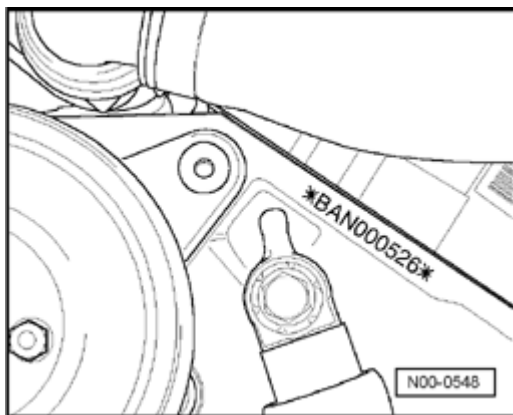
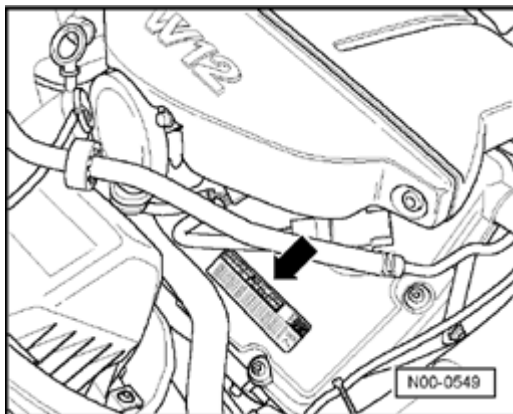


ENGINE**6.0 Liter 12-Cyl. 4V Engine Mechanical, Fuel Injection & Ignition, Engine Code(s): BRP, BAP****00 - GENERAL, TECHNICAL DATA****TECHNICAL DATA****Engine Number****Fig. 1: Engine Number****Courtesy of VOLKSWAGEN UNITED STATES, INC.**

The engine number - **arrow** - ("engine code" and "serial number") is located on left of cylinder block.

The engine number consists of up to nine characters (alphanumeric). The first part (maximum 3 letters) represents the "engine code", the second (six digit) is the "serial number". If more than 999,999 engines with the same engine code are produced, the first of the six characters is replaced with a letter.

**Fig. 2: Identifying Engine Number Sticker****Courtesy of VOLKSWAGEN UNITED STATES, INC.**

Additionally, a sticker - **arrow** - with "engine code" and "serial number" is affixed at cylinder head cover.

2004 Volkswagen Phaeton

ENGINE 6.0 Liter 12-Cyl. 4V Engine Mechanical, Fuel Injection & Ignition, Engine Code(s): BRP, BAP

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

Engine Data

Code letters		BAP	BRP
Manufactured		from 05.03	from 05.05
Displacement	liter	6.0	6.0
Output	kW at RPM	309 at 6000	331 at 6000
Torque	Nm at RPM	560/3000 to 4750	560/2750 to 5200
Bore	dia. mm	84.0	84.0
Stroke	mm	90.3	90.2
Compression ratio		10.8	10.75
Valves per cylinder		4	4
RON		98 unleaded	98 unleaded
System designation		Motronic ME7.1.1	Motronic ME7.1.1
Emission values in accordance with		LEV Standard	LEV Standard
Knock control		yes	yes
Oxygen sensor regulation		8 sensors	8 sensors
Catalytic converters		4	4
Exhaust gas recirculation		no	no
Variable valve timing		4 adjusters	4 adjusters
Secondary air injection (AIR) system		yes	yes
Turbocharger, G-Charger		no	no
Leak diagnostic system		yes	yes

*In exceptional circumstances min. 95 RON, however with reduced performance

10 - ENGINE - ASSEMBLY

ENGINE, REMOVING AND INSTALLING

Engine, Removing and Installing

Engine, Removing and Installing

--> **Engine, Removing**

--> **Engine, Securing to Engine and Transmission Holder**

--> **Engine, Installing**

--> **Tightening Specifications**

2004 Volkswagen Phaeton

ENGINE 6.0 Liter 12-Cyl. 4V Engine Mechanical, Fuel Injection & Ignition, Engine Code(s): BRP, BAP

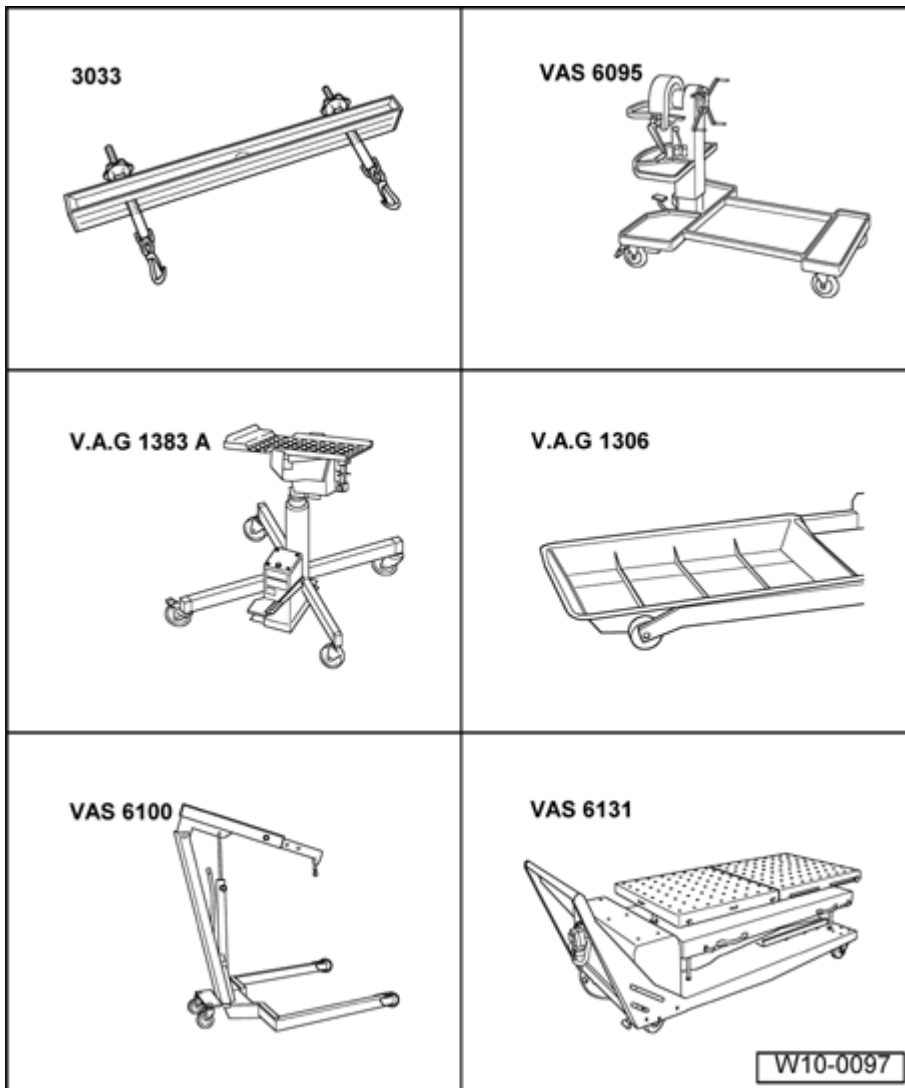


Fig. 3: Identifying Special Tools - Engine, Removing And Installing (1 Of 2)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools, testers and auxiliary items required

- Lifting tackle VAS 3033
- Engine and transmission holder VAS 6095 with bracket for W12 engine VAS 6095/1-1
- Engine/transmission jack V.A.G 1383 A
- Drip tray V.A.G 1306 or drip tray for VAS 6100 VAS 6208
- Shop crane VAS 6100
- Scissor Lift Table VAS 6131

2004 Volkswagen Phaeton

ENGINE 6.0 Liter 12-Cyl. 4V Engine Mechanical, Fuel Injection & Ignition, Engine Code(s): BRP, BAP

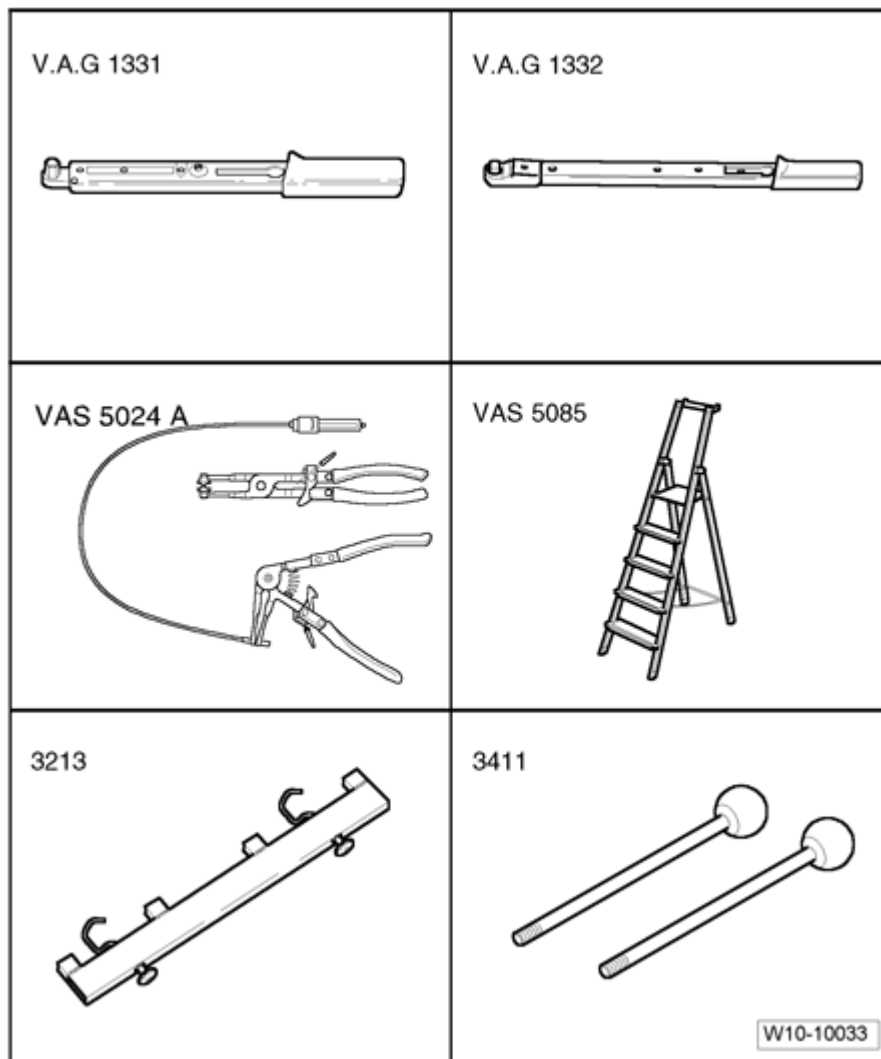


Fig. 4: Identifying Special Tools - Engine, Removing And Installing (2 Of 2)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools, testers and auxiliary items required

- Torque wrench (5 to 50 Nm) V.A.G 1331
- Torque wrench (40 to 200 Nm) V.A.G 1332
- Spring-type clip pliers VAS 5024
- Step ladder VAS 5085
- Assembly tool 3213
- Guide pins 3411

Without illustration

With Engine Codes BAP:

2004 Volkswagen Phaeton

ENGINE 6.0 Liter 12-Cyl. 4V Engine Mechanical, Fuel Injection & Ignition, Engine Code(s): BRP, BAP

- Left front engine mount VAS 6131/2-1
- Right front engine mount VAS 6131/2-2
- Rear engine mount (2x) VAS 6131/1-1
- Front transmission mount VAS 6131/1-2
- Rear transmission mount (2x) VAS 6131/1-4
- Frame support T10116

With Engine Code BRP:

- Engine mount (2x) VAS 6131/1-1
- Left engine carrier mount VAS 6131/5-1
- Right engine carrier mount VAS 6131/5-2
- Rear engine mount VAS 6131/5-4
- Front transmission mount VAS 6131/1-2
- Rear transmission mount (2x) VAS 6131/1-4
- Frame support T10319

Continuation for all Vehicles:

- Container for removed components V.A.G 1698
- Engine bung set VAS 6122
- Mounting pins VAS 6131/1-5
- Mounting pins VAS 6131/1-6
- Template T10155
- **Cable tie**

Engine, Removing

Engine, Removing

The engine with transmission is removed downward.

- Check DTC memories of all control modules, before removing engine: --> VAS 5051 Vehicle Diagnostic, Testing and Information System; Guided Fault Finding; Vehicle System Test or VAS 5052; Vehicle Self-Diagnosis

NOTE:

- **To allow free rotation of the driveshaft, move the selector lever in the "N" position.**
- **Leave the key in the ignition lock to prevent the steering wheel lock from engaging.**

- When the engine is installed in the engine compartment some components cannot be removed or can only be removed with great difficulty. Therefore determine which components are faulty before removing engine.
- To prevent damage to the removed components, use a parts trolley V.A.G 1698 for storage.
- It is advisable to remove the front wheels before removing the engine/transmission assembly. The vehicle can be lowered on the hoist until the cover plates of the brake discs are just above the floor. This enables the most ergonomic work position possible regarding accessibility of components in the engine compartment.
- All cable ties which are opened or cut open when removing engine, must be replaced in the same position when installing engine.

○ Bring wiper arms to service position: --> **92 - WINDSHIELD WIPER AND WASHER SYSTEM**

Disconnect batteries:

The procedure must be strictly followed!

- Switch off ignition and all electrical consumers and remove ignition key.
- First, disconnect vehicle battery in right luggage compartment.
- Then disconnect second battery in left luggage compartment: --> **27 - BATTERY, STARTER, GENERATOR, CRUISE CONTROL**

Removing

- Remove intake manifolds between air filters and throttle valve control modules --> **Air Filter, Assembly Overview.**
- Remove plenum chamber cover.

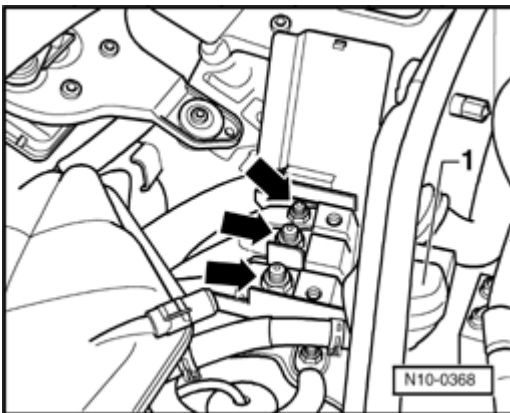


Fig. 5: Terminal 30 And Bracket With Positive Terminal In Engine Compartment
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Loosen wiring from terminal 30 - **arrows** - and remove bracket with positive terminal in engine

compartment - 1 -.

- Remove windshield wiper motor on right side: --> **92 - WINDSHIELD WIPER AND WASHER SYSTEM**
- Remove transmission control module and disconnect small connectors from engine control modules.
- Loosen remaining harness connectors on this wiring harness.

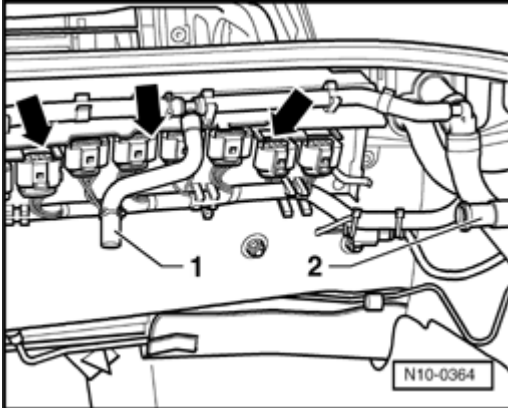


Fig. 6: Disconnecting Connectors From Oxygen Sensors At Bulkhead
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect the connectors from the oxygen sensors at the bulkhead - **arrows** - :
 - Cylinders 1 to 3 = black
 - Cylinders 4 to 6 = green
 - Cylinders 7 to 9 = brown
 - Cylinders 10 to 12 = gray
- Set wiring harness on engine together with transmission control module and secure with cable ties.

NOTE:

- **Coolant line - 1 - toward connection are not disconnected.**
- **Observe disposal regulations!**

- Remove noise insulation. --> **50 BODY - FRONT**

CAUTION: Hot steam may escape when opening expansion tank. Wear protective goggles and protective clothing to prevent damage to eyes and scalding. Cover cap with a rag and open carefully.

- Open and close the cap on the expansion tank, to relieve the cooling system pressure.
- Drain coolant --> **Cooling System, Draining and Filling.**

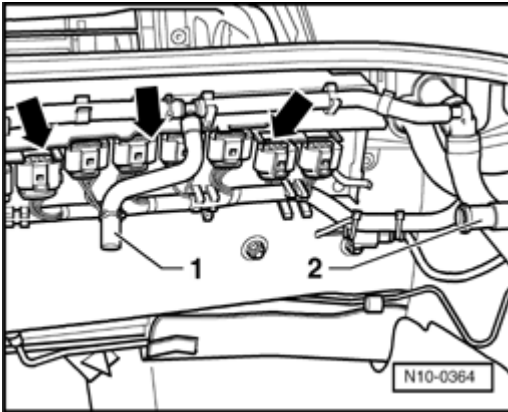


Fig. 7: Disconnecting Connectors From Oxygen Sensors At Bulkhead
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect coolant line - 2 -.
- Disconnect coolant hose at coolant pipe toward heater core.
- Disconnect coolant line from upper expansion tank.
- Disconnect vacuum hose to brake booster from intake manifold.
- Pull off/disconnect all electrical connections as necessary from engine and lay aside.
- Remove catalytic converters with front muffler --> **Muffler with Mounts, Assembly Overview.**

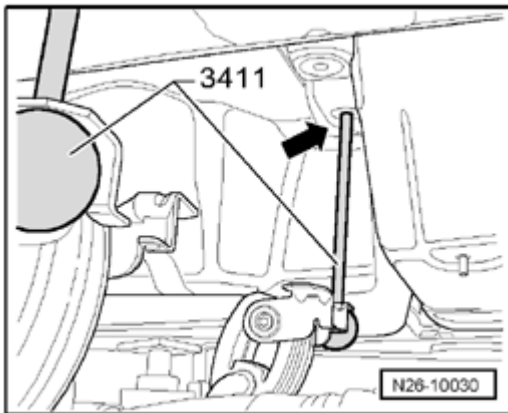


Fig. 8: Exhaust System With Support Tool 3411 Supported At Mounting Of Exhaust Pipe Junction
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Support the remaining exhaust system at center muffler mounts using support tool 3411.
- Replace bolts (with large washer), one after the other, at intermediate bearing of driveshaft by bolts without washer.
- Remove heat shield for driveshaft from vehicle floor.

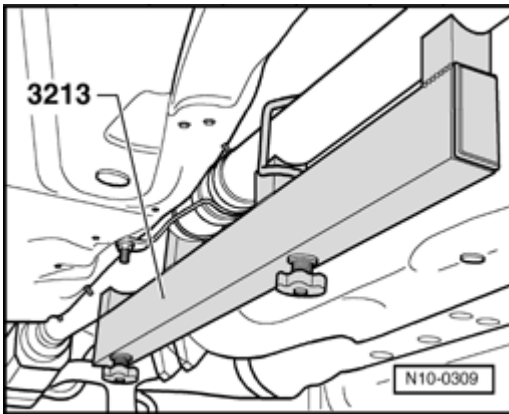


Fig. 9: Driveshaft Alignment Fixture 3213

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Secure driveshaft using alignment fixture 3213.
- Remove driveshaft from transmission: -->
 - **39F FINAL DRIVE, DIFFERENTIAL (FRONT)**
 - **39R FINAL DRIVE, DIFFERENTIAL (REAR)**

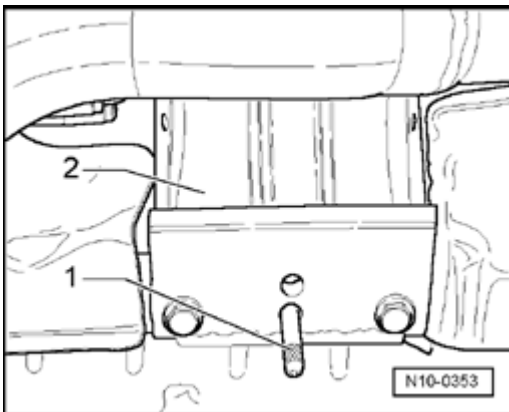


Fig. 10: Removing Center Bolt Of Transmission Plate And Installing Locating Pin VAS 6131/1-5 In Position

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove center bolt, respectively, of transmission plate - **2** - and install locating pin VAS 6131/1-5 in position - **1** - instead.

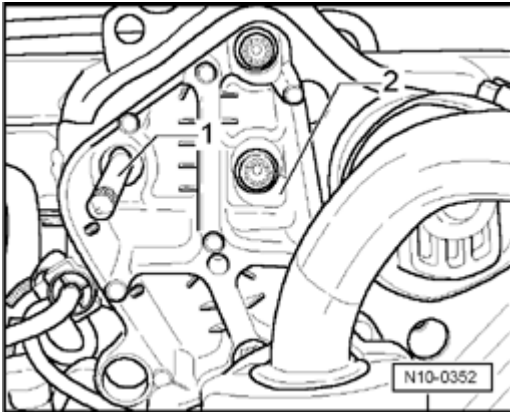


Fig. 11: Removing Center Bolt Of Transmission Plate And Installing Locating Pin VAS 6131/1-6 In Position

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove center bolt, respectively, of transmission plate - 2 - and install locating pin VAS 6131/1-6 in position - 1 - instead.
- Extract refrigerant from air conditioning system: --> **87 - AIR CONDITIONING**
- Remove front bumper: --> **63 BUMPERS**

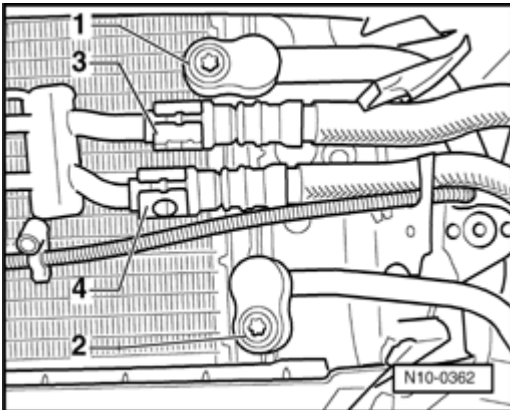


Fig. 12: Disconnecting A/C Lines At Condenser And Lines At Oil Cooler For Power Assisted Steering
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect A/C lines - 1 - and - 2 - at condenser and lines - 3 - and - 4 - at oil cooler for power assisted steering. Catch escaping hydraulic oil.

NOTE:

- **Observe disposal regulations!**
- **To prevent damage to condenser and also to the refrigerant lines/hoses, ensure that the pipes and hoses are not stretched, kinked or bent.**

- Disconnect pressure hoses of secondary air system --> **Secondary Air Injection System, Body Side, Assembly Overview.**
- Remove front wheels.

- Remove wheel housing liners: --> **66 EXTERIOR EQUIPMENT**
- Loosen front brake calipers and secure to body. --> **46 - BRAKES - MECHANICAL COMPONENTS**
- In wheel housings, separate all connectors between body and front axle.
- Removing lock carrier with attachments: --> **50 BODY - FRONT**
- Remove crash strut between longitudinal control arms.

CAUTION: Fuel supply lines are under pressure! Wear protective goggles and protective gloves to avoid damage and contact with skin. Before removing from hose connection wrap a cloth around connection. Then release pressure by carefully pulling hose off connection.

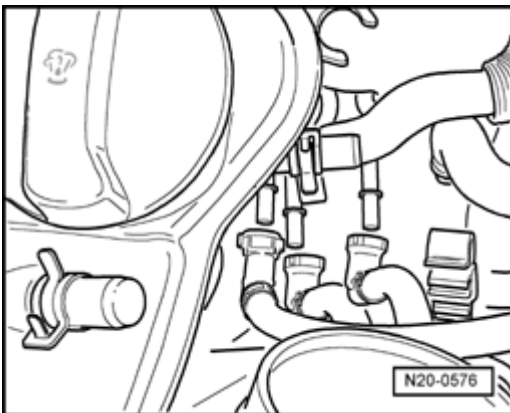


Fig. 13: Disconnecting Fuel Supply And Fuel Return Line And Line To EVAP Canister
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect fuel supply and fuel return line and line to EVAP canister.

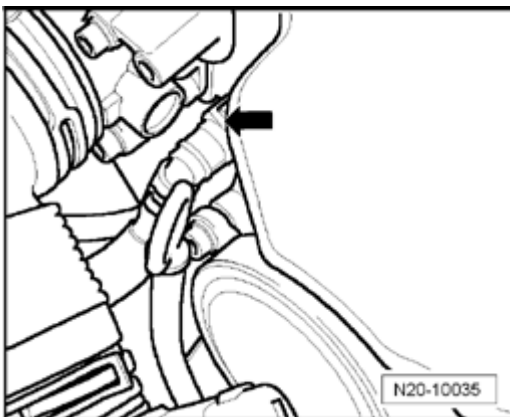


Fig. 14: Disconnecting Ventilation Line From Leak Detection Pump (LDP) V144 At Intake Manifold Side-Part
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect ventilation line from Leak Detection Pump (LDP) V144 - **arrow** - at intake manifold side-part.

- Disconnect intake hose - **arrow** - at power steering pump and catch escaping hydraulic oil.

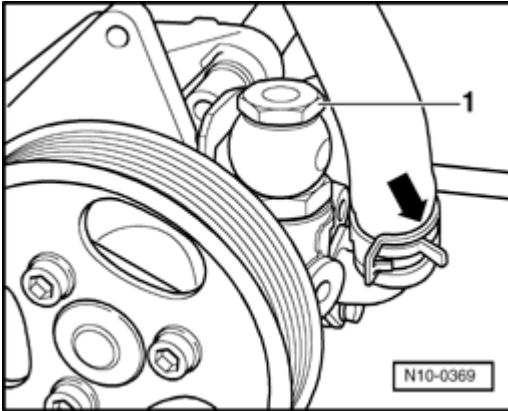


Fig. 15: Disconnecting Pressure Line At Power Steering Pump
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect pressure line - **1** - at power steering pump. Catch escaping hydraulic oil.
- Disconnect refrigerant line from A/C compressor and lay aside.

NOTE:

- **Observe disposal regulations!**

- Disconnect coolant hose at left coolant pipe toward coolant pump for auxiliary heating.
- Disconnect coolant hose from coolant pump V36.
- Remove windshield washer fluid reservoir and horn.

With Engine Code BAP:

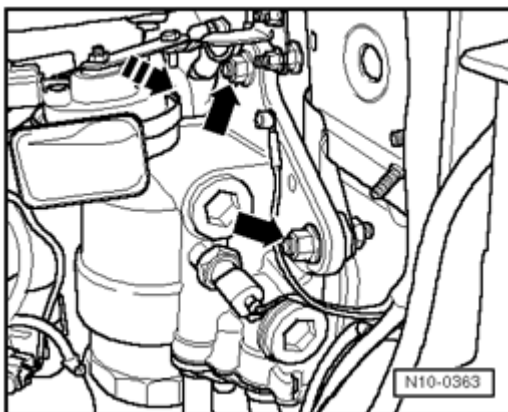


Fig. 16: Loosening Oil Filter Housing At Longitudinal Control Arm And Securing To Connection Of Right Combination Valve
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Loosen oil filter housing at longitudinal control arm - **arrows** - and secure to connection of right combination valve.

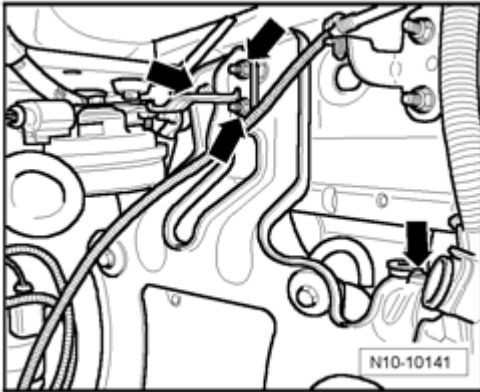
With Engine Code BRP:

Fig. 17: Removing Bracket With Transmission Oil Cooler From Longitudinal Control Arm
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bracket with transmission oil cooler from longitudinal control arm - **arrows** -.

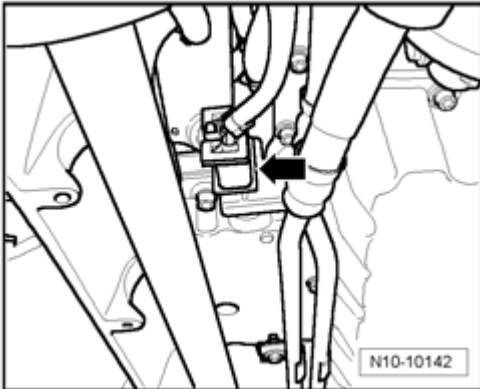


Fig. 18: Disconnecting Connector
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect connector - **arrow** -.

Continuation for all Vehicles:

- Remove Ground (GND) strap from right longitudinal control arm and lay aside.
- Remove subframe: --> **40 - FRONT SUSPENSION**
- Remove drive axles from transmission: --> **40 - FRONT SUSPENSION**

Preparing Scissor Lift Table VAS 6131 for the continued work procedure:

- Install mounts in the following positions:

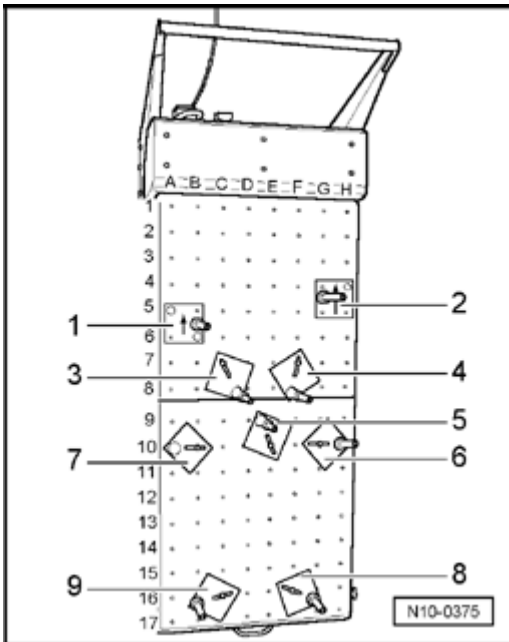


Fig. 19: Identifying Scissor Lift Table VAS 6131 (With Engine Code BAP)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

With Engine Code BAP:

NOTE:

- Mounts - 1 - and - 2 - have defined positions, remaining mounts must be aligned and threaded in according to illustration.
- Mounts - 6 - and - 7 - are not needed

1 - Left front engine mount VAS 6131/2-1 : A5 and B6 (arrow points in direction of travel)

2 - Right front engine mount VAS 6131/2-2 : G5 and H4 (arrow points in direction of travel)

3 - Left rear engine mount VAS 6131/1-1 : C7

4 - Right rear engine mount VAS 6131/1-1 : F7

5 - Front transmission mount VAS 6131/1-2 : E10

8 - Right rear transmission mount VAS 6131/1-4 : F16

9 - Left rear transmission mount VAS 6131/1-4 : C16

- Move lift table under powertrain aggregate. Front engine mounts must be guided into corresponding mounts:

- A - - Left front engine mount - **arrow** -

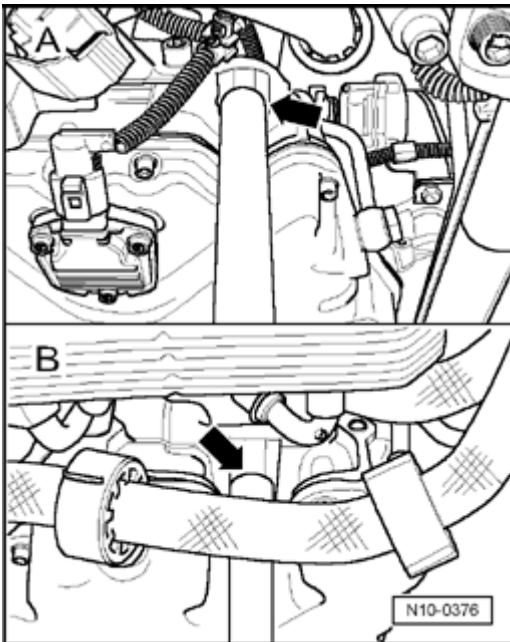


Fig. 20: Identifying Left/Right Front Engine Mount
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- B - - Right front engine mount - arrow -

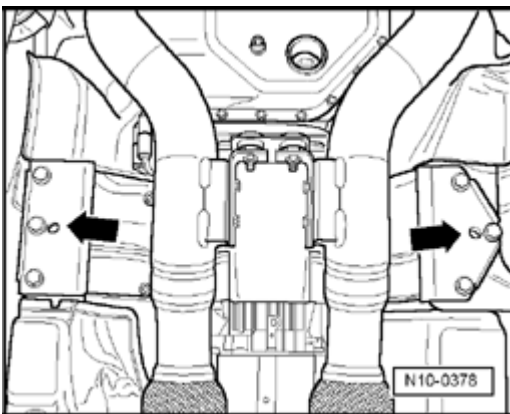


Fig. 21: Guiding Rear Transmission Mount Supports Into Holes
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Guide rear transmission mount supports into holes - **arrows** -.

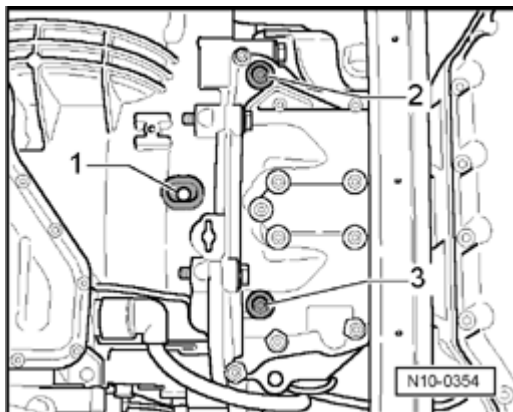


Fig. 22: Guiding Front Transmission Mount Into Hole And Rear Engine Mounts Into Holes
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Guide front transmission mount into hole - 1 - and rear engine mounts into holes - 2 - and - 3 -.

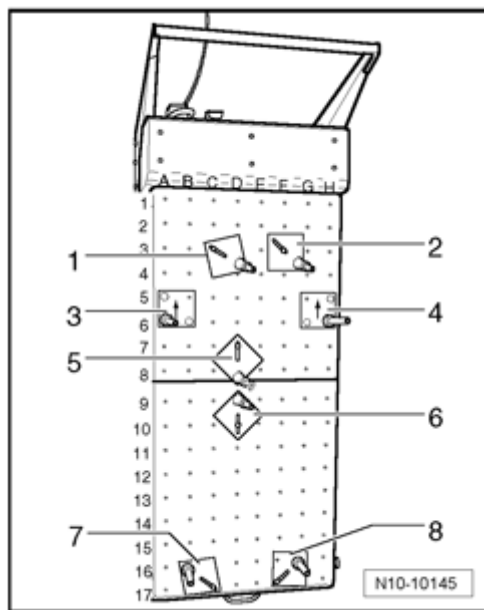


Fig. 23: Identifying Scissor Lift Table VAS 6131 (With Engine Code BRP)
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

With Engine Code BRP:

NOTE:

- Mounts - 3 - and - 4 - have defined positions, remaining mounts must be aligned and threaded in according to illustration.

1 - Left engine mount VAS 6131/1-1 : C3

2 - Right engine mount VAS 6131/1-1 : F3

- 3 - Left engine carrier mount VAS 6131/5-1 : A5 and B6 (arrow points in direction of travel)
 - 4 - Right engine carrier mount VAS 6131/5-2 : G6 and H5 (arrow points in direction of travel)
 - 5 - Rear engine mount VAS 6131/5-4 : D7
 - 6 - Front transmission mount VAS 6131/1-2 : D10
 - 7 - Left rear transmission mount VAS 6131/1-4 : C17
 - 8 - Right rear transmission mount VAS 6131/1-4 : F17
- Remove lower engine/transmission mounting bolt.
 - Move lift table under powertrain aggregate. Front engine mounts must be guided into corresponding mounts:

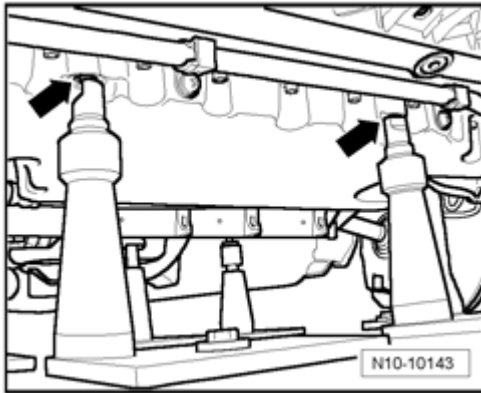


Fig. 24: Guiding Front Engine Mounts Into Holes Of Oil Pan
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Guide front engine mounts into holes - **arrow** - of oil pan.

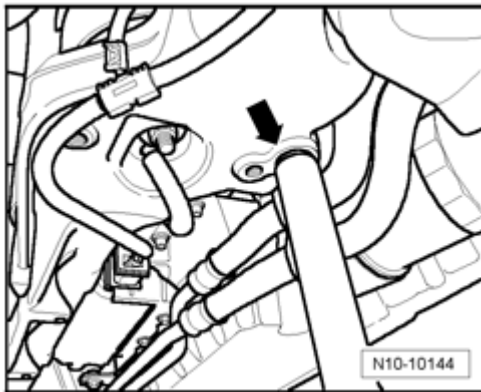


Fig. 25: Guiding Left/Right Engine Carrier Mounts Into Corresponding Hole Of Engine Carrier
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Guide left and right engine carrier mounts into corresponding hole - **arrow** - of engine carrier

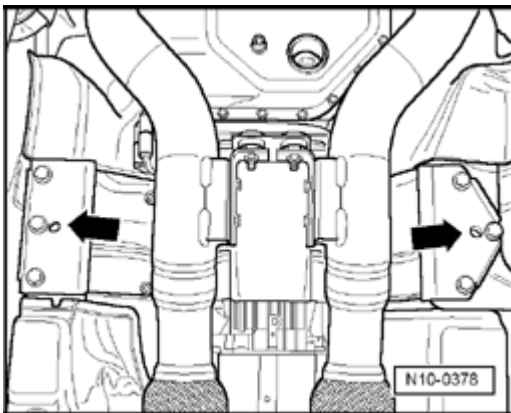


Fig. 26: Guiding Rear Transmission Mount Supports Into Holes
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Guide supports for rear transmission mount into holes - **arrow** -.

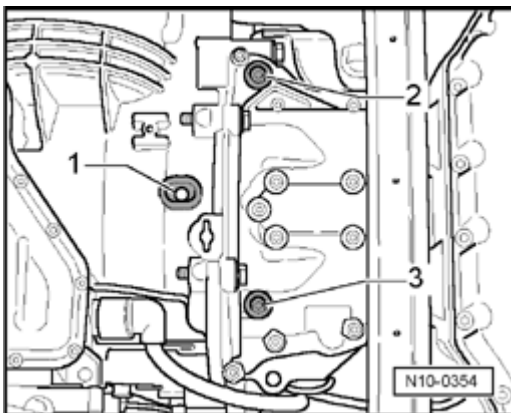


Fig. 27: Guiding Front Transmission Mount Into Hole And Rear Engine Mounts Into Holes
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Guide front transmission mount into hole - **1** -.

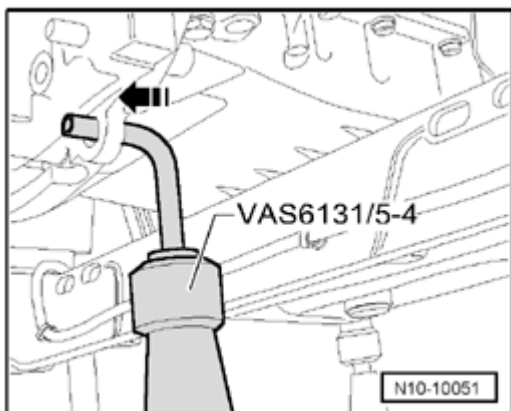


Fig. 28: Inserting Angled Locating Pins Of Rear Engine Mount Into Bolt Hole From Engine Side
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Insert angled locating pins of rear engine mount into bolt hole from engine side in - **direction of arrow** -.

Continuation for All Vehicles:

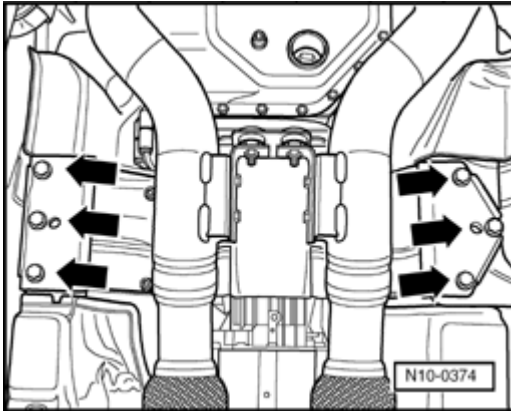


Fig. 29: Removing Outer Bolts Of Transmission Plate
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove outer bolts of transmission plate - **arrows** -.

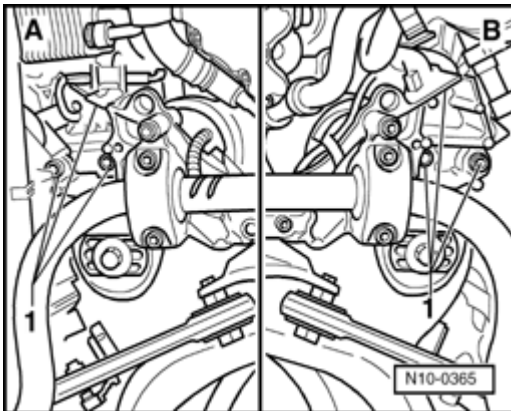


Fig. 30: Removing Rear Bolts For Engine Carrier
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove rear bolts - **arrows** - for engine carrier.
- Lower Scissor Lift Table VAS 6131 with engine and transmission far enough to disengage selector lever cable.
- Check whether all connections between engine and bulkhead are disconnected.
- Remove engine and transmission downward.

NOTE:

- **Engine must be guided carefully when removed to prevent damage to the body.**

If Engine must be Separated from Transmission:

- Remove exhaust pipes on right and left side of engine --> **Exhaust Manifold with Primary Catalytic Converters and Bank 1 Attachments, Assembly Overview** , and --> **Exhaust Manifold with Primary Catalytic Converters and Bank 2 Attachments, Assembly Overview**.
- Disconnect transmission from engine --> **37 AUTOMATIC TRANSMISSION - CONTROLS, HOUSING**
- Disconnect engine and transmission --> Operating instructions for Scissor Lift Table VAS 6131

NOTE:

- **How to remove engine from Scissor Lift Table VAS 6131 and secure to Engine and Transmission Holder VAS 6095 --> Engine, Securing to Engine and Transmission Holder.**
- **Engine must not be set down on oil pan, because the fluid seal between lower and upper oil pan is otherwise damaged. To set down the engine, use suitable frame : Vehicles with engine code BAP use frame T10116. Use Frame T10319 on vehicles with engine code BRP.**

Engine, Securing to Engine and Transmission Holder

Engine, Securing to Engine and Transmission Holder

NOTE:

- **To perform repair work and to mount engine, Engine and Transmission Holder VAS 6095 must be modified with universal mounting VAS 6095/1 and bracket for W12 engine VAS 6095/1-1. Before mounting, engine must be removed from transmission --> Operating instructions for Scissor Lift Table VAS 6131.**
- **Engine must not be set down on oil pan, because the fluid seal between lower and upper oil pan is otherwise damaged. To set down the engine, use suitable frame : Vehicles with engine code BAP use frame T10116. Use Frame T10319 on vehicles with engine code BRP.**

- Remove primary catalytic converters from engine --> **Exhaust System Components**.
- Remove oil filler neck and seal opening using clean rag.
- Remove Throttle Valve Control Module 2 J544 from intake manifold side-part at cylinder bank 1 and seal opening in intake manifold side-part using clean rag.
- Hook in lifting tackle 3033 at lifting eyes:

Vibration damper side: Position 1

Flywheel side: Position 12

- Adjust difference of length at threaded spindle.
- Remove mounting bolts for subframe mount/engine carrier.
- Lower engine from Scissor Lift Table VAS 6131 using Shop Crane VAS 6100.

- Remove both engine carriers from cylinder block.

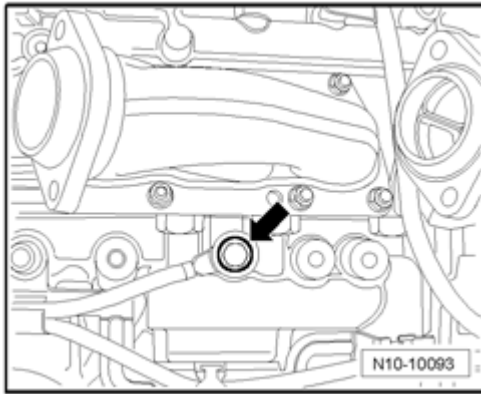


Fig. 31: Removing Knock Sensor (KS) 2 G66 From Cylinder Block (Cylinder Bank 1)

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove Knock Sensor (KS) 2 G66 - **arrow** - from cylinder block (cylinder bank 1) --> **Knock Sensors 1 and 2 for Bank 1**

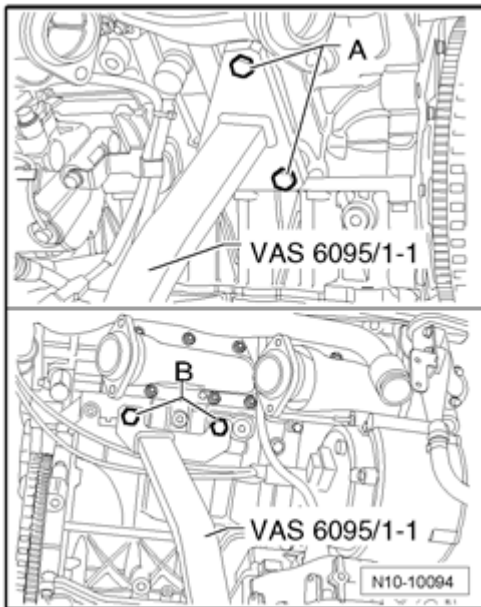


Fig. 32: Identifying Brackets For W12 Engine VAS 6095/1-1 Can Now Be Secured To Cylinder Block On Left/Right

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Brackets for W12 engine VAS 6095/1-1 can now be secured to cylinder block on left - **A** - and right - **B** - , as shown.
- Bolt on engine with brackets to universal mounting VAS 6095/1.

Engine, Installing

2004 Volkswagen Phaeton

ENGINE 6.0 Liter 12-Cyl. 4V Engine Mechanical, Fuel Injection & Ignition, Engine Code(s): BRP, BAP

Engine, Installing

Installation is performed in reverse order. When doing this note the following:

CAUTION: When doing any repair work, especially in the engine compartment, pay attention to the following due to clearance issues:

- Route lines of all types (e.g. for fuel, hydraulic, EVAP canister system, coolant and refrigerant, brake fluid, vacuum) and electrical wiring so that the original path is followed.
- To prevent damages to the lines, make sure there is sufficient clearance to all moving or hot components.

If Engine was Separated from Transmission:

- Make sure centering sleeves for engine to transmission are installed in cylinder block. Install if necessary.
- Reconnect all lines, hoses and connections that were disconnected for the removal sequence.
- Align primary catalytic converters to front exhaust pipes --> **Primary Catalytic Converters with Exhaust Pipes, Aligning.**

With Engine Code BAP:

- Replace bonded rubber bushing for oil filter housing.

Continuation for all Vehicles:

NOTE:

- When installing engine/transmission assembly into the body, it is always necessary to bring engine carrier into contact on body using the Scissor Lift Table VAS 6131. "Pulling up" engine carrier with mounting bolts damages thread inserts!

- When installing the engine, use scissor lift table to lift so far that the selector cable can be attached.
- Electrical connections and routing: --> Electrical Wiring Diagrams, Troubleshooting and Component Locations
- Connect A/C system lines and fill up refrigerant: --> **87 - AIR CONDITIONING**
- Fill up oil for power steering: --> **48 - STEERING**
- Fill with coolant --> **Cooling System, Draining and Filling.**
- Fill up with engine oil.
- Connect battery.

Observe required actions after connecting battery --> **27 - BATTERY, STARTER, GENERATOR, CRUISE CONTROL**

2004 Volkswagen Phaeton

ENGINE 6.0 Liter 12-Cyl. 4V Engine Mechanical, Fuel Injection & Ignition, Engine Code(s): BRP, BAP

NOTE:

- **After installing the assembly, perform a vehicle alignment --> 44 - WHEELS, TIRES, WHEEL ALIGNMENT**

- Check headlight adjustment and adjust if necessary: --> **01 - MAINTENANCE**
- Perform vehicle system test "Guided Fault Finding".
- End vehicle system test so that DTC entries, created during repair work, can be automatically erased.
- Generate readiness code in conjunction with a road test.

Observe safety precautions that apply to road tests.

- Perform a road test.
- Then, perform vehicle system test again and repair malfunctions, if necessary.

Tightening Specifications

Tightening Specifications

Bolted connections		Tightening specifications
Bolts and Nuts	M6	10 Nm
	M7	15 Nm
	M8	25 Nm
	M10	40 Nm
	M12	60 Nm
Deviation from		
Engine bracket to cylinder block	M10	50 Nm
Engine carrier to subframe mount	M10	70 Nm
Shielding plate to subframe mount	M6	8 Nm
Engine carrier to chassis	M12	90 Nm plus an additional 1/4 turn (90°)
Drive axles to transmission		Suspension, Wheels, Steering 40 Drive Axle, Overview
Subframe to body		Suspension, Wheels, Steering 40 Subframe, Lower Link and Stabilizer Bar, Assembly Overview

*Replace bolt

13 - ENGINE - CRANKSHAFT, CYLINDER BLOCK

ENGINE, DISASSEMBLING AND ASSEMBLING

Engine, Disassembling and Assembling

Engine, Disassembling and Assembling

--> Ribbed Belt, Removing and Installing

NOTE:

- Engine must not be set down on oil pan, because the fluid seal between lower and upper oil pan is otherwise damaged. To set down the engine, use frame T10116.
- To perform repair work and for mounting of engine, Engine and Transmission Holder VAS 6095 must be modified with universal mounting VAS 6095/1. Before mounting, engine must be removed from transmission and brackets for W12 engine VAS 6095/1-1 must be bolted to cylinder block --> Engine, Securing to Engine and Transmission Holder.

CAUTION: Crankshaft, pistons and connecting rods must not be removed.

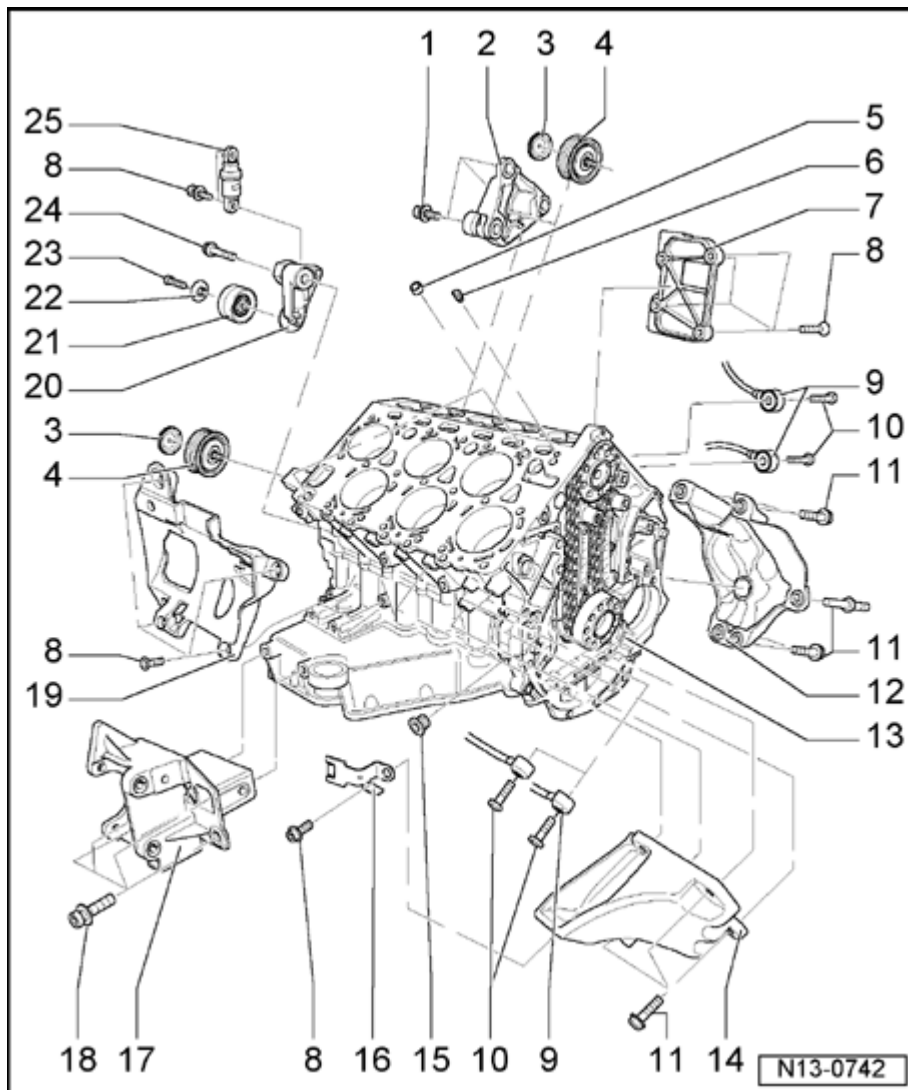


Fig. 33: Engine Remove/Install Components**Courtesy of VOLKSWAGEN UNITED STATES, INC.**

1 - 40 Nm

2 - Torque bracket

3 - Cap

4 - Idler roller, 30 Nm

5 - Alignment bushing

- Observe installation position --> **Installing**.

6 - Oil check valve, 6 Nm

- Note installation position
- Clean if badly soiled

7 - Bracket

- For generator

8 - 25 Nm

9 - Knock sensors

- Installation position --> **Knock Sensors 1 and 2 for Bank 1** and --> **Knock Sensors 3 and 4 for Bank 2**

10 - 20 Nm

- Tightening specifications affect function of Knock Sensor (KS)

11 - 50 Nm

12 - Right engine bracket

13 - Cylinder block

- Sealing flange and drive plate, removing and installing --> **Sealing Flange and Drive Plate, Assembly Overview**.

14 - Left engine bracket

15 - Locking bolt, 20 Nm

2004 Volkswagen Phaeton

ENGINE 6.0 Liter 12-Cyl. 4V Engine Mechanical, Fuel Injection & Ignition, Engine Code(s): BRP, BAP

- For threaded hole
- For crankshaft holder 3242

16 - Bracket

- For wiring harness

17 - Bracket

- For power steering pump

18 - 40 Nm

19 - Bracket

- For air conditioning compressor

20 - Tensioning element

- For ribbed belt
- Removing and installing ribbed belt --> **Ribbed Belt, Removing and Installing.**

21 - Tensioning roller

22 - Washer

23 - 20 Nm

24 - 30 Nm + $\frac{1}{4}$ turn (90)

25 - Tensioning element

To loosen and tighten securing bolt, lock vibration damper using counter-holder tool T10069

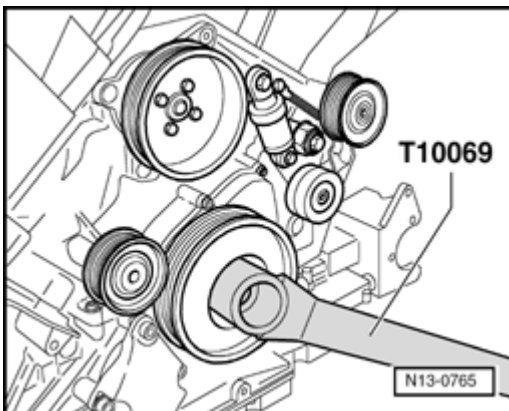


Fig. 34: Loosening/Tightening Securing Bolt, Lock Vibration Damper Using Counter-Holder Tool T10069

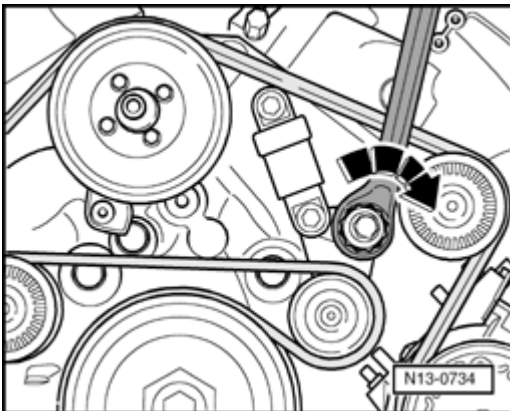
Courtesy of VOLKSWAGEN UNITED STATES, INC.

NOTE:

- Vibration damper securing bolt must be replaced.
- Tighten mounting bolt using torque wrench V.A.G 1601

Ribbed Belt, Removing and Installing**Ribbed Belt, Removing and Installing****Removing**

- Remove front bumper: --> **63 BUMPERS**
- Bring lock carrier into service position: --> **50 BODY - FRONT**
- Mark direction of rotation of ribbed belt.

**Fig. 35: Relieving Tension On Ribbed Belt**

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Move tensioner in - **direction of arrow** - to release tension on ribbed belt.
- Remove ribbed belt.

Installing**NOTE:**

- Before installing ribbed belt, make sure all components (generator, A/C compressor, vane pump and coolant pump) are securely fastened.
- Note previously marked direction of belt rotation and be sure that it is seated correctly on pulley.

The rest of the assembly is basically a reverse of the disassembling sequence.

- Place ribbed belt, according to engine code, as shown in illustrations:

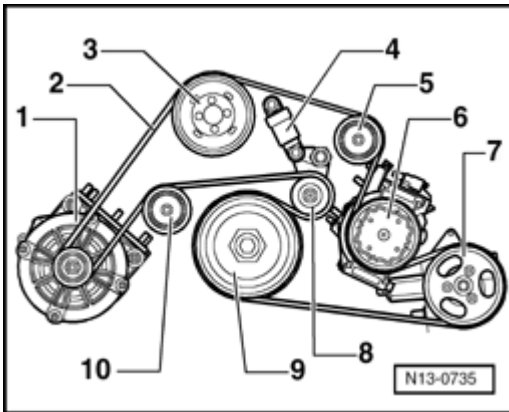


Fig. 36: Routing Of Ribbed Belt For Engine Code BAP
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Routing of Ribbed Belt for Engine Code BAP:

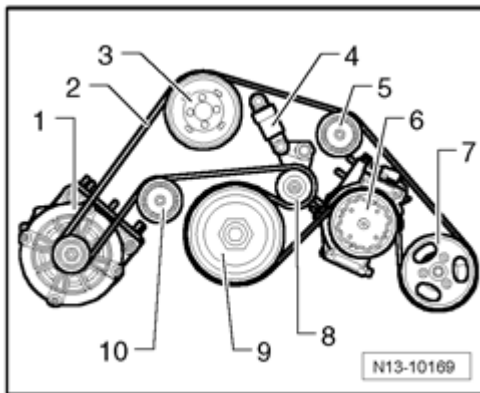


Fig. 37: Routing Of Ribbed Belt For Engine Code BRP
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Routing of Ribbed Belt for Engine Code BRP:

- 1 - Generator
- 2 - Ribbed belt
- 3 - Coolant pump
- 4 - Tensioning element
- 5 - Idler roller
- 6 - Air conditioner compressor
- 7 - Power steering pump

2004 Volkswagen Phaeton

ENGINE 6.0 Liter 12-Cyl. 4V Engine Mechanical, Fuel Injection & Ignition, Engine Code(s): BRP, BAP

8 - Tensioning roller

9 - Vibration damper

10 - Idler roller

After completing repairs always:

- Start engine and check belt running.

SEALING FLANGE AND DRIVE PLATE, ASSEMBLY OVERVIEW

Sealing Flange and Drive Plate, Assembly Overview

Sealing Flange and Drive Plate, Assembly Overview

CAUTION: Crankshaft, pistons and connecting rods must not be removed.

NOTE:

- Engine must not be set down on oil pan, because the fluid seal between lower and upper oil pan is otherwise damaged. To set down the engine, use Frame T10116 for engine code BAP and use Frame T10319 for engine code BRP.
- When performing repair work, secure engine to Engine and Transmission Holder VAS 6095 with universal mounting VAS 6095/1 and bracket for W12 engine VAS 6095/1-1.

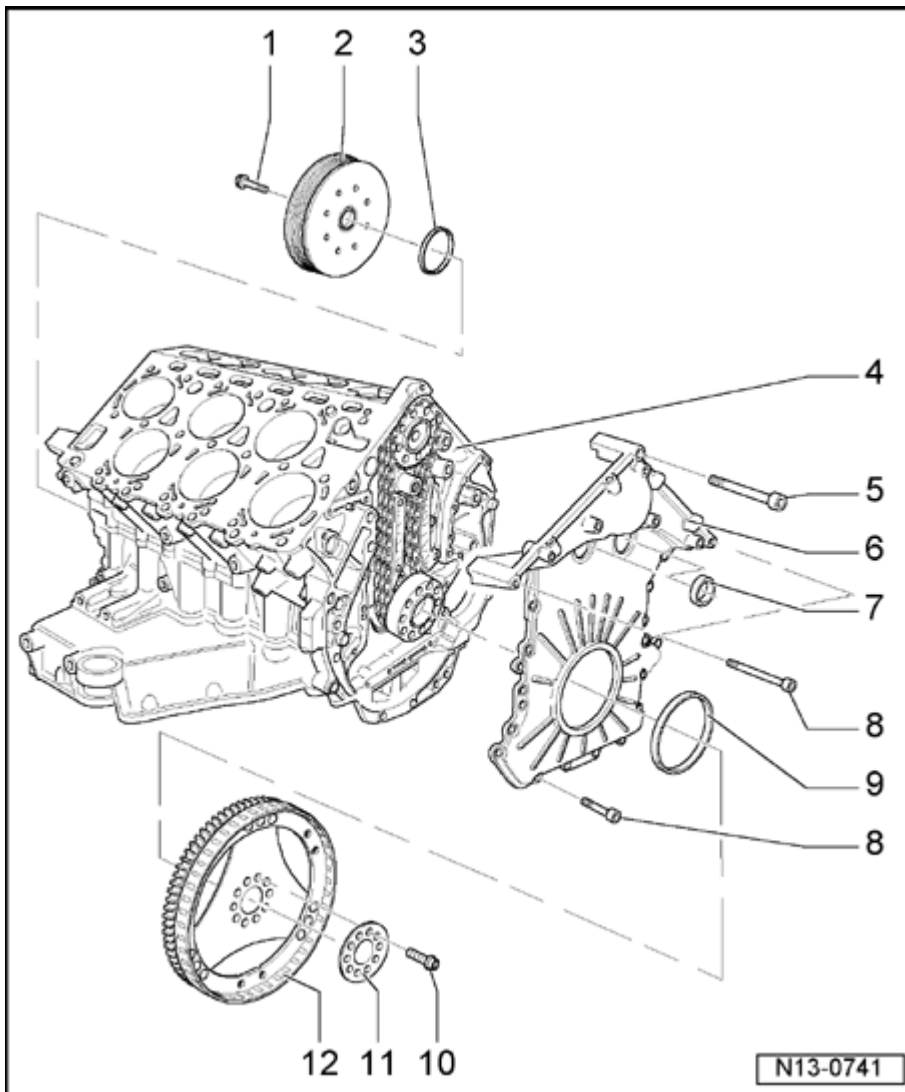


Fig. 38: Sealing Flange And Drive Plate, Assembly Overview
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - 100 Nm + $\frac{1}{4}$ turn (90)

- Replace
- Use counter-holder tool T10069 for loosening and tightening --> **Crankshaft Seal, Vibration Damper Side, Removing and Installing.**
- Tighten using torque wrench V.A.G 1601

2 - Vibration damper

- Removing and installing ribbed belt --> **Ribbed Belt, Removing and Installing.**

3 - Seal

2004 Volkswagen Phaeton

ENGINE 6.0 Liter 12-Cyl. 4V Engine Mechanical, Fuel Injection & Ignition, Engine Code(s): BRP, BAP

- PTFE version of oil seal
- Identification: no inner coil spring
- Do not additionally oil or grease sealing lip of oil seal
- Before installing, remove oil remains from crankshaft journal with a clean cloth
- Replacing --> **Crankshaft Seal, Vibration Damper Side, Removing and Installing.**

4 - Aluminum cylinder block

5 - 20 Nm

6 - Sealing flange

- Clean sealing surface before installing
- Coat sealing surface of cylinder block using **sealant D 176 501**
- Seal sealing surface to cover pieces --> **Valve Timing, Engine Code BAP, Adjusting.**

7 - Seal

- Do not additionally oil or grease sealing lip of oil seal
- Fit into sealing flange using fitting sleeve 3378 and pull in flush using fitting sleeve 3253/6 from wheel bearing assembly set 3253.

8 - 8 Nm

9 - Seal

- PTFE version of oil seal
- Identification: no inner coil spring
- Do not additionally oil or grease sealing lip of oil seal
- Before installing, remove oil remains from crankshaft journal with a clean cloth
- Replacing --> **Crankshaft Seal, Drive Plate Side, Removing and Installing.**

10 - 60 Nm + $\frac{1}{4}$ turn (90)

- Use counter-holder T10069 to loosen and tighten
- Replace

11 - Washer

12 - Drive plate

- Removing and installing --> **Drive Plate, Removing and Installing.**

Crankshaft Seal, Vibration Damper Side, Removing and Installing

Crankshaft Seal, Vibration Damper Side, Removing and Installing

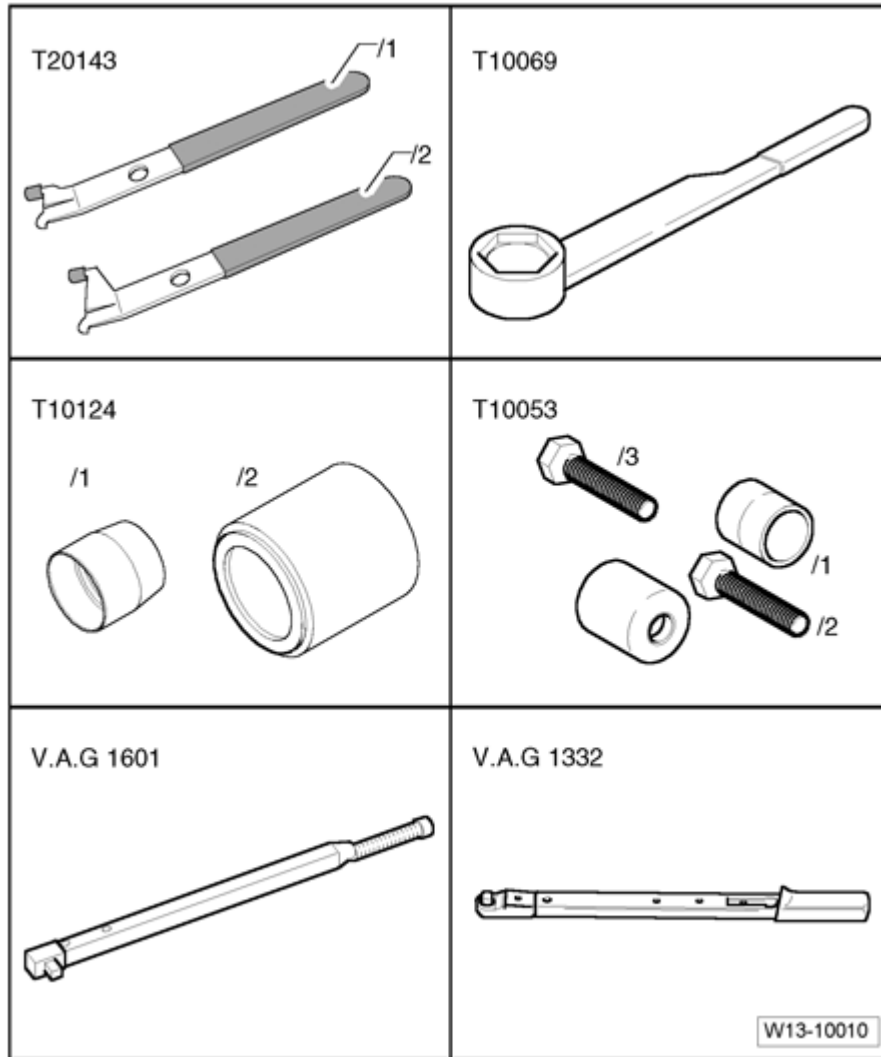


Fig. 39: Identifying Special Tools - Crankshaft Seal, Vibration Damper Side, Removing And Installing
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools, testers and auxiliary items required

- Extractor hook T20143
- Counter-holder tool T10069
- Pulling fixture T10124
- Assembly tool T10053
- Torque wrench (150 to 800 Nm) V.A.G 1601
- Torque wrench (40 to 200 Nm) V.A.G 1332

Removing

- Remove ribbed belt --> **Ribbed Belt, Removing and Installing.**

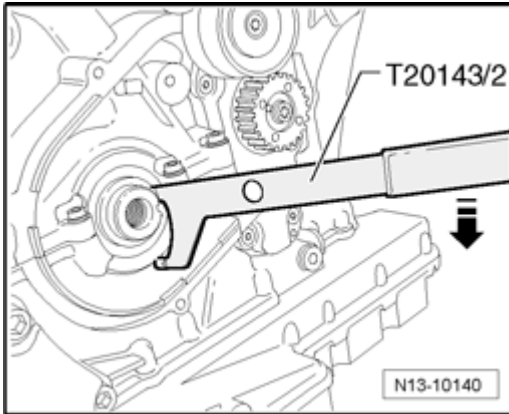


Fig. 40: Removing Seal With Pulling Hook T20143/2
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove gasket using pulling hook T20143/2.

NOTE:

- Be careful not to damage sealing surface when removing sealing ring.

Installing

- Before installing, remove oil remains from end of crankshaft with a clean cloth.

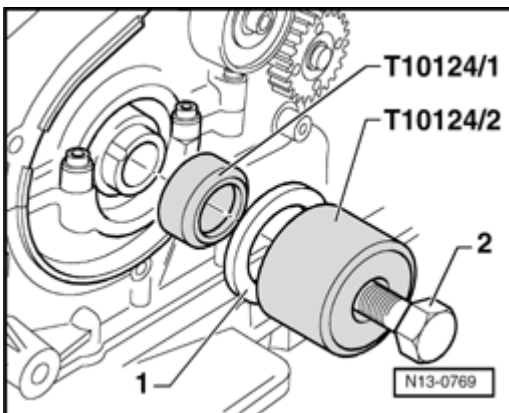
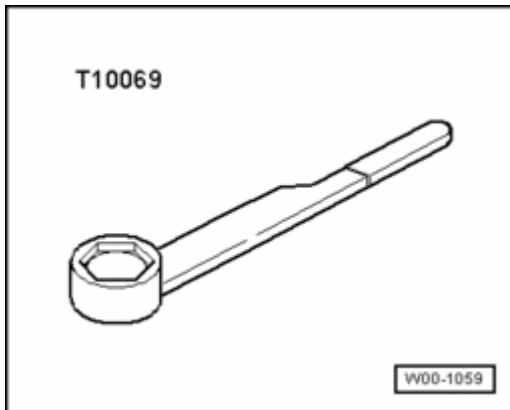
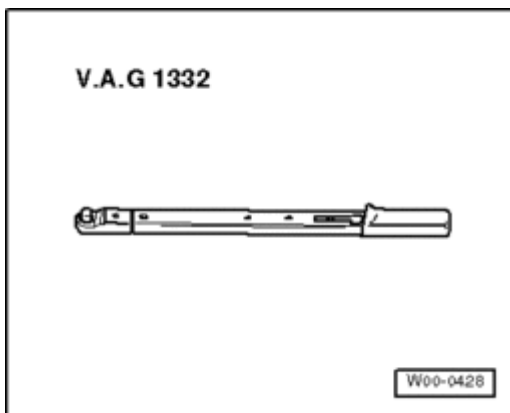


Fig. 41: Installing Crankshaft Seal
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Place guide sleeve T10124/1 on crankshaft pin.
- Slide dry oil seal - 1 - over guide sleeve.
- Press in seal - 1 - up to stop using Thrust Sleeve T10124/2. To do so, use bolt T10053/2 - 2 -.
- Install ribbed belt --> **Ribbed Belt, Removing and Installing.**

Drive Plate, Removing and Installing**Drive Plate, Removing and Installing****Special tools, testers and auxiliary items required****Fig. 42: Counter-Holder Tool T10069****Courtesy of VOLKSWAGEN UNITED STATES, INC.**

- Counter-holder tool T10069

**Fig. 43: Torque Wrench V.A.G. 1332****Courtesy of VOLKSWAGEN UNITED STATES, INC.**

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

Not illustrated:

- Depth gauge
- Straight edge

Removing

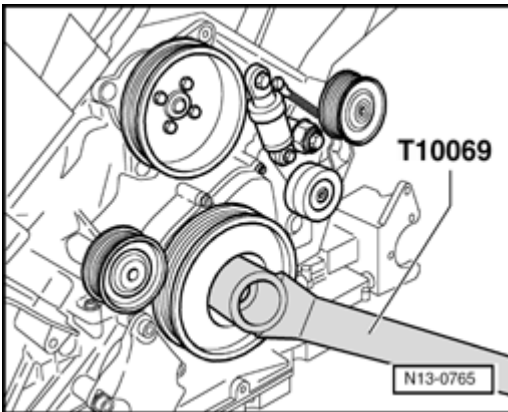


Fig. 44: Loosening/Tightening Securing Bolt, Lock Vibration Damper Using Counter-Holder Tool T10069

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove drive plate. To do so, secure vibration damper using counter-holder tool T10069.
- Loosen drive plate securing bolts diagonally and remove.
- Remove drive plate.

Installing

- Position the drive plate without the shim on the crankshaft.
- Insert at least 3 old securing bolts and tighten to 30 Nm.

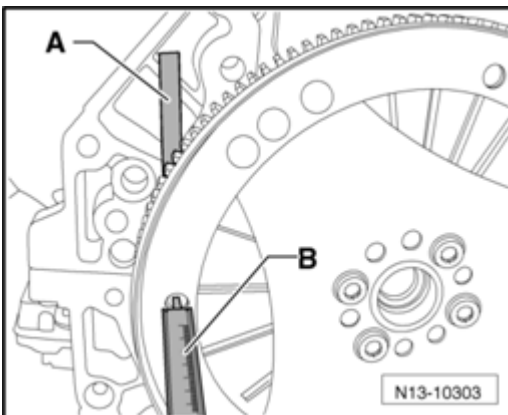


Fig. 45: Positioning Straight Edge On Transmission Bolting Flange & Using Caliper Gauge To Measure Against Straight Edge Through Converter Mounting Holes

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Position the straight edge - A - on the transmission bolting flange.
- Using a caliper gauge - B - measure against the straight edge through the converter mounting holes.

NOTE:

- The straight edge must lie level on the bolting flange.
- To prevent measurement errors, have a second technician hold the

straight edge.

- The straight edge must not sag.

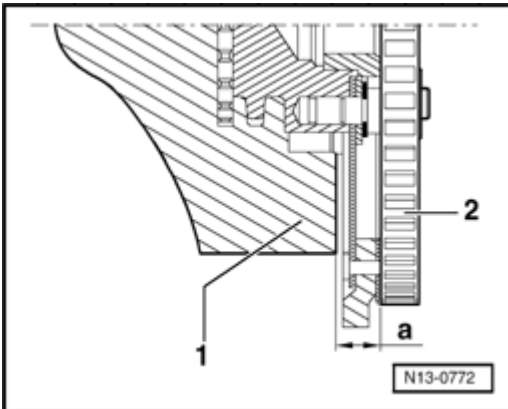


Fig. 46: Checking Dimension "a"

Courtesy of VOLKSWAGEN UNITED STATES, INC.

Measured distance + straight edge thickness = dimension - **a** -. Specified value - **a** - : 18.1 to 19.7 mm

1. Transmission bolting flange
2. Drive plate

- Compare measured value (measured distance + thickness of straight edge) with the specification.

If specified value is not reached:

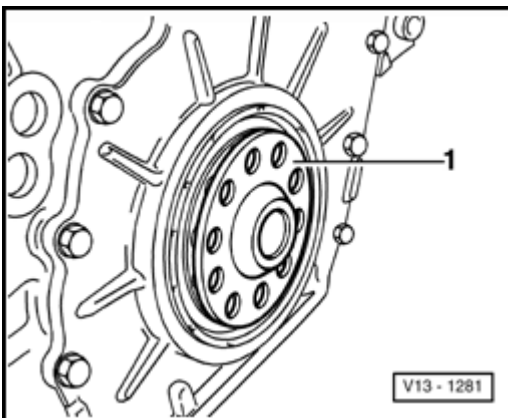


Fig. 47: Removing Drive Plate Again And Use Appropriate Shim

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove drive plate again and use appropriate shim - **1** -.

NOTE:

- Only one shim of the appropriate thickness may be used.

If specified value is obtained:

- Insert new mounting bolts with a washer and tighten by hand.

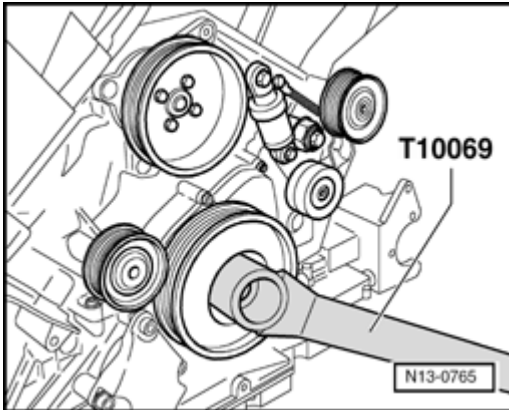


Fig. 48: Loosening/Tightening Securing Bolt, Lock Vibration Damper Using Counter-Holder Tool T10069

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Tighten the drive plate. To do so, secure vibration damper using counter-holder tool T10069.
- Tighten the mounting bolts to 60 Nm + 90 ($\frac{1}{4}$ turn). (The additional turn may be performed in several steps).

Crankshaft Seal, Drive Plate Side, Removing and Installing

Crankshaft Seal, Drive Plate Side, Removing and Installing

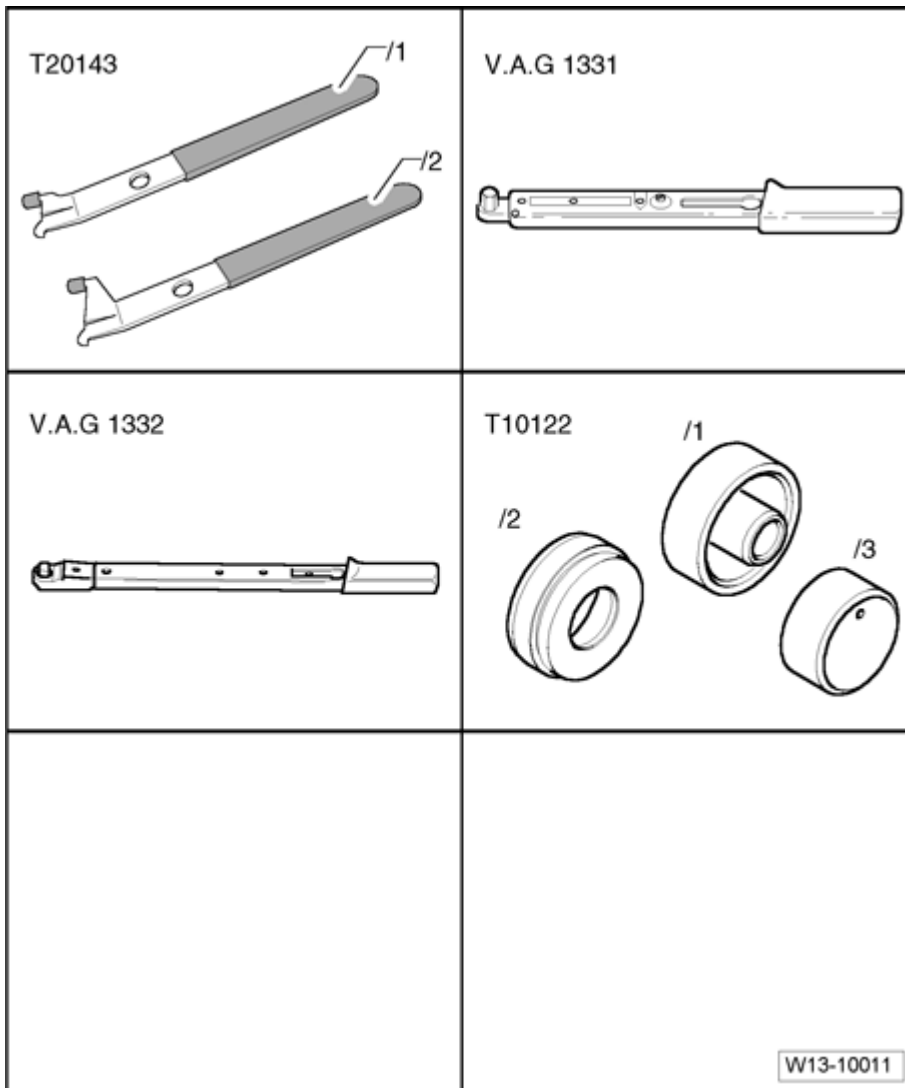


Fig. 49: Identifying Special Tools - Crankshaft Seal, Drive Plate Side, Removing And Installing
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools, testers and auxiliary items required

- Extractor hook T20143
- Torque wrench (5 to 50 Nm) V.A.G 1331
- Torque wrench (40 to 200 Nm) V.A.G 1332
- Pulling fixture T10122

Removing

- Remove drive plate.

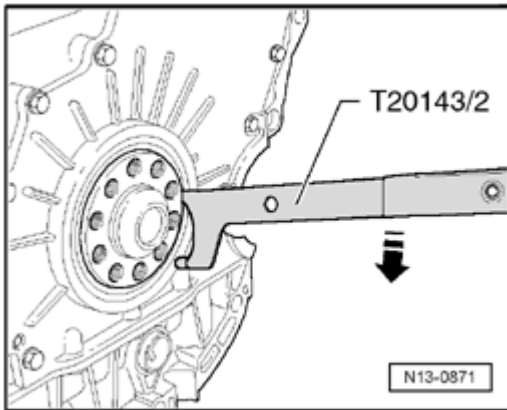


Fig. 50: Supporting Pulling Hook T20143/2 On Sealing Flange And Pry Out Sealing Ring
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Pull out gasket using pulling hook T20143.

Installing

NOTE:

- Do not remove support ring out of seal until immediately before installation.

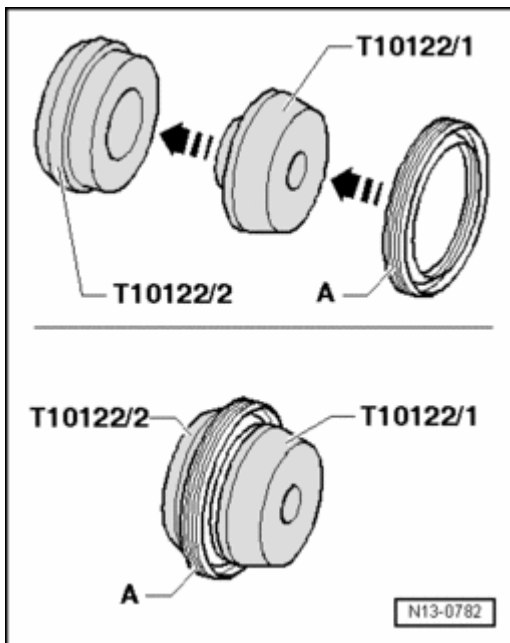


Fig. 51: Identifying Seal, Sleeve T10122/1 And Assembly Tool T10122/2
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Join assembly sleeve T10122/1 and T10122/2. Slide sealing ring - A - to stop on assembly sleeve T10122/2.
- Separate two assembly sleeves.

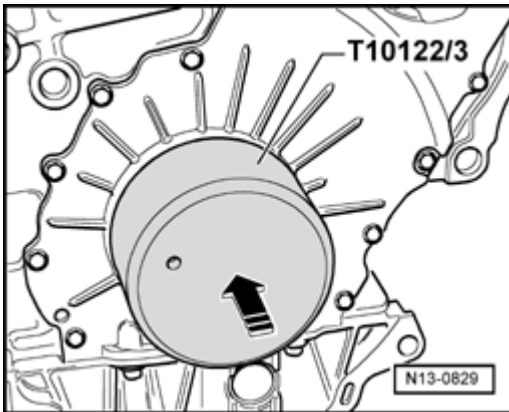


Fig. 52: Installing Assembly Sleeve T10122/2 Together With Gasket Onto Crankshaft Flange
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Install assembly sleeve T10122/2 together with gasket onto crankshaft flange.
- Press in seal up to stop using pressure sleeve T10122/3.

The rest of the assembly is basically a reverse of the disassembling sequence.

15 - ENGINE - CYLINDER HEAD, VALVETRAIN

CYLINDER HEADS

Cylinder Heads

--> **Bank 1, Assembly Overview**

--> **Bank 2, Assembly Overview**

--> **Cylinder Head Cover, Removing and Installing**

--> **Cylinder Head, Removing and installing**

--> **Compression, Checking**

NOTE:

- Removing cylinder heads is only possible with engine removed --> **Engine, Removing and Installing.**
- To perform repair work and for mounting of engine, Engine and Transmission Holder VAS 6095 must be modified with universal mounting VAS 6095/1 and bracket for W12 engine VAS 6095/1-1 --> **Engine, Securing to Engine and Transmission Holder.**
- If a replacement cylinder head is installed, all contact surfaces between support elements, roller cam followers and cam lubricating surfaces of camshafts must be oiled before installing the cylinder head cover.
- The plastic protectors installed to protect the open valves must only be

removed immediately before fitting the cylinder head.

- Complete coolant must be replaced when replacing cylinder head.

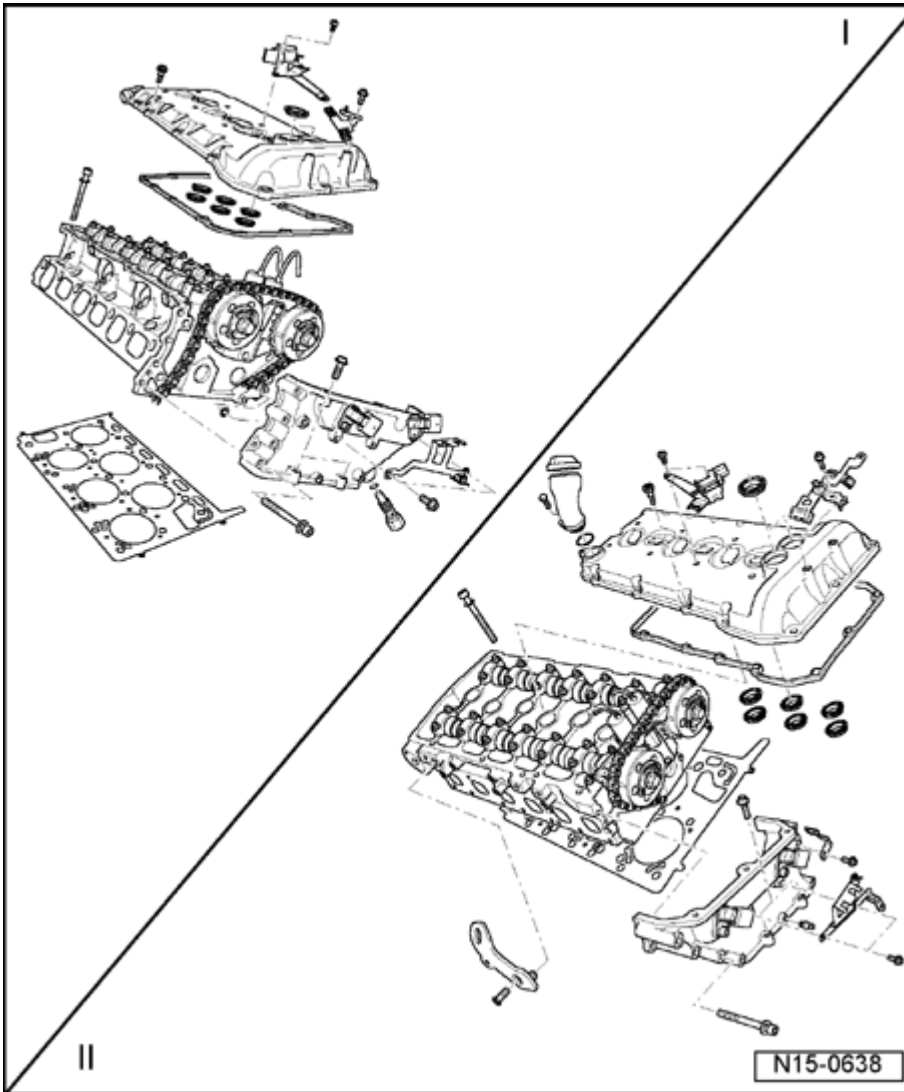


Fig. 53: Cylinder Heads Bank 1 & Bank 2 Assembly Overview
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Bank 1, Assembly Overview

Bank 1, Assembly Overview

NOTE:

- Cylinder bank 1 is located on right side in direction of travel.
- Intake manifold, assembly overview --> Intake Manifold Upper Section, Engine Code BRP, Assembly Overview , and --> Intake Manifold, Engine Code BAP, Assembly Overview.
- Chain drive --> Chain Drive.

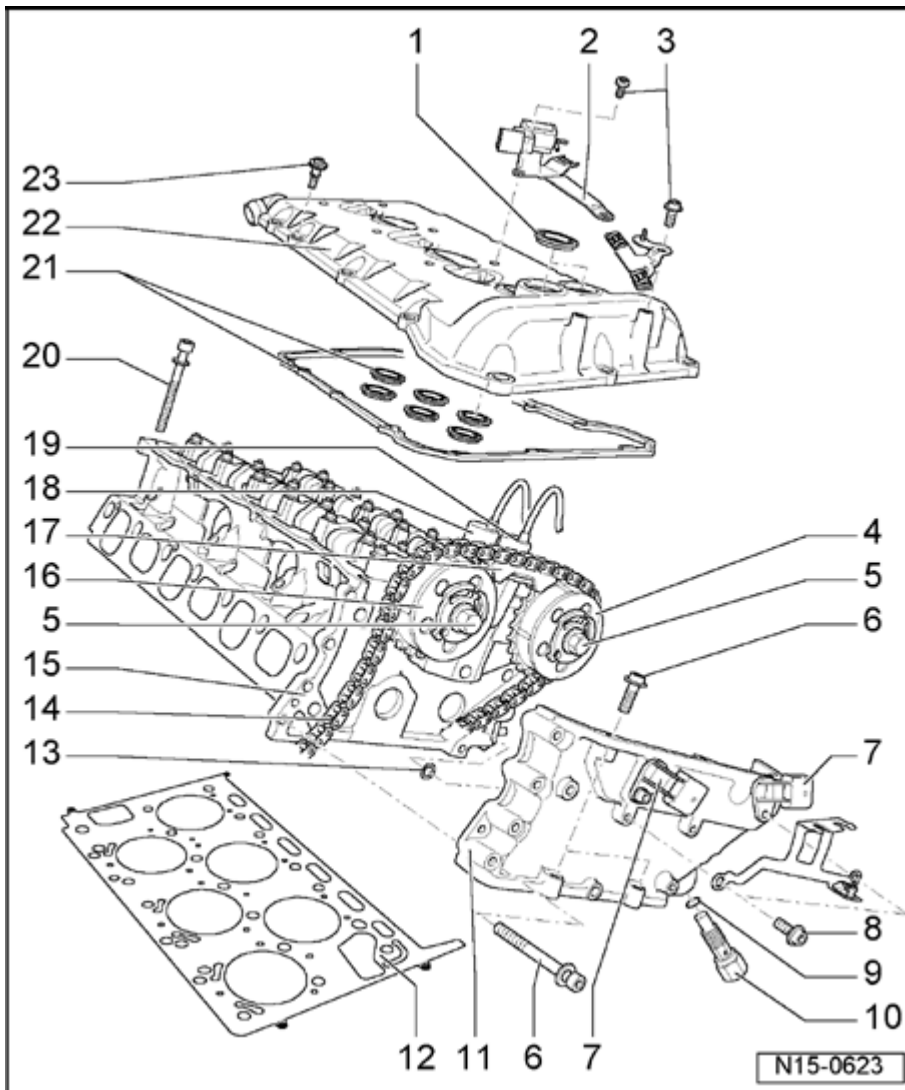


Fig. 54: Bank 1, Assembly Overview

Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Seal

- Replace if damaged or leaking
- Installing --> **Installing Seals of Camshaft Adjustment Valves**

2 - Bracket

- For Secondary Air Injection (AIR) Solenoid Valve

3 - 8 Nm

4 - Exhaust camshaft adjuster

- Identification: B1

- Only rotate engine with camshaft adjuster installed
- With alignment pin, can only be mounted in one position on camshaft
- Installing --> **Chain Drive**.

5 - 60 Nm + $\frac{1}{4}$ turn (90)

- Replace
- Contact surface of sensor wheel at bolt head must be dry when installing
- To remove and install, counter-hold at camshaft using an open-end spanner (32 mm)

6 - 10 Nm

- Observe installation instructions and sequence when tightening

7 - Camshaft Position (CMP) sensor

- Before disconnecting harness connector, mark allocation to component

8 - 10 Nm

9 - Seal

- Replace if damaged or leaking

10 - Chain tensioner, 40 Nm

- Only rotate engine with chain tensioner installed

11 - Cover

- Can be removed and installed with cylinder head installed
- Install, according to engine code --> **Chain Drive**.

12 - Cylinder head gasket

- Replace --> **Cylinder Head, Removing and installing**.
- After replacing replace entire amount of coolant

13 - O-ring

- For oil channel seal
- Replace
- Oil before assembling

14 - Camshaft roller chain

- Mark direction of rotation before removing (installation position) --> **Roller Chain, Marking**
- Installing --> **Chain Drive**.

15 - Cylinder head

- Check for distortion --> **Checking Cylinder Head for Distortion**
- Removing and installing --> **Cylinder Head, Removing and installing**.
- After replacing replace entire amount of coolant

16 - Intake camshaft adjuster

- Identification: B1
- Only rotate engine with camshaft adjuster installed
- With alignment pin, can only be mounted in one position on camshaft
- Installing --> **Chain Drive**.

17 - Guide rail

- Clipped in at control housing

18 - Camshaft adjustment valve 1 N205

- For intake camshaft
- Before disconnecting, mark allocation of connector to component
- Removing and installing --> **Camshaft Adjuster Valves, Removing and Installing**.

19 - Camshaft adjustment valve 1 (exhaust) N318

- For exhaust camshaft
- Before disconnecting, mark allocation of connector to component
- Removing and installing --> **Camshaft Adjuster Valves, Removing and Installing**.

20 - Cylinder head bolt

- Replace
- Observe installation instructions and sequence for loosening and tightening --> **Cylinder Head, Removing and installing**.

21 - Gasket for cylinder head cover

- Replace if damaged or leaking
- Note installation position

22 - Cylinder head cover

- Removing and installing --> **Cylinder Head Cover, Removing and Installing.**
- Replace if damaged

23 - 10 Nm

- With spacer sleeve and seal
- Replace seal if damaged
- Observe tightening sequence --> **Cylinder Head Cover, Removing and Installing.**

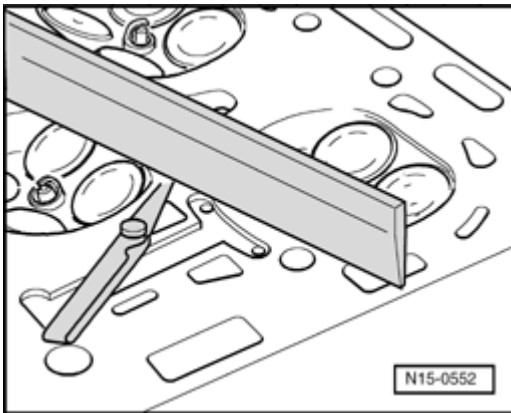
Checking Cylinder Head for Distortion

Fig. 55: Checking Cylinder Head For Distortion
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools, testers and auxiliary items required

- Straight edge
- Feeler gauge

Max. permissible distortion: 0.05 mm

Installing Seals of Camshaft Adjustment Valves

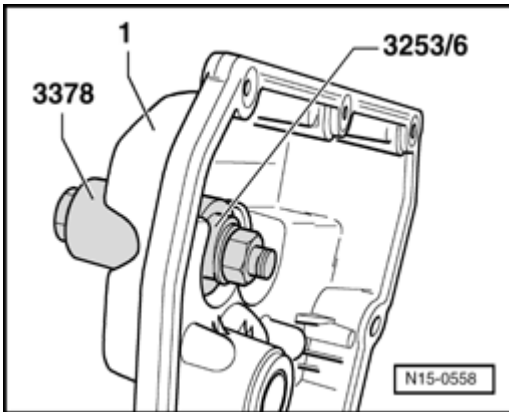


Fig. 56: Installing Seals Of Camshaft Adjustment Valves
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools, testers and auxiliary items required

- Fitting sleeve 3378
- Thrust pad 3253/6 from wheel bearing assembly set 3253

Installing

- Do not lubricate seal.
- Fit seal into the cylinder head cover - 1 - using the fitting sleeve 3378 and pull in flush using the thrust pad 3253/6 from the wheel bearing assembly set 3253.

Bank 2, Assembly Overview

Bank 2, Assembly Overview

NOTE:

- Cylinder bank 2 is located on left side in direction of travel.
- Intake manifold, assembly overview --> Intake Manifold Upper Section, Engine Code BRP, Assembly Overview , and --> Intake Manifold, Engine Code BAP, Assembly Overview.
- Chain drive --> Chain Drive.

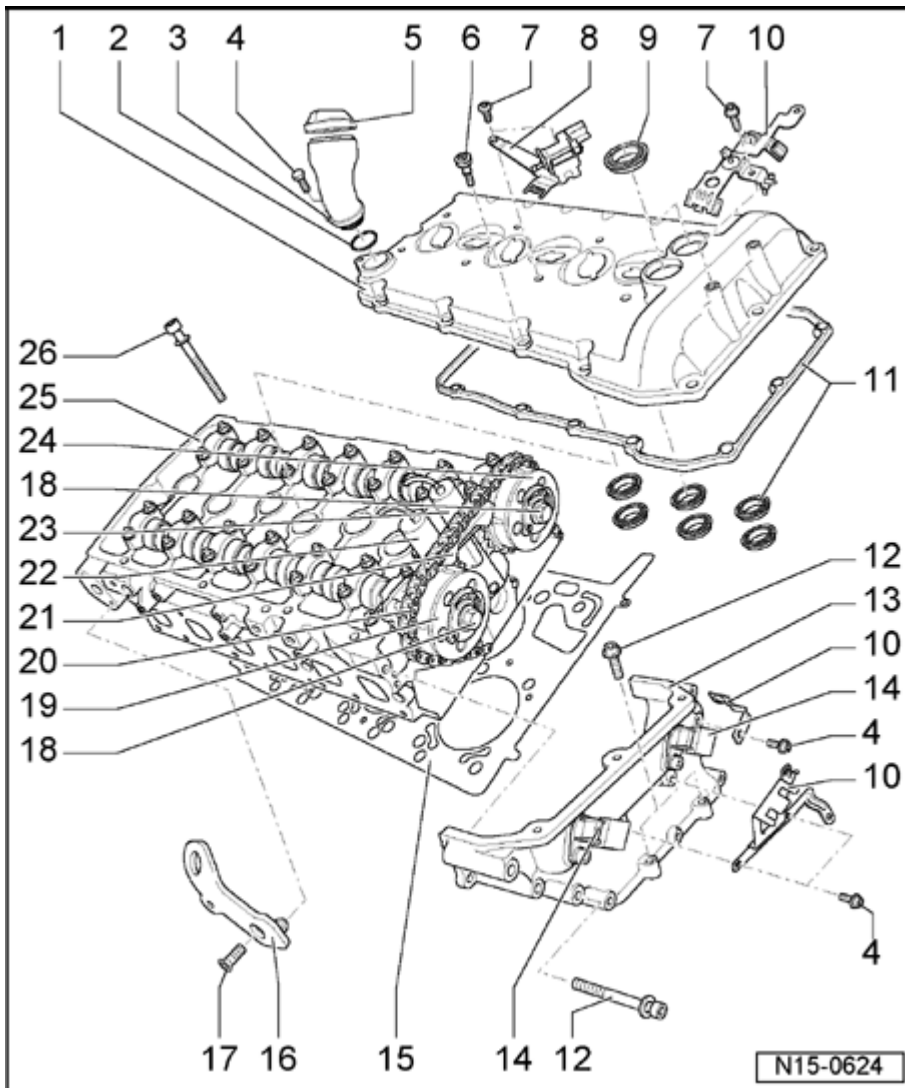


Fig. 57: Bank 2, Assembly Overview

Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Cylinder head cover

- Removing and installing --> **Cylinder Head Cover, Removing and Installing.**
- Replace if damaged

2 - O-ring

- Replace if damaged
- Oil before assembling

3 - Oil filler neck

- Coat sealing surfaces with **sealant AMV 188 001 02**

4 - 10 Nm

5 - Cap

- Replace gaskets if damaged

6 - 10 Nm

- With spacer sleeve and seal
- Replace seal if damaged
- Observe tightening sequence --> **Cylinder Head Cover, Removing and Installing.**

7 - 8 Nm

8 - Bracket

- For Secondary Air Injection (AIR) Solenoid Valve

9 - Seal

- Replace if damaged or leaking
- Installing --> **Installing Seals of Camshaft Adjustment Valves**

10 - Bracket

- For wiring harness

11 - Gasket for cylinder head cover

- Replace if damaged or leaking
- Note installation position

12 - 10 Nm

- Observe installation instructions and sequence for tightening, according to engine code --> **Chain Drive.**

13 - Cover

- Can be removed and installed with cylinder head installed
- Without O-ring for oil channel seal
- Install, according to engine code --> **Chain Drive.**

14 - Camshaft Position (CMP) sensor

- Before disconnecting, mark allocation of connector to component

15 - Cylinder head gasket

- Replace --> **Cylinder Head, Removing and installing.**
- After replacing replace entire amount of coolant

16 - Lifting eye

17 - 23 Nm

18 - 60 Nm + $\frac{1}{4}$ turn (90)

- Replace
- Contact surface of sensor wheel at bolt head must be dry when installing
- To remove and install, counter-hold at camshaft using an open-end wrench (32 mm)

19 - Exhaust camshaft adjuster

- Identification: B2
- Only rotate engine with camshaft adjuster installed
- With alignment pin, can only be mounted in one position on camshaft
- Installing --> **Chain Drive.**

20 - Camshaft roller chain

- Mark direction of rotation before removing (installation position) --> **Roller Chain, Marking.**
- Installing --> **Chain Drive.**

21 - Guide rail

- Clipped in at control housing

22 - Camshaft adjustment valve 2 (exhaust) N319

- For exhaust camshaft
- Before disconnecting, mark allocation of connector to component
- Removing and installing --> **Camshaft Adjuster Valves, Removing and Installing.**

23 - Camshaft adjustment valve 2 N208

- For intake camshaft
- Before disconnecting, mark allocation of connector to component
- Removing and installing --> **Camshaft Adjuster Valves, Removing and Installing.**

24 - Intake camshaft adjuster

- Identification: B2
- Only rotate engine with camshaft adjuster installed
- With alignment pin, can only be mounted in one position on camshaft
- Installing --> **Chain Drive**.

25 - Cylinder head

- Check for distortion --> **Checking Cylinder Head for Distortion**
- Removing and installing --> **Cylinder Head, Removing and installing**.
- After replacing replace entire amount of coolant

26 - Cylinder head bolt

- Replace
- Observe installation instructions and sequence for loosening and tightening --> **Cylinder Head, Removing and installing**.

Cylinder Head Cover, Removing and Installing

Cylinder Head Cover, Removing and Installing

(Work procedure with engine installed)

Special tools, testers and auxiliary items required

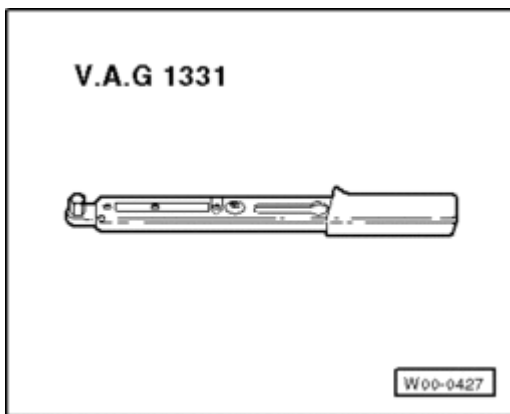


Fig. 58: Torque Wrench V.A.G 1331

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Torque wrench (5 to 50 Nm) V.A.G 1331
- Sealant D 176 404

Removing

CAUTION: When doing any repair work, especially in the engine compartment, pay

attention to the following due to clearance issues:

- Route lines of all types (e.g. for fuel, hydraulic, EVAP canister system, coolant and refrigerant, brake fluid, vacuum) and electrical wiring so that the original path is followed.
 - Ensure sufficient clearance to all moving or hot components.
- All cable ties which are opened or cut open when removing, must be replaced in the same position when installing.
 - Remove upper part of intake manifold. For engine code BAP --> **Intake Manifold, Engine Code BAP, Assembly Overview** , or engine code BRP --> **Intake Manifold Upper Section, Engine Code BRP, Assembly Overview**.

NOTE:

- Seal the intake channels in lower part of intake manifold using a clean rag.

- Remove ignition coils with power output stage --> **Ignition Coils with Power Output Stages, Removing and Installing**.
- Disconnect hose for crankshaft housing ventilation from cylinder head covers.

NOTE:

- Press buttons together on hose connections to do so.

- Remove cylinder head covers.

Installing**NOTE:**

- Replace cylinder head cover if damaged.
 - Replace seal for cylinder head cover if damaged or leaking.
- Clean sealing surfaces. They must be free of oil and grease.

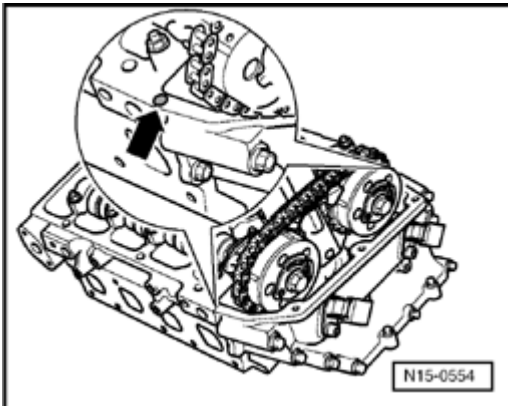


Fig. 59: Apply Sealant D 176 404 A2 To Clean Sealing Surface Between Cylinder Head And Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

2004 Volkswagen Phaeton

ENGINE 6.0 Liter 12-Cyl. 4V Engine Mechanical, Fuel Injection & Ignition, Engine Code(s): BRP, BAP

- Apply **sealant D 176 404** onto clean sealing surface between cylinder head and cover piece as shown.

NOTE:

- **Note the expiration date of the sealing compound.**
- **The cylinder head cover must be installed within 5 minutes after application of sealant.**

- Install cylinder head cover immediately and hand-tighten all attachment bolts.

Bank 1:

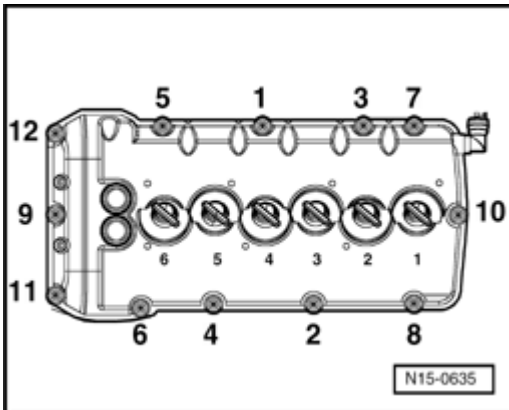


Fig. 60: Attachment Bolts Tightening Sequence (Bank 1)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Tighten attachment bolts in tightening sequence as shown. Tightening specification: 10 Nm

Bank 2:

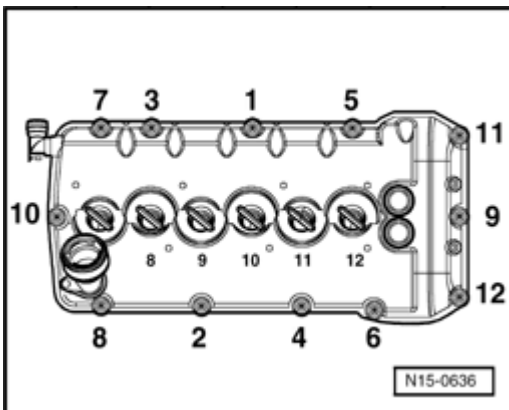


Fig. 61: Attachment Bolts Tightening Sequence (Bank 2)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Tighten attachment bolts in tightening sequence as shown. Tightening specification: 10 Nm

Banks 1 and 2:

The rest of assembly is basically a reverse of disassembling sequence.

Cylinder Head, Removing and installing

Cylinder Head, Removing and installing

(Work procedure only possible with engine removed) --> **Engine, Removing and Installing.**

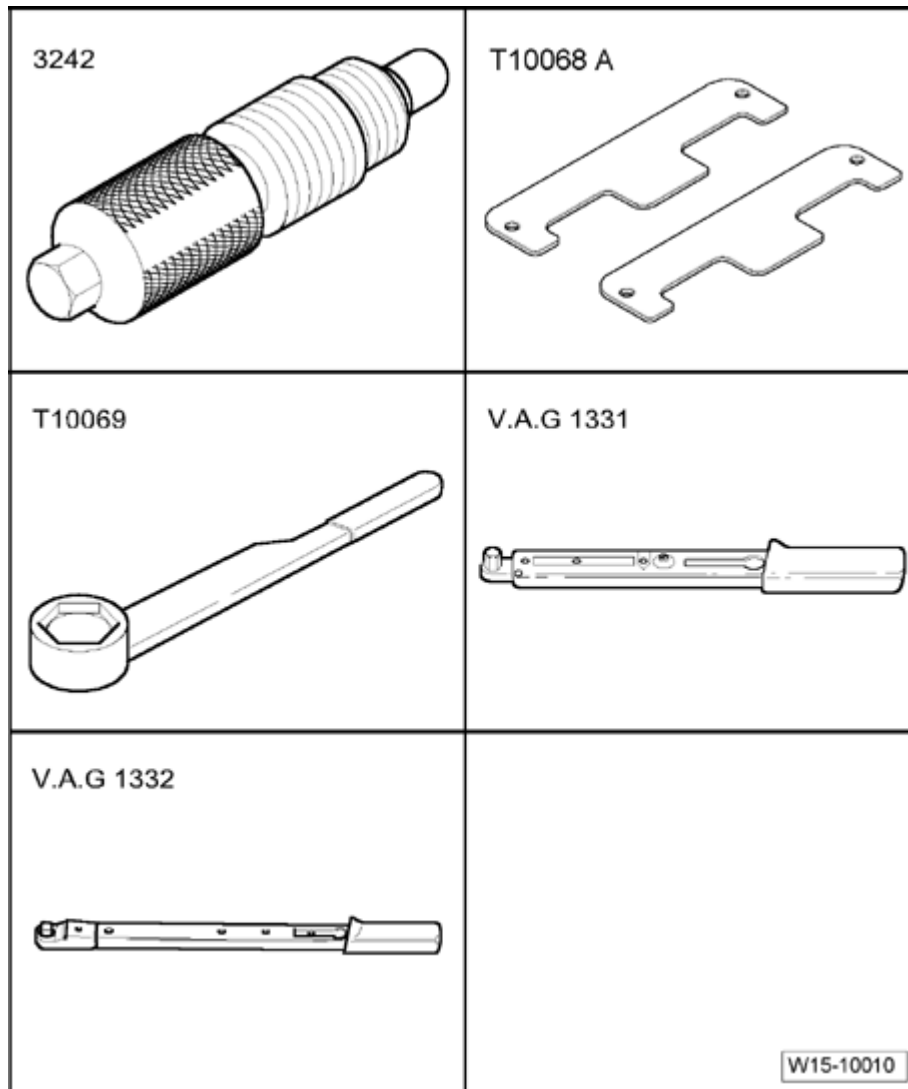


Fig. 62: Identifying Special Tools - Cylinder Head, Removing And Installing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools, testers and auxiliary items required

- Locking pin 3242
- Camshaft bar T10068 A
- Counter-holder tool T10069

- Torque wrench (5 to 50 Nm) V.A.G 1331
- Torque wrench (40 to 200 Nm) V.A.G 1332

Removing

- Remove engine --> **Engine, Removing and Installing.**
- For engine code BRP, remove intake manifold upper part --> **Intake Manifold Upper Section, Engine Code BRP, Assembly Overview.**
- For engine code BAP, remove upper and lower part of intake manifold --> **Intake Manifold, Engine Code BAP, Assembly Overview.**
- Remove ignition coils with power output stage --> **Ignition Coils with Power Output Stages, Removing and Installing.**
- Disconnect hose for crankshaft housing ventilation from cylinder head covers.
- Remove fuel rail with fuel injectors --> **Fuel Rail with Fuel Injectors, Assembly Overview.**
- With engine code BRP, remove lower part of intake manifold --> **Intake Manifold Lower Section, Engine Code BRP, Assembly Overview.**

NOTE:

- **Seal the intake channels in cylinder head using a clean rag.**

- Remove connection.
- Remove cylinder head covers --> **Cylinder Head Cover, Removing and Installing.**
- Remove catalytic converters at exhaust manifold from cylinder heads of all cylinder banks.

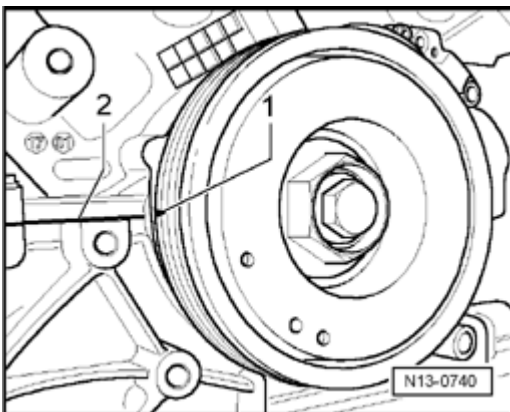


Fig. 63: Identifying Marking Aligns With Partition Of Cylinder Block
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Turn crankshaft to set cylinder 1 at TDC.

Marking - 1 - must align with partition of cylinder block - 2 -.

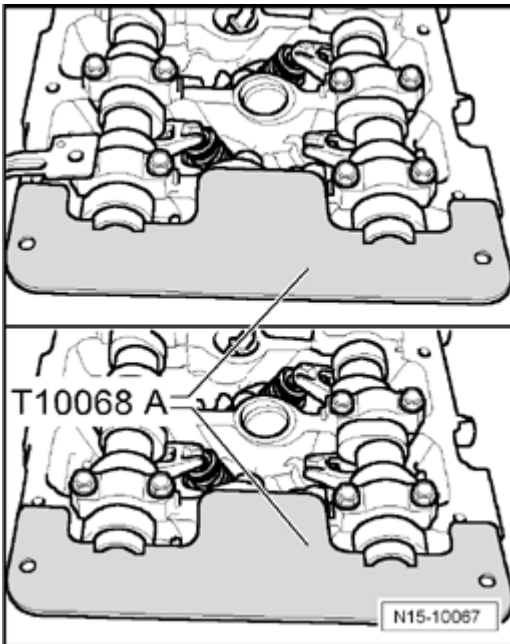


Fig. 64: Inserting Camshaft Bar T10068 A Into Both Shaft Grooves
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- It must be possible to insert camshaft bar T10068 A into both shaft grooves.

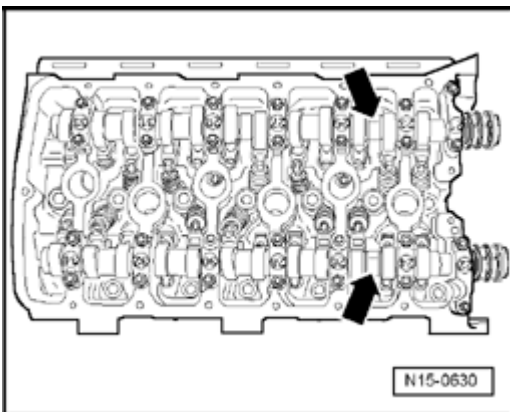


Fig. 65: Identifying Camshafts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

NOTE:

- If necessary, turn camshafts - arrows - slightly in right position using open-end wrench (32 mm).

CAUTION: Do not turn camshafts more than $1/4$ turn when cylinder heads are installed and crankshaft is locked! Valves may strike pistons!

If camshaft bar T10068 A cannot be inserted, turn crankshaft additional rotation in direction of engine. Camshaft bar T10068 A must now be able to be inserted.

- Remove locking bolt from lower left side of cylinder block.

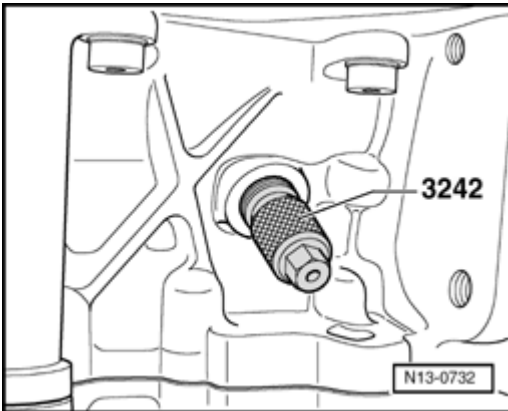


Fig. 66: Crankshaft Holder 3242 - Securing Crankshaft From Turning
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Install crankshaft holder 3242 in bore thus securing crankshaft against turning.

Bank 1:

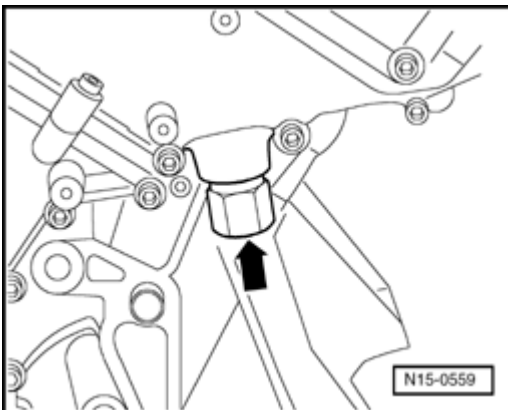


Fig. 67: Camshaft Roller Chain Tensioner
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove chain tensioner for camshaft roller chain - **arrow** -.
- Remove brackets for connectors at cover piece.
- Remove cover piece for camshafts.

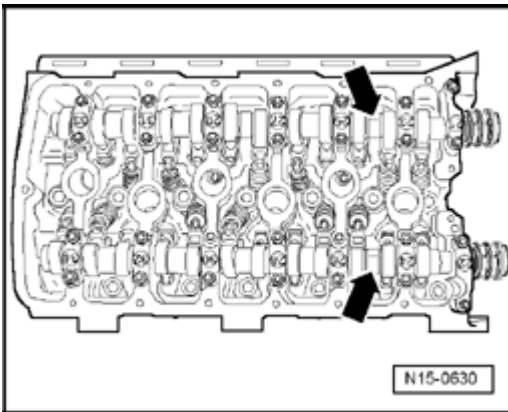


Fig. 68: Identifying Camshafts

Courtesy of VOLKSWAGEN UNITED STATES, INC.

NOTE:

- Only counter-hold at camshaft using open-end wrench (32 mm) - arrows -. Camshaft bar T10068 A must not be inserted when loosening or tightening camshaft adjuster.

- Loosen securing bolts for camshaft adjusters.
- Remove both camshaft adjusters together with camshaft roller chain from camshafts.
- Remove glide track for camshaft roller chain from pivot pins.
- Place camshaft roller chain aside.

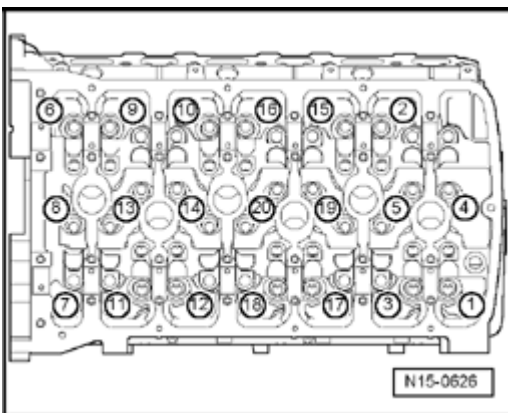


Fig. 69: Loosening/Removing Sequence Of Cylinder Head Bolts

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Loosen and remove cylinder head bolts in specified sequence.
- Carefully lift cylinder head off.
- Stuff clean cloths into cylinder bores so that no dirt or abrasive powder can get between cylinder wall and piston.
- Do not allow dirt or abrasive powder to get into coolant either.
- Carefully clean cylinder head and cylinder block sealing surfaces. Avoid introducing scratches or scoring

(do not use sandpaper with grit below "100")

Bank 2:

- Remove brackets for connectors at cover piece.
- Remove cover piece for camshafts.

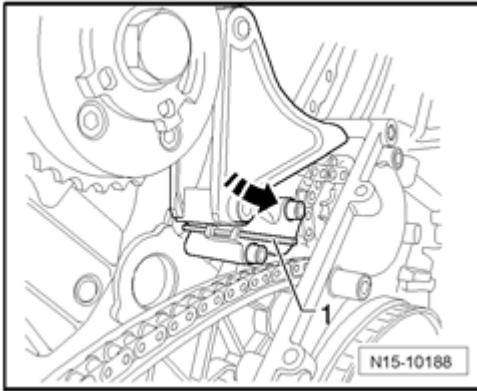


Fig. 70: Pushing Chain Tensioner For Camshaft Roller Chain In And Securing Chain Tensioner
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Push chain tensioner for camshaft roller chain in - **direction of arrow** - and secure chain tensioner - **1** - using drill bit (dia. 3.5 mm).

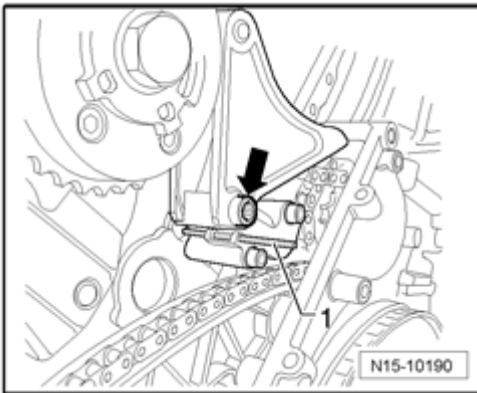
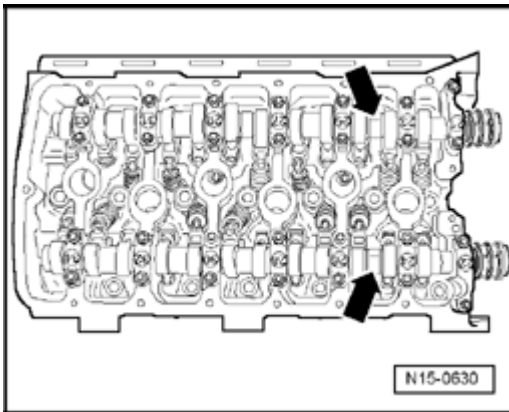


Fig. 71: Loosening Mounting Bolt And Removing Bolt Stop Together With Bolt
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Loosen mounting bolt - **arrow** - and remove bolt stop together with bolt.
- Remove chain tensioner secured with drill bit.
- Swing tensioning track upward and remove from pivot pin.

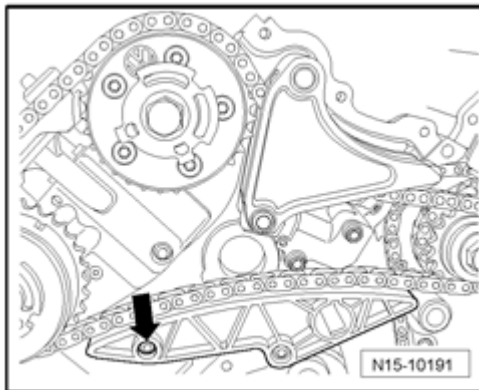
**Fig. 72: Identifying Camshafts**

Courtesy of VOLKSWAGEN UNITED STATES, INC.

NOTE:

- Only counter-hold at camshaft using open-end wrench (32 mm) - arrows -. Camshaft bar T10068 A must not be inserted when tightening or loosening camshaft adjuster.

- Loosen securing bolts for camshaft adjusters.
- Remove both camshaft adjusters together with camshaft roller chain from camshafts.
- Remove pivot pin for glide track - **arrow** - from cylinder head.

**Fig. 73: Identifying Pivot Pin**

Courtesy of VOLKSWAGEN UNITED STATES, INC.

Since the pivot pin has a shoulder, it cannot be removed from glide track.

- Lay aside camshaft roller chain together with tensioning track.

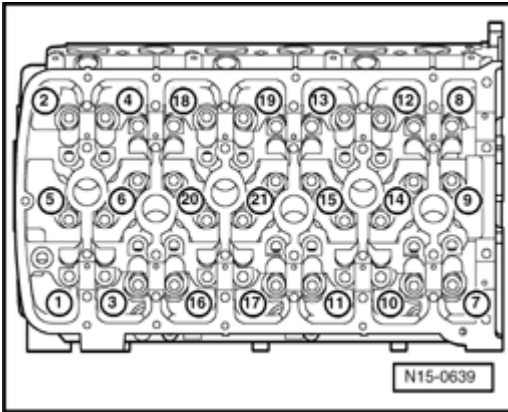


Fig. 74: Loosening/Removing Sequence Of Cylinder Head Bolts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Loosen and remove cylinder head bolts in specified sequence.
- Carefully lift cylinder head off.
- Stuff clean cloths into cylinder bores so that no dirt or abrasive powder can get between cylinder wall and piston.
- Do not allow dirt or abrasive powder to get into coolant either.
- Carefully clean cylinder head and cylinder block sealing surfaces. Avoid introducing scratches or scoring (do not use sandpaper with grit below "100")

Installing

- Carefully remove metal particles, emery remains and cloths.

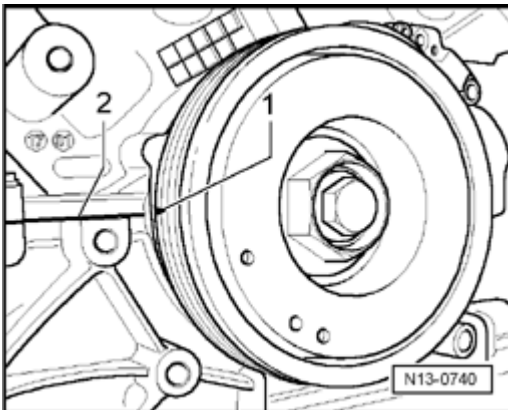


Fig. 75: Identifying Marking Aligns With Partition Of Cylinder Block
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Check whether marking - 1 - aligns with partition of cylinder block - 2 - and crankshaft holder 3242 is still bolted.

Bank 1:

2004 Volkswagen Phaeton

ENGINE 6.0 Liter 12-Cyl. 4V Engine Mechanical, Fuel Injection & Ignition, Engine Code(s): BRP, BAP

NOTE:

- Only remove the new cylinder head gasket from its packing immediately before installing.
- Handle the new gasket with extreme care. Damaging will lead to leaks.

- Install new cylinder head gasket.

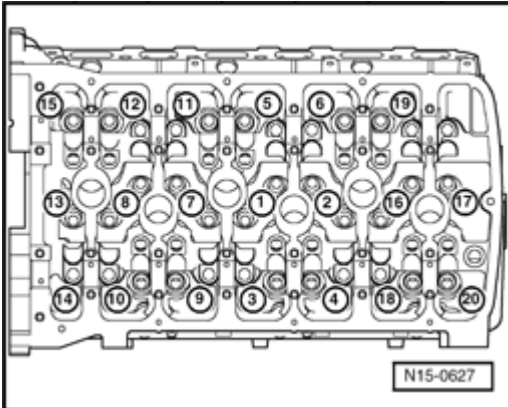


Fig. 76: Identifying Cylinder Head Bolts Tightening/Removal Sequence (Bank 1)

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Make sure centering sleeves in cylinder block bore 19 and 14 are inserted and the cylinder head gasket is secured.

Bank 2:

- Install new cylinder head gasket.

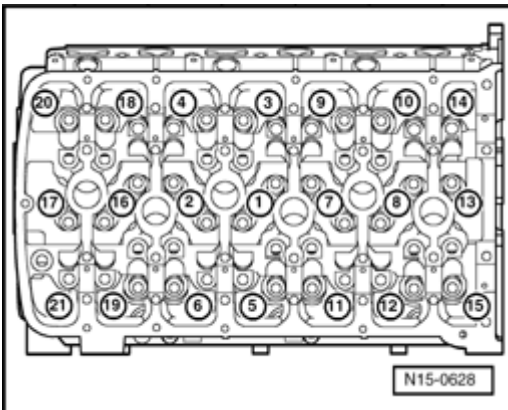


Fig. 77: Identifying Cylinder Head Bolts Tightening/Removal Sequence (Bank 2)

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Make sure centering sleeves in cylinder block bore 10 and 21 are inserted and the cylinder head gasket is secured.

Banks 1 and 2:

- Before installing, adjust camshafts in respective cylinder head to TDC cylinder 1.

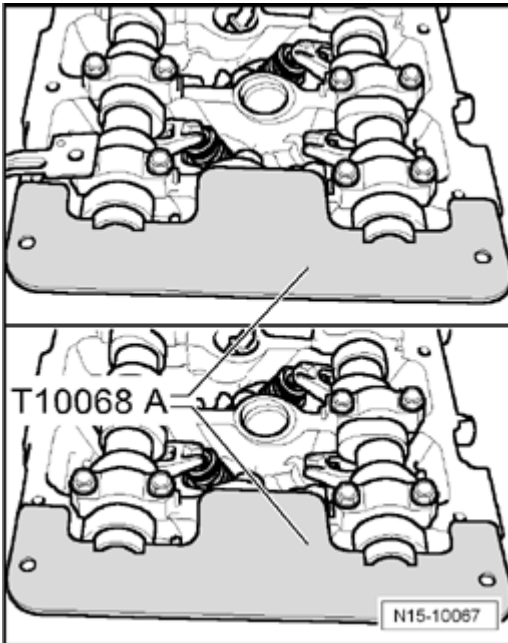


Fig. 78: Inserting Camshaft Bar T10068 A Into Both Shaft Grooves
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Insert camshaft bar T10068 A into both shaft grooves.
- Install cylinder head, insert new cylinder head bolts and hand tighten.

NOTE:

- Only remove camshaft bar T10068 A from shaft grooves when tightening cylinder head bolts and make sure camshafts do not turn.
- The longer cylinder head bolts must be inserted in the middle holes of cylinder head.

Bank 1:

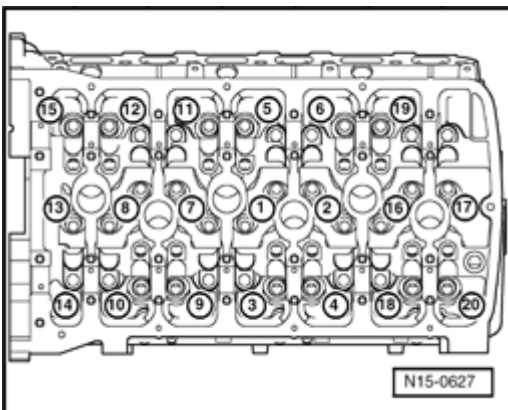
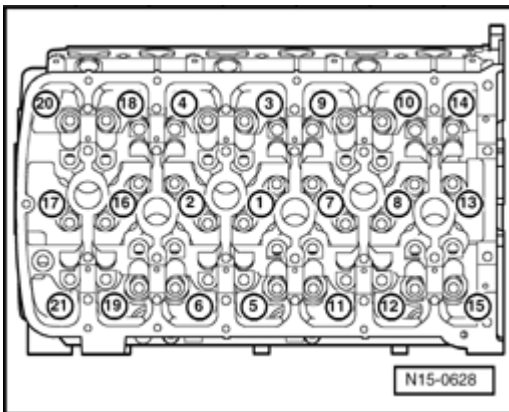


Fig. 79: Identifying Cylinder Head Bolts Tightening/Removal Sequence (Bank 1)

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Tighten cylinder head in tightening sequence as follows:
- Pre-tighten all the bolts to 30 Nm.
- Then tighten all the bolts to 50 Nm.
- Tighten all bolts ($1/4$ turn) (90) further using a rigid wrench.
- Afterwards, tighten all bolts again $1/4$ turn (90) further
- Insert camshaft bar T10068 A into both shaft grooves.

Bank 2:**Fig. 80: Identifying Cylinder Head Bolts Tightening/Removal Sequence (Bank 2)****Courtesy of VOLKSWAGEN UNITED STATES, INC.**

- Tighten cylinder head in tightening sequence as follows:
- Pre-tighten all the bolts to 30 Nm.
- Then tighten all the bolts to 50 Nm.
- Tighten all bolts ($1/4$ turn) (90) further using a rigid wrench.
- Afterwards, tighten all bolts again $1/4$ turn (90) further
- Again, insert camshaft bar T10068 A into both shaft grooves.

Banks 1 and 2:**NOTE:**

- **There is no requirement to retighten the cylinder head bolts after repairs.**

Note that all glide tracks are installed before installing camshaft roller chains.

The rest of the assembly is basically a reverse of the disassembling sequence.

NOTE:

- If a cylinder head of a cylinder bank of an engine that has already run is removed and installed, the position of the copper chain elements of the camshaft roller chains can be disregarded as this position can only be obtained at first installation of chains.
- After adjusting timing, both camshaft bars T10068 A , DTC cyl. 1 of crankshaft, must be able to fit in both shaft grooves of camshafts for cylinder bank 1 and 2.

How to adjust timing --> Chain Drive.

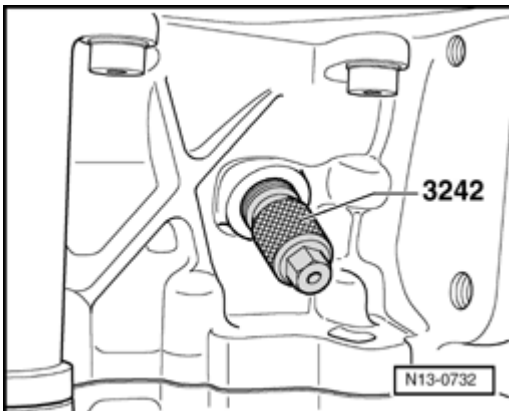


Fig. 81: Crankshaft Holder 3242 - Securing Crankshaft From Turning
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove crankshaft holder 3242.
- Install locking bolt in lower left side of cylinder block.

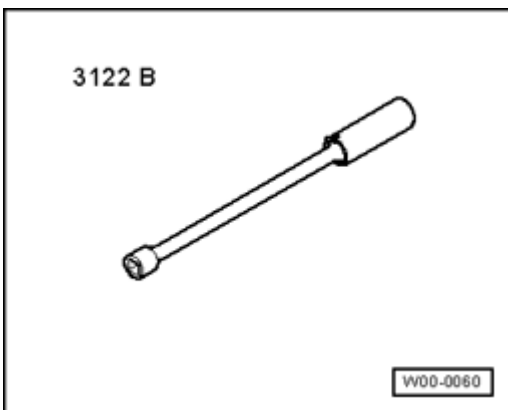
Compression, Checking**Compression, Checking****Special tools, testers and auxiliary items required**

Fig. 82: Identifying Spark Plug Wrench 3122 B

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Spark plug removal tool 3122 B



Fig. 83: Compression Tester V.A.G 1763

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Compression tester V.A.G 1763
- Torque wrench (5 to 50 Nm) V.A.G 1331

Test Conditions

- Engine oil temperature 20 to 30 C.
- The battery voltage must be at least 11.5 Volts.
- All electrical consumers such as, for example, lights and rear window defroster must be switched off.
- If vehicle is equipped with an A/C system, it must be switched off.
- For vehicles with automatic transmission, selector lever must be in position "P" or "N".

Test Sequence

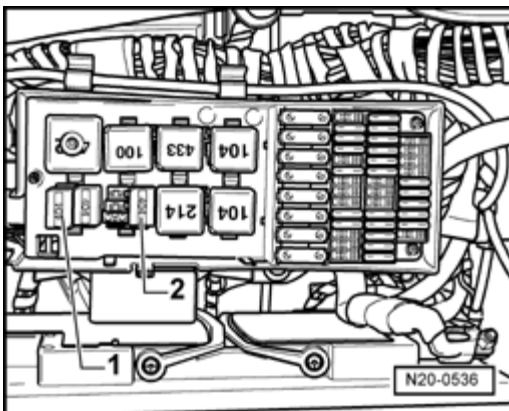


Fig. 84: Fuel Pump Relays, Right And Left Side

Courtesy of VOLKSWAGEN UNITED STATES, INC.

2004 Volkswagen Phaeton

ENGINE 6.0 Liter 12-Cyl. 4V Engine Mechanical, Fuel Injection & Ignition, Engine Code(s): BRP, BAP

- Remove fuel pump (FP) relays - **1** - and - **2** - from position.
- Remove side parts of intake manifold.
- Remove ignition coils with power output stage --> **Ignition Coils with Power Output Stages, Removing and Installing.**
- Remove spark plugs using spark plug removal tool 3122 B.
- Check compression pressure using the compression tester V.A.G 1763.

NOTE:

- **Using the compression tester --> Operating instructions.**

- Operate starter until tester shows no further pressure increase.

Compression Pressure

New: 10 to 13 bar positive pressure.

Wear limit: 9 bar pressure

Permissible difference between all cylinders: 3 bar

After test is completed:

- Connect Vehicle Diagnosis and Service System VAS 5052.
- Perform vehicle system test "Guided Fault Finding".
- End vehicle system test so that DTC entries, created during repair work, can be automatically erased.
- Generate readiness code in conjunction with a road test.

Observe safety precautions that apply to road tests.

- Then, perform vehicle system test again and repair malfunctions, if necessary.

CHAIN DRIVE

Chain Drive

Chain Drive

--> **Chain Drive, Engine Code BAP, Component Overview**

--> **Chain Drive, Engine Code BRP, Component Overview**

--> **Valve Timing, Engine Code BAP, Adjusting**

--> **Valve Timing, Engine Code BRP, Adjusting**

NOTE:

- Cylinder bank 1 is located on right side in direction of travel.
- Cylinder bank 2 is located on left side in direction of travel.
- Disassembling and assembling intake manifold --> Intake Manifold, Engine Code BAP, Assembly Overview , or --> Intake Manifold Upper Section, Engine Code BRP, Assembly Overview.
- Removal and installation of cover pieces is described in respective work procedure "Adjusting timing"

Chain Drive, Engine Code BAP, Component Overview

Chain Drive, Engine Code BAP, Component Overview

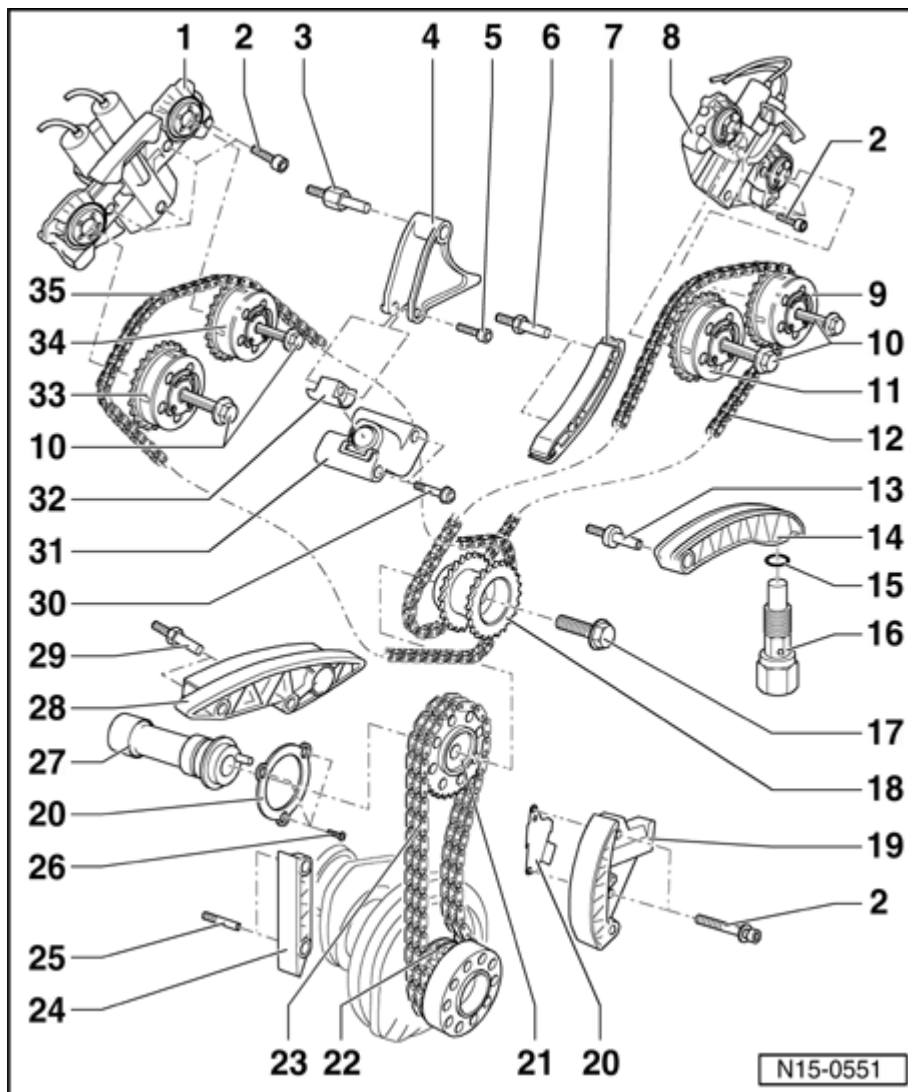


Fig. 85: Chain Drive, Engine Code BAP, Component Overview
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Control housing

- Cylinder bank 2
- Lightly lubricate contact surfaces of oil seals before installing
- Removing and installing --> **Camshafts, Removing and Installing.**
- Disassembling and assembling --> **Disassembling and Assembling Control Housing:**

2 - 8 Nm

3 - Pivot pin, 18 Nm

4 - Tensioning rail

5 - 20 Nm

6 - Pivot pin, 18 Nm

7 - Guide rail

8 - Control housing

- Cylinder bank 1
- Lightly lubricate contact surfaces of oil seals before installing
- Removing and installing --> **Camshafts, Removing and Installing.**
- Disassembling and assembling --> **Disassembling and Assembling Control Housing:**

9 - Exhaust camshaft adjuster

- Cylinder bank 1
- Identification: B1 and A9
- With alignment pin, can only be mounted in one position on camshaft
- Only rotate engine with camshaft adjuster installed
- Installing --> **Valve Timing, Engine Code BAP, Adjusting.**

10 - 60 Nm + $\frac{1}{4}$ turn (90)

- Replace
- Contact surface of sensor wheel at bolt head must be dry when installing
- To remove and install, counter-hold at camshaft using an open-end spanner (32 mm)

11 - Intake camshaft adjuster

- Cylinder bank 1
- Identification: B1 and A2

- With alignment pin, can only be mounted in one position on camshaft
- Only rotate engine with camshaft adjuster installed
- Installing --> **Valve Timing, Engine Code BAP, Adjusting.**

12 - Camshaft roller chain

- Cylinder bank 1
- Mark direction of rotation before removing (installation position) --> **Roller Chain, Marking**
- Installing --> **Valve Timing, Engine Code BAP, Adjusting.**

13 - Pivot pin, 12 Nm**14 - Tensioning rail**

- To remove, rear sealing flange must be removed

15 - Seal

- Replace if damaged or leaking

16 - Chain tensioner, 40 Nm

- Only rotate engine with chain tensioner installed

17 - 60 Nm + $\frac{1}{4}$ turn (90)

- Replace
- Use counter-holder tool T10069 for loosening and tightening --> **Valve Timing, Engine Code BAP, Adjusting.**

18 - Chain sprocket

- Installing --> **Valve Timing, Engine Code BAP, Adjusting.**

19 - Chain tensioner with tensioning rail

- Secure chain tensioner using drill bit (dia. 3.5 mm)
- Only rotate engine with chain tensioner installed

20 - Securing plate**21 - Chain sprocket**

- Installing --> **Valve Timing, Engine Code BAP, Adjusting.**

22 - Drive gear

- Integral part of crankshaft

23 - Roller chain

- Mark direction of rotation before removing (installation position) --> **Roller Chain, Marking.**
- Installing --> **Valve Timing, Engine Code BAP, Adjusting.**

24 - Guide rail

25 - Locating pin without collar, 10 Nm

26 - 10 Nm

- Insert using **locking fluid D 000 600 A2**

27 - Intermediate shaft

28 - Guide rail

- To remove, rear sealing flange must be removed

29 - Pivot pin, 10 Nm

30 - 9 Nm

31 - Chain tensioner

- Secure chain tensioner using drill bit (dia. 3.5 mm)
- Only rotate engine with chain tensioner installed

32 - Limit stop

33 - Exhaust camshaft adjuster

- Cylinder bank 2
- Identification: B2 and A9
- With alignment pin, can only be mounted in one position on camshaft
- Only rotate engine with camshaft adjuster installed
- Installing --> **Valve Timing, Engine Code BAP, Adjusting.**

34 - Intake camshaft adjuster

- Cylinder bank 2

2004 Volkswagen Phaeton

ENGINE 6.0 Liter 12-Cyl. 4V Engine Mechanical, Fuel Injection & Ignition, Engine Code(s): BRP, BAP

- Identification: B2 and A2
- With alignment pin, can only be mounted in one position on camshaft
- Only rotate engine with camshaft adjuster installed
- Installing --> **Valve Timing, Engine Code BAP, Adjusting.**

35 - Camshaft roller chain

- Cylinder bank 2
- Mark direction of rotation before removing (installation position) --> **Roller Chain, Marking.**
- Installing --> **Valve Timing, Engine Code BAP, Adjusting.**

Chain Drive, Engine Code BRP, Component Overview

Chain Drive, Engine Code BRP, Component Overview

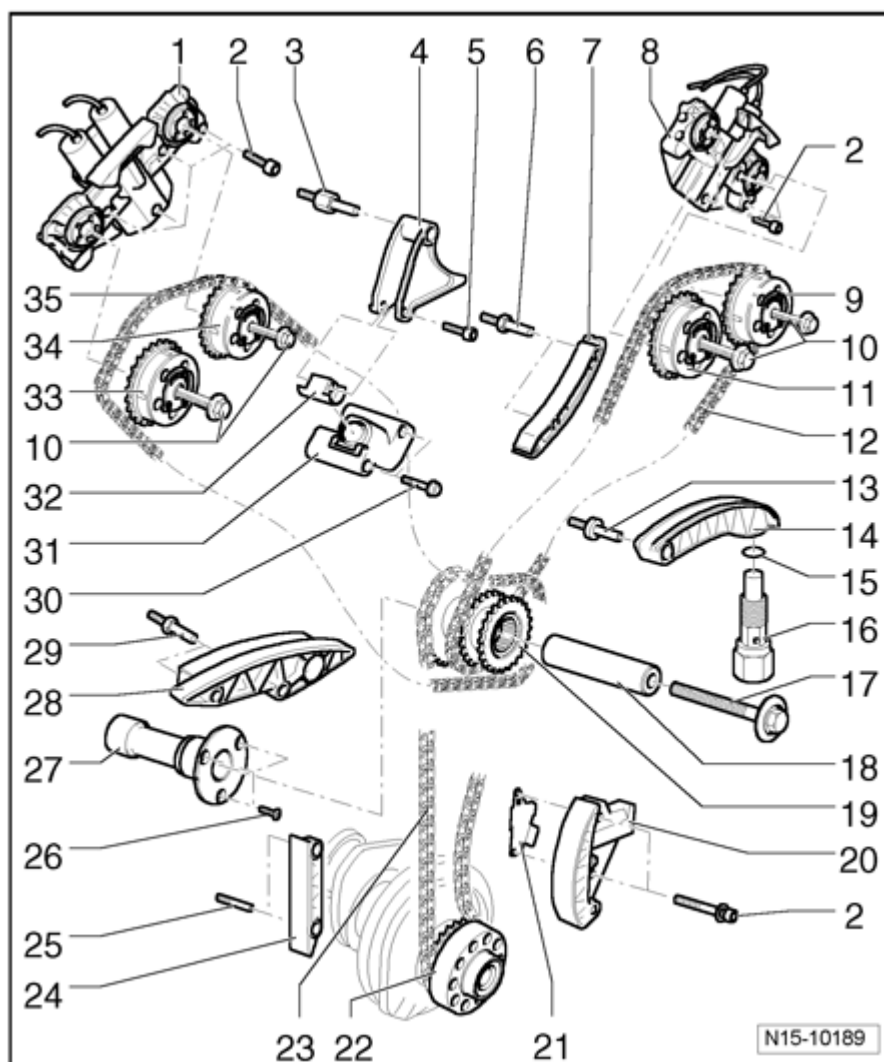


Fig. 86: Chain Drive, Engine Code BRP, Component Overview
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Control housing

- Cylinder bank 2
- Lightly lubricate contact surfaces of oil seals before installing
- Removing and installing --> **Camshafts, Removing and Installing.**
- Disassembling and assembling --> **Disassembling and Assembling Control Housing:**

2 - 8 Nm

3 - Pivot pin, 18 Nm

4 - Tensioning rail

5 - 20 Nm

6 - Pivot pin, 18 Nm

7 - Guide rail

8 - Control housing

- Cylinder bank 1
- Lightly lubricate contact surfaces of oil seals before installing
- Removing and installing --> **Camshafts, Removing and Installing.**
- Disassembling and assembling --> **Disassembling and Assembling Control Housing:**

9 - Exhaust camshaft adjuster

- Cylinder bank 1
- Identification: B1
- With alignment pin, can only be mounted in one position on camshaft
- Only rotate engine with camshaft adjuster installed
- Installing --> **Valve Timing, Engine Code BRP, Adjusting.**

10 - 60 Nm + $\frac{1}{4}$ turn (90)

- Replace
- Contact surface of sensor wheel at bolt head must be dry when installing
- To remove and install, counter-hold at camshaft using an open-end wrench (32 mm) --> **Camshafts, Removing and Installing.**

11 - Intake camshaft adjuster

- Cylinder bank 1
- Identification: B1
- With alignment pin, can only be mounted in one position on camshaft
- Only rotate engine with camshaft adjuster installed
- Installing --> **Valve Timing, Engine Code BRP, Adjusting.**

12 - Camshaft roller chain

- Cylinder bank 1
- Mark direction of rotation before removing (installation position) --> **Roller Chain, Marking.**
- Installing --> **Valve Timing, Engine Code BRP, Adjusting.**

13 - Pivot pin, 12 Nm**14 - Tensioning rail**

- To remove, rear sealing flange must be removed

15 - Seal

- Replace if damaged or leaking

16 - Chain tensioner, 40 Nm

- Only rotate engine with chain tensioner installed

17 - 60 Nm + $\frac{1}{4}$ turn (90)

- With "left thread"
- Replace
- Use counter-holder tool T10069 for loosening and tightening --> **Valve Timing, Engine Code BRP, Adjusting.**

18 - Intermediate shaft

- Coat with engine oil before installing

19 - Chain sprocket

- Installing --> **Valve Timing, Engine Code BRP, Adjusting.**

20 - Chain tensioner with tensioning rail

- Secure chain tensioner using drill bit (dia. 3.5 mm)
- Only rotate engine with chain tensioner installed

21 - Securing plate

22 - Chain sprocket

- Integrated into crankshaft
- Install chain --> **Valve Timing, Engine Code BRP, Adjusting.**

23 - Roller chain

- Mark direction of rotation before removing (installation position) --> **Roller Chain, Marking.**
- Installing --> **Valve Timing, Engine Code BRP, Adjusting.**

24 - Guide rail

25 - Locating pin without collar, 10 Nm

26 - 10 Nm

- Replace

27 - Intermediate shaft

28 - Guide rail

To remove cylinder head, upper pivot pin must be removed from cylinder head

- To remove glide track, rear sealing flange must be removed

29 - Pivot pin, 10 Nm

30 - 9 Nm

31 - Chain tensioner

- Before removal, press chain tensioner together and secure using drill bit (dia. 3.5 mm)
- Only rotate engine with chain tensioner installed

32 - Limit stop

33 - Exhaust camshaft adjuster

- Cylinder bank 2
- Identification: B2

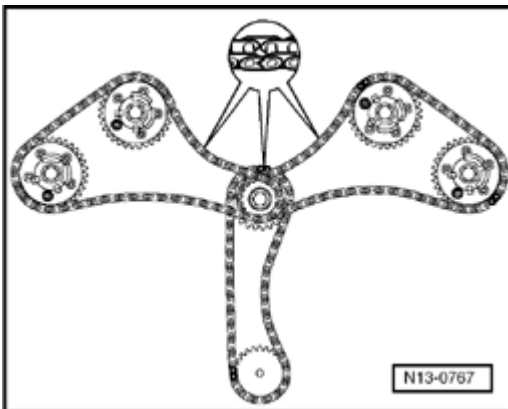
- With alignment pin, can only be mounted in one position on camshaft
- Only rotate engine with camshaft adjuster installed
- Installing --> **Valve Timing, Engine Code BRP, Adjusting.**

34 - Intake camshaft adjuster

- Cylinder bank 2
- Identification: B2
- With alignment pin, can only be mounted in one position on camshaft
- Only rotate engine with camshaft adjuster installed
- Installing --> **Valve Timing, Engine Code BRP, Adjusting.**

35 - Camshaft roller chain

- Cylinder bank 2
- Mark direction of rotation before removing (installation position) --> **Roller Chain, Marking**
- Installing --> **Valve Timing, Engine Code BRP, Adjusting.**

Roller Chain, Marking**Fig. 87: Roller Chain, Marking**

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Mark roller chains before removing (e.g. with paint, arrow pointing in direction of rotation).

NOTE:

- **Do not mark chain using a center punch or similar means!**

Valve Timing, Engine Code BAP, Adjusting**Valve Timing, Engine Code BAP, Adjusting**

(Removing and installing roller chains, only possible with engine removed)

2004 Volkswagen Phaeton

ENGINE 6.0 Liter 12-Cyl. 4V Engine Mechanical, Fuel Injection & Ignition, Engine Code(s): BRP, BAP

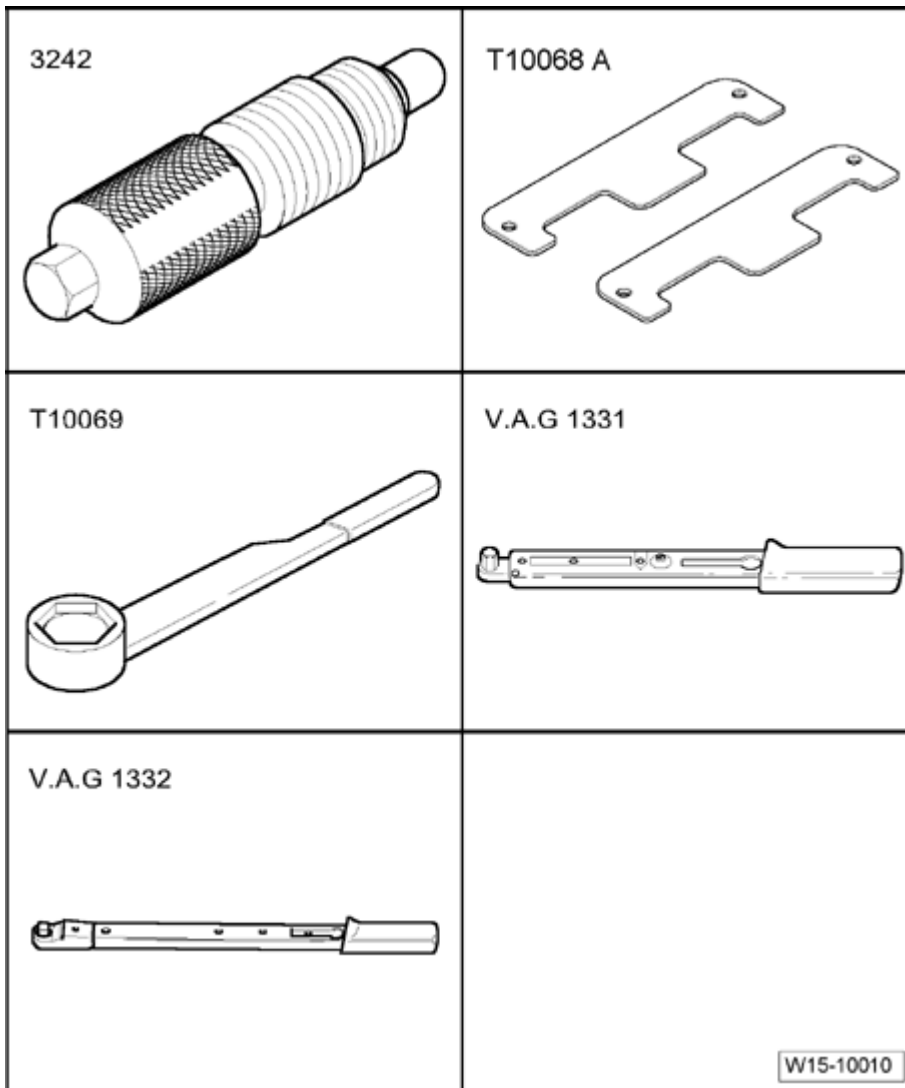


Fig. 88: Identifying Special Tools - Valve Timing, Engine Code BAP, Adjusting
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools, testers and auxiliary items required

- Locking pin 3242
- Camshaft bar T10068 A
- Counter-holder tool T10069
- Torque wrench (5 to 50 Nm) V.A.G 1331
- Torque wrench (40 to 200 Nm) V.A.G 1332
- **Sealant D 176 501**
- Drill bit dia. 3.5 mm

NOTE:

- The following work steps can only be performed with engine removed.

Therefore the adjustment can be started on a specific location depending on the degree of disassembly of the engine.

- Note direction of rotation of used chains --> Roller Chain, Marking.
- Roller chains must run absolutely straight in glide and tensioner tracks.
- Note that all securing bolts for chain sprockets must be replaced.

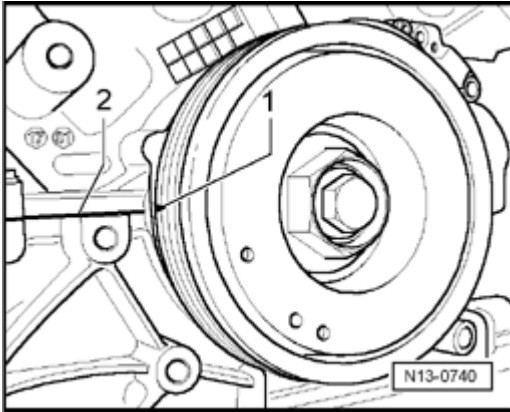


Fig. 89: Identifying Marking Aligns With Partition Of Cylinder Block
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Turn crankshaft to set cylinder 1 at TDC.

Marking - 1 - must align with partition of cylinder block - 2 -.

- Adjust camshafts in cylinder heads to TDC cyl. 1.

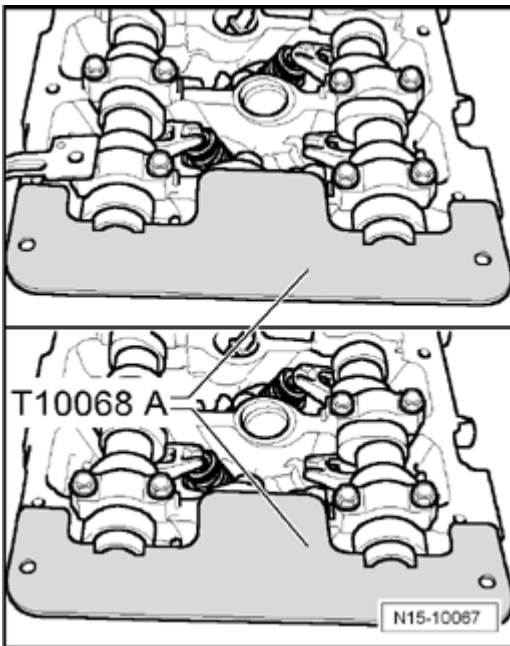


Fig. 90: Inserting Camshaft Bar T10068 A Into Both Shaft Grooves
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- It must be possible to insert camshaft bar T10068 A into both shaft grooves.

NOTE:

- If necessary, turn camshafts slightly in right position using open-end wrench (32 mm). It must be possible to insert camshaft bar T10068 A. If this is not possible, turn crankshaft one revolution further in direction of engine rotation.

CAUTION: Do not turn camshafts more than $\frac{1}{4}$ turn when cylinder heads are installed and crankshaft is locked! Valves may strike pistons!

- Remove locking bolt from lower left side of cylinder block.

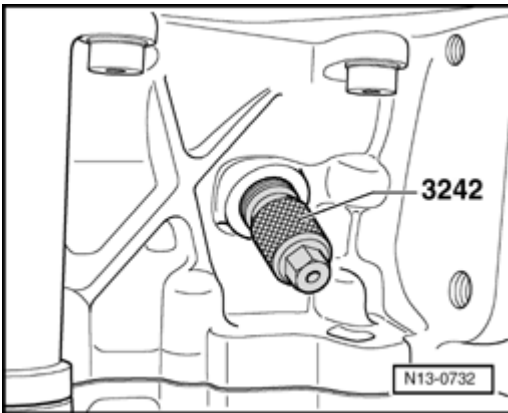


Fig. 91: Crankshaft Holder 3242 - Securing Crankshaft From Turning
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Install crankshaft holder 3242 in bore thus securing crankshaft against turning.

Install Roller Chain (crankshaft/intermediate shaft):

- Install intermediate shaft. Alignment pin for chain sprockets must face upward.
- Install roller chain (crankshaft/intermediate shaft) - 1 - together with chain sprocket for intermediate shaft - 2 -.

Copper chain element - **arrow A** - must align with partition of cylinder block - 3 -.

Copper chain element - **arrow B** - must be at top of intermediate shaft chain sprocket - 2 -.

- Place chain sprocket (intermediate shaft/camshaft adjuster) - 4 - on chain sprocket for intermediate shaft - 2 -.

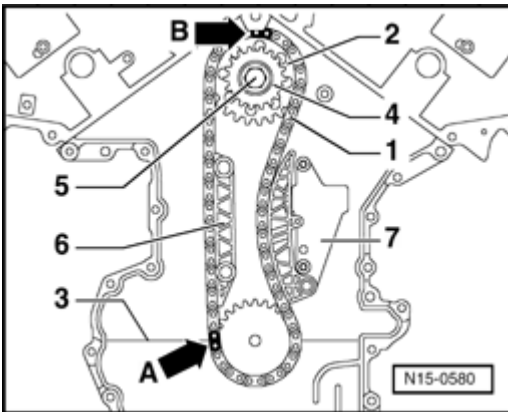


Fig. 92: Installing Roller Chain (Crankshaft/Intermediate Shaft)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Hand-tighten new securing bolt of chain sprockets - 5 -.
- Insert glide track - 6 -.
- Install chain tensioner - 7 - with securing plate. Tightening specification: 8 Nm
- Unlock chain tensioner - 7 -.

Install Roller Chain (intermediate shaft/camshaft adjuster bank 1):

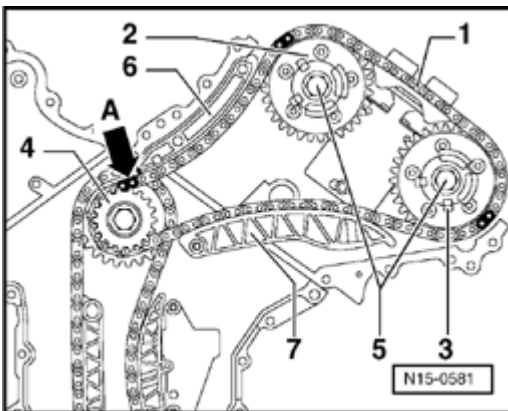


Fig. 93: Identifying Copper Colored Link Of Roller Chain, Guide Rail, Tensioning Rail & Bolts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Install roller chain (intermediate shaft/camshaft adjuster cylinder bank 1) - 1 - together with camshaft adjusters.

2 - Marking of intake camshaft adjuster: B1 and A2

3 - Marking of exhaust camshaft adjuster: B1 and A9

NOTE:

- Camshaft adjusters can be turned in two directions. Before installation, make sure sensor wheel for camshaft position sensor is turned until respective stop.

- **Camshaft adjuster can only be secured to camshaft in one position because of alignment pin. Therefore, if roller chain is installed correctly on camshaft adjuster, camshaft adjuster must be easily bolted on camshaft.**

Intake camshaft adjuster cylinder bank 1

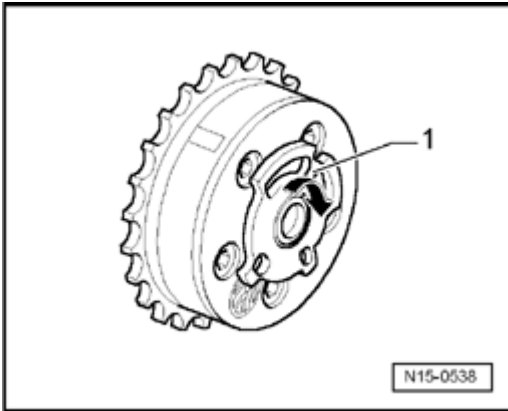


Fig. 94: Turning Sensor Wheel For Camshaft Position Sensor (Intake Camshaft Adjuster Cylinder Bank 1)

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Turn sensor wheel - **1** - for camshaft position sensor in - **direction of arrow** - until stop.

Exhaust camshaft adjuster cylinder bank 1

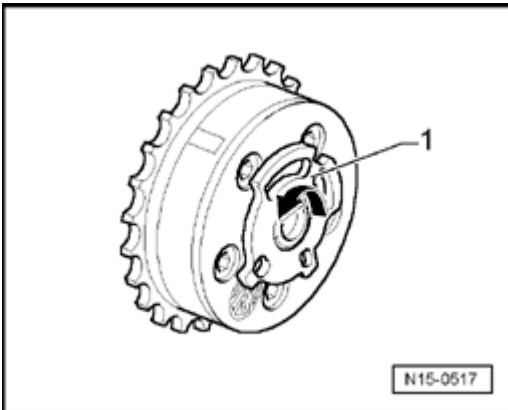


Fig. 95: Turning Sensor Wheel For Camshaft Position Sensor (Exhaust Camshaft Adjuster Cylinder Bank 1)

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Turn sensor wheel - **1** - for camshaft position sensor in - **direction of arrow** - until stop.

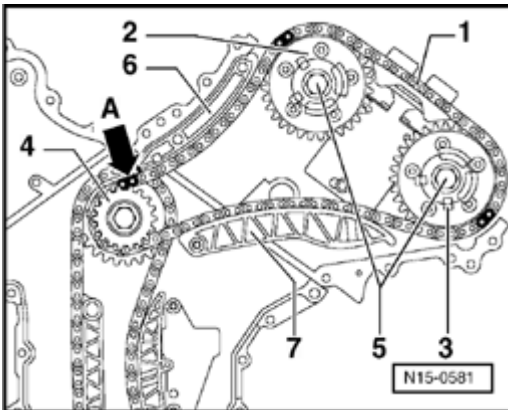


Fig. 96: Identifying Copper Colored Link Of Roller Chain, Guide Rail, Tensioning Rail & Bolts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Copper chain element - **arrow A** - must be at top of intermediate shaft chain sprocket - **4** -.

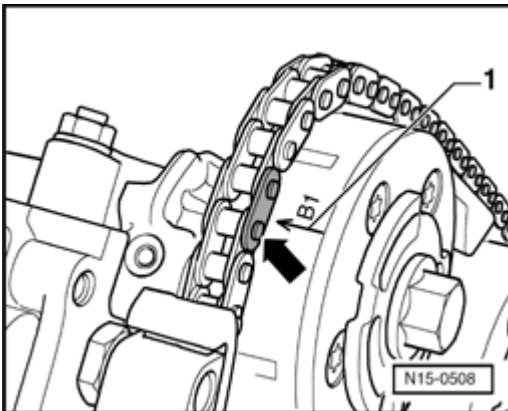


Fig. 97: Aligning Copper Link Of The Camshaft Roller Chain
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Copper element of camshaft roller chain - **arrow** - must align with arrow - **1** - on intake camshaft adjuster.

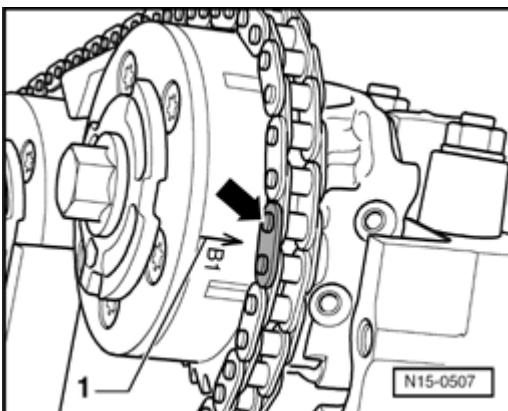


Fig. 98: Aligning Copper Link Of The Camshaft Roller Chain (Cylinder Bank 1, Exhaust Side)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Copper element of camshaft roller chain - **arrow** - must align with arrow - **1** - on intake camshaft adjuster.

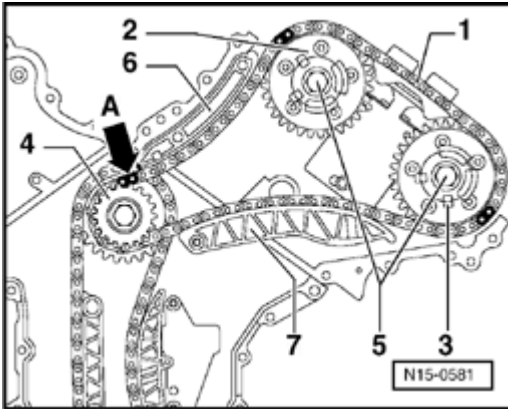


Fig. 99: Identifying Copper Colored Link Of Roller Chain, Guide Rail, Tensioning Rail & Bolts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Hand-tighten new securing bolts of camshaft adjusters - **5** -.
- Insert glide track - **6** -.
- Insert tensioning track - **7** -.

Install Roller Chain (intermediate shaft/camshaft adjuster bank 2):

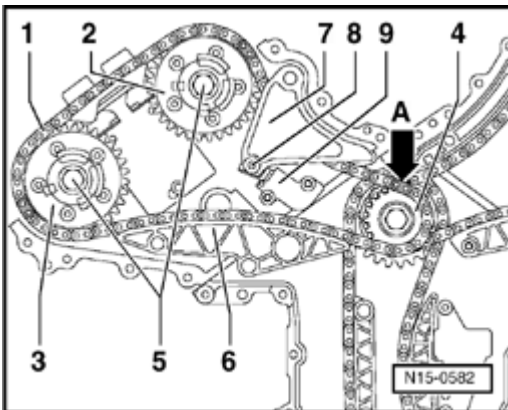


Fig. 100: Identifying Copper Colored Link Of Roller Chain, Guide Rail, Tensioning Rail & Bolts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Install roller chain (intermediate shaft/camshaft adjuster cylinder bank 2) - **1** - together with camshaft adjusters.

2 - Marking of intake camshaft adjuster: B2 and A2

3 - Marking of exhaust camshaft adjuster: B2 and A9

NOTE:

- **Camshaft adjusters can be turned in two directions. Before installation, make sure sensor wheel for camshaft position sensor is turned until**

respective stop.

- **Camshaft adjuster can only be secured to camshaft in one position because of alignment pin. Therefore, if roller chain is installed correctly on camshaft adjuster, camshaft adjuster must be easily bolted on camshaft.**

Intake camshaft adjuster cylinder bank 2

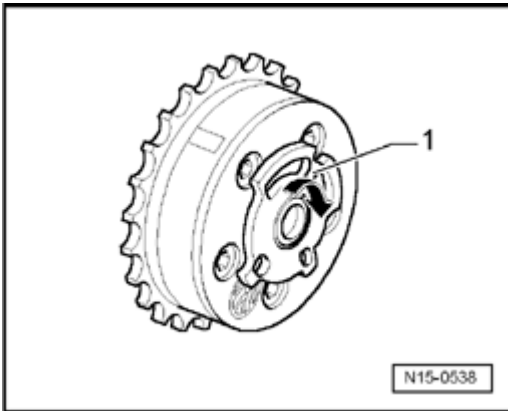


Fig. 101: Turning Sensor Wheel For Camshaft Position Sensor (Intake Camshaft Adjuster Cylinder Bank 1)

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Turn sensor wheel - **1** - for camshaft position sensor in - **direction of arrow** - until stop.

Exhaust camshaft adjuster cylinder bank 2

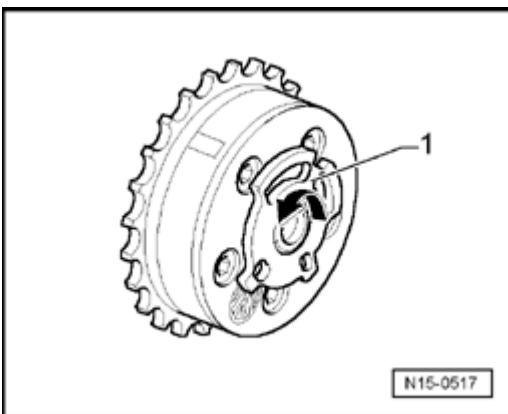


Fig. 102: Turning Sensor Wheel For Camshaft Position Sensor (Exhaust Camshaft Adjuster Cylinder Bank 1)

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Turn sensor wheel - **1** - for camshaft position sensor in - **direction of arrow** - until stop.

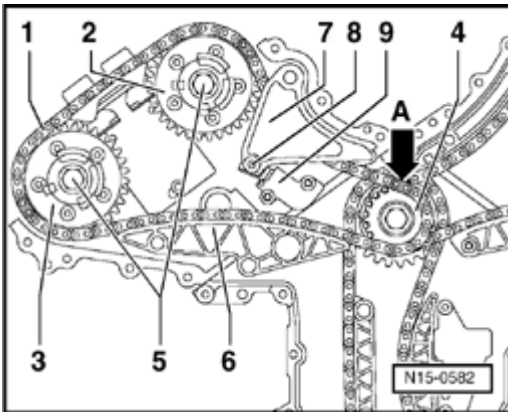


Fig. 103: Identifying Copper Colored Link Of Roller Chain, Guide Rail, Tensioning Rail & Bolts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Copper chain element - **arrow A** - must be at top of intermediate shaft chain sprocket - **4** -.

NOTE:

- Copper elements of camshaft roller chain of cylinder bank 2 are visible from rear.

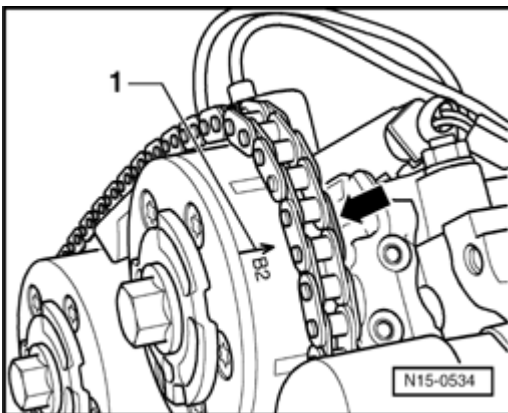


Fig. 104: Aligning Copper Link Of Camshaft Roller Chain (Cylinder Bank 2, Intake Side)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Copper element of camshaft roller chain - **arrow** - must align with arrow - **1** - on intake camshaft adjuster.

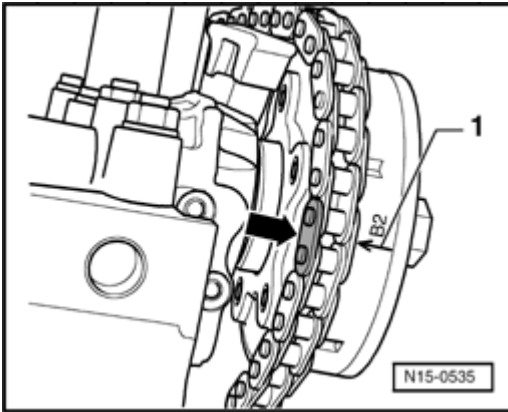


Fig. 105: Aligning Copper Link Of Camshaft Roller Chain (Cylinder Bank 2, Exhaust Side)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Copper element of camshaft roller chain - **arrow** - must align with arrow - **1** - on intake camshaft adjuster.

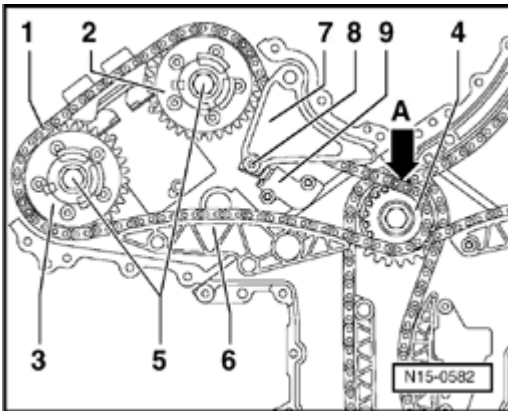


Fig. 106: Identifying Copper Colored Link Of Roller Chain, Guide Rail, Tensioning Rail & Bolts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Hand-tighten new securing bolts of camshaft adjusters - **5** -.
- Insert glide track - **6** -.
- Insert tensioning track - **7** -.
- Install chain tensioner stop - **8** -. Tightening specification: 20 Nm
- Install chain tensioner - **9** -. Tightening specification: 9 Nm
- Unlock chain tensioner - **9** -.

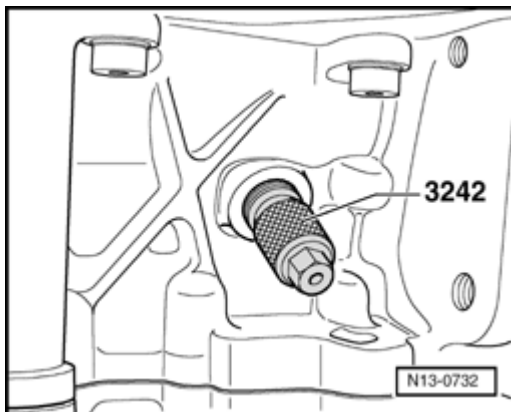


Fig. 107: Crankshaft Holder 3242 - Securing Crankshaft From Turning
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove crankshaft holder 3242.
- Install locking bolt into cylinder block. Tightening specification: 20 Nm
- Remove camshaft bar T10068 A.

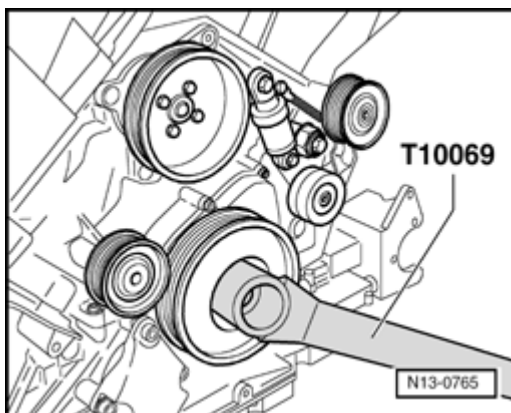


Fig. 108: Loosening/Tightening Securing Bolt, Lock Vibration Damper Using Counter-Holder Tool T10069

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Lock vibration damper using counter-holder tool T10069.

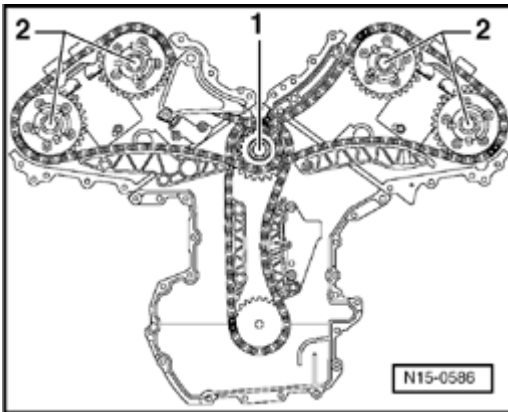


Fig. 109: Identifying Securing Bolt For Intermediate Shaft Chain Sprocket & Camshaft Timing Adjusters

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Tighten the intermediate shaft chain sprocket mounting bolt - **1** - to $60 + 90$ ($1 \frac{1}{4}$ turn).

NOTE:

- Only counter-hold at camshaft using open-end wrench (32 mm) - arrows - . Camshaft bar T10068 A must not be inserted when tightening or loosening camshaft adjuster.

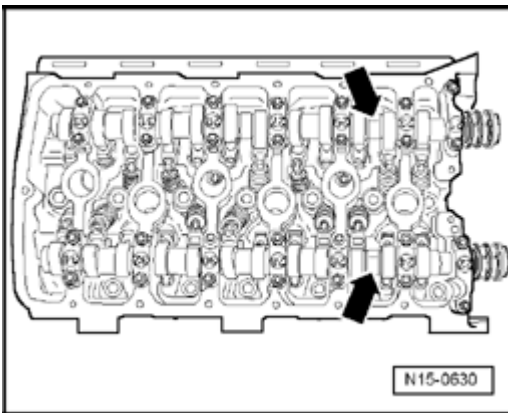


Fig. 110: Identifying Camshafts

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Counter hold camshafts.

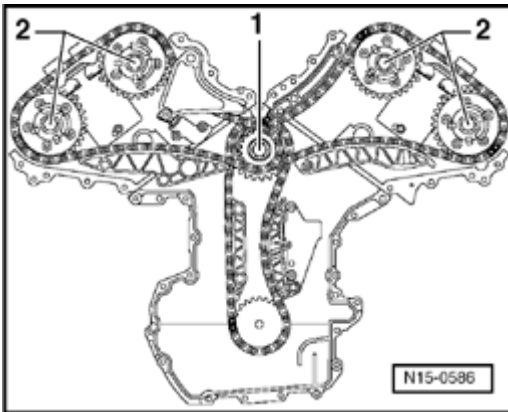


Fig. 111: Identifying Securing Bolt For Intermediate Shaft Chain Sprocket & Camshaft Timing Adjusters

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Tighten securing bolts of camshaft adjusters - 2 - to 60 Nm + 90 ($1 \frac{1}{4}$ turn), additional turning may occur in several stages.
- Replace gasket in drive plate sealing flange --> **Crankshaft Seal, Drive Plate Side, Removing and Installing**
- Coat sealing surface of sealing flange with **Sealant D 176 501** and install it.

Install Cover Piece (banks 1 and 2):

NOTE:

- Note expiration date of sealant.

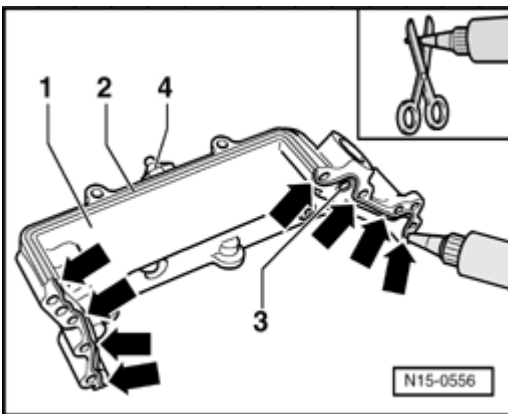


Fig. 112: Installing Cover (Cylinder Banks 1 And 2)

Courtesy of VOLKSWAGEN UNITED STATES, INC.

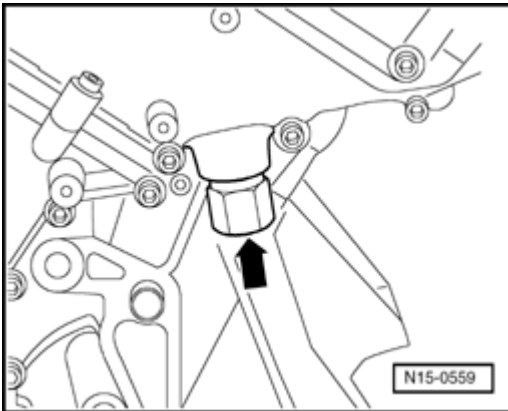
- Clean sealing surfaces and sealing groove - 2 - in cover piece - 1 - and sealing surface of drive plate sealing flange. They must be free of oil and grease.
- Lubricate O-ring for oil channel seal - 3 - (only cylinder bank 1) and insert into cover piece - 1 -.
- Cut tube nozzle of **sealant D 176 501** at front marking (nozzle dia. approximately 2 mm).

- Apply **sealant** onto clean sealing surface of cover piece to cylinder head and onto sealing surface to rear sealing flange - **2** -. The sealing compound bead must be:
 - Be approximately 2 mm thick
 - Run on inside of bolt holes - **arrows** -

NOTE:

- **The cover piece must be installed within 5 minutes after application of sealant.**

- Attach cover piece immediately, insert all securing bolts and lightly tighten:
- Tighten securing bolts of cover piece/sealing flange first. Tightening specification: 8 Nm
- Tighten securing bolts of cover piece/cylinder head from center toward outside in diagonal sequence. Tightening specification: 8 Nm
- Remove excess sealant.

Bank 1:**Fig. 113: Camshaft Roller Chain Tensioner**

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Install chain tensioner for camshaft roller chain - **arrow** -. Tightening specification: 40 Nm

Banks 1 and 2:

- Install cylinder head cover --> Cylinder Head Cover, Removing and Installing.

Valve Timing, Engine Code BRP, Adjusting**Valve Timing, Engine Code BRP, Adjusting**

(Removing and installing roller chains, only possible with engine removed)

2004 Volkswagen Phaeton

ENGINE 6.0 Liter 12-Cyl. 4V Engine Mechanical, Fuel Injection & Ignition, Engine Code(s): BRP, BAP

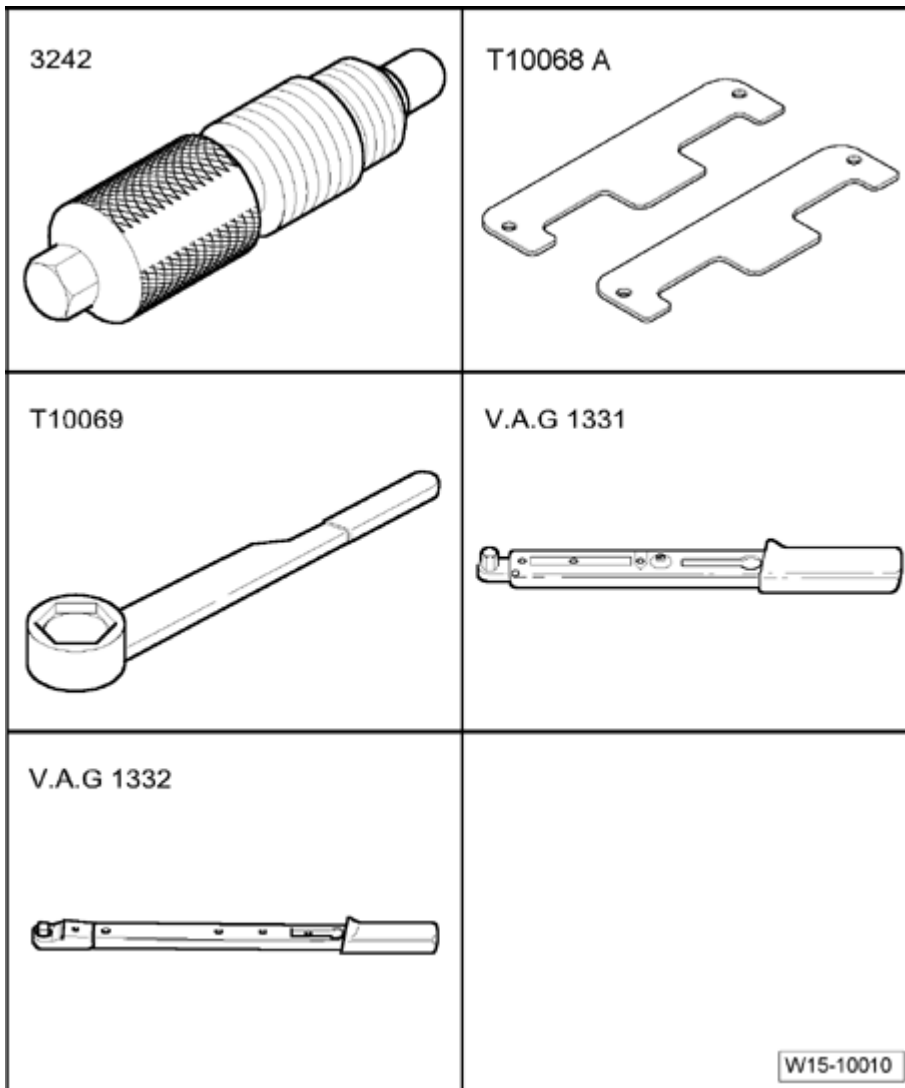


Fig. 114: Identifying Special Tools - Valve Timing, Engine Code BRP, Adjusting
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools, testers and auxiliary items required

- Locking pin 3242
- Camshaft bar T10068 A
- Counter-holder tool T10069
- Torque wrench (5 to 50 Nm) V.A.G 1331
- Torque wrench (40 to 200 Nm) V.A.G 1332
- **Sealant D 176 501**
- Drill bit dia. 3.5 mm

NOTE:

- The following work steps can only be performed with engine removed.

Therefore the adjustment can be started on a specific location depending on the degree of disassembly of the engine.

- Note direction of rotation of used chains --> Roller Chain, Marking.
- Roller chains must run absolutely straight in glide and tensioner tracks.
- Note that all securing bolts for chain sprockets must be replaced.

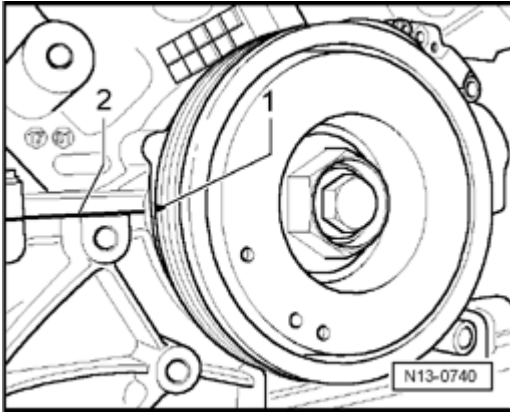


Fig. 115: Identifying Marking Aligns With Partition Of Cylinder Block
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Turn crankshaft to set cylinder 1 at TDC.

Marking - 1 - must align with partition of cylinder block - 2 -.

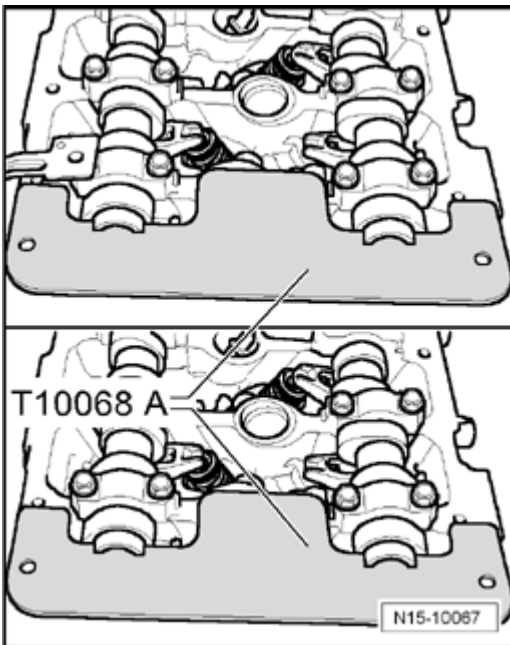
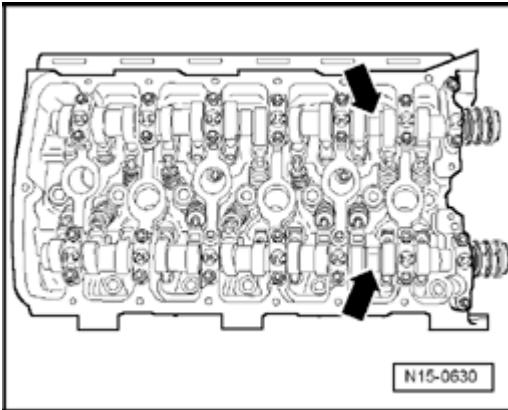


Fig. 116: Inserting Camshaft Bar T10068 A Into Both Shaft Grooves
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- It must be possible to insert camshaft bar T10068 A into both shaft grooves.

**Fig. 117: Identifying Camshafts**

Courtesy of VOLKSWAGEN UNITED STATES, INC.

NOTE:

- If necessary, turn camshafts - arrows - slightly in right position using open-end wrench (32 mm).

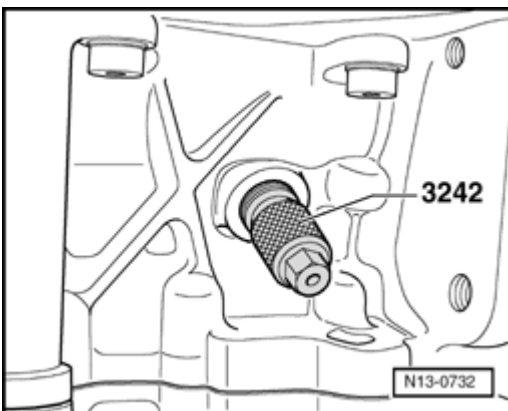
CAUTION: Do not turn camshafts more than $\frac{1}{4}$ turn when cylinder heads are installed and crankshaft is locked! Valves may strike pistons!

If camshaft bar T10068 A cannot be inserted, turn crankshaft additional rotation in direction of engine. Camshaft bar T10068 A must now be able to be inserted.

NOTE:

- Camshaft bars T10068 A must be inserted in shaft grooves during the entire work procedure.

- Remove locking bolt from lower left side of cylinder block.

**Fig. 118: Crankshaft Holder 3242 - Securing Crankshaft From Turning**

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Install crankshaft holder 3242 in bore thus securing crankshaft against turning.

Install Intermediate Shaft:

If intermediate shaft was removed:

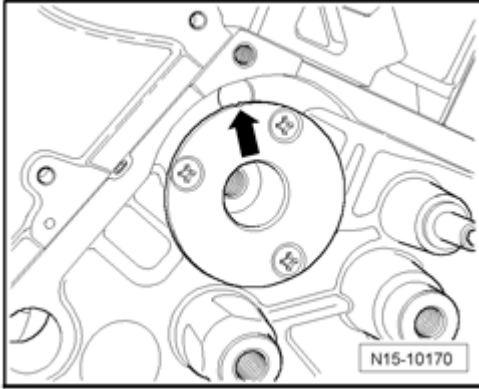


Fig. 119: Installing Intermediate Shaft Mount With Notch At Top
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Install the intermediate shaft mount with the notch at the top - **arrow** - and tighten the new bolts to 15 Nm.

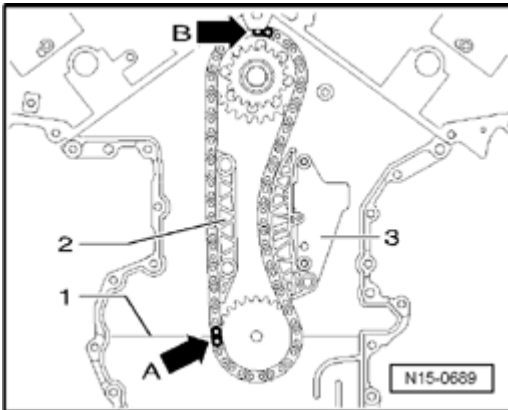
Install Roller Chain (crankshaft/intermediate shaft):

Fig. 120: Identifying Copper Colored Link Of Roller Chain, Guide Rail & Chain Tensioner
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Copper chain element - **arrow A** - must align with partition of cylinder block - **1** -.

- Copper chain element - **arrow B** - must be at top of intermediate shaft chain sprocket - **1** - at marking.

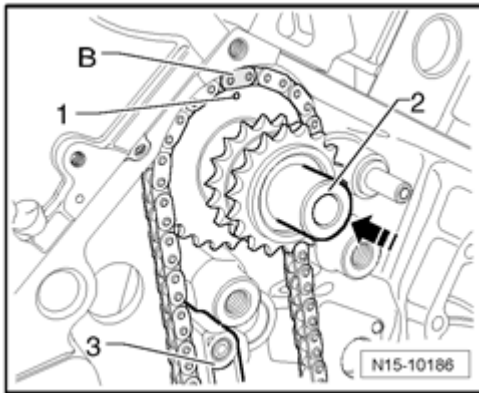


Fig. 121: Identifying Glide Track & Intermediate Shaft
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- If roller chain runs parallel to glide track - 3 - , intermediate shaft - 2 - must be able to slide in - **direction of arrow** - .

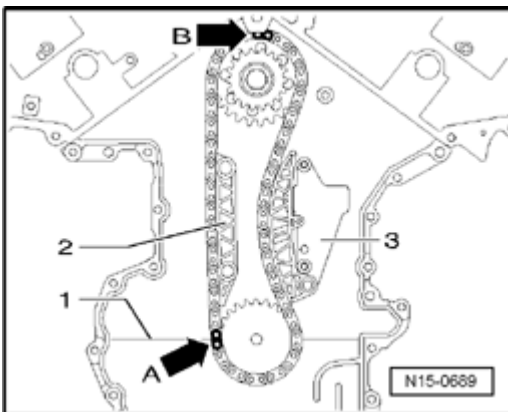


Fig. 122: Identifying Copper Colored Link Of Roller Chain, Guide Rail & Chain Tensioner
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Install chain tensioner - 3 - with securing plate. Tightening specification: 8 Nm

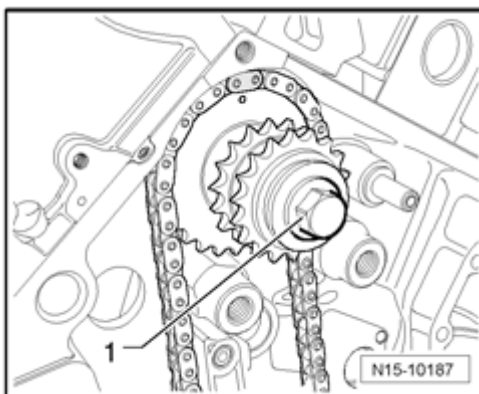


Fig. 123: Hand-Tightening New Securing Bolt Of Intermediate Shaft With "Left Thread"

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Hand-tighten new securing bolt of intermediate shaft with "left thread" - 1 -.

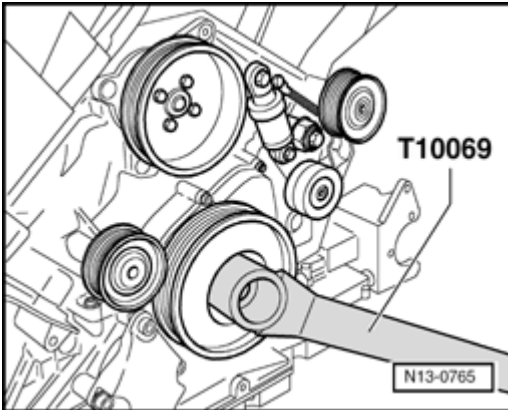


Fig. 124: Loosening/Tightening Securing Bolt, Lock Vibration Damper Using Counter-Holder Tool T10069

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Counter-hold vibration damper with counter-holder tool T10069 , do not turn crankshaft while doing so.
- Tighten the bolt with the "left thread" on the intermediate shaft to 60 Nm + 90 ¹ /₄ additional turn.
- Remove counter-holder tool T10069.

Install Roller Chain (intermediate shaft/camshafts bank 1):

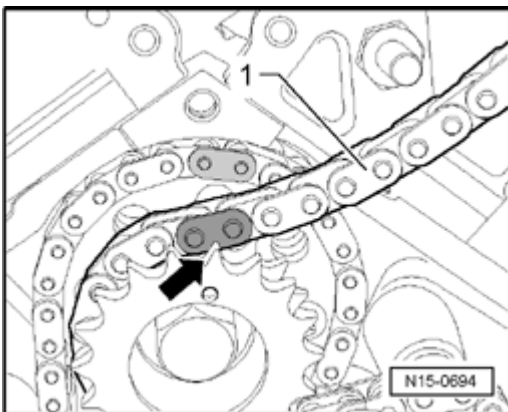


Fig. 125: Installing Roller Chain With First Copper Chain Element Onto Intermediate Shaft So That Both Copper Elements Align

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Install roller chain - 1 - with first copper chain element - **arrow** - onto intermediate shaft so that both copper elements align.

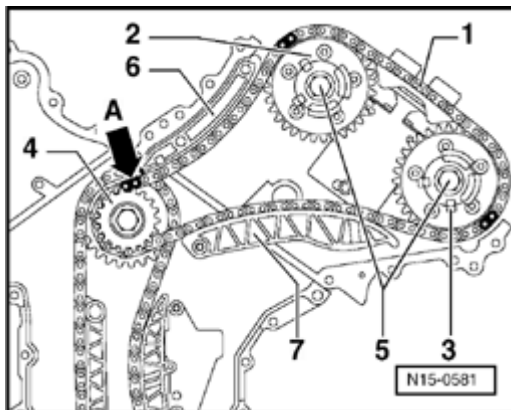


Fig. 126: Identifying Copper Colored Link Of Roller Chain, Guide Rail, Tensioning Rail & Bolts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Install glide track - 6 -.

NOTE:

- Intake camshaft adjuster can be offset in two directions. Before installation, make sure sensor wheel - 1 - for camshaft position sensor is turned until stop.

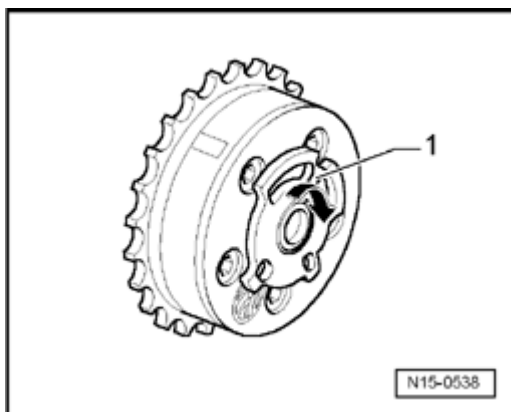


Fig. 127: Turning Sensor Wheel For Camshaft Position Sensor (Intake Camshaft Adjuster Cylinder Bank 1)

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Turn sensor wheel - 1 - in direction of arrow until stop and secure in this position.

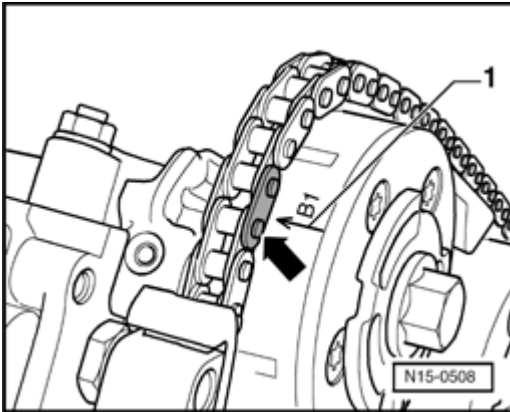


Fig. 128: Aligning Copper Link Of The Camshaft Roller Chain
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Install second copper element of camshaft roller chain - **arrow** - onto adjuster as shown. Marking (arrow) - 1 - on intake camshaft adjuster must align with copper element when doing so.

- Intake camshaft adjuster must now be able to be easily installed onto camshaft and hand-tightened.

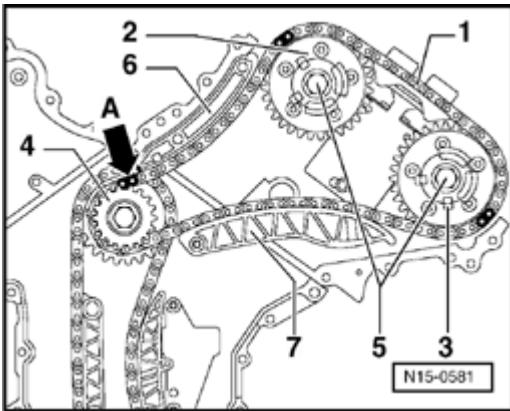


Fig. 129: Identifying Copper Colored Link Of Roller Chain, Guide Rail, Tensioning Rail & Bolts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Both copper elements - **arrow A** - must still align on top of intermediate shaft - 4 - and chain must make contact "tightly" with glide track - 6 -.

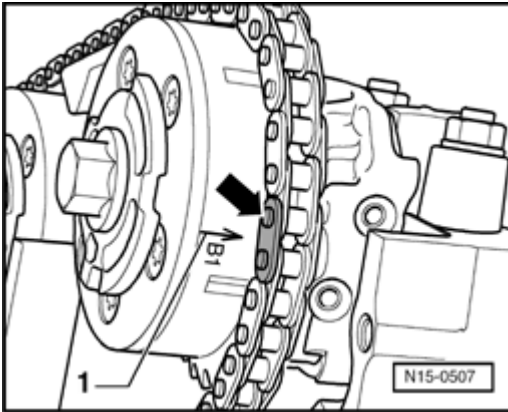


Fig. 130: Aligning Copper Link Of The Camshaft Roller Chain (Cylinder Bank 1, Exhaust Side)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Attach third copper element of camshaft roller chain - **arrow** - onto exhaust camshaft adjuster as shown. It must align with arrow - **1** - marked on exhaust camshaft adjuster. Adjuster must now be able to be easily installed onto camshaft and hand-tightened.

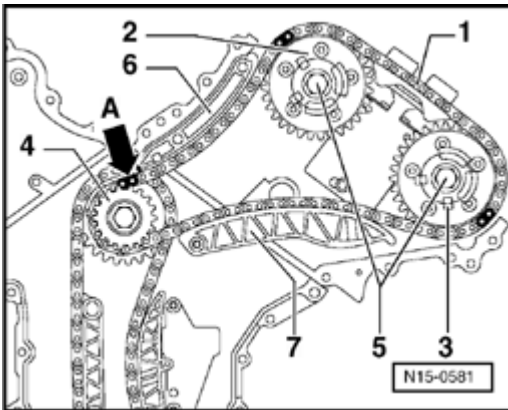


Fig. 131: Identifying Copper Colored Link Of Roller Chain, Guide Rail, Tensioning Rail & Bolts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Insert tensioning track - 7 -.

Install Roller Chain (intermediate shaft/camshafts bank 2):

NOTE:

- Three copper chain elements of roller chain for cylinder bank 2 that is to be installed now are only visible from rear.

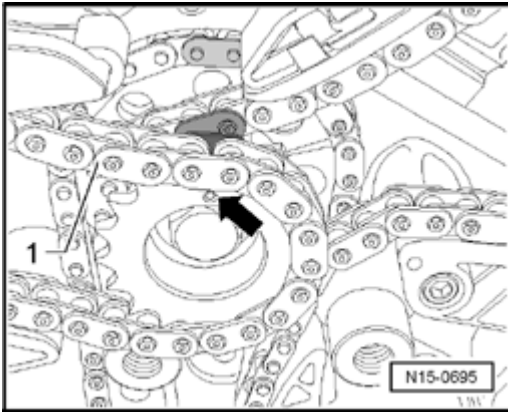


Fig. 132: Installing Roller Chain With First Copper Chain Element Onto Intermediate Shaft So That All Three Copper Elements Align

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Install roller chain - 1 - with first copper chain element onto intermediate shaft so that all three copper elements align - arrow -.

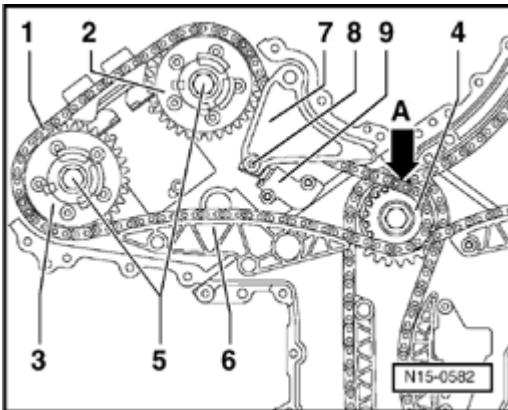


Fig. 133: Identifying Copper Colored Link Of Roller Chain, Guide Rail, Tensioning Rail & Bolts

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Install glide track - 6 -. Guide chain "tightly" from intermediate shaft over glide track.

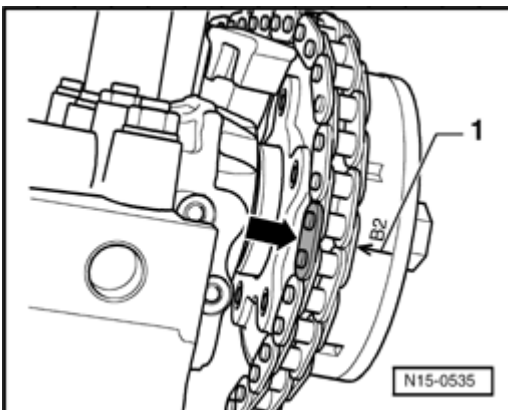


Fig. 134: Aligning Copper Link Of The Camshaft Roller Chain (Cylinder Bank 2, Exhaust Side)

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Attach second copper chain element - **arrow** - onto marked tooth "B2" of exhaust camshaft adjuster - **1** -. Adjuster must now be able to be easily installed onto exhaust camshaft and hand-tightened.

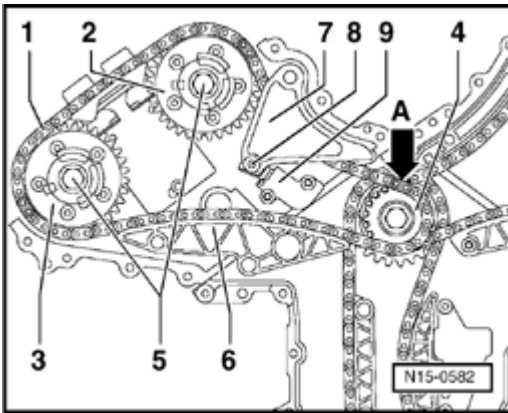


Fig. 135: Identifying Copper Colored Link Of Roller Chain, Guide Rail, Tensioning Rail & Bolts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Make sure that roller chain - **1** - runs tightly over glide track - **6** - and does not sag anywhere.
- Install intake camshaft adjuster cylinder bank 2 as follows:

NOTE:

- Intake camshaft adjuster can be offset in two directions. Before installation, make sure sensor wheel - **1** - for camshaft position sensor is turned until stop.

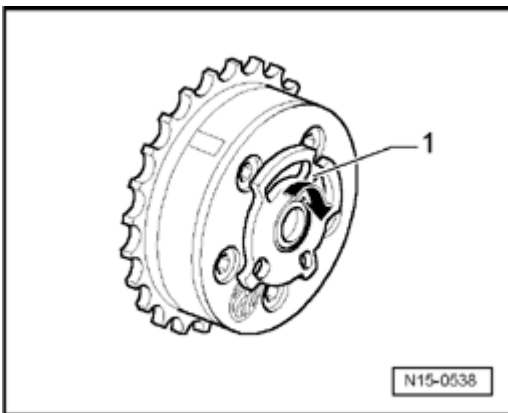


Fig. 136: Turning Sensor Wheel For Camshaft Position Sensor (Intake Camshaft Adjuster Cylinder Bank 1)

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Turn sensor wheel - **1** - for camshaft position sensor in - **direction of arrow** - until stop and secure in this position.

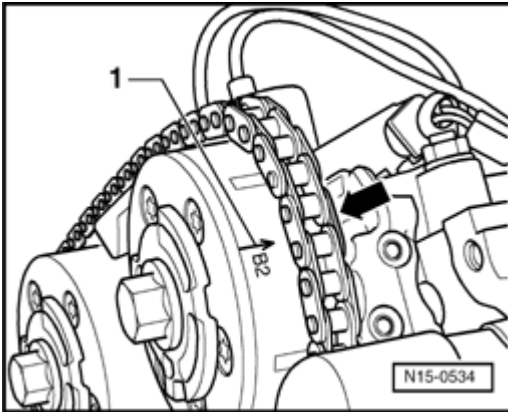


Fig. 137: Aligning Copper Link Of The Camshaft Roller Chain (Cylinder Bank 2, Intake Side)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Attach copper chain element - **arrow** - onto marked tooth "B2" of intake camshaft adjuster - **1** -. Adjuster must now be able to be easily installed onto intake camshaft and hand-tightened.

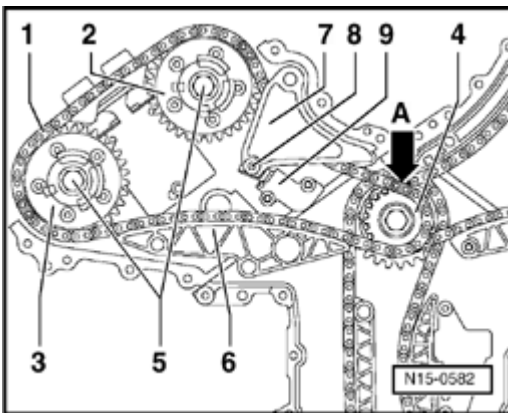


Fig. 138: Identifying Copper Colored Link Of Roller Chain, Guide Rail, Tensioning Rail & Bolts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Attach tensioning lever - **7** - onto its guide pin.
- Install chain tensioner stop in tensioning lever - **arrow** -. Tightening specification: 20 Nm

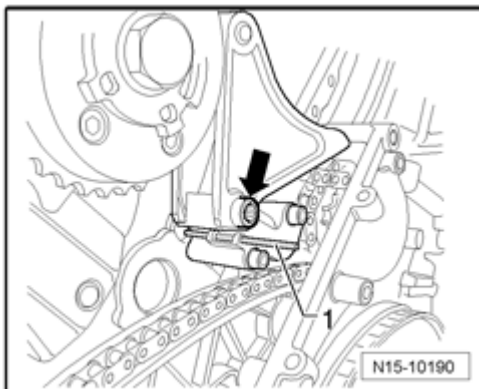


Fig. 139: Loosening Mounting Bolt And Removing Bolt Stop Together With Bolt
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Install still secured chain tensioner - **1** -. Tightening specification: 9 Nm

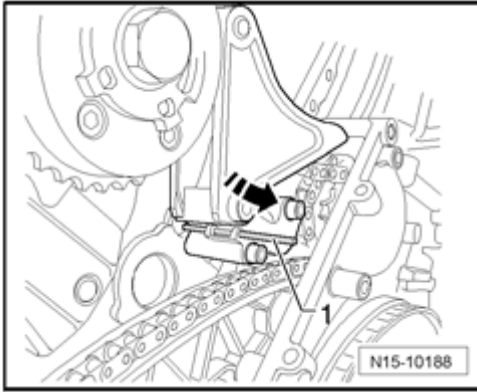


Fig. 140: Pushing Chain Tensioner For Camshaft Roller Chain In And Securing Chain Tensioner
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Press tensioning lever in - **direction of arrow** - and unlock chain tensioner - **1** - by pulling out drill bit.
- Check all copper chain elements for correct position again.
- Remove camshaft bar T10068 A.

Tighten camshaft adjuster:

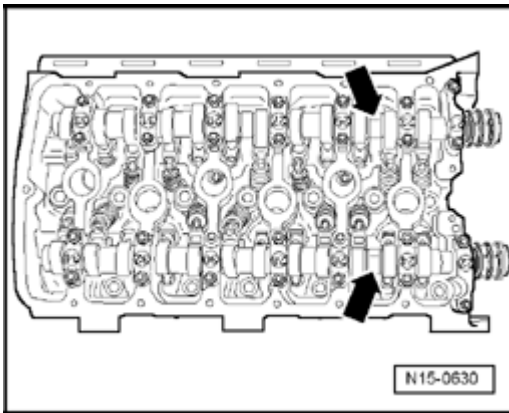


Fig. 141: Identifying Camshafts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

NOTE:

- Only counter-hold at respective camshaft using open-end wrench (32 mm) - **arrows** -. Camshaft bar T10068 A must not be inserted when tightening or loosening camshaft adjuster.

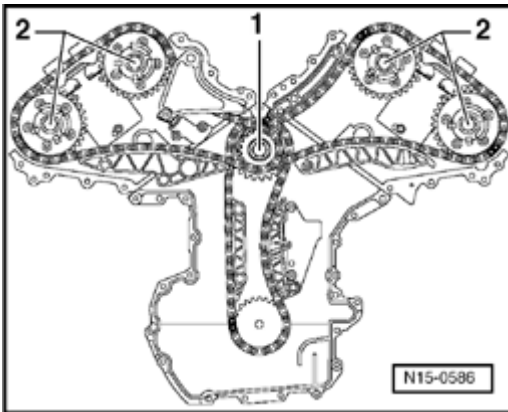


Fig. 142: Identifying Securing Bolt For Intermediate Shaft Chain Sprocket & Camshaft Timing Adjusters

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Tighten all four camshaft adjuster mounting bolts - 2 - to 60 Nm + 90 ($1 \frac{1}{4}$ turn, additional turn may be done in several stages).

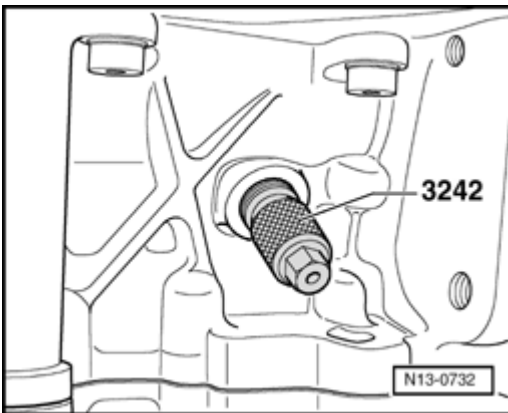


Fig. 143: Crankshaft Holder 3242 - Securing Crankshaft From Turning

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove crankshaft holder 3242 from cylinder block.
- Install locking bolt into cylinder block. Tightening specification: 20 Nm
- Replace seal for crankshaft - drive plate side --> **Crankshaft Seal, Drive Plate Side, Removing and Installing.**
- Install sealing flange for drive plate.

Install Cover Piece (banks 1 and 2):

NOTE:

- **Note the expiration date of the sealing compound.**

- Clean sealing surfaces in cover piece - 1 - and sealing surface of drive plate sealing flange. They must be free of oil and grease.

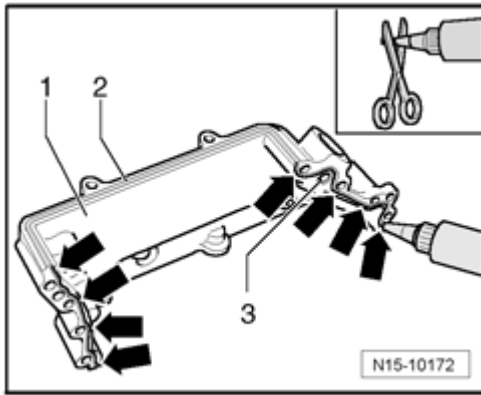


Fig. 144: Applying Onto Clean Sealing Surface Of Cover Piece To Cylinder Head And Onto Sealing Surface To Rear Sealing Flange

Courtesy of VOLKSWAGEN UNITED STATES, INC.

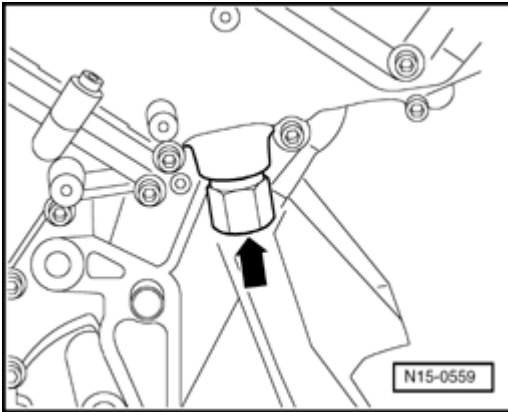
- Cut tube nozzle of **sealant D 176 501** at front marking (nozzle dia. approximately 2 mm).
- Apply **sealant** onto clean sealing surface of cover piece to cylinder head and onto sealing surface to rear sealing flange - **2** -. The sealing compound bead must be:
 - Be approximately 2 mm thick
 - Run on inside of bolt holes - **arrows** -
- Lubricate O-ring for oil channel seal - **3** - (only cylinder bank 1) and insert into cover piece - **1** -.

NOTE:

- **The cover piece must be installed within 5 minutes after application of sealant.**

- Attach cover piece immediately, insert all securing bolts and lightly tighten:
- Tighten securing bolts of cover piece/sealing flange first. Tightening specification: 8 Nm
- Tighten securing bolts of cover piece/cylinder head from center toward outside in diagonal sequence. Tightening specification: 8 Nm
- Remove excess sealant.

Bank 1:

**Fig. 145: Camshaft Roller Chain Tensioner**

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Install chain tensioner for camshaft roller chain - **arrow** -. Tightening specification: 40 Nm

Banks 1 and 2:

- Install cylinder head cover --> Cylinder Head Cover, Removing and Installing.

VALVETRAIN**Valvetrain****Valvetrain**

--> Valvetrain, Assembly Overview

--> Valve Seats, Refacing

--> Camshaft Adjuster Valves, Removing and Installing

--> Camshafts, Removing and Installing

--> Valve Guides, Checking

--> Valve Stem Seals, Removing and Installing

NOTE:

- Cylinder bank 1 is located on right side in direction of travel.
- Cylinder bank 2 is located on left side in direction of travel.
- Oil all bearing and contact surfaces before assembly work.

Valvetrain, Assembly Overview**Valvetrain, Assembly Overview**

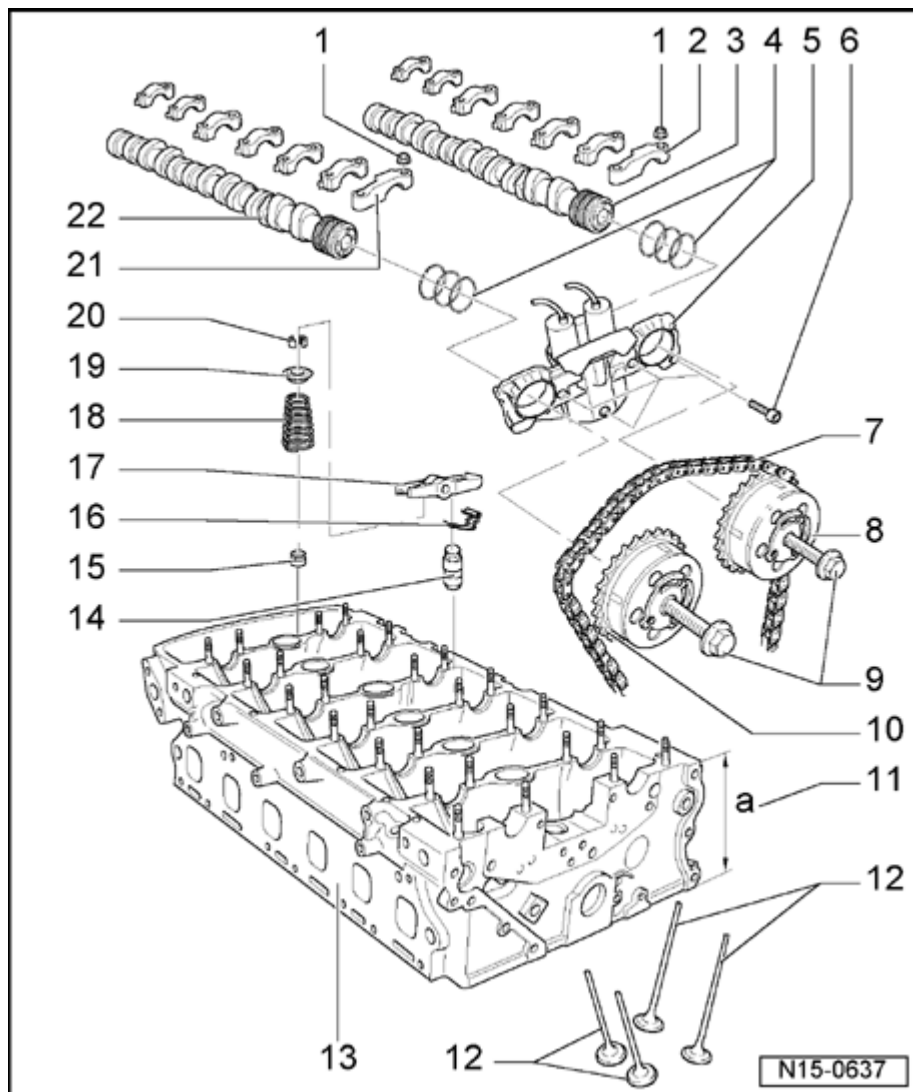


Fig. 146: Valvetrain, Assembly Overview

Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - 5 Nm plus + $\frac{1}{8}$ turn (45)

2 - Intake camshaft bearing cap

- Before installing, lightly coat contact surface of bearing caps using **grease G 052 723 A2** --> **Before installing, lightly coat contact surface of bearing caps using grease G 052 723 A2**

Cylinder bank 1: Bearing cap 7

Cylinder bank 2: Bearing cap 27

- Installation position: Cylinder bank 1 --> **Installation Position Camshaft Bearing Caps, Cylinder Bank 1**

- Installation position: Cylinder bank 2 --> **Installation Position Camshaft Bearing Caps, Bank 2:**
- Installation sequence --> **Camshafts, Removing and Installing.**

3 - Intake camshaft

- Checking radial clearance with Plastigage, Wear limit: 0.1 mm
- Run-out: max. 0.01 mm
- Checking axial play --> **Camshafts, Checking Axial Play**
- Identification: Cylinder bank 1 --> **Camshaft Identification (Bank 1):**
- Identification: Cylinder bank 2 --> **Camshaft Identification (Bank 2):**
- Removing and installing --> **Camshafts, Removing and Installing.**

4 - Seal

- If seal is leaking, replace completely
- Lightly oil contact surface of sealing rings when installing control housing
- Do not spread sealing rings excessively when inserting
- Offset gaps by 120°

5 - Control housing

- Lightly lubricate contact surfaces of oil seals before installing
- Disassembling and assembling --> **Disassembling and Assembling Control Housing:**
- Removing and installing --> **Camshafts, Removing and Installing.**

6 - 8 Nm

7 - Camshaft roller chain

- Mark direction of rotation before removing (installation position)
- Installing --> **Chain Drive.**

8 - Intake camshaft adjuster

- Identification cylinder bank 1: B1
- Identification cylinder bank 2: B2
- Only rotate engine with camshaft adjuster installed
- Installing --> **Chain Drive.**

9 - 60 Nm + $\frac{1}{4}$ turn (90°)

- Replace

- Contact surface of sensor wheel must be dry around bolt head when assembling
- To remove and install, counter-hold at camshaft using an open-end spanner (32 mm) --> **Camshafts, Removing and Installing.**

10 - Exhaust camshaft adjuster

- Identification cylinder bank 1: B1
- Identification cylinder bank 2: B2
- Only rotate engine with camshaft adjuster installed
- Installing --> **Chain Drive.**

11 - Cylinder head height

- Minimum height: a = 139.9 mm

12 - Valves

- Do not rework, only lapping is permitted
- Valve dimensions --> **Valve Dimensions:**

13 - Cylinder head

- Cylinder bank 2
- After replacing replace entire amount of coolant
- See note --> **Valvetrain.**
- Check for distortion --> **Checking Cylinder Head for Distortion**
- Removing and installing --> **Cylinder Head, Removing and installing.**
- Rework valve seats --> **Valve Seats, Refacing.**

14 - Support element

- Before installing, check axial play in camshafts --> **Camshafts, Checking Axial Play**
- Do not interchange
- With hydraulic valve clearance compensation

15 - Valve stem seal

- Replacing --> **Valve Stem Seals, Removing and Installing.**

16 - Securing clip

- Check for secure seat

17 - Roller rocker lever

- Before installing, check axial play in camshafts --> **Camshafts, Checking Axial Play**
- Do not interchange
- Check roller for easy movement
- Lubricate contact surface
- Use securing clip to clip onto support element when installing

18 - Valve spring

- Note installation position
- Removing and installing --> **Valve Stem Seals, Removing and Installing.**

19 - Valve spring plate

20 - Valve keepers

21 - Exhaust camshaft bearing cap

- Before installing, lightly coat contact surface of bearing caps using grease G 052 723 A2 --> **Before installing, lightly coat contact surface of bearing caps using grease G 052 723 A2**

Cylinder bank 1: Bearing cap 8

Cylinder bank 2: Bearing cap 28

- Installation position cylinder bank 1 --> **Installation Position Camshaft Bearing Caps, Cylinder Bank 1**
- Installation position cylinder bank 2 --> **Installation Position Camshaft Bearing Caps, Bank 2:**
- Installation sequence --> **Camshafts, Removing and Installing.**

22 - Exhaust camshaft

- Checking radial clearance with Plastigage, Wear limit: 0.1 mm
- Run-out: max. 0.01 mm
- Checking axial play --> **Camshafts, Checking Axial Play**
- Identification cylinder bank 1 --> **Camshaft Identification (Bank 1):**
- Identification cylinder bank 2 --> **Camshaft Identification (Bank 2):**
- Removing and installing --> **Camshafts, Removing and Installing.**

Camshafts, Checking Axial Play

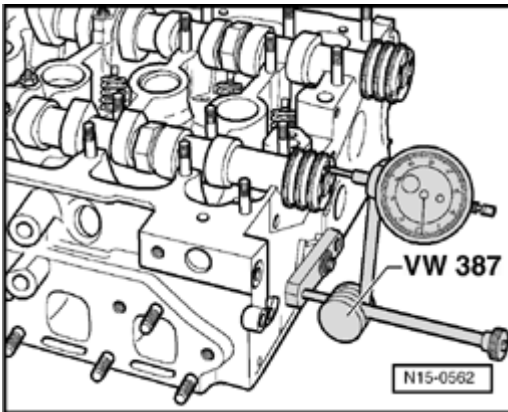


Fig. 147: Camshafts, Checking Axial Play

Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools, testers and auxiliary items required

- Dial gauge holder VW 387
- Dial gauge

Test Sequence

Perform measurements with support elements and roller rocker levers removed.

Wear limit: max. 0.10 mm

Bank 1:

Intake camshaft bearing cap 7 installed.

Exhaust camshaft bearing cap 8 installed.

Bank 2:

Intake camshaft bearing cap 27 installed.

Exhaust camshaft bearing cap 28 installed.

Before installing, lightly coat contact surface of bearing caps using grease G 052 723 A2

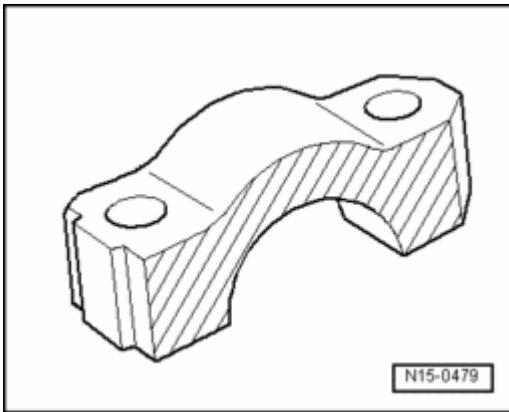


Fig. 148: Identifying Contact Surfaces Of Bearing Caps 7 And 8
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Bank 1:

Bearing caps 7 and 8.

Bank 2:

Bearing caps 27 and 28.

Installation Position Camshaft Bearing Caps, Cylinder Bank 1

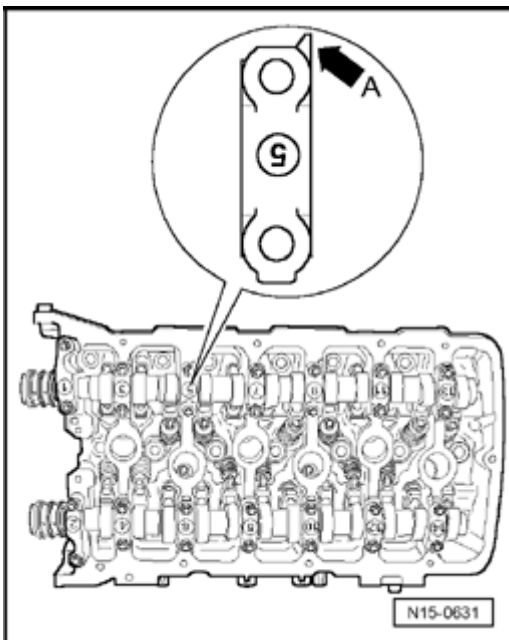


Fig. 149: Installation Position Camshaft Bearing Caps, Cylinder Bank 1
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Points of bearing caps - **arrow A** - of intake and exhaust camshaft point outward.

Markings on bearing caps are legible when viewed from the intake side.

Installation Position Camshaft Bearing Caps, Bank 2:

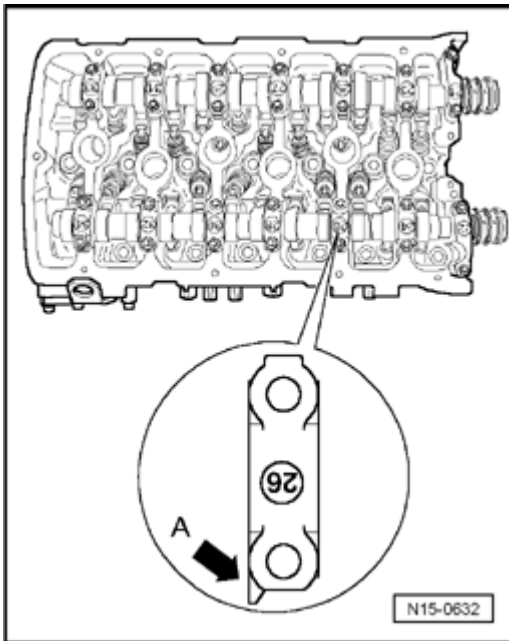


Fig. 150: Installation Position Camshaft Bearing Caps, Bank 2
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Points of bearing caps - **arrow A** - of intake and exhaust camshaft point outward.

Markings on bearing caps are legible when viewed from the intake side.

Valve Dimensions:

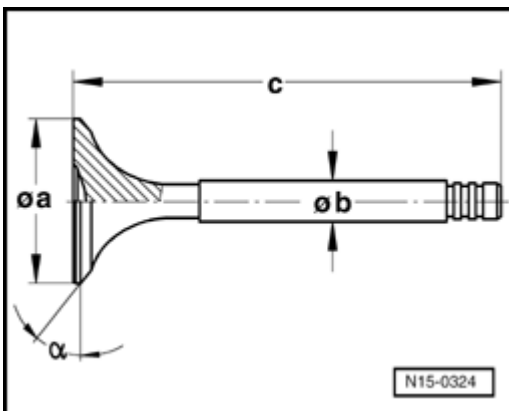


Fig. 151: Valve Dimensions
Courtesy of VOLKSWAGEN UNITED STATES, INC.

NOTE:

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

2004 Volkswagen Phaeton

ENGINE 6.0 Liter 12-Cyl. 4V Engine Mechanical, Fuel Injection & Ignition, Engine Code(s): BRP, BAP

Intake valves

Dimension		Short intake valve	Long intake valve
Dia. a	mm	32.50	32.50
Dia. b	mm	5.96	5.96
c	mm	102.20	136.10
a	Angle°	45	45

Exhaust valves

Dimension		Short exhaust valve	Long exhaust valve
Dia. a	mm	27.00	27.00
Dia. b	mm	5.94	5.94
c	mm	102.50	136.40
a	Angle°	45	45

Camshaft Identification (Bank 1):

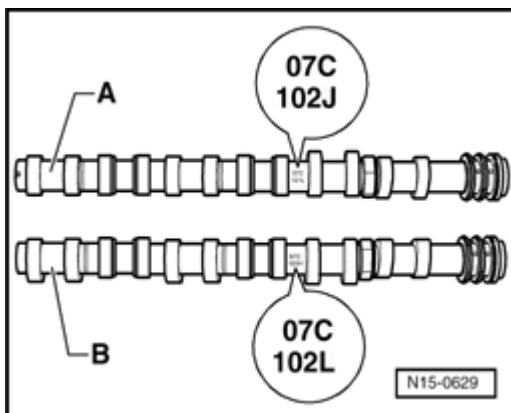


Fig. 152: Camshaft Identification (Bank 1)

Courtesy of VOLKSWAGEN UNITED STATES, INC.

Identification between cam pair cyl. 4 and cyl. 5 of respective camshaft.

Camshaft	Identification
A - Exhaust camshaft	07C 102J
B - Intake camshaft	07C 102L

Camshaft Identification (Bank 2):

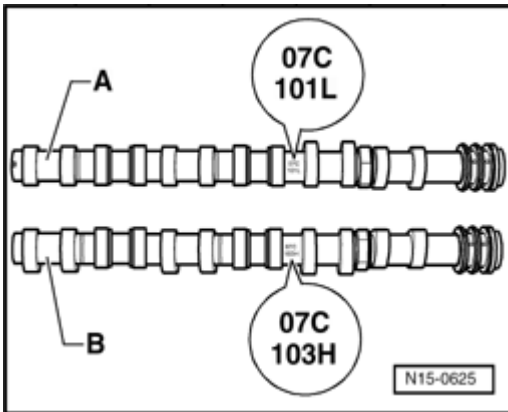


Fig. 153: Camshaft Identification (Bank 2)

Courtesy of VOLKSWAGEN UNITED STATES, INC.

Identification between cam pair cyl. 10 and cyl. 11 of respective camshaft.

Camshaft	Identification
A - Intake camshaft	07C 101L
B - Exhaust camshaft	07C 103H

Disassembling and Assembling Control Housing:

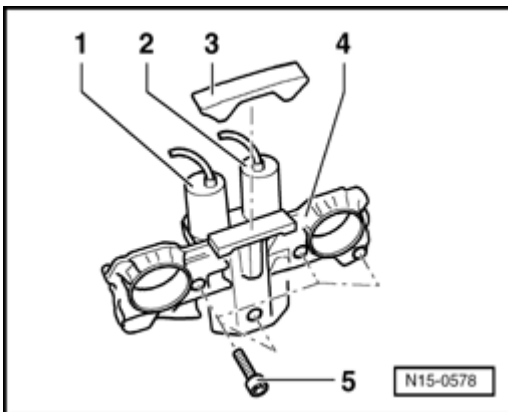


Fig. 154: Disassembling/Assembling Control Housing

Courtesy of VOLKSWAGEN UNITED STATES, INC.

Bank 1:

1 - Removing and installing Camshaft Adjustment Valve 1 N205 --> **Camshaft Adjuster Valves, Removing and Installing.**

2 - Camshaft Adjustment Valve 1 (exhaust) N318 , removing and installing --> **Camshaft Adjuster Valves, Removing and Installing.**

3 - Glide track: clipped in at control housing

4 - Control housing

5 - 8 Nm

Bank 2:

1 - Camshaft Adjustment Valve 2 (exhaust) N319 , removing and installing --> Camshaft Adjuster Valves, Removing and Installing.

2 - Removing and installing Camshaft Adjustment Valve 2 N208 --> Camshaft Adjuster Valves, Removing and Installing.

3 - Glide track: clipped in at control housing

4 - Control housing

5 - 8 Nm

Valve Seats, Refacing**Valve Seats, Refacing****Special tools, testers and auxiliary items required**

- Depth gauge
- Valve seat refacing tool

NOTE:

- When repairing engines with leaking valves, it is not sufficient to rework or replace valve seats and valves. It is also necessary to check the valve guides for wear. This is particularly important on high mileage engines --> Valve Guides, Checking.
- Only reface valve seats enough until a perfect contact pattern is obtained. The maximum permissible reworking dimension must be calculated before work is carried out. If the reworking dimension is exceeded, the function of the hydraulic lifters can no longer be guaranteed and therefore the cylinder head should be replaced.

- Camshafts, removing --> Camshafts, Removing and Installing.

Maximum Permitted Refacing Dimension is Calculated as Follows:

- Insert valve and press firmly against seat.

NOTE:

- If the valve is to be replaced as part of a repair, use a new valve for the calculation.

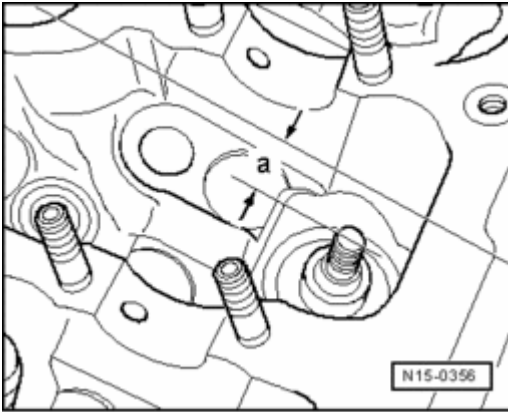


Fig. 155: Identifying Distance Between End Of Valve Stem And Upper Edge Of Cylinder Head
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Measure distance - **a** - between end of valve stem and upper edge of cylinder head.
- Calculate max. permissible reworking dimension from measured distance - **a** - and minimum dimension.

Minimum Dimensions:

Short intake valve	mm	31.9
Long intake valve	mm	10.4
Short exhaust valve	mm	31.9
Long exhaust valve	mm	10.4

Measured distance minus minimum dimension = max. permissible reworking dimension.

Example:

	Measured distance	10.8 mm
	Minimum dimension	10.4 mm
=	Max. perm. rework dimension	0.4 mm

* Maximum allowable refacing dimension is represented in illustrations for refacing valve seats as dimension "b" --> **Intake Valve Seat, Refacing:** and --> **Exhaust Valve Seat, Refacing:**.

Intake Valve Seat, Refacing:

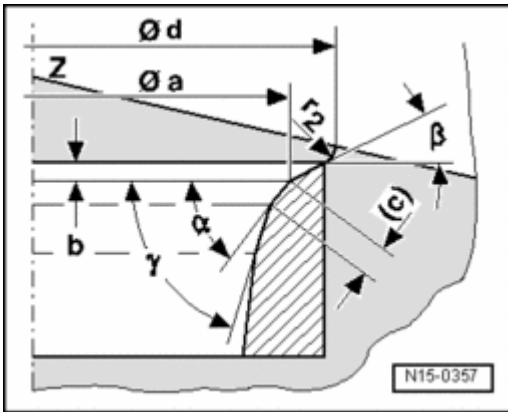


Fig. 156: Reworking Intake/Exhaust Valve Seat
Courtesy of VOLKSWAGEN UNITED STATES, INC.

a - Dia. 32.6 mm

b - Max. permissible refacing dimension * See note

c - 0.9 to 1.5 mm

d - Max. dia. 35.0 mm

r2 - Radius 2.0 mm

Z - Cylinder head lower edge

a - 45 valve seat angle

β - 30 upper correction angle

γ - 60 lower correction angle

* How to calculate maximum permissible refacing dimension --> **Valve Seats, Refacing.**

Exhaust Valve Seat, Refacing:

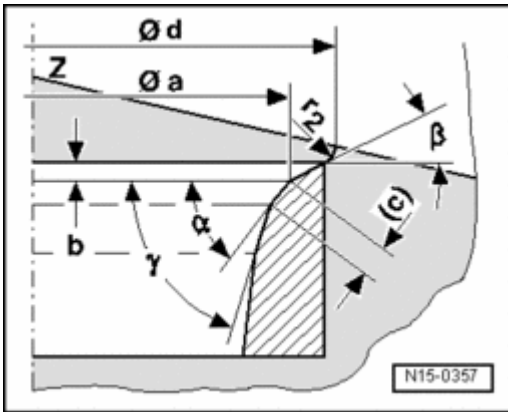


Fig. 157: Reworking Intake/Exhaust Valve Seat
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

a - Dia. 26.7 mm

b - Max. permissible refacing dimension * See note

c - 1.2 to 1.7 mm

d - Max. dia. 29.0 mm

r2 - Radius 2.0 mm

Z - Cylinder head lower edge

a - 45 valve seat angle

β - 30 upper correction angle

γ - 60 lower correction angle

* How to calculate maximum permissible refacing dimension --> **Valve Seats, Refacing.**

Camshaft Adjuster Valves, Removing and Installing

Camshaft Adjuster Valves, Removing and Installing

2004 Volkswagen Phaeton

ENGINE 6.0 Liter 12-Cyl. 4V Engine Mechanical, Fuel Injection & Ignition, Engine Code(s): BRP, BAP

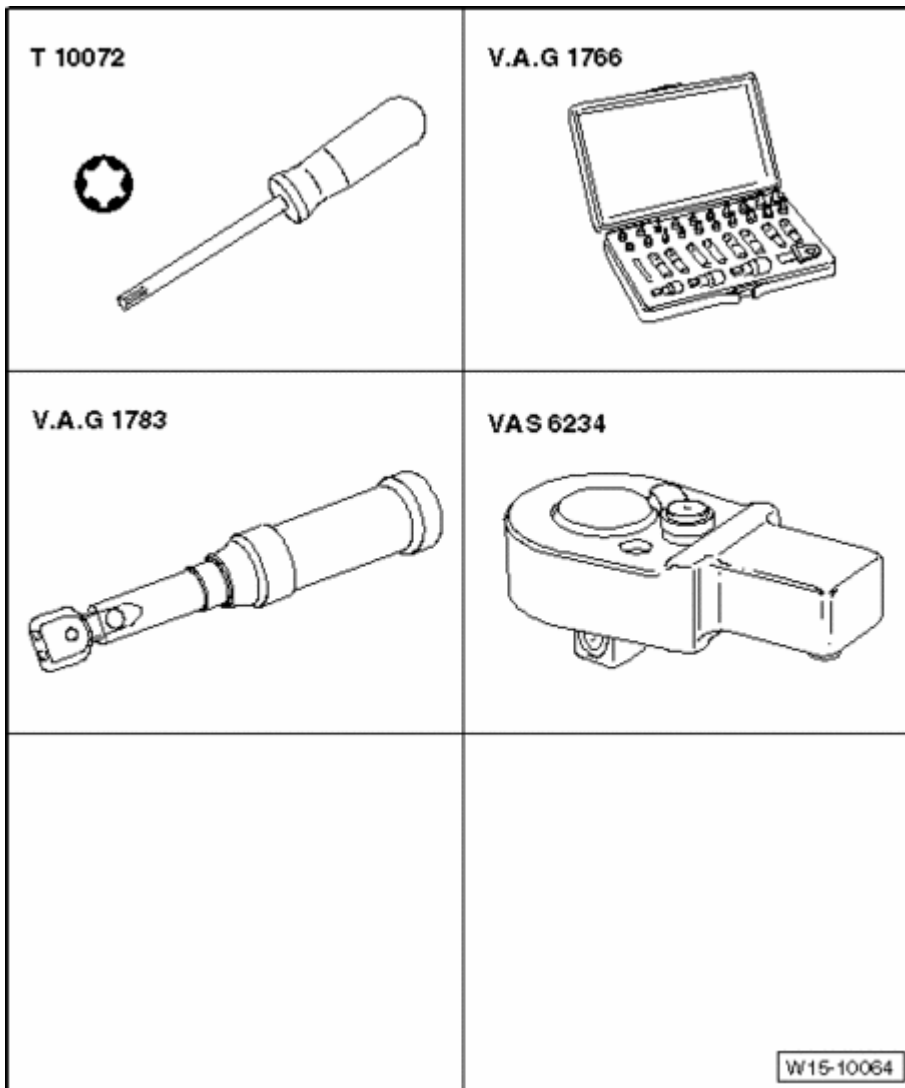


Fig. 158: Identifying Special Tools - Camshaft Adjuster Valves, Removing And Installing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools, testers and auxiliary items required

- Torque wrench V.A.G 1783
- Torx bit assortment V.A.G 1766
- Ratchet 1/4" VAS 6234
- Socket Wrench T10072

Removing

- Remove the cylinder head cover on the corresponding cylinder bank --> **Cylinder Head Cover, Removing and Installing.**

CAUTION: • Cover the chain compartment and valve train carefully so no parts

fall inside.

- Do not completely remove camshaft adjustment valve securing bolts so that valve is not tilted when removed.

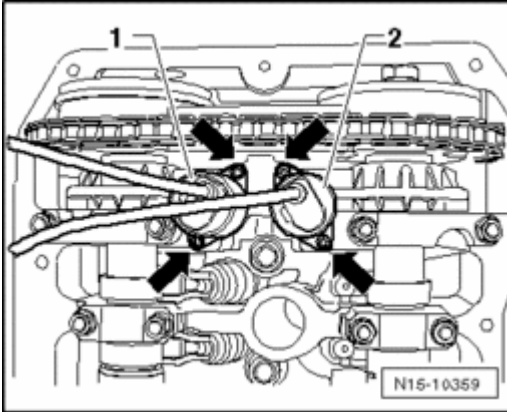


Fig. 159: Loosening/Tightening Mounting Bolts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Loosen camshaft adjustment valve securing bolts approximately 3 mm (5 turns) - **arrows** - using Socket Wrench T10072.
- Pull Camshaft Adjustment Valve out of seal seat in control housing against loosened bolts.
- Completely remove securing bolts and remove Camshaft Adjustment Valve from control housing.

Installing

CAUTION:

- The valve seat in the control housing must not be scored or scratched.
 - The camshaft adjustment valves and control housing must be free of dust and contamination.
 - The camshaft adjustment valves must not be subjected to knocks or impacts.
 - Only remove new camshaft adjustment valve from packaging right before installation.
 - Camshaft adjustment valves must not be pulled into valve seat by securing bolts. Only press them in by hand.
- Coat the Camshaft Adjuster Valve sealing rings with clean engine oil.
 - Carefully insert Camshaft Adjustment Valve into housing and press it perpendicular to valve axle in by hand until it stops.

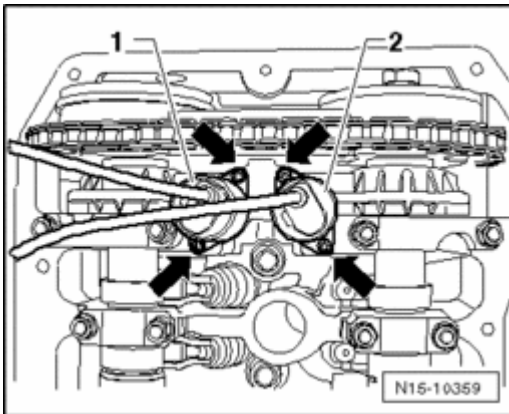


Fig. 160: Loosening/Tightening Mounting Bolts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Tighten the mounting bolts - **arrows** - to 3.8 Nm.
- If the sealing rings in the cylinder head cover are to be replaced --> **Installing Seals of Camshaft Adjustment Valves**

The rest of the assembly is basically a reverse of the disassembling sequence.

Camshafts, Removing and Installing

Camshafts, Removing and Installing

(Work procedure only possible with engine removed)

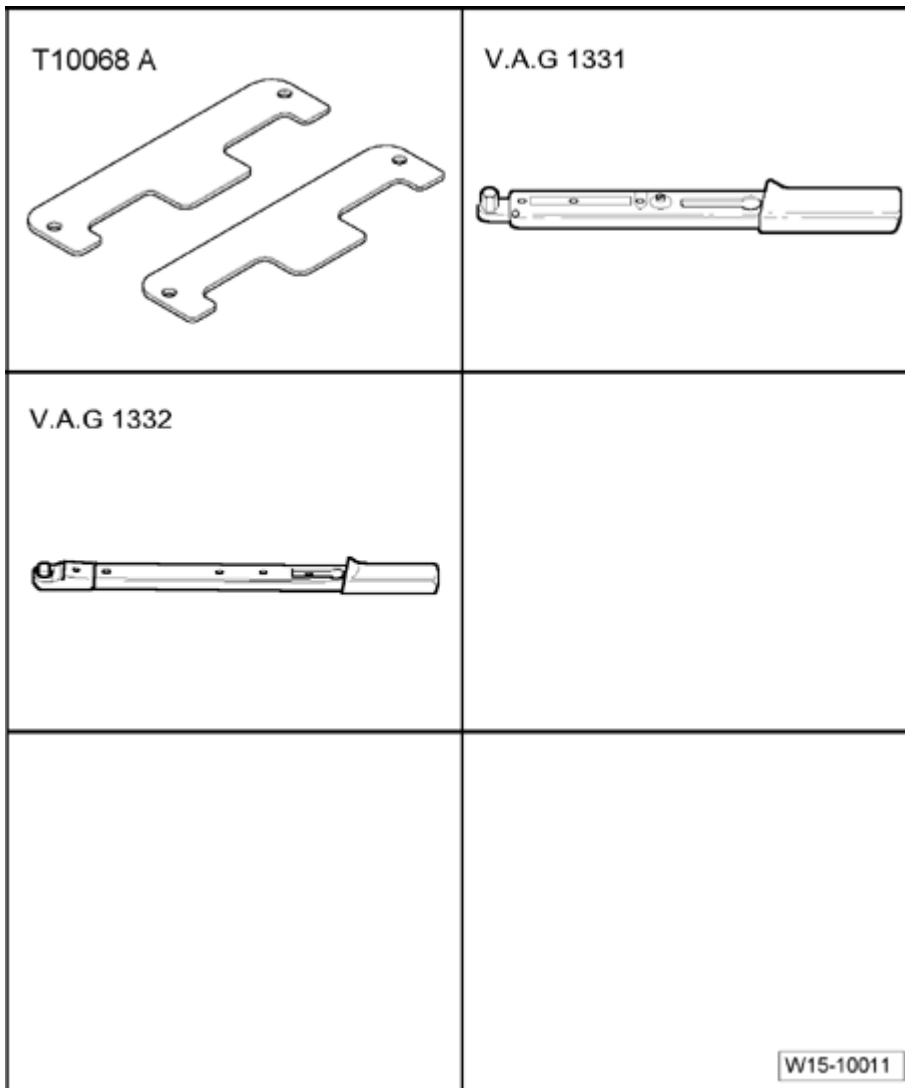


Fig. 161: Identifying Special Tools - Camshafts, Removing And Installing
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools, testers and auxiliary items required

- Camshaft bar T10068 A
- Torque wrench (5 to 50 Nm) V.A.G 1331
- Torque wrench (40 to 200 Nm) V.A.G 1332
- Grease G 052 723 A2
- Sealant D 176 501

Removing

- Remove cylinder head cover --> **Cylinder Head Cover, Removing and Installing.**

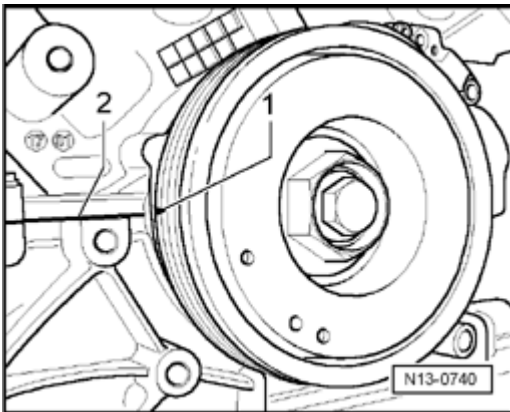


Fig. 162: Identifying Marking Aligns With Partition Of Cylinder Block
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Turn crankshaft to set cylinder 1 at TDC.

Marking - 1 - must align with partition of cylinder block - 2 -.

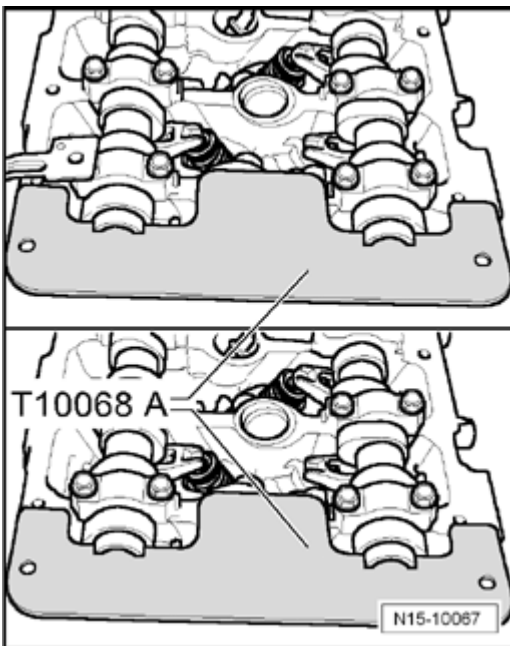
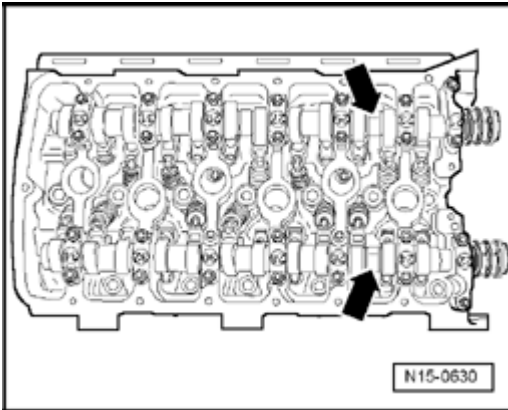


Fig. 163: Inserting Camshaft Bar T10068 A Into Both Shaft Grooves
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- It must be possible to insert camshaft bar T10068 A into both shaft grooves.

**Fig. 164: Identifying Camshafts**

Courtesy of VOLKSWAGEN UNITED STATES, INC.

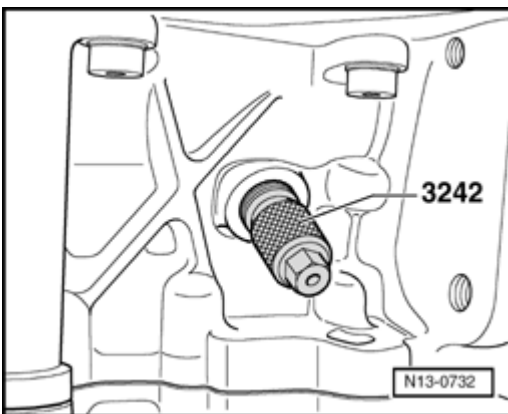
NOTE:

- If necessary, turn camshafts - arrows - slightly in right position using open-end wrench (32 mm).

CAUTION: Do not turn camshafts more than $\frac{1}{4}$ turn when cylinder heads are installed and crankshaft is locked! Valves may strike pistons!

If camshaft bar T10068 A cannot be inserted, turn crankshaft additional rotation in direction of engine. Camshaft bar T10068 A must now be able to be inserted.

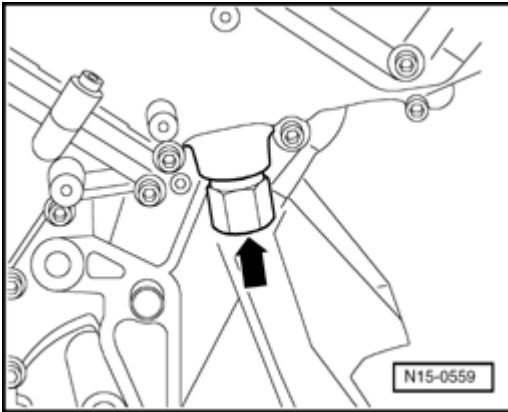
- Remove locking bolt from lower left side of cylinder block.

**Fig. 165: Crankshaft Holder 3242 - Securing Crankshaft From Turning**

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Install crankshaft holder 3242 in bore thus securing crankshaft against turning.

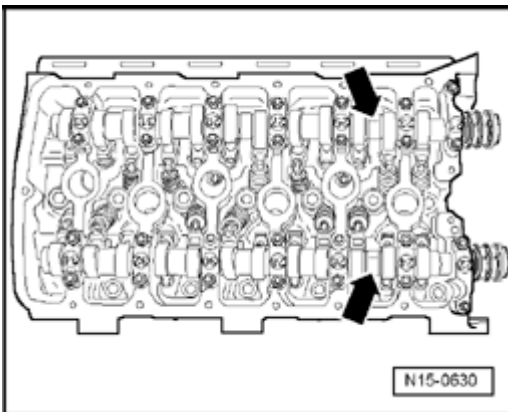
Bank 1:

**Fig. 166: Camshaft Roller Chain Tensioner**

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove chain tensioner for camshaft roller chain - **arrow** -.
- Remove cover piece for camshafts.

For loosening camshaft adjusters:

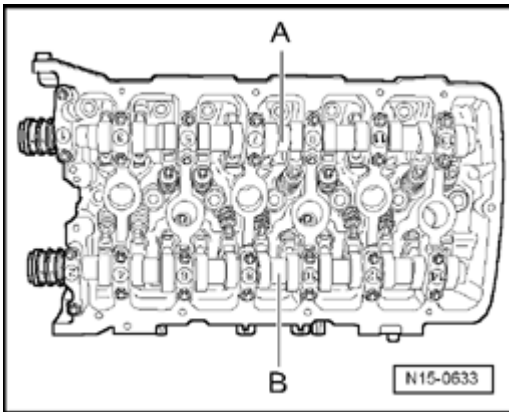
**Fig. 167: Identifying Camshafts**

Courtesy of VOLKSWAGEN UNITED STATES, INC.

NOTE:

- **Only counter-hold at camshaft using open-end wrench (32 mm) - arrows - . Camshaft bar T10068 A must not be inserted when tightening or loosening camshaft adjuster.**

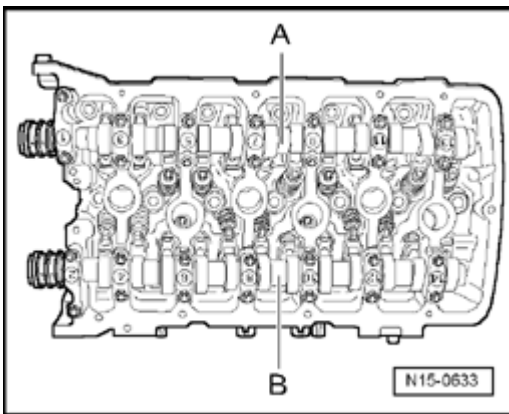
- Remove exhaust and intake camshaft adjuster from camshafts first.
- Remove both camshaft adjusters together with camshaft roller chain from camshafts.
- Place camshaft roller chain aside.
- Remove control housing from cylinder head.
- Pull control housing carefully off camshaft seals.

**Fig. 168: Identifying Intake/Exhaust Camshaft**

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- A - Intake camshaft

- First remove bearing caps 1 and 13.
- Remove bearing caps 5 and 9.
- Remove bearing cap 7.
- Loosen bearing caps 3 and 11 alternately and diagonally, and remove.

**Fig. 169: Identifying Intake/Exhaust Camshaft**

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- B - Exhaust camshaft

- First remove bearing caps 2 and 14.
- Remove bearing caps 6 and 10.
- Remove bearing cap 8.
- Loosen bearing caps 4 and 12 alternately and diagonally and remove.

Bank 2:

- Remove cover piece for camshafts.

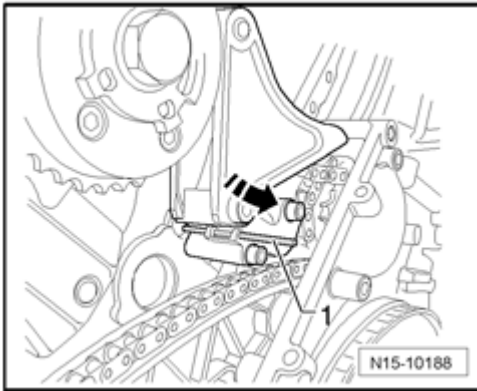


Fig. 170: Pushing Chain Tensioner For Camshaft Roller Chain In And Securing Chain Tensioner
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Push chain tensioner for camshaft roller chain in - **direction of arrow** - and secure chain tensioner - **1** - using drill bit (dia. 3.5 mm).
- Loosen mounting bolt - **arrow** - and remove bolt stop together with bolt.

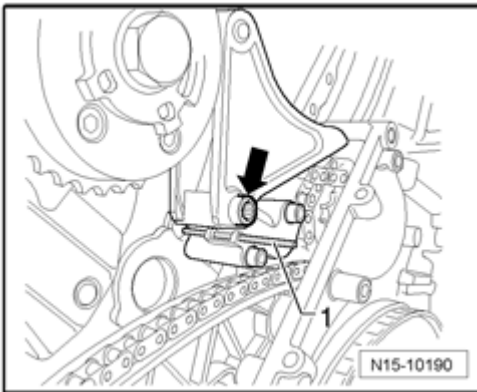


Fig. 171: Loosening Mounting Bolt And Removing Bolt Stop Together With Bolt
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove chain tensioner secured with drill bit - **1** -.

For loosening camshaft adjusters:

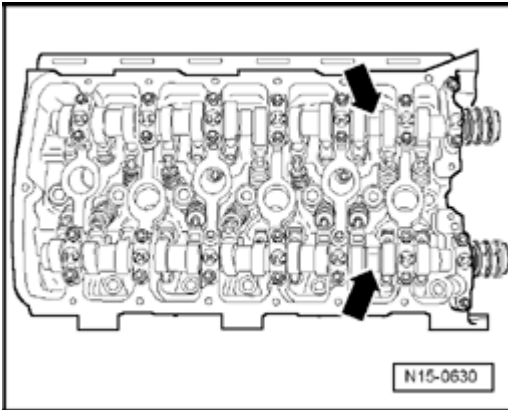


Fig. 172: Identifying Camshafts

Courtesy of VOLKSWAGEN UNITED STATES, INC.

NOTE:

- Only counter-hold at camshaft using open-end wrench (32 mm) - arrows -. Camshaft bar T10068 A must not be inserted when tightening or loosening camshaft adjuster.

- Remove exhaust and intake camshaft adjuster from camshafts first.
- Remove both camshaft adjusters together with camshaft roller chain from camshafts.
- Place camshaft roller chain aside.
- Remove control housing from cylinder head.
- Pull control housing carefully off camshaft seals.

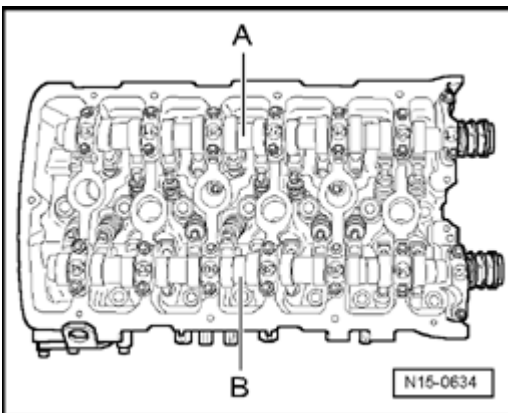


Fig. 173: Identifying Intake/Exhaust Camshaft

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- A - Intake camshaft

- First remove bearing caps 21 and 33.
- Remove bearing caps 25 and 29.
- Remove bearing cap 27.

- Loosen bearing caps 23 and 31 alternately and diagonally, and remove.

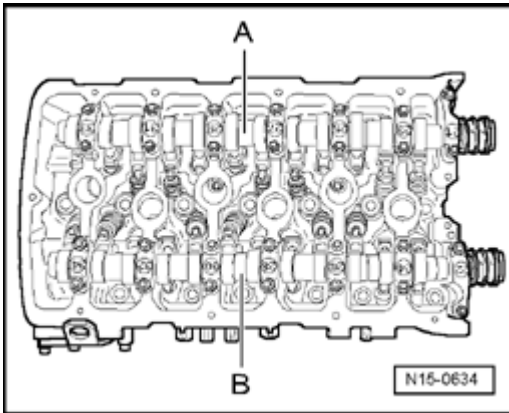


Fig. 174: Identifying Intake/Exhaust Camshaft
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- B - Exhaust camshaft

- First remove bearing caps 22 and 34.
- Remove bearing caps 26 and 30.
- Remove bearing cap 28.
- Loosen bearing caps 24 and 32 alternating and diagonally and remove.

Banks 1 and 2:

- Carefully remove camshafts and place on a clean surface.
- If necessary, remove roller cam followers together with the support elements and place these on a clean surface.
- Ensure the roller rocker levers and the support elements are not interchanged.

Installing

Requirements

- When installing, camshafts must be set to TDC cyl. 1.
- Crankshaft must be at TDC cyl. 1.

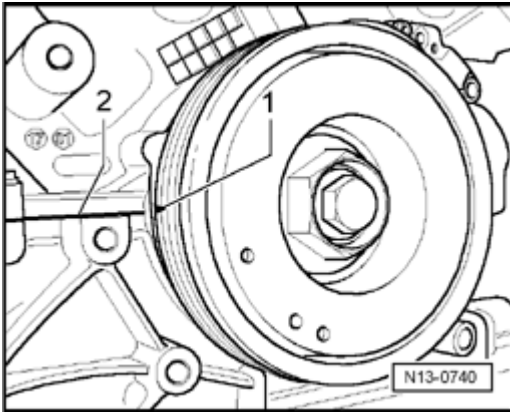


Fig. 175: Identifying Marking Aligns With Partition Of Cylinder Block
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Marking - 1 - must align with partition of cylinder block - 2 -.

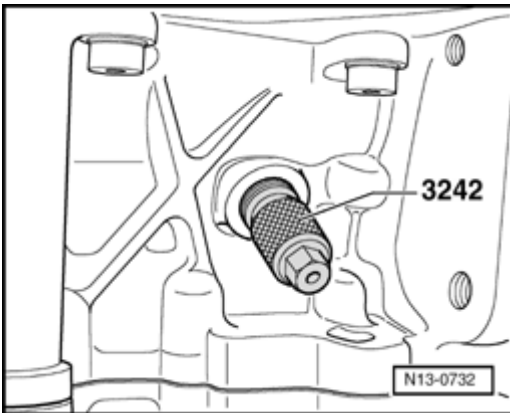


Fig. 176: Crankshaft Holder 3242 - Securing Crankshaft From Turning
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Check whether crankshaft holder 3242 is still installed in hole of cylinder block to secure crankshaft against turning.
- Insert support element in cylinder head and install roller rocker lever onto respective valve stem end and support element.

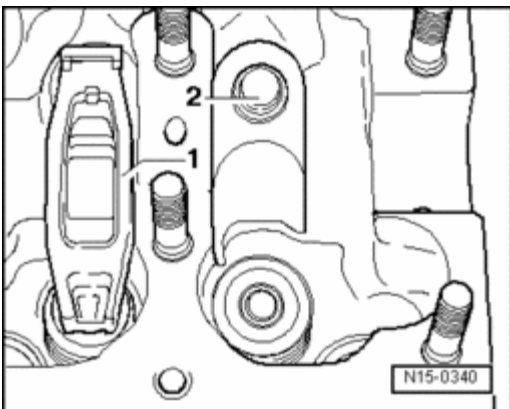
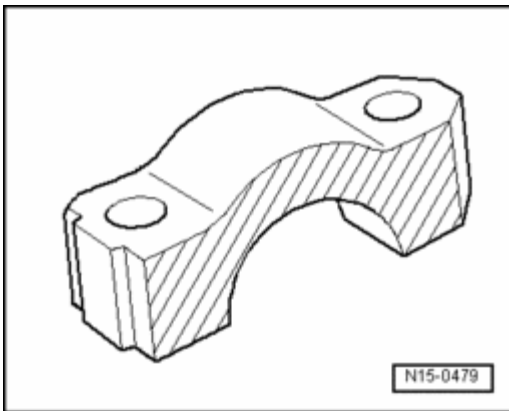


Fig. 177: Identifying Valve Stem Ends & Support Elements

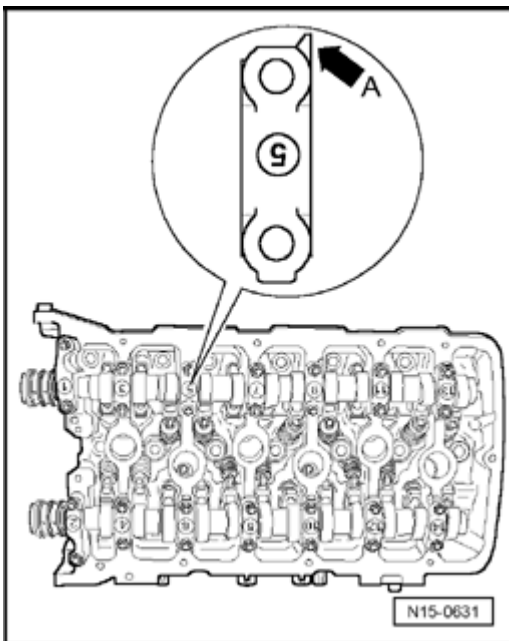
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Make sure that all roller cam followers - **1** - properly contact valve shaft tips and are clipped into the respective support elements - **2** -.

Bank 1:**Fig. 178: Identifying Contact Surfaces Of Bearing Caps 7 And 8**

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Before installing, lightly coat contact surface of bearing caps 7 and 8 using **grease G 052 723 A2**.
- Oil running surfaces of both camshafts.
- Insert respective camshaft into camshaft bearings of cylinder head in the right position. While doing so, observe identification of camshafts --> **Camshaft Identification (Bank 1):**

**Fig. 179: Installation Position Camshaft Bearing Caps, Cylinder Bank 1**

Courtesy of VOLKSWAGEN UNITED STATES, INC.

NOTE:

- Observe installed position of bearing caps:
- Points of bearing caps - arrow A - of intake and exhaust camshaft point outward.
- Markings on bearing caps are legible when viewed from the intake side.

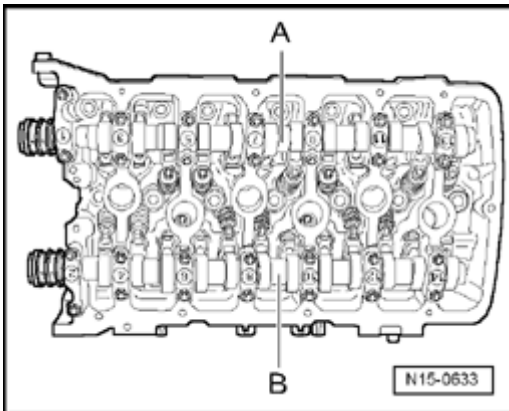


Fig. 180: Identifying Intake/Exhaust Camshaft

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- A - Intake camshaft

- Tighten bearing caps 3 and 11 alternately and in a diagonal sequence to 5 Nm and $\frac{1}{8}$ (45) additional turn.
- Install bearing cap 7 and tighten to 5 Nm and $\frac{1}{8}$ (45) additional turn.
- Install bearing caps 5 and 9 and tighten to 5 Nm and $\frac{1}{8}$ (45) additional turn.
- Install bearing caps 1 and 13 and tighten to 5 Nm and $\frac{1}{8}$ (45) additional turn.

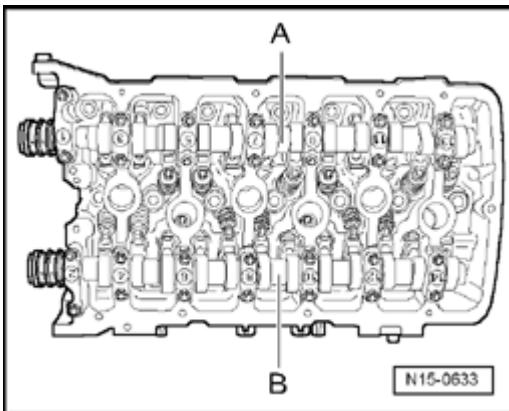


Fig. 181: Identifying Intake/Exhaust Camshaft

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- B - Exhaust camshaft

- Tighten bearing caps 4 and 12 alternating in diagonal sequence and tighten to 5 Nm + $\frac{1}{8}$ (45) additional turn.
- Install bearing cap 8 and tighten to 5 Nm and $\frac{1}{8}$ (45) additional turn.
- Install bearing caps 6 and 10 and tighten to 5 Nm and $\frac{1}{8}$ (45) additional turn.
- Install bearing caps 2 and 14 and tighten to 5 Nm and $\frac{1}{8}$ (45) additional turn.

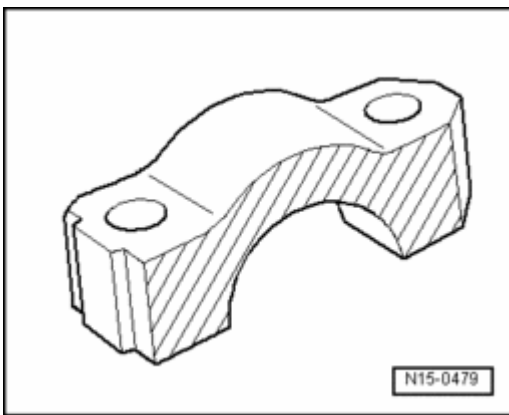
Bank 2:

Fig. 182: Identifying Contact Surfaces Of Bearing Caps 7 And 8
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Before installing, lightly coat contact surface of bearing caps 27 and 28 using **grease G 052 723 A2** .
- Oil running surfaces of both camshafts.
- Insert respective camshaft into camshaft bearings of cylinder head in the right position. While doing so, observe identification of camshafts --> **Camshaft Identification (Bank 2):**

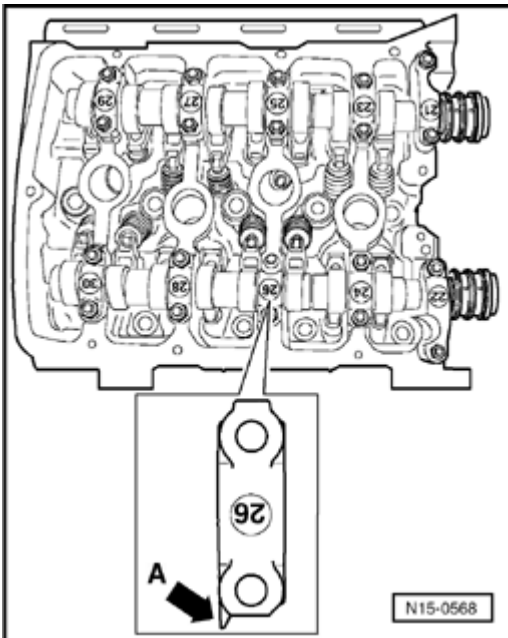


Fig. 183: Observing Installed Position Of Bearing Caps
Courtesy of VOLKSWAGEN UNITED STATES, INC.

NOTE:

- Observe installed position of bearing caps:
- Points of bearing caps - arrow A - of intake and exhaust camshaft point outward.
- Markings on bearing caps are legible when viewed from the intake side.

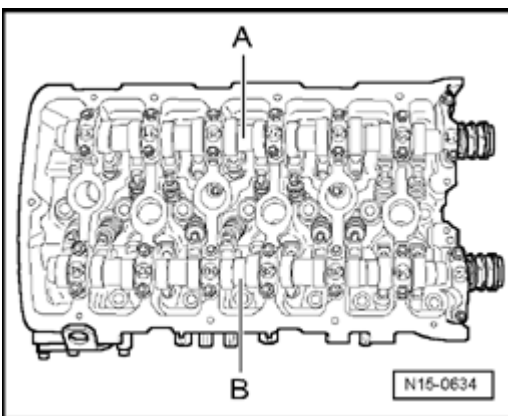


Fig. 184: Identifying Intake/Exhaust Camshaft
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- A - Intake camshaft

- Tighten bearing caps 23 and 31 alternately and in a diagonal sequence to 5 Nm and $\frac{1}{8}$ (45) additional turn.

- Install bearing cap 27 and tighten to 5 Nm and $\frac{1}{8}$ (45) additional turn.
- Install bearing caps 25 and 29 and tighten to 5 Nm and $\frac{1}{8}$ (45) additional turn.
- Install bearing caps 21 and 33 and tighten to 5 Nm and $\frac{1}{8}$ (45) additional turn.

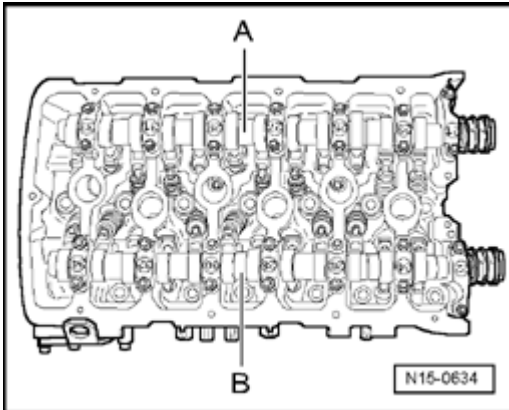


Fig. 185: Identifying Intake/Exhaust Camshaft
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- B - Exhaust camshaft

- Tighten bearing caps 24 and 32 alternately and in a diagonal sequence to 5 Nm and $\frac{1}{8}$ (45) additional turn.
- Install bearing cap 28 and tighten to 5 Nm and $\frac{1}{8}$ (45) additional turn.
- Install bearing caps 26 and 30 and tighten to 5 Nm and $\frac{1}{8}$ (45) additional turn.
- Install bearing caps 22 and 34 and tighten to 5 Nm and $\frac{1}{8}$ (45) additional turn.

Banks 1 and 2:

- If necessary, correct position of camshafts slightly in cylinder heads.

CAUTION: Do not turn camshafts more than $\frac{1}{4}$ turn when cylinder heads are installed and crankshaft is locked! Valves may strike pistons!

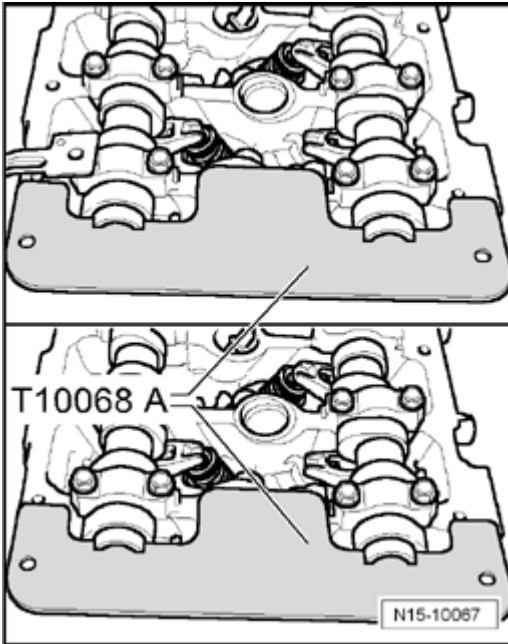


Fig. 186: Inserting Camshaft Bar T10068 A Into Both Shaft Grooves
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- It must be possible to insert camshaft bar T10068 A into both shaft grooves.
- Before installing control housing, lightly oil sealing ring contact surfaces of camshafts in control housing.
- Lightly oil sealing ring contact surfaces of camshafts and slowly slide control housing over camshaft sealing rings.
- Install control housing. Tightening specification: 8 Nm

How to adjust timing --> **Chain Drive**.

NOTE:

- If a camshaft of an engine that has already run is removed and installed, the position of the copper chain elements of the camshaft roller chains can be disregarded as this position can only be obtained at first installation of chains.
- After adjusting timing, both camshaft bars T10068 A , DTC cyl. 1 of crankshaft, must be able to fit in both shaft grooves of camshafts for cylinder bank 1 and 2.

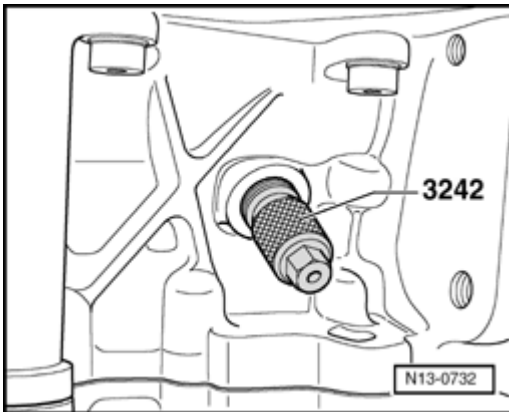


Fig. 187: Crankshaft Holder 3242 - Securing Crankshaft From Turning
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove crankshaft holder 3242 from bore and install locking bolt.
- Install cover piece for cylinder bank 1 and 2 --> Chain Drive.
- Install cylinder head cover --> Cylinder Head Cover, Removing and Installing.

Valve Guides, Checking

Valve Guides, Checking

Special tools, testers and auxiliary items required

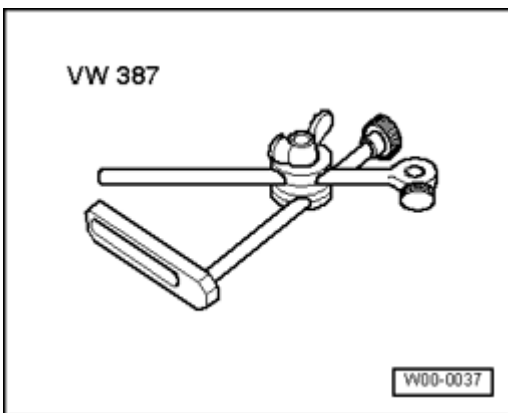


Fig. 188: Dial Gauge Holder VW 387
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Dial gauge holder VW 387
- Dial gauge

Test Sequence

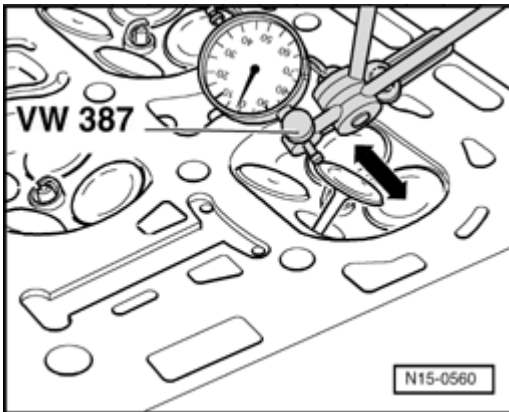


Fig. 189: Measuring Valve Tilt Clearance

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Insert new valve into guide. The end of the valve stem must be flush with the guide. Due to the slight difference in stem diameters, ensure that only an intake valve is used in the intake guide and an exhaust valve in the exhaust guide.
- Determine tilt clearance. Wear limit: 0.8 mm

If tilt clearance is exceeded:

- Replace cylinder head.

Valve Stem Seals, Removing and Installing

Valve Stem Seals, Removing and Installing

(Work procedure with cylinder head installed)

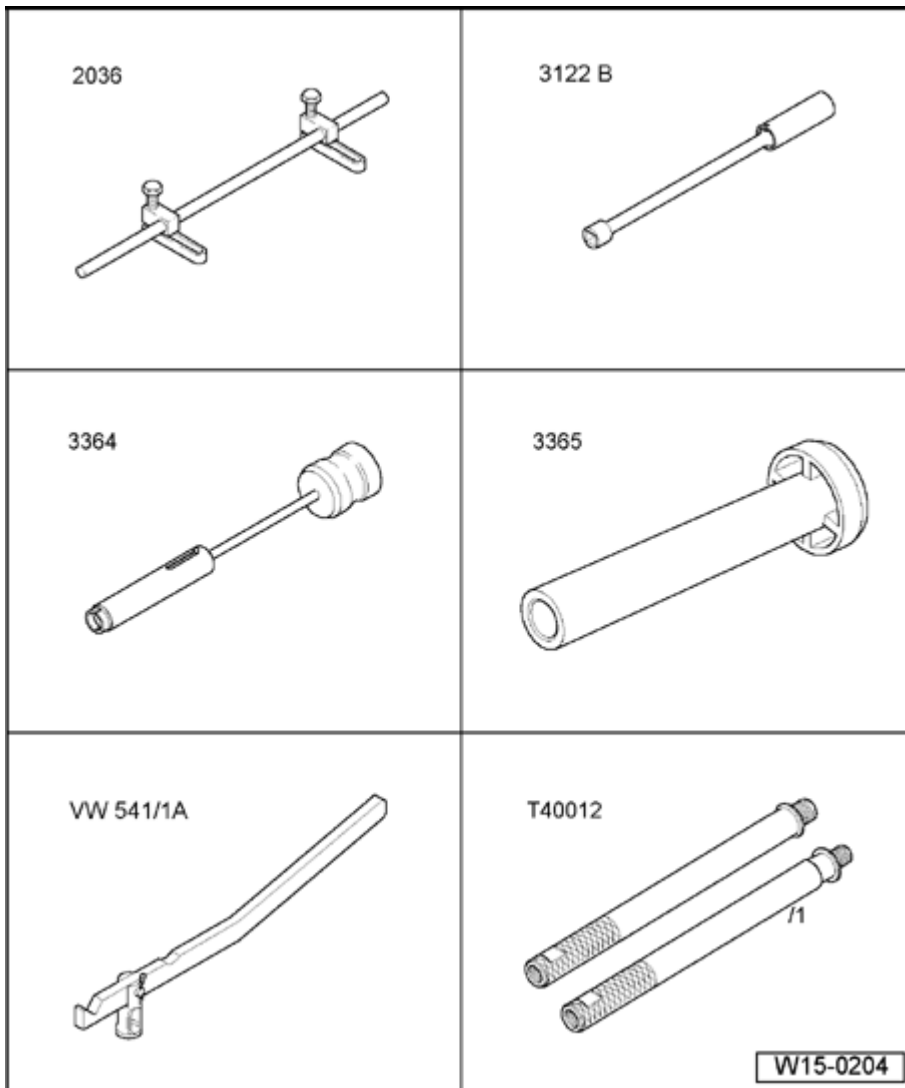
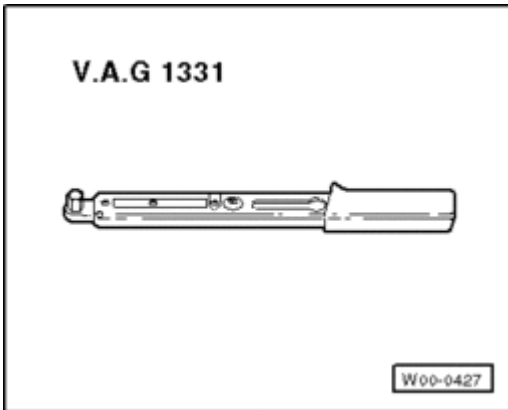


Fig. 190: Identifying Special Tools - Valve Stem Seals, Removing And Installing
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools, testers and auxiliary items required

- Adjustable rod 2036 with adapter plates 2036/1
- Spark plug removal tool 3122 B
- Valve seal removal tool 3364
- Valve stem seal driver 3365
- Valve lever VW 541/1 A with Pressure piece for VW 541/1 A and 2037 VW 541/6
- Adapter T40012

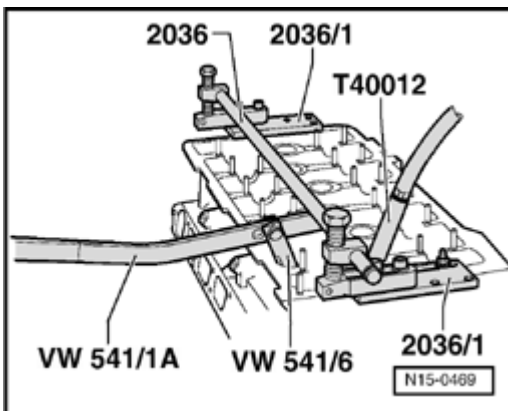
**Fig. 191: Torque Wrench V.A.G 1331**

Courtesy of VOLKSWAGEN UNITED STATES, INC.

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

Removing

- Remove spark plugs using spark plug removal tool 3122 B.
- Camshafts, removing --> **Camshafts, Removing and Installing.**
- Remove roller rocker lever together with support elements and place on a clean surface.
- Move piston for respective cylinder to "Bottom Dead Center (BDC) position".

**Fig. 192: Identifying Adjustable Rod 2036, Adapter T40012 And Valve Lever VW 541/1 A**

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Insert adjustable rod 2036 with adapter plates 2036/1 and adjust bearing.
- Install adapter T40012 into spark plug thread, connect to pressurized air lines using commercially available adapter and apply constant pressure (at least 6 bar positive pressure).
- Remove the valve springs using a valve lever VW 541/1 A and pressure piece for VW 541/1 A and 2037 VW 541/6.

NOTE:

- Tight keepers can be loosened by tapping lightly on the lever.

- Remove valve stem seals using Valve Seal Removal Tool 3364.

Installing

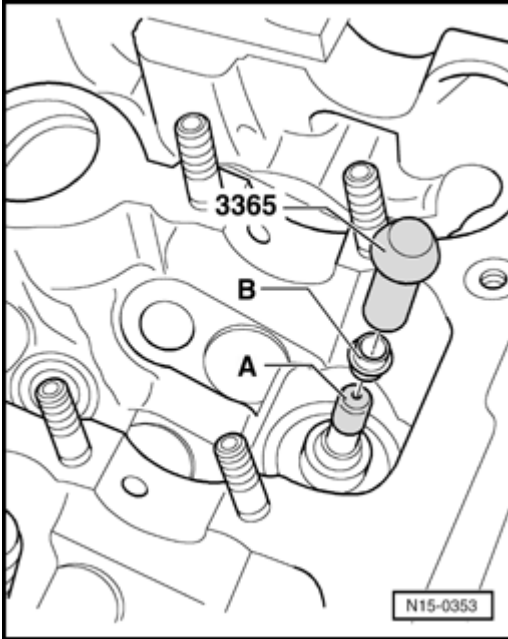


Fig. 193: Plastic Sleeve, Valve Stem Seal And Valve Stem Seal Driver 3365
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Place plastic sleeve - **A** - on valve stem to prevent damage to new valve stem oil seals.
- Oil the sealing lip of valve stem oil seal - **B** - , insert into valve stem seal driver 3365 and carefully slide onto valve guide.
- Install camshafts --> **Installing**.

17 - ENGINE - LUBRICATION

LUBRICATION SYSTEM COMPONENTS

Lubrication System Components

Lubrication System Components

--> **Engine Oil Specifications**

--> **Engine Oil Capacities**

--> **Engine Oil Level, Checking**

--> **Oil Pan, Engine Code BAP, Assembly Overview**

--> **Oil Pan, Engine Code BRP, Assembly Overview**

2004 Volkswagen Phaeton

ENGINE 6.0 Liter 12-Cyl. 4V Engine Mechanical, Fuel Injection & Ignition, Engine Code(s): BRP, BAP

--> Oil Pan, Lower Section, Removing and Installing

--> Oil Pan, Upper Section, Removing and Installing

--> Oil Pump, Assembly Overview

--> Oil Pump, Removing and Installing

--> Oil Filter Housing, Engine Code BAP, Assembly Overview

--> Oil Filter Housing, Engine Code BRP, Assembly Overview

--> Oil Pressure and Oil Pressure Switch, Checking

NOTE:

- The oil level must not be above the max. mark - danger of damage to catalytic converter! Markings --> Engine Oil Level, Checking.
- If large quantities of metal particles are found when repairing the engine, oil passages must be cleaned and oil cooler must be replaced in order to prevent further damage.

Engine Oil Specifications

Engine Oil Specifications

Use "long life engine oils" according to VW standard **503 01** or **504 00** .

NOTE:

- The engine is filled at the factory with engine oil designed for long maintenance intervals.
- Engine oils according to VW standard **502 00** and **505 01** may still be used. Refer to --> 01 - MAINTENANCE . The service interval display must be programmed correspondingly. Procedure: --> 01 - MAINTENANCE
- Due to the oil pan design, extracting engine oil is not permitted!
- Engine oil "ILSAC GF3 with viscosity class SAE 0W-40" can be used for changing and topping off.
- Engine oil "ILSAC GF3 with viscosity class SAE 5W-40" can only be used for topping off.

Engine Oil Capacities

Engine Oil Capacities

NOTE:

- Due to the oil pan design, extracting engine oil is not permitted!

Engine code	Oil capacity without filter	Oil capacity with oil filter

2004 Volkswagen Phaeton

ENGINE 6.0 Liter 12-Cyl. 4V Engine Mechanical, Fuel Injection & Ignition, Engine Code(s): BRP, BAP

BAP	11.0 l	11.8 l
BRP	11.5 l	12.5 l

Engine Oil Level, Checking

Engine Oil Level, Checking

Test Conditions

- Engine oil temperature min. 60 C.
- Vehicle in level position.
- After stopping engine, wait a few minutes to allow oil to flow back into oil pan.

Test Sequence

- Pull out oil dipstick, wipe off with a clean cloth and re-insert dipstick again up to stop.
- Withdraw dipstick again and read oil level.

Range of Markings on Oil Dipstick (Engine Code BAP)

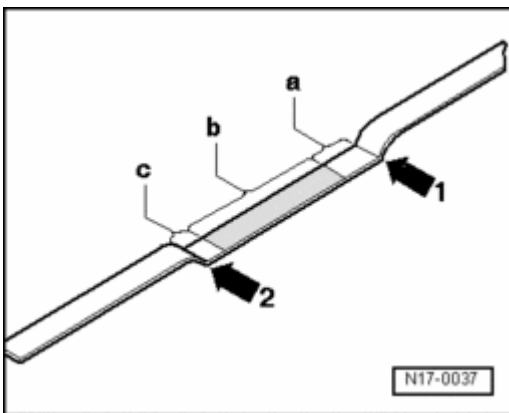


Fig. 194: Range Of Markings On Oil Dipstick (Engine Code BAP)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Max. mark

2 - Min. mark

a - Area above hatched field up to Max. mark: Do not replenish with engine oil!

b - Oil level within hatched field: Engine oil may be topped off: max. 0.5 l.

c - Area from Min. mark up to hatched field: Do not add more than 1.0 L oil.

Range of Markings on Oil Dipstick (Engine Code BRP)



c - Oil level from min. marking to hatched area: add approximately 0.5 L oil.

Oil Pan, Engine Code BAP, Assembly Overview

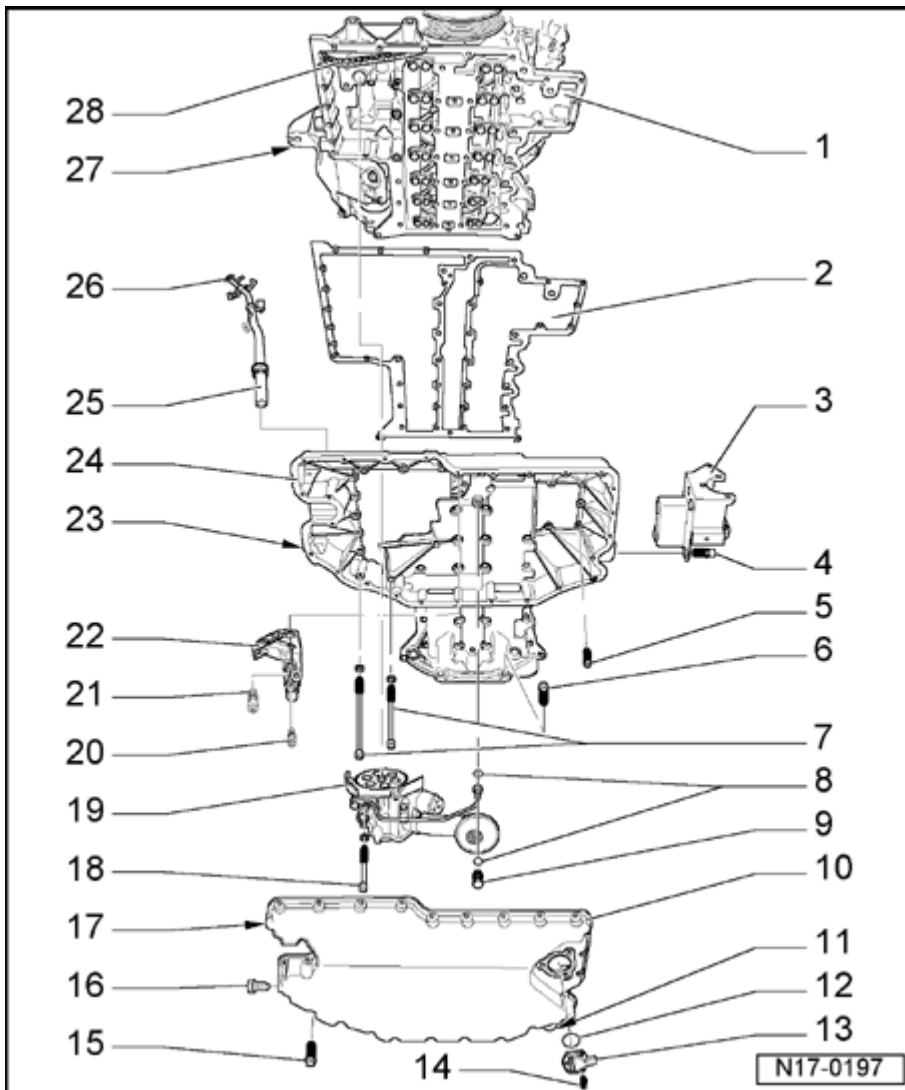


Fig. 196: Oil Pan, Engine Code BAP, Assembly Overview
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Cylinder block/bearing support

2 - Gasket

- Replace

3 - Bracket

- For power steering pump

4 - 40 Nm

5 - 8 Nm

2004 Volkswagen Phaeton

ENGINE 6.0 Liter 12-Cyl. 4V Engine Mechanical, Fuel Injection & Ignition, Engine Code(s): BRP, BAP

- Note tightening sequence and length of attachment bolts --> **Oil Pan, Upper Section, Removing and Installing.**

6 - 40 Nm

7 - 20 Nm

- Note tightening sequence and length of attachment bolts --> **Oil Pan, Upper Section, Removing and Installing.**

8 - Seal

- Replace

9 - Banjo bolt, 20 Nm

10 - Oil pan, lower part

- Clean sealing surface before installing
- Insert with **silicone sealant D 176 404**
- Removing and installing --> **Oil Pan, Lower Section, Removing and Installing.**

11 - Oil return line connection

- Of crankshaft housing ventilation

12 - Seal

- Secured to oil level thermal sensor G266
- Oil before assembling

13 - Oil level thermal sensor G266

- Checking: --> Electrical Wiring Diagrams, Troubleshooting and Component Locations

14 - 8 Nm

15 - 8 Nm

16 - Oil drain plug, 30 Nm

- Replace

17 - Oil return line connection

- Of crankshaft housing ventilation

18 - 20 Nm

19 - Oil pump

- With positive pressure valve 9 to 12 bar
- Removing and installing --> **Oil Pump, Removing and Installing.**

20 - 8 Nm

21 - 20 Nm

22 - Chain tensioner with tensioning rail

- Individual components --> **Chain Tensioner with Tensioning Rail**

23 - Connection for oil return line of oil filter bracket

24 - Oil pan, upper part

- Remove to remove oil pump
- Clean sealing surface before installing
- Upper part of oil pan, removing and installing --> **Oil Pan, Upper Section, Removing and Installing.**

25 - Guide tube

- For dipstick
- Secured to cylinder head

26 - Dipstick

- Oil level must not be above the max. mark!
- Checking engine oil level --> **Engine Oil Level, Checking.**

27 - Connection for oil return line of oil filter bracket

28 - Chain

Chain Tensioner with Tensioning Rail

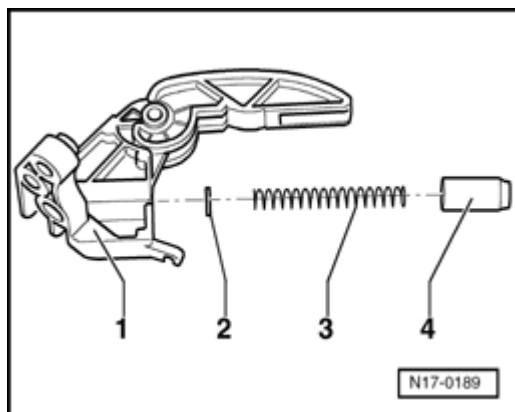


Fig. 197: Chain Tensioner With Tensioning Rail
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Chain tensioner

2 - Washer

3 - Spring

4 - Piston

Oil Pan, Engine Code BRP, Assembly Overview

Oil Pan, Engine Code BRP, Assembly Overview

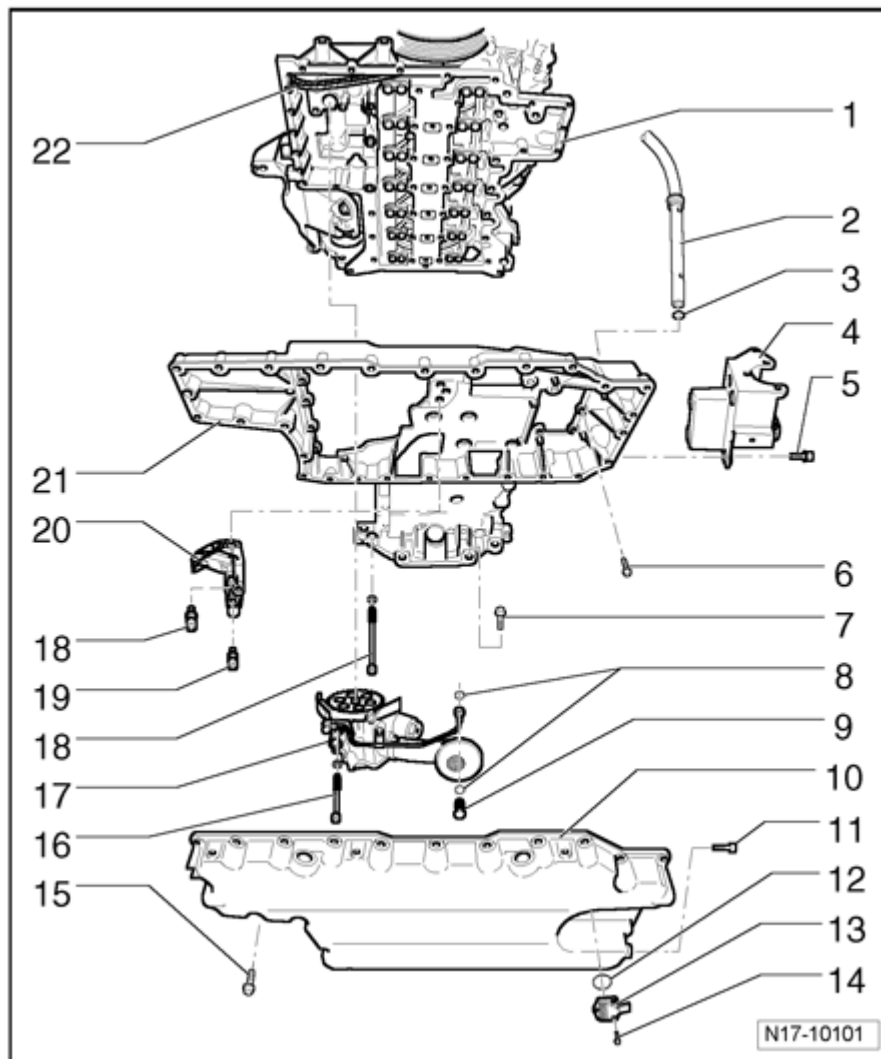


Fig. 198: Oil Pan, Engine Code BRP, Assembly Overview
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- 1 - Cylinder block/bearing support
- 2 - Guide tube
 - For oil dipstick
 - Checking engine oil level --> **Engine Oil Level, Checking.**
- 3 - O-ring
 - Replace
- 4 - Bracket
 - For power steering pump

2004 Volkswagen Phaeton

ENGINE 6.0 Liter 12-Cyl. 4V Engine Mechanical, Fuel Injection & Ignition, Engine Code(s): BRP, BAP

5 - 40 Nm

6 - 8 Nm

- Note tightening sequence and length of attachment bolts --> **Oil Pan, Upper Section, Removing and Installing.**

7 - 40 Nm

8 - Seal

- Replace

9 - Banjo bolt, 20 Nm

10 - Oil pan, lower part

- Clean sealing surface before installing
- Insert with **silicone sealant D 176 404**
- Lower part of oil pan, removing and installing --> **Oil Pan, Lower Section, Removing and Installing.**

11 - Oil drain plug, 30 Nm

- Replace

12 - Seal

- Replace
- Secured to oil level thermal sensor G266
- Oil before assembling

13 - Oil level thermal sensor G266

- Checking: --> Electrical Wiring Diagrams, Troubleshooting and Component Locations

14 - 10 Nm

15 - 8 Nm

16 - 20 Nm

17 - Oil pump

- With positive pressure valve 9 to 12 bar
- Removing and installing --> **Oil Pump, Removing and Installing.**

18 - 20 Nm

- Note tightening sequence and length of attachment bolts --> **Oil Pan, Upper Section, Removing and Installing.**

19 - 8 Nm

20 - Chain tensioner with tensioning rail

- Individual components --> **Chain Tensioner with Tensioning Rail**

21 - Oil pan, upper part

- Remove to remove oil pump
- Clean sealing surface before installing
- Insert with **silicone sealant D 176 501**
- Upper part of oil pan, removing and installing --> **Oil Pan, Upper Section, Removing and Installing.**

22 - Drive chain

- For oil pump

Chain Tensioner with Tensioning Rail

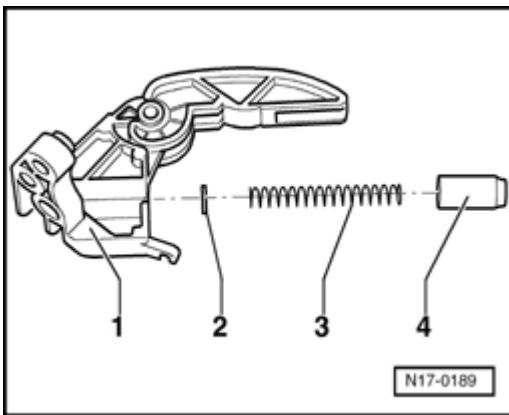


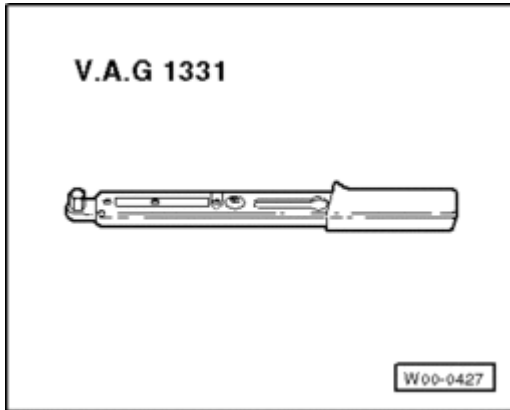
Fig. 199: Chain Tensioner With Tensioning Rail
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Chain tensioner

2 - Washer

3 - Spring

4 - Piston

Oil Pan, Lower Section, Removing and Installing**Oil Pan, Lower Section, Removing and Installing****Special tools, testers and auxiliary items required****Fig. 200: Torque Wrench V.A.G 1331**

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Torque wrench (5 to 50 Nm) V.A.G 1331
- Old oil collecting and extracting device V.A.G 1782
- **Silicone sealant D 176 404**
- Hand drill with plastic brush attachment

- Protective glasses
- Flat scraper

Removing

- Remove noise insulation: --> **50 BODY - FRONT**
- Disconnect 3-pin connector from Oil Level Thermal Sensor G266.

With engine code BAP:

- Loosen brackets of secondary air line at upper oil pan

With engine code BRP:

- Unclip secondary air lines from retainers.

Continuation for All Vehicles:

- Drain engine oil.

NOTE:

- **Observe disposal regulations!**

- Remove lower part of oil pan.
- If necessary, loosen lower part of oil pan by hitting lightly with a rubber hammer.
- Remove any remaining sealant from upper part of oil pan using a scraping tool.

CAUTION: Wear safety glasses.

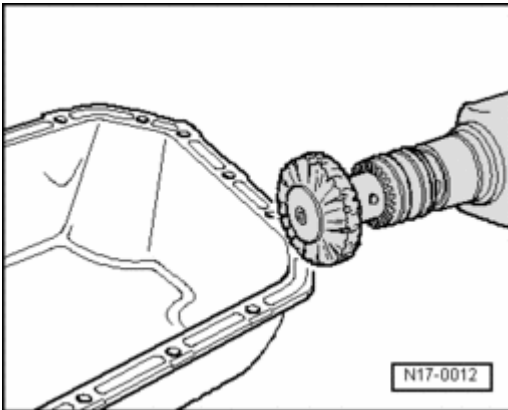


Fig. 201: Removing Sealant Residue From Oil Pan With A Rotating Brush
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove remaining sealant at lower oil pan using a rotating brush, e.g. a drill with plastic brush attachment.
- Clean sealing surfaces. They must be free of oil and grease.

Installing

NOTE:

- **Note the expiration date of the sealing compound.**
- **Lower part of oil pan must be installed within 5 minutes after application of silicone sealant.**

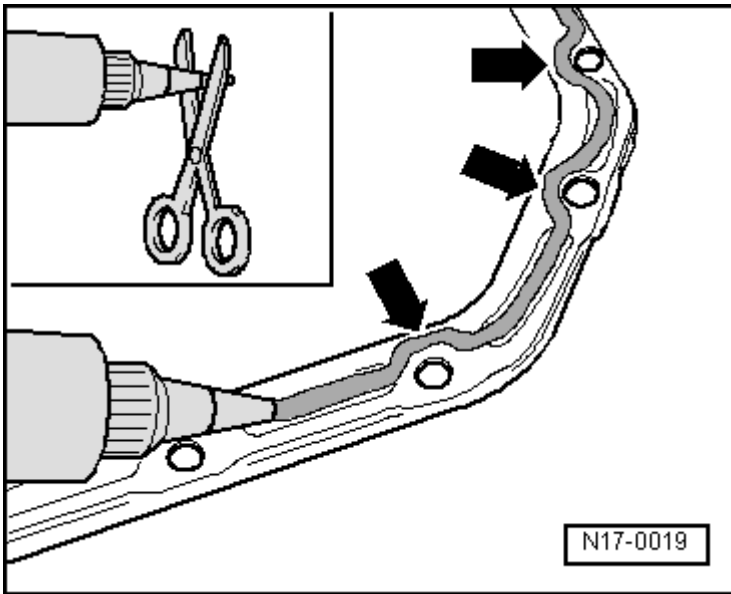


Fig. 202: Cutting Off Tube Nozzle & Applying Silicone Sealing Compound To Oil Pan Sealing Surface
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Cut off the nozzle on the tube of sealant at the front mark (dia. of nozzle approximately 3 mm).
- Apply silicone sealant to clean sealing surfaces of oil pan as shown. The sealing compound bead must be:
 - 2 to 3 mm thick
 - Run on inside of bolt holes - **arrows** -

NOTE:

- **Sealant bead must not be thicker than specified. Otherwise, excess sealant could get into oil pan and clog strainer in intake line of oil pump.**

- Position lower part of oil pan immediately and lightly tighten all oil pan bolts.
- Tighten the oil pan bolts to 8 Nm.

NOTE:

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

The rest of the assembly is basically a reverse of the disassembling sequence.

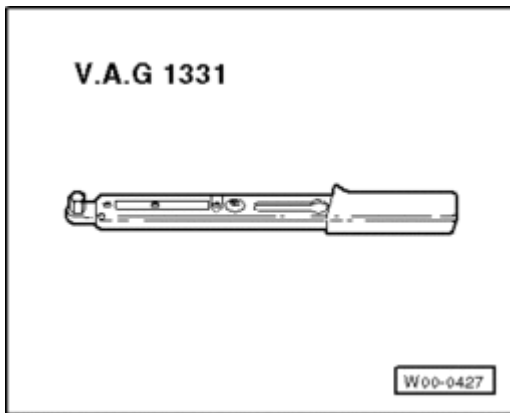
Engine must not be set down on oil pan, because the fluid seal between lower and upper oil pan is otherwise damaged. To set down the engine, use suitable frame : Vehicles with engine code BAP use frame T10116. Use Frame T10319 on vehicles with engine code BRP.

Oil Pan, Upper Section, Removing and Installing

Oil Pan, Upper Section, Removing and Installing

NOTE:

- Upper part of oil pan can only be removed and installed with engine removed --> Engine, Removing and Installing.

Special tools, testers and auxiliary items required**Fig. 203: Torque Wrench V.A.G 1331**

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Torque wrench (5 to 50 Nm) V.A.G 1331
- Old oil collecting and extracting device V.A.G 1782
- **Silicone sealant D 176 501** (only vehicles with engine code BRP)
- Hand drill with plastic brush attachment
- Protective glasses
- Flat scraper

Removing

- Drain engine oil.

NOTE:

- **Observe disposal regulations!**

- Remove engine --> Engine, Removing and Installing.
- Disconnect transmission from engine --> 37 AUTOMATIC TRANSMISSION - CONTROLS, HOUSING
- Secure engine on Engine and Transmission Holder VAS 6095 --> Engine, Securing to Engine and Transmission Holder.
- Remove lower part of oil pan --> Oil Pan, Lower Section, Removing and Installing.
- Remove bracket for power steering pump.

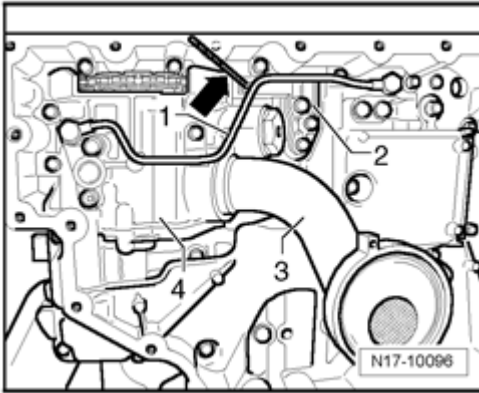


Fig. 204: Identifying Oil Line, Chain Tensioner, Drill Bit, Intake Line & Oil Pump
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove oil line - 1 -.
- Carefully push tensioning track of chain tensioner - 2 - back using a screwdriver.
- Secure chain tensioner - 2 - using 2.5 mm drill bit - **arrow** - and remove.
- Remove intake line - 3 - from oil pump - 4 -.
- Remove upper part of oil pan from cylinder block.
- If necessary loosen upper part of oil pan by hitting it lightly with a rubber hammer.
- Remove sealant residue from cylinder block with a flat scraper.

CAUTION: Wear safety glasses.

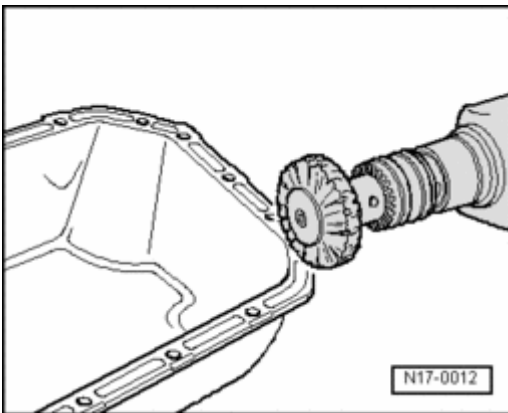
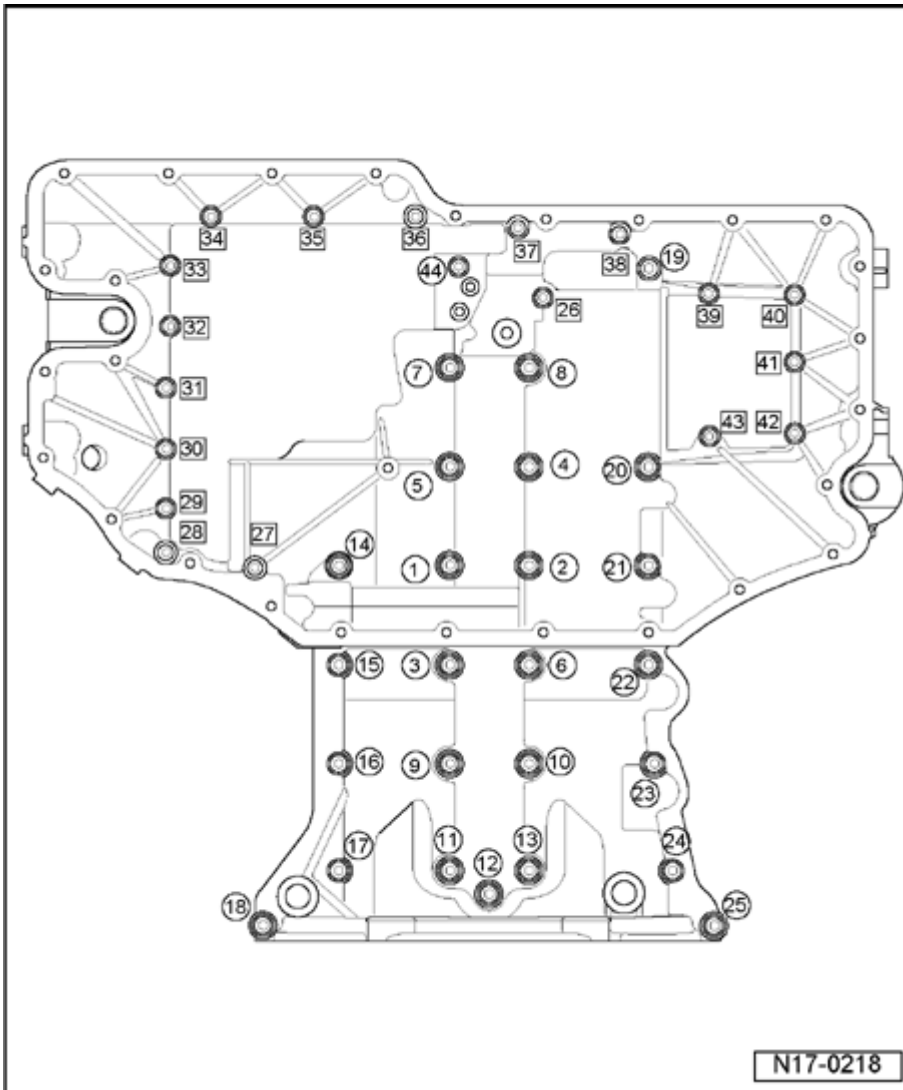


Fig. 205: Removing Sealant Residue From Oil Pan With A Rotating Brush
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove remaining sealant at upper oil pan using a rotating brush, e.g. a drill with plastic brush attachment.
- Clean sealing surfaces. They must be free of oil and grease.

Installing**With engine code BAP:**

- Install upper part of oil pan with new seal.
- Tighten bolts in sequence as depicted to corresponding tightening specifications as follows. Note different length of bolts:

**Fig. 206: Oil Pan Bolts Tightening Sequence (With Engine Code BAP)**

Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 to 13 - M8x26

- Tightening specifications: 20 Nm

14 to 17 - M8x140

2004 Volkswagen Phaeton

ENGINE 6.0 Liter 12-Cyl. 4V Engine Mechanical, Fuel Injection & Ignition, Engine Code(s): BRP, BAP

- Tightening specifications: 20 Nm

18 and 25 - M8x26

- Tightening specifications: 20 Nm

19 to 24 - M8x140

- Tightening specifications: 20 Nm

26 - M6x22

- Tightening specifications: 8 Nm

27 and 28 - M6x62

- Tightening specifications: 8 Nm

29 to 33 - M6x22

- Tightening specifications: 8 Nm

34 to 38 - M6x62

- Tightening specifications: 8 Nm

39 to 43 - M6x22

- Tightening specifications: 8 Nm

44 - M8x45

- Tightening specifications: 20 Nm
- Bolt for chain tensioner

With engine code BRP:

NOTE:

- Note the expiration date of the sealing compound.
- Upper part of oil pan must be installed within 5 minutes after application of silicone sealant.

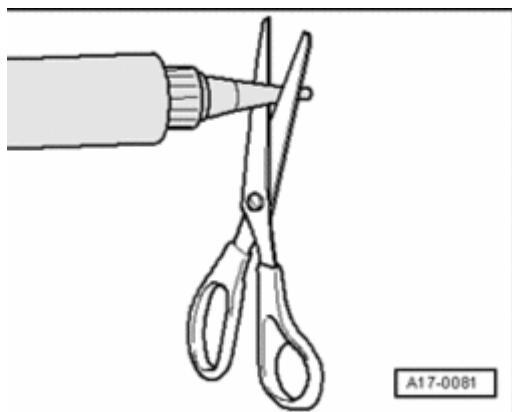


Fig. 207: Cutting Tube Nozzle At Front Marking
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Cut off the nozzle on the tube of sealant at the front mark (dia. of nozzle approximately 3 mm).

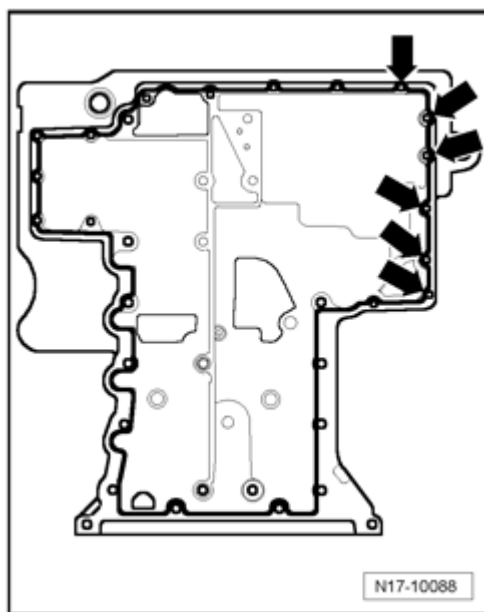


Fig. 208: Applying Silicone Sealant To Clean Sealing Surfaces Of Oil Pan
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Apply silicone sealant to clean sealing surfaces of oil pan as shown. The sealing compound bead must be:
 - 2 to 3 mm thick
 - Continue to inner or outer side in area of screw holes - **arrows** -

NOTE:

- **Sealant bead must not be thicker than specified. Otherwise, excess sealant could get into oil pan and clog strainer in intake line of oil pump.**

- Position upper part of oil pan immediately and lightly tighten all oil pan bolts.

- Tighten bolts in sequence as depicted to corresponding tightening specifications as follows. Note different length of bolts:

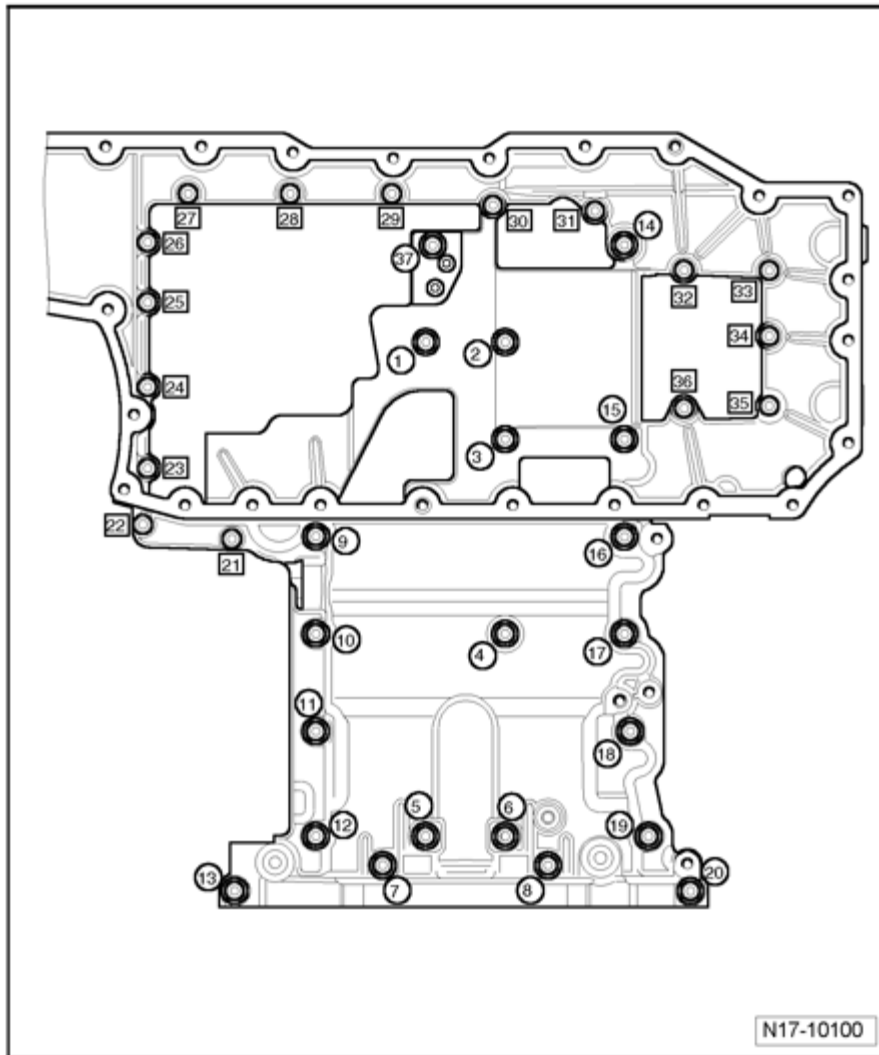


Fig. 209: Oil Pan Bolts Tightening Sequence

Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 to 6 - M8x26

- Tightening specifications: 20 Nm

7 and 8 - M8x45

- Tightening specifications: 20 Nm

9 to 12 - M8x140

- Tightening specifications: 20 Nm

2004 Volkswagen Phaeton

ENGINE 6.0 Liter 12-Cyl. 4V Engine Mechanical, Fuel Injection & Ignition, Engine Code(s): BRP, BAP

13 - M8x45

- Tightening specifications: 20 Nm

14 to 19 - M8x140

- Tightening specifications: 20 Nm

20 - M8x45

- Tightening specifications: 20 Nm

21 to 36 - M6x22

- Tightening specifications: 8 Nm

37 - M8x45

- Tightening specifications: 20 Nm
- Attachment bolt for chain tensioner

NOTE:

- After installing the oil pan the sealant must be allowed to dry for approximately 30 minutes. Only after then may the engine oil be replenished.

Continuation for All Vehicles:

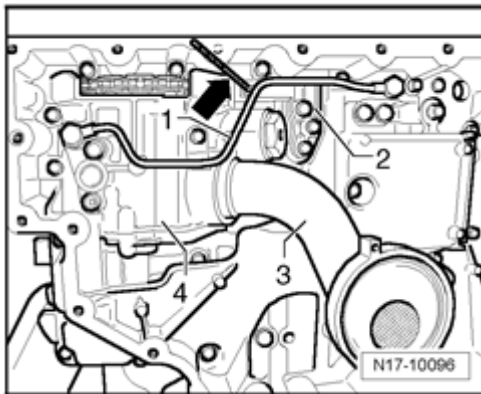


Fig. 210: Identifying Oil Line, Chain Tensioner, Drill Bit, Intake Line & Oil Pump
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Install chain tensioner - 2 -.
- Tighten chain tensioner bolts and remove drill - **arrow** -.
- M6 = 8 Nm

- M8 = 20 Nm
- Install the intake line - 3 - and tighten to 8 Nm.
- Tighten the oil line banjo bolts - 1 - to 20 Nm and the mounting bolt to 8 Nm.

NOTE: • Replace seals for banjo fittings.

The rest of the assembly is basically a reverse of the disassembling sequence.

Oil Pump, Assembly Overview

Oil Pump, Assembly Overview

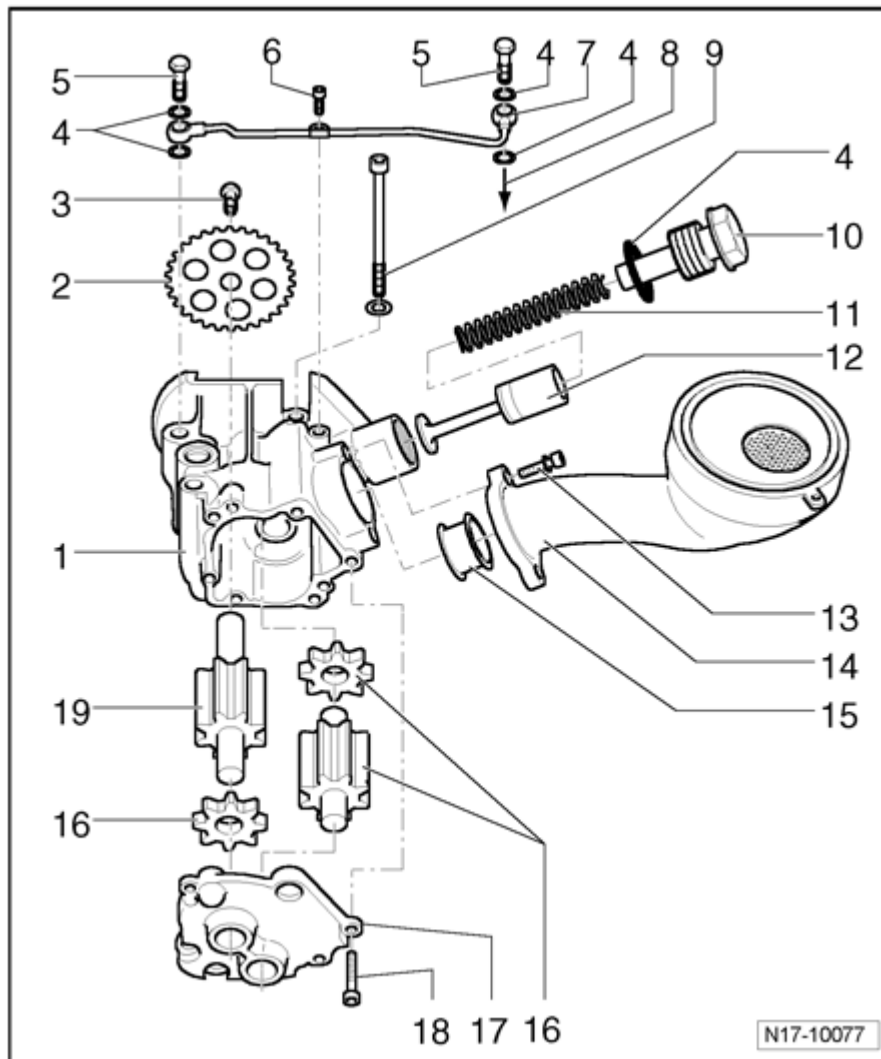


Fig. 211: Oil Pump, Assembly Overview
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Oil pump

- With positive pressure valve 9 to 12 bar
- Replace if running surfaces and gears are scored
- Removing and installing --> **Oil Pump, Removing and Installing.**

2 - Chain sprocket**3 - 20 Nm + $\frac{1}{4}$ turn (90)****4 - Seal**

- Replace

5 - Banjo bolt, 20 Nm**6 - 8 Nm****7 - Oil line****8 - To upper oil pan****9 - 20 Nm****10 - Locking bolt, 40 Nm**

- For pressure control valve approximately 4 bar

11 - Spring

- For pressure control valve approximately 4 bar

12 - Piston

- For pressure control valve approximately 4 bar

13 - 8 Nm**14 - Suction line**

- Clean strainer if soiled

15 - Damping ring/O-ring

- Replace if damaged
- Oil before assembling

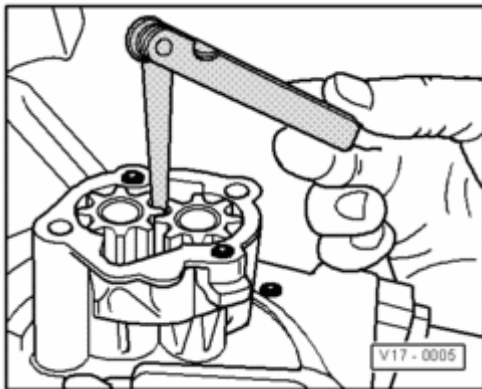
16 - Gears

- Checking backlash --> **Checking Oil Pump Backlash**
- Checking axial play --> **Checking Oil Pump Axial Clearance**

17 - Cover

18 - 8 Nm

19 - Drive gear

Checking Oil Pump Backlash**Fig. 212: Checking Oil Pump Backlash**

Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools, testers and auxiliary items required

- Feeler gauge

Wear limit: 0.20 mm

NOTE:

- To avoid errors, press gears into housing during measurement.

Checking Oil Pump Axial Clearance

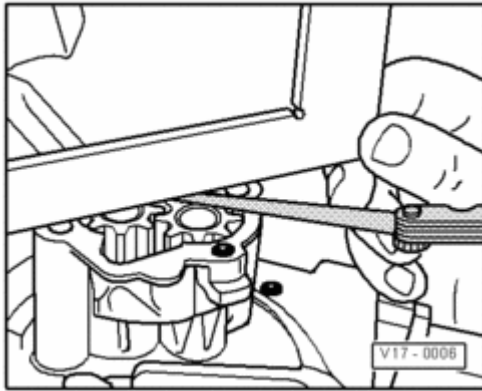


Fig. 213: Checking Oil Pump Axial Clearance
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools, testers and auxiliary items required

- Straight edge
- Feeler gauge

Wear limit: 0.10 mm

Oil Pump, Removing and Installing

Oil Pump, Removing and Installing

NOTE:

- With engine code BRP, the oil pump can only be removed and installed with engine removed --> Engine, Removing and Installing.

Special tools, testers and auxiliary items required

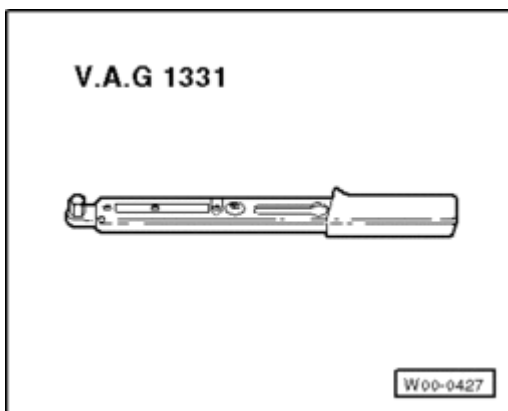


Fig. 214: Torque Wrench V.A.G 1331
Courtesy of VOLKSWAGEN UNITED STATES, INC.

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

- Old oil collecting and extracting device V.A.G 1782

Procedure for Engine Code BRP:**Removing**

- Drain engine oil.

NOTE:

- **Observe disposal regulations!**

- Remove engine --> Engine, Removing and Installing.
- Disconnect transmission from engine --> 37 AUTOMATIC TRANSMISSION - CONTROLS, HOUSING
- Secure engine on Engine and Transmission Holder VAS 6095 --> Engine, Securing to Engine and Transmission Holder.
- Remove lower part of oil pan --> Oil Pan, Lower Section, Removing and Installing.
- Remove oil line.
- Remove upper part of oil pan --> Oil Pan, Upper Section, Removing and Installing.
- Remove chain sprocket from oil pump.
- Unscrew chain sprocket from oil pump.
- Remove oil pump.

Installing

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

- Tighten the oil pump mounting bolts to 20 Nm.
- Tighten chain sprocket using new mounting bolt. Tightening specification: 20 Nm + $\frac{1}{4}$ turn (90)

Procedure for Engine Code BAP:**Removing**

- Drain engine oil.

NOTE:

- **Observe disposal regulations!**

- Remove lower part of oil pan --> Oil Pan, Lower Section, Removing and Installing.
- Remove oil line.
- Unscrew chain sprocket from oil pump.
- Remove chain sprocket from oil pump.

- Remove oil pump.

Installing

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

- Tighten the oil pump mounting bolts to 20 Nm.
- Tighten chain sprocket using new mounting bolt. Tightening specification: 20 Nm + $\frac{1}{4}$ turn (90)

Oil Filter Housing, Engine Code BAP, Assembly Overview

Oil Filter Housing, Engine Code BAP, Assembly Overview

NOTE:

- To remove oil filter housing, front right wheel housing liner must be removed: --> 66 EXTERIOR EQUIPMENT

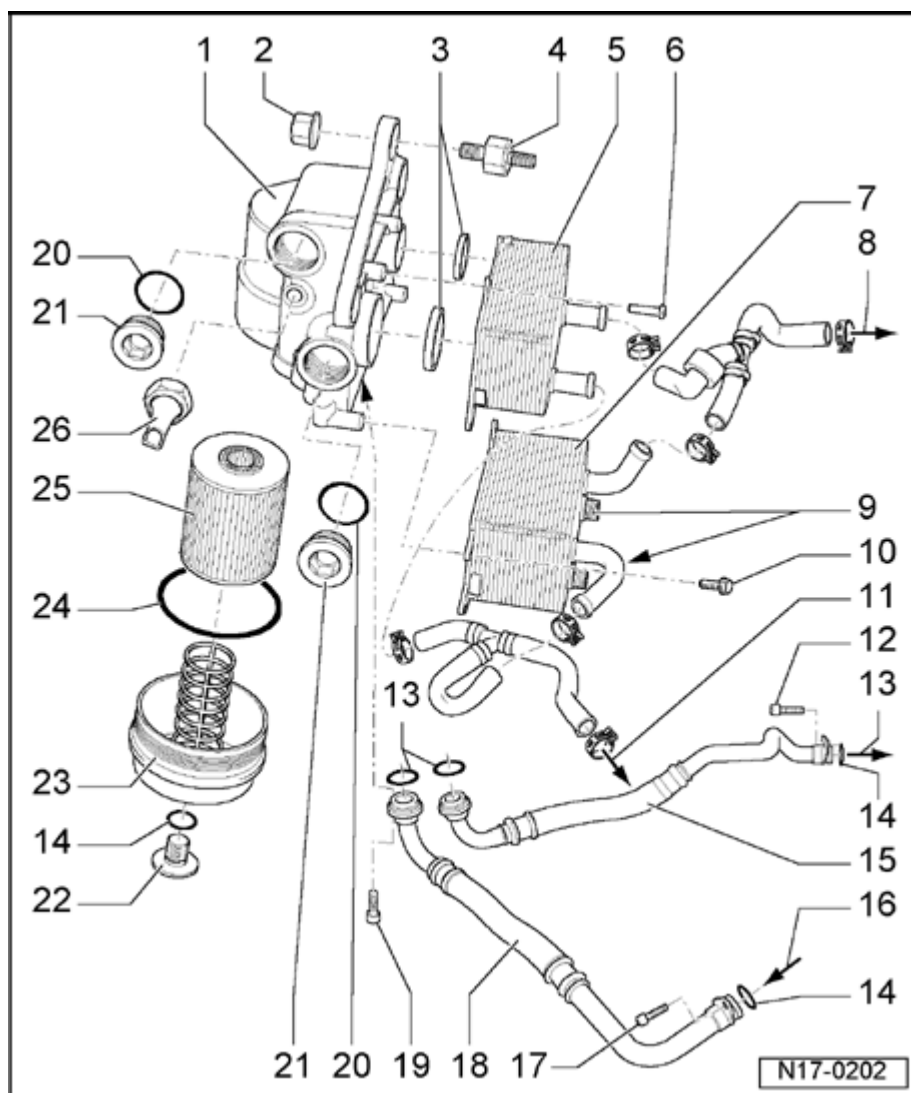


Fig. 215: Oil Filter Housing, Engine Code BAP, Assembly Overview
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Oil filter bracket

- With bypass valve for oil cooler

2 - 9 Nm

- Position with **sealant AMV 200 002**

3 - Gasket

- Replace

4 - Bonded rubber bushing

- Installed on right side of longitudinal control arm
- Replace

5 - Oil cooler

- See note --> **Lubrication System Components.**

6 - 10 Nm

7 - Transmission oil cooler

8 - To rear right coolant pipe

- Coolant hose connection diagram --> **Coolant Hose Connection Diagram.**

9 - Connections for transmission oil lines

10 - 10 Nm

11 - To front coolant pipe

- Coolant hose connection diagram --> **Coolant Hose Connection Diagram.**

12 - 10 Nm

13 - Oil upper part of oil pan

14 - O-ring

- Replace

- Oil before assembling

15 - Oil return line

16 - Connection at bearing support

17 - 10 Nm

18 - Oil supply line

19 - 20 Nm

20 - Seal

- Replace

21 - Locking bolt, 70 Nm

22 - Oil drain plug, 10 Nm

23 - Screw cap, 25 Nm

- With bypass valve for oil filter

24 - O-ring

- Replace
- Oil before assembling

25 - Oil filter element

- Observe change intervals --> **01 - MAINTENANCE**

26 - Oil pressure switch F1 , 20 Nm

- Checking --> **Oil Pressure and Oil Pressure Switch, Checking.**

Oil Filter Housing, Engine Code BRP, Assembly Overview

Oil Filter Housing, Engine Code BRP, Assembly Overview

NOTE:

- **To remove oil filter housing, engine must be removed --> Engine, Removing and Installing.**

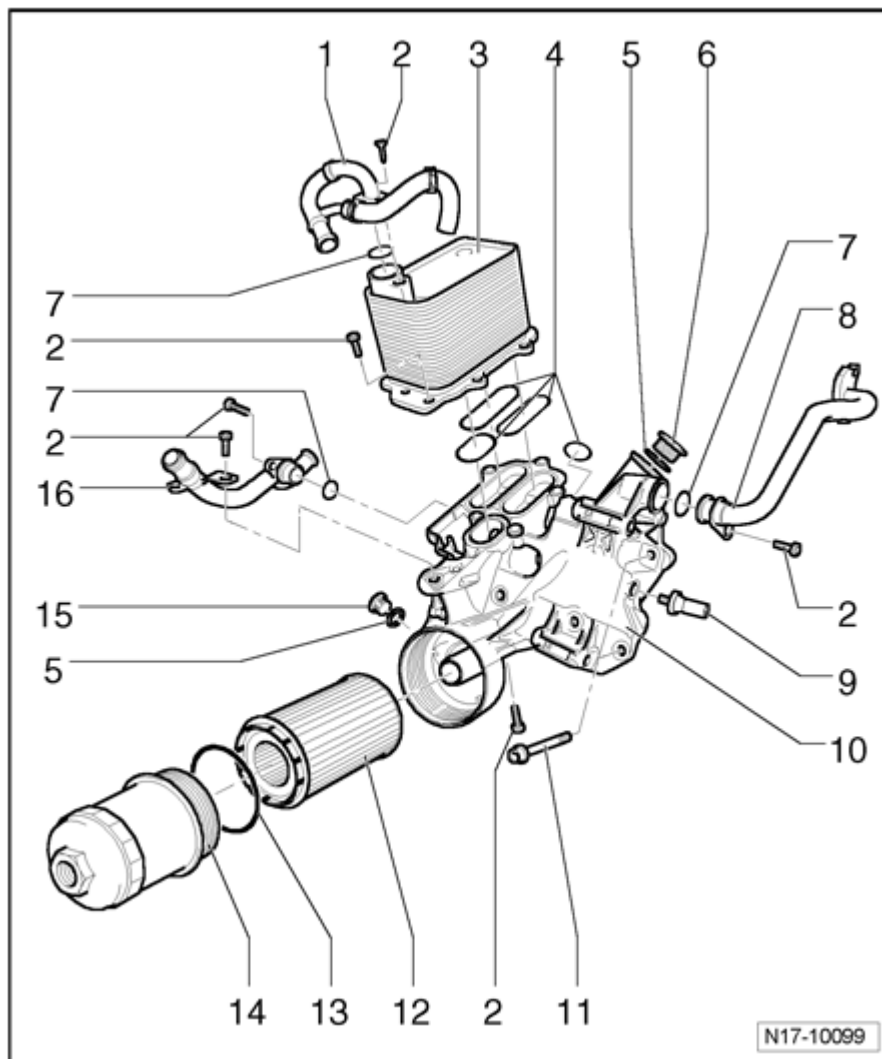


Fig. 216: Oil Filter Housing, Engine Code BRP, Assembly Overview
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Coolant line

- Coolant hose connection diagram --> [Coolant Hose Connection Diagram](#).

2 - 10 Nm

3 - Oil cooler

4 - Gasket

- Replace

5 - Seal

2004 Volkswagen Phaeton

ENGINE 6.0 Liter 12-Cyl. 4V Engine Mechanical, Fuel Injection & Ignition, Engine Code(s): BRP, BAP

- Replace

6 - Locking bolt, 70 Nm

7 - O-ring

- Replace

8 - Oil line

- To cylinder block

9 - Oil pressure switch F1 , 20 Nm

- Checking --> **Oil Pressure and Oil Pressure Switch, Checking.**

10 - Oil filter housing

11 - 20 Nm

12 - Oil filter element

- Observe change intervals --> **01 - MAINTENANCE**

13 - Seal

- Replace

14 - Oil filter frame, 25 Nm

15 - Oil drain plug, 20 Nm

16 - Coolant line

- Coolant hose connection diagram --> **Coolant Hose Connection Diagram.**

Oil Pressure and Oil Pressure Switch, Checking

Oil Pressure and Oil Pressure Switch, Checking

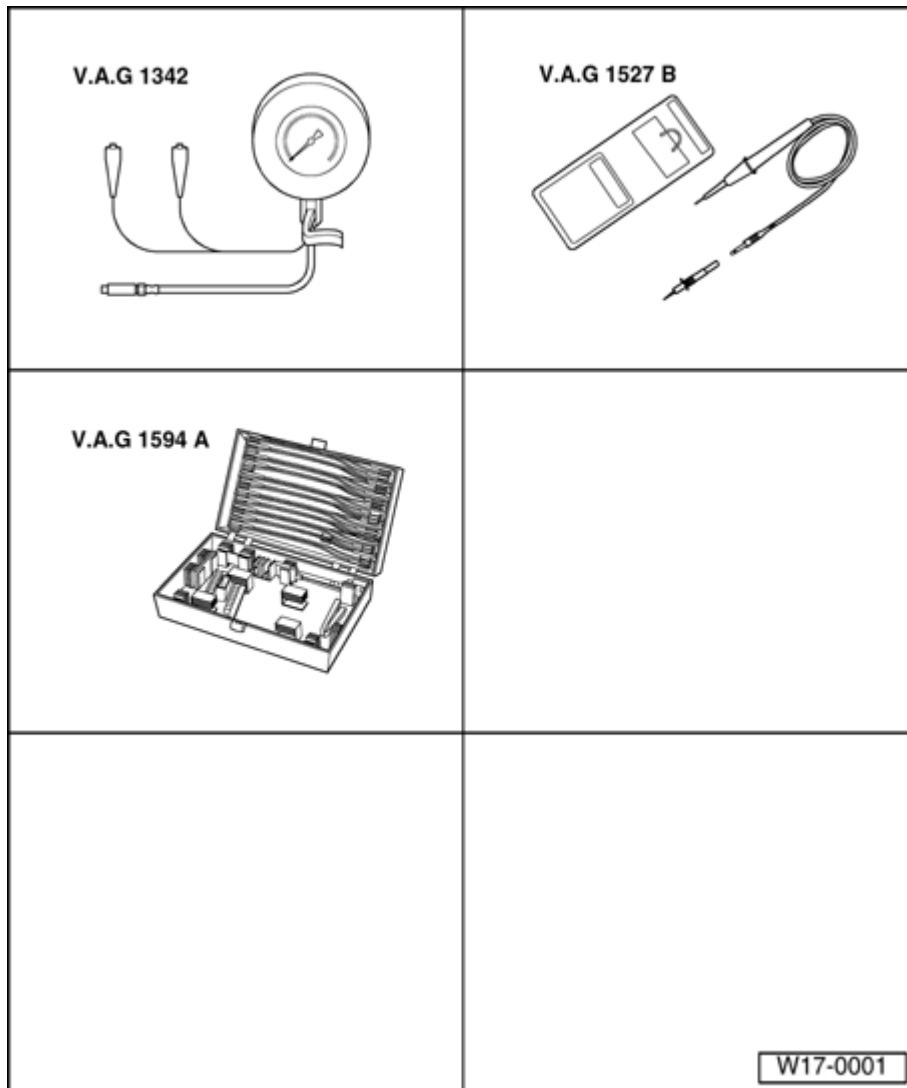


Fig. 217: Identifying Special Tools - Oil Pressure And Oil Pressure Switch, Checking
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools, testers and auxiliary items required

- Oil pressure gauge V.A.G 1342
- Voltage tester V.A.G 1527 B
- Test adapter kit 1594 A

Test Sequence

- Remove front bumper: --> **63 BUMPERS**
- Bring lock carrier into service position: --> **50 BODY - FRONT**

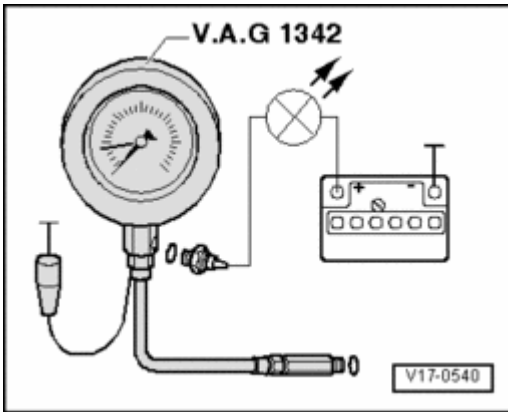


Fig. 218: Identifying Oil Pressure Tester V.A.G 1342

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove oil pressure switch F1 and screw into oil pressure gauge.
- Thread oil pressure gauge into oil filter bracket in place of oil pressure switch.
- Connect brown wire of tester to Ground (GND) (-).
- Connect voltage tester V.A.G 1527 B using adapter cables from connector test kit V.A.G 1594 A to B+ and oil pressure switch. LED must not light up.
- If LED lights up, replace 1.4 bar Oil Pressure Switch F1.

If the LED does not light up:

- Start engine and let run at idle:

LED must light up with 1.2 to 1.6 bar positive pressure, otherwise replace oil pressure switch.

- Increase engine speed (RPM) further:

At 2000 RPM and an oil temperature of 80 C, the oil pressure should be between 3.0 to 4.5 bar.

If the specifications are not obtained:

- Repair mechanical damage, e.g. bearing damage.
- Replace oil filter bracket with pressure valve, or oil pump.

At higher engine speeds oil pressure must not exceed 7.0 bar

19 - ENGINE - COOLING SYSTEM

COOLING SYSTEM COMPONENTS

Cooling System Components

- > **Radiator, Assembly Overview**
- > **Fan, Assembly Overview**
- > **Cooling System, Body Side, Overview**
- > **Cooling System, Upper Engine, Overview**
- > **Cooling System, Engine Rear and Side, Overview**
- > **Cooling System, Engine Front, Overview**
- > **Coolant Hose Connection Diagram**
- > **Cooling System, Draining and Filling**
- > **Radiator, Removing and Installing**
- > **Coolant Pump, Removing and Installing**
- > **Cooling System, Checking for Leaks**

CAUTION: When doing any repair work, especially in the engine compartment, pay attention to the following due to clearance issues:

- Route lines of all types (e.g. for fuel, hydraulic, EVAP canister system, coolant and refrigerant, brake fluid, vacuum) and electrical wiring so that the original path is followed.
- To prevent damages to the lines, make sure there is sufficient clearance to all moving or hot components.

NOTE:

- When the engine is warm the cooling system is under pressure. If necessary release pressure before commencing repair work.
- Hoses are secured with spring-type clips. In cases of repair only use spring-type clips.

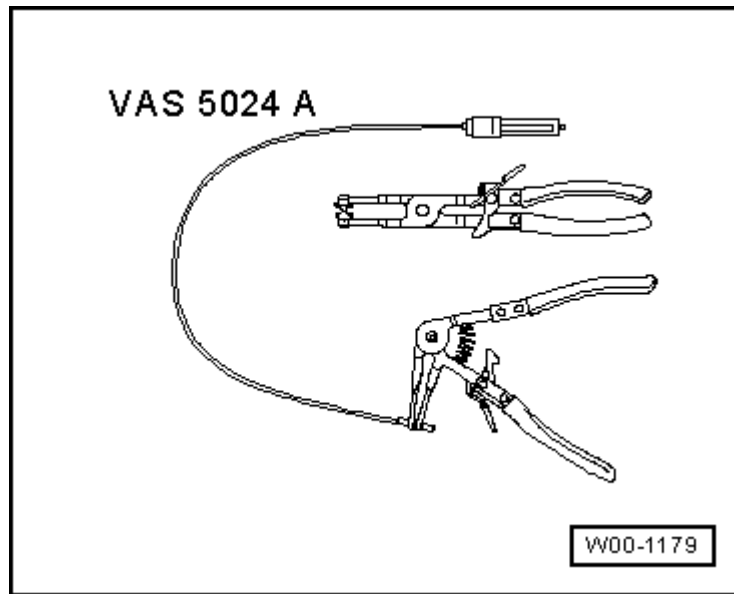


Fig. 219: Spring-Type Clip Pliers VAS 5024A
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Spring-type clip pliers VAS 5024A are recommended for installing spring-type clips.
- When installing coolant hoses, make sure they are free of stress and do not come into contact with other components (observe markings on coolant connections and hoses).

Perform leak test of cooling system using cooling system tester V.A.G 1274 and adapters V.A.G 1274/1A and V.A.G 1274/7.

Radiator, Assembly Overview

Radiator, Assembly Overview

NOTE:

- Coolant hose connection --> Coolant Hose Connection Diagram.

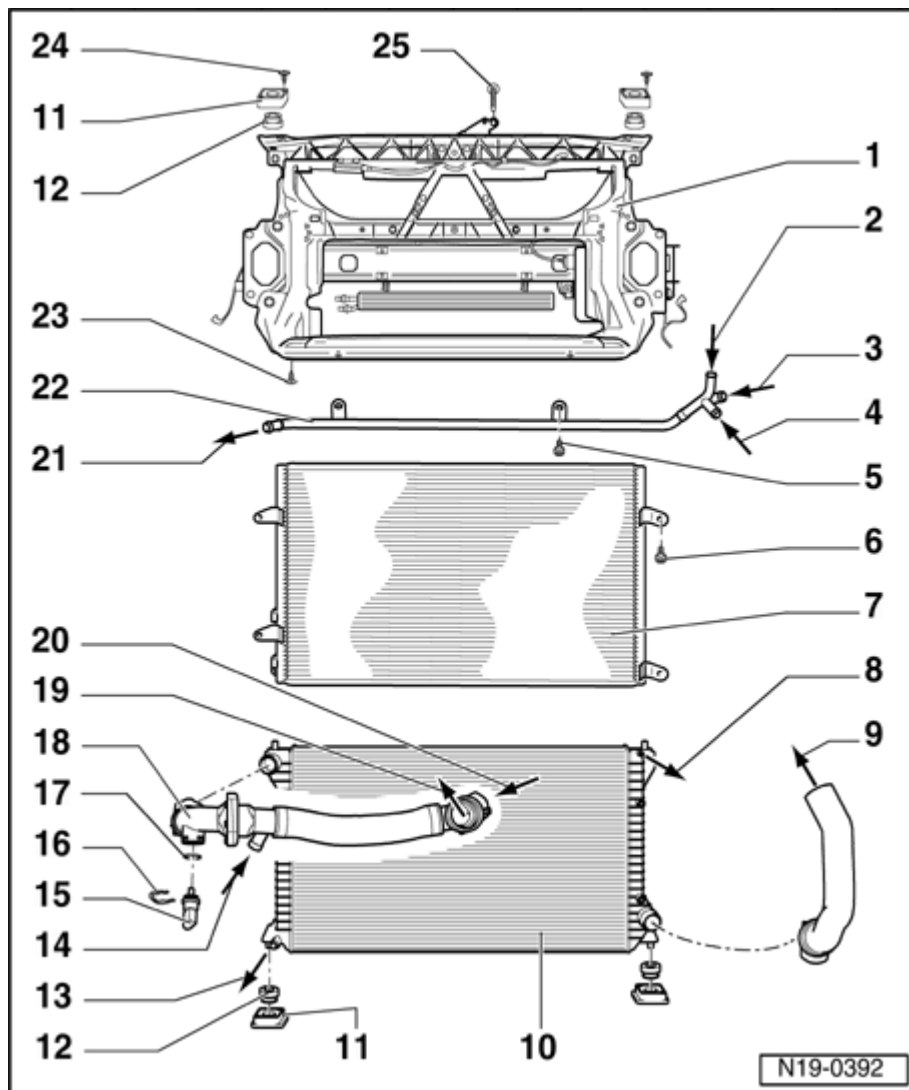


Fig. 220: Radiator, Assembly Overview

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- 1 - Lock carrier
- 2 - From right coolant pipe
- 3 - From generator
- 4 - From transmission oil cooler
- 5 - 10 Nm
- 6 - 10 Nm
- 7 - Condenser

8 - To upper coolant pipe

- Depending on equipment version, connection is sealed with a blind plug.

9 - To front coolant pipe

10 - Radiator

- Removing and installing --> **Radiator, Removing and Installing.**
- After replacing replace entire amount of coolant

11 - Securing rubber

12 - Rubber bushing

13 - To Coolant pump V36

14 - From Coolant pump V36

15 - Engine Coolant Temperature (ECT) sensor (on radiator) G83

- If necessary release pressure in cooling system before removing
- Component location --> **Engine Coolant Temperature (ECT) sensor (on radiator) G83 component location**

16 - Retaining clip

- Check for secure seat

17 - O-ring

- Replace

18 - Upper coolant hose

- Secured to radiator and coolant regulator housing with retaining clip
- Ensure seated tightly
- With check valve

19 - To thermostat housing

20 - From front coolant pipe

21 - To left coolant pipe

22 - Lower front coolant pipe

2004 Volkswagen Phaeton

ENGINE 6.0 Liter 12-Cyl. 4V Engine Mechanical, Fuel Injection & Ignition, Engine Code(s): BRP, BAP

23 - 10 Nm

24 - Bolt

25 - 10 Nm

- Bolt for hood lock

Engine Coolant Temperature (ECT) sensor (on radiator) G83 component location

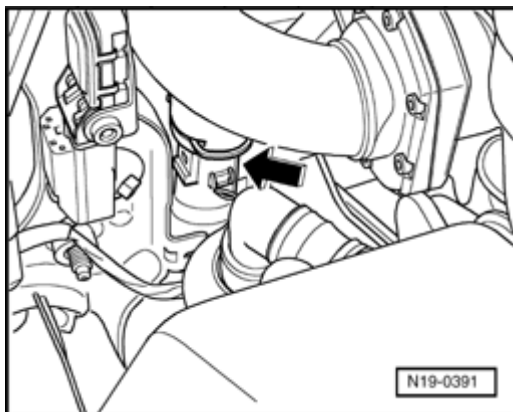
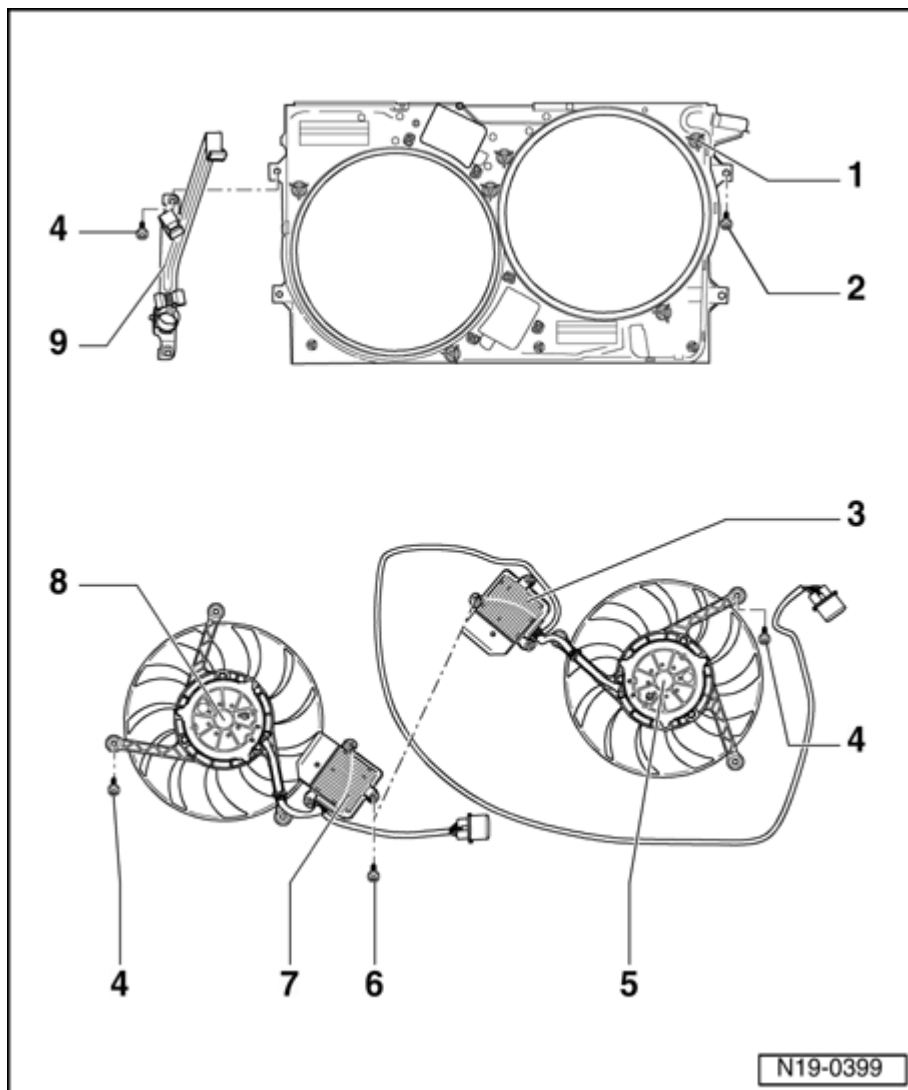


Fig. 221: Engine Coolant Temperature (ECT) Sensor (On Radiator) G83 Component Location
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Fan, Assembly Overview

Fan, Assembly Overview



N19-0399

Fig. 222: Fan, Assembly Overview**Courtesy of VOLKSWAGEN UNITED STATES, INC.**

1 - Fan support

2 - 10 Nm

3 - Coolant Fan Control (FC) control module J293

4 - 10 Nm

5 - Coolant Fan V7

6 - 10 Nm

7 - Coolant Fan Control (FC) control module 2 J671

8 - Coolant Fan 2 V177

9 - Bracket

Cooling System, Body Side, Overview

Cooling System, Body Side, Overview

NOTE:

- Coolant hose connection diagram --> Coolant Hose Connection Diagram.

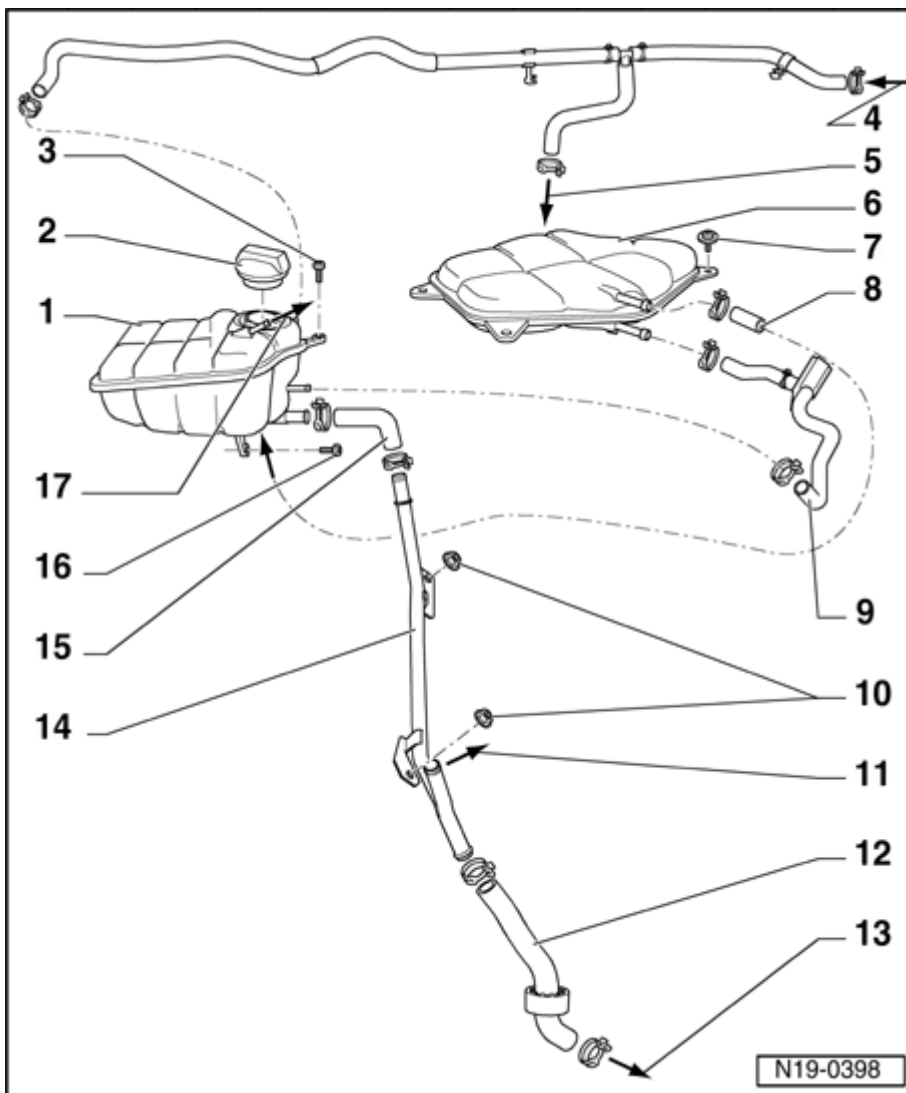


Fig. 223: Cooling System, Body Side, Overview
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Expansion tank

- Perform leak test of cooling system cooling system tester V.A.G 1274 and adapter V.A.G 1274/7 --> Cooling System, Checking for Leaks.

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ENGINE 6.0 Liter 12-Cyl. 4V Engine Mechanical, Fuel Injection & Ignition, Engine Code(s): BRP, BAP

2 - Cap

- Check using cooling system tester V.A.G 1274 and adapter V.A.G 1274/1A --> **Cooling System, Checking for Leaks.**
- Test pressure 1.4 to 1.6 bar

3 - 10 Nm

4 - From heat exchanger

5 - To connection

6 - Auxiliary expansion tank

7 - 10 Nm

8 - Coolant hose

- Depending on equipment version, connection is sealed with a blind plug.

9 - Coolant hose

10 - 10 Nm

11 - To coolant pipe

- At front coolant regulator housing

12 - Coolant hose

13 - To lower front coolant pipe

14 - Right coolant line

15 - Coolant hose

16 - 10 Nm

17 - To front coolant pipe

Cooling System, Upper Engine, Overview

Cooling System, Upper Engine, Overview

NOTE:

- Coolant hose connection diagram --> **Coolant Hose Connection Diagram.**

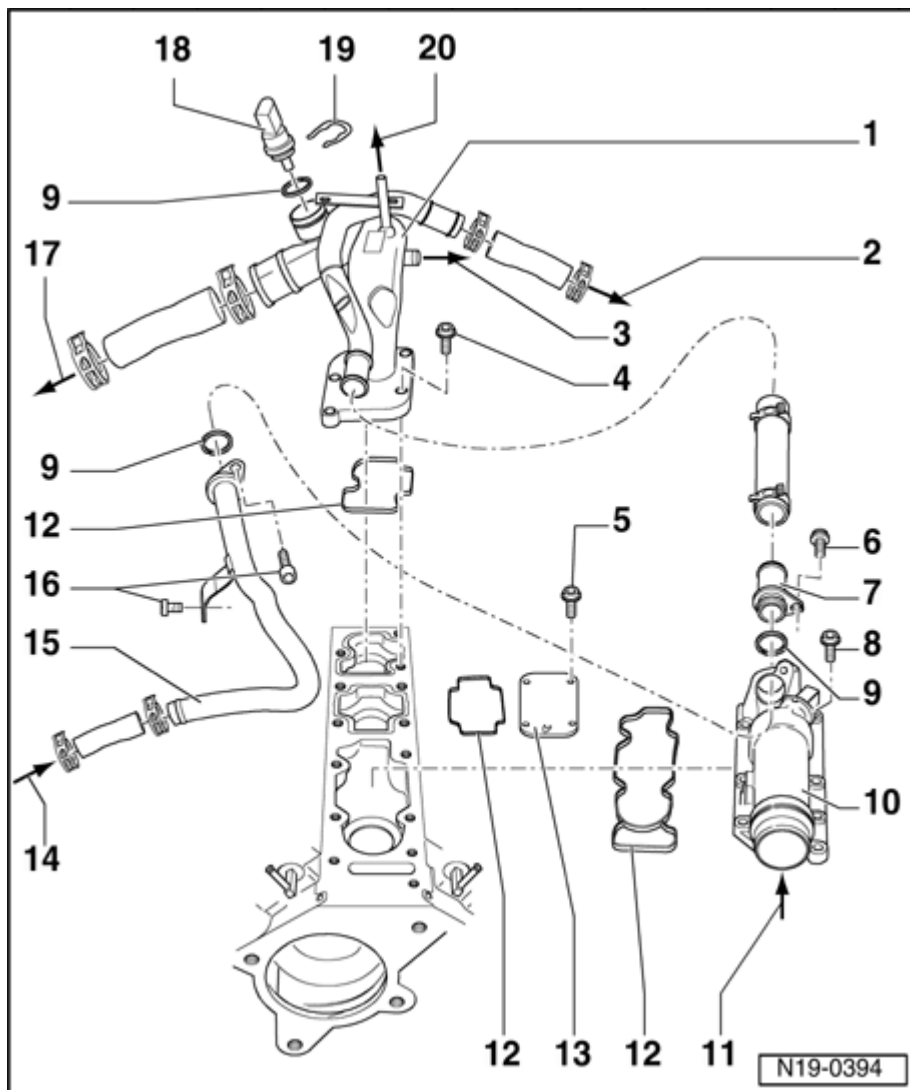


Fig. 224: Cooling System, Upper Engine, Overview
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- 1 - Connection
- 2 - To left coolant pipe
- 3 - To left coolant pipe
- 4 - 10 Nm
- 5 - 10 Nm
- 6 - 10 Nm
- 7 - Connection

2004 Volkswagen Phaeton

ENGINE 6.0 Liter 12-Cyl. 4V Engine Mechanical, Fuel Injection & Ignition, Engine Code(s): BRP, BAP

8 - 10 Nm

9 - O-ring

- Replace

10 - Coolant thermostat housing

- With coolant regulator and Map Controlled Engine Cooling Thermostat F265

11 - From upper coolant hose

12 - Gasket

- Replace if damaged

13 - Cover plate

14 - From right coolant pipe

15 - Coolant line

- At front coolant regulator housing

16 - 10 Nm

17 - To upper coolant pipe

18 - Engine Coolant Temperature (ECT) sensor G62

- For engine control unit
- If necessary release pressure in cooling system before removing

19 - Retaining clip

- Check for secure seat

20 - To rear coolant hose

Cooling System, Engine Rear and Side, Overview

Cooling System, Engine Rear and Side, Overview

NOTE:

- Coolant hose connection diagram --> Coolant Hose Connection Diagram.

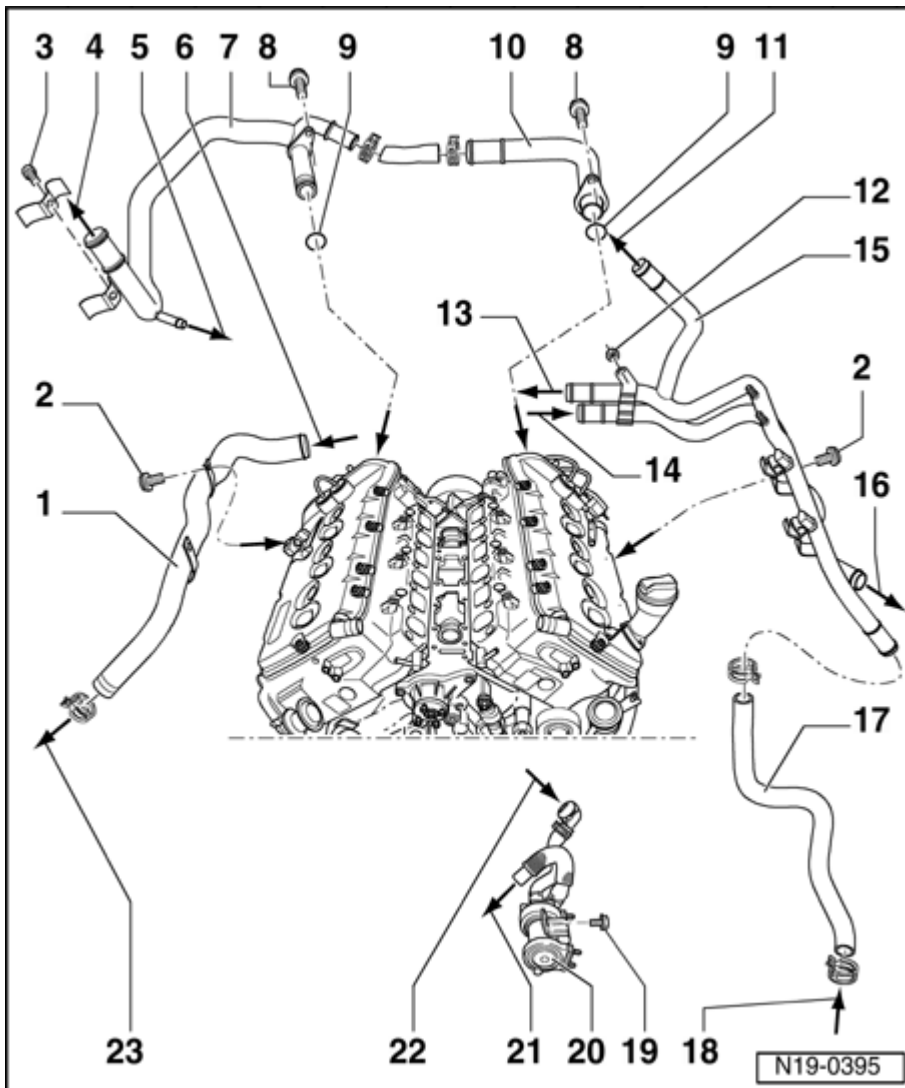


Fig. 225: Cooling System, Engine Rear And Side, Overview
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Upper coolant line

- Secured to cylinder head

2 - 10 Nm

3 - 10 Nm

4 - To oil cooler

5 - To generator

6 - From connecting piece

2004 Volkswagen Phaeton

ENGINE 6.0 Liter 12-Cyl. 4V Engine Mechanical, Fuel Injection & Ignition, Engine Code(s): BRP, BAP

7 - Rear right coolant pipe

8 - 10 Nm

9 - O-ring

- Replace

10 - Rear left coolant pipe

11 - To distributor for auxiliary heating

12 - 10 Nm

13 - To connection

14 - From connecting piece

15 - Left coolant line

- At cylinder head bank 2

16 - To coolant pump for auxiliary heating

17 - Coolant hose

- Ensure seated tightly

18 - From lower front coolant pipe

19 - 10 Nm

20 - Coolant pump V36

21 - To top coolant hose

22 - From lower radiator

23 - To top coolant hose

Cooling System, Engine Front, Overview

Cooling System, Engine Front, Overview

NOTE:

- Coolant hose connection diagram --> Coolant Hose Connection Diagram.

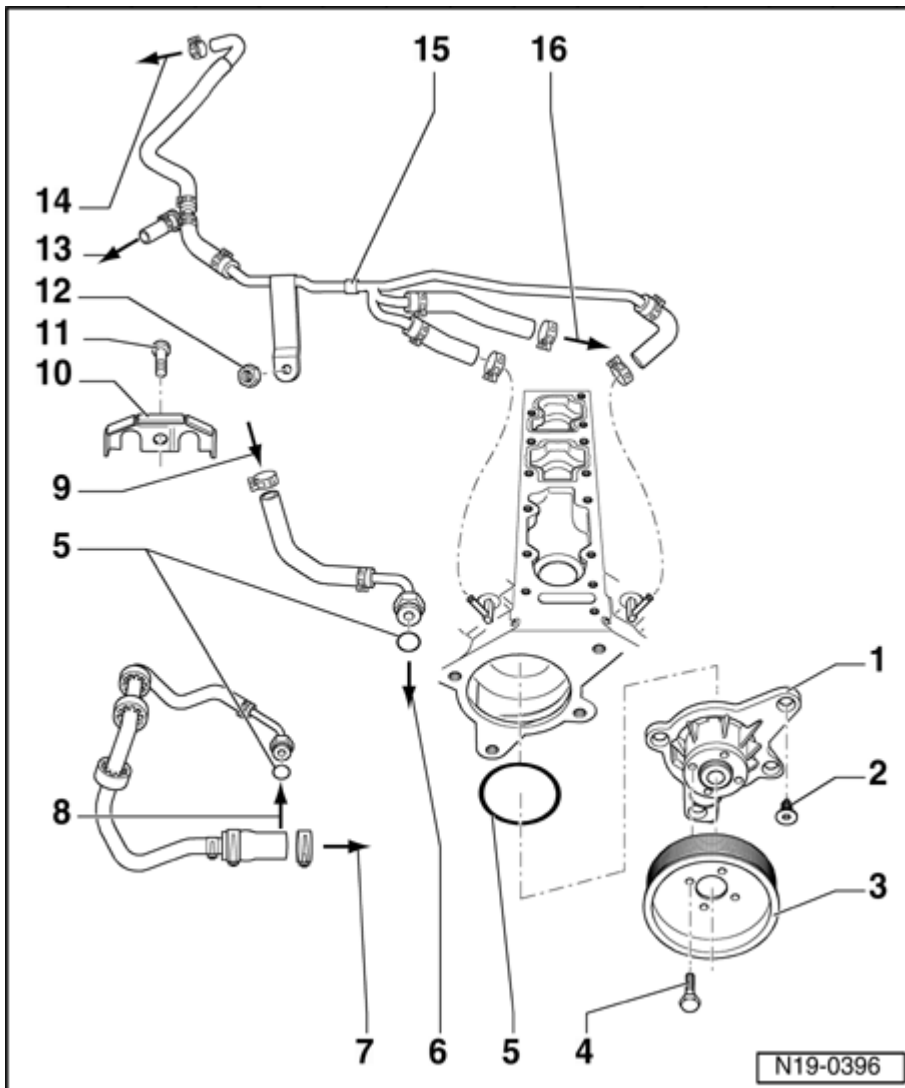


Fig. 226: Cooling System, Engine Front, Overview
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Coolant pump

- Check for ease of movement
- If damaged or leaking replace completely
- Removing and installing --> **Coolant Pump, Removing and Installing.**

2 - 20 Nm

3 - Pulley

4 - 15 Nm

5 - O-ring

2004 Volkswagen Phaeton

ENGINE 6.0 Liter 12-Cyl. 4V Engine Mechanical, Fuel Injection & Ignition, Engine Code(s): BRP, BAP

- Replace

6 - To generator

7 - To lower front coolant pipe

8 - From generator

9 - From rear right coolant pipe

10 - Securing plate

- For coolant pipes at generator

11 - 10 Nm

12 - 10 Nm

13 - To upper radiator

- Depending on equipment version, connection is sealed with a blind plug.

14 - To expansion tank

15 - Front coolant line

16 - To top coolant hose

Coolant Hose Connection Diagram

Coolant Hose Connection Diagram

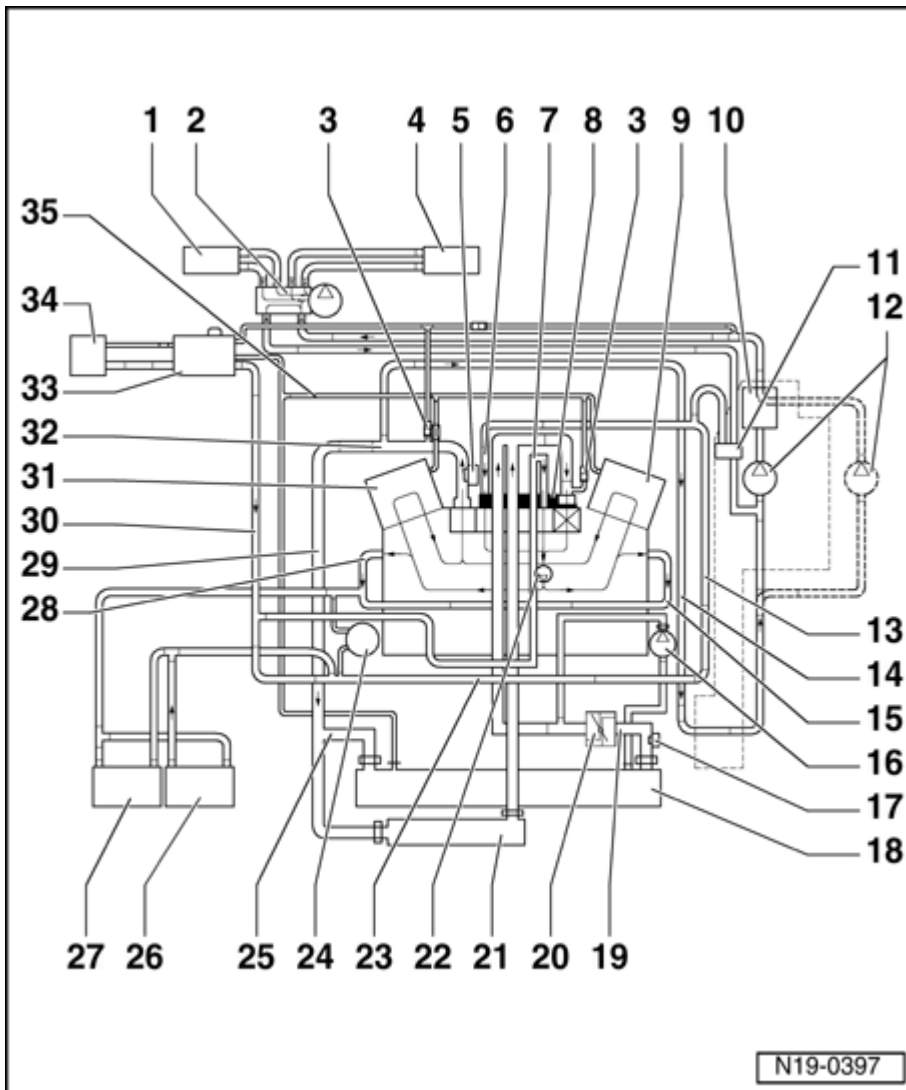


Fig. 227: Coolant Hose Connection Diagram

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- 1 - Right heater core
- 2 - Heater control
- 3 - Non-return valve
- 4 - Left heater core
- 5 - Engine Coolant Temperature (ECT) sensor G62
- 6 - Coolant line
 - At rear coolant regulator housing

2004 Volkswagen Phaeton

ENGINE 6.0 Liter 12-Cyl. 4V Engine Mechanical, Fuel Injection & Ignition, Engine Code(s): BRP, BAP

7 - Coolant line

- At front coolant regulator housing

8 - Coolant thermostat housing

- With coolant regulator and Map Controlled Engine Cooling Thermostat F265

9 - Cylinder head bank 2

10 - Auxiliary heater

- Optional equipment package

11 - Distributor for auxiliary heating

12 - Recirculation pump V55

13 - Upper left coolant pipe

- On left longitudinal member

14 - Lower left coolant pipe

- On left longitudinal member

15 - Rear left coolant pipe

- At left engine block

16 - Coolant pump V36

17 - Engine Coolant Temperature (ECT) sensor (on radiator) G83

- Component location --> **Engine Coolant Temperature (ECT) sensor (on radiator) G83 component location**

18 - Radiator

19 - Upper coolant hose

20 - Check valve

21 - Auxiliary cooler

22 - Coolant pump

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ENGINE 6.0 Liter 12-Cyl. 4V Engine Mechanical, Fuel Injection & Ignition, Engine Code(s): BRP, BAP

23 - Lower front coolant pipe

24 - Generator

25 - Lower coolant hose

26 - Oil cooler

- For transmission oil

27 - Oil cooler

- For engine oil

28 - Rear right coolant pipe

- At right engine block

29 - Upper coolant line

- At cylinder head bank 1

30 - Right coolant line

- At right long member

31 - Cylinder head bank 1

32 - Connection

33 - Expansion tank

34 - Auxiliary expansion tank

35 - Front coolant line

Cooling System, Draining and Filling

Cooling System, Draining and Filling

2004 Volkswagen Phaeton

ENGINE 6.0 Liter 12-Cyl. 4V Engine Mechanical, Fuel Injection & Ignition, Engine Code(s): BRP, BAP

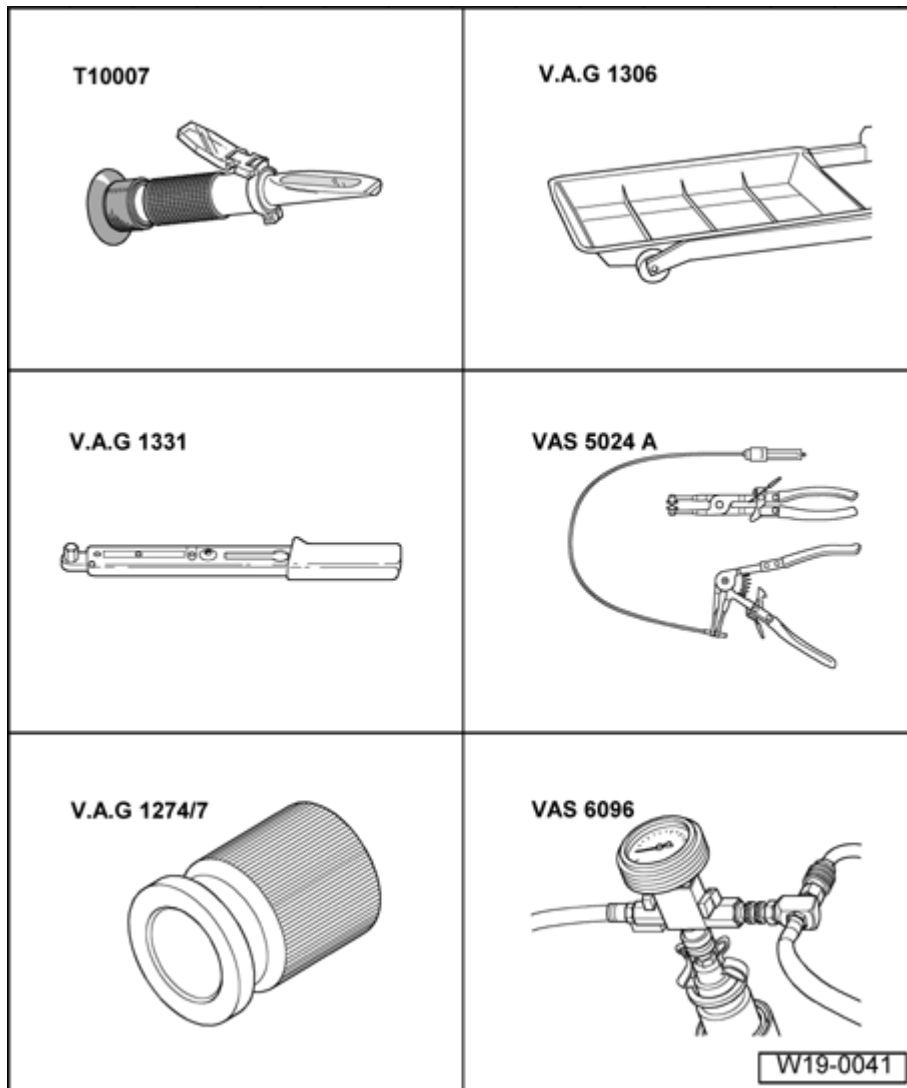


Fig. 228: Identifying Special Tools - Cooling System, Draining And Filling
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools, testers and auxiliary items required

- Refractometer T10007
- Drip tray V.A.G 1306 or drip tray for 6100 VAS 6208
- Torque wrench (5 to 50 Nm) V.A.G 1331
- Spring-type clip pliers VAS 5024A
- Adapter V.A.G 1274/7
- Cooling system charge unit VAS 6096

Draining

- Open cap on coolant expansion tank.

CAUTION: Hot steam may escape when opening expansion tank. Wear protective goggles and protective clothing to prevent damage to eyes and scalding. Cover cap with a rag and open carefully.

- Remove noise insulation. --> **50 BODY - FRONT**
- Remove front bumper: --> **63 BUMPERS**

NOTE: • **Observe disposal regulations for coolant!**

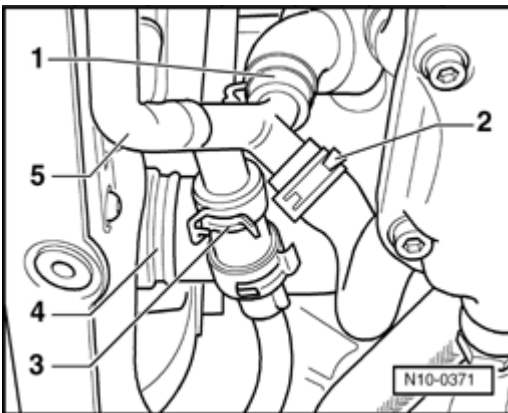


Fig. 229: Identifying Coolant Hoses

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Pull off retaining clamp from lower right coolant hose - 4 - and remove coolant hose from radiator.
- Disconnect right coolant hoses - 1 - , - 2 - and - 3 - from coolant pipe - 5 -.

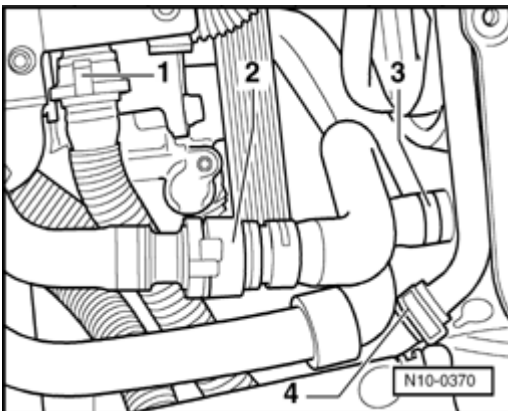


Fig. 230: Identifying Coolant Hose & Connection

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Pull off retaining clamp from left coolant hose - 3 - and remove coolant hose from radiator.
- Disconnect connection - 2 - and disconnect hose - 4 - from lower front coolant pipe.

Filling

CAUTION: A new coolant additive (G12 plus plus) which must be used has be implemented in this vehicle. If the conventional G12 is used, it can cause the Climatronic to malfunction.

NOTE:

- Only G12 plus-plus conforming to "TL VW 774 G" must be used as a coolant additive.
- G 12 plus-plus marked "in accordance with TL VW 774 F" prevents freeze and corrosion damage, scaling and also raise the boiling point of the coolant. For this reason the system must be filled all year round with frost and corrosion protection additives.
- Because of its high boiling point, the coolant improves engine reliability under heavy loads, particularly in countries with tropical climates.
- Protection against frost must be assured to about -25 C (in arctic climatic countries to about -35 C).
- The coolant concentration must not be reduced by adding water even in warmer seasons and in warmer countries. The anti-freeze ratio must be at least 40%.
- If for climatic reasons greater frost protection is required, the amount of G 12 plus can be increased, but only up to 60% (frost protection to about -40 C), otherwise frost protection and cooling effectiveness will be reduced.
- If radiator, heat exchanger, cylinder head or cylinder head gasket is replaced, do not reuse old coolant.

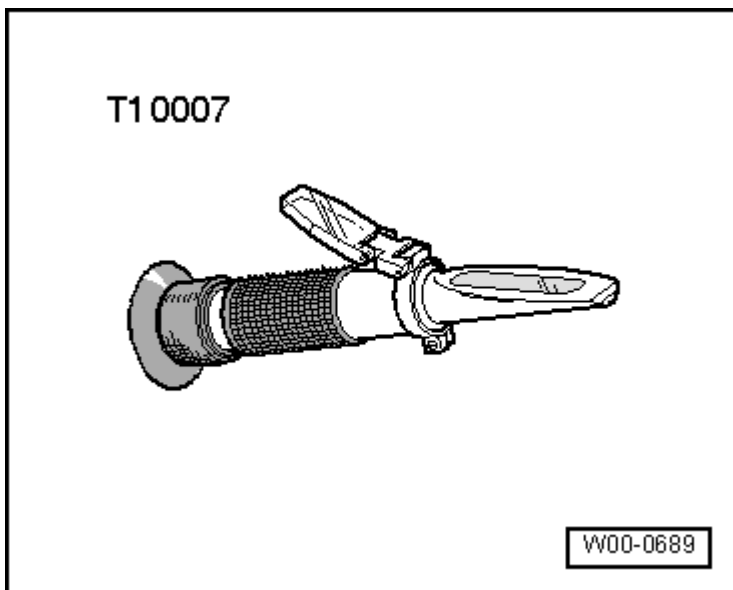


Fig. 231: Refractometer T10007

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- The refractometer T10007 is recommended for determining freeze protection density.

2004 Volkswagen Phaeton

ENGINE 6.0 Liter 12-Cyl. 4V Engine Mechanical, Fuel Injection & Ignition, Engine Code(s): BRP, BAP

Recommended Mixture Ratios:

NOTE:

- The quantity of coolant can vary depending upon the vehicle equipment.

Frost protection to	Anti-freeze portion	G 12 plus-plus	Water
-25° C	40%	7.0 L	10.0 L
-35° C	50%	8.5 L	8.5 L

- Install coolant hoses and secure.
- Screw adapter V.A.G 1274/7 onto expansion tank.
- Clamp off coolant hoses (and) to auxiliary expansion tank using hose clamps.
- Fill coolant circuit using cooling system charge unit VAS 6096 : --> Operating instructions for cooling system charge unit VAS 6096
- Loosen hose clamps at coolant hoses to auxiliary expansion tank.
- Allow engine to idle until upper coolant hose at radiator is hot.
- Check coolant level and top off if necessary. With engine at operating temperature, coolant level must be at max. marking, with engine cold, it must be between min. and max. marking.

Radiator, Removing and Installing

Radiator, Removing and Installing

2004 Volkswagen Phaeton

ENGINE 6.0 Liter 12-Cyl. 4V Engine Mechanical, Fuel Injection & Ignition, Engine Code(s): BRP, BAP

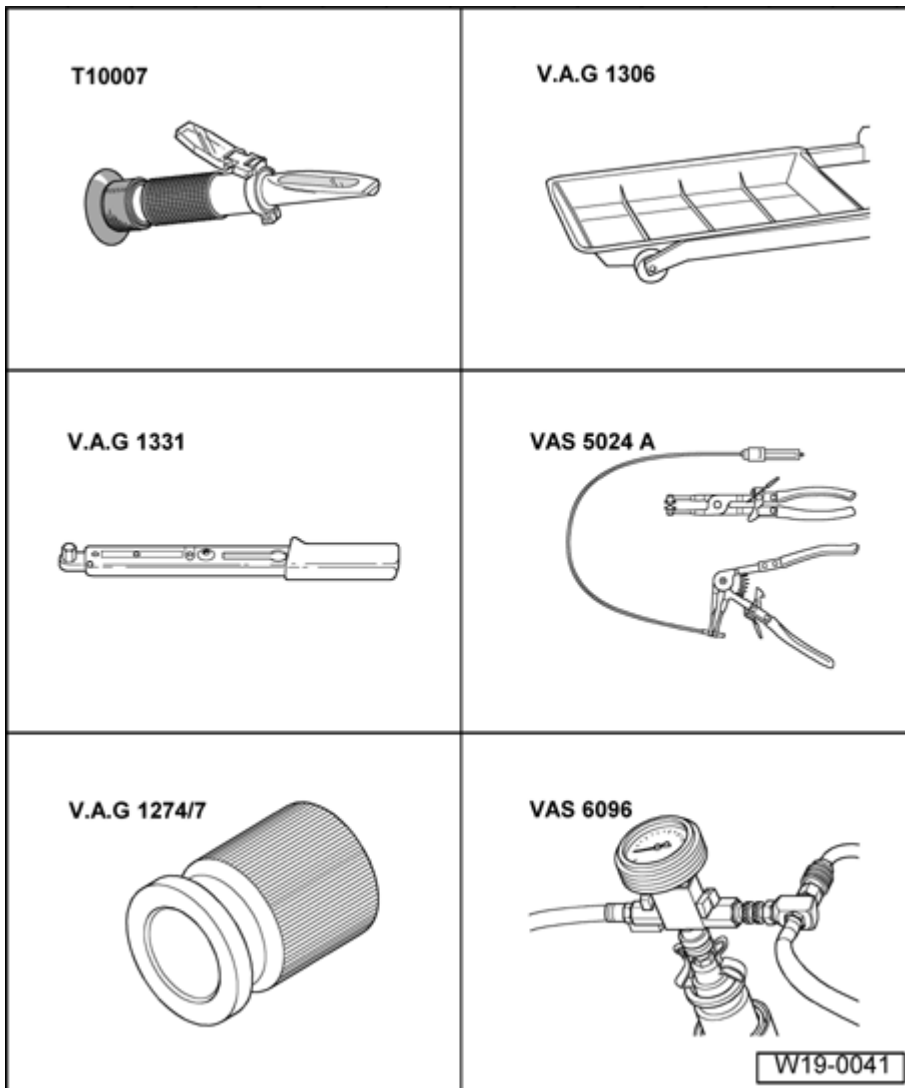


Fig. 232: Identifying Special Tools - Radiator, Removing And Installing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools, testers and auxiliary items required

- Refractometer T10007
- Drip tray V.A.G 1306 or drip tray for VAS 6100 VAS 6208
- Torque wrench (5 to 50 Nm) V.A.G 1331
- Spring-type clip pliers VAS 5024A
- Adapter V.A.G 1274/7
- Cooling system charge unit VAS 6096

Removing

- Drain coolant --> **Cooling System, Draining and Filling.**

2004 Volkswagen Phaeton

ENGINE 6.0 Liter 12-Cyl. 4V Engine Mechanical, Fuel Injection & Ignition, Engine Code(s): BRP, BAP

- Pull out retaining clamp from coolant hose at top and remove coolant hose from radiator.
- Remove front bumper: --> **63 BUMPERS**
- Bring lock carrier into service position: --> **50 BODY - FRONT**
- Remove fans and fan mount --> **Fan, Assembly Overview.**
- Remove upper radiator securing pins and remove radiator toward rear.

Installing

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

- Fill with coolant --> **Cooling System, Draining and Filling.**
- Electrical connections and routing: --> Electrical Wiring Diagrams, Troubleshooting and Component Locations
- Install front bumper --> **63 BUMPERS**
- Check headlight adjustment and adjust if necessary: --> **01 - MAINTENANCE**

Coolant Pump, Removing and Installing

Coolant Pump, Removing and Installing

2004 Volkswagen Phaeton

ENGINE 6.0 Liter 12-Cyl. 4V Engine Mechanical, Fuel Injection & Ignition, Engine Code(s): BRP, BAP

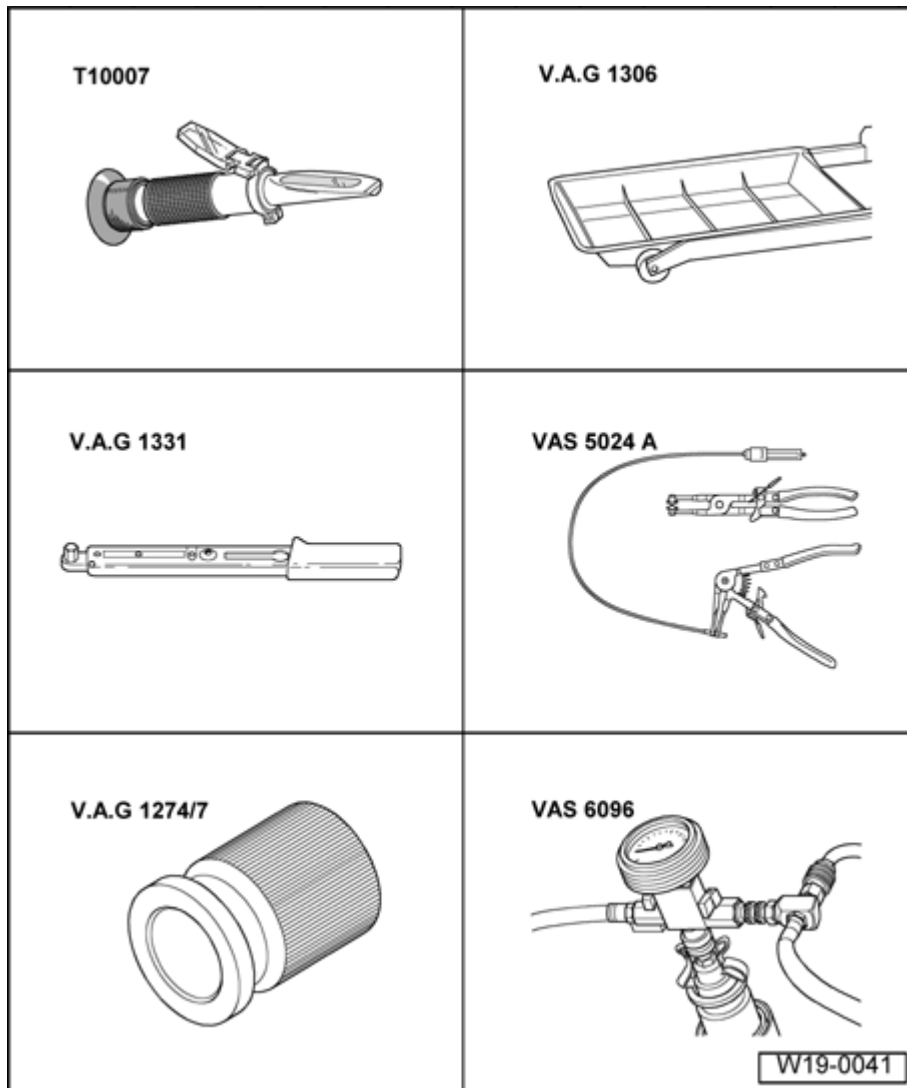


Fig. 233: Identifying Special Tools - Coolant Pump, Removing And Installing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools, testers and auxiliary items required

- Refractometer T10007
- Drip tray V.A.G 1306 or drip tray for VAS 6100 VAS 6208
- Torque wrench (5 to 50 Nm) V.A.G 1331
- Spring-type clip pliers VAS 5024A
- Adapter V.A.G 1274/7
- Cooling system charge unit VAS 6096

Removing

- Remove front bumper: --> **63 BUMPERS**

- Bring lock carrier into service position: --> **50 BODY - FRONT**
- Drain coolant --> **Cooling System, Draining and Filling.**
- Remove ribbed belt --> **Ribbed Belt, Removing and Installing.**
- Remove belt pulley for coolant pump.
- Unscrew mounting bolts for coolant pump and remove coolant pump.

Installing

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

- Moisten new O-Ring with coolant.
- Install coolant pump.
- Tighten securing bolts. Tightening specification: 20 Nm
- Tighten mounting bolts of belt pulley. Tightening specification: 15 Nm
- Install ribbed belt --> **Ribbed Belt, Removing and Installing.**
- Fill with coolant --> **Cooling System, Draining and Filling.**

Cooling System, Checking for Leaks

Cooling System, Checking for Leaks

Special tools, testers and auxiliary items required

- Cooling system tester V.A.G 1274

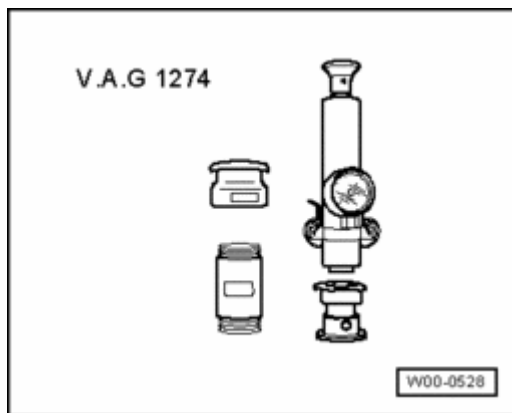


Fig. 234: Adapter V.A.G 1274/1A

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Adapter V.A.G 1274/1A

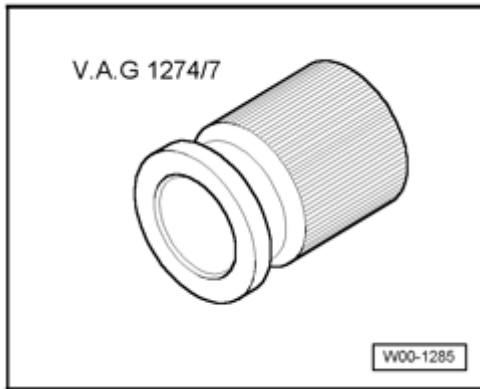


Fig. 235: Adapter V.A.G 1274/7

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Adapter V.A.G 1274/7

Test Conditions

- Engine at operating temperature.

Test Sequence

CAUTION: Hot steam may escape when opening expansion tank. Wear protective goggles and protective clothing to prevent damage to eyes and scalding. Cover cap with a rag and open carefully.

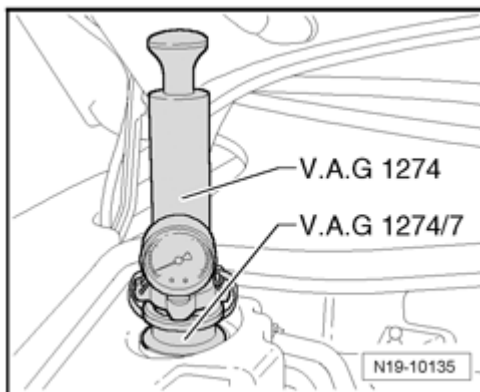


Fig. 236: Installing Cooling System Tester V.A.G 1274 With Adapter V.A.G 1274/7 On Expansion Tank

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Install cooling system tester V.A.G 1274 with adapter V.A.G 1274/7 on expansion tank.
- Operate pump and generate a positive pressure of 1.4 to 1.6 bar.
- Check cooling system for leaks.
- Also check cap.

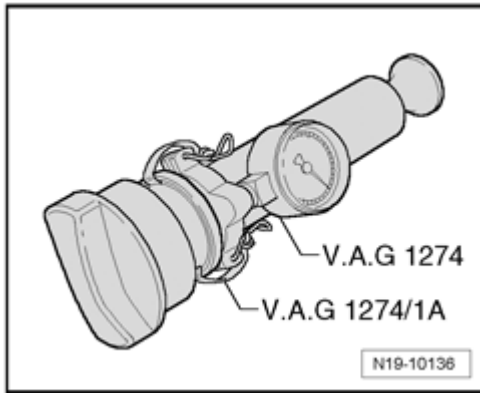


Fig. 237: Installing Cap As Shown Onto Cooling System Tester V.A.G 1274 And Adapter V.A.G 1274/1A
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- To do so, install cap as shown onto cooling system tester V.A.G 1274 and adapter V.A.G 1274/1A.
- Operate pump and generate a positive pressure of max. 1.6 bar.
- Pressure relief valve in cap must not open yet.
- If valve opens early, replace cap.

20 - FUEL SUPPLY

FUEL SUPPLY SYSTEM COMPONENTS

Fuel Supply System Components

--> **Fuel Supply System, Safety Precautions**

--> **Clean Working Conditions**

--> **Fuel Tank with Fuel Filter, Assembly Overview**

--> **Fuel Delivery Unit, Fuel Level Sensor and Suction Jet Pump, Right Side, Assembly Overview**

--> **Fuel Delivery Unit, Fuel Level Sensor and Suction Jet Pump, Left Side, Assembly Overview**

--> **Fuel Lines and Fuel Tank Components, Connection Diagram**

--> **Fuel Tank, Draining**

--> **Fuel Delivery Unit, Fuel Level Sensor and Suction Jet Pump, Right Side, Removing and Installing**

--> **Fuel Delivery Unit, Fuel Level Sensor and Suction Jet Pump, Left Side, Removing and Installing**

--> **Fuel Tank with Attachments and Fuel Filter, Removing and Installing**

--> Fuel Pumps, Checking**NOTE:**

- Hose connections are secured with couplings or spring-type or clamp-type clips.
- Always replace clamp-type clips with spring-type clips.
- Fuel hoses at engine must only be secured with spring-type clips. The use of clamp or screw type clips is not permissible.

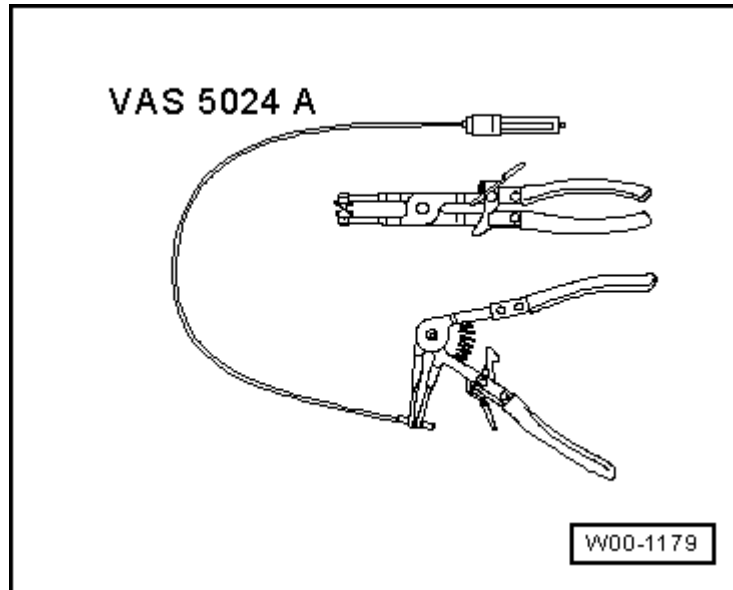


Fig. 238: Spring-Type Clip Pliers VAS 5024A
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Spring-type clip pliers VAS 5024A are recommended for installing spring-type clips.

Fuel Supply System, Safety Precautions**Fuel Supply System, Safety Precautions**

CAUTION: When doing any repair work, especially in the engine compartment, pay attention to the following due to clearance issues:

- Route lines of all types (e.g. for fuel, hydraulic, EVAP canister system, coolant and refrigerant, brake fluid, vacuum) and electrical wiring so that the original path is followed.
- Ensure sufficient clearance to all moving or hot components.

Observe the following when removing and installing the fuel level sensors or fuel pumps (fuel delivery units) from filled or partially filled fuel tanks:

CAUTION: Fuel supply lines are under pressure! Wear protective goggles and protective gloves to avoid damage and contact with skin. Before removing from hose connection wrap a cloth around the connection. Then release pressure by carefully pulling hose off connection.

- Before starting work, switch on exhaust extraction system and place an extraction hose close to the installation opening of fuel tank to extract escaping fuel fumes. If no exhaust extraction system is available, a radial fan (as long as motor is not in air flow) with a displacement greater than 15 m³/h can be used.
- Prevent fuel from contacting skin! Wear fuel-resistant gloves!

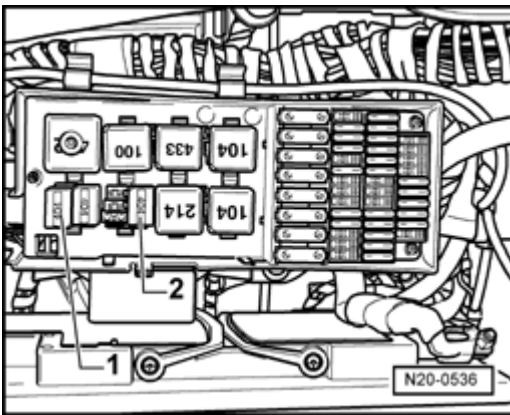


Fig. 239: Fuel Pump Relays, Right And Left Side
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- For safety reasons, fuel pump relays - 1 - (for right side) and - 2 - (for left side) must be removed from fuse holder of E-box in luggage compartment before opening fuel system, as fuel pump may be activated when opening drivers door.

NOTE:

- **Do not remove relay from relay plate with metal tools. The terminals could conduct electricity.**

Clean Working Conditions

Clean Working Conditions

When working on the fuel supply/injection system, pay careful attention to the following "5 rules" of cleanliness:

- Thoroughly clean all connections and the surrounding area before disconnecting.
- Place parts that have been removed on a clean surface and cover them. Use lint-free cloths.
- Carefully cover over opened components or seal, if repairs are not performed immediately.
- Only install clean components: Only unpack replacement parts immediately prior to installation. Do not use parts that have been stored loose (e.g. in tool boxes etc.).

- When the system is open: Avoid working with compressed air if possible. Do not move vehicle unless absolutely necessary.

Fuel Tank with Fuel Filter, Assembly Overview

Fuel Tank with Fuel Filter, Assembly Overview

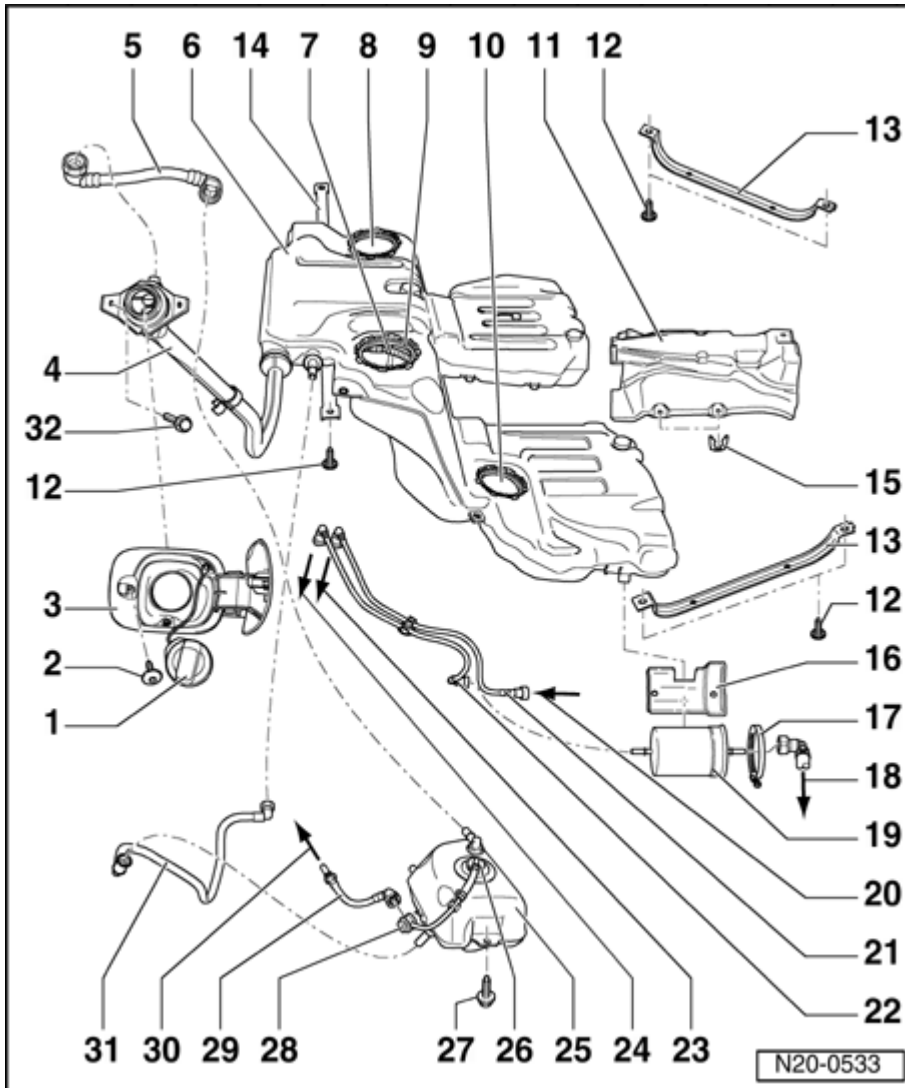


Fig. 240: Fuel Tank With Fuel Filter, Assembly Overview
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- 1 - Sealing cap
- 2 - Bolt
- 3 - Tank flap unit
 - With rubber gasket

4 - Fuel filler tube

5 - Vent line

- Ensure seated tightly

6 - Fuel tank

- Support using Engine/transmission jack V.A.G 1383 A when removing
- Removing and installing --> **Fuel Tank with Attachments and Fuel Filter, Removing and Installing.**

7 - Fill hose

- From filler tube

8 - Sensor opening, left side

- Components, removing and installing --> **Fuel Delivery Unit, Fuel Level Sensor and Suction Jet Pump, Left Side, Removing and Installing.**

9 - Sensor opening, right side

- Components, removing and installing --> **Fuel Delivery Unit, Fuel Level Sensor and Suction Jet Pump, Right Side, Removing and Installing.**

10 - Opening for supply and return flange

11 - Heat shield

- For fuel tank

12 - 20 Nm + $\frac{1}{4}$ turn (90)

13 - Securing strap

- Note installation position

14 - Cross member

- For fuel tank

15 - Securing clip

- Ensure seated tightly

16 - Cover

2004 Volkswagen Phaeton

ENGINE 6.0 Liter 12-Cyl. 4V Engine Mechanical, Fuel Injection & Ignition, Engine Code(s): BRP, BAP

17 - Screw clamp

18 - To fuel rail

19 - Fuel filter

20 - From fuel rail

21 - Return line

- Blue
- Ensure seated tightly

22 - Supply line

- Black
- Ensure seated tightly

23 - To connection on supply and return flange

24 - To connection on supply and return flange

25 - Expansion tank

26 - Breather valve

27 - 8 Nm + $\frac{1}{4}$ turn (90)

28 - Pressure retention valve

- Only vehicles with engine codes BAN and BRN

29 - Vent line

- Ensure seated tightly

30 - To EVAP canister

31 - Vent line

32 - 8 Nm + $\frac{1}{4}$ turn (90)

Fuel Delivery Unit, Fuel Level Sensor and Suction Jet Pump, Right Side, Assembly Overview

Fuel Delivery Unit, Fuel Level Sensor and Suction Jet Pump, Right Side, Assembly Overview

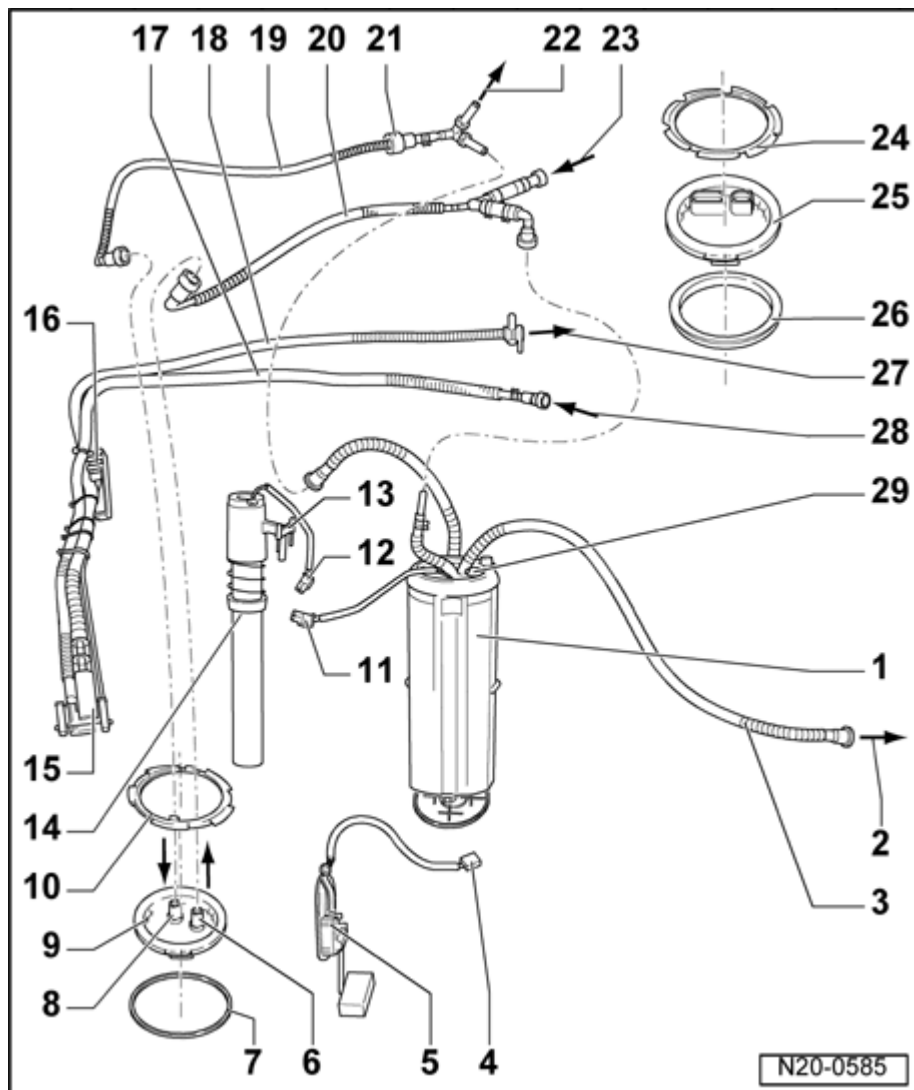


Fig. 241: Fuel Delivery Unit, Fuel Level Sensor And Suction Jet Pump, Right Side, Assembly Overview
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Fuel delivery unit

- Check fuel pump --> **Fuel Pumps, Checking.**
- Removing and installing --> **Fuel Delivery Unit, Fuel Level Sensor and Suction Jet Pump, Right Side, Removing and Installing.**

2 - To Y-piece on supply line for left side suction jet pump

3 - Supply line for suction jet pump

4 - Connector

5 - Fuel level sensor 2 G169

- Lever-type sensor
- Clipped in on mount for Fuel Pump (FP) unit
- Checking: --> Electrical Wiring Diagrams, Troubleshooting and Component Locations

6 - Connection

- Arrow points away from connection

7 - Seal

- Replace if damaged

8 - Connection

- Arrow points to connection

9 - Supply and return flange**10 - Locking ring, 60 Nm**

- Ensure seated tightly
- Use wrench 3087 to remove and install

11 - Connector

- For fuel pump

12 - Connector**13 - Retaining tab**

- Clipped in at right on Fuel Pump (FP) unit

14 - Fuel gauge sender G

- Tubular sensor
- Checking: --> Electrical Wiring Diagrams, Troubleshooting and Component Locations

15 - Suction jet pump**16 - Retaining tab**

- Clipped in on mount for Fuel Pump (FP) unit

17 - Supply line

- Suction jet pump, right side

18 - Delivery line

- Suction jet pump, right side

19 - Return line

20 - Supply line

21 - Non-return valve

- Note installation position

22 - To return line of Fuel Pump (FP) unit, left side

23 - From supply line of Fuel Pump (FP) unit, left side

24 - Locking ring, 110 Nm

- Ensure seated tightly
- Use wrench 3087 to remove and install

25 - Flange

- Note installation position on fuel tank --> **Installation Position of Flange for Fuel Pumps**

26 - Seal

- Replace

27 - To Fuel Pump (FP) unit, left side

- Clipped in at right on Fuel Pump (FP) unit

28 - From supply line for suction jet pump at Fuel Pump (FP) unit, right side

29 - Connection for fill hose

Fuel Delivery Unit, Fuel Level Sensor and Suction Jet Pump, Left Side, Assembly Overview

Fuel Delivery Unit, Fuel Level Sensor and Suction Jet Pump, Left Side, Assembly Overview

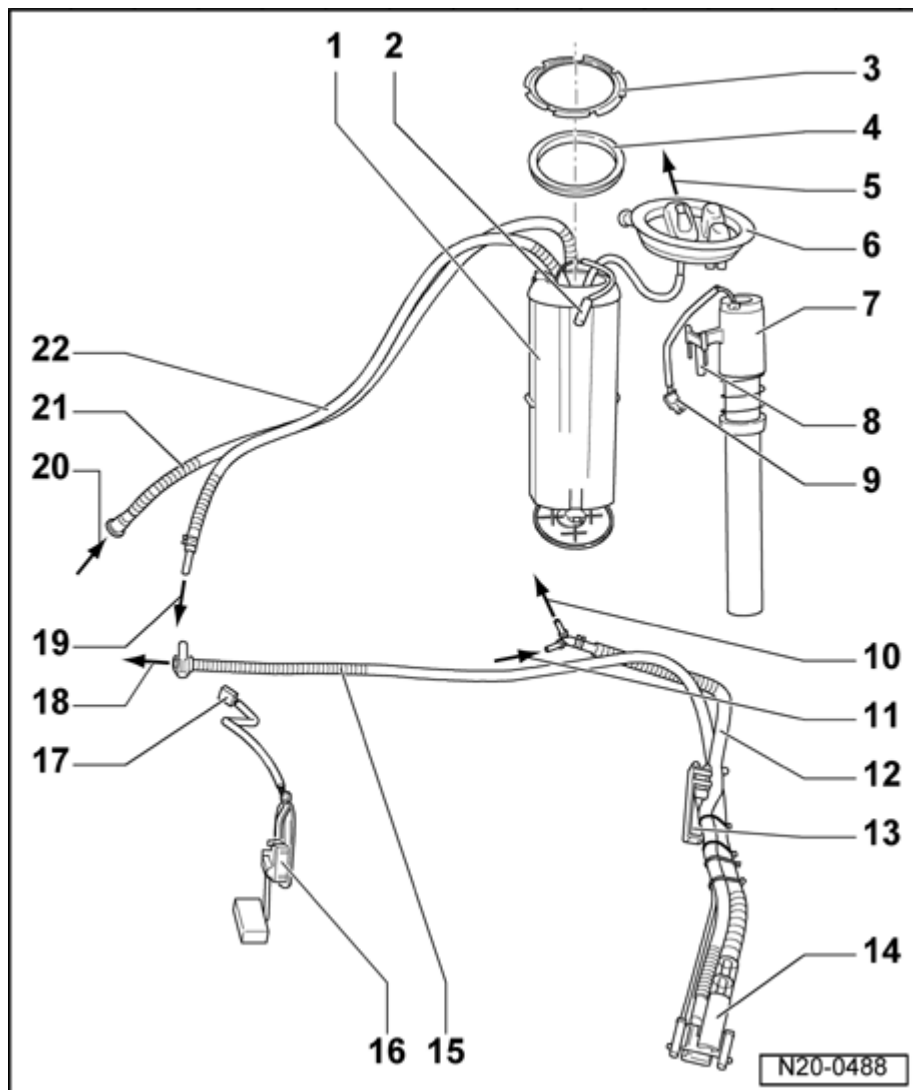


Fig. 242: Fuel Delivery Unit, Fuel Level Sensor And Suction Jet Pump, Left Side, Assembly Overview
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Fuel delivery unit

- Check fuel pump --> **Fuel Pumps, Checking.**
- Removing and installing --> **Fuel Delivery Unit, Fuel Level Sensor and Suction Jet Pump, Left Side, Removing and Installing.**

2 - Connector

- For fuel pump

3 - Locking ring, 110 Nm

- Ensure seated tightly

- Use wrench 3087 to remove and install

4 - Seal

- Replace

5 - Supply line

- For auxiliary heater

6 - Flange

- Note installation position on fuel tank --> **Installation Position of Flange for Fuel Pumps**

7 - Fuel level sensor 3 G237

- Tubular sensor
- Checking: --> Electrical Wiring Diagrams, Troubleshooting and Component Locations

8 - Retaining tab

- Clipped in at left on Fuel Pump (FP) unit

9 - Connector

10 - To supply line of suction jet pump, right side

11 - From supply line for suction jet pump at Fuel Pump (FP) unit, right side

12 - Supply line

- Suction jet pump, left side

13 - Retaining tab

- Clipped in on mount for Fuel Pump (FP) unit

14 - Suction jet pump

15 - Delivery line

- Suction jet pump, left side

16 - Fuel level sensor 4 G393

- Lever-type sensor

- Clipped in on mount for Fuel Pump (FP) unit
- Checking: --> Electrical Wiring Diagrams, Troubleshooting and Component Locations

17 - Connector

18 - To Fuel Pump (FP) unit, right side

- Clipped in at top left on Fuel Pump (FP) unit

19 - To supply line

20 - From return line

21 - Return line

22 - Supply line

Installation Position of Flange for Fuel Pumps

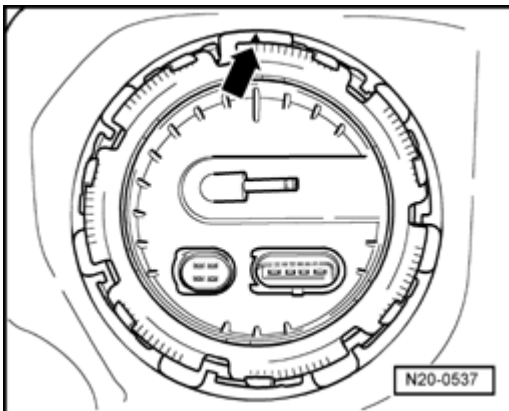


Fig. 243: Installation Position Of Flange For Fuel Pumps

Courtesy of VOLKSWAGEN UNITED STATES, INC.

Insert sensor flange with marking in direction of travel - **arrow** -.

Fuel Lines and Fuel Tank Components, Connection Diagram

Fuel Lines and Fuel Tank Components, Connection Diagram

- **A** - Left side of tank

- **B** - Right side of tank

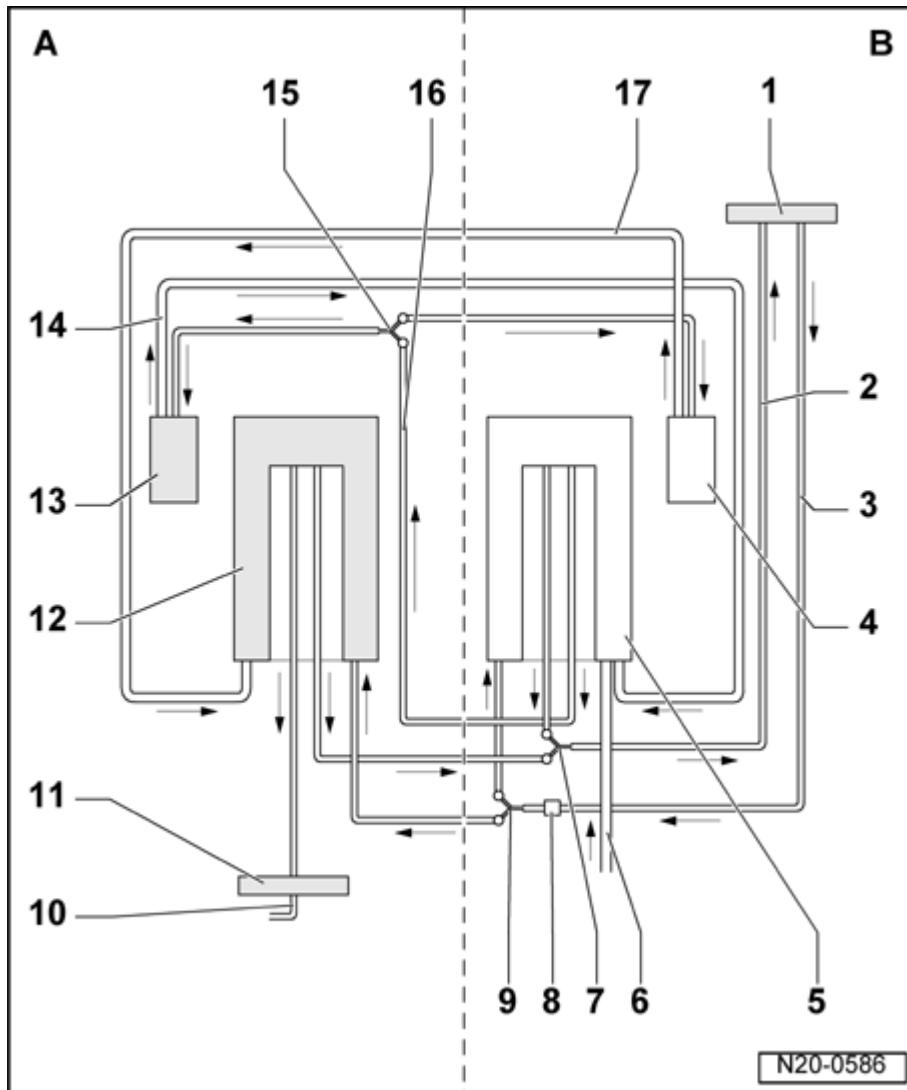


Fig. 244: Fuel Lines And Fuel Tank Components, Connection Diagram
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Supply and return flange

2 - Supply line

3 - Return line

4 - Suction jet pump

- Right side

5 - Fuel delivery unit

- Right side

2004 Volkswagen Phaeton

ENGINE 6.0 Liter 12-Cyl. 4V Engine Mechanical, Fuel Injection & Ignition, Engine Code(s): BRP, BAP

6 - Fill hose

- From filler tube

7 - Y-piece

8 - Non-return valve

9 - Y-piece

10 - Supply line for auxiliary heating

11 - Flange

- Left side

12 - Fuel delivery unit

- Left side

13 - Suction jet pump

- Left side

14 - Delivery line

- To Fuel Pump (FP) unit, right side

15 - Y-piece

16 - Supply line for suction jet pump

17 - Delivery line

- To Fuel Pump (FP) unit, left side

Fuel Tank, Draining

Fuel Tank, Draining

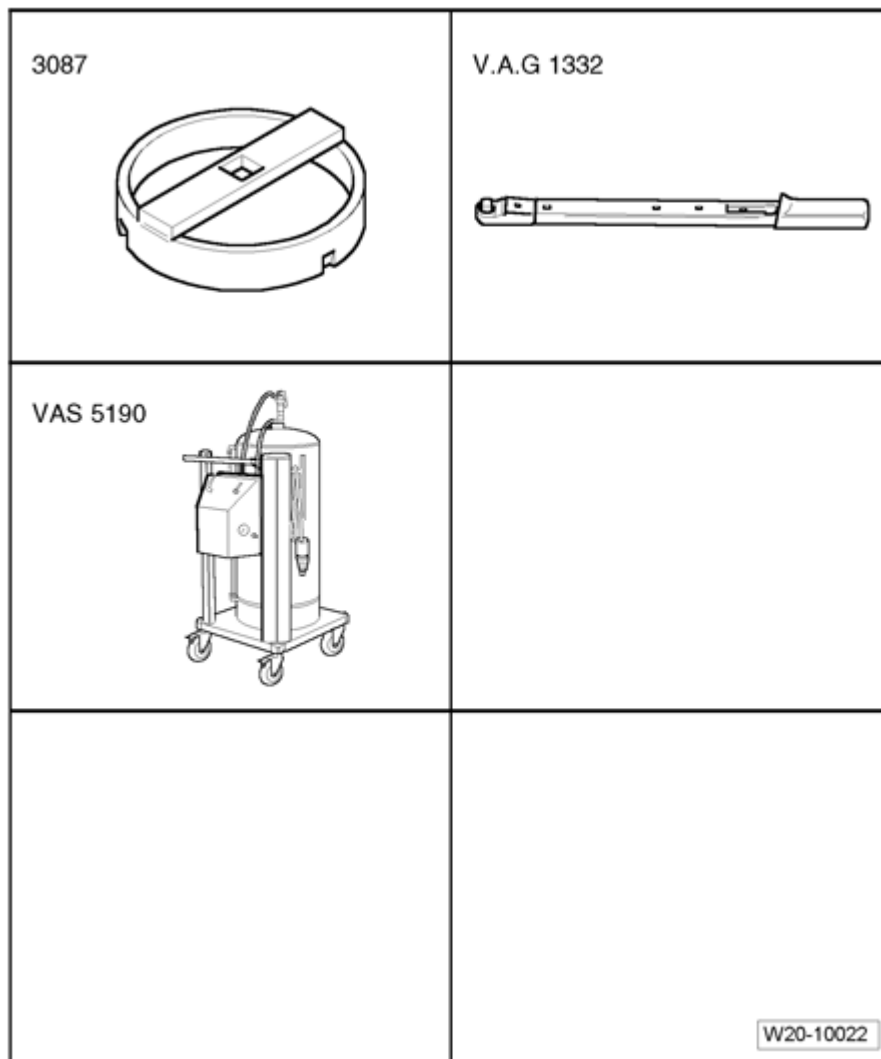


Fig. 245: Identifying Special Tools - Fuel Tank, Draining
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools, testers and auxiliary items required

- Wrench for tank sensor 3087
- Torque wrench (40 to 200 Nm) V.A.G 1332
- Fuel extracting device VAS 5190

CAUTION: Fuel supply lines are under pressure! Wear protective goggles and protective gloves to avoid damage and contact with skin. Before removing from hose connection wrap a cloth around the connection. Then release pressure by carefully pulling hose off connection.

- Read safety precautions before beginning work --> **Fuel Supply System, Safety Precautions.**
- Observe the rules for cleanliness --> **Clean Working Conditions.**

- Open the fuel tank flap.

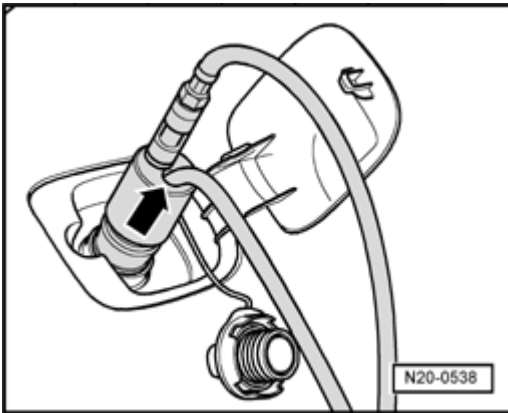


Fig. 246: Sliding Extraction Hose Of VAS 5190 Into Fuel Filler Tube And Extract Fuel
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Slide extraction hose - **arrow** - of VAS 5190 approximately 160 to 170 cm into fuel filler tube and extract fuel.

If no more fuel is extracted:

- Unclip both covers for sensor flanges in luggage compartment floor.

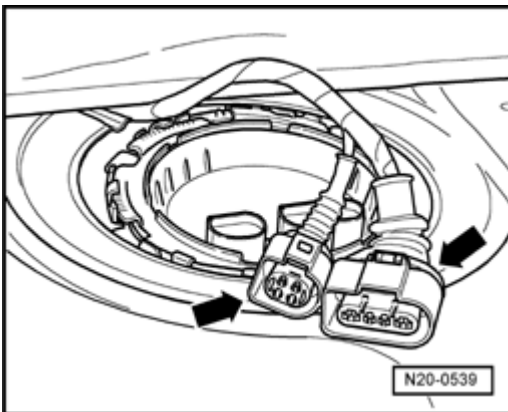


Fig. 247: Disconnecting Connectors From Right Sensor Flange
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect connectors - **arrows** - from right sensor flange.

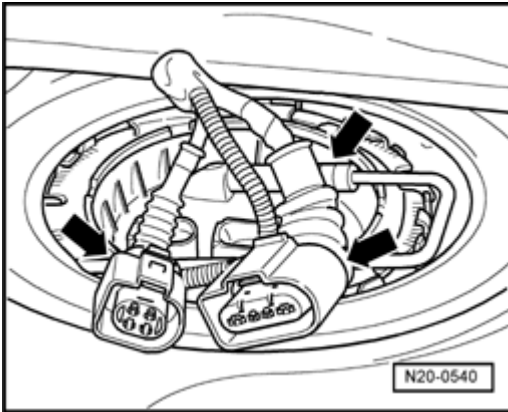


Fig. 248: Disconnecting Connectors And Supply Line For Auxiliary Heater From Left Flange
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect connectors and supply line - **arrows** - from left sensor flange.
- Hold a cleaning rag over fuel line for auxiliary heating at left sensor flange and disconnect fuel line.
- Remove lock ring from left and right sensor flanges using wrench 3087.
- Carefully pry out sensor flanges and remove.
- Insert extraction hose of VAS 5190 as deeply as possible into right or left side of fuel tank and extract fuel.

For additional work on components inside of fuel tank, sensor flanges may remain removed.

If fuel tank only needed to be emptied, install sensor flange again.

- First check that sender flange seals are properly seated.

NOTE:

- If seals are swollen with fuel, always replace.

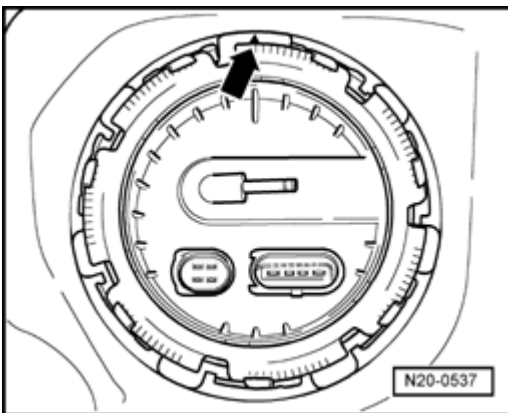


Fig. 249: Installing Flanges With Alignment Tab In Direction Of Travel
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Insert sender flange with marking in direction of travel - **arrow** -.

2004 Volkswagen Phaeton

ENGINE 6.0 Liter 12-Cyl. 4V Engine Mechanical, Fuel Injection & Ignition, Engine Code(s): BRP, BAP

- Tighten the sealing rings at the right and left to 145 Nm using a wrench 3087.

Fuel Delivery Unit, Fuel Level Sensor and Suction Jet Pump, Right Side, Removing and Installing

Fuel Delivery Unit, Fuel Level Sensor and Suction Jet Pump, Right Side, Removing and Installing

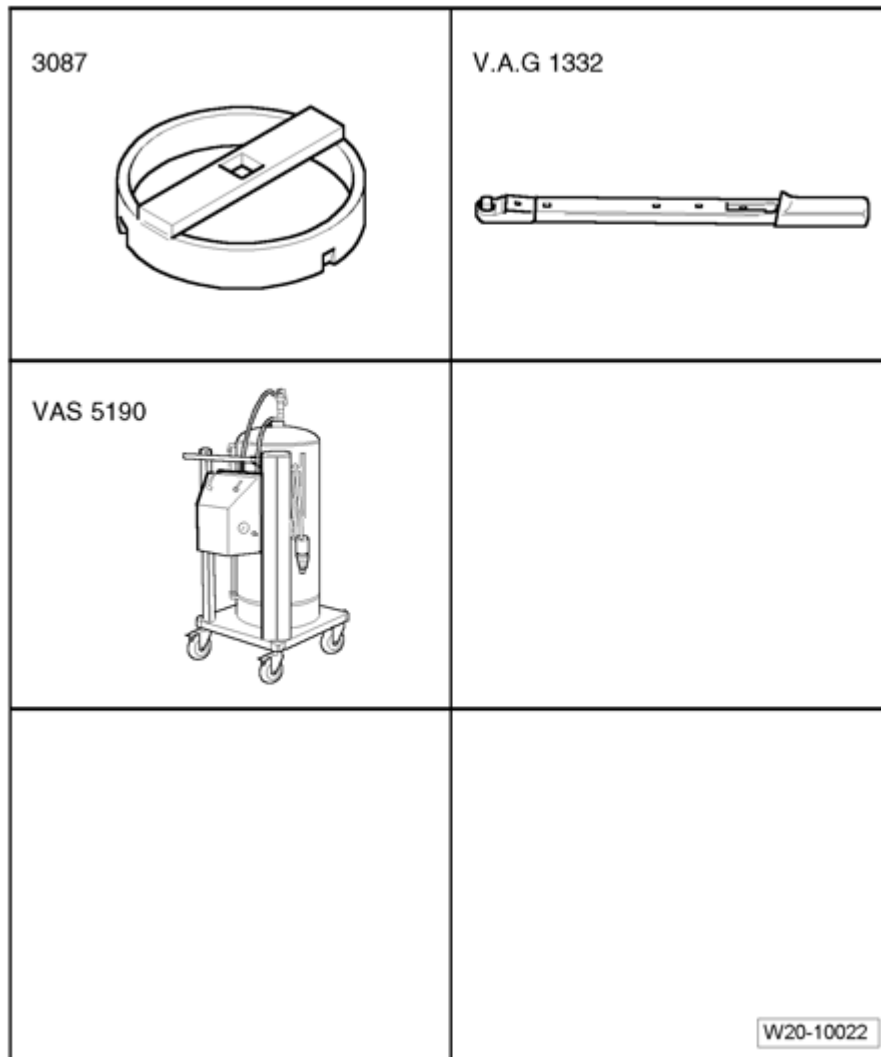


Fig. 250: Identifying Special Tools - Fuel Delivery Unit, Fuel Level Sensor And Suction Jet Pump, Right Side, Removing And Installing

Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools, testers and auxiliary items required

- Wrench for tank sensor 3087
- Torque wrench (40 to 200 Nm) V.A.G 1332
- Fuel extracting device VAS 5190

Test Conditions

- The fuel tank must be drained --> **Fuel Tank, Draining.**
- Connectors and wires for left and right sender flanges have been removed.
- Locking rings of sensor flanges, right and left, are removed.

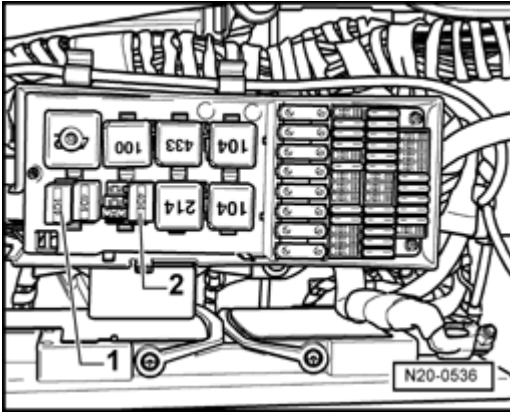


Fig. 251: Fuel Pump Relays, Right And Left Side
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Fuel Pump (FP) relays - 1 - and - 2 - must be removed from fuse holder of E-box in luggage compartment.

NOTE:

- **Do not remove relay from relay plate with metal tools. The terminals could conduct electricity.**

Removing

- Read safety precautions before beginning work --> **Fuel Supply System, Safety Precautions.**
- Observe the rules for cleanliness --> **Clean Working Conditions.**

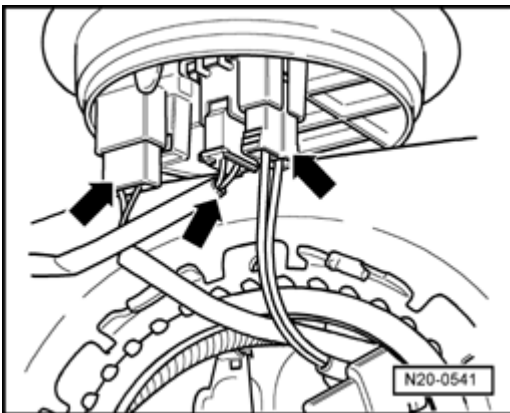


Fig. 252: Disconnecting Three Connectors Underneath Right Flange
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect three connectors - **arrows** - underneath right sensor flange.

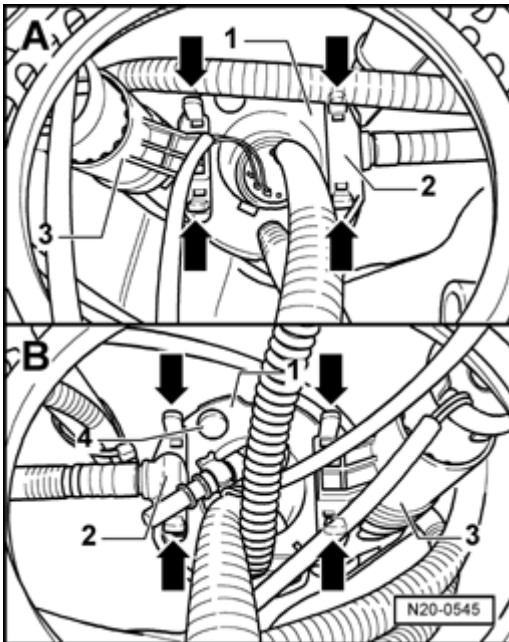


Fig. 253: Identifying Tubular Sensor, Fuel Pump (FP) Unit, Black Fill Hose Opening & Suction Jet Pump
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unclip tubular sensor - 3 - from Fuel Pump (FP) unit - 1 - on right side - **B** - - **arrows** - and remove it carefully.
- Now pull out the black fill hose from opening - 4 - in housing for Fuel Pump (FP) unit - 1 -.
- Unclip return hose of left suction jet pump - 2 - out of Fuel Pump (FP) unit - 1 - on right side - **B** - - **arrows** -.

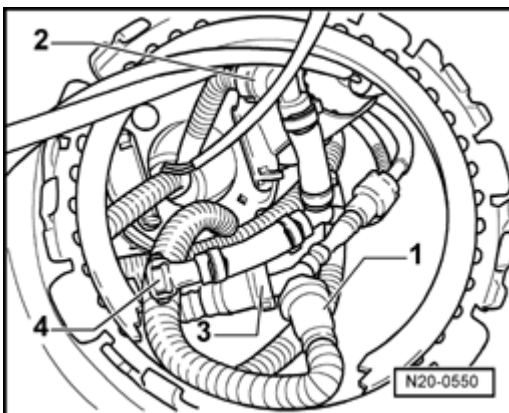


Fig. 254: Identifying Fuel Supply Lines
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect return line - 1 - as well as supply line - 2 - on right side.

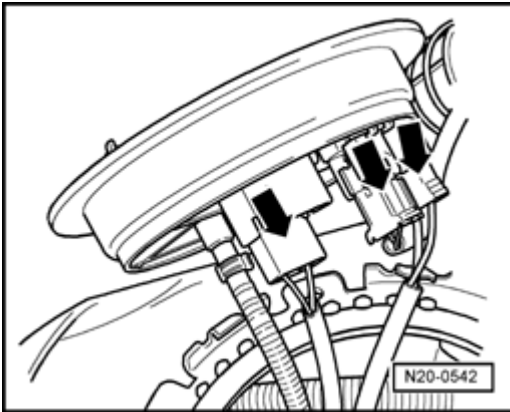


Fig. 255: Disconnecting Three Connectors Underneath Left Flange
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect three connectors - **arrows** - underneath left sensor flange.

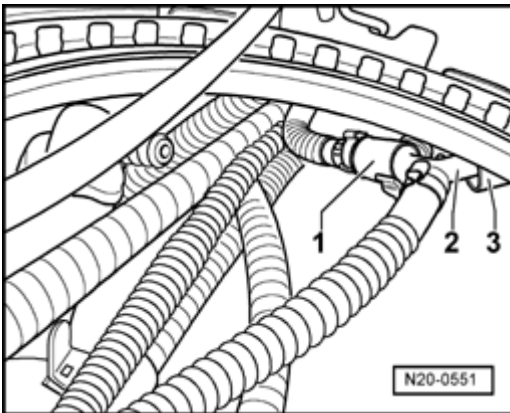


Fig. 256: Disconnecting Supply Hose From Y-Piece On Left Side
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect supply hose - **1** - from Y-piece - **2** - on left side and pull out through right sensor opening.

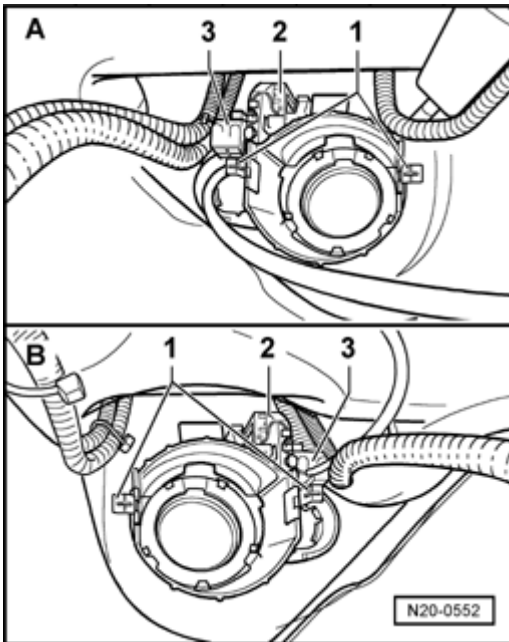


Fig. 257: Identifying Suction Jet Pump, Fuel Level Sensor & Retaining Clips
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Press both retaining clips - 1 - of right Fuel Pump (FP) unit - B - slightly the to side and carefully remove pump unit.

NOTE:

- The fuel delivery unit housing is filled with fuel. Fuel may run out if the housing is tipped or tilted.

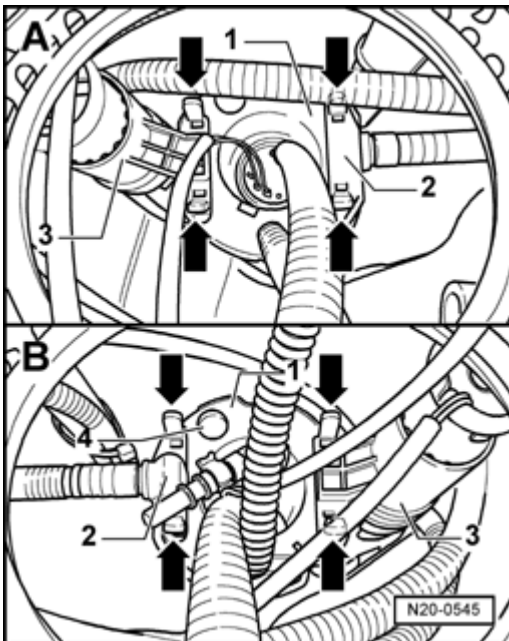


Fig. 258: Identifying Tubular Sensor, Fuel Pump (FP) Unit, Black Fill Hose Opening & Suction Jet Pump
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unclip black return hose - **2** - from housing for Fuel Pump (FP) unit - **1** - on left side - **A** - - **arrows** -.

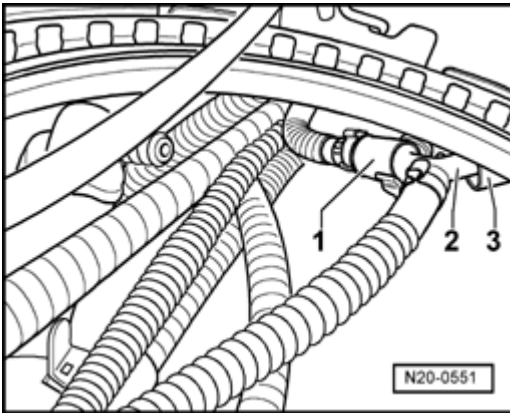


Fig. 259: Disconnecting Supply Hose From Y-Piece On Left Side
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect supply hose - **3** - from Y-piece - **2** -. Pull both hoses for suction jet pump through the right sensor opening.

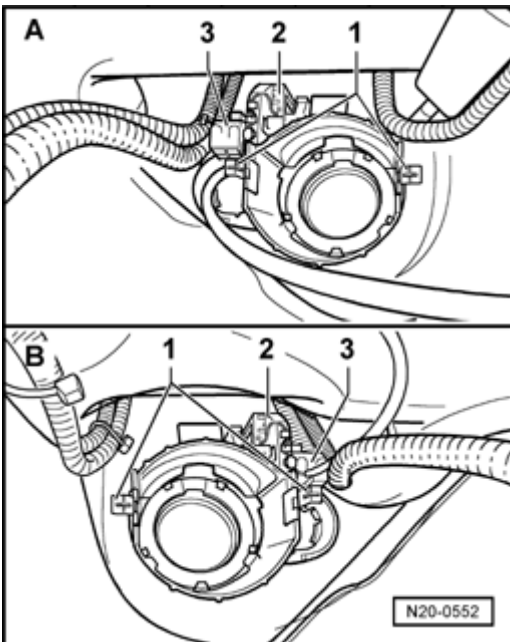


Fig. 260: Identifying Suction Jet Pump, Fuel Level Sensor & Retaining Clips
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Suction jet pump - **3** - on the right side - **B** - can be unclipped and removed by rotating them slightly.
- Unclip fuel level sensor - **2** - and pull out.

Installing

Installation is performed in the reverse order of removal.

Fuel Delivery Unit, Fuel Level Sensor and Suction Jet Pump, Left Side, Removing and Installing

Fuel Delivery Unit, Fuel Level Sensor and Suction Jet Pump, Left Side, Removing and Installing

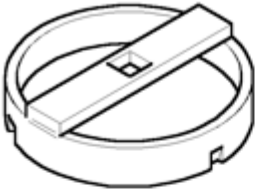
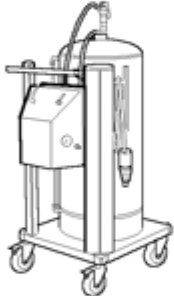
3087 	V.A.G 1332 
VAS 5190 	
	W20-10022

Fig. 261: Identifying Special Tools - Fuel Delivery Unit, Fuel Level Sensor And Suction Jet Pump, Left Side, Removing And Installing

Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools, testers and auxiliary items required

- Wrench for tank sensor 3087
- Torque wrench (40 to 200 Nm) V.A.G 1332
- Fuel extracting device VAS 5190

Test Conditions

- The fuel tank must be drained --> **Fuel Tank, Draining.**

- Connectors and wires for left and right sender flanges have been removed.
- Locking rings of sensor flanges, right and left, are removed.

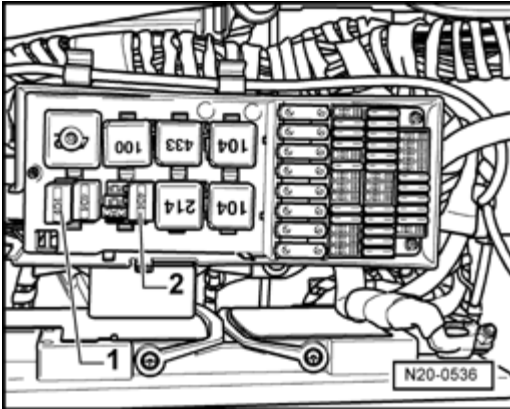


Fig. 262: Fuel Pump Relays, Right And Left Side
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Fuel Pump (FP) relays - 1 - and - 2 - must be removed from fuse holder of E-box in luggage compartment.

NOTE:

- Do not remove relay from relay plate with metal tools. The terminals could conduct electricity.

Removing

- Read safety precautions before beginning work --> Fuel Supply System, Safety Precautions.
- Observe the rules for cleanliness --> Clean Working Conditions.

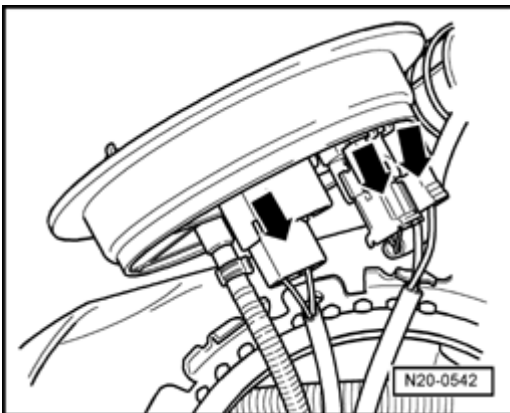


Fig. 263: Disconnecting Three Connectors Underneath Left Flange
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect three connectors - **arrows** - underneath left sensor flange.

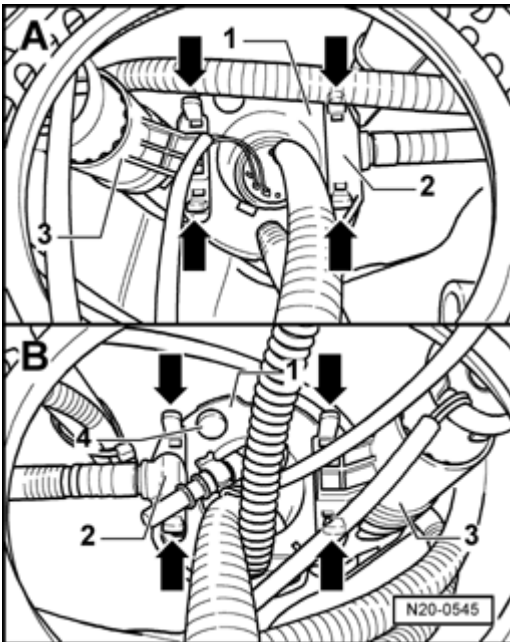


Fig. 264: Identifying Tubular Sensor, Fuel Pump (FP) Unit, Black Fill Hose Opening & Suction Jet Pump
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unclip tubular sensor - 3 - from Fuel Pump (FP) unit - 1 - on left side - A - - **arrows** - and remove it carefully.
- Unclip return hose of right suction jet pump - 2 - out of Fuel Pump (FP) unit - 1 - on left side - A - .

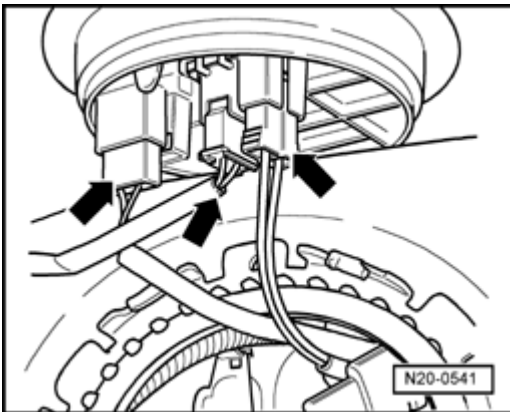


Fig. 265: Disconnecting Three Connectors Underneath Right Flange
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect three connectors - **arrows** - underneath right sensor flange.

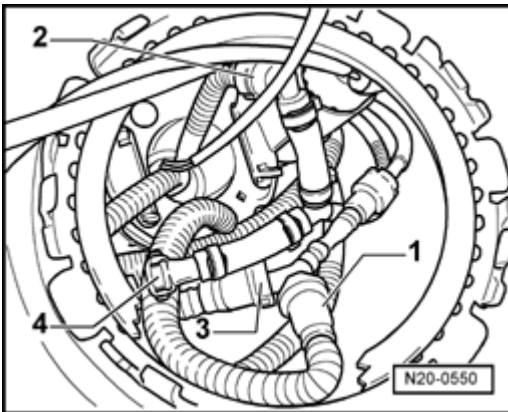


Fig. 266: Identifying Fuel Supply Lines

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect return line - 3 - as well as supply line - 4 - on right side.
- Pull both hose ends through the left sensor opening.

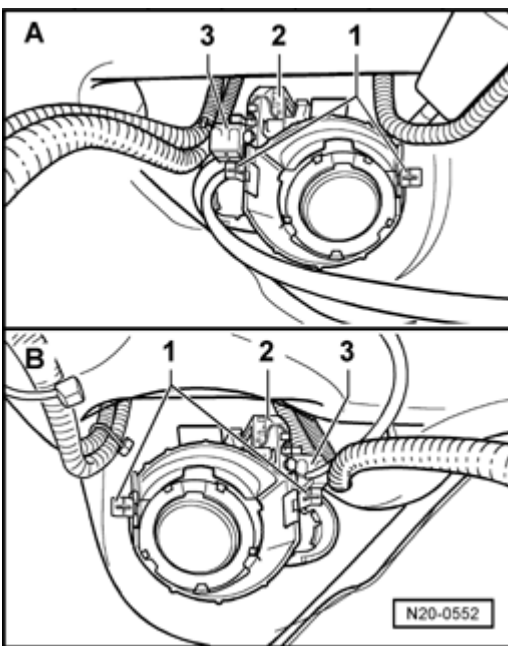


Fig. 267: Identifying Suction Jet Pump, Fuel Level Sensor & Retaining Clips

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Press both retaining clips - 1 - of left Fuel Pump (FP) unit - A - slightly to the side and carefully remove pump unit with sensor flange connected.

NOTE:

- The fuel delivery unit housing is filled with fuel. Fuel may run out if the housing is tipped or tilted.

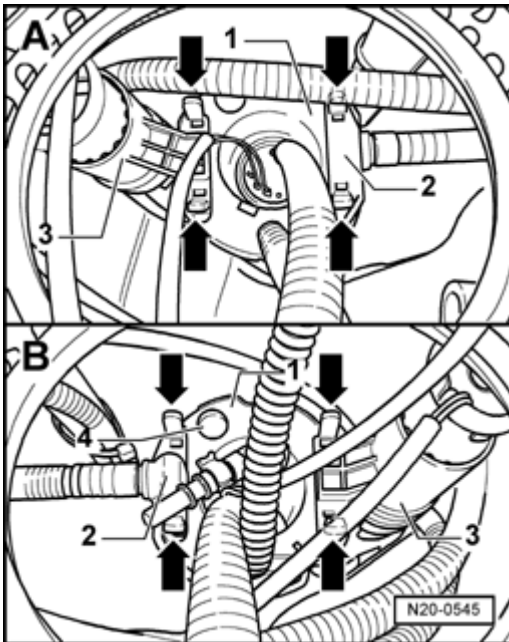


Fig. 268: Identifying Tubular Sensor, Fuel Pump (FP) Unit, Black Fill Hose Opening & Suction Jet Pump
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unclip black return hose - 2 - from housing for Fuel Pump (FP) unit - 1 - on right side - B - - arrows -.
- Pull out black fill hose for suction jet pump through the left sensor opening.

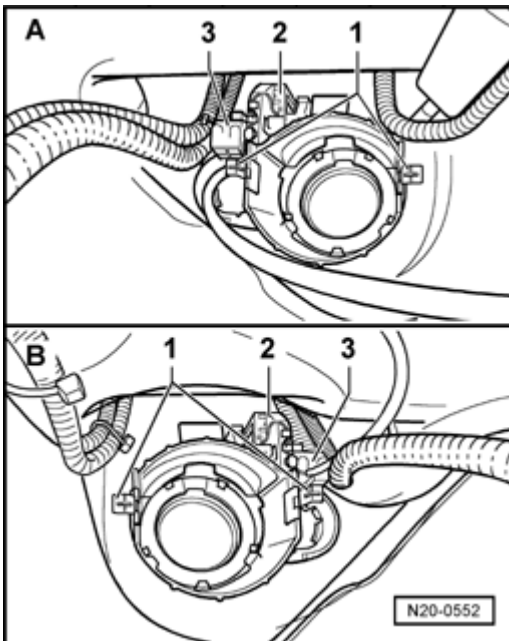


Fig. 269: Identifying Suction Jet Pump, Fuel Level Sensor & Retaining Clips
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unclip suction jet pump - 3 - on left side - A - and remove by rotating slightly.
- Unclip fuel level sensor - 2 - and pull out.

Installing

Installation is performed in the reverse order of removal.

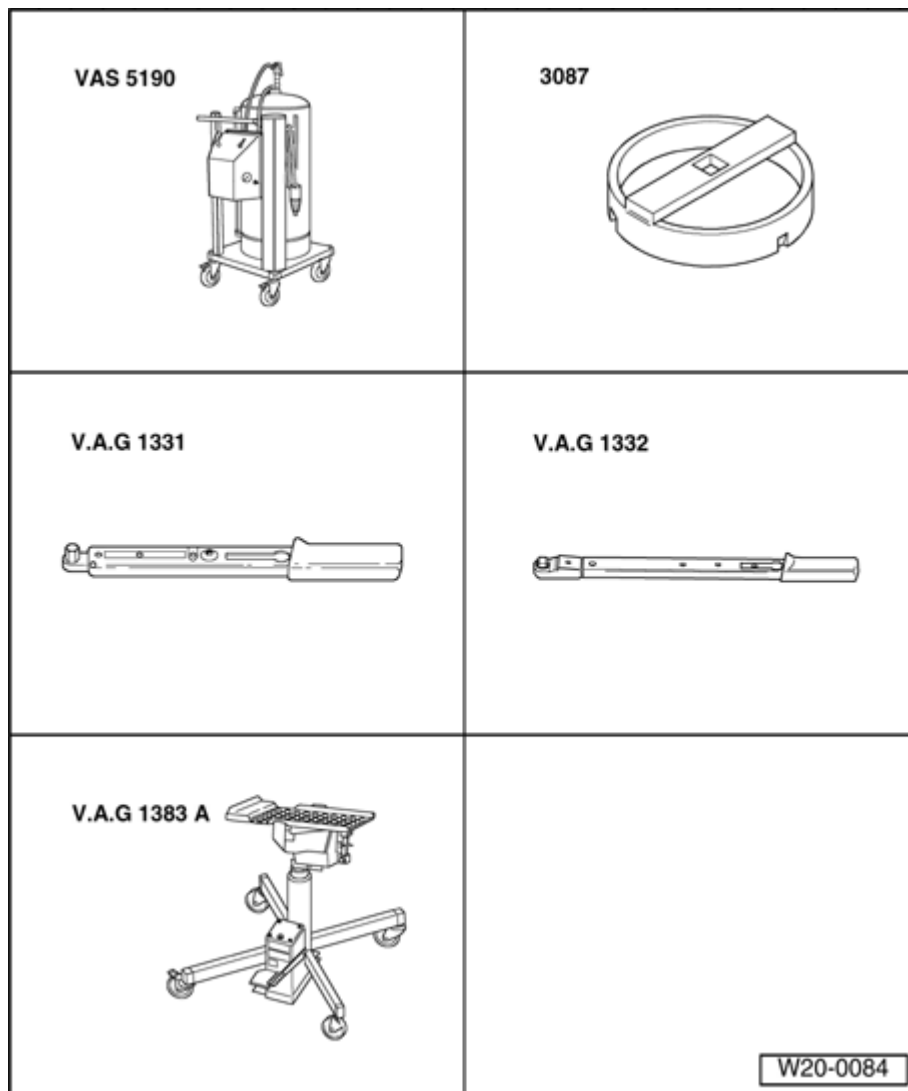
Fuel Tank with Attachments and Fuel Filter, Removing and Installing**Fuel Tank with Attachments and Fuel Filter, Removing and Installing**

Fig. 270: Identifying Special Tools - Fuel Tank With Attachments And Fuel Filter, Removing And Installing

Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools, testers and auxiliary items required

- Fuel extracting device VAS 5190
- Wrench for tank sensor 3087
- Torque wrench (5 to 50 Nm) V.A.G 1331

- Torque wrench (40 to 200 Nm) V.A.G 1332
- Engine/transmission jack V.A.G 1383 A

Test Conditions

- The fuel tank must be drained --> **Fuel Tank, Draining.**

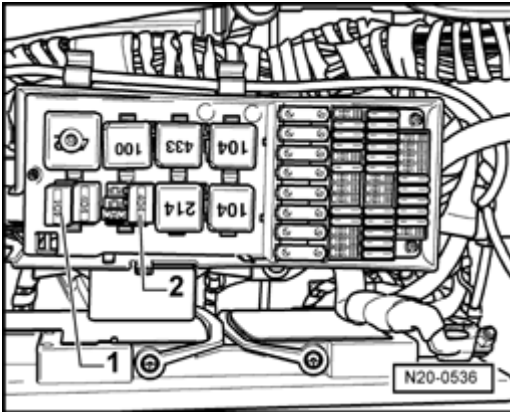


Fig. 271: Fuel Pump Relays, Right And Left Side
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Fuel Pump (FP) relays - 1 - and - 2 - must be removed from fuse holder of E-box in luggage compartment.

NOTE:

- **Do not remove relay from relay plate with metal tools. The terminals could conduct electricity.**

Removing

- Read safety precautions before beginning work --> **Fuel Supply System, Safety Precautions.**
- Remove rear bumper: --> **63 BUMPERS**
- Remove right rear wheel housing liner: --> **66 EXTERIOR EQUIPMENT**
- Remove center and rear muffler --> **Muffler with Mounts, Assembly Overview** , muffler with mounts
- Remove driveshaft: -->
 - **39F FINAL DRIVE, DIFFERENTIAL (FRONT)**
 - **39R FINAL DRIVE, DIFFERENTIAL (REAR)**
- Remove rear axle: --> **42 - REAR SUSPENSION**
- Open fuel tank flap.
- Remove mounting bolt and remove fuel flap unit with rubber gasket.
- Remove mounting bolts from filler tube.

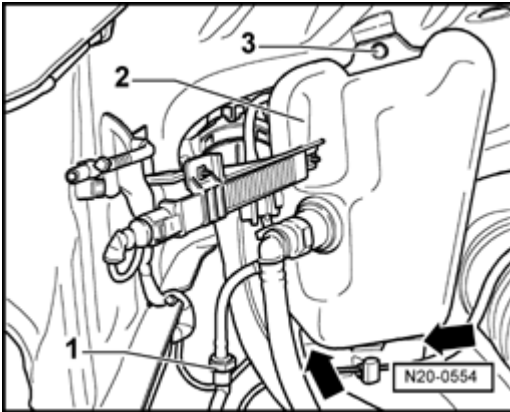


Fig. 272: Identifying Ventilation Line, Mounting Bolt & Expansion Tank
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect ventilation line - 1 -.
- Remove mounting bolt - 3 - from expansion tank - 2 - and pull out of mount in inner wheel housing - **arrows** -.
- Unclip both covers for sensor flanges in luggage compartment floor.

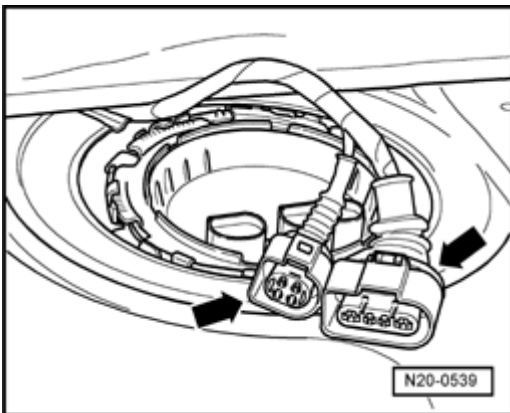


Fig. 273: Disconnecting Connectors From Right Sensor Flange
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect connectors - **arrows** - from right sensor flange.

CAUTION: Fuel supply lines are under pressure! Wear protective goggles and protective gloves to avoid damage and contact with skin. Before removing from hose connection wrap a cloth around the connection. Then release pressure by carefully pulling hose off connection.

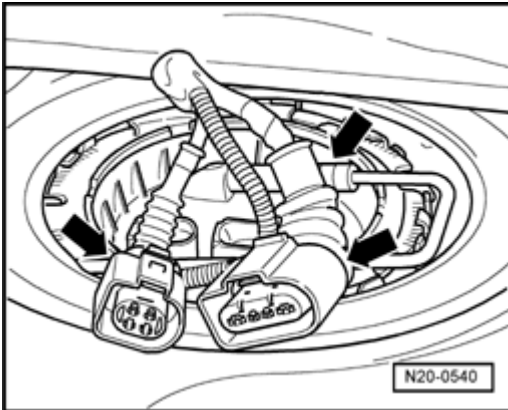


Fig. 274: Disconnecting Connectors And Supply Line For Auxiliary Heater From Left Flange
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect connectors and supply line - **arrows** - from left sensor flange. When pulling off fuel supply line, hold a cloth around fuel supply line.

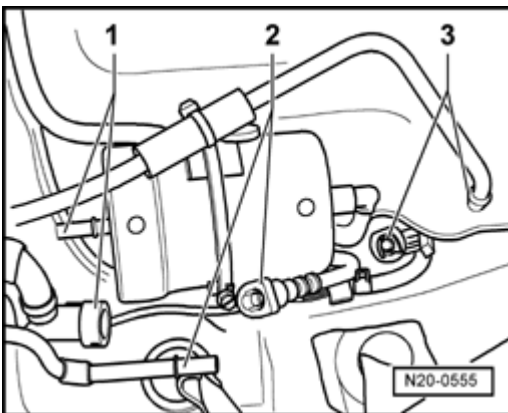


Fig. 275: Fuel Lines And Breather Line Connection
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Hold a cleaning rag over fuel line connections - **1** - and - **2** - pull them apart.
- Disconnect harness connector - **3** - of ventilation line.

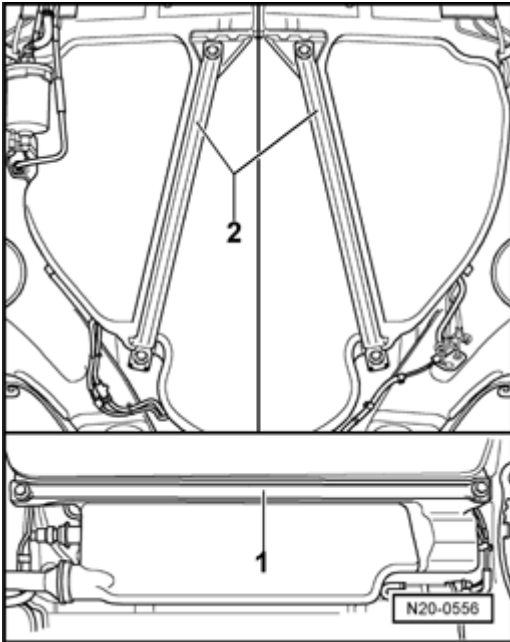


Fig. 276: Crossmember And Tension Straps
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove cross member - **1** -.
- Support fuel tank using Engine/transmission jack V.A.G 1383 A and disengage tension straps - **2** -.
- Lower fuel tank.

Installing

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

- Connections for breather and fuel lines must engage audibly when joined.
- Do not interchange supply and return hose (return hose blue or blue markings, supply hose black).
- Make sure ventilation and fuel lines are not kinked when installed.
- Secure fuel hoses with spring-type clamps.
- Ensure fuel hoses are seated securely.

NOTE:

- **Before lifting Fuel Pump (FP), check whether supply, return and vent lines are still clipped in at fuel tank.**

Fuel Pumps, Checking

Fuel Pumps, Checking

--> Delivery Quantity, Checking

--> Pumps, Current Draw, Checking

--> **Fuel Pump Check Valves, Checking**

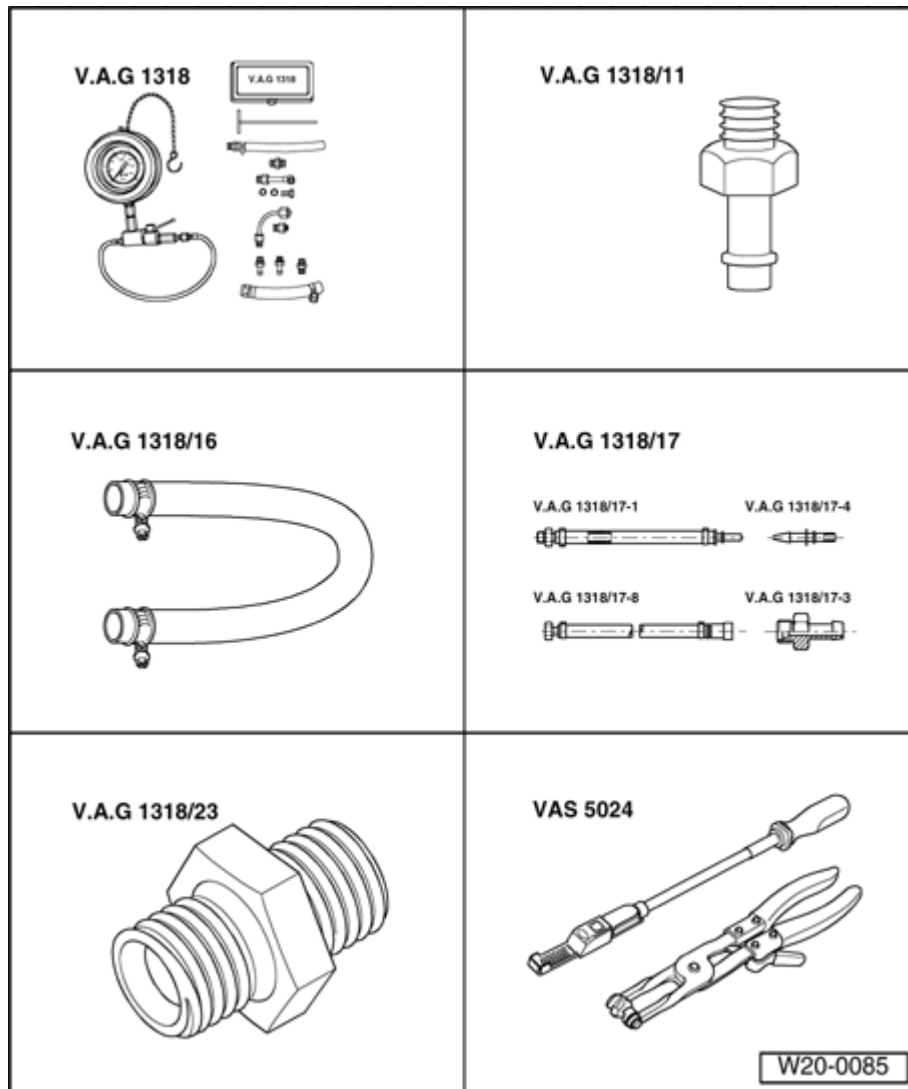


Fig. 277: Identifying Special Tools - Fuel Pumps, Checking (1 Of 2)
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools, testers and auxiliary items required

- Pressure gauge V.A.G 1318
- Adapter V.A.G 1318/11
- Hose adapter V.A.G 1318/16
- Pressure gauge adapter V.A.G 1318/17
- Adapter V.A.G 1318/23
- Spring-type clip pliers VAS 5024A

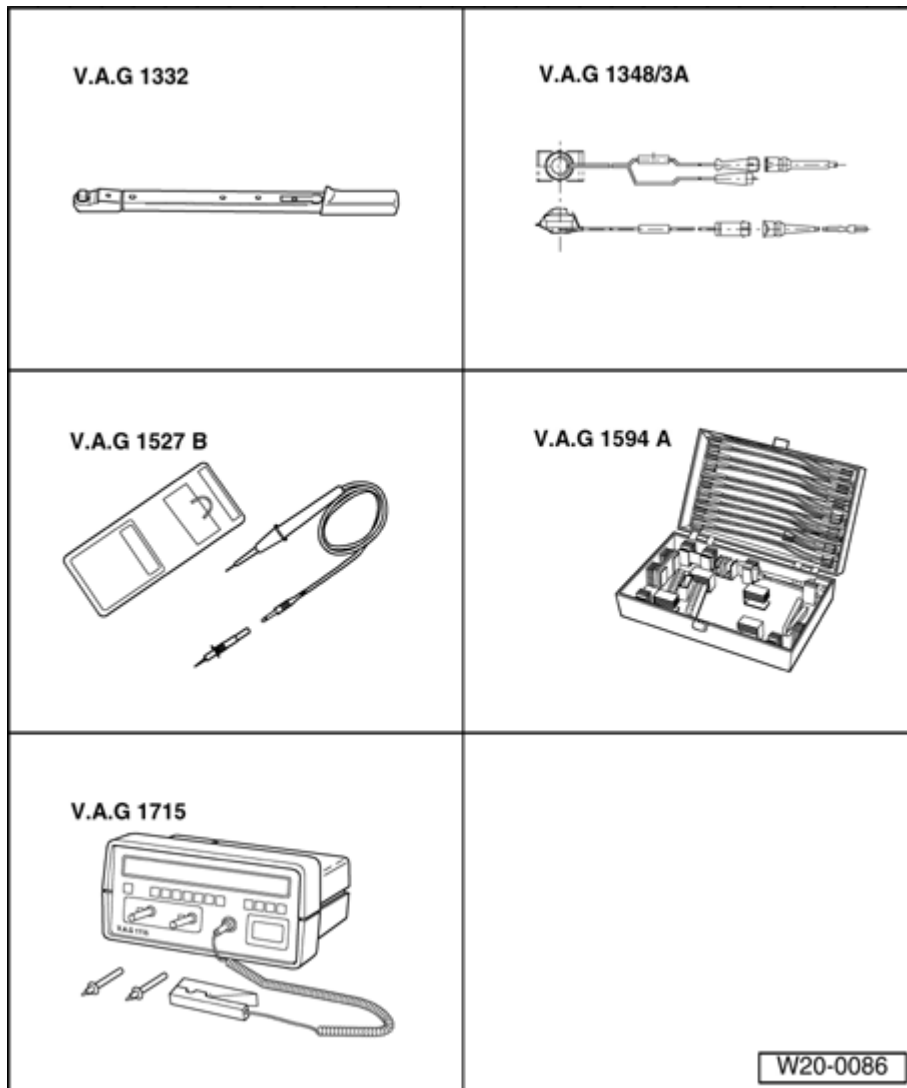


Fig. 278: Identifying Special Tools - Fuel Pumps, Checking (2 Of 2)
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools, testers and auxiliary items required

- Torque wrench (40 to 200 Nm) V.A.G 1332
- Remote control V.A.G 1348/3 A with adapter cable V.A.G 1348/3-3
- Voltage tester V.A.G 1527 B
- Test adapter kit V.A.G 1594 A
- Multimeter V.A.G 1715

Not illustrated:

Measuring container

Wiring diagram**Delivery Quantity, Checking****Test Conditions**

- Both battery voltages are OK

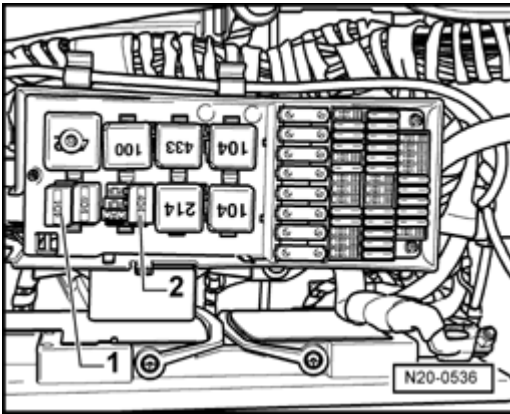


Fig. 279: Fuel Pump Relays, Right And Left Side
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Fuel Pump (FP) relays - 1 - and - 2 - must be removed from fuse holder of E-box in luggage compartment.

NOTE:

- Do not use metallic tools to pry off relays from relay carrier. The terminals could conduct electricity.

Test Sequence

- Remove fuel filler cap from fuel filler tube.
- Remove intake air hose between Mass Air Flow (MAF) sensor and right throttle valve control module.

CAUTION: Fuel supply lines are under pressure! Wear protective goggles and protective gloves to avoid damage and contact with skin. Before removing from hose connection wrap a cloth around the connection. Then release pressure by carefully pulling hose off connection.

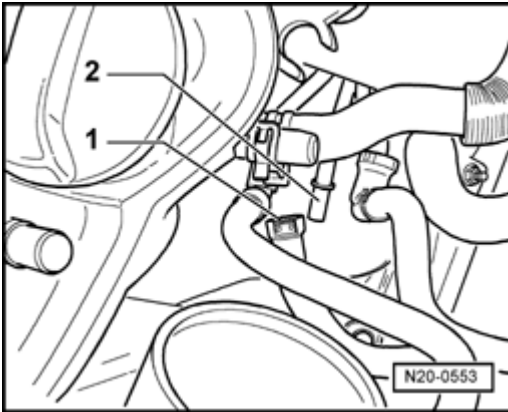


Fig. 280: Disconnecting Supply Hose From Supply Line
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect supply hose - 1 - from supply line - 2 - and catch escaping fuel using a rag.

NOTE:

- For this, press together button at hose connection.

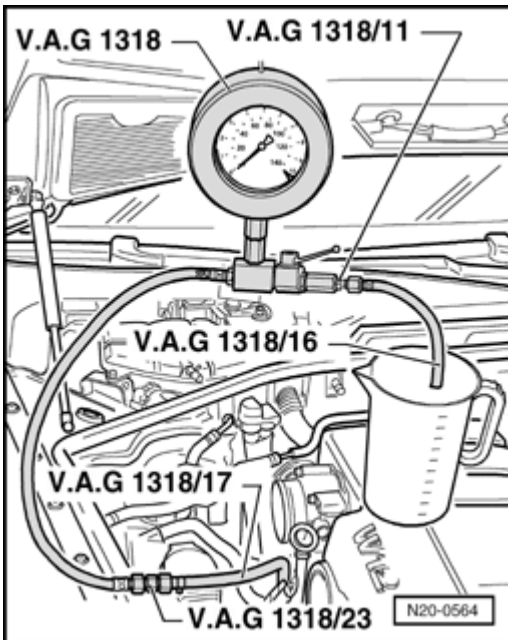


Fig. 281: Connecting Pressure Gauge (V.A.G 1318) To Fuel Supply Line Using Adapters (V.A.G 1318/23 And V.A.G 1318/17)

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect pressure gauge V.A.G 1318 with adapter V.A.G 1318/23 and V.A.G 1318/17 to fuel supply line.
- Connect hose adapter V.A.G 1318/16 onto adapter V.A.G 1318/11 of pressure gauge and hold it in a measuring container.
- Open shut-off valve on pressure gauge. The lever then points in direction of flow.

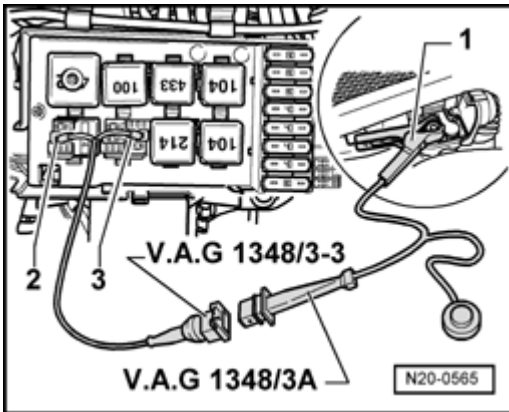


Fig. 282: Connecting V.A.G 1348/3 A Remote Control To Connectors Of Fuel Pump (FP) Relays For Left Fuel Pump (FP) Using V.A.G 1348/3-3 Adapter

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect remote control V.A.G 1348/3 A with adapter cable V.A.G 1348/3-3 to connections of fuel pump relay - 2 - and - 3 -.
- Connect positive terminal clamp - 1 - of remote control to positive pole in engine compartment.
- Operate remote control V.A.G 1348/3 A. Slowly close shut-off tap, until pressure gauge shows 4 bar. From this point on do not move position of shut-off tap.
- Empty measuring container.
- Delivery rate of Fuel Pumps (FP) is dependent on battery voltage. Therefore, connect multimeter to left vehicle battery using adapter cables from V.A.G 1594 A.
- Operate remote control for 30 seconds and measure battery voltage.

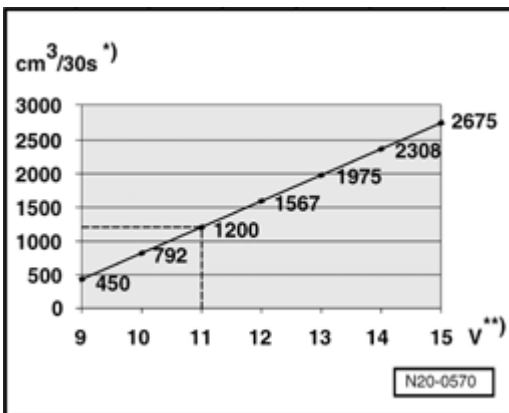


Fig. 283: Fuel Delivery Chart

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Compare the quantity of fuel delivered with specification.

* Delivery rate $\text{cm}^3 / 30 \text{ seconds}$

* Voltage at fuel pumps with engine off and pumps running (approximately 2 volts less than battery voltage).

Example:

During the test, a voltage of 13.0 volts is measured at the battery. Since the voltage at the pumps is approximately 2 volts less than battery voltage, there is a minimum delivery rate of 1,200 cm³ /30 s.

If the delivery rate has been attained but nevertheless you suspect a fuel supply system malfunction (e.g. intermittent failure of fuel supply system):

- Check current draw of fuel pumps --> **Pumps, Current Draw, Checking.**

If the minimum delivery rate is not attained:

- Check the fuel lines for possible restrictions (kinks) or blockages.

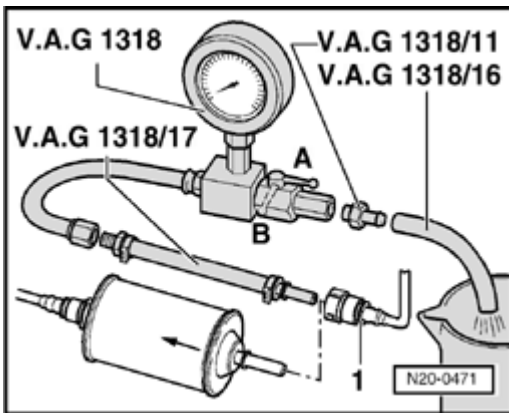


Fig. 284: Connecting Pressure Gauge VAG 1318 To Hose With Adapter VAG 1318/17 To Fuel Filter
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect supply line - 1 - from fuel filter input.

NOTE:

- **Press buttons together on hose connections to do so.**

- Connect pressure gauge V.A.G 1318 with adapter V.A.G 1318/17 to hose.
- Repeat delivery rate check.

If the minimum delivery rate is now obtained:

- Replace fuel filter.

If the minimum delivery rate is again not obtained:

Check Delivery Quantity of Right Pump

- Interrupt activation of left pump:

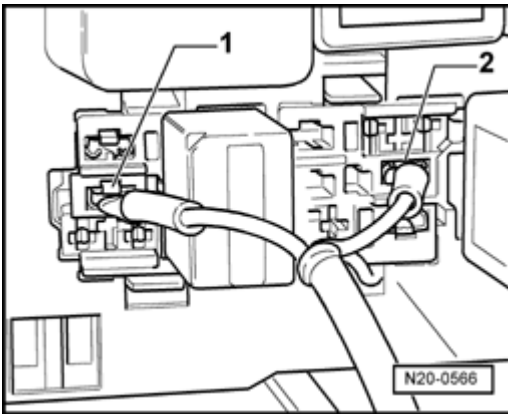


Fig. 285: Identifying Remote Control Connectors

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- To do so, disconnect connector - 2 - of remote control from relay socket for left pump.
- Empty measuring container.
- Operate remote control for 30 seconds and measure battery voltage.

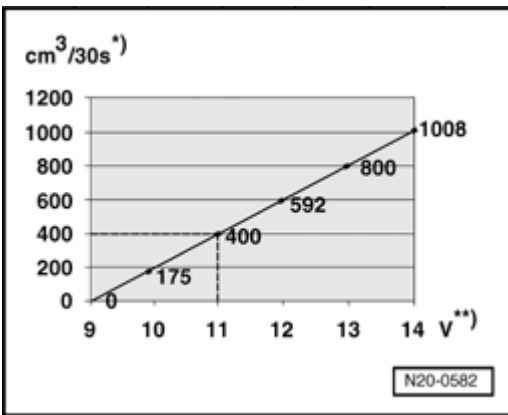


Fig. 286: Quantity Of Fuel Delivered Graph

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Compare the quantity of fuel delivered with specification.

* Delivery rate cm³ /30 seconds

* Voltage at fuel pumps with engine off and pumps running (approximately 2 volts less than battery voltage).

If minimum delivery rate is again not obtained:

- Remove fuel delivery unit and check filter strainer for dirt.

Only when up to now no malfunction has been detected:

- Right fuel pump is faulty. Replace fuel delivery unit --> **Fuel Delivery Unit, Fuel Level Sensor and**

Suction Jet Pump, Right Side, Removing and Installing.

If minimum delivery rate is not attained:

Check Delivery Quantity of Left Pump

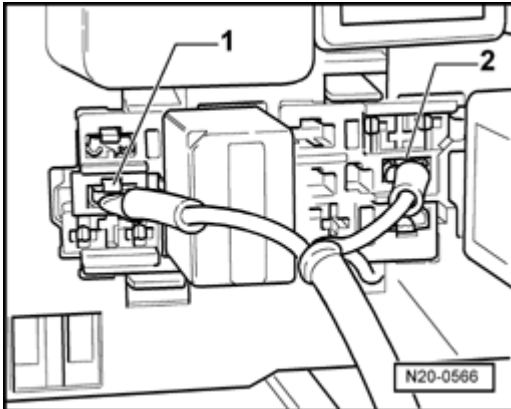


Fig. 287: Identifying Remote Control Connectors
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Reconnect remote control connector - 2 -.
- Interrupt activation of right pump:
- To do so, disconnect connector - 1 - of remote control from relay socket for right pump.
- Empty measuring container.
- Operate remote control for 30 seconds and measure battery voltage.

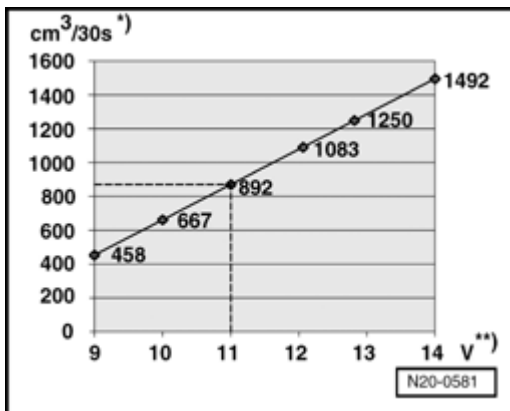


Fig. 288: Fuel Delivery Chart
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Compare quantity of fuel delivered with specification.

* Delivery $\text{cm}^3 / 30 \text{ seconds}$

* Voltage at fuel pumps with engine off and pumps running (approximately. 2 volts less than battery voltage).

If minimum delivery rate is again not obtained:

- Remove fuel delivery unit and check filter strainer for dirt.

Only when up to now no malfunction has been detected:

- Left Fuel Pump (FP) malfunctioning, replace fuel pump unit --> **Fuel Delivery Unit, Fuel Level Sensor and Suction Jet Pump, Left Side, Removing and Installing.**

Pumps, Current Draw, Checking

Check current draw of each individual Fuel Pump (FP) as follows:

- Install intake air hose between Mass Air Flow (MAF) sensor and throttle valve control module.
- Reconnect all disconnected fuel lines.

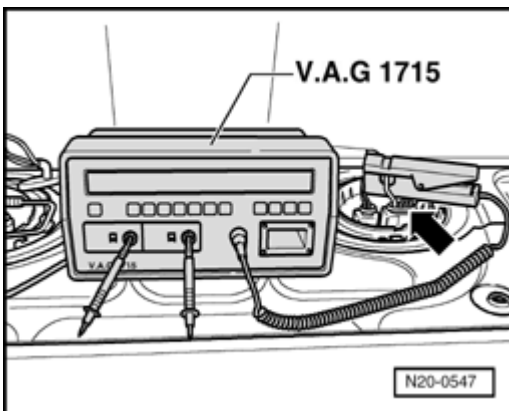


Fig. 289: Connecting Multimeter With Electrical Current Probe To Wire Of 4-Pin Connector Terminal From Wiring Harness To Transfer Fuel Pump (FP) G23

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect the multimeter V.A.G 1715 current clamp to the wiring harness 4-pin connector contact wire - **arrow** - to the right fuel delivery unit.
- Start the engine and run at idle speed.
- Measure current draw of fuel pump. Specified value: max. 11 amps.
- Repeat test on left fuel delivery unit.

NOTE:

- **Left Fuel Pump (FP) is switched off at idle for a few seconds after engine start.**

If the current draw is exceeded:

- Right fuel pump is faulty. Replace fuel delivery unit --> **Fuel Delivery Unit, Fuel Level Sensor and**

Suction Jet Pump, Right Side, Removing and Installing.

- Left Fuel Pump (FP) malfunctioning, replace fuel pump unit --> **Fuel Delivery Unit, Fuel Level Sensor and Suction Jet Pump, Left Side, Removing and Installing.**

NOTE:

- If malfunction in fuel system is sporadic, test can also be performed during a road test, but a second person is required.

Fuel Pump Check Valves, Checking**Test Conditions**

- Remote control V.A.G 1348/3 A is still connected.

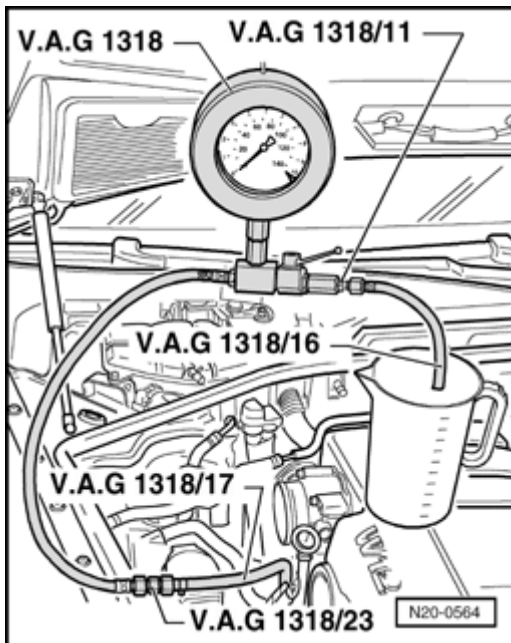


Fig. 290: Connecting Pressure Gauge (V.A.G 1318) To Fuel Supply Line Using Adapters (V.A.G 1318/23 And V.A.G 1318/17)

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Pressure gauge V.A.G 1318 is still connected.

Test Sequence**NOTE:**

- This test checks the connections of the fuel supply line from fuel delivery units to connection point of pressure gauge V.A.G 1318 for leaks.

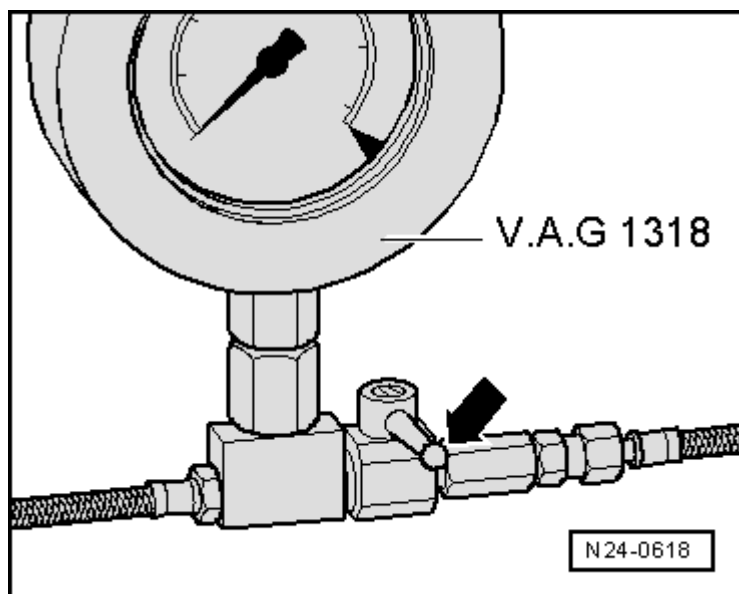


Fig. 291: Locating V.A.G 1318 Shut-Off Tap

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Close shut-off valve on pressure gauge V.A.G 1318 (lever perpendicular to direction of flow).
- Operate remote control at short intervals, until a pressure of approximately 4 bar has built up.
- If pressure builds up too high, lower excess pressure by carefully opening the shut-off tap.

CAUTION: Danger of spray when opening the shut-off tap, hold container over the free connection of the pressure gauge.

- Watch pressure drop on gauge. After 10 minutes the pressure must not drop below a 3.0 bar decrease.

If the pressure drops further:

- Check fuel lines and connections to fuel tank for leaks.

If no fault is detected in the wiring:

Check Right Pump Check Valve

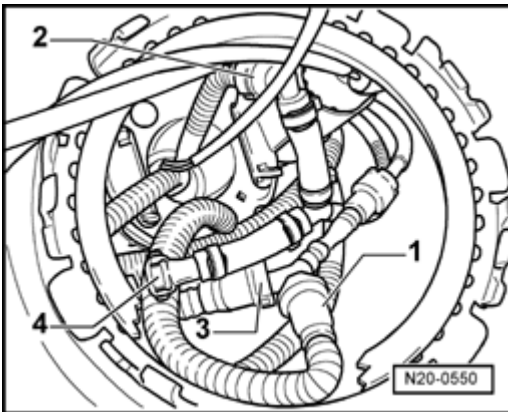


Fig. 292: Identifying Fuel Supply Lines

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect supply line - 2 - on right side.

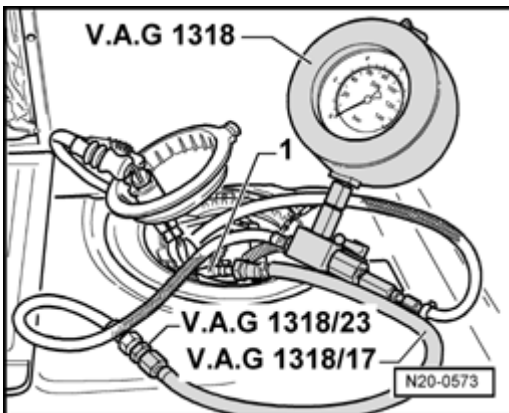


Fig. 293: Connecting Pressure Gauge V.A.G 1318 (Lever Perpendicular To Direction Of Flow) With Adapter V.A.G 1318/23 And V.A.G 1318/17 At Hose To Pump

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect pressure gauge V.A.G 1318 (lever perpendicular to direction of flow) with adapter V.A.G 1318/23 and V.A.G 1318/17 at hose - 1 - to pump.
- Interrupt activation of left pump:

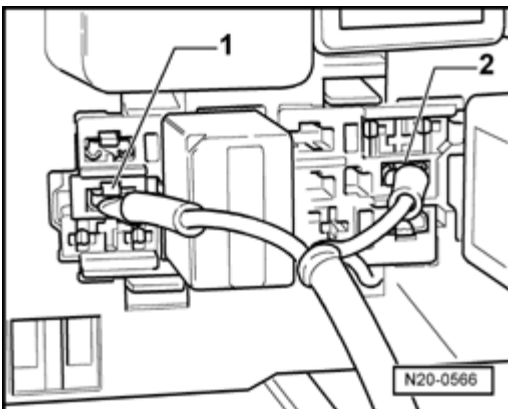


Fig. 294: Identifying Remote Control Connectors

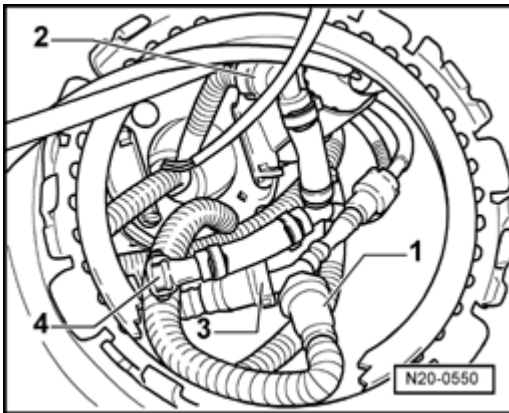
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- To do so, disconnect connector - 2 - of remote control from relay socket for left pump.
- Repeat the test.

If the pressure drops further:

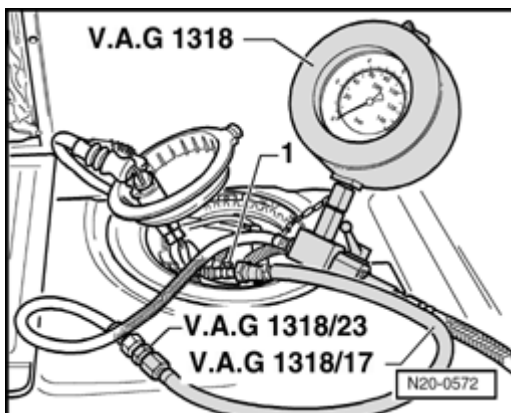
- Right fuel pump is faulty. Replace fuel delivery unit --> **Fuel Delivery Unit, Fuel Level Sensor and Suction Jet Pump, Right Side, Removing and Installing.**

If the pressure drops further:

Check Left Pump Check Valve**Fig. 295: Identifying Fuel Supply Lines**

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Reconnect supply line - 2 - on right side.
- Disconnect supply line - 4 - on the right side to left pump.

**Fig. 296: Connecting Pressure Gauge V.A.G 1318 (Lever Perpendicular To Direction Of Flow) With Adapter V.A.G 1318/23 And V.A.G 1318/17 At Hose To Pump**

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect pressure gauge V.A.G 1318 (lever perpendicular to direction of flow) with adapter V.A.G 1318/23 and V.A.G 1318/17 at hose - **1** - to pump.

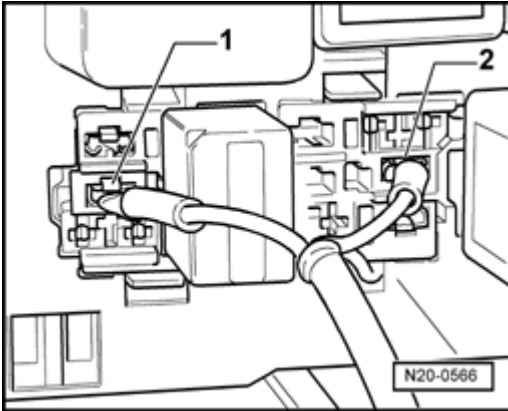


Fig. 297: Identifying Remote Control Connectors
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Reconnect remote control connector - **2** -.
- Interrupt activation of right pump.
- To do so, disconnect connector - **1** - of remote control from relay socket for right pump.
- Repeat the test.

If the pressure drops further:

- Left Fuel Pump (FP) malfunctioning, replace fuel pump unit --> **Fuel Delivery Unit, Fuel Level Sensor and Suction Jet Pump, Left Side, Removing and Installing.**

ELECTRONIC ENGINE POWER CONTROL

Electronic Engine Power Control

The position of the accelerator pedal is transmitted to the engine control module via two accelerator pedal position sensors (adjustable resistances, accommodated in one housing), that are connected to the accelerator pedal.

The position of the accelerator pedal (driver controlled) is a main input for the engine control module.

Operation of the throttle valve occurs via an electric motor (throttle valve actuator) in the throttle valve control module. This is true across the entire engine speed and engine load spectrum.

The throttle valve is operated by the throttle drive according to the instructions of the Engine Control Module (ECM).

With the engine at stand still and the ignition switched on, the Engine Control Module (ECM) activates the throttle valve actuator precisely according to the specifications of the Throttle Position (TP) Sensor. This means, if the accelerator pedal is depressed half way, the throttle drive opens the throttle valve to the same

degree; i.e. throttle valve is then opened approximately half way.

With engine running (under load) the engine control module can open and close the throttle valve independently of the accelerator pedal position sensor.

That way e.g. the throttle valve can already be completely opened, although the accelerator pedal is only depressed half way. An advantage of this is that throttle losses at the throttle valve are avoided.

Aside from that, it results in clearly better pollutant output and consumption values under certain load conditions.

The necessary engine torque can be produced by the engine control module (ECM) via the optimal combination of throttle valve profile and charge pressure.

The Engine Control Module (ECM) calculates after evaluation of torque requirements of the different components (e.g. A/C system, automatic transmission, ABS/ESP, etc.) a throttle valve opening angle optimal for the respective situation.

Accelerator Mechanism, Assembly Overview

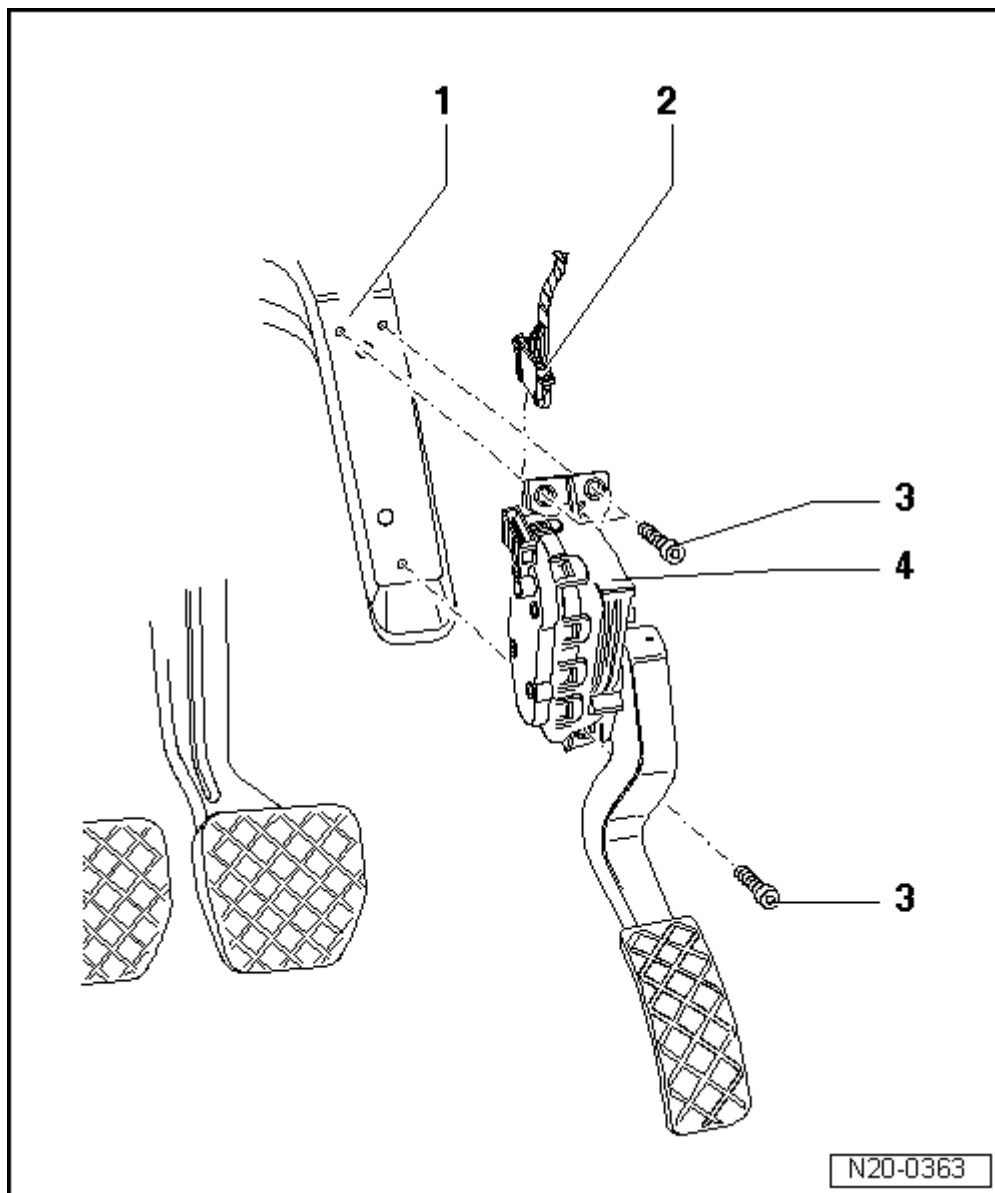


Fig. 298: Accelerator Mechanism, Assembly Overview
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Bracket

2 - Connector

- Black, 6-pin

3 - 10 Nm

4 - Throttle Position (TP) sensor G79 and accelerator pedal position sensor 2 G185

- Not adjustable

- Remove footwell cover to remove sensor
- If Throttle Position (TP) Sensor is replaced ; "Guided Function" "Adapting kick down shift point".

EVAP SYSTEM

EVAP System

--> Fuel Supply System, Safety Precautions

--> Clean Working Conditions

--> EVAP System, Function

--> EVAP System, Assembly Overview

NOTE:

- Hose connections are secured with either spring-type or clamp-type clips.
- Always replace clamp-type clips with spring-type clips.

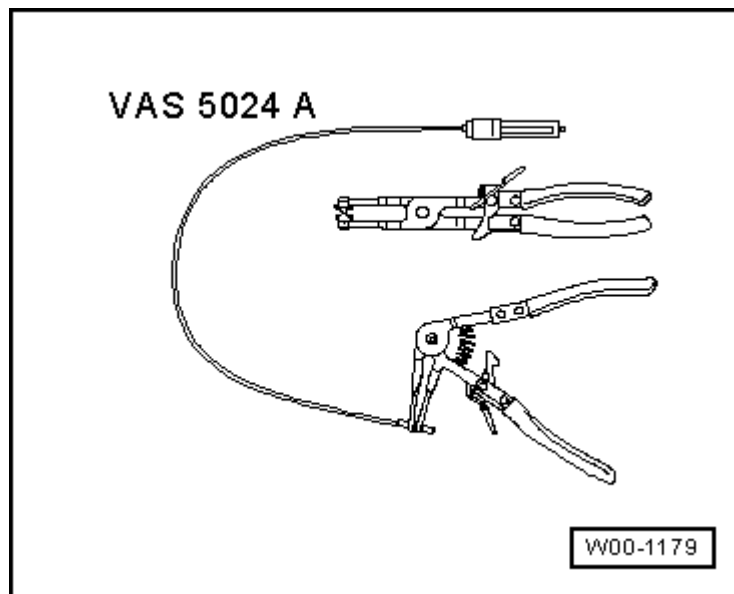


Fig. 299: Spring-Type Clip Pliers VAS 5024A
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- The spring-type clip pliers VAS 5024A are recommended for installing spring-type clips.

EVAP System, Function

EVAP System, Function

Depending on air pressure and ambient temperature, varying quantities of fuel vapors form above the fuel surface in the fuel tank.

The evaporative emissions system prevents these HC emissions from dispersing into the atmosphere.

Fuel vapors travel from the highest point of the fuel tank (at filler tube) via expansion tank into the EVAP canister.

The activated charcoal in the canister stores these gases like a sponge.

While driving, with oxygen sensor control active (engine warm), the Evaporative Emission (EVAP) Canister Purge Regulator Valve 2 N333 is activated by the Engine Control Module (ECM) in pulses dependent on load and engine speed. The opening time is dependent on input signals.

During the cleansing process (regeneration of active charcoal), the intake manifold vacuum sucks fresh air through the breather connection of the EVAP canister. The fuel vapors stored amongst the activated charcoal and fresh air are proportionately supplied to be burned.

Evaporative Emission (EVAP) Canister Purge Regulator Valve 2 N333 is closed without current (e.g. open circuit). The EVAP canister is not purged.

Leak Detection Function Description

The EVAP system (including fuel tank) is equipped with leak diagnosis. The leak diagnosis will detect whether the system is leaking.

The diagnosis operates by pressurizing the system and should detect leaks where the damage exceeds 1 mm in diameter.

During the diagnostic, the Leak Detection Pump (LDP) V144 generates a positive pressure of approximately 30 mbar in the EVAP canister system. The pump will switch off when the pressure is attained. When the pressure falls to below a certain figure, the pump will switch on again. On Board Diagnostic monitors the switch intervals and stores a DTC in DTC memory if the intervals are too short.

EVAP System, Assembly Overview

EVAP System, Assembly Overview

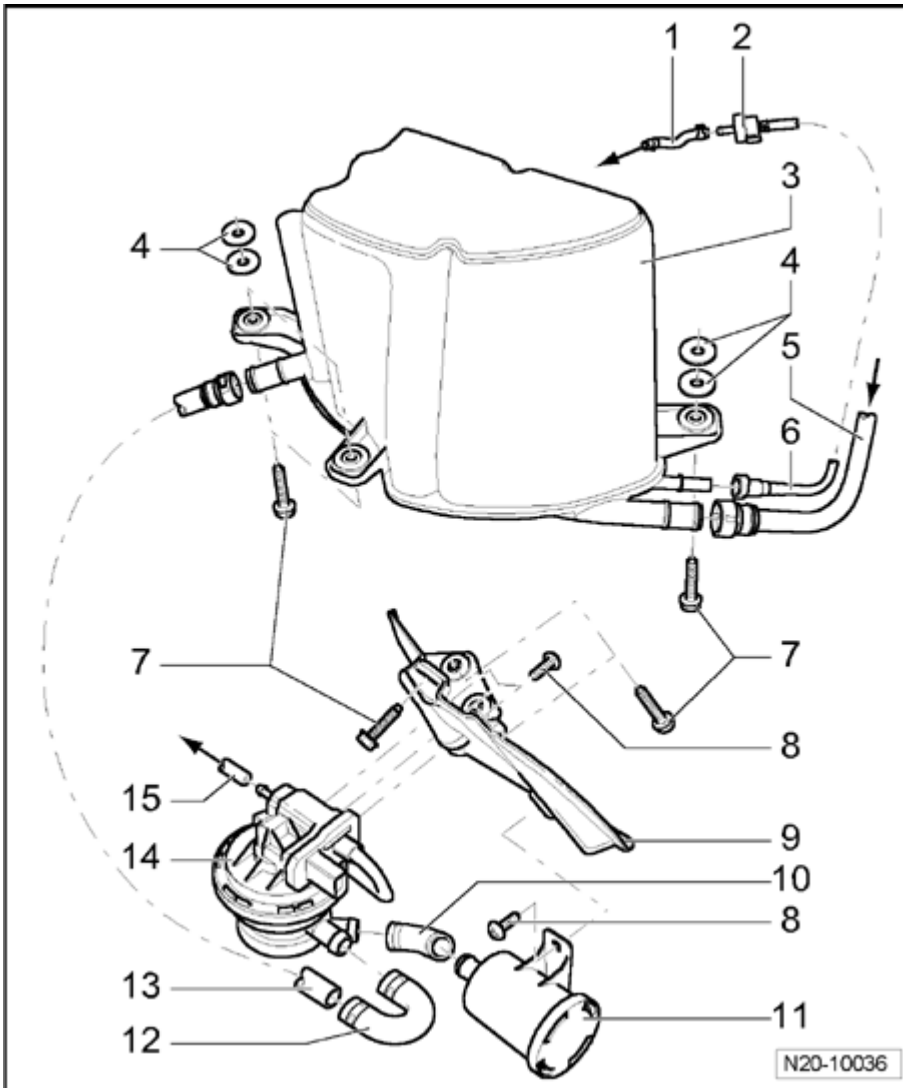


Fig. 300: EVAP System, Assembly Overview

Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - To connection

- At upper part of intake manifold
- Ensure seated tightly
- Intake manifold - assembly overview for vehicles with engine code BAP --> **Intake Manifold, Engine Code BAP, Assembly Overview.**
- Upper part of intake manifold - assembly overview for vehicles with engine code BRP --> **Intake Manifold Upper Section, Engine Code BRP, Assembly Overview.**

2 - Evaporative Emission (EVAP) canister purge regulator valve 2 N333

- Note installation position
- Black connector, 2-pin

3 - EVAP canister

- In spare wheel well on vehicle floor

4 - Washers

5 - Vent line

- Ensure seated tightly

6 - Connecting line

- Ensure seated tightly

7 - 9 Nm

8 - 5 Nm

9 - Bracket

10 - Connecting hose

- Ensure seated tightly

11 - Air filter housing

- Clean if soiled

12 - Connecting hose

- Ensure seated tightly

13 - Connecting line

- Ensure seated tightly

14 - Leak Detection Pump (LDP) V144

- Black connector, 3-pin

15 - Vent line

- To upper section of intake manifold
- Ensure seated tightly
- Intake manifold - assembly overview for vehicles with engine code BAP --> **Intake Manifold, Engine Code BAP, Assembly Overview.**

- Upper part of intake manifold - assembly overview for vehicles with engine code BRP --> **Intake Manifold Upper Section, Engine Code BRP, Assembly Overview.**

24 - MULTIPOINT FUEL INJECTION (MFI)

FUEL INJECTION SYSTEM

Fuel Injection System

--> **Safety Precautions**

--> **Clean Working Conditions**

--> **General Information**

--> **Technical Data**

--> **Intake Manifold, Engine Code BAP, Assembly Overview**

--> **Intake Manifold Upper Section, Engine Code BRP, Assembly Overview**

--> **Intake Manifold Lower Section, Engine Code BRP, Assembly Overview**

--> **Fuel Rail with Fuel Injectors, Assembly Overview**

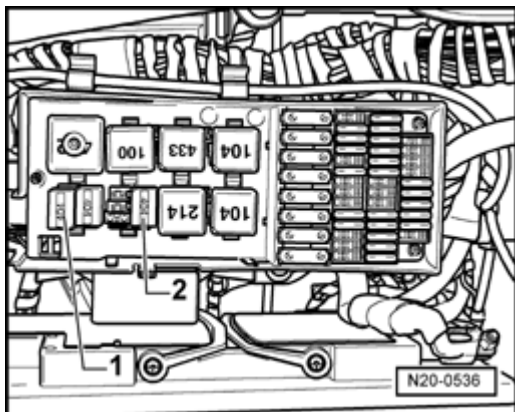
--> **Air Filter, Assembly Overview**

Safety Precautions

Safety Precautions

CAUTION: When doing any repair work, especially in the engine compartment, pay attention to the following due to clearance issues:

- Route lines of all types (e.g. for fuel, hydraulic, EVAP canister system, coolant and refrigerant, brake fluid, vacuum) and electrical wiring so that the original path is followed.
- To prevent damages to the lines, make sure there is sufficient clearance to all moving or hot components.

**Fig. 301: Fuel Pump Relays, Right And Left Side**

Courtesy of VOLKSWAGEN UNITED STATES, INC.

For safety reasons, fuel pump relays - 1 - (for right side) and - 2 - (for left side) must be removed from fuse holder of E-box in luggage compartment before opening fuel system, as fuel pump may be activated when opening drivers door.

NOTE:

- Do not remove relay from relay plate with metal tools. The terminals could conduct electricity.

CAUTION: Fuel supply lines are under pressure! Wear protective goggles and protective gloves to avoid damage and contact with skin. Before removing from hose connection wrap a cloth around the connection. Then release pressure by carefully pulling hose off connection.

To reduce the risk of personal injury and/or damage to the fuel injection and ignition system, always observe the following:

- Only disconnect and reconnect wires for injection and ignition system, including test leads, when ignition is switched off.

If test and measuring equipment is required during road test, note the following:

- Test and measuring instruments must be secured to rear seat and operated by a 2nd person from this location.

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

- If the engine is to be turned at starter speed, without starting:
 - Disconnect connectors from ignition coils with power output stage 1 to 12.

Clean Working Conditions

Clean Working Conditions

When working on the fuel supply/injection system, pay careful attention to the following "5 rules" of cleanliness:

- Thoroughly clean all connections and the surrounding area before disconnecting.
- Place parts that have been removed on a clean surface and cover them. Use lint-free cloths.
- Carefully cover over opened components or seal, if repairs are not performed immediately.
- Only install clean components: Only unpack replacement parts immediately prior to installation. Do not use parts that have been stored loose (e.g. in tool boxes etc.).
- When the system is open: Avoid working with compressed air if possible. Do not move vehicle unless absolutely necessary.

General Information**General Information**

- Do not use sealants containing silicone. Traces of silicone components which are sucked into the engine are not burned there, and they damage the oxygen sensors.
- Fuel hoses in engine compartment must only be secured with spring-type clips. The use of clamp or screw type clips is not permissible.

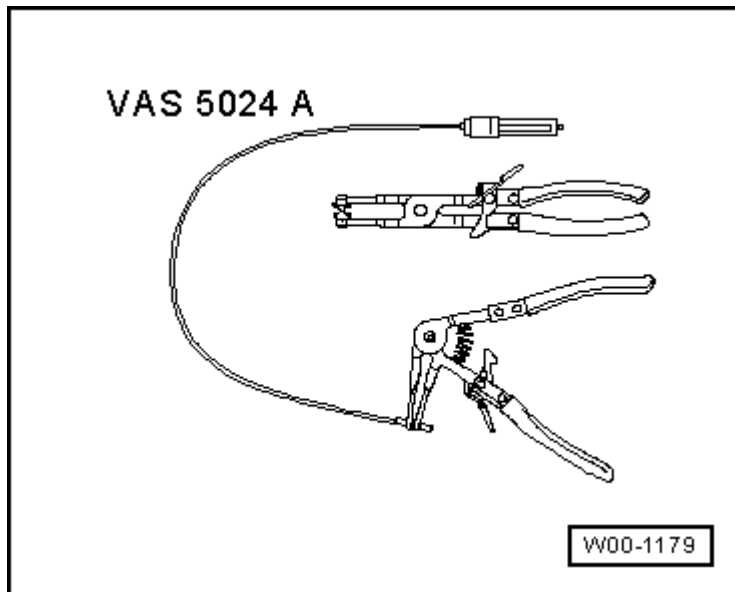


Fig. 302: Spring-Type Clip Pliers VAS 5024A
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- The spring-type clip pliers VAS 5024A are recommended for installing spring-type clips.

Allocation of Exhaust Banks and Cylinders at Engine

2004 Volkswagen Phaeton

ENGINE 6.0 Liter 12-Cyl. 4V Engine Mechanical, Fuel Injection & Ignition, Engine Code(s): BRP, BAP

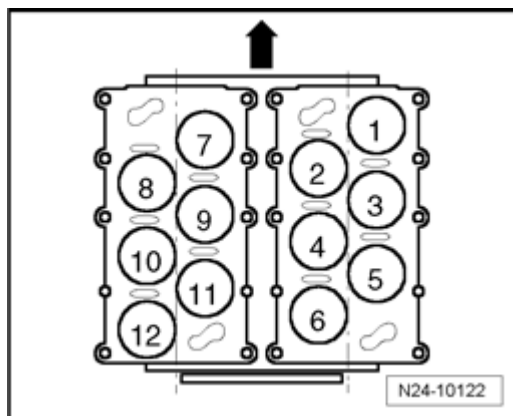


Fig. 303: Allocation Of Exhaust Banks And Cylinders At Engine
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- **Arrow** - points in direction of travel.

NOTE:

- **Cylinder bank 1 (bank 1) of cylinders - 1 - to - 6 - are located at right in direction of travel.**
- **Cylinder bank 2 (bank 2) of cylinders - 7 - to - 12 - are located at left in direction of travel.**

Cylinder bank 1 for	Allocation of cylinders
Exhaust bank 1	of cylinders: 1, 2, 3
Exhaust bank 2	of cylinders 4, 5, 6

Cylinder bank 2 for	Allocation of cylinders
Exhaust bank 3	of cylinders: 7, 8, 9
Exhaust bank 4	of cylinders 10, 11, 12

Technical Data

Technical Data

Engine code			BAP	BRP
Idle check				
	Engine idle speed	RPM	560 to 650	560 to 650
Engine control module				
	System designation		Motronic ME7.1.1	Motronic ME7.1.1
	Replacement part number			
	Engine speed (RPM) limitation	RPM	from approximately 6800	from approximately 6800

*Not adjustable

Intake Manifold, Engine Code BAP, Assembly Overview

Intake Manifold, Engine Code BAP, Assembly Overview

NOTE:

- Cylinder bank 1 is located on right side in direction of travel. The accompanying Throttle Valve Control Module J338 is installed at left in direction of travel.
- Cylinder bank 2 is located on left side in direction of travel. The accompanying Throttle Valve Control Module J544 is installed at right in direction of travel.
- Allocation of exhaust banks and cylinders at engine --> Allocation of Exhaust Banks and Cylinders at Engine

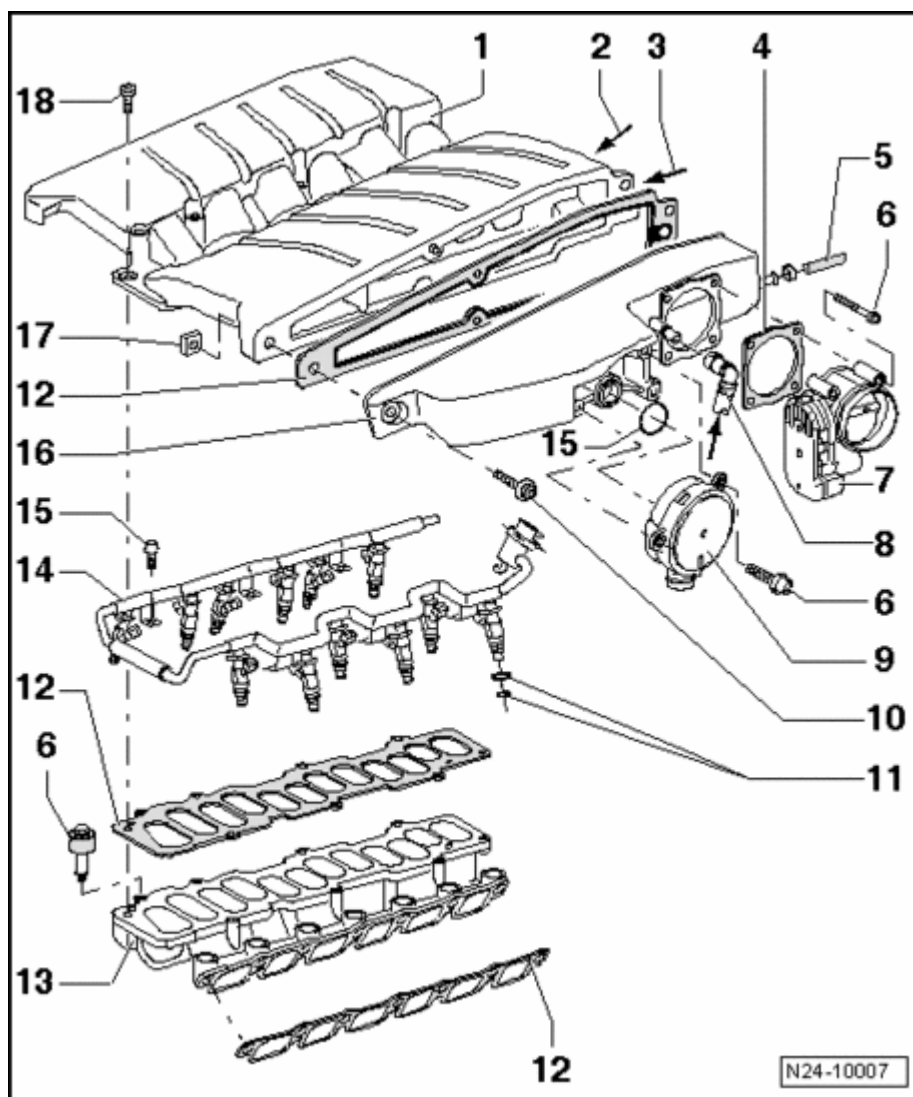


Fig. 304: Intake Manifold, Engine Code BAP, Assembly Overview

Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Intake manifold upper part

2 - Vacuum connection

- At intake manifold, left

3 - From Evaporative Emission (EVAP) canister purge regulator valve

Vehicles with engine code BAP (only cylinder bank 2)

- Connection sealed with sealing plug

4 - Gasket

- Replace

5 - To brake booster vacuum line

- Ensure seated tightly

6 - 8 Nm

7 - Throttle valve control module

Cylinder bank 1:

- Throttle valve control module J338

Cylinder bank 2:

- Throttle Valve Control Module 2 J544
- When replacing, adapt Engine Control Module (ECM) to Throttle Valve Control Module ; "Guided Function" "Adapting throttle valve control module"

8 - Vent line

Vehicles with engine code BAP (only cylinder bank 1)

- To vacuum connection at Leak Detection Pump (LDP) V144
- Ensure seated tightly

9 - Pressure control valve for crankcase ventilation

10 - 20 Nm

11 - O-ring

- Replace

12 - Gasket

- Replace if damaged

13 - Intake manifold lower part

14 - Fuel distributor with fuel injectors

- Fuel distributor, assembly overview --> **Fuel Rail with Fuel Injectors, Assembly Overview.**

15 - 8 Nm

16 - Intake manifold side-part

17 - Threaded plate

18 - 7 Nm + $\frac{1}{2}$ turn (180)

Intake Manifold Upper Section, Engine Code BRP, Assembly Overview

Intake Manifold Upper Section, Engine Code BRP, Assembly Overview

NOTE:

- **Cylinder bank 1 is located on right side in direction of travel. The accompanying Throttle Valve Control Module J338 is installed at left in direction of travel.**
- **Cylinder bank 2 is located on left side in direction of travel. The accompanying Throttle Valve Control Module J544 is installed at right in direction of travel.**
- **Allocation of exhaust banks and cylinders at engine --> Allocation of Exhaust Banks and Cylinders at Engine**

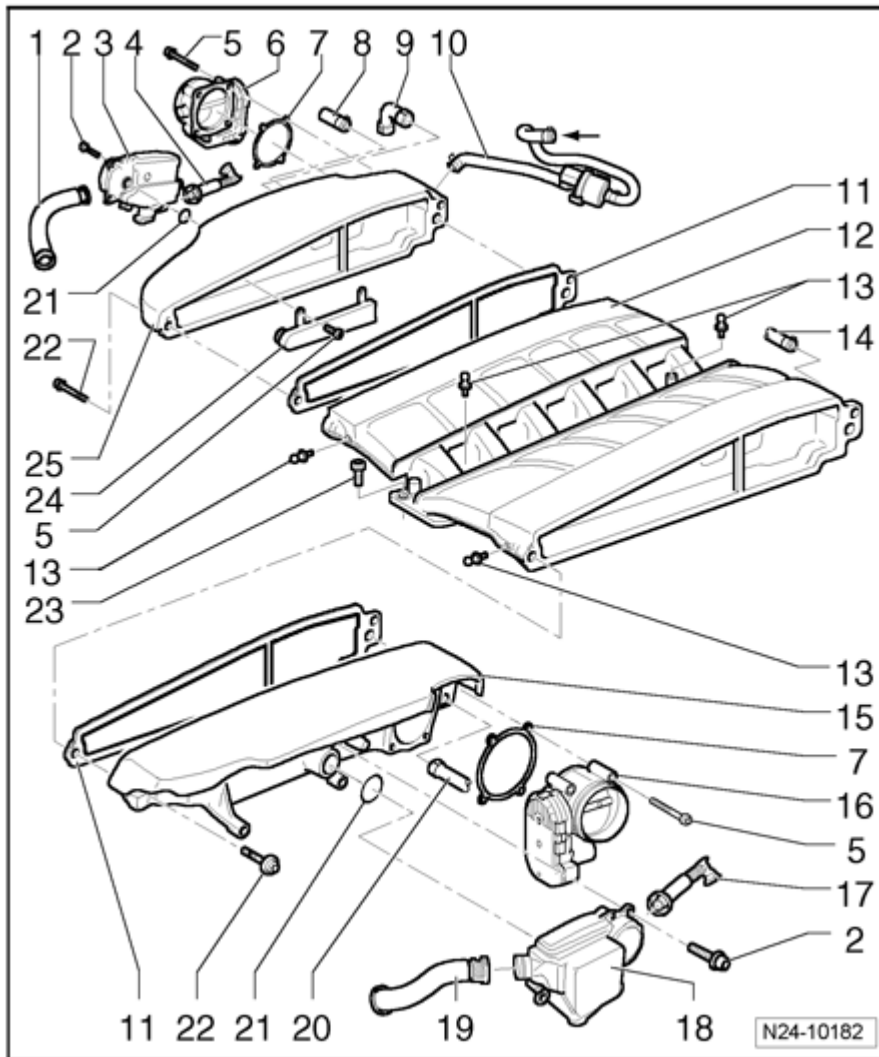


Fig. 305: Intake Manifold Upper Section, Engine Code BRP, Assembly Overview
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Connecting hose

- For crankshaft housing ventilation of cylinder bank 1
- From cylinder head cover, front

2 - 8 Nm

3 - Pressure control valve for crankcase ventilation

- For crankshaft housing ventilation of cylinder bank 1

4 - Connecting hose

- For crankshaft housing ventilation of cylinder bank 1

2004 Volkswagen Phaeton

ENGINE 6.0 Liter 12-Cyl. 4V Engine Mechanical, Fuel Injection & Ignition, Engine Code(s): BRP, BAP

- From cylinder head cover, rear

5 - 8 Nm

6 - Throttle valve control module J544

- For cylinder bank 2
- When replacing, adapt Engine Control Module (ECM) to Throttle Valve Control Module ; "Guided Function" "Adapting throttle valve control module"

7 - Gasket

- Replace

8 - Sealing plugs

- Ensure seated tightly
- Only vehicles with engine code BRN
- Vehicles with engine code BRP with vent line to vacuum connection at Leak Detection Pump (LDP) V144

9 - To brake booster

10 - Connecting hose

- Ensure seated tightly
- From EVAP canister
- To Evaporative Emission (EVAP) Canister Purge Regulator Valve 2 N333

11 - Gasket

- Replace if damaged

12 - Intake manifold upper part

13 - Mounting pins

- For intake manifold cover

14 - From fuel pressure regulator

15 - Intake manifold side-part

- For cylinder bank 1

16 - Throttle valve control module J338

- For cylinder bank 1
- When replacing, adapt Engine Control Module (ECM) to Throttle Valve Control Module ; "Guided Function" "Adapting throttle valve control module"

17 - Connecting hose

- For crankshaft housing ventilation of cylinder bank 2
- From cylinder head cover, rear

18 - Pressure control valve for crankcase ventilation

- For crankshaft housing ventilation of cylinder bank 2

19 - Connecting hose

- For crankshaft housing ventilation of cylinder bank 2
- From cylinder head cover, front

20 - To intake manifold for air filter

- For cylinder bank 1
- Ensure seated tightly

21 - O-ring

- Replace

22 - 20 Nm**23 - 7 Nm + $\frac{1}{2}$ turn (180)****24 - Connecting piece**

- For crankshaft housing ventilation of cylinder bank 1

25 - Intake manifold side-part

- For cylinder bank 2

Intake Manifold Lower Section, Engine Code BRP, Assembly Overview**Intake Manifold Lower Section, Engine Code BRP, Assembly Overview**

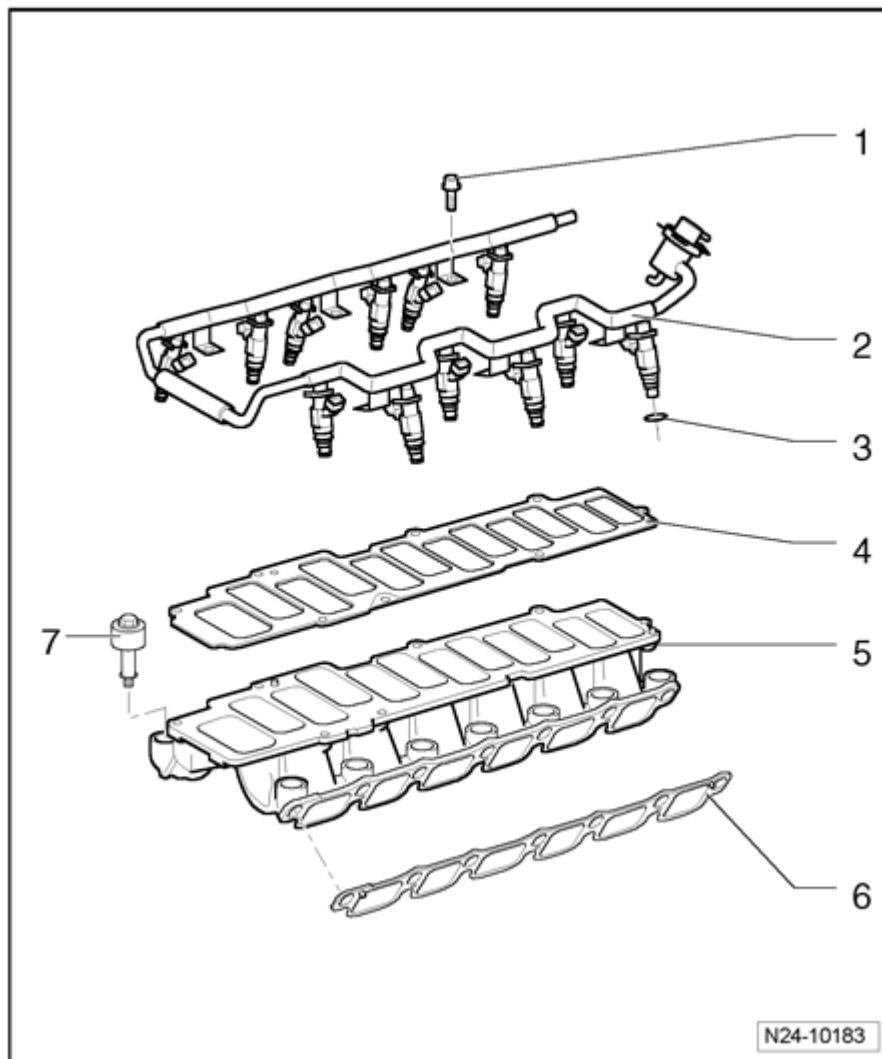


Fig. 306: Intake Manifold Lower Section, Engine Code BRP, Assembly Overview
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - 8 Nm

2 - Fuel rail

With fuel injectors

- Fuel rail with fuel injectors, assembly overview --> **Fuel Rail with Fuel Injectors, Assembly Overview.**

3 - O-ring

- Replace
- Before installing, moisten with clean engine oil

4 - Gasket

2004 Volkswagen Phaeton

ENGINE 6.0 Liter 12-Cyl. 4V Engine Mechanical, Fuel Injection & Ignition, Engine Code(s): BRP, BAP

- Replace if damaged
- Ensure correct seating of dowel sleeves

5 - Intake manifold lower part

6 - Gasket

- Replace if damaged
- Ensure proper seating of tabs in cylinder head

7 - 8 Nm

Fuel Rail with Fuel Injectors, Assembly Overview

Fuel Rail with Fuel Injectors, Assembly Overview

NOTE:

- **Cylinder bank 1 (bank 1) is located on right side in direction of travel.**
- **Cylinder bank 2 (bank 2) is located on left side in direction of travel.**
- **Allocation of exhaust banks and cylinders at engine --> Allocation of Exhaust Banks and Cylinders at Engine**

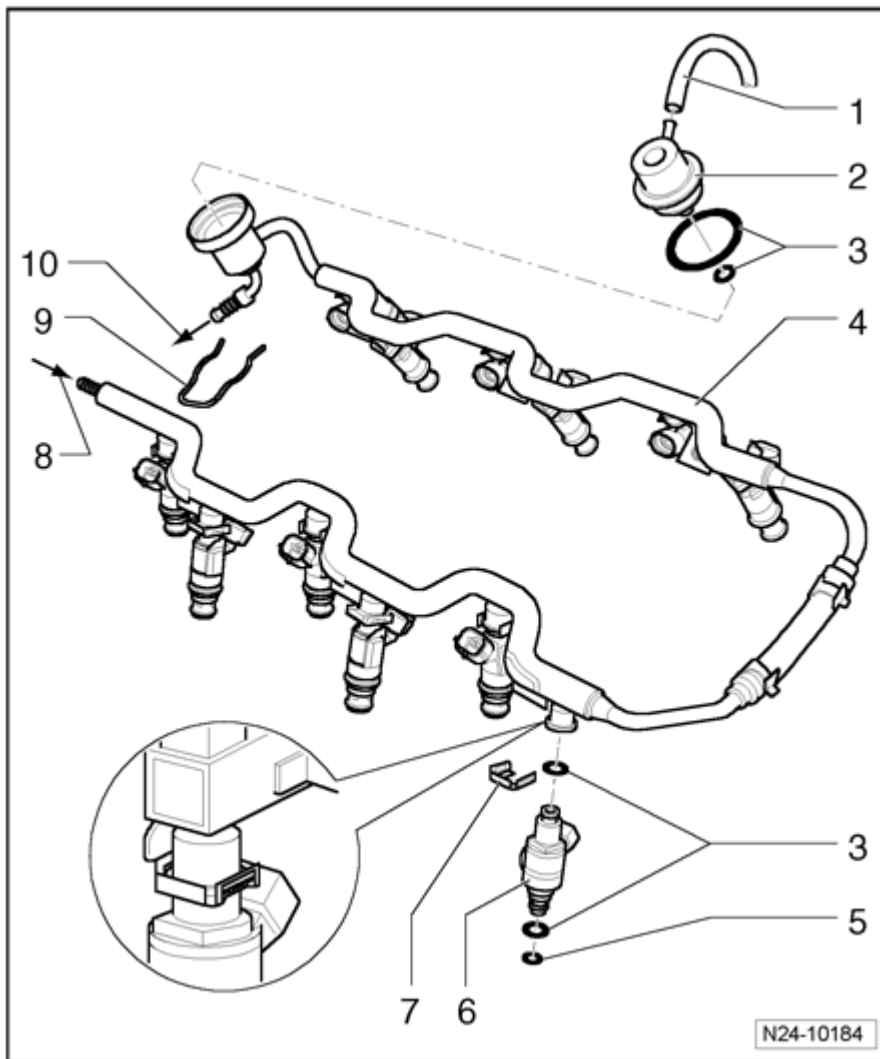


Fig. 307: Fuel Rail With Fuel Injectors, Assembly Overview
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - To vacuum connection at upper part of intake manifold

- Intake manifold - assembly overview (Vehicles with engine code BAP) --> **Intake Manifold, Engine Code BAP, Assembly Overview.**
- Upper part of intake manifold - assembly overview for (vehicles with engine code BRP) --> **Intake Manifold Upper Section, Engine Code BRP, Assembly Overview.**

2 - Fuel pressure regulator

- Checking --> **Fuel Pressure Regulator and Residual Pressure, Checking.**

3 - O-ring

- Replace

- Before installing, moisten with clean engine oil

4 - Fuel distributor with fuel injectors

5 - O-ring

- Replace
- Only vehicles with engine code BAP
- Before installing, moisten with clean engine oil

6 - Fuel injector

- Cylinder bank 1, fuel injectors 1 to 6: N30, N31, N32, N33, N83, N84
- Cylinder bank 2, fuel injectors 7 to 12: N85, N86, N299, N300, N301, N302
- Checking --> **Fuel Injectors, Checking.**

7 - Retaining clip

- Make sure clip is correctly seated on fuel injector and fuel distributor

8 - Supply line

- Secure with spring-type clips
- Ensure seated tightly

9 - Retaining clip

- Check for secure seat

10 - Return line

- Secure with spring-type clips
- Ensure seated tightly

Air Filter, Assembly Overview

Air Filter, Assembly Overview

NOTE:

- Illustration shows air filter of cylinder bank 2.
- Cylinder bank 1 (bank 1) is located on right side in direction of travel.
- Cylinder bank 2 (bank 2) is located on left side in direction of travel.
- Allocation of exhaust banks and cylinders at engine --> **Allocation of Exhaust Banks and Cylinders at Engine**

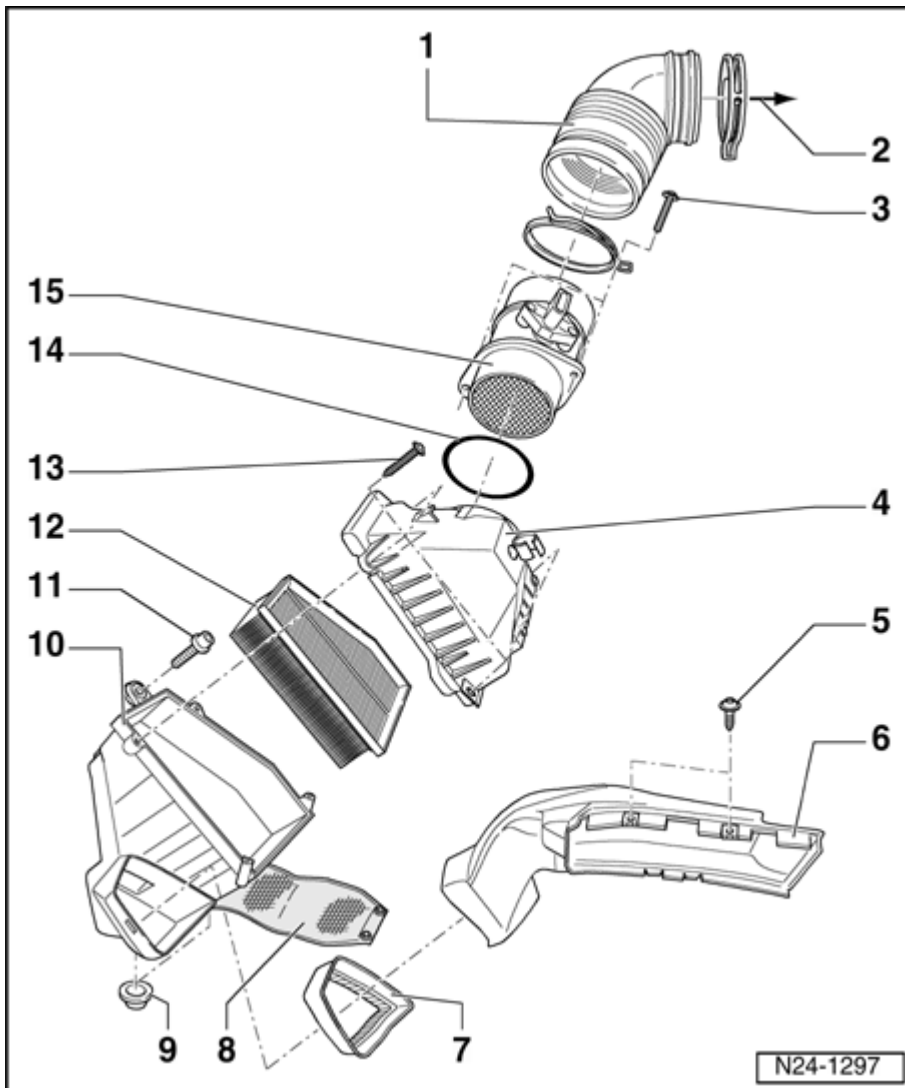


Fig. 308: Air Filter, Assembly Overview

Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Intake manifold

- Vehicles with engine code BRP with connection hose from intake manifold for cylinder bank 1 to upper part of intake manifold
- Upper part of intake manifold - assembly overview for vehicles with engine code BRP --> **Intake Manifold Upper Section, Engine Code BRP, Assembly Overview.**

2 - To Throttle valve control module

3 - 6 Nm

4 - Air filter upper part

5 - 6 Nm

2004 Volkswagen Phaeton

ENGINE 6.0 Liter 12-Cyl. 4V Engine Mechanical, Fuel Injection & Ignition, Engine Code(s): BRP, BAP

6 - Air duct

- To lock carrier

7 - Rubber grommet

8 - Heat shield foil

- Is clipped in at upper section of air filter

9 - Rubber grommet

10 - Air filter lower part

11 - 10 Nm

12 - Filter element

13 - 6 Nm

14 - Seal

- Replace if damaged

15 - Mass Air Flow (MAF) sensor

- Cylinder bank 1: Mass Air Flow (MAF) Sensor G70 with Intake Air Temperature (IAT) Sensor G42
- Cylinder bank 2: Mass Air Flow (MAF) Sensor 2 G246 with Intake Air Temperature (IAT) Sensor 2 G299

OXYGEN SENSORS

Oxygen Sensors

Oxygen Sensors

--> Heated Oxygen Sensors 1 and 2, Removing and Installing

--> Heated Oxygen Sensors 3 and 4, Removing and Installing

--> Oxygen Sensor 2 after Catalytic Converter, Removing and Installing

--> Oxygen Sensors 3 and 4 after Catalytic Converter, Removing and Installing

2004 Volkswagen Phaeton

ENGINE 6.0 Liter 12-Cyl. 4V Engine Mechanical, Fuel Injection & Ignition, Engine Code(s): BRP, BAP

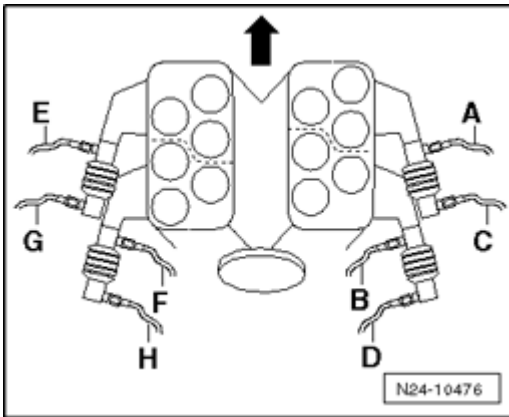


Fig. 309: Oxygen Sensor Allocation

Courtesy of VOLKSWAGEN UNITED STATES, INC.

Oxygen Sensor Allocation

- **Arrow** - points in direction of travel.

Cylinder Bank 2		Cylinder Bank 1	
E	Heated Oxygen Sensor (HO2S) 3 G285	A	Oxygen sensor G39
F	Heated Oxygen Sensor (HO2S) 4 G286	B	Heated Oxygen Sensor (HO2S) 2 G108
G	Oxygen Sensor (O2S) 3 Behind Three Way Catalytic Converter (TWC) G287	C	Oxygen Sensor (O2S) Behind Three Way Catalytic Converter (TWC) G130
H	Oxygen Sensor (O2S) 4 Behind Three Way Catalytic Converter (TWC) G288	D	Oxygen Sensor (O2S) 2 Behind Three Way Catalytic Converter (TWC) G131

Oxygen Sensor Connector Overview

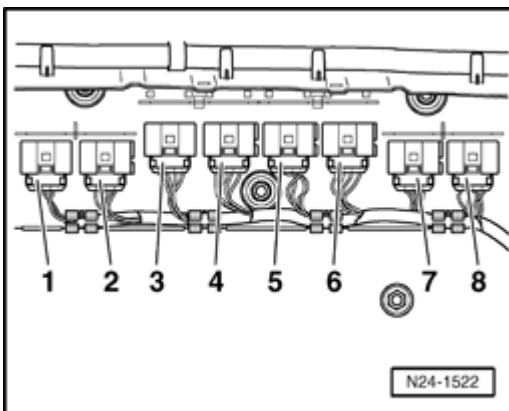


Fig. 310: Oxygen Sensor Connector Overview**Courtesy of VOLKSWAGEN UNITED STATES, INC.**

1 - 6-pin harness connector, black: For Heated Oxygen Sensor (HO) G39

2 - 6-pin harness connector, green: For Heated Oxygen Sensor (HO) 2 G108

3 - 4-pin harness connector, black: For Oxygen Sensor (O) Behind Three Way Catalytic Converter (TWO) G130

4 - 4-pin harness connector, green: For Oxygen Sensor (O) 2 Behind Three Way Catalytic Converter (TWO) G131

5 - 4-pin harness connector, gray: For Oxygen Sensor (O) 4 Behind Three Way Catalytic Converter (TWO) G288

6 - 4-pin harness connector, brown: For Oxygen Sensor (O) 3 Behind Three Way Catalytic Converter (TWO) G287

7 - 6-pin harness connector, gray: For Heated Oxygen Sensor (HO) 4 G286

8 - 6-pin harness connector, brown: For Heated Oxygen Sensor (HO) 3 G285

Heated Oxygen Sensor (HO2S) G39 and Heated Oxygen Sensor (HO2S) 2 G108 , removing and installing --> **Heated Oxygen Sensors 1 and 2, Removing and Installing.**

Heated Oxygen Sensor 3 G285 and Heated Oxygen Sensor 4 G286 , Removing and Installing --> **Heated Oxygen Sensors 3 and 4, Removing and Installing.**

Oxygen Sensor behind Three Way Catalytic Converter G130 and Oxygen Sensor 2 behind Catalytic Converter G131 , Removing and Installing --> **Oxygen Sensor 2 after Catalytic Converter, Removing and Installing.**

Oxygen Sensor 3 behind Three Way Catalytic Converter G287 and Oxygen Sensor 4 behind Three Way Catalytic Converter G288 , Removing and Installing --> **Oxygen Sensors 3 and 4 after Catalytic Converter, Removing and Installing.**

NOTE:

- The oxygen sensor behind three way catalytic converter G130 can only be replaced when the engine is removed because otherwise it would not be possible to tighten it using a torque wrench.

Heated Oxygen Sensors 1 and 2, Removing and Installing

Heated Oxygen Sensors 1 and 2, Removing and Installing

Special tools, testers and auxiliary items required

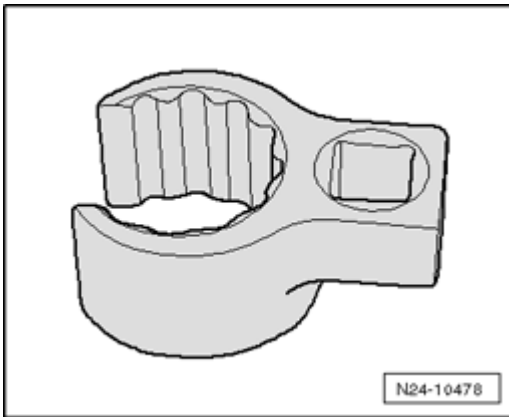


Fig. 311: Open-End Wrench With 3/8" Drive
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Open-end wrench with 3/8" drive

Removing

- Remove the engine covers.

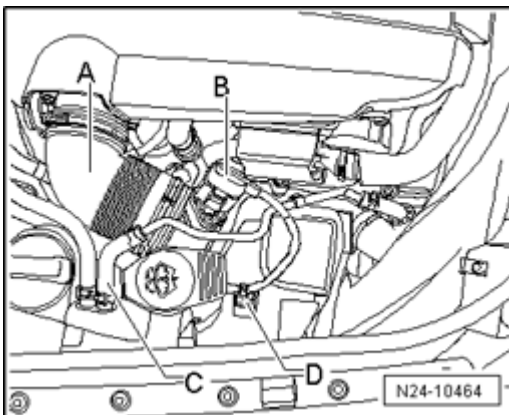


Fig. 312: Removing Intake Hose, Connector & Coolant Hose
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove the intake hose - **A** - and the connector - **B** -. Remove the coolant hose - **C** - and release the wire clip - **D** -.

NOTE:

- The crankcase ventilation pressure control valve must be removed so the air filter upper section can be removed.

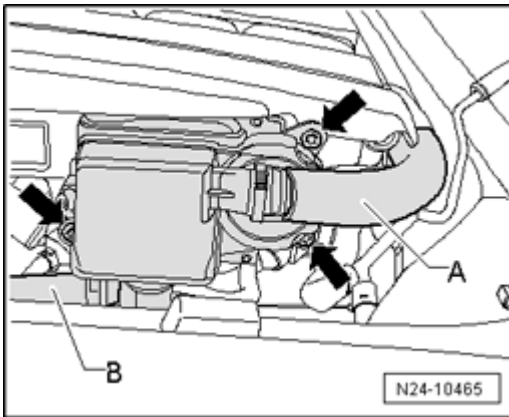


Fig. 313: Removing Ventilation Hose, Bolts & Disconnecting Ventilation Hose
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove the ventilation hose - **A** - from the pressure control valve.
- Remove the bolts - **arrows** -.
- Disconnect the ventilation hose - **B** - from the cylinder head cover and remove the pressure control valve.
- Loosen the air filter housing upper section mounting bolts and remove the upper section.

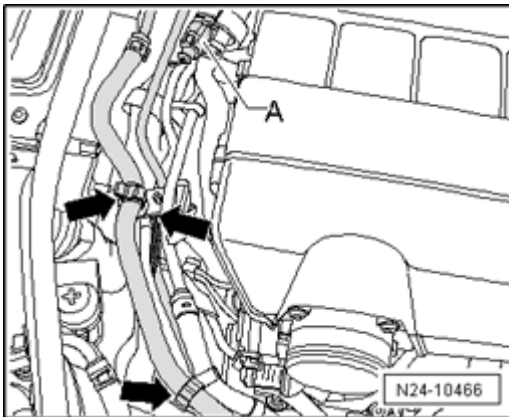


Fig. 314: Removing Connector From EVAP Canister Purge Regulator Valve N80
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Open the retainers for the coolant hose and the pressure line - **arrows** -. Remove the connector - **A** - from the EVAP canister purge regulator valve N80.

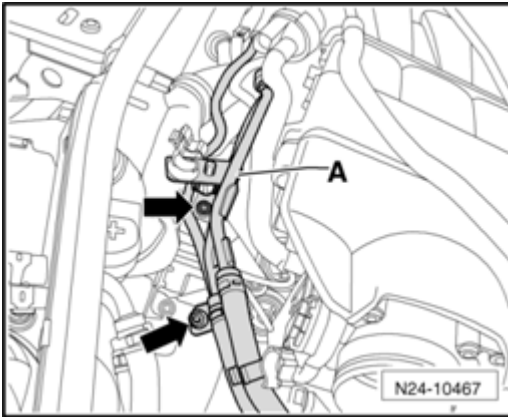


Fig. 315: Removing Retainers For Fuel Pipes

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove the retainers - **arrows** - for the fuel pipes - **A** -.

CAUTION: Fuel supply lines are under pressure! Wear protective goggles and protective gloves to avoid damage and contact with skin. Before removing from hose connection wrap a cloth around the connection. Then release pressure by carefully pulling hose off connection.

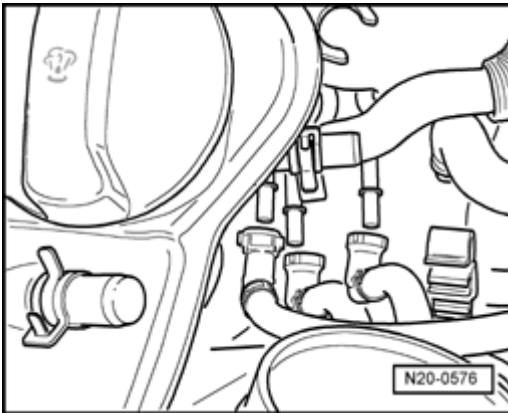
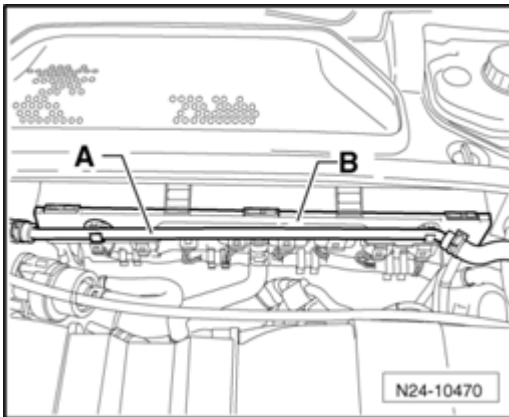


Fig. 316: Disconnecting Fuel Supply And Fuel Return Line And Line To EVAP Canister

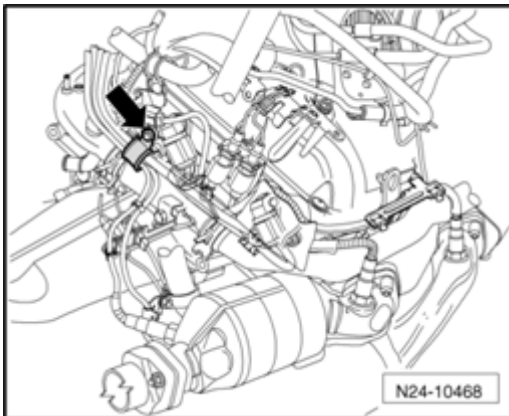
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect fuel supply and fuel return line and line to EVAP canister. Lay the vacuum lines aside.

**Fig. 317: Removing Coolant Pipe And Cover**

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove the coolant pipe - **A** - and remove the cover - **B** -.

**Fig. 318: Removing Oxygen Sensor Wire Clamp**

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove the oxygen sensor wire clamp - **arrow** -.
- Loosen the oxygen sensor wire from the clamps and disconnect the connector on the sensor that will be removed.

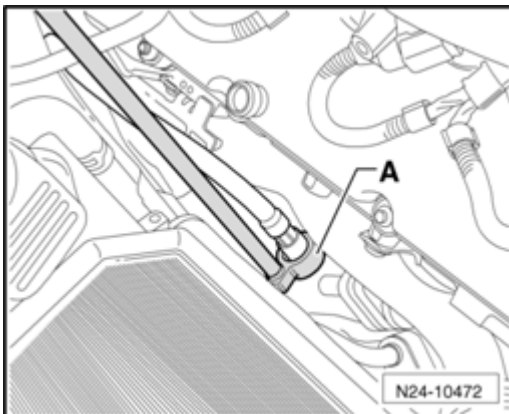


Fig. 319: Removing Oxygen Sensor Using An Open End Wrench
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove the oxygen sensor using an open end wrench - A -.

Installing

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

- The oxygen sensor wire must not be untwisted when installing.
- Route the wires so the original path is followed.
- Oxygen sensor tightening specification: 50 Nm.
- Oxygen sensor connector overview --> [Oxygen Sensor Connector Overview](#)

Heated Oxygen Sensors 3 and 4, Removing and Installing

Heated Oxygen Sensors 3 and 4, Removing and Installing

Special tools, testers and auxiliary items required

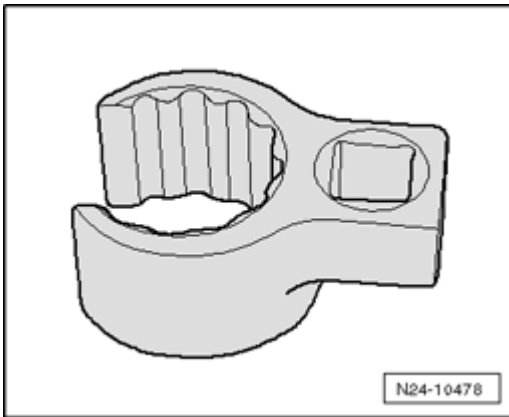


Fig. 320: Open-End Wrench With 3/8" Drive
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Open-end wrench with 3/8" drive

Removing

- Remove the engine covers.

NOTE:

- The crankcase ventilation pressure control valve must be removed so the air filter upper section can be removed.

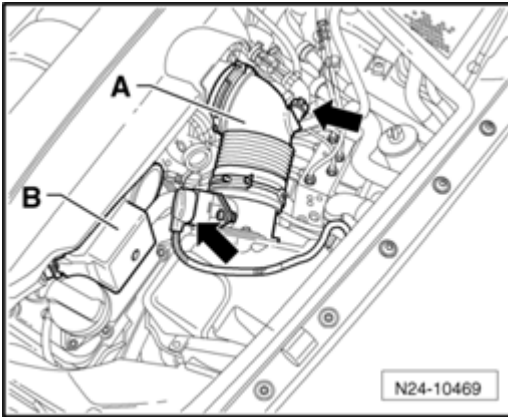


Fig. 321: Removing Connector From Mass Air Flow Sensor, Hose, Crankcase Ventilation, Intake Hose & Pressure Control Valve

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove the connector from the mass air flow sensor and the hose - **arrows** -.
- Remove the crankcase ventilation - **B** - intake hose - **A** - and pressure control valve.
- Loosen the air filter housing upper section mounting bolts and remove the upper section.

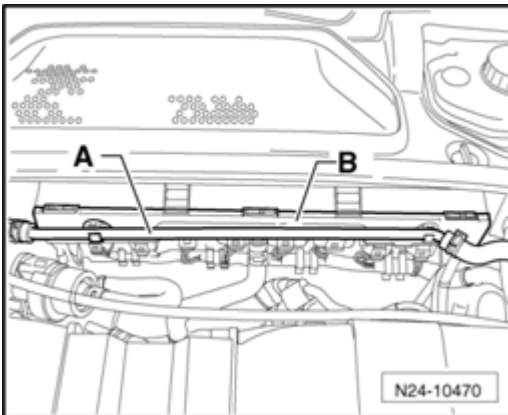
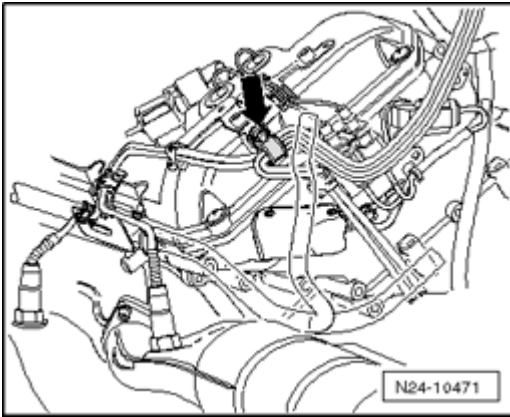


Fig. 322: Removing Coolant Pipe And Cover

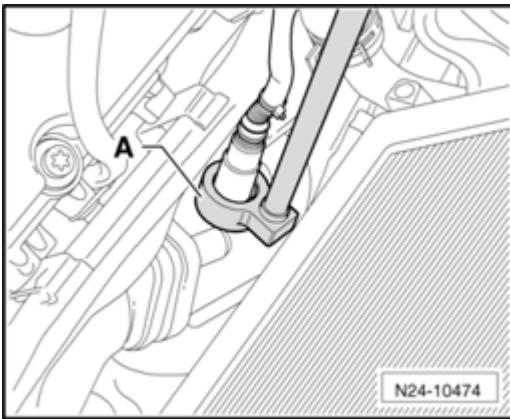
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove the coolant pipe - **A** - and remove the cover - **B** -.

**Fig. 323: Removing Oxygen Sensor Wire Clamp**

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove the oxygen sensor wire clamp - **arrow** -.
- Loosen the oxygen sensor wire from the clamps and disconnect the connector on the sensor that will be removed.

**Fig. 324: Removing Oxygen Sensor Using An Open End Wrench**

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove the oxygen sensor using an open end wrench - **A** -.

Installing

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

- The oxygen sensor wire must not be untwisted when installing.
- Route the wires so the original path is followed.
- Oxygen sensor tightening specification: 50 Nm.
- Oxygen sensor connector overview --> **Oxygen Sensor Connector Overview**

Oxygen Sensor 2 after Catalytic Converter, Removing and Installing

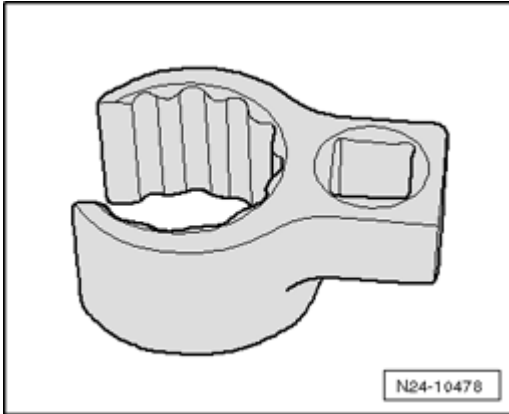
Oxygen Sensor 2 after Catalytic Converter, Removing and Installing**Special tools, testers and auxiliary items required**

Fig. 325: Open-End Wrench With 3/8" Drive
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Open-end wrench with 3/8" drive

NOTE:

- The oxygen sensor behind three way catalytic converter G130 can only be replaced when the engine is removed because otherwise it would not be possible to tighten it using a torque wrench.

Removing

- Remove the engine covers.

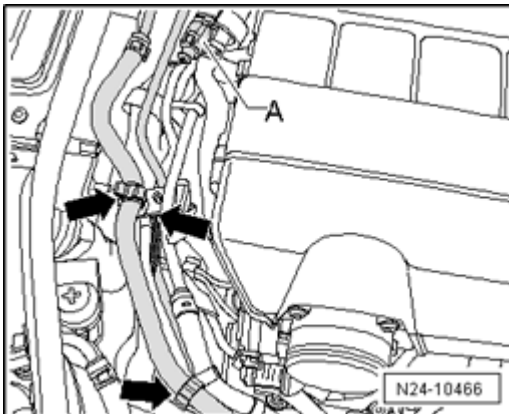
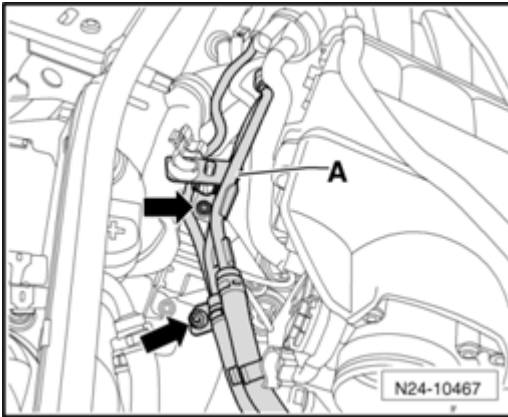


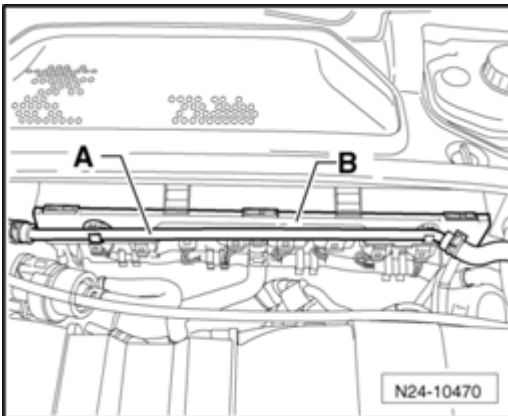
Fig. 326: Removing Connector From EVAP Canister Purge Regulator Valve N80
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Open the retainers for the coolant hose and the pressure line - **arrows** -. Remove the connector - **A** - from the EVAP canister purge regulator valve N80.

**Fig. 327: Removing Retainers For Fuel Pipes**

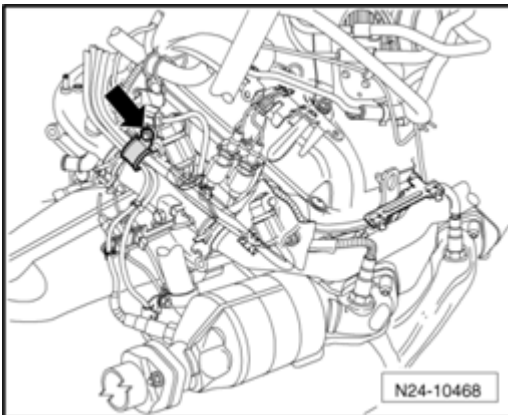
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove the retainers - **arrows** - for the fuel pipes - **A** -.

**Fig. 328: Removing Coolant Pipe And Cover**

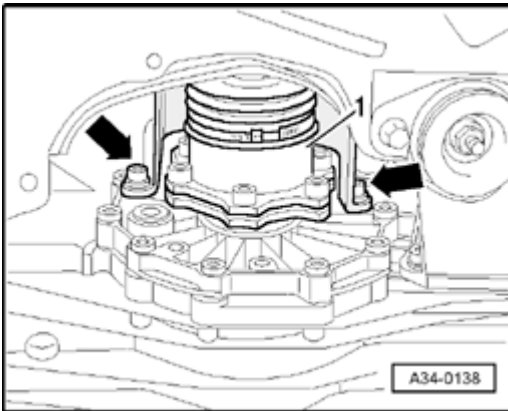
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove the coolant pipe - **A** - and remove the cover - **B** -.

**Fig. 329: Removing Oxygen Sensor Wire Clamp**

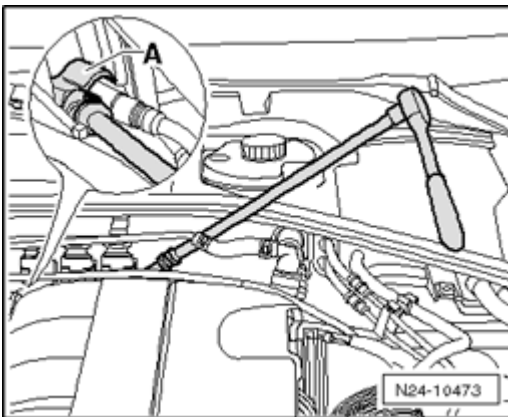
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove the oxygen sensor wire clamp - **arrow** -.
- Disconnect the connector for the oxygen sensor that will be removed. Oxygen sensor connector overview --> **Oxygen Sensor Connector Overview**
- Remove the rear noise insulation --> **50 BODY - FRONT** .
- Remove the catalytic converter with the front muffler (cylinder bank 1).
- Remove right front wheel.

**Fig. 330: Removing Right Drive Axle Heat Shield**

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove the right drive axle heat shield - **arrows** -. Third bolt is not visible in the illustration.
- Remove the right front exhaust pipe (cylinder bank 1).
- Loosen the oxygen sensor wire from the clips.

**Fig. 331: Removing Oxygen Sensor 2 Behind Three Way Catalytic Converter G131 Using An Open End Wrench, Link And Extension**

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove the oxygen sensor 2 behind three way catalytic converter G131 using an open end wrench - **A** - , link and an extension.

Installing

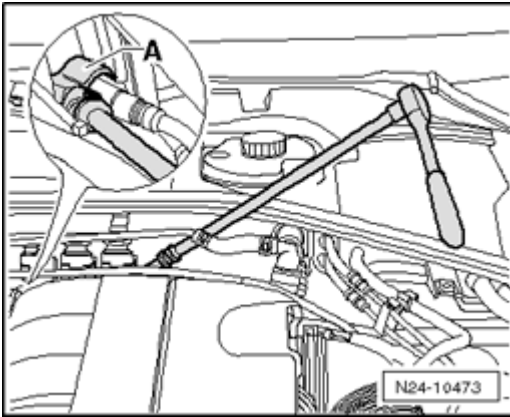


Fig. 332: Removing Oxygen Sensor 2 Behind Three Way Catalytic Converter G131 Using An Open End Wrench, Link And Extension

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Install the oxygen sensor and tighten by hand. Tighten to 50 Nm using an open end wrench - A - , link and an extension.

Further assembly is performed in the reverse order of removal, noting the following:

- Route the wires so the original path is followed.
- Oxygen sensor connector overview --> [Oxygen Sensor Connector Overview](#)

Oxygen Sensors 3 and 4 after Catalytic Converter, Removing and Installing

Oxygen Sensors 3 and 4 after Catalytic Converter, Removing and Installing

Special tools, testers and auxiliary items required

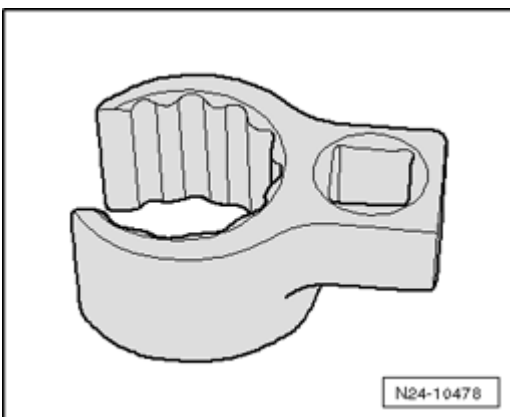


Fig. 333: Open-End Wrench With 3/8" Drive

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Open-end wrench with 3/8" drive

Removing

- Remove the engine covers.

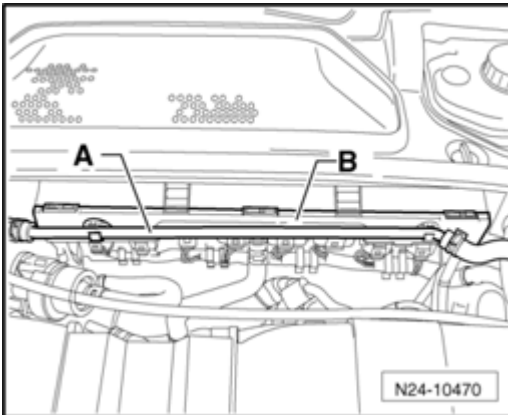


Fig. 334: Removing Coolant Pipe And Cover

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove the coolant pipe - **A** - and remove the cover - **B** -.

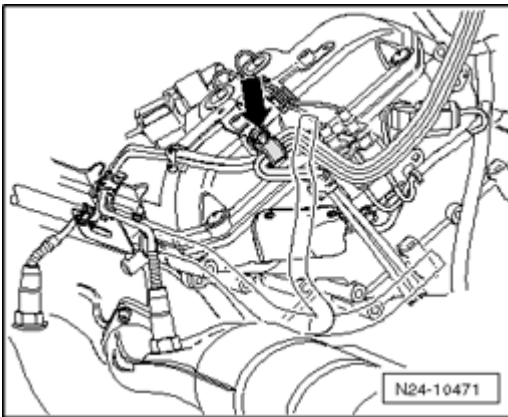
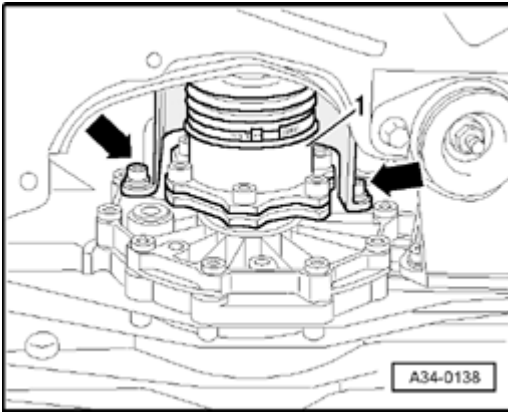


Fig. 335: Removing Oxygen Sensor Wire Clamp

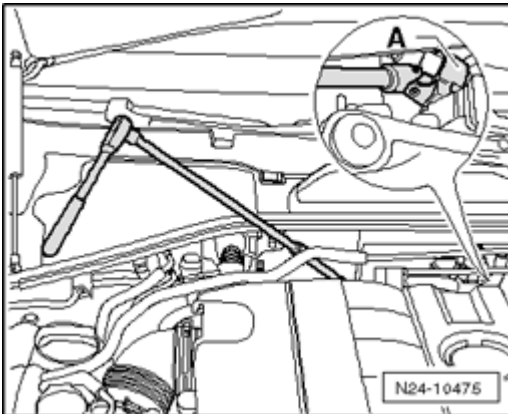
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove the oxygen sensor wire clamp - **arrow** -.
- Disconnect the connector for the oxygen sensor that will be removed. Oxygen sensor connector overview --> **Oxygen Sensor Connector Overview**
- Remove the rear noise insulation --> **50 BODY - FRONT** .
- Remove the catalytic converter with the front muffler (cylinder bank 2).
- Remove left front wheel.

**Fig. 336: Removing Right Drive Axle Heat Shield**

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove the left drive axle heat shield - **arrows** -. Third bolt is not visible in the illustration.
- Remove the left front exhaust pipe (cylinder bank 2).
- Loosen the oxygen sensor wire from the clips.

**Fig. 337: Removing/Installing Oxygen Sensor 3 Behind Three Way Catalytic Converter G287 Using An Open End Wrench, Link And Extension**

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove the oxygen sensor 3 behind three way catalytic converter G287 using an open end wrench - **A** - , link and an extension.
- The oxygen sensor 4 behind three way catalytic converter G288 is bolted from below.

Installing

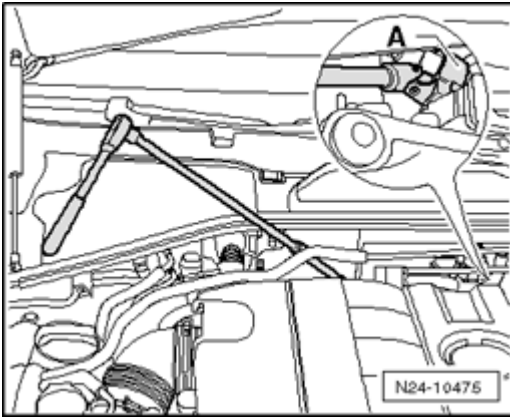


Fig. 338: Removing/Installing Oxygen Sensor 3 Behind Three Way Catalytic Converter G287 Using An Open End Wrench, Link And Extension
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Install the oxygen sensor 3 behind three way catalytic converter G287 and tighten by hand. Tighten to 50 Nm using an open end wrench - A - , link and an extension.
- Install the oxygen sensor 4 behind three way catalytic converter G288 and tighten by hand. Tighten to 50 Nm using an open end wrench - A - , link and an extension.

Further assembly is performed in the reverse order of removal, noting the following:

- Route the wires so the original path is followed.
- Oxygen sensor connector overview --> **Oxygen Sensor Connector Overview**

COMPONENTS, CHECKING

Components, Checking

--> **Fuel Injectors, Checking**

--> **Fuel Pressure Regulator and Residual Pressure, Checking**

Fuel Injectors, Checking

Fuel Injectors, Checking

2004 Volkswagen Phaeton

ENGINE 6.0 Liter 12-Cyl. 4V Engine Mechanical, Fuel Injection & Ignition, Engine Code(s): BRP, BAP

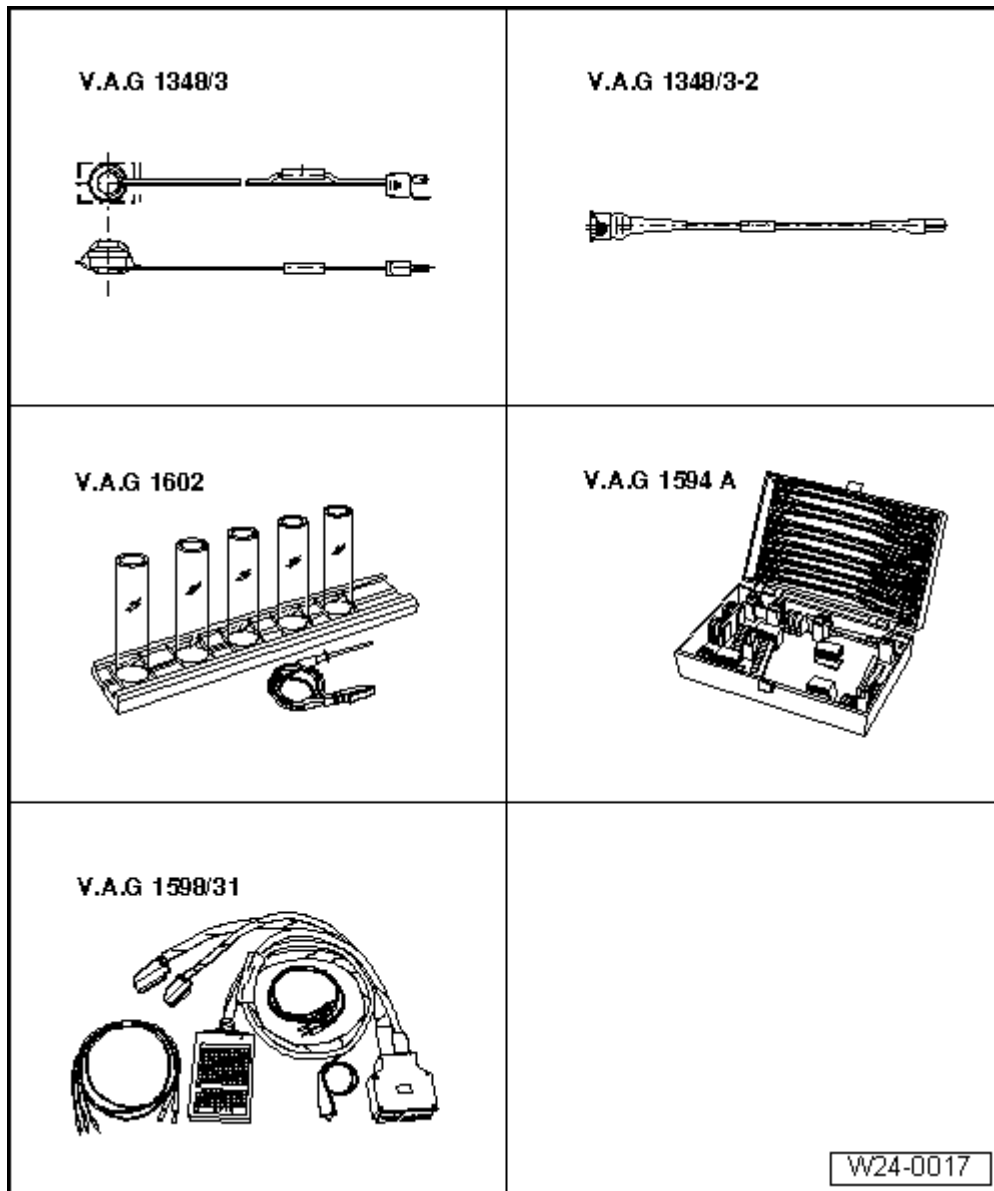


Fig. 339: Identifying Special Tools - Fuel Injectors, Checking
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools, testers and auxiliary items required

- Remote control connection V.A.G 1348/3 A
- Adapter cable V.A.G 1348/3-2
- Injector quantity testing device V.A.G 1602
- Test adapter kit V.A.G 1594 A
- Adapter cable, 121-pin V.A.G 1598/31

Test Conditions

- Fuel pressure must be OK, checking --> **Fuel Pressure Regulator and Residual Pressure, Checking.**

CAUTION: Fuel supply lines are under pressure! Wear protective goggles and protective gloves to avoid damage and contact with skin. Before removing from hose connection wrap a cloth around connection. Then release pressure by carefully pulling hose off connection.

Test Sequence

With Engine Code BAP:

- Remove upper part of intake manifold --> **Intake Manifold, Engine Code BAP, Assembly Overview.**

With Engine Code BRP:

- Remove upper part of intake manifold --> **Intake Manifold Upper Section, Engine Code BRP, Assembly Overview.**

Continuation for all Vehicles:

- Connect adapter cable, 121-pin V.A.G 1598/31 to wiring harness Engine Control Module 1 (ECM).
Engine Control Module 1 (ECM) is not connected.

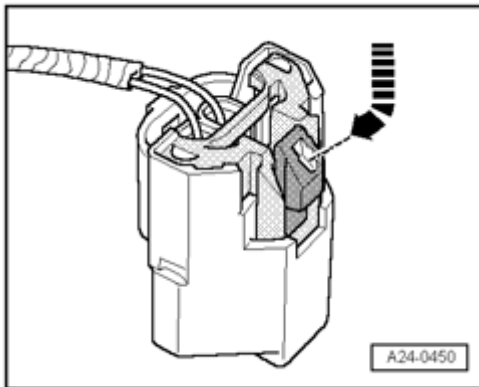


Fig. 340: Disconnecting Electrical Connectors For Fuel Injectors By Pressing Retaining Tab
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Pull off connectors from fuel injectors.
- Remove fuel rail securing bolts.

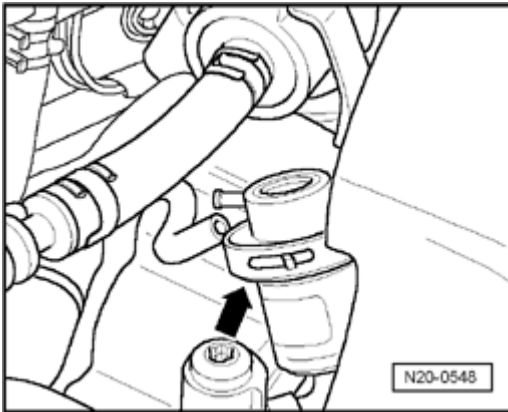


Fig. 341: Disconnecting Vacuum Hose From Fuel Pressure Regulator
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Pull the vacuum hose off from fuel pressure regulator - **arrow** -.
- Lift fuel rail with injectors off intake manifold and support it.
- Bridge test box sockets 1 and 65 using adapter cables from connector test kit V.A.G 1594C.

NOTE: • **This work step allows the fuel pump to run when the engine is not running.**

- Switch ignition on.

Checking for Leaks

- Check injectors for leaks (visual inspection). Only 1 to 2 drops per minute may emit from each valve when fuel pump is running.

If the fuel loss is greater:

- Switch off ignition and replace leaking fuel injector.

NOTE: • **Always use new seals.**

Injection Quantity, Checking

Test conditions:

- Adapter cable, 121-pin V.A.G 1598/31 is still connected and sockets 1 and 65 bridged with auxiliary wire from connector test set V.A.G 1594C.

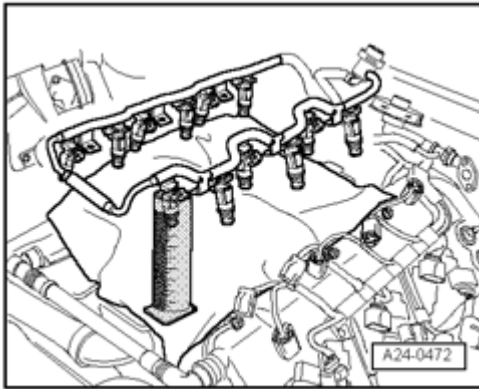


Fig. 342: Injector To Be Tested Inserted In A Measuring Glass Of Calibration Tester V.A.G 1602
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Place a fuel injector to be tested into a graduated measuring glass of injection rate tester V.A.G 1602.

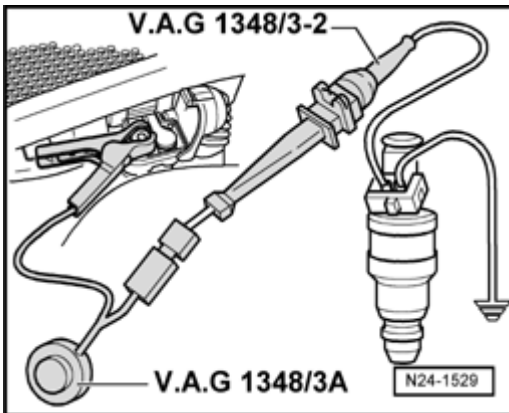


Fig. 343: V.A.G 1348/3 A And V.A.G 1348/3-2
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Using adapter cables from connector test kit V.A.G 1594C , connect one terminal of fuel injector to be checked to engine Ground (GND).
- Connect second fuel injector terminal with adapter cable to remote control V.A.G 1348/3 A using adapter cable V.A.G 1348/3-2.
- Connect alligator clip to positive pole in engine compartment.
- Operate remote control V.A.G 1348/3 A for 30 seconds.
- Repeat check on the other injectors. To do this use new measuring beakers.
- After all injectors have been activated, place the measuring glasses on a horizontal surface and compare the injected quantity. Specified value: 128 to 140 ml per injector

If the measured value of one or more fuel injectors is below or above the indicated specified value:

- Replace the defective fuel injector.

2004 Volkswagen Phaeton

ENGINE 6.0 Liter 12-Cyl. 4V Engine Mechanical, Fuel Injection & Ignition, Engine Code(s): BRP, BAP

Perform installation of injectors in reverse order. When doing this note the following:

- Replace O-rings on all injectors and lightly moisten with clean engine oil.
- Insert fuel injectors into fuel rail perpendicular and in correct position, and secure them with retaining clips.
- Position fuel rail with secured fuel injectors on intake manifold and apply uniform pressure to press it in.

Fuel Pressure Regulator and Residual Pressure, Checking

Fuel Pressure Regulator and Residual Pressure, Checking

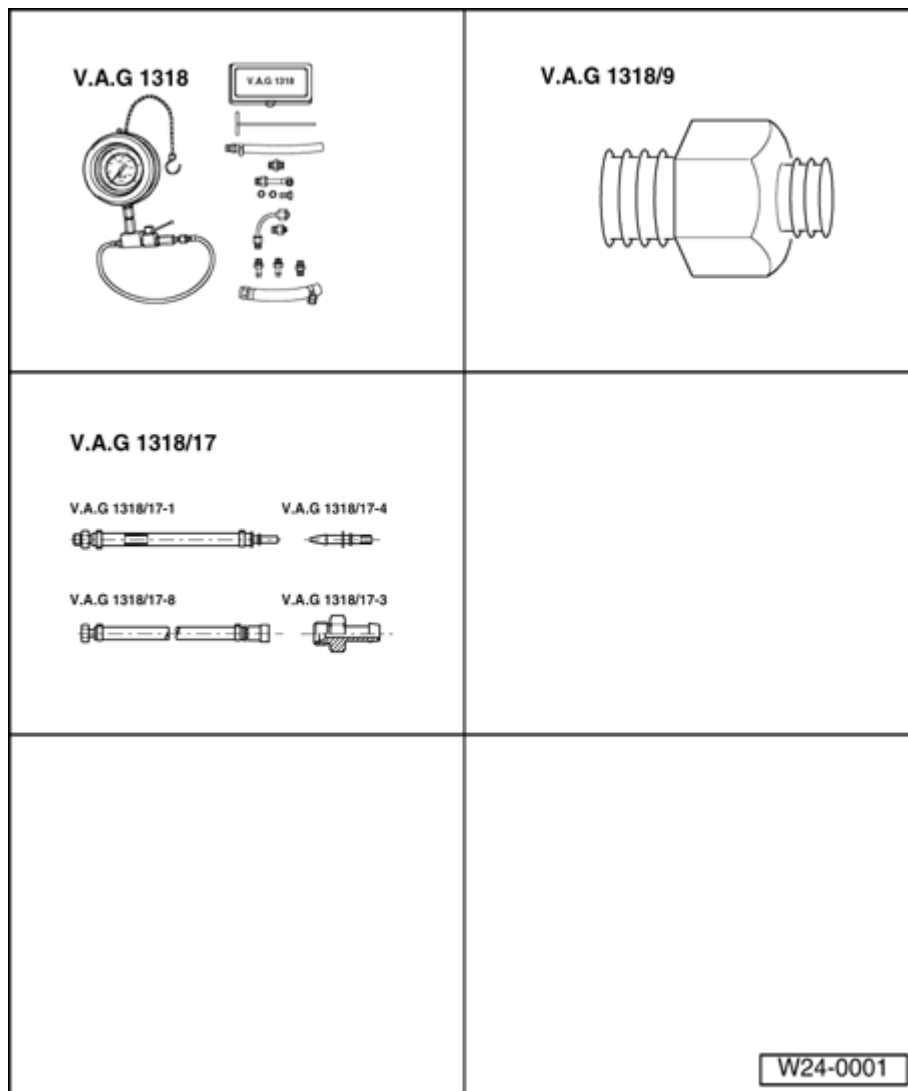


Fig. 344: Identifying Special Tools - Fuel Pressure Regulator And Residual Pressure, Checking
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools, testers and auxiliary items required

- Pressure gauge V.A.G 1318

- Adapter V.A.G 1318/9
- Pressure gauge adapter V.A.G 1318/17

NOTE:

- The fuel pressure regulator controls the fuel pressure and is dependent on intake manifold pressure.

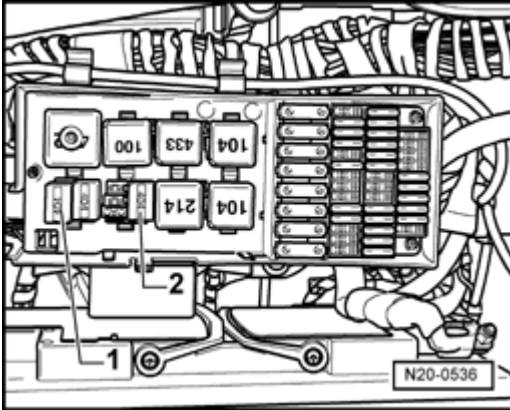
Test Sequence

Fig. 345: Fuel Pump Relays, Right And Left Side

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove Fuel Pump (FP) relays - 1 - and - 2 - from fuse holder of E-box in luggage compartment.

NOTE:

- Fuel pumps are activated when opening the door. For safety reasons, fuel pump relays - 1 - and - 2 - must be removed.
- Do not remove relay from relay plate with metal tools. The terminals could conduct electricity.

CAUTION: Fuel supply lines are under pressure! Wear protective goggles and protective gloves to avoid damage and contact with skin. Before removing from hose connection wrap a cloth around the connection. Then release pressure by carefully pulling hose off connection.

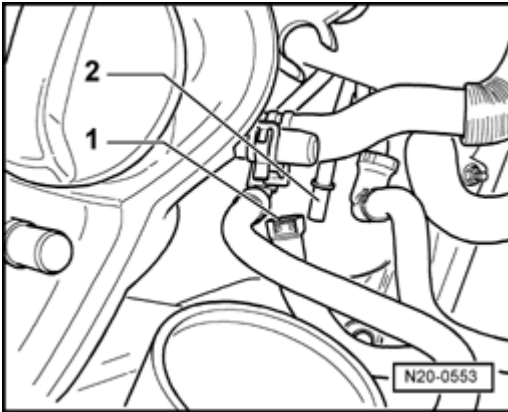


Fig. 346: Disconnecting Supply Hose From Supply Line
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect fuel supply line - 1 - and catch escaping fuel using a rag.

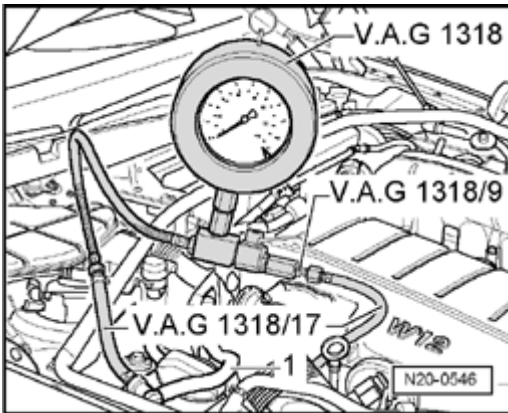


Fig. 347: Connecting Pressure Gauge V.A.G 1318 With Adapter V.A.G 1318/9 And Adapters V.A.G 1318/17 To Supply Line And To Hose For Fuel Distributor
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect pressure gauge V.A.G 1318 with adapter V.A.G 1318/9 and adapters V.A.G 1318/17 to supply line and to hose for fuel distributor.
- Open shut-off valve on pressure gauge V.A.G 1318. The lever points in direction of flow.
- Install relays to their positions in E-box in luggage compartment.
- Start the engine and run at idle speed.
- Measure fuel pressure. Specified value: approximately 3.5 bar positive pressure

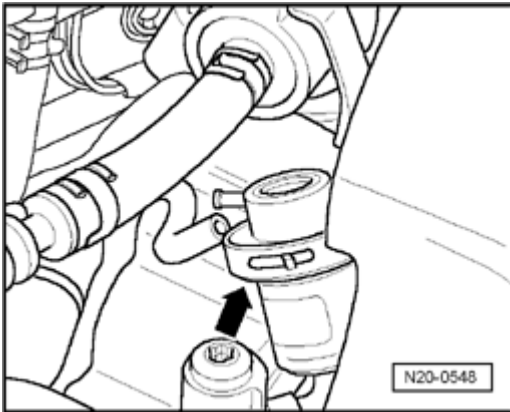


Fig. 348: Disconnecting Vacuum Hose From Fuel Pressure Regulator
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Pull the vacuum hose off from fuel pressure regulator - **arrow** -. Fuel pressure must increase to approximately 4.0 bar.

If the specification is not obtained:

- Check delivery quantity of Fuel Pumps (FP) --> **Delivery Quantity, Checking.**

If specified value is achieved:

- Switch off ignition.
- Check for leaks and residual pressure. Observe pressure drop on pressure gauge. After 10 minutes there must be a residual pressure of at least 3.0 bar.

If the holding pressure drops below 3 bar:

- Start the engine and run at idle speed.

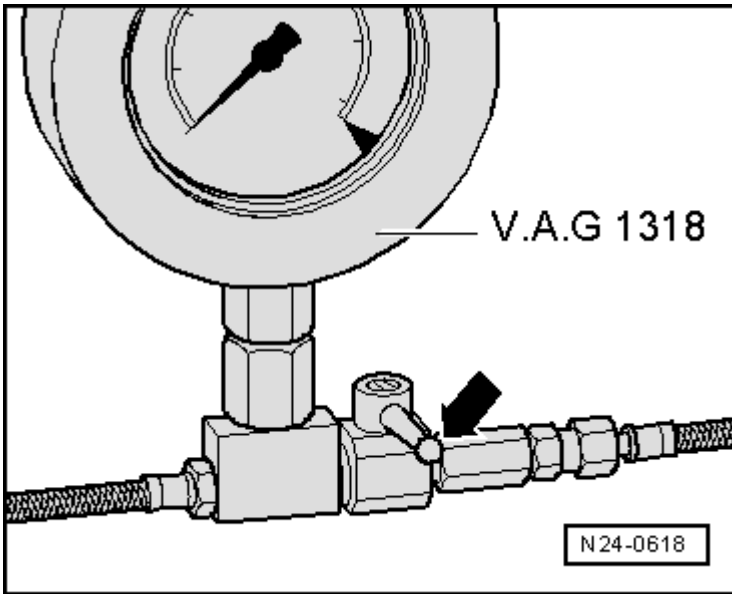


Fig. 349: Locating V.A.G 1318 Shut-Off Tap
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Wait until pressure has built up, then switch off ignition. Simultaneously close shut-off valve of pressure gauge V.A.G 1318 (lever perpendicular to direction of flow - **arrow** -).
- Watch pressure drop on gauge.

If the pressure drops again:

- Check line connections, O-rings on fuel rail and injectors for leaks.
- Check pressure gauge V.A.G 1318 for leaks.

If the pressure does not drop:

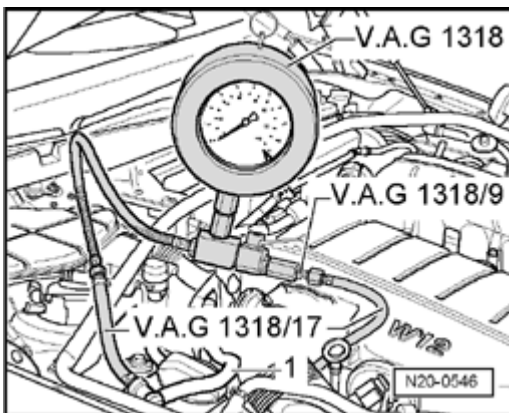


Fig. 350: Connecting Pressure Gauge V.A.G 1318 With Adapter V.A.G 1318/9 And Adapters V.A.G 1318/17 To Supply Line And To Hose For Fuel Distributor
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Open shut-off valve of pressure gauge V.A.G 1318 (lever in direction of flow).

2004 Volkswagen Phaeton

ENGINE 6.0 Liter 12-Cyl. 4V Engine Mechanical, Fuel Injection & Ignition, Engine Code(s): BRP, BAP

- Start the engine and run at idle speed.
- Wait until pressure has built up, then switch off ignition. Simultaneously pinch return hose tightly together.

If pressure drops:

- Test check valves of Fuel Pumps (FP) --> **Fuel Pumps, Checking.**

If the pressure does not drop:

- Replace the fuel pressure regulator

CAUTION: Fuel supply lines are under pressure! Wear protective goggles and protective gloves to avoid damage and contact with skin. Before removing from hose connection wrap a cloth around the connection. Then release pressure by carefully pulling hose off connection.

NOTE:

- Before pressure gauge V.A.G 1318 is removed, put cleaning rag around line connection and release fuel pressure by temporarily opening line.

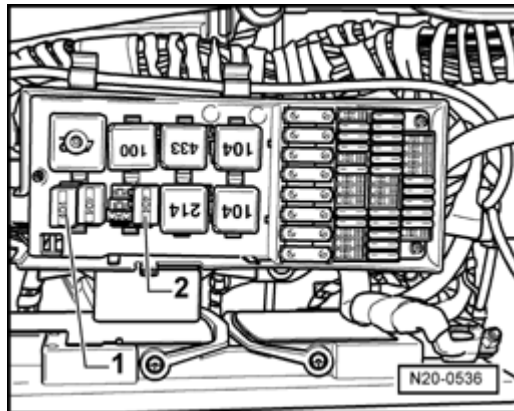


Fig. 351: Fuel Pump Relays, Right And Left Side
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- After removing pressure gauge V.A.G 1318 , install fuel pump relays - 1 - and - 2 - in fuse holder of E-box in luggage compartment again.

ENGINE CONTROL MODULE

Engine Control Module

Special tools, testers and auxiliary items required

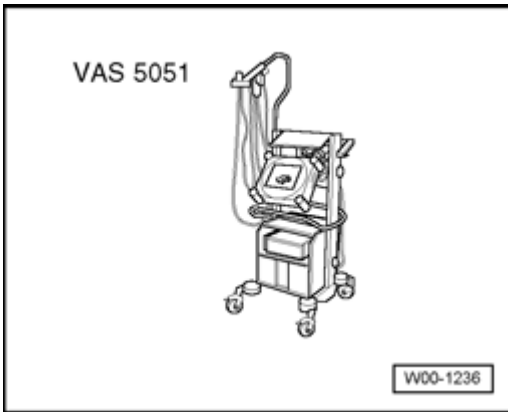


Fig. 352: VAS 5051 Vehicle Diagnosis, Testing and Information System
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Vehicle diagnostic, testing, and information system VAS 5051
- Diagnosis cable VAS 5051/1 or VAS 5051/3

If Engine Control Module (ECM) will be replaced, connect Vehicle Diagnosis, testing info. system VAS 5051B and perform Guided Function "Replace control module".

Removing

- Switch off ignition.
- Remove plenum chamber cover.
- Remove windshield wiper motor on the right side: --> **92 - WINDSHIELD WIPER AND WASHER SYSTEM**
- Remove transmission control module.
- Disengage connector from control module and disconnect it.
- Control module can now be removed.

Installing

- To install, connect connectors to control module and engage.
- Install windshield wiper motor on right side: --> **92 - WINDSHIELD WIPER AND WASHER SYSTEM**
- Install plenum chamber cover.

If Engine Control Module (ECM) was replaced:

- Adapt new Engine Control Module (ECM): Guided Functions

26 - EXHAUST SYSTEM, EMISSION CONTROLS

EXHAUST SYSTEM COMPONENTS

Exhaust System Components**Exhaust System Components**

--> **Exhaust Manifold with Primary Catalytic Converters and Bank 1 Attachments, Assembly Overview**

--> **Exhaust Manifold with Primary Catalytic Converters and Bank 2 Attachments, Assembly Overview**

--> **Primary Catalytic Converters with Exhaust Pipes, Aligning**

--> **Muffler with Mounts, Assembly Overview**

CAUTION: When doing any repair work, especially in the engine compartment, pay attention to the following due to clearance issues:

- Route lines of all types (e.g. for fuel, hydraulic, EVAP canister system, coolant and refrigerant, brake fluid, vacuum) and electrical wiring so that the original path is followed.
- Ensure sufficient clearance to all moving or hot components.

NOTE:

- After working on the exhaust system ensure that the system is not under stress, and that it has sufficient clearance from the bodywork. If necessary, loosen double clamps and clamp and align exhaust pipe so that sufficient clearance is maintained to the bodywork and support rings carry uniform loads, align exhaust system if necessary --> **Aligning Exhaust System**
- Replace self-locking nuts.
- Do not use sealants containing silicone. Traces of silicone components which are sucked into the engine are not burned there, and they damage the oxygen sensors.
- Cylinder bank 1 (bank 1) is located on right side in direction of travel.
- Cylinder bank 2 (bank 2) is located on left side in direction of travel.
- Allocation of exhaust banks and cylinders at engine --> **Allocation of Exhaust Banks and Cylinders at Engine**

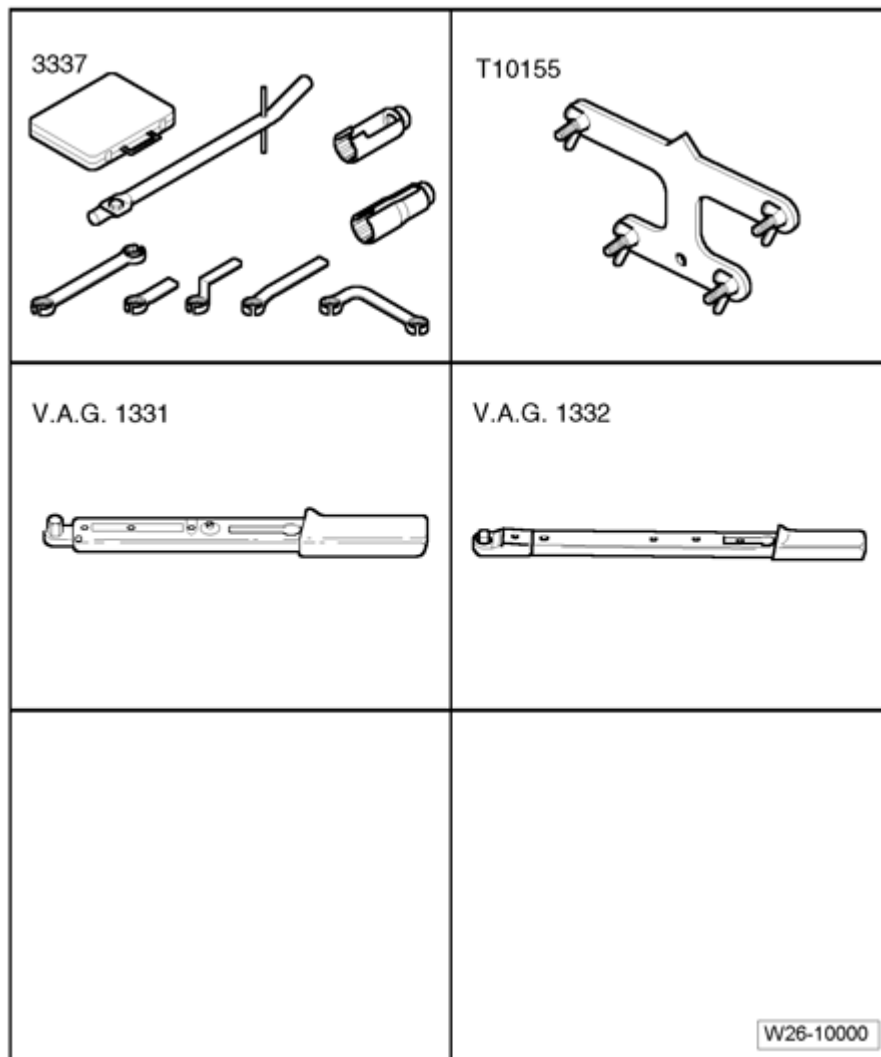


Fig. 353: Identifying Special Tools - Exhaust System Components
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools, testers and auxiliary items required

- Ring spanner 7-piece set for oxygen sensor 3337
- Template T10155
- Torque wrench (5 to 50 Nm) V.A.G 1331
- Torque wrench (40 to 200 Nm) V.A.G 1332

Exhaust Manifold with Primary Catalytic Converters and Bank 1 Attachments, Assembly Overview

Exhaust Manifold with Primary Catalytic Converters and Bank 1 Attachments, Assembly Overview

NOTE:

- **Cylinder bank 1 (bank 1) is located on right side in direction of travel.**
- **Cylinder bank 2 (bank 2) is located on left side in direction of travel.**

- Allocation of exhaust banks and cylinders at engine --> Allocation of Exhaust Banks and Cylinders at Engine

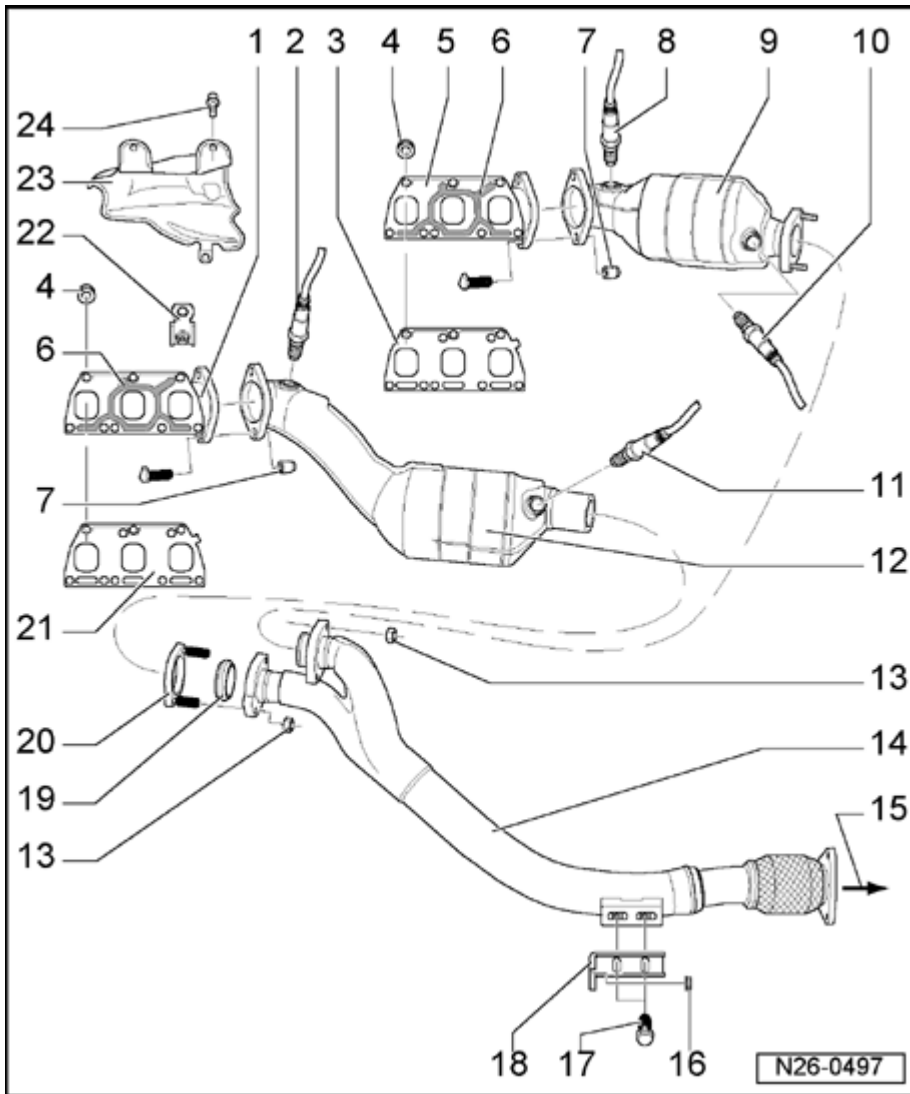


Fig. 354: Exhaust Manifold With Primary Catalytic Converters And Bank 1 Attachments, Assembly Overview

Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Exhaust manifold

- For exhaust bank 1 of cylinders 1, 2 and 3
- Can only be removed with engine removed --> Engine, Removing and Installing.

2 - Heated oxygen sensor G39 , 50 Nm

- Installed in exhaust gas stream of cylinders 1 to 3
- Removing and installing --> Oxygen Sensors.

- Black connector
- Component location of harness connectors --> **Component Location of Oxygen Sensors Harness Connectors for Bank 1**
- Grease thread only using **G 052 112 A3** ; do not let **G 052 112 A3** get onto slits of oxygen sensor body

3 - Gasket

- Replace

4 - 25 Nm

- Replace
- Coat thread with **G 052 112 A3**

5 - Exhaust manifold

- For exhaust bank 2 of cylinders 4, 5 and 6
- Can only be removed with engine removed --> **Engine, Removing and Installing.**

6 - Secondary air channels**7 - 25 Nm**

- Replace
- Coat thread with **G 052 112 A3**

8 - Heated Oxygen Sensor (HO2S) 2 G108 , 50 Nm

- Installed in exhaust gas stream of cylinders 4 to 6
- Removing and installing --> **Oxygen Sensors.**
- Green connector
- Component location of harness connectors --> **Component Location of Oxygen Sensors Harness Connectors for Bank 1**
- Grease thread only using **G 052 112 A3** ; do not let **G 052 112 A3** get onto slits of oxygen sensor body

9 - Primary catalytic converter

- For exhaust bank 2 of cylinders 4, 5 and 6
- Can only be removed with engine removed --> **Engine, Removing and Installing.**
- Aligning primary catalytic converters with exhaust pipes --> **Primary Catalytic Converters with Exhaust Pipes, Aligning.**

10 - Oxygen Sensor (O2S) 2 behind Three Way Catalytic Converter (TWC) G131 , 50 Nm

- Installed in exhaust gas stream of cylinders 4 to 6
- Removing and installing --> **Oxygen Sensors**.
- Green connector
- Component location of harness connectors --> **Component Location of Oxygen Sensors Harness Connectors for Bank 1**
- Grease thread only using **G 052 112 A3** ; do not let **G 052 112 A3** get onto slits of oxygen sensor body

11 - Oxygen sensor behind three way catalytic converter G130 , 50 Nm

- Installed in exhaust gas stream of cylinders 1 to 3
- Can only be replaced with the engine removed. Otherwise it is not possible to tighten using a torque wrench.
- Black connector
- Component location of harness connectors --> **Component Location of Oxygen Sensors Harness Connectors for Bank 1**
- Grease thread only using **G 052 112 A3** ; do not let **G 052 112 A3** get onto slits of oxygen sensor body

12 - Primary catalytic converter

- For exhaust bank 1 of cylinders 1, 2 and 3
- Can only be removed with engine removed --> **Engine, Removing and Installing**.
- Aligning primary catalytic converters with exhaust pipes --> **Primary Catalytic Converters with Exhaust Pipes, Aligning**.

13 - 25 Nm

- Replace
- Coat thread with **G 052 112 A3**

14 - Right front exhaust pipe

- Aligning primary catalytic converters with exhaust pipes --> **Primary Catalytic Converters with Exhaust Pipes, Aligning**.

15 - To catalytic converter with front muffler

- --> **Muffler with Mounts, Assembly Overview**.

16 - 25 Nm

- Replace
- Coat thread with **G 052 112 A3**

17 - 25 Nm

- Replace
- Coat thread with **G 052 112 A3**

18 - Bracket

19 - Seal

- Replace

20 - Sealing flange

21 - Gasket

- Replace

22 - Bracket

23 - Upper heat shield

24 - 10 Nm

Component Location of Oxygen Sensors Harness Connectors for Bank 1

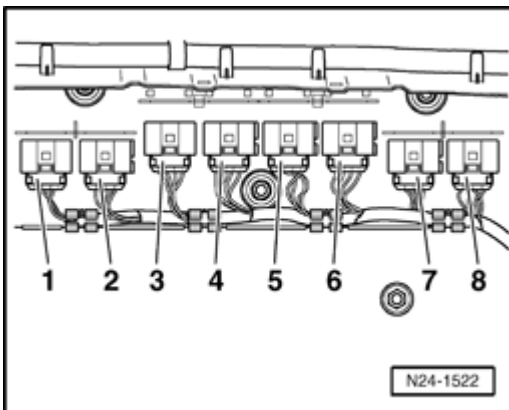


Fig. 355: Component Location Of Oxygen Sensors Harness Connectors For Bank 1
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - 6-pin harness connector, black: For Heated Oxygen Sensor (HO2S) G39

2 - 6-pin harness connector, green: For Heated Oxygen Sensor (HO2S) 2 G108

3 - 4-pin harness connector, black: For Oxygen Sensor (O2S) Behind Three Way Catalytic Converter (TWC) G130

4 - 4-pin harness connector, green: For Oxygen Sensor (O2S) 2 Behind Three Way Catalytic Converter (TWC)

G131

Exhaust Manifold with Primary Catalytic Converters and Bank 2 Attachments, Assembly Overview

Exhaust Manifold with Primary Catalytic Converters and Bank 2 Attachments, Assembly Overview

NOTE:

- Cylinder bank 1 (bank 1) is located on right side in direction of travel.
- Cylinder bank 2 (bank 2) is located on left side in direction of travel.
- Allocation of exhaust banks and cylinders at engine --> Allocation of Exhaust Banks and Cylinders at Engine

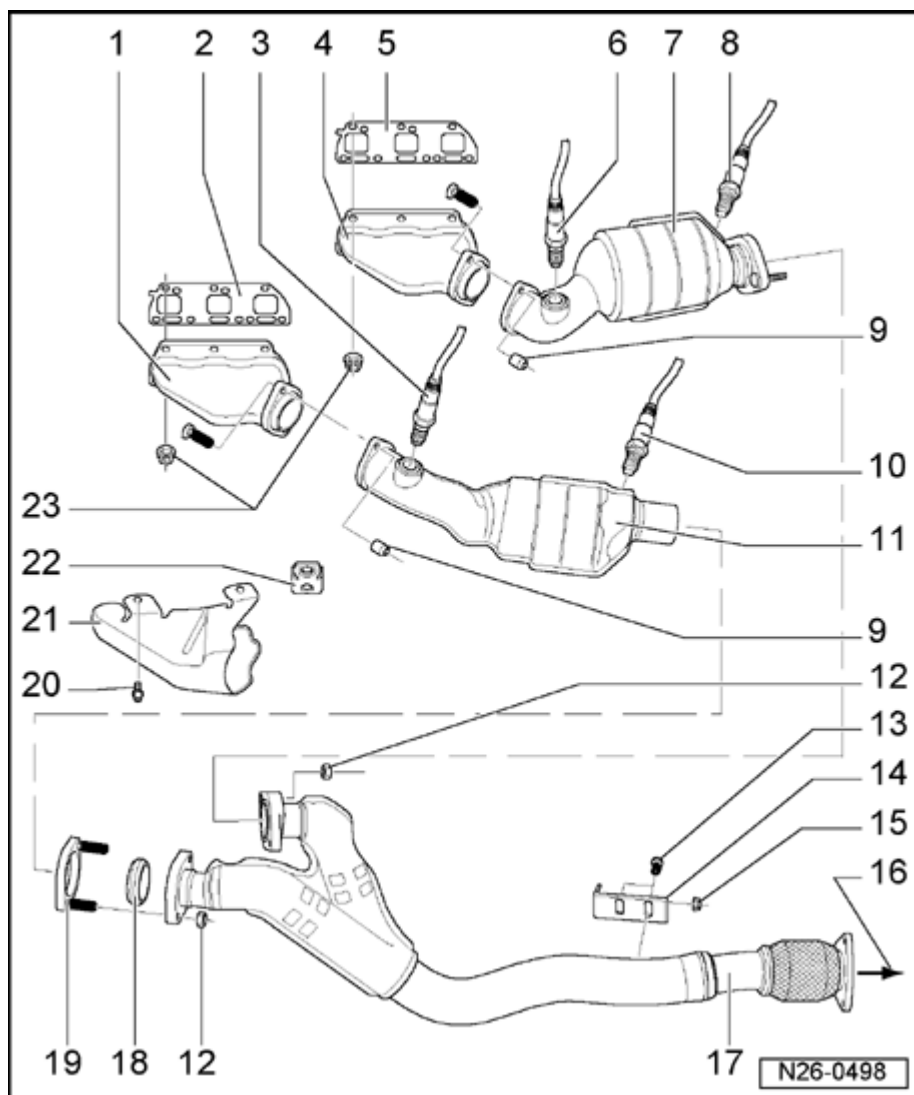


Fig. 356: Exhaust Manifold With Primary Catalytic Converters And Bank 2 Attachments, Assembly Overview

Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Exhaust manifold

- For exhaust bank 3 of cylinders 7, 8 and 9
- Can only be removed with engine removed --> **Engine, Removing and Installing.**

2 - Gasket

- Replace

3 - Heated Oxygen Sensor (HO2S) 3 G285 , 50 Nm

- Installed in exhaust gas stream of cylinders 7 to 9
- Removing and installing --> **Oxygen Sensors.**
- Brown connector
- Component location of harness connectors --> **Component Location of Oxygen Sensors Harness Connectors for Bank 2**
- Grease thread only using **G 052 112 A3** ; do not let **G 052 112 A3** get onto slits of oxygen sensor body

4 - Exhaust manifold

- For exhaust bank 4 of cylinders 10, 11 and 12
- Can only be removed with engine removed --> **Engine, Removing and Installing.**

5 - Gasket

- Replace

6 - Heated Oxygen Sensor (HO2S) 4 G286 , 50 Nm

- Installed in exhaust gas stream of cylinders 10 to 12
- Removing and installing --> **Oxygen Sensors.**
- Gray connector
- Component location of harness connectors --> **Component Location of Oxygen Sensors Harness Connectors for Bank 2**
- Grease thread only using **G 052 112 A3** ; do not let **G 052 112 A3** get onto slits of oxygen sensor body

7 - Primary catalytic converter

- For exhaust bank 4 of cylinders 10, 11 and 12
- Can only be removed with engine removed --> **Engine, Removing and Installing.**
- Aligning primary catalytic converters with exhaust pipes --> **Primary Catalytic Converters with Exhaust Pipes, Aligning.**

8 - Oxygen Sensor (O2S) 4 behind Three Way Catalytic Converter (TWC) G288 , 50 Nm

- Installed in exhaust gas stream of cylinders 10 to 12
- Removing and installing --> **Oxygen Sensors.**
- Gray connector
- Component location of harness connectors --> **Component Location of Oxygen Sensors Harness Connectors for Bank 2**
- Grease thread only using **G 052 112 A3** ; do not let **G 052 112 A3** get onto slits of oxygen sensor body

9 - 25 Nm

- Replace
- Coat thread with **G 052 112 A3**

10 - Oxygen Sensor (O2S) 3 behind Three Way Catalytic Converter (TWC) G287 , 50 Nm

- Installed in exhaust gas stream of cylinders 7 to 9
- Removing and installing --> **Oxygen Sensors.**
- Brown connector
- Component location of harness connectors --> **Component Location of Oxygen Sensors Harness Connectors for Bank 2**
- Grease thread only using **G 052 112 A3** ; do not let **G 052 112 A3** get onto slits of oxygen sensor body

11 - Primary catalytic converter

- For exhaust bank 3 of cylinders 7, 8 and 9
- Can only be removed with engine removed --> **Engine, Removing and Installing.**
- Aligning primary catalytic converters with exhaust pipes --> **Primary Catalytic Converters with Exhaust Pipes, Aligning.**

12 - 25 Nm

- Replace
- Coat thread with **G 052 112 A3**

13 - 25 Nm

- Replace
- Coat thread with **G 052 112 A3**

14 - Bracket

15 - 25 Nm

- Replace
- Coat thread with **G 052 112 A3**

16 - To catalytic converter with front muffler

- --> **Muffler with Mounts, Assembly Overview.**

17 - Left front exhaust pipe

- Aligning primary catalytic converters with exhaust pipes --> **Primary Catalytic Converters with Exhaust Pipes, Aligning.**

18 - Seal

- Replace

19 - Sealing flange

20 - 10 Nm

21 - Upper heat shield

22 - Bracket

23 - 25 Nm

- Replace
- Coat thread with **G 052 112 A3**

Component Location of Oxygen Sensors Harness Connectors for Bank 2

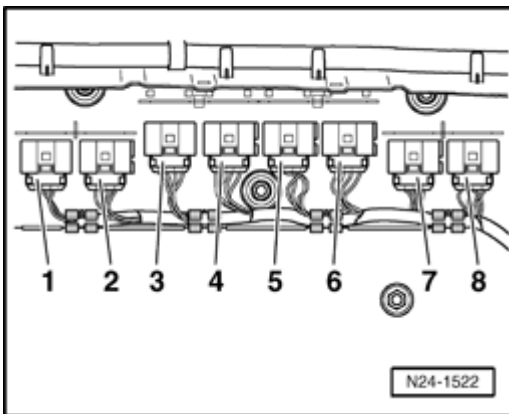


Fig. 357: Component Location Of Oxygen Sensors Harness Connectors For Bank 2
Courtesy of VOLKSWAGEN UNITED STATES, INC.

5 - 4-pin harness connector, gray: For Oxygen Sensor (O2S) 4 Behind Three Way Catalytic Converter (TWC)

G288

6 - 4-pin harness connector, brown: For Oxygen Sensor (O2S) 3 Behind Three Way Catalytic Converter (TWC)
G287

7 - 6-pin harness connector, gray: For Heated Oxygen Sensor (HO2S) 4 G286

8 - 6-pin harness connector, brown: For Heated Oxygen Sensor (HO2S) 3 G285

Primary Catalytic Converters with Exhaust Pipes, Aligning

Primary Catalytic Converters with Exhaust Pipes, Aligning

Special tools, testers and auxiliary items required

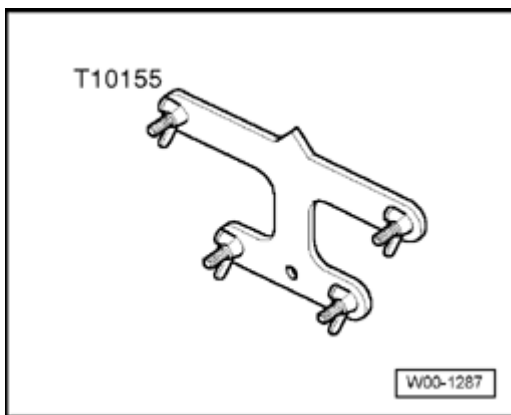


Fig. 358: Template T10155

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Template T10155

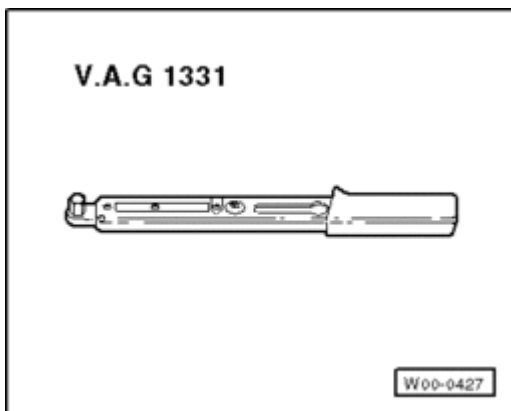


Fig. 359: Torque Wrench V.A.G 1331

Courtesy of VOLKSWAGEN UNITED STATES, INC.

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

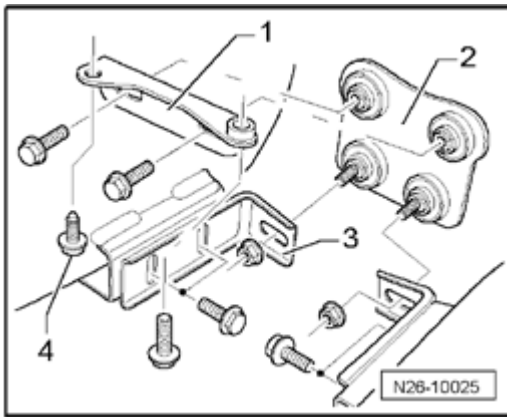


Fig. 360: Identifying Bracket, Base Plate, Angle Bracket & Tapered Bushings
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Install bracket - 1 - on transmission.
- Place base plate - 2 - with tapered bushings on bracket - 1 - and lightly counter hold mounting bolts.
- Then, tighten angle bracket - 3 - onto exhaust pipes and base plate by lightly counter holding.

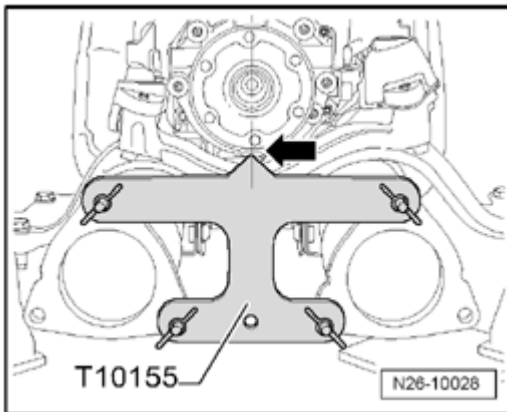


Fig. 361: Bolting Template T10155 Onto Exhaust Pipes
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Bolt template T10155 onto exhaust pipes as shown and align exhaust pipes to center axis of transmission - **arrow** -.
- Tighten exhaust system when primary catalytic converters and exhaust pipes have sufficient clearance on both sides of transmission.

Muffler with Mounts, Assembly Overview

Muffler with Mounts, Assembly Overview

NOTE:

- **Cylinder bank 1 (bank 1) is located on right side in direction of travel.**
- **Cylinder bank 2 (bank 2) is located on left side in direction of travel.**
- **Allocation of exhaust banks and cylinders at engine --> Allocation of**

Exhaust Banks and Cylinders at Engine

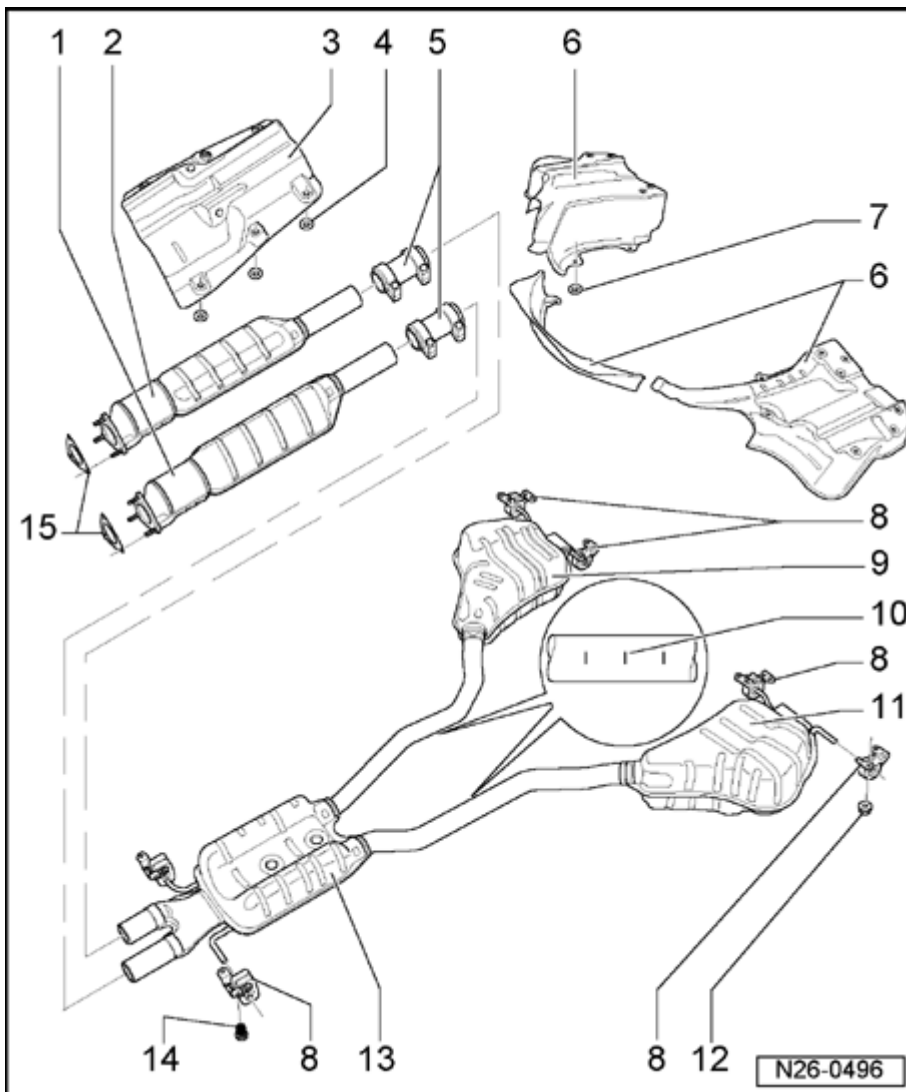


Fig. 362: Muffler With Mounts, Assembly Overview
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- 1 - Catalytic converter with front muffler, bank 2
- 2 - Catalytic converter with front muffler, bank 1
- 3 - Heat shield
- 4 - Plate nut
- 5 - Double clamp

- Installed location --> **Installation Position of Double Clamps**

6 - Heat shield

7 - Plate nut

8 - Suspended mount

- Replace if damaged
- Aligning exhaust system --> **Aligning Exhaust System**

9 - Right rear muffler

- Installed location --> **Installation Position of Rear Mufflers**

10 - Separating point

- As standard, center and rear mufflers are installed as a single component. In cases of repair, the center and rear muffler are supplied individually and with a double clamp for connecting.
- Cut connecting pipe at right angle at separating point using e.g. body saw V.A.G 1523.
- Notches left and right of separating point must still be visible after installing double clamps.
- Installation position of double clamps --> **Installation Position of Double Clamps in Direction of Travel**

11 - Left rear muffler

- Installed location --> **Installation Position of Rear Mufflers**

12 - 25 Nm

13 - Center muffler

14 - 25 Nm

15 - Gasket

- Replace

Aligning Exhaust System

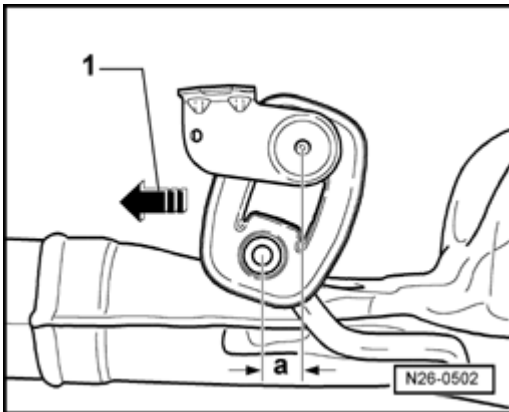


Fig. 363: Aligning Exhaust System

Courtesy of VOLKSWAGEN UNITED STATES, INC.

Requirement

- Exhaust system, cold
- Press exhaust system in direction of travel - **1** - and tighten double clamps tightly until dimension - **a** - at suspensions is reached.
- Center muffler: Dimension - **a** - = 10 mm
- Rear muffler Dimension - **a** - = 15 mm

Installation Position of Double Clamps

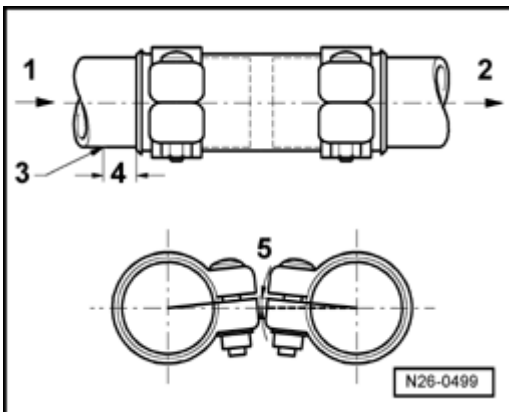


Fig. 364: Installation Position Of Double Clamps

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- 1 - From main catalytic converter
- 2 - To middle muffler
- 3 - Marking 3x on perimeter

4 - Dimension = 5 mm

5 - Angle 5

Installation Position of Double Clamps in Direction of Travel

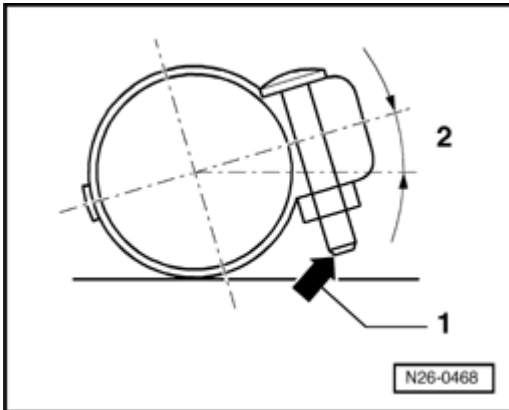


Fig. 365: Installation Position Of Double Clamps In Direction Of Travel
Courtesy of VOLKSWAGEN UNITED STATES, INC.

2 - Angle 10 + 5

1 - Screw tips must not project beyond the lower edge of the clamp

Installation Position of Rear Mufflers

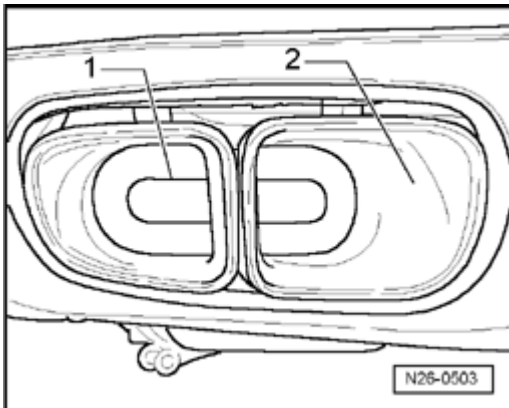


Fig. 366: Installation Position Of Rear Mufflers
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Rear mufflers - 1 - must be aligned centrally in panel - 2 -.

SECONDARY AIR INJECTION SYSTEM

Secondary Air Injection System

--> **Secondary Air Injection System, Diagnosing**

--> **Secondary Air Injection System, Body Side, Assembly Overview**

--> **Secondary Air Injection System, Engine Side, Assembly Overview**

--> **Combination Valves, Engine Code BAP, Checking**

Cylinder bank 1 (bank 1) is located on right side in direction of travel.

Cylinder bank 2 (bank 2) is located on left side in direction of travel.

Allocation of exhaust banks and cylinders at engine --> **Allocation of Exhaust Banks and Cylinders at Engine**

CAUTION: When doing any repair work, especially in the engine compartment, pay attention to the following due to clearance issues:

- **Route lines of all types (e.g. for fuel, hydraulic, EVAP canister system, coolant and refrigerant, brake fluid, vacuum) and electrical wiring so that the original path is followed.**
- **Ensure sufficient clearance to all moving or hot components.**

Secondary Air Injection System, Diagnosing

Secondary Air Injection System, Diagnosing

With Engine Code BAP:

After cold start (+5 C to +33 C coolant temperature), air is blown behind exhaust valve by Secondary Air Injection (AIR) system for max. 100 seconds. This produces an oxygen rich exhaust gas, causes after burning and reduces the heating-up phase of the catalytic converter. Activation is triggered by the Engine Control Module (ECM) and sent via the Secondary Air Injection (AIR) Pump Relay to the Secondary Air Injection (AIR) Solenoid Valve (change-over valve) and the combination valve. Additionally after each subsequent engine start (up to max. 96 C engine temperature), secondary air system will switch on for 10 seconds at idle and will be checked by On Board Diagnostics. The Lambda regulation must then be active.

With Engine Code BRP:

During cold start (+15 C to +35 C coolant temperature), air is blown behind exhaust valve by Secondary Air Injection (AIR) system for 65 seconds. This produces an oxygen rich exhaust gas, causes after burning and reduces the heating-up phase of the catalytic converter. Activation is triggered by the Engine Control Module (ECM) via Secondary Air Injection (AIR) Pump Relay J299 to the combination valve. Combination valve opens automatically. In addition, the Secondary Air Injection (AIR) system is switched on with a delay of approximately 20 seconds during idle for 5 seconds after every subsequent engine start (up to max. 80 C engine temperature) and is checked via On Board Diagnostic (OBD).

Secondary Air Injection System, Body Side, Assembly Overview

NOTE:

- **Cylinder bank 1 (bank 1) is located on right side in direction of travel.**
- **Cylinder bank 2 (bank 2) is located on left side in direction of travel.**
- **Allocation of exhaust banks and cylinders at engine --> Allocation of Exhaust Banks and Cylinders at Engine**

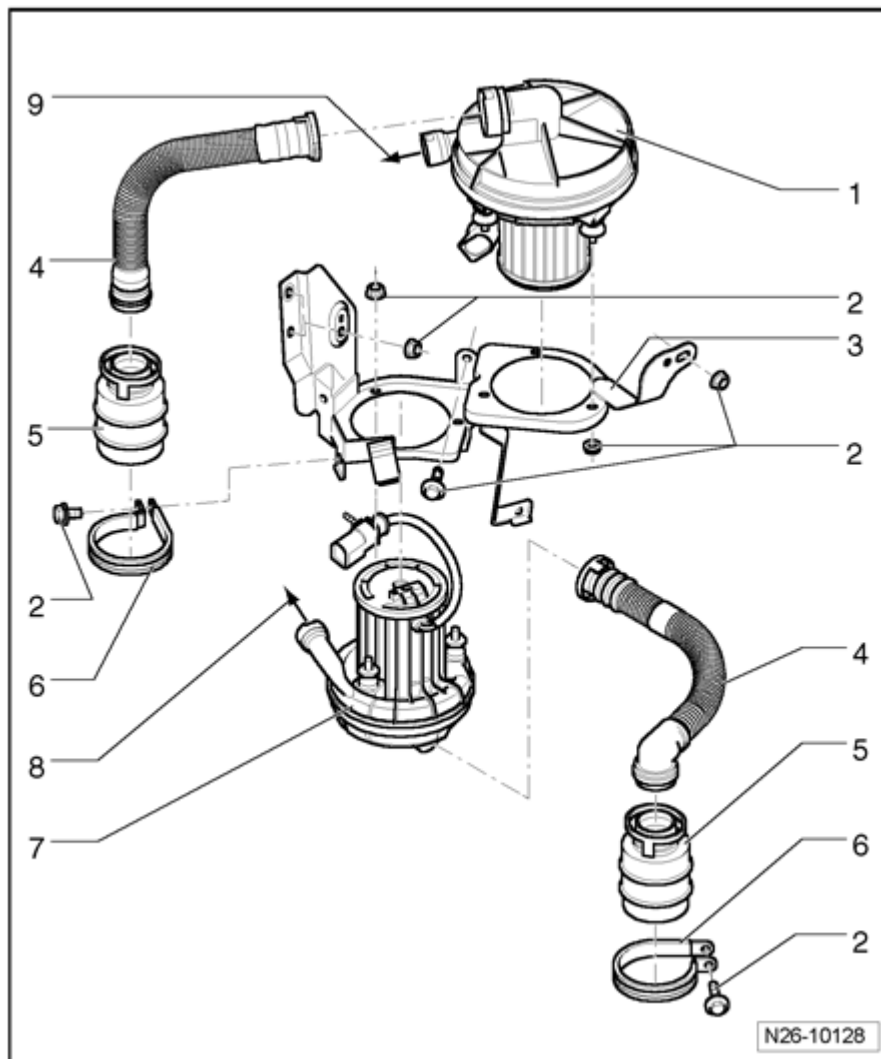


Fig. 367: Secondary Air Injection System, Body Side, Assembly Overview
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Secondary Air Injection (AIR) pump motor 1 V101

- For cylinder bank 1

2 - 10 Nm

3 - Bracket

- For motor for secondary air injection (AIR) pump 1 and 2
- On left longitudinal member

4 - Intake tube

- Ensure seated tightly
- Press together at front to release

5 - Air filter housing

- Clean if soiled

6 - Securing clamp**7 - Secondary Air Injection (AIR) pump motor 2 V189**

- For cylinder bank 2

8 - To pressure hose of cylinder bank 2**9 - To pressure hose of cylinder bank 1****Secondary Air Injection System, Engine Side, Assembly Overview****Secondary Air Injection System, Engine Side, Assembly Overview****NOTE:**

- **Cylinder bank 1 (bank 1) is located on right side in direction of travel.**
- **Cylinder bank 2 (bank 2) is located on left side in direction of travel.**
- **Allocation of exhaust banks and cylinders at engine --> Allocation of Exhaust Banks and Cylinders at Engine**

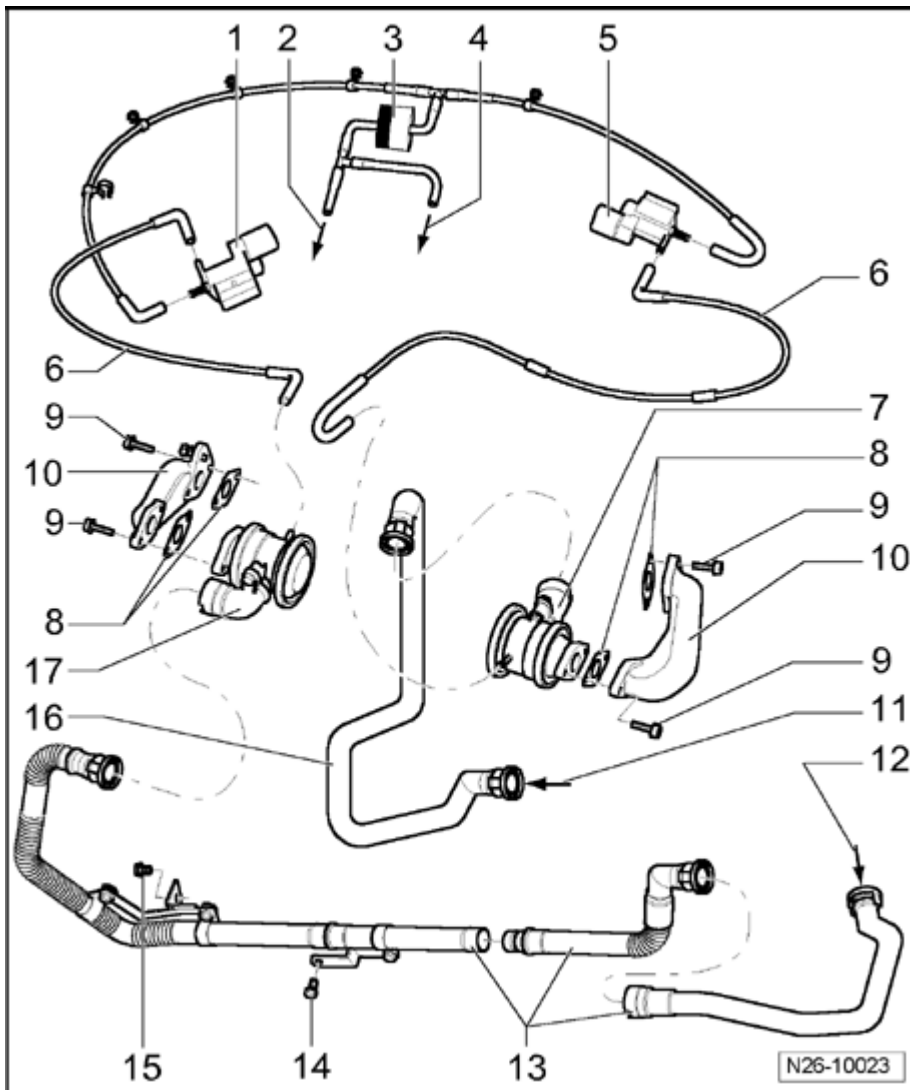


Fig. 368: Secondary Air Injection System, Engine Side, Assembly Overview
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Secondary Air Injection (AIR) solenoid valve 1 N112

- For cylinder bank 1
- Secured to cylinder head cover bank 1
- Only vehicles with engine code BAP

2 - To fuel pressure regulator

- Only vehicles with engine code BAP

3 - Non-return valve

- Note installation position

- White connection faces secondary air injection solenoid valves
- Only vehicles with engine code BAP

4 - To vacuum connection at intake manifold

- Only vehicles with engine code BAP

5 - Secondary Air Injection (AIR) solenoid valve 2 N320

- For cylinder bank 2
- Secured to cylinder head cover bank 2
- Only vehicles with engine code BAP

6 - Vacuum line

- Ensure seated tightly
- Only vehicles with engine code BAP

7 - Left combination valve

- For cylinder bank 2
- Checking --> **Combination Valves, Engine Code BAP, Checking.**
- Opens automatically on vehicles with engine code BRP

8 - Gasket

- Replace

9 - 8 Nm

10 - Connection

11 - From Secondary Air Injection (AIR) pump motor 2 V189

- For cylinder bank 2

12 - From Secondary Air Injection (AIR) pump motor 1 V101

- For cylinder bank 1

13 - Pressure hose

- Ensure seated tightly
- Press together at front to release
- For cylinder bank 1

- Built as one-piece connecting pipe on vehicles with engine code BRP

14 - 10 Nm

15 - 25 Nm

16 - Pressure hose

- Ensure seated tightly
- Press together at front to release
- For cylinder bank 2

17 - Right combination valve

- For cylinder bank 1
- Checking --> **Combination Valves, Engine Code BAP, Checking.**
- Opens automatically on vehicles with engine code BRP

Combination Valves, Engine Code BAP, Checking

Combination Valves, Engine Code BAP, Checking

Special tools, testers and auxiliary items required

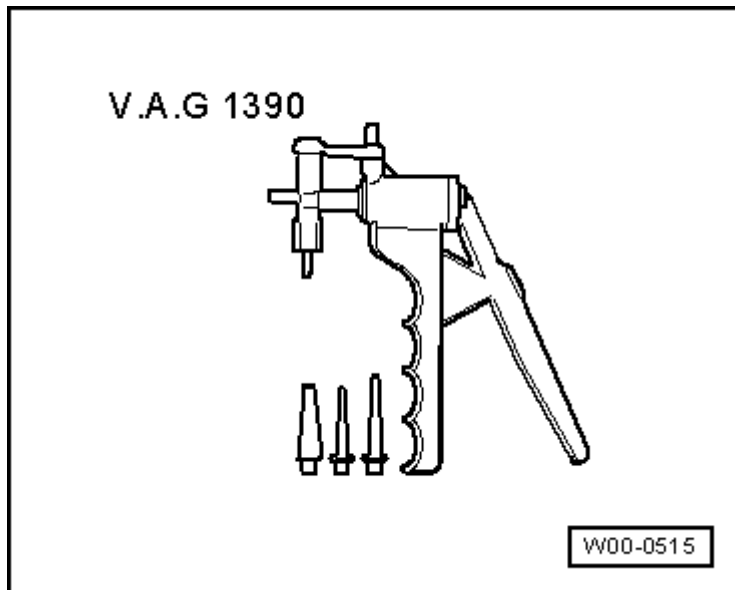


Fig. 369: Hand Vacuum Pump V.A.G 1390
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Hand vacuum pump V.A.G 1390
- Assisting hose

Test Conditions

- Vacuum lines and hose connections free of leaks.
- Vacuum lines not clogged or kinked.
- Pressure hoses and pressure lines between combination valves not clogged, kinked or damaged.
- Ignition is switched off.

Test Sequence

- Remove front bumper: --> **63 BUMPERS**
- Disconnect the corresponding vacuum line of combination valve to be checked.
- Connect hand vacuum pump V.A.G 1390 to corresponding vacuum connection.
- Disconnect the corresponding pressure hose from combination valve to be checked on Secondary Air Injection (AIR) pump motor.

NOTE:

- **To disengage, compress buttons at hose couplings.**
- **Do not use pressurized air for the following test.**

- Blow with light pressure into pressure hose. (if necessary use assisting hose). Both combination valves must be closed.
- Operate hand vacuum pump V.A.G 1390. The respective combination valve must open.

If combination valve does not open or it is constantly open:

- Replace the respective combination valve.

28 - IGNITION/GLOW PLUG SYSTEM**IGNITION, SERVICING****Ignition, Servicing**

--> **Safety Precautions**

--> **Spark Plugs, Technical Data**

--> **Ignition, Assembly Overview**

--> **Ignition Coils with Power Output Stages, Removing and Installing**

Ignition System, General Information

- For trouble-free operation of the electrical components a voltage of at least 11.5 V is necessary.
- During some checks it is possible that the control module will detect and store a malfunction. Therefore

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after completing all checks and repairs the DTC memory must be checked and if necessary erased.

Safety Precautions

Safety Precautions

To reduce the risk of personal injury and/or damage to the fuel injection and ignition system, always observe the following:

- The ignition must be switched off before connecting or disconnecting injection and ignition system wiring or tester cables.

If special testing equipment is required during road test, note the following:

- Test and measuring instruments must be secured to rear seat and operated by a 2nd person from this location.

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

Spark Plugs, Technical Data

Spark Plugs, Technical Data

Engine code		BAP, BRP
Ignition sequence		1-12-5-8-3-10-6-7-2-11-4-9
Spark plugs		
	VW/Audi	101,905,600 A
	Manufacturers designation	PZFR 6 J-11
	Electrode gap	1.1 mm
	Tightening specifications	30 Nm

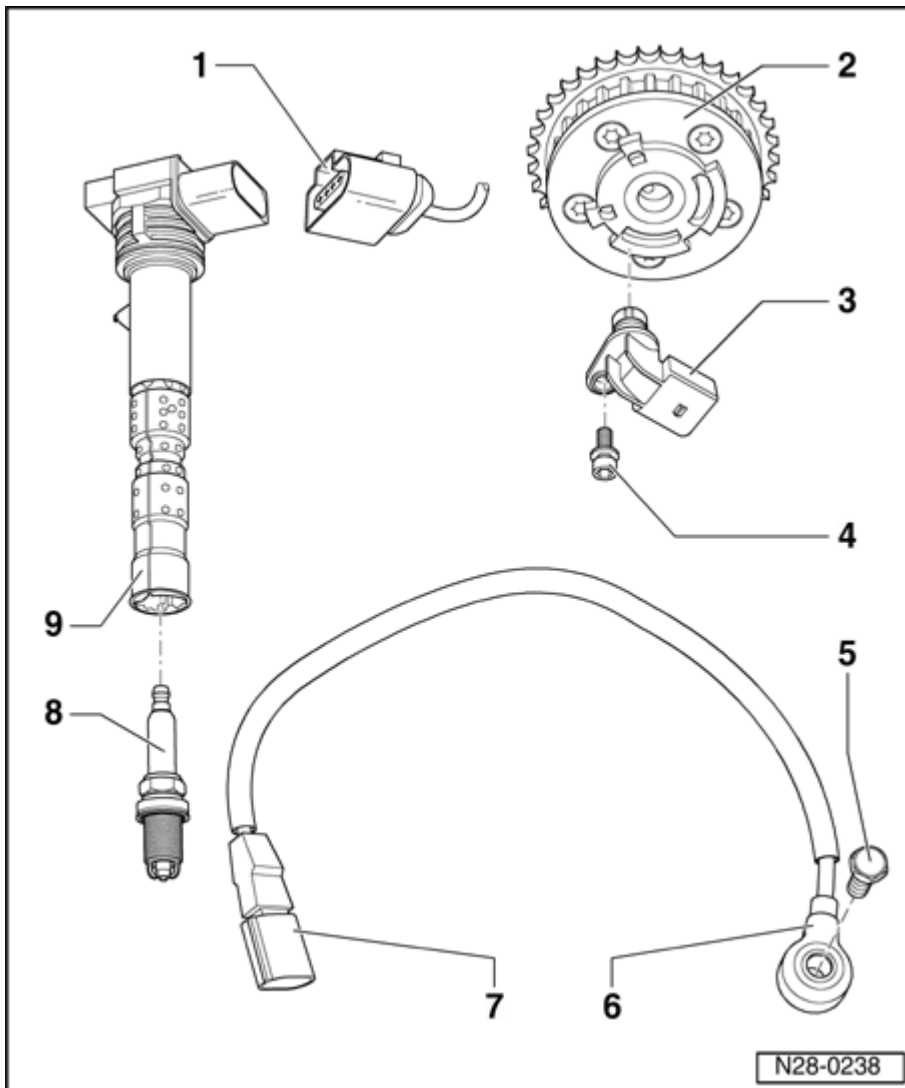
* Use Spark plug removal tool 3122 B to remove or install spark plugs

Ignition, Assembly Overview

Ignition, Assembly Overview

NOTE:

- **Cylinder bank 1 (bank 1) is located on right side in direction of travel.**
- **Cylinder bank 2 (bank 2) is located on left side in direction of travel.**
- **Allocation of exhaust banks and cylinders at engine --> Allocation of Exhaust Banks and Cylinders at Engine**

**Fig. 370: Ignition, Assembly Overview**

Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Connector

- Black, 4-pin

2 - Hood

- For Camshaft Position (CMP) Sensor

3 - Camshaft Position (CMP) sensor

- Camshaft Position (CMP) Sensor G40 = bank 1 intake camshaft
- Camshaft Position (CMP) Sensor 3 G300 = bank 1 exhaust camshaft
- Camshaft Position (CMP) Sensor 2 G163 = bank 2 intake camshaft

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ENGINE 6.0 Liter 12-Cyl. 4V Engine Mechanical, Fuel Injection & Ignition, Engine Code(s): BRP, BAP

- Camshaft Position (CMP) Sensor 4 G301 = bank 2 exhaust camshaft
- Before disconnecting, mark allocation of connector to component

4 - 10 Nm

5 - 20 Nm

- Tightening specifications affect function of Knock Sensor (KS)

6 - Knock sensors

- Component location: Knock Sensor (KS) 1 G61 and Knock Sensor 2 G66 on cylinder bank 1 --> **Knock Sensors 1 and 2 for Bank 1**
- Component location: Knock Sensor 3 G198 and Knock Sensor 4 G199 on cylinder bank 2 --> **Knock Sensors 3 and 4 for Bank 2**

7 - 3-pin connector

- Contacts gold plated
- Light gray for Knock Sensor (KS) 1 G61
- Gray for Knock Sensor (KS) 2 G66
- Orange for Knock Sensor 3 G198
- Black for Knock Sensor 4 G199

8 - Spark plug, 30 Nm

- Removing and installing with spark plug removal tool 3122 B
- Type and spark plug gap --> **Spark Plugs, Technical Data.**

9 - Ignition coil with power output stage

- Cylinder bank 1, ignition coil with power output stage 1 to 6: N70, N127, N291, N292, N323, N324
- Cylinder bank 2, ignition coil with power output stage 7 to 12: N325, N326, N327, N328, N329, N330
- Removing and installing --> **Ignition Coils with Power Output Stages, Removing and Installing.**

Knock Sensors 1 and 2 for Bank 1

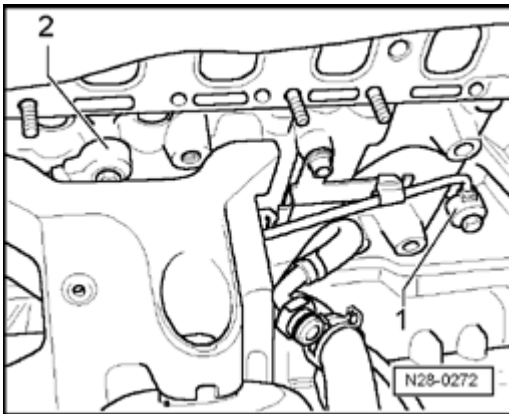


Fig. 371: Knock Sensors 1 And 2 For Bank 1
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Knock Sensor (KS) 1 G61 - 1 -

- Color identification: Light gray
- For cylinder 1 to 3

Knock Sensor (KS) 2 G66 - 2 -

- Color identification: Gray
- For cylinder 4 to 6

Knock Sensors 3 and 4 for Bank 2

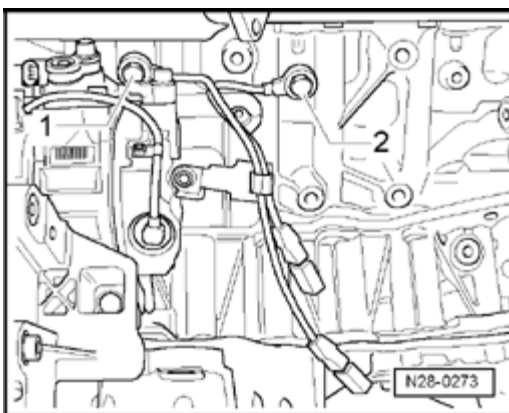


Fig. 372: Knock Sensors 3 And 4 For Bank 2
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Knock Sensor (KS) 3 G198 - 1 -

- Color identification: Orange
- For cylinder 7 to 9

Knock Sensor (KS) 4 G199 - 2 -

- Color identification: Black
- For cylinder 10 to 12

Ignition Coils with Power Output Stages, Removing and Installing

Ignition Coils with Power Output Stages, Removing and Installing

Special tools, testers and auxiliary items required

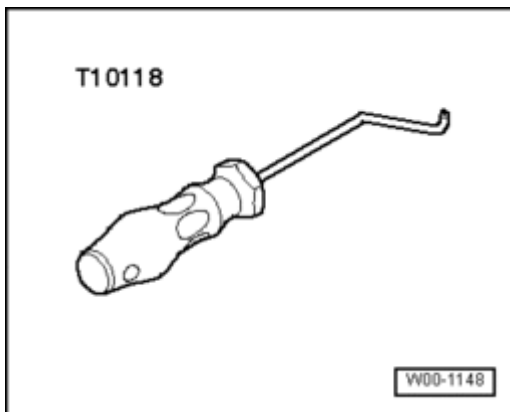


Fig. 373: Assembly Tool T10118

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Assembly tool T10118

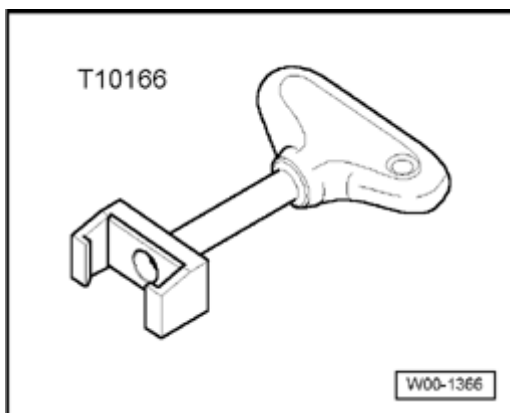


Fig. 374: Ignition Coil Puller (W8 W12 Eng.) T10166

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Ignition Coil Puller (W8 W12 Eng.) T10166

Removing

- Remove engine covers.

With engine code BAP:

- Remove both side parts of intake manifold --> **Intake Manifold, Engine Code BAP, Assembly Overview.**

With engine code BRP:

- Remove both side parts of intake manifold --> **Intake Manifold Upper Section, Engine Code BRP, Assembly Overview.**

Continuation for All Vehicles:

- Disconnect connectors from ignition coils 1 to 12. Assembly tool T10118 can be used to release connector catches.

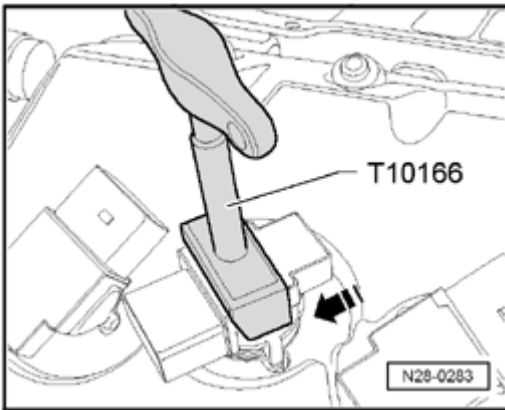


Fig. 375: Sliding On Puller T10166 In And Pull Out Ignition Coil With Power Output Stage
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Slide on puller T10166 in - **direction of arrow** - , and pull out ignition coil with power output stage.

Installing

- To install, insert ignition coil with power output stage into respective spark plug shaft so that connector connections do not contact cylinder head cover.
- Press ignition coil with power output stage onto spark plug by hand.