ENGINE

1.8 Liter 4-Cyl. 5V Turbo Engine Mechanical, Engine Code(s): AMB

00 - GENERAL, TECHNICAL DATA

TECHNICAL DATA

Engine number

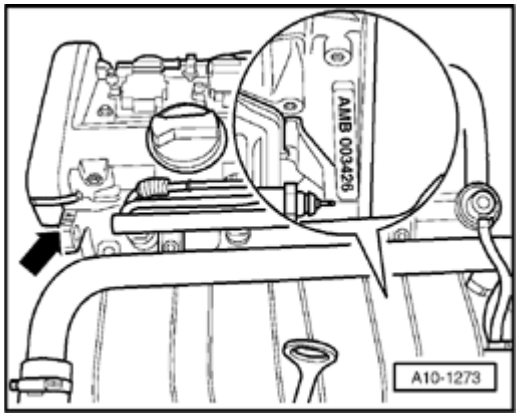

Fig. 1: Locating Engine Number
Courtesy of VOLKSWAGEN UNITED STATES, INC.

The engine number ("Engine code" and "Serial number") can be found on the rear left of the cylinder block.

Additionally there is a sticker on the toothed belt guard giving the "Engine code" and "Serial number".

The engine code is also given on the vehicle data sticker.

NOTE:

- **The engine code is also stamped on the front lifting eye (visible when engine cover panel is removed).**

Engine data

Engine code		**AMB**
Manufactured		08.01 -->
Capacity	l	1.781
Power	kW at RPM	125/5700
Torque	Nm at RPM	210/1750 to 4600
Bore	diameter mm	81.0
Stroke	mm	86.4
Compression ratio		9.5
RON		95 * See note

Injection/ignition system		Bosch Motronic
Knock control		yes
On Board Diagnostic		yes
Oxygen sensor control		yes
Catalytic converter		yes
Charging		yes

*Standard unleaded RON 91 also permitted, however reduced power.

Engine code	**AMB**
Exhaust gas recirculation	no
Intake manifold change-over function	no
Camshaft timing control	yes
Secondary air system	yes
Valve timing	
at 1 mm valve lift and 0 mm valve clearance	
Intake opens after TDC	18 °
Intake closes after BDC	28 °
Exhaust opens before BDC	28 °
Exhaust closes before TDC	8 °

10 - ENGINE - ASSEMBLY

ENGINE, REMOVING AND INSTALLING

Engine, removing and installing

CAUTION: Before beginning repairs on the electrical system:

Obtain the anti-theft radio security code.

Switch the ignition off.

Disconnect the battery Ground (GND) strap.

On vehicles equipped with Audi Telematics by OnStar, switch-off the emergency (back-up) battery for the Telematic/Telephone Control Module prior to disconnecting vehicle battery --> 91 - COMMUNICATION

After reconnecting vehicle battery, re-code and check operation of anti-theft radio. Also check operation of clock and power windows according to Repair Article and/or Owners Manual.

After reconnecting vehicle battery on vehicles equipped with Audi

Telematics by OnStar, switch-on the emergency (back-up) battery for the Telematic/Telephone Control Module --> 91 - COMMUNICATION

Engine, removing and installing

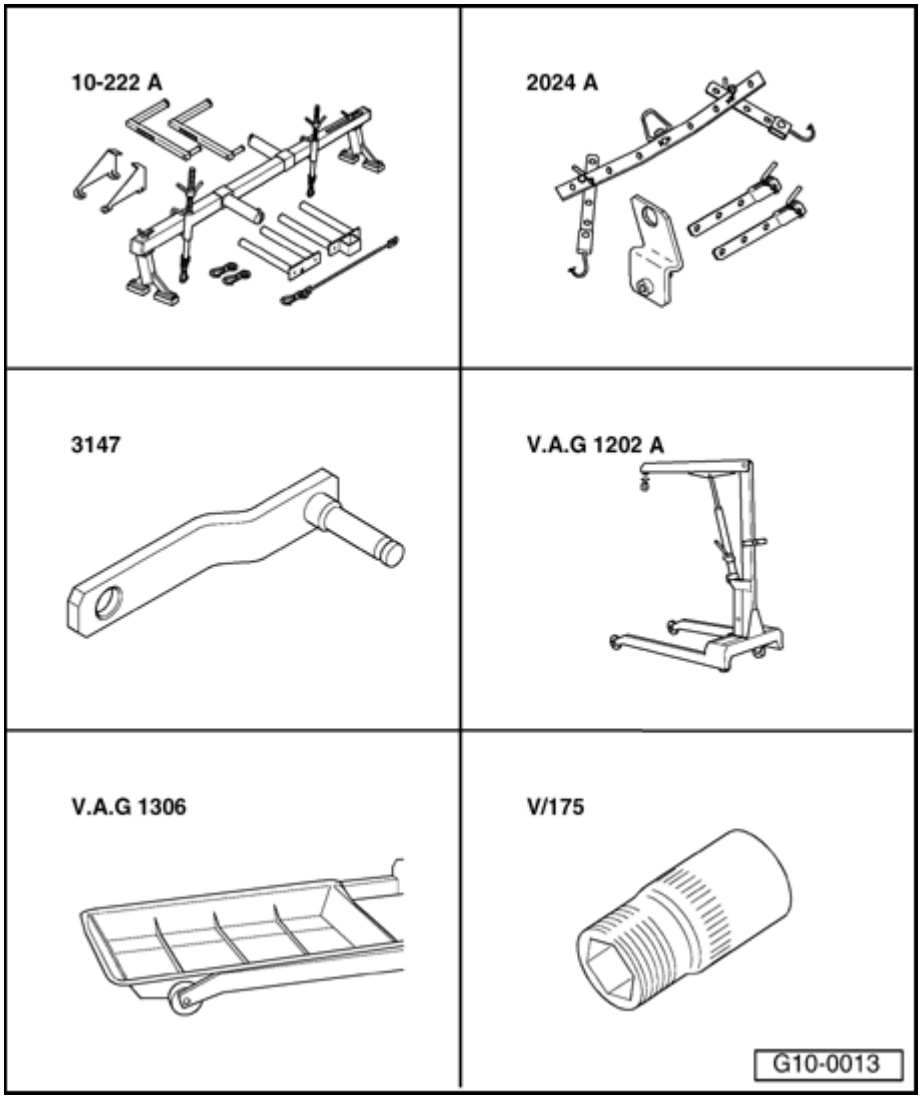

Fig. 2: Identifying Special Tools - Engine, Removing And Installing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools, testers and auxiliary items required

- Support bar 10-222A
- Lifting tackle 2024A
- Special tool 3147
- Workshop crane VAG1202A
- Drip tray VAG1306

- Socket attachment 15 mm A/F Matra V/175

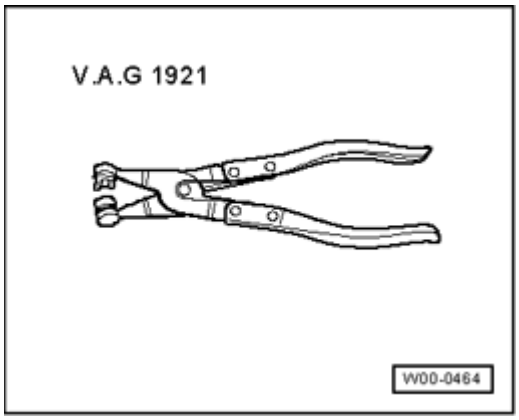

Fig. 3: Identifying Hose Clip Pliers VAG 1921
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Hose clip pliers VAG5024

Engine, removing

NOTE:

- **All cable ties unfastened or cut when removing engine are to be reattached in same position during installation.**
- **Engine must be removed without transmission from front of vehicle.**
- **Catch drained coolant in a clean container for re-use or disposal.**

Vehicles with automatic transmission

- Move selector lever to position N.

All models

- Obtain radio anti-theft code for vehicles with encoded radio.

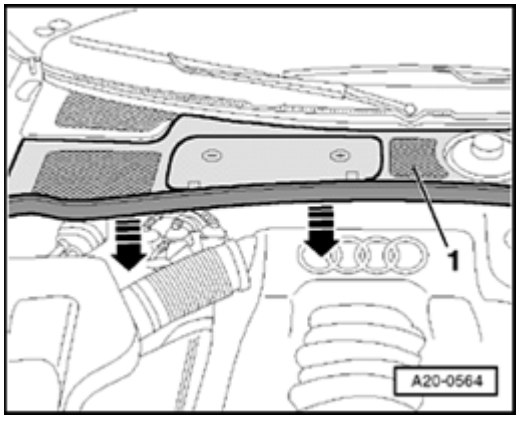

Fig. 4: Removing Rubber Seal From Plenum Chamber Cover

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove rubber seal from plenum chamber cover in direction of - **arrow** -.
- Pull plenum chamber cover - **1** - toward front and remove.

See Caution before beginning repairs on electrical system --> **Engine, removing and installing**

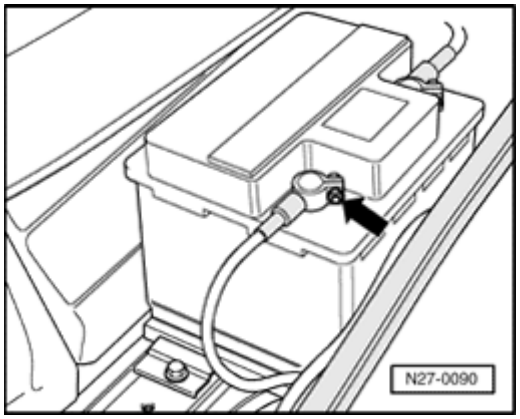

Fig. 5: Identifying Battery Ground (GND) Terminal
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- With ignition switched off, disconnect battery Ground strap - **arrow** -.
- Use screwdriver to pry off caps - **3** - from wiper arms.

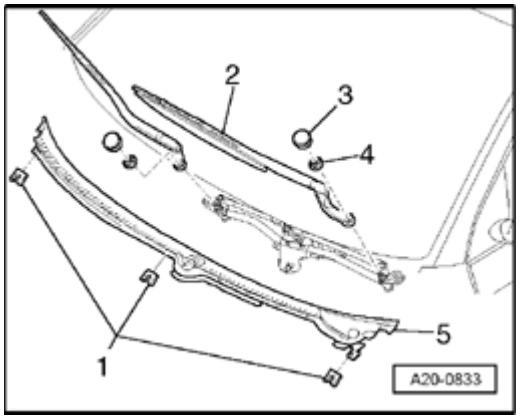

Fig. 6: Removing Securing Clips And Cowl
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Loosen hex nuts - **4** - by a few turns.
- Tilt wiper arm - **2** - slightly to remove it from wiper shaft.
- Remove hex nuts completely and remove wiper arms.
- Pull off securing clips - **1** - and remove panel trim.

CAUTION: Hot steam can escape when cap on expansion tank is opened. Cover cap with cloth and open carefully.

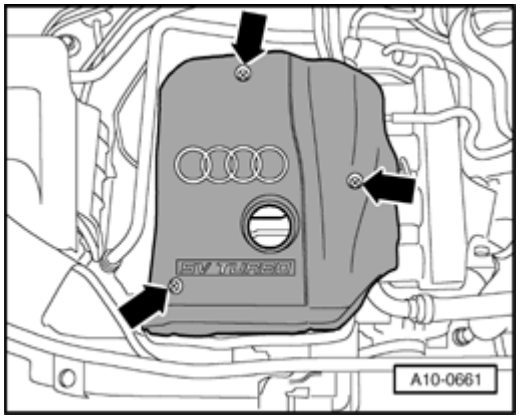

Fig. 7: Removing Engine Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove engine cover - **arrows** -.

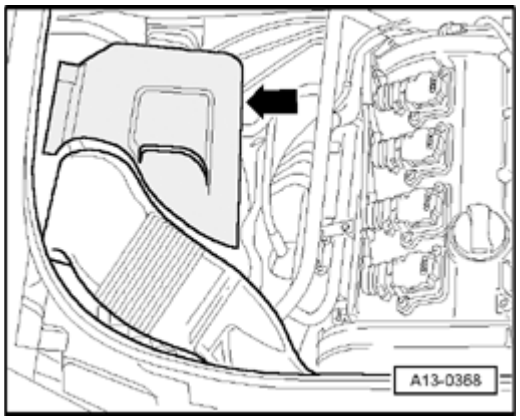

Fig. 8: Air Cleaner Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove air cleaner cover - **arrow** -.

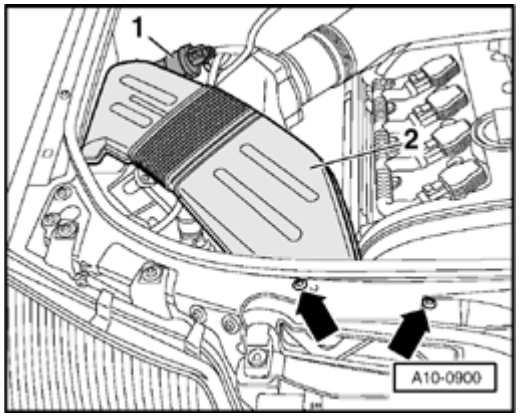

Fig. 9: Evaporative Emission Canister Purge Regulator Valve N80 And Air Duct

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts - **arrows** -.
- Disengage EVAP canister purge regulator valve N80 - **1** - from air duct - **2** -.
- Remove both screws - **arrows** - for air duct - **2** -.
- Remove front bumper: -->
  - **63 BUMPER**
  - **63 - BUMPERS** for CABRIOLET

Vehicles with auxiliary heater

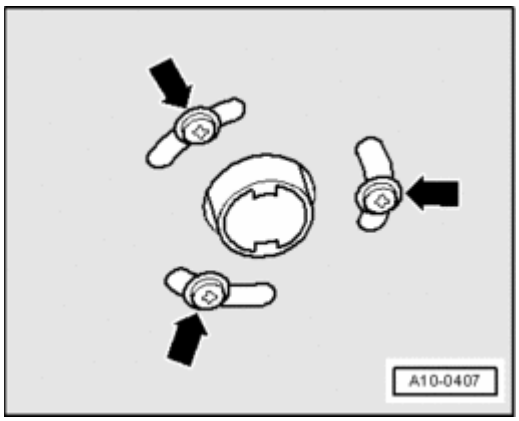

Fig. 10: Removing Bolts Securing Exhaust Pipe Of Auxiliary/Additional Heater To Sound Insulation
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts - **arrows** - securing exhaust pipe of auxiliary/additional heater to sound insulation.

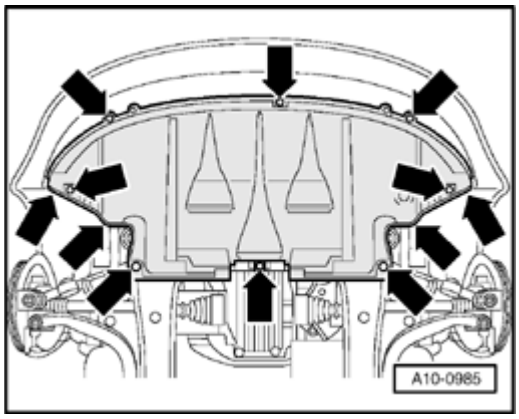

Fig. 11: Removing Sound Insulation
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove sound insulation - **arrows** -.

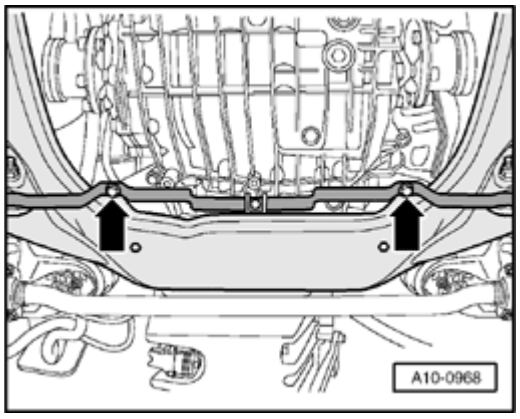

Fig. 12: Unbolting Sound Insulation Holder
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unbolt sound insulation holder.

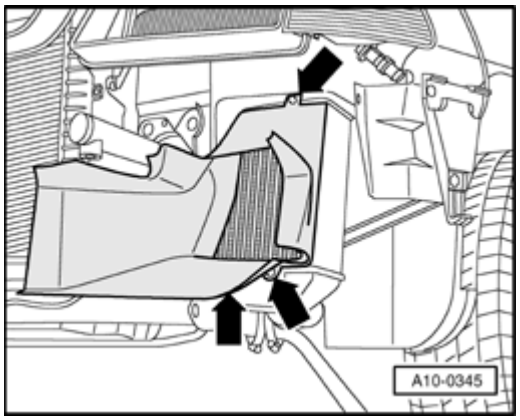

Fig. 13: Removing Air Duct In Front Of Charge Air Cooler
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove air duct in front of charge air cooler - **arrows** -.
- Place drip tray VAG1306 under engine.

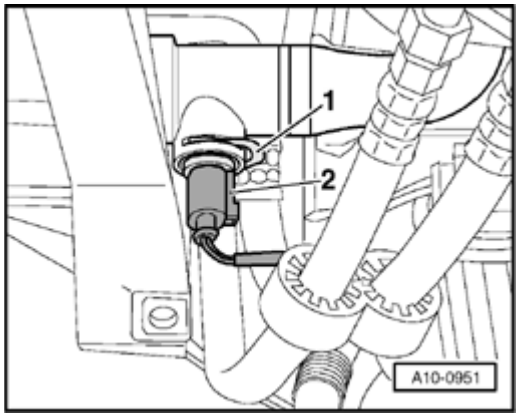

Fig. 14: Pulling Retaining Clip For Engine Coolant Temperature (ECT) Sensor G2 Off Lower Coolant

Hose And Drain Coolant From Radiator
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Pull retaining clip - **1** - for Engine Coolant Temperature (ECT) sensor G2 - **2** - off lower coolant hose and drain coolant from radiator.
- Remove lower coolant hose from radiator.

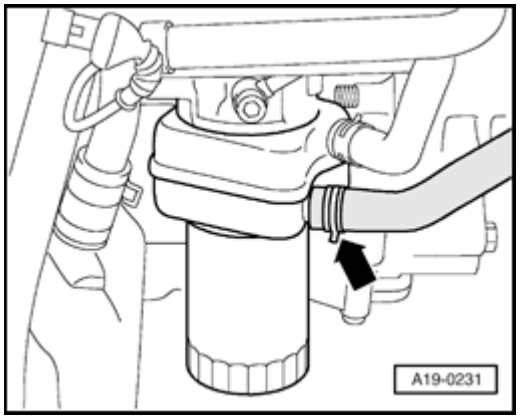

Fig. 15: Disconnecting Coolant Hose From Oil Cooler
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect coolant hose from oil cooler - **arrow** - and drain remaining coolant.

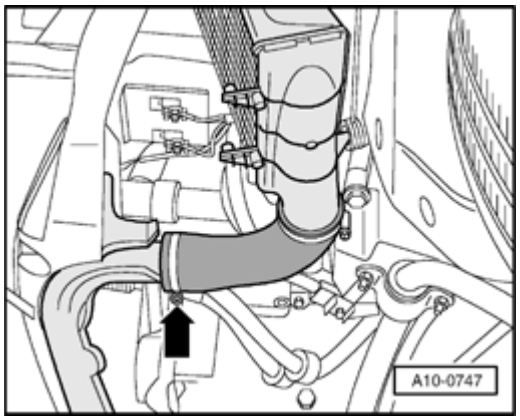

Fig. 16: Removing Air Hose To Charge Air Cooler At Bottom Left Of Lock Carrier
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove air hose - **arrow** - to charge air cooler at bottom left of lock carrier.

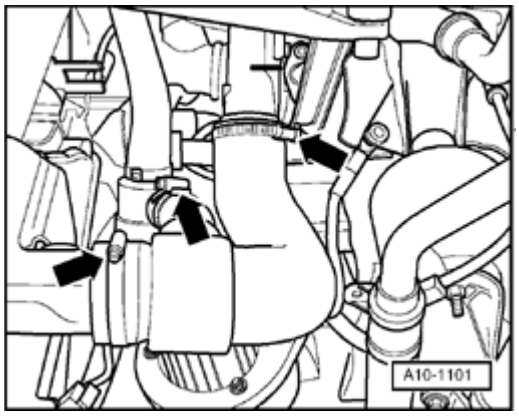

Fig. 17: Removing Lower Air Hose Between Turbocharger And Lock Carrier
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove lower air hose - **arrow** - between turbocharger and lock carrier.

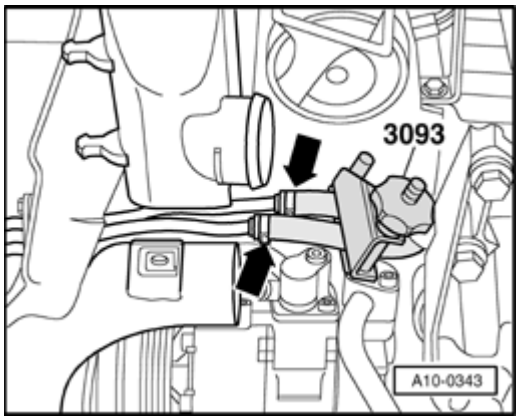

Fig. 18: Using 3093 To Clamp Off Inlet And Outlet Pipe Of Cooling Coil For Power Steering Hydraulic Fluid
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Use 3093 to clamp off inlet and outlet pipe of cooling coil for power steering hydraulic fluid.
- Place suitable container under hoses.
- Disconnect hoses from cooling coil.

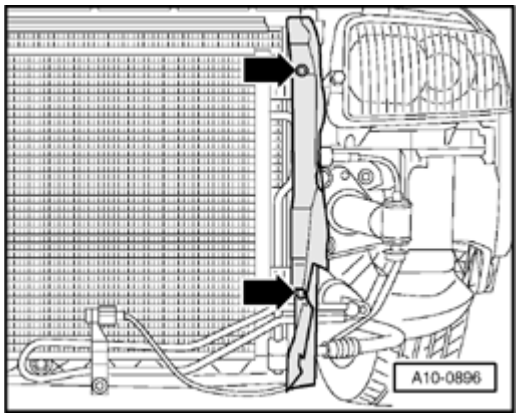

Fig. 19: Removing Air Ducts On Left/Right Of Radiator
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove air ducts on left and right of radiator - **arrows** -.

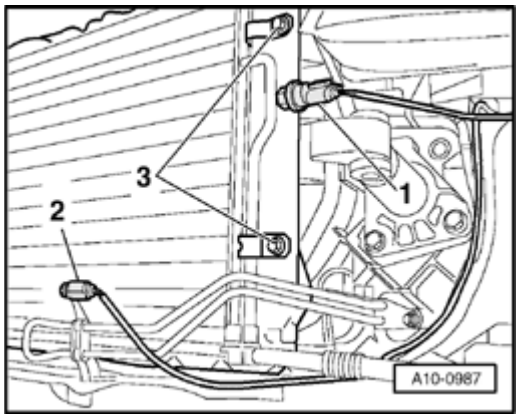

Fig. 20: Disconnecting Connector From A/C Pressure Switch F129 & Ambient Temperature Sensor
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect connector - **1** - from A/C pressure switch F129.
- Disconnect connector - **2** - from ambient temperature sensor.
- Move both wires clear.

CAUTION: Air conditioner refrigerant circuit must not be opened.

- Unbolt condenser - **arrows** - from radiator.

NOTE:

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

- Carefully swivel condenser downward and set down.

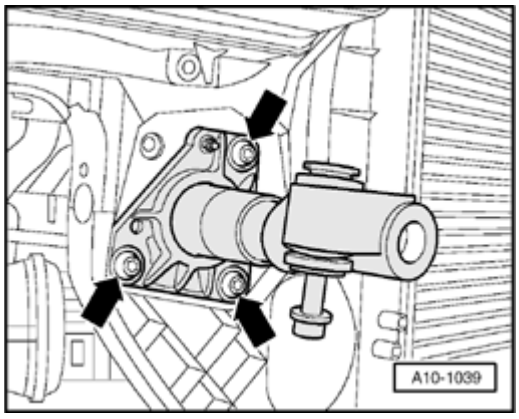

Fig. 21: Removing Impact Absorber Bolts On Left/Right
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove impact absorber bolts on left and right - **arrows** -.
- Remove hood lock cable from lock carrier: -->
  - **55 HOOD, LIDS**
  - **55 - HOOD, LIDS** for CABRIOLET

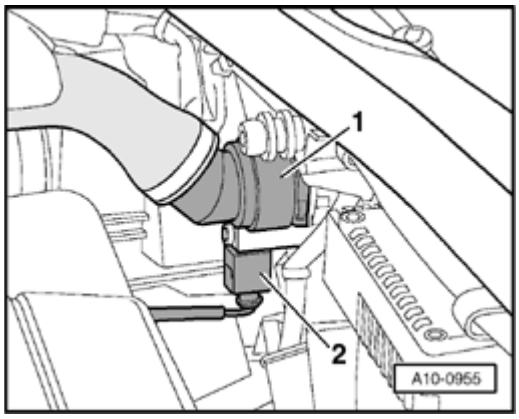

Fig. 22: Removing Top Coolant Hose From Radiator & Disconnecting Connectors For Left/Right Airbag Sensor
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove top coolant hose from radiator - **1** -.
- Disconnect connectors - **2** - for left and right airbag sensor.

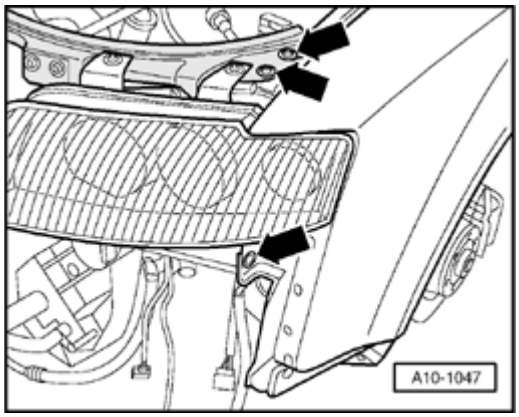

Fig. 23: Unbolting Lock Carrier On Left/Right
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unbolt lock carrier on left and right - **arrows** -.

NOTE:

- **A second technician is required to remove the lock carrier.**
- **Place lock carrier in a secure position.**

- Remove lock carrier.

Vehicles with automatic transmission

NOTE:

- **Observe the rules for cleanliness when working on an automatic transmission:**
- **-->**
  - **37 - AUTOMATIC TRANSMISSION - CONTROLS, HOUSING for 5 SPD. AUTOMATIC TRANSMISSION 01V**
  - **37 - AUTOMATIC TRANSMISSION - CONTROLS, HOUSING for 5 SPD. AUTOMATIC TRANSMISSION 01V FRONT AND ALL WHEEL DRIVE - INTERNAL COMPONENTS, SERVICING**
  - **37 CONTROLS, HOUSING for AUTOMATIC TRANSMISSION 09L, FOUR-WHEEL DRIVE**

- Place drip tray underneath.

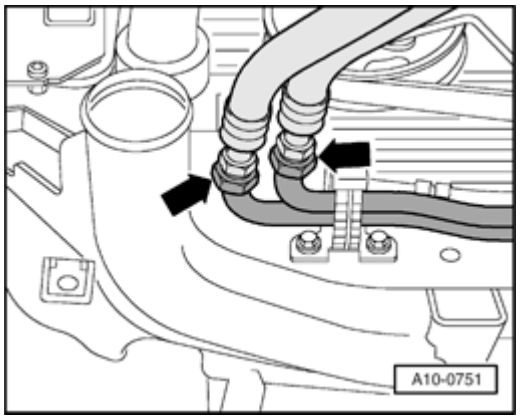

Fig. 24: Disconnecting ATF Lines
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect ATF lines - **arrows** -.
- Unbolt bracket for ATF lines on left of engine.

Vehicles up to 06.03

CAUTION: Fuel system is under pressure! Before opening system, place rags around the connection point. Then release pressure by carefully loosening connection.

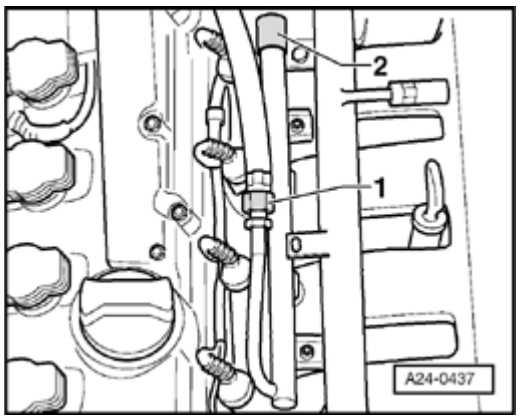

Fig. 25: Disconnecting Fuel Supply Line And Set Aside
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect fuel supply line - **1** - and set aside.

NOTE:

- **Disregard - 2 -.**

Vehicles as of 07.03

CAUTION: Fuel system is under pressure! Before opening system, place rags around the connection point. Then release pressure by carefully loosening

connection.

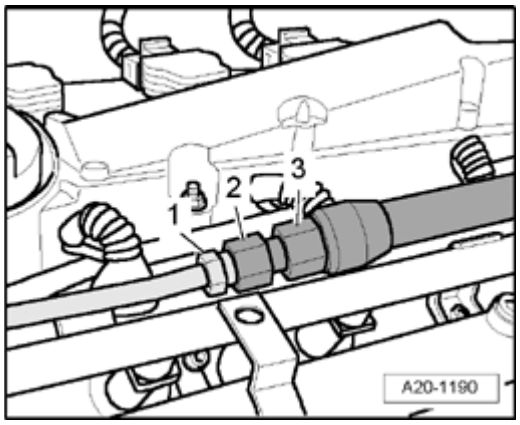

Fig. 26: Counterholding Using An Open-End Wrench At Each Hex Head & Unscrew Union Nut
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unscrew fuel hose from connection on fuel rail pipe. To do so, counterhold using an open-end wrench at each hex head - **1** - and - **3** - and unscrew union nut - **2** -.

All

- Seal off line so that no dirt will get into fuel system.

CAUTION: Fuel system is under pressure! Before opening system, place rags around the connection point. Then release pressure by carefully loosening connection.

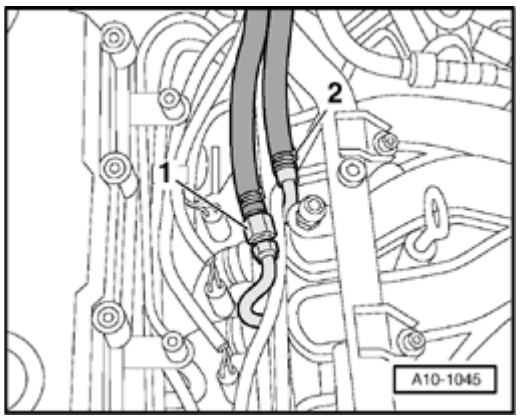

Fig. 27: Disconnecting Fuel Supply Line
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect fuel supply line.
- Seal off line so that no dirt can enter fuel system.
- Unbolt Ground connection from plenum chamber.
- Remove vacuum line to brake servo from plenum chamber.

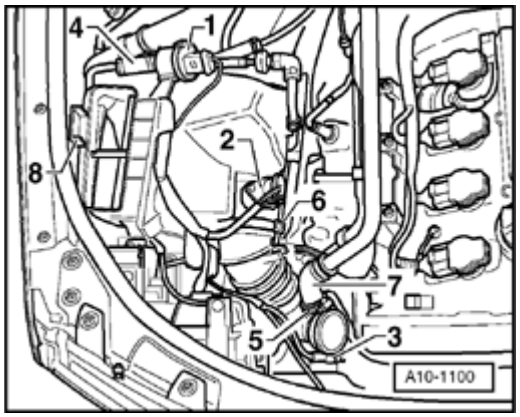

Fig. 28: Disconnect Wires/Unplug Connectors From
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect wires/unplug connectors from:

1. EVAP canister purge regulator valve
2. Mass air flow sensor
3. Wastegate bypass regulator valve N75

- Disconnect hoses 4...7.
- Disconnect hose to secondary air injection pump motor - **8** -.
- Move wires clear.
- Unbolt air cleaner housing - **9** -.

- Remove air cleaner.

NOTE:

- **Vacuum pipe to secondary air combination valve is clipped to underside of air intake hose.**

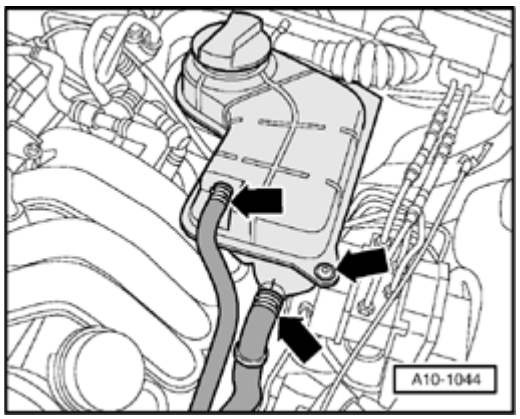

Fig. 29: Removing Both Coolant Hoses From Coolant Expansion Tank
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove both coolant hoses from coolant expansion tank.
- Unbolt coolant expansion tank.
- Lift coolant expansion tank slightly at bolt side and pull it out of catch on plenum chamber side.

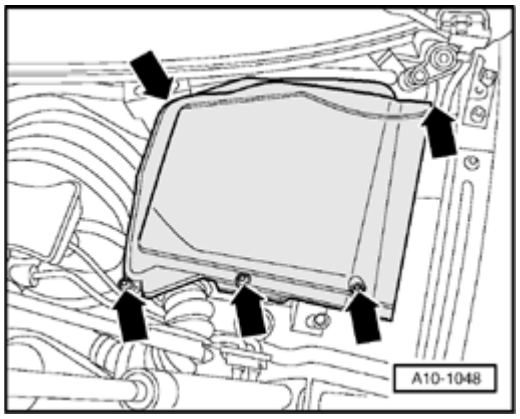

Fig. 30: Unbolting Cover Of Electronics Box In Plenum Chamber
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unbolt cover of electronics box in plenum chamber.

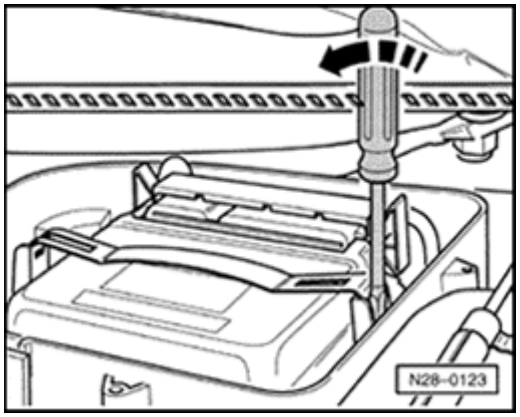

Fig. 31: Removing Engine Control Module
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Carefully pry off retainer bar with screwdriver - **arrow** -.

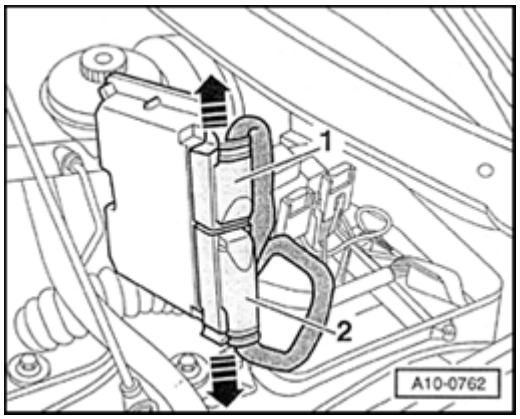

Fig. 32: Disengaging Electrical Connector Retainers And Disconnecting Electrical Connectors From Engine Control Module (ECM) J623
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Release catches - **arrows** - and disconnect control module connectors - **1** - and - **2** -.

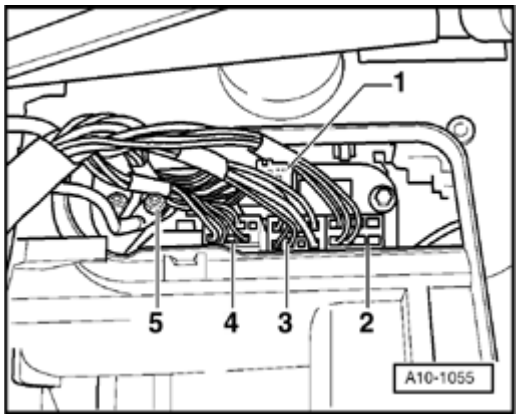

Fig. 33: Disconnecting Connectors From Connector Rail
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect connectors 1...4 from connector rail.
- Unbolt wire connector - **5** -.

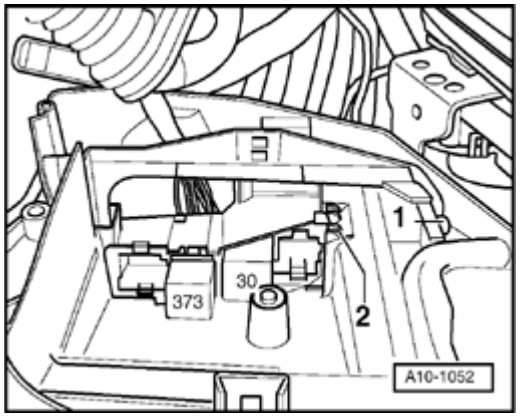

Fig. 34: Releasing Catches, Lifting Off Control Module Support & Pulling Auxiliary Relay Carrier In Electronics Box Upward To Remove
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Release catch - **1** - and lift off control module support.
- Release catch - **2** - and pull auxiliary relay carrier in electronics box upward to remove.
- Disengage wiring harness from electronics box housing and plenum chamber, and place on engine.

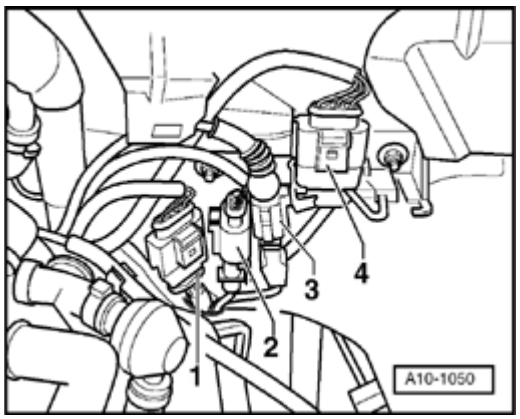

Fig. 35: Disconnecting 4-Pin Connectors Of Oxygen Sensors
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove connectors 1...4 from mount.
- Disconnect connectors.
- Open cable ties and place wires to electrical engine components to one side.
- Pull out retainers for both coolant hoses to heat exchanger at rear of engine.
- Disconnect coolant hoses between engine and heat exchanger.

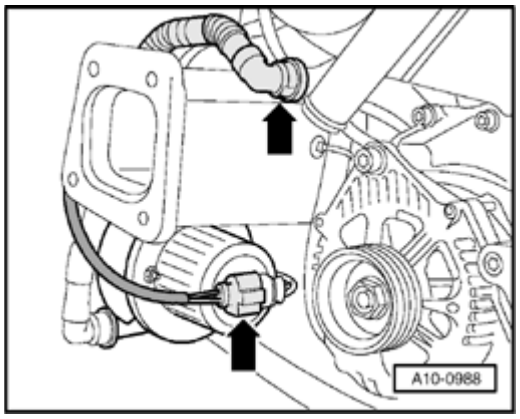

Fig. 36: Disconnecting Connector From Secondary Air Injection (AIR) Pump Motor V101 & Hose From Pipe To Secondary Air Combination Valve
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect connector - **arrow** - from secondary Air Injection (AIR) pump motor V101 and move wire

clear.

- Disconnect hose - **arrow** - from pipe to secondary air combination valve.

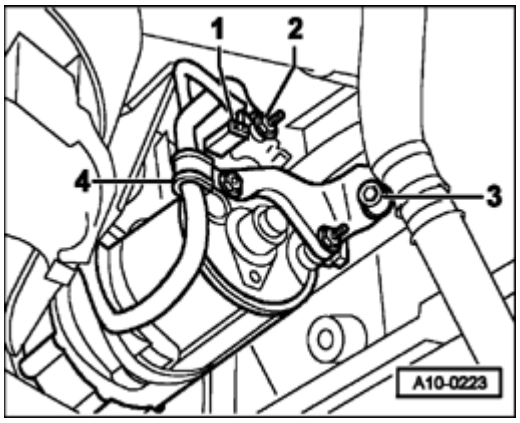

Fig. 37: Removing Wires From Starter & Insulator From Positive Connection On Starter
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove wires - **1** - and - **2** - from starter, remove insulator from positive connection on starter.
- Remove clamp from starter holder - **4** -.
- Unbolt mount from cylinder block - **3** - and starter.
- Unbolt starter from transmission and remove.

- Unbolt Ground (GND) wire from right engine support.

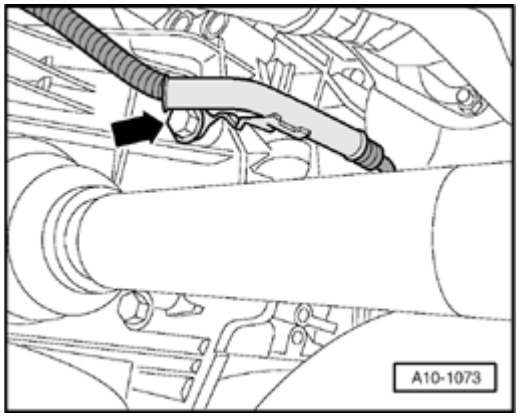

Fig. 38: Guiding Tube For Positive Wire To Starter Is Attached Using Bolt Securing Engine To Transmission
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Guide tube for positive wire to starter is attached using bolt securing engine to transmission.

Vehicles with automatic transmission

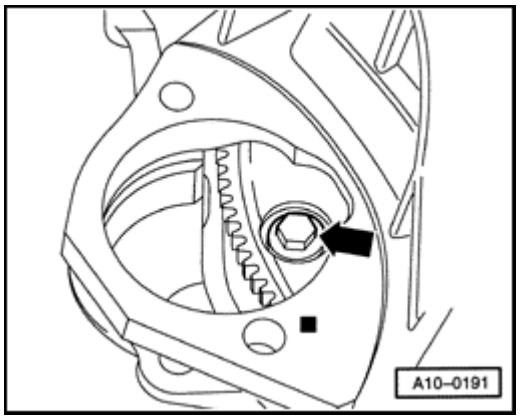

Fig. 39: Removing Torque Converter Bolts Through Opening Of Removed Starter
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove 3 torque converter bolts through opening of removed starter using Matra V175 15 mm A/F socket attachment (rotate crankshaft by 1/3 turn each time).

NOTE:

- **When loosening torque converter bolts, counterhold the crankshaft by applying a wrench to the central bolt on the vibration damper.**

All models

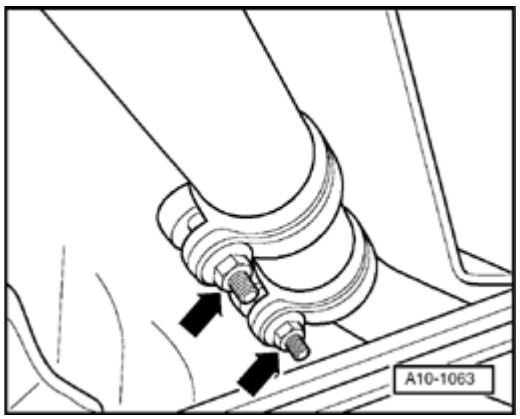

Fig. 40: Separating Exhaust System At Clamp
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Separate exhaust system at clamp.

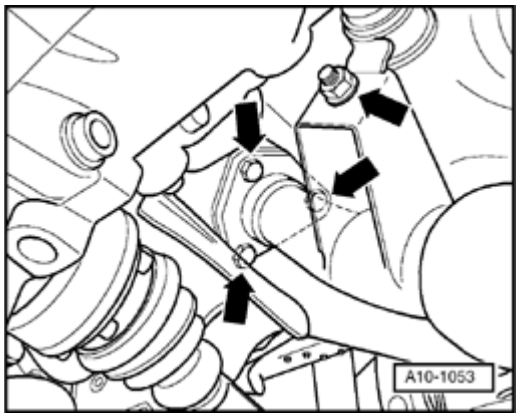

Fig. 41: Removing Bolts Securing Catalytic Converter To Front Exhaust Pipe
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts - **arrows** - securing catalytic converter to front exhaust pipe.
- Unbolt transmission bracket for exhaust system - **arrow** -.

NOTE:

- **To avoid damage, do not bend decoupling element of front exhaust pipe by more than 10 °.**

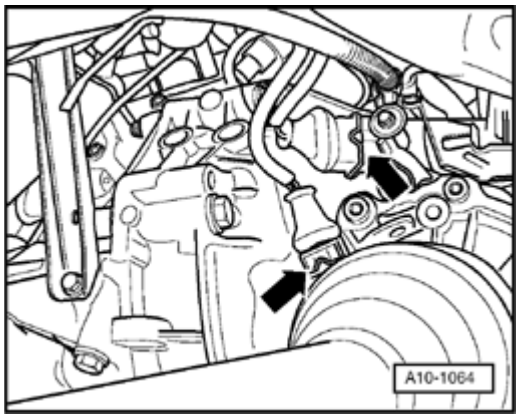

Fig. 42: Disconnecting Connectors From Transmission
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect both connectors - **arrows** - from transmission.

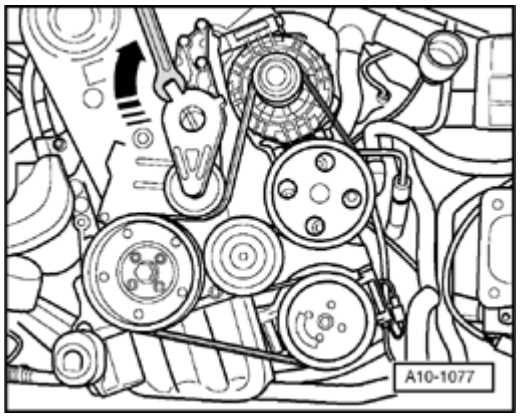

Fig. 43: Swiveling Tensioner In To Loosen Ribbed Belt
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Swivel tensioner in direction of - **arrow** - to loosen ribbed belt.
- Remove ribbed belt from generator pulley.

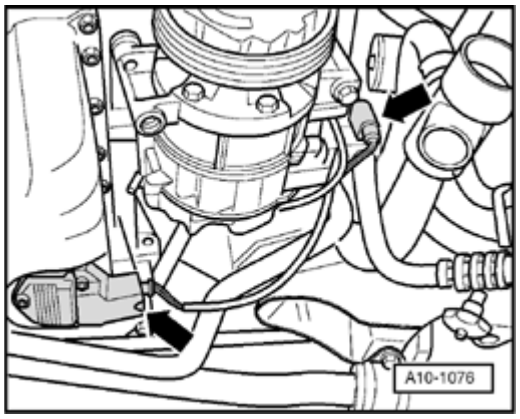

Fig. 44: Disconnecting Compressor Clutch Connector From Air Conditioning Compressor & Oil Level Gauge Connector From Oil Pan
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect compressor clutch connector from air conditioning compressor.
- Disconnect oil level gauge connector from oil pan.

CAUTION: Air conditioner refrigerant circuit must not be opened.

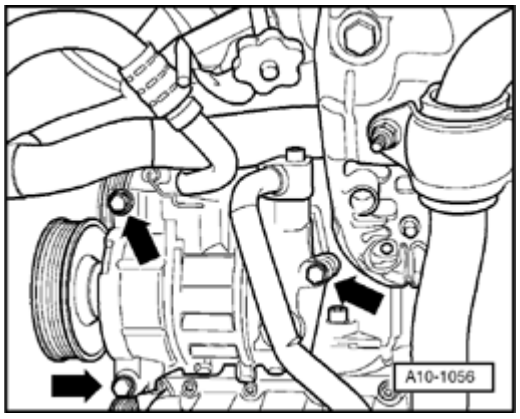

Fig. 45: Unbolting Air Conditioning Compressor From Bracket
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unbolt air conditioning compressor from bracket.
- Hang air conditioning compressor together with condenser and connected wires at right of vehicle.
- Use hose clamp 3093 to clamp off hose between expansion tank and power steering pump.
- Place drip tray underneath.

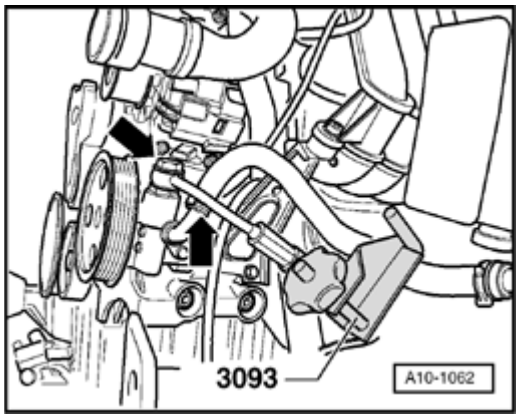

Fig. 46: Disconnecting ATF Lines From Power Steering Pump
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect ATF lines - **arrows** - from power steering pump.

NOTE:

- **Differing mounting holes are provided for different engine versions.**

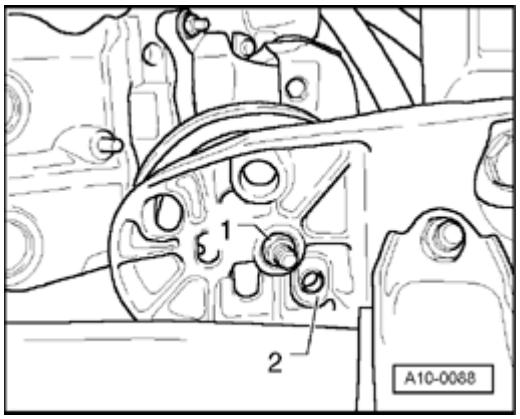

Fig. 47: Threaded Connections And Positioning Sleeves On Lower Engine Mounts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Mark positions of bolted connections - **1** - and locating sleeves - **2** - on lower right and left engine mounts.
- Remove lower nuts - **1** - on left and right engine mounts.

NOTE:

- **Illustration shows vehicle with engine removed.**

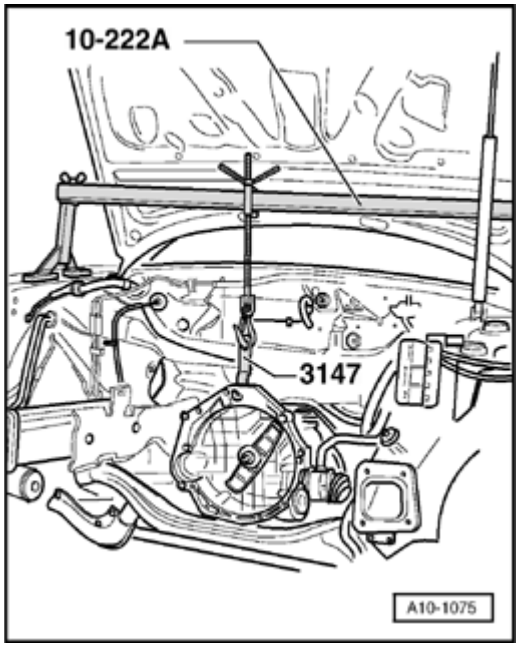

Fig. 48: Placing Support Bar 10-222A Behind Gas-Filled Strut On Suspension Strut Domes
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Place support bar 10-222A behind gas-filled strut on suspension strut domes. Spindle at front.
- Engage transmission support 3147 in bolt hole of transmission bell housing.
- Attach transmission support 3147 to support bar 10-222A.
- Use support bar 10-222A to lift engine/transmission assembly until engine mount bolts are positioned

approx. 1 cm above engine supports.

- Remove engine/transmission connecting bolts accessible from below.
- Remove upper engine/transmission securing bolts. Leave one bolt hand-tight in place.

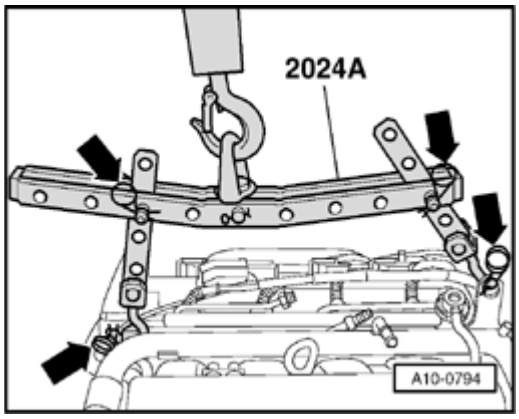

Fig. 49: Attaching Lifting Tackle 2024A To Engine And Hook Onto Workshop Crane VAG1202A
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Attach lifting tackle 2024A to engine and hook onto workshop crane VAG1202A.

NOTE:

- **To balance the center of gravity of the assembly, position hole rails of hook attachments as shown in the illustration.**

CAUTION: Hook attachments and locating pins on lifting tackle must be secured with locking pins - arrows - in illustration.

- Remove last securing bolt.

NOTE:

- **Check that all hoses and other connections between engine and body have been removed.**

- Lift engine over studs of engine mounts.
- Loosen support bar 10-222A slightly.

Vehicles with automatic transmission

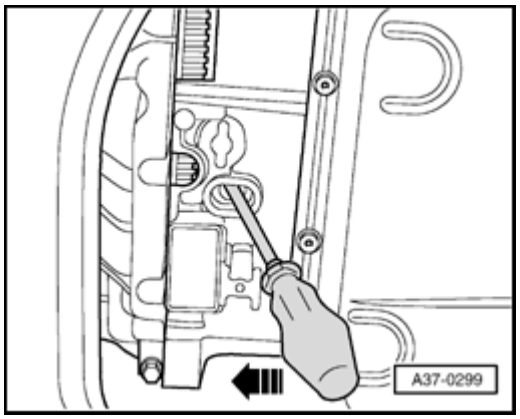

Fig. 50: Separating Transmission From Engine And At Same Time Remove Torque Converter From Drive Plate
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Separate transmission from engine and at same time remove torque converter from drive plate.

All models

- Pull engine away from transmission and lift engine toward front of vehicle out of engine compartment.

Vehicles with automatic transmission

- If necessary, secure torque converter in transmission with wire to prevent it from falling out.

Engine, securing to repair stand

Special tools, testers and auxiliary items required

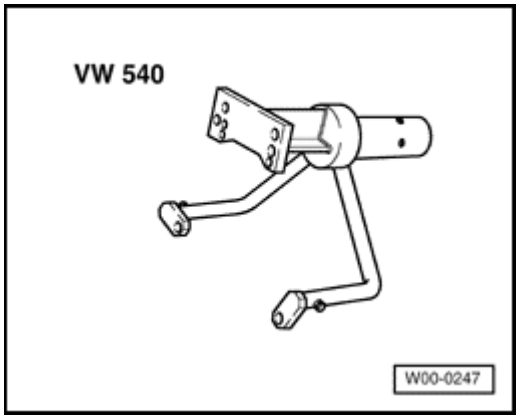

Fig. 51: Holding Fixture VW 540
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Engine and transmission bracket VW540

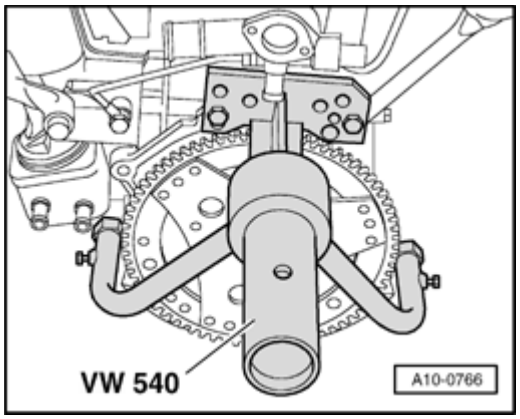

Fig. 52: Identifying Engine Transmission Bracket VW540
Courtesy of VOLKSWAGEN UNITED STATES, INC.

When working on the engine, secure it to the engine stand using engine bracket VW540.

Engine, installing

Install in reverse order, paying attention to the following:

NOTE:

- **When performing repairs, replace seals, gaskets, self-locking nuts and bolts which have a specified tightening angle.**

- Check whether dowel sleeves for centering engine/transmission in cylinder block have been installed and install if necessary.
- Push intermediate plate onto dowel sleeves.

Vehicles with manual transmission

- Check clutch release bearing for wear and replace if necessary.
- Lightly grease splines on transmission input shaft with G 000 100. Do not grease guide sleeve for release bearing.
- If necessary check that clutch plate is properly centered.
- A needle bearing must be installed in crankshaft on vehicles with manual transmission. Install needle bearing if necessary --> **Pilot needle bearing in crankshaft, extracting and driving**.

Vehicles with automatic transmission

- On vehicles with automatic transmission, no needle bearing must be installed in crankshaft. Remove needle bearing if necessary --> **Pilot needle bearing in crankshaft, extracting and driving**.
- To secure torque converter on drive plate, only use correct bolts
- Tighten torque converter bolts with Matra V175 15 mm A/F socket attachment.

Checking position of torque converter

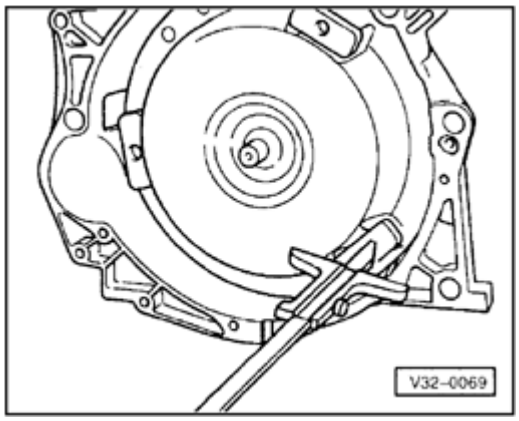

Fig. 53: Checking Torque Converter Is Correctly Positioned
Courtesy of VOLKSWAGEN UNITED STATES, INC.

If the torque converter has been correctly installed, the distance between bottom contact surfaces at threaded holes in torque converter and joint surface on torque converter bell housing with automatic transmission 01V, is approx. 23 mm.

If torque converter has not been completely inserted, this distance will be approx. 11 mm.

CAUTION: If the torque converter is incorrectly installed, the torque converter drive or the ATF pump will be severely damaged when the transmission is attached to the engine.

All models

- Ensure that engine mounts are installed free of mechanical stress. To do so, shake engine to align it before tightening engine mounts.
- Install air conditioning compressor.
- Install ribbed belt.

Vehicles with automatic transmission

- Secure ATF lines: -->
  - **37 - AUTOMATIC TRANSMISSION - CONTROLS, HOUSING** for 5 SPD. AUTOMATIC TRANSMISSION 01V
  - **37 - AUTOMATIC TRANSMISSION - CONTROLS, HOUSING** for 5 SPD. AUTOMATIC TRANSMISSION 01V FRONT AND ALL WHEEL DRIVE - INTERNAL COMPONENTS, SERVICING
  - **37 CONTROLS, HOUSING** for AUTOMATIC TRANSMISSION 09L, FOUR-WHEEL DRIVE

Stress-free alignment of exhaust system --> **Exhaust system - vehicles with front wheel drive, aligning stress-free**.

Vehicles up to 06.03

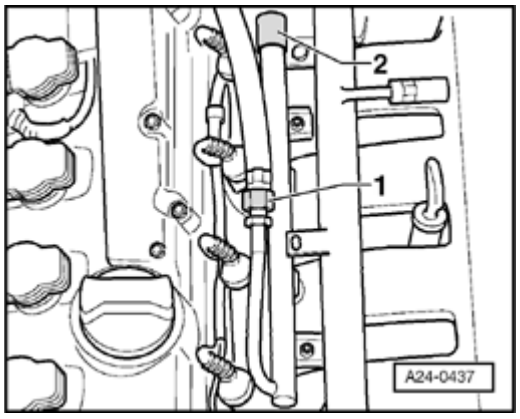

Fig. 54: Disconnecting Fuel Supply Line And Set Aside
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Tighten union nut of fuel supply line - **1** - to 22 Nm.

Vehicles as of 07.03

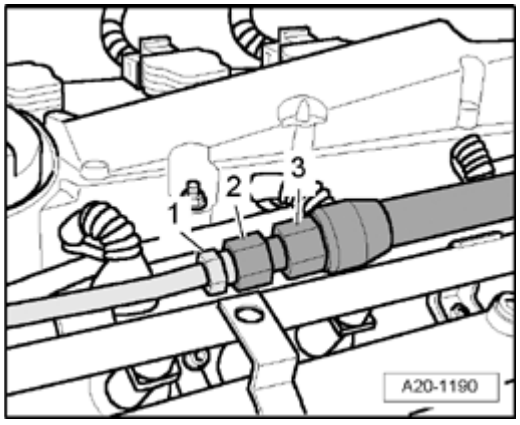

Fig. 55: Counterholding Using An Open-End Wrench At Each Hex Head & Unscrew Union Nut
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Secure fuel hose to connection on fuel rail pipe. To do so, counterhold using an open-end wrench at each hex head - **1** - and - **3** - and tighten union nut - **2** - to 22 Nm.

All

Electrical connections and routing:

--> Electrical Wiring Diagrams, Troubleshooting and Component Locations

CAUTION: Boost-starting using a battery charger may damage vehicle control modules.

See Caution for connecting Telematics battery --> **Engine, removing and installing**

- After connecting battery, enter radio anti-theft code. Radio operating instructions.
- Use electric window lifters to completely close door windows.
- Then actuate all window lifter switches again for at least 1 second in "close" position to activate automatic one-touch function.
- Set clock to correct time.

- Check oil level before starting engine.
- Fill cooling system --> **Cooling system, draining and filling**.

NOTE:

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

- Perform adaptation of throttle valve control module: --> **24 - MULTIPORT FUEL INJECTION (MFI)**
- Check Diagnostic Trouble Code (DTC) memory:

NOTE:

- **Diagnostic Trouble Codes (DTCs) will have been recorded in the DTC memory because connectors have been disconnected. Interrogate and, if necessary, erase DTC memory after installation.**

Vehicles with automatic transmission

- Check ATF level: -->
  - **37 - AUTOMATIC TRANSMISSION - CONTROLS, HOUSING** for 5 SPD. AUTOMATIC TRANSMISSION 01V
  - **37 - AUTOMATIC TRANSMISSION - CONTROLS, HOUSING** for 5 SPD. AUTOMATIC TRANSMISSION 01V FRONT AND ALL WHEEL DRIVE - INTERNAL COMPONENTS, SERVICING
  - **37 CONTROLS, HOUSING** for AUTOMATIC TRANSMISSION 09L, FOUR-WHEEL DRIVE

All models

- Adjust headlights: --> **94 LIGHTS, SWITCHES - EXTERIOR**

Tightening torques

NOTE:

- **The tightening torques listed in this section apply only to lightly greased, oiled, phosphated, or black-finished nuts and bolts.**
- **Additional lubricant such as engine or transmission oil may be used, but do not use graphite lubricant.**
- **Do not use degreased parts.**
- **Tolerance for tightening torques is ± 15%.**

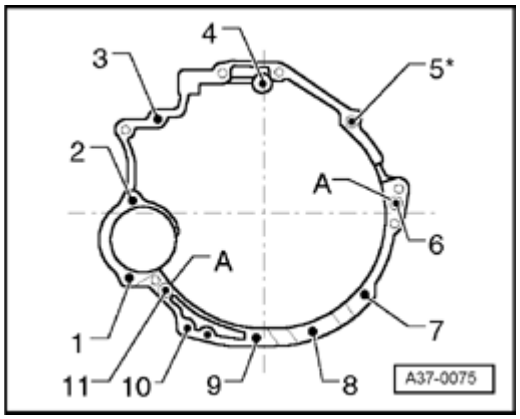

Fig. 56: Identifying Engine/Transmission Mountings (Automatic/Manual Transmission)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Engine/transmission mountings (manual transmission)

Item	Bolt	Nm
1, 3, 4	M12 x 67	65
2, 6	M12 x 90	65
5, 11	M12 x 110	65
7... 10	M10 x 45	45

A: Dowel sleeves for centering

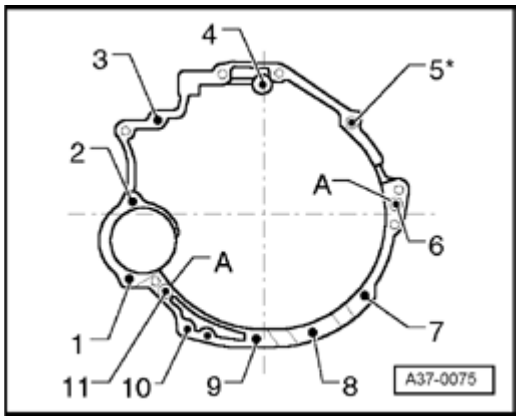

Fig. 57: Identifying Engine/Transmission Mountings (Automatic/Manual Transmission)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Engine/transmission mountings (automatic transmission)

Item	Bolt	Nm
1, 8, 9, 10	M10 x 45	45
2, 3, 4, 11	M12 x 67	65
5	M12 x 110	65

6	M12 x 90	65
7	M10 x 60	45

A: Dowel sleeves for centering

Component		Nm
Bolts/nuts	M6	10
	M8	20
	M10	45
	M12	65
except the following:		
Engine mount to subframe		25
Engine support to engine mount		25
Drive plate to		
Torque converter	M10 x1	85
Catalytic converter to turbocharger		30
Brackets for ATF lines		10
Power steering pump to bracket		25
Pulley to power steering pump		25
Pulley to coolant pump		25
Viscous fan to bearing		45
Air conditioning compressor to bracket		25

Component		Nm
Drain plug to coolant pump		30
Torque reaction support stop to torque reaction support bracket		28
Hose clamps for coolant hoses		2
Hose clamps for air hoses		3.5

13 - ENGINE - CRANKSHAFT, CYLINDER BLOCK

ENGINE, DISASSEMBLING AND ASSEMBLING

Engine, disassembling and assembling

CAUTION: Before beginning repairs on the electrical system:

Obtain the anti-theft radio security code.

Switch the ignition off.

Disconnect the battery Ground (GND) strap.

On vehicles equipped with Audi Telematics by OnStar, switch-off the emergency (back-up) battery for the Telematic/Telephone Control Module prior to disconnecting vehicle battery --> 91 - COMMUNICATION

After reconnecting vehicle battery, re-code and check operation of anti-theft radio. Also check operation of clock and power windows according to Repair Article and/or Owners Manual.

After reconnecting vehicle battery on vehicles equipped with Audi Telematics by OnStar, switch-on the emergency (back-up) battery for the Telematic/Telephone Control Module --> 91 - COMMUNICATION

Lock carrier, moving to service position

Special tools, testers and auxiliary items required

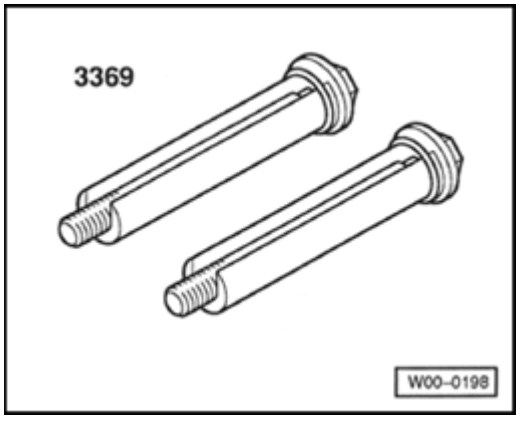

Fig. 58: Identifying Special Tool 3369
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Special tool 3369

Lock carrier in service position, overview

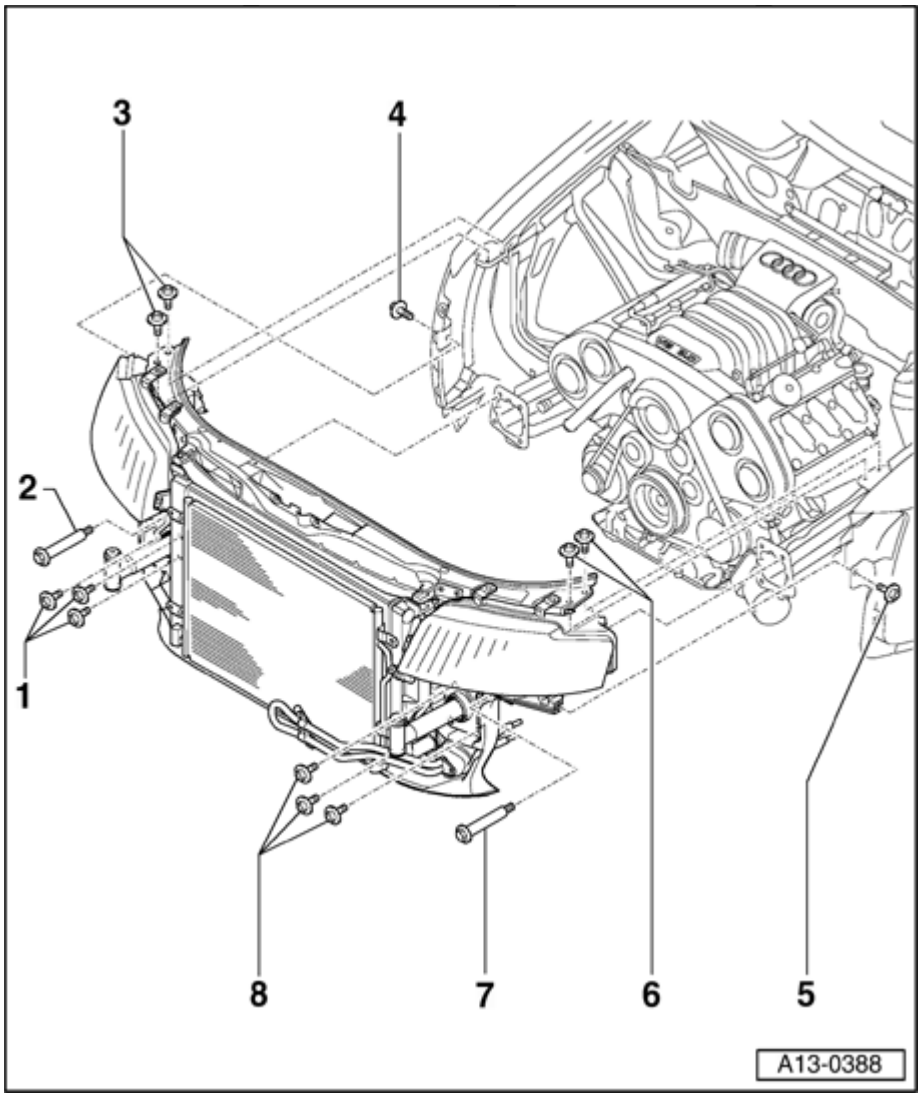

Fig. 59: Lock Carrier In Service Position, Overview
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - 45 Nm

2 - 45 Nm

3 - 10 Nm

4 - 10 Nm

5 - Hole

- For special tool 3369

6 - Hole in lock carrier

7 - Hole in fender

Removing

Vehicles with auxiliary heater

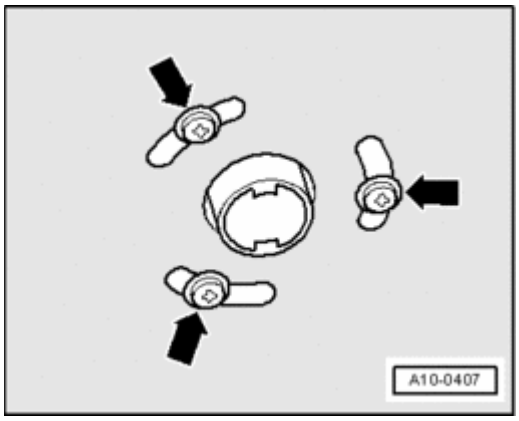

Fig. 60: Removing Bolts Securing Exhaust Pipe Of Auxiliary/Additional Heater To Sound Insulation
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts - **arrows** - securing exhaust pipe of auxiliary/additional heater to sound insulation.

All models

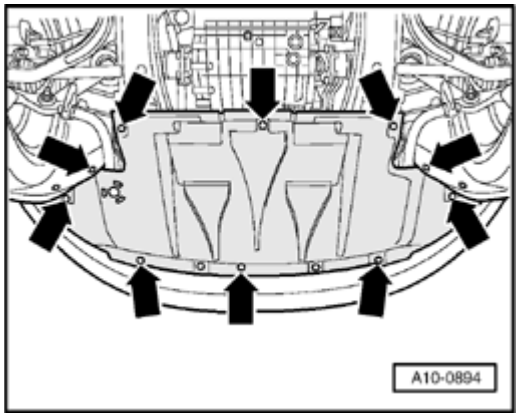

Fig. 61: Removing Sound Insulation
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove sound insulation - **arrows** -.

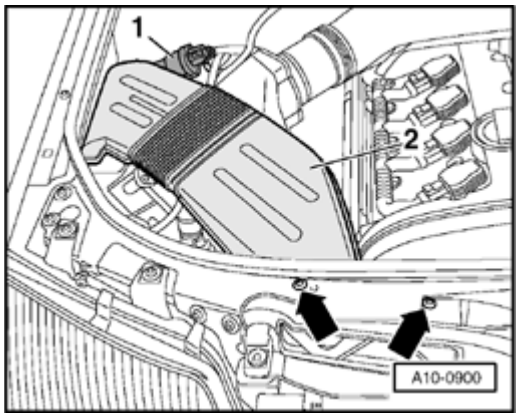

Fig. 62: Evaporative Emission Canister Purge Regulator Valve N80 And Air Duct
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts - **arrows** -.
- Disengage EVAP canister purge regulator valve N80 - **1** - from air duct.
- Remove air duct - **2** -.
- Pull off hood seals at lock carrier and fender edges.

- Remove front bumper: -->
  - **63 BUMPER**
  - **63 - BUMPERS** for CABRIOLET

- Remove bolts on left and right - **arrows** -.

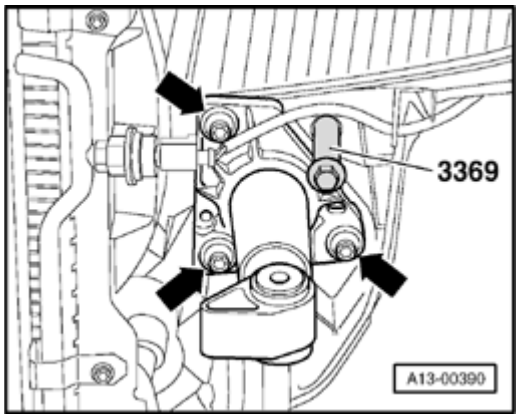

Fig. 63: Screwing Special Tool 3369 Into Free Holes On Left/Right
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Screw special tool 3369 into free holes on left and right.
- Remove bolts on left and right - **arrows** -.
- Carefully pull lock carrier forward.

Installing

Install in reverse order, paying attention to the following:

- Bolt lock carrier to longitudinal member (50 Nm) and to fenders (10 Nm).

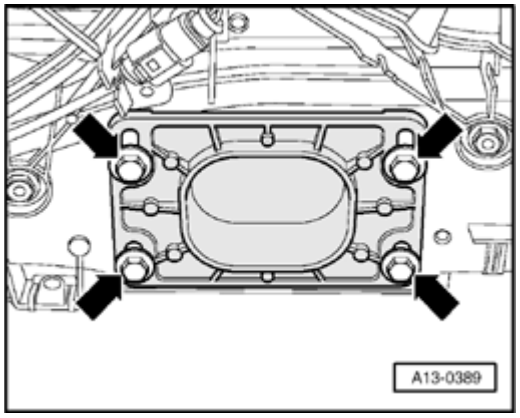

Fig. 64: Bolt Lock Carrier To Longitudinal Member And To Fenders
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Allow stop for torque reaction support to rest on rubber buffer for torque reaction support under its own weight, and tighten bolts - **arrows** - to 28 Nm.
- Install front bumper: -->
  - **63 BUMPER**
  - **63 - BUMPERS** for CABRIOLET
- Adjust headlights: --> **94 LIGHTS, SWITCHES - EXTERIOR**

Tightening torques

Component		Nm
Lock carrier to	longitudinal member	50
	fender	10
Torque reaction support stop to lock carrier		28

Ribbed belt for generator, vane pump and air conditioner compressor

NOTE:

- **Mark direction of the ribbed belt with chalk or felt-tip pen prior to removal. Running a used belt in the opposite direction could destroy it. When installing the belt, make sure it is properly seated on pulleys.**

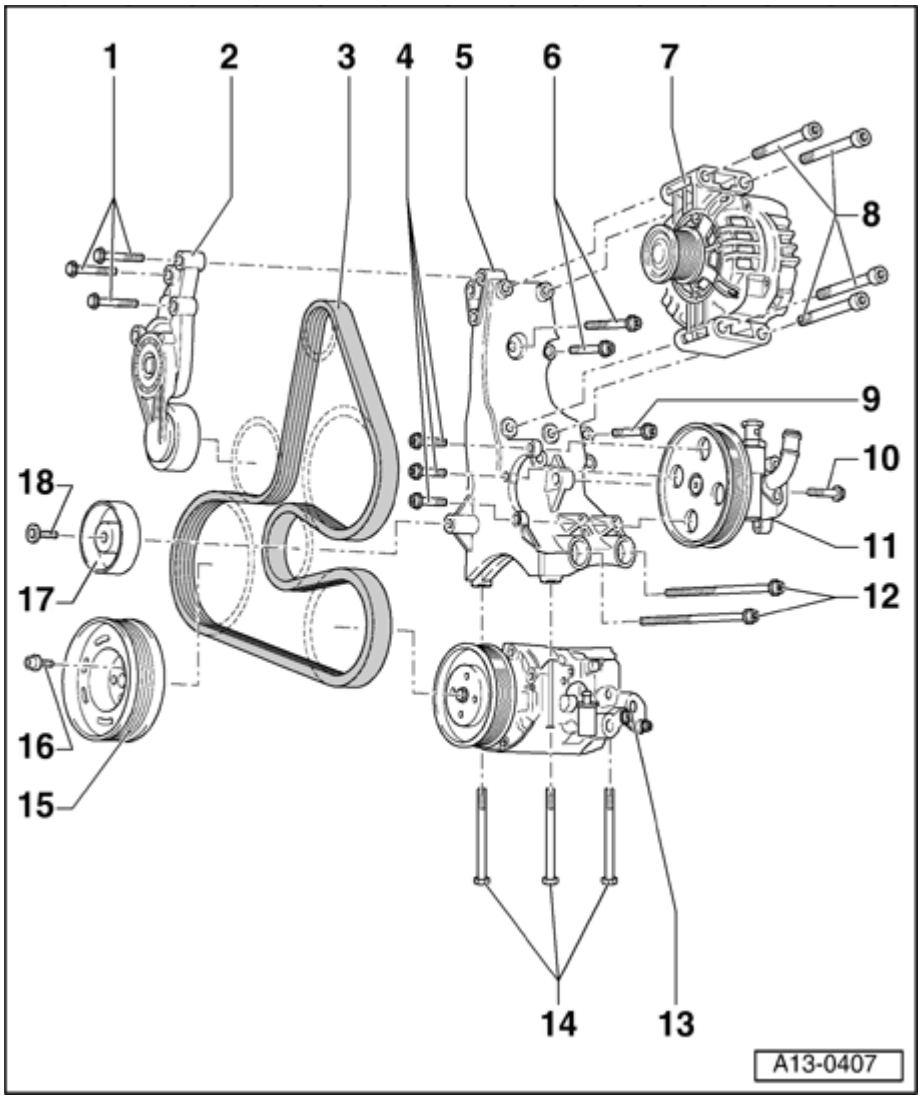

Fig. 65: Ribbed Belt For Generator, Vane Pump And Air Conditioner Compressor Remove/Install Components
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - 25 Nm

2 - Tensioning roller

3 - Ribbed belt

- Mark direction of rotation before removing
- Removing and installing --> **Ribbed belt, removing and installing**

4 - 25 Nm

5 - Bracket

- For generator, power steering pump and air conditioning compressor
- Removing and installing --> **Bracket for generator, power steering pump and air conditioning compressor, removing and installing**

6 - 40 Nm

7 - Generator

- Removing:

See Caution before beginning repairs on electrical system --> **Engine, disassembling and assembling**

- Disconnect battery Ground (GND) strap
- Loosen ribbed belt and remove from generator --> **Ribbed belt, removing and installing**.
- Loosen bolted connection at top and bottom.
- Swivel generator to side slightly and disconnect electrical connectors.
- Remove generator.

8 - 20 Nm

9 - 40 Nm

10 - 20 Nm

11 - Power steering pump

- Removing and installing: --> **48 - STEERING**

12 - 40 Nm

13 - Air conditioning compressor

- When installing, pay attention to dowel sleeves

14 - 20 Nm

15 - Vibration damper/pulley

- Can only be installed in one position **Installing vibration damper/pulley**

16 - Collared bolt, 10 Nm + 90 ° * See note

17 - Idler wheel

- Secured to bracket for generator, power steering pump and air conditioning compressor

18 - Special bolt, 25 Nm

- For idler wheel

Installing vibration damper/pulley

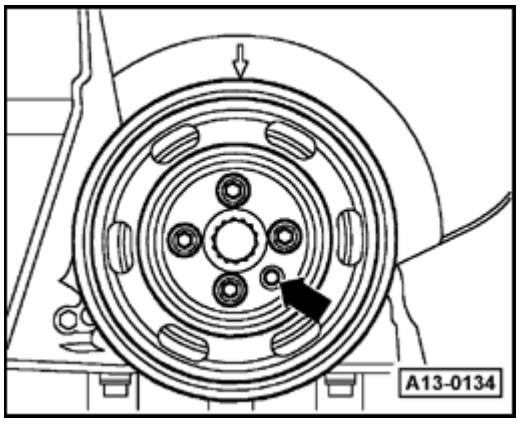

Fig. 66: Installing Vibration Damper/Pulley
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Lock carrier in service position --> **Lock carrier, moving to service position**.
- Removing ribbed belt --> **Ribbed belt, removing and installing**.

- When installing vibration damper, only use genuine bolts

- Vibration damper can only be installed in one position: Hole - **arrow** - in vibration damper must fit over projection on toothed belt sprocket.

Ribbed belt, removing and installing

Special tools, testers and auxiliary items required

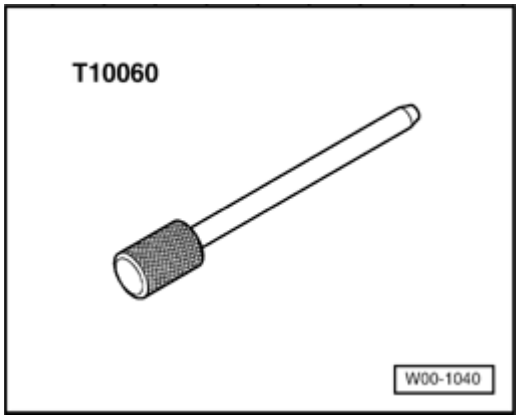

Fig. 67: Mandrel T10060
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Mandrel T10060

Removing

NOTE:

- **Mark direction of the ribbed belt with chalk or felt-tip pen prior to removal. Running a used belt in the opposite direction could destroy it. When installing the belt, make sure it is properly seated in the pulleys.**

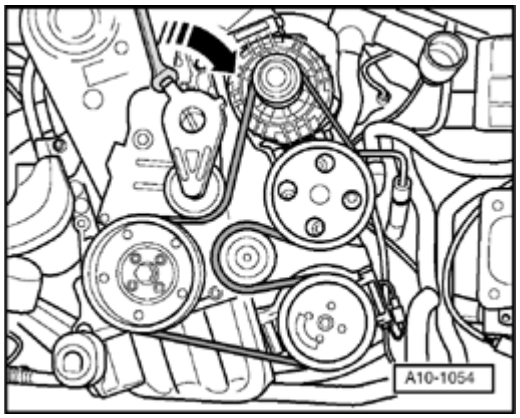

Fig. 68: Swiveling Tensioning Element In, To Loosen Ribbed Belt
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Swivel tensioning element in direction of - **arrow** - to loosen ribbed belt.

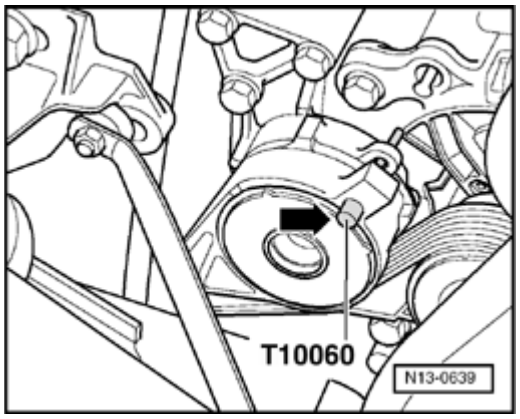

Fig. 69: Locking Tensioner Using Mandrel T10060
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Lock tensioner using mandrel T10060 - **arrow** -.
- Remove ribbed belt.

Installing

- Install in reverse order.

NOTE:

- **Before installing the ribbed belt, make sure that all mechanical units (generator, air conditioning compressor, power steering pump) are securely attached.**
- **When installing the ribbed belt, make sure that the direction of rotation is correct and that the belt is installed correctly in the pulleys.**
- **On vehicles with an air conditioner, install the ribbed belt to the air conditioning compressor last.**
- **If the vibration damper/pulley is replaced, refer to Installing vibration damper/pulley.**

- Install ribbed belt.

On completion of work, always:

- Start engine and check belt running.

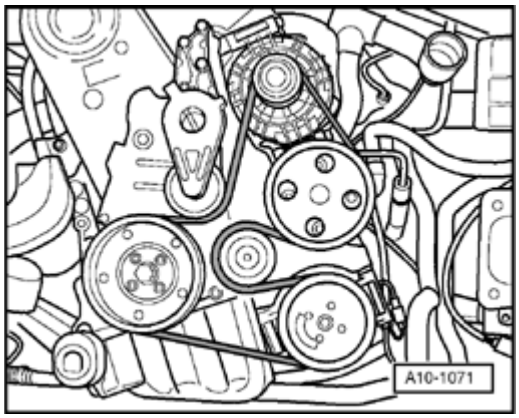

Fig. 70: Correctly Installed Belt
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Correctly installed belt

Bracket for generator, power steering pump and air conditioning compressor, removing and installing

Removing

- Lock carrier in service position --> **Lock carrier, moving to service position**.
- Removing ribbed belt --> **Ribbed belt, removing and installing**.
- Draining cooling system --> **Cooling system, draining and filling**.

- Obtain and record radio anti-theft code for vehicles with a coded radio.

See Caution for disconnecting Telematics battery --> **Engine, disassembling and assembling**

- Disconnect battery Ground (GND) strap with ignition switched off.

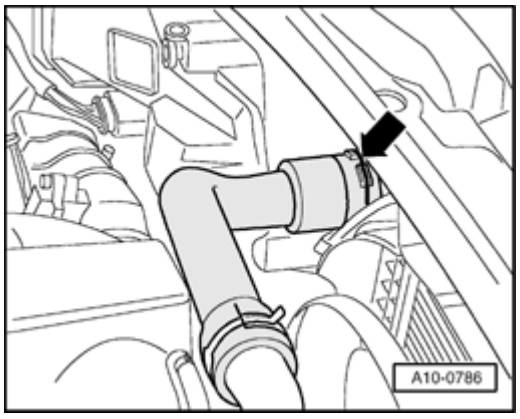

Fig. 71: Disconnecting Top Coolant Hose From Radiator
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect top coolant hose from radiator - **arrow** -.

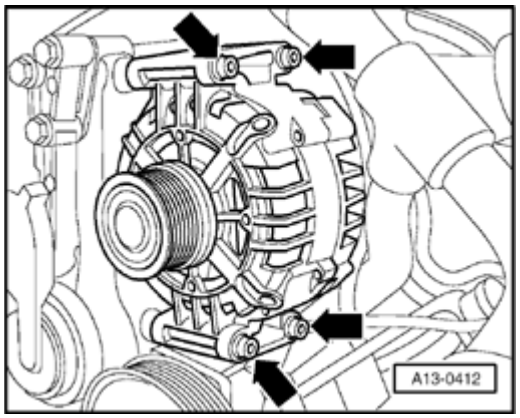

Fig. 72: Unboltin Generator From Bracket
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unbolt generator from bracket.
- Disconnect wiring from generator.
- Remove generator.
- Unbolt supports and braces from bracket for generator, power steering pump and viscous pump:

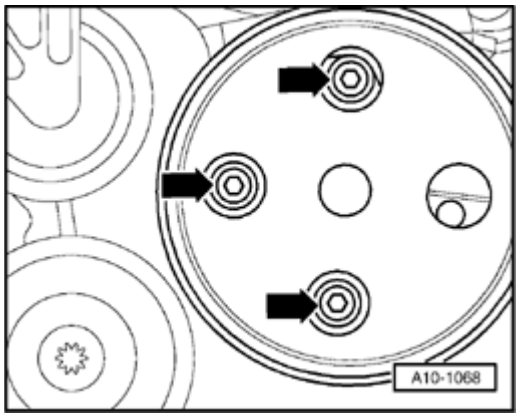

Fig. 73: Unbolting Power Steering Pump At Ribbed Belt Side
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unbolt power steering pump at ribbed belt side; bolts can be accessed through pulley. Do not disconnect connections.

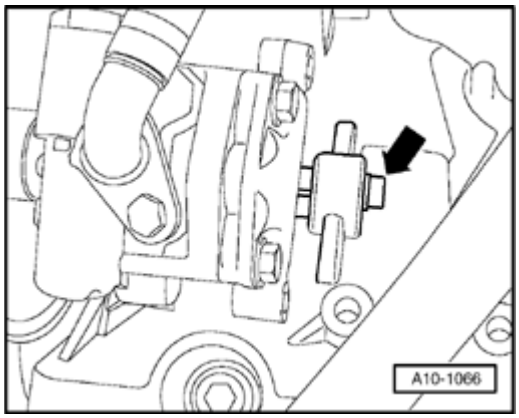

Fig. 74: Unbolting Power Steering Pump From Rear Bracket
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unbolt power steering pump from rear bracket.
- Place power steering pump to one side.

CAUTION: Air conditioner refrigerant circuit must not be opened.

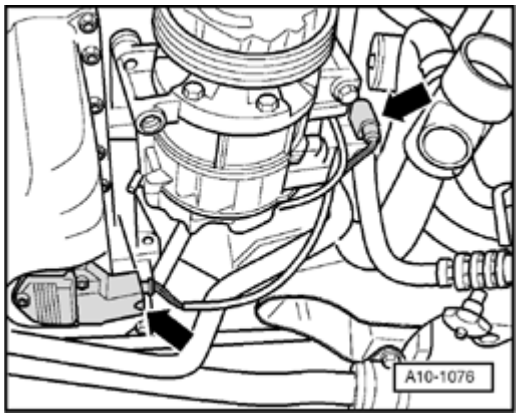

Fig. 75: Disconnecting Compressor Clutch Connector From Air Conditioning Compressor & Oil Level Gauge Connector From Oil Pan
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect air conditioning compressor connector - **right arrow** -.

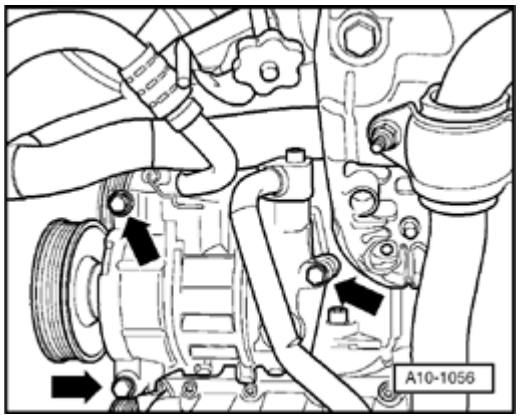

Fig. 76: Unbolting Air Conditioning Compressor From Bracket
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unbolt air conditioning compressor from bracket.
- Hang air conditioning compressor with lines still connected at left of vehicle.

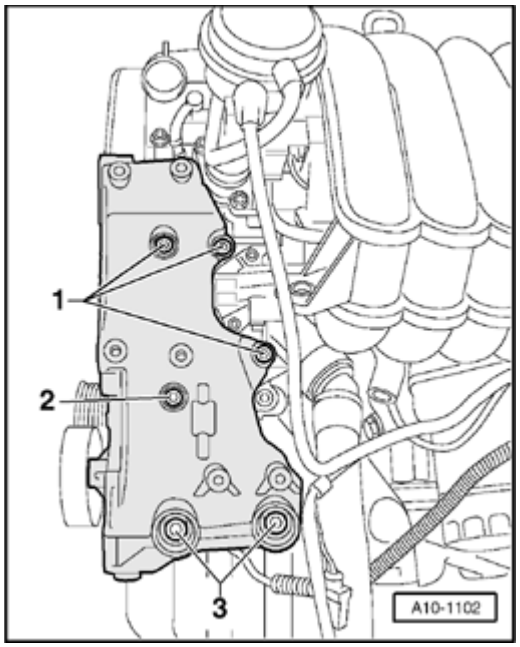

Fig. 77: Removing/Installing Bracket For Generator, Power Steering Pump And A/C Compressor At Bolts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bracket for generator, power steering pump and A/C compressor at bolts - **1** - through - **3** -.

Only for replacement of bracket

- Remove idler roller for ribbed belt from bracket for generator, power steering pump and A/C compressor.

Installing

Install in reverse order, paying attention to the following:

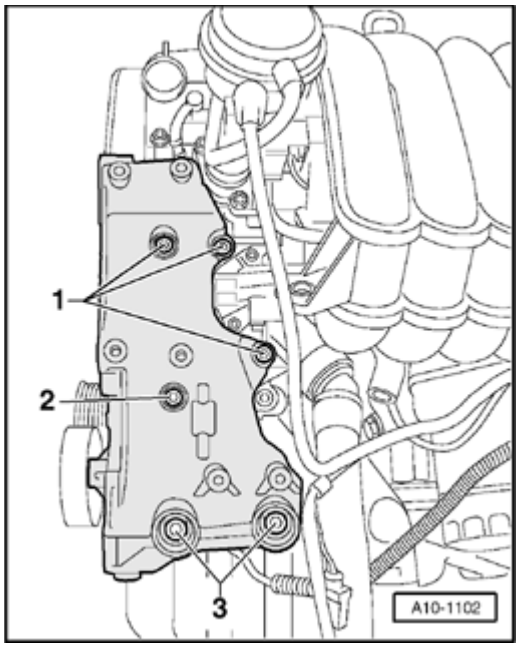

Fig. 78: Removing/Installing Bracket For Generator, Power Steering Pump And A/C Compressor At Bolts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Replace micro-encapsulated (threads coated with locking compound) collared bolts and position bracket for generator, power steering pump and air conditioning compressor on cylinder block.
- Tighten micro-encapsulated collared bolts in diagonal sequence:

1. Bolt M10 x 45
2. Bolt M10 x 75
3. Bolt M10 x 155

Only for replacement of bracket

- Bolt idler wheel for ribbed belt to bracket for generator, power steering pump and air conditioning compressor.

All models

- To ease installation of power steering pump, knock back bushing on rear securing bolt slightly.
- Install ribbed belt --> **Ribbed belt, removing and installing**.
- Fill cooling system --> **Cooling system, draining and filling**.

See Caution for connecting Telematics battery --> **Engine, disassembling and assembling**

- After connecting battery, enter radio anti-theft code. Radio operating instructions.
- Use electric window lifters to completely close door windows.
- Then actuate all window lifter switches again for at least 1 second in "close" position to activate

automatic one-touch function.

- Set clock to correct time.

Tightening torques

Component		Nm
Idler wheel for ribbed belt to bracket		25
Bracket for generator, power steering pump and A/C compressor to cylinder block		40
Support for intake manifold		20
A/C compressor to bracket		25

Component		Nm
Generator to bracket		20
Power steering pump to bracket		20
Hose clamps for coolant hoses		2
Hose clamps for air hoses		3.5

Toothed belt drive, overview

NOTE:

- **Mark direction of toothed belt with chalk or felt-tip pen prior to removal. Running a used belt in the opposite direction could destroy it.**

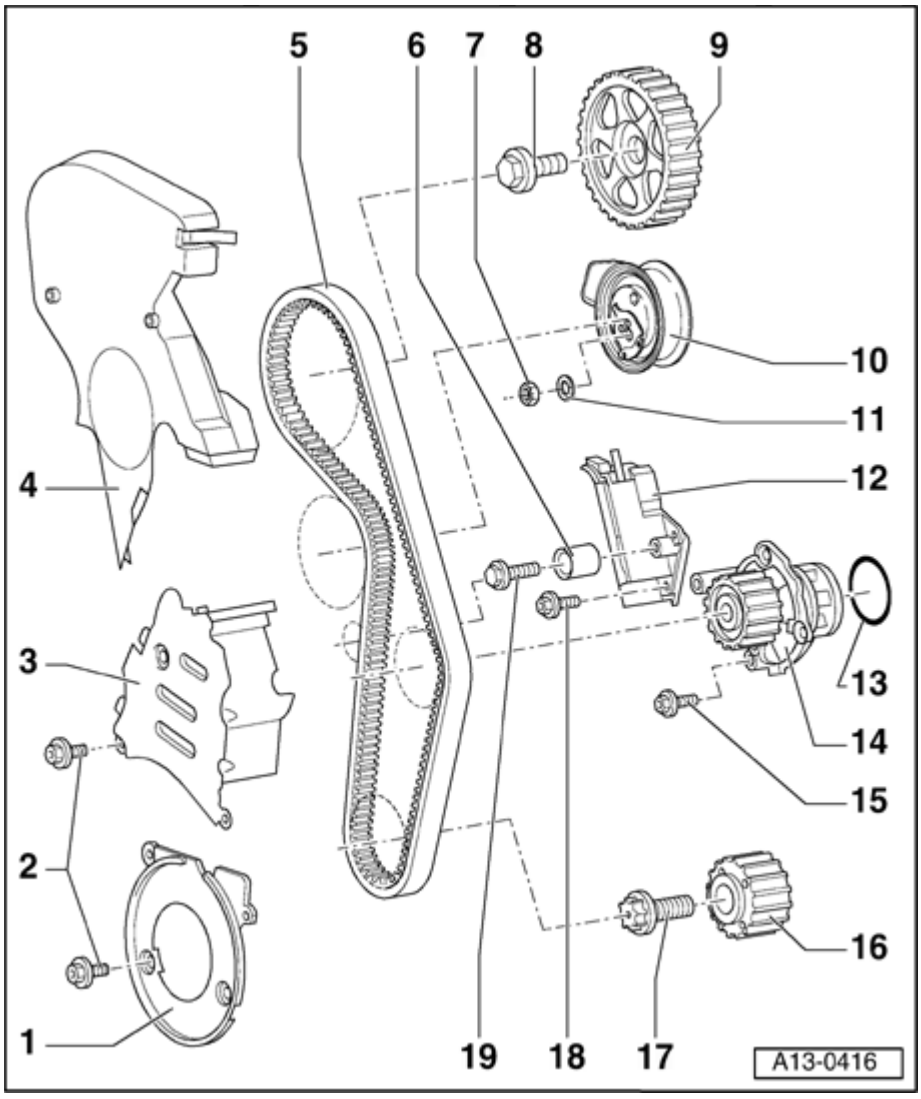

Fig. 79: Toothed Belt Drive, Overview
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Toothed belt guard (lower)

- To remove, unbolt vibration damper

2 - 10 Nm

- Apply D 000 600 when installing

3 - Toothed belt guard (center)

- To remove, unbolt ribbed belt tensioner

4 - Toothed belt guard (top)

- Carefully engage in center section of toothed belt guard when installing

5 - Toothed belt

- Mark direction of rotation with chalk or felt-tip pen before removing
- Check for wear
- Removing --> **Toothed drive belt, removing, installing and tensioning**
- Installing (adjusting valve timing)

6 - Idler wheel

7 - 27 Nm

8 - 65 Nm

- Use counterhold 3036 to loosen and tighten

9 - Camshaft sprocket

- For exhaust camshaft
- To remove and install first remove toothed belt --> **Toothed drive belt, removing, installing and tensioning**
- Installed position **Installed position of camshaft sprocket**

10 - Tensioning roller

11 - Washer

12 - Toothed belt tensioner

13 - O-ring

- Replace
- Coat with coolant G 012 A8 D before installing

14 - Coolant pump

- Removing and installing --> **Coolant pump, removing and installing**

15 - 15 Nm

16 - Crankshaft toothed belt sprocket

- Contact surface between toothed belt sprocket and crankshaft must be free of oil
- Removing and installing **Removing and installing crankshaft toothed belt sprocket**

17 - 90 Nm + 1/4 turn (90 °) further

- Replace
- Do not use oil
- Use counterhold tool 3415 to loosen and tighten

18 - 15 Nm

19 - 25 Nm

Installed position of camshaft sprocket

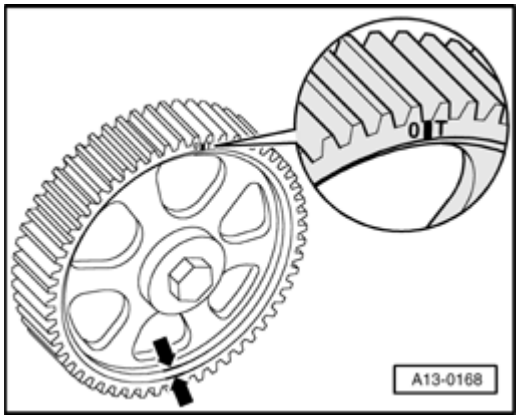

Fig. 80: Identifying Camshaft Gear Thin Rib Toward Outside And TDC Marking Visible
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Narrow chamfer of camshaft sprocket must face outward - **arrows** - and marking for TDC No. 1 cylinder must be visible from front.

Removing and installing crankshaft toothed belt sprocket

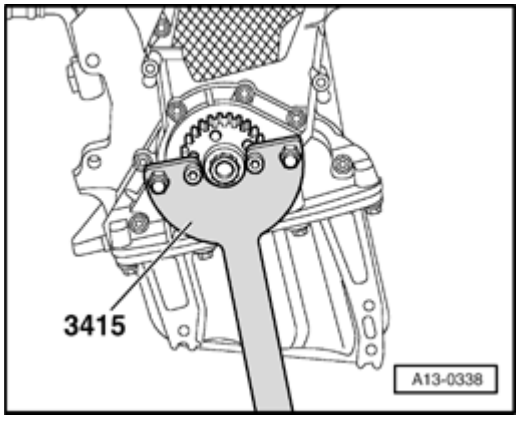

Fig. 81: Removing And Installing Crankshaft Toothed Belt Sprocket
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Use counterhold tool 3415 to loosen and tighten central bolt.

Toothed drive belt, removing, installing and tensioning

(Adjusting valve timing)

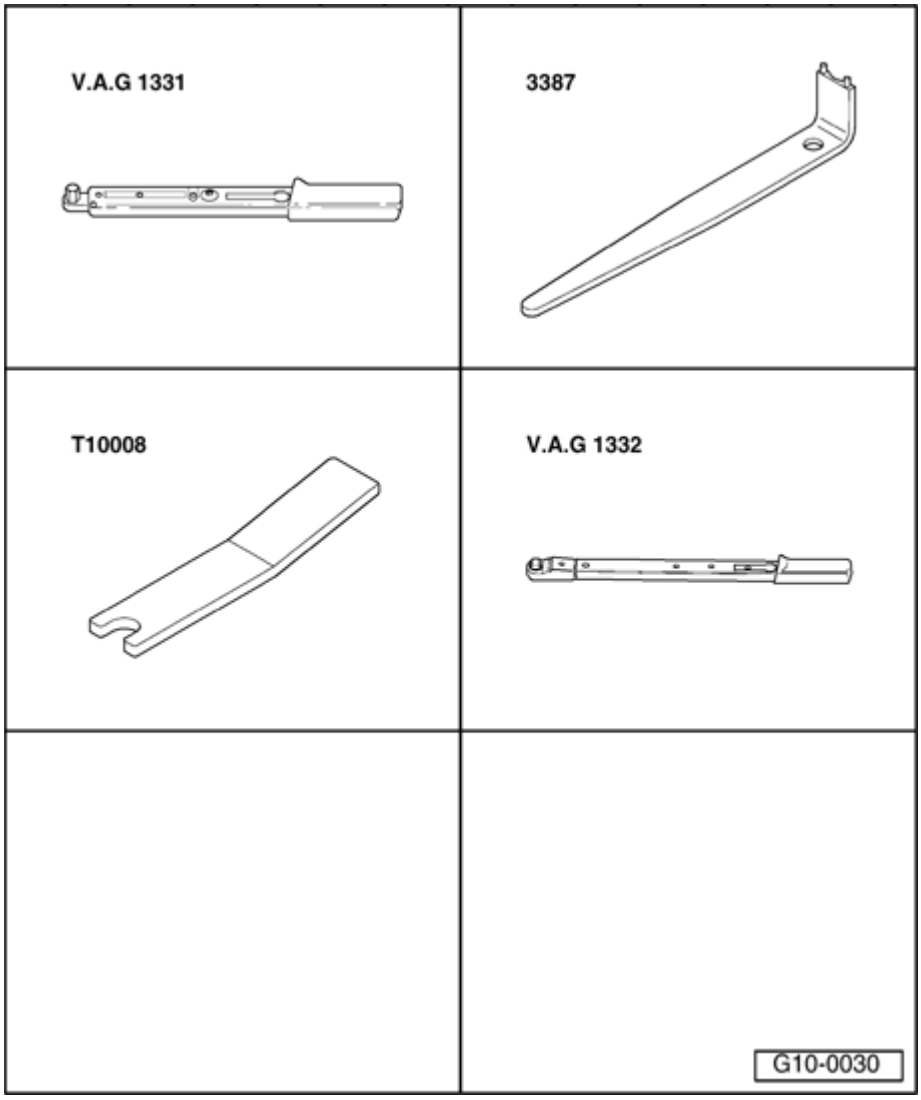

Fig. 82: Identifying Special Tools - Toothed Drive Belt, Removing, Installing And Tensioning
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools, testers and auxiliary items required

- torque wrench (5 to 50 Nm) VAG1331
- Locking plate T10008
- torque wrench (40 to 200 Nm) VAG1332
- Special tool 3387

Removing

- With engine in vehicle.

  - Move lock carrier to service position --> **Lock carrier in service position, overview**.

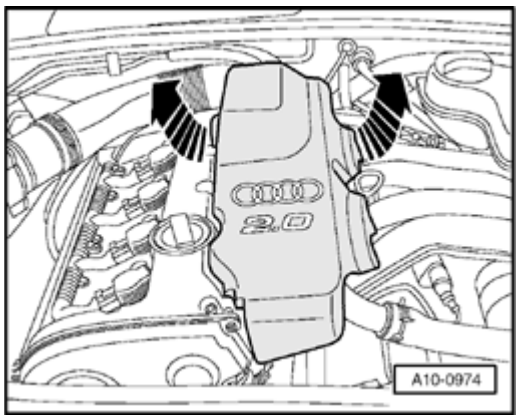

Fig. 83: Removing Engine Cover By Lifting Up
Courtesy of VOLKSWAGEN UNITED STATES, INC.

  - Remove engine cover by lifting up - **arrows** -.
  - Remove ribbed belt --> **Ribbed belt, removing and installing**.

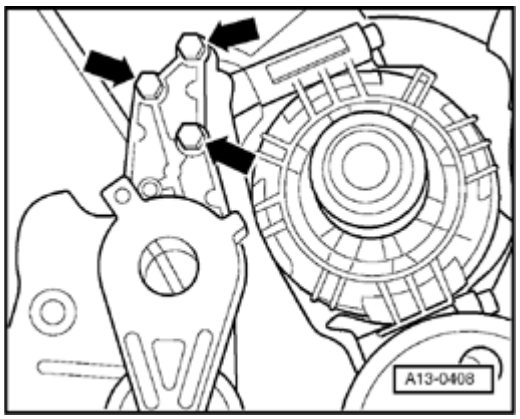

Fig. 84: Removing/Installing Ribbed Belt Tensioner
Courtesy of VOLKSWAGEN UNITED STATES, INC.

  - Remove ribbed belt tensioner - **arrows** -.

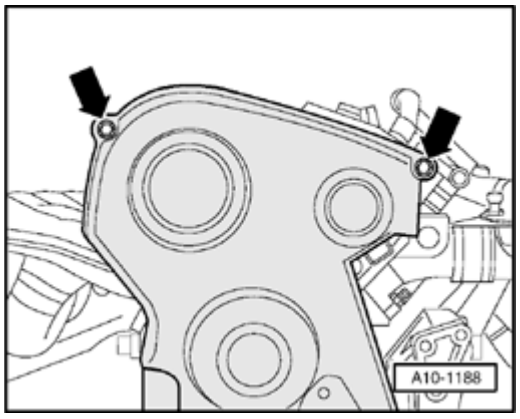

Fig. 85: Removing Upper Part Of Drive Belt Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove upper part of drive belt cover.

NOTE:

- **Take special note of the installed position of the upper part of the drive belt cover, particularly where it meets the center part of the drive belt cover.**

CAUTION: The engine must only be turned in the direction of engine rotation (clockwise) at the crankshaft.

NOTE:

- **To turn the engine over use the center bolt on the crankshaft.**

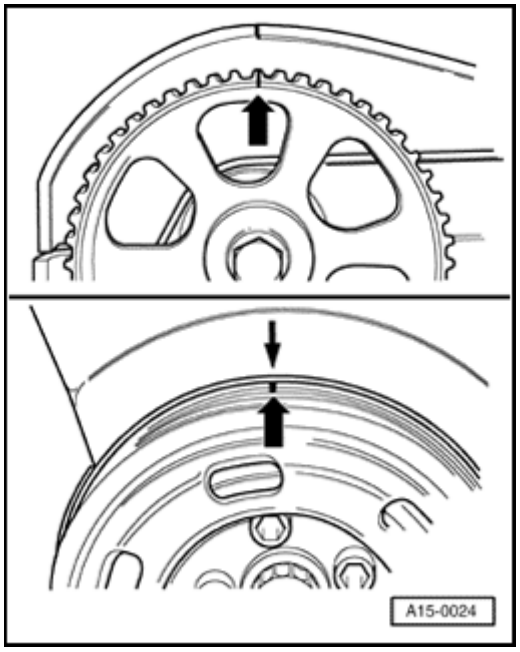

Fig. 86: Identifying Marking On Camshaft Gear Aligned With Marking On Cylinder Head Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Bring engine to TDC cylinder 1 by turning crankshaft in direction of engine rotation, using center camshaft drive sprocket bolt on crankshaft. Mark on camshaft sprocket and mark on crankshaft must be at TDC cylinder 1 - **arrows** -.

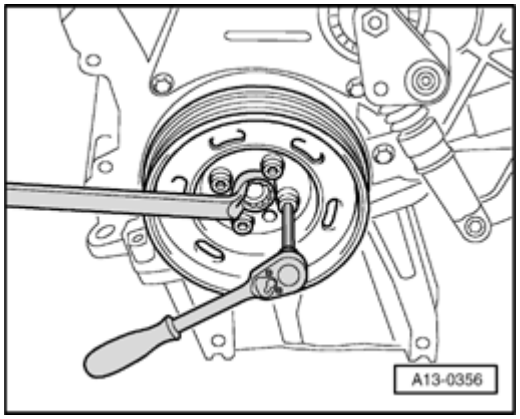

Fig. 87: Removing/Installing Vibration Damper/Belt Pulley
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unbolt vibration damper.

Fig. 88: Removing Center And Lower Part Of Drive Belt Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove center and lower part of drive belt cover.

CAUTION: The drive belt tensioner is oil-damped and can only be compressed slowly and with evenly applied force.

When compressing the tensioner, excessive force can damage the tensioning pulley.

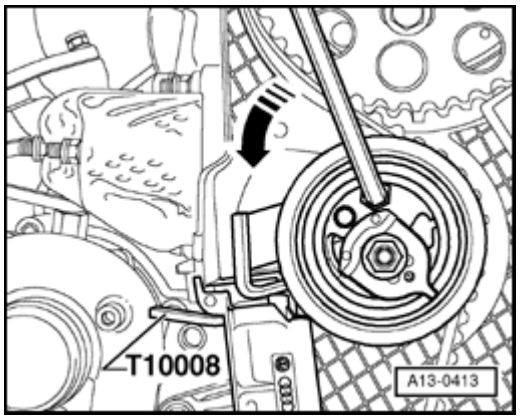

Fig. 89: Inserting An Allen Wrench Into Socket-Head
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Push pulley on counter-clockwise in direction of - **arrow** - with a socket head wrench using even but not excessive application of force until tensioner piston can be locked with locking plate T10008.

NOTE:

- **The stop tab of the eccentric bolt must not be bent.**

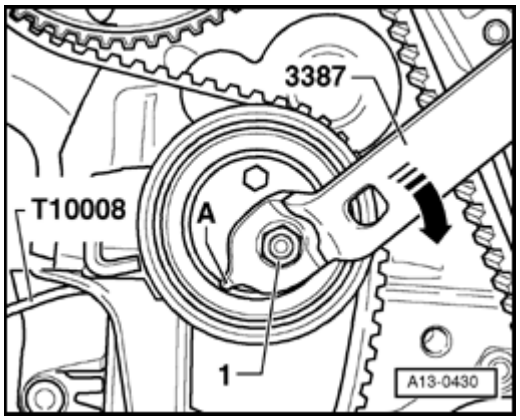

Fig. 90: Releasing Tension Of Tensioner Roller
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- To release tension from drive belt, loosen nut - **1** - on pulley and rotate eccentric bolt clockwise in direction of - **arrow** - using special tool 3387.
- Mark direction of rotation of drive belt with chalk or felt tip pen.
- Remove drive belt.

Installing (adjusting valve timing)

NOTE:

- **Even with repairs which require the drive belt to be removed only from the camshaft sprocket, the drive belt adjustment must be performed as follows.**
- **When rotating the camshaft the crankshaft must not be at TDC for any**

cylinder. Risk of damaging valves/piston crown.

- Place drive belt on crankshaft sprocket (observe direction of rotation).
- Install lower part of drive belt cover.

NOTE:

- **The vibration damper/pulley can be installed in only one position. The hole - arrow - in the vibration damper must be located over the raised part on the crankshaft drive belt sprocket.**

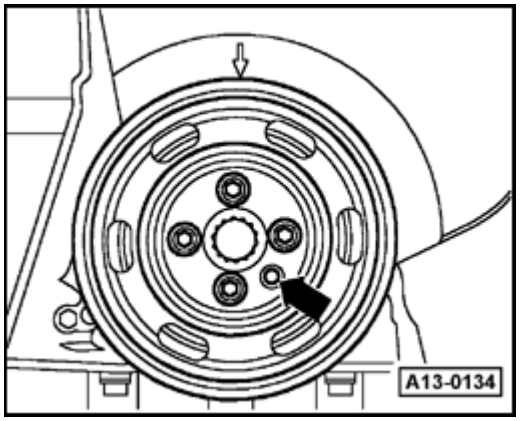

Fig. 91: Tightening Vibration Damper/Pulley, Take Note Of Locating Point
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Tighten vibration damper/pulley, take note of locating point - **arrow** -.

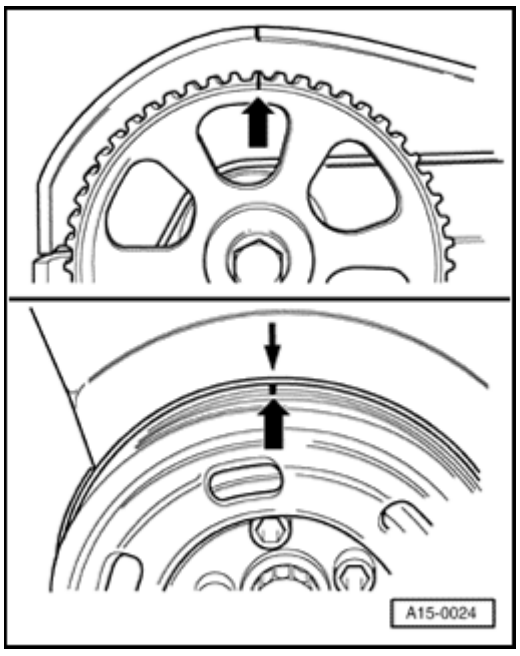

Fig. 92: Identifying Marking On Camshaft Gear Aligned With Marking On Cylinder Head Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Align camshaft sprocket-to-cylinder head cover positioning marks and vibration damper-to-drive belt cover positioning marks.
- Install drive belt in this order: water pump, tensioning pulley, camshaft sprocket.

Tensioning drive belt

If the drive belt tensioner is completely extended:

CAUTION: If the drive belt tensioner is at its travel limit, it must be pushed back in the installed position together with the pulley. This procedure can take up to 5 minutes.

When compressing the tensioner, excessive force can damage the tensioning pulley.

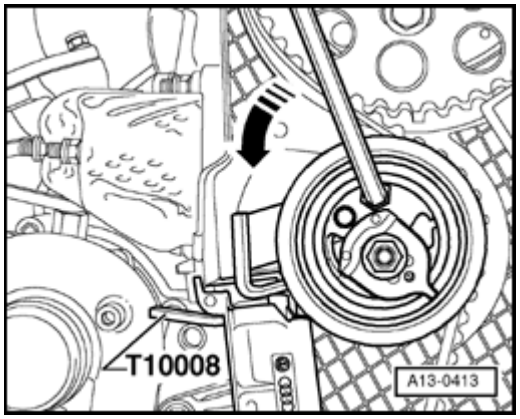

Fig. 93: Inserting An Allen Wrench Into Socket-Head
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Push pulley on counter-clockwise in direction of - **arrow** - with a socket head wrench using even but not excessive application of force until tensioner piston can be locked with locking plate T10008.

All

NOTE:

- **The stop tab of the eccentric bolt must not be bent.**

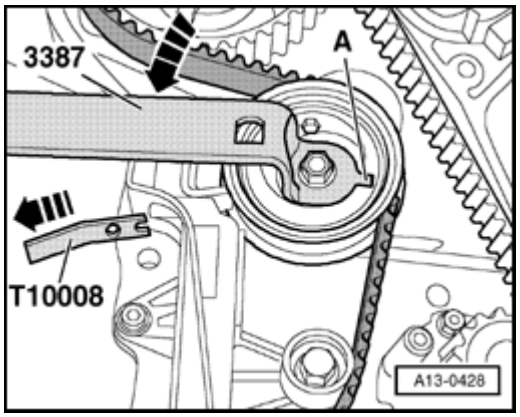

Fig. 94: Adjusting Tensioning Roller
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Turn eccentric bolt counter-clockwise in direction of - **arrow** - using special tool 3387.
- Hold eccentric bolt in this position and withdraw locking plate T10008.

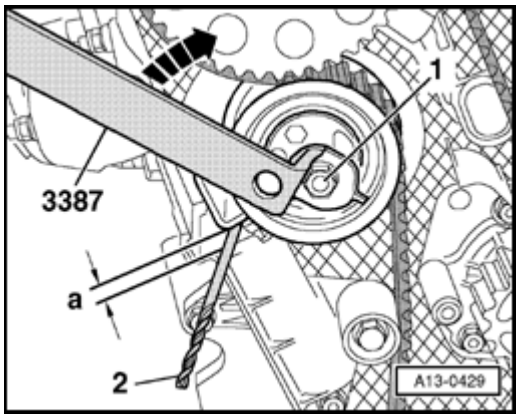

Fig. 95: Checking Tensioning Roller Specified Dimension
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Turn eccentric bolt clockwise to right in direction of - **arrow** - until a gauge - **2** - with dimension - **a** - (e.g. drill bit) can be passed between tensioning lever and tensioner housing.

- Dimension a = 8 mm

- Hold eccentric bolt in this position and tighten pulley nut - **1** -.

Tightening torque: 27 Nm

CAUTION: The engine must only be turned in the direction of engine rotation (clockwise) at the crankshaft.

NOTE:

- **To turn the engine over apply tool at the center bolt on the crankshaft.**

- Turn crankshaft two complete turns in direction of engine rotation until crankshaft is at TDC again.

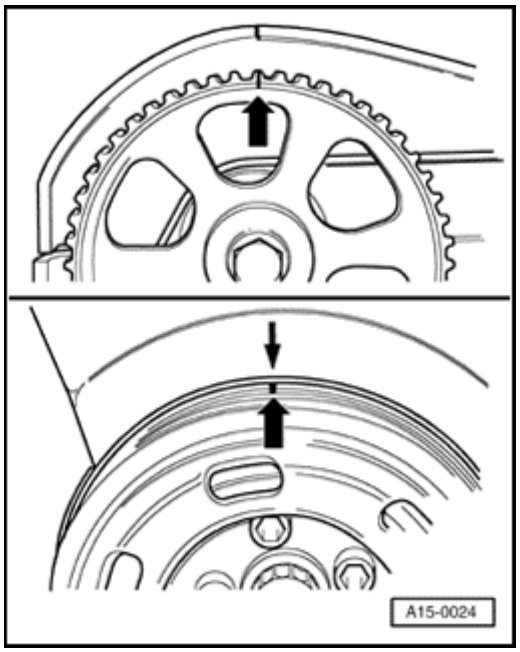

Fig. 96: Identifying Marking On Camshaft Gear Aligned With Marking On Cylinder Head Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Mark on camshaft sprocket and mark on crankshaft must be at TDC cylinder 1 - **arrows** -.

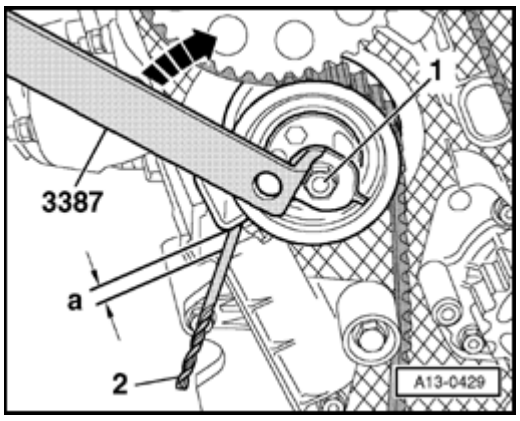

Fig. 97: Checking Tensioning Roller Specified Dimension
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Check dimension - **a** - between tensioning lever and tensioner housing with a gauge - **2** - (e.g. drill bit).

- Dimension a = 6 - 10mm

If dimension -a- is not obtained

CAUTION: The drive belt tensioner is oil-damped and can only be compressed slowly

and with evenly applied force.

When compressing the tensioner, excessive force can damage the tensioning pulley.

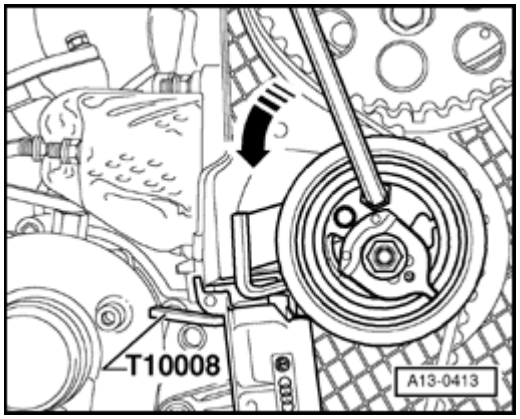

Fig. 98: Inserting An Allen Wrench Into Socket-Head
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Push pulley on counter-clockwise in direction of - **arrow** - with a socket head wrench using even but not excessive application of force until tensioner piston can be locked with locking plate T10008.

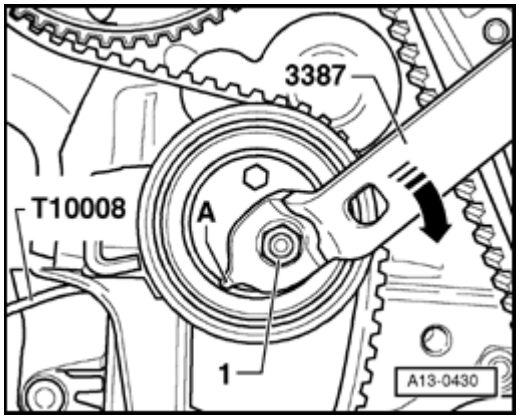

Fig. 99: Releasing Tension Of Tensioner Roller
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Loosen nut - **1** - on pulley.
- Continue under "Tensioning drive belt".

If dimension -a- is obtained

- Install center and upper drive belt cover.

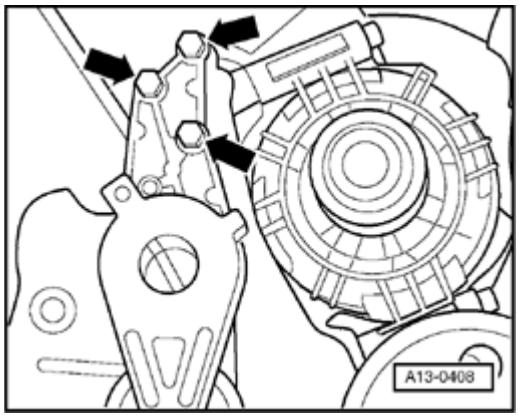

Fig. 100: Removing/Installing Ribbed Belt Tensioner
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Install ribbed belt tensioner.
- Install ribbed belt --> **Ribbed belt, removing and installing**.

Tightening Torques

Component		Nm
Lower drive belt cover at cylinder block		10 * See note
Center drive belt cover at cylinder block		10 * See note
Ribbed belt tensioner at bracket		23
Vibration damper/pulley at crankshaft		10 + 90 ° * See note
Drive belt tensioning pulley		27

*Install using locking adhesive

*Replace bolts

* 90 ° equals one quarter turn

Toothed drive belt, removing from camshaft sprocket

Special tools, testers and auxiliary items required

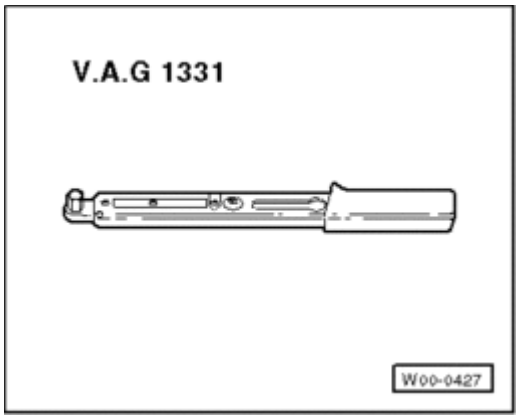

Fig. 101: Identifying Torque Wrench V.A.G. 1331
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- torque wrench (5 to 50 Nm) VAG1331

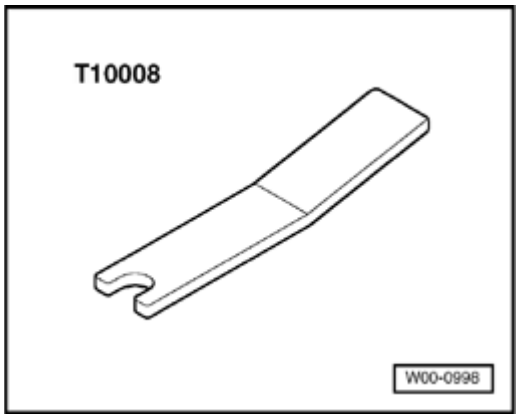

Fig. 102: Identifying Marking Plate T10008 (For Engines With Hydraulic Tensioning Device)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Locking plate T10008
- With engine in vehicle.

Removing

- Move lock carrier to service position --> **Lock carrier in service position, overview**.

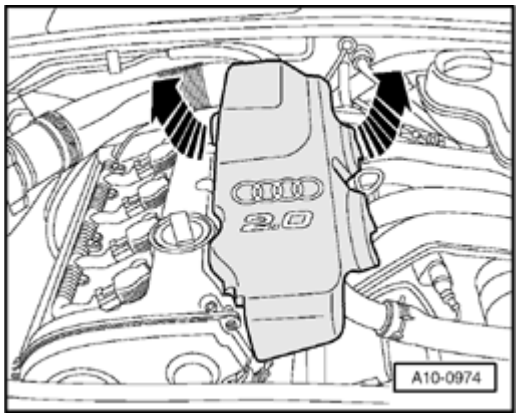

Fig. 103: Removing Engine Cover By Lifting Up
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove engine cover by lifting up - **arrows** -.
- Remove ribbed belt --> **Ribbed belt, removing and installing**.

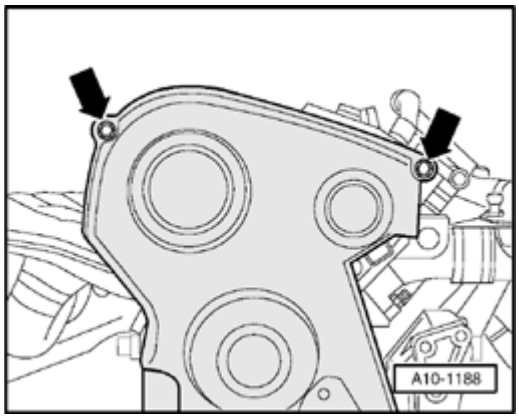

Fig. 104: Removing Upper Part Of Drive Belt Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove upper part of drive belt cover.

NOTE:

- **Take special note of the installed position of the upper part of the drive belt cover particularly where it meets the center part of the drive belt cover.**

CAUTION: The engine must only be turned in the direction of the engine rotation (clockwise) at the crankshaft.

NOTE:

- **To turn the engine over use the center bolt on the crankshaft.**

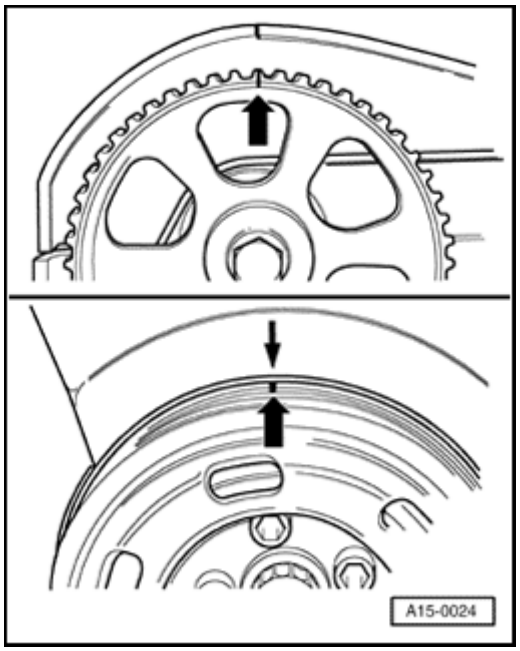

Fig. 105: Identifying Marking On Camshaft Gear Aligned With Marking On Cylinder Head Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Bring engine to TDC on cylinder 1 and turn crankshaft in direction of engine rotation using center camshaft drive sprocket bolt on camshaft. Mark on camshaft sprocket and mark on crankshaft must be at TDC cylinder 1 - **arrows** -.

CAUTION: The drive belt tensioner is oil-damped and can only be compressed slowly and with evenly applied force.

When compressing the tensioner, excessive force can damage the tensioning pulley.

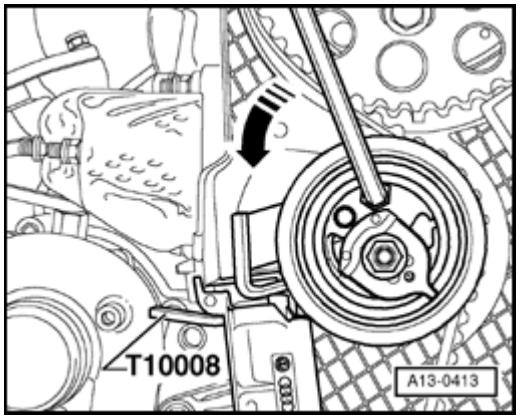

Fig. 106: Inserting An Allen Wrench Into Socket-Head
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Push pulley on counter-clockwise in direction of - **arrow** - with a socket head wrench using even but not

excessive application of force until tensioner can be locked with locking plate T10008.

NOTE:

- **The stop tab of the eccentric bolt must not be bent.**

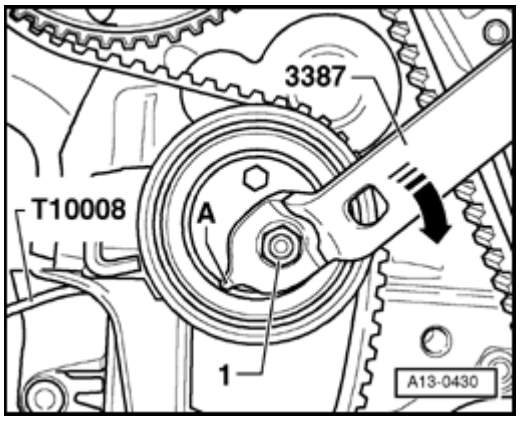

Fig. 107: Releasing Tension Of Tensioner Roller
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- To release tension from drive belt, loosen nut - **1** - on pulley and rotate eccentric bolt clockwise in direction of - **arrow** - using special tool 3387.
- Remove drive belt from camshaft.

Installing

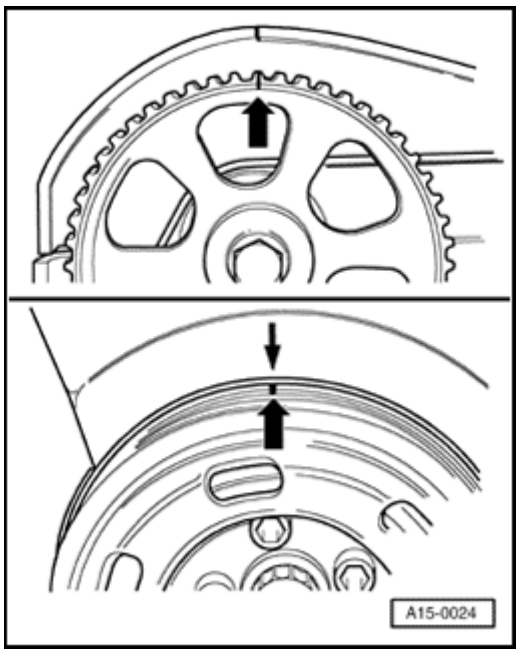

Fig. 108: Identifying Marking On Camshaft Gear Aligned With Marking On Cylinder Head Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Align camshaft sprocket-to-cylinder head cover positioning marks and vibration damper-to-drive belt

cover positioning marks.

- Install drive belt in this order: water pump, idler pulley, camshaft sprocket.
- Tension drive belt.

Tightening Torques

Component	Nm
Drive belt cover at the cylinder block	10 * See note
Lower drive belt cover at cylinder block	10 * See note
Center drive belt cover at cylinder block	10 * See note
Vibration damper/pulley at crankshaft	10 + 90 ° * See note
Ribbed belt tensioner at bracket	23
Drive belt tensioning pulley	27

*Install using locking adhesive

*Replace bolts

* 90 ° equals one quarter turn

SEALING FLANGES AND FLYWHEEL/DRIVE PLATE, REMOVING AND INSTALLING

Sealing flanges and flywheel/drive plate, removing and installing

NOTE:

- **Servicing work on clutch:**
- **-->**
  - **30 CLUTCH for 5 SPD. MANUAL TRANSMISSION 012/01W FRONT WHEEL DRIVE**
  - **30 CLUTCH for 5 SPD. MANUAL TRANSMISSION 01A ALL WHEEL DRIVE**
  - **30 CLUTCH for 6 SPD. MANUAL TRANSMISSION 01E ALL WHEEL DRIVE**
  - **30 CLUTCH for 6-SPEED MANUAL TRANSMISSION 01X, FRONT-WHEEL DRIVE**
  - **30 CLUTCH for 6-SPEED MANUAL TRANSMISSION 02X, FOUR-WHEEL DRIVE**
  - **30 CLUTCH for 6-SPEED MANUAL TRANSMISSION 0A3, ALL WHEEL DRIVE**

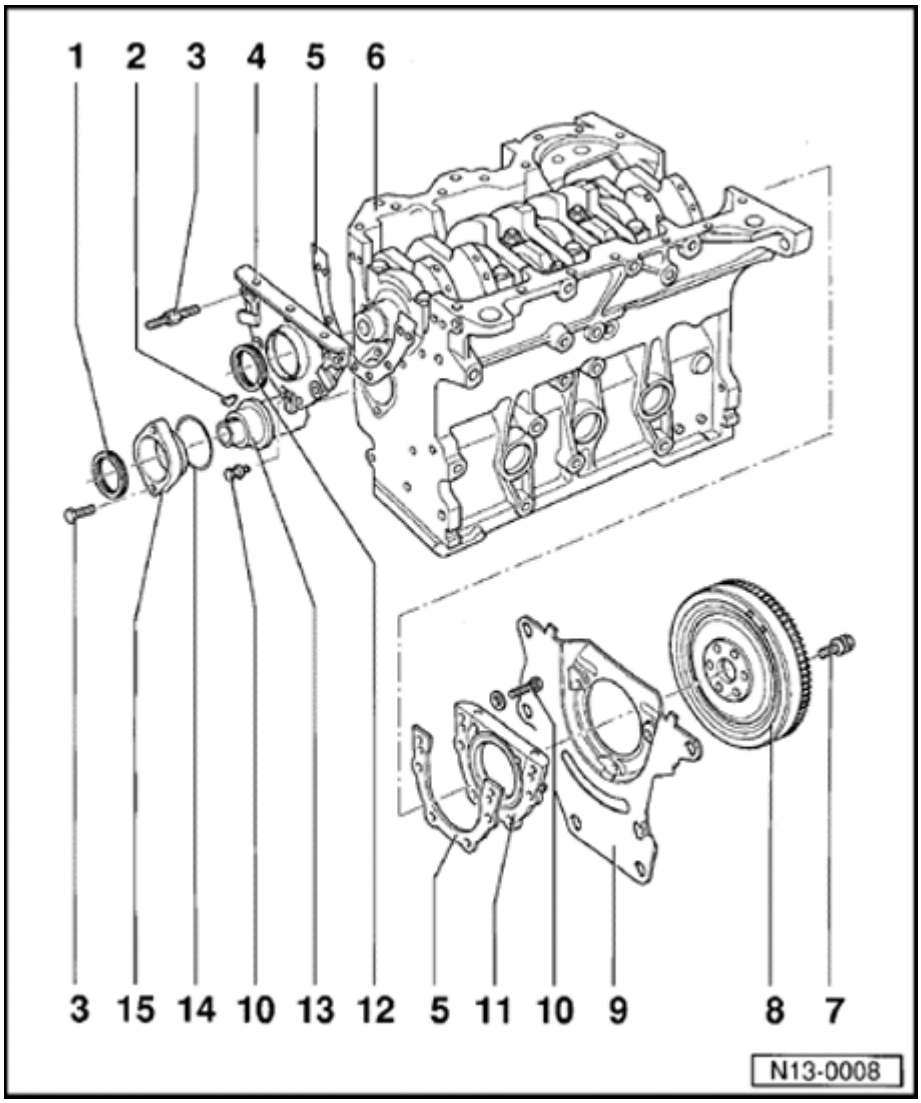

Fig. 109: Sealing Flanges And Flywheel/Drive Plate, Removing And Installing Overview
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Oil seal

- Install with 10-203

2 - Woodruff key

- Make sure key is seated properly

3 - 25 Nm

4 - Front sealing flange

- Remove oil pan to remove and install --> **Oil pan, removing and installing**

5 - Gasket

- Replace

6 - Cylinder block

- Removing and installing crankshaft --> **Crankshaft, removing and installing**
- Disassembling and assembling pistons and connecting rods --> **Pistons and connecting rods, disassembling and assembling**

7 - Securing bolt for dual-mass flywheel/drive plate

- Replace
- Tightening torque for dual-mass flywheel: 60 Nm + 1/2 turn (180 °) further
- Tightening torque for drive plate (vehicles with automatic transmission): 60 Nm + 1/4 turn (90 °) further

8 - Dual-mass flywheel/drive plate

- Removing and installing dual-mass flywheel --> **Dual-mass flywheel/drive plate, removing and installing**
- Removing and installing drive plate

9 - Intermediate plate

- Must be located on dowel sleeves
- Do not damage/bend when installing

10 - 10 Nm

11 - Rear sealing flange

- With oil seal
- Remove oil pan to remove and install --> **Oil pan, removing and installing**
- Replace only as complete assembly

12 - Oil seal

- Replacing --> **Crankshaft oil seal - pulley end, replacing**

13 - Intermediate shaft

- Axial clearance max. 0.25 mm

14 - O-ring

- Replace

15 - Sealing flange for intermediate shaft

Crankshaft oil seal - pulley end, replacing

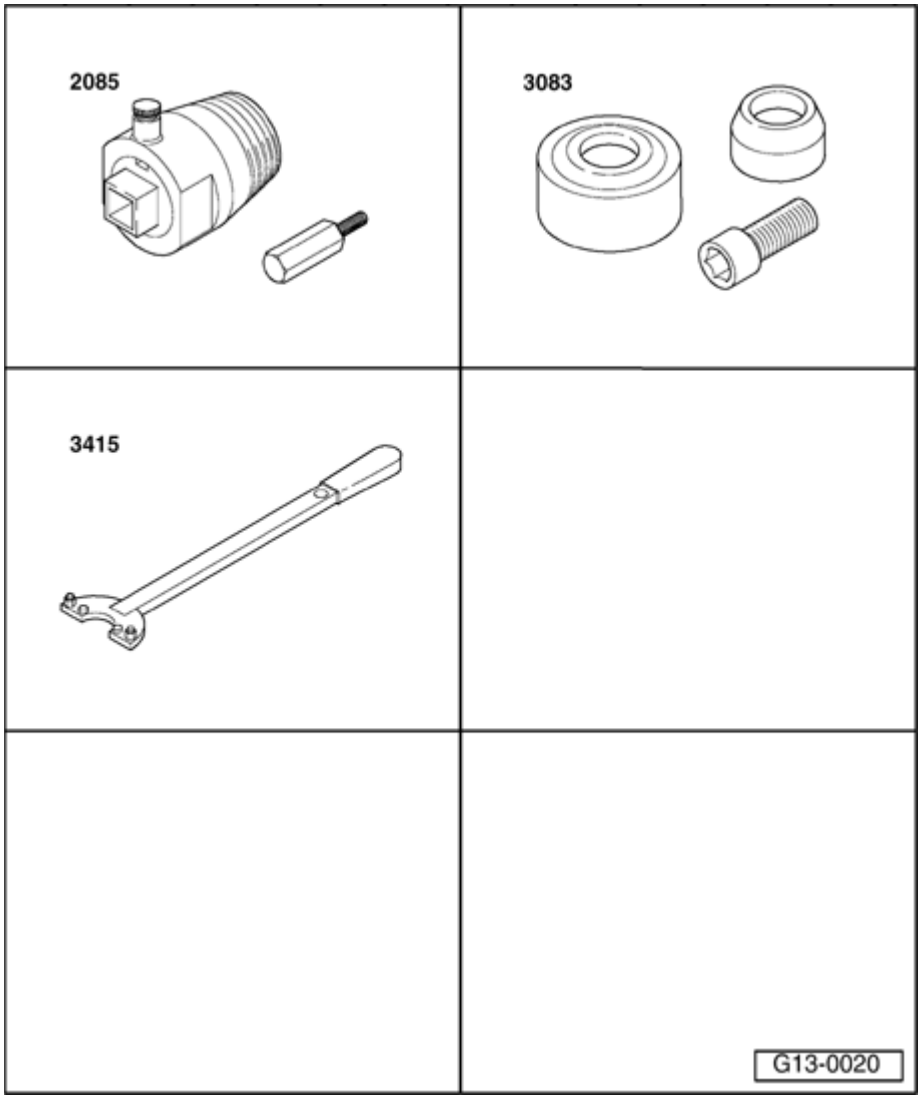

Fig. 110: Identifying Special Tools - Crankshaft Oil Seal - Pulley End, Replacing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools, testers and auxiliary items required

- Oil seal extractor 2085
- Puller 3083
- Counterhold 3415

Removing

- Engine in vehicle.
- Lock carrier in service position --> **Lock carrier, moving to service position**.

  - Remove toothed belt --> **Toothed drive belt, removing, installing and tensioning**.

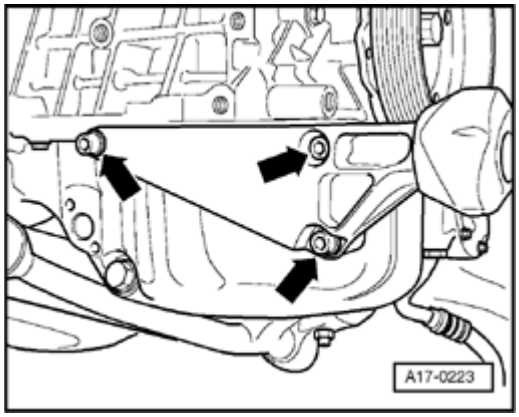

Fig. 111: Unbolting Stop For Torque Reaction Support
Courtesy of VOLKSWAGEN UNITED STATES, INC.

  - Unbolt stop for torque reaction support - **arrows** -.

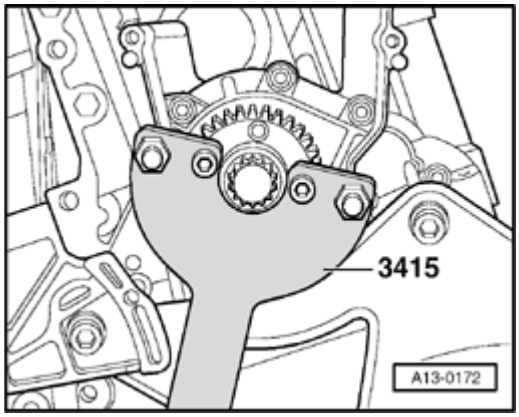

Fig. 112: Removing Crankshaft Toothed Belt Sprocket
Courtesy of VOLKSWAGEN UNITED STATES, INC.

  - Remove crankshaft toothed belt sprocket. To do so, hold sprocket in position with counterhold 3415.

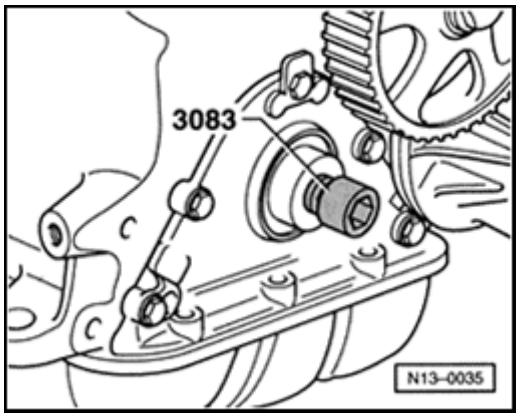

Fig. 113: Screwing Phillips-Head Bolt From 3083 Into Crankshaft
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Before installing oil seal extractor, screw Phillips-head bolt from 3083 into crankshaft as far as it will go.
- Remove inner part of oil seal extractor 2085 two turns (approx. 3 mm) out of outer part and lock with knurled screw.

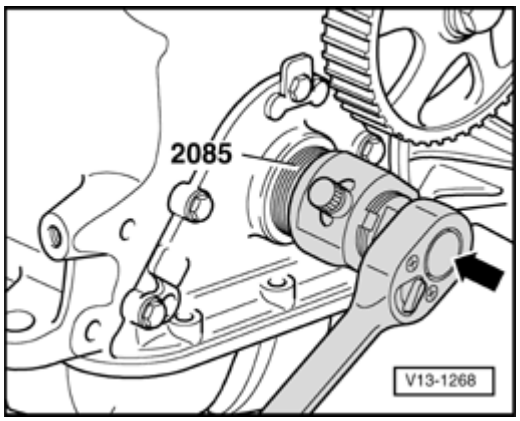

Fig. 114: Identifying Seal Puller 2085
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Lubricate threaded head of oil seal extractor, place in position and exerting firm pressure, screw as far as possible into oil seal.
- Loosen knurled screw and turn inner part against crankshaft until oil seal is pulled out.
- Clamp flats of oil seal extractor in vise. Remove oil seal with pliers.
- Clean contact surface and sealing surface.

Installing

NOTE:

- **Do not oil sealing lip of oil seal.**

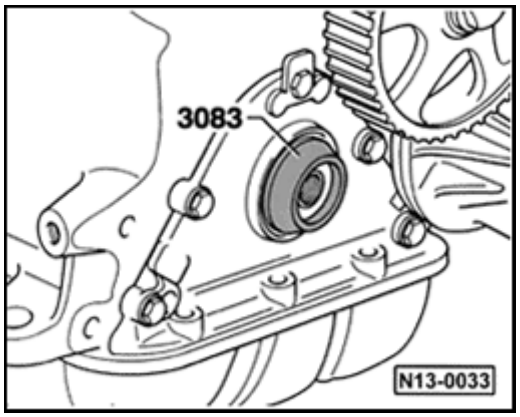

Fig. 115: Installing Guide Sleeve From 3083 Onto Crankshaft Journal
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Install guide sleeve from 3083 onto crankshaft journal.
- Slide oil seal over guide sleeve.

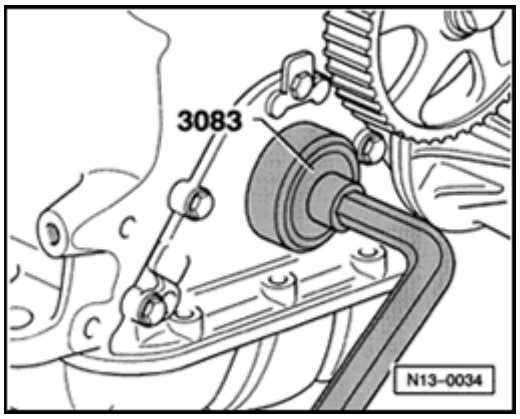

Fig. 116: Pushing In Oil Seal As Far As It Will Go Using Thrust Sleeve And Bolt From 3083
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Push in oil seal as far as it will go using thrust sleeve and bolt from 3083.
- Replace bolt for toothed belt sprocket.

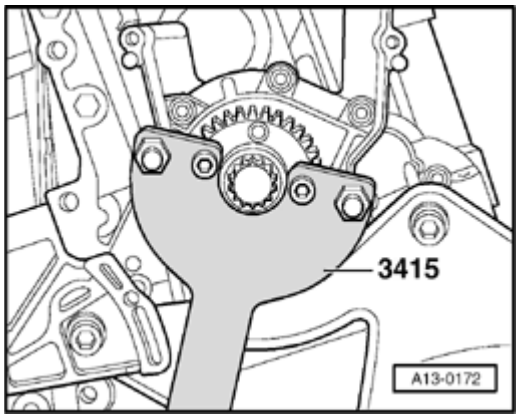

Fig. 117: Removing Crankshaft Toothed Belt Sprocket
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Install crankshaft toothed belt sprocket. To do so, hold sprocket in position with counterhold 3415.

NOTE:

- **Contact surface between toothed belt sprocket and crankshaft must be free of oil.**
- **Do not oil bolt for crankshaft toothed belt sprocket.**

- Install toothed belt (adjust valve timing).
- Install ribbed belt and ribbed belt tensioner.
- Install lock carrier --> **Lock carrier, moving to service position**.

Tightening torque

Component	Nm
Toothed belt sprocket to crankshaft	90 + 90 ° * See note

*Replace bolt

* 90 ° is a quarter turn

Dual-mass flywheel/drive plate, removing and installing

Dual-mass flywheel

Special tools, testers and auxiliary items required

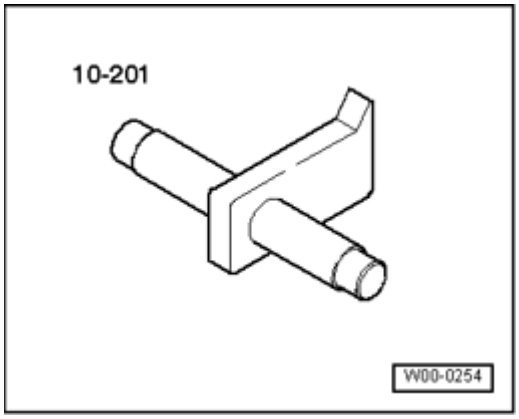

Fig. 118: Counterhold 10-201
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Counterhold 10-201

Removing

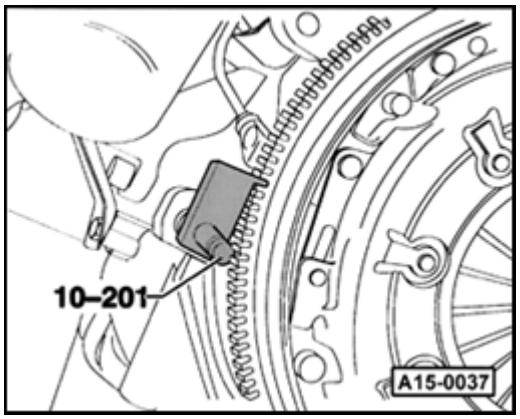

Fig. 119: Reversing Position Of Counterhold 10-201 To Loosen/Tighten Bolts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Reverse position of counterhold 10-201 to loosen/tighten bolts.
- Mark position of flywheel relative to engine.
- Unbolt and remove flywheel.

Installing

Install in reverse order, paying attention to the following:

- Replace bolts.

Component	Nm
Dual-mass flywheel to crankshaft: Bolt length 22.5 mm Bolt length 35.0 mm Bolt length 43.0 mm	60 + 90 [degrees] * See note 60 + 180 [degrees] * See note 60 + 180 [degrees] * See note * See note
Sealing flange to cylinder block	10

* 90 ° is one quarter turn

*Replace bolts

* 180 ° is one half turn

Drive plate

Special tools, testers and auxiliary items required

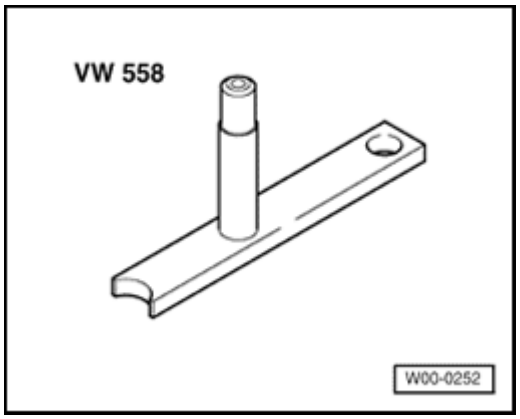

Fig. 120: Identifying Counterhold VW 558
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Counterhold VW558
- Hex bolt M8 x 45 and two M10 hex nuts
- Calliper gauge or depth gauge

Removing

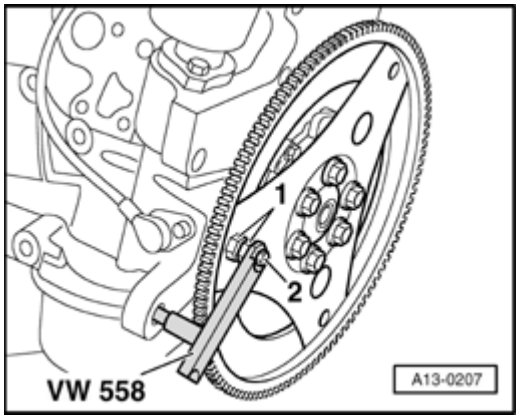

Fig. 121: Securing Counterhold VW558 To Drive Plate
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Secure counterhold VW558 to drive plate using hex bolt M8 x 45 - 2-. Place two M10 hex nuts - **1** - between counterhold and drive plate.
- Mark position of drive plate relative to engine.
- Unbolt drive plate.

Installing

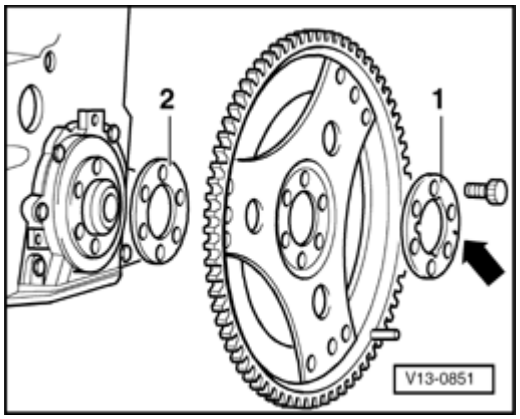

Fig. 122: Identifying Drive Plate, Grooved Washer And New Bolt
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Locate drive plate with shim - **2** - and packing plate - **1** -. Lug - **arrow** - must face toward torque converter.
- Insert at least 3 old securing bolts and tighten to 30 Nm.

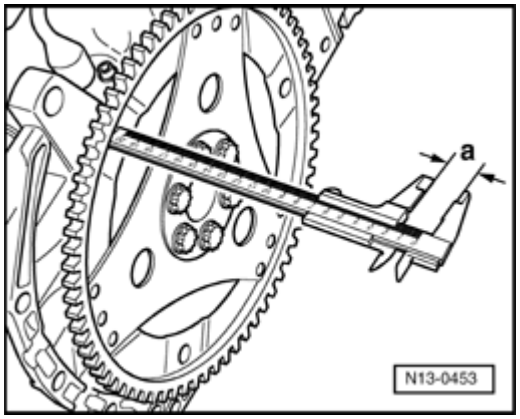

Fig. 123: Checking Distance Between Drive Plate And Cylinder Block
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Perform measurement by passing sliding calliper with depth gauge through hole used for securing converter.

- Specification: 18.9... 20.5 mm

If measured value exceeds specification:

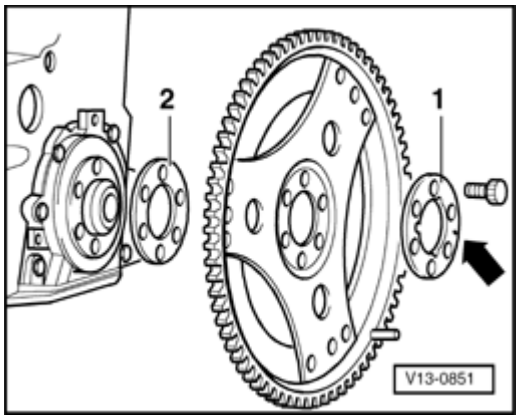

Fig. 124: Identifying Drive Plate, Grooved Washer And New Bolt
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove drive plate again and correct value by installing with/without shim - **2** -. Tighten bolts to 30 Nm again.
- Measure distance again.

If measured value matches specification:

- Install new bolts and tighten.

Tightening torque

Component	Nm
Drive plate to crankshaft	60 + 90 ° * See note

* 90 ° is one quarter turn

CRANKSHAFT, REMOVING AND INSTALLING

Crankshaft, removing and installing

NOTE:

- **Before removing crankshaft, provide suitable support to ensure that sensor wheel (- 6 -) is not damaged.**
- **When working on engine, secure it to engine stand using engine bracket VW540 --> Engine, securing to repair stand.**

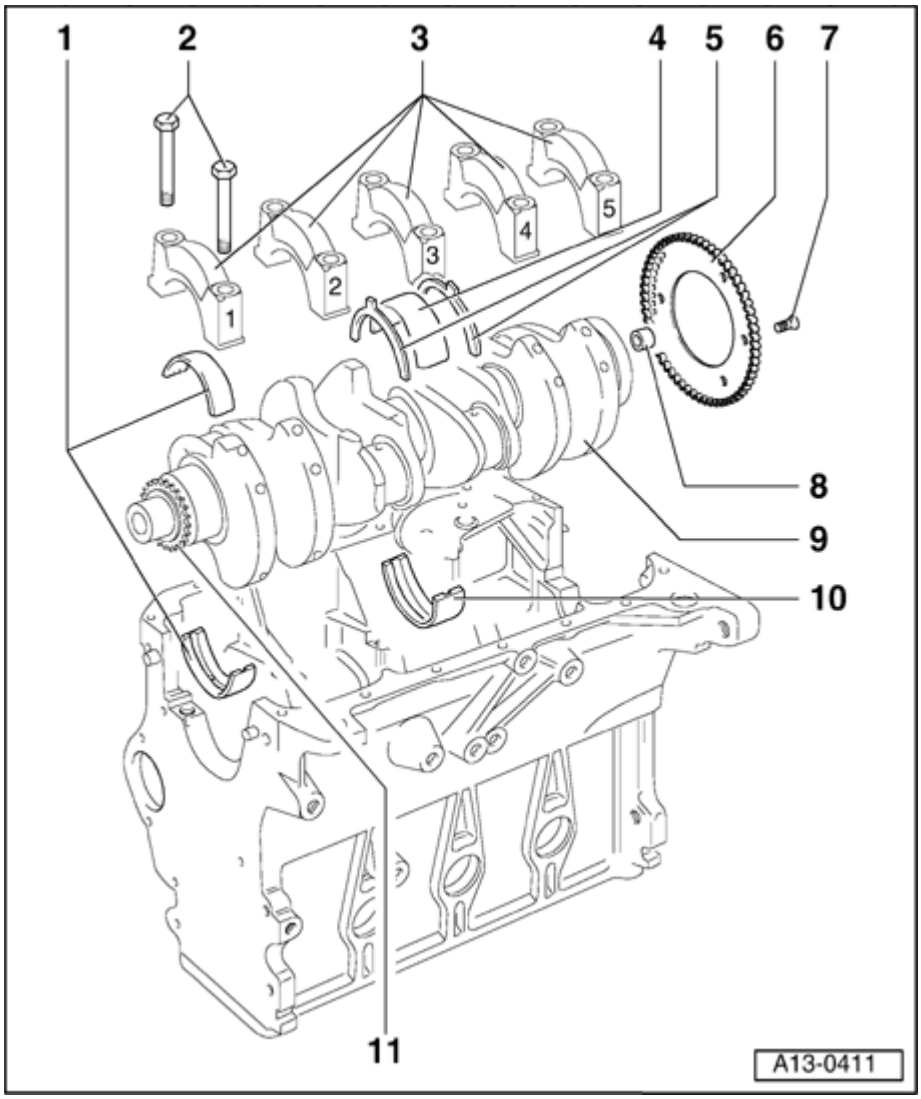

Fig. 125: Crankshaft, Removing And Installing Overview
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Bearing shells 1, 2, 4 and 5

- For bearing cap without oil groove
- For cylinder block with oil groove
- Do not interchange used bearing shells (mark)

2 - 65 Nm + 1/4 turn (90 °) further

- Replace
- When measuring radial clearance of crankshaft, tighten to 65 Nm but do not turn further

3 - Bearing caps

- Bearing cap 1: pulley end
- Bearing shell retaining lugs of cylinder block/bearing cap must be on same side

4 - Bearing shell 3 (top)

- For bearing cap without oil groove
- For cylinder block with oil groove
- Do not interchange used bearing shells (mark)

5 - Thrust washers

- For bearing cap, bearing 3
- Note fixing arrangement

6 - Sensor wheel

- For Engine speed (RPM) sensor G28
- Can only be installed in one position, holes are offset
- Always replace sensor wheel if bolts have been removed
- Removing and installing **Removing and installing sensor wheel**

7 - 10 Nm + 1/4 turn (90 °) further

- Replace
- Always replace sensor wheel if bolts have been removed **Removing and installing sensor wheel**

8 - Pilot needle bearing

- Pulling out and driving in --> **Pilot needle bearing in crankshaft, extracting and driving**

9 - Crankshaft

- Axial clearance, New: 0.07...0.23 mm; Wear limit: 0.30 mm

Check radial clearance with Plastigage™

- New: 0.02...0.04 mm
- Wear limit: 0.15 mm
- Do not rotate crankshaft when checking radial clearance
- Crankshaft dimensions --> **Crankshaft dimensions**

10 - Bearing shell 3 (bottom)

- For bearing cap without oil groove

- For cylinder block with oil groove
- Do not interchange used bearing shells (mark)

11 - Chain sprocket

- Drive for oil pump
- Replacing --> **Chain sprocket, removing and installing**

Removing and installing sensor wheel

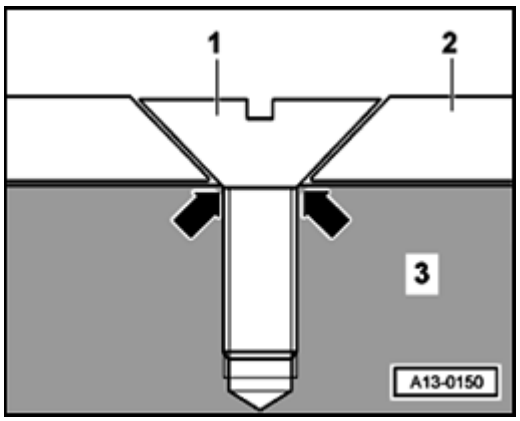

Fig. 126: Identifying Attachment Points, Countersunk Screws, Crankshaft & Sensor Wheel
Courtesy of VOLKSWAGEN UNITED STATES, INC.

NOTE:

- **Always replace sensor wheel - 2 - if bolts - 1 - have been removed.**
- **If the securing bolts are tightened a second time, seats for the countersunk bolt heads in the sensor wheel will be distorted to such an extent that the bolt heads will come into direct contact with the crankshaft - 3 - - arrows - and the sensor wheel will only fit loosely under the bolts.**
- **It is only possible to install the sensor wheel in one position, mounting holes are offset.**

Tightening torque

Component	Nm
Sensor wheel to crankshaft	10 + 90 ° * See note

*Replace bolts

* 90 ° is one quarter turn

Identification of top crankshaft bearing

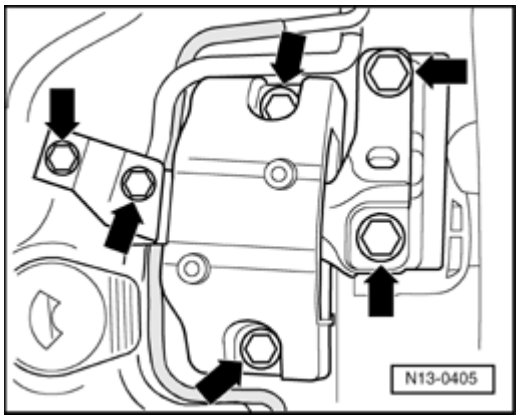

Fig. 127: Removing Engine Mount Bolts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Top crankshaft bearing shells are graded at factory and identified on cylinder block as shown in illustration.

Bearing shell identification by color codes

A	=	Identification for bearing 1
B	=	Identification for bearing 2
C	=	Identification for bearing 3
D	=	Identification for bearing 4
E	=	Identification for bearing 5
S	=	black
R	=	red
G	=	yellow
B	=	blue

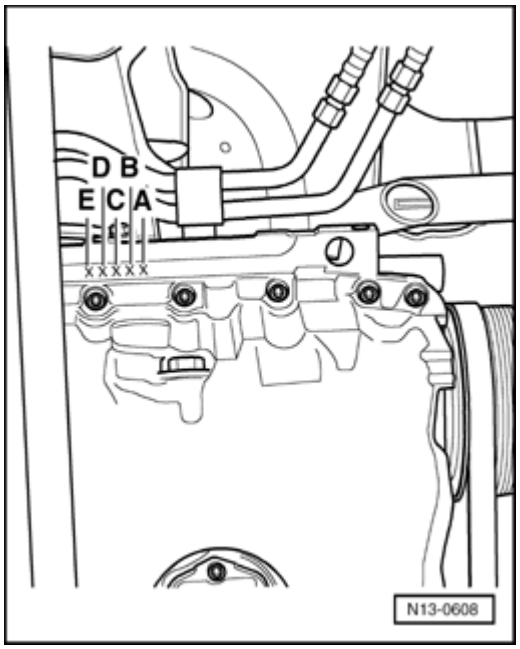

Fig. 128: Bearing Shell Identification By Color Codes
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Lower crankshaft bearing shells supplied as replacement parts are always color-coded "yellow".

Crankshaft dimensions

(in mm)

Grinding dimension	Crankshaft bearing journal dia.	Connecting rod bearing journal dia.
Basic dimension	-0.017 48.00 -0.037	-0.022 42.00 -0.042
Step I	-0.017 47.75 -0.037	-0.022 41.75 -0.042
Step II	-0.017 47.50 -0.037	-0.022 41.50 -0.042
Step III	-0.017 47.25 -0.037	-0.022 41.25 -0.042

Pilot needle bearing in crankshaft, extracting and driving

Special tools, testers and auxiliary items required

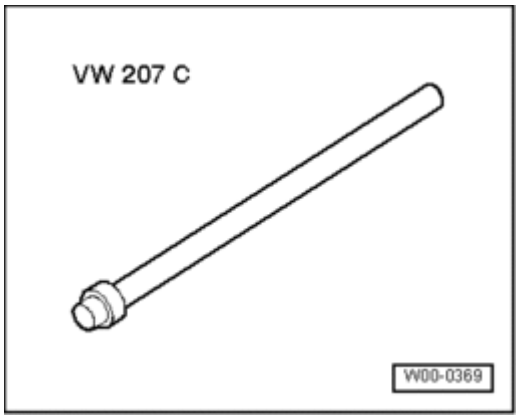

Fig. 129: Identifying Drift VW 207 C
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Drift VW207C

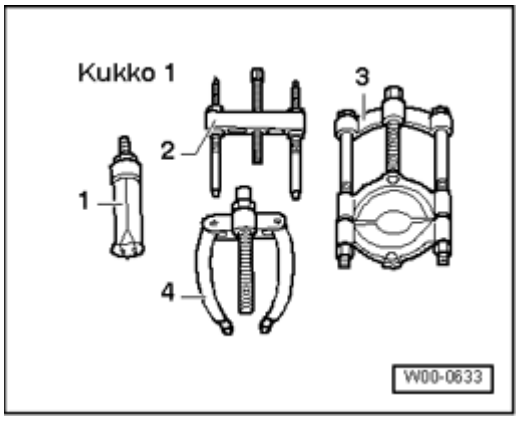

Fig. 130: Kukko 21/2 Internal puller, Kukko 21/4 Internal puller, Kukko 22/2 Counter support
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Puller Kukko 21/1 (1) and Kukko 22/1 (4)
- Depth gauge

NOTE:

- **A pilot needle bearing must be installed in the crankshaft on vehicles with a manual transmission. Install a pilot needle bearing if necessary.**
- **On vehicles with an automatic transmission, no pilot needle bearing must be installed in crankshaft. Remove the pilot needle bearing if necessary.**

Removing

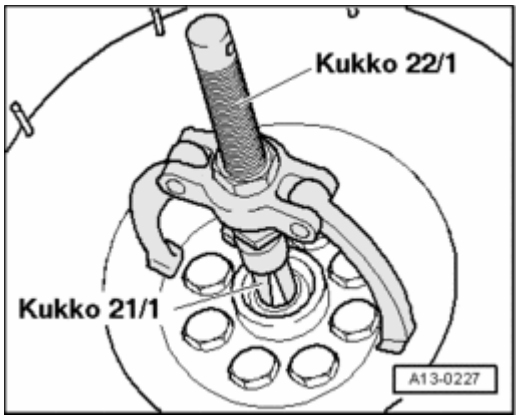

Fig. 131: Pulling Out Pilot Needle Bearing Using Kukko 21/1 And Kukko 22/1
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Pull out pilot needle bearing using Kukko 21/1 and Kukko 22/1.

Installing

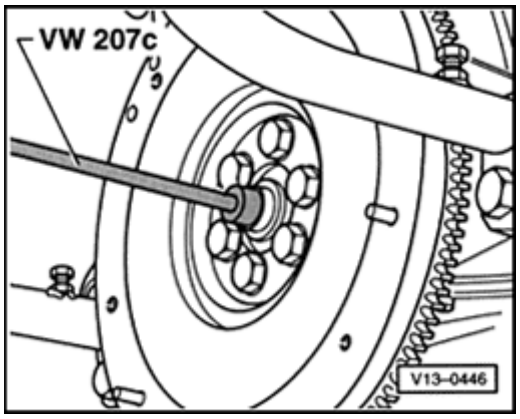

Fig. 132: Driving In Needle Bearing Using Drift VW 207 C
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Drive in with drift VW207C or centering mandrel 3176.

- Lettering on pilot needle bearing must be visible when installed.

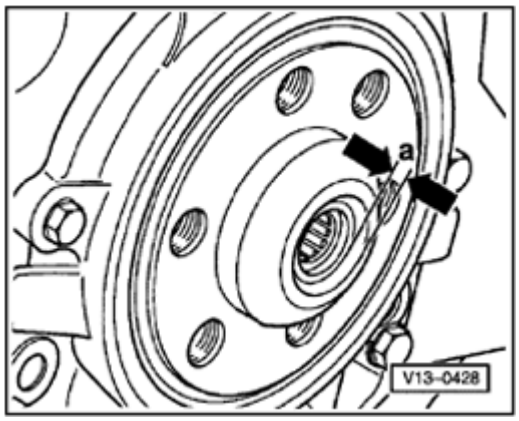

Fig. 133: Identifying Installation Depth Dimension
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Installation depth for pilot needle bearing

- Distance a = 1.5 mm

Chain sprocket, removing and installing

Special tools, testers and auxiliary items required

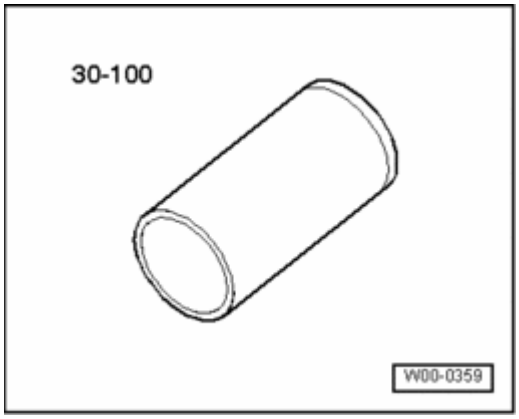

Fig. 134: Press Tube 30-100Identifying Special Tools - Oil Pump/Front Sealing Flange, Drive Chain And Chain Sprocket For Oil Pump, Removing And Installing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Drift sleeve 30-100
- Two-arm puller, commercial type
- Protective gloves

Removing

- Remove oil pan --> **Oil pan, removing and installing**.
- Remove front sealing flange --> **Crankshaft oil seal - pulley end, replacing**.

- Oil pump chain sprocket, chain tensioner and chain, removing.

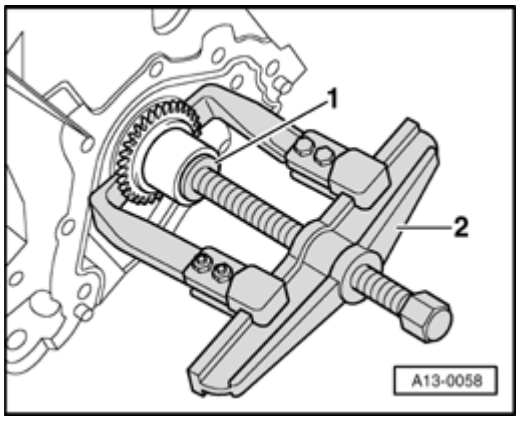

Fig. 135: Pulling Off Chain Sprocket From Crankshaft
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Pull chain sprocket off crankshaft with puller - **2** - , use suitable washer - **1** - to protect end of crankshaft.

Installing

Install in reverse order, paying attention to the following:

CAUTION: Wear protective gloves.

- Heat chain sprocket in oven for approx. 15 minutes to 220 °C.

NOTE:

- **Installed position: Large shoulder of chain sprocket must point to engine.**

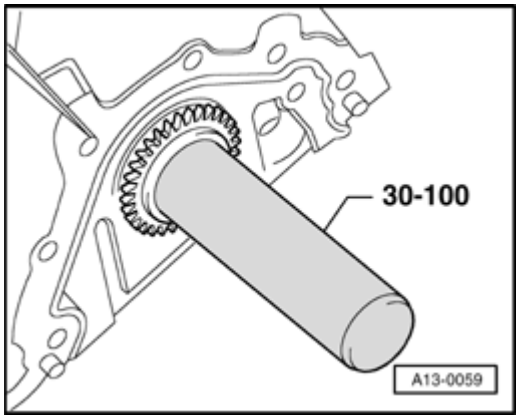

Fig. 136: Installing Chain Sprocket Onto Crankshaft Up To Limit Stop Using Press Tube 30-100
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Install chain sprocket on end of crankshaft using pliers and press onto crankshaft until fully seated using drift sleeve 30-100.

PISTONS AND CONNECTING RODS, DISASSEMBLING AND ASSEMBLING

Pistons and connecting rods, disassembling and assembling

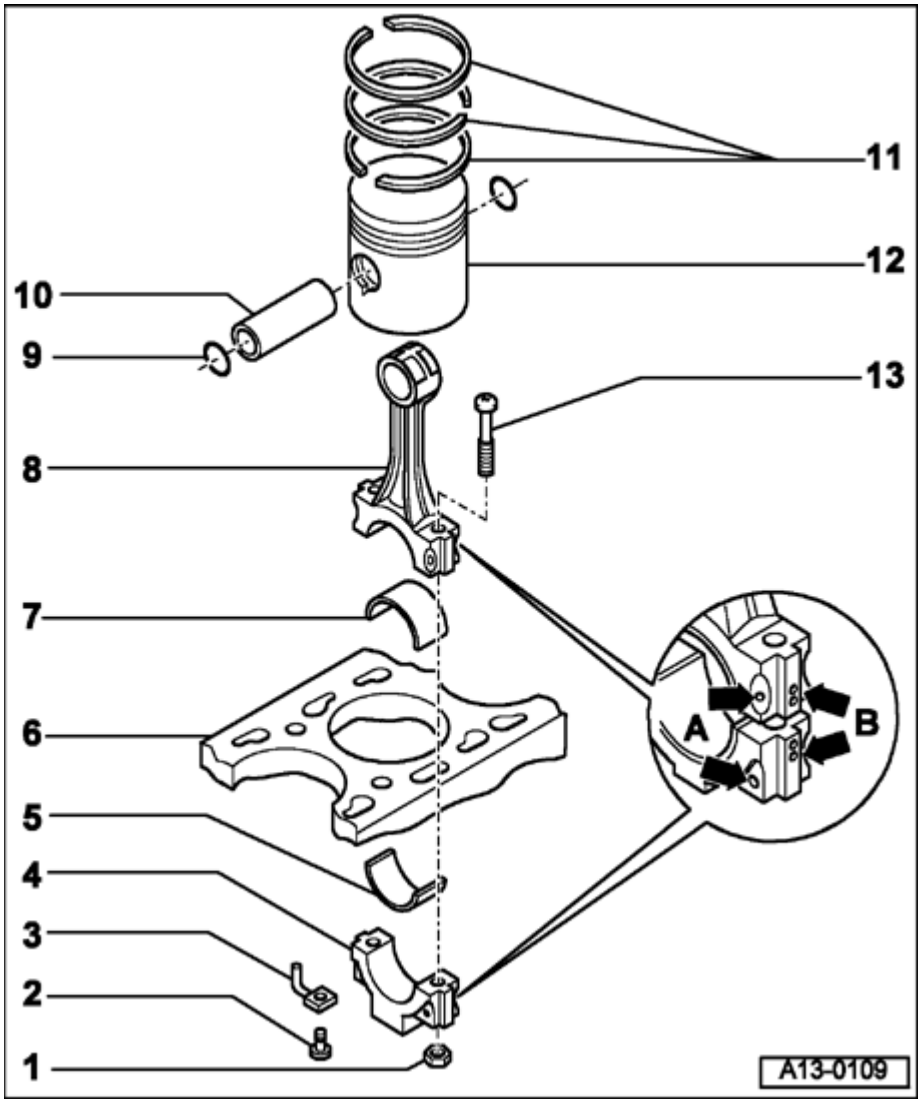

Fig. 137: Pistons And Connecting Rods, Disassembling And Assembling Overview
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - 30 Nm + 1/4 turn (90 °) further

- Oil threads and contact surface
- To measure radial clearance, tighten to 30 Nm but not further

2 - Pressure relief valve, 27 Nm

- Opens at: 2.5...3.2 bar

3 - Oil spray jet

- For piston cooling

4 - Connecting rod bearing cap

- Mark cylinder number - **B** -
- Installed position: Marking - **A** - must face toward pulley end

5 - Bearing shell

- Note installed position
- Do not interchange used bearing shells (mark)
- Make sure that bearing shell is seated correctly in retaining lugs
- Axial clearance, New: 0.10...0.35 mm; Wear limit: 0.40 mm

- Check radial clearance with Plastigage™, New: 0.01...0.05 mm; Wear limit: 0.12 mm
- Do not rotate crankshaft when checking radial clearance

6 - Cylinder block

- Checking cylinder bore **Checking cylinder bore**
- Piston and cylinder dimensions --> **Piston and cylinder dimensions**

7 - Bearing shell

- With oil drilling for piston pin lubrication
- Note installed position
- Do not interchange used bearing shells (mark)
- Axial clearance, New 0.10...0.35 mm; Wear limit: 0.40 mm

- Check radial clearance with Plastigage™, New: 0.01...0.05 mm; Wear limit: 0.12 mm
- Do not rotate crankshaft when checking radial clearance

8 - Connecting rod

- Only replace as set
- Mark cylinder number - **B** -
- Installed position: Marking - **A** - must face toward pulley end
- With oil drilling for piston pin lubrication

9 - Circlip

10 - Piston pin

- If difficult to move, heat piston to approx. 60 °C

- Remove and install with VW222a

11 - Piston rings

- Offset gaps by 120 °
- Remove and install with piston ring pliers
- "TOP" must face toward piston crown
- Checking ring gap **Checking piston ring gap**
- Checking ring to groove clearance **Checking ring to groove clearance**

12 - Piston

- Checking **Checking piston**
- Mark installed position and cylinder number
- Arrow on piston crown must point to pulley end
- Install using piston ring clamp

13 - Connecting rod bolt

- Replace

Checking piston ring gap

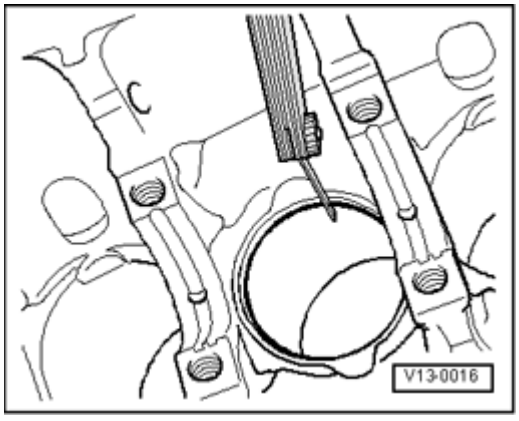

Fig. 138: Checking Piston Ring Gap
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Push ring squarely from above down to lower cylinder bore, approx. 15 mm from cylinder edge. To do this use a piston without rings.

Piston ring Dimensions in mm	New	Wear limit
Compression ring 1	0.20...0.40	0.8
Compression ring 2	0.20...0.40	0.8

Oil scraper ring	0.25...0.50	0.8

Checking ring to groove clearance

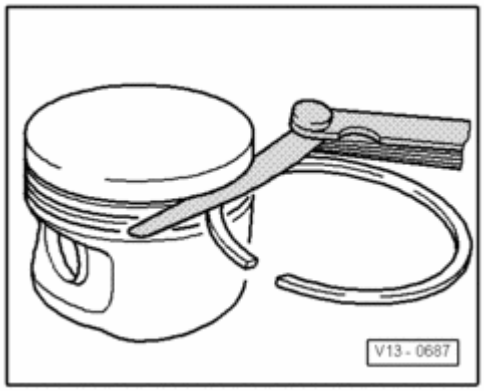

Fig. 139: Checking Ring To Groove Clearance
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Clean groove before checking clearance.

Piston ring Dimensions in mm	New	Wear limit
Compression ring 1	0.06...0.09	0.20
Compression ring 2	0.05...0.08	0.20
Oil scraper ring	0.03...0.06	0.15

Checking piston

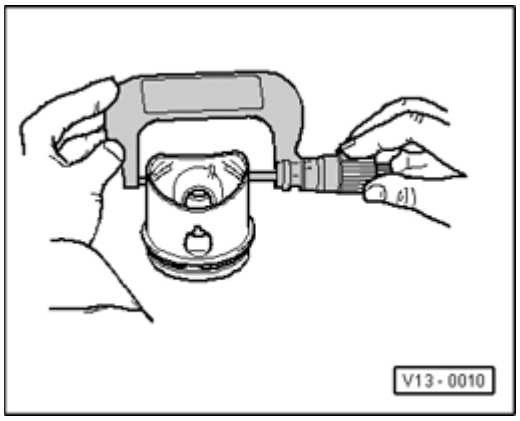

Fig. 140: Checking Piston
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Measure pistons approx. 10 mm from lower edge of skirt, at 90 ° to piston pin axis.
- Deviation from nominal dimension: max. 0.04 mm

Checking cylinder bore

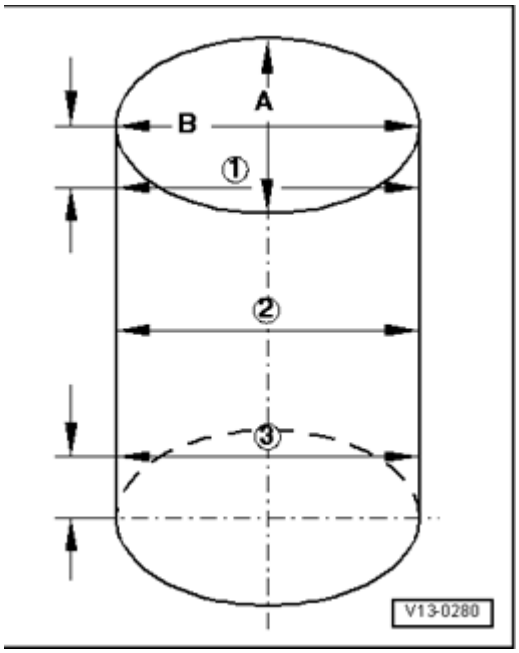

Fig. 141: Checking Cylinder Bores
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools, testers and auxiliary items required

- Internal dial gauge 50...100 mm
  - Take measurements at 3 positions in both lateral - **A** - and longitudinal - **B** - directions.
- Deviation from nominal dimension: max. 0.08 mm

Piston and cylinder dimensions

Honing dimension		Piston dia.	Cylinder bore dia.
Basic dimension	mm	80.950 * See note	81.01
Oversize	mm	81.450 * See note	81.51

*Dimensions without graphite coating (thickness 0.02 mm) Graphite coating wears away.

15 - ENGINE - CYLINDER HEAD, VALVETRAIN

CYLINDER HEAD, REMOVING AND INSTALLING

Cylinder head, removing and installing

CAUTION: Before beginning repairs on the electrical system:

Obtain the anti-theft radio security code.

Switch the ignition off.

Disconnect the battery Ground (GND) strap.

On vehicles equipped with Audi Telematics by OnStar, switch-off the emergency (back-up) battery for the Telematic/Telephone Control Module prior to disconnecting vehicle battery --> 91 - COMMUNICATION

After reconnecting vehicle battery, re-code and check operation of anti-theft radio. Also check operation of clock and power windows according to Repair Article and/or Owners Manual.

After reconnecting vehicle battery on vehicles equipped with Audi Telematics by OnStar, switch-on the emergency (back-up) battery for the Telematic/Telephone Control Module --> 91 - COMMUNICATION

Cylinder head, removing and installing

NOTE:

- **Replace cylinder head bolts.**
- **When performing repairs, replace seals, gaskets, self-locking nuts and bolts which have a specified tightening angle.**
- **Charge air hose connections and hoses must be free from oil and grease before installing.**
- **When installing a replacement cylinder head with camshafts installed, contact surfaces between valve lifter and cam running surface must be oiled after installation of cylinder head.**
- **The plastic protectors installed to protect open valves must only be removed immediately before installing cylinder head.**
- **When replacing cylinder head or cylinder head gasket, the coolant must be completely replaced.**
- **Cylinder heads which have cracks between valve seats or between valve seat inserts and the spark plug thread can be used further without reducing service life, provided cracks do not exceed a max. of 0.3 mm in width, or when no more than first 4 turns of spark plug threads are cracked.**

Part I

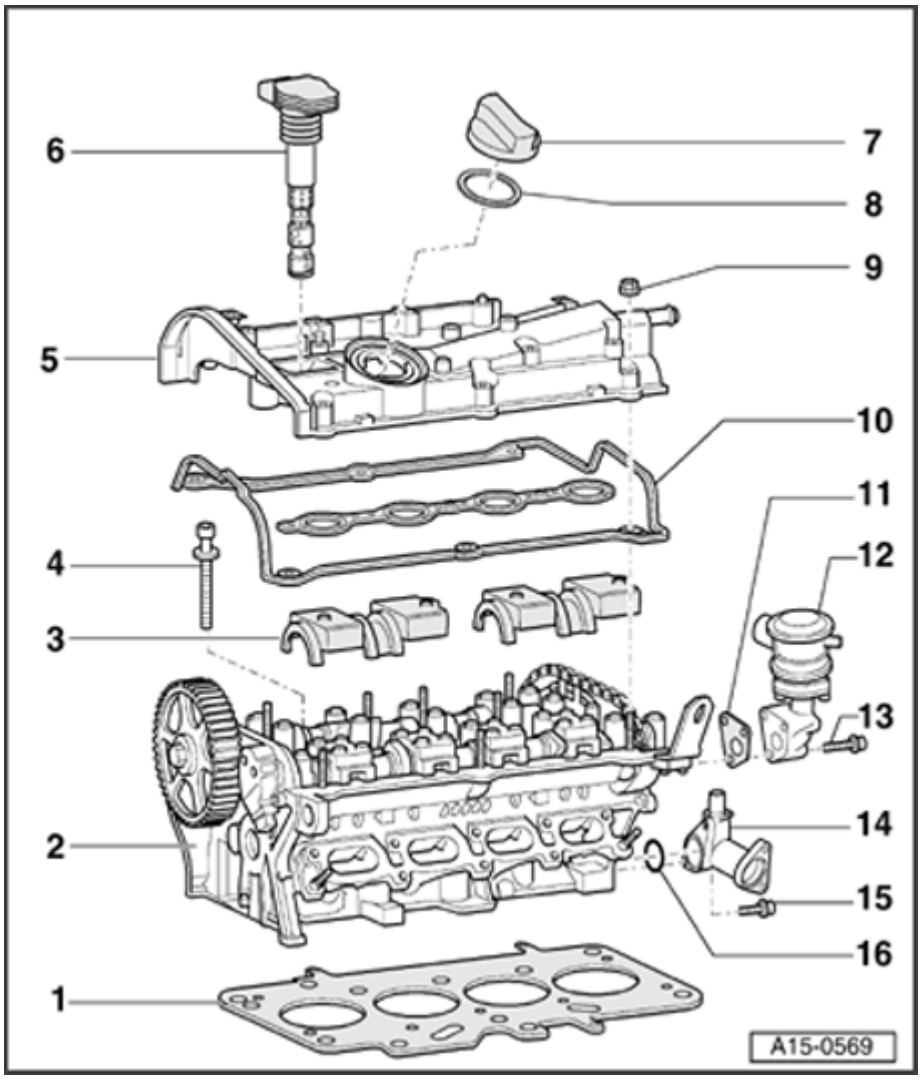

Fig. 142: Cylinder Head, Removing And Installing Overview - Part I
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Cylinder head gasket

- Replace Removing cylinder head, --> **Cylinder head, removing**
- Installation position: Part No. toward cylinder head
- After replacing, fill with fresh coolant

2 - Cylinder head

- Removing --> **Cylinder head, removing**
- Checking for distortion **Checking cylinder head for distortion**
- Resurfacing limit **Cylinder head resurfacing limit**
- Installing --> **Cylinder head, installing**

- After replacing, fill with fresh coolant

3 - Oil deflector

- Note installed position

4 - Cylinder head bolt

- Replace
- Note sequence when loosening
- Note sequence when tightening

5 - Cylinder head cover

- Removing and installing --> **Cylinder head cover, removing and installing**

6 - Ignition coil

7 - Cap

8 - Gasket

- Replace if damaged or leaking

9 - 10 Nm

- Tighten inner nuts first
- Tighten outer nuts in diagonal sequence

10 - Cylinder head cover gaskets

- Replace if damaged or leaking
- Before installing gaskets apply AMV 174 004 01 at sealing points **Sealing transition points between double bearing cap and cylinder head (2 points):** and **Sealing camshaft adjuster/cylinder head transition (4 points)**

11 - Gasket

- Replace

12 - Secondary air combination valve

- With screw connection

13 - 10 Nm

14 - Coolant flange

- With coolant temperature sensor

15 - 10 Nm

16 - O-ring

- Replace

Part II

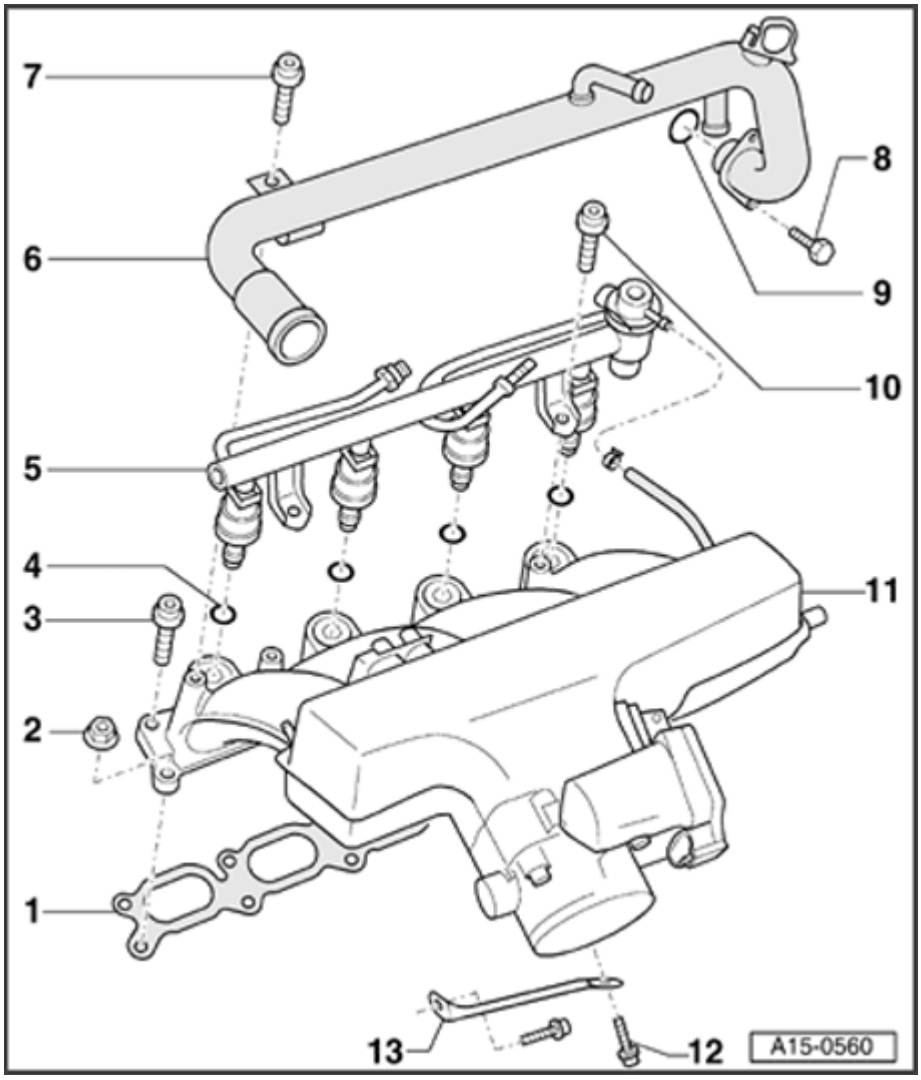

Fig. 143: Cylinder Head, Removing And Installing Overview - Part II
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Gasket

- Note installed position

- Replace

2 - 10 Nm

3 - 10 Nm

4 - O-ring

- For injector
- Replace

5 - Fuel rail

- With injectors
- Vehicles up to 06.03: Tighten union nut for fuel supply line to 22 Nm
- Vehicles as of 07.03: Loosening and tightening union nut for fuel supply line to fuel rail pipe **Loosening and tightening union nut for fuel supply line in vehicles as of 07.03**

6 - Coolant line (top)

7 - 10 Nm

8 - 10 Nm

9 - O-ring

- For top coolant line
- Replace

10 - 10 Nm

11 - Intake manifold

12 - 20 Nm

13 - Support

- For intake manifold

Checking cylinder head for distortion

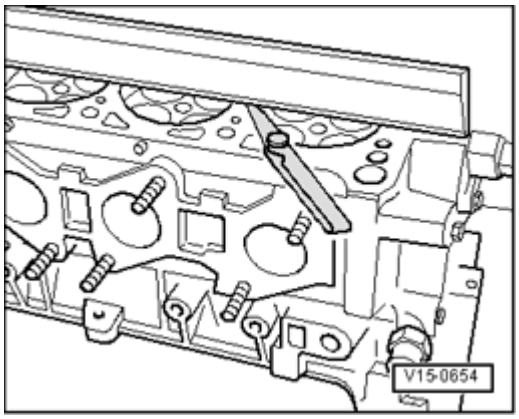

Fig. 144: Checking Cylinder Head For Distortion
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Check cylinder head for distortion at several points using knife-edge straightedge and feeler gauge.
- Max. permissible distortion: 0.1 mm

Cylinder head resurfacing limit

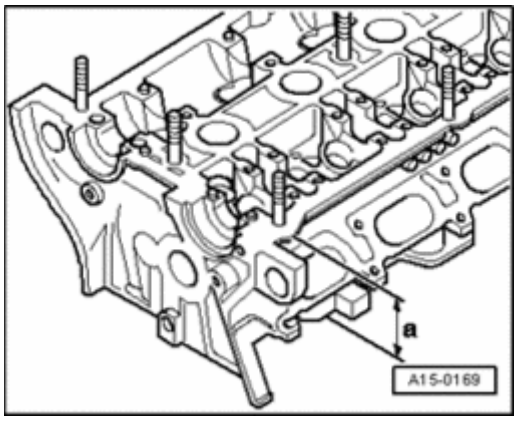

Fig. 145: Cylinder Head Resurfacing Limit
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Resurfacing the cylinder head (skimming) is only permitted down to minimum dimension - **a** -.
- Minimum dimension: - **a** - = 139.20 mm

Sealing transition points between double bearing cap and cylinder head (2 points):

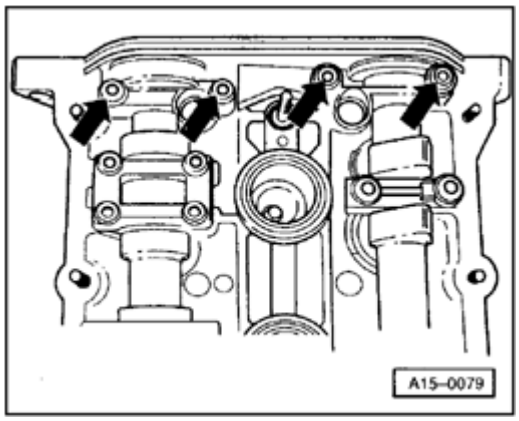

Fig. 146: Sealing Transition Points Between Double Bearing Cap And Cylinder Head (2 Points)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Apply a small quantity of sealant Part No: AMV 174 004 01 to sides of joints - **arrows** - on upper sealing surface of cylinder head.

Sealing camshaft adjuster/cylinder head transition (4 points)

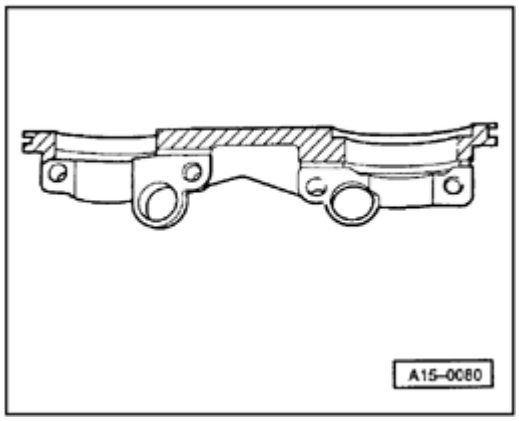

Fig. 147: Sealing Camshaft Adjuster/Cylinder Head Transition (4 Points)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Apply a small quantity of sealant Part No: AMV 174 004 01 to sides of joints - **arrows** - on upper sealing surface of cylinder head.

Loosening and tightening union nut for fuel supply line in vehicles as of 07.03

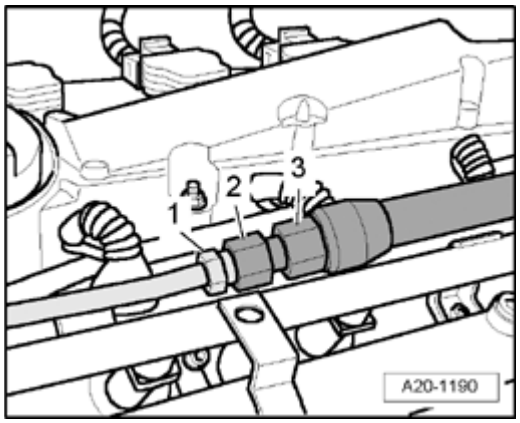

Fig. 148: Loosening And Tightening Union Nut For Fuel Supply Line In Vehicles As Of 07.03
Courtesy of VOLKSWAGEN UNITED STATES, INC.

CAUTION: Fuel system is under pressure! Before opening system, place rags around the connection point. Then release pressure by carefully loosening connection.

Loosening

- Unscrew fuel hose from connection on fuel rail pipe. To do so, counterhold using an open-end wrench at each hex head - **1** - and - **3** - and unscrew union nut - **2** -.

Tightening

- Secure fuel hose to connection on fuel rail pipe. To do so, counterhold using an open-end wrench at each hex head - **1** - and - **3** - and tighten union nut - **2** - to 22 Nm.

Cylinder head cover, removing and installing

Removing

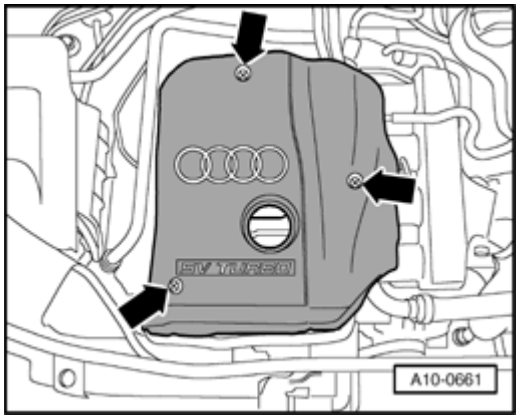

Fig. 149: Removing Engine Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove engine cover - **arrows** -.

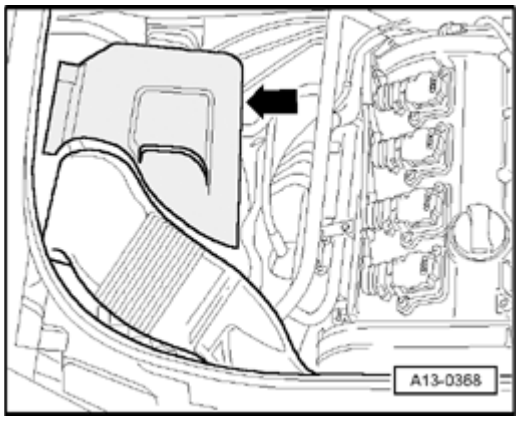

Fig. 150: Air Cleaner Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove air cleaner cover - **arrow** -.

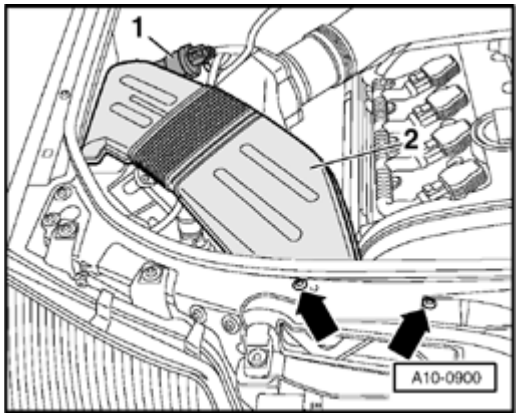

Fig. 151: Evaporative Emission Canister Purge Regulator Valve N80 And Air Duct
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts - **arrows** -.
- Disengage EVAP canister purge regulator valve N80 - **1** - from air duct - **2** -.
- Remove both screws - **arrows** - for air duct - **2** -.

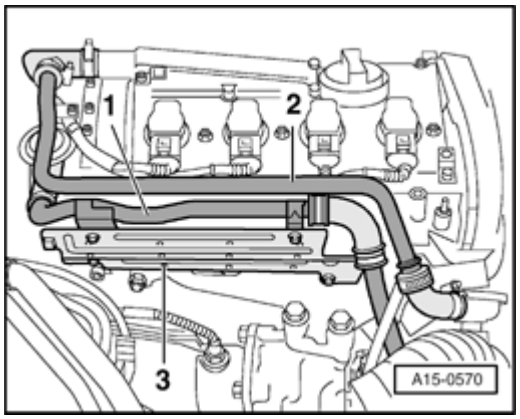

Fig. 152: Crankcase Breather Line, Secondary Air Combination Valve Line And Heat Shield
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove crankcase breather line - **2** -.
- Remove crankcase breather hose at cylinder head cover.
- Remove line - **1** - on secondary air combination valve on cylinder head cover and heat shield - **3** -.
- Move secondary air line slightly to one side.

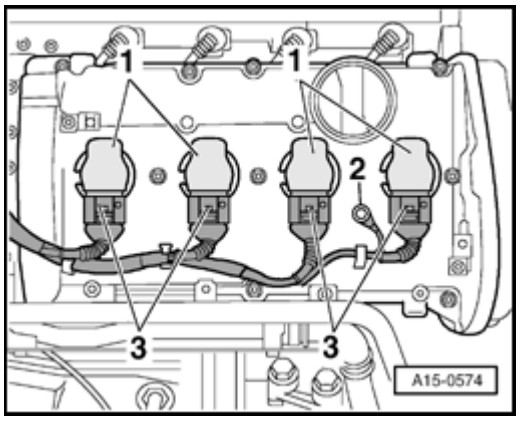

Fig. 153: Ignition Coils, Ground Wire And Connectors
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove Ground wire - **2** -.
- Disconnect connectors - **3** -.
- Move wiring clear.
- Pull out ignition coils - **1** -.

- Release 2 retaining clips for top section of toothed belt guard.

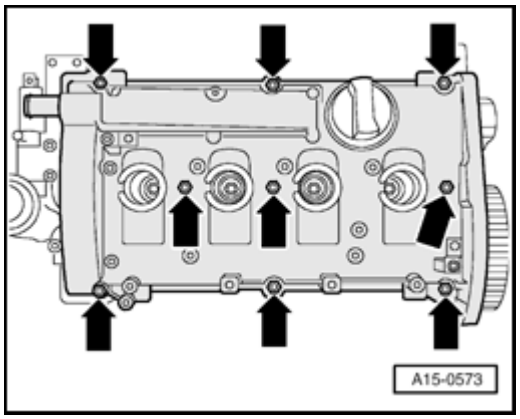

Fig. 154: Cylinder Head Cover Nuts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Loosen nuts - **arrows** - on cylinder head cover and remove cylinder head cover.

Installing

Install in reverse order, paying attention to the following:

NOTE:

- **Replace gaskets and sealing rings.**
- **Replace cylinder head cover gaskets if damaged.**

- First tighten inner nuts for cylinder head cover, then tighten outer nuts in diagonal sequence.
- Ensure that top section of toothed belt guard is seated correctly.

Tightening torques

Component	Nm
Cylinder head cover to cylinder head	10
Crankcase breather line to cylinder head cover	10
Secondary air line to cylinder head cover	10
Hose clamps	2

Cylinder head, removing

Conditions

- Engine in vehicle.
- Lock carrier in service position --> **Lock carrier, moving to service position**.

NOTE:

- **All cable ties unfastened or cut open on removal are to be re-attached in same position on installation.**

- Obtain and record radio anti-theft code for vehicles with coded radio.

See Caution for disconnecting Telematics battery --> **Cylinder head, removing and installing**

- Disconnect battery Ground strap with ignition switched off.
- Drain cooling system --> **Cooling system, draining and filling**.
- Remove intake manifold from cylinder head. --> **24 - MULTIPORT FUEL INJECTION (MFI)**
- Remove ribbed belt and ribbed belt tensioner --> **Ribbed belt, removing and installing**.
- Remove toothed belt from camshaft sprocket --> **Toothed drive belt, removing, installing and tensioning**.

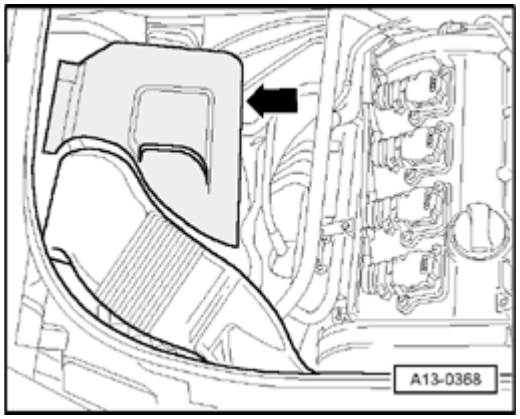

Fig. 155: Air Cleaner Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove air cleaner cover - **arrow** -.

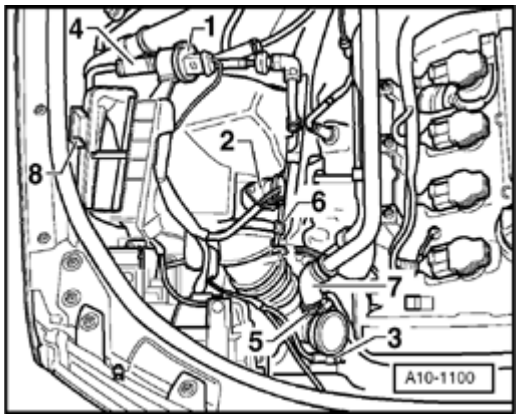

Fig. 156: Disconnect Wires/Unplug Connectors From
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect wiring connectors from:

1. EVAP canister purge regulator valve N80

2. Mass Air Flow (MAF) sensor G70
3. Wastegate bypass regulator valve N75

- Disconnect hoses 4...7.
- Disconnect hose to secondary air injection pump motor - **8** -.
- Move wires clear.
- Unbolt air cleaner housing - **9** -.
- Remove air cleaner.

NOTE:

- **Vacuum line to secondary air combination valve is clipped to underside of air intake hose.**

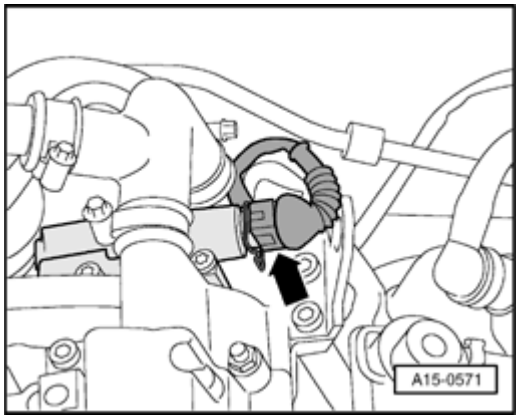

Fig. 157: Disconnecting Connector At Camshaft Adjuster
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect connector - **arrow** - at camshaft adjuster.

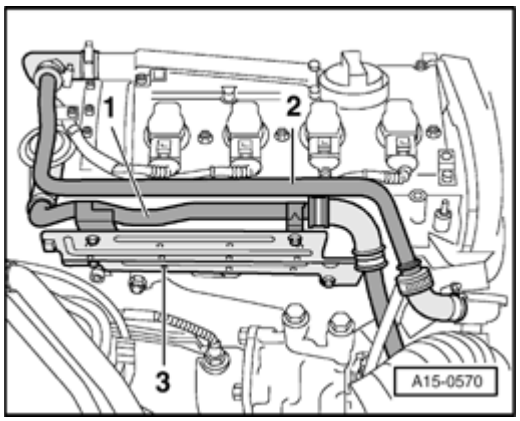

Fig. 158: Crankcase Breather Line, Secondary Air Combination Valve Line And Heat Shield
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove crankcase breather line - **2** -.

- Remove crankcase breather hose at cylinder head cover.
- Remove line - **1** - on secondary air combination valve on cylinder head cover and heat shield - **3** -.
- Move secondary air line slightly to one side.
- Remove heat shield.

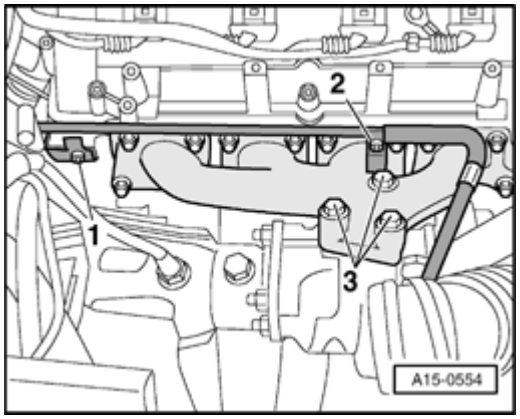

Fig. 159: Removing Bolts Of Oil Supply Line & For Turbocharger
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts - **1** - and - **2** - of oil supply line.
- Remove bolts - **3** - for turbocharger.

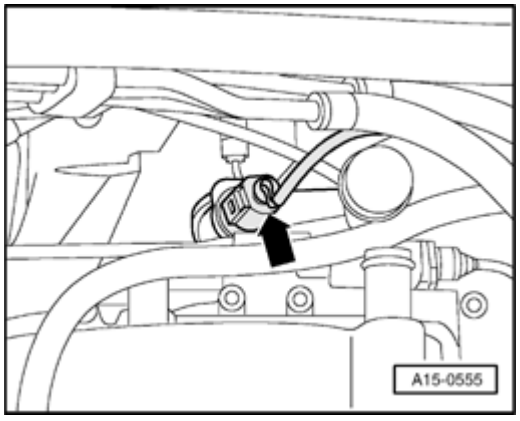

Fig. 160: Disconnecting Connector At Coolant Temperature Sensor G2/G62
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect connector - **arrow** - at coolant temperature sensor G2/G62.

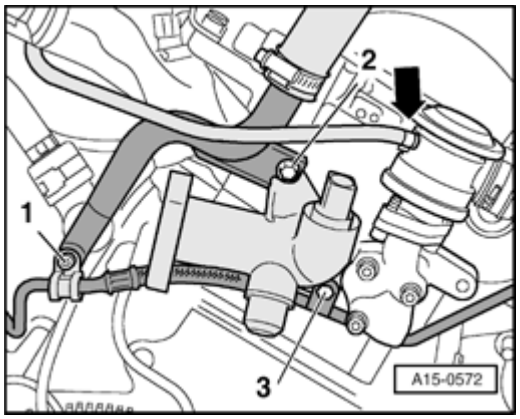

Fig. 161: Identifying Vacuum Hose, Oil Supply Line Bracket, Coolant Flange & Bolts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect vacuum hose - **arrow** - at combination valve.
- Remove coolant flange, bolts - **2** - and - **3** -.
- Remove bracket - **1** - for oil supply line.
- Unclip all wiring on cylinder head and move it clear.

- Pull off coolant hose to heater unit heat exchanger at rear of cylinder head. To do so, first release retainers on connecting flange.

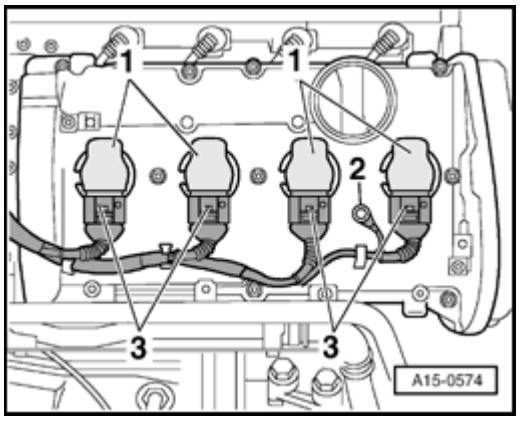

Fig. 162: Ignition Coils, Ground Wire And Connectors
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove Ground wire - **2** -.
- Disconnect connectors - **3** -.
- Move wiring clear.
- Pull out ignition coils - **1** -.

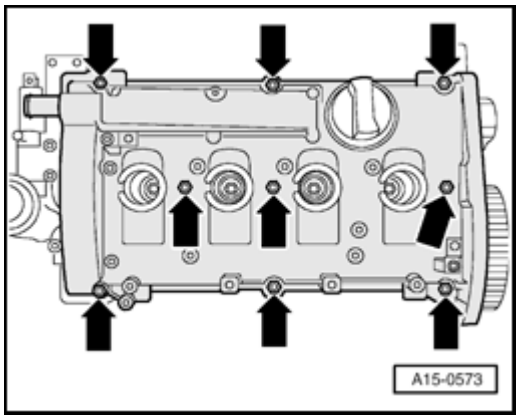

Fig. 163: Cylinder Head Cover Nuts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Loosen nuts - **arrows** - on cylinder head cover and remove cylinder head cover.
- Remove both oil deflectors.

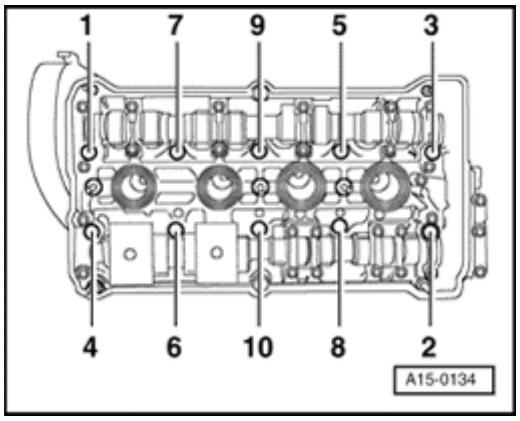

Fig. 164: Cylinder Head Bolts Loosening Sequence
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Keep to specified sequence and loosen cylinder head bolts.
- Remove cylinder head.

Cylinder head, installing

NOTE:

- **Replace cylinder head bolts.**
- **When performing repairs, replace seals, gaskets, self-locking nuts and bolts which have a specified tightening angle.**
- **Secure all hose connections with standard hose clamps**
- **When performing repair work, carefully remove any remains of gasket material from cylinder head and cylinder block. Make sure that no long scores or scratches are made on surfaces.**
- **Carefully remove any remaining emery and abrasive material.**

- **Remove new cylinder head gasket from packaging just before installation.**
- **Handle gasket extremely carefully. Damaging the silicone layer or indented area will lead to leaks.**
- **No oil or coolant must be allowed to remain in blind holes for cylinder head bolts in cylinder block.**

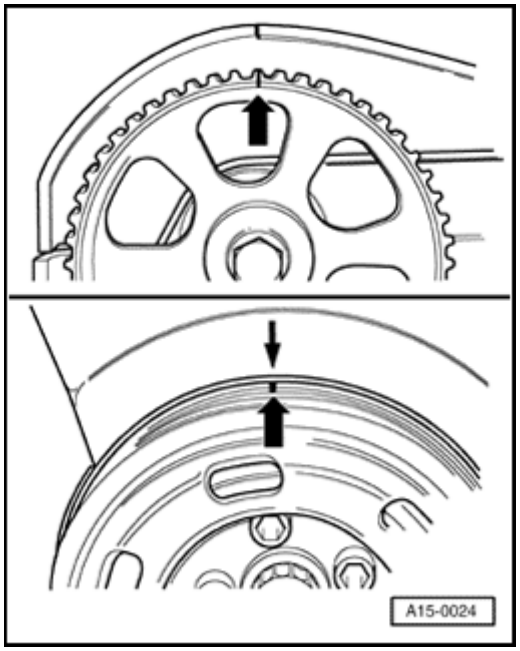

Fig. 165: Identifying Marking On Camshaft Gear Aligned With Marking On Cylinder Head Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Before positioning cylinder head, set crankshaft and camshaft to TDC No. 1 cylinder.

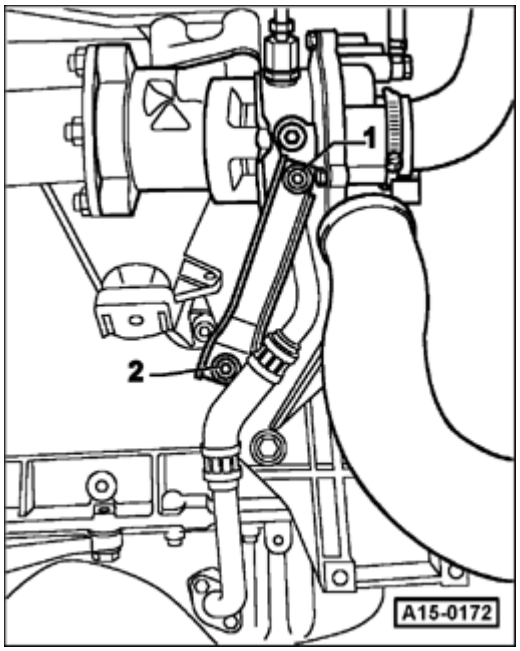

Fig. 166: Loosening Bolts On Turbocharger Bracket
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Loosen bolts - **1** - and - **2** - on turbocharger bracket approx. 2 turns to avoid setting up stresses when installing cylinder head.

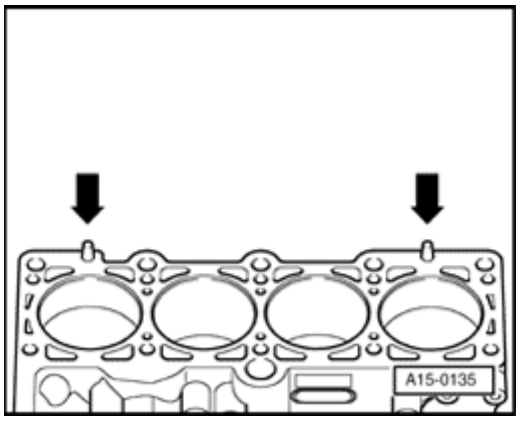

Fig. 167: Identifying Cylinder Block Centering Pins
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Place cylinder head gasket in position.

- Note position of centering pins in cylinder block - **arrows** -.
- Check installed position of cylinder head gasket: Part No. should be visible from intake side.

- Position cylinder head.
- Insert cylinder head bolts and hand-tighten.

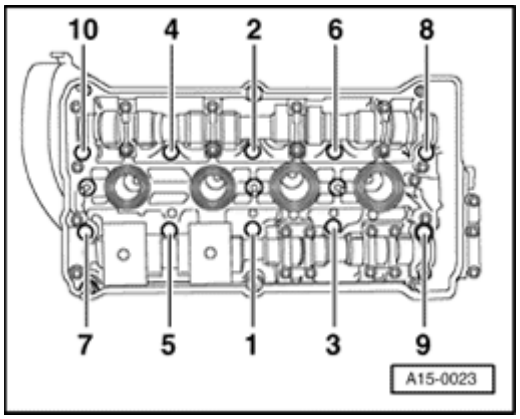

Fig. 168: Cylinder Head Bolt Tightening Sequence
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Tighten cylinder head bolts in two stages in sequence shown as follows:
- Tighten using torque wrench:

- Step 1: 40 Nm

- Tighten with normal fixed wrench:

- Step 2: 180 ° (1/2 turn) further (2 x 90 ° turns permissible)

NOTE:

- **It is not necessary to re-tighten cylinder head bolts after repairs have been performed.**

- Bolt turbocharger with new gasket to exhaust manifold and bolt bracket to cylinder block --> **Turbocharger, removing and installing - overview**.
- Install cylinder head cover
- Install toothed belt (adjust valve timing) --> **Toothed drive belt, removing, installing and tensioning**.
- Install ribbed belt and ribbed belt tensioner --> **Ribbed belt, removing and installing**.

- Install intake manifold.
- Replace coolant --> **Cooling system, draining and filling**.

See Caution for connecting Telematics battery --> **Cylinder head, removing and installing**

- After connecting battery, enter radio anti-theft code. Radio operating instructions.
- Use electric window lifters to completely close door windows.
- Then actuate all window lifter switches again for at least 1 second in "close" position to activate automatic one-touch function.
- Set clock to correct time.

- Perform adaptation of throttle valve control module: --> **24 - MULTIPORT FUEL INJECTION (MFI)**

Tightening torques

Component		Nm
Intake manifold support	to intake manifold	20
	to bracket	20
Turbocharger to exhaust manifold		35 * See note
Turbocharger bracket to cylinder block		25
Turbocharger bracket to turbocharger		30
Hose clamps for coolant hoses		2
Hose clamps for air hoses		3.5

*Replace bolts

*Coat thread and contact surface of bolt head with hot bolt paste

G 052 112 A3 (anti-seize compound)

Compression pressure, checking

Special tools, testers and auxiliary items required

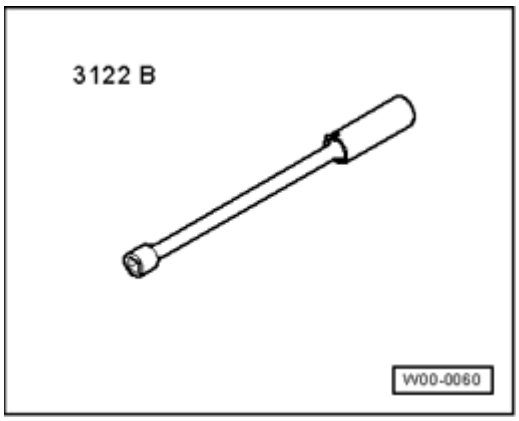

Fig. 169: Identifying Spark Plug Wrench 3122 B
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Spark plug wrench 3122B

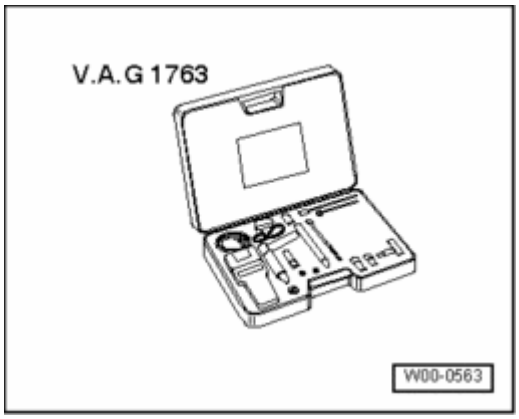

Fig. 170: Compression Tester VAG1381 Or VAG1763
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Compression tester VAG1381 or VAG1763

Requirements

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

Work sequence

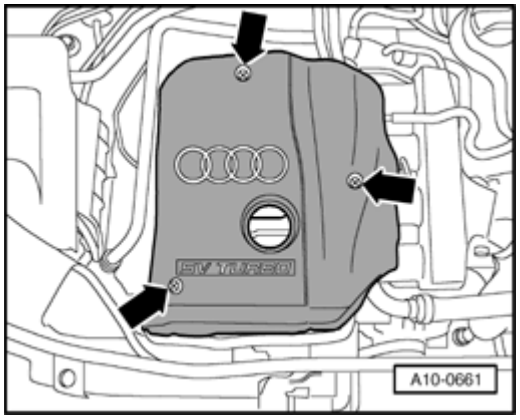

Fig. 171: Removing Engine Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove engine cover - **arrows** -.
- Switch off ignition.

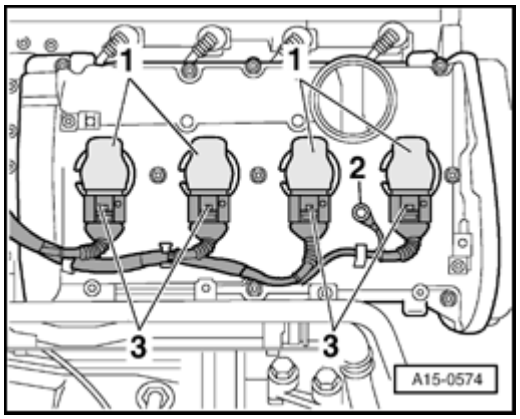

Fig. 172: Ignition Coils, Ground Wire And Connectors
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect connectors - **3** -.
- Pull out ignition coils - **1** -.
- Use spark plug wrench 3122B to remove spark plugs.
- Disconnect connectors from all injectors.

- Fully open throttle valve.
- Check compression with compression tester VAG1381 or VAG1763.

NOTE:

- **Using the compression tester.**

- Operate starter until tester shows no further pressure increase.

Compression pressure

New (bar)	Wear limit (bar)	Difference between cylinders (bar)
9.0...14.0	7.5	max. 3.0

- Install spark plugs and ignition coils.

NOTE:

- **Replace gaskets for ignition coils if damaged.**

- Check Diagnostic Trouble Code (DTC) memory: --> Guided Fault Finding in VAS5051 - **01 ON BOARD DIAGNOSTIC (OBD)**

NOTE:

- **Diagnostic Trouble Codes (DTCs) will have been recorded in DTC memory because connectors have been disconnected. Check and, if necessary, erase DTC memory after completing check.**

Tightening torques

Component	Nm
Spark plugs in cylinder head	30

VALVE GEAR, SERVICING

Valve gear, servicing

NOTE:

- **Cylinder heads which have cracks between valve seats or between valve seat inserts and the spark plug thread can be used further without reducing service life, provided cracks do not exceed a max. of 0.3 mm in width, or when no more than first 4 turns of spark plug threads are cracked.**
- **After installing camshafts, engine must not be started for approx. 30 minutes. Hydraulic valve compensation elements have to settle (otherwise valves will strike pistons).**
- **After working on valve gear, turn engine carefully at least 2 rotations to ensure that none of the valves make contact when starter is operated.**
- **Always replace gaskets and sealing rings.**

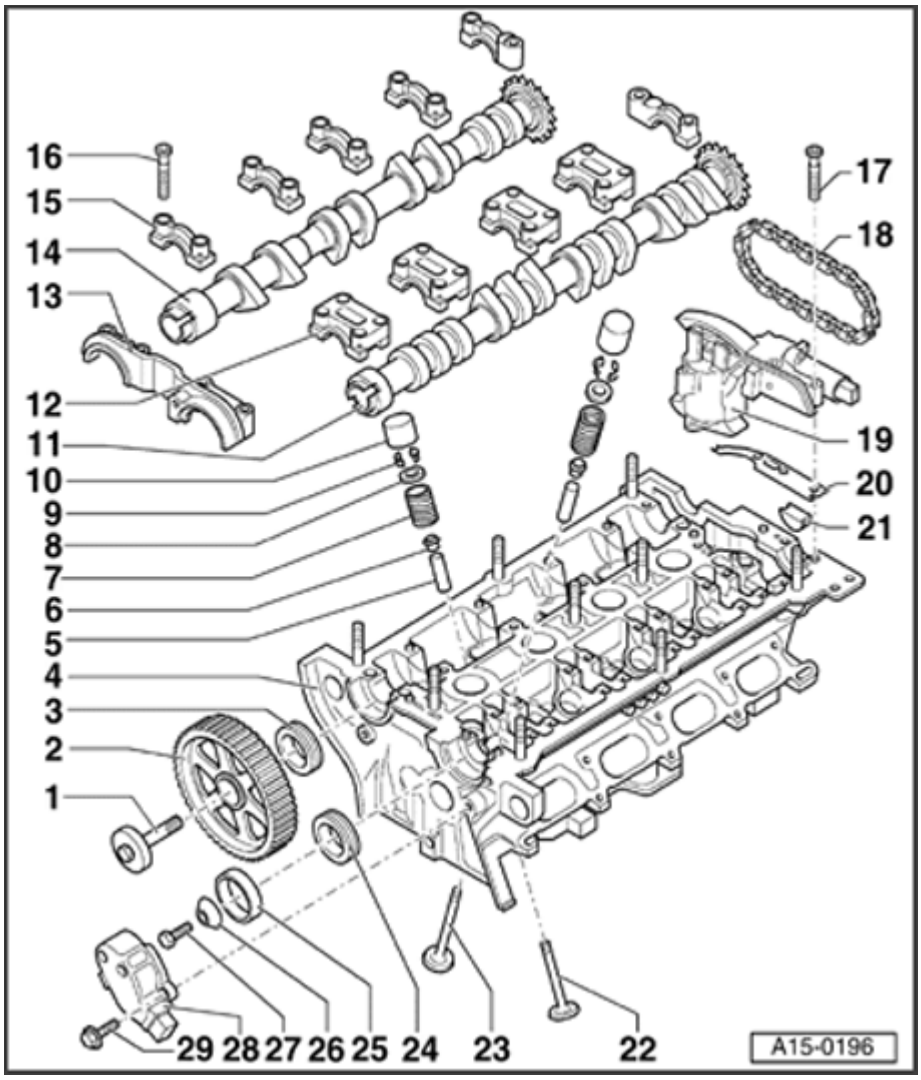

Fig. 173: Valve Gear, Servicing Overview
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - 65 Nm

- Use counterhold 3036 to loosen and tighten

2 - Camshaft sprocket

- For exhaust camshaft
- Note installed position: Narrow web of camshaft sprocket must face toward front and marking for TDC No. 1 cylinder must be visible from front *Install camshaft sprocket.* under **Installing**

3 - Oil seal

- For exhaust camshaft
- Replacing --> **Exhaust camshaft oil seal, replacing**

4 - Cylinder head

- See note --> **Valve gear, servicing**
- Checking valve guides --> **Valve guides, checking**
- Refacing valve seats --> **Valve seats, refacing**
- Dowel sleeves for bearing caps must be located in cylinder head
- Sealing transition points **Sealing transition points between double bearing cap and cylinder head (2 points):** and **Sealing camshaft adjuster/cylinder head transition (4 points)**

5 - Valve guide

- Checking --> **Valve guides, checking**

6 - Valve stem seal

- Replacing --> **Valve stem seals, replacing**

7 - Valve spring

- Removing and installing --> **Valve stem seals, replacing**

8 - Valve spring plate

9 - Valve keeper

10 - Hydraulic valve lifter

- Checking --> **Hydraulic valve lifters, checking**
- Removing and installing --> **Valve stem seals, replacing**
- Do not interchange
- Store with contact surface downward
- Before installing check camshaft axial clearance --> **Camshaft axial clearance, checking**
- Oil contact surface

11 - Intake camshaft

- Check radial clearance with Plastigage™ (valve lifters not installed), Wear limit: 0.1 mm; Run-out: max. 0.035 mm
- Checking axial clearance --> **Camshaft axial clearance, checking** :
- Removing and installing camshafts --> **Camshafts and camshaft adjuster, removing and installing**

12 - Bearing cap for intake camshaft

- Must be located on dowel sleeves
- Dowel sleeves must be located in cylinder head
- Note installed position
- Installation sequence

13 - Double bearing cap

- Must be located on dowel sleeves
- Dowel sleeves must be located in cylinder head
- Apply small amount of AMV 188 001 02 to sealing surface before installation
- Sealing transition points between double bearing cap and cylinder head **Sealing transition points between double bearing cap and cylinder head (2 points):**

14 - Exhaust camshaft

- Check radial clearance with Plastigage™ (valve lifters not installed): Wear limit: 0.1 mm; Run-out: max. 0.035 mm
- Checking axial clearance --> **Camshaft axial clearance, checking**
- Removing and installing camshafts --> **Camshafts and camshaft adjuster, removing and installing**

15 - Bearing cap for exhaust camshaft

- Must be located on dowel sleeves
- Dowel sleeves must be located in cylinder head
- Note installed position
- Installation sequence

16 - 10 Nm

17 - 10 Nm

18 - Drive chain

- Check for wear
- Mark position of chain before removing *Clean chain and camshaft sprockets opposite two* under **Removing**
- Removing and installing --> **Camshafts and camshaft adjuster, removing and installing** , Camshaft, removing and installing

19 - Camshaft adjuster

- With Valve 1 for camshaft adjustment N205
- Checking --> **Camshaft timing control, checking**

- Secure with retainer for chain tensioner 3366 before removing
- Removing and installing --> **Camshafts and camshaft adjuster, removing and installing**

- Sealing transition points between camshaft adjuster and cylinder head **Sealing camshaft adjuster/cylinder head transition (4 points)**

20 - Rubber/metal gasket

- Apply sealant AMV 188 001 022 before installation

21 - Gasket

- Replace

22 - Exhaust valve

- With sodium filling
- Note instructions on scrapping valves with sodium filling **Valve dimensions**
- Do not rework, only lapping is permitted
- Valve dimensions **Valve dimensions**

- Checking valve guides --> **Valve guides, checking**
- Refacing valve seats --> **Valve seats, refacing**

23 - Intake valve

- Do not rework, only lapping is permitted
- Valve dimensions **Valve dimensions**
- Checking valve guides --> **Valve guides, checking**
- Refacing valve seats --> **Valve seats, refacing**

24 - Oil seal

- For intake camshaft
- Replacing --> **Intake camshaft oil seal, replacing**

25 - Camshaft position sensor rotor ring

- Note installed position: locate lug in notch on camshaft

26 - Washer

- Conical
- Note installed position

27 - 25 Nm

28 - Housing for Camshaft Position (CMP) sensor G40

29 - 10 Nm

Valve dimensions

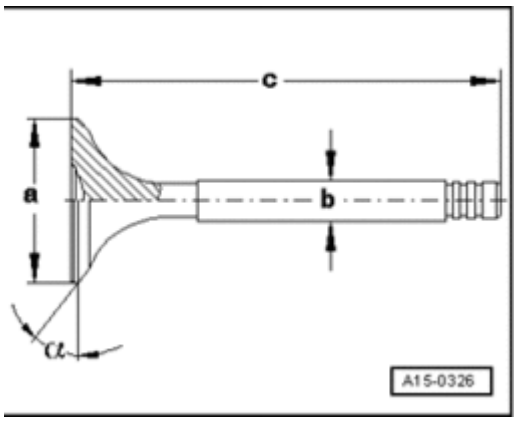

Fig. 174: Valve Dimensions
Courtesy of VOLKSWAGEN UNITED STATES, INC.

NOTE:

- **Intake and exhaust valves must not be reworked. Only lapping is permitted.**

Dimension		Intake valve	Exhaust valve
dia. a	mm	26.80...27.00	29.80...30.00
dia. b	mm	5.95...5.97	5.94...5.95
c	mm	104.84...105.34	103.64...104.14
a	Angle °	45	45

CAUTION: Worn exhaust valves with sodium filling must not be scrapped in the usual way.

The valves must be cut into two pieces between the shaft center and the valve head using a metal saw. When doing this they must not come into contact with water. Throw a maximum of ten valves prepared in this way into a bucket of water. Then step backward because a sudden chemical reaction occurs during which the sodium filling is burned.

Parts treated in this way can be scrapped in the usual manner.

Camshaft axial clearance, checking

Special tools, testers and auxiliary items required

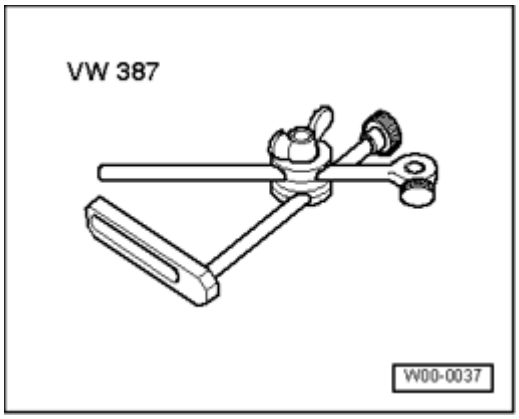

Fig. 175: Identifying Dial Gauge Holder VW 387
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Universal dial indicator holder VW387
- Dial indicator

Work sequence

Perform measurement with valve lifters removed and with bearing cap at chain sprocket end and double bearing cap at camshaft sprocket end installed.

- Attach dial indicator with universal dial indicator holder VW387 to cylinder head:

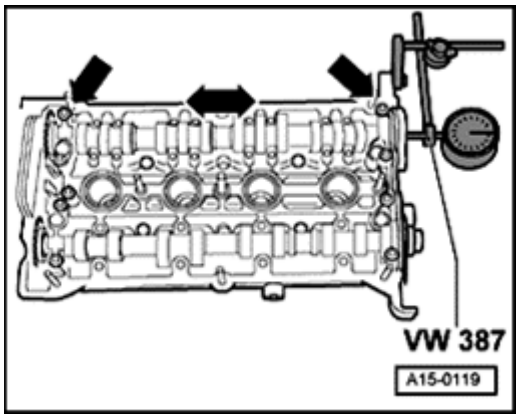

Fig. 176: Camshaft Axial Clearance, Checking - Intake Camshaft
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Intake camshaft

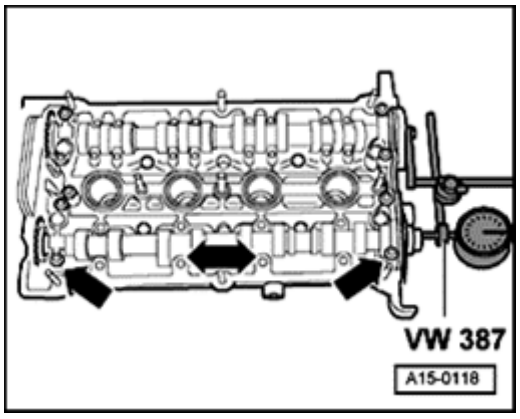

Fig. 177: Camshaft Axial Clearance, Checking - Exhaust Camshaft
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Exhaust camshaft

Wear limit for intake and exhaust camshafts:

- Axial clearance: max. 0.20 mm

Exhaust camshaft oil seal, replacing

Special tools, testers and auxiliary items required

- Oil seal extractor 2085
- Counterhold 3036
- Puller 3241
- Assembly tool T10071

Removing

- Cylinder head installed
- Lock carrier in service position --> **Lock carrier, moving to service position**.

  - Remove toothed belt from camshaft sprocket --> **Toothed drive belt, removing, installing and tensioning**.

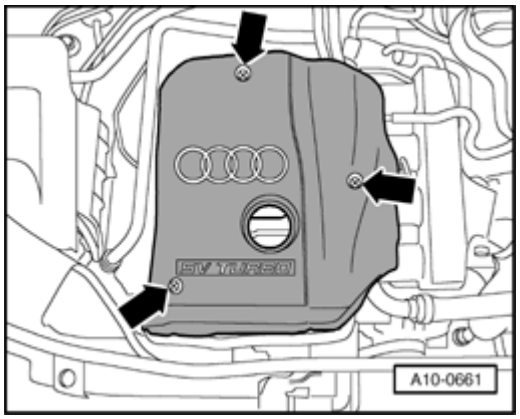

Fig. 178: Removing Engine Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove engine cover - **arrows** -.
- Remove top section of toothed belt guard --> **Toothed drive belt, removing, installing and tensioning**.

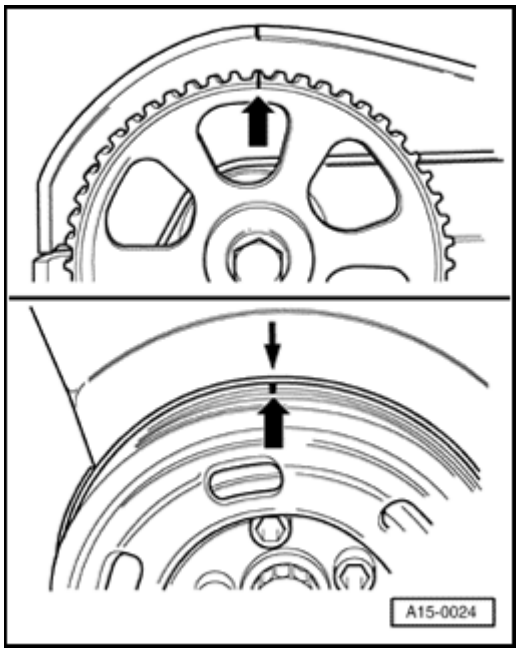

Fig. 179: Identifying Marking On Camshaft Gear Aligned With Marking On Cylinder Head Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Rotate crankshaft at central bolt of crankshaft toothed belt sprocket in direction of engine rotation to TDC No. 1 cylinder - **arrow** -.
- Loosen camshaft sprocket (counterhold with 3036).
- Pull off camshaft sprocket.

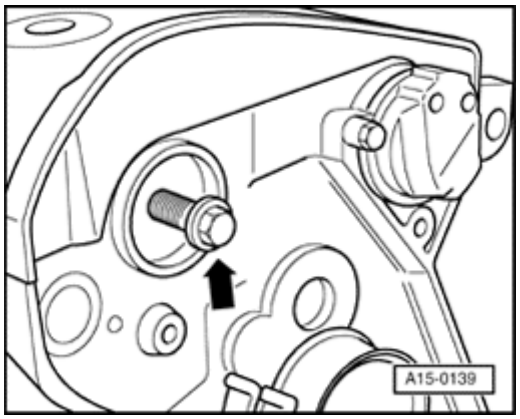

Fig. 180: Camshaft Gear Retaining Bolt Installed Into Camshaft To Stop
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- To guide oil seal extractor, screw bolt for camshaft sprocket - **arrow** - into camshaft as far as it will go by hand.
- Remove inner part of oil seal extractor 2085 two turns (approx. 3 mm) out of outer part and lock with knurled screw.

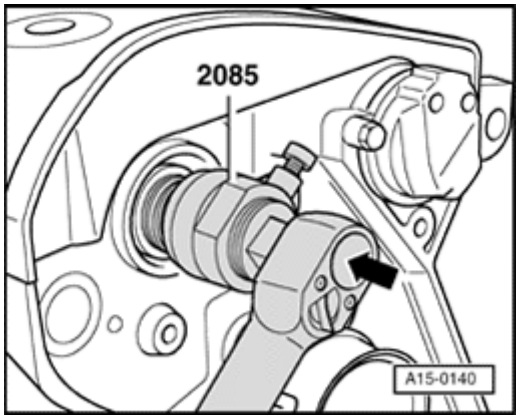

Fig. 181: Positioning And Screwing Bolt Into Oil Seal As Far As Possible With Forced Pressure
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Lubricate threaded head of oil seal extractor 2085 , place in position and exerting firm pressure screw as far as possible into oil seal.
- Loosen knurled screw and turn inner part against camshaft until oil seal is pulled out.
- Clamp flats of oil seal extractor in vise. Remove oil seal with pliers.

Installing

NOTE:

- **Do not oil sealing lip of oil seal.**

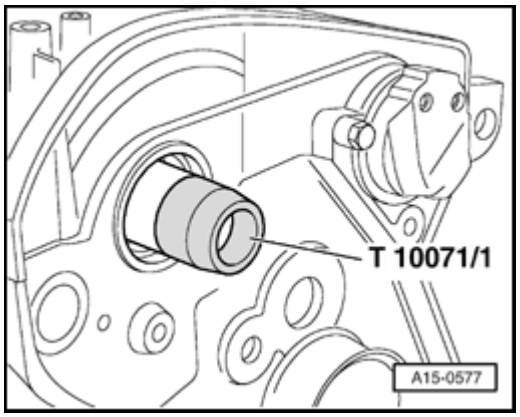

Fig. 182: Placing Guide Sleeve T10071/1 On Camshaft Pin
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Install guide sleeve T10071/1 onto camshaft journal.
- Slide oil seal over guide sleeve onto shaft journal.
- Remove guide sleeve.

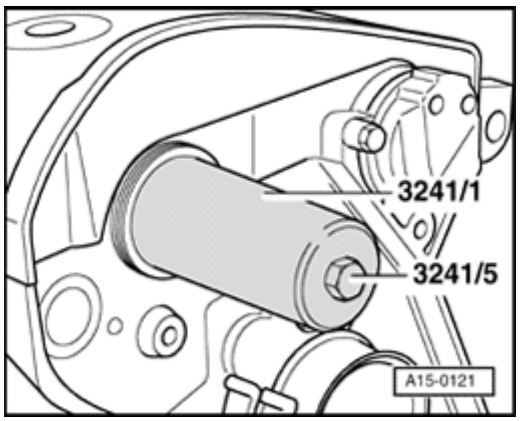

Fig. 183: Pushing In Oil Seal As Far As It Will Go Using Thrust Sleeve 3241/1
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Push in oil seal as far as it will go using thrust sleeve 3241/1. To do so, use bolt 3241/5.

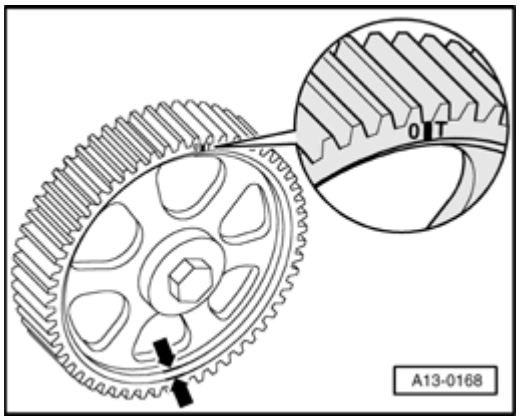

Fig. 184: Identifying Camshaft Gear Thin Rib Toward Outside And TDC Marking Visible
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Install camshaft sprocket.
- Note installed position:

Narrow web of camshaft sprocket must face outward - **arrows** - and marking for TDC No. 1 cylinder must be visible from front.

- Install securing bolts for camshaft sprocket (use counterhold 3036).

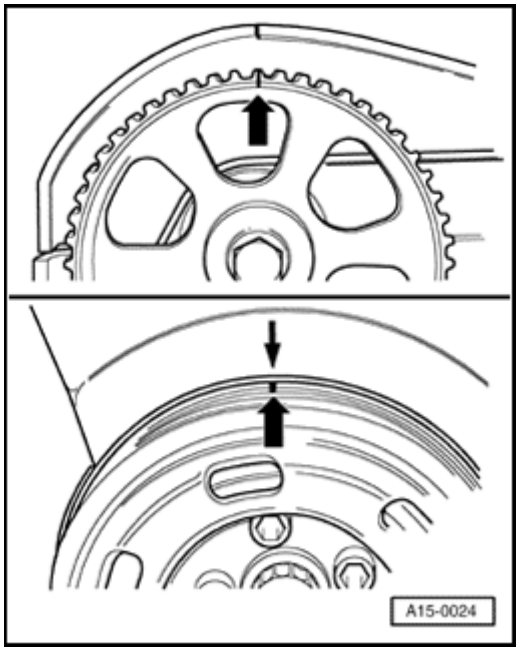

Fig. 185: Identifying Marking On Camshaft Gear Aligned With Marking On Cylinder Head Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Align marking on camshaft sprocket with marking on cylinder head cover.
- Align marking on vibration damper with marking on lower section of toothed belt guard.

NOTE:

- **If a piston is at TDC, valves could strike piston when camshaft is turned. Pistons must not, therefore, be set to TDC.**

- Install toothed belt (adjust valve timing).

Tightening torque

Component	Nm
Camshaft sprocket to camshaft	65

Intake camshaft oil seal, replacing

Special tools, testers and auxiliary items required

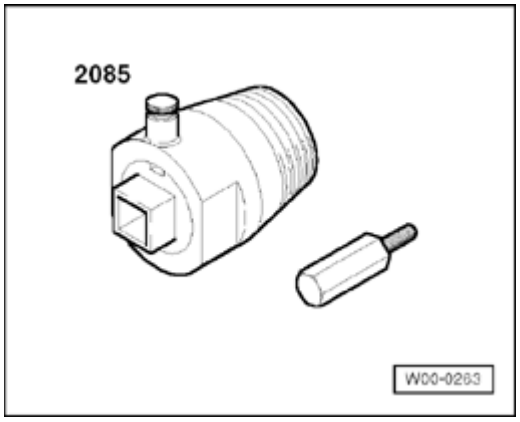

Fig. 186: Oil Seal Extractor 2085
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Oil seal extractor 2085

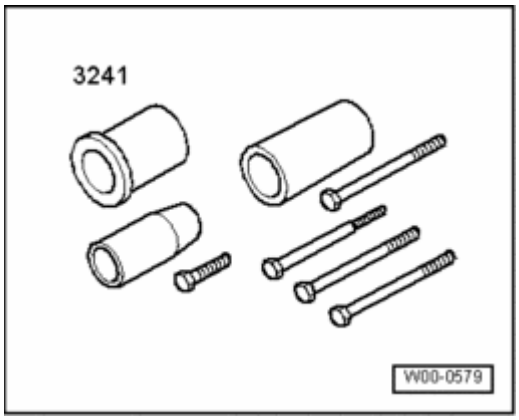

Fig. 187: Puller 3241
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Puller 3241

Removing

- Cylinder head installed
- Lock carrier in service position --> **Lock carrier, moving to service position**.

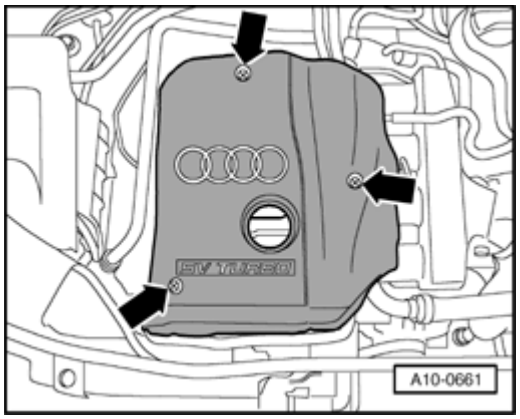

Fig. 188: Removing Engine Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove engine cover - **arrows** -.
- Remove top section of toothed belt guard --> **Toothed drive belt, removing, installing and tensioning**.

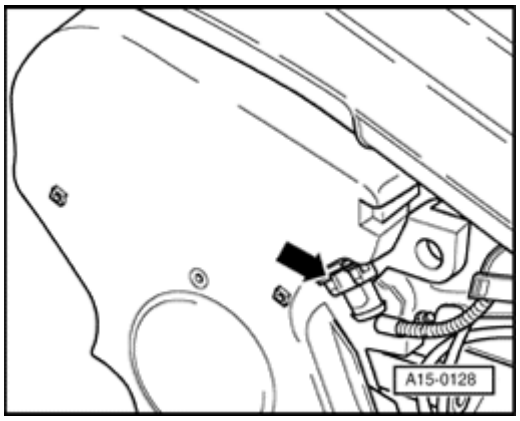

Fig. 189: Locating Connector At Camshaft Position Sensor G40
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect connector from Camshaft Position (CMP) sensor G40 - **arrow** -.
- Remove housing for CMP sensor G40.
- Remove washer and CMP sensor rotor ring.

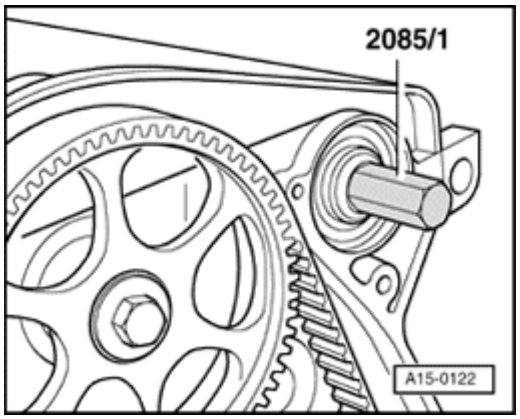

Fig. 190: Adapter 2085/1 Threaded In Camshaft
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- To guide oil seal extractor, screw bolt 2085/1 into camshaft as far as it will go by hand.
- Remove inner part of oil seal extractor 2085 two turns (approx. 3 mm) out of outer part and lock with knurled screw.

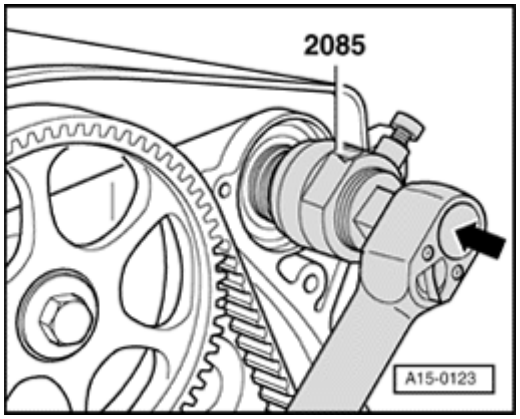

Fig. 191: Screwing Threaded Head Of Seal Extractor With Forced Pressure Into Oil Seal
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Lubricate threaded head of oil seal extractor 2085 , place in position and exerting firm pressure screw as far as possible into oil seal.
- Loosen knurled screw and turn inner part against camshaft until oil seal is pulled out.

Installing

NOTE:

- **Depending on design, radial shaft oil seals with ring spring or socalled PTFE oil seals are used on intake camshaft.**

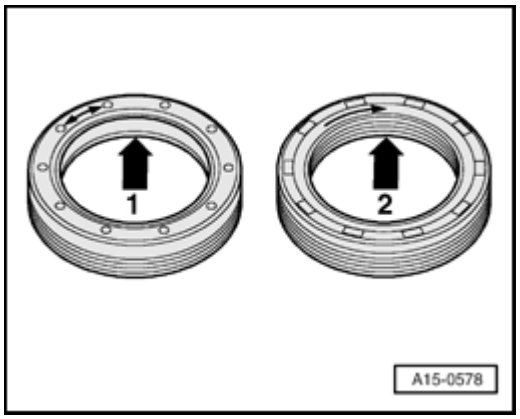

Fig. 192: Identifying A PTFE Seal (Teflon) & Inner Coil Spring Type Seal
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Distinguishing features: Conventional shaft oil seal has just one sealing lip - **arrow 1** - which is pressed against sealing surface by a ring spring.
- PTFE oil seal has a thread-like sealing surface - **arrow 2** - , but no ring spring.
- The sealing surface of the PTFE oil seal must not be stretched during installation. Consequently, the PTFE oil seal must not be inserted using the guide sleeve used for oil seals with ring spring.
- PTFE oil seals must be installed according to the direction of shaft rotation (see - **arrow** - markings on oil seal). Incorrect direction of rotation results in oil leakage.

Installing PTFE oil seal

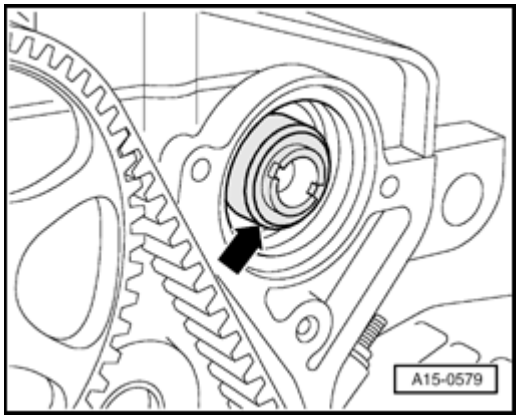

Fig. 193: Checking Chamfer Edge On End Of Intake Camshaft For Burrs Or Sharp Areas
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Check chamfer edge - **arrow** - on end of intake camshaft for burrs or sharp areas.
- If necessary smooth edges using an oil stone.

NOTE:

- **Do not oil sealing lip of oil seal.**

- Carefully push PTFE oil seal onto end of shaft by hand.

Installing oil seal with ring spring

NOTE:

- **Do not oil sealing lip of oil seal.**

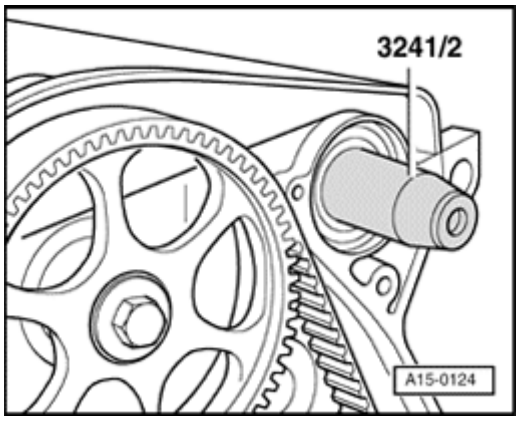

Fig. 194: Guide Sleeve 3241/2 On Camshaft Pin
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Install guide sleeve 3241/2 onto camshaft journal.
- Slide oil seal over guide sleeve.

All models

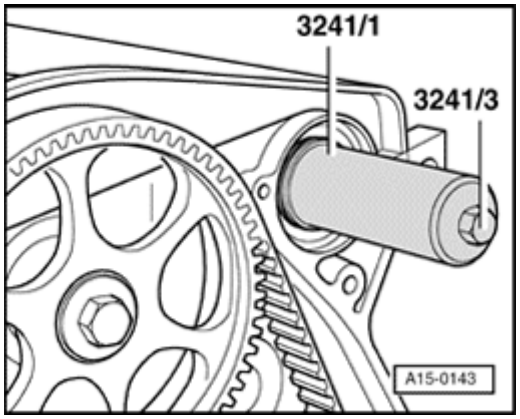

Fig. 195: Pressing In Gasket Up To Stop Using Thrust Sleeve 3241/1 And Bolt 3241/3
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Push in oil seal as far as it will go using thrust sleeve 3241/1. To do so, use bolt 3241/3.
- Install CMP sensor.
- Install top section of toothed belt guard.
- Install lock carrier --> **Lock carrier, moving to service position**.

Tightening torques

Component	Nm
CMP sensor rotor ring to camshaft	25
CMP sensor housing to cylinder head	10

Camshafts and camshaft adjuster, removing and installing

Special tools, testers and auxiliary items required

- Counterhold 3036
- Chain tensioner holder 3366

Removing

- Cylinder head installed
- Lock carrier in service position --> **Lock carrier, moving to service position**.

o Remove toothed belt from camshaft sprocket --> **Toothed drive belt, removing, installing and tensioning**.

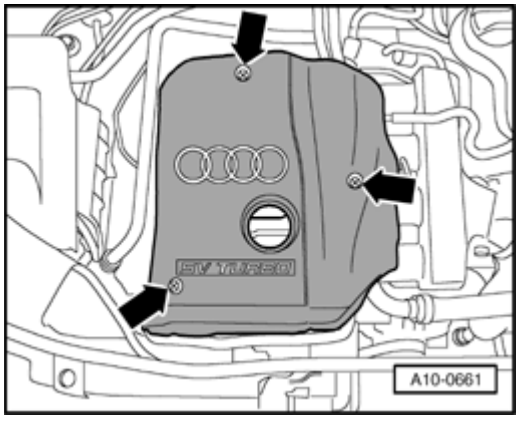

Fig. 196: Removing Engine Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

o Remove engine cover - **arrows** -.
o Remove secondary air combination valve --> **Secondary air combination valve, removing and installing**.

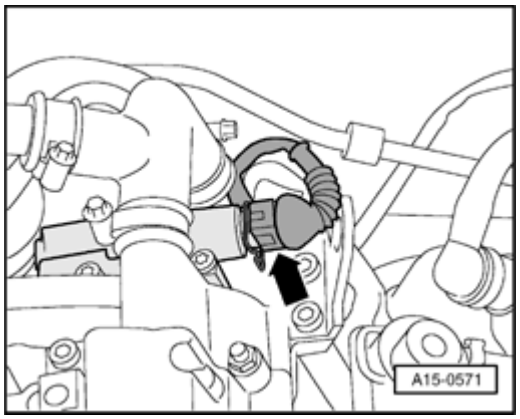

Fig. 197: Disconnecting Connector At Camshaft Adjuster
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect connector - **arrow** - at camshaft adjuster.
- Remove cylinder head cover --> **Cylinder head cover, removing and installing**.
- Loosen camshaft sprocket (counterhold with 3036).
- Pull off camshaft sprocket.

- Remove entire camshaft position sensor.

NOTE:

- **Excessive tightening of chain tensioner holder can damage camshaft adjuster.**

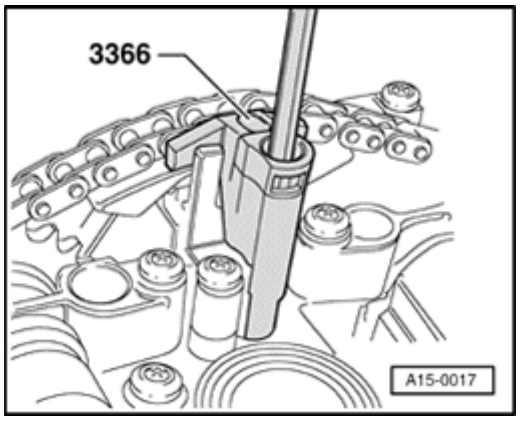

Fig. 198: Securing Camshaft Adjuster Or Chain Tensioner Using Bracket For Chain Adjustment 3366
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Secure camshaft adjuster with chain tensioner holder 3366.

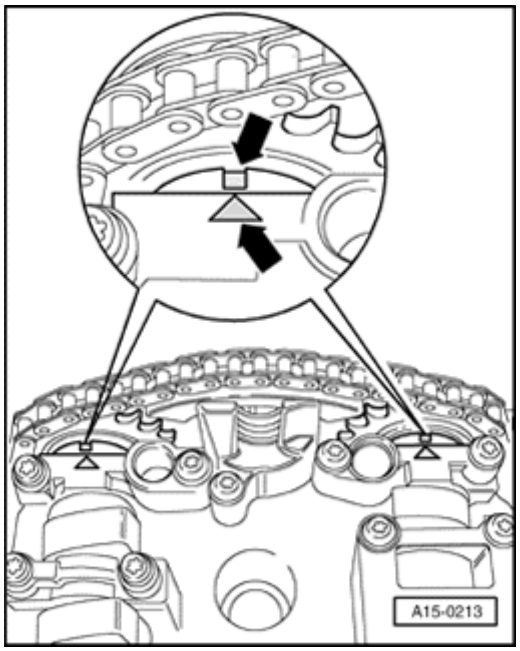

Fig. 199: Checking Position Of Camshafts To Each Other
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Re-check TDC position of camshafts:
- Mark on two camshafts must be in line with - **arrows** - on bearing caps.
- Clean chain and camshaft sprockets opposite two - **arrows** - on bearing caps and mark installed position using colored markings.

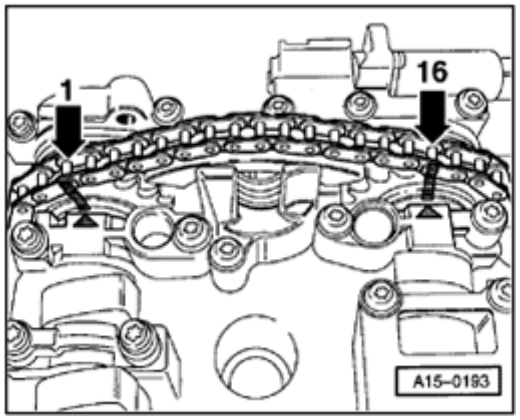

Fig. 200: Checking Distance Between Markings Consists Of 16 Rollers Of The Drive Chain
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Eistance between two - **arrows** - or between colored markings is 16 rollers on drive chain.
- Notch on exhaust camshaft is offset slightly toward inside in relation to chain roller - **1** -.

NOTE:

- **Do not mark chain with a center punch or by making a notch, etc.**

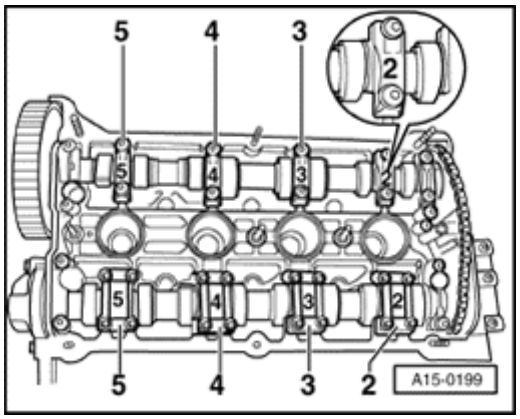

Fig. 201: Identifying Bearing Cap Positions
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- First remove bearing caps 3 and 5 on intake and exhaust camshafts.
- Remove double bearing cap.
- Remove both bearing caps on intake and exhaust camshaft chain sprockets.
- Remove bolts securing camshaft adjuster.

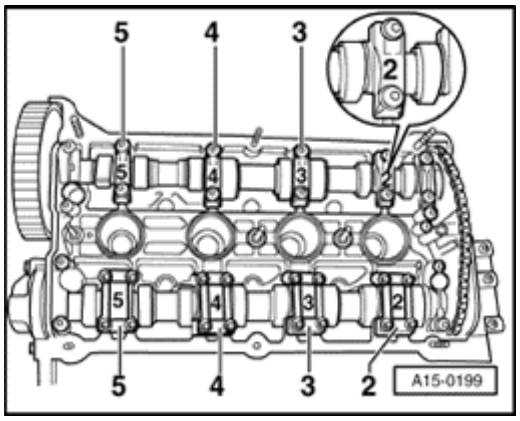

Fig. 202: Identifying Bearing Cap Positions
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Loosen bearing caps 2 and 4 of intake and exhaust camshafts alternately in diagonal sequence and remove.
- Remove intake and exhaust camshafts together with camshaft adjuster.

Installing

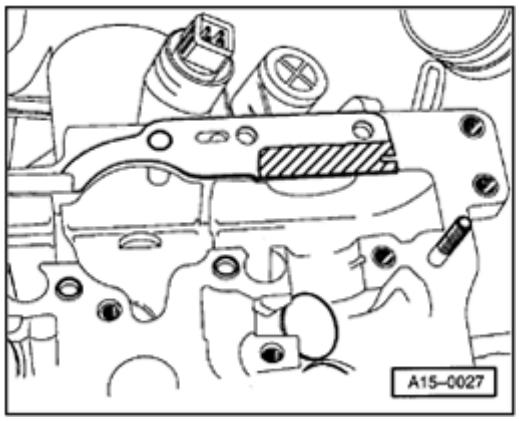

Fig. 203: Sealant Application Area Identified By Hatched Surface
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Replace rubber/metal gasket for camshaft adjuster and apply a thin coat of sealant AMV 188 001 02 to shaded areas.
- Install drive chain on camshaft sprockets as follows:

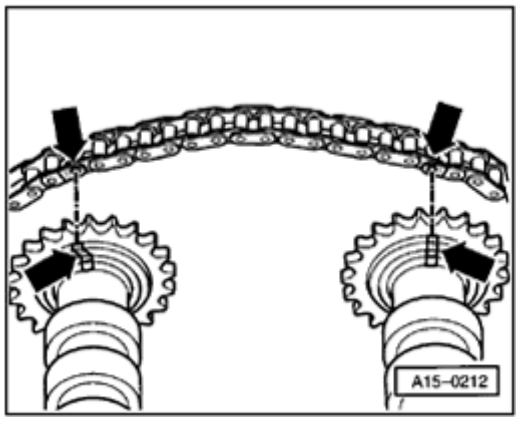

Fig. 204: Installing Chain So That Colored Markings Are In Line
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- If old chain is re-installed, install chain so that colored markings are in line - **arrows** -.

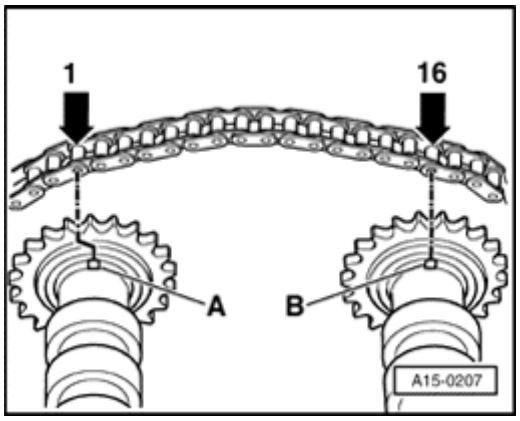

Fig. 205: First And Sixteenth Drive Chain Rollers Installed On Chain Gears
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- If new chain is installed, distance between notches - **A** - and - **B** - on camshafts must be 16 rollers on chain. Illustration shows exact positions of 1st and 16th rollers on sprockets.
- Notch - **A** - is offset slightly toward inside in relation to chain roller - **1** -

- Insert camshaft adjuster between drive chain (2 technicians needed).
- Locate camshafts together with drive chain and camshaft adjuster in cylinder head.
- Oil running surfaces of both camshafts.

NOTE:

- **Dowel sleeves for bearing caps and camshaft adjuster must be installed in cylinder head.**
- **When installing bearing caps ensure that identification mark is readable from intake side of cylinder head.**

- Tighten mountings of camshaft adjuster (watch position of dowel sleeves).

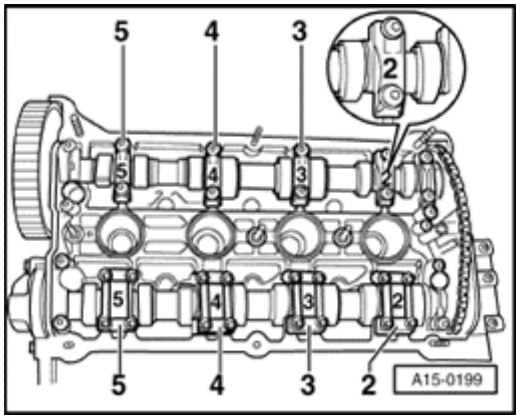

Fig. 206: Identifying Bearing Cap Positions
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Tighten bearing caps 2 and 4 of intake and exhaust camshafts alternately in diagonal sequence (watch position of dowel sleeves).
- Install both bearing caps on intake and exhaust camshaft chain sprockets.
- Check correct setting of camshafts:

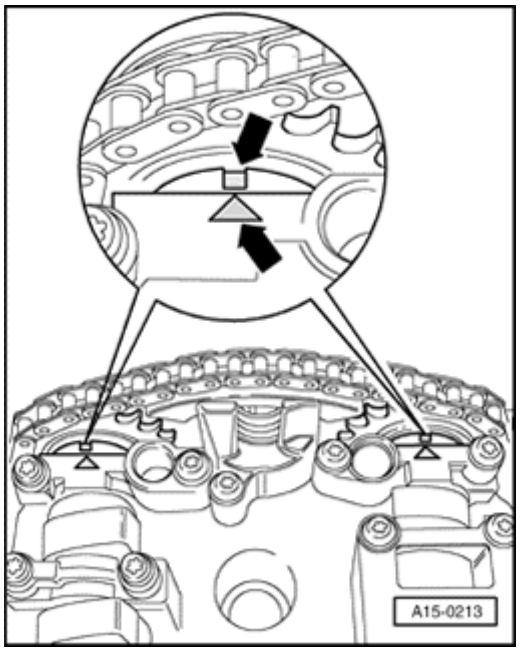

Fig. 207: Checking Position Of Camshafts To Each Other
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Two markings on camshafts must be in line with two - **arrows** - on bearing caps - **arrows** -.

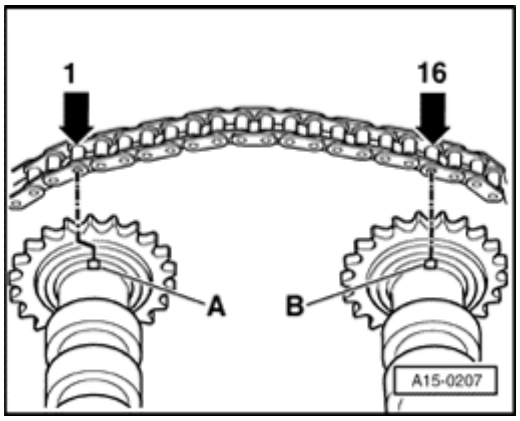

Fig. 208: First And Sixteenth Drive Chain Rollers Installed On Chain Gears
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Distance between two - **arrows** - on bearing caps or between colored markings is 16 rollers on drive chain.
- Notch on exhaust camshaft is offset slightly toward inside in relation to chain roller - **1** -

- Remove chain tensioner holder 3366.

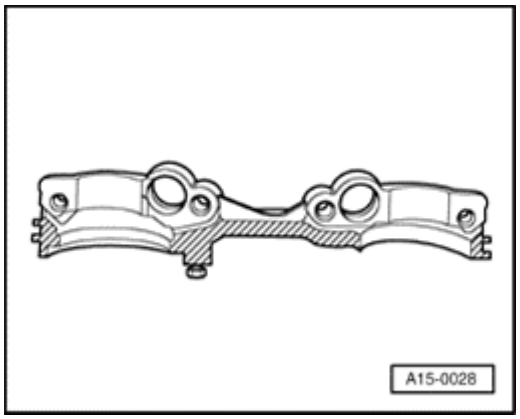

Fig. 209: Identifying Double Bearing Cap Sealant Application Area
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Apply thin coat of sealant AMV 188 001 02 to shaded area on double bearing cap and install bearing cap (watch position of dowel sleeves).
- Install remaining bearing caps (watch position of dowel sleeves).
- Replace oil seals for intake and exhaust camshafts --> **Exhaust camshaft oil seal, replacing** on.

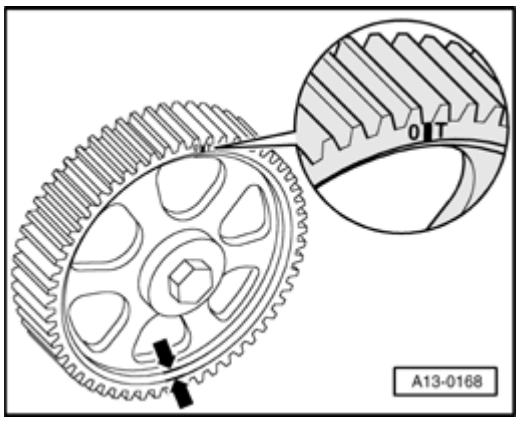

Fig. 210: Identifying Camshaft Gear Thin Rib Toward Outside And TDC Marking Visible
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Install camshaft sprocket.

- Note installed position:

Narrow web of camshaft sprocket must face outward - **arrows** - and marking for TDC No. 1 cylinder must be visible from front.

- Install securing bolt for camshaft sprocket (use counterhold 3036).
- Install camshaft position sensor.
- Install cylinder head cover

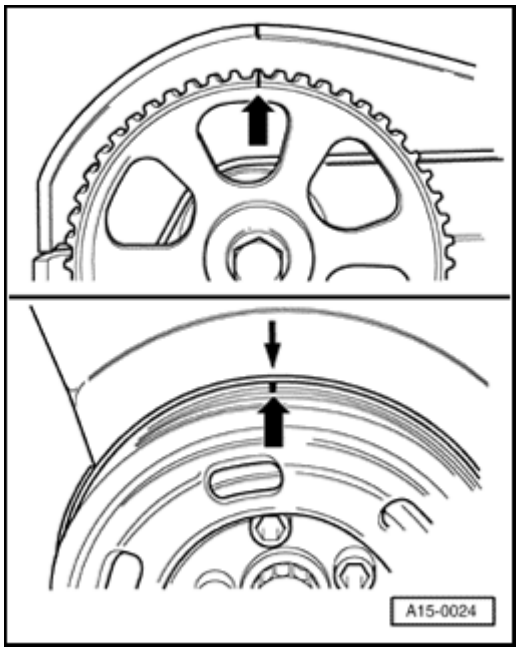

Fig. 211: Identifying Marking On Camshaft Gear Aligned With Marking On Cylinder Head Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Align marking on camshaft sprocket with marking on cylinder head cover.
- Align marking on vibration damper with marking on bottom section of toothed belt guard.

NOTE:

- **The crankshaft must not be at TDC when camshaft is turned. Otherwise there is a risk of damage to valves and piston crowns.**

- Install toothed belt (adjust valve timing) --> **Toothed drive belt, removing, installing and tensioning**.

NOTE:

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

Tightening torques

Component	Nm
Bearing caps to cylinder head	10
Camshaft adjuster to cylinder head	10
Camshaft position sensor rotor ring to camshaft	25
Camshaft position sensor housing to cylinder head	10
Camshaft sprocket to camshaft	65

Hydraulic valve lifters, checking

Special tools, testers and auxiliary items required

- Feeler gauge
- Wooden or plastic wedge

NOTE:

- **Hydraulic valve lifters cannot be repaired.**
- **Irregular valve noises when starting engine are normal.**

Work sequence

- Start engine and run until coolant temperature reaches approx. 80 °C.
- Increase engine speed to about 2500 RPM for 2 minutes, if necessary perform test drive.

If hydraulic lifters are still noisy, locate faulty lifters as follows:

- Remove cylinder head cover --> **Cylinder head cover, removing and installing**.
- Rotate crankshaft until lobes on cams of lifters to be checked are pointing upward:

Vehicles with manual transmission:

- Push vehicle forward with 4th gear engaged and ignition switched off.

Vehicles with automatic transmission:

- Remove sound insulation and turn crankshaft clockwise by applying wrench to central bolt on crankshaft sprocket.
- Measure play between cam and valve lifter.

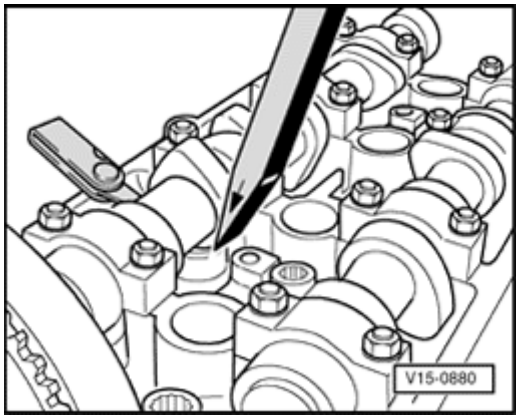

Fig. 212: Pressing Valve Lifter Down With Wooden Or Plastic Wedge
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Use wooden or plastic wedge to push down valve lifter. Replace valve lifter if an 0.20 mm feeler gauge can be inserted between camshaft and valve lifter.

Replacing valve lifter --> **Camshafts and camshaft adjuster, removing and installing** ; Camshafts and camshaft adjuster, removing and installing

NOTE:

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

Valve stem seals, replacing

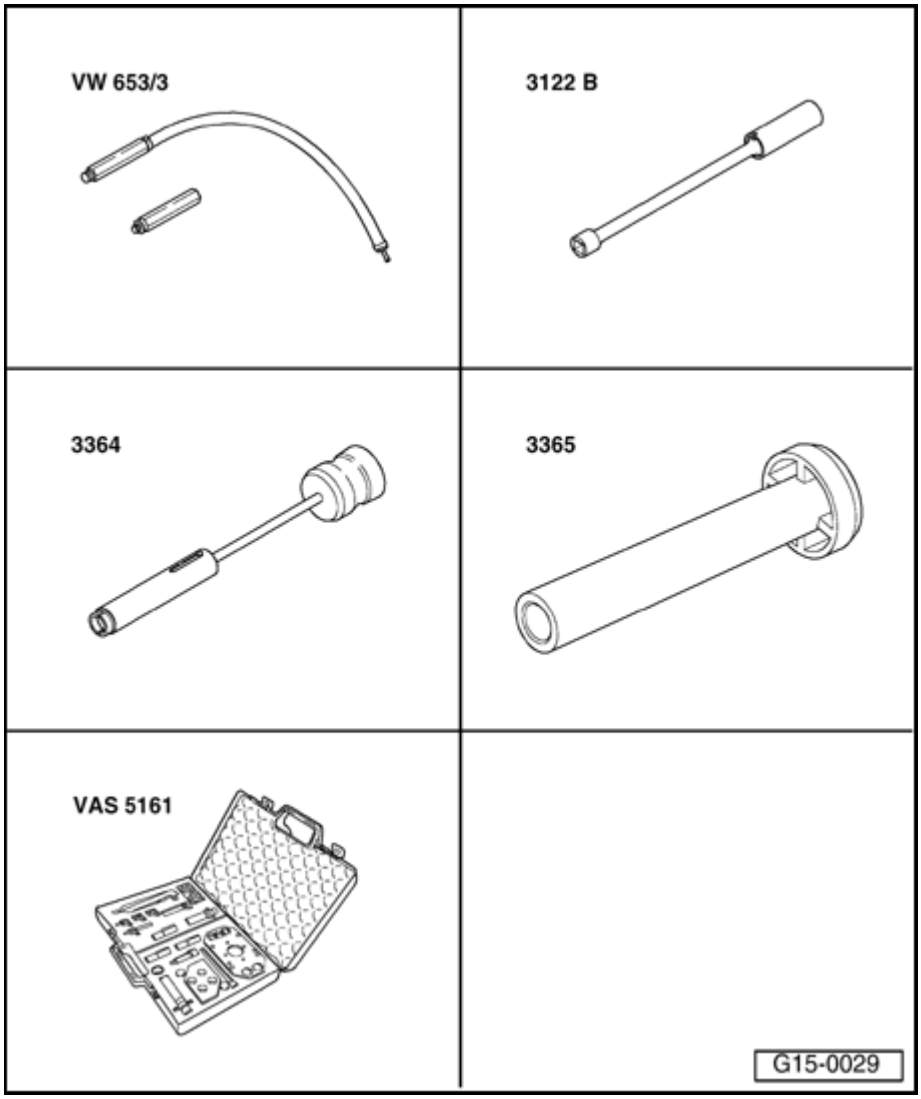

Fig. 213: Identifying Special Tools - Valve Stem Seals, Replacing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools, testers and auxiliary items required

- Pressure hose VW653/3
- Spark plug wrench 3122B
- Valve seal removal tool 3364
- Valve stem seal driver 3365
- Valve keeper assembly/disassembly device VAS5161

Removing

- Cylinder head installed.

- Remove camshafts and camshaft adjuster --> **Camshafts and camshaft adjuster, removing and installing**.

NOTE:

- **Ensure that valve lifters are not interchanged.**
- **Mark installation position on back of valve lifters with water-proof felt-tip pen.**

- Remove valve lifters from guides and set them down with contact surface facing downward.
- Use spark plug wrench 3122B to remove spark plugs.
- Set piston of appropriate cylinder to "bottom dead center".

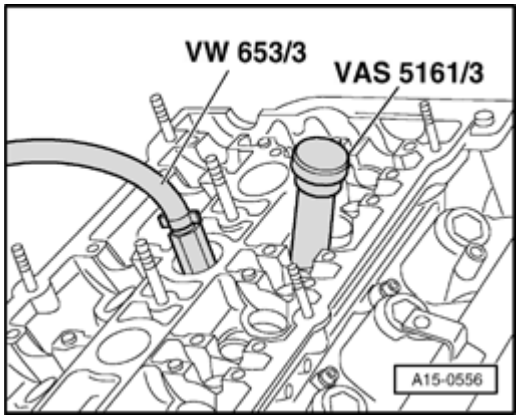

Fig. 214: Identifying Pressure Hose VW653/3 Into Spark Plug Thread & Drift VAS5161/3 In Valve Lifter Guide
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Screw pressure hose VW653/3 into spark plug thread and apply constant pressure of at least 6 bar.

- Place drift VAS5161/3 in valve lifter guide.
- Hammer jammed valve keepers on all five valves loose using a plastic hammer.

Exhaust side

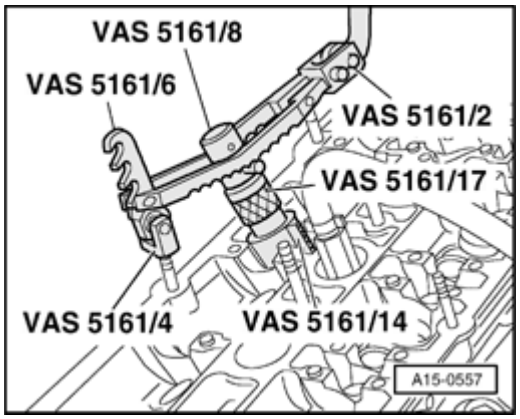

Fig. 215: Screwing Snap-In Device VAS5161/6 With Attaching Fork VAS5161/4 Onto Stud On Cylinder Head

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Screw snap-in device VAS5161/6 with attaching fork VAS5161/4 onto stud on cylinder head.
- Push guide bushing VAS5161/14 as far as it will go into valve lifter guide on valve to be removed.

- Installed position: Checkered areas must be at right angle to direction of travel

- Push knurled spacer ring VAS5161/17 onto cartridge VAS5161/8.

- Push cartridge into guide bushing.
- Attach pressure fork VAS5161/2 to snap-in device VAS5161/6 and press cartridge downward.
- Simultaneously, turn knurled screw of cartridge clockwise until ends engage in valve keepers.
- Move knurled screw back and forth slightly so that valve keepers are pressed apart and taken up into cartridge.

- Release pressure fork.
- Remove cartridge with spacer ring, guide bushing, valve head and valve spring.

Intake side

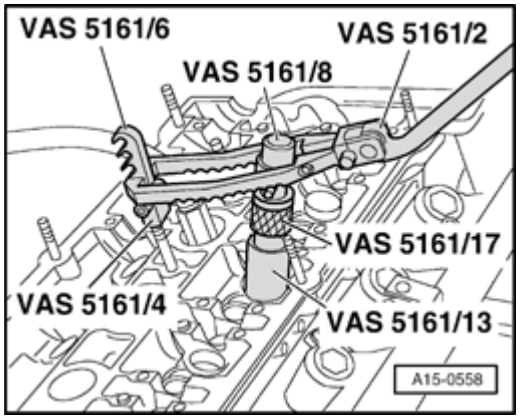

Fig. 216: Releasing Pressure Fork

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Screw snap-in device VAS5161/6 with attaching fork VAS5161/4 onto stud on cylinder head.
- Push guide bushing VAS5161/13 as far as it will go into valve lifter guide on valve to be removed.

- Installed position: Checkered areas must be at right angle to direction of travel

- Push knurled spacer ring VAS5161/17 onto cartridge VAS5161/8.
- Push cartridge into guide bushing.
- Attach pressure fork VAS5161/2 to snap-in device VAS5161/6 and press cartridge downward.
- Simultaneously, turn knurled screw of cartridge clockwise until ends engage in valve keepers.

- Move knurled screw back and forth slightly so that valve keepers are pressed apart and taken up into cartridge.

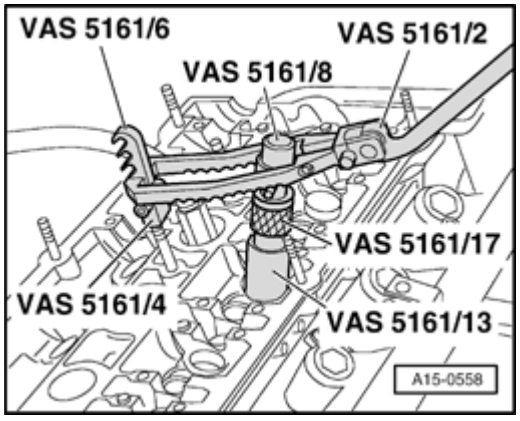

Fig. 217: Releasing Pressure Fork
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Release pressure fork.
- Remove cartridge with spacer ring, guide bushing, valve head and valve spring.

All

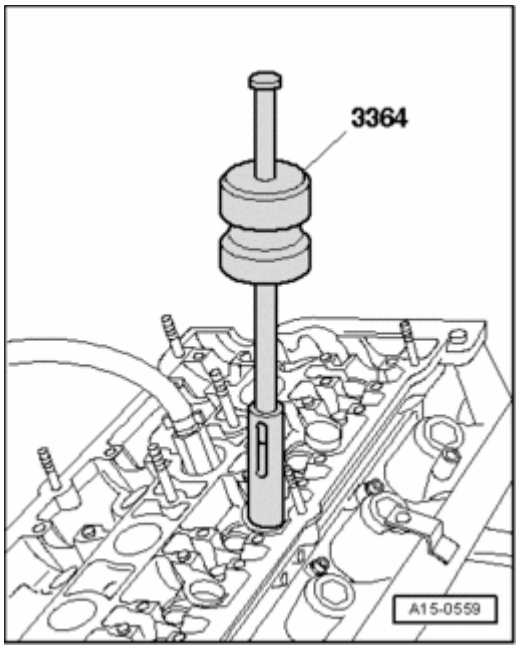

Fig. 218: Identifying Valve Seal Removal Tool 3364
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Pull off valve stem seals with 3364.

Installing

NOTE:

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

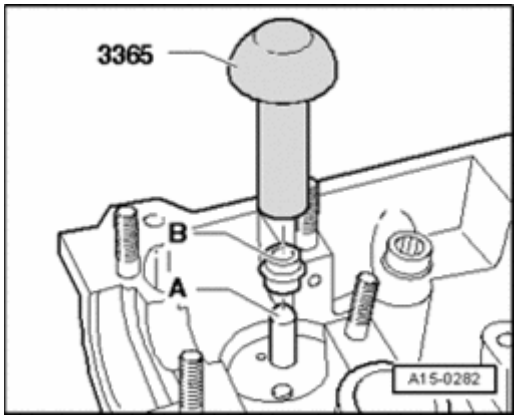

Fig. 219: Identifying Plastic Sleeve, Valve Stem Oil Seal & Valve Stem Seal Driver 3365
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- To prevent damage to new valve stem seals - **B** - , place plastic sleeve - **A** - on valve stem.
- Lightly oil sealing lip of valve stem seal.
- Push valve stem seal onto plastic sleeve.
- Carefully press valve stem seal onto valve guide using seal driver 3365.

- Remove plastic sleeve.

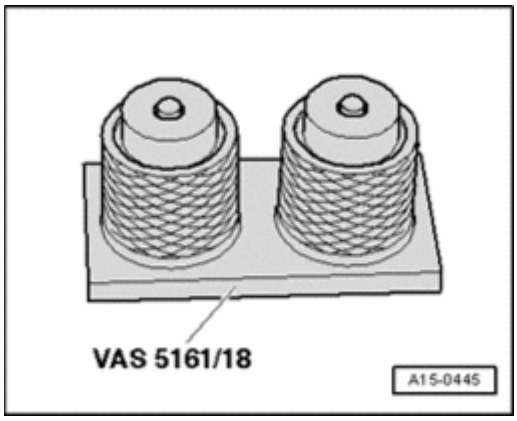

Fig. 220: Identifying Installation Cartridge VAS 5161/8
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- If valve keepers were taken out of cartridge, they must first be placed into insertion device VAS5161/18.

NOTE:

- **Larger diameter of valve keepers must face upward.**

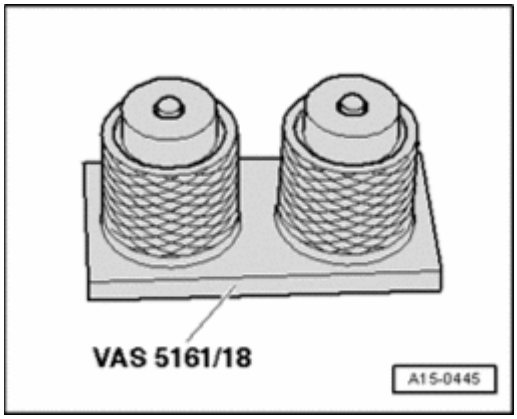

Fig. 221: Identifying Installation Cartridge VAS 5161/8
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Press cartridge VAS5161/8 onto insertion device from above and take up valve keepers.

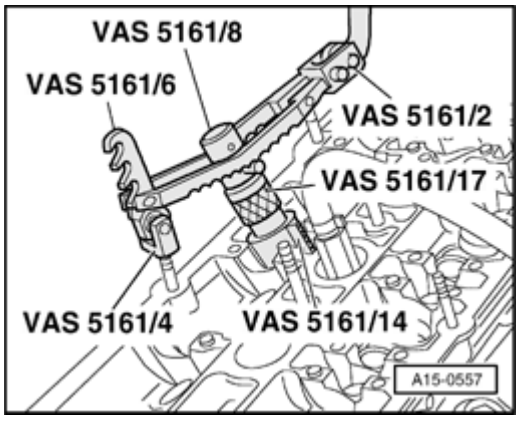

Fig. 222: Inserting Cartridge VAS5161/8 Back Into Guide Bushing VAS5161/13 Or VAS5161/14
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Insert cartridge VAS5161/8 back into guide bushing VAS5161/13 or VAS5161/14.
- Push down pressure fork and pull knurled screw up turning left and right - this inserts valve keepers.
- Release pressure fork with knurled screw still pulled upward.
- Insert valve lifters.

- Install camshafts and camshaft adjuster.

NOTE:

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

Valve guides, checking

Special tools, testers and auxiliary items required

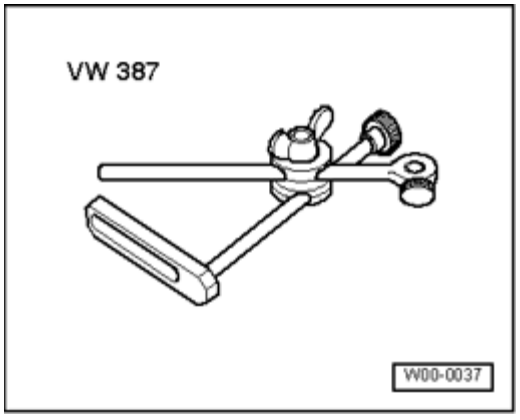

Fig. 223: Identifying Dial Gauge Holder VW 387
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Universal dial indicator holder VW387
- Dial indicator

Work sequence

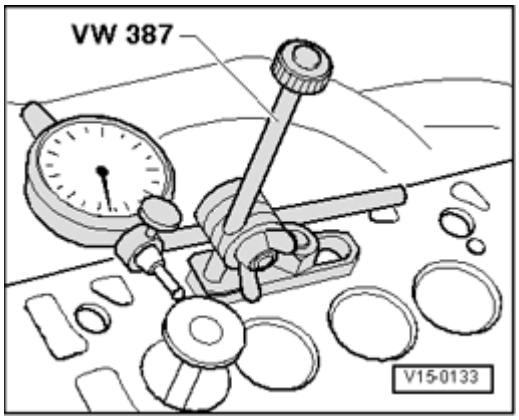

Fig. 224: Identifying Special Tool - VW 387 Installed
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Insert valve into valve guide. Valve stem end must be flush with guide. Due to slight difference in stem diameters, ensure that only an intake valve is used in an intake guide and an exhaust valve in an exhaust guide.
- Measure lateral play.

Wear limit

Intake valve guide	Exhaust valve guide
0.80 mm	0.80 mm

NOTE:

- **If wear limit is exceeded, repeat measurement with new valve. If wear limit is again exceeded, replace valve guide.**
- **If valve is to be replaced as part of a repair, use a new valve for calculation.**

Valve seats, refacing

NOTE:

- **If a good seating pattern cannot be obtained by lapping valve seats, they must be refaced.**

Special tools, testers and auxiliary items required

- Depth gauge
- Valve seat grinding tool

NOTE:

- **When repairing engines with leaking valves, it is not sufficient to reface valve seats and replace valves. Valve guides must also be checked for wear. This is particularly important on high mileage engines --> Valve guides, checking.**
- **Valve seats should only be refaced just enough to produce a perfect seating pattern.**
- **Calculate the maximum permissible refacing dimension before refacing.**
- **If refacing dimension is exceeded, function of hydraulic valve lifters can no longer be guaranteed and cylinder head should be replaced.**

Calculating maximum permissible refacing dimension

- Insert valve and press it firmly against valve seat.

NOTE:

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

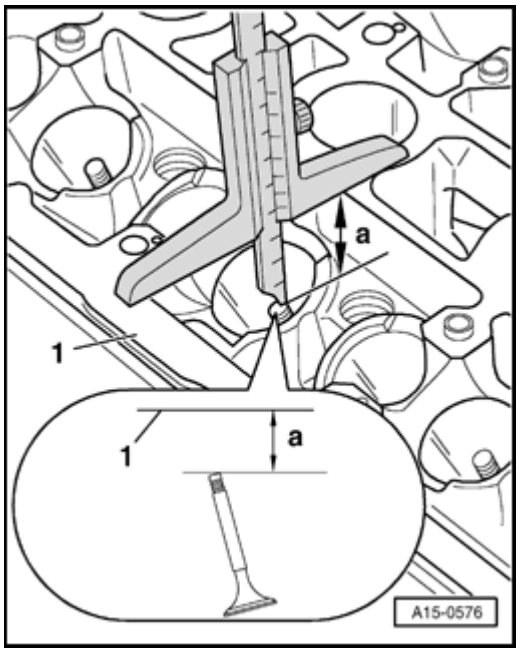

Fig. 225: Measuring Distance Between Valve Stem End (Upper Edge) And Top Surface Of Cylinder Head Using Depth Gauge
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Measure distance - **a** - between valve stem end (upper edge) and top surface of cylinder head using a depth gauge.
- Calculate max. permissible refacing dimension from measured distance and minimum dimension.

Minimum dimension		
Outer intake valves	Center intake valves	Exhaust valves

31.0 mm	32.2 mm	31.9 mm

Measured distance minus minimum dimension = maximum permissible refacing dimension.

Example for outer intake valve:		
	Measured distance	31.4 mm
-	Minimum dimension	- 31.0 mm
=	Max. permissible refacing dimension	= 0.4 mm

NOTE:

- **If the max. permissible refacing dimension is 0 mm or less than 0 mm, repeat the measurement with new valve. If the measured result is again 0 mm or less than 0 mm, replace the cylinder head.**

Refacing valve seats

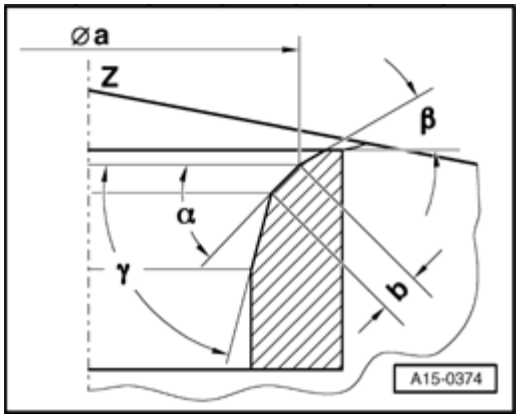

Fig. 226: Refacing Valve Seats Dimension
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Dimension		**Intake valve seat**
dia. a	mm	26.2
b	mm	1.5...1.8
Z		Cylinder head, bottom edge
a	45 °	Valve seat angle
ß	30 °	Adjustment angle (top)
gamma	60 °	Adjustment angle (bottom)

Dimension		**Exhaust valve seat**
dia. a	mm	29.0
b	mm	1.8
Z		Cylinder head, bottom edge
a	45 °	Valve seat angle
ß	30 °	Adjustment angle (top)

gamma	60 °	Adjustment angle (bottom)

CAMSHAFT TIMING CONTROL, CHECKING

Camshaft timing control, checking

The intake camshaft is adjusted according to load and engine speed. The solenoid camshaft adjustment valve causes oil pressure to be applied to the camshaft adjuster (mechanical adjustment device).

NOTE:

- **The camshaft timing control only becomes active 25 seconds after the engine is started.**

Camshaft adjustment valve, checking

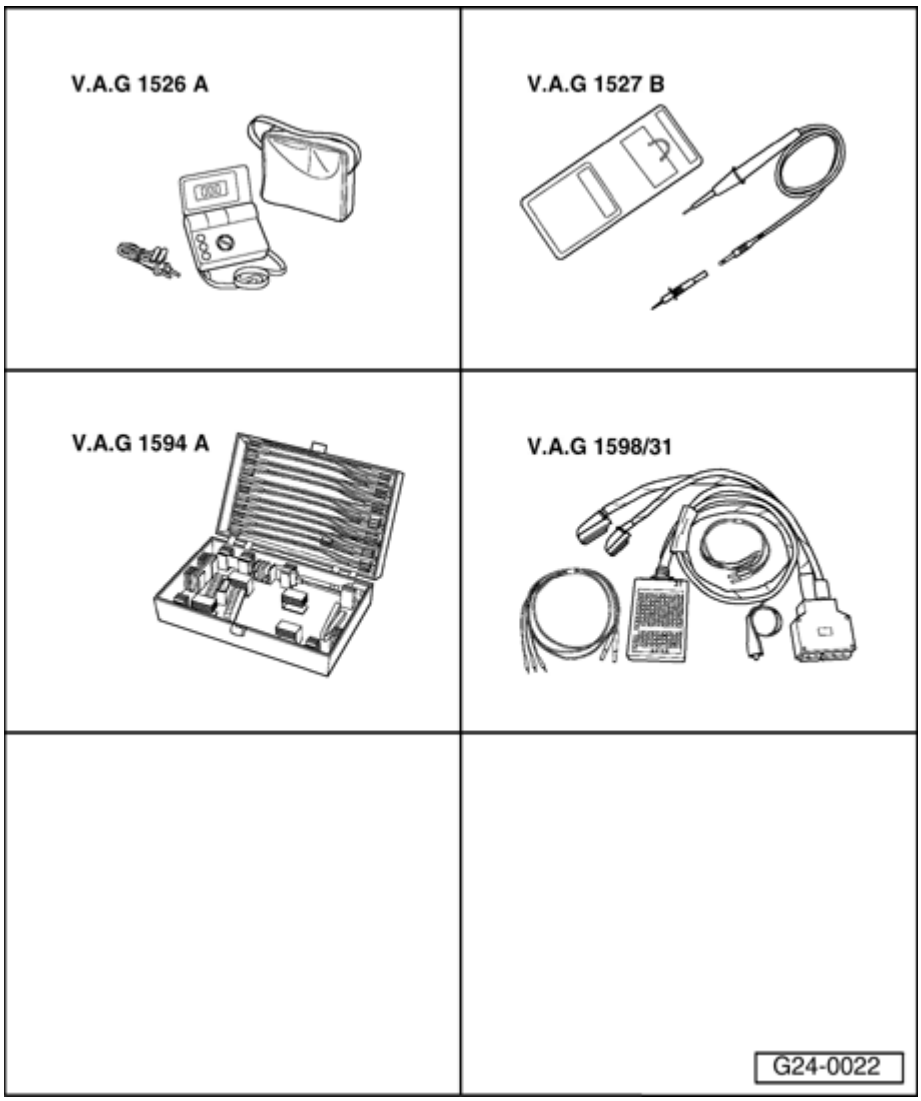

Fig. 227: Identifying Special Tools - Camshaft Adjustment Valve, Checking
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools, testers and auxiliary items required

- Multimeter VAG1526A
- Voltage tester VAG1527B
- Connector test kit VAG1594A
- Adapter VAG1598/31

Requirement

- Vehicle diagnostic, testing and information system VAS5051 or scan tool VAG1551 must be connected.

Work sequence

- Start output Diagnostic Test Mode and activate camshaft adjustment valve.

Indicated on display

Output Diagnostic Test Mode --> Camshaft timing control

- This valve is actuated (clicks) for approx. 1 minute if --> key is not pressed beforehand to select next control element.

If valve is not actuated (does not click):

- Check internal resistance of valve.

Checking internal resistance

- Switch off ignition.

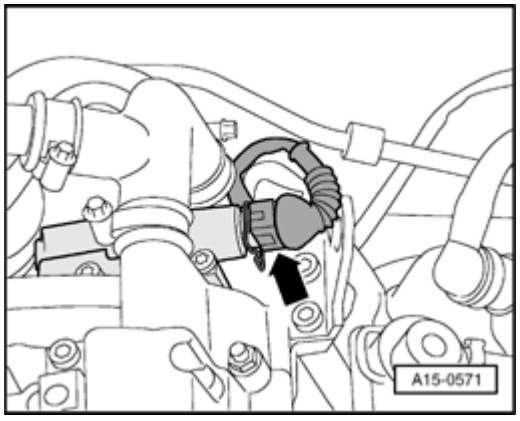

Fig. 228: Disconnecting Connector At Camshaft Adjuster
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect connector - **arrow** - at camshaft adjuster.

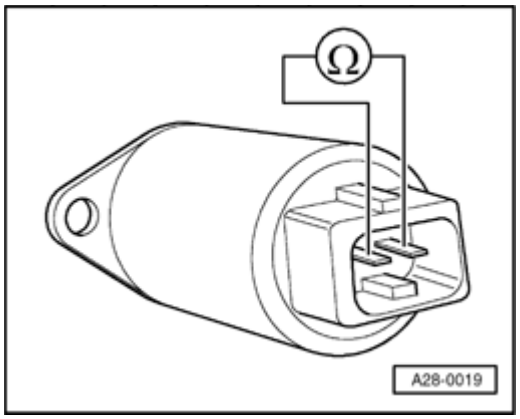

Fig. 229: Measuring Resistance Between Terminals Of Solenoid Valve
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect multimeter and measure resistance at valve.
- Specification: 10...18 ohms

If reading does not match specification:

- Replace valve.

If measured value matches specification:

- Check power supply.

Checking power supply

Requirements

- Fuse for camshaft adjustment valve OK --> Electrical Wiring Diagrams, Troubleshooting and Component Locations
- Fuel pump relay OK --> **24 - MULTIPORT FUEL INJECTION (MFI)**

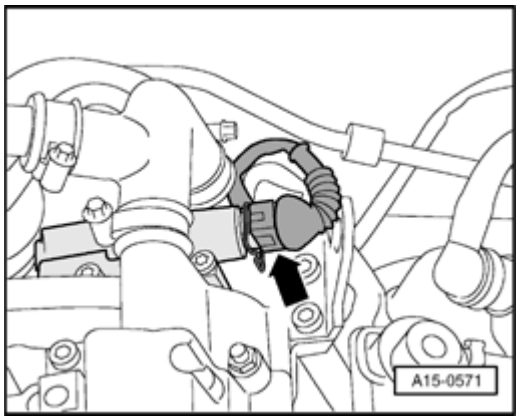

Fig. 230: Disconnecting Connector At Camshaft Adjuster

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect connector - **arrow** - at camshaft adjuster.

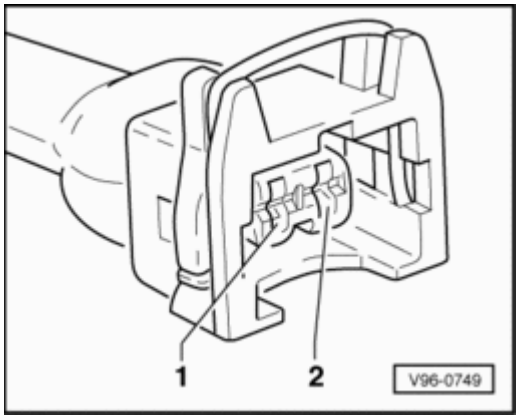

Fig. 231: Identifying 2-Pin Electrical Connector & Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect voltage tester VAG 1527B as follows:

Connector contact	Measure to
1	Engine Ground

- Briefly operate starter.

- LED must light up

If LED does not light up:

- Check for open circuit in wiring from contact 1 of connector through fuse to fuel pump relay. --> Electrical Wiring Diagrams, Troubleshooting and Component Locations
- If necessary, eliminate open circuit.

If LED lights up:

- Check actuation.

Checking actuation

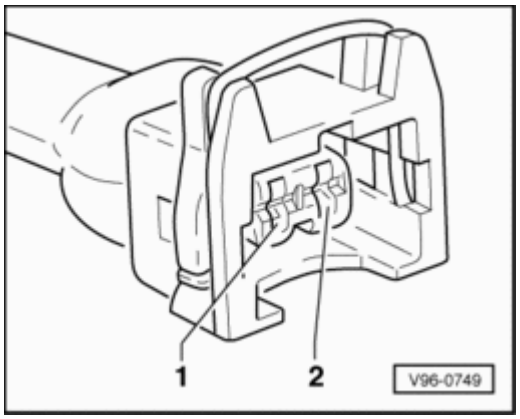

Fig. 232: Identifying 2-Pin Electrical Connector & Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect voltage tester VAG 1527B to contact 1 (positive) and 2 of connector.
- Start output Diagnostic Test Mode and actuate camshaft adjustment valve.

Indicated on display

Output Diagnostic Test Mode --> Camshaft timing control

- LED must flash

If LED does not flash or if it is permanently lit:

- Connect test box VAG 1598/31 to engine control module wiring harness. Engine control module must not be connected. --> **24 - MULTIPORT FUEL INJECTION (MFI)**

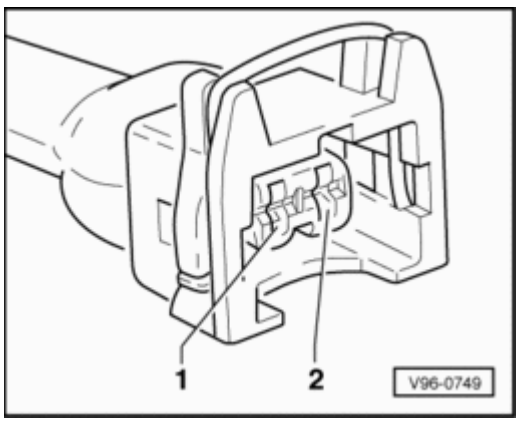

Fig. 233: Identifying 2-Pin Electrical Connector & Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Check for open circuit and short to Ground/positive in following wiring connection:

Connector contact	Test box VAG 1598/31 socket
2	115

- Eliminate any short circuits to Ground or open circuits.

If wiring is OK:

- Replace engine control module.

If no malfunction is found:

- Replace mechanical camshaft adjuster.

17 - ENGINE - LUBRICATION

LUBRICATION SYSTEM COMPONENTS, REMOVING AND INSTALLING

Lubrication system components, removing and installing

NOTE:

- **If large quantities of metal shavings or particles are found in the engine oil when repairing an engine, clean the oil passages carefully, and replace the oil cooler in order to prevent further damage occurring later.**
- **The oil level must not be above the max. mark - danger of damage to the catalyst.**
- **Oil spray jet and pressure relief valve Oil spray jet and pressure relief valve**

Viscosity grades and oil specifications:

Refer to -->

- **01 - MAINTENANCE**
- **01 - MAINTENANCE** for CABRIOLET

Part I

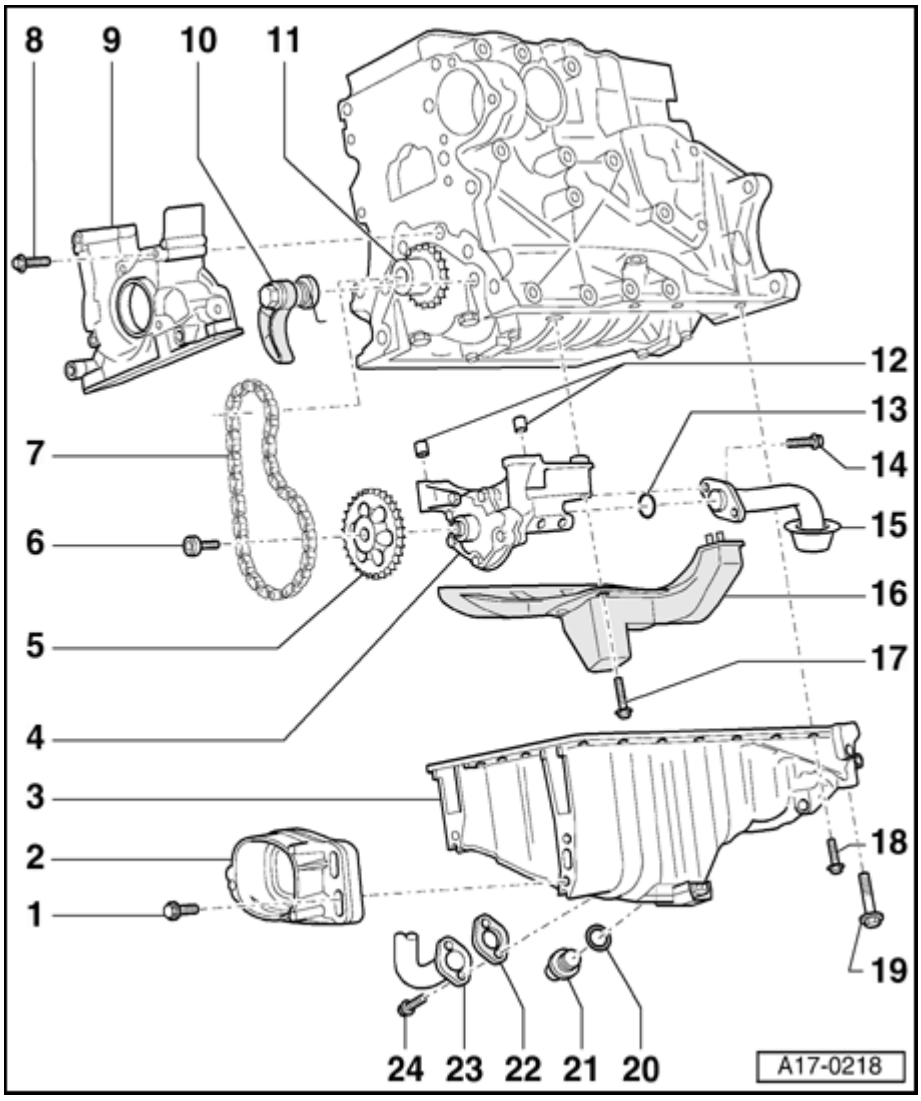

Fig. 234: Lubrication System Components, Removing And Installing - Part I
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - 28 Nm

2 - Stop for torque reaction support

3 - Oil pan

- Apply silicone sealant: D 176 404 A2 before installing
- Removing and installing --> **Oil pan, removing and installing**

4 - Oil pump

- With pressure relief valve, 12 bar
- Removing and installing --> **Oil pump, removing and installing**

- Replace pump if there is scoring on moving surfaces and gear teeth
- Tightening torque for oil pump cover to oil pump housing: 10 Nm

5 - Oil pump chain sprocket

- Sprocket can only be installed on oil pump shaft in one position

6 - 22 Nm

7 - Drive chain for oil pump

- Mark direction of rotation before removing
- Check for wear

8 - 15 Nm

9 - Front sealing flange

- Apply silicone sealant D 176 404 A2 before installing --> **Sealing flanges and flywheel/drive plate, removing and installing**
- Replacing crankshaft oil seal -pulley end --> **Crankshaft oil seal - pulley end, replacing**

10 - Chain tensioner

- Tighten to 16 Nm
- Do not disassemble
- Note installed position
- Pre-tension spring and engage before installing
- If spring is broken, replace complete chain tensioner

11 - Oil pump chain sprocket

- Removing and installing --> **Chain sprocket, removing and installing**

12 - Dowel sleeves

- 2 pcs.

13 - O-ring

- Always replace

14 - 16 Nm

15 - Suction line

- Clean strainer if soiled

16 - Baffle plate

17 - 16 Nm

18 - 15 Nm

- Tighten in stages and diagonally
- Note tightening sequence *Install oil pan immediately and tighten bolts in sequence shown:* under **Installing**

19 - 40 Nm

20 - Sealing ring

- Replace

21 - Oil drain plug, 30 Nm

22 - Gasket

- Always replace

23 - Oil return line

- From turbocharger

24 - 10 Nm

Oil spray jet and pressure relief valve

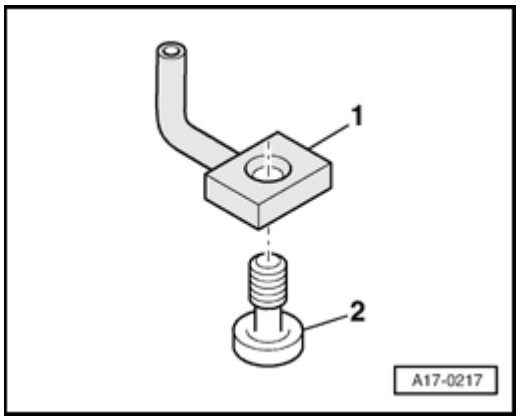

Fig. 235: Oil Spray Jet And Pressure Relief Valve
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1. Oil spray jet (for piston cooling)
2. Bolt with pressure relief valve, 27 Nm
3. Opening pressure 1.3 to 1.6 bar

Part II

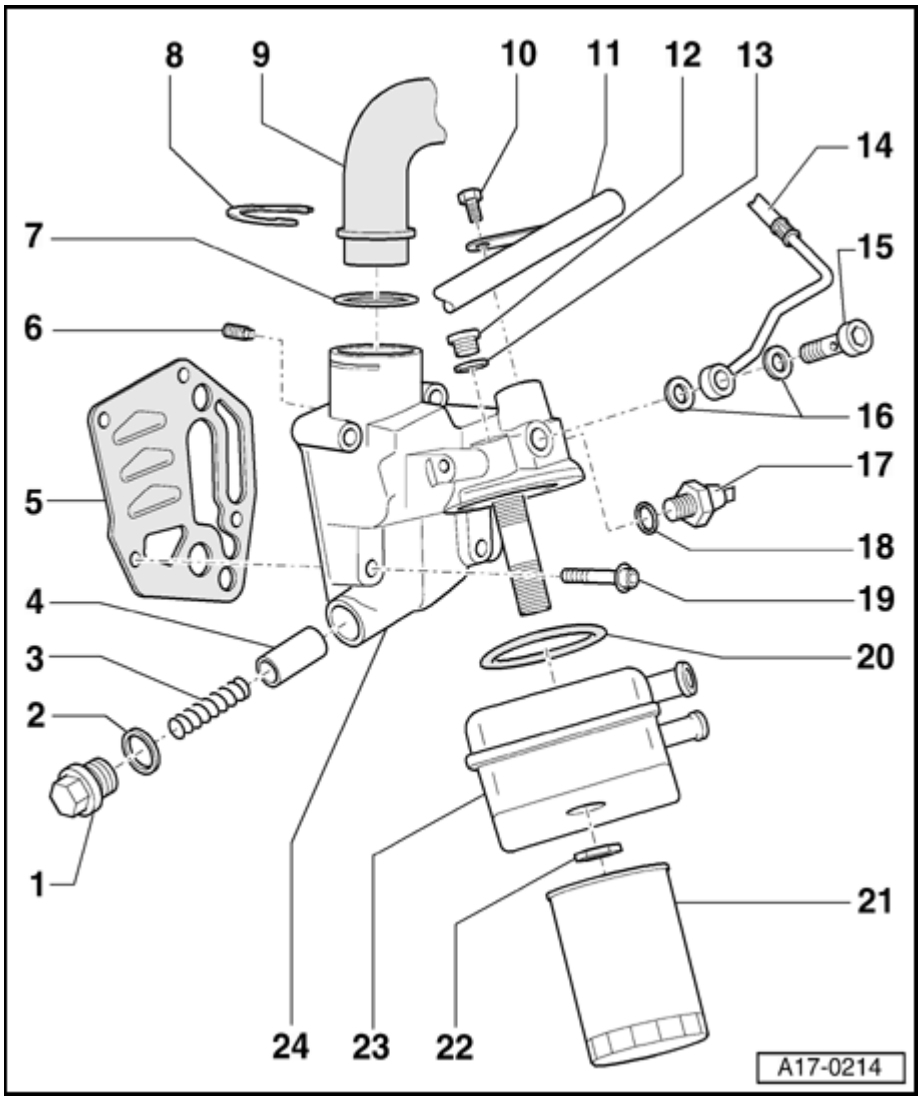

Fig. 236: Lubrication System Components, Removing And Installing - Part II
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Screw plug, 40 Nm

2 - Sealing ring

- Always replace

3 - Spring

- For pressure relief valve, approx. 4 bar

4 - Piston

- For pressure relief valve, approx. 4 bar

5 - Gasket

- Always replace

6 - Oil retention valve

- Tighten to 8 Nm
- Integrated in oil filter holder

7 - O-ring

- Always replace

8 - Retaining clip

9 - Line

- For crankcase breather

10 - 20 Nm

- Apply locking fluid D 000 600 A2 when installing

11 - Lower coolant line

12 - Screw plug, 15 Nm

13 - Sealing ring

- If seal is leaking, cut open and replace

14 - Oil supply line

- To turbocharger

15 - Banjo bolt, 30 Nm

16 - Sealing rings

- Always replace

17 - Oil pressure switch F1 , 1.4 bar, 25 Nm

- Black insulation
- Checking --> **Oil pressure and oil pressure switch, checking**

18 - Sealing ring

- If seal is leaking, cut open and replace

19 - 15 Nm plus additional 90 ° turn

- Always replace

20 - Gasket

- Always replace
- Engage in projections on oil cooler

21 - Oil filter

- Note replacement intervals. Refer to -->
  - **01 - MAINTENANCE**
  - **01 - MAINTENANCE** for CABRIOLET
- Observe installation instructions on oil filter
- Tighten to 20 Nm

22 - 25 Nm

23 - Oil cooler

- See note --> **Lubrication system components, removing and installing**
- Ensure clearance to adjacent components
- Coolant hose connection diagram --> **Cooling system components, overview**

24 - Oil filter holder

- With pressure relief valve approx. 4 bar

Oil pan, removing and installing

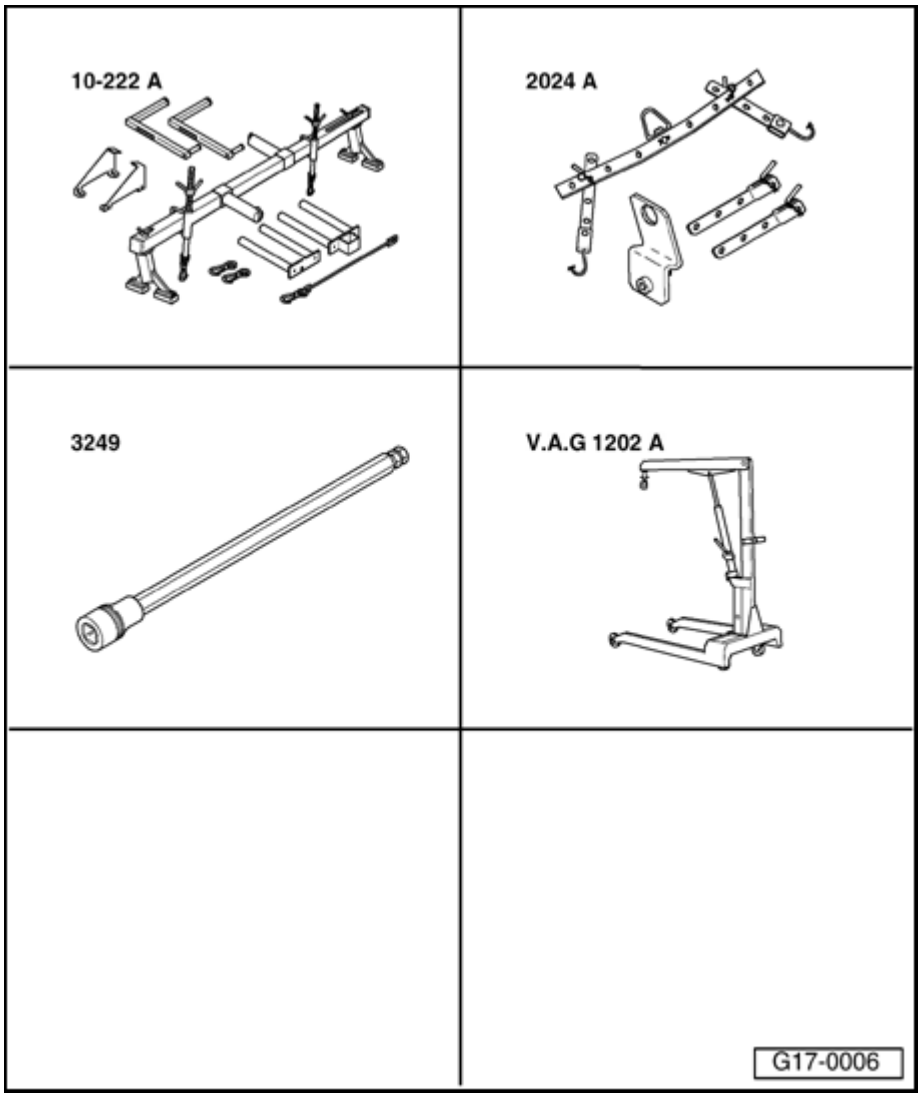

Fig. 237: Identifying Special Tools - Oil Pan, Removing And Installing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools, testers and auxiliary items required

- Support bar 10-222A
- Lifting tackle 2024A
- Socket attachment 3249 or T10058
- Workshop crane VAG1202A
- Electric drill with plastic brush attachment
- Protective goggles

Removing

- Engine in vehicle.

- Lock carrier in service position --> **Lock carrier, moving to service position**.

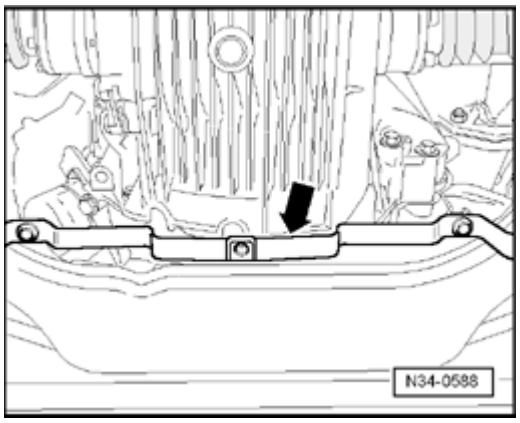

Fig. 238: Removing Noise Insulation Bracket
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unbolt sound insulation holder - **arrow** -.
- Disconnect lower left air hose from charge air cooler.

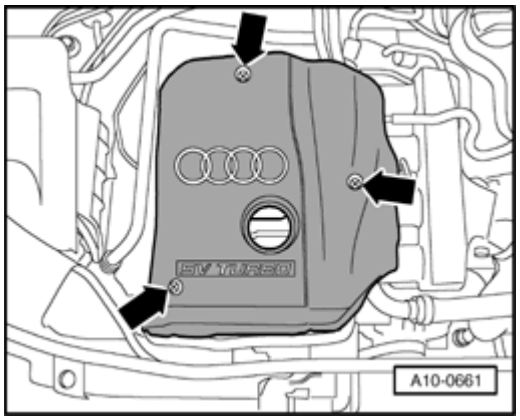

Fig. 239: Removing Engine Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove engine cover - **arrows** -.

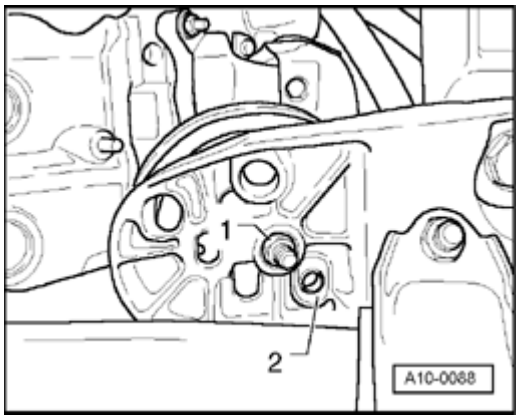

Fig. 240: Threaded Connections And Positioning Sleeves On Lower Engine Mounts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Mark positions of bolted connections - **1** - and locating sleeves - **2** - underneath right and left engine mounts.

NOTE:

- **Differing mounting holes are provided for different engine versions.**

- Remove nuts - **1** - underneath left and right engine mounts.

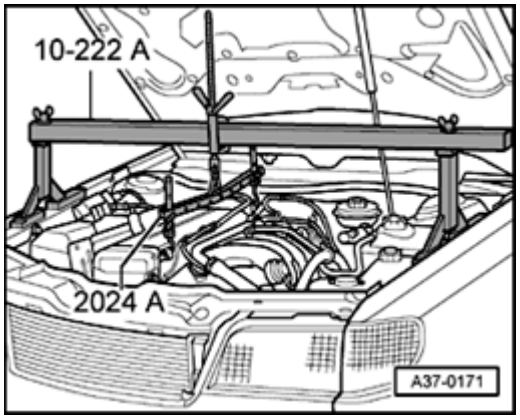

Fig. 241: Placing Support Bar 10-222A On Fender Mounting Flange
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Place support bar 10-222A on fender mounting flange.

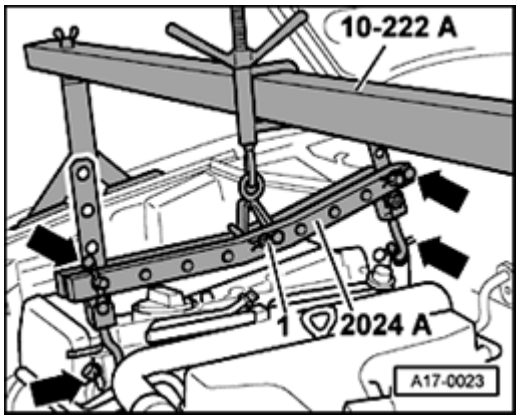

Fig. 242: Installing Engine Support Bridge 10-222A
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove eye from lifting tackle 2024A.
- Insert pin - **1** - back into center hole of lifting tackle and secure it using cotter pin.
- Attach pin of lifting tackle 2024A to spindle of support bar 10-222A.

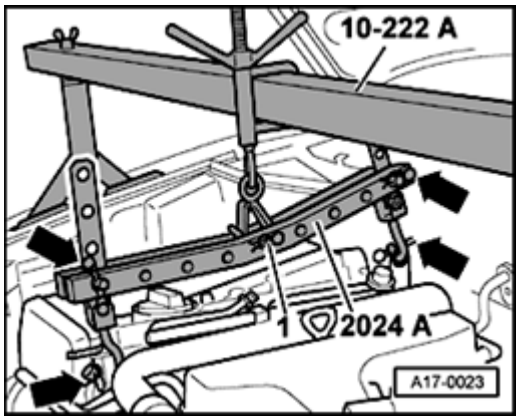

Fig. 243: Installing Engine Support Bridge 10-222A
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Attach lifting tackle 2024A to lifting eyes at front and rear of engine.

CAUTION: Hook attachments and locating pins on lifting tackle must be secured with locking pins - arrows -.

- Pre-tension engine with spindle of engine support bar, do not lift.
- Drain engine oil.
- Unbolt turbocharger oil return line from oil pan.

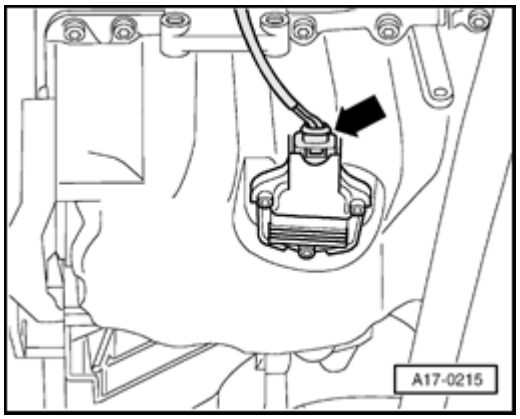

Fig. 244: Disconnecting Connector For Oil Level Thermal Sensor -G266-
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect connector from oil level sensor - **arrow** -.

Vehicles with automatic transmission

NOTE:

- **Observe the rules for cleanliness when working on the automatic transmission:**
- **-->**
  - **37 - AUTOMATIC TRANSMISSION - CONTROLS, HOUSING for 5 SPD. AUTOMATIC TRANSMISSION 01V**
  - **37 - AUTOMATIC TRANSMISSION - CONTROLS, HOUSING for 5 SPD. AUTOMATIC TRANSMISSION 01V FRONT AND ALL WHEEL DRIVE - INTERNAL COMPONENTS, SERVICING**
  - **37 CONTROLS, HOUSING for AUTOMATIC TRANSMISSION 09L, FOUR-WHEEL DRIVE**

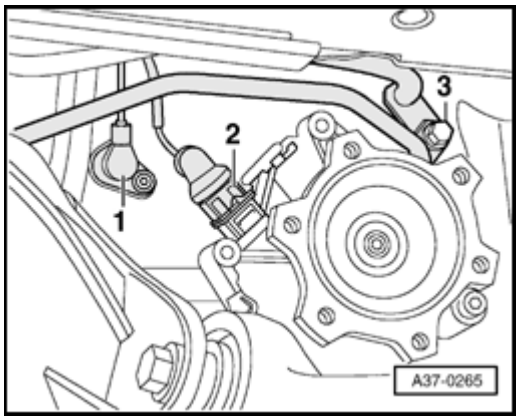

Fig. 245: Removing Bolt And Disconnecting ATF Lines From Transmission
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolt - **3** - and disconnect ATF lines from transmission.

NOTE:

- **Please ignore items - 1 - and - 2 - in the illustration.**

- Unbolt holder for ATF line from engine.
- Move ATF lines clear to one side.

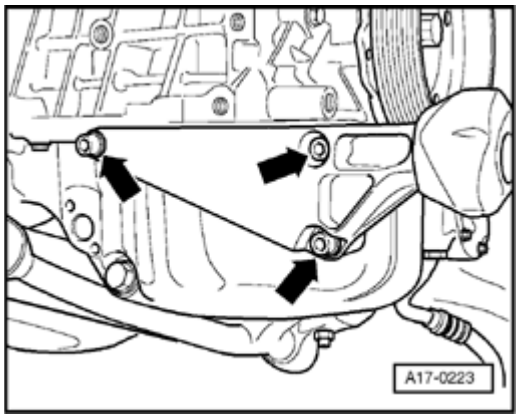

Fig. 246: Unbolting Torque Reaction Support
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unbolt torque reaction support - **arrows** -.

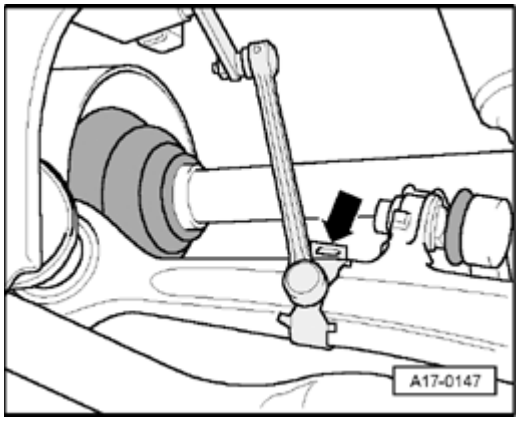

Fig. 247: Unclipping Operating Rod For Vehicle Levelling Sensor At Lower Transverse Link
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- If installed, unclip operating rod for vehicle levelling sensor at lower transverse link - **arrow** -.

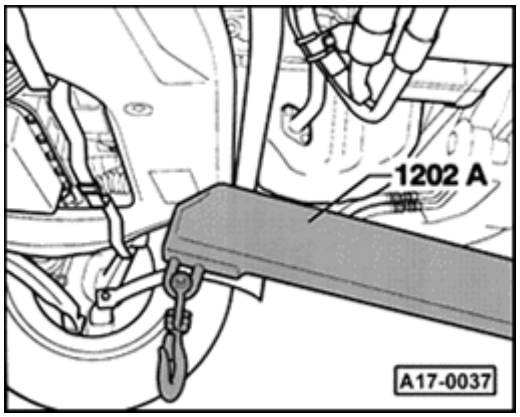

Fig. 248: Subframe Supported Using Workshop Crane V.A.G 1202 A
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Support subframe with workshop crane VAG1202A.

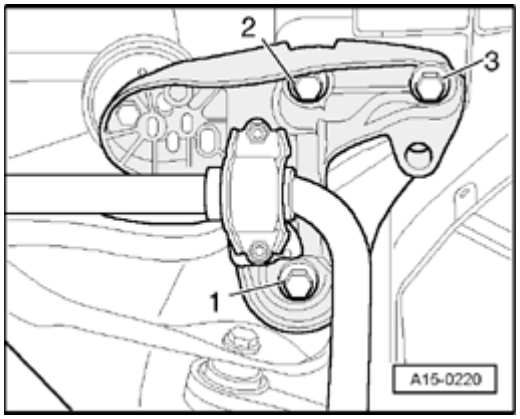

Fig. 249: Removing Front Bolts From Left And Right Subframe
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- First remove front bolts - **2** - and - **3** - from left and right subframe. Then remove bolts - **1** -.

NOTE:

- **The subframe should be removed and lowered only at the front, otherwise it will be necessary to check wheel alignment.**

Vehicles with manual transmission

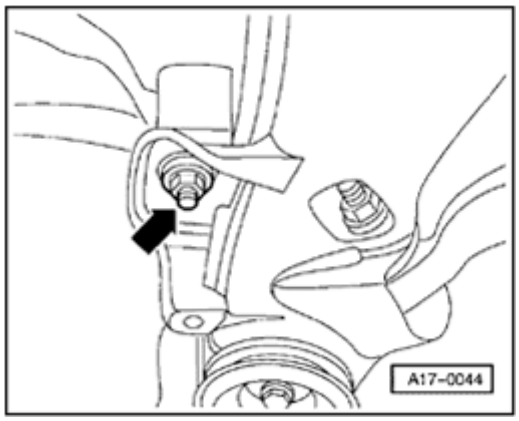

Fig. 250: Left Transmission Mount Nut
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Loosen nuts - **arrow** - on left transmission mount until it is flush with end of bolt (approx. 4 turns on thread).

Vehicles with automatic transmission

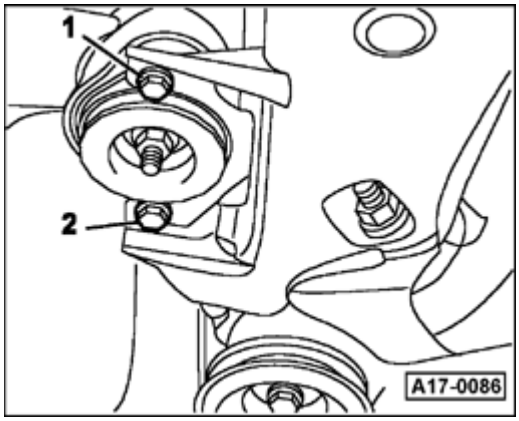

Fig. 251: Identifying Bolt Removal Sequence For Left Transmission Mount
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Loosen rear bolt - **2** - on left transmission mount a few turns, remove and remove front bolt - **1** - on left transmission mount.

All models

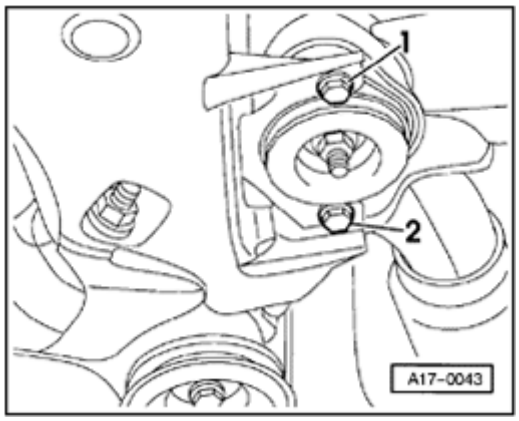

Fig. 252: Right Transmission Mount Bolts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Loosen rear bolt - **2** - on right transmission mount a few turns, remove front bolt - **1** - on right transmission mount.

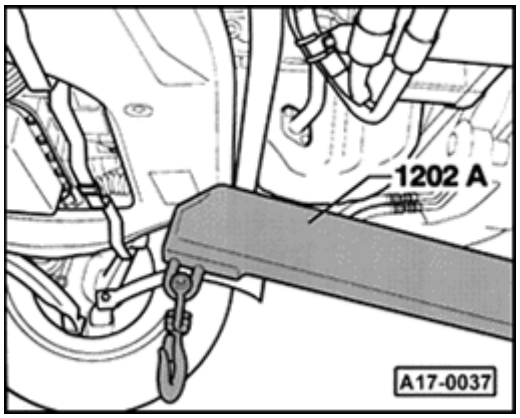

Fig. 253: Subframe Supported Using Workshop Crane V.A.G 1202 A
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Lower subframe slowly using workshop crane VAG1202A..
- Roll out workshop crane VAG1202A..
- Remove bolts securing transmission to oil pan.

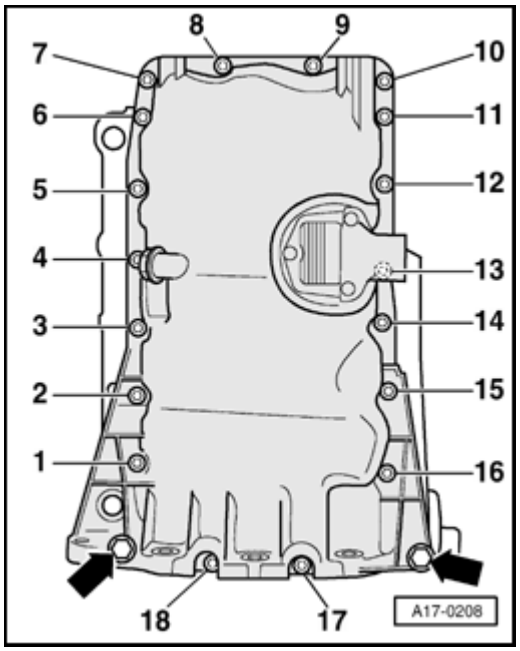

Fig. 254: M10 Bolts Removal Sequence
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove M10 bolts - **arrows** -.
- Loosen bolts -1 to 18- in diagonal sequence.

NOTE:

- **Use T10058 for bolts - 17 - and - 18 -.**

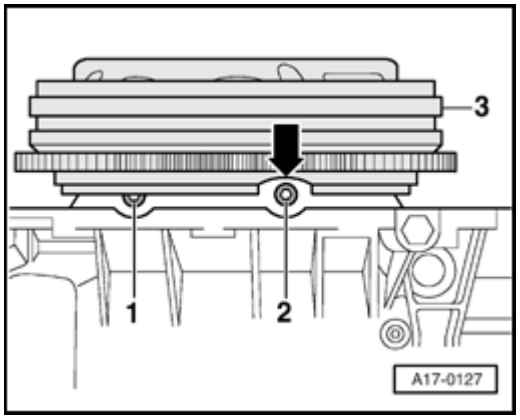

Fig. 255: Identifying Rear Oil Pan Bolts & Turning Flywheel
Courtesy of VOLKSWAGEN UNITED STATES, INC.

NOTE:

- **Remove both rear oil pan bolts - 1 - and - 2 - using socket attachment 3249 or T10058. On vehicles with manual transmission, do this by turning flywheel - 3 - until recess - arrow - is aligned with bolt.**

- Remove oil pan. If necessary, loosen by tapping lightly using a rubber hammer.

- Remove baffle plate and carefully remove sealant remaining on cylinder block.

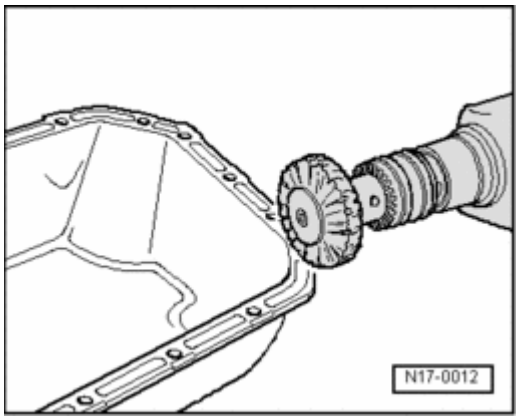

Fig. 256: Removing Sealant Residue From Oil Pan With Rotating Brush
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove remaining sealant from oil pan with rotating plastic brush or similar.

CAUTION: Wear safety goggles.

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

Installing

Install in reverse order, paying attention to the following:

NOTE:

- **The oil pan must be installed within 5 minutes of applying silicone sealant.**

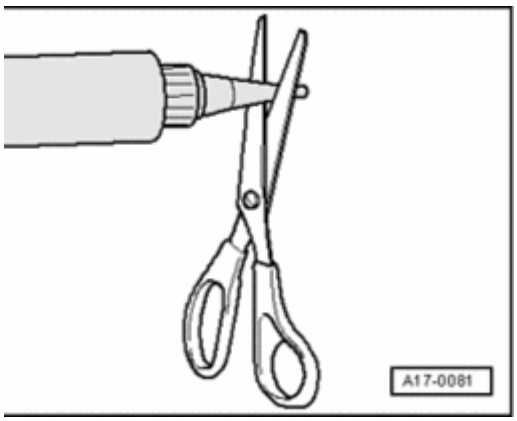

Fig. 257: Cutting Tube Nozzle At Front Marking
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Cut off nozzle of tube at front marking (nozzle diameter approx. 3 mm).

- Silicone sealant D 176 404 A2
- Thickness of sealant bead: 2 to 3 mm

NOTE:

- **The sealant bead must not be thicker than 3 mm, otherwise excess sealant can enter oil pan and obstruct filter screen in oil intake line.**

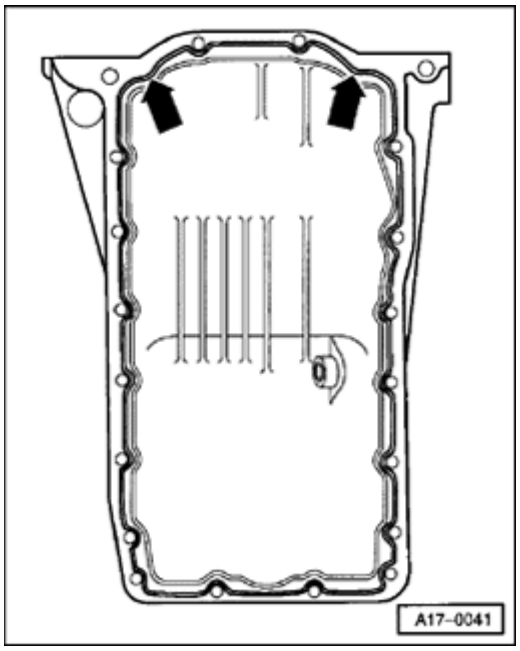

Fig. 258: Identifying Silicone Sealing Compound Application Area
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Apply silicone sealant to clean sealing surface of oil pan, as illustrated. (Illustration shows position of sealant bead on cylinder block.)

NOTE:

- **Take extra care when applying bead of sealant around rear sealing flange - arrows -.**

- Install oil pan immediately and tighten bolts in sequence shown:

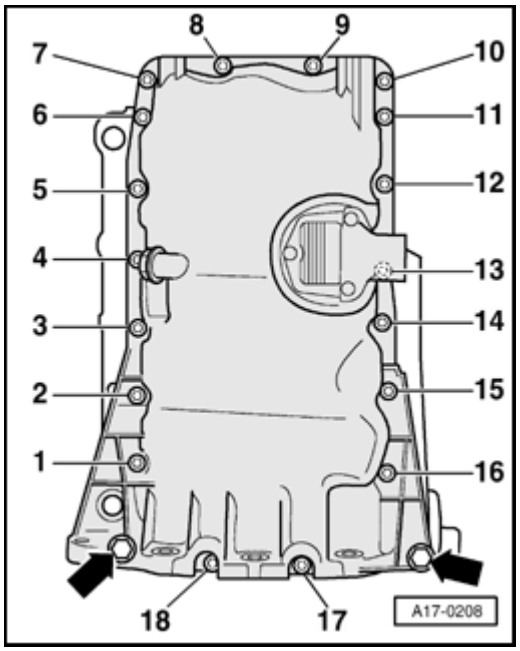

Fig. 259: M10 Bolts Removal Sequence
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Pre-tighten bolts -1 to 18- to 5 Nm in diagonal sequence.
- Tighten bolts securing oil pan to transmission to 45 Nm.
- Tighten M10 bolts - **arrows** - to 40 Nm.
- Tighten bolts -1 to 18- to 15 Nm in diagonal sequence.

NOTE:

- **Replace gaskets and sealing rings.**

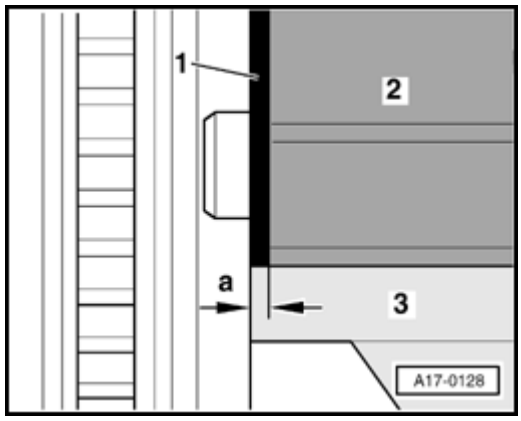

Fig. 260: Ensuring That Oil Pan Is Positioned Flush With Intermediate Plate At Flywheel End
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- **When installing oil pan - 3 - with engine removed, ensure that oil pan is positioned flush with intermediate plate - 1 - at flywheel end, i.e. oil pan**

should protrude by dimension - a - = 0.8 mm from cylinder block - 2 -.

- **After installing oil pan, wait for approx. 30 minutes for sealant to dry before pouring in engine oil.**

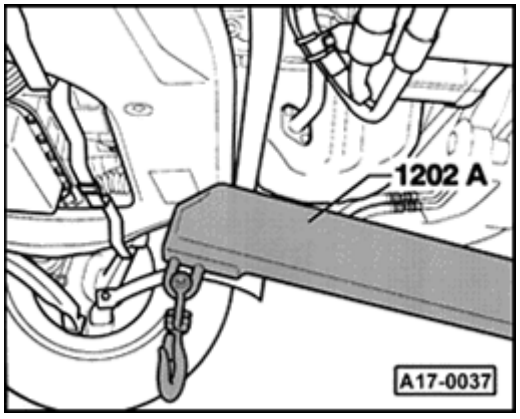

Fig. 261: Subframe Supported Using Workshop Crane V.A.G 1202 A
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Support subframe with workshop crane VAG1202A..
- Install subframe: --> **40 - FRONT SUSPENSION**

Vehicles with automatic transmission

- Secure ATF lines: -->
  - **37 - AUTOMATIC TRANSMISSION - CONTROLS, HOUSING** for 5 SPD. AUTOMATIC TRANSMISSION 01V
  - **37 - AUTOMATIC TRANSMISSION - CONTROLS, HOUSING** for 5 SPD. AUTOMATIC TRANSMISSION 01V FRONT AND ALL WHEEL DRIVE - INTERNAL COMPONENTS, SERVICING
  - **37 CONTROLS, HOUSING** for AUTOMATIC TRANSMISSION 09L, FOUR-WHEEL DRIVE

All models

- Install lock carrier --> **Lock carrier, moving to service position**.
- Fill engine with oil and check oil level.

Vehicles with automatic transmission

- Check ATF level: -->
  - **37 - AUTOMATIC TRANSMISSION - CONTROLS, HOUSING** for 5 SPD. AUTOMATIC TRANSMISSION 01V
  - **37 - AUTOMATIC TRANSMISSION - CONTROLS, HOUSING** for 5 SPD. AUTOMATIC TRANSMISSION 01V FRONT AND ALL WHEEL DRIVE - INTERNAL COMPONENTS, SERVICING

- **37 CONTROLS, HOUSING** for AUTOMATIC TRANSMISSION 09L, FOUR-WHEEL DRIVE

Tightening torques

Component		Nm
Oil pan to cylinder block	M7	15
	M10	40
Oil pan to transmission		45
Torque reaction support stop to oil pan		28
Engine mount to subframe		25
Engine mount to engine support		25
Transmission support to transmission mount	M10	40
Transmission mount to subframe	M8	25
Oil return line to oil pan		10
Oil drain plug		30
Hose clamps for air hoses		3.5

Oil pump, removing and installing

Removing

- Remove oil pan and baffle plate --> **Oil pan, removing and installing**.

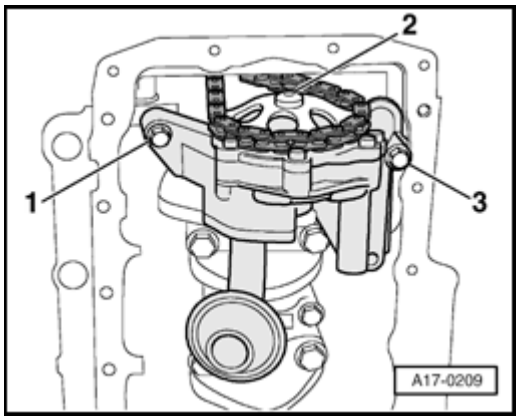

Fig. 262: Identifying Oil Pump & Bolts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolt - **2** -.
- Remove chain sprocket from oil pump shaft.
- Remove bolts - **1** - and - **3** - and remove oil pump.

Installing

Install in reverse order, paying attention to the following:

- Insert dowel sleeves at top of oil pump:
- Installed position of oil pump shaft/chain sprocket: Can only be installed in one position
- Install oil pan.

Tightening torques

Component	Nm
Chain sprocket to oil pump shaft	22
Oil pump to cylinder block	16

Oil pressure and oil pressure switch, checking

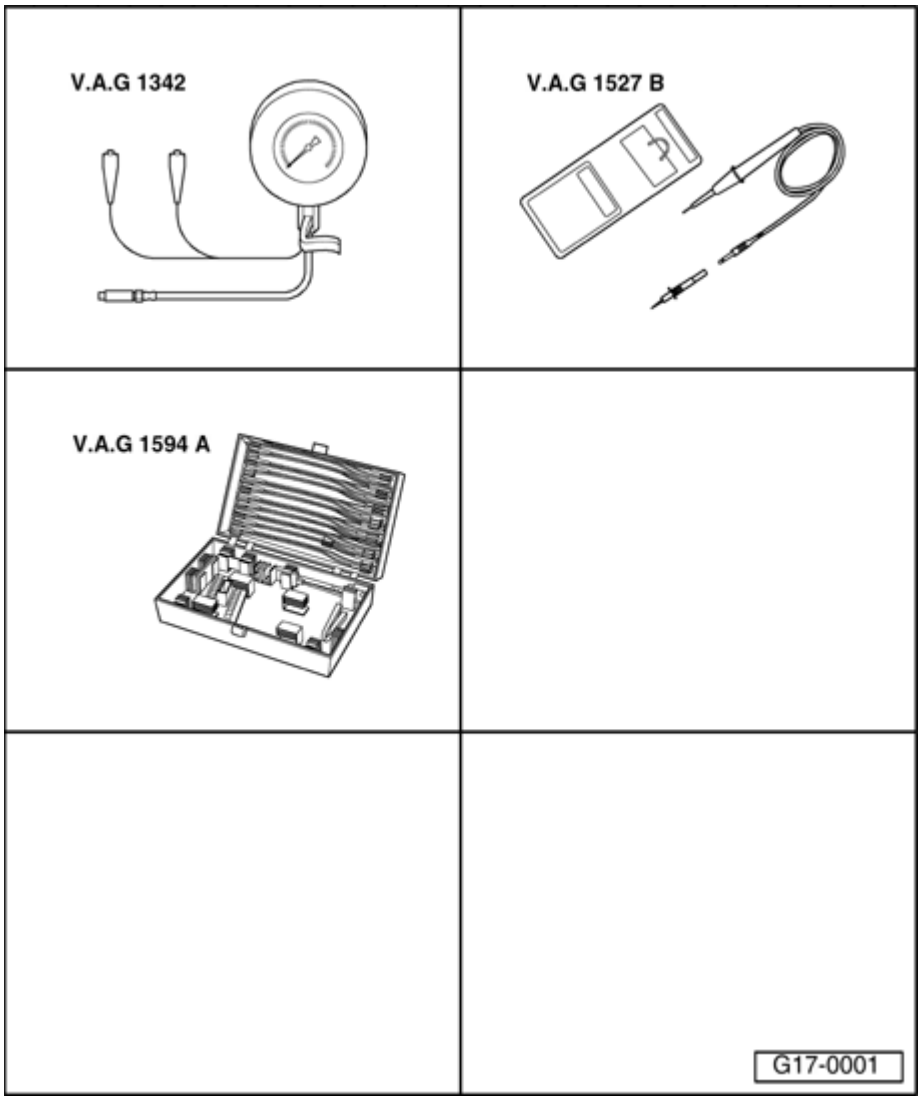

Fig. 263: Identifying Special Tools - Oil Pressure And Oil Pressure Switch, Checking
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools, testers and auxiliary items required

- Oil pressure tester VAG1342
- Voltage tester VAG1527B
- Connector test set VAG1594A

Requirements

- Oil level OK
- Engine oil temperature approx. 80 °C.
- Oil pressure warning lamp K3 must come on when ignition is switched on.
- In vehicles with auto-check system, lamp must light up to indicate "OK" status (interrogate symbol).

Checking oil pressure switch

- Disconnect wire from oil pressure switch.

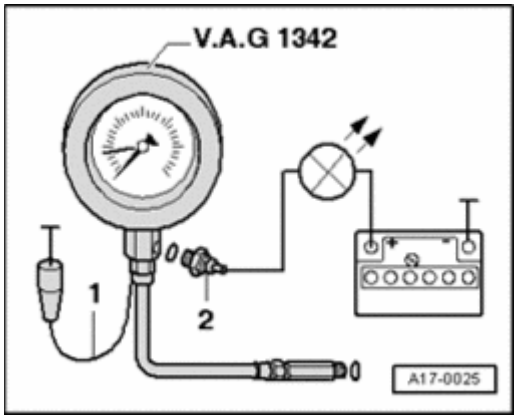

Fig. 264: Connecting Oil Pressure Tester V.A.G 1342 With Adapter V.A.G 1342/14 To Bore For Oil Pressure Switch
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove oil pressure switch and screw into oil pressure tester VAG1342.
- Screw oil pressure switch - **2** - into VAG1342.
- Connect brown wire - **1** - of tester to Ground (-).
- Connect voltage tester VAG1527B to oil pressure switch and positive terminal of battery (+) using test leads from VAG1594A.

- LED should not light up

If LED lights up:

- Replace oil pressure switch.
- Start engine.

NOTE:

- **Switching point of oil pressure switch can be reached when engine is cranked on starter motor, so watch tester and LED while starting engine.**

Black oil pressure switch

- LED should light up at 1.2 to 1.6 bar

If LED does not light up:

- Replace oil pressure switch.

Checking oil pressure

- Disconnect wire from oil pressure switch.

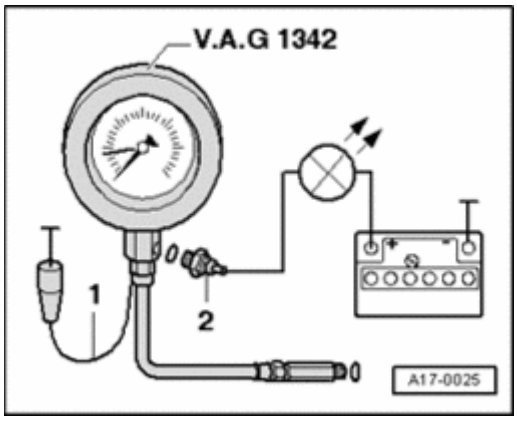

Fig. 265: Connecting Oil Pressure Tester V.A.G 1342 With Adapter V.A.G 1342/14 To Bore For Oil Pressure Switch
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove oil pressure switch and screw in oil pressure tester VAG1342.
- Screw oil pressure switch - **2** - into VAG1342.
- Start engine (engine oil temperature approx. 80 °C).

- Oil pressure at idling speed: 1.0 bar
- Oil pressure at 3000 RPM: 3.5 to 4.5 bar

If readings do not match specifications:

- Pressure relief valve or oil pump faulty, replace oil pump --> **Oil pump, removing and installing**.

Engine oil

The vehicle is filled at the factory with a high-quality multi-grade oil which can be used all year round except in extremely cold climates.

Viscosity grades and oil specifications

Viscosity grades and oil specifications:

Refer to -->

- **01 - MAINTENANCE**
- **01 - MAINTENANCE** for CABRIOLET

Oil level, checking

Requirements

- Engine oil temperature at least 60 °C.
- Vehicle on a flat surface.
- Wait a few minutes after switching off engine to allow oil to flow back into oil pan.

  - Pull out dipstick, wipe off with a clean cloth and insert it again as far as it will go.
  - Pull out dipstick again and read oil level.

Markings on dipstick:

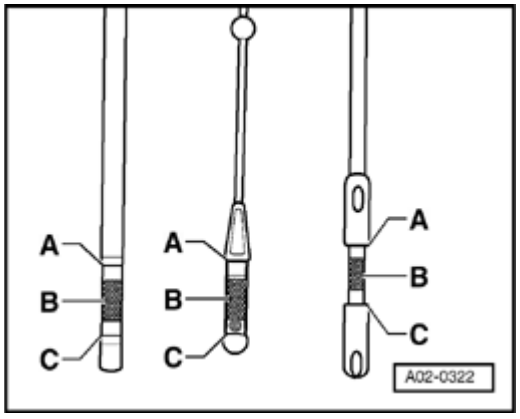

Fig. 266: Markings On Dipstick
Courtesy of VOLKSWAGEN UNITED STATES, INC.

a - Do not top up oil.

b - Oil can be topped up. Oil level may then rise as far as area - **a** -.

c - Oil must be topped up. After topping up, it is sufficient for oil level to be somewhere in area - **b** - (grooved area).

NOTE:

- **Oil level must not be above mark - a - on dipstick.**

19 - ENGINE - COOLING SYSTEM

COOLING SYSTEM COMPONENTS, REMOVING AND INSTALLING

Cooling system components, removing and installing

CAUTION: Hot steam can escape when cap on expansion tank is opened. Cover cap with cloth and open carefully.

NOTE:

- **Cooling system is under pressure when engine is warm. If necessary release pressure before repair work.**
- **Secure all hose connections with standard hose clamps**
- **Special tool VAS5024A is recommended for installing spring clips.**
- **Always replace gaskets and sealing rings.**
- **Arrows on coolant lines and on ends of hoses must be aligned.**

Cooling system components, overview

Coolant hose connection diagram

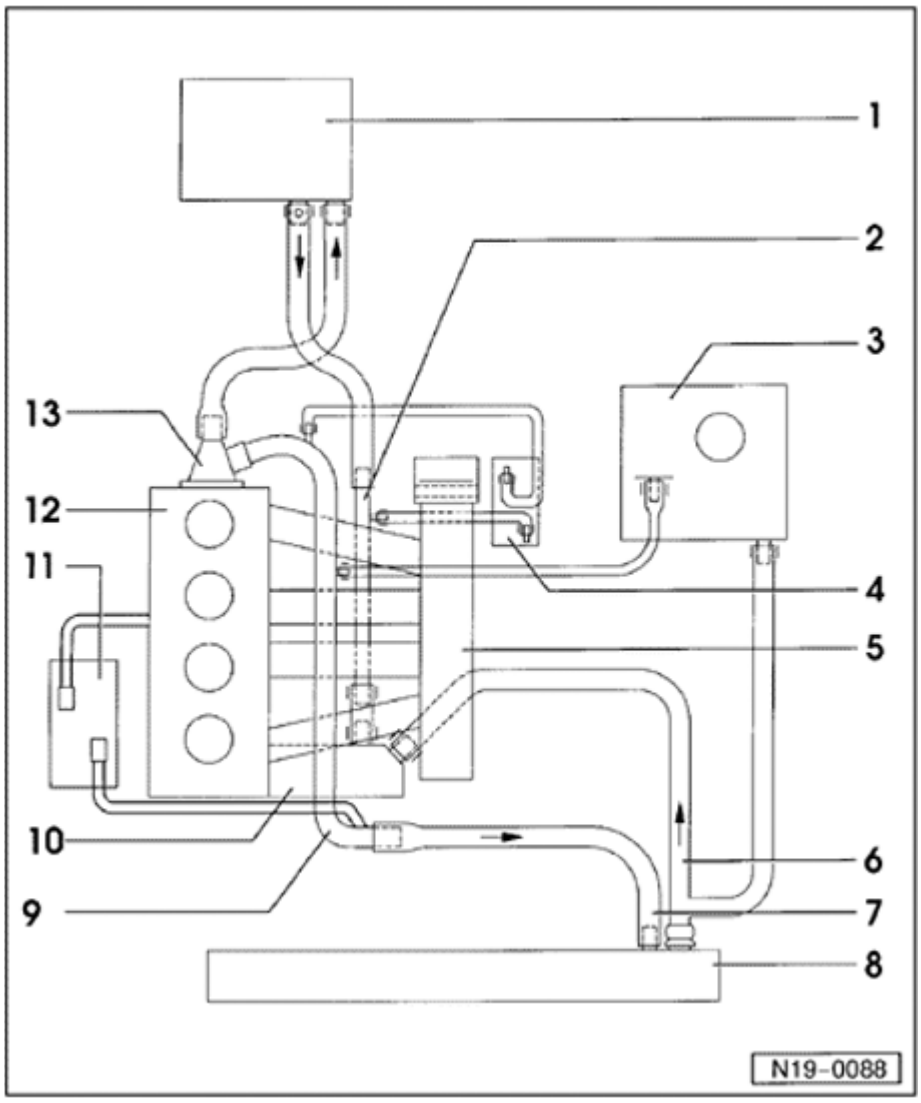

Fig. 267: Cooling System Components, Overview
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Heat exchanger for heater

- After replacing, fill with fresh coolant

2 - Coolant line (lower)

3 - Expansion tank

- With cap
- Checking pressure relief valve in cap

4 - Oil cooler

5 - Intake manifold

6 - Coolant hose (lower)

7 - Coolant hose (top)

8 - Radiator

- Removing and installing --> **Radiator, removing and installing**
- After replacing, fill with fresh coolant

9 - Coolant line (top)

10 - Coolant pump/thermostat

- Removing and installing coolant pump --> **Coolant pump, removing and installing**
- Check for ease of movement

11 - Turbocharger

12 - Cylinder head/cylinder block

- After replacing, fill with fresh coolant

13 - Connection

Cooling system, draining and filling

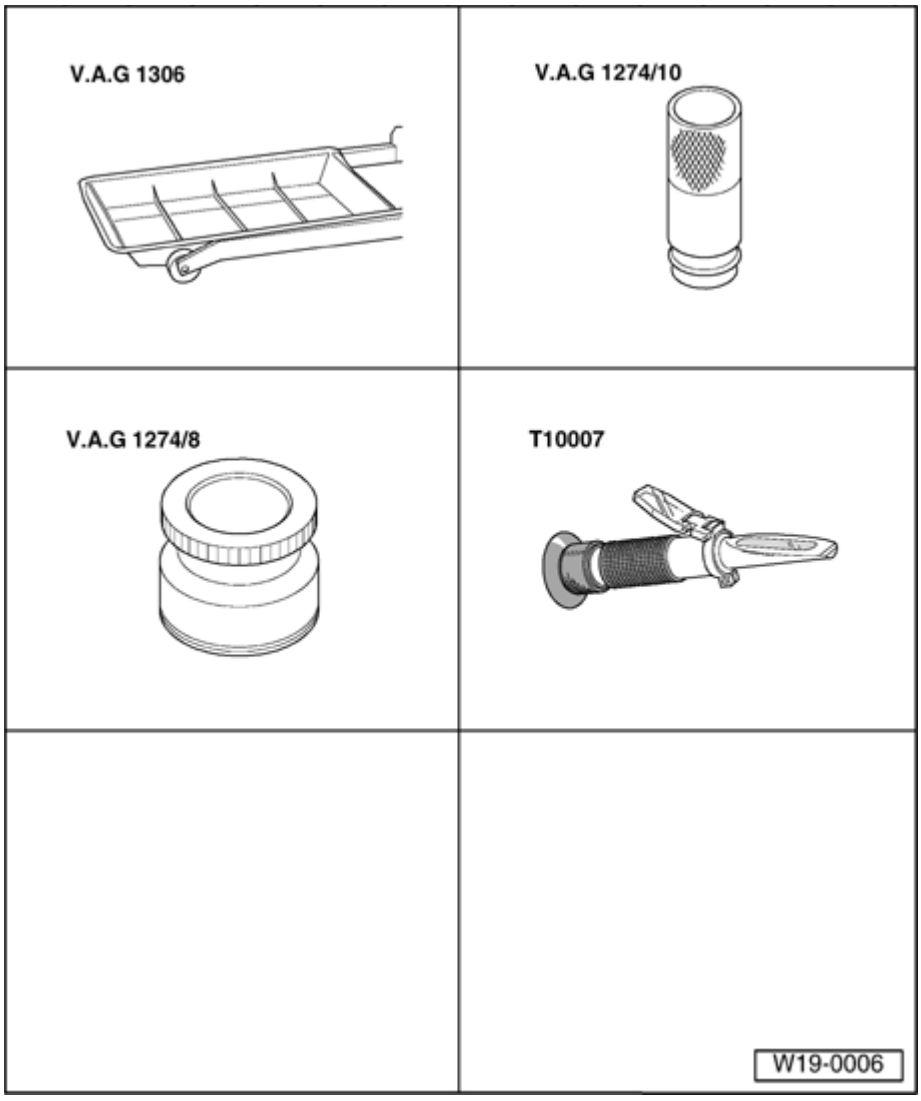

Fig. 268: Identifying Special Tools - Cooling System, Draining And Filling
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools, testers and auxiliary items required

- Refractometer T10007
- Drip tray VAG1306
- Assembly tools for spring clips VAS5024A

Draining

NOTE:

- **Catch drained coolant in a clean container for re-use or disposal.**

CAUTION: Hot steam can escape when cap on expansion tank is opened. Cover cap with cloth and open carefully.

- Open cap on coolant expansion tank.

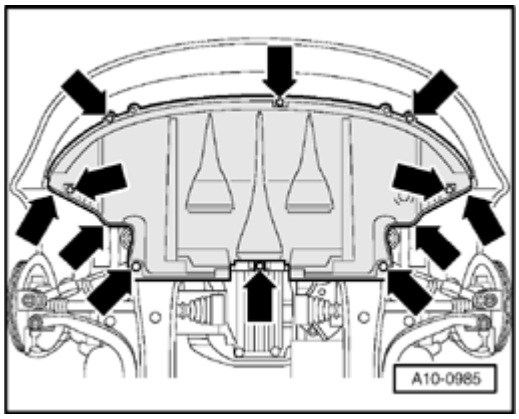

Fig. 269: Removing Sound Insulation
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove sound insulation - **arrows** -.
- Place drip tray VAG1306 under engine.

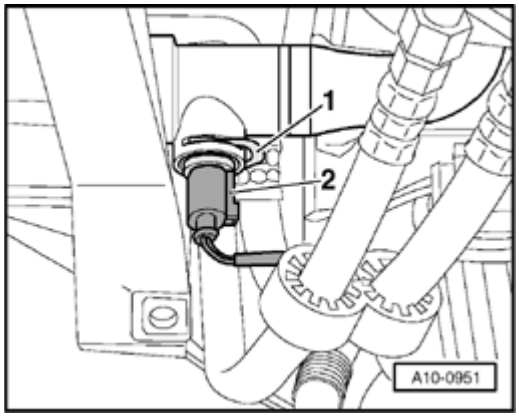

Fig. 270: Pulling Retaining Clip For Engine Coolant Temperature (ECT) Sensor G2 Off Lower Coolant Hose And Drain Coolant From Radiator
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Pull retaining clip - **1** - for Engine Coolant Temperature (ECT) sensor G2 - **2** - off lower coolant hose and drain coolant from radiator.

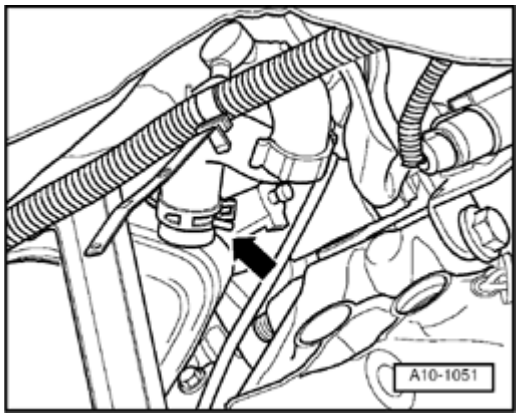

Fig. 271: Disconnecting Coolant Hose From Oil Cooler And Drain Off Remaining Coolant
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect coolant hose from oil cooler - **arrow** - and drain off remaining coolant.

NOTE:

- **Observe disposal regulations.**

Filling

NOTE:

- **Only use coolant additive G 12 meeting specification TL VW 774 D. Identifiable by color: red**

CAUTION: The two coolant additives G 011 A8 C and G 012 A8 D should never be mixed as this will result in serious engine damage.

- Never mix G 12 with other coolant additives.
- If fluid in expansion tank is brown, G 012 A8 D has been mixed with a different type of coolant. In this case, flush out cooling system and replace coolant. To flush out, fill cooling system with clean water and allow engine to run for approx. 2 minutes. This should remove virtually all the old coolant.
- G 011 A8 C or G 012 A8 D and coolant additives marked "meeting TL VW 774 C" or "meeting TL VW 774 D" prevent frost and corrosion damage and stop scale forming. They also raise the boiling point. The cooling system must therefore be filled all year round with the correct anti-freeze and anti-corrosion additive.
- On account of the higher boiling point, the coolant helps to enhance engine reliability under heavy loads particularly in countries with tropical climates.
- Frost protection must be guaranteed to around -25 °C (in countries with arctic climate to around -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 greater frost protection is required in very cold climates, the amount of G 012 A8 D can be increased, however only up to 60 % (giving frost protection to around -40 °C) as otherwise frost protection decreases again and cooling efficiency is also impaired.
- Only use clean drinking water for mixing coolant.

- If radiator, heat exchanger, cylinder head or cylinder head gasket is replaced, do not reuse old coolant.

Recommended mixture ratios:

Frost protection to	Anti-freeze percentage	G 012A8 D * See note	Water * See note
-25 ° C -35 ° C	40% 50%	3.0 l 3.5 l	4.0 l 3.5 l

*Coolant capacity 7.0 liters; may vary depending upon vehicle equipment.

*Use only clean water

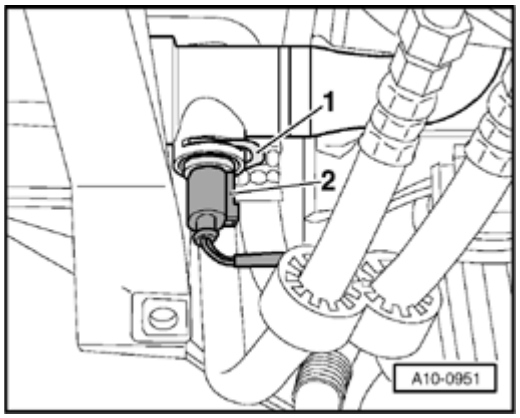

Fig. 272: Pulling Retaining Clip For Engine Coolant Temperature (ECT) Sensor G2 Off Lower Coolant Hose And Drain Coolant From Radiator
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Insert Engine Coolant Temperature (ECT) sensor G2 - **2** - back into lower coolant hose and attach clip - **1** -.
- Attach coolant hose to oil cooler.

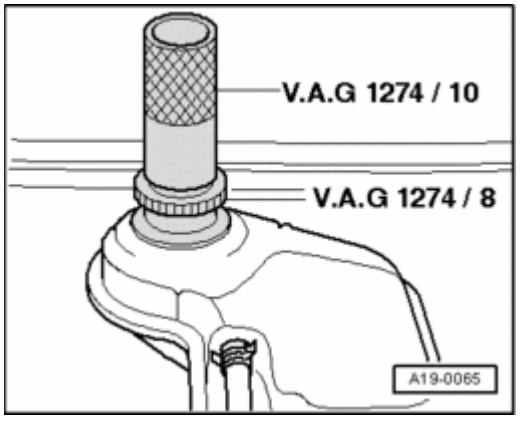

Fig. 273: Screw Adapter VAG1274/8 Onto Coolant Expansion Tank & Fit Special Tool VAG1274/10 Onto Adapter
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Screw adapter VAG1274/8 onto coolant expansion tank.
- Fit special tool VAG1274/10 onto adapter.
- Fill cooling system with coolant.
- Seal expansion tank.

- Start engine and maintain engine speed of approx. 2000 RPM for approx. 3 minutes.
- Allow engine to run at idling speed until lower hose on radiator becomes hot.

CAUTION: Hot steam can escape when cap on expansion tank is opened. Cover cap with cloth and open carefully.

- Check coolant level and top off if necessary.

When engine is at normal operating temperature, coolant level must be at max. mark.

When engine is cold, coolant level must be between min. and max. marks.

- Switch off engine.

Radiator, removing and installing

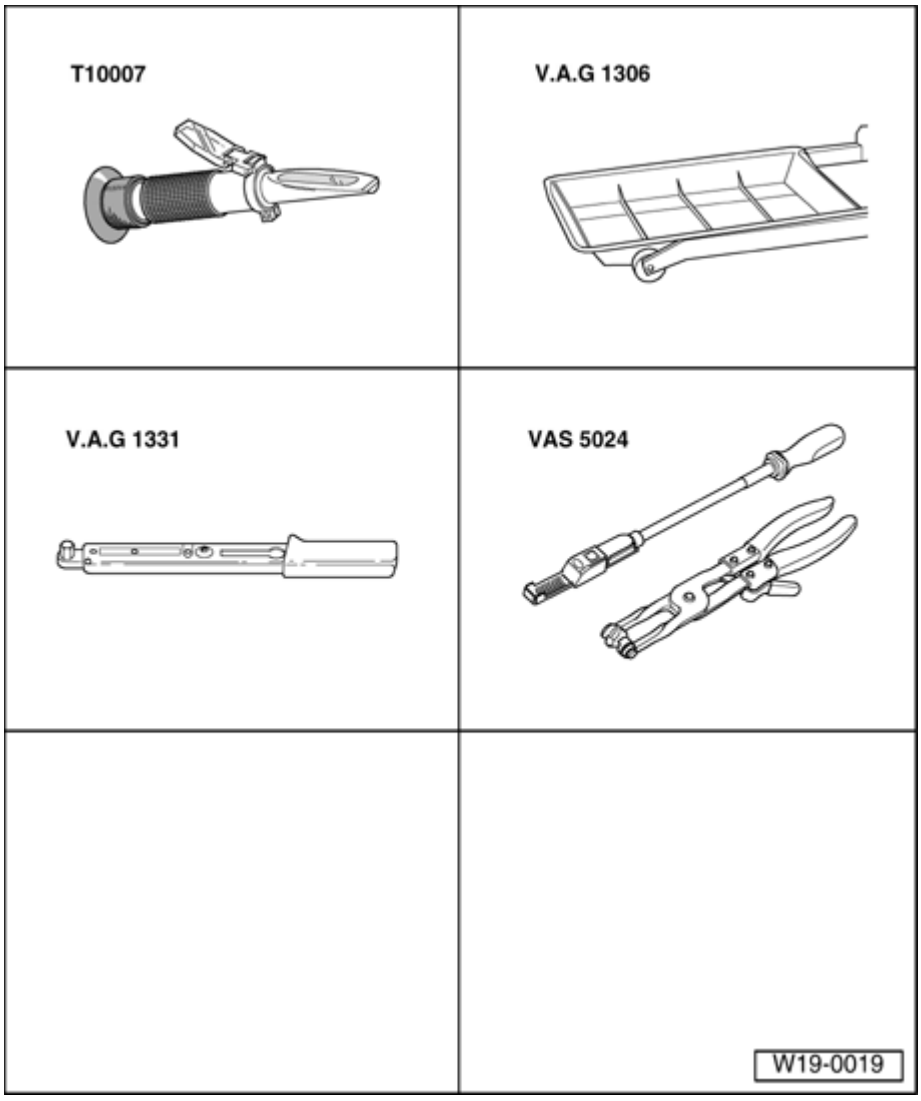

Fig. 274: Identifying Special Tools - Cooling System Components, Servicing, Removing And Installing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools, testers and auxiliary items required

- Refractometer T10007
- Drip tray VAG1306
- Torque wrench (5...50 Nm) VAG1331
- Assembly tools for spring clips VAS5024A

Removing

- Remove front bumper: -->
  - **63 BUMPER**
  - **63 - BUMPERS** for CABRIOLET
- Drain coolant --> **Cooling system, draining and filling**.

- Remove coolant hose couplers from top and bottom of radiator.

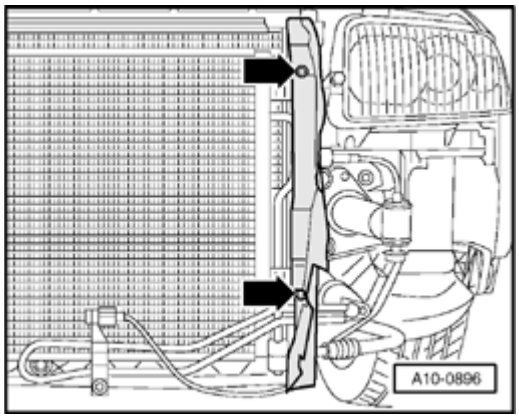

Fig. 275: Removing Air Ducts On Left/Right Of Radiator
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove air ducts on left and right of radiator - **arrows** -.

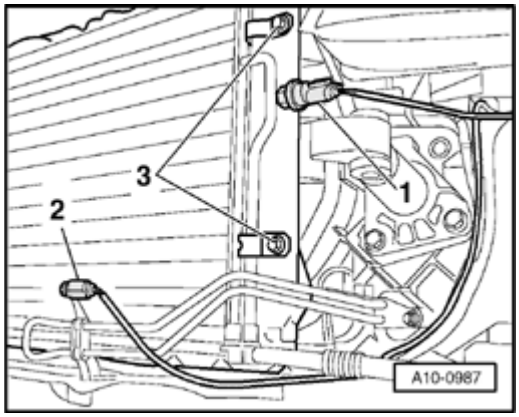

Fig. 276: Disconnecting Connector From A/C Pressure Switch F129 & Ambient Temperature Sensor
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect connector - **1** - from A/C pressure switch F129.
- Disconnect connector - **2** - from ambient temperature sensor.
- Move both wires clear.

CAUTION: Air conditioner refrigerant circuit must not be opened.

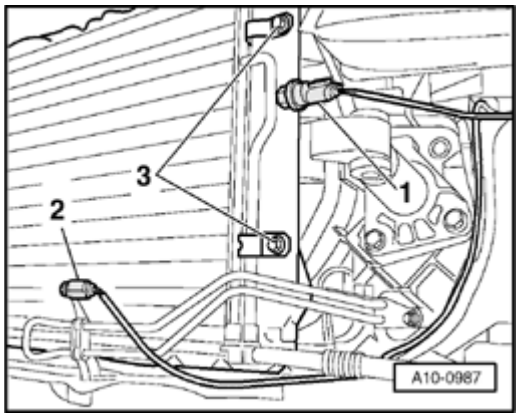

Fig. 277: Unbolting Condenser From Radiator
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unbolt condenser - **arrows** - from radiator.

NOTE:

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

- Carefully swivel condenser downward and set down.

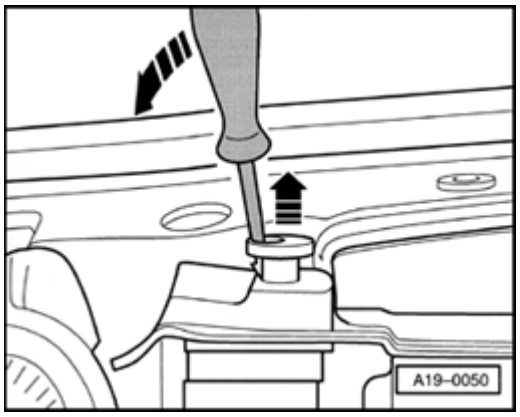

Fig. 278: Releasing Two Retaining Bolts For Radiator And Pulling Out Upward
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Release two retaining bolts for radiator and pull out upward - **arrows** -.
- Swivel radiator forward out of lock carrier and lift out.

Installing

Install in reverse order, paying attention to the following:

- Fill coolant system --> **Cooling system, draining and filling**.
- Install front bumper: -->
  - **63 BUMPER**

- **63 - BUMPERS** for CABRIOLET

Coolant fan, removing and installing

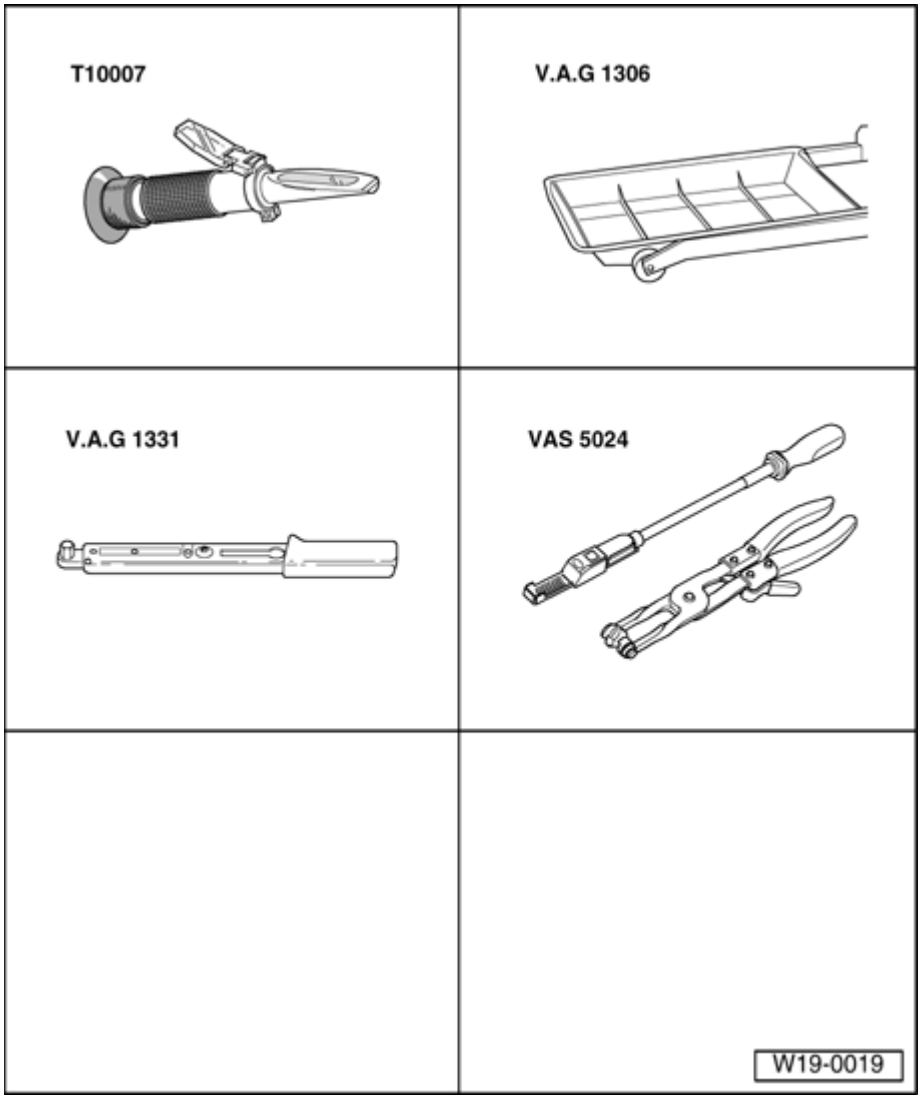

Fig. 279: Identifying Special Tools - Cooling System Components, Servicing, Removing And Installing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools, testers and auxiliary items required

- Refractometer T10007
- Drip tray VAG1306
- Torque wrench (5 to 50 Nm) VAG1331
- Assembly tools for spring clips VAS5024A

Removing

NOTE:

- **Always replace gaskets and sealing rings.**

- Remove front bumper: -->
  - **63 BUMPER**
  - **63 - BUMPERS** for CABRIOLET
- Move lock carrier to service position --> **Lock carrier, moving to service position**.
- Drain coolant --> **Cooling system, draining and filling**.
- Remove radiator --> **Radiator, removing and installing**.

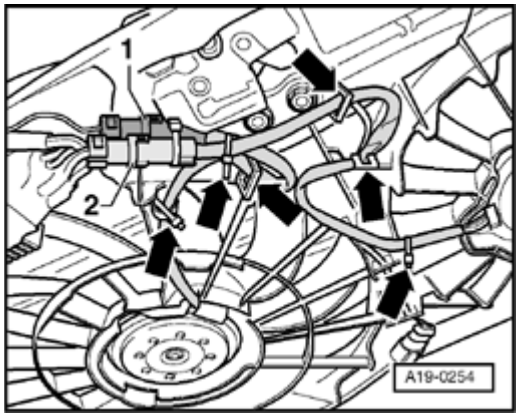

Fig. 280: Disconnecting Fan Motor Connectors
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect connectors - **1** - and - **2** - and move fan motor wires clear.

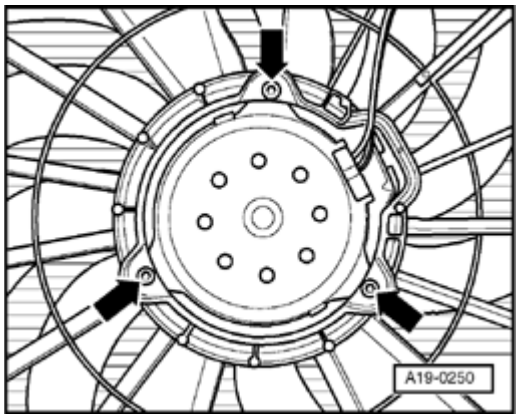

Fig. 281: Unbolting Coolant Fan From Radiator Cowl
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unbolt coolant fan - **arrows** - from radiator cowl.

Installing

Install in reverse order, paying attention to the following:

- Install front bumper: -->
  - **63 BUMPER**
  - **63 - BUMPERS** for CABRIOLET

Coolant pump, removing and installing

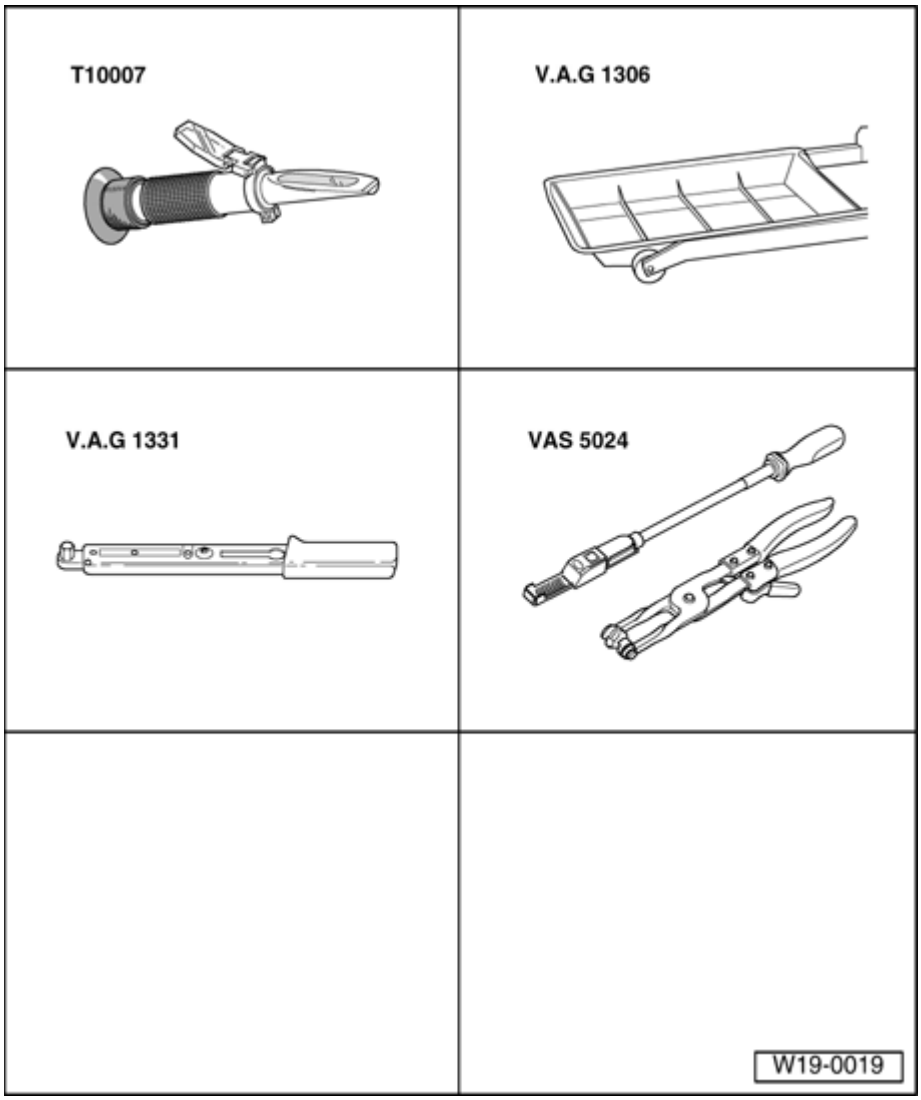

Fig. 282: Identifying Special Tools - Cooling System Components, Servicing, Removing And Installing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools, testers and auxiliary items required

- Refractometer T10007
- Drip tray VAG1306
- Torque wrench (5 to 50 Nm) VAG1331

- Assembly tools for spring clips VAS5024A

Removing

NOTE:

- **Always replace gaskets and sealing rings.**
- **Remove toothed belt completely so that it cannot be damaged by coolant.**

- Drain cooling system --> **Cooling system, draining and filling**.
- Remove ribbed belt --> **Ribbed belt, removing and installing**.
- Remove ribbed belt tensioning element.
- Remove toothed belt --> **Toothed drive belt, removing, installing and tensioning**.

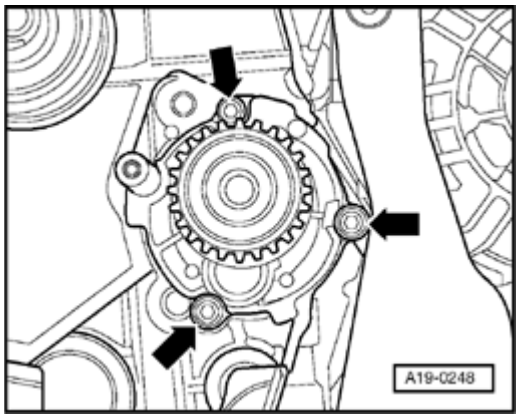

Fig. 283: Removing Bolts Securing Coolant Pump And Coolant Pump
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts - **arrows** - securing coolant pump and remove coolant pump.

Installing

Install in reverse order, paying attention to the following:

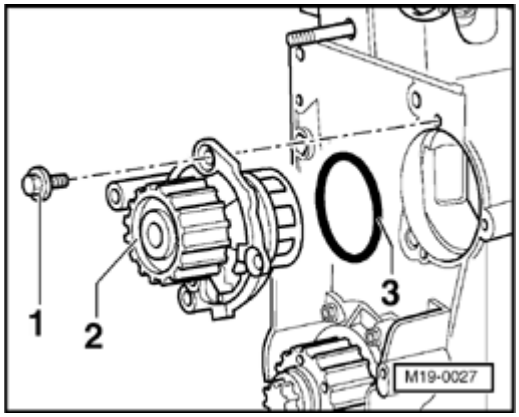

Fig. 284: Inserting Coolant Pump Into Cylinder Block And Securing Bolts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Moisten new O-ring - **3** - with coolant.
- Insert coolant pump into cylinder block and tighten securing bolts - **1** -.

Tightening torque: 15 Nm

Installing toothed belt and adjusting valve timing --> **Toothed drive belt, removing, installing and tensioning**.

- Install ribbed belt tensioning element.

Tightening torque: 25 Nm

- Install ribbed belt --> **Ribbed belt, removing and installing**.
- Fill coolant system --> **Cooling system, draining and filling**.

Cooling system, checking for leaks

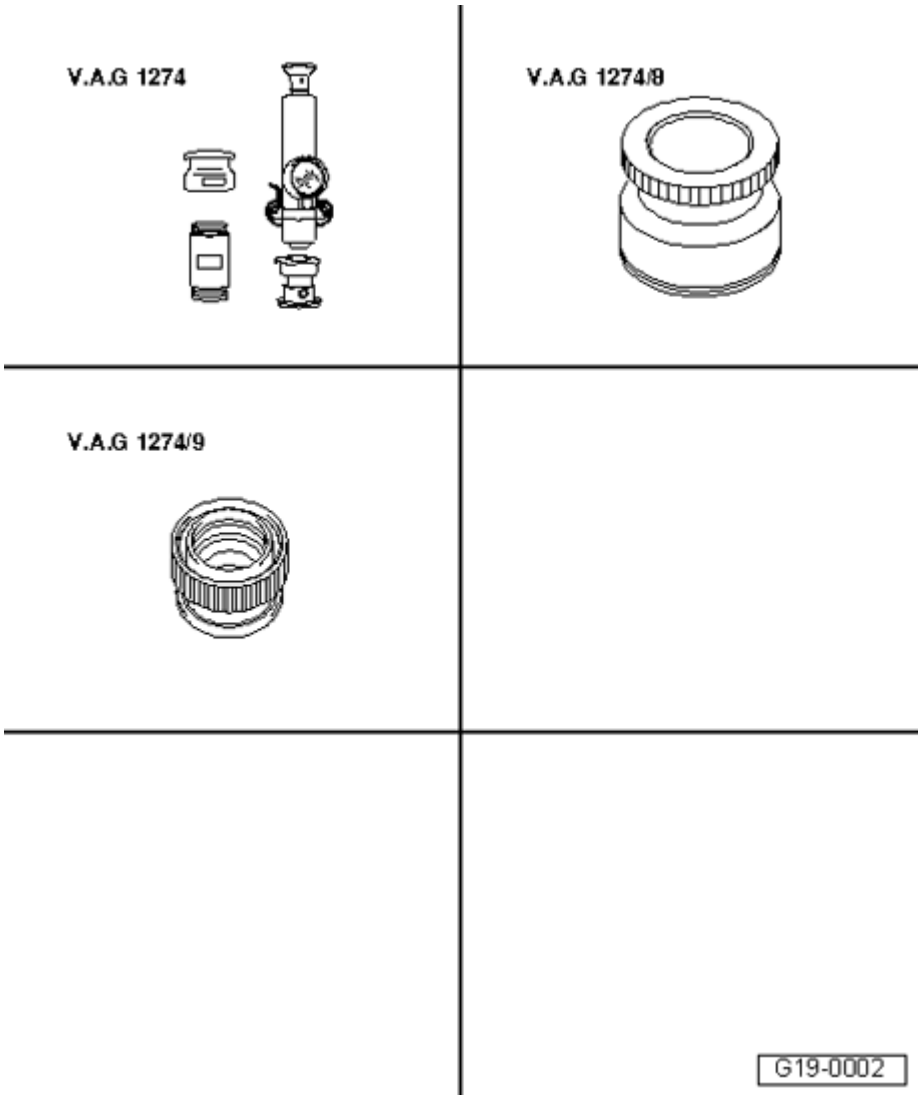

Fig. 285: Identifying Special Tools - Cooling System, Checking For Leaks
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools, testers and auxiliary items required

- Cooling system tester VAG1274
- Adapter VAG1274/8
- Adapter VAG1274/9

Requirement

- Engine warm.

CAUTION: Hot steam can escape when cap on expansion tank is opened. Cover cap with cloth and open carefully.

- Open cap on coolant expansion tank.

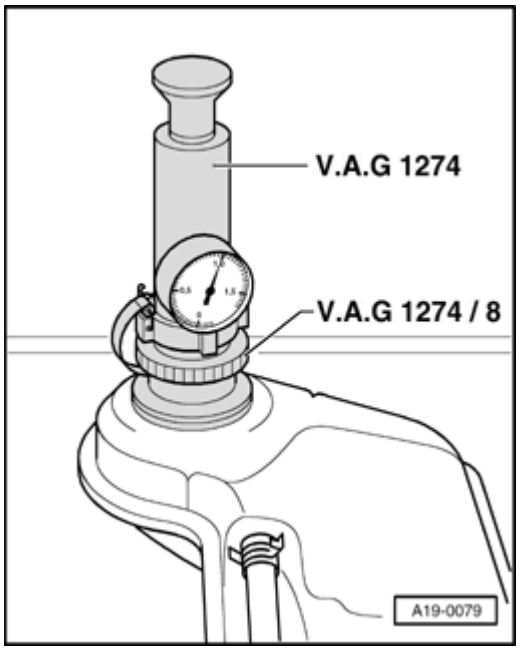

Fig. 286: Installing Tester VAG1274 With Adapter VAG1274/8 Onto Expansion Tank
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Install tester VAG1274 with adapter VAG1274/8 onto expansion tank.
- Use tester hand pump to generate pressure of approx. 1.0 bar.
- If there is a drop in pressure, locate leak and eliminate fault.

Checking pressure relief valve in cap

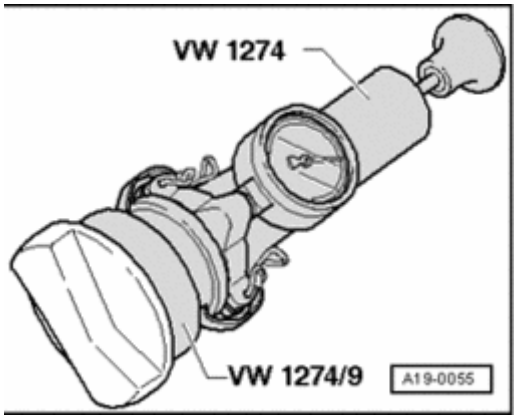

Fig. 287: Checking Pressure Relief Valve In Filler Cap
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Install tester VAG1274 with adapter VAG1274/9 onto cap.
- Operate hand pump.

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

21 - TURBOCHARGER, G-CHARGER

CHARGE AIR PRESSURE SYSTEM WITH TURBOCHARGER, CHECKING

Charge air pressure system with turbocharger, checking

NOTE:

- **Observe rules for cleanliness --> Rules of cleanliness.**
- **Secure all hose connections with standard hose clamps**
- **Before performing checks or repair work, make sure that all lines and hoses are securely connected and that there are no leaks.**
- **Always replace gaskets, sealing rings and self-locking nuts.**

Safety precautions

Pay attention to the following if testers and measuring instruments have to be used in the course of a test drive:

CAUTION: Always attach testers and measuring instruments to the back seat and have them operated from there by a second person.

If testers and measuring instruments were to be operated from front passengers seat, person sitting there could suffer injury in the event of an accident due to triggering of the front passengers airbag.

Boost pressure regulation and vacuum control system, connection diagram for vehicles up to 06.03

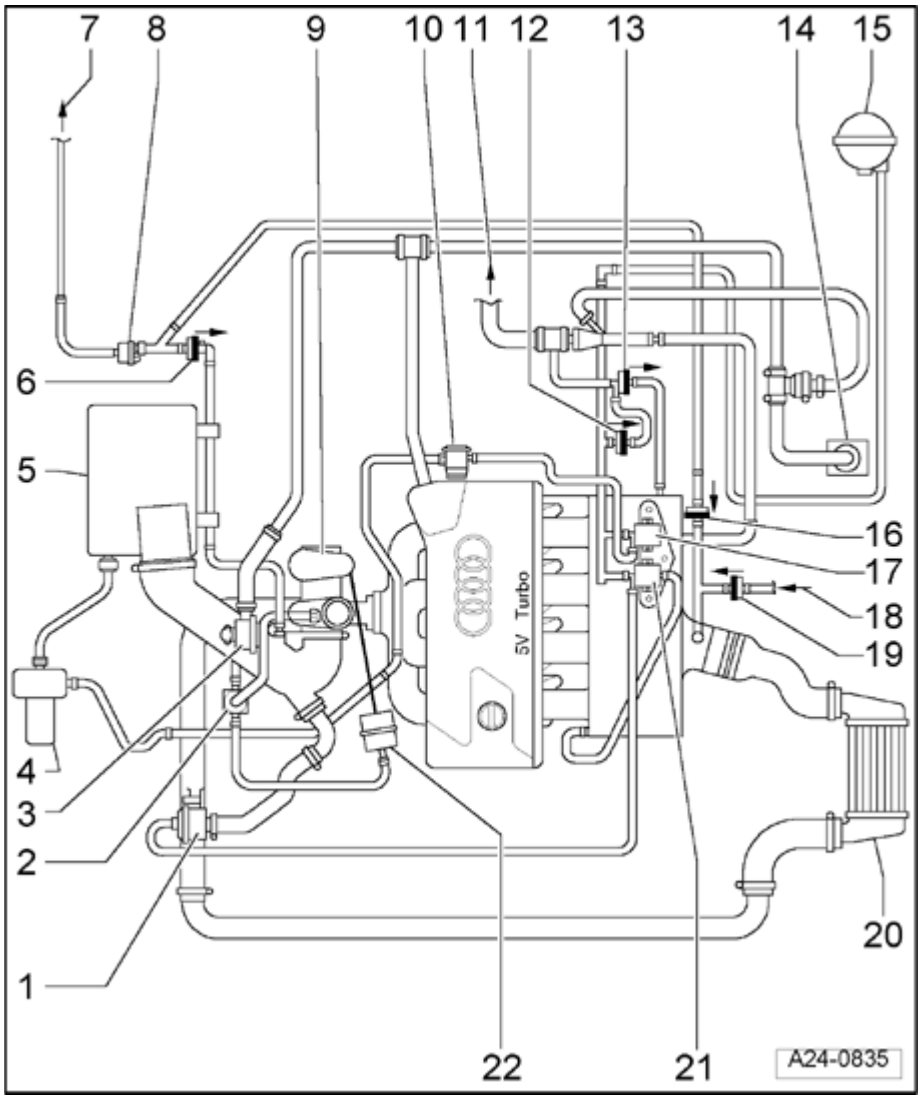

Fig. 288: Boost Pressure Regulation And Vacuum Control System, Connection Diagram For Vehicles Up To 06.03
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Mechanical recirculation valve

2 - Wastegate Bypass Regulator Valve N75

3 - Pressure regulator valve for crankshaft housing ventilation

4 - Secondary Air Injection (AIR) Pump Motor V101

5 - Air filter

- With Mass Air Flow (MAF) Sensor G70

6 - Check valve

- Installed position: Arrow on valve points in direction of flow, as shown in illustration

7 - To EVAP canister

8 - Evaporative Emission (EVAP) Canister Purge Regulator Valve N80

9 - Turbocharger

10 - Combination valve for secondary air injection (AIR)

11 - To brake booster

12 - Check valve

- Installed position: Arrow on valve points in direction of flow, as shown in illustration

13 - Check valve

- Installed position: Arrow on valve points in direction of flow, as shown in illustration

14 - Crankshaft housing ventilation

15 - Vacuum reservoir

- Component location: Under wheelhousing liner in front left wheelhouse

16 - Check valve

- Installed position: Arrow on valve points in direction of flow, as shown in illustration

17 - Secondary Air Injection (AIR) Solenoid Valve N112

- Component location: Below intake manifold

18 - To Leak Detection Pump (LDP) V144

19 - Check valve

- Installed position: Arrow on valve points in direction of flow, as shown in illustration

20 - Charge air cooler

- With Charge Air Pressure Sensor G31

21 - Recirculating valve for turbocharger N249

- Component location: Below intake manifold

22 - Vacuum diaphragm for boost pressure regulation

- When combination valve is opened, mechanical boost pressure regulation valve in turbocharger is opened and secondary air is thereby channeled past turbocharger directly to catalytic converter

Boost pressure regulation and vacuum control system, connection diagram for vehicles as of 07.03

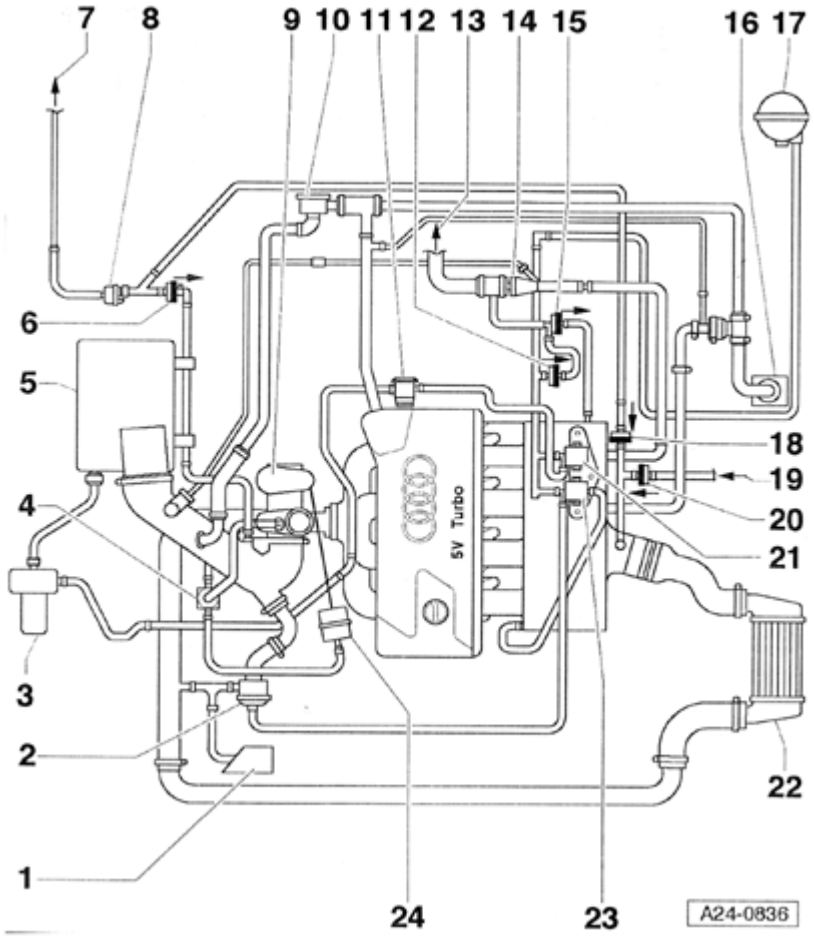

Fig. 289: Boost Pressure Regulation And Vacuum Control System, Connection Diagram For Vehicles As Of 07.03
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Resonator

2 - Mechanical recirculation valve

3 - Secondary Air Injection (AIR) Pump Motor V101

4 - Wastegate Bypass Regulator Valve N75

5 - Air filter

- With Mass Air Flow (MAF) Sensor G70

6 - Check valve

- Installed position: Arrow on valve points in direction of flow, as shown in illustration

7 - To EVAP canister

8 - Evaporative Emission (EVAP) Canister Purge Regulator Valve N80

9 - Turbocharger

10 - Pressure regulator valve for crankshaft housing ventilation

11 - Combination valve for secondary air injection (AIR)

12 - Check valve for EVAP canister

- Installed position: Arrow on valve points in direction of flow, as shown in illustration

13 - To brake booster

14 - Vacuum suction jet pump

15 - Check valve

- Installed position: Arrow on valve points in direction of flow, as shown in illustration

16 - Crankshaft housing ventilation

17 - Vacuum reservoir

- Component location: Under wheelhousing liner in front left wheelhouse

18 - Check valve

- Installed position: Arrow on valve points in direction of flow, as shown in illustration

19 - To Leak Detection Pump (LDP) V144

20 - Check valve

- Installed position: Arrow on valve points in direction of flow, as shown in illustration

21 - Secondary Air Injection (AIR) Solenoid Valve N112

- Component location: Below intake manifold

22 - Charge air cooler

- With Charge Air Pressure Sensor G31

23 - Recirculating valve for turbocharger N249

- Component location: Below intake manifold

24 - Vacuum diaphragm for boost pressure regulation

- When combination valve is opened, mechanical boost pressure regulation valve in turbocharger is opened and secondary air is thereby channeled past turbocharger directly to catalytic converter

Turbocharger and charge pressure control valve, checking

Special tools, testers and auxiliary items required

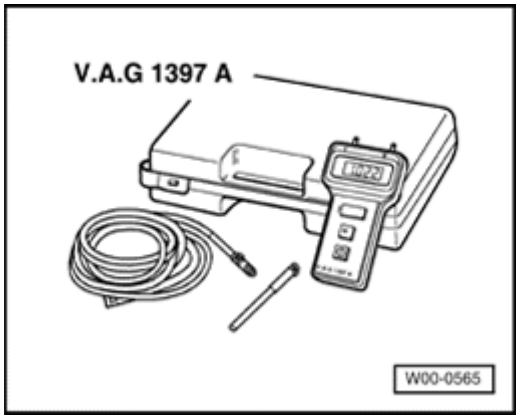

Fig. 290: Identifying Turbocharger Tester V.A.G 1397 A
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Turbocharger tester VAG1397A

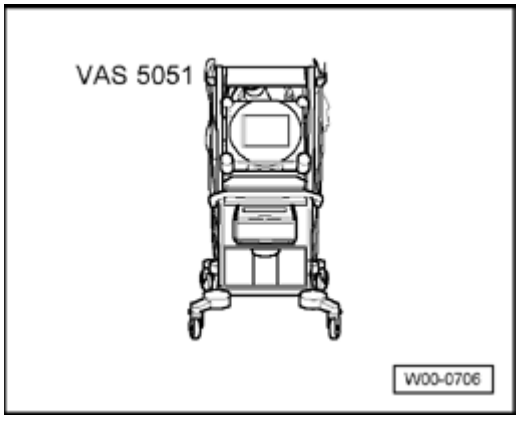

Fig. 291: Identifying Vehicle Diagnosis, Testing And Information System VAS 5051
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- VAS5051 with VAS5051/1

or

- VAG1551 with VAG1551/3A

Requirements

- All hoses and lines must be securely installed and free of leaks.
- Diagnostic Trouble Code (DTC) memory has been checked --> Guided Fault Finding in VAS5051 - **01 ON BOARD DIAGNOSTIC (OBD)**
- Output Diagnostic Test Mode performed --> Guided Fault Finding in VAS5051 - **01 ON BOARD DIAGNOSTIC (OBD)**
- Vehicle Diagnostic, Testing and Information System VAS5051 or Scan Tool VAG1551 must be connected.

Work sequence

CAUTION: Always attach testers and measuring instruments to back seat and have them operated from there by a second person.

If testers and measuring instruments were to be operated from front passengers seat, person sitting there could suffer injury in the event of an accident due to triggering of front passengers airbag.

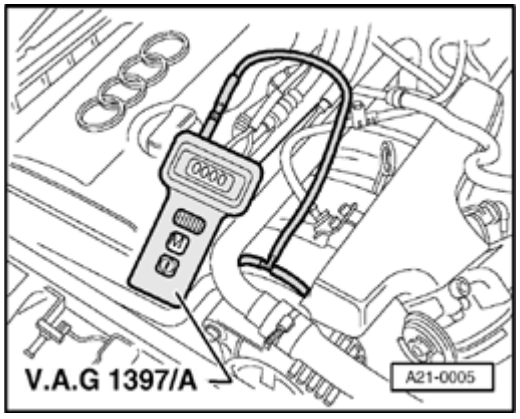

Fig. 292: Connecting T-Piece And Measuring Hose Of Turbocharger Tester VAG1397A To Intake Manifold
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect T-piece and measuring hose of turbocharger tester VAG1397A to intake manifold (front).
- Route measuring hose under rear edge of hood and into passenger compartment via right side window.

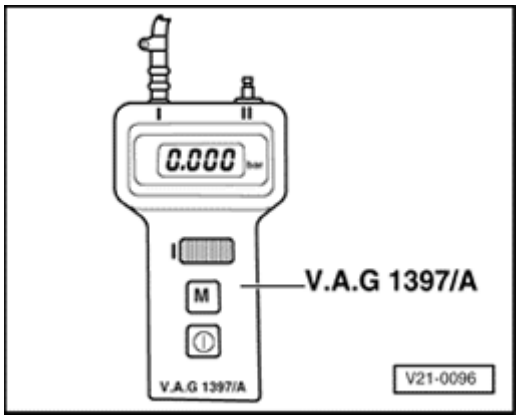

Fig. 293: Identifying Turbocharger Tester V.A.G 1397 A
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Switch on turbocharger tester and set measuring range selector switch to position -I- (absolute pressure).
- Connect measuring hose to connection -I-.

NOTE:

- **Hose connections must be completely airtight, otherwise measurements will not be correct.**
- **Ensure that measuring hose is not pinched at hood or side window.**
- **Pressing memory key -M- on turbocharger tester will store last measured value until memory key -M- is pressed again or tester is switched off.**
- **The decimal point in display flashes to indicate that value is being stored.**
- **If battery voltage of turbocharger tester drops below minimum level, an arrow will appear at top left of display.**
- **Before performing test, drive vehicle at brisk speed for at least 3 km without stopping (i.e. along route without traffic lights, etc.).**
- **A second mechanic is required to note readings on tester when vehicle is moving.**

Reading measured value block 115 -->
1 2 3 4

- Read measured value block, display group 115, engine idling.
- Accelerate vehicle from 2000 RPM to wide open throttle in third gear and watch rev counter.
- At approx. 2500 RPM, press print key on VAS5051 or PRINT key on VAG1551 while simultaneously pressing memory key -M- on VAG1397A.

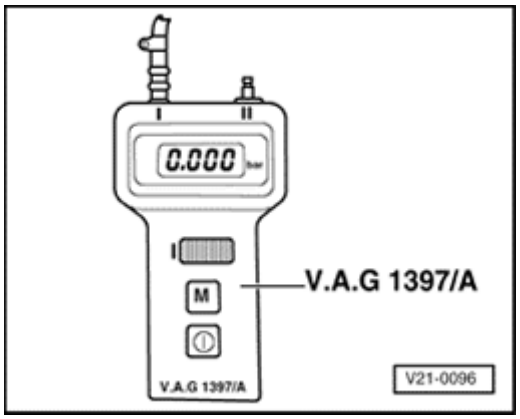

Fig. 294: Identifying Turbocharger Tester V.A.G 1397 A
Courtesy of VOLKSWAGEN UNITED STATES, INC.

NOTE:

- **The charge air pressure should be measured using turbocharger tester VAG1397/A. Vehicle diagnostic, testing and information system VAS5051 or scan tool VAG1551 is used to check whether charge air pressure is being registered by control module.**
- **Specification for VAG1397A : 1.500 to 1.600 bar**
- **Specification on VAG1551 or VAS5051 in display zone 4:**

Reading measured value block 115 --> 1 2 3 4

1500 to 1600 mbar

If reading does not match specification, troubleshooting table.

Malfunctions in charge air pressure control

Malfunction	Possible cause of trouble
Charge air pressure below specification	• Wastegate bypass regulator valve N75 faulty --> **Wastegate bypass regulator valve N75 , checking** , checking • Hoses to Wastegate bypass regulator valve N75 faulty, --> **Boost pressure regulation and vacuum control system, connection diagram for vehicles up to 06.03** , connection diagram or --> **Boost pressure regulation and vacuum control system, connection diagram for vehicles as of 07.03** , connection diagram • Charge pressure control valve in turbocharger sticking in open position

	• Leak between turbocharger and intake manifold --> **Effects of leakage at intake and exhaust end** , effects • Mechanical air recirculation valve faulty --> **Mechanical air recirculation valve, checking** , checking • Recirculating valve for turbocharger N249 faulty --> **Recirculating valve for turbocharger N249 , checking** , checking • Turbocharger faulty --> **Turbocharger, removing and installing** , replacing
Charge air pressure above specification * See note	• Vacuum unit for charge air pressure control valve faulty --> **Turbocharger, removing and installing** , replacing • Hoses to vacuum unit for charge air pressure control (via N75 leaking --> **Boost pressure regulation and vacuum control system, connection diagram for vehicles up to 06.03** , connection diagram or --> **Boost pressure regulation and vacuum control system, connection diagram for vehicles as of 07.03** , connection diagram • Charge air pressure control valve in turbocharger sticking in closed position --> **Turbocharger, removing and installing** , replacing

*If charge air pressure is too high, fuel supply will be interrupted in order to protect engine. This results in misfiring at high engine speeds.

Effects of leakage at intake and exhaust end

Leakage downstream of Mass Air Flow sensor

- Effect: Loss of power

Possible fault sources:

1. Hose connection between mass air flow sensor and turbocharger
2. Connection hose to crankcase breather
3. Connection hose to mechanical air recirculation valve

Leakage downstream of turbocharger

- Effect: Charge air pressure too low

Possible fault sources:

1. Connection hoses and line between turbocharger and charge air cooler
2. Hose between charge air cooler and intake manifold
3. Charge air cooler
4. Gasket of Charge air pressure sensor G31 (in charge air cooler)
5. Gasket between throttle valve control module and intake manifold
6. Gasket between intake manifold and cylinder head

CHARGE PRESSURE LEAK TEST WITH VAG1687

Intake system, checking for leaks using Diagnostic Tool VAG1687

Diagnostic trouble codes (DTCs) related to fuel trim, charge pressure or mass air flow (MAF) may be caused by:

- Leaking (worn/torn) intake hoses during charge conditions
- Incorrectly torqued or improperly placed clamps on intake hoses etc. causing leaks during charge conditions

Fig. 295: Checking Charge Air Pressure System Using Vag1687 Charge Air System Tester
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Check the charge air pressure system using the VAG1687 Charge air system tester.

Special tool VAG1687 Charge air system tester preliminary set-up

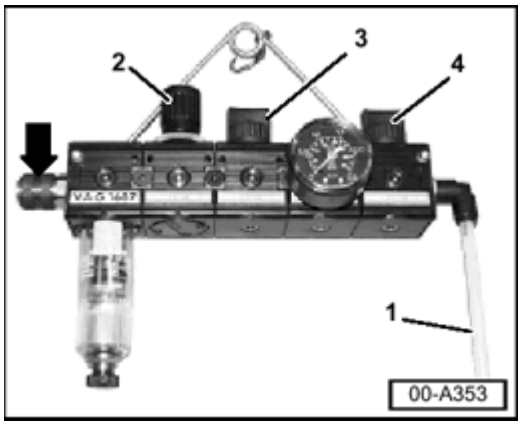

Fig. 296: Special Tool VAG1687 Charge Air System Tester Preliminary Set-Up
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Back off pressure regulator knob - **2** - of VAG1687 fully to protect gauge when shop air supply is applied to assembly.
- Close valve - **3** - before gauge.
- Close valve - **4** - after gauge.

The shop air supply line will later be attached to the inlet of VAG1687.

- Remove female fitting from tester - **arrow** - and install an appropriate "male" air fitting that will connect to your shop air supply line (--> WARNING!).

WARNING: Use only approved air fittings to adapt shop air supply line to VAG 1687 tester.

Special tool VAG 1687/1 pressure adapter, installing (1.8L Turbo)

- Separate intake hose from Mass Air Flow (MAF) sensor assembly.

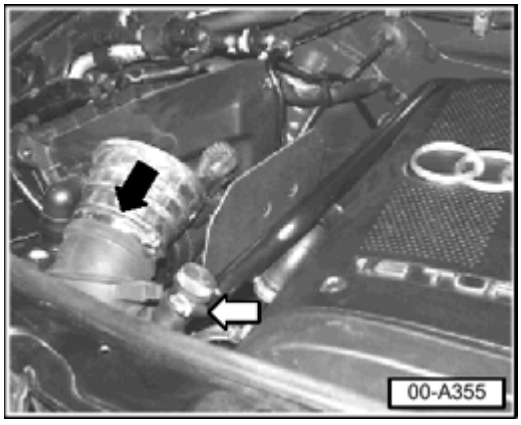

Fig. 297: Special Tool VAG 1687/1 Pressure Adapter, Installing (1.8L Turbo)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Insert VAG1687/1 pressure adapter in intake hose - **black arrow** - using existing clamp (as shown).
- Remove crankcase ventilation tube from intake hose at - **white arrow** -.

NOTE:

- **To help find small leaks, BEFORE pressurizing the system fill system with smoke using special tool KLI9210 and adapter KLI9210/50 as described on.**
- **An ultrasonic detector may also be used to detect extremely small leaks where smoke may not be visible.**

Special tool KLI9210 (Evaporative system leak detector), connecting to 1.8L Turbo

- Install optional fitting LKI9210/50 on hose of special tool KLI9210.

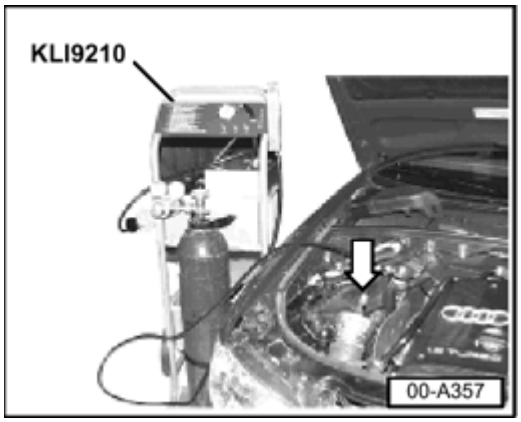

Fig. 298: Special Tool KLI9210 (Evaporative System Leak Detector), Connecting To 1.8L Turbo
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect KLI9210 to VAG 1687/1 adapter (KLI9210 is shown attached to VAG 1687/1 at arrow on 1.8L Turbo).

Special tool LKI9210 (Evaporative system leak detector), preliminary set-up

- Connect smoke generator leads to vehicle battery.

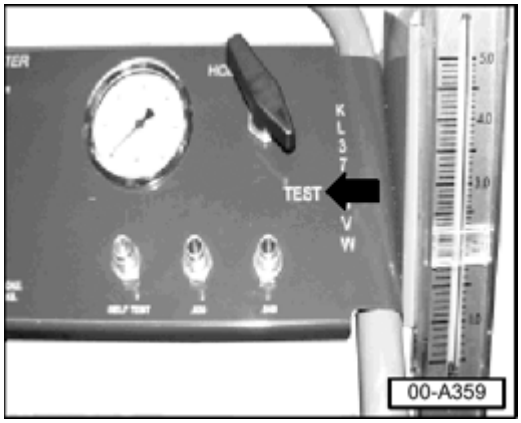

Fig. 299: Special Tool LKI9210 (Evaporative System Leak Detector), Preliminary Set-Up

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Turn valve to test - **black arrow** -.
- Press smoke generator button to fill system with smoke (see instructions printed on tester).

With system filled with smoke:

- Remove smoke generator hose and connect VAG1687 quickly to prevent smoke from leaking out.

Special tool VAG1687 , connecting to pressure adapter VAG1687/1 (1.8L Turbo)

For illustrations purposes VAG is shown lying in the engine compartment. In practice the tool should be hung from the hood.

- Connect VAG1687 quickly to prevent smoke from leaking out.

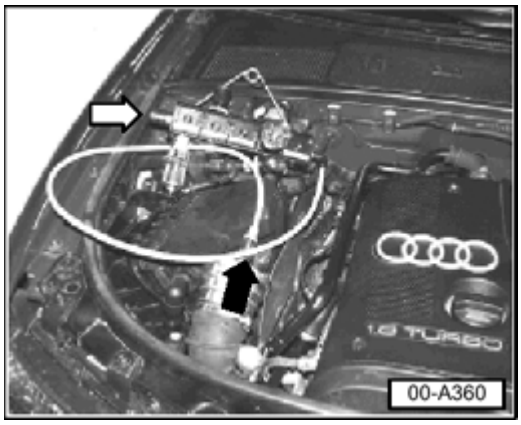

Fig. 300: Special Tool VAG1687 , Connecting To Pressure Adapter VAG1687/1 (1.8L Turbo)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

VAG1687 is shown connected to VAG1687/1 - **black arrow** -

Shop air supply will be connected to VAG1687 at - **white arrow** -

- Perform pressure test.

Performing pressure test

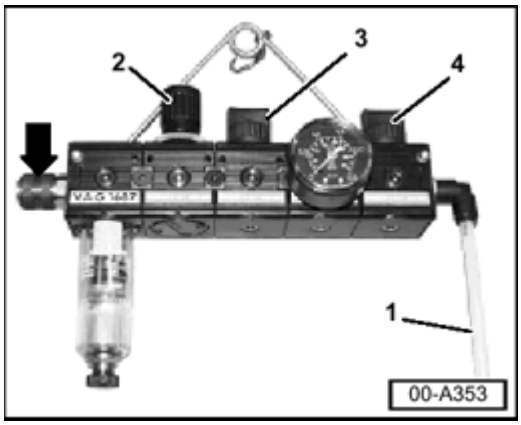

Fig. 301: Special Tool VAG1687 Charge Air System Tester Preliminary Set-Up
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- With outlet hose - **1** - of VAG1687 connected to air pressure adapter:
- Attach shop air supply line to previously installed male fitting --> **Charge pressure leak test with VAG1687**.

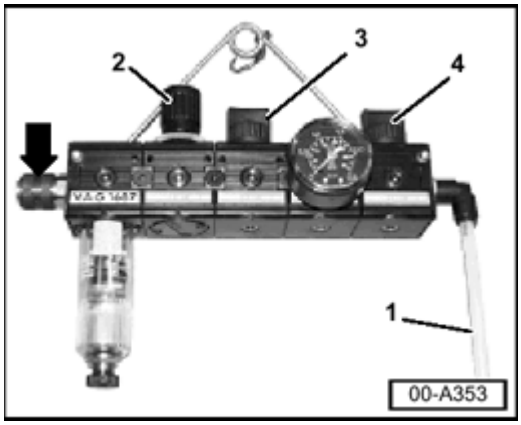

Fig. 302: Special Tool VAG1687 Charge Air System Tester Preliminary Set-Up
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Open valve - **3** - between regulator valve and gauge.
- Adjust test pressure up to 0.5 bar (--> CAUTION below) by turning regulator valve -2-.

CAUTION: DO NOT pressurize the system above 0.5 bar!

Doing so may force oil into the intake system which can damage the engine.

- Slowly open outlet valve - **4** - (after gauge) to test hose connections.
- Observe pressure gauge for a drop in pressure.

NOTE:

- **Some pressure will be lost past the throttle plate.**

- Readjust test pressure to 0.5 bar (CAUTION) by turning regulator valve - **2** -.
- Listen for any very large intake leaks.

If smoke generator was used to fill the system with smoke:

- Inspect intake system connections for smoke at leaks.

NOTE:

- **An ultrasonic detector may also be used to detect extremely small leaks where smoke may not be visible.**

- Repair any leaks found.
- Remove tester.
- Remove plug from crankcase ventilation hose.
- Remove air pressure adapter.

With VAS5051 diagnostic tool connected:

- Erase DTC memory.

If smoke generator was not used to fill the system with smoke:

- Apply soapy water solution or equivalent to intake system connections.

NOTE:

- **An ultrasonic detector may also be used to detect extremely small leaks.**

- Inspect intake system connections for leaks.
- Repair any leaks found.
- Remove tester.
- Remove plug from crankcase ventilation hose.
- Remove air pressure adapter.

With VAS5051 diagnostic tool connected:

- Erase DTC memory.

Effects of leakage at exhaust end

- Effect: Charge air pressure too low, possible exhaust smell, soot traces in engine compartment

Possible fault sources:

1 - Connection between turbocharger/exhaust manifold

2 - Connection between exhaust manifold/cylinder head

Mechanical air recirculation valve, checking

NOTE:

- **The mechanical air recirculation valve is located upstream of turbocharger. It is opened by vacuum via the Recirculating valve for turbocharger N249 when the engine is on overrun, idling and partial load. This reduces charge air pressure upstream of throttle valve, thereby keeping turbocharger rotating at higher speed.**
- **Check the mechanical air recirculation valve if the engine is not producing full power or if it jerks when the throttle is opened and closed.**

Special tools, testers and auxiliary items required

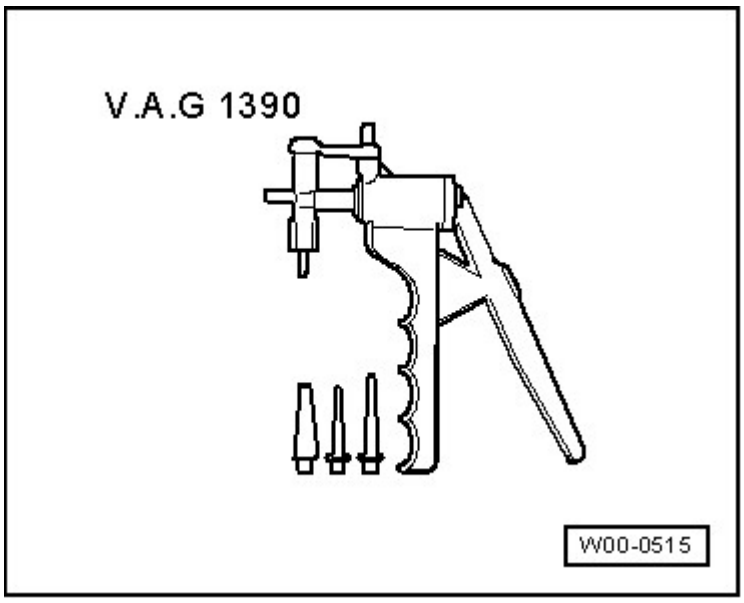

Fig. 303: Identifying Hand Vacuum Pump V.A.G. 1390
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Vacuum hand pump VAG1390

Work sequence

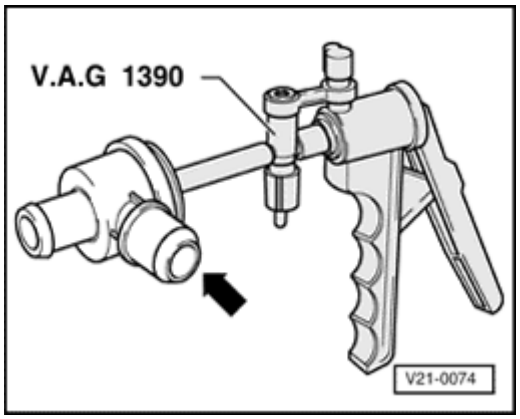

Fig. 304: Connecting Hand Vacuum Pump V.A.G 1390 To Vacuum Connection Of Charge Pressure Bypass Valve
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect vacuum pump VAG1390 to air recirculation valve.
- Operate vacuum hand pump.

- Air recirculation valve should open - **arrow** -.

- Operate air vent valve on vacuum pump after approx. 30 seconds.

- Air recirculation valve should close - **arrow** -.

If the mechanical air recirculation valve does not open and close as specified, or if the valve plate does not seal properly when the valve is closed:

- Replace mechanical air recirculation valve and secure hose connections with hose clamps.

Recirculating valve for turbocharger N249 , checking

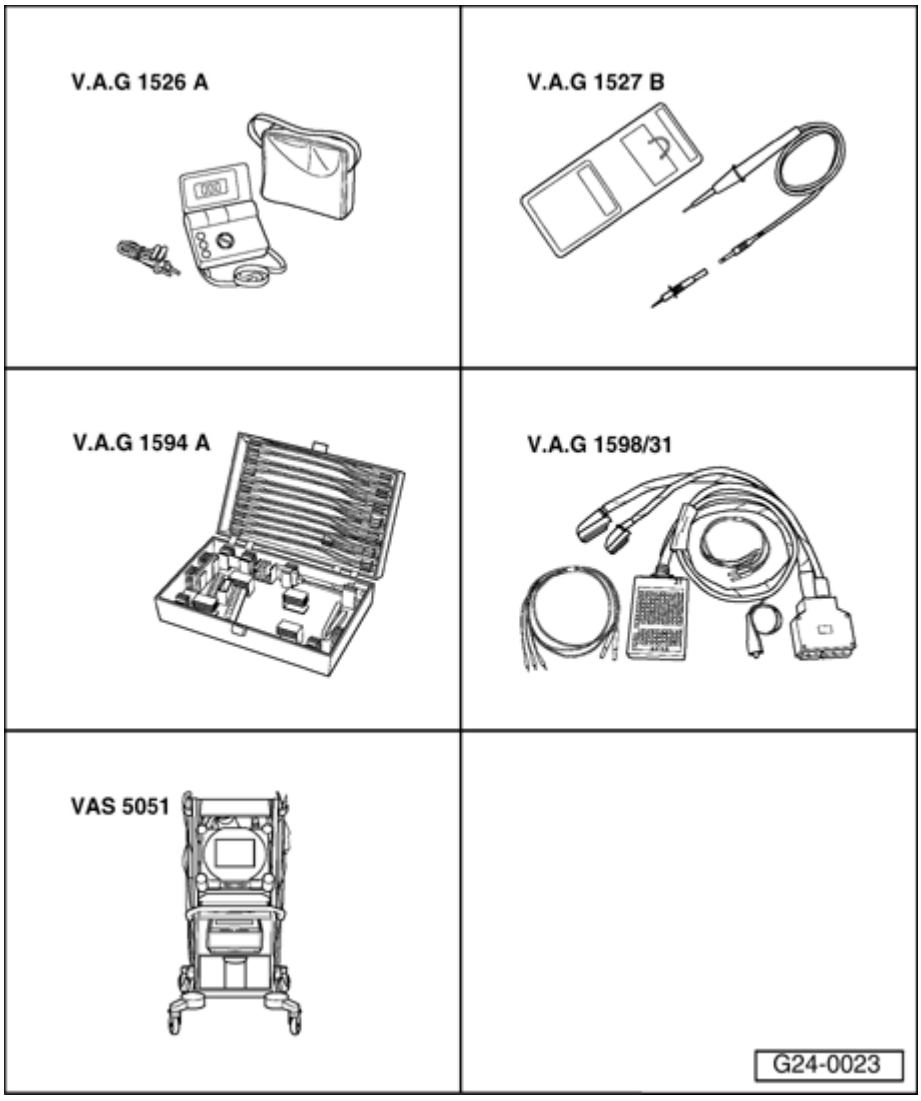

Fig. 305: Identifying Special Tools - Recirculating Valve For Turbocharger N249 , Checking
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools, testers and auxiliary items required

- Multimeter VAG1526A or equivalent
- Voltage tester VAG1527B
- Connector test set VAG1594A
- Adapter VAG1598/31
- Vehicle Diagnostic, Testing and Information System VAS5051 VAS5051 with VAS5051/1

or

- Scan Tool VAG1551 with VAG1551/3A

Requirement

- Vehicle Diagnostic, Testing and Information System VAS5051 or Scan Tool VAG1551 must be connected.

Work sequence

NOTE:

- **The Recirculating valve for turbocharger N249 and its wiring are monitored by the engine control module.**

  - Read DTC memory of engine control module.

If display shows a DTC relating to Recirculating valve for turbocharger N249 :

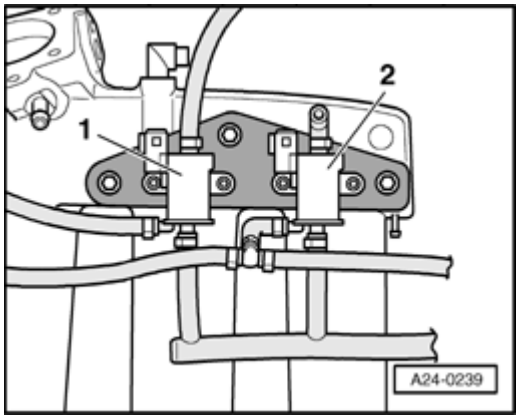

Fig. 306: Identifying Secondary Air Injection (AIR) Solenoid Valve -N112-
Courtesy of VOLKSWAGEN UNITED STATES, INC.

  - Disconnect hoses from Recirculating valve for turbocharger N249 - **1** - ; leave electrical connector connected.

- Location: under intake manifold

NOTE:

- **The illustration shows a removed intake manifold viewed from below.**

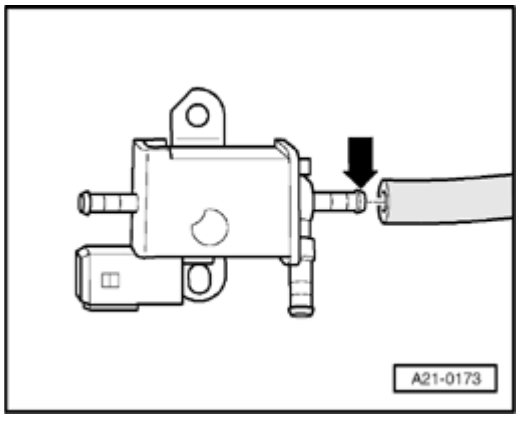

Fig. 307: Connect Test Hose To Valve Connection
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect test hose to valve connection marked with - **arrow** -.
- Start Output Diagnostic Test Mode and actuate Recirculating valve for turbocharger N249.

Indicated on display

Output Diagnostic Test Mode --> Recirculating valve for turbocharger -N249

- Valve must click...
- ..and must open and close (can be checked by blowing into test hose).

If valve does not click:

- Check internal resistance of valve.

If valve does not open or close properly:

- Replace Recirculating valve for turbocharger N249.

Checking internal resistance

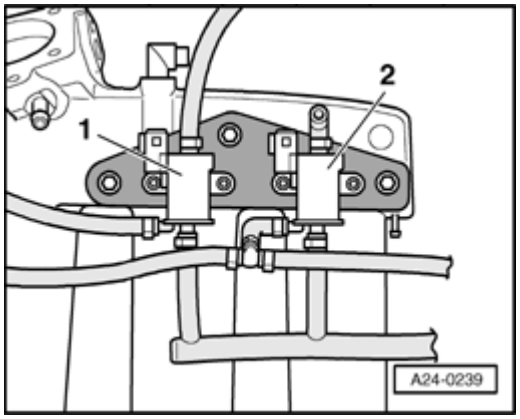

Fig. 308: Identifying Secondary Air Injection (AIR) Solenoid Valve -N112-
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect connector from Recirculating valve for turbocharger N249- - **1** -.

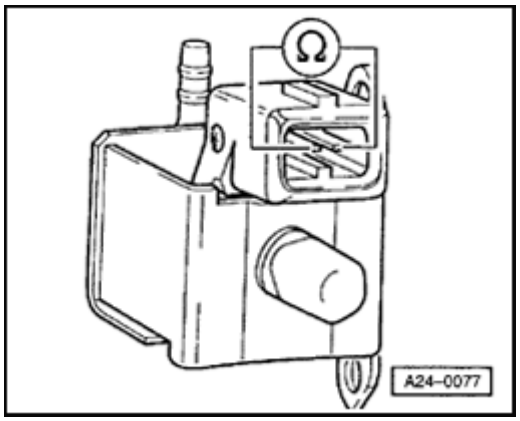

Fig. 309: Connecting Multimeter To Valve (Resistance Measurement Range)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect multimeter and measure resistance at valve.
- Specification: 27... 30 ohms

If reading does not match specification:

- Replace Recirculating valve for turbocharger N249.

If measured value matches specification:

- Check power supply.

Checking power supply

NOTE:

- **The recirculating valve is supplied with power via the fuel pump relay.**

Requirements

- Fuse for recirculating valve OK --> Electrical Wiring Diagrams, Troubleshooting and Component Locations
- Fuel pump relay OK --> **24 - MULTIPORT FUEL INJECTION (MFI)**

- Disconnect connector at valve.

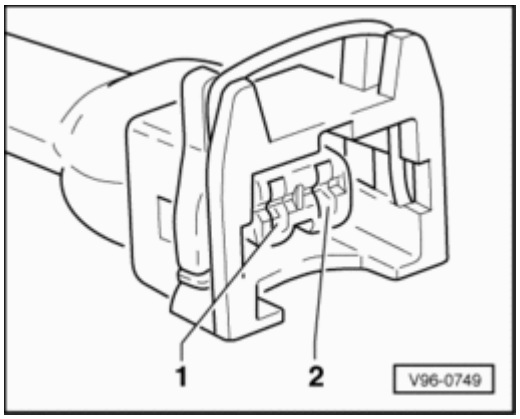

Fig. 310: Identifying 2-Pin Electrical Connector & Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect voltage tester VAG1527B as follows:

Connector contact	Measure to
1	Engine Ground

- Briefly operate starter.

- LED must light up

If LED does not light up:

- Check for open circuit in wiring from contact 1 of connector through fuse to fuel pump relay: --> Electrical Wiring Diagrams, Troubleshooting and Component Locations
- If necessary, eliminate open circuit.

If LED lights up:

- Check actuation.

Checking actuation

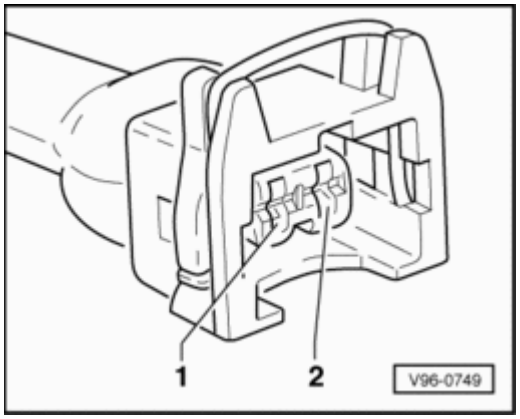

Fig. 311: Identifying 2-Pin Electrical Connector & Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect voltage tester VAG1527B to contact 1 (positive) and 2 of connector.
- Start Output Diagnostic Test Mode and actuate Recirculating valve for turbocharger N249.

- LED must flash

If LED does not flash or if it is permanently lit:

- Connect test box VAG1598/31 to engine control module wiring harness. Engine control module must not be connected. --> **24 - MULTIPORT FUEL INJECTION (MFI)**

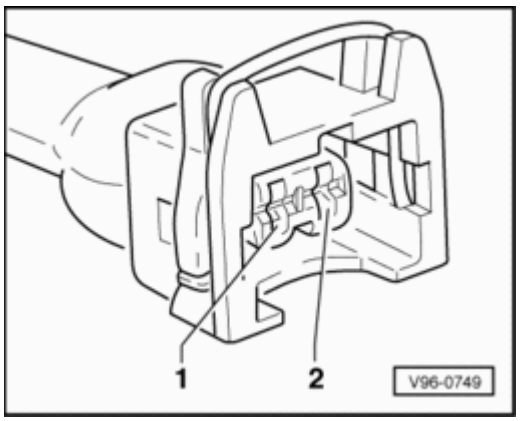

Fig. 312: Identifying 2-Pin Electrical Connector & Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Check for open circuit and short to Ground/positive in the following wiring connection:

Connector contact	Test box VAG1598/31 socket
2	105

- If necessary, eliminate open circuit/short circuit.

If wiring is OK:

- Replace engine control module.

Wastegate bypass regulator valve N75 , checking

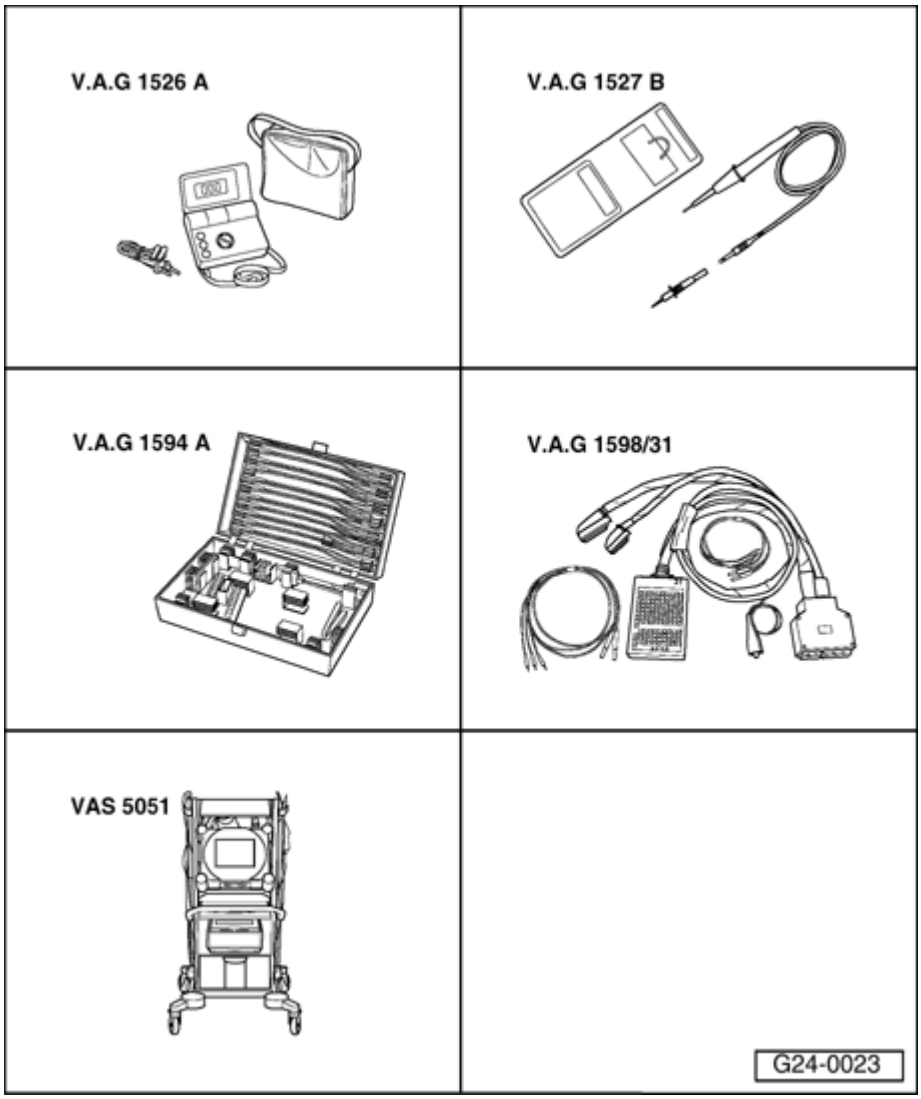

Fig. 313: Identifying Special Tools - Wastegate Bypass Regulator Valve N75 , Checking
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools, testers and auxiliary items required

- Multimeter VAG1526A or equivalent
- Voltage tester VAG1527B
- Connector test set VAG1594A
- Adapter VAG1598/31
- Vehicle Diagnostic, Testing and Information System VAS5051 VAS5051 with VAS5051/1

or

- Scan Tool VAG1551 with VAG1551/3A

Requirement

- Vehicle Diagnostic, Testing and Information System VAS5051 or Scan Tool VAG1551 must be connected.

Work sequence

NOTE:

- **The Wastegate bypass regulator valve N75 and its wiring are monitored by the engine control module.**

  - Read DTC memory of engine control module.

If display shows a DTC relating to Wastegate bypass regulator valve N75 :

  - Disconnect hoses from valve; leave connector connected.

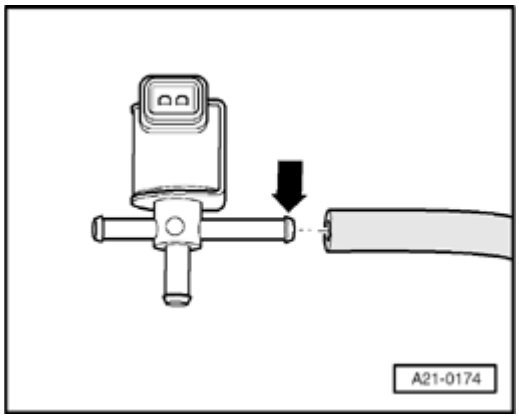

Fig. 314: Connecting Test Hose To Valve Connection
Courtesy of VOLKSWAGEN UNITED STATES, INC.

  - Connect test hose to valve connection marked with - **arrow** -.
  - Start Output Diagnostic Test Mode and actuate Wastegate bypass regulator valve N75.

Indicated on display

Output Diagnostic Test Mode --> Wastegate bypass regulator valve -N75

- Valve must click...
- ..and must open and close (can be checked by blowing into test hose).

If valve does not click:

  - Check internal resistance of valve.

If valve does not open or close properly:

- Replace Wastegate bypass regulator valve N75.

Checking internal resistance

- Disconnect connector at valve.

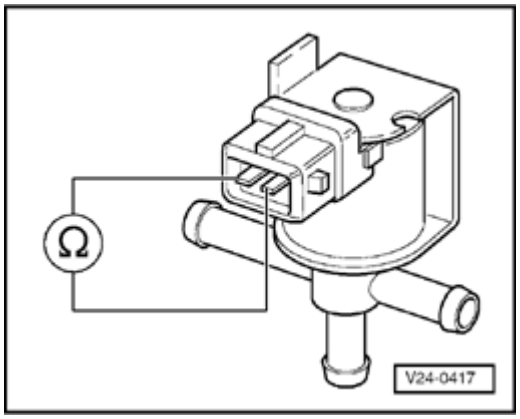

Fig. 315: Connecting Multimeter To Valve (Resistance Measurement Range)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect multimeter and measure resistance at valve.

- Specification: 25.to 35 ohms

If reading does not match specification:

- Replace Wastegate bypass regulator valve N75.

If measured value matches specification:

- Check power supply.

Checking power supply

Requirements

- Fuse for wastegate bypass regulator valve OK --> Electrical Wiring Diagrams, Troubleshooting and Component Locations
- Fuel pump relay OK --> **24 - MULTIPORT FUEL INJECTION (MFI)**

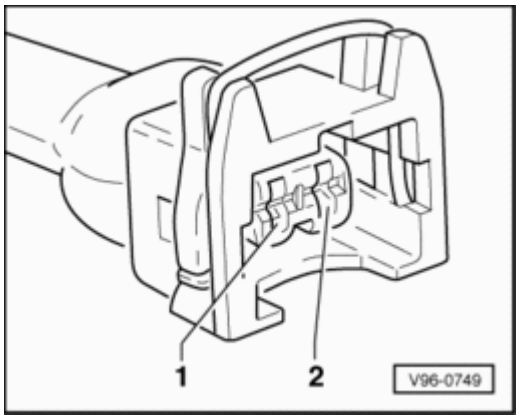

Fig. 316: Identifying 2-Pin Electrical Connector & Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect voltage tester VAG1527B as follows:

Connector contact	Measure to
1	Engine Ground

- Briefly operate starter.

- LED must light up

If LED does not light up:

- Check for open circuit in wiring from contact 1 of connector through fuse to fuel pump relay: --> Electrical Wiring Diagrams, Troubleshooting and Component Locations
- If necessary, eliminate open circuit.

If LED lights up:

- Check actuation.

Checking actuation

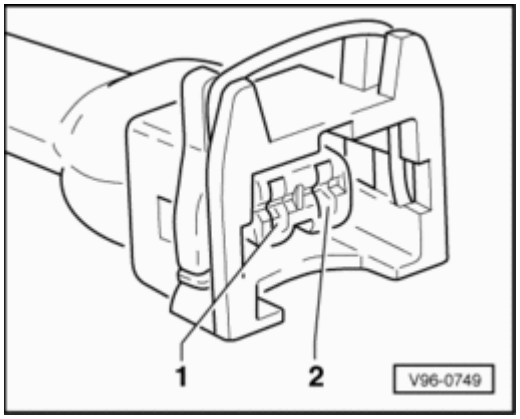

Fig. 317: Identifying 2-Pin Electrical Connector & Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect voltage tester VAG1527B to contact 1 (positive) and 2 of connector.
- Start Output Diagnostic Test Mode and actuate Wastegate bypass regulator valve N75.

Indicated on display:

Output Diagnostic Test Mode --> Wastegate bypass regulator valve -N75-

- LED must flash

If LED does not flash or if it is permanently lit:

- Connect test box VAG1598/31 to engine control module wiring harness. Engine control module must not be connected. --> **24 - MULTIPORT FUEL INJECTION (MFI)**

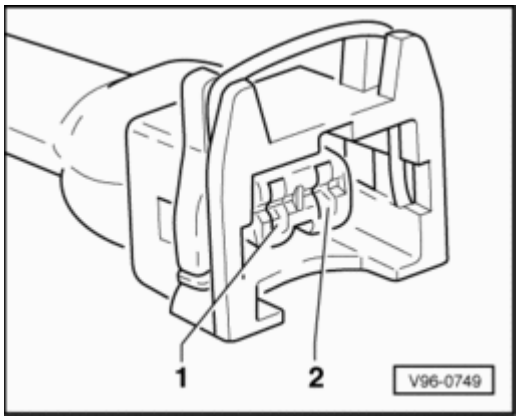

Fig. 318: Identifying 2-Pin Electrical Connector & Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Check for open circuit and short to Ground/positive in following wiring connection:

Connector contact	Test box VAG1598/31 socket
2	104

- If necessary, eliminate open circuit/short circuit.

If wiring is OK:

- Replace engine control module.

Charge air pressure sensor G31 , checking

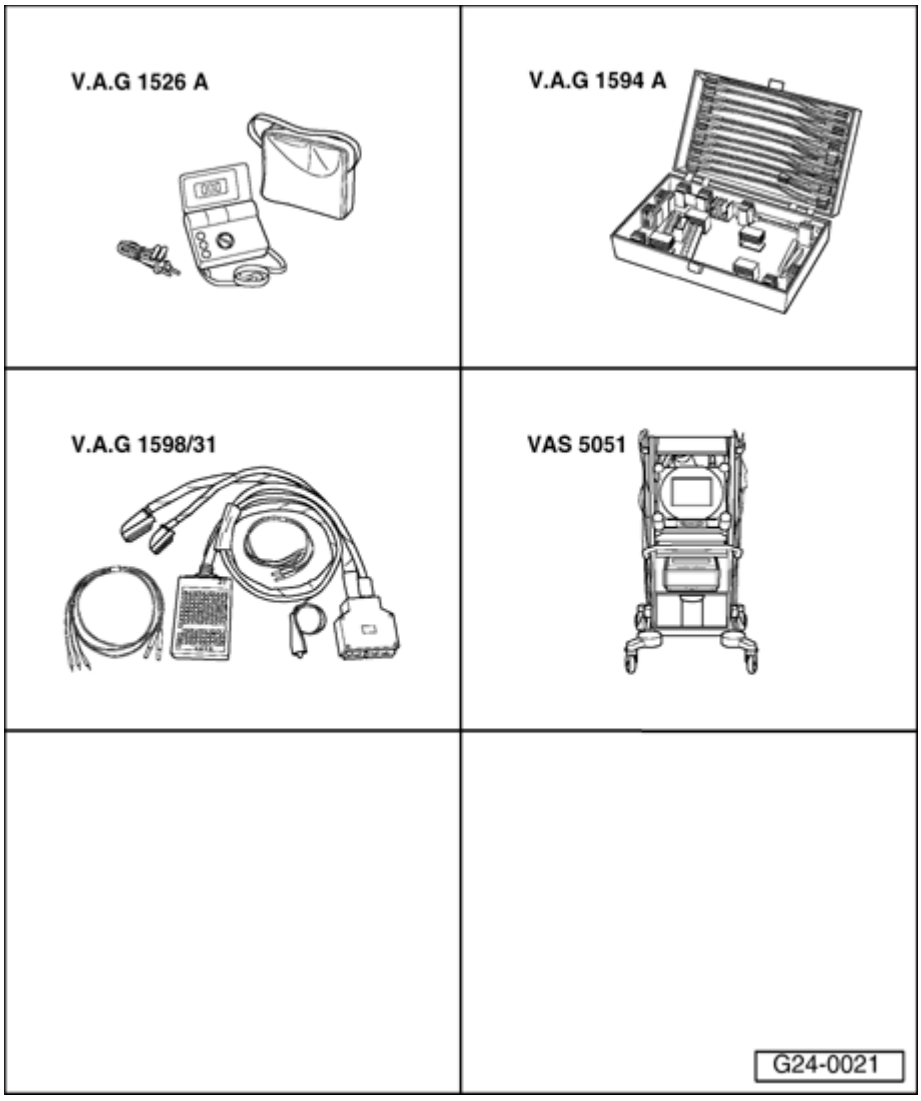

Fig. 319: Identifying Special Tools - Charge Air Pressure Sensor G31 , Checking
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools, testers and auxiliary items required

- Multimeter VAG1526A or equivalent
- Connector test set VAG1594A
- Adapter VAG1598/31
- Vehicle Diagnostic, Testing and Information System VAS5051 VAS5051 with VAS5051/1

or

- Scan Tool VAG1551 with VAG1551/3A

Requirement

- Vehicle Diagnostic, Testing and Information System VAS5051 or Scan Tool VAG1551 must be connected.

Work sequence

NOTE:

- **The Charge air pressure sensor G31 and its wiring are monitored by the engine control module.**

  - Read DTC memory of engine control module.

If display shows a DTC relating to Charge air pressure sensor G31 :

Checking power supply

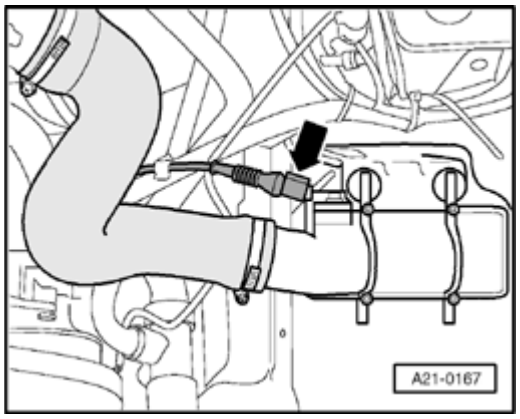

Fig. 320: Disconnecting Connector On Charge Air Pressure Sensor
Courtesy of VOLKSWAGEN UNITED STATES, INC.

  - Disconnect connector - **arrow** - on charge air pressure sensor.

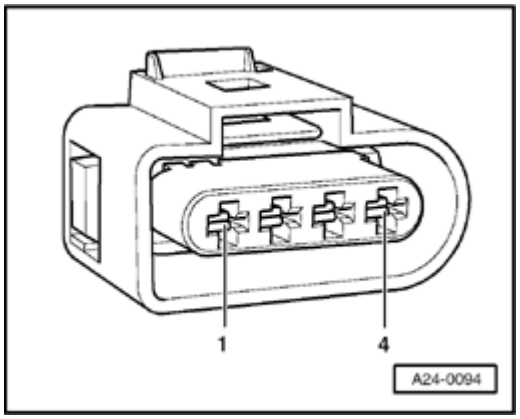

Fig. 321: Identifying Connector Terminals 1 And 4
Courtesy of VOLKSWAGEN UNITED STATES, INC.

  - Connect multimeter and measure voltage between contacts 1 and 3 of connector.

- Switch on ignition.
- Specification: approx. 5 V

If reading does not match specification:

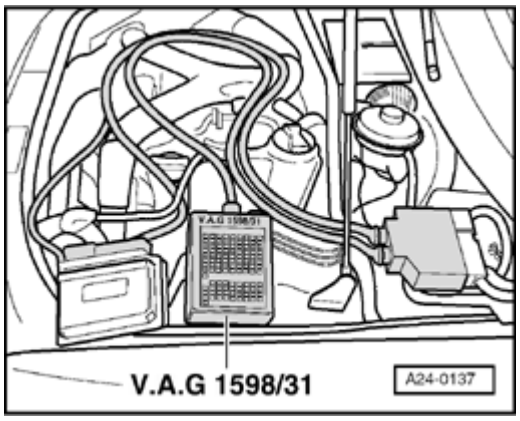

Fig. 322: Connecting Test Box VAG1598/31 To Engine Control Module Wiring Harness
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect test box VAG1598/31 to engine control module wiring harness. Engine control module must also be connected. --> **24 - MULTIPORT FUEL INJECTION (MFI)**

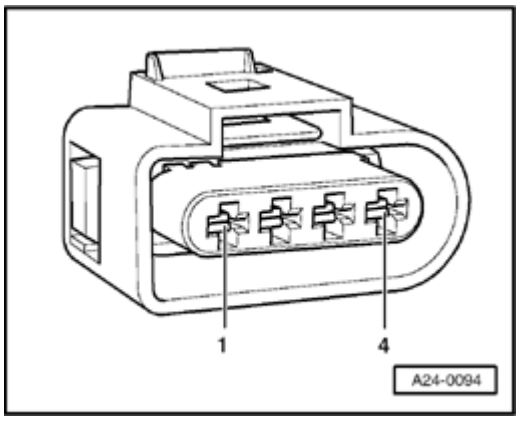

Fig. 323: Identifying Connector Terminals 1 And 4
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Check for open circuit and short to Ground/positive in following wiring:

Connector contact	Test box VAG1598/31 socket
1	108
3	98

- If necessary, eliminate open circuit/short circuit.

If measured value matches specification:

Checking signal wiring

- Connect connector for charge air pressure sensor.
- Connect multimeter and measure voltage at sockets 101 and 108 of test box.
- Start engine and let it idle.

- Specification: approx. 1.90 V

- Increase engine speed by quickly depressing accelerator pedal.

- Specification: 2.00 to 3.00 V

If readings do not match specifications:

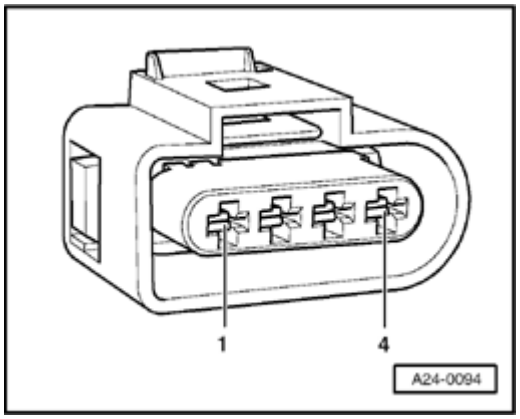

Fig. 324: Identifying Connector Terminals 1 And 4
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Check for open circuit and short to Ground/positive in following wiring connection:

Connector contact	Test box VAG1598/31 socket
4	101

- If necessary, eliminate open circuit/short circuit.

If wiring is OK:

- Replace Charge air pressure sensor G31.

CHARGE AIR SYSTEM WITH TURBOCHARGER, SERVICING

Rules of cleanliness

When working on turbocharger, pay careful attention to the following 5 rules:

- Carefully clean all joints and adjacent areas before disconnecting.
- Place parts removed on a clean surface and cover them over. Do not use fluffy cloths.
- Carefully cover or seal opened components if repairs are not to be performed immediately.
- Only install clean components: Do not remove replacement parts from wrapping until immediately prior to installation. Do not use parts that have been stored loose (e.g. in tool boxes).
- When system is open: Do not work with compressed air if at all possible. Do not move vehicle unless absolutely necessary.

Turbocharger, removing and installing - overview

Part I

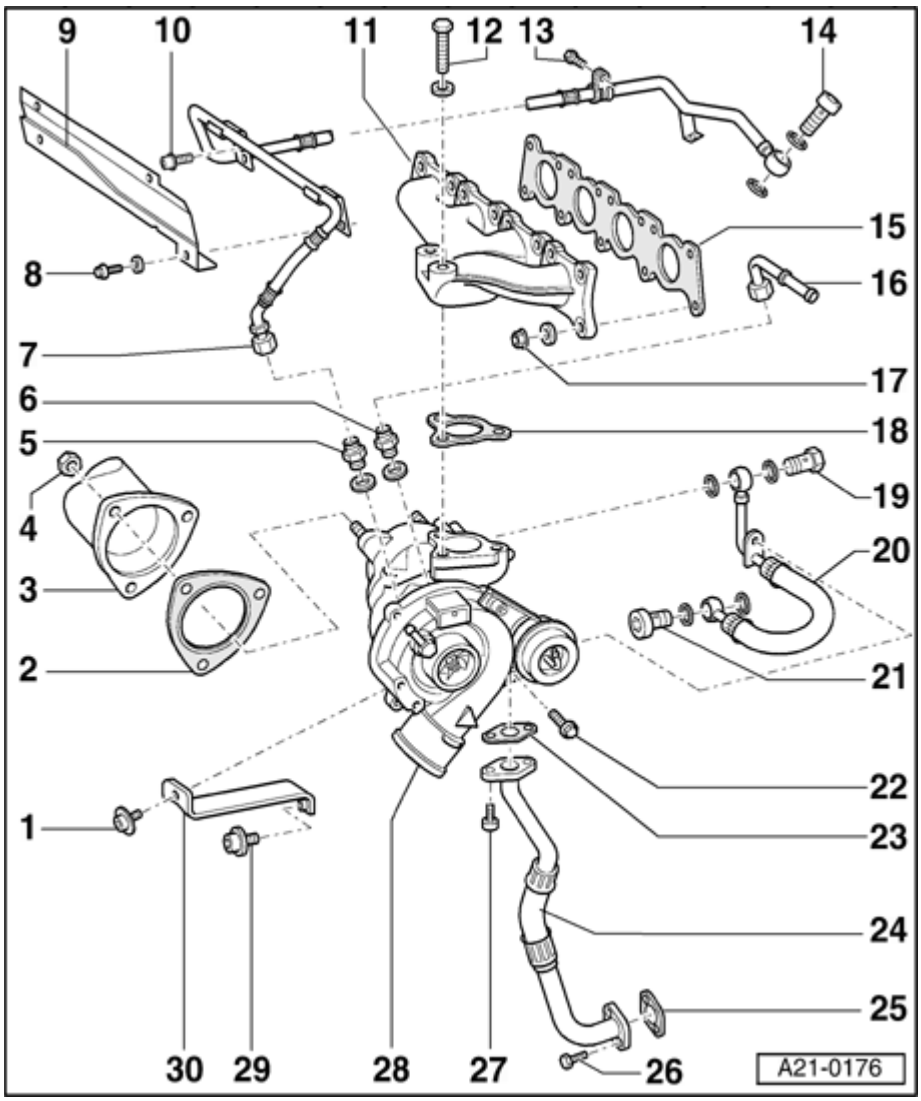

Fig. 325: Turbocharger, Removing And Installing - Overview (Part I)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - 30 Nm

- Only use genuine bolt

2 - Gasket

- Replace

3 - Catalytic converter

4 - 30 Nm

- Always replace

5 - 30 Nm

6 - 35 Nm

7 - Oil supply line

- Tighten union nut to 23 Nm

8 - 3.5 Nm

9 - Heat shield

10 - 23 Nm

11 - Exhaust manifold

- Removing and installing --> **Exhaust manifold, removing and installing**

12 - 35 Nm

- Replace
- Coat thread and contact surface of bolt head with hot bolt paste G 052 112 A3

13 - 10 Nm

14 - Banjo bolt, 30 Nm

15 - Gasket

- Always replace
- Note installed position

16 - Coolant return line

- Tighten union nut to 30 Nm

17 - 30 Nm

- Always replace

18 - Gasket

- Always replace
- Note installed position

19 - Banjo bolt, 35 Nm

20 - Coolant supply line

21 - Banjo bolt, 35 Nm

- Apply D 000 600 when installing

22 - 10 Nm

- Apply D 000 600 when installing

23 - Gasket

- Always replace

24 - Oil return line

- To oil pan

25 - Gasket

- Always replace

26 - 10 Nm

27 - 10 Nm

28 - Turbocharger

- Checking --> **Turbocharger and charge pressure control valve, checking**

29 - 25 Nm

30 - Bracket

Part II

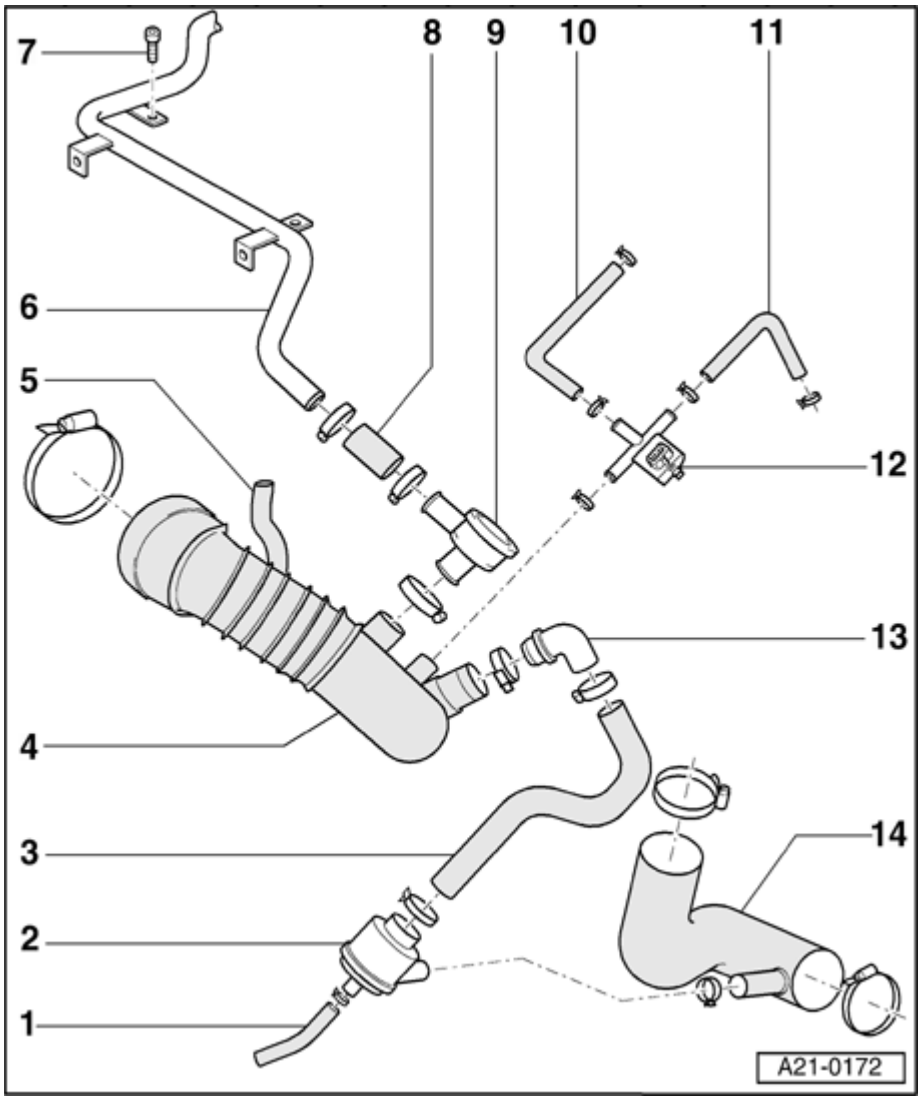

Fig. 326: Turbocharger, Removing And Installing - Overview (Part II)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Vacuum hose

- To Recirculating valve for turbocharger N249

2 - Mechanical air recirculation valve

- Checking --> **Mechanical air recirculation valve, checking**

3 - Hose

- To air recirculation valve

4 - Air hose

- To turbocharger connection

5 - Hose

- To EVAP valve

6 - Line

- To crankcase breather

7 - 10 Nm

8 - Hose

- To crankcase breather line

9 - Pressure control valve

- For crankcase breather

10 - Hose

- To turbocharger

11 - Hose

- To vacuum unit for charge pressure control valve

12 - Wastegate bypass regulator valve N75

13 - Angle piece

14 - Hose

- To turbocharger

Turbocharger, removing and installing

Special tools, testers and auxiliary items required

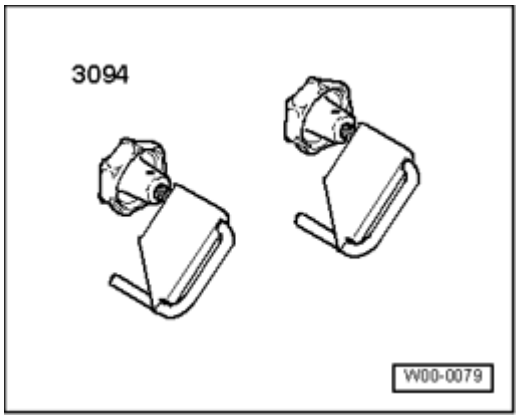

Fig. 327: Identifying Hose Clamps 3094
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Hose clamps 3094

Removing

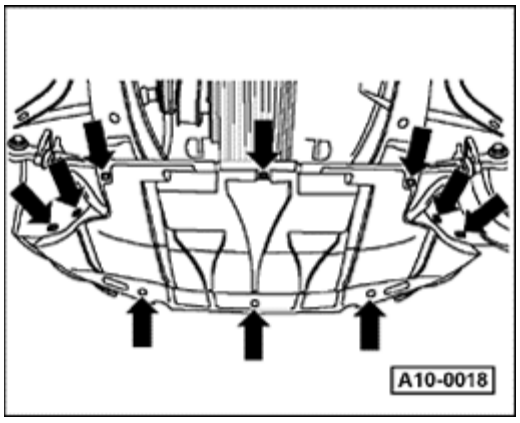

Fig. 328: Noise Insulation Tray Retainers
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove sound insulation - **arrows** -.

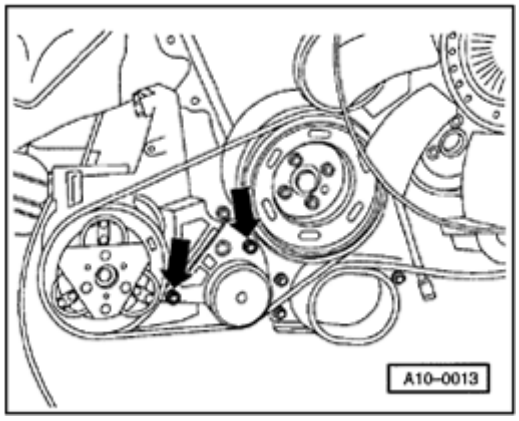

Fig. 329: Locating Securing Bolts For Ribbed Belt Tensioner For A/C Compressor

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Loosen securing bolts of tensioning roller for ribbed belt of air conditioning compressor - **arrows** - , loosen ribbed belt and remove.

CAUTION: Air conditioner refrigerant circuit must not be opened.

- Remove air conditioning compressor from bracket and secure to body with wire.

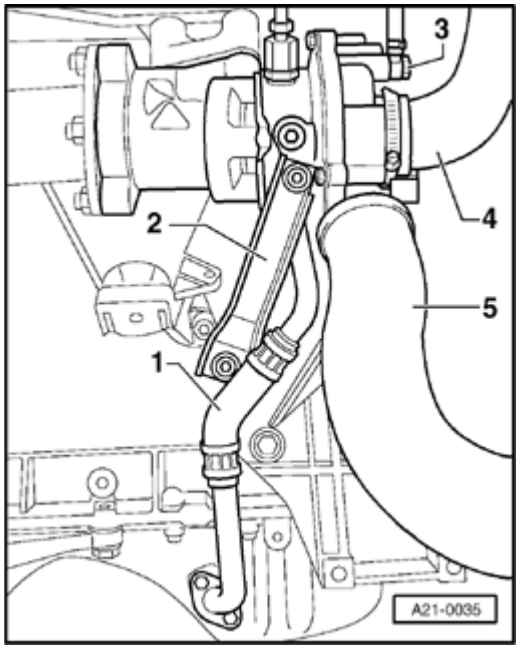

Fig. 330: Identifying Turbocharger Bracket, Oil Return Line, Air Hoses & Banjo Bolt
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unbolt turbocharger bracket - **2** -.
- Unbolt oil return line - **1** - from turbocharger and move it clear to one side.
- Remove air hoses - **4** - and - **5** - from turbocharger.
- Unscrew - **3** - for pressure line.

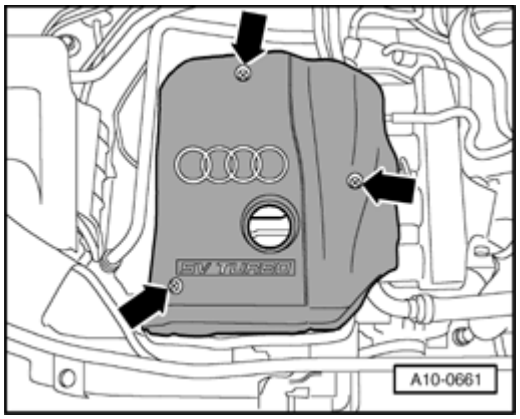

Fig. 331: Removing Engine Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove engine cover - **arrows** -.

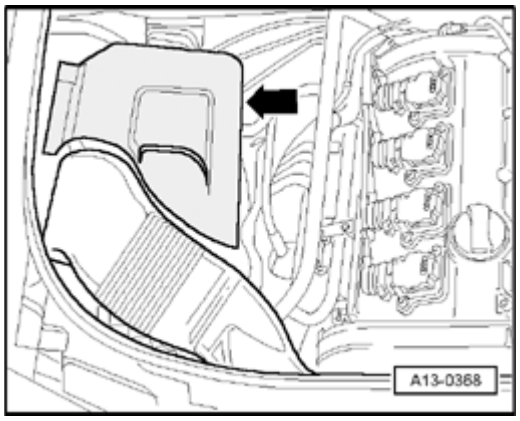

Fig. 332: Air Cleaner Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove air cleaner cover - **arrow** -.

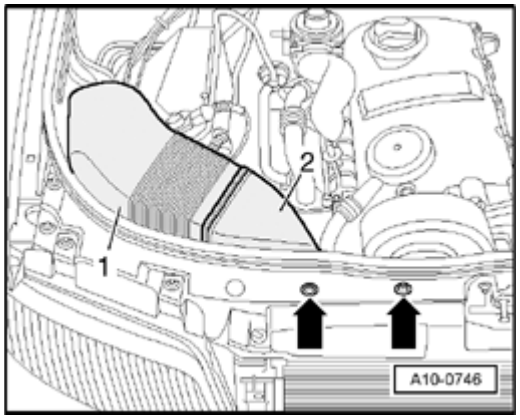

Fig. 333: Removing Bolts & Air Duct
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts - **arrows** -.
- Remove air duct - **1** - and - **2** -.

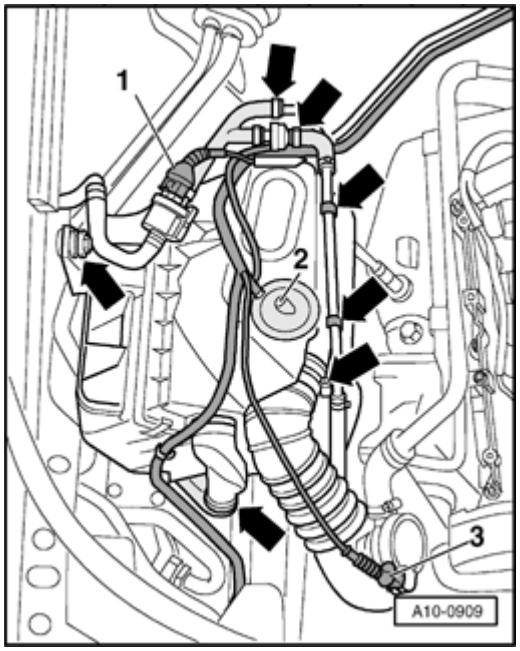

Fig. 334: Disconnecting Wiring Connectors From
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect wiring connectors from:

1. EVAP valve (additionally remove EVAP valve from air cleaner housing)
2. Mass Air Flow sensor
3. Wastegate bypass regulator valve N75

- Pull off hoses, move wiring clear and remove air cleaner housing - **arrows** -.

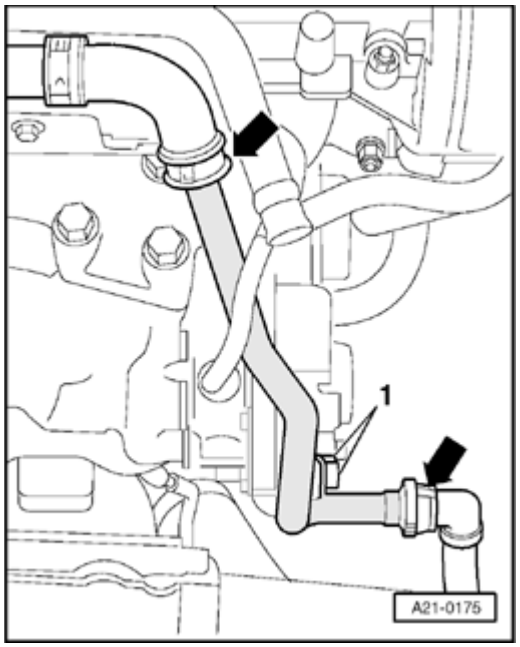

Fig. 335: Removing Secondary Air Line
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove secondary air line. To do so, pull off hoses - **arrows** - and remove bolts - **1** -.
- Remove heat shield on right of cylinder head.
- Pull off hose at vacuum unit for charge pressure control valve on turbocharger.
- Unfasten sleeve on coolant return hose.

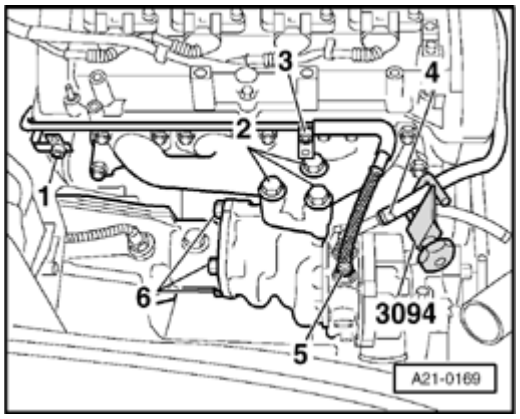

Fig. 336: Using Hose Clamp 3094 To Clamp Off Coolant Return Hose To Turbocharger
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Use hose clamp 3094 to clamp off coolant return hose to turbocharger.
- Release hose clamp - **4** - and pull off coolant return hose from line to turbocharger. Line must remain connected to turbocharger.
- Clamp off coolant supply hose at bottom of turbocharger using hose clamp 3094.

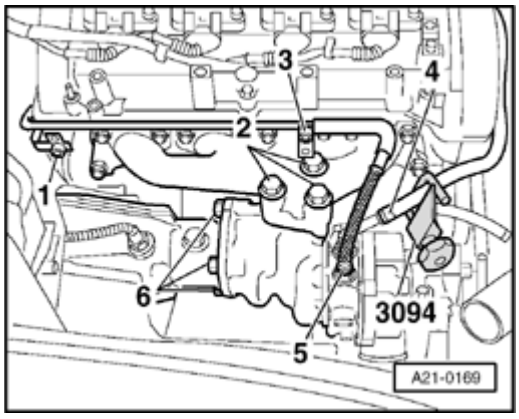

Fig. 337: Using Hose Clamp 3094 To Clamp Off Coolant Return Hose To Turbocharger
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts - **1** - and - **3** - of oil supply line.
- Unbolt oil supply line - **5** - from turbocharger.

NOTE:

- **To avoid damage, do not bend decoupling element of exhaust system by more than 10°.**

- Unbolt catalytic converter from turbocharger - **6** -.
- Unbolt turbocharger from exhaust manifold - **2** -.
- Swivel turbocharger to one side, loosen retaining bracket and banjo bolt for coolant supply line on turbocharger.
- Remove turbocharger.

Installing

Install in reverse order, paying attention to the following:

NOTE:

- **All cable ties unfastened or cut open on removal are to be re-attached in same position on installation.**
- **Secure all hose connections with standard hose clamps**
- **Hose connections and hoses must be free of oil and grease before installing.**
- **Always replace gaskets, sealing rings and self-locking nuts.**

- Perform following steps before tightening turbocharger securing bolts:
- Using bracket, secure coolant supply line loosely to vacuum unit for charge pressure control valve.
- Tighten banjo bolt to 35 Nm and then tighten securing bolt on bracket to 10 Nm.

NOTE:

- **Fill turbocharger with engine oil via oil supply line connection.**

- Top off cooling system --> **Cooling system, draining and filling**.
- Check oil level --> **Oil level, checking**.

NOTE:

- **After installing turbocharger, run engine for approx. 1 minute at idling speed and do not rev up immediately. This ensures turbocharger is properly lubricated.**

Tightening torques

Component	Nm
Coolant supply line to turbocharger	35
Coolant line bracket to turbocharger	10
Turbocharger to exhaust manifold	35 * See note

*Replace bolts

*Coat thread and contact surface of bolt head with hot bolt paste G 052 112 A3

Component	Nm
Turbocharger bracket to cylinder block	25
Turbocharger bracket to turbocharger	30
Catalytic converter to turbocharger	30
Oil return line to turbocharger	10
Oil supply line to turbocharger	23
Oil supply line bracket to cylinder head	23
Heat shield to secondary air line	3.5
Hose clamps for coolant hoses	2
Hose clamps for air hoses	3.5

Charge air cooling components, removing and installing

NOTE:

- **Secure all hose connections with standard hose clamps**
- **Before performing checks or repair work, make sure that all lines and hoses are securely connected and that there are no leaks.**

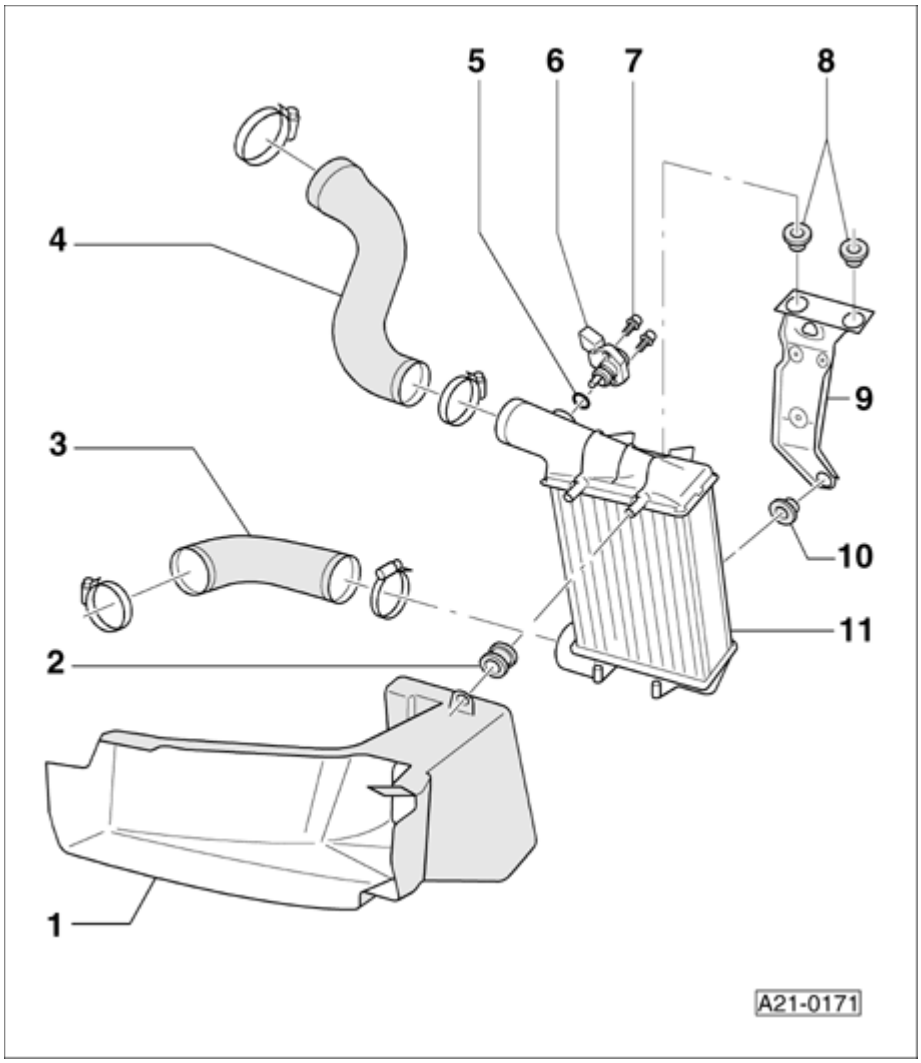

Fig. 338: Charge Air Cooling Components, Removing And Installing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Air duct

2 - Rubber grommet

3 - Air hose

- Between charge air cooler and air duct in lock carrier

4 - Air hose

- Between intake manifold and charge air cooler

5 - O-ring

- Replace if damaged

6 - Charge air pressure sensor G31

7 - 3 Nm

8 - Rubber grommet

9 - Bracket

- Riveted to body

10 - Rubber grommet

11 - Charge air cooler

- Removing and installing --> **Charge air cooler, removing and installing**

Charge air cooler, removing and installing

Removing

- Lock carrier in service position --> **Lock carrier, moving to service position**.

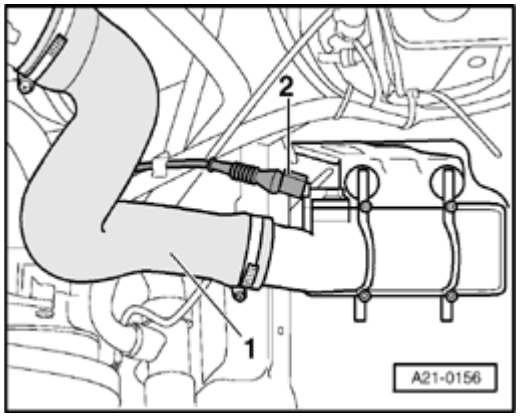

Fig. 339: Removing Air Hose & Disconnect connector - 2 - from Charge air pressure sensor G31
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove air hose - **1** -.
- Disconnect connector - **2** - from Charge air pressure sensor G31.

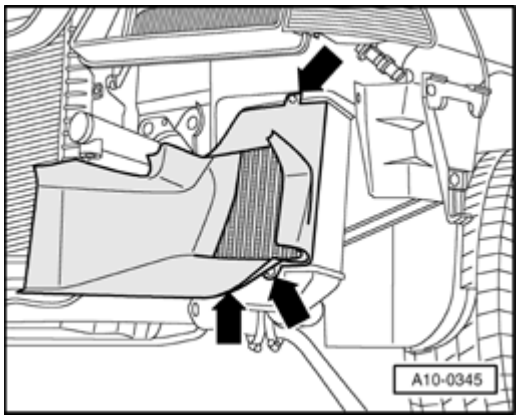

Fig. 340: Removing Air Duct In Front Of Charge Air Cooler
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove air duct in front of charge air cooler - **arrows** -.
- Remove lower air hose to charge air cooler.
- Remove charge air cooler from underneath.

Installing

Install in reverse order, paying attention to the following:

- Install lock carrier --> **Lock carrier, moving to service position**.

Tightening torque

Component	Nm
Hose clamps for air hoses	3.5

26 - EXHAUST SYSTEM, EMISSION CONTROLS

EXHAUST SYSTEM COMPONENTS, SERVICING

Exhaust system components, servicing

NOTE:

- **Always replace gaskets and self-locking nuts.**
- **After working on the exhaust system, ensure that the system is not under stress and that it has sufficient clearance from bodywork. If necessary, loosen clamps and align mufflers and exhaust pipes so that sufficient clearance is maintained to bodywork at all points and mountings are evenly loaded.**
- **To avoid damage, do not bend the decoupling element of the front exhaust pipe by more than 10 °.**

Exhaust system components, removing and installing (Front wheel drive vehicles)

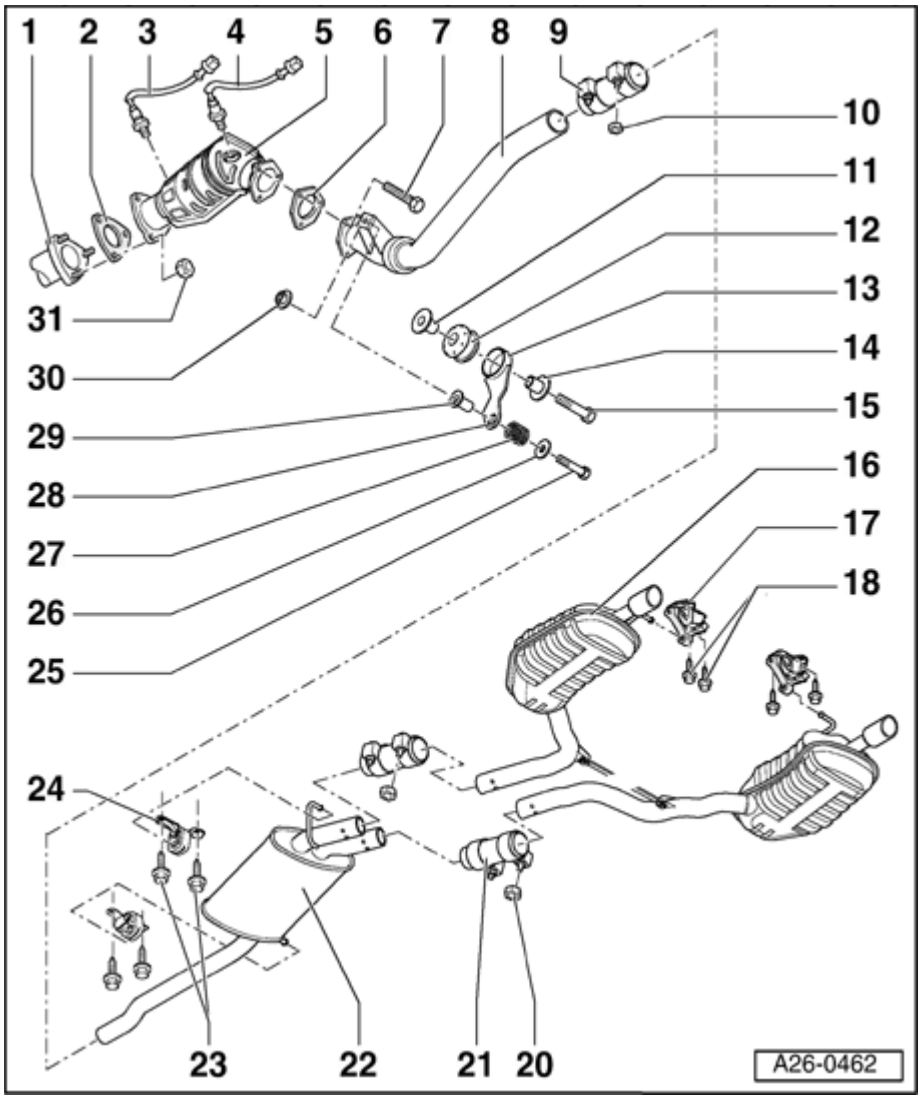

Fig. 341: Exhaust System Components, Removing And Installing (Front Wheel Drive Vehicles)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Turbocharger

- Removing and installing --> **Turbocharger, removing and installing**

2 - Gasket

- Always replace

3 - Heated Oxygen Sensor (HO2S) G39 , 50 Nm

- Black connector
- Grease threads only with hot bolt paste G 052 112 A3; paste must not be allowed to come into contact with slits in sensor body

- Checking: --> **24 - MULTIPORT FUEL INJECTION (MFI)**

4 - Oxygen Sensor (O2S) Behind Three Way Catalytic Converter (TWC) G130 , 50 Nm

- Brown connector
- Grease threads only with hot bolt paste G 052 112 A3; paste must not be allowed to come into contact with slits in sensor body
- Checking: --> **24 - MULTIPORT FUEL INJECTION (MFI)**

5 - Catalytic converter

- Protect from impact damage
- Removing and installing --> **Catalytic converter, removing and installing**

6 - Gasket

- Replace

7 - 25 Nm

8 - Front exhaust pipe

- With decoupling element
- To avoid damage, do not bend decoupling element by more than 10 °

9 - Front clamp

- Align exhaust system so it is free of stress before tightening clamp --> **Exhaust system - vehicles with front wheel drive, aligning stress-free**
- Installed position of bolt ends **Installed position of front clamp**
- Tighten bolted connections evenly

10 - 40 Nm

11 - Spacer sleeve

12 - Buffer

13 - Lug

14 - Washer

15 - M10 bolt, 30 Nm

16 - Mounting

17 - 25 Nm

18 - Rear muffler (left)

- Tailpipe can be replaced
- Rear muffler and center muffler are one unit as original equipment but can be replaced separately for repair purposes.
- Cutting point --> **Center and rear mufflers, separating**
- Stress-free alignment of exhaust system --> **Exhaust system - vehicles with front wheel drive, aligning stress-free**
- Replacing tailpipe **Replacing tailpipe**

19 - Rear muffler (right)

- Tailpipe can be replaced
- Rear muffler and center muffler are one unit as original equipment but can be replaced separately for repair purposes.
- Cutting point --> **Center and rear mufflers, separating**
- Stress-free alignment of exhaust system --> **Exhaust system - vehicles with front wheel drive, aligning stress-free**
- Replacing tailpipe **Replacing tailpipe**

20 - Rear clamps

- For separate replacement of center muffler and both rear mufflers
- Align exhaust system so it is free of stress before tightening clamp --> **Exhaust system - vehicles with front wheel drive, aligning stress-free**
- Installed position **Installed position of rear clamps**
- Tighten bolted connections evenly

21 - 40 Nm

22 - Center muffler

- Center muffler and both rear mufflers are one unit as original equipment but can be replaced separately for repair purposes.
- Cutting point --> **Center and rear mufflers, separating**
- Stress-free alignment of exhaust system --> **Exhaust system - vehicles with front wheel drive, aligning stress-free**

23 - 25 Nm

24 - Mounting

25 - 25 Nm

26 - Mounting

27 - M8 bolt

28 - Washer

29 - Spring

30 - Lug

31 - Spacer sleeve

32 - 25 Nm

33 - 40 Nm

Installed position of front clamp

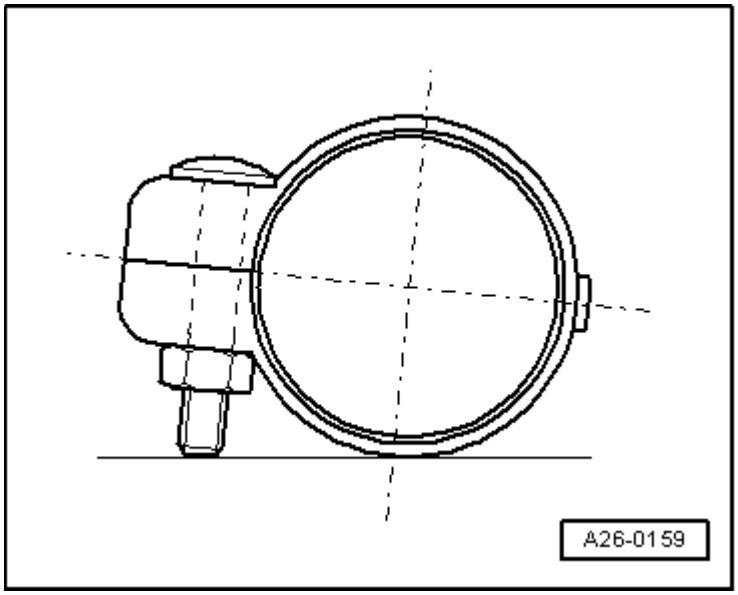

Fig. 342: Installed Position Of Front Clamp
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Install clamp so that ends of bolts are not below bottom circumference of clamp.

- Bolted connection on left

Installed position of rear clamps

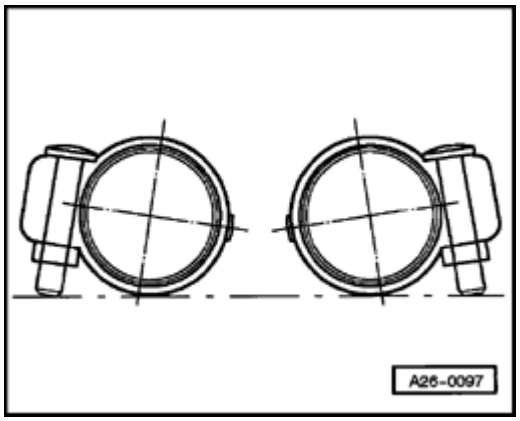

Fig. 343: Installed Position Of Rear Clamps
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Install clamps so that ends of bolts are not below bottom circumference of clamps.
- Bolted connections on outside
- Align exhaust system stress-free --> **Exhaust system - vehicles with front wheel drive, aligning stress-free**
- Tighten bolted connections evenly to 40 Nm.

Replacing tailpipe

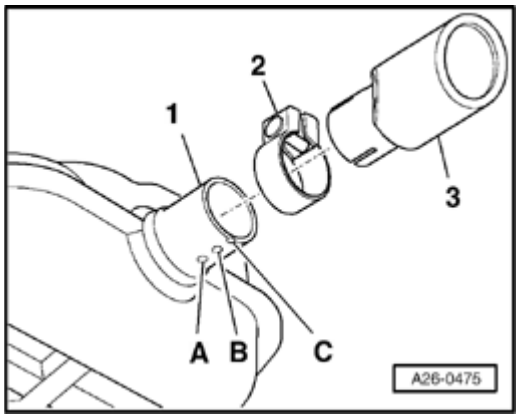

Fig. 344: Replacing Tailpipe
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Cut through tailpipe - **1** - squarely at cutting point - **C** - using body saw, e.g. VAG1523A.
- Push on tailpipe - **3** - up to marking - **A** -. When doing so, make sure that slot in tailpipe is in line with marking - **B** -.
- Tighten bolted connection on clamp - **2** - to 25 Nm.

Exhaust system components, removing and installing (All wheel drive vehicles)

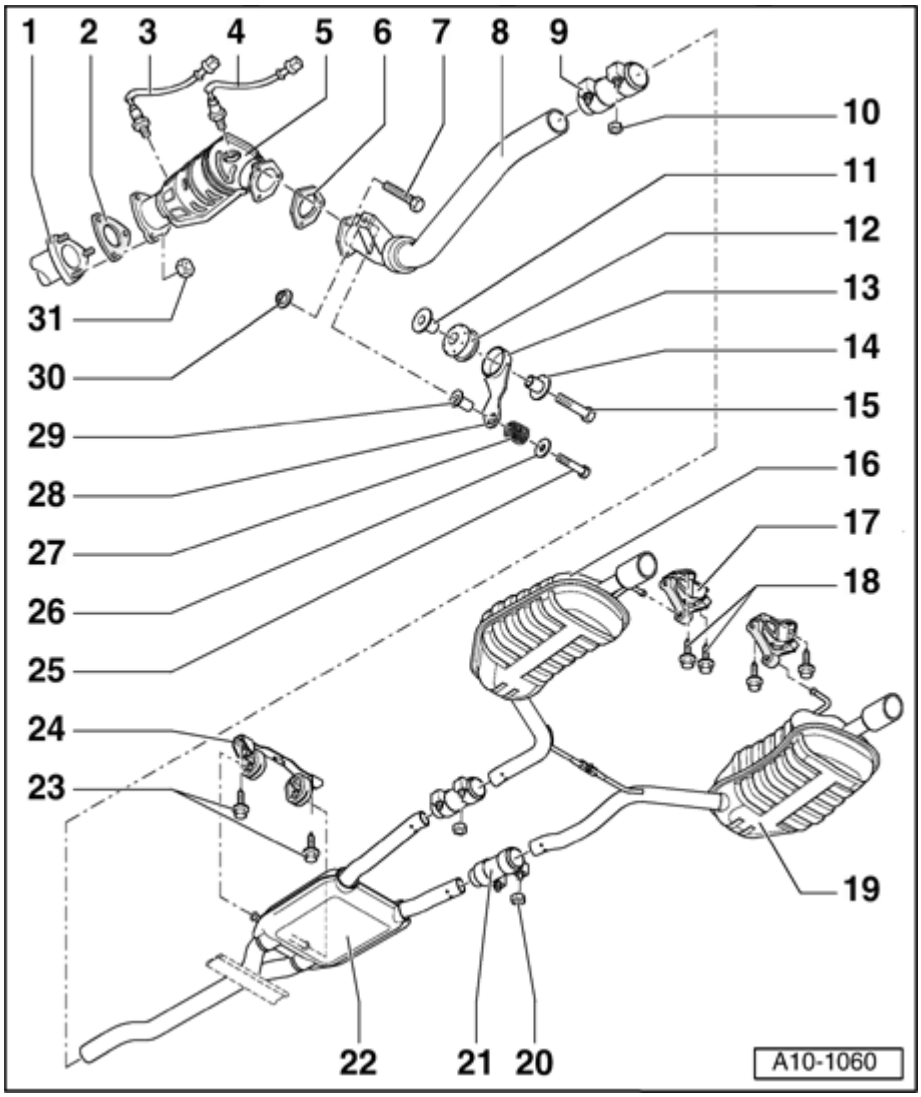

Fig. 345: Exhaust System Components, Removing And Installing (All Wheel Drive Vehicles)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Turbocharger

- Removing and installing --> **Turbocharger, removing and installing**

2 - Gasket

- Always replace

3 - Heated Oxygen Sensor (HO2S) G39 , 50 Nm

- Black connector
- Grease threads only with hot bolt paste G 052 112 A3; paste must not be allowed to come into contact with slits in sensor body

- Checking: --> **24 - MULTIPORT FUEL INJECTION (MFI)**

4 - Oxygen Sensor (O2S) Behind Three Way Catalytic Converter (TWC) G130 , 50 Nm

- Brown connector
- Grease threads only with hot bolt paste G 052 112 A3; paste must not be allowed to come into contact with slits in sensor body
- Checking: --> **24 - MULTIPORT FUEL INJECTION (MFI)**

5 - Catalytic converter

- Protect from impact damage
- Removing and installing --> **Catalytic converter, removing and installing**

6 - Gasket

- Always replace

7 - 25 Nm

8 - Front exhaust pipe

- With decoupling element
- To avoid damage, do not bend decoupling element by more than 10 °

9 - Front clamp

- Align exhaust system so it is free of stress before tightening clamp --> **Exhaust system - vehicles with all wheel drive, aligning stress-free**
- Installed position of bolt ends **Installed position of front clamp**
- Tighten bolted connections evenly

10 - 40 Nm

11 - Spacer sleeve

12 - Buffer

13 - Lug

14 - Washer

15 - M10 bolt, 30 Nm

16 - Rear muffler (left)

- Tailpipe can be replaced
- Rear muffler and center muffler are one unit as original equipment but can be replaced separately for repair purposes.
- Cutting point --> **Center and rear mufflers, separating**
- Stress-free alignment of exhaust system --> **Exhaust system - vehicles with all wheel drive, aligning stress-free**
- Replacing tailpipe **Replacing tailpipe**

17 - Mounting

18 - 25 Nm

19 - Rear muffler (right)

- Tailpipe can be replaced
- Rear muffler and center muffler are one unit as original equipment but can be replaced separately for repair purposes.
- Cutting point --> **Center and rear mufflers, separating**
- Stress-free alignment of exhaust system --> **Exhaust system - vehicles with all wheel drive, aligning stress-free**
- Replacing tailpipe **Replacing tailpipe**

20 - 40 Nm

21 - Rear clamps

- For separate replacement of center muffler and both rear mufflers
- Align exhaust system so it is free of stress before tightening clamp --> **Exhaust system - vehicles with all wheel drive, aligning stress-free**
- Installed position **Installed position of rear clamps**
- Tighten bolted connections evenly

22 - Center muffler

- Center muffler and both rear mufflers are one unit as original equipment but can be replaced separately for repair purposes.
- Cutting point --> **Center and rear mufflers, separating**
- Stress-free alignment of exhaust system --> **Exhaust system - vehicles with all wheel drive, aligning stress-free**

23 - 25 Nm

24 - Mounting

25 - M8 bolt

26 - Washer

27 - Spring

28 - Lug

29 - Spacer sleeve

30 - 25 Nm

31 - 40 Nm

Installed position of front clamp

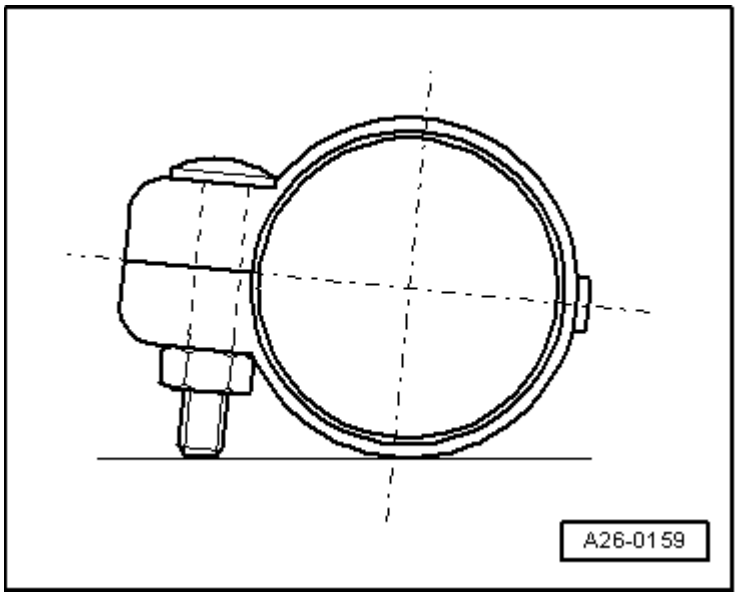

Fig. 346: Installed Position Of Front Clamp
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Install clamp so that ends of bolts are not below bottom circumference of clamp.

- Bolted connection on left

Installed position of rear clamp

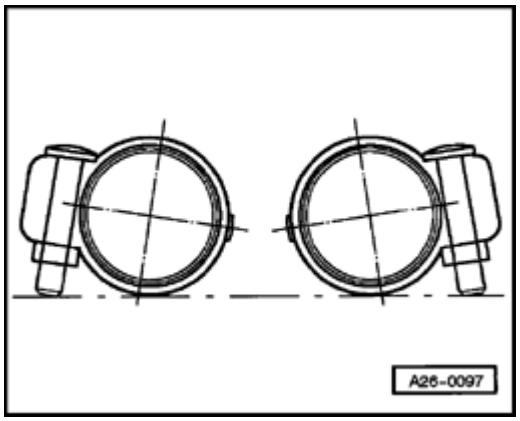

Fig. 347: Installed Position Of Rear Clamp
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Install clamps so that ends of bolts are not below bottom circumference of clamps.
- Bolted connections on outside
- Align exhaust system stress-free --> **Exhaust system - vehicles with all wheel drive, aligning stress-free**.
- Tighten bolted connections evenly to 40 Nm.

Replacing tailpipe

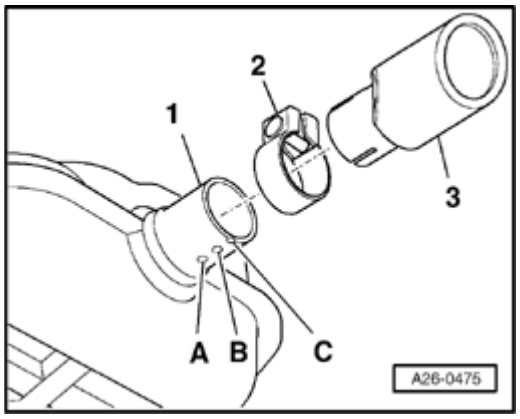

Fig. 348: Replacing Tailpipe
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Cut through tailpipe - **1** - squarely at cutting point - **C** - using body saw, e.g. VAG1523A.
- Push tailpipe - **3** - on up to marking - **A** -. When doing so, make sure that slot in tailpipe is in line with marking - **B** -.
- Tighten bolted connection on clamp - **2** - to 25 Nm.

Center and rear mufflers, separating

- Connecting pipe can be cut through at point marked to allow center and rear mufflers to be replaced

separately.

- Cutting point is marked with indentation on outside of exhaust pipe.

Special tools, testers and auxiliary items required

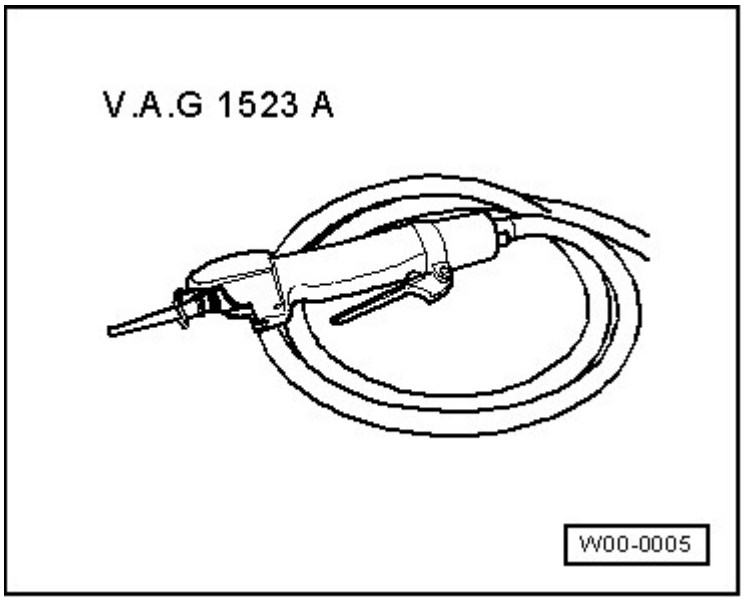

Fig. 349: Identifying Body Repair Saw V.A.G 1523 A
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Body saw VAG1523A
- Protective goggles

Vehicles with front wheel drive

- Cut through exhaust pipe squarely using body saw, e.g. VAG1523A , at position indicated by punch marks.

CAUTION: Wear safety goggles.

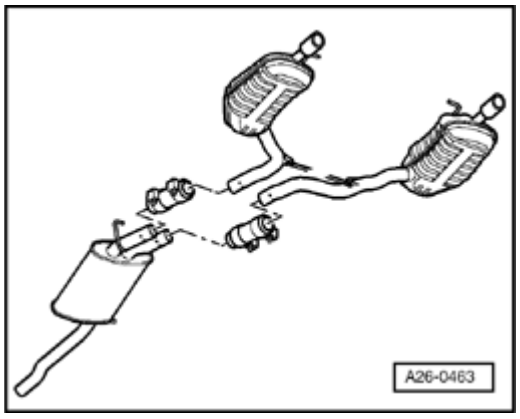

Fig. 350: Position Center Of Clamp Strap Over Saw-Cut
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- When installing, position center of clamp strap over saw-cut.
- Installed position of clamp **Installed position of rear clamps**
- Align exhaust system stress-free --> **Exhaust system - vehicles with front wheel drive, aligning stress-free**.
- Tighten bolted connections on clamp evenly to 40 Nm.

Vehicles with all wheel drive

- Cut through exhaust pipe squarely using body saw, e.g. VAG1523A , at position indicated by punch marks.

CAUTION: Wear safety goggles.

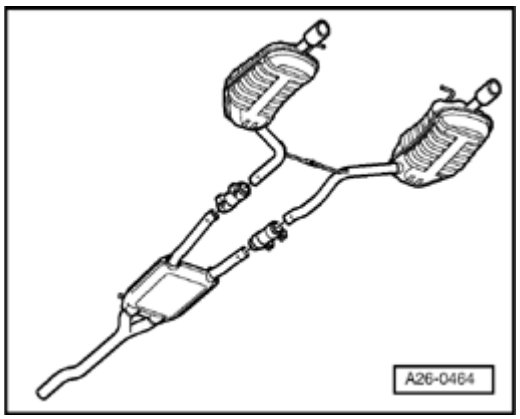

Fig. 351: Positioning Center Of Clamp Strap Over Saw-Cut
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- When installing, position center of clamp strap over saw-cut.

- Installed position of clamp **Installed position of rear clamps**

  - Align exhaust system stress-free --> **Exhaust system - vehicles with all wheel drive, aligning stress-free**.
  - Tighten bolted connections on clamp evenly to 40 Nm.

Exhaust manifold, removing and installing

Removing

NOTE:

- **Always replace gaskets and self-locking nuts.**
- **To avoid damage, do not bend decoupling element of front exhaust pipe by more than 10 °.**

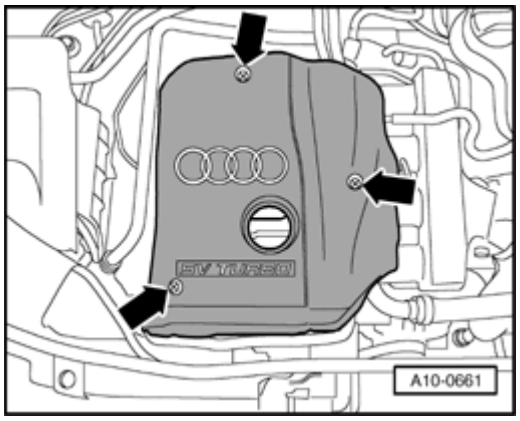

Fig. 352: Removing Engine Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

  - Remove engine cover - **arrows** -.

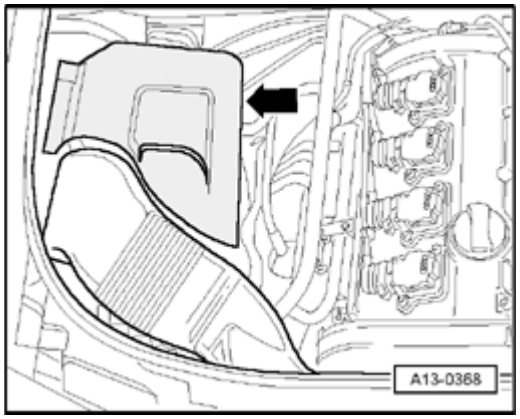

Fig. 353: Air Cleaner Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

  - Remove air cleaner cover - **arrow** -.

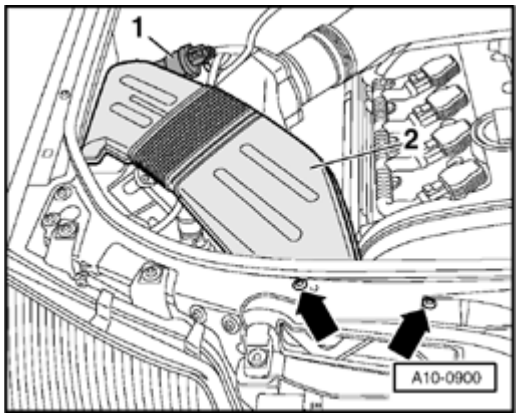

Fig. 354: Evaporative Emission Canister Purge Regulator Valve N80 And Air Duct
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts - **arrows** -.
- Disengage EVAP canister purge regulator valve N80 - **1** - from air duct - **2** -.
- Remove both screws - **arrows** - for air duct - **2** -.

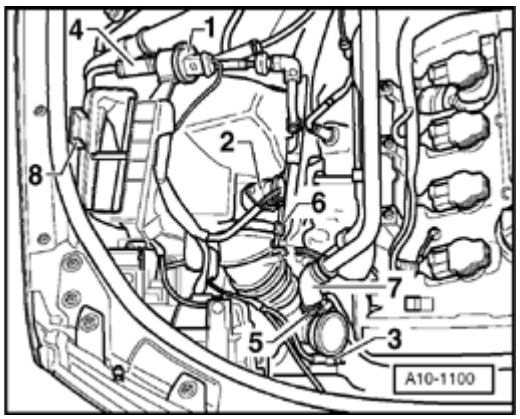

Fig. 355: Disconnect Wires/Unplug Connectors From
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect wiring connectors from:

1. EVAP valve
2. Mass Air Flow sensor
3. Wastegate bypass regulator valve N75

- Disconnect hoses -4 to 7-.

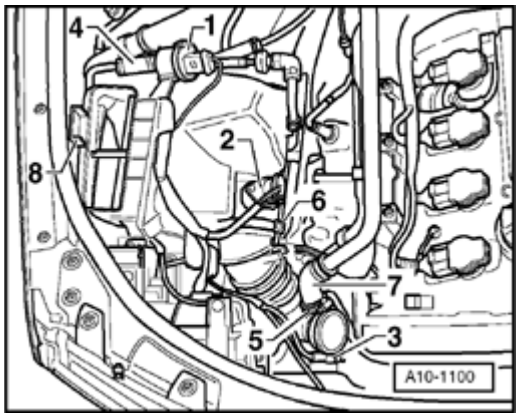

Fig. 356: Disconnect Wires/Unplug Connectors From
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect hose to secondary air injection pump motor - **8** -.
- Move wiring clear.
- Unbolt air cleaner housing - **9** -.
- Remove air cleaner.

NOTE:

- **Vacuum line to secondary air combination valve is clipped to underside of air intake hose.**

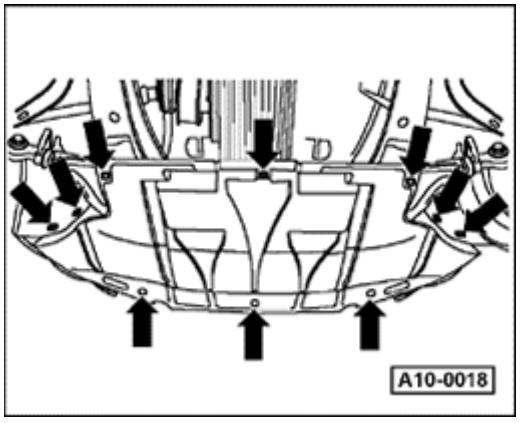

Fig. 357: Noise Insulation Tray Retainers
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove sound insulation - **arrows** -.

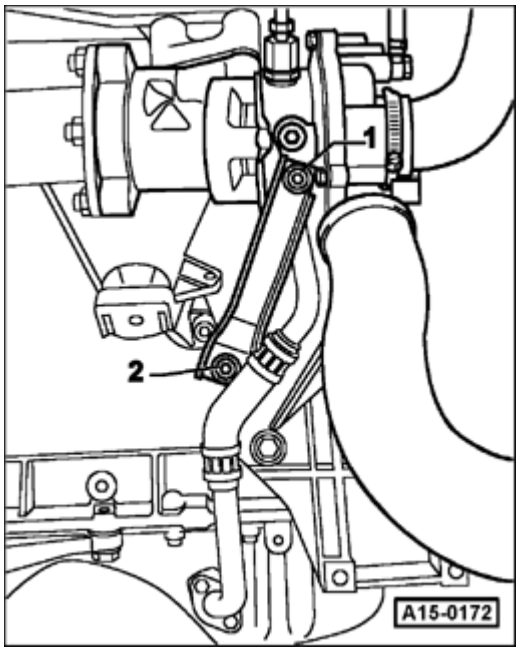

Fig. 358: Loosening Bolts On Turbocharger Bracket
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Loosen bolts - **1** - and - **2** - a few turns.

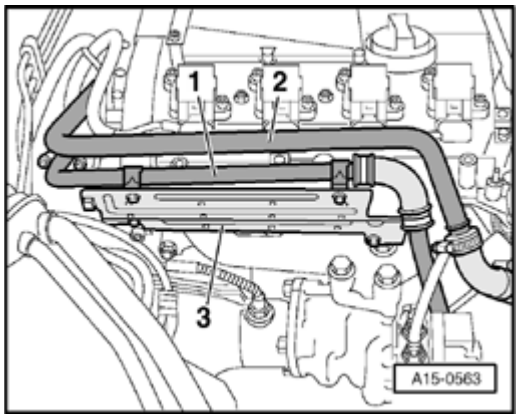

Fig. 359: Pulling Front Hose Off Crankcase Breather Line, Front Hose Off Line To Secondary Air Combination Valve & Removing Heat Shield
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Pull front hose off crankcase breather line - **2** -.
- Pull front hose off line to secondary air combination valve - **1** -.
- Remove heat shield - **3** -.

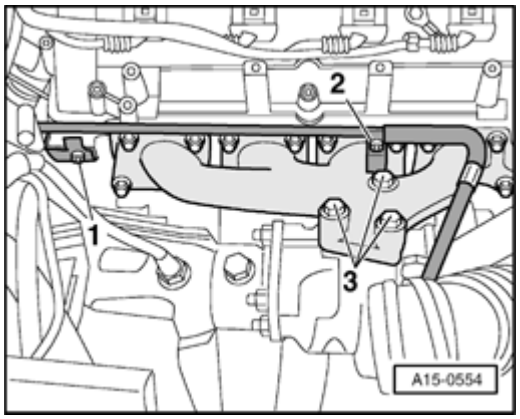

Fig. 360: Removing Bolts Of Oil Supply Line & For Turbocharger
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts - **1** - and - **2** - of oil supply line.
- Remove bolts - **3** - for turbocharger.
- Remove gasket between turbocharger and exhaust manifold.
- Plug opening in turbocharger with clean cloth.

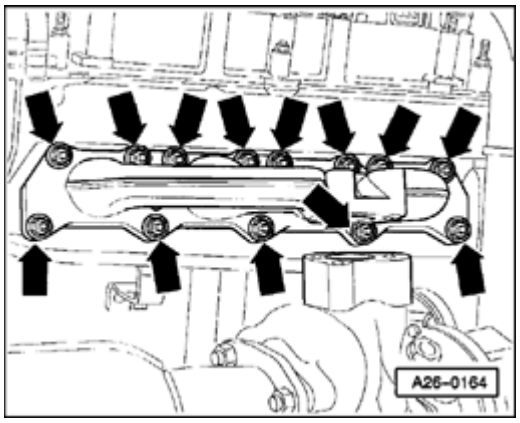

Fig. 361: Removing All Nuts On Exhaust Manifold
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove all nuts - **arrows** - on exhaust manifold.
- Remove washers and exhaust manifold.

Installing

Install in reverse order, paying attention to the following:

- Install components in keeping with following sequence:

Make sure that sealing surface is clean

- Exhaust manifold to cylinder head

- Turbocharger to exhaust manifold
- Turbocharger bracket to cylinder block
- Turbocharger bracket to turbocharger

Tightening torques

Component	Nm
Exhaust manifold to cylinder head	25
Turbocharger to exhaust manifold	35 * See note
Turbocharger bracket to cylinder block	45
Turbocharger bracket to turbocharger M8 collared bolt)	40 * See note
Oil supply line to cylinder head	20
Crankcase breather line to cylinder head	10
Hose clamps for air hoses	3.5

*Replace bolts

*Coat thread and contact surface of bolt head with hot bolt paste G 052 112 A3

*Bolt strength: 10.9

Catalytic converter, removing and installing

Removing

Removing front exhaust pipe --> **Front exhaust pipe, removing and installing**

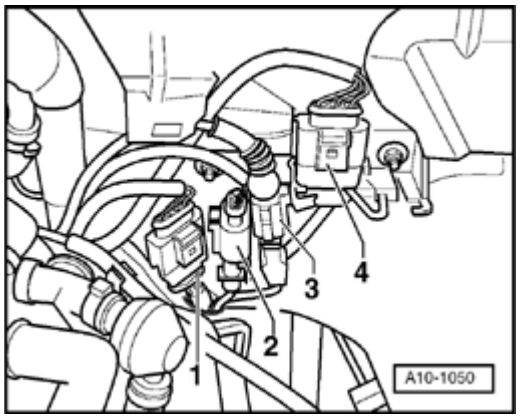

Fig. 362: Disconnecting 4-Pin Connectors Of Oxygen Sensors
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect 4-pin connectors of oxygen sensors and move wires clear.

1. (Brown) to O2S Behind TWC G130 (only with engine code AMB)

2. (Black) to HO2S G39

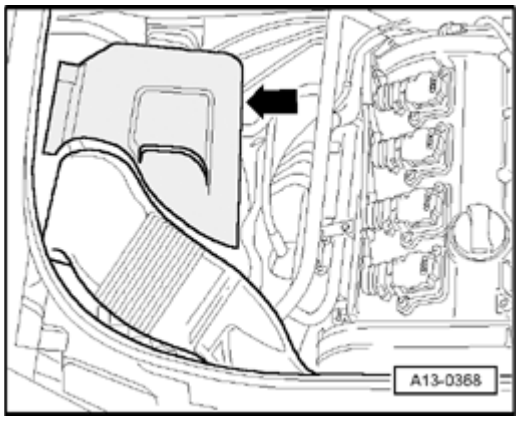

Fig. 363: Air Cleaner Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove air cleaner cover - **arrow** -.

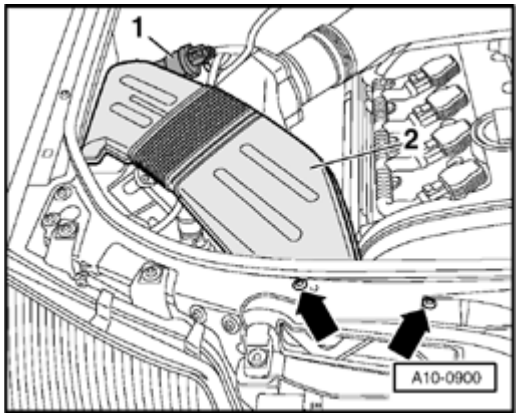

Fig. 364: Evaporative Emission Canister Purge Regulator Valve N80 And Air Duct
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts - **arrows** -.
- Disengage EVAP canister purge regulator valve N80 - **1** - from air duct - **2** -.
- Remove both screws - **arrows** - for air duct - **2** -.

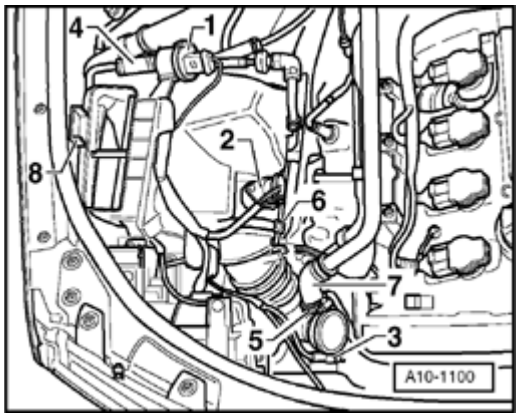

Fig. 365: Disconnect Wires/Unplug Connectors From
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect wiring connectors from:

1. EVAP valve
2. Mass Air Flow sensor
3. Wastegate bypass regulator valve N75

- Disconnect hoses -4 to 7-.

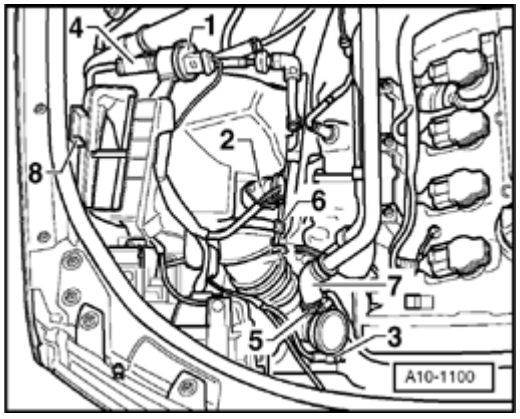

Fig. 366: Disconnect Wires/Unplug Connectors From
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect hose to secondary air injection pump motor - **8** -.
- Move wiring clear.
- Unbolt air cleaner housing - **9** -.
- Remove air cleaner.

NOTE:

- **Vacuum line to secondary air combination valve is clipped to underside of air intake hose.**

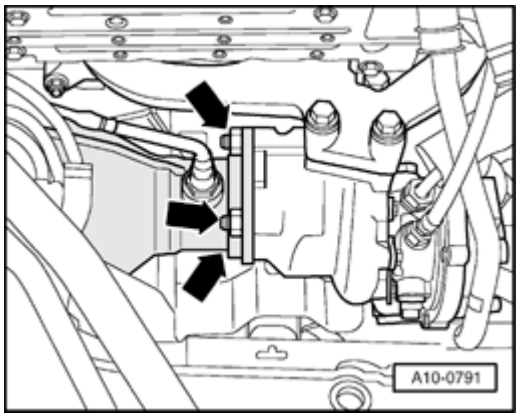

Fig. 367: Removing Bolts Securing Turbocharger To Catalytic Converter
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts - **arrows** - securing turbocharger to catalytic converter.
- Lift out catalytic converter.

Installing

Install in reverse order, paying attention to the following:

- Grease threads of oxygen sensor only with hot bolt paste G 052 112 A3; paste must not be allowed to come into contact with slits in sensor body.
- Align exhaust system free of stress --> **Exhaust system - vehicles with front wheel drive, aligning stress-free** and --> **Exhaust system - vehicles with all wheel drive, aligning stress-free**.

Tightening torques

Components	Nm
Oxygen sensor to catalytic converter	55
Catalytic converter to turbocharger	40
Front exhaust pipe to catalytic converter	25
Front exhaust pipe to transmission bracket	25
Clamp for front exhaust pipe	40
Heat shield to transmission	23
Hose clamps for air hoses	3.5

Front exhaust pipe, removing and installing

Removing

NOTE:

- **Always replace gaskets and self-locking nuts.**
- **To avoid damage, do not bend decoupling element of front exhaust pipe by more than 10 °.**

- Loosen bolts securing front exhaust pipe to catalytic converter, accessible from above.

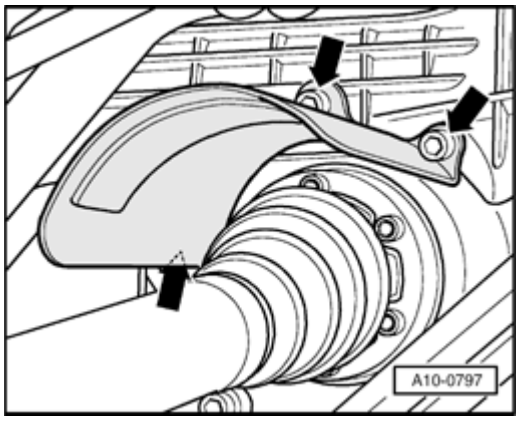

Fig. 368: Removing Heat Shield Above Right Side Drive Axle
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove heat shield - **arrows** - above right side drive axle.

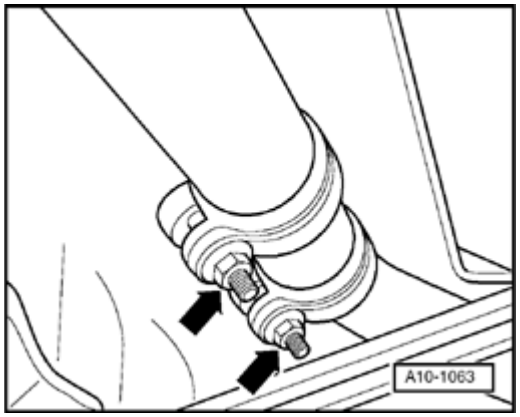

Fig. 369: Separating Exhaust System At Clamp
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Separate exhaust system at clamp.

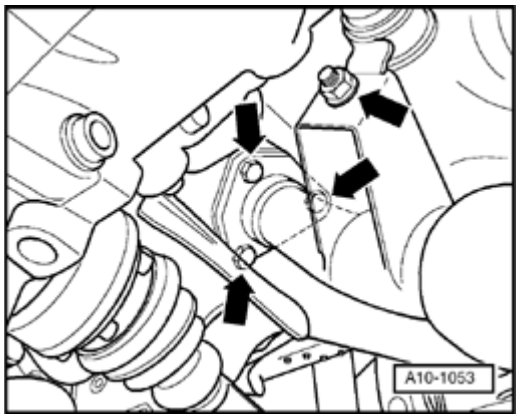

Fig. 370: Removing Bolts Securing Catalytic Converter To Front Exhaust Pipe
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts - **arrows** - securing catalytic converter to front exhaust pipe.
- Unbolt transmission bracket for exhaust system - **arrow** -.

NOTE:

- **To avoid damage, do not bend decoupling element of front exhaust pipe by more than 10 °.**

- Remove front exhaust pipe.

Installing

Install in reverse order, paying attention to the following:

- Stress-free alignment of exhaust system --> **Exhaust system - vehicles with front wheel drive, aligning stress-free** or --> **Exhaust system - vehicles with all wheel drive, aligning stress-free**.

Tightening torques

Components	Nm
Front exhaust pipe to catalytic converter	25
Clamp for front exhaust pipe	40
Heat shield to transmission	23

Exhaust system - vehicles with front wheel drive, aligning stress-free

Vehicles without clamp between center muffler and rear muffler

- Exhaust system must be aligned when cold.

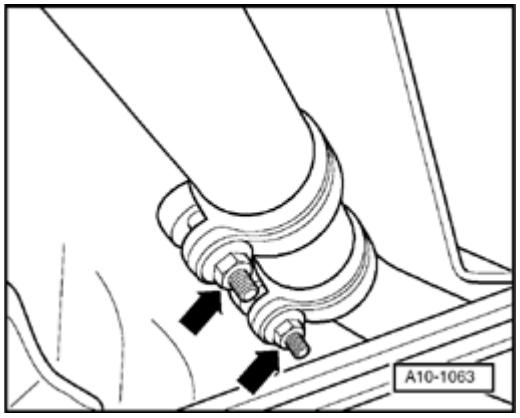

Fig. 371: Separating Exhaust System At Clamp
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Loosen bolted connections on front clamp.

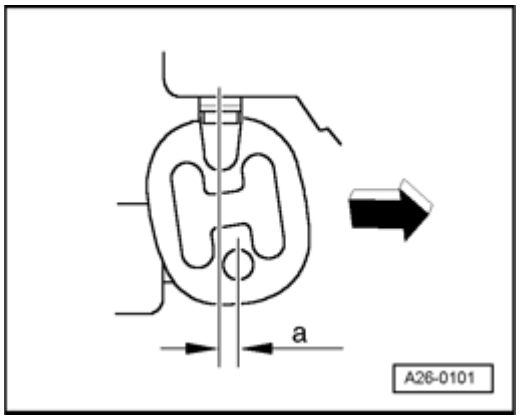

Fig. 372: Pushing Exhaust System Toward Front Of Vehicle
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Push exhaust system toward front of vehicle - **arrow** - until preloading at right side mounting of center muffler is - **a** - = 5 to 9 mm.
- Tighten bolted connections on clamp evenly to 40 Nm.

Aligning tailpipes

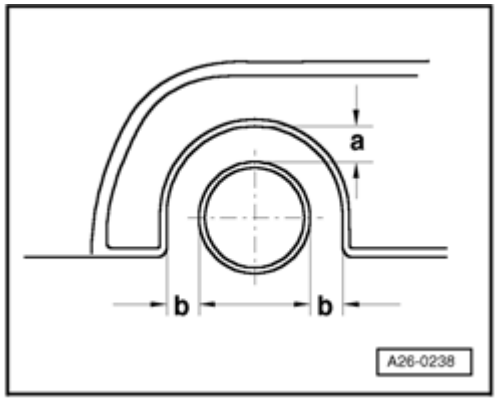

Fig. 373: Aligning Tailpipes
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Check to make sure that distances - **a** - and - **b** - between tailpipe and bumper are equal.

Vehicles with clamp between center muffler and rear muffler

- Exhaust system must be aligned when cold.

NOTE:

- **It is only necessary to additionally align center muffler on vehicles with a clamp installed between center muffler and rear muffler.**
- **Installed position of front clamp Installed position of front clamp**

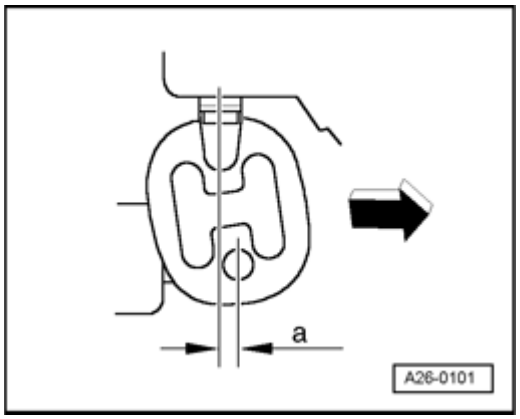

Fig. 374: Pushing Exhaust System Toward Front Of Vehicle
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Push front section of exhaust system toward front of vehicle - **arrow** - until preloading at right side mounting of center muffler is - **a** - = 5 to 9 mm.
- Tighten bolted connections on front clamp evenly to 40 Nm.

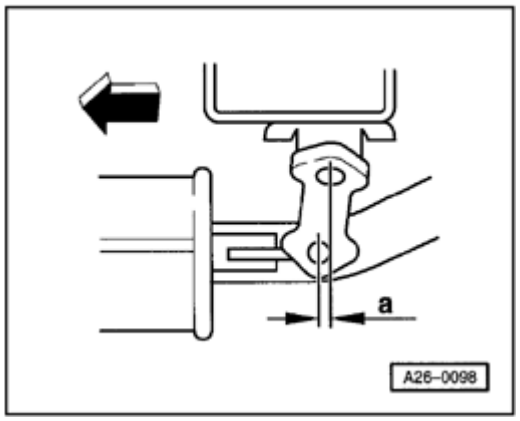

Fig. 375: Pushing Rear Section Of Exhaust System Toward Front Of Vehicle
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Push rear section of exhaust system toward front of vehicle - **arrow** - until preloading at rear mounting of rear muffler is a = 12 mm. Also make sure that center muffler is horizontal to bottom of vehicle (as viewed at right angle to direction of travel).

- Installed position of rear clamps **Installed position of rear clamps**

- Tighten bolted connections on rear clamp evenly to 40 Nm.

Aligning tailpipes

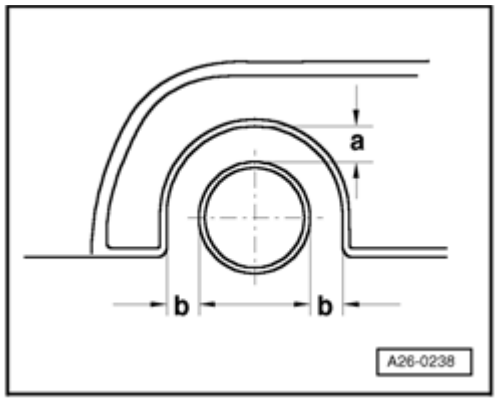

Fig. 376: Aligning Tailpipes
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Check to make sure that distances - **a** - and - **b** - between tailpipe and bumper are equal.

Exhaust system - vehicles with all wheel drive, aligning stress-free

Vehicles without clamp between center muffler and rear muffler

- Exhaust system must be aligned when cold.

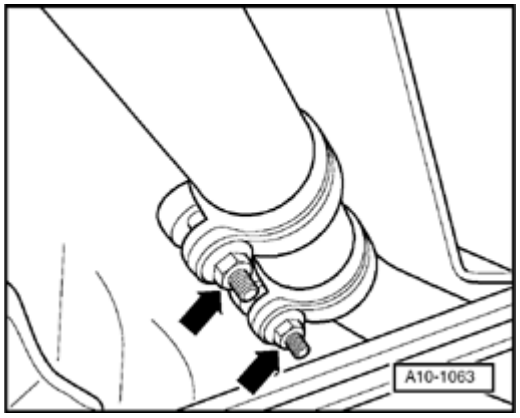

Fig. 377: Separating Exhaust System At Clamp
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Loosen bolted connections on front clamp.

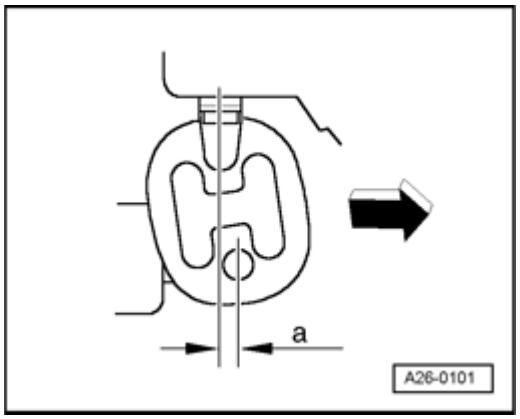

Fig. 378: Pushing Exhaust System Toward Front Of Vehicle
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Push exhaust system toward front of vehicle - **arrow** - until preloading at right side mounting of center muffler is - **a** - = 5 to 9 mm.
- Tighten bolted connections on clamp evenly to 40 Nm.

Vehicles with clamp between center muffler and rear muffler

- Exhaust system must be aligned when cold.

NOTE:

- **It is only necessary to additionally align center muffler on vehicles with clamp installed between center muffler and rear muffler.**
- **Installed position of front clamp Installed position of front clamp**

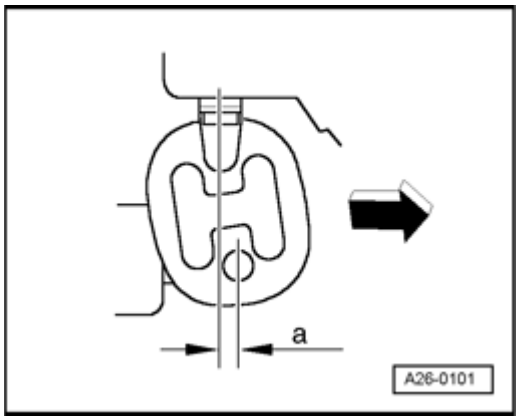

Fig. 379: Pushing Exhaust System Toward Front Of Vehicle
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Push front section of exhaust system toward front of vehicle - **arrow** - until preloading at right side mounting of center muffler is - **a** - = 5 to 9 mm.
- Tighten bolted connections on front clamp evenly to 40 Nm.

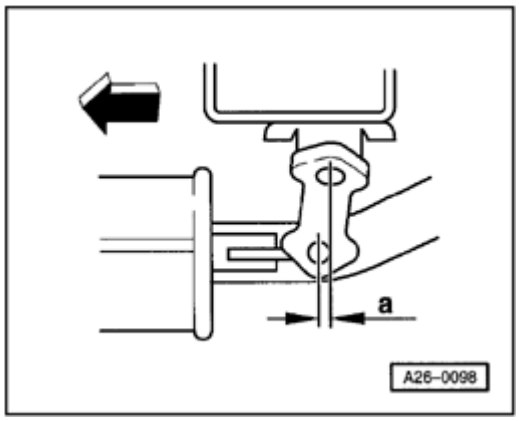

Fig. 380: Pushing Rear Section Of Exhaust System Toward Front Of Vehicle
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Push rear section of exhaust system toward front of vehicle - **arrow** - until preloading at rear mounting of rear muffler is - **a** - = 12 mm. Also make sure that center muffler is horizontal to bottom of vehicle (as viewed from right angle to direction of travel).

- Installed position of rear clamps **Installed position of rear clamps** and **Installed position of rear clamp**

- Tighten bolted connections on rear clamps evenly to 40 Nm.

Aligning tailpipes

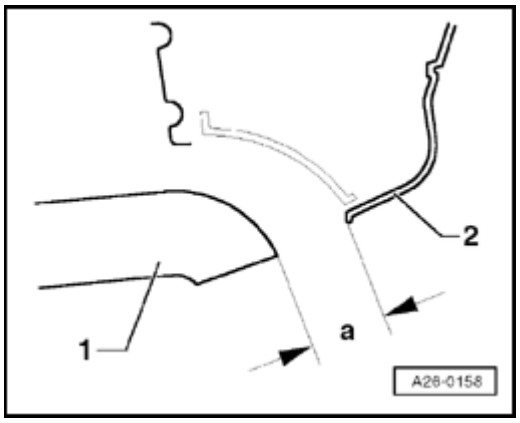

Fig. 381: Aligning Tailpipes
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Check distance - **a** - between tailpipe - **1** - and bumper - **2** -.

- Distance a = at least 40 mm

Exhaust system, checking for leaks

- Start engine and let it idle.
- Plug tailpipes with rags or stoppers until check is completed.

- Listen for noise at connection points of cylinder head/manifold, manifold/turbocharger, turbocharger/catalytic converter etc., to locate any leaks.
- Correct any leaks that are found.

SECONDARY AIR SYSTEM, CHECKING

Secondary air system, checking

The secondary air system is designed to enable the catalytic converter to heat up and reach its operating temperature more quickly after a cold start.

Principle of operation

Due to extra mixture enrichment during the cold-start phase, an increased amount of unburned hydrocarbons is present in the exhaust gas. The secondary air system improves the oxidation process in the catalytic converter thereby reducing toxic emissions. The heat generated by oxidation accelerates the "light off" of the catalytic converter and significantly improves exhaust gas quality during warm-up.

Function

- After a cold start, the engine control module - **6** - activates the secondary air injection pump - **1** - via the secondary air injection pump relay - **5** - , and air is fed to the secondary air combination valve - **3** -.
- At the same time, the system activates the secondary air injection solenoid valve - **8** - which supplies vacuum to the secondary air combination valve - **3** -. The relevant combination valve opens a passage for the secondary air injection system to supply air to exhaust ports in the cylinder head.

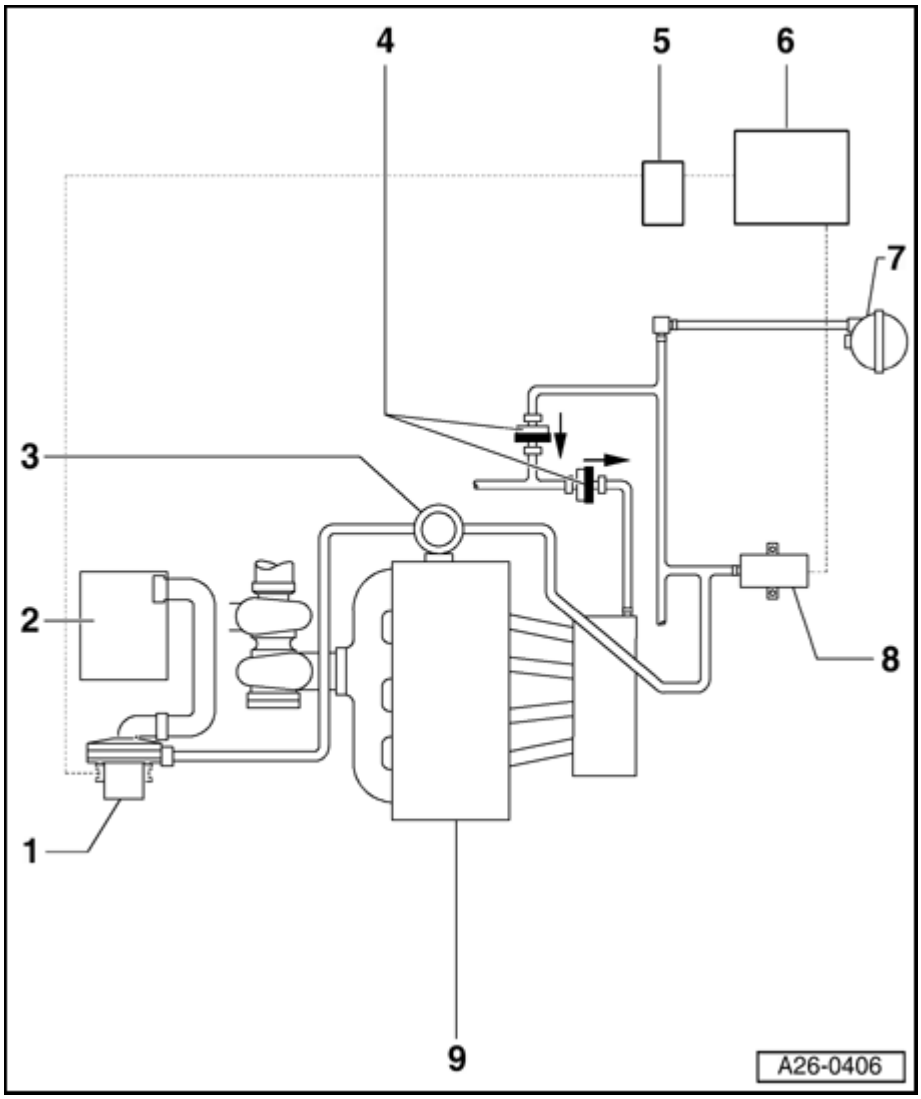

Fig. 382: Secondary Air System, Checking Overview
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Secondary Air Injection (AIR) pump motor V101

- Location --> **Location of Secondary Air Injection (AIR) pump motor V101**

2 - Air cleaner

3 - Secondary air combination valve

- Location **Location of Secondary air combination valve**

4 - Non-return valve

- Installed position (light/dark side and direction of arrow): as shown in illustration. Arrow indicates direction of flow.

5 - Secondary Air Injection (AIR) pump relay J299

- Location **Location of Secondary Air Injection (AIR) pump relay J299**

6 - Engine Control Module (ECM) J220

7 - Vacuum reservoir

- Location: in front left wheelhousing behind wheelhouse liner

8 - Secondary Air Injection (AIR) solenoid valve N112

- Location **Location of Secondary Air Injection (AIR) solenoid valve N112**

9 - Cylinder head

Location of Secondary Air Injection (AIR) solenoid valve N112

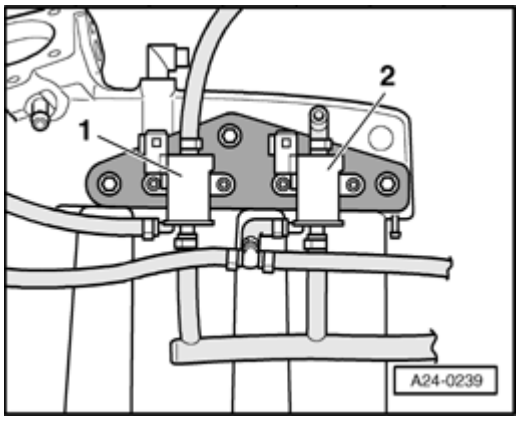

Fig. 383: Identifying Secondary Air Injection (AIR) Solenoid Valve -N112-
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Under intake manifold

1. Recirculating valve for turbocharger N249 (green connector)
2. Secondary Air Injection (AIR) solenoid valve N112 (brown connector)

NOTE:

- **The illustration shows a removed intake manifold viewed from below.**

Location of Secondary Air Injection (AIR) pump motor V101

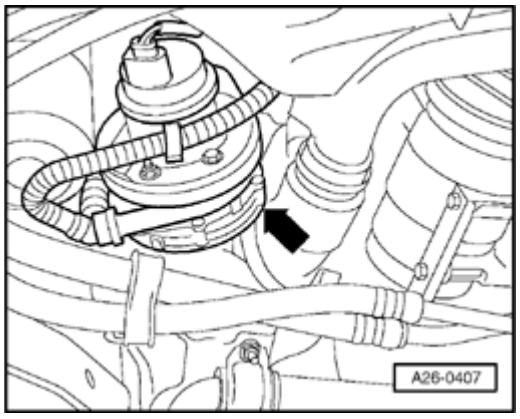

Fig. 384: Disconnecting Connector From Secondary AIR Pump Motor V101
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Front right in engine compartment below air cleaner housing

Location of Secondary Air Injection (AIR) pump relay J299

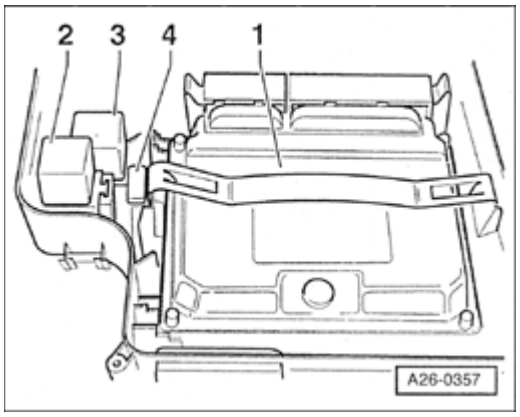

Fig. 385: Location Of Secondary Air Injection (AIR) Pump Relay J299
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- 3-way relay carrier in electronics box in plenum chamber, position 2

1. Engine control module
2. Secondary Air Injection (AIR) pump relay J299
3. Motronic ECM Power Supply relay J271
4. Fuse S130 for secondary air injection pump

Location of Secondary air combination valve

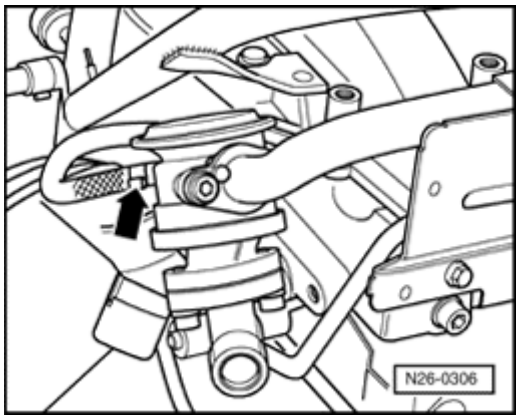

Fig. 386: Vacuum Hose Disconnected At Combination Valve
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Right rear on cylinder head

Secondary Air Injection (AIR) solenoid valve N112 , checking

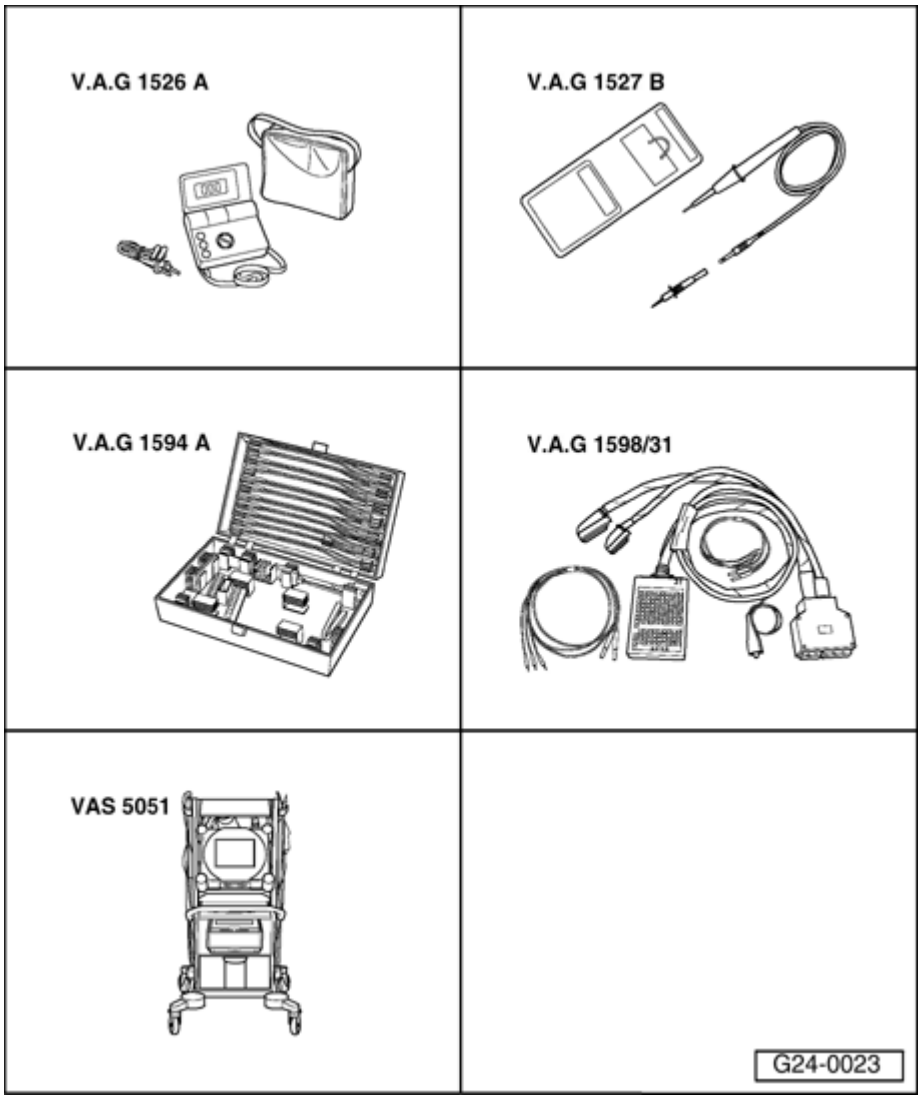

Fig. 387: Identifying Special Tools - Secondary Air Injection (AIR) Solenoid Valve N112 , Checking
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools, testers and auxiliary items required

- Multimeter VAG1526A or equivalent
- Voltage tester VAG1527B
- Connector test set VAG1594A
- Adapter VAG1598/31
- Vehicle Diagnostic, Testing and Information System VAS5051 VAS5051 with VAS5051/1

or

- Scan Tool VAG1551 with VAG1551/3A

Requirement

- Vehicle Diagnostic, Testing and Information System VAS5051 or Scan Tool VAG1551 must be connected.

Work sequence

NOTE:

- **The Secondary Air Injection (AIR) solenoid valve N112 and its wiring are monitored by the engine control module.**

  - Read DTC memory of engine control module.

If display shows a DTC relating to secondary Air Injection (AIR) solenoid valve N112 :

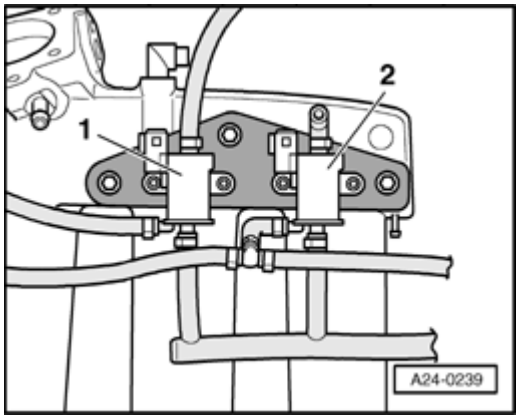

Fig. 388: Identifying Secondary Air Injection (AIR) Solenoid Valve -N112-
Courtesy of VOLKSWAGEN UNITED STATES, INC.

  - Disconnect hoses from secondary Air Injection (AIR) solenoid valve N112 - **2** - , but leave electrical connector connected.

- Installation location: under intake manifold

NOTE:

- **Illustration shows removed intake manifold viewed from below.**

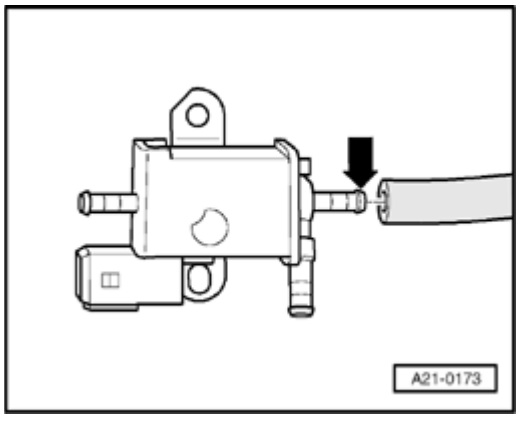

Fig. 389: Connect Test Hose To Valve Connection
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect test hose to valve connection marked with an - **arrow** -.
- Start output Diagnostic Test Mode and actuate Secondary Air Injection (AIR) solenoid valve N112.

Indicated on display

Output Diagnostic Test Mode --> Secondary Air Injection solenoid valve -N112

- Valve must click...
- ..and must open and close (can be checked by blowing into test hose).

If valve does not click:

- Check internal resistance of valve.

If valve does not open or close properly:

- Replace Secondary Air Injection (AIR) solenoid valve N112.

Checking internal resistance

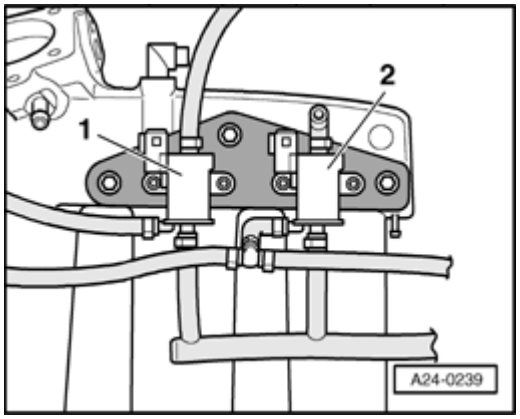

Fig. 390: Identifying Secondary Air Injection (AIR) Solenoid Valve -N112-
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect connector at Secondary Air Injection (AIR) solenoid valve N112 - **2** -.

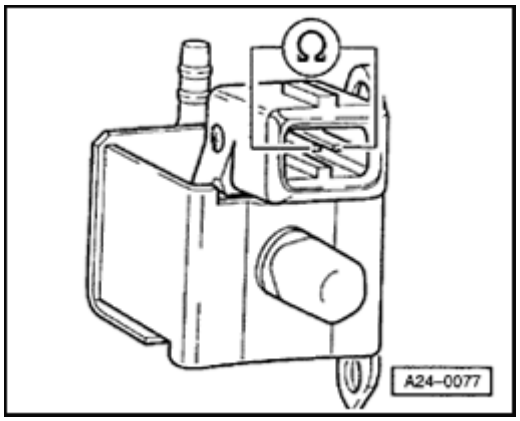

Fig. 391: Connecting Multimeter To Valve (Resistance Measurement Range)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect multimeter and measure resistance at valve.
- Specification: 27 to 30 ohms

If reading does not match specification:

- Replace Secondary Air Injection (AIR) solenoid valve N112.

If measured value matches specification:

- Check power supply.

Checking power supply

NOTE:

- **Secondary Air Injection (AIR) solenoid valve N112 is supplied with power via fuel pump relay.**

Requirements

- Fuse for secondary air injection solenoid valve OK --> Electrical Wiring Diagrams, Troubleshooting and Component Locations
- Fuel pump relay OK --> **24 - MULTIPORT FUEL INJECTION (MFI)**

- Disconnect connector at valve.

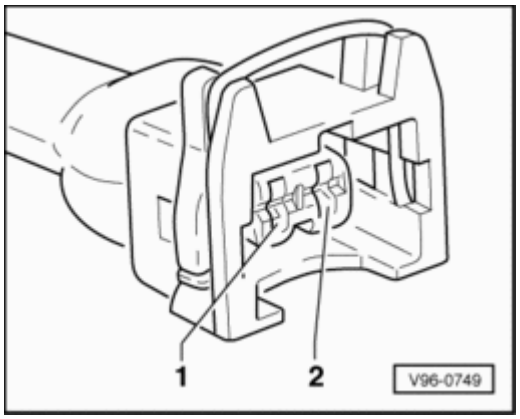

Fig. 392: Identifying 2-Pin Electrical Connector & Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect voltage tester VAG1527B as follows:

Connector contact	Measure to
1	Engine Ground

- Briefly operate starter.

- LED must light up

If LED does not light up:

- Check for open circuit in wiring from contact 1 of connector through fuse to fuel pump relay. --> Electrical Wiring Diagrams, Troubleshooting and Component Locations
- If necessary, eliminate open circuit.

If LED lights up:

- Check actuation.

Checking actuation

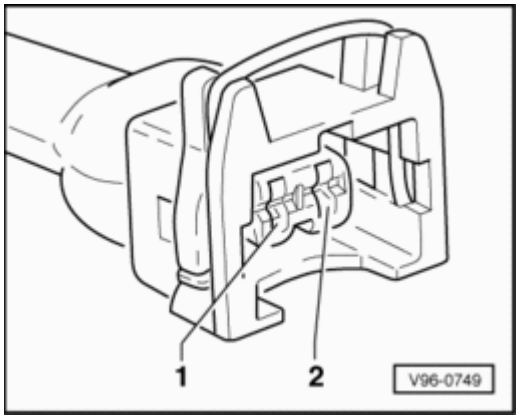

Fig. 393: Identifying 2-Pin Electrical Connector & Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect voltage tester VAG1527B to contact 1 (positive) and 2 of connector.
- Start output Diagnostic Test Mode and actuate Secondary Air Injection (AIR) solenoid valve N112.

- LED must flash

If LED does not flash or if it is permanently lit:

- Connect test box VAG1598/31 to engine control module wiring harness. Engine control module must not be connected. --> **24 - MULTIPORT FUEL INJECTION (MFI)**

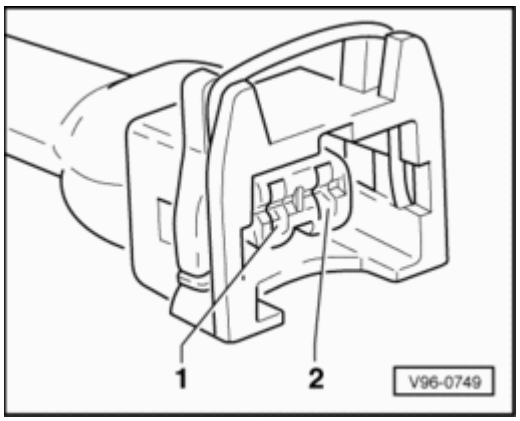

Fig. 394: Identifying 2-Pin Electrical Connector & Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Check for open circuit and short to Ground/positive in following wiring connection:

Connector contact	Test box VAG1598/31 socket
2	9

- If necessary, eliminate open circuit/short circuit.

If wiring is OK:

- Replace engine control module.

Secondary Air Injection (AIR) pump relay J299 and Secondary Air Injection (AIR) pump motor V101 , checking

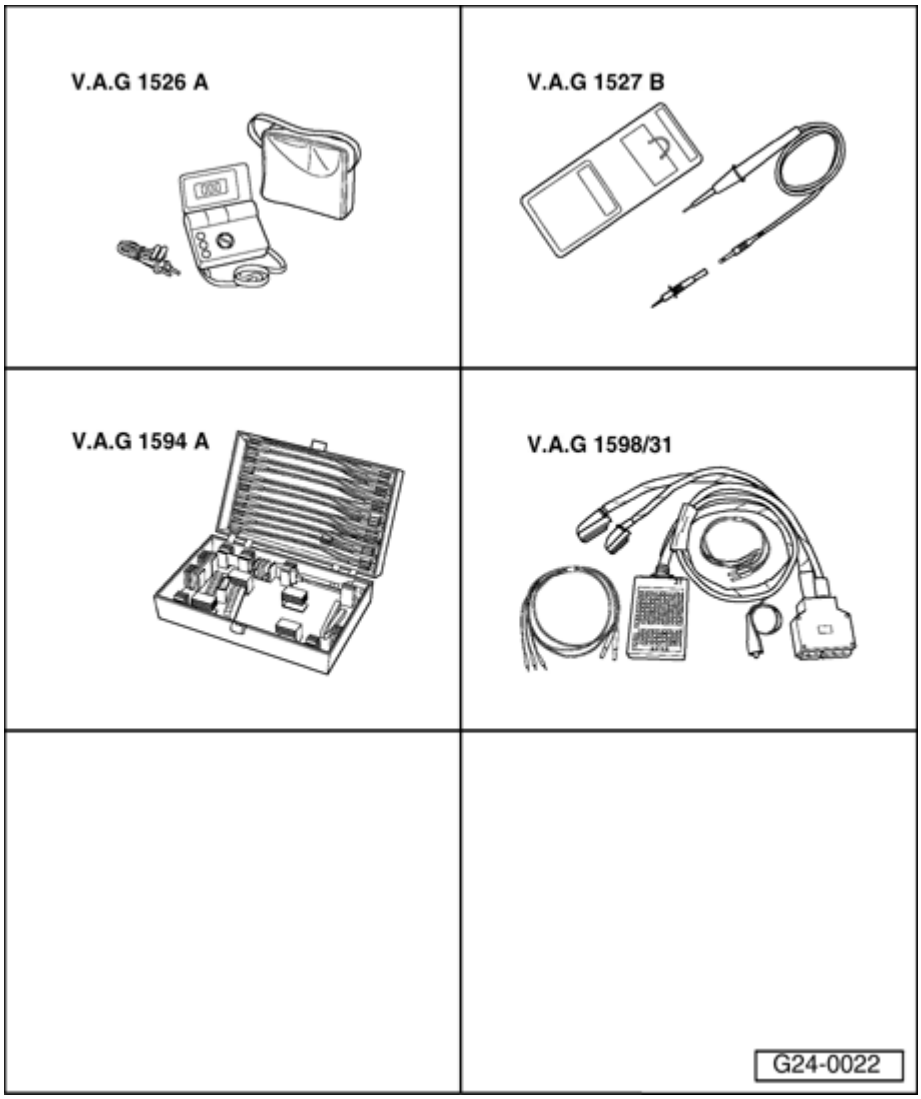

Fig. 395: Identifying Special Tools - Secondary Air Injection (AIR) Pump Relay J299 And Secondary Air Injection (AIR) Pump Motor V101 , Checking
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools, testers and auxiliary items required

- Multimeter VAG1526A or equivalent
- Voltage tester VAG1527B
- Connector test set VAG1594A
- Adapter VAG1598/31

Requirement

- Vehicle Diagnostic, Testing and Information System VAS5051 or Scan Tool VAG1551 must be connected.

Work sequence

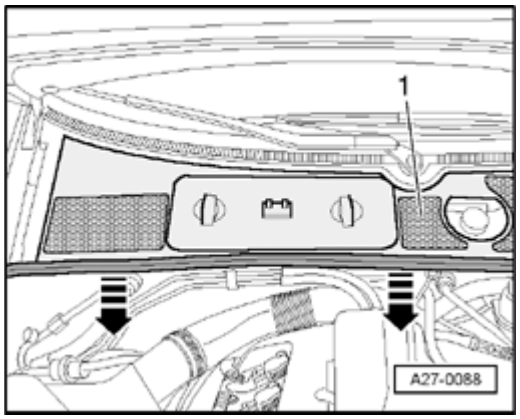

Fig. 396: Identifying Plenum Chamber Cover & Removing Rubber Seal
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove rubber seal from plenum chamber cover in direction of - **arrow** -.
- Pull plenum chamber cover - **1** - toward front and remove.

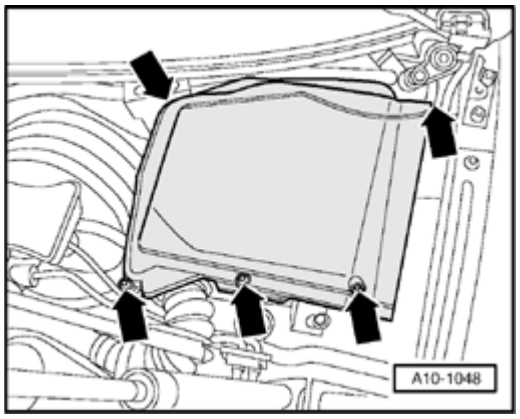

Fig. 397: Unbolting Cover Of Electronics Box In Plenum Chamber
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unbolt cover of electronics box in plenum chamber.
- Start output Diagnostic Test Mode and actuate Secondary Air Injection (AIR) pump relay J299.

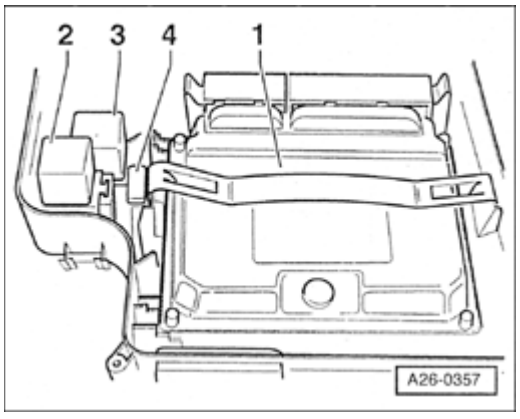

Fig. 398: Location Of Secondary Air Injection (AIR) Pump Relay J299
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Secondary AIR pump relay - **2** - (in 3-way relay carrier of electronics box at left side of plenum chamber, position 2) must pick up and Secondary AIR pump motor V101 must run intermittently.

A - If relay does not pick up:

- Check power supply of secondary AIR pump relay.
- Check actuation of secondary AIR pump relay.

B - If relay picks up, but secondary AIR pump motor does not run:

- Check power supply for secondary AIR pump motor.

Checking power supply of secondary AIR pump relay

- Switch off ignition.
- Disconnect secondary AIR pump relay.

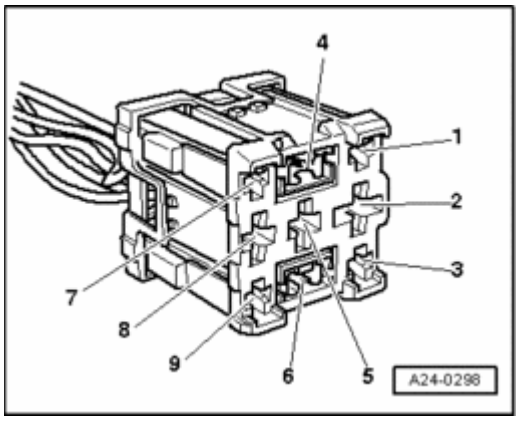

Fig. 399: Identifying Secondary Air Pump Relay Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect multimeter and measure voltage as follows.

3-way relay carrier in electronics box in plenum chamber, position 2, contact	Measure to
8	Engine Ground

- Specification: approx. battery voltage

If reading does not match specification:

- Perform following checks marked with a dot:

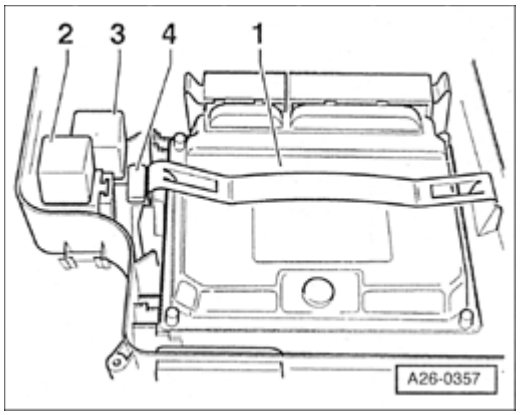

Fig. 400: Location Of Secondary Air Injection (AIR) Pump Relay J299
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Check fuse S130 (40 A) in 3-way relay carrier of electronics box in plenum chamber, position 7.
- Check for open circuit in wiring from battery+ (terminal 30) to fuse S130 to Secondary AIR pump relay J299 (in 3-way relay carrier of electronics box in plenum chamber, position 2).

--> Electrical Wiring Diagrams, Troubleshooting and Component Locations

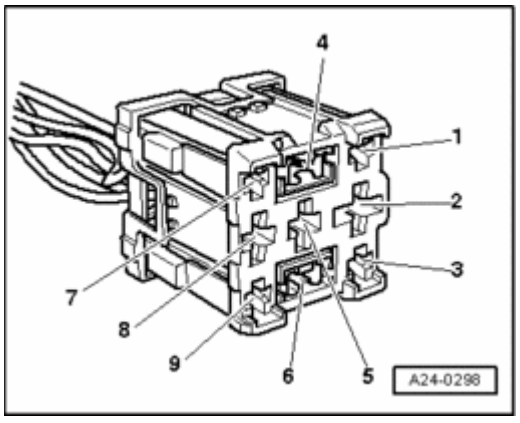

Fig. 401: Identifying Secondary Air Pump Relay Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect multimeter and measure voltage as follows.

3-way relay carrier in electronics box in plenum chamber, position 2, contact	Measure to
4	Engine Ground

- Briefly operate starter.

- Specification: approx. battery voltage

If reading does not match specification:

- Perform following checks marked with a dot:

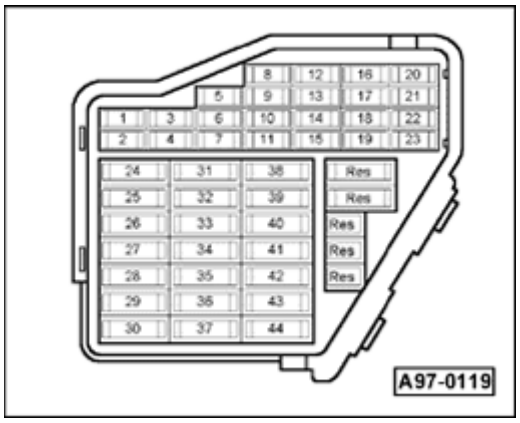

Fig. 402: Identifying Main Fuse Box
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Check fuse S234 (in fuse box, position 34). --> Electrical Wiring Diagrams, Troubleshooting and Component Locations
- Check for open circuit in wiring from Secondary AIR pump relay J299- (in 3-way relay carrier of electronics box in plenum chamber) to fuel pump relay via fuse S234 (in fuse box, position 34): --> Electrical Wiring Diagrams, Troubleshooting and Component Locations

Checking actuation of secondary AIR pump relay

- Switch off ignition.
- Disconnect secondary AIR pump relay.

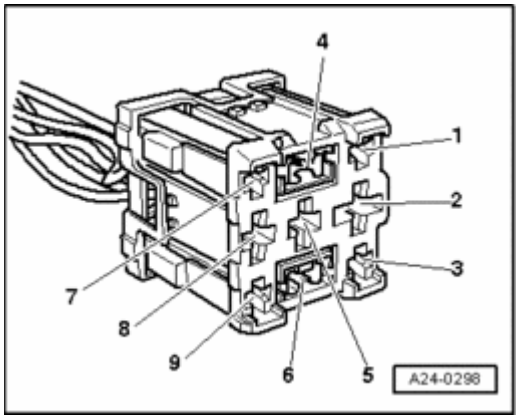

Fig. 403: Identifying Secondary Air Pump Relay Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect voltage tester VAG1527B as follows:

3-way relay carrier in electronics box in plenum chamber, position 2, contact	Measure to

6	Engine Ground

- Start output Diagnostic Test Mode and actuate Secondary AIR pump relay J299.
- LED must flash

If LED does not flash:

- Switch off ignition.
- Connect test box VAG1598/31 to engine control module wiring harness. Engine control module must not be connected: --> **24 - MULTIPORT FUEL INJECTION (MFI)**

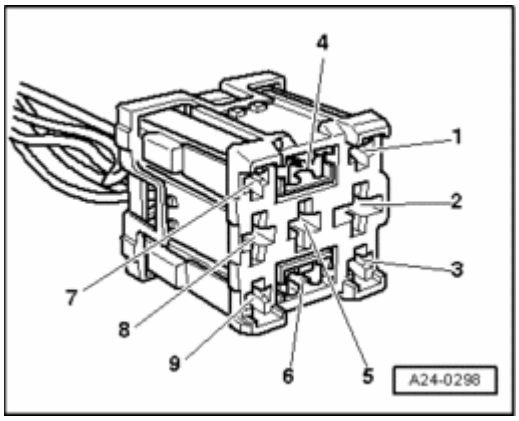

Fig. 404: Identifying Secondary Air Pump Relay Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Check for open circuit and short to Ground/positive in following wiring connection:

3-way relay carrier in electronics box in plenum chamber, position 2, contact	Test box VAG1598/31 ocket
6	66

- If necessary, eliminate open circuit/short circuit.

If no fault is found:

- Replace Secondary AIR pump relay J299.

Checking power supply for secondary AIR pump motor

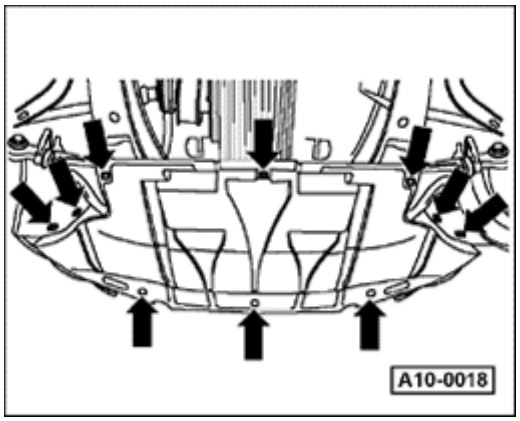

Fig. 405: Noise Insulation Tray Retainers
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove sound insulation - **arrows** -.

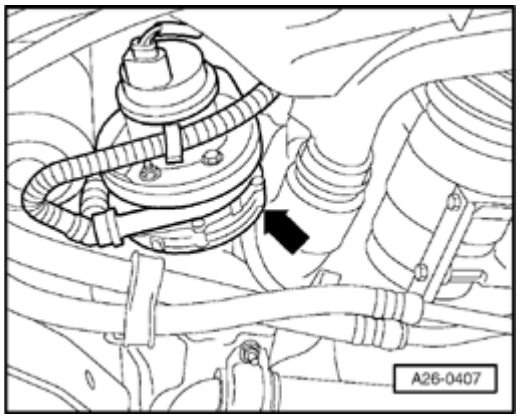

Fig. 406: Disconnecting Connector From Secondary AIR Pump Motor V101
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect connector from Secondary AIR pump motor V101 - **arrow** -.

- Location: right front in engine compartment below air cleaner housing

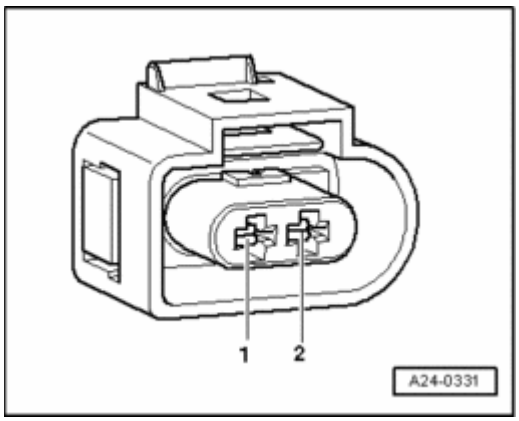

Fig. 407: Identifying 2-Pin Electrical Harness Connector & Terminals

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect voltage tester VAG1527B between contacts 1 and 2.
- Start output Diagnostic Test Mode and actuate Secondary AIR pump relay J299.

- LED must flash

If LED does not flash:

- Perform following checks marked with a dot:

- Check for open circuit in wiring from contact 1 of connector to secondary AIR pump relay J299 (in 3-way relay carrier in electronics box of plenum chamber, position 2). --> Electrical Wiring Diagrams, Troubleshooting and Component Locations
- Check for open circuit in wiring from contact 2 of connector to Ground: --> Electrical Wiring Diagrams, Troubleshooting and Component Locations

If no fault is found:

- Replace Secondary Air Injection (AIR) pump motor V101.

Function and tightness of secondary air combination valve, checking

Special tools, testers and auxiliary items required

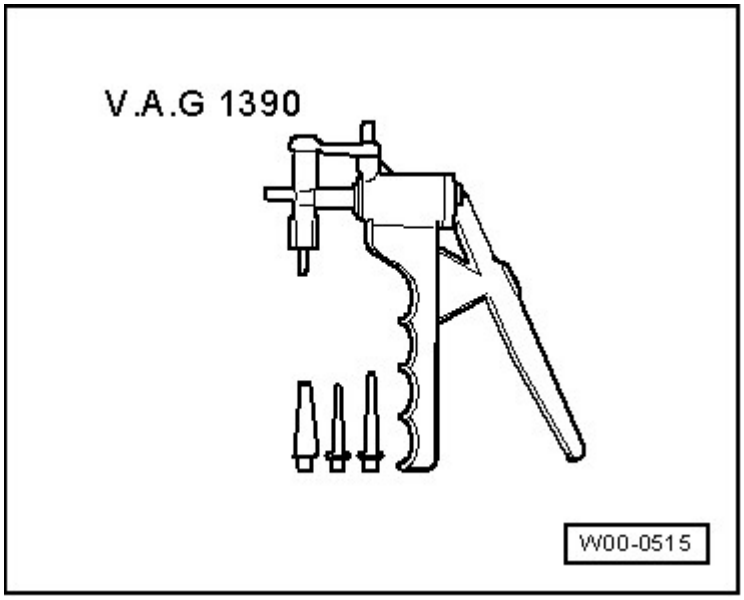

Fig. 408: Identifying Hand Vacuum Pump V.A.G. 1390
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Vacuum hand pump VAG1390

Requirements

- No leaks along vacuum hoses or at hose connections.
- No obstructions in vacuum hoses.

Work sequence

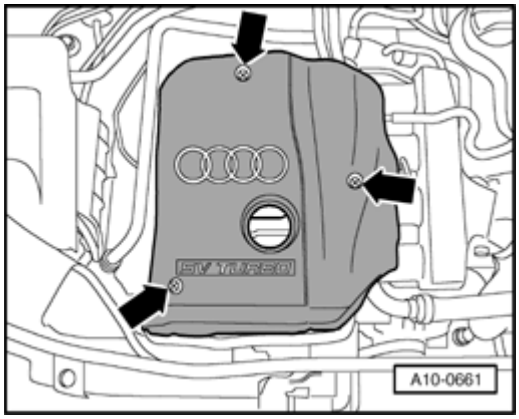

Fig. 409: Removing Engine Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove engine cover - **arrows** -.

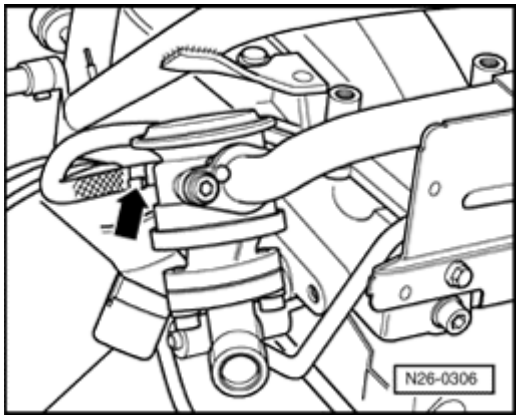

Fig. 410: Vacuum Hose Disconnected At Combination Valve
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect vacuum hose - **arrow** - at combination valve.
- Connect vacuum hand pump VAG1390 to vacuum hose of combination valve.

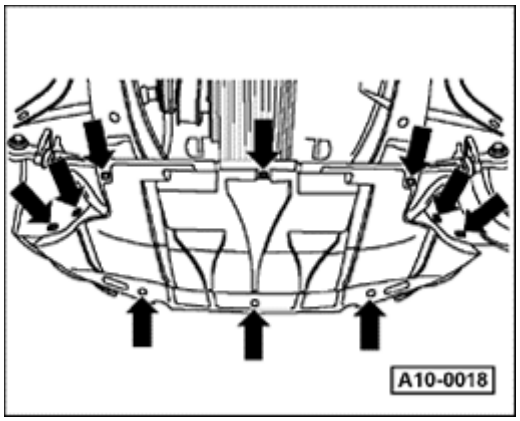

Fig. 411: Noise Insulation Tray Retainers
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove sound insulation - **arrows** -.

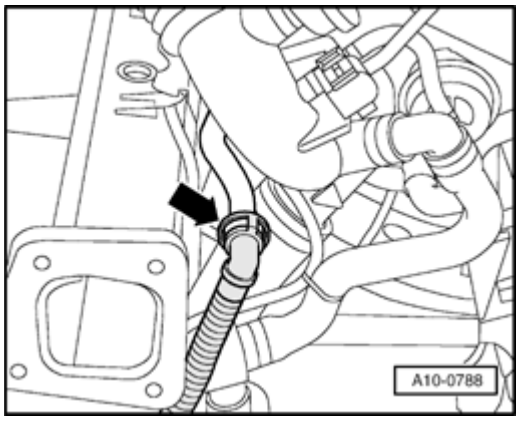

Fig. 412: Disconnecting Hose At Line For Secondary Air Combination Valve
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect hose - **arrow** - at line for secondary air combination valve.
- Connect test hose to line...
- .. and blow into hose with slight pressure (do not use compressed air).

- Combination valve should be closed. It should not be possible to blow through hose.

- Operate vacuum hand pump.

- Combination valve should open. It should now be possible to blow through hose.

If combination valve does not open:

- Replace combination valve --> **Secondary air combination valve, removing and installing**.

Secondary air combination valve, removing and installing

Removing

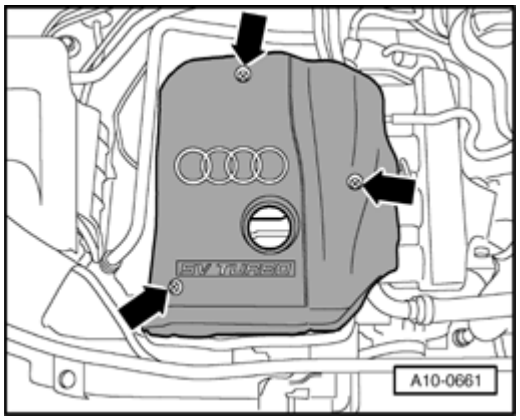

Fig. 413: Removing Engine Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove engine cover - **arrows** -.

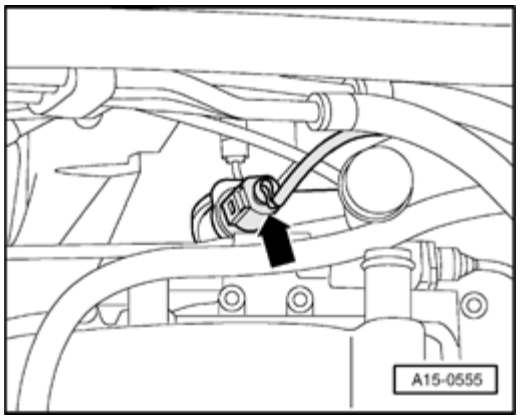

Fig. 414: Disconnecting Connector At Engine Coolant Temperature (ECT) Sensor G2/G62
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect connector - **arrow** - at Engine Coolant Temperature (ECT) sensor G2/G62.
- Move wiring harness at bulkhead clear.

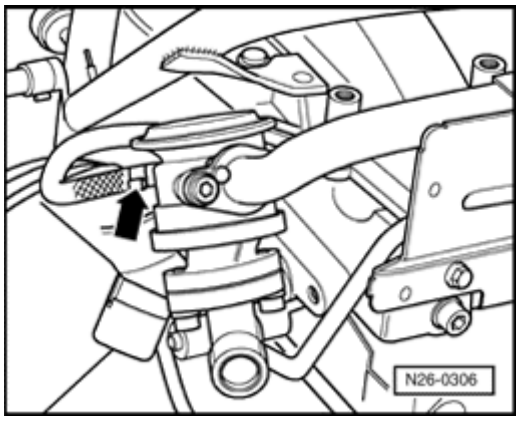

Fig. 415: Vacuum Hose Disconnected At Combination Valve
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect vacuum hose - **arrow** - at combination valve.
- Remove 4 bolts from combination valve and remove combination valve.

Installing

Install in reverse order, paying attention to the following:

NOTE:

- **Replace seals.**

Tightening torques

Component	Nm
Secondary air combination valve to cylinder head	10
Secondary air line to cylinder head cover	10
Secondary air line to secondary air combination valve	10

