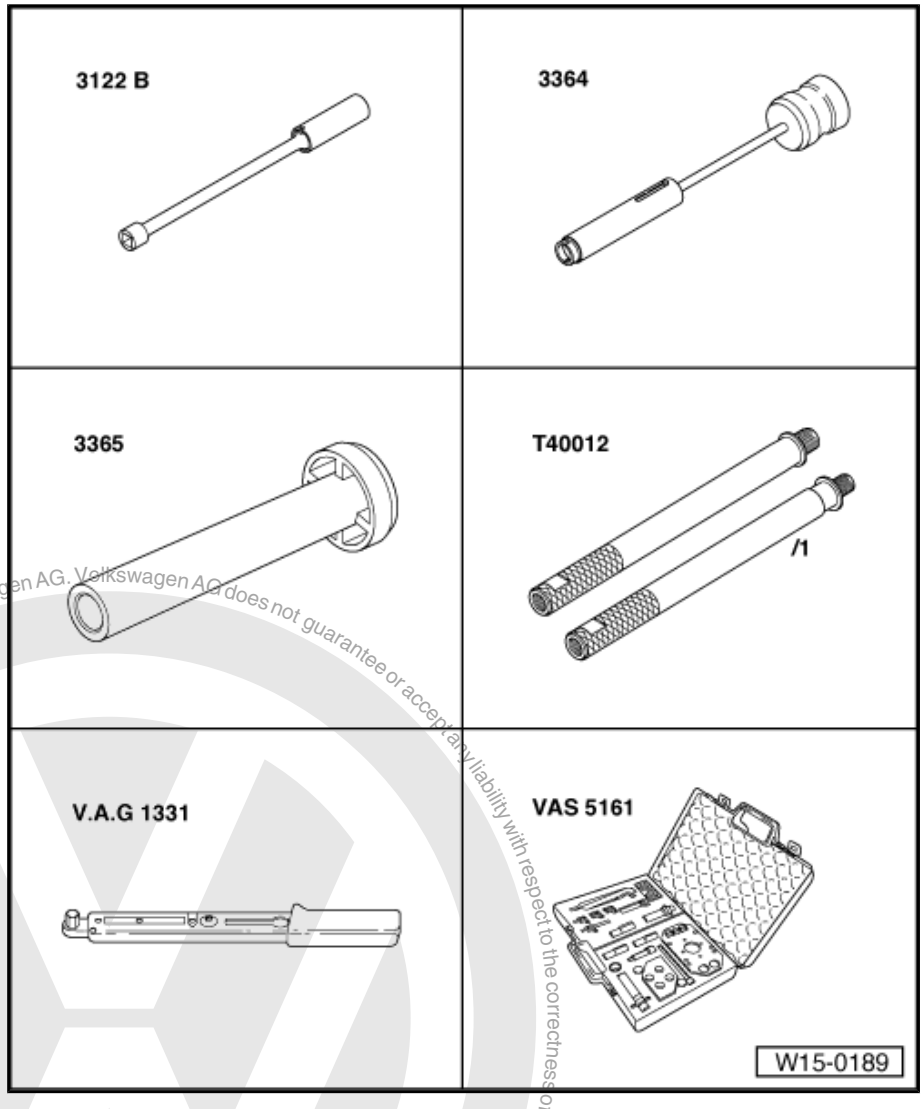
- Central Valve Assembly Tool - T10352-
- Counterhold - Vibration Damper - T10355-
- Locking Pin (3 pc.) - T40011-
- Chain Tensioner Lever - T40243-
- Tensioner Locking Tool - T40267-
- Camshaft Locks - T40271-



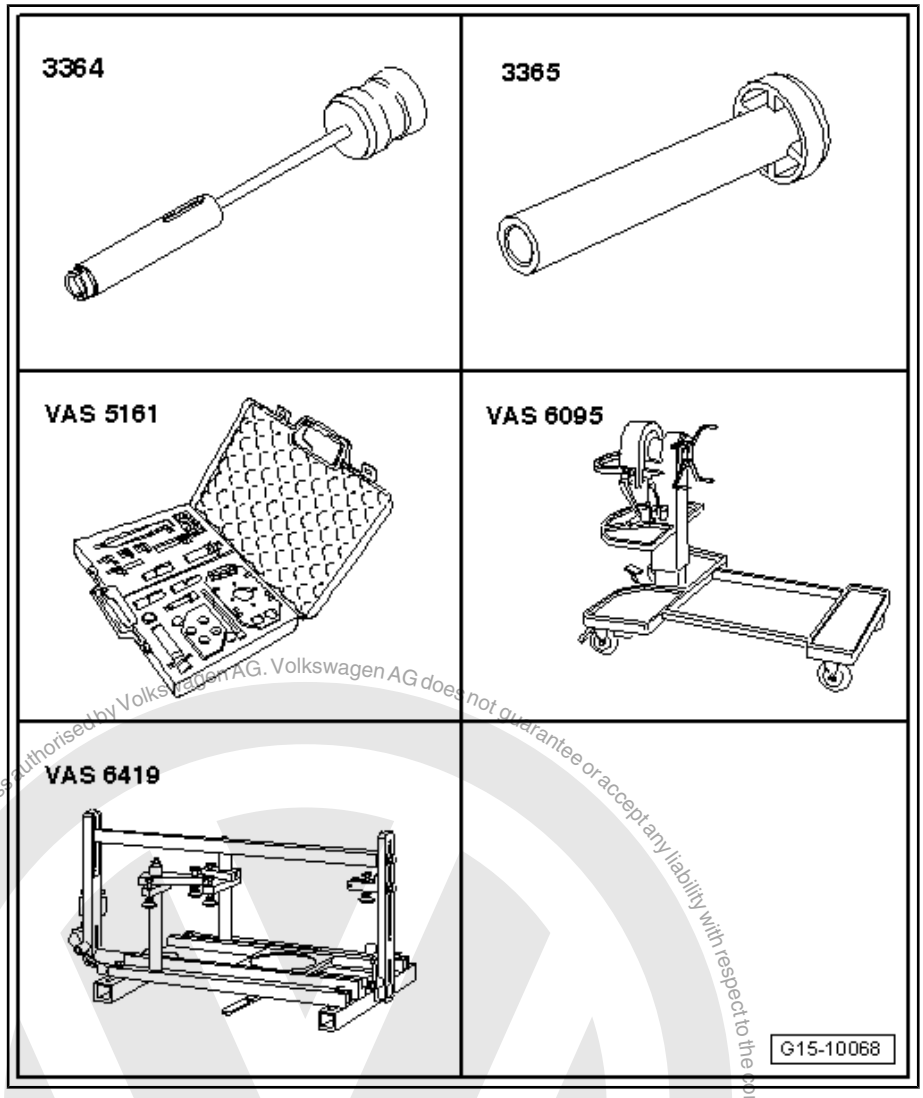
- Central Valve Assembly Tool - T10352-
- Counterhold - Vibration Damper - T10355-
- Chain Tensioner Lever - T40243-
- Tensioner Locking Tool - T40267-
- Camshaft Locks - T40271-
- Adapter - T40266-
- Vehicle Diagnostic Tester
- Sealant - D 154 103 A1-



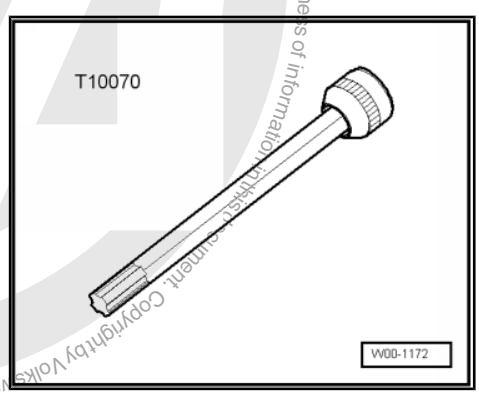
- Spark Plug Removal Tool - 3122B-
- Puller - Valve Seal - 3364-
- Seal Installer - Valve Stem - 3365-
- Valve Cotter Tool Kit - Adapter - T40012-
- Torque Wrench 1331 5-50Nm - VAG1331-
- Valve Cotter Tool Kit - VAS5161A-
- Valve Cotter Tool Kit - Guide Plate 19B - VAS5161/19B-



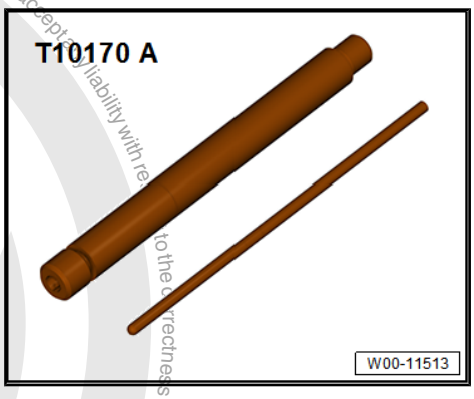
- Puller - Valve Seal - 3364-
- Seal Installer - Valve Stem - 3365-
- Valve Keeper Tool Kit - VAS5161A-
- Valve Cotter Tool Kit - Guide Plate 19B - VAS5161/19B-
- Engine and Gearbox Bracket - VAS6095A-
- Cylinder Head Tensioning Device - VAS6419-



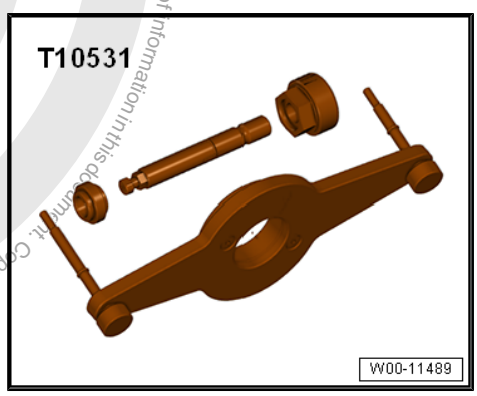
- Polydrive Bit Drive Socket - T10070-



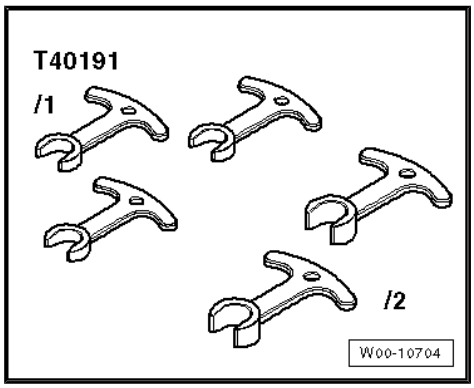
- Dial Gauge Adapter - T10170A-



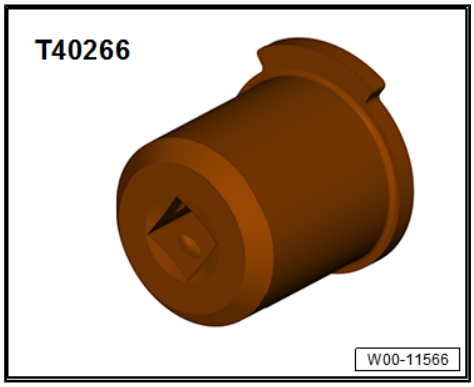
- Vibration Damper Assembly Tool - T10531-



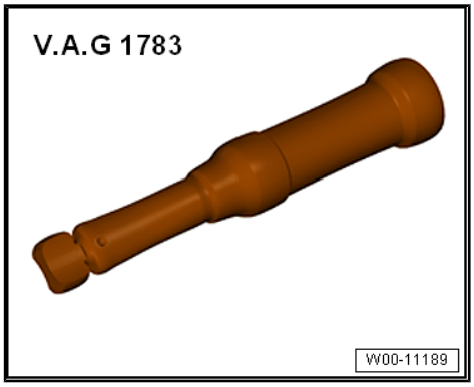
- Camshaft Spacer - T40191-



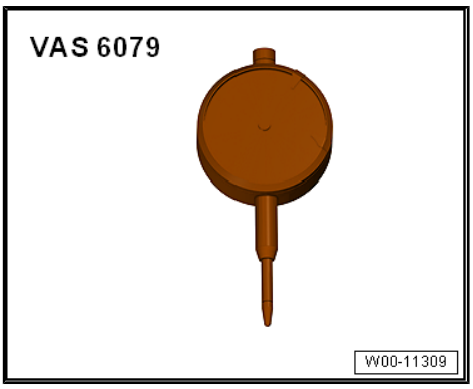
- Adapter - T40266-



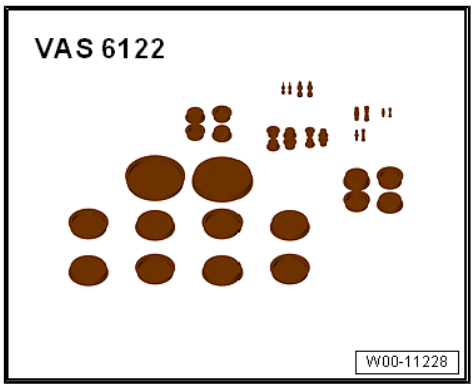
- Torque Wrench 1783 - 2-10Nm - VAG1783-



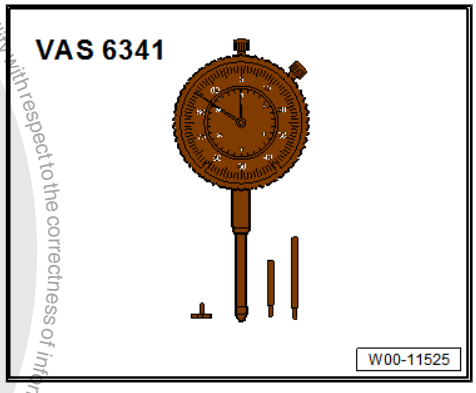
- Dial Gauge - 0-10mm - VAS6079-



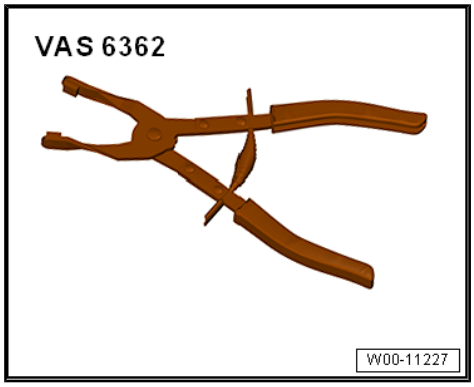
- Engine Bung Set - VAS6122-



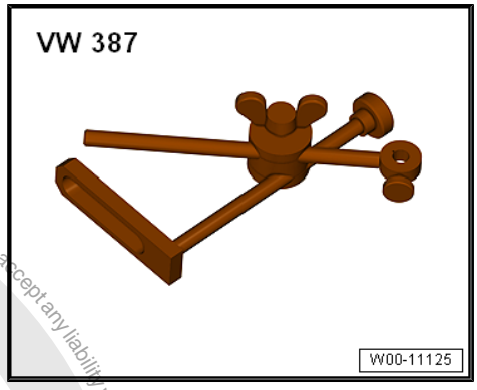
- Dial Gauge Set - VAS6341-



- Hose Clip Pliers - VAS6362-



- Dial Gauge Holder - VW387-



- Not Illustrated:
- Torque Wrench 1783 - Open Jaw - 10mm - VAG1783/1-
- Silicone Grease . Refer to the Parts Catalog.

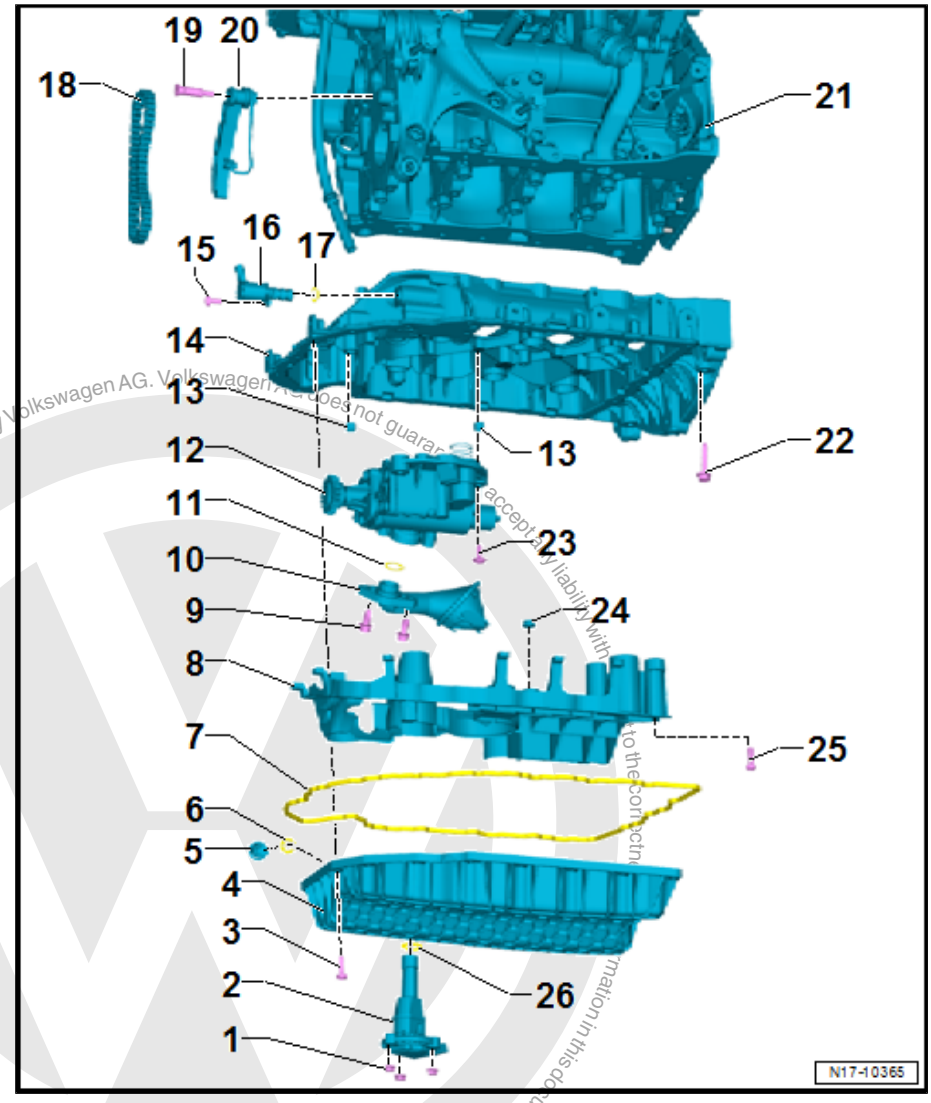
17 – Lubrication

1 Oil Pan/Oil Pump

1.1 Overview - Oil Pan/Oil Pump

Note

If large quantities of metal particles or other deposits (such as those caused by partial seizure of the crankshaft or connecting rod damage) are found in the engine oil, clean the oil channels thoroughly and replace the engine oil cooler to prevent further damage.



1 - Nuts

- ❑ 9 Nm

2 - Oil Level Thermal Sensor - G266-

- ❑ Removing and installing. Refer to ⇒ “1.2 Oil Level Thermal Sensor G266 , Removing and Installing”, page 174 .

3 - Screws

- ❑ 8 Nm +90°
- ❑ Replace after removing
- ❑ Note the tightening sequence. Refer to ⇒ Fig. ““Plastic Oil Pan Lower Section - Tightening Sequence”“ , page 173 .

4 - Oil Pan Lower Section

- ❑ Made out of plastic
- ❑ Removing and installing. Refer to ⇒ “1.3 Oil Pan Lower Section, Removing and Installing”, page 174 .

5 - Plugs

- ❑ Tighten sealing plug all the way

6 - O-Ring

- ❑ Replace after removing
- ❑ Coat the O-ring with engine oil

7 - Seal

8 - Oil Baffle

- ❑ Replace after removing

9 - Screws

- ❑ 4 Nm +45°
- ❑ Replace after removing

10 - Oil Intake Pipe

- ❑ Clean the strainer if it is dirty.

11 - O-Ring

- ❑ Replace after removing
- ❑ Coat with engine oil

12 - Oil Pump

- ❑ Removing and installing. Refer to ⇒ “1.4 Oil Pump, Removing and Installing”, page 174 .

13 - Centering Sleeves

14 - Oil Pan Upper Section

- ❑ Removing and installing. Refer to ⇒ “1.5 Oil Pan Upper Section, Removing and Installing”, page 176 .

15 - Bolt

- ❑ 4 Nm +90°
- ❑ Replace after removing

16 - Oil Pressure Regulation Valve - N428-

- ❑ Removing and installing. Refer to
  ⇒ “4.4 Oil Pressure Regulation Valve N428 , Removing and Installing”, page 188 .

17 - O-Ring

- ❑ Replace after removing
- ❑ Coat with engine oil

18 - Oil Pump Drive Chain

- ❑ Mark direction of rotation before removing

19 - Bolt

- ❑ 9 Nm

20 - Chain Tensioner

21 - Cylinder Block

22 - Screws

- ❑ Replace after removing
- ❑ Tightening sequence. Refer to ⇒ Fig. ““Oil Pan Upper Section - Tightening Sequence”“ , page 173

23 - Screws

- ❑ 8 Nm +90°
- ❑ Replace after removing

24 - Centering Bracket

25 - Screws

- ❑ 4 Nm +45°
- ❑ Replace after removing

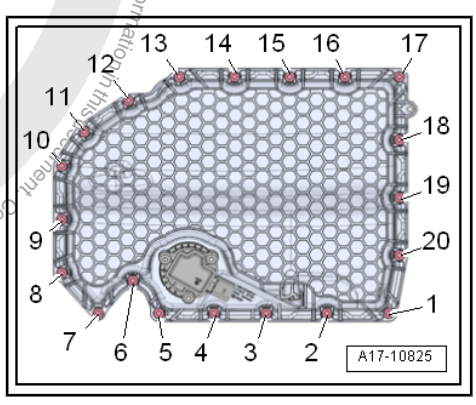
26 - Seal

- ❑ Replace after removing

Plastic Oil Pan Lower Section - Tightening Sequence

– Mount the oil pan and tighten bolts -1 to 20- in two steps in the sequence shown:

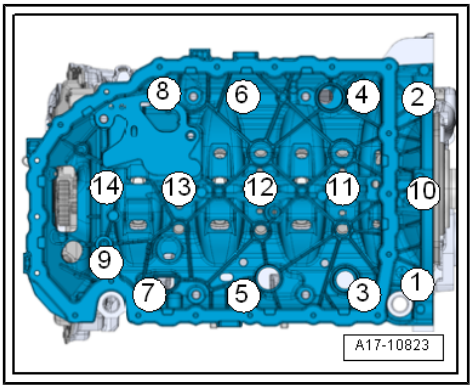
Steps and Tightening Sequence	Tightening Specification
1. Bolts -1- through -20-	8 Nm
2. Bolts -1- through -20-	Turn an additional 90°



Oil Pan Upper Section - Tightening Sequence

– Tighten the bolts -1 through 14- in the sequence shown.

Step	Tightening Sequence and Tightening Specification
1. Bolts -1- through -14-	8 Nm
2. Bolts -1- and -2-	180° additional turn
3. Bolts -3- through -9-	45° additional turn
4. Bolt -10-	180° additional turn
5. Bolts -11- through -14-	Turn an additional 90°.



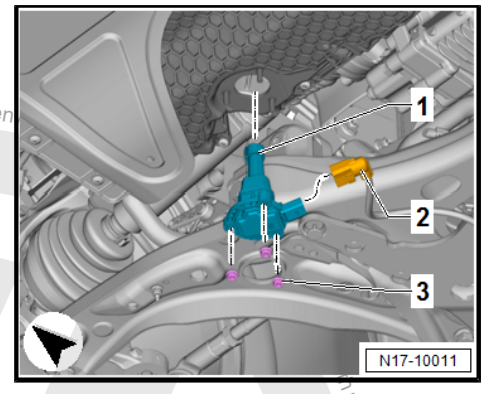
1.2 Oil Level Thermal Sensor - G266- , Removing and Installing

Removing

– Drain the engine oil. Refer to ⇒ Maintenance ; Booklet 36.1 .

– Disconnect the connector -2-.

– Remove the nuts -3- and remove the Oil Level Thermal Sensor - G266- -1-.



Installing

Install in reverse order of removal and note the following:

– Replace the gasket.

– Fill with engine oil and then check the level. Refer to ⇒ Maintenance ; Booklet 36.1 .

Tightening Specifications

♦ Refer to ⇒ “1.1 Overview - Oil Pan/Oil Pump”, page 171

1.3 Oil Pan Lower Section, Removing and Installing

Special tools and workshop equipment required

♦ Used Oil Collection and Extraction Unit - SMN372500-

♦ Hand Drill with Plastic Brush Attachment

♦ Protective Eyewear

♦ Silicone grease. Refer to the Parts Catalog.

Removing

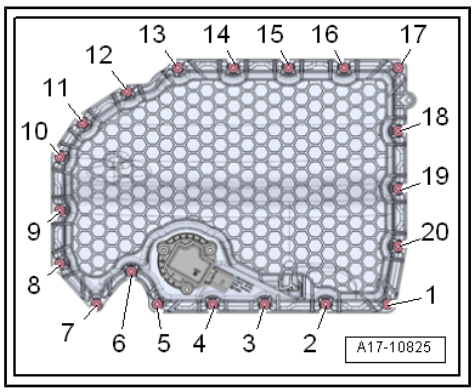
– Remove the noise insulation. Refer to ⇒ Body Exterior; Rep. Gr. 66 ; Noise Insulation; Overview - Noise Insulation .

– Place the Used Oil Collection and Extraction Unit - SMN372500- under the engine and drain the engine oil. Refer to ⇒ Maintenance ; Booklet 36.1 .

Note

Observe the disposal regulations!

– Remove the bolts -1 through 20- and remove the oil pan.



Installing

Install in reverse order of removal and note the following:

Note the bolt tightening sequence. Refer to ⇒ Fig. ““Plastic Oil Pan Lower Section - Tightening Sequence”“ , page 173 .

– Fill with engine oil and then check the level. Refer to ⇒ Maintenance ; Booklet 36.1 .

Tightening Specifications

♦ Refer to ⇒ “1.1 Overview - Oil Pan/Oil Pump”, page 171

1.4 Oil Pump, Removing and Installing

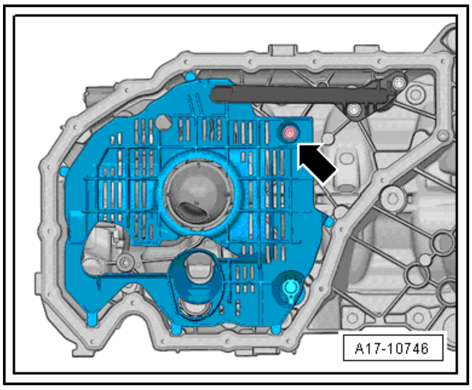
Special tools and workshop equipment required

- Elbow Assembly Tool - T10118-
- Chain Tensioner Locking Tool - T40265-

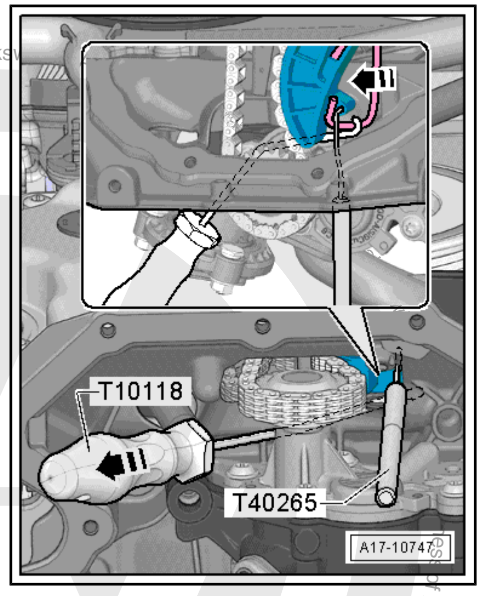
Removing

– Remove the oil pan lower section. Refer to ⇒ “1.3 Oil Pan Lower Section, Removing and Installing”, page 174 .

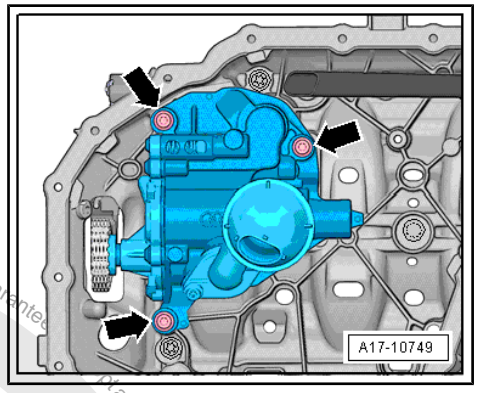
– Remove the bolt -arrow- and remove the oil baffle.



– Pull the chain tensioner spring using the Elbow Assembly Tool - T10118- in direction of -arrow- and secure it with the Chain Tensioner Locking Tool - T40265- .



– Remove the bolts -arrows- and remove the oil pump.



Installing

Install in reverse order of removal and note the following:

– Make sure there are both alignment bushings for centering the oil pump.

– Check the oil intake pipe screen and the oil channels in the oil pan upper section for contamination before installing the oil pump.

– Guide the oil pump chain sprocket into the drive chain and install the oil pump.

Caution

Risk of destroying the engine.

- *The following procedure must be observed otherwise the chain tensioner spring will not spring into the installation position:*

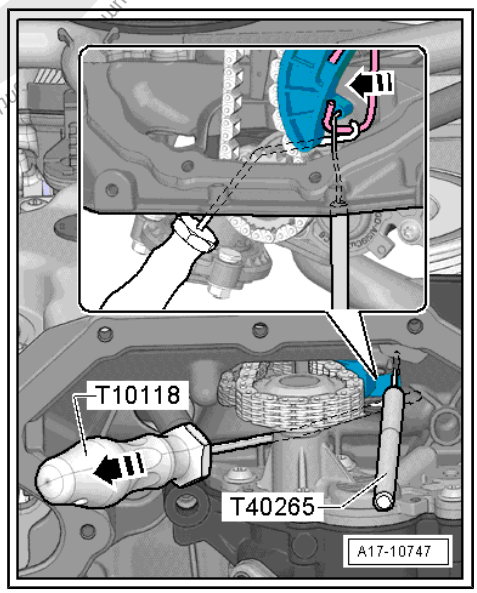
– Pull the chain tensioner spring with the Elbow Assembly Tool - T10118- in the direction of -arrow- and remove the Chain Tensioner Locking Tool - T40265- .

– Place the O-ring on the new oil baffle and coat with engine oil.

– Insert the new oil baffle and secure it.

– Install the oil pan lower section. Refer to ⇒ “1.3 Oil Pan Lower Section, Removing and Installing”, page 174 .

– Fill with engine oil and then check the level. Refer to ⇒ Maintenance ; Booklet 36.1 .



Tightening Specifications

- Refer to ⇒ “1.1 Overview - Oil Pan/Oil Pump”, page 171.

1.5 Oil Pan Upper Section, Removing and Installing

Removing

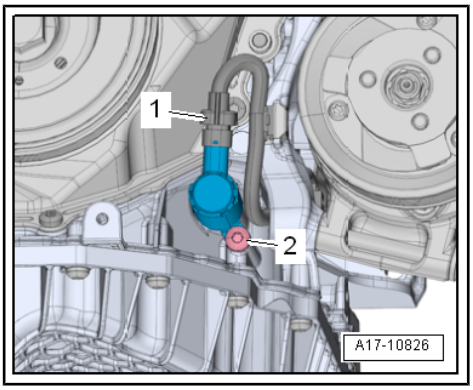
- The transmission is removed.

– Remove the rear sealing flange. Refer to ⇒ “2.3 Sealing Flange, Removing and Installing, Transmission Side”, page 54 .

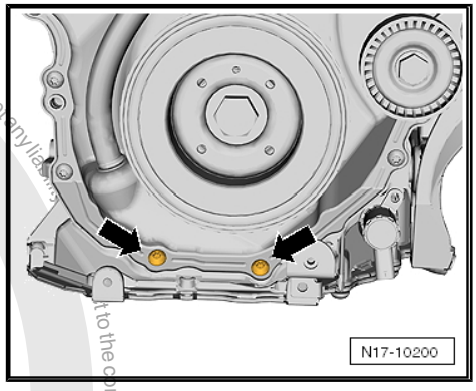
– Remove the oil pump. Refer to
⇒ “1.4 Oil Pump, Removing and Installing”, page 174 .

– Remove the windshield washer fluid reservoir. Refer to ⇒ Electrical Equipment; Rep. Gr. 92 ; Windshield Washer System; Windshield Washer Fluid Reservoir, Removing and Installing .

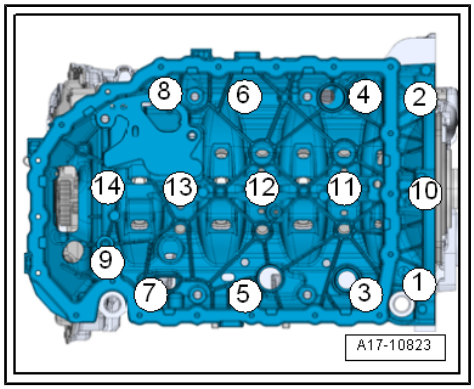
– Disconnect the connector -1-.



– Remove the bolts -arrows-.



– Remove the bolts -1 through 14- and the upper section of the oil pan.



Caution

First pry the oil pan upper section out on the transmission side. When prying out, be careful not to bend the timing chain cover.

Installing

Install in reverse order of removal and note the following:

Note

- *Be sure to check the expiration date of the silicone sealant.*
- *The oil pan upper section must be installed within five minutes after applying the silicone sealant.*
- *Replace the bolts that were tightened with an additional turn.*
- *Replace the gaskets, seals and self-locking nuts.*

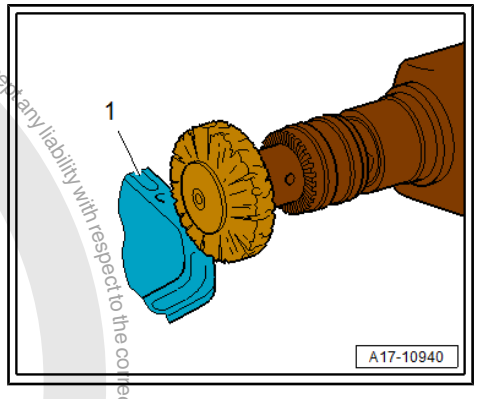
– Remove any sealant residue on the cylinder block using a flat blade scraper.

WARNING

Risk of eye injury.

- ***Wear protective eyewear!***

– Remove any remaining sealant on oil pan upper section using, for example, a rotating plastic brush.



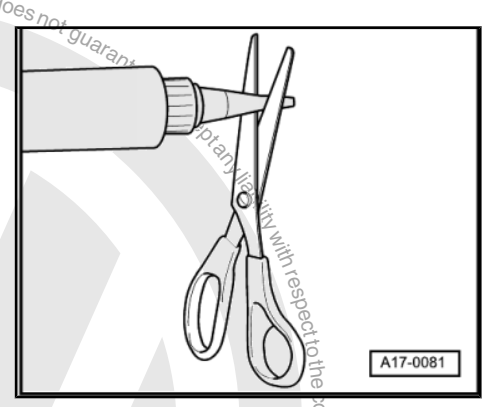
Note

See if the timing chain cover is deformed. Then mount the oil pan upper section without any sealant and check the gap between the cover and the oil pan upper section. If deformation is found and the cover cannot be aligned, replace the cover after installing the oil pan upper section.

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

– Check for dirt in the oil passages in the oil pan upper section and in the crankshaft housing.

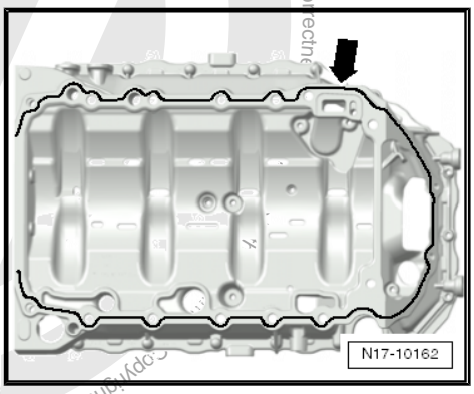
– Cut the tube nozzle at the front marking (nozzle diameter: approximately 2 mm).



Caution

Risk of blocking the lubrication system due to excess sealant.

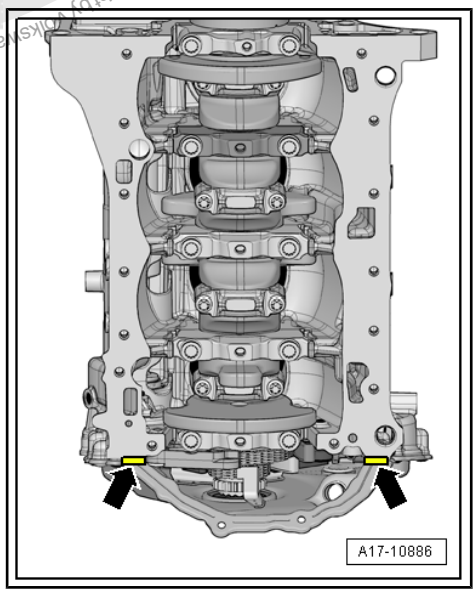
- ***Do not apply sealant bead thicker than indicated.***



- Sealant bead thickness: 2 to 3 mm.

– Apply the silicone sealant on the clean sealing surface of the upper oil pan section as shown -arrows-.

– Apply the silicone sealant between the cylinder block and the lower timing chain cover as shown -arrows-.

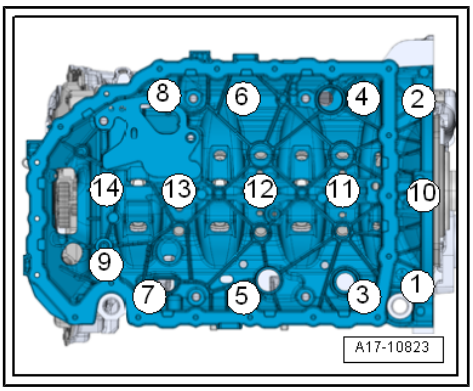


Note

- *The oil pan upper section must be installed within five minutes after applying the silicone sealant.*
- *The sealant bead may not be thicker than specified, otherwise excess sealant could enter the oil pan and clog the oil intake pipe screen.*

• On the transmission side, the oil pan upper section and the crankcase must align.

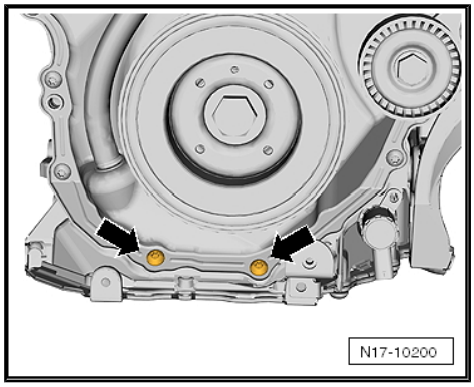
– Install the oil pan upper section immediately and tighten the bolts -1 to 14- in the sequence shown.



Step	Tightening Sequence and Tightening Specification
1. Bolts -1- through -14-	8 Nm
2. Bolts -1- and -2-	180° additional turn
3. Bolts -3- through -9-	45° additional turn
4. Bolt -10-	180° additional turn
5. Bolts -11- through -14-	Turn an additional 90°.

– Tighten the new bolts -arrows-.

Component	Tightening Specification
Bolts -arrows-	8 Nm +45°



– Install the rear sealing flange. Refer to ⇒ “2.3 Sealing Flange, Removing and Installing, Transmission Side”, page 54 .

– Install the oil pump. Refer to ⇒ “1.4 Oil Pump, Removing and Installing”, page 174 .

– Insert the new oil baffle and secure it.

– Install the oil pan lower section. Refer to ⇒ “1.3 Oil Pan Lower Section, Removing and Installing”, page 174 .

– Fill with engine oil and then check the level. Refer to ⇒ Maintenance ; Booklet 36.1 .

Tightening Specifications

♦ Refer to ⇒ “1.1 Overview - Oil Pan/Oil Pump”, page 171

1.6 Engine Oil

Oil Capacity:

Refer to ⇒ Fluid Capacity Tables; Rep. Gr. 03

Engine oil specification. Refer to the ⇒ Fluid Capacity Tables; Rep. Gr. 03 .

Replacing the engine oil. Refer to ⇒ Maintenance ; Booklet 36.1 .

Checking the Oil Level

Note

The oil level must not exceed the max. marking or the catalytic converter will be damaged.

Test Conditions

- The engine oil temperature must be at least 60 °C (140 °F).
- Vehicle must be at a level position.
- After stopping engine, wait a few minutes to allow oil to flow back into oil pan.

Test Sequence

– Pull out the oil dipstick, wipe off with a clean cloth and insert it all the way.

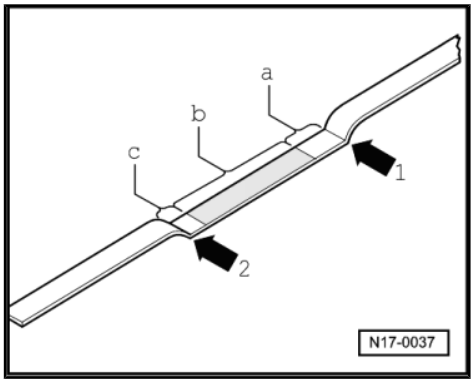
– Withdraw dipstick again and check the oil level.

Range of markings on dipstick:

a - Oil must not be added.

b - Oil may be added.

c - Oil must be added.

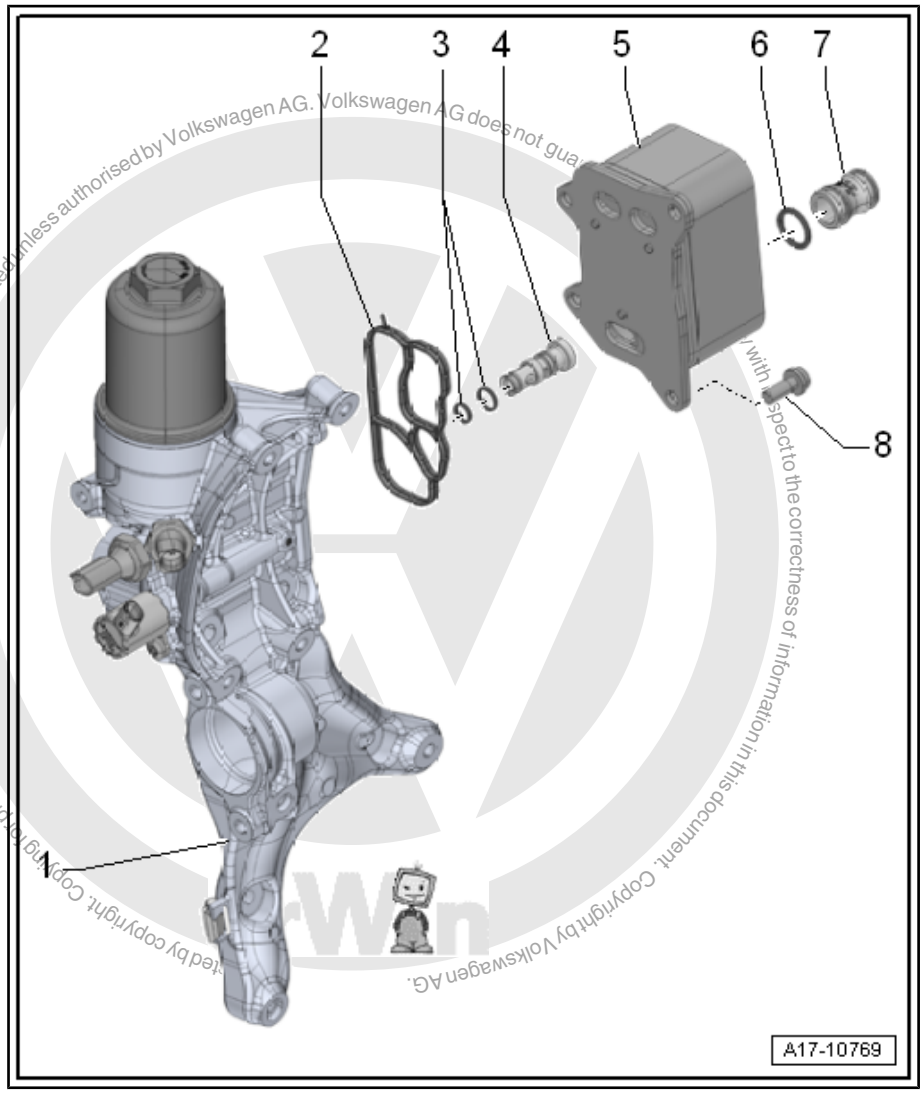


Note

Oil level must not exceed max. marking -arrow 1- and must not fall short of min. marking -arrow 2-.

2 Engine Oil Cooler

2.1 Overview - Engine Oil Cooler



1 - Sub-Assembly Bracket

- ❑ Removing and installing. Refer to ⇒ “1.4 Sub-Assembly Bracket, Removing and Installing”, page 42 .

2 - Seal

- ❑ Replace after removing

3 - O-Rings

- ❑ Replace after removing
- ❑ Coat with engine oil

4 - Mechanical Switch Valve

- ❑ Replacing. Refer to ⇒ “2.3 Mechanical Switch Valve, Removing and Installing”, page 183 .

5 - Engine Oil Cooler

- ❑ See note. Refer to ⇒ “1 Oil Pan/Oil Pump”, page 171 .
- ❑ Removing and installing. Refer to ⇒ “2.2 Engine Oil Cooler, Removing and Installing”, page 182 .

6 - Seal

- ❑ Replace after removing
- ❑ Coat with coolant

7 - Connection

8 - Bolt

- ❑ 8 Nm +45°
- ❑ Replace after removing

2.2 Engine Oil Cooler, Removing and Installing

Special tools and workshop equipment required

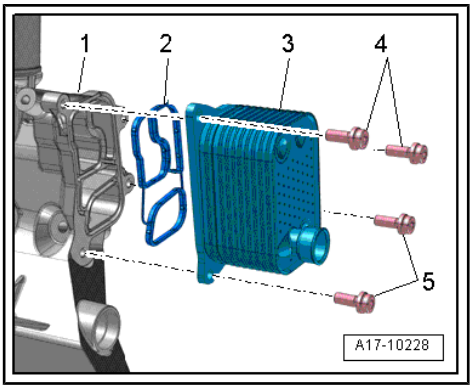
- ◆ Shop Crane - Drip Tray - VAS6208-

Removing

– Drain the coolant. Refer to ⇒ “1.2 Coolant, Draining and Filling”, page 201 .

– Remove the sub-assembly bracket. Refer to ⇒ “1.4 Sub-Assembly Bracket, Removing and Installing”, page 42 .

– Remove the bolts -4 and 5- and remove the engine oil cooler -3- together with the seal -2-.



Installing

Install in reverse order of removal and note the following:

Note

- *Replace the gaskets and seals.*
- *Secure all hose connections with standard production hose clamps. Refer to the Parts Catalog.*

– Install the engine oil cooler with a new seal.

– Install the sub-assembly bracket. Refer to ⇒ “1.4 Sub-Assembly Bracket, Removing and Installing”, page 42 .

– Fill with coolant. Refer to ⇒ page 202 .

– Fill with engine oil and then check the level. Refer to ⇒ Maintenance ; Booklet 36.1 .

Tightening Specifications

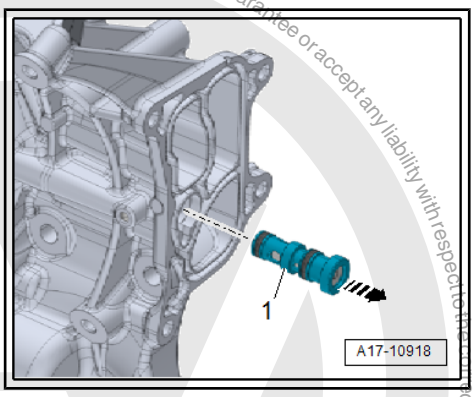
- Refer to ⇒ “2.1 Overview - Engine Oil Cooler”, page 182

2.3 Mechanical Switch Valve, Removing and Installing

Removing

– Remove the engine oil cooler. Refer to ⇒ “2.2 Engine Oil Cooler, Removing and Installing”, page 182 .

– Remove the mechanical switch valve -1- from the auxiliary components bracket -arrow-.



Installing

Install in reverse order of removal and note the following:

Note

- *Replace the gaskets and seals.*
- *Secure all hose connections with standard production hose clamps. Refer to the Parts Catalog.*

– Coat the mechanical switch valve O-rings with engine oil and install the switch valve.

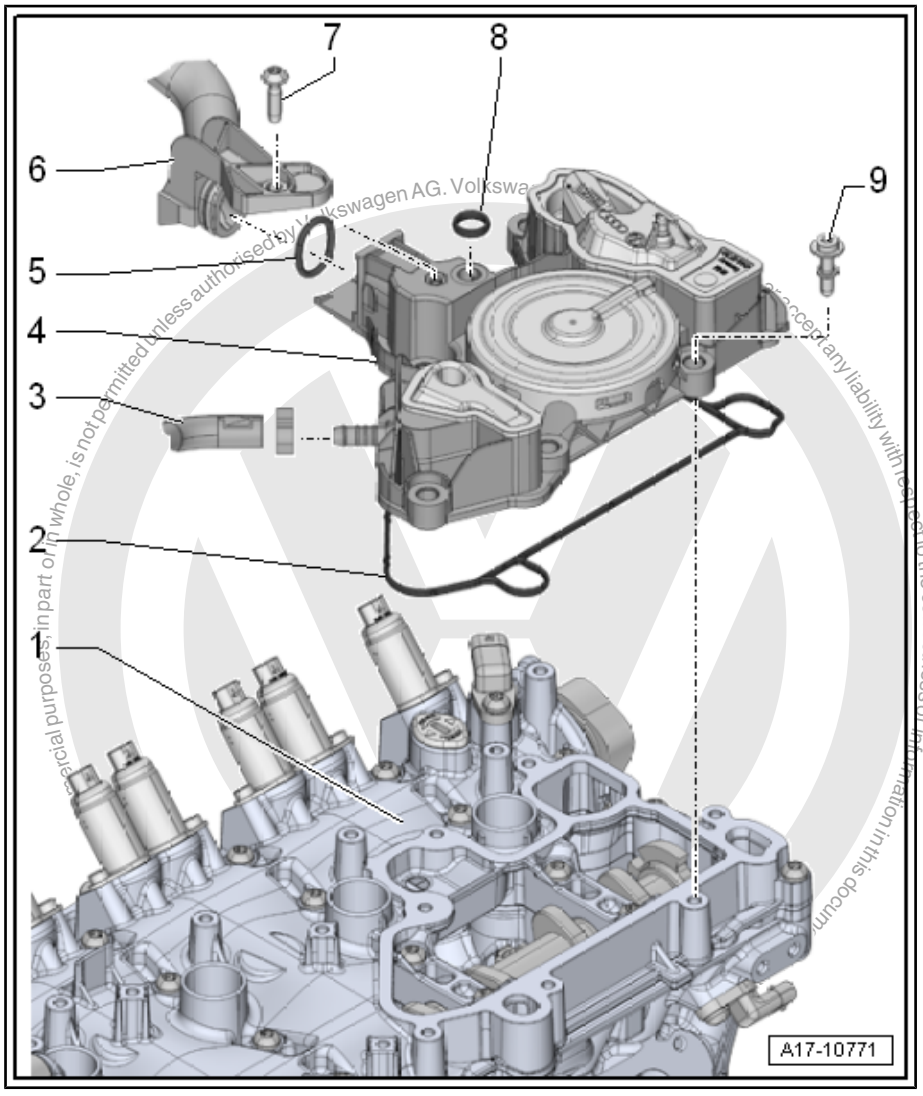
– Install the engine oil cooler. Refer to ⇒ “2.2 Engine Oil Cooler, Removing and Installing”, page 182 .

3 Crankcase Ventilation

⇒ “3.1 Overview - Crankcase Ventilation”, page 184

⇒ “3.2 Oil Separator, Removing and Installing”, page 185

3.1 Overview - Crankcase Ventilation



1 - Cylinder Head Cover

2 - Seal

- ❑ Replace after removing

3 - Hose

- ❑ To the EVAP Canister Purge Regulator Valve 1 - N80-

4 - Oil Separator

- ❑ Removing and installing. Refer to ⇒ “3.2 Oil Separator, Removing and Installing”, page 185 .

5 - Seal

- ❑ Replace after removing

6 - Hose

- ❑ For the crankcase ventilation
- ❑ To the turbocharger

7 - Bolt

- ❑ 4 Nm
- ❑ Self-tapping
- ❑ Position the bolt by hand and tighten it until it finds the old threads. Then tighten the bolt to the specification.

8 - Seal

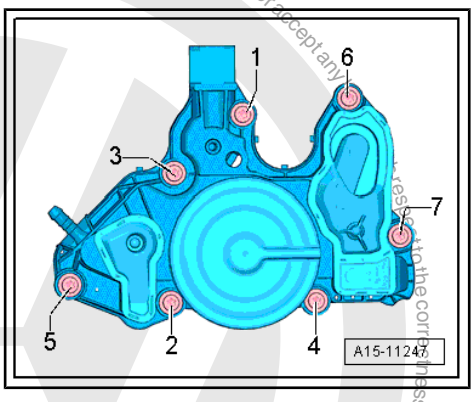
- ❑ Replace after removing

9 - Bolt

- ❑ 9 Nm
- ❑ Self-tapping
- ❑ Position the bolt by hand and tighten it until it finds the old threads. Then tighten the bolt to the specification.
- ❑ Tightening sequence. Refer to ⇒ Fig. ““Oil Separator - Tightening Sequence”“ , page 185

Oil Separator - Tightening Sequence

– Tighten the bolt in the following sequence: -1 to 7-.



3.2 Oil Separator, Removing and Installing

Removing

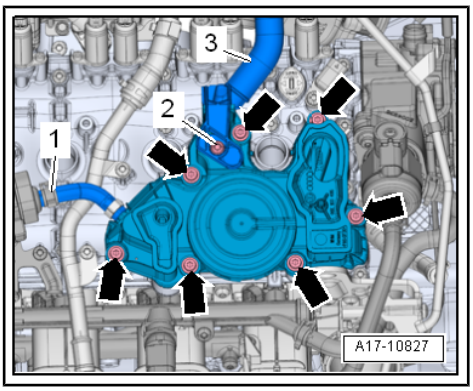
– Disconnect the ignition coil sensors connectors and remove them from the ignition coils at the same time.

– Remove the ignition coil bolts “3 and 4”, and remove the ignition coils.

– Loosen the hose clamp -1- and remove the hose from EVAP Canister Purge Regulator Valve 1 - N80- .

– Remove bolt -2- and then remove crankcase ventilation hose -3- from oil separator.

– Remove the bolts -arrows- and the oil separator.



Installing

Install in reverse order of removal and note the following:

Note

- *Always replace gasket and seals.*
- *Secure all hose connections with standard production hose clamps. Refer to the Parts Catalog.*

Tightening Specifications

- Refer to ⇒ “3.1 Overview - Crankcase Ventilation”, page 184

4 Oil Filter/Oil Pressure Switch

4.1 Overview - Oil Filter

1 - Sub-Assembly Bracket

- ❑ Removing and installing. Refer to ⇒ “1.4 Sub-Assembly Bracket, Removing and Installing”, page 42 .

2 - Seal

- ❑ Replace after removing

3 - Oil Filter

- ❑ Removing and installing. Refer to ⇒ Maintenance ; Booklet 36.1 .

4 - O-Ring

- ❑ Replace after removing
- ❑ Coat with engine oil

5 - Oil Filter Housing

- ❑ 25 Nm

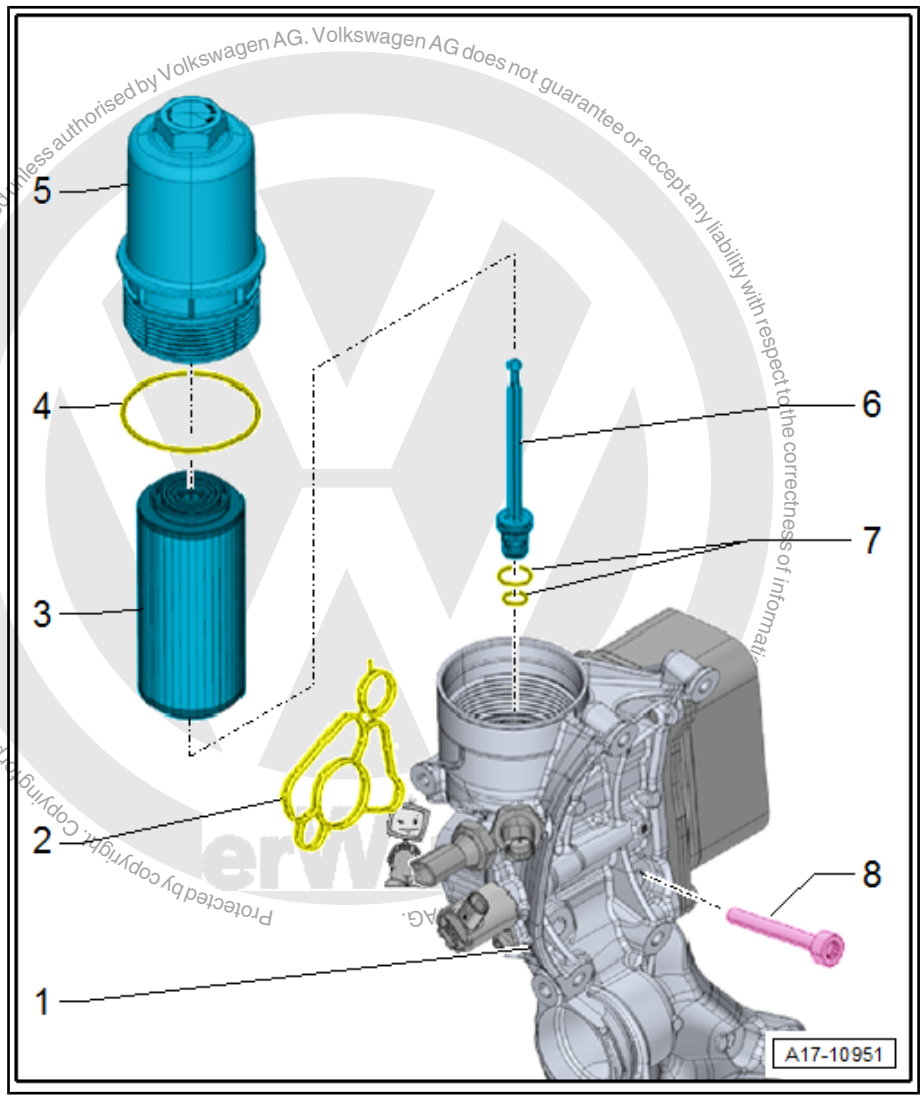
6 - Oil Drain Supports

7 - O-Rings

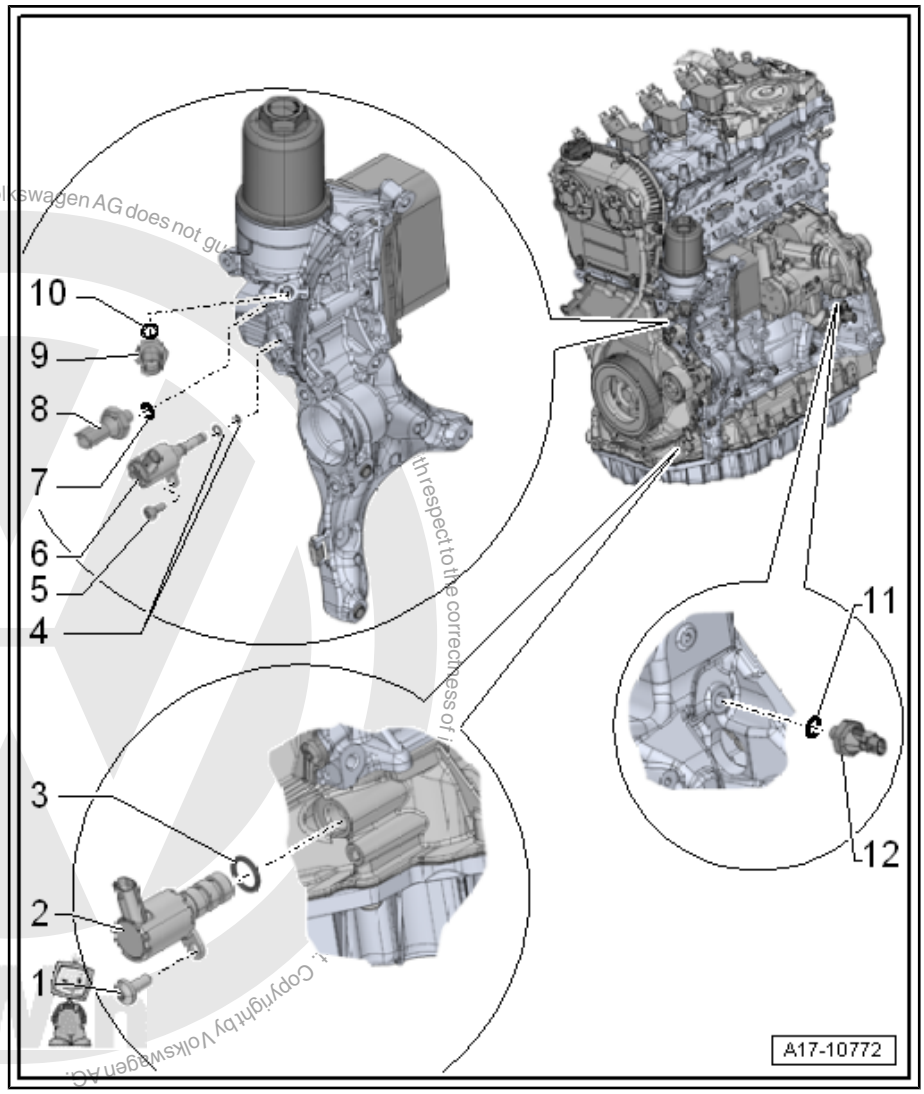
- ❑ No replacement part, part of the valve unit delivery package -item 6- ⇒ Item 6 (page 186)

8 - Bolt

- ❑ Tightening specification and sequence. Refer to ⇒ Fig. ““Accessory Assembly Bracket - Tightening Specifications and Tightening Sequence”“ , page 40 .



4.2 Overview - Oil Pressure Switch/Oil Pressure Regulation Valve



1 - Bolt

- ❑ 4 Nm +90°
- ❑ Replace after removing

2 - Oil Pressure Regulation Valve - N428-

- ❑ Removing and installing. Refer to ⇒ “4.4 Oil Pressure Regulation Valve N428 , Removing and Installing”, page 188 .

3 - O-Ring

- ❑ Replace after removing
- ❑ Coat with engine oil

4 - O-Rings

- ❑ Replace after removing
- ❑ Coat with engine oil

5 - Bolt

- ❑ 4 Nm +45°
- ❑ Replace after removing

6 - Piston Cooling Nozzle Control Valve - N522-

- ❑ Removing and installing. Refer to ⇒ “4.3 Piston Cooling Nozzle Control Valve N522 , Removing and Installing”, page 188 .

7 - Seal

8 - Oil Pressure Switch - F1-

- ❑ 20 Nm
- ❑ Blue or gray insulation
- ❑ Checking. Refer to Vehicle Diagnostic Tester .
- ❑ Removing and installing. Refer to ⇒ “4.5 Oil Pressure Switch F1 , Removing and Installing”, page 189 .

9 - Reduced Oil Pressure Switch - F378-

- ❑ 20 Nm
- ❑ Brown insulation
- ❑ Checking. Refer to Vehicle Diagnostic Tester .
- ❑ Removing and installing. Refer to ⇒ “4.6 Reduced Oil Pressure Switch F378 , Removing and Installing”, page 190 .

10 - Seal

11 - Seal

12 - Oil Pressure Switch, Level 3 - F447-

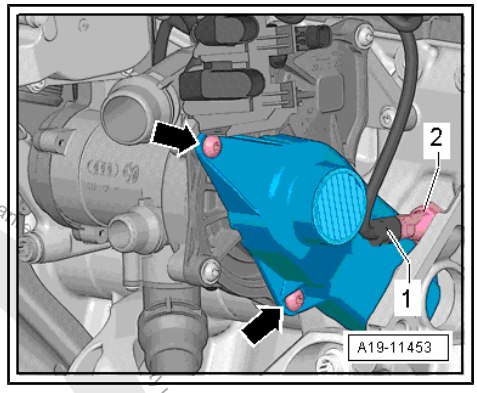
- ❑ 20 Nm
- ❑ Checking. Refer to Vehicle Diagnostic Tester .
- ❑ Removing and installing. Refer to ⇒ “4.7 Oil Pressure Switch, Level 3 F447 , Removing and Installing”, page 190 .

❑ Installation position. Refer to
⇒ Fig. “” Oil Pressure Switch, Level 3 -F447- Installation Position -2- ”“ , page 188

Note

Ignore arrows and 1

Oil Pressure Switch, Level 3 - F447- Installation Position -2-



4.3 Piston Cooling Nozzle Control Valve - N522- , Removing and Installing

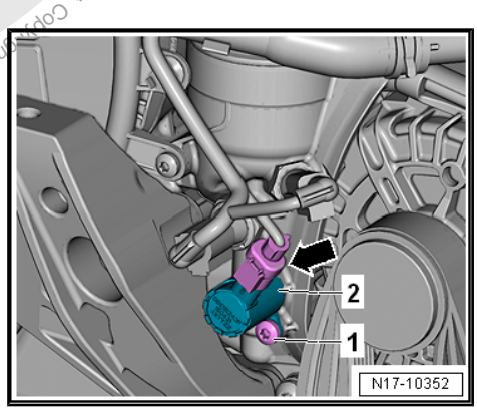
Removing

– Remove the upper section of the washer fluid reservoir. Refer to ⇒ Electrical Equipment; Rep. Gr. 92 ; Windshield Washer System; Windshield Washer Fluid Reservoir, Removing and Installing .

Note

Place a cloth under the accessory assembly bracket to collect leaking engine oil.

– Disconnect the connector -arrow- from the Piston Cooling Nozzle Control Valve - N522- .
– Remove the bolt -1- and remove the Piston Cooling Nozzle Control Valve - N522- -2-.



Installing

Install in reverse order of removal and note the following:

Note

- *Replace the O-rings.*
- *To prevent oil loss, insert the new Piston Cooling Nozzle Control Valve - N522- immediately in the opening.*

– Check the oil level. Refer to ⇒ Maintenance ; Booklet 36.1 .

Tightening Specifications

- Refer to
⇒ “4.2 Overview - Oil Pressure Switch/Oil Pressure Regulation Valve”, page 187

4.4 Oil Pressure Regulation Valve - N428- , Removing and Installing

Special tools and workshop equipment required

- Used Oil Collection and Extraction Unit - SMN372500-

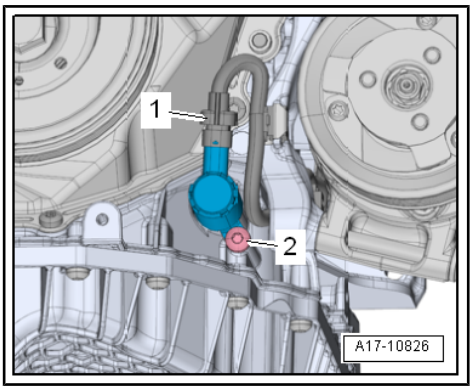
Removing

– Remove the ribbed belt. Refer to
⇒ “1.2 Ribbed Belt, Removing and Installing”, page 41 .

– Place the Used Oil Collection and Extraction Unit - SMN372500- under the engine.

– Disconnect the connector -1-.

– Remove the bolt -2- and the Oil Pressure Regulation Valve - N428- -3-.



Installing

Install in reverse order of removal and note the following:

Note

Replace the O-ring.

Tightening Specifications

- Refer to
⇒ “4.2 Overview - Oil Pressure Switch/Oil Pressure Regulation Valve”, page 187
- Refer to ⇒ Body Exterior; Rep. Gr. 66 ; Noise Insulation; Overview - Noise Insulation .

4.5 Oil Pressure Switch - F1- , Removing and Installing

Special tools and workshop equipment required

- Socket and Jointed Extension - 24mm - T40175-

Removing

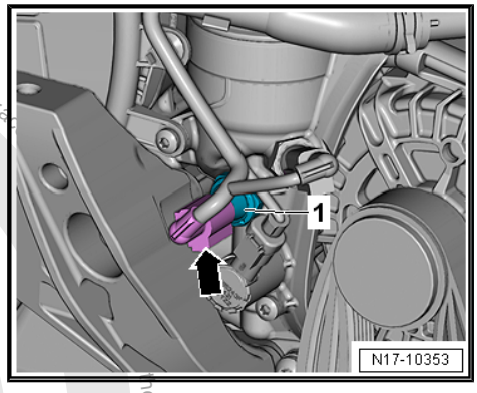
– Remove the upper section of the washer fluid reservoir. Refer to ⇒ Electrical Equipment; Rep. Gr. 92 ; Windshield Washer System; Windshield Washer Fluid Reservoir, Removing and Installing .

Note

- *Place a cloth under the accessory assembly bracket to collect leaking engine oil.*
- *The oil pressure switch must be replaced after removing, because the gasket cannot be replaced separately.*

– Disconnect the connector -arrow- from the Oil Pressure Switch - F1- .

– Remove the Oil Pressure Switch - F1- -1-.



Installing

Install in reverse order of removal and note the following:

Note

To prevent oil loss, attach the new Oil Pressure Switch - F1- immediately in the opening.

– Check the oil level. Refer to ⇒ Maintenance ; Booklet 36.1 .

Tightening Specifications

♦ Refer to
⇒ “4.2 Overview - Oil Pressure Switch/Oil Pressure Regulation Valve”, page 187

4.6 Reduced Oil Pressure Switch - F378- , Removing and Installing

Special tools and workshop equipment required

♦ Socket and Jointed Extension - 24mm - T40175-

Removing

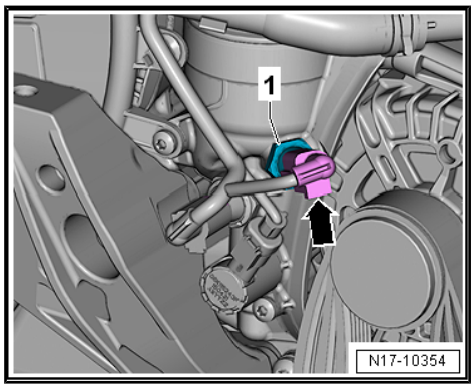
Note

♦ *Place a cloth under the accessory assembly bracket to collect leaking engine oil.*

♦ *The oil pressure switch must be replaced after removing, because the gasket cannot be replaced separately.*

– Disconnect the electrical connector -arrow- on the Reduced Oil Pressure Switch - F378- .

– Remove the Reduced Oil Pressure Switch - F378- -1-.



Installing

Install in reverse order of removal and note the following:

Note

Insert the new Reduced Oil Pressure Switch - F378- immediately to prevent losing any engine oil.

– Check the oil level. Refer to ⇒ Maintenance ; Booklet 36.1 .

Tightening Specifications

♦ Refer to
⇒ “4.2 Overview - Oil Pressure Switch/Oil Pressure Regulation Valve”, page 187

4.7 Oil Pressure Switch, Level 3 - F447- , Removing and Installing

Special tools and workshop equipment required

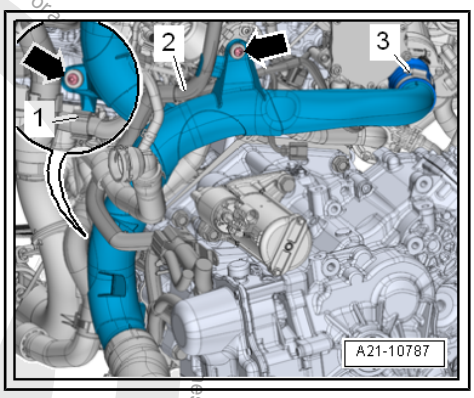
♦ Socket and Jointed Extension - 24mm - T40175-

Note

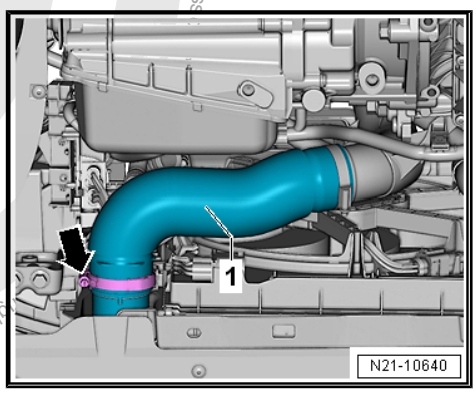
The oil pressure switch must be replaced after removing, because the gasket cannot be replaced separately.

Removing

- Remove the noise insulation. Refer to ⇒ Body Exterior; Rep. Gr. 66 ; Noise Insulation; Overview - Noise Insulation .
- Remove the air filter housing. Refer to ⇒ "2.2 Air Filter Housing, Removing and Installing", page 269 .
- Free up the wiring harness -1 and 2- from the air guide pipe.
- Loosen the screw-type clamp -3-.
- Remove the bolts -arrows-.



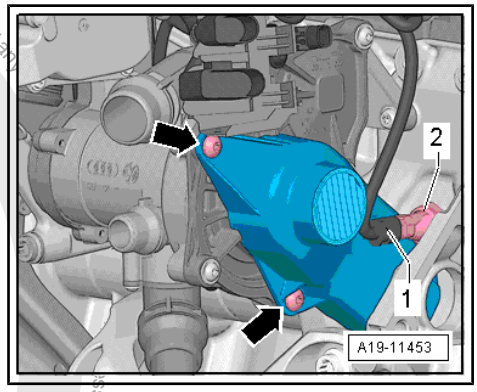
- Loosen the hose clamp -arrow- and remove the charge air hose -A- with the air guide pipe downward.
- Disconnect the connector -1- from the Oil Pressure Switch, Level 3 - F447- .
- Remove the bolts -arrows- and remove the toothed belt cover.



Note

Place a cleaning cloth underneath, to catch oil leaking out.

– Remove the Oil Pressure Switch, Level 3 - F447- -2- using the Socket and Jointed Extension - 24mm - T40175- .



Installing

Install in reverse order of removal and note the following:

Note

To prevent coolant loss, install the new Oil Pressure Switch, Level 3 - F447- in the hole immediately.

– Check the oil level. Refer to ⇒ Maintenance ; Booklet 36.1 .

Tightening Specifications

- Refer to ⇒ "4.2 Overview - Oil Pressure Switch/Oil Pressure Regulation Valve", page 187
- Refer to ⇒ "2.1 Overview - Air Filter Housing", page 268
- Refer to ⇒ Body Exterior; Rep. Gr. 66 ; Noise Insulation; Overview - Noise Insulation .

4.8 Oil Pressure, Checking

⇒ "4.8.1 Engine Oil Pressure, Checking", page 192

⇒ "4.8.2 Piston Spray Nozzles Oil Pressure, Checking", page 193

4.8.1 Engine Oil Pressure, Checking

Special tools and workshop equipment required

- Oil Pressure Gauge Kit - VAG1342-

Test Prerequisites

- Oil level OK
- The engine oil temperature at least 80 °C (176 °F) (the Radiator Fan must start up once).

Note

- *The oil pump is regulated and has two pressure stages. The pressure stages are checked one after the other.*
- *During the break-in phase or in engine emergency running mode the oil pump only pumps in the higher pressure stage.*
- *The oil pressure depends on the engine oil temperature. At an engine oil temperature of 80 °C (176 °F) approximately the average must be reached.*

Test Sequence

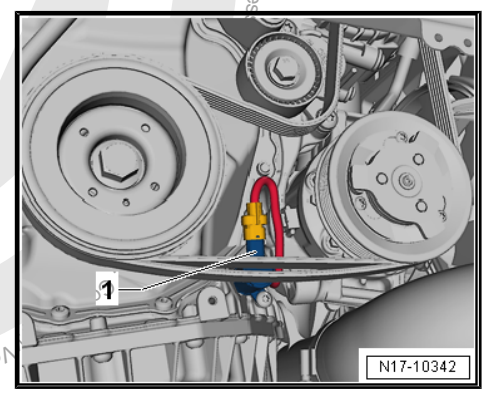
Note

- *Place a cloth under the accessory assembly bracket to collect leaking engine oil.*
- *The oil pressure switch must be replaced after removing, because the gasket cannot be replaced separately.*

– Remove the Reduced Oil Pressure Switch - F378- . Refer to ⇒ “4.6 Reduced Oil Pressure Switch F378 , Removing and Installing”, page 190 .
– Install the Oil Pressure Gauge Kit - VAG1342- into the oil filter bracket in place of the oil pressure switch.
– Install the Reduced Oil Pressure Switch - F378- in the Oil Pressure Gauge Kit - VAG1342- .
– Connect the Oil Pressure Tester to the ground.
– Start the engine and check the oil pressure of the specified RPMs.

- Oil pressure at idle: 0.85 to 1.6 bar (12.3 to 23.2 psi)
- Oil pressure at 2000 RPM: 1.2 to 1.6 bar (17.4 to 23.2 psi)
- Oil pressure at 3700 RPM: 1.2 to 1.6 bar (17.4 to 23.2 psi)

– Turn off the engine.
– Remove the noise insulation. Refer to ⇒ Body Exterior; Rep. Gr. 66 ; Noise Insulation; Overview - Noise Insulation .
– Disconnect the connector -1- from the Oil Pressure Regulation Valve - N428- . Unclip the cable and route downward so that is not in the belt drive unit. With the connector removed the oil pump only pumps in the higher pressure stage.



– Start the engine and check the oil pressure of the specified RPMs.

- Oil pressure at idle: 0.85 to 4.0 bar (12.3 to 43 psi)
- Oil pressure at 2000 RPM: 2.0 to 4.0 bar (29 to 43 psi)
- Oil pressure at 3,700 RPM: 3.0 to 4.0 bar (43.5 to 58 psi)

Assembling

– Install the oil pressure switch.
– Connect the connector to the Oil Pressure Regulation Valve - N428- . Carefully route the cable.
– Install the noise insulation. Refer to ⇒ Body Exterior; Rep. Gr. 66 ; Noise Insulation; Overview - Noise Insulation .
– Check the engine control module DTC memory and delete all entries. Refer to Vehicle Diagnostic Tester .

Tightening Specifications

◆ Refer to ⇒ “4.2 Overview - Oil Pressure Switch/Oil Pressure Regulation Valve”, page 187

4.8.2 Piston Spray Nozzles Oil Pressure, Checking

Special tools and workshop equipment required

◆ Oil Pressure Gauge Kit - VAG1342-
◆ Vehicle Diagnostic Tester - Test Adapter - 2+3 Pin - VAS5571-

Test Prerequisites

- Oil level OK
- The engine oil temperature at least 80 °C (176 °F) (the Radiator Fan must start up once).

Test Sequence

– Remove the Oil Pressure Switch, Level 3 - F447- . Refer to ⇒ “4.7 Oil Pressure Switch, Level 3 F447 , Removing and Installing”, page 190 .

– Install the Oil Pressure Switch, Level 3 - F447- in the Oil Pressure Gauge Kit - VAG1342- .

– Install the Oil Pressure Gauge Kit - VAG1342- in place of the oil pressure switch.

– Connect the Vehicle Diagnostic Tester - Test Adapter - 2+3 Pin - VAS5571- to the oil pressure switch.

– Connect the Oil Pressure Switch, Level 3 - F447- connector to Vehicle Diagnostic Tester - Test Adapter - 2+3 Pin - VAS5571- .

– Check the oil pressure through `Oil Pressure Switch, Level 3 - F447`. Refer to Vehicle Diagnostic Tester .

Assembling

– Install the oil pressure switch.

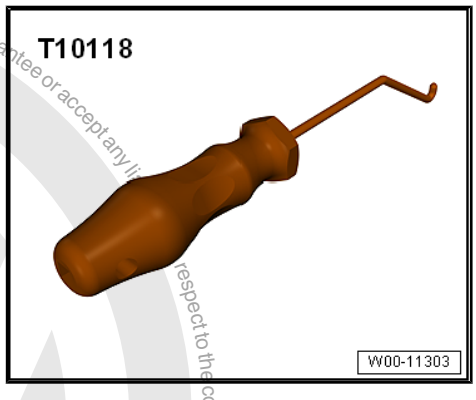
Tightening Specifications

♦ Refer to ⇒ “4.2 Overview - Oil Pressure Switch/Oil Pressure Regulation Valve”, page 187

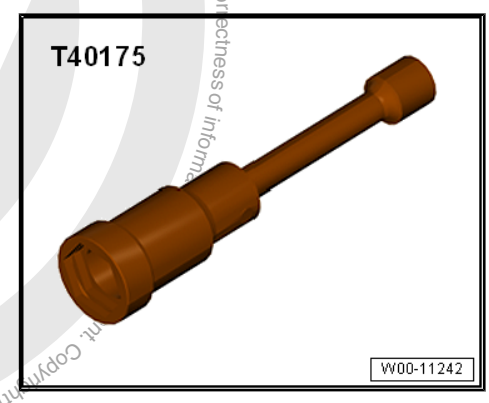
5 Special Tools

Special tools and workshop equipment required

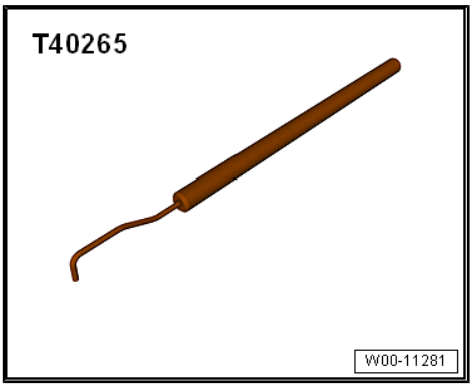
- Elbow Assembly Tool - T10118-



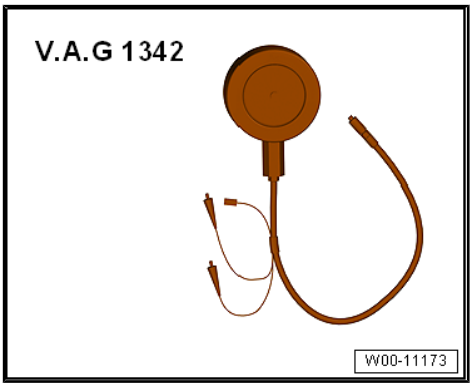
- Socket and Jointed Extension - 24mm - T40175-



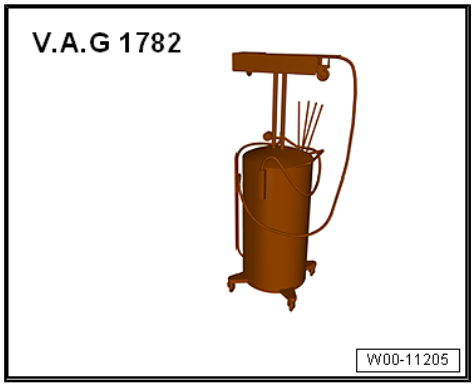
- Chain Tensioner Locking Tool - T40265-



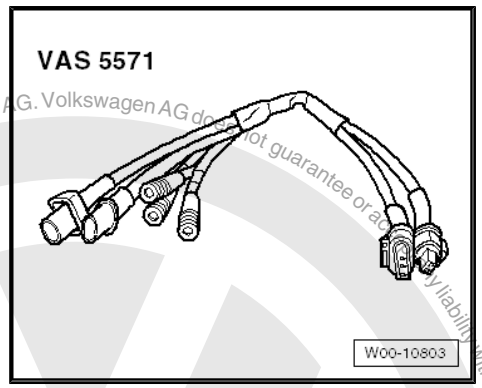
- Oil Pressure Gauge Kit - VAG1342-



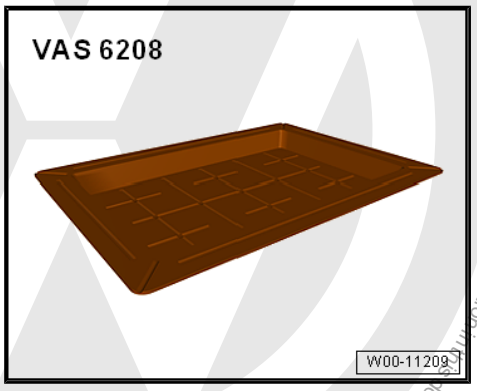
- Used Oil Collection and Extraction Unit - SMN372500-



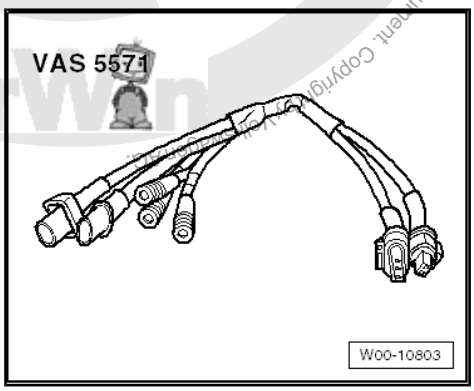
- Vehicle Diagnostic Tester - Test Adapter - 2+3 Pin - VAS5571-



- Shop Crane - Drip Tray - VAS6208-



- Vehicle Diagnostic Tester - Test Adapter - 2+3 Pin - VAS5571-



- Not Illustrated:
- Hand Drill with Plastic Brush Attachment
- Protective Eyewear
- Silicone grease. Refer to the Parts Catalog.

19 – Cooling System

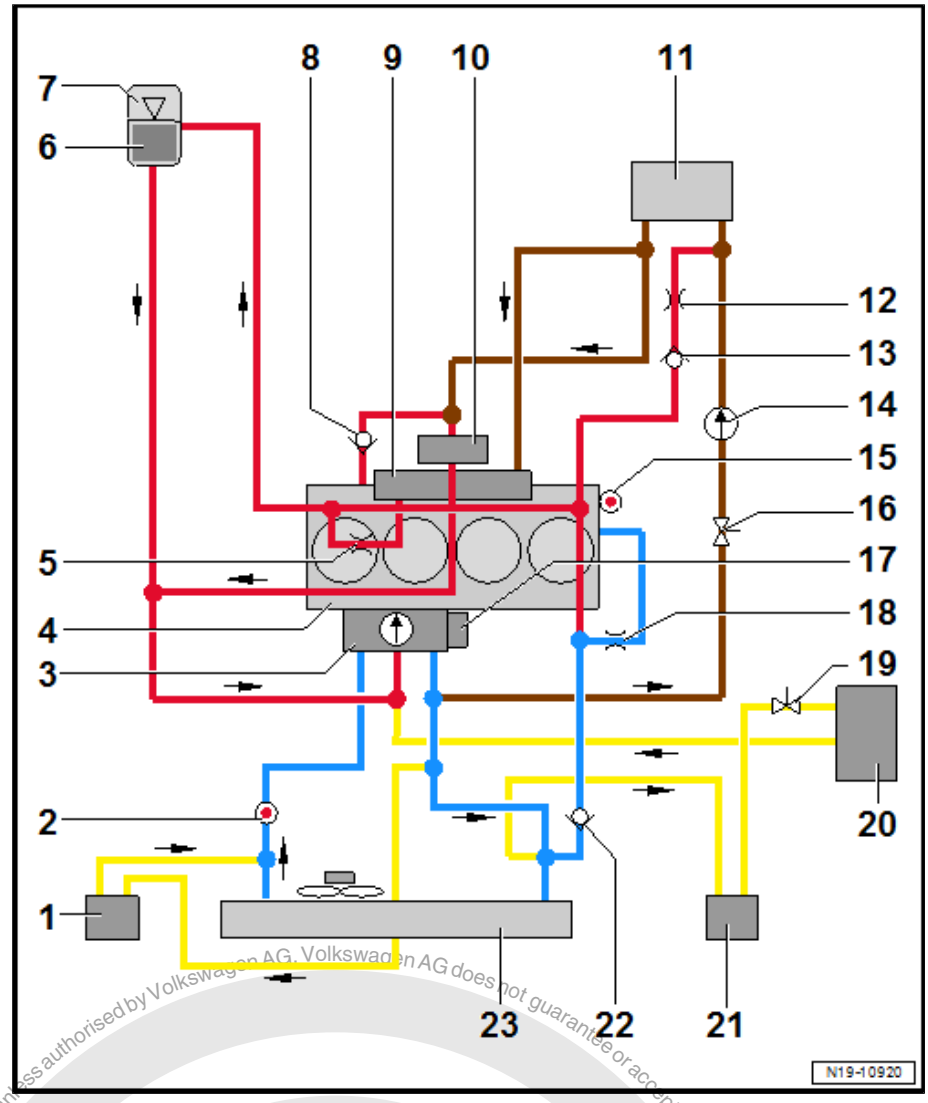
1 Coolant System/Coolant

1.1 Connection Diagram - Coolant Hoses

1.1.1 Vehicles with DSG® Transmission

Note

- *Blue = large coolant circuit.*
- *Red = small coolant circuit.*
- *Brown = heating circuit*
- *Yellow = transmission fluid cooler*
- *The arrows show the coolant flow direction.*



1 - Auxiliary Cooler

- ❑ Installed location: inside the right front wheel housing
- ❑ Overview. Refer to ⇒ “4.3 Overview - Auxiliary Cooler”, page 232 .
- ❑ Removing and installing. Refer to ⇒ “4.5 Auxiliary Cooler, Removing and Installing”, page 235 .

2 - Engine Coolant Temperature Sensor on Radiator Outlet - G83-

- ❑ Overview. Refer to ⇒ “2.3 Overview - Engine Coolant Temperature Sensor”, page 213 .
- ❑ Removing and installing. Refer to ⇒ “2.11 Engine Coolant Temperature Sensor on Radiator Outlet G83 , Removing and Installing”, page 223 .

3 - Engine Temperature Control Actuator - N493-

4 - Cylinder Head/Cylinder Block

- ❑ Change the coolant after replacing
- ❑ Overview. Refer to ⇒ “3.1 Overview - Cylinder Head”, page 112 .
- ❑ Removing and installing. Refer to ⇒ “3.2 Cylinder Head, Removing and Installing”, page 114 .

5 - Restrictor

6 - Coolant Expansion Tank

7 - Coolant Reservoir Cap

- ❑ Checking the pressure relief valve. Refer to ⇒ page 206 .

8 - Check Valve

9 - Exhaust Manifold

10 - Turbocharger

- ❑ Overview. Refer to ⇒ “1.1 Overview - Turbocharger”, page 243 .
- ❑ Removing and installing. Refer to ⇒ “1.2 Turbocharger, Removing and Installing”, page 245 .

11 - Heater Core for the Heater

- ❑ Change the coolant after replacing

12 - Restrictor

13 - Check Valve

14 - After-Run Coolant Pump - V51-

- ❑ Overview. Refer to ⇒ “2.2 Overview - Electric Coolant Pump”, page 211 .
- ❑ Removing and installing. Refer to ⇒ “2.6 After-Run Coolant Pump V51 , Removing and Installing”, page 217 .

15 - Engine Coolant Temperature Sensor - G62-

- ❑ Overview. Refer to ⇒ “2.3 Overview - Engine Coolant Temperature Sensor”, page 213 .
- ❑ Removing and installing. Refer to ⇒ “2.10 Engine Coolant Temperature Sensor G62 , Removing and Installing”, page 222 .

16 - Coolant Shut-Off Valve - N82-

- ❑ Overview. Refer to ⇒ “2.2 Overview - Electric Coolant Pump”, page 211 .
- ❑ Removing and installing. Refer to ⇒ “2.7 Coolant Shut-Off Valve N82 , Removing and Installing”, page 218 .

17 - Coolant Pump

- ❑ Overview. Refer to ⇒ “2.1 Overview - Coolant Pump/Thermostat”, page 208 .
- ❑ Removing and installing. Refer to ⇒ “2.5 Coolant Pump, Removing and Installing”, page 215 .

18 - Restrictor

19 - Coolant Shut-Off Valve - N82-

20 - Transmission Fluid Cooler

21 - Auxiliary Cooler

- ❑ Installed location: inside the left front wheel housing
- ❑ Overview. Refer to ⇒ “4.3 Overview - Auxiliary Cooler”, page 232 .
- ❑ Removing and installing. Refer to ⇒ “4.5 Auxiliary Cooler, Removing and Installing”, page 235 .

22 - Check Valve

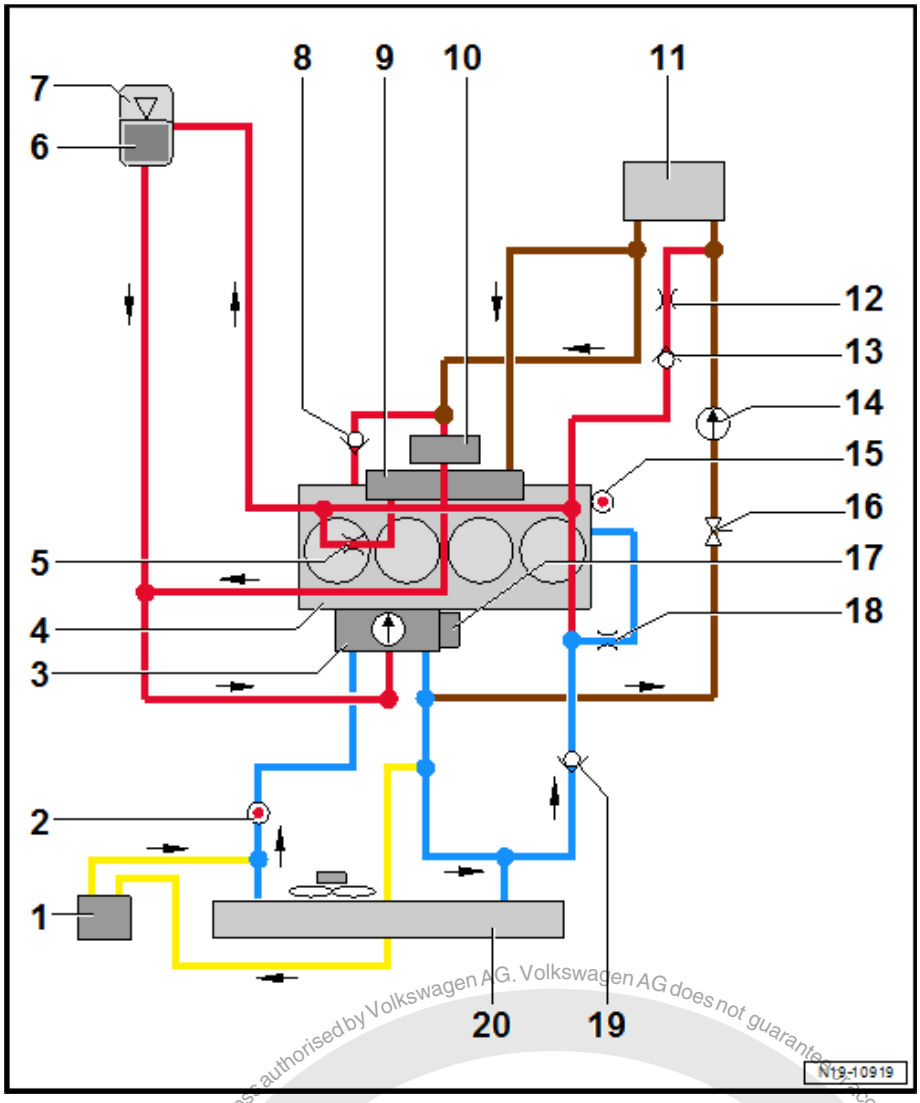
23 - Radiator

- ❑ Change the coolant after replacing
- ❑ Overview. Refer to ⇒ “4.1 Overview - Radiator/Radiator Fan”, page 230 .
- ❑ Removing and installing. Refer to ⇒ “4.4 Radiator, Removing and Installing”, page 233 .

1.1.2 Vehicles with Manual Transmission

Note

- *Blue = large coolant circuit.*
- *Red = small coolant circuit.*
- *Brown = heating circuit*
- *Yellow = transmission fluid cooler*
- *The arrows show the coolant flow direction.*



1 - Auxiliary Cooler

- ❑ Installed location: inside the right front wheel housing
- ❑ Overview. Refer to ⇒ “4.3 Overview - Auxiliary Cooler”, page 232 .
- ❑ Removing and installing. Refer to ⇒ “4.5 Auxiliary Cooler, Removing and Installing”, page 235 .

2 - Engine Coolant Temperature Sensor on Radiator Outlet - G83-

- ❑ Overview. Refer to ⇒ “2.3 Overview - Engine Coolant Temperature Sensor”, page 213 .
- ❑ Removing and installing. Refer to ⇒ “2.11 Engine Coolant Temperature Sensor on Radiator Outlet G83 , Removing and Installing”, page 223 .

3 - Engine Temperature Control Actuator - N493-

4 - Cylinder Head/Cylinder Block

- ❑ Change the coolant after replacing
- ❑ Overview. Refer to ⇒ “3.1 Overview - Cylinder Head”, page 112 .
- ❑ Removing and installing. Refer to ⇒ “3.2 Cylinder Head, Removing and Installing”, page 114 .

5 - Restrictor

6 - Coolant Expansion Tank

7 - Coolant Reservoir Cap

- ❑ Checking the pressure relief valve. Refer to ⇒ page 206 .

8 - Check Valve

9 - Exhaust Manifold

10 - Turbocharger

- ❑ Overview. Refer to ⇒ “1.1 Overview - Turbocharger”, page 243 .
- ❑ Removing and installing. Refer to ⇒ “1.2 Turbocharger, Removing and Installing”, page 245 .

11 - Heater Core for the Heater

- ❑ Change the coolant after replacing

12 - Restrictor

13 - Check Valve

14 - After-Run Coolant Pump - V51-

- ❑ Overview. Refer to ⇒ “2.2 Overview - Electric Coolant Pump”, page 211 .
- ❑ Removing and installing. Refer to ⇒ “2.6 After-Run Coolant Pump V51 , Removing and Installing”, page 217 .

15 - Engine Coolant Temperature Sensor - G62-

- ❑ Overview. Refer to ⇒ “2.3 Overview - Engine Coolant Temperature Sensor”, page 213 .
- ❑ Removing and installing. Refer to ⇒ “2.10 Engine Coolant Temperature Sensor G62 , Removing and Installing”, page 222 .

16 - Coolant Shut-Off Valve - N82-

- ❑ Overview. Refer to ⇒ “2.2 Overview - Electric Coolant Pump”, page 211 .
- ❑ Removing and installing. Refer to ⇒ “2.7 Coolant Shut-Off Valve N82 , Removing and Installing”, page 218 .

17 - Coolant Pump

- ❑ Overview. Refer to ⇒ “2.1 Overview - Coolant Pump/Thermostat”, page 208 .
- ❑ Removing and installing. Refer to ⇒ “2.5 Coolant Pump, Removing and Installing”, page 215 .

18 - Restrictor

19 - Check Valve

20 - Radiator

- ❑ Change the coolant after replacing
- ❑ Overview. Refer to ⇒ “4.1 Overview - Radiator/Radiator Fan”, page 230 .
- ❑ Removing and installing. Refer to ⇒ “4.4 Radiator, Removing and Installing”, page 233 .

1.2 Coolant, Draining and Filling

Special tools and workshop equipment required

- ♦ Refractometer - T10007A-
- ♦ Shop Crane - Drip Tray - VAS6208-
- ♦ Hose Clip Pliers - VAS6340-
- ♦ Cooling System Charge Kit - VAS6096-
- ♦ Cooling System Tester - Adapter - VAG1274/8-

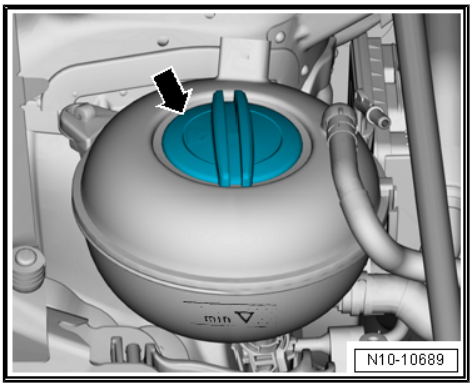
Draining

> **WARNING**
>
> ***The coolant system is under pressure when the engine is warm.***
>
> ***Risk of scalding due to hot steam and hot coolant.***
>
> ***Reduce pressure by covering the coolant reservoir cap with a cloth and carefully opening.***

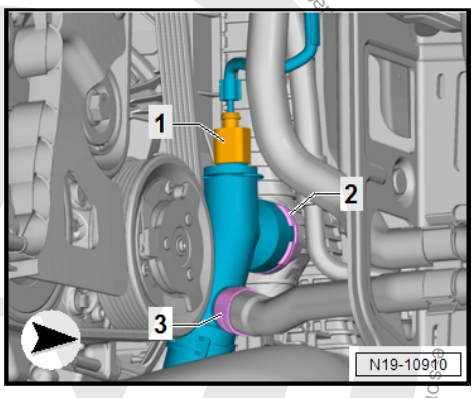
– Open the coolant reservoir cap -arrow-.

– Remove the noise insulation. Refer to ⇒ Body Exterior; Rep. Gr. 66 ; Noise Insulation; Overview - Noise Insulation .

– Place the Shop Crane - Drip Tray - VAS6208- underneath.

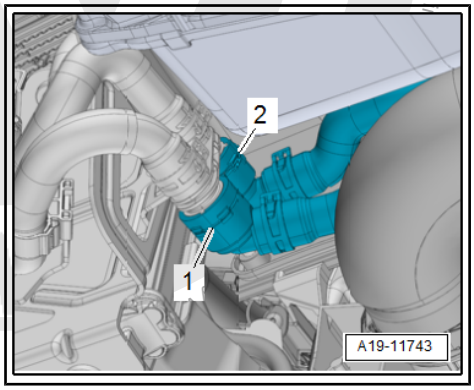


– Lift up the clamp -2-, remove the connection and let the coolant drain.



Vehicles with DSG Transmission:

– Also release the clamps -1 and 2-. Disconnect the coolant hoses to the coolant auxiliary cooler on the left and let the coolant drain.

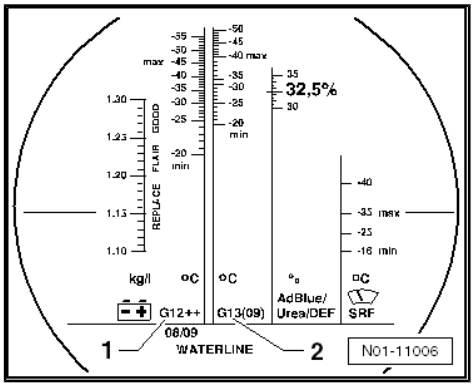


Continuation for All:

Filling

Caution

Only mix distilled water with coolant additives. Using distilled water provides optimum corrosion protection.



Note

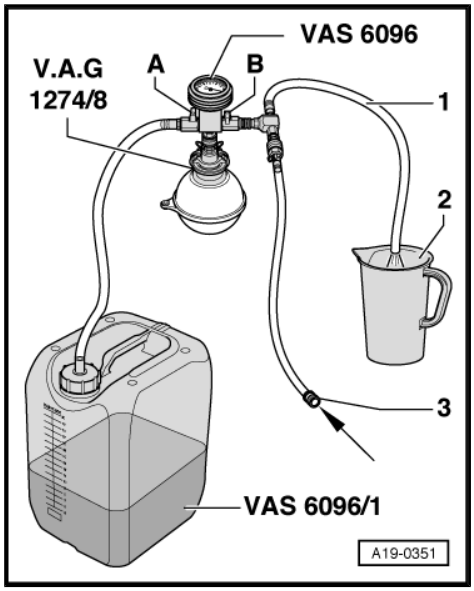
- *The mixture of the water used greatly influences the effectiveness of the coolant. The water quality to be used is based on the contents, which can be specific to a country or even a region. Distilled water fulfills all requirements. For this reason, use distilled water when adding coolant or filling coolant for the first time.*
- *Use only coolant additives listed. Refer to the Parts Catalog. Other coolant additives may above all reduce the corrosion protection effect significantly. The damage resulting from this may lead to loss of coolant and consequently to severe engine damage.*
- *Coolant with the correct mixture ratio prevents freezing and corrosion damage and calcium deposits. Additionally, the boiling temperature will be raised. For this reason the cooling system must be filled with coolant additive year-round.*
- *Because of its high boiling point, the coolant contributes to engine reliability under heavy engine loads, particularly in countries with tropical climates.*
- *The Refractometer - T10007A- MUST be used to determine the current freeze protection value.*
- *Protection against frost must be assured down to minimum -25 °C (-13 °F) (in arctic climatic countries down to approximately -36 °C (-32.8 °F)). The freeze protection may only be increased, when stronger freeze protection is needed due to the climate. But only down to -48 °C (-54 °F), otherwise the effectiveness of the coolant decreases.*
- *The coolant concentration must not be reduced by adding water even in warmer seasons and in warmer countries. The frost protection must be at least -25 °C (-13 °F).*
- *Read the freeze protection value on the scale for the coolant additive that has been added.*
- *The temperature on the Refractometer - T10007A- corresponds to the »freezing point«. At this temperature, ice crystals may begin to form in the coolant.*
- *Do not reuse coolant.*
- *Only use water/coolant additive to lubricate the coolant hoses.*

Coolant Mixture Ratio

- Coolant (40%) and distilled water (60%) for freeze protection down to -25 ºC (-13 °F)
- Coolant (50%) and distilled water (50%) for freeze protection down to -36 ºC (-32.8 °F)
- Coolant. Refer to the Parts Catalog.

– Reconnect the coolant hoses.

– Fill the Cooling System Charge Kit - VAS6096- with 10 liters (10.56 quarts) of coolant in the correct mixture ratio, mixture ratio. Refer to ⇒ page 203 .
– Install the Cooling System Tester - Adapter - VAG1274/8- on the coolant expansion tank.
– Secure the Cooling System Charge Kit - VAS6096- on the adapter -VAG1274/8- .
– Place the drain hose -1- in a small container -2-.

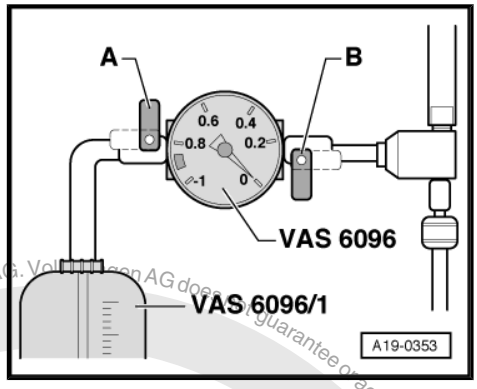


Note

A small amount of coolant which should be collected is drawn off with the discharged air.

– Close valves -A and B- by turning lever at a right angle to the flow direction.
– Connect the hose -3- to compressed air.
• Pressure: 6 to 10 bar (87 to 145 psi) positive pressure.
– Connect the Vehicle Diagnostic Tester .
– Turn on the ignition and select the following menu items. Refer to Vehicle Diagnostic Tester :

♦ `Guided functions`
♦ `01 - Engine electronics`
♦ `01 - Cooling system filling/bleeding`



– Open the valve -B- by turning the lever in the flow direction.

• A further vacuum is created in the cooling system by the suction jet pump. The needle on the instrument display must travel into the green region.

– Briefly open valve -A- by turning lever in direction of flow so that the coolant expansion tank hose on the Cooling System Charge Kit - VAS6096- fills with coolant.

– Close the valve -A- again.

– Leave the valve -B- open another two minutes.

• A further vacuum is created in the cooling system by the suction jet pump. Needle on the instrument display must still remain in the green region.

– Close the valve -B-.

– Remove the pressure hose.

• The needle on display must remain in the green range. Only then is there enough vacuum in the coolant system for the filling.

Note

♦ *Repeat the procedure if the needle goes below the green range.*

♦ *Check the cooling system for leak if the pressure drops.*

– Open the valve -A- slowly.

• Coolant is extracted from the Cooling System Charge Kit - VAS6096- coolant expansion tank due to a vacuum in the coolant system and the system is filled.

– Remove the Cooling System Charge Kit - VAS6096- from the coolant reservoir.

– Fill the coolant to the MAX marking.

– Install the noise insulation. Refer to ⇒ Body Exterior; Rep. Gr. 66 ; Noise Insulation; Overview - Noise Insulation .

– If the vehicle has a parking heater, switch it on for about 30 seconds.

– Set the temperature at “HI”.

– Press the AC button to turn off the A/C compressor.

• The LED in the button must not come on.

– Start the engine and run it at approximately 1500 RPM for a maximum of two minutes.

– With engine running, fill coolant up to overflow hole on coolant expansion tank.

– Close the coolant reservoir cap until it locks into place.

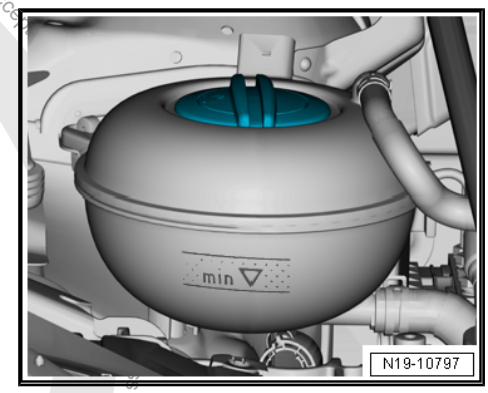
– Let the engine run at idle until both large coolant hoses on the radiator are warm.

– Turn off engine and allow it to cool off.

– Check the coolant level.

- The coolant level must be between the min mark and the max markings when the engine is cold.
- Coolant level may be at the MAX marking with engine at operating temperature.

– Add more coolant if necessary.



1.3 Coolant System, Checking for Leaks

Special tools and workshop equipment required

- ♦ Cooling System Tester - Adapter - VAG1274/8-
- ♦ Cooling System Tester - Adapter - VAG1274/9-
- ♦ Cooling System Tester - VAG1274B-

Procedure

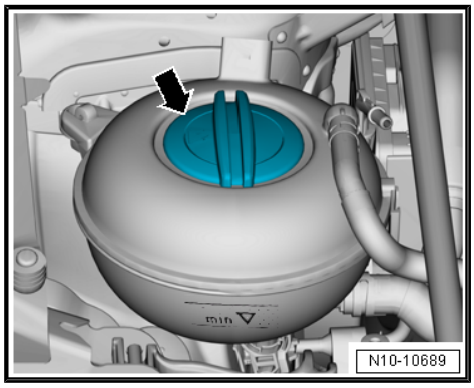
- Engine at operating temperature.

WARNING

The coolant system is under pressure when the engine is warm.

Risk of scalding due to hot steam and hot coolant.

Reduce pressure by covering the coolant reservoir cap with a cloth and carefully opening.



– Open the coolant reservoir cap -arrow-.

– Position the Cooling System Tester - VAG1274B- with the Cooling System Tester - Adapter - VAG1274/8- on the coolant reservoir.

– Generate approximately 1 bar (14.5 psi) pressure using the cooling system tester hand pump.

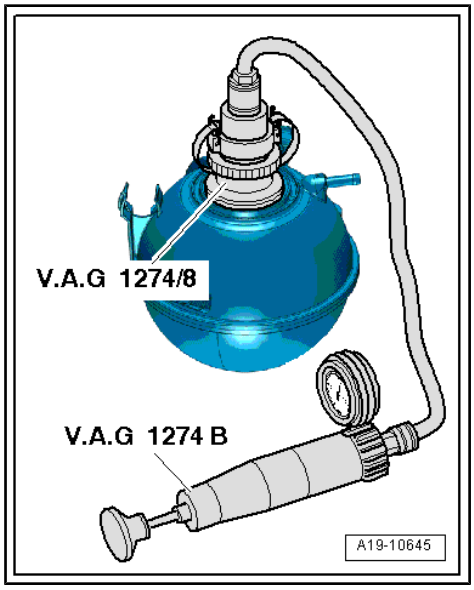
– If the pressure falls, search for leaks and correct the problem.

Pressure Relief Valve in Cap, Checking

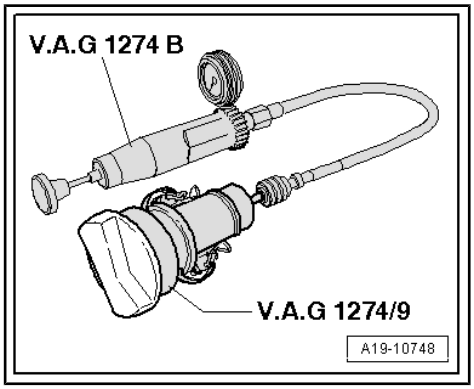
– Position the Cooling System Tester - VAG1274B- with the Cooling System Tester - Adapter - VAG1274/9- on the cap.

– Generate pressure with the cooling system tester hand pump.

- The pressure release valve must open at 1.6 to 1.8 bar (23.2 to 26.1 psi).

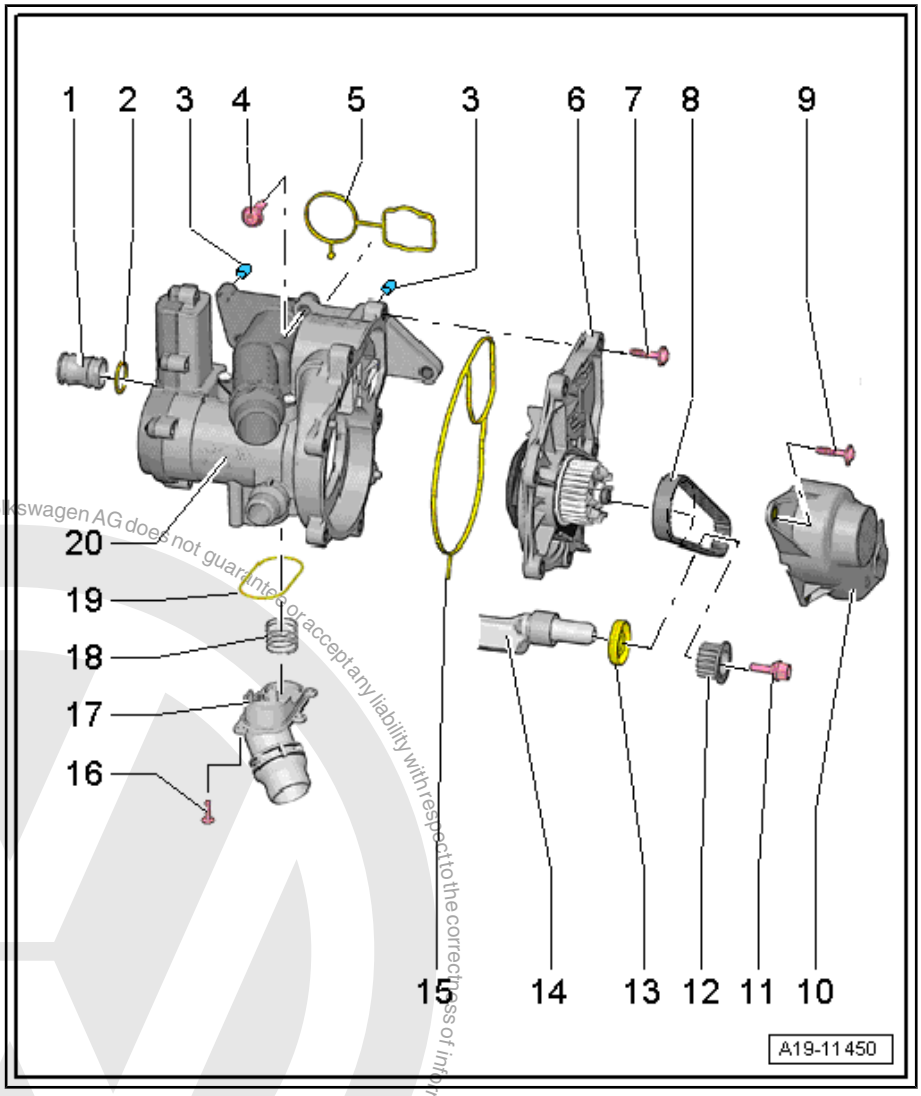


– If pressure relief valve does not open as specified, replace the cap.



2 Coolant Pump/Thermostat

2.1 Overview - Coolant Pump/Thermostat



1 - Connection

2 - O-Ring

- ❑ Replace after removing
- ❑ Coat with coolant

3 - Centering Pin

4 - Bolt

- ❑ 9 Nm
- ❑ Note the tightening sequence. Refer to ⇒ Fig. ““ Engine Temperature Control Actuator -N493- - Tightening Sequence”“ , page 210 .

5 - Seal

- ❑ Replace after removing

6 - Coolant Pump

- ❑ For a new coolant pump, remove the protective cap
- ❑ Removing and installing. Refer to ⇒ “2.5 Coolant Pump, Removing and Installing”, page 215 .

7 - Bolt

- ❑ 9 Nm
- ❑ Note the tightening sequence. Refer to ⇒ Fig. ““Coolant Pump - Tightening Sequence”“ , page 210

8 - Toothed Belt

- ❑ For the coolant pump
- ❑ Removing and installing. Refer to ⇒ “2.4 Coolant Pump Toothed Belt, Removing and Installing”, page 213 .

9 - Bolt

- ❑ 9 Nm

10 - Toothed Belt Guard

11 - Bolt

- ❑ 10 Nm +90°
- ❑ Replace after removing
- ❑ Left-hand thread

12 - Toothed Belt Drive Gear

- ❑ Note the installation position

13 - Balance Shaft Seal Intake Side

- ❑ Replacing. Refer to ⇒ “4.3 Balance Shaft Sealing Ring, Replacing, Intake Side”, page 70 .

14 - Balance Shaft

15 - Seal

- ❑ Replace after removing

16 - Bolt

- ❑ 9 Nm

17 - Connection

18 - Spring

19 - Seal

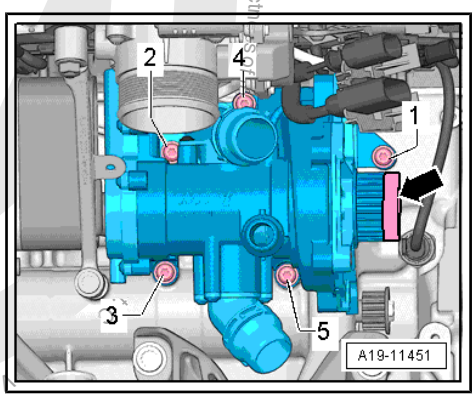
- ❑ Replace after removing

20 - Engine Temperature Control Actuator - N493-

- ❑ Removing and installing. Refer to ⇒ “2.9 Engine Temperature Control Actuator N493 , Removing and Installing”, page 220 .

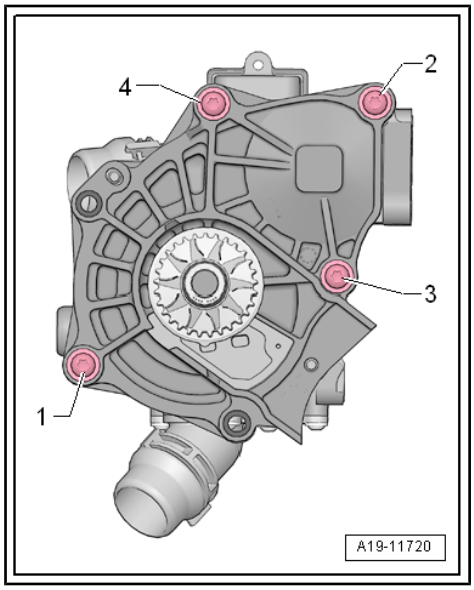
Engine Temperature Control Actuator - N493- - Tightening Sequence

– Tighten the bolt in the following sequence: -1 to 5-.

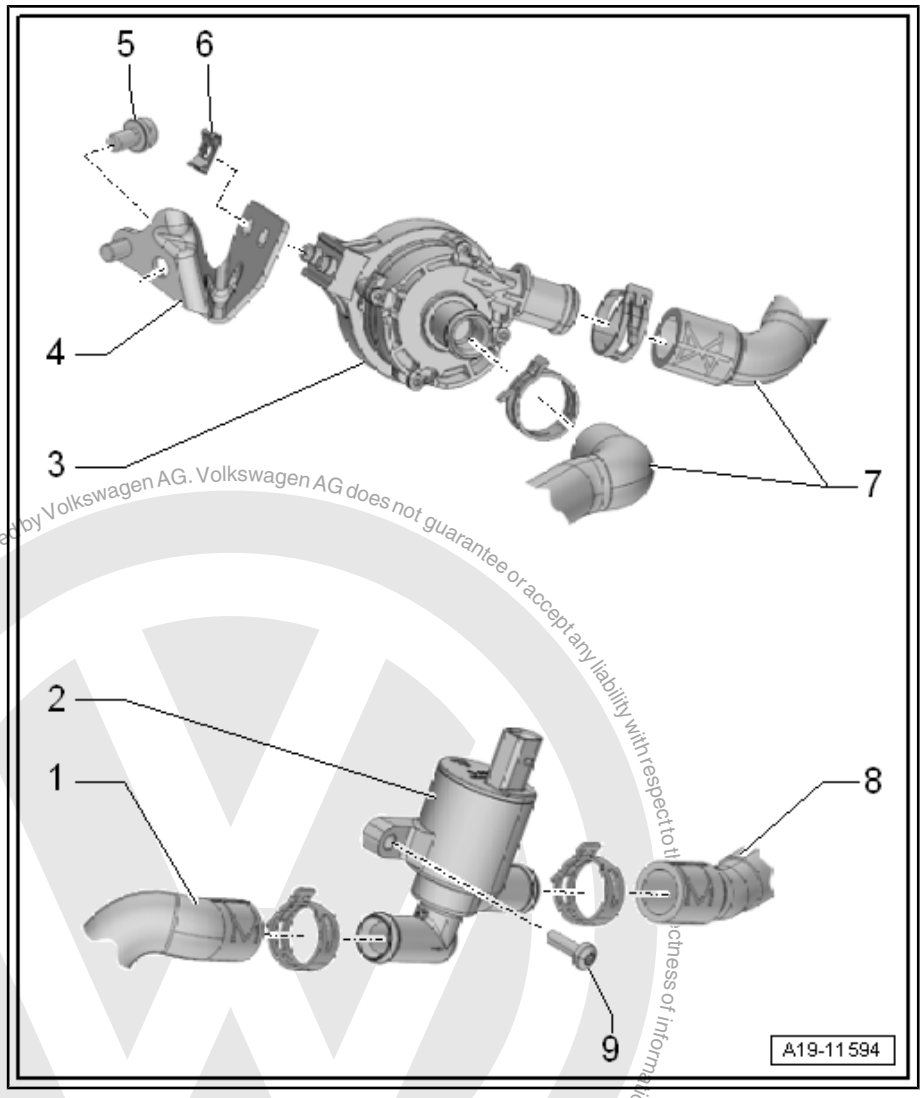


Coolant Pump - Tightening Sequence

– Tighten the coolant pump bolts in the sequence -1 to 4-.



2.2 Overview - Electric Coolant Pump



1 - Coolant Hose

2 - Coolant Shut-Off Valve - N82-

- ❑ Removing and installing. Refer to ⇒ “2.7 Coolant Shut-Off Valve N82 , Removing and Installing”, page 218 .

3 - After-Run Coolant Pump - V51-

- ❑ With bracket
- ❑ There can be slight differences depending on the version.
- ❑ Removing and installing. Refer to ⇒ “2.6 After-Run Coolant Pump V51 , Removing and Installing”, page 217 .

4 - Bracket

- ❑ For After-Run Coolant Pump - V51-

5 - Bolt

- ❑ 20 Nm

6 - Clip

7 - Coolant Hoses

8 - Coolant Hose

9 - Bolt

- ❑ 9 Nm

Transmission Coolant Valve - N488- , Vehicles with DSG® Transmission

1 - Bolt

- ❑ 9 Nm

2 - Coolant Hose

3 - Nut

- ❑ 9 Nm

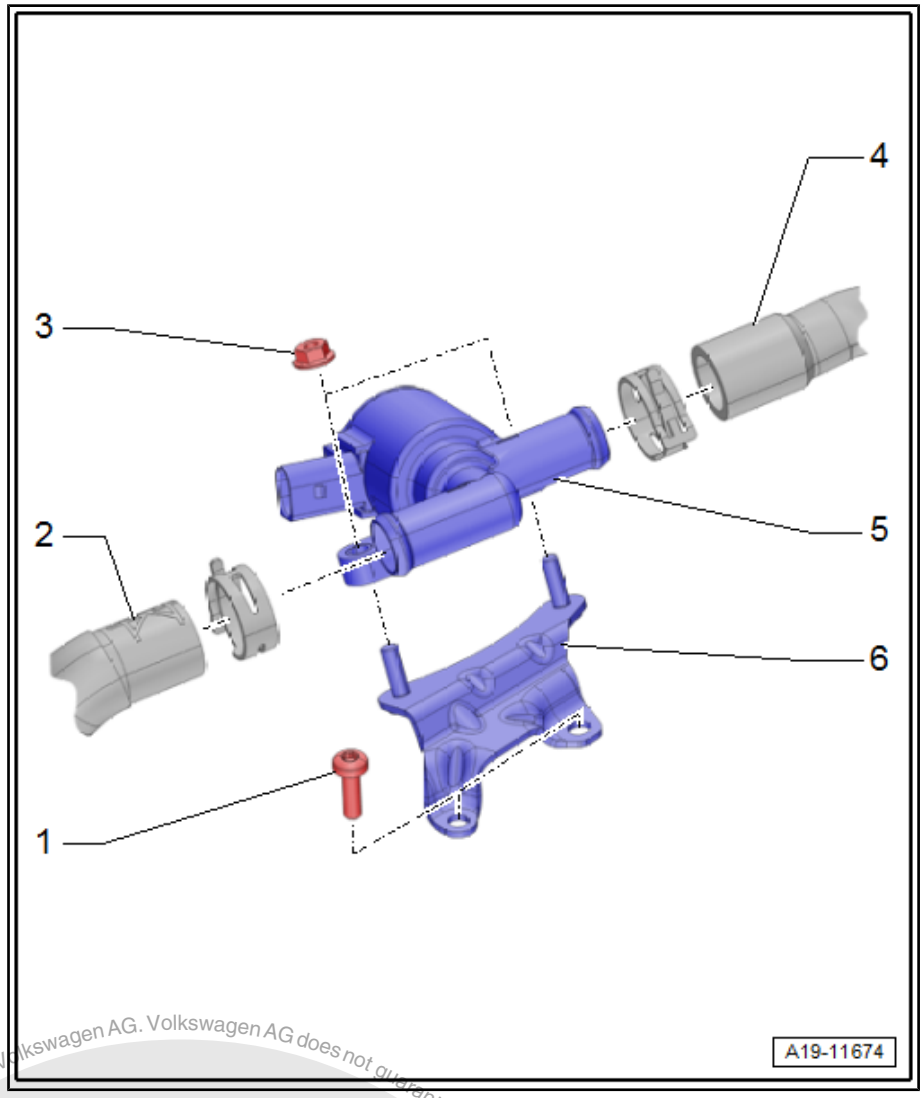
4 - Coolant Hose

5 - Transmission Coolant Valve - N488-

- ❑ Removing and installing. Refer to ⇒ “2.7 Coolant Shut-Off Valve N82 , Removing and Installing”, page 218 .

6 - Bracket

- ❑ For the Transmission Coolant Valve - N488-



2.3 Overview - Engine Coolant Temperature Sensor

1 - Clip

- ❑ Check that it is secure

2 - O-Ring

- ❑ Replace after removing

3 - Engine Coolant Temperature Sensor on Radiator Outlet - G83-

- ❑ Removing and installing. Refer to ⇒ “2.11 Engine Coolant Temperature Sensor on Radiator Outlet G83 , Removing and Installing”, page 223 .

4 - Connector

5 - Engine Coolant Temperature Sensor - G62-

- ❑ On transmission side of the cylinder head
- ❑ Removing and installing. Refer to ⇒ “2.10 Engine Coolant Temperature Sensor G62 , Removing and Installing”, page 222 .

6 - O-Ring

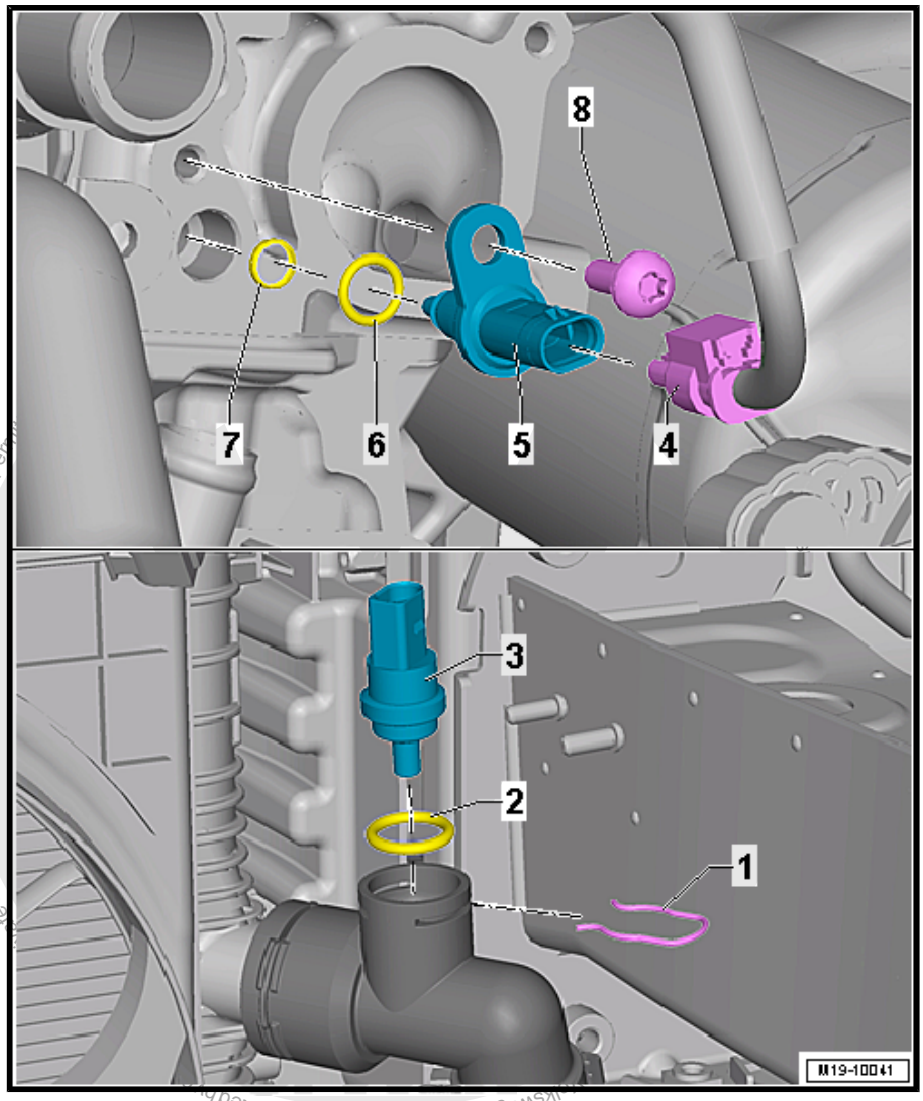
- ❑ Replace after removing
- ❑ Coat with coolant

7 - O-Ring

- ❑ Replace after removing
- ❑ Coat with coolant

8 - Bolt

- ❑ 4 Nm +45°
- ❑ Replace after removing



2.4 Coolant Pump Toothed Belt, Removing and Installing

Special tools and workshop equipment required

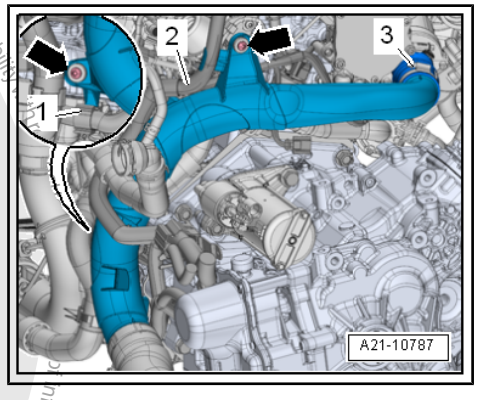
- ♦ Torque Wrench 1331 Insert - Ring Wrench - 12mm - T10360-

Removing

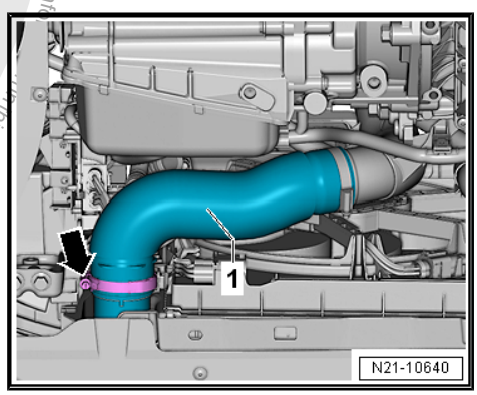
– Drain the coolant. Refer to ⇒ “1.2 Coolant, Draining and Filling”, page 201 .

– Remove the air filter housing. Refer to ⇒ “2.2 Air Filter Housing, Removing and Installing”, page 269 .

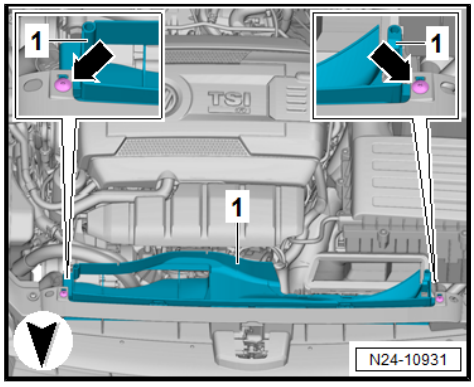
– Free up the wiring harness -1 and 2- from the air guide pipe.
– Loosen the screw-type clamp -3-.
– Remove the bolts -arrows-.



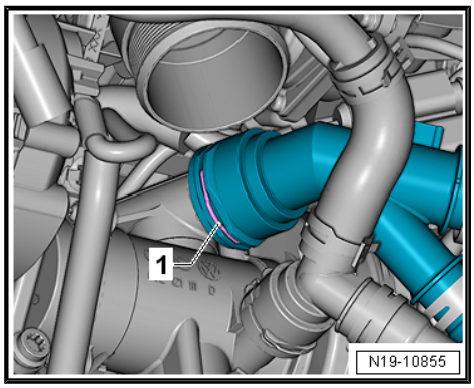
– Loosen the hose clamp -arrow- and remove the charge air hose -A- with the air guide pipe downward.



– Remove the bolts -arrows-.
– Unclip and remove the lower section -1- of the air duct.

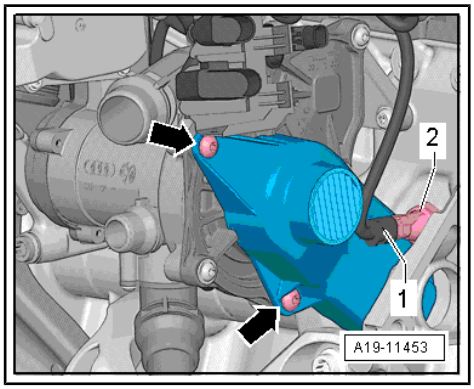


– Lift the clamp -1-, remove the upper coolant supports and set them aside.



– Disconnect the connector -1- from the Oil Pressure Switch - F1- -2-.

– Remove the bolts -arrows- and remove the toothed belt cover.



Caution

Risk of damaging the threads.

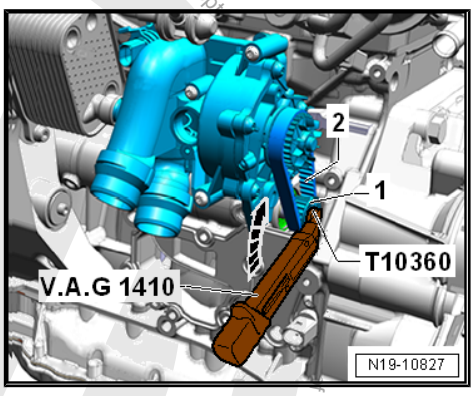
- *The drive gear bolt has a left-hand thread.*

– Counterhold the vibration damper and remove the bolt from the coolant pump drive wheel -1- by loosening three turns. Use Torque Wrench 1410 - VAG1410- and Torque Wrench 1331 Insert - Ring Wrench - 12mm - T10360- .

Note

If on vehicles with a manual transmission a starter bolt hinders attaching the tool, remove the bolt approximately 15 mm.

– Remove the toothed belt -2-.



Installing

Install in reverse order of removal and note the following:

– Replace the bolt for the drive wheel.

– Drive gear installation position: the collar on the drive gear faces the transmission.

– Position the toothed belt and tighten the bolts.

– Fill with coolant. Refer to ⇒ page 202 .

Tightening Specifications

- Refer to ⇒ “2.1 Overview - Coolant Pump/Thermostat”, page 208
- Refer to ⇒ “2.1 Overview - Air Filter Housing”, page 268

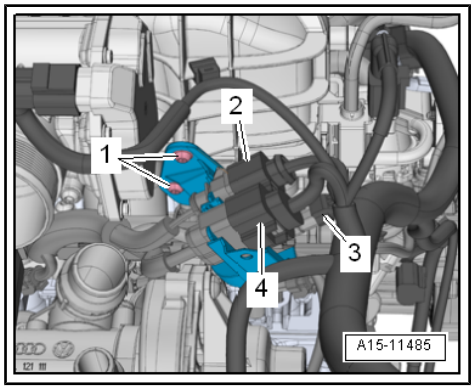
2.5 Coolant Pump, Removing and Installing

Removing

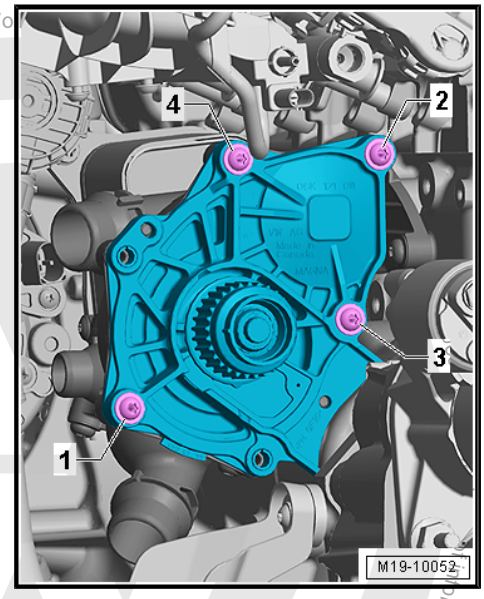
– Remove the coolant pump toothed belt. Refer to ⇒ “2.4 Coolant Pump Toothed Belt, Removing and Installing”, page 213 .

– Remove the throttle valve control module. Refer to ⇒ “3.3 Throttle Valve Control Module GX3 , Removing and Installing”, page 276 .

– Disconnect the connectors -2, 3 and 4-. Remove the bolts -1- and move the bracket to the side.



– Remove the bolts -1 through 4-, and remove the coolant pump from the Engine Temperature Control Actuator - N493-.



Installing

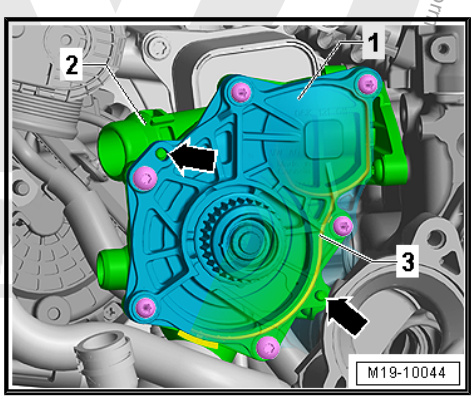
Install in reverse order of removal and note the following:

– Install the coolant pump and toothed belt.

– Pay attention to the seating of the centering piece -arrows- and seal -3-.

– Tighten the coolant pump bolts. Refer to ⇒ Fig. ""Coolant Pump - Tightening Sequence"" , page 210 .

– After installing a new coolant pump -2-, remove the protective cap -1- from the drive wheel.

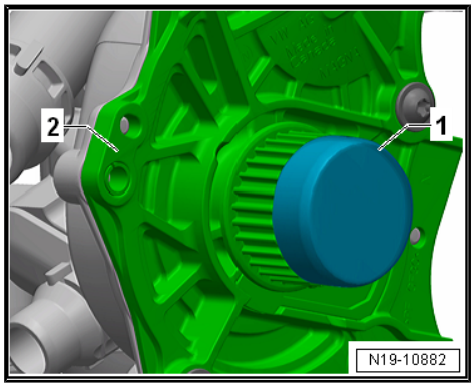


– Fill with coolant. Refer to ⇒ "1.2 Coolant, Draining and Filling", page 201 .

Tightening Specifications

♦ Refer to ⇒ "2.1 Overview - Coolant Pump/Thermostat", page 208

♦ Refer to ⇒ "2.1 Overview - Air Filter Housing", page 268



2.6 After-Run Coolant Pump - V51- , Removing and Installing

Special tools and workshop equipment required

- Hose Clamps - Up To 25 mm - 3094-
- Hose Clip Pliers - VAS6340-

Removing

Note

During installation, all heat insulation sleeves must be installed at the same location.

WARNING

The coolant system is under pressure when the engine is warm.

Risk of scalding due to hot steam and hot coolant.

Reduce pressure by covering the coolant reservoir cap with a cloth and carefully opening.

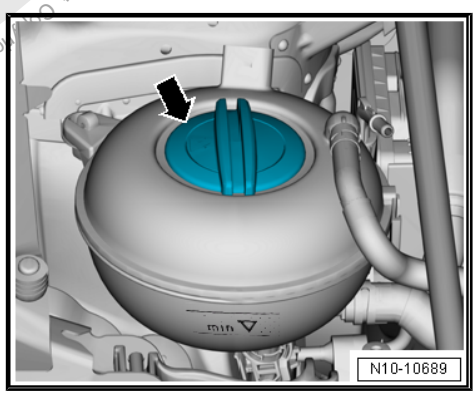
– Open the coolant reservoir cap -arrow-.

– Remove the noise insulation. Refer to ⇒ Body Exterior; Rep. Gr. 66 ; Noise Insulation; Overview - Noise Insulation .

– Open the heat protection sleeve -3-.

– Disconnect the connector -1-.

– Disconnect the coolant hose from the After-Run Coolant Pump - V51- with the Hose Clamps - Up To 25mm - 3094- .

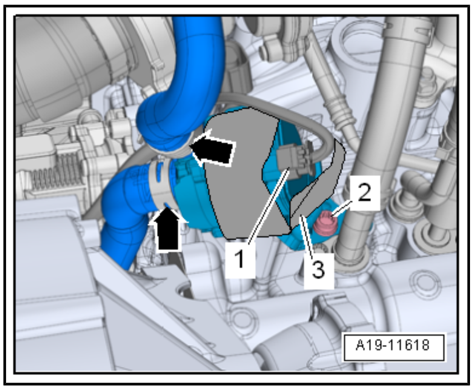


Note

Place a cleaning cloth underneath, to catch coolant leaking out.

– Loosen the clamps -arrows- and remove the coolant hoses.

– Remove the bolt -2- and remove the After-Run Coolant Pump - V51- with bracket.



Installing

Install in reverse order of removal and note the following:

Note

Secure all hose connections with standard production hose clamps. Refer to the Parts Catalog.

– Check the coolant level. Refer to ⇒ page 206 .

Tightening Specifications

- Refer to ⇒ “2.2 Overview - Electric Coolant Pump”, page 211
- Refer to ⇒ “2.1 Overview - Air Filter Housing”, page 268
- Refer to ⇒ Body Exterior; Rep. Gr. 66 ; Noise Insulation; Overview - Noise Insulation .

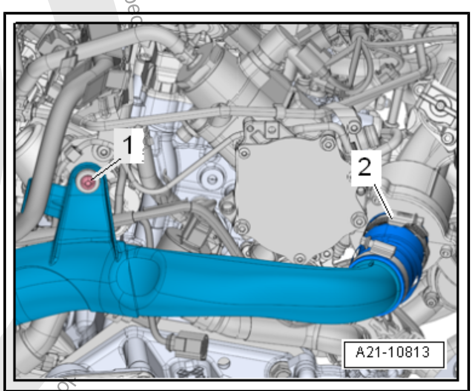
2.7 Coolant Shut-Off Valve - N82- , Removing and Installing

Special tools and workshop equipment required

- Hose Clamps - Up To 25mm - 3094-
- Hose Clip Pliers - VAS6362-

Removing

– Remove the air filter housing. Refer to ⇒ “2.2 Air Filter Housing, Removing and Installing”, page 269 .



– Loosen the hose clamp -2-.

– Remove bolt -1-, push the left air guide pipe left.

– Disconnect the connector -2-.

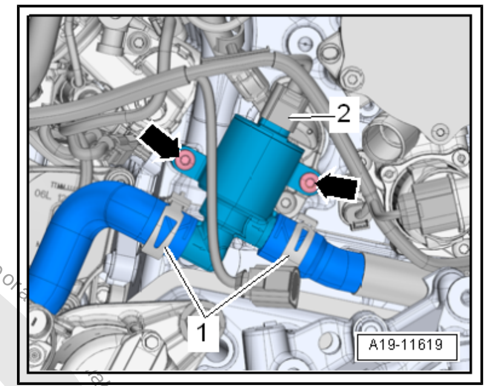
– Clamp the coolant hoses on Coolant Shut-Off Valve - N82- with the Hose Clamps - Up To 25mm - 3094- .

Note

Place a cleaning cloth underneath, to catch coolant leaking out.

– Loosen the hose clamps -1- and remove the coolant hoses.

– Remove the bolts -arrows-, and remove the Coolant Shut-Off Valve - N82- .



Installing

Install in reverse order of removal and note the following:

Note

Secure all hose connections with standard production hose clamps. Refer to the Parts Catalog.

– Check the coolant level. Refer to ⇒ page 206 .

Tightening Specifications

♦ Refer to ⇒ “2.2 Overview - Electric Coolant Pump”, page 211

♦ Refer to ⇒ “2.1 Overview - Air Filter Housing”, page 268

2.8 Transmission Coolant Valve - N488- , Removing and Installing

Note

Vehicles with DSG Transmission

Special tools and workshop equipment required

♦ Hose Clamps - Up To 25 mm - 3094-

♦ Hose Clip Pliers - VAS6362-

Removing

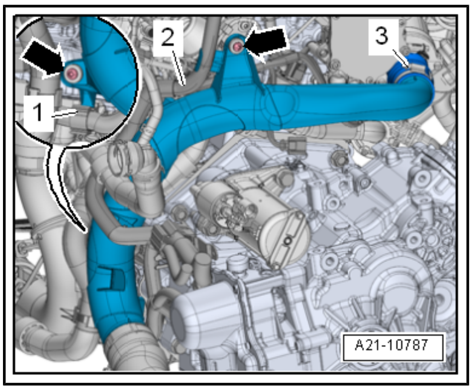
– Remove the noise insulation. Refer to ⇒ Body Exterior; Rep. Gr. 66 ; Noise Insulation; Overview - Noise Insulation .

– Remove the air filter housing. Refer to ⇒ “2.2 Air Filter Housing, Removing and Installing”, page 269 .

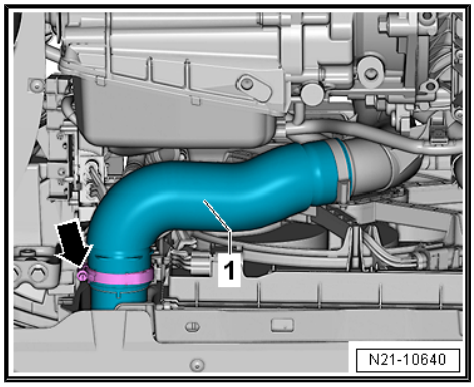
– Free up the wiring harness -1 and 2- from the air guide pipe.

– Loosen the screw-type clamp -3-.

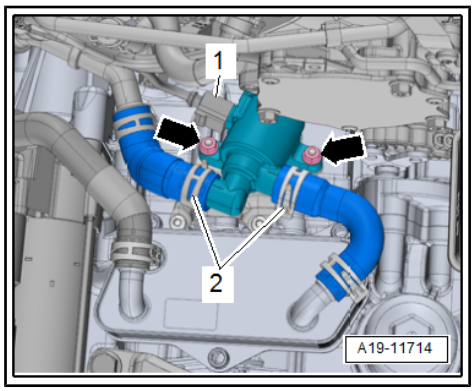
– Remove the bolts -arrows-.



– Loosen the hose clamp -arrow- and remove the charge air hose -A- with the air guide pipe downward.



– Disconnect the connector -1-.
– Clamp the coolant hoses on Transmission Coolant Valve - N488- with Hose Clamps - Up to 25mm - 3094- .



Note

Place a cleaning cloth underneath, to catch coolant leaking out.

– Loosen the clamps -2- and remove the coolant hoses.
– Remove the nuts -arrows- and then remove the Transmission Coolant Valve - N488- .

Installing

Install in reverse order of removal and note the following:

Note

Secure all hose connections with standard production hose clamps. Refer to the Parts Catalog.

– Check the coolant level. Refer to ⇒ page 206 .

Tightening Specifications

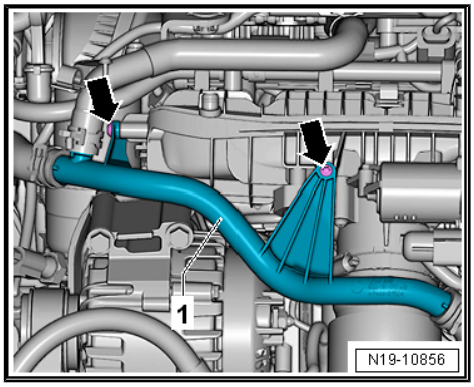
- Refer to ⇒ “2.2 Overview - Electric Coolant Pump”, page 211
- Refer to ⇒ “2.1 Overview - Air Filter Housing”, page 268
- Refer to ⇒ Body Exterior; Rep. Gr. 66 ; Noise Insulation; Overview - Noise Insulation .

2.9 Engine Temperature Control Actuator - N493- , Removing and Installing

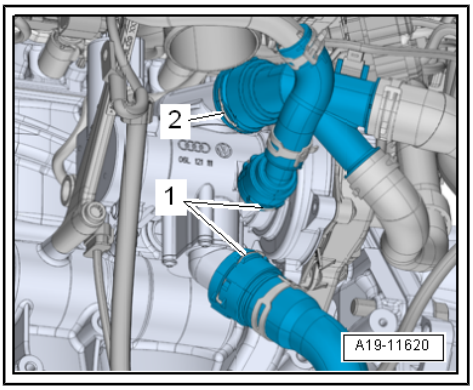
Removing

– Remove the coolant pump. Refer to ⇒ “2.5 Coolant Pump, Removing and Installing”, page 215 .
– Remove the Throttle Valve Control Module - GX3- . Refer to ⇒ “3.3 Throttle Valve Control Module GX3 , Removing and Installing”, page 276 .

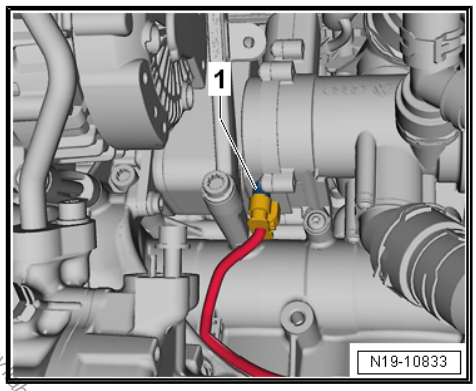
– Remove the coolant pipe from the intake manifold -arrows-.



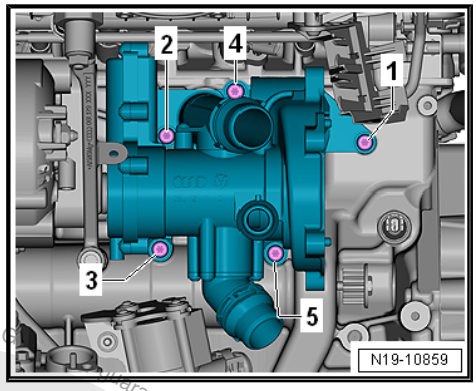
– Lift the clamp -1-, and remove the coolant hoses.



– Remove the connector -1- from the Engine Temperature Control Actuator - N493- .
– Remove the bolts -1 to 5-.



– Remove the Engine Temperature Control Actuator - N493- from the centering pin and disconnect it from the engine oil cooler.



Installing

Install in reverse order of removal and note the following:

Note

Replace the seals and O-rings.

– Coat the new O-rings -4- with coolant.

– Make sure that both centering pins are installed in the cylinder block if necessary insert.

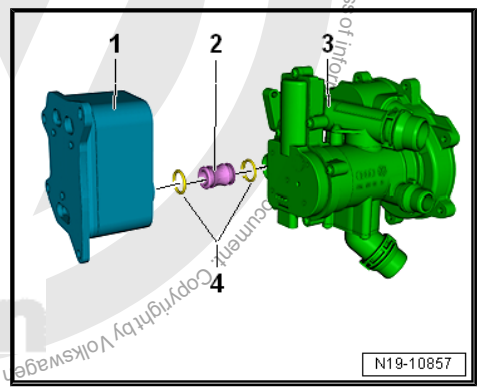
– Install the connection piece -2- into the engine oil cooler -1-.

– Push the Engine Temperature Control Actuator - N493- -3- into the connection piece and onto the centering pins in the cylinder block.

– Tighten the bolts for the Engine Temperature Control Actuator - N493- . Refer to
⇒ Fig. "" Engine Temperature Control Actuator -N493- - Tightening Sequence"" , page 210 .

– Install the coolant pump. Refer to
⇒ "2.5 Coolant Pump, Removing and Installing", page 215 .

– Fill with coolant. Refer to ⇒ page 202 .



Tightening Specifications

♦ Refer to
⇒ "2.1 Overview - Coolant Pump/Thermostat", page 208

♦ Refer to ⇒ "3.1 Overview - Intake Manifold", page 270

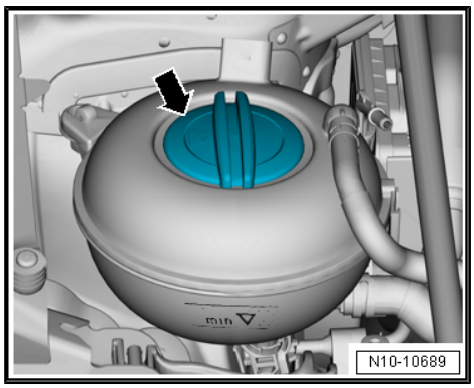
2.10 Engine Coolant Temperature Sensor - G62- , Removing and Installing

Removing

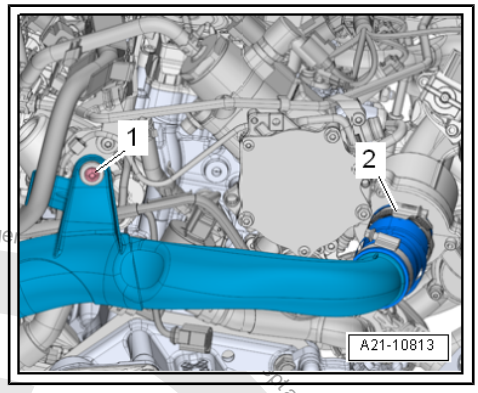
• The engine is cold.

– Quickly open the coolant reservoir cap -arrow- and release any remaining pressure in the cooling system and then close it again.

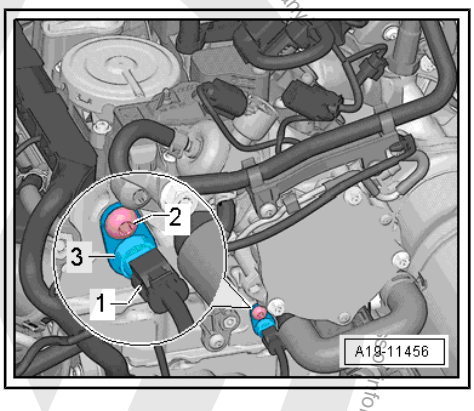
– Remove the air filter housing. Refer to
⇒ "2.2 Air Filter Housing, Removing and Installing", page 269 .



– Loosen the hose clamp -2-.
– Remove bolt -1-, push the left air guide pipe left.



– Disconnect the connector -1-.



Note

- *Place a cleaning cloth underneath, to catch coolant leaking out.*
- *To prevent coolant loss, immediately insert the new Engine Coolant Temperature Sensor - G62- in the connection.*

– Remove the bolts -2-, and remove the Engine Coolant Temperature Sensor - G62- -3-.

Installing

Install in reverse order of removal and note the following:

Note

Replace the O-rings.

– Check the coolant level. Refer to ⇒ page 202 .

Tightening Specifications

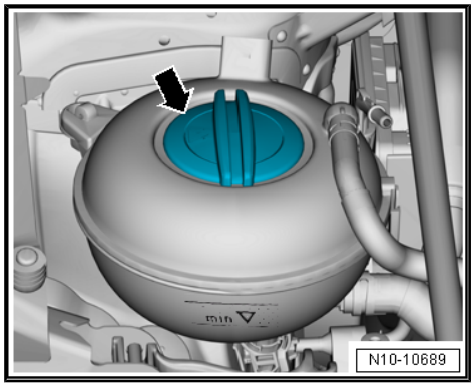
- Refer to ⇒ “2.3 Overview - Engine Coolant Temperature Sensor”, page 213
- Refer to ⇒ “2.1 Overview - Air Filter Housing”, page 268

2.11 Engine Coolant Temperature Sensor on Radiator Outlet - G83- , Removing and Installing

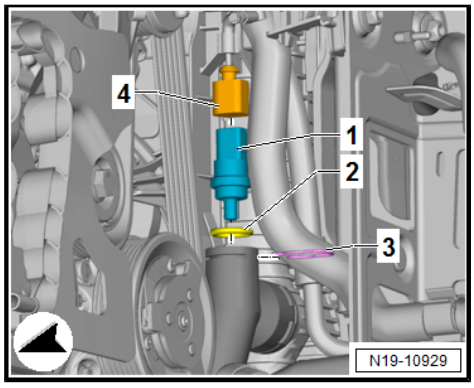
Removing

- The engine is cold.

– Quickly open the coolant reservoir cap -arrow- and release any remaining pressure in the cooling system and then close it again.
– Remove the noise insulation. Refer to ⇒ Body Exterior; Rep. Gr. 66 ; Noise Insulation; Overview - Noise Insulation .



– Disconnect the connector -4- and remove the clamp -3-.
– Remove the Engine Coolant Temperature Sensor on Radiator Outlet - G83- -1- with the O-ring -2-.



Note

- *Place a cleaning cloth underneath, to catch coolant leaking out.*
- *Insert the new Engine Coolant Temperature Sensor on Radiator Outlet - G83- immediately in the connection to prevent coolant loss.*

Installing

Install in reverse order of removal and note the following:

Note

Replace the O-ring.

– Check the coolant level. Refer to ⇒ page 202 .

Tightening Specifications

- Refer to ⇒ Body Exterior; Rep. Gr. 66 ; Noise Insulation; Overview - Noise Insulation .

3 Coolant Pipes

3.1 Overview - Coolant Pipes

1 - Coolant Pipe
- ❑ At top of engine
- ❑ Removing and installing. Refer to ⇒ “3.3 Coolant Pipe on Upper Engine, Removing and Installing”, page 227 .

2 - Screws
- ❑ 9 Nm

3 - Screws
- ❑ 9 Nm

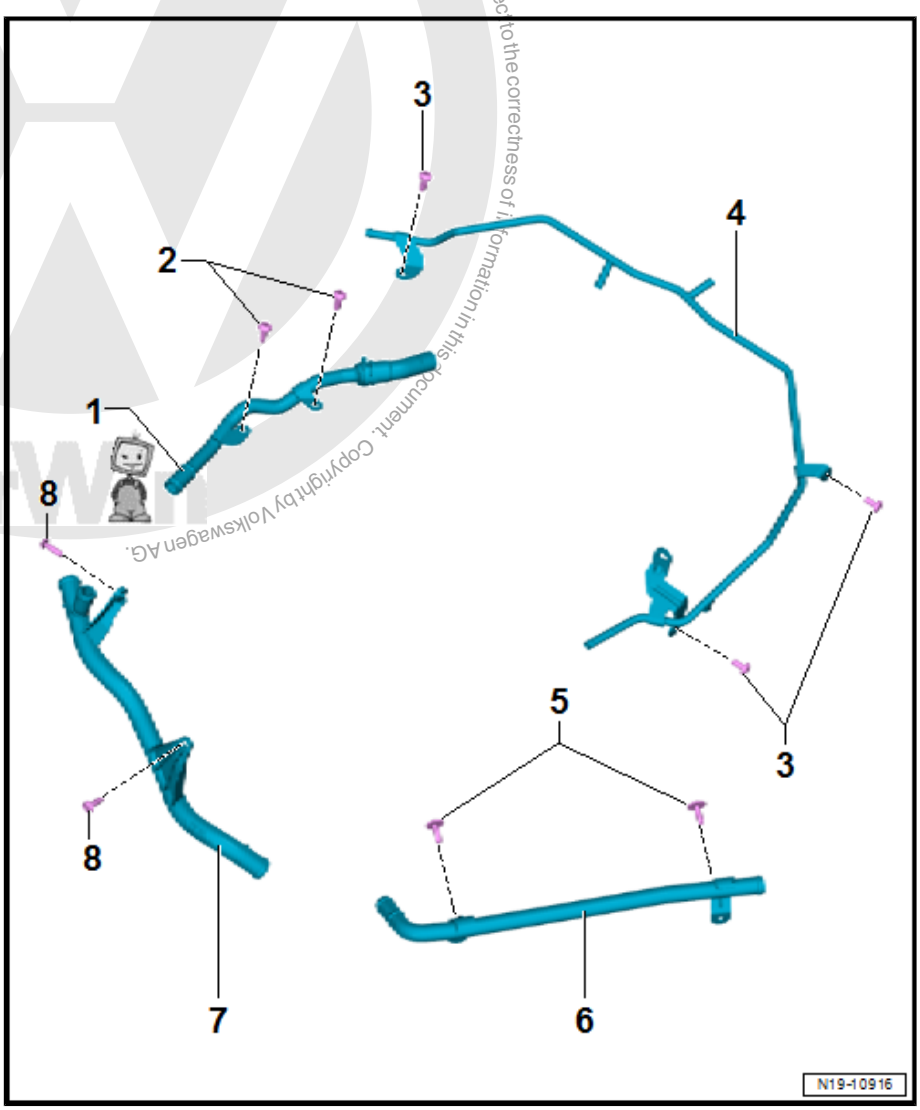
4 - Coolant Line

5 - Screws
- ❑ 9 Nm

6 - Coolant Pipe
- ❑ To fan shroud
- ❑ Removing and installing. Refer to ⇒ “3.4 Coolant Pipe on Fan Shroud, Removing and Installing”, page 228 .

7 - Coolant Pipe
- ❑ At front of engine
- ❑ Removing and installing. Refer to ⇒ “3.2 Coolant Pipe on Front Engine, Removing and Installing”, page 225 .

8 - Screws
- ❑ 6 Nm



3.2 Coolant Pipe on Front Engine, Removing and Installing

Special tools and workshop equipment required

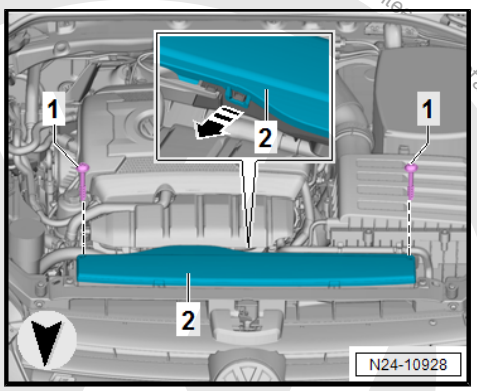
- ♦ Hose Clamps - Up To 25mm - 3094-
- ♦ Hose Clip Pliers - VAS6362-

Removing

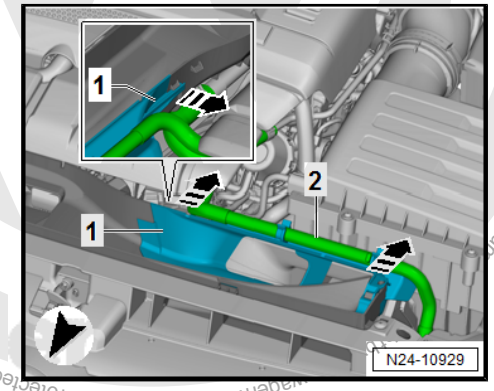
– Remove the bolts -1-.

– Open the catch in direction of -arrow- and remove the cover -2-.

– Free up the coolant hose -2-.

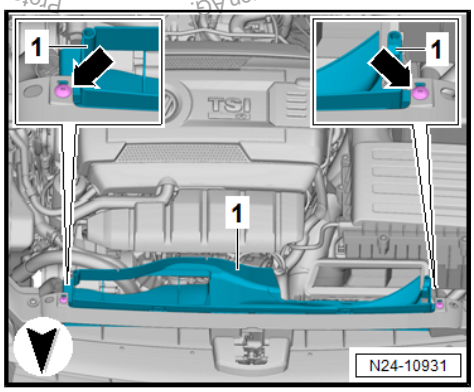


– Release the retainers in direction of -arrows- and remove the air guide upper section -1-.



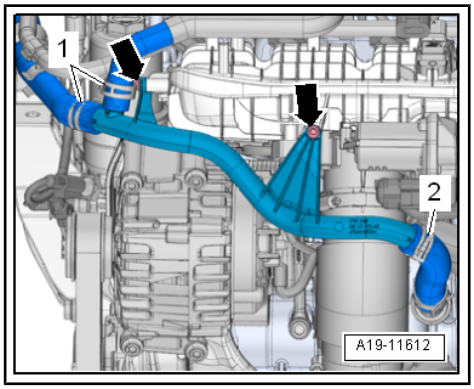
– Remove the bolts -arrows-.

– Unclip and remove the lower section -1- of the air duct.



Note

Place a cleaning cloth underneath, to catch coolant leaking out.



- Disconnect the coolant hoses -1 and 2- with Hose Clamps up to 25 mm Diameter - 3094- .
- Loosen the clamps and remove the coolant hoses.
- Remove the bolts -arrows- and the front coolant pipe.

Installing

Install in reverse order of removal and note the following:

Note

Secure all hose connections with standard production hose clamps. Refer to the Parts Catalog.

- Check the coolant level. Refer to ⇒ page 206 .

Tightening Specifications

- Refer to ⇒ “3.1 Overview - Coolant Pipes”, page 225

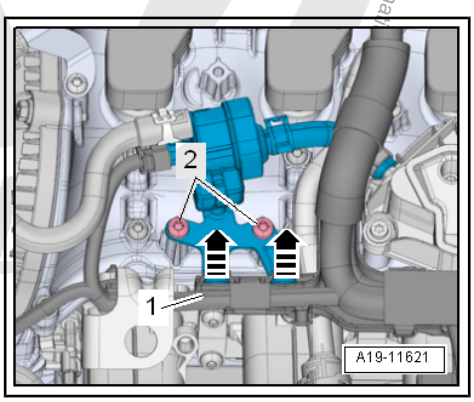
3.3 Coolant Pipe on Upper Engine, Removing and Installing

Special tools and workshop equipment required

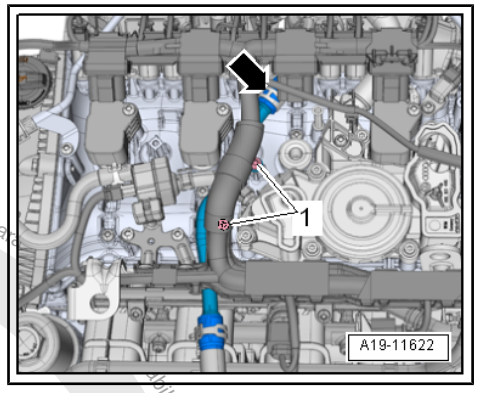
- Hose Clamps - Up To 25 mm - 3094-
- Hose Clip Pliers - VAS6362-

Removing

- Remove the ignition coils with power output stages cylinder “3”. Refer to ⇒ “1.2 Ignition Coils with Power Output Stages, Removing and Installing”, page 328 .
- Release retainers -arrows- and remove wiring duct -1- from bracket.
- Clamp off the coolant hoses -arrows- with the Hose Clamps - Up To 25 mm - 3094- .
- Loosen the clamps and remove the coolant hoses.



– Remove the bolt -1- and remove the upper coolant pipe.



Installing

Install in reverse order of removal and note the following:

Note

Secure all hose connections with standard production hose clamps. Refer to the Parts Catalog.

– Check the coolant level. Refer to ⇒ page 206 .

Tightening Specifications

♦ Refer to ⇒ “3.1 Overview - Coolant Pipes”, page 225

3.4 Coolant Pipe on Fan Shroud, Removing and Installing

Special tools and workshop equipment required

♦ Hose Clamps - Up To 25 mm - 3094-

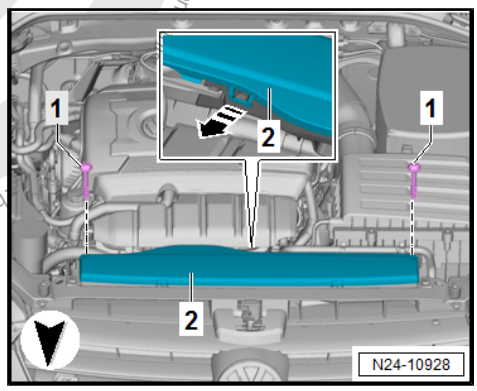
♦ Hose Clip Pliers - VAS6362-

Removing

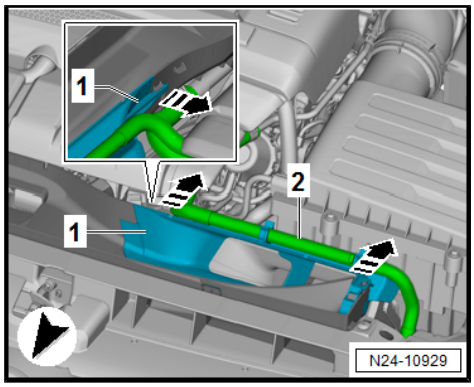
– Remove the bolts -1-.

– Open the catch in direction of -arrow- and remove the cover -2-.

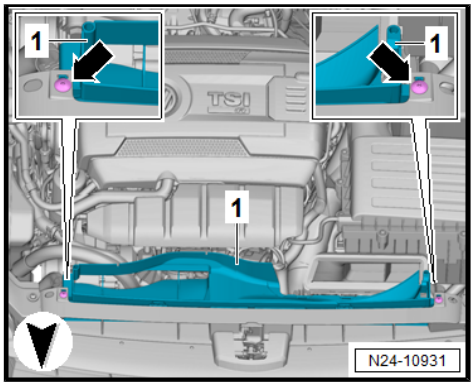
– Free up the coolant hose -2-.



– Release the retainers in direction of -arrows- and remove the air guide upper section -1-.



– Remove the bolts -arrows-.
– Unclip and remove the lower section -1- of the air duct.
– Seal off the coolant hoses with Hose Clamps up to 25 mm Diameter - 3094- .

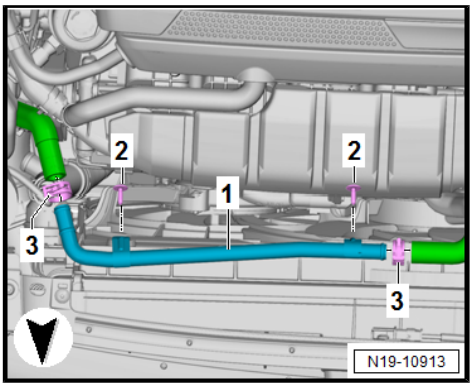


Note

Place a cleaning cloth underneath, to catch coolant leaking out.

– Loosen the clamps -3- and remove the coolant hoses.

– Remove the bolts -2- and remove the coolant pipe -1-.



Installing

Install in reverse order of removal and note the following:

Note

Secure all hose connections with standard production hose clamps. Refer to the Parts Catalog.

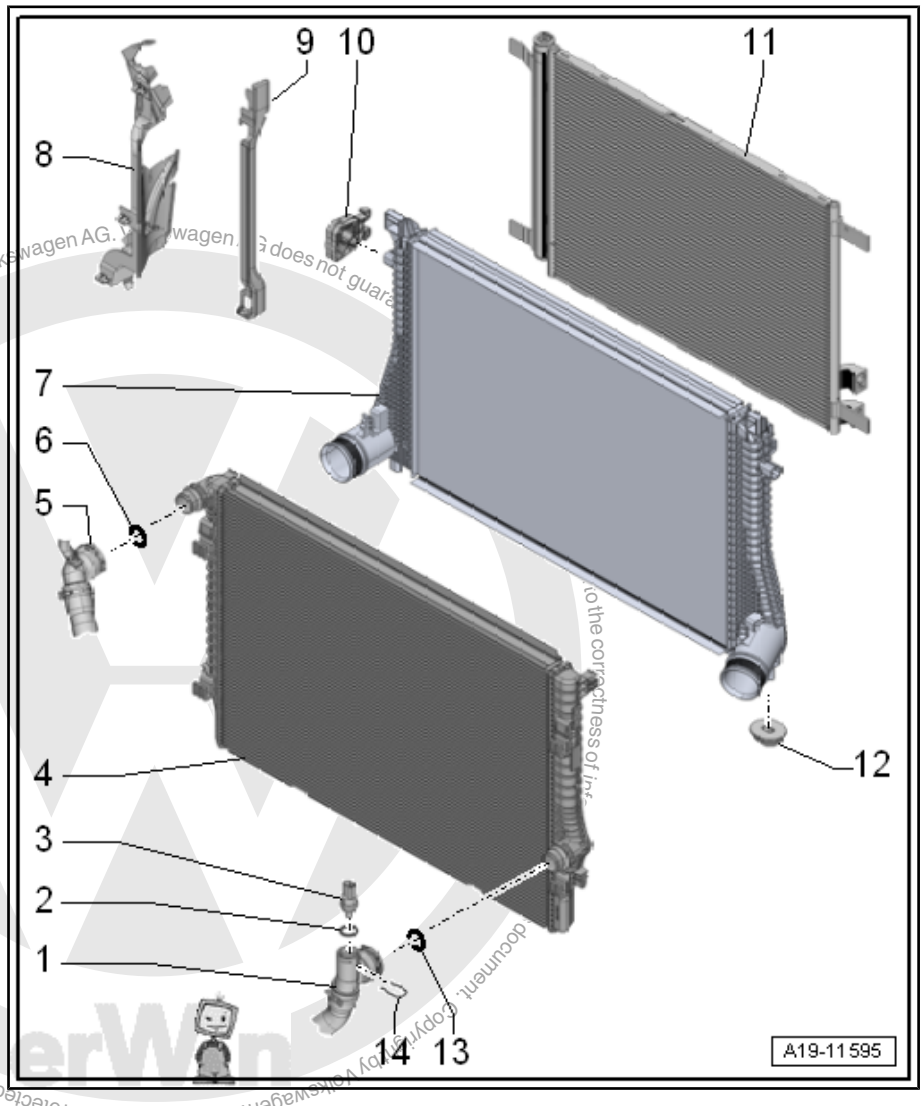
– Check the coolant level. Refer to ⇒ page 206 .

Tightening Specifications

♦ Refer to ⇒ “3.1 Overview - Coolant Pipes”, page 225

4 Radiator/Radiator Fan

4.1 Overview - Radiator/Radiator Fan



1 - Coolant Hose

- ❑ Lift the clamp to remove
- ❑ Connecting. Refer to ⇒ Fig. ““Connect the Coolant Hose to the Connector Coupling”“ , page 231

2 - O-Ring

- ❑ Replace after removing
- ❑ Coat with coolant

3 - Engine Coolant Temperature Sensor on Radiator Outlet - G83-

- ❑ Removing and installing. Refer to ⇒ “2.11 Engine Coolant Temperature Sensor on Radiator Outlet G83 , Removing and Installing”, page 223 .

4 - Radiator

- ❑ Change the coolant after replacing
- ❑ Removing and installing. Refer to ⇒ 4.4 Radiator, Removing and Installing”, page 233

5 - Coolant Hose

- ❑ Lift the clamp to remove
- ❑ Connecting. Refer to ⇒ Fig. ““Connect the Coolant Hose to the Connector Coupling”“ page 231

6 - O-Ring

- ❑ Replace after removing
- ❑ Coat with coolant

7 - Charge Air Cooler

- ❑ Removing and installing. Refer to ⇒ “2.3 Charge Air Cooler, Removing and Installing”, page 251 .

8 - Air Duct

9 - Air Duct

10 - Rubber Bushing

- ❑ For the radiator

11 - Condenser

- ❑ Removing and installing. Refer to ⇒ Heating, Ventilation and Air Conditioning; Rep. Gr. 87 ; Refrigerant Circuit; Condenser, Removing and Installing .

12 - Rubber Bushing

- ❑ For the charge air cooler

13 - O-Ring

- ❑ Replace after removing
- ❑ Coat with coolant

14 - Clip

- ❑ For Engine Coolant Temperature Sensor on Radiator Outlet - G83-

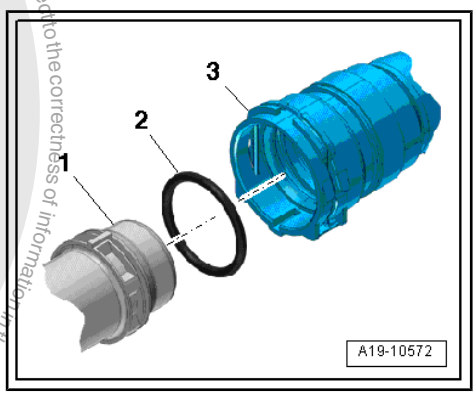
Connect the Coolant Hose to the Connector Coupling

– Remove the old O-ring -2- in the coolant hose -3-.

– Coat the new O-ring with coolant and insert it in the coolant hose.

– Press the coolant hose on to the coolant pipe -1- until you hear it engage.

– Press the coolant hose on again and pull to make sure the connection is engaged correctly.



4.2 Overview - Fan Shroud and Radiator Fan

1 - Bolt

- ❑ 5 Nm

2 - Fan Shroud

- ❑ Removing and installing. Refer to ⇒ “4.6 Fan Shroud, Removing and Installing”, page 237 .

3 - Bolt

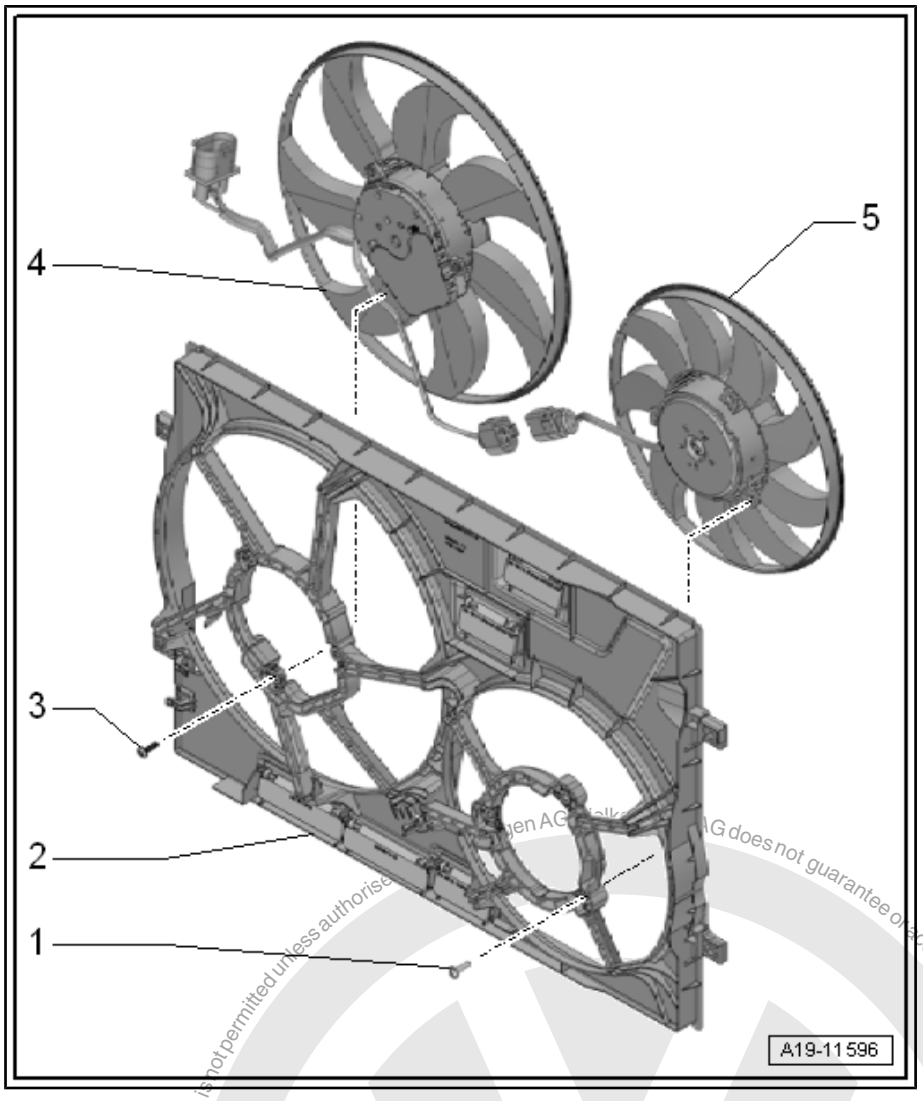
- ❑ 5 Nm

4 - Radiator Fan - V7-

- ❑ Removing and installing. Refer to ⇒ “4.7.1 Radiator Fan V7 , Removing and Installing”, page 238 .

5 - Radiator Fan 2 - V177-

- ❑ Removing and installing. Refer to ⇒ “4.7.2 Radiator Fan 2 V177 , Removing and Installing”, page 239 .



4.3 Overview - Auxiliary Cooler

Note

- *The auxiliary cooler is installed in the right front on vehicles with a manual transmission.*
- *Vehicles with a DSG transmission have two auxiliary coolers at the front right and front left.*

1 - Air Duct

2 - Protective Grille

3 - Auxiliary Cooler

- ❑ Removing and installing. Refer to ⇒ “4.5 Auxiliary Cooler, Removing and Installing”, page 235 .

4 - Hose Bracket

5 - Connecting Piece

6 - Hose Clamps

7 - Nut

- ❑ 9 Nm

8 - Bracket

- ❑ For auxiliary cooler

9 - Nut

- ❑ 9 Nm

10 - Rubber Grommet

- ❑ For auxiliary cooler

11 - Air Duct

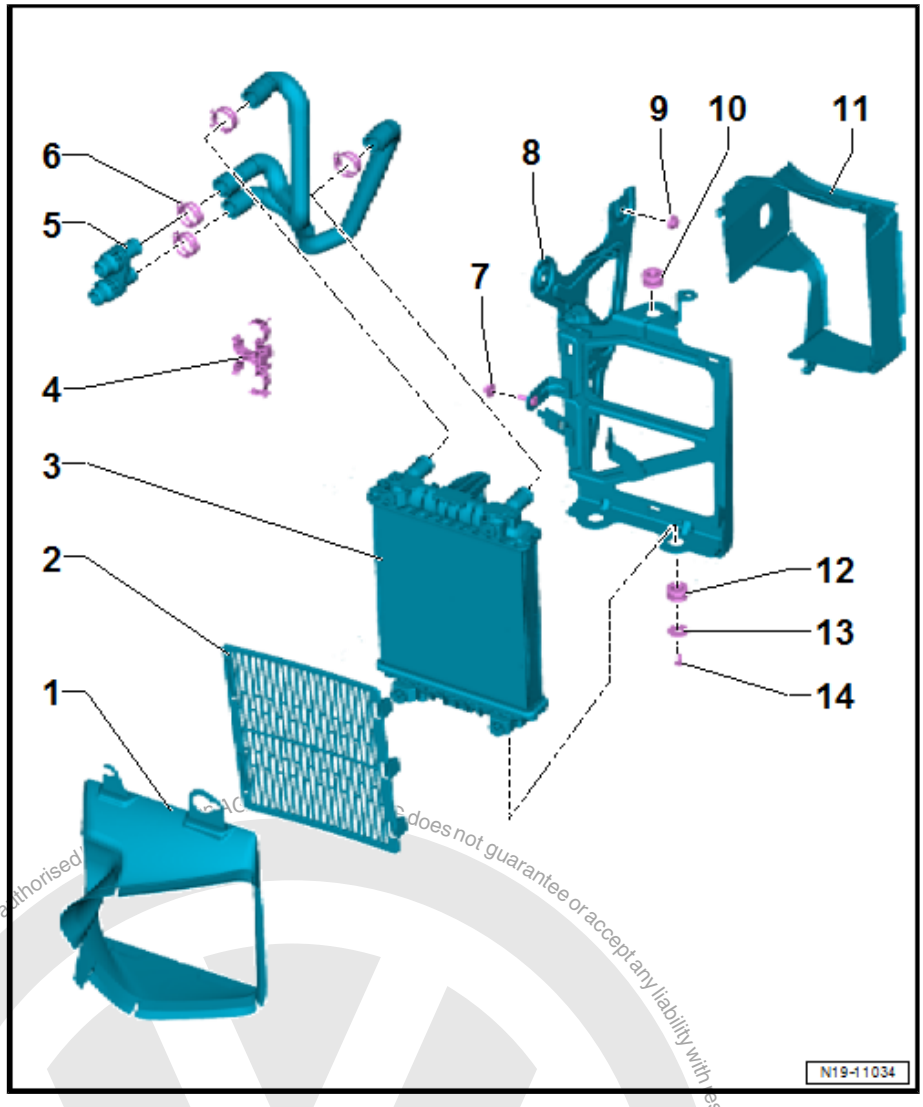
12 - Rubber Grommet

- ❑ For auxiliary cooler

13 - Backing Plate

14 - Bolt

- ❑ 3.5 Nm



4.4 Radiator, Removing and Installing

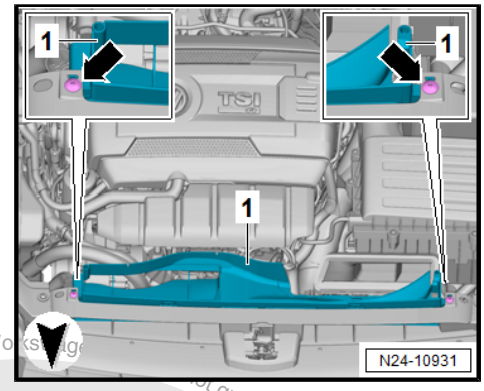
Removing

– Drain the coolant. Refer to ⇒ “1.2 Coolant, Draining and Filling”, page 201 .

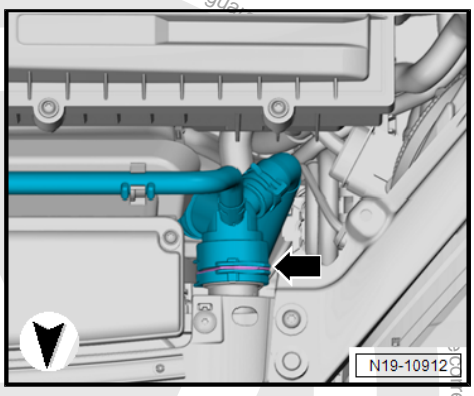
– Remove the fan shroud. Refer to ⇒ “4.6 Fan Shroud, Removing and Installing”, page 237 .

– Remove the radiator grille. Refer to ⇒ Body Exterior; Rep. Gr. 66 ; Radiator Grille/Front Trim; Radiator Grille, Removing and Installing .

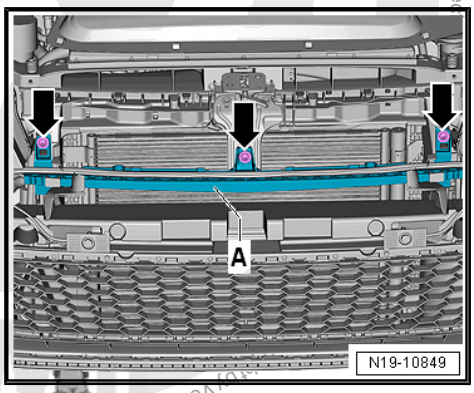
– Remove the bolts -arrows-.
– Unclip and remove the lower section -1- of the air duct.



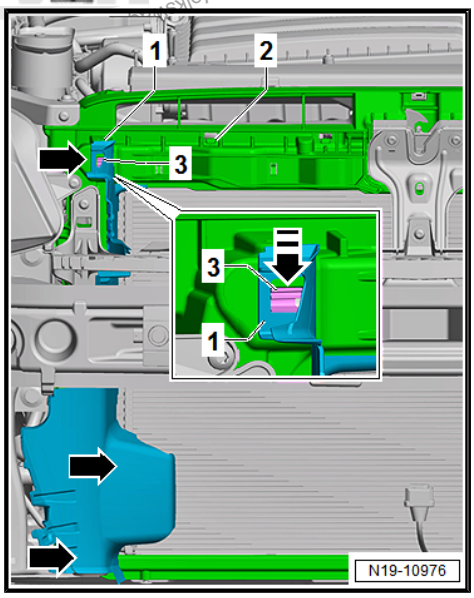
– Lift the clamp -arrow- and remove the upper left coolant hose from the radiator.

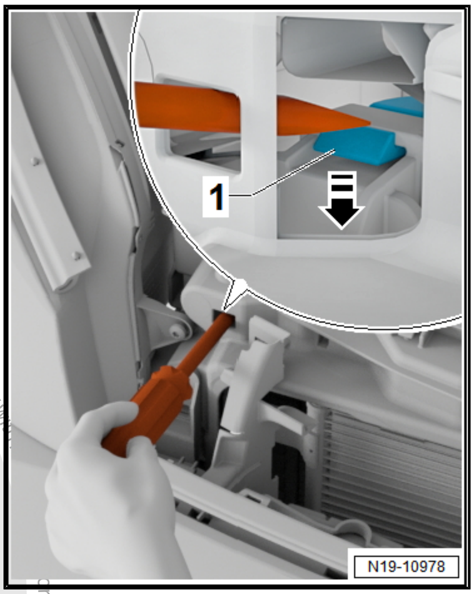


– If equipped, remove the center guide profile -A- on the lock carrier -arrows-.
– Unclip the air ducts -1- on both sides of the lock carrier -2- -arrow-.



– To do this release the catches -3- in the direction of -arrow- and remove the air guide. Ignore the lower arrows.
– Through the opening in the lock carrier, press the left and right locking tabs -1- for the radiator downward. Pull the radiator off of the charge air cooler.





– Pivot the radiator to the engine and lift upward from the charge air cooler bracket. Remove radiator downward.

Installing

Install in reverse order of removal and note the following:

Note

- *If there are small impressions on the fins, pay attention to the repair information. Refer to ⇒ “3.5 Radiator and Condenser Assembly”, page 7 .*
- *Replace the O-rings.*
- *All of the coolant must be changed if the radiator was replaced.*

– Install the fan shroud. Refer to ⇒ “4.6 Fan Shroud, Removing and Installing”, page 237 .

– Connect the coolant hose to the connector coupling. Refer to ⇒ Fig. ““Connect the Coolant Hose to the Connector Coupling”“ , page 231 .

– Install the radiator grille. Refer to ⇒ Body Exterior; Rep. Gr. 66 ; Radiator Grille/Front Trim; Radiator Grille, Removing and Installing .

– Fill with coolant. Refer to ⇒ page 206 .

Tightening Specifications

- Refer to ⇒ “4.1 Overview - Radiator/Radiator Fan”, page 230

Component	Tightening Specification
Bolts on lock carrier	5 Nm

4.5 Auxiliary Cooler, Removing and Installing

Special tools and workshop equipment required

- Hose Clamps - Up To 25 mm - 3094-
- Hose Clip Pliers - VAS6362-

Note

- *The auxiliary cooler is installed in the right front on vehicles with a manual transmission.*
- *Vehicles with a DSG transmission have two auxiliary coolers at the front right and front left.*

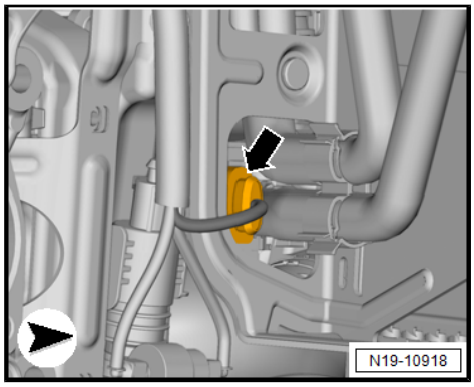
Removing

– Remove the wheel. Refer to ⇒ Suspension, Wheels, Steering; Rep. Gr. 44 ; Wheels and Tires .

– Remove the front section of the wheel housing liner. Refer to ⇒ Body Exterior; Rep. Gr. 66 ; Wheel Housing Liner .

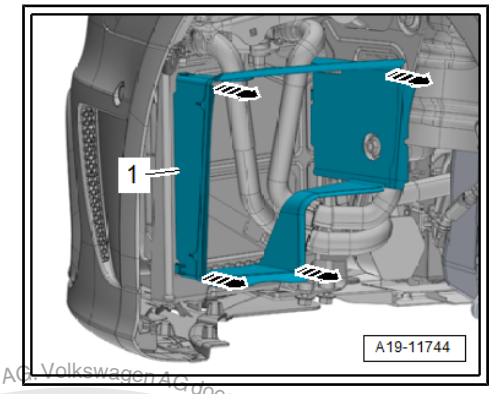
Right Auxiliary Cooler

– Disconnect the connector -arrow-.



Continuation for All Vehicles

– Unclip the air guide -1- while doing so remove in the direction of -arrow-.



Note

Place a cloth underneath to catch any escaping coolant.

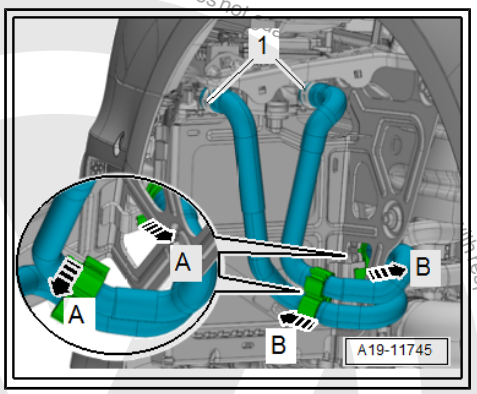
Left Auxiliary Cooler

– Clamp off the coolant hoses with Hose Clamps up to 25 mm Diameter - 3094- .

– Loosen the hose clamps -1-, while doing so remove the coolant hoses.

– Free up the coolant hoses from the bracket, to do so open the retainers in direction of -A arrows- and remove in direction of -B arrows-.

– Remove the nuts -arrows-.



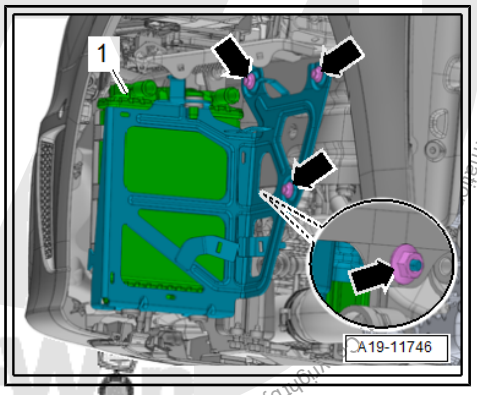
– Remove the auxiliary cooler -1- together with the bracket.

Right Auxiliary Cooler

– Clamp off the coolant hoses with Hose Clamps up to 25 mm Diameter - 3094- .

– Loosen the hose clamps -1-, while doing so remove the coolant hoses.

– Remove the nuts -arrows-.

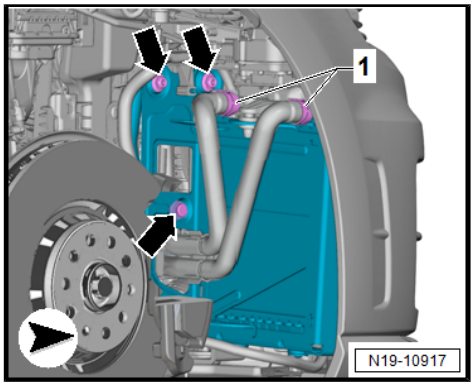


– Remove the auxiliary cooler together with the bracket.

Continuation for All Vehicles

– Remove the air guide -1- in the direction of -arrow-.

– Remove the bolts -4-.



– Remove the auxiliary cooler -2- from the bracket -3-.

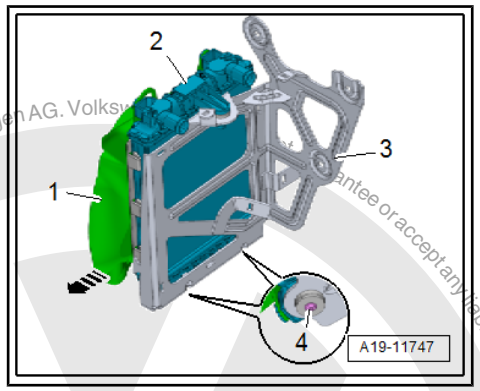
Installing

Install in reverse order of removal and note the following:

– Bleed the cooling system. Refer to ⇒ “1.2 Coolant, Draining and Filling”, page 201 .

Tightening Specifications

♦ Refer to ⇒ “4.3 Overview - Auxiliary Cooler”, page 232



4.6 Fan Shroud, Removing and Installing

Removing

– Remove the air filter housing. Refer to ⇒ “2.2 Air Filter Housing, Removing and Installing”, page 269 .

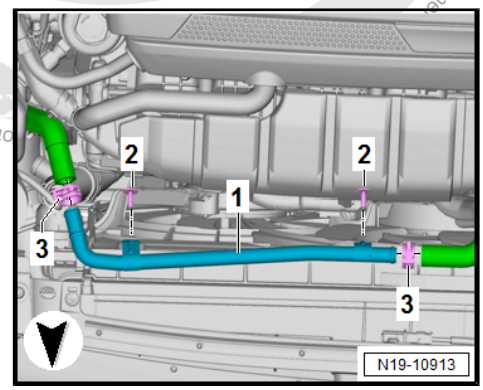
WARNING

There is a risk of injury if the radiator fan turns on by itself.

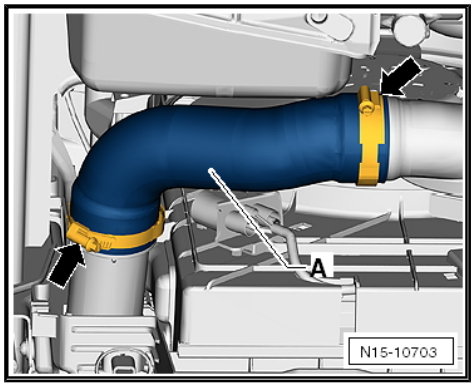
♦ *Disconnect the connectors before working near the fan shroud.*

– Remove the coolant pipe -1- from the fan shroud by removing the bolts -2-.

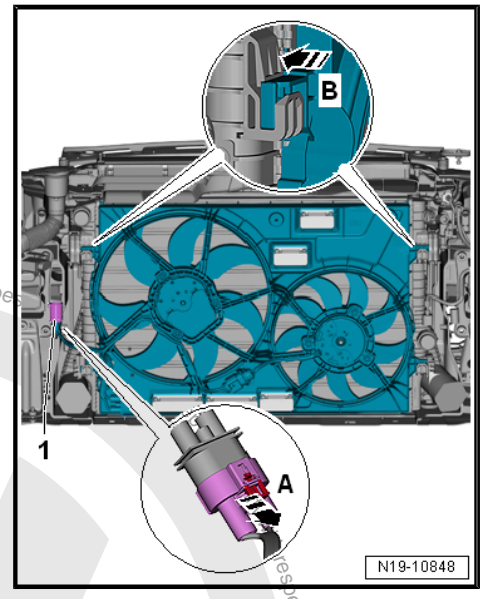
– Remove the noise insulation. Refer to ⇒ Body Exterior; Rep. Gr. 66 ; Noise Insulation; Overview - Noise Insulation .



– Loosen the hose clamps -arrows- and remove the left charge air hose -A-.
– Disconnect the radiator fan connector -1-. To do so, slide the retainer in the direction of -arrow A- and push the release downward.



– Press the left and right fan shroud locking tabs evenly in direction of -arrow B-. Pull the fan shroud upward from the radiator and remove downward.



Installing

Install in reverse order of removal.

Tightening Specifications

♦ Refer to ⇒ Body Exterior; Rep. Gr. 66 ; Noise Insulation; Overview - Noise Insulation .

4.7 Radiator Fan, Removing and Installing

⇒ “4.7.1 Radiator Fan V7 , Removing and Installing”, page 238

⇒ “4.7.2 Radiator Fan 2 V177 , Removing and Installing”, page 239

4.7.1 Radiator Fan - V7- , Removing and Installing

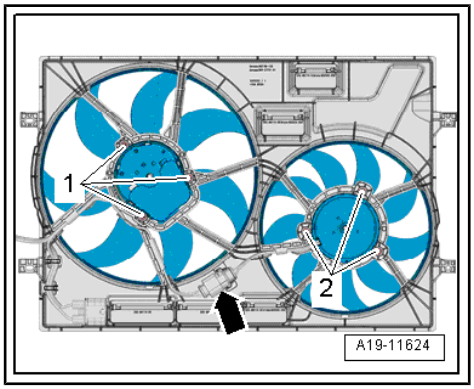
Removing

Note

During installation, all cable ties must be installed at the same location.

– Remove the fan shroud. Refer to ⇒ “4.6 Fan Shroud, Removing and Installing”, page 237 .
– Disconnect the connector -arrow-.

– Remove the bolts -1-, and remove the Radiator Fan - V7- .



Installing

Install in reverse order of removal and note the following:

– Install the fan shroud. Refer to
⇒ “4.6 Fan Shroud, Removing and Installing”, page 237 .

Tightening Specifications

♦ Refer to
⇒ “4.2 Overview - Fan Shroud and Radiator Fan”, page 232

4.7.2 Radiator Fan 2 - V177- , Removing and Installing

Removing

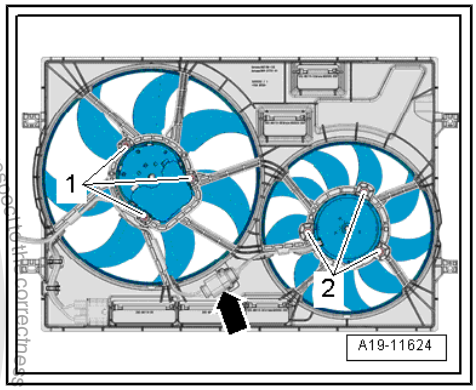
Note

During installation, all cable ties must be installed at the same location.

– Remove the fan shroud. Refer to
⇒ “4.6 Fan Shroud, Removing and Installing”, page 237 .

– Disconnect the connector -arrow-.

– Remove the bolts -2-, and remove the Radiator Fan 2 - V177- .



Installing

Install in reverse order of removal and note the following:

– Install the fan shroud. Refer to
⇒ “4.6 Fan Shroud, Removing and Installing”, page 237 .

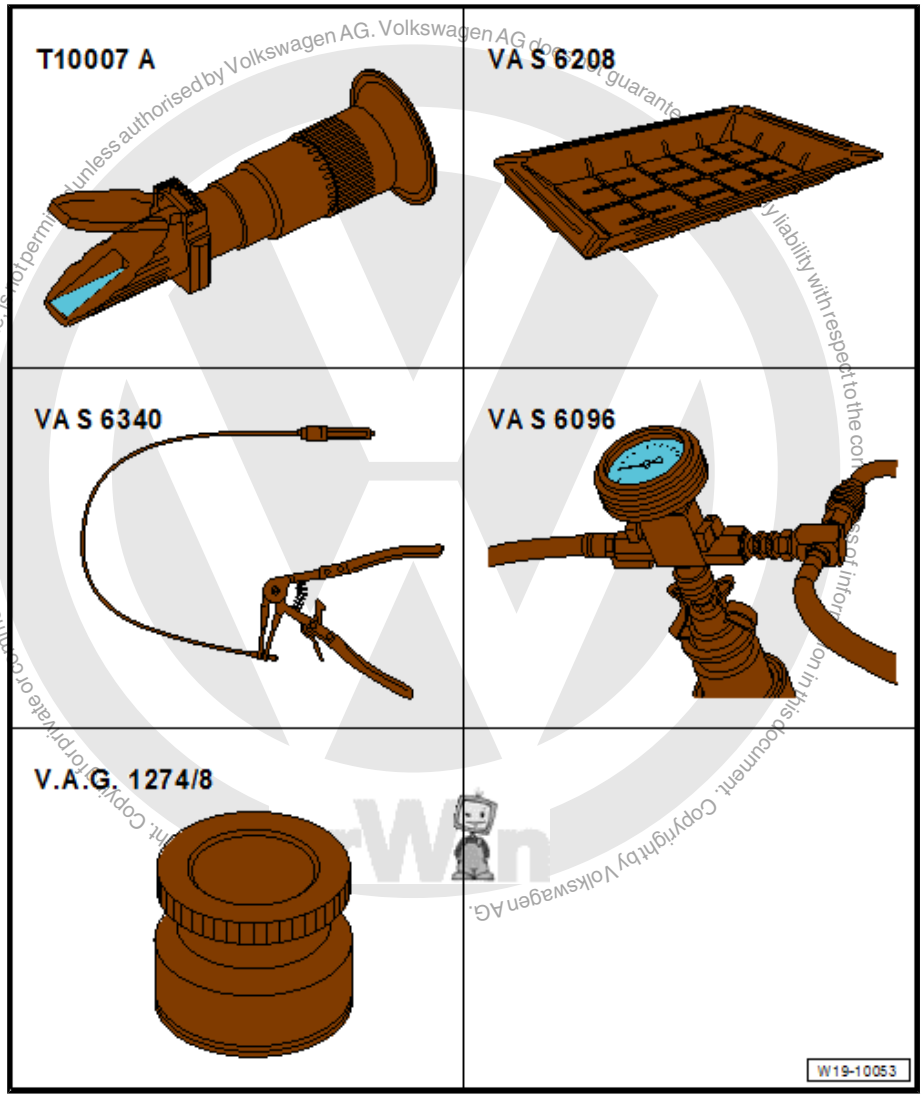
Tightening Specifications

♦ Refer to
⇒ “4.2 Overview - Fan Shroud and Radiator Fan”, page 232

5 Special Tools

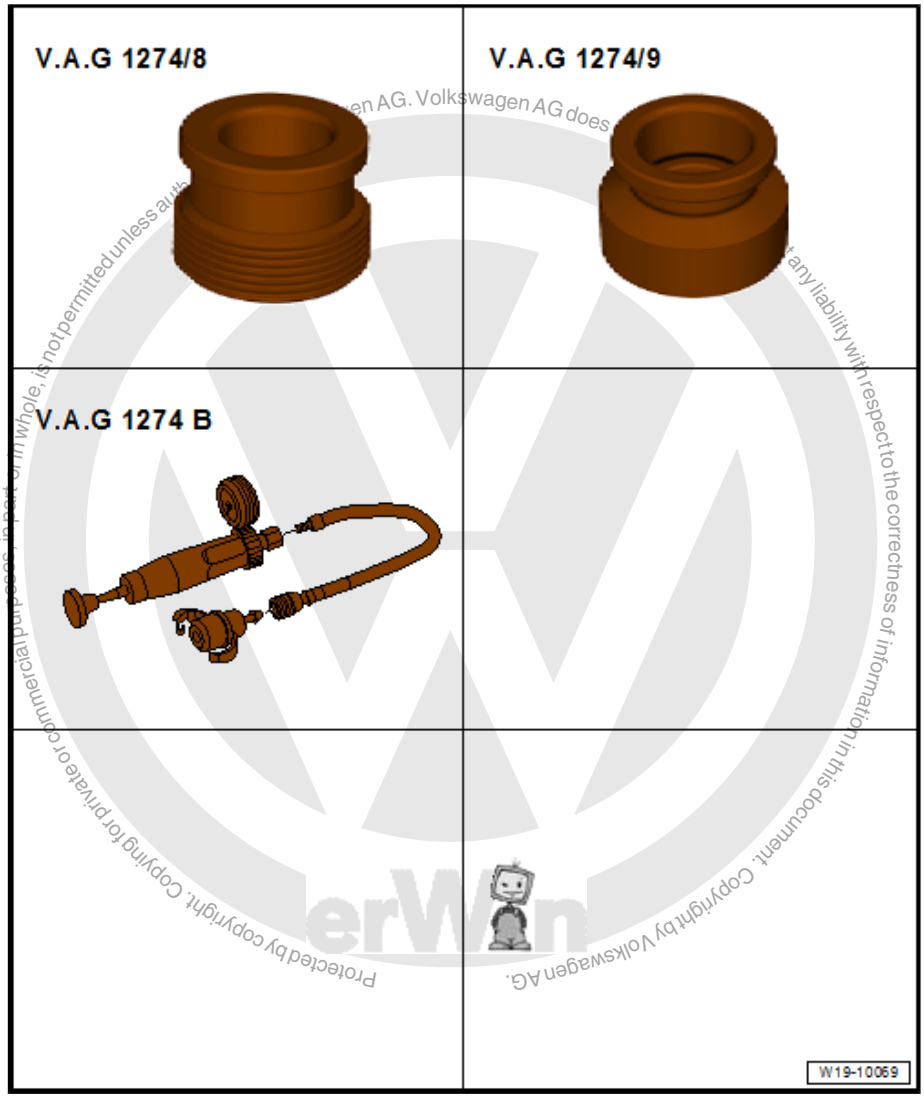
Special tools and workshop equipment required

- Refractometer - T10007A-
- Shop Crane - Drip Tray - VAS6208-
- Hose Clip Pliers - VAS6340-
- Cooling System Charge Kit - VAS6096-
- Cooling System Tester - Adapter - VAG1274/8-

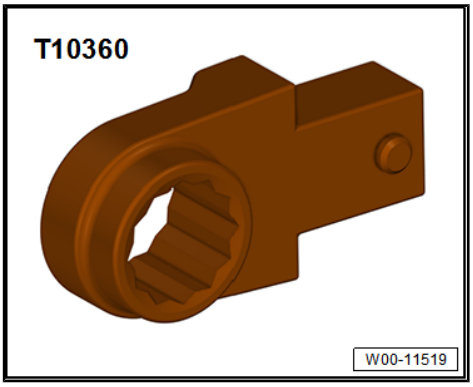


Special tools and workshop equipment required

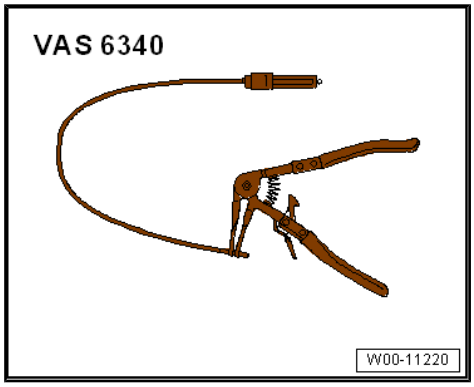
- Cooling System Tester - Adapter - VAG1274/8-
- Cooling System Tester - Adapter - VAG1274/9-
- Cooling System Tester - VAG1274B-



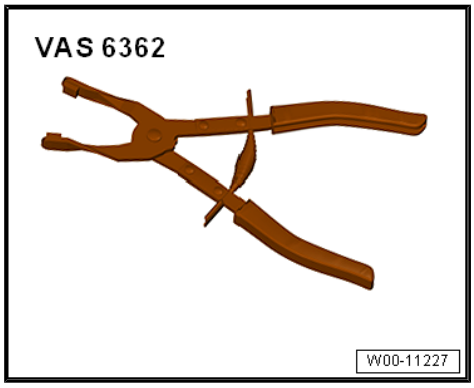
Torque Wrench 1331 Insert - Ring Wrench - 12mm - T10360-



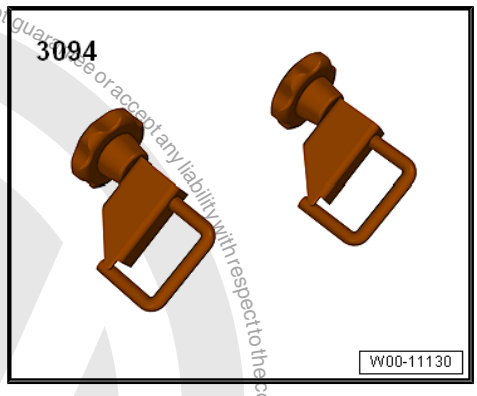
Hose Clip Pliers - VAS6340-



Hose Clip Pliers - VAS6362-



Hose Clamps - Up To 25 mm - 3094-



21 – Turbocharger, Supercharger

1 Turbocharger

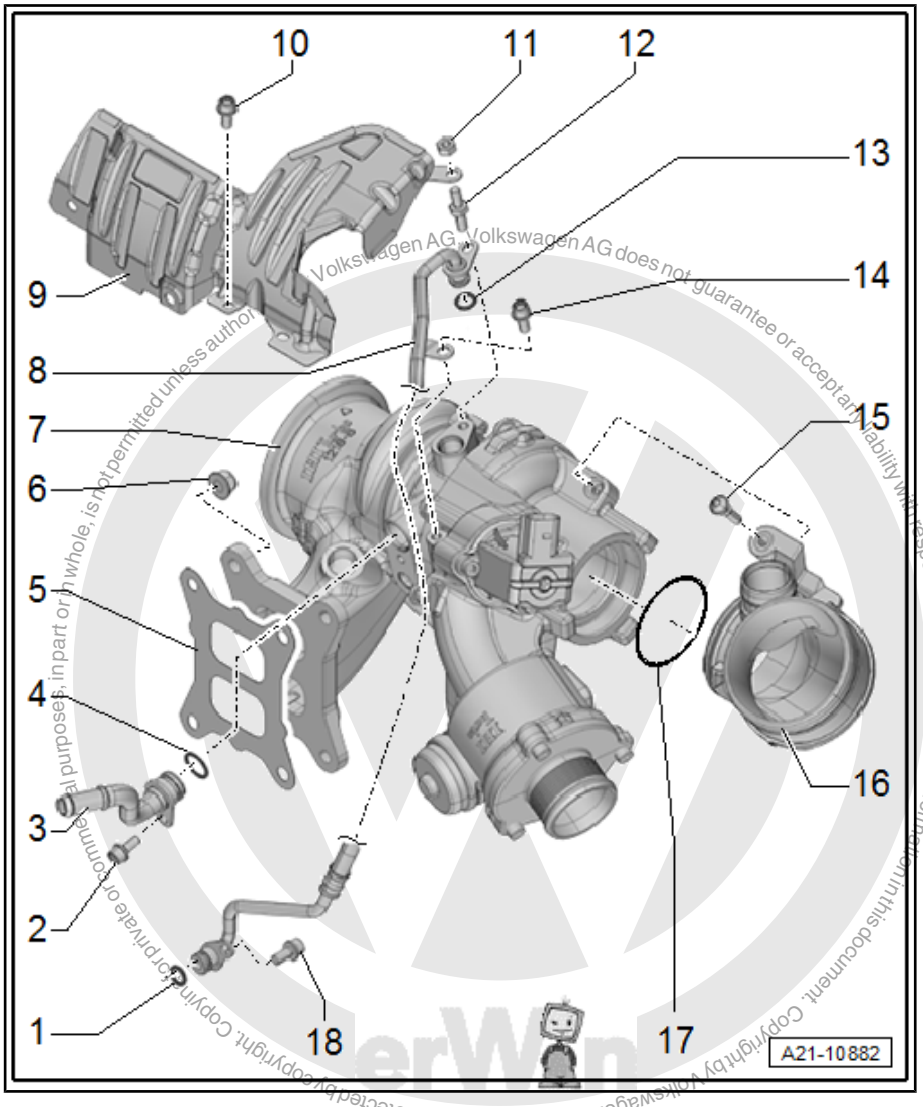
⇒ “1.1 Overview - Turbocharger”, page 243

⇒ “1.2 Turbocharger, Removing and Installing”, page 245

1.1 Overview - Turbocharger

Part I

Part II. Refer to ⇒ page 244 .



1 - O-Ring
- ❑ Replace after removing
- ❑ Coat with engine oil

2 - Bolt
- ❑ 9 Nm

3 - Coolant Supply Line

4 - O-Ring
- ❑ Replace after removing
- ❑ Coat with coolant

5 - Seal
- ❑ Replace after removing

6 - Nut
- ❑ 25 Nm
- ❑ Replace after removing

7 - Turbocharger
- ❑ Removing and installing. Refer to ⇒ “1.2 Turbocharger, Removing and Installing”, page 245 .

8 - Oil Supply Line

9 - Heat Shield

10 - Bolt
- ❑ 9 Nm

11 - Nut
- ❑ 9 Nm

12 - Bolt
- ❑ 9 Nm

13 - O-Ring
- ❑ Replace after removing
- ❑ Coat with engine oil

14 - Bolt
- ❑ 9 Nm

15 - Bolt
- ❑ 9 Nm

16 - Connection

17 - O-Ring

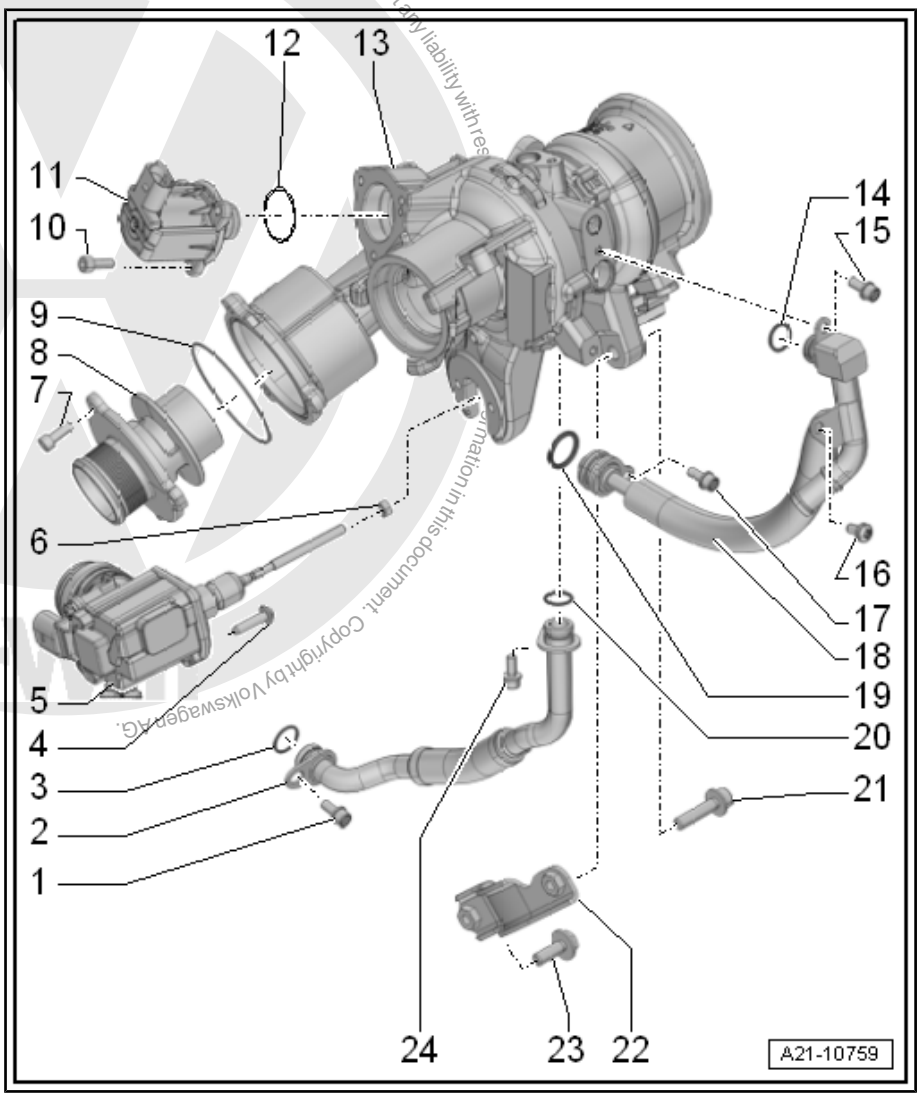
- ❑ Replace after removing

18 - Bolt

- ❑ 9 Nm

Part II

Part I. Refer to ⇒ page 243 .



1 - Bolt

- ❑ 9 Nm

2 - Oil Return Line

3 - O-Ring

- ❑ Replace after removing
- ❑ Coat with engine oil

4 - Bolt

- ❑ 10 Nm

5 - Charge Air Pressure Actuator - V465-

6 - Nut

- ❑ 10 Nm

7 - Bolt

- ❑ 9 Nm

8 - Connection

9 - O-Ring

- ❑ Replace after removing

10 - Bolt

- ❑ 9 Nm

11 - Turbocharger Recirculation Valve - N249-

- ❑ Note the installation position. Refer to ⇒ Fig. "" Turbocharger Recirculation Valve - N249- Installation Position"" , page 245 .

12 - O-Ring

- ❑ Replace after removing

13 - Turbocharger

- ❑ Removing and installing. Refer to ⇒ "1.2 Turbocharger, Removing and Installing", page 245 .

14 - O-Ring

- ❑ Replace after removing
- ❑ Coat with coolant

15 - Bolt

- ❑ 9 Nm

16 - Bolt

- ❑ 9 Nm

17 - Bolt

- ❑ 9 Nm

18 - Coolant Supply Line

19 - O-Ring

- ❑ Replace after removing
- ❑ Coat with coolant

20 - O-Ring

- ❑ Replace after removing
- ❑ Coat with engine oil

21 - Bolt

- ❑ 30 Nm
- ❑ Coat the thread with hot bolt paste. Refer to the Parts Catalog.

22 - Bracket

- ❑ For the turbocharger

23 - Bolt

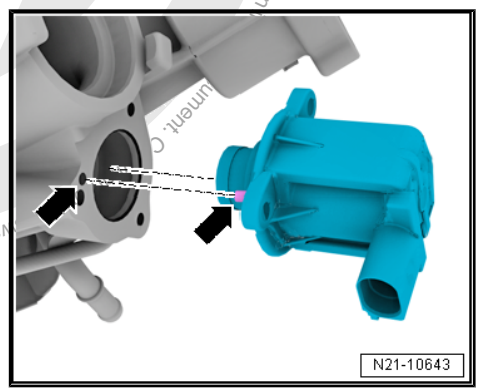
- ❑ 30 Nm

24 - Bolt

- ❑ 9 Nm

Turbocharger Recirculation Valve - N249- Installation Position

– Note the installation location -arrows-.



1.2 Turbocharger, Removing and Installing

Special tools and workshop equipment required

- ♦ Tensioning Strap - T10038-
- ♦ Engine Bung Set - VAS6122-
- ♦ Hose Clip Pliers - VAS6362-

Caution

If mechanical damage (such as a destroyed compression wheel) is found on the turbocharger, just replacing the turbocharger is not enough. To avoid subsequent damage later, perform the following steps:

- *Check the air filter housing, air filter element and air duct hoses for contamination.*
- *Check the entire charge air circuit and charge air cooler for foreign objects.*
- *If there are foreign objects in the charge air system, clean the charge air circuit and replace the charge air cooler if necessary.*
- *Risk of malfunctions caused by debris. Observe the guidelines for clean working conditions. Refer to ⇒ "3.1 Guidelines for Clean Working Conditions", page 6 .*

Removing

– Drain the coolant. Refer to ⇒ "1.2 Coolant, Draining and Filling", page 201 .

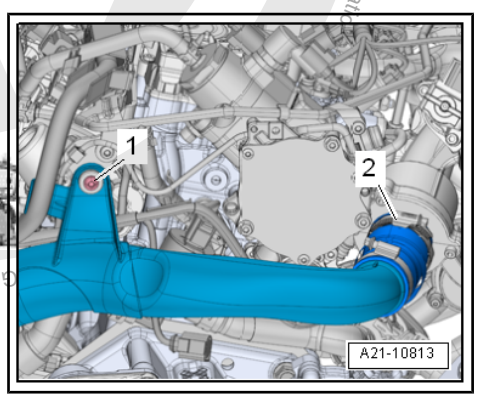
– Remove the front exhaust pipe with catalytic converter. Refer to ⇒ "2.2 Catalytic Converter, Removing and Installing", page 319 .

– Remove the air filter housing and intake hose. Refer to ⇒ "2.2 Air Filter Housing, Removing and Installing", page 269 .

– Loosen the hose clamp -2-.

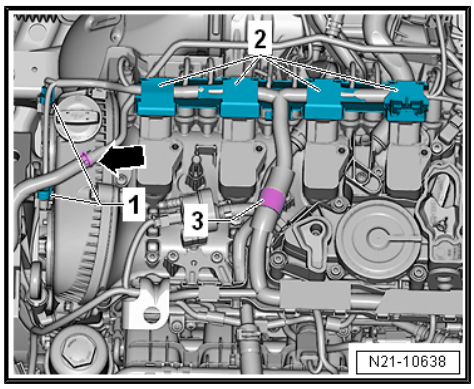
– Remove the bolt -1- and then remove the air guide pipe from the turbocharger.

– Remove the coolant hose -arrow-.

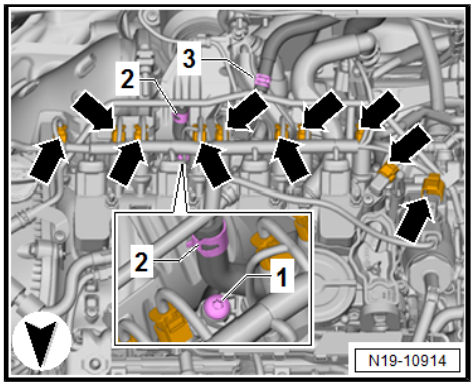


– Disconnect connectors -1 and 2-. Open the bracket -3-.

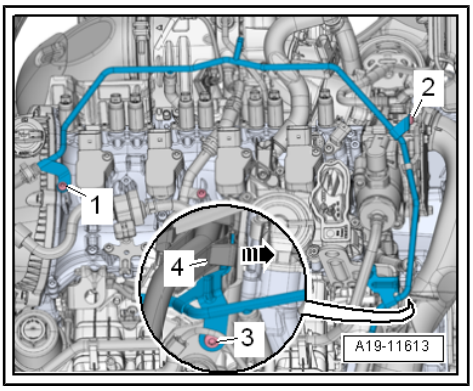
– Remove the ground cable bolt -1- and remove the coolant hoses -2 and 3-.



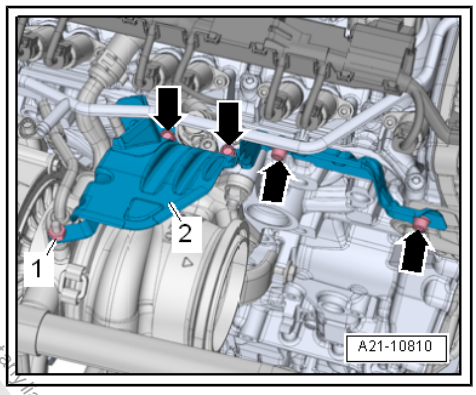
– Disconnect the connector -arrows-.
– Release the catch -arrow- and remove the wiring duct -4- upward from the bracket.



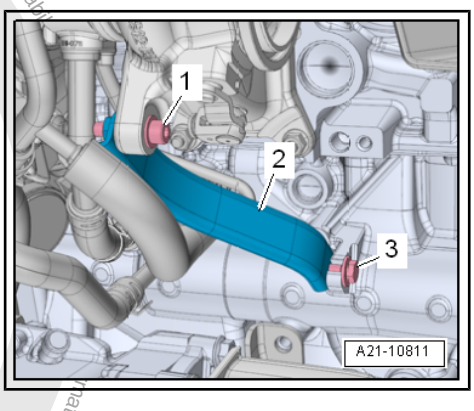
– Remove the bolts -1, 2 and 3-. Pivot the coolant pipe to the side.
– Remove the Oxygen Sensor 1 before Catalytic Converter - GX10- . Refer to
⇒ “7.2 Heated Oxygen Sensor, Removing and Installing”, page 302 .
– Remove the cam adjustment actuator. Refer to
⇒ “4.6 Cam Adjustment Actuator 1 F366 / Cam Adjustment Actuator 8 F373 , Removing and Installing”, page 161 .
– Remove the ignition coil with power output stage. Refer to
⇒ “1.2 Ignition Coils with Power Output Stages, Removing and Installing”, page 328 .



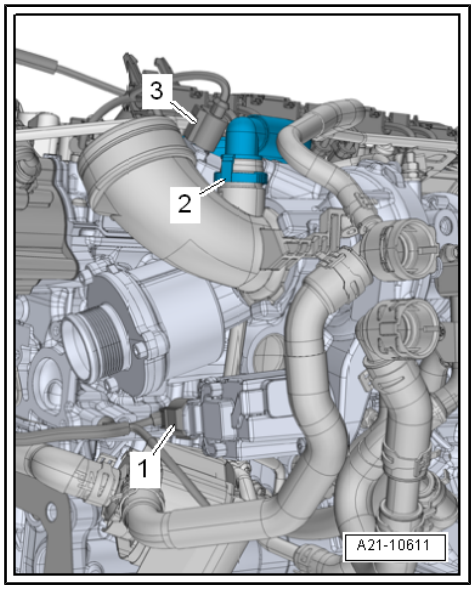
– Remove the bolts -arrows- and nut -1-.
– Remove the heat shield -2-.



– Remove the bolt -1-. Just loosen bolt -3-.
– Remove the turbocharger bracket -2-.



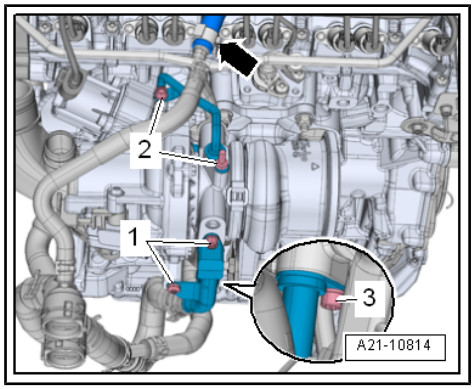
– Disconnect the connectors -1 and 3-.
– Press the release button on the crankcase ventilation hose -2- and remove the hose.
– Remove the heat shield on the wires and hoses if necessary.
– Remove the bolts -1- and then remove the connections.
– Remove the bolts -2 and 3-, the oil supply line and oil return line.



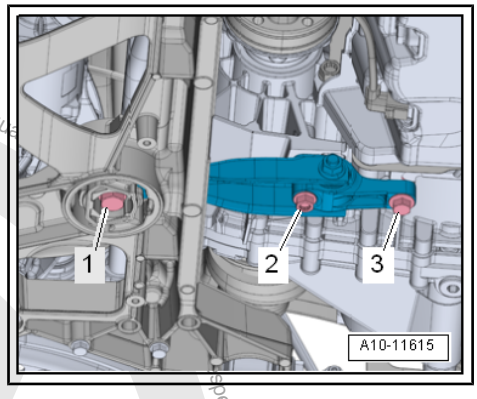
– Open the hose clamp -arrow -.

Note

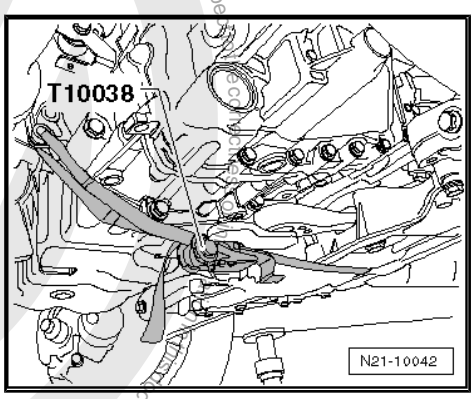
The following work step is necessary to achieve some more room between the cylinder head and the bulkhead.



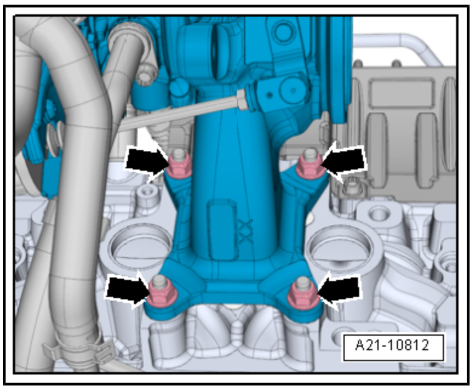
– Remove bolts -1, 2 and 3- and remove pendulum support.



– Pull the engine toward the rear with the Tensioning Strap - T10038- approximately 20 mm.
– Remove the nuts -arrows-.



– Remove the turbocharger from the cylinder head and pry up upward.



Installing

Install in reverse order of removal and note the following:

Note

- *Replace seals, gaskets, O-rings and self-locking nuts.*
- *Coat the stud bolts on the turbocharger with hot bolt paste; hot bolt paste. Refer to the Parts Catalog.*
- *Fill the turbocharger with engine oil at the connection for oil supply line.*
- *Hose connections and charge air system hoses must be free of oil and grease before installing.*
- *Secure hose connections with standard production clamps. Refer to the Parts Catalog.*

– Install the front exhaust pipe with the catalytic converter. Refer to ⇒ “2.2 Catalytic Converter, Removing and Installing”, page 319 .

– Install the exhaust system without tension. Refer to ⇒ “1.4 Exhaust System, Installing without Tension”, page 314 .

– Fill with coolant. Refer to ⇒ page 202 .

– Check the oil level.

Note

After installing turbocharger, let engine idle for approximately 1 minute without increasing engine speed. This ensures adequate oil supply to the turbocharger.

Tightening Specifications

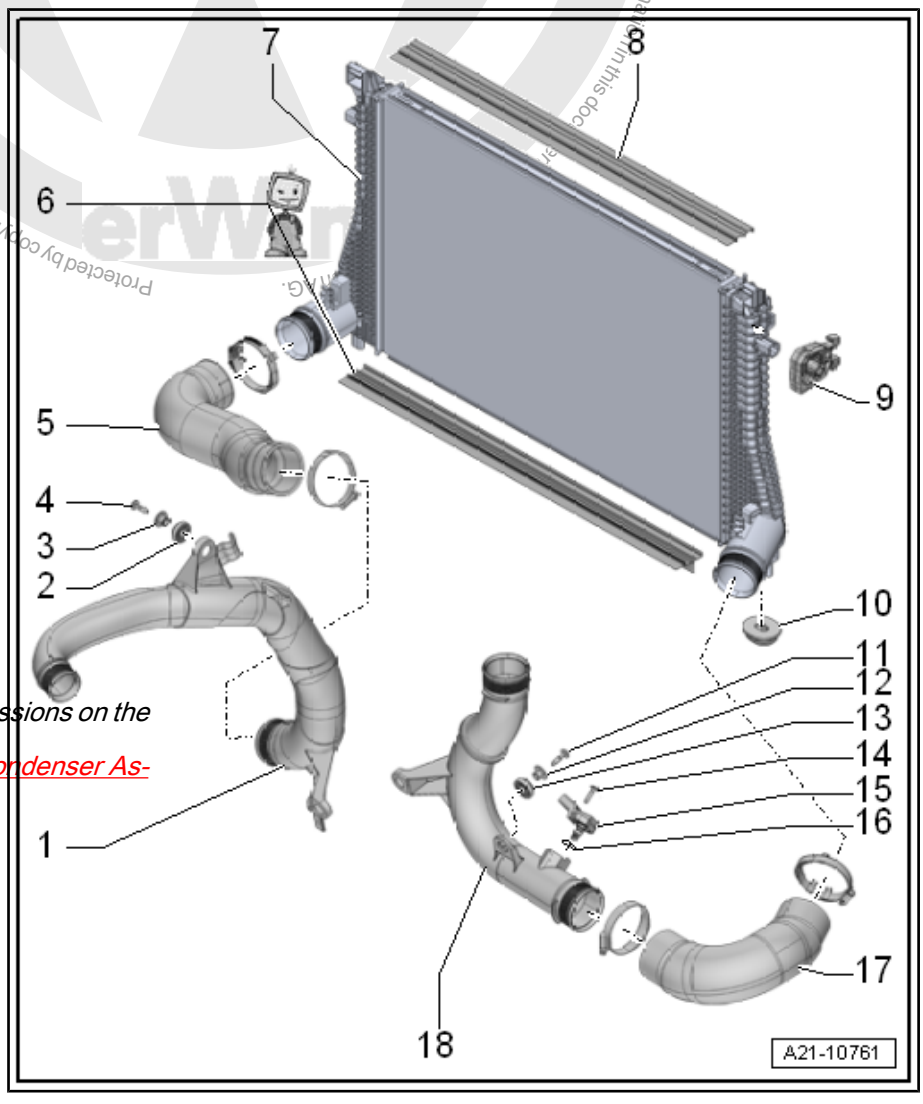
- Refer to ⇒ “1.1 Overview - Turbocharger”, page 243
- Refer to ⇒ “2.1 Overview - Air Filter Housing”, page 268
- Refer to ⇒ “7.1 Overview - Heated Oxygen Sensor”, page 301

2 Charge Air System

2.1 Overview - Charge Air System

Note

- *Assembly of screw-type clamps for the charge air hose connections. Refer to ⇒ “2.2 Overview - Charge Air Hose Connections”, page 251 .*
- *Before testing or performing a repair, check all air guide pipes and hoses and all vacuum lines for leaks and secure positioning.*
- *Follow the guidelines for clean working conditions. Refer to ⇒ “3.1 Guidelines for Clean Working Conditions”, page 6 .*



1 - Air Duct Pipe

2 - Grommet

3 - Spacer Sleeve

4 - Bolt

- ❑ 7 Nm

5 - Air Duct Hose

- ❑ Installing. Refer to ⇒ “2.2 Overview - Charge Air Hose Connections”, page 251 .

6 - Air Duct

7 - Charge Air Cooler

- ❑ Removing and installing. Refer to ⇒ “2.3 Charge Air Cooler, Removing and Installing”, page 251 .

Note

If there are small impressions on the discs. Refer to ⇒ “3.5 Radiator and Condenser Assembly”, page 7 .

8 - Air Duct

9 - Rubber Bushing

- ❑ For the charge air cooler

10 - Rubber Bushing

- ❑ For the charge air cooler

11 - Bolt

- ❑ 7 Nm

12 - Spacer Sleeve

13 - Grommet

14 - Bolt

- ❑ 5 Nm

15 - Charge Air Pressure Sensor - G31-

- ❑ Removing and installing. Refer to ⇒ "2.4 Charge Air Pressure Sensor G31 , Removing and Installing", page 252 .

16 - O-Ring

- ❑ Replace after removing

17 - Air Duct Hose

- ❑ Installing. Refer to ⇒ "2.2 Overview - Charge Air Hose Connections", page 251 .

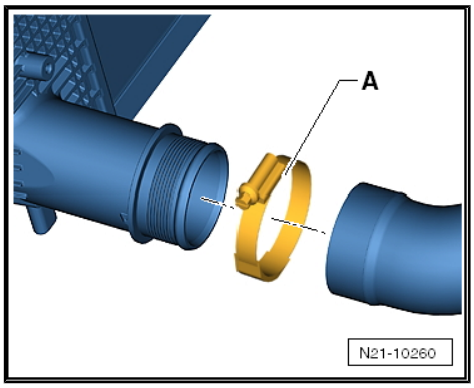
18 - Air Duct Pipe

2.2 Overview - Charge Air Hose Connections

Installing Hose Connections with Threaded Connections

Caution

Tighten the clamps -A- on the charge air pipes to 5.5 Nm. An insufficient or excessive torque can cause the charge air hose to come off the charge air pipe while driving.



Note

- *Before testing or performing a repair, check all air guide pipes and hoses and all vacuum lines for leaks and secure seating.*
- *The hose connections as well as air duct pipes and hoses must be free of oil and grease before installing.*
- *Secure all hose connections with standard production hose clamps. Refer to the Parts Catalog.*
- *In order to be able to securely mount the air guide hoses on their connectors, the screws on the used clamps must be sprayed with a rust remover before installing.*

2.3 Charge Air Cooler, Removing and Installing

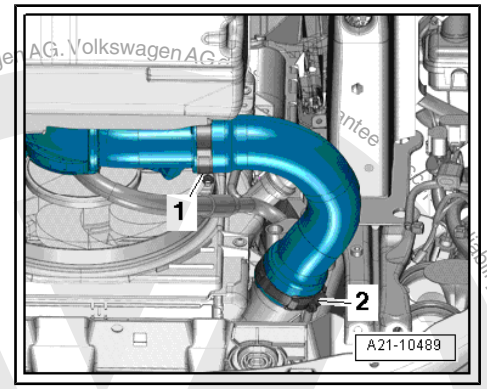
Removing

Special tools and workshop equipment required

- Engine Bung Set - VAS6122-

– Remove the noise insulation. Refer to ⇒ Body Exterior; Rep. Gr. 66 ; Noise Insulation; Overview - Noise Insulation .

– Open the clamp -1 and 2- and remove the air guide hose.



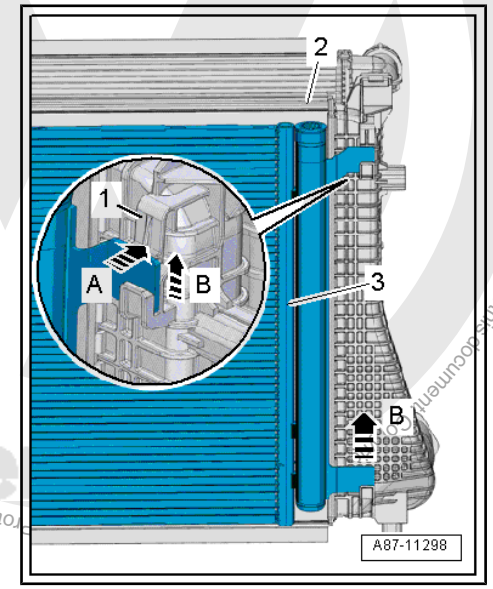
– Remove the radiator. Refer to ⇒ “4.4 Radiator, Removing and Installing”, page 233 .

– Seal the open lines and connections with clean plugs from the Engine Bung Set - VAS6122- .

– Have a second technician release the left and right clamps -1- in the direction of -arrow A-. Remove the condenser -3- upward out of the mounts in direction of -arrow B-.

– Secure the condenser to the lock carrier.

– Remove the charge air cooler downward.



Installing

Install in reverse order of removal and note the following:

Note

- *If there are small impressions on the discs. Refer to ⇒ “3.5 Radiator and Condenser Assembly”, page 7 .*
- *The hose connections and charge air system hoses must be free of oil and grease before installing.*
- *Secure all hose connections with standard production hose clamps. Refer to the Parts Catalog.*
- *In order to be able to securely mount the charge air hoses on their connectors, the screws on the used clamps must be sprayed with a rust remover before installing.*

Tightening Specifications:

- Refer to ⇒ “2.1 Overview - Charge Air System”, page 250

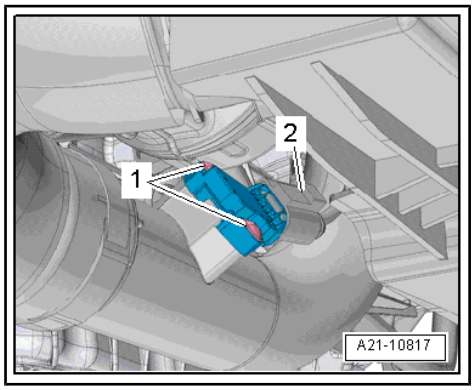
2.4 Charge Air Pressure Sensor - G31- , Removing and Installing

Removing

– Remove the noise insulation. Refer to ⇒ Body Exterior; Rep. Gr. 66 ; Noise Insulation; Overview - Noise Insulation .

– Disconnect the connector -2-.

– Remove the bolts -1- and remove the Charge Air Pressure Sensor - G31- from the air duct pipe.



Installing

Install in reverse order of removal and note the following:

Tightening Specifications

- Refer to ⇒ “2.1 Overview - Charge Air System”, page 250
- Refer to ⇒ Body Exterior; Rep. Gr. 66 ; Noise Insulation; Overview - Noise Insulation .

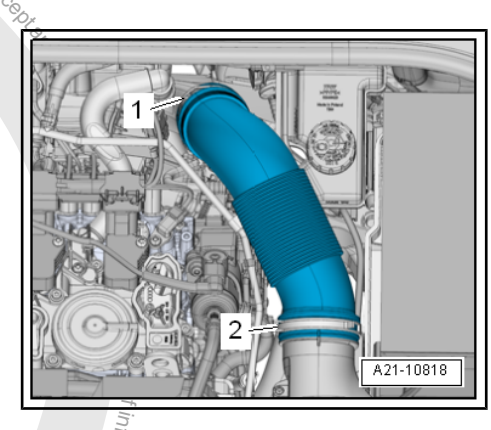
2.5 Charge Air System, Checking for Leaks

Special tools and workshop equipment required

- Turbo System Tester Kit - VAG1687-
- Ultrasonic Measuring Device - VAG1842-

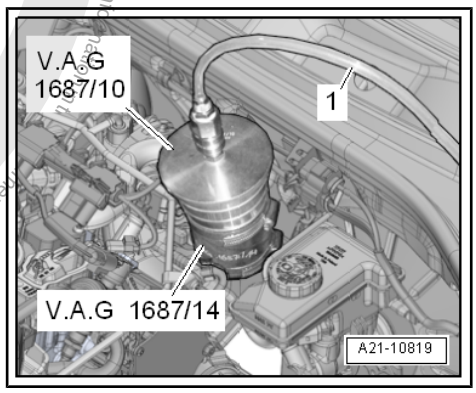
Procedure

– Loosen the clamps -1 and 2- and remove the air guide pipe.

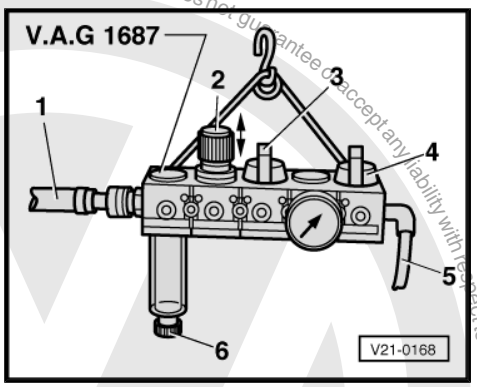


– Connect the Turbo System Tester Kit - Adapter 10 - VAG1687/10- with the Turbo System Tester Kit - Adapter - VAG1687/14- to the turbocharger.

– Connect the Turbo System Tester Kit - VAG1687- to the adapter.



Prepare the Turbo System Tester Kit - VAG1687- as follows:



– Completely remove the pressure regulating valve -2- and close the valves -3 and 4-.

Note

Pull the knob in order to rotate the pressure regulating valve -2-.

– Connect the Turbo System Tester Kit - VAG1687- to compressed air -1- with a commercially available adapter piece.

Note

If there is water in the viewing glass, drain it through the drain plug -6-.

– Open the valve -3-.

Caution

Risk of damage if the pressure is set too high.

- ***Pressure must not exceed 0.5 bar (7.2 psi)!***

– Set the pressure to 0.5 bar (7.2 psi) using the pressure control valve -2-.

– Open the valve -4- and wait until the test circuit is filled. Regulate the pressure to 0.5 bar (7.2 psi) again if necessary.

– Listen, feel and use commercially available leak detection spray or the Ultrasonic Measuring Device - VAG1842- to check the charge air system for leaks.

Note

- *A small quantity of air dissipates via the valves in the engine. For this reason a pressure retention test is not possible.*
- *Information on the Ultrasonic Tester - VAG1842S- . Refer to the Operating Instructions.*
- *Release the pressure in the test circuit by pulling off the hose coupling before removing the adapter.*

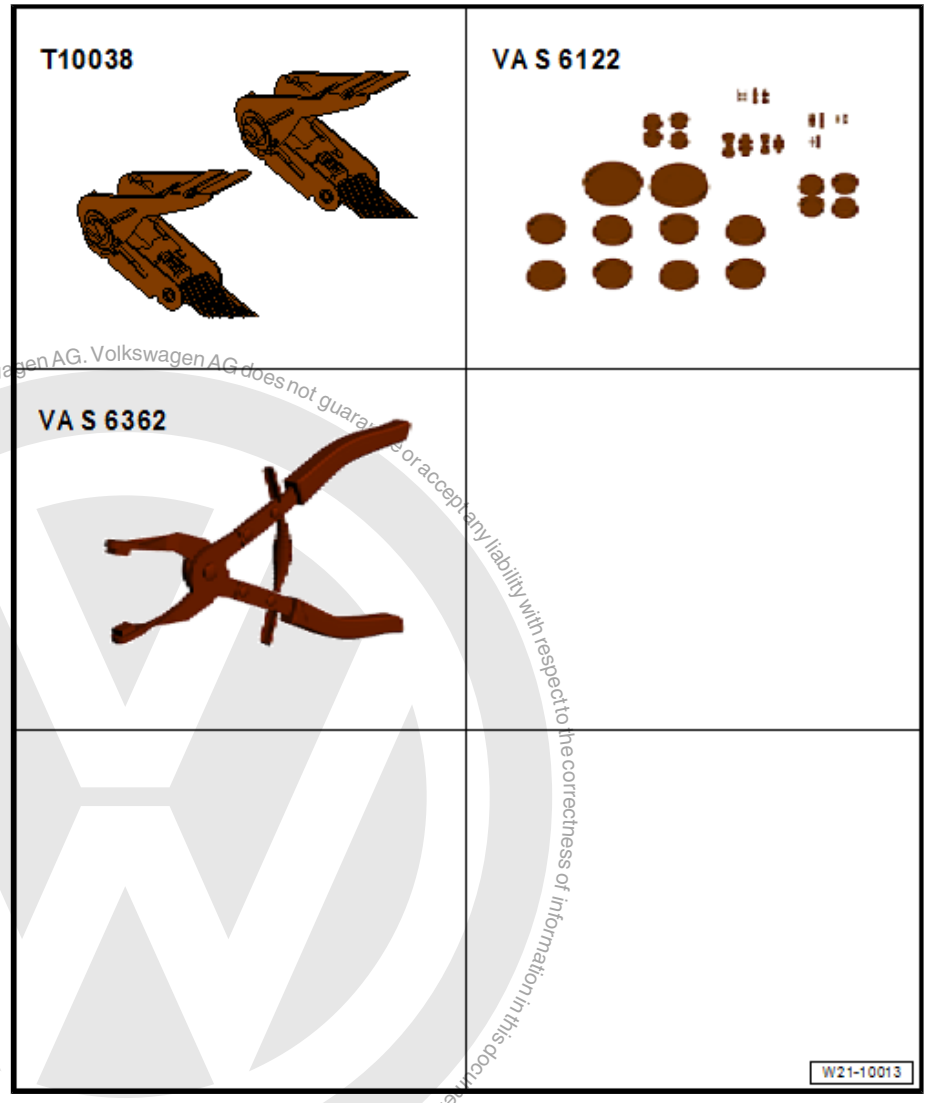
Assembling

Assembly is performed in reverse order of removal.

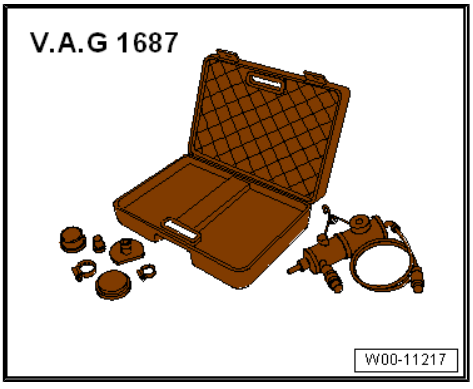
3 Special Tools

Special tools and workshop equipment required

- Tensioning Strap - T10038-
- Engine Bung Set - VAS6122-
- Hose Clip Pliers - VAS6362-



- Turbo System Tester Kit - VAG1687-



- Not illustrated:
- Ultrasonic Measuring Device - VAG1842-

24 – Multiport Fuel Injection

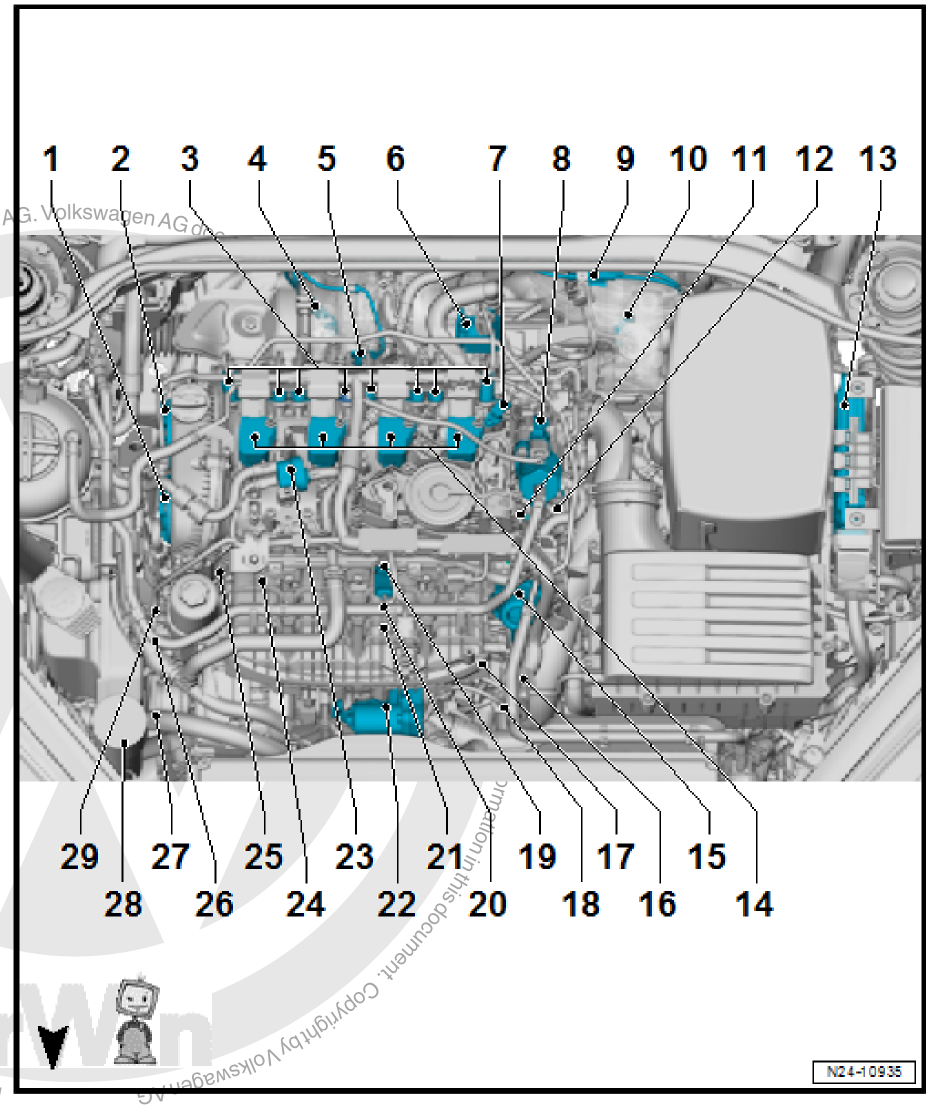
1 Injection System

⇒ "1.1 Component Location Overview - Injection System", page 256

⇒ "1.2 High Fuel Pressure, Reducing", page 266

1.1 Component Location Overview - Injection System

Components A through H are not depicted in the exploded view illustration.



1 - Camshaft Adjustment Valve 1 - N205-

- Component location. Refer to ⇒ "1.1 Overview - Timing Chain Cover", page 82 .
- Removing and installing. Refer to ⇒ "4.5 Camshaft Adjustment Valve 1 N205 / Exhaust Camshaft Adjustment Valve 1 N318 , Removing and Installing", page 160 .

2 - Exhaust Camshaft Adjustment Valve 1 - N318-

- Component location. Refer to ⇒ "1.1 Overview - Timing Chain Cover", page 82 .
- Removing and installing. Refer to ⇒ "4.5 Camshaft Adjustment Valve 1 N205 / Exhaust Camshaft Adjustment Valve 1 N318 , Removing and Installing", page 160 .

3 -

- Cylinder 1 Exhaust Camshaft Adjuster A - N580-
- Cylinder 1 Exhaust

Camshaft B - N581-

- ❑ Cylinder 2 Exhaust Camshaft Adjuster A - N588-
- ❑ Cylinder 2 Exhaust Camshaft B - N589-
- ❑ Cylinder 3 Exhaust Camshaft Adjuster A - N596-
- ❑ Cylinder 3 Exhaust Camshaft B - N597-
- ❑ Cylinder 4 Exhaust Camshaft Adjuster A - N604-
- ❑ Cylinder 4 Exhaust Camshaft B - N605-
- ❑ Component location. Refer to ⇒ Fig. ""Ignition Coils and Adjusting Elements"" , page 263 .

4 - Oxygen Sensor 1 after Catalytic Converter - GX7-

- ❑ Consists of:

  Oxygen Sensor after Three Way Catalytic Converter - G130-

  Heater For Oxygen Sensor 2 after Catalytic Converter - Z30-

- ❑ Component location. Refer to ⇒ Fig. "" Oxygen Sensor 1 after Catalytic Converter -GX7- -1- "" , page 266 .
- ❑ Removing and installing. Refer to ⇒ "7.2.2 Oxygen Sensor 1 after Catalytic Converter GX7 , Removing and Installing", page 303 .

5 - Oxygen Sensor 1 Before Catalytic Converter - GX10-

- ❑ Consists of:

  Heated Oxygen Sensor - G39-

Oxygen Sensor Heater - Z19-

- ❑ Component location. Refer to ⇒ Fig. ““ Oxygen Sensor 1 before Catalytic Converter -GX10- -1- ”“ , page 266 .
- ❑ Removing and installing. Refer to ⇒ “7.2.1 Oxygen Sensor 1 before Catalytic Converter GX10 , Removing and Installing”, page 302 .

6 - Turbocharger Recirculation Valve - N249- and Charge Air Pressure Actuator - V465-

- ❑ Components are installed directly on the turbocharger
- ❑ Component location. Refer to ⇒ “1.1 Overview - Turbocharger”, page 243 .
- ❑ Removing and installing. Refer to ⇒ “1.1 Overview - Turbocharger”, page 243 .

7 - Camshaft Position Sensor 3 - G300-

- ❑ 9 Nm
- ❑ Component location. Refer to ⇒ Fig. ““High Pressure Pump and Camshaft Position Sensor”“ , page 265 .
- ❑ Removing and installing. Refer to ⇒ “1.4.2 Camshaft Position Sensor 3 G300 , Removing and Installing”, page 331 .

8 - High Pressure Pump with Fuel Pressure Regulator Valve - N276-

- ❑ Component location. Refer to ⇒ Fig. ““High Pressure Pump and Camshaft Position Sensor”“ , page 265 .
- ❑ Overview - High Pressure Pump. Refer to ⇒ “6.1 Overview - High Pressure Pump”, page 296 .
- ❑ Removing and installing. Refer to ⇒ “6.2 High Pressure Pump, Removing and Installing”, page 297 .

9 - Connectors

- ❑ For Oxygen Sensor 1 before Catalytic Converter - GX10-
- ❑ For Oxygen Sensor 1 after Catalytic Converter - GX7-
- ❑ Component location. Refer to ⇒ Fig. ““Heated Oxygen Sensors”“ , page 265 .

10 - Brake Lamp Switch - F- and Brake Pedal Switch - F47-

- ❑ Component location. Refer to ⇒ Fig. ““ Brake Lamp Switch -F- / Brake Pedal Switch -F63- and Vacuum Sensor -G608- .”“ , page 261 .
- ❑ Removing and installing. Refer to ⇒ Break System; Rep. Gr. 45 ; Component Location Overview; Component Location Overview - ABS/ESP .

11 - Camshaft Position Sensor - G40-

- ❑ 9 Nm
- ❑ Removing and installing. Refer to ⇒ “1.4.1 Camshaft Position Sensor G40 , Removing and Installing”, page 330 .

12 - Engine Coolant Temperature Sensor - G62-

- ❑ Component location. Refer to ⇒ “2.3 Overview - Engine Coolant Temperature Sensor”, page 213 .
- ❑ Removing and installing. Refer to ⇒ “2.10 Engine Coolant Temperature Sensor G62 , Removing and Installing”, page 222 .

13 - Engine Control Module - J623-

- ❑ Removing and installing. Refer to ⇒ “8.1 Engine Control Module J623 , Removing and Installing”, page 304 .

14 - Ignition Coils with Power Output Stages

- ❑ Component location. Refer to ⇒ Fig. ““Ignition Coils and Adjusting Elements”“ , page 263 .
- ❑ Removing and installing. Refer to ⇒ “1.2 Ignition Coils with Power Output Stages, Removing and Installing”, page 328 .

15 - Channel Separating Plate Vacuum Diaphragm (Intake Manifold Flaps)

- ❑ Component location. Refer to ⇒ Fig. ““Variable Intake Manifold”“ , page 264 .

16 - Intake Manifold Runner Control Valve - N316-

- ❑ Component location. Refer to ⇒ Fig. ““Variable Intake Manifold”“ , page 264 .

17 - Engine Speed Sensor - G28-

- ❑ 4 Nm and 45° additional turn
- ❑ Component location. Refer to ⇒ Fig. ““ Engine Speed Sensor -G28- -1- ”“ , page 265 .
- ❑ Coat the seal with oil
- ❑ Replacing the bolt
- ❑ Removing and installing. Refer to ⇒ “1.5 Engine Speed Sensor G28 , Removing and Installing”, page 331 .

18 - Connectors for

- ❑ Knock Sensor 1 - G61-
- ❑ Intake Manifold Runner Control Valve - N316-
- ❑ Fuel Pressure Sensor - G247-
- ❑ Intake Manifold Runner Position Sensor - G336-
- ❑ Camshaft Position Sensor - G40-
- ❑ Combustion chamber fuel injectors N30 to N33
- ❑ Component location. Refer to ⇒ Fig. ““Connectors”“ , page 265 .

19 - Low Fuel Pressure Sensor - G410-

- ❑ 15 Nm
- ❑ Install the Low Fuel Pressure Sensor - G410- with an adapter
- ❑ Component location. Refer to ⇒ Fig. ““View from Above”“ , page 264 .
- ❑ Removing and installing. Refer to ⇒ “5.3 Low Fuel Pressure Sensor G410 , Removing and Installing”, page 293 .

20 - Knock Sensor 1 - G61-

- ❑ 20 Nm
- ❑ In order to remove, the coolant pump and coolant thermostat must be removed
- ❑ Removing and installing. Refer to ⇒ “1.3 Knock Sensor 1 G61 , Removing and Installing”, page 330 .

21 - Intake Manifold Sensor - GX9-

- ❑ Consists of:

  Intake Air Temperature Sensor - G42-

  Manifold Absolute Pressure Sensor - G71-
- ❑ Component location. Refer to ⇒ Fig. ““View from Above”“ , page 264 .
- ❑ Removing and installing. Refer to ⇒ “5.4 Intake Air Temperature Sensor G42 / Manifold Absolute Pressure Sensor G71 , Removing and Installing”, page 294 .

22 - Throttle Valve Control Module - GX3-

- ❑ Consists of:

  EPC Throttle Drive - G186-

  EPC Throttle Drive Angle Sensor 1 - G187-

EPC Throttle Drive Angle Sensor 2 - G188-

- After replacing or removing and installing, the Throttle Valve Control Module - GX3- must be adapted to the Engine Control Module - J623- . Refer to Vehicle Diagnostic Tester .

23 - EVAP Canister Purge Regulator Valve 1 - N80-

- Component location. Refer to ⇒ Fig. ""Ignition Coils and Adjusting Elements"" , page 263 .

24 - Fuel Pressure Sensor - G247-

- 27 Nm
- Component location. Refer to ⇒ Fig. ""Combustion Chambers Fuel Injectors"" , page 263 .
- Removing and installing. Refer to ⇒ "5.2 Fuel Pressure Sensor G247 , Removing and Installing", page 291 .

25 - Intake Manifold Runner Position Sensor - G336-

- Component location. Refer to ⇒ Fig. "" Intake Manifold Runner Position Sensor -G336- -1- "" , page 264 .

26 - Oil Pressure Regulation Valve - N428-

- Component location. Refer to ⇒ "4.2 Overview - Oil Pressure Switch/Oil Pressure Regulation Valve", page 187 .
- Removing and installing. Refer to ⇒ "4.4 Oil Pressure Regulation Valve N428 , Removing and Installing", page 188 .

27 - Engine Coolant Temperature Sensor on Radiator Outlet - G83-

- Component location. Refer to ⇒ "2.3 Overview - Engine Coolant Temperature Sensor", page 213 .
- Removing and installing. Refer to ⇒ "2.11 Engine Coolant Temperature Sensor on Radiator Outlet G83 , Removing and Installing", page 223 .

28 - Charge Air Pressure Sensor - G31-

- Component location. Refer to ⇒ "2.1 Overview - Charge Air System", page 250 .
- Removing and installing. Refer to ⇒ "2.4 Charge Air Pressure Sensor G31 , Removing and Installing", page 252 .

29 - Oil Pressure Switch - F1- , Reduced Oil Pressure Switch - F378- and Piston Cooling Nozzle Control Valve - N522-

- Component location. Refer to ⇒ "4.2 Overview - Oil Pressure Switch/Oil Pressure Regulation Valve", page 187 .
- Checking. Refer to Vehicle Diagnostic Tester .
- Removing and installing. Refer to ⇒ "4.2 Overview - Oil Pressure Switch/Oil Pressure Regulation Valve", page 187 .

A - Fuel Injector, Direct Fuel Injection

- Component location. Refer to ⇒ Fig. ""Combustion Chambers Fuel Injectors"" , page 263 .
- Cylinder 1 Fuel Injector - N30-
- Cylinder 2 Fuel Injector - N31-
- Cylinder 3 Fuel Injector - N32-
- Cylinder 4 Fuel Injector - N33-
- Removing and installing. Refer to ⇒ "4.3 Fuel Injectors, Removing and Installing", page 283 .

B - Fuel Injector, Multiport Fuel Injection

- Component location. Refer to ⇒ Fig. ""Intake Manifold Fuel Injectors"" , page 263 .
- Cylinder 1 Fuel Injector 2 - N532-
- Cylinder 2 Fuel Injector 2 - N533-
- Cylinder 3 Fuel Injector 2 - N534-
- Cylinder 4 Fuel Injector 2 - N535-
- Removing and installing. Refer to ⇒ "4.3 Fuel Injectors, Removing and Installing", page 283 .

C - Fuel Pump Control Module - J538-

- ❑ Component location. Refer to ⇒ Fig. "" Fuel Pump Control Module -J538- "" , page 262 .
- ❑ Removing and installing. Refer to ⇒ Rep. Gr. 20 ; Fuel Pump .

D - Clutch Position Sensor - G476-

- ❑ Only on vehicles with a manual transmission
- ❑ Component location. Refer to ⇒ Fig. "" Clutch Position Sensor -G476- "" , page 262 .

E - Accelerator Pedal Module - GX2-

- ❑ Consists of:

  Accelerator Pedal Position Sensor - G79-

  Accelerator Pedal Position Sensor 2 - G185-

- ❑ Component location. Refer to ⇒ Fig. "" Accelerator Pedal Module -GX2- "" , page 261 .
- ❑ Removing and installing. Refer to ⇒ Fuel Supply System; Rep. Gr. 20 ; Accelerator Mechanism .

F - Radiator Fan Control Module - J293-

- ❑ Installed inside the radiator fan

G - Oil Pressure Switch, Level 3 - F447-

- ❑ Component location. Refer to ⇒ "4.2 Overview - Oil Pressure Switch/Oil Pressure Regulation Valve", page 187 .
- ❑ Checking and removing and installing. Refer to ⇒ "4.6 Reduced Oil Pressure Switch F378 , Removing and Installing", page 190 .

H - Left Electrohydraulic Engine Mount Solenoid Valve - N144- and Right Electrohydraulic Engine Mount Solenoid Valve - N145-

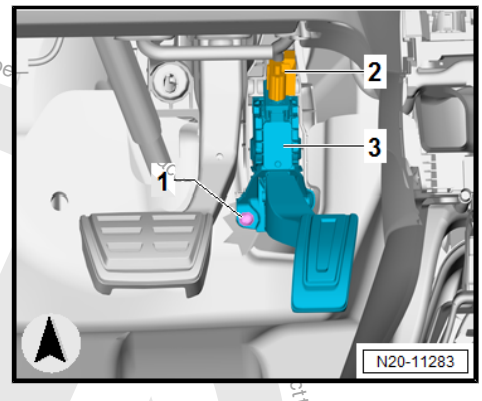
- ❑ Not installed on all vehicles (dependent on the transmission)

Accelerator Pedal Module - GX2-

1 - Accelerator Pedal Module Mount

2 - Connector

3 - Accelerator Pedal Module - GX2-

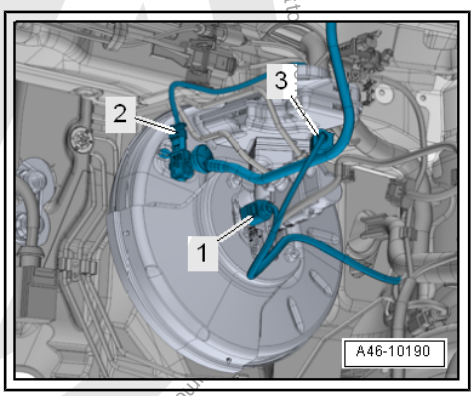


Brake Lamp Switch - F- / Brake Pedal Switch - F63- and Vacuum Sensor - G608- .

1 - Brake Lamp Switch - F- / Brake Pedal Switch - F63-

2 - Vacuum Sensor - G608-

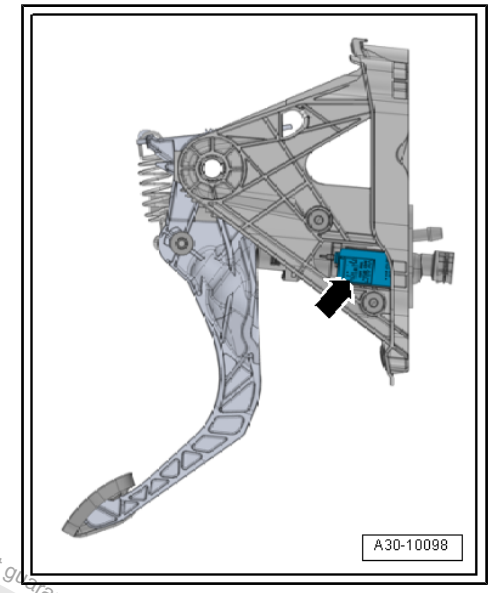
◆ In the engine compartment on the brake booster.



Clutch Position Sensor - G476-

- On the clutch pedal bracket -arrow-.

Removing and installing. Refer to ⇒ Rep. Gr. 30 ; Clutch Mechanism .

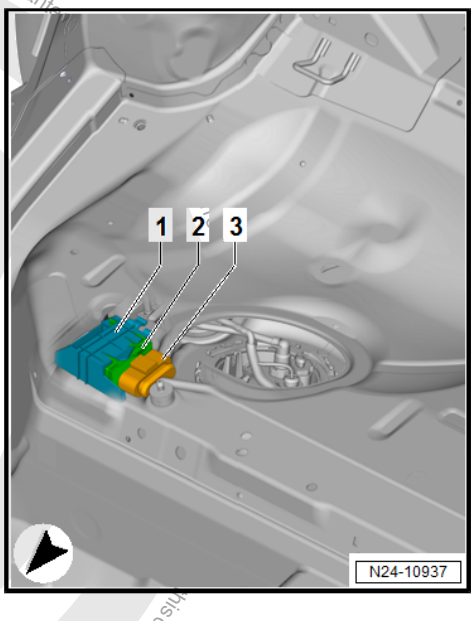


Fuel Pump Control Module - J538-

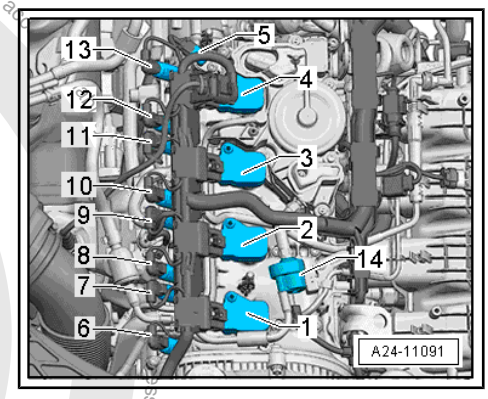
1 - Bracket

2 - Fuel Pump Control Module - J538-

3 - Connector

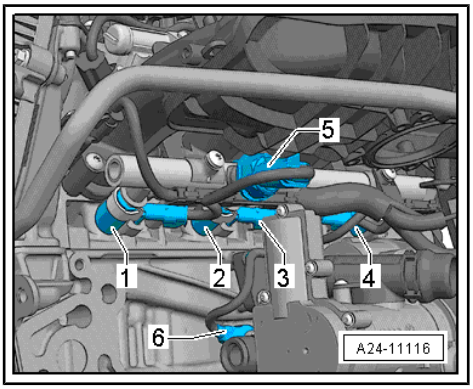


Ignition Coils and Adjusting Elements



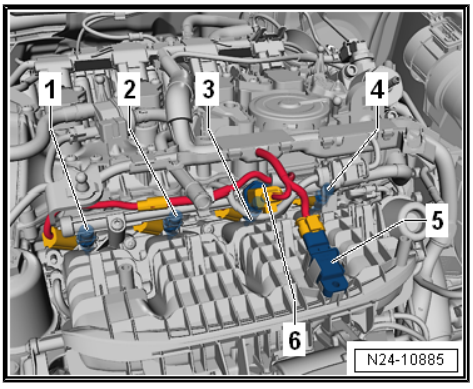
1 - Ignition Coil 1 with Power Output Stage - N70-
2 - Ignition Coil 2 with Power Output Stage - N127-
3 - Ignition Coil 3 with Power Output Stage - N291-
4 - Ignition Coil 4 with Power Output Stage - N292-
5 - Camshaft Position Sensor 3 - G300-
6 - Cylinder 1 Exhaust Camshaft Adjuster A - N580-
7 - Cylinder 1 Exhaust Camshaft B - N581-
8 - Cylinder 2 Exhaust Camshaft Adjuster A - N588-
9 - Cylinder 2 Exhaust Camshaft B - N589-
10 - Cylinder 3 Exhaust Camshaft Adjuster A - N596-
11 - Cylinder 3 Exhaust Camshaft B - N597-
12 - Cylinder 4 Exhaust Camshaft Adjuster A - N604-
13 - Cylinder 4 Exhaust Camshaft B - N605-
14 - EVAP Canister Purge Regulator Valve 1 - N80-

Combustion Chambers Fuel Injectors



1 - Cylinder 1 Fuel Injector - N30-
2 - Cylinder 2 Fuel Injector - N31-
3 - Cylinder 3 Fuel Injector - N32-
4 - Cylinder 4 Fuel Injector - N33-
5 - Fuel Pressure Sensor - G247-
6 - Knock Sensor 1 - G61-

Intake Manifold Fuel Injectors



1 - Cylinder 1 Fuel Injector 2 - N532-
2 - Cylinder 2 Fuel Injector 2 - N533-
3 - Cylinder 3 Fuel Injector 2 - N534-
4 - Cylinder 4 Fuel Injector 2 - N535-
5 - Intake Manifold Sensor - GX9-
6 - Low Fuel Pressure Sensor - G410-

View from Above

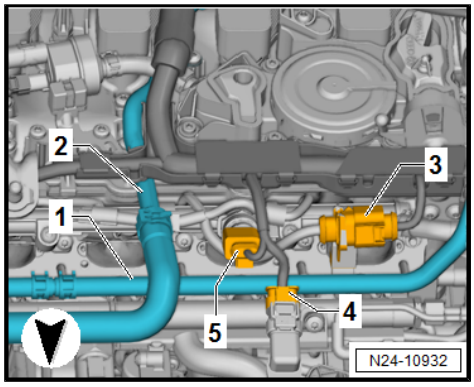
1 - Fuel Supply Line

2 - Coolant line

3 - Connector for the intake manifold-fuel Injector

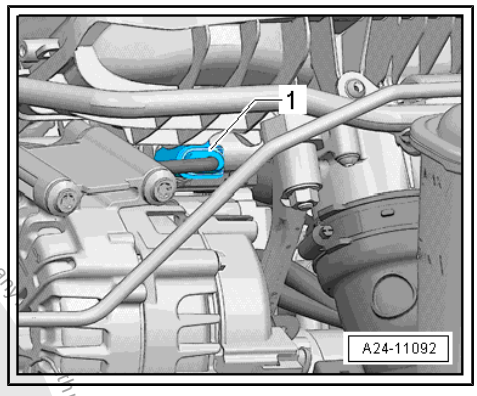
4 - Intake Manifold Sensor - GX9-

5 - Low Fuel Pressure Sensor - G410-



Fuel Pressure Sensor in the High Pressure System

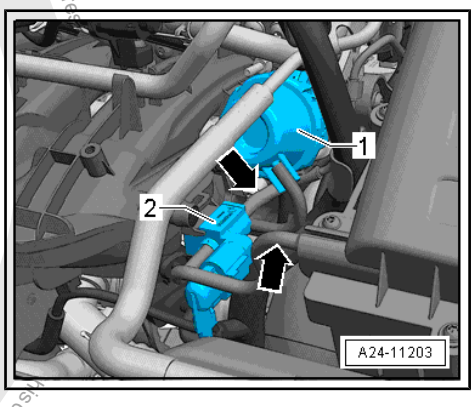
1 - Fuel Pressure Sensor - G247-



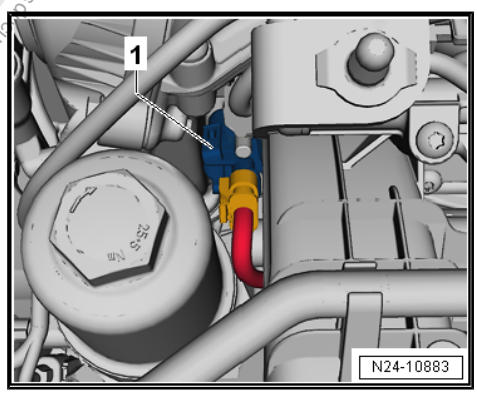
Variable Intake Manifold

1 - Channel separating plate vacuum diaphragm (intake manifold flaps)

2 - Intake Manifold Runner Control Valve - N316-



Intake Manifold Runner Position Sensor - G336- -1-



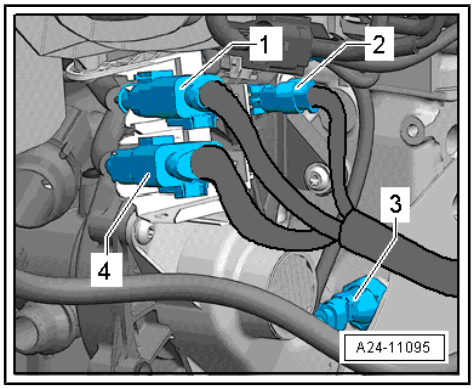
Connectors

1 - For combustion chambers fuel injectors

2 - For Knock Sensor 1 - G61-

3 - Oil Pressure Switch, Level 3 - F447-

4 - For Intake Manifold Runner Control Valve - N316- , Fuel Pressure Sensor - G247- , Intake Manifold Runner Position Sensor - G336- , Engine Coolant Temperature Sensor - G62- , Camshaft Position Sensor - G40-



High Pressure Pump and Camshaft Position Sensor

1 - Camshaft Position Sensor 3 - G300-

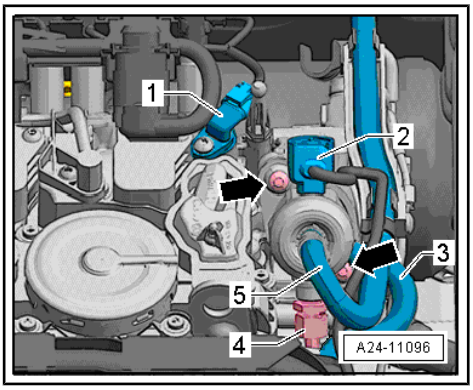
2 - Fuel Pressure Regulator Valve - N276-

3 - Fuel supply line to the intake manifold fuel injector fuel rail

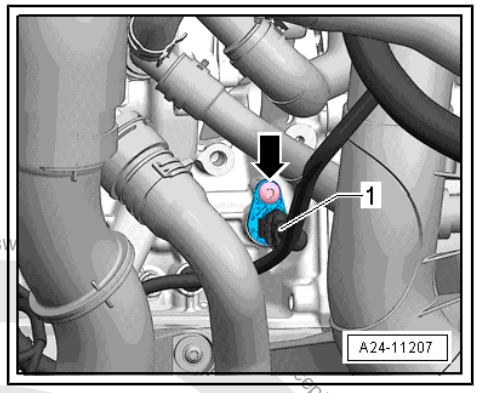
4 - Direct Fuel Injection Fuel Supply Line to Fuel Rail

5 - Fuel Supply Line from the Fuel Tank

- -arrows- bolts



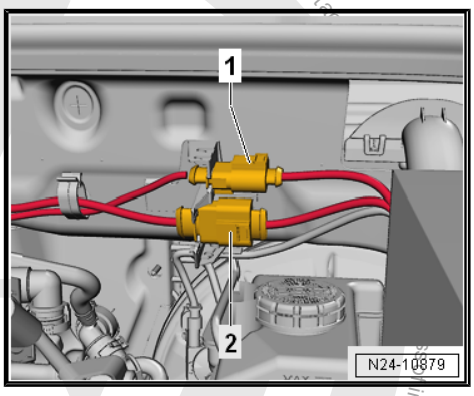
Engine Speed Sensor - G28- -1-



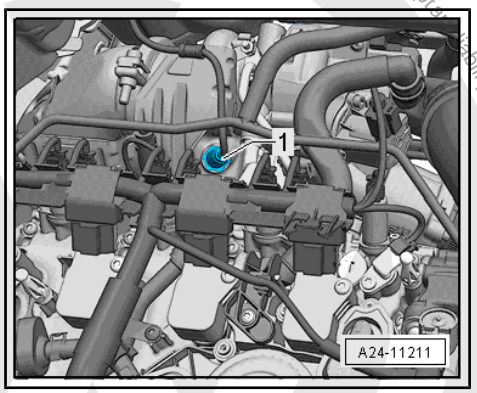
Heated Oxygen Sensors

1 - Oxygen Sensor 1 after Catalytic Converter - GX7- connector

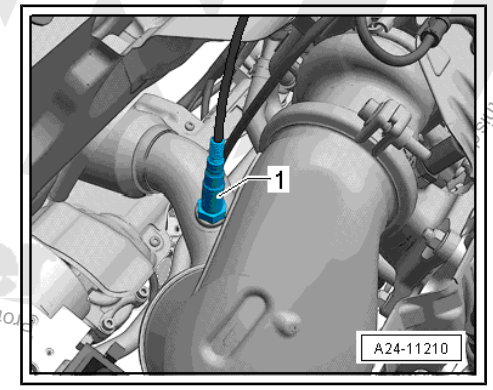
2 - Oxygen Sensor 1 before Catalytic Converter - GX10- connector



Oxygen Sensor 1 before Catalytic Converter - GX10- -1-



Oxygen Sensor 1 after Catalytic Converter - GX7- -1-



1.2 High Fuel Pressure, Reducing

WARNING

The fuel system is under high pressure.

- *Risk of injury from fuel spraying out.*
- *Reducing the fuel high pressure.*

High Fuel Pressure, Reducing:

– Turn on the ignition and select the following menu items. Refer to Vehicle Diagnostic Tester :

- `01 - Engine electronics`
- `Guided functions`
- `01 - Reduce high fuel pressure`

• The fuel pressure reduces to a specified value.

– Switch off the ignition.

The fuel rail will continue to be filled with fuel, but it will no longer be under high pressure.

WARNING

Fuel system is under pressure.

- *Risk of injury from fuel spraying out.*
- *Wear protective eyewear.*
- *Wear safety gloves.*
- *Reduce the pressure: Lay clean cloths around the connection point and carefully open the connection point.*

– The high pressure system must be opened immediately after reducing the fuel high pressure. To do this place a clean cloth around the connection location. Escaping fuel must be absorbed.

Note

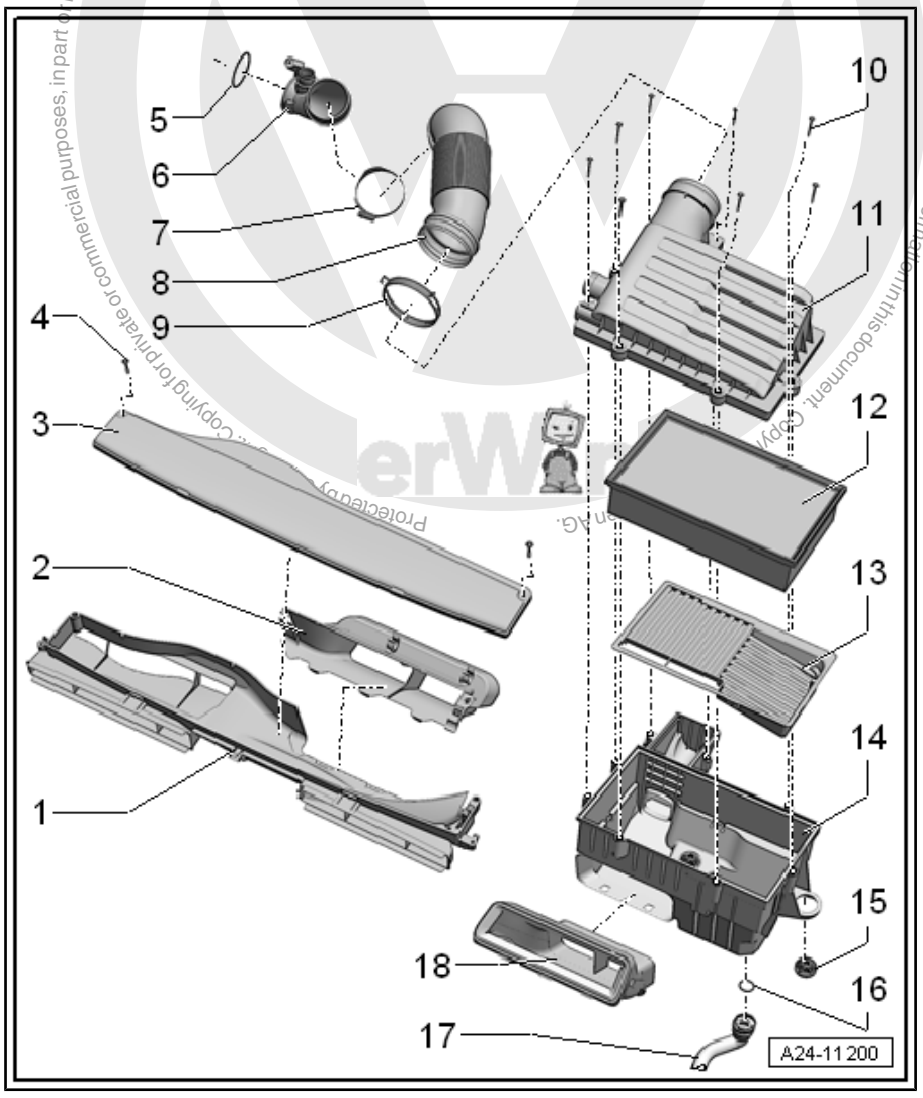
- *If the high pressure system is not opened immediately, the pressure will increase because of post-heating.*
- *The ignition can no longer be switched on, otherwise the pressure will increase again.*

2 Air Filter

⇒ “2.1 Overview - Air Filter Housing”, page 268

⇒ “2.2 Air Filter Housing, Removing and Installing”, page 269

2.1 Overview - Air Filter Housing



1 - Air Guide Lower Section
- ❑ On the lock carrier

2 - Air Guide Upper Section
- ❑ On the lock carrier

3 - Cover
- ❑ For the air guide

4 - Bolt
- ❑ 2 Nm

5 - Seal

6 - Air Duct Hose

7 - Screw-Type Clamp

8 - Air Duct Hose

9 - Spring Clamp

10 - Screws
- ❑ 1.5 Nm

11 - Air Filter Upper Section
- ❑ Clean off dirt, leaves and salt residue

12 - Air Filter Element
- ❑ Use the original-air filter element. Refer to the Parts Catalog.
- ❑ Change intervals. Refer to the ⇒ Maintenance ; Booklet 36.1 .
- ❑ Removing and installing. Refer to ⇒ Maintenance ; Booklet 36.1 .

13 - Insert
- ❑ For the air filter lower section

14 - Air Filter Lower Section
- ❑ Clean off dirt, leaves and salt residue

15 - Rubber Buffer

16 - O-Ring
- ❑ Replace if damaged

17 - Water Drain Hose
- ❑ With valve
- ❑ Clean

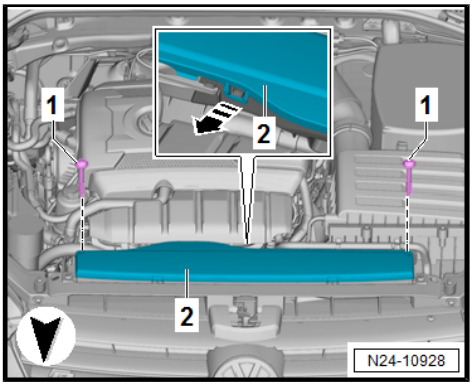
18 - Air Duct
- ❑ On the air filter housing lower section

2.2 Air Filter Housing, Removing and Installing

Removing

– Remove the bolts -1-.

– Open the lock in direction of -arrow- and remove the cover -2-.

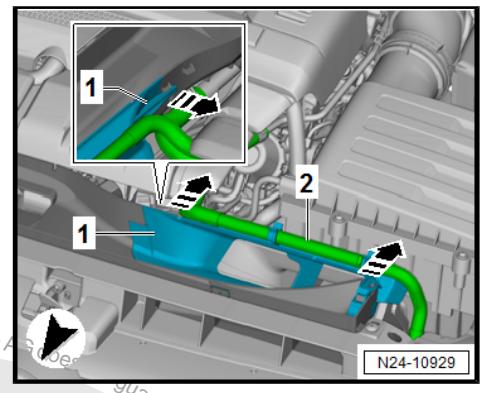


– Free up the coolant hose -2-.

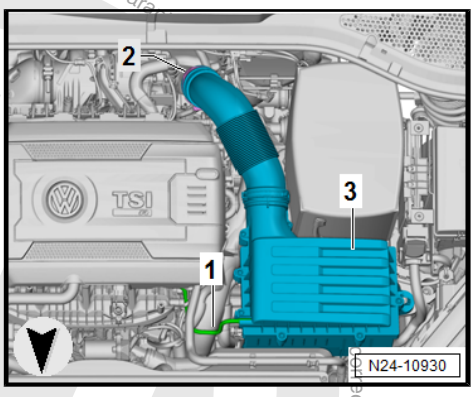
– Release the locking mechanisms in direction of -arrows- and remove the air guide upper section -1-.

– Disconnect the vacuum hose -1-.

– Loosen the clamp -2- and remove the air guide hose.



– Carefully remove the air filter housing -3-.



Installing

Install in reverse order of removal and note the following:

Note

- *Use a silicone-free lubricant to mount the air guide hose.*
- *Secure all hose connections with standard production hose clamps. Refer to the Parts Catalog.*

– Check the air duct hose (intake air side) for salt residue, dirt and leaves.

– Check intake channels up to the air filter insert for dirt.

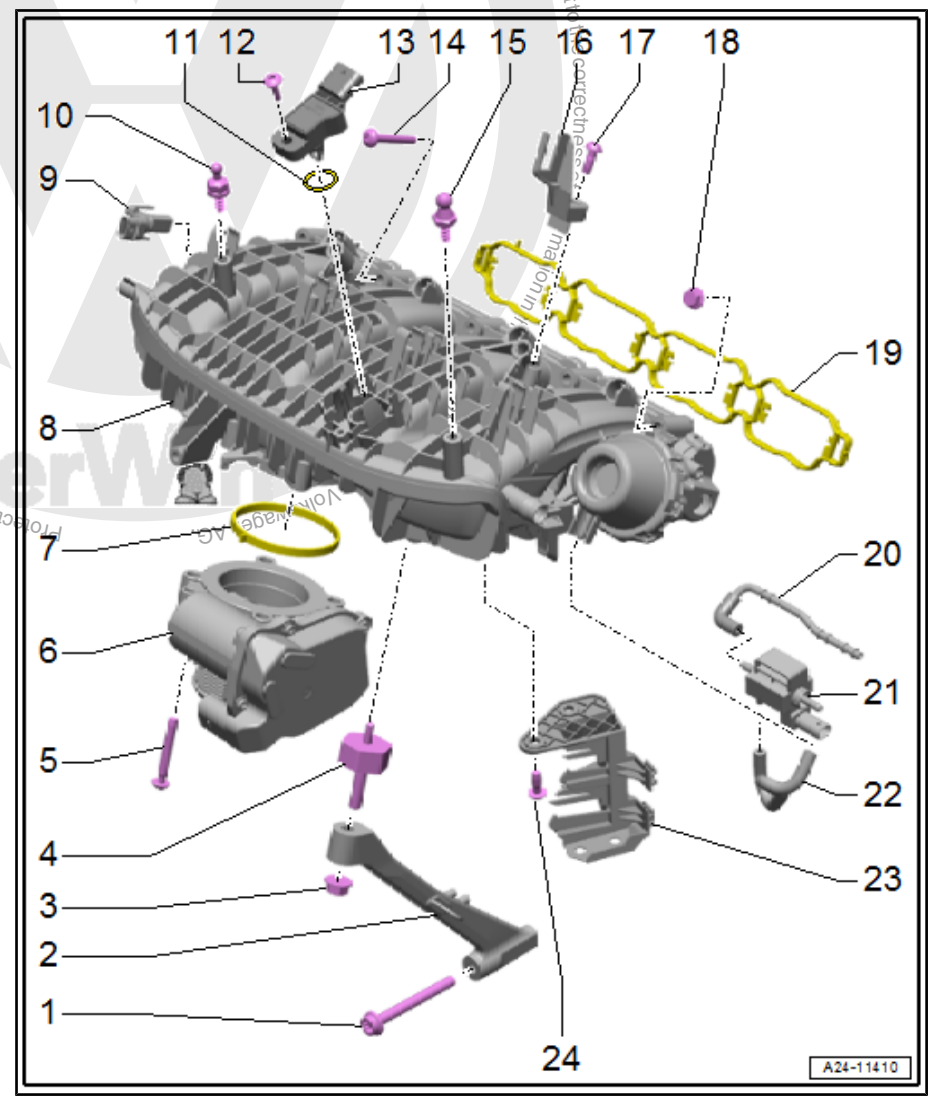
– Install the air filter housing.

Note

The water drain hose must be routed straight down and without any bends.

3 Intake Manifold

3.1 Overview - Intake Manifold



1 - Bolt

- ❑ 20 Nm

2 - Intake Manifold Support

3 - Nut

- ❑ 10 Nm

4 - Bonded Rubber Bushing

- ❑ 5 Nm

5 - Bolt

- ❑ 7 Nm

6 - Throttle Valve Control Module - J338-

- ❑ With EPC Throttle Drive - G186- , EPC Throttle Drive Angle Sensor 1 - G187- and EPC Throttle Drive Angle Sensor 2 - G188-
- ❑ The Throttle Valve Control Module - J338- must be readapted to the Engine Control Module - J623- when it is removed and installed or replaced.

7 - Seal

- ❑ Replace after removing

8 - Intake Manifold

- ❑ Removing and installing. Refer to ⇒ “3.2 Intake Manifold, Removing and Installing”, page 271 .

9 - Intake Manifold Runner Position Sensor - G336-

10 - Ball Pin

- ❑ 5 Nm
- ❑ For engine cover

11 - O-Ring

- ❑ Replace after removing

12 - Bolt

- ❑ 2.5 Nm

13 - Intake Air Temperature Sensor - G42- / Manifold Absolute Pressure Sensor - G71-

- ❑ Removing and installing. Refer to ⇒ “5.4 Intake Air Temperature Sensor G42 / Manifold Absolute Pressure Sensor G71 , Removing and Installing”, page 294 .

14 - Bolt

- ❑ 9 Nm
- ❑ Tighten diagonally in multiple steps
- ❑ Quantity: 8

15 - Ball Pin

- ❑ 5 Nm
- ❑ For engine cover

16 - Bracket

- ❑ For the connector

17 - Bolt

- ❑ 5 Nm

18 - Nut

- ❑ 9 Nm
- ❑ Tighten diagonally in multiple steps
- ❑ Quantity: 2

19 - Seal

- ❑ Replace after removing

20 - Vacuum Hose

21 - Intake Manifold Runner Control Valve - N316-

22 - Vacuum Hose

23 - Bracket

- ❑ For the connectors

24 - Bolt

- ❑ 5 Nm

3.2 Intake Manifold, Removing and Installing

Special tools and workshop equipment required

- ♦ Torx Socket - T30 - T10347-

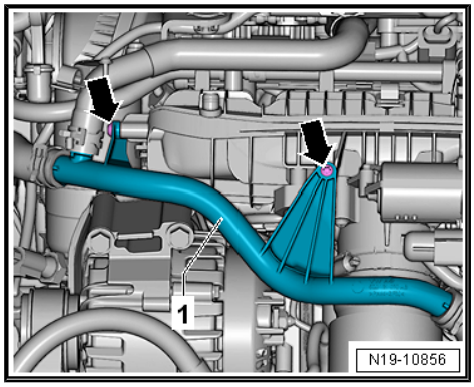
If the intake manifold is removed or replaced, the Intake Manifold Runner Position Sensor - G336- must be adapted to the Engine Control Module - J623- .

Removing

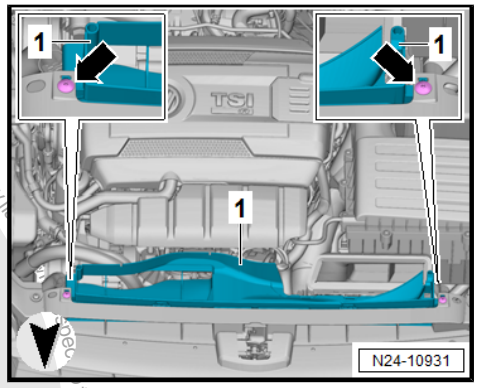
– Disconnect the battery. Refer to ⇒ Electrical Equipment; Rep. Gr. 27 ; Battery; Battery, Disconnecting and Connecting .

– Remove the engine cover. Refer to ⇒ “3.1 Engine Cover, Removing and Installing”, page 34 .

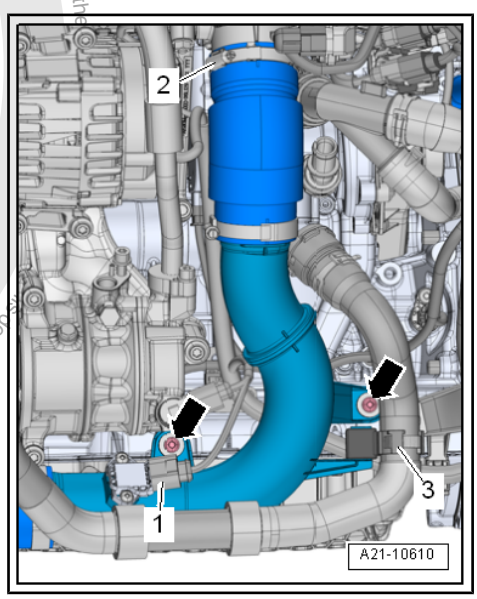
– Remove the bolts -arrows-.
– Remove the air filter housing. Refer to ⇒ “2.2 Air Filter Housing, Removing and Installing”, page 269 .



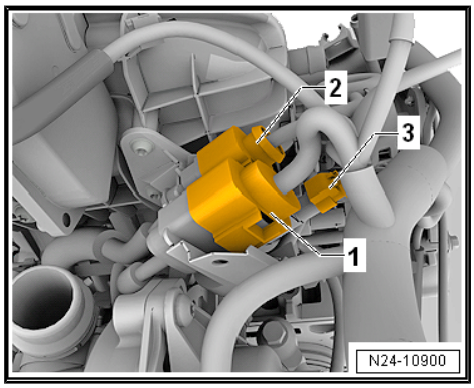
– Remove the bolts -arrows-.
– Unclip and remove the lower section -1- of the air duct.
– Remove the noise insulation -1-. Refer to ⇒ Body Exterior, Rep. Gr. 66 ; Noise Insulation; Overview - Noise Insulation .
– Free up the coolant hose -3-.
– Remove the connector -1- from the Charge Air Pressure Sensor - G31- .
– Remove the bolts -arrows-.



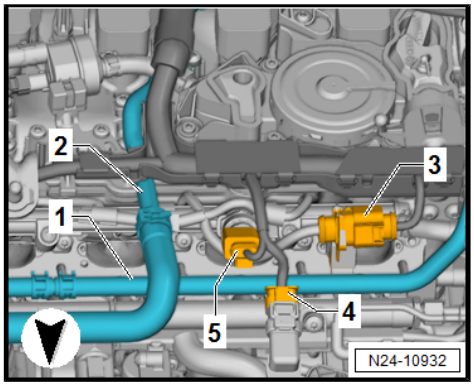
– Loosen air guide hose clamp -2- and remove the air duct hose from the Throttle Valve Control Module - GX3- downward.



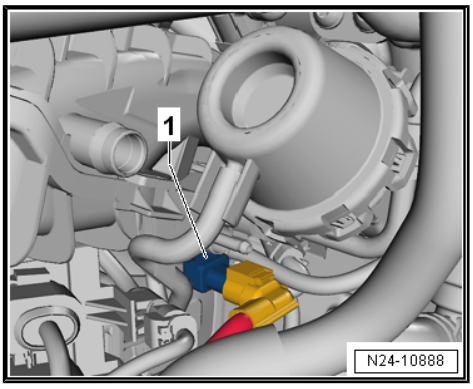
– Disconnect the connectors -1, 2 and 3- underneath the intake manifold.
– Remove the fuel return hose -1- from the intake manifold.
– Disconnect the connector -3- from the mount.
– Disconnect the connectors -4 and 5-.



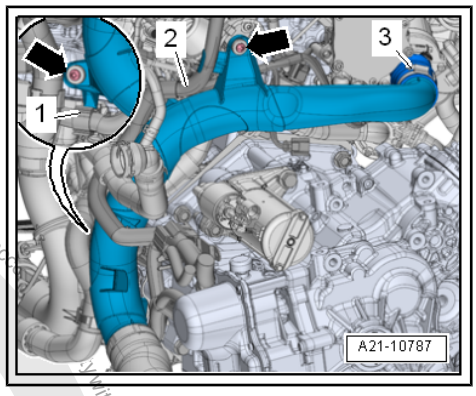
– Free up the wiring harness from the fuel rail.



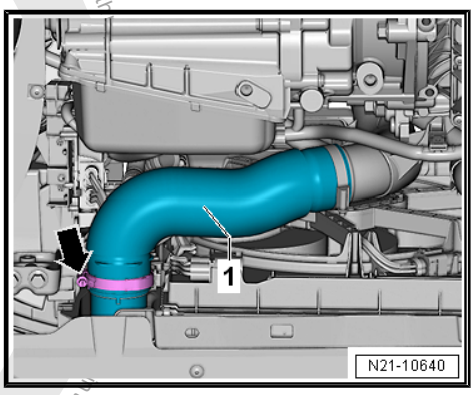
– Remove the connector and vacuum hoses from the Intake Manifold Runner Control Valve - N316- -1-.



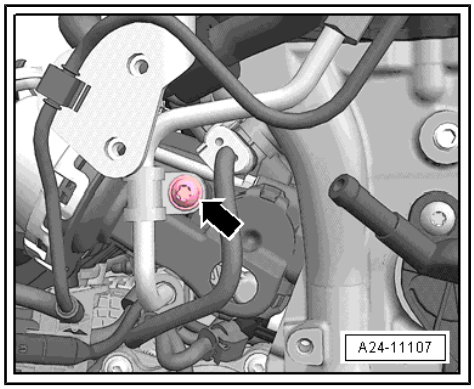
– Free up the wiring harness -1 and 2- from the air guide pipe.
– Loosen the screw-type clamp -3-.
– Remove the bolts -arrows-.



– Loosen the hose clamp -arrow- and remove the left charge air hose -1- with the air guide pipe downward.



– Remove the pipe clamp -arrow- for the high pressure line.



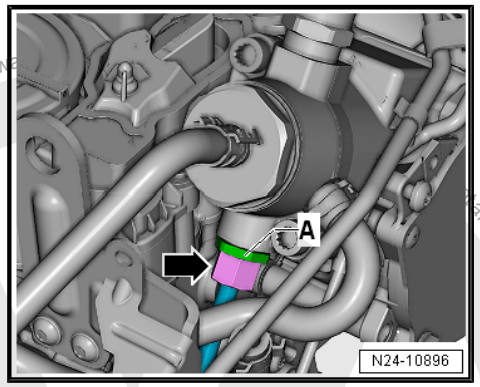
WARNING

The fuel lines are under pressure.

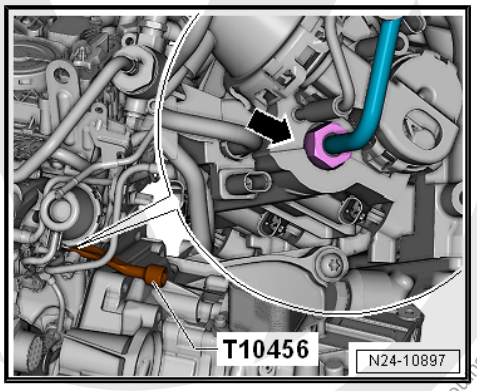
Fuel poses a risk of injury to the eyes and skin.

Wear protective eyewear and protective clothing to avoid injury and contact with the skin. Place a cleaning cloth around the connection point before loosening hose connections. Carefully open the connection points to release the pressure.

– Counterhold the connection -A- and loosen the union nut -arrow-.



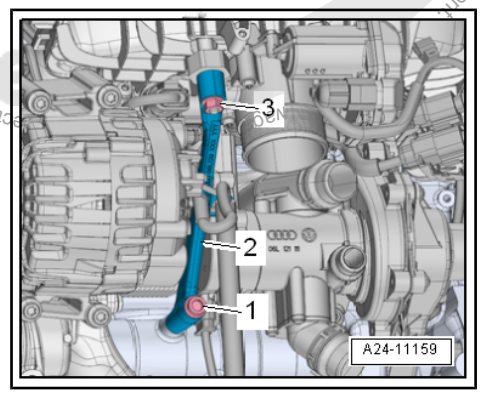
– Loosen the union nut -arrow- on the fuel rail with the Flare Nut Attachment - 17mm - T10456- and remove the high pressure line.



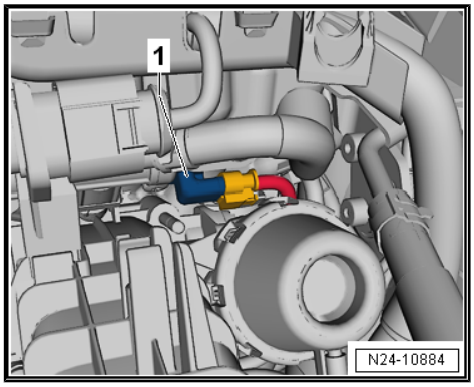
Note

- *The fuel system must have no pressure.*
- *Contain escaping fuel with a clean cloth.*
- *Seal the open connections with clean caps. Make sure that no dirt enters the fuel system.*

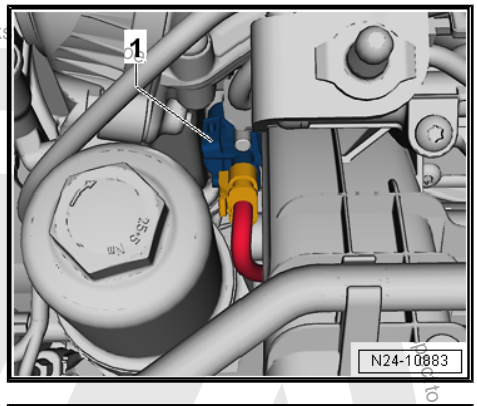
– Slightly loosen the nut -3- and remove the bolt -1- completely.



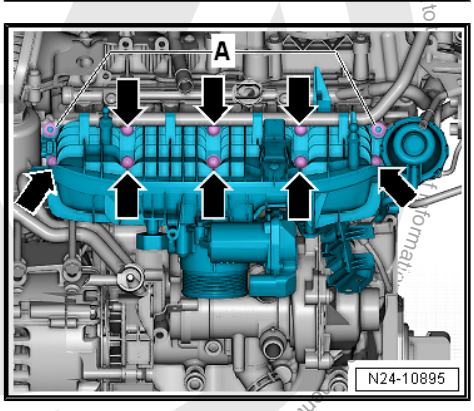
– Disconnect the connector -1- from the Camshaft Position Sensor - G40- .



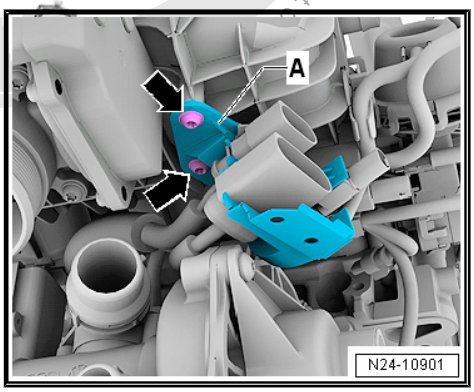
– Disconnect the connector -1- from the Intake Manifold Runner Position Sensor - G336- .



– Remove the nuts -A- from the intake manifold and remove the bolts -arrows- using the Torx Socket - T30 - T10347- .



– Pull the intake manifold slightly away from the cylinder head and remove the bolts -arrows- for the bracket -A-.
– Remove the intake manifold from the cylinder head.



Note

Cover the intake channels with a clean cloth.

Installing

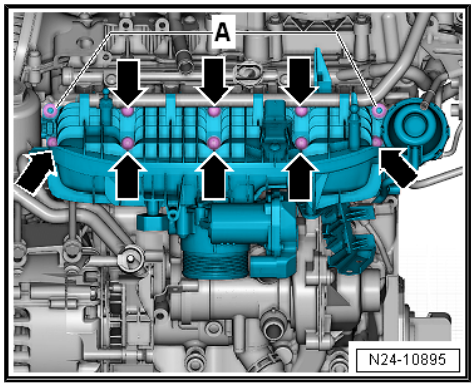
Install in reverse order of removal and note the following:

Note

If the connections on the high pressure pump were loosened, replace the connections.

– Tighten the nuts -A- hand-tight.

– Tighten the bolts -arrows- evenly, working from the inside to the outside. Use the Torx Socket - T30 - T10347- .



Tightening Specifications

- Refer to
⇒ “4.1 Overview - Fuel Rail with Fuel Injectors”, page 280

3.3 Throttle Valve Control Module - GX3- , Removing and Installing

The Throttle Valve Control Module - GX3- is comprised of:

- EPC Throttle Drive - G186-
- EPC Throttle Drive Angle Sensor 1 - G187-
- EPC Throttle Drive Angle Sensor 2 - G188-

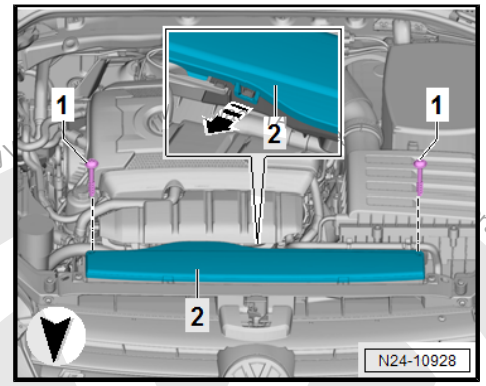
Removing

– Remove the engine cover. Refer to
⇒ “3.1 Engine Cover, Removing and Installing”, page 34 .

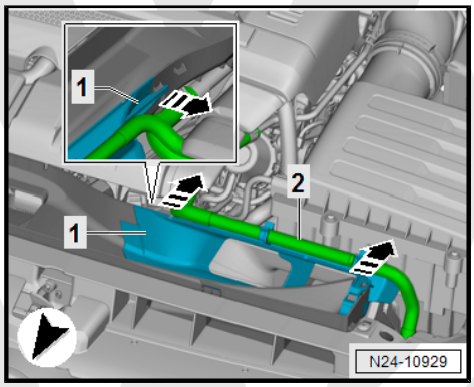
– Remove the bolts -1-.

– Open the catch in direction of -arrow- and remove the cover -2-.

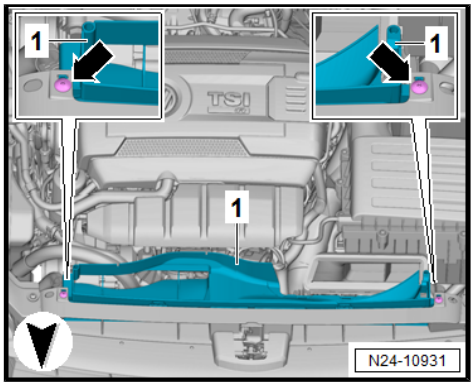
– Free up the coolant hose -2-.



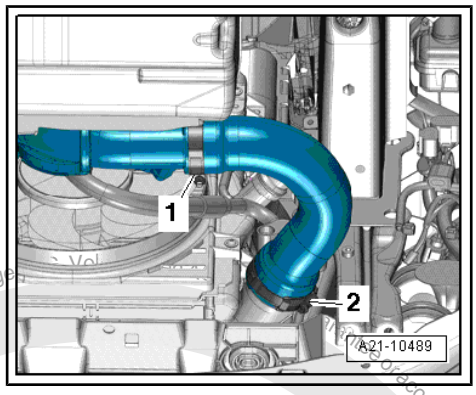
– Release the retainers in direction of -arrows- and remove the air guide upper section -1-.



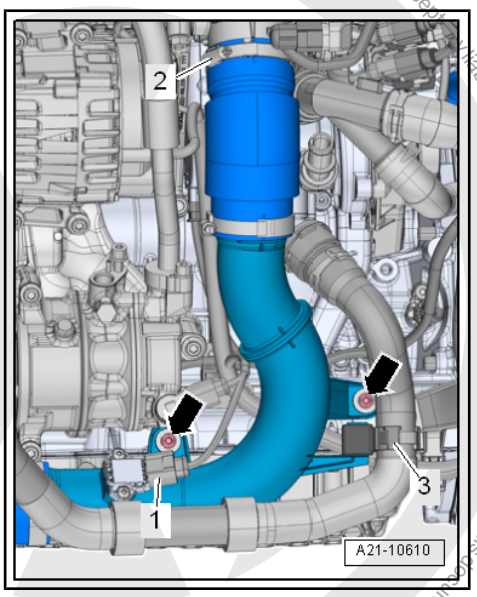
– Remove the bolts -arrows-.
– Unclip and remove the lower section -1- of the air duct.
– Remove the noise insulation -1-. Refer to ⇒ Body Exterior; Rep. Gr. 66 ; Noise Insulation; Overview - Noise Insulation .



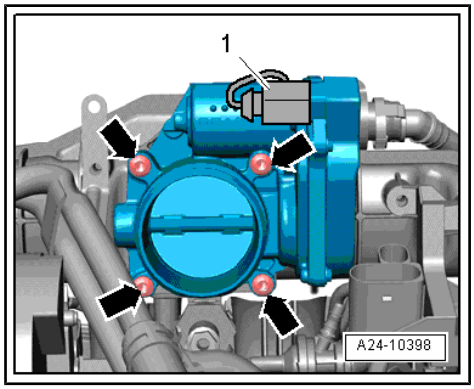
– Open the clamp -1 and 2- and remove the air guide hose.



– Free up the coolant hose -3-.
– Remove the connector -1- from the Charge Air Pressure Sensor - G31- .
– Remove the bolts -arrows-.
– Loosen air guide hose clamp -2- and remove the air duct hose from the Throttle Valve Control Module - GX3- .
– Remove the air guide hose downward.
– Disconnect the connector -1- from the Throttle Valve Control Module - GX3- .



– Remove the bolts -arrows- downward from the Throttle Valve Control Module - GX3- and remove the Throttle Valve Control Module - GX3- .



Installing

Install in reverse order of removal and note the following:

– Clean the gasket sealing surface.

– Replace the gasket.

Tightening Specifications

♦ Refer to ⇒ “3.1 Overview - Intake Manifold”, page 270

– After replacing the Throttle Valve Control Module - GX3- , it must be adapted to the Engine Control Module - J623- . Refer to Vehicle Diagnostic Tester .

3.4 Throttle Valve Control Module , Cleaning

Note

♦ *If a new Engine Control Module - J623- is installed, then it must be adapted to the throttle valve control module.*

♦ *Dirt and coking on the end stop can produce incorrect adaptation values.*

♦ *The throttle valve connections must not be scratched when cleaning.*

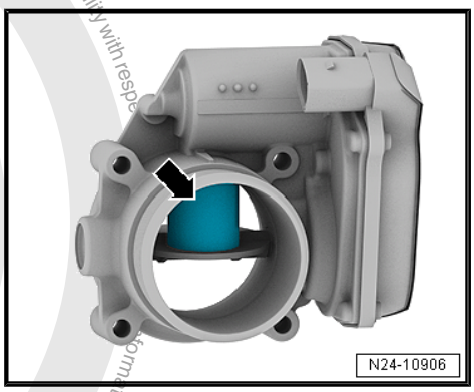
Special tools and workshop equipment required

♦ Acetone, commercially available

♦ Brush

– Remove the Throttle Valve Control Module - GX3- . Refer to ⇒ “3.3 Throttle Valve Control Module GX3 , Removing and Installing”, page 276 .

– Open the throttle valve by hand and hold it in this position using a plastic or wood wedge -arrow-.

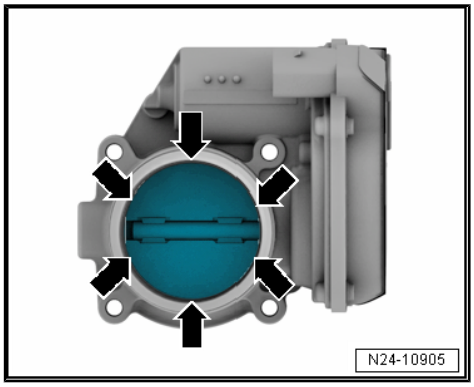


WARNING

Acetone is easily flammable.

- ***Observe accident prevention measures and safety information when working with easily flammable fluids.***
- ***Do not use compressed air when cleaning the throttle valve.***
- ***To prevent injuries and skin contact, wear protective goggles and protective clothing.***

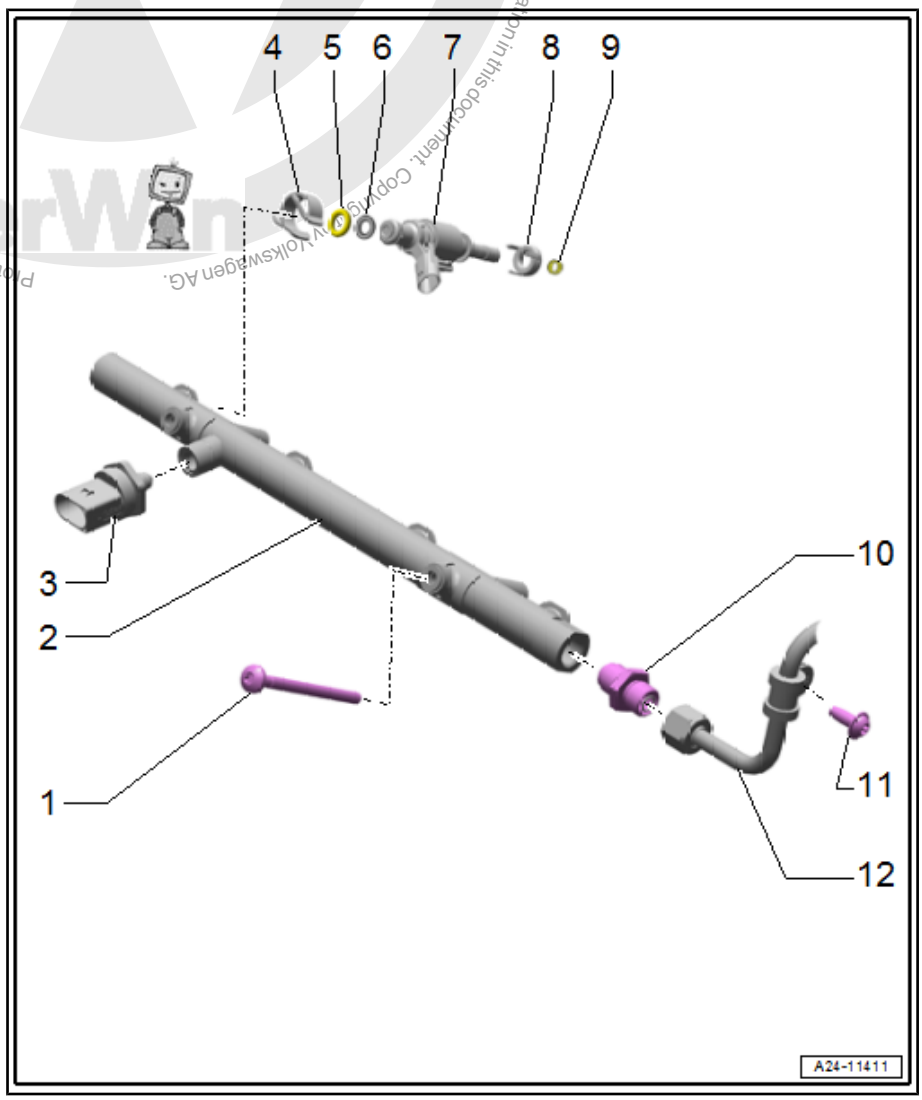
– Clean the throttle valve connection thoroughly with acetone and a brush especially in the area -arrows- near the closed throttle valve.
– Wipe the throttle valve connections with a lint-free cloth.
– Let the acetone dry completely.
– Install the Throttle Valve Control Module - GX3- . Refer to ⇒ “3.3 Throttle Valve Control Module GX3 , Removing and Installing”, page 276 .
– Erase the adaptation values and adapt the Engine Control Module - J623- to the Throttle Valve Control Module - GX3- . Refer to Vehicle Diagnostic Tester .



4 Fuel Injectors

4.1 Overview - Fuel Rail with Fuel Injectors

4.1.1 Overview - Fuel Rail with Fuel Injectors, Direct Fuel Injection



1 - Bolt

- ❑ 9 Nm
- ❑ Quantity: 2

2 - Fuel Rail for Combustion Chamber Fuel Injectors

- ❑ Removing and installing. Refer to ⇒ “4.2 Fuel Rail, Removing and Installing”, page 282 .

3 - Fuel Pressure Sensor - G247-

- ❑ 27 Nm
- ❑ Coat the ball and thread with clean engine oil
- ❑ Removing and installing. Refer to ⇒ “5.2 Fuel Pressure Sensor G247 , Removing and Installing”, page 291 .

4 - Support Ring

- ❑ Replace after removing

5 - O-Ring

- ❑ Replace after removing

6 - Spacer Ring

- ❑ Replace after removing

7 - Fuel Injector

- ❑ Make sure it is installed in the correct position.
- ❑ Removing and installing. Refer to ⇒ “4.3 Fuel Injectors, Removing and Installing”, page 283 .

8 - Sealing Washer

9 - Combustion Chamber Seal

- ❑ Replace after removing the fuel injector. Refer to ⇒ “4.3.1 Fuel Injectors, Removing and Installing, Direct Fuel Injection”, page 283 .

10 - Connection

- ❑ 40 Nm
- ❑ For high pressure lines on the fuel rail
- ❑ Replace after removing
- ❑ Coat the threads with clean engine oil.
- ❑ Counterhold when tightening to the fuel rail

11 - Bolt

- ❑ 5 Nm

12 - High Pressure Line

- ❑ 20 Nm
- ❑ Coat the ball with clean engine oil.

4.1.2 Overview - Fuel Rail with Fuel Injectors, Multi-Port Fuel Injection

1 - Clip

- ❑ For Low Fuel Pressure Sensor - G410-

2 - O-Ring

- ❑ Replace after removing

3 - Adapter

- ❑ 15 Nm
- ❑ Must be bolted with the Low Fuel Pressure Sensor - G410- -4-.

4 - Low Fuel Pressure Sensor - G410-

- ❑ 15 Nm
- ❑ Must be bolted with the adapter -3-
- ❑ Removing and installing. Refer to ⇒ “5.3 Low Fuel Pressure Sensor G410 , Removing and Installing”, page 293 .

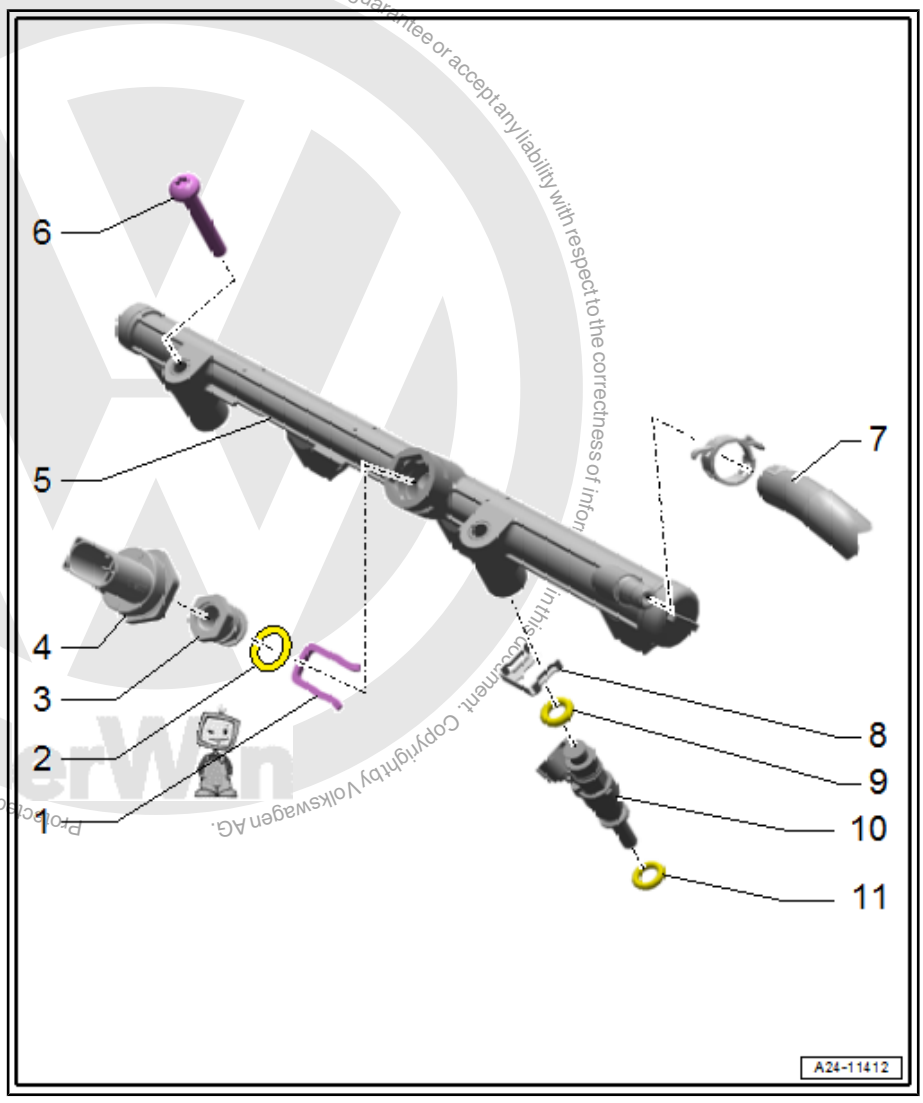
5 - Fuel Rail for Intake Manifold Fuel Injectors

6 - Bolt

- ❑ 9 Nm
- ❑ Quantity: 2

7 - Fuel Supply Line

- ❑ To the fuel rail for intake manifold fuel injectors
- ❑ Do not install when under tension



8 - Clip

9 - O-Ring

- ❑ Replace after removing

10 - Fuel Injector

- ❑ Make sure it is installed in the correct position.
- ❑ Removing and installing. Refer to
  ⇒ “4.3.2 Fuel Injectors, Removing and Installing, Multi-Point Fuel Injection”, page 285 .

11 - O-Ring

- ❑ Replace after removing

4.2 Fuel Rail, Removing and Installing

Note

This work procedure is based on the direct fuel injection.

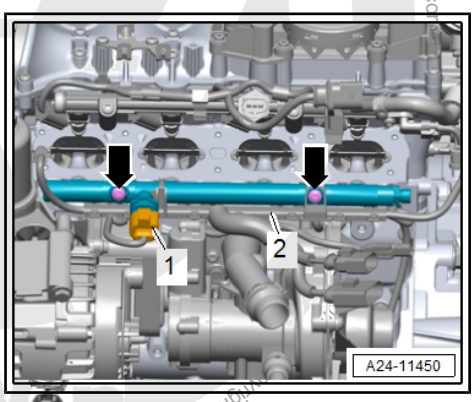
Removing

– Remove the intake manifold. Refer to
  ⇒ “3.2 Intake Manifold, Removing and Installing”, page 271 .

– Disconnect the connector -1- on the Fuel Pressure Sensor - G247- .

– Remove the bolts -arrows-.

– Free up the wiring duct --2 from the fuel rail and remove the fuel rail from the fuel injectors.



Note

If the fuel injectors stick in the fuel rail disconnect the connectors.

Installing

Install in reverse order of removal and note the following:

– Install the intake manifold. Refer to
  ⇒ “3.2 Intake Manifold, Removing and Installing”, page 271 .

Tightening Specifications

◆ Refer to
  ⇒ “4.1.1 Overview - Fuel Rail with Fuel Injectors, Direct Fuel Injection”, page 280

4.3 Fuel Injectors, Removing and Installing

⇒ “4.3.1 Fuel Injectors, Removing and Installing, Direct Fuel Injection”, page 283

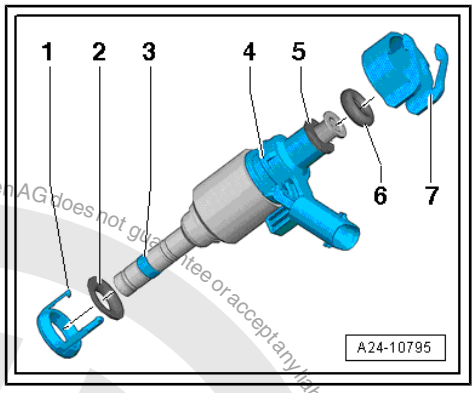
⇒ “4.3.2 Fuel Injectors, Removing and Installing, Multi-Point Fuel Injection”, page 285

4.3.1 Fuel Injectors, Removing and Installing, Direct Fuel Injection

Special tools and workshop equipment required

- Injector/Combustion Chamber Seal Tool Set - T10133B-

Overview - Fuel Injector



1 - Replace intermediate ring.

2 - Replace the mount.

3 - Replace the combustion chamber seal (teflon seal). When installing, the ring must not be greased or handled with any other lubricants.

4 - Fuel Injector

5 - Replace the spacer ring.

6 - Replace the O-ring (lightly coat with clean engine oil for installation).

7 - Support ring, replacing. The strength of the support ring allows the fuel rail to hold the fuel injector tightly in the cylinder head.

Removing

Note

The fuel injectors can only be removed when the engine is cold.

– Remove the intake manifold. Refer to ⇒ “3.2 Intake Manifold, Removing and Installing”, page 271 .

– Remove the fuel rail. Refer to ⇒ “4.2 Fuel Rail, Removing and Installing”, page 282 .

Note

Remove the fuel injectors, in the event that they are stuck in the fuel rail.

Carefully remove the fuel injectors out of the fuel rail.

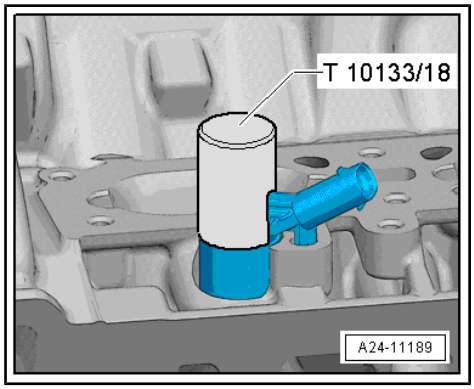
Note

Removing fuel injectors, in the event that they are stuck in the cylinder head

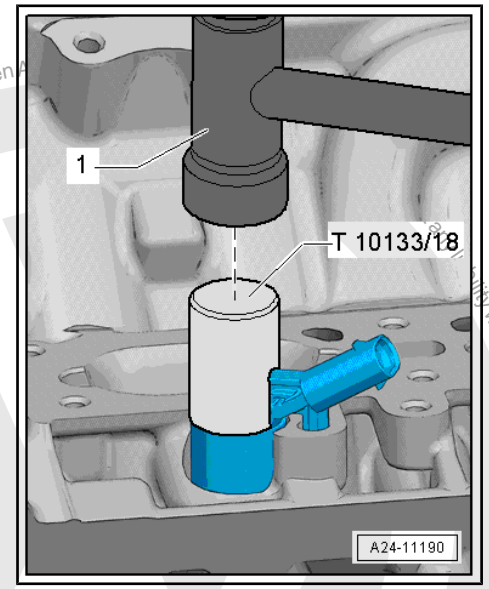
– Cover the open intake channels with a clean cloth.

– Remove the electrical connector on the fuel injector that is about to be removed.

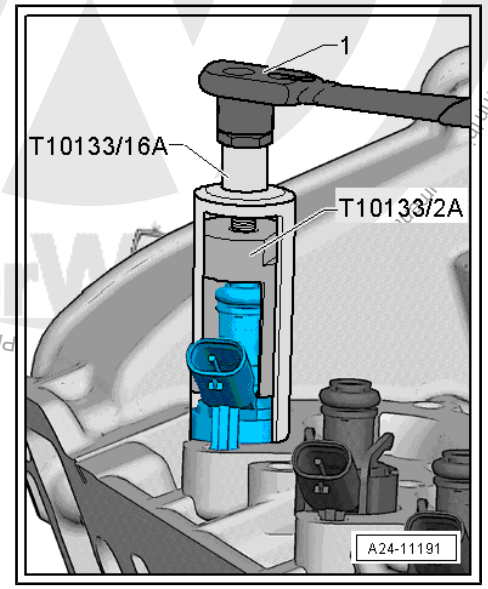
– Slide the Injector/Combustion Chamber Seal Tool Set - 18 - T10133/18- over the fuel injector.



– Carefully tap the sleeve a few times to loosen the fuel injector.



– Guide the Injector/Combustion Chamber Seal Tool Set - Puller - T10133/2A- in the groove on the fuel injector.
– Install the removal tool Injector/Combustion Chamber Seal Tool Set - 16A - T10133/16A- .
– Remove the fuel injector by using the torque wrench -1- to turn the bolt.
– If the tightening specification limit of »5 Nm« is achieved without the fuel injector loosening, remove the puller and try again to loosen the fuel injector with the sleeve.



Note

- *The fuel injectors may be damaged if the tightening specifications are not observed.*
- *The combustion chamber seal must always be replaced before installing the fuel injector. Refer to ⇒ “4.4 Fuel Injector Seals, Replacing”, page 286 .*

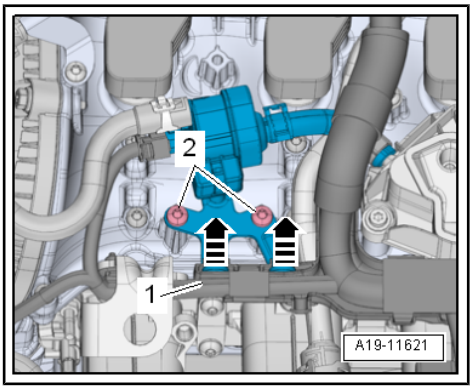
– Replace combustion chamber seal and install fuel injector. Refer to ⇒ “4.4 Fuel Injector Seals, Replacing”, page 286 .

4.3.2 Fuel Injectors, Removing and Installing, Multi-Point Fuel Injection

Removing

– Remove the engine cover. Refer to ⇒ “3.1 Engine Cover, Removing and Installing”, page 34 .

– Release retainers in direction of -arrows- and remove wiring duct -1- from bracket.



Note

Ignore -2-.

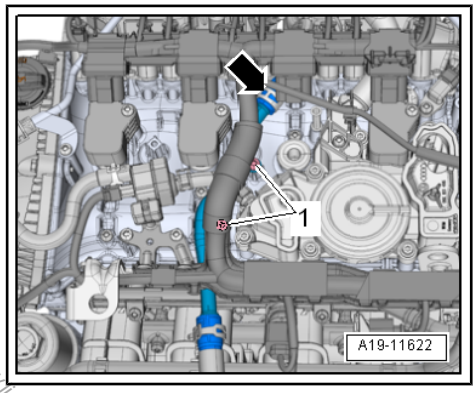
– Remove the bolts -1- for the upper coolant pipe -arrow-.

– Disconnect the connectors:

2 - For Low Fuel Pressure Sensor - G410-

3 - For Intake Manifold Sensor - GX9-

4 - Intermediate Connector for Intake Manifold Fuel Injectors



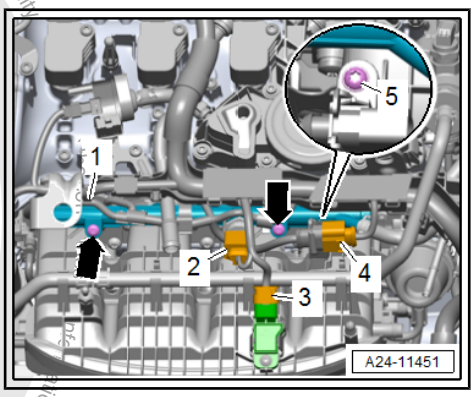
– Free up the wiring harness -1- from the engine lifting eyelet.

– Remove the bolts -arrows- on the fuel rail.

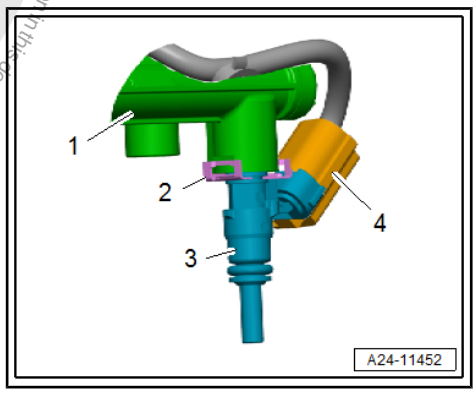
– Remove the bolt -5- from the bracket for the connector.

– Remove the fuel rail with the fuel injectors upwards carefully.

– Disconnect the connector -4-.



– Remove the clamp -2- and remove the fuel injector -3- from the fuel rail -1-.



Installing

Install in reverse order of removal and note the following:

– Place the O-rings -1 and 4- on the fuel injector -2-.

– Coat the O-rings with clean engine oil before installing.

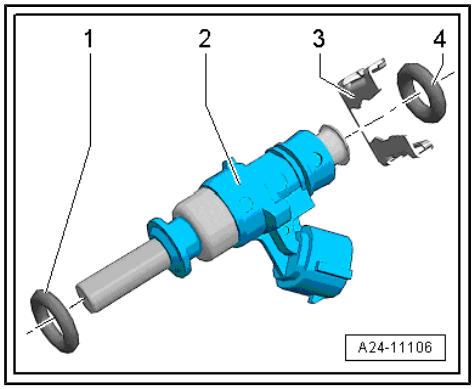
– Secure the fuel injector with the clamp -3- in the fuel rail.

– Connect the connectors.

– Press the fuel rail and the fuel injector by hand all the way into the opening for the intake manifold (oil and grease free).

Tightening Specifications

♦ Refer to
⇒ “4.1.2 Overview - Fuel Rail with Fuel Injectors, Multi-Port Fuel Injection”, page 281

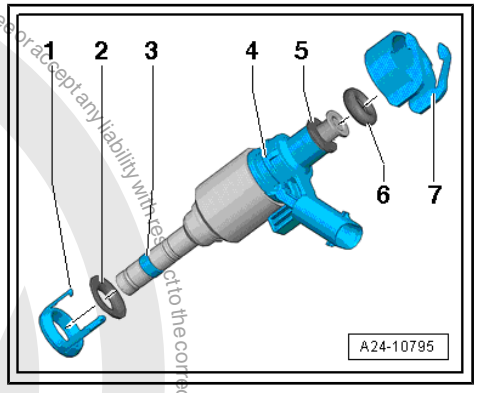


4.4 Fuel Injector Seals, Replacing

Note

The combustion chamber seal must always be replaced before installing the fuel injector.

– Carefully remove the combustion chamber seal -3- with the appropriate tool (for example cut the seal open with a razor and spread seal open with a small screwdriver and pull it forward and off.) When doing this, be sure not to damage the groove and the surrounding rib in the groove base.

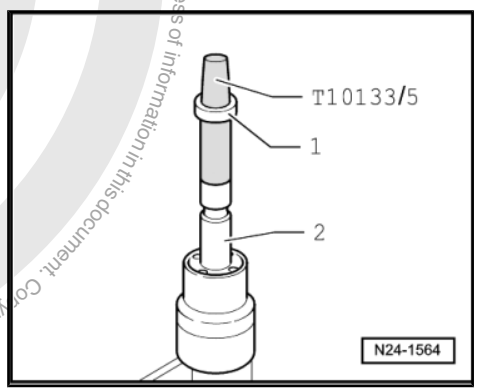


Note

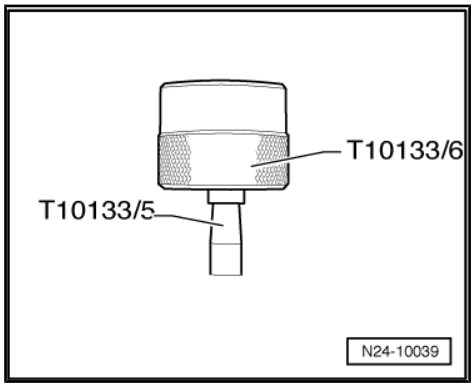
If the groove is damage, the fuel injector must be replaced.

– Clean off any combustion residue on the seal groove and on the shaft of the fuel injector with a clean cloth before installing the new combustion chamber seal.

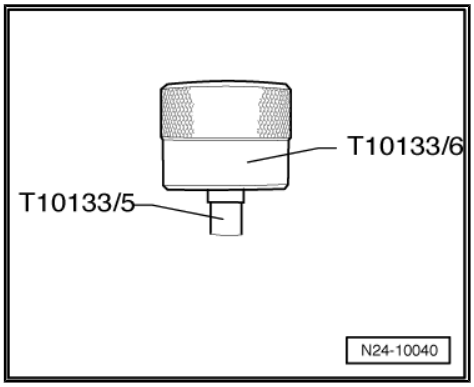
– Place the Injector/Combustion Chamber Seal Tool Set - Assembly Cone - T10133/5- with a new combustion chamber seal -1- onto the fuel injector -2-.



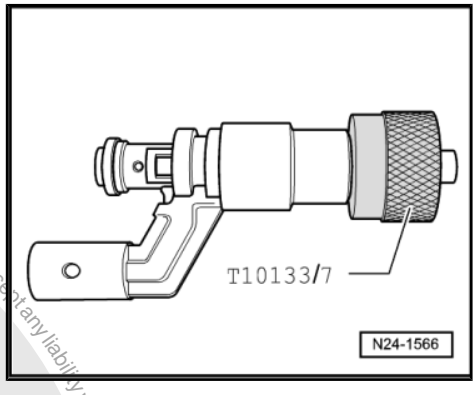
– Slide the combustion chamber seal with the Injector/Combustion Chamber Seal Tool Set - Assembly Sleeve - T10133/6- onto the Assembly Cone Injector/Combustion Chamber Seal Tool Set - Assembly Cone - T10133/5- as far as possible.



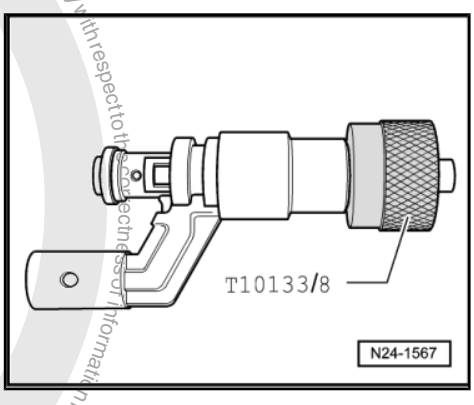
– Rotate the Injector/Combustion Chamber Seal Tool Set - Assembly Sleeve - T10133/6- and slide the combustion chamber seal all the way onto the assembly cone Injector/Combustion Chamber Seal Tool Set - Assembly Cone - T10133/5- .
– Remove the Injector/Combustion Chamber Seal Tool Set - Assembly Cone - T10133/5- and slide the combustion chamber seal with the Injector/Combustion Chamber Seal Tool Set - Assembly Sleeve - T10133/6- all the way up to the seal groove.



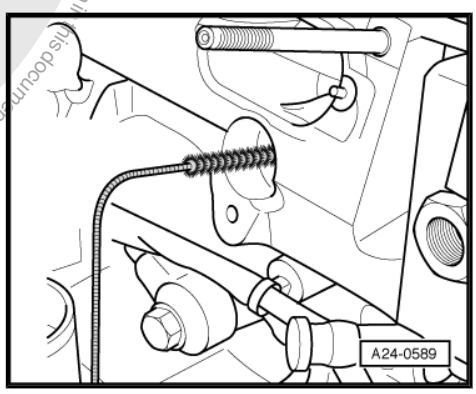
– Press the Injector/Combustion Chamber Seal Tool Set - Calibration Sleeve - T10133/7- with a gentle turning movement (approximately 180°) all the way onto the fuel injector.
– Pull off the Calibration Sleeve Injector/Combustion Chamber Seal Tool Set - Calibration Sleeve - T10133/7- again using turning motion in opposite direction.



– Press the Injector/Combustion Chamber Seal Tool Set - Calibration Sleeve - T10133/8- with a gentle turning movement (approximately 180°) all the way onto the fuel injector.
– Pull off Calibration Sleeve Injector/Combustion Chamber Seal Tool Set - Calibration Sleeve - T10133/8- again using turning motion in opposite direction.
– Replace the O-ring on the fuel injector and coat with clean oil before installing.



– Use the included Injector/Combustion Chamber Seal Tool Set Nylon Brush - T10133/4- to thoroughly clean the high-pressure fuel injector bores in the cylinder head before installing the fuel injectors.

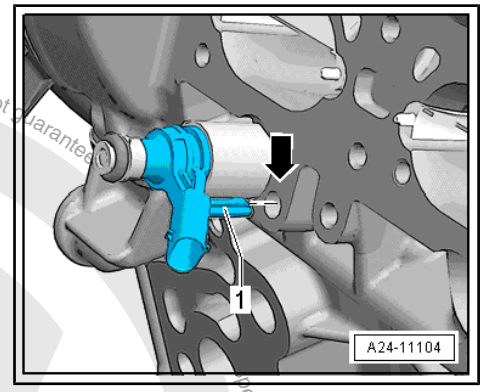


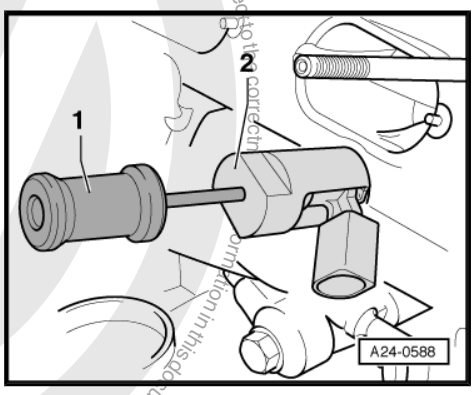
Note

- *Do not oil or grease the combustion chamber sealing ring on the fuel injector.*
- *When installing the injector valve, make sure there is no cleaning product or oil in the holes in the cylinder head.*

– Press fuel injector by hand all the way into cylinder head bore (free of oil and grease). Make sure the fuel injectors are positioned correctly inside the cylinder head.

– The tab -1- and the opening -arrow- must be on top of each other in the cylinder head.





Note

- *The fuel injector must be easy to install. If necessary, wait until the combustion chamber seal continues to pull itself together.*
- *Make sure the fuel injectors are installed securely in the cylinder head.*
- *If it is difficult to install the fuel injector by hand, use the Injector/Combustion Chamber Seal Tool Set - Puller - T10133/2A--2- with the Sliding Hammer - T10133/3- to guide in the fuel injector.*

– Coat the O-rings and fuel injectors with clean engine oil for easier insertion in the fuel rail.

– Install the fuel rail. Refer to ⇒ “4.2 Fuel Rail, Removing and Installing”, page 282

– Install the intake manifold. Refer to ⇒ “3.2 Intake Manifold, Removing and Installing”, page 271 .

4.5 Fuel Injectors, Cleaning

Note

This work procedure is based on the combustion chamber fuel injectors.

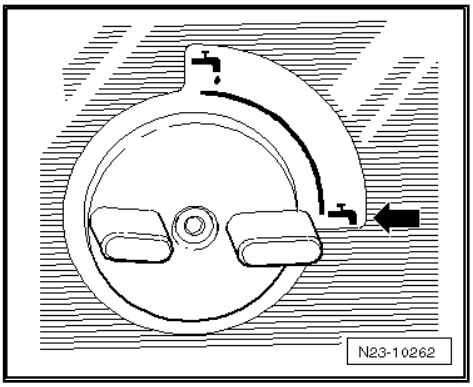
Special tools and workshop equipment required

- Ultrasonic Cleaning Unit - VAS6418-
- Ultrasonic Cleaning Unit - Mounting Plate for Injection Modules - VAS6418/1-
- Ultrasonic Cleaning Unit - Cleaning Fluid - VAS6418/2-

Cleaning

– Connect the drain valve -arrow- of the Ultrasonic Cleaning Unit - VAS6418- to the right side of the transmission housing.

– Fill the ultrasonic device with 2120 ml settled water and Cleaning Fluid - VAS6418/2- .

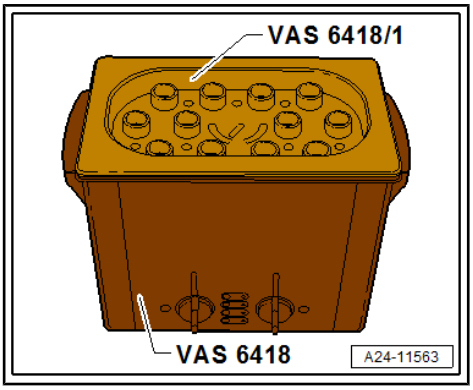


Cleaning Fluid Mixture Ratio

- 2100 ml (2.21 quarts) settled tap water and 20 ml (0.67 oz) Cleaning Fluid - VAS6418/2- .

– Remove the fuel injectors. Refer to ⇒ “4.3 Fuel Injectors, Removing and Installing”, page 283 .

– Place the Mounting Plate for Injection Modules - VAS6418/1- on the cleaning unit.



Note

- *Before operating the Ultrasonic Cleaning Unit - VAS6418- pay attention to the safety precautions in the Owner's Manual.*
- *The ideal fluid level is reached when the cleaning fluid is approximately 1-4 mm above the bottom of the mounting plate. A fluid level which is too low can damage the Ultrasonic Cleaning Unit - VAS6418- .*

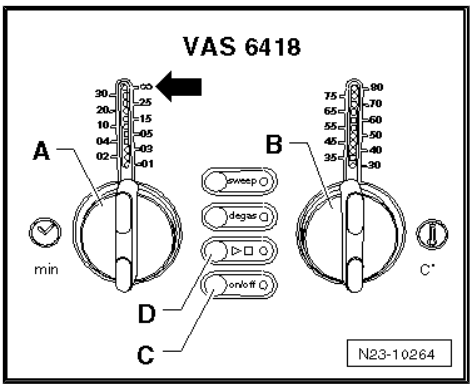
– Insert the fuel injectors all the way into the guides on the Mounting Plate for Injection Modules - VAS6418/1- .

– Switch on the cleaning unit by pressing the on/off button -C-.

– Set the cleaning time on the knob -A- to 30 minutes.

– Set the temperature on the knob -B- to 50 °C (122 °F).

– Press the ▶ button -D- to start cleaning.



Note

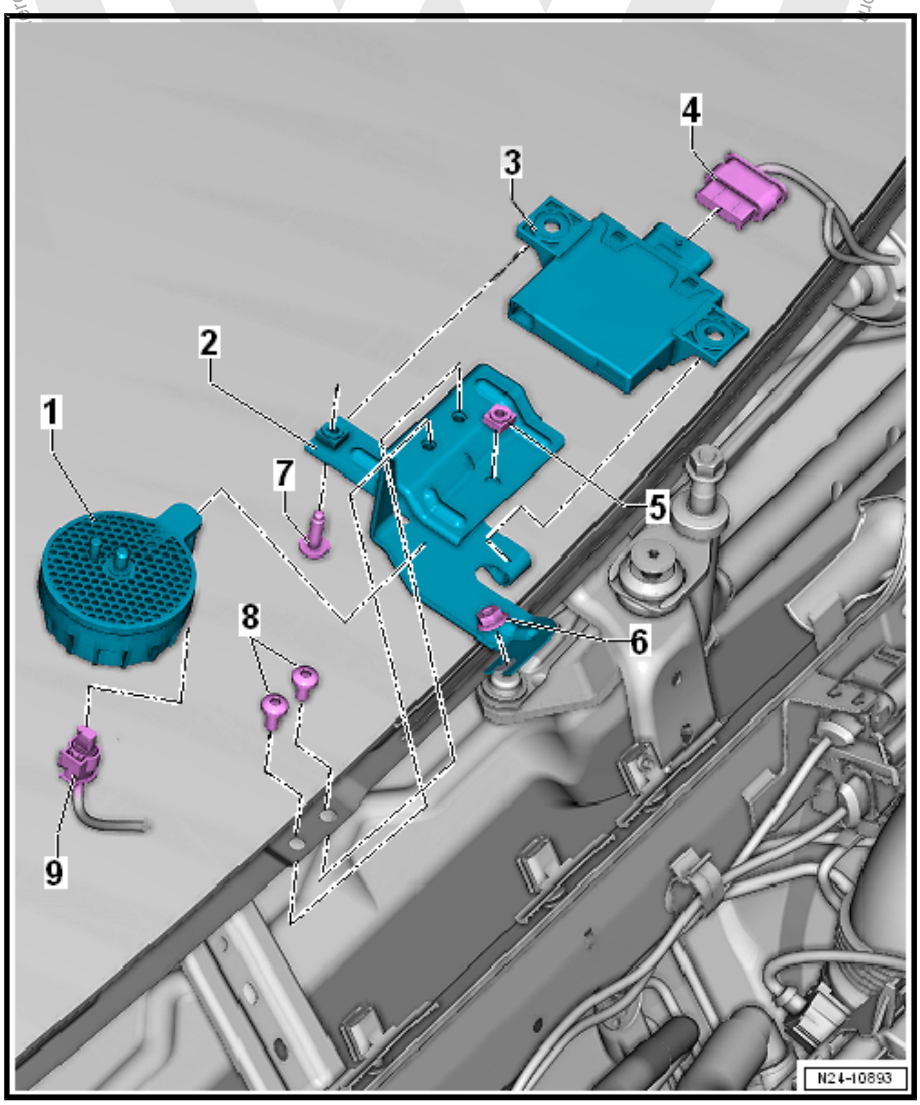
- *The temperature controlled cleaning is now switched on. During the heating-up phase the ultrasonic switches on the cleaning fluid circulation in intervals. After reaching the pre-selected temperature the ultrasonic remains permanently switched on.*
- *The cleaning must take at least 30 minutes and first begins once a temperature of at least 50 °C (122 °F) is reached.*

– Replace the combustion chamber seal (Teflon® seal) after cleaning the combustion chamber fuel injectors. Refer to ⇒ “4.4 Fuel Injector Seals, Replacing”, page 286 .

– Install the combustion chamber fuel injectors. Refer to ⇒ “4.3.1 Fuel Injectors, Removing and Installing, Direct Fuel Injection”, page 283 .

5 Sensors

5.1 Overview - Structure Borne Sound Actuator and Control Module



1 - Structure-Borne Sound Actuator - R214-

- ❑ Component location: inside the plenum chamber
- ❑ Removing and installing. Refer to ⇒ “5.5 Structure-Borne Sound Actuator R214 , Removing and Installing”, page 295 .

2 - Bracket

- ❑ For the Structure-Borne Sound Actuator - R214- and Structure Borne Sound Control Module - J869-
- ❑ Can only be replaced when the windshield is removed

3 - Structure Borne Sound Control Module - J869-

- ❑ Component location: inside the plenum chamber
- ❑ To remove and install, remove the plenum chamber cover. Refer to ⇒ Body Exterior; Rep. Gr. 50 ; Bulkhead; Plenum Chamber Cover, Removing and Installing .
- ❑ Depending on the version, secured with a screw or with two nuts

4 - Connector

- ❑ For the Structure Borne Sound Control Module - J869-

5 - Nut

- ❑ 7 Nm
- ❑ For the Structure-Borne Sound Actuator - R214-

6 - Nut

- ❑ 9 Nm

7 - Bolt/Nut

- ❑ 3 Nm
- ❑ For the Structure Borne Sound Control Module - J869-

8 - Bolt

- ❑ 9 Nm

9 - Connector

- ❑ For the Structure-Borne Sound Actuator - R214-

5.2 Fuel Pressure Sensor - G247- , Removing and Installing

Special tools and workshop equipment required

- ♦ Elbow Assembly Tool - T10118-
- ♦ Socket - 27mm - T40218- or a commercially available 27 mm socket

Check the Fuel Pressure Sensor - G247- . Refer to Vehicle Diagnostic Tester .

If the Fuel Pressure Sensor - G247- should fail, the Fuel Pressure Regulator Valve - N276- will switch off, the electric fuel pump is completely controlled and the engine will be driven by the fuel pressure present. This will reduce the engine torque dramatically.

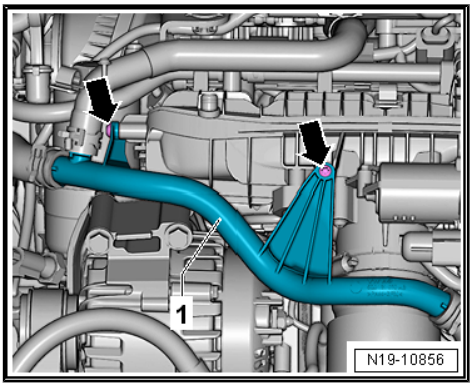
Removing

– Remove the engine cover. Refer to ⇒ “3.1 Engine Cover, Removing and Installing”, page 34 .

– Remove the coolant pipe bolts -arrows- from the intake manifold.

– Remove the air filter housing. Refer to ⇒ “2.2 Air Filter Housing, Removing and Installing”, page 269 .

– Remove the bolts -arrows-.



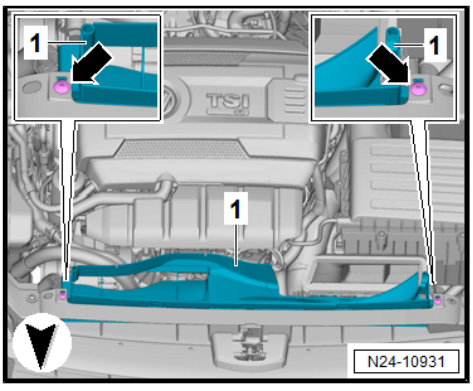
– Unclip and remove the lower section -1- of the air duct.

– Remove the noise insulation. Refer to ⇒ Body Exterior; Rep. Gr. 66 ; Noise Insulation; Overview - Noise Insulation .

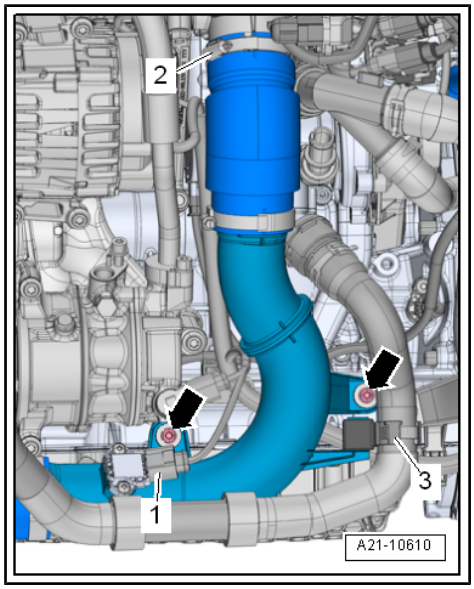
– Free up the coolant hose -3-.

– Remove the connector -1- from the Charge Air Pressure Sensor - G31- .

– Remove the bolts -arrows-.



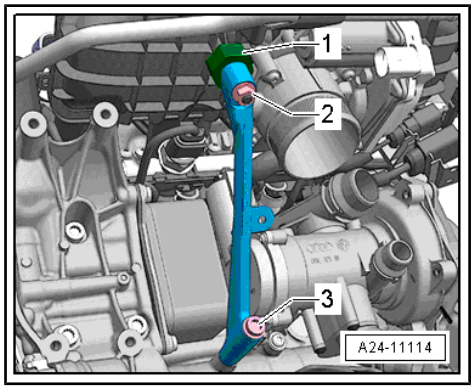
– Loosen air guide hose clamp -2- and remove the air duct hose from the Throttle Valve Control Module - GX3- downward.
– Remove the nut -2- and bolt -3- and then remove the intake manifold support.



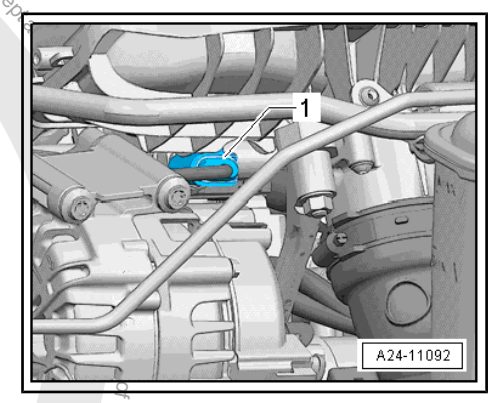
– Remove the rubber bushing -1- for the intake manifold support.

WARNING

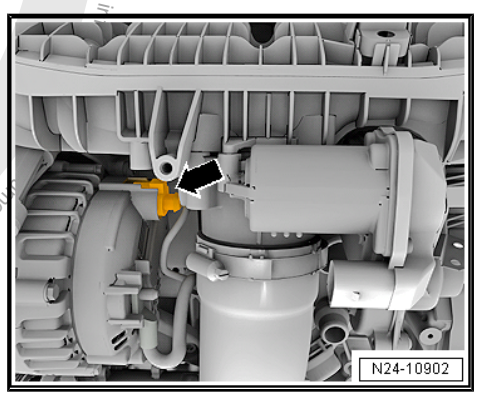
Fuel system is under high pressure! Always release the pressure in the high pressure system before opening the system. Procedure. Refer to ⇒ "1.2 High Fuel Pressure, Reducing", page 266 .



– Use the Elbow Assembly Tool - T10118- -1- to release the connector from the Fuel Pressure Sensor - G247- .



– Remove the connector -arrow- from the generator, otherwise the socket can get hooked to the connector.
– Remove the Fuel Pressure Sensor - G247- using the Socket - 27mm - T40218- .



Installing

Install in reverse order of removal and note the following:

Tightening Specifications

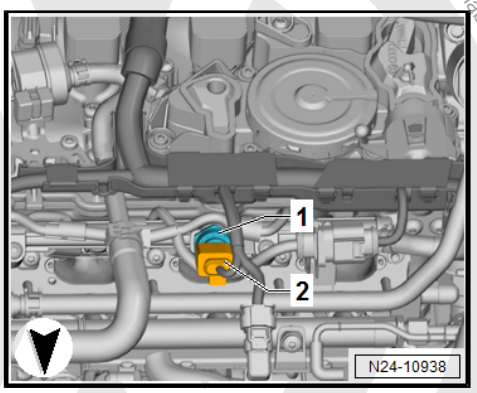
- Refer to ⇒ "4.1 Overview - Fuel Rail with Fuel Injectors", page 280

5.3 Low Fuel Pressure Sensor - G410- , Removing and Installing

Removing

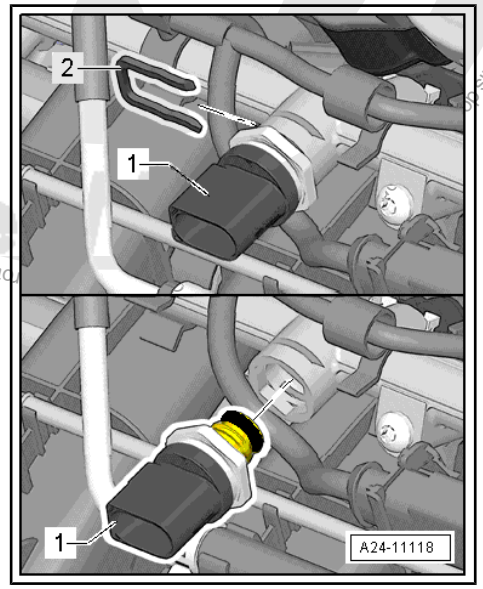
– Remove the engine cover. Refer to ⇒ “3.1 Engine Cover, Removing and Installing”, page 34 .

– Disconnect the connector -2- from the Low Fuel Pressure Sensor - G410- -1-.

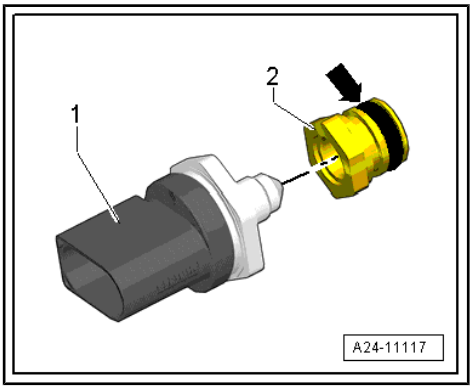


– Remove the clamp -2-.

– Remove the Low Fuel Pressure Sensor - G410- -1- from the fuel rail.



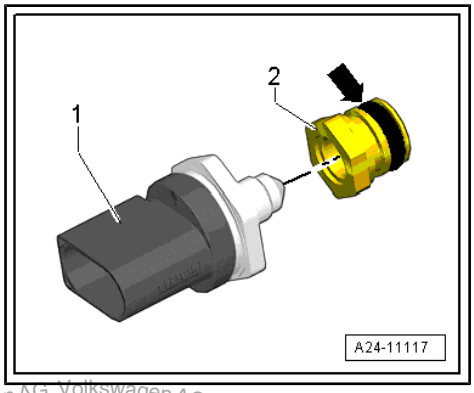
– Remove the Low Fuel Pressure Sensor - G410- -1- from the adapter -2-.



Installing

Install in reverse order of removal and note the following:

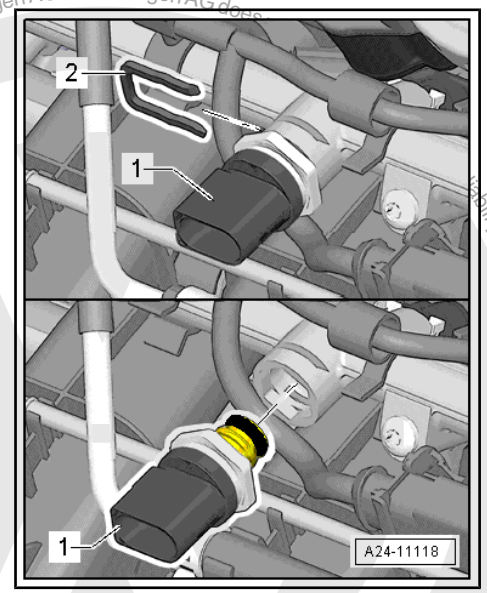
– Replace the O-ring -arrow-.
– Bolt together the adapter -2- and the Low Fuel Pressure Sensor - G410- -1-.



– Carefully slide the Low Fuel Pressure Sensor - G410- -1- all the way into the fuel rail.
– To secure the Low Fuel Pressure Sensor - G410-, slide the clip -2- into the groove.
– Connect the connector.

Tightening Specifications

◆ Refer to
⇒ “4.1 Overview - Fuel Rail with Fuel Injectors”, page 280



5.4 Intake Air Temperature Sensor - G42- / Manifold Absolute Pressure Sensor - G71- , Removing and Installing

Removing

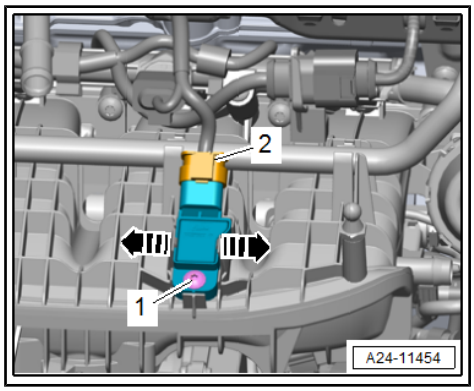
– Remove the engine cover. Refer to
⇒ “3.1 Engine Cover, Removing and Installing”, page 34 .
– Disconnect the connector -2-.
– Remove the bolt -1-.
– Release the catches in direction of -arrow-, and remove the Intake Air Temperature Sensor - G42- / Manifold Absolute Pressure Sensor - G71- from the intake manifold.

Installing

Install in reverse order of removal and note the following:

Tightening Specifications

◆ Refer to ⇒ “3.1 Overview - Intake Manifold”, page 270



5.5 Structure-Borne Sound Actuator - R214- , Removing and Installing

Removing

Note

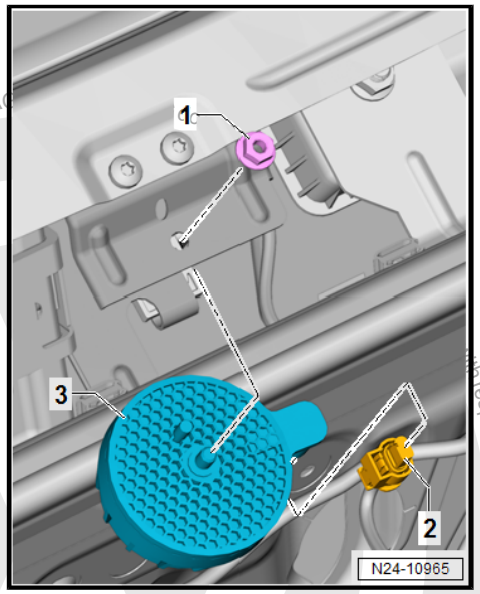
- *The bracket for the Structure-Borne Sound Actuator - R214- stays installed.*
- *Bracket can only be replaced when the windshield is removed.*

– Remove the plenum chamber cover. Refer to ⇒ Body Exterior; Rep. Gr. 50 ; Bulkhead; Plenum Chamber Cover, Removing and Installing .

– Disconnect the connector -2-.

– Remove the nut -1-.

– Remove the Structure-Borne Sound Actuator - R214- -3-.



Installing

Install in reverse order of removal and note the following:

Tightening Specifications

- Refer to ⇒ “5.1 Overview - Structure Borne Sound Actuator and Control Module”, page 290

6 High Pressure Pump

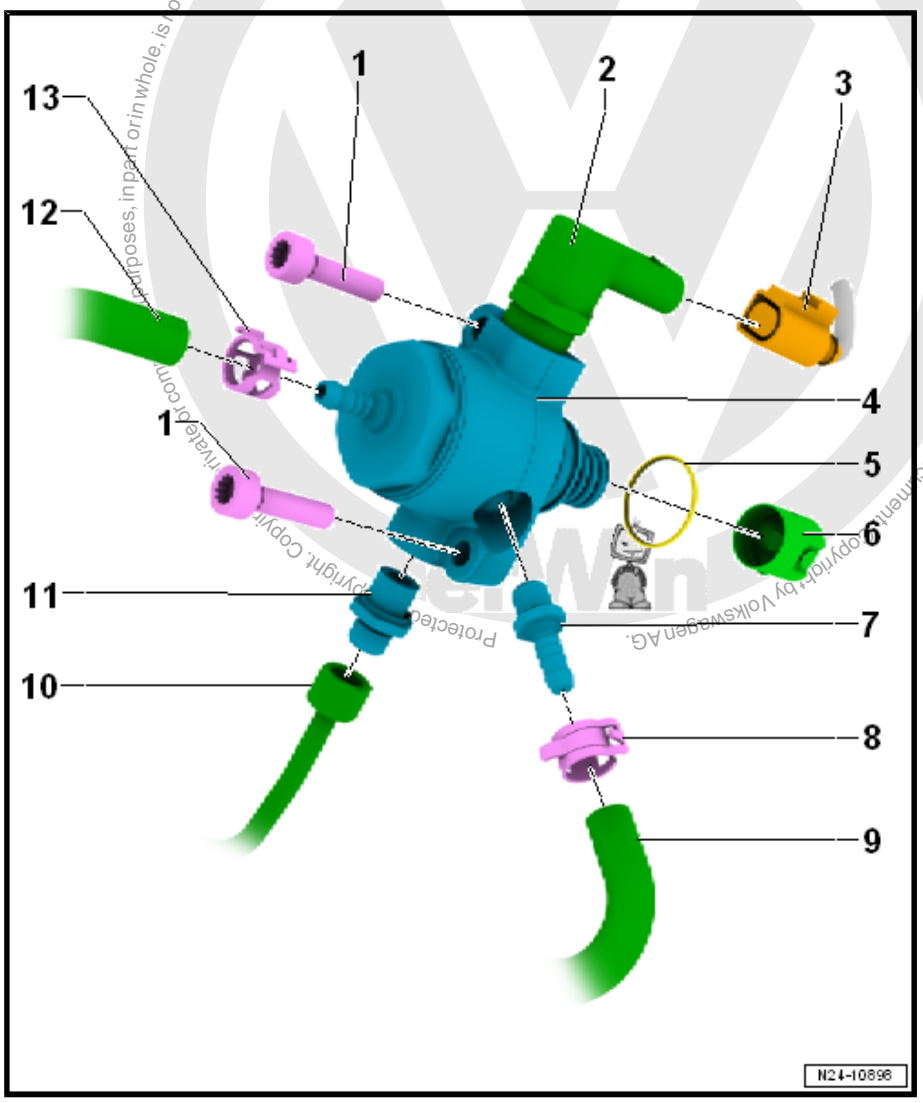
⇒ “6.1 Overview - High Pressure Pump”, page 296

⇒ “6.2 High Pressure Pump, Removing and Installing”, page 297

6.1 Overview - High Pressure Pump

WARNING

Fuel system is under high pressure! Always release the pressure in the high pressure system before opening the system. Procedure. Refer to ⇒ “1.2 High Fuel Pressure, Reducing”, page 266 .



1 - Bolt

- ❑ 20 Nm
- ❑ Replace after removing
- ❑ Tighten uniformly

2 - Fuel Pressure Regulator Valve - N276-

3 - Connector

- ❑ For Fuel Pressure Regulator Valve - N276-

4 - High Pressure Pump

- ❑ There is an electric fuel pump located in the fuel tank that supplies the fuel to the mechanical high pressure pump.
- ❑ When installing the high pressure pump, make sure that no dirt enters the fuel system.
- ❑ The fuel system must be without pressure, release fuel pressure. Refer to ⇒ “1.2 High Fuel Pressure, Reducing”, page 266 .
- ❑ Install the fuel lines free of tension
- ❑ Inspect the O-ring, and replace if damaged
- ❑ Removing and installing. Refer to ⇒ “6.2 High Pressure Pump, Removing and Installing”, page 297 .

5 - O-Ring

- ❑ Replace if damaged

6 - Roller Tappet

- ❑ Installation position: the roller points to the camshaft
- ❑ remains inserted in the vacuum pump after removing the high pressure pump

7 - Fuel Line Connections

- ❑ 20 Nm

8 - Spring Clamp

- ❑ Replace after removing

9 - Fuel Line

- ❑ To the fuel rail intake manifold fuel injectors

10 - High Pressure Line

- ❑ 20 Nm
- ❑ To the combustion chamber fuel injectors fuel rail
- ❑ Lubricate the high pressure line with engine oil
- ❑ Install the high pressure line without tension
- ❑ Pay attention to cleanliness.

11 - High Pressure Line Connection

- ❑ 30 Nm
- ❑ If the connection was loosened, it must be replaced.

12 - Fuel Supply Line

13 - Spring Clamp

- ❑ Replace after removing

6.2 High Pressure Pump, Removing and Installing

Special tools and workshop equipment required

- ♦ Flare Nut Attachment - 17mm - T10456-

Note

- ♦ *Only remove the high pressure pump when the engine is cold.*
- ♦ *When installing the high pressure pump, make sure that no dirt enters the fuel system.*
- ♦ *Collect escaping fuel with a cleaning cloth.*
- ♦ *Inspect the O-ring for the high pressure pump, and replace it if damaged.*
- ♦ *If the connection for the high pressure line -item 11- ⇒ Item 11 (page 297) is loosened, it must be replaced.*
- ♦ *Lubricate the high-pressure fuel lines with engine oil and always fasten them free of tension.*

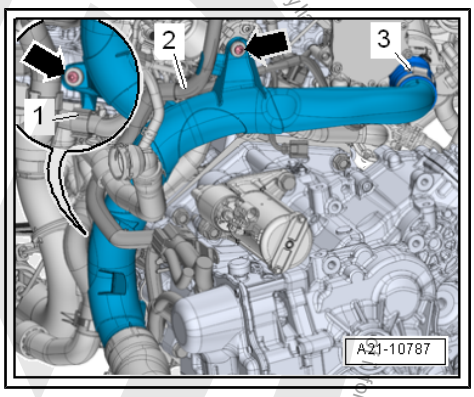
Removing

– Remove the engine cover. Refer to ⇒ “3.1 Engine Cover, Removing and Installing”, page 34 .

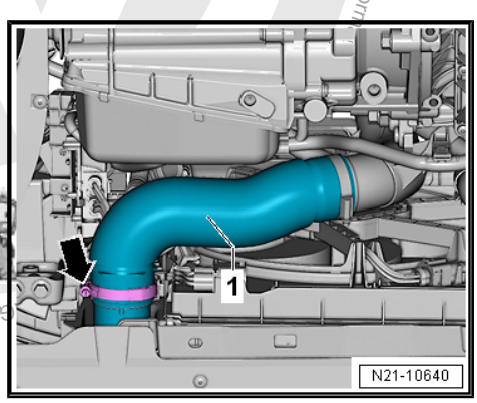
WARNING

Fuel system is under high pressure! Always release the pressure in the high pressure system before opening the system. Procedure. Refer to ⇒ “1.2 High Fuel Pressure, Reducing”, page 266 .

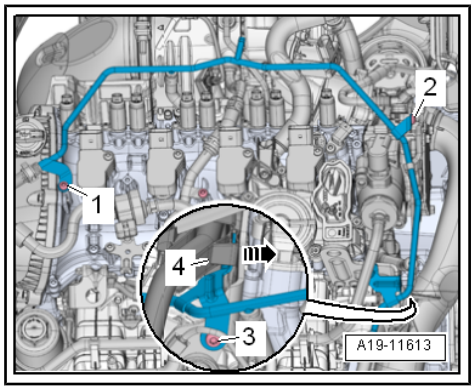
– Remove the air filter housing. Refer to ⇒ “2.2 Air Filter Housing, Removing and Installing”, page 269 .
– Free up the wiring harness -1 and 2- from the air guide pipe.
– Loosen the screw-type clamp -3-.
– Remove the bolts -arrows-.



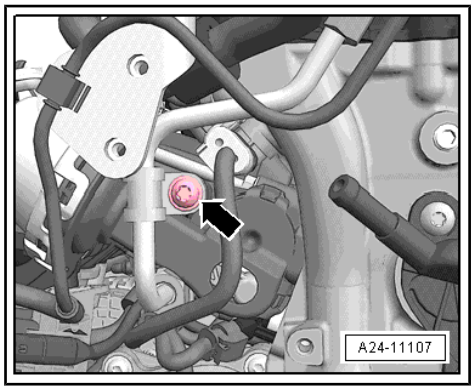
– Loosen the hose clamp -arrow- and remove the left charge air hose -1- with the air guide pipe downward.



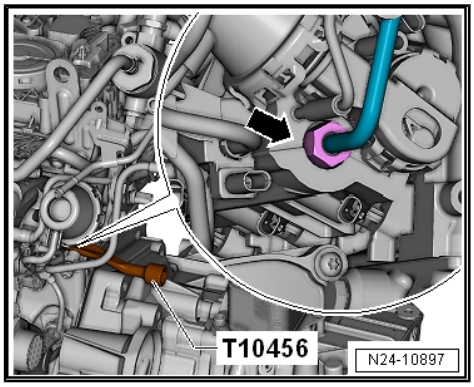
– Release the retainers -arrow-, remove the wiring duct upward from the bracket and move it towards the front.
– Remove the bolts -1, 2 and 3-.



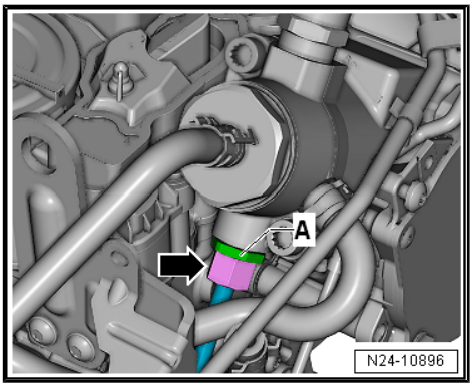
– Remove the pipe clamp -arrow-.



– Loosen the union nut -arrow- on the fuel rail -arrow- with the Flare Nut Attachment - 17mm - T10456- .



– Counterhold on the hex fitting -A- and loosen the union nut -arrow-. Remove the high pressure line.
– Disconnect the connector -1- from the Fuel Pressure Regulator Valve - N276-.
– Remove the fuel hoses -2 and 3-.
– Remove the bolts -arrows-.

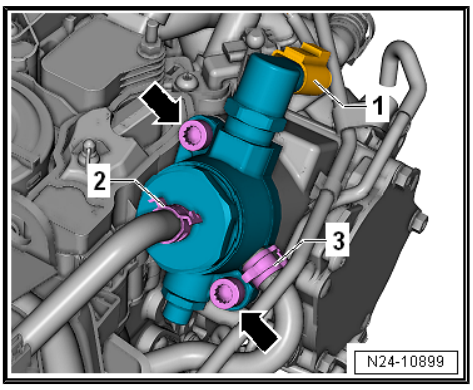


– Carefully remove the high pressure pump. The roller tappet can possibly remain in the vacuum pump.

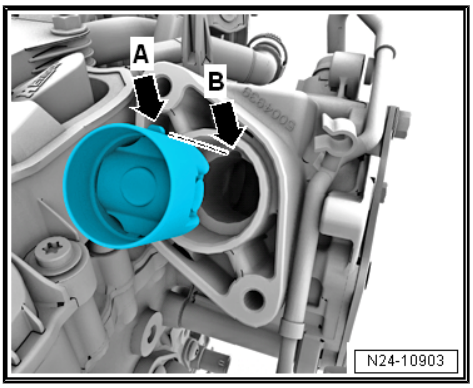
Installing

Install in reverse order of removal and note the following:

– Replace the high pressure pump O-ring.
– Inspect the roller tappet for damages before installing and replace if necessary.



– Insert the roller tappet into the vacuum pump as shown.

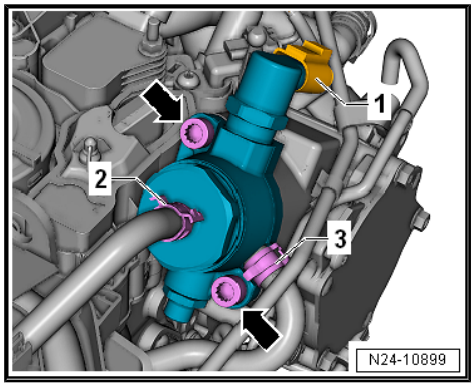


Note

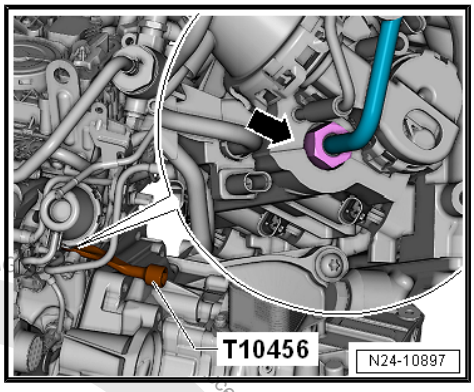
- *To insert the high pressure pump, the roller tappet must be at its lowest point.*
- *If the connection for the high pressure line -item 11- ⇒ Item 11 (page 297) is loosened, it must be replaced.*

– Rotate the crankshaft until the roller tappet is at the lowest point.
– Insert the high pressure pump in the vacuum pump.
– Tighten the bolts -arrows- by hand in a diagonal sequence.
– Tighten the bolts in a diagonal sequence to the required tightening specification.

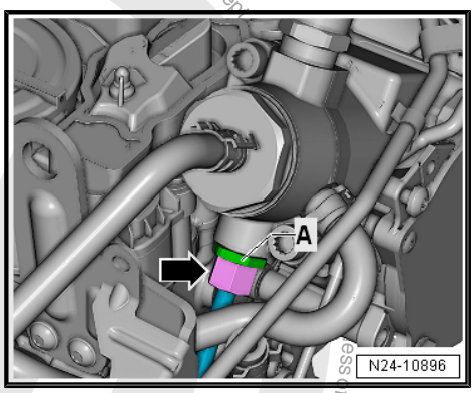
– Attach the fuel hoses -2 and 3- and secure with the spring clamp.
– Connect the connector -1- to the Fuel Pressure Regulator Valve - N276- .
– Coat the high pressure line ball with engine oil and install the high pressure line. Tighten the union nut hand-tight and align the high pressure line free of tension.



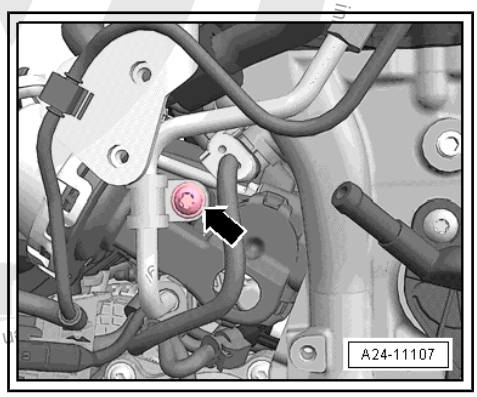
– Tighten the union nut on the fuel rail -arrow- with the Flare Nut Attachment - 17mm - T10456- .



– Counterhold on the hex fitting -A- and tighten the union nut -arrow-.



– Install the pipe clamp -arrow-.



Note

Check the fuel system for leaks after completing all work.

Tightening Specifications

◆ Refer to ⇒ “6.1 Overview - High Pressure Pump”, page 296

7 Heated Oxygen Sensor

7.1 Overview - Heated Oxygen Sensor

Note

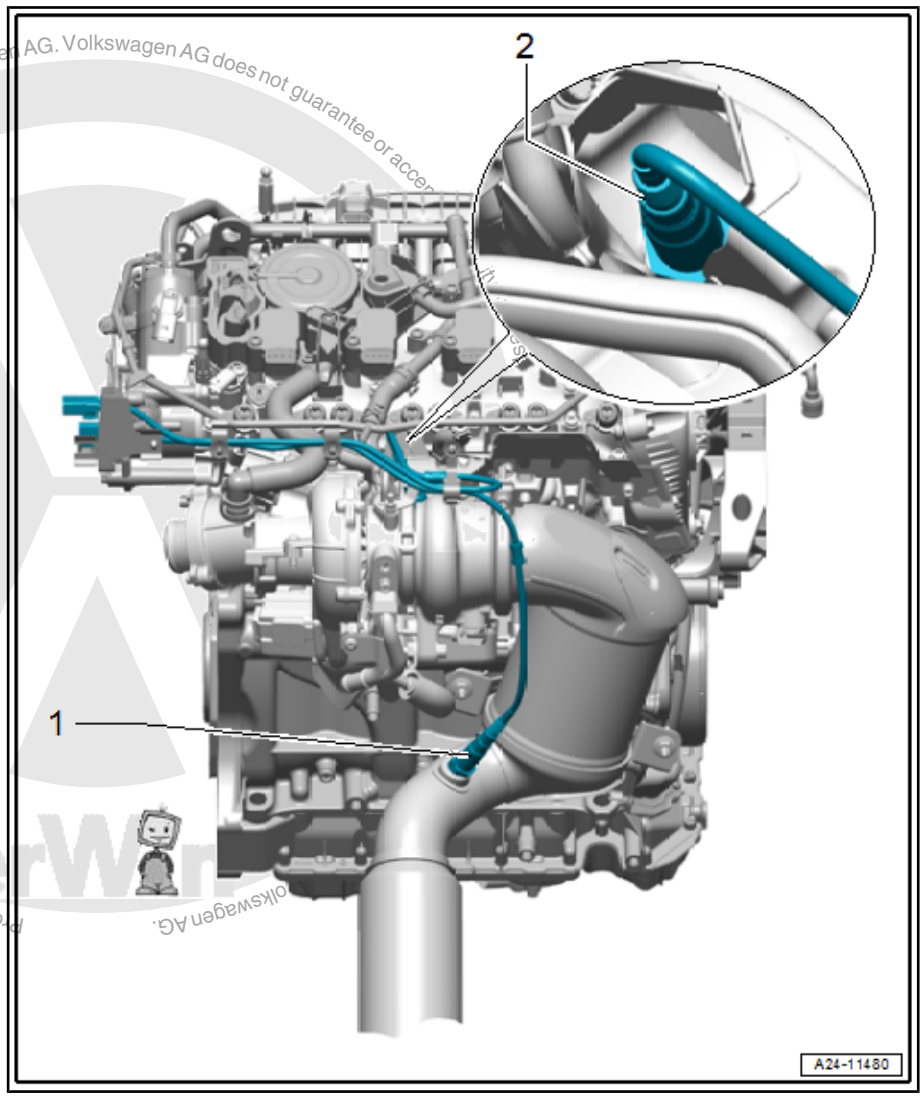
- *Coat new oxygen sensors with an assembly paste. This paste must not come into contact with oxygen sensor slots.*
- *For a used heated oxygen sensor, only coat the threads with hot bolt paste. This paste must not come into contact with oxygen sensor slots. Hot bolt paste. Refer to the Parts Catalog.*
- *The oxygen sensor wire must always be attached at the same location when installing. Do not the electrical wire connection come in contact with the exhaust pipe.*

1 - Oxygen Sensor 1 after Catalytic Converter - GX7-

- ❑ 55 Nm
- ❑ Removing and installing. Refer to ⇒ “7.2.2 Oxygen Sensor 1 after Catalytic Converter GX7 , Removing and Installing”, page 303 .

2 - Oxygen Sensor 1 Before Catalytic Converter - GX10-

- ❑ 55 Nm
- ❑ Removing and installing. Refer to ⇒ “7.2.1 Oxygen Sensor 1 before Catalytic Converter GX10 , Removing and Installing”, page 302 .



7.2 Heated Oxygen Sensor, Removing and Installing

⇒ “7.2.1 Oxygen Sensor 1 before Catalytic Converter GX10 , Removing and Installing”, page 302

⇒ “7.2.2 Oxygen Sensor 1 after Catalytic Converter GX7 , Removing and Installing”, page 303

7.2.1 Oxygen Sensor 1 before Catalytic Converter - GX10- , Removing and Installing

Special tools and workshop equipment required

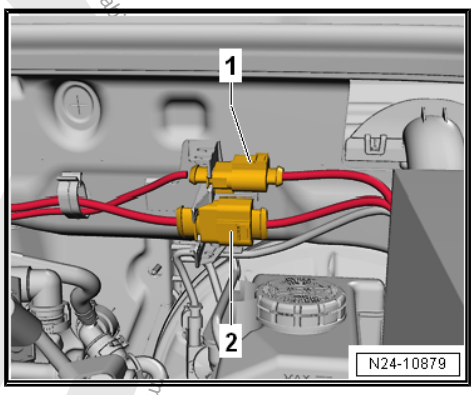
- Ring Wrench 7-Piece Set - 3337-

Oxygen Sensor 1 before Catalytic Converter - GX10- is composed of:

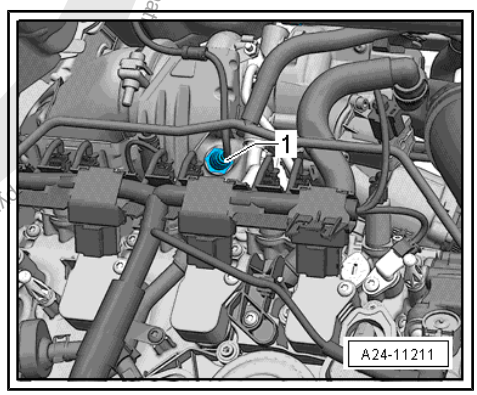
- Heated Oxygen Sensor - G39-
- Oxygen Sensor Heater - Z19-

Removing

– Disconnect the connector -2- of the Oxygen Sensor 1 before Catalytic Converter - GX10- .



– Remove the Oxygen Sensor 1 before Catalytic Converter - GX10- -1- using a tool from the Ring Wrench 7-Piece Set - 3337- .



Installing

Install in reverse order of removal and note the following:

Note

- *Coat new oxygen sensors with an assembly paste. This paste must not come into contact with oxygen sensor slots.*
- *For a used heated oxygen sensor, only coat the threads with hot bolt paste. This paste must not come into contact with oxygen sensor slots. Hot bolt paste. Refer to the Parts Catalog.*
- *The oxygen sensor wire must always be attached at the same location when installing. Do not the electrical wire connection come in contact with the exhaust pipe.*

Tightening Specifications

- Refer to
⇒ “7.1 Overview - Heated Oxygen Sensor”, page 301

7.2.2 Oxygen Sensor 1 after Catalytic Converter - GX7- , Removing and Installing

Special tools and workshop equipment required

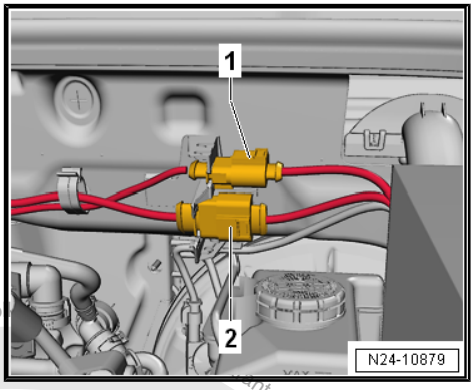
- Ring Wrench 7-Piece Set - 3337-

The Oxygen Sensor 1 after Catalytic Converter - GX7- is composed of:

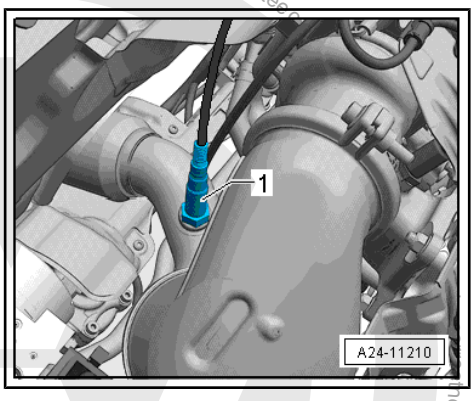
- Oxygen Sensor after Three Way Catalytic Converter - G130-
- Heater For Oxygen Sensor 1 after Catalytic Converter - Z30-

Removing

– Disconnect the Oxygen Sensor 1 after Catalytic Converter - GX7- connector -1-.



– Remove the Heated Oxygen Sensor -1- using a tool from the Ring Spanner 7-Piece Set - 3337- .



Installing

Install in reverse order of removal and note the following:

Note

- *Coat new oxygen sensors with an assembly paste. This paste must not come into contact with oxygen sensor slots.*
- *For a used heated oxygen sensor, only coat the threads with hot bolt paste. This paste must not come into contact with oxygen sensor slots. Hot bolt paste. Refer to the Parts Catalog.*
- *The oxygen sensor wire must always be attached at the same location when installing. Do not the electrical wire connection come in contact with the exhaust pipe.*

Tightening Specifications

- Refer to
⇒ “7.1 Overview - Heated Oxygen Sensor”, page 301

8 Engine Control Module

⇒ “8.1 Engine Control Module J623 , Removing and Installing”, page 304

8.1 Engine Control Module - J623- , Removing and Installing

⇒ “8.1.1 Engine Control Module J623 , Removing and Installing, without Protective Housing”, page 304

⇒ “8.1.2 Engine Control Module J623 with Protective Housing, Removing and Installing”, page 305

8.1.1 Engine Control Module - J623- , Removing and Installing, without Protective Housing

Special tools and workshop equipment required

- ♦ Vehicle Diagnostic Tester

Removing

– The chain length adaptation values from the engine control module need to be read out before removing the engine control module.

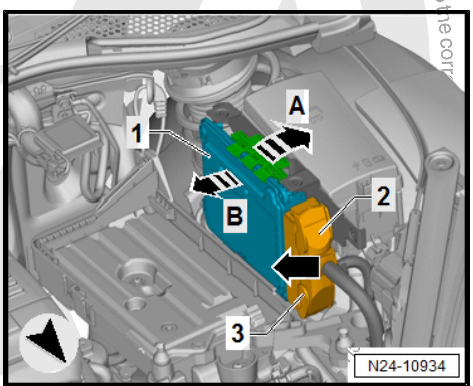
– Active the `Replace Engine Control Module` function in the `Guided Functions` mode . Refer to Vehicle Diagnostic Tester .

– Turn off the ignition and remove the key.

> ⚠ **Caution**
>
> *Touching the engine control module with the battery positive terminal damages the engine control module. For this reason the battery must be disconnected before removing the engine control module from its mount. Refer to ⇒ Electrical Equipment; Rep. Gr. 27 ; Battery; Battery, Disconnecting and Connecting .*

– Unlock and disconnect the connectors -2 and 3- from the Engine Control Module - J623- .

– Release the retainers in direction of -arrow A- and remove the Engine Control Module - J623- -1- in direction of -arrow B-.



Installing

Install in reverse order of removal and note the following:

– Connect the battery. Refer to ⇒ Electrical Equipment; Rep. Gr. 27 ; Battery; Battery, Disconnecting and Connecting .

Perform the following after Installing a New Engine Control Module:

– Activate the `Replace Engine Control Module` function in `Guided Functions` mode. Refer to Vehicle Diagnostic Tester .

8.1.2 Engine Control Module - J623- with Protective Housing, Removing and Installing

Special tools and workshop equipment required

- Wiring Harness Repair Set - Hot Air Blower - VAS1978/14A- Wiring Harness Repair Set - VAS1978B- .
- Vehicle Diagnostic Tester
- Mini-grinder, commercially available

Removing

– The chain length adaptation values from the engine control module need to be read out before removing the engine control module.

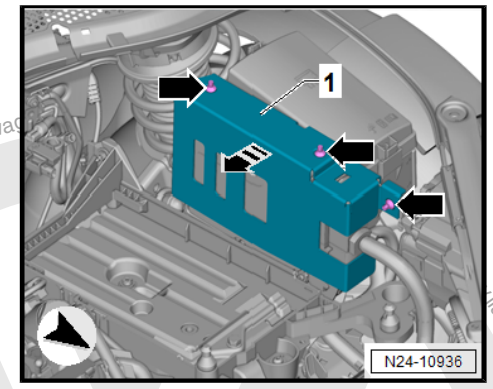
– Active the `Replace Engine Control Module` function in the `Guided Functions` mode. Refer to Vehicle Diagnostic Tester .

– Turn off the ignition and remove the key.

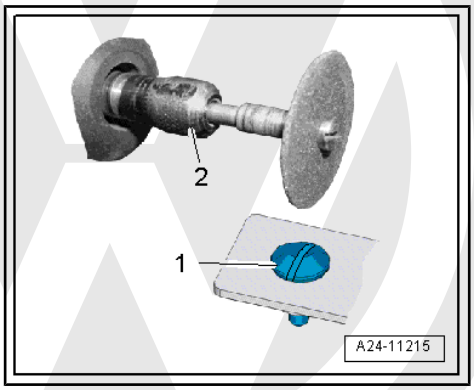
Caution

Touching the engine control module with the battery positive terminal damages the engine control module. For this reason the battery must be disconnected before removing the engine control module from its mount. Refer to ⇒ Electrical Equipment; Rep. Gr. 27 ; Battery; Battery, Disconnecting and Connecting .

Remove the shear bolts -arrows- to remove the protective housing -1- as follows:

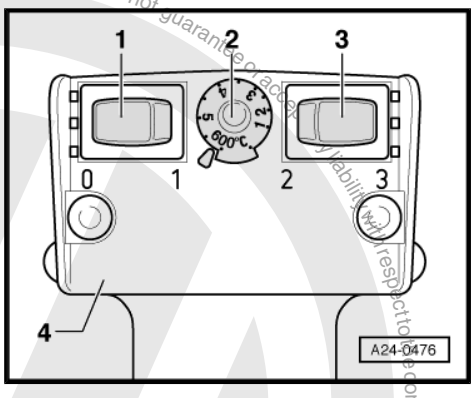


– Make a recess in the head of the shear bolt -1- for a screwdriver. Use a mini-grinder -2- to make the recess.



Note

The shear bolts were installed with a locking fluid. For this reason, the threads must be heated with the heat gun to remove both bolts.



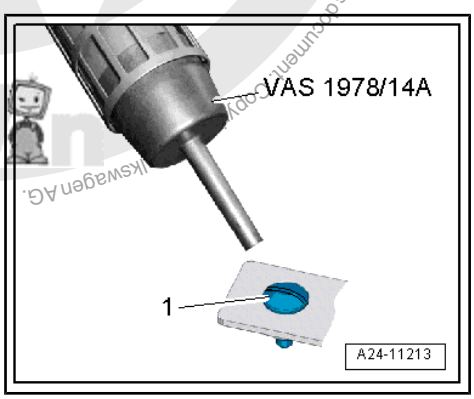
– Set the adjustment on the hot air blower as shown in the illustration, with the temperature setting potentiometer -2- set to maximum heat and the two-stage airflow switch -3- set to level 3.

WARNING

Risk of getting burned by the hot air blower.

- ***By heating the threads, parts of the protective housing are heated intensely. Make sure that only the thread is heated, and not any of the surrounding parts. Cover these up if necessary.***

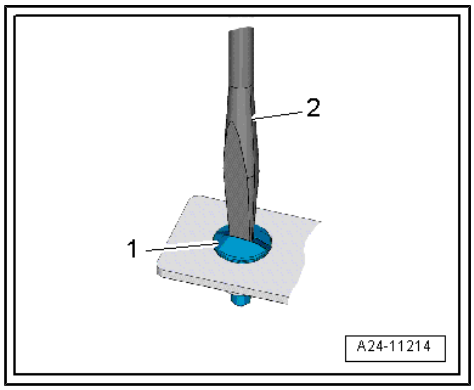
– Warm the head of the shear bolt -1- for 20 to 30 seconds.



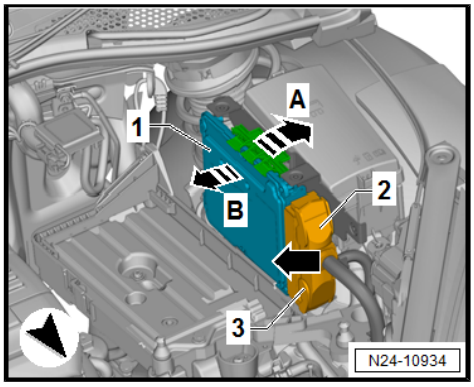
– Remove the shear bolt -1- with a screwdriver -2-.

– Remove the protective housing from the Engine Control Module - J623- .

– Unlock and disconnect the connectors -2 and 3- from the Engine Control Module - J623- .



– Release the retainers in direction of -arrow A- and remove the Engine Control Module - J623- -1- in direction of -arrow B-.



Installing

Install in reverse order of removal and note the following:

– Engine Control Module - J623- must be installed again with protective housing.

– Clean any locking fluid still in the threaded holes for the shear bolts. Cleaning can be performed with a thread cutter (tap).

– Connect the battery. Refer to ⇒ Electrical Equipment; Rep. Gr. 27 ; Battery; Battery, Disconnecting and Connecting .

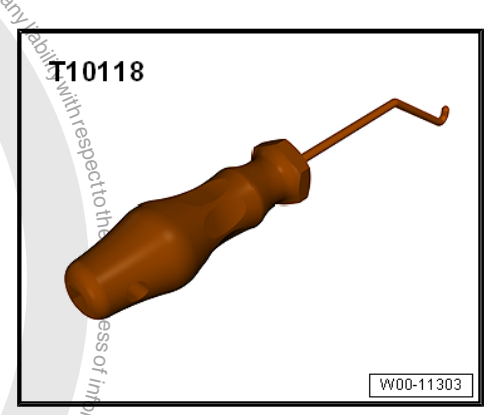
Perform the following after Installing a New Engine Control Module:

– Activate the `Replace Engine Control Module` function in `Guided Functions` mode. Refer to Vehicle Diagnostic Tester .

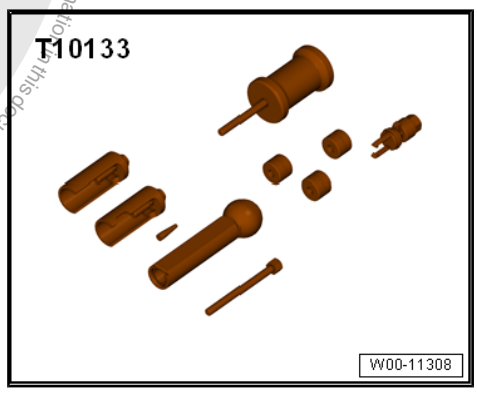
9 Special Tools

Special tools and workshop equipment required

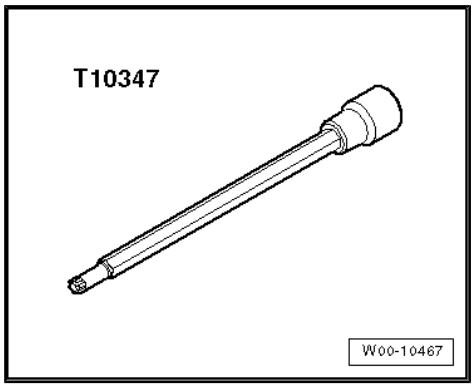
- Elbow Assembly Tool - T10118-



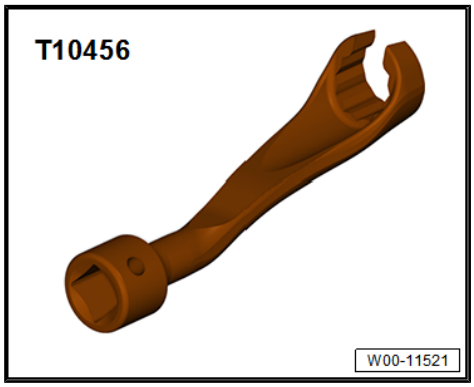
- Injector/Combustion Chamber Seal Tool Set - T10133B-



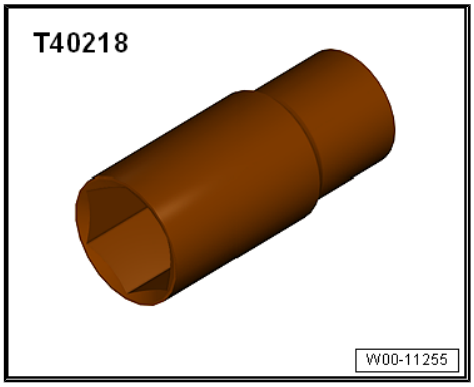
- Torx Socket - T30 - T10347-



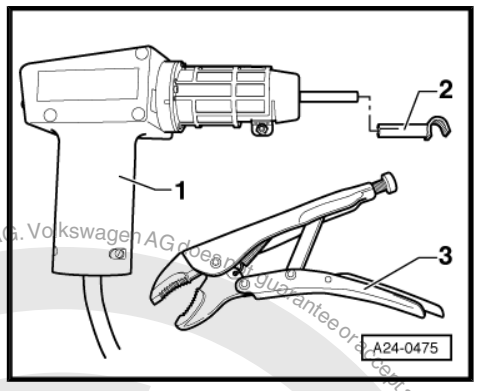
- Flare Nut Attachment - 17mm - T10456-



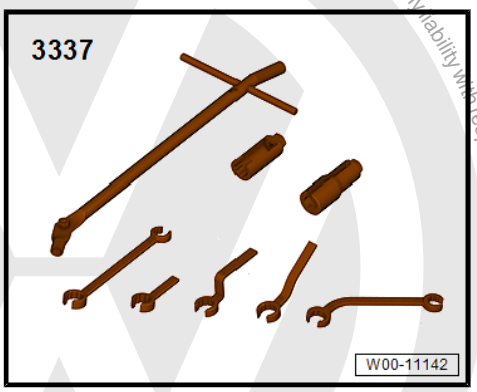
- Socket - 27mm - T40218- or a commercially available 27 mm socket



- Wiring Harness Repair Set - Hot Air Blower - VAS1978/14A- -1- with nozzle attachment -2- from the Wiring Harness Repair Set - VAS1978B- .



- Ring Wrench 7-Piece Set - 3337-



26 – Exhaust System, Emission Controls

1 Exhaust Pipes/Mufflers

1.1 Overview - Muffler

1.1.1 Overview - Muffler

1 - Bolt
- ❑ 20 Nm

2 - Bracket

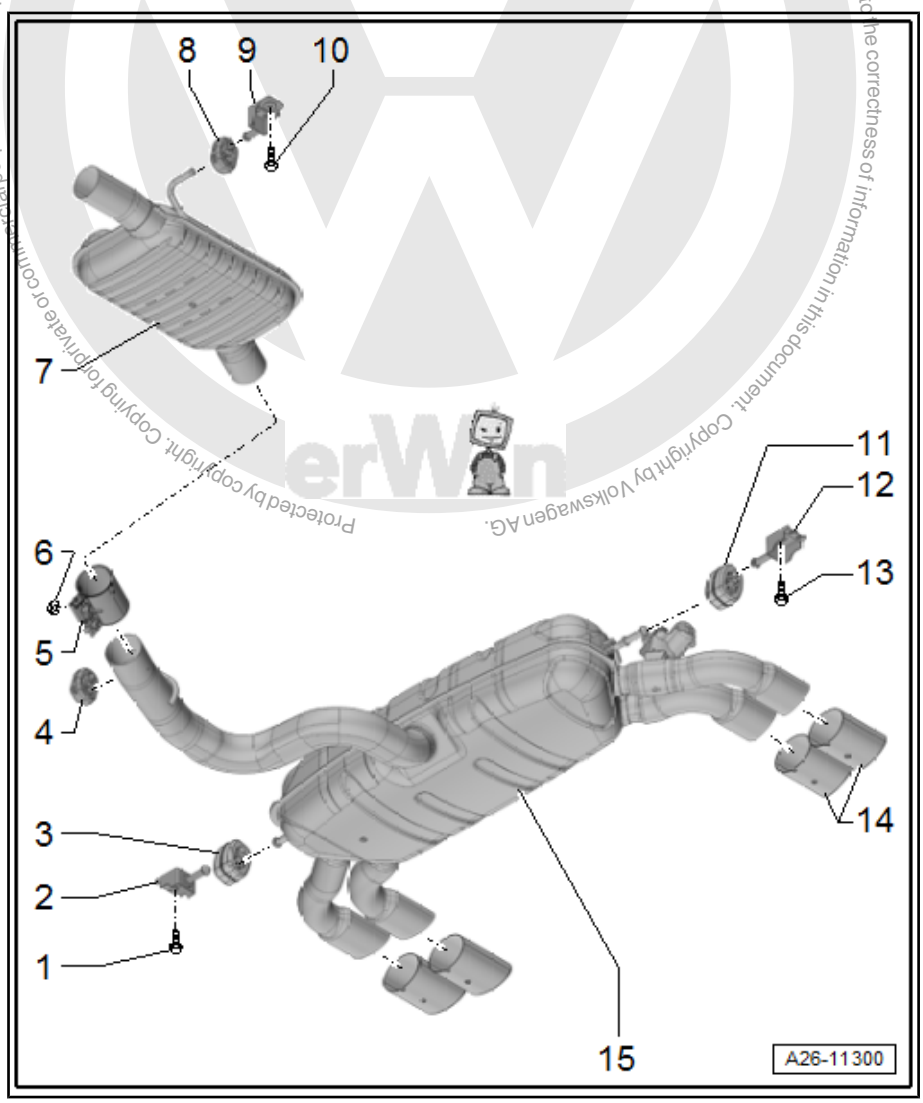
3 - Retaining Ring
- ❑ Replace if damaged

4 - Retaining Ring
- ❑ Replace if damaged

5 - Rear Clamping Sleeve
- ❑ Installation position. Refer to ⇒ “1.7 Clamping Sleeve Installation Position”, page 316
- ❑ Exhaust System, Installing without Tension. Refer to ⇒ “1.4 Exhaust System, Installing without Tension”, page 314 .
- ❑ Tighten threaded connections evenly.

6 - Nut
- ❑ 20 Nm

7 - Center Muffler
- ❑ Separating the exhaust pipes/mufflers. Refer to ⇒ “1.3 Exhaust Pipes/Mufflers, Disconnecting”, page 313 .
- ❑ Removing and installing. Refer to ⇒ “1.2 Muffler, Removing and Installing”, page 313 .



- ❑ Exhaust System, Installing without Tension. Refer to ⇒ “1.4 Exhaust System, Installing without Tension”, page 314 .

8 - Retaining Ring

- ❑ Replace if damaged

9 - Bracket

10 - Bolt

- ❑ 20 Nm

11 - Retaining Ring

- ❑ Replace if damaged

12 - Bracket

13 - Bolt

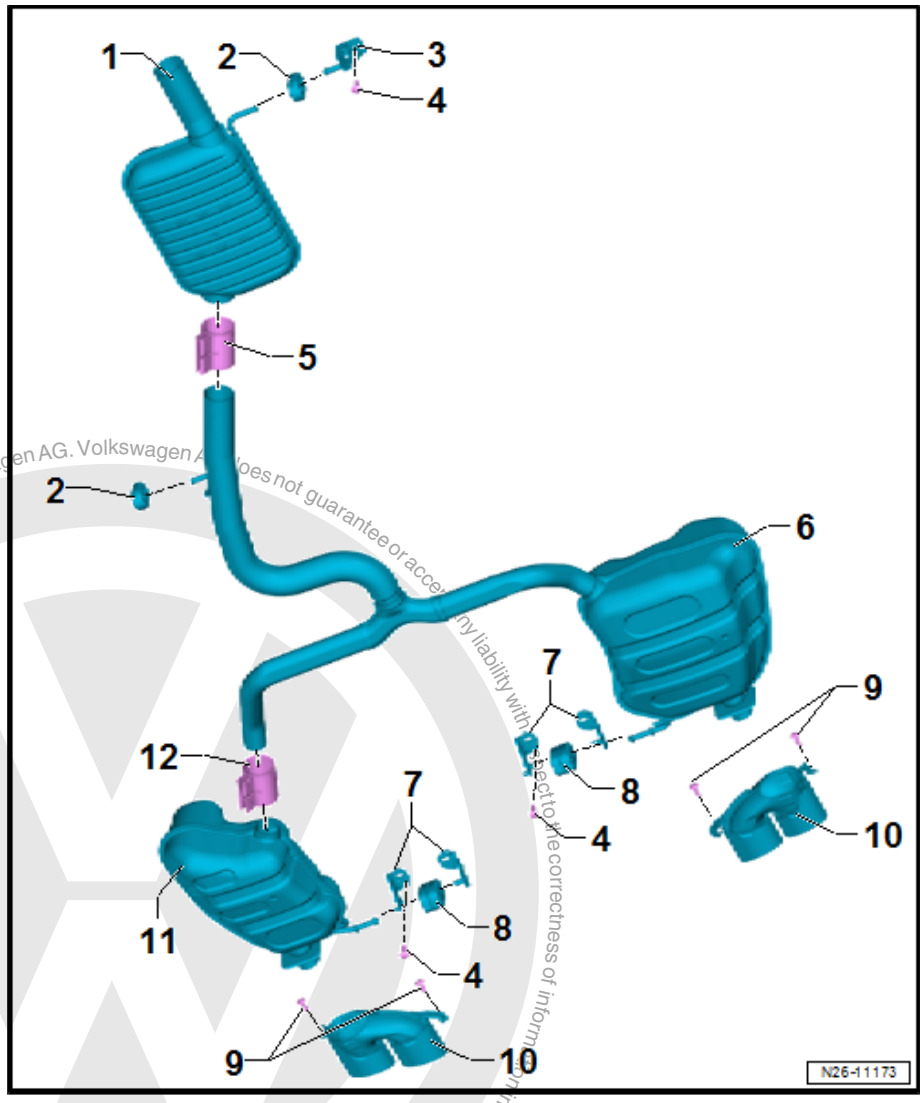
- ❑ 20 Nm

14 - Trim

15 - Rear Muffler

- ❑ with Exhaust Door Control Unit - J883- / Exhaust Door Control Unit 2 - J945-
- ❑ Separating the exhaust pipes/mufflers. Refer to ⇒ “1.3 Exhaust Pipes/Mufflers, Disconnecting”, page 313 .
- ❑ Removing and installing. Refer to ⇒ “1.2 Muffler, Removing and Installing”, page 313 .
- ❑ Exhaust System, Installing without Tension. Refer to ⇒ “1.4 Exhaust System, Installing without Tension”, page 314 .

1.1.2 Overview - Muffler, Wagon, 4MOTION



1 - Center Muffler

- ❑ Separating the exhaust pipes/mufflers. Refer to ⇒ “1.3 Exhaust Pipes/Mufflers, Disconnecting”, page 313 .
- ❑ Exhaust System, Installing without Tension. Refer to ⇒ “1.4 Exhaust System, Installing without Tension”, page 314 .

2 - Retaining Ring

- ❑ Replace if damaged

3 - Bracket

4 - Bolt

- ❑ 20 Nm

5 - Double Clamp

- ❑ 20 Nm
- ❑ Tighten threaded connections evenly.
- ❑ Installation position. Refer to ⇒ “1.7 Clamping Sleeve Installation Position”, page 316
- ❑ Exhaust System, Installing without Tension. Refer to ⇒ “1.4 Exhaust System, Installing without Tension”, page 314 .

6 - Rear Muffler

- ❑ Separating the exhaust pipes/mufflers. Refer to ⇒ “1.3 Exhaust Pipes/Mufflers, Disconnecting”, page 313 .
- ❑ Exhaust System, Installing without Tension. Refer to ⇒ “1.4 Exhaust System, Installing without Tension”, page 314 .

7 - Bracket

8 - Retaining Ring

- ❑ Replace if damaged

9 - Screws

- ❑ Tightening specification. Refer to ⇒ Body Exterior; Rep. Gr. 63 ; Rear Bumper; Overview - Attachments .

10 - Tail Pipe

- ❑ Removing and installing. Refer to ⇒ Body Exterior; Rep. Gr. 63 ; Rear Bumper

11 - Rear Muffler

- ❑ Separating the exhaust pipes/mufflers. Refer to ⇒ “1.3 Exhaust Pipes/Mufflers, Disconnecting”, page 313 .
- ❑ Exhaust System, Installing without Tension. Refer to ⇒ “1.4 Exhaust System, Installing without Tension”, page 314 .

12 - Double Clamp

- ❑ 20 Nm

- ❑ Tighten threaded connections evenly.
- ❑ Installation position. Refer to ⇒ “1.7 Clamping Sleeve Installation Position”, page 316
- ❑ Exhaust System, Installing without Tension. Refer to ⇒ “1.4 Exhaust System, Installing without Tension”, page 314 .

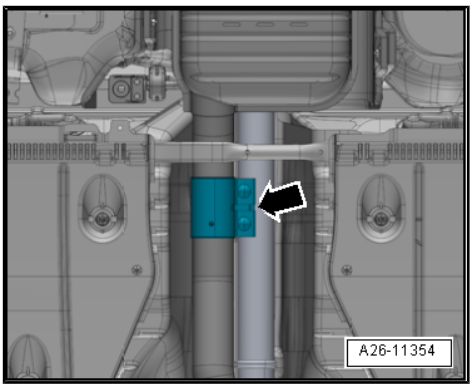
1.2 Muffler, Removing and Installing

Removing

– Loosen the screws for the front clamping sleeve -arrow-.

– If equipped, disconnect the connector from the exhaust door control unit. Refer to ⇒ Fig. ““Exhaust Door Control Unit Tightening Specification”“ , page 318 .

– Disengage the mount -3- from the exhaust system rear section.

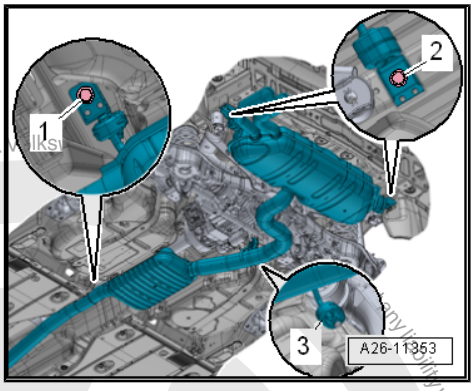


WARNING

Risk of accident due to the weight of the muffler.

- ♦ *A second technician is needed to remove the rear muffler.*

– Remove the bolts -1 and 2- and then remove the muffler.



Installing

Install in reverse order of removal and note the following:

– Install the exhaust system without tension. Refer to ⇒ “1.4 Exhaust System, Installing without Tension”, page 314 .

Tightening Specifications

- ♦ Refer to ⇒ “1.1 Overview - Muffler”, page 310

1.3 Exhaust Pipes/Mufflers, Disconnecting

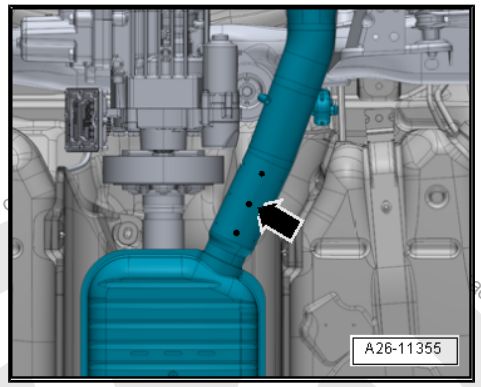
- ♦ A coupling rod has been provided in the connecting pipe for individual replacement of the center or rear muffler.
- ♦ The coupling rod is marked by a depression around the circumference of the exhaust pipe.

Special tools and workshop equipment required

- ♦ Chain Pipe Cutter - VAS6254-
- ♦ Pneumatic Body Saw - VAS6780-

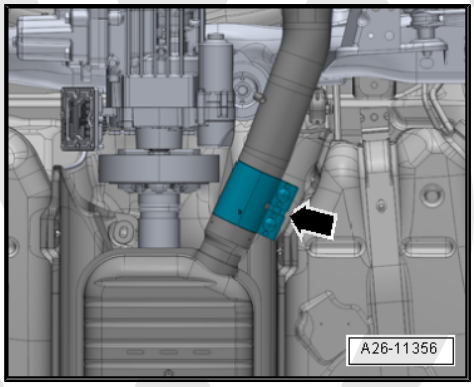
Procedure

– Separate the exhaust pipe at a right angle at the coupling rod -arrow- using a Chain Pipe Cutter - VAS6254- .

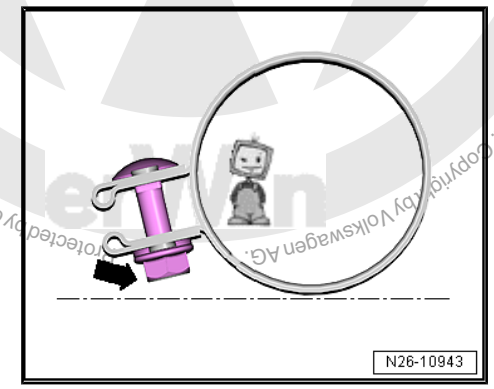


– When installing, position clamping sleeve -arrows- centrally on the separation point.

– Install the clamping sleeve so that the bolt end -arrow- does not project beyond the lower edge of clamping sleeve.



– Install the exhaust system without tension. Refer to ⇒ “1.4 Exhaust System, Installing without Tension”, page 314 .

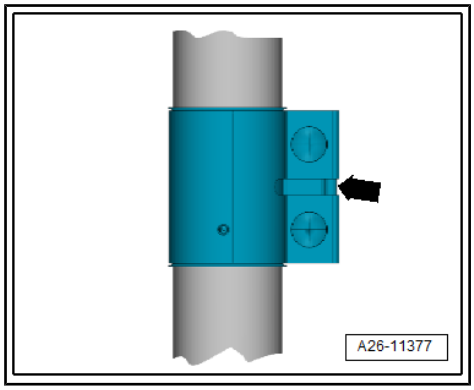


1.4 Exhaust System, Installing without Tension

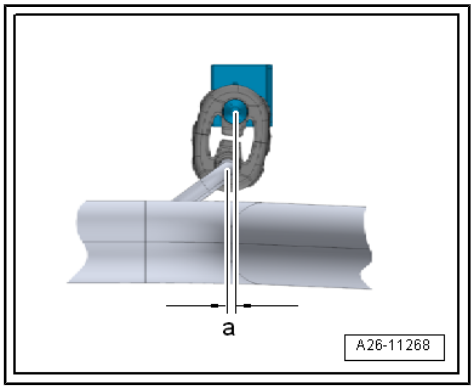
Procedure

• Align the exhaust system when cold.

– Loosen the screws for the front clamping sleeve -arrow-.



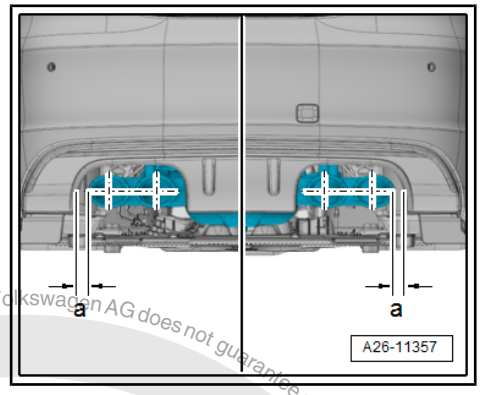
– Push the exhaust system far enough forward until the on the bracket at the exhaust pipe -a- = 5 mm.
– Align the rear muffler so that the space between the opening for the bumper and the tail pipes is the same.



– Tighten the clamping sleeves evenly.

Tightening Specifications

♦ Refer to ⇒ “1.1 Overview - Muffler”, page 310



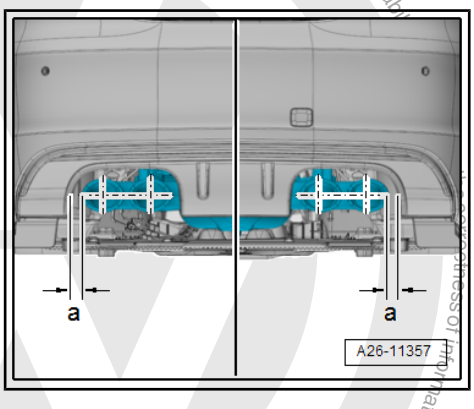
1.5 Tail Pipes, Aligning

Procedure

– Align the rear muffler so that the space between the opening for the bumper and the tail pipes is the same.

• -a- = -a-

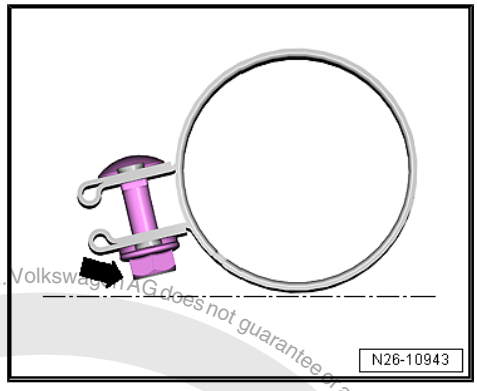
– Loosen the rear muffler suspended mount to align the tail pipes.



1.6 Exhaust System, Checking for Leaks

– Start the engine and let it run at idle.
– Seal the tail pipes with cloths or plugs during the leakage test.
– Check for leaks where the exhaust manifold attaches to the cylinder head and where the turbocharger attaches to the front exhaust pipe.
– Repair the detected leaks.

1.7 Clamping Sleeve Installation Position



Clamping Sleeve Installation Position

– Install the clamping sleeve in the shown position. The threaded connection -arrows- must not project over the lower edge of the clamp.

- Bolted connections point toward the left.
- The threaded connection -arrows- must not project over the lower edge of the lock washer.

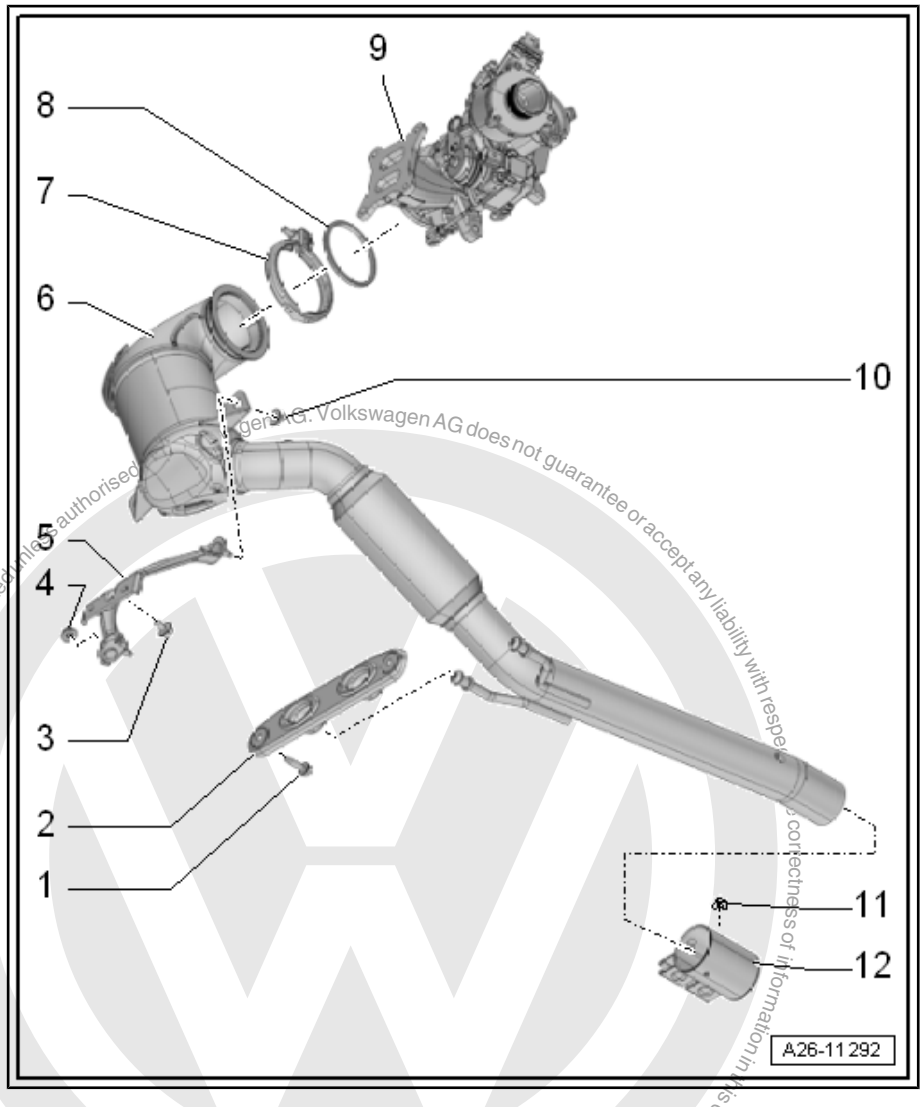
2 Emissions Control

⇒ “2.1 Overview - Emissions Control”, page 317

⇒ “2.2 Catalytic Converter, Removing and Installing”, page 319

⇒ “2.3 Exhaust Door Control Units J883 / J945 , Removing and Installing”, page 320

2.1 Overview - Emissions Control



1 - Bolt

- ❑ 20 Nm

2 - Bracket

- ❑ Replace if damaged

3 - Bolt

Tightening specification and sequence. Refer to ⇒ Fig. ““Catalytic Converter - Tightening Specification and Sequence”“ , page 318 .

4 - Nut

Tightening specification and sequence. Refer to ⇒ Fig. ““Catalytic Converter - Tightening Specification and Sequence”“ , page 318 .

5 - Bracket

- ❑ For catalytic converter

6 - Catalytic Converter

- ❑ With front exhaust pipe
- ❑ Protect catalytic converter from shocks and impact stress
- ❑ Removing and installing. Refer to ⇒ “2.2 Catalytic Converter, Removing and Installing”, page 319 .
- ❑ Exhaust System, Installing without Tension. Refer to ⇒ “1.4 Exhaust System, Installing without Tension”, page 314 .

7 - Screw-Type Clamp

- ❑ Replace after removing
- ❑ Installation position. Refer to ⇒ Fig. ““Installed Location of the Catalytic Converter Screw Clamp”“, page 318
- ❑ Tightening specification and sequence. Refer to ⇒ Fig. ““Catalytic Converter - Tightening Specification and Sequence”“ , page 318 .

8 - Seal

- ❑ Replace after removing

9 - Turbocharger

- ❑ Removing and installing. Refer to ⇒ “1 Turbocharger”, page 243 .

10 - Nut

Tightening specification and sequence. Refer to
⇒ Fig. ""Catalytic Converter - Tightening Specification and Sequence"" , page 318 .

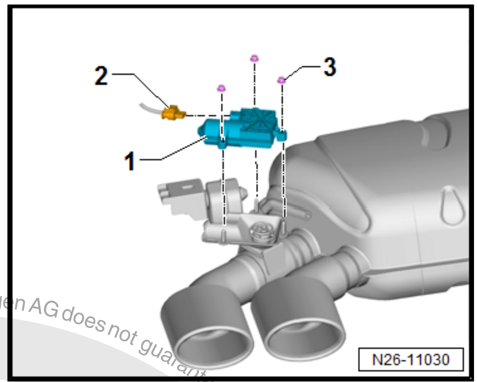
11 - Nut

- ❑ 30 Nm

12 - Front Clamping Sleeve

- ❑ Before tightening, align the exhaust system without tension. Refer to ⇒ "1.4 Exhaust System, Installing without Tension", page 314 .
- ❑ Installation position. Refer to ⇒ "1.7 Clamping Sleeve Installation Position", page 316
- ❑ Tighten threaded connections evenly.

Exhaust Door Control Unit Tightening Specification

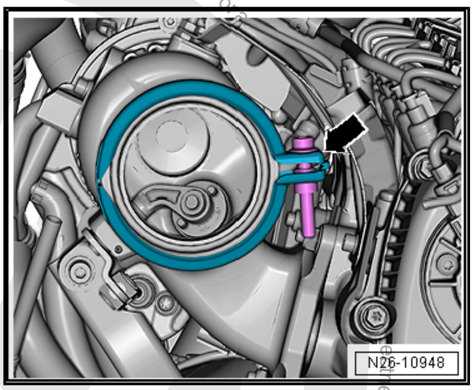


Component	Tightening Specification
Nuts -3-	3 Nm

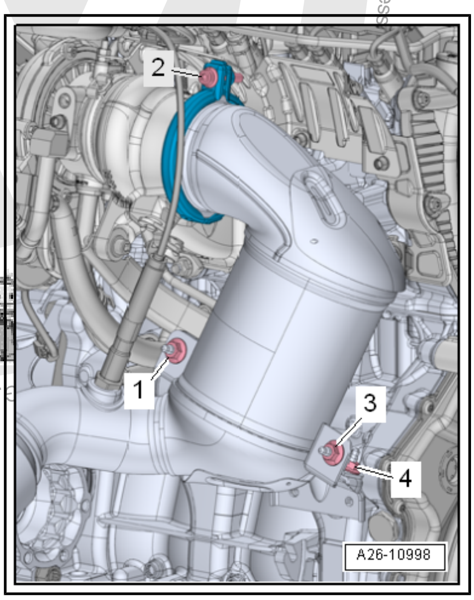
Note

Replace nuts.

Installed Location of the Catalytic Converter Screw Clamp



Catalytic Converter - Tightening Specification and Sequence



– Tighten the threaded connections in steps in the sequence shown:

Step	Threaded Connections/Nuts	Tightening Specification
1.	-1, 3 and 4-	Install all the way in by hand. • It must be possible to slide the catalytic converter and bracket back and forth.
2.	-2-	Tighten the screw-type clamp to 15 Nm.
3.	-1, 3 and 4-	tighten to 20 Nm

2.2 Catalytic Converter, Removing and Installing

Removing

Note

- *The catalytic converter is removed with the front exhaust pipe.*
- *Install cable ties at the same locations when installing.*

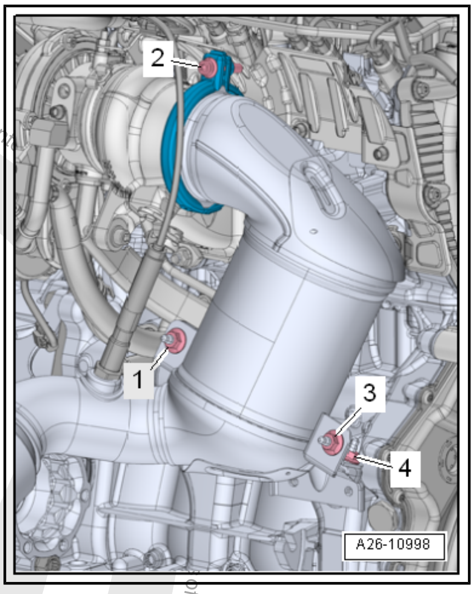
– Remove the noise insulation. Refer to ⇒ Body Exterior; Rep. Gr. 66 ; Noise Insulation; Overview - Noise Insulation .

– If equipped, remove the driveshaft. Refer to ⇒ Rear Final Drive; Rep. Gr. 39 ; Driveshaft; Driveshaft, Removing and Installing .

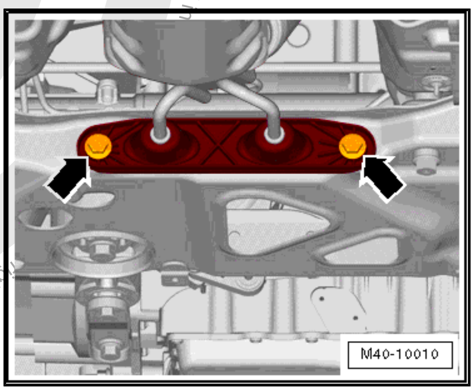
– Remove the Oxygen Sensor 1 after Catalytic Converter -GX7- . Refer to ⇒ "7.2.2 Oxygen Sensor 1 after Catalytic Converter GX7 , Removing and Installing", page 303 .

– Remove the bolt -2- and the screw-type clamp.

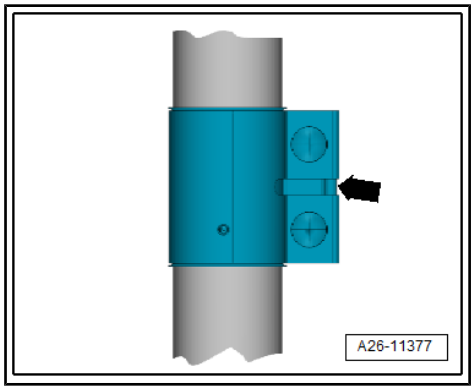
– Remove the nuts -1 and 3-.



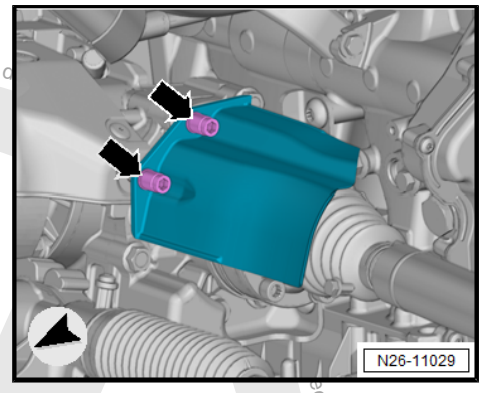
– Remove the bolts -arrows-.



– Loosen the clamping sleeve -arrow- and push it toward the rear.



– Remove the bolts -arrows- and remove the drive axle heat shield.
– Remove the pendulum support bolts -1- from the transmission.
– Push the engine/transmission slightly towards the front end (second technician needed).

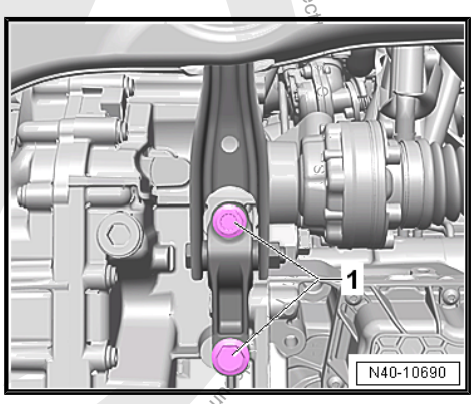


– Remove the catalytic converter with the front exhaust pipe.

Installing

Install in reverse order of removal and note the following:

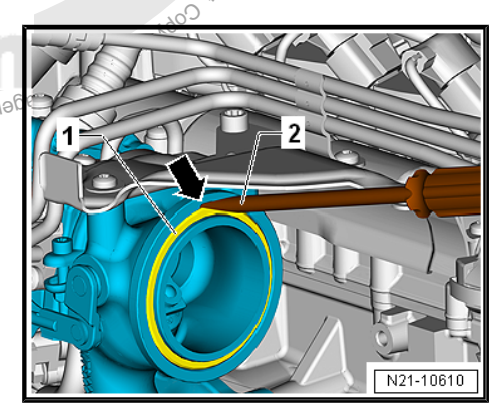
– Place the screwdriver -2- into the opening -arrow- on the turbocharger and pry out the seal -1-.
– Install new seal.
– Mount the catalytic converter on the turbocharger and install the screw-type clamp loose.
– Tighten the nuts and screw clamp. Refer to ⇒ Fig. ""Catalytic Converter - Tightening Specification and Sequence"" , page 318 .



– Install the exhaust system without tension. Refer to ⇒ "1.4 Exhaust System, Installing without Tension", page 314 .

Tightening Specifications

♦ Refer to ⇒ "2.1 Overview - Emissions Control", page 317
♦ Refer to ⇒ "7.1 Overview - Heated Oxygen Sensor", page 301

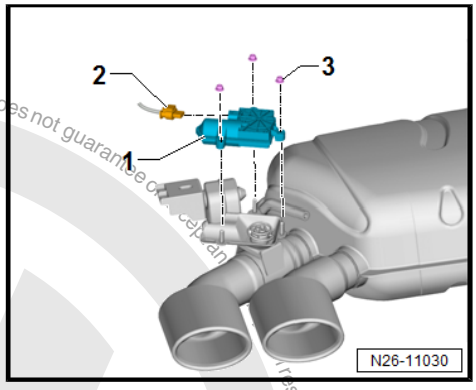


2.3 Exhaust Door Control Units -J883- / -J945- , Removing and Installing

Removing

– Lower the exhaust system rear section slightly.
– Disconnect the connector -2-.

– Remove the nuts -3- and then remove the Exhaust Door Control Unit -1-.



Installing

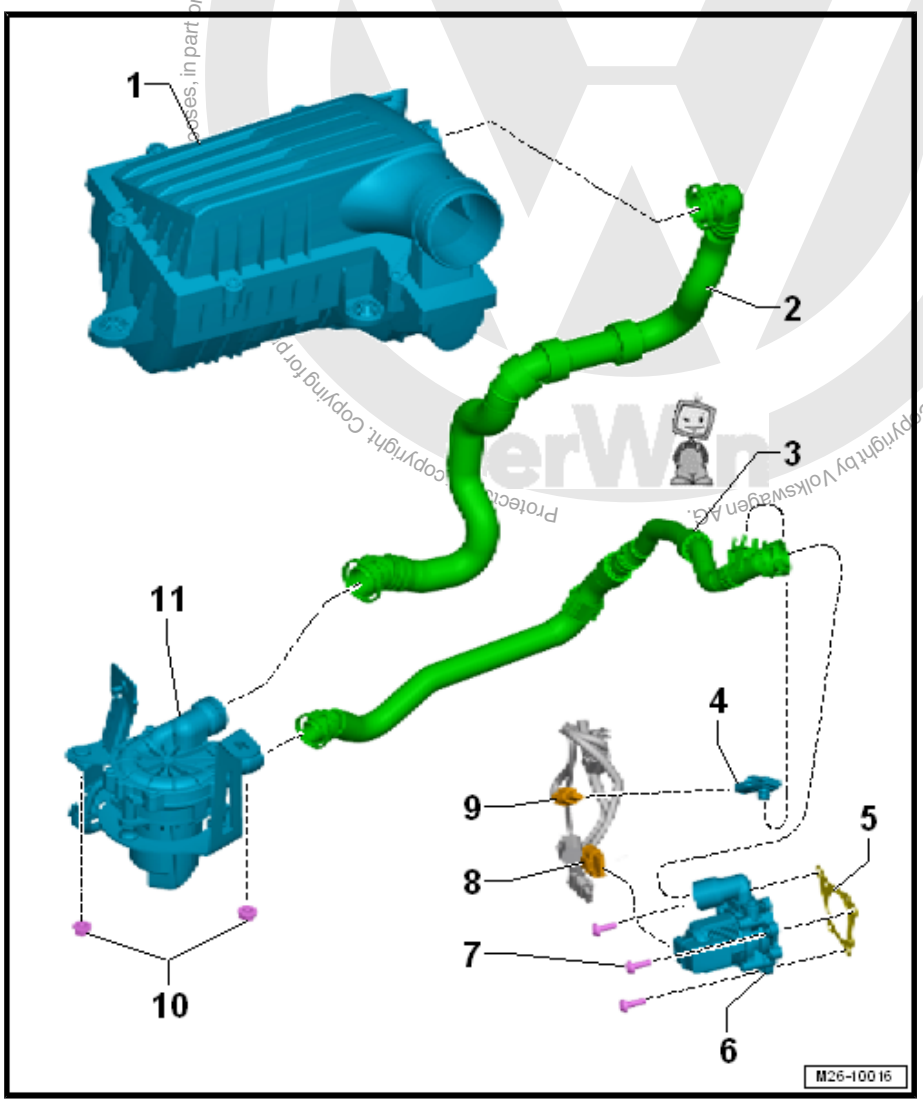
Install in reverse order of removal and note the following:

Tightening Specifications

♦ Refer to
⇒ Fig. ""Exhaust Door Control Unit Tightening Specification"" , page 318

3 Secondary Air System

3.1 Overview - Secondary Air Injection System



1 - Air Filter Housing

- ❑ Removing and installing. Refer to ⇒ “2.2 Air Filter Housing, Removing and Installing”, page 269 .

2 - Connecting Line

- ❑ From the Secondary Air Injection Pump Motor - V101- on the air filter housing

3 - Connecting Line

- ❑ From the Secondary Air Injection Solenoid Valve - N112- on the Secondary Air Injection Pump Motor - V101-

4 - Secondary Air Injection Sensor 1 - G609-

5 - Seal

- ❑ Replace after removing the Secondary Air Injection Solenoid Valve - N112- .

6 - Secondary Air Injection Solenoid Valve - N112-

- ❑ Removing and installing. Refer to ⇒ “3.4 Secondary Air Injection Solenoid Valve N112 , Removing and Installing”, page 324 .

7 - Screws

- ❑ 9 Nm

8 - Electric Connection

- ❑ For the Secondary Air Injection Solenoid Valve - N112-

9 - Electric Connection

- ❑ For the Secondary Air Injection Sensor 1 - G609-

10 - Nuts

- ❑ 8 Nm

11 - Secondary Air Injection Pump Motor - V101-

❑ Removing and installing. Refer to
⇒ “3.2 Secondary Air Injection Pump Motor V101 , Removing and Installing”, page 323 .

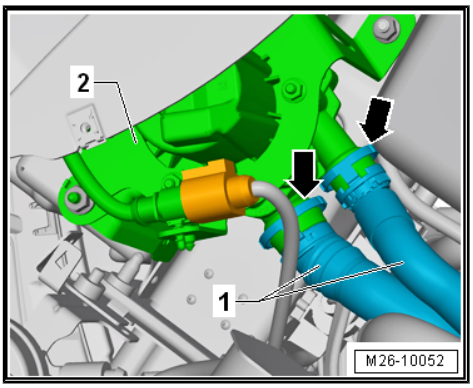
3.2 Secondary Air Injection Pump Motor - V101- , Removing and Installing

Removing

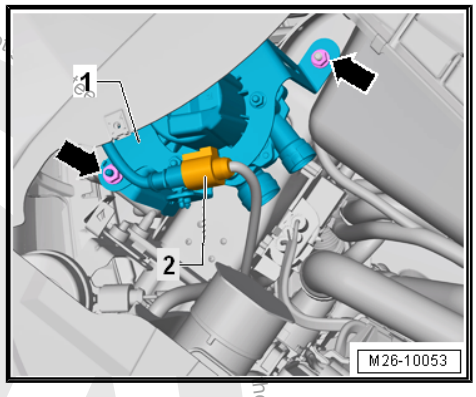
– Remove the noise insulation. Refer to ⇒ Body Exterior; Rep. Gr. 66 ; Noise Insulation; Overview - Noise Insulation .

– Open the release -arrows- and remove the lines -1- from the Secondary Air Injection Pump Motor - V101- -2-.

– Disconnect the connector -2- from the Secondary Air Injection Pump Motor - V101- .



– Remove the nuts -arrows- and the Secondary Air Injection Pump Motor - V101- -1- with the bracket.



Installing

Install in reverse order of removal and note the following:

Tightening Specifications

◆ Refer to
⇒ “3.1 Overview - Secondary Air Injection System”, page 322

3.3 Secondary Air Injection Sensor 1 - G609- , Removing and Installing

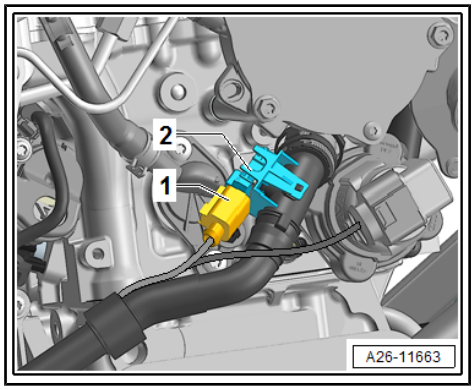
Removing

– Remove the air filter housing. Refer to
⇒ “2.2 Air Filter Housing, Removing and Installing”, page 269 .

– Remove the battery tray. Refer to ⇒ Electrical Equipment; Rep. Gr. 27 ; Battery; Battery Tray, Removing and Installing .

– Disconnect the connector -1-.

– Release the retainers and remove the Secondary Air Injection Sensor 1 - G609- -2-.



Installing

Install in reverse order of removal and note the following:

Note

Replace the O-ring.

3.4 Secondary Air Injection Solenoid Valve - N112- , Removing and Installing

- The flange must not be separated from the secondary air injection solenoid valve.
- Both the secondary air injection solenoid valve and the flange are replaced completely.

Removing

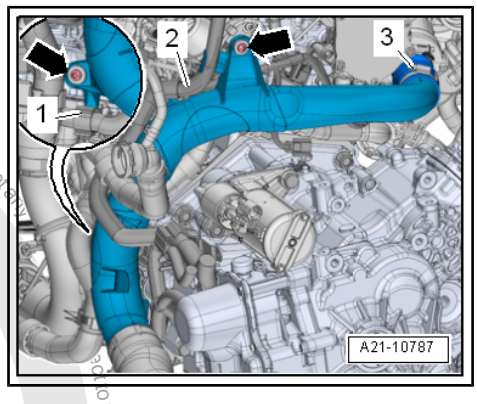
– Remove the air filter housing. Refer to ⇒ “2.2 Air Filter Housing, Removing and Installing”, page 269 .

– Remove the battery tray. Refer to ⇒ Electrical Equipment; Rep. Gr. 27 ; Battery; Battery Tray, Removing and Installing .

– Free up the wiring harness -1 and 2- from the air guide pipe.

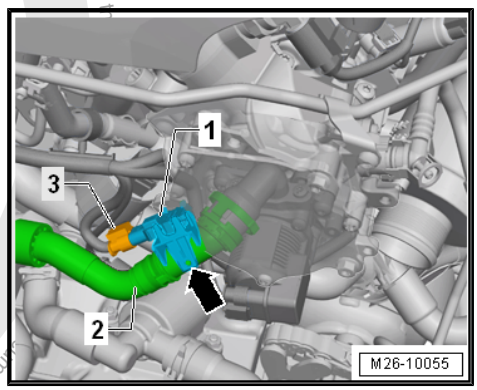
– Loosen the screw-type clamp -3-.

– Remove the bolts -arrows- and remove the air guide pipe.

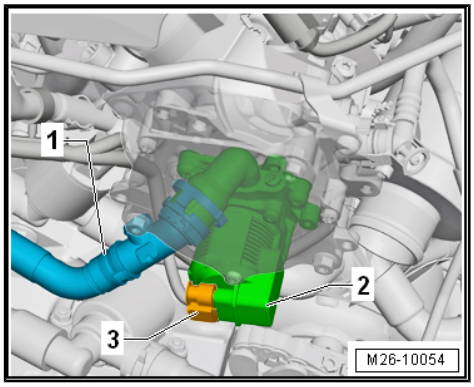


– Remove the connector -3- from the Secondary Air Injection Sensor 1 - G609- -1- and unclip the sensor.

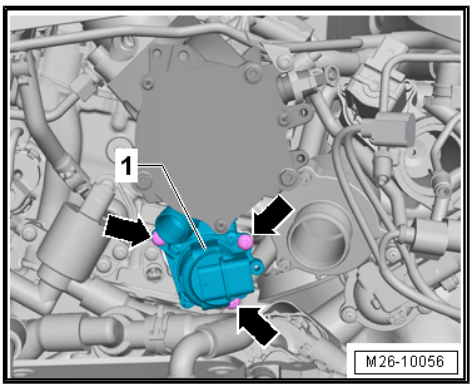
– Release both retaining tabs -arrow- from the Secondary Air Injection Sensor 1 - G609- -1- from the connecting line -2-.



– Disconnect the connector -3- from the Secondary Air Injection Solenoid Valve - N112- -2-.
– Squeeze the locking ring on both side and remove the connecting pipe -1-.
– Remove the bolts -arrows-.



– Remove the Secondary Air Injection Solenoid Valve - N112- -1-.



Installing

Install in reverse order of removal and note the following:

- Replace the seal. Refer to Parts Catalog.

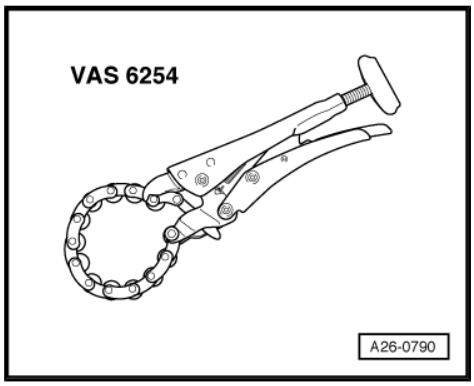
Tightening Specifications

♦ Refer to
⇒ “3.1 Overview - Secondary Air Injection System”, page 322

4 Special Tools

Special tools and workshop equipment required

- Chain Pipe Cutter - VAS6254-

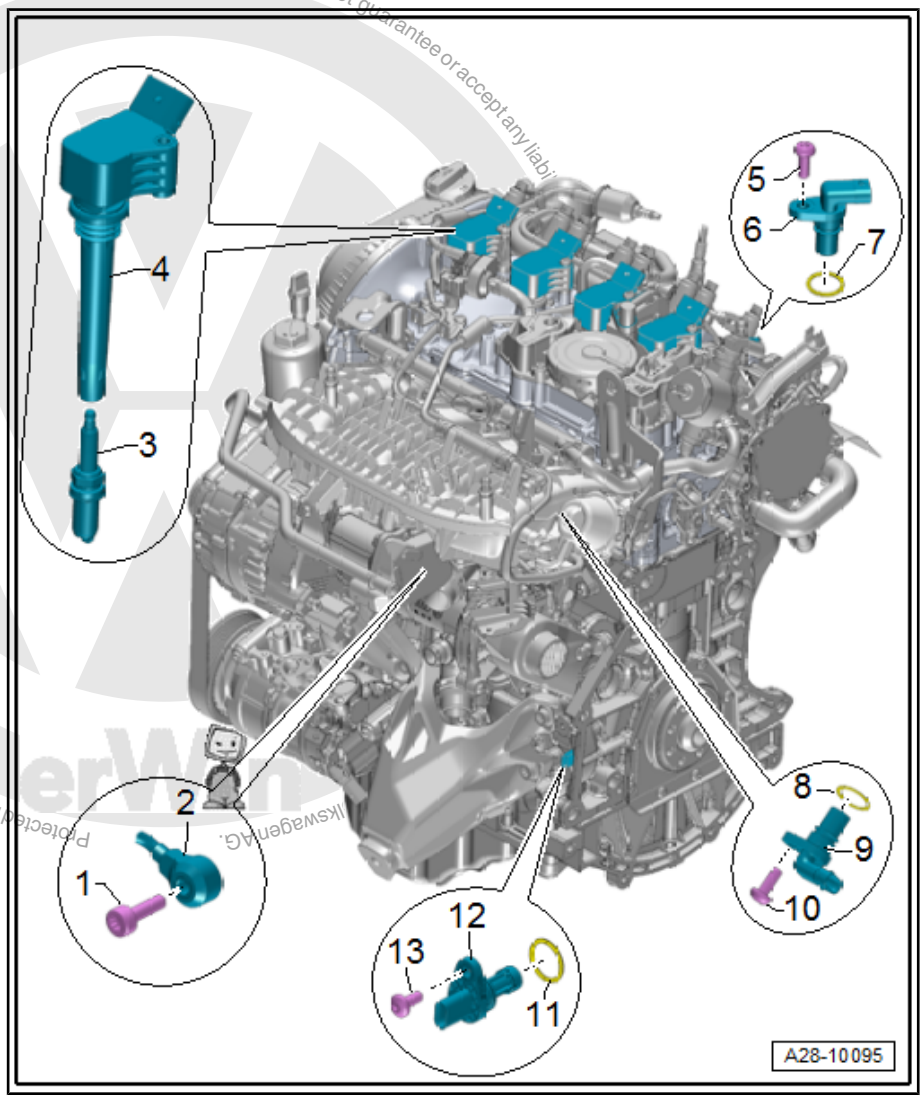


- Not Illustrated:
- Pneumatic Body Saw - VAS6780-

28 – Ignition/Glow Plug System

1 Ignition System

1.1 Overview - Ignition System



1 - Bolt

- ❑ 20 Nm
- ❑ Replace after removing
- ❑ The tightening specification affects the knock sensor functions.

2 - Knock Sensor 1 - G61-

- ❑ Removing and installing. Refer to ⇒ “1.3 Knock Sensor 1 G61 , Removing and Installing”, page 330 .

3 - Spark Plug

- ❑ 30 Nm
- ❑ Remove and install using Spark Plug Removal Tool - 3122B-

4 - Ignition Coil with Power Output Stage

- ❑ 10 Nm
- ❑ Ignition Coil 1 with Power Output Stage - N70-
- ❑ Ignition Coil 2 with Power Output Stage - N127-
- ❑ Ignition Coil 3 with Power Output Stage - N291-
- ❑ Ignition Coil 4 with Power Output Stage - N292-
- ❑ Removing and installing. Refer to ⇒ “1.2 Ignition Coils with Power Output Stages, Removing and Installing”, page 328 .

5 - Bolt

- ❑ 9 Nm

6 - Camshaft Position Sensor 3 - G300-

- ❑ Removing and installing. Refer to ⇒ “1.4.2 Camshaft Position Sensor 3 G300 , Removing and Installing”, page 331 .

7 - O-Ring

- ❑ Replace if damaged

8 - O-Ring

- ❑ Replace if damaged

9 - Camshaft Position Sensor - G40-

- ❑ Removing and installing. Refer to ⇒ “1.4.1 Camshaft Position Sensor G40 , Removing and Installing”, page 330 .

10 - Bolt

- ❑ 9 Nm

11 - O-Ring

- ❑ Replace if damaged

12 - Engine Speed Sensor - G28-

- ❑ Check the O-ring for damage
- ❑ Removing and installing. Refer to ⇒ “1.5 Engine Speed Sensor G28 , Removing and Installing”, page 331.

13 - Bolt

- ❑ 9 Nm

1.2 Ignition Coils with Power Output Stages, Removing and Installing

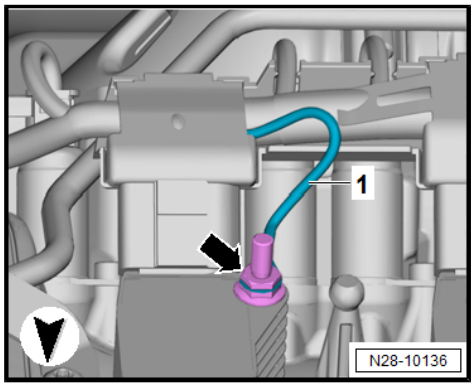
Special tools and workshop equipment required

- ♦ Puller - T10530-

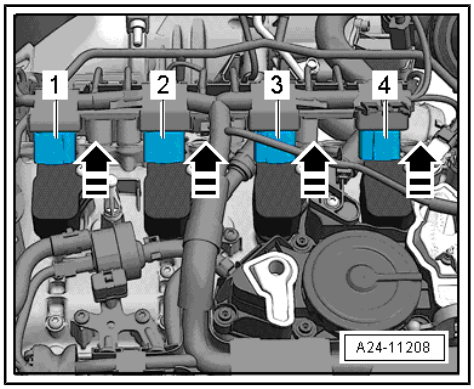
Removing

– Remove the engine cover. Refer to ⇒ “3.1 Engine Cover, Removing and Installing”, page 34 .

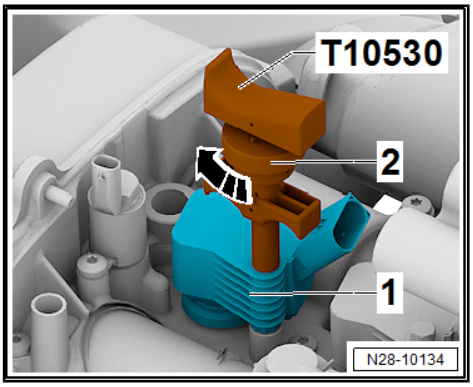
– If equipped, loosen the ground cable -1- from the ignition coil being removed and remove the bolt -arrow-.



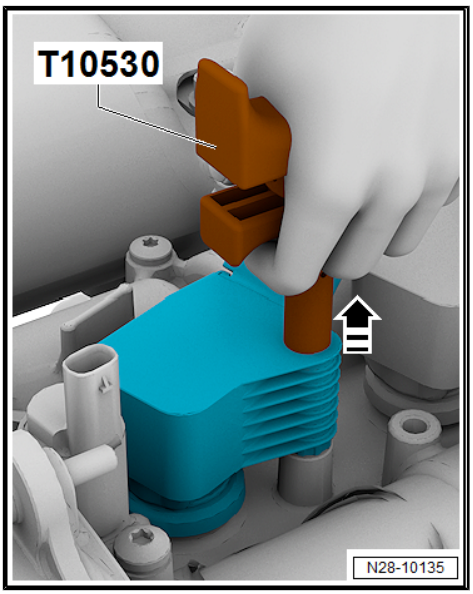
– Release the connector and disconnect all the connectors at the same time from the ignition coils.



– Insert the Puller - T10530- in the ignition coil opening -1-.
– Turn the knurled nut -2- clockwise until the puller is clamped.



– Carefully remove the ignition coil vertically upward using the Puller - T10530- .



Installing

Install in reverse order of removal and note the following:

– Push the ignition coils evenly onto the spark plugs using your hands (do not use any impact tools).
– Secure the ignition coil.

Tightening Specifications

♦ Refer to ⇒ “1.1 Overview - Ignition System”, page 327

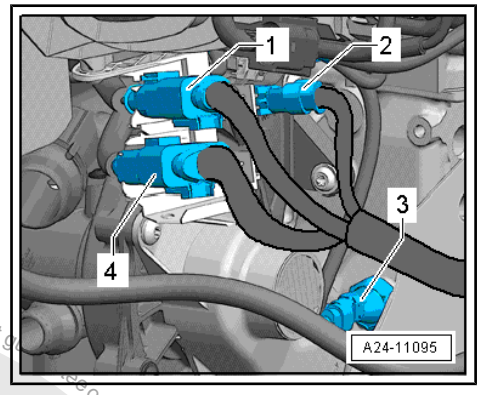
Component	Tightening Specification
Ignition coil ground cable	9 Nm

1.3 Knock Sensor 1 - G61- , Removing and Installing

Removing

– Disconnect the connector -2- from Knock Sensor 1 - G61- .

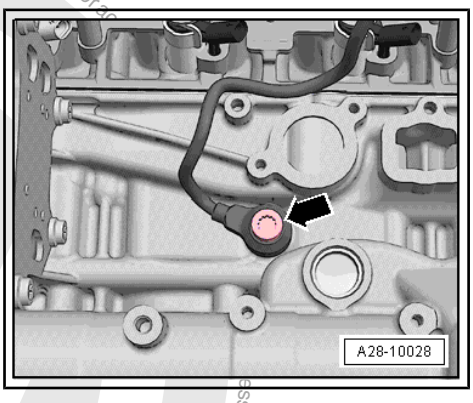
– Remove the Engine Temperature Control Actuator - N493- . Refer to
⇒ “2.9 Engine Temperature Control Actuator N493 , Removing and Installing”, page 220 .



Note

The Knock Sensor 1 - G61- is located below the intake manifold behind the coolant pump.

– Remove the Knock Sensor 1 - G61- -arrow-.

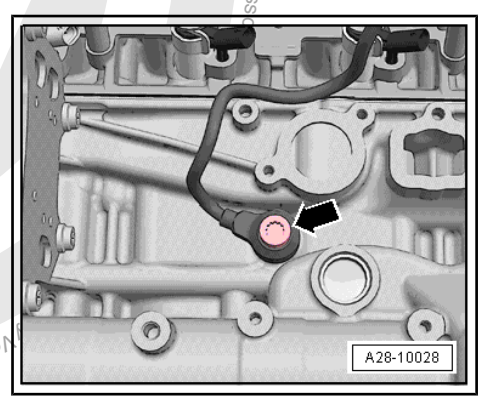


Installing

Install in reverse order of removal and note the following:

– Note the installed position of the Knock Sensor 1 - G61- .

– Install the Engine Temperature Control Actuator - N493- . Refer to
⇒ “2.9 Engine Temperature Control Actuator N493 , Removing and Installing”, page 220 .



Tightening Specifications

♦ Refer to ⇒ “1.1 Overview - Ignition System”, page 327

1.4 Camshaft Position Sensor, Removing and Installing

⇒ “1.4.1 Camshaft Position Sensor G40 , Removing and Installing”, page 330

⇒ “1.4.2 Camshaft Position Sensor 3 G300 , Removing and Installing”, page 331

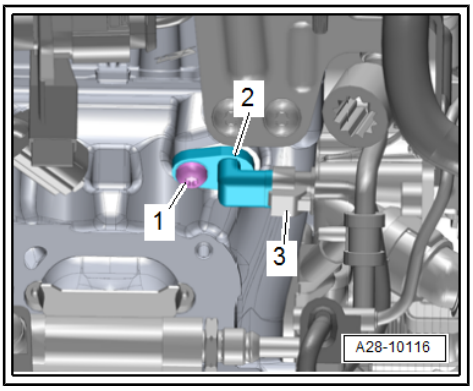
1.4.1 Camshaft Position Sensor - G40- , Removing and Installing

Removing

– Remove the engine cover. Refer to
⇒ “3.1 Engine Cover, Removing and Installing”, page 34 .

– Remove the intake manifold. Refer to
⇒ “3.2 Intake Manifold, Removing and Installing”, page 271 .

– Disconnect the connector -3-.
– Remove the screw -1- and camshaft position sensor -2-.



Installing

Install in reverse order of removal and note the following:

– Replace the O-ring.

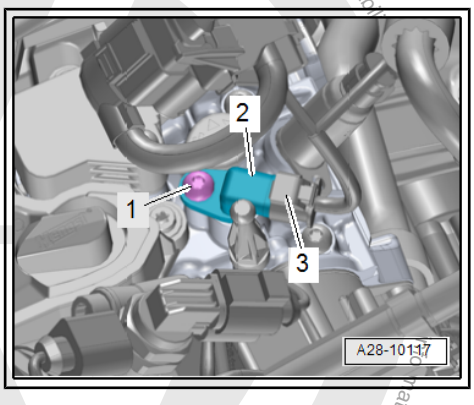
Tightening Specifications

♦ Refer to ⇒ “1.1 Overview - Ignition System”, page 327

1.4.2 Camshaft Position Sensor 3 - G300- , Removing and Installing

Removing

– Remove the engine cover. Refer to ⇒ “3.1 Engine Cover, Removing and Installing”, page 34 .
– Disconnect the connector -3-.
– Remove the screw -1- and camshaft position sensor -2-.



Installing

Install in reverse order of removal and note the following:

– Replace the O-ring.

Tightening Specifications

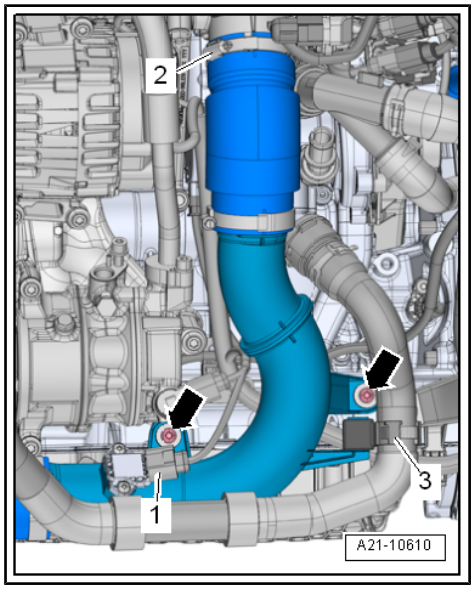
♦ Refer to ⇒ “1.1 Overview - Ignition System”, page 327

1.5 Engine Speed Sensor - G28- , Removing and Installing

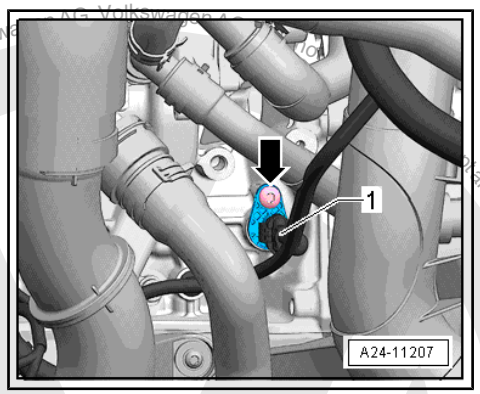
Removing

– Remove the noise insulation. Refer to ⇒ Body Exterior; Rep. Gr. 66 ; Noise Insulation; Overview - Noise Insulation .

– Free up the coolant hose -3-.
– Remove the connector -1- from the Charge Air Pressure Sensor - G31- .
– Remove the bolts -arrows-.
– Loosen air guide hose clamp -2- and remove the air guide hose from the Throttle Valve Control Module - J338- .
– Remove the air guide hose downward.
– Disconnect the connector -1- from the Engine Speed Sensor - G28- .



– Remove the bolt -arrow-.



Installing

Install in reverse order of removal and note the following:

– Install the air guide pipe.
– Install the noise insulation. Refer to ⇒ Body Exterior; Rep. Gr. 66 ; Noise Insulation; Overview - Noise Insulation .

Tightening Specifications

♦ Refer to ⇒ “1.1 Overview - Ignition System”, page 327

2 Special Tools

Special tools and workshop equipment required

- Puller - T10530-

3 Revision History

DRUCK NUMBER: K0059212721

Factory Edition	Edit Edition	Job Type	Feedback	Notes	Quality Checked By
07.2015	07/24/2015	Factory Update	N/A	Removed AU1 and BX5 from metadata, not for NAR	Eric P.
03.2015	03/31/2015	Factory Update	N/A		Eric P.
12.2014	1/7/2015	Factory Update	N/A		Jim H.
11.2014	12/11/2014	Factory Update	N/A		Jim H.
03.2014	11/19/2014	Factory Update and Link Checking	N/A	Engine code CYFB added per pending update from LIVAS	Tom P.

Cautions & Warnings

Please read these WARNINGS and CAUTIONS before proceeding with maintenance and repair work. You must answer that you have read and you understand these WARNINGS and CAUTIONS before you will be allowed to view this information.

- If you lack the skills, tools and equipment, or a suitable workshop for any procedure described in this manual, we suggest you leave such repairs to an authorized Volkswagen retailer or other qualified shop. We especially urge you to consult an authorized Volkswagen retailer before beginning repairs on any vehicle that may still be covered wholly or in part by any of the extensive warranties issued by Volkswagen.
- Disconnect the battery negative terminal (ground strap) whenever you work on the fuel system or the electrical system. Do not smoke or work near heaters or other fire hazards. Keep an approved fire extinguisher handy.
- Volkswagen is constantly improving its vehicles and sometimes these changes, both in parts and specifications, are made applicable to earlier models. Therefore, part numbers listed in this manual are for reference only. Always check with your authorized Volkswagen retailer parts department for the latest information.
- Any time the battery has been disconnected on an automatic transmission vehicle, it will be necessary to reestablish Transmission Control Module (TCM) basic settings using the VAG 1551 Scan Tool (ST).
- Never work under a lifted vehicle unless it is solidly supported on stands designed for the purpose. Do not support a vehicle on cinder blocks, hollow tiles or other props that may crumble under continuous load. Never work under a vehicle that is supported solely by a jack. Never work under the vehicle while the engine is running.
- For vehicles equipped with an anti-theft radio, be sure of the correct radio activation code before disconnecting the battery or removing the radio. If the wrong code is entered when the power is restored, the radio may lock up and become inoperable, even if the correct code is used in a later attempt.
- If you are going to work under a vehicle on the ground, make sure that the ground is level. Block the wheels to keep the vehicle from rolling. Disconnect the battery negative terminal (ground strap) to prevent others from starting the vehicle while you are under it.
- Do not attempt to work on your vehicle if you do not feel well. You increase the danger of injury to yourself and others if you are tired, upset or have taken medicine or any other substances that may impair you or keep you from being fully alert.
- Never run the engine unless the work area is well ventilated. Carbon monoxide (CO) kills.
- Always observe good workshop practices. Wear goggles when you operate machine tools or work with acid. Wear goggles, gloves and other protective clothing whenever the job requires working with harmful substances.
- Tie long hair behind your head. Do not wear a necktie, a scarf, loose clothing, or a necklace when you work near machine tools or running engines. If your hair, clothing, or jewelry were to get caught in the machinery, severe injury could result.
- Do not re-use any fasteners that are worn or deformed in normal use. Some fasteners are designed to be used only once and are unreliable and may fail if used a second time. This includes, but is not limited to, nuts, bolts, washers, circlips and cotter pins. Always follow the recommendations in this manual - replace these fasteners with new parts where indicated, and any other time it is deemed necessary by inspection.

Version 1.0

Cautions & Warnings

- Illuminate the work area adequately but safely. Use a portable safety light for working inside or under the vehicle. Make sure the bulb is enclosed by a wire cage. The hot filament of an accidentally broken bulb can ignite spilled fuel or oil.

- Friction materials such as brake pads and clutch discs may contain asbestos fibers. Do not create dust by grinding, sanding, or by cleaning with compressed air. Avoid breathing asbestos fibers and asbestos dust. Breathing asbestos can cause serious diseases such as asbestosis or cancer, and may result in death.

- Finger rings should be removed so that they cannot cause electrical shorts, get caught in running machinery, or be crushed by heavy parts.

- Before starting a job, make certain that you have all the necessary tools and parts on hand. Read all the instructions thoroughly; do not attempt shortcuts. Use tools that are appropriate to the work and use only replacement parts meeting Volkswagen specifications. Makeshift tools, parts and procedures will not make good repairs.

- Catch draining fuel, oil or brake fluid in suitable containers. Do not use empty food or beverage containers that might mislead someone into drinking from them. Store flammable fluids away from fire hazards. Wipe up spills at once, but do not store the oily rags, which can ignite and burn spontaneously.

- Use pneumatic and electric tools only to loosen threaded parts and fasteners. Never use these tools to tighten fasteners, especially on light alloy parts. Always use a torque wrench to tighten fasteners to the tightening torque listed.

- Keep sparks, lighted matches, and open flame away from the top of the battery. If escaping hydrogen gas is ignited, it will ignite gas trapped in the cells and cause the battery to explode.

- Be mindful of the environment and ecology. Before you drain the crankcase, find out the proper way to dispose of the oil. Do not pour oil onto the ground, down a drain, or into a stream, pond, or lake. Consult local ordinances that govern the disposal of wastes.

- The air-conditioning (A/C) system is filled with a chemical refrigerant that is hazardous. The A/C system should be serviced only by trained automotive service technicians using approved refrigerant recovery/recycling equipment, trained in related safety precautions, and familiar with regulations governing the discharging and disposal of automotive chemical refrigerants.

- Before doing any electrical welding on vehicles equipped with anti-lock brakes (ABS), disconnect the battery negative terminal (ground strap) and the ABS control module connector.

- Do not expose any part of the A/C system to high temperatures such as open flame. Excessive heat will increase system pressure and may cause the system to burst.

- When boost-charging the battery, first remove the fuses for the Engine Control Module (ECM), the Transmission Control Module (TCM), the ABS control module, and the trip computer. In cases where one or more of these components is not separately fused, disconnect the control module connector(s).

- Some of the vehicles covered by this manual are equipped with a supplemental restraint system (SRS), that automatically deploys an airbag in the event of a frontal impact. The airbag is operated by an explosive device. Handled improperly or without adequate safeguards, it can be accidentally activated and cause serious personal injury. To guard against personal injury or airbag system failure, only trained Volkswagen Service technicians should test, disassemble or service the airbag system.

Cautions & Warnings

- Do not quick-charge the battery (for boost starting) for longer than one minute, and do not exceed 16.5 volts at the battery with the boosting cables attached. Wait at least one minute before boosting the battery a second time.

- Never use a test light to conduct electrical tests of the airbag system. The system must only be tested by trained Volkswagen Service technicians using the VAG 1551 Scan Tool (ST) or an approved equivalent. The airbag unit must never be electrically tested while it is not installed in the vehicle.

- Some aerosol tire inflators are highly flammable. Be extremely cautious when repairing a tire that may have been inflated using an aerosol tire inflator. Keep sparks, open flame or other sources of ignition away from the tire repair area. Inflate and deflate the tire at least four times before breaking the bead from the rim. Completely remove the tire from the rim before attempting any repair.

- When driving or riding in an airbag-equipped vehicle, never hold test equipment in your hands or lap while the vehicle is in motion. Objects between you and the airbag can increase the risk of injury in an accident.

I have read and I understand these Cautions and Warnings.