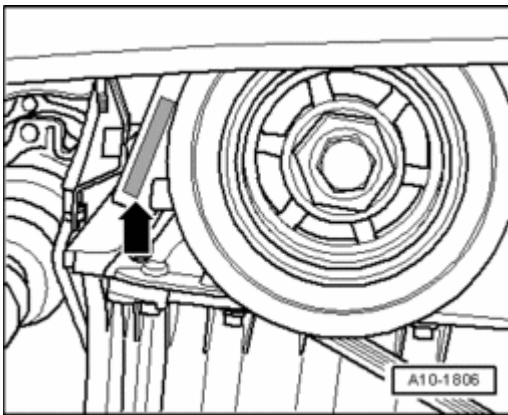


ENGINE**3.2 Liter V6 4V Engine Mechanical, Engine Code(s): BHE****00 GENERAL, TECHNICAL DATA****TECHNICAL DATA****Engine number****Fig. 1: Locating Engine Number**

Courtesy of VOLKSWAGEN UNITED STATES, INC.

The engine number (engine code and serial number) can be found at the joint between the engine and transmission (arrow).

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.

NOTE: The engine code is additionally marked at the engine lifting eye (right side).

Engine data

Code letters		BHE
Displacement	Liters	3.189
Output	kw @ RPM	184/6300
Torque	Nm at RPM	320/2800 to 3200
Bore	Diameter in mm	84
Stroke	mm	95.9
Compression ratio		11.3
RON minimum		98 1)
Injection/ignition system		Motronic
Firing order		1-5-3-6-2-4

2005 Audi TT

ENGINE 3.2 Liter V6 4V Engine Mechanical, Engine Code(s): BHE

Exhaust Gas Recirculation (EGR)	No
Turbocharger	No
Knock control	Yes
Variable valve timing	Yes
Intake manifold change-over	Yes
Secondary Air Injection	Yes

1) Also Super-unleaded RON 95 is permissible, however with reduced performance.

10 ENGINE - ASSEMBLY

ENGINE, REMOVING AND INSTALLING

Engine, removing and installing

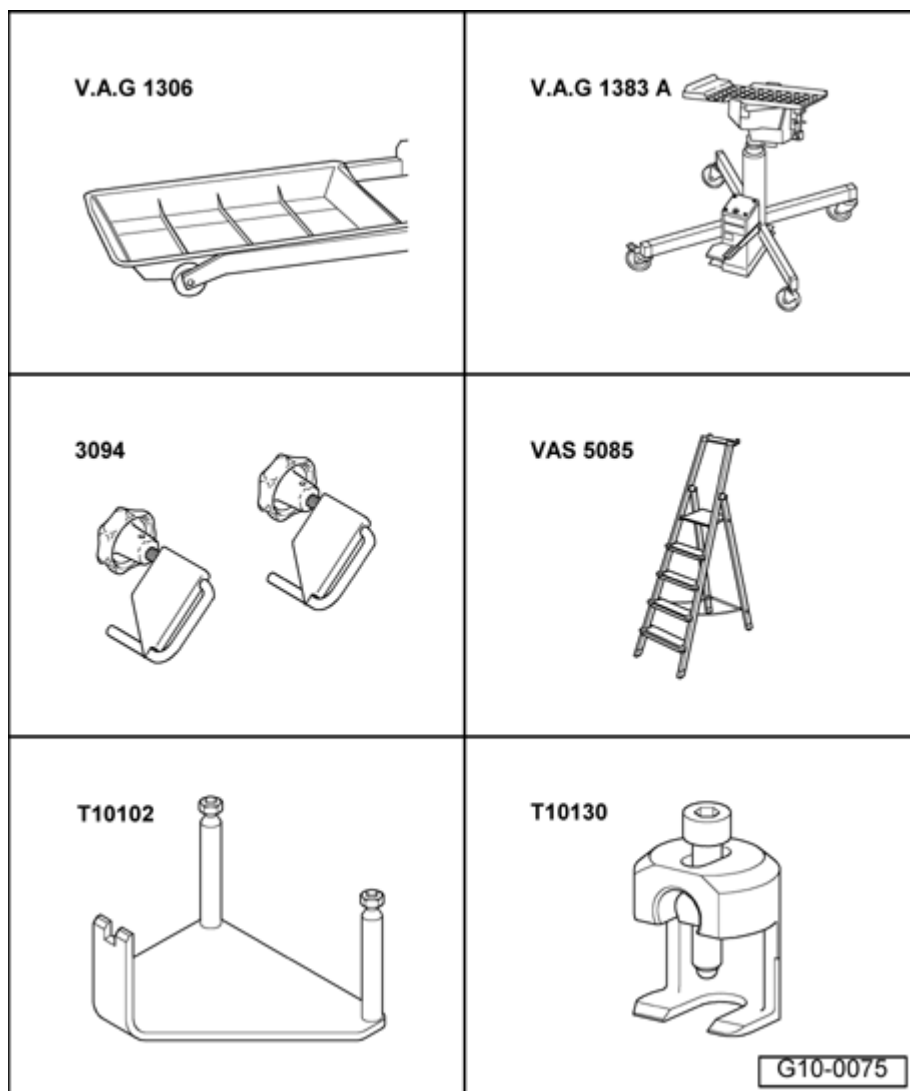


Fig. 2: Identifying Special Tools - Engine, Removing And Installing

Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools and equipment

- VAG1306 drip tray for VAG1202A
- VAG1383A engine/transmission jack
- Hose clamps up to 25 mm in diameter 3094
- Stepladder VAS 5085
- T10102 Engine bracket
- Puller T10130

Removing

NOTE:

- Engine is removed from underneath together with the transmission.
- All cable ties opened or cut during engine removal must be reinstalled at the same locations.
- Heat insulation sleeves, which are removed during engine removal must be reinstalled at the same locations when re-installing the engine.
- Drained coolant must be stored in a clean container for disposal or reuse.

CAUTION: Observe notes on procedure for disconnecting the battery.

Refer to 27 BATTERY, STARTER, GENERATOR, CRUISE CONTROL

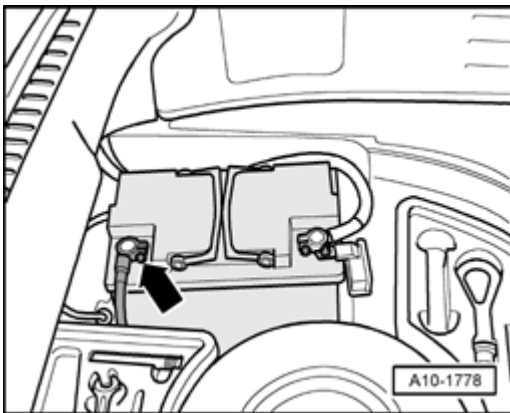


Fig. 3: Disconnecting Battery Ground (GND) Strap

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Switch ignition off and disconnect Ground cable (arrow) at battery (in luggage compartment under floor cover).

WARNING: Cover cap of expansion tank with rag and open carefully, as hot steam i.e. hot coolant may escape when opening.

- Open filler cap on coolant expansion tank.
- Remove both front wheels.

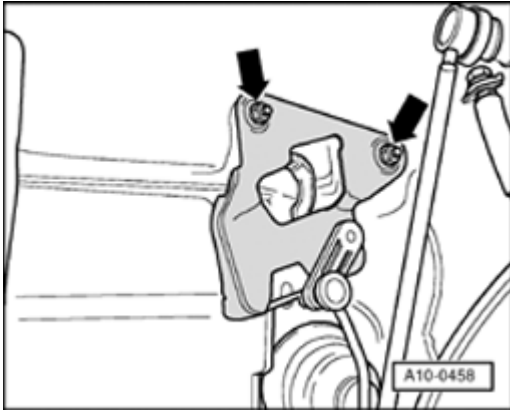


Fig. 4: Unbolting Bracket For Headlight Range Control In Left Wheel Housing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unbolt bracket for headlight range control in left wheel housing (arrows).

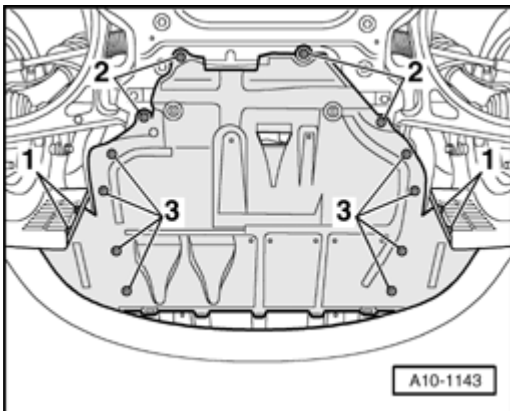


Fig. 5: Identifying Center Sound Insulation Fasteners
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove fasteners -1...3- and center sound insulation.

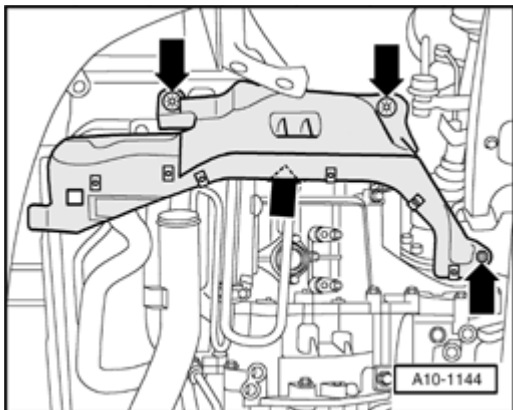


Fig. 6: Left Sound Insulation Panel

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove left sound insulation (arrows).

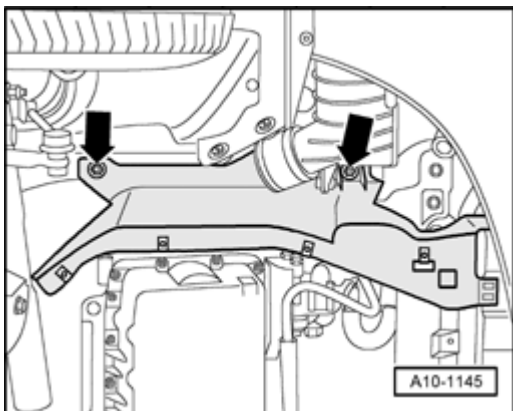


Fig. 7: Removing Right Sound Insulation

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove right sound insulation (arrows).

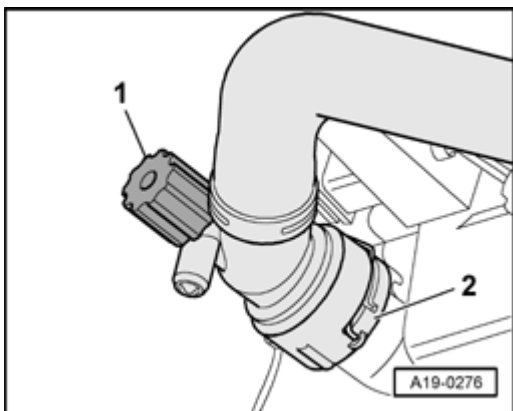


Fig. 8: Identifying Drain Plug & Retaining Clip

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Place drip tray V.A.G 1306 under engine.
- Turn drain plug -1- on radiator counter-clockwise. Install an auxiliary hose to connection if necessary.
- Remove lower coolant hose from radiator by pulling off retaining clip -2-.

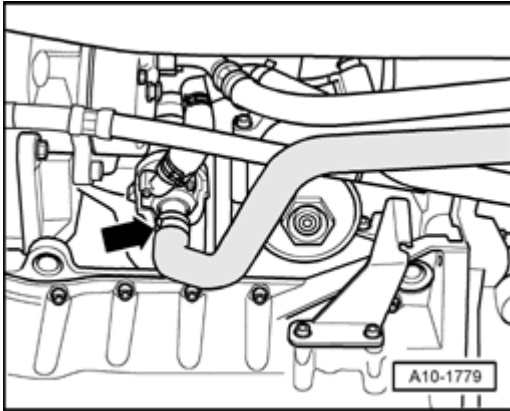


Fig. 9: Removing/Installing Lower Coolant Hose At After-Run Coolant Pump -V51-
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- In addition, remove lower coolant hose at After-run coolant pump -V51- (arrow) and drain remaining coolant.

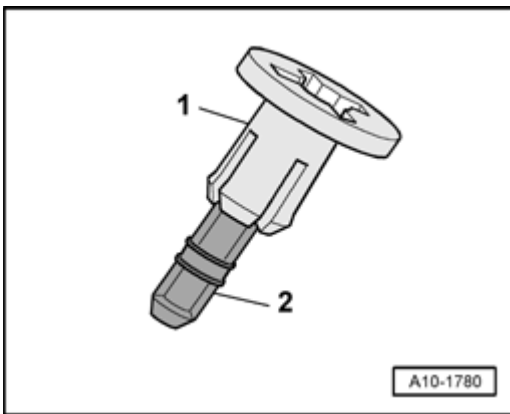


Fig. 10: Identifying Fasteners At Lock Carrier & Pin
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- To remove fasteners -1- at lock carrier, press pin -2- in approx. 4 mm (do not push in completely). Then pull fastener out upward.

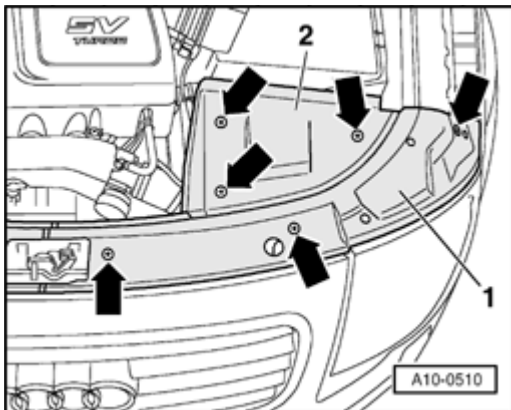


Fig. 11: Removing Left-Hand Cover Panels On Lock Carrier And Battery
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove left side covers -1- and -2- at lock carrier and above main fuse box (arrows).

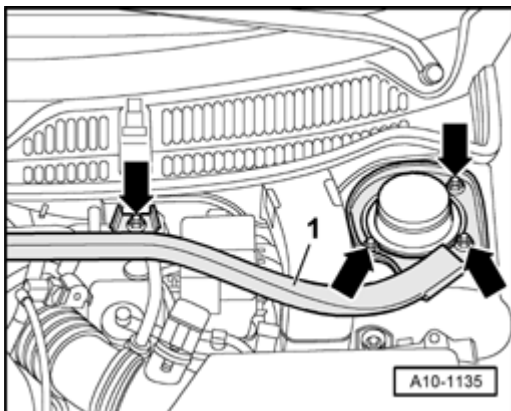


Fig. 12: Removing Body Brace
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove body brace -1- (arrows).

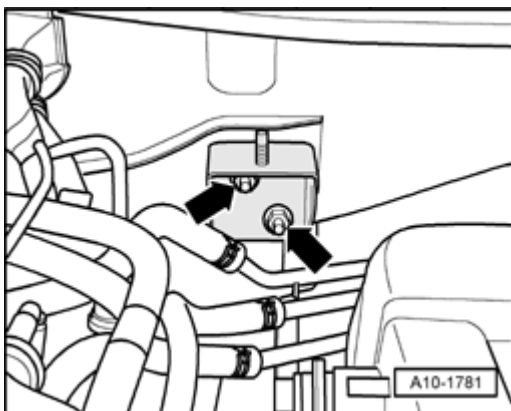


Fig. 13: Removing Bracket (Right Side) For Body Brace
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bracket (right side) for body brace (arrows).

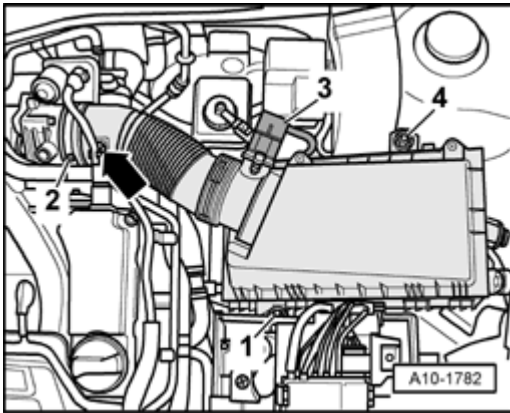


Fig. 14: Identifying Air Hose, Mass Air Flow Sensor -G70- & Bolts
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect air hose -2- at Throttle valve control module -J338-.
- Disconnect electrical connector for Mass Air Flow sensor -G70-, -3-.
- Remove bolts -1- and -4-.
- Take out air cleaner housing.

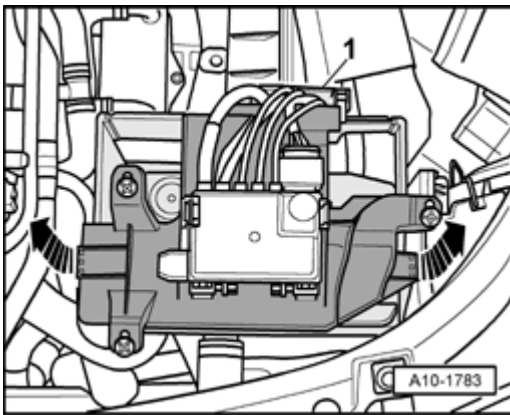


Fig. 15: Unclipping Protective Cover For Electrical Cable
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unclip protective cover -1- for electrical cables.
- Fold bracket for fuse box upward (arrows).

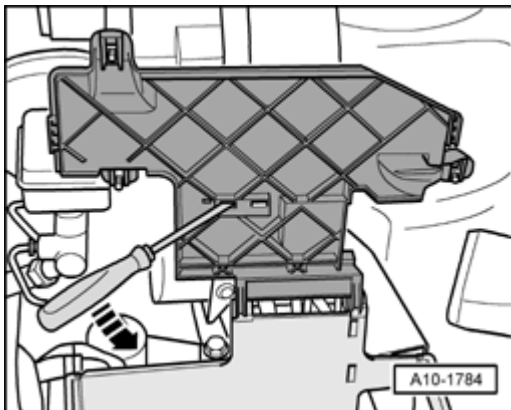


Fig. 16: Removing Fuse Box By Releasing Retaining Tabs
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove fuse box by releasing retaining tabs (arrow).

NOTE: The wires remain connected.

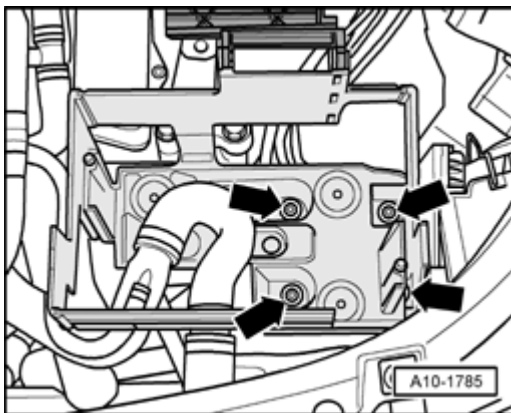


Fig. 17: Removing Carrier
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove carrier (arrows).

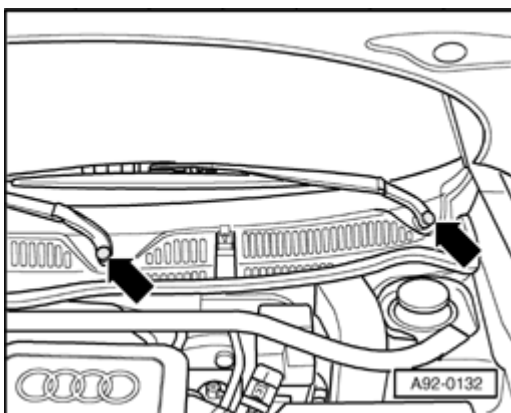
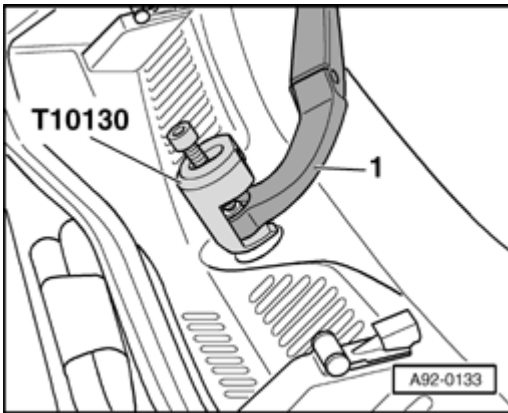


Fig. 18: Prying Off Covers At Wiper Arms

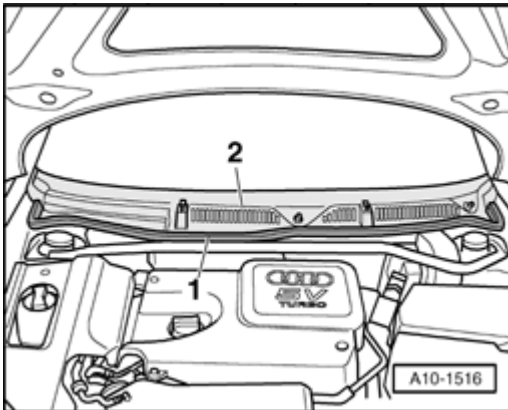
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Use screwdriver to pry off covers at wiper arms (arrows) and unscrew hex nuts.

**Fig. 19: Using Puller T10130 To Remove Wiper Arms From Wiper Shafts**

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Use puller T10130 to remove wiper arms -1- from wiper shafts.

**Fig. 20: Pulling Off Rubber Seal On Plenum Chamber Cover & Plenum Chamber Cover**

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Pull off rubber seal -1- on plenum chamber cover.
- Take off plenum chamber cover -2-.
- Disconnect washer hose and electrical connectors at windshield washer jets.
- Lay plenum chamber cover aside (toward windshield).

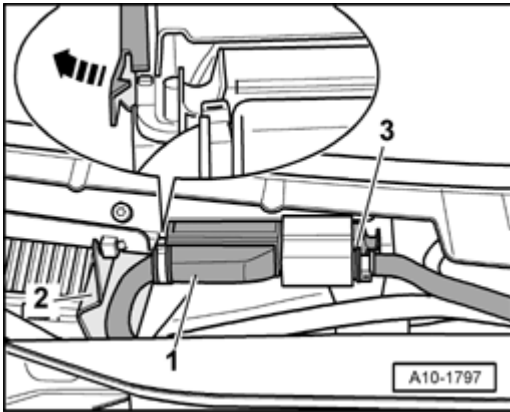


Fig. 21: Releasing Retaining Tab And Pulling Engine Control Module Forward Out Of Bracket
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unclip cover -2-.
- Disconnect multi-pin connector -1- at engine control module.
- Release retaining tab (arrow) and pull engine control module forward out of bracket.

NOTE: The multi-pin connector -3- remains attached to the engine control module.

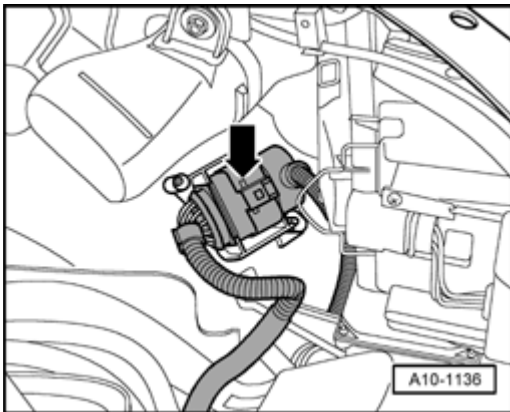


Fig. 22: Opening Cable Duct In Engine Compartment
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Open cable duct (left side) in engine compartment (arrows).
- Disconnect connector in cable duct.
- Remove electrical connector from bracket (near left-side headlight) and disconnect (arrow).
- Set aside wiring harness leading to engine control module.
- Place engine control module with wiring harness on top of engine.
- Secure engine control module to prevent it from falling.

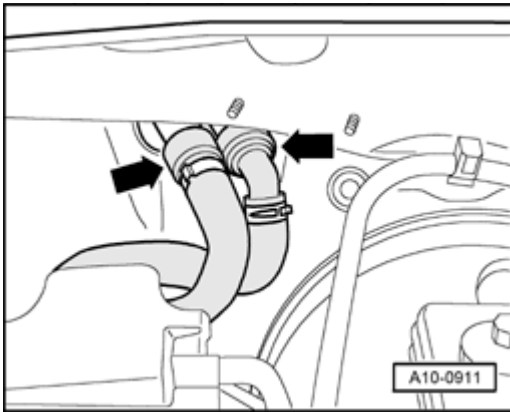


Fig. 23: Disconnecting Coolant Hoses Going To Heat Exchanger At Bulkhead
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect coolant hoses going to heat exchanger at bulkhead (arrows) by releasing retaining clips.

NOTE:

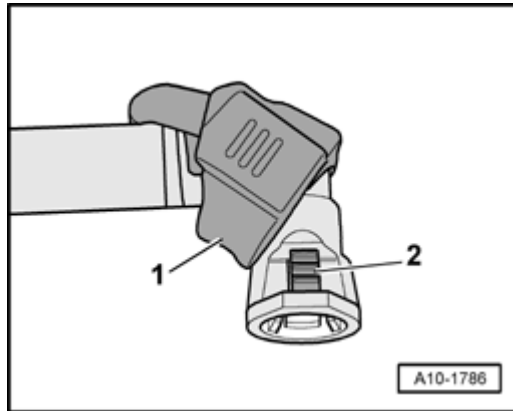


Fig. 24: Identifying Vacuum Connections Back Rubber Cap & Retaining Tab
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

To disconnect vacuum connections at the intake manifold, push back rubber cap -1- and release retaining tab -2-.

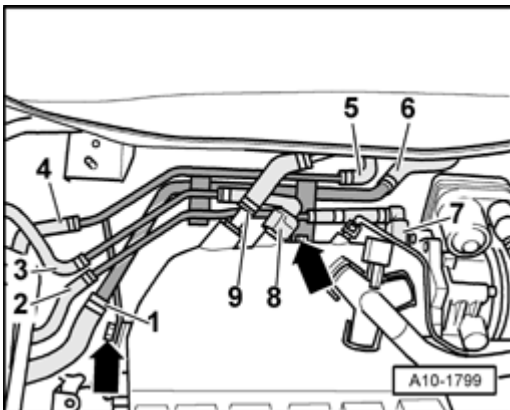


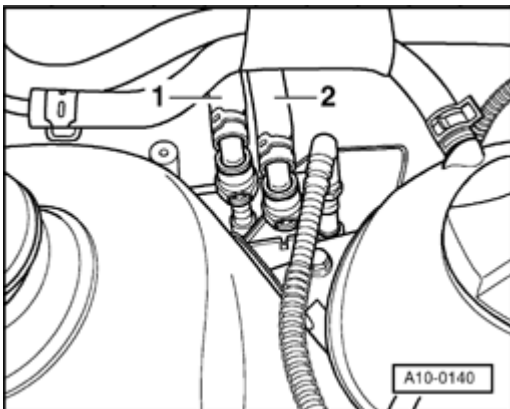
Fig. 25: Disconnecting Hoses From Hose Bracket**Courtesy of VOLKSWAGEN UNITED STATES, INC.**

- Mark installed position of hoses at hose bracket behind intake manifold.
- Disconnect hoses from hose bracket at indicated locations:

- 1 - Coolant hose to expansion tank
- 2 - Vacuum hose to EVAP canister purge regulator valve -N80- and to vacuum canister
- 3 - Vacuum hose to exhaust flap
- 4 - Coolant hose to expansion tank
- 5 - Coolant hose to connection at heat exchanger
- 6 - Coolant hose to heat exchanger
- 7 - Vacuum hose to EVAP canister purge regulator valve -N80-
- 8 - Vacuum hose to exhaust flap
- 9 - Vacuum hose to brake servo

- Unbolt hose bracket (arrows) and remove.

CAUTION: The fuel system is pressurized. Before opening the system place a cloth around the connection. Then dissipate the pressure by carefully loosening the connection.

**Fig. 26: Identifying Supply Line And Return Line****Courtesy of VOLKSWAGEN UNITED STATES, INC.**

- Disconnect fuel supply line -1- and fuel return line -2- by pressing release tabs.

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

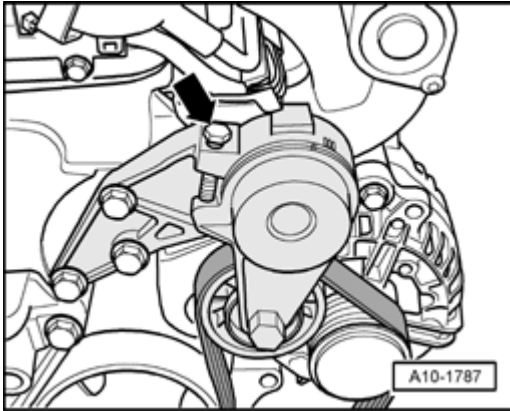


Fig. 27: Screwing Into Bore On Tensioning Element
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- To release tension of poly V-belt, screw an M8 x 40 bolt (arrow) into bore on tensioning element.
- Remove poly V-belt.

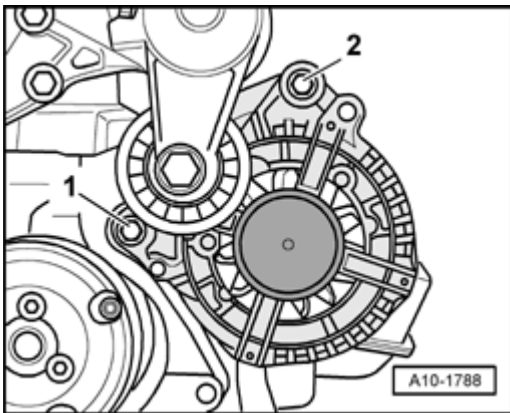


Fig. 28: Removing Upper/Lower Securing Bolt For Generator
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove upper securing bolt -2- for Generator.

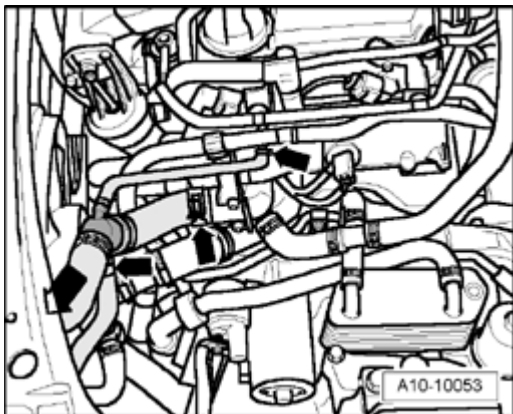


Fig. 29: Removing Upper Coolant Hose Leading To Radiator
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove upper coolant hose leading to radiator (arrows).

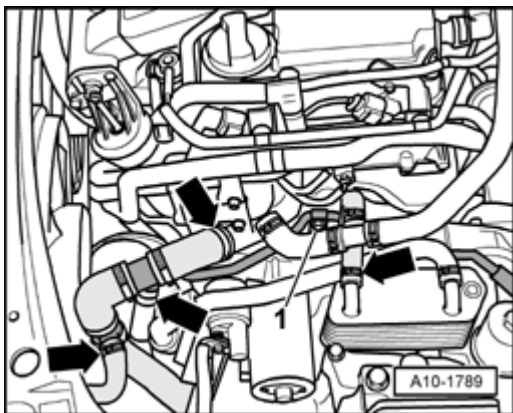


Fig. 30: Disconnecting Hoses
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect hoses at connections indicated (arrows).
- Unscrew nut at bracket for power steering pressure line -1-.
- Move line clear.

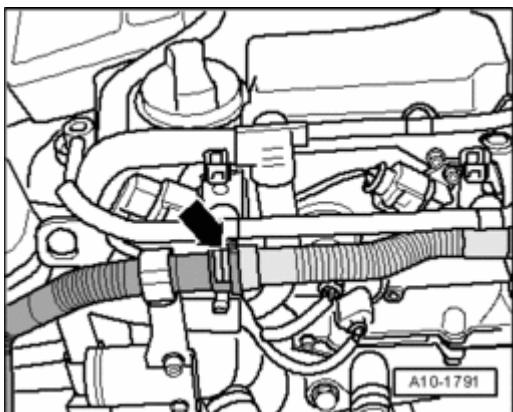
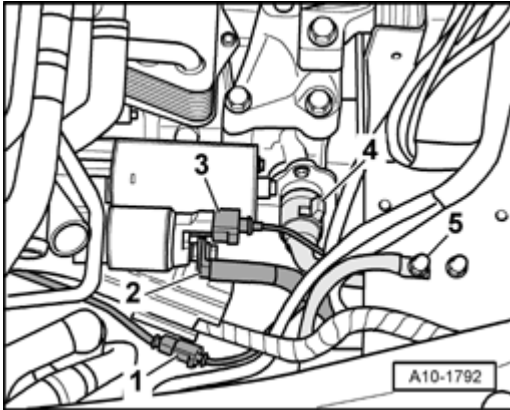


Fig. 31: Identifying Secondary Air Injection Hose

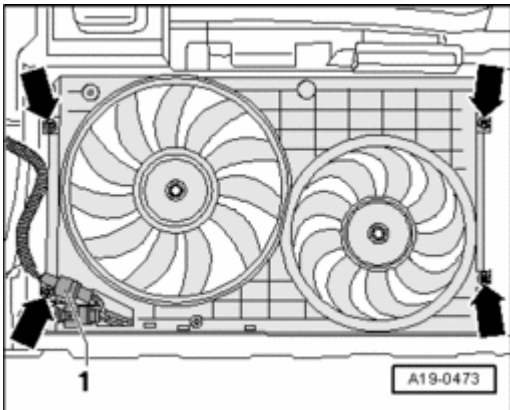
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect secondary air hose at position marked with an arrow.
- Move air hose clear.

**Fig. 32: Disconnect Electrical Connectors, Ground Cable & Unscrewing Wire At Solenoid Switch For Starter**

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical connectors -1-, -3- and -4-.
- Unscrew wire -2- at solenoid switch for starter.
- Disconnect Ground cable -5-.

**Fig. 33: Identifying Harness Connector And Fan Mount Mounting Bolts**

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove upper securing bolts (upper arrows) for radiator cowl.

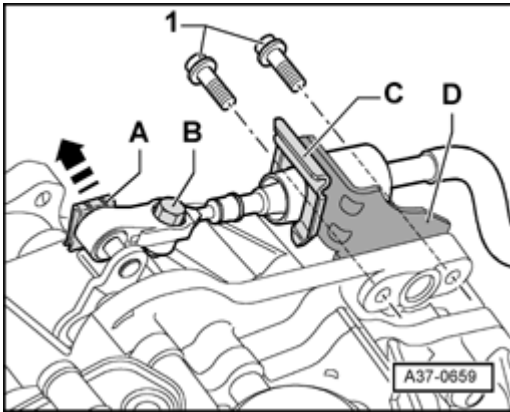


Fig. 34: Removing Bolts For Support Bracket, Pulling Off Retaining Clip Upward & Disconnecting Selector Lever Cable From Transmission

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts -1- for support bracket -D-.
- Pull off retaining clip -A- upward (arrow) and disconnect selector lever cable from transmission.

NOTE: Ignore items marked -B- and -C- in the illustration.

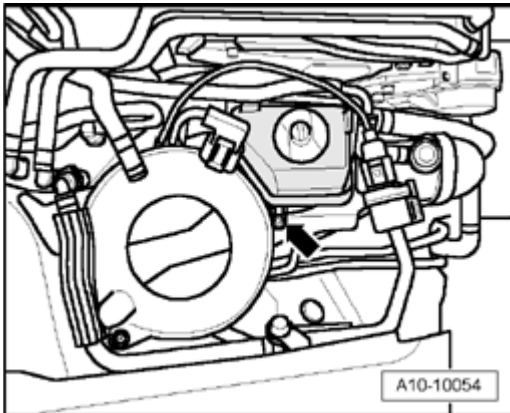


Fig. 35: Removing Securing Bolt For Power Steering Reservoir

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove securing bolt (arrow) for power steering reservoir.

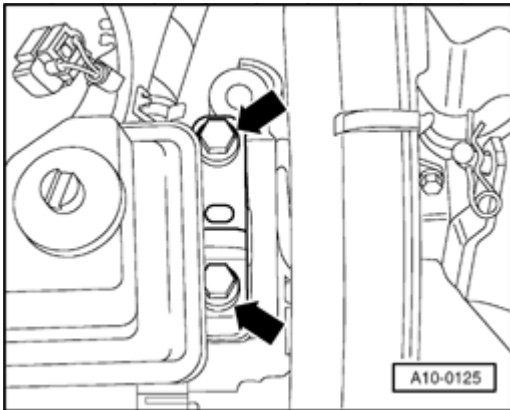


Fig. 36: Locating Engine Carrier Bolts (Engine Side)
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Loosen bolts of assembly mounting on engine (arrows)...

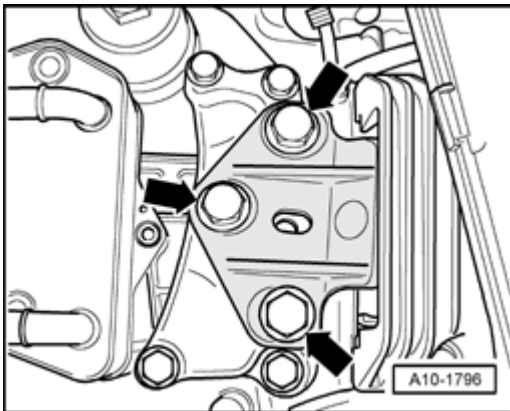


Fig. 37: Locating Engine Carrier Bolts (Transmission Side)
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- ..and on transmission (arrows) approx. 2 turns.

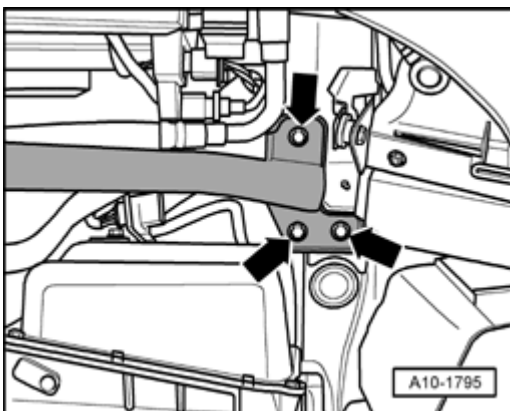


Fig. 38: Removing Cross Piece
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove cross piece (arrows).

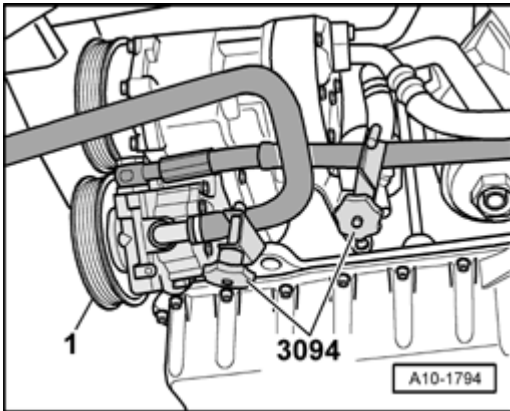


Fig. 39: Using Hose Clamps 3094 To Clamp Off Both Hydraulic Hoses To Power Steering Pump
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unbolt pulley -1- for power steering pump (counterhold with mandrel).
- Use hose clamps 3094 to clamp off both hydraulic hoses to power steering pump.

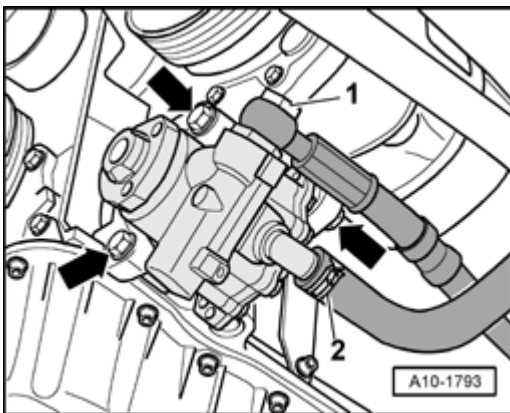


Fig. 40: Removing Bolts And Power Steering Pump From Bracket
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Place drip tray beneath power steering pump.
- Disconnect hydraulic hoses -1- and -2- at power steering pump.
- Remove bolts (arrows) and remove power steering pump from bracket.

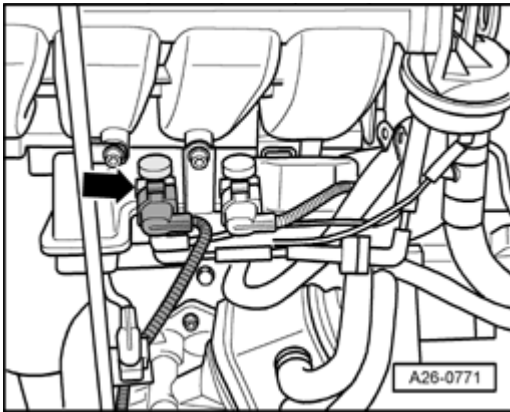


Fig. 41: Disconnecting Electrical Connector At Secondary Air Injection (AIR) Solenoid Valve -N112-
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical connector (arrow) at Secondary Air Injection (AIR) solenoid valve -N112-.

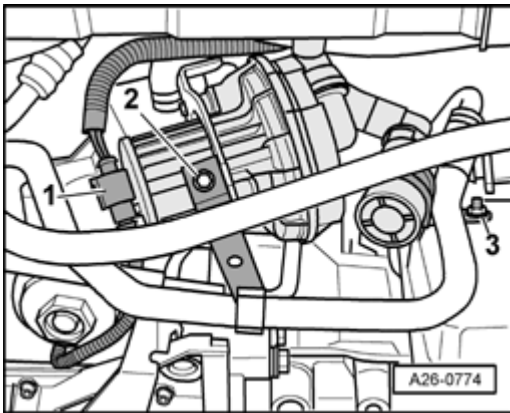


Fig. 42: Disconnecting Electrical Connector At Secondary Air Injection (AIR) Pump Motor -V101-
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical connector -1- at Secondary Air Injection (AIR) pump motor -V101-.
- Move wire clear.
- Unscrew bracket -2- for coolant hose.
- Unscrew bracket -3- for secondary air injection pump air filter.

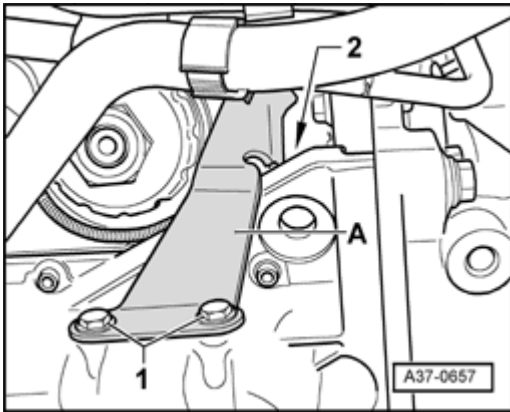


Fig. 43: Removing Bolts And Secondary Air Injection Pump With Bracket
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts -1- and -2- and remove secondary air injection pump with bracket -A-.

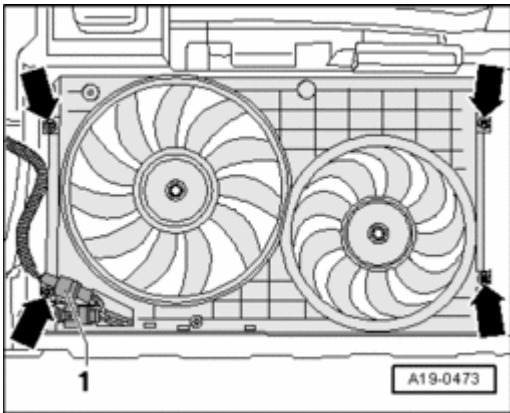


Fig. 44: Identifying Harness Connector And Fan Mount Mounting Bolts
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical connectors -1- for coolant fans at bottom of radiator cowl.
- Remove lower securing bolts (lower arrows) for radiator cowl.
- Remove radiator cowl with both fans from below.

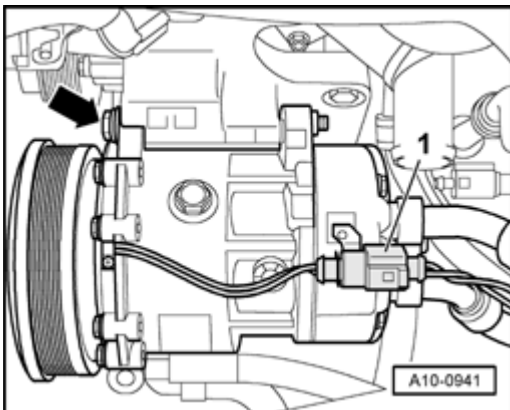


Fig. 45: Disconnecting Electrical Connector For Air Conditioning Compressor Clutch
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical connector -1- for air conditioning compressor clutch.

CAUTION: The refrigerant circuit must not be opened.

NOTE: The air conditioning compressor can only be removed from the bracket with the upper securing bolt still inserted. To do this, press the engine simultaneously to the left side with an assembly lever (2nd technician required). If required, loosen all bolts of the assembly mounting 1 turn.

- Remove bolt (arrow) for air conditioning compressor.
- Tie up air conditioning compressor together with refrigerant hoses at front of longitudinal member (refrigerant hoses remain connected).

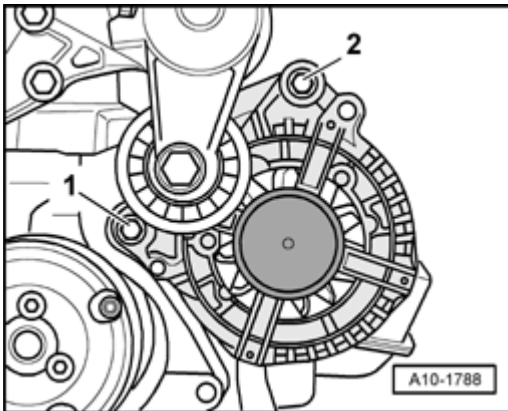


Fig. 46: Removing Upper/Lower Securing Bolt For Generator
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove lower securing bolt -1- for Generator.
- Remove Generator from bracket for ancillary units (electrical wiring remains connected).

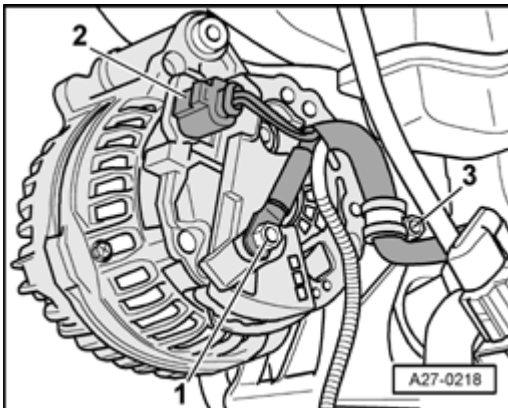


Fig. 47: Identifying Connector, Electrical Wire And Wiring Clamp On Generator
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unscrew clamp -3-.
- Disconnect wire -1- at Generator.
- Disconnect electrical connector -2-.
- Remove Generator.

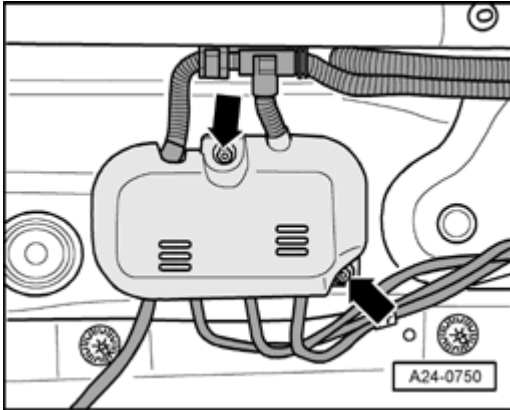


Fig. 48: Removing Protective Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unbolt and remove protective cover (arrows).
- Disconnect electrical connectors for both oxygen sensors (behind catalytic converter) and move clear to side.

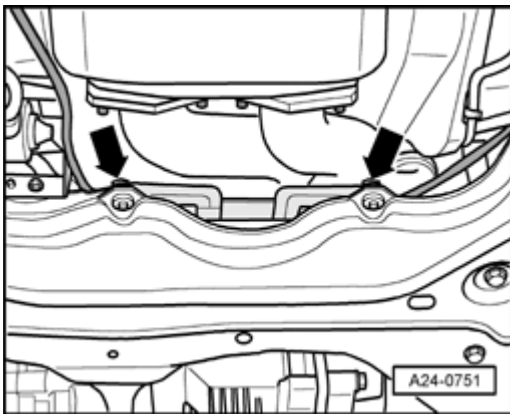


Fig. 49: Removing Fasteners And Wire Guide
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove fasteners (arrows) and wire guide.

NOTE: To avoid damage, do not bend the flexible joints in the front exhaust pipe more than 10°.

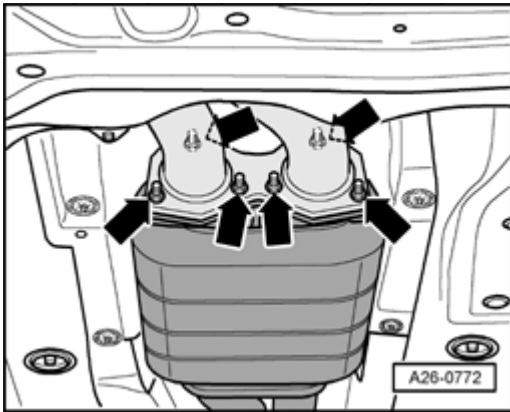


Fig. 50: Unbolting Catalytic Converter From Front Exhaust Pipe
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unbolt catalytic converter from front exhaust pipe (arrows).

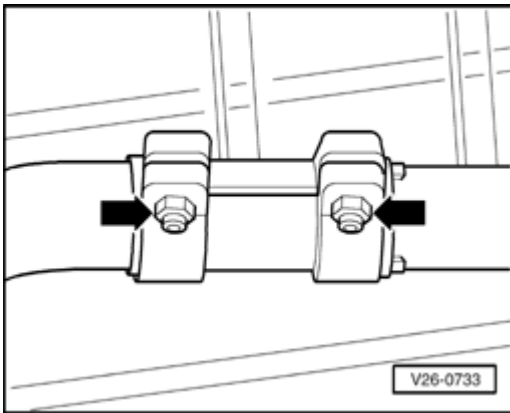


Fig. 51: Separating Exhaust System At Clamp
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Separate exhaust system at clamp (arrows).
- Push clamp back and remove catalytic converter.

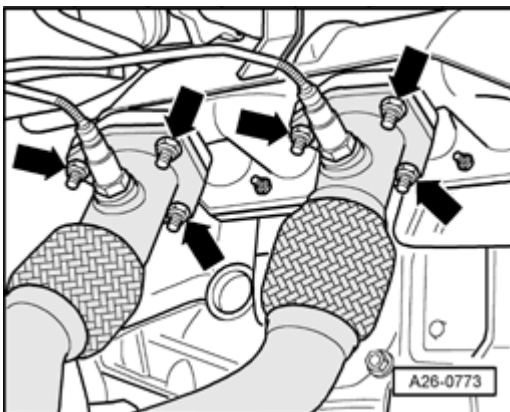


Fig. 52: Unbolting Front Exhaust Pipe At Exhaust Manifold

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unbolt front exhaust pipe at exhaust manifold (arrows) and move clear to rear.

CAUTION: When loosening the flange bolt securing the axle shaft, the wheel bearing must not be under load (vehicle must not be standing on its wheels).

- Press brake pedal (2nd technician required).

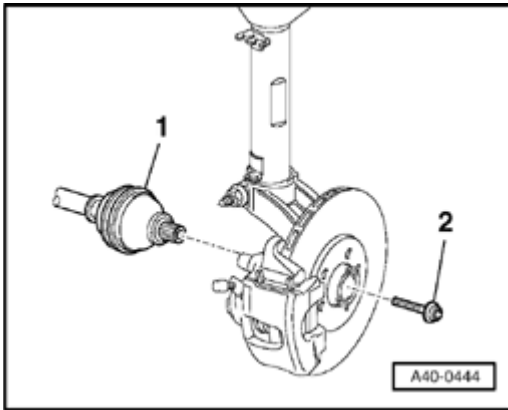


Fig. 53: Identifying Collar Bolt For Right Drive Axle

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove flange bolt -2- from right side axle shaft.
- Disconnect axle shaft (left side) from flange of transmission.

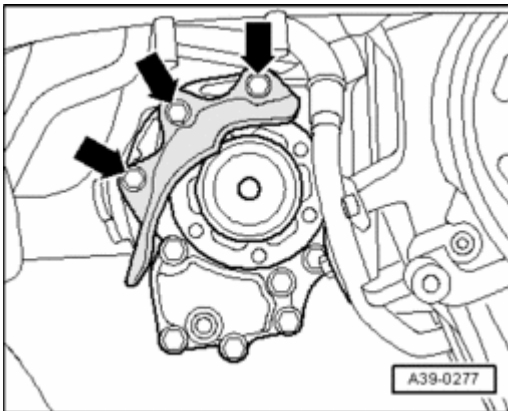


Fig. 54: Removing Right Driveshaft Heat Shield From Bevel Box

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts (arrows) and remove axle shaft heat shield from bevel box.
- Remove right side axle shaft.

Refer to **40 FRONT SUSPENSION**

- Remove bolts and remove left axle shaft from transmission flange.
- Mark position of flexible coupling and flange for bevel box in relation to each other.

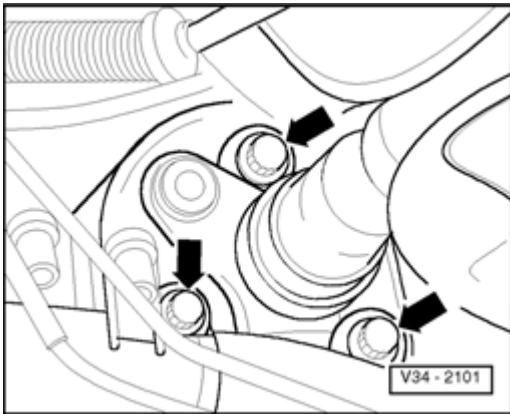


Fig. 55: Identifying Bevel Gear Transfer Case Flange Bolts
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unbolt flexible coupling for driveshaft at bevel box (arrows)

NOTE: When loosening bolts, counterhold at driveshaft flange/final drive with a suitable lever.

- Push driveshaft horizontally as far back as possible.

CAUTION:

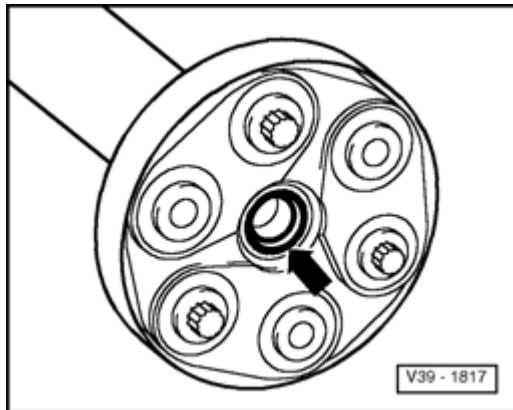


Fig. 56: Identifying Sealing Ring In Driveshaft Flange
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- The oil seal (arrow) in the flange of the driveshaft must not be damaged when removing and installing the engine/transmission assembly. The driveshaft must be replaced if the oil seal is damaged.
- When removing the bolts for the pendulum support/subframe, the engine/transmission assembly swings slightly forward.

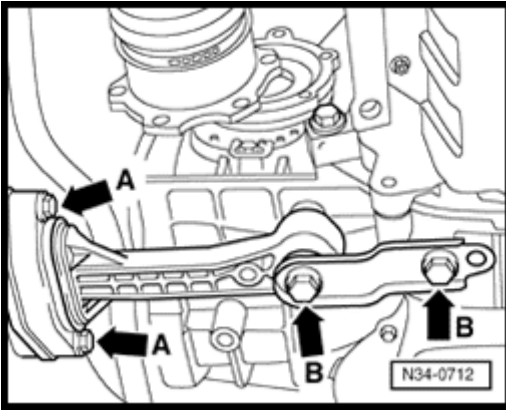


Fig. 57: Identifying Pendulum Support & Bolts
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- First, remove bolts (arrows -A-) and then bolts (arrows -B-) from pendulum support.
- Remove pendulum support.

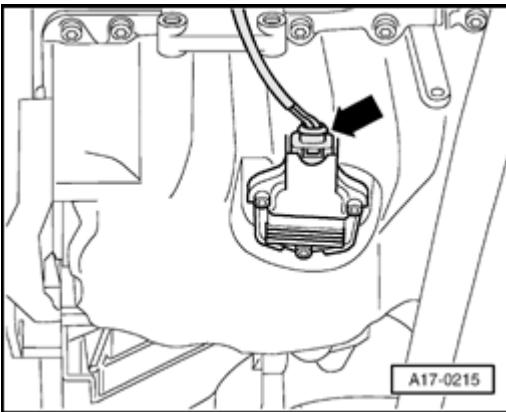


Fig. 58: Separating Electrical Connector For Oil Level Thermal Sensor -G266-
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Separate electrical connector (arrow) for Oil level thermal sensor -G266-.

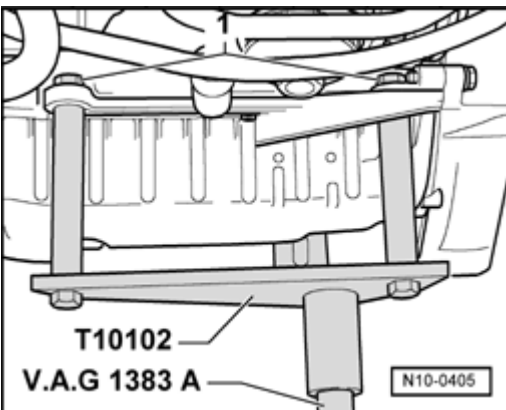


Fig. 59: Identifying Engine/Transmission Support T10102 And Engine/Transmission Jack V.A.G 1383 A

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Attach engine bracket T10102 with securing nuts to cylinder block. Torque nuts to approx. 20 Nm.
- Insert engine and transmission jack V.A.G 1383 A in engine bracket T10102 and raise engine/transmission assembly slightly.

NOTE: To unscrew bolts for assembly mounting use stepladder VAS 5085 or equivalent.

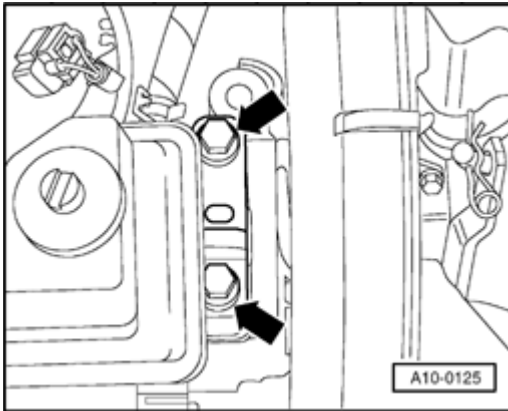


Fig. 60: Locating Engine Carrier Bolts (Engine Side)

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts of assembly mounting on engine (arrows)...

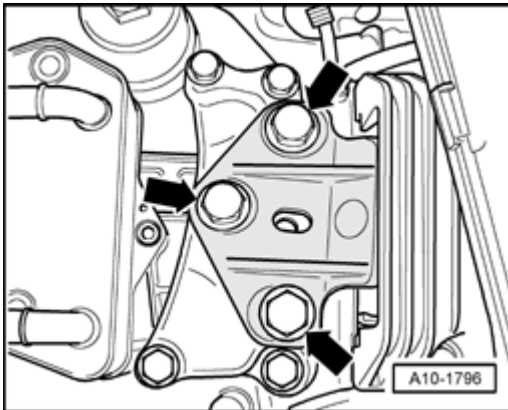


Fig. 61: Locating Engine Carrier Bolts (Transmission Side)

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- ..and on transmission (arrows).

NOTE:

- Check that all hoses and wiring connections between engine, transmission and body have been disconnected.
- Be careful when guiding engine/transmission assembly during lowering to avoid damage.

- Pull engine/transmission assembly as far forward as possible and lower gradually.

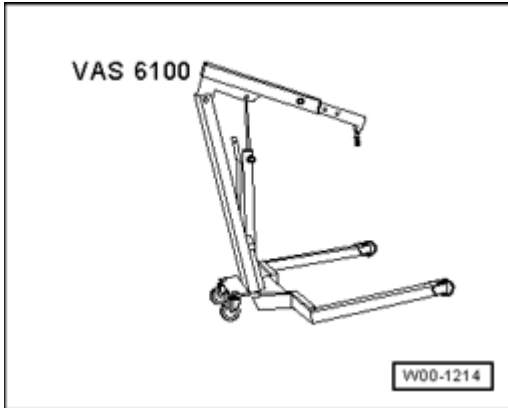
Engine and transmission, separating**Special tools and equipment required**

Fig. 62: Identifying Shop Crane VAS 6100
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Workshop crane VAS 6100

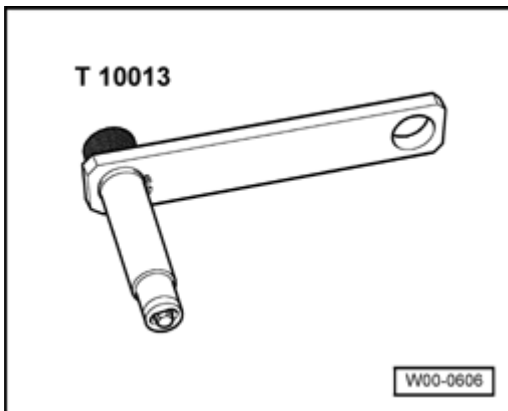


Fig. 63: Bracket T10013
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Bracket T10013
- Bolt M8 x 40 with nut and 30 mm diameter washer

Work sequence

- Engine/transmission assembly removed and attached to engine bracket T10102

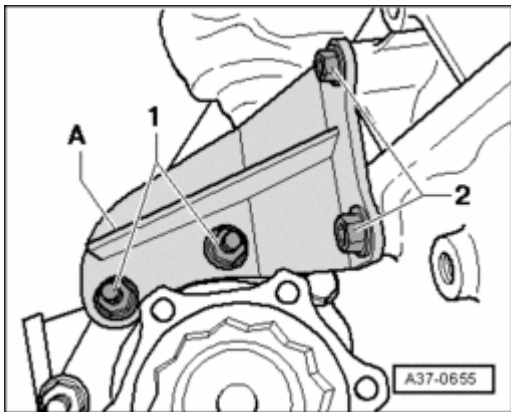


Fig. 64: Identifying Bracket For Bevel Box & Bolts
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts -1- and -2- at bracket for bevel box and remove bracket.

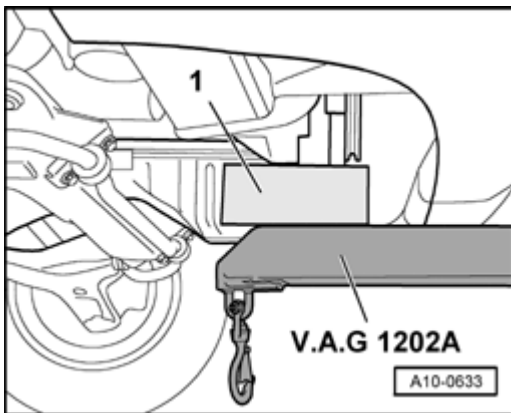


Fig. 65: Disconnecting Coolant Hose At ATF Cooler
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect coolant hose at ATF cooler (arrow).

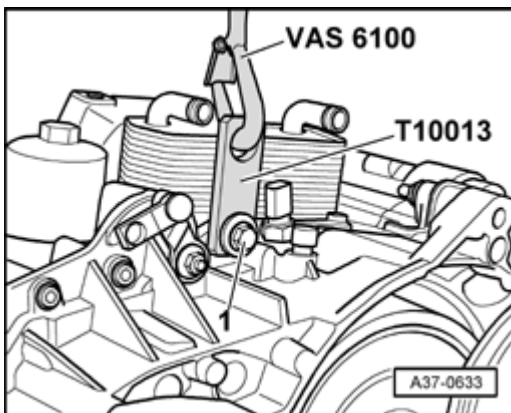


Fig. 66: Attaching Workshop Crane VAS 6100 To Bracket T10013
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove circlip and remove pin from bracket T10013.
- Secure bracket T10013 with bolt M8 x 40 and 30 mm diameter washer to transmission lifting eye.
- Attach workshop crane VAS 6100 to bracket T10013.

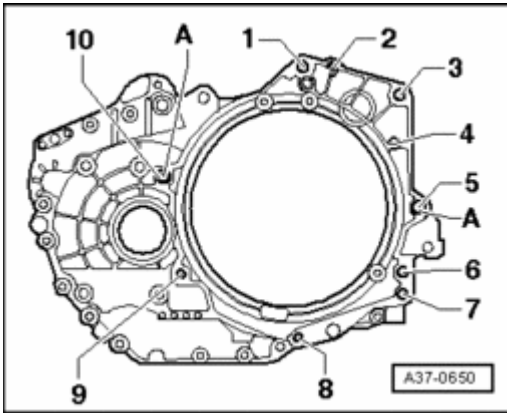


Fig. 67: Identifying Bolts On Engine/Transmission Flange
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts -1...10- on engine/transmission flange.
- Separate transmission from engine.

Engine, securing to engine stand

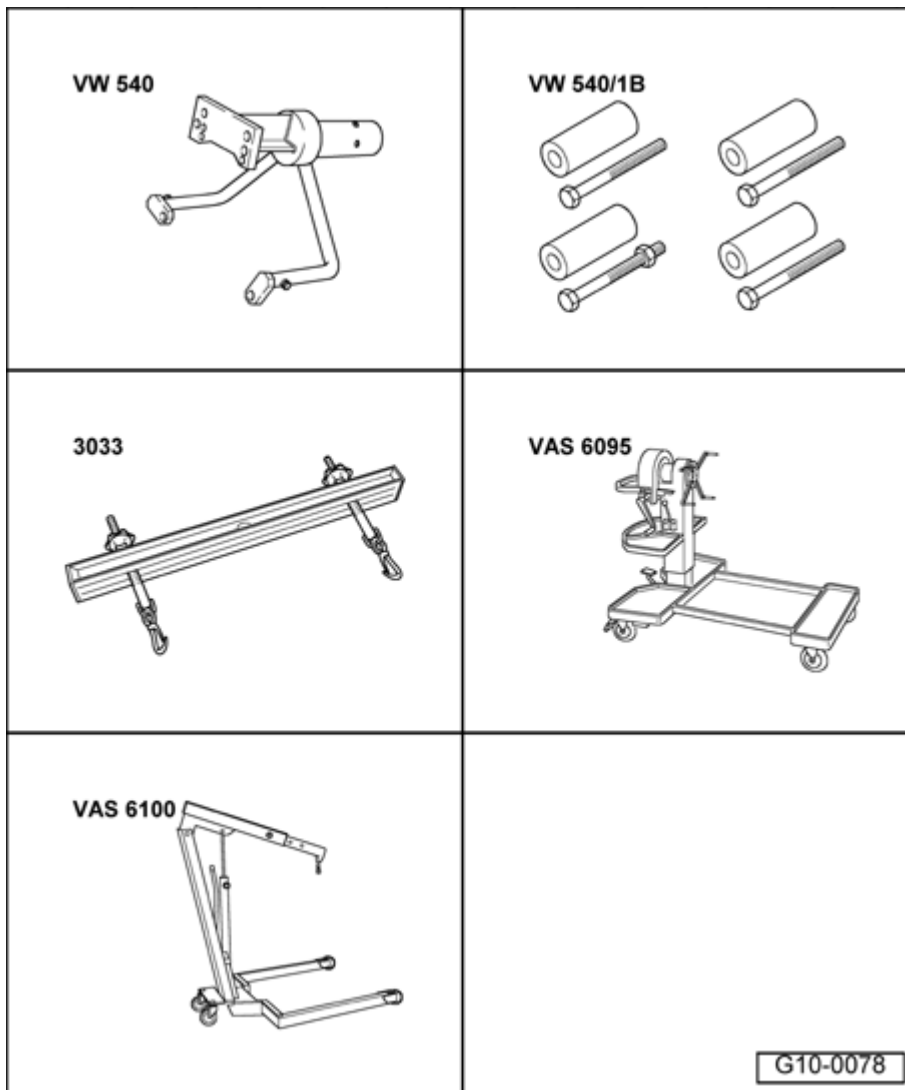


Fig. 68: Identifying Special Tools - Engine, Securing To Engine Stand
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools and equipment

- Engine and transmission support VW 540
- Engine and transmission support supplement VW540/1B
- Lifting tackle 3033
- Engine stand VAS 6095
- Workshop crane VAS 6100

Not illustrated:

- Bolt M12 x 160

Work sequence

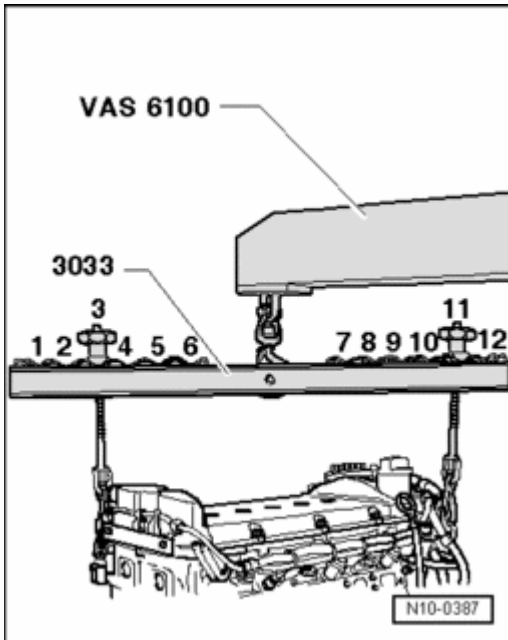


Fig. 69: Identifying Lifting Tackle 3033 & VAS 6100
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Attach lifting tackle 3033 to engine and workshop crane VAS 6100 as shown in illustration.
- Lift engine off engine bracket T10102 using workshop crane VAS 6100.

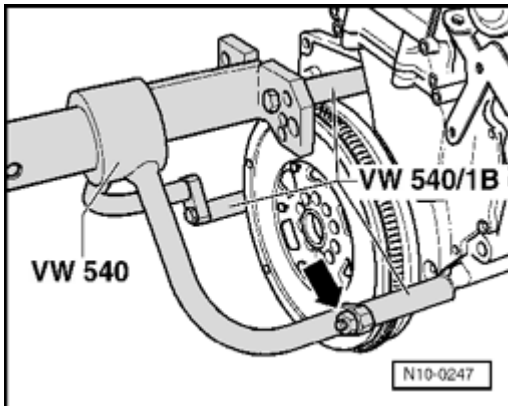


Fig. 70: Securing Engine/Transmission Support VW 540 With Parts From Engine And Transmission Support Supplement VW 540/1B To Cylinder Block
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Secure engine and transmission support VW 540 with parts from engine and transmission support supplement VW 540/1B to cylinder block.

NOTE: Use the M12 x 160 bolt to secure the lower right arm (arrow).

- Fasten engine to engine and transmission support VW 540 for assembly work.

Installing

Installation is performed in reverse order of removal. Note the following:

NOTE:

- On assembly, replace the self-locking nuts and bolts that are tightened by turning through to a specified angle, as well as oil seals and gaskets.
- Secure all hose connections with the correct type of hose clamps (same as original equipment).

- Check whether dowel sleeves for centering engine/transmission assembly are installed in cylinder block; install dowel sleeves if necessary.
- Bolt transmission to engine using new bolts.

NOTE:

- Tightening torques only apply to lightly greased, oiled, phosphated or blackened nuts and bolts.
- Additional lubricant such as engine oil or transmission oil may be used, but do not use lubricant containing graphite.
- Do not use degreased parts.
- Tolerance for tightening torques: $\pm 15\%$.

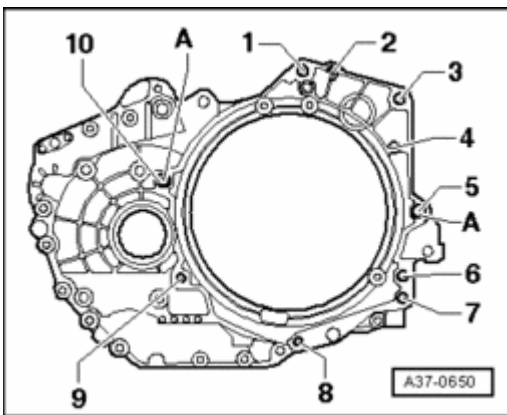


Fig. 71: Identifying Bolts On Engine/Transmission Flange
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Securing engine to transmission

A - dowel sleeves for centering

Item no.	Bolt	Nm
1	M12 x 55	80
2 1)2)	M10 x 40	40

2005 Audi TT

ENGINE 3.2 Liter V6 4V Engine Mechanical, Engine Code(s): BHE

3 1), 6	M12 x 55	80
4 2), 9	M10 x 45	40
5	M12 x 65	80
7, 8	M10 x 50	40
10	M12 x 70	80

1) Bolt with M8 stud

2) Bolt is only used to secure starter to transmission

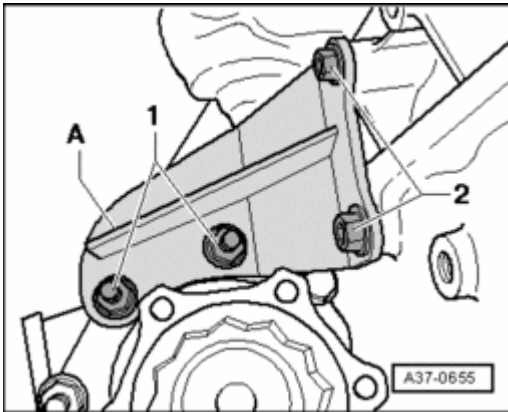


Fig. 72: Identifying Bracket For Bevel Box & Bolts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Install bracket -A- for bevel box; note following procedure:
- Initially tighten bolts -1- to 3 Nm.
- Tighten bolts -2- to 35 Nm.
- Tighten bolts -1- to 45 Nm.
- Guide engine/transmission assembly into body.

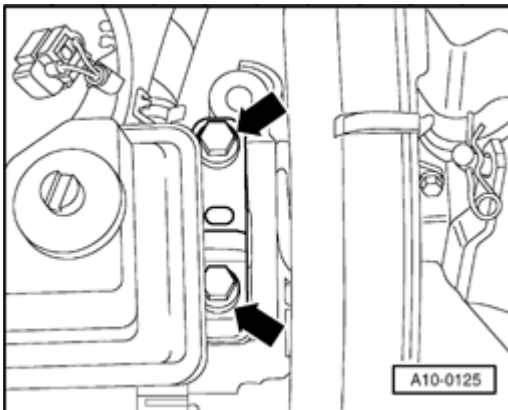


Fig. 73: Locating Engine Carrier Bolts (Engine Side)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Tighten bolts (use new bolts) for engine support to engine console (arrows)...

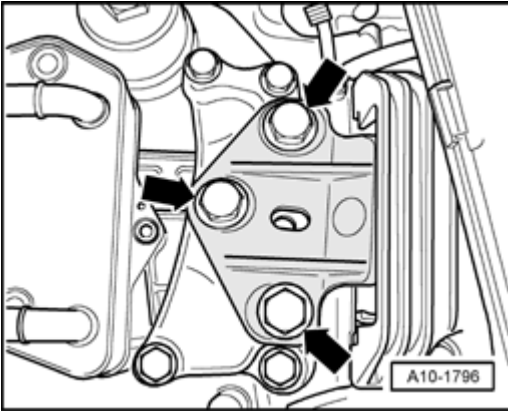


Fig. 74: Locating Engine Carrier Bolts (Transmission Side)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- ..and transmission support to transmission mount (arrows) initially finger tight.

NOTE: The bolts are tightened to final torque only after adjusting the engine mountings. Refer to Engine mountings, checking and adjusting.

- Remove engine bracket T10102 from engine.
- Install axle shafts and tighten bolts hand tight.

Refer to **40 FRONT SUSPENSION**

NOTE: Axle shafts must be installed prior to further assembly.

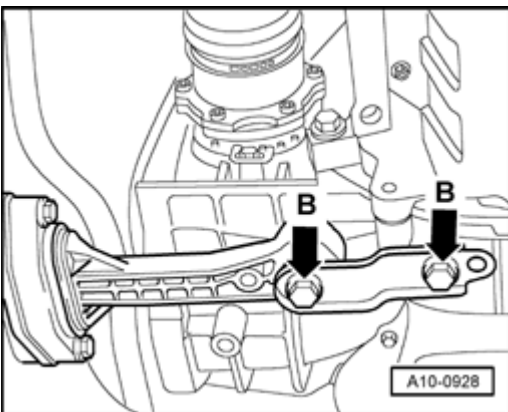


Fig. 75: Securing Pendulum Support At Transmission
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Secure pendulum support at transmission (arrows -B-). Use new bolts.

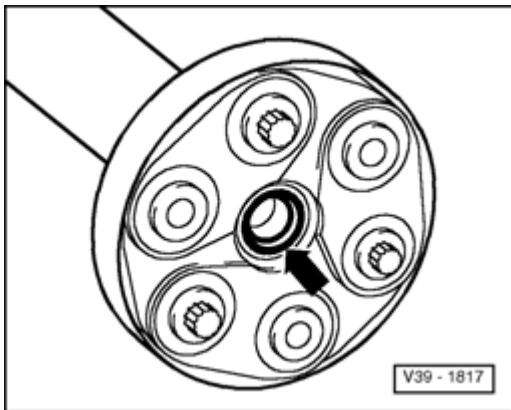


Fig. 76: Identifying Sealing Ring In Driveshaft Flange

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Push engine/transmission assembly toward bulkhead. Journal of bevel box must be simultaneously inserted horizontally and carefully into flange of driveshaft.

CAUTION: The oil seal (arrow) in the flange of the driveshaft must no be damaged when installing the engine/transmission assembly. The driveshaft must be replaced if the oil seal is damaged.

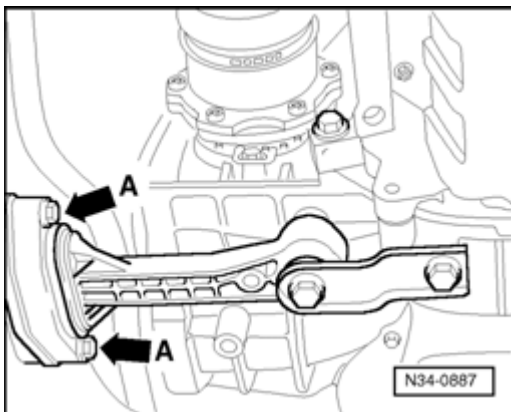


Fig. 77: Identifying Pendulum Support On Subframe

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Secure pendulum support at subframe (arrows -A-). Use new bolts.

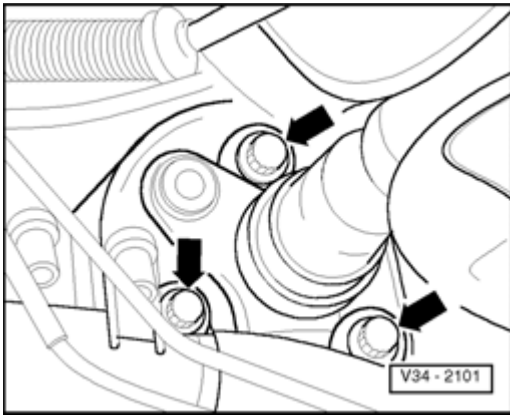


Fig. 78: Identifying Bevel Gear Transfer Case Flange Bolts
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Secure driveshaft with flexible coupling to flange of bevel box (arrows).
- Tighten axle shaft bolts.

Refer to **40 FRONT SUSPENSION**

Perform further installation in reverse order. Pay attention to the following:

- Install exhaust system and align it free of stress. Refer to **Exhaust system, aligning free of stress.**
- Install selector lever cable.

Refer to **34 MANUAL TRANSMISSION - CONTROLS, HOUSING**

- Install bracket for ancillary units. Refer to **Bracket for ancillary units, removing and installing.**
- Drive back respective bushings for securing bolts slightly to facilitate installation of Generator, power steering pump and A/C compressor.
- Install Generator.

Refer to **27 BATTERY, STARTER, GENERATOR, CRUISE CONTROL**

- Install air conditioning compressor.

Refer to **87 AIR CONDITIONING**

- Install radiator cowl. Refer to **Radiator, removing and installing.**
- Install power steering pump.

Refer to **48 STEERING**

- Install body brace and cross piece.

Refer to **40 FRONT SUSPENSION**

- Install poly V-belt.
- Adjust engine mountings. Refer to **Engine mountings, checking and adjusting**.
- Connect electrical connections and check routing.

Refer to Electrical Wiring Diagrams, Troubleshooting & Component Locations

- Connect Ground strap to battery.

Refer to **27 BATTERY, STARTER, GENERATOR, CRUISE CONTROL**

- Check oil level. Refer to **Oil pump, component overview**.

CAUTION: Never use the battery charging equipment for boost starting. There is a danger of damaging the vehicle control modules.

- Fill cooling system. Refer to **Cooling system, draining and filling**.

NOTE:

- Drained coolant may only be used again if the original cylinder head or cylinder block are reinstalled.
- Contaminated or dirty coolant must not be used again.

Tightening torques

Component		Nm
Bolts/nuts	M6	10
	M8	20
	M10	45
	M12	65
Except for the following:		
Pendulum support to transmission		40 + 90° 1)2)

1) Replace nuts and bolts

2) 90° equals one quarter turn

Component	Nm
Pendulum support to subframe	20 + 90° 1)2)
Flexible coupling to bevel box	60
Front exhaust pipe to exhaust manifold	40 1)
Front exhaust pipe to catalytic converter	25
Wire guide to subframe	10
Axle shaft heat shield to bevel box	23

2005 Audi TT

ENGINE 3.2 Liter V6 4V Engine Mechanical, Engine Code(s): BHE

Bracket for coolant pump for After-run coolant pump -V51- to cylinder block		20
Wiper arms to wiper shafts		16
Bracket for secondary air pump	M6	10
to engine	M8	20

1) Replace nuts and bolts

2) 90° equals one quarter turn

ENGINE MOUNTINGS, ADJUSTING

Engine mountings, checking and adjusting

Checking

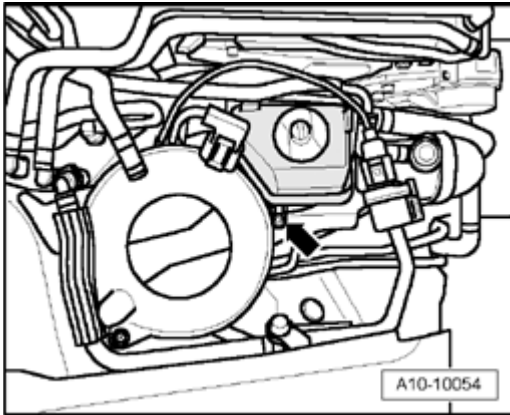


Fig. 79: Removing Securing Bolt For Power Steering Reservoir
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove securing bolt (arrow) for power steering reservoir.

CAUTION: The fuel system is pressurized. Before opening the system place a cloth around the connection. Then dissipate the pressure by carefully loosening the connection.

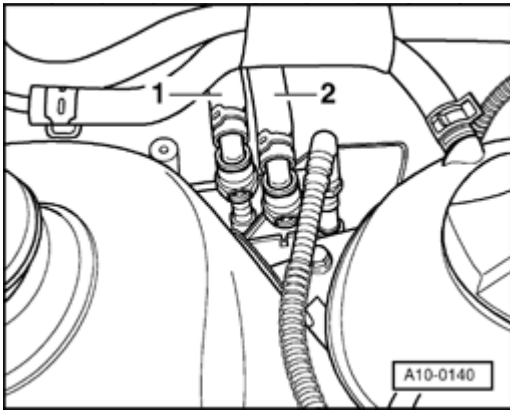


Fig. 80: Identifying Fuel Supply Line And Fuel Return Line By Pressing Release Tabs
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect fuel supply line -1- and fuel return line -2- by pressing release tabs.

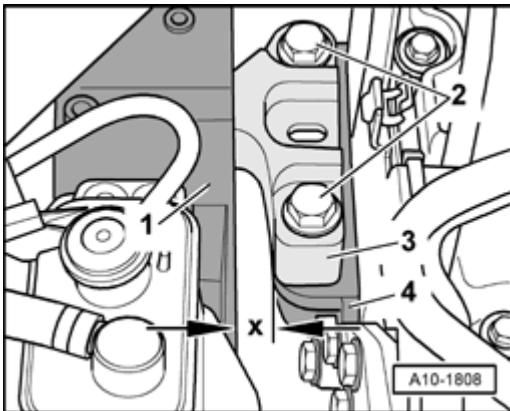


Fig. 81: Checking Dimensions At Engine/Transmission Assembly Mounting
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Check following dimensions at engine/transmission assembly mounting (right side):
 - Both bolt heads -2- must be parallel to edge of support arm -3-.
 - There must be a distance of -x- = 10...13 mm between engine mount -1- and engine support -4-.
- Check gap -x- with 12 mm iron bar (or support bridge 2011).
 - Bar must be easy to insert

If the distance measured is too large or small, proceed as follows:

Adjusting

Special tools and equipment required

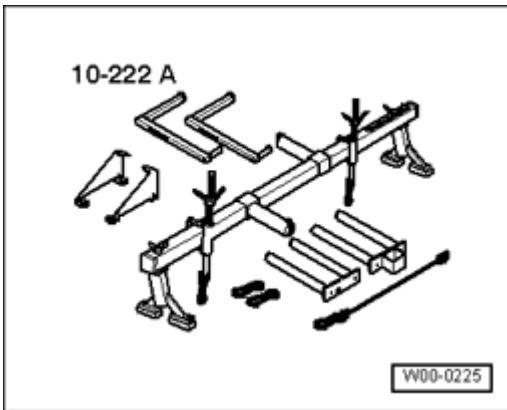


Fig. 82: Identifying Support Assembly 10-222A
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Support bracket 10-222 A

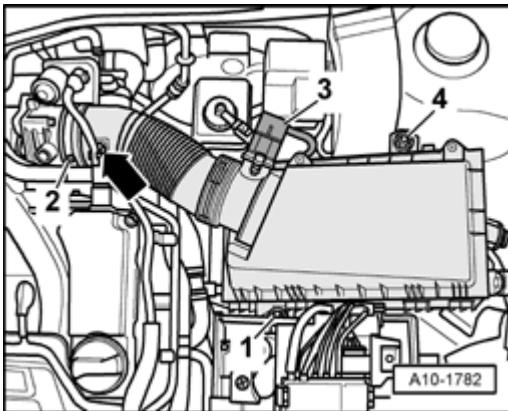


Fig. 83: Identifying Air Hose, Mass Air Flow Sensor -G70- & Bolts
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect air hose -2- at Throttle valve control module -J338-.
- Disconnect electrical connector for Mass Air Flow (MAF) sensor -G70-, item -3-.
- Remove bolts -1- and -4-.
- Take out air cleaner housing.

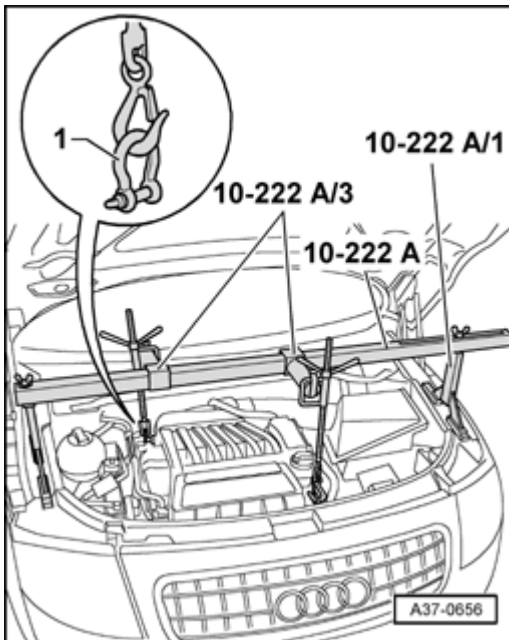


Fig. 84: Setting Up Support Bracket 10-222 A With Adapters 10-222 A/3 On Surface Of Panel Flange
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Secure one shackle 10-222 A/12 item -1- to engine lifting eye at right rear.
- Set up support bracket 10-222 A with adapters 10-222 A/3 on surface of panel flange.
- Attach spindles to lifting eye and to shackle.
- Lift engine evenly a short distance with both spindles.

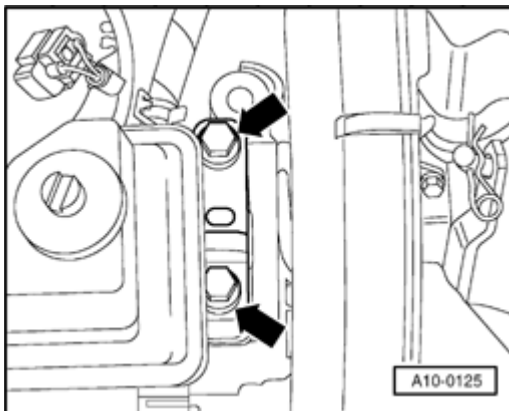


Fig. 85: Locating Engine Carrier Bolts (Engine Side)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unscrew bolts of assembly mounting on engine (arrows)...

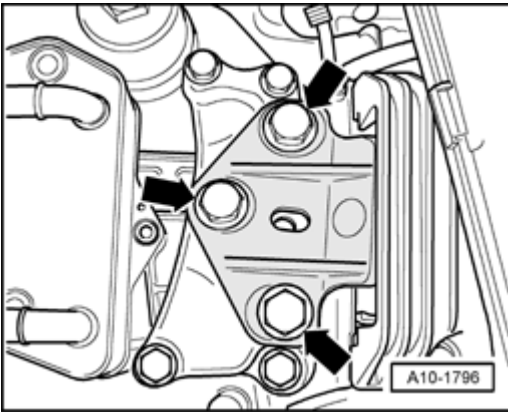


Fig. 86: Locating Engine Carrier Bolts (Transmission Side)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- ..and on transmission (arrows) one after another.
- Replace all 5 bolts one by one (if not already replaced when engine was installed) and tighten them finger tight.
- Loosen bolts for support arms on right and left approx. 2 turns.

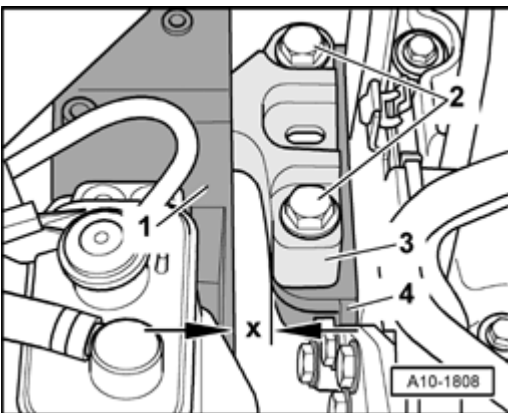


Fig. 87: Checking Dimensions At Engine/Transmission Assembly Mounting
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Move engine slightly with an assembly lever.
- Both bolt heads -2- must be parallel to edge of support arm -3-.
- There must be a distance of -x- = 10...13 mm between engine mount -1- and engine support -4-.
- Check gap -x- with 12 mm iron bar (or support bridge 2011).
- Bar must be easy to insert.
- Tighten bolts -2- for engine assembly mounting.

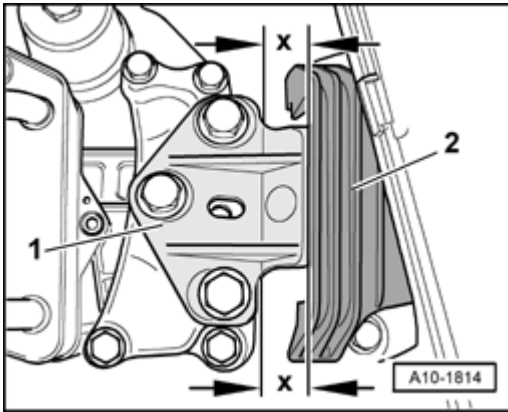


Fig. 88: Ensuring Edges On Support Arm And Transmission Mount Are Parallel
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Ensure that edges on support arm (on transmission assembly mounting) -1- and transmission mount -2- are parallel.
- Distance -x- = -x-
- Tighten bolts for transmission assembly mounting.

The remaining installation steps are performed in the reverse sequence.

13 ENGINE - CRANKSHAFT, CYLINDER BLOCK

ENGINE, DISASSEMBLING AND ASSEMBLING

Poly V-belt, component overview

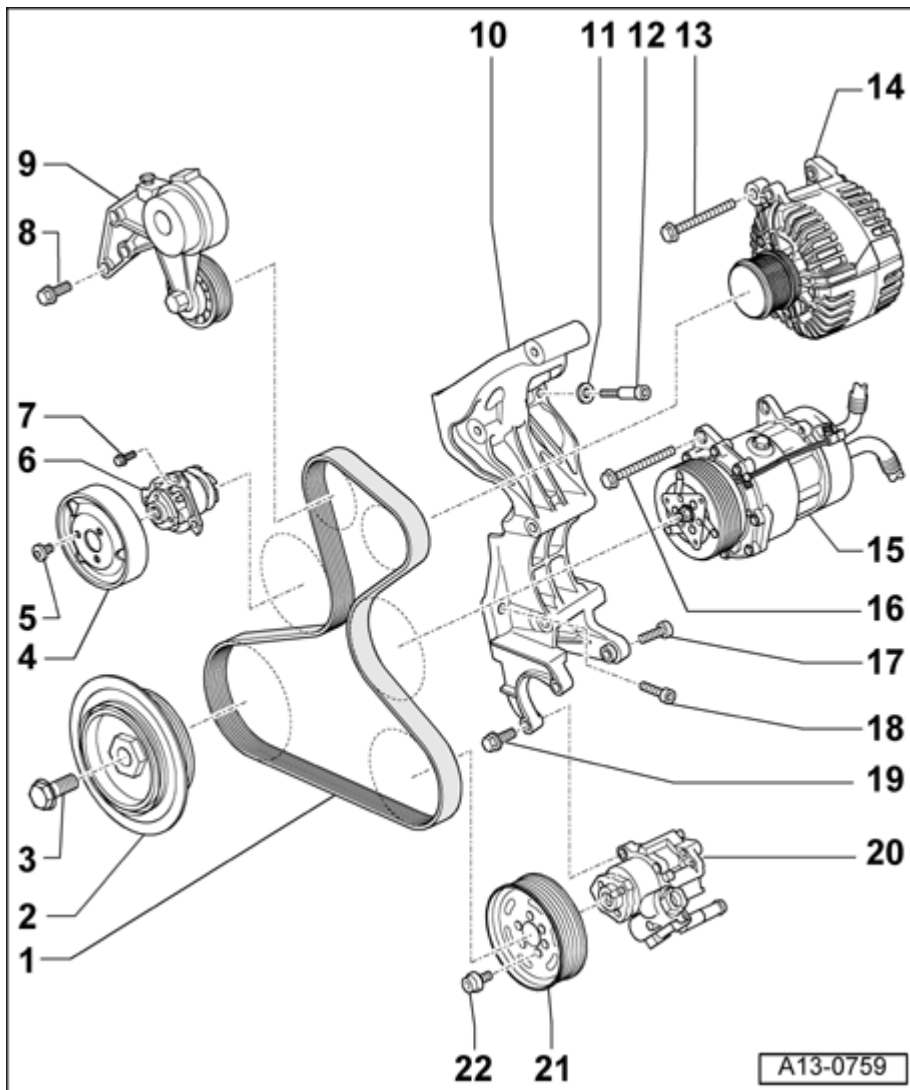


Fig. 89: Poly V-Belt, Component Overview

Courtesy of VOLKSWAGEN UNITED STATES, INC.

NOTE: Before removing, mark the direction of rotation of the poly V-belt with chalk or a fel-tipped pen. If the belt runs in the opposite direction when it is reinstalled, this can cause breakage. Ensure that the belt is properly seated in the pulleys when installing.

1 - Poly V-belt

- Poly V-belt routing. See [Poly V-belt routing](#)
- Check for wear
- Do not kink
- Removing and installing. Refer to [Poly V-belt, removing and installing](#)

2 - Vibration damper

- With pulley for poly V-belt
- Removing and installing. Refer to **Vibration damper, removing and installing**

3 - 100 Nm + 90° (1/4 turn) further

- Replace
- Use counterhold tool T10069 to loosen and tighten

4 - Pulley for coolant pump**5 - 20 Nm****6 - Coolant pump**

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

7 - 8 Nm**8 - 23 Nm****9 - Tensioner for poly V-belt**

- To release tension of poly V-belt, screw a bolt M8 x 40 into bore on tensioning element

10 - Bracket for ancillary units

- Removing and installing. Refer to **Bracket for ancillary units, removing and installing**

11 - Washer**12 - Dowel bolt, 23 Nm**

- 2x
- Tightening sequence. Refer to **Installing**

13 - 23 Nm**14 - Generator**

- Removing and installing

Refer to 27 BATTERY, STARTER, GENERATOR, CRUISE CONTROL

- To facilitate attachment of Generator, slightly drive back threaded bushing for Generator securing bolts.

15 - Air conditioning compressor

- Do not unscrew or disconnect refrigerant hoses or lines
- To facilitate attachment of air conditioning compressor, slightly drive back threaded bushing for compressor securing bolts.

16 - 45 Nm

17 - 23 Nm

18 - 23 Nm

- 3x
- Tightening sequence. Refer to **Installing**

19 - 23 Nm

20 - Power steering pump

- Removing and installing:

Refer to **48 STEERING**

- To facilitate attachment of power steering pump, slightly drive back threaded bushing for pump securing bolts.

21 - Pulley for power steering pump

22 - 23 Nm

Poly V-belt routing

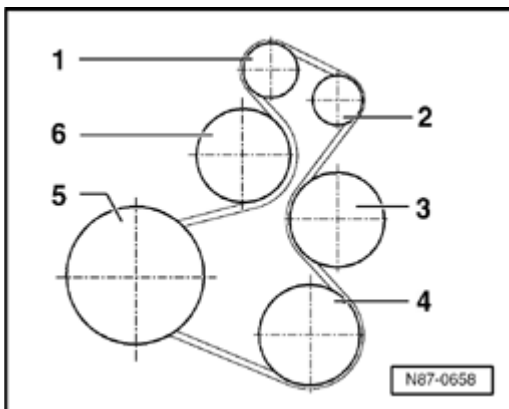


Fig. 90: Poly V-Belt Routing

Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Tensioning roller

- 2 - Poly V-belt for Generator
- 3 - Poly V-belt pulley for air conditioning compressor
- 4 - Poly V-belt pulley for power steering pump
- 5 - Vibration damper/poly V-belt pulley
- 6 - Poly V-belt pulley for coolant pump

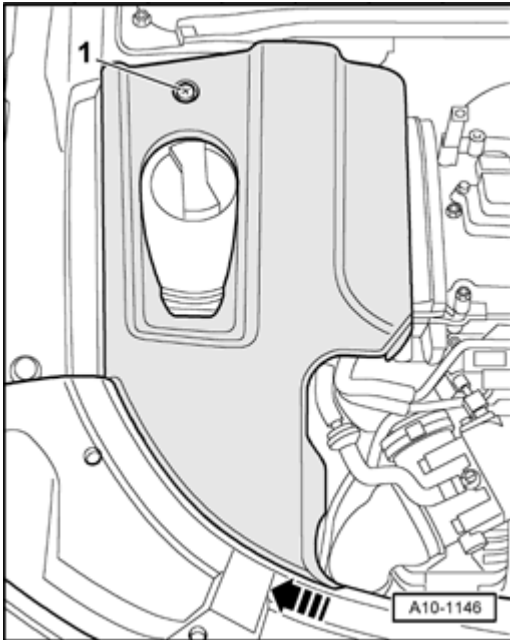
Poly V-belt, removing and installing**Removing**

Fig. 91: Removing Screw And Coolant Expansion Tank Cover

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove screw -1- and remove cover over coolant expansion tank (arrow).

NOTE: Before removing, mark the direction of rotation of the poly V-belt with chalk or a fel-tipped pen. If the belt runs in the opposite direction when it is reinstalled, this can cause breakage. Ensure that the belt is properly seated in the pulleys when installing.

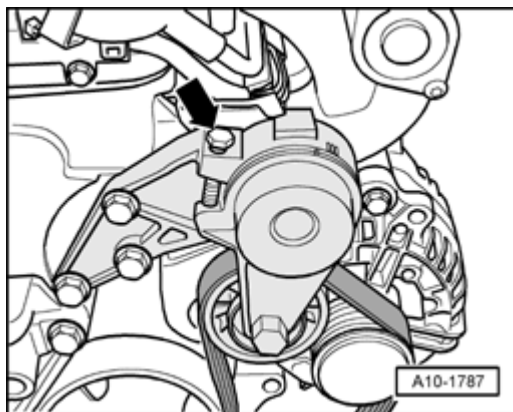


Fig. 92: Screwing Into Bore On Tensioning Element
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- To release tension of poly V-belt, screw an M8 x 40 bolt (arrow) into bore on tensioning element.
- Remove poly V-belt from Generator pulley.

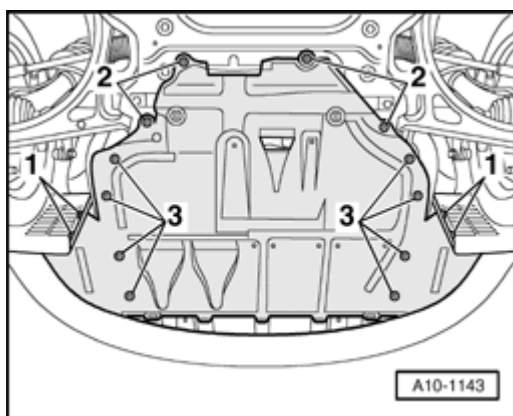


Fig. 93: Identifying Center Sound Insulation Fasteners
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove fasteners -1...3- and center sound insulation.

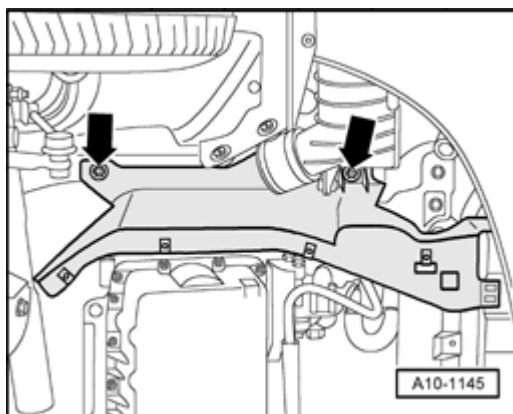


Fig. 94: Removing Right Sound Insulation

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove right sound insulation (arrows).
- Remove poly V-belt from remaining pulleys.

Installation is performed in reverse order of removal. Note the following:

NOTE: Before installing the poly V-belt ensure that all mechanical units (Generator, air conditioning compressor, power steering pump) are tightened.

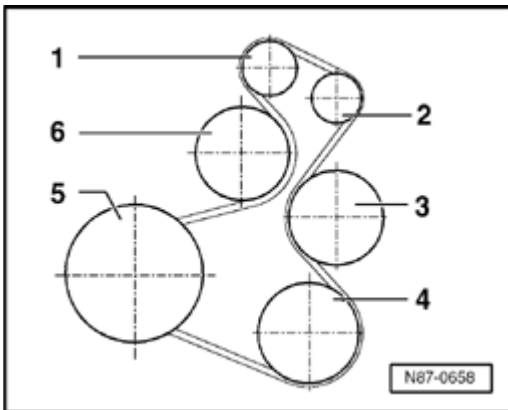


Fig. 95: Poly V-Belt Routing

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Place poly V-belt on pulleys in following order: -1...6-

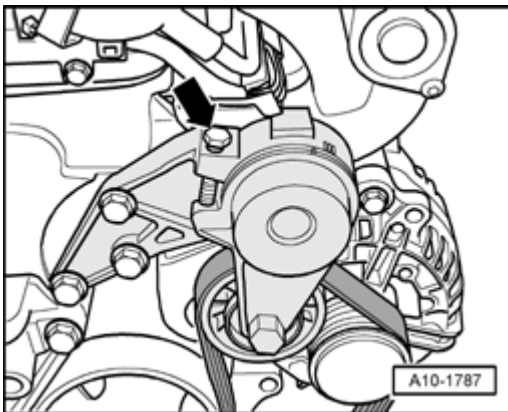


Fig. 96: Screwing Into Bore On Tensioning Element

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Release tension of tensioning element as necessary by loosening bolt (arrow).
- Check poly V-belt for proper seating.
- Start engine and check that belt runs properly.

Vibration damper, removing and installing

Special tools and equipment required

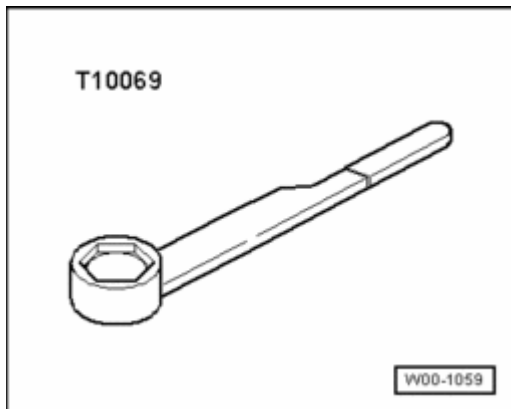


Fig. 97: Identifying Counter-Holder Tool T10069
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Counterhold T10069

Removing

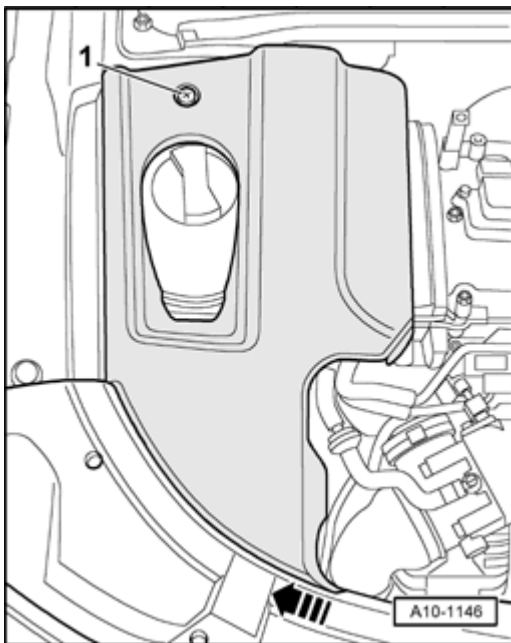


Fig. 98: Removing Screw And Coolant Expansion Tank Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove screw -1- and remove cover over coolant expansion tank (arrow).

NOTE: Before removing, mark the direction of rotation of the poly V-belt with chalk or a fel-tipped pen. If the belt runs in the opposite direction when it is reinstalled, this can cause breakage. Ensure that the belt is properly seated in the pulleys

when installing.

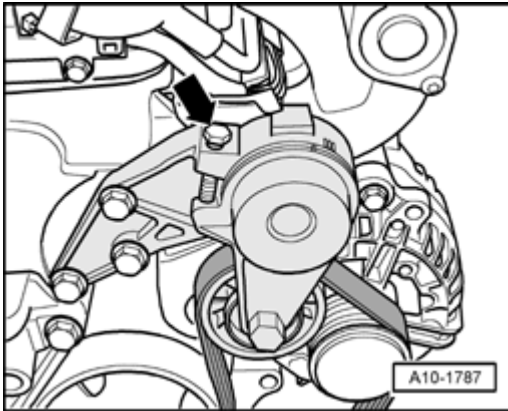


Fig. 99: Screwing Into Bore On Tensioning Element
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- To release tension of poly V-belt, screw an M8 x 40 bolt (arrow) into bore on tensioning element.
- Remove poly V-belt from Generator pulley.

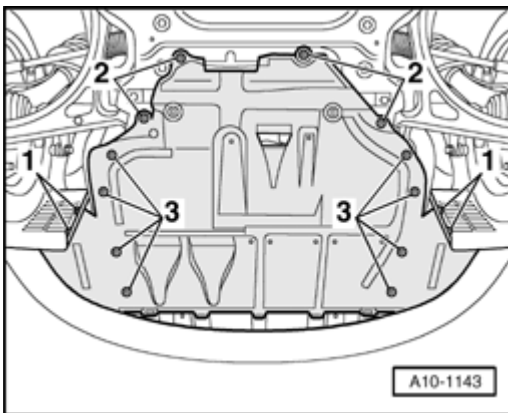
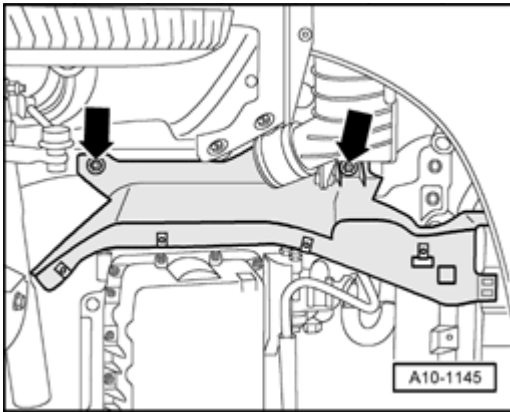


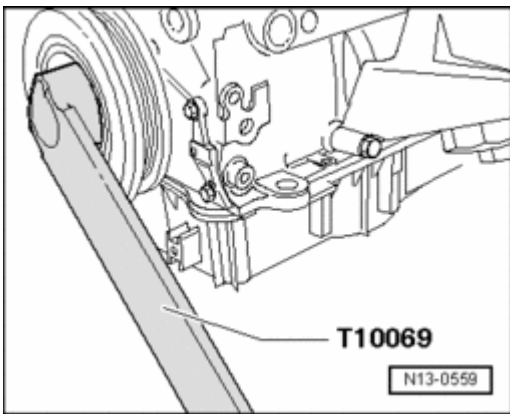
Fig. 100: Identifying Center Sound Insulation Fasteners
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove fasteners -1...3- and center sound insulation.

**Fig. 101: Removing Right Sound Insulation**

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove right sound insulation (arrows).
- Remove poly V-belt from pulley for vibration damper.

**Fig. 102: Loosening/Tightening Securing Bolt, Using Counter-Holder T10069 To Hold Vibration Damper**

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolt for vibration damper using counterhold T10069.

Installation is performed in reverse order. Note the following:

- Use a new bolt and counterhold tool T10069 to install vibration damper.
- Install poly V-belt. Refer to **Poly V-belt, removing and installing.**

Tightening torque

Component	Nm
Vibration damper to crankshaft	100 + 90° 1)2)

1) Replace bolt

2) 90° equals one quarter turn

Bracket for ancillary units, removing and installing

Removing

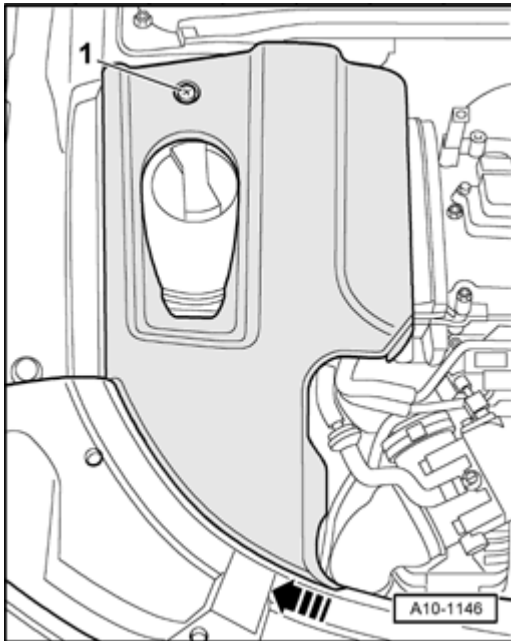


Fig. 103: Removing Screw And Coolant Expansion Tank Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove screw -1- and remove cover over coolant expansion tank (arrow).

NOTE: Before removing, mark the direction of rotation of the poly V-belt with chalk or a fel-tipped pen. If the belt runs in the opposite direction when it is reinstalled, this can cause breakage. Ensure that the belt is properly seated in the pulleys when installing.

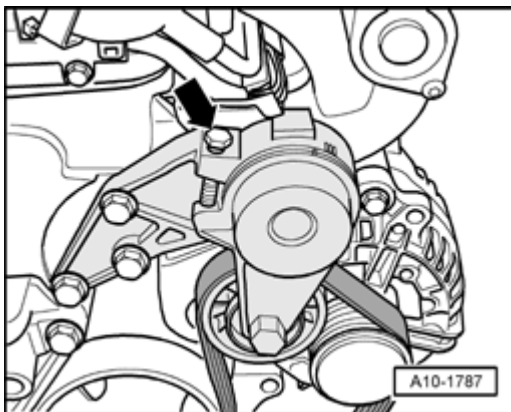


Fig. 104: Screwing Into Bore On Tensioning Element
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- To release tension of poly V-belt, screw an M8 x 40 bolt (arrow) into bore on tensioning element.
- Remove poly V-belt from Generator pulley.

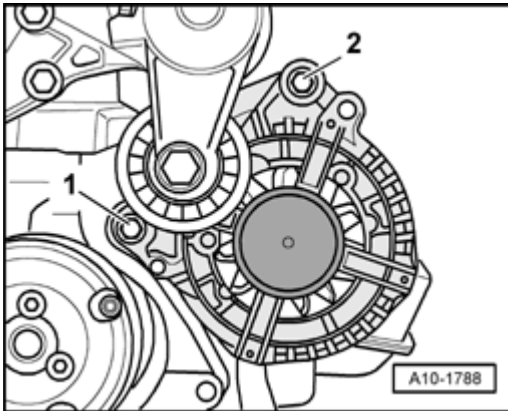


Fig. 105: Removing Upper/Lower Securing Bolt For Generator
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove upper securing bolt -2- for Generator.

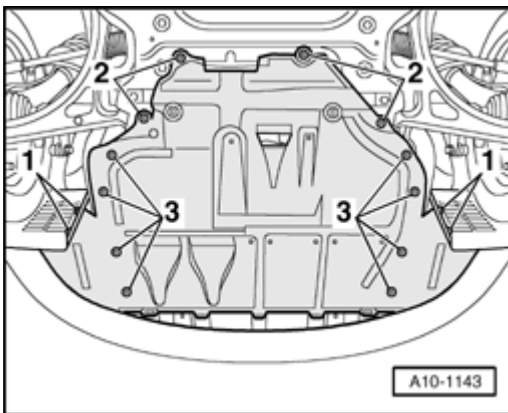


Fig. 106: Identifying Center Sound Insulation Fasteners
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove fasteners -1...3- and remove center sound insulation.

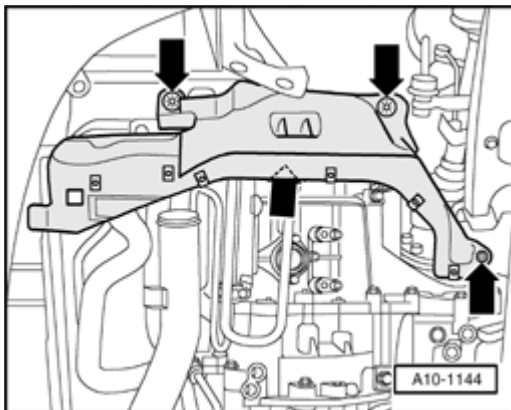


Fig. 107: Left Sound Insulation Panel

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove left sound insulation (arrows).

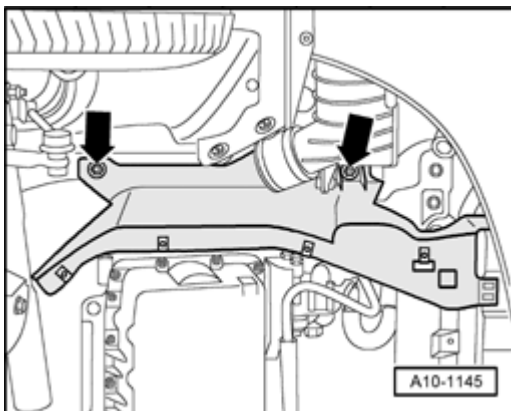


Fig. 108: Removing Right Sound Insulation

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove right sound insulation (arrows).

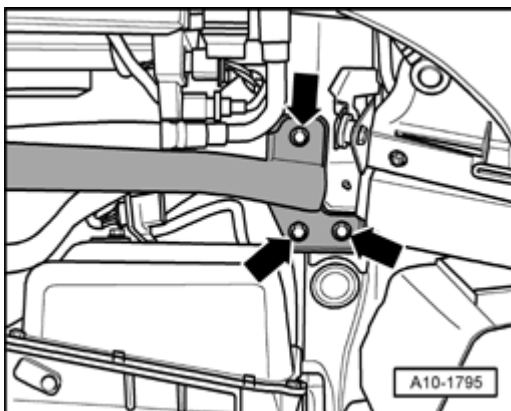


Fig. 109: Removing Cross Piece

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove cross piece (arrows).
- Unbolt pulley for power steering pump (counterhold with mandrel).

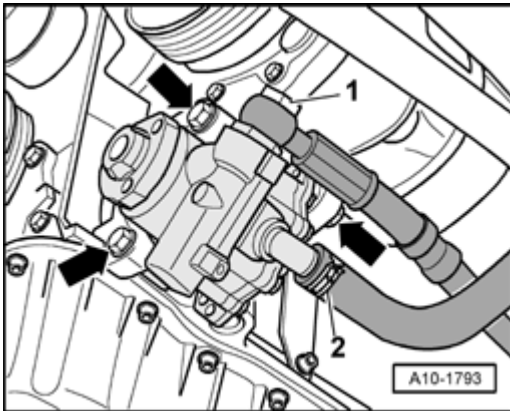


Fig. 110: Removing Bolts And Power Steering Pump From Bracket
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts (arrows) and remove power steering pump from bracket.
- Hang power steering pump on lock carrier with hydraulic hoses -1- and -2- attached.

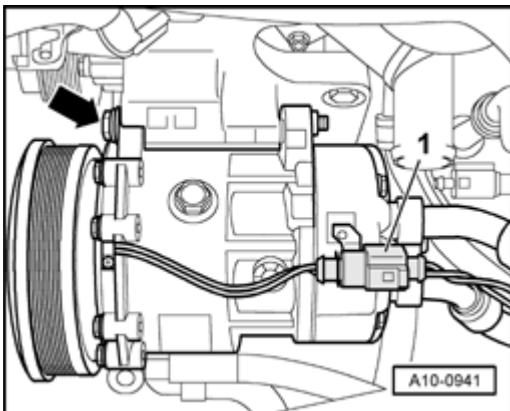


Fig. 111: Disconnecting Electrical Connector For Air Conditioning Compressor Clutch
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical connector -1- for air conditioning compressor clutch.

CAUTION: The refrigerant circuit of the air conditioning system must not be opened.

NOTE: The air conditioning compressor can only be removed from the bracket with the upper securing bolt still inserted. To do so, press the engine simultaneously to the left side with an assembly lever (2nd technician required). If required, loosen all bolts of the assembly mounting 1 turn.

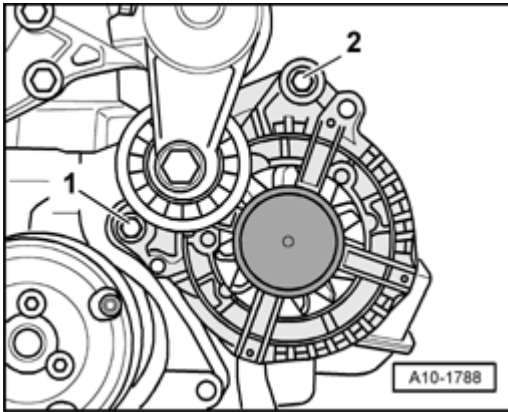


Fig. 112: Removing Upper/Lower Securing Bolt For Generator
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts (arrows) and air conditioning compressor.
- Tie up compressor together with refrigerant hoses at front longitudinal member (refrigerant hoses remain attached).
- Remove lower securing bolt -1- for Generator.
- Remove Generator from bracket for ancillary units (electrical wiring remains connected).

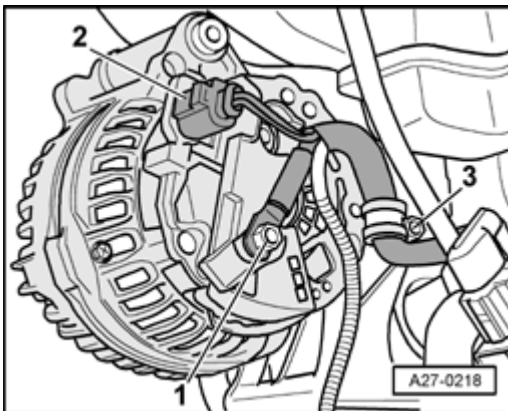


Fig. 113: Identifying Connector, Electrical Wire And Wiring Clamp On Generator
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unscrew clamp -3-.
- Disconnect wire -1- at Generator.
- Separate electrical connector -2-.
- Remove Generator.

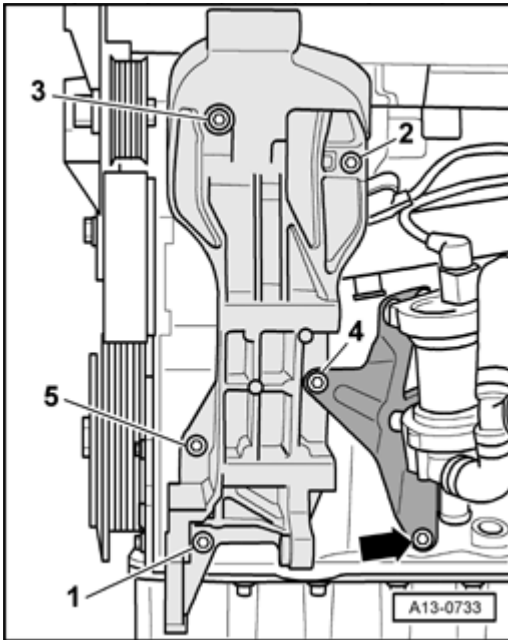


Fig. 114: Removing Bolt At Bracket For After-Run Coolant Pump -V51
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolt (arrow) at bracket for After-run coolant pump -V51-.
- Remove bolts -1...5- and take off bracket for ancillary units.

Installing

Installation is performed in the reverse order. Note the following:

NOTE: Bolts -1- and -2- are dowel bolts.

- Tighten bolts in sequence -1...5- initially only finger-tight.
- Then tighten bolts in sequence -1...5- to specified torque.
- Tighten bolt (arrow) at bracket for After-run coolant pump -V51-.
- Drive back respective bushings for securing bolts slightly to facilitate installation of Generator, power steering pump and air conditioning compressor.
- Install Generator.

Refer to **27 BATTERY, STARTER, GENERATOR, CRUISE CONTROL**

- Install air conditioning compressor.

Refer to **87 AIR CONDITIONING**

- Install power steering pump.
- Install cross piece.

Refer to **40 FRONT SUSPENSION**

- Install poly V-belt. Refer to **Poly V-belt, removing and installing.**

Component	Nm
Bracket for ancillary units to engine	25
Bracket for After-run coolant pump -V51- to cylinder block	20

SEALING FLANGES AND FLYWHEEL, REMOVING AND INSTALLING

Sealing flanges and flywheel, removing and installing

NOTE: **Secure the engine to an engine stand when performing assembly work. Refer to Engine, securing to engine stand.**

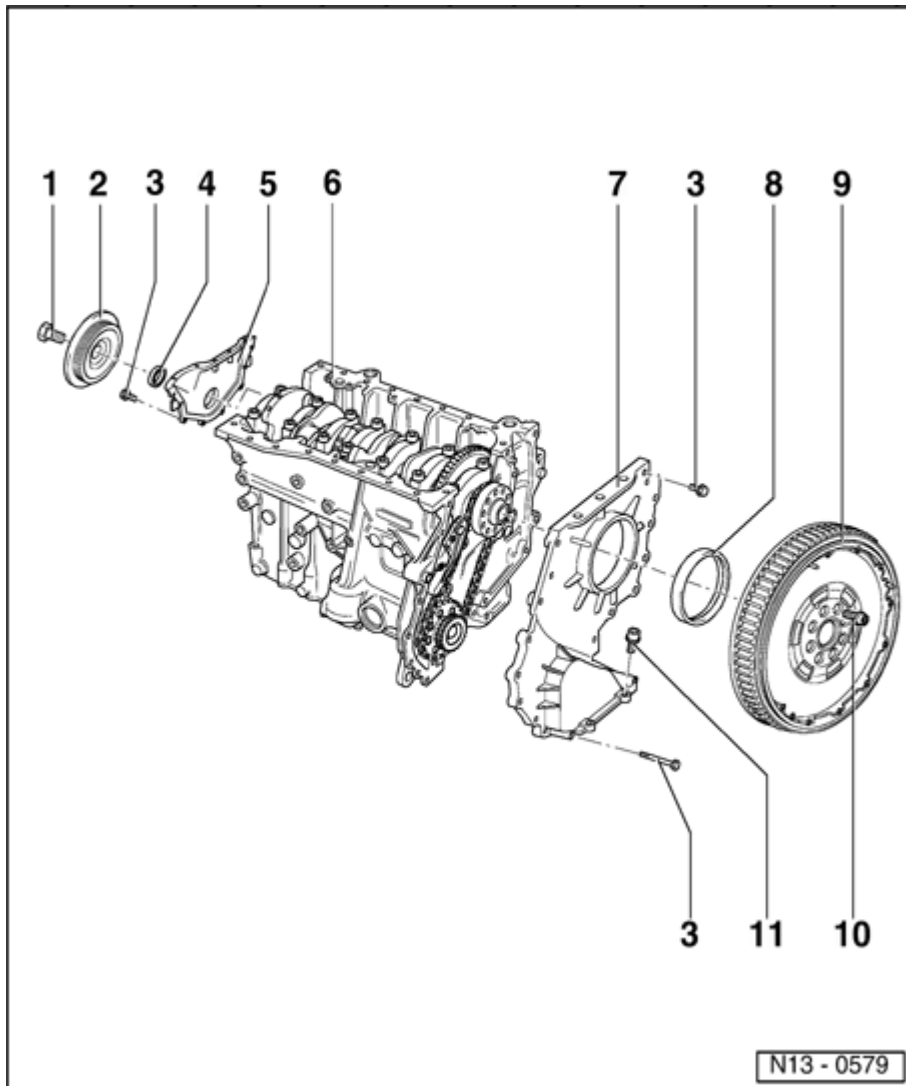


Fig. 115: Sealing Flanges And Flywheel, Removing And Installing Remove/Install Components
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - 100 Nm + 90° (1/4 turn) further

- Replace
- Use counterhold T10069 to loosen and tighten

2 - Vibration damper

- With pulley for poly V-belt
- Removing and installing. Refer to **Vibration damper, removing and installing**

3 - 10 Nm

4 - Oil seal

- Replace

5 - Front sealing flange

- Coat sealing surfaces with sealing paste when 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, component overview**

7 - Lower cover for timing chain

- Coat sealing surfaces with sealing paste when installing

8 - Oil seal

- Replace. Refer to **Crankshaft oil seal - timing chain end, replacing**

9 - Dual-mass flywheel

- Removing and installing. Refer to **Dual mass flywheel, removing and installing**

10 - 60 Nm + 90° (1/4 turn) further

- Replace

11 - 23 Nm

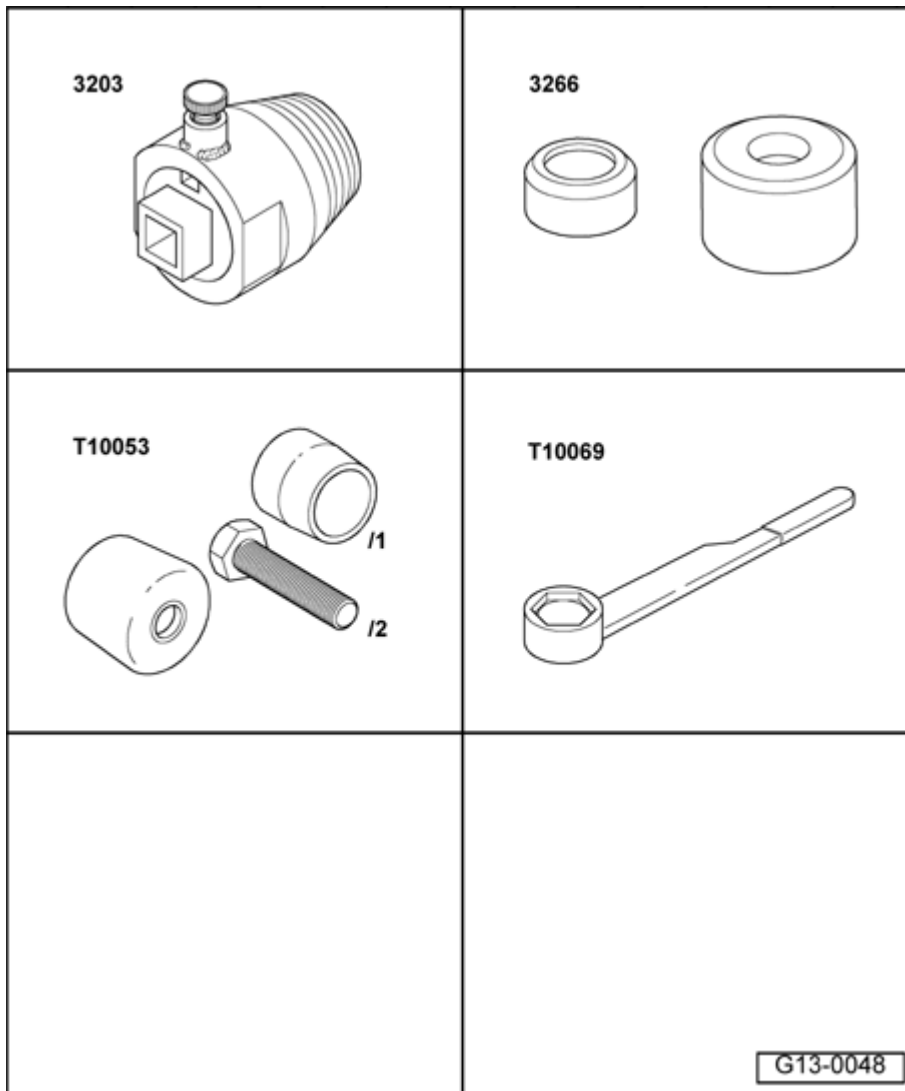
Crankshaft oil seal - vibration damper end, replacing

Fig. 116: Identifying Special Tools - Crankshaft Oil Seal - Vibration Damper End, Replacing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools and equipment required

- Oil seal extractor 3203
- Installation sleeves 3266
- Assembly tool T10053
- Counterhold tool T10069

Removing

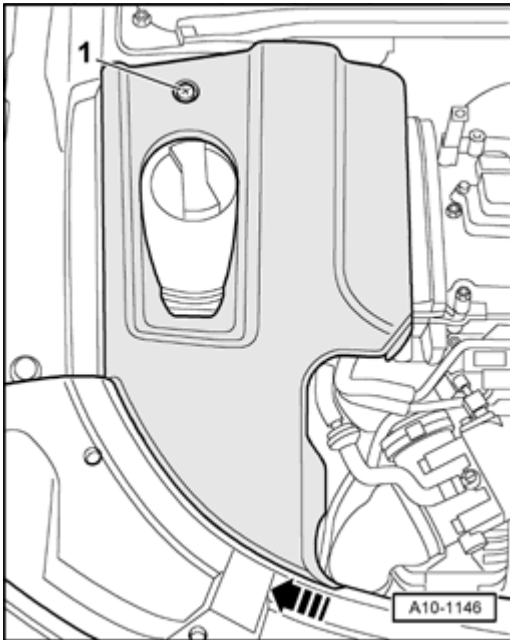


Fig. 117: Removing Screw And Coolant Expansion Tank Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove screw -1- and remove cover over coolant expansion tank (arrow).

NOTE: Before removing the poly V-belt, mark the direction of rotation on the belt with chalk or a felt-tipped pen. A reversed rotation direction can cause the belt to be damaged in operation. Ensure that the belt is properly seated in the pulleys when installing.

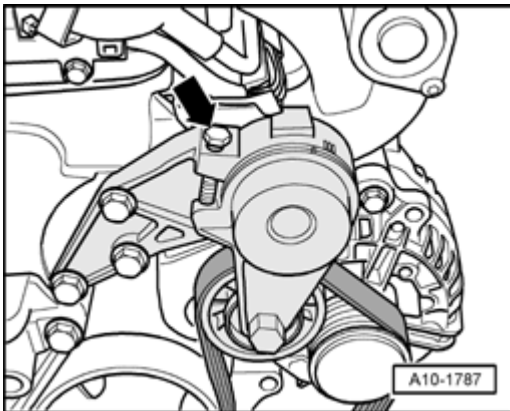


Fig. 118: Screwing Into Bore On Tensioning Element
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- To release tension of poly V-belt, screw an M8 x 40 bolt (arrow) into bore on tensioning element.
- Remove poly V-belt from Generator pulley.

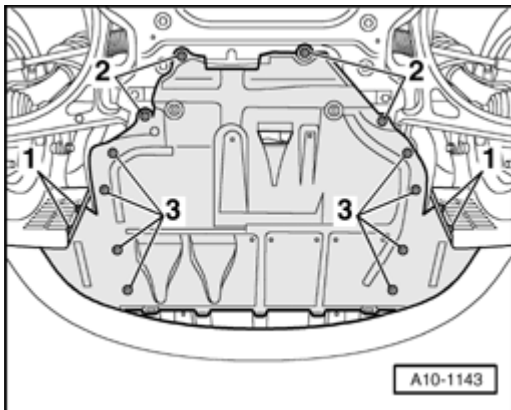


Fig. 119: Identifying Center Sound Insulation Fasteners
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove fasteners -1...3- and center sound insulation.

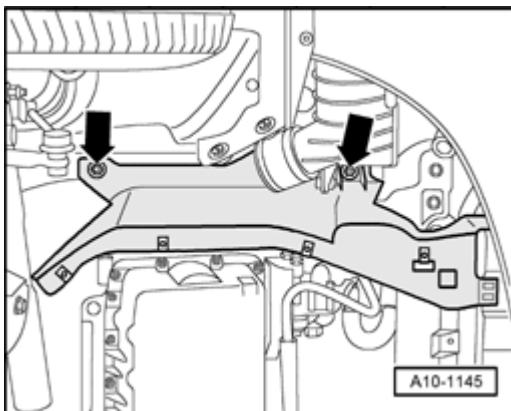


Fig. 120: Removing Right Sound Insulation
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove right sound insulation (arrows).
- Remove poly V-belt from pulley for vibration damper.

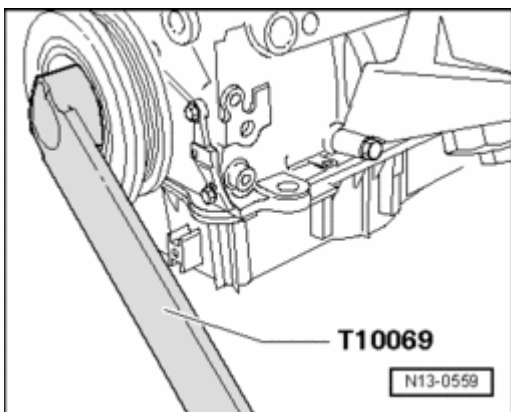


Fig. 121: Loosening/Tightening Securing Bolt, Using Counter-Holder T10069 To Hold Vibration Damper

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolt for vibration damper using counterhold T10069.

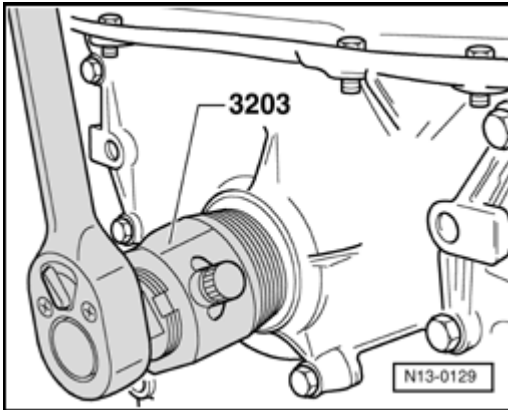


Fig. 122: Identifying Oil Seal Remover 3203

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unscrew inner section of oil seal extractor 3203 3 turns (approx. 4 mm) out of outer section and lock with knurled screw.
- Lubricate threaded head of oil seal extractor, place it in position and, exerting firm pressure, screw it into oil seal as far as possible.
- Loosen knurled screw and turn inner part against crankshaft until oil seal is pulled out.
- Clamp flats of oil seal extractor in vise. Remove oil seal with pliers.
- Clean running surface and sealing surface.

Installing

NOTE: Do not lubricate the oil seal before installing.

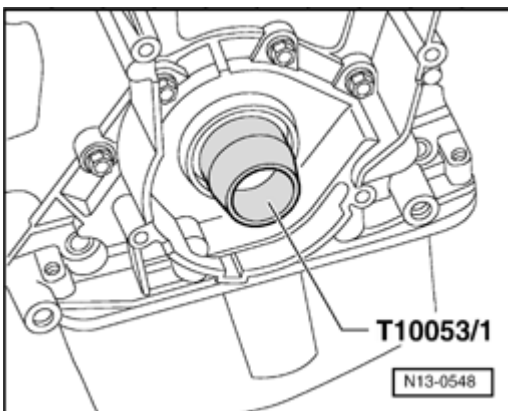


Fig. 123: Identifying Guide Sleeve T10053/1 Mounted Onto Crankshaft Journal

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Place guide sleeve T10053/1 onto crankshaft journal.
- Push oil seal carefully over guide sleeve onto crankshaft journal as far as possible.
- Remove guide sleeve.

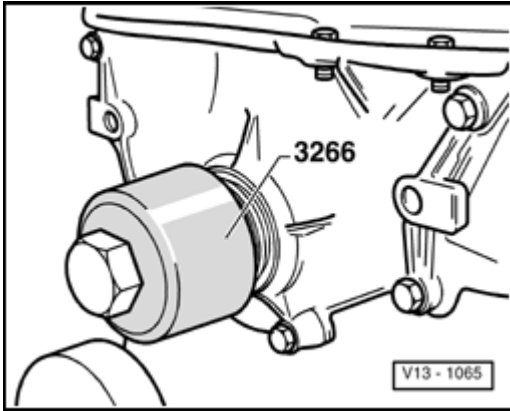


Fig. 124: Sealer Installer 3266

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Press oil seal in as far as stop using old securing bolt for vibration damper and installation sleeve from 3266.
- Install vibration damper with new securing bolt. Refer to **Vibration damper, removing and installing**.
- Install poly V-belt. Refer to **Poly V-belt, removing and installing**.

Front sealing flange, removing and installing

Special tools, testers and auxiliary items required

- Sealant

Removing

- Engine installed

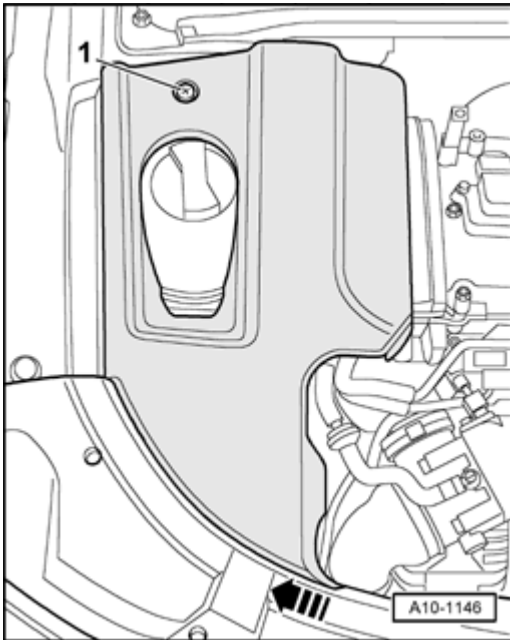


Fig. 125: Removing Screw And Coolant Expansion Tank Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove screw -1- and remove cover over coolant expansion tank (arrow).

NOTE: Before removing the poly V-belt, mark the direction of rotation on the belt with chalk or a felt-tipped pen. A reversed rotation direction can cause the belt to be damaged in operation.

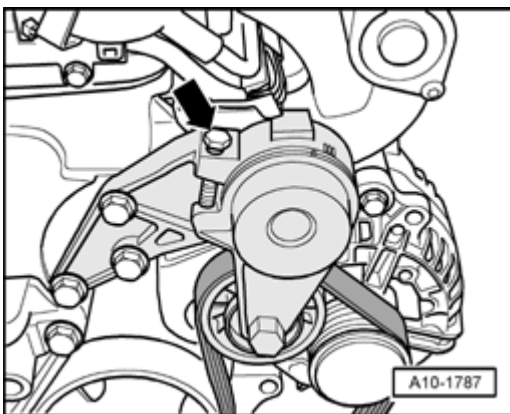


Fig. 126: Screwing Into Bore On Tensioning Element
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- To release tension of poly V-belt, screw an M8 x 40 bolt (arrow) into bore on tensioning element.
- Remove poly V-belt from Generator pulley.

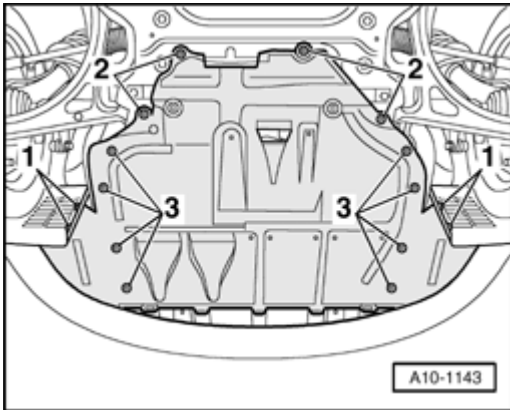


Fig. 127: Identifying Center Sound Insulation Fasteners
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove fasteners -1...3- and center sound insulation.

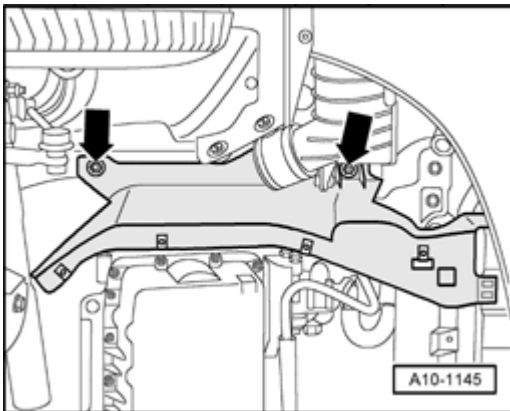


Fig. 128: Removing Right Sound Insulation
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove right sound insulation (arrows).
- Remove poly V-belt from pulley for vibration damper.

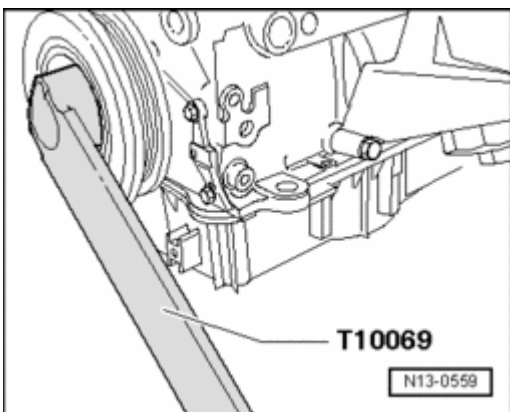


Fig. 129: Loosening/Tightening Securing Bolt, Using Counter-Holder T10069 To Hold Vibration Damper

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolt from vibration damper using counter-hold T10069.

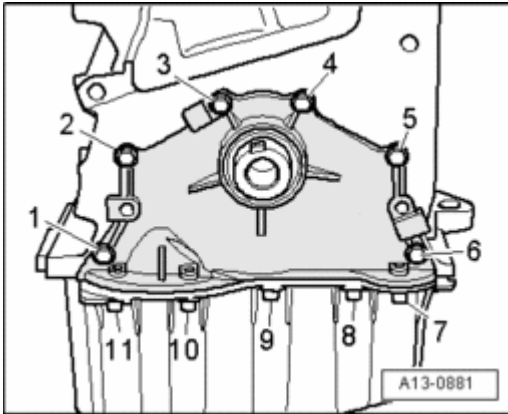


Fig. 130: Identifying Sealing Flange Bolts

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts -1...11-.
- Pry off and remove front sealing flange.
- Drive seal out of removed flange.

Installing

Installation is performed in the reverse order of removal. Note the following:

NOTE: Place a rag over the open portion of the oil sump

WARNING: Wear safety glasses.

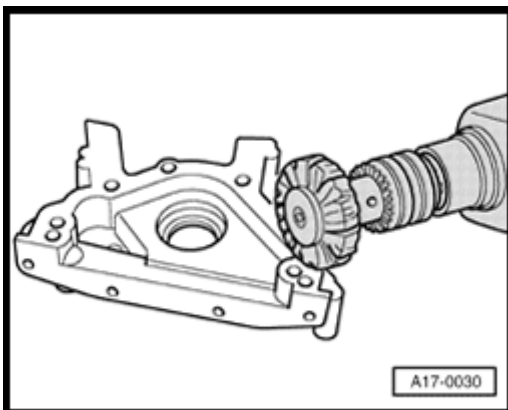


Fig. 131: Removing Sealant Remains On Sealing Flange With A Rotating Plastic Brush

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove residual sealant from sealing flange with a rotating plastic brush.
- Clean sealing surfaces. They must be free of oil and grease.

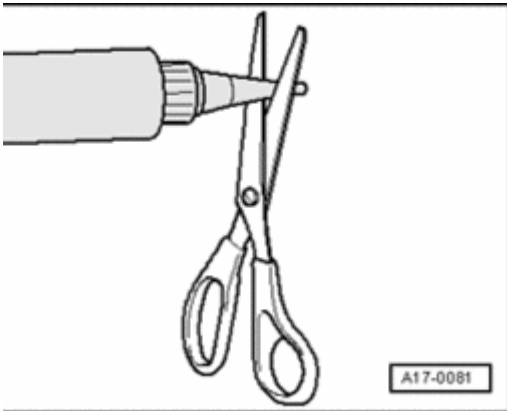


Fig. 132: Cutting Tube Nozzle At Front Marking
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Cut off nozzle on tube of sealant at front mark (diameter of nozzle approx. 3 mm).

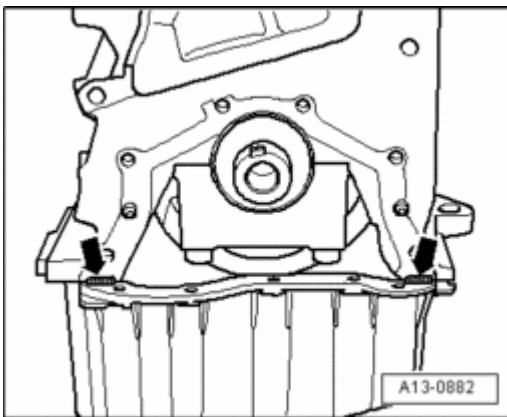


Fig. 133: Applying Thin Bead Of Sealant To Edge Between Cylinder Block And Oil Sump
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Apply a thin bead of sealant to edge between cylinder block and oil sump (arrow).

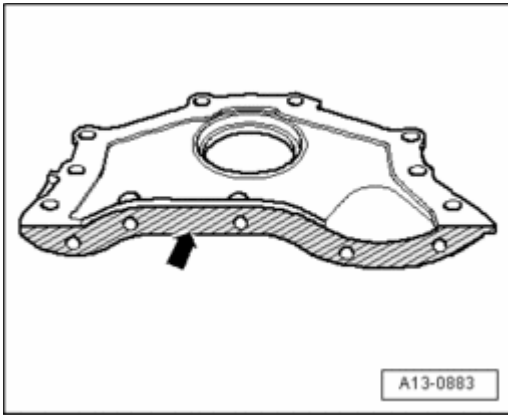


Fig. 134: Lightly Coating Lower Sealing Surface Of Sealing Flange With Sealant
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Lightly coat lower sealing surface of sealing flange with sealant (shaded area).

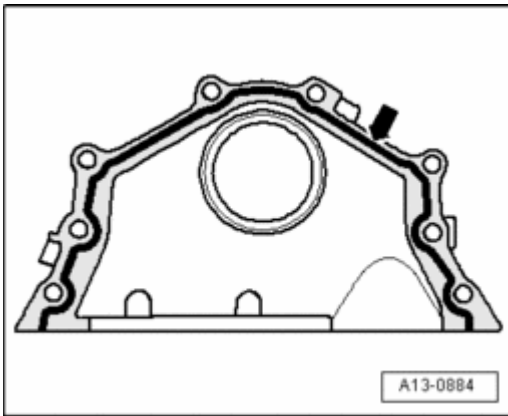


Fig. 135: Applying Thin Bead Of Sealant To Clean Sealing Surface Of Sealing Flange
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Apply a thin bead of sealant (arrow) to clean sealing surface of sealing flange, as shown in illustration.
- Thickness of sealant bead (arrow): 2 to 3 mm

NOTE:

- The sealant bead may not be thicker than 2 to 3 mm. If thicker, the excess sealant could enter the oil sump and clog the oil intake tube.
- The sealing flange must be installed within 5 minutes of applying the sealant.

- Carefully push sealing flange onto locating pins on cylinder block.

NOTE:

To install the sealing flange with an installed seal, use guide sleeve T10053/1.

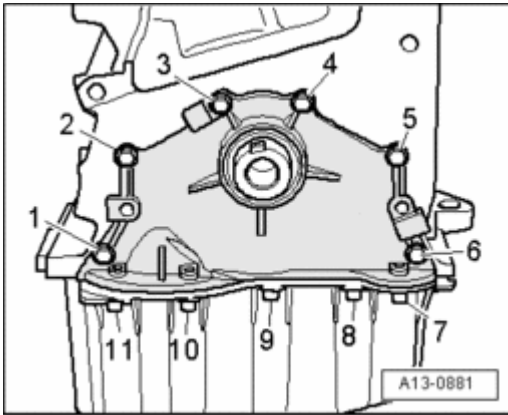


Fig. 136: Identifying Sealing Flange Bolts Tightening Sequence
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Fasten bolts in specified order:
- Fasten bolts -1...6-.
- Fasten bolts -7...16-.
- Install crankshaft seal for vibration damper side. Refer to **Crankshaft oil seal - vibration damper end, replacing.**
- Install vibration damper with new bolt. Refer to **Vibration damper, removing and installing.**
- Install poly V-belt. Refer to **Poly V-belt, removing and installing..**

Tightening torque

Component	Nm
Sealing flange to cylinder block	10

Timing chain covers & dual mass flywheel, assembly overview

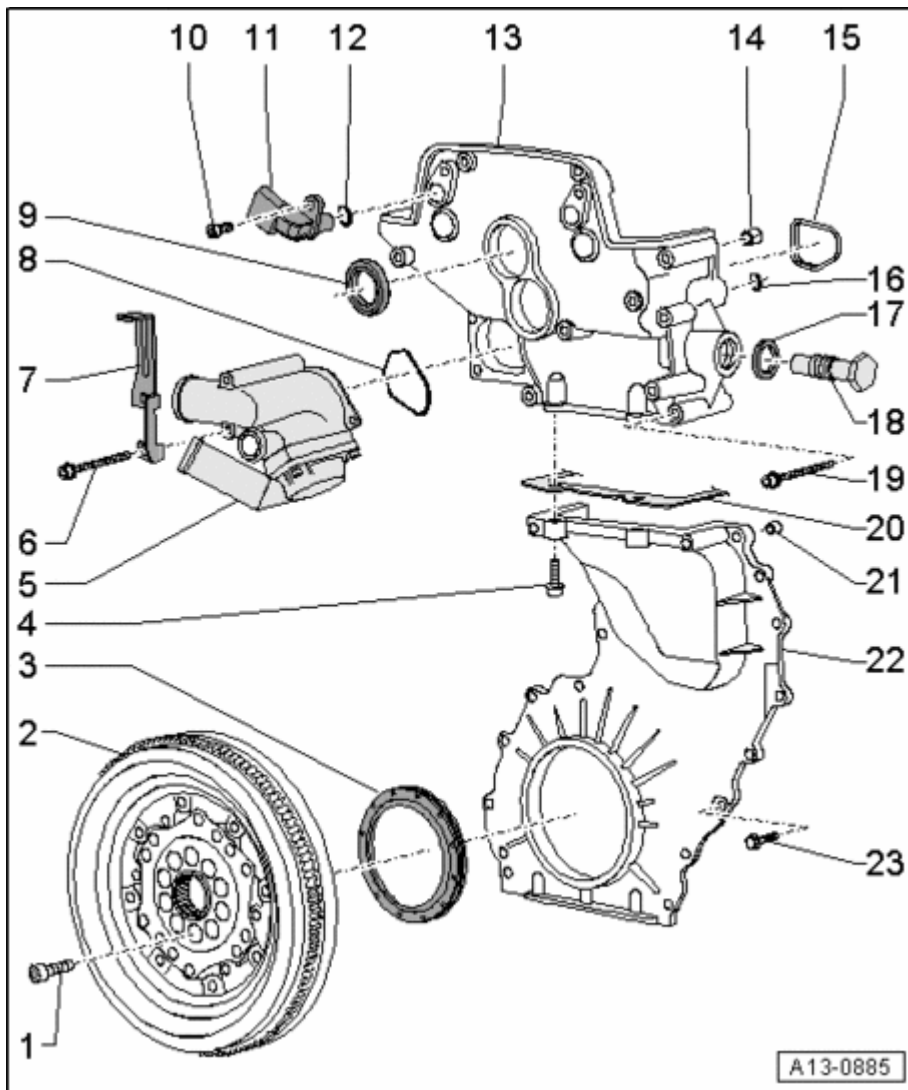


Fig. 137: Timing Chain Covers & Dual Mass Flywheel, Assembly Overview
Courtesy of VOLKSWAGEN UNITED STATES, INC.

NOTE: To perform assembly work, secure engine to engine stand. Refer to Engine, securing to engine stand.

1 - 60 Nm + 90° (1/4 turn) further

- Replace

2 - Dual-mass flywheel

- Removing and installing. Refer to Dual mass flywheel, removing and installing

3 - Seal

- Replace. Refer to Crankshaft oil seal - timing chain end, replacing

4 - 23 Nm

- Tightening order. Refer to **Drive chain for valve gear and camshaft timing chain, removing and installing**

5 - Thermostat housing

- Removing and installing. Refer to **Thermostat housing, removing and installing**

6 - 10 Nm**7 - Secondary air hose retainer****8 - Gasket**

- Replace

9 - Seal

- 2 pieces
- For Valve -1- for camshaft adjustment -N205- and Camshaft adjustment valve 1 (exhaust) -N318-
- Removing and installing. Refer to **Oil seals in upper cover for camshaft timing chain, removing and installing**

10 - 10 Nm**11 - Camshaft position sensor**

- 2 pieces
- Mark electrical connector before disconnecting

12 - O-ring

- 2 pieces
- Replace

13 - Upper timing chain cover

- Coat sealing surfaces with sealant when installing

14 - Guide sleeve

- 2 pieces

15 - Gasket

- Replace

16 - O-ring

- Replace

17 - Seal

- Replace

18 - Chain tensioner for camshaft timing chain

- Fasten to 40 Nm

19 - 10 Nm

- Tightening order. Refer to **Drive chain for valve gear and camshaft timing chain, removing and installing**

20 - Cylinder head gasket

- Clean holes and fill with sealing compound. Refer to **Camshaft timing chain, removing from camshafts**

21 - Guide pin**22 - Lower timing chain cover**

- Coat sealing surfaces with sealant.

23 - 10 Nm

- Fasten diagonally in steps

Dual mass flywheel, removing and installing**Special tools and equipment required**

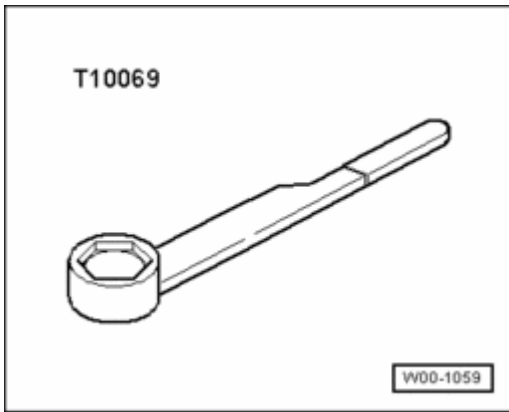


Fig. 138: Identifying Counter-Holder Tool T10069
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Counterhold T10069

Removing

- Transmission removed
 - Mark installation position of flywheel on engine.

NOTE: To prevent damage to the dual-mass flywheel when removing, the bolts -B- must not be removed with an impact wrench or similar. Removing the bolts must be done by hand with conventional tools.

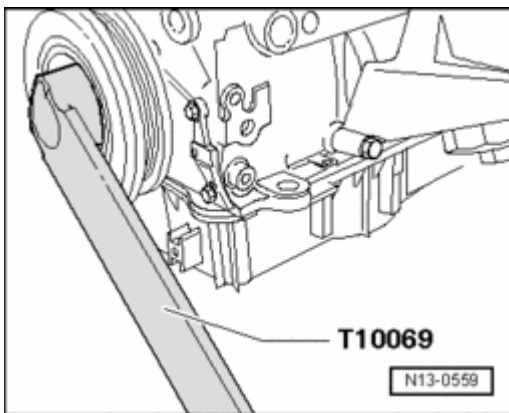


Fig. 139: Loosening/Tightening Securing Bolt, Using Counter-Holder T10069 To Hold Vibration Damper
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Rotate dual-mass flywheel -A- so that bolts align with holes (arrows).

NOTE: When removing the bolts, make sure that the bolt heads do not come into contact with the dual-mass flywheel. The flywheel will otherwise be damaged as the bolts are unscrewed.

- Unbolt dual-mass flywheel (counterhold on vibration damper with T10069).

Installing

Installation is performed in the reverse order. Note the following.

NOTE: Use new bolts for securing the flywheel.

Tightening torque

Component	Nm
Dual-mass flywheel to crankshaft	60 + 90° 1)2)

Crankshaft needle bearing, removing and installing

Special tools and equipment

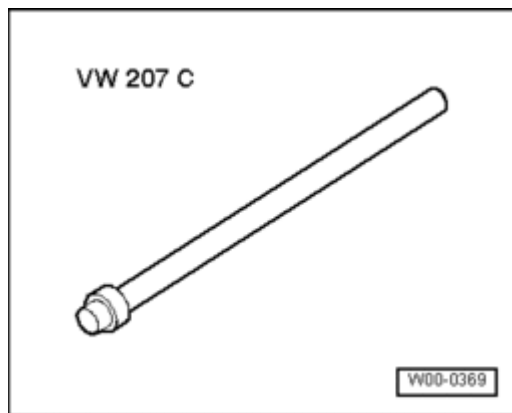


Fig. 140: Identifying Drift VW 207 C
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Drift VW 207 C or centering drift 3176

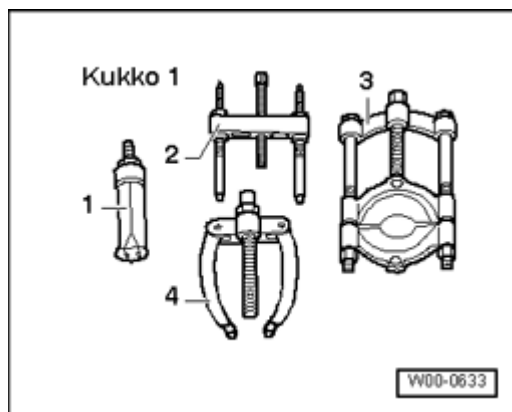


Fig. 141: Identifying Kukko Tools

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- 1 - Kukko 21/1 interior extractor
- 4 - Kukko 22/1 counterhold
- Depth gauge

Removing

- Transmission removed

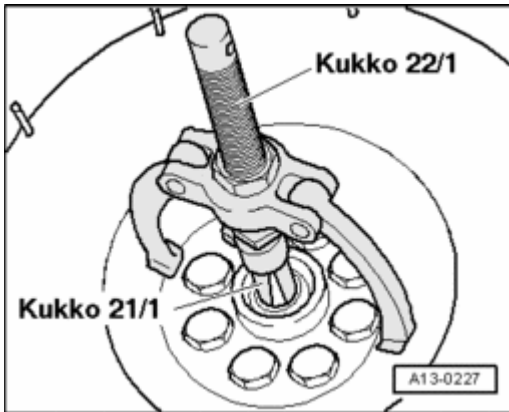


Fig. 142: Removing Needle Bearing Using Internal Extractor Kukko 21/1 And Counterhold Kukko 22/1
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove needle bearing using internal extractor Kukko 21/1 and counterhold Kukko 22/1.

Installing

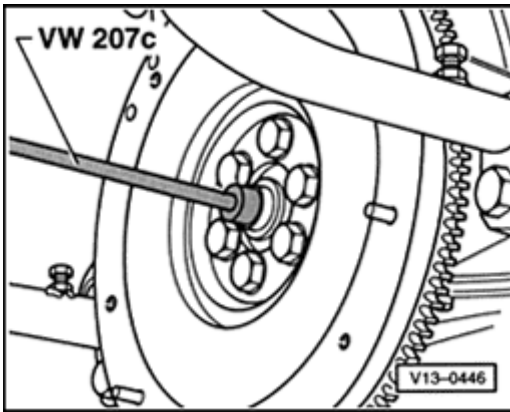


Fig. 143: Driving In Needle Bearing Using Drift VW 207 C Or Centering Mandrel 3176
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Drive in needle bearing using drift VW 207 C or centering drift 3176.

Inscription on needle bearing must be visible when installed.

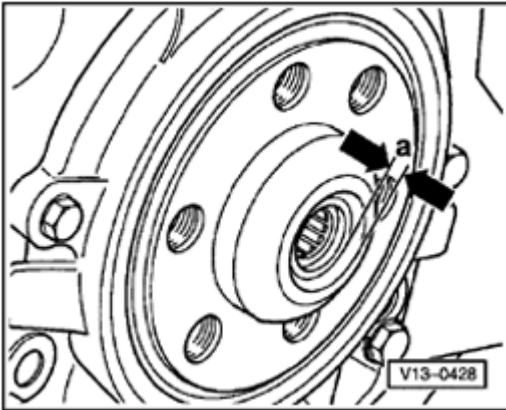


Fig. 144: Installation Depth Of Needle Bearing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Installed position for needle bearing:

- Dimension -a- = 2.0 mm

Crankshaft oil seal - timing chain end, replacing

Special tools and equipment

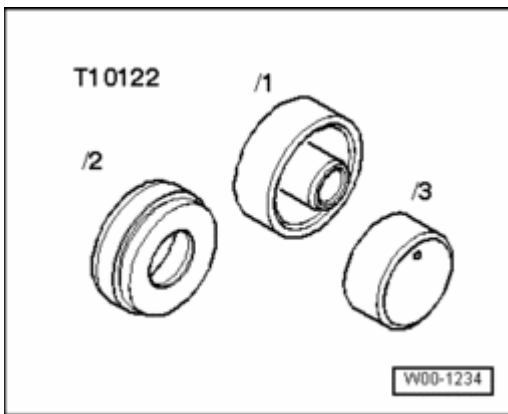


Fig. 145: Identifying Installation Tool T10122
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Installation tool T10122

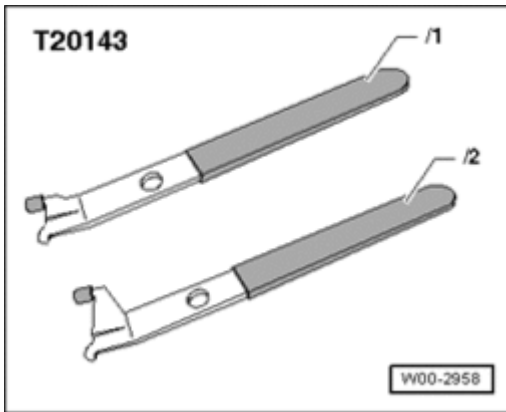


Fig. 146: Identifying Pressing-Out Tool T20143/2
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Pressing-out tool T20143/2

Work sequence

- Transmission removed

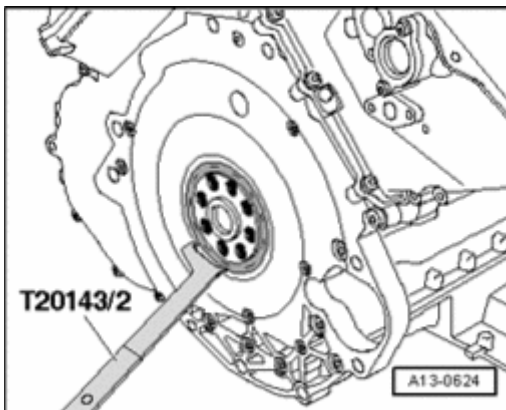


Fig. 147: Removing Dual-Mass Flywheel
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove dual-mass flywheel. Refer to **Dual mass flywheel, removing and installing.**

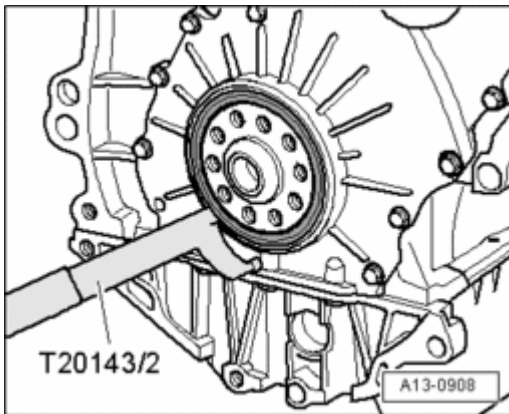


Fig. 148: Prying Out Oil Seal Using Pressing-Out Tool T20143/2
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Pry out oil seal using pressing-out tool T20143/2.
- Clean running surface and sealing surface.

NOTE: Do not lubricate the oil seal before installing.

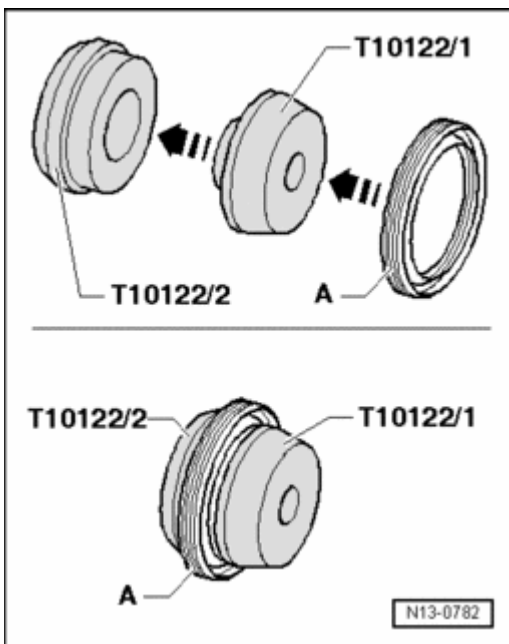


Fig. 149: Identifying Seal, Sleeve T10122/1 And Assembly Tool T10122/2
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Press new oil seal -A- over installation sleeve T10122/1 onto guide sleeve T10122/2.
- Installed position: closed side faces installation sleeve
- Separate both sleeves.

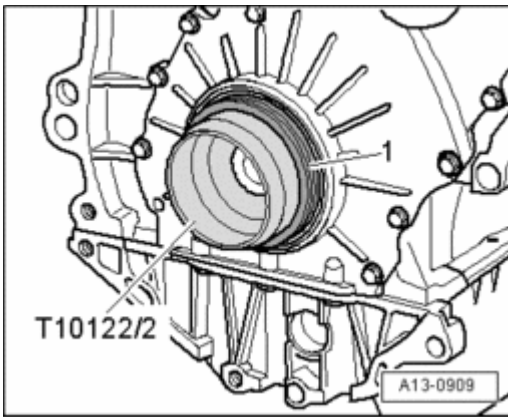


Fig. 150: Inserting Guide Sleeve T10122/2 With Oil Seal Onto Crankshaft
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Insert guide sleeve T10122/2 with oil seal -1- onto crankshaft.

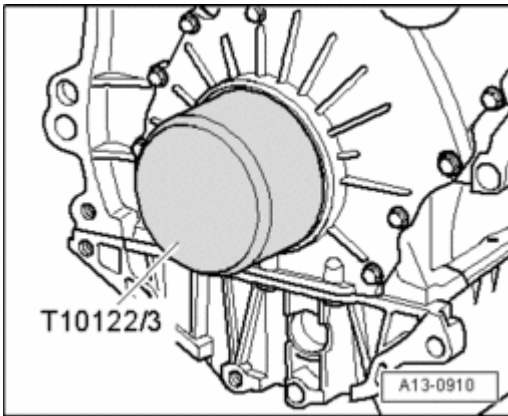


Fig. 151: Pressing In Oil Seal With Press Tool T10122/3 Evenly And Flush
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Press in oil seal with press tool T10122/3 evenly and flush.

Perform further installation in reverse order. Note the following:

- Install dual-mass flywheel. Refer to **Dual mass flywheel, removing and installing.**

CAMSHAFT DRIVE

Upper cover for camshaft timing chain, component overview

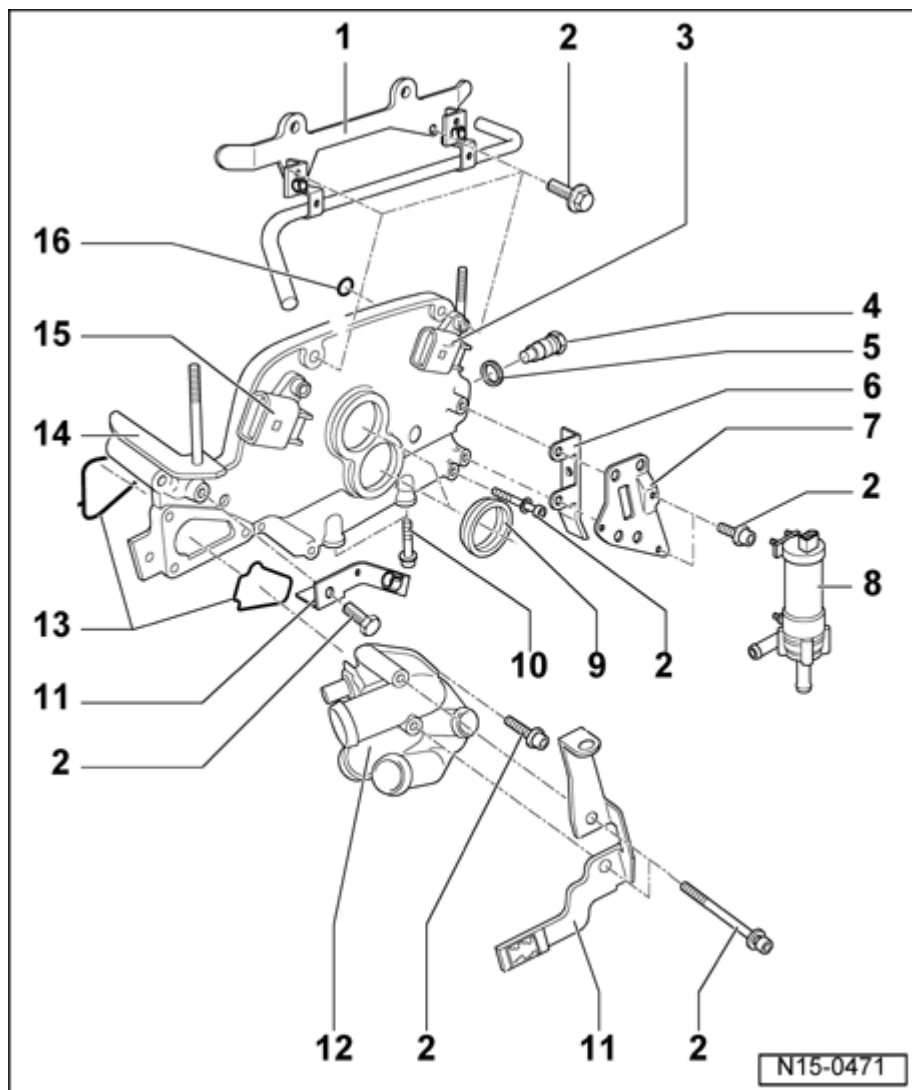


Fig. 152: Upper Cover For Camshaft Timing Chain, Component Overview
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Cable bracket

- For coolant hoses and wiring harness

2 - 8 Nm

3 - Camshaft Position (CMP) sensor 2 -G163-

- For exhaust camshaft
- Mark electrical connector before disconnecting

4 - Chain tensioner for camshaft timing chain

- Tighten to 40 Nm

5 - Seal

- Replace if damaged or leaking

6 - Not installed**7 - Not installed****8 - Not installed****9 - Oil seal**

- 2x
- For Valve -1- for camshaft adjustment -N205-
- Replace if damaged or leaking
- Removing and installing. Refer to **Oil seals in upper cover for camshaft timing chain, removing and installing**

10 - 23 Nm**11 - Bracket for wiring harness****12 - Thermostat housing**

- Removing and installing. Refer to **Thermostat housing, removing and installing**

13 - Seal

- Replace

14 - Upper cover for camshaft timing chain

- Removing and installing. Refer to **Oil seals in upper cover for camshaft timing chain, removing and installing**

15 - Camshaft Position (CMP) sensor -G40-

- For intake camshaft
- Mark electrical connector before disconnecting

16 - O-ring for oil chained seal

- Replace
- Lubricate before installing

Oil seals in upper cover for camshaft timing chain, removing and installing

Special tools and equipment



Fig. 153: Identifying Seal Installer 3253/6 From Assembly Tool 3253
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Assembly tool 3253

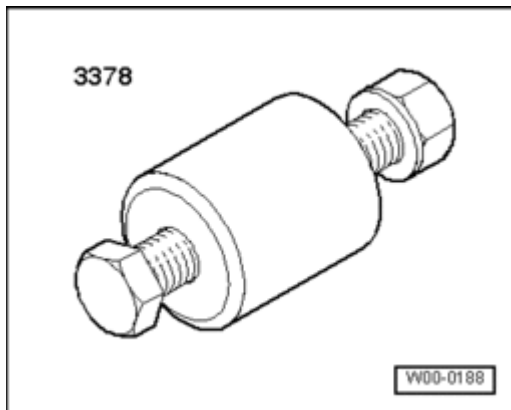


Fig. 154: Identifying Fitting Sleeve 3378
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Installation sleeve 3378

Removing

- Upper cover for camshaft timing chain must be removed.
- Drive out oil seals using a drift.

Installing

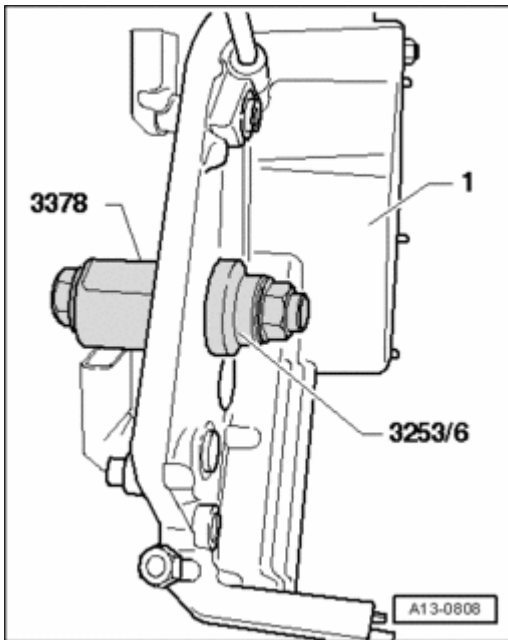


Fig. 155: Inserting Oil Seal Into Upper Cover For Camshaft Timing Chain With Installation Sleeve 3378 And Use Assembly Tool 3253/6 To Press It In Flush

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Insert oil seal into upper cover for camshaft timing chain -1- with installation sleeve 3378 and then use assembly tool 3253/6 to press it in flush.

Timing chain, component overview

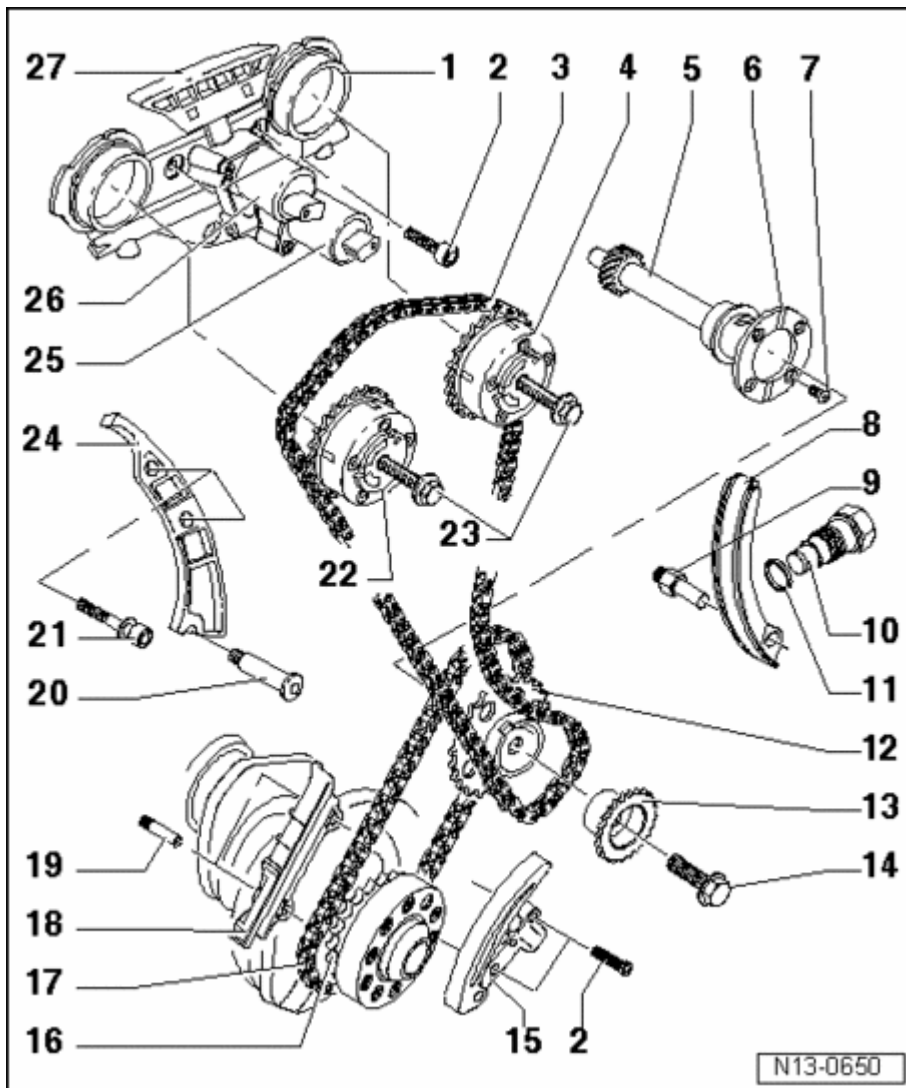


Fig. 156: Timing Chain, Component Overview

Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Valve timing housing

- Removing and installing. Refer to **Camshafts, removing and installing**
- Disassembling and assembling. Refer to **Disassembling and assembling valve timing housing**
- Check filter for dirt. Refer to **Checking filter of valve timing housing for dirt**
- Lightly coat contact surfaces of oil seals before installing

2 - 8 Nm

- Replace

3 - Camshaft timing chain

- Mark rotation direction before removing. See **Fig. 157**
- Removing from camshafts. Refer to **Camshaft timing chain, removing from camshafts**
- Removing and installing. Refer to **Camshaft timing chain, removing from camshafts**

4 - Camshaft adjuster - exhaust

- Identification: 32A
- Removing and installing. Refer to **Camshaft timing chain, removing from camshafts**

5 - Intermediate shaft**6 - Thrust washer****7 - 8 Nm**

- Install using locking fluid

8 - Guide rail for timing chain

- To remove it is first necessary to remove both upper and lower covers for timing chains

9 - Pivot pin**10 - Chain tensioner for camshaft timing chain, 40 Nm**

- Removing and installing. Refer to **Camshaft timing chain, removing from camshafts**

11 - Seal

- Replace if damaged or leaking

12 - Sprocket for drive chain for valve gear

- Removing and installing. Refer to **Drive chain for valve gear and camshaft timing chain, removing and installing**

13 - Sprocket for camshaft timing chain

- Removing and installing. Refer to **Drive chain for valve gear and camshaft timing chain, removing and installing**

14 - 60 Nm + 90° (1/4 turn) further

- Replace
- When loosening and tightening, counterhold vibration damper with counterhold tool T10069

15 - Chain tensioner with guide rail

- For drive chain
- Before installing, release locking spline in chain tensioner with a small screwdriver and press guide rail against chain tensioner

16 - Drive sprocket chain

- Integral part of chain

17 - Drive chain for valve gear

- Mark rotation direction before removing. See **Fig. 157**
- Removing and installing. Refer to **Drive chain for valve gear and camshaft timing chain, removing and installing**

18 - Guide rail for drive chain for valve gear

- Removing and installing. Refer to **Drive chain for valve gear and camshaft timing chain, removing and installing**

19 - Pin, 10 Nm

- For guide rail

20 - 18 Nm**21 - 23 Nm****22 - Camshaft adjuster - intake**

- Identification: 24E
- Removing and installing. Refer to **Camshaft timing chain, removing from camshafts**

23 - 60 Nm + 90° (1/4 turn) further

- Replace
- Contact surface of sender wheel at bolt head must be dry when installing
- To remove and install: counterhold with 32 mm open end wrench on camshaft. Refer to **Camshaft timing chain, removing from camshafts**

24 - Guide rail for camshaft timing chain

- Removing and installing. Refer to **Camshaft timing chain, removing from camshafts**

25 - Valve -1- for camshaft adjustment -N205-

- For intake camshaft
- Mark electrical connector before disconnecting

26 - Camshaft adjustment valve 1 (exhaust) -N318-

- For exhaust camshaft
- Mark electrical connector before disconnecting

27 - Guide rail for camshaft timing chain

- Clipped onto valve timing housing

Marking rotation direction of timing chains

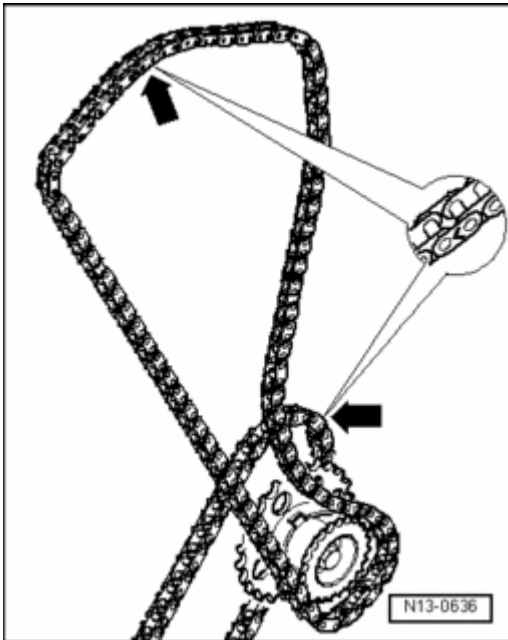


Fig. 157: Identifying Markings On Roller Chains

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Mark rotation direction of timing chains with colored arrows before removing (arrows).

NOTE: Do not mark chains using a center punch or by notching.

Camshaft timing chain, removing from camshafts

Special tools, equipment, and material required

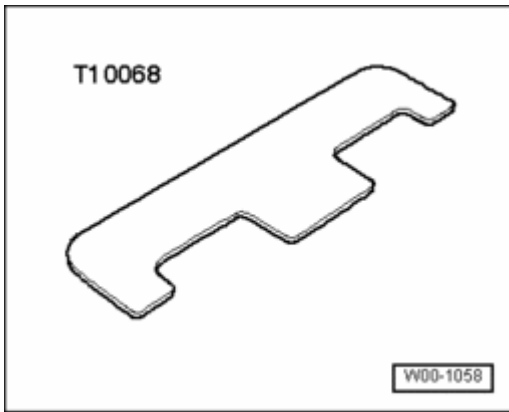


Fig. 158: Camshaft Bar T10068 A

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Camshaft plate T10068
- Gasket sealant, black, Part No AMV 174 04 01
- Gasket paste, Part No. AMV 188 001 02

Removing

- Engine in vehicle
 - Drain coolant. Refer to **Cooling system, draining and filling.**
 - Remove intake manifold. Refer to **Intake manifold, removing and installing.**
 - Disconnect electrical connector for Mass Air Flow (MAF) sensor -G70-.

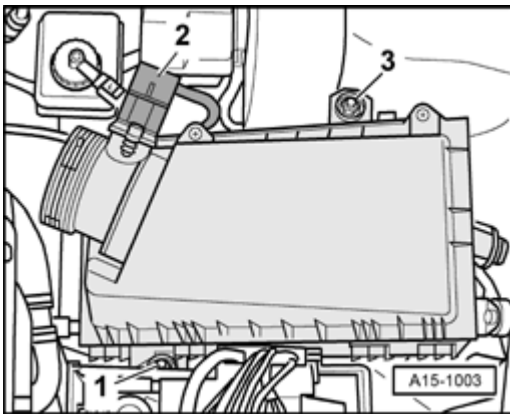


Fig. 159: Removing Air Cleaner Housing Bolts

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts -1- and -3-.
- Take out air cleaner housing.

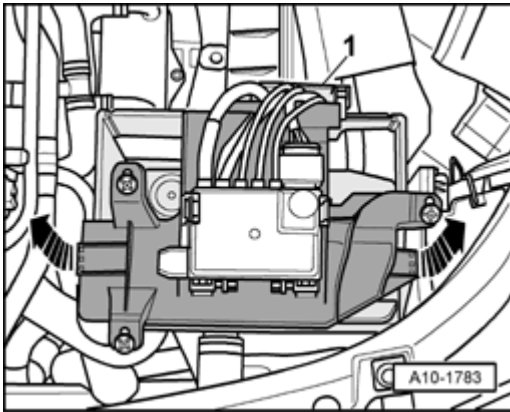


Fig. 160: Unclipping Protective Cover For Electrical Cable
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unclip protective cover -1- for electrical wiring.
- Fold bracket box upward (arrows).

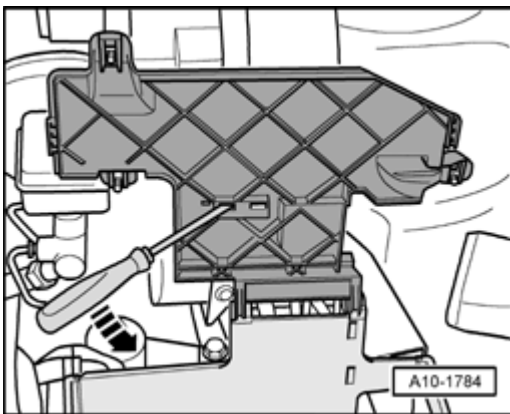


Fig. 161: Removing Fuse Box By Releasing Retaining Tabs
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove fuse box by releasing retaining tabs (arrow).

NOTE: **The wires remain connected.**

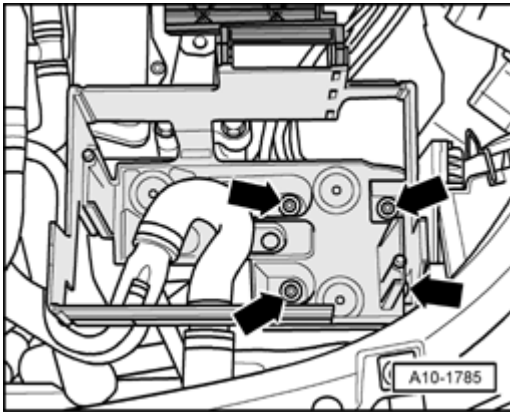


Fig. 162: Removing Carrier

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove carrier (arrows).

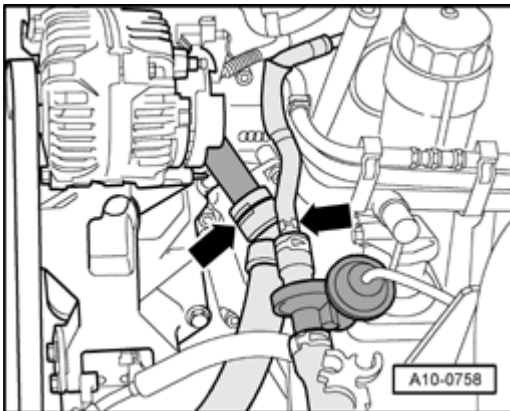


Fig. 163: Disconnecting Electrical Connector At Engine Coolant Temperature (ECT) Sensor -G62-

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical connector at Engine Coolant Temperature (ECT) sensor -G62-.

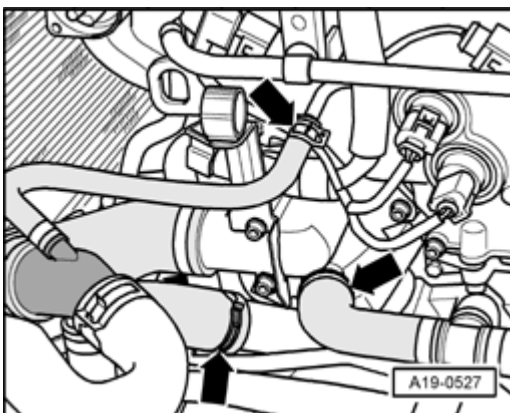


Fig. 164: Disconnecting Coolant Hoses At Connections Indicated

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect coolant hoses at connections indicated (arrows).

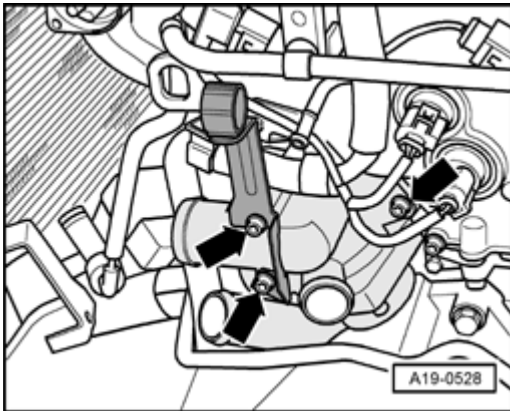


Fig. 165: Removing Secondary Air Injection Hose
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts (arrows).
- Swing bracket for secondary air injection hose forward.

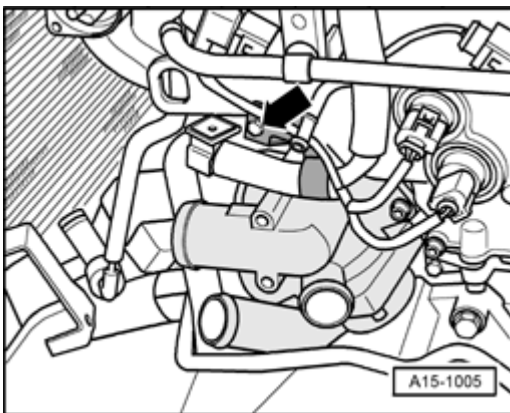


Fig. 166: Removing Bolt On Bracket For Wiring Harness
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolt (arrow) on bracket for wiring harness.

CAUTION: When removing the thermostat housing, push the coolant pipe toward the coolant pump with an assembly lever to prevent it from also being removed.

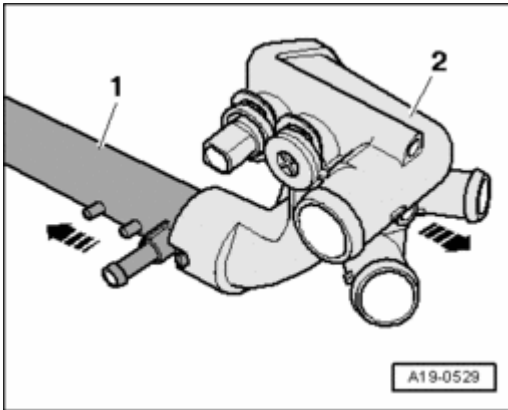


Fig. 167: Removing Thermostat Housing

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove thermostat housing -2-. To do so, press coolant pipe -1- toward coolant pump with an assembly lever.

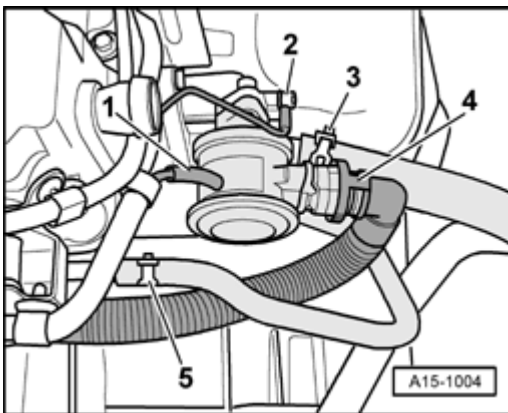


Fig. 168: Disconnecting Air Hose And Vacuum Hose At Combination Valve For Secondary Air Injection System

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect air hose -4- and vacuum hose -1- at combination valve for secondary air injection system.
- Disconnect Ground cable -2-.
- Disconnect coolant hoses -3- and -5-.
- Place Throttle valve control module -J338- on bulkhead.

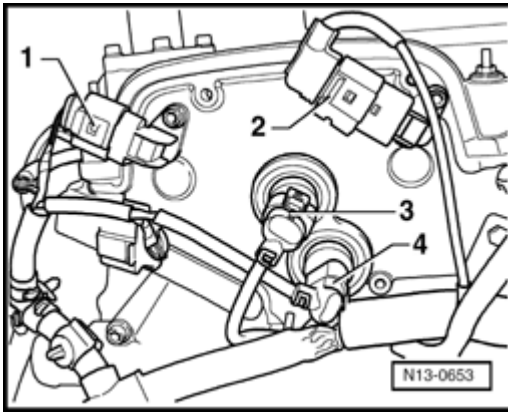


Fig. 169: Identifying CMP Sensor G40, CMP Sensor 2 G163 And Connectors
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Mark and disconnect electrical connectors:

- 1 - Camshaft Position (CMP) sensor -G40-
- 2 - Camshaft Position (CMP) sensor 2 -G163-
- 3 - Valve -1- for camshaft adjustment -N205-
- 4 - Camshaft adjustment valve 1 (exhaust) -N318-

- Disconnect electrical connector (left side) on cylinder head and move connector clear.

CAUTION: The fuel system is pressurized. Before opening the system place a clean cloth around the connection. Then dissipate the pressure by carefully loosening the connection.

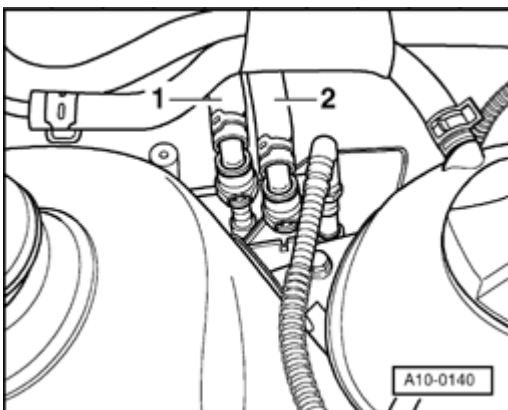


Fig. 170: Identifying Supply Line And Return Line
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect fuel supply line -1- and fuel return line -2- by pressing release tabs.
- Unscrew and move clear all electrical connectors on cylinder head and lay them back together with fuel

rail.

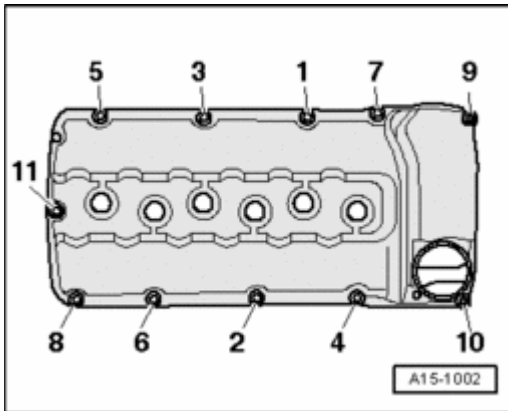


Fig. 171: Unscrewing Cylinder Head Cover Bolts In Sequence
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unscrew cylinder head cover bolts in sequence -11...1-.

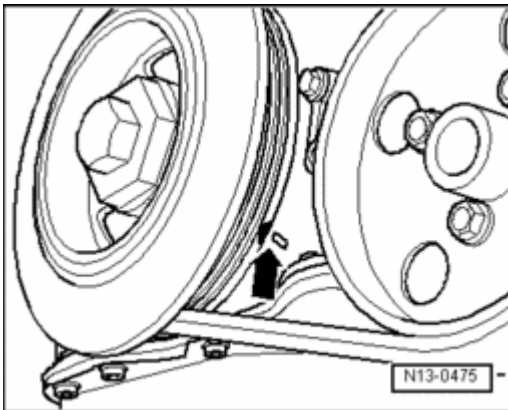


Fig. 172: Identifying Crankshaft At Vibration Damper Securing Bolt In Engine At TDC Cyl. 1
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Turn crankshaft to TDC marking (arrow) in normal direction of rotation via securing bolt on vibration damper...

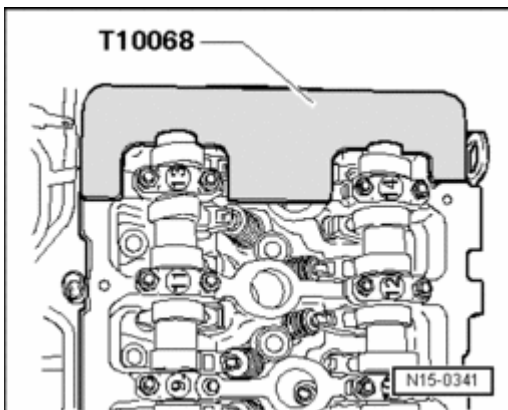


Fig. 173: Identifying Camshaft Bar T10068 Engage In Both Shaft Grooves

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Simultaneously insert camshaft plate T10068 into grooves on both camshafts. If necessary, turn crankshaft 1 rotation further.

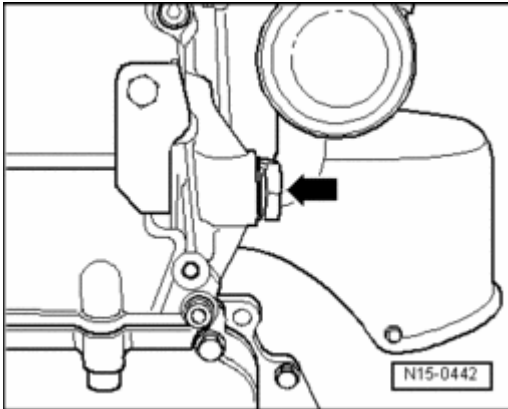


Fig. 174: Locating Camshaft Roller Chain Tensioner

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolt for camshaft timing chain tensioner (arrow).

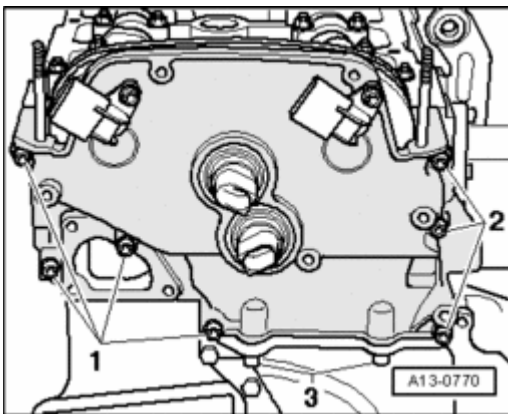


Fig. 175: Installing Upper Cover For Camshaft Timing Chain And Tightening Bolts

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts -1...3- and remove upper cover for camshaft timing chain from cylinder head horizontally. Take care not to damage cylinder head gasket when removing.

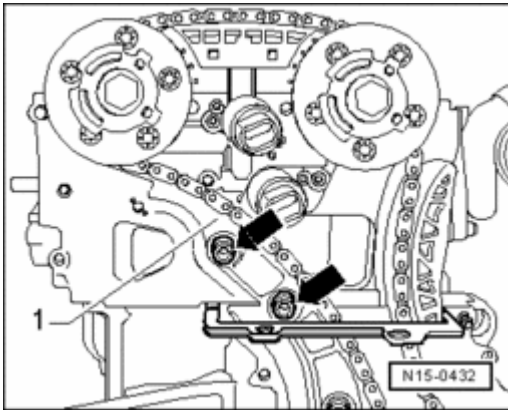


Fig. 176: Removing/Installing Bolts And Guide Rail
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts (arrows) and remove guide rail -1-.
- Remove camshaft plate T1068.

NOTE: The camshaft plate T10068 must not be inserted when loosening and tightening the securing bolts for the camshaft adjuster.

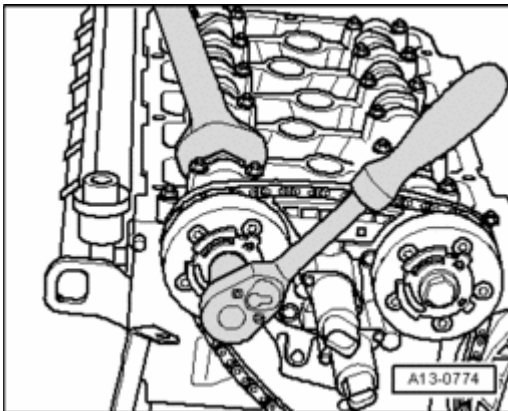


Fig. 177: Unscrewing Securing Bolt At Camshaft Adjuster (Intake Side)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unscrew securing bolt at camshaft adjuster (intake side). Counterhold with open end wrench (32 mm) on hex flats of camshaft.
- Remove camshaft adjuster (intake side).

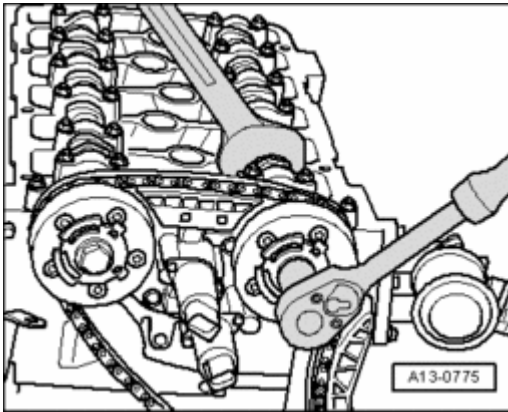


Fig. 178: Unscrewing Securing Bolt At Camshaft Adjuster (Exhaust Side)
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unscrew securing bolt at camshaft adjuster (exhaust side). Counterhold with open end wrench (32 mm) on hex flats of camshaft.
- Remove camshaft adjuster (exhaust side).
- Remove camshaft timing chain over valves for camshaft adjustment and set aside.

Installing

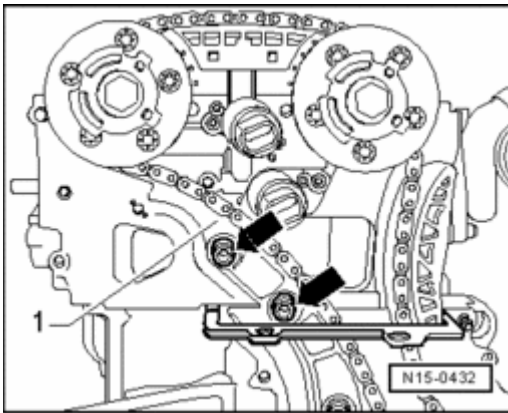


Fig. 179: Removing/Installing Bolts And Guide Rail
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Install guide rail -1- and tighten bolts (arrows).

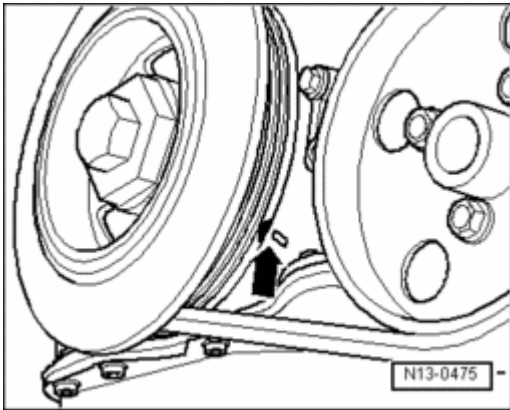


Fig. 180: Identifying Crankshaft At Vibration Damper Securing Bolt In Engine At TDC Cyl. 1
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Recheck TDC position of crankshaft (arrow)

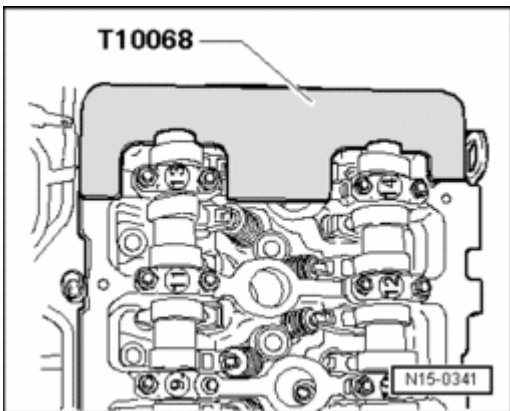


Fig. 181: Identifying Camshaft Bar T10068 Engage In Both Shaft Grooves
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Check TDC position of camshafts:

It must be possible to insert camshaft plate T10068 into both camshaft grooves...

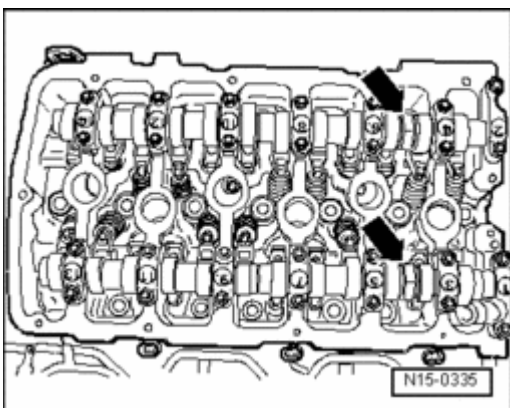


Fig. 182: Locating Counter-Hold Area On Camshaft

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- ..If necessary, turn camshafts to correct position at hex flats (arrows) using an open end wrench (32 mm).

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

- First install camshaft adjuster for intake side.

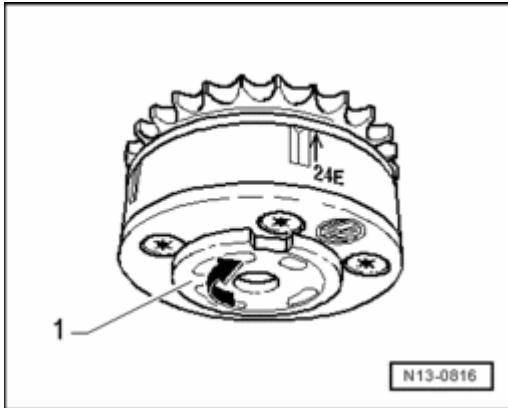


Fig. 183: Turning Sensor Wheel On Intake Camshaft Adjuster Clockwise
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Turn sender wheel -1- clockwise (arrow) in camshaft adjuster as far as stop.

NOTE: The camshaft plate must not be used as a counterhold.

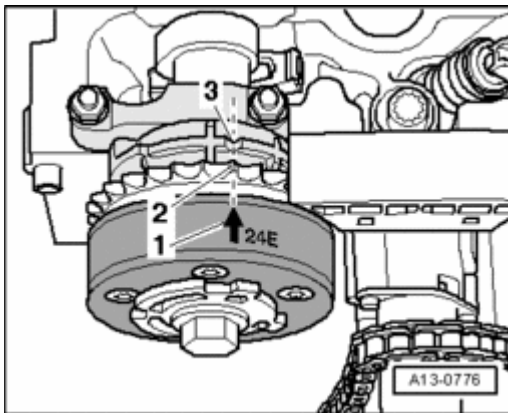


Fig. 184: Tighten Camshaft Adjuster (Intake Side) To Intake Camshaft Finger-Tight
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Tighten camshaft adjuster (intake side) in this position to intake camshaft finger-tight.
- Contact surface of sender wheel at bolt head must be dry when installing
- Inscription "24E" item -1- and tooth just behind it -2- must align with notch -3- in valve timing housing.

- Lay camshaft timing chain in this position tautly onto sprocket of camshaft adjusted (intake side).

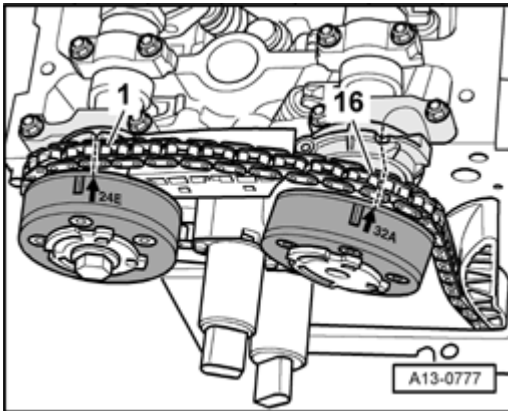


Fig. 185: Counting 16 Rollers Of Timing Chain Starting From Inscription "24E" On Camshaft Adjuster (Intake Side) Moving Toward Exhaust Side

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Count exactly 16 rollers of timing chain starting from inscription "24E" on camshaft adjuster (intake side) moving toward exhaust side.
- Place tooth at inscription "32A" on camshaft adjuster (exhaust side) exactly behind 16th roller of chain.
- There should be now 16 chain rollers between teeth.
- Inscription "32A" and tooth just behind it must also align with notch in valve timing housing.

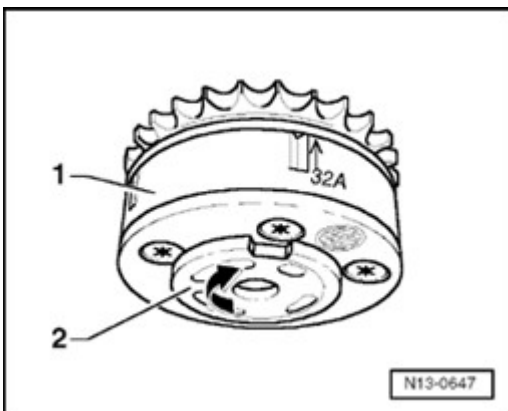


Fig. 186: Turning Sender Wheel Clockwise In Camshaft Adjuster (Exhaust Side)

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Turn sender wheel -2- clockwise (arrow) in camshaft adjuster -1- (exhaust side) as far as stop.
- Tighten camshaft adjuster (exhaust side) in this position to exhaust camshaft finger-tight.
- Contact surface of sender wheel at bolt head must be dry when installing.

NOTE:

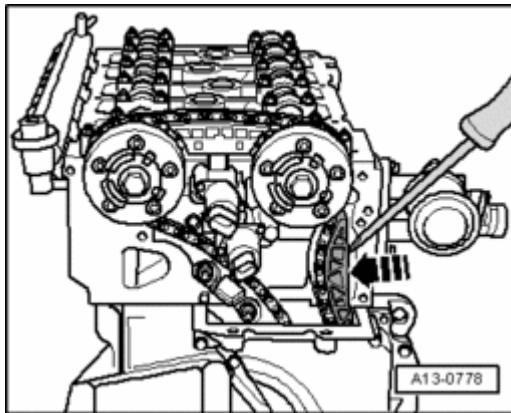


Fig. 187: Pressing Guide Rail Firmly Against Camshaft Timing Chain Manually To Prevent Chain From Slipping
Courtesy of VOLKSWAGEN UNITED STATES, INC.

When turning the crankshaft, it is necessary to press the guide rail firmly against the camshaft timing chain manually (instead of using the tensioning element) -arrow- to prevent the chain from slipping.

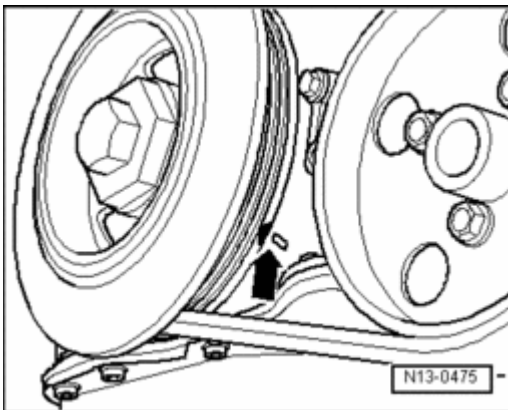


Fig. 188: Identifying Crankshaft At Vibration Damper Securing Bolt In Engine At TDC Cyl. 1
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Turn crankshaft via securing bolt for vibration damper 2 revolutions in normal direction of rotation until marking is at TDC (arrow)...

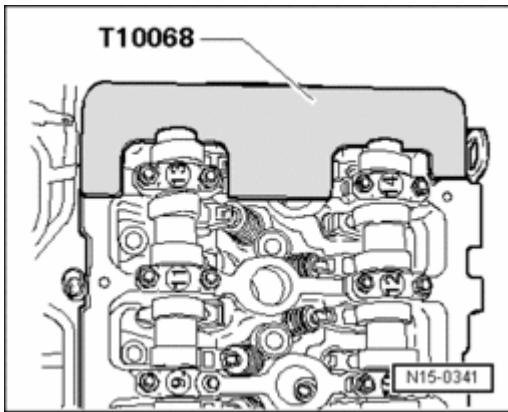


Fig. 189: Identifying Camshaft Bar T10068 Engage In Both Shaft Grooves
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- ..and simultaneously be able to insert camshaft plate T10068 in both camshaft grooves.

If the camshaft plate cannot be inserted:

- Repeat adjustment of valve timing.

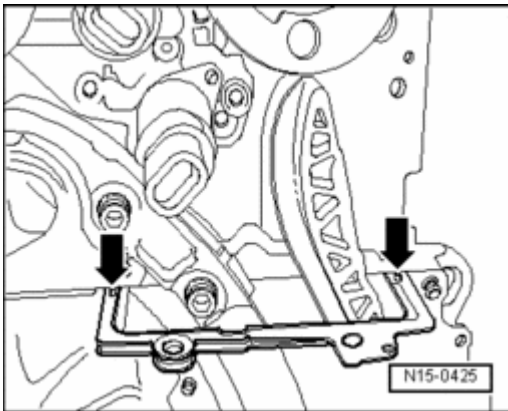


Fig. 190: Locating 3 mm Holes In Cylinder Head Gasket
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Clean any old sealing compound from 3 mm bores (arrows) in cylinder head gasket.
- Fill 3 mm bores in cylinder head gasket with sealing compound (black) AMV 174 04 01.

NOTE: With the cylinder head installed the holes in the cylinder head gasket are only half visible.

- Replace oil seals in upper cover for camshaft timing chain. Refer to **Oil seals in upper cover for camshaft timing chain, removing and installing.**
- Clean sealing surfaces.
- Sealing surfaces must be free of grease and oil.

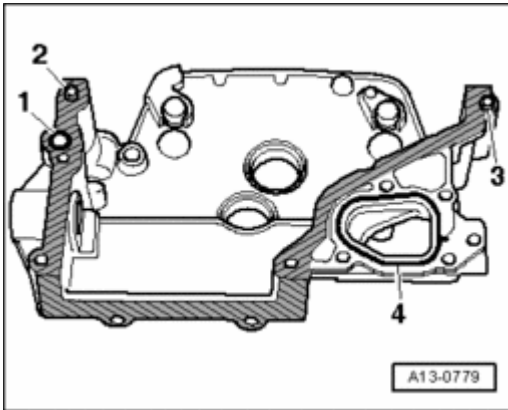


Fig. 191: Checking Dowel Sleeves And Are Inserted In Upper Cover For Camshaft Timing Chain
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Check if dowel sleeves -2- and -3- are inserted in upper cover for camshaft timing chain.
- Insert a new oil seal -1- and a new seal -4-.
- Thinly coat clean surface of upper cover for camshaft timing chain (hatched surface in illustration) with sealing past AMV 188 001 02.

NOTE:

- Also apply a thin coat of sealing paste to the surface beneath the cylinder head gasket (do not kink gasket).
- The upper cover for the camshaft timing chain must be installed within 5 minutes after applying the sealing paste.

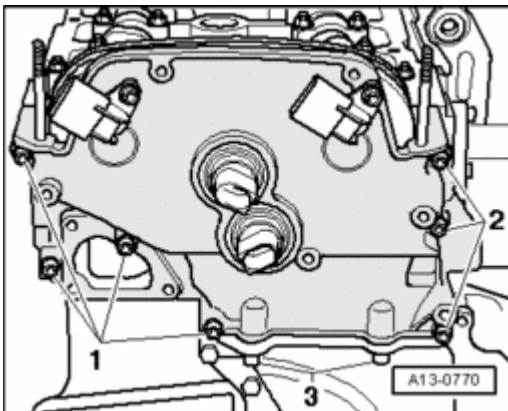


Fig. 192: Installing Upper Cover For Camshaft Timing Chain And Tightening Bolts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Install upper cover for camshaft timing chain and tighten bolts in following sequence:

- 1 - Tighten bolts -1- and -2- to 5 Nm
- 2 - Tighten bolts -3- to 23 Nm
- 3 - Tighten bolts -1- and -2- to 10 Nm

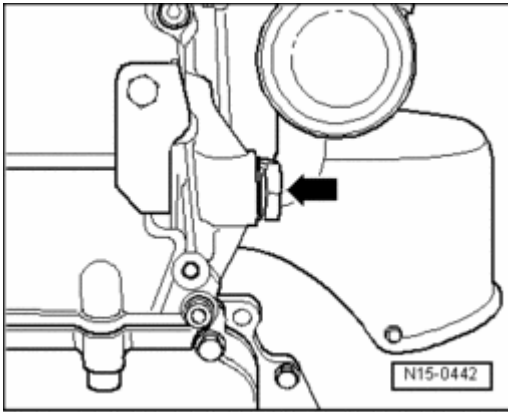


Fig. 193: Locating Camshaft Roller Chain Tensioner
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Secure chain tensioner (arrow) for camshaft timing chain.
- Turn crankshaft 2 revolutions in normal direction of rotation and recheck valve timing.
- Install cylinder head cover. Refer to **Cylinder head cover, removing and installing**.
- Install intake manifold. Refer to **Intake manifold, removing and installing**.
- Install thermostat housing. Refer to **Thermostat housing, removing and installing**.

Tightening torques

Component		Nm
Guide rail to cylinder block		10
Camshaft adjuster to camshafts		60 + 90° 1)2)
Upper cover for camshaft timing chain	M6	10
	M8	23
Chain tensioner for camshaft timing chain to upper cover for timing chain		40

1) Replace bolt

2) 90° equals one quarter turn

Drive chain for valve gear and camshaft timing chain, removing and installing

Special tools and equipment required

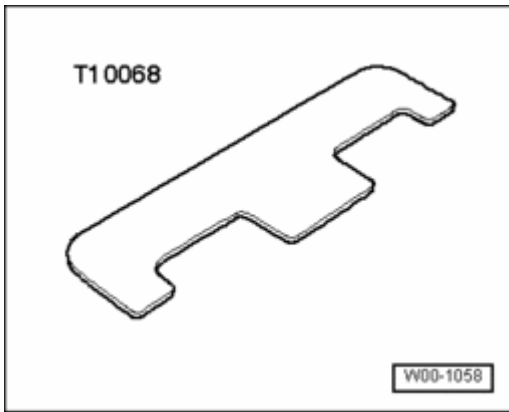


Fig. 194: Camshaft Bar T10068 A

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Camshaft plate T10068

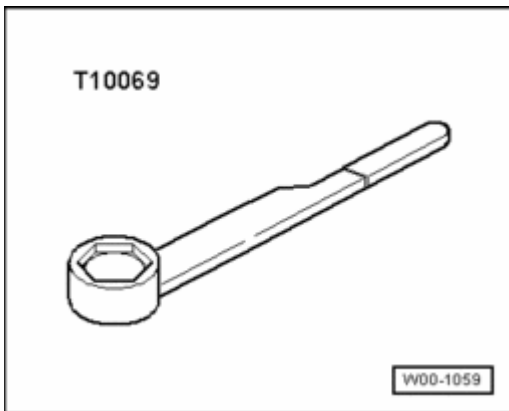


Fig. 195: Identifying Counter-Holder Tool T10069

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Counterhold T10069

Removing

- Engine removed. Refer to **Engine, removing and installing.**
- Engine separated from transmission. Refer to **Engine and transmission, separating.**
- Dual-mass flywheel removed. Refer to **Dual mass flywheel, removing and installing.**
- Intake manifold removed. Refer to **Intake manifold, removing and installing.**
- Cylinder head cover removed. Refer to **Cylinder head cover, removing and installing.**
- Thermostat housing removed. Refer to **Thermostat housing, removing and installing**
- Sump removed. Refer to **Sump, removing and installing.**

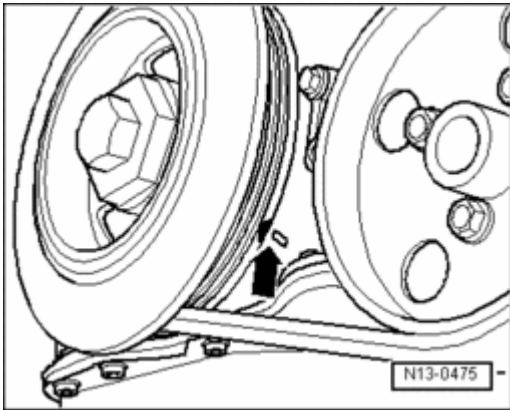


Fig. 196: Identifying Crankshaft At Vibration Damper Securing Bolt In Engine At TDC Cyl. 1
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Turn crankshaft to TDC marking (arrow) in normal direction of rotation via securing bolt on vibration damper...

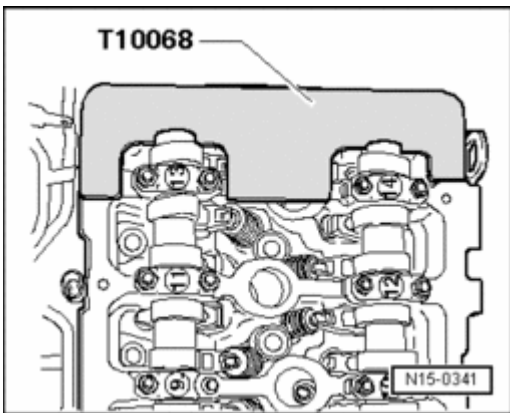


Fig. 197: Identifying Camshaft Bar T10068 Engage In Both Shaft Grooves
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- ..camshaft plate must simultaneously be inserted in camshaft grooves. If necessary, turn crankshaft 1 rotation further.

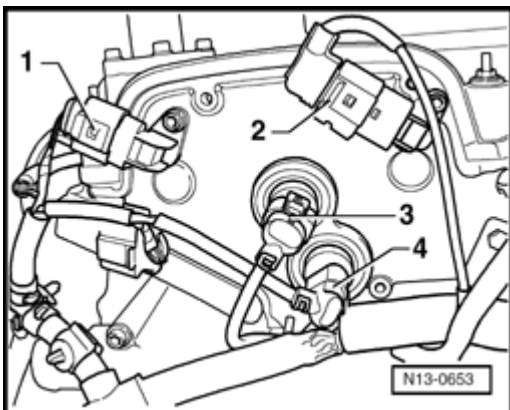


Fig. 198: Identifying CMP Sensor G40, CMP Sensor 2 G163 And Connectors

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Mark and disconnect electrical connectors:

- 1 - Camshaft Position (CMP) sensor -G40-
- 2 - Camshaft Position (CMP) sensor 2 -G163
- 3 - Valve -1- for camshaft adjustment -N205-
- 4 - Camshaft adjustment valve 1 (exhaust) -N318-

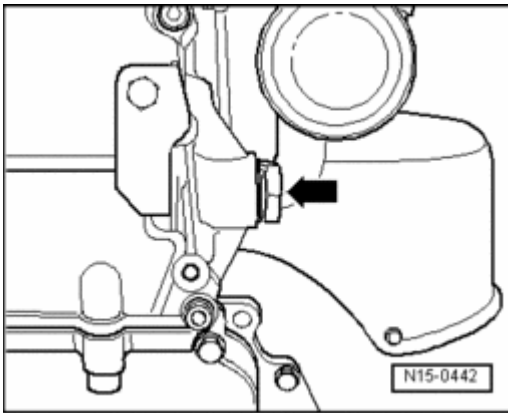


Fig. 199: Locating Camshaft Roller Chain Tensioner
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolt for chain tensioner for camshaft timing chain (arrow).

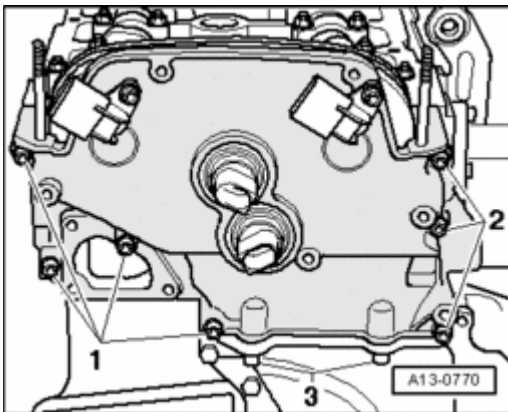


Fig. 200: Installing Upper Cover For Camshaft Timing Chain And Tightening Bolts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts -1...3- and remove upper cover for camshaft timing chain from cylinder head horizontally. Take care not to damage cylinder head gasket when removing.

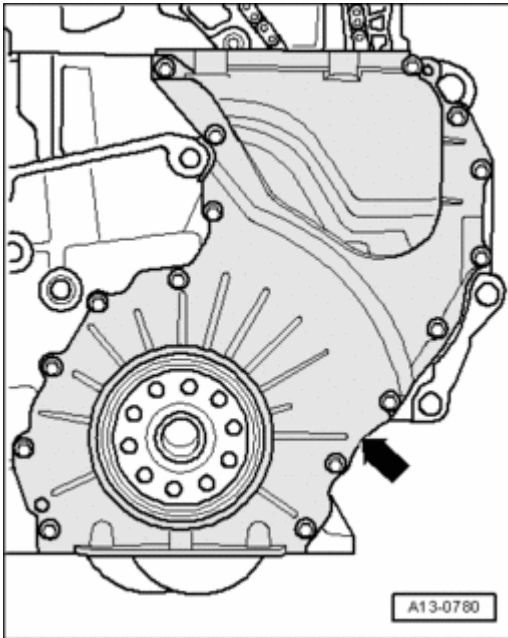


Fig. 201: Removing Bolts And Lower Cover For Timing Chains Horizontally From Cylinder Block
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts and remove lower cover (arrow) for timing chains horizontally from cylinder block. Take care not to damage cylinder head gasket when removing.
- Press out crankshaft oil seal (timing chain end) from timing chain cover.

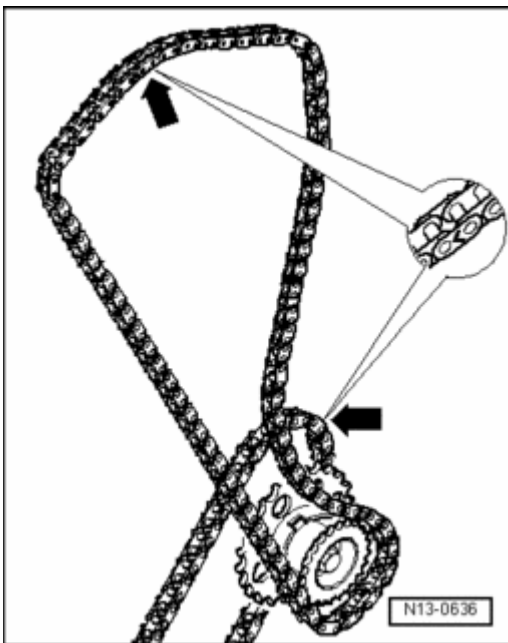


Fig. 202: Identifying Markings On Roller Chains
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Mark rotation direction of timing chains with colored arrows before removing (arrows).

NOTE: Do not mark the chains using a center punch, a notch or similar.

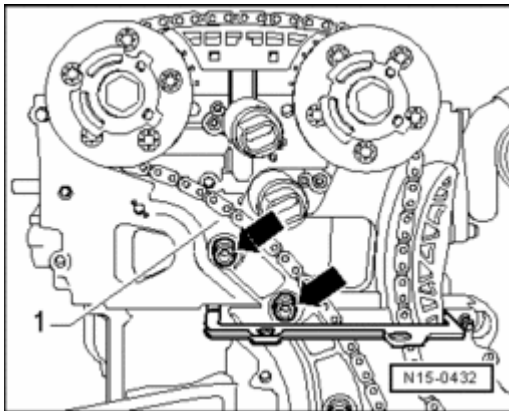


Fig. 203: Removing/Installing Bolts And Guide Rail
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts (arrows) and remove guide rail -1-.
- Remove camshaft timing chain from sprocket for intermediate shaft.
- Remove camshaft timing chain carefully from behind projection of cylinder head gasket.

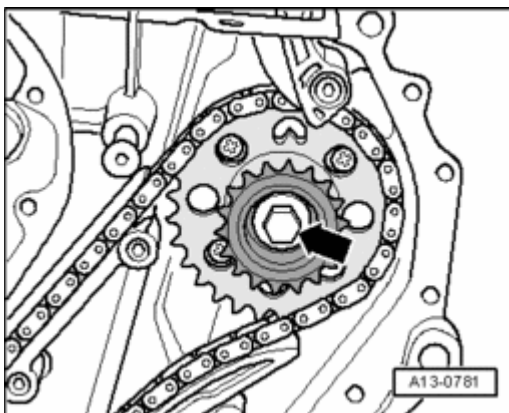


Fig. 204: Replacing Securing Bolt For Chain Sprockets Of Intermediate Shaft
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Loosen bolt (arrow) for chain sprocket of intermediate shaft approx. 1 turn...

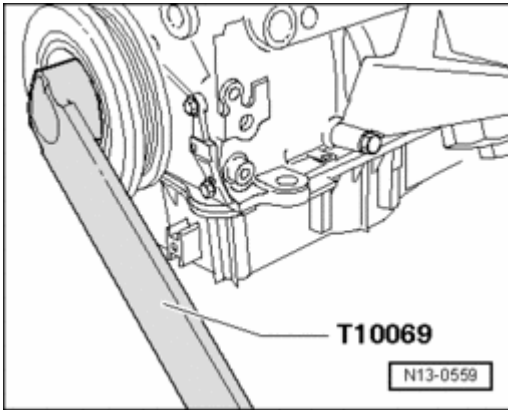


Fig. 205: Loosening/Tightening Securing Bolt, Using Counter-Holder T10069 To Hold Vibration Damper
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- ..by counterholding with T10069 on vibration damper for support.

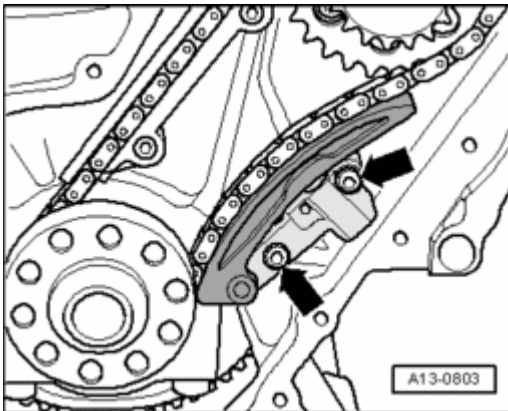


Fig. 206: Unscrewing Chain Tensioner For Drive Chain For Valve Gear
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unscrew chain tensioner for drive chain for valve gear (arrows).

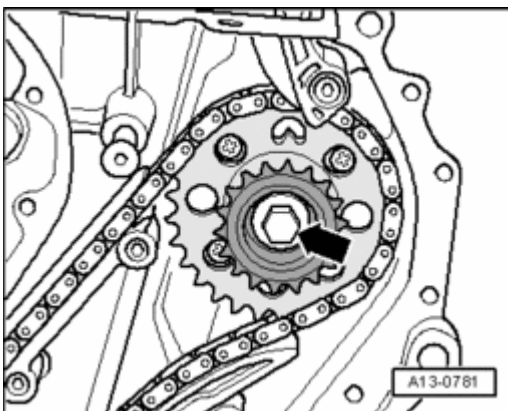


Fig. 207: Replacing Securing Bolt For Chain Sprockets Of Intermediate Shaft
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unscrew bolt (arrow) and remove drive chain together with gears for intermediate shaft.

Installing

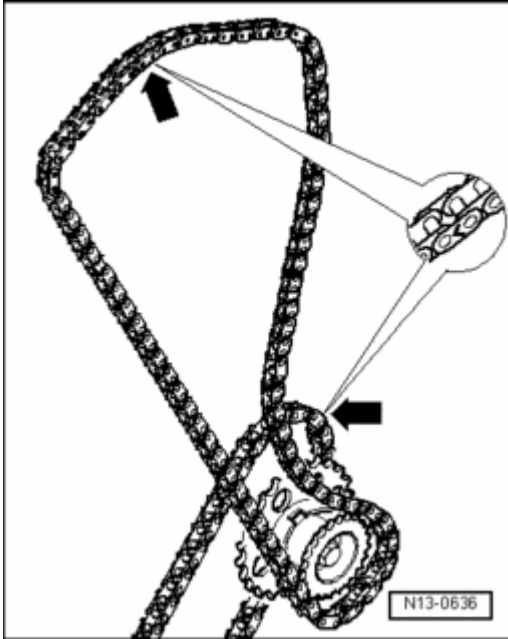


Fig. 208: Identifying Markings On Roller Chains
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Note marking for rotation direction (lower arrow) when reinstalling a used drive chain for valve gear.

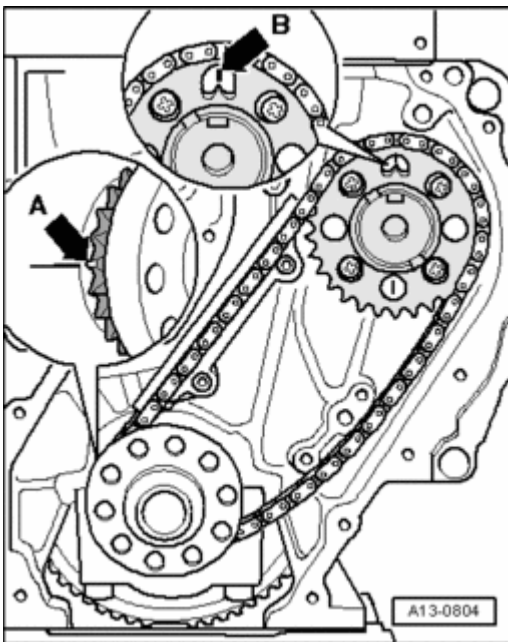


Fig. 209: Installing Drive Chain Together With Large Sprocket Of Intermediate Shaft
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Install drive chain together with large sprocket of intermediate shaft.
- Note installation position of sprocket:
 - Sprocket can only be installed on intermediate shaft in one position. If necessary, turn intermediate shaft slightly.
- Check TDC position of crankshaft:
 - Ground-down tooth of drive chain sprocket must align with main bearing joint (arrow -A-).
 - Notch on sprocket for intermediate shaft must align with groove (arrow -B-) on thrust washer for intermediate shaft.
- Install small sprocket for intermediate shaft:
 - Sprocket can only be installed in one position on intermediate shaft.

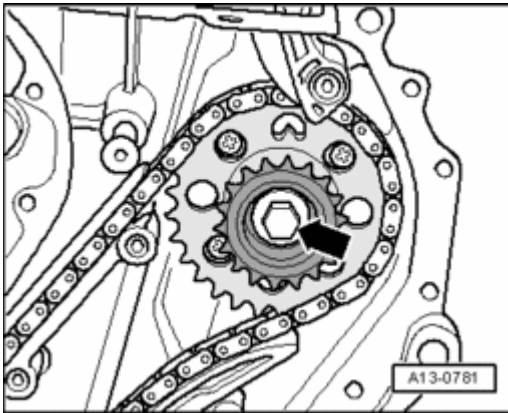


Fig. 210: Replacing Securing Bolt For Chain Sprockets Of Intermediate Shaft
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Replace securing bolt (arrow) for chain sprockets of intermediate shaft.
- Tighten bolt finger-tight.

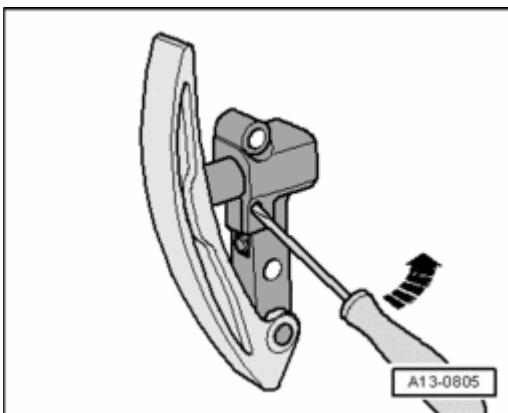
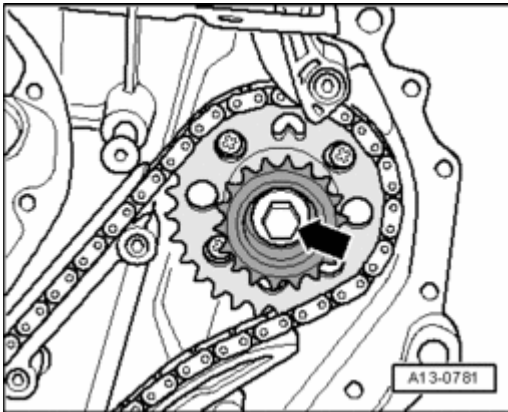


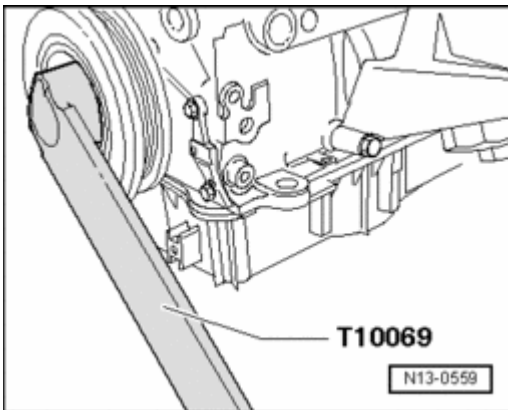
Fig. 211: Releasing Locking Spline In Chain Tensioner With Small Screwdriver And Pressing Guide Rail

Against Chain Tensioner**Courtesy of VOLKSWAGEN UNITED STATES, INC.**

- Release locking spline in chain tensioner with a small screwdriver (arrow) and press guide rail against chain tensioner.
- Secure chain tensioner in this position.

**Fig. 212: Tightening Securing Bolt For Chain Sprockets****Courtesy of VOLKSWAGEN UNITED STATES, INC.**

- Tighten securing bolt for chain sprockets (arrow)...

**Fig. 213: Loosening/Tightening Securing Bolt, Using Counter-Holder T10069 To Hold Vibration Damper****Courtesy of VOLKSWAGEN UNITED STATES, INC.**

- ..by counterholding at vibration damper with T10069 for support.

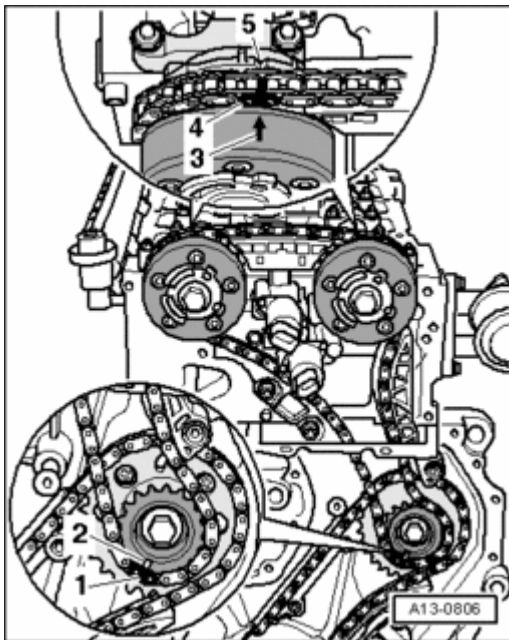


Fig. 214: Installing Camshaft Timing Chain
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Install camshaft timing chain as follows:
 - Yellow chain link -1- must align with marking -2- on small chain sprocket for intermediate shaft.
 - Copper-colored chain links -4- must align with arrows -3- on camshaft adjusters and notches -5- on valve timing housing.
 - There must be 16 chain rollers between arrows.

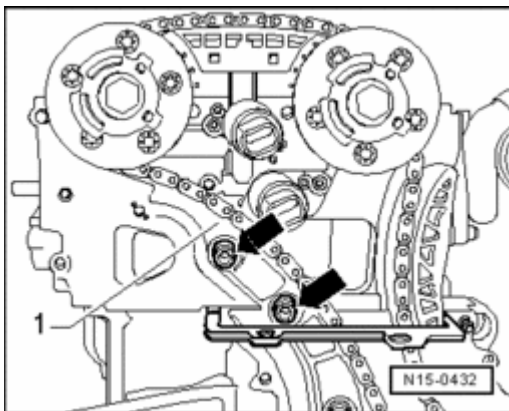


Fig. 215: Removing/Installing Bolts And Guide Rail
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Install guide rail -1- and tighten bolts (arrows).
- Remove camshaft plate T10068.

NOTE:

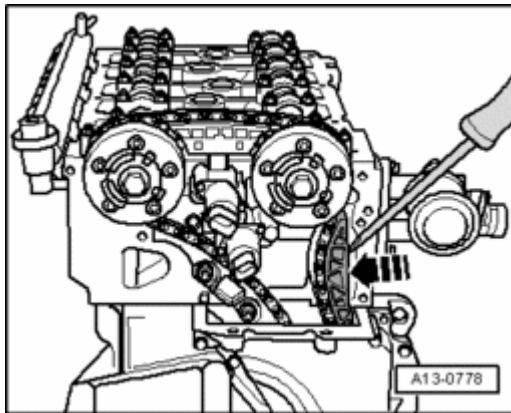


Fig. 216: Pressing Guide Rail Firmly Against Camshaft Timing Chain Manually To Prevent Chain From Slipping
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

When turning the crankshaft, it is necessary to press the guide rail firmly against the camshaft timing chain manually (instead of using the tensioning element) -arrow- to prevent the chain from slipping.

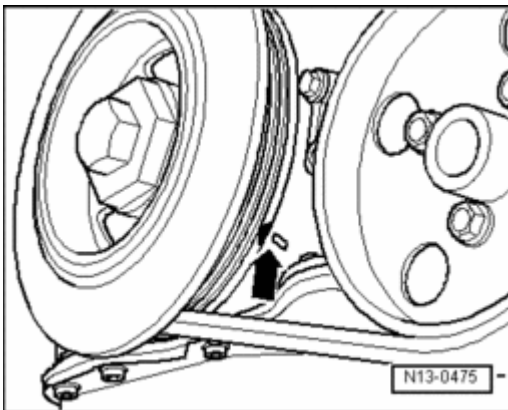


Fig. 217: Identifying Crankshaft At Vibration Damper Securing Bolt In Engine At TDC Cyl. 1
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Turn crankshaft via securing bolt for vibration damper 2 revolutions in normal direction of rotation until marking is at TDC (arrow)...

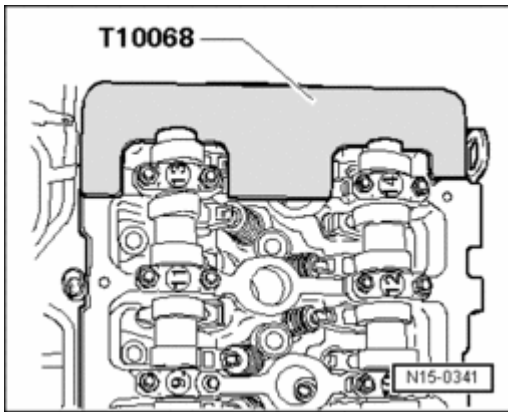


Fig. 218: Identifying Camshaft Bar T10068 Engage In Both Shaft Grooves
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- ..and simultaneously be able to insert camshaft plate T10068 in both camshaft grooves.

NOTE: The marked chain links will now be in an undefined position.

If the camshaft plate cannot be inserted:

- Repeat adjustment of valve timing.

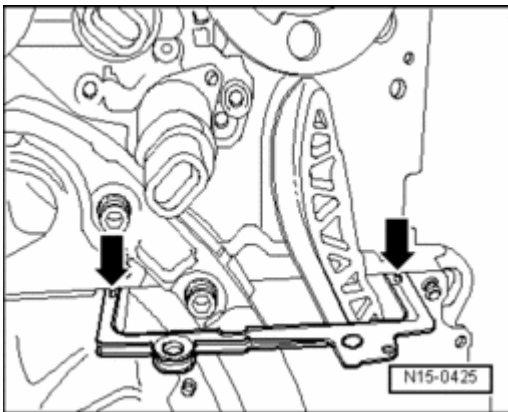


Fig. 219: Locating 3 mm Holes In Cylinder Head Gasket
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Clean old sealing compound from 3 mm bores (arrows) in cylinder head gasket.

NOTE: With the cylinder head installed the holes in the cylinder head gasket are only half visible.

- Clean sealing surfaces on engine and on both covers; they must be free of oil and grease.
- Check whether dowel pins for lower cover for timing chains are inserted in cylinder block.

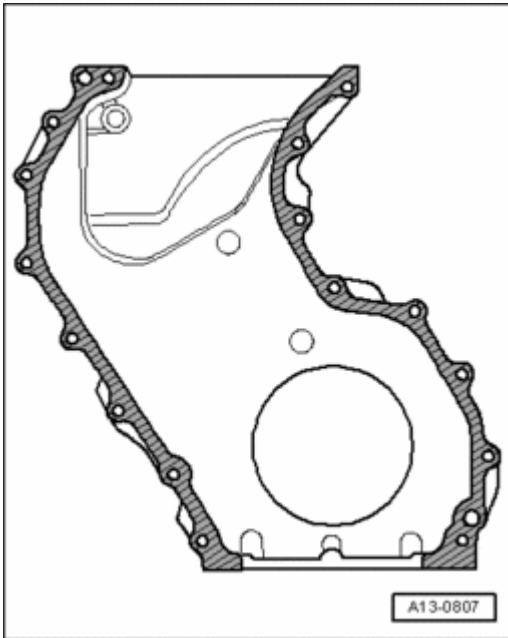


Fig. 220: Thinly Coating Clean Surface Of Lower Cover For Timing Chains With Sealing Paste AMV 188 001 02

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Thinly coat clean surface of lower cover for timing chains (hatched surface in illustration) with sealing paste AMV 188 001 02.

NOTE: The lower cover for the timing chains must be installed within 5 minutes after applying the sealing paste.

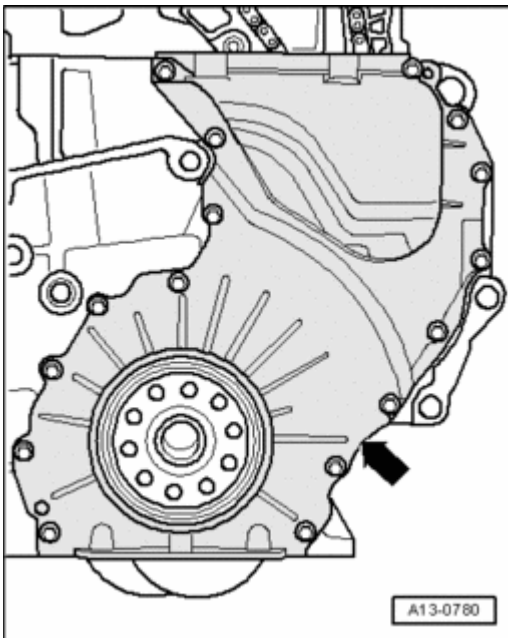


Fig. 221: Tightening Bolts Securing Lower Cover For Timing Chains In Diagonal Sequence And In

Stages

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Tighten bolts securing lower cover (arrow) for timing chains in diagonal sequence and in stages.

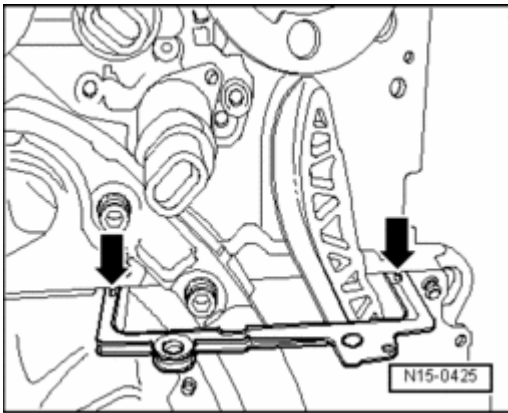


Fig. 222: Locating 3 mm Holes In Cylinder Head Gasket

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Fill 3 mm bores (arrows) in cylinder head gasket with sealing compound (black) AMV 174 04 01.
- Replace oil seals in upper cover for camshaft timing chain. Refer to **Oil seals in upper cover for camshaft timing chain, removing and installing.**

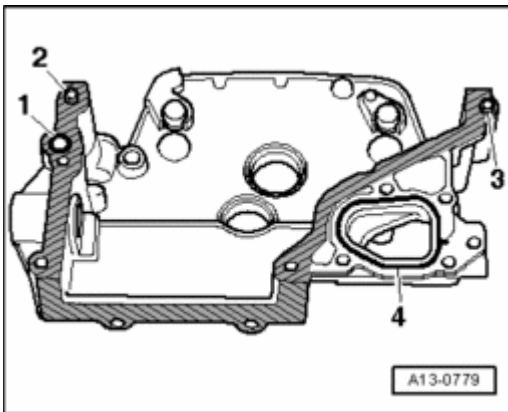


Fig. 223: Checking Dowel Sleeves And Are Inserted In Upper Cover For Camshaft Timing Chain

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Check if dowel sleeves -2- and -3- are inserted in upper cover for camshaft timing chain.
- Insert a new oil seal -1- and a new seal -4-.
- Thinly coat clean surface of upper cover for camshaft timing chain (hatched surface in illustration) with sealing past AMV 188 001 02.

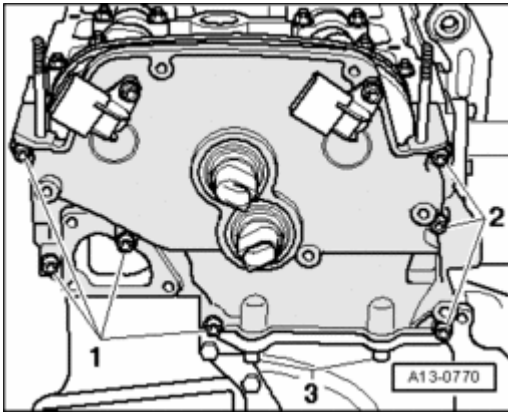


Fig. 224: Installing Upper Cover For Camshaft Timing Chain And Tightening Bolts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Install upper cover for camshaft timing chain and tighten bolts in following sequence:

1 - Tighten bolts -1- and -2- to 5 Nm

2 - Tighten bolts -3- to 23 Nm

3 - Tighten bolts -1- and -2- to 10 Nm

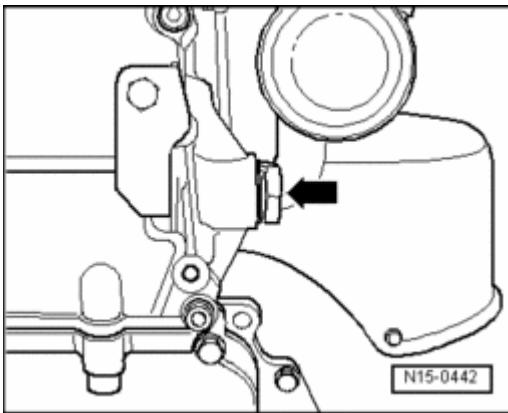


Fig. 225: Locating Camshaft Roller Chain Tensioner
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Secure chain tensioner (arrow) for camshaft timing chain.
- Turn crankshaft 2 revolutions in normal direction of rotation and recheck valve timing.
- Install crankshaft oil seal (timing chain side). Refer to **Crankshaft oil seal - timing chain end, replacing.**
- Install cylinder head cover. Refer to **Cylinder head cover, removing and installing.**
- Install intake manifold. Refer to **Intake manifold, removing and installing.**
- Install thermostat housing. Refer to **Thermostat housing, removing and installing**
- Install sump. Refer to **Sump, removing and installing.**

2005 Audi TT

ENGINE 3.2 Liter V6 4V Engine Mechanical, Engine Code(s): BHE

- Install dual-mass flywheel. Refer to **Dual mass flywheel, removing and installing**.
- Install engine. Refer to **Engine, removing and installing**.
- Fill engine with oil and check oil level. Refer to **Oil pump, component overview**.

Tightening torques

Component		Nm
Pins for guide rail to cylinder block		10
Chain tensioner to cylinder block		8
Chain sprockets to intermediate shaft		60 + 90° 1)2)
Camshaft adjuster to camshafts		60 + 90° 1)2)
Lower cover for timing chains to cylinder block		10
Upper cover for camshaft timing chain	M6	10
	M8	23
Chain tensioner for camshaft timing chain to upper cover for timing chain		40

1) Replace bolt

2) 90° equals one quarter turn

CRANKSHAFT, REMOVING AND INSTALLING

Crankshaft, removing and installing

NOTE:

- Secure the engine to an engine stand when performing assembly work.
- If large quantities of metal shavings or abrasions are found when performing engine repairs, it may indicate damage to the crankshaft or connecting rod bearings. To prevent further damage, the following procedures must be performed during or after completion of repair work: the oil galleries must be carefully cleaned and the oil spray jets, oil cooler and oil filter must be replaced.

Crankshaft, component overview

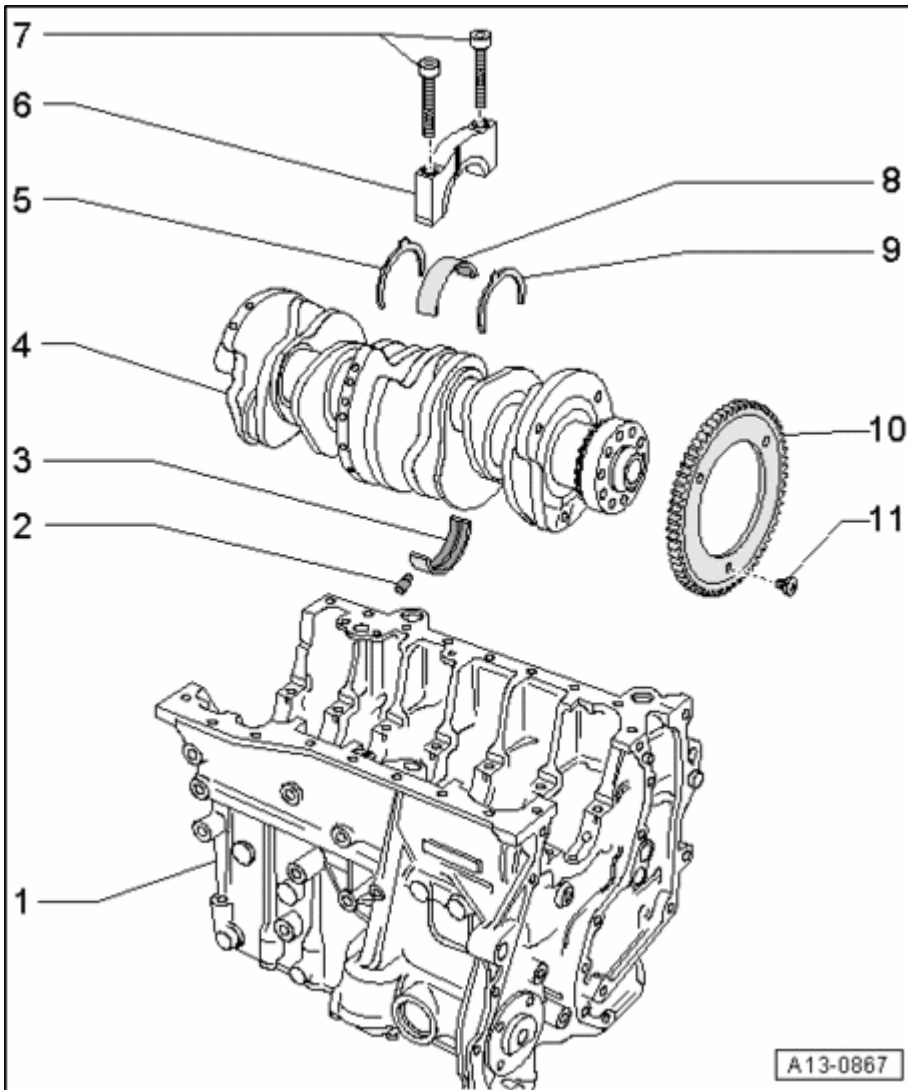


Fig. 226: Crankshaft, Component Overview

Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Cylinder block

- Cylinder bore, checking. Refer to [Checking cylinder bore](#)
- Piston and cylinder dimensions. Refer to [Piston and cylinder dimensions](#)

2 - Oil spray nozzle for piston cooling

- For crankshaft bearings 2...7
- Opening pressure: 2.0 bar
- Removing and installing. Refer to [Removing and installing oil spray jet](#)

3 - Bearing shell

- For cylinder block with oil intake bore
- Do not interchange used bearings (mark)
- Replacement parts are only color coded "yellow"

4 - Crankshaft

- After removal, lay aside so that sensor wheel item -10- is not supporting weight or it will be damaged
- Axial play, New: 0.07...0.23 mm; Wear limit: 0.30 mm
- Measure radial play with Plastigage
- Do not turn crankshaft when measuring radial play
- Radial play, New: 0.02...0.06 mm; Wear limit: 0.10 mm
- Crankshaft dimensions. Refer to **Crankshaft dimensions**

5 - Thrust washer

- For bearing 5
- Observe locating point
- Lubricating groove faces crankshaft

6 - Bearing cap

- Bearing cap 1: belt pulley side
- Bearing cap 5 with notches for thrust washers
- Retaining tabs of bearing shells and cylinder block/bearing caps must lie above one another

7 - 30 Nm + 180° (1/2 turn) further

- Replace

8 - Bearing shell

- For bearing cap without bore
- Do not interchange used bearings (mark)
- Replacement parts are only color coded "yellow"

9 - Thrust washer

- For bearing 5
- Observe locating point
- Lubricating groove faces crankshaft

10 - Sensor wheel

- For Engine speed sensor -G28-
- Sensor wheel must be replaced every time bolts are loosened. Refer to **Removing and installing sensor wheel**
- Installing. Refer to **Removing and installing sensor wheel**

11 - 10 Nm + 90° (1/4 turn) further

- Replace
- Sensor wheel must be replaced every time bolts are loosened. Refer to **Removing and installing sensor wheel**

Removing and installing sensor wheel

The sensor wheel and securing bolts must be replaced every time the bolts are loosened.

- Contact surface of crankshaft/sensor wheel must be free of oil and grease.
 - Thinly coat contact surface of crankshaft/sensor wheel with locking fluid

Installed location

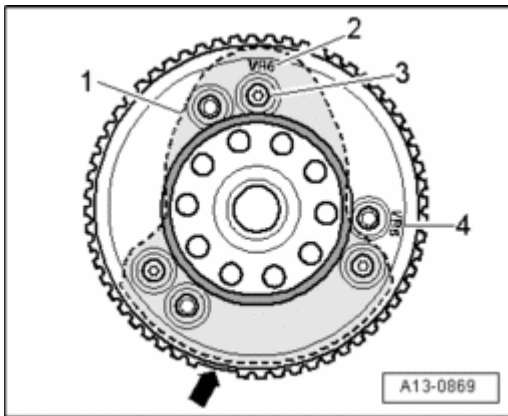


Fig. 227: Identifying "VR6" Marking Positioned At Bore Of Bolt That Goes Into Crankshaft Crankpin
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- "VR6" marking -2- must be positioned at bore of bolt -3- that goes into crankshaft crankpin (contour of crankshaft is shown by dashed line -1-)
- Gap (arrow) in ring gear lies across from designation
- Second "VR6" marking -4- may be ignored
 - Tighten new bolts only finger-tight.
 - Tighten bolt -1-.
 - Tighten bolt -2-.

Tightening torques

2005 Audi TT

ENGINE 3.2 Liter V6 4V Engine Mechanical, Engine Code(s): BHE

Component	Nm
Sender wheel to crankshaft	10 + 90° 1)

1) 90° equals one quarter turn

Crankshaft dimensions

Honing dimension (in mm)	Crankshaft bearing main journal diameter	Connecting rod bearing journal diameter
Basic dimension 1)	59.958...59.978	53.958...53.978

1) 90° equals one quarter turn

PISTONS AND CONNECTING RODS, DISASSEMBLING AND ASSEMBLING**Pistons and connecting rods, component overview**

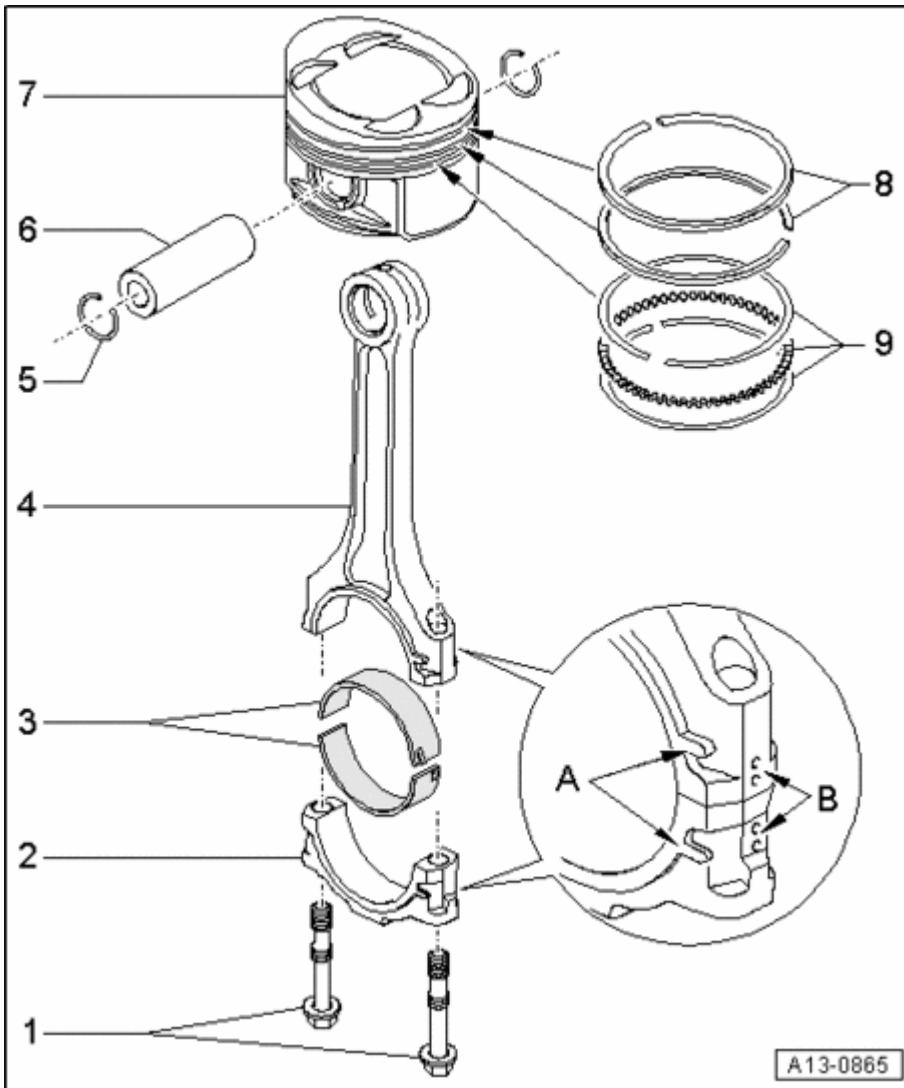


Fig. 228: Pistons And Connecting Rods, Component Overview
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Connecting rod bolt, 30 Nm + 90° (1/4 turn) further

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

2 - Connecting rod bearing cap

- Mark cylinder allocation -B-
- Installed position: Markings -A- must be on same side

3 - Bearing shells

- Installed position: retaining tabs of both bearing shells lie on same side of connecting rod
- Do not interchange used bearing shells (mark)
- Retaining tabs on bearing shells must fit tightly in recesses
- Axial clearance, New: 0.05...0.31 mm; Wear limit: 0.40 mm
- Measure radial clearance with Plastigage
- Do not rotate crankshaft when measuring radial clearance
- Radial clearance, New: 0.02...0.07 mm; Wear limit: 0.10 mm
- Replacement parts are color coded "yellow" for lower and "red" for upper

4 - Connecting rod

- With hole for piston pin lubrication
- Only replace as a set
- Mark cylinder allocation -B-
- Installed position: Mark -A- faces toward shallow side of piston (shallow side of piston crown faces cylinder block center)

5 - Circlip

6 - Piston pin

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

7 - Piston

- Checking. Refer to **Checking piston**
- Mark installed position to connecting rod and cylinder allocation
- Shallow side of piston crown faces center of cylinder block
- Piston and cylinder dimensions. Refer to **Piston and cylinder dimensions**
- Install using T10147. Refer to **Installing piston with tool T10147**

8 - Piston rings

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

9 - Piston ring

- Oil scraping ring
- 3-part
- Install upper steel ring so gap is offset by 120° to neighboring compression ring
- Offset all gaps of oil scraping ring components to each other

Checking piston ring gap

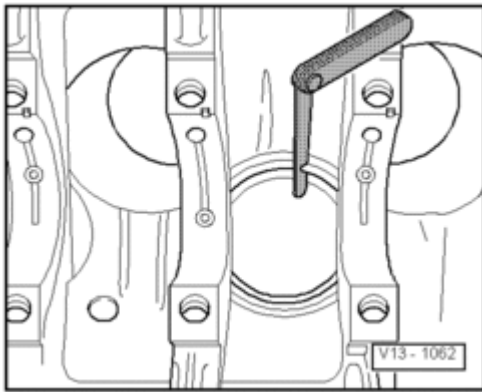


Fig. 229: Checking Piston Ring Gap

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Insert ring at right angle to cylinder wall from above and push down into lower cylinder opening approx. 15 mm from bottom of cylinder. To do so, use a piston without rings.
- Use a feeler gauge to measure.

Piston ring (in mm)	New	Wear limit
Compression ring	0.20...0.40	1.00
Tapered stepped ring	0.20...0.40	1.00
Oil scraper ring	0.25...0.50	1.00

Checking ring to groove clearance

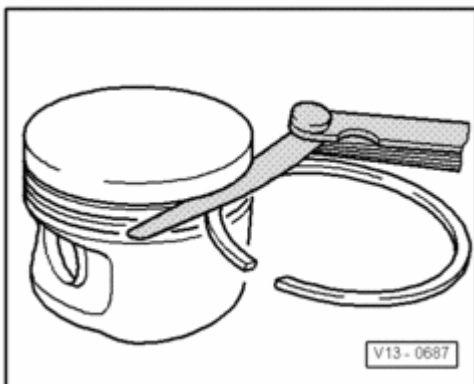
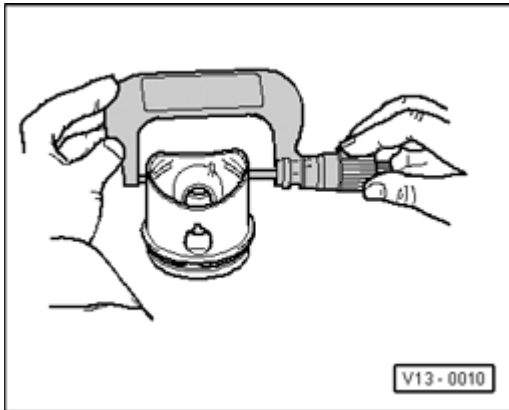


Fig. 230: Checking Ring To Groove Clearance

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Clean groove in piston before checking clearance.
- Use a feeler gauge to measure.

Piston ring (in mm)	New	Wear limit
Compression ring	0.04...0.09	0.15
Tapered stepped ring	0.03...0.06	0.15
Oil scraper ring	0.02...0.06	0.15

Checking piston**Fig. 231: Checking Piston**

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Measure approx. 6 mm from lower edge, perpendicular to piston pin axis. Use an external micrometer, 75...100 mm, to measure.
- Max. deviation from nominal dimension: 0.04 mm

Checking cylinder bore

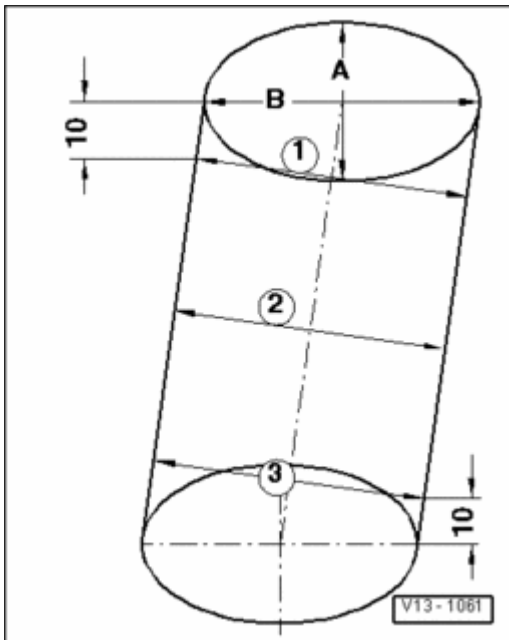


Fig. 232: Checking Cylinder Bore

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Make measurements at three positions diagonally in transverse direction -A- and in longitudinal direction -B-. Use a cylinder gauge, 50...100 mm, to measure.
- Max. deviation from nominal dimension: 0.08 mm

Installing piston with tool T10147

NOTE: If a new installing tool (funnel) is used to install the pistons, first pass a piston (with oiled piston rings) twice through the tool and remove any resulting metal debris. Only then install the piston with the piston rings.

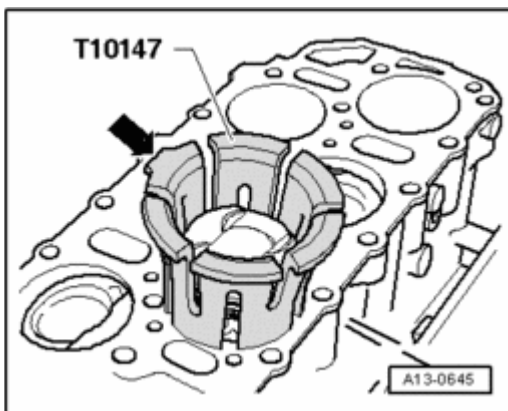


Fig. 233: Installing Piston With Tool T10147

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Lubricate tool and push piston in by hand.

- Flat side of piston crown must face projection on installing tool (arrow).
 - Hold tool (with piston inserted) on upper edge and press piston in with both thumbs.
 - Push piston in until it protrudes approx. 15 mm from lower edge of installing tool.
 - Place piston in appropriate cylinder bore.
- Projection on installing tool (arrow) must face center of cylinder block.
 - Hold installing tool firmly against cylinder block and push in piston.

Piston and cylinder dimensions

Honing dimension (in mm)	Piston diameter	Cylinder bore diameter
Basic dimension	83.965	84.010

15 ENGINE - CYLINDER HEAD, VALVETRAIN**CYLINDER HEAD, REMOVING AND INSTALLING****Cylinder head, removing and installing****NOTE:**

- Replace cylinder head bolts.
- On assembly, replace self-locking nuts and bolts that are tightened by turning through to a specified angle, as well as oil seals and gaskets.
- When installing an exchange cylinder head, the contact surfaces between supporting elements, roller rocker fingers and cams must be oiled before installing the head.
- The plastic protectors fitted 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 all of the old coolant and refill with new coolant.

Cylinder head, component overview

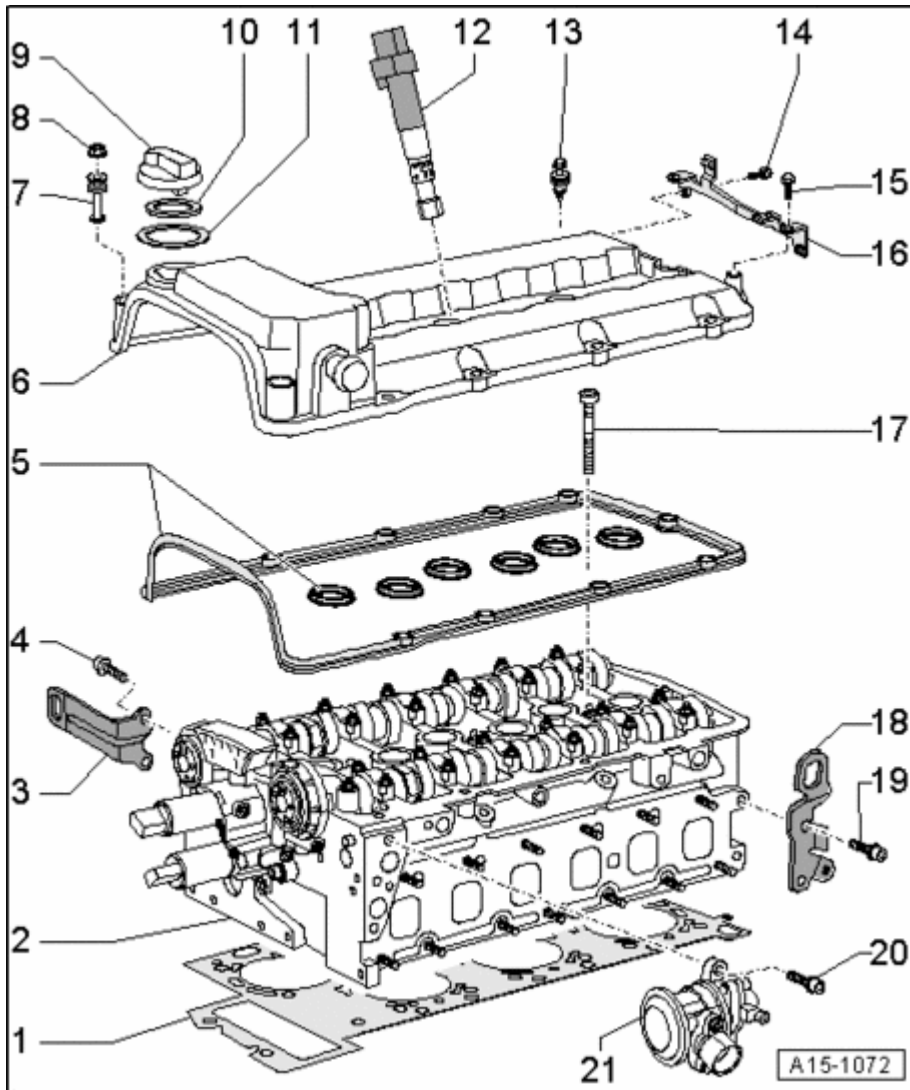


Fig. 234: Cylinder Head, Component Overview
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Cylinder head gasket

- Metal gasket
- Replace
- After replacing, fill with new coolant

2 - Cylinder head

- Removing. Refer to Cylinder head, removing
- Checking for distortion. Refer to Checking cylinder head for distortion
- Installing. Refer to Cylinder head, installing
- After replacing, fill with new coolant

3 - Lifting eye**4 - 23 Nm****5 - Cylinder head cover gasket**

- Replace if damaged

6 - Cylinder head cover

- Removing and installing. Refer to Cylinder head cover, removing and installing

7 - Spacing sleeve

- With seal
- Replace seal if damaged

8 - 10 Nm**9 - Filler cap****10 - Filler cap seal**

- Replace if damaged

11 - Rubber buffer

- Replace if damaged

12 - Ignition coil

- Use puller for ignition coil T10095 A for removal

13 - 10 Nm

- Bolt with spacer sleeve and seal
- Replace seal if damaged

14 - 10 Nm**15 - 10 Nm****16 - Wire harness retainer****17 - Cylinder head bolt**

- Replace

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

18 - Lifting eye

19 - 23 Nm

20 - 10 Nm

21 - Combination valve for secondary air injection system

- Removing and installing. Refer to Combination valve for secondary air system, removing and installing

Checking cylinder head for distortion

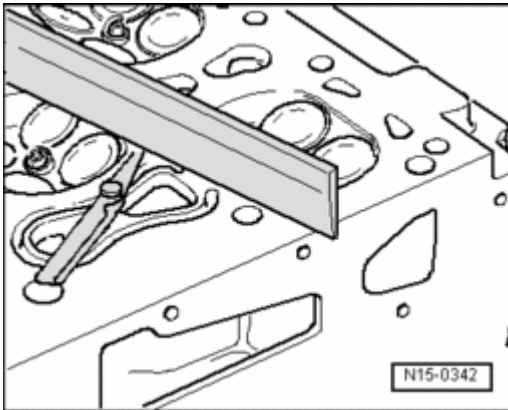


Fig. 235: Checking Cylinder Head For Distortion

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Use a straight edge and feeler gauge to measure for distortion at several points.
- Max. permissible distortion: 0.05 mm

Cylinder head cover, removing and installing

Removing

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

CAUTION: Observe notes on procedure for disconnecting the battery.

Refer to 27 BATTERY, STARTER, GENERATOR, CRUISE CONTROL

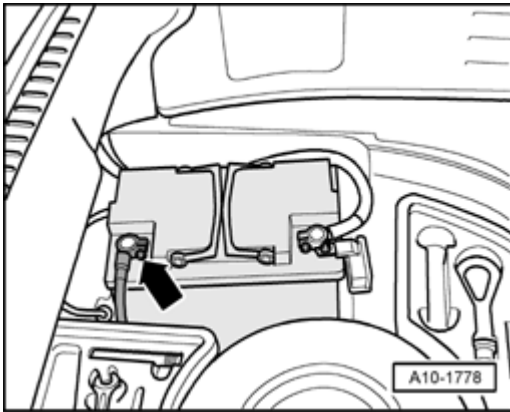


Fig. 236: Disconnecting Battery Ground (GND) Strap
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- With ignition switched off, disconnect ground cable (arrow) at battery in rear compartment under floor covering.

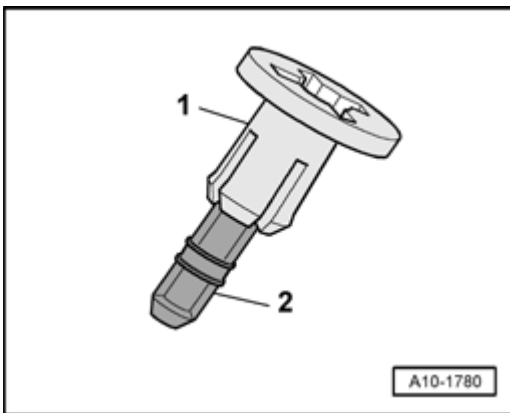


Fig. 237: Identifying Fasteners At Lock Carrier & Pin
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- To remove fasteners -1- at lock carrier, press pin -2- in approx. 4 mm (do not push in completely). Then pull fastener out upward.

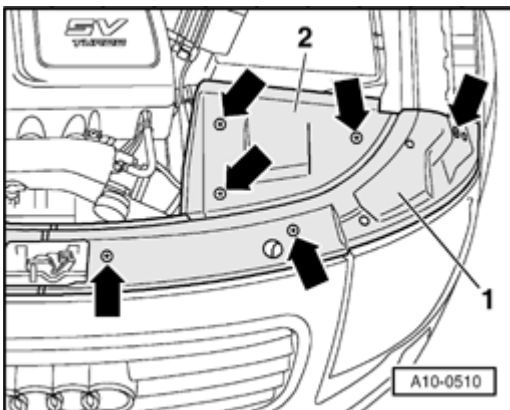


Fig. 238: Removing Left-Hand Cover Panels On Lock Carrier And Battery

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove covers (left side) -1- and -2- at lock carrier and above main fuse box (arrows).

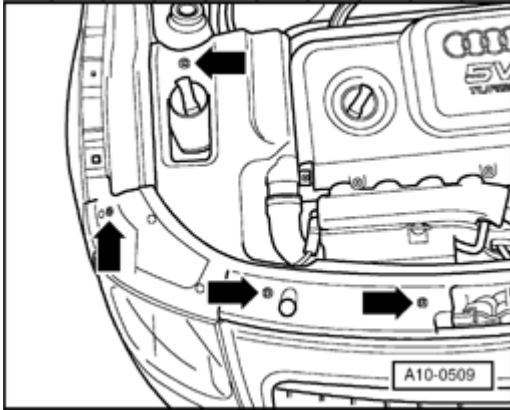


Fig. 239: Removing Covers At Lock Carrier And Above Coolant Expansion Tank
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove covers (right side) -1- and -2- at lock carrier and above coolant expansion tank (arrows).
- Pull out oil dipstick.

NOTE: Before removing, mark direction of rotation of poly V-belt with chalk or felt-tipped pen. If the belt runs in the opposite direction when it is reinstalled, it can be damaged.

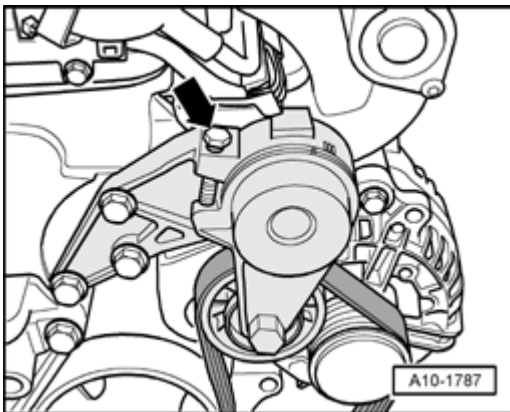


Fig. 240: Screwing Into Bore On Tensioning Element
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- To release tension of poly V-belt, screw an M8 x 40 bolt (arrow) into bore on tensioning element.
- Remove poly V-belt from Generator pulley.

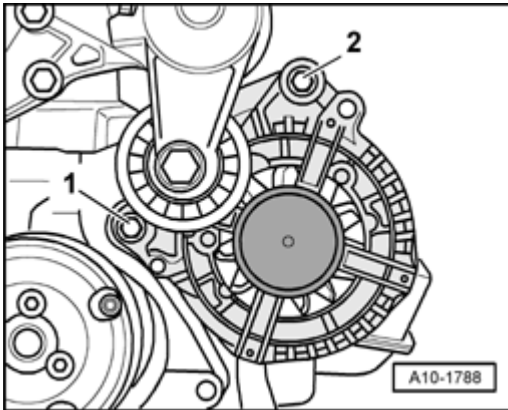


Fig. 241: Removing Upper/Lower Securing Bolt For Generator
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unscrew upper securing bolt -2- for Generator.

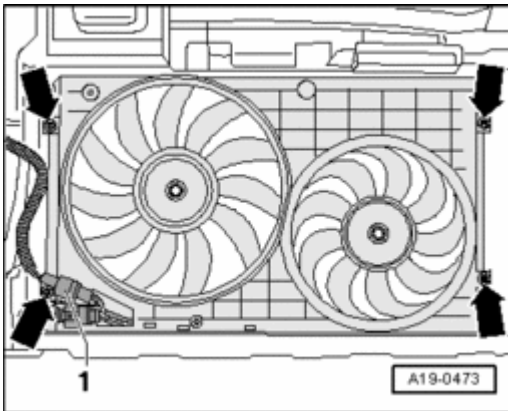


Fig. 242: Identifying Harness Connector And Fan Mount Mounting Bolts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove upper securing bolts (upper arrows) for radiator cowl.

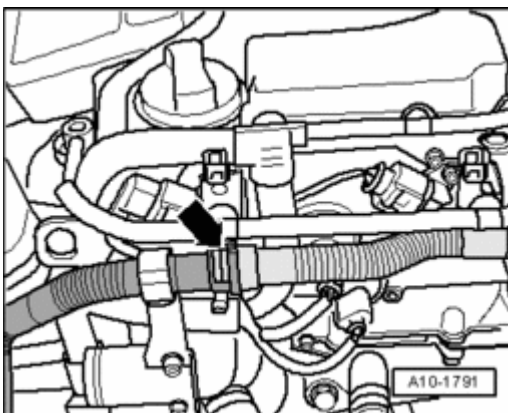


Fig. 243: Identifying Secondary Air Injection Hose
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect secondary air hose at position marked with an arrow.
- Move air hose clear.

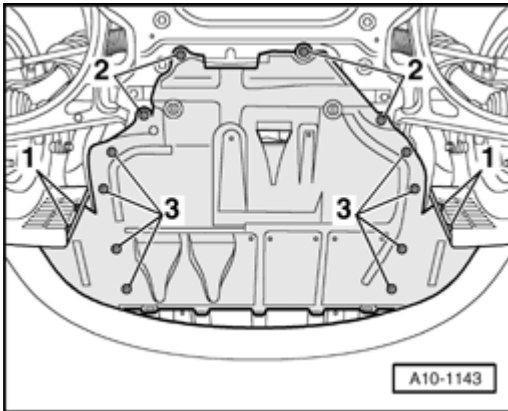


Fig. 244: Identifying Center Sound Insulation Fasteners
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove center sound insulation fasteners -1...3-.

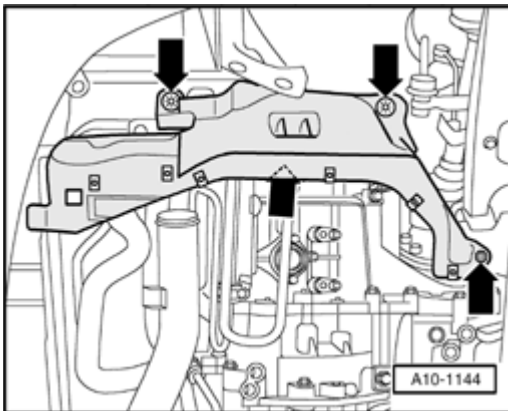


Fig. 245: Left Sound Insulation Panel
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove left sound insulation (arrows).

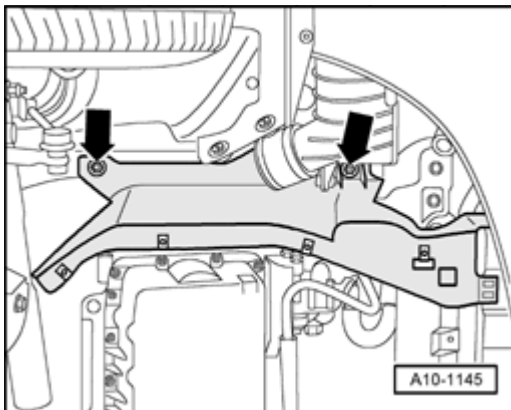


Fig. 246: Removing Right Sound Insulation

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove right sound insulation (arrows).

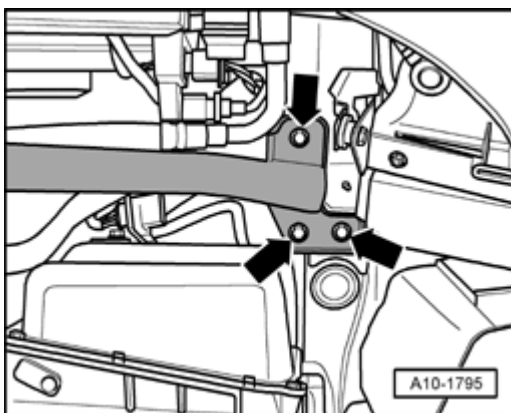


Fig. 247: Removing Cross Piece

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove cross piece (arrows).
- Unbolt pulley for power steering pump (counterhold with mandrel).

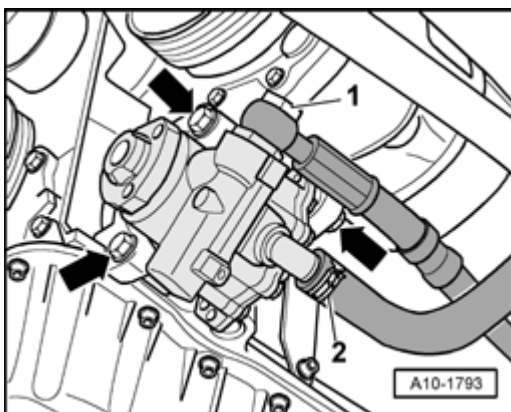


Fig. 248: Removing Bolts And Power Steering Pump From Bracket

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts (arrows) and remove power steering pump from bracket.
- Hang power steering pump on lock carrier with hydraulic hoses -1- and -2- still attached.

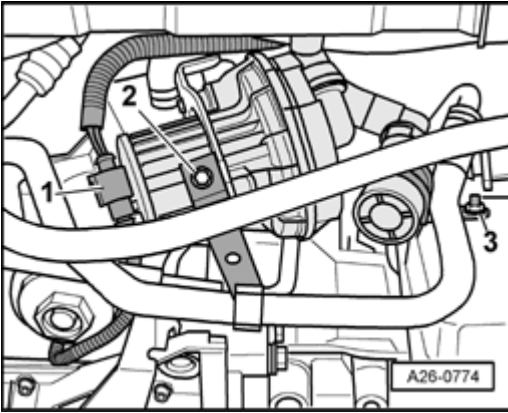


Fig. 249: Disconnecting Electrical Connector At Secondary Air Injection (AIR) Pump Motor -V101-
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical connector -1- at Secondary Air Injection (AIR) pump motor -V101-.
- Move wire clear.
- Unscrew bracket -2- for coolant hose.
- Unscrew bracket -3- for air filter for secondary air pump.

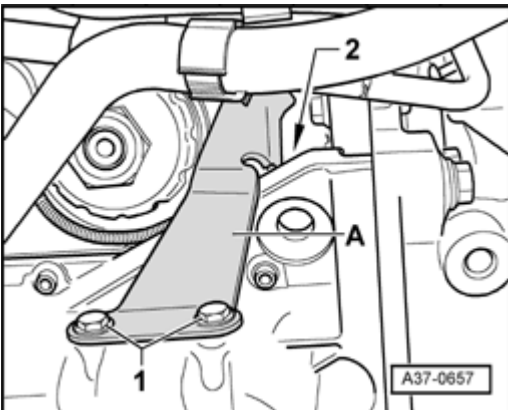


Fig. 250: Removing Bolts And Secondary Air Injection Pump With Bracket
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts -1- and -2- and remove secondary air injection pump with bracket -A-.

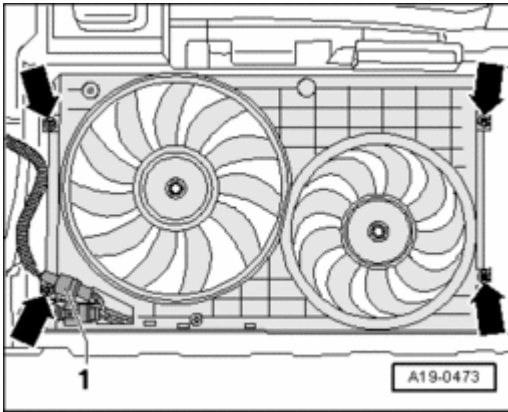


Fig. 251: Identifying Harness Connector And Fan Mount Mounting Bolts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical connectors -1- for coolant fans at bottom of radiator cowl.
- Remove lower securing bolts (lower arrows) for radiator cowl.
- Remove radiator cowl with both fans from below.

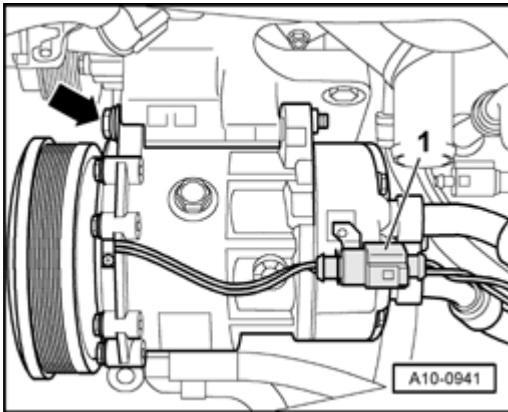


Fig. 252: Disconnecting Electrical Connector For Air Conditioning Compressor Clutch
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical connector -1- for air conditioning compressor clutch.

CAUTION: The refrigerant circuit of the air conditioner must not be opened.

- Unscrew bolt (arrow) for air conditioning compressor.

NOTE: The air conditioning compressor can only be removed from the bracket with the upper securing bolt still inserted. To do so, press the engine simultaneously to the left side with an assembly lever (2nd technician required). If required, loosen all bolts of the assembly mounting 1 turn.

- Tie up air conditioning compressor together with refrigerant hoses at front of longitudinal member

(refrigerant hoses remain connected).

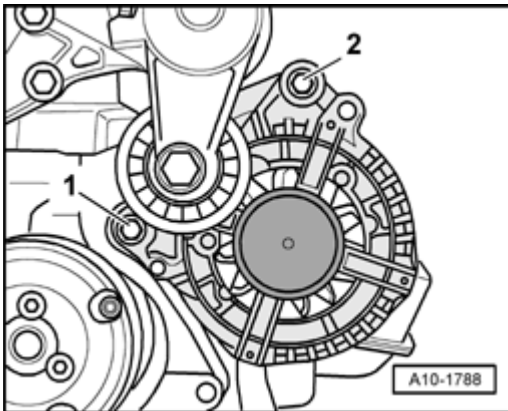


Fig. 253: Removing Upper/Lower Securing Bolt For Generator
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove lower securing bolt -1- for Generator.
- Remove Generator from bracket for ancillary units (electrical wires remain connected).

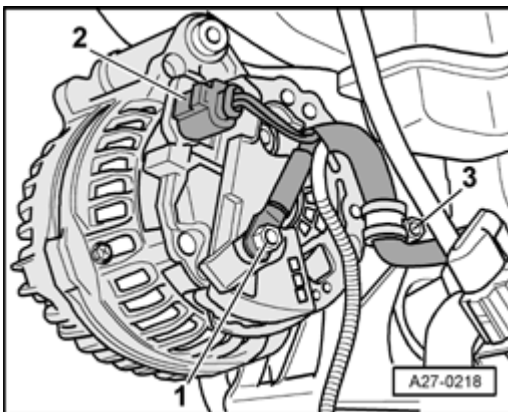


Fig. 254: Identifying Connector, Electrical Wire And Wiring Clamp On Generator
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unscrew clamp -3-.
- Unscrew wire -1- at Generator.
- Disconnect electrical connector -2-.
- Remove Generator.

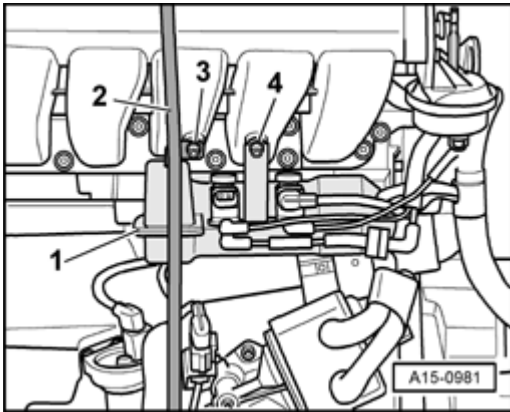


Fig. 255: Identifying Mounting Bolts, Oil Dipstick Guide Tube & Vacuum Reservoir
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolt -3- and pull out guide tube for oil dipstick -2-.
- Remove bolt -4- and disconnect vacuum reservoir from manifold.
- Move vacuum reservoir to side (hoses still attached).

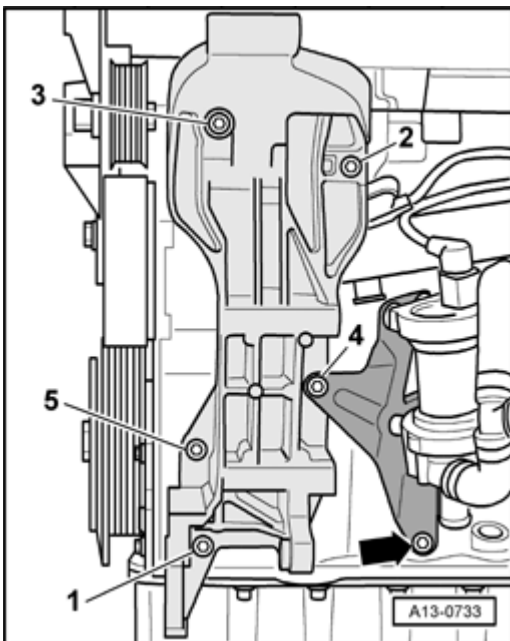


Fig. 256: Removing Bolt At Bracket For After-Run Coolant Pump -V51-
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolt (arrow) at bracket for coolant pump for After-run coolant pump -V51-.
- Remove bolts -1...5- and take off bracket for ancillary units.

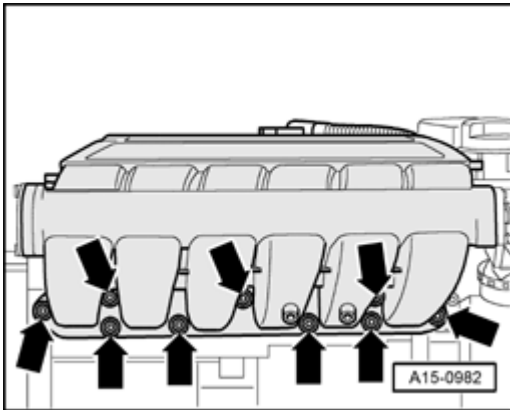


Fig. 257: Removing Bolts At Front Of Intake Manifold
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts (arrows) at front of intake manifold.

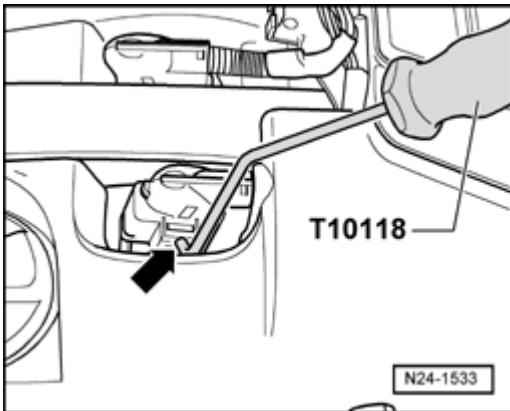


Fig. 258: Identifying Assembly Tool T10118 On Release Button
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical connectors at ignition coils by releasing tab (arrow) with assembly tool T10118 and carefully pulling connector.

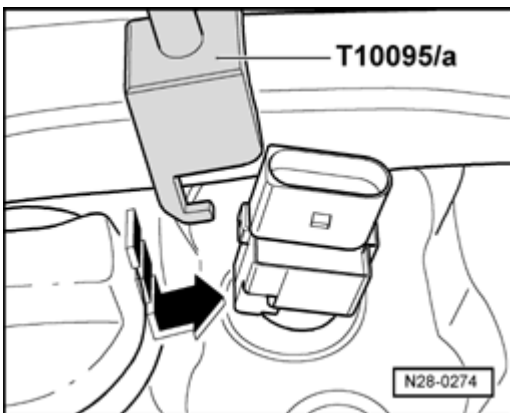


Fig. 259: Attaching Puller T10095A To Ignition Coils And Removing Ignition Coils
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Attach puller T10095A to ignition coils as shown in illustration (arrow) and remove ignition coils one at a time.

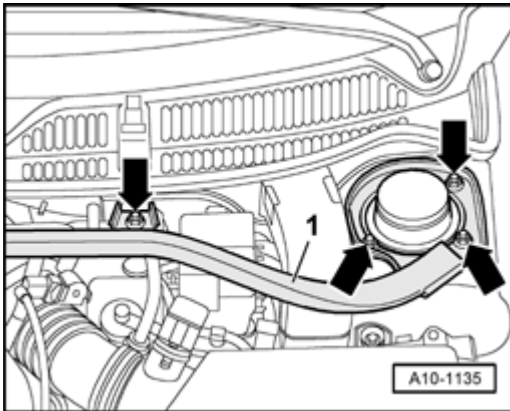


Fig. 260: Removing Body Brace

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove body brace -1- (arrows).

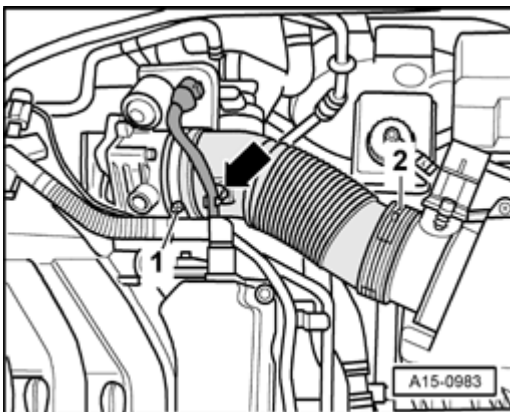


Fig. 261: Loosening Hose Clamps And Removing Air Hose Between Air Cleaner Housing & Throttle Valve Control Module -J338-

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Move electrical wire (arrow) clear.
- Loosen hose clamps -1- and -2- and remove air hose between air cleaner housing and Throttle valve control module -J338-.

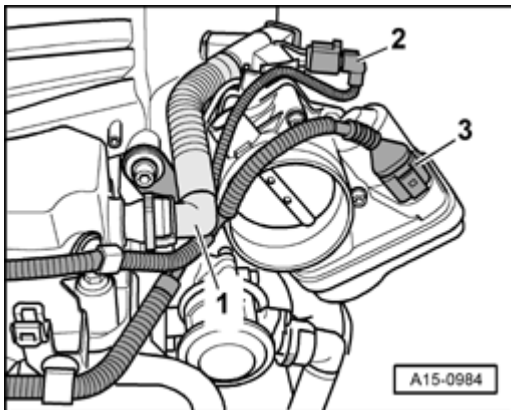


Fig. 262: Disconnecting Crankcase Breather Hose & Electrical Connectors
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical connectors -2- and -3-.
- Disconnect crankcase breather hose -1-.

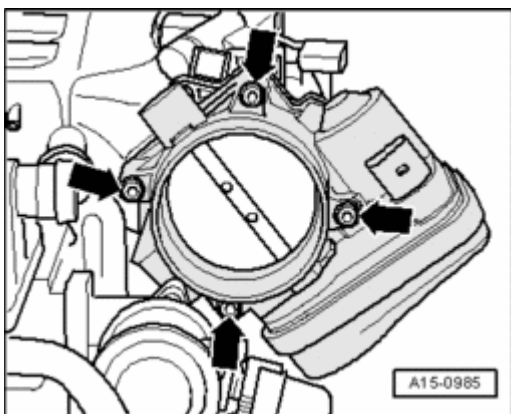


Fig. 263: Removing Bolts And Throttle Valve Control Module -J338- From Intake Manifold
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts (arrows) for Throttle valve control module -J338- and move it clear to one side (coolant hoses remain attached).

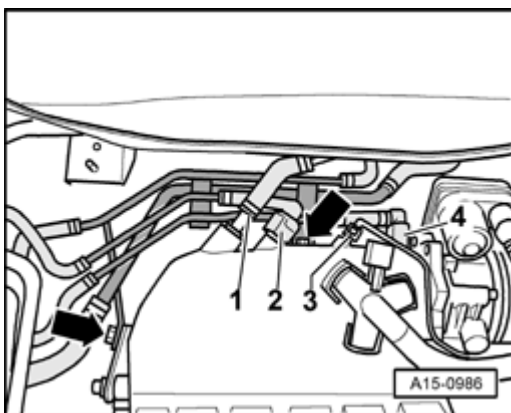


Fig. 264: Disconnecting Vacuum Hoses At Rear Of Intake Manifold
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect vacuum hoses -1...4- at rear of intake manifold.

NOTE: The other hoses remain attached on hose bracket.

- Unbolt hose bracket from intake manifold (arrows).

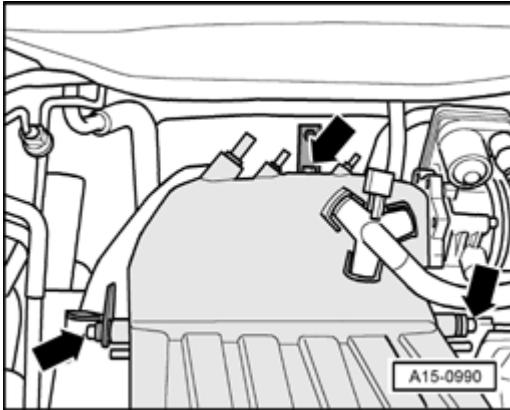


Fig. 265: Removing Rear Securing Bolts For Intake Manifold
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove rear securing bolts (arrows) for intake manifold.

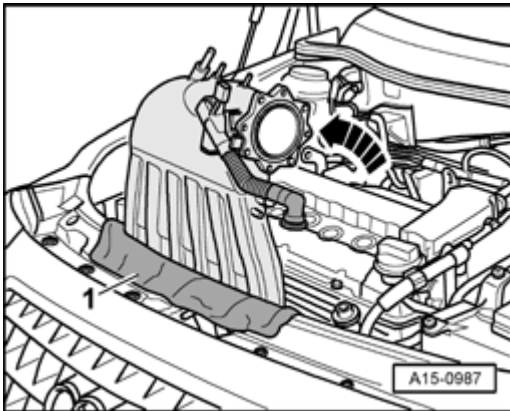


Fig. 266: Protecting Intake Manifold From Damage With Clean Cloth & Swing Intake Manifold Forward
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Protect intake manifold from damage with a clean cloth -1-.
- Swing intake manifold forward (arrow).

NOTE: Cover or plug the intake ports in the cylinder head with a clean cloth or foam plastic to prevent small items from falling in.

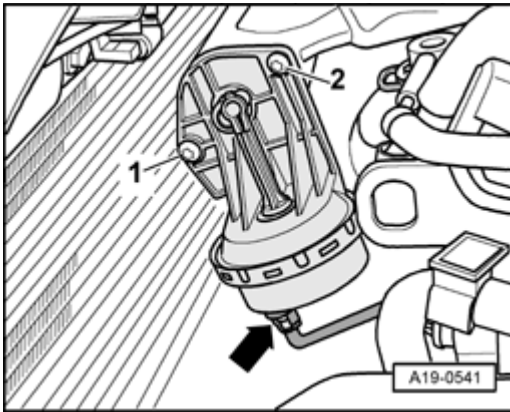


Fig. 267: Disconnecting Vacuum Hose At Vacuum Unit For Intake Manifold Change-Over
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect vacuum hose (arrow) at vacuum unit for intake manifold change-over.

NOTE: Items -1- and -2- are not applicable here.

- Unbolt brackets for electrical wires at left on cover for timing chains and at right on cylinder head cover.

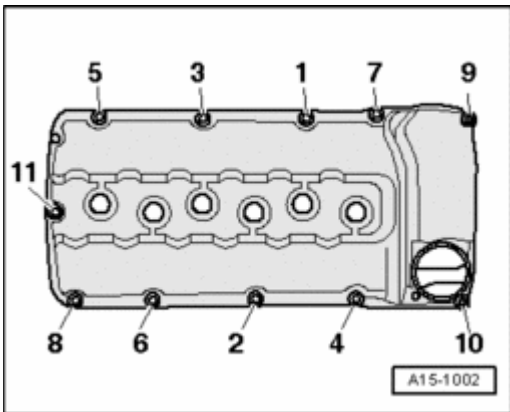


Fig. 268: Unscrewing Cylinder Head Cover Bolts In Sequence
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unscrew cylinder head cover bolts in sequence -11...1-.

Installing

Installation is performed in the reverse order. Note the following:

- NOTE:**
- Replace gaskets for the cylinder head cover and securing bolts if damaged.
 - Replace gaskets for the ignition coils if damaged.

- Tighten cylinder head cover bolts in sequence -1...11-.

- Install bracket for ancillary units. Refer to **Bracket for ancillary units, removing and installing.**
- Drive back respective bushings for securing bolts slightly to facilitate installation of Generator, power steering pump and air conditioning compressor.
- Install Generator.

Refer to **27 BATTERY, STARTER, GENERATOR, CRUISE CONTROL**

- Install air conditioning compressor.

Refer to **87 AIR CONDITIONING**

- Install radiator cowl. Refer to **Radiator, removing and installing.**
- Install secondary air injection pump. Refer to **Secondary air injection pump, removing and installing.**
- Install power steering pump.

Refer to **48 STEERING**

- Install body brace and cross piece.

Refer to **40 FRONT SUSPENSION**

- Install poly V-belt. Refer to **Poly V-belt, removing and installing.**
- Connect Ground strap to battery.

Refer to **27 BATTERY, STARTER, GENERATOR, CRUISE CONTROL**

Tightening torques

Component	Nm
Cylinder head cover to cylinder head	10
Intake manifold to cylinder head	13
Bracket for After-run coolant pump -V51- to cylinder block	20
Intake manifold support to intake manifold	20
Throttle valve control module -J338- to intake manifold	10
Vacuum reservoir to intake manifold	5
Guide tube for oil dipstick to intake manifold	5

Intake manifold, removing and installing

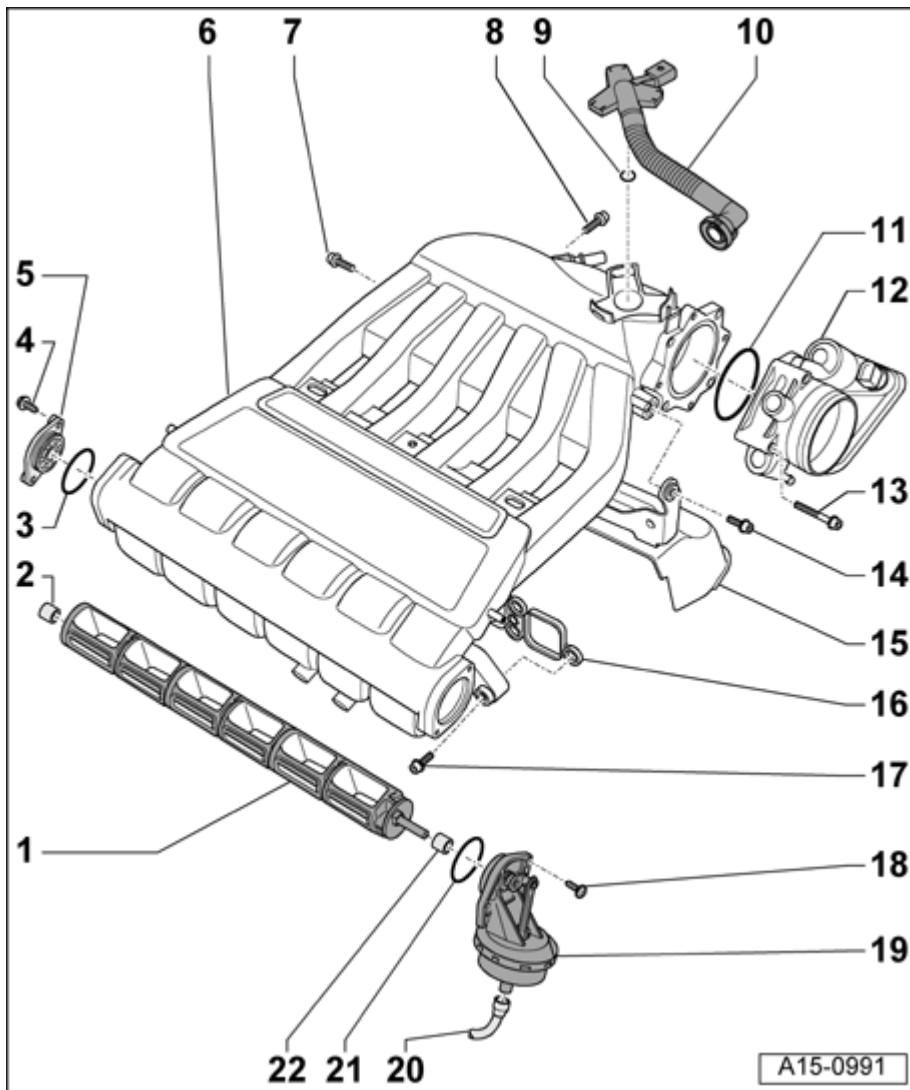


Fig. 269: Intake Manifold, Removing And Installing Overview
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

Overview of intake manifold components

1 - Change-over mechanism

2 - Bushing

3 - O-ring

- Replace

4 - Panel bolt

5 - Bearing cap

6 - Intake manifold**7 - 20 Nm****8 - 20 Nm****9 - Seal****10 - Connection for crankcase breather**

- With Positive Crankcase Ventilation (PCV) heating element -N79-

11 - O-ring**12 - Throttle valve control module -J338-****13 - 10 Nm****14 - 20 Nm****15 - Heat shield for exhaust manifold**

- With support for intake manifold

16 - Gasket

- Replace
- Insert into manifold

17 - 13 Nm**18 - Panel bolt****19 - Vacuum unit****20 - Vacuum connection**

- To Intake manifold change-over valve -N156-

21 - O-ring

- Replace

22 - Bushing**Removing**

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

CAUTION: Observe notes on procedure for disconnecting the battery.

Refer to **27 BATTERY, STARTER, GENERATOR, CRUISE CONTROL**

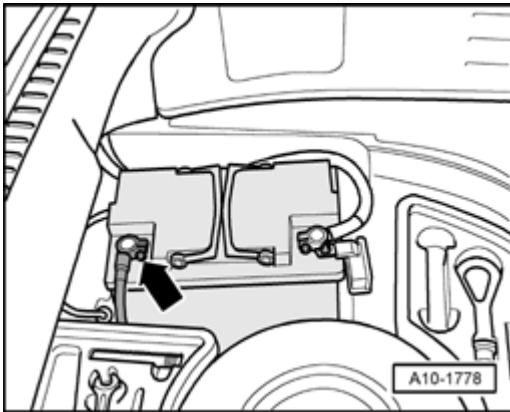


Fig. 270: Disconnecting Battery Ground (GND) Strap
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- With ignition switched off, disconnect ground cable (arrow) at battery in rear compartment under floor covering.

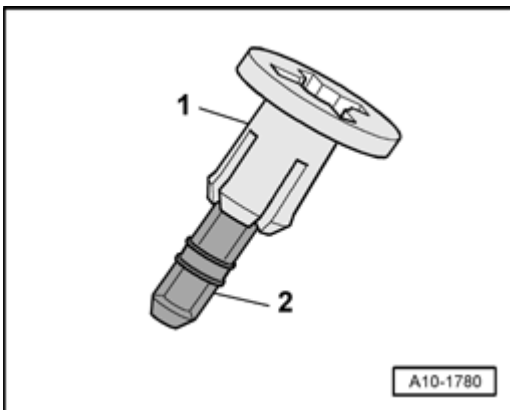


Fig. 271: Identifying Fasteners At Lock Carrier & Pin
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- To remove fasteners -1- at lock carrier, press pin -2- in approx. 4 mm (do not push in completely). Then pull fastener out upward.

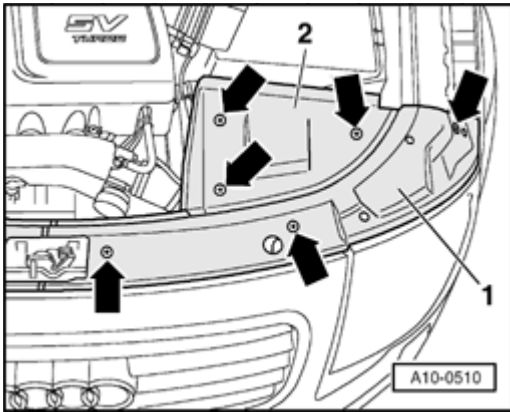


Fig. 272: Removing Left-Hand Cover Panels On Lock Carrier And Battery
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove covers (left side) -1- and -2- at lock carrier and above main fuse box (arrows).

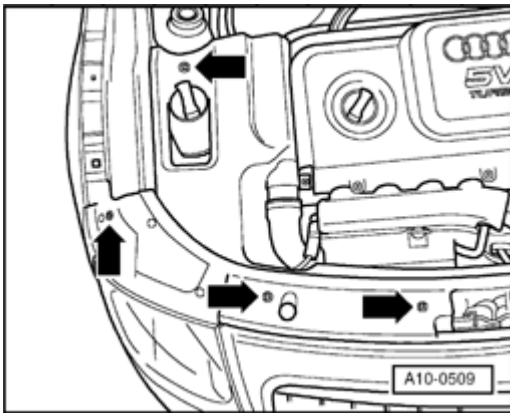


Fig. 273: Removing Covers At Lock Carrier And Above Coolant Expansion Tank
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove covers (right side) -1- and -2- at lock carrier and above coolant expansion tank (arrows).
- Pull out oil dipstick.

NOTE: Before removing, mark direction of rotation of poly V-belt with chalk or felt-tipped pen. If the belt runs in the opposite direction when it is reinstalled, it can be damaged.

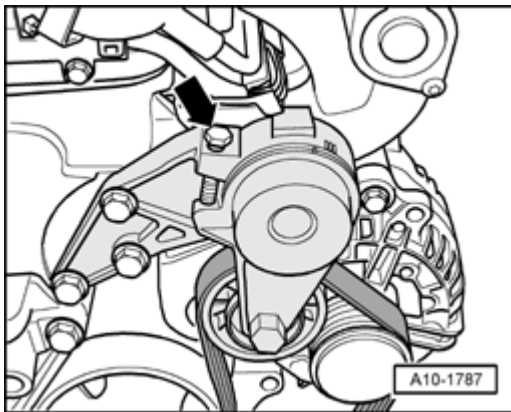


Fig. 274: Screwing Into Bore On Tensioning Element
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- To release tension of poly V-belt, screw an M8 x 40 bolt (arrow) into bore on tensioning element.
- Remove poly V-belt from Generator pulley.

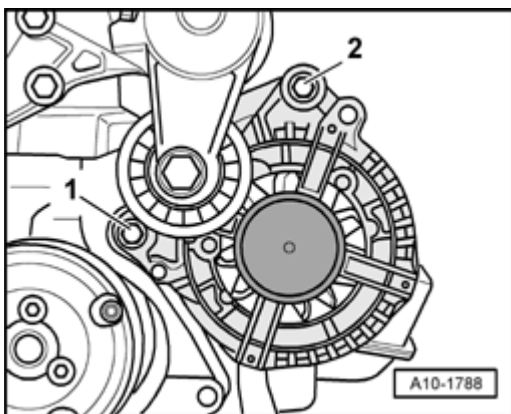


Fig. 275: Removing Upper/Lower Securing Bolt For Generator
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unscrew upper securing bolt -2- for Generator.

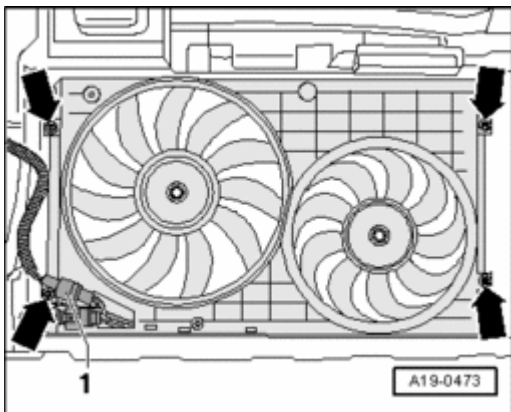


Fig. 276: Identifying Harness Connector And Fan Mount Mounting Bolts

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove upper securing bolts (upper arrows) for radiator cowl.

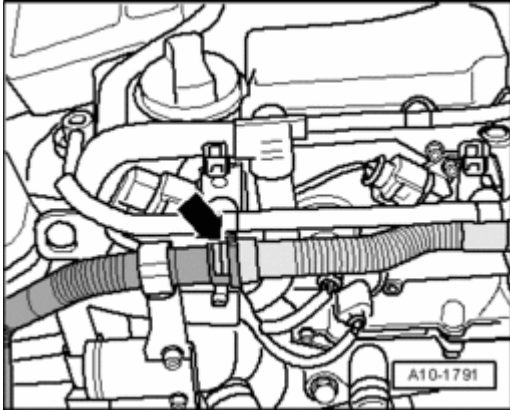


Fig. 277: Identifying Secondary Air Injection Hose

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect secondary air hose at position marked with an arrow.
- Move air hose clear.

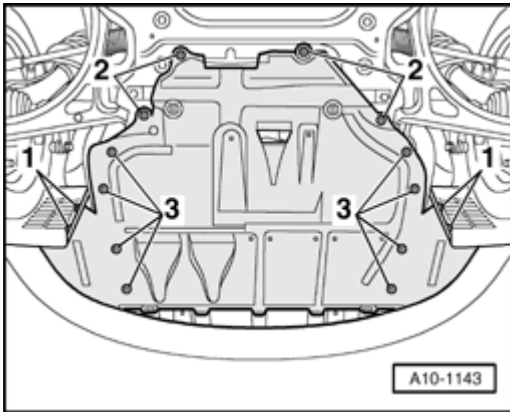
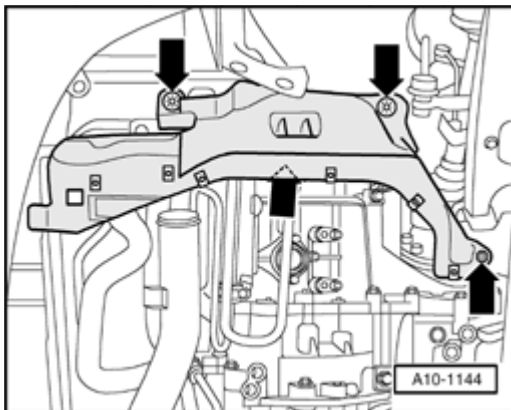


Fig. 278: Identifying Center Sound Insulation Fasteners

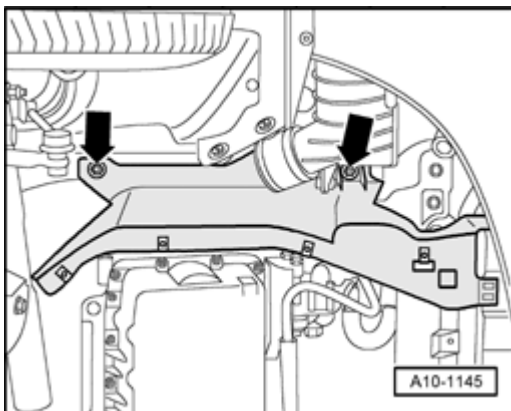
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove center sound insulation fasteners -1...3-.

**Fig. 279: Left Sound Insulation Panel**

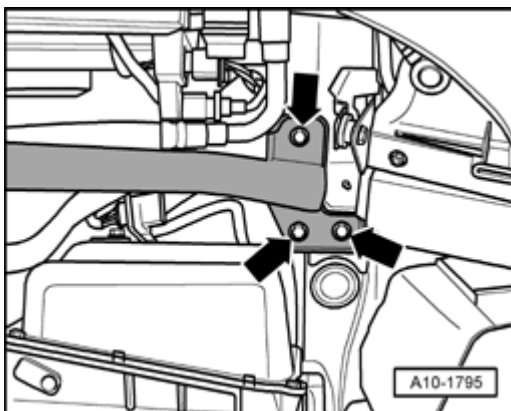
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove left sound insulation (arrows).

**Fig. 280: Removing Right Sound Insulation**

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove right sound insulation (arrows).

**Fig. 281: Removing Cross Piece**

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove cross piece (arrows).
- Unbolt pulley for power steering pump (counterhold with mandrel).

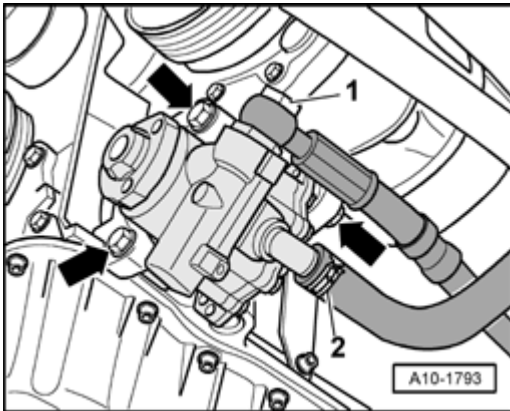


Fig. 282: Removing Bolts And Power Steering Pump From Bracket
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts (arrows) and remove power steering pump from bracket.
- Hang power steering pump on lock carrier with hydraulic hoses -1- and -2- still attached.

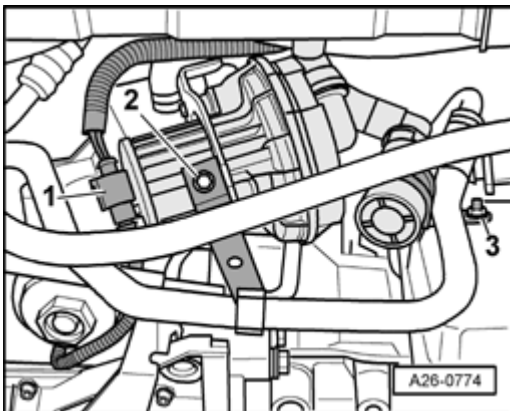


Fig. 283: Disconnecting Electrical Connector At Secondary Air Injection (AIR) Pump Motor -V101-
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical connector -1- at Secondary Air Injection (AIR) pump motor -V101-.
- Move wire clear.
- Unscrew bracket -2- for coolant hose.
- Unscrew bracket -3- for air filter for secondary air pump.

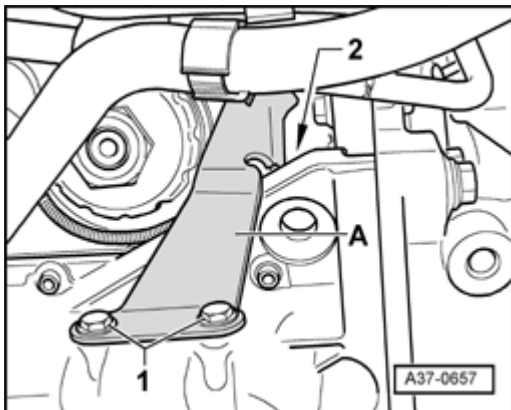


Fig. 284: Removing Bolts And Secondary Air Injection Pump With Bracket
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts -1- and -2- and remove secondary air injection pump with bracket -A-.

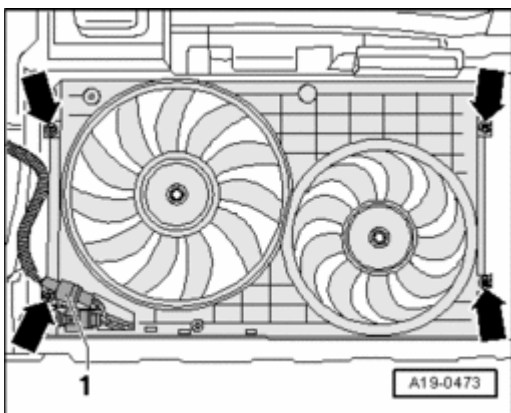


Fig. 285: Identifying Harness Connector And Fan Mount Mounting Bolts
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical connectors -1- for coolant fans at bottom of radiator cowl.
- Remove lower securing bolts (lower arrows) for radiator cowl.
- Remove radiator cowl with both fans from below.

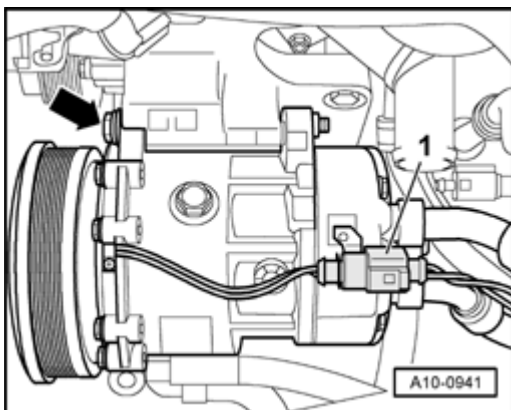


Fig. 286: Disconnecting Electrical Connector For Air Conditioning Compressor Clutch
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical connector -1- for air conditioning compressor clutch.

CAUTION: The refrigerant circuit of the air conditioner must not be opened.

- Unscrew bolt (arrow) for air conditioning compressor.

NOTE: The air conditioning compressor can only be removed from the bracket with the upper securing bolt still inserted. To do so, press the engine simultaneously to the left side with an assembly lever (2nd technician required). If required, loosen all bolts of the assembly mounting 1 turn.

- Tie up air conditioning compressor together with refrigerant hoses at front of longitudinal member (refrigerant hoses remain connected).

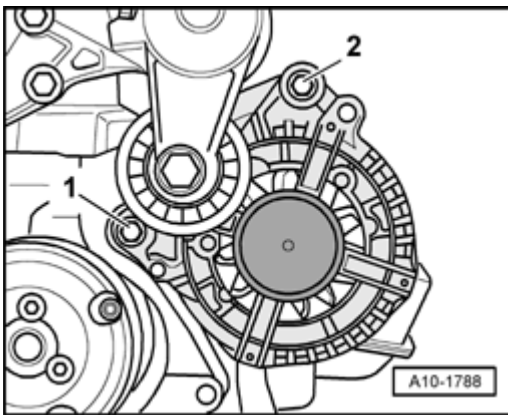


Fig. 287: Removing Upper/Lower Securing Bolt For Generator
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove lower securing bolt -1- for Generator.
- Remove Generator from bracket for ancillary units (electrical wires remain connected).

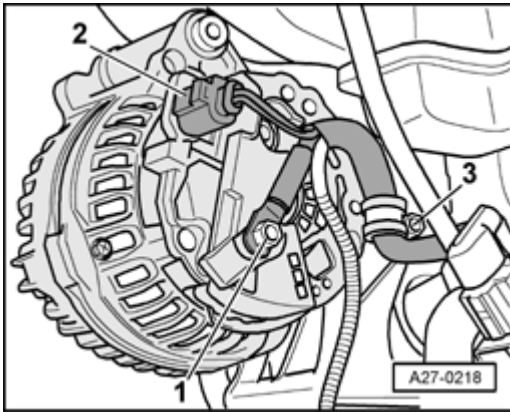


Fig. 288: Identifying Connector, Electrical Wire And Wiring Clamp On Generator
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unscrew clamp -3-.
- Unscrew wire -1- at Generator.
- Disconnect electrical connector -2-.
- Remove Generator.

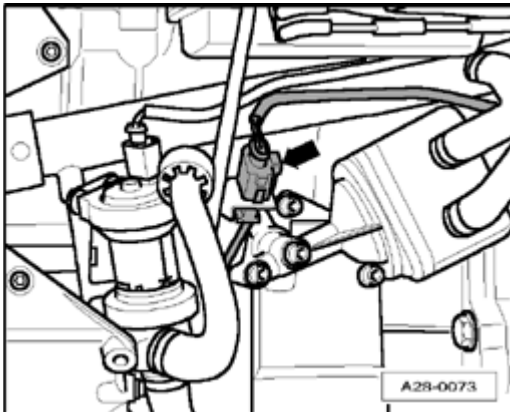


Fig. 289: Removing Connector For Engine Speed (RPM) Sensor -G28- From Retainer On Oil Dipstick Guide Tube
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove connector (arrow) for Engine speed (RPM) sensor -G28- from retainer on oil dipstick guide tube.

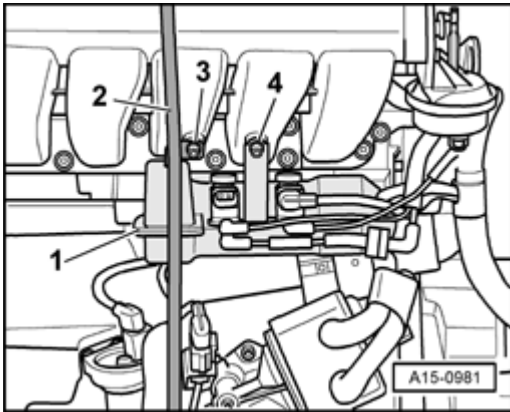


Fig. 290: Identifying Mounting Bolts, Oil Dipstick Guide Tube & Vacuum Reservoir
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolt -3- and pull out guide tube for oil dipstick -2-.
- Remove bolt -4- and disconnect vacuum reservoir from manifold.
- Move vacuum reservoir to side (hoses still attached).

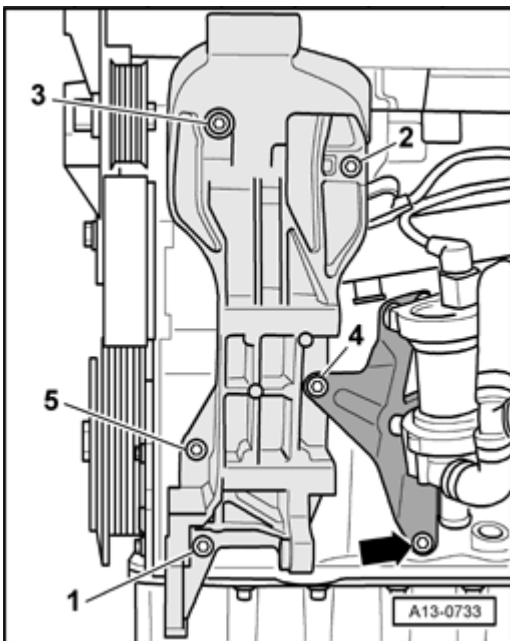


Fig. 291: Removing Bolt At Bracket For After-Run Coolant Pump -V51-
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolt (arrow) at bracket for coolant pump for After-run coolant pump -V51-.
- Remove bolts -1...5- and take off bracket for ancillary units.

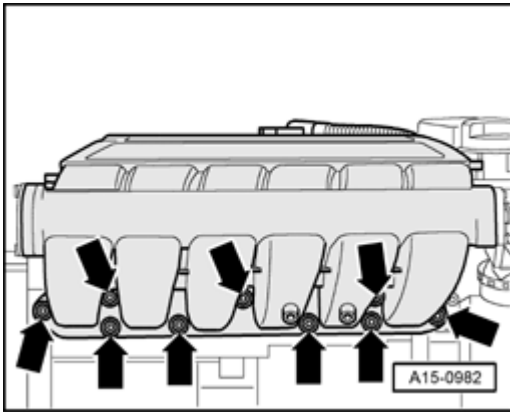


Fig. 292: Removing Bolts At Front Of Intake Manifold
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts (arrows) at front of intake manifold.

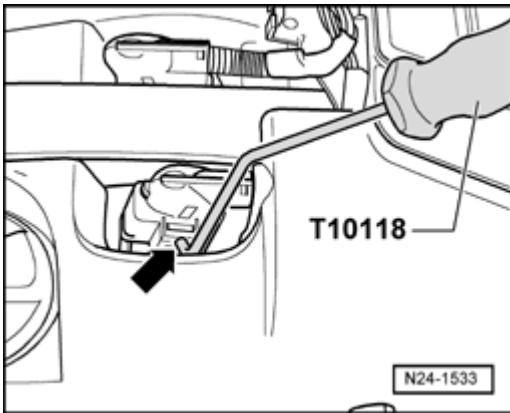


Fig. 293: Identifying Assembly Tool T10118 On Release Button
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical connectors at ignition coils by releasing tab (arrow) with assembly tool T10118 and carefully pulling connector.

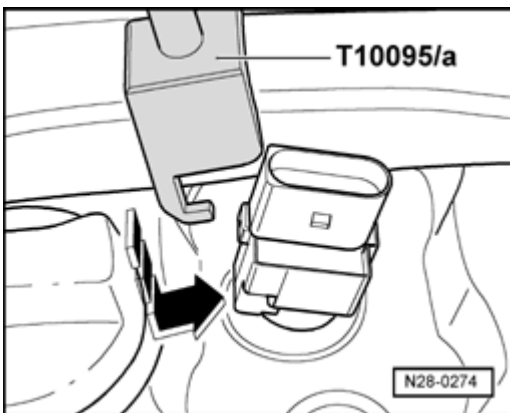
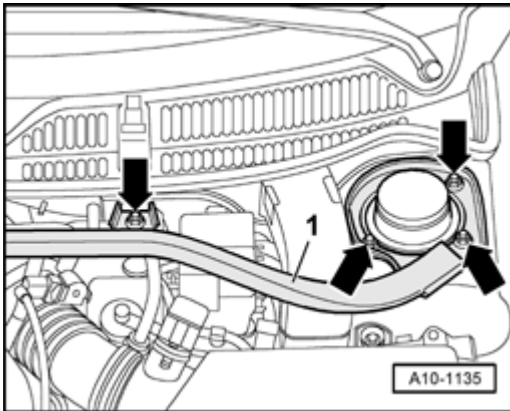


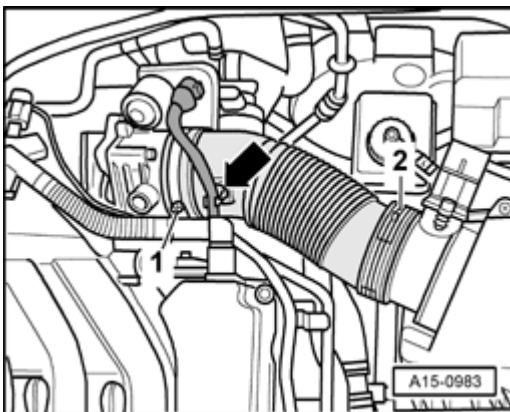
Fig. 294: Attaching Puller T10095A To Ignition Coils And Removing Ignition Coils
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Attach puller T10095A to ignition coils as shown in illustration (arrow) and remove ignition coils one at a time.

**Fig. 295: Removing Body Brace**

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove body brace -1- (arrows).

**Fig. 296: Loosening Hose Clamps And Removing Air Hose Between Air Cleaner Housing & Throttle Valve Control Module -J338-**

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Move electrical wire (arrow) clear.
- Loosen hose clamps -1- and -2- and remove air hose between air cleaner housing and Throttle valve control module -J338-.

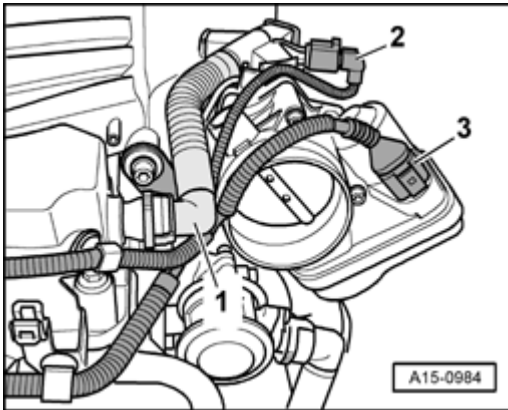


Fig. 297: Identifying Electrical Connectors & Crankcase Breather Hose
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical connectors -2- and -3-.
- Disconnect crankcase breather hose -1-.

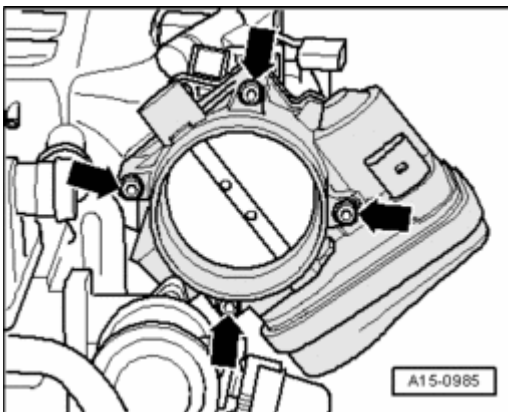


Fig. 298: Removing Bolts And Throttle Valve Control Module -J338- From Intake Manifold
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts (arrows) for Throttle valve control module -J338- and move it clear to one side (coolant hoses remain attached).

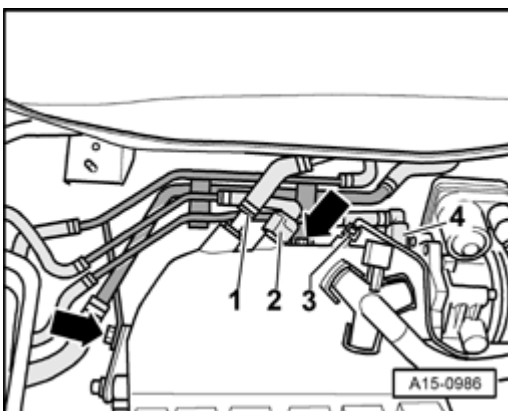


Fig. 299: Disconnecting Vacuum Hoses At Rear Of Intake Manifold
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect vacuum hoses -1...4- at rear of intake manifold.

NOTE: The other hoses remain attached on hose bracket.

- Unbolt hose bracket from intake manifold (arrows).

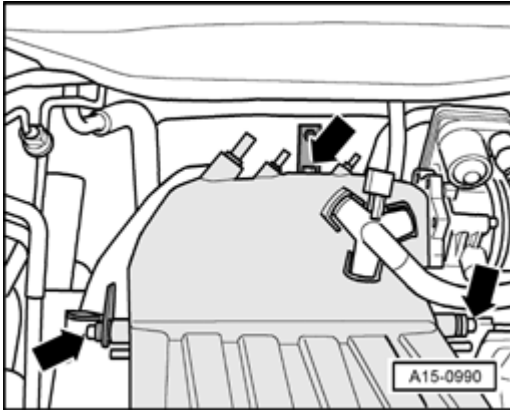


Fig. 300: Removing Rear Securing Bolts For Intake Manifold
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove rear securing bolts (arrows) for intake manifold.

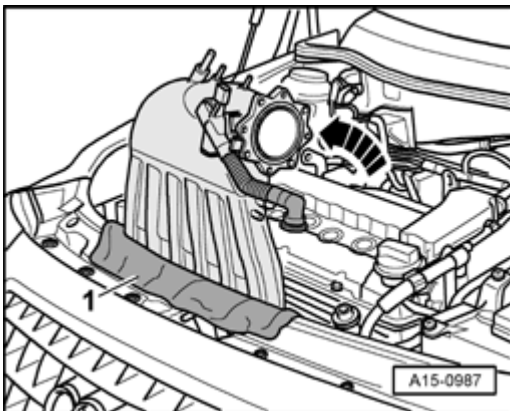


Fig. 301: Protecting Intake Manifold From Damage With Clean Cloth & Swing Intake Manifold Forward
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Protect intake manifold from damage with a clean cloth -1-.
- Swing intake manifold forward (arrow).

NOTE: Cover or plug the intake ports in the cylinder head with a clean cloth or foam plastic to prevent small items from falling in.

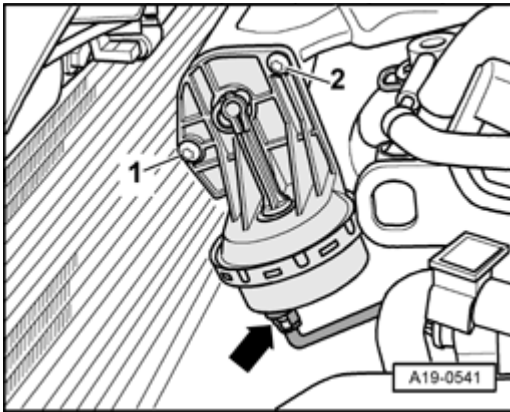


Fig. 302: Disconnecting Vacuum Hose At Vacuum Unit For Intake Manifold Change-Over
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect vacuum hose (arrow) at vacuum unit for intake manifold change-over.

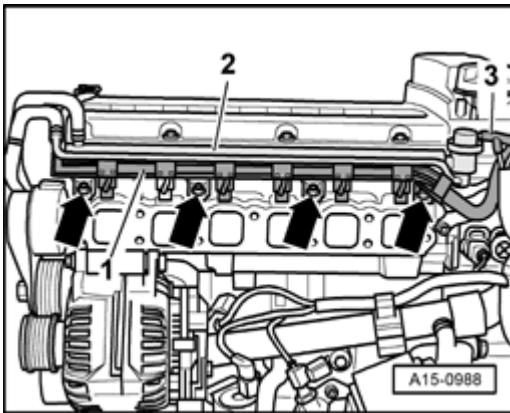


Fig. 303: Unclipping Pipe Guide From Fuel Rail & Disconnecting Vacuum Pipe From Fuel Pressure Regulator
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unclip pipe guide -1- from fuel rail -2-.
- Disconnect vacuum pipe -3- from fuel pressure regulator.
- Remove bolts (arrows).
- Remove fuel rail with fuel injectors from cylinder head and move clear to one side (fuel lines remain attached).
- Swing intake manifold back to its installed position and remove.

Installing

Installation is performed in the reverse order. Note the following:

NOTE: Replace seals and gaskets.

2005 Audi TT

ENGINE 3.2 Liter V6 4V Engine Mechanical, Engine Code(s): BHE

- Install bracket for ancillary units. Refer to **Bracket for ancillary units, removing and installing.**
- Drive back respective bushings for securing bolts slightly to facilitate installation of Generator, power steering pump and air conditioning compressor.
- Install Generator.

Refer to **27 BATTERY, STARTER, GENERATOR, CRUISE CONTROL**

- Install air conditioning compressor.

Refer to **87 AIR CONDITIONING**

- Install radiator cowl. Refer to **Radiator, removing and installing.**
- Install secondary air injection pump. Refer to **Secondary air injection pump, removing and installing.**
- Install power steering pump.

Refer to **48 STEERING**

- Install body brace and cross piece.

Refer to **40 FRONT SUSPENSION**

- Install poly V-belt. Refer to **Poly V-belt, removing and installing.**
- Connect Ground strap to battery.

Refer to **27 BATTERY, STARTER, GENERATOR, CRUISE CONTROL**

Tightening torques

Component	Nm
Intake manifold to cylinder head	13
Bracket for After-run coolant pump -V51- to cylinder block	20
Intake manifold support to intake manifold	20
Throttle valve control module -J338- to intake manifold	10
Vacuum reservoir to intake manifold	5
Guide tube for oil dipstick to intake manifold	5

Cylinder head, removing

- Engine in vehicle

NOTE:

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

- Heat insulation sleeves that have been removed are to be reinstalled in the original position.
- If engine oil is contaminated, perform oil change.

Refer to **01 MAINTENANCE**

- Drain coolant. Refer to **Cooling system, draining and filling**.
- Remove intake manifold. Refer to **Intake manifold, removing and installing**.
- Remove timing chain from camshafts. Refer to **Camshaft timing chain, removing from camshafts**.

NOTE: To avoid damage, the flexible joints in the front exhaust pipe must not be bent more than 10°.

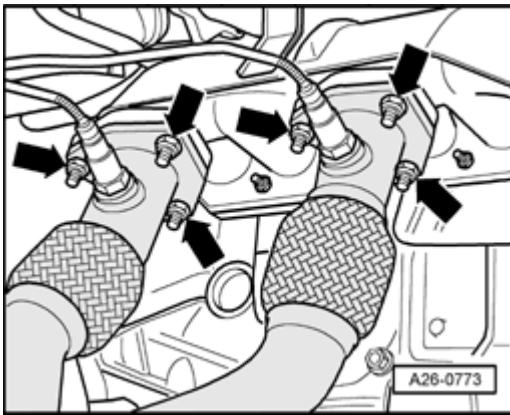


Fig. 304: Unbolting Front Exhaust Pipe At Exhaust Manifold
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unbolt front exhaust pipe from exhaust manifolds (arrows).

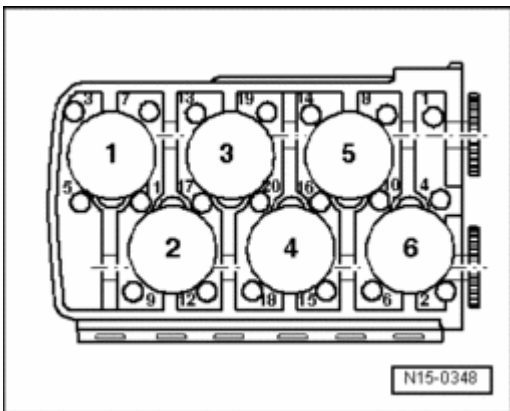


Fig. 305: Cylinder Head Bolts Removal Sequence
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Loosen and remove cylinder head bolts in sequence indicated.

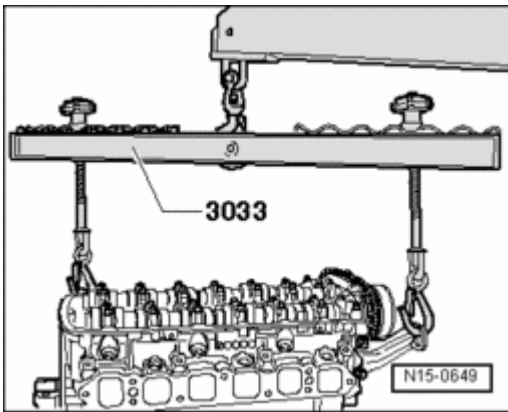


Fig. 306: Attaching Lifting Tackle 3033

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Attach lifting tackle 3033 as follows:
 - Belt pulley end: position 3
 - Timing chain end: position 10

NOTE: The positions marked 1...12 on the lifting tackle 3033 face toward the timing chain end.

- Carefully lift off cylinder head.
- Place clean cloths in cylinders to prevent dirt from getting between cylinder wall and piston.

Cylinder head, installing

Special tools, testers and auxiliary items required

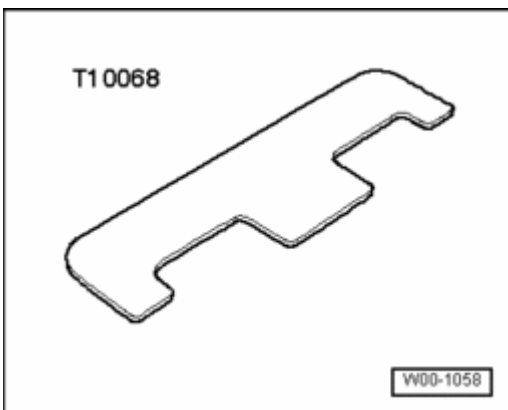


Fig. 307: Camshaft Bar T10068 A

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Camshaft bar T10068

NOTE:

- Replace cylinder head bolts.
- On assembly, replace self-locking nuts and bolts that are tightened by turning through to a specified angle, as well as oil seals and gaskets.
- Secure all hose connections with the correct type of hose clamps (same as original equipment).
- If repairing, carefully remove any remaining gasket material from the cylinder head and cylinder block. Ensure that no long scores or scratches are made on the surfaces.
- Do not remove new cylinder head gasket from packaging until it is ready to be installed.
- Handle the gasket very carefully. Damage to 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.

- Set camshafts to TDC for cylinder No. 1 before installing cylinder head.

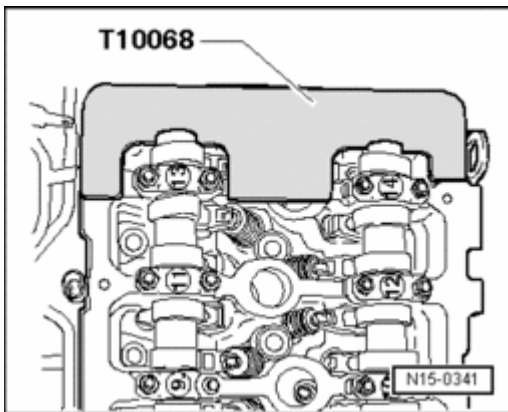


Fig. 308: Identifying Camshaft Bar T10068 Engage In Both Shaft Grooves
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- It must be possible to insert camshaft plate T10068 in both camshaft grooves.

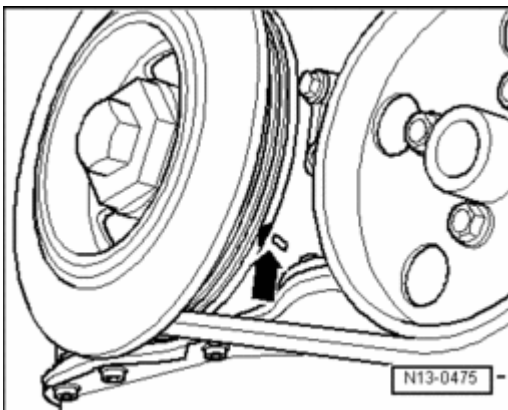


Fig. 309: Identifying Crankshaft At Vibration Damper Securing Bolt In Engine At TDC Cyl. 1
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Check again whether crankshaft is positioned at TDC (arrow).

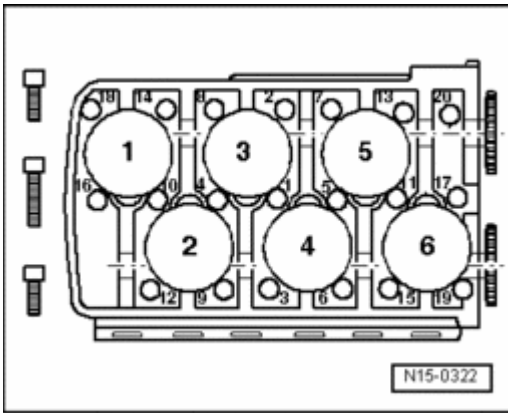


Fig. 310: Cylinder Head Tightening Sequence
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Install new cylinder head gasket.
- Pay attention to centering pins in cylinder block.
- Check installed position of cylinder head gasket; Part No. must be visible from intake side.
- Install cylinder head.
- Insert cylinder head bolts and tighten by hand.

NOTE: **The long cylinder head bolts are inserted in the middle bores in the cylinder head.**

- Tighten cylinder head in 4 stages in following sequence:
- Tighten using a torque wrench:
 - 1st stage: 30 Nm
 - 2nd stage: 50 Nm
- Tighten with a Torx key:
 - 3rd stage: 90° (1/4 turn) further
 - 4th stage: 90° (1/4 turn) further

NOTE: **Re-tightening of the cylinder head bolts is not necessary on completion of repair work.**

- Install camshaft timing chain. Refer to Camshaft timing chain, removing from camshafts.

2005 Audi TT

ENGINE 3.2 Liter V6 4V Engine Mechanical, Engine Code(s): BHE

- Install cylinder head cover. Refer to **Cylinder head cover, removing and installing.**
- Install intake manifold. Refer to **Intake manifold, removing and installing.**
- Replace coolant. Refer to **Cooling system, draining and filling.**
- Connect Ground strap to battery

Refer to **27 BATTERY, STARTER, GENERATOR, CRUISE CONTROL**

Tightening torque

Component	Nm
Front exhaust pipe to exhaust manifold	25 1)

1) Replace nuts

Compression, checking

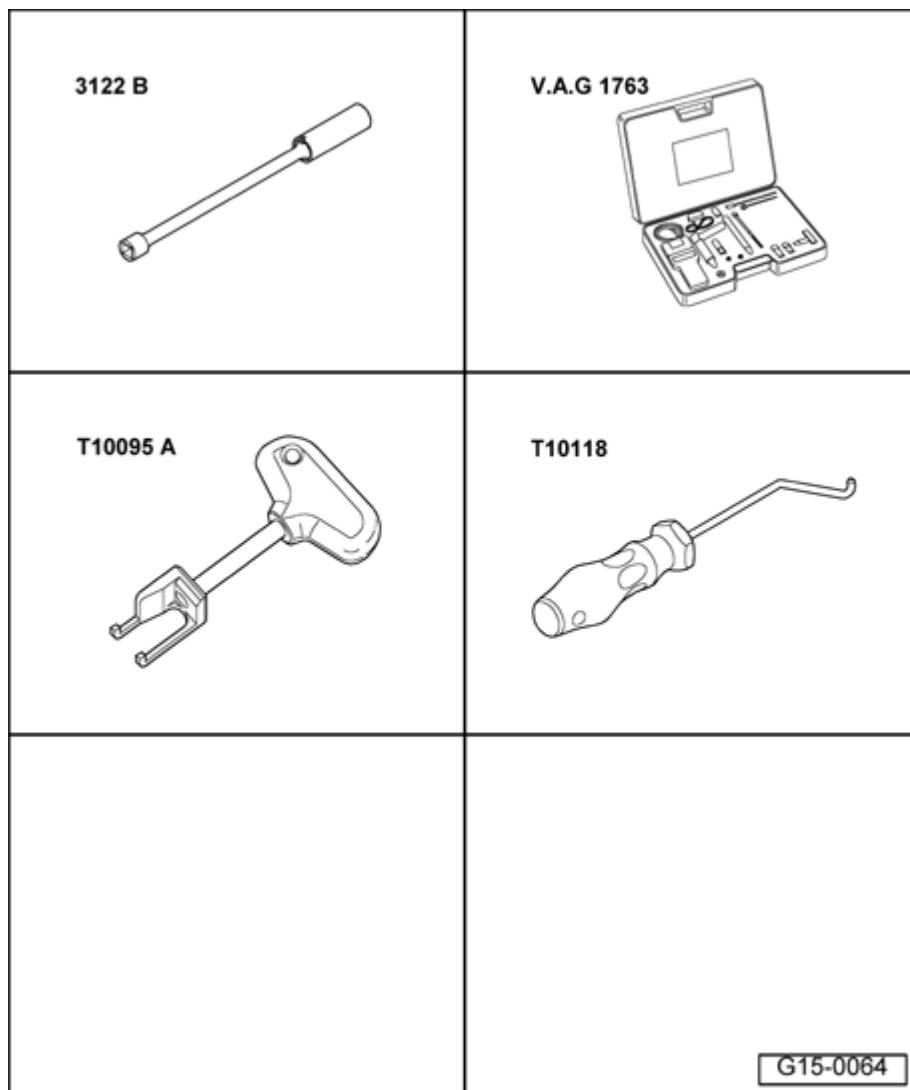


Fig. 311: Identifying Special Tools - Compression, Checking
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools and equipment required

- Spark plug socket 3122 B
- Compression tester V.A.G 1763
- Puller T10095 A
- Assembly tool T10118

Conditions

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

Work sequence

- Switch off ignition.

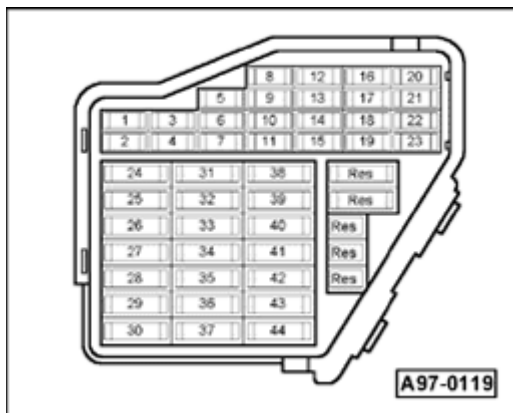


Fig. 312: Main Fuse Case

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove fuel pump fuse from slot No. 28.

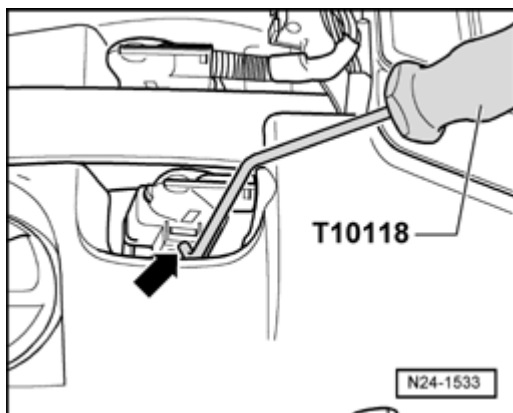


Fig. 313: Identifying Assembly Tool T10118 On Release Button

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical connectors at ignition coils by releasing tab (arrow) with assembly tool T10095/a and carefully pulling connector.

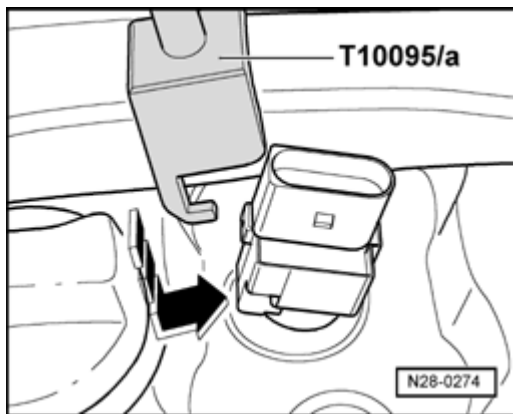


Fig. 314: Attaching Puller T10095A To Ignition Coils And Removing Ignition Coils
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Attach puller T10095 A to ignition coils as shown in illustration (arrow) and remove ignition coils one at a time.
- Remove spark plugs with spark plug wrench 3122 B.
- Check compression pressure with compression tester V.A.G 1763.

NOTE: For use of compression tester. Refer to tester operating instructions.

- Have a second technician press down accelerator pedal completely and simultaneously operate starter until pressure no longer increases on tester display.

Compression pressure

New pressure in bar	Wear limit bar	Permissible difference between cylinders in bar
10.0...13.0	7.5	max. 3.0

Installation is performed in the reverse order. Note the following:

- Upon completion of compression test, interrogate and erase engine control module fault memory. Faults will have been stored during fuse removal and connector separation. Use vehicle diagnostic, testing and information system VAS 5051 A.

Tightening torque

Spark plugs in cylinder head	30 Nm
------------------------------	-------

VALVE GEAR, SERVICING

Valve gear, servicing

NOTE:

- The engine is not to be started for approx. 30 minutes after installing the camshafts. The 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.
- Replace seals and gaskets.

Valve gear, component overview

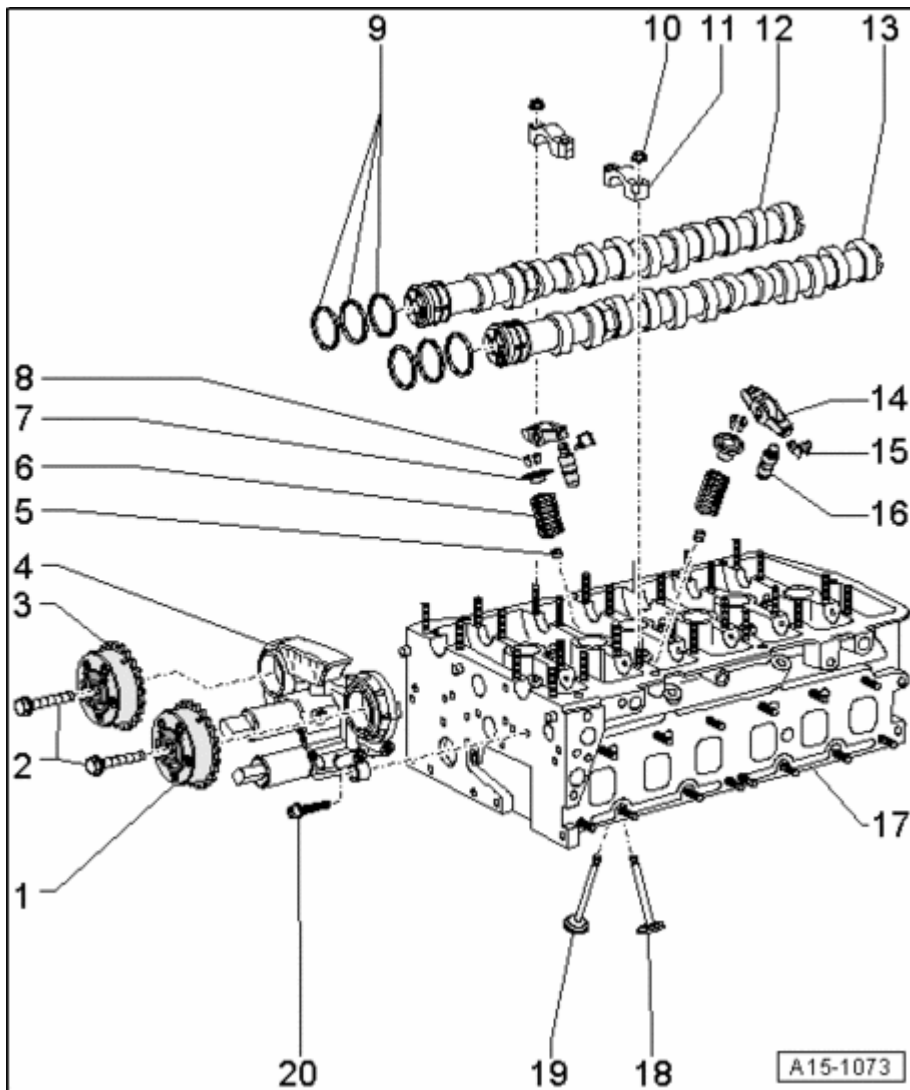


Fig. 315: Valve Gear, Component Overview

Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Camshaft adjuster - exhaust

- Identification: 32A
- Removing and installing. Refer to Camshaft timing chain, removing from camshafts

2 - 60 Nm + 90° (1/4 turn) further

- Replace
- To remove and install, counterhold with 32 mm open end wrench on camshaft. Refer to Camshaft timing chain, removing from camshafts

3 - Camshaft adjuster - intake

- Identification: 24E
- Removing and installing. Refer to **Camshaft timing chain, removing from camshafts**

4 - Valve timing housing

- Removing and installing. Refer to **Camshafts, removing and installing**
- Check filter of valve timing housing for dirt before installing. Refer to **Checking filter of valve timing housing for dirt**
- When installing, lightly oil contact surfaces of oil seals
- Disassembling and assembling. Refer to **Disassembling and assembling valve timing housing**

5 - Valve stem oil seal

6 - Valve spring

- Installed position: larger diameter on bottom

7 - Valve spring plate

8 - Valve keepers

9 - Camshaft seals

- 3 per camshaft
- Replace all if leak detected
- When installing valve timing housing, item -5-, lightly oil contact surfaces of oil seals
- Offset gaps by 120° when installing
- Do not stretch seals too wide when replacing

10 - 5 Nm + 45° (1/8 turn) further

11 - Bearing cap

- Installed position. Refer to **Installed position of bearing caps for camshafts**
- Installation sequence. Refer to **Camshafts, removing and installing**

12 - Intake camshaft

- Check radial clearance with Plastigage ®
- Wear limit (radial clearance): 0.1 mm
- Run-out: 0.01 mm (max.)
- Checking axial clearance. Refer to **Camshaft axial clearance, checking**

- Removing and installing camshafts. Refer to **Camshafts, removing and installing**
- Identification. Refer to **Camshaft identification**

13 - Exhaust camshaft

- Check radial clearance with Plastigage ®
- Wear limit (radial clearance): 0.1 mm
- Run-out: 0.01 mm (max.)
- Checking axial clearance. Refer to **Camshaft axial clearance, checking**
- Removing and installing camshafts. Refer to **Camshafts, removing and installing**
- Identification. Refer to **Camshaft identification**

14 - Roller rocker finger

- Do not interchange
- Check roller bearing
- Before installing, check camshaft axial clearance. Refer to **Camshaft axial clearance, checking**
- Lubricate contact surface
- Assembly: attach to supporting element using securing clip, item -15-

15 - Securing clip

- Check for firm attachment

16 - Supporting element

- With hydraulic valve clearance compensation
- Do not interchange
- Before installing, check camshaft axial clearance. Refer to **Camshaft axial clearance, checking**
- Lubricate contact surface

17 - Cylinder head

- Checking valve guides. Refer to **Valve guides, checking**
- Machining valve seats. Refer to **Valve seats, machining**

18 - Valves

- Must not be machined; only lapping is permissible
- Valve dimensions. Refer to **Valve dimensions**
- Checking valve guides. Refer to **Valve guides, checking**

- Machining valve seats. Refer to **Valve seats, machining**

19 - 8 Nm

Camshaft identification

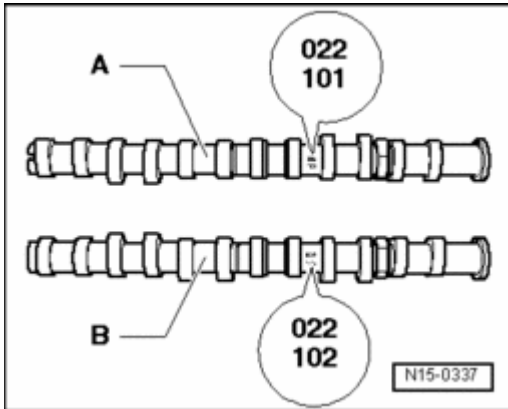


Fig. 316: Camshaft Identification, Valve Timing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

The camshaft identification is located between the cam pairs for cylinder No. 4 and 5.

A - Exhaust camshaft; identification 022 - index 101

B - Intake camshaft; identification 022 - index 102

Coat surface of bearing caps 7 and 8 with lubricating paste

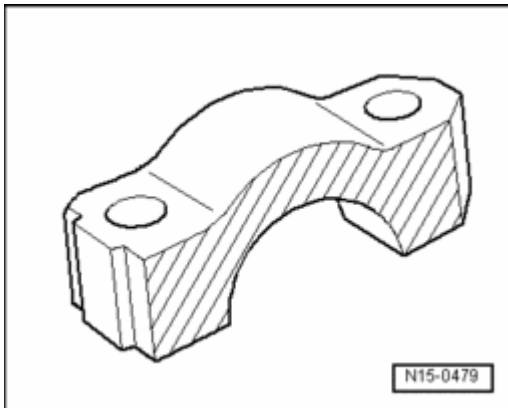


Fig. 317: Identifying Contact Surfaces Of Bearing Caps 7 And 8
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Thinly coat contact surface (hatched surface in illustration) of bearing caps 7 and 8 with lubricating paste G 052 723 A2.

Installed position of bearing caps for camshafts

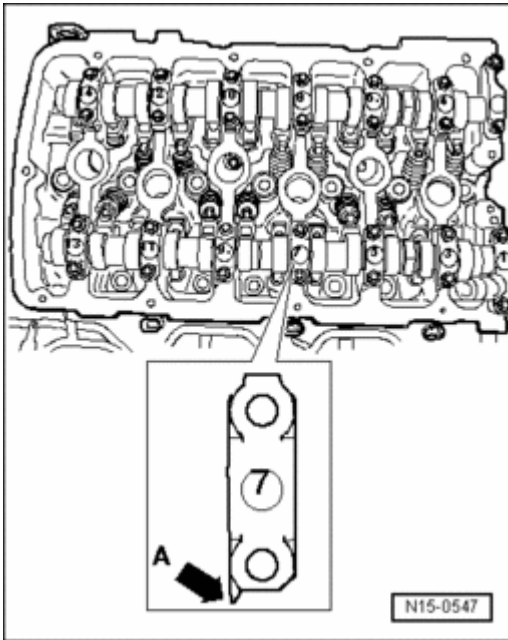


Fig. 318: Installed Position Of Bearing Caps For Camshafts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Pointed section of bearing caps -A- for intake and exhaust camshafts faces outward.

Disassembling and assembling valve timing housing

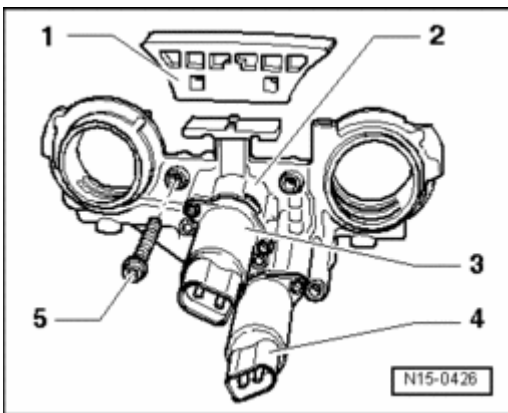


Fig. 319: Disassembling And Assembling Valve Timing Housing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- 1 - Guide rail; clipped onto valve timing housing
- 2 - Valve timing housing
- 3 - Valve -1- for camshaft adjustment -N205-
- 4 - Camshaft adjustment valve 1 (exhaust) -N318-

5 - 8 Nm

Checking filter of valve timing housing for dirt

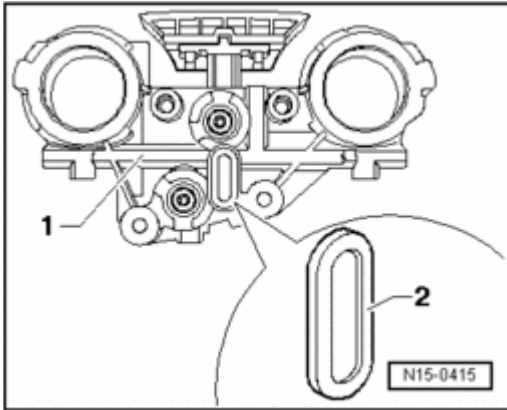


Fig. 320: Checking Filter Of Valve Timing Housing For Dirt
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unclip filter -2- on back of valve timing housing -1- and clean away any dirt or grime.

Valve dimensions

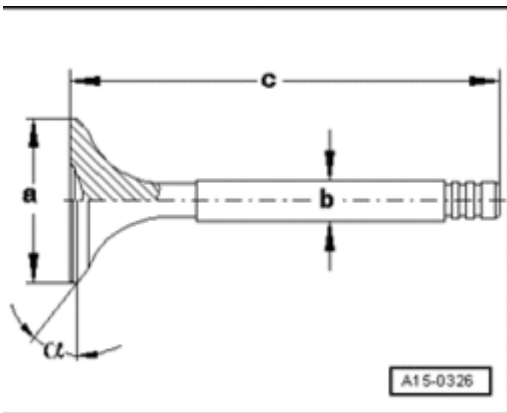


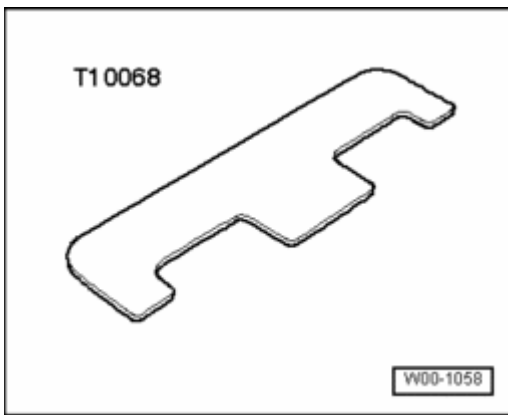
Fig. 321: Valve Dimensions
Courtesy of VOLKSWAGEN UNITED STATES, INC.

NOTE: Intake and exhaust valves must not be machined. Only lapping is permitted.

Dimension		Short intake valve	Long intake valve	Short exhaust valves	Long exhaust valve
Dia.a	mm	31.00	31.00	27.00	27.00
Dia.b	mm	5.96	5.96	5.94	5.94
c	mm	102.20	136.10	102.50	136.40
a	Angle°	45	45	45	45

WARNING:

- Sodium-filled exhaust valves must not be scrapped without first being properly treated.
- Using a metal saw, the valves must be cut in half between the shaft center and valve plate. They must not come into contact with water while being cut. After cutting open valves, throw not more than 10 at a time into a bucket of water. Then step back. A sudden chemical reaction will occur during which the sodium filling is consumed.
- Valves that have been treated in this manner can then be disposed of as normal scrap metal.

Camshafts, removing and installing**Special tools, testers and auxiliary items required****Fig. 322: Camshaft Bar T10068 A**

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Camshaft bar T10068
- Adhesive lubricating paste G 052 723 A2

Removing

- Engine in vehicle

NOTE:

- All cable ties which are released or cut open when removing must be replaced in the same position when installing.
 - Heat insulation sleeves that have been removed are to be reinstalled in the original position.
- Remove timing chain from camshafts. Refer to Camshaft timing chain, removing from camshafts.

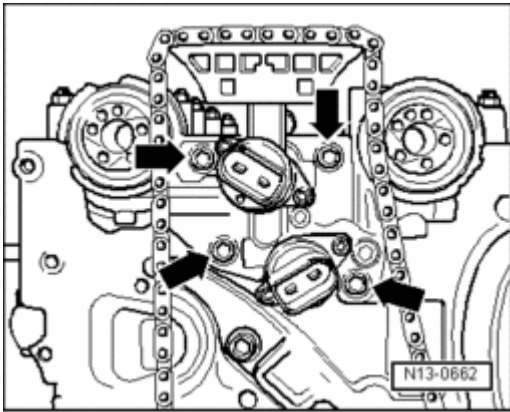


Fig. 323: Locating Control Housing-To-Cylinder Head Bolts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unbolt valve timing housing (arrows).
- Carefully separate valve timing housing from oil seals for camshafts.

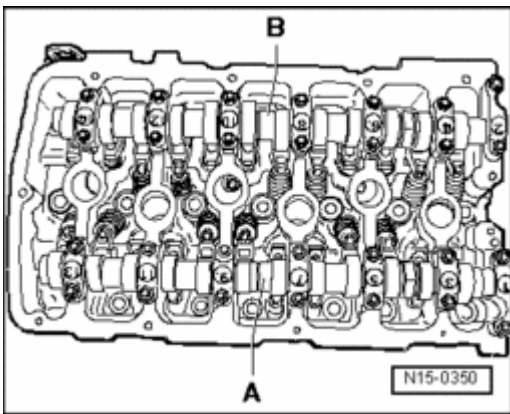


Fig. 324: Identifying Intake Camshaft And Exhaust Camshaft
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove intake camshaft -A- as follows:

- 1 - Unbolt bearing caps 1 and 13.
- 2 - Unbolt bearing caps 3 and 11.
- 3 - Unbolt bearing cap 7.
- 4 - Loosen bearing caps 5 and 9 alternately in a diagonal sequence and remove.

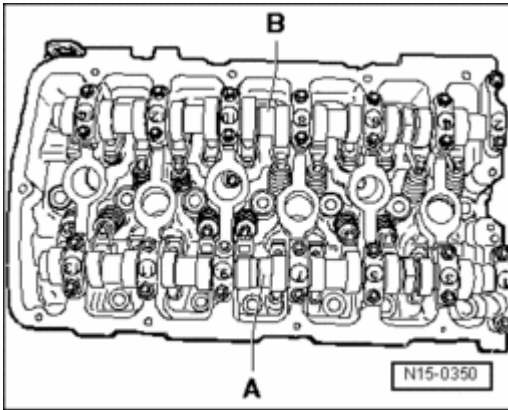


Fig. 325: Identifying Intake Camshaft And Exhaust Camshaft
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove exhaust camshaft -B- as follows:

- 1 - Unbolt bearing caps 2 and 14.
- 2 - Unbolt bearing caps 4 and 12.
- 3 - Unbolt bearing cap 8.
- 4 - Loosen bearing caps 6 and 10 alternately in a diagonal sequence and remove.

- Carefully remove camshafts and place them down on a clean surface.

Installing

NOTE:

- The crankshaft must not be at TDC at any cylinder when the camshafts are installed. Otherwise, there is a risk of damage to the valves and piston crowns.
- The engine is not to be started for approx. 30 minutes after installing the camshafts. The 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.

- Insert supporting elements into cylinder head.

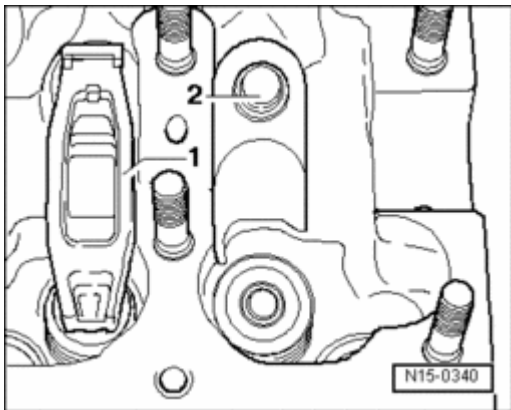


Fig. 326: Identifying Roller Rocker Fingers & Supporting Elements
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Install roller rocker fingers -1- so that they touch valve stems and are clipped onto supporting elements - 2-.
- Lubricate running surfaces of camshafts.
- Insert respective camshaft in camshaft bearings of cylinder head.

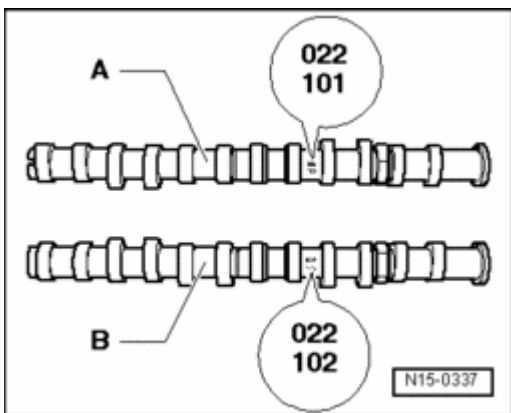


Fig. 327: Camshaft Identification, Valve Timing
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Pay attention to camshaft identification located between cam pairs for cylinder No. 4 and 5.

A - Exhaust camshaft; identification 022 - index 101

B - Intake camshaft; identification 022 - index 102

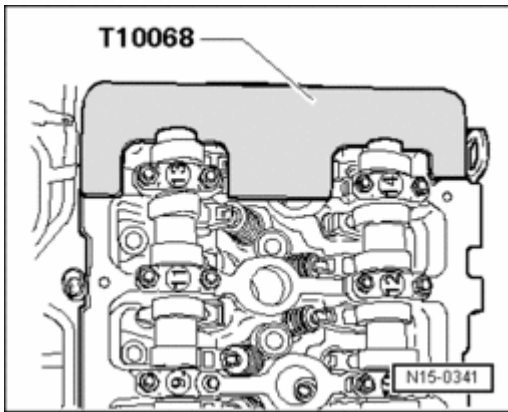


Fig. 328: Identifying Camshaft Bar T10068 Engage In Both Shaft Grooves
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Insert camshafts into cylinder head so that they are located at TDC for cylinder 1.
- It must be possible to insert camshaft plate T10068 in both camshaft grooves.

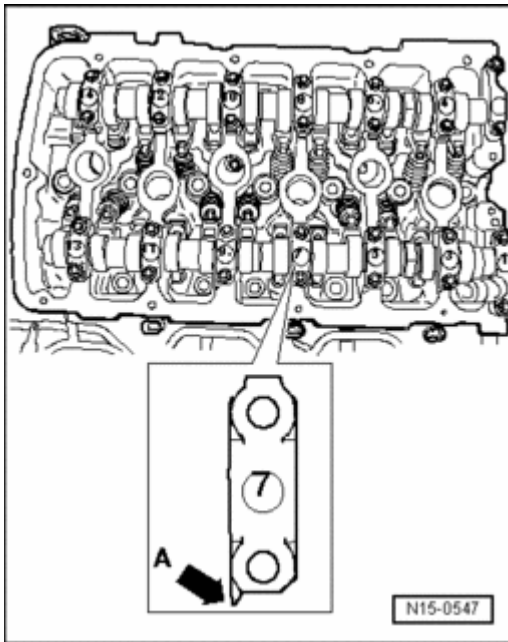


Fig. 329: Noting Installed Position Of Bearing Caps
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Note installed position of bearing caps:
 - Pointed section -A- of bearing caps for intake and exhaust camshafts faces outward.
 - Identification markings for bearing caps are legible from intake side.

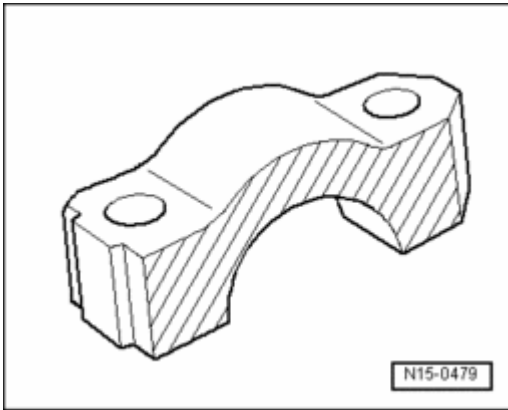


Fig. 330: Identifying Contact Surfaces Of Bearing Caps 7 And 8
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Thinly coat contact surface (hatched surface in illustration) of bearing caps 7 and 8 with lubricating paste G052 723 A2.

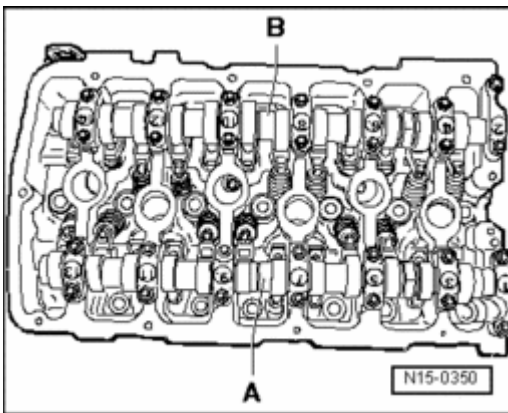


Fig. 331: Identifying Intake Camshaft And Exhaust Camshaft
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Install intake camshaft as follows:

- 1 - Tighten bearing caps 5 and 9 alternately in a diagonal sequence and then tighten to final torque.
- 2 - Tighten bearing caps 1 and 13.
- 3 - Tighten bearing cap 7.
- 4 - Tighten bearing caps 3 and 11.

- Install exhaust camshaft as follows:

- 1 - Tighten bearing caps 6 and 10 alternately in a diagonal sequence and then tighten to final torque.
- 2 - Tighten bearing caps 2 and 14.

3 - Tighten bearing cap 8.

4 - Tighten bearing caps 4 and 12.

- Position camshafts in cylinder head to TDC for cylinder 1.

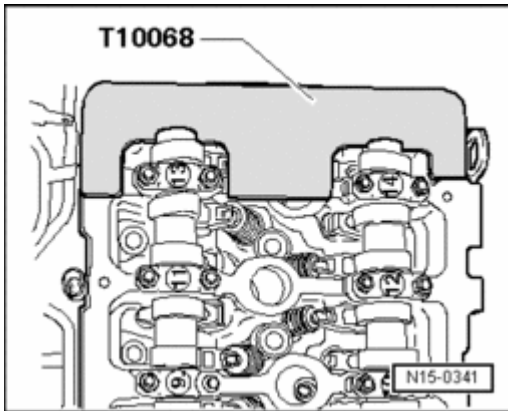


Fig. 332: Identifying Camshaft Bar T10068 Engage In Both Shaft Grooves
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- It must be possible to insert camshaft plate T10068 in both camshaft grooves.

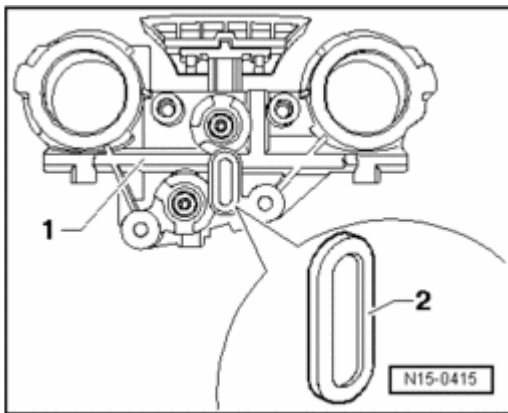


Fig. 333: Unclipping Filter On Back Of Valve Timing Housing And Clean Away Any Dirt Or Grime
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unclip filter -2- on back of valve timing housing -1- and clean away any dirt or grime.
- Lightly oil contact surfaces for camshaft oil seals in valve timing housing.
- Lightly oil contact surfaces of oil seals on camshafts and carefully push valve timing housing over camshaft oil seals.

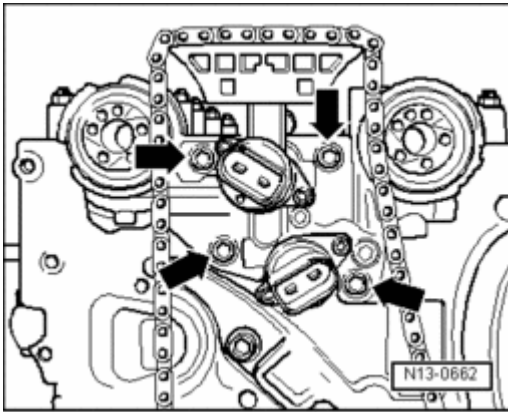


Fig. 334: Locating Control Housing-To-Cylinder Head Bolts
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Tighten valve timing housing (arrows).
- Install camshaft timing chain (adjusting valve timing). Refer to **Camshaft timing chain, removing from camshafts.**

Tightening torques

Component	Nm
Bearing cap to cylinder head	5 + 45° 1)
Valve timing housing to cylinder head	8

1) 45° equals 1/8 of a turn

Camshaft axial clearance, checking

Special tools and equipment required

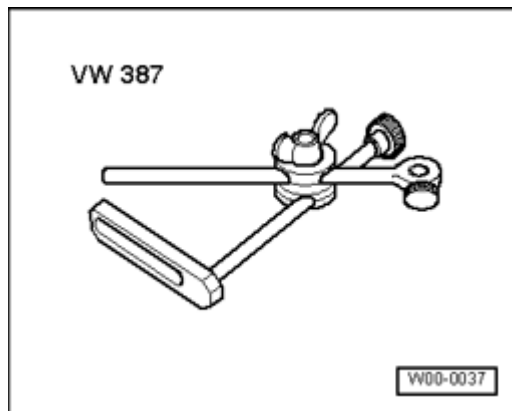


Fig. 335: Identifying Universal Dial Gauge Bracket VW 387
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Universal dial gauge bracket VW 387

- Dial gauge

Work sequence

- Perform measurement with roller rocker fingers and supporting elements removed. Center bearing caps for respective camshaft remain tightened.

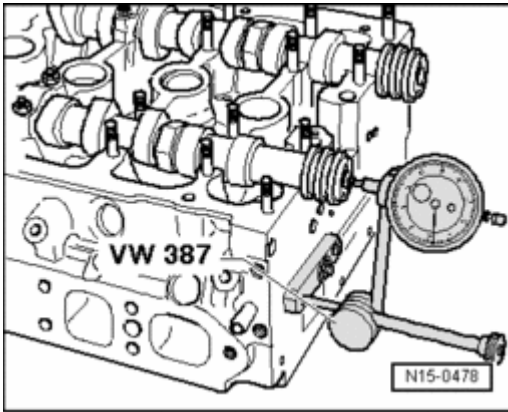


Fig. 336: Securing Universal Dial Gauge Bracket VW 387 With Dial Gauge To Cylinder Head
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Secure universal dial gauge bracket VW 387 with dial gauge to cylinder head.
- Determine axial clearance.
- Wear limit: (axial clearance): 0.10 mm

Valve stem oil seals, replacing

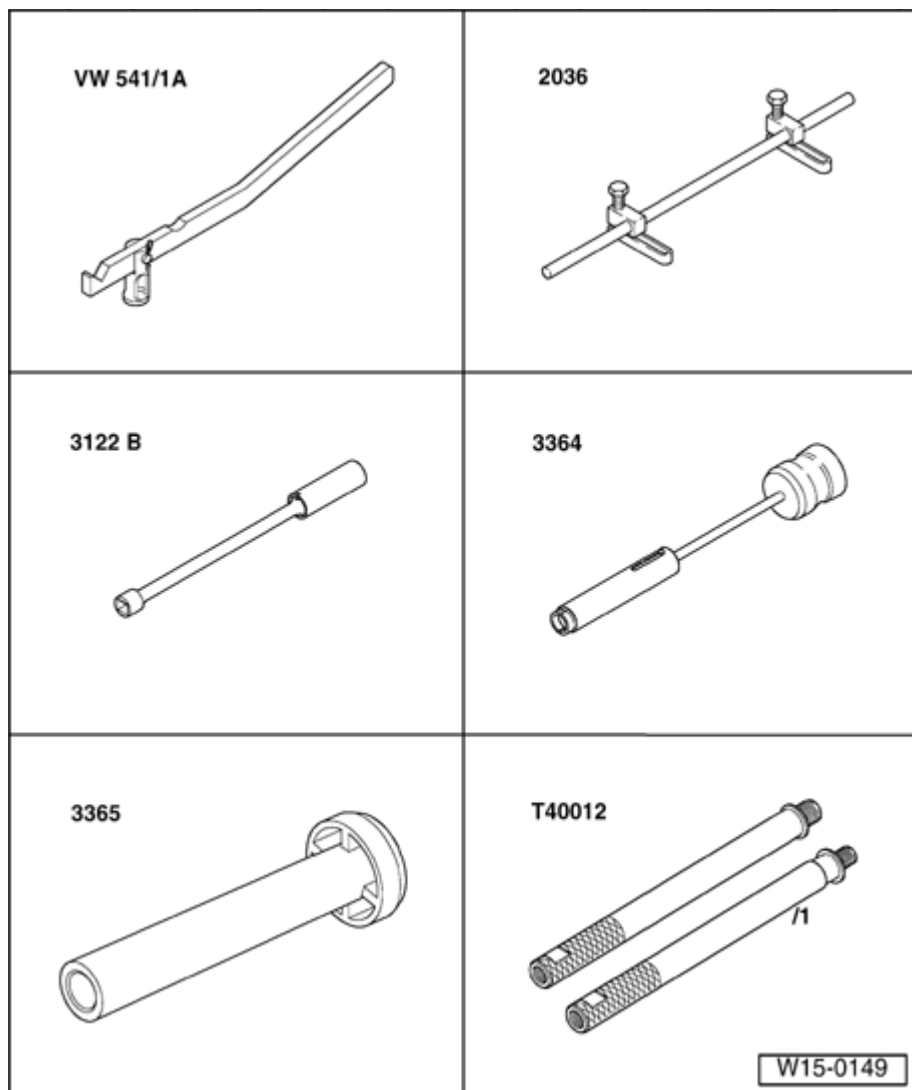


Fig. 337: Identifying Special Tools - Valve Stem Oil Seals, Replacing
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools and equipment required

- Valve lever VW 541/1 A with press piece VW 541/6
- Assembly device for valves 2036
- Spark plug socket 3122 B
- Puller for valve stem oil seal 3364
- Press tool for valve stem oil seal 3365
- Adapter T40012

Removing

- Remove timing chain from camshafts. Refer to **Camshaft timing chain, removing from camshafts.**

- Remove camshafts. Refer to **Camshafts, removing and installing**.
- Remove roller rocker fingers together with supporting elements.
- Place roller rocker fingers and supporting elements down on a clean surface in order that they were removed.

NOTE: **The roller rocker fingers and the supporting elements must not be interchanged.**

- Remove spark plugs with spark plug wrench 3122 B.
- Set piston of respective cylinder to "bottom dead center".

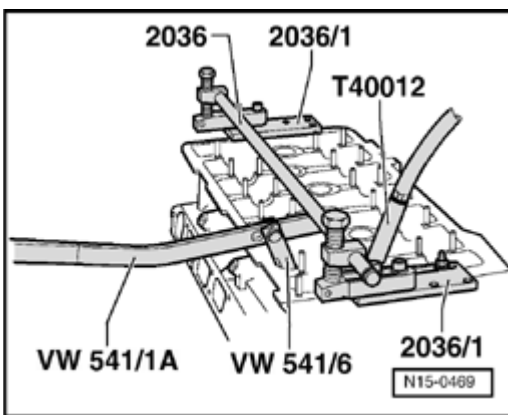


Fig. 338: Identifying Adjustable Rod 2036, Adapter T40012 And Valve Lever VW 541/1 A
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Install assembly device for valves 2036 with adapter plates 2036/1 and adjust to correct position.
- Screw adapter T40012 with seal finger-tight into corresponding spark plug thread, connect to compressed air hose and apply a steady pressure.
 - Air pressure: at least 6 bar
- Remove valve springs using valve lever VW541/1 A with press piece VW 541/6.

NOTE: **Tap assembly lever lightly with a hammer to loosen valve keepers that are stuck.**

- Remove valve stem oil seals using puller for valve stem oil seals 3364.

Installing

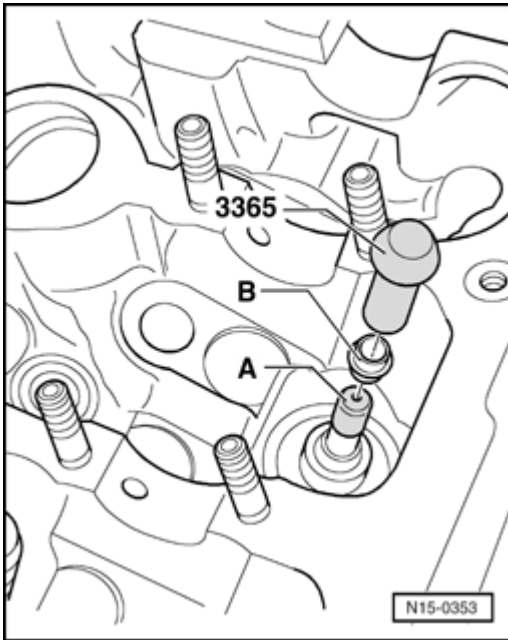


Fig. 339: Identifying Plastic Sleeve, Valve Stem Seal And Valve Stem Seal Driver 3365
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Insert plastic sleeve -A- onto valve stem to prevent damage to new valve stem oil seal -B-.
- Lubricate sealing lip of valve stem oil seal.
- Insert valve stem oil seal into press piece for valve stem oil seal 3365 and push carefully onto valve guide.
- Install camshafts. Refer to **Camshafts, removing and installing.**

Valve guides, checking

Special tools and equipment required

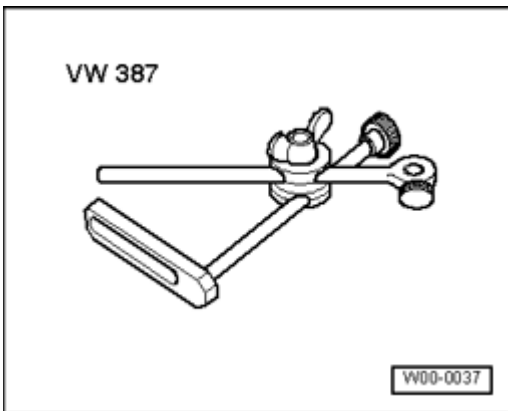


Fig. 340: Identifying Universal Dial Gauge Bracket VW 387
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Universal dial gauge bracket VW 387

- Dial gauge

Work sequence

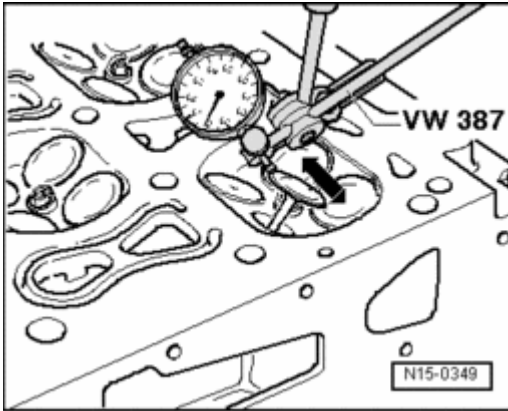


Fig. 341: Checking Valve Guides

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Insert valve into valve guide. Only insert intake valve into intake guide and exhaust valve into exhaust guide, as stem diameters are different.
- End of valve stem must be flush with valve guide
- Determine amount of sideways play.
- Wear limit (sideways play): 0.8 mm

If the amount of sideways play is exceeded:

- Replace cylinder head.

Valve seats, machining

NOTE: If a good seating pattern cannot be obtained by grinding the valve seats (lapping), they must be refaced (machined).

Special tools and equipment required

- Depth gauge
- Valve seat machining tool

NOTE:

- When servicing engines with leaking valves, it is not sufficient to machine (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

- Valve seats should only be machined to the extent required to give a proper seating pattern.
- The maximum permissible machining dimension must be calculated before starting work.
- If the machining dimension is exceeded, the function of the hydraulic valve play compensation can no longer be guaranteed and the cylinder head must be replaced.

Calculating maximum permissible machining dimension

- Insert valve and press firmly against valve seat.

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

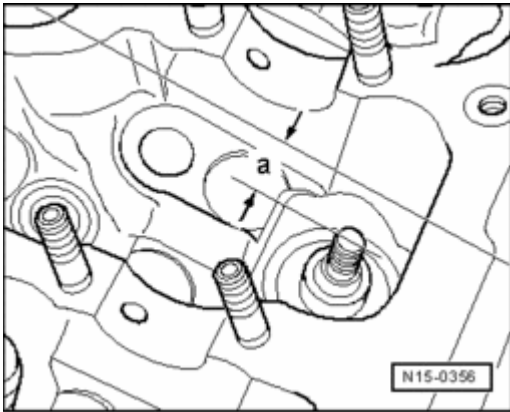


Fig. 342: Measuring Distance Between End Of Valve Stem And Upper Edge Of Cylinder Head
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Measure distance -a- between end of valve stem and upper cylinder head surface with a depth gauge.
- Calculate maximum permissible machining dimension using measured distance and minimum dimension.

Minimum dimension			
Short intake valve	Long intake valve	Short exhaust valve	Long exhaust valve
31.8 mm	10.2 mm	31.8 mm	10.2 mm

Distance measured minus minimum dimension = maximum permissible machining dimension.

Example for outer intake valve:		
	Distance measured	10.6 mm
-	Minimum dimension	- 10.2 mm
=	Maximum allowable machining dimension	= 0.4 mm

NOTE: If the maximum allowed machining dimension is 0 mm or less than 0 mm, repeat the measurement using new valve. If the measurement result is still 0 mm or less than 0 mm, replace the cylinder head.

Machining intake valve seat

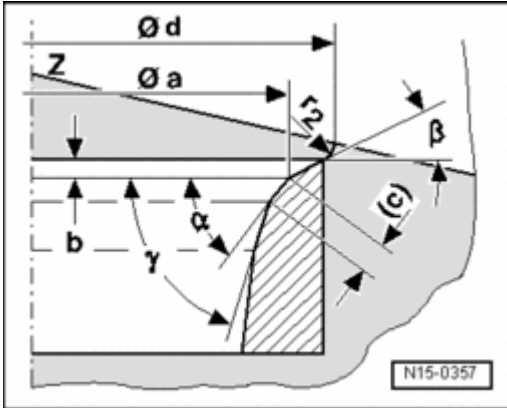


Fig. 343: Reworking Intake And Exhaust Valve Seat
Courtesy of VOLKSWAGEN UNITED STATES, INC.

NOTE: Calculating maximum permissible machining dimension. Refer to Calculating maximum permissible machining dimension.

Dimension		Intake valve seat
a	=	Diameter 30.6 mm
b	=	Maximum permissible machining dimension
c	=	0.9...1.5 mm
d	=	max. diameter 35.0 mm
r2	=	Radius 2.0 mm
Z	=	Bottom surface of cylinder head
α	=	45° valve seat angle
β	=	30° upper correction angle
γ	=	60° lower correction angle

Machining exhaust valve seat

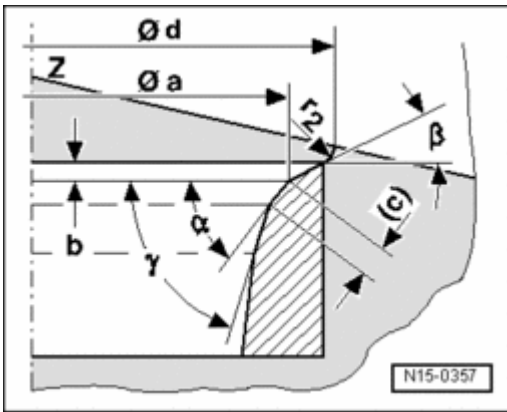


Fig. 344: Reworking Intake And Exhaust Valve Seat
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

NOTE: Calculating maximum permissible machining dimension. Refer to Calculating maximum permissible machining dimension.

Dimension		Exhaust valve seat
a	=	Diameter 26.7 mm
b	=	Maximum permissible machining dimension
c	=	1.2...1.7 mm
d	=	max. diameter 29.0 mm
r2	=	Radius 2.0 mm
Z	=	Bottom surface of cylinder head
α	=	45° valve seat angle
β	=	30° upper correction angle
γ	=	60° lower correction angle

17 ENGINE - LUBRICATION

LUBRICATION SYSTEM COMPONENTS, REMOVING AND INSTALLING

Lubrication system components, removing and installing

NOTE:

- If large quantities of metal shavings or abraded material are found in the engine oil while servicing the engine, it may indicate damage to the crankshaft or connecting rod bearings. To prevent further damage, the following procedures must be performed after the completion of repair work: oil passages must be carefully cleaned, oil spray jets, oil filter and the oil cooler must be replaced.
- Oil level must not exceed max. marking - risk of catalytic converter damage!

Viscosity classes and oil specifications:

Refer to Additional Information, Fluid Capacity Chart

Oil capacities:

Refer to Additional Information, Fluid Capacity Chart

Lubrication system, component overview

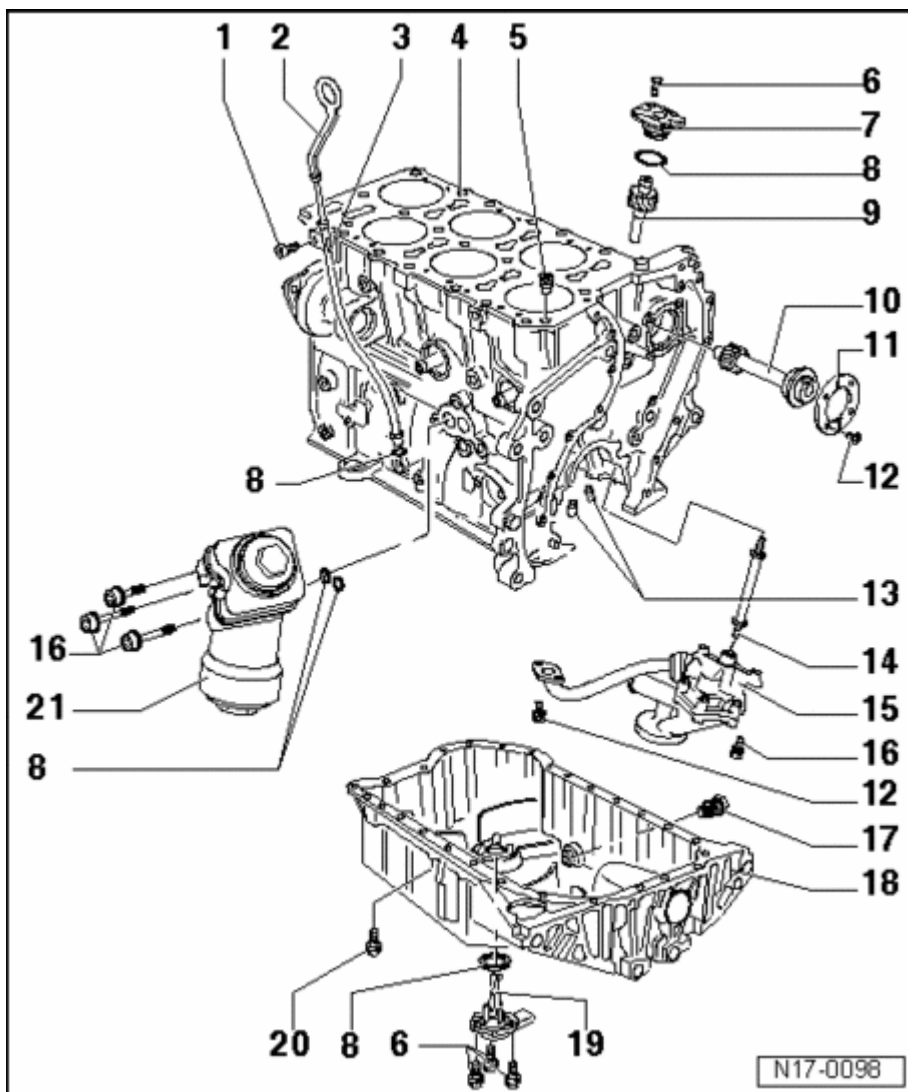


Fig. 345: Lubrication System, Component Overview
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - 5 Nm

- Secured to intake manifold

2 - Oil dipstick**3 - Guide tube for oil dipstick****4 - Cylinder block****5 - Oil return valve**

- Removing and installing. Refer to **Removing and installing oil return valve**
- Note installed position

6 - 8 Nm**7 - Cover for oil pump drive****8 - O-ring**

- Replace
- Lubricate before installing

9 - Oil pump drive**10 - Intermediate shaft****11 - Thrust washer****12 - 10 Nm**

- Install using locking fluid

13 - Oil spray jet (for cooling of pistons)

- For crankshaft bearings 2...7
- Opening pressure: 2.0 bar
- Removing and installing. Refer to **Removing and installing oil spray jet**

14 - Input shaft for oil pump drive**15 - Oil pump**

- Disassembling and assembling. Refer to **Oil pump, component overview**
- Coat oil pressure pipe at cylinder block and at oil pump housing with sealing paste

16 - 23 Nm**17 - Oil drain plug, 30 Nm**

18 - Sump

- Removing and installing. Refer to **Sump, removing and installing**

19 - Oil level/Oil level thermal sensor -G266-

- Removing and installing. Refer to **Removing and installing Oil level thermal sensor -G266-**

20 - 12 Nm**21 - Oil filter bracket**

- Overview of components. Refer to **Oil filter bracket, component overview**
- Removing and installing. Refer to **Oil filter bracket, removing and installing**

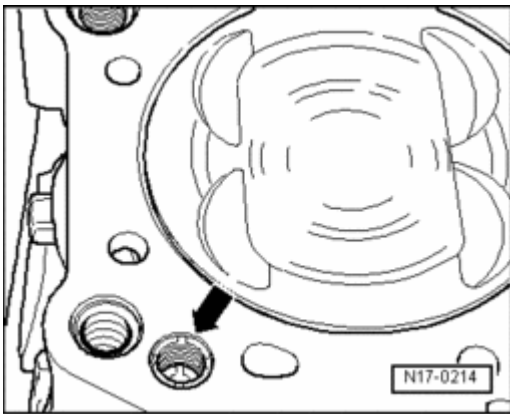
Removing and installing oil return valve

Fig. 346: Removing And Installing Oil Return Valve
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- To remove, screw in M8 x 1.5 bolt approx. 4 turns into valve (arrow) and pull out.
- To install, lubricate O-ring and press valve into oil drained by hand.

Removing and installing oil spray jet

NOTE: **Oil spray jets are installed in crankshaft main bearings 2...7.**

- To remove, use a 4 mm drift to press out oil spray jet toward crankshaft bearing.

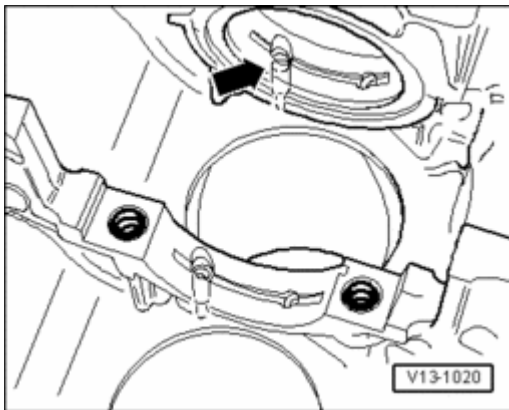


Fig. 347: Removing And Installing Oil Spray Jet
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- To install, use a 6 mm drift to press in oil spray jet (arrow) by hand.

Removing and installing Oil level thermal sensor -G266-

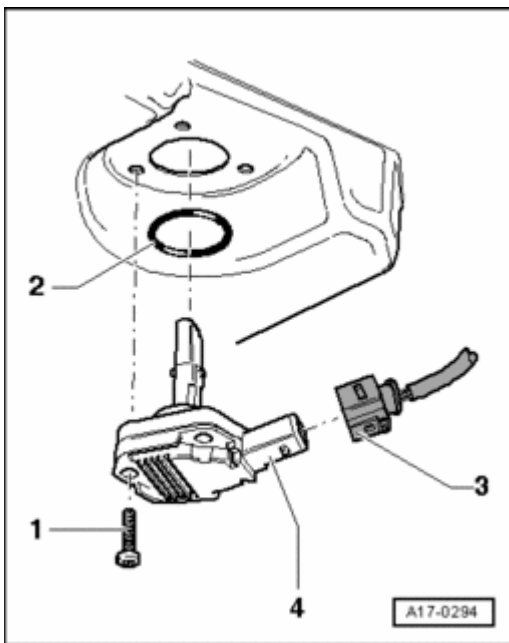


Fig. 348: Removing And Installing Oil Level Thermal Sensor -G266-
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- 1 - Bolt, 10 Nm; self-locking, replace
- 2 - Seal; replace
- 3 - Electrical connector
- 4 - Oil level thermal sensor -G266-

Sump, removing and installing**Special tools and equipment required**

- Electric drill with plastic brush attachment
- Safety goggles
- Silicone sealant.

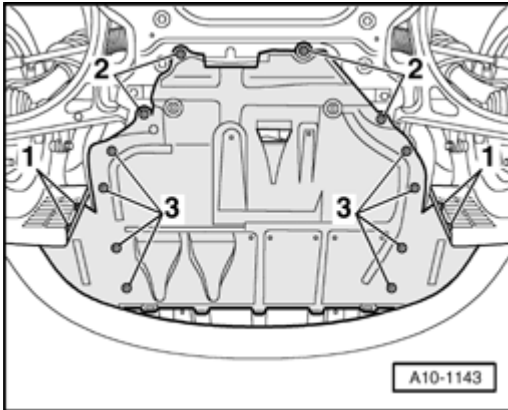
Removing

Fig. 349: Identifying Center Sound Insulation Fasteners
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove fasteners -1...3- and remove center sound insulation.

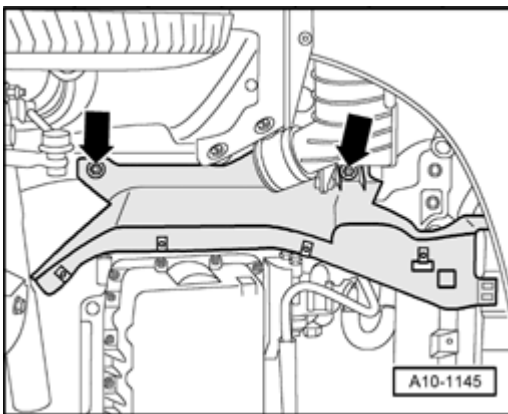


Fig. 350: Removing Right Sound Insulation
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove right sound insulation (arrows).
- Drain engine oil.
- Disconnect connector at Oil level thermal sensor -G266-.

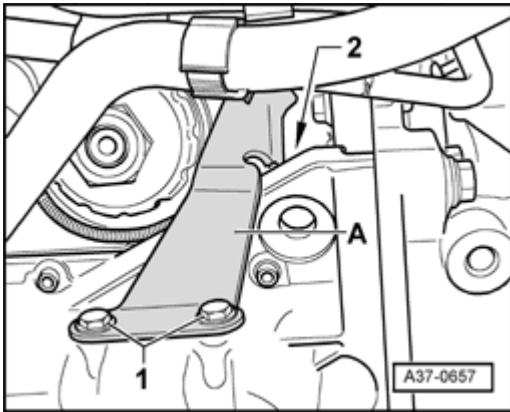


Fig. 351: Removing Bolts And Secondary Air Injection Pump With Bracket
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts -1- and -2- and remove secondary air injection pump with bracket -A-.
- Unscrew sump/transmission bolts.
- Unscrew securing bolts for sump in diagonal sequence.
- Take off sump. If necessary, loosen sump by striking lightly with a rubber hammer.

Installing

Installation is performed in the reverse order. Note the following:

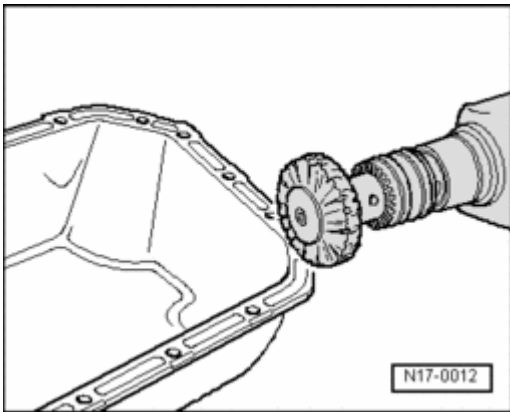


Fig. 352: Removing Sealant Residue From Oil Pan With A Rotating Brush
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Carefully remove sealant residue form cylinder block.

CAUTION: Wear safety goggles.

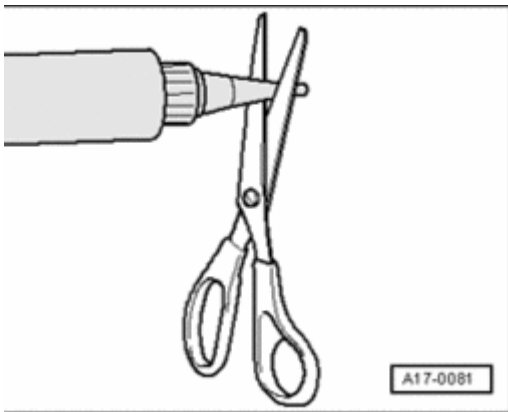


Fig. 353: Cutting Tube Nozzle At Front Marking

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove sealant residue from sump, e.g. with a rotating plastic brush or similar.
- Clean sealing surfaces.
- Cut off tube nozzle at front marking (nozzle approx. 3 mm diameter).

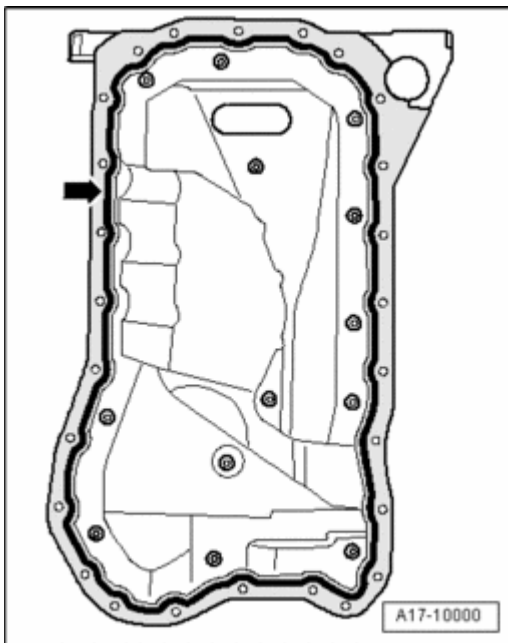


Fig. 354: Applying Bead Of Silicone Sealant Onto Clean Sealing Surface Of Sump

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Apply bead of silicone sealant onto clean sealing surface of sump as shown.
- Width of sealing bead: 2 mm

NOTE:

- The bead of sealant must not be thicker than specified, otherwise excess sealant can enter to sump and obstruct the strainer in the oil intake pipe.

2005 Audi TT

ENGINE 3.2 Liter V6 4V Engine Mechanical, Engine Code(s): BHE

- Use extra care when applying sealant bead in the area around the cover for the timing chains (arrows).
- The sump must be installed within 5 minutes after applying silicone sealant.

- Immediately install sump and tighten bolts in following sequence:
- Tighten securing bolts for sump in diagonal sequence initially to 5 Nm.
- Tighten bolts for sump/transmission to 40 Nm. Use new bolts.
- Tighten securing bolts for sump in diagonal sequence to 12 Nm.

NOTE: After installing the sump assembly, the sealant must dry for approx. 30 minutes. Only then fill the engine with oil.

- Fill engine with oil and check oil level. Refer to Oil pump, component overview.

Tightening torques

Component	Nm
Sump to cylinder block	12
Sump to transmission	40
Oil drain plug	30

Oil filter bracket, component overview

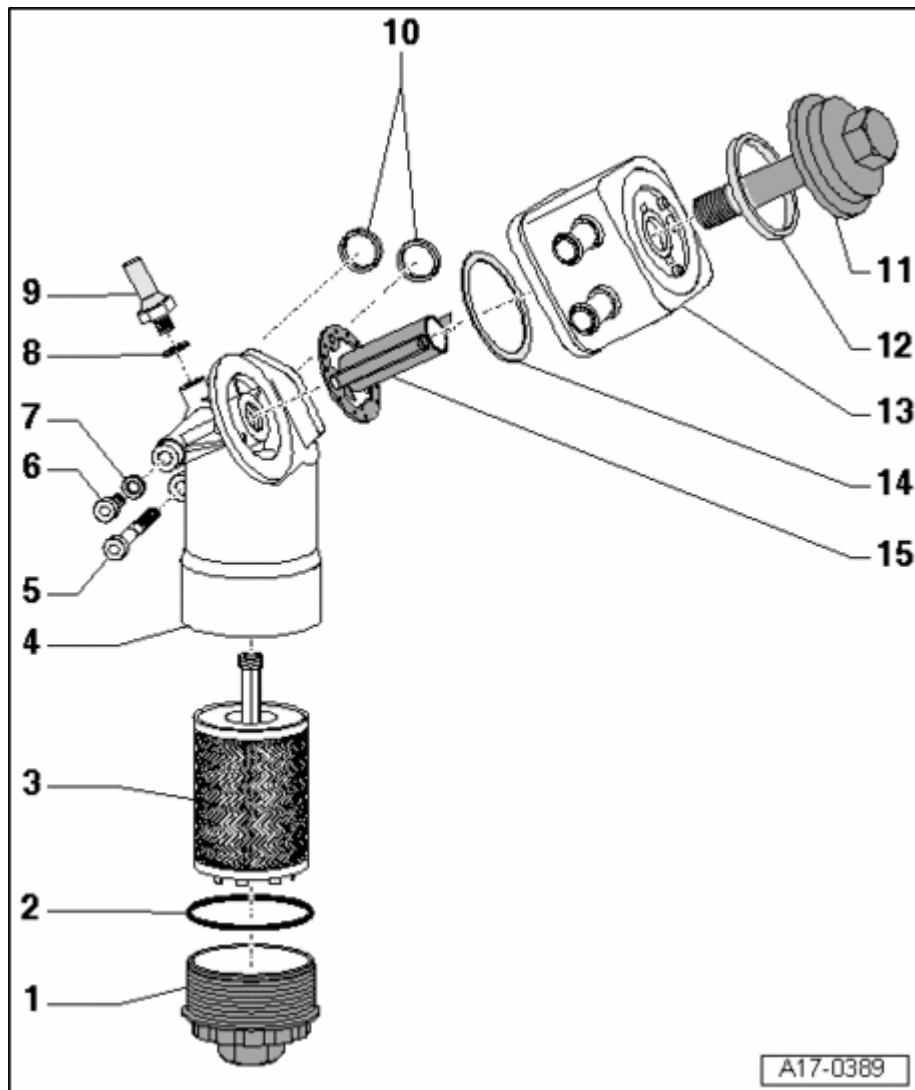


Fig. 355: Oil Filter Bracket, Component Overview
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Sealing cap

- Tighten to 25 Nm

2 - O-ring

- Replace

3 - Oil filter element

- Observe change intervals

Refer to **01 MAINTENANCE**

4 - Oil filter bracket

- With oil retention valve

5 - 23 Nm**6 - Screw plug, 15 Nm****7 - Oil seal**

- If seal is leaking, cut open and replace

8 - Oil seal

- If seal is leaking, cut open and replace

9 - Oil pressure switch -F1-, 1.4 bar

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

10 - Oil seals

- Replace

11 - Sealing cap

- Tighten to 25 Nm

12 - Oil seal

- Replace
- Lubricate before installing

13 - Oil cooler

- Ensure clearance from adjacent components
- Diagram of coolant hose connections. Refer to **Cooling system, component overview**
- Read note if making repairs on engine. Refer to **Lubrication system components, removing and installing**

14 - Oil seal

- Installed position. Refer to **Installed position of oil seal and plastic element in oil cooler**
- Lubricate before installing

- Press onto oil cooler with plastic element item -15-

15 - Plastic element

- Insert into oil cooler together with oil seal item -14-
- Installed position. Refer to **Installed position of oil seal and plastic element in oil cooler**

Installed position of oil seal and plastic element in oil cooler

- Insert oil seal (coat with oil) into oil cooler.
- Insert plastic element into oil cooler.

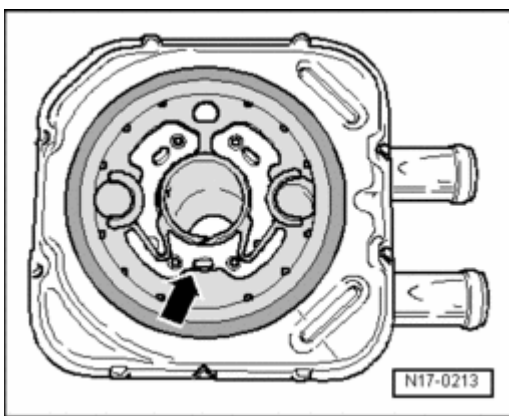


Fig. 356: Installed Position Of Oil Seal And Plastic Element In Oil Cooler
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Side of plastic element without support must align with lug (arrow) of oil cooler.

Oil filter bracket, removing and installing

Special tools and equipment required

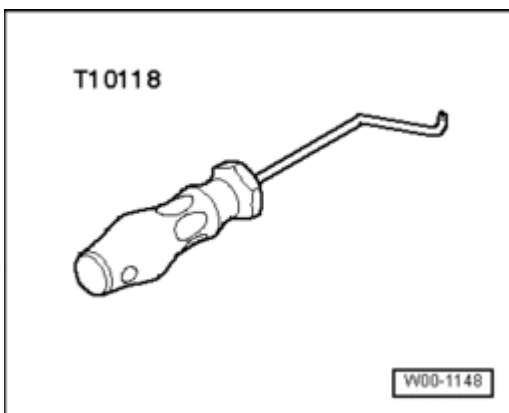


Fig. 357: Identifying Assembly Tool T10118
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Assembly tool T10118
- Drip trap V.A.G 1306

Removing

CAUTION: Hot steam can escape when opening the cap on the expansion tank. Cover the filler cap with a cloth and open it carefully.

- Open filler cap on coolant expansion tank.

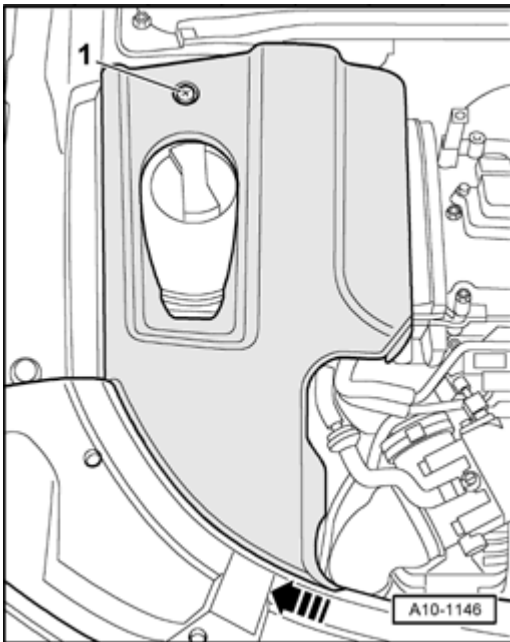


Fig. 358: Removing Screw And Coolant Expansion Tank Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove screw -1- and remove cover over coolant expansion tank (arrow).

NOTE: Mark the rotation direction of the poly V-belt with chalk or a felt-tipped pen. If the belt runs in the opposite direction when it is reinstalled, breakage may result.

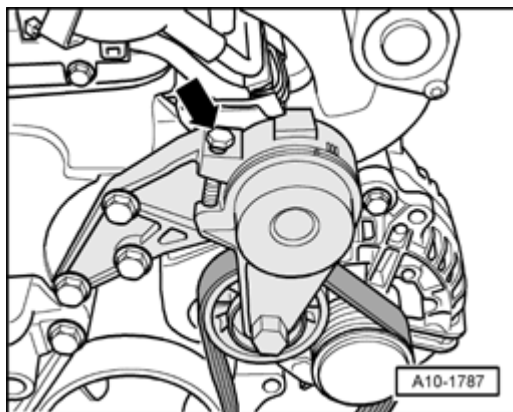


Fig. 359: Screwing Into Bore On Tensioning Element

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- To release tension of poly V-belt, screw an M8 x 40 bolt (arrow) into bore on tensioning element.

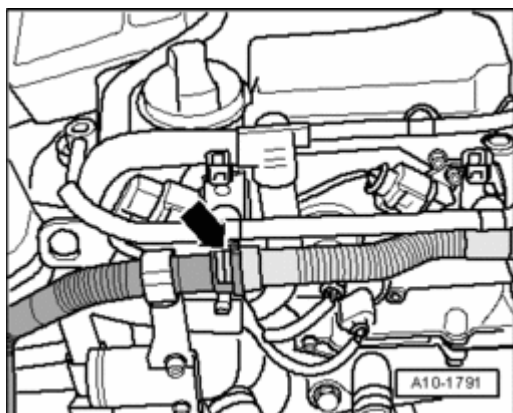


Fig. 360: Identifying Secondary Air Injection Hose

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect secondary air injection air hose at position marked with an arrow.
- Move air hose at bracket clear.

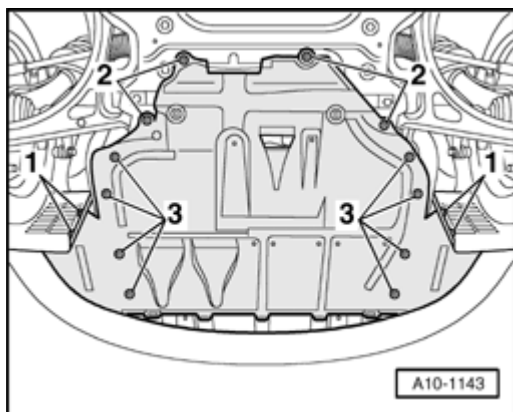


Fig. 361: Identifying Center Sound Insulation Fasteners

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove fasteners -1...3- and remove center sound insulation.

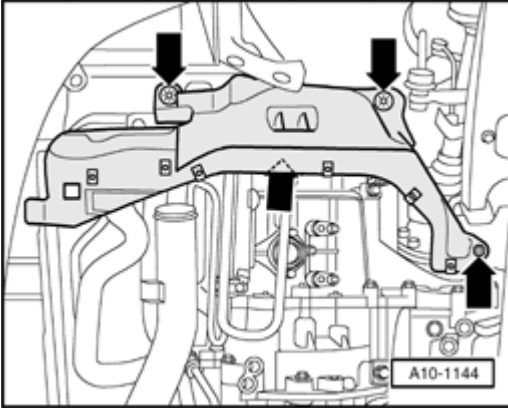


Fig. 362: Left Sound Insulation Panel

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove left sound insulation (arrows).

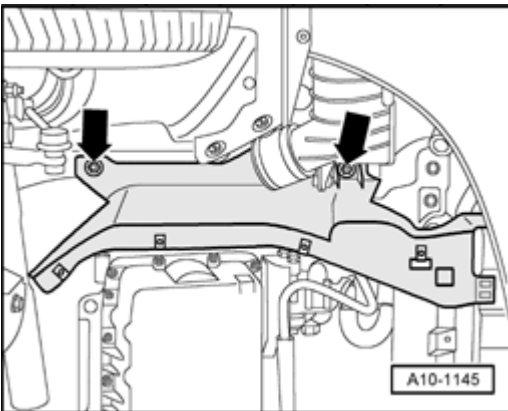


Fig. 363: Removing Right Sound Insulation

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove right sound insulation (arrows).
- Place drip tray V.A.G 1306 under engine.

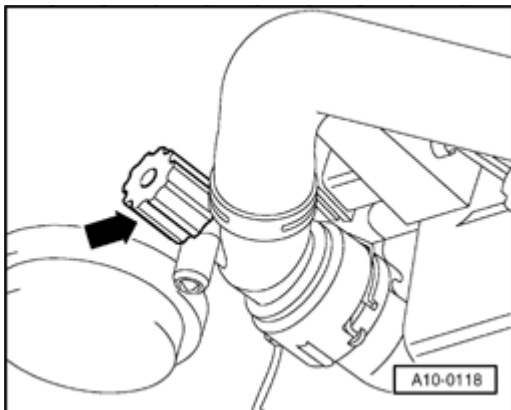


Fig. 364: Locating Radiator Drain Plug

Courtesy of VOLKSWAGEN UNITED STATES, INC.

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

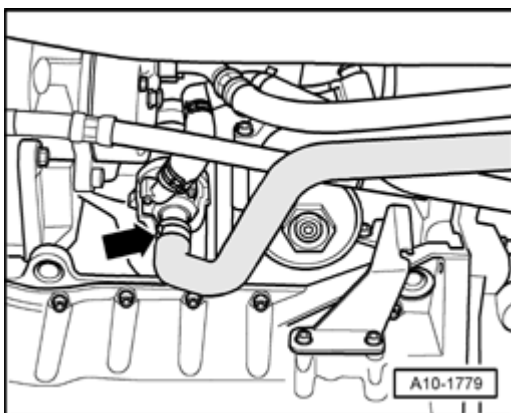


Fig. 365: Removing/Installing Lower Coolant Hose At After-Run Coolant Pump -V51-

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- In addition, remove lower coolant hose at After-run coolant pump -V51- (arrow) and drain remaining coolant.

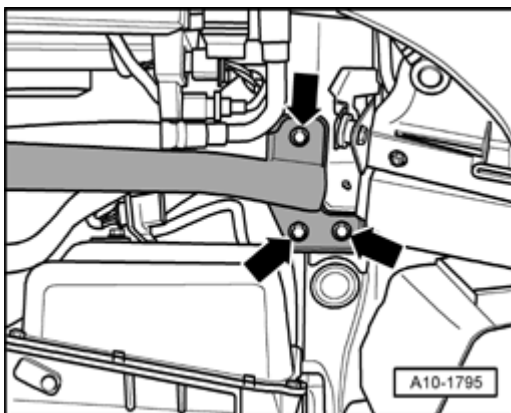


Fig. 366: Removing Cross Piece

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove cross piece (arrows).
- Unbolt pulley for power steering pump (counterhold with mandrel).

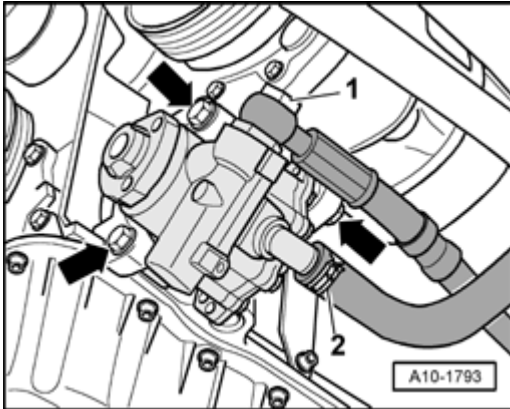


Fig. 367: Removing Bolts And Power Steering Pump From Bracket
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts securing power steering pump to bracket (arrows).
- Hang power steering pump on lock carrier with hydraulic hoses -1- and -2- attached.

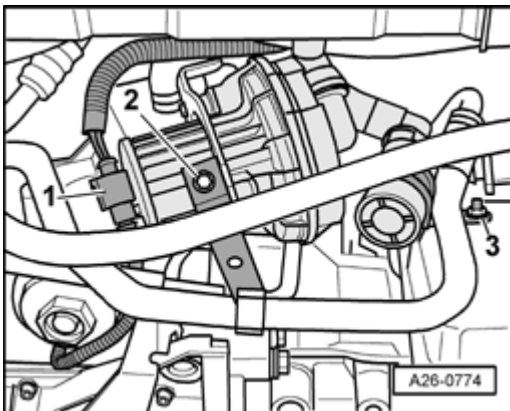


Fig. 368: Disconnecting Electrical Connector At Secondary Air Injection (AIR) Pump Motor -V101-
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical connector -1- at Secondary Air Injection (AIR) pump motor -V101-.
- Move wire clear.
- Remove bracket -2- for coolant hoses.
- Remove bracket -3- for secondary air pump air filter.

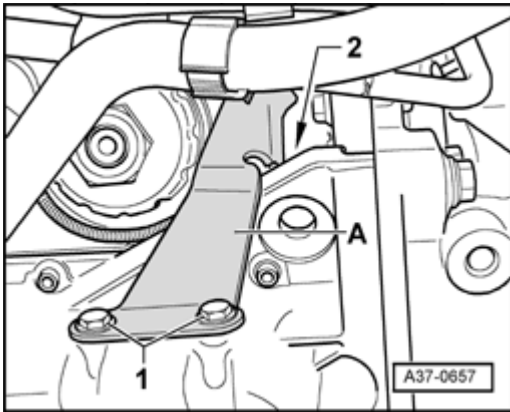


Fig. 369: Removing Bolts And Secondary Air Injection Pump With Bracket
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts -1- and -2- and remove secondary air pump with bracket -A-.

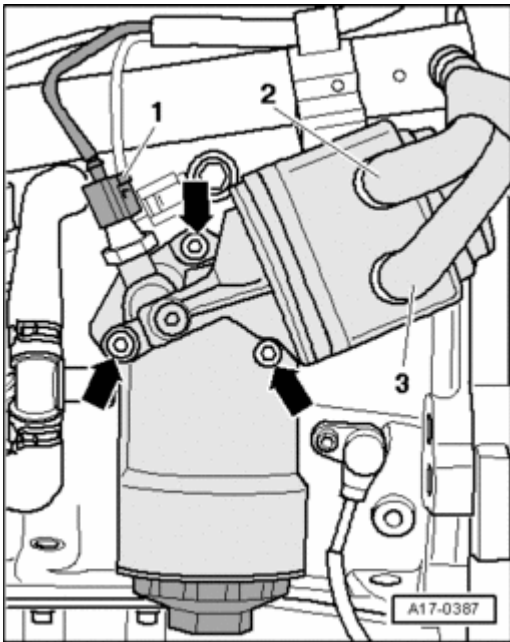


Fig. 370: Disconnecting Electrical Connector At Oil Pressure Switch Using Assembly Tool T10118, Coolant Hoses At Oil Filter Bracket & Unscrewing Bolts And Removing Oil Filter Bracket
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical connector -1- at oil pressure switch using assembly tool T10118.
- Disconnect coolant hoses -2- and -3- at oil filter bracket.
- Unscrew bolts (arrows) and remove oil filter bracket.

Installing

Installation is performed in reverse order of removal. Note the following:

NOTE: Replace seals.

- Install secondary air pump. Refer to **Secondary air injection pump, removing and installing.**
- Install power steering pump

Refer to **48 STEERING**

- Install cross piece.

Refer to **40 FRONT SUSPENSION**

- Install poly V-belt. Refer to **Poly V-belt, removing and installing.**
- Fill cooling system. Refer to **Cooling system, draining and filling.**

Tightening torque

Component	Nm
Oil filter bracket to cylinder block	23

Oil pump, component overview

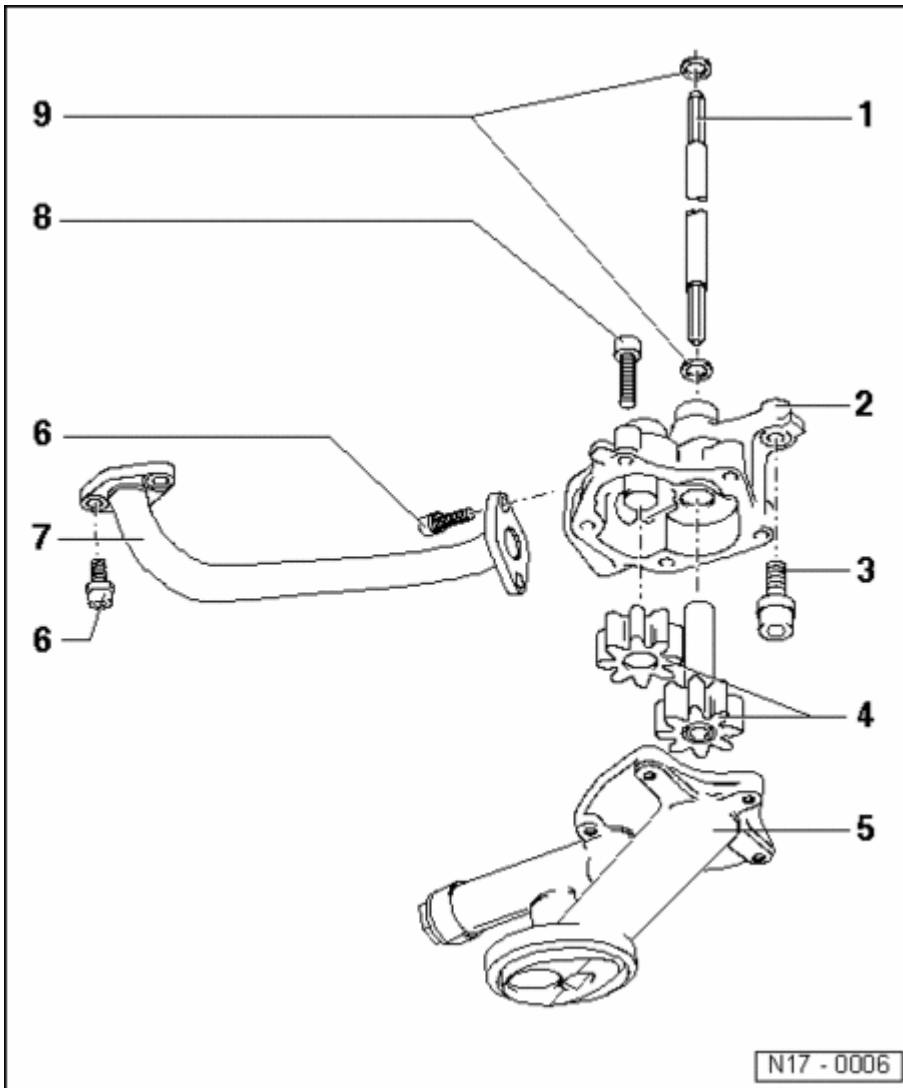


Fig. 371: Oil Pump, Component Overview

Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Input shaft for oil pump drive

2 - Oil pump housing

3 - 23 Nm

4 - Gears

- Checking backlash. Refer to **Checking backlash**
- Checking axial clearance. Refer to **Checking axial clearance**

5 - Oil pump cover

- With pressure relief valve

- Opening pressure: 5.3...5.7
- Clean strainer if dirty

6 - 8 Nm

- Install using locking fluid

7 - Oil pressure pipe

- Apply sealing paste at cylinder block and at oil pump housing

Refer to Parts catalog

8 - 10 Nm**9 - Oil seal**

- Replace if damaged

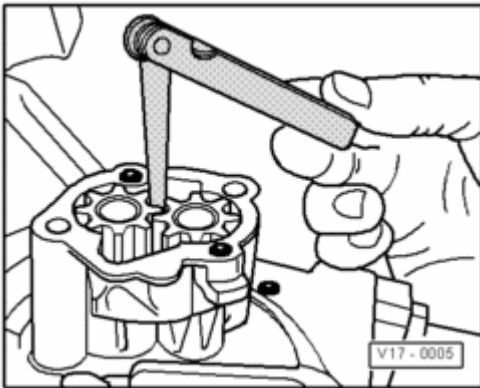
Checking backlash

Fig. 372: Checking Backlash

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Use a feeler gauge to measure.
- Wear limit (backlash): 0.20 mm

Checking axial clearance

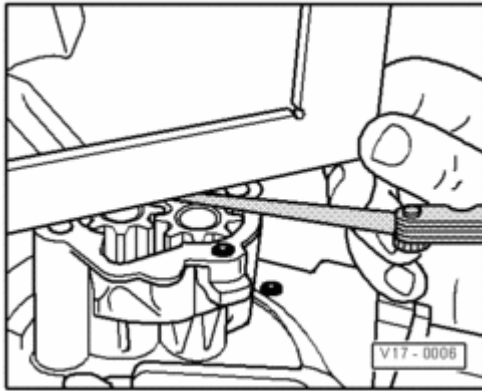


Fig. 373: Checking Axial Clearance

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Use a feeler gauge and straightedge to measure.
- Wear limit (axial clearance): 0.10 mm

Oil pressure and oil pressure switch, checking

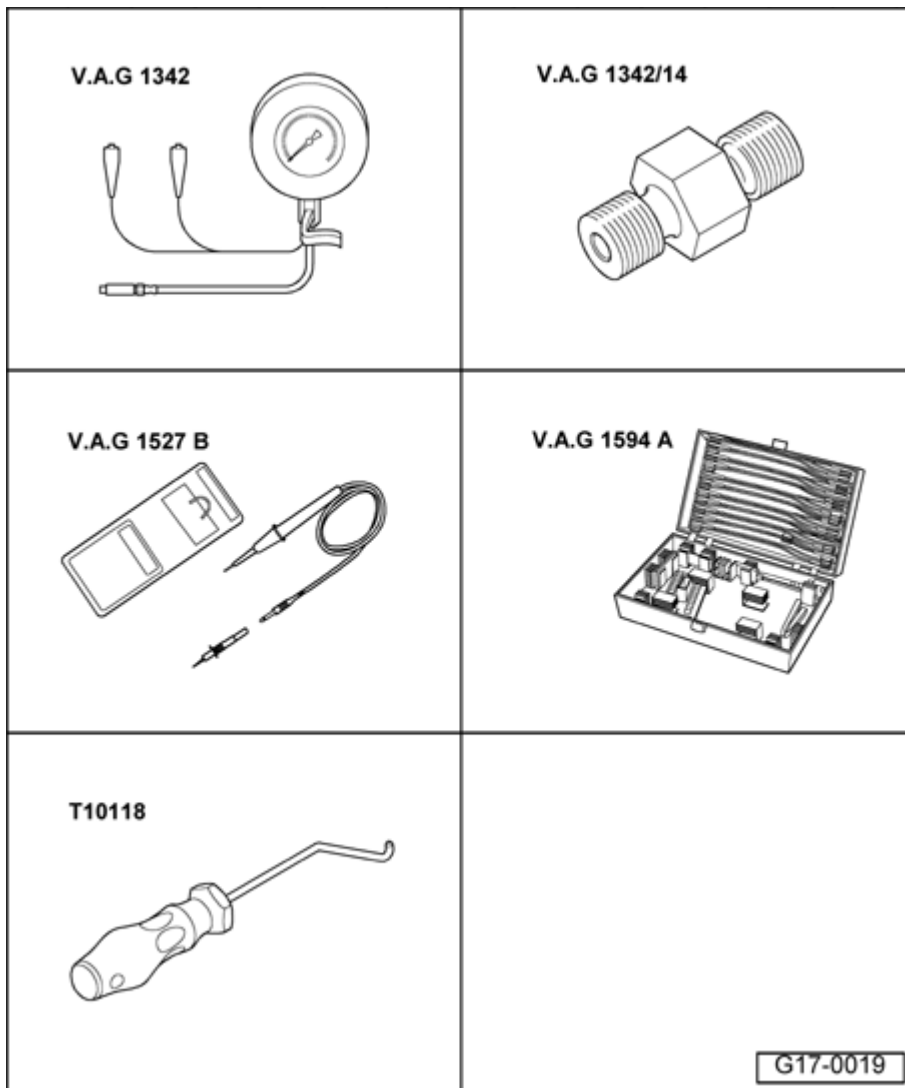


Fig. 374: Identifying Special Tools - Oil Pressure And Oil Pressure Switch, Checking
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools and equipment required

- Oil pressure tester V.A.G 1342
- Adapter V.A.G 1342/14
- Voltage tester V.A.G 1527 B
- Adapter set V.A.G 1594 A
- Assembly tool T10118

Conditions

- Oil level OK
- Engine oil temperature approx. 80° C

- Message "OK" must light up in driver information display

Work sequence

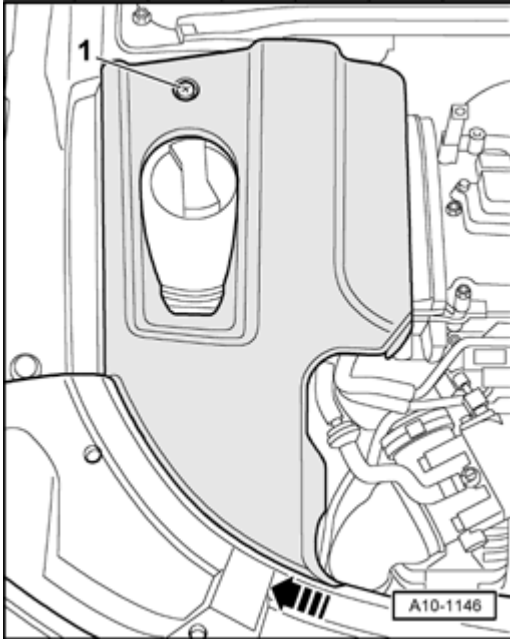


Fig. 375: Removing Screw And Coolant Expansion Tank Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolt -1- and remove cover over coolant expansion tank (arrow).

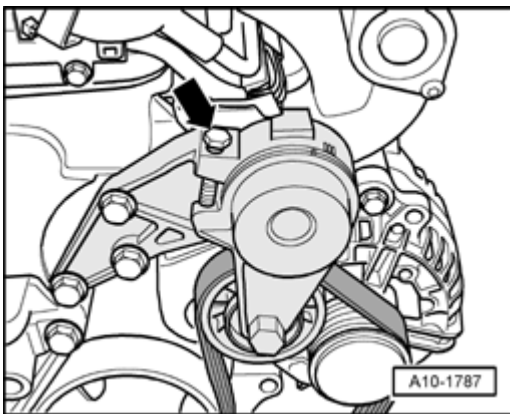


Fig. 376: Screwing Into Bore On Tensioning Element
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- To release tension of poly V-belt, screw an M8 x 40 bolt (arrow) into bore on tensioning element.

NOTE: Mark the rotation direction of the poly V-belt with chalk or a felt-tipped pen. If the belt runs in the opposite direction when it is reinstalled, breakage may result.

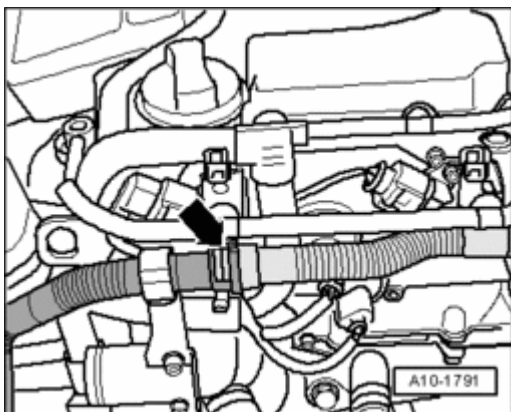


Fig. 377: Identifying Secondary Air Injection Hose

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect secondary air hose at position marked with an arrow.
- Move air hose clear.

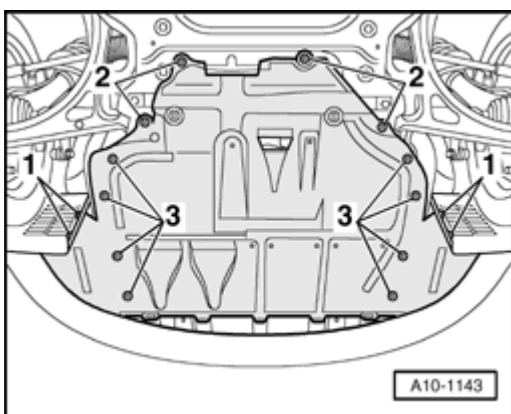


Fig. 378: Identifying Center Sound Insulation Fasteners

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove fasteners -1...3- and remove sound insulation.

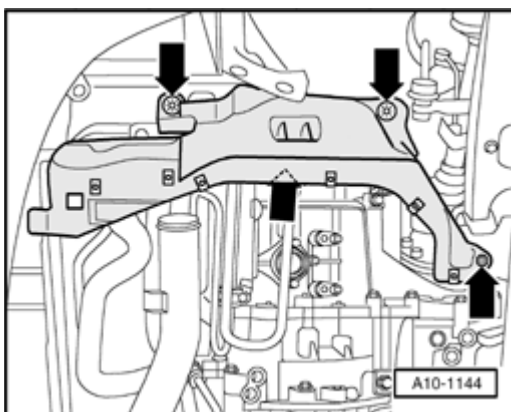


Fig. 379: Left Sound Insulation Panel

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove left sound insulation (arrows).

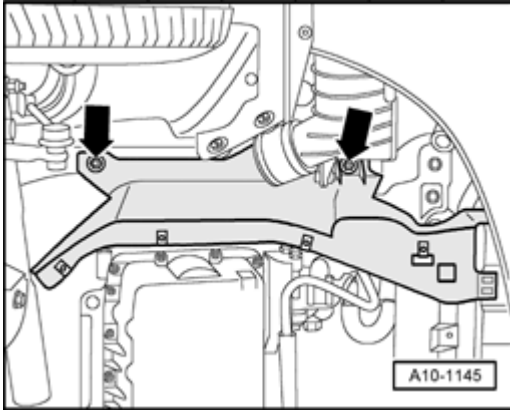


Fig. 380: Removing Right Sound Insulation

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove right sound insulation (arrows).

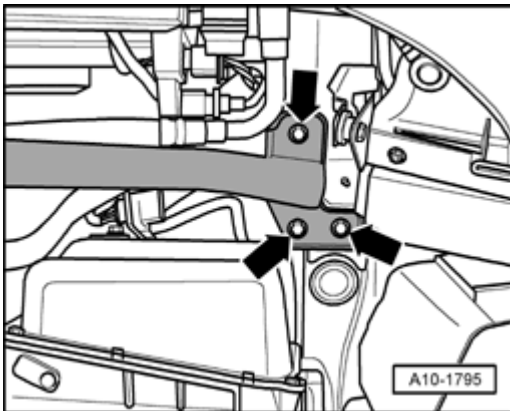


Fig. 381: Removing Cross Piece

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove cross piece (arrows).
- Unbolt pulley for power steering pump (counterhold with mandrel).

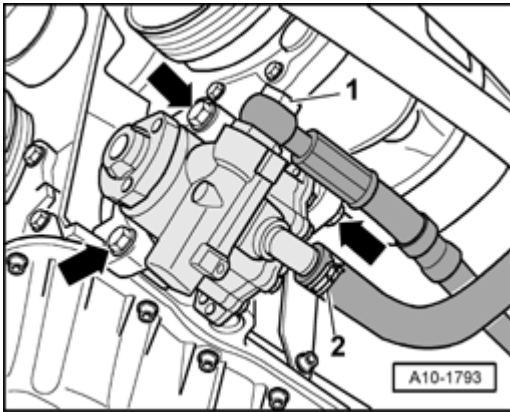


Fig. 382: Removing Bolts And Power Steering Pump From Bracket
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts securing power steering pump to bracket (arrows).
- Hang power steering pump on lock carrier with hydraulic hoses -1- and -2- attached.

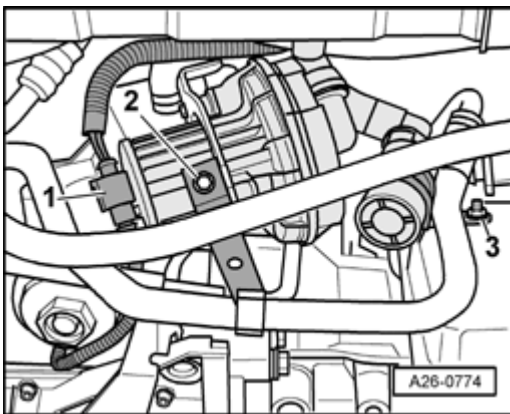


Fig. 383: Disconnecting Electrical Connector At Secondary Air Injection (AIR) Pump Motor -V101-
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical connector -1- at Secondary Air Injection (AIR) pump motor -V101-.
- Move wire clear.
- Remove bracket -2- for coolant hose.
- Remove bracket -3- for secondary air pump air filter.

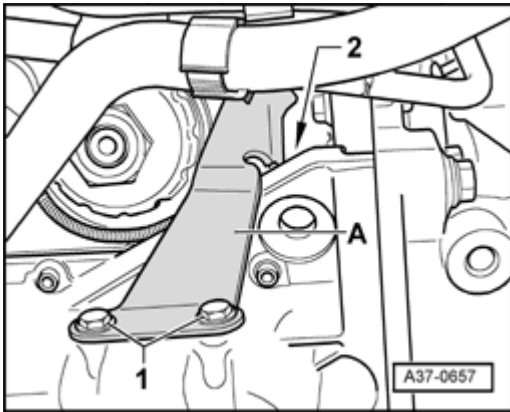


Fig. 384: Removing Bolts And Secondary Air Injection Pump With Bracket
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts -1- and -2- and remove secondary air injection pump with bracket -A-.

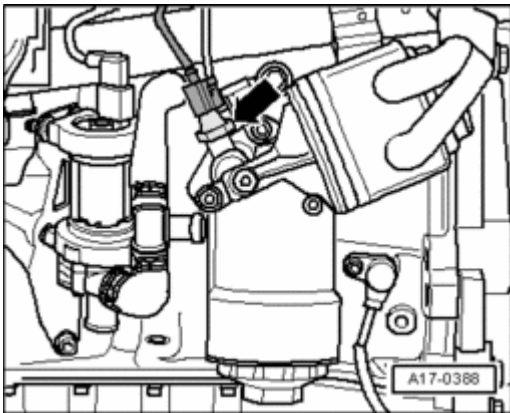


Fig. 385: Disconnecting Electrical Connector At Oil Pressure Switch Using Assembly Tool T10118
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical connector (arrow) at oil pressure switch using assembly tool T10118.
- Unscrew oil pressure switch.

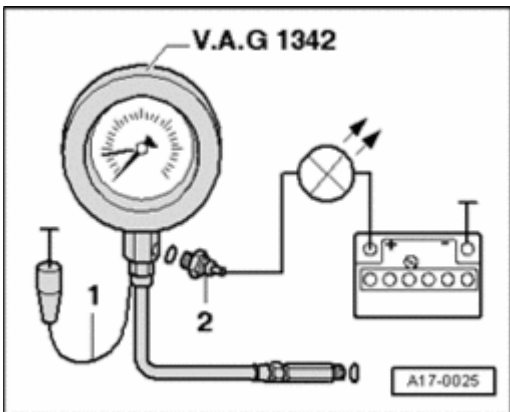


Fig. 386: Connecting Oil Pressure Tester V.A.G 1342 With Adapter V.A.G 1342/14 To Bore For Oil

Pressure Switch**Courtesy of VOLKSWAGEN UNITED STATES, INC.**

- Connect oil pressure tester V.A.G 1342 with adapter V.A.G 1342/14 to bore for oil pressure switch.
- Screw oil pressure switch -2- into oil pressure tester V.A.G 1342.

Checking oil pressure switch

- Connect brown wire -1- of oil pressure tester to Ground (-).
- Connect voltage tester V.A.G 1527 B with test leads from adapter set V.A.G 1594 A to oil pressure switch and battery positive (+).
- LED must not light up

If the LED lights up:

- Replace oil pressure switch.
- Install power steering pump

Refer to **48 STEERING**

- Install poly V-belt. Refer to **Poly V-belt, removing and installing**

NOTE: **Observe oil pressure tester and LED while starting. Switching point of oil pressure switch may already be exceeded when starting.**

- Start engine.
- Test lamp must light up at 1.2...1.6 bar

If the LED does not light up:

- Replace oil pressure switch.

Checking oil pressure

- Install power steering pump

Refer to **48 STEERING**

- Install poly V-belt. Refer to **Poly V-belt, removing and installing.**
- Start engine.
- Minimum oil pressure at idling speed: 2.0 bar
- Minimum oil pressure at 2000 RPM: 3.0 bar

- Oil pressure at higher engine speeds: max. 7.0 bar

The pressure relief valve or oil pump is faulty if the specifications are not attained.

- Replace oil pump. Refer to **Oil pump, component overview**.

Assembling

Assembly is performed in the reverse order. Note the following:

- Install secondary air injection pump. Refer to **Secondary air injection pump, removing and installing**.
- Install power steering pump

Refer to **48 STEERING**

- Install cross piece.

Refer to **40 FRONT SUSPENSION**

- Install poly V-belt. Refer to **Poly V-belt, removing and installing**.

Engine oil, general information

The engine is filled at the factory with a high quality multi-grade oil that can be used all year round, except in extremely cold climates.

Viscosity grades and oil specifications

Refer to Additional Information, Fluid Capacity Chart

Oil level, checking

- Engine oil temperature at least 60° C
- Vehicle must be level (horizontal)
- Wait a few minutes after switching off the engine to allow the oil to flow back into the sump

Work sequence

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

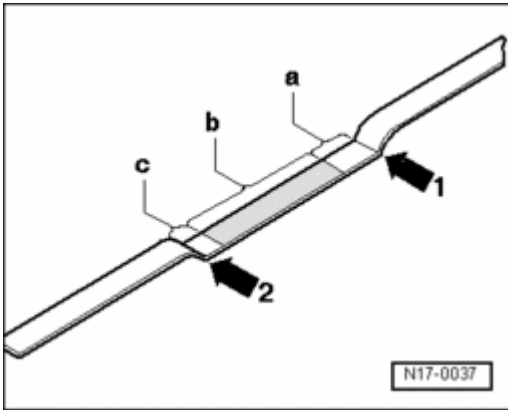


Fig. 387: Identifying Dipstick Markings

Courtesy of VOLKSWAGEN UNITED STATES, INC.

Markings on oil dipstick:

a - Do not top up oil

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

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

NOTE: The oil level must not be above the MAX marking (arrow -1-) and not below the MIN marking (arrow -2-).

19 ENGINE - COOLING SYSTEM

COOLING SYSTEM COMPONENTS, REMOVING AND INSTALLING

Cooling system components, removing and installing

WARNING: Cover cap of expansion tank with rag and open carefully, as hot steam i.e. hot coolant may escape when opening.

NOTE:

- The cooling system is under pressure when the engine is warm. If necessary reduce pressure before repair.
- Secure all hose connections using hose clamps appropriate for the model type
- VAG 1921 hose clip pliers are recommended for installing spring-type clamps.
- Always replace gaskets, seals and O-rings.
- The arrows which are marked on coolant lines and hoses must face each other.

Cooling system, component overview

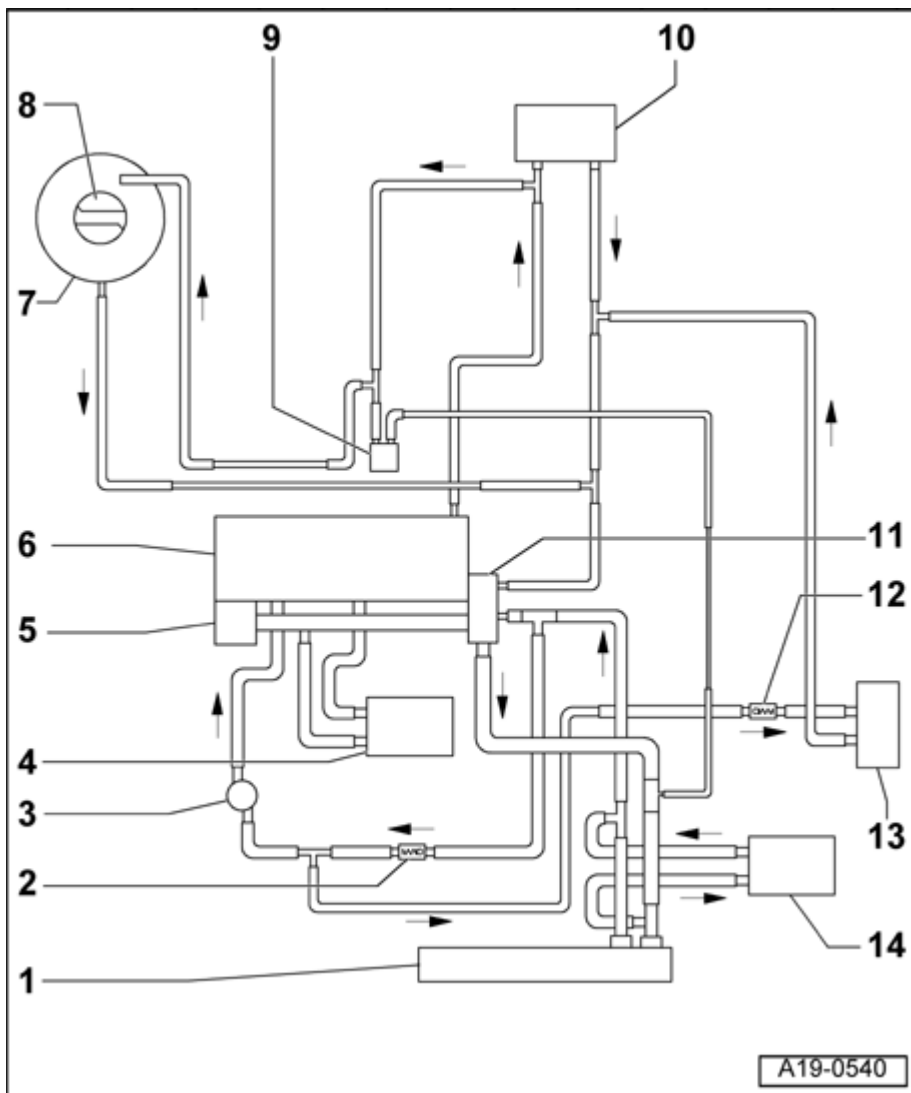


Fig. 388: Cooling System, Component Overview
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

Coolant hose connection diagram

1 - Radiator

- Removing and installing. Refer to **Radiator, removing and installing**
- After replacing, fill with new coolant

2 - Non-return valve

3 - After-run coolant pump -V51-

- Removing and installing. Refer to **After-run coolant pump -V51-, removing and installing**

4 - Oil cooler

- After replacing, fill with new coolant

5 - Coolant pump

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

6 - Cylinder head/cylinder block

- After replacing, fill with new coolant

7 - Expansion tank**8 - Filler cap for expansion tank**

- With pressure relief valve
- Checking pressure relief valve. Refer to Pressure relief valve in filler cap, checking

9 - Throttle valve control module -J338-**10 - Heat exchanger**

- After replacing, fill with new coolant

11 - Thermostat

- Removing and installing. Refer to Thermostat housing, removing and installing
- Checking. Refer to Thermostat housing, checking

12 - Non-return valve**13 - ATF cooler**

- After replacing, fill with new coolant

14 - Auxiliary radiator

- After replacing, fill with new coolant

Cooling system, draining and filling

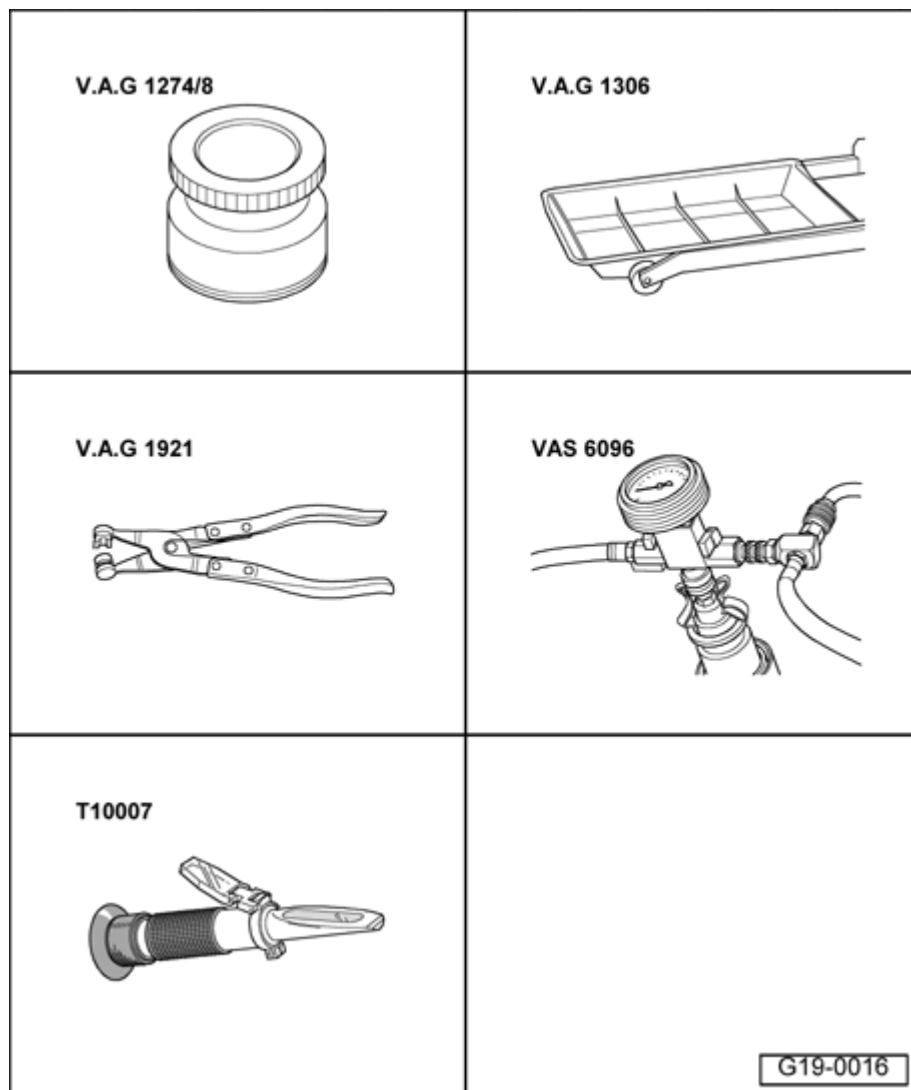


Fig. 389: Identifying Special Tools - Cooling System, Draining And Filling
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools and equipment required

- Adapter for cooling system tester V.A.G 1274/8
- Drip tray V.A.G 1306
- Hose clamp pliers V.A.G 1921
- Cooling system charge unit VAS 6096 with VAS 6096/1
- Refractometer T10007

Draining

NOTE: Collect drained coolant in a clean container for re-use or disposal.

CAUTION: Cover cap of expansion tank with rag and open carefully, as hot steam i.e. hot coolant may escape when opening.

- Open filler cap on expansion tank.

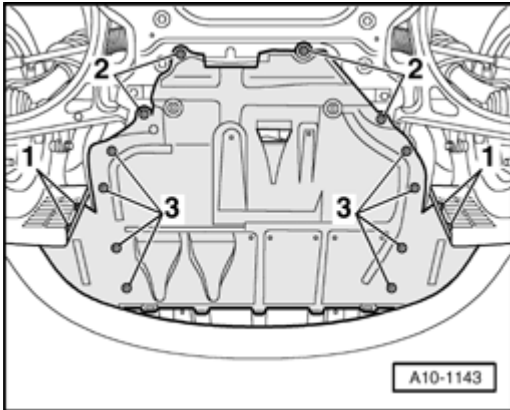


Fig. 390: Identifying Center Sound Insulation Fasteners
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove fasteners -1...3- and remove center sound insulation.
- Place drip tray V.A.G 1306 under engine.

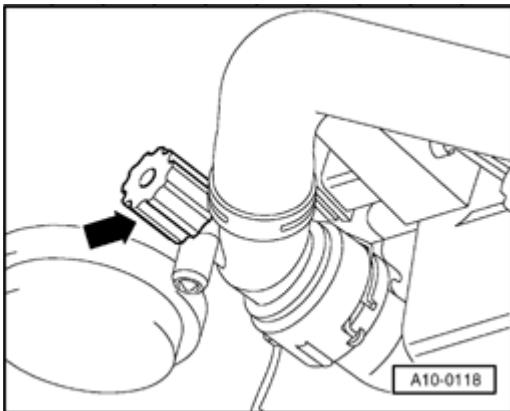


Fig. 391: Locating Radiator Drain Plug
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Turn drain plug (arrow) on radiator counter-clockwise and, if necessary, fit a drain hose to connection.

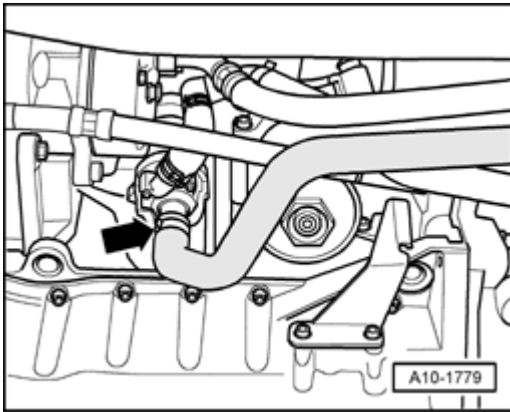


Fig. 392: Removing/Installing Lower Coolant Hose At After-Run Coolant Pump -V51-
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- In addition, remove lower coolant hose at After-run coolant pump -V51- (arrow) and drain remaining coolant.

Filling

NOTE:

- The cooling system must be filled year round with a mixture of water and frost and corrosion protection additives.
- Only use coolant additive Plus G 012 A8F A1 (also designated as "G12+") meeting specification TL VW 774 F. Other coolant additives could seriously impair in particular the anticorrosion properties. The resulting damage could lead to loss of coolant and consequently to serious engine damage.
- Coolant additive "G12+" may be mixed with additives "G11" and "G12".
- "G12+" and coolant additives marked with "Meets specification TL VW 774 F" prevent frost and corrosion damage as well as stop scale from forming. They also raise the boiling point. Therefore, cooling system must be filled year round with the correct antifreeze and corrosion protection additives.
- A higher boiling point improves engine reliability under heavy load particularly in countries with tropical climates.
- Frost protection must be ensured to about -25° C (about -35° C in countries with arctic climates).
- The coolant concentration must not be reduced by adding water even in warmer seasons and in warmer countries. The coolant additive portion must be at least 40%.
- If greater frost protection is required in very cold climates, the amount of "G12+" can be increased, but only up to 60% (this gives frost protection to about -40° C). If the antifreeze percentage exceeds 60%, frost protection decreases again and cooling efficiency is also impaired.
- Only use clean drinking water for mixing coolant.
- If the radiator, heat exchanger, cylinder head, cylinder head gasket or

cylinder block have been replaced, do not re-use the old coolant.

- Contaminated or dirty coolant must not be used again.
- To check frost protection level of coolant additive "G12+" use refractometer T10007.

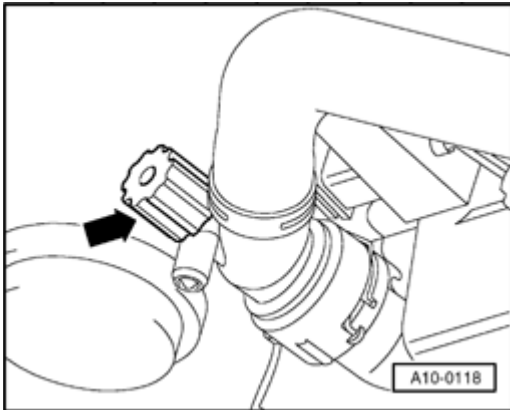


Fig. 393: Locating Radiator Drain Plug

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Close drain plug (arrow).

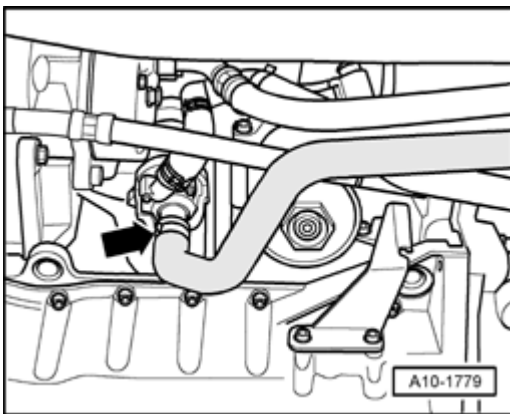


Fig. 394: Removing/Installing Lower Coolant Hose At After-Run Coolant Pump -V51-

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect coolant hose to After-run coolant pump -V51- (arrow).

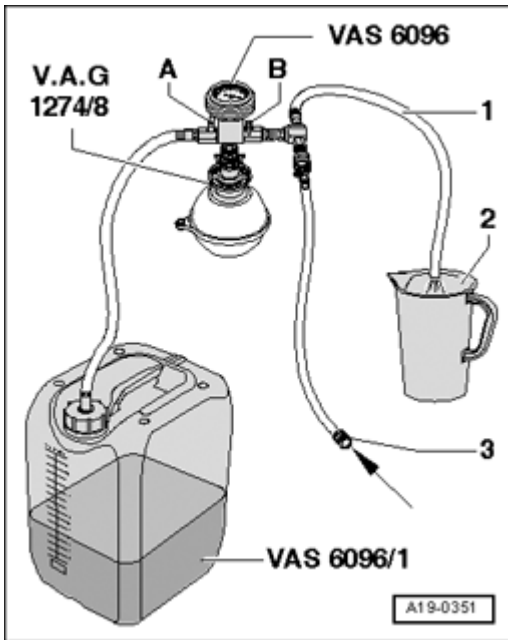


Fig. 395: Filling Reservoir VAS 6096/1 With At Least 8 Liters Of Premixed Coolant
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Fill reservoir VAS 6096/1 with at least 8 liters of premixed coolant (based on recommended ratio):
 - "G12+" (40%) and water (60%) for frost protection to 25° C
 - "G12+" (50%) and water (50%) for frost protection to 35° C
 - "G12+" (60%) and water (40%) for frost protection to 40° C
- Screw adapter for cooling system tester V.A.G 1274/8 onto coolant expansion tank.
- Mount cooling system charge unit VAS 6096 onto adapter V.A.G 1274/8.
- Feed vent hose -1- into a small container -2-. (The vented air draws along a small amount of coolant, which should be collected.)
- Close both valves -A- and -B- (turn lever perpendicular to direction of flow).
- Connect hose -3- to compressed air.
- Pressure: 6...10 bar
- Open valve -B- (turn lever in direction of flow).

The suction jet pump generates a vacuum in the cooling system.

- Needle on gauge must move into green zone

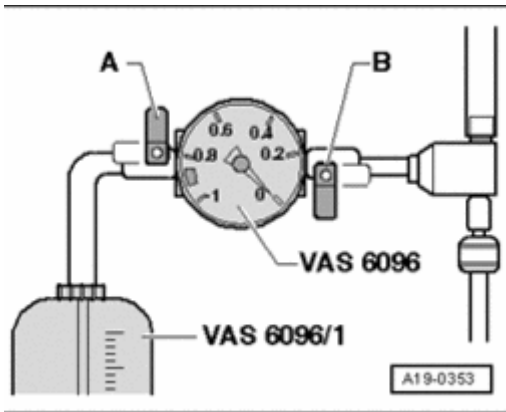


Fig. 396: Cooling System, Draining And Filling

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Also briefly open valve -A- (turn lever in direction of flow) so that hose on coolant expansion tank, VAS 6096/1, can fill with coolant.
- Close valve -A- again.
- Leave valve -B- open for another 2 minutes.
- Suction jet pump will continue generating a vacuum in the cooling system.
- Needle on gauge must remain in green zone.
- Close valve -B-.
- Needle on gauge must stop in green zone. Vacuum level in cooling system is then sufficient for subsequent filling.

If the needle does not reach the green area, repeat the process.

If the vacuum level drops, there is a leak in the cooling system.

- Disconnect compressed air hose.
- Open valve -A-.

The vacuum in the cooling system causes the coolant to be drawn out of the cooling system charge unit VAS 6096/1; the cooling system is then filled.

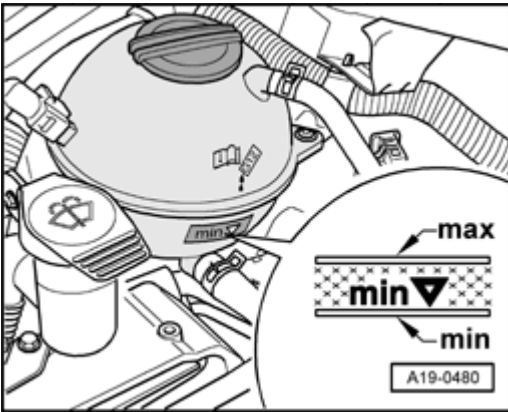


Fig. 397: Identifying Expansion Tank Max/Min Fill Marking
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Check coolant level and top up coolant as far as MAX mark.
- Start engine, run for maximum of 2 minutes at approx. 1500 RPM and fill coolant up to overflow hole on expansion tank.
- Close expansion tank.
- Run engine until coolant fan starts.

WARNING: Cover cap of expansion tank with rag and open carefully, as hot steam i.e. hot coolant may escape when opening.

- Check coolant level and top up if necessary.
- When engine is at normal operating temperature, coolant level must be at MAX mark. When engine is cold coolant level must be between MIN and MAX marks.
- Switch engine off.

Coolant pump, removing and installing

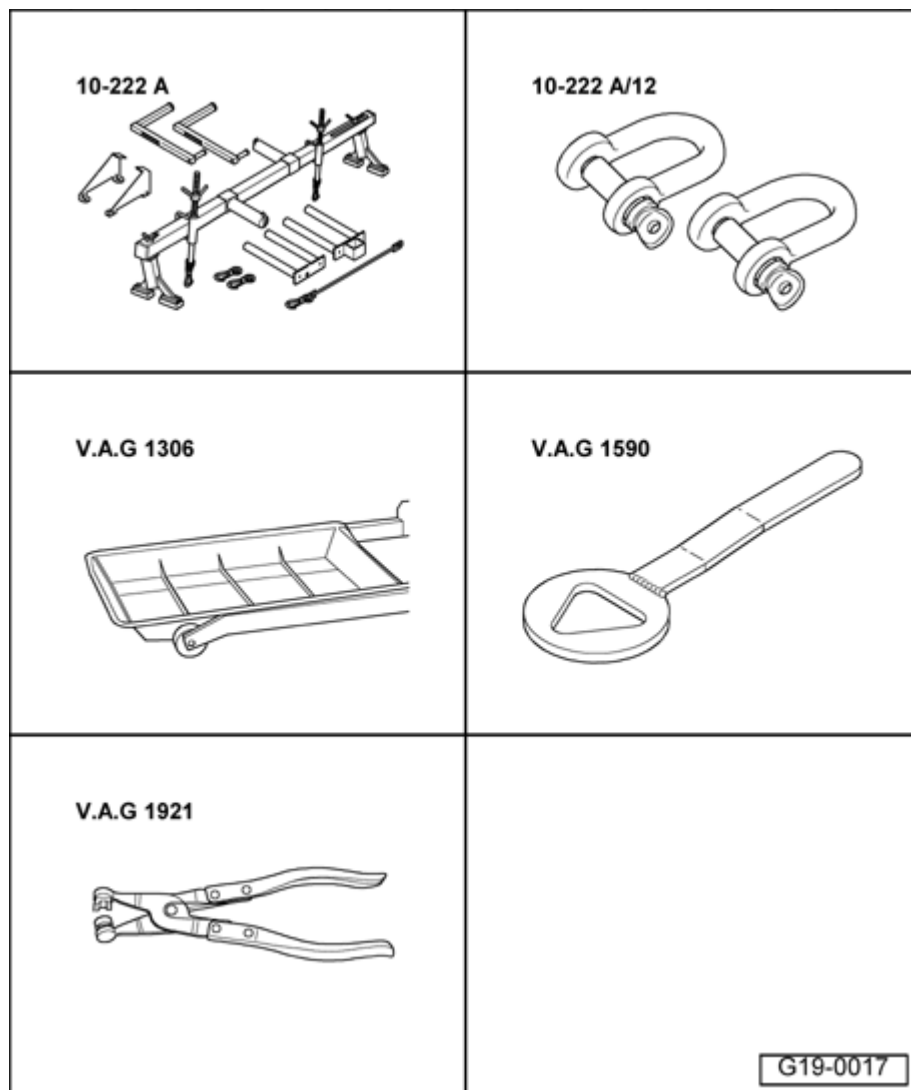


Fig. 398: Identifying Special Tools - Coolant Pump, Removing And Installing
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools and equipment required

- Support bracket 10-222 A
- Shackle 10-222 A/12
- Drip tray V.A.G 1306
- Coolant pump spanner V.A.G 1590
- Hose clamp pliers V.A.G 1921
- Bolt M8 x 40

Removing

WARNING: Cover cap of expansion tank with rag and open carefully, as hot steam i.e.

hot coolant may escape when opening.

- Open filler cap on coolant expansion tank.

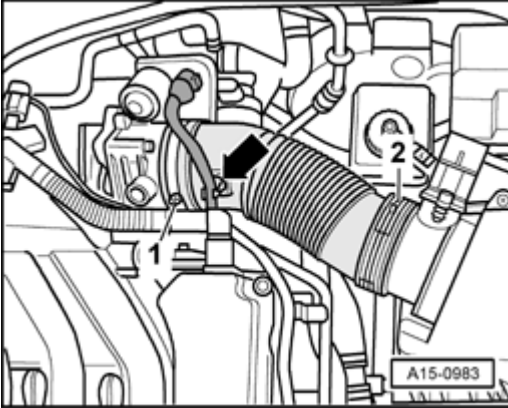


Fig. 399: Loosening Hose Clamps And Removing Air Hose Between Air Cleaner Housing & Throttle Valve Control Module -J338-
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Loosen hose clamp -1- and disconnect air hose at Throttle valve control module -J338-.
- Move electrical wire (arrow) clear.

NOTE: Hose clamp -2- remains attached.

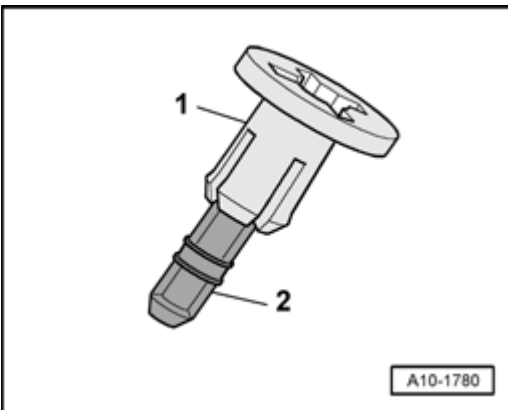


Fig. 400: Identifying Fasteners At Lock Carrier & Pin
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- To remove fasteners -1- at lock carrier, press pin -2- in approx. 4 mm (do not push in completely). Then pull fastener out upward.

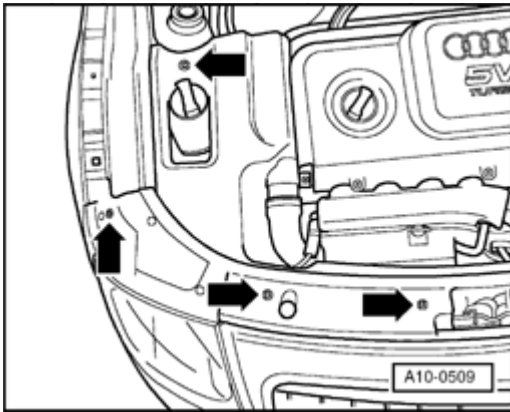


Fig. 401: Removing Covers At Lock Carrier And Above Coolant Expansion Tank
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove covers (right side) -1- and -2- at lock carrier and above coolant expansion tank (arrows).

NOTE: Before removing, mark direction of rotation of poly V-belt with chalk or a felt-tipped pen. If the belt runs in the opposite direction when it is re-installed, breakage may result.

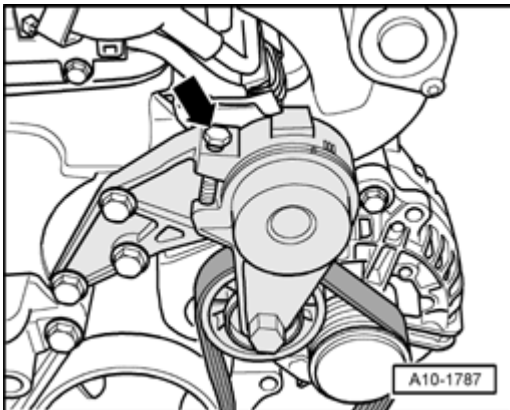


Fig. 402: Screwing Into Bore On Tensioning Element
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- To release tension of poly V-belt, screw an M8 x 40 bolt into bore on tensioning element.

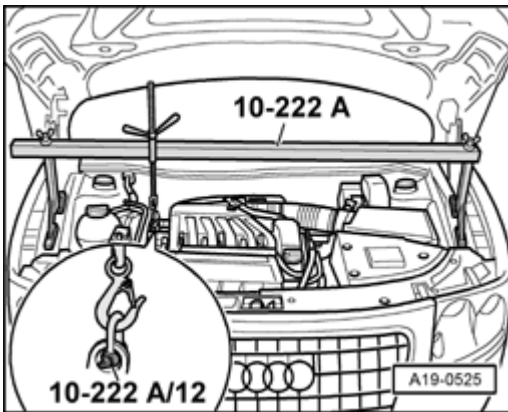


Fig. 403: Attaching Shackle 10-222 A/12 To Right Rear Engine Lifting Eye
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Attach shackle 10-222 A/12 to right rear engine lifting eye.
- Place support bracket 10-222 A on surface of panel flange; spindle faces forward.
- Attach spindle hook to shackle.
- Pretension spindle slightly.

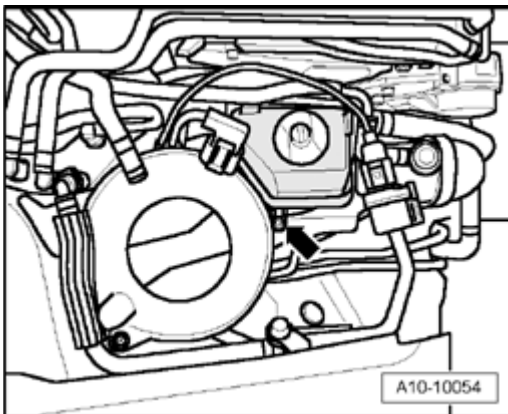


Fig. 404: Removing Securing Bolt For Power Steering Reservoir
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove securing bolt (arrow) for power steering reservoir.

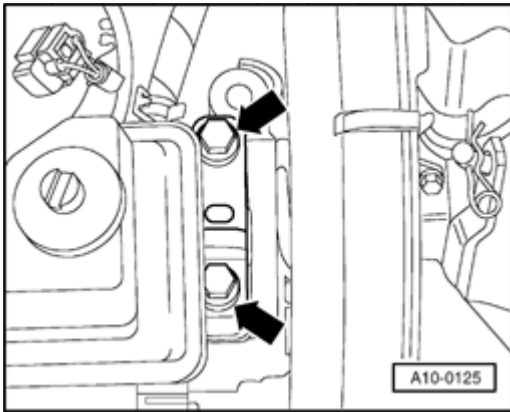


Fig. 405: Locating Engine Carrier Bolts (Engine Side)

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Loosen bolts (arrows) of assembly mounting (left side) on engine.

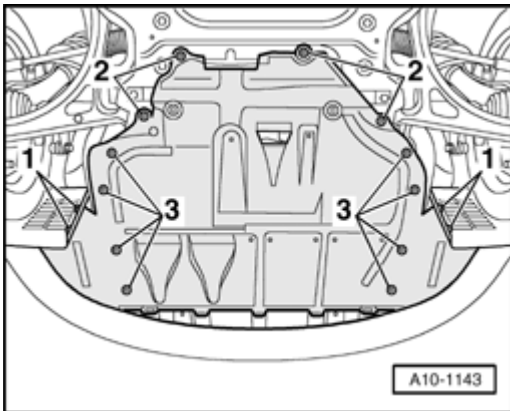


Fig. 406: Identifying Center Sound Insulation Fasteners

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove fasteners -1...3- and remove center sound insulation.

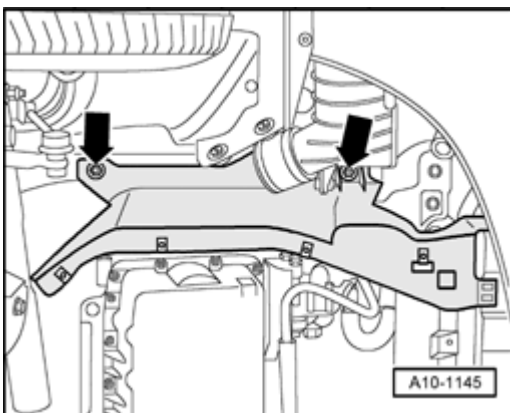


Fig. 407: Removing Right Sound Insulation

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove right sound insulation (arrows).
- Place drip tray V.A.G 1306 under engine.

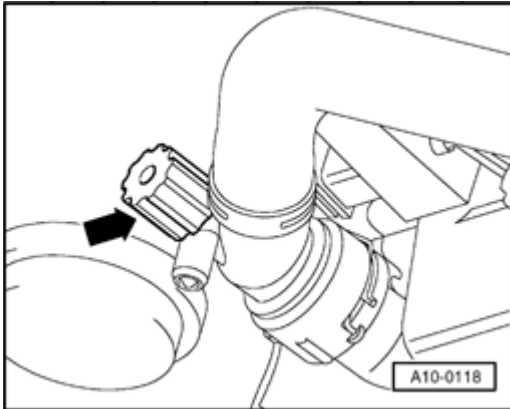


Fig. 408: Locating Radiator Drain Plug

Courtesy of VOLKSWAGEN UNITED STATES, INC.

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

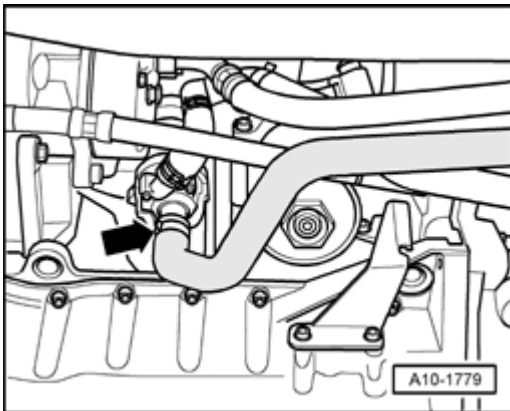


Fig. 409: Removing/Installing Lower Coolant Hose At After-Run Coolant Pump -V51-

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- In addition, remove lower coolant hose at After-run coolant pump -V51- (arrow) and drain remaining coolant.

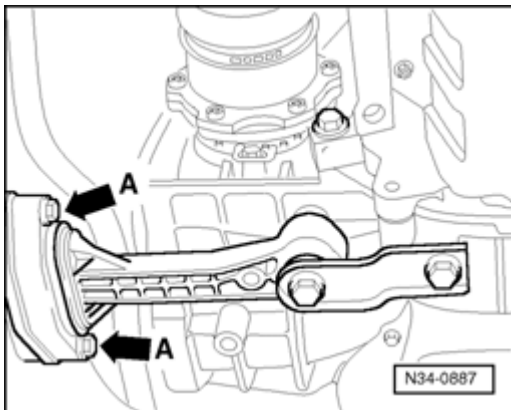


Fig. 410: Identifying Pendulum Support On Subframe
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts (arrows -A-) for pendulum support at subframe.

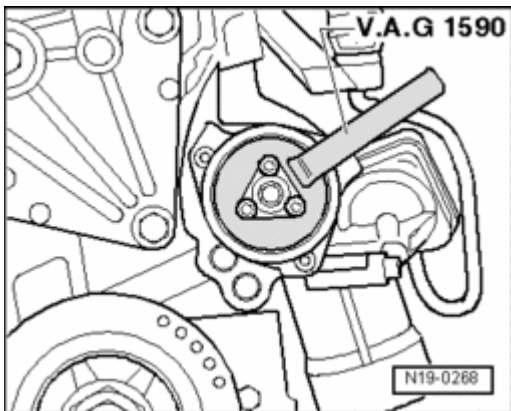


Fig. 411: Removing Pulley; Counterhold Using Coolant Pump Spanner V.A.G 1590
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove pulley; counterhold using coolant pump spanner V.A.G 1590.

NOTE: The pulley must not be removed if the engine has been taken out. In this case, the securing bolts for the coolant pump are accessible through the holes of the pulley.

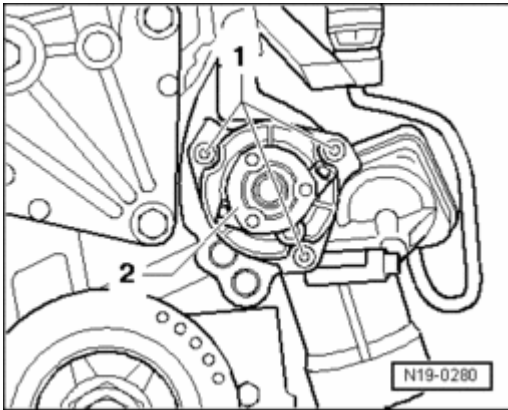


Fig. 412: Coolant Pump Securing & Bolts

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts -1- for coolant pump -2-.

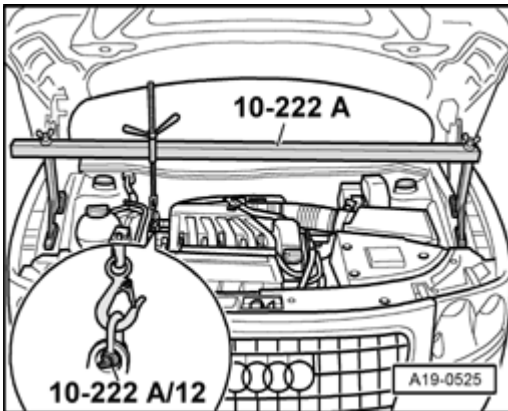


Fig. 413: Attaching Shackle 10-222 A/12 To Right Rear Engine Lifting Eye

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Lower engine via spindle approx. 65 mm.
- Swing coolant pump forward and remove.

Installing

Installation is performed in the reverse order. Note the following:

NOTE: Replace the O-ring.

- Clean and smooth surface for O-ring as required.
- Moisten new O-ring with coolant "G12+".

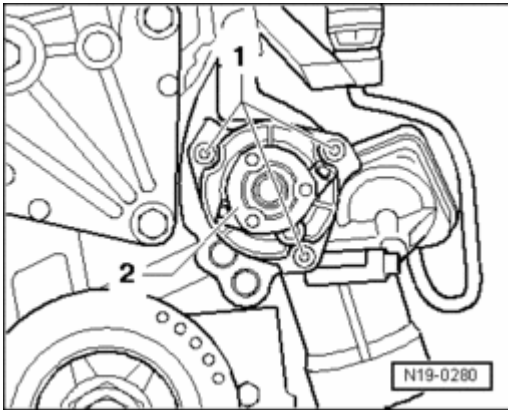


Fig. 414: Coolant Pump Securing & Bolts

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Install coolant pump -2-.
- Tighten bolts -1- for coolant pump.
- Install coolant pump pulley.
- Install poly V-belt. Refer to **Poly V-belt, removing and installing.**
- Adjust engine mountings. Refer to **Engine mountings, checking and adjusting.**

Tightening torques

Component	Nm
Coolant pump to cylinder block	8
Pulley to coolant pump	20

Thermostat housing, component overview

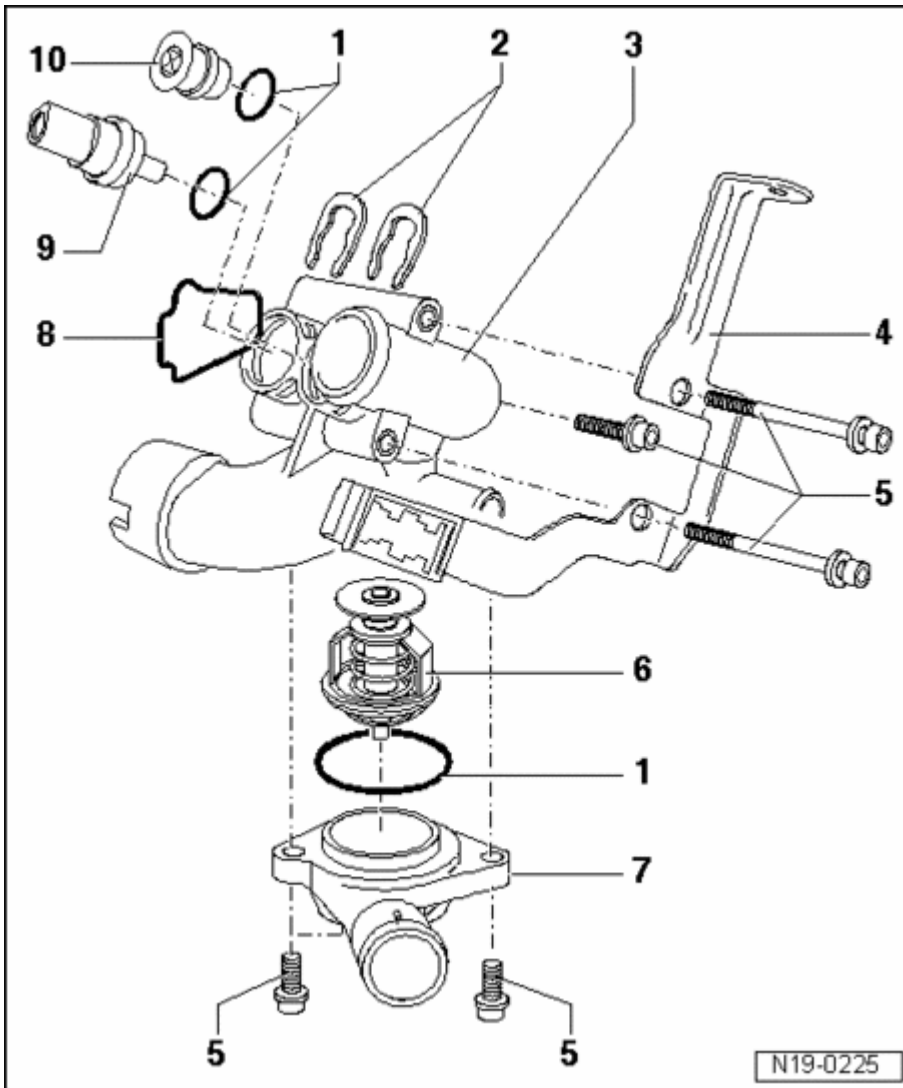


Fig. 415: Thermostat Housing, Component Overview
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - O-ring

- Replace

2 - Retaining clip

3 - Thermostat housing

- Removing and installing. Refer to **Thermostat housing, removing and installing**

4 - Bracket

5 - 10 Nm

6 - Thermostat

- Removing and installing. Refer to **Thermostat housing, removing and installing**
- Checking. Refer to **Thermostat housing, checking**

7 - Connection**8 - Gasket**

- Replace

9 - Engine Coolant Temperature (ECT) sensor -G62-

- With ECT sensor -G2-
- Dissipate cooling system pressure before removal if necessary

10 - Sealing plug

- Dissipate cooling system pressure before removal if necessary

Thermostat housing, removing and installing

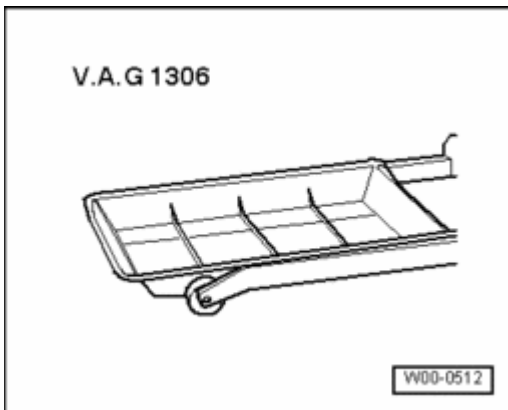
Special tools and equipment required

Fig. 416: Identifying Drip Tray V.A.G 1306

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Drip tray V.A.G 1306

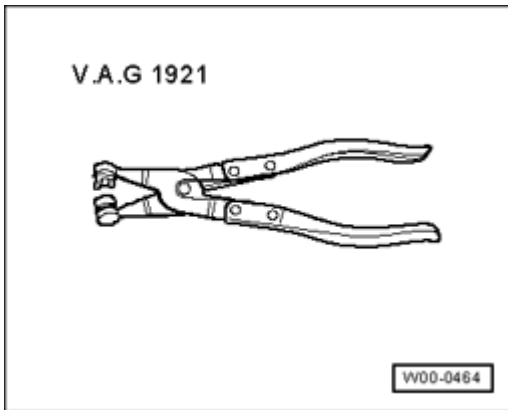


Fig. 417: Identifying Hose Clip Pliers VAG 1921
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Hose clamp pliers V.A.G 1921

Removing

NOTE: Collect drained coolant in a clean container for re-use or disposal.

CAUTION: Observe procedure for disconnecting the battery.

Refer to 27 BATTERY, STARTER, GENERATOR, CRUISE CONTROL

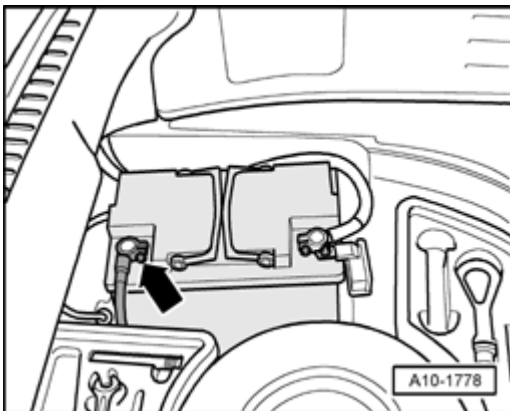


Fig. 418: Disconnecting Battery Ground (GND) Strap
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- With ignition switched off, disconnect Ground cable (arrow) at battery (in luggage compartment, under floor cover).

WARNING: Cover cap of expansion tank with rag and open carefully, as hot steam i.e. hot coolant may escape when opening.

- Open filler cap on coolant expansion tank.

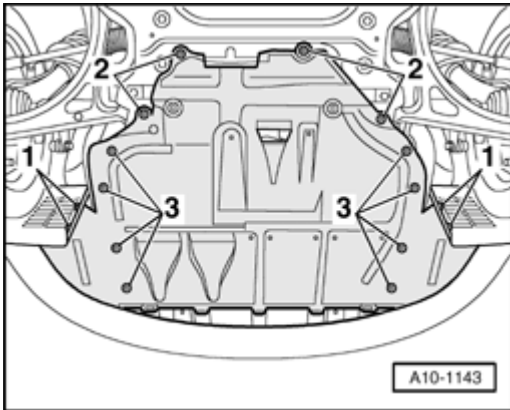


Fig. 419: Identifying Center Sound Insulation Fasteners
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove fasteners -1...3- and remove center sound insulation.
- Place drip tray V.A.G 1306 under engine.

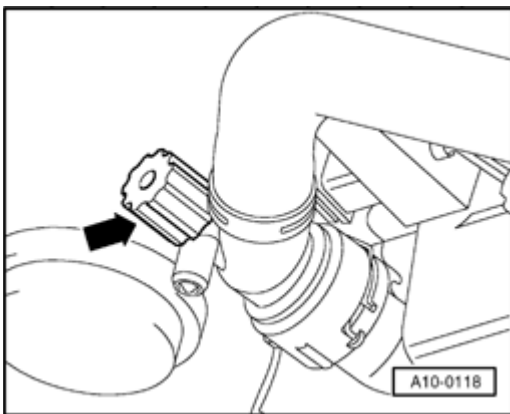


Fig. 420: Locating Radiator Drain Plug
Courtesy of VOLKSWAGEN UNITED STATES, INC.

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

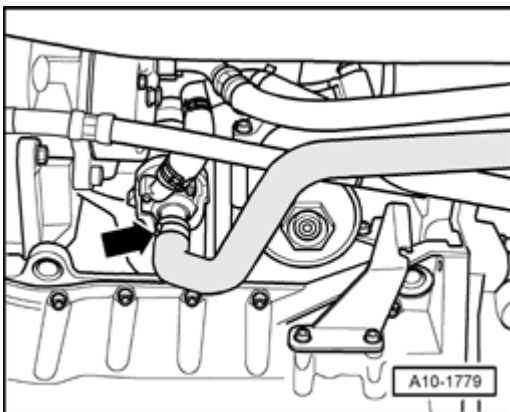
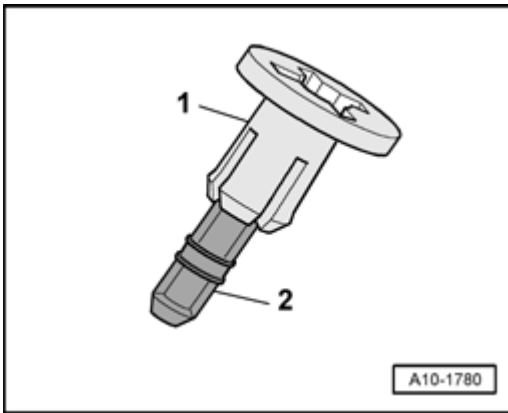


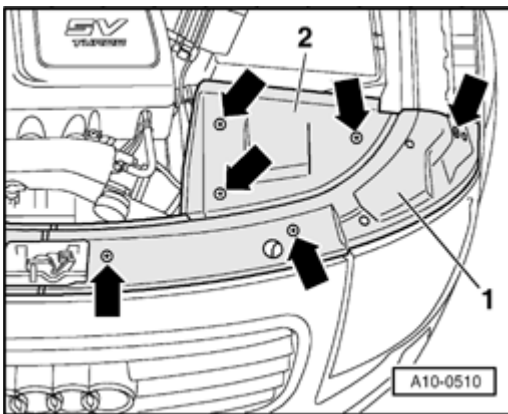
Fig. 421: Removing/Installing Lower Coolant Hose At After-Run Coolant Pump -V51-

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- In addition, remove lower coolant hose at After-run coolant pump -V51- (arrow) and drain remaining coolant.

**Fig. 422: Identifying Fasteners At Lock Carrier & Pin****Courtesy of VOLKSWAGEN UNITED STATES, INC.**

- To remove fasteners -1- at lock carrier, press pin -2- in approx. 4 mm (do not push in completely). Then pull fastener out upward.

**Fig. 423: Removing Left-Hand Cover Panels On Lock Carrier And Battery****Courtesy of VOLKSWAGEN UNITED STATES, INC.**

- Remove covers (left side) -1- and -2- at lock carrier and above main fuse box (arrows).

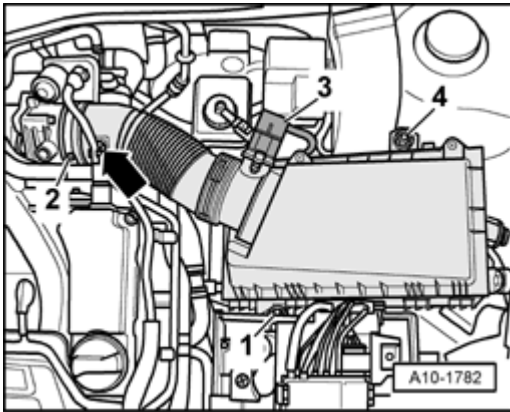


Fig. 424: Identifying Air Hose, Mass Air Flow Sensor -G70- & Bolts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect air hose -2- at Throttle valve control module -J338-.
- Disconnect electrical connector for Mass Air Flow (MAF) sensor -G70-, item -3-.
- Remove bolts -1- and -4-.
- Move electrical wire clear.
- Take out air cleaner housing.

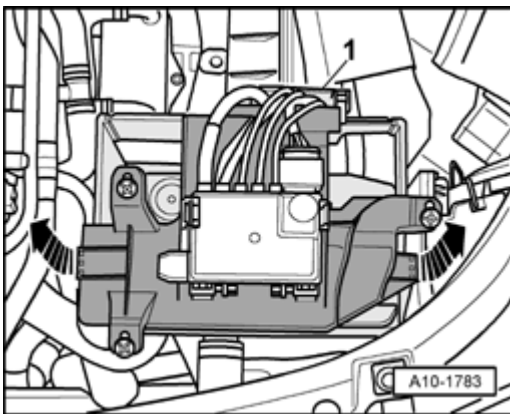


Fig. 425: Unclipping Protective Cover For Electrical Cable
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unclip protective cover -1- for electrical cables.
- Fold bracket for fuse box upward (arrows).

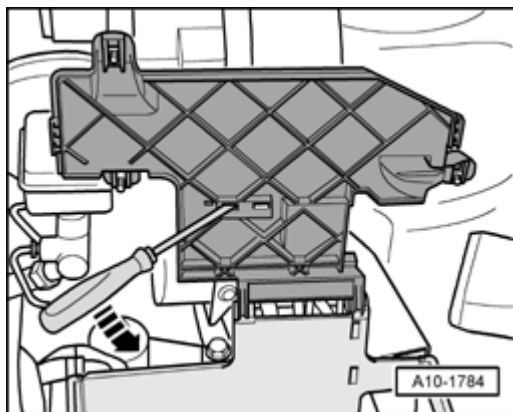


Fig. 426: Removing Fuse Box By Releasing Tabs
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove fuse box by releasing tabs (arrow).

NOTE: The wires remain connected.

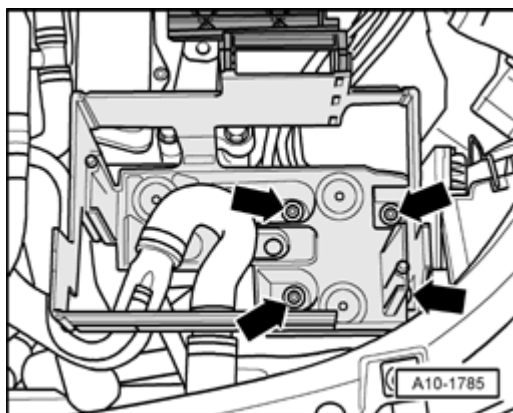


Fig. 427: Removing Carrier
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove carrier (arrows).

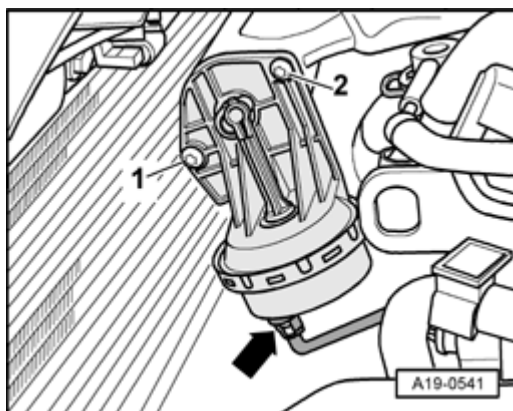
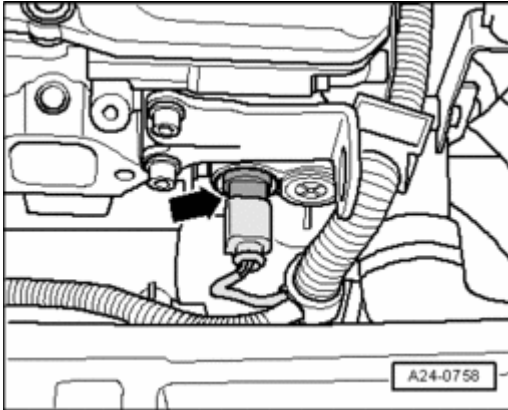


Fig. 428: Removing Bolts And Actuator From Intake Manifold

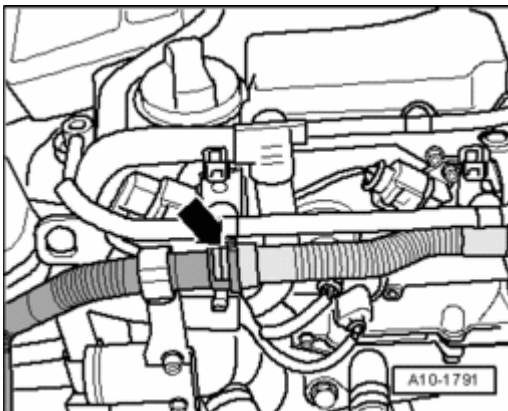
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect vacuum hose (arrow) at actuator for intake manifold change-over.
- Remove bolts -1- and -2- and remove actuator from intake manifold.

**Fig. 429: Disconnecting Electrical Connector At Engine Coolant Temperature (ECT) Sensor -G62-**

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical connector (arrow) at Engine Coolant Temperature (ECT) sensor -G62-.

**Fig. 430: Identifying Secondary Air Injection Hose**

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect secondary air hose at position marked with an arrow.
- Move air hose at bracket clear.

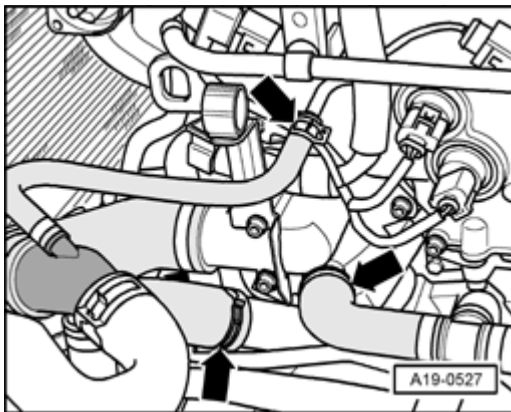


Fig. 431: Disconnecting Coolant Hoses At Connections Indicated
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect coolant hoses at connections indicated (arrows).

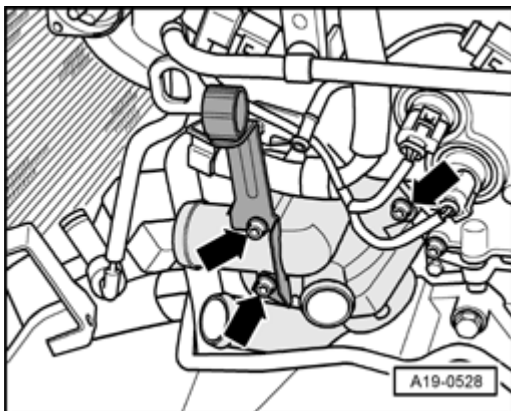


Fig. 432: Removing Secondary Air Injection Hose
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts (arrows).
- Swing bracket for secondary air hose forward.

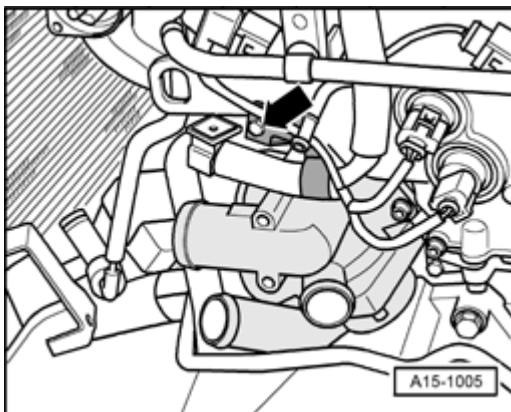


Fig. 433: Removing Bolt On Bracket For Wiring Harness

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolt (arrow) on bracket for wiring harness.

CAUTION: When removing the thermostat housing, push coolant pipe toward coolant pump with an assembly lever to prevent it from also being removed.

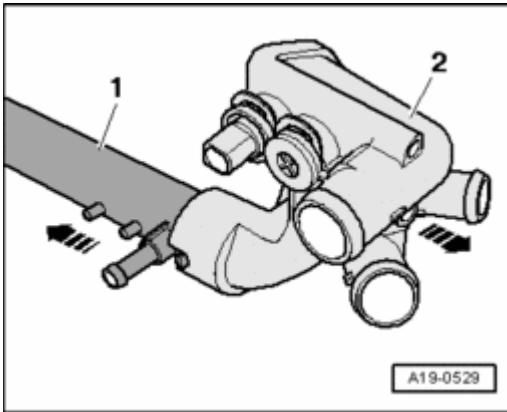


Fig. 434: Removing Thermostat Housing

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove thermostat housing -2-. When doing so, press coolant pipe -1- toward coolant pump with an assembly lever.

Installing

Installation is performed in the reverse order of removal. Note the following.

NOTE: Replace the seals and gaskets.

- Connect battery.

Refer to **27 BATTERY, STARTER, GENERATOR, CRUISE CONTROL**

- Fill cooling system. Refer to **Cooling system, draining and filling.**

Tightening torques

Component	Nm
Thermostat housing to engine	10
Bracket for wiring harness to engine	10
Carrier to longitudinal member	10
Air cleaner housing to body	10

Thermostat housing, checking

NOTE: Collect drained coolant in a clean container for re-use or disposal.

- Remove thermostat housing. Refer to Thermostat housing, removing and installing.

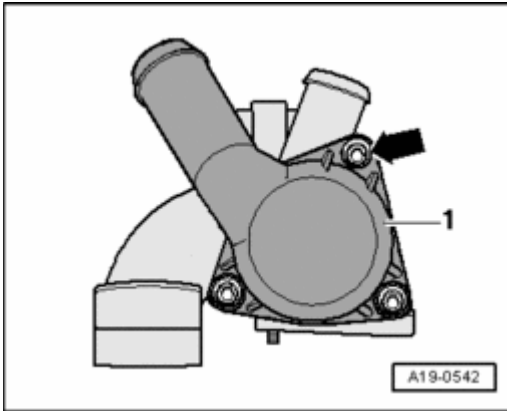


Fig. 435: Removing Bolts And Connection

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts (arrows) and remove connection -1-.

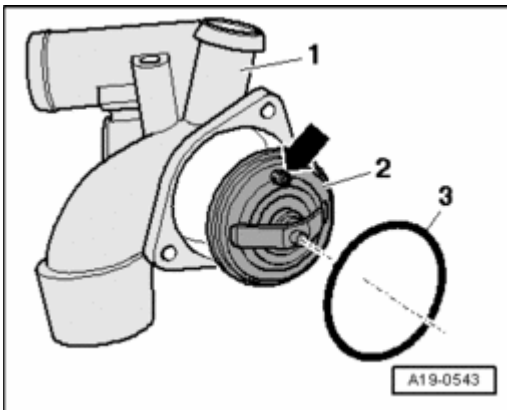


Fig. 436: Removing O-Ring With Thermostat From Thermostat Housing

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove O-ring -3- with thermostat -2- from thermostat housing -1-.
- Heat thermostat in container of water.

Starts to open	Fully open	Opening travel
approx. 80° C	approx. 105° C 1)	at least 7 mm

1) Cannot be tested

- Install thermostat housing. Refer to Thermostat housing, removing and installing.
- Fill cooling system. Refer to Cooling system, draining and filling.

Tightening torque

Component	Nm
Connection to thermostat housing	10

Coolant pipe, removing and installing**Removing**

NOTE: Collect drained coolant in a clean container for re-use or disposal.

- Remove thermostat housing. Refer to Thermostat housing, removing and installing.
- Remove bracket for ancillary units. Refer to Bracket for ancillary units, removing and installing.
- Unclip bracket for wiring on right from coolant pipe.
- Remove wiring harness from retainer on left.
- Pull off coolant hose to oil cooler.
- Pull coolant pipe out of cylinder block.

Installing

NOTE: Always replace seals and gaskets.

- Before installing, clean and smoothen sealing surfaces for O-ring.

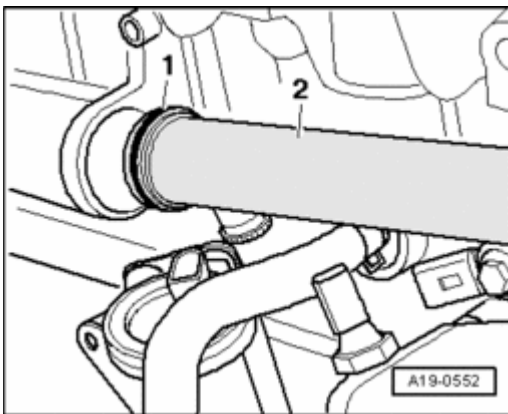


Fig. 437: Lubricating New O-Ring With "G 12+" And Pushing Onto Coolant Pipe
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Lubricate new O-ring -1- with "G 12+" and push onto coolant pipe -2-.
- Slide coolant pipe into bore in cylinder block.
- Install bracket for ancillary units. Refer to Bracket for ancillary units, removing and installing.
- Install thermostat housing. Refer to Thermostat housing, removing and installing.

- Fill cooling system. Refer to **Cooling system, draining and filling.**

After-run coolant pump -V51-, removing and installing

Special tools and equipment required

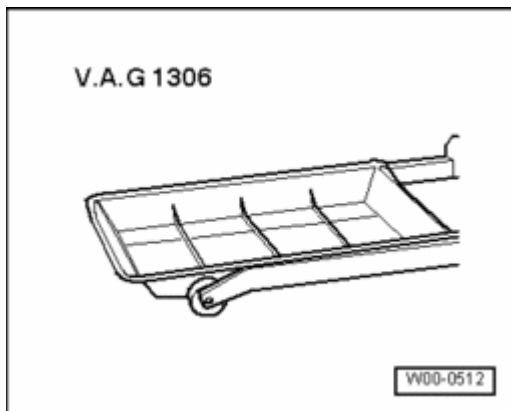


Fig. 438: Identifying Drip Tray V.A.G 1306
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Drip tray V.A.G 1306

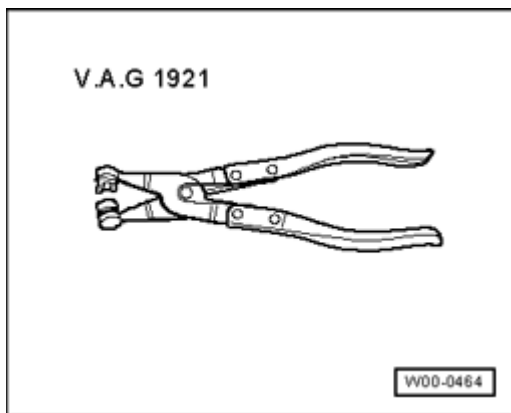


Fig. 439: Identifying Hose Clip Pliers VAG 1921
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Hose clip pliers V.A.G 1921

Removing

WARNING: Cover cap of expansion tank with rag and open carefully, as hot steam i.e. hot coolant may escape when opening.

- Open filler cap on coolant expansion tank.

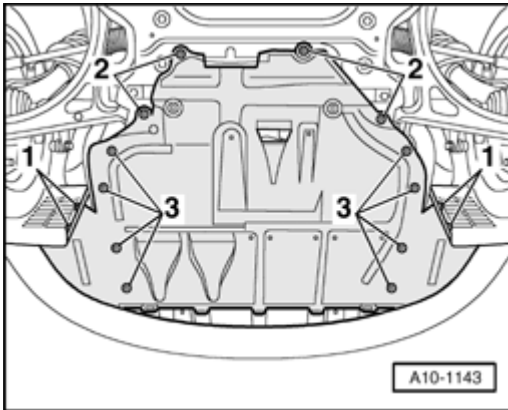


Fig. 440: Identifying Center Sound Insulation Fasteners
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove fasteners -1...3- and center sound insulation.
- Place drip tray V.A.G 1306 under engine.

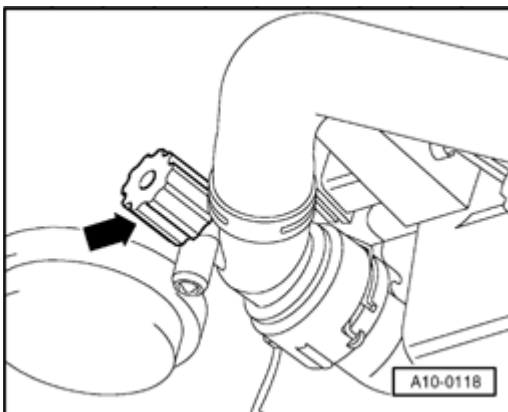


Fig. 441: Locating Radiator Drain Plug
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Turn drain plug (arrow) on radiator counter-clockwise. If necessary install a drain hose to connection.

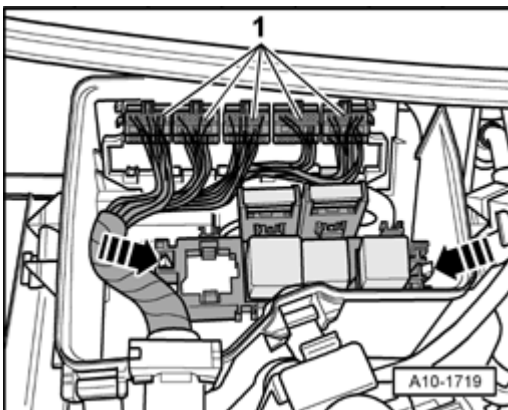


Fig. 442: Removing Lower Coolant Hose At After-Run Coolant Pump -V51- And Drain Remaining

Coolant

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- In addition, remove lower coolant hose at After-run coolant pump -V51- (arrow) and drain remaining coolant.

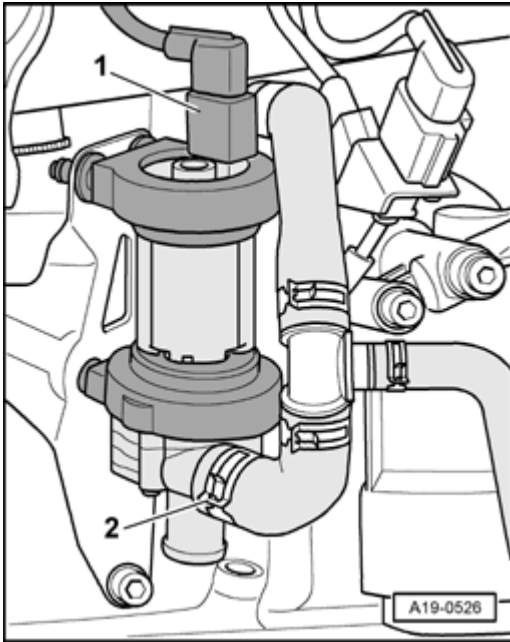


Fig. 443: Disconnecting Electrical Connector, Coolant Hose & Pulling After-Run Coolant Pump -V51- Downward Out Of Rubber Retainers

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical connector -1-.
- Disconnect coolant hose -2-.
- Pull After-run coolant pump -V51- downward out of rubber retainers. If necessary, spray with silicone-free lubricant.

Installing

Installation is performed in the reverse order. Note the following:

- Fill cooling system. Refer to **Cooling system, draining and filling.**

Radiator and coolant fan, component overview

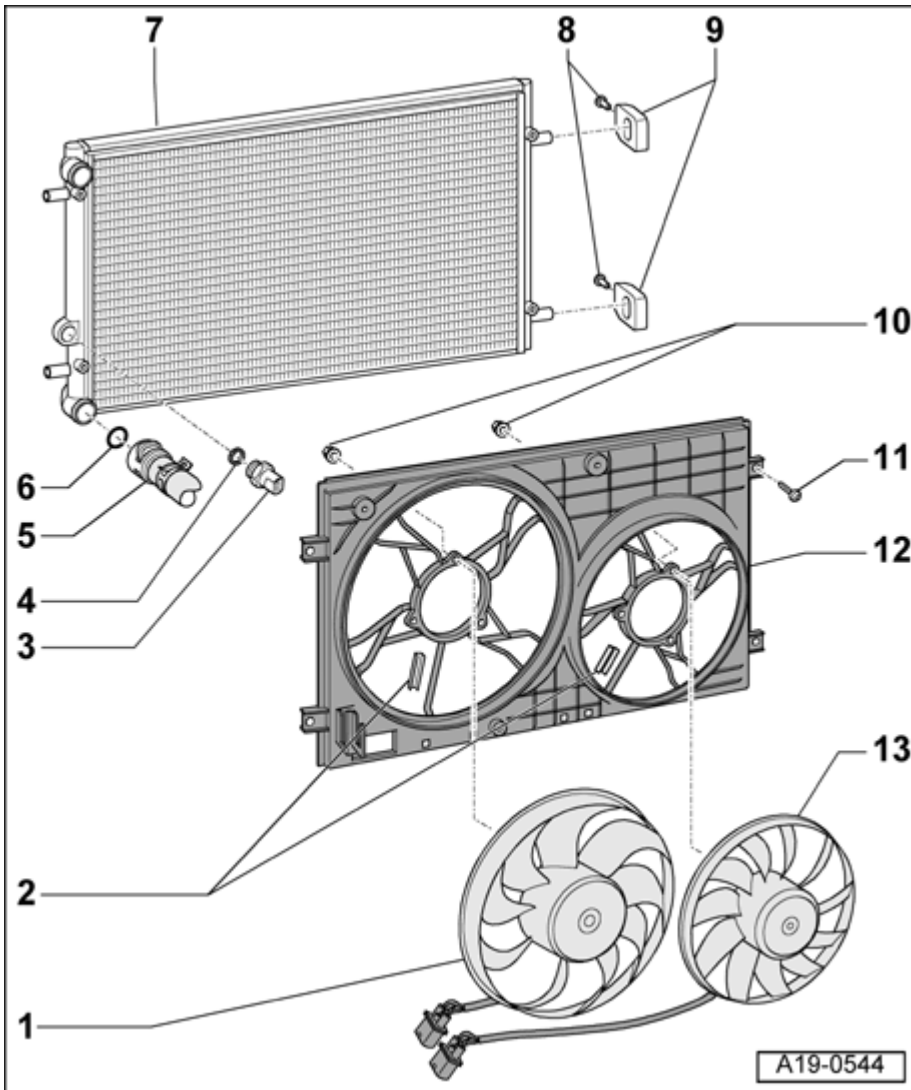


Fig. 444: Radiator And Coolant Fan, Component Overview
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Coolant fan -V7-

- Removing and installing. Refer to Coolant fan -V7- and Coolant fan -2- -V177-, removing and installing

2 - Retaining clips

- For electrical wiring going to fans
- Check for firm attachment

3 - Coolant Fan Control (FC) thermal switch -F18-

- Tighten to 35 Nm

4 - Seal

- Replace

5 - Coolant hose

- To disconnect, release retaining clip

6 - O-ring

- Replace

7 - Radiator

- Removing and installing. Refer to **Radiator, removing and installing**
- After replacing, fill with new coolant

8 - 15 Nm**9 - Bracket for radiator**

- Note installed position

10 - 10 Nm**11 - 10 Nm****12 - Radiator cowl****13 - Coolant fan -2- -V177-**

- Removing and installing. Refer to **Coolant fan -V7- and Coolant fan -2- -V177-, removing and installing**

Radiator, removing and installing

Special tools and equipment required

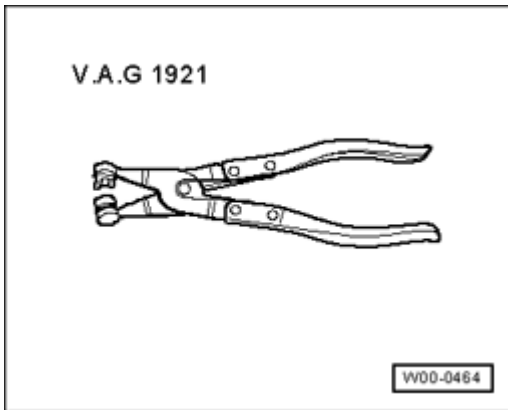


Fig. 445: Identifying Hose Clip Pliers VAG 1921
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Hose clip pliers V.A.G 1921
- Drip tray V.A.G 1306

WARNING: Cover cap of expansion tank with rag and open carefully, as hot steam i.e. hot coolant may escape when opening.

- Open filler cap on coolant expansion tank.

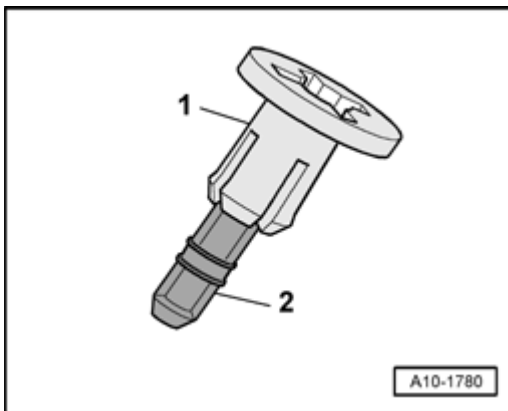


Fig. 446: Identifying Fasteners At Lock Carrier & Pin
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove fasteners -1- at lock carrier, press pin -2- in approx. 4 mm (do not push in completely). Then pull fastener out upward.

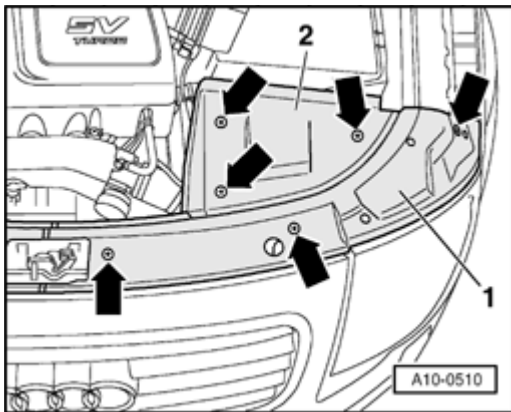


Fig. 447: Removing Left-Hand Cover Panels On Lock Carrier And Battery
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove covers (left side) -1- and -2- at lock carrier and above main fuse box (arrows).

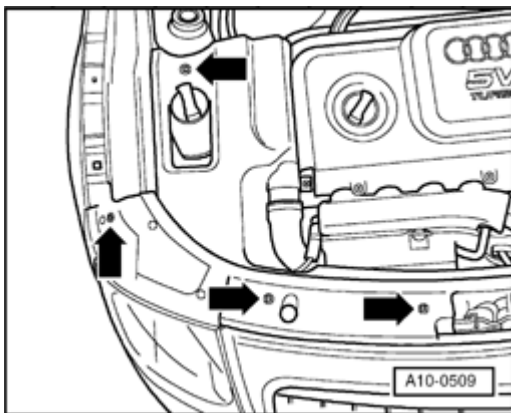


Fig. 448: Removing Covers At Lock Carrier And Above Coolant Expansion Tank
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove covers (right side) -1- and -2- at lock carrier and above coolant expansion tank (arrows).

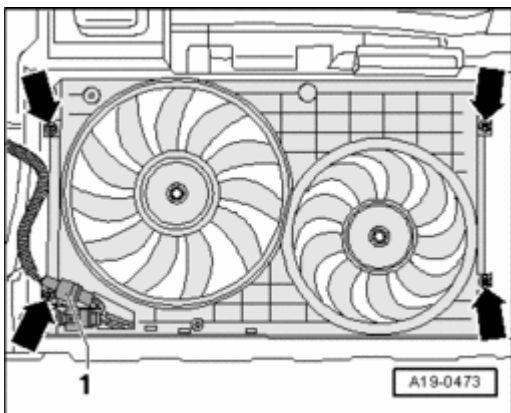


Fig. 449: Identifying Harness Connector And Fan Mount Mounting Bolts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove upper securing bolts (upper arrows) for radiator cowl.

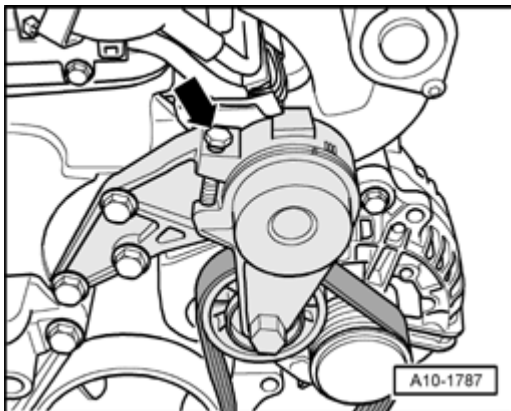


Fig. 450: Screwing Into Bore On Tensioning Element
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Release tension of poly V-belt by screwing an M8 x 40 bolt (arrow) into bore on tensioning element.

NOTE: Mark the rotation direction of the poly V-belt with chalk or a felt-tipped pen. If the belt runs in the opposite direction when it is reinstalled, breakage can result.

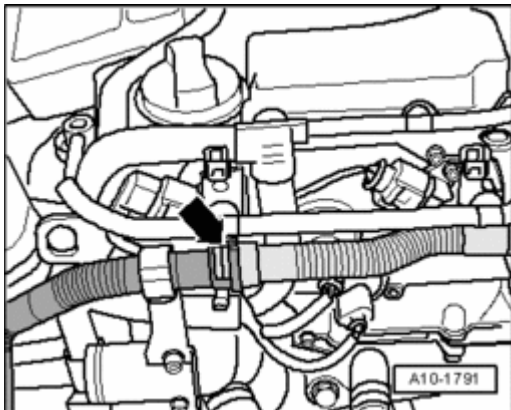


Fig. 451: Identifying Secondary Air Injection Hose
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect secondary air hose at position marked with an arrow.
- Move air hose clear.

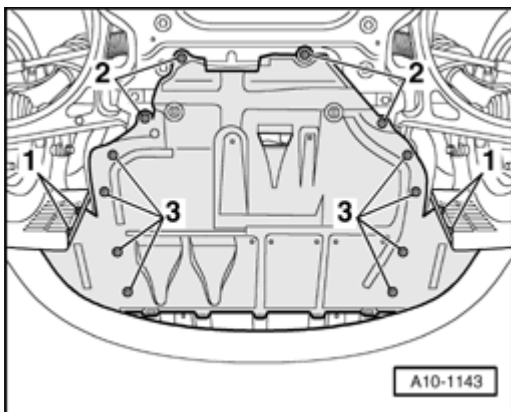


Fig. 452: Identifying Center Sound Insulation Fasteners
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove fasteners -1...3- and remove sound insulation.

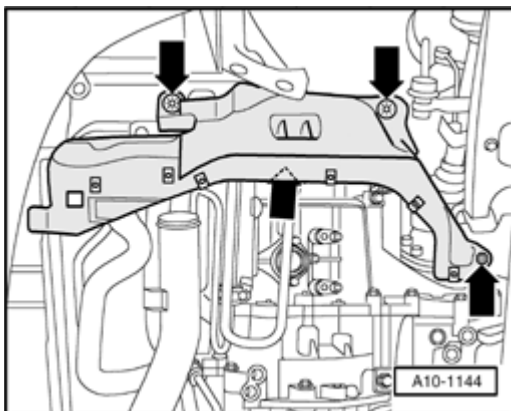


Fig. 453: Left Sound Insulation Panel
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove left sound insulation (arrows).

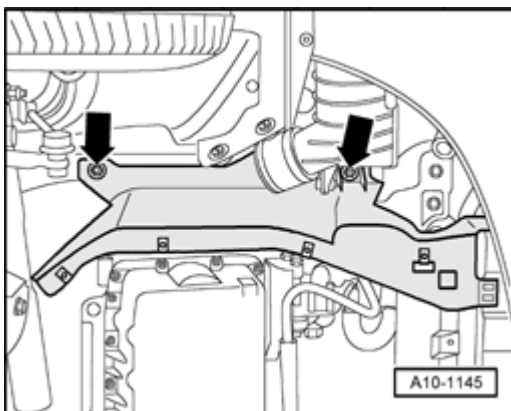


Fig. 454: Removing Right Sound Insulation
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove right sound insulation (arrows).

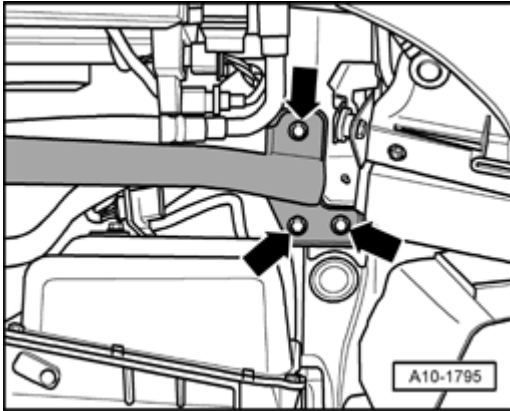


Fig. 455: Removing Cross Piece

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove cross piece (arrows).

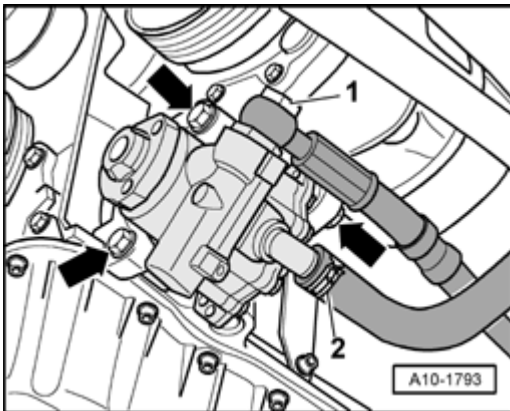


Fig. 456: Removing Bolts And Power Steering Pump From Bracket

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove power steering pump pulley (counterhold with mandrel).
- Remove bolts (arrows) and remove power steering pump from bracket.
- Hang power steering pump on lock carrier with hydraulic hoses -1- and -2- attached.

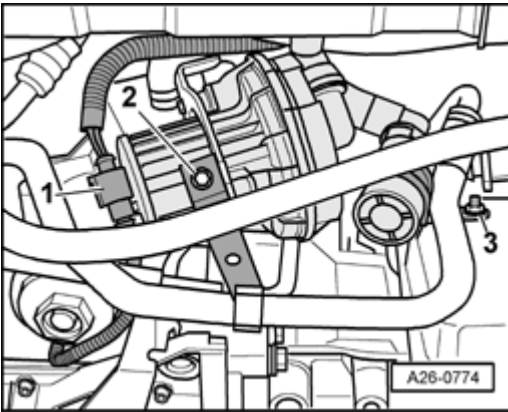


Fig. 457: Disconnecting Electrical Connector At Secondary Air Injection (AIR) Pump Motor -V101-
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical connector -1- at Secondary Air Injection (AIR) pump motor -V101-.
- Move wiring clear.
- Remove bolt -2- for coolant hose bracket.
- Remove bolt -3- for secondary air pump air filter.

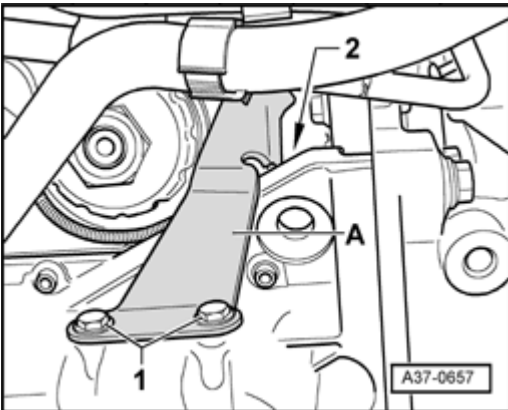


Fig. 458: Removing Bolts And Secondary Air Injection Pump With Bracket
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts -1- and -2- and remove secondary air pump with bracket -A-.

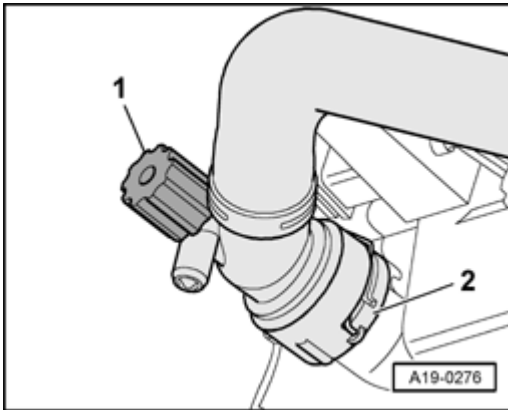


Fig. 459: Identifying Drain Plug & Retaining Clip

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Turn drain plug -1- on radiator counter-clockwise and drain coolant. If necessary, fit auxiliary hose to connection.
- Release retaining clip -2- for lower coolant hose and disconnect coolant hose from radiator.

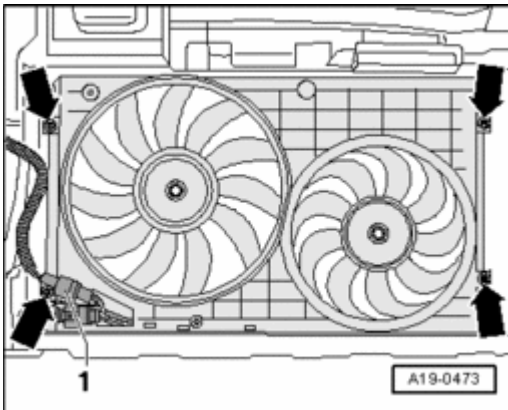


Fig. 460: Identifying Harness Connector And Fan Mount Mounting Bolts

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical connectors -1- for coolant fans at bottom of radiator cowl.
- Unscrew lower securing bolts (lower arrows) for radiator cowl.
- Remove radiator cowl with both fans from below.

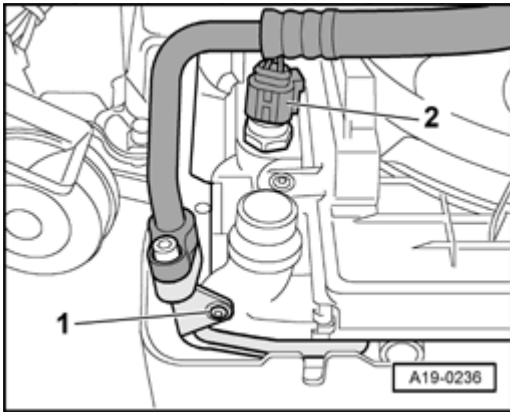


Fig. 461: Disconnecting Connector At Coolant Fan Control (FC) Thermal Switch -F18-
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect connector -2- at Coolant Fan Control (FC) thermal switch -F18-.

CAUTION: The air conditioning refrigerant circuit must not be opened.

- Remove refrigerant line -1- at radiator.

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

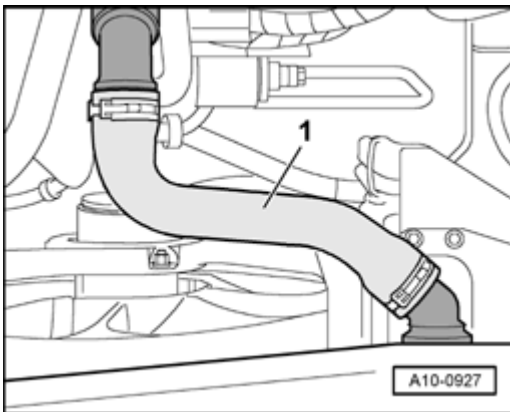


Fig. 462: Removing Upper Coolant Hose At Radiator
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove upper coolant hose -1- at radiator.
- Remove front bumper cover.

Refer to **63 BUMPERS** .

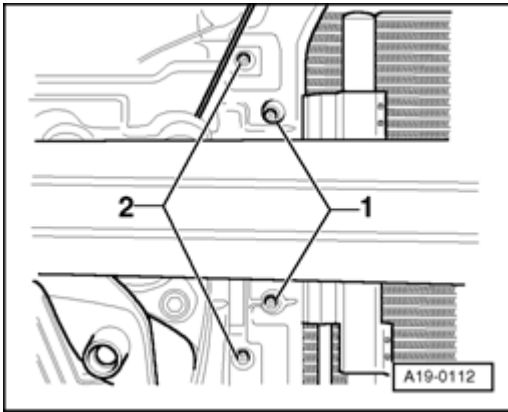


Fig. 463: Removing Four Securing Bolts For Condenser & Radiator
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove securing bolts -1- for condenser.
- Remove securing bolts -2- for radiator.
- Remove Coolant Fan Control (FC) module -J293- at longitudinal member (left side) in front of battery.
- Remove bolts for lock carrier at front.
- Loosen upper bolts for lock carrier 2 turns.

Installing

Installation is performed in the reverse order. Note the following:

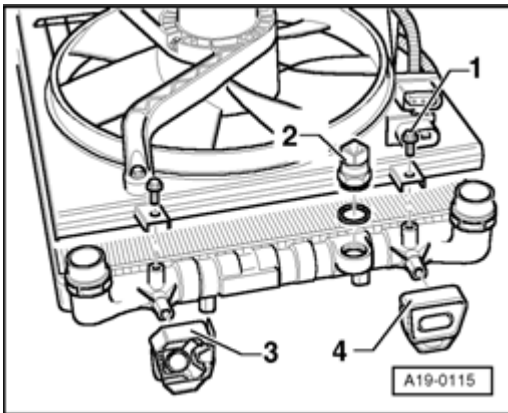


Fig. 464: Installing Brackets On Radiator
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Install brackets -3- and -4- on radiator as shown.
- Install radiator.
- Fit securing bolts for radiator (help of a second technician is required).
- Install secondary air injection pump. Refer to **Secondary air injection pump, removing and installing**.
- Install power steering pump

Refer to **48 STEERING**

- Install cross piece.

Refer to **40 FRONT SUSPENSION**

- Install front bumper cover.

Refer to **63 BUMPERS**

- Replace O-rings in connections for radiator hoses.
- Fill cooling system. Refer to **Cooling system, draining and filling.**

Tightening torques

Component	Nm
Radiator cowl to radiator	10
Thermal switch to radiator	35
Refrigerant line to radiator	10
Condenser to radiator	10
Radiator to lock carrier	15

Cooling system, checking for leaks

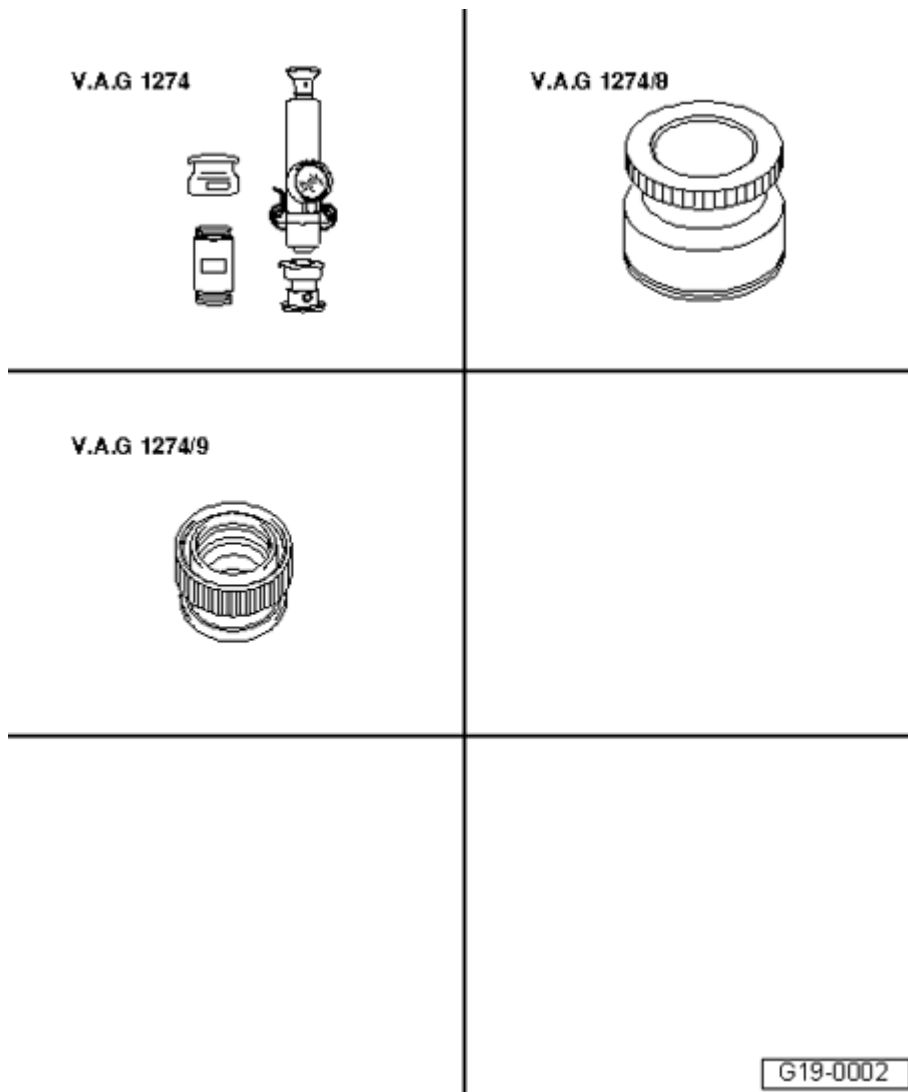


Fig. 465: Identifying Special Tools - Cooling System, Checking For Leaks
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special Tools and Equipment

- VAG1274 Cooling system tester
- VAG1274/8 Adapter
- VAG1274/9 Adapter

Requirement

- Engine at operating temperature.

Work sequence

WARNING: Cover cap of expansion tank with rag and open carefully, as hot steam i.e.

hot coolant may escape when opening.

- Open cap of coolant expansion tank.

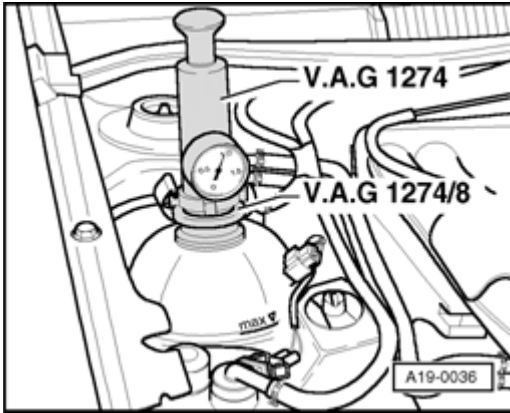


Fig. 466: Attaching VAG1274 Cooling System Tester Together With VAG1274/8 Adapter To Coolant Expansion Tank

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Attach VAG1274 Cooling System Tester together with VAG1274/8 adapter to coolant expansion tank.
- Use tester hand pump to create a pressure of approx. 1.0 bar.

If pressure drops:

- Detect leak and repair malfunction.

Pressure relief valve in filler cap, checking

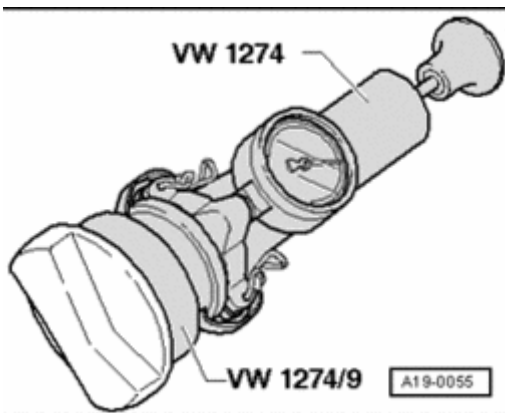


Fig. 467: Attaching VAG1274 Cooling System Tester Together With VAG1274/9 Adapter To Filler Cap
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Attach VAG1274 cooling system tester together with VAG1274/9 adapter to filler cap.
- Pump using hand pump.

- Pressure release valve must open at a positive pressure of 1.4 to 1.6 bar.

If the pressure relief valve does not open as described:

- Replace filler cap.

Coolant fan -V7- and Coolant fan -2- -V177-, removing and installing

WARNING: Cover cap of expansion tank with rag and open carefully, as hot steam i.e. hot coolant may escape when opening.

- Open filler cap on coolant expansion tank.

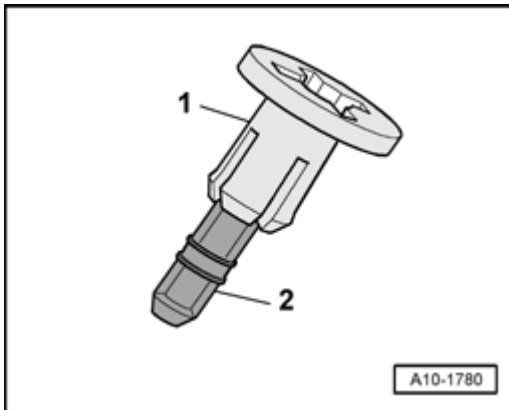


Fig. 468: Identifying Fasteners At Lock Carrier & Pin
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove fasteners -1- at lock carrier by pressing in pin -2- approx. 4 mm (do not push in completely). Then pull fastener out upward.

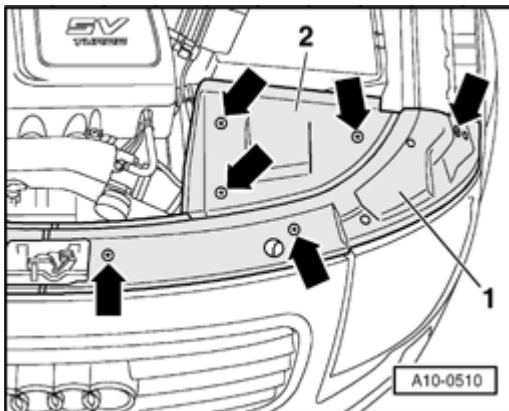


Fig. 469: Removing Left-Hand Cover Panels On Lock Carrier And Battery
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove covers (left side) -1- and -2- at lock carrier and above main fuse box (arrows).

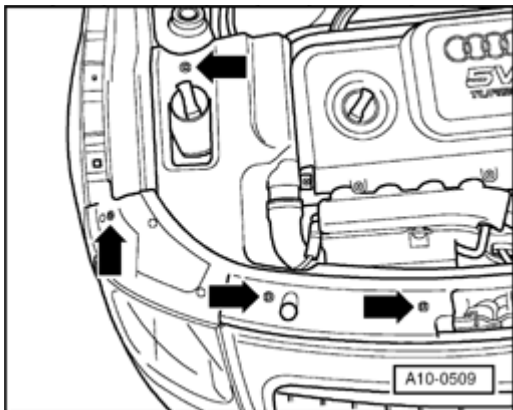


Fig. 470: Removing Covers At Lock Carrier And Above Coolant Expansion Tank
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove covers (right side) -1- and -2- at lock carrier and above coolant expansion tank (arrows).

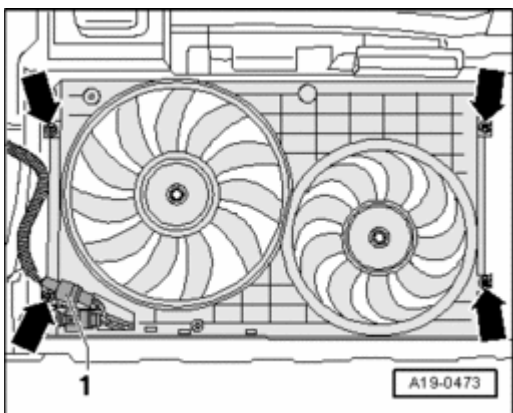


Fig. 471: Identifying Harness Connector And Fan Mount Mounting Bolts
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove upper securing bolts (upper arrows) for radiator cowl.

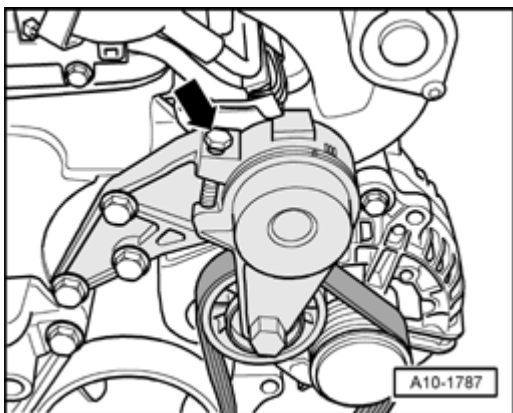


Fig. 472: Screwing Into Bore On Tensioning Element
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Release tension of poly V-belt by screwing an M8 x 40 bolt (arrow) into bore on tensioning element.

NOTE: Mark the rotation direction of the poly V-belt with chalk or a felt-tipped pen. If the belt runs in the opposite direction when it is reinstalled, this can cause breakage.

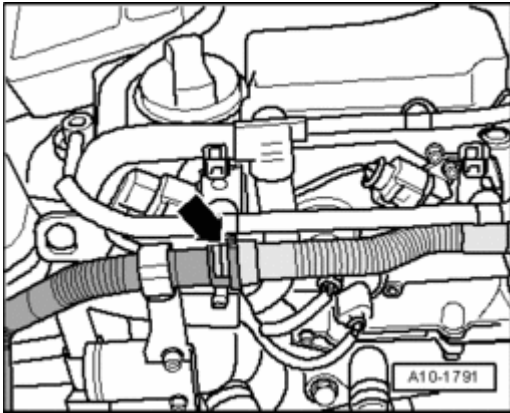


Fig. 473: Identifying Secondary Air Injection Hose
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect secondary air hose at position marked with an arrow.
- Move air hose clear.

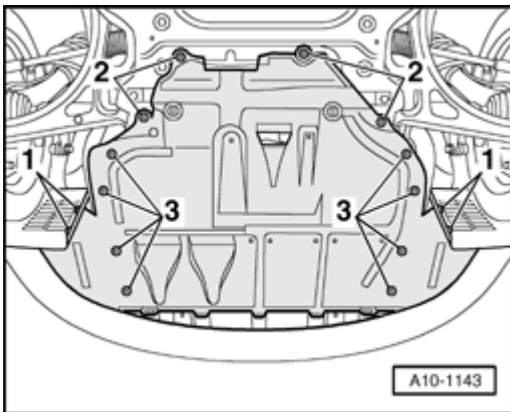


Fig. 474: Identifying Center Sound Insulation Fasteners
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove fasteners -1...3- and remove sound insulation.

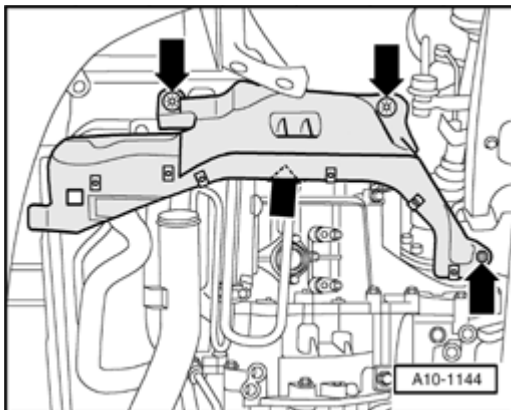


Fig. 475: Left Sound Insulation Panel

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove left sound insulation (arrows).

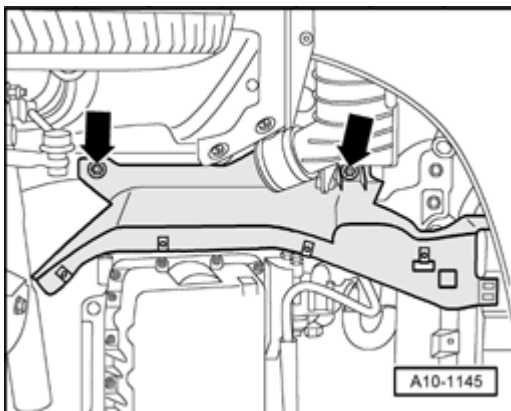


Fig. 476: Removing Right Sound Insulation

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove right sound insulation (arrows).

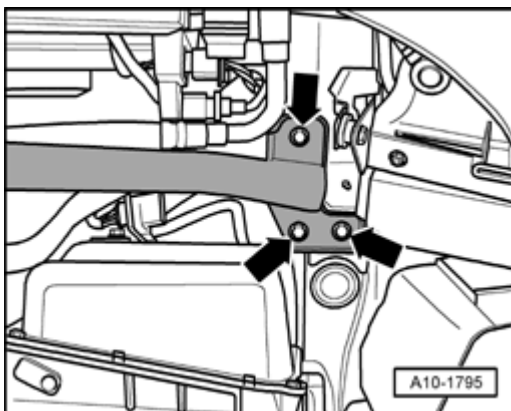


Fig. 477: Removing Cross Piece

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove cross piece (arrows).
- Remove power steering pump pulley (counterhold with mandrel).

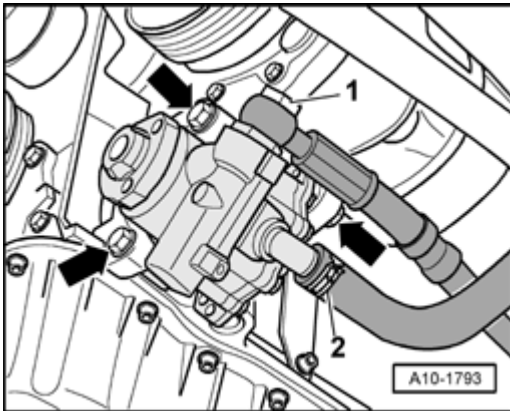


Fig. 478: Removing Bolts And Power Steering Pump From Bracket
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts (arrows) and remove power steering pump from bracket.
- Hang power steering pump on lock carrier with hydraulic hoses -1- and -2- attached.

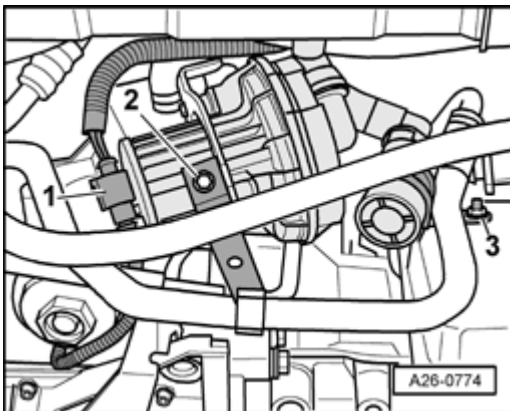


Fig. 479: Disconnecting Electrical Connector At Secondary Air Injection (AIR) Pump Motor -V101-
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical connector -1- at Secondary Air Injection (AIR) pump motor -V101-.
- Move wiring clear.
- Remove bolt -2- for coolant hose bracket.
- Remove bolt -3- for secondary air pump air filter.

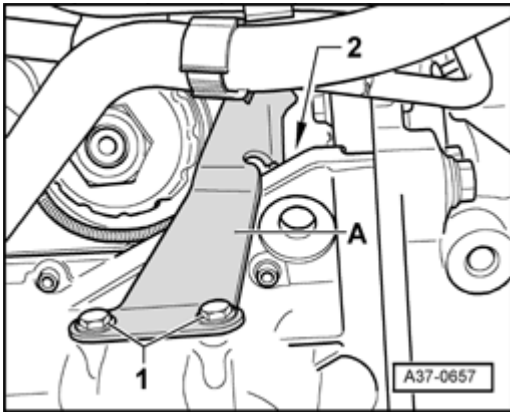


Fig. 480: Removing Bolts And Secondary Air Injection Pump With Bracket
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts -1- and -2- and remove secondary air pump with bracket -A-.

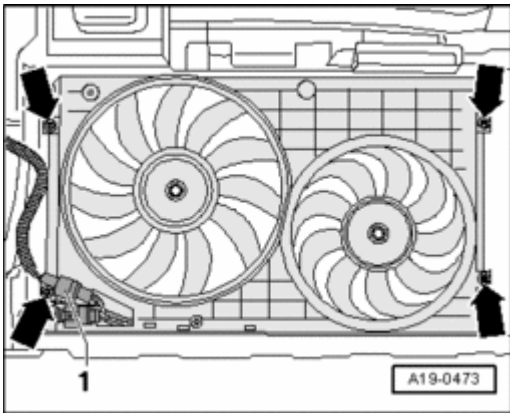


Fig. 481: Identifying Harness Connector And Fan Mount Mounting Bolts
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical connectors -1- for coolant fans at bottom of radiator cowl.
- Unscrew lower securing bolts (lower arrows) for radiator cowl.

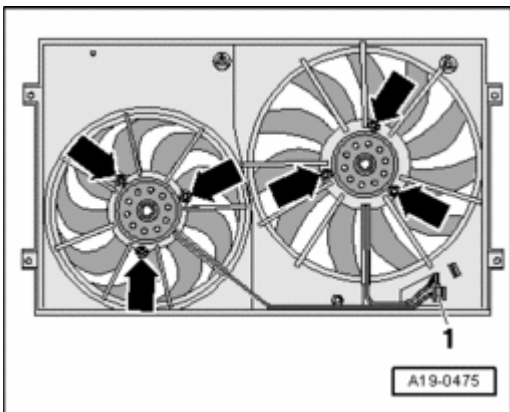


Fig. 482: Identifying Coolant Fan Electrical Harness Connector & Nuts

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical connector -1-.
- Move wiring clear.
- Remove nuts (arrows) and remove fans.

Installing

Installation is performed in the reverse order. Note the following:

- Install secondary air pump. Refer to **Secondary air injection pump, removing and installing.**
- Install power steering pump.

Refer to **48 STEERING**

- Install cross piece.

Refer to **40 FRONT SUSPENSION**

- Install poly V-belt.

Tightening torques

Component	Nm
Coolant fan to radiator cowl	10
Radiator cowl to radiator	10

26 EXHAUST SYSTEM, EMISSION CONTROLS**EXHAUST SYSTEM, SERVICING**

Exhaust system, servicing

NOTE:

- Always replace gaskets and self-locking nuts.
- After exhaust system repairs, make sure the exhaust system is not under stress and is far enough from the body. If necessary, loosen clamps and align mufflers and exhaust pipes so that there is adequate distance to the vehicle body, and weight is evenly distributed among the exhaust hangers.
- Use a screwdriver to unfasten and tighten lock washers for heat shields. Tightening torque: 2 Nm.
- The flex joint in the front exhaust pipe must not be bent more than 10°, otherwise it may be damaged.

Exhaust system, component overview

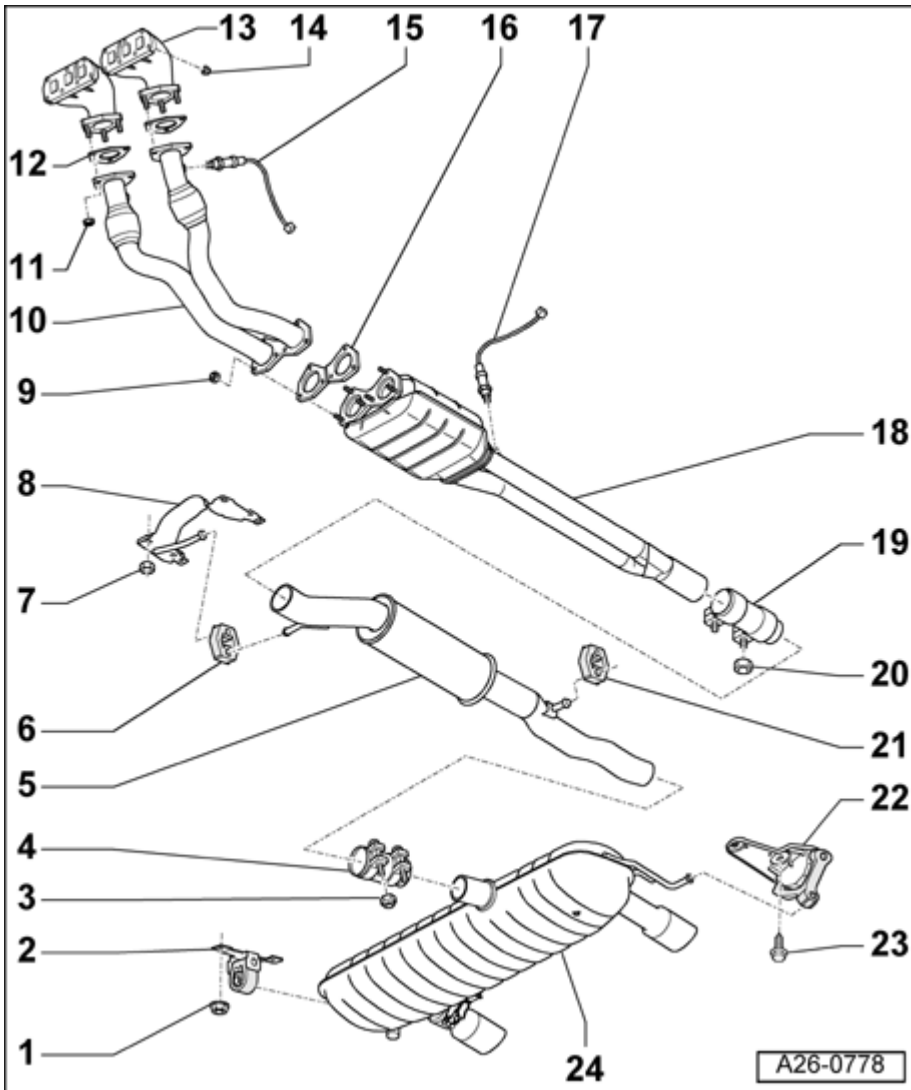


Fig. 483: Exhaust System, Component Overview
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - 23 Nm

2 - Mounting

- Replace if damaged

3 - 40 Nm

4 - Rear clamp

- For separate replacement of center and rear mufflers
- Installed position. Refer to **Installed position of rear clamp**
- Before tightening, adjust exhaust system free of stress. Refer to **Exhaust system, aligning free of stress**

- Tighten bolt connections evenly

5 - Center muffler

- Center and rear muffler are one unit as original equipment and can be replaced individually for repair purposes
- Cutting location. Refer to **Center and rear muffler, separating**
- Align exhaust system so it is free of stress before tightening clamp. Refer to **Exhaust system, aligning free of stress**

6 - Rubber mounting

- Replace if damaged

7 - 23 Nm**8 - Bracket**

- For exhaust system mounting in driveshaft tunnel.

9 - 23 Nm

- Replace

10 - Front exhaust pipe with flexible joint

- Do not bend flexible joint more than 10° otherwise it can be damaged
- Removing and installing. Refer to **Front exhaust pipe, removing and installing**
- Align exhaust system so it is free of stress before tightening clamp. Refer to **Exhaust system, aligning free of stress**

11 - 40 Nm

- Replace

12 - Gasket

- Replace

13 - Exhaust manifold

- Removing and installing. Refer to **Exhaust manifold, removing and installing**

14 - 23 Nm

- Replace

15 - Heated oxygen sensor

- 2x
- Threads of new oxygen sensors are already greased with assembly paste. Paste must not get into slots on sensor body
- When reusing old oxygen sensor, grease threads lightly with hot bolt paste
- Removing and installing:

Refer to **24 MULTIPOINT FUEL INJECTION (MPI)**

16 - Gasket**17 - Oxygen sensor behind catalytic converter**

- 2x
- Threads of new oxygen sensors are already greased with assembly paste. Paste must not get into slots on sensor body
- When reusing old oxygen sensor, grease threads lightly with hot bolt paste:
- Removing and installing:

18 - Catalytic converter

- Protect from damage due to impact
- Aligning. Refer to **Aligning catalytic converter**

19 - Front clamp

- Align exhaust system so it is free of stress before tightening clamp. Refer to **Exhaust system, aligning free of stress**

20 - 40 Nm**21 - Rubber mounting**

- Replace if damaged

22 - Mounting

- Replace if damaged

23 - 23 Nm**24 - Rear muffler**

- Rear and center muffler are one unit as original equipment. Can be replaced individually for repair

purposes

- Cutting location. Refer to **Center and rear muffler, separating**
- Align exhaust system so it is free of stress before tightening clamp. Refer to **Exhaust system, aligning free of stress**

Installed position of front clamp

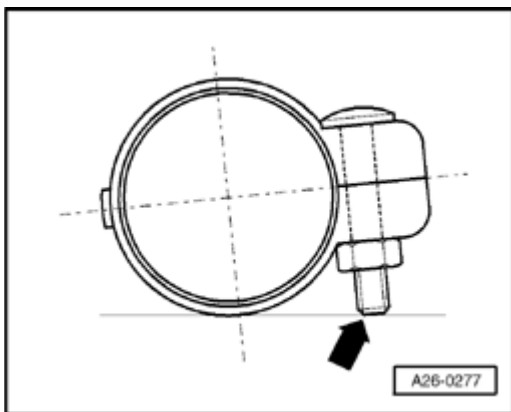


Fig. 484: Installed Position Of Front Clamp

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Install clamps so that bolt ends do not project beyond lower edge of clamp (arrow).
- Threaded connections face to right

Installed position of rear clamp

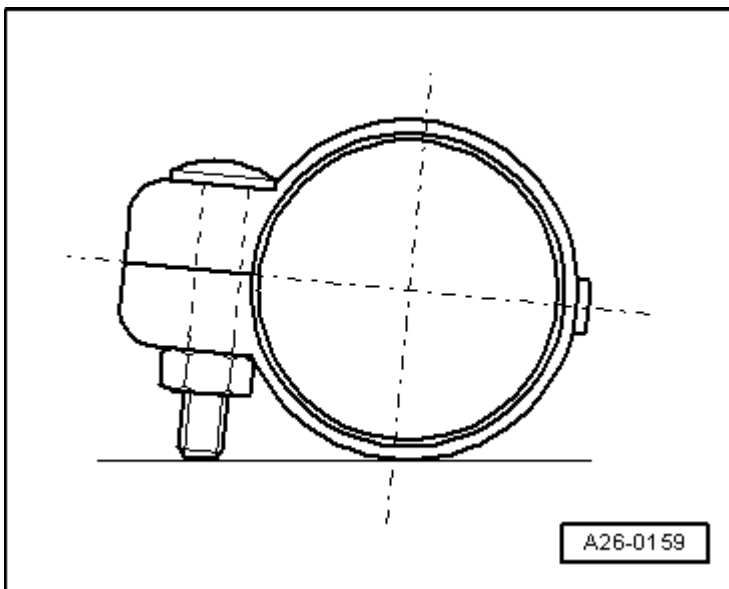


Fig. 485: Installation Position Of Double Clamp

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Install clamp so that bolt end does not project over lower edge of double clamp.
- Bolt connection faces to left

Aligning catalytic converter

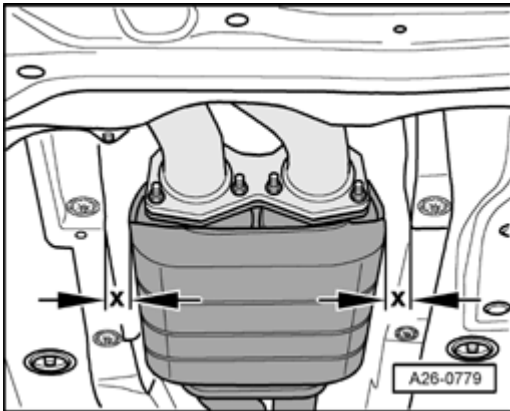


Fig. 486: Aligning Catalytic Converter

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Align catalytic converter horizontally.

Distance to heat shield on right and on left in tunnel should be same on both sides.

- Distance $x = x$

Center and rear muffler, separating

- A separating point has been provided in the separating pipe for individual replacement of the center or rear muffler.
- Separating point is marked by a depression around the circumference of the exhaust pipe.

Special tools and equipment

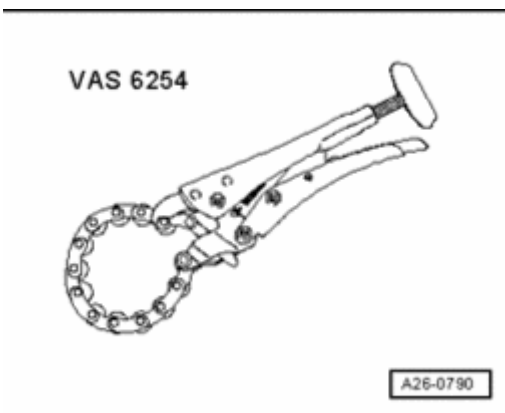


Fig. 487: Cutting Chain VAS 6524

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Cutting chain VAS 6524
- Protective glasses

Work sequence

WARNING: Wear protective glasses.

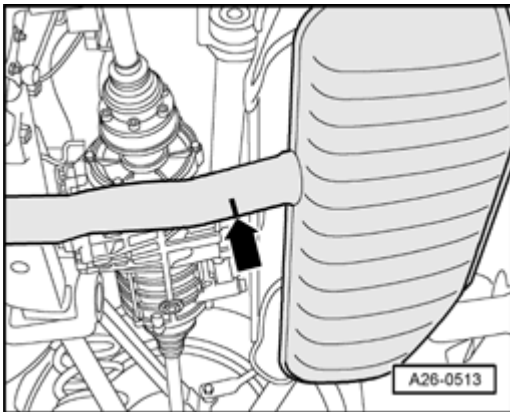


Fig. 488: Using VAS 6524 To Cut Exhaust Pipe At Separating Point At Right Angle
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Using VAS 6524, cut exhaust pipe at separating point (arrow) at right angle.

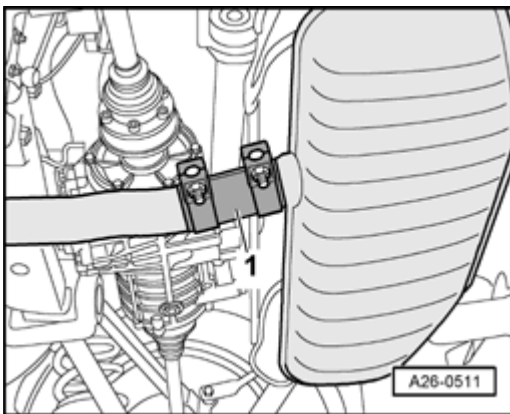


Fig. 489: Identifying Center Clamp On Separation Point
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- When installing, center clamp -1- on separation point.

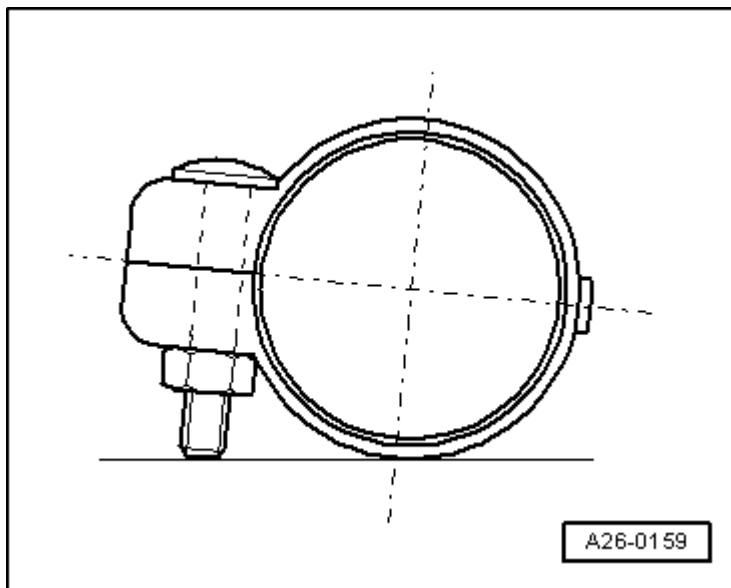


Fig. 490: Installation Position Of Double Clamp

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Install clamp so that bolt ends do not protrude beyond bottom of clamp.

Bolt connection faces to left

- Align exhaust system free of stress. Refer to **Exhaust system, aligning free of stress.**
- Tighten bolts on clamp evenly to 40 Nm.

Exhaust manifold, removing and installing

Special tools and equipment

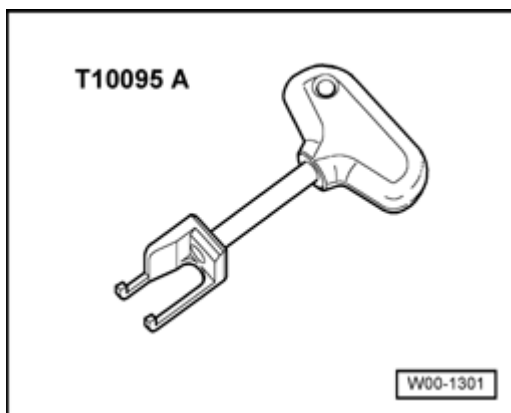


Fig. 491: Identifying Puller For Ignition Coil T10095 A

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Puller T10095 A

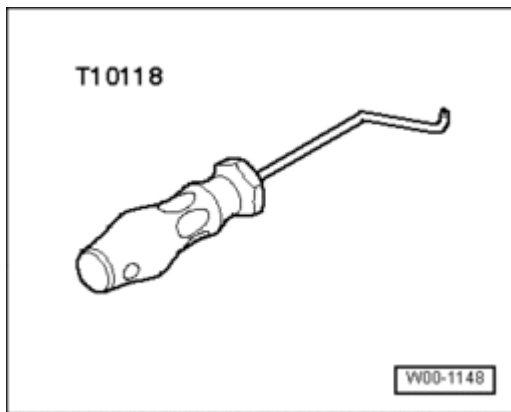


Fig. 492: Identifying Assembly Tool T10118

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Installation tool T10118

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

CAUTION: Observe notes on procedure for disconnecting the battery.

Refer to **27 BATTERY, STARTER, GENERATOR, CRUISE CONTROL**

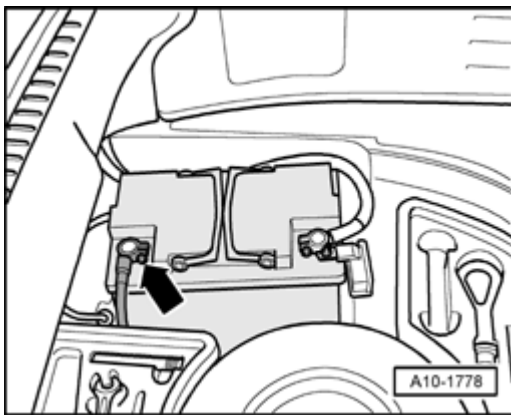


Fig. 493: Disconnecting Battery Ground (GND) Strap

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- With ignition switched off, disconnect Ground cable (arrow) at battery (in luggage compartment, under floor cover).

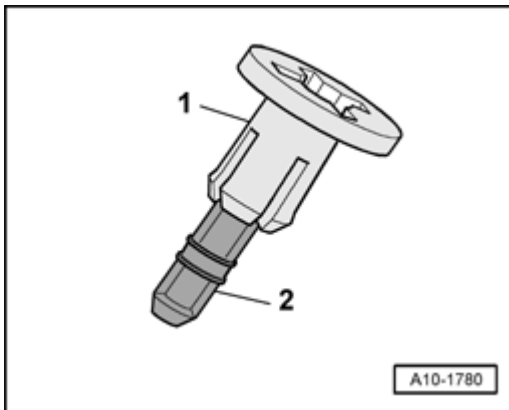


Fig. 494: Identifying Fasteners At Lock Carrier & Pin
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove fasteners -1- at lock carrier by pressing pin -2- approx. 4 mm (do not push in completely). Then pull fastener out upward.

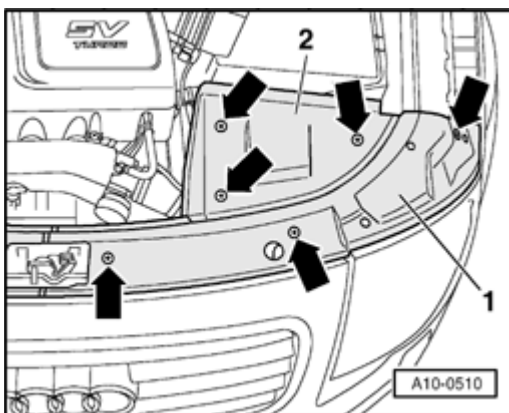


Fig. 495: Removing Left-Hand Cover Panels On Lock Carrier And Battery
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove covers (left side) -1- and -2- at lock carrier and above main fuse box (arrows).

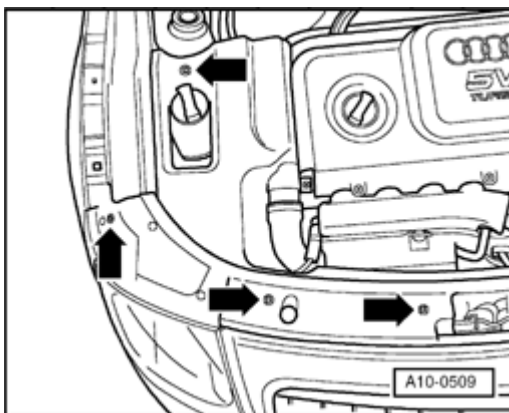


Fig. 496: Removing Covers At Lock Carrier And Above Coolant Expansion Tank
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove covers (right side) -1- and -2- at lock carrier and above coolant expansion tank (arrows).
- Pull out oil dipstick.

NOTE: Before removing, mark direction of rotation of poly V-belt with chalk or felt-tipped pen. If the belt runs in the opposite direction when it is reinstalled, breakage can result.

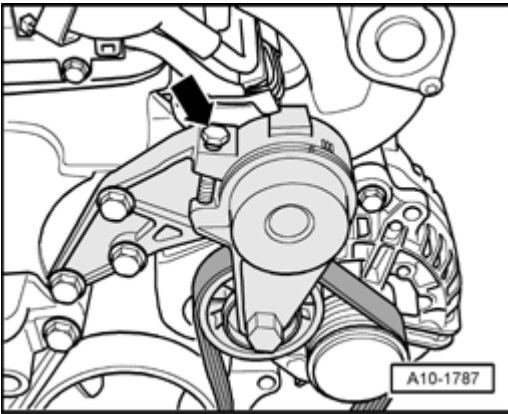


Fig. 497: Screwing Into Bore On Tensioning Element
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Release tension of poly V-belt by screwing an M8 x 40 bolt (arrow) into bore on tensioning element.
- Remove poly V-belt from Generator pulley.

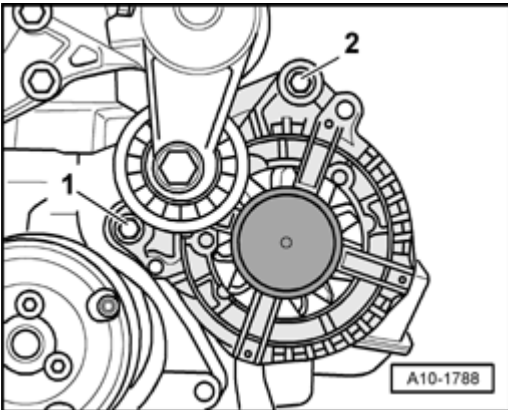


Fig. 498: Removing Upper/Lower Securing Bolt For Generator
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove upper securing bolt -2- for Generator.

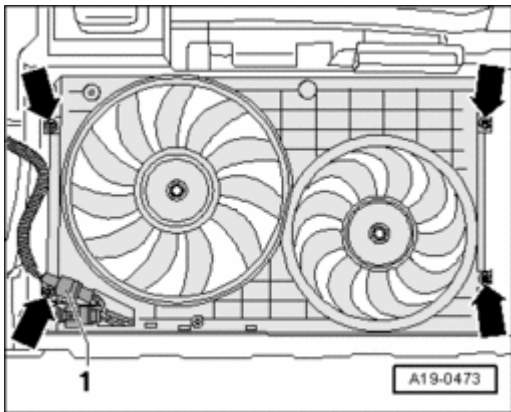


Fig. 499: Identifying Harness Connector And Fan Mount Mounting Bolts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove upper securing bolts (upper arrows) for radiator cowl.

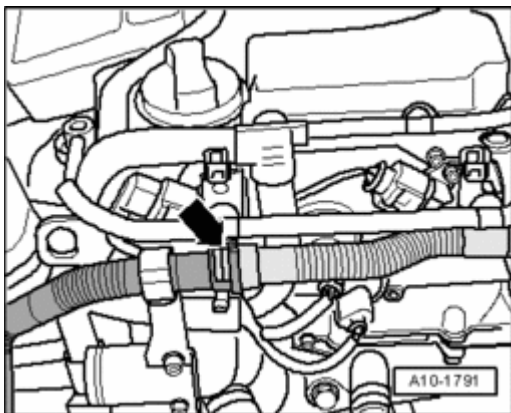


Fig. 500: Identifying Secondary Air Injection Hose
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect secondary air hose at position marked with an arrow.
- Move air hose at bracket clear.

WARNING: Hot steam can escape when opening the expansion tank cap. Cover the filler cap with a cloth and open it carefully.

- Open filler cap on coolant expansion tank.

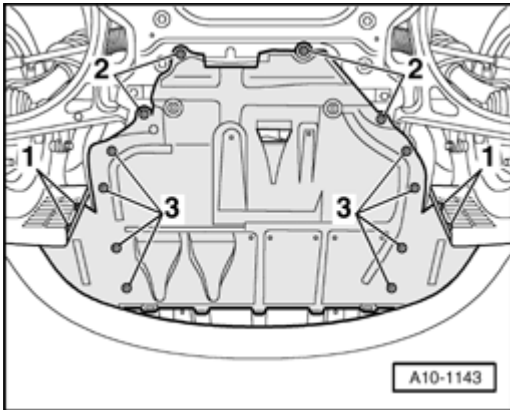


Fig. 501: Identifying Center Sound Insulation Fasteners
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove fasteners -1...3- and remove center sound insulation.

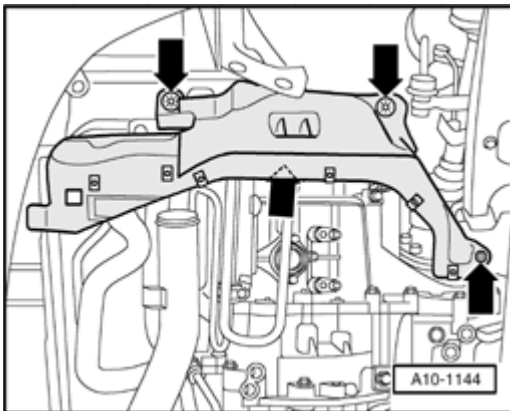


Fig. 502: Left Sound Insulation Panel
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove left sound insulation (arrows).

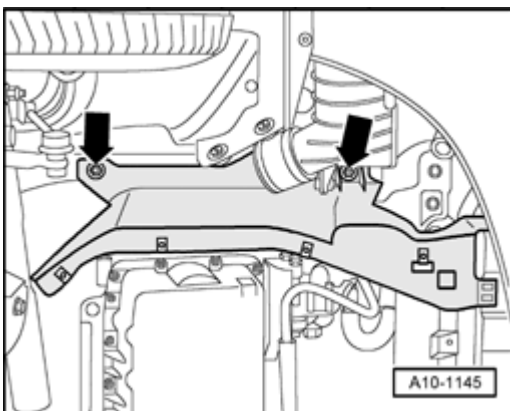


Fig. 503: Removing Right Sound Insulation
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove right sound insulation (arrows).

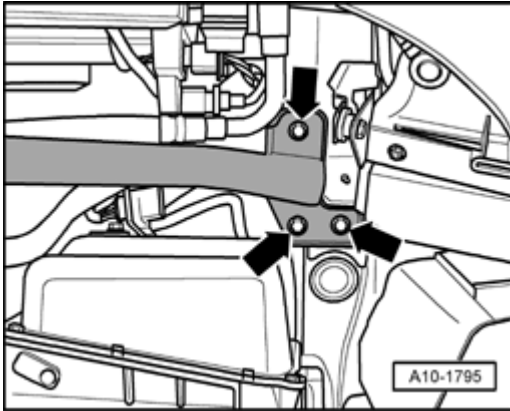


Fig. 504: Removing Cross Piece

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove cross piece (arrows).

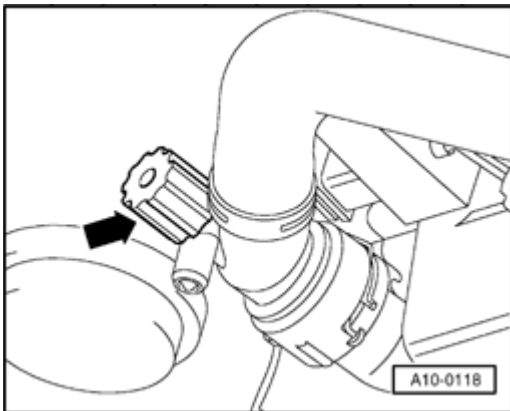


Fig. 505: Locating Radiator Drain Plug

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Place drip tray V.A.G 1306 under engine.
- Turn drain plug (arrow) on radiator counter-clockwise. If necessary, install a drain hose to connection.

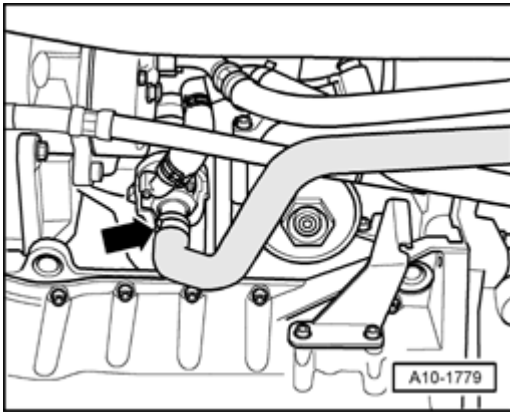


Fig. 506: Removing/Installing Lower Coolant Hose At After-Run Coolant Pump -V51-
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Additionally, remove lower coolant hose at After-run coolant pump -V51- (arrow) and drain remaining coolant.

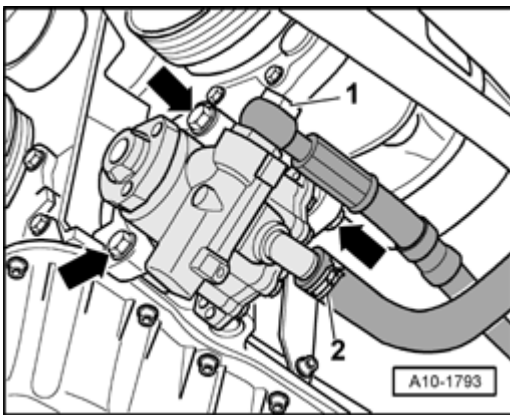


Fig. 507: Removing Bolts And Power Steering Pump From Bracket
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove pulley for power steering pump (counterhold with mandrel).
- Remove bolts (arrows) and remove power steering pump from bracket.
- Hang power steering pump on lock carrier with hydraulic hoses -1- and -2- attached.

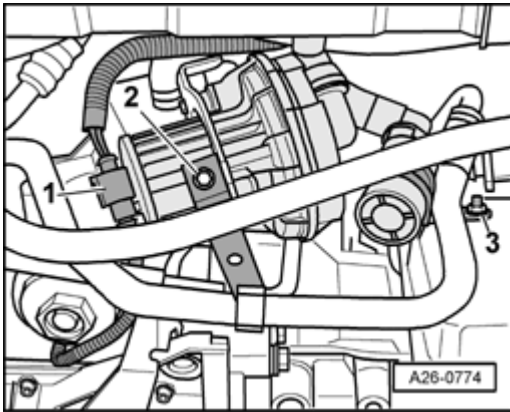


Fig. 508: Disconnecting Electrical Connector At Secondary Air Injection (AIR) Pump Motor -V101-
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical connector -1- at Secondary Air Injection (AIR) pump motor -V101-.
- Move wiring clear.
- Remove bolt -2- for coolant hose bracket.
- Remove bolt -3- for secondary air pump filter bracket.

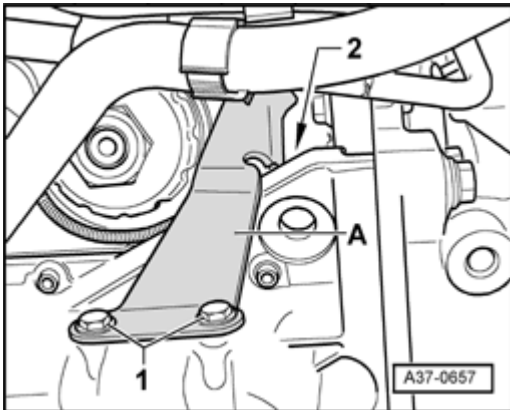


Fig. 509: Removing Bolts And Secondary Air Injection Pump With Bracket
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts -1- and -2- and remove secondary air pump with bracket -A-.

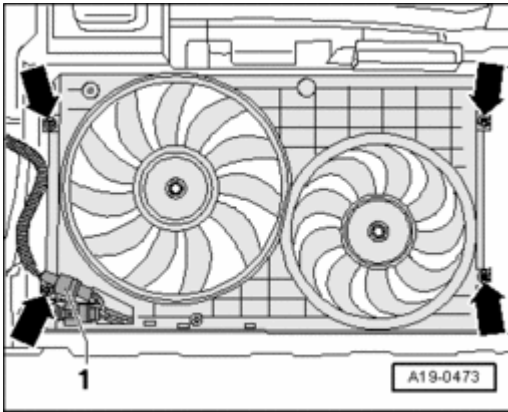


Fig. 510: Identifying Harness Connector And Fan Mount Mounting Bolts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical connectors -1- for coolant fans at bottom of radiator cowl.
- Unscrew lower securing bolts (lower arrows) for radiator cowl.
- Remove radiator cowl with both fans from below.

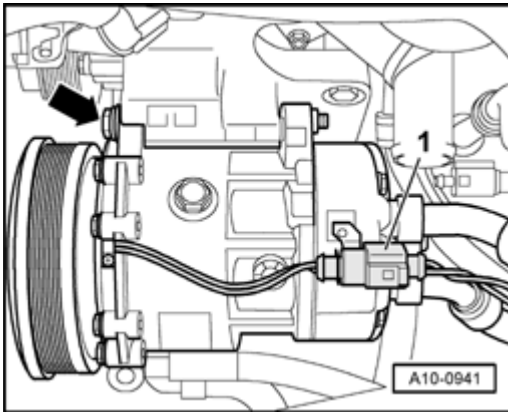


Fig. 511: Disconnecting Electrical Connector For Magnetic Clutch Of Air Conditioning Compressor
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical connector -1- for magnetic clutch of air conditioning compressor.

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

NOTE: The air conditioning compressor can only be removed from the bracket with the upper securing bolt still inserted. To do so, press the engine simultaneously to the left side with an assembly lever (second technician required). If required, loosen all bolts of the assembly mounting 1 turn.

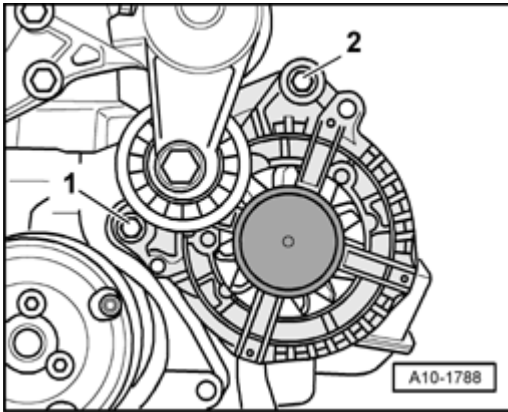


Fig. 512: Removing Upper/Lower Securing Bolt For Generator
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts (arrow) for air conditioning compressor.
- Tie up air conditioning compressor together with refrigerant hoses at front of longitudinal member (refrigerant hoses remain connected).
- Remove lower securing bolt -1- for Generator.
- Remove Generator from bracket for ancillary units (electrical wires remain connected).

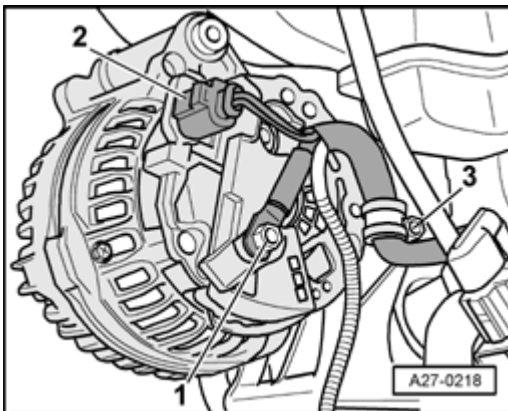


Fig. 513: Identifying Connector, Electrical Wire And Wiring Clamp On Generator
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unscrew clamp -3-.
- Remove nut and disconnect wire -1- at Generator.
- Disconnect electrical connector -2-.
- Remove Generator.

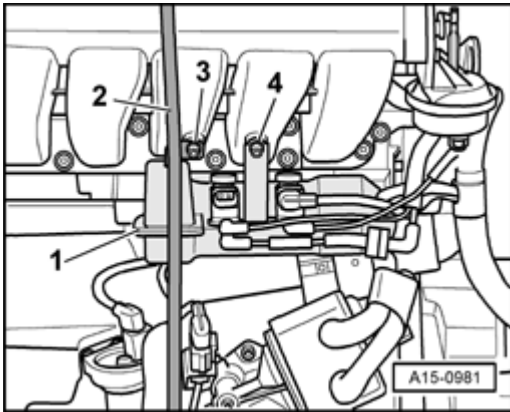


Fig. 514: Identifying Mounting Bolts, Oil Dipstick Guide Tube & Vacuum Reservoir
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolt -3- and pull out guide tube for oil dipstick -2-.
- Remove bolt -4- and remove vacuum reservoir -1- from manifold.
- Move vacuum reservoir to side (hoses remain attached).

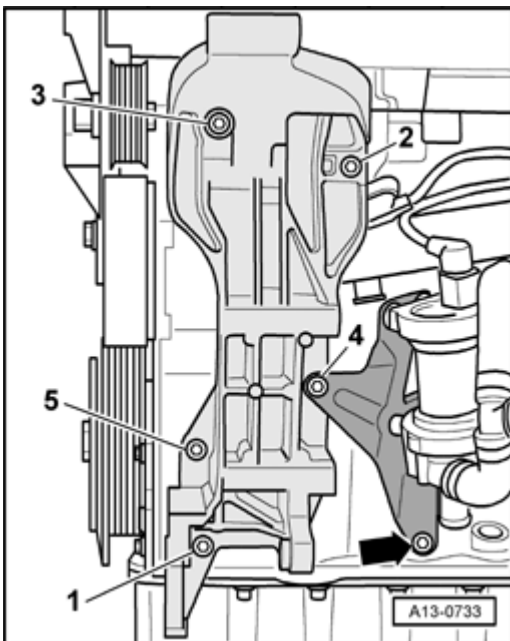


Fig. 515: Removing Bolt At Bracket For After-Run Coolant Pump -V51-
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolt (arrow) at bracket for After-run coolant pump -V51-.
- Remove bolts -1...5- and remove bracket for ancillary units.

NOTE: To avoid damage, the flexible joints in the front exhaust pipe must not be bent more than 10°.

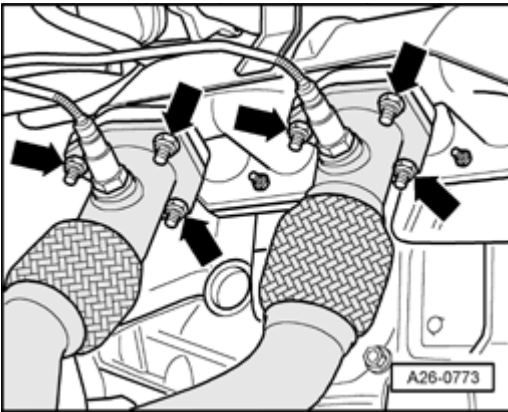


Fig. 516: Unbolting Front Exhaust Pipe At Exhaust Manifold
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unbolt front exhaust pipe from exhaust manifolds (arrows).

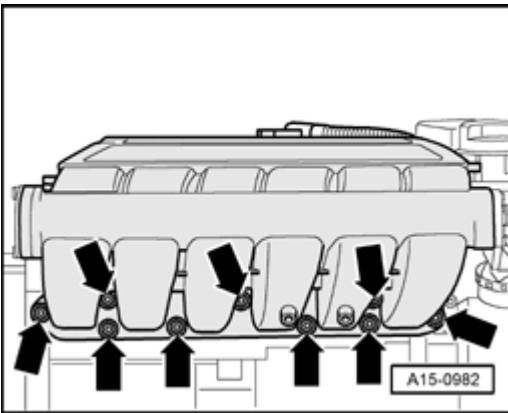


Fig. 517: Removing Bolts At Front Of Intake Manifold
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts (arrows) at front of intake manifold.

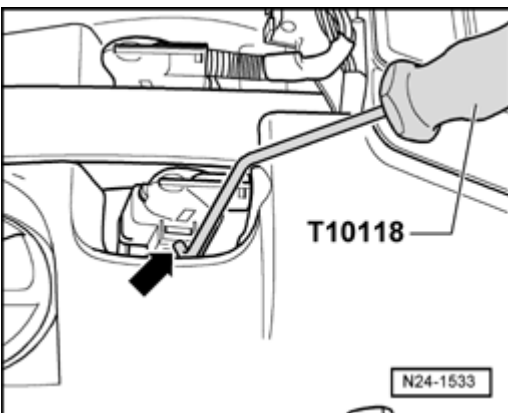


Fig. 518: Identifying Assembly Tool T10118 On Release Button
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical connectors at ignition coils by releasing tab (arrow) with assembly tool T10118 and carefully pulling connector.

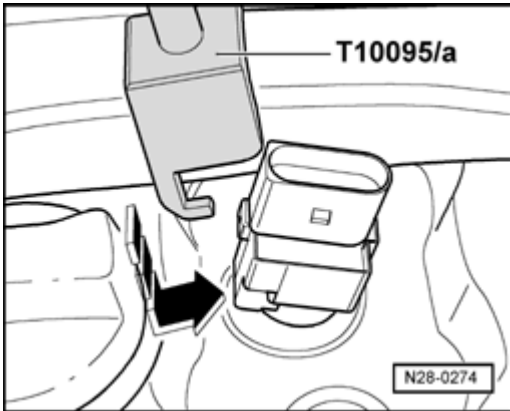


Fig. 519: Attaching Puller T10095A To Ignition Coils And Removing Ignition Coils
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Attach puller T10095 A to ignition coils as shown in illustration (arrow) and remove ignition coils one at a time.

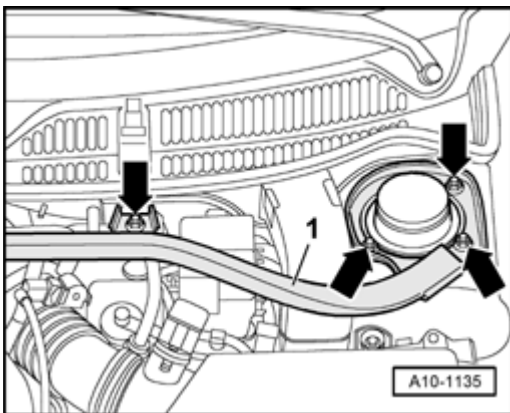


Fig. 520: Removing Body Brace
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove body brace -1- (arrows).

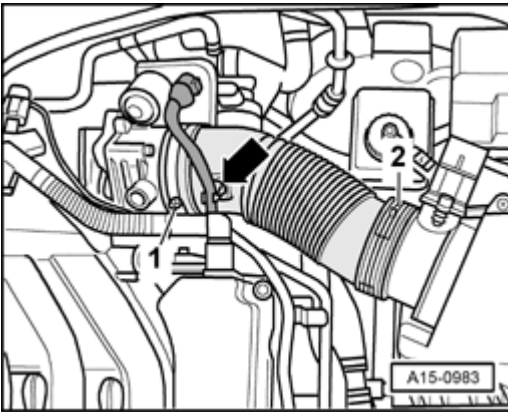


Fig. 521: Loosening Hose Clamps And Removing Air Hose Between Air Cleaner Housing & Throttle Valve Control Module -J338-

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Move electrical wire (arrow) clear.
- Loosen hose clips -1- and -2- and remove air hose between air cleaner housing and Throttle valve control module -J338-.

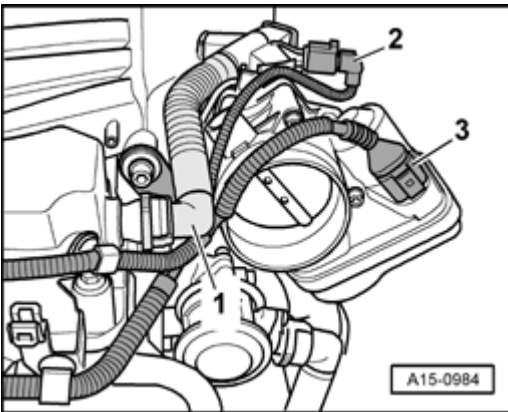


Fig. 522: Disconnecting Electrical Connectors & Crankcase Breather Hose

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical connectors -2- and -3-.
- Disconnect crankcase breather hose -1-.

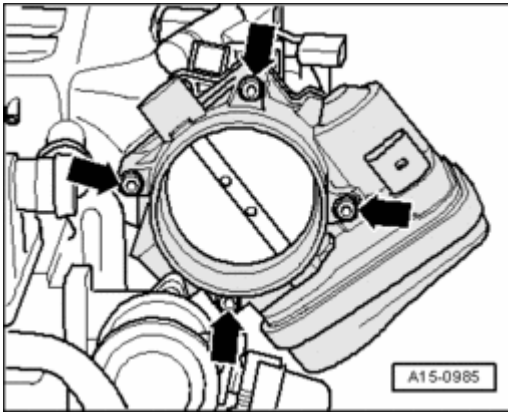


Fig. 523: Removing Bolts And Throttle Valve Control Module -J338- From Intake Manifold
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts (arrows) and remove Throttle valve control module -J338- from intake manifold.

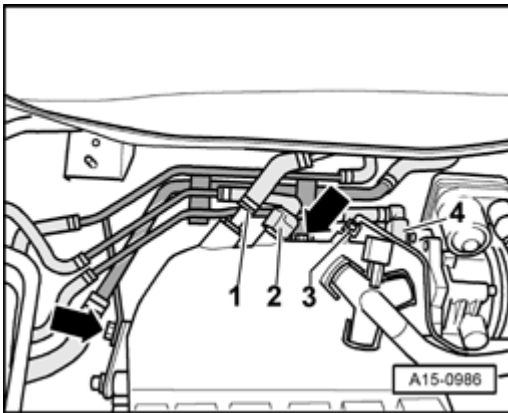


Fig. 524: Disconnecting Vacuum Hoses At Rear Of Intake Manifold
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect vacuum hoses -1...4- at rear of intake manifold.

NOTE: The other hoses remain connected in the hose bracket.

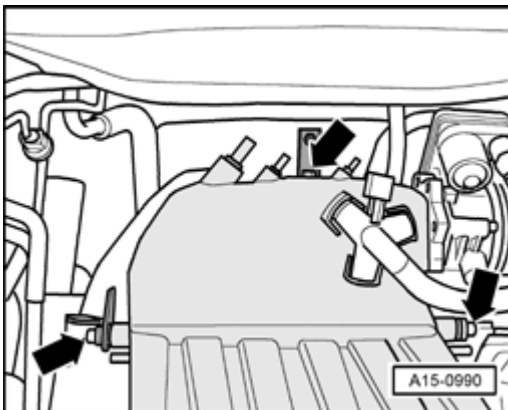


Fig. 525: Removing Hose Bracket & Securing Bolts For Intake Manifold
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unbolt hose bracket (arrows) and remove.
- Unscrew securing bolts at right and at rear (arrows) for intake manifold.

NOTE: Illustration shows view from the rear with engine removed.

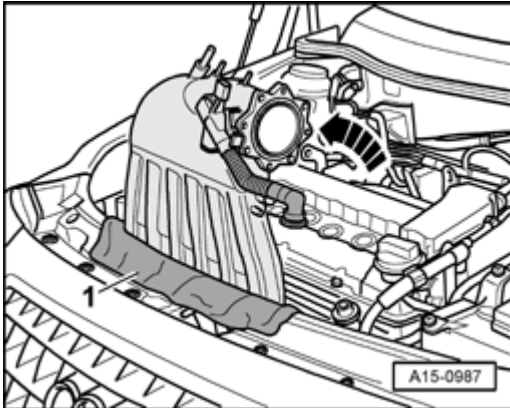


Fig. 526: Protecting Intake Manifold From Damage With Clean Cloth & Swing Intake Manifold Forward
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Protect intake manifold from damage with a clean cloth -1-.
- Swing intake manifold forward (arrow).

NOTE: Cover or plug the intake ports in the cylinder head with a clean cloth or foam plastic to prevent small items from falling in.

- Remove both bolts from heat shield and remove shield.

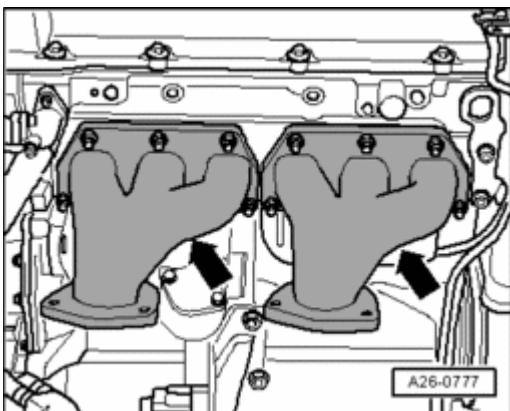


Fig. 527: Unscrewing Nuts On Both Exhaust Manifolds And Removing Together With Washers
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unscrew 7 nuts (arrows) on both exhaust manifolds and remove together with washers.
- Pull exhaust manifolds to rear and remove.

Installing

Installation is performed in the reverse order. Note the following:

NOTE: **Replace gaskets and self-locking nuts.**

- Install intake manifold. Refer to Intake manifold, removing and installing.

Tightening torques

Component	Nm
Exhaust manifold to cylinder head	23 1)
Front exhaust pipe to exhaust manifold	40 1)

1) Replace nuts

Front exhaust pipe, removing and installing

Special tools and equipment required

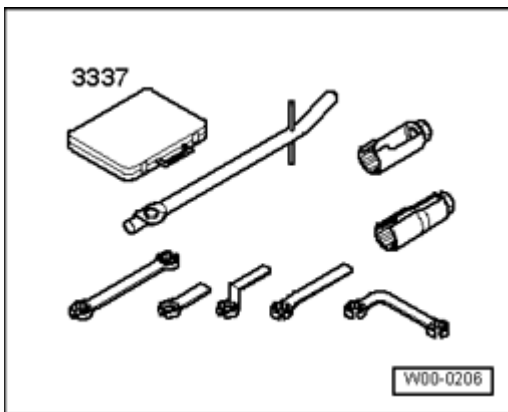


Fig. 528: Identifying Ring Spanner 7-Piece Set 3337
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Oxygen sensor open ring spanner set 3337

Removing

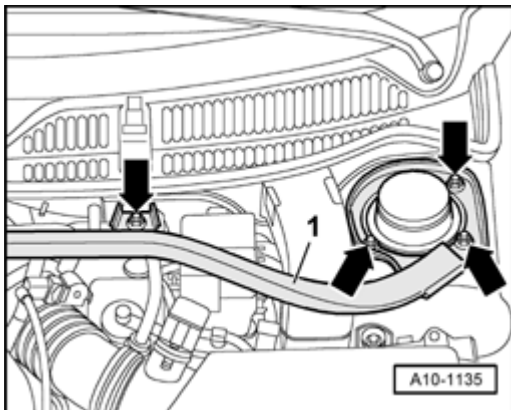


Fig. 529: Removing Body Brace

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove body brace -1- (arrows).

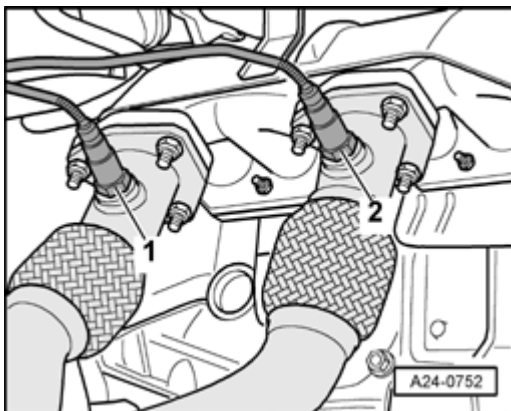


Fig. 530: Loosening Both Oxygen Sensors

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Loosen both oxygen sensors -1- and -2- about 1 turn (accessible from above).

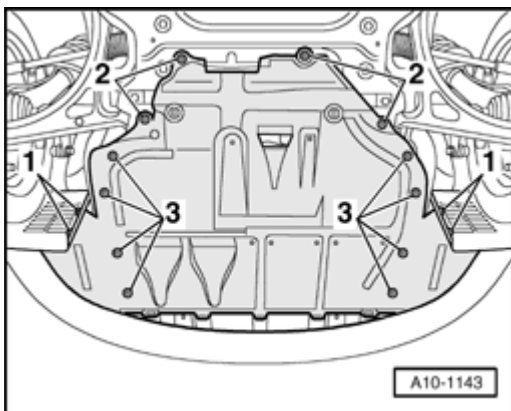


Fig. 531: Identifying Center Sound Insulation Fasteners

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove fasteners -1...3- and remove center sound insulation.

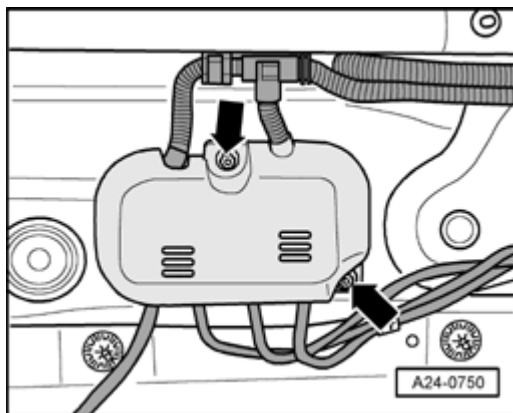


Fig. 532: Removing Protective Cover

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts (arrows) for protective cover.
- Disconnect connectors for all oxygen sensors and move clear.

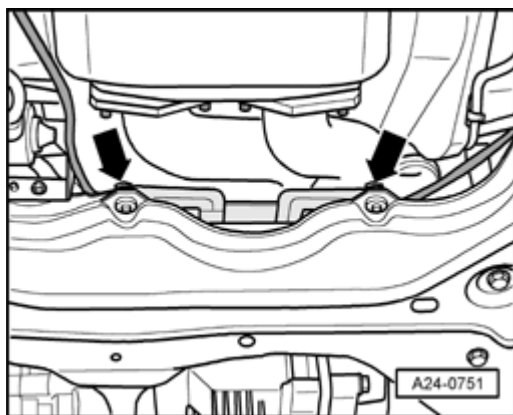


Fig. 533: Unscrewing Wire Guide

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unscrew wire guide (arrows).

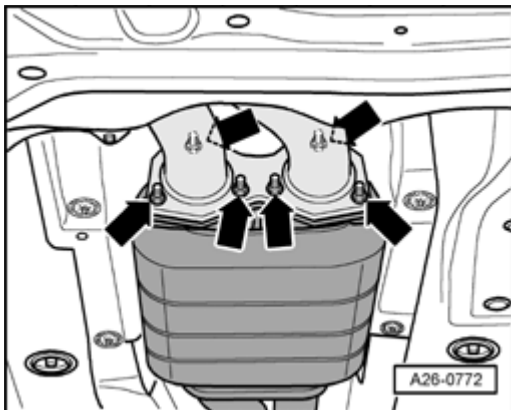


Fig. 534: Unbolting Catalytic Converter From Front Exhaust Pipe
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unbolt catalytic converter from front exhaust pipe (arrows).

NOTE: To avoid damage, the flexible joints in the front exhaust pipe must not be bent more than 10°.

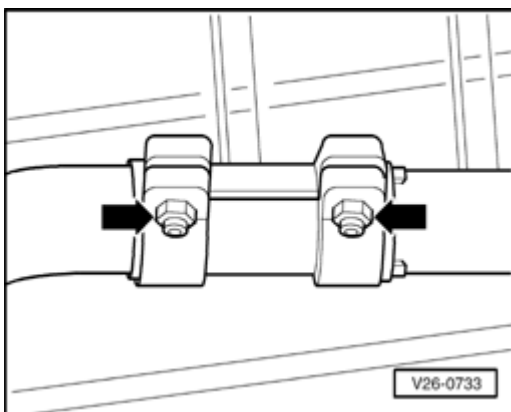


Fig. 535: Separating Exhaust System At Clamp
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Separate exhaust system at clamp (arrows).
- Push clamp back and remove catalytic converter.

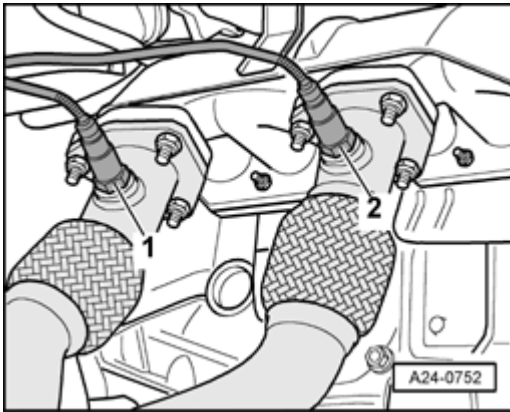


Fig. 536: Loosening Both Oxygen Sensors

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Completely unscrew both oxygen sensors -1- and -2-.

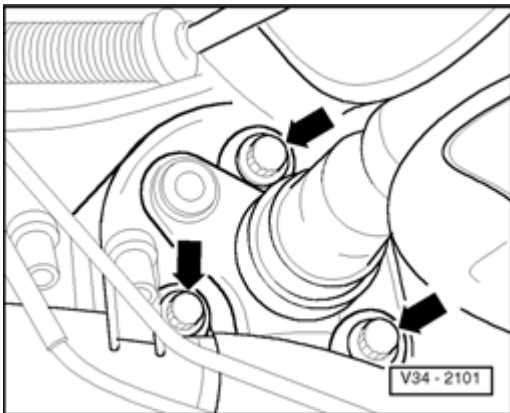


Fig. 537: Identifying Bevel Gear Transfer Case Flange Bolts

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unbolt flexible coupling for driveshaft at bevel box (arrows).

NOTE: When loosening the bolts, counterhold at the driveshaft flange/final drive with a suitable lever.

- Push front section of driveshaft approx. 10 mm toward rear.

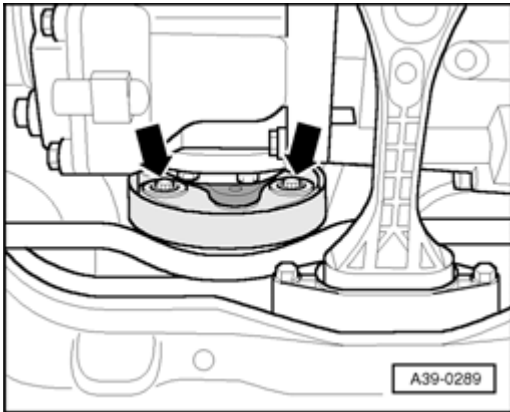


Fig. 538: Unbolting Flexible Coupling From Driveshaft
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unbolt flexible coupling from driveshaft (arrows).

NOTE: When loosening the bolts, counterhold using a suitable lever at the triangular flange.

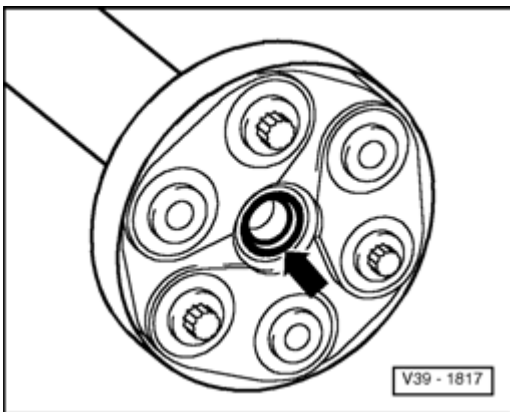


Fig. 539: Identifying Sealing Ring In Driveshaft Flange
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Push front section of driveshaft as far as possible toward rear.

CAUTION:

- After unscrewing the bolts -A- at pendulum support, the engine/transmission assembly swings slightly forward.
- The seal (arrow) in the flange of the driveshaft must not be damaged. The driveshaft must be replaced if the oil seal is damaged.

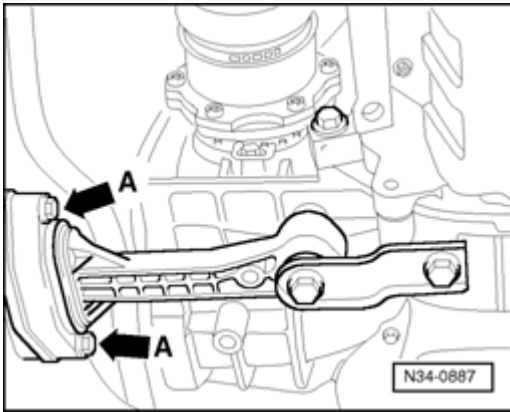


Fig. 540: Identifying Pendulum Support On Subframe
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unscrew pendulum support from subframe (arrows -A-).
- Carefully push engine/transmission assembly toward front and remove flexible coupling.

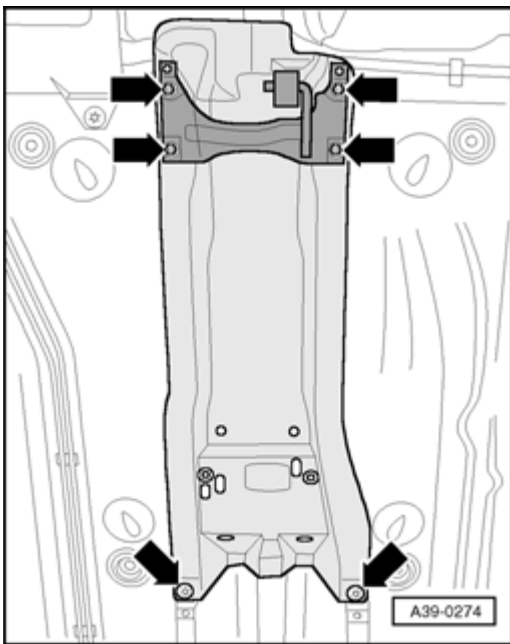


Fig. 541: Unbolting Center Heat Shield At Both Front Securing Points
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unbolt center heat shield at both front securing points (lower arrows) and swing it down slightly.

NOTE: **The bracket for the exhaust system (upper arrows) remains secured.**

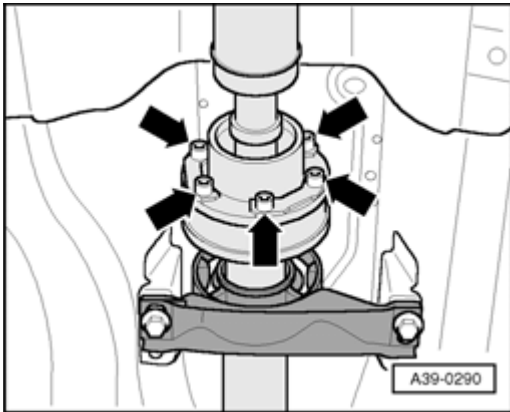


Fig. 542: Identifying Front Drive Shaft Tube To Rear Drive Shaft Tube Bolts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unbolt front section of driveshaft from rear section (arrows).
- Push front section of driveshaft toward front and swivel it out of rear section of driveshaft.

NOTE: Take care to bend the front section of the driveshaft downward as little as possible when disconnecting it.

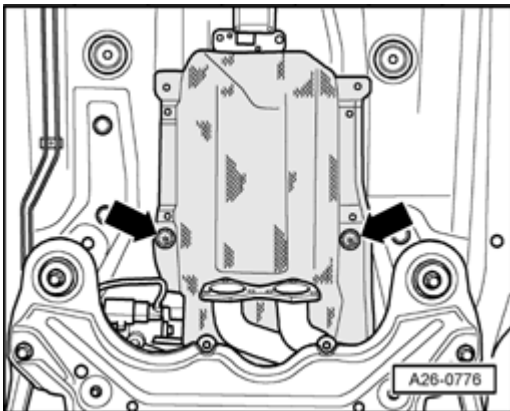


Fig. 543: Removing Front Heat Shield
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove front heat shield (arrows).

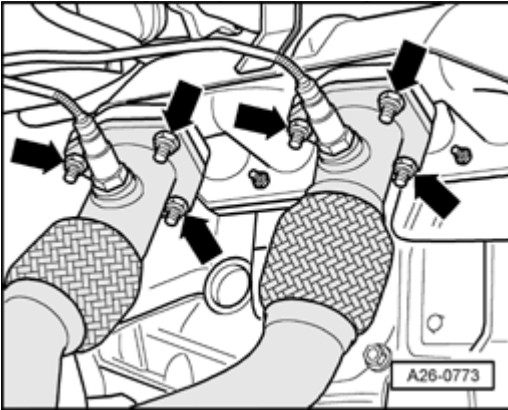


Fig. 544: Unbolting Front Exhaust Pipe At Exhaust Manifold
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unbolt front exhaust pipe from exhaust manifolds (arrows).
- Remove front exhaust pipe.

Installing

Installation is performed in the reverse order. Note the following:

NOTE: **Replace gaskets and self-locking nuts.**

- Install front section of driveshaft.

Refer to **39 FINAL DRIVE - DIFFERENTIAL**

- Install body brace.

Refer to **40 FRONT SUSPENSION**

- Align exhaust system free of stress. Refer to **Exhaust system, aligning free of stress.**

Tightening torques

Component	Nm
Front exhaust pipe to exhaust manifold	40 1)
Catalytic converter to front exhaust pipe	23 1)
Oxygen sensor in front exhaust pipe	55
Pendulum support to subframe	20 + 90° 1)2)

1) Replace nuts and bolts

2) 90° equals one quarter turn

Exhaust system, aligning free of stress**Vehicles without clamp between center and rear mufflers**

- The exhaust system must be aligned when it is cool.
- Loosen bolts of front clamp. Refer to item -19- under **Exhaust system, component overview.**

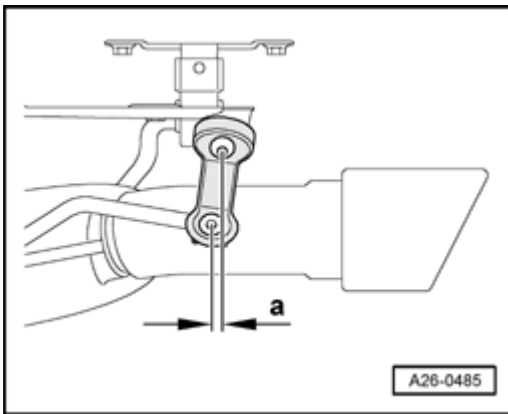


Fig. 545: Pushing Exhaust System Toward Front Of Vehicle
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Push exhaust system toward front of vehicle (arrow), so that mounting for rear muffler is preloaded by -a- = 5...11 mm.

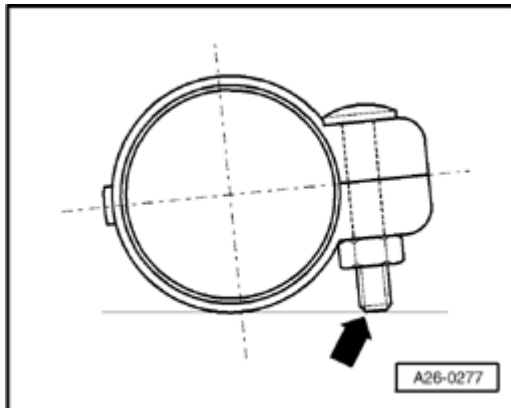
NOTE:

Fig. 546: Identifying End Of Bolt Does Not Project Below Bottom Of Clamp
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- When installing the clamp, make sure the end of the bolt does not project below the bottom of the clamp (arrow).
 - The bolt connection faces to the right.
- Tighten bolts on clamp evenly to 40 Nm.

Aligning tailpipes

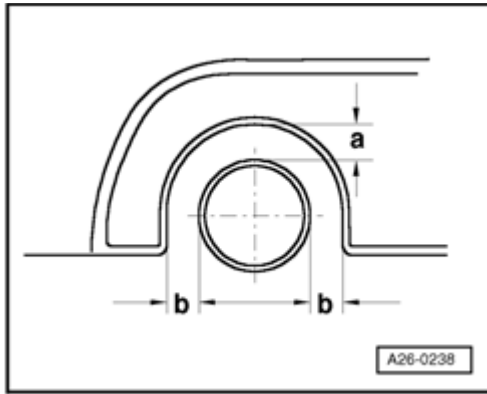


Fig. 547: Aligning Tailpipe In Bumper Cut-Out

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Adjust rear muffler so that an even distance of -b- is between bumper cover cutout and tailpipe ends.

Dimension -a- = 26 mm

- If necessary, loosen mounting for rear muffler to adjust tailpipes.

Vehicles with clamp between center and rear mufflers

- The exhaust system must be aligned when it is cool.
- Loosen bolts of front clamp. Refer to item -19- under **Exhaust system, component overview** and rear clamp. Refer to item -4- under **Exhaust system, component overview**.

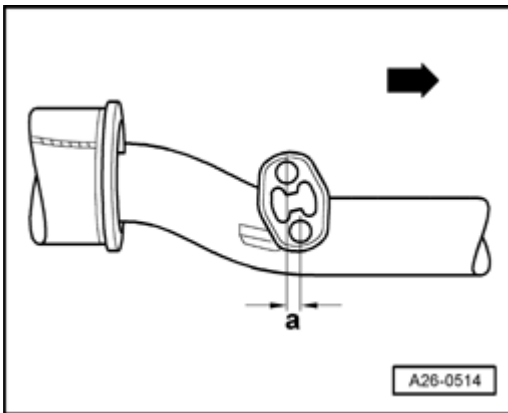


Fig. 548: Pushing Front Section Of Exhaust System Toward Front Of Vehicle

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Push front section of exhaust system toward front of vehicle (arrow) so that mounting for center muffler is preloaded by -a- = 5...11 mm.

NOTE:

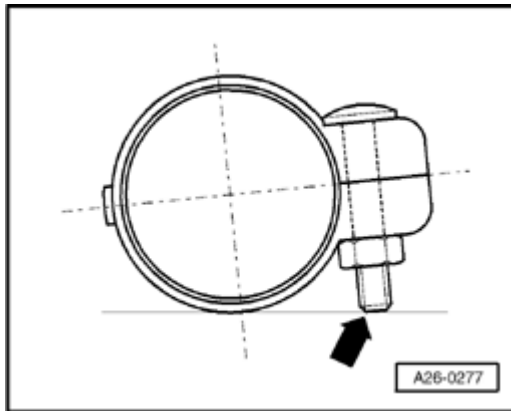


Fig. 549: Identifying End Of Bolt Does Not Project Below The Bottom Of Clamp
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- When installing the clamp, make sure the end of the bolt does not project below the bottom of the clamp (arrow).
- The bolt connection faces to the right.

- Tighten bolts on front clamp evenly to 40 Nm.

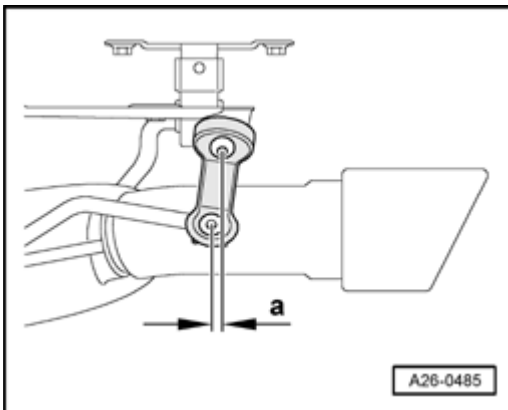


Fig. 550: Pushing Rear Section Of Exhaust System Toward Front Of Vehicle
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Push rear section of exhaust system toward front of vehicle (arrow) so that left side mounting for rear muffler is preloaded by -a- = 5...11 mm.

NOTE:

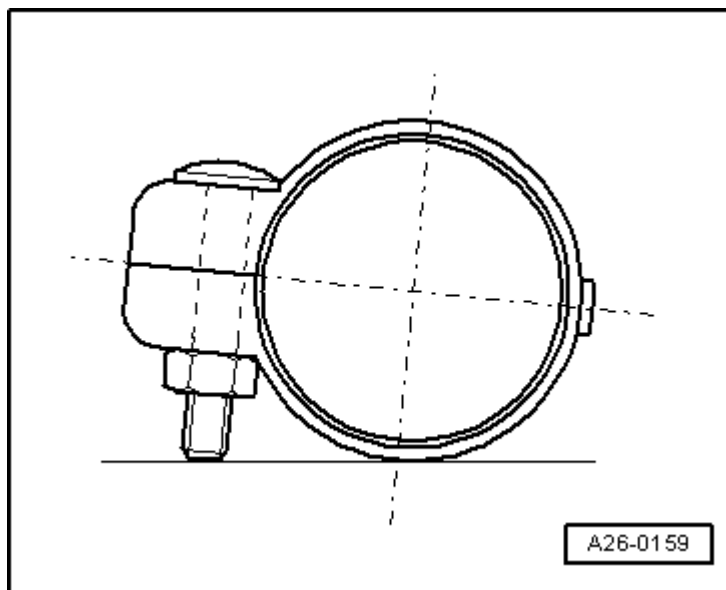


Fig. 551: Installation Position Of Double Clamp
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- When installing the rear clamp, make sure the ends of the bolts do not project below the bottom of the clamp (arrow).
 - The bolt connection faces to the left.
- Align exhaust system free of stress. Refer to Exhaust system, aligning free of stress.
 - Tighten bolts on front clamp evenly to 40 Nm.

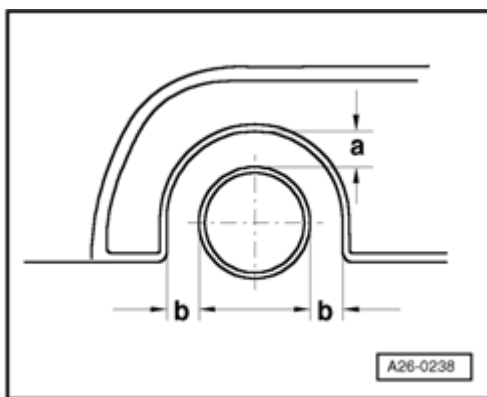


Fig. 552: Aligning Tailpipe In Bumper Cut-Out
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Adjust rear muffler so that an even distance is between bumper cover cutout and tailpipe ends.

Dimension -a- = 26 mm

Distance -b- = -b-

- If necessary, loosen mounting for rear muffler to adjust tailpipes.

Exhaust system, checking for leaks

- Start engine and run at idling speed.
- Plug tailpipes with cloths or stoppers until check is completed.
- Listen for noise at connection points (cylinder head/exhaust manifold, exhaust manifold/front exhaust pipe, etc.) to locate any leaks.
- Correct any leaks that are found.

SECONDARY AIR SYSTEM, SERVICING**Secondary air system, principle and function****Principle**

Because of the over-enrichment of the mixture in the cold start phase, the percentage of unburned hydrocarbons in the exhaust gas is higher at that time. The injection of secondary air improves the post-oxidation in the catalytic converter and thus reduces pollutant emissions. The heat produced by the post-oxidation considerably shortens the start-up time of the catalytic converter and significantly enhances the emission quality in the cold-running phase.

Function

- During the cold start phase (coolant temperature at + 15...+ 35° C) the secondary air system blows air behind the exhaust valves for approx. 65 seconds. This produces an oxygen-rich exhaust gas, causes afterburning and reduces the heating-up phase of the catalytic converter.
- In addition, 20 seconds after each following engine start (until coolant temperature reaches 85° C), the secondary air system switches on for 5 seconds when at idling speed and is checked by the self-diagnosis.
- The Secondary Air Injection (AIR) pump motor -V101- is actuated via the Motronic Engine Control Module (ECM) -J220-, the Secondary Air Injection (AIR) pump relay -J299-, the Secondary Air Injection (AIR) solenoid valve -N112-, the change-over valve and the combination valve.

Secondary air system, component overview

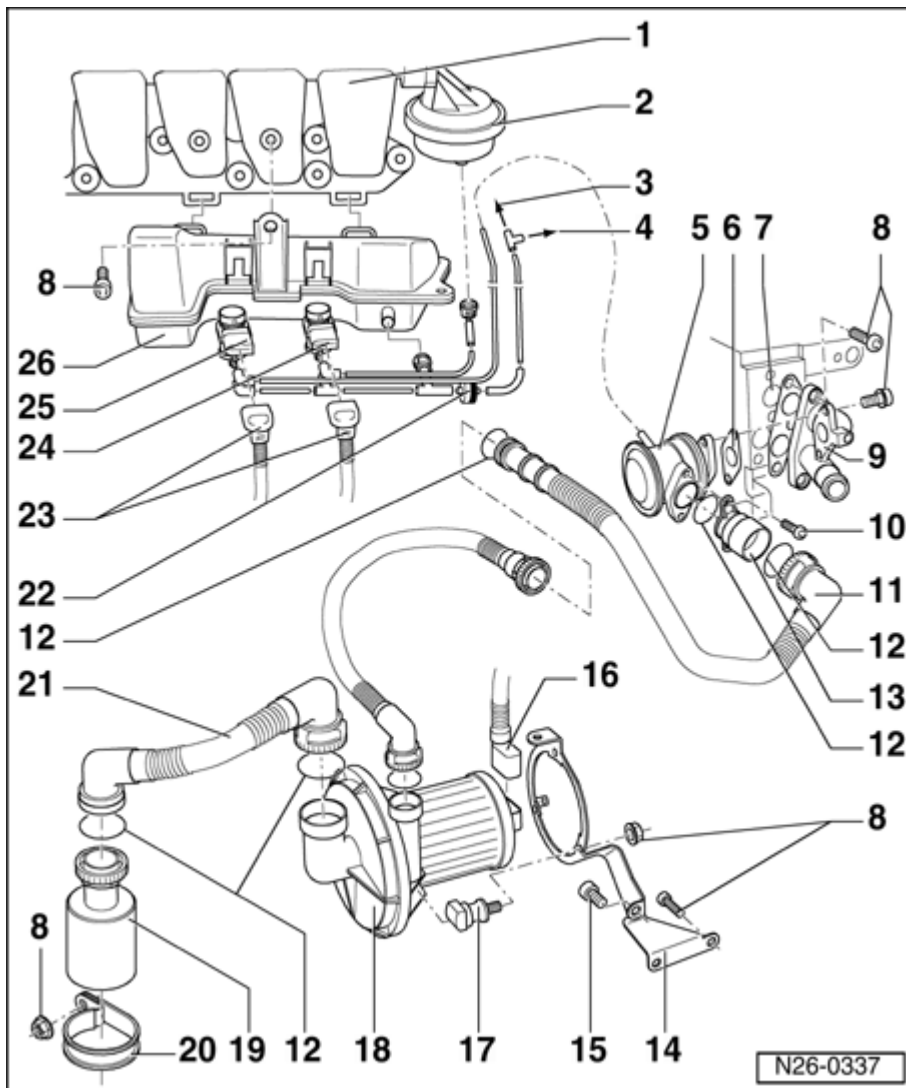


Fig. 553: Secondary Air System, Component Overview
Courtesy of VOLKSWAGEN UNITED STATES, INC.

NOTE: For installed location for AIR pump relay -J299-. Refer to Installed location of Secondary Air Injection (AIR) pump relay -J299-.

1 - Intake manifold

2 - Vacuum unit for intake manifold change-over

3 - To intake manifold

4 - To fuel pressure regulator

5 - Combination valve for secondary air system

- Removing and installing. Refer to Combination valve for secondary air system, checking for proper

operation and leakage**6 - Gasket**

- Replace

7 - Air channel

- In cylinder head

8 - 10 Nm**9 - Connection for combination valve****10 - 5 Nm****11 - Pressure hose**

- Check for secure connection

12 - O-ring

- Replace if damaged

13 - Connection**14 - Bracket**

- For AIR pump motor -V101-
- With support for sump

15 - 20 Nm**16 - Electrical connector****17 - Rubber bushing****18 - Secondary Air Injection (AIR) pump motor -V101-**

- Removing and installing. Refer to **Secondary air injection pump, removing and installing**

19 - Air cleaner

- Clean if dirty

20 - Retaining clamp

21 - Intake hose

- Check for secure connection

22 - Non-return valve

- Installed position (light side/dark side): as shown in illustration; arrow indicates direction of flow

23 - Electrical connector**24 - Intake manifold change-over valve -N156-****25 - Secondary Air Injection (AIR) solenoid valve -N112-****26 - Vacuum reservoir**

Installed location of Secondary Air Injection (AIR) pump relay -J299-

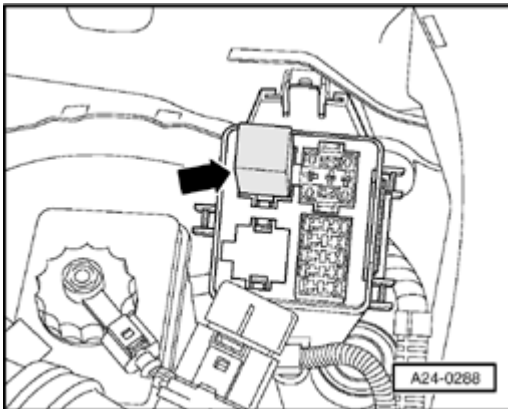


Fig. 554: Installed Location Of Secondary Air Injection (AIR) Pump Relay -J299-
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Beneath cover on left at bulkhead

NOTE: To remove the protective cover, disconnect the relay at the bulkhead and lower.
If necessary, unplug connector at Mass Air Flow sensor.

Combination valve for secondary air system, checking for proper operation and leakage

Special tools and equipment required

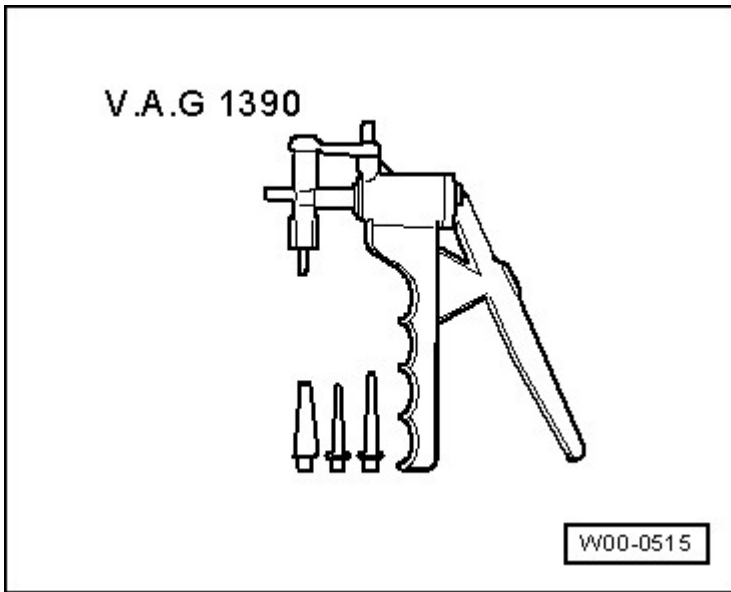


Fig. 555: Hand Vacuum Pump V.A.G 1390
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Hand operated vacuum pump V.A.G 1390

Requirements

- Vacuum hoses and hose connections do not leak
- Vacuum hoses are not clogged

Work sequence

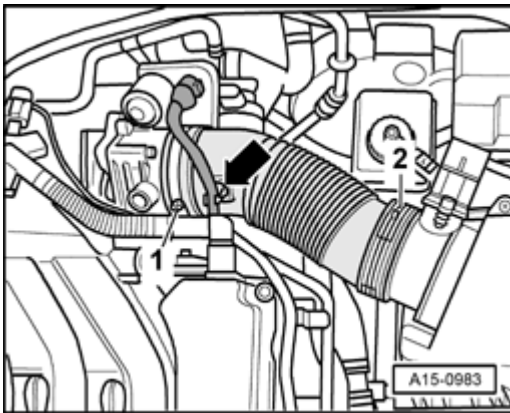


Fig. 556: Loosening Hose Clamps And Removing Air Hose Between Air Cleaner Housing & Throttle Valve Control Module -J338-
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Move electrical wire (arrow) clear.
- Loosen hose clips -1- and -2- and remove air hose between air cleaner housing and Throttle valve control module -J338-.

- Disconnect vacuum hose at combination valve.

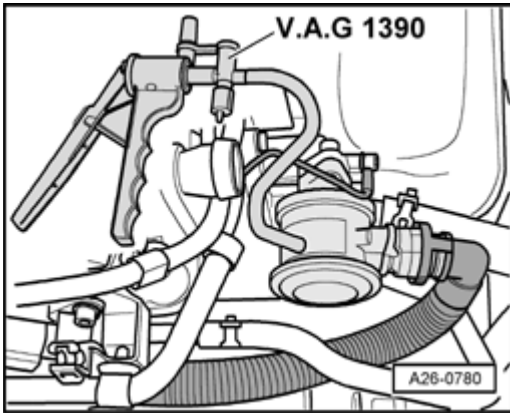


Fig. 557: Connecting Hand Vacuum Pump V.A.G 1390 To Vacuum Connection Of Combination Valve
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect hand vacuum pump V.A.G 1390 to vacuum connection of combination valve.

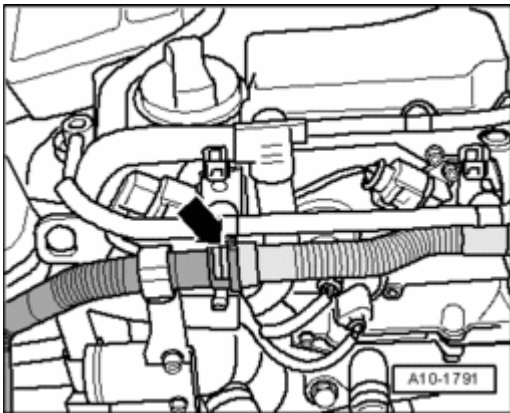


Fig. 558: Identifying Secondary Air Injection Hose
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect secondary air hose at position marked with an arrow.
- Blow gently into hose for combination valve (do not use compressed air).
- Combination valve must be closed; blowing through must not be possible
- Operate hand vacuum pump.
- Combination valve should open; it should now be possible to blow through hose

If the combination valve does not open:

- Replace combination valve. Refer to **Combination valve for secondary air system, removing and installing.**

Combination valve for secondary air system, removing and installing

Removing

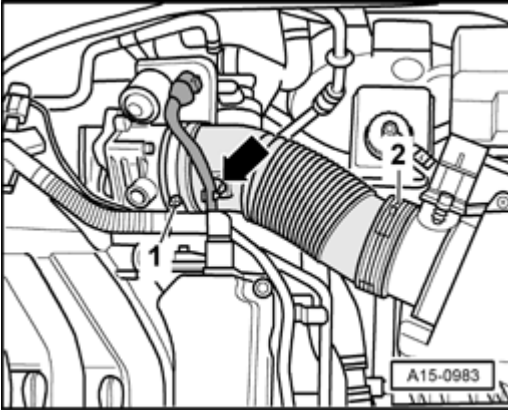


Fig. 559: Loosening Hose Clamps And Removing Air Hose Between Air Cleaner Housing & Throttle Valve Control Module -J338-

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Move electrical wire (arrow) clear.
- Loosen hose clips -1- and -2- and remove air hose between air cleaner housing and Throttle valve control module -J338-.
- Take out air cleaner housing.

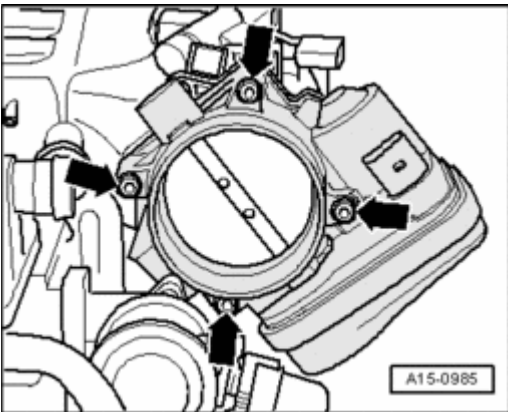


Fig. 560: Removing Bolts And Throttle Valve Control Module -J338- From Intake Manifold

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unbolt Throttle valve control module -J338- from intake manifold (arrows) and move clear to one side (coolant hoses remain attached).

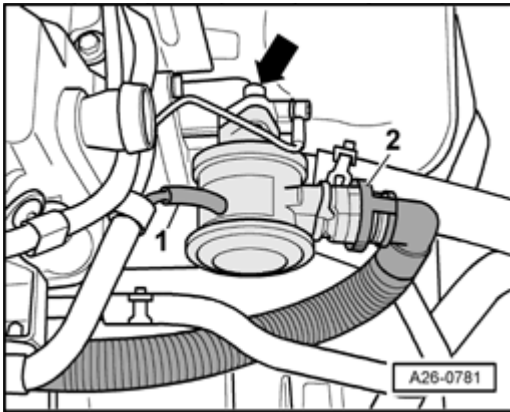


Fig. 561: Disconnecting Air Hose And Vacuum Hose At Combination Valve For Secondary Air System
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect air hose -2- and vacuum hose -1- at combination valve for secondary air system.
- Unscrew 2 bolts (arrow) and remove combination valve.

Installing

Installation is performed in the reverse order. Note the following:

NOTE: **Replace seals and gaskets.**

Tightening torques

Component	Nm
Combination valve for secondary air system to bracket	10
Throttle valve control module -J338- to intake manifold	10

Secondary air injection pump, removing and installing

Removing

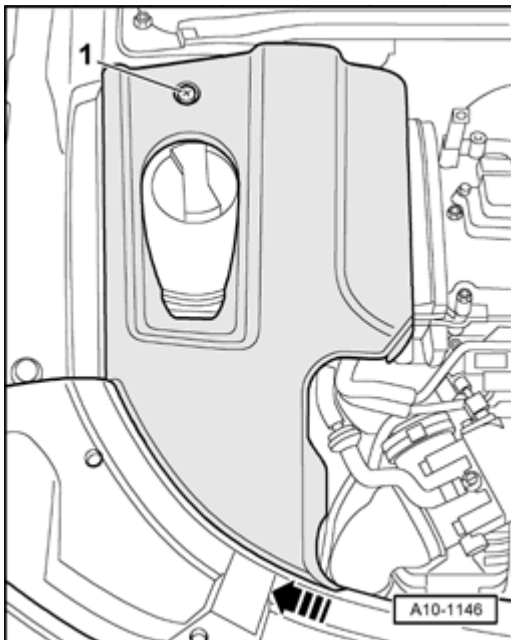


Fig. 562: Removing Screw And Coolant Expansion Tank Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolt -1- and remove cover over coolant expansion tank (arrow).

NOTE: Mark the rotation direction of the poly V-belt with chalk or a felt-tipped pen. If the belt runs in the opposite direction when it is reinstalled, breakage can result.

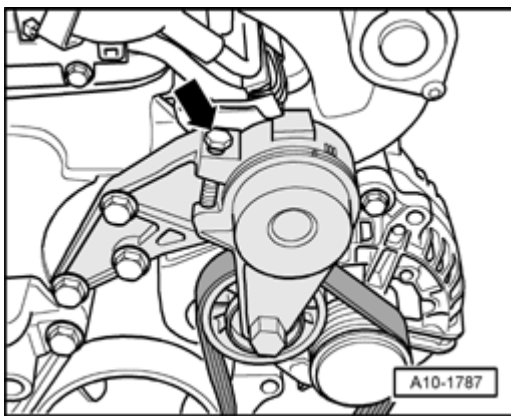


Fig. 563: Screwing Into Bore On Tensioning Element
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Release tension on poly V-belt by screwing an M8 x 40 bolt (arrow) into bore on tensioning element.

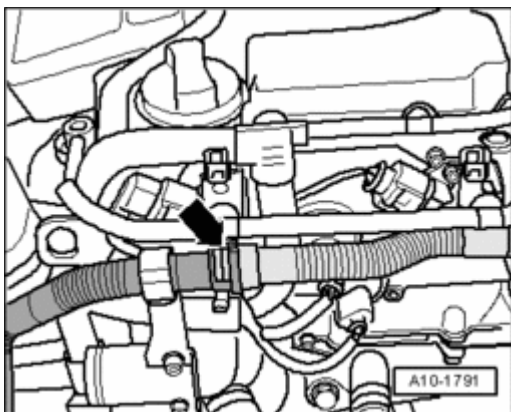


Fig. 564: Identifying Secondary Air Injection Hose

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect secondary air hose at position marked with an arrow.
- Move air hose clear.

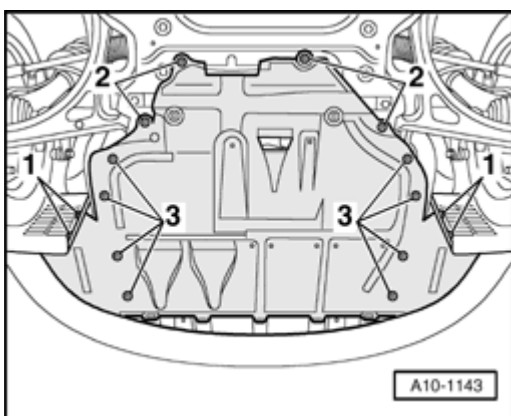


Fig. 565: Identifying Center Sound Insulation Fasteners

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove fasteners -1...3- and remove center sound insulation.

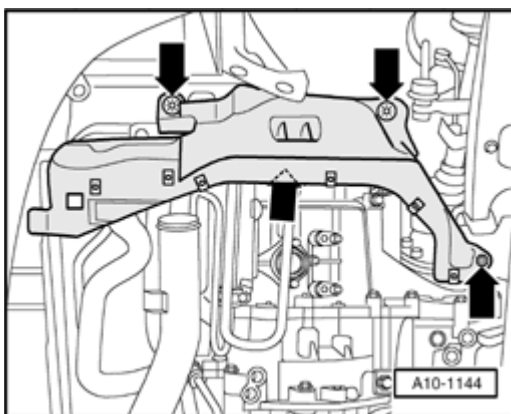


Fig. 566: Left Sound Insulation Panel

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove left sound insulation (arrows).

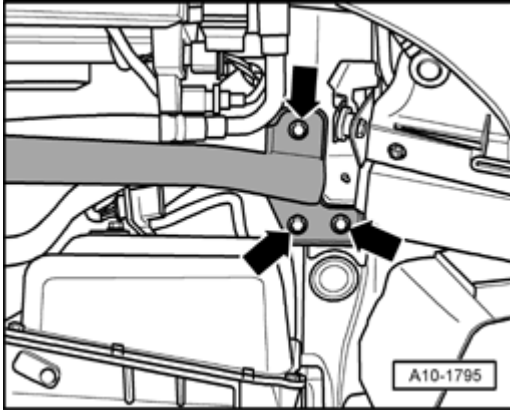


Fig. 567: Removing Cross Piece

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove right sound insulation (arrows).
- Remove pulley for power steering pump (counterhold with mandrel).

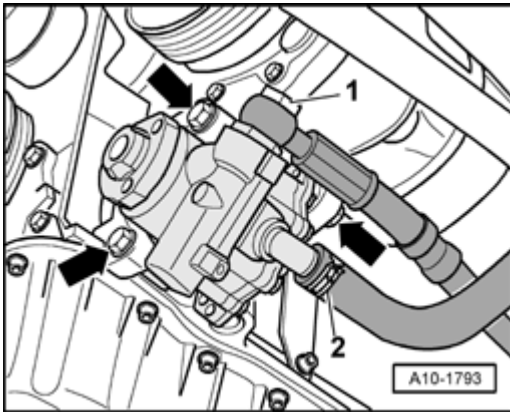


Fig. 568: Removing Bolts And Power Steering Pump From Bracket

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts (arrows) and remove power steering pump from bracket.
- Hang power steering pump on lock carrier with hydraulic hoses -1- and -2- attached.

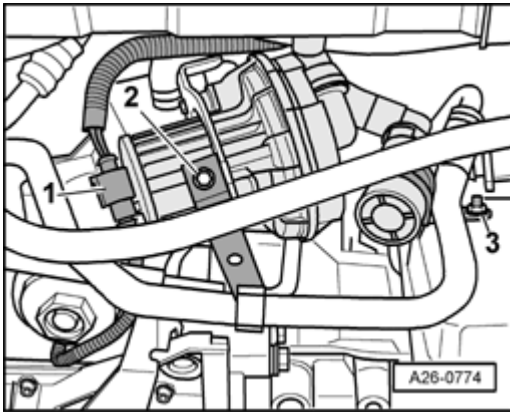


Fig. 569: Disconnecting Electrical Connector At Secondary Air Injection (AIR) Pump Motor -V101-
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical connector -1- at Secondary Air Injection (AIR) pump motor -V101-.
- Move wiring clear.
- Remove bolt -2- for coolant hose bracket.
- Remove bolt -3- for secondary air pump filter bracket.

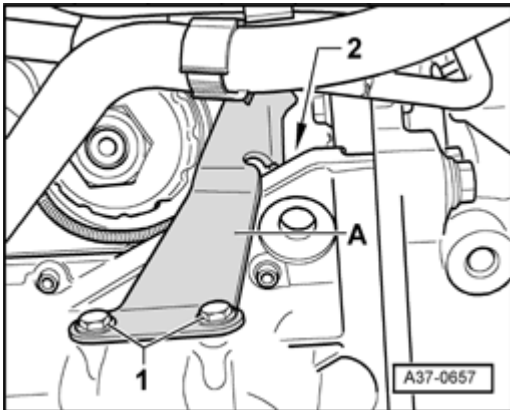


Fig. 570: Removing Bolts And Secondary Air Injection Pump With Bracket
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts -1- and -2- and remove secondary air pump with bracket -A-.
- Remove secondary air injection pump from bracket.

Installing

Installation is performed in the reverse order. Note the following:

- Install power steering pump.

Refer to **48 STEERING**

- Install cross piece.

2005 Audi TT

ENGINE 3.2 Liter V6 4V Engine Mechanical, Engine Code(s): BHE

Refer to **40 FRONT SUSPENSION**

- Install poly V-belt. Refer to **Poly V-belt, removing and installing.**

Tightening torques

Component	Nm
Secondary air pump to bracket	10
Bracket for secondary air pump, M6	10
Bracket for secondary air pump, M8	20