ENGINE

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

00 GENERAL, TECHNICAL DATA

TECHNICAL DATA

Engine number

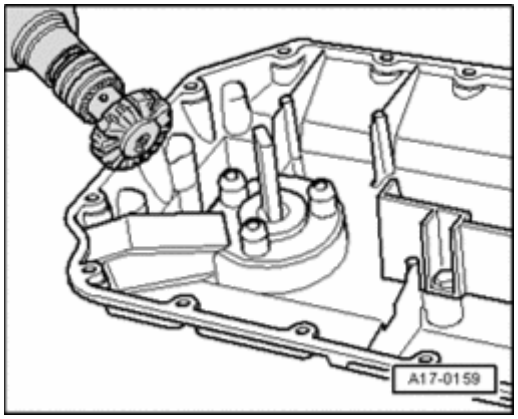

Fig. 1: Identifying Engine Number
Courtesy of VOLKSWAGEN UNITED STATES, INC.

The engine number ("Engine code" and "Serial number") can be found at the front next to the joint between engine and transmission.

There is also a sticker on the cylinder head cover showing the engine code and serial number.

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

Engine data

Engine code		**AMU**
Manufactured		10.99 >
Displacement	Liters	1.781
Power output	HP/kW at RPM	225/165 5900
Torque	lbs. ft/Nm at RPM	207/280 2200 - 5500
Bore	mm	81
Stroke	mm	86.4
Compression ratio		9:1
RON	min.	95 unleaded
Injection/ignition system		Motronic

Knock control	x
On Board Diagnostic (OBD)	x
Oxygen sensor control	x
Catalytic converter	x
Turbo charging	x
Exhaust gas recirculation system	-
Secondary air system	x

Engine code	**AMU**
Valve timing	
At 1 mm valve lift and 0 mm valve Clearance, camshaft adjustment inactive	
Intake opens after TDC	18°
Intake closes after BDC	28°
Exhaust opens before BDC	30°
Exhaust closes before TDC	10°

10 ENGINE - ASSEMBLY

ENGINE, REMOVING AND INSTALLING

Engine, removing and installing

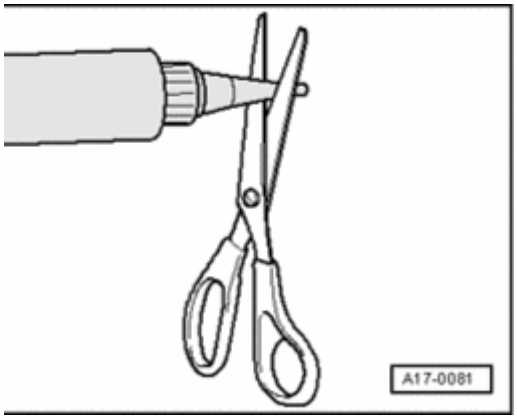

Fig. 2: Identifying Special Tools - Engine, Removing And Installing (1 Of 3)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools, testers and repair equipment required

- V.A.G 1306 Drip tray
- T10012 Engine bracket
- VW 313 Support clamp
- VW 540 Engine and transmission support

- 3180 Retainer
- V.A.G 1202 A Workshop crane
- 2024 A Lifting tackle

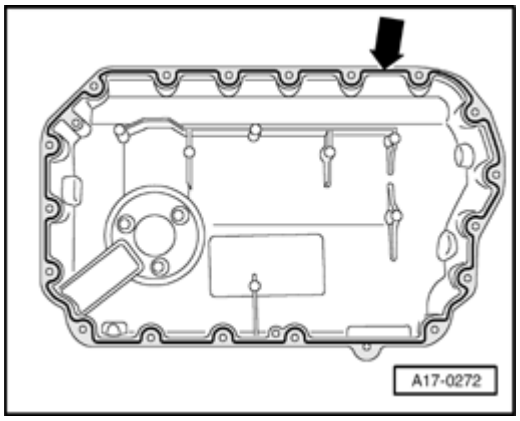

Fig. 3: Identifying Special Tools - Engine, Removing And Installing (2 Of 3)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- V.A.G 1331 Torque wrench (5-50 Nm)
- V.A.G 1332 Torque wrench (40-200 Nm)
- V.A.G 1383 A Engine/transmission jack
- V.A.G 1921 Spring-type clip pliers
- VW 457 Support rails
- 3300 A Engine support device

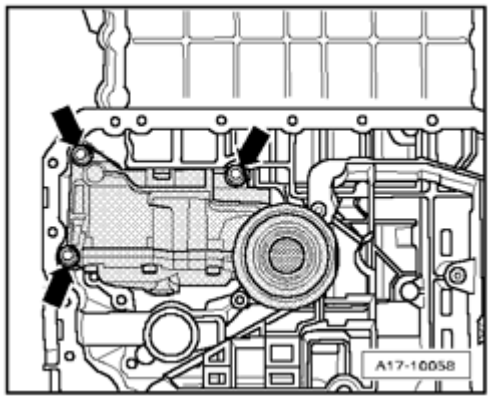

Fig. 4: Identifying Special Tools - Engine, Removing And Installing (3 Of 3)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- 3283 Pressing-out appliance
- VAS 5085 Step ladder
- V.A.G 1756 Angle wrench

- G 000 100 Grease
- Bolt M10 X 25/8.8
- Bolt M8 X 25/8.8

Removing

NOTE:

- **The engine is removed from underneath together with the transmission.**
- **All cable ties which are opened or cut open when removing the engine must be replaced in the same position when installing the engine.**
- **Secure all hose connections with hose clamps of the same type as those fitted at the factory.**
- **V.A.G 1921 hose clip pliers are recommended when installing spring-type clips.**
- **Make sure the connectors are correctly assigned; mark if necessary.**

- Obtain radio anti-theft code on vehicles with coded radio.
- With the ignition switched off, disconnect the battery Ground (GND) strap.

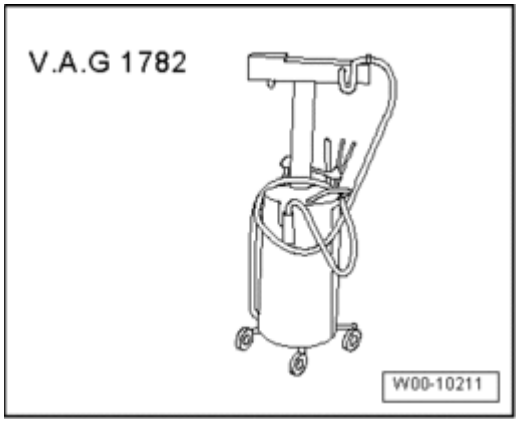

Fig. 5: Removing Right-Hand Cover Panels On Lock Carrier And Expansion Tank
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove right-hand cover panels -1- on lock carrier and -2- above expansion tank.

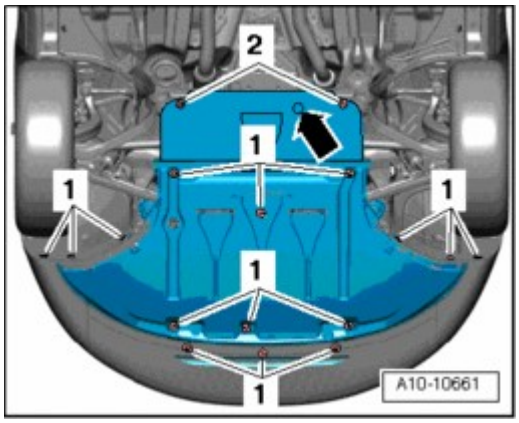

Fig. 6: Removing Left-Hand Cover Panels On Lock Carrier And Battery
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove left-hand cover panels -1- on lock carrier and -2- above battery.

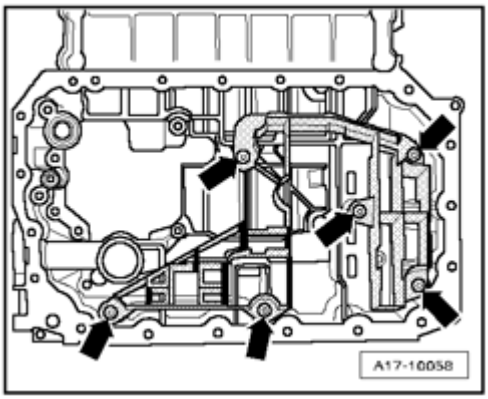

Fig. 7: Removing Cover Panel Above Cylinder Head Cover And In Front Of Intake Manifold
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove cover panel above cylinder head cover and in front of intake manifold (if applicable).

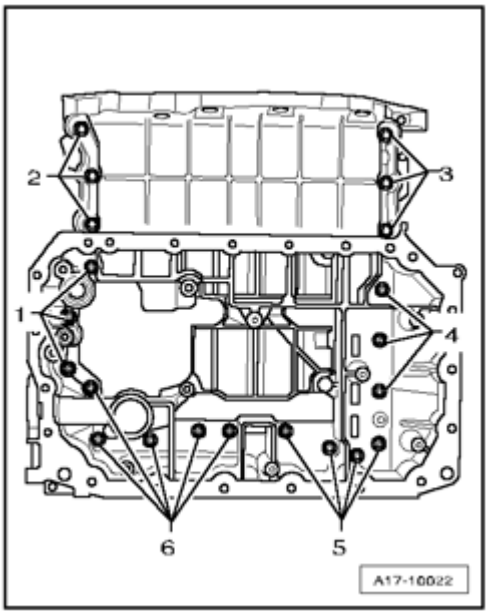

Fig. 8: Removing Intake Air Duct
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove intake air duct.
- Disconnect secondary air intake hose -1- from air cleaner.

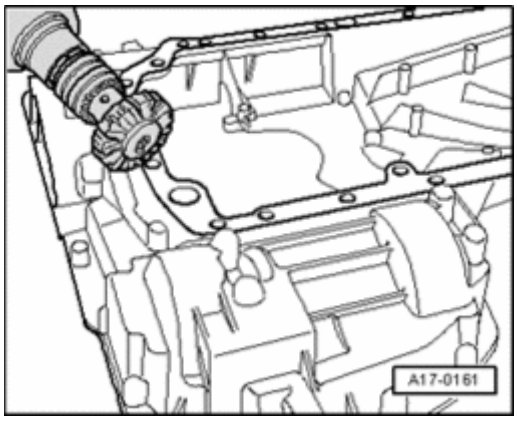

Fig. 9: Identifying Air Hose, Connectors, Bolts & Mass Air Flow Sensor
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect air hose -2- from mass air flow sensor.
- Disconnect connectors -3- from mass air flow sensor.
- Remove bolts -4- and -5-, and remove air cleaner housing.
- Remove battery.

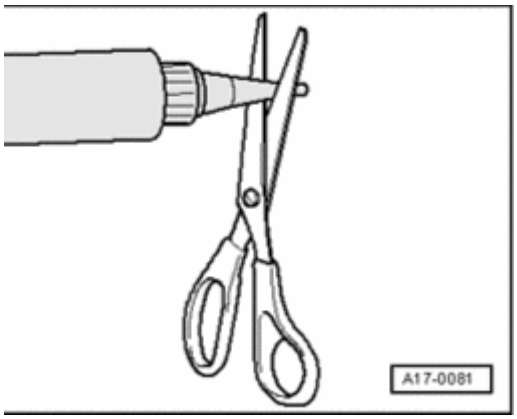

Fig. 10: Removing Battery Platform
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove battery platform (arrows).

Disconnect both selector cables at transmission as follows:

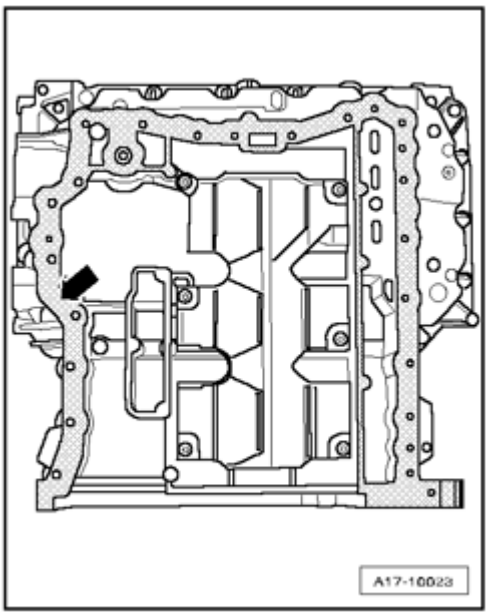

Fig. 11: Pulling Collar (Toward Ball Joint) To Compress Spring, Then Turning Collar Clockwise To Lock In Position
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Mark position of both selector cables with waterproof felt-tip pen -1-.
- Pull collar in direction of (arrow -2-) (toward ball joint) to compress spring, then turn collar clockwise (arrow -3-) to lock in position.
- Disengage both selector cables.

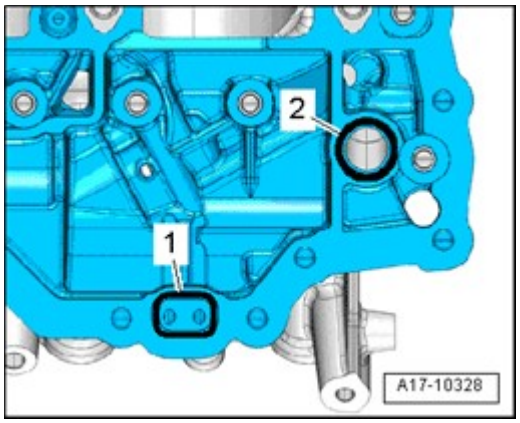

Fig. 12: Removing Bolts & Selector Cable Support Bracket From Transmission
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts (arrows), remove selector cable support bracket from transmission and place to one side.
- Remove both windshield wipers.
- Detach rubber seal from plenum chamber.
- Detach cover from plenum chamber and move clear toward windshield.

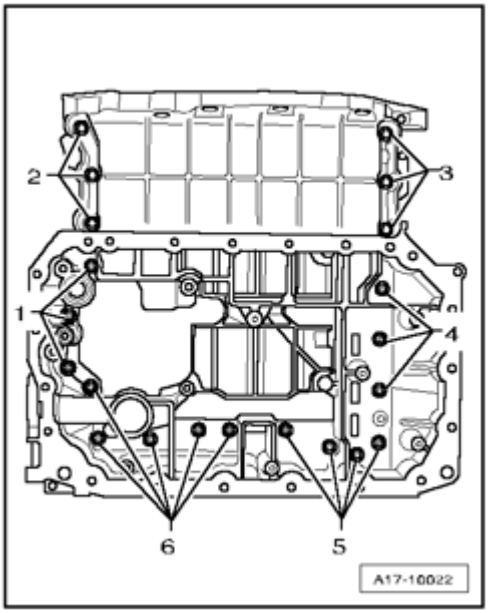

Fig. 13: Opening Cable Duct On Left Side Of Engine Compartment
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Open cable duct on left side of engine compartment.
- Disconnect connector in cable duct and move wiring clear.

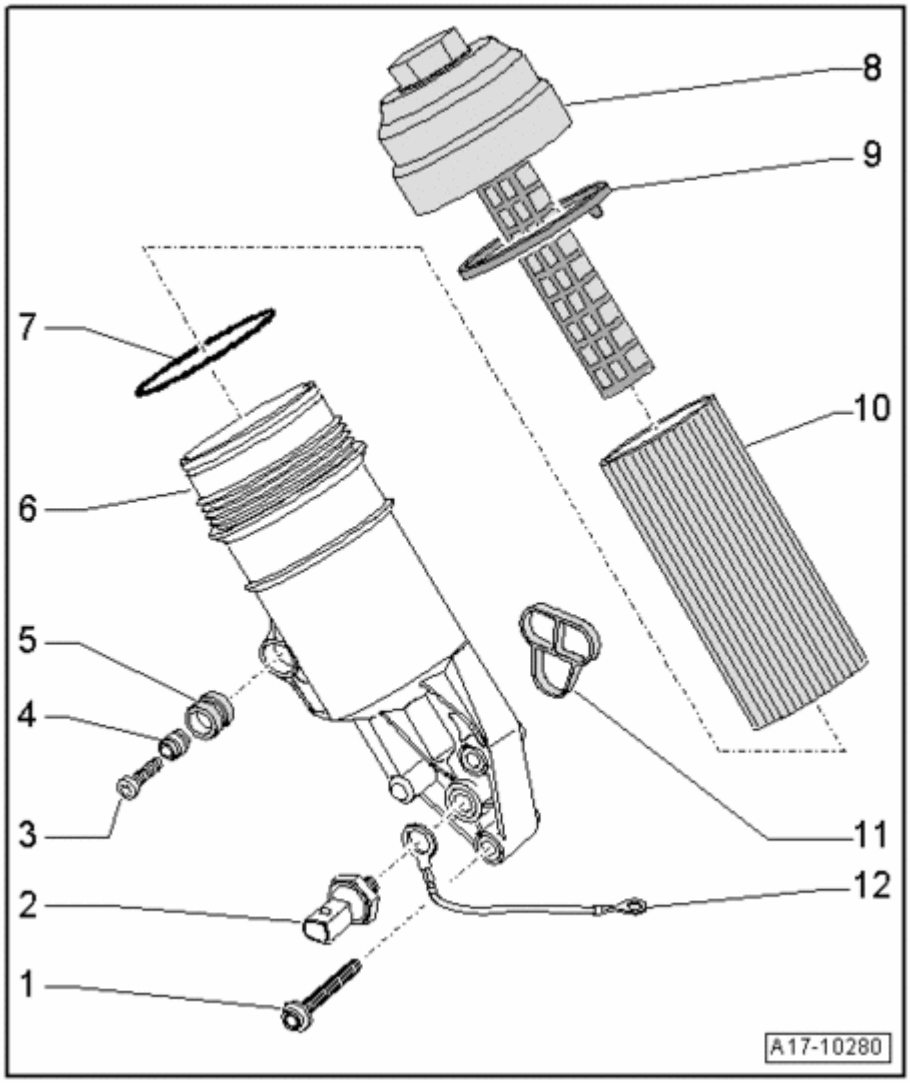

Fig. 14: Releasing Retainer Catch On Left Control Module Connector And Disconnecting Connector From Control Module
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Release retainer catch on left control module connector and disconnect connector from control module.
- Release control module wiring harness as far as engine.

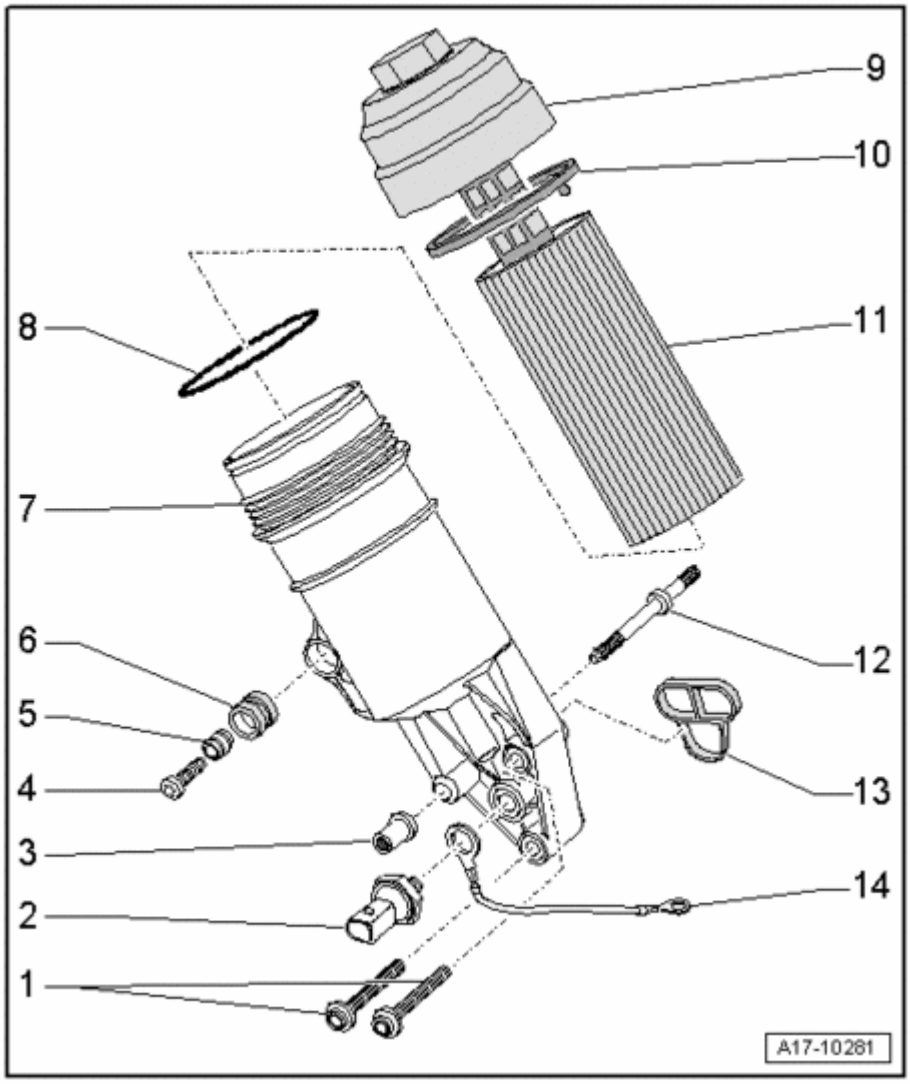

Fig. 15: Disconnecting Connector Below Intake Manifold
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect connector below intake manifold.

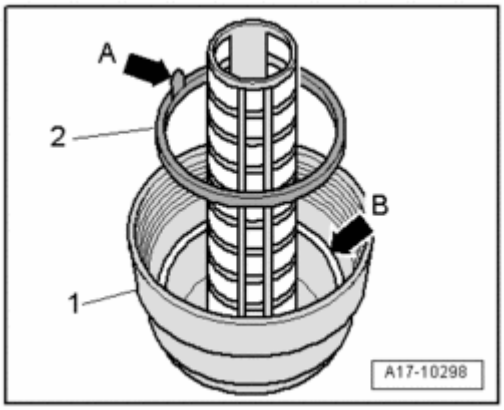

Fig. 16: Identifying Battery Ground Cable, Connector & Electrical Connections
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unbolt Ground wire -1- on engine/transmission flange.
- Disconnect wires -3- and -4- from starter.
- Disconnect connector -2- and pull out of retainer.
- Disengage wires from retainer on starter and move wires to one side.

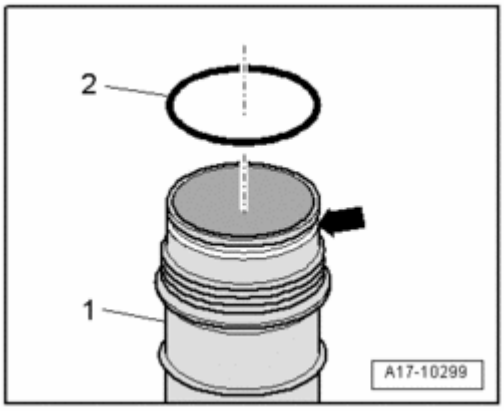

Fig. 17: Disconnecting Connector From Charge Air Pressure Sensor And Unclipping Wire From Charge Air Hose
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect connector from charge air pressure sensor and unclip wire from charge air hose.
- Disconnect air hose from throttle valve control module.

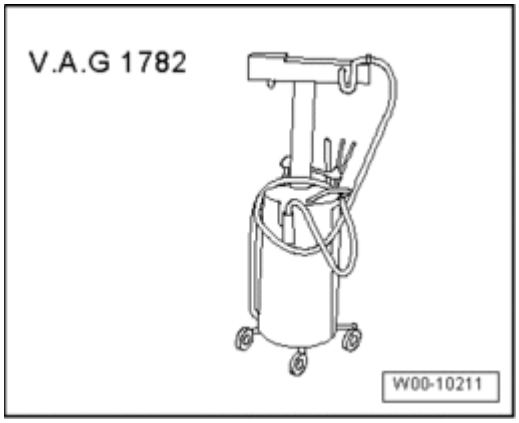

Fig. 18: Disconnecting Connector From Coolant Temperature Switch On Coolant Line
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect connector from coolant temperature switch on coolant line and move wiring clear.

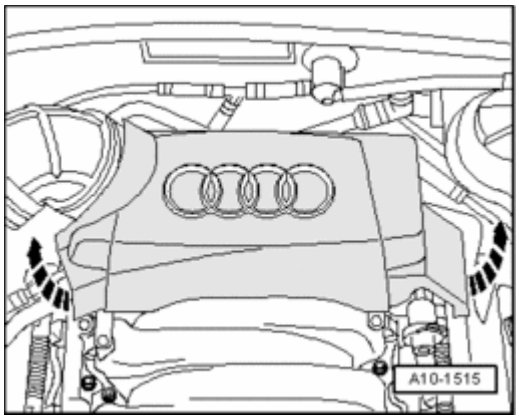

Fig. 19: Identifying Pull Fuel Supply Line And Fuel Return Line
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect fuel supply line -1- and fuel return line -2- at the connection point by pressing the release tabs.

NOTE: Watch color coding of connectors when reconnecting fuel supply and return lines.

WARNING: Fuel system is under pressure! Before opening the system place a cloth around the connection. Then release pressure by carefully loosening the connection.

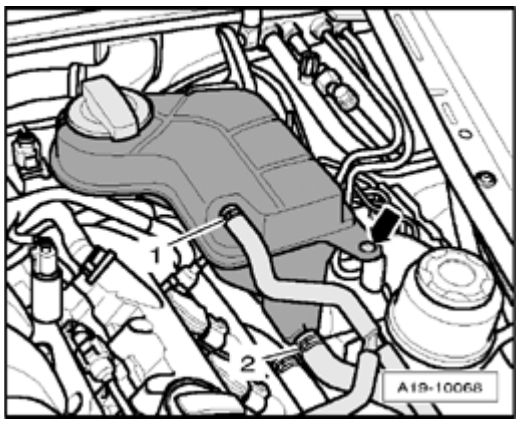

Fig. 20: Slackening Ribbed Belt
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Slacken ribbed belt by turning tensioning element in direction indicated (arrow).

NOTE: Before removing the ribbed belt, mark the direction of rotation with chalk or a felt pen. If a used belt rotates in the wrong direction when refitted, this can result in breakage. When installing the belt, ensure it is correctly seated in the pulleys.

- Remove ribbed belt.

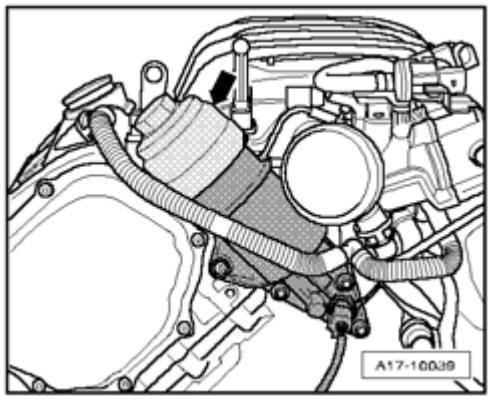

Fig. 21: Blocking Tensioner With 3090
Courtesy of VOLKSWAGEN UNITED STATES, INC.

The tensioning element can be locked in position with a suitable punch (4.5 mm diameter, approx. 55 mm long). Connecting rod support 3090 can also be used.

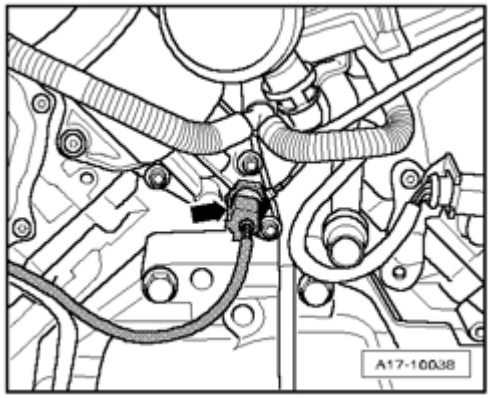

Fig. 22: Detaching Intake Air Hose Between Air Cleaner And Turbocharger
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Detach intake air hose between air cleaner and turbocharger as follows:
- Disconnect connector at Wastegate Bypass Regulator Valve -N75-.
- 1- Connection at air cleaner
- 2- Detach pressure control valve for crankcase breather -8- from hose.

- 3- Disconnect vacuum hose for air recirculation valve at connection on cylinder head.
- 4- Detach hose from Wastegate Bypass Regulator Valve -N75- at intake air duct.
- 5- Detach hose from air recirculation valve at intake air duct.
- 6- Detach connection to active charcoal filter at non-return valve.

- 7- Detach connection between Wastegate Bypass Regulator Valve -N75- and pressure unit for charge air

pressure control.

- 8- Detach air intake hose at connection on turbocharger and remove hose.
- Remove cap from coolant expansion tank.

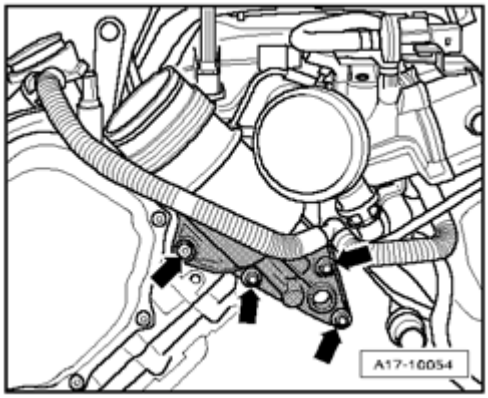

Fig. 23: Disconnecting Vacuum Hose From Intake Manifold To T-Piece In Front Of Retainer In Plenum Chamber
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect vacuum hose from intake manifold to T-piece in front of retainer in plenum chamber.
- Disconnect coolant hose to expansion tank in plenum chamber.

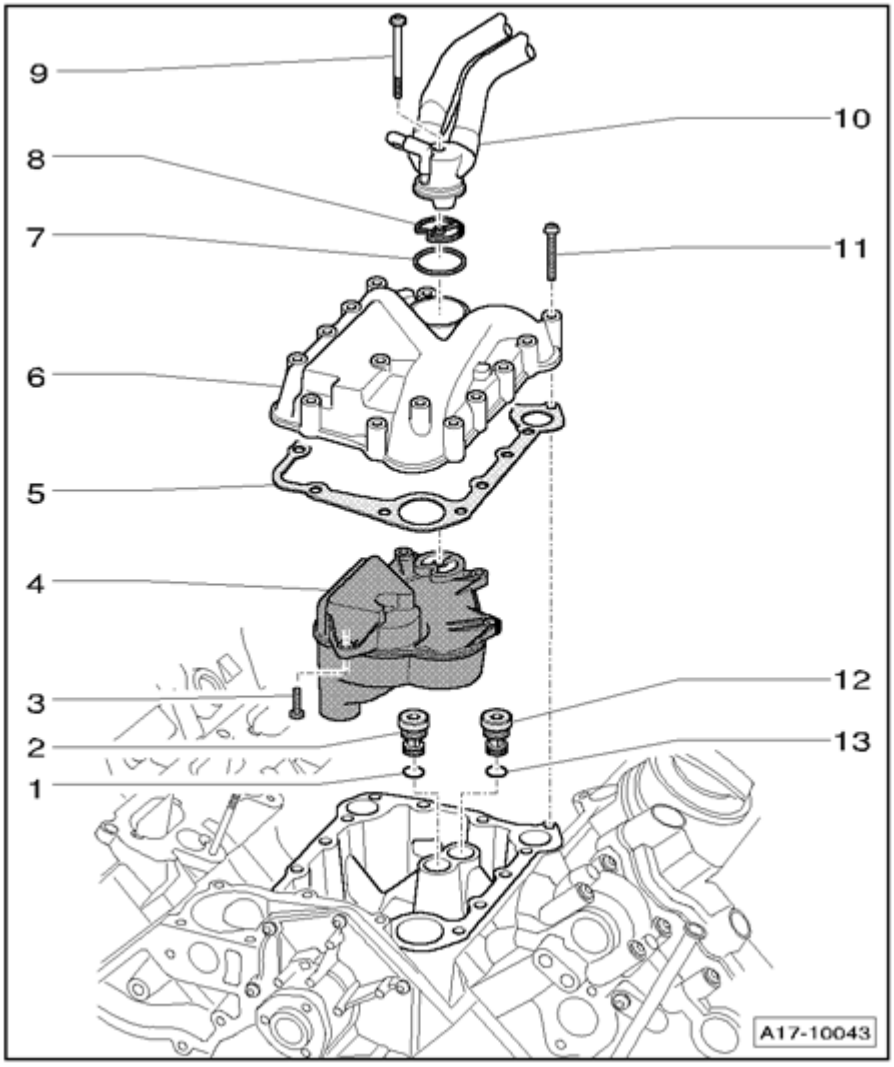

Fig. 24: Identifying Coolant Pump Electrical Connector & Bolts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical connector at coolant pump.
- Unbolt coolant pump from fan cowl; leave coolant hoses connected.
- Remove both front wheels.

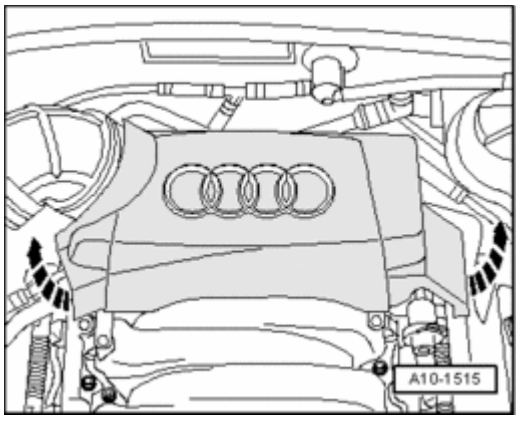

Fig. 25: Unbolting Bracket For Headlight Range Control In Left Wheelhousing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unbolt bracket for headlight range control in left wheelhousing (top); detach retainer from suspension link and disconnect electrical connector.

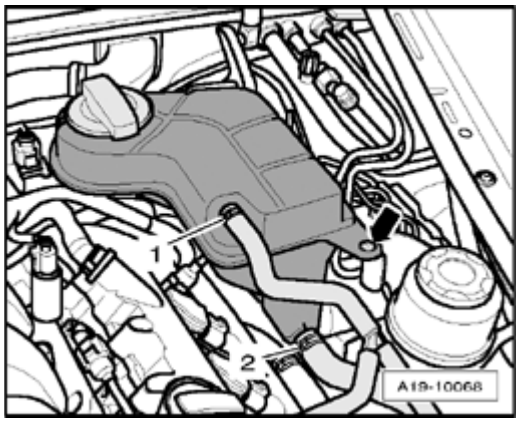

Fig. 26: Removing Noise Insulation Panels (Center, Left And Right)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove noise insulation panels (center, left and right) (arrows).
- Place drip tray V.A.G 1306 below engine.

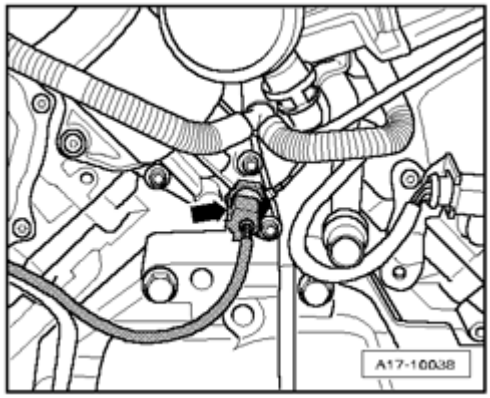

Fig. 27: Turning Drain Screw On Radiator
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Turn drain screw (arrow) on radiator counter-clockwise, if necessary install drain hose to connection.

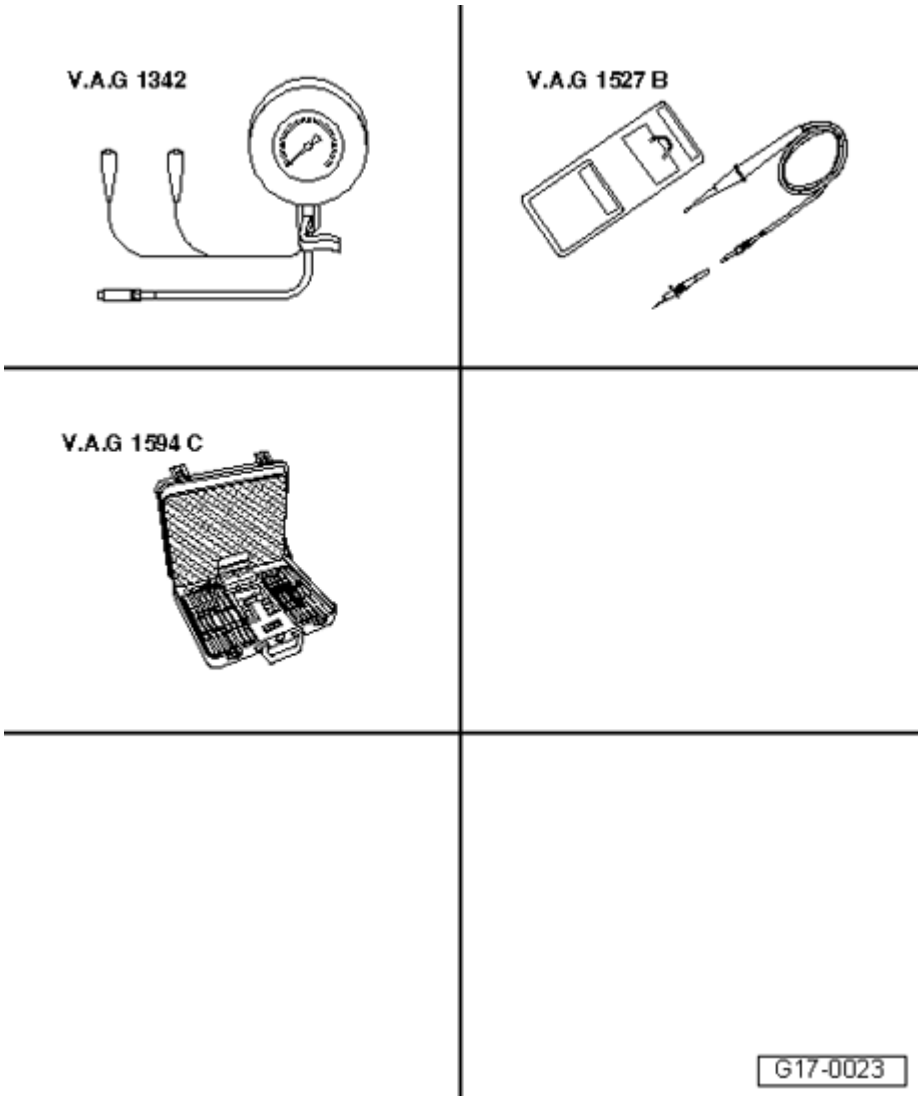

Fig. 28: Disconnecting Bottom Coolant Hose At Oil Cooler To Drain Off Remaining Coolant
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect bottom coolant hose at oil cooler (arrow) to drain off remaining coolant.

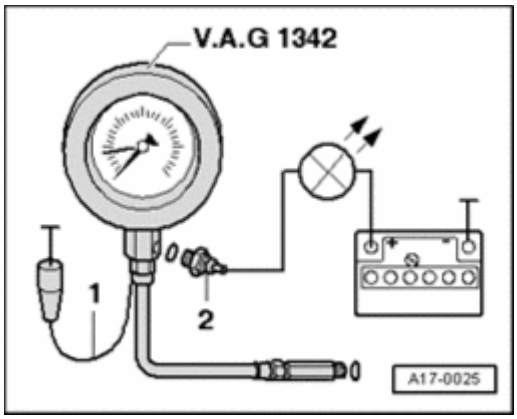

Fig. 29: Identifying Connecting Line Bolts (Left)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unbolt connecting line between left....

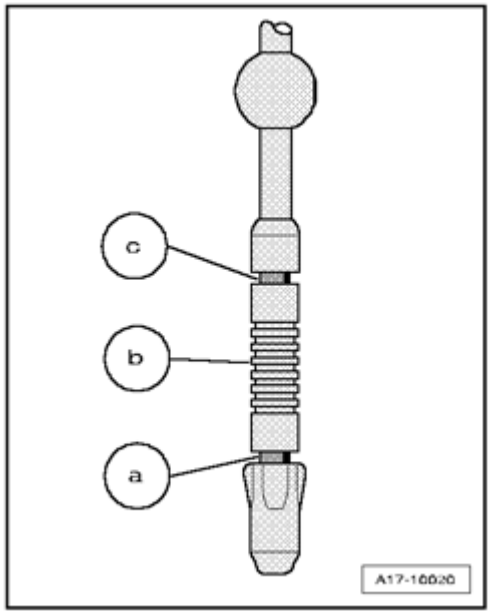

Fig. 30: Identifying Connecting Line Bolts & Right Charge Air Coolers
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- ... and right charge air coolers from longitudinal members and disconnect both hoses from charge air coolers.
- Remove connecting line.

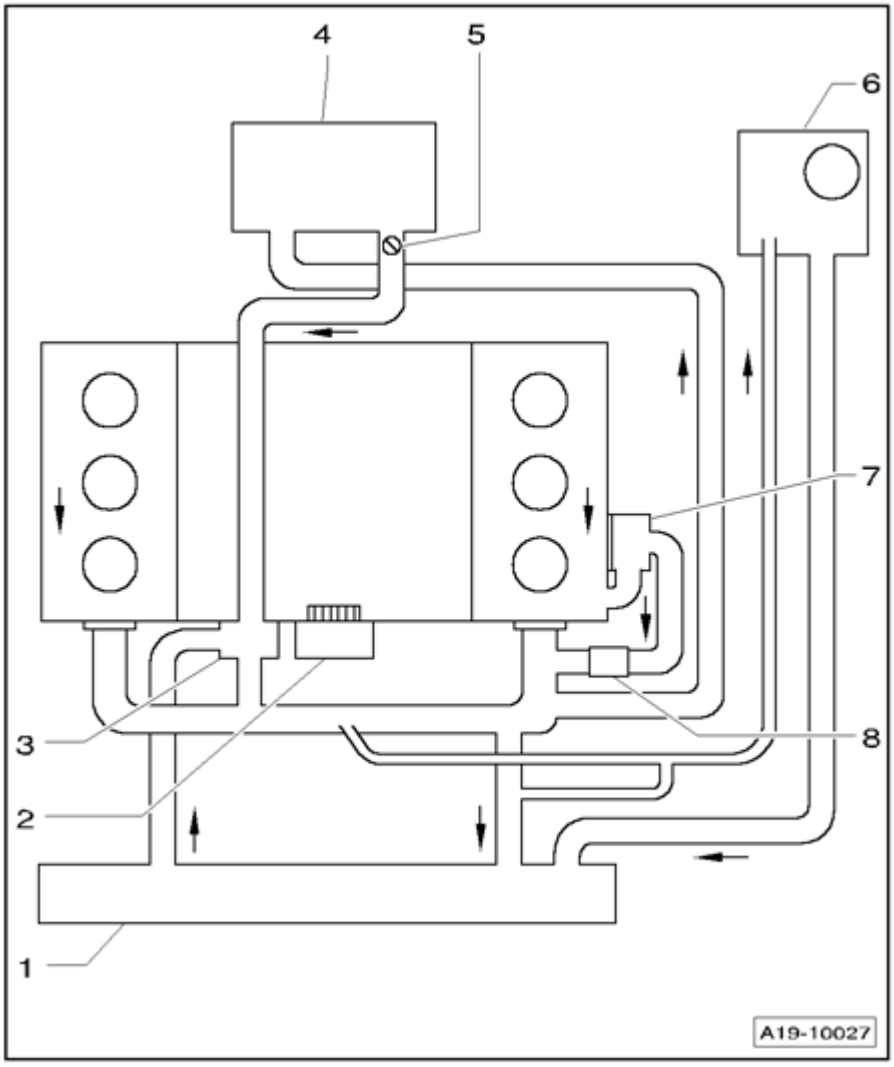

Fig. 31: Disconnecting Connectors On Starter And Transmission
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect connectors on starter and transmission.
- Remove positive connection on starter.

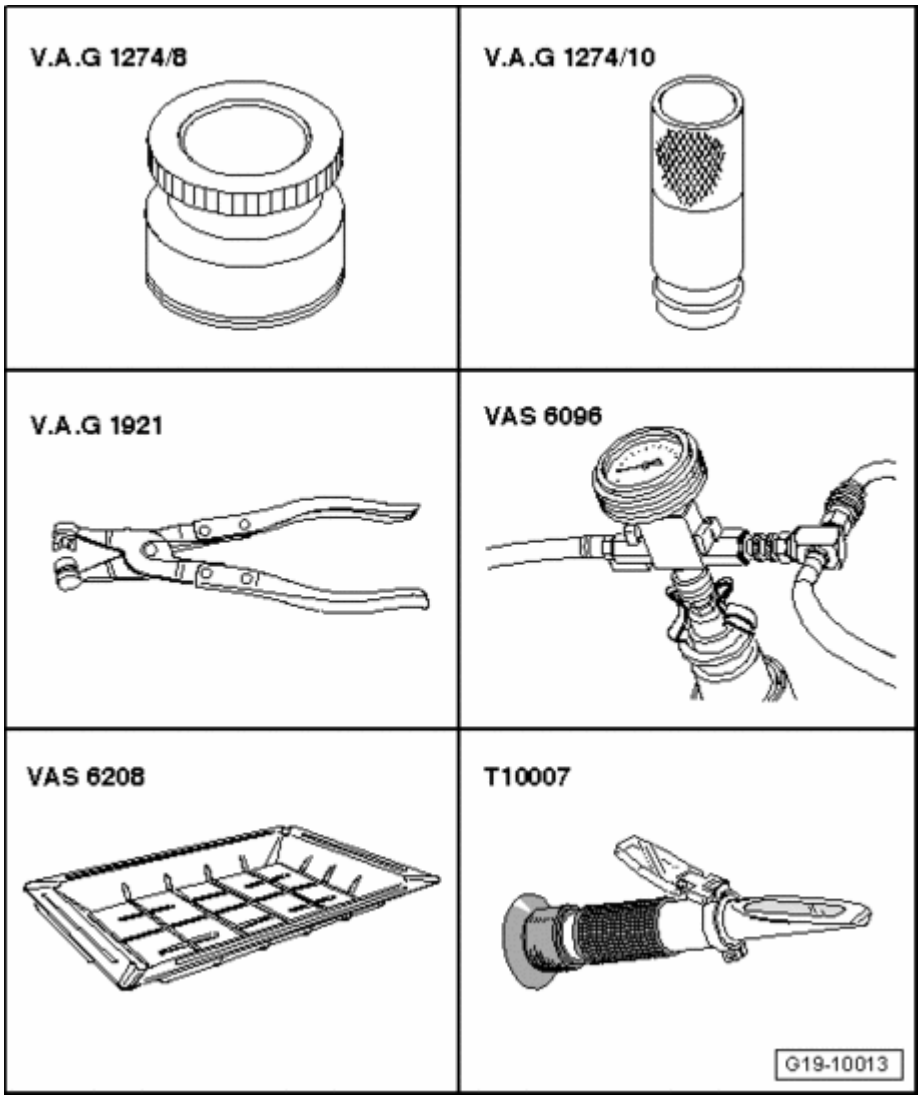

Fig. 32: Removing Cooling Line From Transmission
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove cooling line from transmission.
- Pull out retaining clip from coolant hose on radiator (bottom left) and disconnect coolant hose.
- Open hose retainer on radiator (bottom left) and remove coolant hose completely.

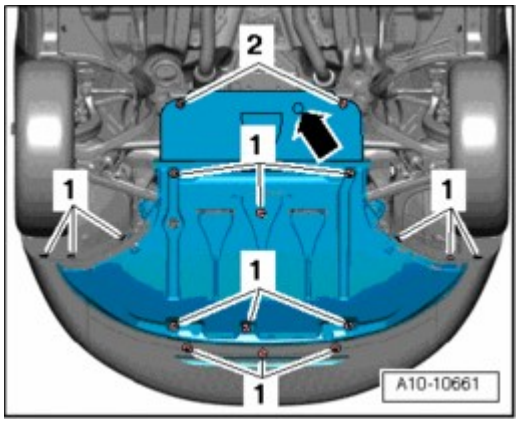

Fig. 33: Unbolting Pump Pulley (Brace Pulley With Hexagon Socket Wrench)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unbolt pump pulley (brace pulley with hexagon socket wrench).

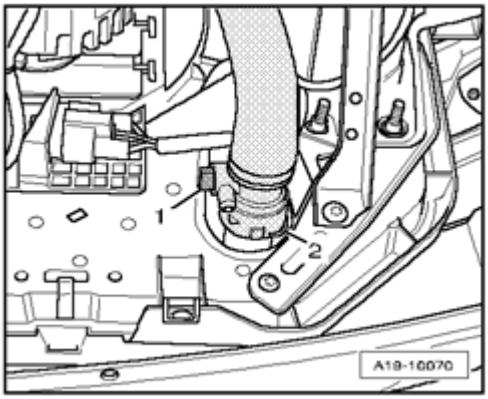

Fig. 34: Identifying Spring Clamp, Expansion Hose & Bracket
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Place clean container under pump.
- Open spring clamp -3- on intake hose and disconnect hose.
- Disconnect expansion hose -4-.

NOTE: On vehicles with pressure switch, first disconnect connector and remove switch.

- Unbolt pump from bracket -1- and -2- (4 bolts).

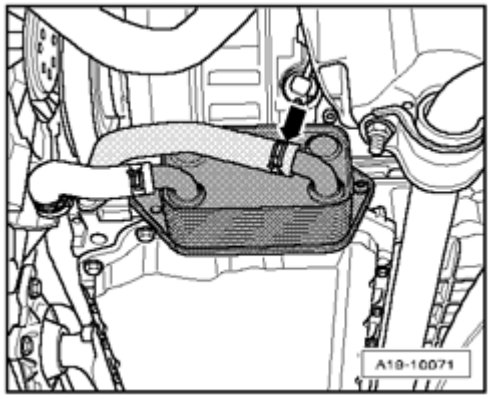

Fig. 35: Removing Coupling Link Nut From Stabilizer Bar
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove coupling link nut from stabilizer bar.
- Remove upper nut on ball joint.

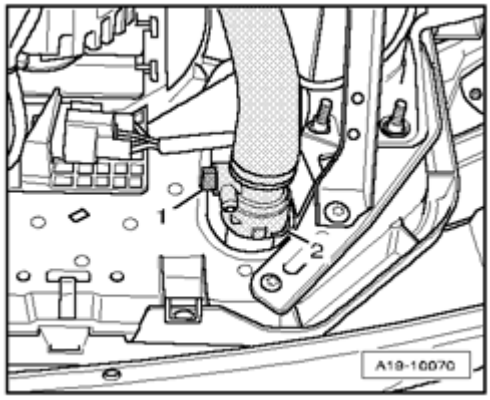

Fig. 36: Installing Ball Joint Splitter
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Install ball joint splitter as shown in illustration and press out ball joint.

NOTE: To protect ball joint threads leave nut on a few turns.

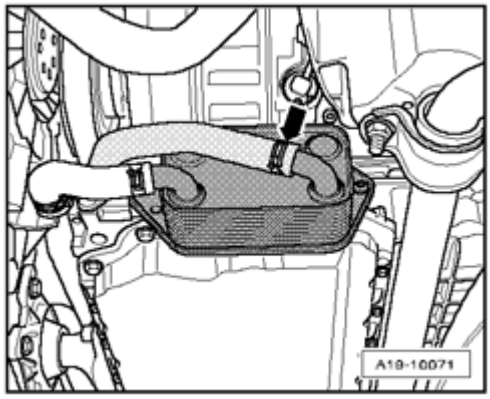

Fig. 37: Identifying Subframe Bolts, Steering Gear Bolts & Pendulum Support Bolts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts -1- for steering gear and bolts -2- for pendulum support.
- Unbolt bracket for line to hydraulic fluid reservoir at steering gear (right).
- Detach rubber mount at front exhaust pipe.
- Place engine/transmission jack V.A.G 1383 A with universal support 1359/2 under subframe.

- Remove subframe bolts -3- and -4-.
- Lower subframe carefully.
- Unbolt heat shield for right-hand drive axle.
- Unbolt left and right drive axles from transmission flanges.

- Move drive axles clear toward rear of vehicle and tie them to bolts provided for this purpose on subframe.
- Remove front exhaust pipe. Refer to **Exhaust system components, removing and installing**.

NOTE: Do not bend the flexible connection on the front exhaust pipe more than necessary (not more than 10°).

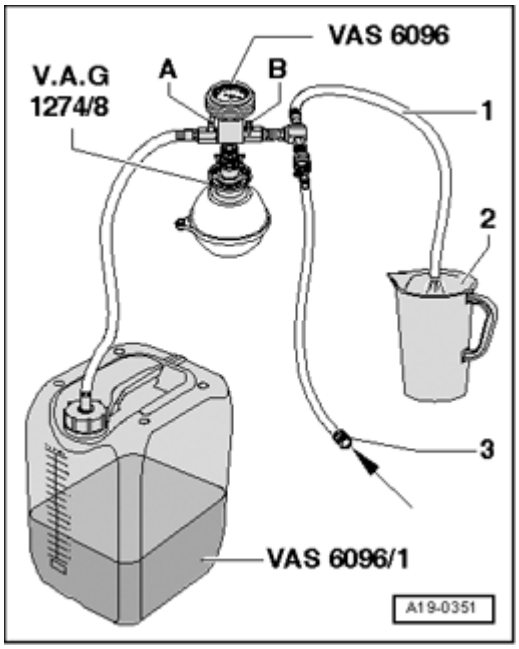

Fig. 38: Disconnecting Hoses And Connectors On Secondary Air Pump
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect hoses and connectors from secondary air pump.
- Remove secondary air pump.

Vehicles with air conditioner:

- Disconnect connector on A/C compressor and move wiring clear.

WARNING: The air conditioner refrigerant circuit must not be opened.

- Detach retainers for refrigerant hoses.

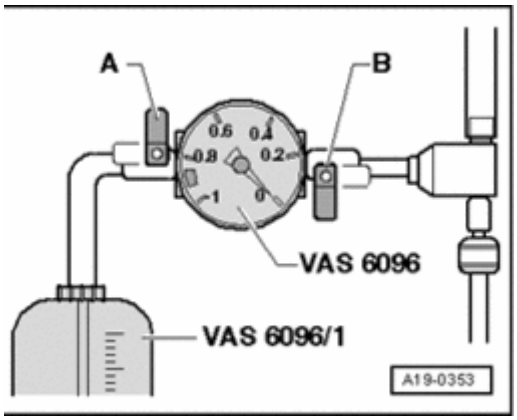

Fig. 39: Unbolting A/C Compressor & Pressing Sliding Bushing Back Into Hole
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unbolt A/C compressor -A-, lift clear and tie up on hood lock together with refrigerant hoses.

NOTE: Before installing compressor press sliding bushing -B- back into hole.

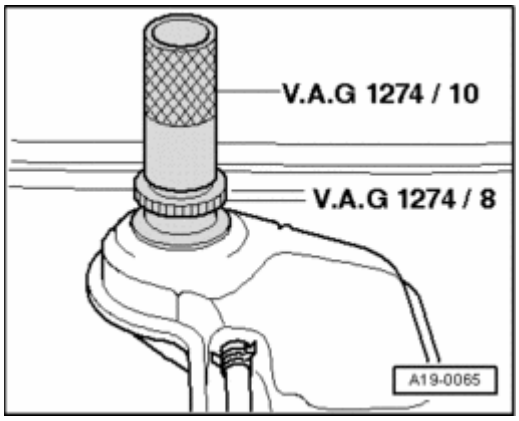

Fig. 40: Using Hose Clamp 3094 To Clamp Off Pressure Hose To Clutch Slave Cylinder
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Using hose clamp 3094, clamp off pressure hose -1- to clutch slave cylinder.
- Pull out retainer toward the top (arrow) and disconnect pressure hose -1- from hose connector.
- Disconnect connector from reversing light switch.

NOTE:

- **Do not depress clutch pedal.**
- **The starter motor is removed in the illustration to give a clear picture.**

- Disengage wiring harness from retainers and place to one side.
- Unbolt drive axle from transmission.

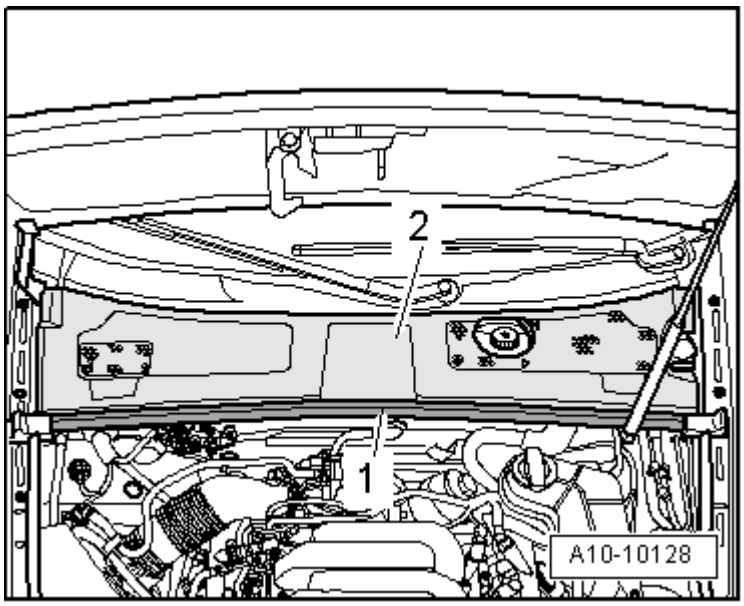

Fig. 41: Locating Engine Carrier Bolts (Engine Side)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Loosen engine/transmission assembly mount on engine side...

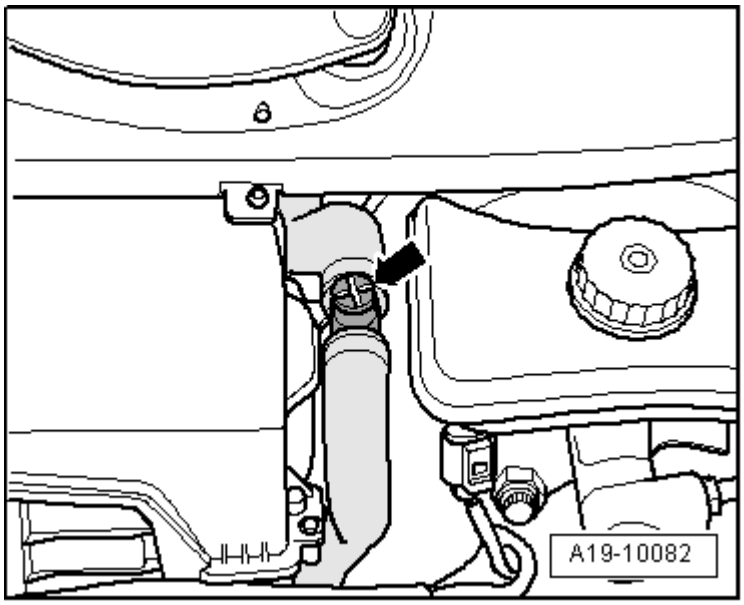

Fig. 42: Locating Transmission Mounting Bracket Bolts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- and on transmission side (about 2 turns only). Do not remove the bolts completely.
- Raise the vehicle.

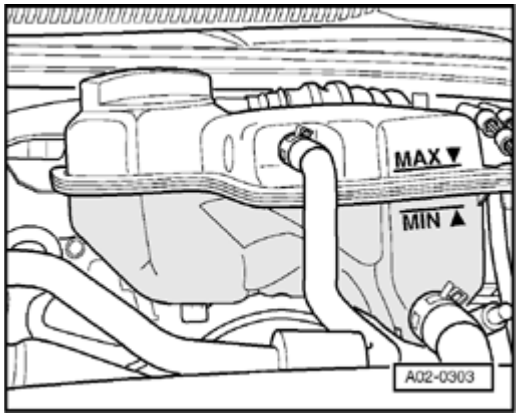

Fig. 43: Identifying Engine Bracket T10012 & Engine/Transmission Jack V.A.G. 1383A
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Bolt engine bracket T10012 to cylinder block with securing nut and bolt (M10 x 25/8.8). Tighten to about 20 Nm.
- Install engine/transmission jack V.A.G 1383A to engine bracket and raise engine/transmission slightly.

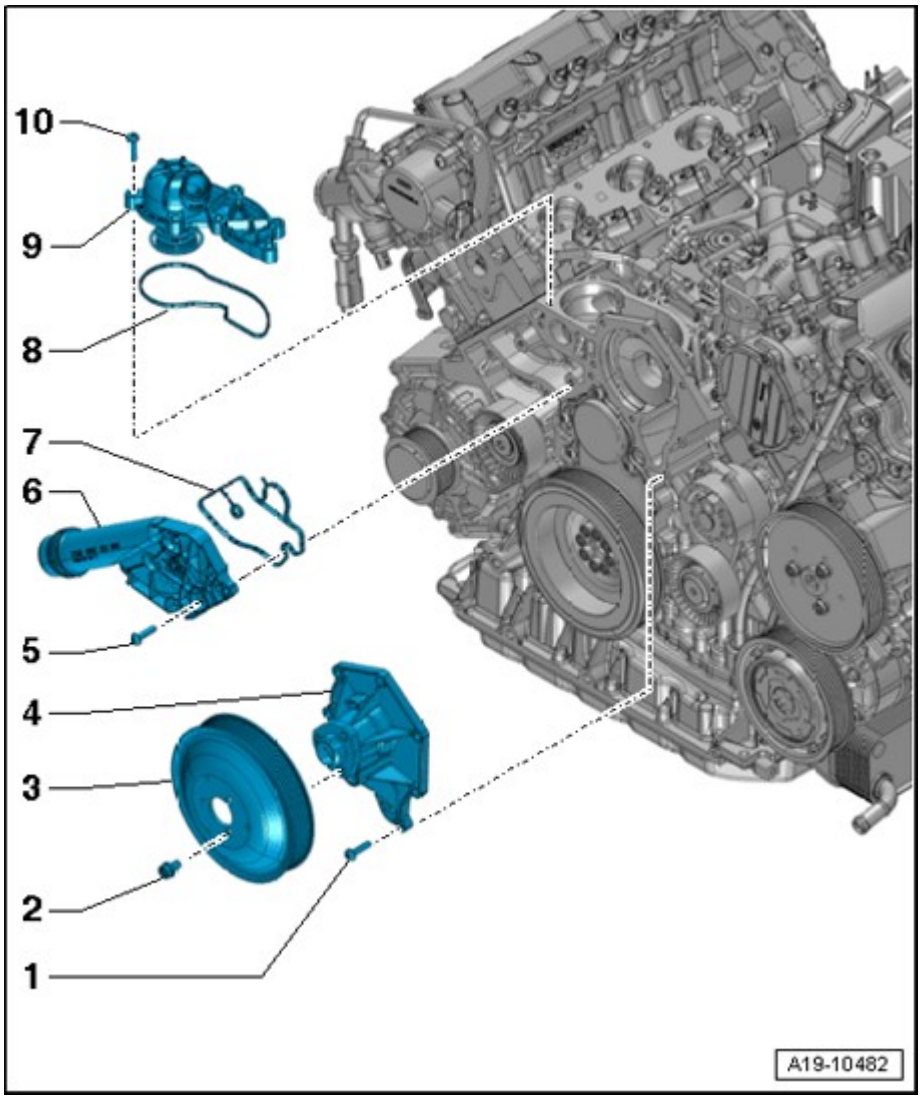

Fig. 44: Locating Engine Carrier Bolts (Engine Side)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unbolt engine/transmission mount on the engine side. (Use step ladder VAS 5085 for access to engine compartment from above.)

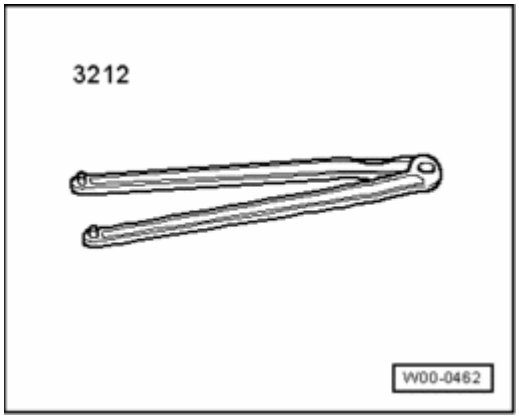

Fig. 45: Locating Transmission Mounting Bracket Bolts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unbolt engine/transmission mount on the transmission side.
- Carefully lower the engine/transmission assembly.

NOTE:

- **Check to make sure that all connections between engine and body have been detached.**
- **The engine/transmission assembly must be carefully guided by a second mechanic while it is being lowered so as to avoid damaging the body panels.**

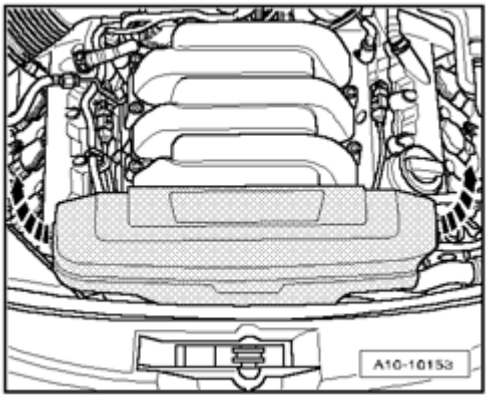

Fig. 46: Removing Bolts And From Bracket On Bevel Box
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts -1- and -2- from bracket on bevel box.

NOTE: The bracket cannot be removed.

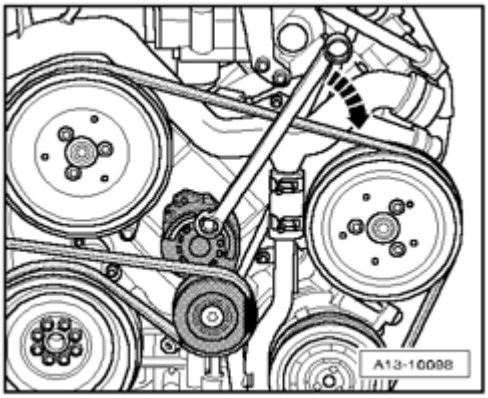

Fig. 47: Removing/Installing Bolt & Small Cover Plate
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- With transmission still in position, remove bolt -1- (wrench width = 10 mm) and pull out small cover plate -2- toward the top.

NOTE: The transmission is removed in the illustration to give a clear picture.

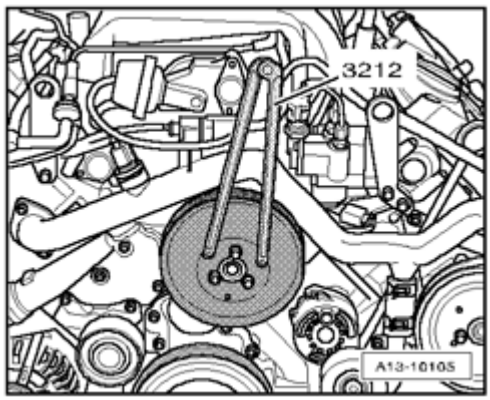

Fig. 48: Removing Bolts On Engine/Transmission Flange
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts -1- to -8- on engine/transmission flange.
- Separate engine from transmission.

Engine, attaching to engine stand

Before carrying out repair work, attach the engine to support clamp VW 313 with engine and transmission support VW 540.

Procedure:

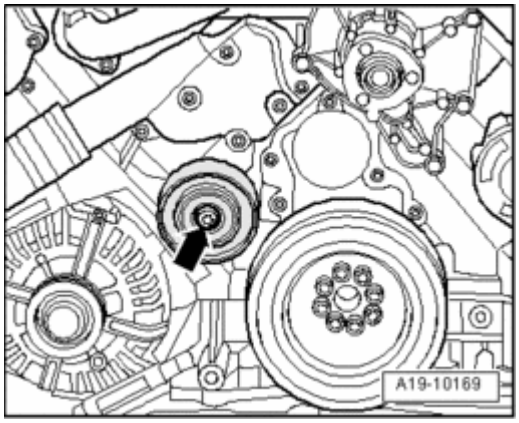

Fig. 49: Attaching Engine Sling 2024 A With Retainer 3180 And Lifting Off Engine/Transmission Jack V.A.G 1383 A With Workshop Crane V.A.G 1202 A
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Attach lifting tackle 2024 A with retainer 3180 as illustrated. Using workshop crane V.A.G 1202 A, lift

engine off engine/transmission jack V.A.G 1383 A.

- Pulley end:

2nd hole on support bar in position 1

- Flywheel end:

3rd hole on support bar in position 5

WARNING: Always use split pins to secure hooks and retainer pins.

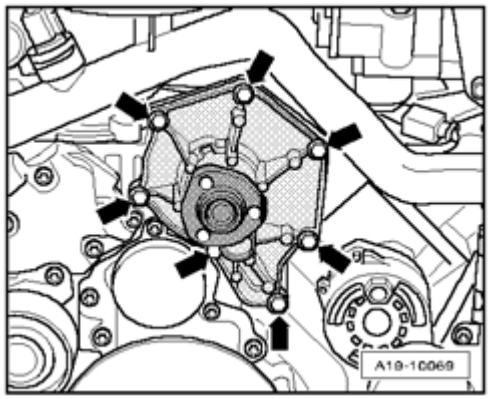

Fig. 50: Identifying Engine Fastened Using Holding Fixture VW 540 & Holding Fixture VW 313
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Secure engine to engine/transmission support VW 540 and fit to support clamp.

Installing

NOTE: When carrying out repairs, always replace seals and gaskets as well as self-locking nuts and bolts which have a specified tightening angle.

Installation is carried out in the reverse order, when doing this note the following:

- Check whether the dowel sleeves for centering engine/transmission are in the cylinder block, install if necessary.

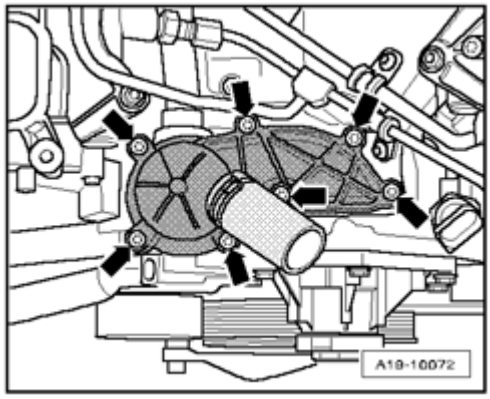

Fig. 51: Identifying Intermediate Plate, Sealing Flange And Dowel Sleeves
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Engage intermediate plate on sealing flange, and press onto dowel sleeves (arrows).
- Make sure that clutch plate is properly centered.
- Check clutch release bearing for wear, replace if necessary.
- Lightly grease clutch release bearing, release bearing guide sleeve and splines on input shaft with G 000 100.

- Bleed clutch system:

Refer to **30 CLUTCH**

- Before securing transmission to engine, insert transmission bracket behind right-hand drive axle flange.

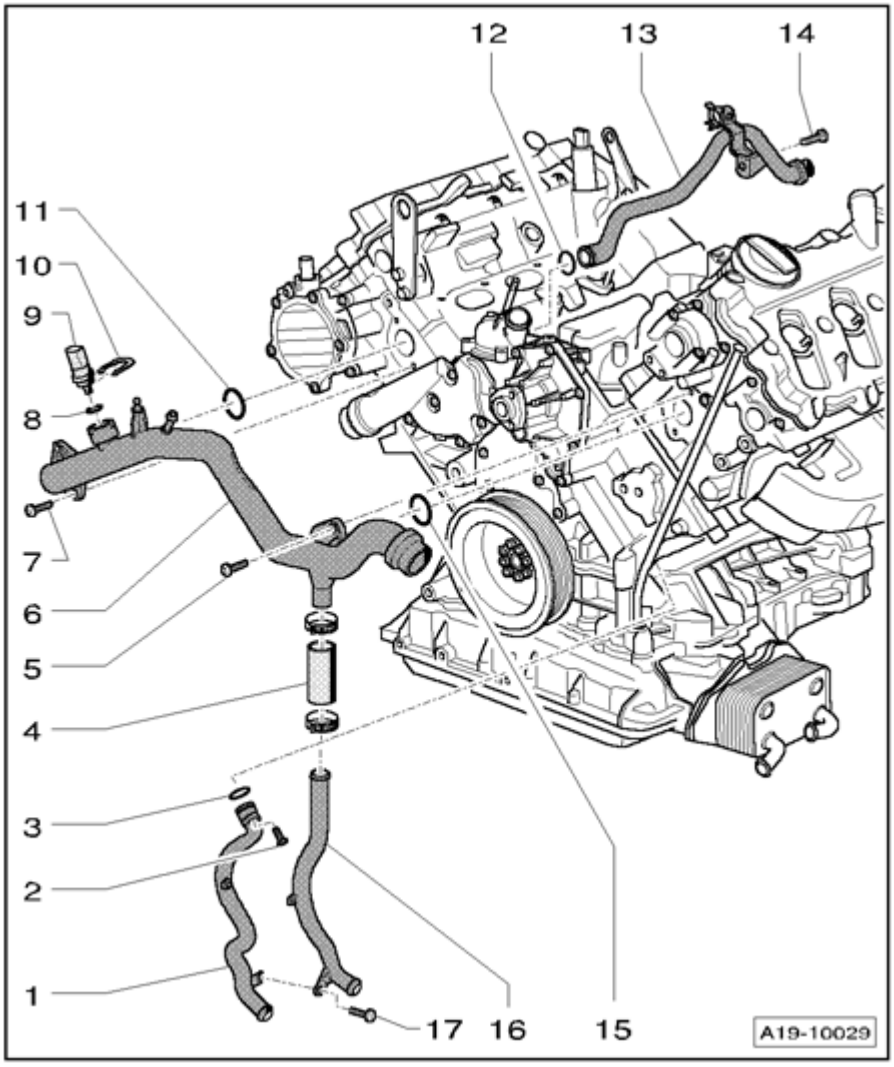

Fig. 52: Removing/Installing Bolt & Small Cover Plate
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Slide in small cover plate -2- so that bottom lug on crankcase engages, and secure at the top with bolt -1- (wrench width = 10 mm).

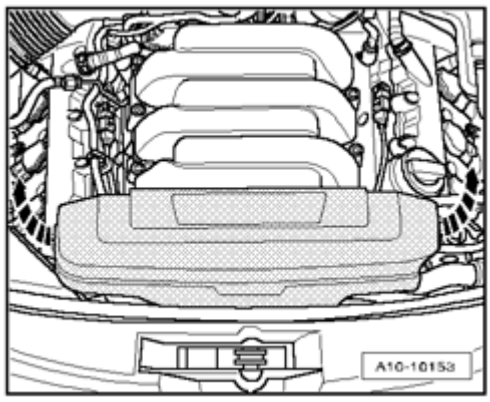

Fig. 53: Identifying Engine Supports Bolts & Distance Between Engine Console & Support Arm
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Align engine mounts so that distance -a- , (measured on right-hand mount) is approx. 13 mm. It should be possible to insert a 12 mm flat iron bar without difficulty (e.g. special tool 2011). To move engine in engine console, bolts -b- on left and right engine supports must be loosened about 2 turns. Adjusting engine mounts. Refer to **Engine mounts, adjusting**
- Attach selector cables to transmission and adjust:

Refer to **34 MANUAL TRANSMISSION - CONTROLS, HOUSING** ; Removing and installing selector cables

- Installing power steering vane pump:

Refer to **48 STEERING** ; Removing and installing pump

Vehicles with air conditioner:

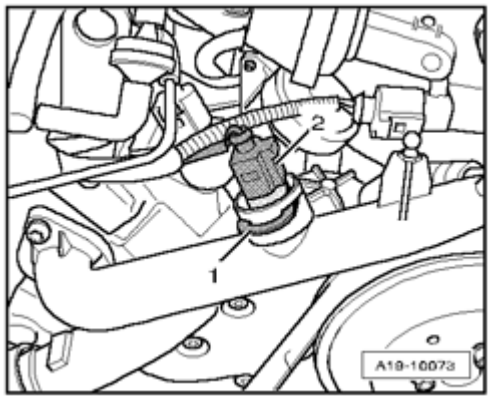

Fig. 54: Knocking Back Threaded Bushings For Mount Bolts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- To facilitate installing the air conditioner compressor, knock back threaded bushings -B- for mount bolts -A- slightly in the direction indicated (arrow).

All vehicles:

- Install ribbed belt. Refer to **Installing ribbed belt**.
- Install front exhaust pipe. Refer to **Front exhaust pipe, removing and installing**.

NOTE: Avoid excessive bending of the de-coupling element (no more than 10°).

- Stress-free alignment of exhaust system. Refer to **Exhaust system, aligning free of stress**.
- Connect coolant hoses. Refer to **Fig. 185**.
- Connect vacuum hoses. Refer to **Fig. 211**

- Fill up with coolant. Refer to **Filling**.

NOTE:

- **Drained-off coolant may only be used again if the original cylinder head and cylinder block are re-installed.**
- **Do not use coolant that is dirty or contaminated.**

- Check the oil level before starting engine. Refer to **Oil level, checking**.
- Electrical connections and routing:

Refer to Electrical Wiring Diagrams, Troubleshooting & Component Locations

- After connecting battery terminals, enter anti-theft code for radio

Refer to Radio operating instructions

WARNING: If a battery charger is used to give the engine an assisted start, there is a risk that the control units in the vehicle will be damaged.

- Close electric windows in front doors all the way to their top positions using electric switches.
- Then operate all electric window switches again for at least one second in the "close" direction to activate the automatic one-touch function.
- Set clock to correct time.
- Perform adaption of throttle valve control module:

Refer to

- **24 MULTIPORT FUEL INJECTION (MFI)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): AMU
- **24 MULTIPORT FUEL INJECTION (MFI)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): ATC
- **24 MULTIPORT FUEL INJECTION (MFI)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): AWP
- **24 MULTIPORT FUEL INJECTION (MFI)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): BEA

; Performing adaptation of throttle valve control module

- Interrogate malfunction memory:

Refer to

- **01 ON BOARD DIAGNOSTIC (OBD)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): AMU

- **01 ON BOARD DIAGNOSTIC (OBD)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): ATC
- **01 ON BOARD DIAGNOSTIC (OBD)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): AWP
- **01 ON BOARD DIAGNOSTIC (OBD)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): BEA

; DTC memory, checking and erasing

NOTE: DTCs will have been stored in the memory because connectors have been disconnected. Therefore interrogate and erase DTC memory after installing engine.

Tightening torques

NOTE:

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

- Tightening torque for screw clamps: 2 Nm

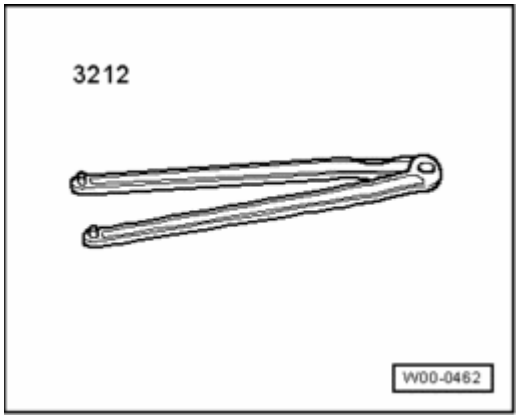

Fig. 55: Removing Bolts On Engine/Transmission Flange
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Engine/transmission mounts (manual transmission)

A: centering sleeves

Item No.	Bolt	Nm
1	M12 x 55	65

2	M12 x 55 1)	65
3	M12 x 140 1)	65
4	M12 x 140 1)	65
5	M10 x 50	45
6	M10 x 70	45
7	M10 x 50	45
8	M12 x 55	65

1) Bolt with M8 stud

Components		**Nm**
Bolts/nuts	M6	10
	M8	20
	M10	45
	M12	65
Except for the following:		
Drive axles to transmission	M8	40
Engine support to engine console		85
Transmission support to transmission console 1)		60 + 90°
Drive plate to		
Torque converter	M10 x1	85
Pendulum support to transmission 1)		40 + 90° 2)
Pendulum support to subframe1)		20 + 90° 2)
Front exhaust pipe to turbocharger		40
A/C compressor to bracket		45
Drive axle heat shield to cylinder block		35
Nuts for clamp		40

1) stretch bolts - replace

2) 90° is a quarter turn

Engine mounts, adjusting

- Unbolt hydraulic fluid reservoir above right-hand engine mount and pull to one side.

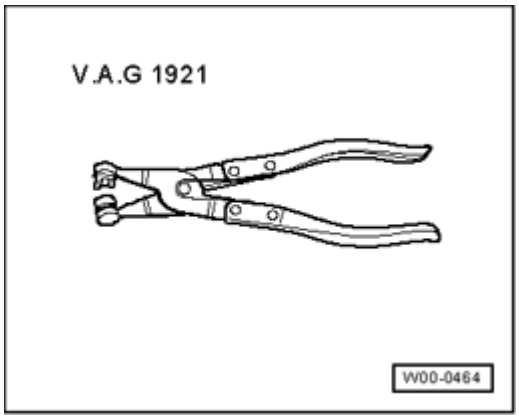

Fig. 56: Identifying Engine Supports Bolts & Distance Between Engine Console & Support Arm
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Distance -a- between engine console -1- and support arm -2- of right-hand engine mount should be about 13 mm. It should be possible to insert a 12 mm flat iron bar without difficulty (e.g. special tool 2011).

If the gap is too narrow or too wide, proceed as follows:

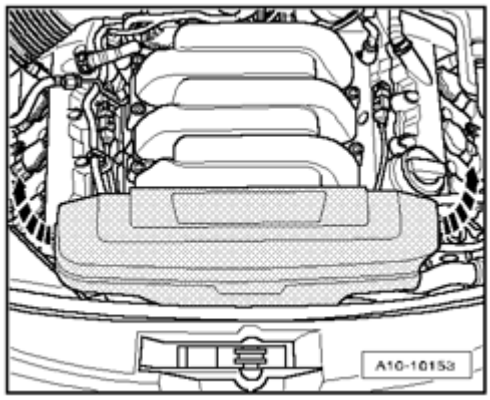

Fig. 57: Identifying Air Hose, Mass Air Flow Sensor & Bolts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove air hose -4- from mass air flow sensor.
- Disconnect electrical connectors for mass air flow sensor -1-.
- Remove bolts -2- and -3-, then remove air cleaner housing.

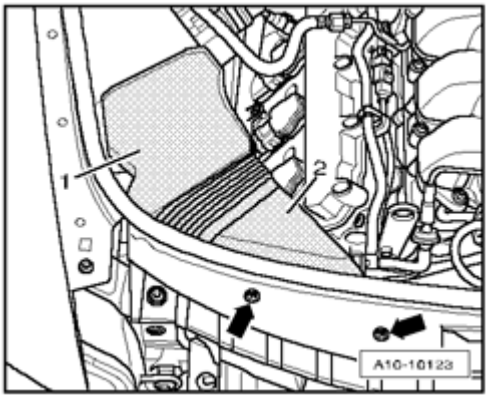

Fig. 58: Setting Up Engine Support 10-222A On Two Wing Panel Flanges And Set Up With Supports 10-222A/1 And Two Spindles
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Set up engine support 10-222A on the two wing panel flanges and set up with supports10-222A/1 and two spindles.
- Bolt retainer 3180 to the right-hand lifting eye and engage on hook at end of right-hand spindle.
- Engage hook at end of left-hand spindle in left-hand lifting eye.
- Raise the engine slightly, taking up the weight evenly on both spindles.

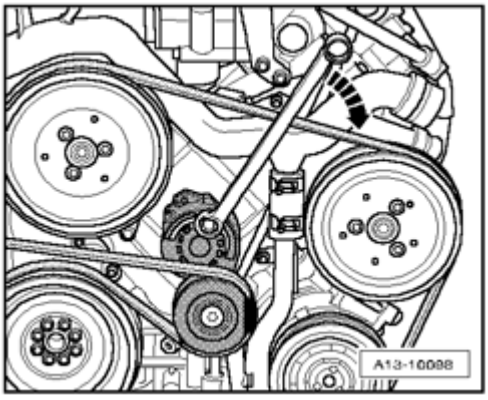

Fig. 59: Identifying Engine Supports Bolts & Distance Between Engine Console & Support Arm
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Slacken bolts -b- on left and right-hand support arms by about two turns each.
- Insert an iron bar between engine console and support arm, then move engine until gap -a- measures 13 mm.
- Tighten (by hand) all four bolts -b- on left and right-hand support arms.
- Then tighten all four bolts to 85 Nm.

Note the following important points when installing:

Tightening torques. Refer to **Tightening torques**

- Routing of ribbed belt on vehicles without air conditioner. Refer to **Fig. 1 Ribbed belt on vehicles without air conditioner**.
- Routing of ribbed belt on vehicles with air conditioner. Refer to **Fig. 2 Ribbed belt on vehicles with air conditioner**.

NOTE:

- **Pumps supplied as spare parts are not filled with fluid. For this reason, the pump must be filled with G 002 000 hydraulic fluid and rotated by hand before installation. The pump may otherwise be damaged or noisy during operation.**
- **There should not be any paint on the contact surfaces or threads on either side of the vane pump.**
- **Do not reuse drained hydraulic oil.**
- **Replace O-rings.**

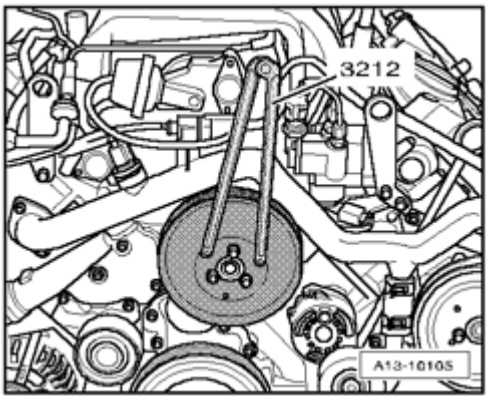

Fig. 60: Installing Spring Clip And Suction Hose
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Install spring clip and suction hose as shown in the illustration.
- Longitudinal mark -A- on suction hose must line up with seam on pump.
- Install spring clip no further than transverse mark -B-.

13 ENGINE - CRANKSHAFT, CYLINDER BLOCK

ENGINE, DISASSEMBLING AND ASSEMBLING

Ribbed belt, removing and installing

NOTE:

- **The following illustration shows the belt drive on vehicles without air conditioner.**
- **Before removing the ribbed belt, mark the direction of rotation using chalk or a felt marker pen. If the belt rotates in the wrong direction when it is reinstalled, this can cause breakage. Ensure that the belt is properly**

seated in the pulleys when installing.

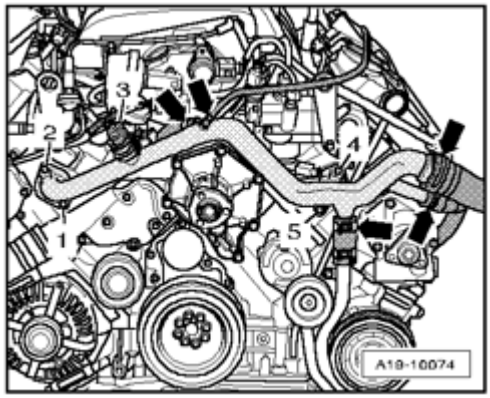

Fig. 61: Ribbed Belt Remove/Install Components
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - 25 Nm

2 - Tensioning element for ribbed belt

- Turn with open-end wrench to loosen ribbed belt. Refer to **Removing ribbed belt**

3 - Vibration damper

- With pulley for ribbed belt
- Can only be installed in one position

4 - 25 Nm

5 - Alternator

- Removing and installing:

Refer to **27 BATTERY, STARTER, GENERATOR, CRUISE CONTROL** ; Removing and installing alternator

- To facilitate the positioning of alternator on bracket, knock back threaded bushings for retaining bolts slightly

6 - 25 Nm

7 - Bracket

- Illustration shows version for vehicles without air conditioner

8 - 45 Nm

9 - 25 Nm

10 - Banjo bolt, 30 Nm

11 - Sealing ring

- Always replace

12 - Pressure line

13 - Sealing ring

- Always replace

14 - Vane pump

- For power steering
- Removing and installing:

Refer to **48 STEERING** ; Removing and installing vane pump

- To facilitate positioning of vane pump on bracket, knock back threaded bushings for retaining bolts slightly

15 - Pulley

- For vane pump

16 - 25 Nm

17 - 25 Nm

18 - Ribbed belt

- Position of ribbed belt on vehicles without air conditioner. See **Fig. 1 Ribbed belt on vehicles without air conditioner**
- Position of ribbed belt on vehicles with air conditioner. See **Fig. 2 Ribbed belt on vehicles with air conditioner**
- A double ribbed belt is installed on engines with A/C compressor
- Mark direction of rotation before removing

- Check for wear
- Do not kink
- Removing ribbed belt. Refer to **Removing ribbed belt**
- Installing ribbed belt. Refer to **Installing ribbed belt**

Ribbed belt on vehicles without air conditioner

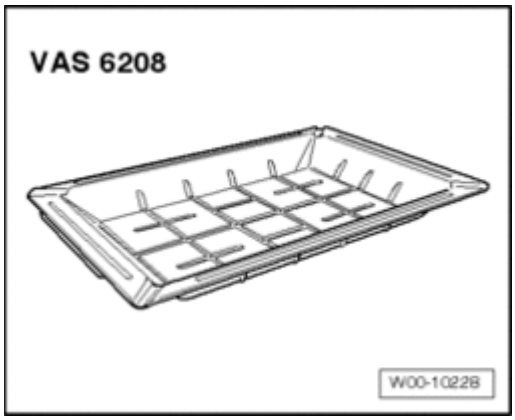

Fig. 62: Ribbed Belt On Vehicles Without Air Conditioner
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Ribbed belt on vehicles with air conditioner

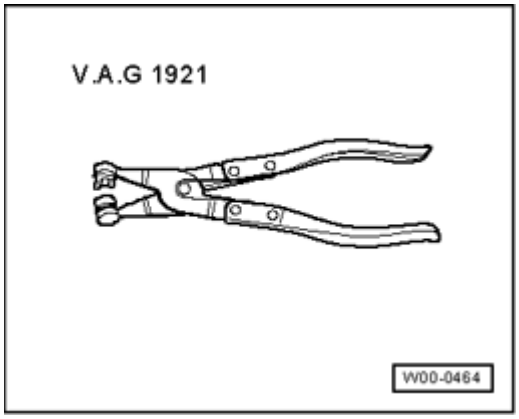

Fig. 63: Ribbed Belt On Vehicles With Air Conditioner
Courtesy of VOLKSWAGEN UNITED STATES, INC.

NOTE: Engines with an air conditioner compressor are installed with a double ribbed belt.

Installing air conditioner compressor

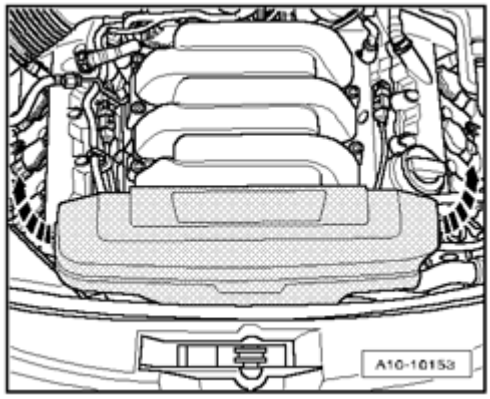

Fig. 64: Installing Air Conditioner Compressor
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- To facilitate the positioning of the A/C compressor, knock back threaded bushings -B- for retaining bolts -A- slightly in direction indicated (arrow).
- Tighten bolts to 45 Nm.

Removing ribbed belt

NOTE: Mark the direction of rotation with chalk or felt pen before removing the ribbed belt. If the belt rotates in the wrong direction when it is reinstalled, it can break. Ensure that the belt is properly seated in the pulleys when installing.

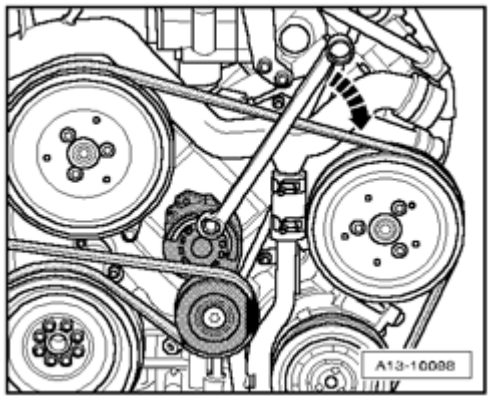

Fig. 65: Slackening Ribbed Belt
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- To loosen ribbed belt turn tensioning element in direction of arrow.
- Remove ribbed belt.

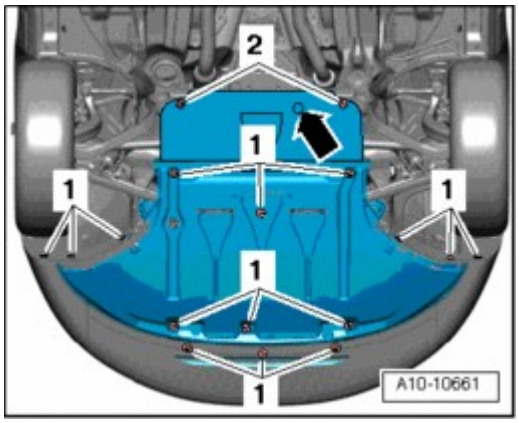

Fig. 66: Blocking Tensioner With 3090
Courtesy of VOLKSWAGEN UNITED STATES, INC.

The tensioning element can be locked in position with a suitable punch (4.5 mm diameter, approx. 55 mm long). Connecting rod support 3090 can also be used.

Installing ribbed belt

NOTE: Before installing the ribbed belt ensure that all sub-assemblies (alternator, air conditioner compressor, vane pump) are tight.

- Install ribbed belt.

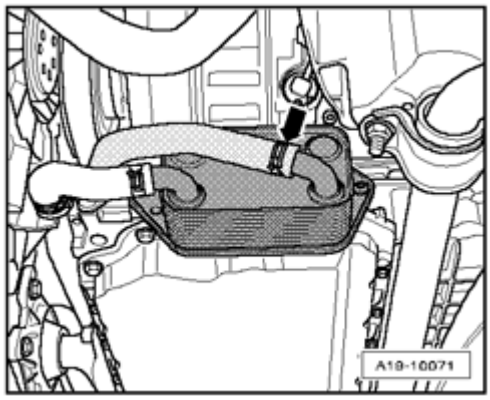

Fig. 67: Slackening Tensioning Element For Ribbed Belt & Pulling Out Punch Or Corned Support 3090
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Slacken tensioning element for ribbed belt. Pull out punch or corned support 3090 (arrows).
- Start engine and check belt running.

NOTE: Engines with an air conditioner compressor are installed with a double ribbed belt.

Toothed belt, removing and installing

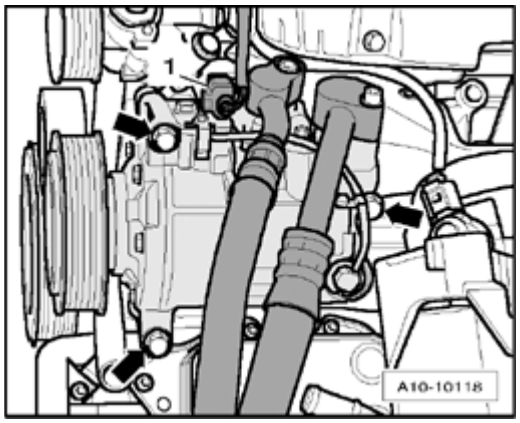

Fig. 68: Toothed Belt Remove/Install Components
Courtesy of VOLKSWAGEN UNITED STATES, INC.

NOTE: Mark the direction of rotation before removing the toothed belt. If a used belt rotates in the wrong direction when reinstalled, this can result in breakage.

1 - Engine support

- Removing. Refer to **Removing toothed belt**, removing toothed belt

2 - 45 Nm

3 - Toothed belt guard - top

- To remove belt guard, it may be necessary to unbolt retainer for coolant return line (for turbocharger).

4 - Toothed belt

- Mark direction of rotation before removing
- Check for wear
- Do not kink
- Removing. Refer to **Toothed belt, removing and installing**
- Installing and adjusting timing. Refer to **Installing (adjusting valve timing)**

5 - Idler roller

6 - 27 Nm

7 - 65 Nm

- Use counter-hold 3036 to loosen and tighten

8 - Camshaft sprocket

- For exhaust camshaft
- To remove and install, first remove toothed belt. Refer to **Toothed belt, removing and installing**
- Note installation position: The camshaft sprocket is installed with the smaller side facing out and the TDC marking for cylinder 1 visible

9 - Tensioning roller

10 - Washer

11 - Tensioner for toothed belt

12 - O ring

- Always replace
- Lightly coat with coolant G 012 A8 D before installing

13 - Coolant pump

- Removing and installing. Refer to **Coolant pump, removing and installing**

14 - 15 Nm

15 - Crankshaft sprocket

- Contact surface between sprocket and crankshaft must be free of oil.
- Can only be installed in one position.

16 - 90 Nm plus an additional 1/4turn (90°)

- Replace
- Counter-hold with 3099 to loosen and tighten
- Place 2 washers between sprocket and retainer when screwing on retainer

17 - 15 Nm

18 - 20 Nm

19 - Toothed belt guard - center

20 - Toothed belt guard - bottom

21 - 10 Nm

Removing toothed belt

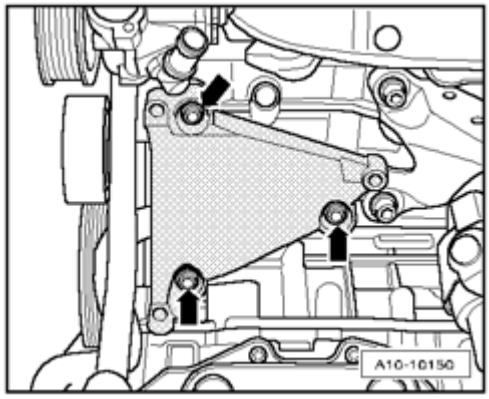

Fig. 69: Identifying Support Assembly 10-222A
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools, testers and workshop equipment required:

- 10-222A

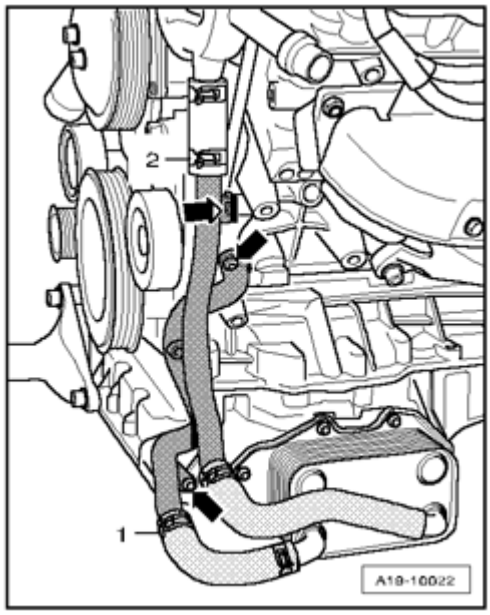

Fig. 70: Identifying Support Assembly 10-222A/1
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- 10-222A/1

- Engine in vehicle

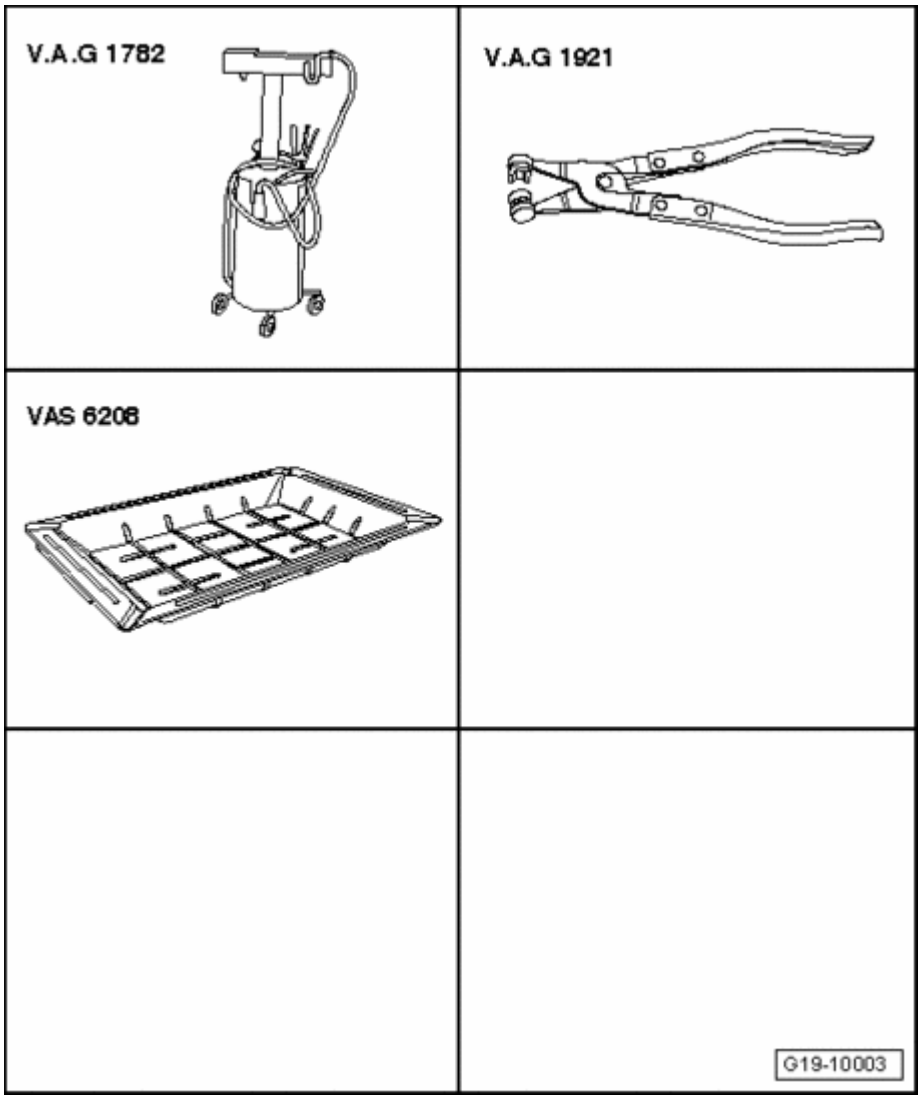

Fig. 71: Removing Noise Insulation Panels (Center, Left And Right)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove sound insulation panels in center and on the right (arrows).
- Removing ribbed belt and tensioning element. Refer to **Ribbed belt, removing and installing**.

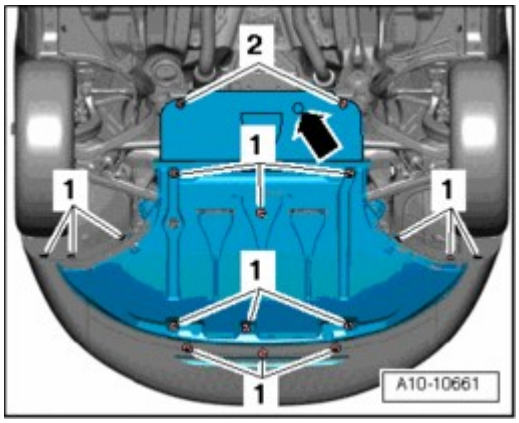

Fig. 72: Detaching Coolant Expansion Tank And Power Steering Reservoir
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Detach coolant expansion tank and power steering reservoir (arrows) and move to one side with the hoses connected.
- Disconnect vacuum hose from activated charcoal filter and from connection on throttle valve.
- Unplug electrical connectors on coolant expansion tank and activated charcoal filter.
- Remove toothed belt guard (top).

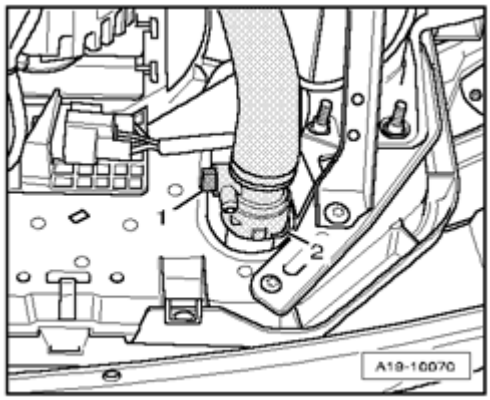

Fig. 73: Engine Support Bridge 10 - 222 A Install With Bracket For Engine 10 - 222 A/1
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Install engine support bracket 10-222 A with supports10-222 A/1.
- Fix retainer 3180 to right lifting eye and and attach to engine support bracket 10-222 A.
- Lift engine slightly with spindle of engine support bracket 10-222 A.

NOTE: Lift coolant expansion tank and power steering reservoir and tie them in place on the engine support bracket.

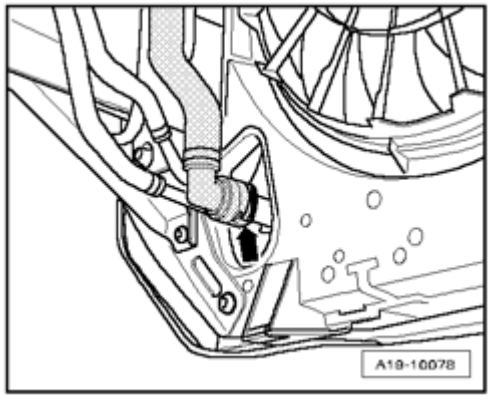

Fig. 74: Setting Crankshaft To Markings For TDC Of No. 1 Cylinder
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Set crankshaft to markings for TDC of No. 1 cylinder (arrows) by turning central bolt on crankshaft sprocket in direction of rotation.
- Remove vibration damper, making sure not to change the TDC position.
- Remove center and bottom sections of toothed belt guard.

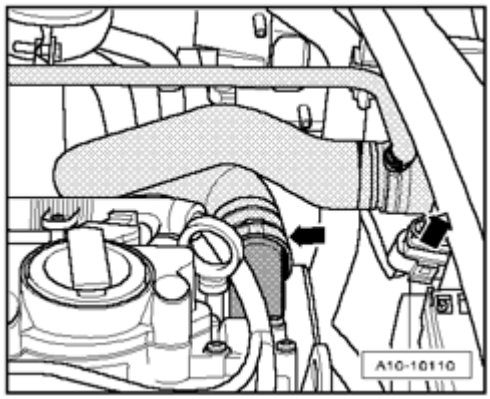

Fig. 75: Unbolting Engine Support From Engine Console And Engine Console From Body
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unbolt engine support from engine console and engine console from body -arrows-.
- Unbolt connecting piece between engine console and body.
- Take out engine console.

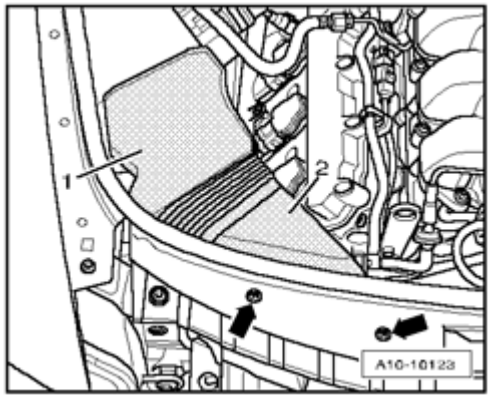

Fig. 76: Identifying Engine Bracket-To-Cylinder Head Bolts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts for engine support (arrows) but do not take out the engine support.

NOTE: To remove the bolts for the engine support, raise or lower the engine slightly as necessary via the spindles on engine support bracket 10-222A.

- Mark direction of rotation of toothed belt with chalk or felt pen.

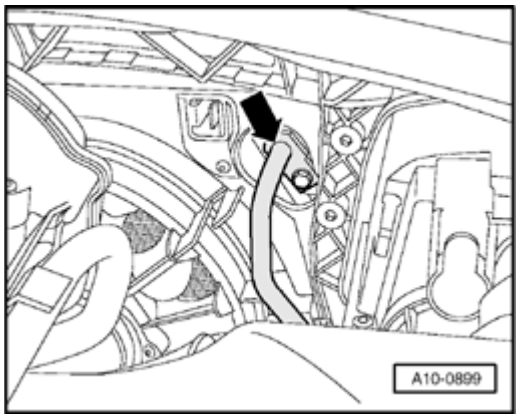

Fig. 77: Screwing Stud Into Toothed Belt Tensioning Element & Hex Nut Onto Stud Using Large Washer
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Screw M5x55 stud -1- into toothed belt tensioning element. Screw hex nut -2- onto stud -1- using a large washer -3-.
- Only tension piston of tensioning element as far as necessary to secure it with a locking pin (e. g. from lifting appliance 2024 A) (arrow).
- Pull out toothed belt through space between engine support and cylinder block.

Installing (adjusting valve timing)

NOTE:

- **The position of the toothed belt must be set as described below, even after repairs in which the belt is only taken off the camshaft sprocket.**

- **When turning the camshaft the crankshaft must not be at TDC. Danger of damage valves/piston crown.**

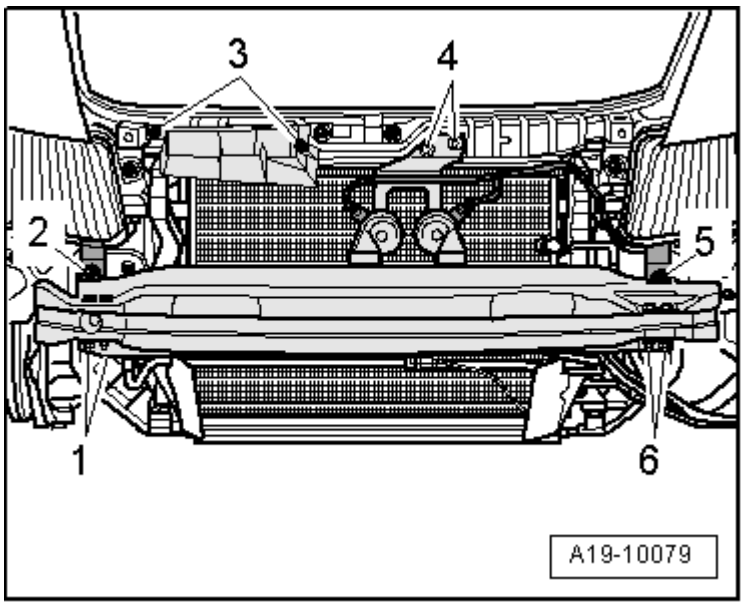

Fig. 78: Setting Crankshaft To Markings For TDC Of No. 1 Cylinder
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Align camshaft sprocket mark with marking on cylinder head cover.
- Place toothed belt on crankshaft sprocket (note direction of rotation).
- Install toothed belt guard - lower part.
- Install vibration damper (note installation position: hole in vibration damper is over projection on toothed belt sprocket).

- Align vibration damper marking with marking on lower part of toothed belt guard.
- Install toothed belt onto coolant pump, then tensioning roller, and finally camshaft sprocket.

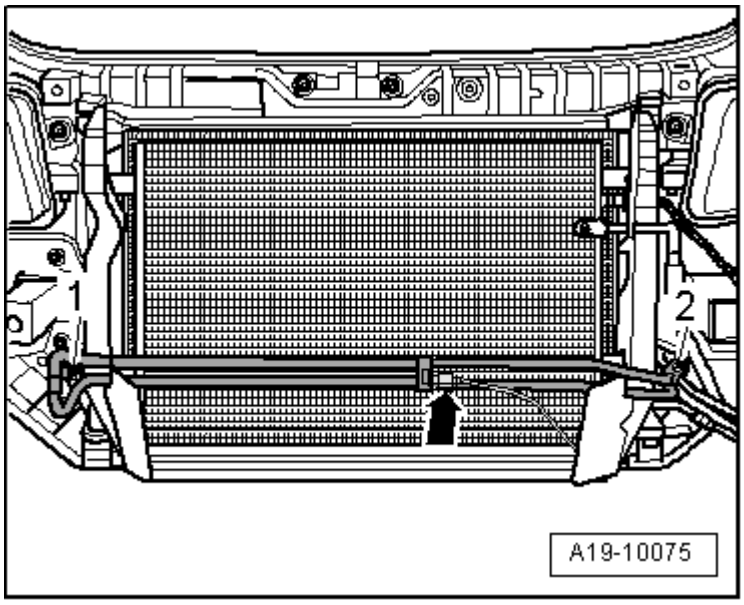

Fig. 79: Pulling Out Locking Pin, Loosening Piston Of Toothed Belt Tensioning Element & Removing Stud
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Pull out locking pin (arrow) and loosen piston of toothed belt tensioning element. Remove stud -1-.
- Turn crankshaft two complete turns in engine direction of rotation, set again to TDC and check adjustment.
- Install engine support and console.
- Remove engine support bracket 10-222 A with retainer 3180.

- Install toothed belt guard (center and top sections).
- Installing ribbed belt and tensioning element. Refer to **Ribbed belt, removing and installing**.
- Install and secure coolant expansion tank and power steering reservoir.

Tightening torques

Component		Nm
Bottom section of toothed belt guard to cylinder block		10
Center section of toothed belt guard to cylinder block		10
Vibration damper to crankshaft		25
Engine support to cylinder block		45
Engine support to engine console 1)		60 + 90° 2)
Engine console to body 1)		40 + 90° 2)
Coolant expansion tank to body		10
Power assisted steering reservoir to body		10

1) stretch bolts - replace

2) 90° is a quarter turn

SEALING FLANGE AND FLYWHEEL, REMOVING AND INSTALLING

Sealing flange and flywheel, removing and installing

NOTE:

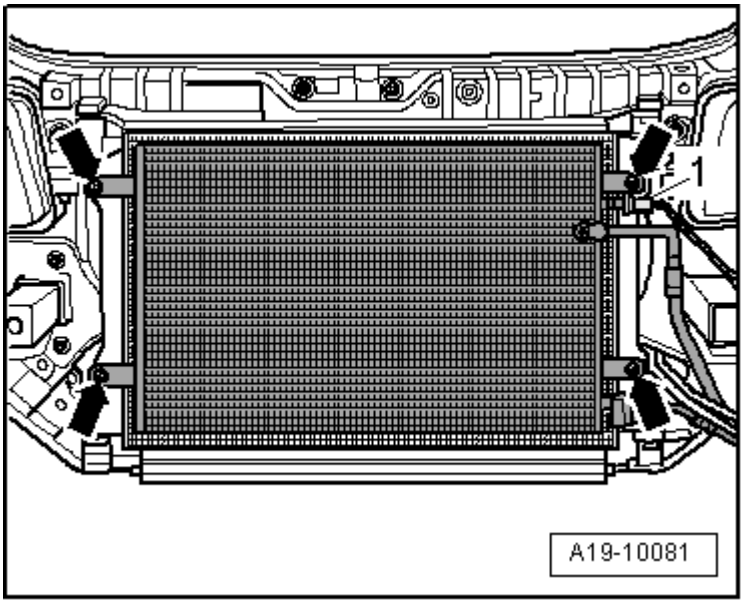

Fig. 80: Identifying Sealing Flanges And Flywheel/Drive Plate
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- For repairs to the clutch:

Refer to **30 CLUTCH** ; servicing clutch

- When working on the engine, it should be secured to the engine stand using the engine bracket VW 540.

1 - 90 Nm plus an additional 1/4turn (90°)

- Always replace
- Counter-hold with special tool 3099 to loosen and tighten
- Place 2 washers between sprocket and special tool when screwing on special tool

2 - Crankshaft sprocket

- Can only be installed in one position.
- Contact surface between sprocket and crankshaft must be free of oil.
- Removing and installing toothed belt. Refer to **Toothed belt, removing and installing**

3 - 15 Nm

4 - Oil seal

- Replacing. Refer to **Crankshaft oil seal (pulley end), replacing**

5 - Sealing flange - front

- Must be located on dowel sleeves
- Removing and installing. Refer to **Front sealing flange, removing and installing**

6 - Cylinder block

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

7 - 60 Nm plus an additional 1/4 turn (90°)

- The half turn further can be done in several stages.
- Always replace

8 - Dual mass flywheel/drive plate

- Can only be installed in one position. Holes are off-set
- Removing and installing dual mass flywheel. Refer to **Dual mass flywheel, removing and installing**
- Removing and installing drive plate. Refer to **Drive plate, removing and installing**

9 - Intermediate plate

- Must be located on dowel sleeves
- Do not damage/bend when assembling
- Is installed on sealing flange. See **Fig. 1 Installing intermediate plate**

10 - Rear sealing flange with oil seal

- With gasket for cylinder block
- Replacement sealing flange has oil seal in different position.
- Remove oil pan in order to remove and install. Refer to **Oil pan, removing and installing**.
- Clean sealing surface before installing

- Must be located on dowel sleeves
- Lightly oil sealing lip of oil seal
- When installing, push guide sleeve from repair kit onto crankshaft.

Installing intermediate plate

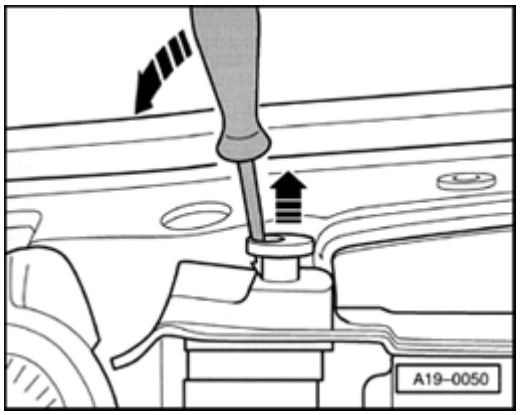

Fig. 81: Identifying Intermediate Plate, Sealing Flange And Dowel Sleeves
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Engage intermediate plate on sealing flange and press onto dowel sleeves (arrows).

Crankshaft oil seal (pulley end), replacing

Removing

- Remove ribbed belt. Refer to **Removing ribbed belt**.
- Remove toothed belt. Refer to **Toothed belt, removing and installing**.
- Remove lower air duct.

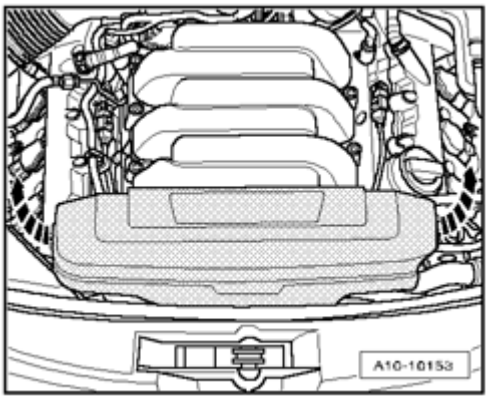

Fig. 82: Identifying Counterhold 3099
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove crankshaft sprocket. To do this counter-hold sprocket with retainer 3099.
- When installing retainer, place 2 washers between sprocket and special tool.

NOTE: On some engines there is a rib on the oil pan flange which prevents retainer 3099 from being attached as shown. In this case proceed as follows:

- Remove bolts from retainer, and screw back in from the reverse side.

- Knock the installed pins in the square bars downward until they are flush with the top surface of the bars.
- Bolt the retainer to the crankshaft (install 2 washers between sprocket and retainer).
- Screw central bolt from sprocket back into crankshaft in order to remove oil seal.

- Remove inner part of oil seal extractor 3203 two turns (approx. 3 mm) out of outer part and lock with knurled screw.

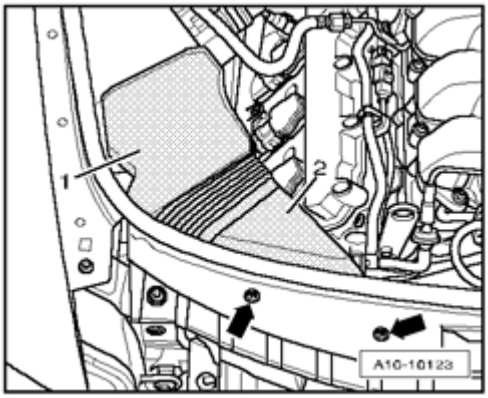

Fig. 83: Loosening Knurled Screw And Turning Inner Part Against Crankshaft Until Oil Seal Is Pulled Out
Courtesy of VOLKSWAGEN UNITED STATES, INC.

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

Installing

- Lightly oil sealing lip of oil seal.

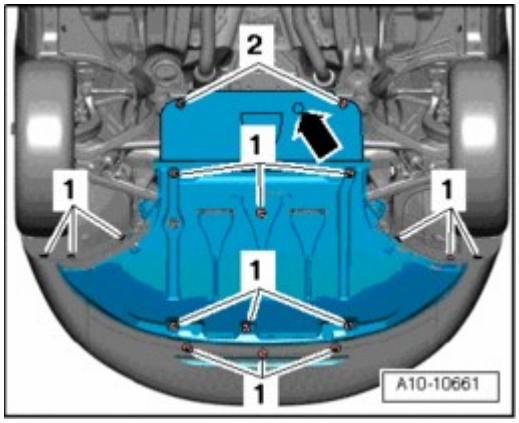

Fig. 84: Identifying Guide Sleeve 2080 A Mount Onto Crankshaft Journal
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Place guide sleeve from 2080 A onto crankshaft journal.

- Slide oil seal over guide sleeve.

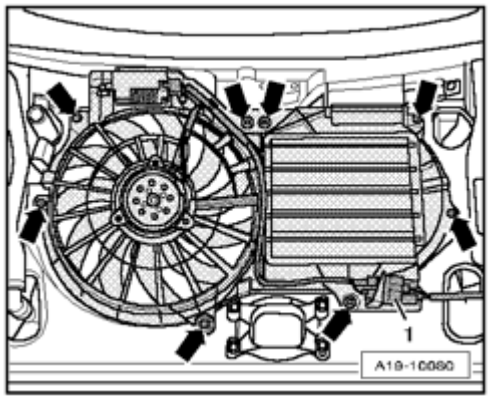

Fig. 85: Pressing Seal With Center Bolt Into Sealing Flange Using Seal Installer 3265
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Press oil seal in until flush with press sleeve from 3265, using central bolt -1- for toothed belt sprocket.
- Install crankshaft sprocket and lock in position with retainer 3099.

NOTE: Replace central bolt for toothed belt sprocket.

- Tighten central bolt.
- Install toothed belt. Refer to **Installing (adjusting valve timing)**.
- Install ribbed belt. Refer to **Installing ribbed belt**.

Tightening torque

Component		Nm
Toothed belt sprocket to crankshaft		90 + 90° 1)

1) 90° = 1/4 turn

Dual mass flywheel, removing and installing

Removing

- Mark installing position of dual mass flywheel on crankshaft with a permanent felt-marker.

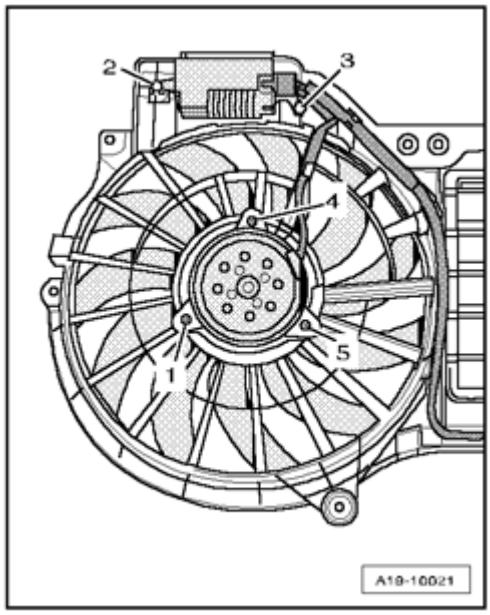

Fig. 86: Inserting Retainer 3067 In Hole On Cylinder Block
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Insert counter-hold tool 3067 in drilling in cylinder block, and engage on flywheel.

- Insertion position for counter-hold tool:

A - To tighten

B - To loosen

- Loosen flywheel bolts.

Installing

- Install dual mass flywheel to crankshaft in the position marked when removing it.
- Install new bolts and tighten.

Tightening torque

Component	Nm
Flywheel to crankshaft	60 + 90° 1)

1) 90° = 1/4 turn

Drive plate, removing and installing

Removing

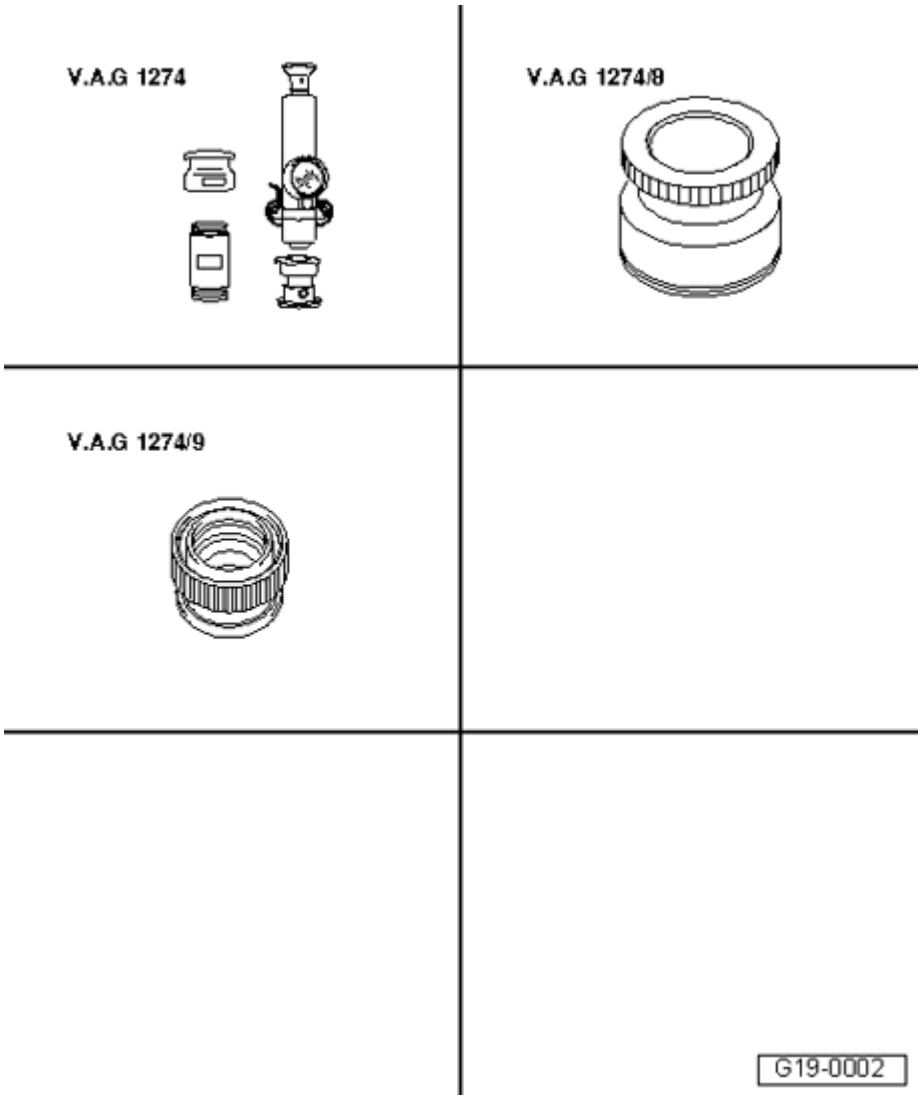

Fig. 87: Securing Counter-Hold Tool VW 558 To Drive Plate With Hexagon Bolt
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Secure counter-hold tool VW 558 to the drive plate with a hexagon bolt M8x45. Place two M10 hexagon nuts -1- between counter-hold tool and drive plate.
- Loosen securing bolts on drive plate.

Installing

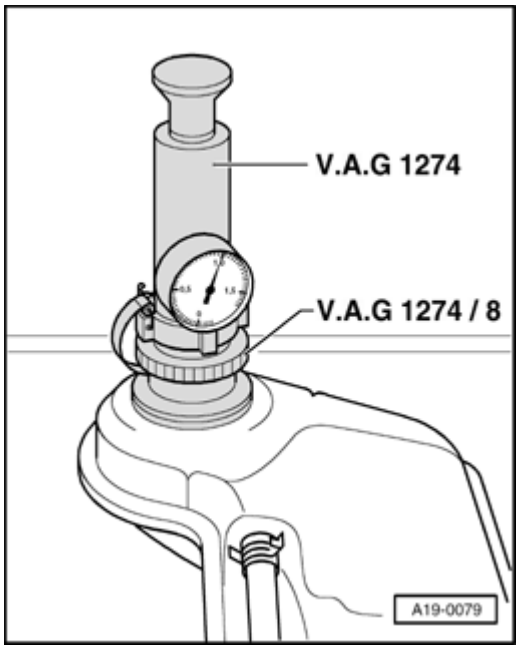

Fig. 88: Identifying Drive Plate, Grooved Washer & Bolts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Install drive plate using packing plate with notches -1-.
- Insert at least 3 of the old securing bolts -3- and tighten to 30 Nm.

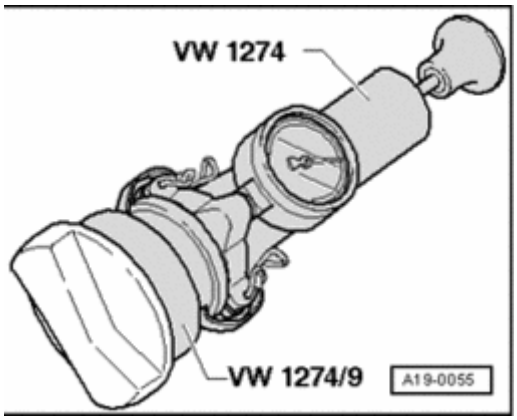

Fig. 89: Checking Installation Position Of Drive Plate By Measuring At Three Points And Calculate Average
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Check installation position of drive plate by measuring at three points and calculate average.

- Specification: 19.5-21.1 mm

NOTE: Measurement is taken through the hole in the drive plate to the machined surface of the cylinder block.

- If the distance is too large:

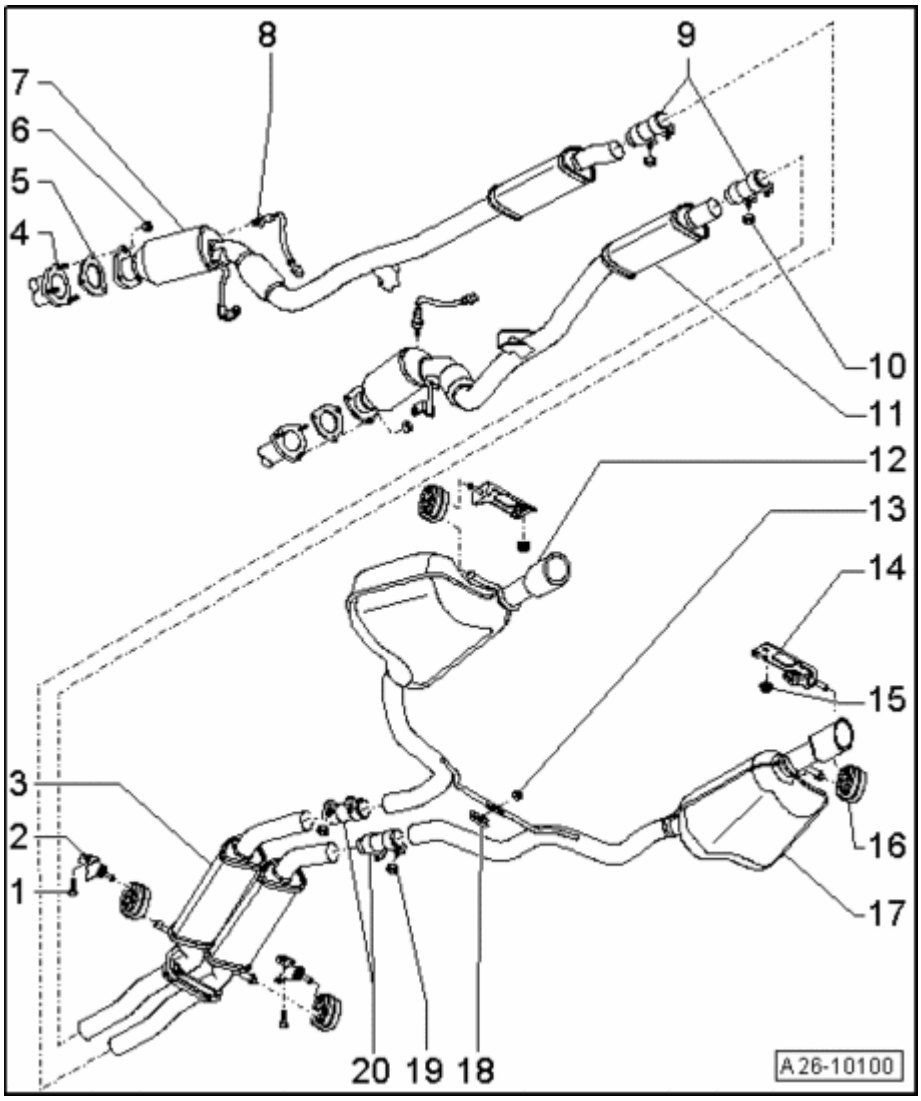

Fig. 90: Identifying Drive Plate, Grooved Washer & Bolts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

  - Remove drive plate again and install appropriate shim -2-.
  - Measure distance again.

- If specification is achieved:

  - Install new bolts and tighten.

Tightening torque

Component		Nm
Drive plate to crankshaft		60 + 90° 1)

1) 90° = 1/4 turn

Front sealing flange, removing and installing

Special tools, testers and auxiliary items required:

- Electric drill with plastic brush attachment
- Silicone sealant D 176 404 A2

Removing

- Remove ribbed belt and tensioning element. Refer to **Ribbed belt, removing and installing**.
- Remove bottom air line. Refer to **Charge air cooling system components, removing and installing**, item - 28.
- Remove toothed belt. Refer to **Toothed belt, removing and installing**.

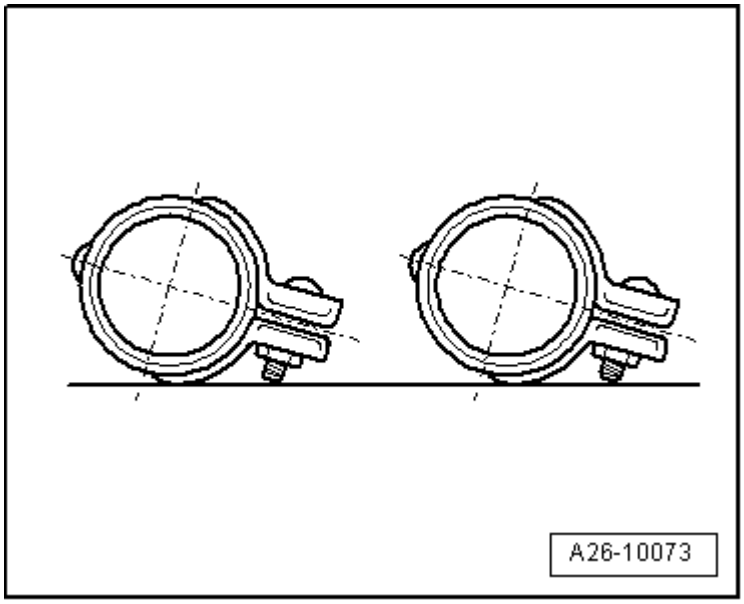

Fig. 91: Identifying Counterhold 3099
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove crankshaft sprocket. To do this counter-hold sprocket with 3099.
- When installing retainer, place 2 washers between sprocket and retainer.

NOTE: On some engines there is a rib on the oil pan flange which prevents retainer 3099 from being attached as shown. In this case proceed as follows:

- Remove bolts from retainer, and screw back in from the reverse side.
- Knock the fitted pins in the square bars downward until they are flush with the top surface of the bars.
- Bolt the retainer to the crankshaft (install 2 washers between sprocket and retainer).
- Drain off engine oil.

- Remove oil pan. Refer to **Oil pan, removing and installing**.
- Unbolt front sealing flange.
- Remove sealing flange: release by tapping lightly with a rubber hammer if necessary.
- Remove sealant remaining on cylinder block with flat scraper.

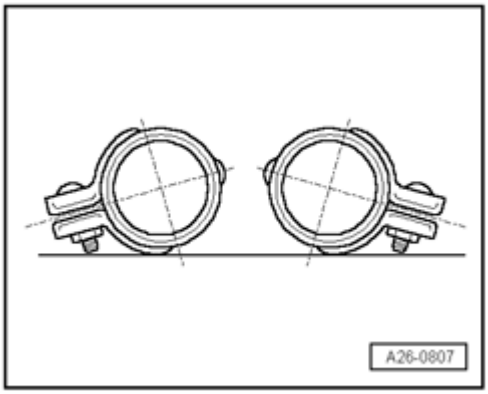

Fig. 92: Removing Sealant Remains On Sealing Flange With Rotating Plastic Brush
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove sealant remaining on sealing flange (with rotating plastic brush or similar).

WARNING: Wear eye protection

- Clean sealing surfaces: they must be free of oil and grease.

Installing

NOTE: The sealing flange must be installed within 5 minutes after applying silicone sealant.

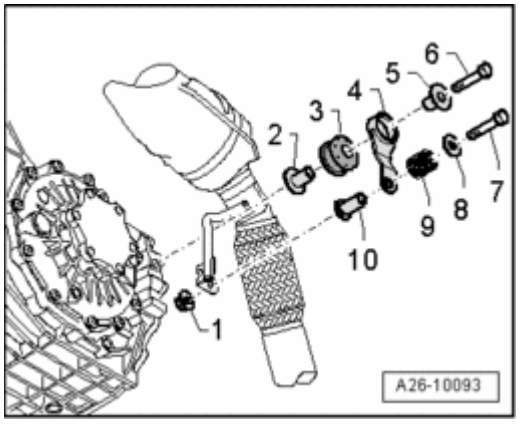

Fig. 93: Cutting Off Tube Nozzle & Applying Silicone Sealing Compound To Oil Pan Sealing Surface
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Cut off nozzle of tube at front marking (nozzle dia. approx. 3 mm).
- The sealant should applied in a bead 2 - 3 mm wide (arrows).

NOTE: The bead of sealant must not be thicker than 3 mm, otherwise excess sealant can enter the oil pan and obstruct the filter screen in the oil intake line.

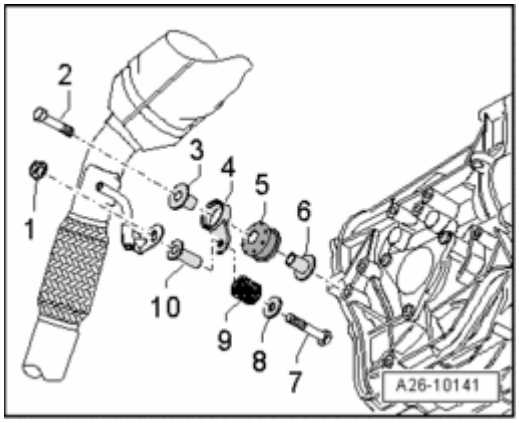

Fig. 94: Applying Silicone Sealant Bead To Clean Sealing Surface Of Sealing Flange
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Apply the bead of silicone sealant onto the clean sealing surfaces of the sealing flange, as illustrated.
- Install the sealing flange immediately, and tighten all bolts lightly.

NOTE:

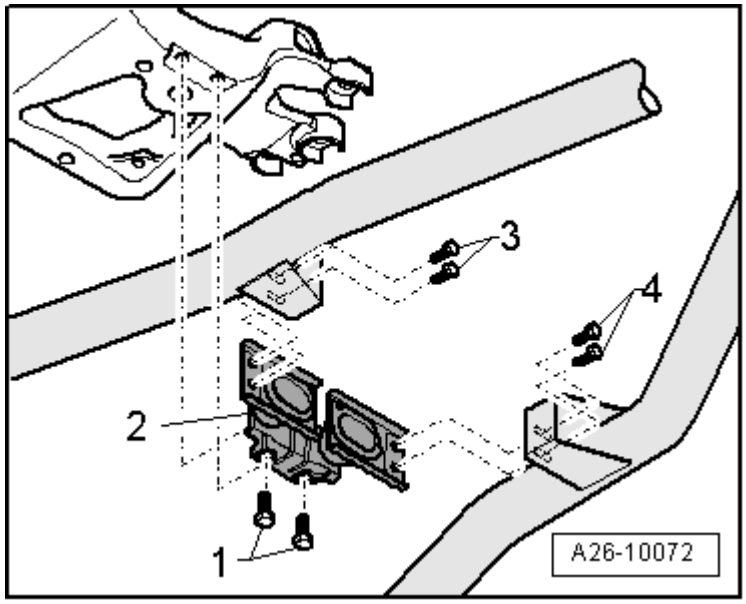

Fig. 95: Identifying Guide Sleeve 2080 A Mount Onto Crankshaft Journal
Courtesy of VOLKSWAGEN UNITED STATES, INC.

To install sealing flange with the oil seal already installed, use guide sleeve from 2080A.

- Tighten bolts on sealing flange in diagonal sequence.
- Install oil pan. Refer to **Installing**.

NOTE: After installing, the sealant must be allowed to dry for about 30 minutes before putting in engine oil.

- Install crankshaft sprocket.

NOTE: Replace central bolt for sprocket.

- Install toothed belt (adjust valve timing). Refer to **Installing (adjusting valve timing)**
- Installing ribbed belt and tensioning element. Refer to **Ribbed belt, removing and installing**.

Tightening torques

Component	Nm
Sealing flange to cylinder block	15
Toothed belt sprocket to crankshaft	90 + 90° (1)

1) 90° = 1/4 turn

Chain sprocket, removing and installing

Removing

- Remove oil pan. Refer to **Removing**.
- Remove front sealing flange. Refer to **Front sealing flange, removing and installing**.
- Remove chain tensioner, oil pump sprocket and chain.

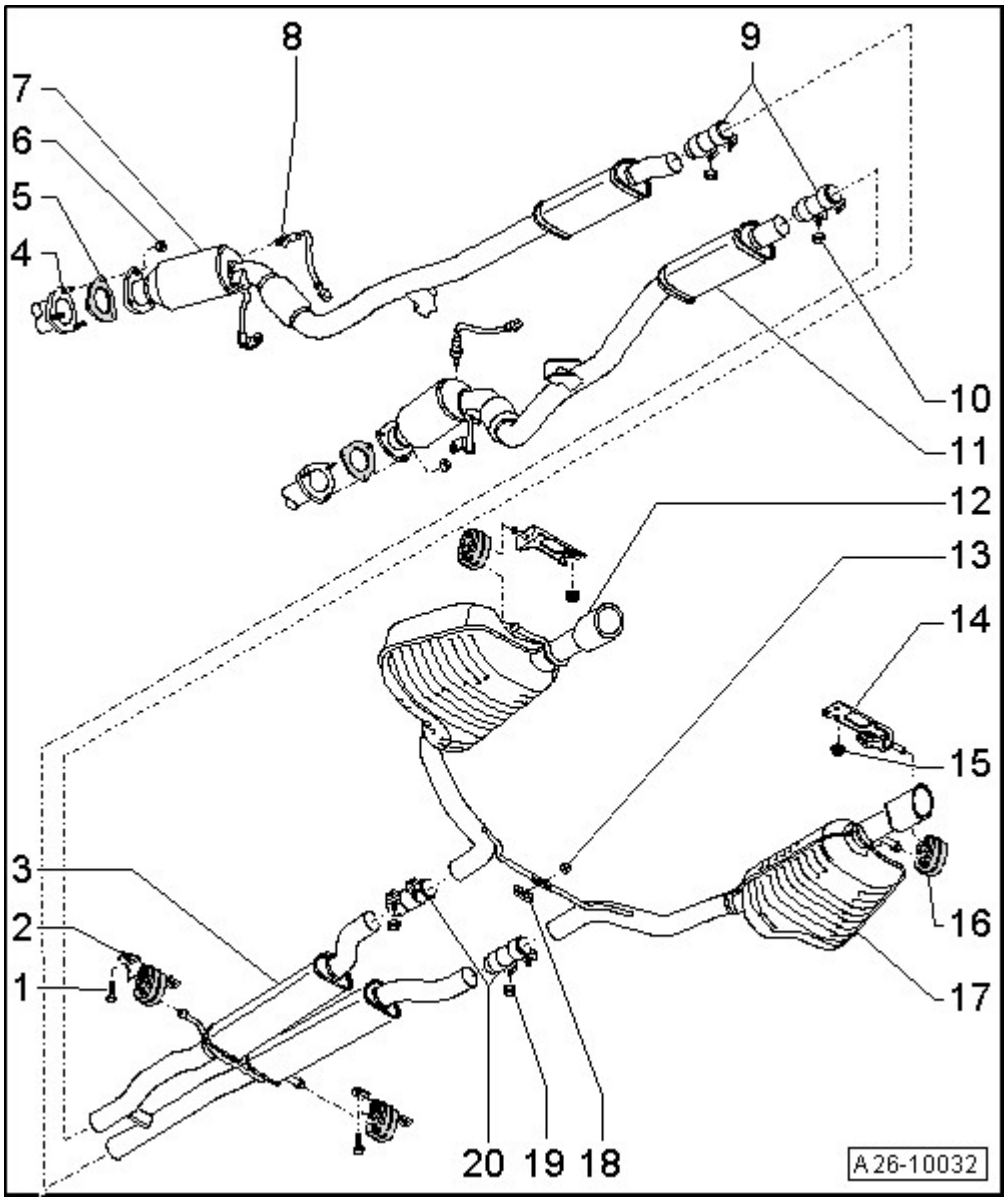

Fig. 96: Pulling Off Chain Sprocket From Crankshaft
Courtesy of VOLKSWAGEN UNITED STATES, INC.

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

Installing

- Heat chain sprocket to 220° C in oven.

WARNING: Wear protective gloves.

NOTE: Installation position: wide collar on sprocket facing toward engine

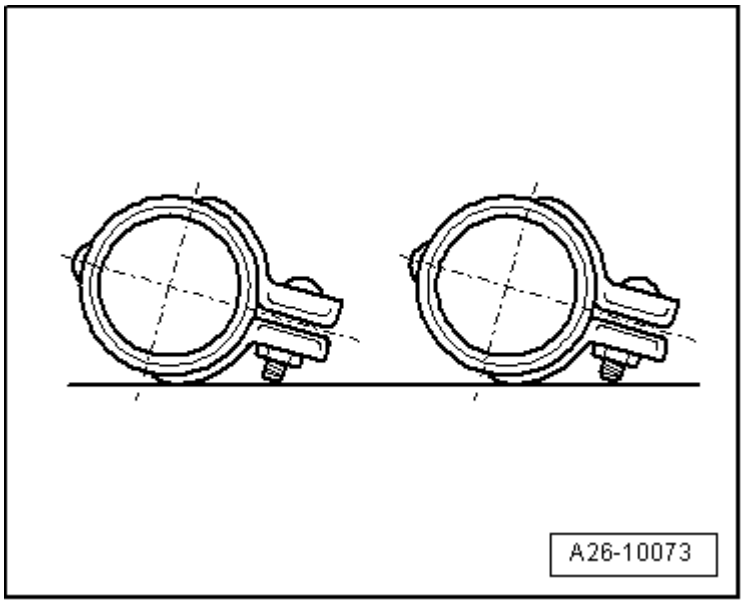

Fig. 97: Installing Chain Sprocket Onto Crankshaft Up To Limit Stop Using Press Tube 30-100
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Using pliers, locate sprocket on end of crankshaft and push onto seat on crankshaft with drift sleeve 30-100.

CRANKSHAFT, REMOVING AND INSTALLING

Crankshaft, removing and installing

NOTE: When working on the engine it should be secured to engine stand with engine bracket VW 540.

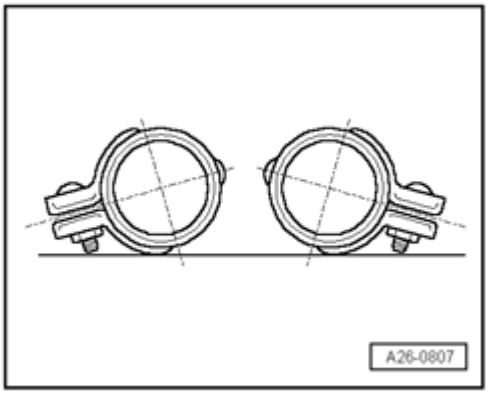

Fig. 98: Crankshaft, Assembly Overview
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Oil pump

- Removing and installing. Refer to **Lubrication system components, removing and installing**

2 - 15 Nm

3 - Chain sprocket

- For oil pump drive
- Removing and installing. Refer to **Chain sprocket, removing and installing**

4 - Bearing caps 1, 2, 4 and 5

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

5 - 65 Nm plus an additional 1/4 turn (90°)

- Always replace
- Tighten to 65 Nm to measure crankshaft radial play

6 - Bearing cap

- Bearing cap 1: Pulley end
- Bearing cap 3 with recesses for thrust washers
- Bearing shell retaining lugs (cylinder block/bearing cap) must be on the same side

7 - Bearing shell 3

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

8 - Sensor wheel

- For engine speed sensor (-G28-)
- Always replace sender wheel if securing bolts have been removed
- Can only be installed in one position. Holes are off-set

9 - 10 Nm plus an additional 1/4turn (90°)

- Always replace

10 - Thrust washer

- For bearing cap and cylinder block, bearing 3
- Note fixing arrangement

11 - Crankshaft

- Axial clearance:
  - New: 0.07-0.21 mm
  - Wear limit: 0.30 mm
- Check radial clearance with Plastigage ™
  - New: 0.01-0.04 mm
  - Wear limit: 0.15 mm
- Do not rotate the crankshaft when checking the radial clearance
- Crankshaft dimensions. Refer to **Crankshaft dimensions**

Crankshaft dimensions

(in mm)

Honing Dimension	Main journal dia.	Connecting rod journal dia.
	-0.022	-0.022
Basic dimension	54.00	47.80
	-0.042	-0.042
	-0.022	-0.022
1st undersize	53.75	47.55
	-0.042	-0.042
	-0.022	-0.022
2nd undersize	53.50	47.30
	-0.042	-0.042
	-0.022	-0.022
3rd undersize	53.25	47.05
	-0.042	-0.042

PISTONS AND CONNECTING RODS, DISASSEMBLING AND ASSEMBLING

Pistons and connecting rods, disassembling and assembling

NOTE: When working on the engine it should be secured to engine stand with engine bracket VW 540.

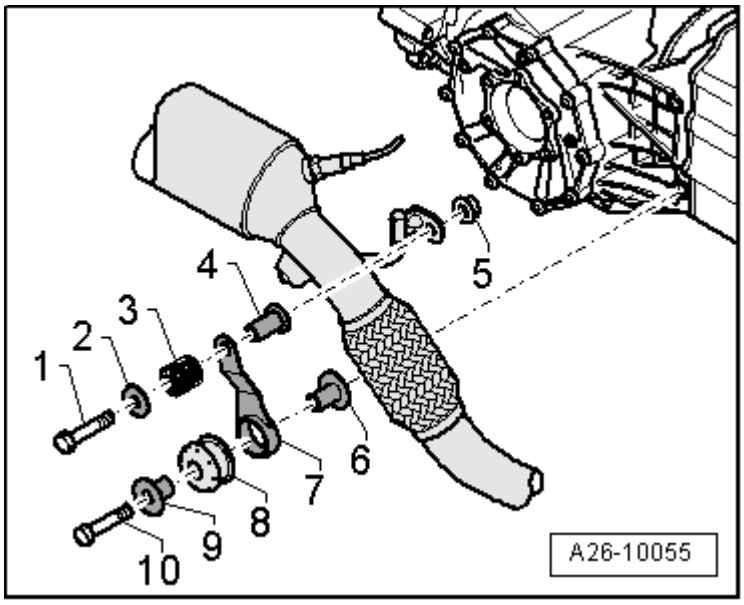

Fig. 99: Pistons And Connecting Rods, Assembly Overview
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Piston ring

- Offset gaps by 120°
- Remove and install with piston ring pliers
- "TOP" faces toward piston crown
- Checking ring gap. See **Fig. 1 Checking piston ring gap**
- Checking ring to groove clearance. See **Fig. 2 Checking ring to groove clearance**

2 - Piston

- Checking. See **Fig. 3 Checking piston**
- Mark installation position in relation to corned and cylinder number with a permanent felt-marker
- Arrow on piston crown points to pulley end
- Install using piston ring clamp
- Piston and cylinder dimensions. Refer to **Piston and cylinder dimensions**

3 - Connecting rod

- Only replace as a set
- Mark cylinder number -B-
- Installation position: Marks -A- must be aligned and facing belt pulley side
- With oil drilling for piston pin lubrication

4 - Connecting rod bearing cap

- Mark cylinder number -B-
- Installation position: Marks -A- must be aligned and facing belt pulley side

5 - 30 Nm plus an additional 1/4turn (90°)

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

6 - Pressure relief valve, 27 Nm

- Opens at: 2.5 - 3.2 bar
- Do not apply sealant when installing

7 - Oil spray jet

- For piston cooling

8 - Bearing shell

- Note installation position
- Do not interchange used bearing shells (mark)
- Ensure retaining lugs fit tightly in recesses
- 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
- With oil drilling for piston pin lubrication

9 - Cylinder block

- Checking cylinder bores. See **Fig. 4 Checking cylinder bores**
- Piston and cylinder dimensions. Refer to **Piston and cylinder dimensions**

10 - Connecting rod bolt

- Replace together with Item 5 under **Pistons and connecting rods, disassembling and assembling**

11 - Circlip

12 - Piston pin

- If difficult to move, heat piston to approx. 60° C
- Remove and install with drift VW 222a

Checking piston ring gap

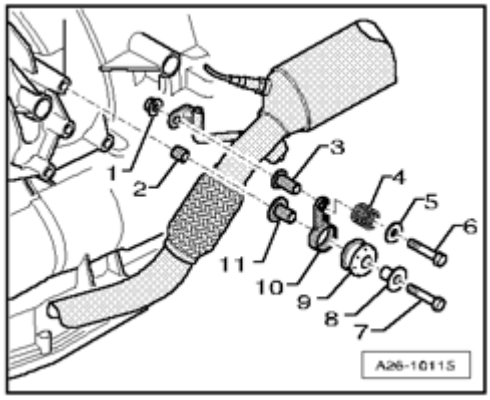

Fig. 100: Checking Piston Ring Gap
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Push ring squarely from above down to approx. 15 mm from bottom end of cylinder. To do this use a piston without rings.

Piston ring		Gap	
		New	Wear limit
Compression rings	mm	0.15-0.40	0.80
Oil scraper ring	mm	0.25-0.50	1.00

Checking ring to groove clearance

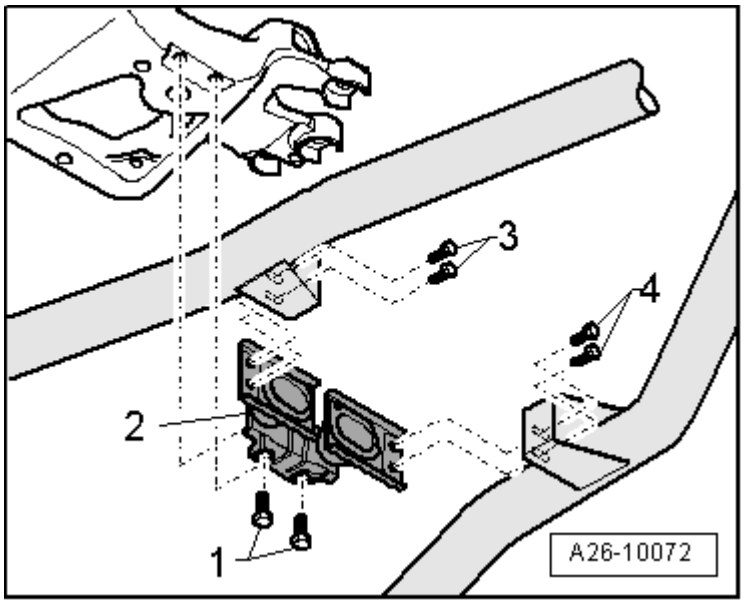

Fig. 101: Checking Ring To Groove Clearance
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Clean groove before checking clearance.

Piston ring		Clearance	
		New	Wear limit
Compression rings	mm	0.02-0.07	0.12
Oil scraper ring	mm	0.02-0.06	0.12

Checking piston

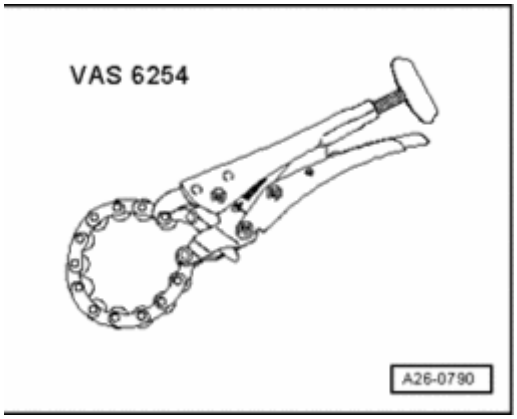

Fig. 102: Checking Piston
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Measure pistons approx. 10 mm from the lower edge of skirt, at 90° to the piston pin axis.

- Permissible deviation from nominal dimension: max. 0.04 mm

Checking cylinder bores

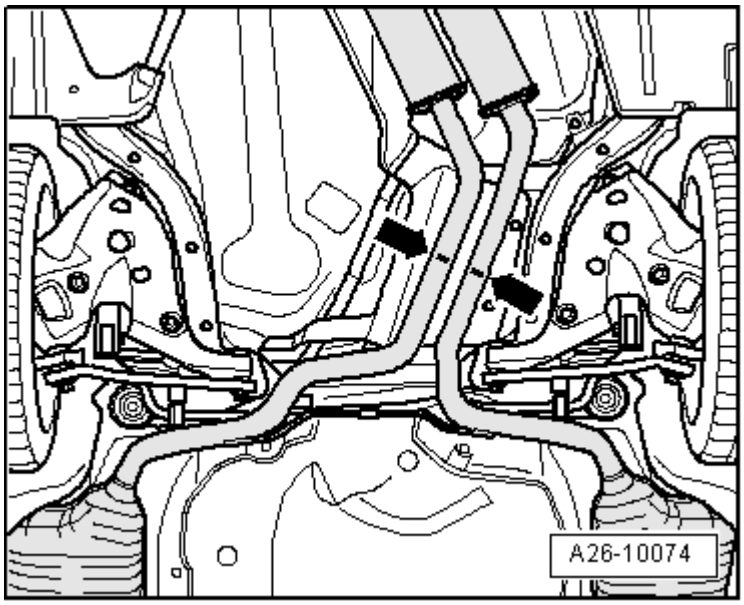

Fig. 103: Checking Cylinder Bores
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Use internal dial indicator (50-100 mm).
- Take measurements at 3 positions in both lateral direction -A- and longitudinal direction -B-.

- Permissible deviation from nominal dimension: max. 0.10 mm

NOTE: Measuring the cylinder bores must not be done when the cylinder block is mounted on a repair stand with adapter bracket VW 540, as incorrect measurements would then be possible.

Piston and cylinder dimensions

Honing Dimension		Piston dia.	Cylinder bore
Basic dimension	mm	80.985	81.01
Oversize	mm	81.485	81.51

15 ENGINE - CYLINDER HEAD, VALVETRAIN

CYLINDER HEAD, REMOVING AND INSTALLING

Cylinder head, removing and installing

NOTE:

- **Always replace cylinder head bolts when assembling.**
- **Replace self-locking nuts.**

- **Always replace bolts that are tightened to a specified angle.**
- **Always replace sealing rings and gaskets when assembling.**
- **When installing an exchange cylinder head with the camshafts installed, the contact surfaces between hydraulic lifter and cam running surface must be oiled after installation of the cylinder head.**
- **The plastic protectors installed to protect the open valves must only be removed immediately before installing the cylinder head.**
- **When installing a new cylinder head or cylinder head gasket, drain off all the old coolant and re-fill with new coolant.**
- **Cylinder heads which have cracks between the valve seats or between valve seat inserts and the spark plug thread can be used further without reducing service life, provided the cracks do not exceed a maximum of 0.3 mm in width, or when no more than the first 4 turns of the spark plug threads are cracked.**

Removing and installing toothed belt. Refer to **Toothed belt, removing and installing**.

Checking cylinder compression. Refer to **Compression, checking**.

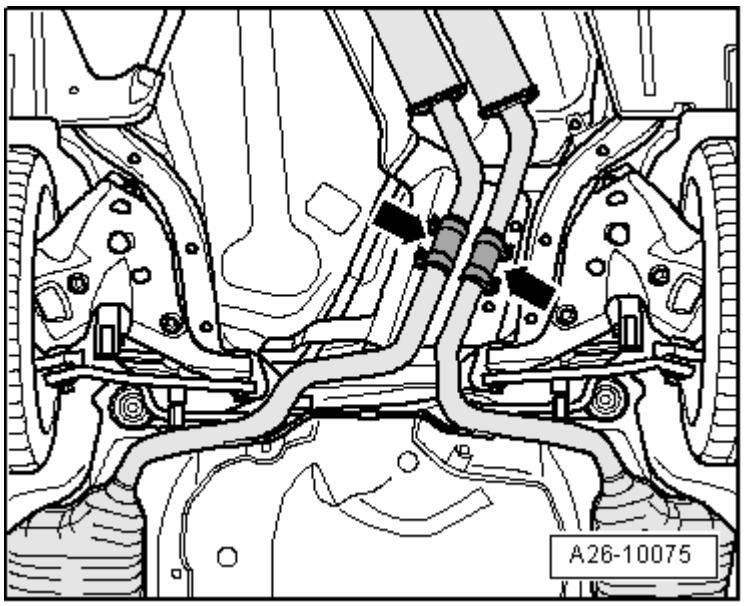

Fig. 104: Cylinder Head, Removing And Installing - Overview
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Cylinder head

- If replaced, replace the complete coolant
- Removing cylinder head. Refer to **Cylinder head, removing**
- Installing cylinder head. Refer to **Cylinder head, installing**
- Check for distortion. See **Fig. 1 Checking cylinder head for distortion**

- Reworking limit. See **Fig. 2 Cylinder head reworking limit**

2 - Oil deflector

- Note installation position: Above intake camshaft between No. 1 and No. 2 cylinders

3 - Cylinder head bolt

- Always replace
- Note sequence when loosening. Refer to **Cylinder head, removing**
- Note sequence when tightening. Refer to **Cylinder head, installing**

4 - Cylinder head cover gasket

- Replace if damaged or leaking

Before installing gasket, apply sealant D 454 300 02 to sides of sealing surfaces.

- Between double bearing cap and cylinder head. See **Fig. 3 Sealing transition points between double bearing cap and cylinder head**
- Between hydraulic chain tensioner and cylinder head. See **Fig. 4 Sealing points: hydraulic chain tensioner/cylinder head**

5 - Cylinder head cover

6 - Gasket

- For ignition coil
- Replace if damaged

7 - Ignition coil

- Testing

Refer to

- **24 MULTIPORT FUEL INJECTION (MFI)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): AMU
- **24 MULTIPORT FUEL INJECTION (MFI)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): ATC
- **24 MULTIPORT FUEL INJECTION (MFI)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): AWP
- **24 MULTIPORT FUEL INJECTION (MFI)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): BEA

; Testing ignition coils

8 - 10 Nm

9 - Filler cap

10 - Seal

- Replace if damaged

11 - 10 Nm

12 - Intake manifold gasket

- Always replace

13 - Cylinder head gasket

- Replace. Refer to **Cylinder head, removing**, Removing cylinder head
- Position: Part No. toward cylinder head
- If replaced, replace the complete coolant

Checking cylinder head for distortion

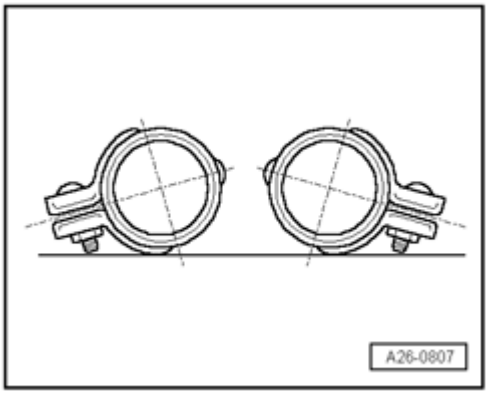

Fig. 105: Checking Cylinder Head For Distortion
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Use knife-edge straightedge and feeler gauge to measure at several points.

- Max. permissible distortion: 0.1 mm

Cylinder head reworking limit

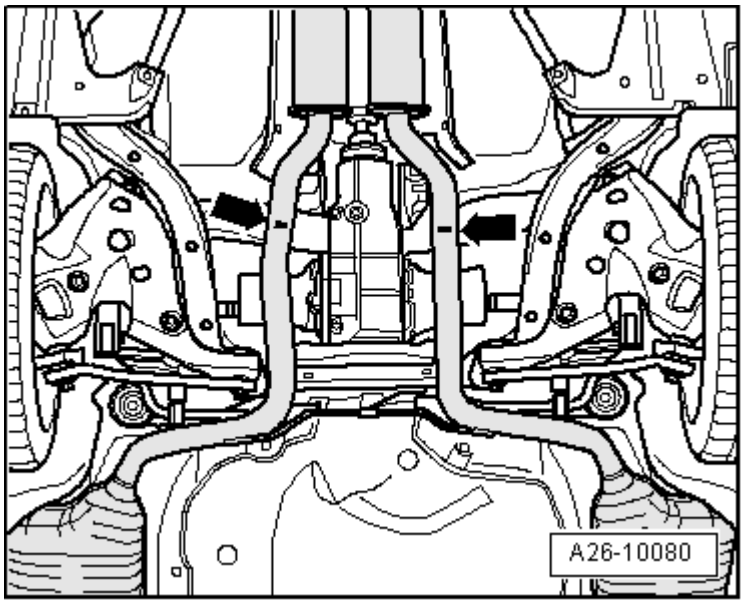

Fig. 106: Cylinder Head Reworking Limit
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Reworking the cylinder head (shaving) is only permitted down to minimum dimension a.
- Minimum dimension a = 139.25 mm

Sealing transition points between double bearing cap and cylinder head

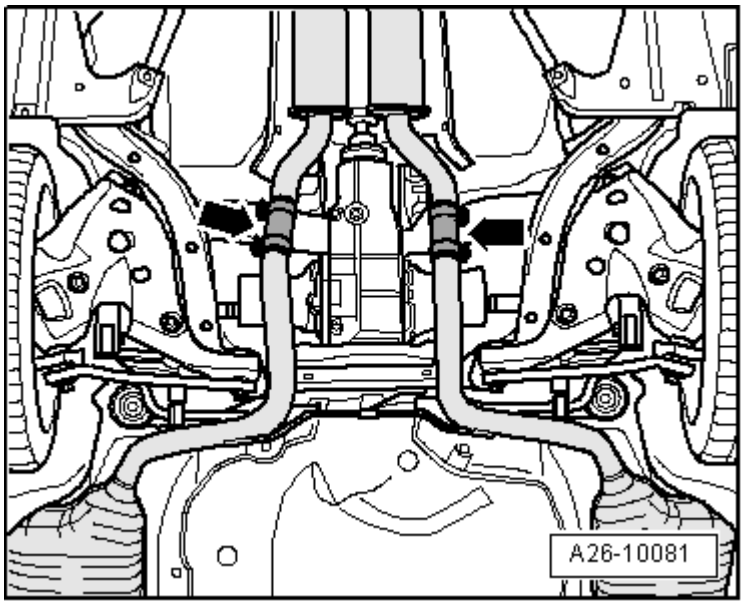

Fig. 107: Sealing Transition Points Between Double Bearing Cap And Cylinder Head
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Carefully apply a thin coat of sealant "D 454 300 02" to both edges of sealing surfaces between double bearing cap and cylinder head (arrows) using a small screwdriver.

Sealing points: hydraulic chain tensioner/cylinder head

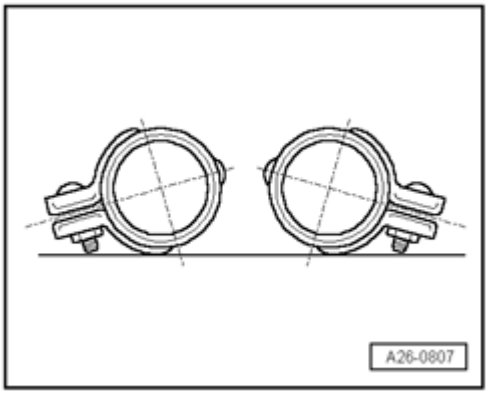

Fig. 108: Sealing Points: Hydraulic Chain Tensioner/Cylinder Head
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Carefully apply a thin coat of sealant "D 454 300 02" to both edges of sealing surfaces between hydraulic chain tensioner and cylinder head (arrows) using a small screwdriver.

Intake manifold, removing and installing

Removing:

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

- Obtain radio anti-theft code on vehicles with coded radio.
- With ignition switched off disconnect battery Ground (GND) strap.
- Remove engine cover.

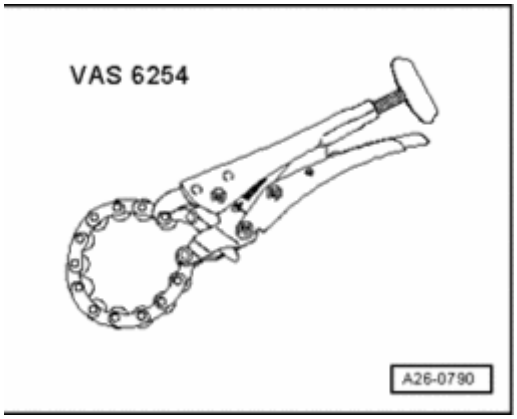

Fig. 109: Identifying Connector, Intake Air Temperature (IAT) Sensor -G42-, Throttle Valve Control Module -J338- Connector, Air Hose & Vacuum Hose
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect connector -3- for Intake Air Temperature (IAT) sensor -G42- and connector -4- for throttle valve control module -J338- (below throttle valve control module).
- Disconnect air hose -2- from throttle valve control module.
- Disconnect vacuum hose -1- from throttle valve control module (hose leads to activated charcoal filter).

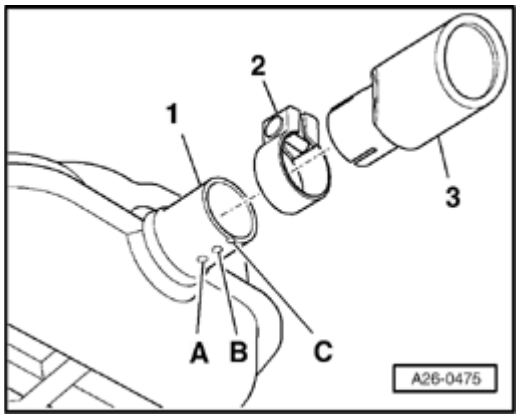

Fig. 110: Removing Intake Air Duct
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove intake air duct -arrows-.

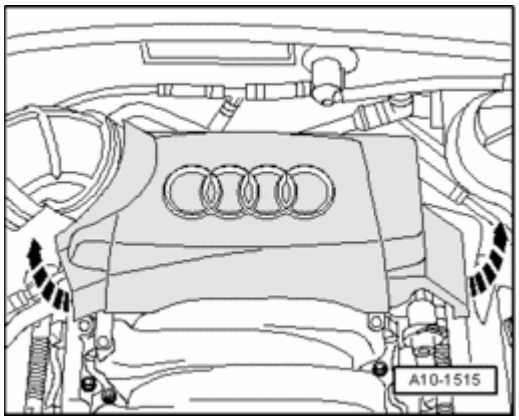

Fig. 111: Locating Connector At Camshaft Position Sensor G40
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Pull connector off Camshaft Position (CMP) Sensor -G40- (arrow).

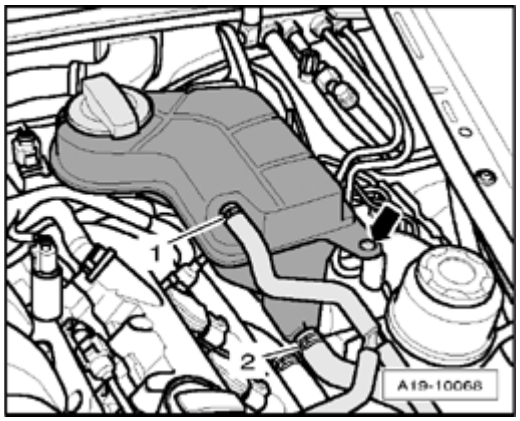

Fig. 112: Disconnecting Connectors For Injectors And Unclipping Support Bar From Fuel Rail
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect connectors -1- for injectors and unclip support bar from fuel rail -2-.

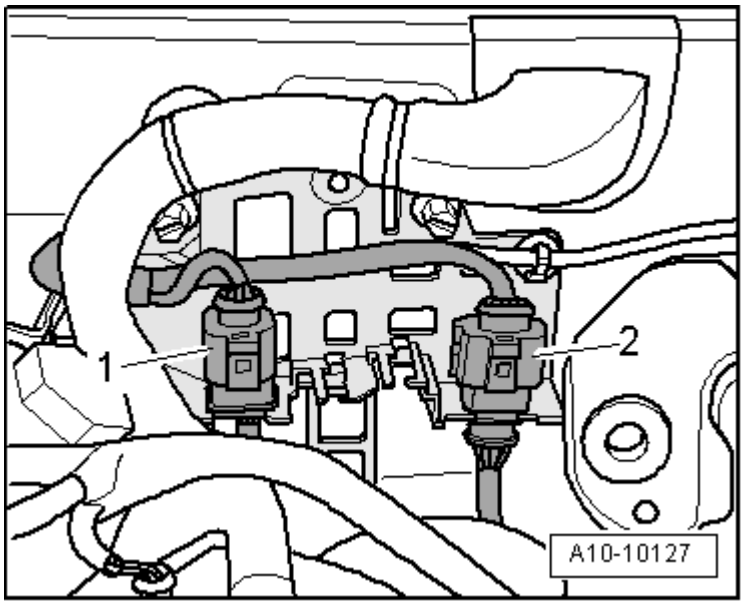

Fig. 113: Identifying Electrical Change-Over Valve Connector, Intake Manifold Brackets & Dipstick Tube
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect connector -1- for electrical change-over valve on underside of bracket.
- Unbolt bracket from intake manifold (-2- and -3-) and disengage dipstick tube -4-.

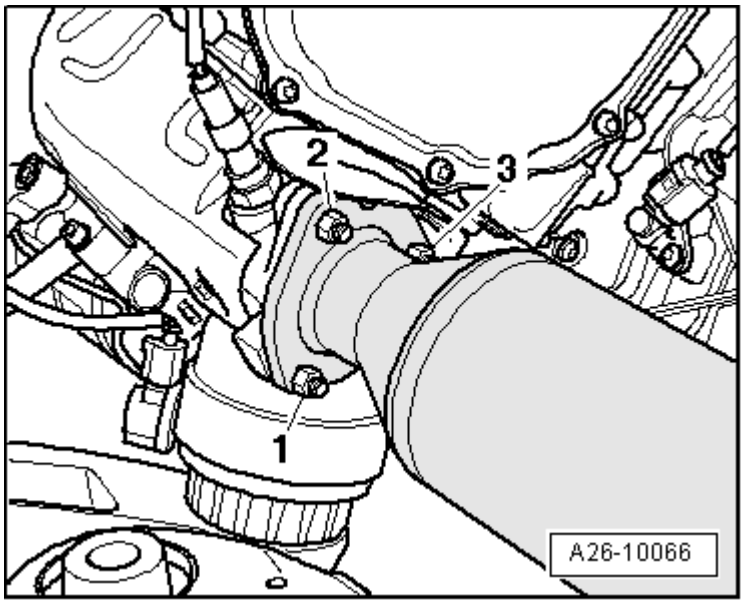

Fig. 114: Identifying Pull Fuel Supply Line And Fuel Return Line
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Press release tabs and pull fuel supply line -1- and fuel return line -2- off connections.

> **WARNING: Fuel system is under pressure! Before opening the system place a cloth around the connection. Then release pressure by carefully loosening the connection.**

- Disconnect crankcase breather hose from T-piece.
- Unbolt intake manifold support from intake manifold.
- Pull out oil dipstick.
- Unbolt intake manifold at flange and remove.

Installing:

Installation is carried out in the reverse order, when doing this note the following:

- After connecting battery terminals, enter anti-theft code for radio

Refer to Radio operating instructions

- Close electric windows in front doors all the way to their top positions using electric switches.
- Then operate all electric window switches again for at least one second in the "close" direction to activate the automatic one-touch function.
- Set clock to correct time.
- Perform adaption of throttle valve control module:

Refer to

- **24 MULTIPORT FUEL INJECTION (MFI)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): AMU
- **24 MULTIPORT FUEL INJECTION (MFI)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): ATC
- **24 MULTIPORT FUEL INJECTION (MFI)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): AWP
- **24 MULTIPORT FUEL INJECTION (MFI)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): BEA

; Checking throttle valve control module; Performing adaption of throttle valve control module

- Interrogate DTC memory:

Refer to

- **01 ON BOARD DIAGNOSTIC (OBD)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): AMU
- **01 ON BOARD DIAGNOSTIC (OBD)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): ATC
- **01 ON BOARD DIAGNOSTIC (OBD)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): AWP
- **01 ON BOARD DIAGNOSTIC (OBD)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): BEA

; On Board Diagnostic (OBD) of Motronic system; checking and erasing DTC memory

NOTE: **DTCs will have been stored in the memory because connectors have been disconnected. Therefore interrogate and erase DTC memory after installing engine.**

Cylinder head, removing

- Engine in vehicle

NOTE:

- **Secure all hose connections with the correct hose clips (same as original equipment).**
- **All cable ties which are opened or cut open when removing must be replaced in the same position when installing.**

- Obtain radio anti-theft code on vehicles with coded radio.
- With ignition switched off disconnect battery Ground (GND) strap.
- Draining cooling system. Refer to **Draining**
- Remove intake manifold. Refer to **Intake manifold, removing and installing**.

- Disconnect coolant pipe from thermostat housing only. Refer to **Coolant line, removing and installing**.
- Remove front exhaust pipe. Refer to **Front exhaust pipe, removing and installing**.
- Unbolt coolant pipe flange from cylinder head (left) and place it to one side.
- Disconnect connectors on ignition coils.

- Unclip/release all pipes and hoses on the cylinder head and move clear.

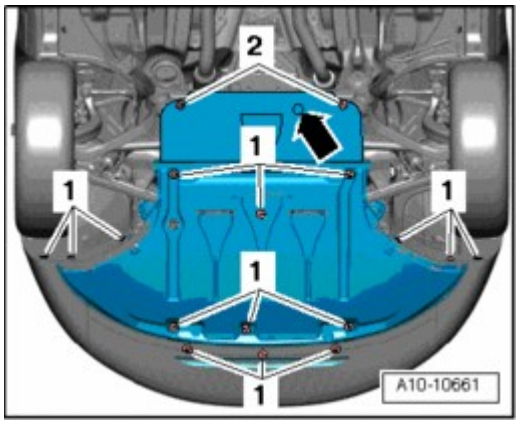

Fig. 115: Removing Turbocharger From Exhaust Manifold
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unbolt turbocharger from exhaust manifold.
- Remove bolts of heat shield on back side of cylinder head.
- Remove ribbed belt and tensioning element. Refer to **Ribbed belt, removing and installing**.
- Remove toothed belt guard (upper). Refer to **Toothed belt, removing and installing**.

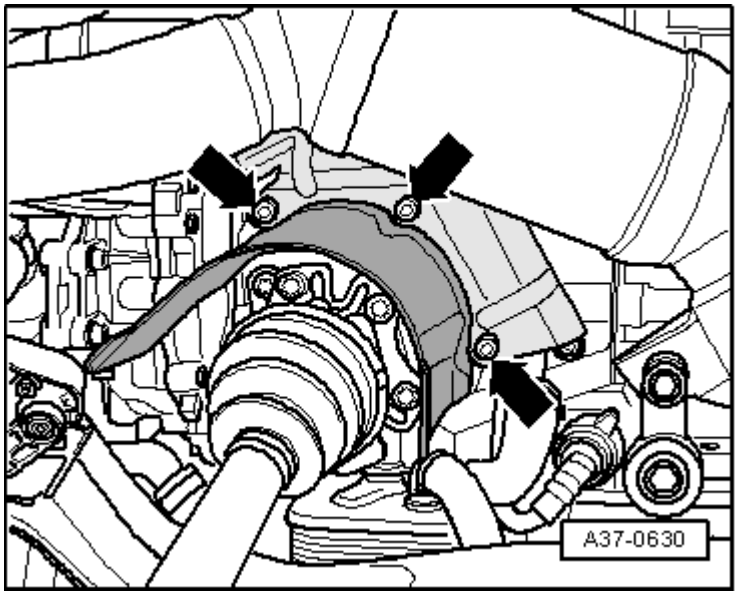

Fig. 116: Setting Crankshaft To Markings For TDC Of No. 1 Cylinder
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Set crankshaft to markings for TDC of No. 1 cylinder (arrows) by turning central bolt on crankshaft sprocket in direction of rotation.

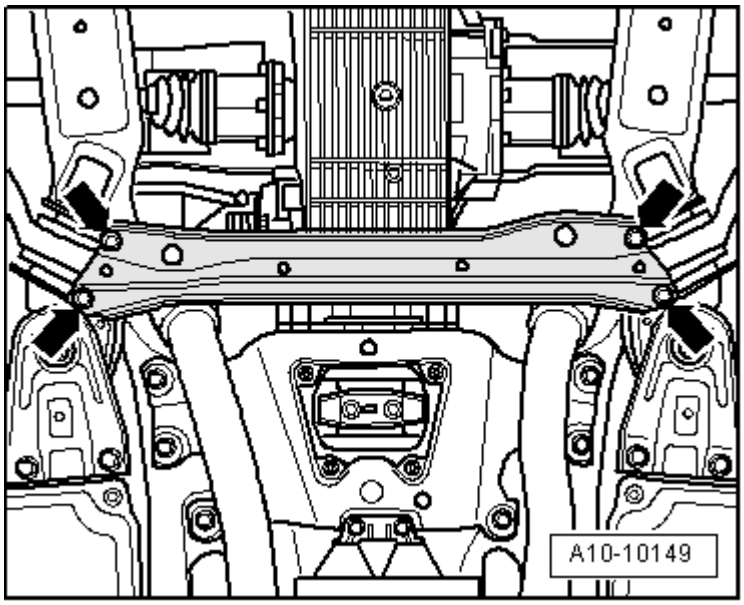

Fig. 117: Detaching Coolant Expansion Tank And Power Steering Reservoir
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts (left-hand arrows) and remove coolant expansion tank together with hoses.
- Remove bolt (right-hand arrow) and remove power steering reservoir. Do not disconnect the hoses.

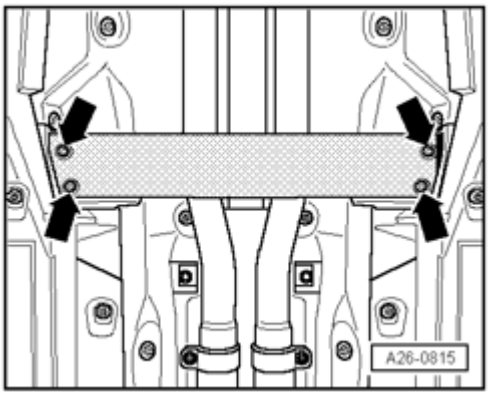

Fig. 118: Screwing Stud Into Toothed Belt Tensioning Element & Hex Nut Onto Stud Using Large Washer
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Screw M5x55 stud -1- into toothed belt tensioning element. Screw hexagonal nut -2- onto stud -1- using a large washer -3-.
- Tension pressure piston of tensioning element only until it can be secured with a locking pin (e.g. from lifting appliance 2024 A) (arrow).

NOTE: **If it is not possible to insert the locking pin, carefully tension the pressure piston of the tensioning element just enough to allow the toothed belt to be removed.**

- Take toothed belt off camshaft sprocket.
- Unbolt ignition coils.
- Remove cylinder head cover. Refer to **Cylinder head, removing and installing**.

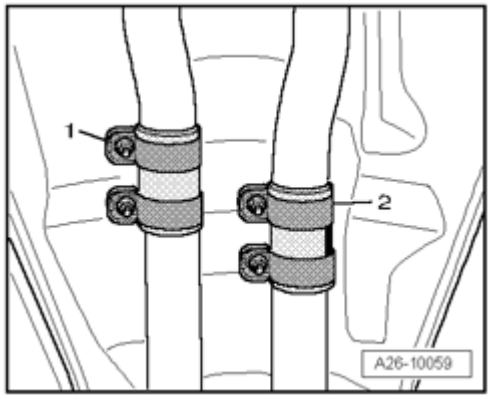

Fig. 119: Cylinder Head Bolts Loosening Sequence
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Maintain sequence when loosening and tightening cylinder head bolts.
- Remove cylinder head.

Cylinder head, installing

NOTE:

- **Always replace cylinder head bolts when assembling.**
- **Replace self-locking nuts.**
- **Always replace bolts that are tightened to a specified angle.**
- **If repairing, carefully remove any remains of gasket material from the cylinder head and cylinder block. Make sure that no long scores or scratches are made on the 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 coating or the indented area will lead to leaks.**
- **No oil or coolant must be allowed to remain in the blind holes for the cylinder head bolts in the cylinder block.**
- **Ensure fuel hoses are tight.**

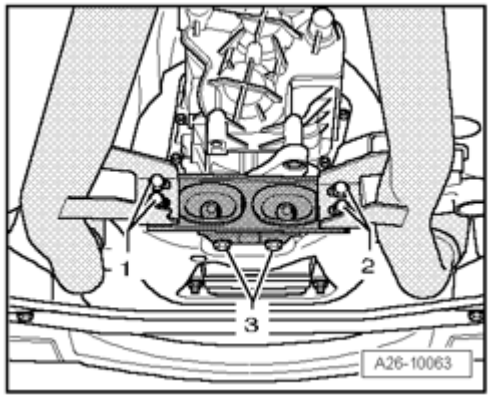

Fig. 120: Setting Crankshaft To Markings For TDC Of No. 1 Cylinder
Courtesy of VOLKSWAGEN UNITED STATES, INC.

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

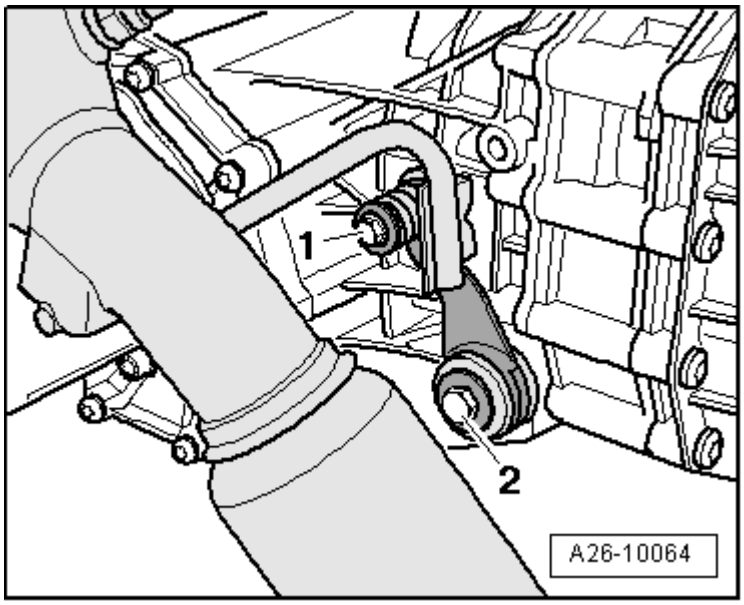

Fig. 121: Identifying Turbocharger Bracket Bolts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts -1- and -2- on turbocharger bracket (about 2 full turns each) to avoid stressing when installing the cylinder head.

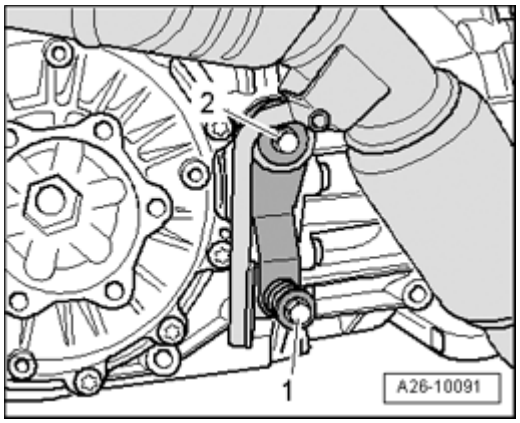

Fig. 122: Identifying Cylinder Block Centering Pins
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Place cylinder head gasket in position.

- Note position of centralizing pins in cylinder block (arrows).
- Check installation position of cylinder head gasket. The Part No. should be legible from intake side.

- Place cylinder head in position.
- Insert cylinder head bolts and tighten by hand.

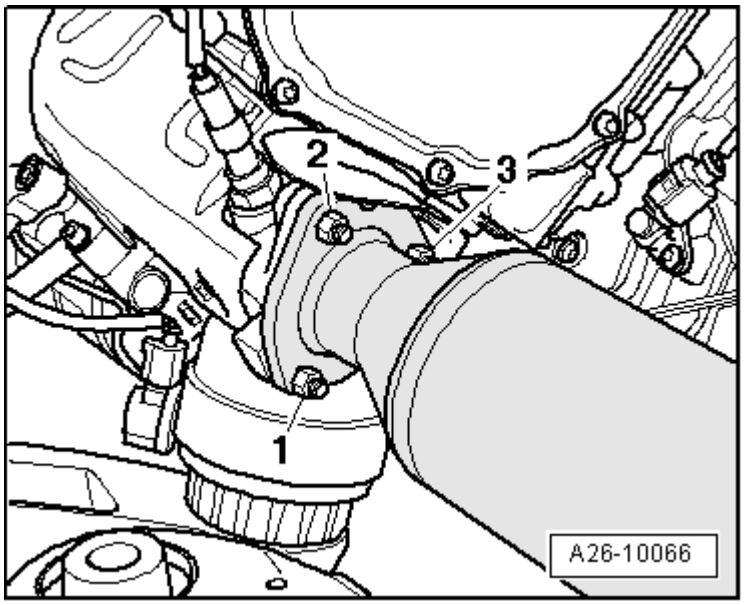

Fig. 123: Cylinder Head Bolt Tightening Sequence
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Tighten cylinder head bolts in two stages in sequence shown as follows:
- Stage 1: 40 Nm
- Stage 2: Torque a further 180° (1/2 turn) with a rigid wrench.

It is permissible to torque by 2 x 90°.

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

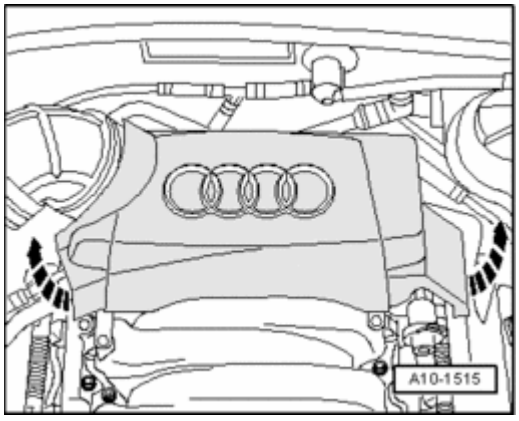

Fig. 124: Setting Crankshaft To Markings For TDC Of No. 1 Cylinder
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Install turbocharger with new gasket and bolt bracket to cylinder block. Refer to **Cylinder head, installing**.
- Install toothed belt (adjust valve timing). Refer to **Installing (adjusting valve timing)**.

NOTE: Follow all instructions for removing and installing toothed belt. Refer to Toothed belt, removing and installing.

- Install cylinder head cover. Refer to **Cylinder head, removing and installing**.
- Installing ribbed belt and tensioning element. Refer to **Ribbed belt, removing and installing**.
- After connecting battery terminals, enter anti-theft code for radio

Refer to Radio operating instructions

- Close electric windows in front doors all the way to their top positions using electric switches.
- Then operate all electric window switches again for at least one second in the "close" direction to activate the automatic one-touch function.
- Set clock to correct time.
- Perform adaption of throttle valve control module:

Refer to

- **24 MULTIPORT FUEL INJECTION (MFI)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): AMU
- **24 MULTIPORT FUEL INJECTION (MFI)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): ATC

- **24 MULTIPORT FUEL INJECTION (MFI)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): AWP
- **24 MULTIPORT FUEL INJECTION (MFI)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): BEA

; Checking throttle valve control module; Performing adaption of throttle valve control module

- Interrogate DTC memory:

Refer to

- **01 ON BOARD DIAGNOSTIC (OBD)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): AMU
- **01 ON BOARD DIAGNOSTIC (OBD)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): ATC
- **01 ON BOARD DIAGNOSTIC (OBD)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): AWP
- **01 ON BOARD DIAGNOSTIC (OBD)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): BEA

; On Board Diagnostic of Motronic; checking and erasing DTC memory

NOTE: DTCs will have been stored in the memory because connectors have been disconnected. Therefore interrogate and erase DTC memory after installing engine.

- Electrical connections and routing:

Refer to Electrical Wiring Diagrams, Troubleshooting & Component Locations

Compression, checking

Test requirements

- Engine oil temperature not less than 30° C

Test sequence

- Remove engine cover.

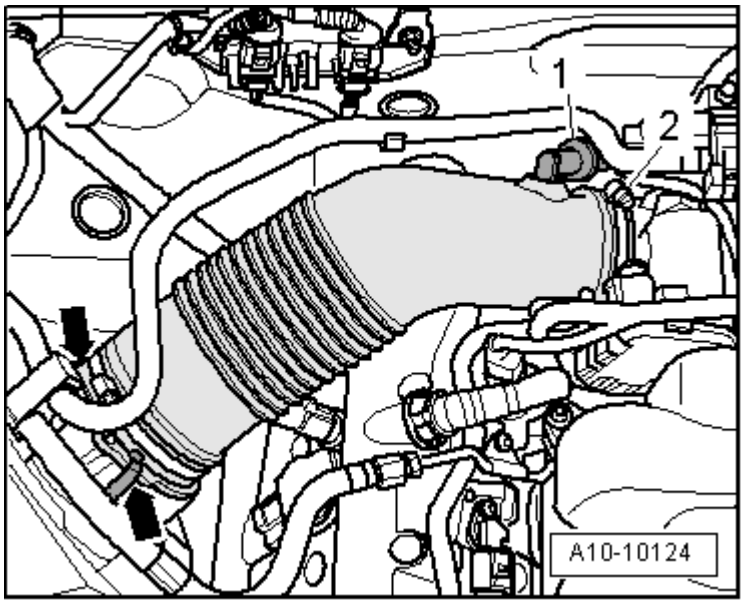

Fig. 125: Locating Connector At Camshaft Position Sensor G40
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Pull connector off Camshaft Position (CMP) Sensor -G40- (arrow).
- With ignition switched off, disconnect connectors from ignition coils.
- Remove ignition coils.
- Remove spark plugs with spark plug wrench 3122B.

- Fully open throttle valve.
- Check compressions with compression tester VAG 1381/VAG 1763.

NOTE: Using the compression tester

Refer to Operating instructions

- Operate starter until tester shows no further pressure increase.

Compression pressure:

New bar	Wear limit bar	Permissible Difference between cylinders bar
10.0 - 13.0	7.0	max. 3.0

- Install spark plugs and ignition coils.
- Interrogate DTC memory:

Refer to

- **01 ON BOARD DIAGNOSTIC (OBD)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): AMU
- **01 ON BOARD DIAGNOSTIC (OBD)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): ATC
- **01 ON BOARD DIAGNOSTIC (OBD)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): AWP
- **01 ON BOARD DIAGNOSTIC (OBD)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): BEA

; On Board Diagnostic of Motronic system; checking and erasing DTC memory

NOTE: DTCs will have been stored in the memory because the connector to the Camshaft Position (CMP) Sensor has been disconnected. Therefore interrogate and erase DTC memory after the test.

Tightening torque

Component	Nm
Ignition coils to cylinder head	10
Spark plugs to cylinder head	30
Vacuum reservoir to cylinder head	30

VALVES, SERVICING

Valves, servicing

NOTE:

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

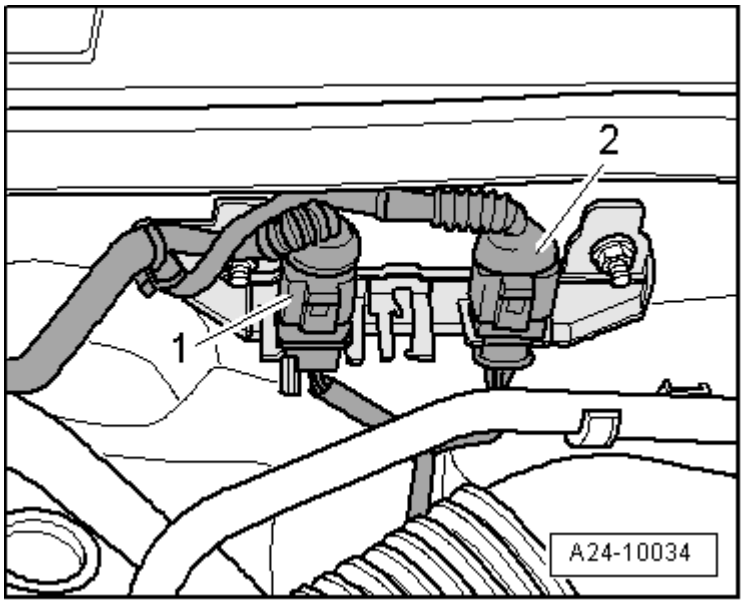

Fig. 126: Exploded View Of Valves, Servicing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - 65 Nm

- Use counter-hold 3036 to loosen and tighten

2 - Camshaft sprocket

- For exhaust camshaft
- Note installation position: The camshaft sprocket is installed with the smaller side facing out and the TDC marking for cylinder 1 visible

3 - Oil seal

- For exhaust camshaft
- Replacing. Refer to **Camshaft oil seals, replacing**

4 - Cylinder head

- Removing. Refer to **Cylinder head, removing**
- Checking cylinder head for distortion. See **Fig. 1 Checking cylinder head for distortion**
- Reworking cylinder head. See **Fig. 2 Cylinder head reworking limit**
- Checking valve guides, grinding-in valve seats. Refer to **Valve guides, checking**
- Installing. Refer to **Cylinder head, installing**
- Sealing connections. See **Fig. 3 Sealing transition points between double bearing cap and cylinder head**, **Fig. 4 Sealing points: hydraulic chain tensioner/cylinder head**

5 - Valve guide

- Checking. Refer to **Valve guides, checking**
- Replacing. Refer to **Valve guides, replacing**

6 - Valve stem seal

- Replacing. Refer to **Valve stem seals, replacing**

7 - Valve springs

- Removing and installing. Refer to **Valve stem seals, replacing**

8 - Valve spring plate

9 - Valve cotters

10 - Hydraulic lifter

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

11 - Intake camshaft

- Check radial clearance with Plastigage ™ (hydraulic lifters not installed): Wear limit: 0.1 mm
- Run-out: max. 0.01 mm
- Valve timing. Refer to **Engine data**
- Checking axial clearance. Refer to **Camshaft axial clearance, checking**
- Removing and installing camshafts. Refer to **Camshafts and hydraulic chain tensioner, removing and installing**

12 - Bearing cap/intake camshaft

- Must be located on dowel sleeves
- Note installation position
- Installation sequence. Refer to **Camshafts and hydraulic chain tensioner, removing and installing**

13 - Double bearing cap

- Must be located on dowel sleeves
- Seal connections between double bearing cap and cylinder head. See **Fig. 3 Sealing transition points between double bearing cap and cylinder head**
- Coat sealing surface lightly with "D 454 300 02" before installation. Refer to **Camshafts and hydraulic chain tensioner, removing and installing**

14 - Exhaust camshaft

- Check radial clearance with Plastigage ™ (hydraulic lifter not installed): Wear limit: 0.1 mm
- Run-out: max. 0.01 mm
- Valve timing. Refer to **Engine data**
- Checking axial clearance. Refer to **Camshaft axial clearance, checking**
- Removing and installing camshafts. Refer to **Camshafts and hydraulic chain tensioner, removing and installing**

15 - Bearing cap/exhaust camshaft

- Must be located on dowel sleeves
- Note installation position
- Installation sequence. Refer to **Camshafts and hydraulic chain tensioner, removing and installing**

16 - 10 Nm

17 - 10 Nm

18 - Drive chain

- Check for wear
- Before removing, mark running direction (installation position). Refer to **Camshafts and hydraulic chain tensioner, removing and installing**

19 - Hydraulic chain tensioner

- Before removing, lock in position with retainer VAG 3366
- Removing and installing. Refer to **Camshafts and hydraulic chain tensioner, removing and installing**
- Seal connections between hydraulic chain tensioner and cylinder head. See **Fig. 4 Sealing points: hydraulic chain tensioner/cylinder head**

20 - Metal/rubber gasket

- Replace. Refer to **Camshafts and hydraulic chain tensioner, removing and installing**

21 - Gasket

- Always replace

22 - Exhaust valve

- With sodium filling
- Note instructions on scrapping valves with a sodium filling. Refer to **Fig. 1 Valve dimensions**
- Do not rework, only grinding-in is permitted
- Valve dimensions. See **Fig. 1 Valve dimensions**

- Checking valve guides, grinding in valve seats. Refer to **Valve guides, checking**

23 - Intake valve

- Do not rework, only grinding-in is permitted
- Valve dimensions. See **Fig. 1 Valve dimensions**
- Checking valve guides, grinding in valve seats. Refer to **Valve guides, checking**

24 - Oil seal

- For intake camshaft
- Replacing. Refer to **Camshaft oil seals, replacing**

25 - Hall sensor rotor

- Note installation position: locate notch in camshaft

26 - Washer

- With cone
- Note installation position

27 - 25 Nm

28 - Camshaft Position (CMP) Sensor -G40-

29 - 10 Nm

Valve dimensions

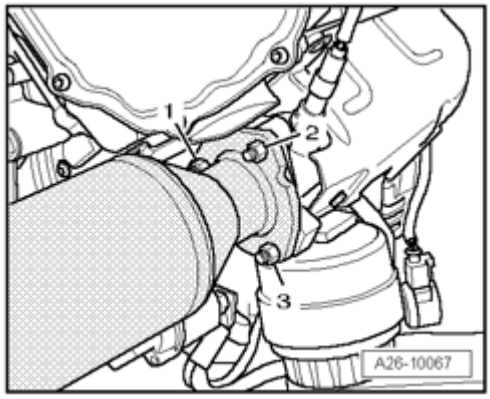

Fig. 127: Valve Dimensions
Courtesy of VOLKSWAGEN UNITED STATES, INC.

NOTE: Intake and exhaust valves must not be reworked. Only grinding-in 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	-5	45	45

WARNING: WARNING

- **Worn exhaust valves with sodium filling must not be disposed of until they have been treated as follows:**
- **The valves must be sawn into two sections with a metal saw at a point between the center of the shaft and the valve head. They must not come into contact with water when this is done. Then throw the valves into a bucket of water (not more than ten at time). Then step back because a chemical reaction occurs when the sodium filling burns.**
- **After this treatment the valves can be disposed of in the normal way.**

Camshaft axial clearance, checking

Perform measurement with hydraulic 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 VW 387 to cylinder head:

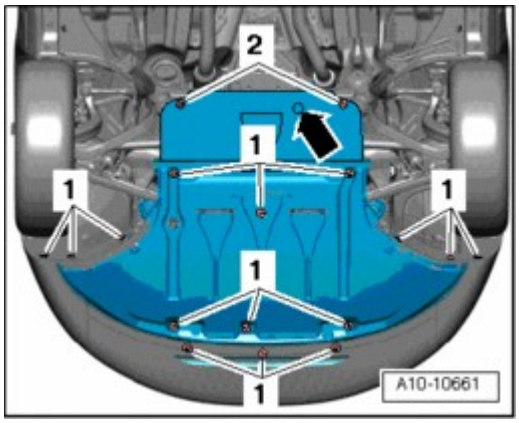

Fig. 128: Camshaft Axial Clearance, Checking - Intake Camshaft
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Intake camshaft

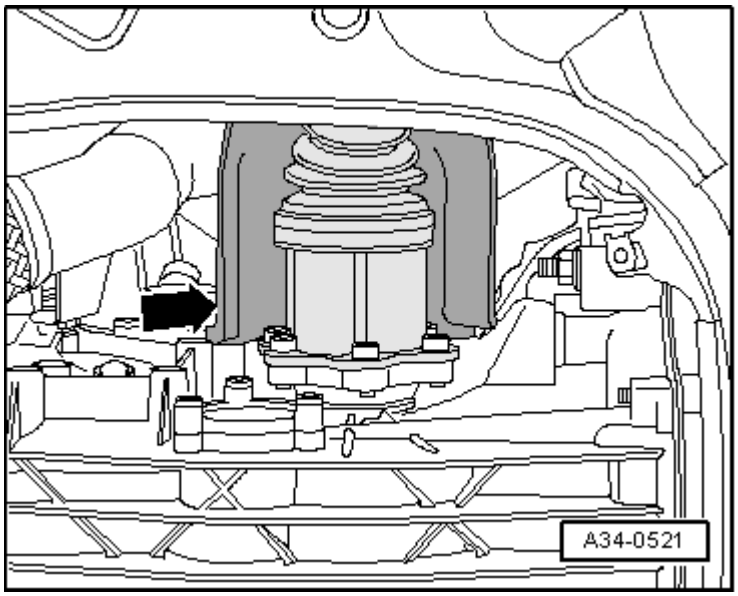

Fig. 129: Camshaft Axial Clearance, Checking - Exhaust Camshaft
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Exhaust camshaft

Wear limit for intake and exhaust camshaft.

- Axial play: no more than 0.20 mm

Camshaft oil seals, replacing

Replacing exhaust camshaft oil seal

Removing

- Remove noise insulation in center and on right-hand side.
- Removing ribbed belt and tensioning element. Refer to **Ribbed belt, removing and installing**.
- Remove upper toothed belt guard. Refer to **Toothed belt, removing and installing**.

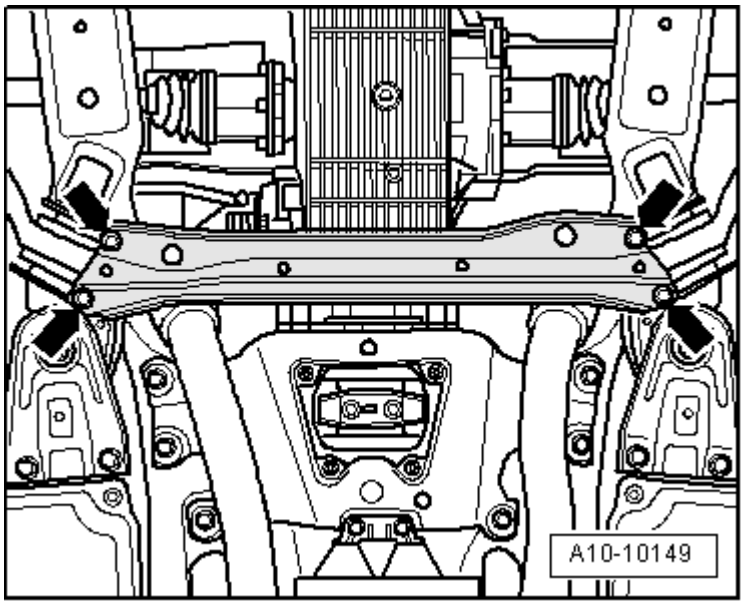

Fig. 130: Setting Crankshaft To Markings For TDC Of No. 1 Cylinder
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Set crankshaft to markings for TDC of No. 1 cylinder -arrows- by turning central bolt on crankshaft sprocket in direction of rotation.
- Disconnect vacuum hose from activated charcoal filter and from throttle valve connection.
- Unbolt coolant expansion tank and power steering reservoir, but do not disconnect the hoses.

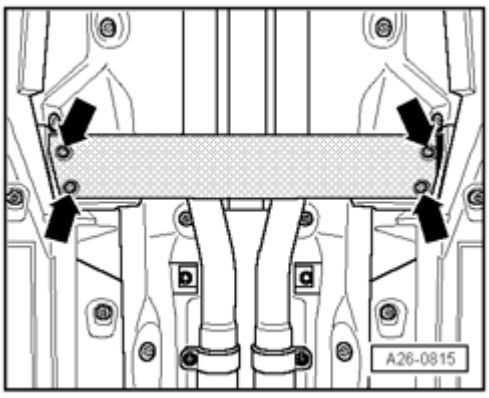

Fig. 131: Screwing Stud Into Toothed Belt Tensioning Element & Hex Nut Onto Stud Using Large Washer
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Screw M5x55 stud -1- into toothed belt tensioning element. Screw hex nut -2- with a large washer -3- onto stud -1-.

- Tension pressure piston of tensioning element just enough so that it can be secured with a suitable locking pin (e.g. from lifting appliance 2024 A).

NOTE: If it is not possible to insert the locking pin, carefully tension the pressure piston of the tensioning element just enough to allow the toothed belt to be removed.

- Take toothed belt off camshaft sprocket.
- Loosen camshaft sprocket (counter-hold with 3036).
- Pull off camshaft sprocket.

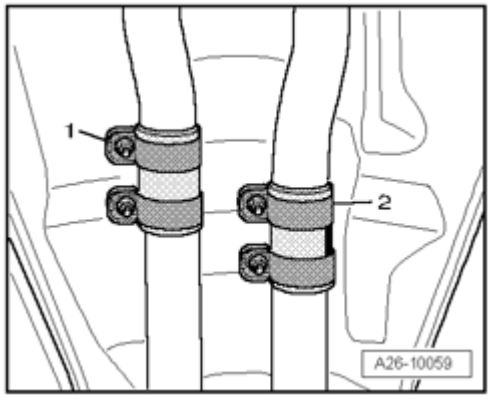

Fig. 132: Camshaft Gear Retaining Bolt Installed Into Camshaft To Stop
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- To guide oil seal extractor, screw securing 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 the outer part and lock in position with knurled screw.

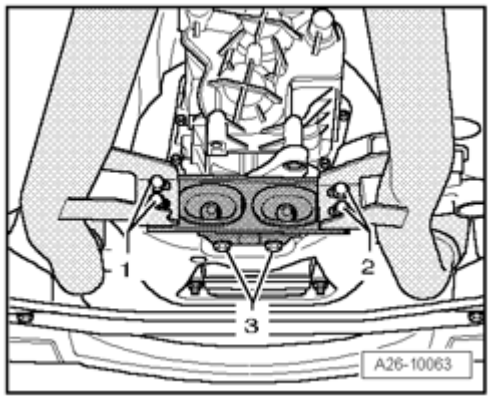

Fig. 133: Loosening Knurled Screw And Turning Inner Part Of Extractor Against Camshaft Until Oil Seal Has Been Extracted
Courtesy of VOLKSWAGEN UNITED STATES, INC.

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

Installing

- Lightly oil sealing lip of oil seal.

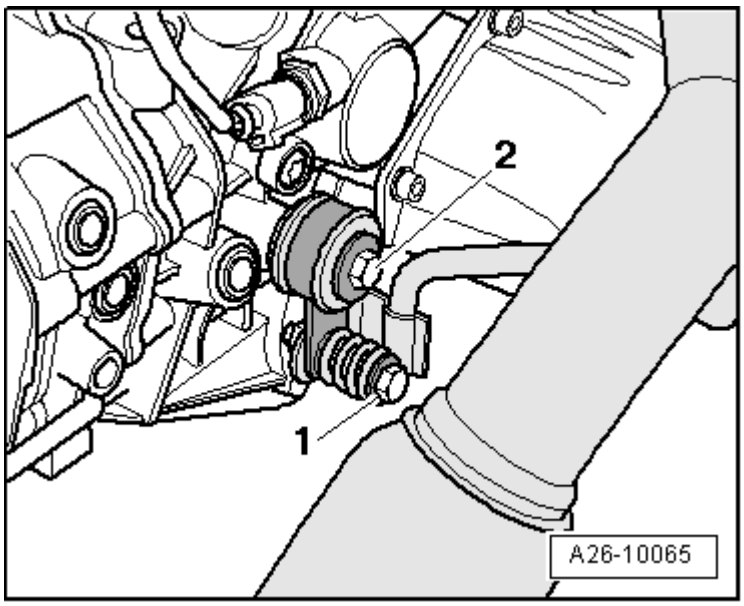

Fig. 134: Installing Guide Sleeve 3241/2 Onto Camshaft Journal
Courtesy of VOLKSWAGEN UNITED STATES, INC.

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

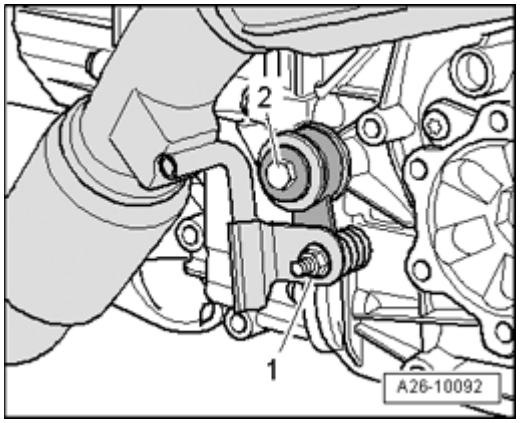

Fig. 135: Pressing Oil Seal In Onto Stop With Press Sleeve 3241/1
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Press oil seal in onto stop with press sleeve 3241/1. To do this use bolt 3241/5.

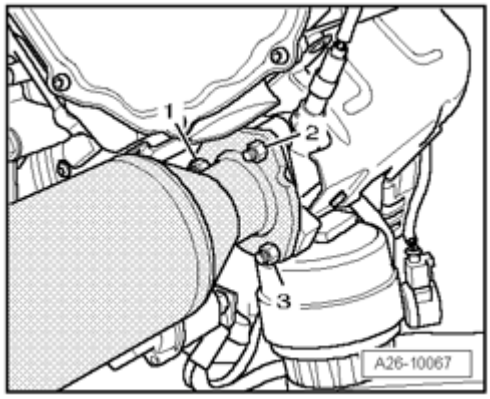

Fig. 136: Installing Camshaft Sprocket
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Install camshaft sprocket.
- Check installation position: The narrow web of the camshaft sprocket faces outward -arrows- and the marking for No. 1 cylinder TDC is visible.
- Install securing bolt for camshaft sprocket (use counter-hold tool 3036).

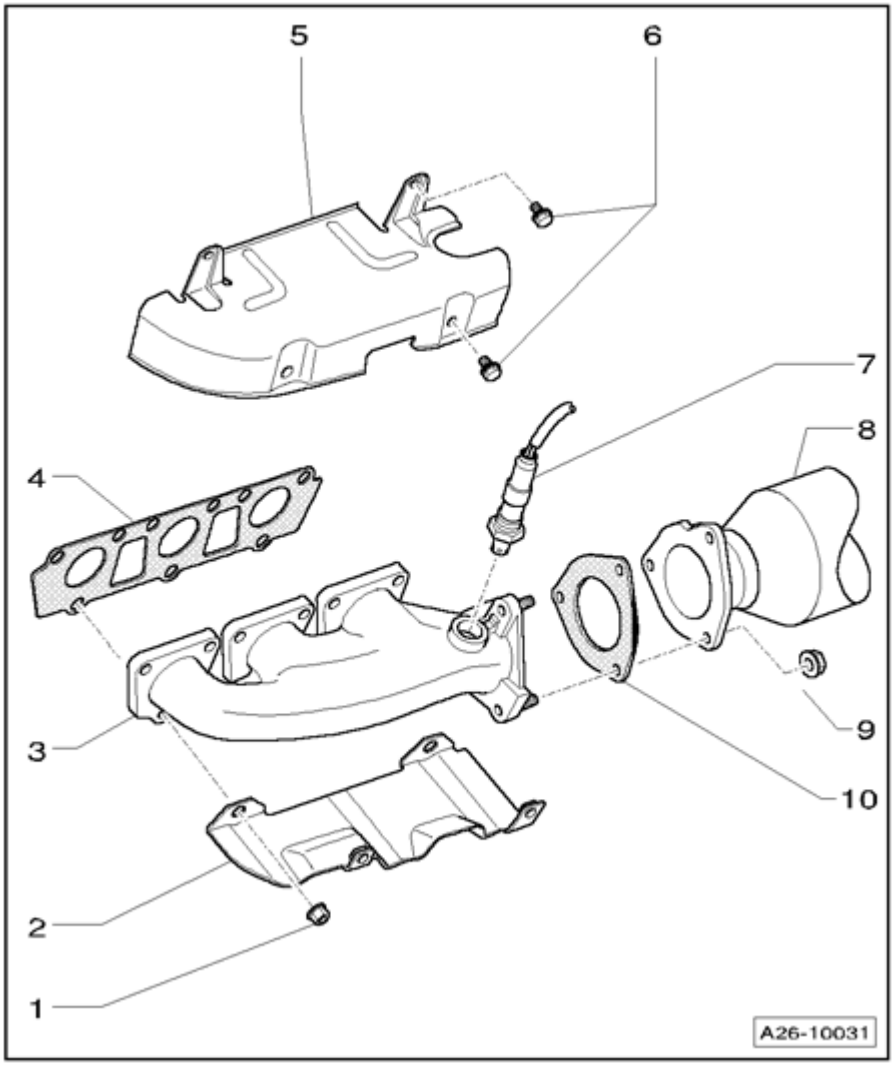

Fig. 137: Setting Crankshaft To Markings For TDC Of No. 1 Cylinder
Courtesy of VOLKSWAGEN UNITED STATES, INC.

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

NOTE: If a piston is at TDC the valves could strike the piston when turning the camshaft. To avoid damage to valves and pistons the pistons must not be at TDC.

- Install toothed belt onto camshaft sprocket.

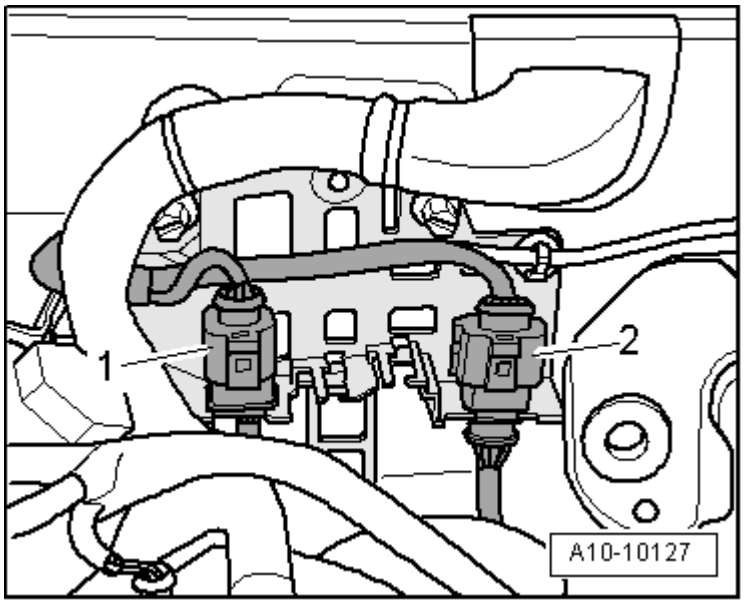

Fig. 138: Pulling Out Locking Pin, Loosening Piston Of Toothed Belt Tensioning Element & Removing Stud
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Pull out locking pin (arrow) and loosen piston of toothed belt tensioning element. Remove stud -1-.
- Turn crankshaft two complete turns in engine direction of rotation, set again to TDC and check adjustment.
- Install upper toothed belt guard.
- Installing ribbed belt and tensioning element. Refer to **Ribbed belt, removing and installing**.

Tightening torques

Component		Nm
Camshaft sprocket to camshaft		65
Ribbed belt tensioner to bracket		25

Replacing intake camshaft oil seal

Removing

- Remove ribbed belt. Refer to **Removing ribbed belt**.

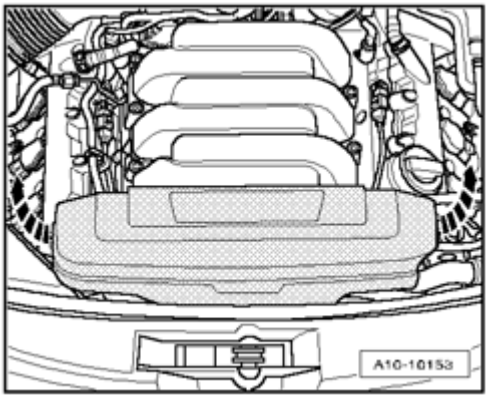

Fig. 139: Locating Connector At Camshaft Position Sensor G40
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Pull connector off Camshaft Position (CMP) Sensor -G40- (arrow).
- Remove toothed belt guard (upper section). Refer to **Toothed belt, removing and installing**.
- Remove Camshaft Position (CMP) Sensor housing.
- Remove Camshaft Position (CMP) Sensor rotor and washer.

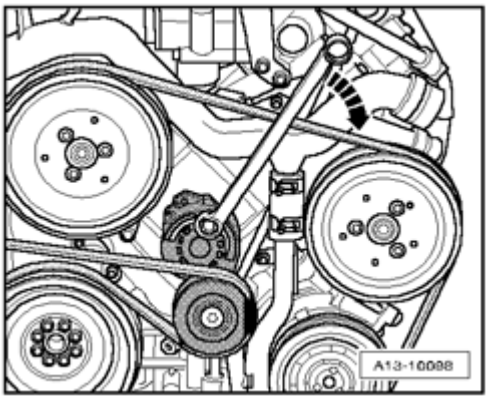

Fig. 140: Adapter 2085/1 Threaded In Camshaft
Courtesy of VOLKSWAGEN UNITED STATES, INC.

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

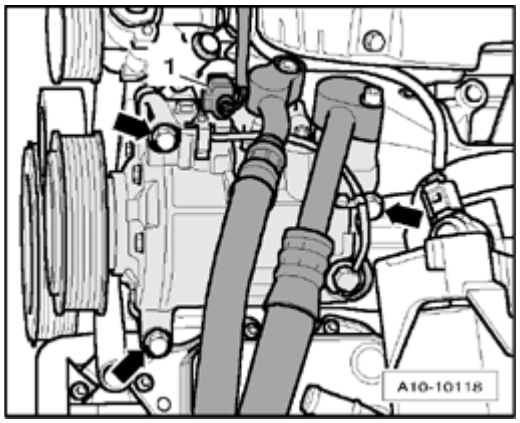

Fig. 141: Screwing Threaded Head Of Seal Extractor With Forced Pressure Into Oil Seal
Courtesy of VOLKSWAGEN UNITED STATES, INC.

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

Installing

- Lightly oil sealing lip of oil seal.

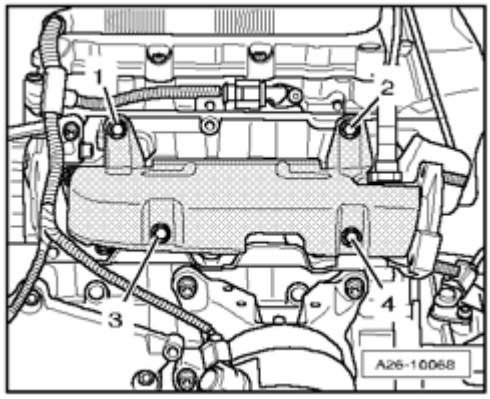

Fig. 142: Installing Guide Sleeve 3241/2 Onto Camshaft Journal
Courtesy of VOLKSWAGEN UNITED STATES, INC.

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

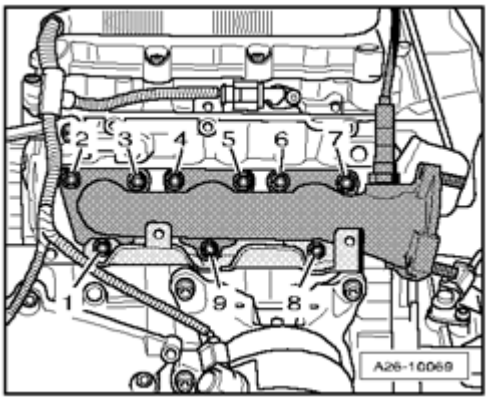

Fig. 143: Pressing In Gasket Up To Stop Using Thrust Sleeve 3241/1 And Bolt 3241/3
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Press oil seal in onto stop with press sleeve 3241/1. To do this use bolt 3241/3.
- Install notch in Hall sensor rotor into intake camshaft.
- Install washer (conical taper facing outward).
- Install Camshaft Position (CMP) Sensor housing.

- Install toothed belt guard (upper section).
- Connect Camshaft Position (CMP) Sensor connector.
- Install ribbed belt. Refer to **Installing ribbed belt**.

Tightening torques

Component		Nm
Camshaft Position (CMP) Sensor rotor to camshaft		25
Camshaft Position (CMP) Sensor housing to cylinder head		10

Camshafts and hydraulic chain tensioner, removing and installing

- Cylinder head installed

Special tools, testers and auxiliary items

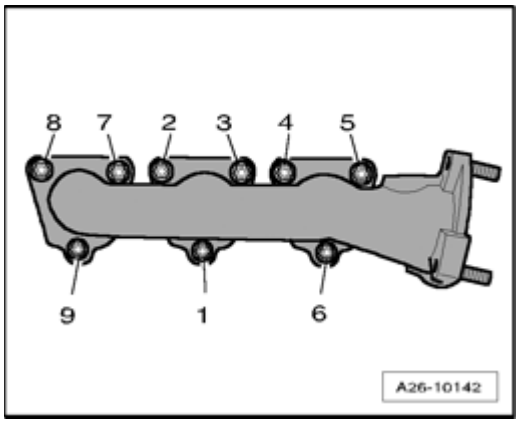

Fig. 144: Identifying Counter-Hold Tool 3036
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Counter-hold tool 3036

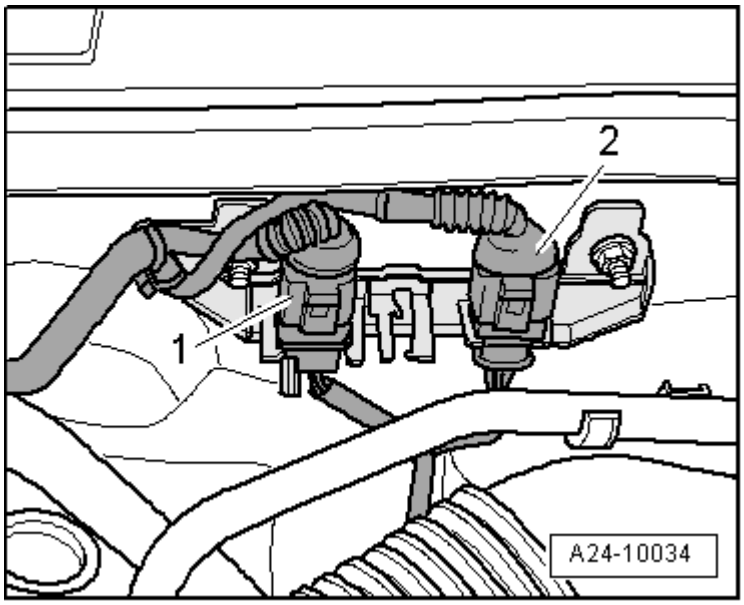

Fig. 145: Identifying Retainer For Chain Tensioner 3366
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Retainer for chain tensioner 3366

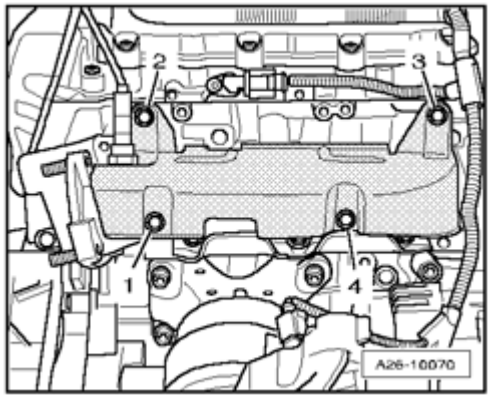

Fig. 146: Identifying Puller T40001
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Puller T40001

Removing

- Remove ribbed belt and tensioning element for ribbed belt. Refer to **Removing ribbed belt**.

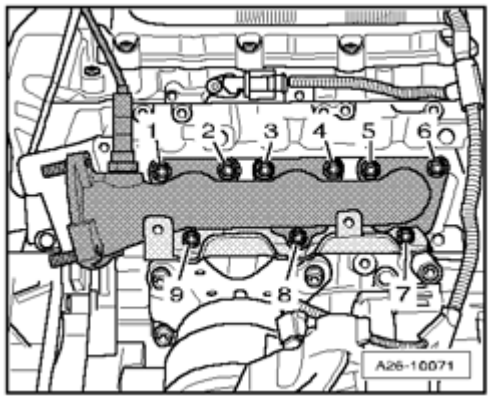

Fig. 147: Remove Engine Cover Panel Above Cylinder Head.
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove engine cover panel above cylinder head.
- Remove toothed belt guard (upper section). Refer to **Toothed belt, removing and installing**.

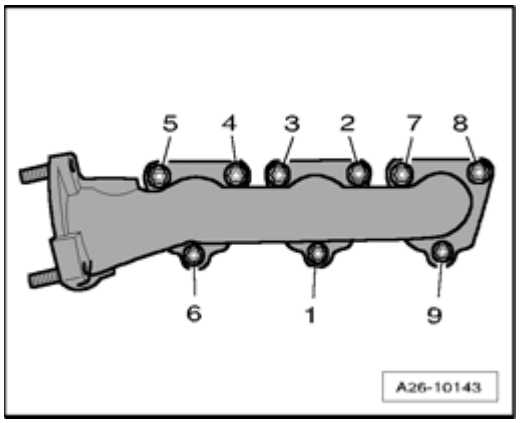

Fig. 148: Setting Crankshaft To Markings For TDC Of No. 1 Cylinder
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Set crankshaft to markings for TDC of No. 1 cylinder (arrows) by turning central bolt on crankshaft sprocket in direction of rotation.
- Remove cylinder head cover. Refer to **Cylinder head, removing and installing**.

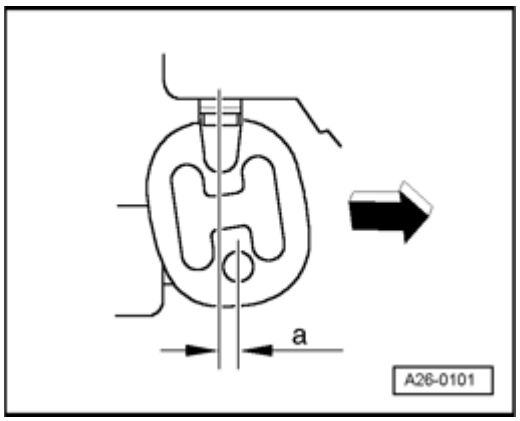

Fig. 149: Screwing Stud Into Toothed Belt Tensioning Element & Hex Nut Onto Stud Using Large Washer
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Screw M5x55 stud -1- into toothed belt tensioning element. Screw hex nut -2- onto stud -1- using a large washer -3-.
- Only tension piston of tensioning element as far as necessary to secure it with a locking pin (e. g. from lifting appliance 2024 A) (arrow).

NOTE: If it is not possible to insert the locking pin, carefully tension the pressure piston of the tensioning element just enough to allow the toothed belt to be removed.

- Take toothed belt off camshaft sprocket.
- Loosen camshaft sprocket (using 3036).
- Remove camshaft sprocket using puller T40001.

- Remove Camshaft Position (CMP) Sensor housing.
- Remove rotor for Camshaft Position (CMP) Sensor.

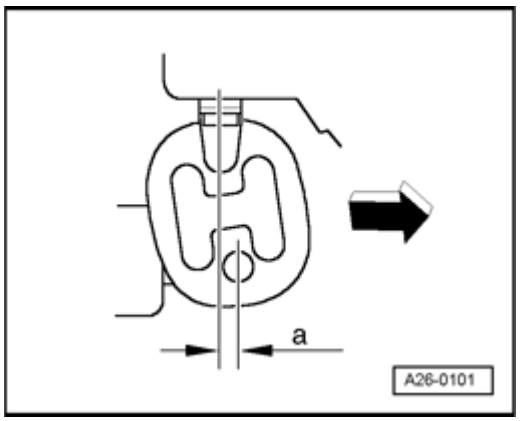

Fig. 150: Securing Camshaft Adjuster Or Chain Tensioner Using Bracket For Chain Adjustment 3366
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Secure hydraulic chain tensioner with retainer for chain tensioner 3366.

NOTE: If the retainer for chain tensioner is tightened excessively, this can damage the hydraulic chain tensioner.

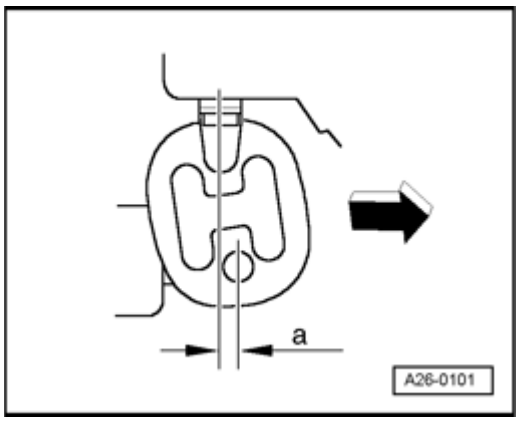

Fig. 151: Positioning Camshafts To TDC Cyl. 3
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Re-check TDC position of camshafts.
- The marks on the two camshafts must be in line with the (arrows) on the bearing caps.
- Clean chain and camshaft sprockets opposite the two (arrows) on the bearing caps and mark installation position with colored marks.

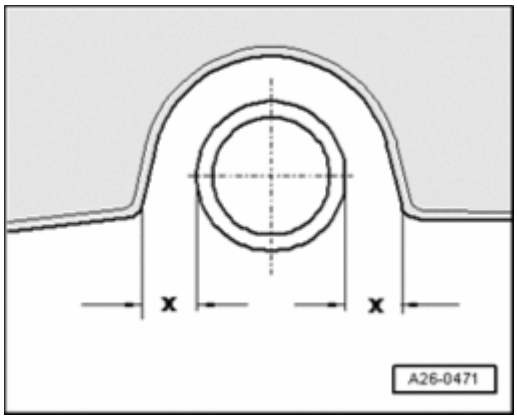

Fig. 152: Checking Distance Between Markings Consists Of 16 Rollers Of Drive Chain
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- The distance between the two arrows (and thus between the colored markings) is 16 rollers on the chain.
- The notch on the exhaust camshaft is offset slightly toward the inside in relation to chain roller -1-.

NOTE: Do not mark chain with a center punch or by making a notch or similar.

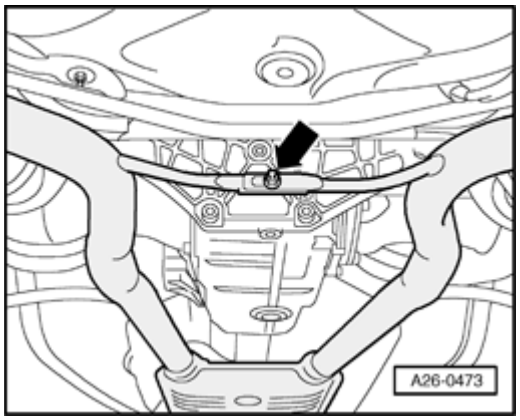

Fig. 153: Identifying Bearing Cap Positions
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- First remove bearing caps 3 and 5 on intake and exhaust camshafts.
- Remove double bearing cap.
- Remove both bearing caps next to intake and exhaust camshaft chain sprockets.
- Remove securing bolts of hydraulic chain tensioner.

- Slacken off bearing caps 2 and 4 of intake and exhaust camshafts alternately and diagonally, and remove.
- Remove intake and exhaust camshafts with hydraulic chain tensioner.

Installing

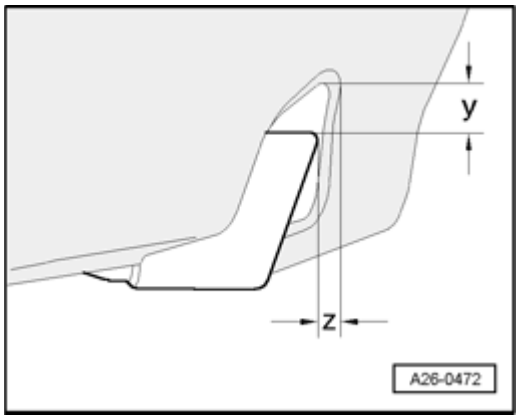

Fig. 154: Sealant Application Area Identified By Hatched Surface
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Replace rubber/metal gasket for hydraulic chain tensioner and apply a thin coat of sealant "D 454 300 A2" to the shaded area.
- Install drive chain on camshaft sprockets as follows:

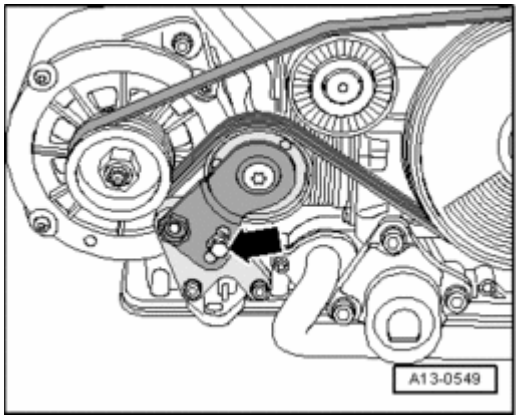

Fig. 155: Installing Chain So That Colored Markings Are In Line
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- When the old chain is being re-installed, install the chain so that the colored markings are in line (arrows).

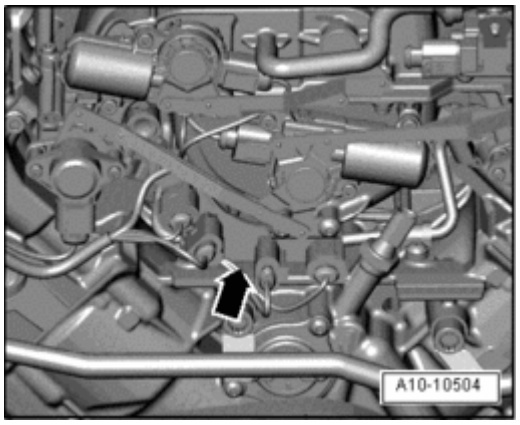

Fig. 156: First And Sixteenth Drive Chain Rollers Installed On Chain Gears
Courtesy of VOLKSWAGEN UNITED STATES, INC.

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

- Insert hydraulic chain tensioner into the chain.
- Locate camshafts together with chain and hydraulic chain tensioner on cylinder head.
- Oil running surfaces of both camshafts.

NOTE:

- **Dowel sleeves for bearing caps and hydraulic chain tensioner must be located in cylinder head.**
- **When installing bearing caps ensure that the identification mark is readable from the intake side of cylinder head.**

- Tighten mounts of hydraulic chain tensioner (watch position of dowel sleeves).

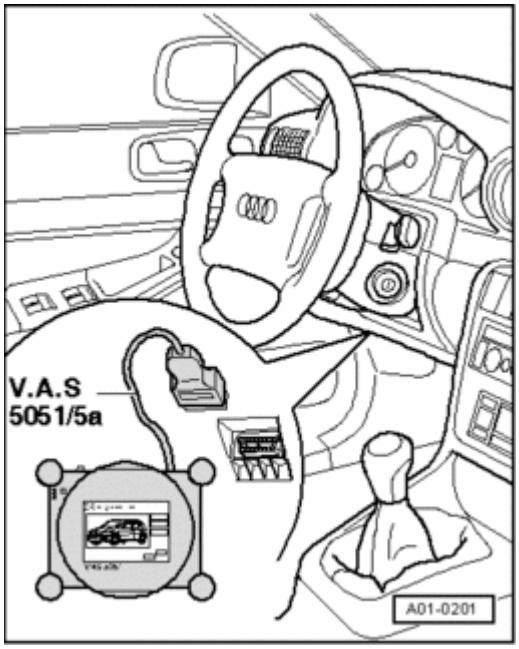

Fig. 157: Identifying Bearing Cap Positions
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Tighten bearing caps 2 and 4 of intake and exhaust camshafts in stages and in diagonal sequence (watch position of dowel sleeves).
- Install the two bearing caps next to the chain sprockets on the intake and exhaust camshafts.
- Check correct setting of camshafts:

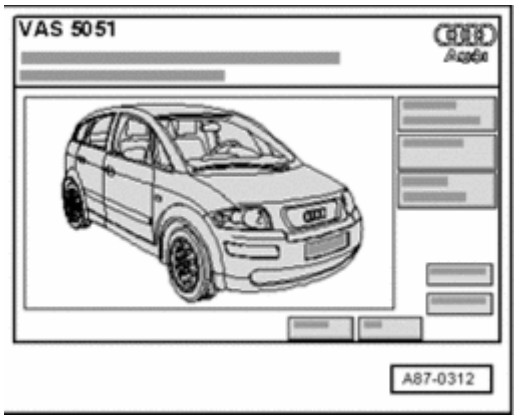

Fig. 158: Positioning Camshafts To TDC Cyl. 3
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- The two markings on the camshafts must be in line with the two arrows on the bearing caps (arrows).

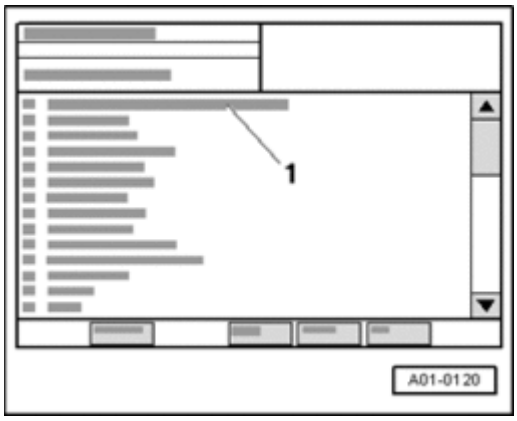

Fig. 159: First And Sixteenth Drive Chain Rollers Installed On Chain Gears
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- The distance between the two arrows on the bearing caps (or between the colored markings) is 16 rollers on the chain.
- The notch on the exhaust camshaft is offset slightly toward the inside in relation to chain roller -1-.

- Remove holder for chain tensioner 3366.

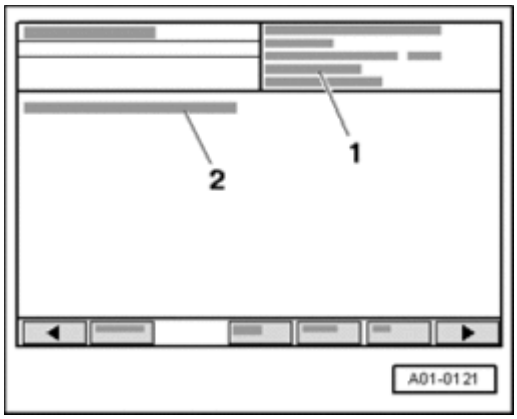

Fig. 160: Identifying Double Bearing Cap Sealant Application Area
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Apply a thin coat of sealant "D 454 300 A2" 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).
- Install new intake and exhaust camshaft oil seals. Refer to **Camshaft oil seals, replacing**.

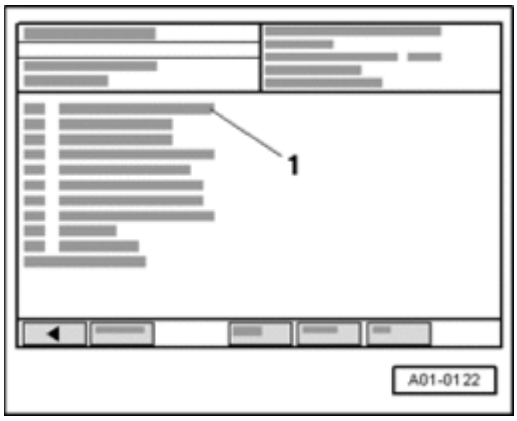

Fig. 161: Identifying Camshaft Gear Thin Rib Toward Outside And TDC Marking Visible
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Install camshaft sprocket.

- Check installation position: The narrow web of the camshaft sprocket faces outward (arrows) and the marking for No.1 cylinder TDC is visible from the front.

- Install securing bolt for camshaft sprocket (hold in place with retainer 3036).
- Install Camshaft Position (CMP) Sensor.
- Install cylinder head cover. Refer to **Cylinder head, removing and installing**.

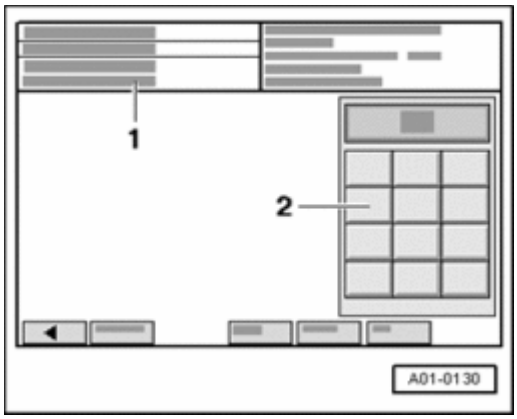

Fig. 162: Setting Crankshaft To Markings For TDC Of No. 1 Cylinder
Courtesy of VOLKSWAGEN UNITED STATES, INC.

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

NOTE: The crankshaft must not be at TDC when the camshaft is rotated, otherwise valves can contact pistons and cause damage.

- Install toothed belt (adjust valve timing). Refer to **Installing (adjusting valve timing)**.
- Install ribbed belt and ribbed belt tensioning element. Refer to **Installing ribbed belt**.

NOTE:

- **Follow all instructions for removing and installing toothed belt. Refer to Toothed belt, removing and installing.**
- **Wait about 30 minutes after installing the camshafts before starting the engine. The hydraulic valve compensating elements must settle (otherwise the valves will strike the pistons).**
- **After working on the valve gear, turn the engine carefully at least 2 rotations to ensure that none of the valves make contact when the starter is operated.**

Hydraulic lifters, checking

NOTE:

- **Replace defective valve lifter complete (cannot be adjusted or repaired).**
- **Irregular valve noises when starting engine are normal.**

- Start engine and run until the radiator fan has switched on once.
- Increase engine speed to about 2500 RPM for 2 minutes (perform road test if necessary).

NOTE: If the irregular valve noises stop but recur repeatedly during short journeys, a new oil retention valve must be installed. The oil retention valve is located in the oil filter bracket. Refer to Part II.

If the hydraulic valve lifters are still noisy, locate defective valve lifters as follows:

- Remove cylinder head cover. Refer to **Cylinder head, removing and installing**.
- Rotate crankshaft clockwise by turning the central securing bolt on the crankshaft toothed belt sprocket until the cams of the valve lifter to be checked are pointing upward.
- Determine play between cam and hydraulic lifter.

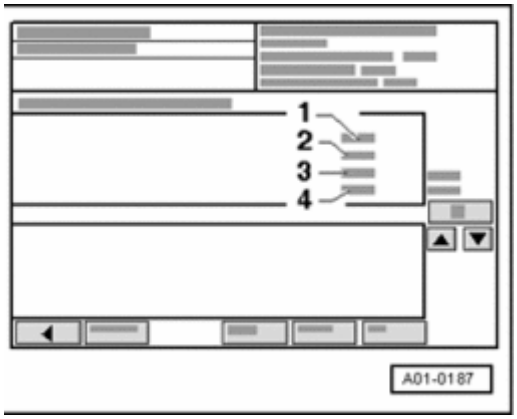

Fig. 163: Pressing Valve Lifter Down With Wooden Or Plastic Wedge
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Press valve lifter down with a wooden or plastic wedge. If an 0.20 mm feeler gauge can be inserted between camshaft and valve lifter, replace valve lifter.
- Replacing valve lifter. Refer to **Camshafts and hydraulic chain tensioner, removing and installing**, Removing and installing camshafts and hydraulic chain tensioner

NOTE:

- **After installing new valve lifters the engine must not be started for approx. 30 minutes (otherwise valves will strike pistons). Rotate crankshaft two times before starting engine.**
- **After working on the valve gear, turn the engine carefully at least 2 rotations to ensure that none of the valves make contact when the starter is operated.**

Valve stem seals, replacing

- Cylinder head installed

Removing

- Remove camshafts. Refer to **Camshafts and hydraulic chain tensioner, removing and installing**.
- Remove the hydraulic lifters and put them down with the contact surface downward. When doing this ensure that the valve lifters are not interchanged.
- Remove spark plugs with spark plug spanner 3122B.
- Set piston of appropriate cylinder to "bottom dead center".

- Screw pressure hose VW 653/3 into the spark plug thread.

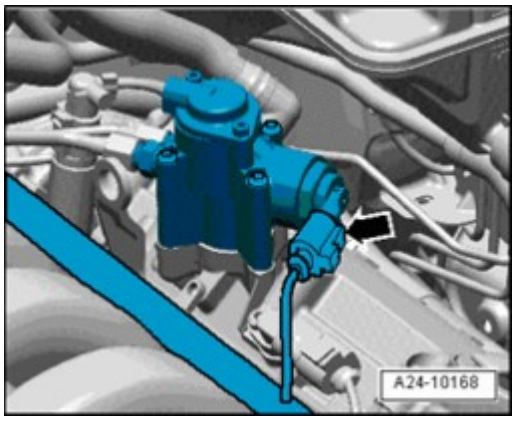

Fig. 164: Identifying Intake And Exhaust Valves Installation Position
Courtesy of VOLKSWAGEN UNITED STATES, INC.

The intake and exhaust valves are installed at different angles in the cylinder head. Valve spring compressor 3362 can be set accordingly to two different positions:

1 - upper position for center intake valve

2 - lower position for the two outer intake valves and the two exhaust valves

3 - Threaded holes on each side to take two M6 x 25 bolts for securing spring compressor to cylinder head

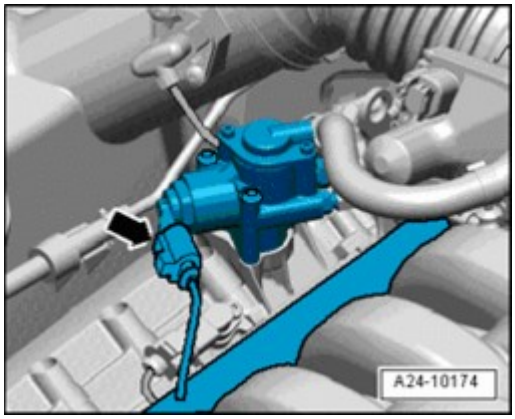

Fig. 165: Mounting Fitting Tool 3362 On Cylinder Head With Fitting Tool Securing Bolts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Mount fitting tool 3362 on cylinder head with fitting tool securing bolts.

NOTE: To install assembly tool 2036 on the exhaust side the studs at the back of the exhaust side have to be removed.

- Set the correct position for the valve concerned.

- Connect pressure hose to compressed air supply.

- Air pressure: at least 6 bar

- Press valve springs down with threaded spindle and thrust piece 3362/1 and remove.

NOTE: Tight cotters can be loosened by tapping lightly on the valve spring plate.

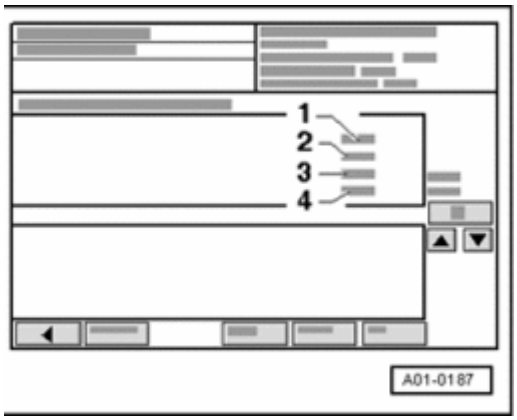

Fig. 166: Pulling Off Valve Stem Seals With Extractor 3364
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Pull off valve stem seals with extractor 3364.

Installing

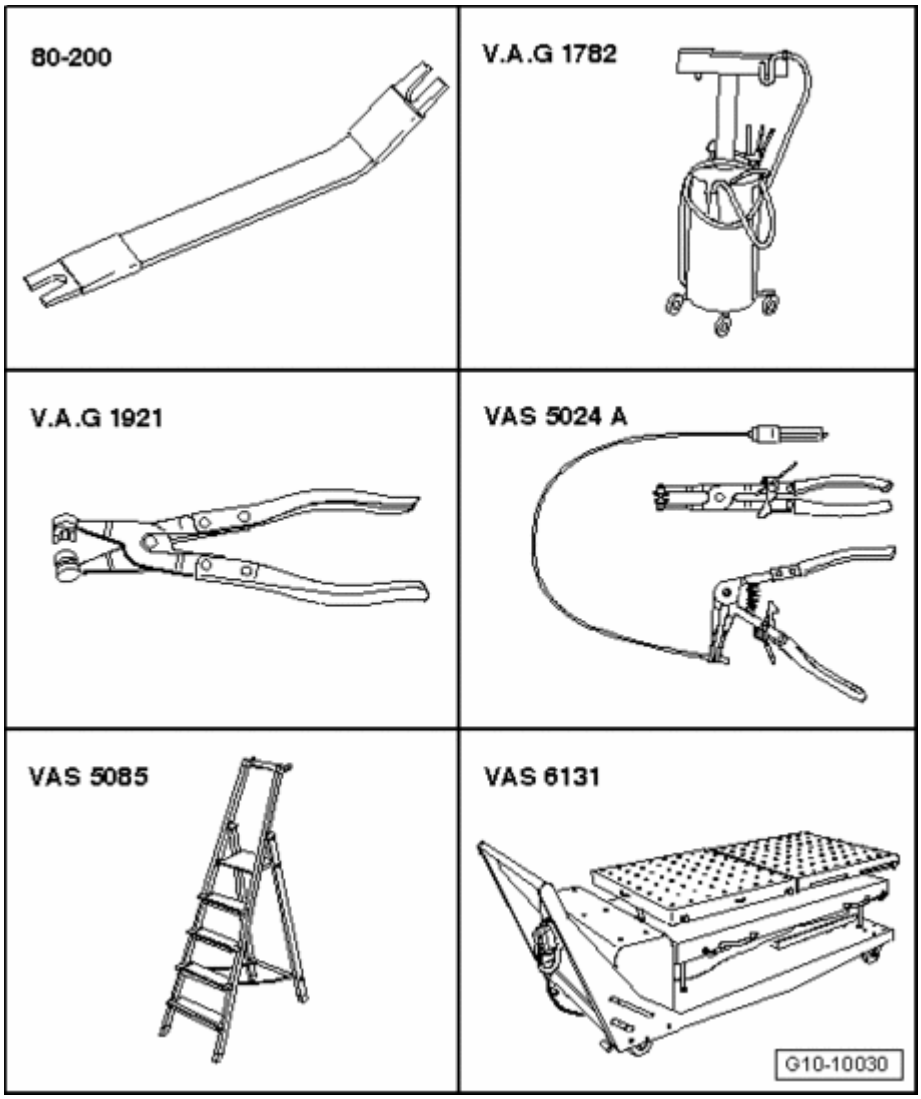

Fig. 167: Placing Plastic Sleeve On Valve Stem & Placing Valve Stem Seal In The Tool 3365
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- To prevent damage to the new valve stem seals, place plastic sleeve -A- on valve stem.
- Lightly oil sealing lip of valve stem seal.
- Place valve stem seal -B- in the tool 3365 and push carefully onto the valve guide.

NOTE: When replacing intake and exhaust valves lightly oil valve stems before installing.

- Install camshafts. Refer to **Camshafts and hydraulic chain tensioner, removing and installing**.

NOTE:

- **After installing camshafts wait for approx. 30 minutes before starting engine. Hydraulic valve compensation elements have to settle (otherwise valves will strike pistons).**

- **After working on the valve gear, turn the engine carefully at least 2 rotations to ensure that none of the valves make contact when the starter is operated.**

Valve guides, checking

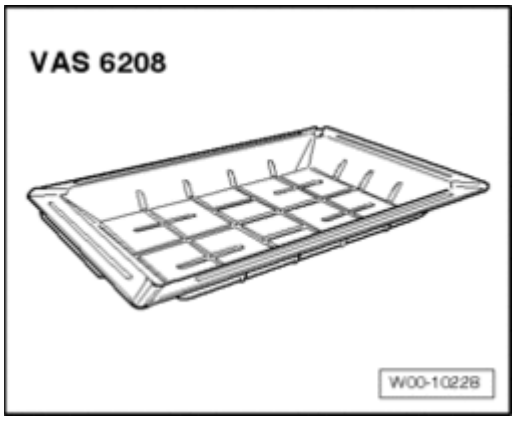

Fig. 168: Valve Guides, Checking
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Insert valve into valve guide until end of valve stem is flush with end of guide. Due to the slight difference in stem diameters, ensure that only an intake valve is used in the intake guide and an exhaust valve in the exhaust guide.
- Measure the amount of sideways play (lateral play).

Wear limit

Intake valve guide	Exhaust valve guide
0.80 mm	0.80 mm

NOTE:

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

Grinding in valve seats

- Grind in valve seats only as far as necessary to achieve a good seating pattern.

Valve guides, replacing

Special tools, testers, measuring instruments and auxiliary items required

- Drift 3360

- Support 3361
- Hand reamer 3363 and cutting fluid
- Press tool VW 411

Removing

- First check whether the valve seat insert rings and if necessary the cylinder head sealing surface can be reworked. If this is not the case then the valve guide should not be replaced.

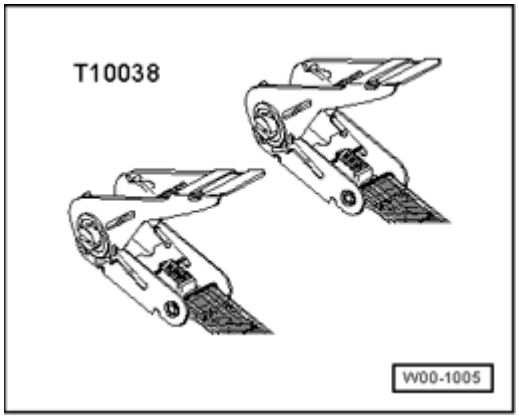

Fig. 169: Inserting Locating Pins For Cylinder Head Bolt Holes In Appropriate Holes
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Set up the support as follows:
- Insert locating pins for cylinder head bolt holes -A- in holes 2 and 3.
- Insert pin -B- in the appropriate hole (marked according to valve angle).

Outer intake valves: 21.5 -5

Central intake valve: 15 -5

Exhaust valves: 20 -5

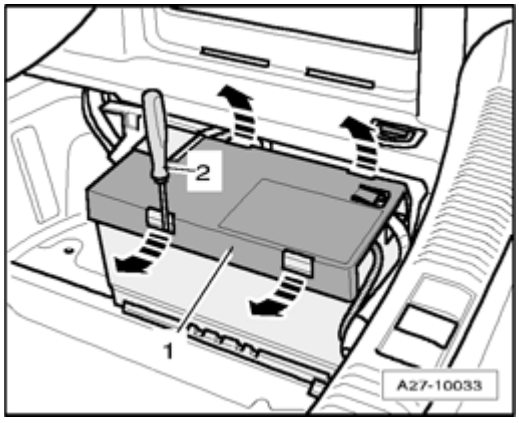

Fig. 170: Pressing Out Worn Valve Guides Using Drift 3360

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Press out the worn valve guides as follows using drift 3360:

- Valve guides without shoulder from the camshaft side
- Valve guides with shoulder (repair version) from the combustion chamber side

Installing

NOTE: When the shoulder on guide makes contact, the pressure must not exceed 10 kN (approx. 1.0 t) otherwise shoulder may break off.

- Coat the new valve guides with oil and press with drift 3360 into cold cylinder head from the camshaft side until the shoulder makes contact.
- Ream guides out with hand reamer 3363 using plenty of cutting fluid.
- Rework valve seats. Refer to **Valve seats, reworking**.
- Replace valve stem seals. Refer to **Valve stem seals, replacing**.

Valve seats, reworking

Special tools, testers, measuring instruments and auxiliary items required

- Depth gauge
- Valve seat refacing tool

NOTE:

- **When repairing engines with leaking valves, it is not sufficient to reface the valve seats and replace the valves. The valve guides must also be checked for wear. This is particularly important on high mileage engines. Refer to Valve guides, checking.**
- **Only rework the valve seats as far as is necessary to ensure a good seating pattern.**
- **Before starting to rework the valve seats, calculate the maximum permissible reworking dimension.**
- **If the maximum reworking dimension is exceeded, the hydraulic valve lifters will not work properly and the cylinder head will have to be replaced.**

Calculating maximum permissible reworking dimension

- Insert valve and press firmly against valve seat.

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

- Measure distance between end of valve stem and central axis of camshaft. (Central axis of camshaft is level with top of cylinder head.)
- Calculate max. permissible reworking dimension from measured distance and minimum dimension.

Minimum dimensions		
Outer intake valves	Central intake valve	Exhaust valves
34.0 mm	33.7 mm	34.4 mm

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

Example (for outer intake valve):		
	Measured distance	34.4 mm
-	Minimum dimension	- 34.0 mm
=	Max. permissible reworking dimension 1)	= 0.4 mm

*) The maximum permissible reworking dimension is shown in the illustration under **Reworking valve seats** as dimension "b".

NOTE: If the maximum permissible reworking dimension is 0 mm or less than 0 mm, repeat the measurement with a new valve. If the measured result is again 0 mm or less than 0 mm, replace the cylinder head.

Reworking valve seats

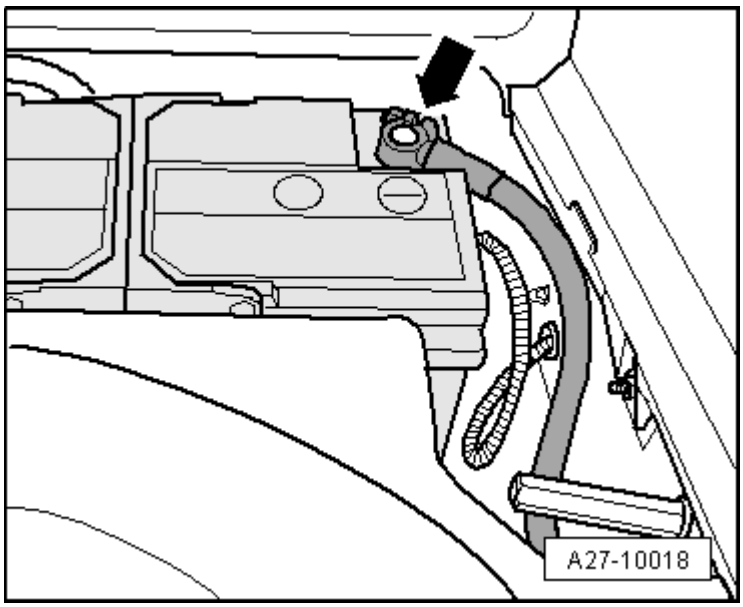

Fig. 171: Intake/Exhaust Valve Seat Measurements
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Intake valve seat		

a	=	26.2 mm dia.
b	=	Max. permissible reworking dimension 1)
c	=	1.5 - 1.8 mm
Z	=	Bottom surface of cylinder head
a	=	45° valve seat angle
ß	=	30° upper correction angle
gamma	=	60° lower correction angle

Exhaust valve seat		
a	=	29.0 mm dia.
b	=	Max. permissible reworking dimension 1)
c	=	Approx. 1.8 mm
Z	=	Bottom surface of cylinder head
a	=	45° valve seat angle
ß	=	30° upper correction angle
gamma	=	60° lower correction angle

1) Calculating maximum permissible reworking dimension. Refer to **Calculating maximum permissible reworking dimension**.

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 the engine, carefully clean the oil passages and replace the oil cooler and all the oil spray jets in order to prevent further damage occurring later.**
- **The oil level must not be above the max. mark - danger of damage to catalytic converter.**

Checking oil pressure and oil pressure switch. Refer to **Oil pressure and oil pressure switch, checking**

Viscosity grades and oil specifications. Refer to **Engine oil**.

Checking engine oil level. Refer to **Oil level, checking**.

Part I

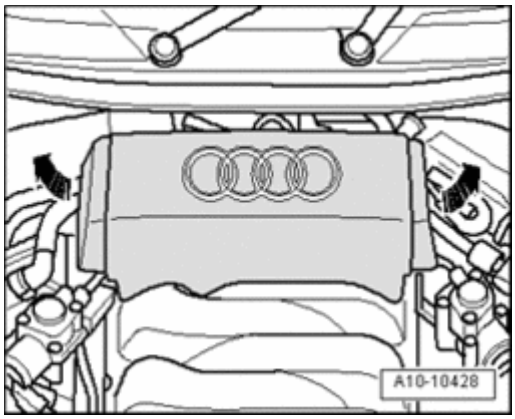

Fig. 172: Lubrication System Components, Removing And Installing Overview - Part I
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Oil pump

- With pressure relief valve (12 bar)
- Removing and installing. Refer to **Oil pump, removing and installing**
- Before installing, check that the two dowel sleeves for centering oil pump/cylinder block are installed.
- Replace pump if there is scoring on moving surfaces and gear teeth.
- Tightening torque for oil pump cover to oil pump housing: 10 Nm

2 - Chain sprocket for oil pump

- Note correct position
- Sprocket can only be fitted on oil pump shaft in one position.

3 - 25 Nm

4 - Drive chain for oil pump

- Mark direction of rotation before removing
- Check for wear

5 - Sealing flange

- Apply silicone sealant D 176 404 A2 before installing. Refer to **Installing**
- Replacing crankshaft oil seal on pulley end. Refer to **Crankshaft oil seal (pulley end), replacing**

6 - 15 Nm

7 - Chain tensioner

- Tighten to 15 Nm

- Do not dismantle
- Note installation position
- Pre-tension spring and engage before installing
- If the spring is broken replace chain tensioner complete

8 - Chain sprocket

- Removing and installing. Refer to **Chain sprocket, removing and installing**

9 - Dowel sleeves

10 - 15 Nm

11 - Suction pipe

- Clean strainer if soiled

12 - O ring

- Always replace

13 - Baffle plate

- Only install with oil pump installed

14 - 15 Nm

15 - 15 Nm

16 - Oil pan

- Apply silicone sealant D 176 404 A2 when installing. Refer to **Installing**

17 - Seal

- Always replace

18 - Oil drain plug - 30 Nm

Part II

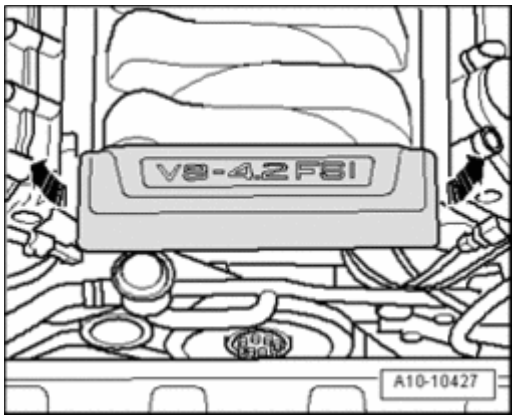

Fig. 173: Lubrication System Components, Removing And Installing Overview - Part II
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Plug - 40 Nm

2 - Seal

- 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

- Tightening torque 8 Nm
- Built into oil filter bracket

7 - O ring

- Always replace
- Slide on until flush with collar on pipe -Item 8 under **Part II**

8 - Pipe

9 - Retaining clip

10 - Screw plug - 15 Nm

11 - Seal

- If seal is leaking, cut open and replace.

12 - 20 Nm

13 - Oil supply line

- To turbocharger

14 - Banjo bolt - 30 Nm

15 - Seals

- Always replace

16 - Oil pressure switch -F1-

- 1.4 bar, 25 Nm
- Black insulation
- Checking. Refer to **Oil pressure and oil pressure switch, checking**

17 - Seal

- If seal is leaking, cut open and replace.

18 - 15 Nm plus an additional 1/4turn (90°)

- Always replace

19 - Gasket

- Always replace
- Engage in projections on oil cooler

20 - Oil filter

- Loosen with oil filter wrench 3417
- Tighten to 20 Nm
- Observe installation instructions on oil filter
- Observe change intervals

21 - 25 Nm

22 - Oil cooler

- See note. Refer to **Lubrication system components, removing and installing**
- Ensure clearance to adjacent components
- Coat contact area to flange, outside the seal, with AMV 188 001 02
- Coolant hose connection diagram. Refer to **Fig. 185**

23 - Oil filter bracket

- With pressure relief valve (approx. 4 bar)

Oil pan, removing and installing

Special tools, testers and auxiliary items required

- Electric drill with plastic brush attachment
- Silicone sealant D 176 404 A2

Removing

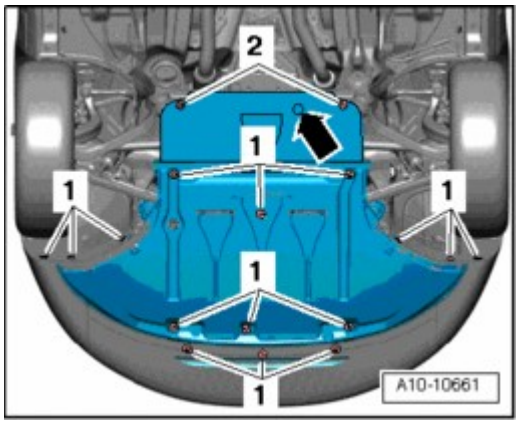

Fig. 174: Removing Noise Insulation
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove noise insulation in the center (arrows).
- Drain engine oil.

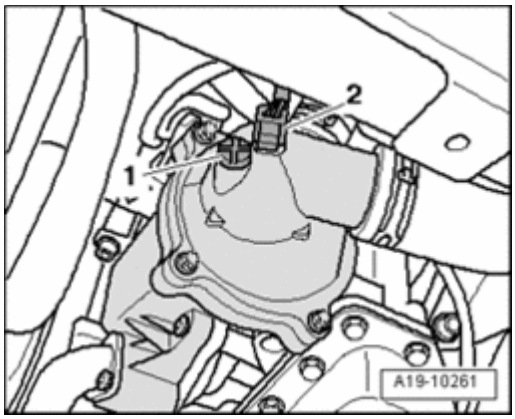

Fig. 175: Removing Oil Return Line From Oil Pan
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove oil return line -3- from oil pan.
- Remove oil pan.

NOTE: Loosen and tighten oil pan bolts with jointed wrench 3185. Remove bolts with socket attachment 3249.

- Take off oil pan: if necessary loosen it by striking lightly with a rubber hammer.
- Remove sealant remaining on cylinder block with flat scraper.

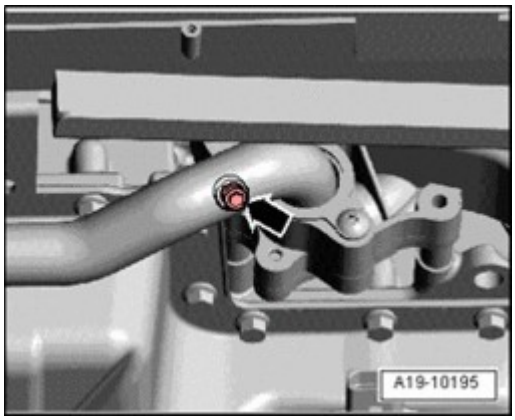

Fig. 176: Removing Remaining Sealant From Oil Pan
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove remaining sealant from oil pan (with rotating plastic brush or similar).

WARNING: Wear eye protection

- Clean sealing surfaces: they must be free of oil and grease.

Installing

NOTE: The oil pan must be installed within 5 minutes after applying the silicone sealant.

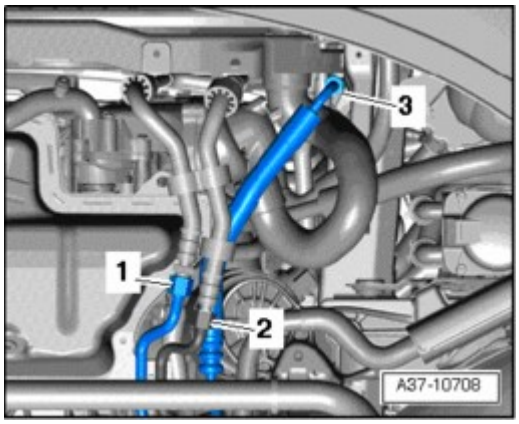

Fig. 177: Cutting Off Tube Nozzle & Applying Silicone Sealing Compound To Oil Pan Sealing Surface
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Cut off nozzle on tube at front marking (nozzle dia. approx. 3 mm).
- Thickness of sealant bead: 2 - 3 mm

NOTE: The bead of sealant must not be thicker than 3 mm, as otherwise excess sealant will enter the oil pan and obstruct the strainer in the oil intake line.

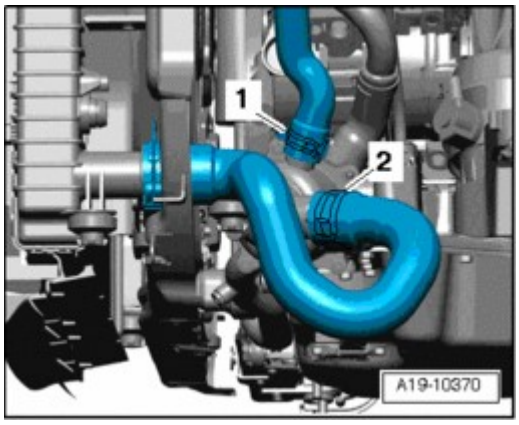

Fig. 178: Identifying Clean Sealing Surfaces Sealant Application Areas
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Apply silicone sealant to the clean sealing surface on the oil pan as illustrated. (The illustration shows the position of the sealant bead on the cylinder block.)
- Apply the sealant bead with particular care around the rear sealing flange (arrows).
- Install the oil pan immediately and bolt to cylinder block. Start by tightening all the bolts by hand.
- Tighten the 3 bolts securing oil pan to transmission.
- Tighten bolts securing oil pan to cylinder block in two stages in diagonal sequence.

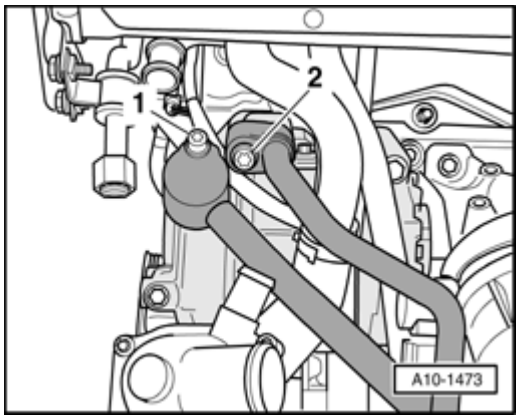

Fig. 179: Removing Oil Return Line From Oil Pan
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove oil return line -3- at oil pan.

Tightening torques

Component	Nm
Oil pan to cylinder block	15
Oil pan to transmission	45
Oil return line to oil pan	15

NOTE:

- **When installing the oil pan with the engine out of the vehicle, ensure that the oil pan is flush with the cylinder block at the flywheel end.**
- **After installing the oil pan, wait for about 30 minutes for the sealant to dry before putting in engine oil.**

Oil pump, removing and installing

Removing

- Remove oil pan. Refer to **Oil pan, removing and installing**.

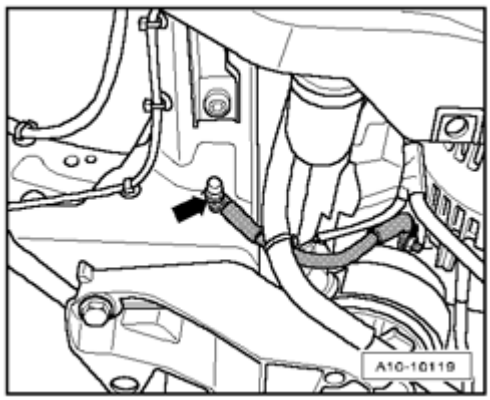

Fig. 180: Detaching Oil Pump
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Loosen bolts (arrows).
- Detach oil pump but leave chain sprocket in place.

Installing

- Insert dowel sleeves at top of oil pump.

- Chain sprocket can only be installed in one position on oil pump shaft.

- Install oil pan. Refer to **Installing**.

Tightening torques

Component		Nm
Chain sprocket to oil pump shaft		25
Oil pump to cylinder block		15

Oil pressure and oil pressure switch, checking

Function of dynamic oil pressure warning system

Testing warning lamp

The oil pressure warning lamp lights up when the ignition is switched on ("Terminal 15 on") with the engine not running (this does not apply to vehicles with auto-check system).

Conditions for activation of warning

- Engine not running; oil pressure switch closed.
- Coolant temperature above 60° C, engine speed above 1500 RPM and oil pressure switch open.
- When engine speed is above 5000 RPM an active oil pressure warning is not cancelled, irrespective of the condition of the oil pressure switch.
- If the power supply to the control module is ok (Terminal 15) and the oil pressure switch is open for longer than 0.5 seconds at engine speeds above 1500 RPM, this condition is stored in the memory. If this condition occurs three times with "Terminal 15 on", the warning will also become active or remain active at engine speeds below 1300 RPM.

Requirements for test:

- Oil level ok.
- Oil pressure warning light -K3- must come on when ignition is switched on.
- In vehicles with auto-check system the "OK" display must appear (call up symbol).

- Engine oil temperature approx. 80° C (radiator fan must have cut in once).

Testing oil pressure switch

- Disconnect wire from oil pressure switch.

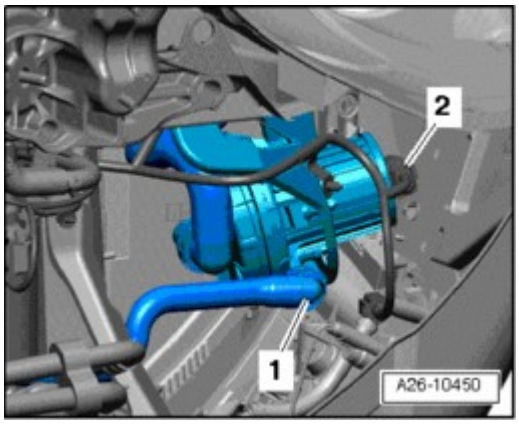

Fig. 181: Removing Oil Pressure Switch And Screwing In Oil Pressure Tester V.A.G 1342
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove oil pressure switch and screw in oil pressure tester V.A.G 1342.
- Screw oil pressure switch -2- intoV.A.G 1342.
- Connect brown wire -1- of tester to Ground (-).
- Connect LED voltage tester V.A.G 1527 to oil pressure switch and positive side of battery (+).

- LED voltage tester should not light up.

- If the LED voltage tester lamp lights up, install a new oil pressure switch.
- Start the engine.

- LED voltage tester should light up at 1.2-1.6 bar.

- If the LED voltage tester lamp does not light up, install a new oil pressure switch.

NOTE: The oil pressure switch may reach its switching point while the engine is being turned over by the starter. It is therefore important to watch the LED voltage tester and the tester lamp while starting the engine.

Testing oil pressure

- Disconnect wire from oil pressure switch.

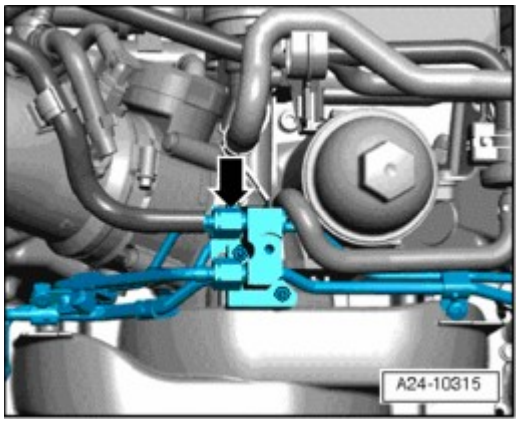

Fig. 182: Removing Oil Pressure Switch And Screwing In Oil Pressure Tester V.A.G 1342
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove oil pressure switch and screw in oil pressure tester V.A.G 1342.
- Screw oil pressure switch -2- intoV.A.G 1342.
- Start engine (engine oil temperature at least 80° C).

- Oil pressure at idling speed: 1.0 bar
- Oil pressure at 3000 RPM: between 3.5 to 4.5 bar

If the specifications are not obtained:

- Replace oil filter bracket with pressure relief valve. Refer to **Part II** or oil pump. Refer to **Oil pump, removing and installing**.

Engine oil

A high-quality multi-grade oil is put in at the factory: this can be used all year round, except in extremely cold climates.

Viscosity grades and oil specifications

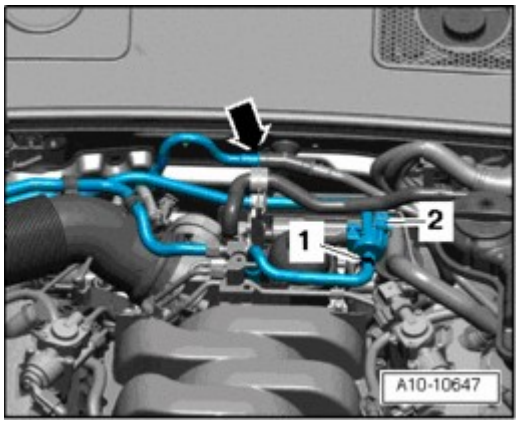

Fig. 183: Viscosity Grades And Oil Specifications

Courtesy of VOLKSWAGEN UNITED STATES, INC.

Select the viscosity grade of the oil according to the chart. The oil does not need changing for brief variations of temperature outside the temperature ranges shown.

The specifications listed here must appear on the container - either singly or together with other specifications.

A - High lubricity multi-grade oils, specification VW 500 001)

B - Multi-grade oils, specification VW 501 011)

Multi-grade oils, specification API-SJ or API-SL2)

1) The date given after the VW specification must be not earlier than 10.91.

2) Only use these grades of oil if the approved grades are not available.

Different types of oil may be mixed if necessary when topping off.

Oil level, checking

Check conditions

- Check the oil level only when the engine is warm (oil temperature above 60° C).
- The car must be standing on level ground when checking the oil level. Wait a few minutes after switching off the engine to allow the oil to flow back into the oil pan.

Test sequence

- Pull out the dipstick, wipe off with a clean cloth and insert it again as far as it will go.
- Pull out the dipstick again and read off the oil level.

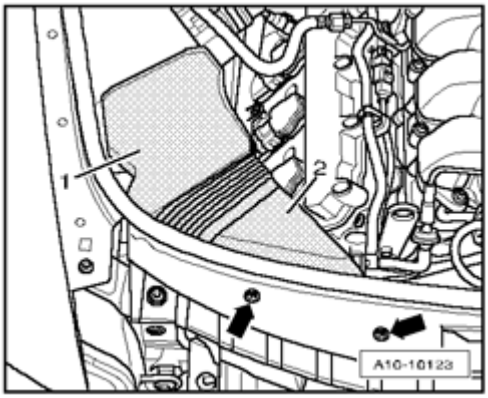

Fig. 184: Markings On Oil Dipstick
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Markings on oil dipstick:

a - Do not top off oil.

b - Oil can be topped off. The oil level may rise as far as area -a- after topping up.

c - Oil must be topped off. It is sufficient if the oil level is somewhere in area -b- (grooved area on dipstick) after topping off.

NOTE: The oil level must not be above the max. marking on the dipstick.

19 ENGINE - COOLING SYSTEM

COOLING SYSTEM COMPONENTS, REMOVING AND INSTALLING

Cooling system components, removing and installing

NOTE:

- **When the engine is warm the cooling system is under pressure. If necessary release pressure before commencing repair work.**
- **Secure all hose connections with hose clamps of the same type as those installed at the factory.**
- **V.A.G 1921 hose clip pliers are recommended when installing spring-type clips.**
- **Replace all gaskets and seals.**
- **The arrow markings on the coolant pipes and on the ends of the hoses must be aligned with each other.**
- **Tightening torque for screw clamps: 2 Nm.**

Draining and filling cooling system. Refer to **Draining**.

Anti-freeze concentration. Refer to **Filling**.

Coolant hose connection diagram. Refer to **Fig. 185**.

Checking cooling system for leaks with V.A.G 1274 and 1274/8. Refer to **Cooling system, checking for leaks**.

Removing coolant pump. Refer to **Coolant pump, removing and installing**.

Removing coolant thermostat. Refer to **Coolant thermostat, removing, installing and checking**.

Cooling system components

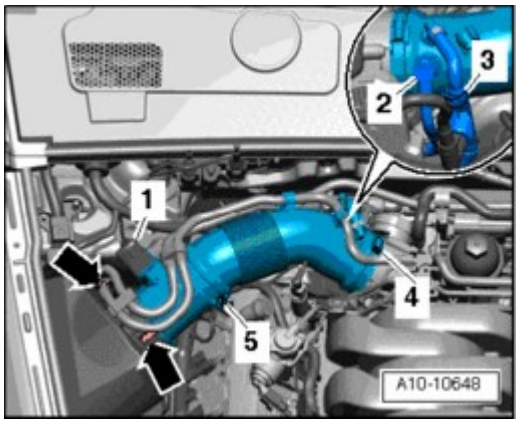

Fig. 185: Cooling System Components
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Expansion tank

2 - Filler cap for expansion tank

- Testing. Refer to **Testing pressure relief valve in filler cap.**

3 - Intake manifold

4 - Heating system heat exchanger

5 - Cylinder block

6 - Oil cooler

- Removing and installing. Refer to **Part II**, Item 22

7 - Radiator

- After replacing, refill complete system with fresh coolant

8 - After-run coolant pump -V51-

- Testing. Refer to **After-run coolant pump -V51-, checking**

9 - Coolant pump, coolant thermostat

- Removing and installing coolant pump. Refer to **Coolant pump, removing and installing**
- Check for ease of movement
- Removing and installing coolant thermostat. Refer to **Coolant thermostat, removing, installing and checking**
- Testing, operating data. Refer to **Testing coolant thermostat**

10 - Turbocharger

Cooling system, draining and filling

Draining

NOTE:

- **Catch drained-off coolant in a clean container for re-use or disposal.**
- **Coolant must only be mixed with clean drinking water.**

- Remove cap from coolant expansion tank.

WARNING: Hot steam can escape when the cap on the expansion tank is opened. Cover the cap with a cloth, and open it carefully.

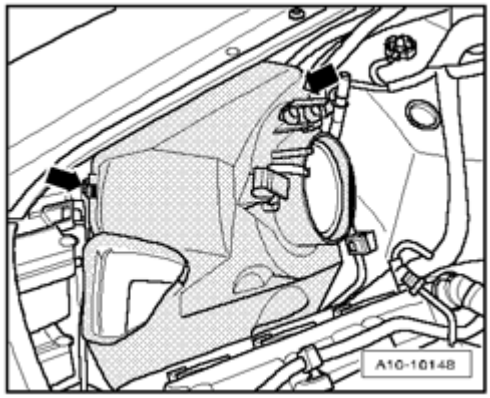

Fig. 186: Removing Noise Insulation
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove center section of noise insulation.
- Place drip tray V.A.G 1306 below engine.

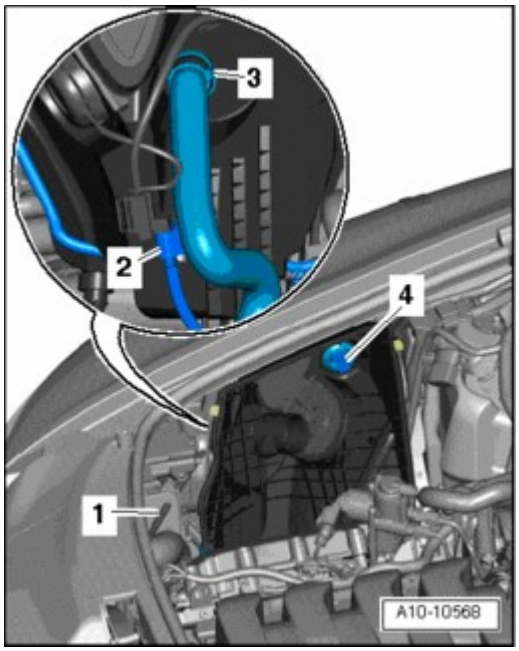

Fig. 187: Turning Drain Screw On Radiator
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Turn drain screw (arrow) on radiator counter-clockwise, install an extension hose to the connection if necessary.

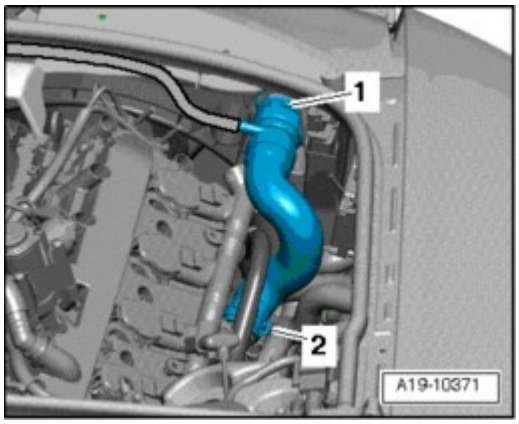

Fig. 188: Disconnecting Bottom Coolant Hose At Oil Cooler To Drain Off Remaining Coolant
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect coolant hose at bottom of oil cooler (arrow), and drain off remaining coolant.

Filling

NOTE:

- **Only use coolant additive G 012 A8 D - meeting specification TL VW 774 D. Identifiable by red color**

CAUTION: Do not use G 011 A8 C. The two different coolant additives G 011 A8 C and

G 012 A8 D must not be mixed together. Otherwise this can result in serious damage to the engine.

- If the fluid in the expansion tank is brown, this means G 012 A8 D has been mixed with another type of coolant. In this case, flush out the cooling system and put in fresh coolant. To flush the system, fill it with clean water and run the engine for about 2 minutes. This should remove very nearly all of the old coolant.
- G 012 A8 D and coolant additives marked "meeting specification TL VW 774 D" prevent frost and corrosion damage, stop scaling and at the same time raise the boiling point of coolant. For these reasons the cooling system must be filled all year round with the correct anti-freeze and anti-corrosion additive.
- Because of its high boiling point, the coolant improves engine reliability under heavy loads, particularly in countries with tropical climates.
- Frost protection is required down to about -25° C (in countries with arctic climates down to about -35° C).
- The coolant concentration must not be reduced by adding water even in warmer seasons and in warmer countries. The anti-freeze ratio must be at least 40%.
- If greater frost protection is required in very cold climates, the amount of G 012 A8 D can be increased, but only up to 60% (this gives frost protection to about -40° C), as otherwise frost protection is reduced again and cooling effectiveness is also reduced.
- 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 concentration	Quantity of G 012A8 D1)	Quantity of water1)
-25° C	40%	2.0 ltr.	3.0 ltr.
-35° C	50%	2.5 ltr.	2.5 ltr.

1) Coolant quantity: 5.0 liters (may vary depending upon the vehicle equipment)

- Screw in coolant drain plug.

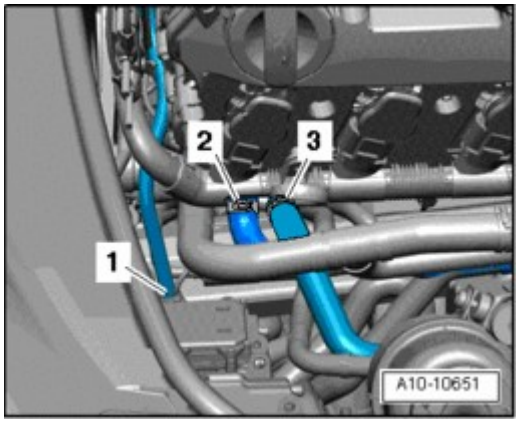

Fig. 189: Identifying Expansion Tank
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Top off coolant to max. mark on expansion tank.
- Start engine and run at approx. 1500 RPM for max. 2 minutes and at the same time fill with coolant up to over-flow hole on expansion tank.
- Install expansion tank cap.
- Run engine until radiator fan cuts in.

- Stop engine.
- Check coolant level and top off, if necessary. When the engine is at normal operating temperature, the coolant level must be on the max. mark, when the engine is cold, between the min. and max. marks.

WARNING: Hot steam can escape when the cap on the expansion tank is opened. Cover the cap with a cloth, and open it carefully.

After-run coolant pump -V51-, checking

NOTE:

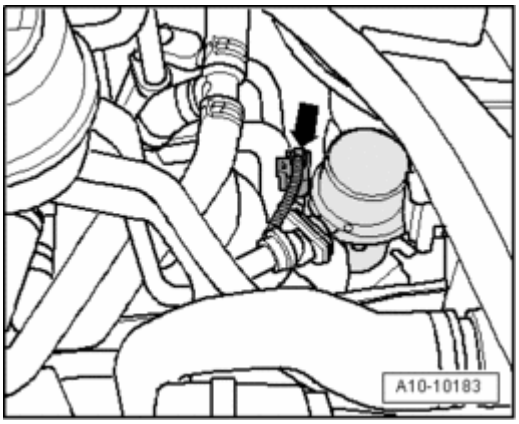

Fig. 190: Identifying Coolant Pump Electrical Connector & Bolts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

After-run coolant pump -V51- is located on the fan cowl to the right of the radiator fan.

- Switch on ignition.

After-run coolant pump -V51- should start running (pump can be felt and heard).

If pump does not run:

Check fuse and wiring according to wiring diagram.

If the fuse is OK and there is no open circuit in the wiring:

Replace after-run coolant pump -V51-

Coolant pump, removing and installing

NOTE: Always replace seals and gaskets.

Removing

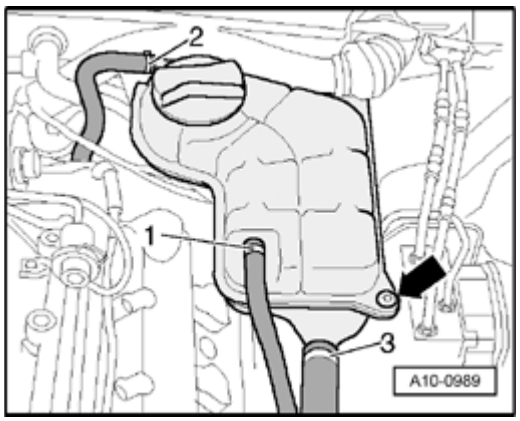

Fig. 191: Remove Engine Cover Panel Above Cylinder Head.
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove engine cover.
- Drain cooling system. Refer to **Draining**

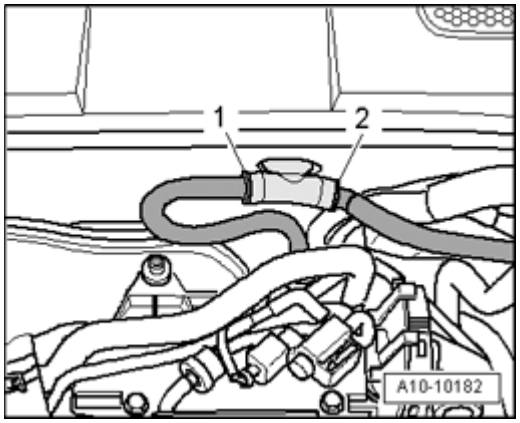

Fig. 192: Removing Noise Insulation Panels (Center, Left And Right)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove center and right-hand sections of noise insulation (arrows).
- Removing ribbed belt and tensioning element. Refer to **Ribbed belt, removing and installing**.
- Disconnect vacuum hose from activated charcoal filter and from throttle valve connection.

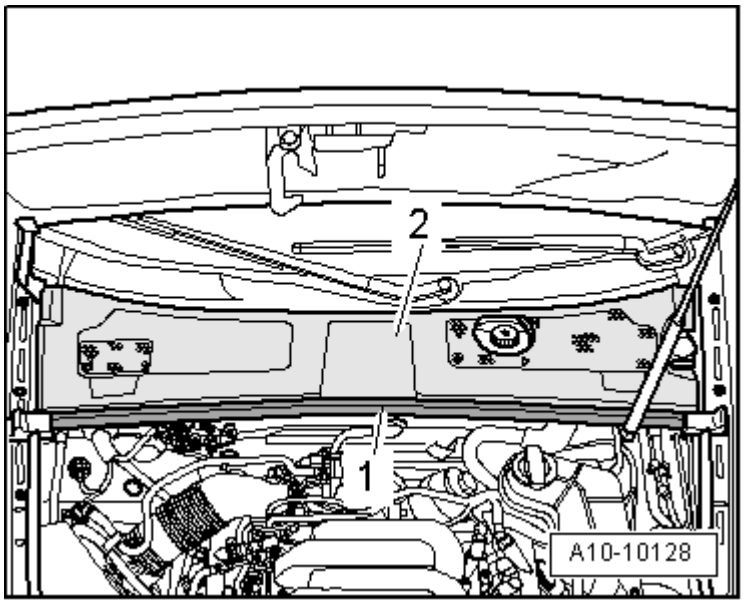

Fig. 193: Detaching Coolant Expansion Tank And Power Steering Reservoir
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove coolant expansion tank (see left-hand arrows) together with hoses.
- Unbolt power steering reservoir (see right-hand arrow). Do not disconnect the hoses.
- Remove toothed belt guards (upper and center). Refer to **Toothed belt, removing and installing**.

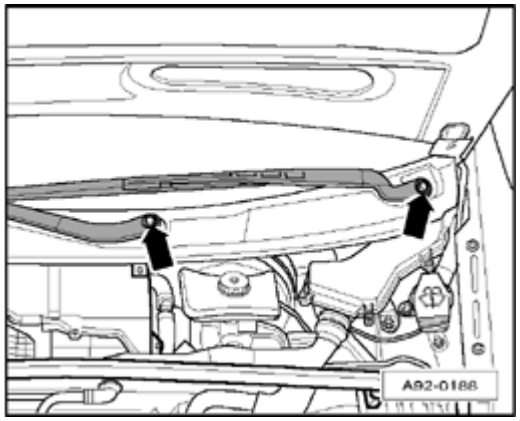

Fig. 194: Setting Crankshaft To Markings For TDC Of No. 1 Cylinder
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Set crankshaft to markings for TDC of No. 1 cylinder (arrows) by turning central bolt on crankshaft sprocket in direction of rotation.

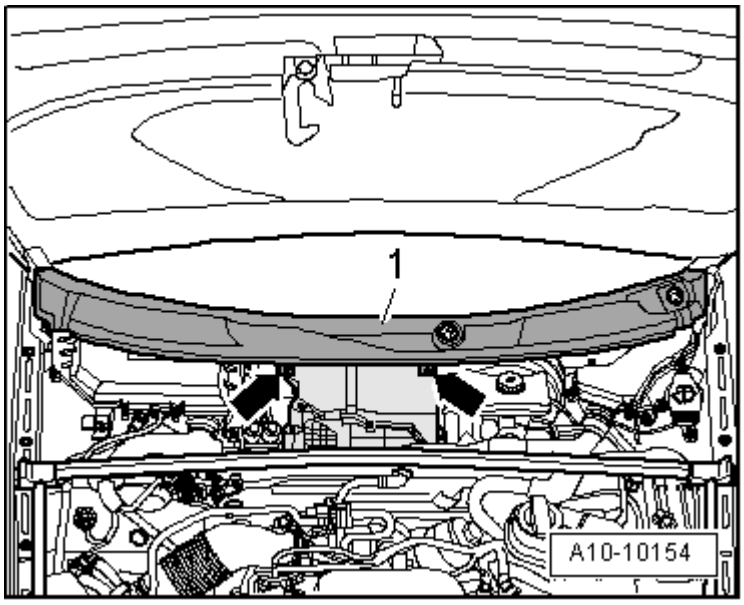

Fig. 195: Screwing Stud Into Toothed Belt Tensioning Element & Hex Nut Onto Stud Using Large Washer
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Screw M5x55 stud -1- into toothed belt tensioning element. Screw hex nut -2- onto stud -1- using a large washer -3-.
- Tension pressure piston of tensioning element only until it can be secured with a locking pin (e.g. from lifting appliance 2024 A) (arrow).

NOTE: If it is not possible to insert the locking pin, carefully tension the pressure piston of the tensioning element just enough to allow the toothed belt to be removed.

- Take toothed belt off camshaft sprocket.

NOTE:

- **The vibration damper and bottom toothed belt guard do not have to be removed.**
- **The toothed belt should be left in position on the crankshaft sprocket.**
- **Cover toothed belt with a cloth to protect it from coolant before removing coolant pump.**

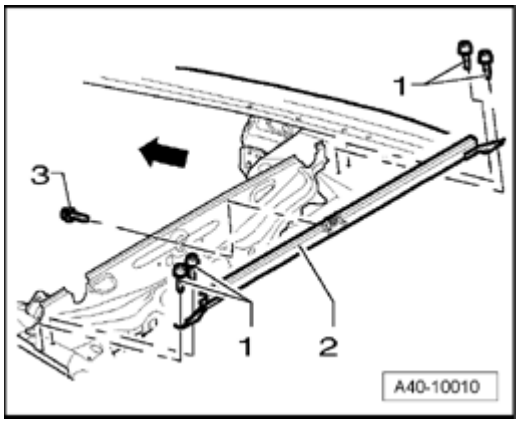

Fig. 196: Identifying Coolant Pump & Securing Bolts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove coolant pump securing bolts -1- and remove coolant pump -2-.

Installing

Installation is carried out in the reverse order, when doing this note the following:

- Clean and smooth down sealing surface for O-ring as required.
- Moisten new O-ring with coolant G 012 A8 D.
- Install coolant pump. Installation position: plug in housing faces downward.
- Install toothed belt (adjust valve timing). Refer to **Installing (adjusting valve timing)**

NOTE: Follow all the instructions on removing and installing the toothed belt. Refer to Toothed belt, removing and installing.

- Installing ribbed belt and tensioning element. Refer to **Ribbed belt, removing and installing**.
- Fill up with coolant. Refer to **Filling**.

Tightening torque

Component	Nm
Coolant pump to cylinder block	15

Coolant thermostat, removing, installing and checking

Removing

NOTE:

- **Always replace seals and gaskets.**
- **Obtain radio anti-theft code on vehicles with coded radio.**
- **Secure all hose connections with hose clamps of the same type as those installed at the factory.**

- With the ignition switched off, disconnect the battery Ground (GND) strap.
- Drain cooling system. Refer to **Draining**
- Detach coolant hose at bracket for solenoid valves above alternator.

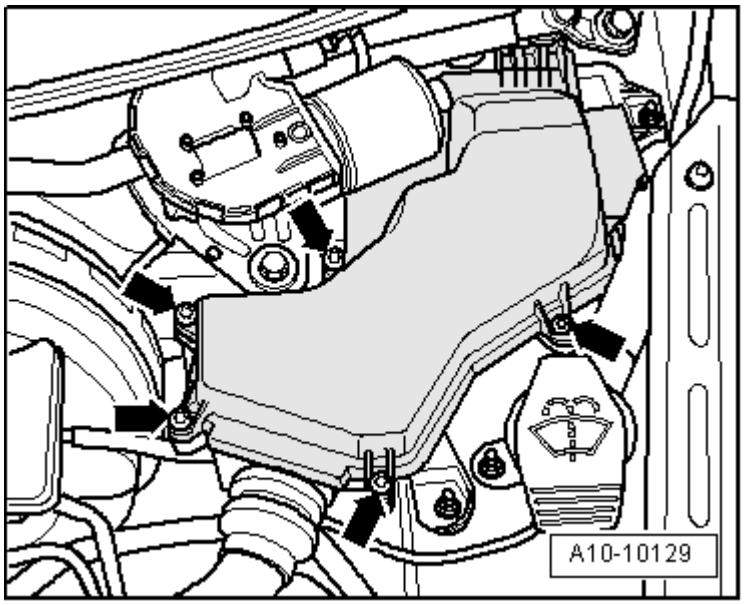

Fig. 197: Identifying Electrical Change-Over Valve Connector, Intake Manifold Brackets & Dipstick Tube
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unbolt bracket for solenoid valves -2- and -3- in front of intake manifold and detach dipstick guide tube -4-.

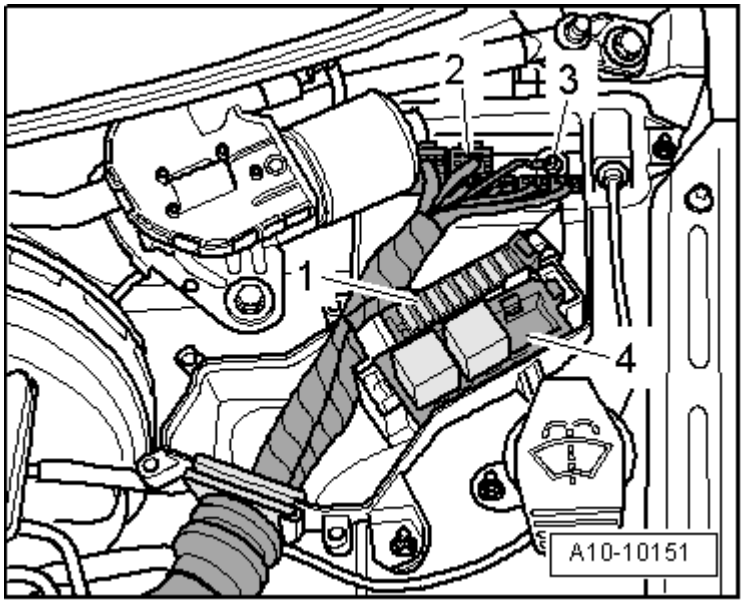

Fig. 198: Pulling Connector And Vacuum Hose Out Of Bracket
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Pull connector -3- and vacuum hose -1- out of bracket.
- Lay bracket clear to the side without detaching remaining connections.

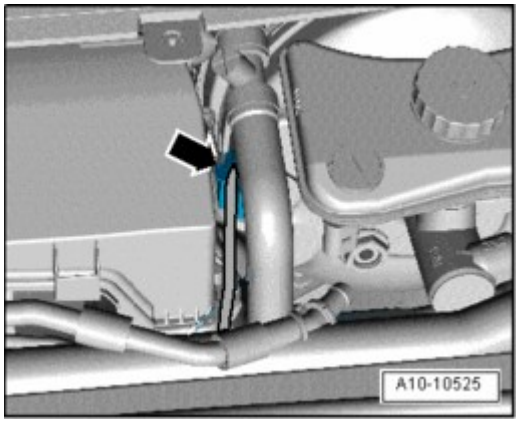

Fig. 199: Identifying Elbow Connection, Bolts, O-Ring & Thermostat
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect coolant hose from elbow connection -3-.
- Remove bolts -4- and take off elbow connection, O-ring and thermostat -1-.

Installing

- Clean and smooth down sealing surface for O-ring as required.
- Insert coolant thermostat. Installation position: bowed metal strip on thermostat must be vertical.
- Moisten new O ring with coolant G 012 A8 D.
- Tighten bolts.

- Fill up with coolant. Refer to **Filling**.

Tightening torque

Component	Nm
Elbow connection to cylinder block	15
Bracket for solenoid valves to intake manifold	10

- After connecting battery terminals, enter anti-theft code for radio

Refer to Radio operating instructions

WARNING: If a battery charger is used to give the engine an assisted start, there is a risk that the control modules in the vehicle will be damaged.

- Close electric windows in front doors all the way to their top positions using electric switches.

- Then operate all electric window switches again for at least one second in the "close" direction to activate the automatic one-touch function.
- Set clock to correct time.
- Interrogate DTC memory:

Refer to

- **01 ON BOARD DIAGNOSTIC (OBD)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): AMU
- **01 ON BOARD DIAGNOSTIC (OBD)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): ATC
- **01 ON BOARD DIAGNOSTIC (OBD)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): AWP
- **01 ON BOARD DIAGNOSTIC (OBD)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): BEA

; On Board Diagnostic , checking and erasing DTC memory

NOTE: DTCs will have been stored in the memory because connectors have been disconnected. Therefore interrogate and erase DTC memory after installing engine.

Testing coolant thermostat

- Heat thermostat in water bath.

Starts to open	Fully open	Opening travel
approx. 87° C	approx. 102° C 1)	at least 7 mm

1) cannot be tested

Coolant line, removing and installing

Removing

NOTE: Always replace seals and gaskets.

- Obtain radio anti-theft code on vehicles with coded radio.
- With the ignition switched off disconnect the battery Ground (GND) strap.
- Drain cooling system. Refer to **Draining**
- Remove intake manifold. Refer to **Intake manifold, removing and installing**.

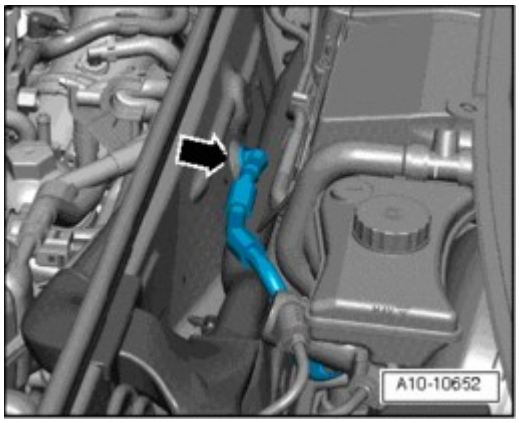

Fig. 200: Identifying Air Hose, Mass Air Flow Sensor & Bolts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect air duct -4- from Mass air flow sensor.
- Disconnect electrical connectors for Mass air flow sensor -1-.
- Remove bolts -2- and -3- and take off air cleaner housing.
- Detach air intake hose from connection on turbocharger as follows:

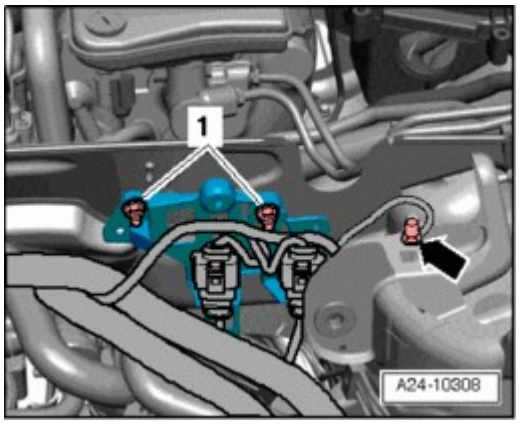

Fig. 201: Identifying Vacuum Hose, Crankcase Breather, Wastegate Bypass Regulator Valve & Hose
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect vacuum hose -1- from air recirculation valve.
- Disconnect hose from pressure control valve for crankcase breather -2-.
- Disconnect electrical connector from Wastegate bypass regulator valve -3- (-N75-).
- Disconnect hose -4- from Wastegate bypass regulator valve -N75-.

- Disconnect hose -5- at bulkhead (hose leads from solenoid valve to turbocharger).
- Take solenoid charge pressure control valve out of air intake hose and place it to one side on the engine.
- Pull retainer off turbocharger connection and detach air intake hose.
- Disconnect coolant hose from coolant line (hose leads to heat exchanger for heater).

Vehicles with automatic transmission

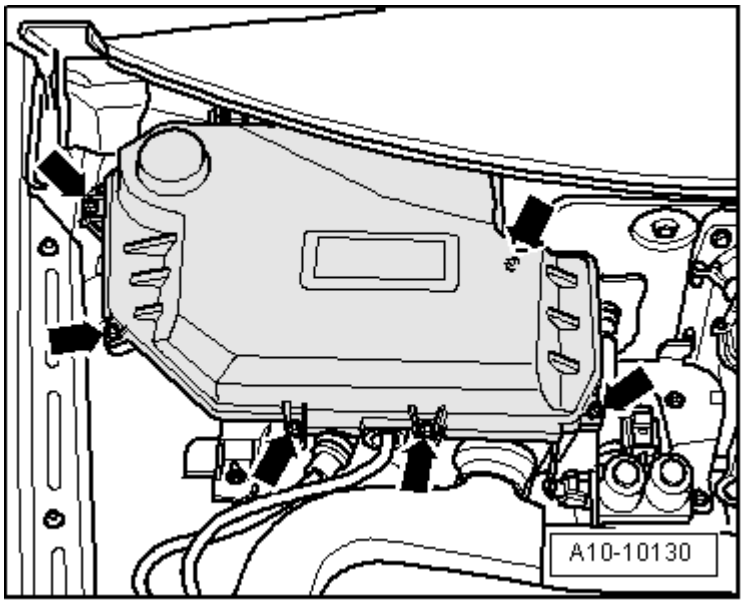

Fig. 202: Identifying Transmission Electrical Connections
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect connectors:

1 - For solenoid valves (10-pin connector)

2 - For Vehicle Speed Sensor (VSS) -G68-

All vehicles:

- Unbolt coolant pipe retainer from coolant line flange on left of cylinder head.
- Disconnect hose (leading to oil cooler) from coolant line.
- Remove crankcase breather line.
- Remove coolant line retainer from cylinder block.

- Disconnect hose (leading to coolant expansion tank) from coolant line (right).
- Remove coolant line retainer from tensioning element for ribbed belt.
- Pull tapered collar off oil dipstick tube.
- Disconnect wires/connectors as follows:

-Knock Sensor (KS) 1 -G61-

-Engine Speed (RPM) Sensor -G28- (middle, grey)

-Knock Sensor (KS) 2 -G66-

- Take connectors out of retainer.
- Remove oil line leading to turbocharger and unbolt retainer for oil line (both are attached to the oil filter

bracket).

- Unbolt retainer for connectors.
- Unbolt Knock Sensor (KS) 1 and 2.
- Unbolt left-hand coolant line flange from cylinder head.
- Detach coolant line.

Installing

Installation is carried out in the reverse order, when doing this note the following:

- Before installing, clean and smooth down sealing surface for O-ring as required.

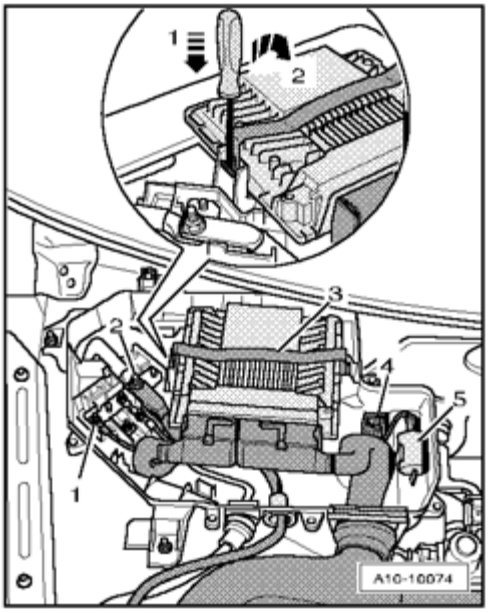

Fig. 203: Identifying O-Ring & Coolant Pipe
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Moisten new O-ring -1- with G 012 A8 D and slide onto coolant pipe -2-.
- Push coolant pipe into opening in cylinder block.
- Fill up with coolant. Refer to **Filling**.
- After connecting battery terminals, enter anti-theft code for radio

Refer to Radio operating instructions

- Close electric windows in front doors all the way to their top positions using electric switches.
- Then operate all electric window switches again for at least one second in the "close" direction to activate the automatic one-touch function.
- Set clock to correct time.

- Interrogate DTC memory:

Refer to

- **01 ON BOARD DIAGNOSTIC (OBD)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): AMU
- **01 ON BOARD DIAGNOSTIC (OBD)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): ATC
- **01 ON BOARD DIAGNOSTIC (OBD)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): AWP
- **01 ON BOARD DIAGNOSTIC (OBD)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): BEA

; On Board Diagnostic , checking and erasing DTC memory

NOTE: DTCs will have been stored in the memory because connectors have been disconnected. Therefore interrogate and erase DTC memory after installing engine.

Tightening torques

Component	Nm
Coolant line bracket to cylinder block	10
Coolant line bracket to oil filter bracket	20
Coolant line bracket to coolant line flange	10

Radiator, removing and installing

NOTE: Always replace gaskets and seals.

Removing

- Obtain radio anti-theft code on vehicles with coded radio.
- With ignition switched off disconnect battery Ground (GND) strap.

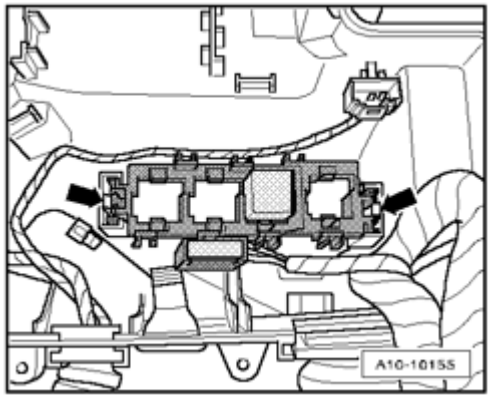

Fig. 204: Removing Noise Insulation
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove noise insulation (arrows).
- Drain cooling system. Refer to **Draining**
- Release clamps and disconnect coolant hoses from connections on radiator (top and bottom).
- Remove front bumper:

Refer to **63 BUMPERS** ; Front bumper, removing and installing

NOTE: Only remove the cover section for the front bumper.

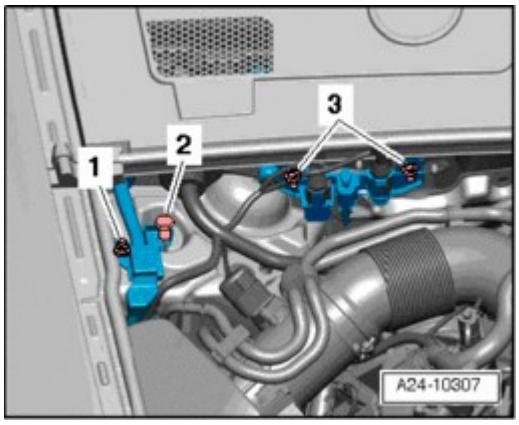

Fig. 205: Identifying Radiator Fan Cowl Connectors, Coolant Fan Control (FC) Thermal Switch -F18- Connectors & Radiator Cowl
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect connectors -1- on radiator fan cowl.
- Disconnect connector -2- from coolant Fan Control (FC) thermal switch -F18-.
- Remove radiator cowl -3- together with radiator fans (4 bolts) and pull downward to remove.

Vehicles without air conditioner:

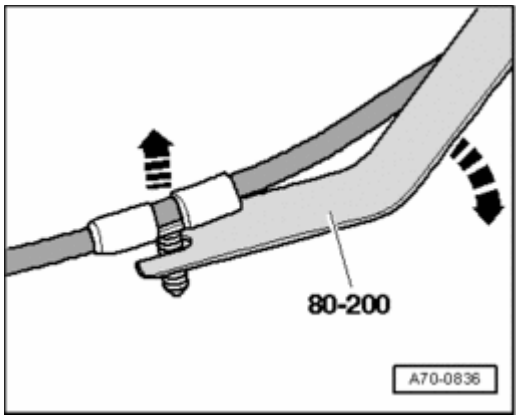

Fig. 206: Removing Securing Bolts On Radiator
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove 4 securing bolts (arrows) on the radiator.
- Lower radiator out of vehicle.

Vehicles with air conditioner:

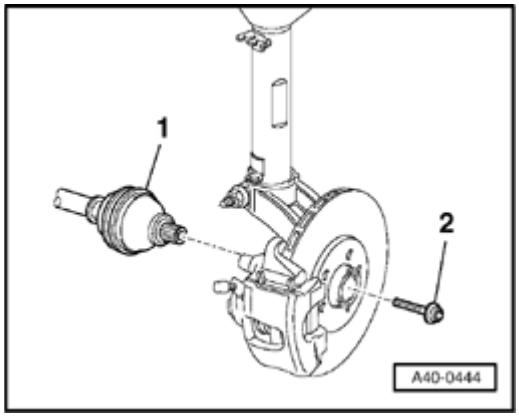

Fig. 207: Removing Four Securing Bolts For Condenser & Radiator
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove four securing bolts -1- for condenser.
- Remove four securing bolts -2- for radiator.

WARNING: The air conditioner refrigerant circuit must not be opened.

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

- Remove Coolant Fan Control (FC) Control Module -J293- from left-hand longitudinal member (in front of battery).

- Carefully lower radiator between engine and condenser and remove from below.

Installing

Installation is carried out in the reverse order, when doing this note the following:

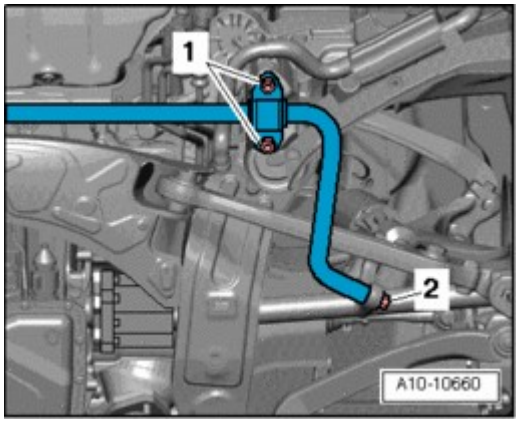

Fig. 208: Installing Mounts And On Radiator
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Install mounts -3- and -4- on radiator as illustrated.
- Install radiator securing bolts (the help of a 2nd mechanic is required).
- Install front bumper:

Refer to **63 BUMPERS** ; Front bumper, removing and installing

- Replace O rings in the coolant hose connections.
- Fill up with coolant. Refer to **Filling**.
- After connecting battery terminals, enter anti-theft code for radio

Refer to Radio operating instructions

- Close electric windows in front doors all the way to their top positions using electric switches.
- Then operate all electric window switches again for at least one second in the "close" direction to activate the automatic one-touch function.
- Set clock to correct time.
- Interrogate DTC memory:

Refer to

- **01 ON BOARD DIAGNOSTIC (OBD)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): AMU
- **01 ON BOARD DIAGNOSTIC (OBD)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): ATC

- **01 ON BOARD DIAGNOSTIC (OBD)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): AWP
- **01 ON BOARD DIAGNOSTIC (OBD)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): BEA

; On Board Diagnostic , checking and erasing DTC memory

NOTE: DTC will have been stored in the memory because connectors have been disconnected. Therefore interrogate and erase DTC memory after installing engine.

Tightening torques

Components	Nm
Radiator fan cowl to radiator	10
Thermal switch to radiator	35
Radiator to lock carrier	10
Condenser to radiator	10
Control unit to longitudinal member	10

Cooling system, checking for leaks

Test requirement:

- Engine at operating temperature.

WARNING: Hot steam can escape when the cap on the expansion tank is opened. Cover the cap with a cloth, and open it carefully.

- Remove cap from coolant expansion tank.

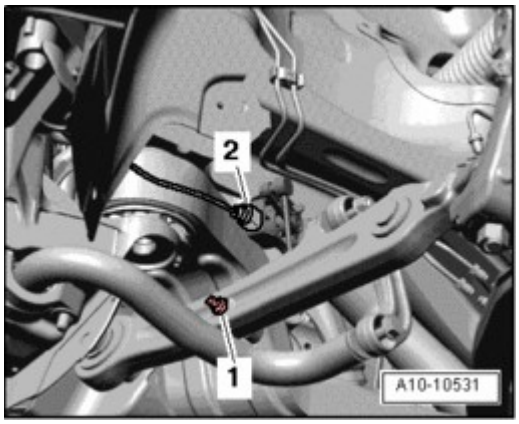

Fig. 209: Positioning Cooling System Tester V.A.G 1274 With Adapter V.A.G 1274/8 On Expansion Tank
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Install tester V.A.G 1274 with adapter V.A.G 1274/8 onto expansion tank.
- Using hand pump on tester, build up a pressure of approx. 1.0 bar.
- If this pressure drops, locate leak and repair.

Testing pressure relief valve in filler cap

- Screw filler cap onto tester with adapter V.A.G 1274/9.

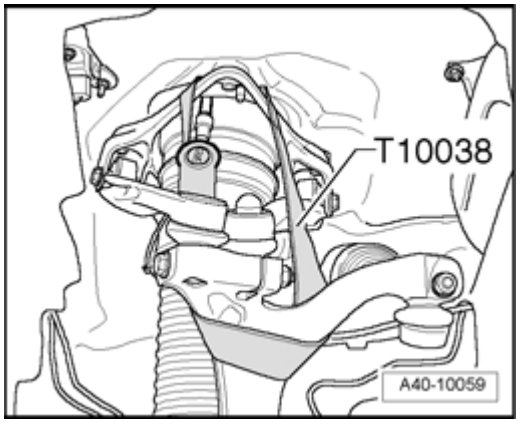

Fig. 210: Checking Pressure Relief Valve In Filler Cap
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Attach hand pump and build up pressure.
- The pressure relief valve should open at a pressure of 1.4 - 1.6 bar.

21 TURBOCHARGER, G-CHARGER

CHARGE AIR PRESSURE SYSTEM WITH TURBOCHARGER

Charge air pressure system with turbocharger

NOTE:

- **Observe rules for cleanliness. Refer to Rules for cleanliness.**
- **When performing repairs, replace seals, gaskets, self-locking nuts and bolts which have a specified tightening angle.**
- **Secure all hose connections with the correct hose clips (same as original equipment).**
- **Before carrying out tests or repair work, make sure that all lines and hoses are securely connected and that there are no leaks.**

- Tightening torque for screw clamps: 2 Nm.

Safety precautions

Note the following points if test equipment has to be used during a road test:

If test and measuring instruments are operated from front passenger's seat and the vehicle is involved in an accident, there is a possibility that the person sitting in this seat may receive serious injuries when the airbag is triggered.

WARNING:

- **To avoid any risk of accident, observe the following precautions when using test instruments while road testing the vehicle:**

Audi TT Coup:

- **Use only VAS 5051 or V.A.G 1551 to read measured value blocks. The tester must always be secured on the rear seat and operated from the rear seat by a second person.**
- **Due to the limited space, slide the front passenger's seat forward as far as it will go and (without pulling the release lever) incline the backrest as far forward as possible by turning the adjuster knob. Do not operate the release lever to tilt the backrest forward.**

Audi TT Roadster:

- **In the Audi TT Roadster, use only V.A.G 1552.**
- **Switch off the front passenger's airbag by means of the key-operated switch in the glove box**
- **Reactivate front passenger's airbag after testing has been completed.**

Diagram of connections for charge air pressure control system and vacuum system

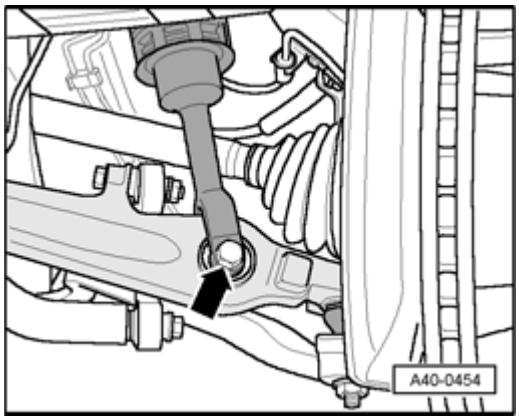

Fig. 211: Diagram Of Connections For Charge Air Pressure Control System And Vacuum System
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - From fuel tank

2 - Activated charcoal filter

- With ACF solenoid valve 1 (-N80-)

3 - Non-return valve for ACF

- Between activated charcoal filter and intake pipe upstream of turbocharger
- Install with light and dark sides in the positions shown in the illustration. Arrow points in direction of flow.

4 - Turbocharger

- Testing charge air pressure. Refer to **Turbocharger and wastegate bypass regulator valve, testing**

5 - Pressure unit for charge air pressure control

6 - Charge air pressure bypass valve

- Testing. Refer to **Charge air pressure bypass valve, testing**

7 - Brake servo

8 - Non-return valve

- Between brake servo and intake manifold
- Install with light and dark sides in the positions shown in the illustration. Arrow points in direction of flow.

9 - Solenoid valve for Wastegate bypass regulator valve -N75-

10 - Mass Air Flow (MAF) Sensor -G70-

11 - Air cleaner

12 - Crankcase breather pressure regulating valve

13 - Mechanical secondary air valve

14 - Vacuum reservoir

- Bolted to cylinder head cover

15 - Charge air cooler

- With charge air pressure sensor -G31-

16 - Fuel pressure regulator

17 - Throttle valve control module -J338-

18 - Intake manifold

- With Intake Air Temperature (IAT) Sensor -G42-

19 - Crankcase breather

20 - Non-return valve

- Install with light and dark sides in the positions shown in the illustration. Arrow points in direction of flow.

21 - Recirculating valve for turbocharger -N249-

- Testing. Refer to **Fig. 214**

22 - Secondary Air Injection (AIR) Solenoid Valve -N112-

23 - Secondary Air Injection (AIR) Pump Motor -V101-

24 - Non-return valve

- Between activated charcoal filter and intake manifold
- Install with light and dark sides in the positions shown in the illustration. Arrow points in direction of flow.

25 - Charge air cooler

Charge air pressure bypass valve, testing

NOTE:

- **The charge air pressure bypass valve is located upstream of the turbocharger. It is opened by vacuum from the electrically operated air recirculation valve for turbocharger (-N249-) when the engine is on overrun or under part load or when idling. This disperses the pressurized air (charge air pressure) upstream of the throttle valve, and thus keeps the turbocharger rotating at a higher speed.**
- **Check the air recirculation valve if the engine is not producing full power, or jerking when the throttle is opened and closed.**

Special tools, testers and auxiliary items

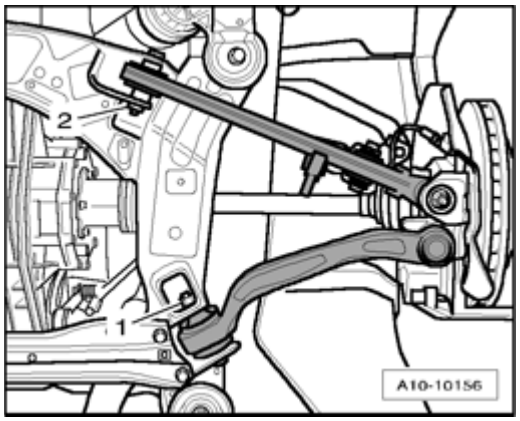

Fig. 212: Identifying Hand Vacuum Pump V.A.G. 1390
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- V.A.G 1390

Test sequence

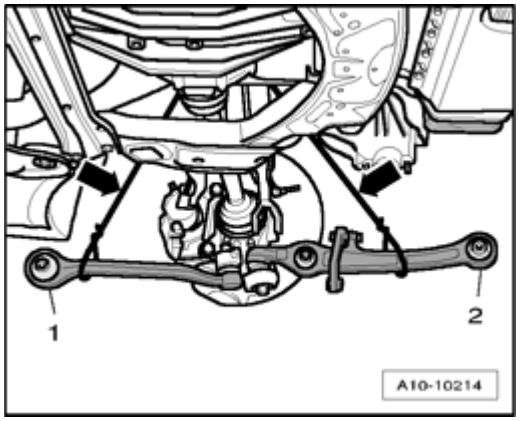

Fig. 213: Connecting Vacuum Pump V.A.G 1390 To Charge Air Pressure Bypass Valve
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect vacuum pump V.A.G 1390 to charge air pressure bypass valve.
- Operate vacuum pump.

- Charge air pressure bypass valve should open (arrow).

- Operate air vent valve on vacuum pump after about 30 seconds.

- Charge air pressure bypass valve should close (arrow).

If the charge air pressure bypass valve does not open and close as specified, or if the valve plate does not seal properly when the valve is closed:

- Replace the charge air pressure bypass valve. Secure the connections on the valve with screw-type clips.

Recirculating valve for turbocharger -N249-, testing

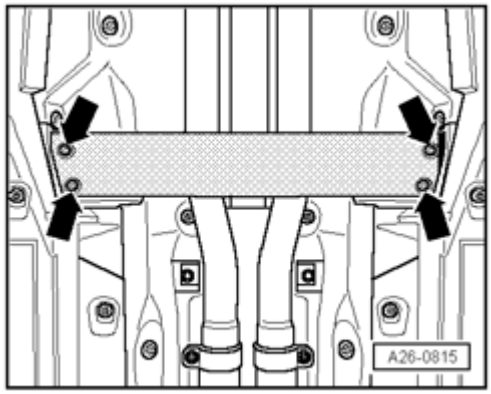

Fig. 214: Identifying Special Tools - Recirculating Valve For Turbocharger -N249-, Testing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools, testers and other equipment required

- V.A.G 1526 A
- V.A.G 1527 B
- V.A.G 1594 A
- V.A.G 1598/31
- VAS 5051 with VAS 5051/1
  - or
- V.A.G 1551 with V.A.G 1551/3 A

NOTE: Recirculating valve for turbocharger -N249- and its wiring are monitored by the engine control module.

- Connect vehicle diagnostic, testing and information system VAS 5051 (or fault reader V.A.G 1551) and select engine electronics control module by entering "Address word" 01. When doing this the engine must be running at idling speed.

Refer to

- **01 ON BOARD DIAGNOSTIC (OBD)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): AMU
- **01 ON BOARD DIAGNOSTIC (OBD)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): ATC
- **01 ON BOARD DIAGNOSTIC (OBD)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): AWP
- **01 ON BOARD DIAGNOSTIC (OBD)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION &

IGNITION, ENGINE CODE(S): BEA

; On Board Diagnostic; Connecting VAS 5051 tester or V.A.G 1551 scan tool and selecting function

- Interrogate DTC memory of engine control module.

Refer to

- **01 ON BOARD DIAGNOSTIC (OBD)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): AMU
- **01 ON BOARD DIAGNOSTIC (OBD)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): ATC
- **01 ON BOARD DIAGNOSTIC (OBD)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): AWP
- **01 ON BOARD DIAGNOSTIC (OBD)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): BEA

; checking and erasing DTC memory

If the display shows a DTC relating to Recirculating valve for turbocharger -N249-:

- Disconnect hoses from valve but leave the electrical connector plugged in.
- Install an auxiliary hose to one of the connections on the valve.
- Start Output Diagnostic Test Mode and activate air recirculation valve for turbocharger -N249-.

Refer to

- **01 ON BOARD DIAGNOSTIC (OBD)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): AMU
- **01 ON BOARD DIAGNOSTIC (OBD)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): ATC
- **01 ON BOARD DIAGNOSTIC (OBD)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): AWP
- **01 ON BOARD DIAGNOSTIC (OBD)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): BEA

; Output Diagnostic Test Mode

Output Diagnostic Test Mode --> Air recirculation valve for turbocharger -N249-

Indicated on display:

The valve should click...

..and should open and close (test by blowing into auxiliary hose).

Valve does not click:

- Test internal resistance of valve.

If the valve does not open and close properly:

- Replace Recirculating valve for turbocharger -N249-.

Testing internal resistance

- Disconnect connector from valve.

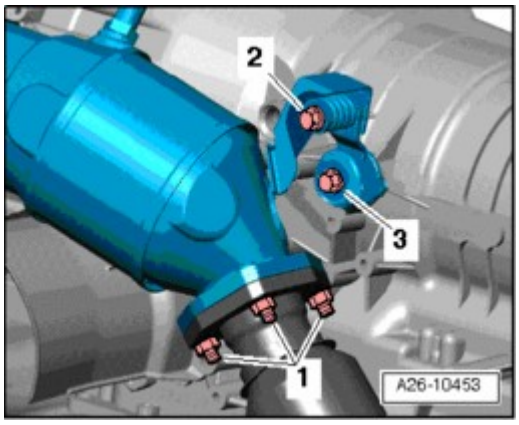

Fig. 215: Connecting Multimeter To Valve (Resistance Measurement Range)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect multimeter to valve (resistance measurement range)

- Specification: 27-30 ohms

If the specification is not attained:

- Replace Recirculating valve for turbocharger -N249-.

If the specification is attained:

- Check voltage supply.

Checking voltage supply

NOTE: The air recirculation valve receives its power supply via the fuel pump relay.

Test requirement:

- Fuse for air recirculation valve must be OK.

  - Disconnect connector from valve.

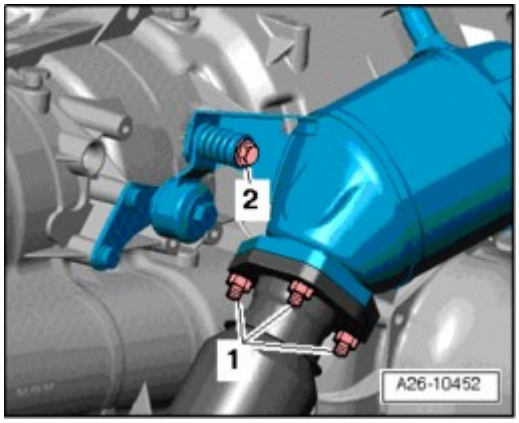

Fig. 216: 2-Pin Electrical Harness Connector & Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

  - Connect voltage tester V.A.G 1527 B as follows:

Connector Contact	Measure against
1	Engine Ground (GND)

  - Operate starter briefly.

  - The LED should light up.

If the LED does not light up:

  - Test for open circuit in wiring from contact 1 to fuel pump relay via fuse.

Refer to Electrical Wiring Diagrams Troubleshooting & Component Locations

  - Rectify any open circuits.

If the wiring is OK:

  - Test fuel pump relay.

Refer to

- **24 MULTIPORT FUEL INJECTION (MFI)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): AMU
- **24 MULTIPORT FUEL INJECTION (MFI)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): ATC

- **24 MULTIPORT FUEL INJECTION (MFI)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): AWP
- **24 MULTIPORT FUEL INJECTION (MFI)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): BEA

; Servicing Motronic injection system; Testing fuel pump relay -J17- and activation

If the LED lights up:

- Test activation.

Checking activation

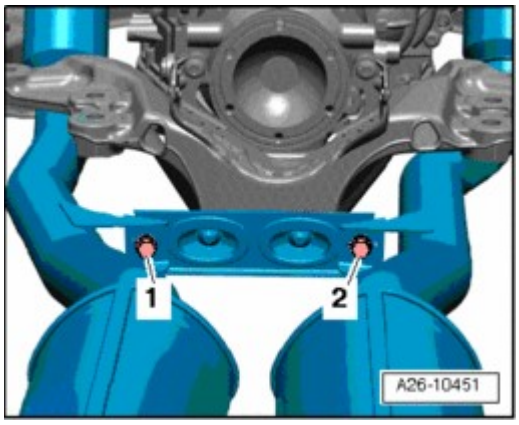

Fig. 217: 2-Pin Electrical Harness Connector & Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect voltage tester V.A.G 1527 B to contact 1 (positive) and contact 2 of the connector.
- Start Output Diagnostic Test Mode and activate air recirculation valve for turbocharger -N249-.

Refer to

- **01 ON BOARD DIAGNOSTIC (OBD)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): AMU
- **01 ON BOARD DIAGNOSTIC (OBD)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): ATC
- **01 ON BOARD DIAGNOSTIC (OBD)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): AWP
- **01 ON BOARD DIAGNOSTIC (OBD)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): BEA

; Output Diagnostic Test Mode

- The LED should flash.

If the LED lamp does not flash or lights up continuously:

- Connect test box V.A.G 1598/31 to wiring harness for engine control module. Do not connect the engine control module itself.

Refer to

- **24 MULTIPORT FUEL INJECTION (MFI)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): AMU
- **24 MULTIPORT FUEL INJECTION (MFI)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): ATC
- **24 MULTIPORT FUEL INJECTION (MFI)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): AWP
- **24 MULTIPORT FUEL INJECTION (MFI)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): BEA

; Servicing Motronic injection system; Wiring and component test using test box V.A.G 1598/31

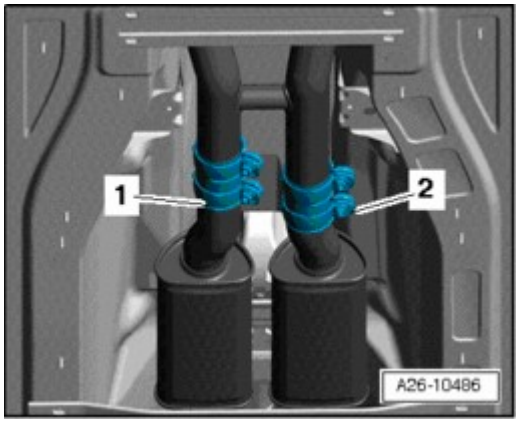

Fig. 218: 2-Pin Electrical Harness Connector & Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Test for open circuit and short to positive or Ground in the following wiring connections:

Connector Contact	Test box V.A.G 1598/31 Contact
2	105

- Rectify short circuit or open circuit if necessary.

If the wiring is OK:

- Replace engine control module.

Refer to

- **24 MULTIPORT FUEL INJECTION (MFI)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): AMU
- **24 MULTIPORT FUEL INJECTION (MFI)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): ATC
- **24 MULTIPORT FUEL INJECTION (MFI)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): AWP
- **24 MULTIPORT FUEL INJECTION (MFI)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): BEA

; Servicing Motronic injection system; Replacing engine control module

Turbocharger and wastegate bypass regulator valve, testing

Special tools, testers and auxiliary items

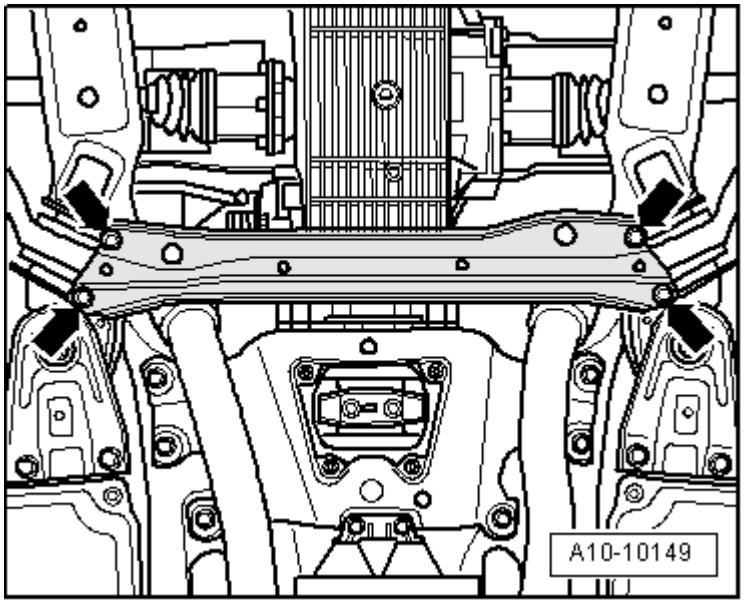

Fig. 219: Identifying Turbocharger Tester V.A.G 1397A
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- V.A.G 1397 A

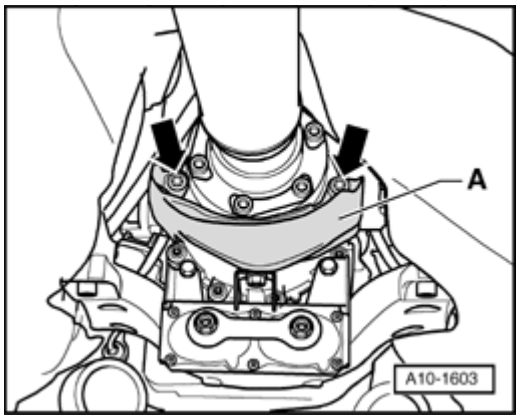

Fig. 220: VAS 5051 Vehicle Diagnosis, Testing & Information System
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- VAS 5051 with VAS 5051/1

or

- Malfunction reader V.A.G 1551 with V.A.G 1551/3 A

Requirements for test:

- All hoses and lines must be securely installed and free of leaks.
- DTC memory has been interrogated

Refer to

- **01 ON BOARD DIAGNOSTIC (OBD)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): AMU
- **01 ON BOARD DIAGNOSTIC (OBD)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): ATC
- **01 ON BOARD DIAGNOSTIC (OBD)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): AWP
- **01 ON BOARD DIAGNOSTIC (OBD)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): BEA

; checking and erasing DTC memory

- Output Diagnostic Test Mode has been performed

Refer to

- **01 ON BOARD DIAGNOSTIC (OBD)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): AMU
- **01 ON BOARD DIAGNOSTIC (OBD)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION &

IGNITION, ENGINE CODE(S): ATC

- **01 ON BOARD DIAGNOSTIC (OBD)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): AWP
- **01 ON BOARD DIAGNOSTIC (OBD)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): BEA

; Output Diagnostic Test Mode

- Vehicle diagnostic, testing and information system VAS 5051 or malfunction reader V.A.G 1551 must be connected.

Test sequence

WARNING: To avoid any risk of accident, observe the safety precautions when using test instruments while road testing the vehicle. Refer to Safety precautions

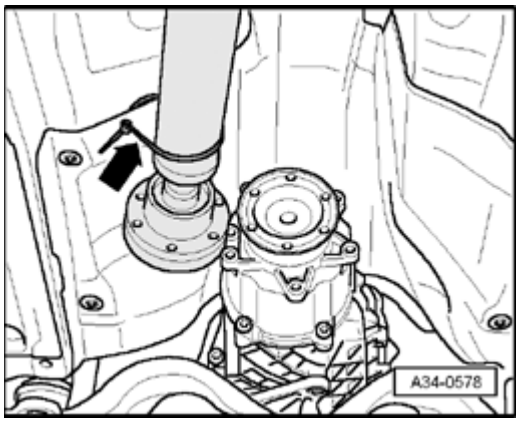

Fig. 221: Connecting T-Piece And Measuring Hose Of Turbocharger Tester V.A.G 1397 A To Intake Manifold
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect T-piece and measuring hose of turbocharger tester V.A.G 1397 A to intake manifold (front).
- Route measuring hose under rear edge of hood and into passenger compartment via right-hand window.

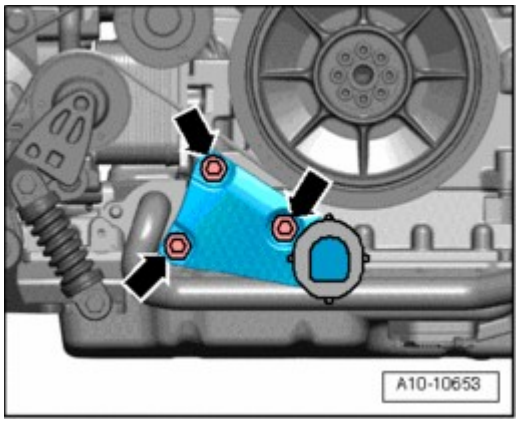

Fig. 222: Identifying Turbocharger Tester V.A.G 1397 A
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- 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 the last measured value until memory key M is pressed again or tester is switched off.**
- **The decimal point in the display flashes to indicate that the value is being stored.**
- **If the battery voltage of the turbocharger tester drops below the minimum level, an arrow will appear at the top left of the display.**
- **Before performing the test, drive the vehicle at a brisk speed for at least 3 km (without stopping at traffic lights etc.).**
- **A second mechanic is required to note the readings on the tester when the vehicle is moving.**

Rapid data transfer HELP Select function XX

Indicated on display:

- Enter "08" to select the function "Read measured value block" and confirm entry with Q key.

Read measured value block Q Enter display group number XXX

Indicated on display:

- Enter "004" to select Display Group 004 and confirm entry with Q key.

Read measured value block 4 --> 1 2 3 4

Indicated on display:

Do not proceed with the test until the intake air temperature shown in display zone 4 is between 20 and 50° C. If necessary, run the engine until the required temperature is reached.

- Press C key.

Read measured value block Q Enter display group number XXX

Indicated on display:

- Enter "115" to select Display Group 115 and confirm entry with Q key.

Read measured value block 115 --> 1 2 3 4

Indicated on display: (1-4 = display zones)

- Accelerate the vehicle from 2000 RPM in 4th gear and observe the rev counter.
- When the engine speed reaches 3000 RPM, press the "PRINT" key on VAS 5051 (or V.A.G 1551) and at the same time press the memory key "M" on V.A.G 1397 A.

NOTE: The charge air pressure should be measured using turbocharger tester V.A.G 1397/A. Vehicle diagnostic, testing and information system VAS 5051 (or malfunction reader V.A.G 1551) is used to check whether the charge pressure is being registered by the control module.

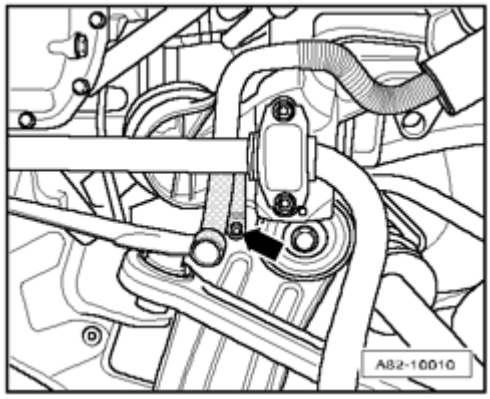

Fig. 223: Identifying Turbocharger Tester V.A.G 1397 A

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Specification on V.A.G 1397 A: 1.700 - 2.000 bar

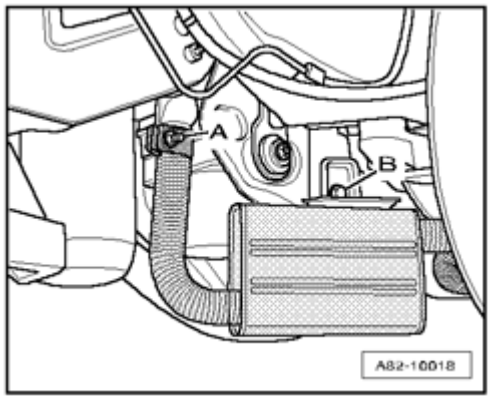

Fig. 224: Identifying Turbocharger Tester V.A.G 1397 A
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Specification on VAS 5051 or V.A.G 1551

Display zone 4: 1700 - 2000 mbar

If specification not attained or exceeded:

- Interrogate DTC memory of engine control module.

Refer to

- **01 ON BOARD DIAGNOSTIC (OBD)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): AMU
- **01 ON BOARD DIAGNOSTIC (OBD)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): ATC
- **01 ON BOARD DIAGNOSTIC (OBD)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): AWP
- **01 ON BOARD DIAGNOSTIC (OBD)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): BEA

; checking and erasing DTC memory

Malfunctions in charge air pressure control function

Malfunction	Charge air pressure	Possible cause of malfunction
Charge air pressure too low	• Measured value less than 1.700 bar or 1700 mbar	• Wastegate bypass regulator valve -N75- defective • Fault in wiring to Wastegate

		bypass regulator valve • Wastegate bypass regulator valve in turbocharger is sticking in the "open" position • Leak between turbocharger and intake manifold • Charge pressure bypass valve defective • Turbocharger defective
Charge air pressure too high 1)	• Measured value higher than 2.000 bar or 2000 mbar	• Pressure unit for Wastegate bypass regulator valve defective • Air leaks in hoses or connections to pressure unit for charge air pressure control (via -N75-) • Wastegate bypass regulator valve in turbocharger sticking in closed position

1) If the charge air pressure is too high the fuel supply will be interrupted in order to protect the engine. This results in misfiring at high engine speeds.

Wastegate bypass regulator valve -N75-, testing

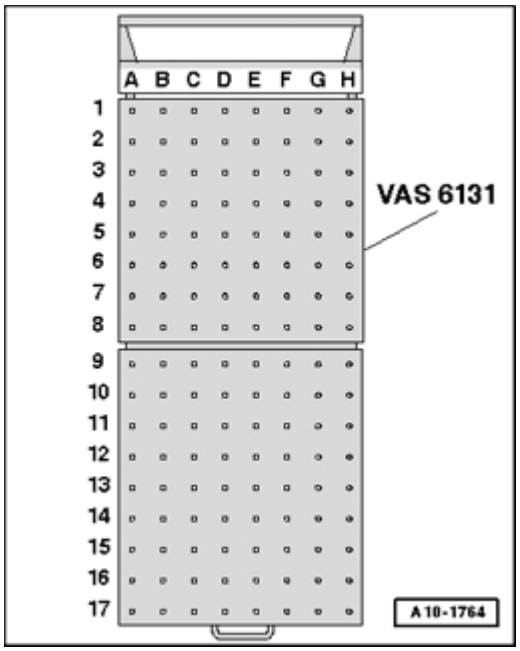

Fig. 225: Identifying Special Tools - Wastegate Bypass Regulator Valve -N75-, Testing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools, testers and other equipment required

- V.A.G 1526 A
- V.A.G 1527 B
- V.A.G 1594 A
- V.A.G 1598/31
- VAS 5051 with VAS 5051/1
  - or
- V.A.G 1551 with V.A.G 1551/3 A

NOTE: Wastegate bypass regulator valve -N75- and its wiring are monitored by the engine control module.

- Connect vehicle diagnostic, testing and information system VAS 5051 (or malfunction reader V.A.G 1551) and select engine electronics control module by entering "Address word" 01. When doing this the engine must be running at idling speed.

Refer to

- **01 ON BOARD DIAGNOSTIC (OBD)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): AMU
- **01 ON BOARD DIAGNOSTIC (OBD)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION &

IGNITION, ENGINE CODE(S): ATC

- **01 ON BOARD DIAGNOSTIC (OBD)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): AWP
- **01 ON BOARD DIAGNOSTIC (OBD)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): BEA

; On Board Diagnostic of Motronic system; Connecting VAS 5051 tester or V.A.G 1551 scan tool and selecting functions

- Interrogate DTC memory of engine control module.

Refer to

- **01 ON BOARD DIAGNOSTIC (OBD)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): AMU
- **01 ON BOARD DIAGNOSTIC (OBD)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): ATC
- **01 ON BOARD DIAGNOSTIC (OBD)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): AWP
- **01 ON BOARD DIAGNOSTIC (OBD)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): BEA

; checking and erasing DTC memory

If the display shows a DTC relating to Wastegate bypass regulator valve -N75-:

- Disconnect hoses from valve but leave the electrical connector connected.
- Install an auxiliary hose to one of the connections on the valve.
- Start Output Diagnostic Test Mode and activate Wastegate bypass regulator valve -N75.

Refer to

- **01 ON BOARD DIAGNOSTIC (OBD)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): AMU
- **01 ON BOARD DIAGNOSTIC (OBD)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): ATC
- **01 ON BOARD DIAGNOSTIC (OBD)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): AWP
- **01 ON BOARD DIAGNOSTIC (OBD)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): BEA

; Output Diagnostic Test Mode

Output Diagnostic Test Mode --> Charge air pressure control solenoid valve -N75-

Indicated on display:

The valve should click...

..and should open and close (test by blowing into auxiliary hose).

Valve does not click:

- Test internal resistance of valve.

If the valve does not open and close properly:

- Replace Wastegate Bypass Regulator Valve -N75-.

Testing internal resistance

- Disconnect electrical connector from valve.

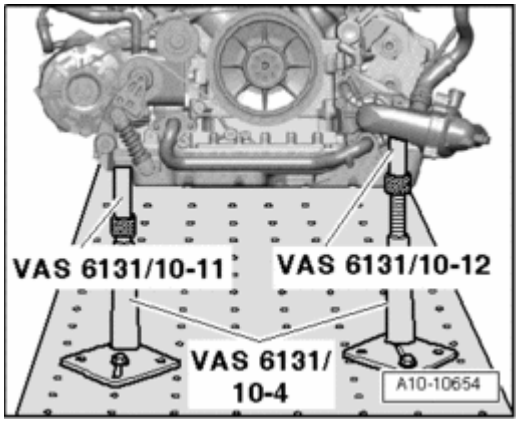

Fig. 226: Connecting Multimeter To Valve (Resistance Measurement Range)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect multimeter to valve (resistance measurement range)

- Specification: 25 - 35 ohms

If the specification is not attained:

- Replace Wastegate Bypass Regulator Valve -N75-.

If the specification is obtained:

Testing voltage supply

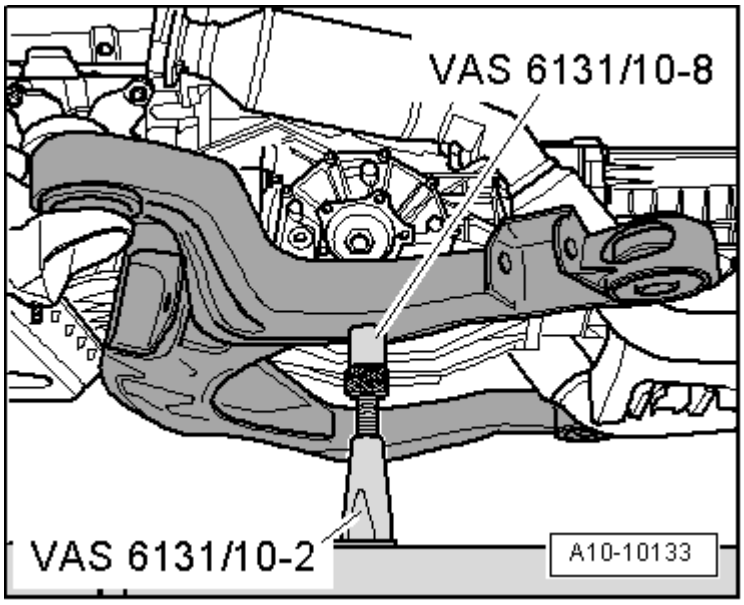

Fig. 227: 2-Pin Electrical Harness Connector & Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect voltage tester V.A.G 1527 B as follows:

Connector Contact	Measure against
1	Engine Ground (GND)

- Operate starter briefly.

- The LED should light up.

If the LED does not light up:

- Test for open circuit in wiring from contact 1 to fuel pump relay via fuse.

Refer to Electrical Wiring Diagrams, Troubleshooting & Component locations

- Correct any open circuits.

If the wiring is OK:

- Test fuel pump relay.

Refer to

- **24 MULTIPORT FUEL INJECTION (MFI)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): AMU
- **24 MULTIPORT FUEL INJECTION (MFI)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION

& IGNITION, ENGINE CODE(S): ATC

- **24 MULTIPORT FUEL INJECTION (MFI)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): AWP
- **24 MULTIPORT FUEL INJECTION (MFI)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): BEA

; Servicing Motronic injection system; Testing Fuel Pump (FP) Relay -J17- and activation

If the LED lights up:

Checking activation

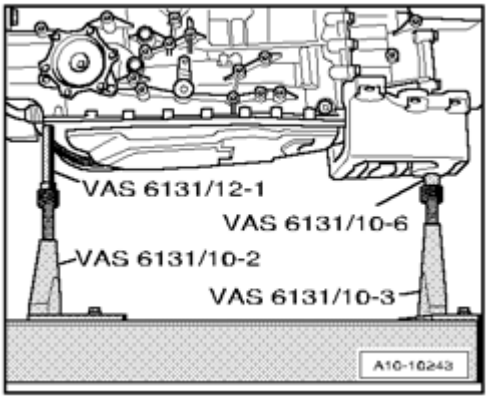

Fig. 228: 2-Pin Electrical Harness Connector & Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect voltage tester V.A.G 1527 B to contact 1 (positive) and contact 2 of the connector.
- Start Output Diagnostic Test Mode and activate Wastegate bypass regulator valve -N75-.

Refer to

- **01 ON BOARD DIAGNOSTIC (OBD)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): AMU
- **01 ON BOARD DIAGNOSTIC (OBD)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): ATC
- **01 ON BOARD DIAGNOSTIC (OBD)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): AWP
- **01 ON BOARD DIAGNOSTIC (OBD)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): BEA

; Output Diagnostic Test Mode

- The LED should flash.

If the LED lamp does not flash or lights up continuously:

- Connect test box V.A.G 1598/31 to wiring harness for engine control module. Do not connect the engine control module itself.

Refer to

- **24 MULTIPORT FUEL INJECTION (MFI)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): AMU
- **24 MULTIPORT FUEL INJECTION (MFI)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): ATC
- **24 MULTIPORT FUEL INJECTION (MFI)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): AWP
- **24 MULTIPORT FUEL INJECTION (MFI)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): BEA

; Servicing Motronic injection system; Wiring and component test using test box V.A.G 1598/31

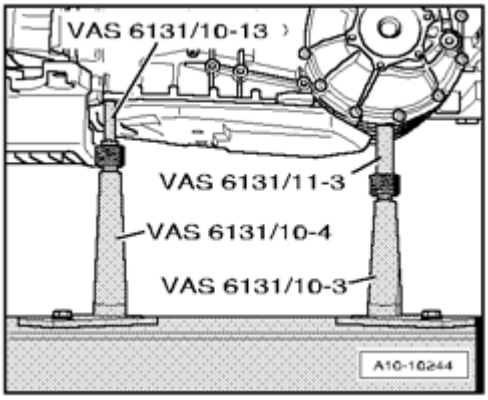

Fig. 229: 2-Pin Electrical Harness Connector & Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Test for open circuit and short to positive or Ground (GND) in the following wiring connections:

Connector Contact	Test box V.A.G 1598/31 Contact
2	104

- Rectify short circuit or open circuit if necessary.

If the wiring is OK:

- Replace engine control module.

Refer to

- **24 MULTIPORT FUEL INJECTION (MFI)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION

& IGNITION, ENGINE CODE(S): AMU

- **24 MULTIPORT FUEL INJECTION (MFI)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): ATC
- **24 MULTIPORT FUEL INJECTION (MFI)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): AWP
- **24 MULTIPORT FUEL INJECTION (MFI)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): BEA

; Servicing Motronic injection system; Replacing engine control module

Intake system, checking for leaks using V.A.G 1687 Diagnostic Tool

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

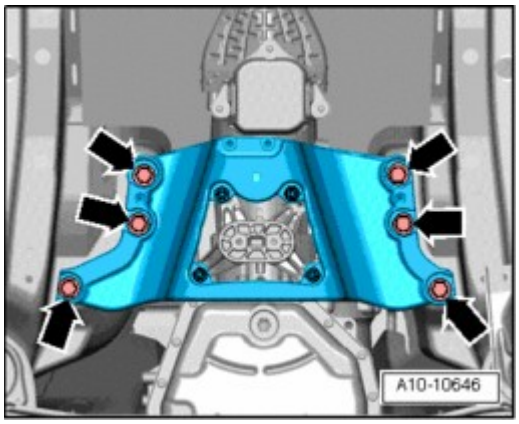

Fig. 230: Checking Charge Air Pressure System Using V.A.G 1687 Charge Air System Tester
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Check the charge air pressure system using the V.A.G 1687 Charge air system tester.

Special tool V.A.G 1687 Charge air system tester preliminary set-up

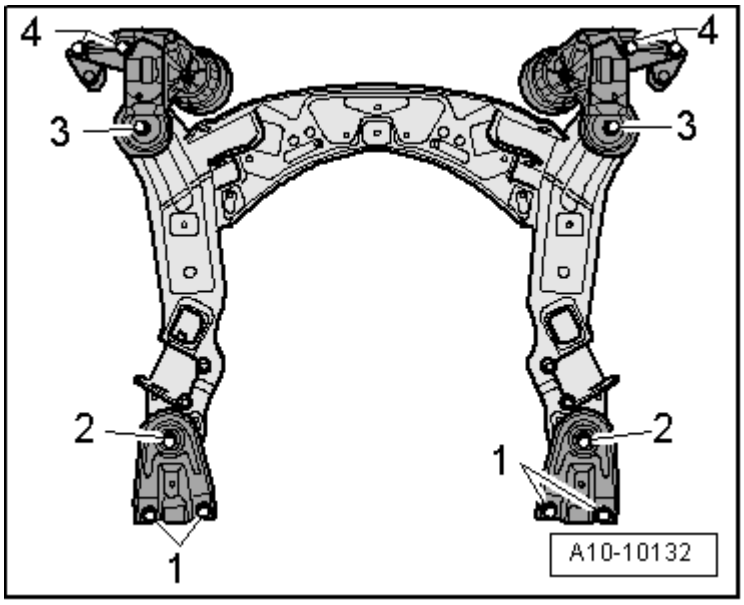

Fig. 231: Special Tool V.A.G 1687 Charge Air System Tester Preliminary Set-Up
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Back off pressure regulator knob -2- of V.A.G 1687 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 V.A.G 1687.

- Remove female fitting from tester (arrow) and install an appropriate "male" air fitting that will connect to your shop air supply line (Refer to WARNING!).

WARNING: Use only approved air fittings to adapt shop air supply line to V.A.G 1687 tester.

Special tool V.A.G 1687/1 pressure adapter, installing (1.8L Turbo)

- Separate intake hose from Mass Air Flow (MAF) sensor assembly.

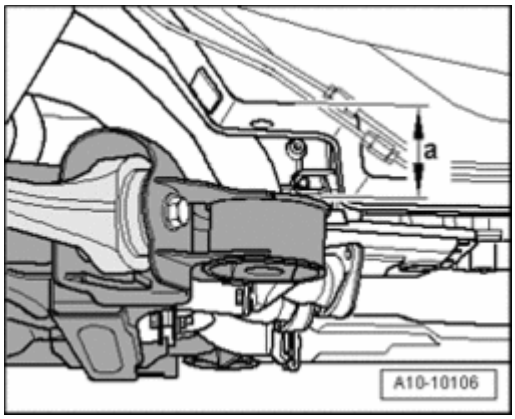

Fig. 232: Special Tool V.A.G 1687/1 Pressure Adapter, Installing (1.8L Turbo)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Insert V.A.G 1687/1 pressure adapter in intake hose (black arrow) using existing clamp (as shown).
- Remove crankcase ventilation tube from intake hose at (white arrow).

Special tool V.A.G 1687/1 pressure adapter, installing (2.7L BiTurbo)

- Remove upper air cleaner housing and hoses to intake manifold as necessary

Refer to **01 MAINTENANCE** ; Air cleaner housing, cleaning; Air cleaner element, replacing

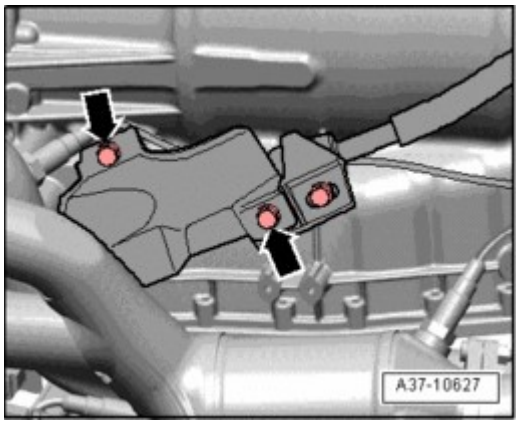

Fig. 233: Special Tool V.A.G 1687/1 Pressure Adapter, Installing (2.7L BiTurbo)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Insert V.A.G 1687/1 pressure adapter in intake hose (white arrow) using existing clamp (as shown).
- Disconnect engine crankcase ventilation hose from intake manifold (black arrow).
- Plug intake manifold fitting (for crankcase ventilation hose) with appropriate hose and metal plug using clamps supplied with V.A.G 1687/1 special tool kit.

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. Refer to Intake system, checking for leaks using V.A.G 1687 Diagnostic**

Tool.

- **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 KLI9210/50 on hose of special tool KLI9210.

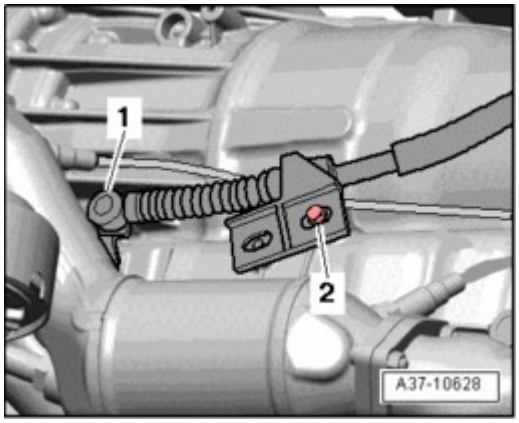

Fig. 234: Special Tool KLI9210 (Evaporative System Leak Detector), Connecting To 1.8L Turbo
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect KLI9210 to V.A.G 1687/1 adapter (KLI9210 is shown attached to V.A.G 1687/1 at arrow on 1.8L Turbo).

Special tool KLI9210 (Evaporative system leak detector), connecting to 2.7L BiTurbo

- Install optional fitting KLI9210/50 on hose of special tool KLI9210.

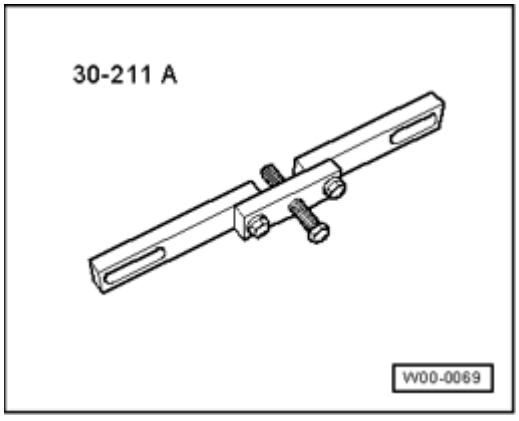

Fig. 235: Special Tool KLI9210 (Evaporative System Leak Detector), Connecting To 2.7L BiTurbo
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect KLI9210 to V.A.G 1687/1 adapter (KLI9210 is shown attached to V.A.G 1687/1 at arrow on 2.7L BiTurbo).

Special tool KLI9210 (Evaporative system leak detector), preliminary set-up

- Connect smoke generator leads to vehicle battery.

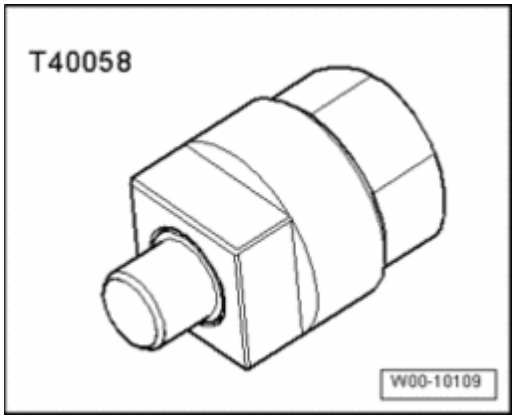

Fig. 236: Special Tool KLI9210 (Evaporative System Leak Detector), Preliminary Set-Up
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- 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 V.A.G1687 quickly to prevent smoke from leaking out (Refer to **Intake system, checking for leaks using V.A.G 1687 Diagnostic Tool**).

Special tool V.A.G 1687, connecting to pressure adapter V.A.G 1687/1 (1.8L Turbo)

For illustrations purposes V.A.G is shown lying in the engine compartment. In practice the tool should be hung from the hood.

- Connect V.A.G 1687 quickly to prevent smoke from leaking out.

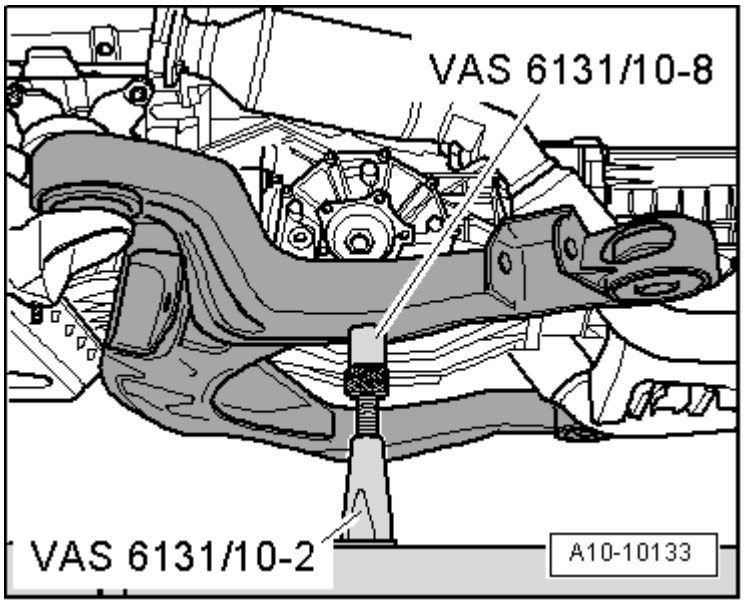

Fig. 237: Special Tool V.A.G 1687, Connecting To Pressure Adapter V.A.G 1687/1 (1.8L Turbo)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

V.A.G 1687 is shown connected to V.A.G 1687/1 (black arrow)

Shop air supply will be connected to V.A.G 1687 at (white arrow)

- Perform pressure test (Refer to **Performing pressure test:**).

Special tool V.A.G 1687, connecting to pressure adapter V.A.G 1687/1 (2.7L BiTurbo)

For illustrations purposes V.A.G is shown lying in the engine compartment. In practice the tool should be hung from the hood.

- Connect V.A.G 1687 quickly to prevent smoke from leaking out.

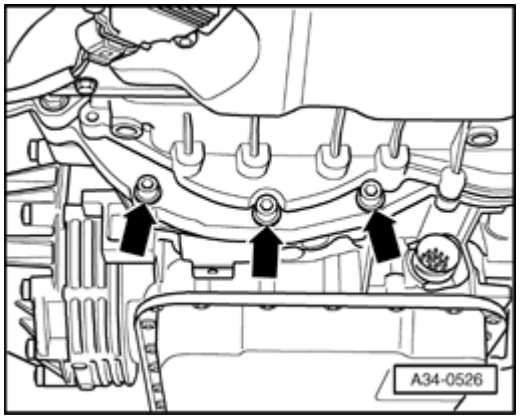

Fig. 238: Special Tool V.A.G 1687, Connecting To Pressure Adapter V.A.G 1687/1 (2.7L BiTurbo)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

V.A.G 1687 is shown connected to V.A.G 1687/1 (black arrow)

Shop air supply will be connected to V.A.G 1687 at (white arrow)

- Perform pressure test (Refer to **Performing pressure test:**).

Performing pressure test:

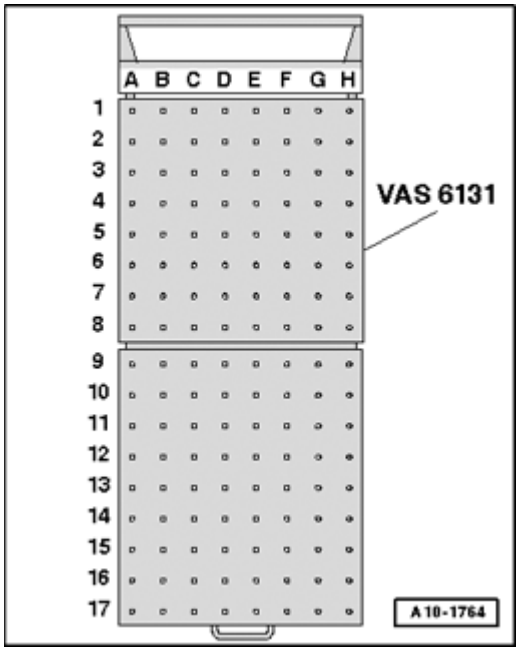

Fig. 239: Special Tool V.A.G 1687 Charge Air System Tester Preliminary Set-Up
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- With outlet hose -1- of V.A.G 1687 connected to air pressure adapter:
- Attach shop air supply line to previously installed male fitting (Refer to **Intake system, checking for leaks using V.A.G 1687 Diagnostic Tool**).

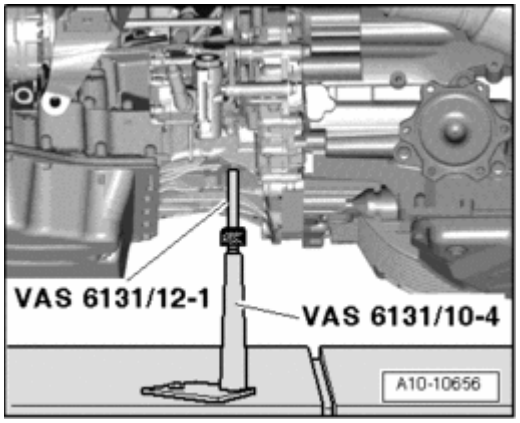

Fig. 240: Special Tool V.A.G 1687 Charge Air System Tester Preliminary Set-Up
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Open valve -3- between regulator valve and gauge.
- Adjust test pressure up to 0.5 bar (see 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 (see CAUTION above) 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 VAS 5051 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 VAS 5051 diagnostic tool connected:

- Erase DTC memory.

Charge air pressure sensor -G31-, testing

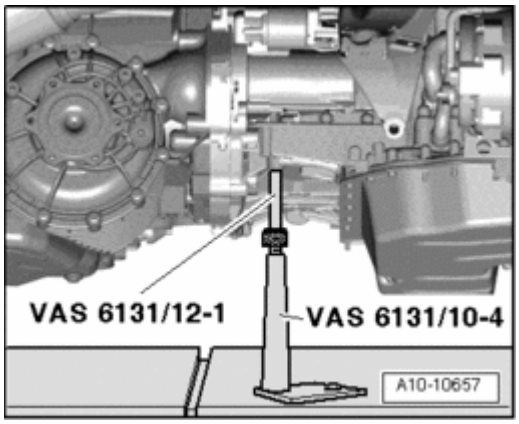

Fig. 241: Identifying Special Tools - Charge Air Pressure Sensor -G31-, Testing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools, testers and other equipment required

- V.A.G 1526 A
- V.A.G 1594 A
- V.A.G 1598/31
- VAS 5051 with VAS 5051/1

- or

- V.A.G 1551 with V.A.G 1551/3 A

NOTE: Charge air pressure sensor -G31- and its wiring are monitored by the engine control module.

- Connect vehicle diagnostic, testing and information system VAS 5051 (or DTC reader V.A.G 1551) and select engine electronics control module by entering "Address word" 01. When doing this the engine must be running at idling speed.

Refer to

- **01 ON BOARD DIAGNOSTIC (OBD)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): AMU
- **01 ON BOARD DIAGNOSTIC (OBD)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): ATC
- **01 ON BOARD DIAGNOSTIC (OBD)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION &

IGNITION, ENGINE CODE(S): AWP

- **01 ON BOARD DIAGNOSTIC (OBD)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): BEA

; On Board Diagnostic of Motronic system; Connecting VAS 5051 tester or V.A.G 1551 scan tool and selecting functions

- Interrogate DTC memory of engine control module.

Refer to

- **01 ON BOARD DIAGNOSTIC (OBD)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): AMU
- **01 ON BOARD DIAGNOSTIC (OBD)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): ATC
- **01 ON BOARD DIAGNOSTIC (OBD)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): AWP
- **01 ON BOARD DIAGNOSTIC (OBD)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): BEA

; Checking and erasing DTC memory

If the display shows a DTC relating to charge air pressure sensor -G31-:

Testing voltage supply

- Disconnect electrical connector on charge air pressure sensor.

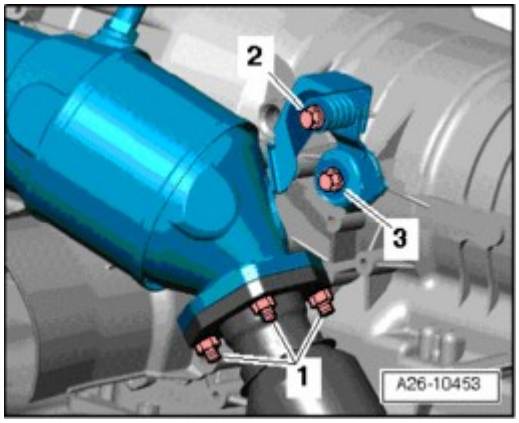

Fig. 242: Identifying Connector Terminals 1 And 4
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect multimeter (voltage measurement range) between contacts 1 and 3 on connector.
- Switch on ignition.

- Specification: approx. 5 V

If the specification is not attained:

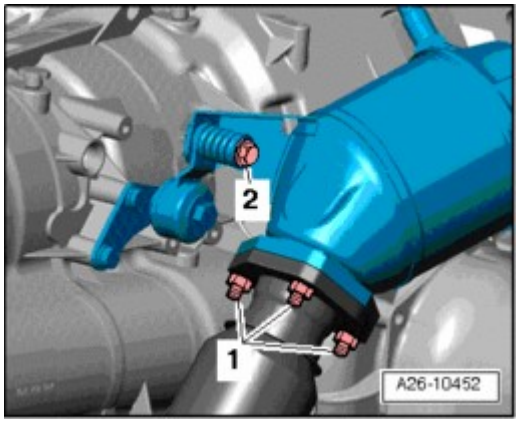

Fig. 243: Connecting Test Box V.A.G 1598/31 To Wiring Harness For Engine Control Module
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect test box V.A.G 1598/31 to wiring harness for engine control module and also to the engine control module itself (-1-).

Refer to

- **24 MULTIPORT FUEL INJECTION (MFI)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): AMU
- **24 MULTIPORT FUEL INJECTION (MFI)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): ATC
- **24 MULTIPORT FUEL INJECTION (MFI)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): AWP
- **24 MULTIPORT FUEL INJECTION (MFI)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): BEA

; Servicing Motronic injection system; Wiring and component test using test box V.A.G 1598/31

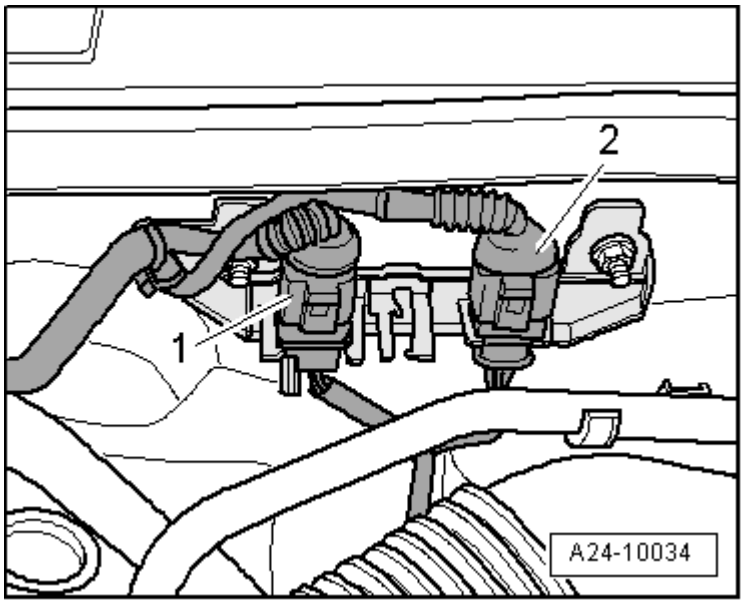

Fig. 244: Identifying Connector Terminals 1 And 4
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Test for open circuit and short to positive or Ground in the following wiring connections:

Connector Contact	Test box V.A.G 1598/31 Contact
1	108
3	98

- Rectify short circuit or open circuit if necessary.

If the specification is attained:

Testing signal wire

- Plug in connector on charge air pressure sensor.
- Connect multimeter (voltage measurement range) between sockets 101 and 108 on test box.
- Start engine and run at idling speed.

- Specification: approx. 1.90 V

- Increase engine speed by operating throttle quickly.

- Specification: 2.00 - 3.00 V

If the specifications are not obtained:

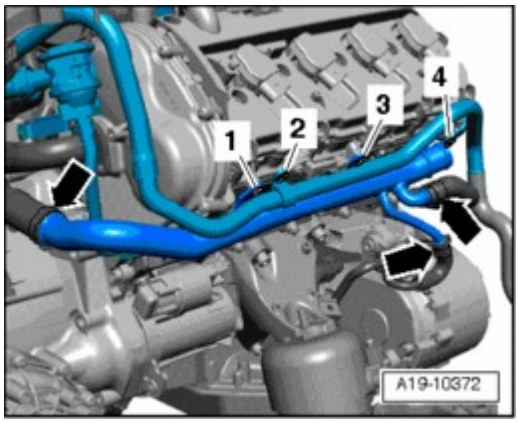

Fig. 245: Identifying Connector Terminals 1 And 4
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Test for open circuit and short to positive or Ground in the following wiring connections:

Connector Contact	Test box V.A.G 1598/31 Contact
4	101

- Rectify short circuit or open circuit if necessary.

If the wiring is OK:

- Replace charge air pressure sensor -G31-.

Rules for cleanliness

When working on the exhaust gas turbocharger, pay careful attention to the following "5 rules":

- Thoroughly clean all unions and the adjacent areas before disconnecting.
- Place parts that have been removed on a clean surface and cover. Do not use fluffy cloths!
- Carefully cover opened components or seal, if the repair cannot be carried out immediately.
- Only install clean components: Only unpack replacement parts immediately prior to installation. Do not use parts that have been stored loose (e.g. in tool boxes etc.).
- When the system is open: Do not work with compressed air if this can be avoided. Do not move vehicle unless absolutely necessary.

Turbocharger, removing and installing: assembly overview

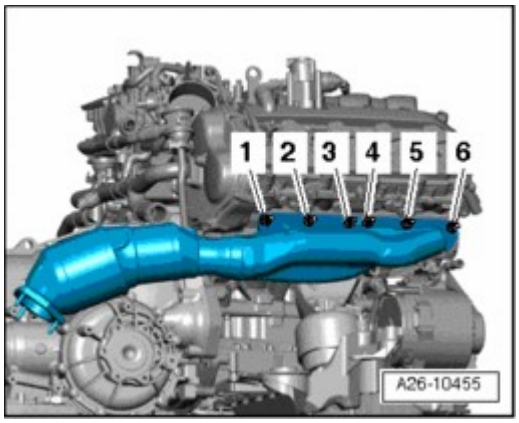

Fig. 246: Turbocharger, Removing And Installing: Assembly Overview
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Part I

NOTE: Replace all gaskets and seals

1 - 10 Nm

2 - Oil return line

- To sump

3 - 10 Nm

- Install with locking fluid D 000 600 A2

4 - Gasket

- Always replace

5 - 10 Nm

6 - 10 Nm

7 - Pressure unit

- For Wastegate bypass regulator valve

8 - Turbocharger

9 - 25 Nm

- Always replace

10 - Gasket

- Always replace
- Note installation position

11 - 10 Nm

12 - Banjo bolt - 30 Nm

13 - Oil supply pipe

- From oil filter bracket -Item 23 **Part II**.

14 - 30 Nm

- Always replace
- Coat threads and bolt head seating surface with G000500

15 - Exhaust manifold

16 - 10 Nm

17 - Banjo bolt - 35 Nm

18 - Gasket

- Always replace
- Note installation position

19 - Banjo bolt - 35 Nm

20 - Coolant return pipe

21 - 20 Nm

22 - Banjo bolt - 30 Nm

23 - 10 Nm

24 - Coolant supply hose/line

25 - Banjo bolt - 35 Nm

26 - Oxygen sensor

27 - 40 Nm

- Always replace

28 - Front exhaust pipe

- With de-coupling element
- Protect from damage by knocks and impact
- De-coupling element may only be bent slightly - not more than 10°
- Removing and installing. Refer to **Front exhaust pipe, removing and installing**

29 - 30 Nm

- Use only genuine bolts

30 - 20 Nm

31 - Bracket

- For turbocharger

32 - Gasket

- Always replace
- Install with locking fluid D 000 600 A2

Turbocharger, removing and installing

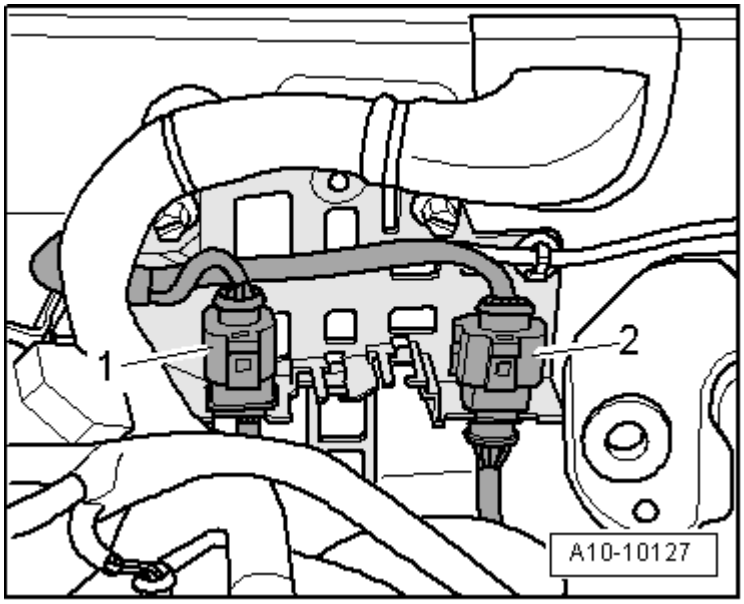

Fig. 247: Identifying Special Tools - Turbocharger, Removing And Installing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools and miscellaneous equipment required

- V.A.G 1383 A transmission jack with universal support V.A.G1359/2
- 3287A Ball joint puller
- V.A.G 1332 Torque wrench

40-200 Nm

Removing

NOTE: The turbocharger is removed from below.

- Remove engine cover panel (complete).
- Remove both front wheels.

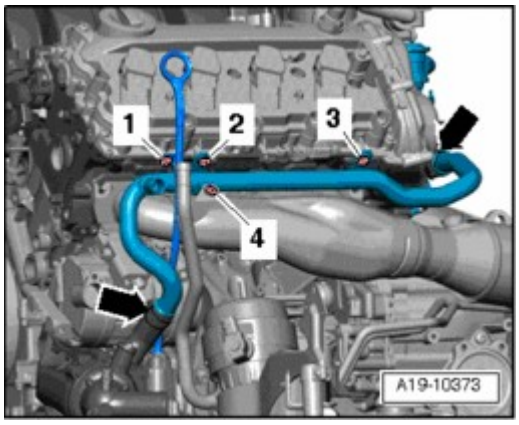

Fig. 248: Removing Noise Insulation
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove noise insulation (bottom and right).

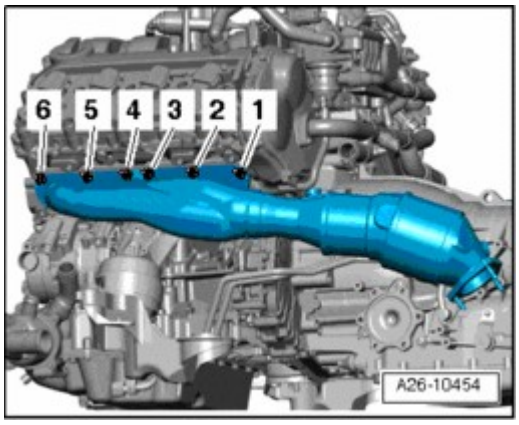

Fig. 249: Removing Coupling Link Nut From Stabilizer Bar
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove coupling link nut from stabilizer bar.
- Remove Torx socket bolt for noise insulation (left).
- Remove upper nut on ball joint.

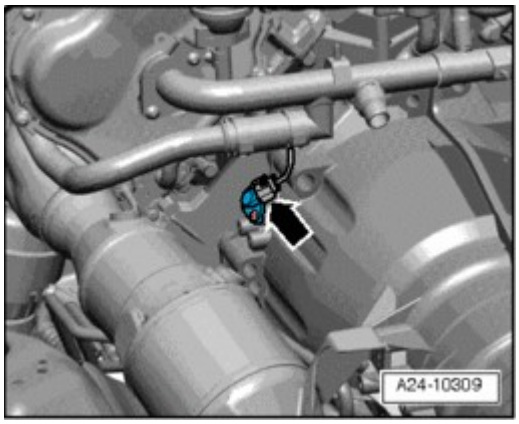

Fig. 250: Installing Ball Joint Splitter
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Install ball joint splitter as shown in illustration and press out ball joint.

NOTE: To protect swivel joint threads leave nut on a few turns.

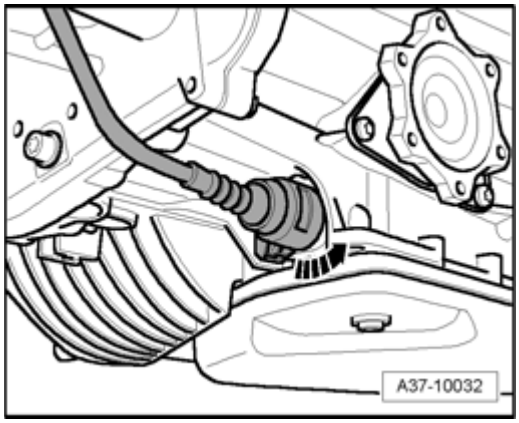

Fig. 251: Identifying Subframe Bolts, Steering Gear Bolts & Pendulum Support Bolts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts -1- for steering box and bolts -2- for pendulum support.
- Detach rubber mount for front exhaust pipe.
- Place engine/transmission jack V.A.G 1383 A with universal support 1359/2 under subframe.
- Remove bolts -3- and -4- for sub-frame.

- Take out subframe carefully.
- Remove heat shield for right-hand drive shaft.
- Remove front exhaust pipe. Refer to **Exhaust system components, removing and installing**.

NOTE: Do not bend the flexible connection (de-coupling element) in the exhaust system more than 10° , otherwise it may be damaged.

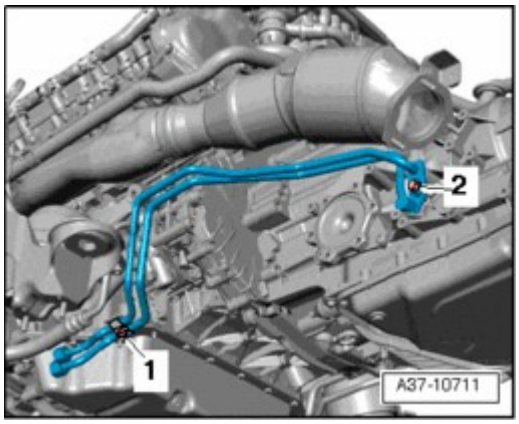

Fig. 252: Removing Oil Return Pipe From Turbocharger
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove oil return pipe from turbocharger using a 5 mm hex socket wrench with ball joint.
- Loosen bolt on turbocharger bracket a few turns, but to not remove bolt.
- Drain cooling system. Refer to **Draining**

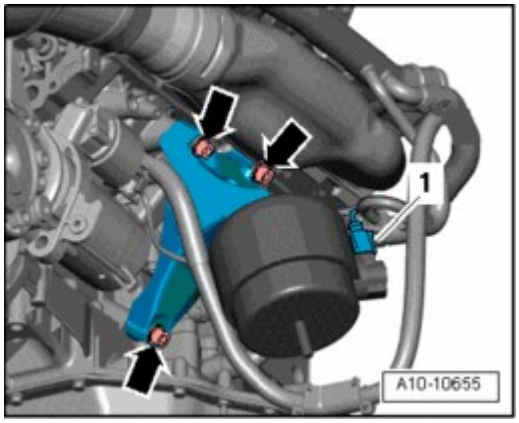

Fig. 253: Removing Intake Air Duct
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove air intake pipe between turbocharger and charge air cooler.
- Disconnect secondary air hose -1- from air cleaner housing.

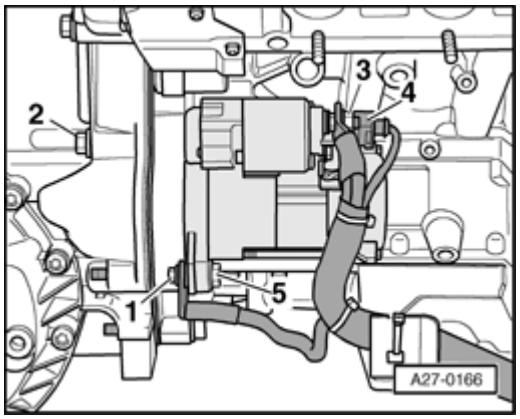

Fig. 254: Identifying Air Hose, Connectors, Bolts & Mass Air Flow Sensor
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Detach air intake hose -2- at Mass air flow sensor.
- Disconnect electrical connectors for air mass meter -3-.
- Remove bolts -4- and -5- and remove air cleaner housing.

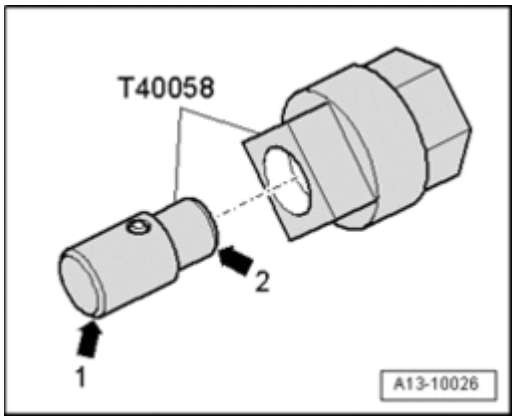

Fig. 255: Detaching Intake Air Hose Between Air Cleaner And Turbocharger
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Detach air intake hose between air cleaner and turbocharger as follows:
- Disconnect connector at Wastegate Bypass Regulator Valve -N75-.
- 1- Connection at air cleaner
- 2- Detach pressure control valve for crankcase breather -8- from hose.

- 3- Disconnect vacuum hose for air recirculation valve at connection on cylinder head.
- 4- Detach hose from Wastegate Bypass Regulator Valve -N75- at air intake pipe.
- 5- Detach hose from air recirculation valve at air intake pipe.
- 6- Detach connection to active charcoal filter at non-return valve.

- 7- Detach connection between Wastegate Bypass Regulator Valve -N75- and pressure unit for charge air pressure control.

- 8- Detach air intake hose at connection on turbocharger and remove hose.
- Remove heat shield above exhaust manifold.

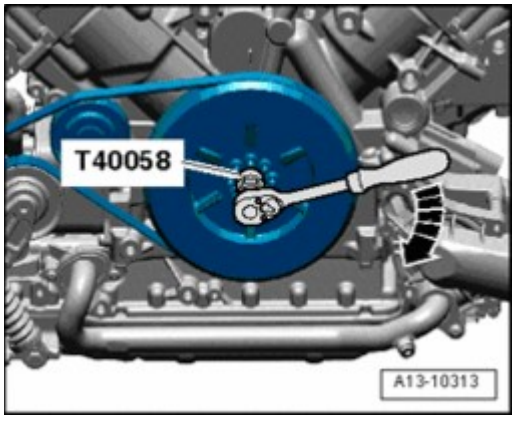

Fig. 256: Removing/Installing Coolant Return Pipe & Oil Supply Pipe
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect coolant return pipe -1- from turbocharger using an 8 mm hex socket wrench with ball joint.

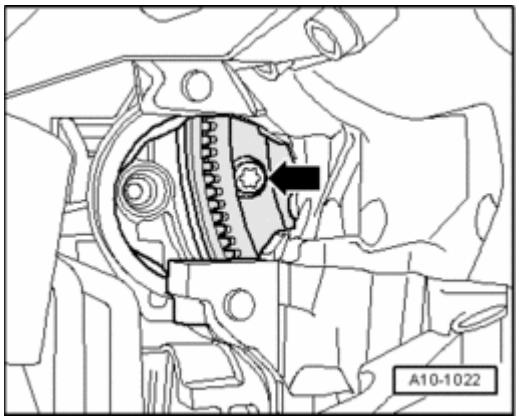

Fig. 257: Removing Turbocharger From Exhaust Manifold
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove turbocharger from exhaust manifold.
- Remove gasket between turbocharger and exhaust manifold and tilt turbocharger slightly away from engine.

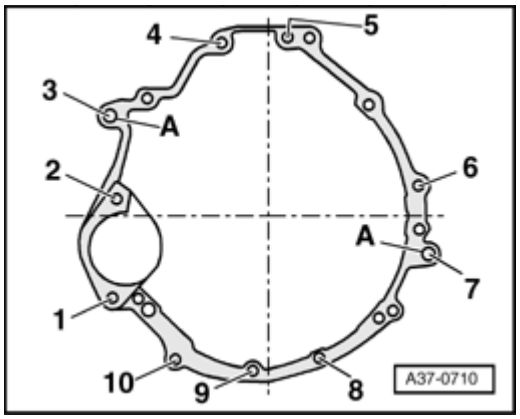

Fig. 258: Removing/Installing Coolant Return Pipe & Oil Supply Pipe
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect oil supply pipe -2- from turbocharger using an 8 mm hex socket wrench with ball joint.

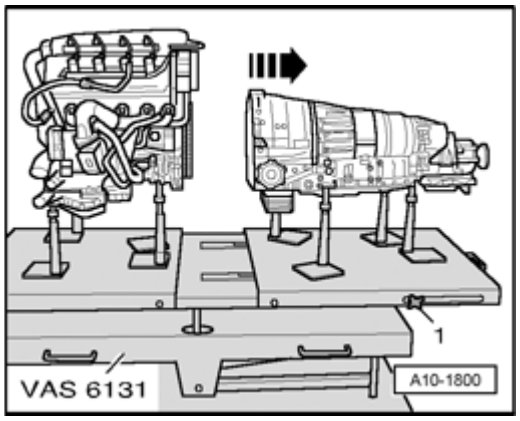

Fig. 259: Identifying Turbocharger, Coolant Supply Pipe & Turbocharger Bracket Bolt
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect bracket for coolant return line from turbocharger -1- at crankcase.
- Disconnect coolant supply pipe -2- from crankcase using an 8 mm hex socket wrench with ball joint.
- Remove bolt on turbocharger bracket completely.
- Lower out turbocharger with coolant supply line connected.

Installing:

Note the following points when installing:

- Before installing turbocharger, connect coolant supply line and attach retaining bar to turbocharger.

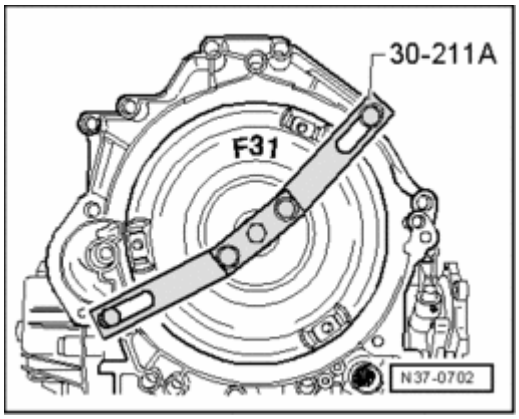

Fig. 260: Identifying Turbocharger, Coolant Supply Pipe & Turbocharger Bracket Bolt
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Guide in turbocharger from below and slide onto bracket. Tighten bolt -3- finger-tight.
- Slide bracket for coolant return line together, install bolt -1- and tighten to 10 Nm.
- Bolt coolant supply line -2- to crankcase (banjo bolt: 35 Nm; bracket -1-: 10 Nm).

NOTE: When tightening connection for coolant supply pipe -2-, make sure line does not turn out of position on turbocharger.

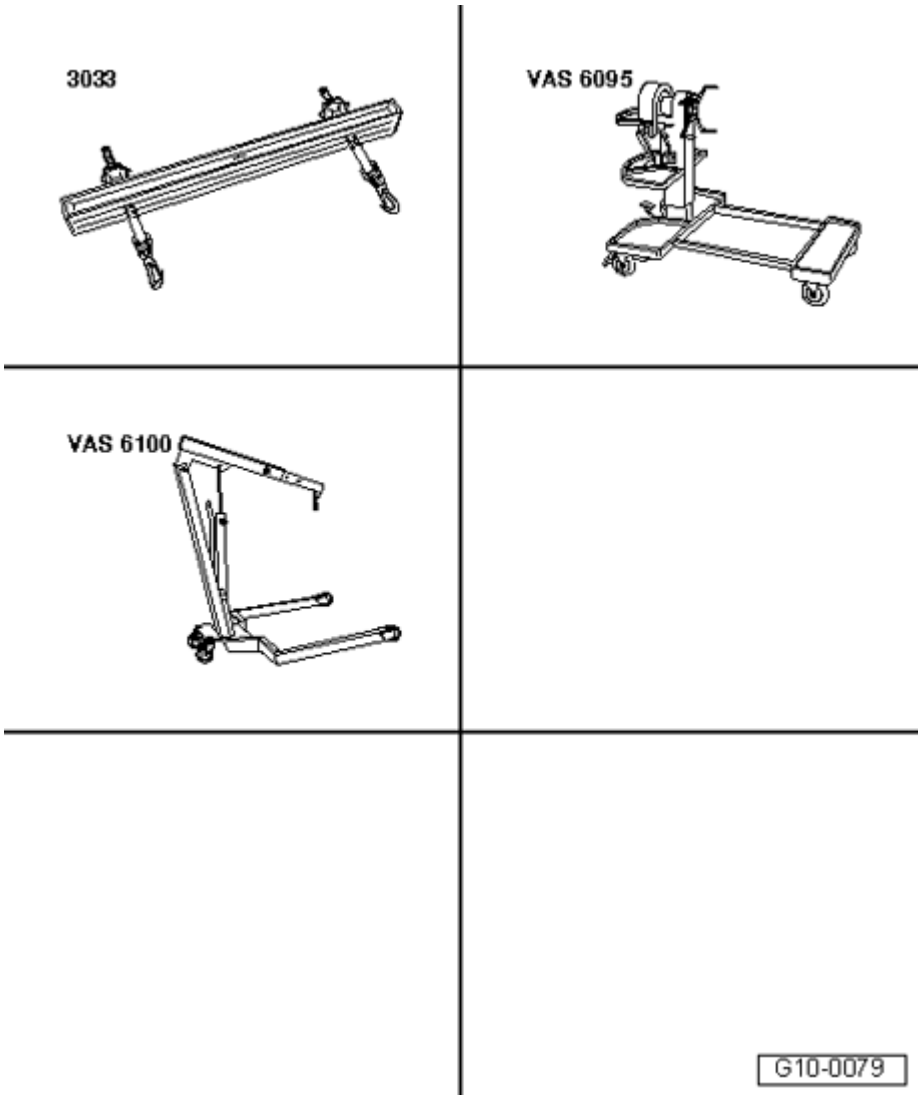

Fig. 261: Removing/Installing Coolant Return Pipe & Oil Supply Pipe
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Attach oil supply line -2- and retaining bar to turbocharger (banjo bolt: 30 Nm; retaining bar: 10 Nm).
- Slide in gasket between exhaust manifold and turbocharger.

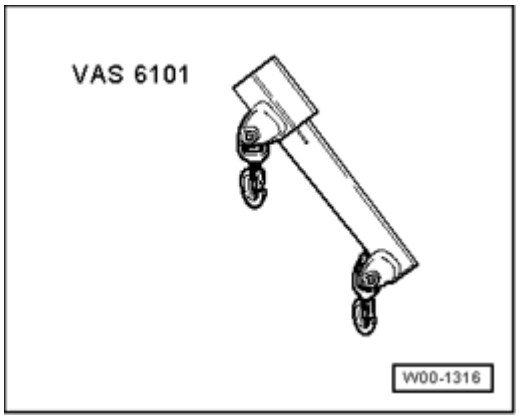

Fig. 262: Removing Turbocharger From Exhaust Manifold
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Bolt turbocharger to exhaust manifold.

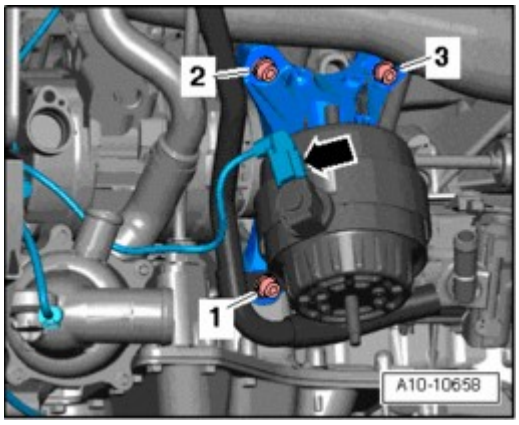

Fig. 263: Removing/Installing Coolant Return Pipe & Oil Supply Pipe
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect coolant return line -1- (35 Nm).

NOTE: Install front exhaust pipe before installing subframe.

- Tighten all bolts to specified torques indicated in table of tightening torques.
- Fill up with coolant. Refer to **Filling**.

NOTE: After installing the turbocharger, run engine for approx. 1 minute at idling speed; do not rev. up immediately. This ensures the turbocharger is properly lubricated.

Tightening torques

Components	Nm
Oil return line to sump	10

Oil return line to turbocharger	10
Coolant supply line to cylinder block	35
Turbocharger bracket to turbocharger *	30
Turbocharger bracket to cylinder block	25
Oil supply line to turbocharger	30
Oil supply line retainer piece to turbocharger	10
Coolant return line to turbocharger	35
Turbocharger to exhaust manifold	50
Drive shaft heat shield to cylinder block	35
Nuts on clamp	40

* Use correct bolt (same as original part)

Before inserting bolts for subframe, position steering gear on subframe and insert bolts.

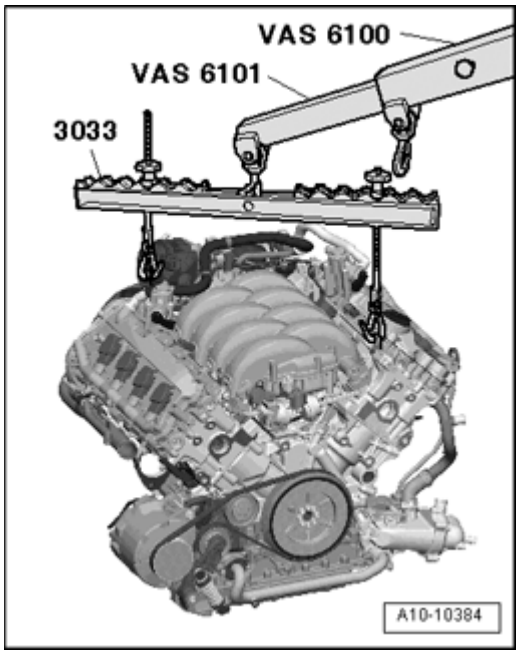

Fig. 264: Seating Threaded Sleeve In Subframe Hole
Courtesy of VOLKSWAGEN UNITED STATES, INC.

The threaded sleeve -1- must seat in subframe hole.

- Install ball joint in wheel bearing housing.

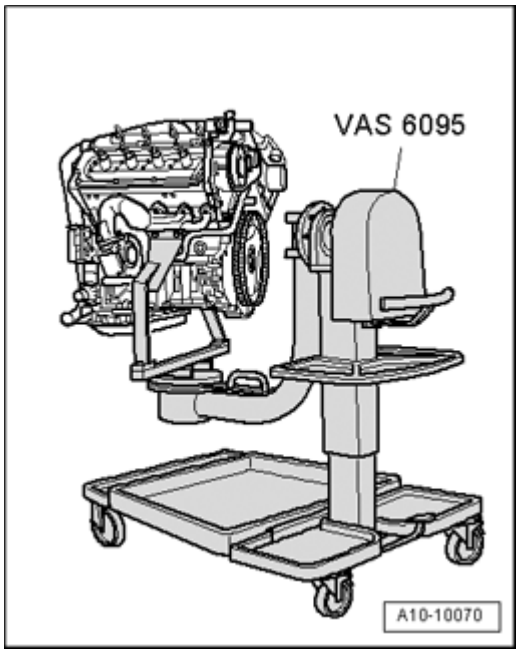

Fig. 265: Installing New Self-Locking Nut, And Counter-Hold With T40 Torx Bit
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Install new self-locking nut, and counter-hold with T40 Torx key.

NOTE:

- **Normal commercially available tools (18 mm ring insert such as Stahlwille 732/10 or Hazet 6630c-18) can also be used instead of V.A.G 1332/10.**
- **Make sure that protective boot is not damaged or twisted.**

Tightening torques:	
Ball joint to wheel bearing housing (use new nuts)	45 Nm
Pendulum support to transmission M 10 x 70 M 10 x 30	50 Nm 50 Nm
Pendulum support to subframe	25 Nm
Steering gear to subframe (use new bolts)	20 Nm + 90°
Coupling link to anti-roll bar (use new nuts)	100 Nm
Subframe to body (use new bolts)	100 Nm + 90°

After installing, check position of steering wheel during a test drive.

If steering wheel is not in straight ahead position the front axle tracking must be checked!

Charge air cooling system components, removing and installing

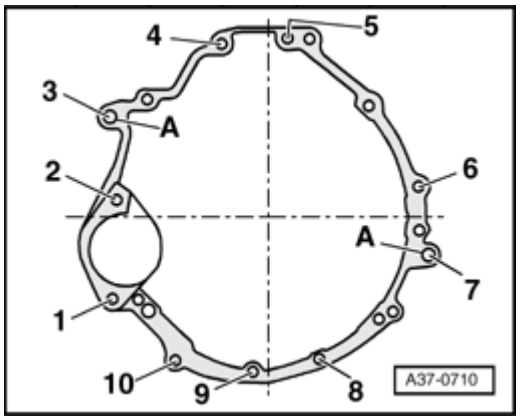

Fig. 266: Charge Air Cooling System Components, Removing And Installing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Part 1

NOTE:

- **All hose connections must be secured with hose clips (same as original parts).**
- **Before carrying out tests or repair work, make sure that all pipes and hoses are securely connected and that there are no leaks.**

1 - Pressure hose

2 - To connection on charge air cooler

3 - 20 Nm

4 - Bottom bracket for pressure line

5 - Pressure pipe

6 - Top bracket for pressure line

7 - 20 Nm

8 - 20 Nm

9 - Top bracket for pressure line

10 - Pressure hose

11 - Turbocharger

12 - To crankcase breather

13 - Pressure regulating valve for crankcase breather

14 - Pressure unit for charge air pressure control

15 - Air intake hose

16 - To air cleaner

17 - To Recirculating valve for turbocharger -N249-

18 - Charge air pressure bypass valve

19 - Connecting piece

20 - Recirculating valve for turbocharger -N249-

21 - Bottom bracket for pressure line

Part 2

1 - Pressure hose

2 - Air duct for charge air cooler (right)

3 - Charge air cooler (right)

- Removing and installing. Refer to **Charge air cooler (intercooler), removing and installing**

4 - Rubber grommet

- With sleeve

5 - 10 Nm

6 - To turbocharger

7 - 10 Nm

8 - Bracket for charge air cooler (right)

9 - Connection on intake manifold

10 - Rubber grommet

- With sleeve

11 - 10 Nm

12 - Bracket

- Secured on longitudinal member

13 - Sleeve

14 - Rubber grommet

15 - Pressure hose

- With clip for wire to charge air pressure sensor -G31-

16 - 10 Nm

17 - 10 Nm

18 - Charge air pressure sensor -G31-

19 - Pressure line

20 - Pressure hose

21 - 10 Nm

22 - Rubber grommet

23 - Charge air cooler (left)

24 - 10 Nm

25 - Rubber grommet

26 - Bracket for charge air cooler

27 - Air duct for charge air cooler (left)

28 - Connecting line between left and right charge air coolers

Charge air cooler (intercooler), removing and installing

This description applies to the right charge air cooler. The procedure is the same for the left charge air cooler, except that the activated charcoal filter does not have to be removed.

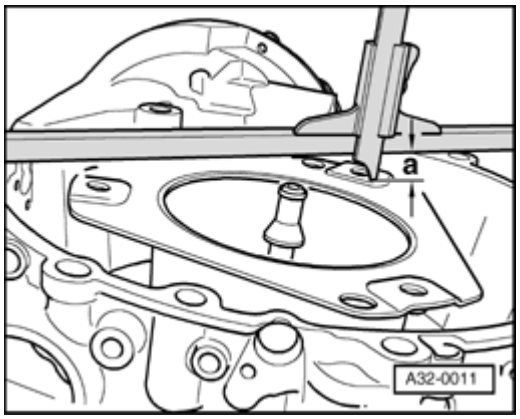

Fig. 267: Removing Noise Insulation
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove sound insulation (arrows).
- Remove front bumper.

Refer to **63 BUMPERS** ; Front bumper; Removing and installing

- Remove right headlight

Refer to **94 LIGHTS, SWITCHES - EXTERIOR** ; Servicing headlights; Removing and installing headlights

- Remove activated charcoal filter.

Refer to

- **20 - FUEL PUMP, FUEL SUPPLY, EVAPORATIVE EMISSIONS** for 1.8 LITER 4-CYL. 5V TURBO GENERIC SCAN TOOL ENGINE CODE(S): AMU, BEA, ATC, AWP
- **20 - FUEL SUPPLY** for 3.2 LITER V6 4V GENERIC SCAN TOOL, ENGINE CODE: BHE

; Servicing parts of activated charcoal filter system (front-wheel drive and all-wheel drive)

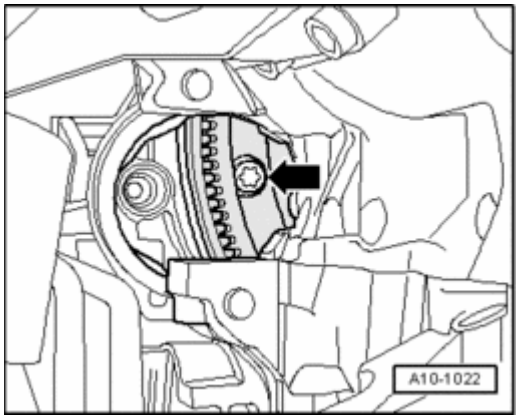

Fig. 268: Identifying Connecting Line Bolts (Left)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove connecting line between charge air coolers from longitudinal members on left side...

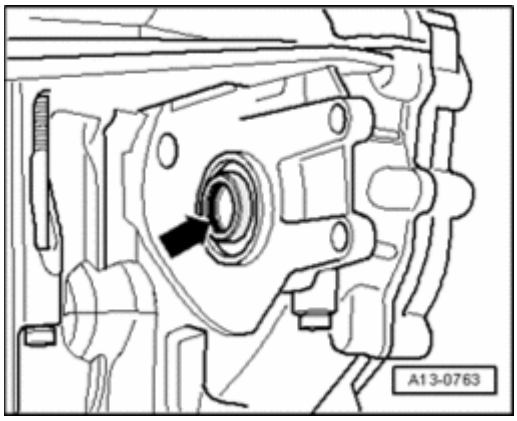

Fig. 269: Identifying Connecting Line Bolts & Right Charge Air Coolers
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- ... and right side: Disconnect hoses from both charge air coolers.
- Remove connecting line.
- Disconnect air hose from top of charge air cooler.

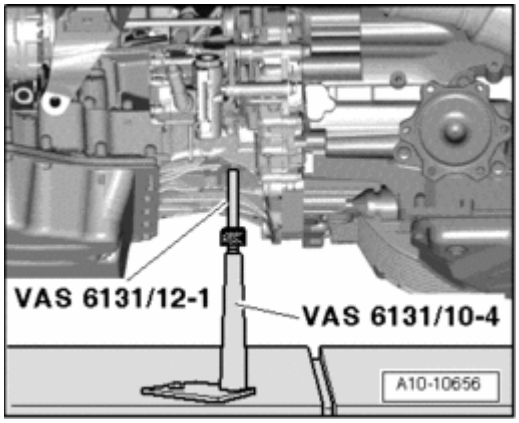

Fig. 270: Removing Bolts For Charge Air Cooler
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove 2 bolts (arrows) for charge air cooler.
- Unclip air duct from charge air cooler.
- Remove lower securing bolt -1- for charge air cooler.
- Take out charge air cooler from underneath.

Installation is carried out in the reverse order, when doing this note the following:

- Adjust headlights.

Refer to **01 MAINTENANCE** ; Description of work; Headlights - checking settings and adjusting if necessary

26 EXHAUST SYSTEM, EMISSION CONTROLS

EXHAUST SYSTEM COMPONENTS, REMOVING AND INSTALLING

Exhaust system components, removing and installing

NOTE:

- **Always replace seals and gaskets, self-locking nuts and clamps.**
- **After working on the exhaust system ensure that the system is not under stress, and that it has sufficient clearance from the bodywork. If necessary, loosen clamp and align silencers and exhaust pipe so that sufficient clearance is maintained to the bodywork at all points and the mounts are evenly loaded.**
- **Loosen and tighten clamping plates for heat shields with a screwdriver. Tightening torque: 2 Nm**
- **De-coupling element on front exhaust pipe may only be bent slightly - not more than 10°.**
- **If droning noises can be heard after aligning the exhaust system, adjust the engine mounts. Refer to Engine mounts, adjusting.**

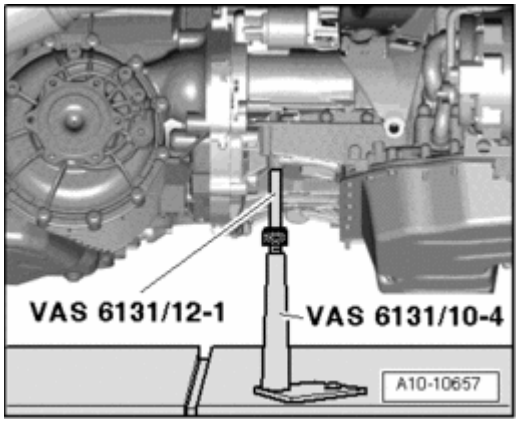

Fig. 271: Exhaust System Components, Removing And Installing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - 40 Nm

- Always replace

2 - Oxygen sensor, 55 Nm

- Apply "G5" lubricant only on the threads; "G5" must not come into contact with the slots on the body of the Oxygen sensor
- Checking:

Refer to

- **24 MULTIPORT FUEL INJECTION (MFI)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): AMU
- **24 MULTIPORT FUEL INJECTION (MFI)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): ATC
- **24 MULTIPORT FUEL INJECTION (MFI)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): AWP
- **24 MULTIPORT FUEL INJECTION (MFI)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): BEA

; Testing Oxygen sensor control

3 - Mounting

- Secured on subframe

4 - 25 Nm

5 - Catalytic converter

6 - Mounting

7 - 25 Nm

8 - Front and rear silencers

- Can be replaced separately if required
- Exhaust pipe with cutting point. See **Fig. 1 Marked position for cutting exhaust pipe**
- Aligning exhaust system free of stress. Refer to **Exhaust system, aligning free of stress**

9 - 25 Nm

10 - Mounting

11 - 25 Nm

12 - 25 Nm

13 - Clamp

- Align exhaust system so it is free of stress before tightening clamp. Refer to **Exhaust system, aligning free of stress**.
- Installation position: horizontal in vehicle, bolted connection facing to the left.
- Tighten bolted connections evenly.

14 - Tunnel cross-piece

- With drilling for aligning exhaust system. Refer to **Exhaust system, aligning free of stress**

15 - Gasket

- Always replace

16 - 25 Nm

17 - Front exhaust pipe

- With de-coupling element
- Protect from damage by knocks and impact
- De-coupling element may only be bent slightly - not more than 10°
- Removing and installing. Refer to **Front exhaust pipe, removing and installing**

Marked position for cutting exhaust pipe

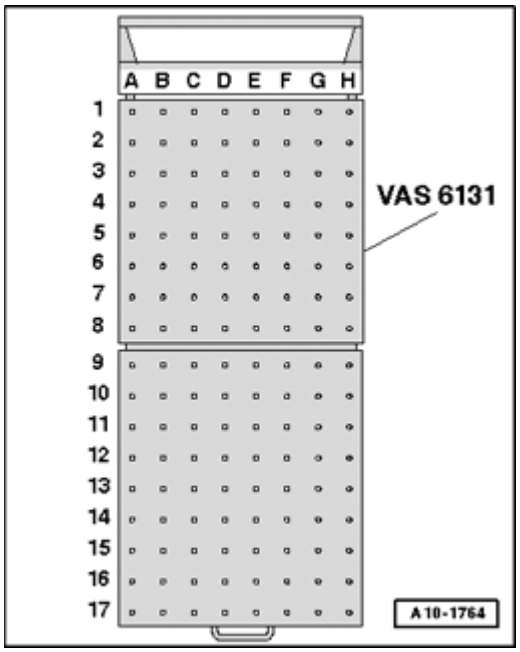

Fig. 272: Separating Point On Exhaust Pipe
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- For separate replacement of front or rear silencer
- Position is marked with three indentations on exhaust pipe.

- Cut through exhaust pipe at right angles with body saw (e.g. V.A.G 1523) at position marked (arrow -2-).
- Position clamp -4- between side markings (arrows 1 and 3) when installing.
- Aligning exhaust system free of stress. Refer to **Exhaust system, aligning free of stress**.
- Align rear silencer so it is horizontal.

- Tighten bolted connections on clamp evenly to 40 Nm.
- Installation position of clamp - horizontal in vehicle; bolted connections facing to the front.

Clearance between exhaust pipe and heat shield for steering gear: not less than 30 mm

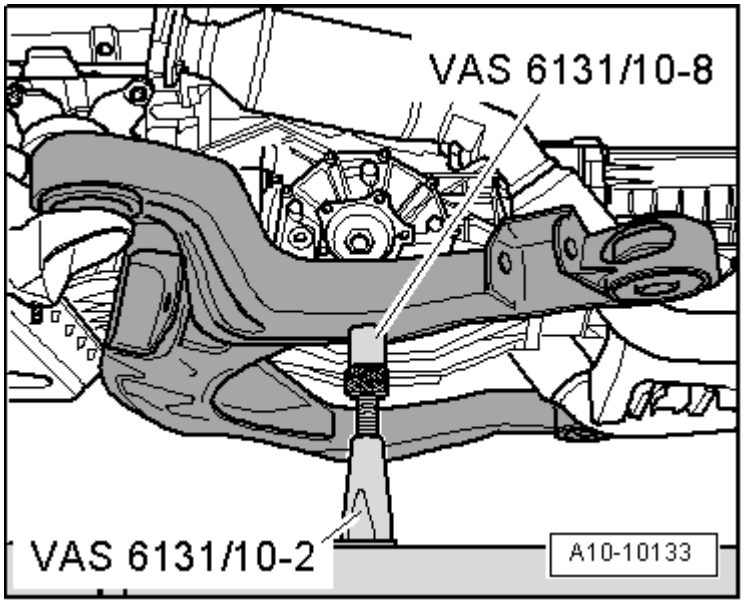

Fig. 273: Identifying Clearance Between Exhaust Pipe And Heat Shield For Steering Gear
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- To check this clearance, install a 22 mm 1/2-inch socket (outside diameter approx. 30 mm) on a long extension and insert between front exhaust pipe and heat shield. The socket attachment must fit easily in the gap.

Align catalytic converter horizontally -4- and with equal spacing -3- from heat shield in center tunnel -2-. Item -1- is the drive shaft.

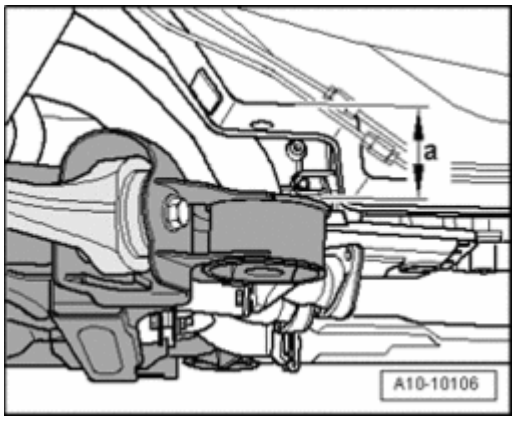

Fig. 274: Aligning Catalytic Converter Horizontally And With Equal Spacing From Heat Shield In Center Tunnel
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Align front and rear silencers centrally and horizontally. If necessary, detach tunnel cross piece.

Front exhaust pipe, removing and installing

Removing

NOTE:

- **Do not bend the flexible connection (de-coupling element) in the exhaust system more than 10° , otherwise it may be damaged.**
- **When performing repairs, replace seals, gaskets, self-locking nuts and stretch bolts which have a specified tightening angle.**

- Disconnect electrical connector for Oxygen sensor.
- Guide out Oxygen sensor wiring from underneath.

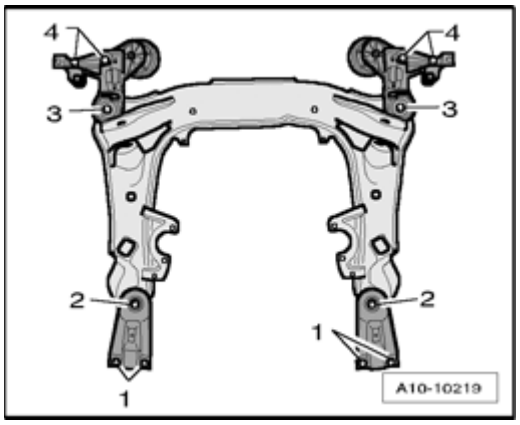

Fig. 275: Removing Noise Insulation Panels (Center, Left And Right)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove noise insulation in the center and on left and right sides (arrows).

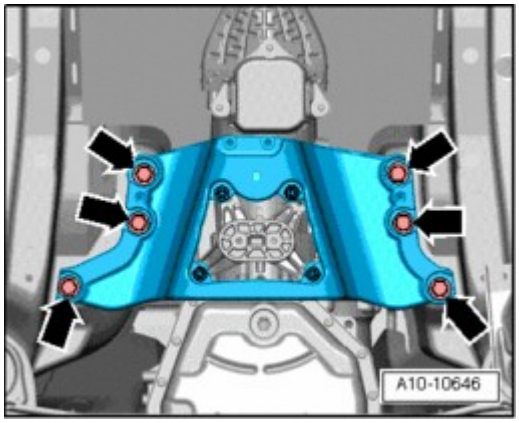

Fig. 276: Disconnecting Exhaust System At Double Clamp
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Loosen clamp (arrows) on exhaust system and disconnect exhaust pipe.

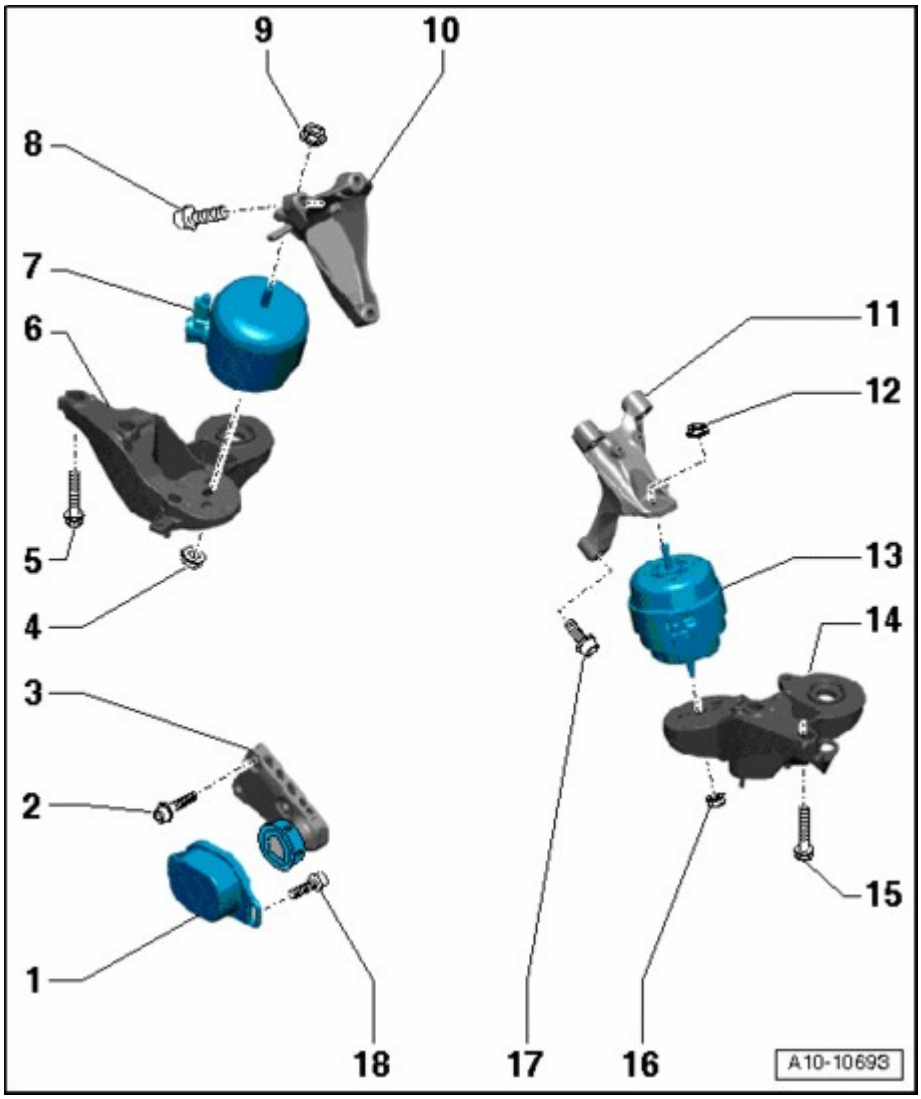

Fig. 277: Removing Catalytic Converters From Front Exhaust Pipe
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove catalytic converters from front exhaust pipe (arrows).
- If installed, detach exhaust mounting on subframe.

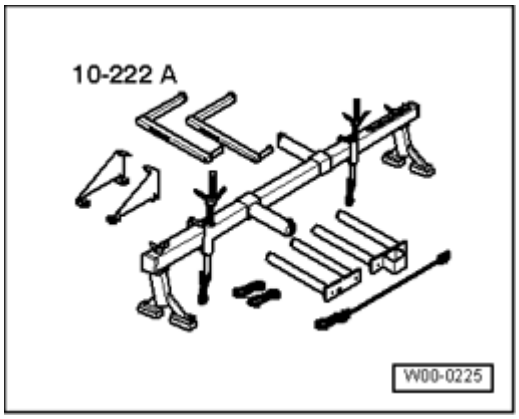

Fig. 278: Removing Drive Shaft From Flexible Coupling On Bevel Box
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove drive shaft from flexible coupling on bevel box (arrows).

NOTE: Use a suitable lever to brace the triangular flange when loosening the bolts.

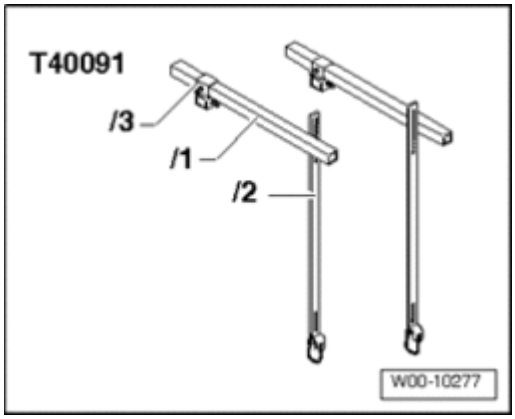

Fig. 279: Removing Pendulum Support At Subframe
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove pendulum support at subframe (arrows -A-).

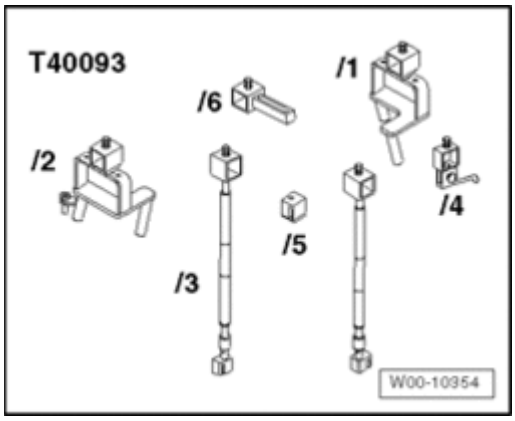

Fig. 280: Identifying Steering Gear Bolts & Subframe Bolts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove steering gear bolts -2-.
- Lever steering gear off subframe (dowel sleeve).
- Place engine/transmission jack V.A.G 1383 A with universal support 1359/2 under subframe.
- Remove subframe bolts -1- and -3-.

- Lower subframe carefully and leave it suspended from the ball joints and connecting links. When doing this, push steering gear upward.
- Remove bracket for power steering pressure pipe from steering gear.
- Remove front exhaust pipe from turbocharger.

NOTE:

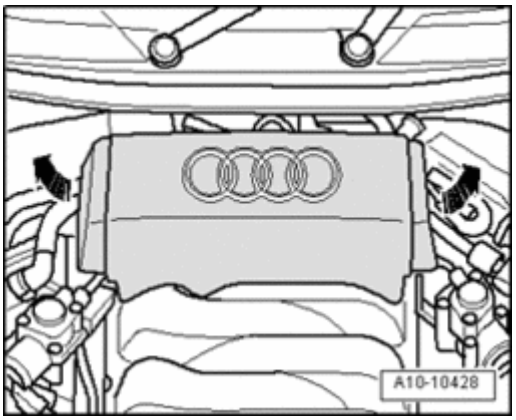

Fig. 281: Removing Upper Bolts Securing Front Exhaust Pipe
Courtesy of VOLKSWAGEN UNITED STATES, INC.

The upper bolts securing the front exhaust pipe are accessible through the brake line opening in the front wheelhousing (remove plug).

Installing

Installation is carried out in the reverse order, when doing this note the following:

- Install subframe as follows:
- Bring subframe into position for installation.
- Insert subframe bolts.
- Bring steering gear into position on subframe and insert steering gear bolts.

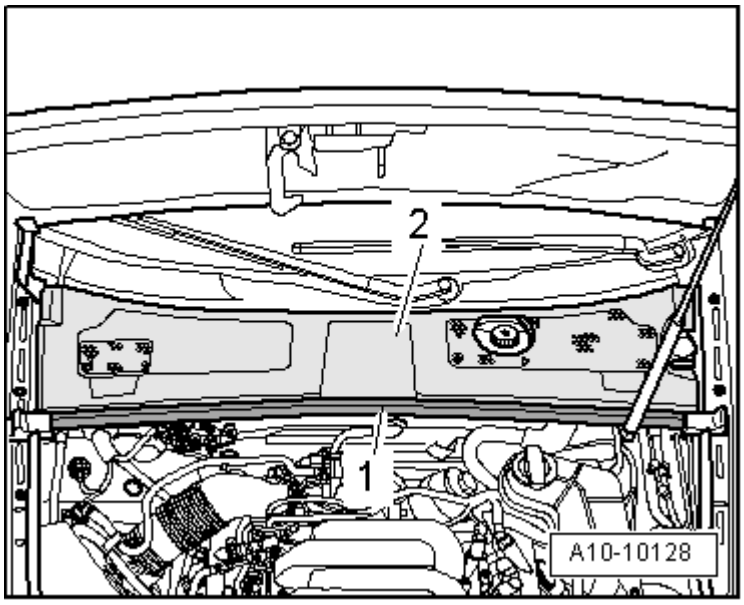

Fig. 282: Seating Threaded Sleeve In Subframe Hole
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Threaded sleeve -1- should be located in hole in subframe.
- Rubber pad on opposite side should be located on projection on subframe.

- Secure steering gear

Refer to **48 STEERING** ; Assembly overview: Power steering gear; all-wheel drive vehicles

- Secure subframe with new bolts:

Refer to **40 FRONT SUSPENSION** ; Assembly overview: Subframe, stabilizer bar, control arms; Removing and installing subframe

- Press engine/transmission assembly toward bulkhead, the bevel box pin must be guided carefully into the driveshaft flange when doing this.

NOTE:

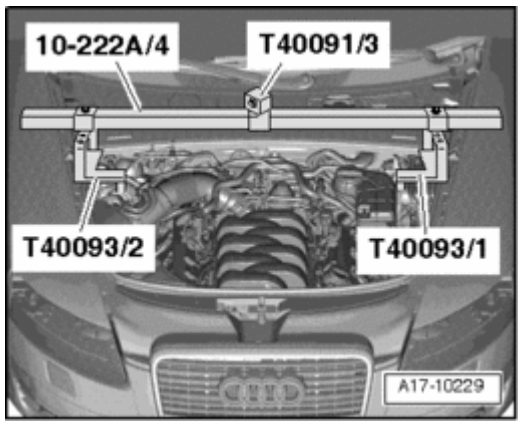

Fig. 283: Identifying Sealing Ring In Driveshaft Flange
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- **Take care not to damage seals in driveshaft flanges when removing and installing. If a seal is damaged the driveshaft must be replaced.**
- **Ensure driveshaft is horizontal when pushing onto guide pins.**

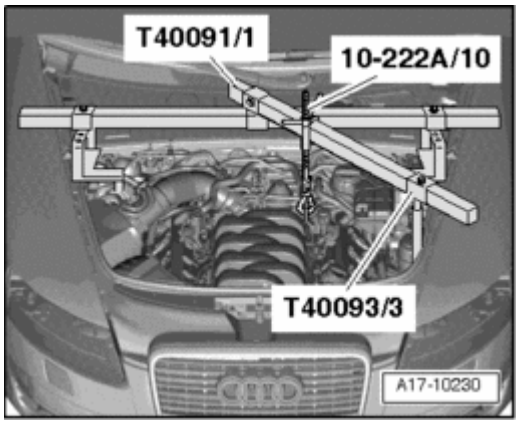

Fig. 284: Removing Pendulum Support At Subframe
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Bolt pendulum support to subframe (arrows -A-) (20 Nm plus an additional 1/4 turn (90°).
- Use new bolts for securing.

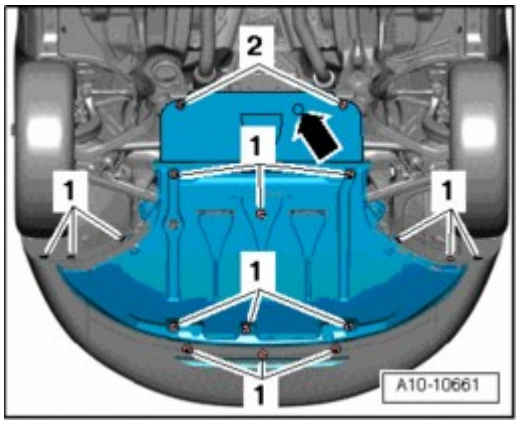

Fig. 285: Removing/Installing Drive Shaft From Flexible Coupling On Bevel Box
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Bolt drive shaft to flexible coupling on bevel box (arrows) (60 Nm).
- Aligning exhaust system free of stress. Refer to **Exhaust system, aligning free of stress**.

Tightening torques

Component		Nm
Pendulum support to subframe		20 + 90° 1) 2)

Flexible coupling to driveshaft	60
Front exhaust pipe to turbocharger	40
Clamp for exhaust pipe	40

1) 90° = 1/4 turn

2) Replace bolts

Exhaust manifold, removing and installing

Removing

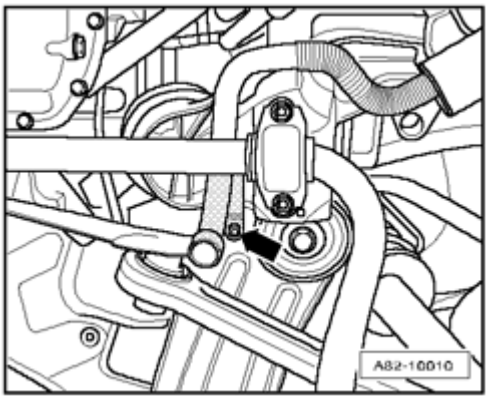

Fig. 286: Remove Engine Cover Panel Above Cylinder Head.
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove section of engine cover from cylinder head cover.

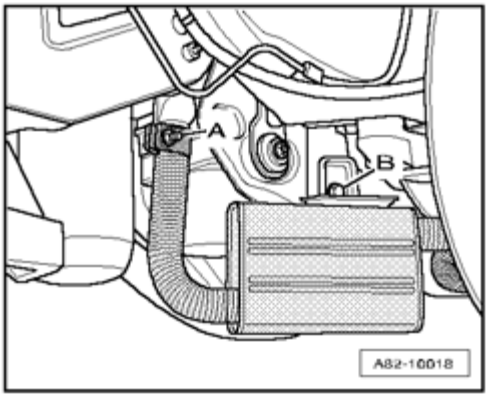

Fig. 287: Removing Cover In Front Of Intake Manifold
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove cover in front of intake manifold.

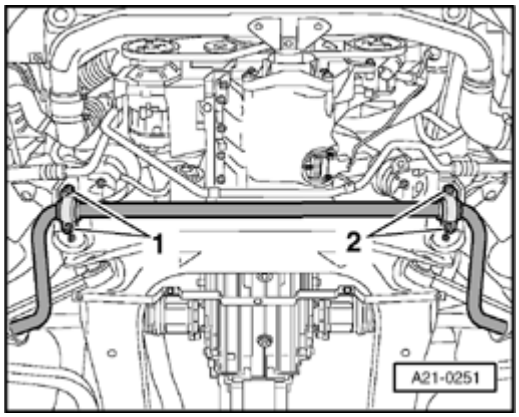

Fig. 288: Removing Noise Insulation
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove noise insulation (arrows).
- Remove heat shield for right-hand drive shaft.
- Remove front exhaust pipe. Refer to **Front exhaust pipe, removing and installing**.

NOTE: The de-coupling element on the front exhaust pipe may only be bent slightly - not more than 10°.

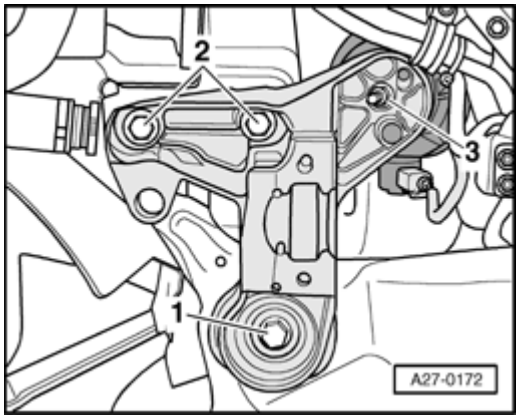

Fig. 289: Removing Oil Return Line From Oil Pan
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove air hose -1- between upper air pipe and lower air pipe.
- Unbolt bracket -2- for upper air pipe.
- Do not disconnect oil return pipe -3- for turbocharger.

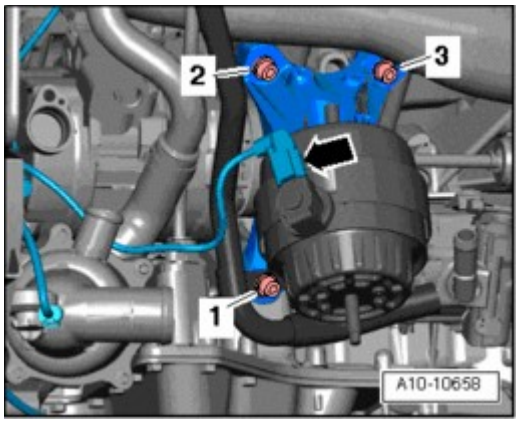

Fig. 290: Identifying Turbocharger Bracket Bolts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Loosen bolted connection -3- for turbocharger bracket by a few turns.
- Remove turbocharger bracket from cylinder block (bolts -1- and -2-).
- Unbolt bracket for coolant return pipe (bolt -4-).
- Detach air intake hose from connection on turbocharger as follows:

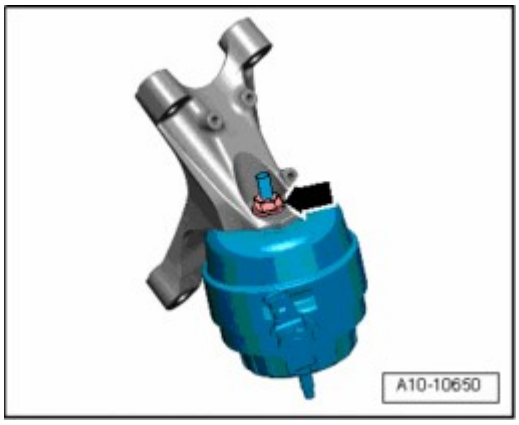

Fig. 291: Removing Intake Air Hose From Turbocharger Union - Engine Code APH
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect vacuum line -1- from air recirculation valve.
- Disconnect hose from pressure control valve -2- for crankcase breather.
- Disconnect electrical connector -3- from charge air pressure control valve -N75-.
- Disconnect hose -4- from Wastegate Bypass Regulator Valve -N75-.

- Detach hose -5- from bulkhead (hose runs between solenoid valve and turbocharger).
- Remove charge pressure control valve from intake air hose and place valve to one side on the engine.
- Detach hose from bulkhead (hose runs between activated charcoal filter and turbocharger).
- Pull locking clip out of turbocharger connection and take off air intake hose.

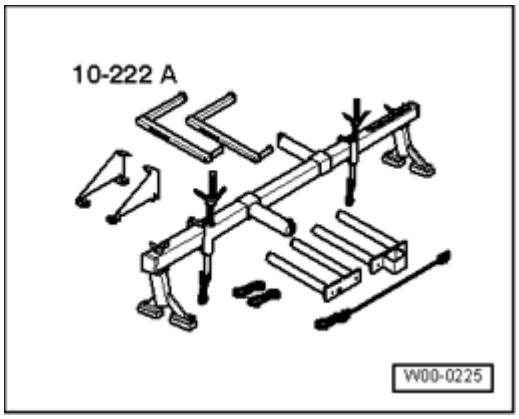

Fig. 292: Identifying Air Pipe Clamps, Turbocharger Hose & Upper Air Line Hose
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect hose -2- (leading to turbocharger) and detach hose -1- from upper air line.
- Remove bolts on heat shield on back of cylinder head.
- Release clamps -3- and -4- on air pipe.
- Remove upper air pipe and heat shield.

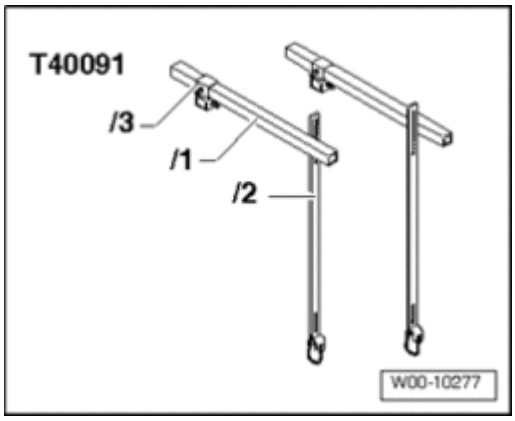

Fig. 293: Unbolting Turbocharger From Exhaust Manifold
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unbolt turbocharger (arrows) from exhaust manifold.
- Remove gasket. The turbocharger will drop down slightly.

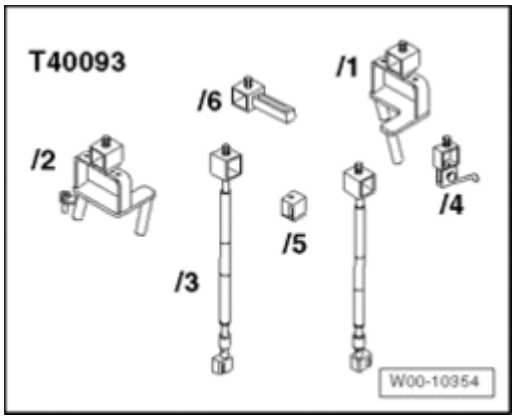

Fig. 294: Removing Exhaust Manifold Nuts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove all nuts (arrows) on exhaust manifold (nuts can be reached from above).
- Remove washers and exhaust manifold.

Installing

Installation is carried out in the reverse order.

Tightening torques

Components	Nm
Clamps for air line	10
Heat shield to manifold	10
Turbocharger bracket to turbocharger	30
Turbocharger bracket to cylinder block	25
Turbocharger to exhaust manifold	30
Exhaust manifold to cylinder head	25
Front exhaust pipe to turbocharger	40
Drive shaft heat shield to cylinder block	35
Nuts for clamp	40
Nuts on connecting flange of Catalytic converter	25

Exhaust system, aligning free of stress

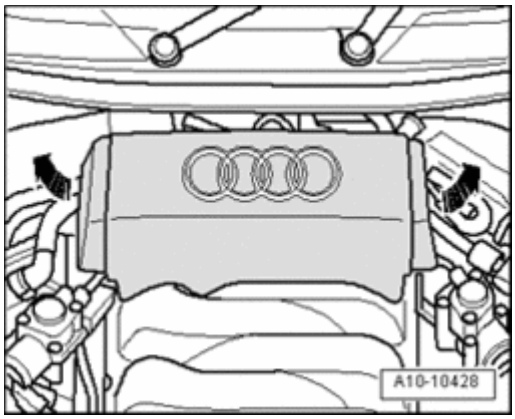

Fig. 295: Identifying Clearance Between Exhaust Pipe And Heat Shield For Steering Gear
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Clearance between exhaust pipe and heat shield for steering gear should be approx. 30 mm.
- To check this clearance, fit a 22 mm 1/2-inch socket (outside diameter approx. 30 mm) on a long extension and insert between front exhaust pipe and heat shield. The socket attachment must fit easily in the gap.

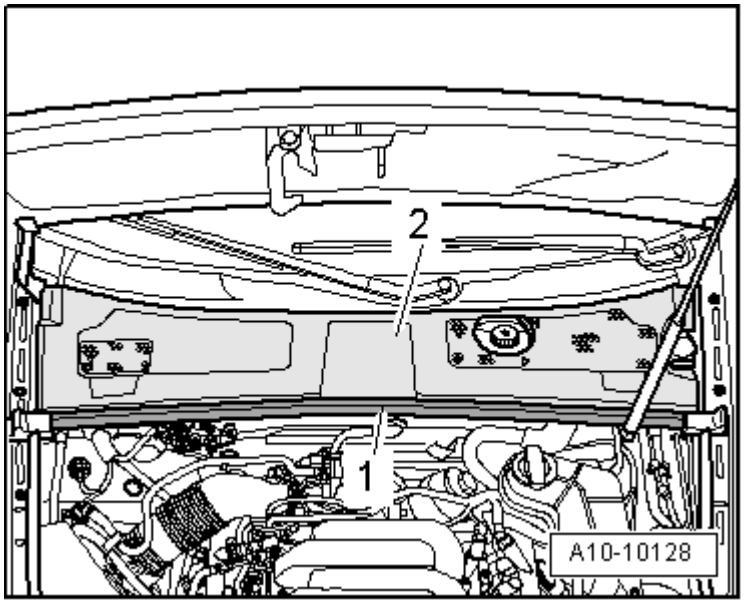

Fig. 296: Aligning Catalytic Converter Horizontally And With Equal Spacing From Heat Shield In Center Tunnel
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Align catalytic converter horizontally -4- and make sure that spacing -3- between catalytic converter and heat shield in tunnel -2- is equal on both sides. Item -1- is the drive shaft.
- Align front and rear silencers centrally and horizontally. If necessary, detach tunnel cross piece.

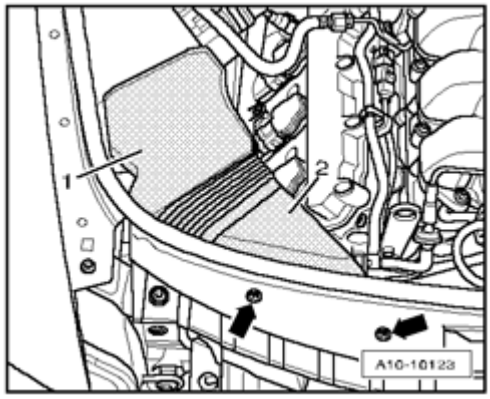

Fig. 297: Aligning Tailpipe In Bumper Cut-Out
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Aligning tailpipe in bumper cut-out

- Align rear silencer to give equal spacing -a- and -b- between tailpipe and bumper cut-out. If necessary, loosen mounts of rear silencer.

On vehicles where the exhaust has been cut through between the front and rear silencers, it may be necessary to loosen the clamp in order to achieve proper alignment.

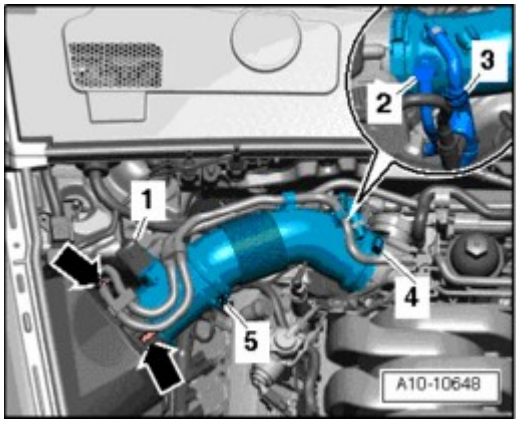

Fig. 298: Installation Position Of Double Clamp
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Install clamps so that ends of bolts do not project beyond lower part of clamp circumference.

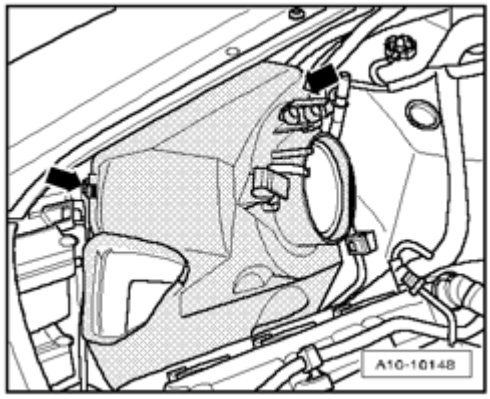

Fig. 299: Positioning Clamp At Distance Of About 5 mm From Notched Markings
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Position clamp at a distance of about 5 mm from the notched markings. Align horizontally, then tighten evenly to 40 Nm.

The bolted connections on the clamp point to the left.

Exhaust system, checking for leaks

- Start engine and run at idling speed.
- Plug the tailpipes (e. g. with rags or stoppers) and leave plugged until the check is complete.
- Listen for noise at the connection points (cylinder head/exhaust manifold, exhaust manifold/turbocharger, turbocharger/front exhaust pipe etc.) to determine whether there are any leaks.
- Repair any leaks that are found.

Secondary air system components, removing and installing

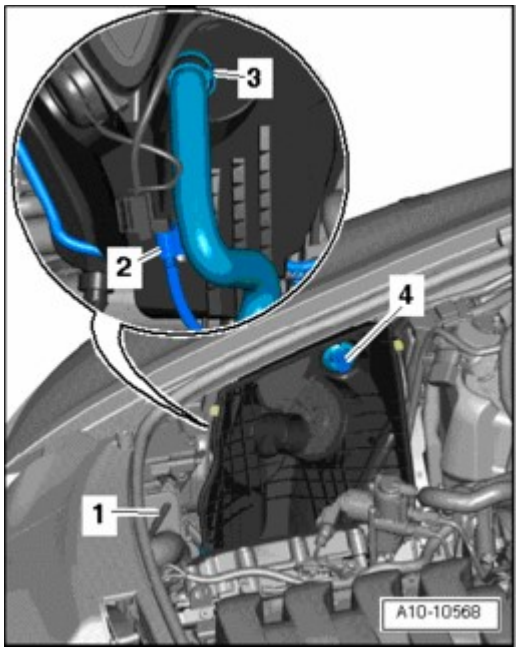

Fig. 300: Secondary Air System Components, Removing And Installing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

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 the extra mixture enrichment during the cold-start phase, an increased amount of unburnt hydrocarbons is carried in the exhaust gas. The secondary air system improves the afterburning (oxidation) process in the catalytic converter, and in this way reduces 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 engine control module -2-activates secondary air pump -12- via secondary air pump relay -1-, and air is fed to mechanical secondary air valve -10- (combination valve).
- At the same time, the system activates secondary air inlet valve -3-, which supplies vacuum to mechanical secondary air valve -10- and to pressure unit -7- for charge air pressure control.
- In this way, the mechanical secondary air valve opens a passage for the secondary air system to supply air to the exhaust ports in the cylinder head.
- To avoid generating unnecessary heat, the secondary air is channelled past the turbocharger. This is achieved by means of the pressure unit for charge air pressure control, which opens the charge air pressure control valve. To perform this function, the pressure unit is designed as a two-way pneumatic unit with an additional vacuum connection on the "pull-in" side.

1 - Secondary Air Injection (AIR) Pump Relay -J299-

2 - Motronic Engine Control Module (ECM) -J220-

3 - Secondary Air Injection (AIR) Solenoid Valve -N112-

4 - Intake manifold

5 - Non-return valve

- Installation position (light side/dark side) as shown in illustration. Arrow indicates direction of flow

6 - Vacuum reservoir

- Bolted to cylinder head cover

7 - Pressure unit for charge air pressure control

8 - Turbocharger

- Testing charge air pressure. Refer to **Turbocharger and wastegate bypass regulator valve, testing**

9 - Cylinder head

10 - Mechanical secondary air valve (combination valve)

- For secondary air system

11 - Air cleaner

12 - Secondary Air Injection (AIR) Pump Motor -V101-

SECONDARY AIR INJECTION (AIR) SYSTEM, CHECKING

Secondary Air Injection (AIR) system, checking

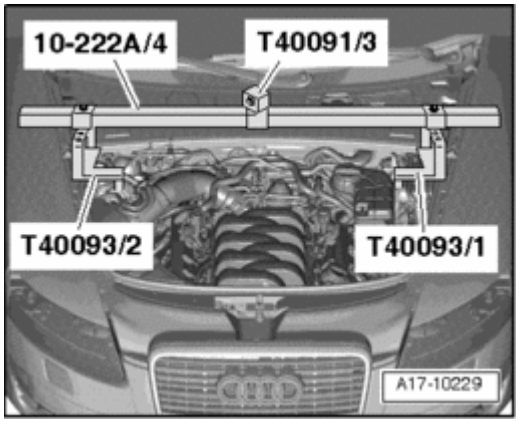

Fig. 301: Secondary Air Injection (Air) System, Checking
Courtesy of VOLKSWAGEN UNITED STATES, INC.

The Secondary Air Injection (AIR) system causes the catalytic converter to heat up more quickly, resulting in

earlier operating readiness following cold start.

Principle

Due to over-enrichment of the mixture during the cold start phase, there is an increased amount of uncombusted carbon monoxide in the exhaust. Secondary Air Injection (AIR) improves secondary oxidation in the catalytic converter and therefore reduces emissions. The heat produced by secondary oxidation greatly reduces start-up time for the catalytic converter, therefore improving exhaust quality during the cold start phase significantly.

Function

- In the cold start phase, the ECM -2- activates the secondary air pump -12- via the relay for Secondary Air Injection (AIR) pump -1-. Air reaches the combination valve for Secondary Air Injection (AIR) -10-.
- The Secondary Air Injection (AIR) valve -3- is activated in parallel, which allows the vacuum to reach the combination valve for Secondary Air Injection (AIR) -10- and the vacuum diaphragm for charge air pressure regulation -7-. The combination valve for Secondary Air Injection (AIR) thereby opens the path for secondary air to the exhaust channels of the cylinder head.

- To prevent unnecessary heating, secondary air is diverted passed the turbocharger -8-. For this, the charge air pressure regulation pressure unit opens the charge air pressure valve. The pressure unit, designed as a double reservoir, has a vacuum connection for this on the intake side.

1 - Secondary Air Injection (AIR) Pump Relay -J299-

2 - Motronic Engine Control Module (ECM) -J220-

3 - Secondary Air Injection (AIR) solenoid valve -N112-

4 - Intake manifold

5 - Check-valve

- Installed position (light/dark half): Arrow points in direction of flow, as shown in figure.

6 - Vacuum reservoir

7 - Pressure unit for charge air pressure regulation

8 - Turbocharger

9 - Cylinder head

10 - Combination valve for secondary air injection (AIR)

11 - Air filter housing

12 - Secondary Air Injection (AIR) pump motor -V101-

Secondary Air Injection (AIR) solenoid valve -N112-, checking

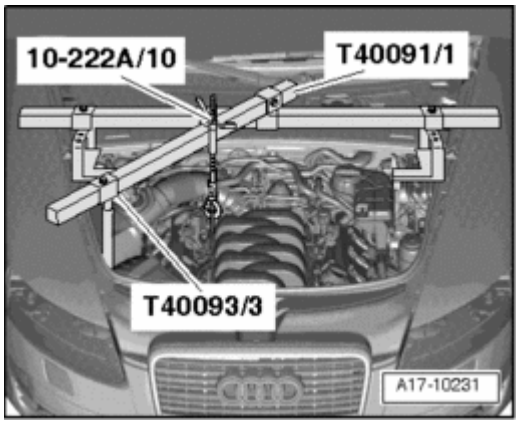

Fig. 302: Identifying Special Tools - Secondary Air Injection (Air) Solenoid Valve -N112-, Checking
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools and equipment

- V.A.G 1526A
- V.A.G 1527B
- V.A.G 1594A
- V.A.G 1598/31
- VAS5051
  - or
- V.A.G 1551 with V.A.G 1551/3A

Component location. Refer to Overview of component locations

Refer to

- **24 MULTIPORT FUEL INJECTION (MFI)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): AMU
- **24 MULTIPORT FUEL INJECTION (MFI)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): ATC
- **24 MULTIPORT FUEL INJECTION (MFI)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): AWP
- **24 MULTIPORT FUEL INJECTION (MFI)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): BEA

, Fuel preparation, injection

Test requirement:

- Output Diagnostic Test Mode (DTM) performed

Checking internal resistance

- Disconnect harness connector from Secondary Air Injection (AIR) valve -N112-.

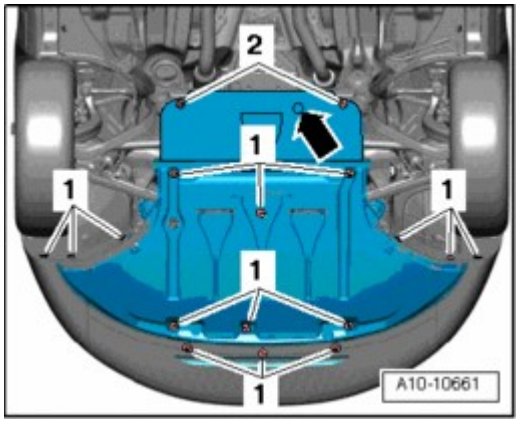

Fig. 303: Connecting Multimeter To Valve (Resistance Measurement Range)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect multimeter at valve for resistance measurement.
- Specified value: 25 - 35 ohms
- If specified value is not obtained, replace Secondary Air Injection (AIR) solenoid valve -N112-.

Checking voltage supply

- Disconnect harness connector from Secondary Air Injection (AIR) valve -N112-.

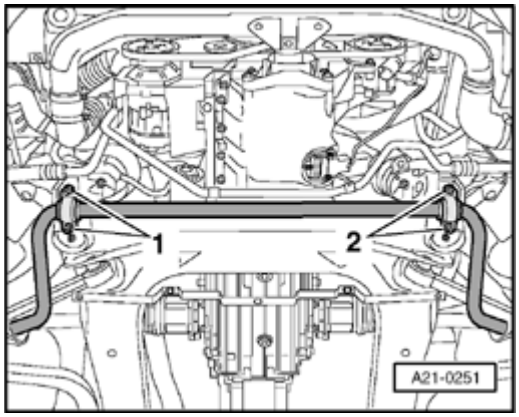

Fig. 304: 2-Pin Electrical Harness Connector & Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect V.A.G 1527B voltage tester as follows:

Harness connector Terminal	Measure to
1	Engine Ground (GND)

- Operate starter briefly (engine can also start).
- LED must light up.

If LED does not light up:

- Perform the following tests marked with dots:

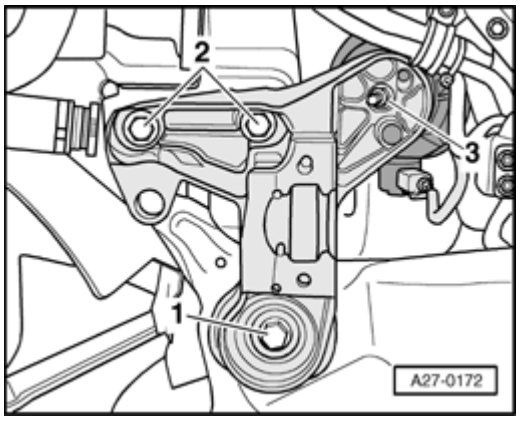

Fig. 305: Main Fuse Case
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Check fuse -S243- (in fuse holder, position 43).

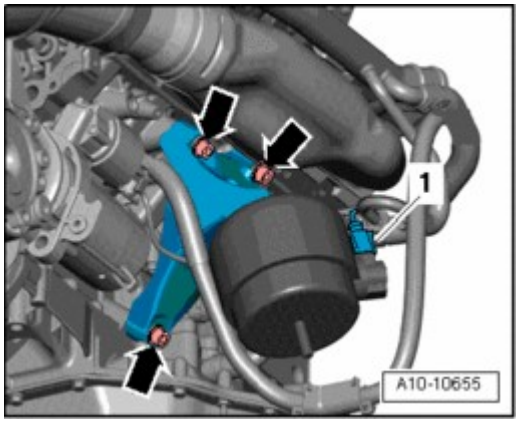

Fig. 306: 2-Pin Electrical Harness Connector & Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Check wire connection from terminal 1 of connector via fuse -S243- (in fuse holder, socket 43) to Fuel Pump (FP) relay for open circuit:

Refer to Electrical Wiring Diagrams, Troubleshooting & Component Locations

- Check Fuel Pump (FP) relay

Refer to

- **24 MULTIPORT FUEL INJECTION (MFI)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): AMU
- **24 MULTIPORT FUEL INJECTION (MFI)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): ATC
- **24 MULTIPORT FUEL INJECTION (MFI)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): AWP
- **24 MULTIPORT FUEL INJECTION (MFI)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): BEA

, Fuel preparation, injection

Checking activation

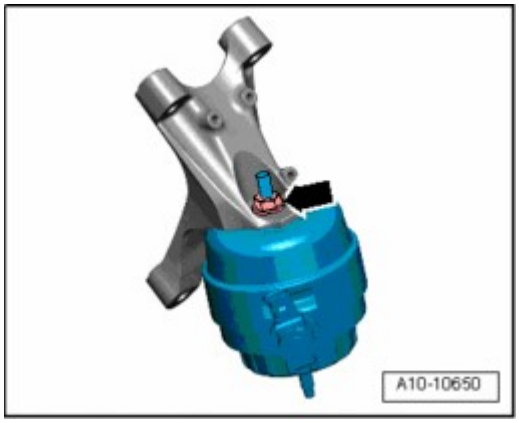

Fig. 307: 2-Pin Electrical Harness Connector & Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect V.A.G 1527B voltage tester as follows:

Harness connector Terminal	Measure to
2	B+

- Initiate output Diagnostic Test Mode (DTM) and activate Secondary Air Injection (AIR) solenoid valve - N112-

Refer to

- **24 MULTIPORT FUEL INJECTION (MFI)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): AMU
- **24 MULTIPORT FUEL INJECTION (MFI)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION

& IGNITION, ENGINE CODE(S): ATC

- **24 MULTIPORT FUEL INJECTION (MFI)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): AWP
- **24 MULTIPORT FUEL INJECTION (MFI)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): BEA

, Fuel preparation, injection

Output Diagnostic Test Mode --> Secondary air injection solenoid valve -N112

Indicated on display

- LED must blink.

If LED does not blink or if it remains constantly lit:

- Connect V.A.G 1598/31 test box at wiring harness to ECM, do not connect ECM.

Refer to

- **24 MULTIPORT FUEL INJECTION (MFI)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): AMU
- **24 MULTIPORT FUEL INJECTION (MFI)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): ATC
- **24 MULTIPORT FUEL INJECTION (MFI)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): AWP
- **24 MULTIPORT FUEL INJECTION (MFI)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): BEA

, Fuel preparation, injection

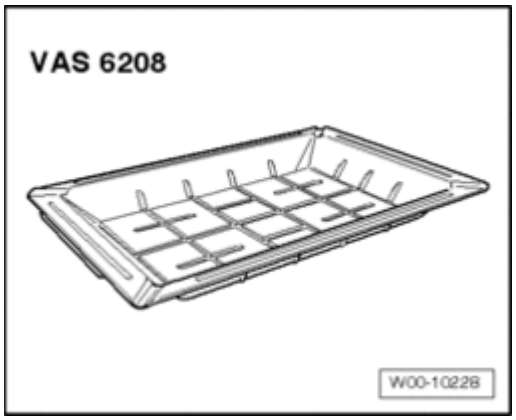

Fig. 308: 2-Pin Electrical Harness Connector & Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Check the following wire connections for open circuit and short circuit to Ground (GND) and B+:

Harness connector Terminal	V.A.G 1598/31 testing box Bushing
2	9

- Repair open circuit or short circuit if necessary.
- If wire connection is OK: Replace Engine Control Module (ECM)

Refer to

- **24 MULTIPORT FUEL INJECTION (MFI)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): AMU
- **24 MULTIPORT FUEL INJECTION (MFI)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): ATC
- **24 MULTIPORT FUEL INJECTION (MFI)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): AWP
- **24 MULTIPORT FUEL INJECTION (MFI)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): BEA

, Fuel preparation, injection

Secondary Air Injection (AIR) pump relay -J299- and activation, checking

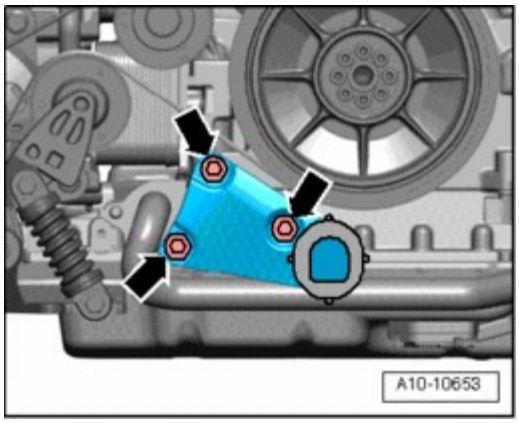

Fig. 309: Identifying Special Tools - Secondary Air Injection (Air) Pump Relay -J299- And Activation, Checking
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools and equipment

- V.A.G 1526A
- V.A.G 1527B
- V.A.G 1594A

- V.A.G 1598/31

Component location. Refer to Overview of component locations

Refer to

- **24 MULTIPORT FUEL INJECTION (MFI)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): AMU
- **24 MULTIPORT FUEL INJECTION (MFI)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): ATC
- **24 MULTIPORT FUEL INJECTION (MFI)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): AWP
- **24 MULTIPORT FUEL INJECTION (MFI)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): BEA

, Fuel preparation, injection

- Initiate output Diagnostic Test Mode (DTM) and activate Secondary Air Injection (AIR) pump relay -J299-

Refer to

- **24 MULTIPORT FUEL INJECTION (MFI)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): AMU
- **24 MULTIPORT FUEL INJECTION (MFI)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): ATC
- **24 MULTIPORT FUEL INJECTION (MFI)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): AWP
- **24 MULTIPORT FUEL INJECTION (MFI)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): BEA

, Fuel preparation, injection

- Secondary Air Injection (AIR) pump relay (under cover, left at bulkhead) must trigger and the Secondary Air Injection (AIR) pump motor -V101- must run.

A - If relay does not trigger:

- Check voltage supply of the Secondary Air Injection (AIR) pump relay. Refer to **Checking voltage supply of Secondary Air Injection (AIR) pump relay**.
- Check activation of the Secondary Air Injection (AIR) pump relay. Refer to **Check activation of the Secondary Air Injection (AIR) pump relay**.

B - If relay triggers, but Secondary Air Injection (AIR) pump does not run:

- Check voltage supply of the Secondary Air Injection (AIR) pump motor. Refer to **Check voltage supply of the Secondary Air Injection (AIR) pump motor**.

Checking voltage supply of Secondary Air Injection (AIR) pump relay

- Switch ignition off.
- Remove Secondary Air Injection (AIR) pump relay
- Connect multimeter for voltage measurement as follows:

Relay carrier below cover, left at bulkhead Terminal	Measure to
1	Engine Ground (GND)

- Specified value: approx. battery voltage

If specified value is not obtained:

- Perform the following tests marked with dots:

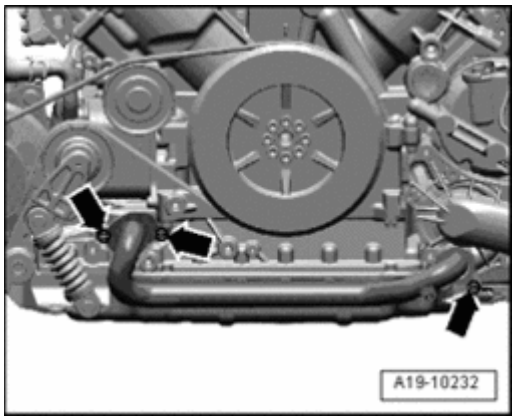

Fig. 310: Identifying Fuses In Main Fuse Box/Battery
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Check fuse -S131- (50 A) in main fuse box/battery.
- Check wire connection from B+ (terminal 30) to fuse -S131- for Secondary Air Injection (AIR) pump relay -J299- (below cover, left at bulkhead) for open circuit.

Refer to Electrical Wiring Diagrams, Troubleshooting & Component Locations

- Connect multimeter for voltage measurement as follows:

Relay carrier below cover, left at bulkhead Terminal	Measure to
3	Engine Ground (GND)

- Operate starter briefly (engine can also start).
- Specified value: approx. battery voltage

If specified value is not obtained:

- Perform the following tests marked with dots:

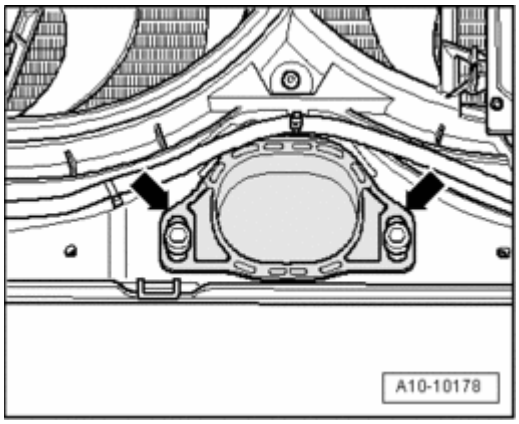

Fig. 311: Main Fuse Case
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Check fuse -S243- (in fuse holder, position 43).
- Check wire connection from B+ (terminal 30) to fuse -S131- for Secondary Air Injection (AIR) pump relay -J299- (below cover, left at bulkhead) for open circuit.

Refer to Electrical Wiring Diagrams, Troubleshooting & Component Locations

Check activation of the Secondary Air Injection (AIR) pump relay

- Switch ignition off.
- Remove Secondary Air Injection (AIR) pump relay
- Connect multimeter for voltage measurement as follows:

Relay carrier below cover, left at bulkhead Terminal	Measure to
4	B+

- Initiate output Diagnostic Test Mode (DTM) and activate Secondary Air Injection (AIR) pump relay -J299-

Refer to

- **24 MULTIPORT FUEL INJECTION (MFI)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): AMU

- **24 MULTIPORT FUEL INJECTION (MFI)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): ATC
- **24 MULTIPORT FUEL INJECTION (MFI)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): AWP
- **24 MULTIPORT FUEL INJECTION (MFI)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): BEA

, Fuel preparation, injection

- Specified value: approx. battery voltage

If specified value is not obtained:

- Switch ignition off.
- Connect V.A.G 1598/31 test box at wiring harness to ECM, do not connect ECM.

Refer to

- **24 MULTIPORT FUEL INJECTION (MFI)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): AMU
- **24 MULTIPORT FUEL INJECTION (MFI)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): ATC
- **24 MULTIPORT FUEL INJECTION (MFI)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): AWP
- **24 MULTIPORT FUEL INJECTION (MFI)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): BEA

, Fuel preparation, injection

- Check the following wire connection for open circuit and short circuit to Ground (GND) and B+:

Relay carrier below cover, left at bulkhead Terminal	**V.A.G 1598/31 testing box Bushing**
4	66

- Repair open circuit or short circuit if necessary.

If no malfunctions are detected:

- Replace Secondary Air Injection (AIR) pump relay -J299-.

Check voltage supply of the Secondary Air Injection (AIR) pump motor

- Remove connector for Secondary Air Injection (AIR) pump motor -V101-.
- Connect V.A.G 1527B voltage tester between terminals 1 and 2

- Initiate output Diagnostic Test Mode (DTM) and activate Secondary Air Injection (AIR) pump relay -J299-

Refer to

- **24 MULTIPORT FUEL INJECTION (MFI)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): AMU
- **24 MULTIPORT FUEL INJECTION (MFI)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): ATC
- **24 MULTIPORT FUEL INJECTION (MFI)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): AWP
- **24 MULTIPORT FUEL INJECTION (MFI)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): BEA

, Fuel preparation, injection

- LED must light up.

If LED does not light up:

- Perform the following tests marked with dots:

- Check wire connection from connector at Secondary Air Injection (AIR) pump motor -V101- to Secondary Air Injection (AIR) pump relay -J299- (in relay carrier below cover, left at bulkhead) for open circuit:

Refer to Electrical Wiring Diagrams, Troubleshooting & Component Locations

- Check wire connection from connector at Secondary Air Injection (AIR) pump motor -V101- to Ground (GND) point in engine compartment, left, for open circuit:

Refer to Electrical Wiring Diagrams, Troubleshooting & Component Locations

If no malfunctions are detected:

- Replace Secondary Air Injection (AIR) pump motor -V101-.

Secondary air system components, removing and installing

- Testing secondary air system

Refer to

- **24 MULTIPORT FUEL INJECTION (MFI)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): AMU
- **24 MULTIPORT FUEL INJECTION (MFI)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION

& IGNITION, ENGINE CODE(S): ATC

- **24 MULTIPORT FUEL INJECTION (MFI)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): AWP
- **24 MULTIPORT FUEL INJECTION (MFI)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): BEA

A- Secondary air pump motor

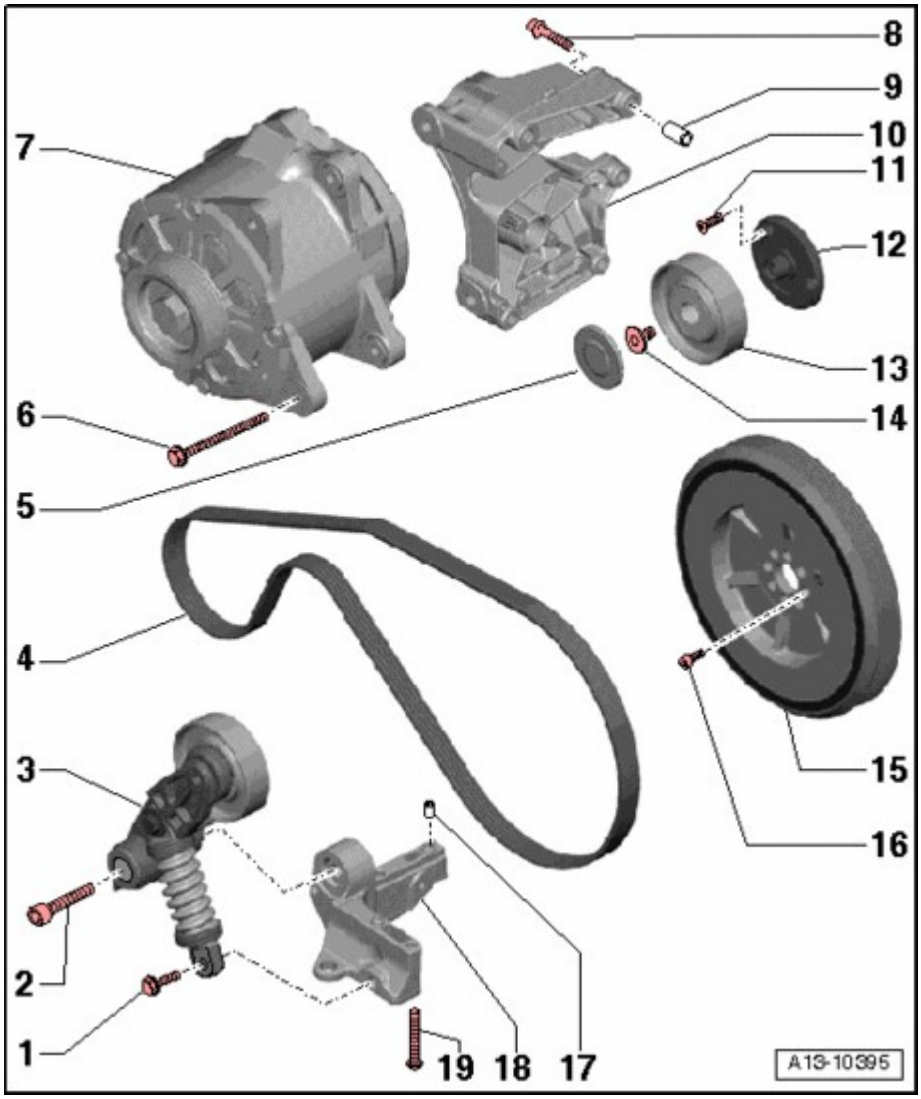

Fig. 312: Removing Noise Insulation
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove center section of noise insulation.

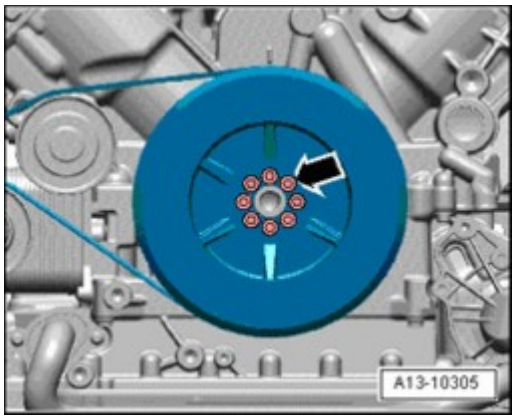

Fig. 313: Disconnecting Hoses And Connectors On Secondary Air Pump
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect hoses and connectors on secondary air pump
- Remove secondary air pump

B- Mechanical secondary air valve (combination valve)

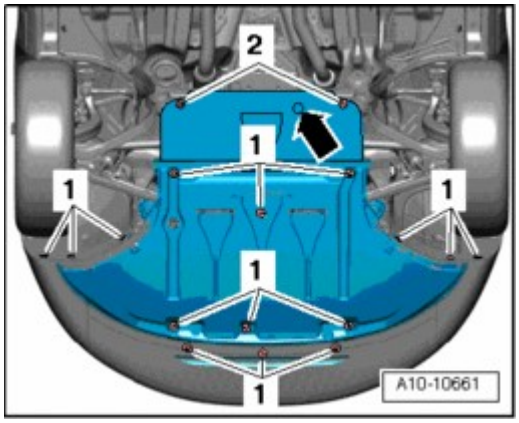

Fig. 314: Removing Engine Cover Panel
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove engine cover panel.

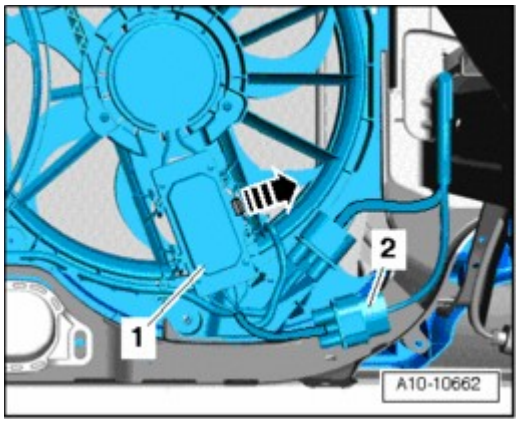

Fig. 315: Disconnecting Vacuum Hose And Connecting Pipe At Combination Valve
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect vacuum hose -1- and connecting pipe -2- at combination valve.
- Remove combination valve from bracket (arrows).

EXHAUST TEMPERATURE MONITORING

Exhaust Gas Temperature (EGT) Sensor 1 -G235-, checking

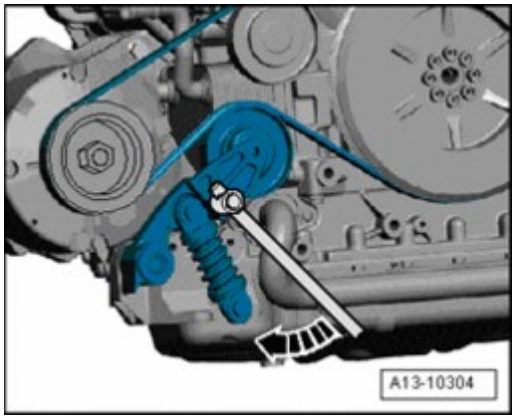

Fig. 316: Identifying Special Tools - Exhaust Gas Temperature (EGT) Sensor 1 -G235-, Checking
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special Tools and Equipment

- V.A.G 1526A
- V.A.G 1527B
- V.A.G 1594A
- V.A.G 1598/31

- VAS5051 with VAS5051/1

Test requirements:

- VAS5051 tester connected and vehicle On Board Diagnostic (OBD) -01 Engine electronics- selected.
- Read DTC memory

Test sequence

- Read measuring value block display group 112, engine at idle.
- Select diagnostic function "08 - read measured value block" in selection -1-.

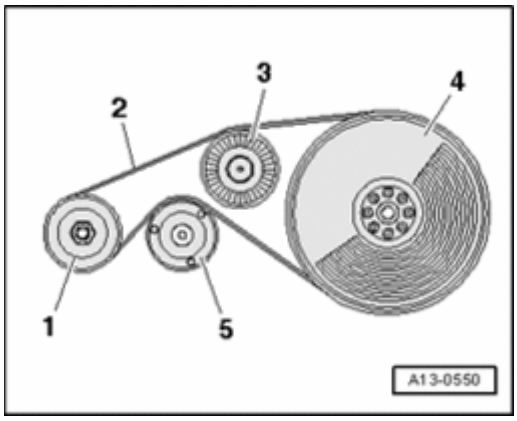

Fig. 317: Identifying VAS5051 Tester Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

- Check indication in display field -1-.
- Increase engine RPMs.

- Exhaust temperature must rise

If exhaust temperature remains constant or indicates an implausible value:

- Check voltage supply. Refer to **Checking voltage supply**.
- Check wire connections. Refer to **Checking wire connections**.

Checking voltage supply

Test requirement:

- Fuse for exhaust temperature sensor OK.

Refer to Electrical Wiring Diagrams, Troubleshooting & Component Locations

- Switch ignition off.
- Remove cover in front of intake manifold.

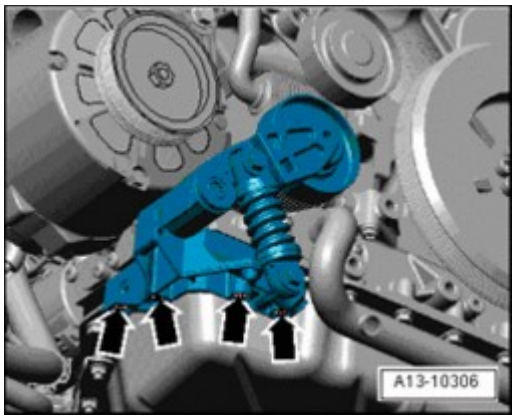

Fig. 318: Disconnecting Electric Harness Connector At Exhaust Gas Temperature (EGT) Sensor 1 -G235-
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electric harness connector -arrow- at Exhaust Gas Temperature (EGT) Sensor 1 -G235-.

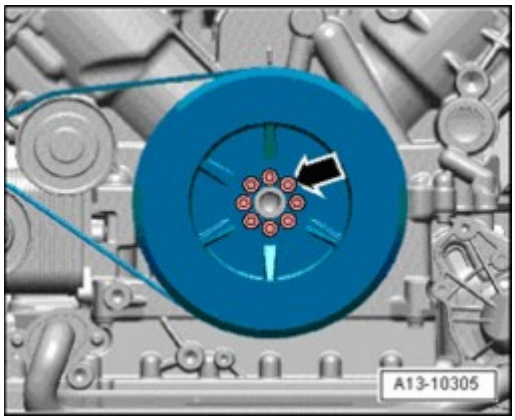

Fig. 319: Identifying 3-Pin Connector Terminals 1 & 3
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect V.A.G 1527B voltage tester as follows:

Harness connector Terminal	Measure to
3	Engine Ground (GND)

- Operate starter briefly.

- LED must light up.

If LED does not light up:

- Perform the following tests marked with dots:

- Check wire connection from Exhaust Gas Temperature (EGT) Sensor 1 -G235- to Fuel Pump (FP) relay

via fuse for open circuit.

Refer to Electrical Wiring Diagrams, Troubleshooting & Component Locations

- Check Fuel Pump (FP) relay.

Refer to

- **24 MULTIPORT FUEL INJECTION (MFI)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): AMU
- **24 MULTIPORT FUEL INJECTION (MFI)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): ATC
- **24 MULTIPORT FUEL INJECTION (MFI)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): AWP
- **24 MULTIPORT FUEL INJECTION (MFI)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): BEA

; servicing Motronic fuel injection system

Checking wire connections

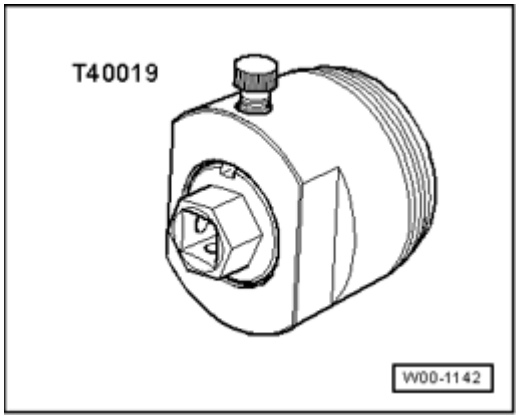

Fig. 320: Connecting VAG1598/31 Test Box To Connector Of Wiring Harness
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect V.A.G 1598/31 test box to harness connectors of wiring harness (do not connect ECM). Clamp test box Ground (GND) clip to Ground (GND) (arrow):

Refer to

- **24 MULTIPORT FUEL INJECTION (MFI)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): AMU
- **24 MULTIPORT FUEL INJECTION (MFI)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): ATC
- **24 MULTIPORT FUEL INJECTION (MFI)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): AWP

- **24 MULTIPORT FUEL INJECTION (MFI)** for 1.8 LITER 4-CYL. 5V TURBO FUEL INJECTION & IGNITION, ENGINE CODE(S): BEA

; servicing Motronic fuel injection system

WARNING: To avoid damaging electronic components, set measuring range before connecting test leads and observe all test requirements.

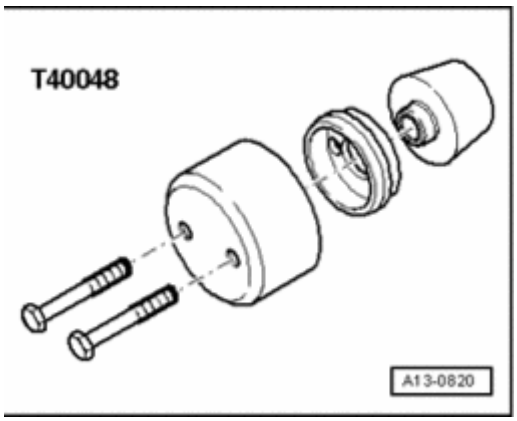

Fig. 321: Identifying 3-Pin Connector Terminals 1 & 3
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Check the following wire connection for open circuit and short circuit to Ground (GND) and B+:

Harness connector Terminal	V.A.G 1598/31 test box Socket
1	61
2	50

- Repair open circuit in wiring or short circuit if necessary.

If no malfunctions are detected:

- Replace exhaust gas temperature sensor.

