Engine

General, Technical Data

00 GENERAL, TECHNICAL DATA

GENERAL INFORMATION

SAFETY PRECAUTIONS

Note the following when working on the fuel system:

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

- **Before opening high pressure area of the fuel injection system, fuel pressure must be relieved to residual pressure.**
- **To reduce remaining residual pressure, lay a clean cloth around the connector and carefully loosen connector.**

-- Procedures before opening high pressure fuel injection system. Refer to **BEFORE OPENING HIGH PRESSURE FUEL INJECTION SYSTEM**.

WARNING: Burn risk due to escaping fuel.

- **Because the transfer fuel pump -G6- runs briefly when the battery is connected and the driver door is opened, the voltage supply to the fuel pump control module -J538- must be disconnected before opening the fuel system.**

CAUTION: Risk of destroying electrical components when battery is disconnected.

- **Observe measures when disconnecting battery.**
- **Only disconnect battery with ignition switched off.**

-- Disconnect battery. Refer to **REMOVAL AND INSTALLATION** .

PREVENTING PERSONAL INJURY AND DAMAGE TO INJECTION AND IGNITION SYSTEMS

To prevent personal injury and damage to the injection and ignition system, observe the following:

- Do not touch or disconnect ignition coils with power output stages when engine is running or turning at starting RPM.
- The ignition must be switched off before connecting or disconnecting injection and ignition system wiring or tester cables.
- If engine is to be cranked at starting RPM without starting (for example for compression testing),

disconnect connectors from ignition coils and from fuel injectors. After performing work, check and erase DTC memory.

- Only clean engine with ignition switched off.
- If electrical connectors were disconnected, faults are saved in ECM:

-- Connect Vehicle Diagnosis, Testing and Information System VAS 5051B.

-- Start "Guided Functions" operating mode.

-- Generate readiness code in ECM.

TEST AND MEASURING INSTRUMENTS DURING TEST DRIVE

If special testing equipment is required during road test, note the following:

WARNING: Distraction and improperly secured test equipment can lead to accidents.

Risk of passenger airbag deploying in an accident.

- **Operating testing and measuring equipment while driving creates a distraction.**
- **There is an increased risk of injury due to unsecured testing and measuring equipment.**

Always secure testers on the rear seat with a strap and have a second person on the rear seat operate them.

WORKING ON COOLING SYSTEM

Note the following when working on the cooling system:

WARNING: Risk of scalding due to hot steam and hot coolant.

- **When the engine is warm the cooling system is under pressure.**
- **To reduce pressure, cover coolant reservoir cap with cloth and carefully open.**

BEFORE OPENING HIGH PRESSURE FUEL INJECTION SYSTEM

- The fuel injection system is separated into a high-pressure section (maximum approximately 120 bar) and a low-pressure section (approximately 6 bar).
- Before a component in the fuel injection system high pressure area is remove, the fuel pressure must be definitely reduced to a residual pressure of approximately 6 bar, as described in the following.

Special tools and workshop equipment required

- Vehicle diagnostic, testing, and information system VAS 5051B

Procedure

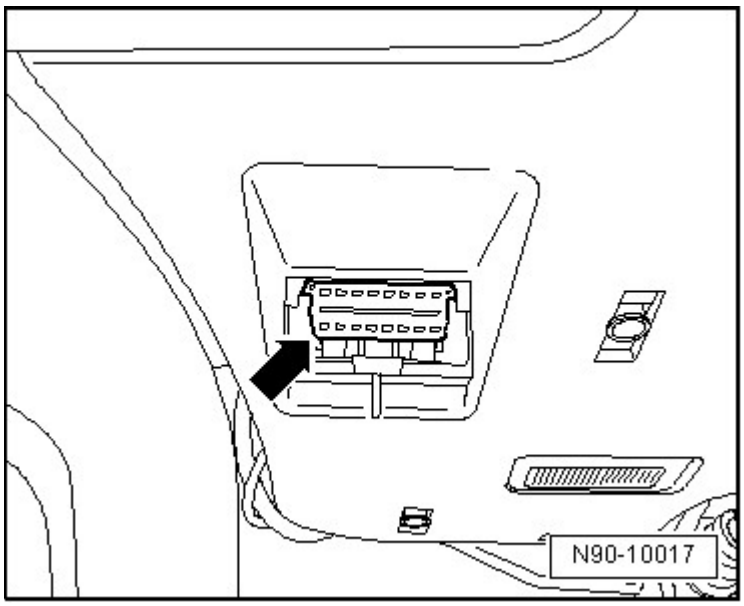

Fig. 1: Locating Data Link Connector
Courtesy of AUDI OF AMERICA, LLC

-- With the ignition off, connect the vehicle diagnosis, testing and information system VAS 5051B to the diagnostic connection using the diagnostic lead.

-- Start engine and let run at idle.

Display on VAS 5051B:

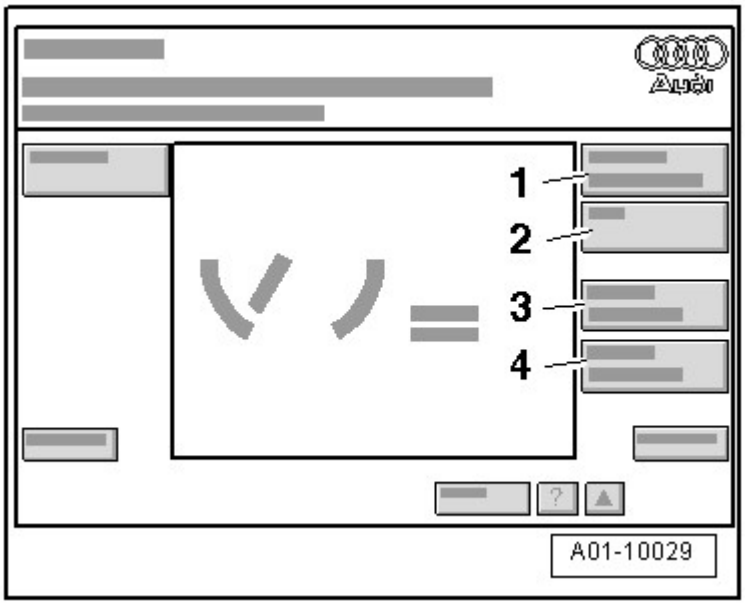

Fig. 2: Display On VAS 5051B - Vehicle Self-Diagnosis Button
Courtesy of AUDI OF AMERICA, LLC

-- Press the **Vehicle Self-Diagnosis** button -1- in the selection.

Display on VAS 5051B:

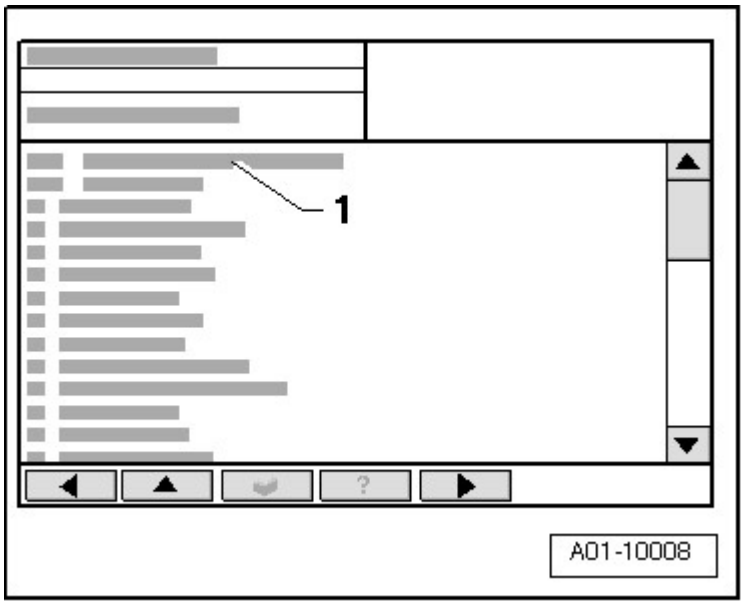

Fig. 3: Display On VAS 5051 - "01 - Engine Electronics"
Courtesy of AUDI OF AMERICA, LLC

-- In selection -1-, press the "Engine electronics" vehicle system and continue by pressing the **-->** button.

Display on VAS 5051B:

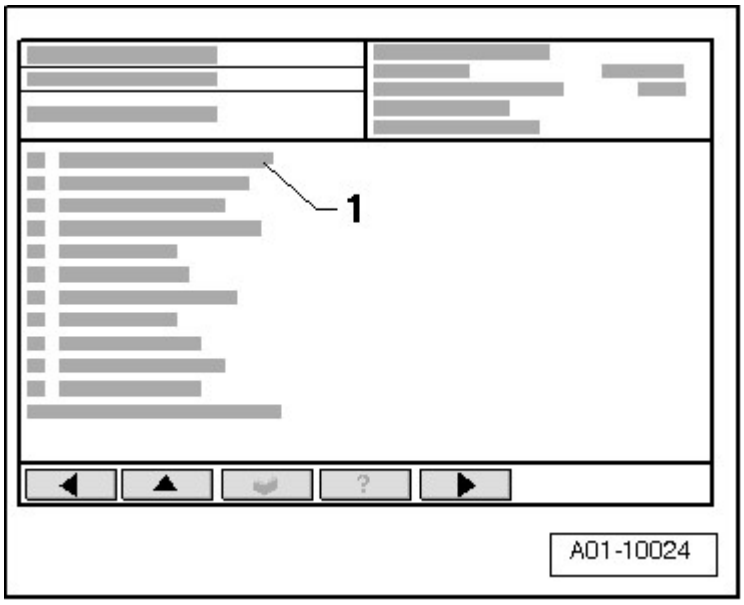

Fig. 4: Display On VAS 5051 - "006 - Basic Setting"
Courtesy of AUDI OF AMERICA, LLC

-- In selection -1-, press the "Measured values" function and continue by pressing the **-->** button.

Display on VAS 5051B:

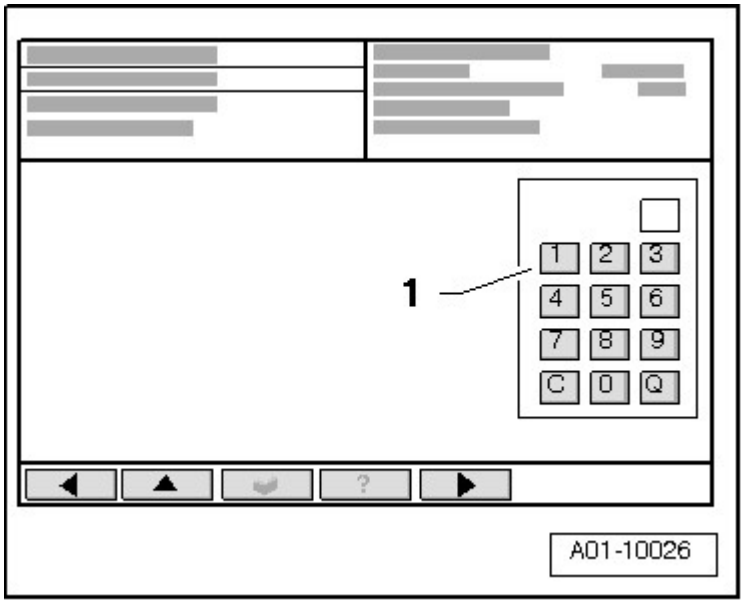

Fig. 5: Display On VAS 5051 - "Display Group 140"
Courtesy of AUDI OF AMERICA, LLC

-- In button field -1-, press the **1 4 0** buttons for "Display group 140" and confirm the entry by pressing the **Q** button.

Display on VAS 5051B:

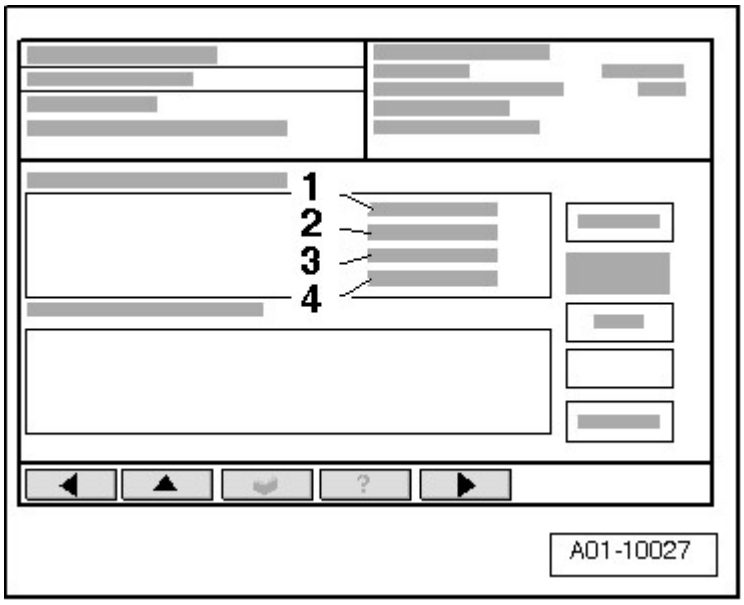

Fig. 6: Display On VAS 5051 - (42%, 39.76 Bar, 40.63 Bar, Inactive)
Courtesy of AUDI OF AMERICA, LLC

-- Check read-out for fuel pressure in fuel rail in display field -3-.

- A value of 35 to 45 bar is displayed when the engine is running at idle. The display shows the actual pressure in the fuel rail which is generated by the high pressure pump.

-- Remove the right luggage compartment side trim. Refer to **Removal and Installation** .

-- Remove the fuse 6 (on fuse panel F) -SF6- for the fuel pump control module -J538- in the fuse holder in the right of the luggage compartment.

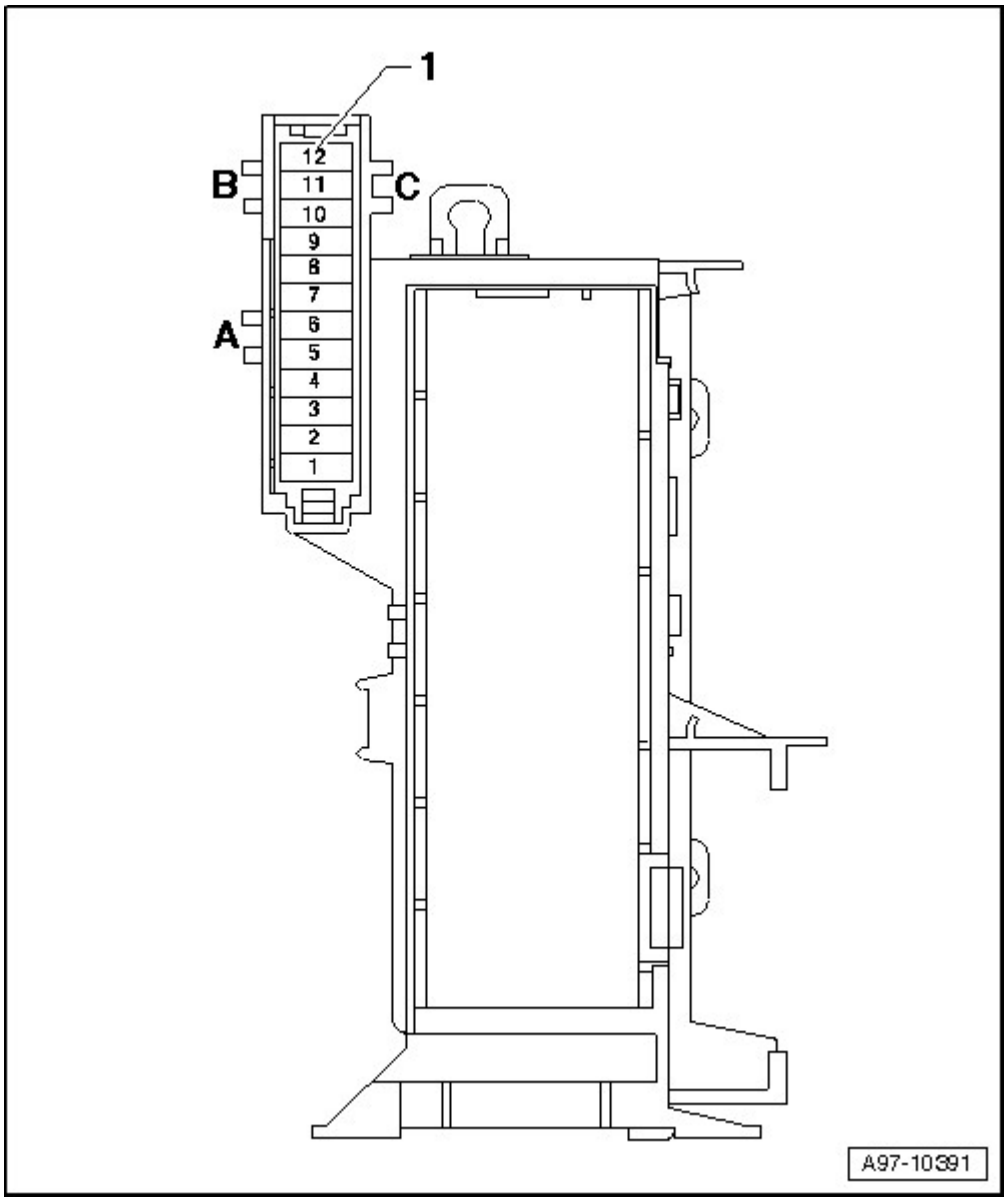

Fig. 7: Fuse Panel
Courtesy of AUDI OF AMERICA, LLC

Display on VAS 5051B:

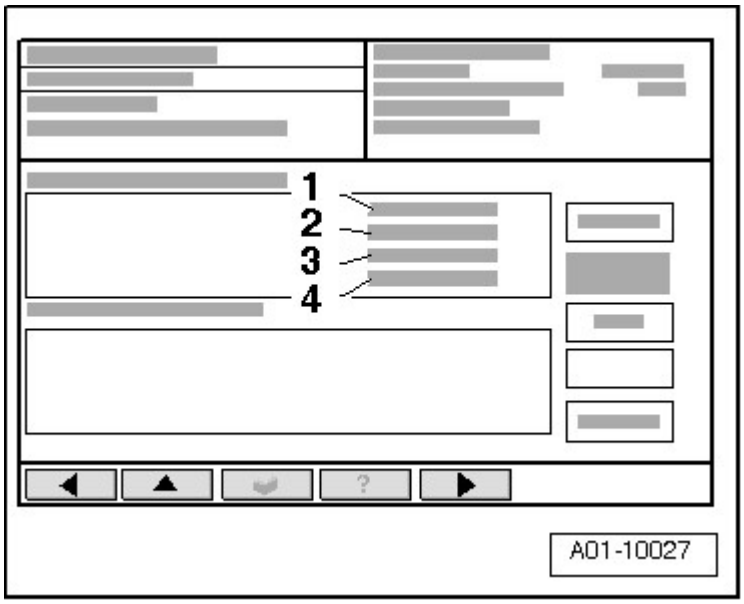

Fig. 8: Display On VAS 5051 - (42%, 39.76 Bar, 40.63 Bar, Inactive)
Courtesy of AUDI OF AMERICA, LLC

-- With the engine still running, check the fuel pressure in fuel system display -3- :

- The fuel pressure decreases rapidly because the mechanical high pressure pump is no longer supplied with fuel by the electrical fuel pump.

-- Switch the ignition off as soon as the fuel pressure drops below 8 bar.

NOTE: The fuel pressure must not drop below 6 bar, because otherwise the engine will shut off (risk of catalytic converter damage).

The fuel rail will continue to be filled with fuel, but it will no longer be under high pressure.

WARNING: Do not let fuel come into contact with skin.

- **Wear protective eyewear and clothing when opening the fuel system.**
- **Lay clean cloths around the connection before opening the high pressure area to collect any fuel that leaks out.**

-- Loosen the wire at a connection immediately.

NOTE: If the high pressure system is not opened immediately, the pressure will increase because of post-heating.

Final procedures

-- Insert fuse 6 (on fuse panel F) -SF6-.

-- Connect the vehicle diagnosis, testing and information system VAS 5051B while the ignition is switched off.

-- Start "Guided Functions" operating mode.

-- Generate the readiness code in the engine control module => .

CLEAN WORKING CONDITIONS

Even a little contamination can lead to faults. Observe the following guidelines for cleanliness when working on the fuel system, injection system and turbocharger:

- Before loosening, connections and surrounding areas must be cleaned thoroughly with engine or brake cleaner, and then cleaned area must be dried completely.
- Seal the open lines and connections immediately with clean plugs, for example, from the engine bung set VAS 6122.
- Place removed parts on a clean surface and cover them with lint-free cloths.
- Carefully cover over opened components or seal, if repairs are not performed immediately.
- Only install clean components: Only unpack replacement parts immediately prior to installation. Do not use parts that have been stored out of their original packaging (for example in tool boxes etc.).
- If system is open, do not work with compressed air and do not move the vehicle.
- Protect disconnected electrical connectors from dirt and moisture and only connect if dry.

ENGINE NUMBER

Engine number ("engine code" and "serial number") us located at front near crankshaft ribbed belt pulley - arrow-.

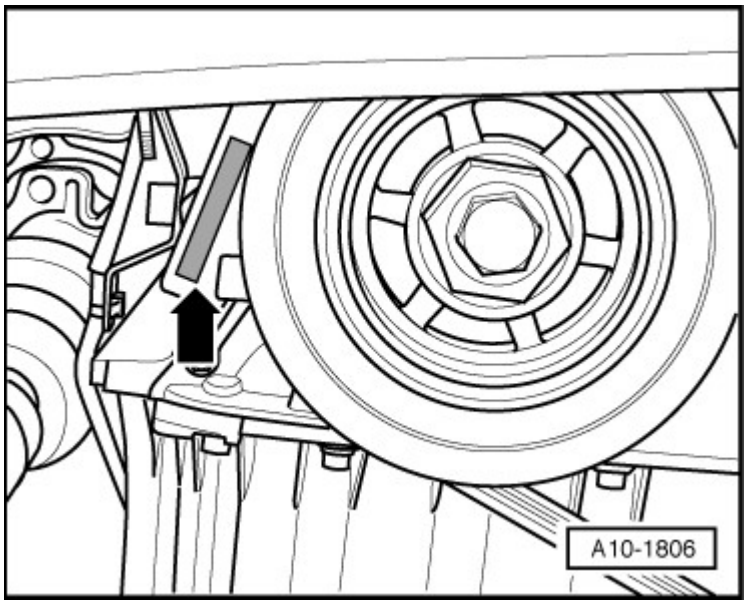

Fig. 9: Locating Engine Number
Courtesy of AUDI OF AMERICA, LLC

In addition, a sticker with "engine code" and "serial number" is affixed to cylinder head cover.

Engine codes beginning with "C" are four-digit.

The first 3 digits of the engine code stand for displacement and the mechanical structure of the engine. They are stamped in the cylinder block, including the serial number.

The fourth digit describes the engine output and torque and depends on the engine control module.

NOTE: **Engine code is also stamped on right engine lifting eye.**

The 3-digit engine code is on the type plate.

The 4-digit engine code is on the type plate, vehicle data label and engine control module.

Locations of the type plate and vehicle data label. Refer to => 808Service Procedures.

ENGINE CONTAMINANTS

- To prevent foreign objects from entering when working on the engine, seal open intake and exhaust channels with suitable plugs, for example from the engine bung set VAS 6122.
- If mechanical damage to a cylinder bank is found, check the intake and exhaust tract and the combustion chambers in the opposite cylinder back for foreign objects to prevent further damage.

CONTACT CORROSION!

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

For this reason, only install connecting elements that are treated with a special coating.

Also, rubber or plastic parts and adhesive consist of non-conductive materials.

If there are doubts about the suitability of parts, generally use new parts.

NOTE:

- **Only original replacement parts are recommended, they are checked and compatible with aluminum.**
- **Audi accessories are recommended.**
- **Damage due to contact corrosion is not covered by warranty.**

LINES, ROUTING AND SECURING

- Mark the individual fuel, hydraulic and vacuum lines for the EVAP canister system as well as the electrical wires before disconnecting and/or removing them. This will prevent a mix-up when reconnecting them. If necessary, draw sketches or take pictures.

- Due to the limited space inside the engine compartment, be especially careful when working near moving or hot parts. This will also prevent damaging the lines.

COOLERS, CONDENSERS AND CHARGE AIR COOLERS, INSTALLING

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

SPECIFICATIONS

ENGINE DATA

Code letters		BUB	CBRA
Displacement	liter	3.189	3.189
Output	kW at RPM	184/6300	184/6300
Torque	Nm at RPM	320/2500 to 3000	320/2500 to 3000
Bore	dia. mm	84	84
Stroke	mm	95.9	95.9
Compression ratio		10.85	10.85
RON	at least	98 1)	98 1)
Fuel injection and ignition system		Motronic	Motronic
Ignition sequence		1-5-3-6-2-4	1-5-3-6-2-4
Emissions values		EU4	LEV2
Exhaust gas recirculation		no	no
Turbocharger		no	no
Oxygen sensor regulation		4 sensors	4 sensors
Variable valve timing		yes	yes
Variable intake manifold		yes	yes
Secondary Air Injection System		yes	yes
Valve per cylinder		4	4

- 1) Super unleaded RON 95 is permissible, although with reduced power.

DIAGNOSIS AND TESTING

FUEL SYSTEM, CHECKING FOR LEAKS

-- Let the engine run a few minutes at a moderate speed.

-- Switch off ignition.

-- Check the entire fuel system for leaks.

-- If there are leaks in spite of correct tightening specifications, the corresponding component must be replaced.

-- Then perform a road test and depress the accelerator pedal all the way at least one time.

-- Then check the high pressure area again for leaks.

VACUUM SYSTEM, CHECKING

Special tools and workshop equipment required

- Hand Vacuum Pump VAS 6213

Procedure

-- Check all vacuum lines in the vacuum system for:

- Cracks
- Damage caused by animals
- Crimps
- Leaks and leakage

-- Check the vacuum line leading to and from the solenoid valve.

-- If there is a fault, check the vacuum lines for the named component, but also all the vacuum lines.

-- If using the VAS 6213 does not produce any pressure or if the pressure drops again right away, then check the hand vacuum pump and the connection hoses for leaks.

SPECIAL TOOLS

Special tools and workshop equipment required

- Hand Vacuum Pump VAS 6213

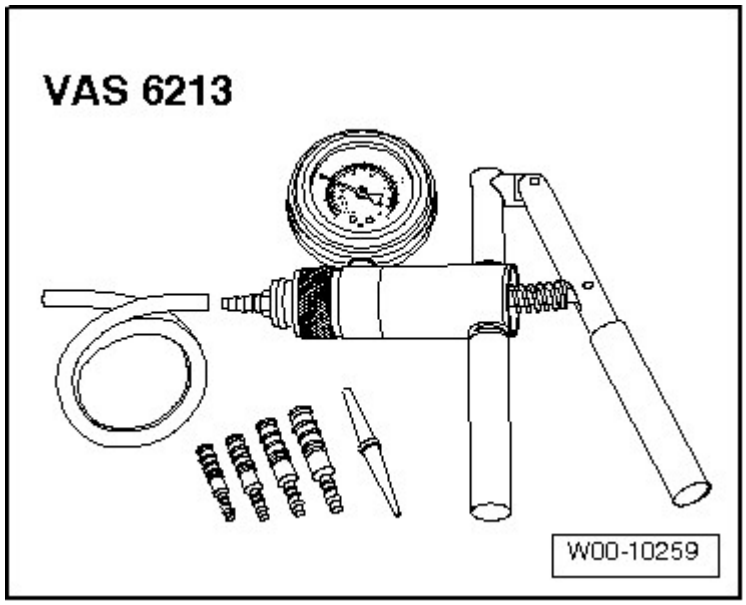

Fig. 10: Hand Vacuum Pump VAS 6213
Courtesy of AUDI OF AMERICA, LLC

ENGINE

3.2 Liter - Crankshaft, Cylinder Block - Engine Code(s): BUB & CBRA

13 CRANKSHAFT, CYLINDER BLOCK

DESCRIPTION AND OPERATION

RIBBED BELT DRIVE COMPONENT OVERVIEW

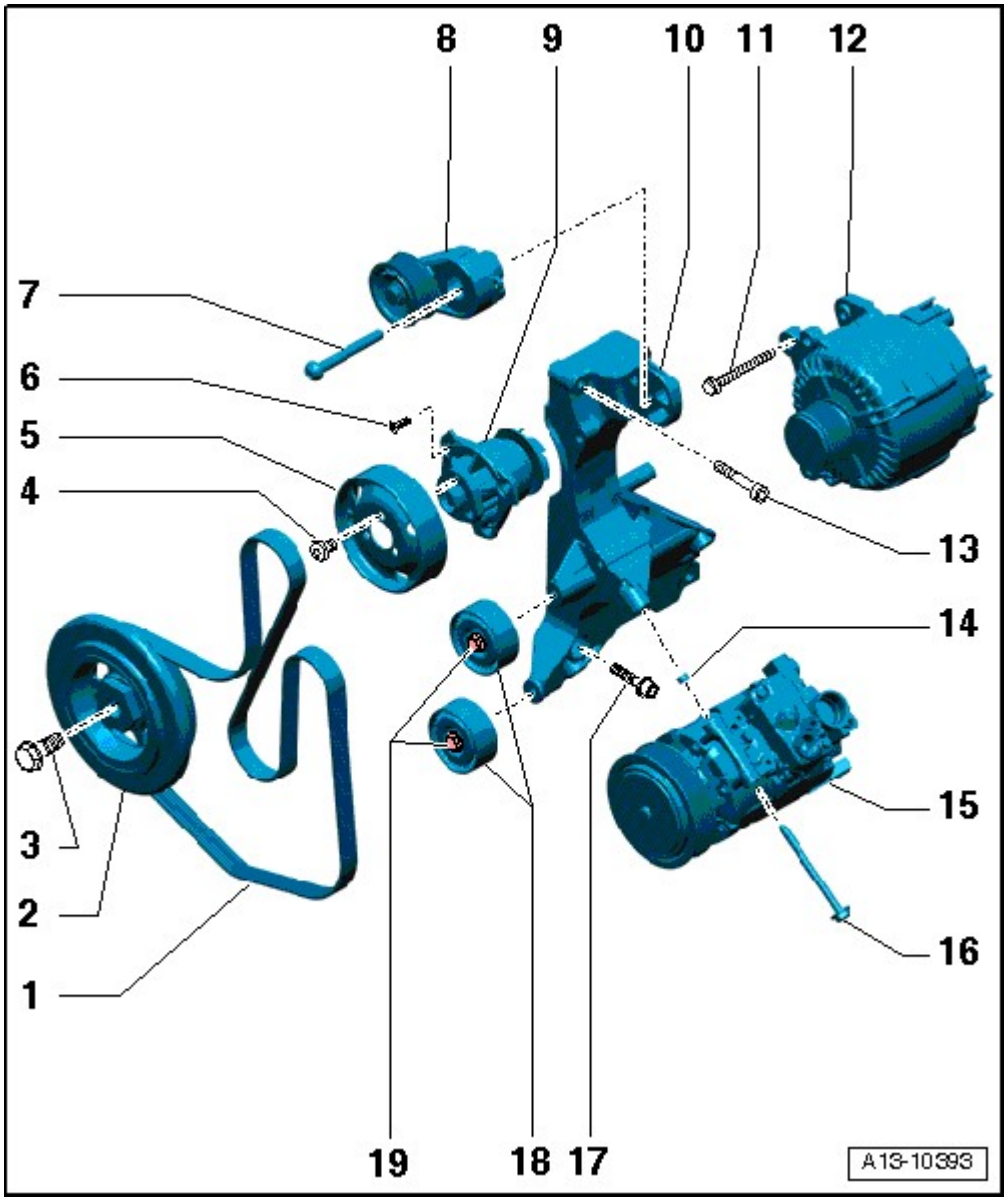

Fig. 1: Ribbed Belt Drive, Component Overview
Courtesy of AUDI OF AMERICA, LLC

1. Ribbed Belt

- Check for wear
- Do not kink
- Before removing, mark direction of rotation using chalk or felt-tip marker. Reversing the running direction on a used belt can destroy it.
- Removal and installation, refer to **RIBBED BELT**
- When installing, make sure it is seated correctly on the pulleys

2. Vibration Damper
   - With ribbed belt pulley
   - Removal and installation, refer to **VIBRATION DAMPER**
3. Bolt
   - Replace
   - 100 Nm plus an additional 180° turn
   - Use counter-holder tool T10069 to loosen and tighten
4. Bolt
   - 20 Nm
5. Ribbed Belt Pulley for Coolant Pump
6. 8 Nm
7. Bolt
   - 50 Nm
8. Tensioning Device for Ribbed Belt
   - To release tension on ribbed belt, swing using open-end wrench.
   - Secure with mandrel T10060 A
   - Removal and installation, refer to **RIBBED BELT TENSIONER**
9. Coolant Pump
   - Removal and installation, refer to **COOLANT PUMP**
10. Bracket for Assemblies
    - Removal and installation, refer to **ACCESSORY ASSEMBLY BRACKET**
11. Bolt
    - 23 Nm
12. Generator
    - Removal and installation, refer to, refer to **REMOVAL AND INSTALLATION**
13. Bolt
    - 3 pieces
    - Tightening specifications and tightening sequence, refer to **Fig. 2**
14. A/C Compressor Fitting Sleeve
15. A/C Compressor
    - Do not remove or disconnect refrigerant lines
    - Removal and installation, refer to **Removal and Installation**

16. 25 Nm
17. Fitting Bolt
    - 2 pieces
    - Tightening specifications and tightening sequence, refer to **Fig. 2**
18. Idler roller
19. Bolt
    - 40 Nm

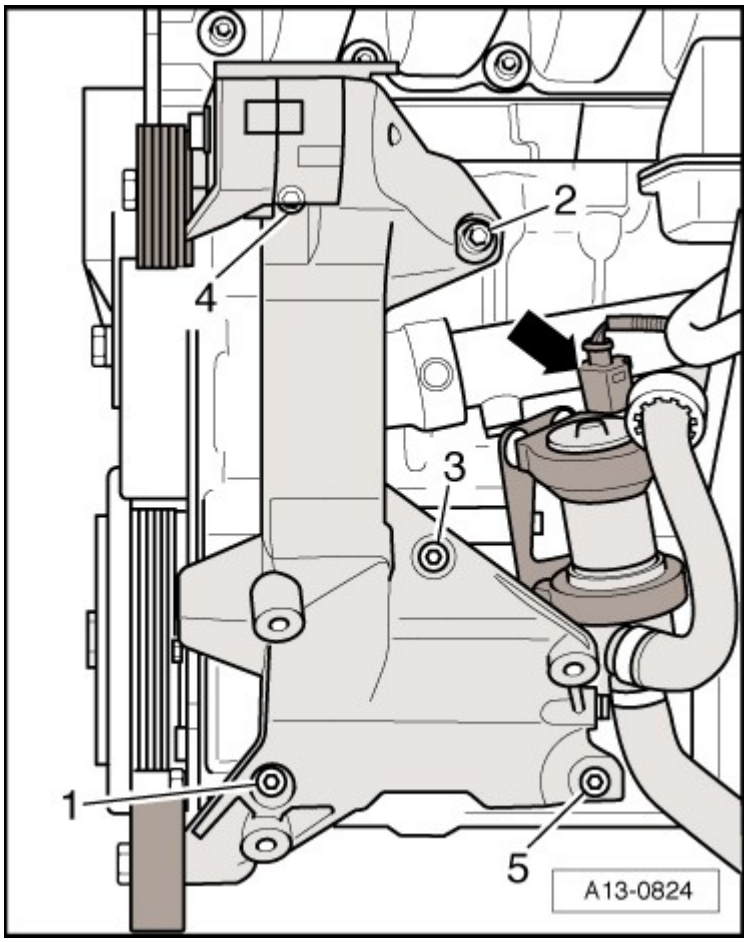

Fig. 2: Accessory Assembly Bracket Bolts & After-Run Coolant Pump V51 Electrical Harness Connector
Courtesy of AUDI OF AMERICA, LLC

-- Tighten bolts in 2 stages in -1 to 5- sequence as follows:

-- Tighten bolts by hand.-- Tighten the bolts to 23 Nm.

DUAL-MASS FLYWHEEL COMPONENT OVERVIEW

NOTE: When working on the engine, secure the engine to the engine and transmission support. Refer to ENGINE, SECURING TO ENGINE AND TRANSMISSION

HOLDER .

NOTE: Items -4 through 23-, refer to TIMING CHAIN COVERS ASSEMBLY OVERVIEW .

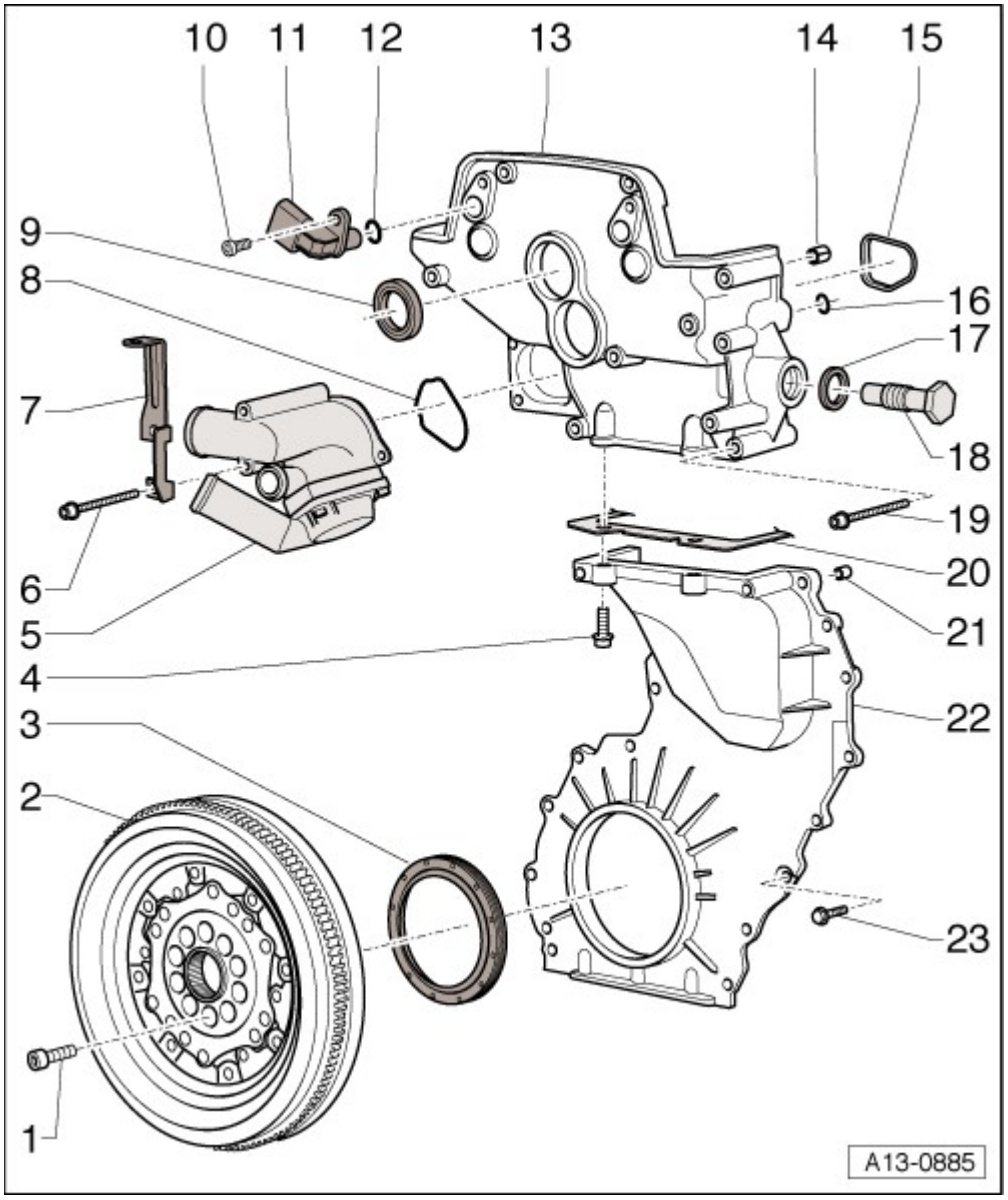

Fig. 3: Timing Chain Covers & Dual Mass Flywheel, Assembly Overview
Courtesy of AUDI OF AMERICA, LLC

1. 60 Nm plus an additional 90° turn
   - Replace
2. Dual Mass Flywheel
   - Removal and installation, refer to **DUAL MASS FLYWHEEL**
3. Seal

- Replacing, refer to **CRANKSHAFT SEAL, REPLACING**.

CRANKSHAFT COMPONENT OVERVIEW

NOTE: **When working on the engine, secure the engine to the engine and transmission support. Refer to ENGINE, SECURING TO ENGINE AND TRANSMISSION HOLDER .**

If a large amount of metal shavings or particles were found when performing engine repairs, these could indicate crankshaft or rod bearings are damaged. To prevent further damage, the following steps must be carried out after the repair: Oil channels must be cleaned carefully; replace oil spray jets, oil cooler and oil filter.

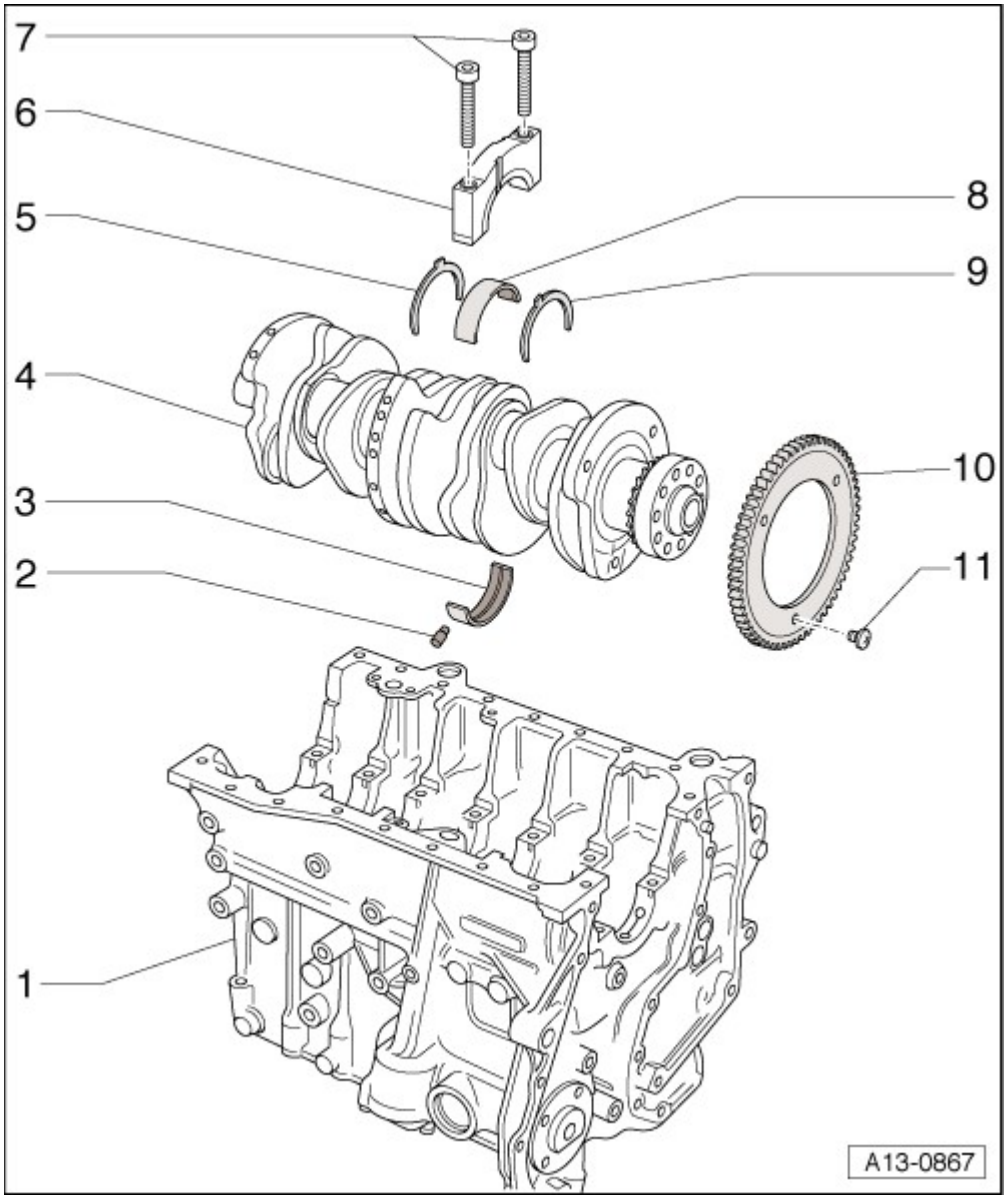

Fig. 4: Crankshaft, Component Overview
Courtesy of AUDI OF AMERICA, LLC

1. Cylinder block
   - Cylinder bore, checking, refer to **Fig. 11**
   - Piston and cylinder dimensions, refer to **PISTON AND CYLINDER DIMENSIONS**
2. Oil Spray Jet for Piston Cooling
   - For crankshaft bearing 2 to 7
   - Opening pressure 2.0 bar pressure
   - Removal and installation, refer to **Fig. 6**
3. Bearing Shell
   - For cylinder block with oil inlet bore
   - Do not interchange used bearing shells (mark)
   - Replacement parts are only color coded "yellow"
4. Crankshaft
   - After removal, lay aside so that sensor wheel item -10- is not rested on and becomes damaged
   - Axial play new: 0.07 to 0.23 mm; wear limit: 0.30 mm
   - Measure radial clearance with Plastigage
   - Do not turn crankshaft when measuring radial play
   - Radial clearance, new: 0.02 to 0.06 mm; wear limit: 0.10 mm
   - Crankshaft dimensions, refer to **CRANKSHAFT DIMENSIONS**
   - Timing chain wheel built into crankshaft
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 plus an additional 180° ($^{1}/_{2}$ turn)
   - Replace
8. Bearing Shell
   - For bearing cap without oil groove
   - Do not interchange used bearing shells (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 (RPM) Sensor -G28-
    - Replace sensor wheel every time bolts are loosened
    - Installing, refer to **Fig. 5**
11. 10 Nm plus an additional 90° ($^{1}/_{4}$ turn)
    - Replace
    - Replace sensor wheel every time bolts are loosened, refer to **Fig. 5**

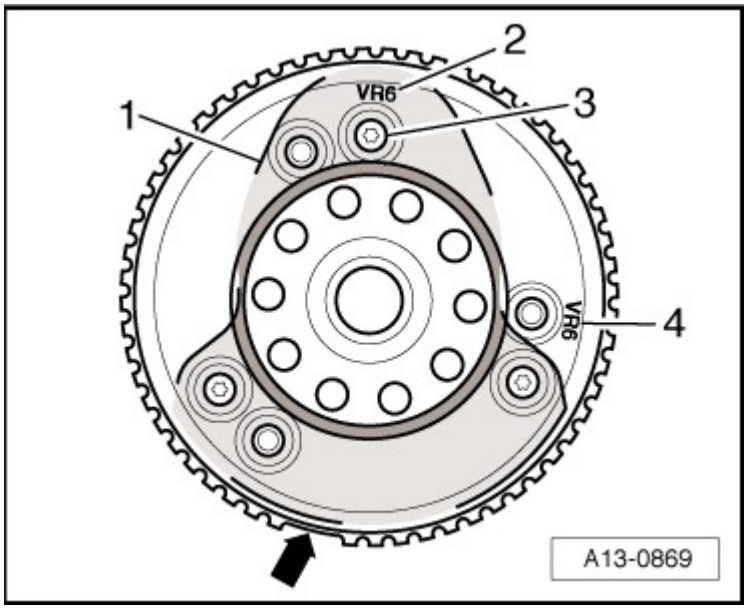

Fig. 5: Identifying "VR6" Marking Positioned At Bore Of Bolt That Goes Into Crankshaft Crankpin
Courtesy of AUDI OF AMERICA, LLC

-- Replace bolts and sensor wheel every time bolts are loosened.

-- Clean the contact surface of the crankshaft/sensor wheel; must be free of oil and grease.

-- Lightly coat the contact surface of the crankshaft/sensor wheel with locking adhesive; Locking adhesive.

Installation position:

- The mark "VR6" -2- must be positioned at the bore of bolt -3-, that goes into the crank pin of the crankshaft (the contour of the crankshaft is shown by the dashed line -1-).
- The gap -arrow- in the ring gear lies across from the designation.
- The second "VR6" -4- is to be ignored.

-- Lightly fasten all new bolts by hand.

-- Then tighten bolt -3-.

-- Finally tighten both remaining bolts.

Tightening Specifications

Component	Nm
Sensor Wheel to Crankshaft	10 + 90° (1)
(1) 90° corresponds to a 1/4 turn	

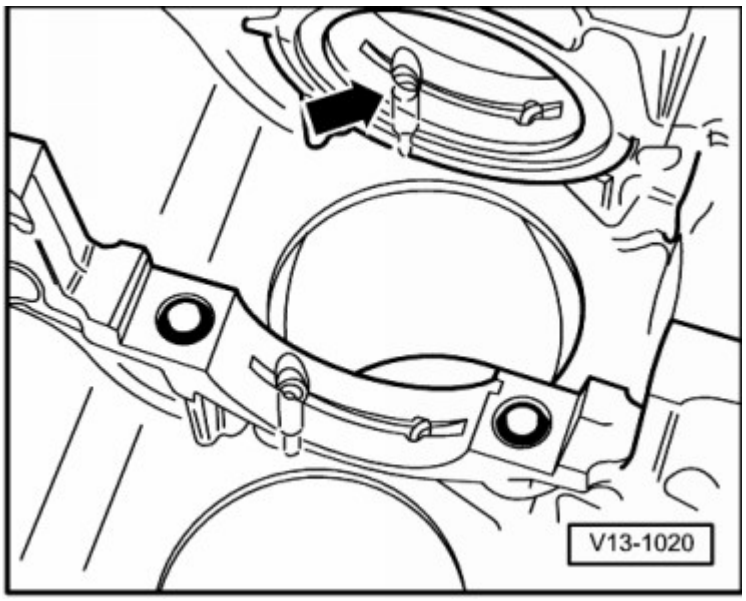

Fig. 6: Identifying Oil Spray Jet Application Area
Courtesy of AUDI OF AMERICA, LLC

PISTON AND CONNECTING ROD COMPONENT OVERVIEW

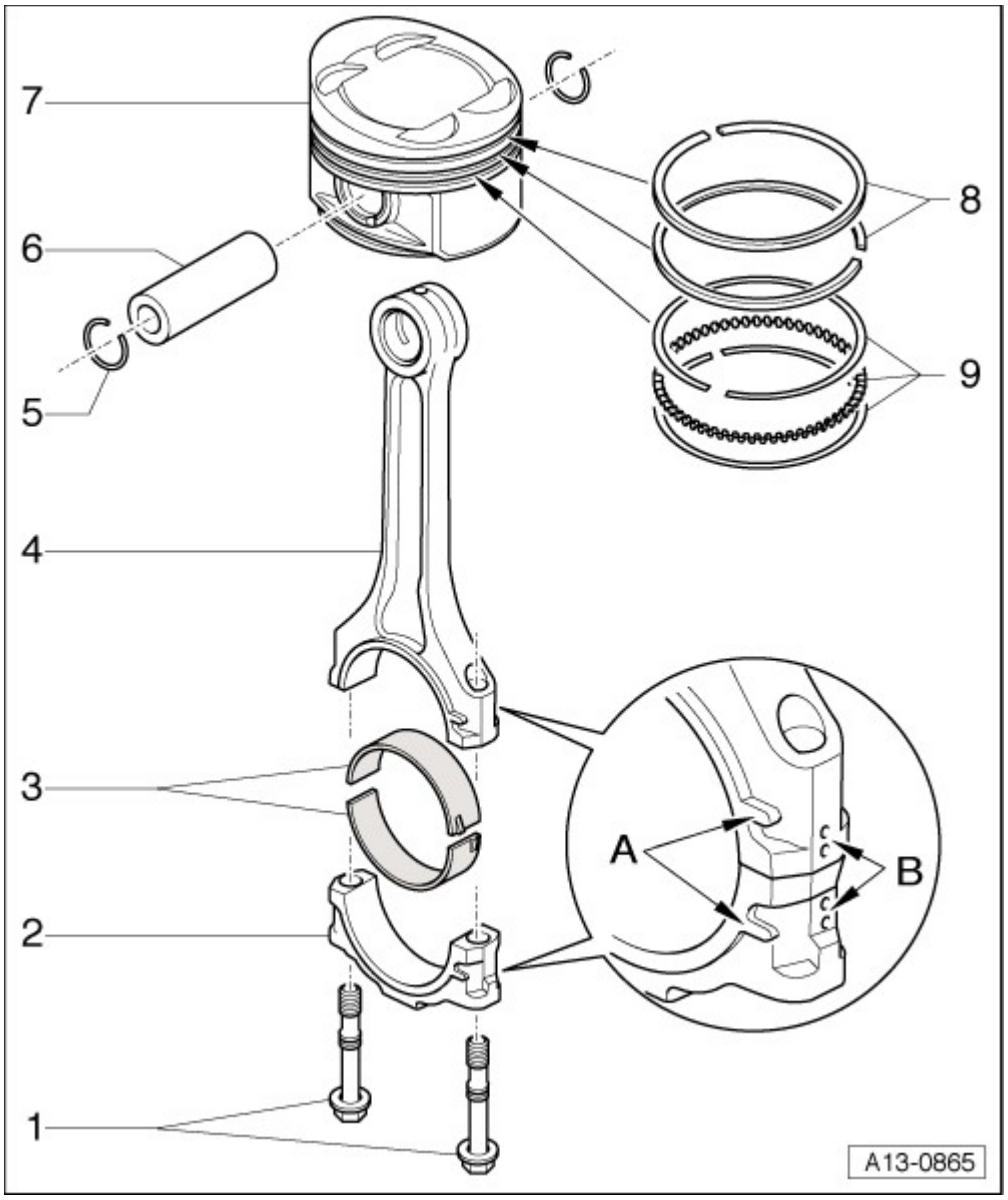

Fig. 7: Piston And Connecting Rod, Component Overview
Courtesy of AUDI OF AMERICA, LLC

1. Connecting rod bolt - 30 Nm plus an additional 90°
   - Replace
   - Lubricate threads and contact surface
   - Use old bolt to measure radial play
   - Tighten to 30 Nm to measure radial play, do not turn further
2. Connecting Rod Bearing Cap
   - Affiliation to the cylinder mark -B-
   - Installation position: Markings -A- must align
3. Bearing Shells

- Do not interchange used bearing shells (mark)
- Bearing shell retaining tabs must be firmly seated in the notches
- Installation position: Retaining tabs of both bearing shells lie on the same side of the connecting rod
- Axial play new: 0.05 to 0.31 mm; wear limit: 0.40 mm
- Measure radial clearance with Plastigage
- Do not turn crankshaft when measuring radial play
- Radial clearance, new: 0.02 to 0.07 mm; wear limit: 0.10 mm
- Replacement parts are color coded "yellow" for lower and "red" for upper

4. Connecting Rod
   - With oil hole for piston pin lubrication
   - Only replace as set
   - Affiliation to the cylinder mark -B-
   - Installation position: Mark -A- faces toward the shallow side of the piston (the shallow side of the piston head faces the cylinder block center)
5. Circlip
6. Piston Pin
   - If tight, heat piston to 60 °C / 140 °F
   - Removing and installing using a drift VW 222 A
7. Piston
   - Checking, refer to **Fig. 10**
   - Mark installed location to connecting rod and affiliation to cylinder
   - Shallow side of piston head faces cylinder block center
   - Piston and cylinder dimensions, refer to **PISTON AND CYLINDER DIMENSIONS**
   - Install using piston insertion funnel T10147, refer to **Fig. 12**
8. Piston Rings
   - Compression rings
   - Offset gaps by 120°
   - Use piston ring pliers for removal and installation
   - Mark "TOP" must face toward piston head
   - Checking ring gap, refer to **Fig. 8**
   - Check piston ring groove clearance, refer to **Fig. 9**
9. Piston Ring
   - Oil scraping ring
   - 3-part
   - Install upper steel ring so gap is offset by 120° to neighboring compression ring
   - Offset all oil scraping ring component gaps to each other

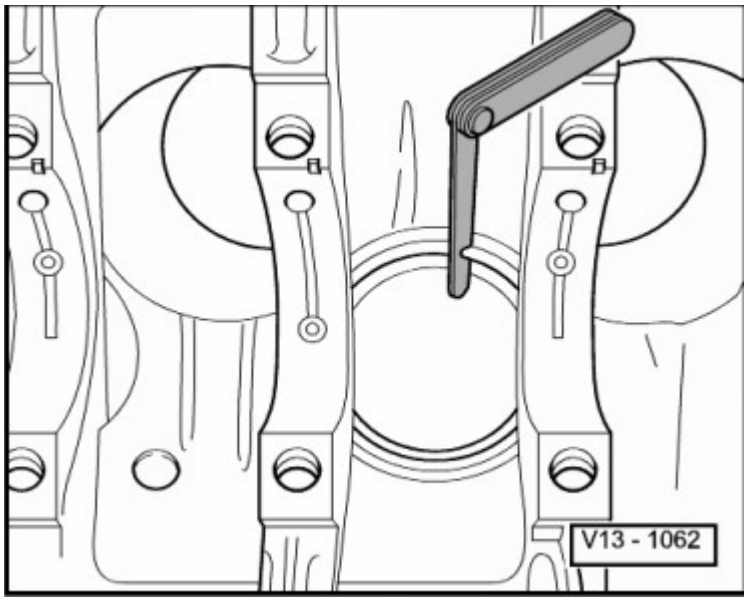

Fig. 8: Checking Piston Ring Gap
Courtesy of AUDI OF AMERICA, LLC

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

-- Use a feeler gauge to measure.

Piston ring (dimensions in mm)	New	Wear limit
Compression ring	0.20 to 0.40	1.00
Tapered ring	0.20 to 0.40	1.00
Oil scraping ring	0.25 to 0.50	1.00

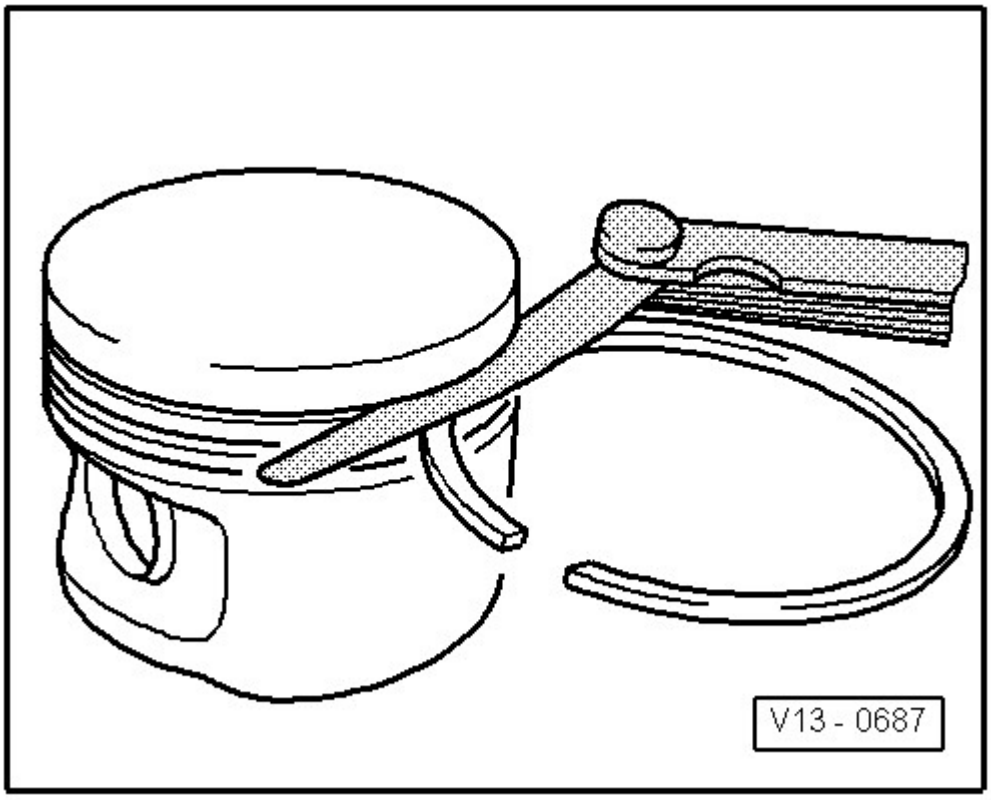

Fig. 9: Checking Piston Ring Gap
Courtesy of AUDI OF AMERICA, LLC

-- Clean the ring groove of piston before checking.

-- Use a feeler gauge to measure.

Piston ring (dimensions in mm)	New	Wear limit
Compression ring	0.04 to 0.09	0.15
Tapered ring	0.03 to 0.06	0.15
Oil scraping ring	0.02 to 0.06	0.15

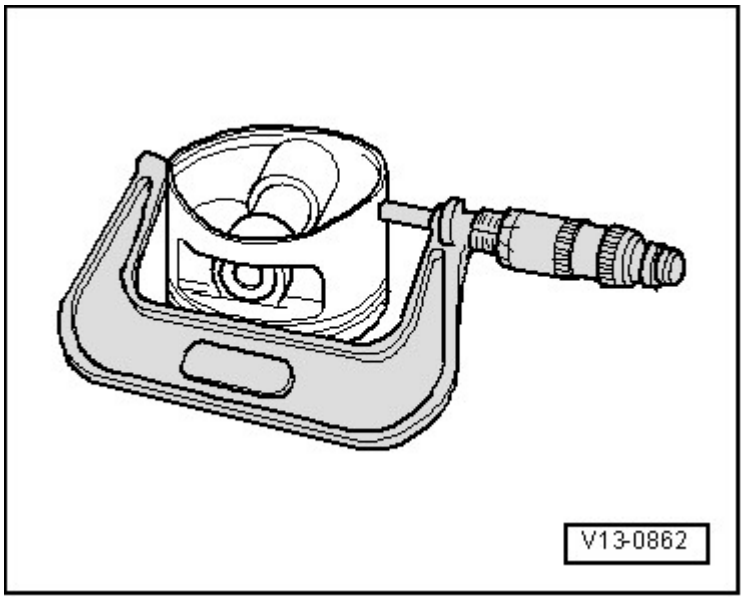

Fig. 10: Checking Piston
Courtesy of AUDI OF AMERICA, LLC

-- Measure pistons approximately 6 mm from bottom edge and at points offset by 90° to piston pin axis.

-- Use external micrometer 75 to 100 mm to measure.

- Maximum deviation from nominal dimension: 0.04 mm.

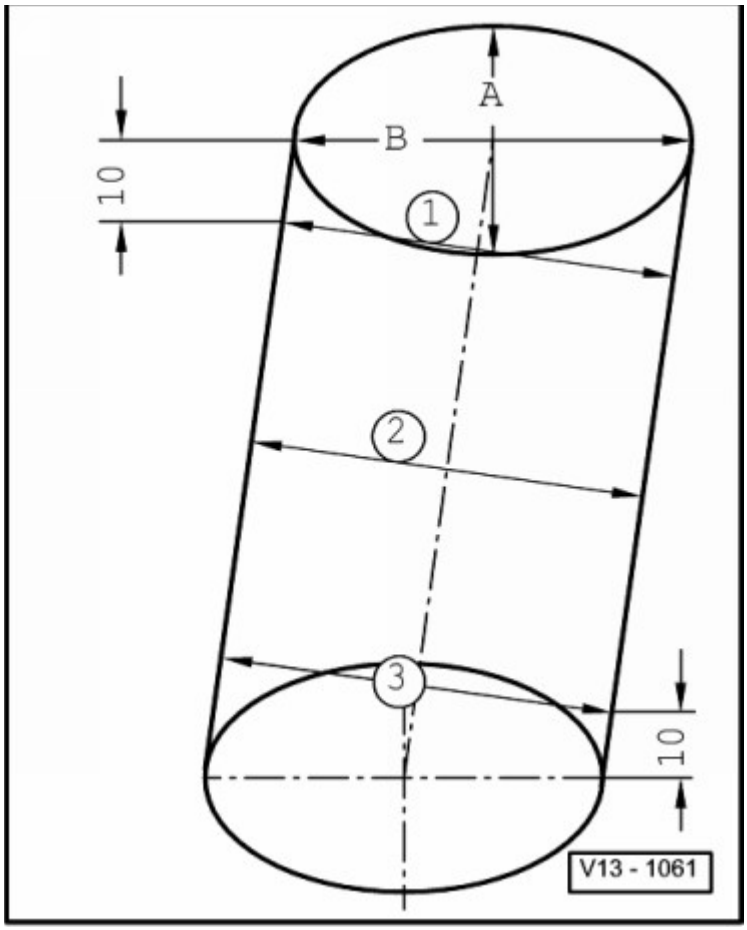

Fig. 11: Checking Cylinder Bore
Courtesy of AUDI OF AMERICA, LLC

-- Measure bores at 3 locations in both directions -A- across engine and -B- in line with crankshaft.

-- Use internal dial gauge 50 to 100 mm to measure.

- Maximum deviation from nominal dimension: 0.08 mm.

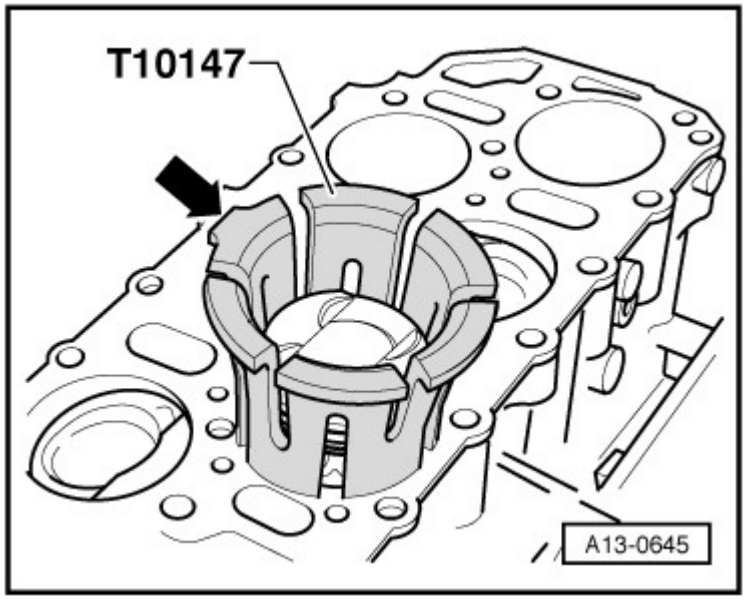

Fig. 12: Installing Piston With Funnel T10147
Courtesy of AUDI OF AMERICA, LLC

NOTE: If a new funnel is used, next guide pistons with oil piston rings through funnel twice and remove resulting metal shavings if necessary. Only then install piston with piston rings.

-- Push piston by hand into oiled piston installation tool.

- Flat side of piston crown must face toward funnel pin -arrow-.

-- Hold funnel (with piston inserted) on upper edge and press piston in with both thumbs.

-- Push piston in until it protrudes approximately 15 mm from lower edge of funnel.

-- Insert piston into appropriate cylinder bore.

- Funnel pin -arrow- must point toward center of cylinder block.

-- Press funnel tightly against cylinder block and push piston in.

SPECIFICATIONS

CRANKSHAFT DIMENSIONS

Reconditioning dimension (dimensions in mm)	Crankshaft bearing pins-diameter	Connecting rod bearing pins-diameter
	59.958 to	53.958 to 53.978

Basic dimension (1)	59.978	

(1) Reworking is not permitted.

PISTON AND CYLINDER DIMENSIONS

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

FASTENER TIGHTENING SPECIFICATIONS

Component	Bolt Size	Nm
A/C Compressor		25
Bearing Cap		30 + 180°[1]
Connecting Rod		30 + 90°[1]
Dual Mass Flywheel		60 + 90°[1]
Generator		23
Idler roller		40
Ribbed Belt Pulley for Coolant Pump		20
Sensor Wheel to Crankshaft		10 + 90°[1]
Tensioning Device for Ribbed Belt		50
Vibration damper		100 + 180°[1]

- [1] Always replace

Accessory assembly bracket tightening sequence

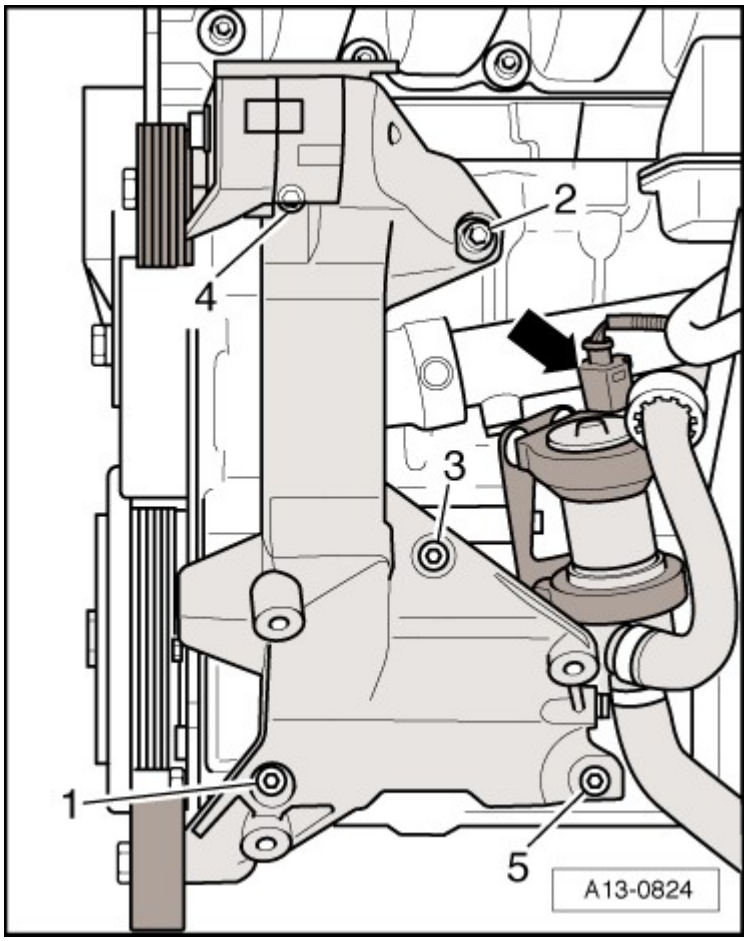

Fig. 13: Accessory Assembly Bracket Bolts & After-Run Coolant Pump V51 Electrical Harness Connector
Courtesy of AUDI OF AMERICA, LLC

-- Tighten bolts in 2 stages in -1 to 5- sequence as follows:

-- Tighten bolts by hand.-- Tighten the bolts to 23 Nm.

REMOVAL AND INSTALLATION

RIBBED BELT

Special tools and workshop equipment required

- Locking Pin T10060 A

Removing

NOTE: Before removing the ribbed belt, mark the turning direction on it with chalk or a felt tip pen. A reversed direction of rotation can cause damage to the belt under operating conditions.

-- Swing tensioning device in direction of -arrow- to relieve tension on the ribbed belt and then lock it in place using the T10060 A.

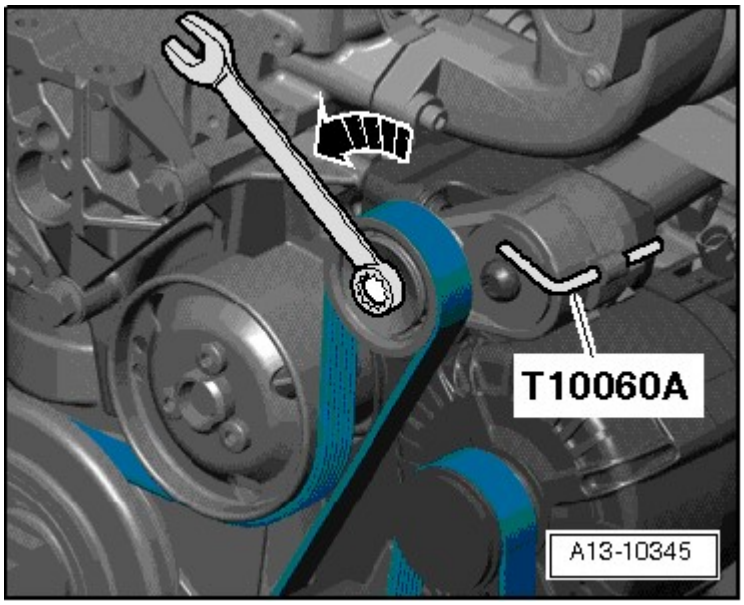

Fig. 14: Relieving Tension On Ribbed Belt
Courtesy of AUDI OF AMERICA, LLC

-- Remove the ribbed belt from the generator belt drive pulley.

-- Remove center noise insulation fasteners -1 to 3-.

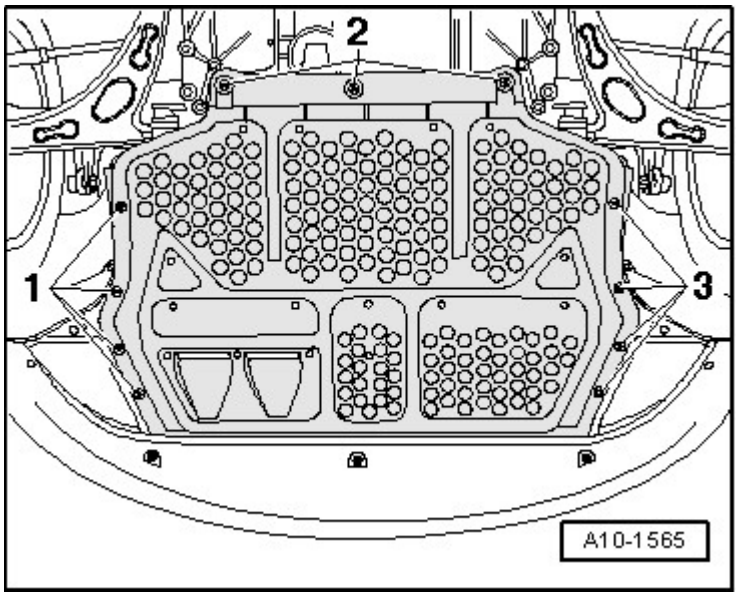

Fig. 15: Center Noise Insulation Bolts
Courtesy of AUDI OF AMERICA, LLC

-- Remove right noise insulation fasteners -1 to 3-.

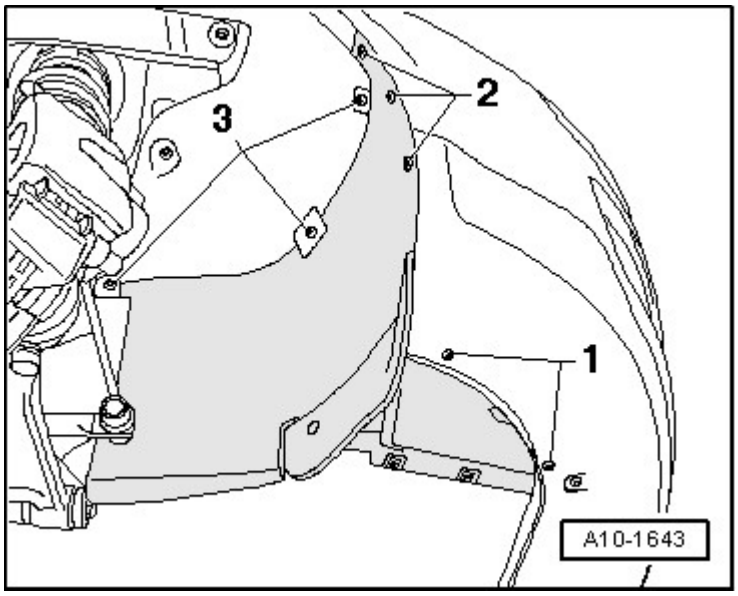

Fig. 16: Identifying Fasteners
Courtesy of AUDI OF AMERICA, LLC

-- Remove ribbed belt from remaining belt pulleys.

Installing

Installation is in reverse order of removal, note the following:

NOTE: All components (generator, A/C compressor) must be installed securely before installing ribbed belt.

-- Route ribbed belt as follows:

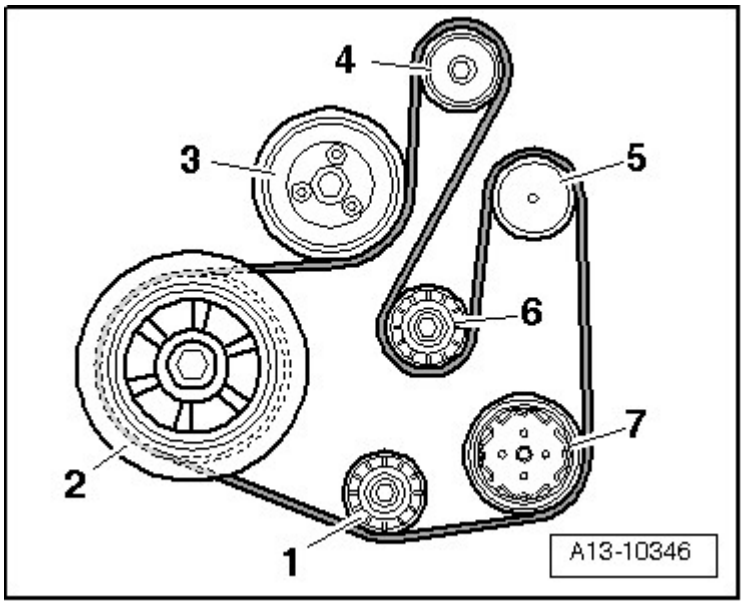

Fig. 17: Ribbed Belt Routing
Courtesy of AUDI OF AMERICA, LLC

1. Idler roller
2. Vibration damper
3. Coolant pump
4. Tensioning roller
5. Generator
6. Idler roller
7. A/C Compressor

-- Hold tensioner with open end wrench, remove T10060 A or angled hex socket head wrench and release tensioner.

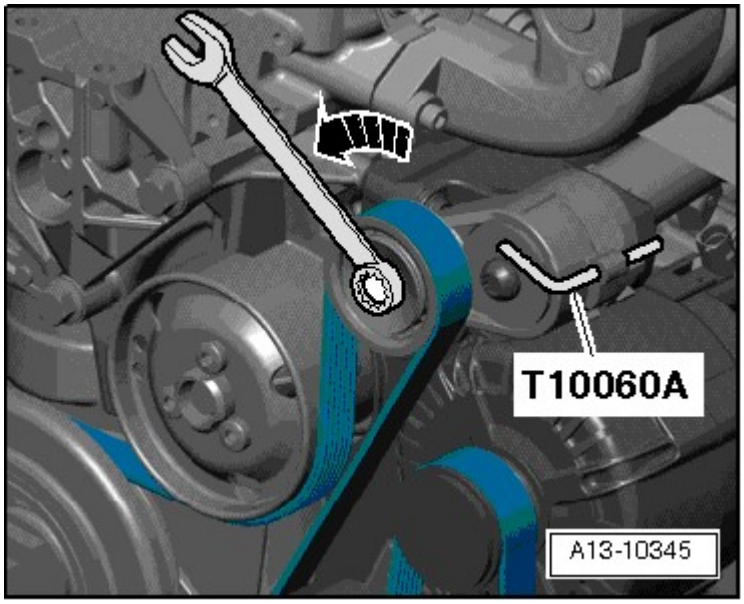

Fig. 18: Relieving Tension On Ribbed Belt
Courtesy of AUDI OF AMERICA, LLC

-- Check ribbed belt for proper seating.

-- Start engine and check belt running.

RIBBED BELT TENSIONER

Removing

NOTE: Before removing the ribbed belt, mark the turning direction on it with chalk or a felt tip pen. A reversed direction of rotation can cause damage to the belt under operating conditions.

-- Swing tensioning device in direction of -arrow- to relieve tension on the ribbed belt and then lock it in place using the T10060 A.

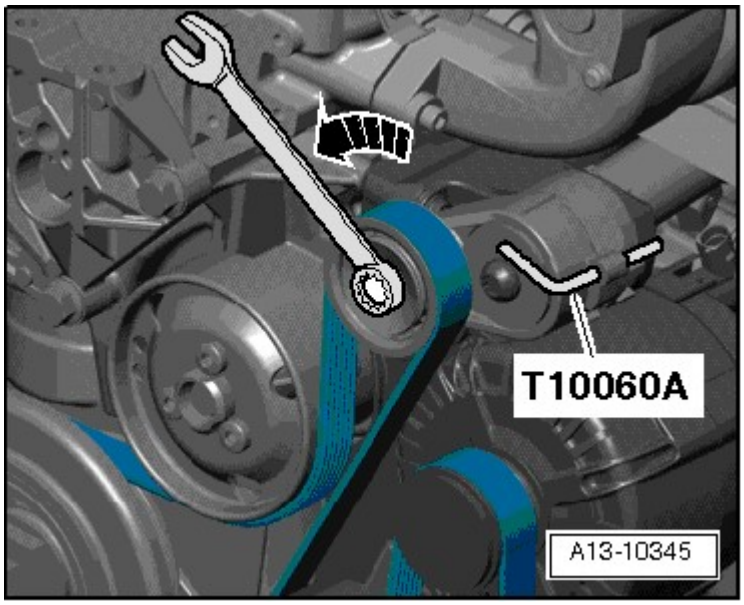

Fig. 19: Relieving Tension On Ribbed Belt
Courtesy of AUDI OF AMERICA, LLC

NOTE: The tensioner is not locked.

-- Remove bolt -arrow- and remove ribbed belt tensioner.

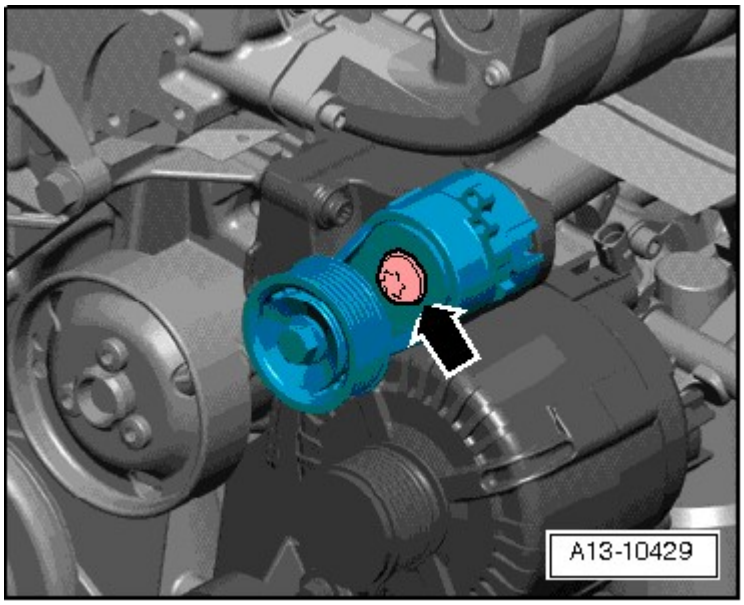

Fig. 20: Ribbed Belt Tensioner Bolt
Courtesy of AUDI OF AMERICA, LLC

Installing

- Tightening specifications, refer to **RIBBED BELT DRIVE COMPONENT OVERVIEW**

Installation is in reverse order of removal, note the following:

-- Install ribbed belt. Refer to **RIBBED BELT**.

ACCESSORY ASSEMBLY BRACKET

Special tools and workshop equipment required

- Locking Pin T10060 A

Removing

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

CAUTION: Observe safety precautions when disconnecting the battery. Refer to REMOVAL AND INSTALLATION .

-- Remove tool formed insert under luggage compartment floor covering.

-- Remove cover -arrow- for battery compartment

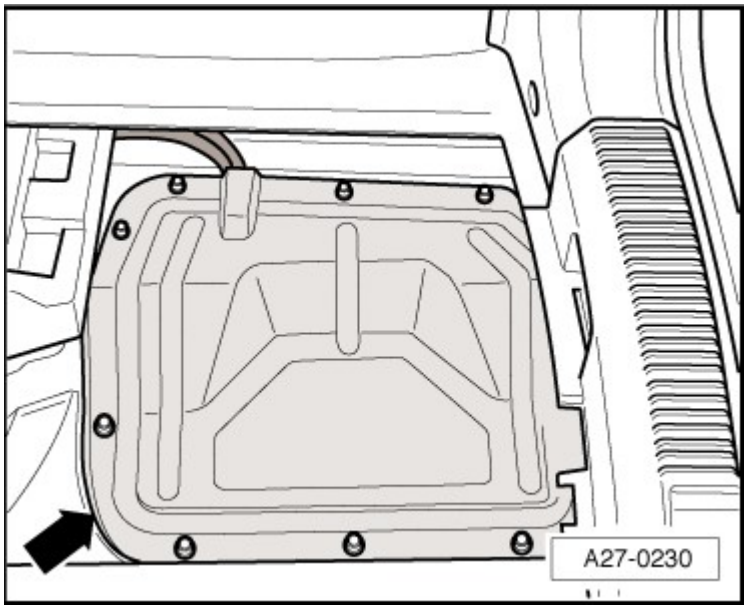

Fig. 21: Battery Compartment Cover
Courtesy of AUDI OF AMERICA, LLC

-- Remove formed insert from over the battery.

-- With ignition switched off, disconnect Battery Ground (GND) cable -arrow-.

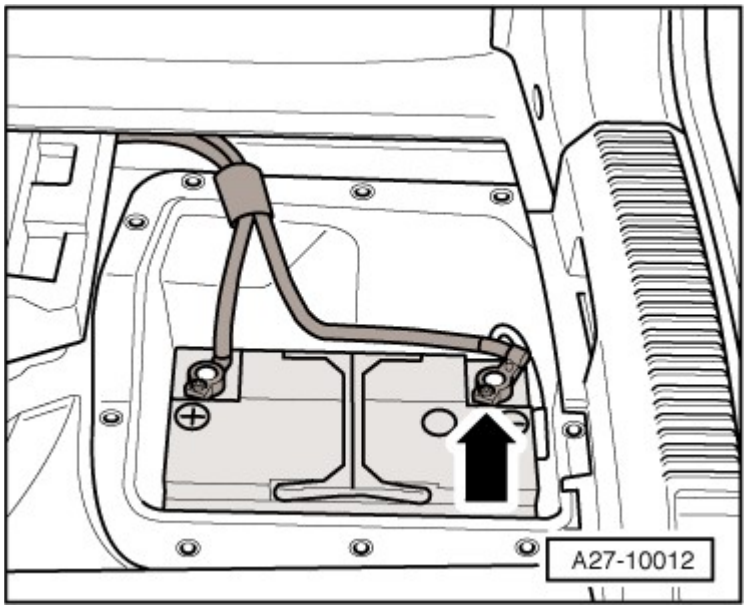

Fig. 22: Battery Ground (GND) Cable
Courtesy of AUDI OF AMERICA, LLC

-- Remove center noise insulation fasteners -1 to 3-.

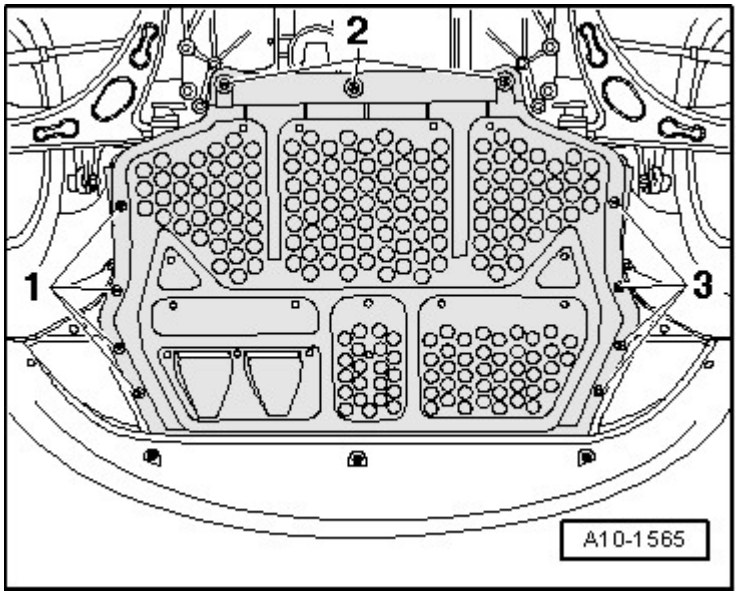

Fig. 23: Center Noise Insulation Bolts
Courtesy of AUDI OF AMERICA, LLC

-- Remove right noise insulation fasteners -1 to 3-.

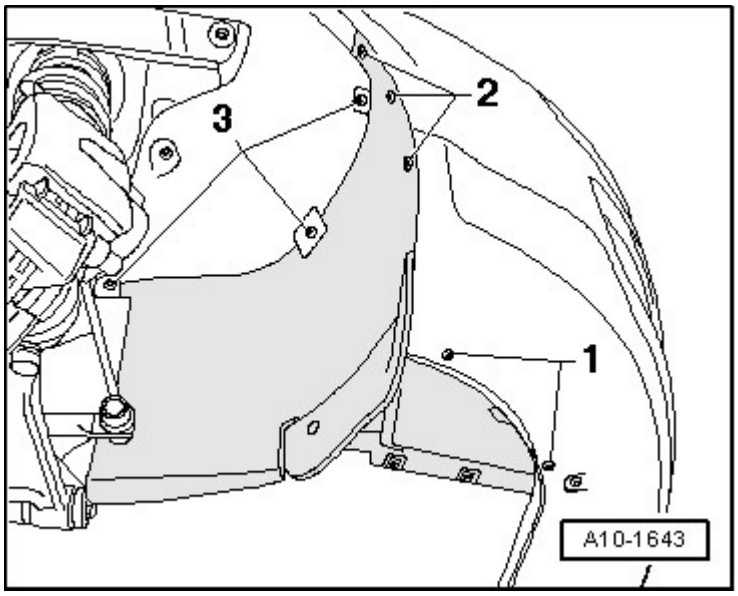

Fig. 24: Identifying Fasteners
Courtesy of AUDI OF AMERICA, LLC

-- Disconnect secondary air hose at position indicated by -arrow-.

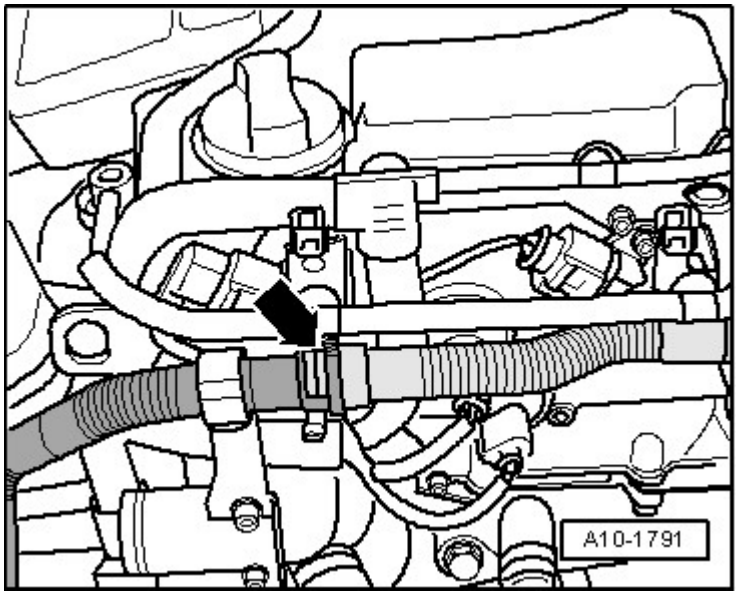

Fig. 25: Disconnecting Secondary Air Hose
Courtesy of AUDI OF AMERICA, LLC

-- Free up air hose to Secondary Air Injection (AIR) pump.

-- Remove top mounting bolts for fan shroud -top arrows-.

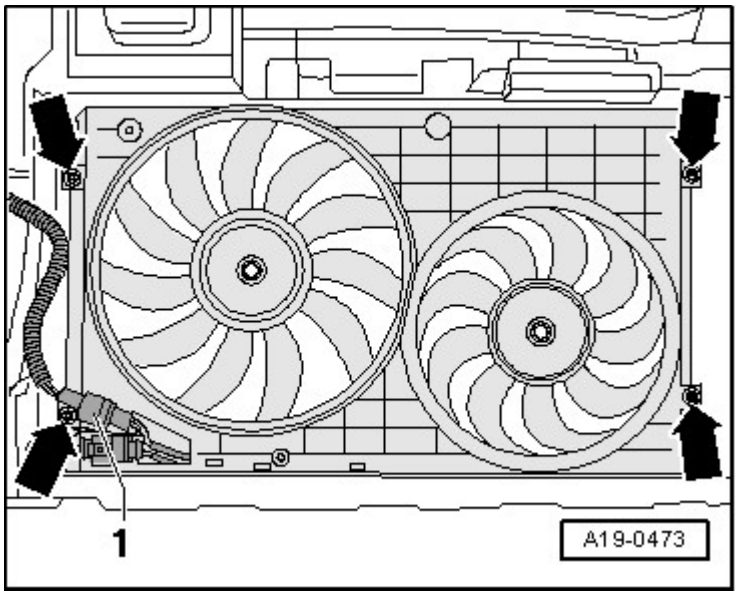

Fig. 26: Coolant Fan Control (FC) Control Module J293
Courtesy of AUDI OF AMERICA, LLC

NOTE: Before removing the ribbed belt, mark the turning direction on it with chalk or a felt tip pen. A reversed direction of rotation can cause damage to the belt under operating conditions.

-- Swing tensioning device in direction of -arrow- to relieve tension on the ribbed belt and then lock it in place using the T10060 A.

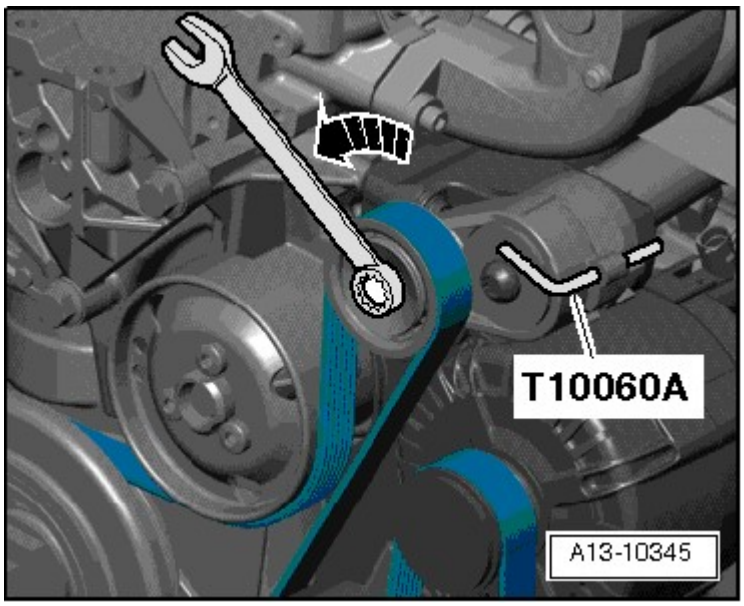

Fig. 27: Relieving Tension On Ribbed Belt
Courtesy of AUDI OF AMERICA, LLC

-- Remove ribbed belt.

-- Free up coolant hose at bottom on fan shroud.

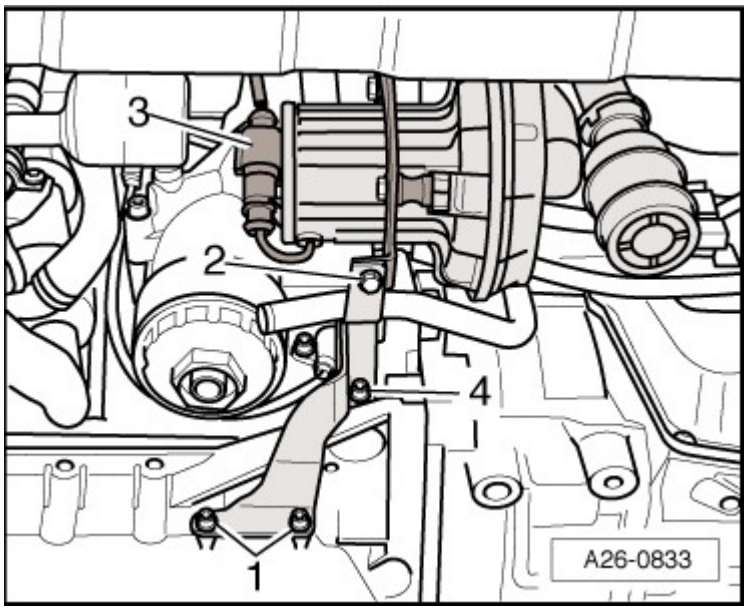

Fig. 28: Identifying Secondary Air Injection (AIR) Pump Motor V101 Electrical Harness Connector
Courtesy of AUDI OF AMERICA, LLC

-- Disconnect electrical connector -3- at secondary air injection (AIR) pump motor -V101- and free up electrical wiring.

-- On vehicles with DSG transmission, remove coolant pipe bracket -2- to transmission oil cooler.

-- Remove bolts -1-.

-- Loosen bolt -4- and remove Secondary Air Injection (AIR) pump with bracket.

-- Disconnect electrical harness connectors -1- for coolant fans at bottom on fan shroud.

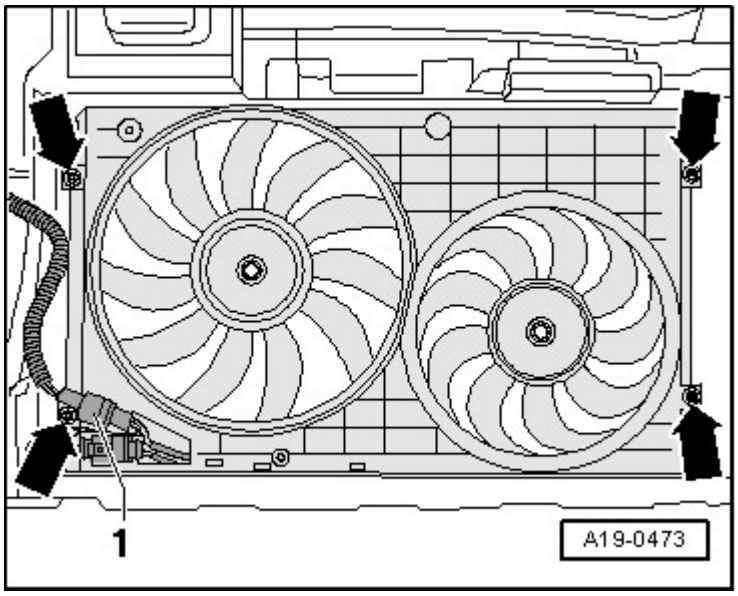

Fig. 29: Coolant Fan Control (FC) Control Module J293
Courtesy of AUDI OF AMERICA, LLC

-- Remove mounting bolts for fan shroud at bottom -bottom arrows-.

-- Pull out fan shroud downward with both fans.

-- Disconnect electrical harness connector -1- for A/C clutch on A/C compressor and free up electrical wire.

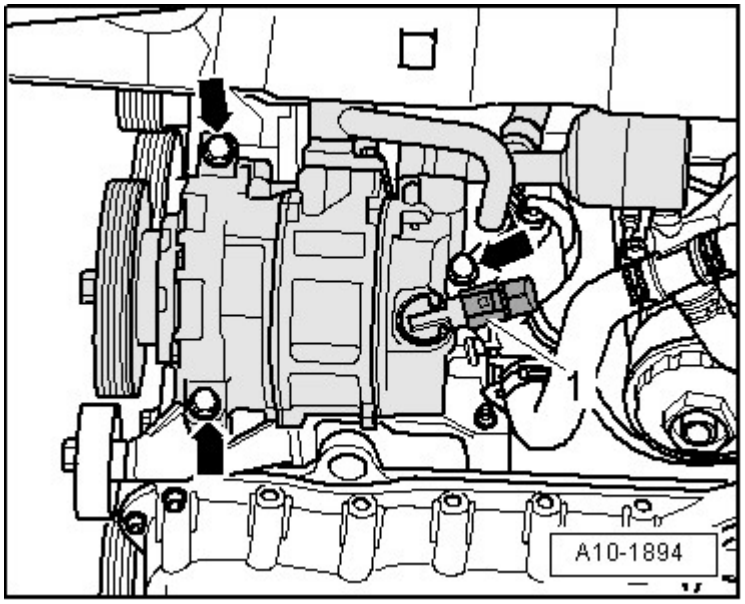

Fig. 30: Electrical Harness Connector For A/C Clutch On A/C Compressor
Courtesy of AUDI OF AMERICA, LLC

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

-- Remove bolts -arrow- for A/C compressor.

-- Securely tie the A/C compressor with connected coolant hoses at front on the longitudinal member.

-- Remove electrical wire -1- on generator.

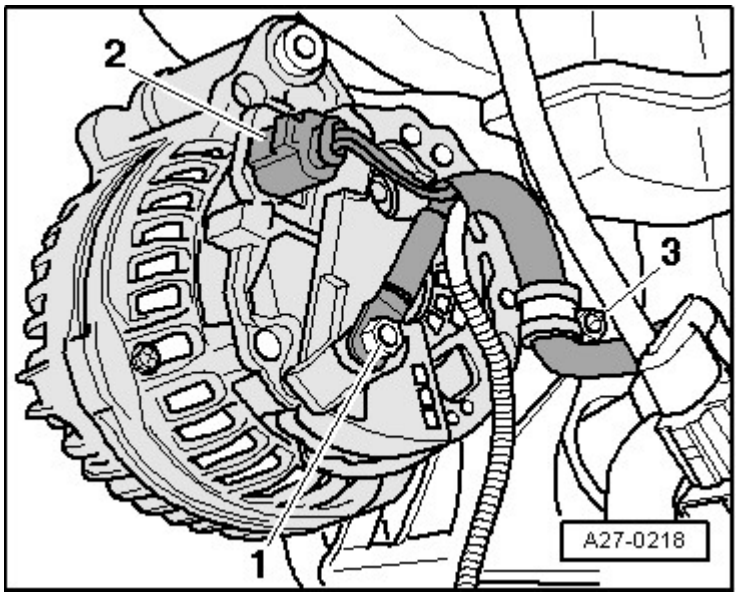

Fig. 31: Identifying Connector, Electrical Wire And Wiring Clamp On Generator
Courtesy of AUDI OF AMERICA, LLC

-- Separate the electrical connector -2-.

NOTE: Ignore -3-.

-- Remove upper idler roller -1-.

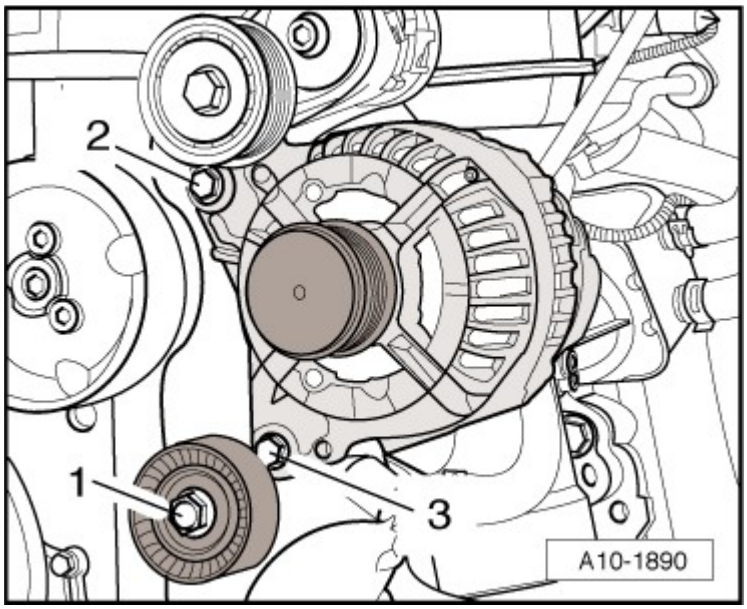

Fig. 32: Identifying Upper Idler Roller And Bolts
Courtesy of AUDI OF AMERICA, LLC

-- Remove mounting bolts -2- and -3- for generator.

NOTE: Generator can be removed from bracket only with the upper mounting bolt still installed.

-- Remove generator from accessory assembly bracket.

-- Remove generator downward and to the left.

-- Disconnect electrical connector -3- at after-run coolant pump -V51- -2- and remove pump with coolant hoses -1- and -4- connected downward from rubber loops on bracket. Spray rubber loops with silicone-free lubricant, if necessary.

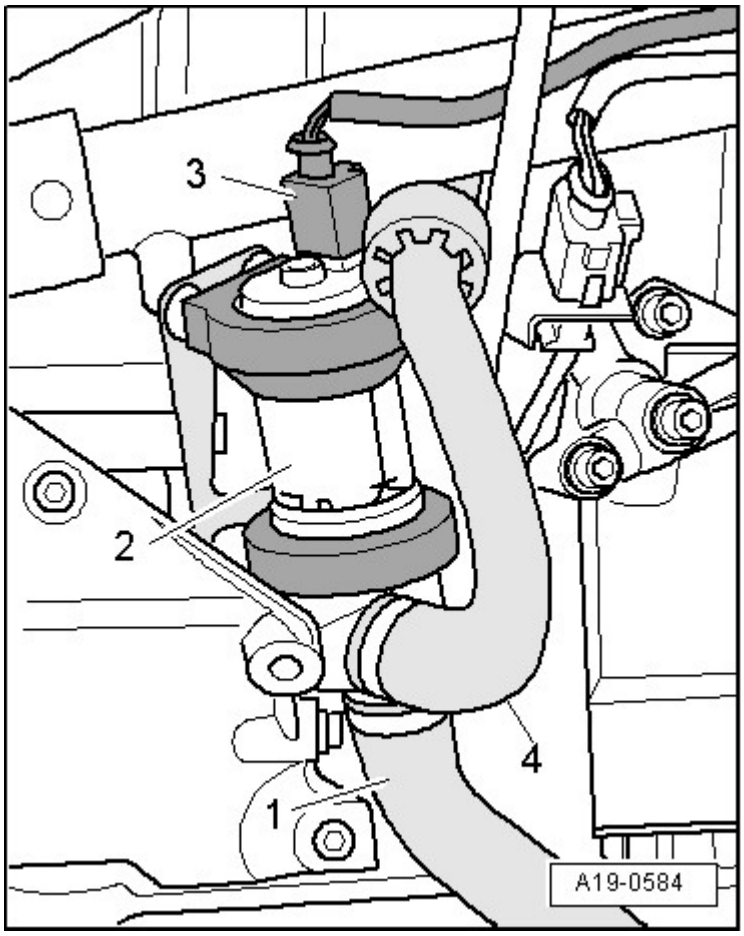

Fig. 33: After-Run Coolant Pump V51, Electrical Connector & Coolant Hoses
Courtesy of AUDI OF AMERICA, LLC

-- Remove bolts -1 to 5- and remove accessory assembly bracket.

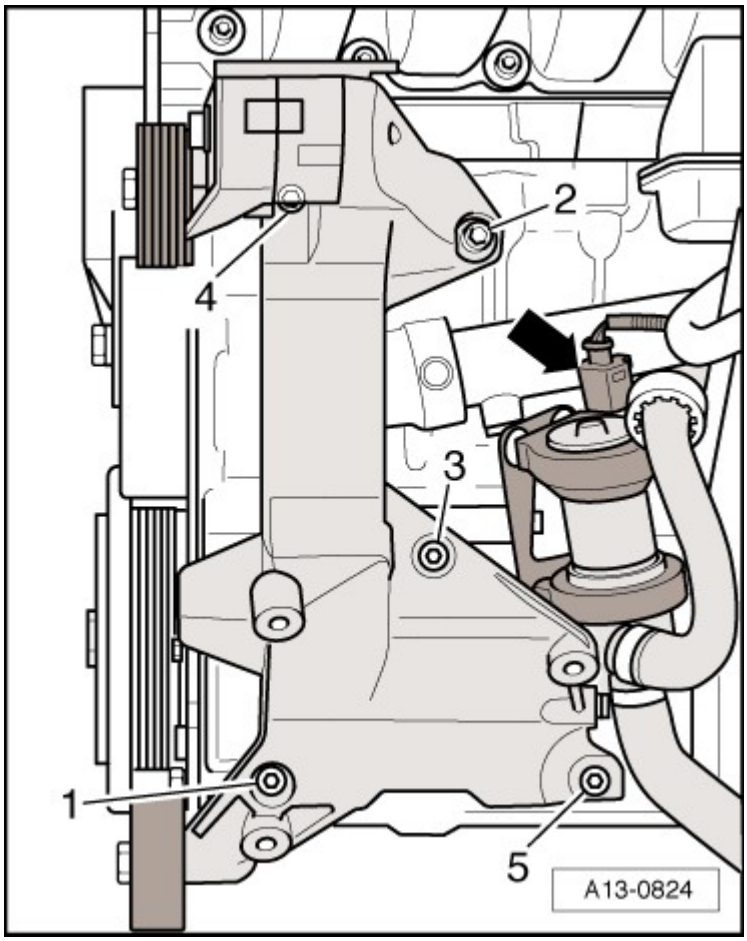

Fig. 34: Accessory Assembly Bracket Bolts & After-Run Coolant Pump V51 Electrical Harness Connector
Courtesy of AUDI OF AMERICA, LLC

NOTE: Disregard -arrow-.

Installing

- Tightening specifications, refer to **RIBBED BELT DRIVE COMPONENT OVERVIEW**

Installation is in reverse order of removal, note the following:

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

-- Next, hand tighten the bolts in sequence -1 to 5-.

-- Then tighten bolts in sequence -1 to 5-.

-- To make it easier to install the generator, drive the bushings for the retaining bolts back slightly.

-- Install generator. Refer to **REMOVAL AND INSTALLATION** .

-- Install A/C compressor. Refer to **Removal and Installation** .

-- Install ribbed belt. Refer to **RIBBED BELT**.

VIBRATION DAMPER

Special tools and workshop equipment required

- Locking Pin T10060 A
- Counter-Holder Tool T10069

Removing

NOTE: Before removing the ribbed belt, mark the turning direction on it with chalk or a felt tip pen. A reversed direction of rotation can cause damage to the belt under operating conditions.

-- Swing tensioning device in direction of -arrow- to relieve tension on the ribbed belt and then lock it in place using the T10060 A.

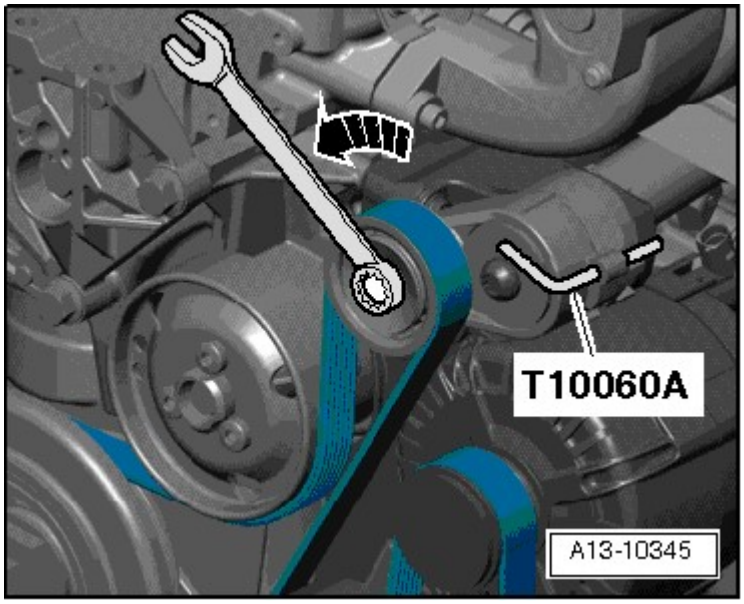

Fig. 35: Relieving Tension On Ribbed Belt
Courtesy of AUDI OF AMERICA, LLC

-- Remove center noise insulation fasteners -1 to 3-.

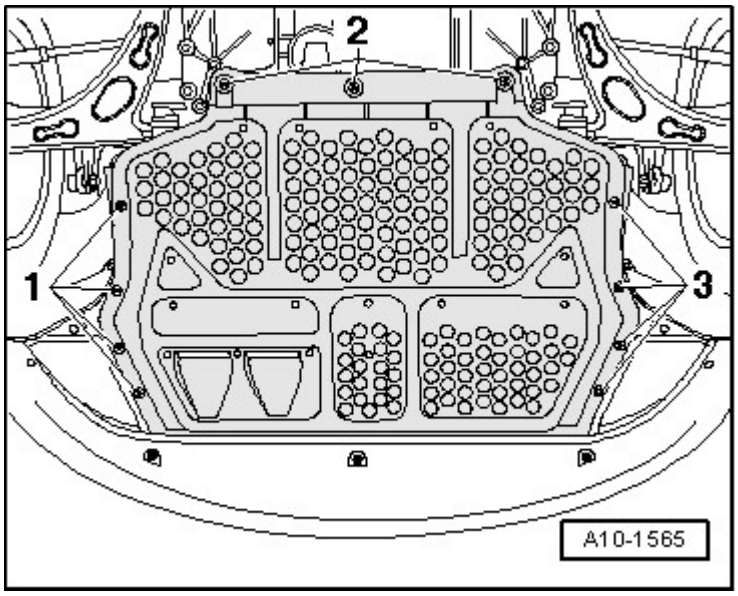

Fig. 36: Center Noise Insulation Bolts
Courtesy of AUDI OF AMERICA, LLC

-- Remove right noise insulation fasteners -1 to 3-.

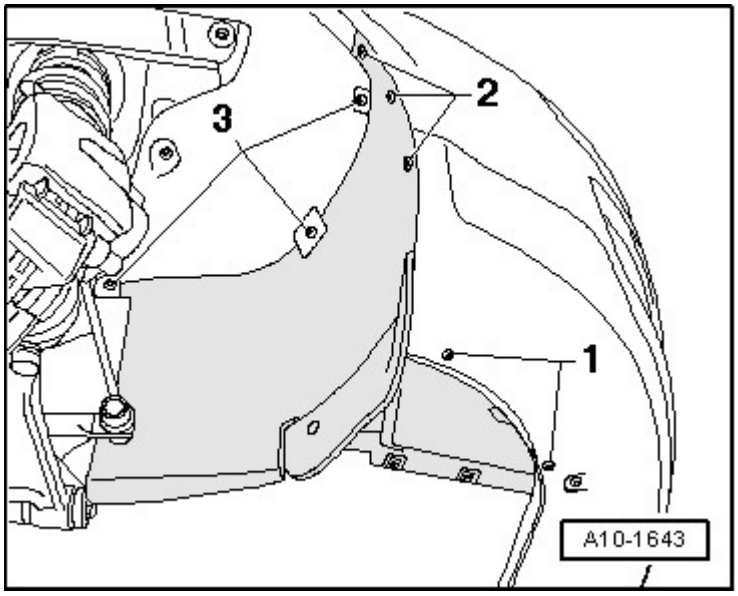

Fig. 37: Identifying Fasteners
Courtesy of AUDI OF AMERICA, LLC

-- Remove the ribbed belt from the vibration damper belt drive pulley.

-- Remove bolt from vibration damper, thereby using T10069 to counter-hold.

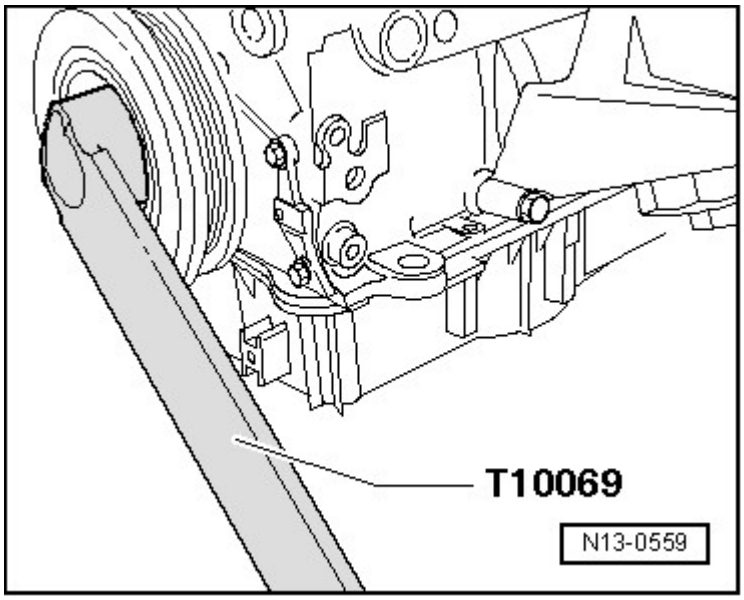

Fig. 38: Counter-Holder T10069 To Hold Vibration Damper
Courtesy of AUDI OF AMERICA, LLC

Installing

- Tightening specifications, refer to **RIBBED BELT DRIVE COMPONENT OVERVIEW**

Installation is in reverse order of removal, note the following:

-- Use new bolt to fasten.

-- To fasten the bolt for vibration damper, counter-hold with T10069.

-- Install ribbed belt. Refer to **RIBBED BELT**.

CRANK SHAFT SEALING RING, BELT PULLEY SIDE, VEHICLES UP TO 11.2004

Special tools and workshop equipment required

- Seal Remover 3203
- Seal Installer 3266
- Assembly Tool T10053
- Locking Pin T10060 A
- Counter-Holder Tool T10069

Procedure

NOTE: Before removing the ribbed belt, mark the turning direction on it with chalk or a felt tip pen. A reversed direction of rotation can cause damage to the belt under

operating conditions.

-- Swing tensioning device in direction of -arrow- to relieve tension on the ribbed belt and then lock it in place using the T10060 A.

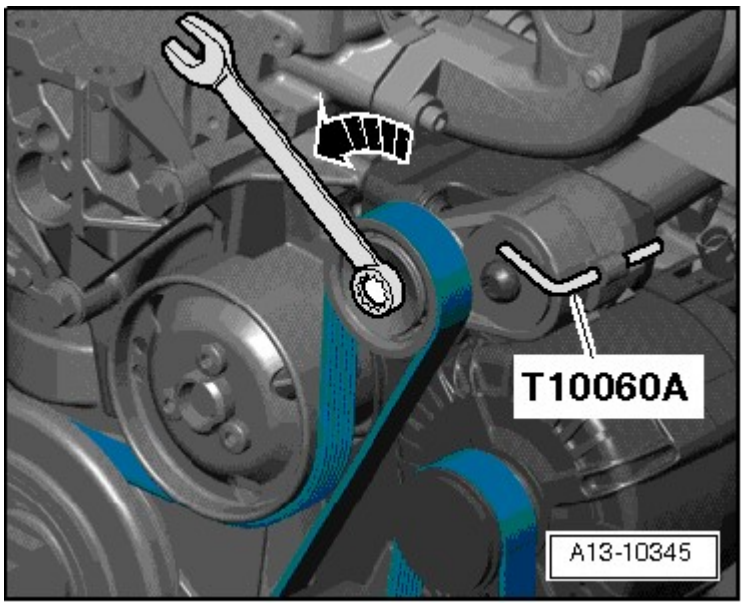

Fig. 39: Relieving Tension On Ribbed Belt
Courtesy of AUDI OF AMERICA, LLC

-- Remove center noise insulation fasteners -1 to 3-.

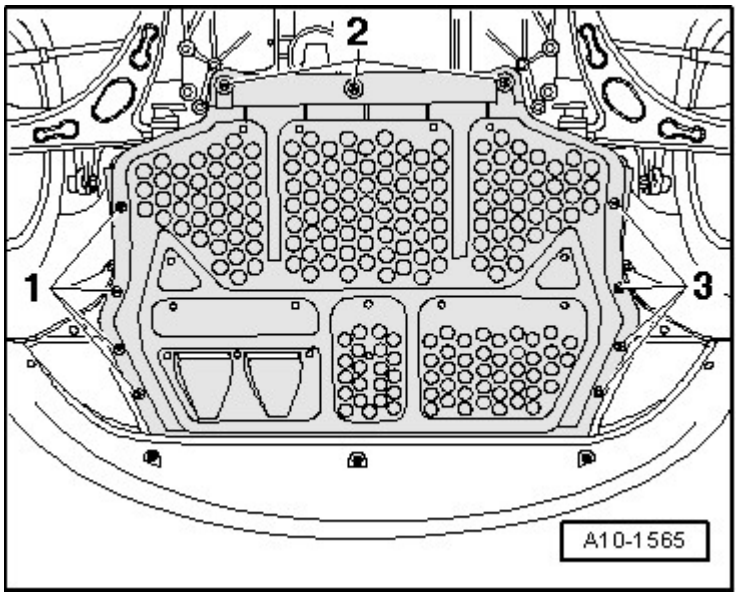

Fig. 40: Center Noise Insulation Bolts
Courtesy of AUDI OF AMERICA, LLC

-- Remove right noise insulation fasteners -1 to 3-.

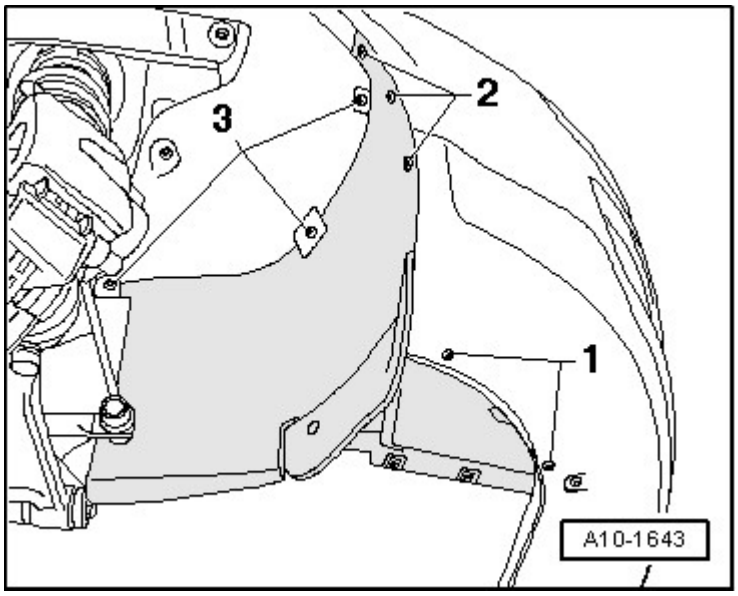

Fig. 41: Identifying Fasteners
Courtesy of AUDI OF AMERICA, LLC

-- Remove the ribbed belt from the vibration damper belt drive pulley.

-- Remove bolt from vibration damper, thereby using T10069 to counter-hold.

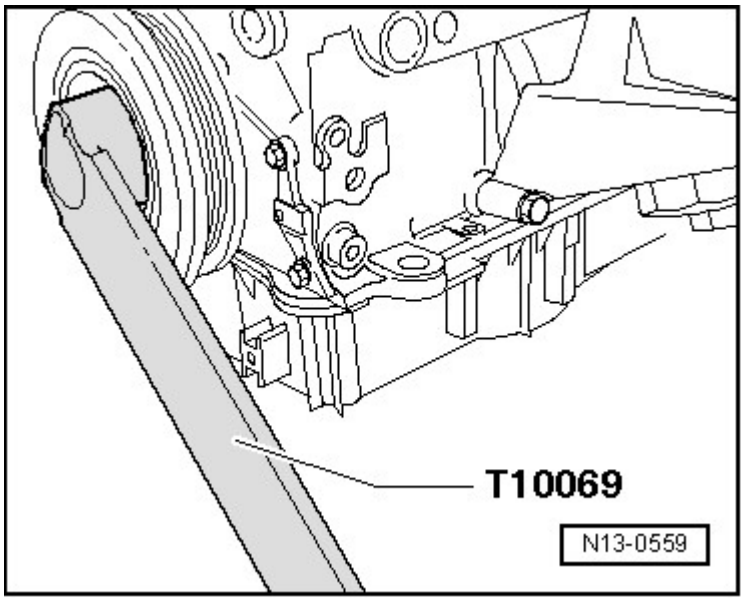

Fig. 42: Counter-Holder T10069 To Hold Vibration Damper
Courtesy of AUDI OF AMERICA, LLC

-- Turn inner portion of 3203 3 turns (approximately 4 mm) out from the outer portion and lock position with knurled thumb screw.

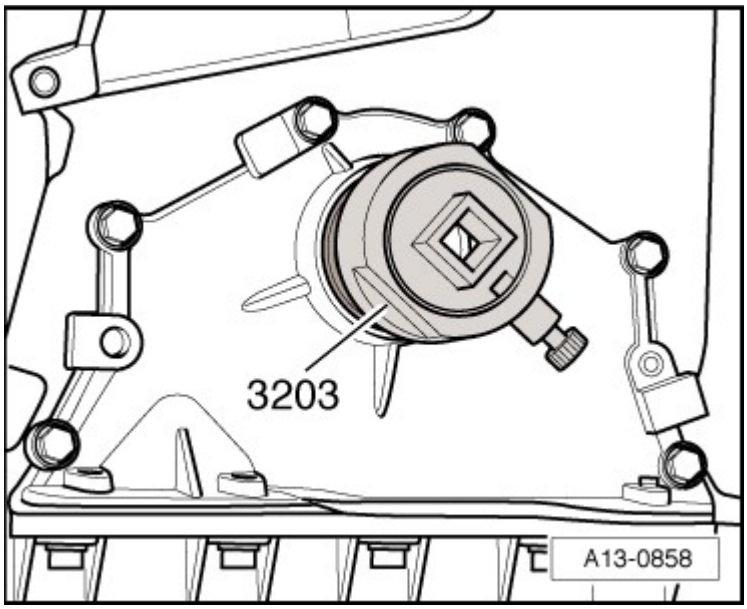

Fig. 43: Seal Remover 3203
Courtesy of AUDI OF AMERICA, LLC

-- Lubricate the threaded head of the seal remover, place against seal, and with strong force screw into the seal as far as possible.

-- Loosen knurled thumb screw and turn inner portion against crankshaft until the seal is pulled out.

-- Secure the seal remover in a vise at the flat spots. Remove seal using pliers

-- Clean the running and sealing surfaces.

NOTE: Do not lubricate seal prior to installation.

-- Place T10053/1 on crankshaft pin.

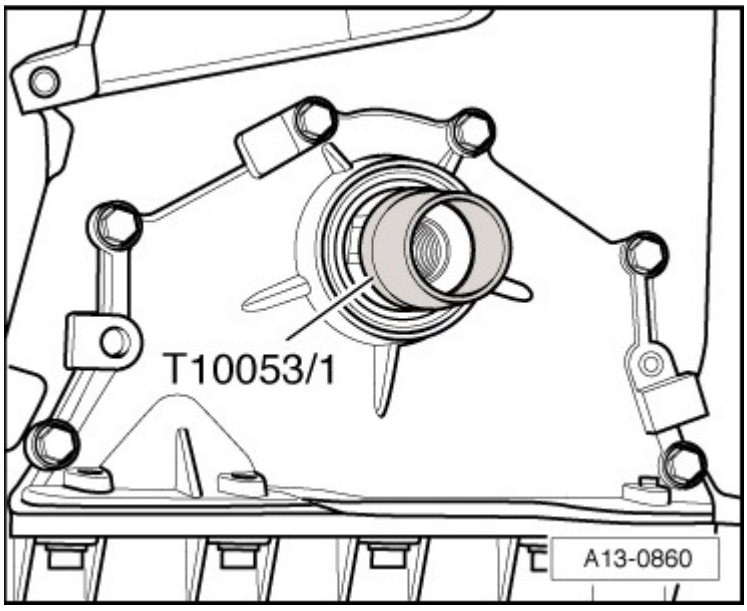

Fig. 44: Guide Sleeve T10053/1 On Crankshaft Pin
Courtesy of AUDI OF AMERICA, LLC

-- Carefully push the seal over the guide sleeve and as far onto the end of the crankshaft as possible.

-- Remove the guide sleeve.

-- Press seal in against stop using old vibration damper screw -1- and 3266.

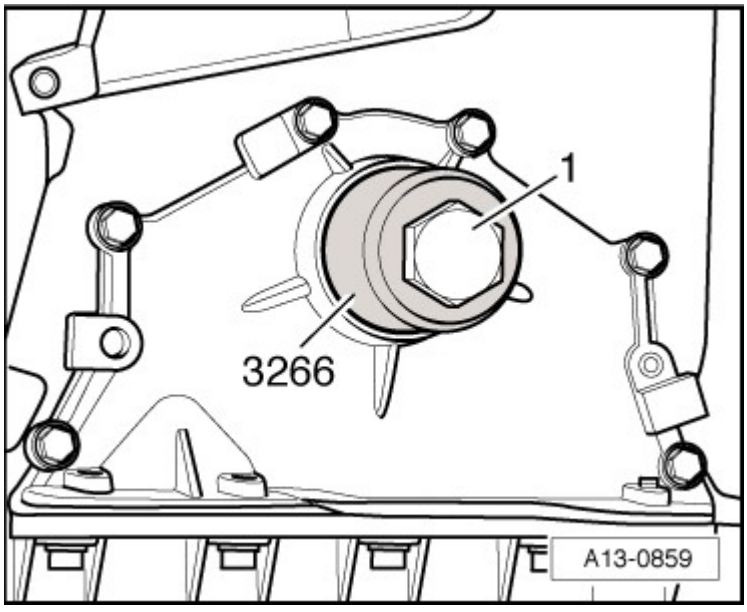

Fig. 45: Pressing Seal In Against Stop Using Old Vibration Damper Screw And Seal Installer 3266
Courtesy of AUDI OF AMERICA, LLC

-- Install vibration damper with new bolt. Refer to **VIBRATION DAMPER**.

-- Install ribbed belt. Refer to **RIBBED BELT**.

SEALING FLANGE, BELT PULLEY SIDE

Special tools and workshop equipment required

- Locking Pin T10060 A
- Counter-Holder Tool T10069
- Assembly Tool T10215 for vehicles from 11.2005
- Hand drill with plastic brush attachment
- Protective eyewear

Removing

- Engine installed.

NOTE: Before removing the ribbed belt, mark the turning direction on it with chalk or a felt tip pen. A reversed direction of rotation can cause damage to the belt under operating conditions.

-- Swing tensioning device in direction of -arrow- to relieve tension on the ribbed belt and then lock it in place using the T10060 A.

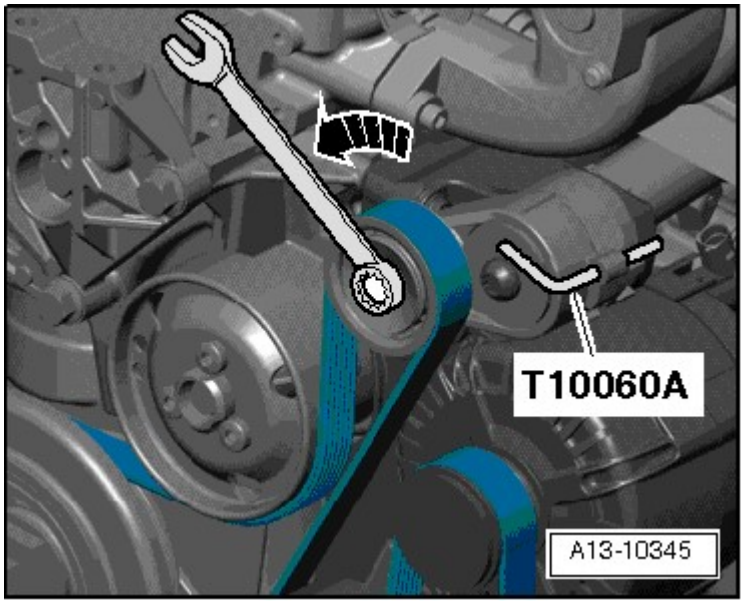

Fig. 46: Relieving Tension On Ribbed Belt
Courtesy of AUDI OF AMERICA, LLC

-- Remove center noise insulation fasteners -1 to 3-.

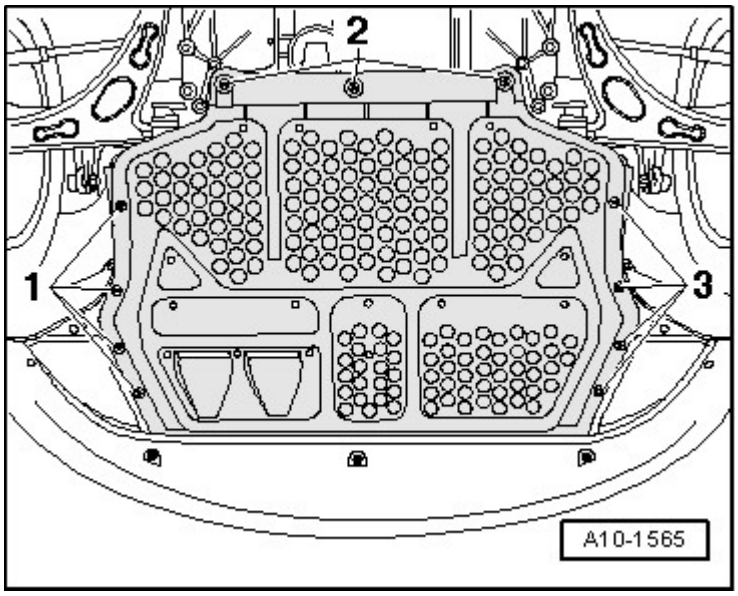

Fig. 47: Center Noise Insulation Bolts
Courtesy of AUDI OF AMERICA, LLC

-- Remove right noise insulation fasteners -1 to 3-.

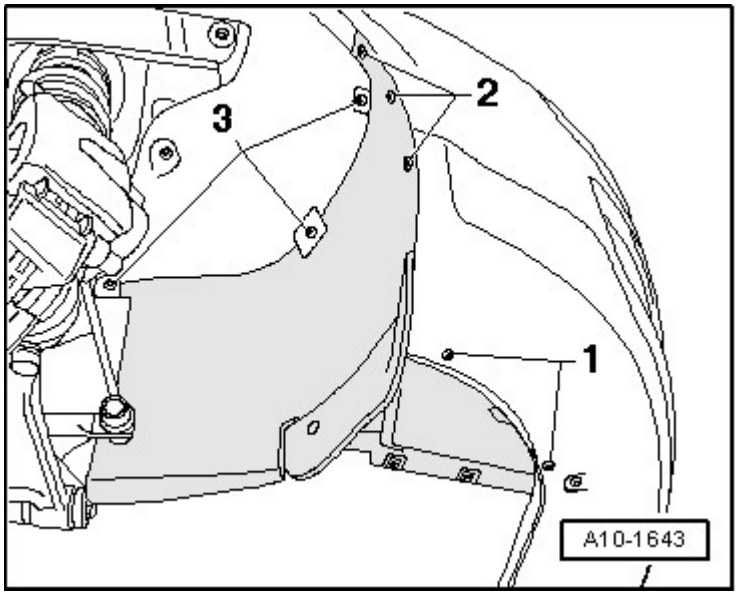

Fig. 48: Identifying Fasteners
Courtesy of AUDI OF AMERICA, LLC

-- Remove the ribbed belt from the vibration damper belt drive pulley.

-- Remove bolt from vibration damper, thereby using T10069 to counter-hold.

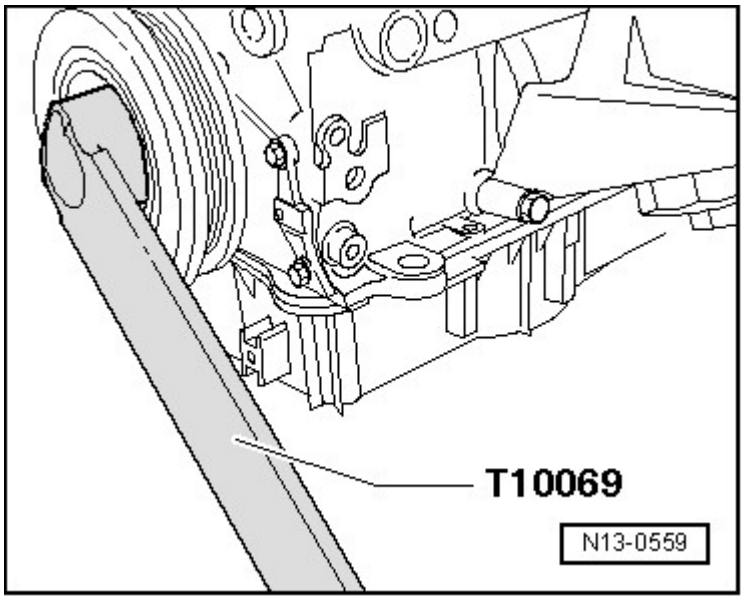

Fig. 49: Counter-Holder T10069 To Hold Vibration Damper
Courtesy of AUDI OF AMERICA, LLC

-- Remove bolts -1 to 11-.

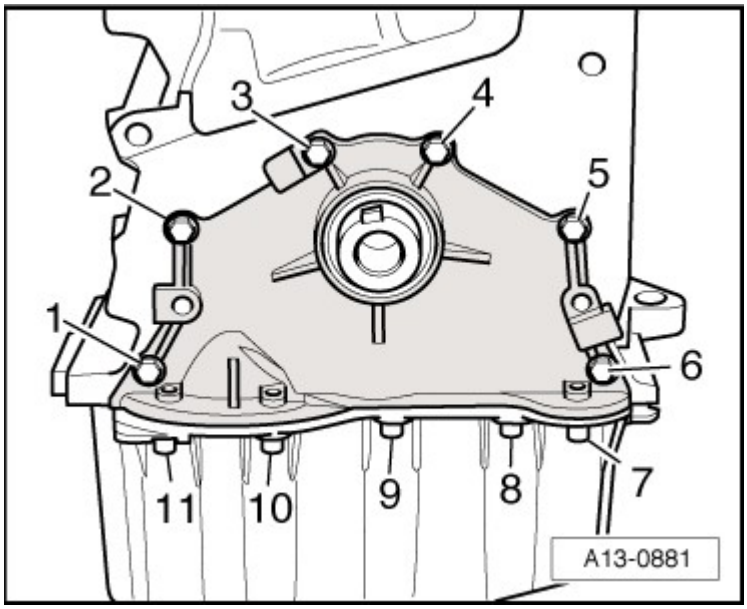

Fig. 50: Identifying Sealing Flange Bolts
Courtesy of AUDI OF AMERICA, LLC

-- Pry off and remove front sealing flange.

-- Drive out the seal from the removed flange.

Installing

- Tightening specifications, refer to **RIBBED BELT DRIVE COMPONENT OVERVIEW**

Installation is in the reverse order of removal, note the following:

NOTE: Place a rag over open section of oil pan.

-- Carefully remove any sealant residue from the cylinder block and oil pan.

WARNING: Risk of eye injury.

- **Wear safety glasses.**

-- Remove sealant residue from sealing flange for example with a rotating plastic brush.

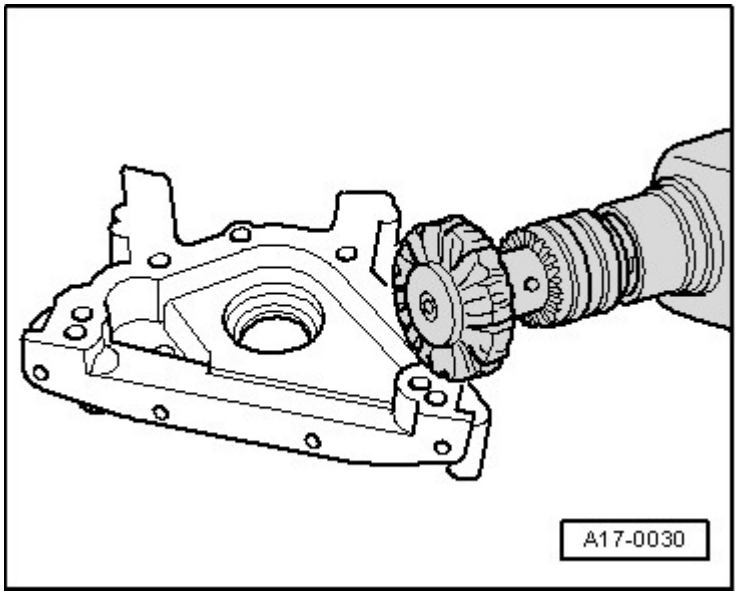

Fig. 51: Identifying Rotating Plastic Brush
Courtesy of AUDI OF AMERICA, LLC

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

-- Cut tube nozzle at front marking (nozzle dia. approximately 3 mm).

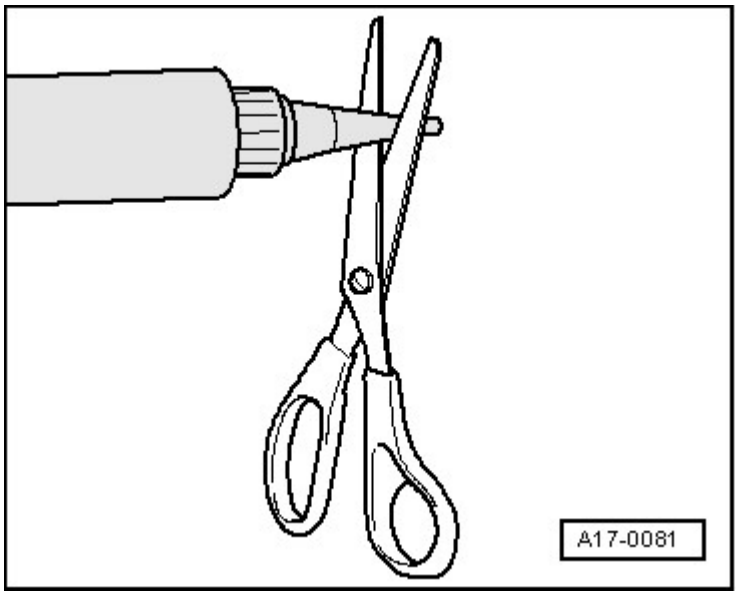

Fig. 52: Cut Tube Nozzle At Front Marking (Nozzle Diameter Approx. 3 Mm)
Courtesy of AUDI OF AMERICA, LLC

-- Apply a thin bead of sealant to the edge between cylinder block and oil pan -arrow-.

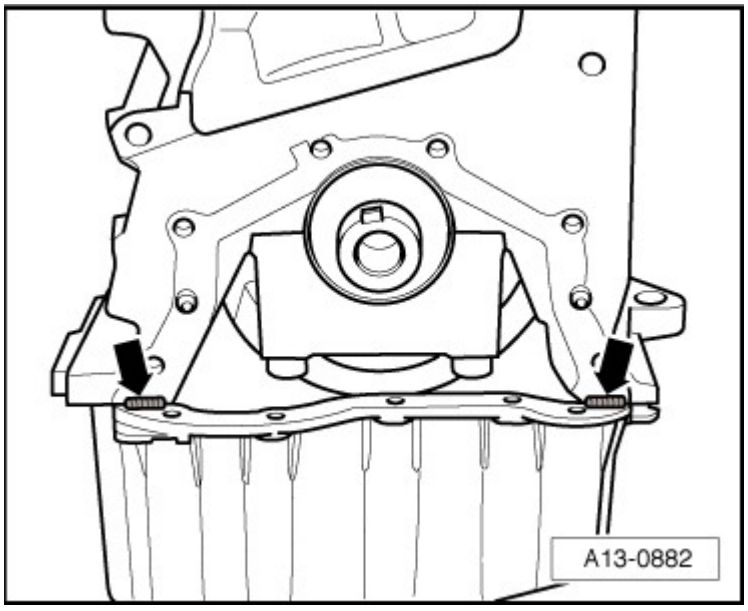

Fig. 53: Applying Thin Bead Of Sealant To Edge Between Cylinder Block And Oil Sump
Courtesy of AUDI OF AMERICA, LLC

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

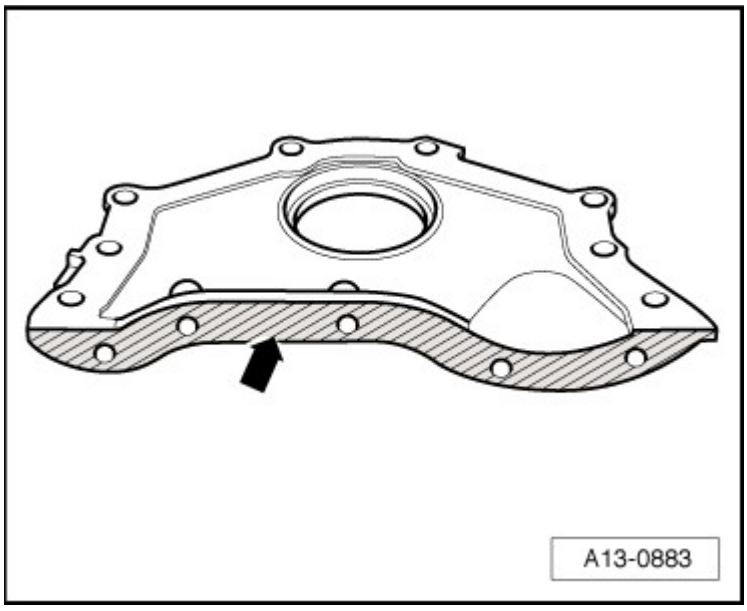

Fig. 54: Lightly Coating Lower Sealing Surface Of Sealing Flange With Sealant
Courtesy of AUDI OF AMERICA, LLC

-- Apply a thin bead of sealant -arrow- to the clean sealing surface of the sealing flange, as shown in the illustration.

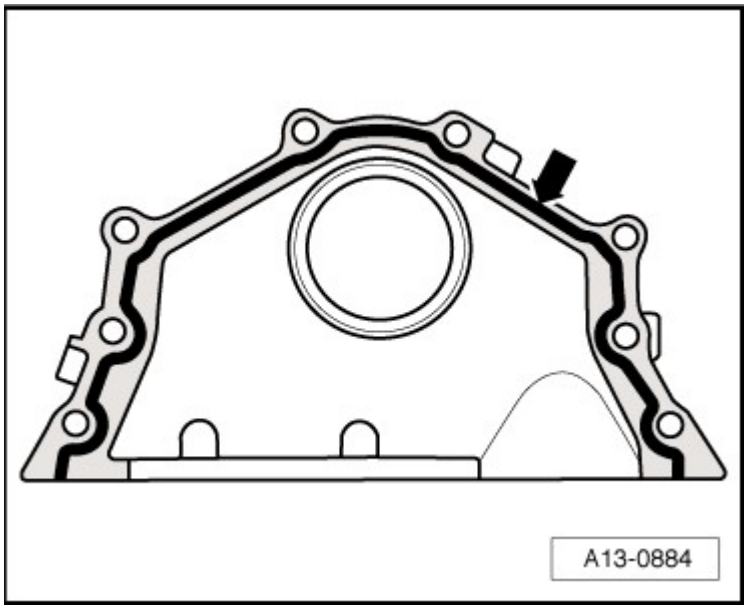

Fig. 55: Applying Thin Bead Of Sealant To Clean Sealing Surface Of Sealing Flange
Courtesy of AUDI OF AMERICA, LLC

- Thickness of sealant bead -arrow- : 2 to 3 mm.

NOTE: The sealant bead may not be thicker than 3 mm, otherwise excess sealant could enter the oil pan and clog the oil intake tube.

The sealing flange must be installed within 5 minutes of being applied with sealant.

Vehicles through 11.2004:

-- Carefully slide sealing flange onto reamed bolt at cylinder block.

NOTE: To install the sealing flange with installed seal, use the T10053/1.

Vehicles from 11.2004:

-- Carefully slide sealing flange onto guide pins -arrows- on cylinder block using T10215.

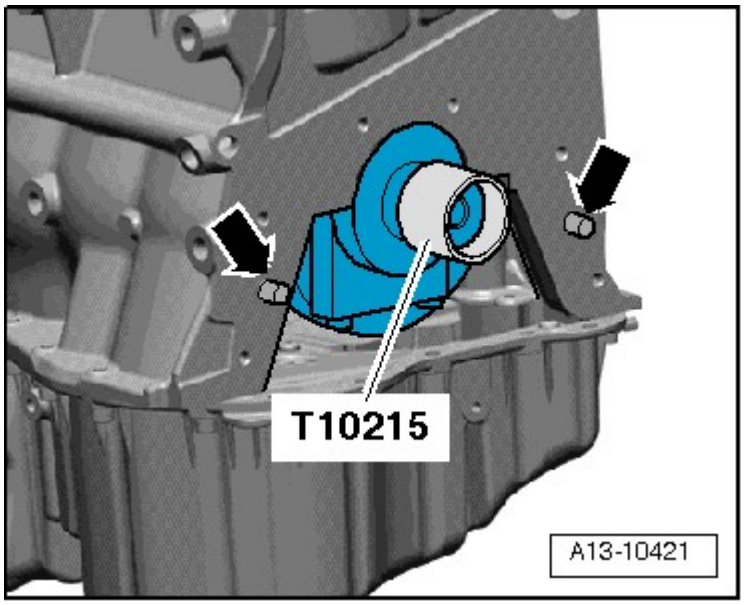

Fig. 56: Sealing Flange Onto Guide Pins On Cylinder Block Using Assembly Tool T10215
Courtesy of AUDI OF AMERICA, LLC

All Vehicles

-- Tighten bolts in 3 stages as follows:

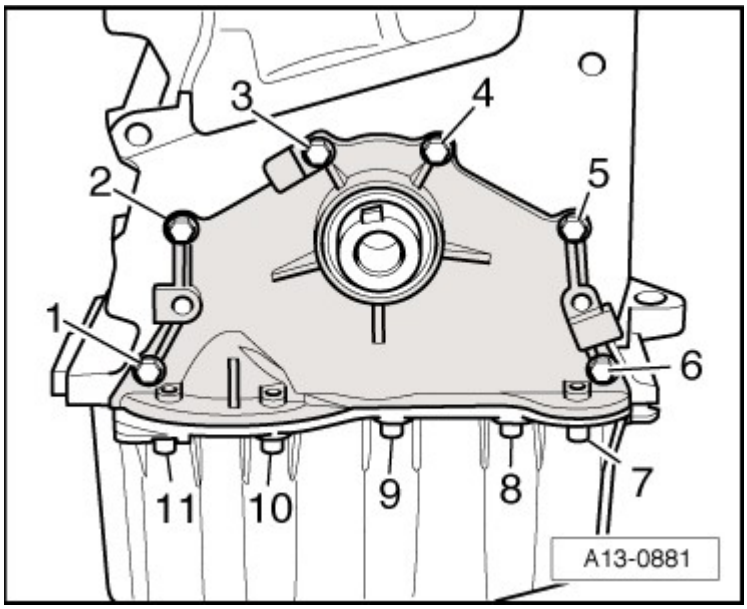

Fig. 57: Identifying Sealing Flange Bolts
Courtesy of AUDI OF AMERICA, LLC

-- Install bolts -1 to 11- and tighten by hand.-- Tighten the bolts -1 to 6- diagonally in stages to 10 Nm.-- Tighten bolts -7 to 11- to 10 Nm.

Vehicles through 11.2004:

-- Install the crankshaft seal belt pulley side. Refer to **CRANK SHAFT SEALING RING, BELT PULLEY SIDE, VEHICLES UP TO 11.2004**.

All Vehicles

-- Install vibration damper with new bolt. Refer to **VIBRATION DAMPER**.

-- Install ribbed belt. Refer to **RIBBED BELT**.

DUAL MASS FLYWHEEL

NOTE: When working on the engine, secure the engine to the engine and transmission support. Refer to ENGINE, SECURING TO ENGINE AND TRANSMISSION HOLDER .

Special tools and workshop equipment required

- Counter-Holder Tool T10069

Removing

- Transmission removed.

-- Mark dual-mass flywheel to engine.

NOTE: To prevent damage to dual-mass flywheel when removing, bolts -B- must not be removed using an air-powered or impact wrench. Only removing bolts by hand is permitted.

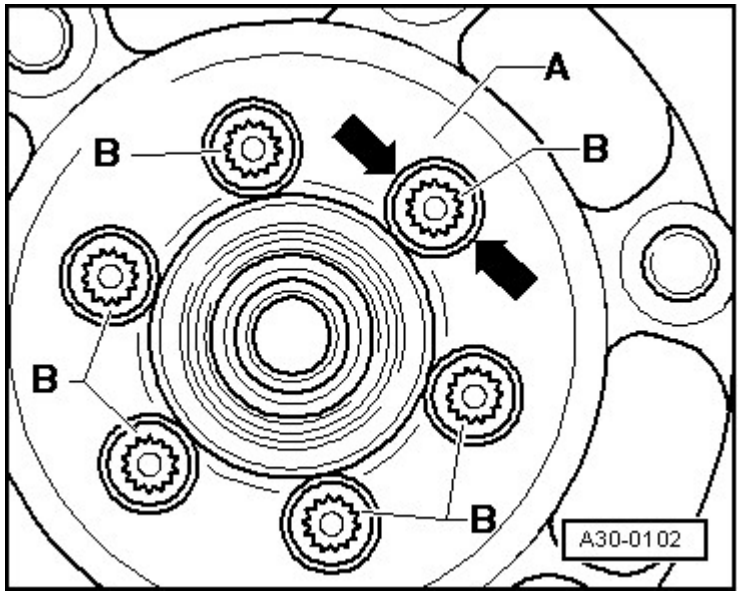

Fig. 58: Identifying Dual-Mass Flywheel & Bolts
Courtesy of AUDI OF AMERICA, LLC

-- Rotate dual-mass flywheel -A- so that bolts stand centered to holes -arrows-.

-- When removing bolts, make sure that no bolt head makes contact on dual-mass flywheel because it will otherwise be damaged when further screwing the bolt.

-- Remove dual-mass flywheel while counter holding vibration damper with T10069.

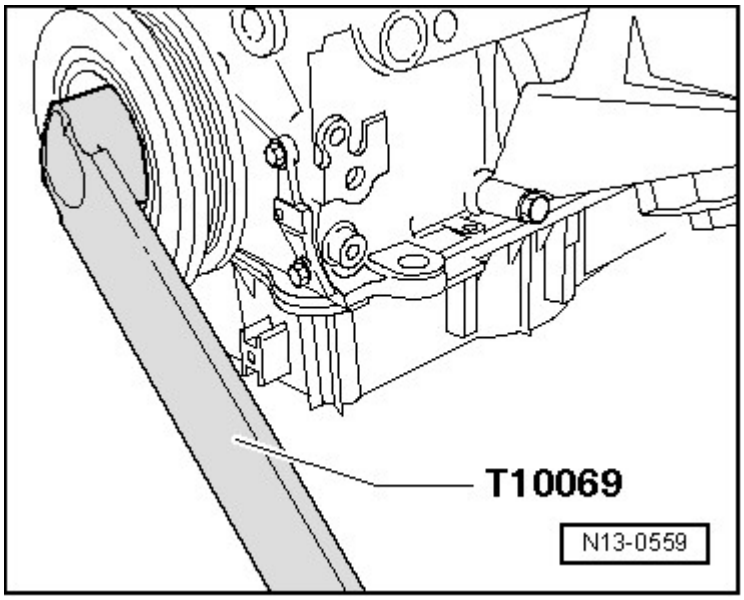

Fig. 59: Counter-Holder T10069 To Hold Vibration Damper
Courtesy of AUDI OF AMERICA, LLC

Installing

- Tightening specifications, refer to **DUAL-MASS FLYWHEEL COMPONENT OVERVIEW**

Installation is in the reverse order of removal, note the following:

-- Secure with new bolts.

NEEDLE BEARING IN CRANKSHAFT

Special tools and workshop equipment required

- Drift VW 207 C or Centering Mandrel 3176
- Internal Puller Kukko 21/1
- Counter-Support Kukko 22/1
- Depth gauge

Removing

- Transmission removed.

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

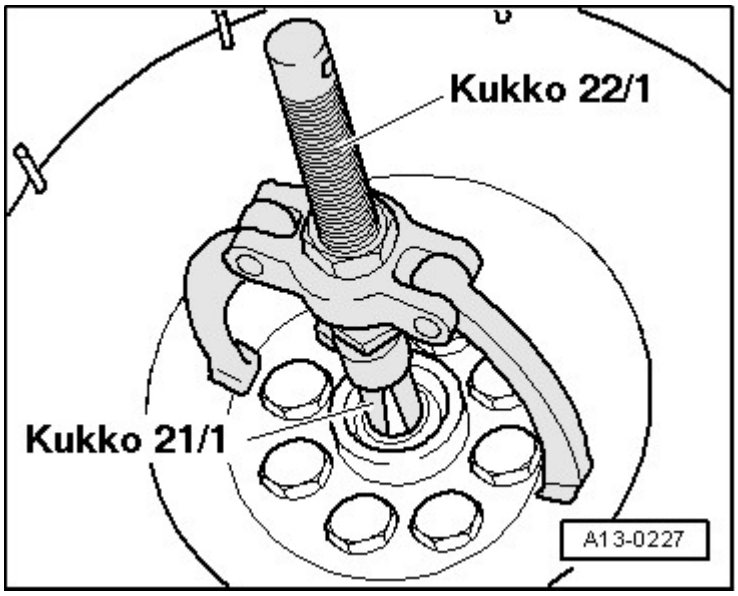

Fig. 60: Pulling Out Pilot Needle Bearing Using Kukko 21/1 And Kukko 22/1
Courtesy of AUDI OF AMERICA, LLC

Installing

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

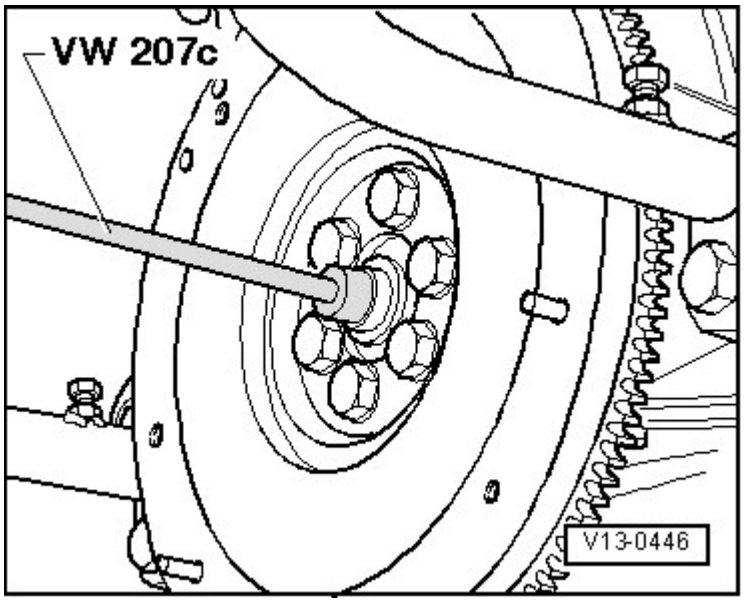

Fig. 61: Driving In Needle Bearing Using Drift VW 207 C
Courtesy of AUDI OF AMERICA, LLC

- Side of needle bearing with writing on it must be readable when installed.

Needle bearing location:

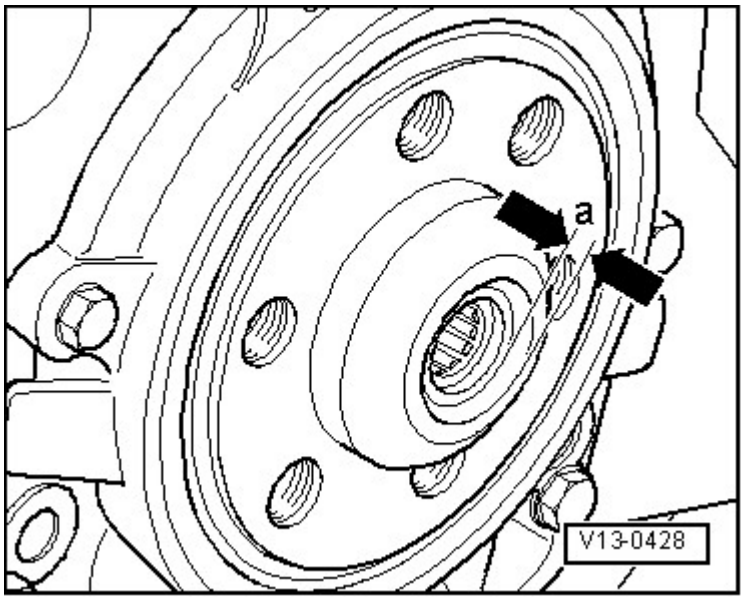

Fig. 62: Identifying Installation Depth Dimension
Courtesy of AUDI OF AMERICA, LLC

- Dimension -a- = 2.0 mm.

CRANKSHAFT SEAL, REPLACING

Special tools and workshop equipment required

- Assembly Tool T10122
- Pulling Hook T20143/2

Procedure

- Transmission removed.

-- Remove the dual-mass flywheel. Refer to **DUAL MASS FLYWHEEL**.

-- Pry out sealing ring using T20143/2.

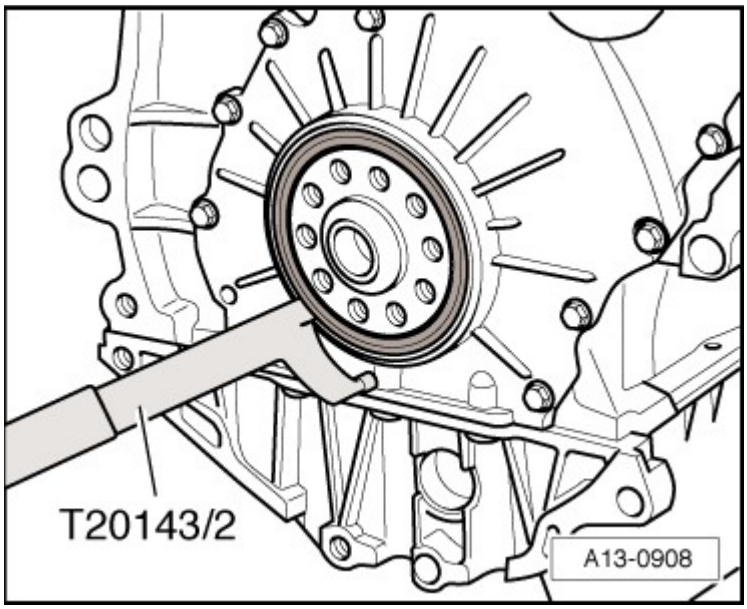

Fig. 63: Prying Out Oil Seal Using Pressing-Out Tool T20143/2
Courtesy of AUDI OF AMERICA, LLC

-- Clean the running and sealing surfaces.

NOTE: Do not lubricate seal prior to installation.

-- Slide new seal -A- over T10122/1 onto T10122/2.

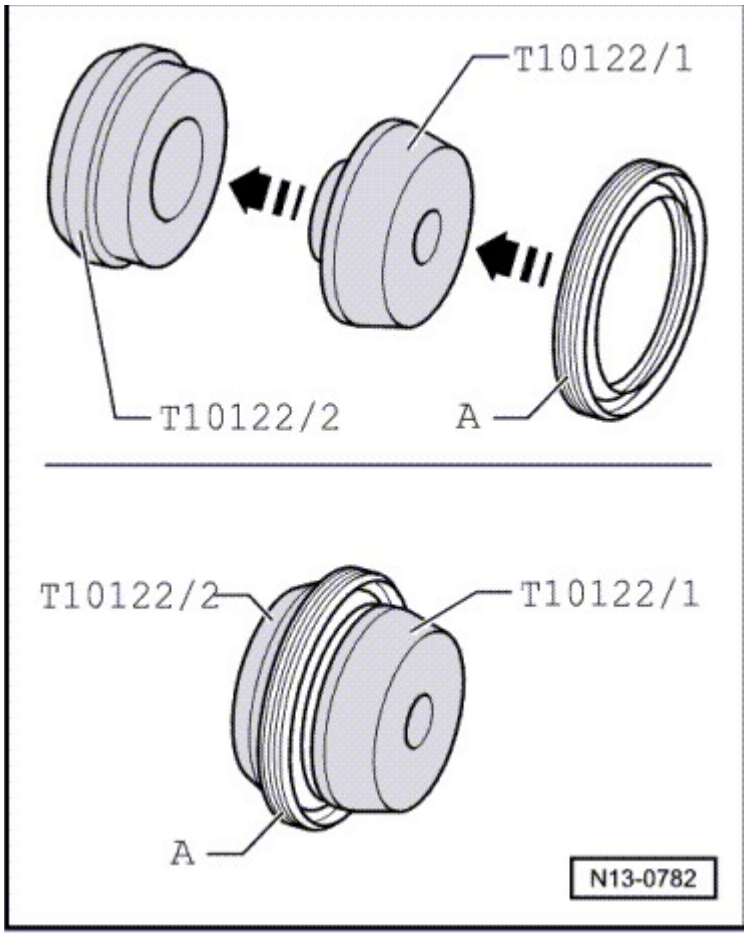

Fig. 64: Identifying Seal, Sleeve T10122/1 And Assembly Tool T10122/2
Courtesy of AUDI OF AMERICA, LLC

- Installation position: Closed side faces toward fitting sleeve.

-- Disconnect both sleeves.

-- Position T10122/2 with seal on crankshaft.

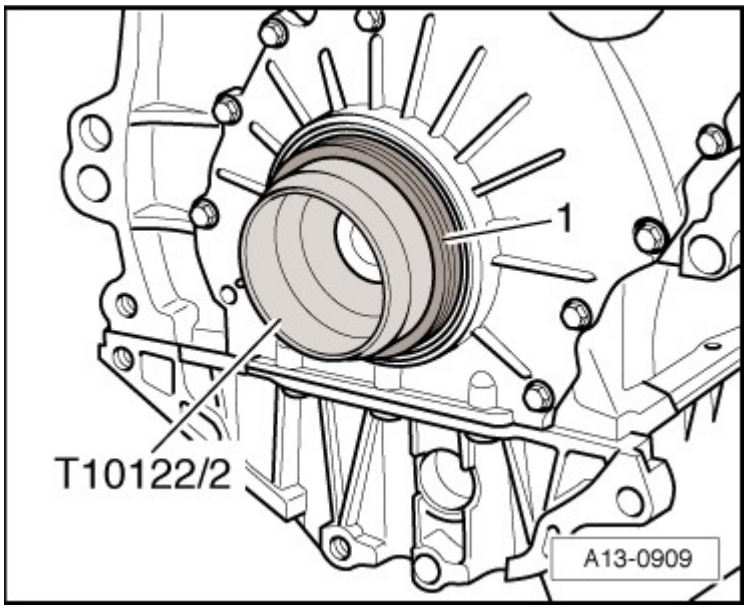

Fig. 65: Inserting Guide Sleeve T10122/2 With Oil Seal Onto Crankshaft
Courtesy of AUDI OF AMERICA, LLC

-- Press seal in evenly all around using T10122/3 until flush.

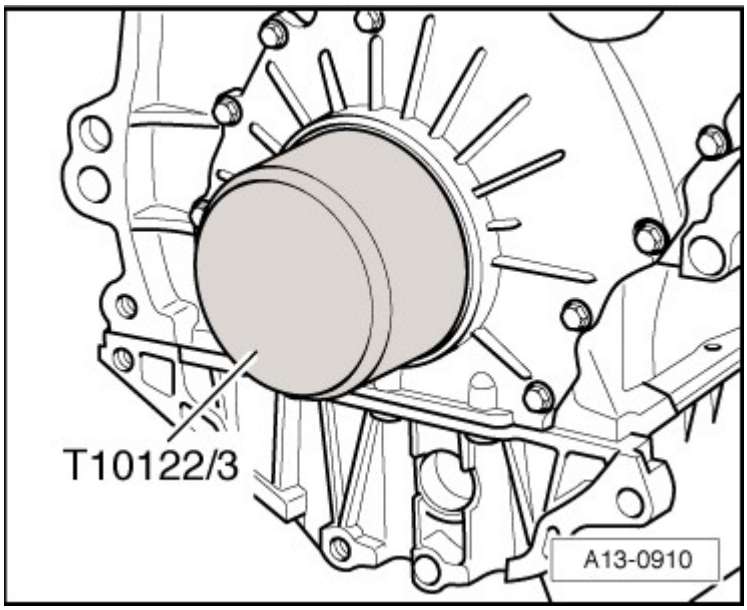

Fig. 66: Pressing In Oil Seal With Press Tool T10122/3 Evenly And Flush
Courtesy of AUDI OF AMERICA, LLC

Further installation is in reverse order of removal, note the following:

-- Install dual-mass flywheel. Refer to **DUAL MASS FLYWHEEL**.

SPECIAL TOOLS

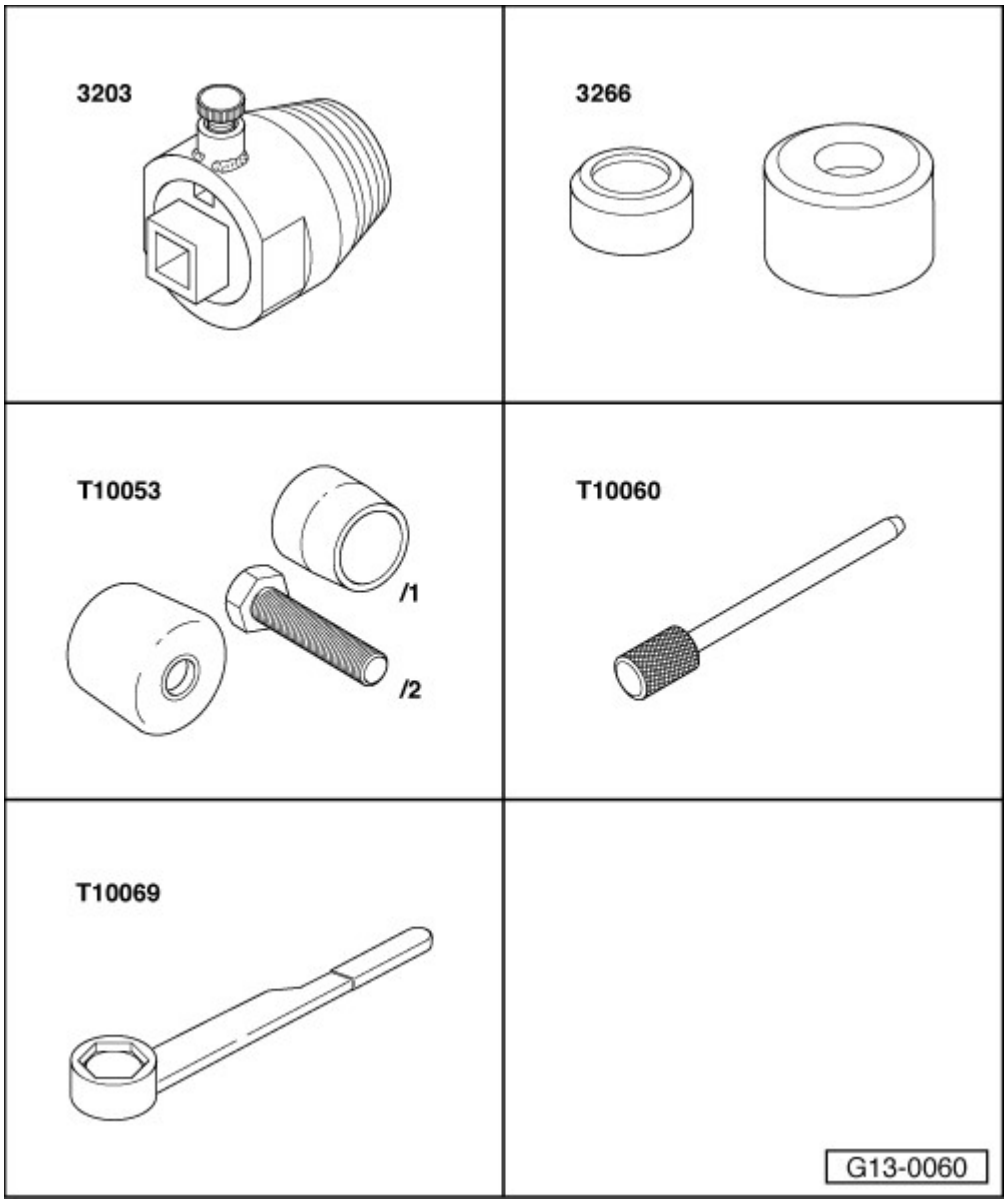

Fig. 67: Crank Shaft Sealing Ring, Belt Pulley Side, Vehicles Up To 11.04, Replacing - Special Tools, Testers And Auxiliary Items Required
Courtesy of AUDI OF AMERICA, LLC

Special tools and workshop equipment required

- Seal Remover 3203
- Seal Installer 3266
- Assembly Tool T10053
- Locking Pin T10060 A
- Counter-Holder Tool T10069

Special tools and workshop equipment required

- Locking Pin T10060 A

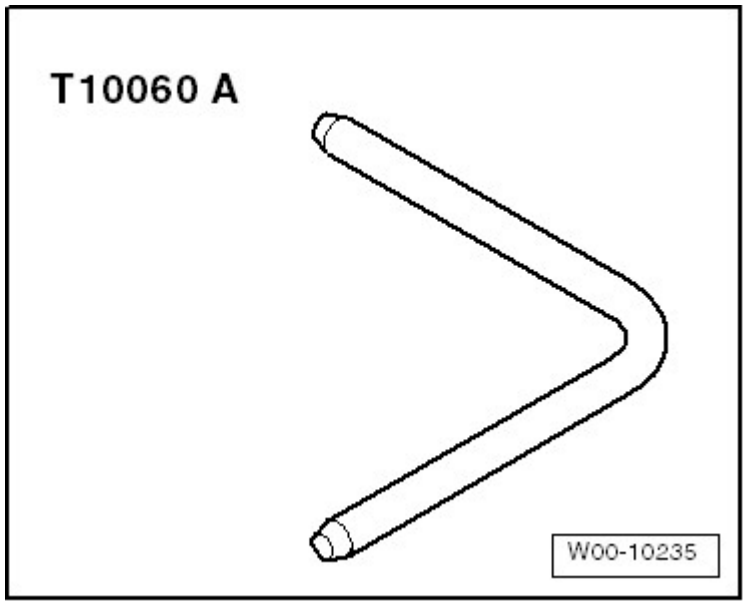

Fig. 68: Identifying Locking Pin T10060 A
Courtesy of AUDI OF AMERICA, LLC

- Counter-Holder Tool T10069

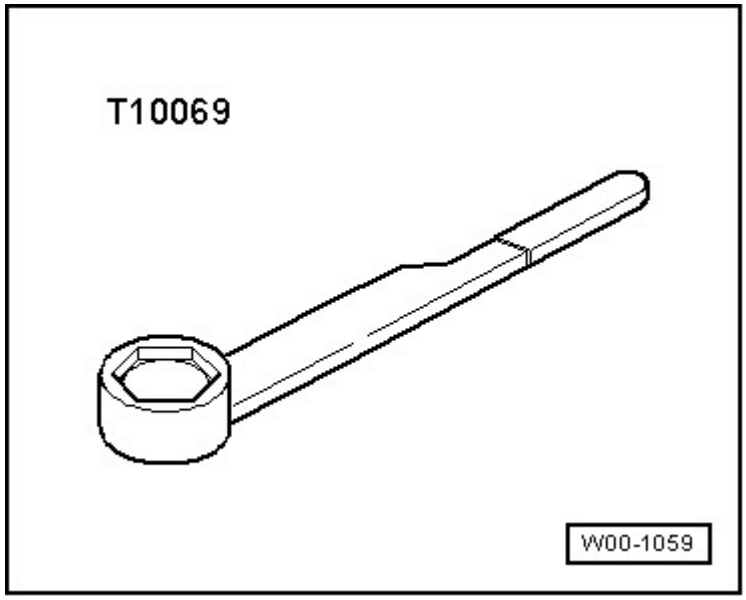

Fig. 69: Counter-Holder Tool T10069
Courtesy of AUDI OF AMERICA, LLC

- Assembly Tool T10215 for vehicles from 11.2005

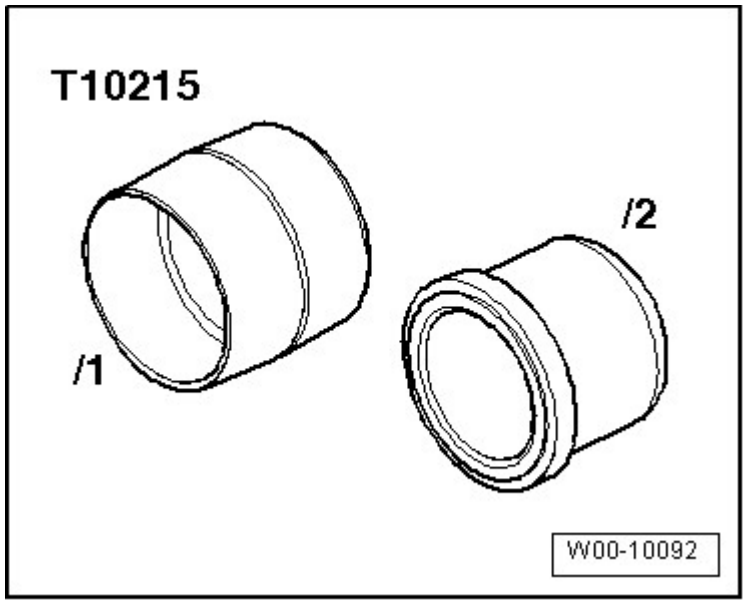

Fig. 70: Assembly Tool T10215 For Vehicles From 11.2005
Courtesy of AUDI OF AMERICA, LLC

- Drift VW 207 C or Centering Mandrel 3176

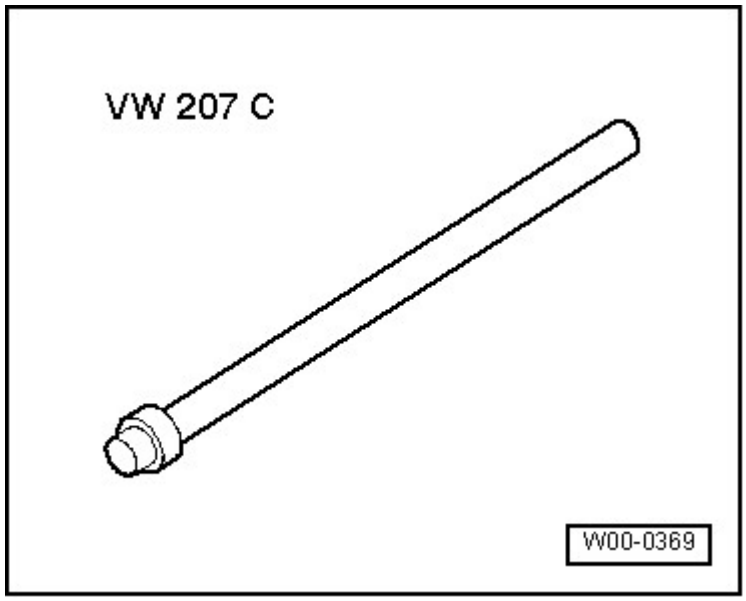

Fig. 71: Drift VW 207 C Or Centering Mandrel 3176
Courtesy of AUDI OF AMERICA, LLC

- 1 - Internal Puller Kukko 21/1

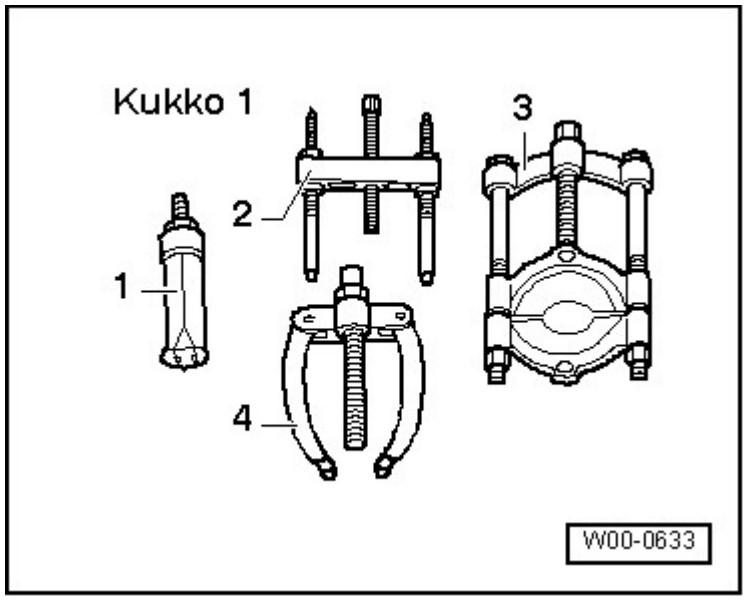

Fig. 72: Identifying Kukko Tools
Courtesy of AUDI OF AMERICA, LLC

- 4 - Counter-Support Kukko 22/1
- Assembly Tool T10122

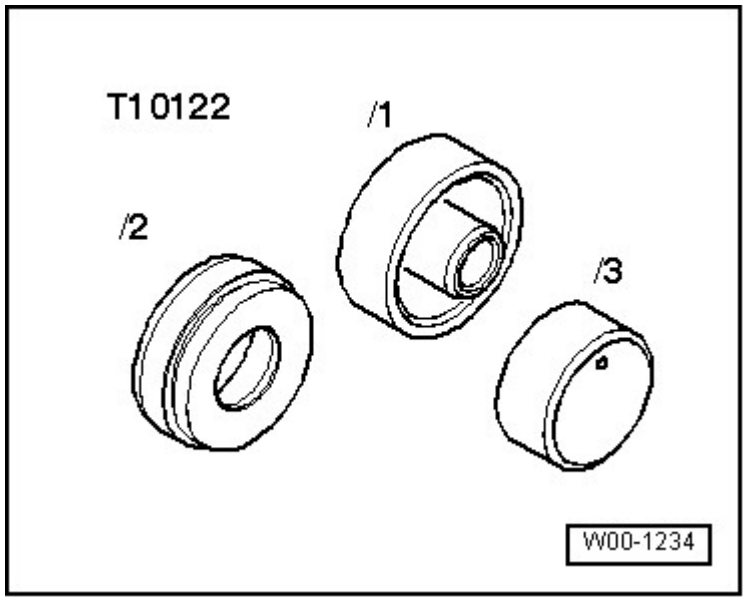

Fig. 73: Identifying Installation Tool T10122
Courtesy of AUDI OF AMERICA, LLC

- Pulling Hook T20143/2

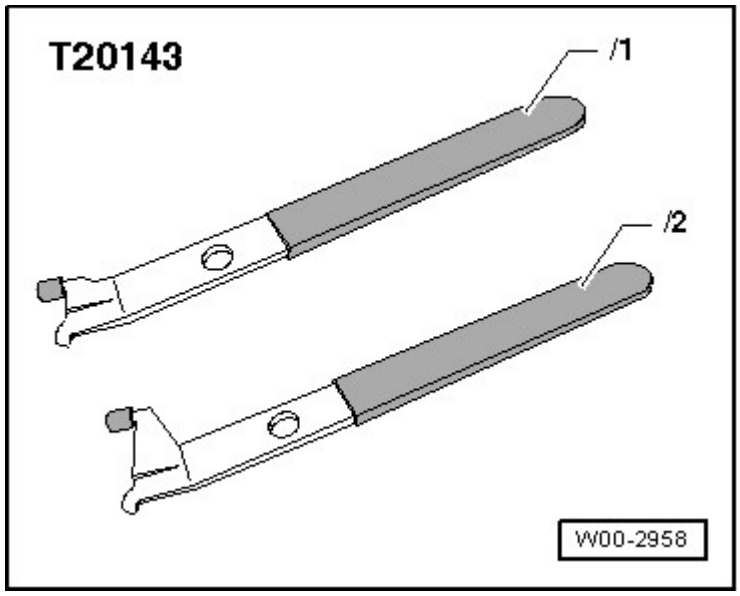

Fig. 74: Extractor Hook T20143
Courtesy of AUDI OF AMERICA, LLC

ENGINE

3.2 Liter - Cylinder Head, Valvetrain - Engine Code(s): BUB & CBRA

15 CYLINDER HEAD, VALVETRAIN

GENERAL INFORMATION

VALVETRAIN

NOTE: **After installing the camshafts, the engine may not be started for approximately 30 minutes. The hydraulic adjusting elements must seat themselves (otherwise the valves will seat themselves on the pistons).**

After working on the valvetrain and lifters, carefully rotate the crankshaft by hand at least 2 full revolutions before starting to be sure that valves do not strike the pistons.

DESCRIPTION AND OPERATION

CYLINDER HEAD COMPONENT OVERVIEW

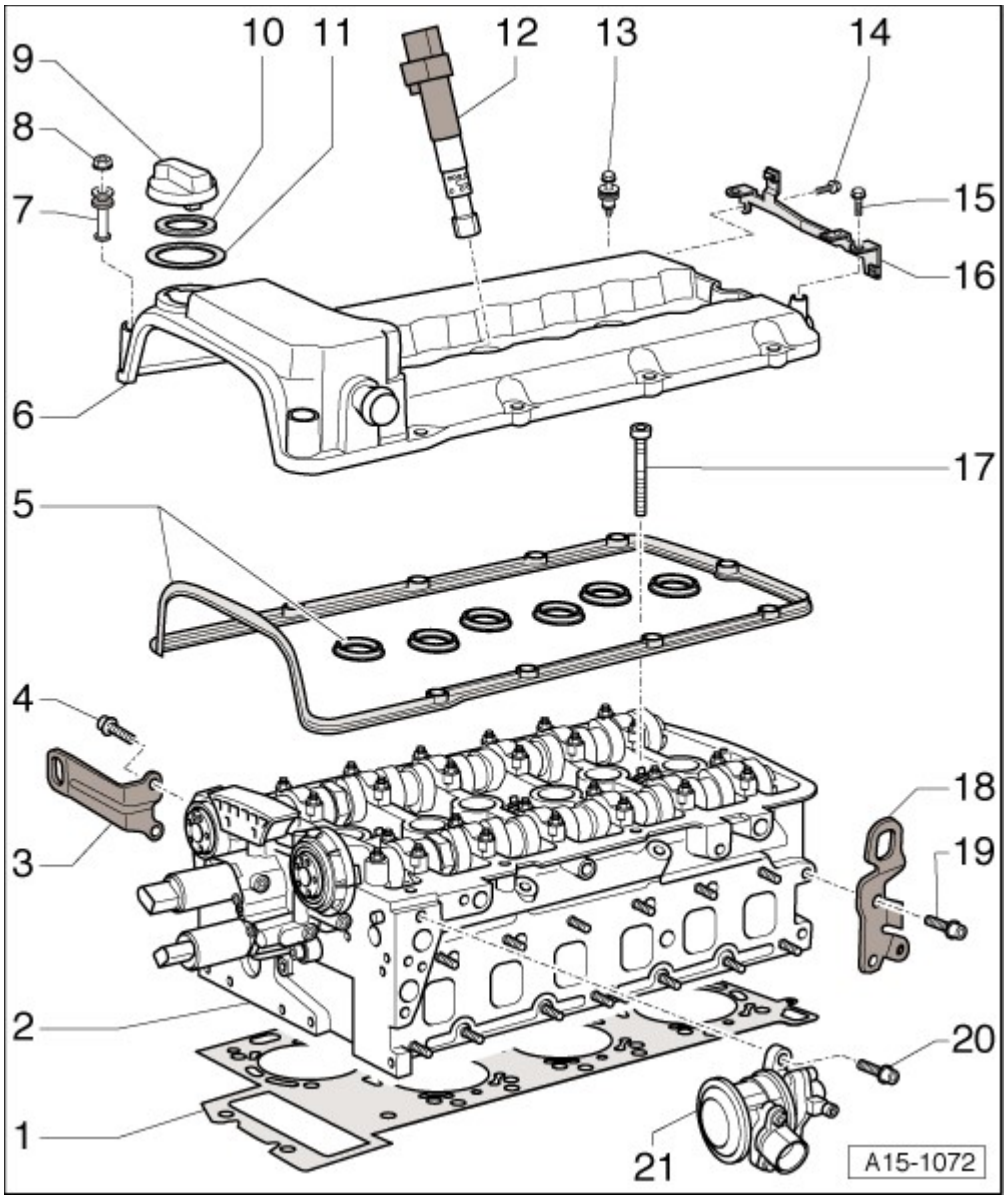

Fig. 1: Cylinder Head, Component Overview
Courtesy of AUDI OF AMERICA, LLC

1. Cylinder Head Gasket
   - Metal gasket
   - Replace
   - After replacing, change coolant and engine oil
2. Cylinder Head
   - Removal, refer to **CYLINDER HEAD, REMOVING**
   - Check for distortion **Fig. 5**
   - Installation, refer to **CYLINDER HEAD, INSTALLING**
   - After replacing, change coolant and engine oil

3. Lifting Eye
4. 23 Nm
5. Cylinder Head Cover Gaskets
    - Replace if damaged
6. Cylinder Head Cover
    - Removal and installation, refer to **CYLINDER HEAD COVER**
7. Spacing Sleeve
    - With seal
    - Replace seal if damaged
8. 10 Nm
9. Cap
10. Seal for Filler Cap
    - 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 spacing sleeve and seal
    - Replace seal if damaged
14. 10 Nm
15. 10 Nm
16. Wire Harness Retainer
17. Cylinder Head Bolt
    - Replace
    - Observe sequence for loosening, refer to **Fig. 3**
    - Observe sequence for tightening, refer to **Fig. 4**
18. Lifting Eye
19. 23 Nm
20. Bolt
21. Combination Valve for Secondary Air System
    - Version and installation location **SECONDARY AIR INJECTION COMPONENT OVERVIEW**

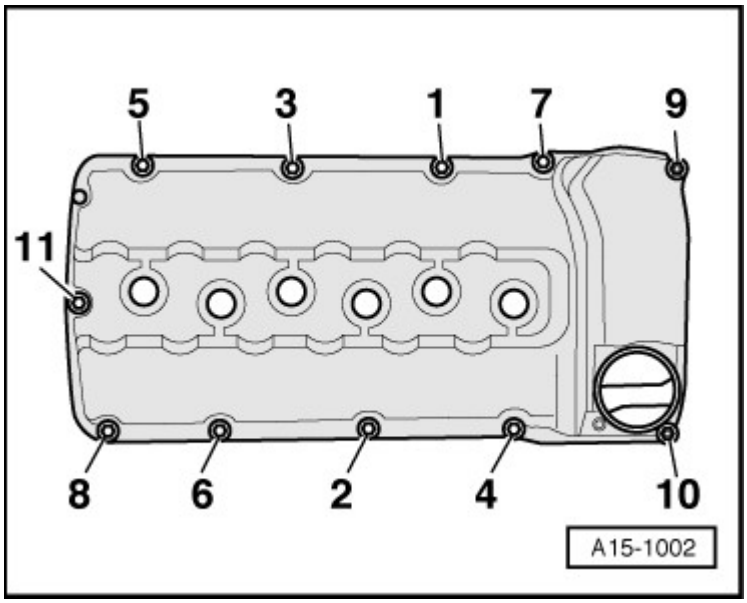

Fig. 2: Cylinder Head Cover Bolts Loosening Sequence
Courtesy of AUDI OF AMERICA, LLC

-- Tighten bolts to 10 Nm in the sequence -1 to 11-.

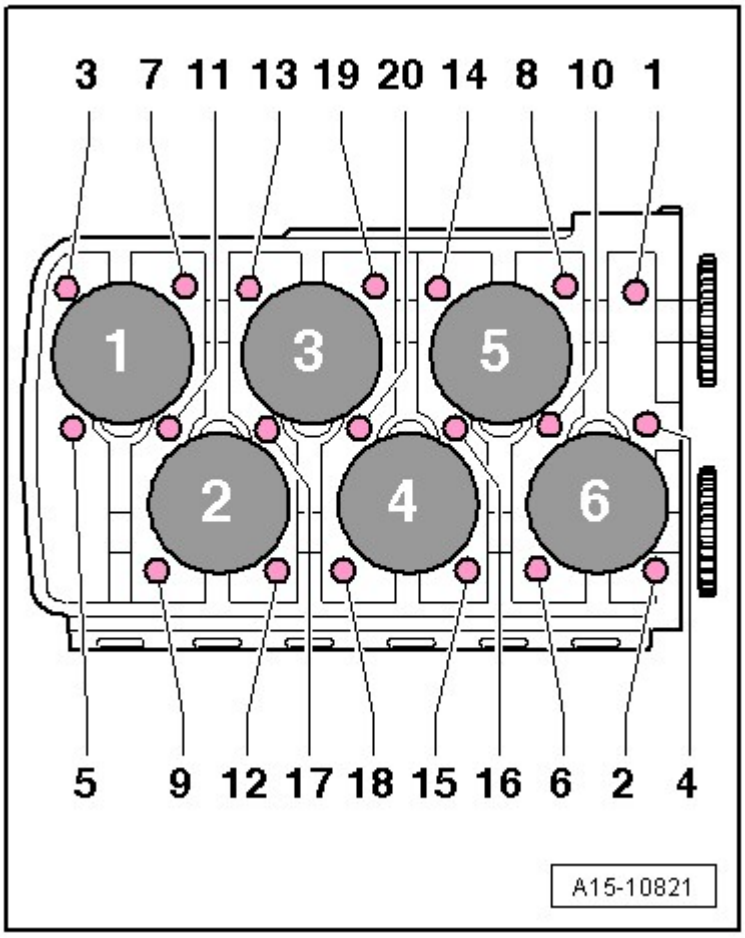

Fig. 3: Loosening Cylinder Head
Courtesy of AUDI OF AMERICA, LLC

-- Loosen the bolts in sequence -1 to 20-.

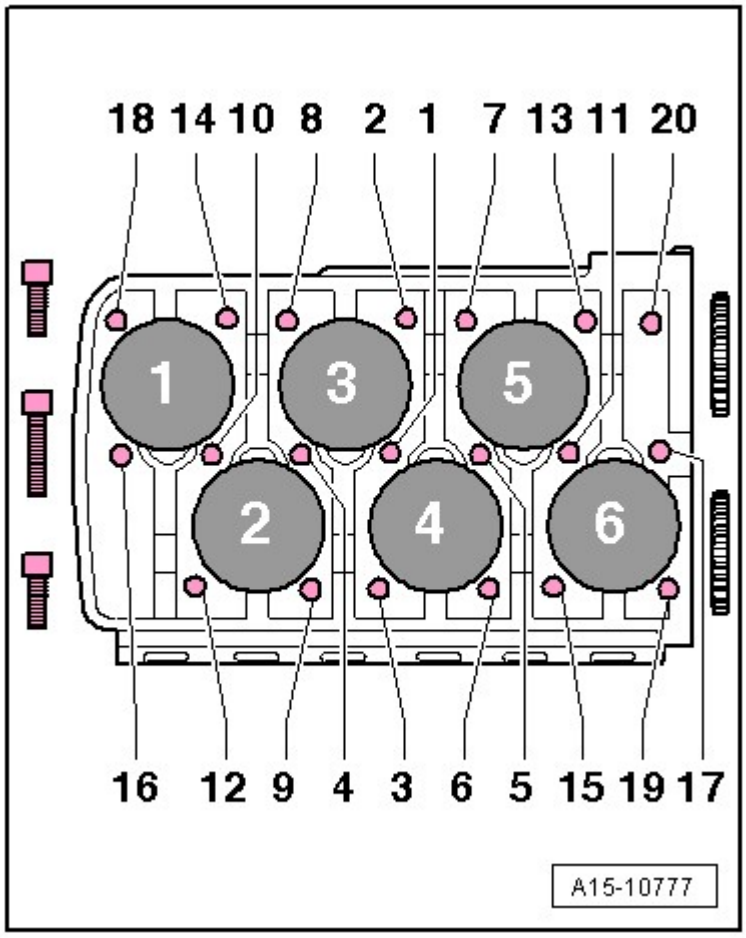

Fig. 4: Cylinder Head - Tightening Specifications And Tightening Sequence
Courtesy of AUDI OF AMERICA, LLC

-- Tighten bolts in 4 stages in -1 to 20- sequence as follows:

NOTE: The longer cylinder head bolts must be inserted in the middle holes of cylinder head.

-- Tighten bolts by hand.

-- Tighten the bolts to 30 Nm.

-- Tighten the bolts to 50 Nm.

-- Tighten an additional 180° ($^{1}/_{2}$ turn).

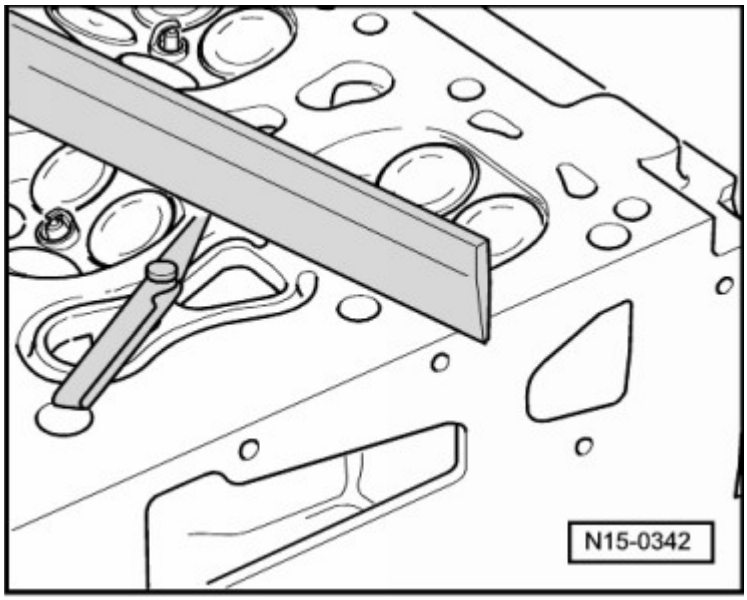

Fig. 5: Checking Cylinder Head For Distortion
Courtesy of AUDI OF AMERICA, LLC

-- Check cylinder head at multiple points for distortion, using straight edge and feeler gauges.

- Max. permissible distortion: 0.05 mm.

TIMING CHAIN COVERS ASSEMBLY OVERVIEW

NOTE: Items -1 through 3-, refer to DUAL-MASS FLYWHEEL COMPONENT OVERVIEW .

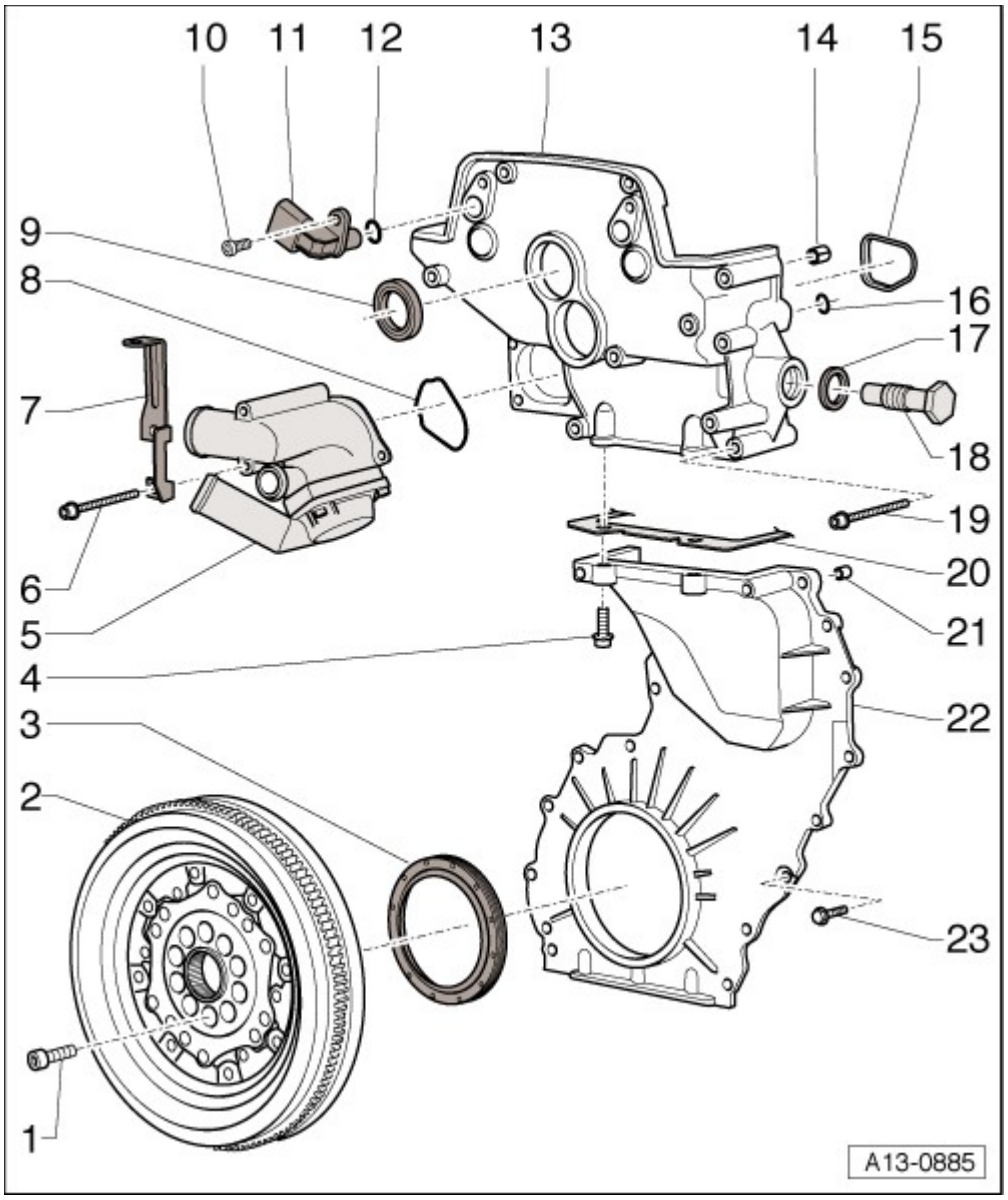

Fig. 6: Timing Chain Covers & Dual Mass Flywheel, Assembly Overview
Courtesy of AUDI OF AMERICA, LLC

1. 4 - Bolt
   - Tightening specifications, refer to **Fig. 7**
2. 5 - Thermostat Housing
   - Removal and installation, refer to **COOLANT THERMOSTAT HOUSING**
3. 6 - Bolt
   - 10 Nm
4. 7 - Bracket
   - Illustration does not correspond to version in vehicle
5. 8 - Gasket

- Replace

6. 9 - Seal
   - 2 pieces
   - For camshaft adjustment valve 1 -N205- and camshaft adjustment valve 1 (exhaust) -N318-
   - Replace if leaking or damaged
   - Replacing, refer to **UPPER TIMING CHAIN COVER SEAL, REPLACING**.
7. 10 - Bolt
   - 10 Nm
8. 11 - Camshaft Position Sensor
   - 2 pieces
   - Mark the electrical connector before disconnecting
9. 12 - O-ring
   - 2 pieces
   - Replace
10. 13 - Upper Timing Chain Cover
    - Coat sealing surfaces with sealant when installing **CAMSHAFT TIMING CHAIN**
11. 14 - Alignment Bushing
    - 2 pieces
12. 15 - Gasket
    - Replace
13. 16 - O-ring
    - Replace
14. 17 - Seal
    - Replace if leaking or damaged
15. 18 - Camshaft Timing Chain Tensioner
    - Tightening specifications, refer to **TIMING CHAIN COMPONENT OVERVIEW**
16. 19 - Bolt
    - Tightening specifications and tightening sequence, refer to **Fig. 7**
17. 20 - Cylinder Head Gasket
    - Clean holes and fill with sealant **CAMSHAFT TIMING CHAIN**
18. 21 - Fitting Pin
19. 22 - Lower Timing Chain Cover
    - When installing, coat the sealing surfaces with sealant; sealant,
20. 23 - Bolt
    - 10 Nm
    - Fasten in diagonal sequence in steps

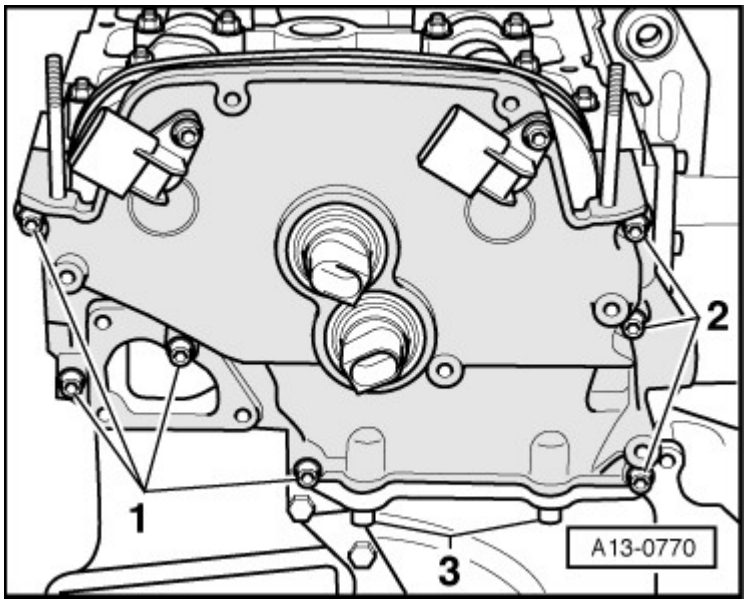

Fig. 7: Identifying Cylinder Head Cover Bolts
Courtesy of AUDI OF AMERICA, LLC

1. Pre-tighten the bolts -1- and -2- to 5 Nm.
2. Tighten the bolts -3- to 23 Nm.
3. Tight the bolts -1- and -2- to 10 Nm.

TIMING CHAIN COMPONENT OVERVIEW

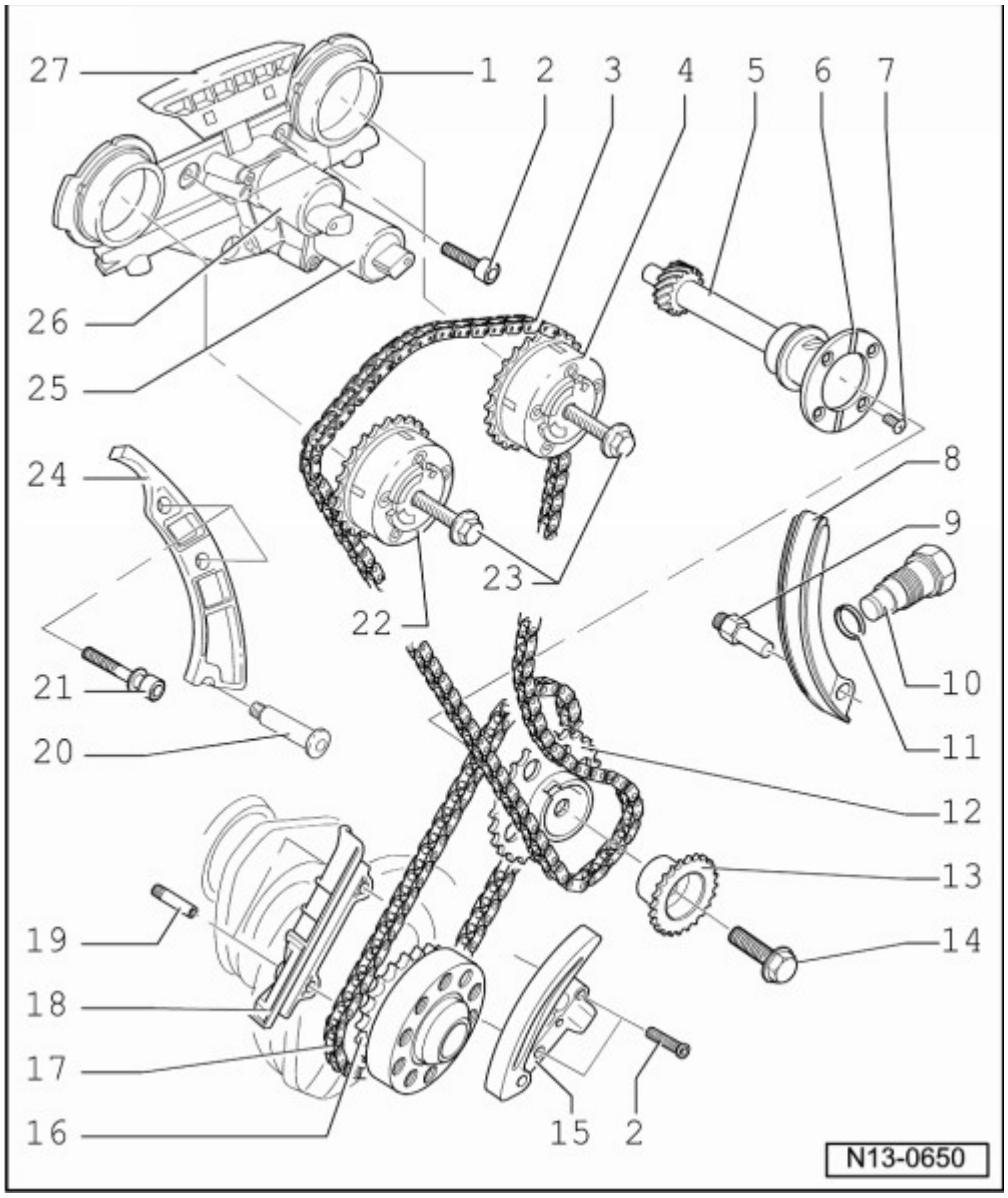

Fig. 8: Chain Drive, Assembly Overview
Courtesy of AUDI OF AMERICA, LLC

1. Control Housing
   - Removal and installation, refer to **CAMSHAFTS**
   - Disassembling and assembling, refer to **Fig. 16**
   - Check screen for dirt, refer to **Fig. 17**
   - Lightly lubricate contact surfaces of oil seals before installing
2. 8 Nm
   - Replace
3. Camshaft Timing Chain
   - Before removing, mark direction of rotation with paint, refer to **Fig. 9**

- Remove from camshafts, refer to **CAMSHAFT TIMING CHAIN**
- Removal and installation, refer to **TIMING MECHANISM DRIVE CHAIN AND CAMSHAFT TIMING CHAIN**

4. Camshaft Adjuster, Exhaust Side
   - Identification: "32A"
   - Removal and installation, refer to **CAMSHAFT TIMING CHAIN**
5. Intermediate Shaft
6. Thrust Washer
7. 8 Nm
8. Timing Chain Tensioning Rail
   - Remove to remove and install upper and lower timing chain covers
9. Mounting Pin
10. Camshaft Timing Chain Tensioner - 40 Nm
    - Removal and installation, refer to **CAMSHAFT TIMING CHAIN**
11. Seal
    - Replace if leaking or damaged
12. Timing Mechanism Drive Chain Sprocket
    - Removal and installation, refer to **TIMING MECHANISM DRIVE CHAIN AND CAMSHAFT TIMING CHAIN**
13. Camshaft Timing Chain Sprocket
    - Removal and installation, refer to **TIMING MECHANISM DRIVE CHAIN AND CAMSHAFT TIMING CHAIN**
14. 60 Nm plus an additional 90° turn
    - Replace
    - Counterhold vibration damper with counterhold T10069 to loosen and tighten
15. Chain Tensioner with Tensioning Rail
    - For drive timing chain
    - Before installation release the locking device in the chain tensioner with a small screwdriver and press the tensioning plate against the chain tensioner
16. Drive Sprocket
    - Integral part of crankshaft
17. Power Take-Off Drive Chain
    - Indicate direction of rotation before removing, refer to **Fig. 9**
    - Removal and installation, refer to **TIMING MECHANISM DRIVE CHAIN AND CAMSHAFT TIMING CHAIN**
18. Timing Mechanism Drive Chain Guide Rail
    - Removal and installation, refer to **TIMING MECHANISM DRIVE CHAIN AND CAMSHAFT TIMING CHAIN**
19. Bolts -10 Nm

- For guide rail

20. 18 Nm
21. 23 Nm
22. Camshaft Adjuster, Intake Side
    - Identification: "24E"
    - Removal and installation, refer to **CAMSHAFT TIMING CHAIN**
23. Bolt
    - Replace
    - Contact surface of sensor wheel at screw head must be dry when installing
    - To loosen and tightening, counterhold with open-end spanner on camshaft hex head **CAMSHAFT TIMING CHAIN**
    - 60 Nm plus an additional 90° ($^{1}/_{4}$) turn.
24. Camshaft Timing Chain Guide Rail
    - Removal and installation, refer to **CAMSHAFT TIMING CHAIN**
25. Camshaft Adjustment Valve 1 -N205-
    - For intake camshaft
    - Mark the electrical connector before disconnecting
26. Camshaft Adjustment Valve 1 (exhaust) -N318-
    - For exhaust camshaft
    - Mark the electrical connector before disconnecting
27. Camshaft Timing Chain Guide Rail
    - Clipped in at control housing

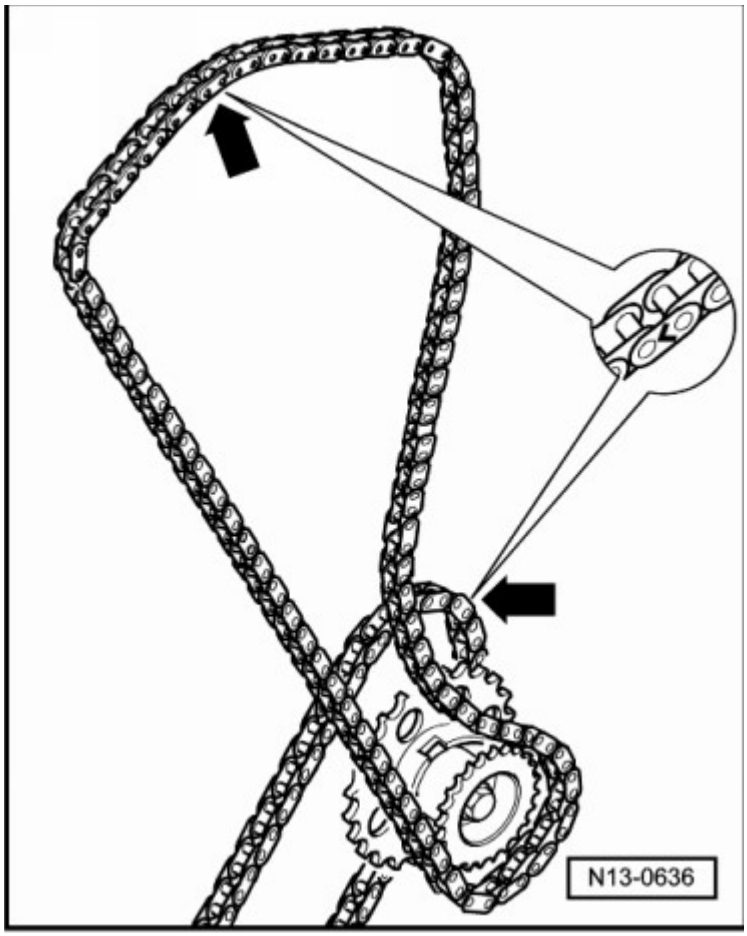

Fig. 9: Identifying Markings On Roller Chains
Courtesy of AUDI OF AMERICA, LLC

-- Identify timing chain direction of rotation with -arrow- mark before removing, using paint -arrows-.

CAUTION: Risk of damaging timing chain.

- **Do not mark chain with punch, notch or something similar.**

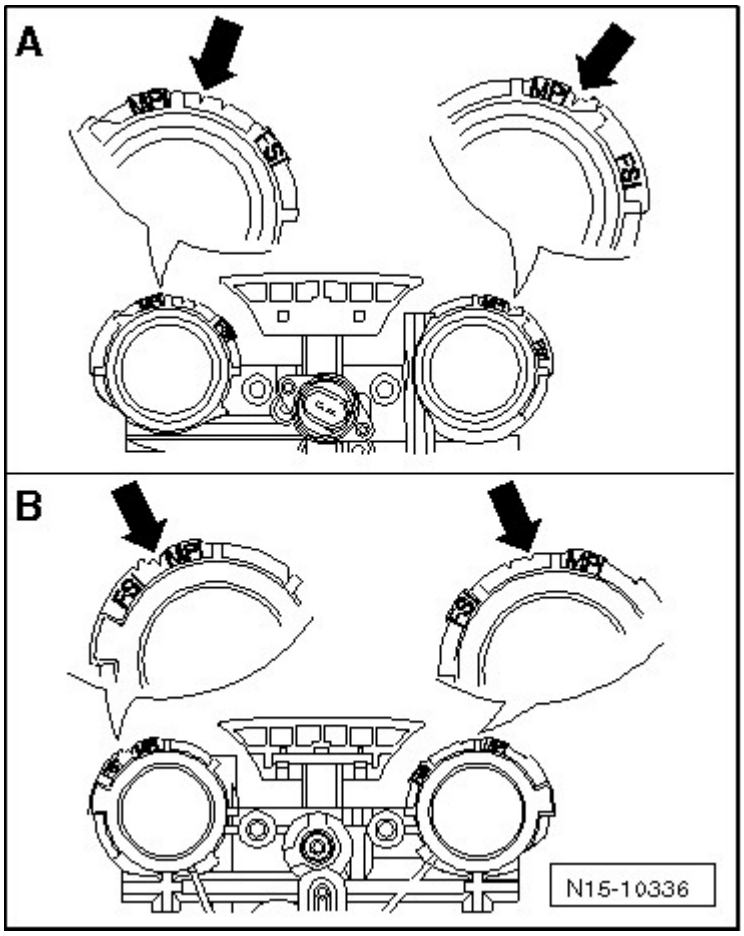

Fig. 10: Identifying Marks On Control Housing With MPI Engines
Courtesy of AUDI OF AMERICA, LLC

-A- Flywheel-side view

-B- Vibration damper-side view

Notches -arrows- are reference points for markings on camshaft adjusters.

VALVETRAIN COMPONENT OVERVIEW

NOTE: After installing the camshafts, the engine may not be started for approximately 30 minutes. The hydraulic adjusting elements must seat themselves (otherwise the valves will seat themselves on the pistons).

After working on the valvetrain and lifters, carefully rotate the crankshaft by hand at least 2 full revolutions before starting to be sure that valves do not strike the pistons.

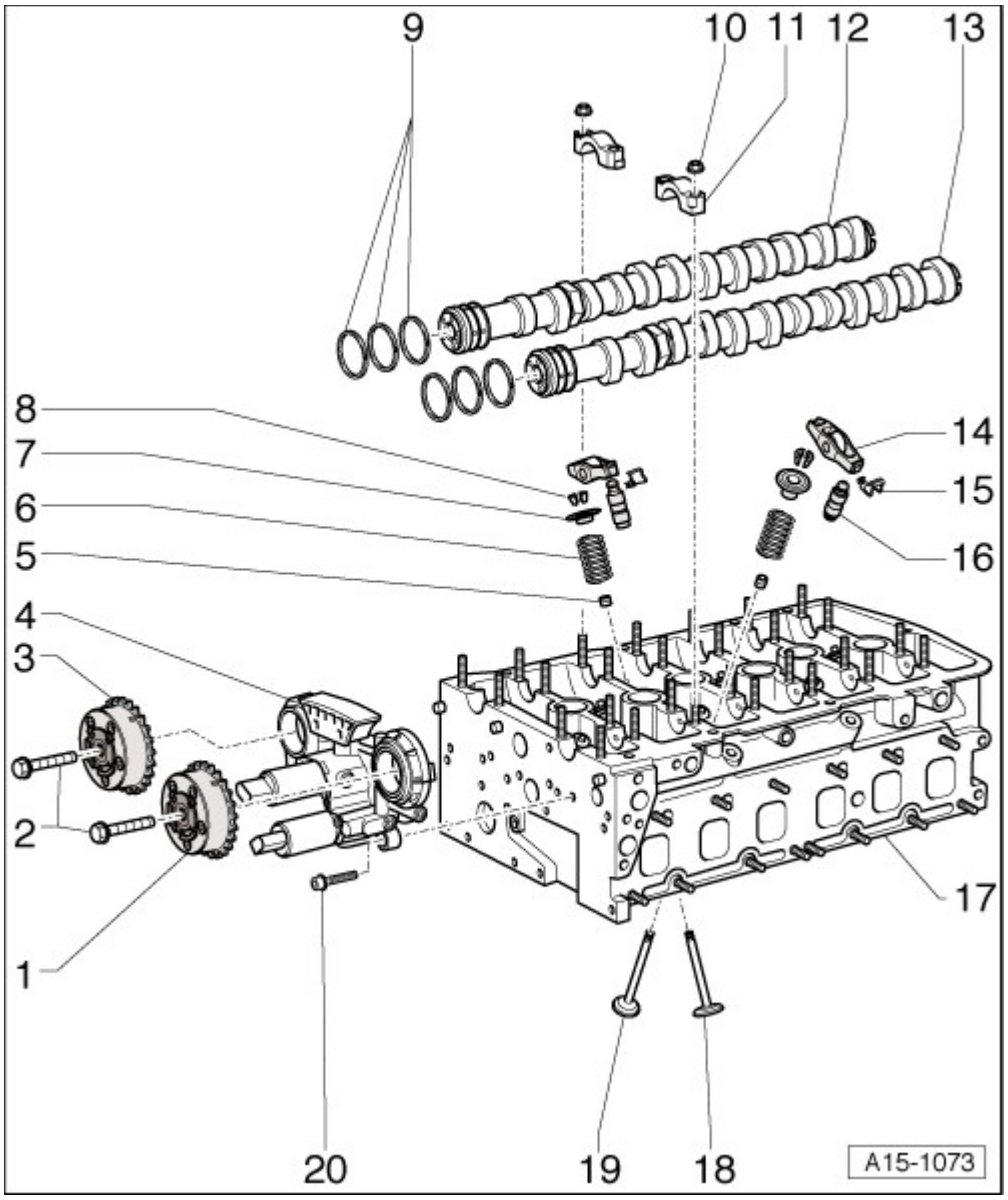

Fig. 11: Valve Gear, Component Overview
Courtesy of AUDI OF AMERICA, LLC

1. Camshaft Adjuster, Exhaust Side
   - Identification: "32A"
   - Removal and installation, refer to **CAMSHAFT TIMING CHAIN**
2. Bolt
   - Replace
   - Counter-hold camshaft using fork wrench SW 32 for removal and installation **CAMSHAFT TIMING CHAIN**
   - Tightening specifications item -23- **TIMING CHAIN COMPONENT OVERVIEW**
3. Camshaft Adjuster, Intake Side

- Identification: "24E"
- Removal and installation, refer to **CAMSHAFT TIMING CHAIN**

4. Control Housing
   - Removal and installation, refer to **CAMSHAFTS**
   - Check control housing strainer for soiling before installation, refer to **Fig. 17**.
   - Lightly lubricate contact surfaces of oil seals before installing
   - disassembling and assembling, refer to **Fig. 16**
5. Valve Stem Seal
   - Replacing with the cylinder head installed, refer to **VALVE STEM SEALS WITH CYLINDER HEAD INSTALLED, REPLACING**
   - Replacing with the cylinder head removed, refer to **VALVE STEM SEALS WITH CYLINDER HEAD REMOVED**
6. Valve Spring
   - Installation position: Larger dia. down
7. Valve Spring Plate
8. Valve Keys
9. Piston Rings
   - 3 per camshaft
   - Replace if leaking
   - When replacing piston rings, do not spread too widely
   - Install with gaps offset 120°
   - When installing control housing item -4- lightly lubricate contact surfaces of piston rings
10. Nut
    - Tightening specifications and tightening sequence, refer to **Fig. 15**
11. Bearing Cap
    - Installed location, refer to **Fig. 14**
    - Installation order **CAMSHAFTS**
12. Intake Camshaft
    - Check radial clearance with Plastigage
    - Radial clearance wear limit: 0.1 mm
    - Run-out: max. 0.01 mm
    - Checking axial play, refer to **CAMSHAFTS, CHECKING AXIAL CLEARANCE**
    - Removal and installation, refer to **CAMSHAFTS**
    - Identification, refer to **Fig. 12**
13. Exhaust Camshaft
    - Check radial clearance with Plastigage
    - Radial clearance wear limit: 0.1 mm
    - Run-out: max. 0.01 mm

- Checking axial play, refer to **CAMSHAFTS, CHECKING AXIAL CLEARANCE**
- Removal and installation, refer to **CAMSHAFTS**
- Identification, refer to **Fig. 12**

14. Roller Rocker Lever
    - Do not interchange
    - Check roller bearing
    - Before installing, check axial play in camshafts, refer to **CAMSHAFTS, CHECKING AXIAL CLEARANCE**
    - Lubricate contact surface
    - Using the locking clamp, clip -item 15- onto the hydraulic adjusting element
15. Securing Clip
    - Check for secure seat
16. Hydraulic Adjusting Element
    - Do not interchange
    - Before installing, check axial play in camshafts, refer to **CAMSHAFTS, CHECKING AXIAL CLEARANCE**
    - Lubricate contact surface
17. Cylinder Head
    - Check valve guides, refer to **VALVE GUIDES, CHECKING**
    - Reface valve seat, refer to **REFACING VALVE SEATS**
18. Intake Valve
    - Do not rework, only lapping is permitted
    - Valve dimensions, refer to **VALVE DIMENSIONS**
    - Check valve guides, refer to **VALVE GUIDES, CHECKING**
    - Refacing valve seats, refer to **REFACING VALVE SEATS**
19. Exhaust Valve
    - Do not rework, only lapping is permitted
    - Valve dimensions, refer to **VALVE DIMENSIONS**
    - Check valve guides, refer to **VALVE GUIDES, CHECKING**
    - Reface valve seats, refer to **REFACING VALVE SEATS**
20. Bolt
    - 8 Nm

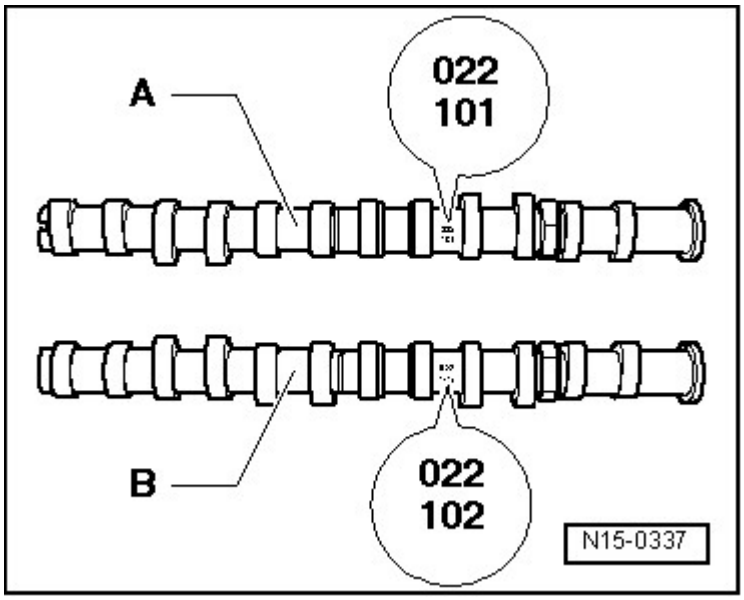

Fig. 12: Camshaft Identification, Valve Timing
Courtesy of AUDI OF AMERICA, LLC

Camshaft identification is located between cylinder 4 and cylinder 5 cam pair.

A - Exhaust camshaft; Identification 022 - Index 101

B - Intake camshaft; Identification 022 - Index 102

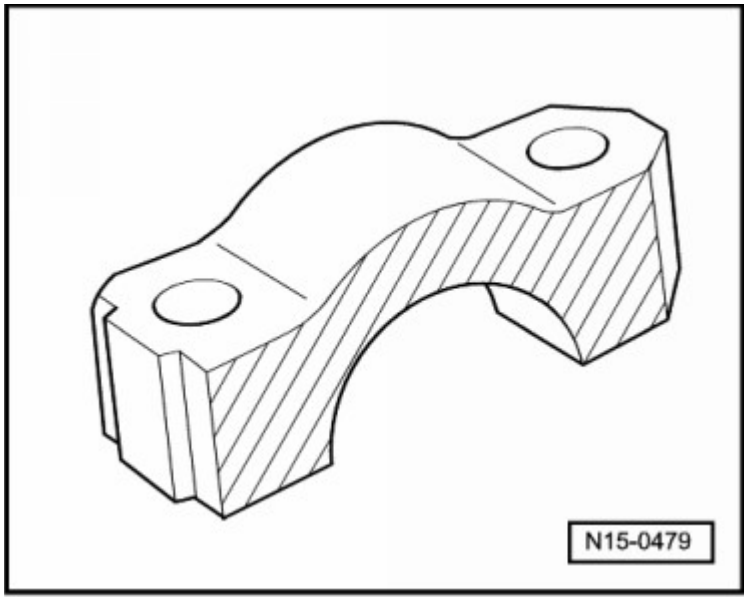

Fig. 13: Coating Bearing Caps 7 And 8 Contact Surface With Adhesive Lubricating Paste
Courtesy of AUDI OF AMERICA, LLC

Lightly coat bearing cap 7 and 8 contact surface -hatched area- with adhesive lubricating paste.

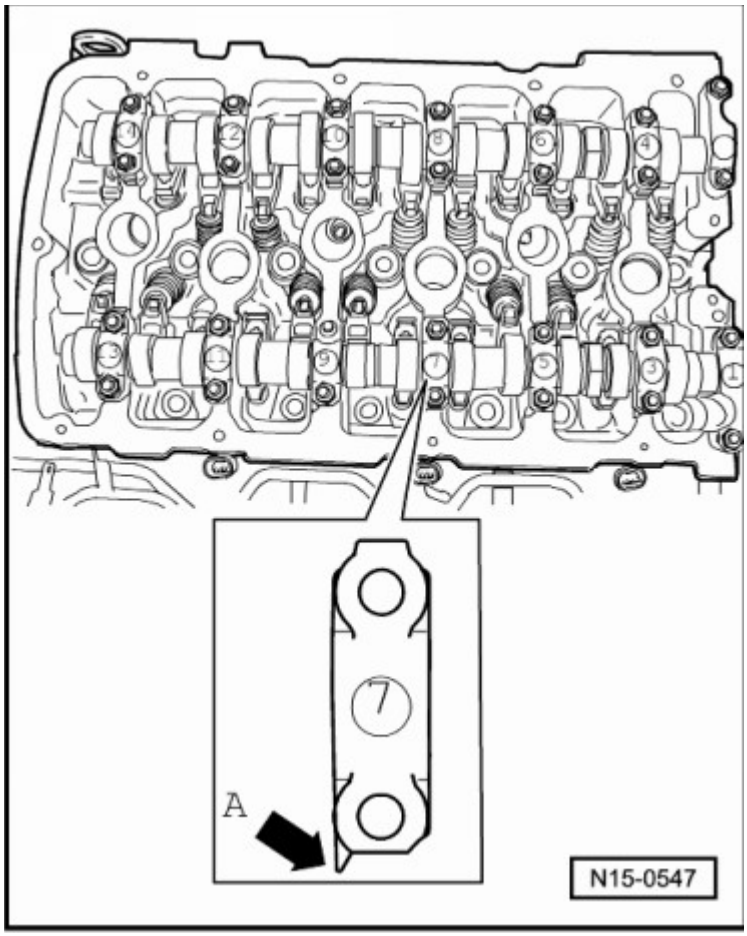

Fig. 14: Identifying Points Of Intake And Exhaust Camshaft Bearing Cap Face Outwards
Courtesy of AUDI OF AMERICA, LLC

- Tops of intake and exhaust camshaft bearing caps -arrow A- face toward outside.

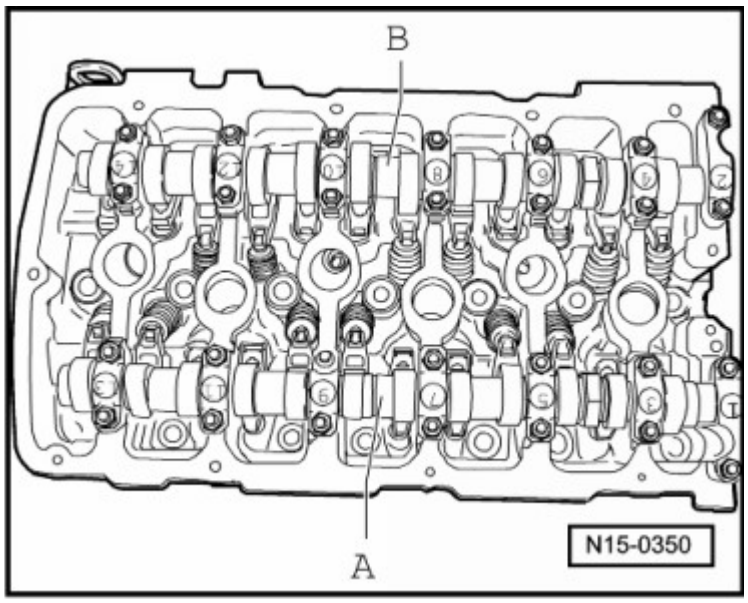

Fig. 15: Identifying Intake Camshaft And Exhaust Camshaft
Courtesy of AUDI OF AMERICA, LLC

-- Tighten nuts on intake camshaft -A- in 5 stages as follows:

1. Install bearing cap 5 and 9 nuts alternately and diagonally as far as stop.
2. Tighten the bearing cap nuts 5 and 9 to 5 Nm plus an additional 45° ($^1/_8$ turn).
3. Tighten the bearing cap nuts 1 and 13 to 5 Nm plus an additional 45° ($^1/_8$ turn).
4. Tighten the bearing cap nuts 7 to 5 Nm plus an additional 45° ($^1/_8$ turn).
5. Tighten the bearing cap nuts 3 and 11 to 5 Nm plus an additional 45° ($^1/_8$ turn).

-- Tighten nuts on exhaust camshaft -B- in 5 stages as follows:

1. Install bearing cap 6 and 10 nuts alternately and diagonally as far as stop.
2. Tighten the bearing cap nuts 6 and 10 to 5 Nm plus an additional 45° ($^1/_8$ turn).
3. Tighten the bearing cap nuts 2 and 14 to 5 Nm plus an additional 45° ($^1/_8$ turn).
4. Tighten the bearing cap nuts 8 to 5 Nm plus an additional 45° ($^1/_8$ turn).
5. Tighten the bearing cap nuts 4 and 12 to 5 Nm plus an additional 45° ($^1/_8$ turn).

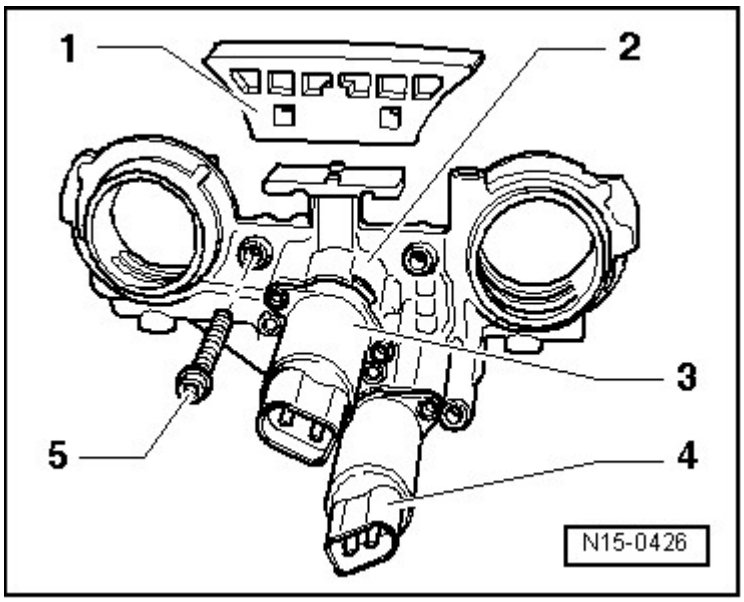

Fig. 16: Control Housing, Assembly Overview
Courtesy of AUDI OF AMERICA, LLC

1. Guide track, clipped in at control housing
2. Control housing

3. Camshaft Adjustment Valve 1 -N205-
4. Camshaft Adjustment Valve 1 (exhaust) -N318-
5. Bolt

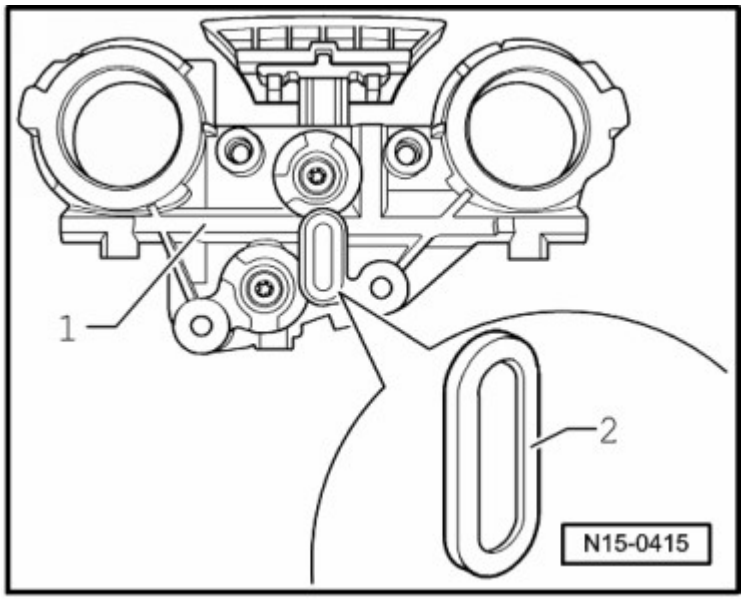

Fig. 17: Backside Of Control Housing & Screen
Courtesy of AUDI OF AMERICA, LLC

-- Unclip screen -2- at backside of control housing -1- and remove any contaminants.

SPECIFICATIONS

VALVE DIMENSIONS

NOTE: Intake and exhaust valves must not be refaced by grinding. Only lapping is permitted.

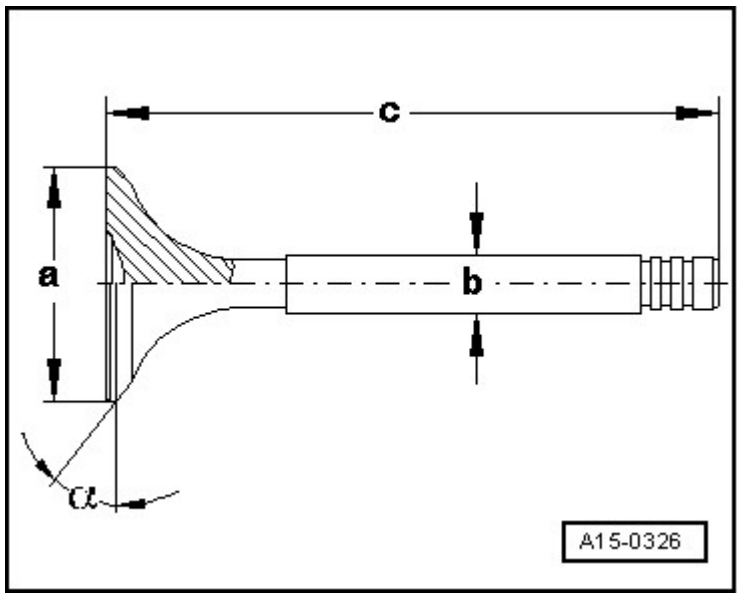

Fig. 18: Identifying Valve Dimensions
Courtesy of AUDI OF AMERICA, LLC

Dimension		Short intake valve	Long intake valve	Short exhaust valve	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:

- **Worn sodium-filled exhaust valves must not be scrapped without first being properly treated.**
- **Using a metal saw, the valves must be cut into two pieces between the shaft center and valve head. While doing this, do not come into contact with water. At the very most, throw 10 of the prepared valves into a bucket filled with water. Then, move quickly away, because a sudden chemical reaction will occur during which the sodium is burnt away.**
- **The treated parts may then be discarded through conventional disposal channels.**

FASTENER TIGHTENING SPECIFICATIONS

Component	Bolt Size	Nm
Camshaft Adjuster, Exhaust Side		60 + 90°
Camshaft Adjuster, Intake Side		60 + 90°
Camshaft Position Sensor		10
Camshaft Timing Chain Guide Rail		

		18[2]
		23[2]
Camshaft Timing Chain Sprocket		60 + 90°[1]
Camshaft Timing Chain Tensioner		40
Chain Tensioner with Tensioning Rail		8[1]
Control Housing		8[1]
Cylinder Head Cover		10
Front exhaust pipe to exhaust manifold, Nuts		25[1]
Lifting Eye		23
Lower Timing Chain Cover		10
Spacing Sleeve, Nut		10
Thermostat Housing Bracket		10
Thrust Washer		8
Timing Mechanism Drive Chain Guide Rail		10
Wire Harness Retainer		10

- [1] Always replace
- [2] For bolt tightening clarification, refer to **TIMING CHAIN COMPONENT OVERVIEW** and see items -20 and 21-

Cylinder Head Cover - Tightening Specifications and Tightening Sequence

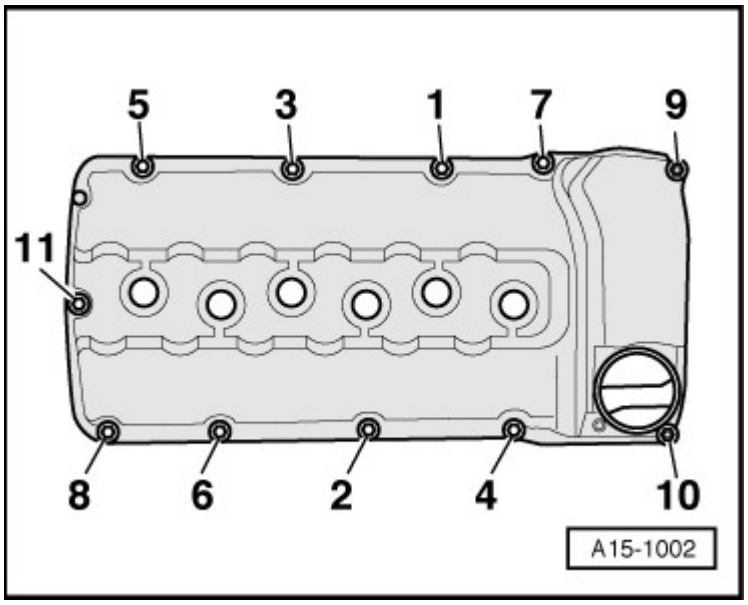

Fig. 19: Cylinder Head Cover Bolts Loosening Sequence
Courtesy of AUDI OF AMERICA, LLC

-- Tighten bolts to 10 Nm in the sequence -1 to 11-.

Cylinder Head - Tightening Specifications and Tightening Sequence

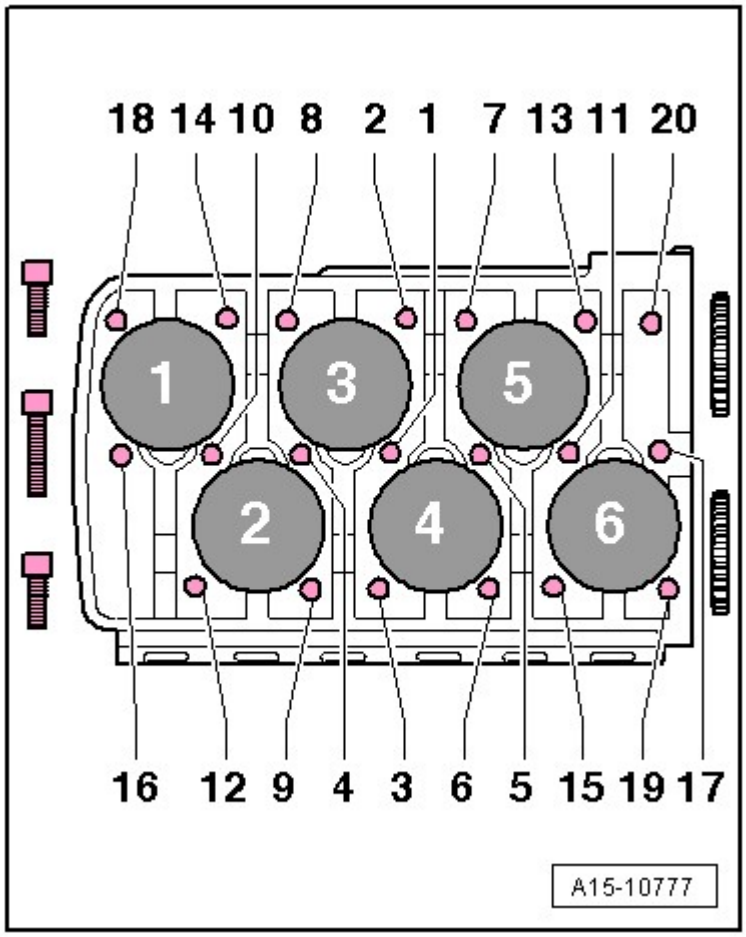

Fig. 20: Cylinder Head - Tightening Specifications And Tightening Sequence
Courtesy of AUDI OF AMERICA, LLC

-- Tighten bolts in 4 stages in -1 to 20- sequence as follows:

NOTE: The longer cylinder head bolts must be inserted in the middle holes of cylinder head.

-- Tighten bolts by hand.

-- Tighten the bolts to 30 Nm.

-- Tighten the bolts to 50 Nm.

-- Tighten an additional 180° ($^{1}/_{2}$ turn).

Upper Timing Chain Cover - Tightening Specifications and Tightening Sequence

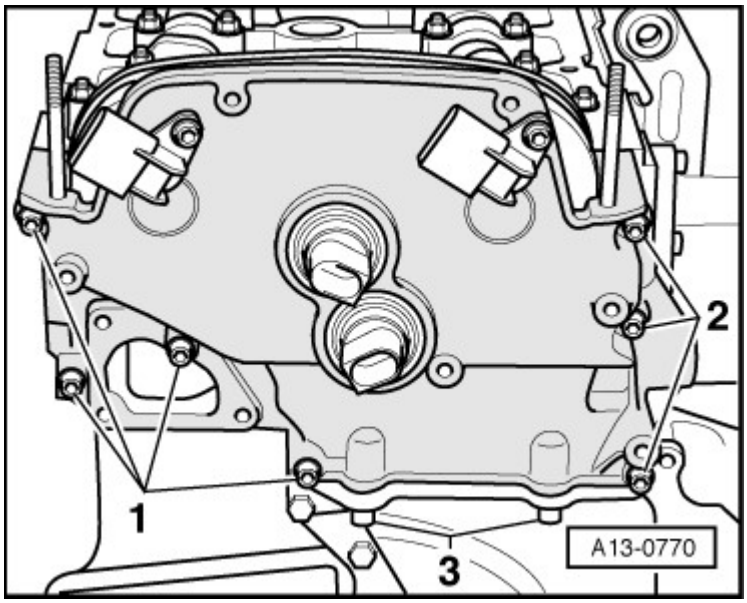

Fig. 21: Identifying Cylinder Head Cover Bolts
Courtesy of AUDI OF AMERICA, LLC

1. Pre-tighten the bolts -1- and -2- to 5 Nm.
2. Tighten the bolts -3- to 23 Nm.
3. Tight the bolts -1- and -2- to 10 Nm.

Camshafts - Tightening Specifications and Tightening Sequence

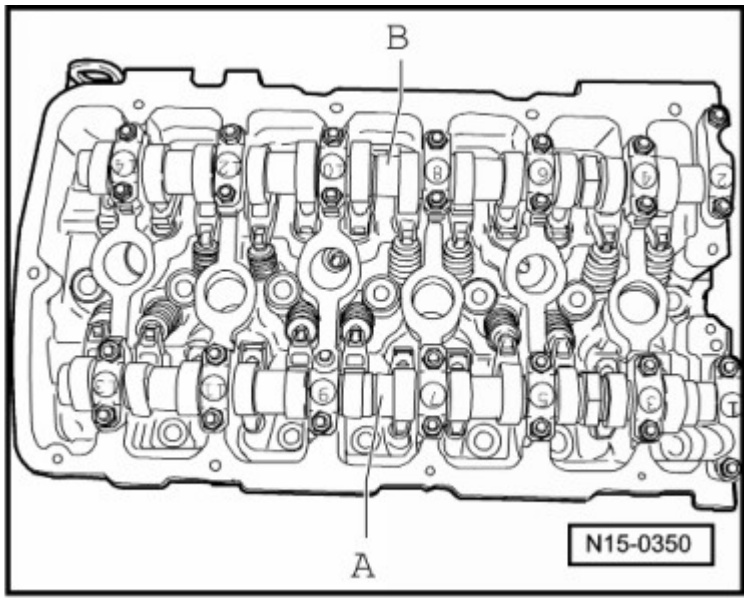

Fig. 22: Identifying Intake Camshaft And Exhaust Camshaft
Courtesy of AUDI OF AMERICA, LLC

-- Tighten nuts on intake camshaft -A- in 5 stages as follows:

1. Install bearing cap 5 and 9 nuts alternately and diagonally as far as stop.
2. Tighten the bearing cap nuts 5 and 9 to 5 Nm plus an additional 45° ($^{1}/_{8}$ turn).
3. Tighten the bearing cap nuts 1 and 13 to 5 Nm plus an additional 45° ($^{1}/_{8}$ turn).
4. Tighten the bearing cap nuts 7 to 5 Nm plus an additional 45° ($^{1}/_{8}$ turn).
5. Tighten the bearing cap nuts 3 and 11 to 5 Nm plus an additional 45° ($^{1}/_{8}$ turn).

-- Tighten nuts on exhaust camshaft -B- in 5 stages as follows:

1. Install bearing cap 6 and 10 nuts alternately and diagonally as far as stop.
2. Tighten the bearing cap nuts 6 and 10 to 5 Nm plus an additional 45° ($^{1}/_{8}$ turn).
3. Tighten the bearing cap nuts 2 and 14 to 5 Nm plus an additional 45° ($^{1}/_{8}$ turn).
4. Tighten the bearing cap nuts 8 to 5 Nm plus an additional 45° ($^{1}/_{8}$ turn).
5. Tighten the bearing cap nuts 4 and 12 to 5 Nm plus an additional 45° ($^{1}/_{8}$ turn).

DIAGNOSIS AND TESTING

COMPRESSION, CHECKING

Special tools and workshop equipment required

- Spark Plug Removal Tool 3122 B
- Compression Tester V.A.G 1763
- Puller For Ignition Coil T10095 A
- Assembly Tool T10118

Procedure

- Engine oil temperature min. 30 °C / 86 °F.
- Battery voltage at least 12.5 V.

-- Switch off ignition.

-- Open engine compartment E-box cover and remove fuel injector fuse -29-.

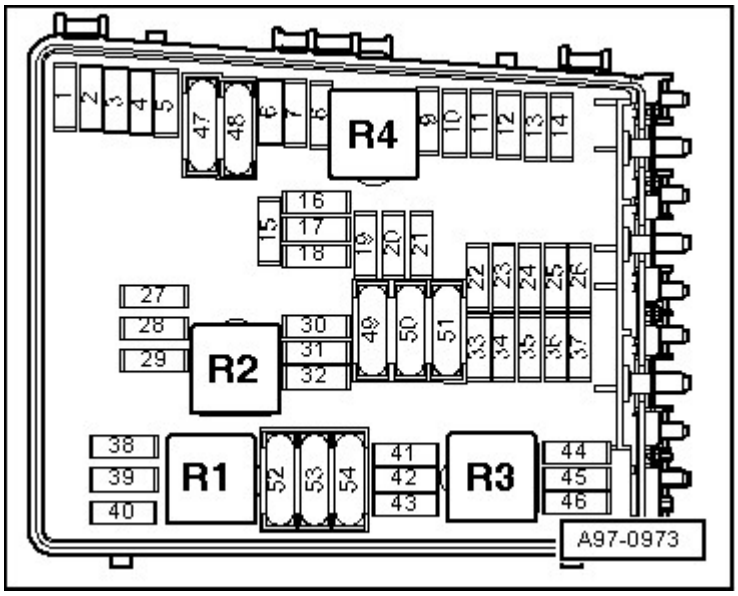

Fig. 23: Fuses On E-Box In Engine Compartment, Left Side
Courtesy of AUDI OF AMERICA, LLC

-- Disconnect electrical harness connectors to ignition coils, to do so attach T10118 on release button -arrow- and carefully disconnect harness connector.

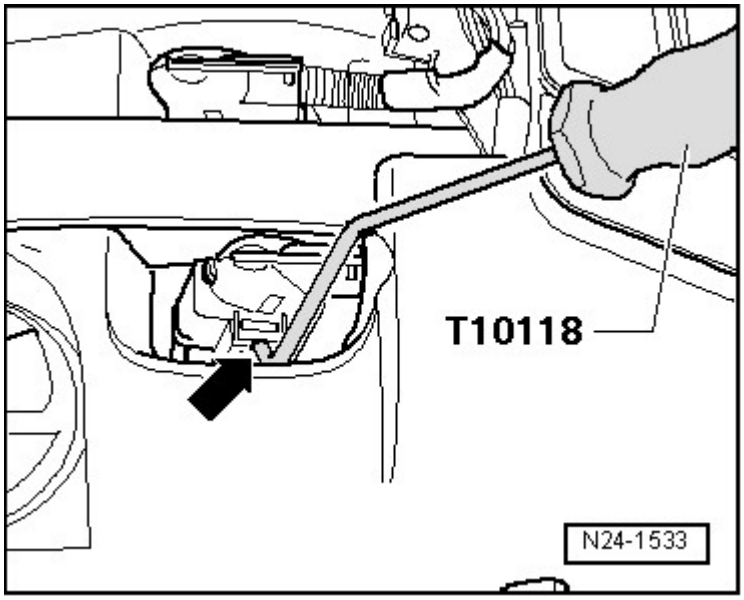

Fig. 24: Disconnecting Electrical Harness Connectors To Ignition Coils
Courtesy of AUDI OF AMERICA, LLC

-- Attach T10095 A on ignition coils -arrow- as depicted in the illustration and pull out ignition coils in succession.

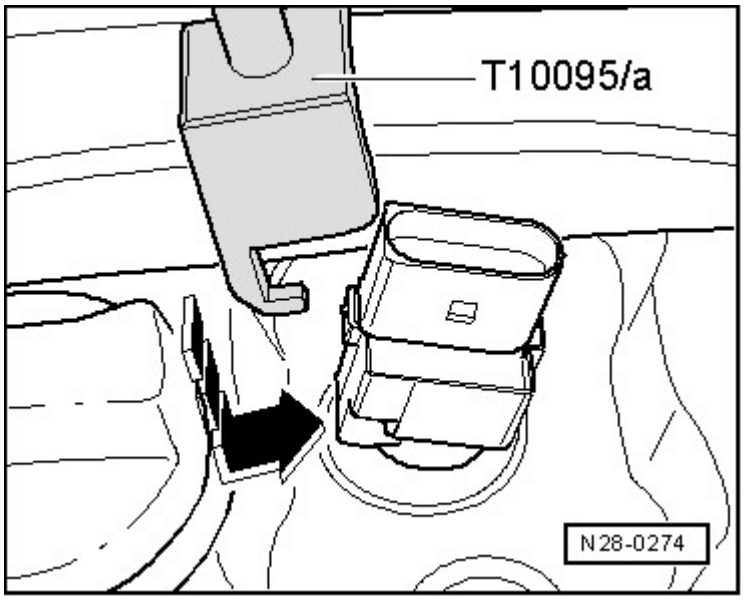

Fig. 25: Attaching Puller For Ignition Coil T10095 A On Ignition Coils And Pulling Out Ignition Coils In Succession
Courtesy of AUDI OF AMERICA, LLC

-- Using 3122 B, remove spark plugs.

-- Check compression using V.A.G 1763.

-- Have a second technician press accelerator pedal completely and at the same time operate starter long enough until pressure increase no longer appears on tester.

Compression pressure	Bar pressure
New	10.0 to 13.0
Wear limit	7.5
Maximum difference between cylinders	3.0

Assembly is in reverse order of removal, note the following:

CAMSHAFTS, CHECKING AXIAL CLEARANCE

Special tools and workshop equipment required

- Dial Gauge Holder VW 387
- Dial gauge

Test Sequence

-- Perform the measurement with the roller rocker levers and hydraulic adjusting elements removed. The bearing cap of axial bearing for respective camshaft remains installed.

-- Secure VW 387 to dial gauge on cylinder head.

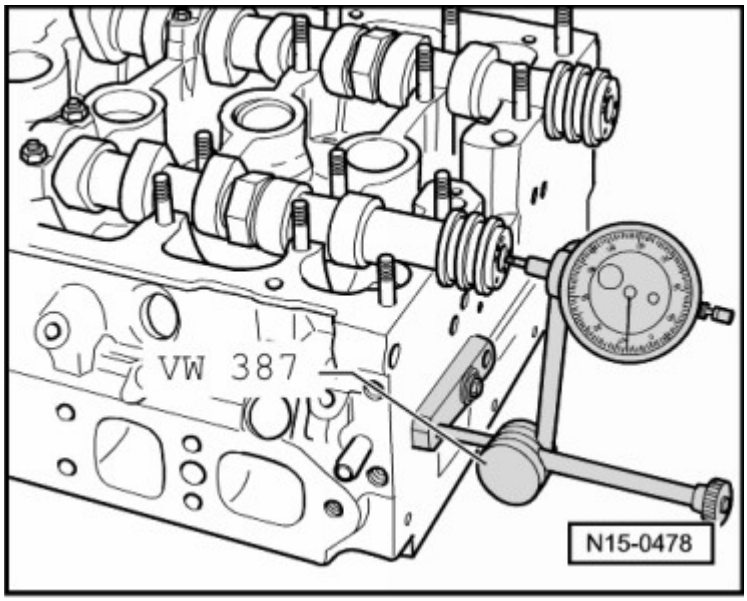

Fig. 26: Checking Camshafts Axial Clearance
Courtesy of AUDI OF AMERICA, LLC

-- Determine axial clearance.

- Axial play wear limit: 0.10 mm.

CAMSHAFT, MEASURING RADIAL PLAY

Procedure

-- Camshafts, removal. Refer to **CAMSHAFTS**.

-- Clean bearing cap and bearing journals.

-- Removing cam follower. Refer to **CAMSHAFTS**.

-- Place Plastigage over entire width of bearing journal or into bearing.

- Plastigage must rest in center of bearing.

-- Position the bearing cap and tighten it to 5 Nm. Refer to **Fig. 15** without rotating the camshaft.

-- Reinstall bearing cap.

-- Compare width of Plastigage with calibrated scale.

Radial clearance:

- Wear limit: 0.1 mm.

VALVE GUIDES, CHECKING

Special tools and workshop equipment required

- Dial Gauge Holder VW 387
- Dial gauge

Test Sequence

-- Insert valve into valve guide. Due to the slight difference in stem dimensions, ensure that only an intake valve is used in the intake guide and an exhaust valve in the exhaust guide.

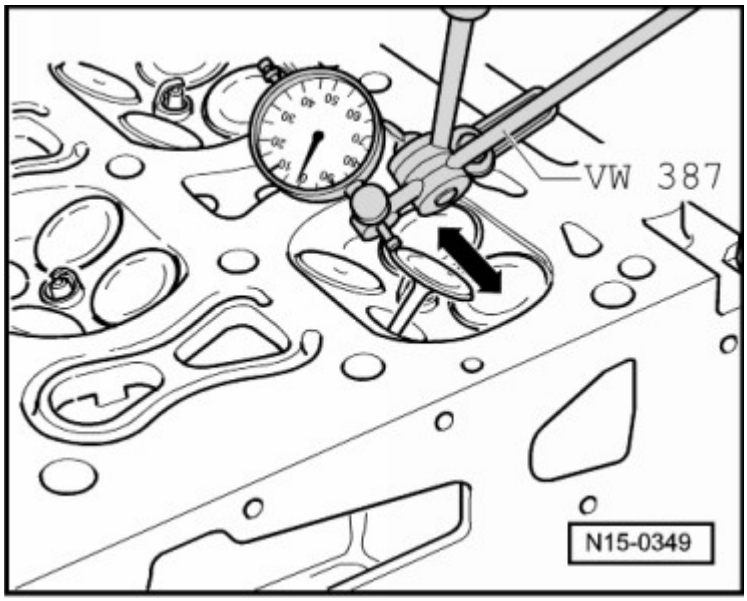

Fig. 27: Checking Valve Guides
Courtesy of AUDI OF AMERICA, LLC

- Valve stem tip must seal with valve guide.

-- Determine tilt clearance.

- Tilt clearance wear limit: 0.8 mm.

NOTE: **If wear limit is exceeded, re-measure using new valves. If wear limit is still exceeded, replace cylinder head. The valve guides cannot be replaced.**

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

REFACING VALVE SEATS

NOTE: If a perfect contact pattern is not achieved by grinding the valve seats, reface the valve seats.

Special tools and workshop equipment required

- Depth gauge
- Valve seat refacing tool

NOTE: When repairing engines with leaking valves, it is not sufficient to rework or replace valve seats and valves. It is particularly important to check valve guides for wear on engines with higher mileage performance. Refer to VALVE GUIDES, CHECKING.

Only reface valve seats enough until a perfect contact pattern is obtained.

Before refacing, determine maximum refacing dimension.

If the reworking dimension is exceeded, the function of the hydraulic lifters can no longer be guaranteed and therefore the cylinder head must be replaced.

Determining maximum allowable reworking dimension

-- Insert valve and press it firmly against the valve seat.

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

-- Measure distance -a- between end of valve stem and the upper cylinder head surface with a depth gauge.

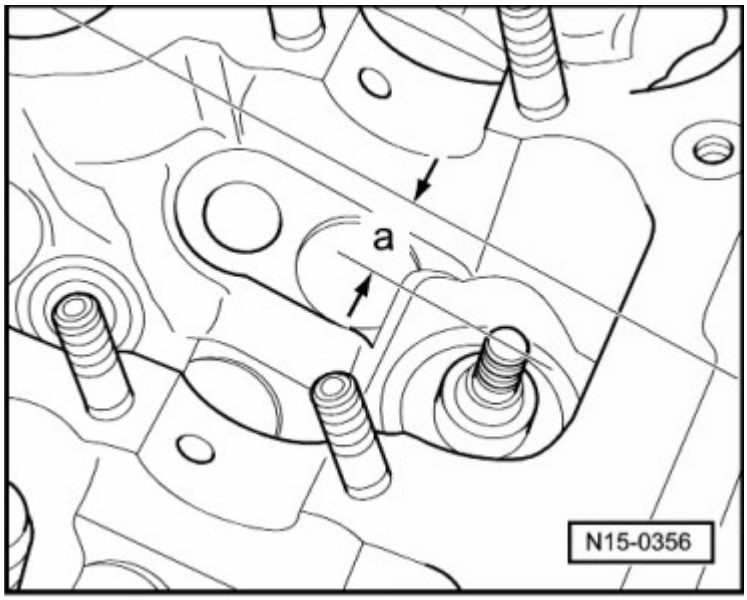

Fig. 28: Identifying Distance Between End Of Valve Stem And Upper Edge Of Cylinder Head
Courtesy of AUDI OF AMERICA, LLC

-- Calculate the maximum allowable refacing dimension from the measured distance and minimum dimension.

Minimum dimensions			
Short intake valve	Long intake valve	Short exhaust valve	Long exhaust valve
31.8 mm	10.2 mm	31.8 mm	10.2 mm

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

Example for long intake valve:		
	Measured distance	10.6 mm
-	Minimum dimension	- 10.2 mm
=	Maximum permissible refacing dimension	= 0.4 mm

NOTE: If the maximum allowed refacing dimension is 0 mm or less than 0 mm, repeat measurement using new valve. If measurement result is still 0 mm or less than 0 mm, replace cylinder head.

Refacing intake valve seat

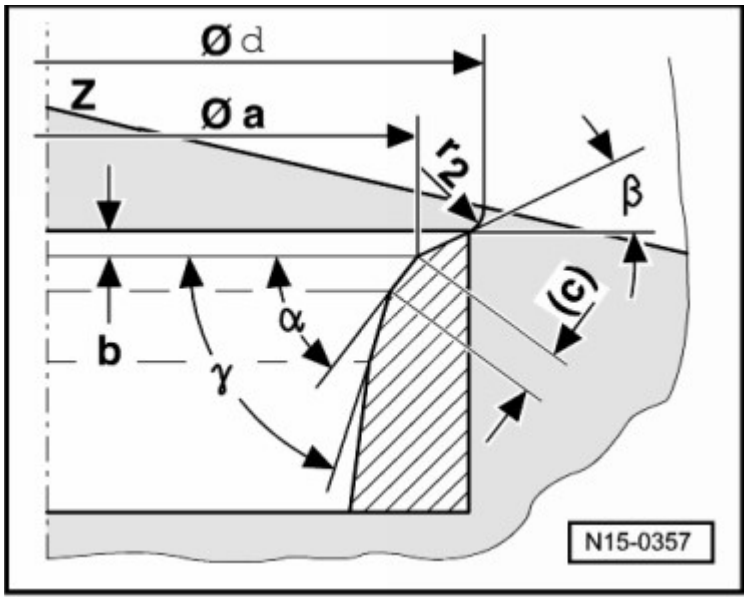

Fig. 29: Identifying Angles And Dimensions To Rework Exhaust Valve Seat
Courtesy of AUDI OF AMERICA, LLC

a - Dia. 30.6 mm

b - Maximum permissible refacing dimension

c - 0.9 to 1.5 mm

d - Max. dia. 35.0 mm

r2 - Radius 2.0 mm

Z - Cylinder head lower edge

a - 45° valve seat angle

ß - 30° upper correction angle

gamma - 60° lower correction angle

NOTE: Calculating maximum allowable refacing dimension REFACING VALVE SEATS.

Refacing exhaust valve seat

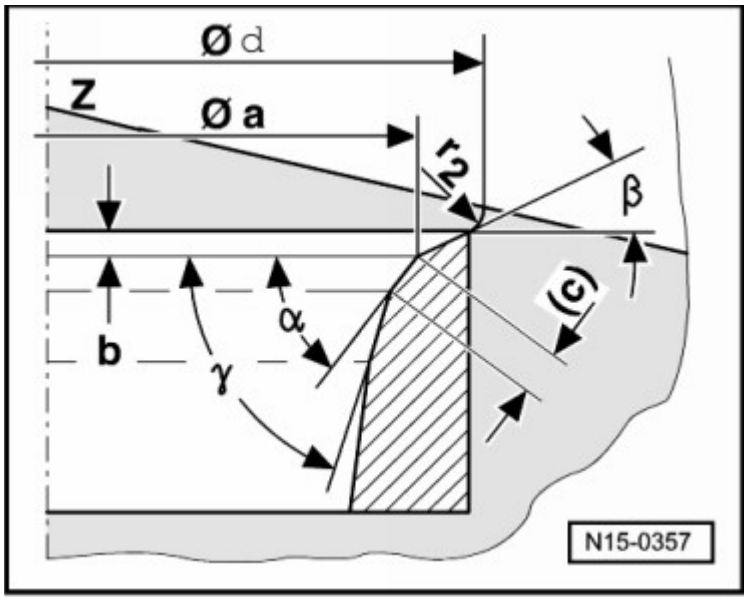

Fig. 30: Identifying Angles And Dimensions To Rework Exhaust Valve Seat
Courtesy of AUDI OF AMERICA, LLC

a - Dia. 26.7 mm

b - Maximum permissible refacing dimension

c - 1.2 to 1.7 mm

d - Max. dia. 29.0 mm

r2 - Radius 2.0 mm

Z - Cylinder head lower edge

a - 45° valve seat angle

ß - 30° upper correction angle

gamma - 60° lower correction angle

NOTE: Calculating maximum allowable refacing dimension REFACING VALVE SEATS.

REMOVAL AND INSTALLATION

CYLINDER HEAD COVER

Special tools and workshop equipment required

- Locking Pin T10060 A

- Ignition Coil Puller T10095 A
- Assembly Tool T10118

Removing

CAUTION: Observe safety precautions when disconnecting the battery. Refer to Removal and Installation .

-- Remove tool formed insert under luggage compartment floor covering.

-- Remove cover -arrow- for battery compartment

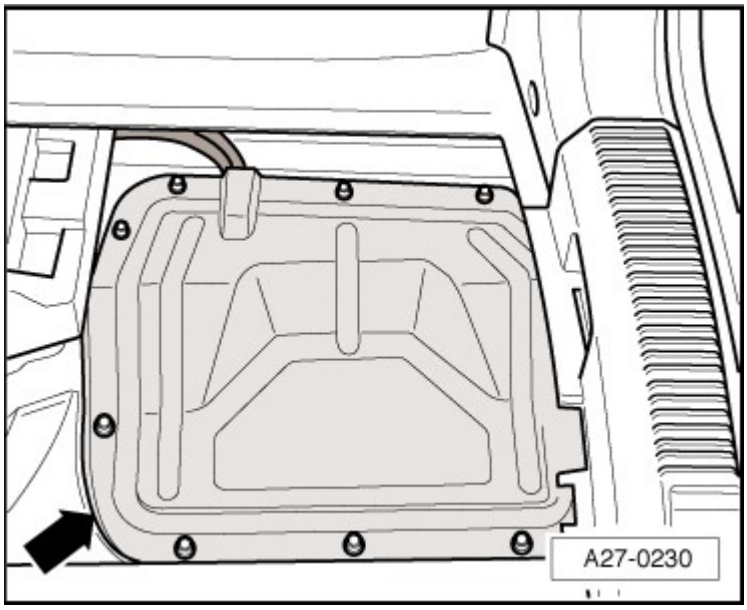

Fig. 31: Battery Compartment Cover
Courtesy of AUDI OF AMERICA, LLC

-- Remove formed insert from over the battery.

-- With ignition switched off, disconnect Battery Ground (GND) cable -arrow-.

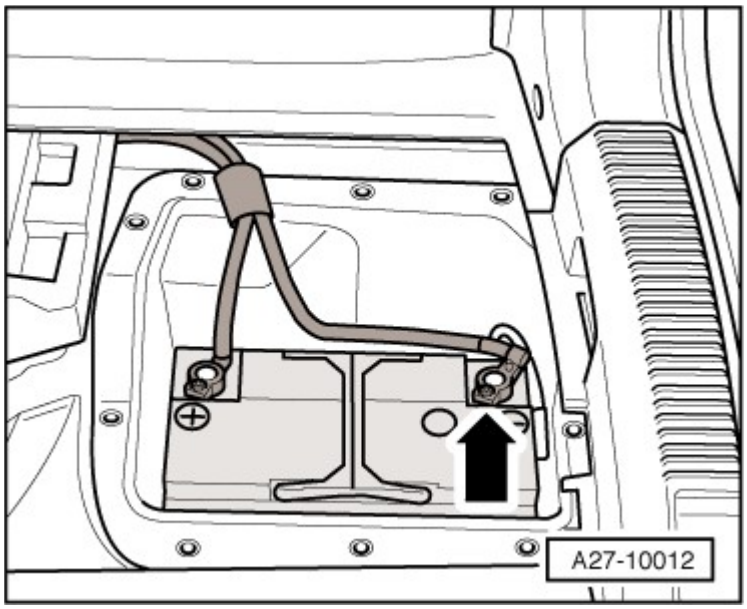

Fig. 32: Battery Ground (GND) Cable
Courtesy of AUDI OF AMERICA, LLC

-- Remove center noise insulation fasteners -1 to 3-.

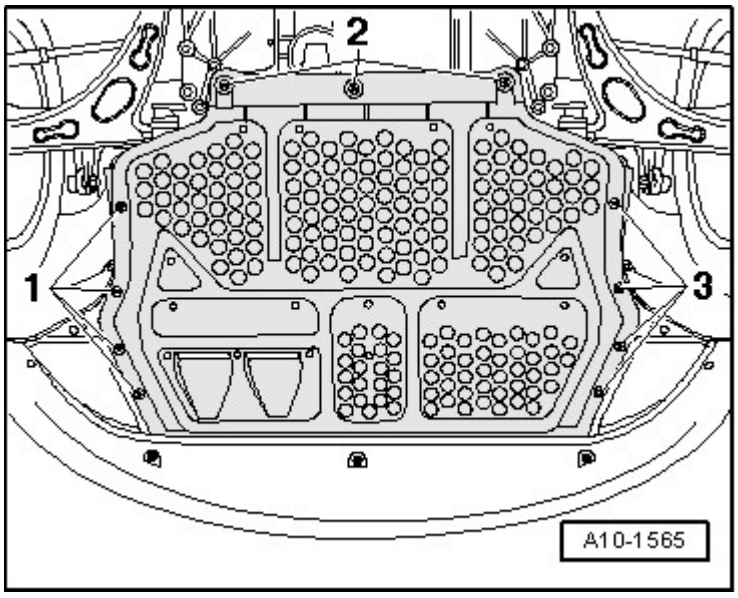

Fig. 33: Center Noise Insulation Bolts
Courtesy of AUDI OF AMERICA, LLC

-- Remove right noise insulation fasteners -1 to 3-.

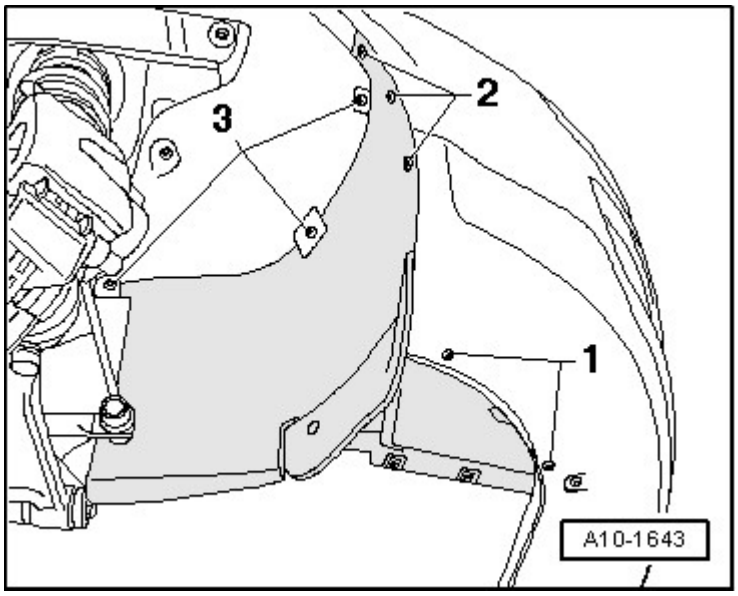

Fig. 34: Identifying Fasteners
Courtesy of AUDI OF AMERICA, LLC

-- If equipped, remove vacuum hose -2- to air guide hose.

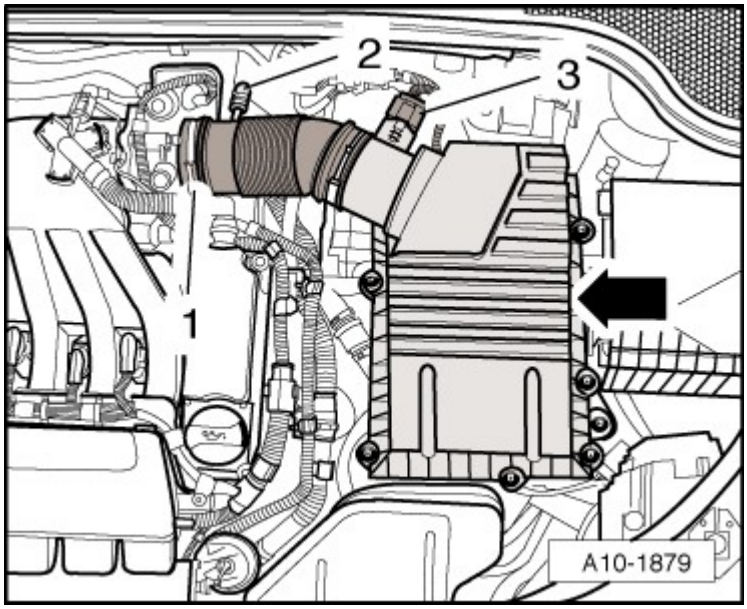

Fig. 35: Identifying Mass Air Flow (MAF) Sensor G70 Electrical Harness Connector
Courtesy of AUDI OF AMERICA, LLC

-- Disconnect air guide hose -1- at throttle valve control module -J338-.

-- Disconnect mass air flow (MAF) sensor -G70- electrical connector -3-.

-- Remove upper section of air filter housing -arrows-.

-- Remove filter element.

-- Pull off air guide cover -1-, disengage clips sideways to do so.

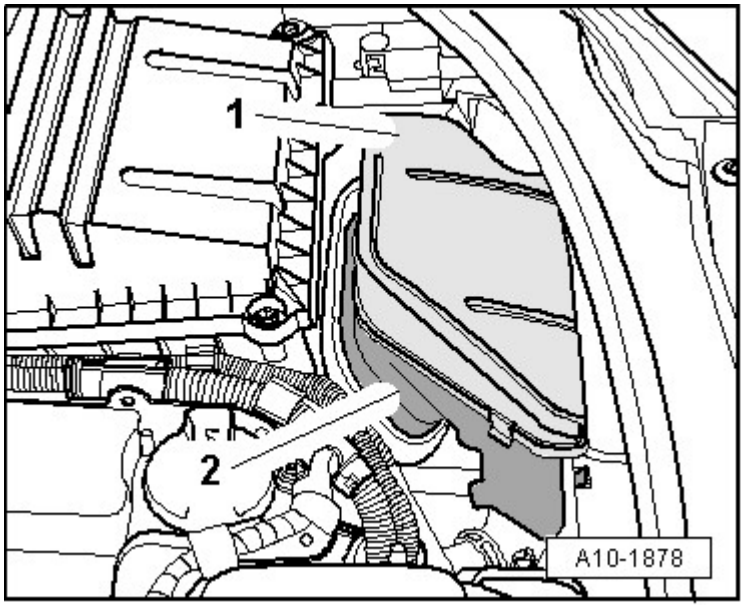

Fig. 36: Air Duct Cover & Air Duct
Courtesy of AUDI OF AMERICA, LLC

-- Unclip air duct -2-.

-- Remove lower section of air duct -arrows-.

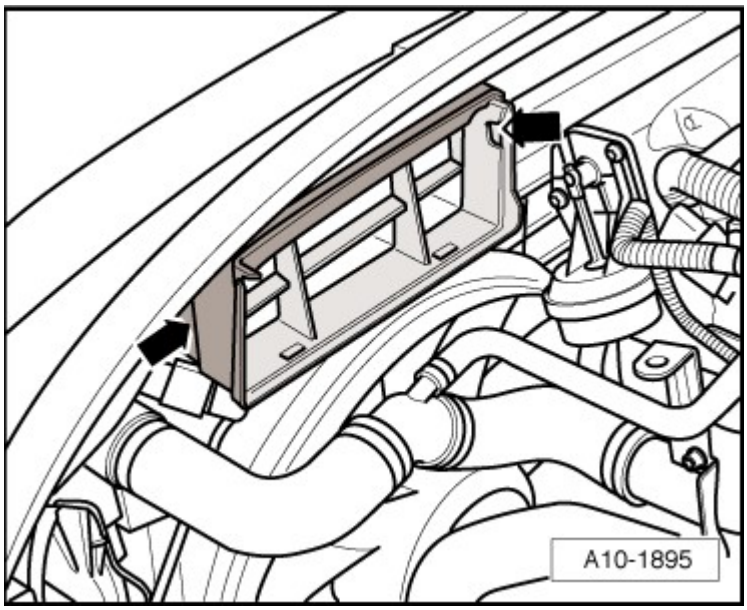

Fig. 37: Lower Part Of Air Duct
Courtesy of AUDI OF AMERICA, LLC

-- Remove lower section of air filter housing -arrows-.

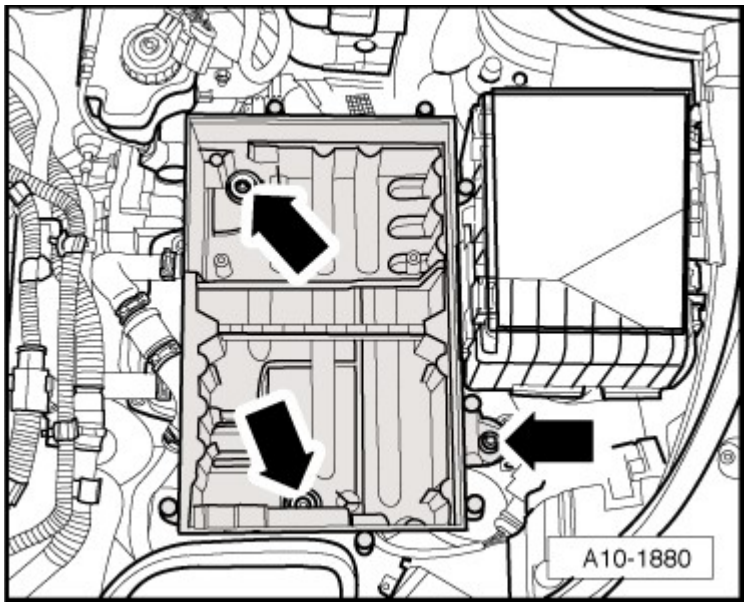

Fig. 38: Identifying Screws For Lower Portion Of Air Cleaner Housing
Courtesy of AUDI OF AMERICA, LLC

-- Disconnect secondary air hose at position indicated by -arrow-.

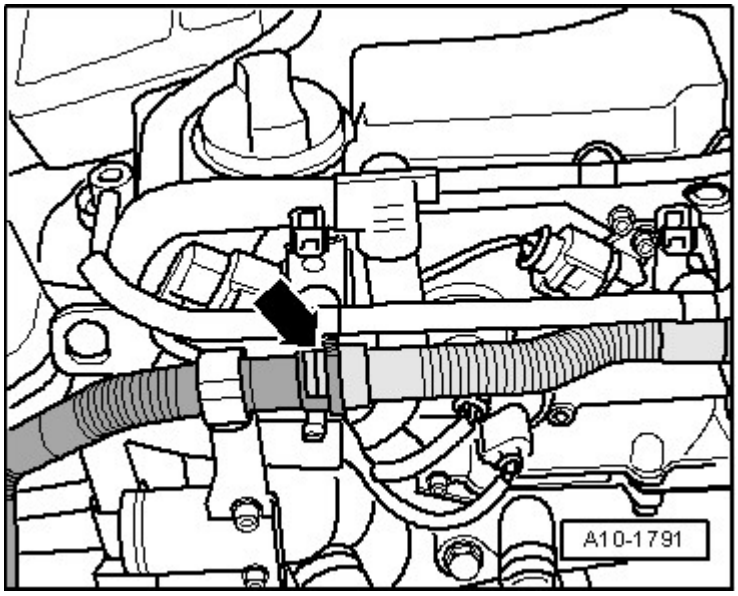

Fig. 39: Disconnecting Secondary Air Hose
Courtesy of AUDI OF AMERICA, LLC

-- Free up air hose to Secondary Air Injection (AIR) pump.

-- Disconnect the connectors -2- and -3-.

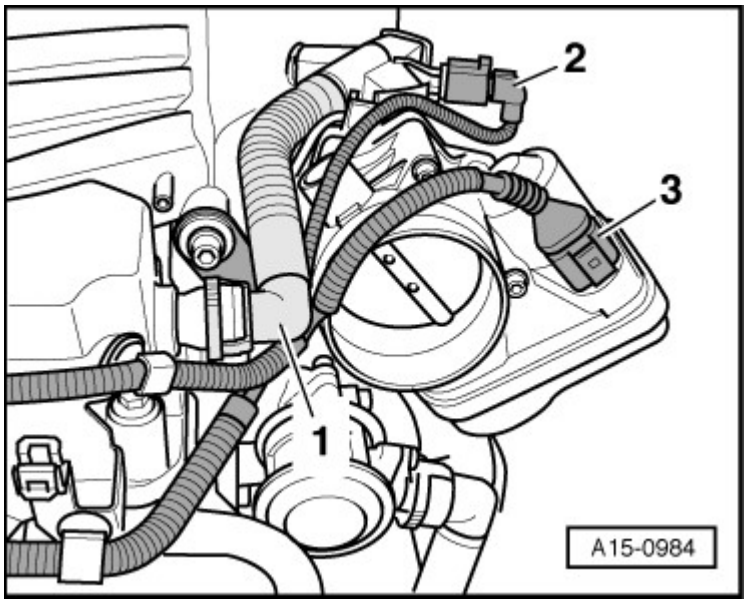

Fig. 40: Crankcase Ventilation Hose & Electrical Connectors
Courtesy of AUDI OF AMERICA, LLC

-- Disconnect crankcase ventilation hose -1-.

-- Remove throttle valve control module -J338- from intake manifold -arrows-.

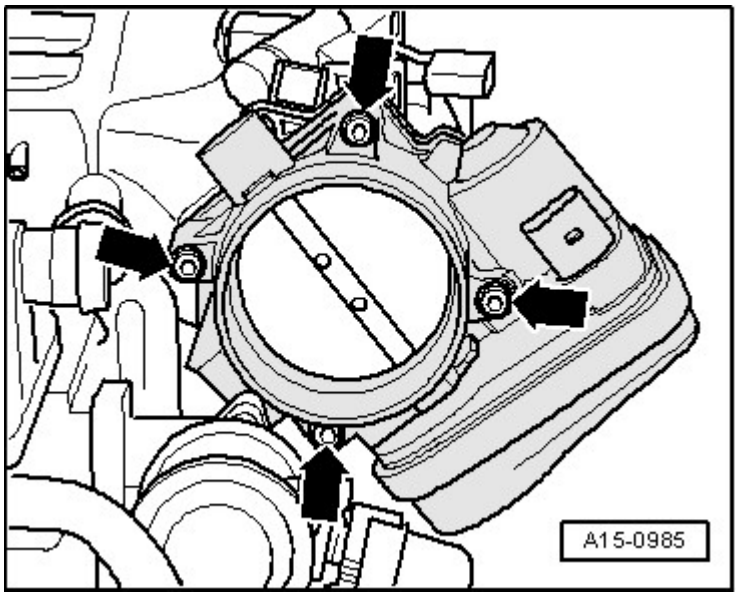

Fig. 41: Identifying Bolts And Throttle Valve Control Module -J338- To Intake Manifold
Courtesy of AUDI OF AMERICA, LLC

-- Disconnect electrical harness connectors to ignition coils, to do so attach T10118 on release button -arrow- and carefully disconnect harness connector.

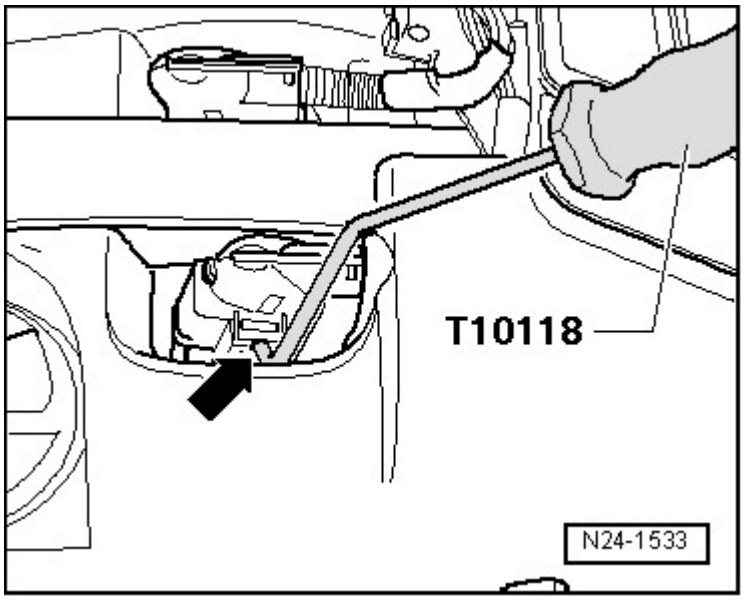

Fig. 42: Disconnecting Electrical Harness Connectors To Ignition Coils
Courtesy of AUDI OF AMERICA, LLC

-- Attach T10095 A on ignition coils -arrow- as depicted in the illustration and pull out ignition coils in succession.

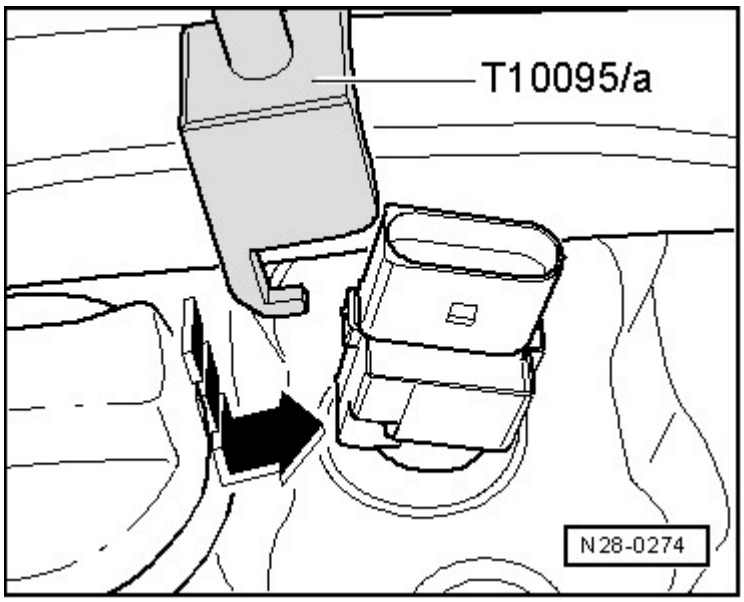

Fig. 43: Attaching Puller For Ignition Coil T10095 A On Ignition Coils And Pulling Out Ignition Coils In Succession
Courtesy of AUDI OF AMERICA, LLC

-- Remove electrical wiring guide from intake manifold and lay aside.

NOTE: Depending on the construction version, low pressure connectors were used in the version shown. To disconnect, slide back rubber cap -1- and slide release

button -2- to the rear.

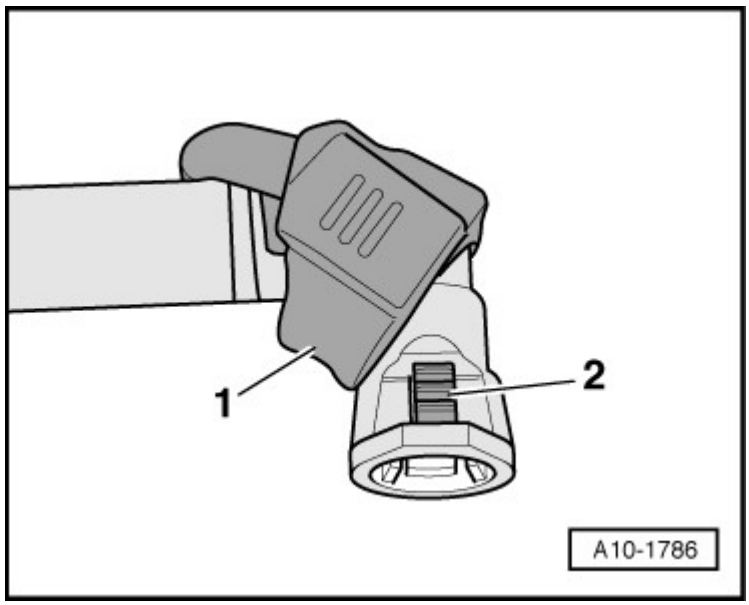

Fig. 44: Identifying Vacuum Connections Back Rubber Cap & Retaining Tab
Courtesy of AUDI OF AMERICA, LLC

-- Remove rear vacuum hoses -2 to 5- at intake manifold.

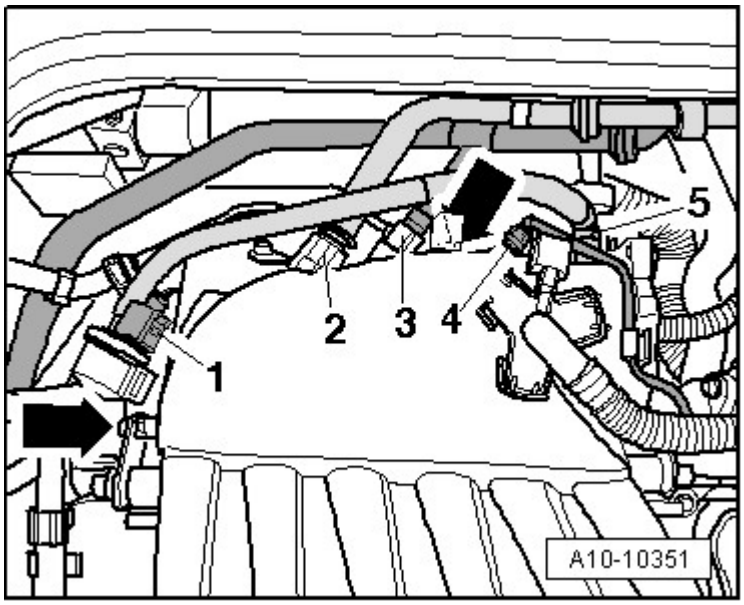

Fig. 45: Electrical Connector To Evaporative Emission (EVAP) Canister Purge Regulator Valve N80 & Vacuum Hoses
Courtesy of AUDI OF AMERICA, LLC

NOTE: Ignore -1-.

-- Remove wiring connection from intake manifold -arrows- and lay back with hoses connected.

-- Remove intake manifold bolts -arrows-.

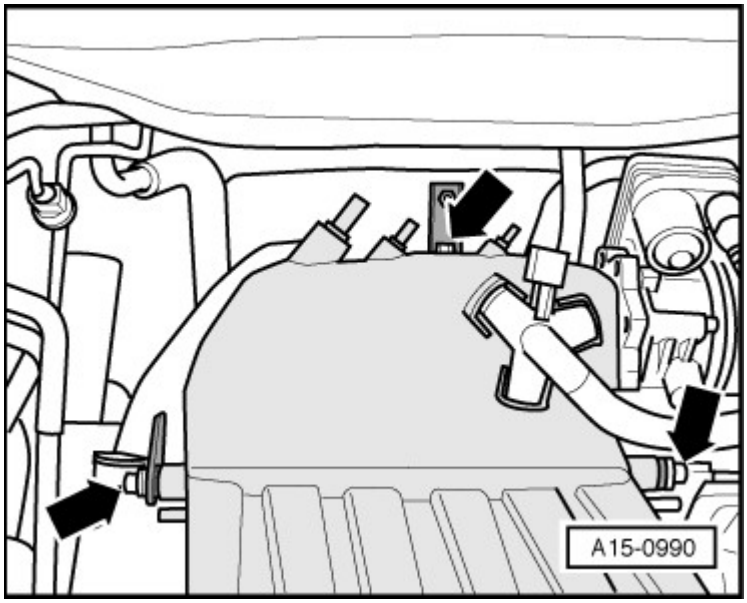

Fig. 46: Intake Manifold Bolts
Courtesy of AUDI OF AMERICA, LLC

-- Remove top mounting bolts for fan shroud -top arrows-.

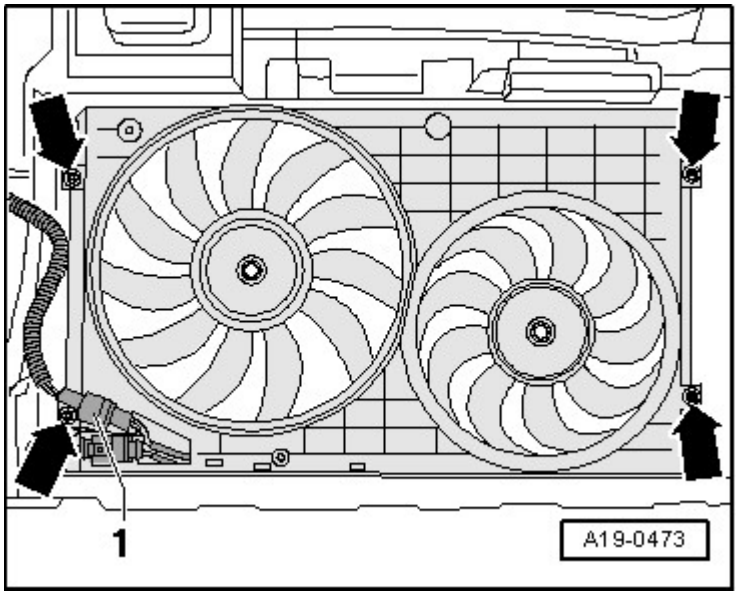

Fig. 47: Coolant Fan Control (FC) Control Module J293 & Bolts
Courtesy of AUDI OF AMERICA, LLC

-- Remove oil dipstick.

NOTE: **Before removing the ribbed belt, mark the turning direction on it with chalk or a felt tip pen. A reversed direction of rotation can cause damage to the belt under operating conditions.**

-- Swing tensioning device in direction of -arrow- to relieve tension on the ribbed belt and then lock it in place using the T10060 A.

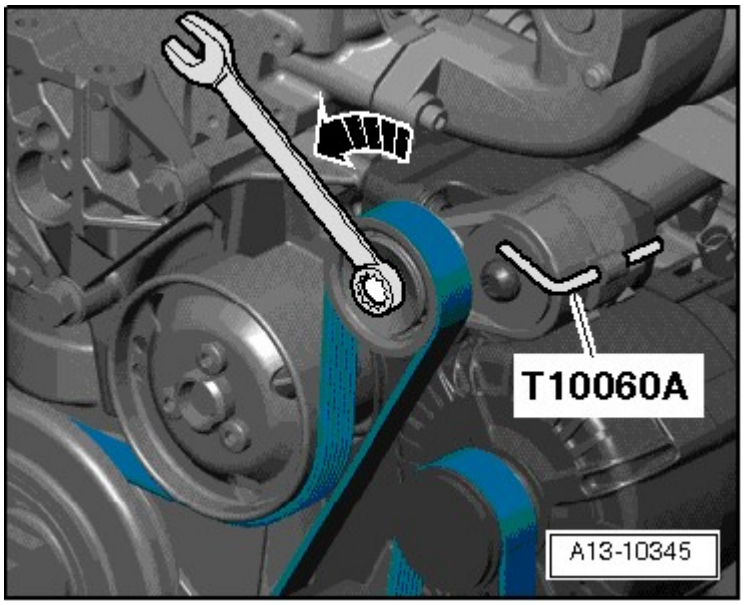

Fig. 48: Relieving Tension On Ribbed Belt
Courtesy of AUDI OF AMERICA, LLC

-- Remove ribbed belt.

-- Free up coolant hose at bottom on fan shroud.

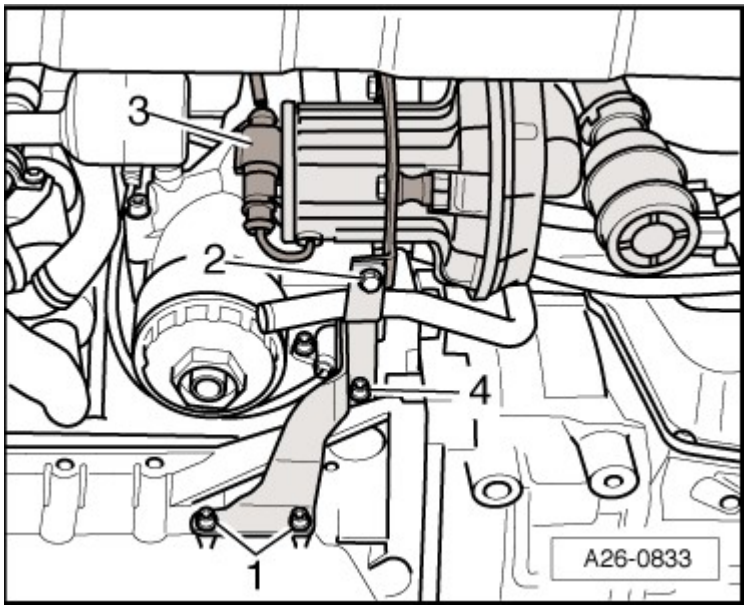

Fig. 49: Identifying Secondary Air Injection (AIR) Pump Motor V101 Electrical Harness Connector
Courtesy of AUDI OF AMERICA, LLC

-- Disconnect electrical harness connector -3- at secondary air injection (AIR) pump motor -V101-.

-- Free up cable.

-- On vehicles with DSG transmission, remove coolant pipe bracket -2- to transmission oil cooler.

-- Remove bolts -1-.

-- Loosen bolt -4- and remove Secondary Air Injection (AIR) pump with bracket.

-- Disconnect electrical harness connectors -1- for coolant fans at bottom on fan shroud.

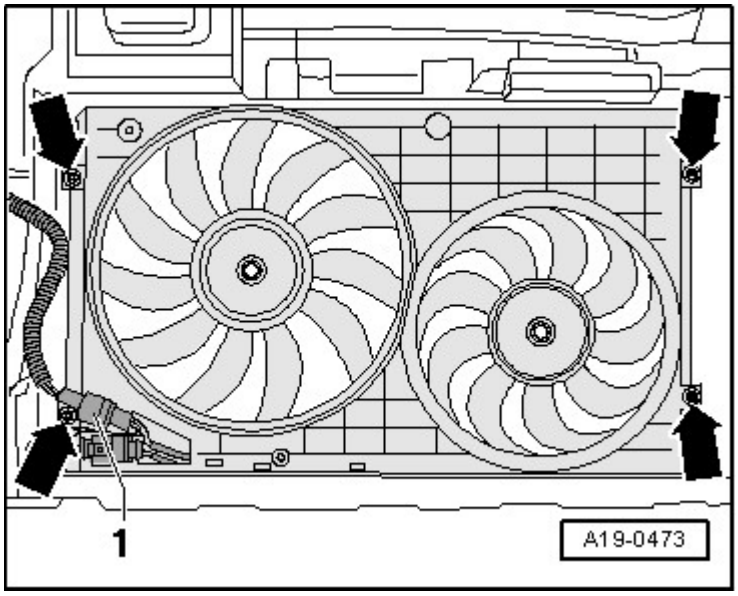

Fig. 50: Coolant Fan Control (FC) Control Module J293 & Bolts
Courtesy of AUDI OF AMERICA, LLC

-- Remove mounting bolts for fan shroud at bottom -bottom arrows-.

-- Pull out fan shroud downward with both fans.

-- Disconnect electrical harness connector -1- for A/C clutch on A/C compressor and free up electrical wire.

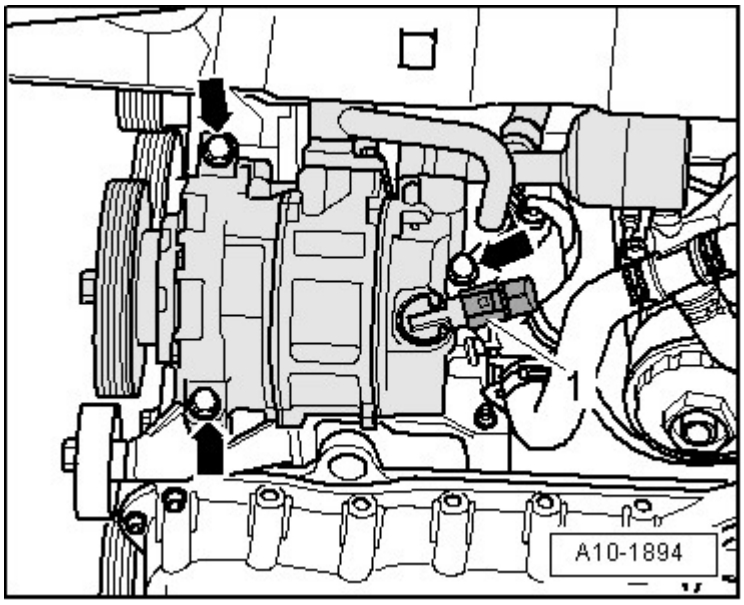

Fig. 51: Electrical Harness Connector For A/C Clutch On A/C Compressor
Courtesy of AUDI OF AMERICA, LLC

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

-- Remove bolts -arrow- for A/C compressor.

-- Securely tie the A/C compressor with connected coolant hoses at front on the longitudinal member.

-- Remove electrical wire -1- on generator.

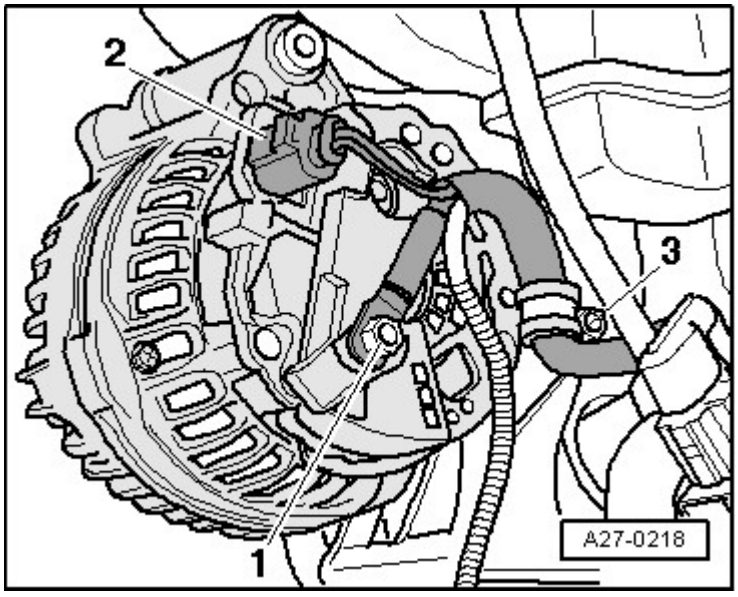

Fig. 52: Identifying Connector, Electrical Wire And Wiring Clamp On Generator

Courtesy of AUDI OF AMERICA, LLC

-- Separate the electrical connector -2-.

NOTE: Ignore -3-.

-- Remove upper idler roller -1-.

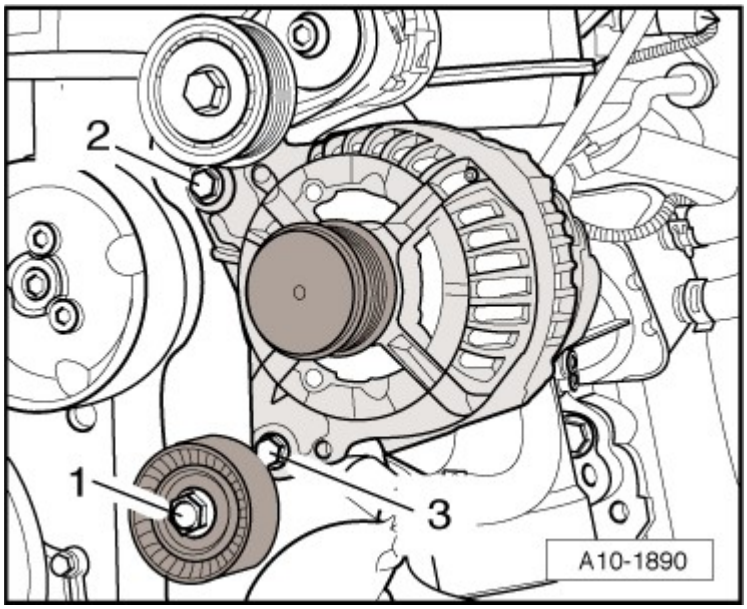

Fig. 53: Identifying Upper Idler Roller And Bolts
Courtesy of AUDI OF AMERICA, LLC

-- Remove mounting bolts -2- and -3- for generator.

NOTE: Generator can be removed from bracket only with the upper mounting bolt still installed.

-- Remove generator with electrical wiring connected from accessory assembly bracket.

-- Remove generator downward and to the left.

-- Disconnect electrical harness connector -arrow- at after-run coolant pump -V51-.

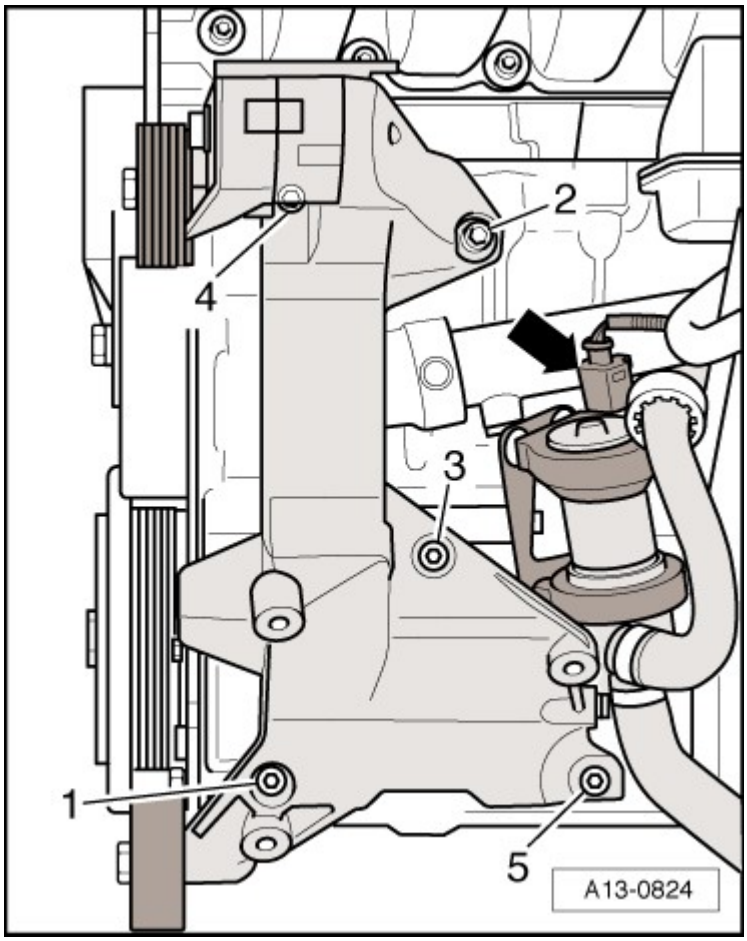

Fig. 54: Accessory Assembly Bracket Bolts & After-Run Coolant Pump V51 Electrical Harness Connector
Courtesy of AUDI OF AMERICA, LLC

-- Remove bolts -1 to 5- and remove accessory assembly bracket.

-- Pull after-run coolant pump -V51-, with coolant hoses connected, downward out of rubber loops of retainer. Spray rubber loops with silicon-free lubricant if necessary.

NOTE: Coolant pump remains on the engine with coolant hoses connected.

-- Disengage for engine speed (RPM) sensor -G28- connector -arrow- from bracket on oil dipstick guide tube.

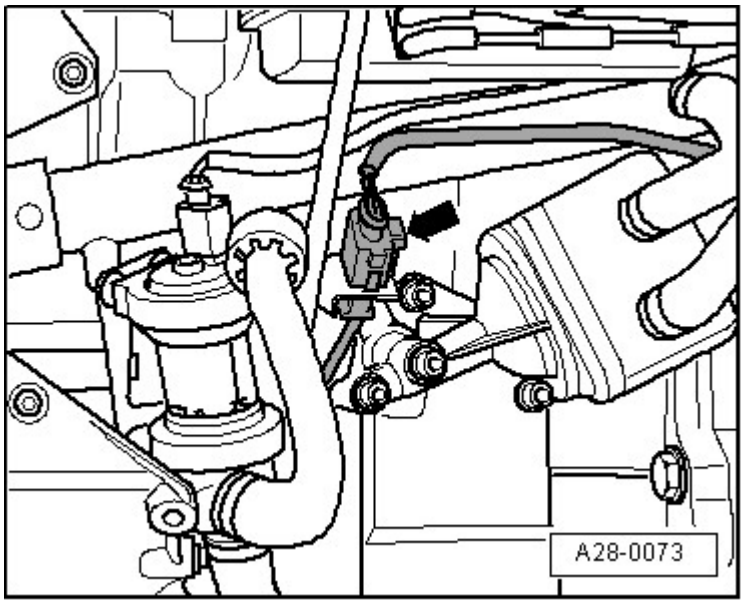

Fig. 55: Disconnecting Gray Engine Speed (RPM) Sensor G28 Electrical Harness Connector
Courtesy of AUDI OF AMERICA, LLC

-- Remove bolt -3- and remove oil dipstick guide tube -2-.

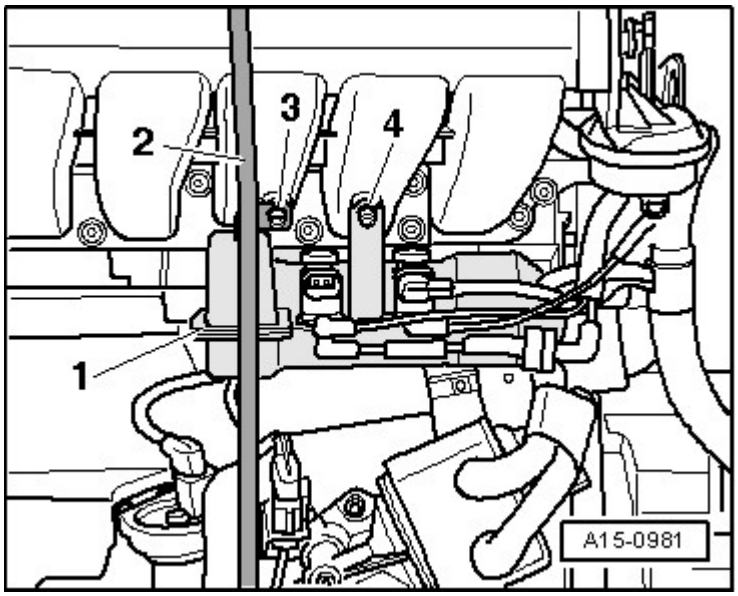

Fig. 56: Identifying Mounting Bolts, Oil Dipstick Guide Tube & Vacuum Reservoir
Courtesy of AUDI OF AMERICA, LLC

-- Remove bolt -4- and remove vacuum reservoir -1- from intake manifold.

-- Lay vacuum reservoir aside with lines connected.

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

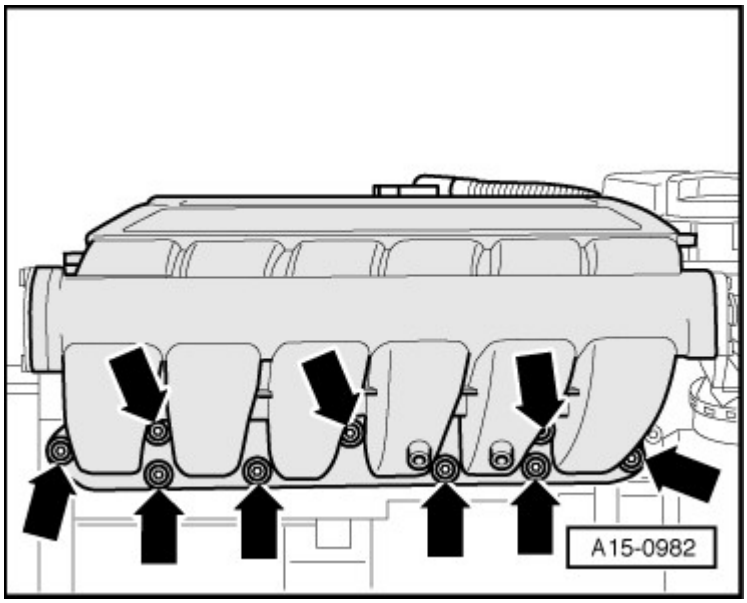

Fig. 57: Front Of Intake Manifold Bolts
Courtesy of AUDI OF AMERICA, LLC

-- Remove vacuum line -arrow- at variable intake manifold actuator.

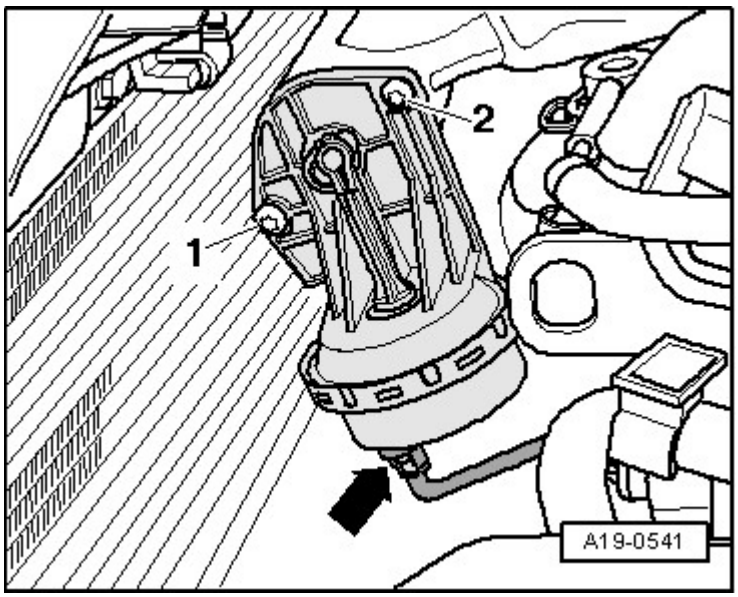

Fig. 58: Disconnecting Vacuum Hose At Vacuum Unit For Intake Manifold Change-Over
Courtesy of AUDI OF AMERICA, LLC

NOTE: Ignore -1- and -2-.

-- Protect intake manifold from damage with a clean cloth -1-.

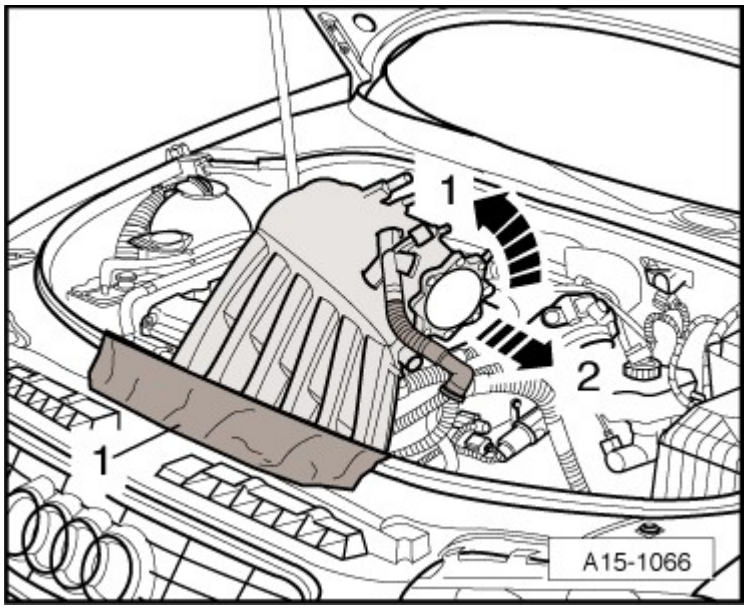

Fig. 59: Protecting Intake Manifold From Damage With Clean Cloth & Swinging Intake Manifold Forward And Pulling Slightly To Left
Courtesy of AUDI OF AMERICA, LLC

-- Swing intake manifold forward -arrow 1- and then pull slightly to left -arrow 2-.

NOTE: Seal intake channel in cylinder head with clean cloth or foam pieces so that no small parts can fall in.

-- Remove right fuel line bracket on cylinder head cover.

-- Remove left electrical line bracket from timing chain cover.

-- Loosen cylinder head cover bolts in sequence -11 to 1-.

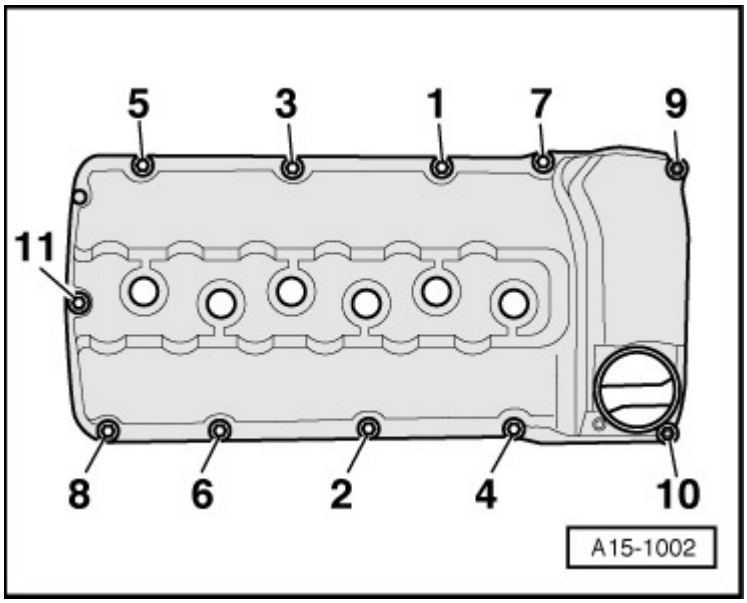

Fig. 60: Cylinder Head Cover Bolts Loosening Sequence
Courtesy of AUDI OF AMERICA, LLC

Installing

- Tightening specifications, refer to **CYLINDER HEAD COMPONENT OVERVIEW**.

Installation is in reverse order of removal, note the following:

NOTE: Replace cylinder head cover seals and screws if damaged.

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

-- Install intake manifold. Refer to **Removal and Installation** .

CYLINDER HEAD, REMOVING

Special tools and workshop equipment required

- Lifting Tackle 3033
- Shop Crane VAS 6100

Procedure

- Engine installed.

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

Heat shield boots that were removed should be installed in the same location

during installation.

-- Drain the coolant. Refer to **COOLING SYSTEM, DRAINING AND FILLING** .

-- Remove the intake manifold. Refer to **Removal and Installation** .

-- Remove coolant hoses to heater core on bulkhead -arrows-.

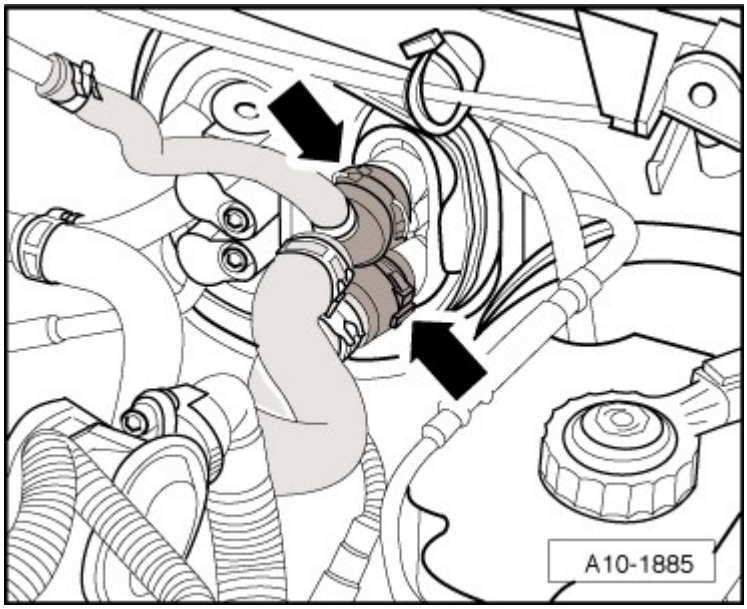

Fig. 61: Coolant Hoses To Heater Core On Bulkhead
Courtesy of AUDI OF AMERICA, LLC

-- Disconnect following hose connections:

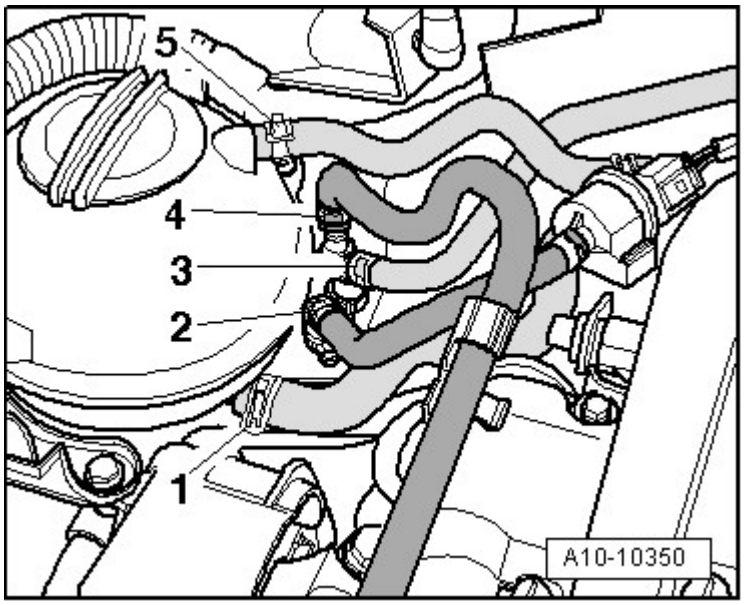

Fig. 62: Identifying Fuel Supply Line, Vent Line & Vacuum Line
Courtesy of AUDI OF AMERICA, LLC

1. Coolant hose to reservoir
2. Vacuum hose to Evaporative Emission (EVAP) Canister
3. Vacuum hose to Leak Detection Pump
4. Fuel supply line
5. Coolant hose to reservoir

-- Disconnect coolant hoses at positions indicated by -arrows-.

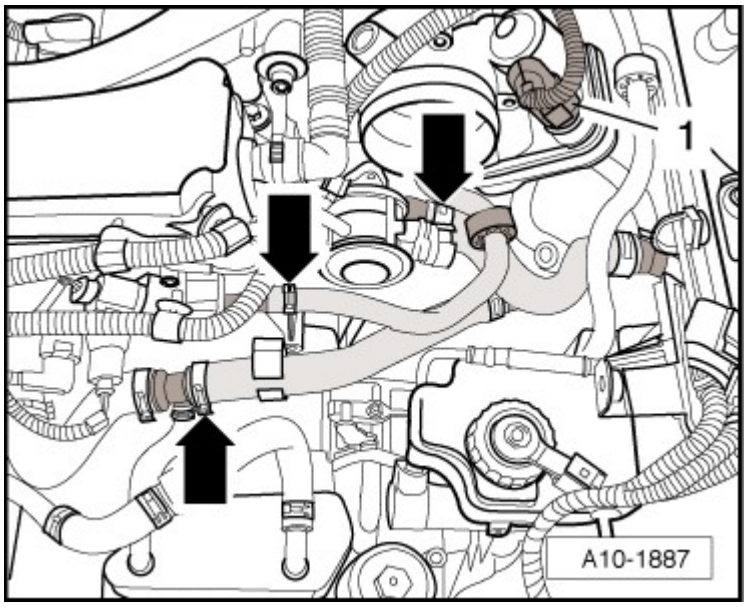

Fig. 63: Throttle Valve Control Module J338 Electrical Connection & Coolant Hose Disconnect Positions
Courtesy of AUDI OF AMERICA, LLC

NOTE: Ignore -1-.

Shown in illustration on vehicle with Direct Shift Gearbox transmission.

-- Remove wiring connections with coolant and vacuum hoses.

-- Remove camshaft timing chain from camshafts. Refer to **CAMSHAFT TIMING CHAIN**.

NOTE: Do not bend the flex joints in front of the exhaust pipe more than 30° or they may be damaged.

-- Remove front exhaust pipe from exhaust manifolds -arrows-.

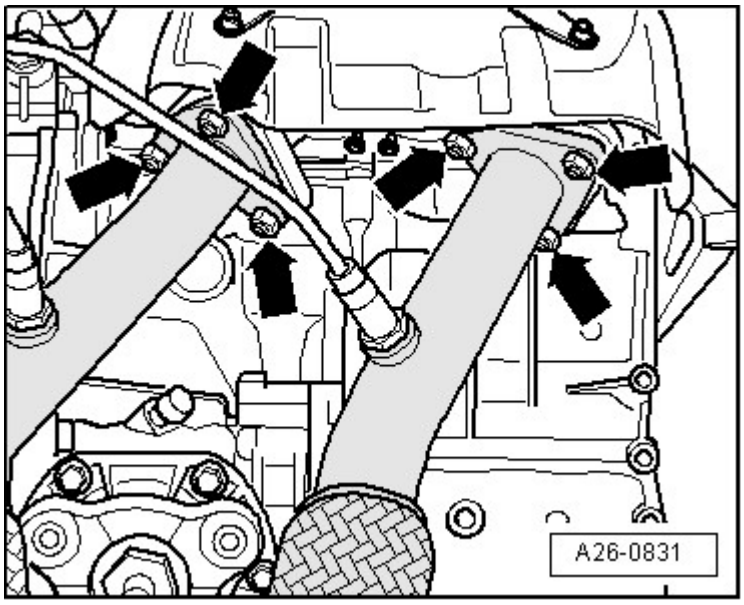

Fig. 64: Front Exhaust Pipe Nuts And Exhaust Manifolds
Courtesy of AUDI OF AMERICA, LLC

-- Loosen and remove cylinder head bolts in sequence shown.

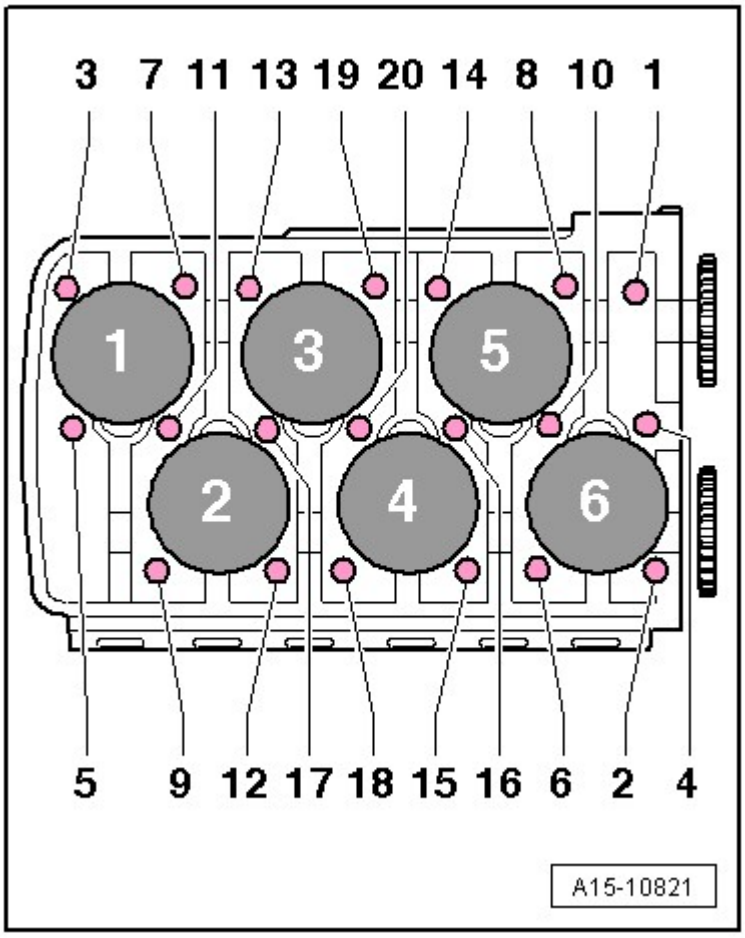

Fig. 65: Loosening Cylinder Head
Courtesy of AUDI OF AMERICA, LLC

-- Engage 3033 as follows:

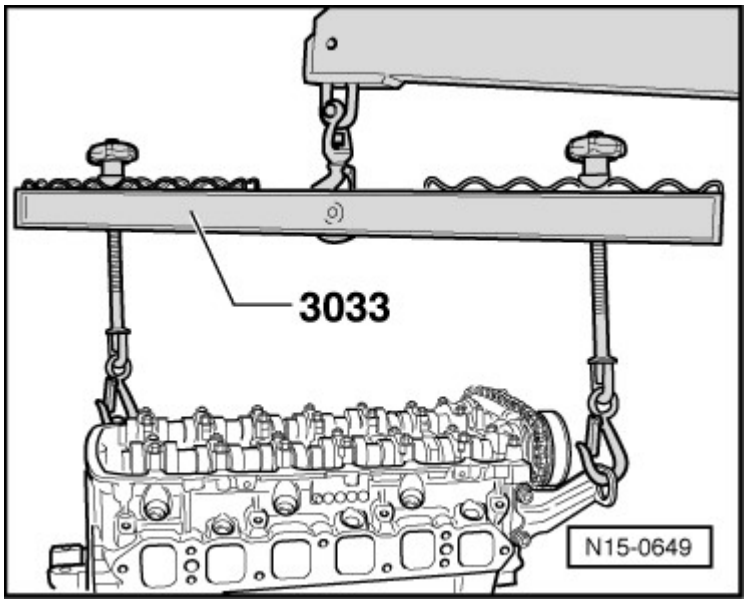

Fig. 66: Attaching Lifting Tackle 3033
Courtesy of AUDI OF AMERICA, LLC

- Belt pulley side: Position -3-.
- Timing chain side: Position -10-.

NOTE: 3033 positions marked with 1 to 12 face toward timing chain side.

-- Carefully raise cylinder head.

-- Place clean cloth in cylinder so that no dirt can enter between cylinder wall and pistons.

CYLINDER HEAD, INSTALLING

Special tools and workshop equipment required

- Camshaft Bar T10068 A

Procedure

NOTE: Replace cylinder head bolts.

Always replace self-locking nuts, bolts which have been tightened to tightening specifications as well as gaskets and O-rings.

Carefully remove residual sealant from cylinder head and cylinder block. Make sure that no long scrapes or scratches result.

Only unpack new cylinder head gasket immediately prior to installation.

Handle gasket carefully. Damage in silicon layer and recessed area lead to leakage.

The plastic protectors installed to protect the open valves must only be removed immediately before fitting the cylinder head.

When installing exchanged cylinder head, contact surfaces between hydraulic adjusting elements, roller rocker levers and cam running surfaces must be oiled before installation.

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

Secure all hose connections with hose clamps appropriate for the model.

When replacing cylinder head or cylinder head seal, coolant and engine oil must be changed.

-- Position camshafts at TDC marking before positioning cylinder head.

-- Cams -A- of cylinder 1 must face each other.

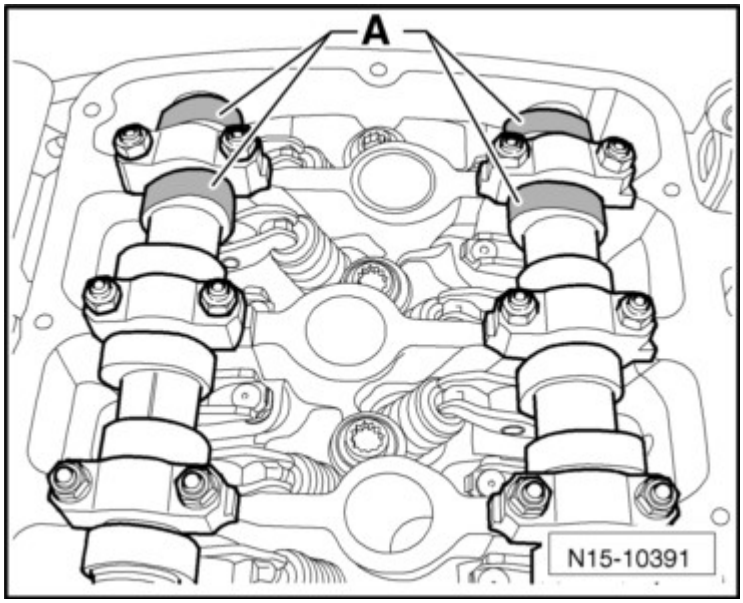

Fig. 67: Camshaft Lobes For Cylinder Facing Each Other
Courtesy of AUDI OF AMERICA, LLC

-- Verify camshaft TDC position:

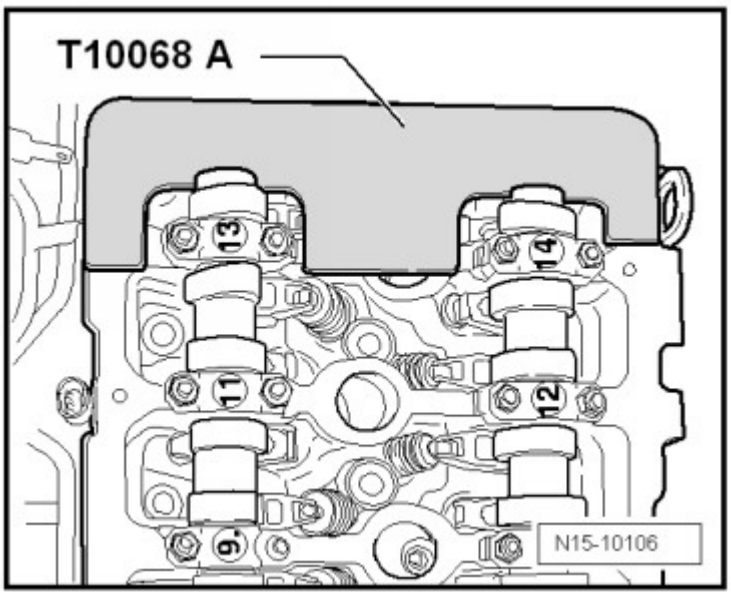

Fig. 68: Identifying Camshaft Bar T10068 A Engage In Shaft Grooves
Courtesy of AUDI OF AMERICA, LLC

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

-- Check again if crankshaft is positioned at TDC -arrow-.

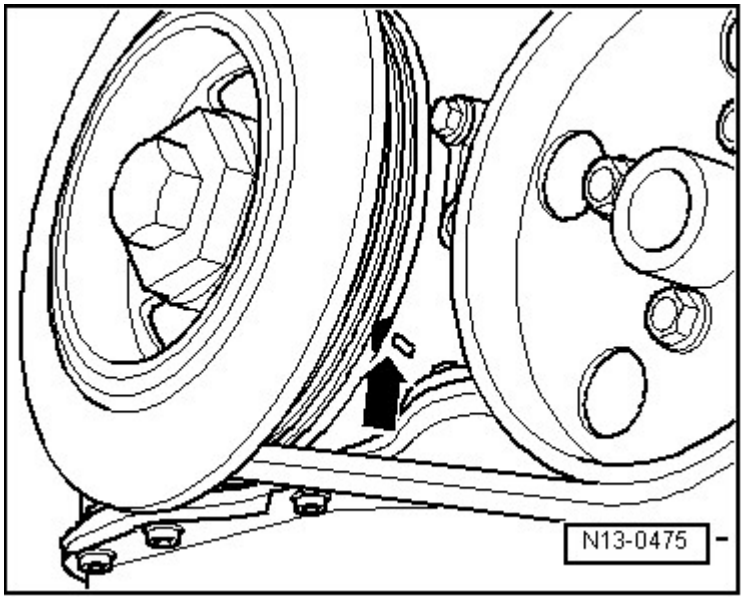

Fig. 69: Identifying Crankshaft At Vibration Damper Securing Bolt In Engine At TDC Cyl. 1
Courtesy of AUDI OF AMERICA, LLC

-- Position cylinder head gasket.

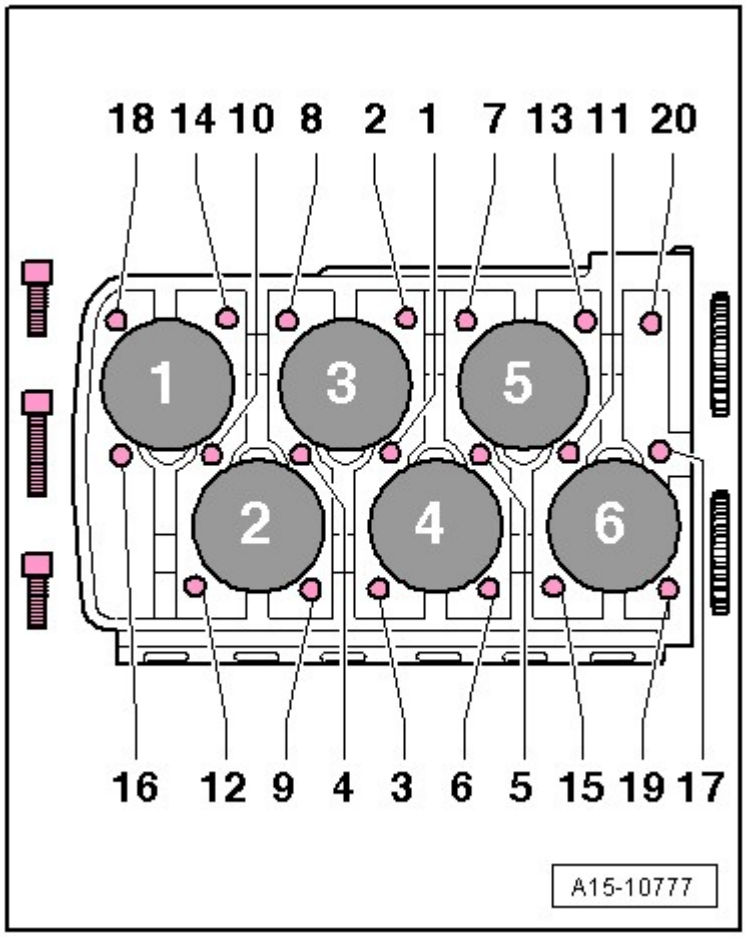

Fig. 70: Cylinder Head - Tightening Specifications And Tightening Sequence
Courtesy of AUDI OF AMERICA, LLC

- Observe the centering pins in cylinder block.
- Observe cylinder head seal location, identification: Part number must be visible from intake side.

-- Install cylinder head.

-- Insert cylinder head bolts and tighten by hand.

NOTE: The longer cylinder head bolts must be inserted in the middle holes of cylinder head.

-- Tighten cylinder head bolts. Refer to **Fig. 4**.

NOTE: There is no requirement to tighten the cylinder head bolts after repairs.

-- Install camshaft timing chain **CAMSHAFT TIMING CHAIN**.

-- Install cylinder head cover. Refer to **CYLINDER HEAD COVER**.

-- Install intake manifold. Refer to **Removal and Installation** .

-- Connect Ground (GND) cable to battery. Refer to **Removal and Installation** .

-- Change coolant. Refer to **COOLING SYSTEM, DRAINING AND FILLING** .

Tightening Specifications

Component	Nm
Front exhaust pipe to exhaust manifold	25 (1)
(1) Replace nuts	

UPPER TIMING CHAIN COVER SEAL, REPLACING

Special tools and workshop equipment required

- Wheel Bearing Assembly Set 3253
- Fitting Sleeve 3378

Procedure

- Upper timing chain cover removed.

-- Drive out seal with a drift.

-- Fit seal into upper camshaft timing chain cover -1- using 3378 and drive in flush using 3253/6.

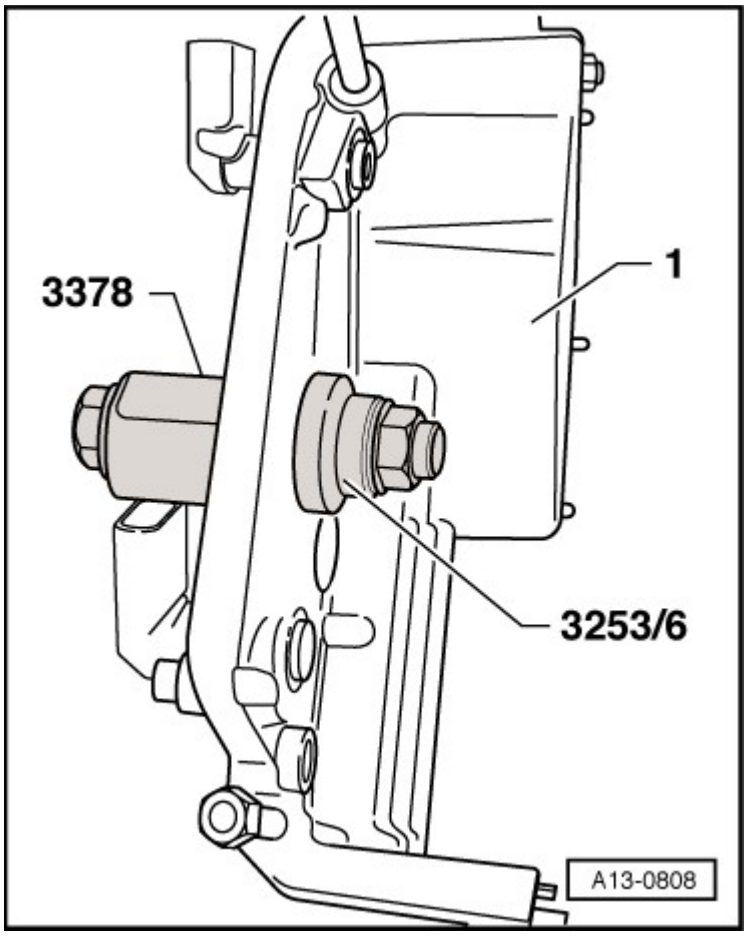

Fig. 71: Inserting Oil Seal Into Upper Cover For Camshaft Timing Chain With Installation Sleeve 3378 And Use Assembly Tool 3253/6 To Press It In Flush
Courtesy of AUDI OF AMERICA, LLC

CAMSHAFT TIMING CHAIN

Special tools and workshop equipment required

- Camshaft Bar T10068 A
- Black Sealant,
- Sealing Compound,

Removing the camshaft timing chain

- Engine installed.

-- Drain the coolant. Refer to **COOLING SYSTEM, DRAINING AND FILLING** .

-- Remove the intake manifold. Refer to **Removal and Installation** .

-- Disconnect electrical connector to engine coolant temperature (ECT) sensor -G62-.

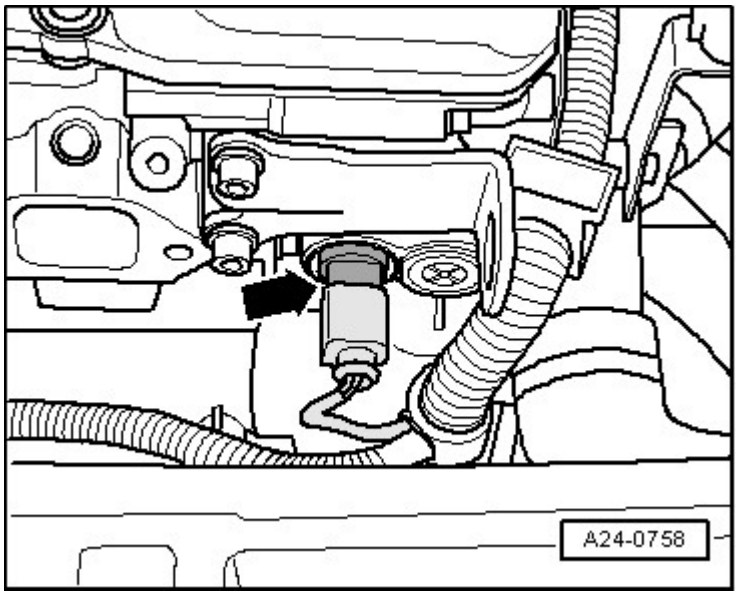

Fig. 72: Component Location Of Engine Coolant Temperature (ECT) Sensor G62
Courtesy of AUDI OF AMERICA, LLC

-- Disconnect coolant hoses at positions indicated by -arrows-.

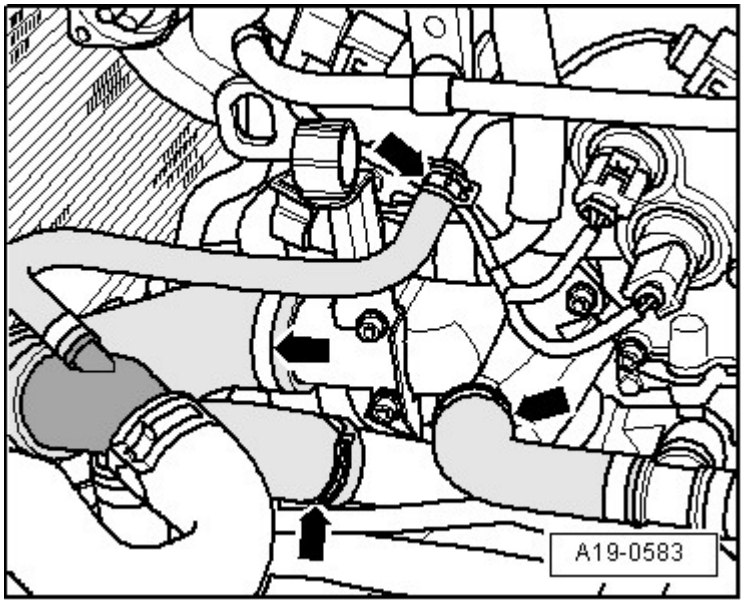

Fig. 73: Coolant Hose Disconnect Positions
Courtesy of AUDI OF AMERICA, LLC

-- Remove the bolts -arrows-.

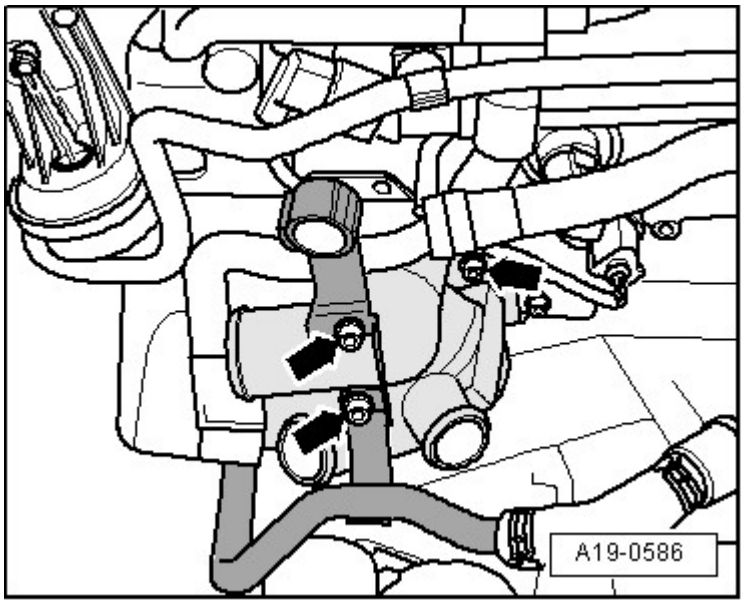

Fig. 74: Identifying Bolts To Transmission Oil Cooler Coolant Pipe Bracket
Courtesy of AUDI OF AMERICA, LLC

-- Pull transmission oil cooler coolant pipe bracket toward left.

-- Swing Secondary Air Injection (AIR) system hose bracket forward.

-- Remove bolt -arrow- at wiring harness bracket.

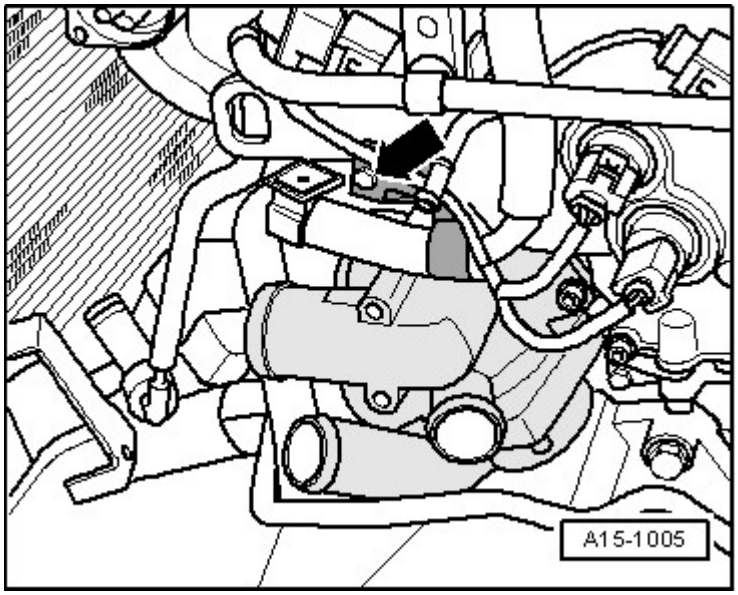

Fig. 75: Identifying Wiring Harness Bracket & Bolt
Courtesy of AUDI OF AMERICA, LLC

CAUTION: Press coolant pipe in direction of coolant pump using pry bar when removing coolant thermostat housing so that is not pulled off.

-- Remove coolant thermostat housing -2- while pressing coolant pipe -1- toward coolant pump with pry bar.

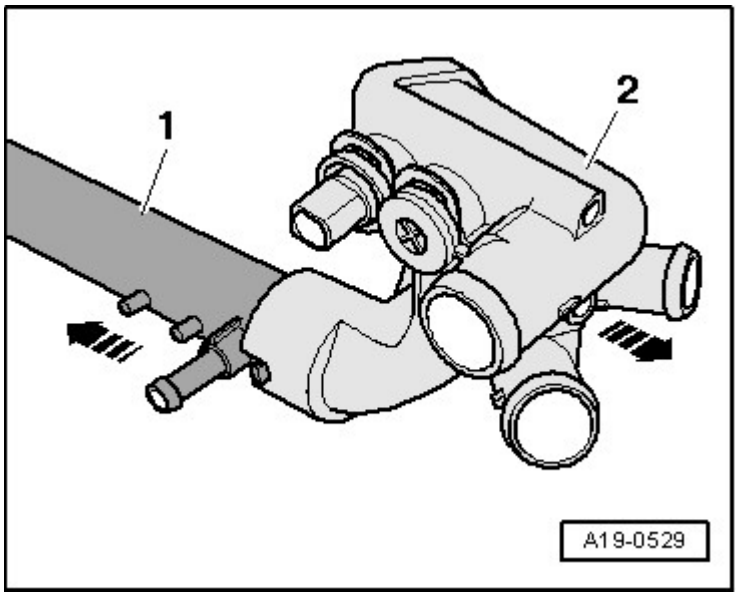

Fig. 76: Identifying Coolant Pipe And Thermostat Housing
Courtesy of AUDI OF AMERICA, LLC

Vehicles with engine code BUB:

-- Disconnect the hose -3- and the vacuum hose -2- from the Secondary Air Injection (AIR) combination valve.

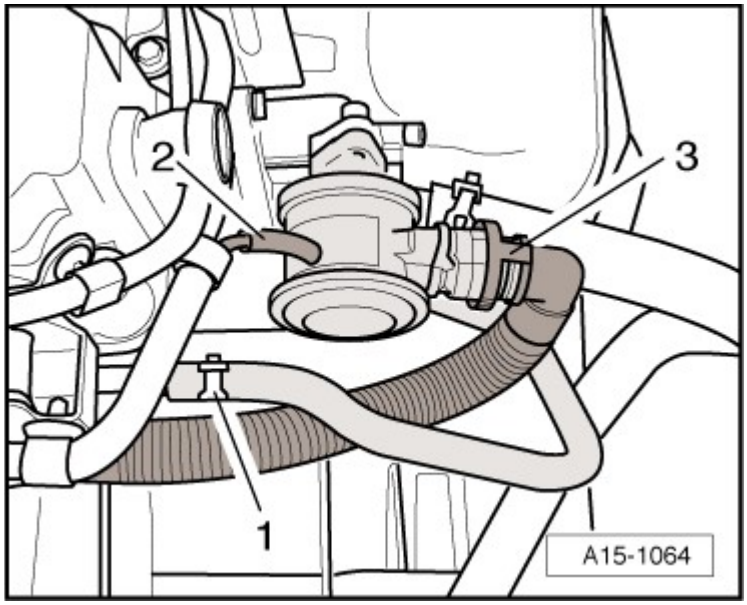

Fig. 77: Identifying Vacuum Hose From Secondary Air Injection (Air) Combination Valve
Courtesy of AUDI OF AMERICA, LLC

-- Disconnect coolant hose -1-.

Vehicles with engine code CBRA:

-- Disconnect the hose -1- and the vacuum hose -2- from the left Secondary Air Injection (AIR) combination valve.

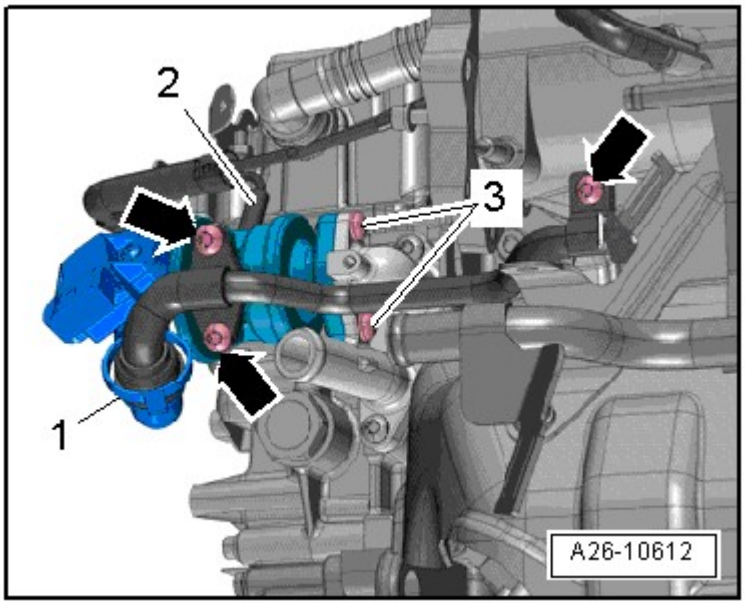

Fig. 78: Identifying Hose -1- And Vacuum Hose -2- From Left AIR Combination Valve
Courtesy of AUDI OF AMERICA, LLC

NOTE: Ignore -3- and -arrows-.

All Vehicles

-- Identify and disconnect electrical connectors:

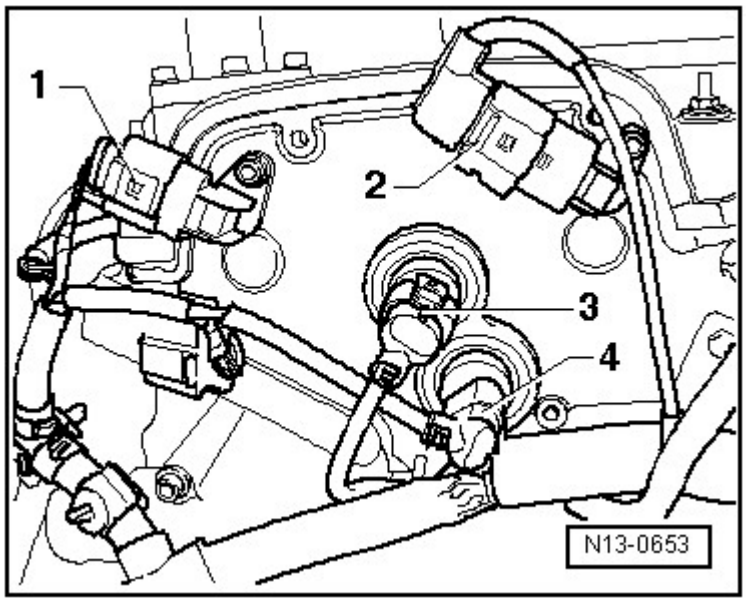

Fig. 79: Identifying CMP Sensor G40, CMP Sensor 2 G163 And Connectors
Courtesy of AUDI OF AMERICA, LLC

1. Camshaft position sensor -G40-
2. Camshaft position (CMP) sensor 2 -G163-
3. Camshaft adjustment valve 1 -N205-
4. Camshaft adjustment valve 1 (exhaust) -N318-

-- Remove wiring guide from camshaft timing chain cover.

-- Loosen cylinder head cover bolts in sequence -11 to 1-.

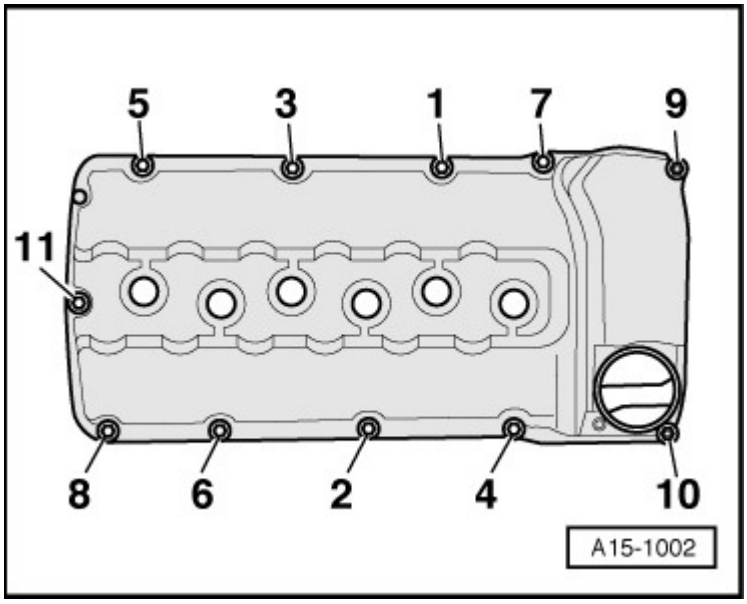

Fig. 80: Cylinder Head Cover Bolts Loosening Sequence

Courtesy of AUDI OF AMERICA, LLC

-- Set crankshaft to TDC mark by turning crankshaft on vibration damper screw in direction of engine rotation - arrow-.

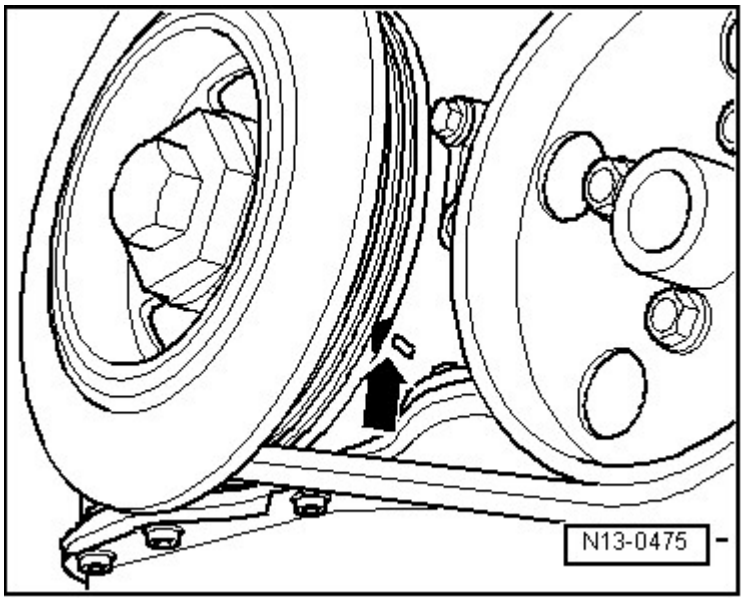

Fig. 81: Identifying Crankshaft At Vibration Damper Securing Bolt In Engine At TDC Cyl. 1
Courtesy of AUDI OF AMERICA, LLC

-- Cams -A- of cylinder 1 must face each other.

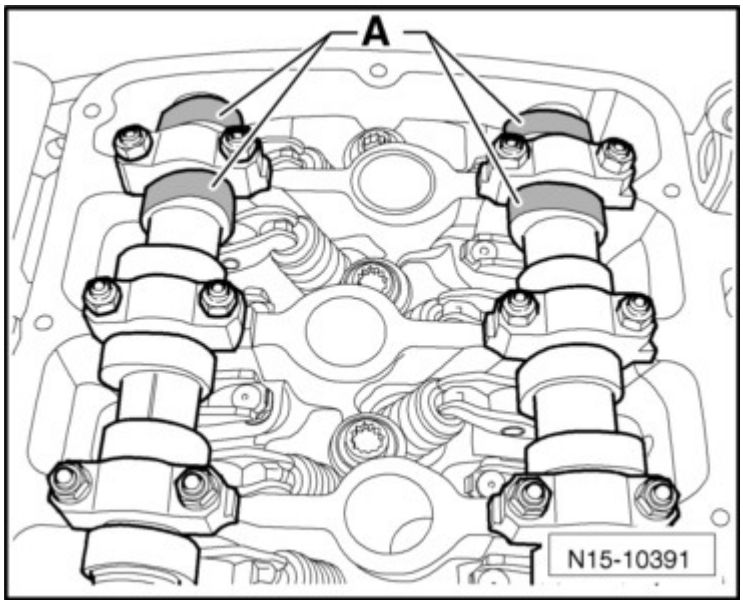

Fig. 82: Camshaft Lobes For Cylinder Facing Each Other
Courtesy of AUDI OF AMERICA, LLC

-- At the same time, T10068 A must engage in both shaft grooves. Turn crankshaft 1 additional turn if

necessary.

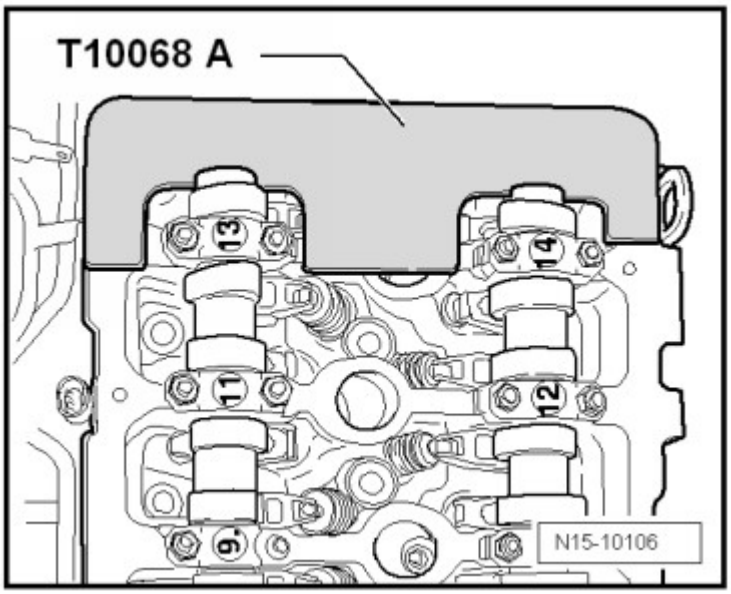

Fig. 83: Identifying Camshaft Bar T10068 A Engage In Shaft Grooves
Courtesy of AUDI OF AMERICA, LLC

-- Remove camshaft timing chain tensioner -arrow-.

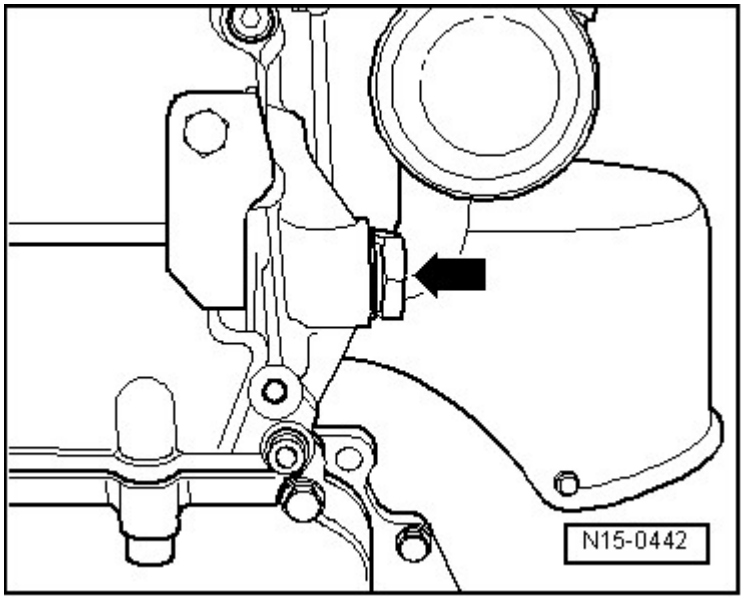

Fig. 84: Camshaft Timing Chain Tensioner
Courtesy of AUDI OF AMERICA, LLC

-- Remove bolts -1 to 3- and upper timing chain cover horizontally from cylinder head. When doing so, ensure cylinder head bolt is not damaged.

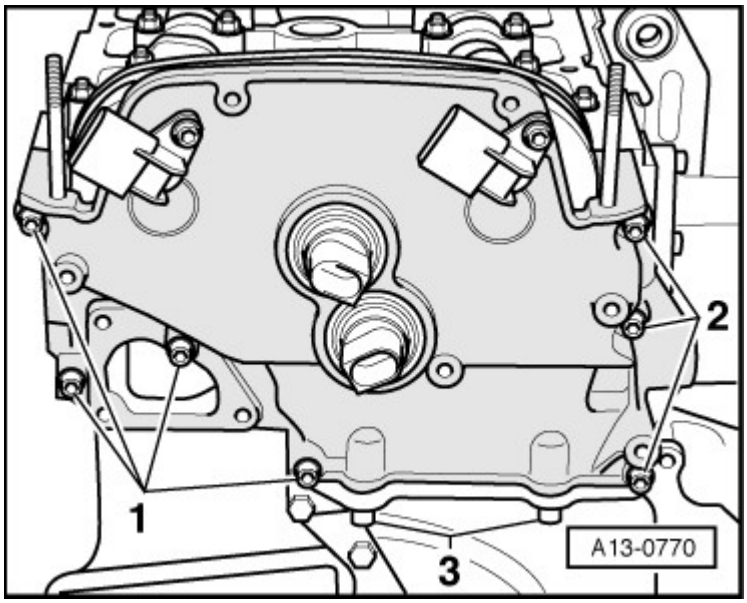

Fig. 85: Identifying Cylinder Head Cover Bolts
Courtesy of AUDI OF AMERICA, LLC

-- Remove bolts -arrows- and remove guide track -1-.

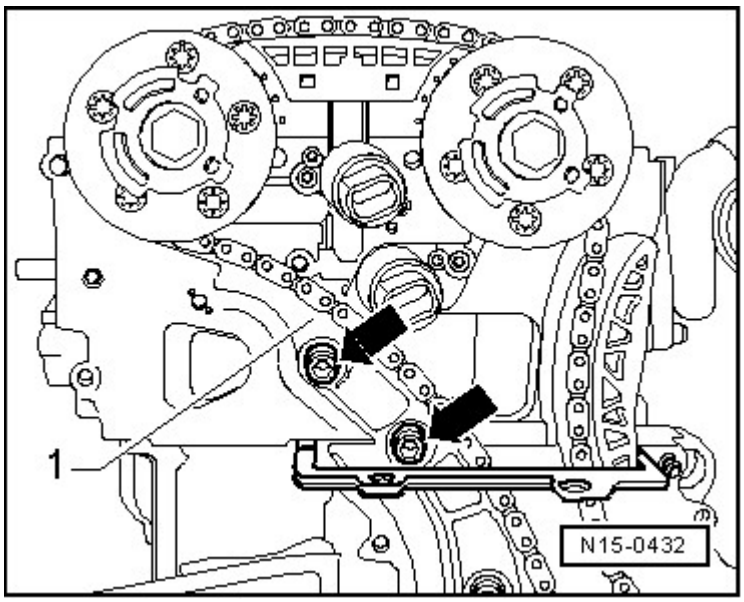

Fig. 86: Locating Guide Rail & Bolts
Courtesy of AUDI OF AMERICA, LLC

-- Remove T10068 A.

NOTE: Camshaft bar T10068 A must not be inserted when loosening or tightening camshaft adjuster screws.

-- Remove retaining screw at intake side camshaft adjuster while counterholding camshaft hex head with open

end wrench SW 32.

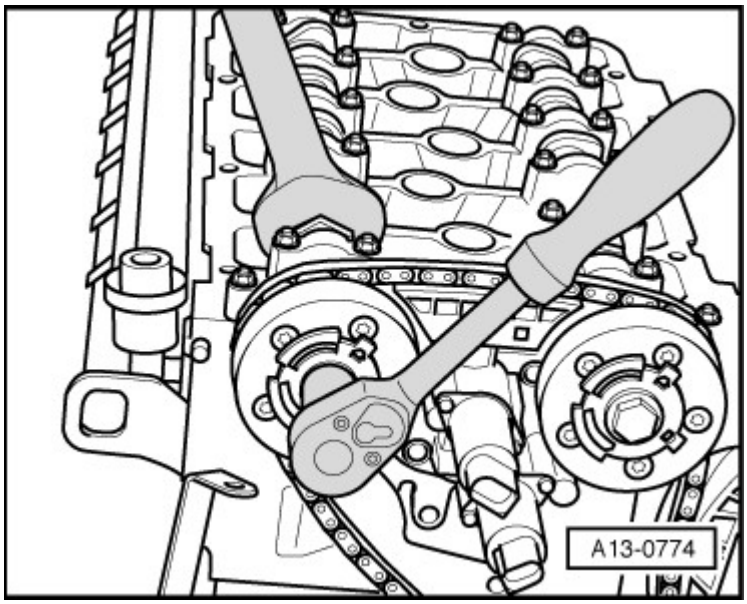

Fig. 87: Identifying Tools To Loosen Intake Camshaft Adjuster Bolt
Courtesy of AUDI OF AMERICA, LLC

-- Remove intake side camshaft adjuster.

-- Remove retaining bolt at exhaust side camshaft adjuster while counterholding camshaft hex head with open end wrench SW 32.

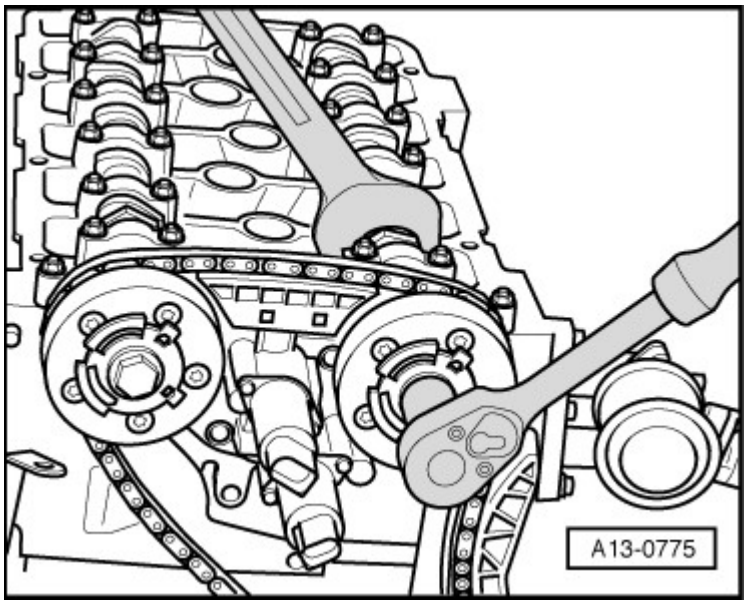

Fig. 88: Identifying Tools To Loosen Exhaust Camshaft Adjuster Bolt
Courtesy of AUDI OF AMERICA, LLC

-- Remove camshaft adjuster exhaust side.

-- Lay camshaft timing chain over camshaft adjuster valves.

Installing the camshaft timing chain (adjusting the timing)

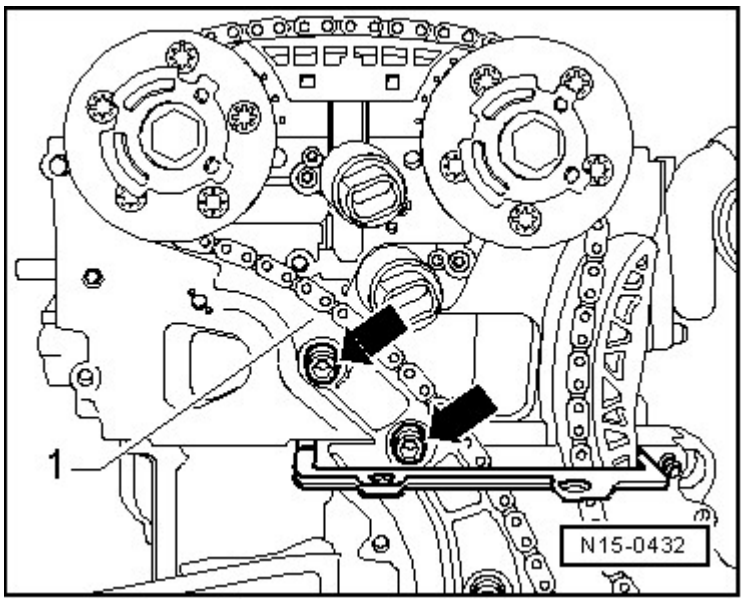

Fig. 89: Locating Guide Rail & Bolts
Courtesy of AUDI OF AMERICA, LLC

- Tightening specifications, refer to **TIMING CHAIN COVERS ASSEMBLY OVERVIEW**, **Fig. 7** and **TIMING CHAIN COMPONENT OVERVIEW**.

-- Insert guide track -1- and tighten bolts -arrows-.

-- Check TDC marking on crankshaft again -arrow-.

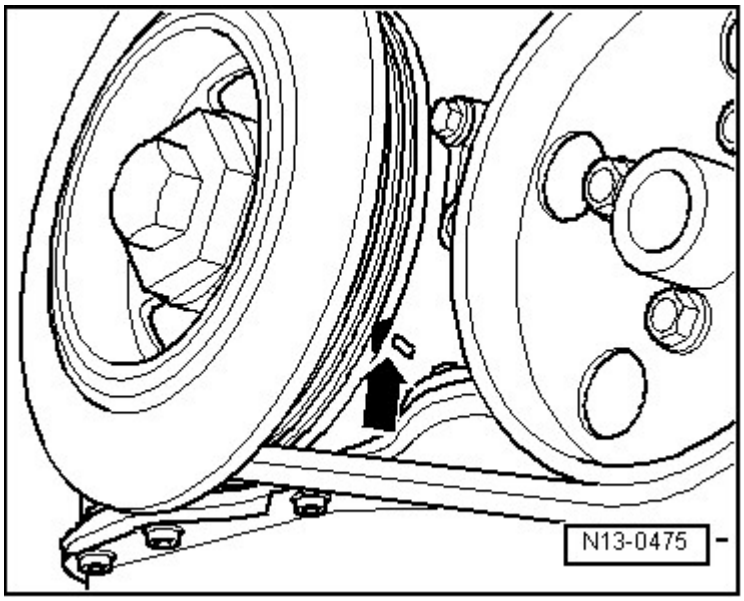

Fig. 90: Identifying Crankshaft At Vibration Damper Securing Bolt In Engine At TDC Cyl. 1
Courtesy of AUDI OF AMERICA, LLC

-- Verify camshaft TDC position:

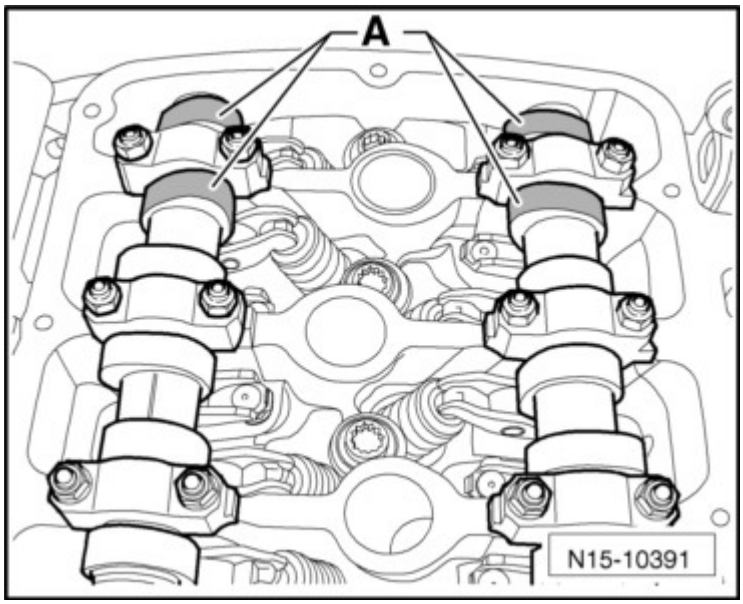

Fig. 91: Camshaft Lobes For Cylinder Facing Each Other
Courtesy of AUDI OF AMERICA, LLC

- Cams -A- of cylinder 1 must face each other.
- It must be possible to insert T10068 A into both shaft grooves.

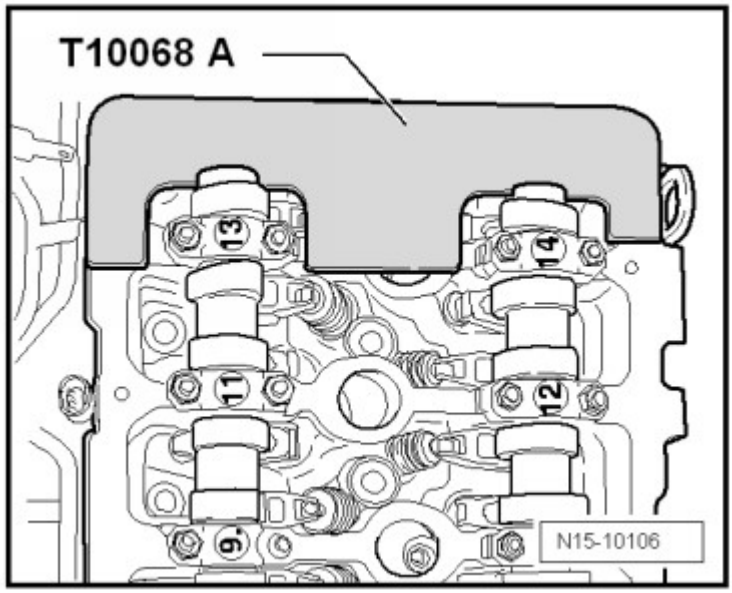

Fig. 92: Identifying Camshaft Bar T10068 A Engage In Shaft Grooves
Courtesy of AUDI OF AMERICA, LLC

-- If necessary, turn camshafts at hex head surfaces -arrows- to correct position using open end wrench SW 32.

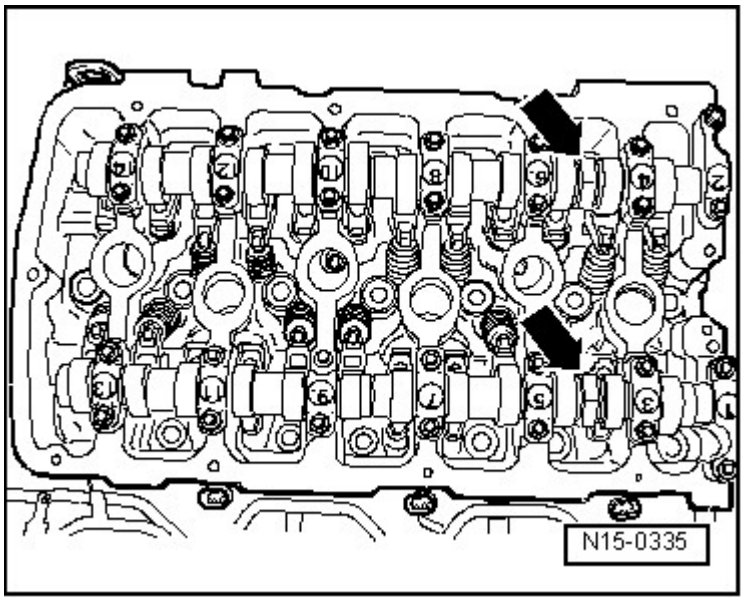

Fig. 93: Locating Counter-Hold Area On Camshaft
Courtesy of AUDI OF AMERICA, LLC

CAUTION: Risk of damaging valves and piston crowns.

- **If camshafts are rotated, crankshaft may not rest with any piston at "TDC".**

NOTE: Both camshaft adjusters (identification: 24E on intake side and 32A on exhaust side) can only be bolted in one position on the camshaft mountings -arrows- by an alignment pin.

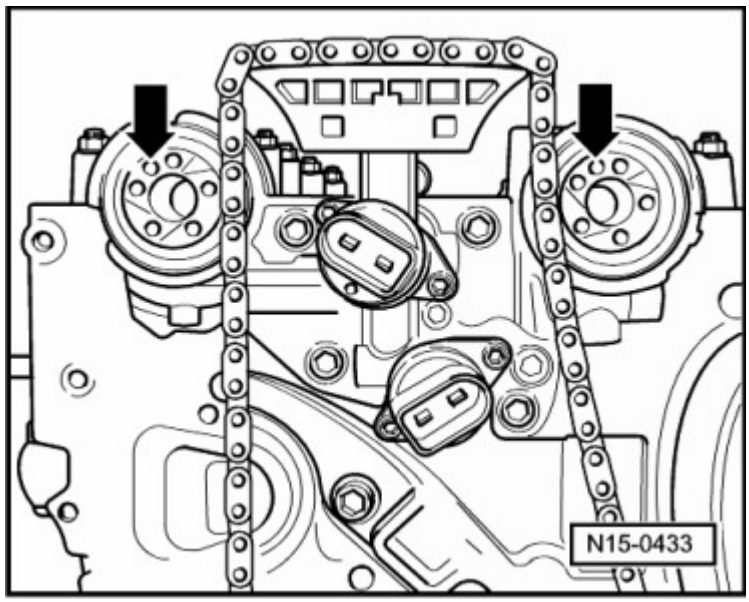

Fig. 94: Camshaft Timing Adjusters Positioned On Camshaft Mountings
Courtesy of AUDI OF AMERICA, LLC

-- First install intake side camshaft adjuster:

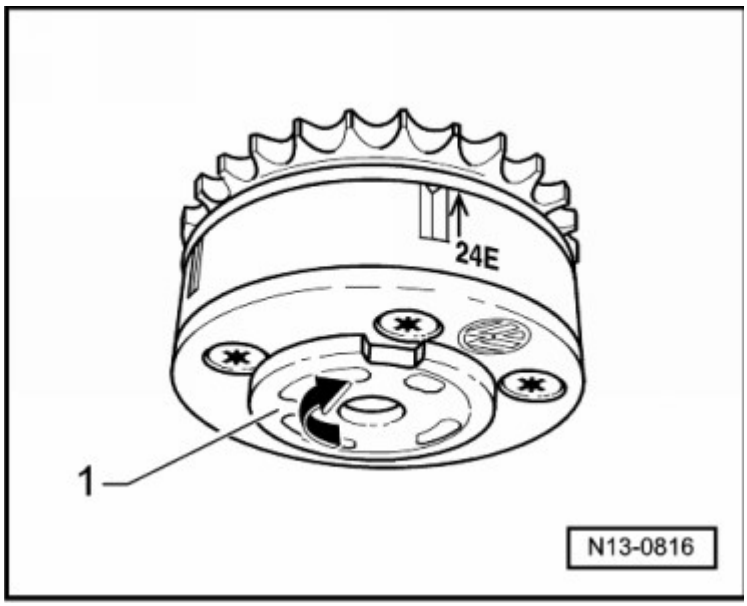

Fig. 95: Identifying Sensor Wheel Turned To Right At Intake Camshaft Adjuster
Courtesy of AUDI OF AMERICA, LLC

-- Turn sensor wheel -1- in camshaft adjuster clockwise -arrow- to stop.

NOTE: Camshaft bar T10068 A must not be used as counterhold.

-- Hand tighten intake side camshaft adjuster in this position to intake camshaft.

- Contact surface of sensor wheel at screw head must be dry when installing.
- The "24E" marking -1- and the tooth behind it must align with notch -2- in control housing. Markings on control housing **Fig. 10**.

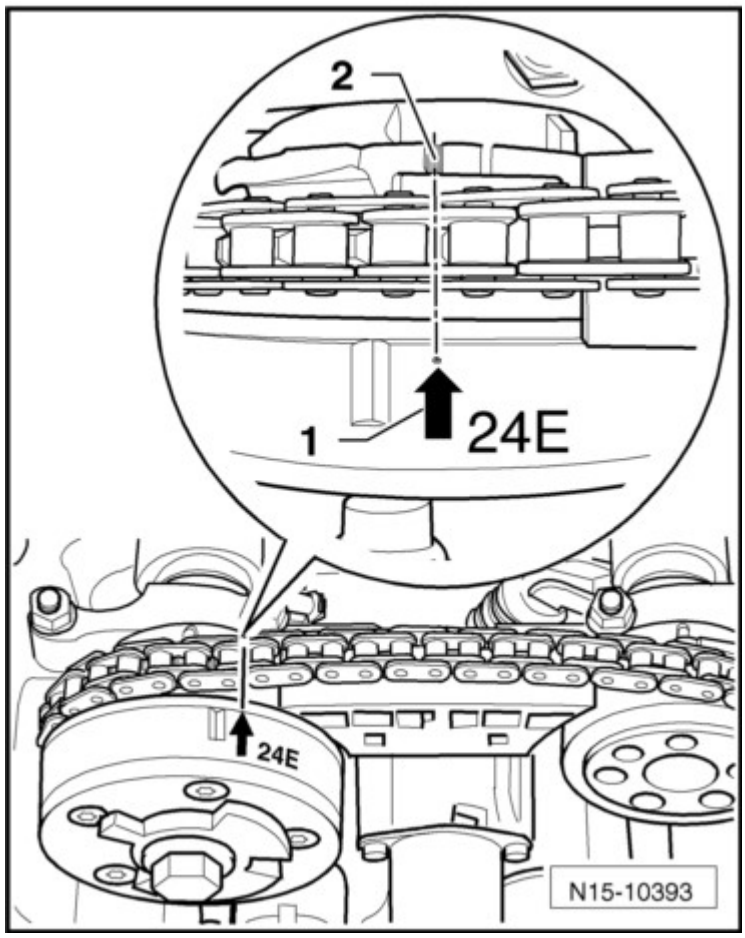

Fig. 96: Identifying Alignment Of Intake Camshaft Adjuster With Left Notch On Control Housing
Courtesy of AUDI OF AMERICA, LLC

-- Lay camshaft timing chain in this position tightly against intake side camshaft adjuster sprocket.

-- Starting with the toothed that has the "24E" marking, count exactly 16 rollers to the right on the timing chain. Mark this roller with a color marker.

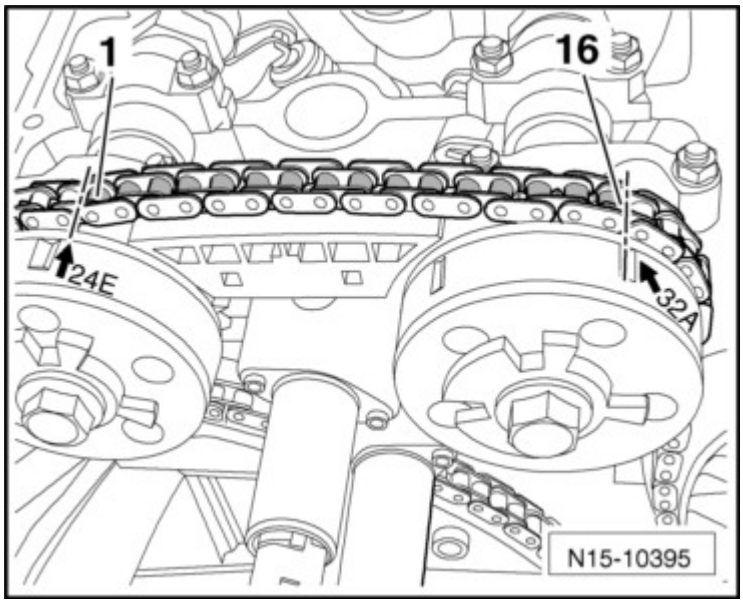

Fig. 97: Identifying Small Offset Between Mark And Notch
Courtesy of AUDI OF AMERICA, LLC

NOTE: Exhaust camshaft adjuster is locked in the rest state. Therefore sensor wheel cannot be rotated when adjusting the valve timing. If locking mechanism is in rest state is not engaged (locked) turn adjuster in both directions by hand until it locks. If that is not possible, replaced camshaft adjuster.

-- Now insert exhaust camshaft adjuster "32A" with tooth at arrow marking -1- into camshaft roller chain so that the exact, previously counted 16 rollers lie between marking "24E" and "32A" and markings -1- and -2- align.

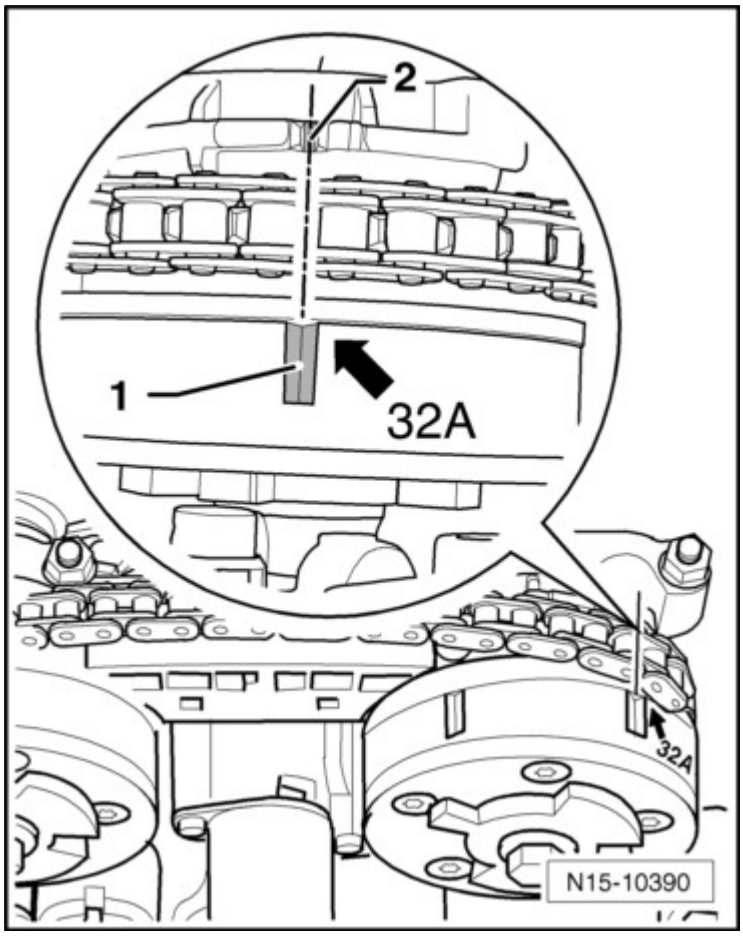

Fig. 98: Identifying Alignment Of Mark On Exhaust Camshaft Adjuster With Left Notch On Control Housing
Courtesy of AUDI OF AMERICA, LLC

-- Exhaust camshaft adjuster must be able to be inserted easily on exhaust camshaft and be tightened hand-tight.

-- Check the position of both camshaft adjusters one more time for correct adjustment.

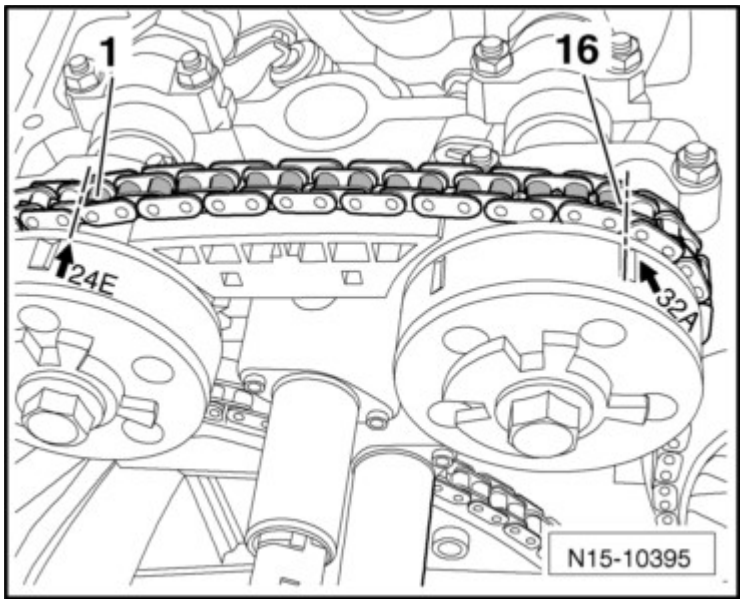

Fig. 99: Identifying Small Offset Between Mark And Notch
Courtesy of AUDI OF AMERICA, LLC

-- Remove T10068 A.

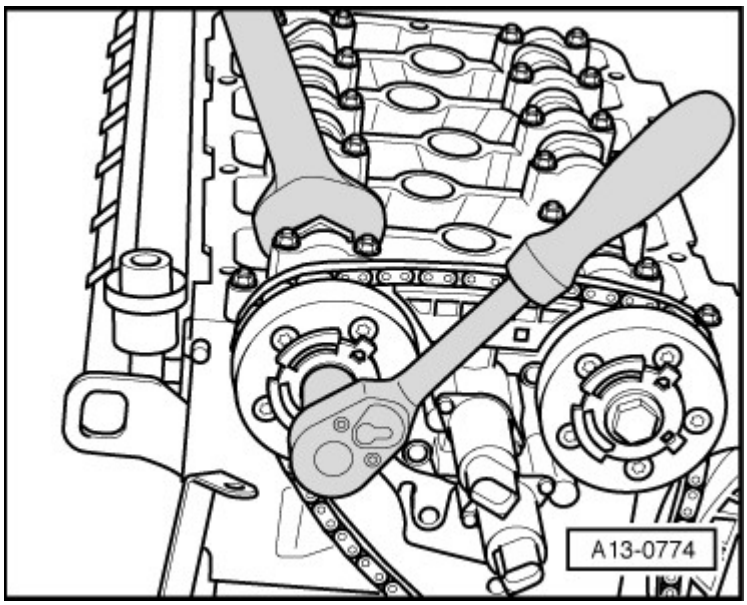

Fig. 100: Identifying Tools To Loosen Intake Camshaft Adjuster Bolt
Courtesy of AUDI OF AMERICA, LLC

-- Tighten bolt on camshaft adjuster intake side by counter-holding with open-end spanner on camshaft hex head.

-- Tighten bolt on camshaft adjuster exhaust side by counter-holding with open-end spanner on camshaft hex head.

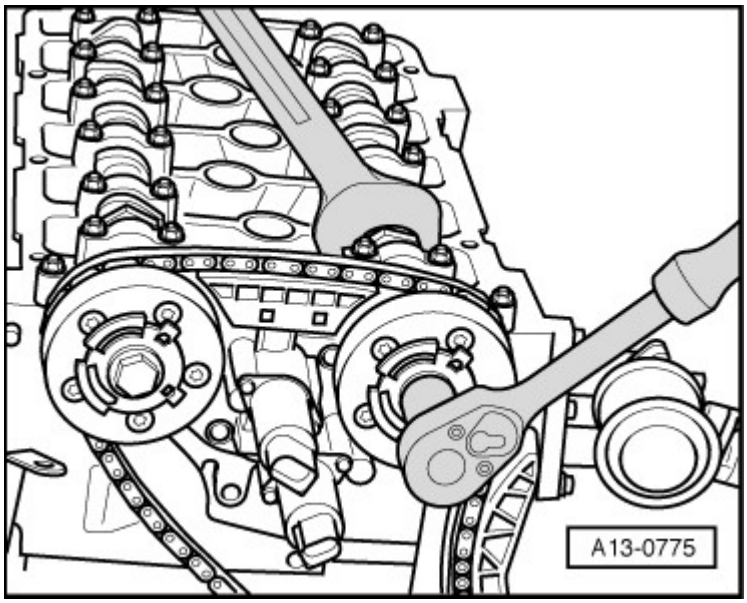

Fig. 101: Identifying Tools To Loosen Exhaust Camshaft Adjuster Bolt
Courtesy of AUDI OF AMERICA, LLC

CAUTION: Risk of timing chain jumping off.

- **If the crankshaft is rotated, forcefully press camshaft tensioning rail by hand (instead of with chain tensioner) against camshaft adjuster timing chain -arrow-.**

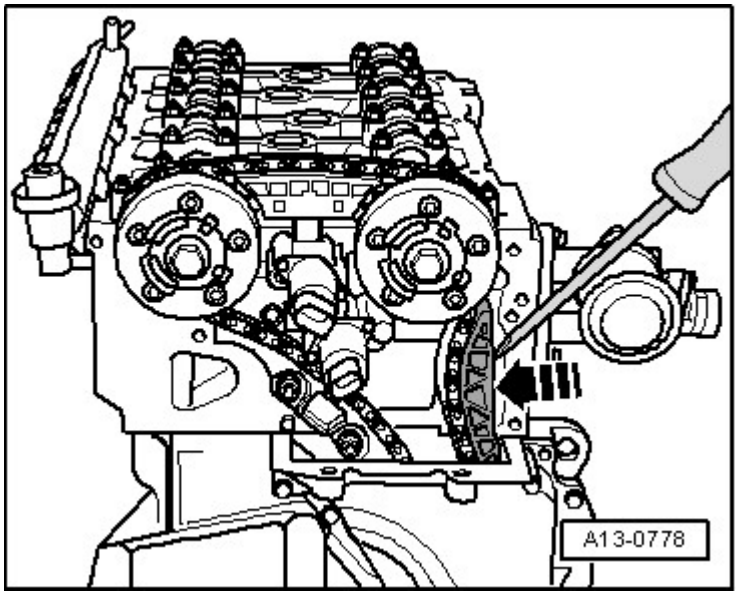

Fig. 102: Identifying Vibration Damper And Counter-Holder Tool T10069
Courtesy of AUDI OF AMERICA, LLC

-- Set crankshaft to TDC mark by turning crankshaft on vibration damper bolt 2 turns in direction of engine rotation -arrow-.

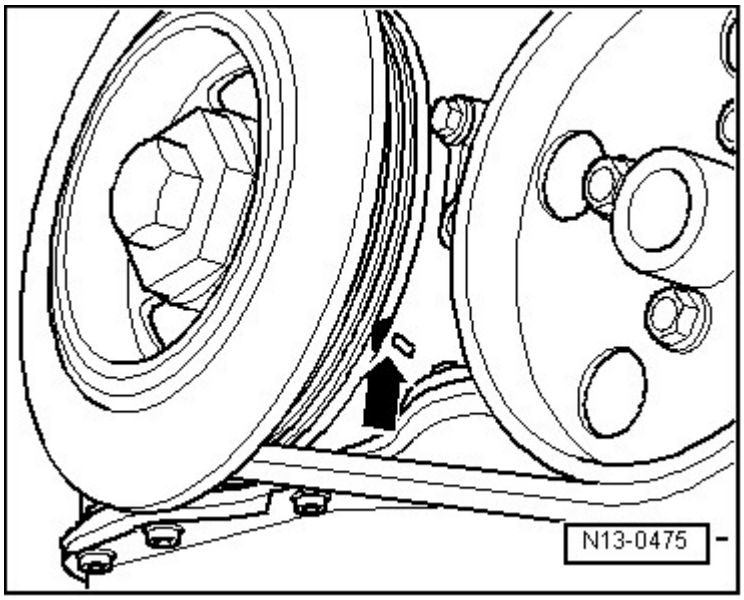

Fig. 103: Identifying Crankshaft At Vibration Damper Securing Bolt In Engine At TDC Cyl. 1
Courtesy of AUDI OF AMERICA, LLC

-- Cams -A- of cylinder 1 must face each other.

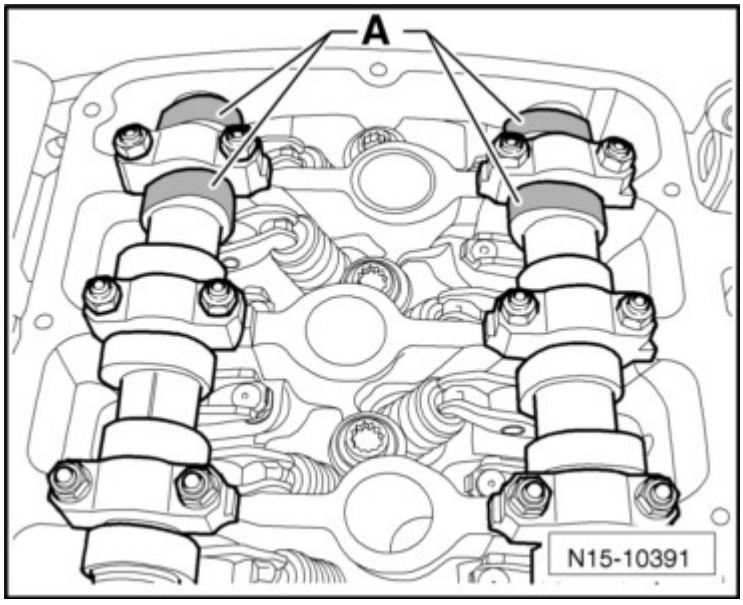

Fig. 104: Camshaft Lobes For Cylinder Facing Each Other
Courtesy of AUDI OF AMERICA, LLC

At the same time, the T10068 A must engage in both shaft grooves.

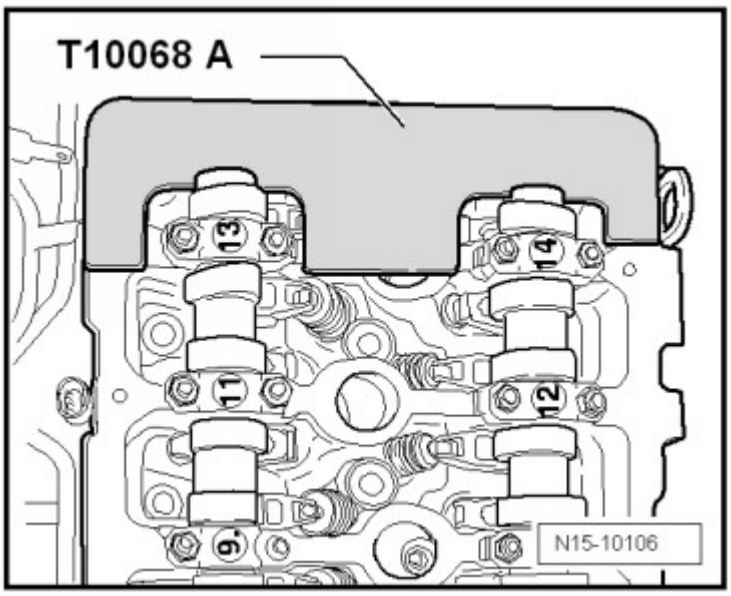

Fig. 105: Identifying Camshaft Bar T10068 A Engage In Shaft Grooves
Courtesy of AUDI OF AMERICA, LLC

If the camshaft bar cannot be inserted:

-- Repeat valve timing adjustment.

-- Clean old sealant from 3 mm holes -arrows- in cylinder head seal.

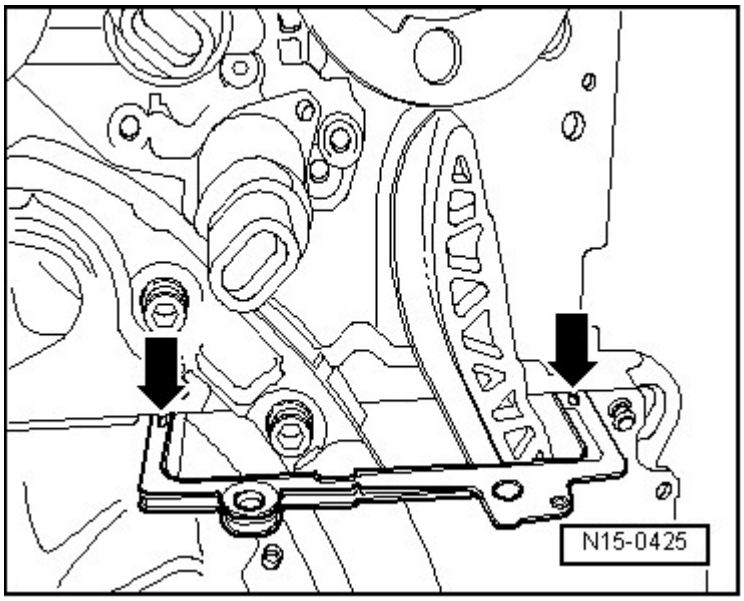

Fig. 106: Locating 3 mm Holes In Cylinder Head Gasket
Courtesy of AUDI OF AMERICA, LLC

- Fill 3 mm holes in cylinder head seal using black sealant.

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

-- Replace seal in upper timing chain cover. Refer to **UPPER TIMING CHAIN COVER SEAL, REPLACING**.

-- Clean sealing surfaces so they are completely free of any oil or grease.

-- Check whether fitting sleeves -2- and -3- are inserted in upper timing chain cover.

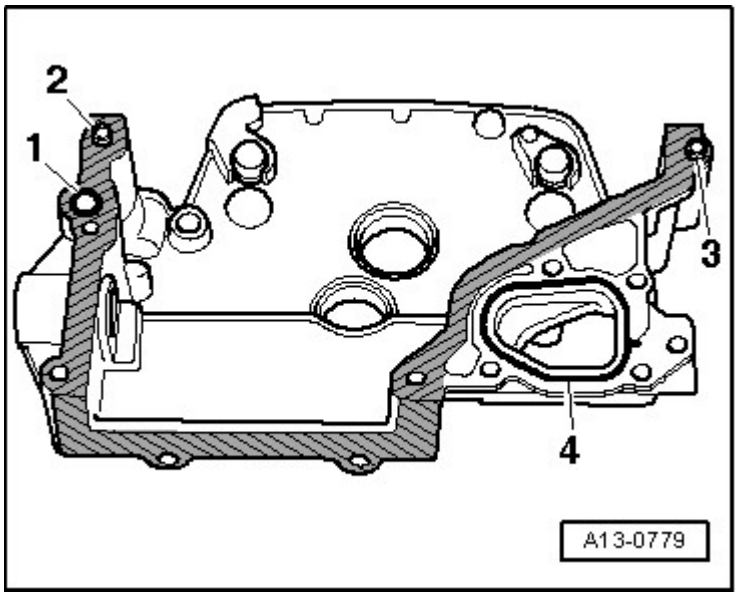

Fig. 107: Checking Dowel Sleeves And Are Inserted In Upper Cover For Camshaft Timing Chain
Courtesy of AUDI OF AMERICA, LLC

-- Insert a new gasket -1- and a new seal -4-.

Lightly coat clean upper timing chain cover sealing surfaces -shown hatched- with sealing paste.

NOTE: Also coat sealing surfaces below cylinder head seal with some sealant do not kink cylinder head seal when doing so.

Upper timing chain cover must be installed within 5 minutes of applying sealing paste.

-- Set upper timing chain cover in place and tighten bolts as follows:

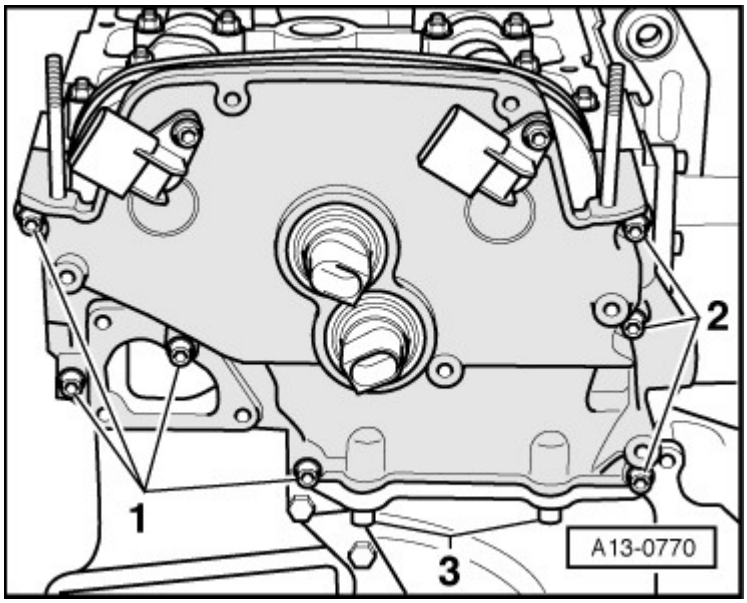

Fig. 108: Identifying Cylinder Head Cover Bolts
Courtesy of AUDI OF AMERICA, LLC

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

-- Tighten camshaft timing chain tensioner -arrow-.

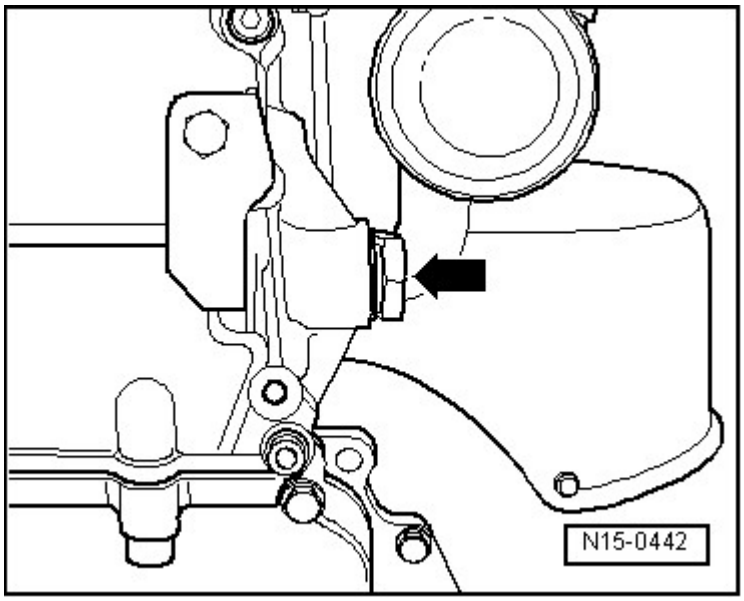

Fig. 109: Camshaft Timing Chain Tensioner
Courtesy of AUDI OF AMERICA, LLC

-- Turn crankshaft 2 times in direction of engine rotation and check valve timing again.

-- Install cylinder head cover. Refer to **CYLINDER HEAD COVER**.

-- Install intake manifold. Refer to **Removal and Installation** .

-- Install coolant thermostat housing. Refer to **COOLANT THERMOSTAT HOUSING** .

1. Replace bolt.

1. 90° corresponds to a 1/4 turn

TIMING MECHANISM DRIVE CHAIN AND CAMSHAFT TIMING CHAIN

Special tools and workshop equipment required

- Camshaft Bar T10068 A
- Counter-Holder Tool T10069
- Black sealant,
- Sealing compound,

Removing

- Engine removed. Refer to **ENGINE, REMOVING** .
- Engine and transmission separated. Refer to **ENGINE AND DSG TRANSMISSION, SEPARATING** .
- Dual-mass flywheel removed. Refer to **DUAL MASS FLYWHEEL** .
- Intake manifold removed. Refer to **Removal and Installation** .
- Cylinder head cover removed. Refer to **CYLINDER HEAD COVER**.
- Coolant thermostat housing removed. Refer to **COOLANT THERMOSTAT HOUSING** .
- Oil pan removed. Refer to **OIL PAN** .

-- Set crankshaft to TDC mark by turning crankshaft on vibration damper bolt in direction of engine rotation -arrow-.

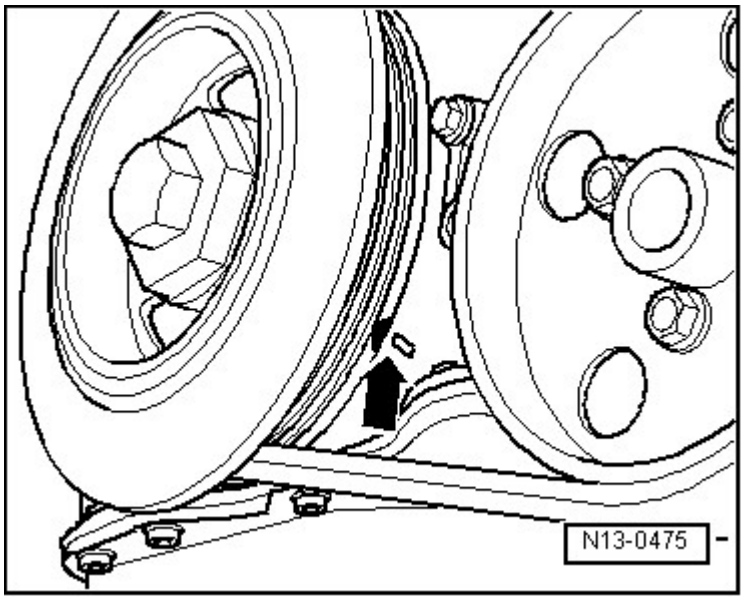

Fig. 110: Identifying Crankshaft At Vibration Damper Securing Bolt In Engine At TDC Cyl. 1
Courtesy of AUDI OF AMERICA, LLC

-- Cams -A- of cylinder 1 must face each other.

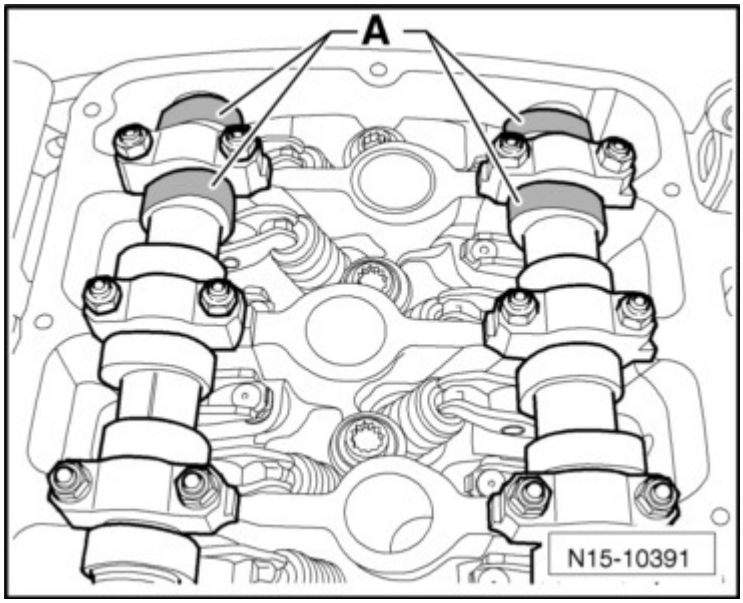

Fig. 111: Camshaft Lobes For Cylinder Facing Each Other
Courtesy of AUDI OF AMERICA, LLC

-- At the same time, T10068 A must engage in both shaft grooves. Turn crankshaft 1 additional turn if necessary.

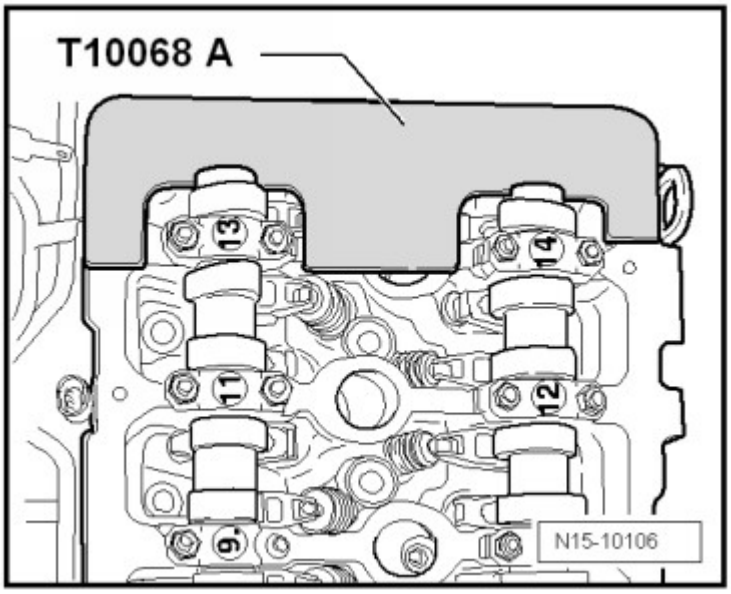

Fig. 112: Identifying Camshaft Bar T10068 A Engage In Shaft Grooves
Courtesy of AUDI OF AMERICA, LLC

-- Identify and disconnect electrical connectors:

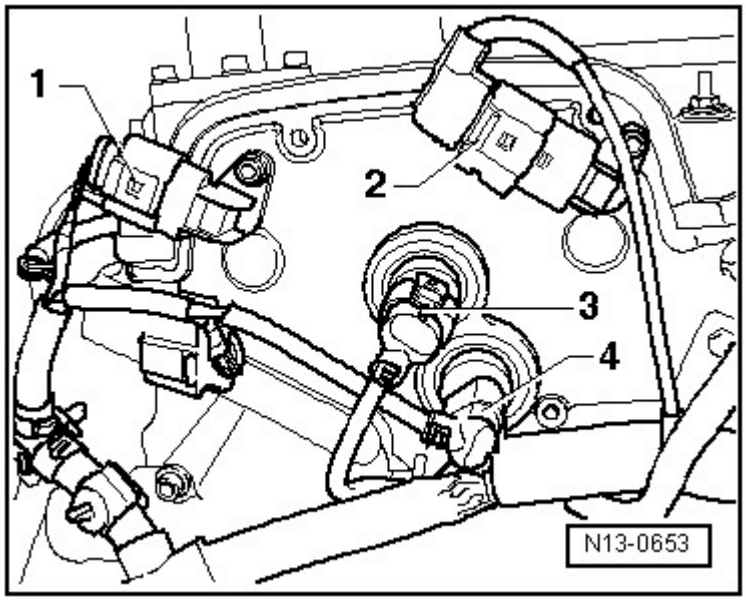

Fig. 113: Identifying CMP Sensor G40, CMP Sensor 2 G163 And Connectors
Courtesy of AUDI OF AMERICA, LLC

1. Camshaft position sensor -G40-
2. Camshaft position (CMP) sensor 2 -G163-
3. Camshaft adjustment valve 1 -N205-
4. Camshaft adjustment valve 1 (exhaust) -N318-

-- Remove camshaft timing chain tensioner -arrow-.

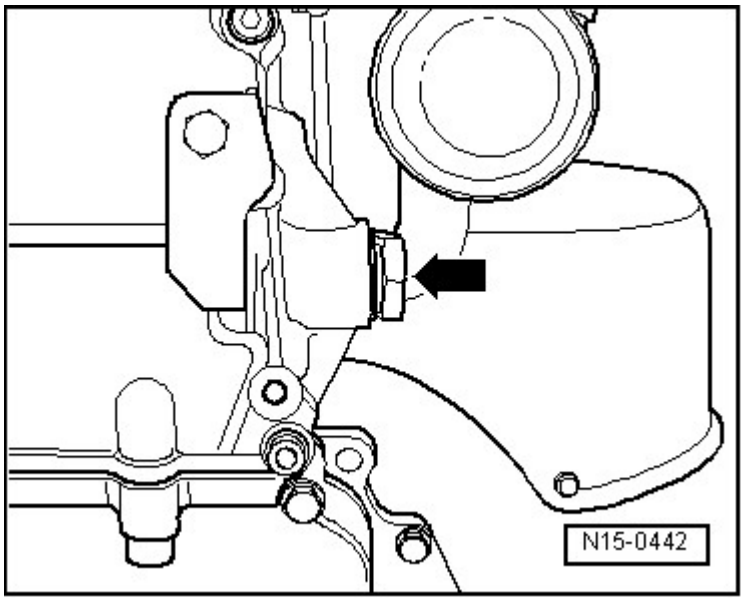

Fig. 114: Camshaft Timing Chain Tensioner
Courtesy of AUDI OF AMERICA, LLC

-- Remove bolts -1 to 3- and upper timing chain cover horizontally from cylinder head. When doing so, ensure cylinder head screw is not damaged.

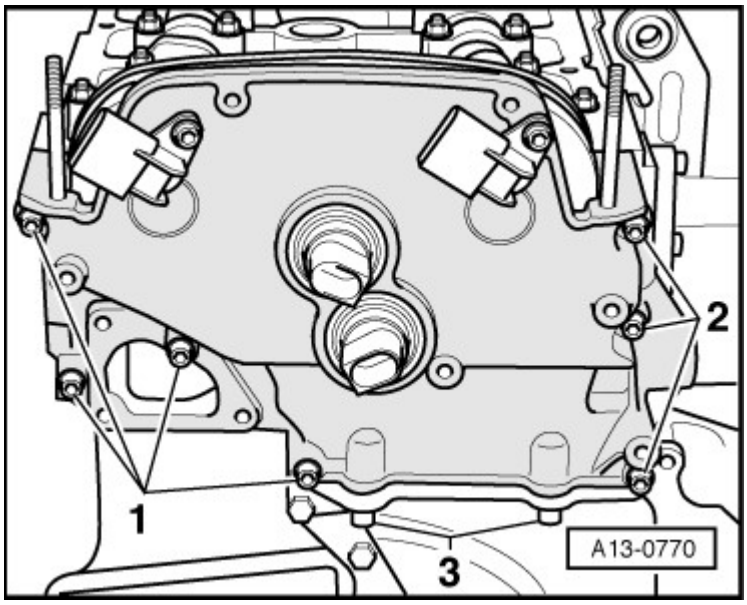

Fig. 115: Identifying Cylinder Head Cover Bolts
Courtesy of AUDI OF AMERICA, LLC

-- Remove bolts and remove lower timing chain cover -arrow- horizontally from cylinder block. When doing so, ensure cylinder head bolt is not damaged.

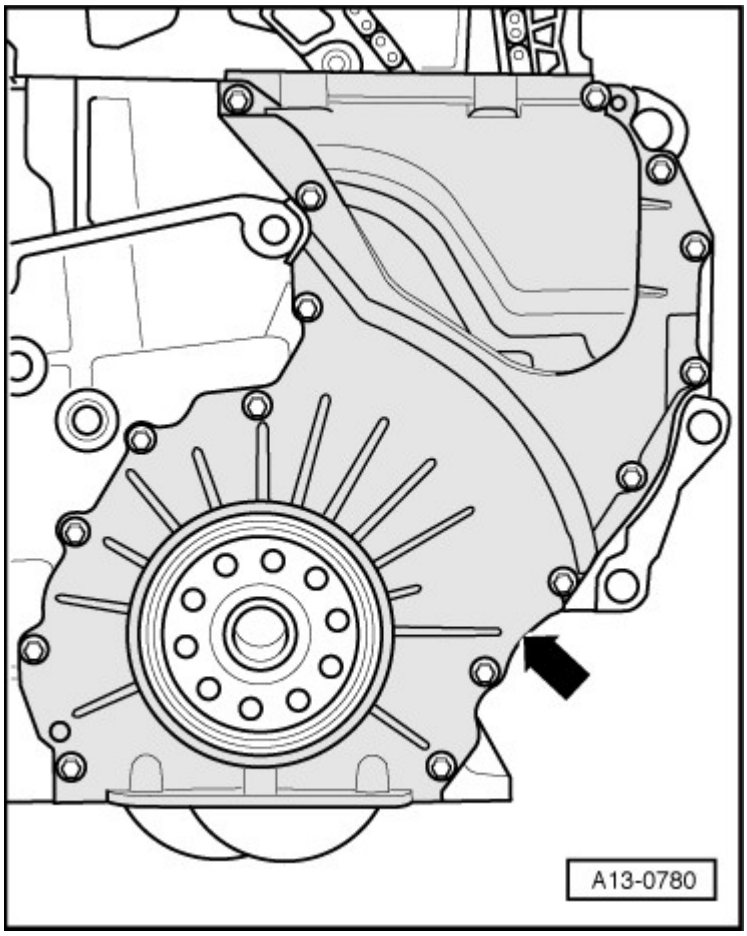

Fig. 116: Identifying Crankshaft Seal On Timing Chain Side Of Cover
Courtesy of AUDI OF AMERICA, LLC

-- Press crankshaft seal timing chain side out of cover.

-- Identify timing chain direction of rotation with arrow mark before removing, using paint -arrows-.

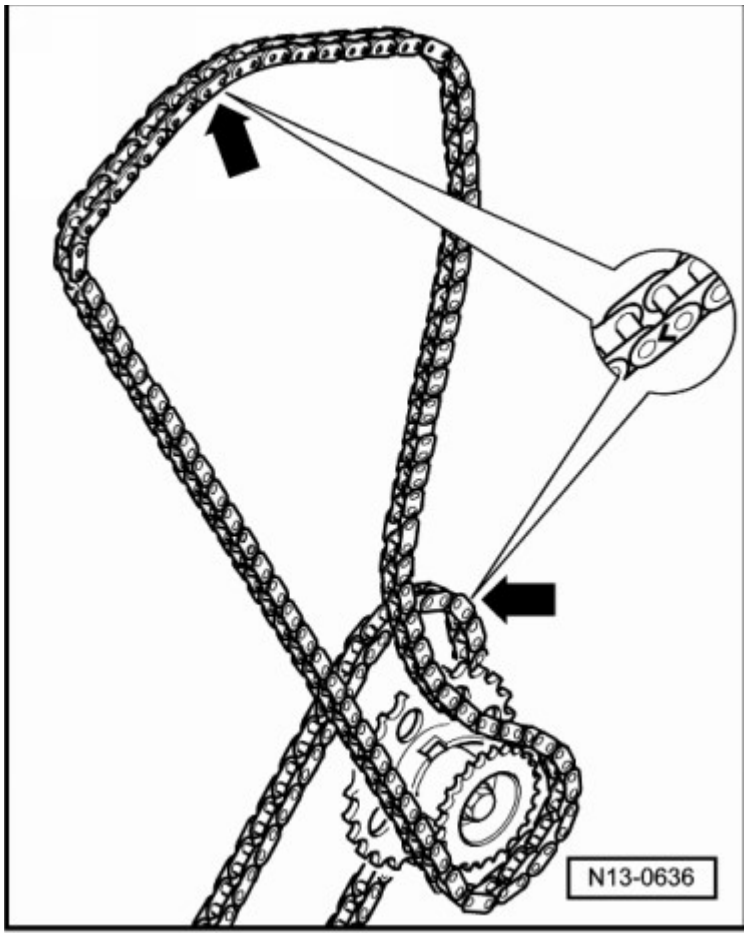

Fig. 117: Identifying Markings On Roller Chains
Courtesy of AUDI OF AMERICA, LLC

CAUTION: Risk of damaging timing chain.

- **Do not mark chain with punch, notch or something similar.**

-- Remove bolts -arrows- and remove guide track -1-.

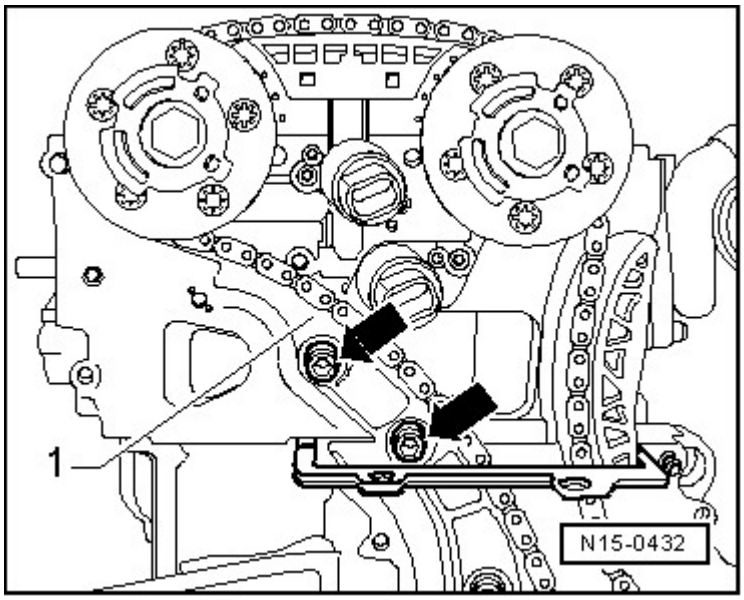

Fig. 118: Locating Guide Rail & Bolts
Courtesy of AUDI OF AMERICA, LLC

-- Remove camshaft timing chain from intermediate shaft sprocket.

-- Carefully remove camshaft timing chain behind cylinder head seal rib.

-- Loosen chain sprocket bolt -arrow- on intermediate shaft approximately 1 turn.

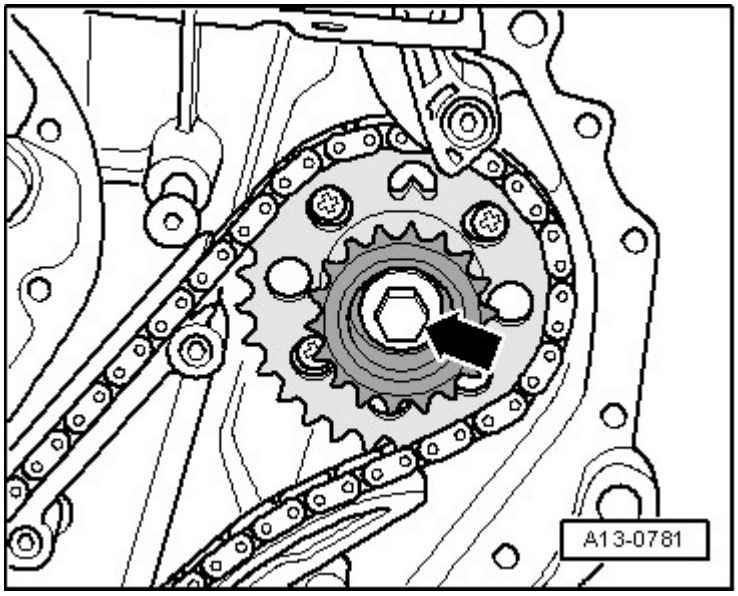

Fig. 119: Chain Sprocket Bolt
Courtesy of AUDI OF AMERICA, LLC

-- Counter hold at vibration damper with T10069 when doing so.

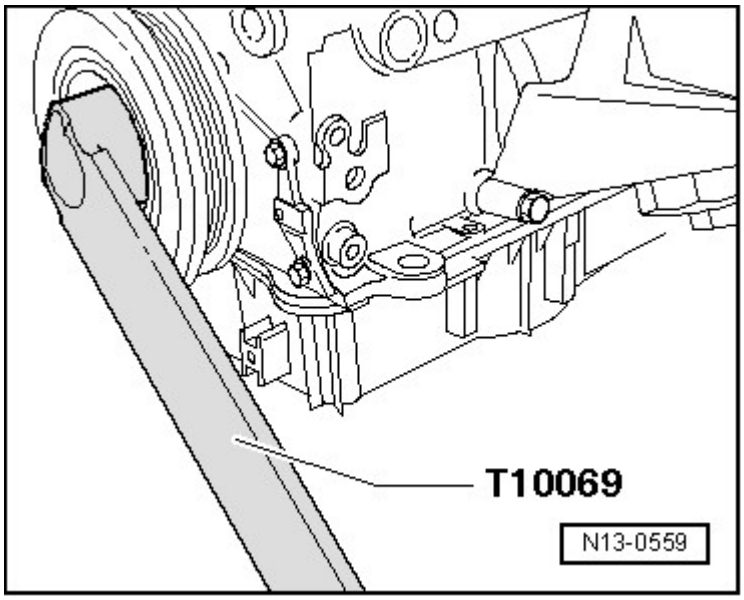

Fig. 120: Counter-Holder T10069 To Hold Vibration Damper
Courtesy of AUDI OF AMERICA, LLC

-- Remove timing mechanism drive chain tensioner -arrows-.

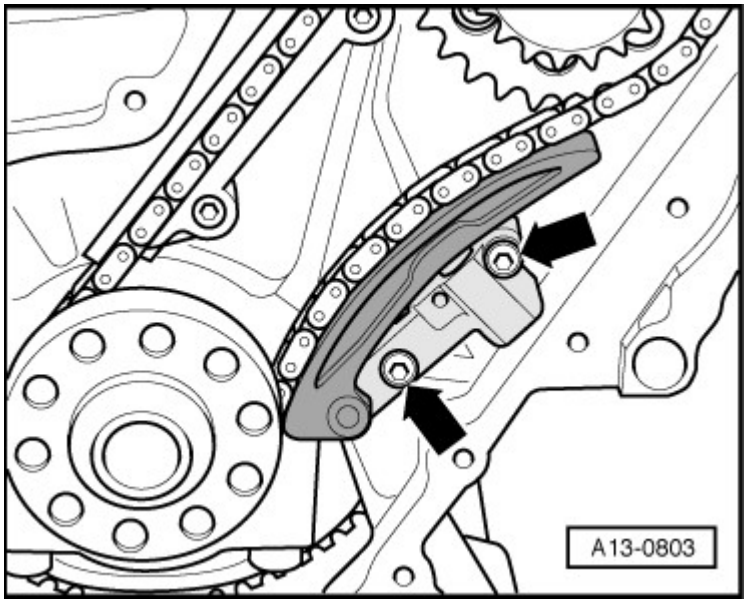

Fig. 121: Chain Tensioner Bolts
Courtesy of AUDI OF AMERICA, LLC

-- Remove bolt -arrow- and remove drive chain together with chain sprockets from intermediate shaft.

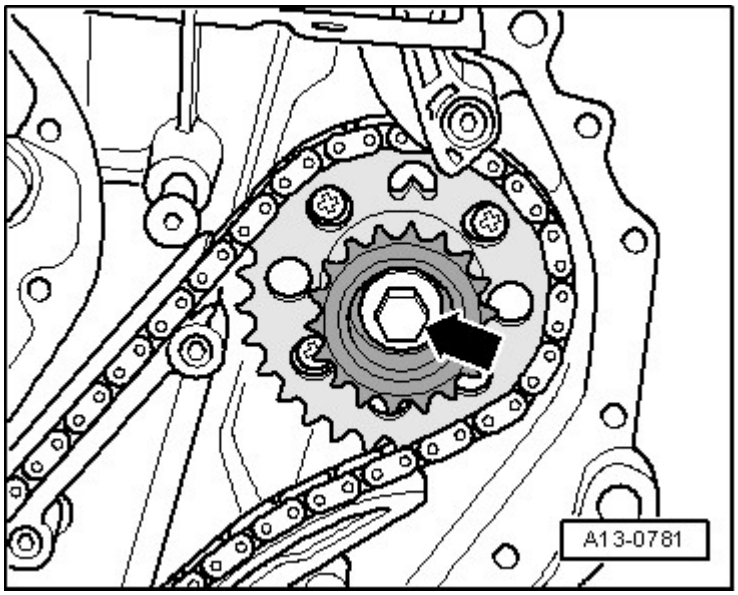

Fig. 122: Chain Sprocket Bolt
Courtesy of AUDI OF AMERICA, LLC

Installing

- Tightening specifications, refer to **TIMING CHAIN COVERS ASSEMBLY OVERVIEW**, **TIMING CHAIN COMPONENT OVERVIEW**.

-- When reinstalling a used timing mechanism drive chain, note running direction marking -lower arrow-.

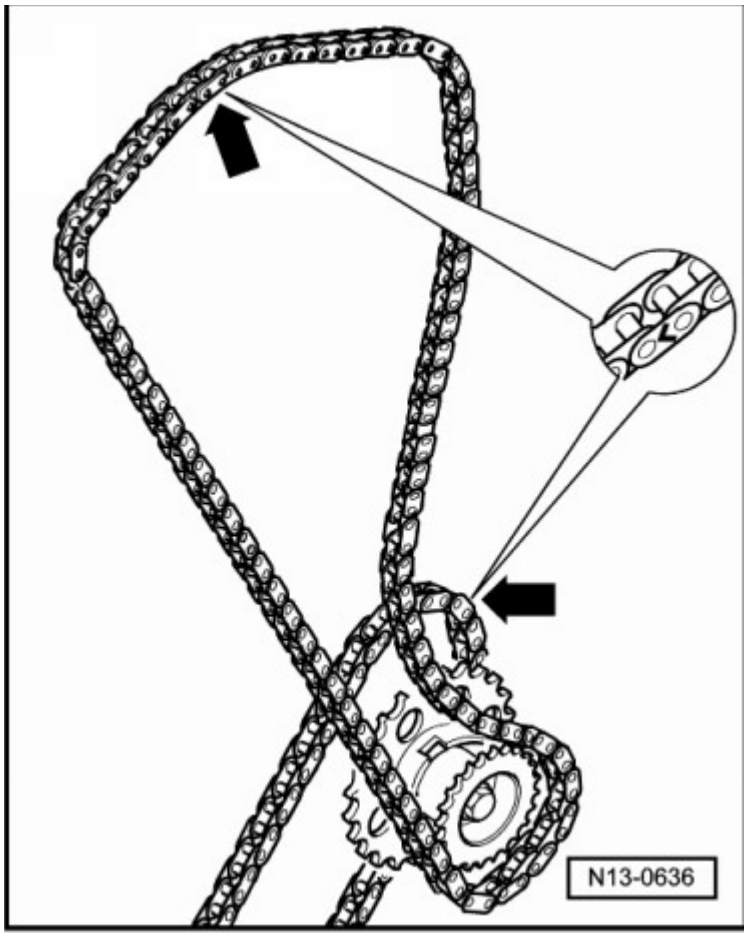

Fig. 123: Identifying Markings On Roller Chains
Courtesy of AUDI OF AMERICA, LLC

-- Install drive chain together with large chain sprocket on intermediate shaft.

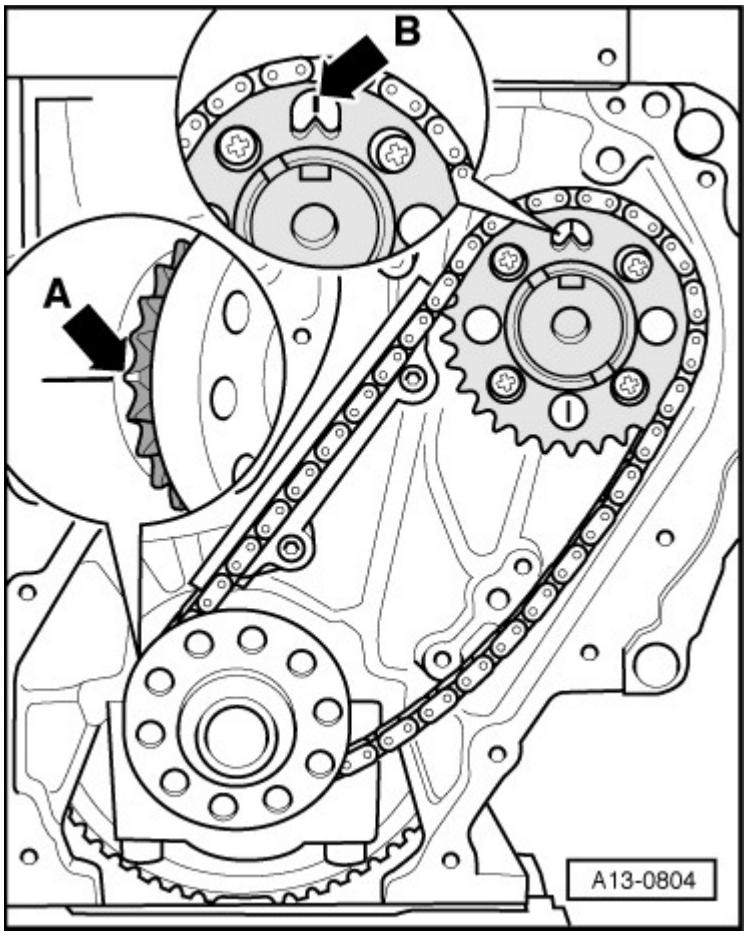

Fig. 124: Identifying Large Sprocket Installed Into Timing Chain With Tab Aligned To Mark On Cylinder Block
Courtesy of AUDI OF AMERICA, LLC

- Installation only possible in one position.

-- If large chain sprocket cannot be installed, rotate intermediate shaft slightly.

-- Check if crankshaft is in "TDC" position:

- Milled drive chain sprocket tooth must align with bearing joint -arrow A-.
- Tab on intermediate shaft sprocket must align with notch -arrow B- on intermediate shaft thrust washer.

-- Install small chain sprocket on intermediate shaft.

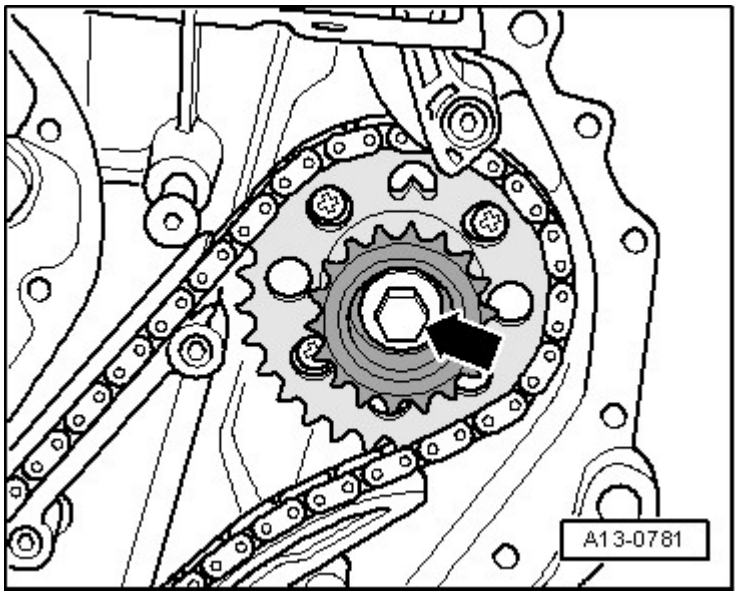

Fig. 125: Chain Sprocket Bolt
Courtesy of AUDI OF AMERICA, LLC

- Installation only possible in one position.

-- Replace the chain sprocket bolt for the intermediate shaft.

-- Tighten chain sprocket bolt -arrow- by hand.

-- Release locking splines in chain tensioner with small screwdriver -arrow-.

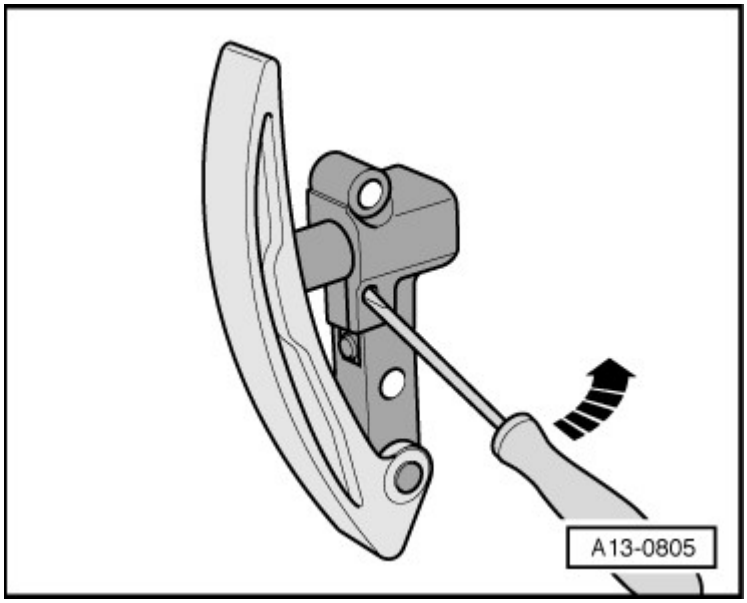

Fig. 126: Identifying Small Screwdriver To Release Locking Splines Of Chain Tensioner
Courtesy of AUDI OF AMERICA, LLC

-- Press tensioning rail against chain tensioner and tighten chain tensioner in this position -arrows-.

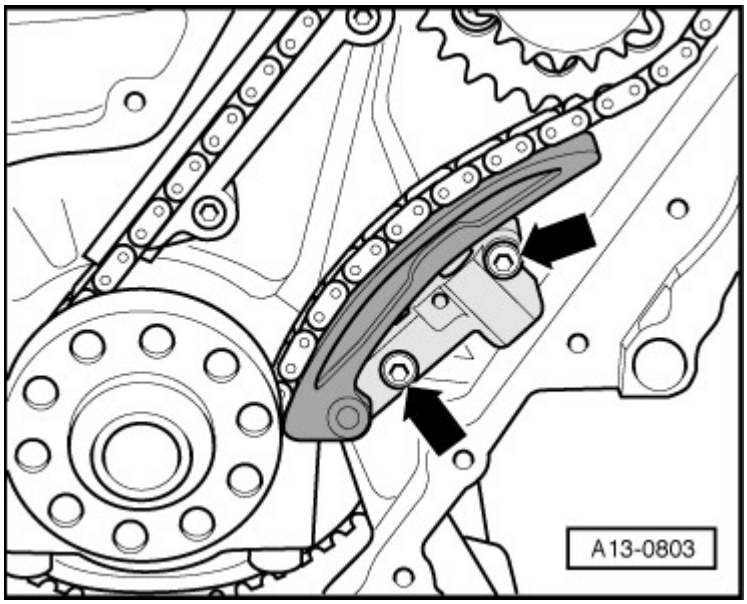

Fig. 127: Chain Tensioner Bolts
Courtesy of AUDI OF AMERICA, LLC

-- Tighten chain sprocket bolt -arrow-.

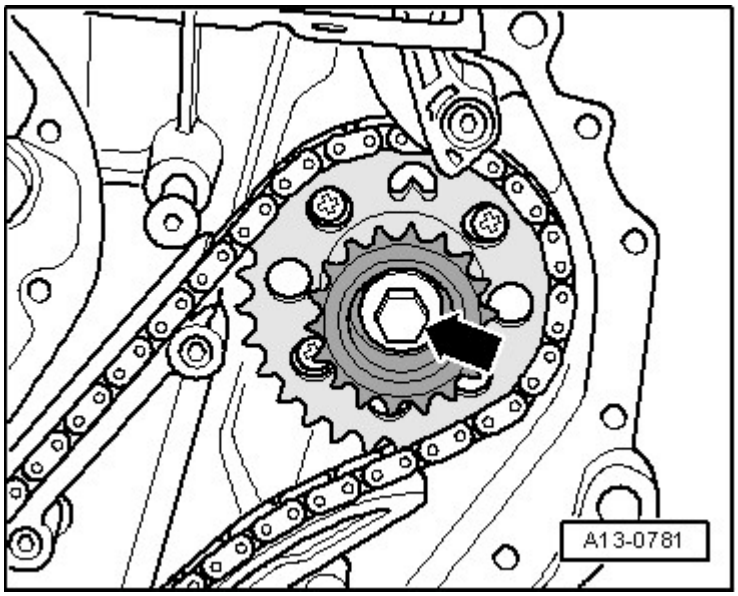

Fig. 128: Chain Sprocket Bolt
Courtesy of AUDI OF AMERICA, LLC

-- Counter hold with T10069 at vibration damper bolt.

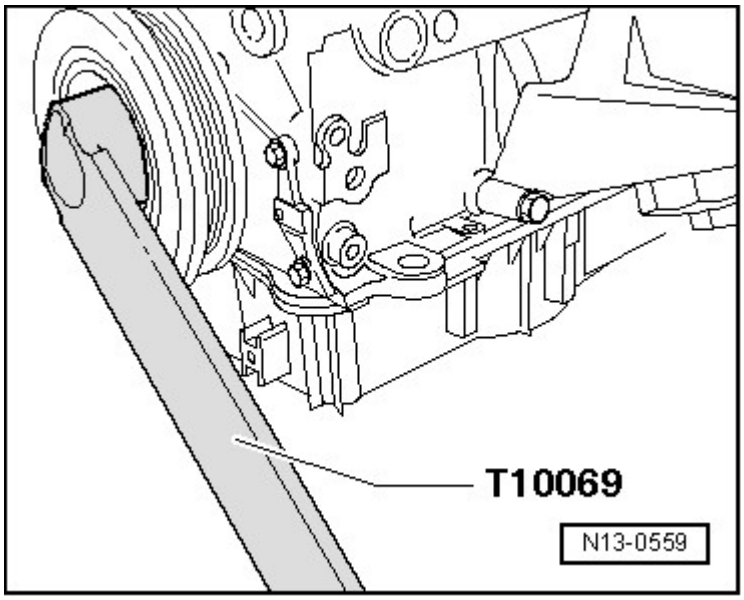

Fig. 129: Counter-Holder T10069 To Hold Vibration Damper
Courtesy of AUDI OF AMERICA, LLC

-- Place the timing chain on the camshaft adjuster in such a way that the 2 individual copper color chain sprockets -CA- align with the markings on the camshaft adjuster. It is possible that the intake camshaft adjust will have to be rotated slightly.

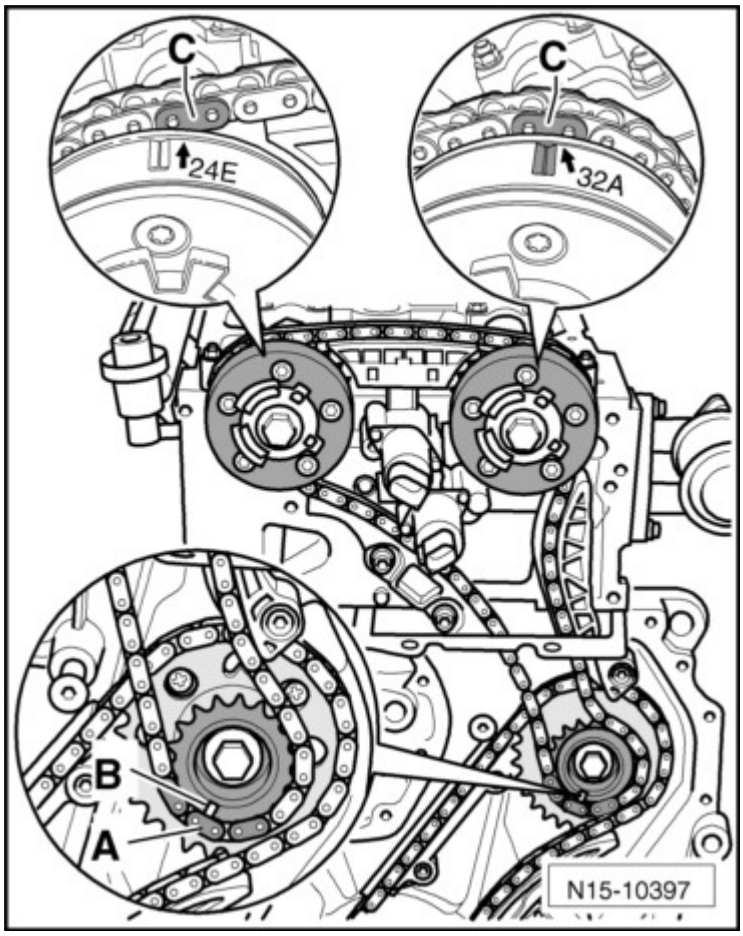

Fig. 130: Identifying Alignment Of Marks To Copper Colored Chain Links
Courtesy of AUDI OF AMERICA, LLC

-- Mount the timing chain on the small chain sprocket. The marking -B- must align with the center copper color chain link -A-.

-- Insert guide track -1- and tighten bolts -arrows-.

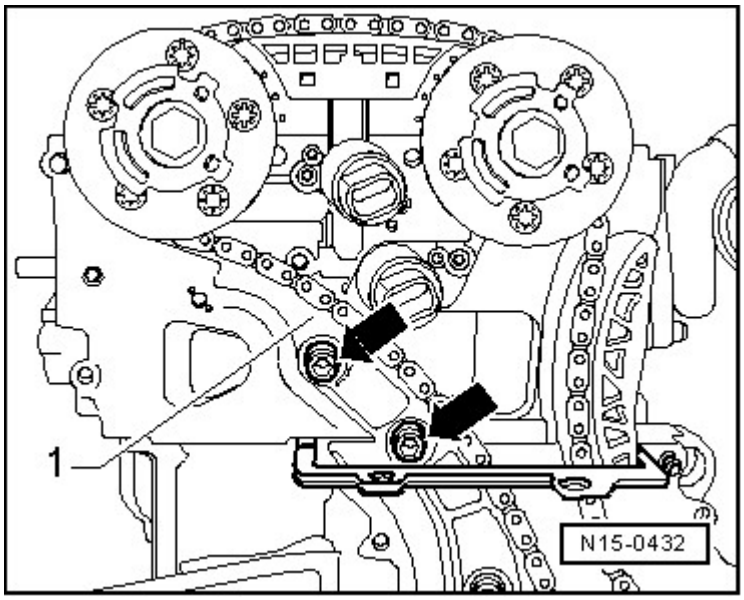

Fig. 131: Locating Guide Rail & Bolts
Courtesy of AUDI OF AMERICA, LLC

-- Remove T10068 A.

CAUTION: Risk of timing chain jumping off.

- **If the crankshaft is rotated, forcefully press camshaft tensioning rail by hand (instead of with chain tensioner) against camshaft adjuster timing chain -arrow-.**

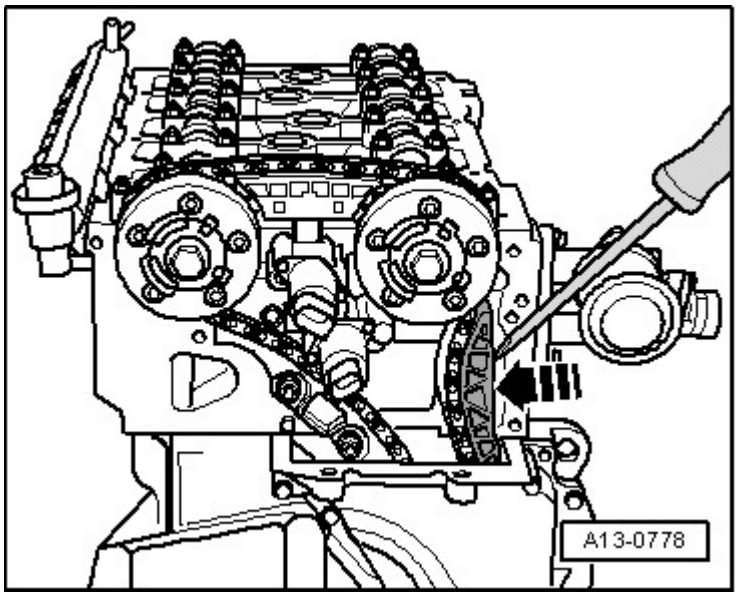

Fig. 132: Identifying Vibration Damper And Counter-Holder Tool T10069
Courtesy of AUDI OF AMERICA, LLC

-- Set crankshaft to TDC mark by turning crankshaft on vibration damper bolt 2 turns in direction of engine rotation -arrow-.

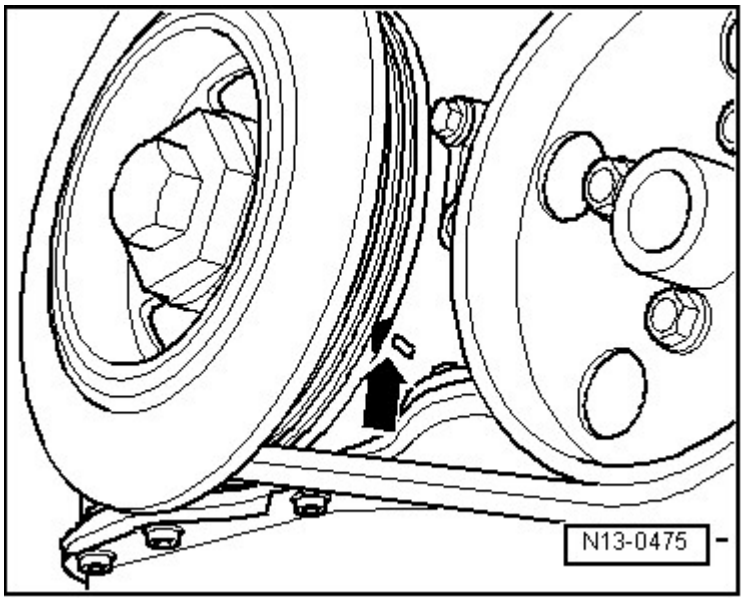

Fig. 133: Identifying Crankshaft At Vibration Damper Securing Bolt In Engine At TDC Cyl. 1
Courtesy of AUDI OF AMERICA, LLC

-- Cams -A- of cylinder 1 must face each other.

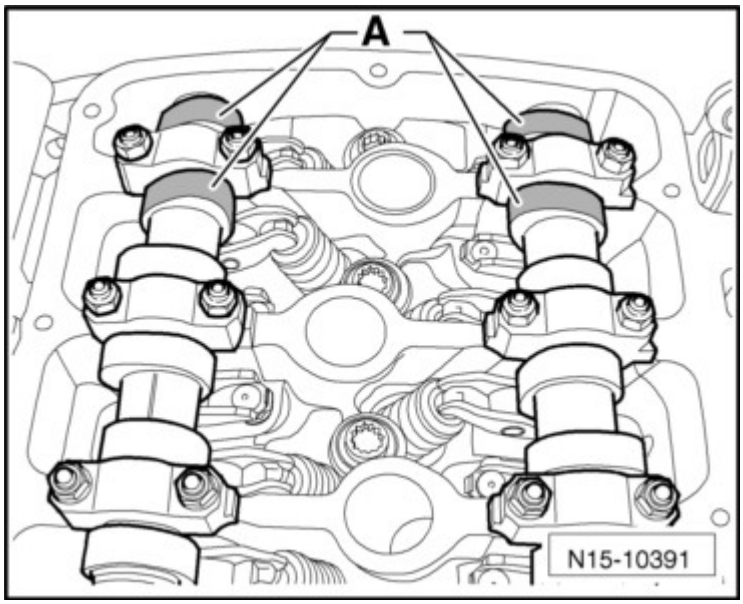

Fig. 134: Camshaft Lobes For Cylinder Facing Each Other
Courtesy of AUDI OF AMERICA, LLC

-- At the same time, the T10068 A must engage in both shaft grooves.

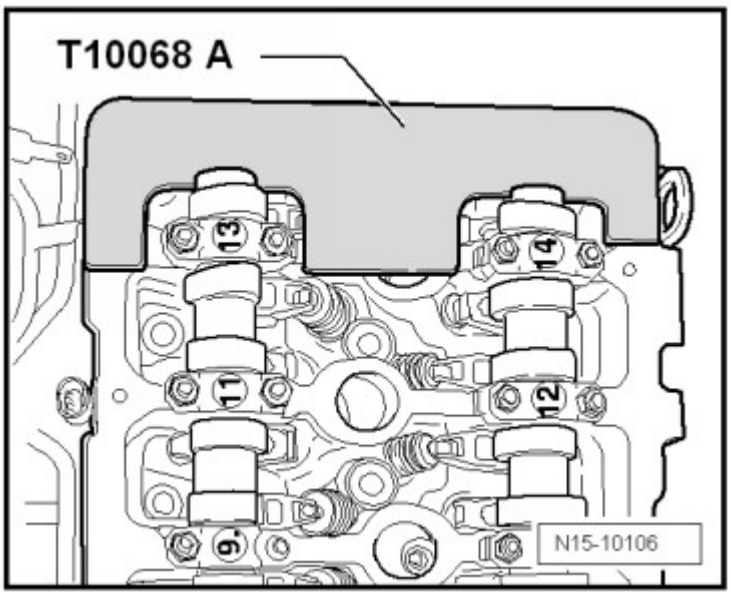

Fig. 135: Identifying Camshaft Bar T10068 A Engage In Shaft Grooves
Courtesy of AUDI OF AMERICA, LLC

NOTE: Marked links now take on an undefined position.

If the camshaft bar cannot be inserted:

-- Repeat valve timing adjustment.

-- Clean old sealant from 3 mm holes -arrows- in cylinder head seal.

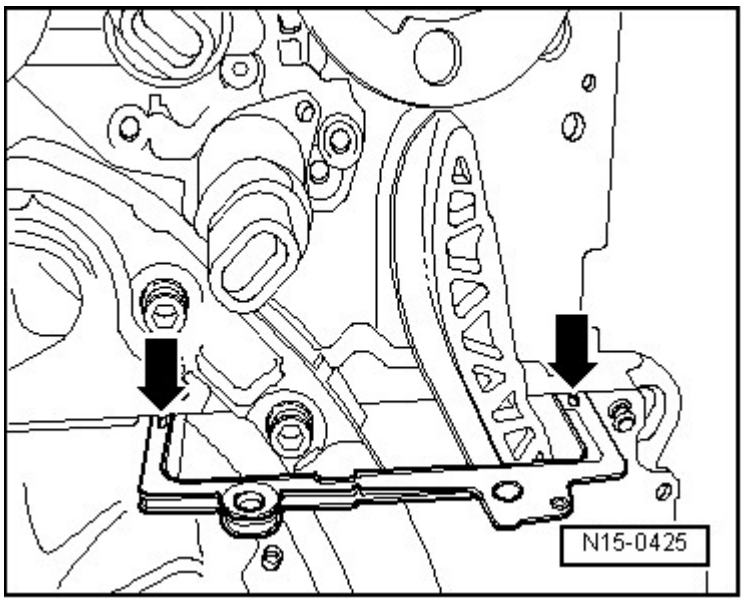

Fig. 136: Locating 3 mm Holes In Cylinder Head Gasket
Courtesy of AUDI OF AMERICA, LLC

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

-- Clean sealing surfaces at engine and both covers; they must be free of oil and grease.

-- Check whether lower timing chain cover alignment pins are inserted in cylinder block.

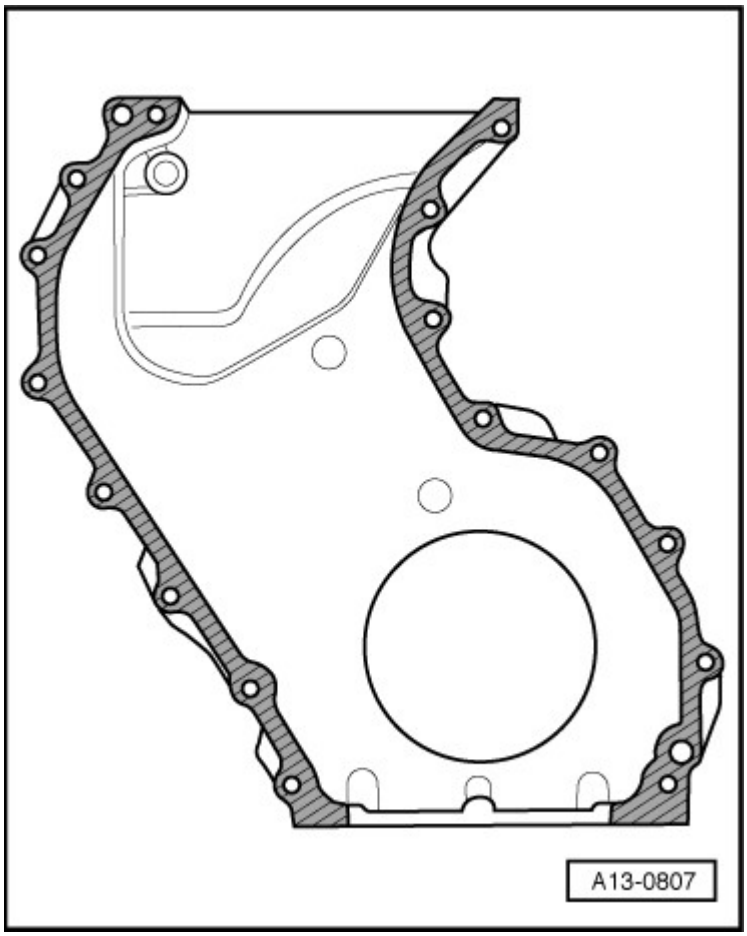

Fig. 137: Identifying Sealing Surfaces
Courtesy of AUDI OF AMERICA, LLC

- Lightly coat clean lower timing chain cover sealing surfaces -shown hatched- with sealing paste.

NOTE: Lower timing chain cover must be installed within 5 minutes of applying sealing paste.

-- Tighten lower timing chain cover bolts -arrow- diagonally in stages.

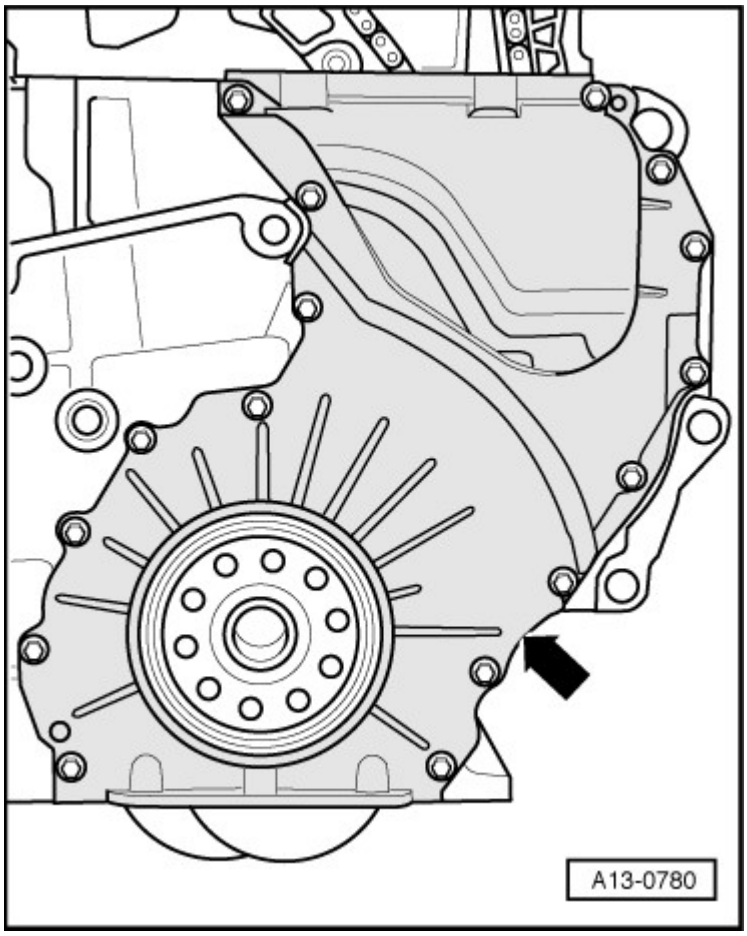

Fig. 138: Identifying Crankshaft Seal On Timing Chain Side Of Cover
Courtesy of AUDI OF AMERICA, LLC

- Fill 3 mm holes in cylinder head seal -arrows- using black sealant.

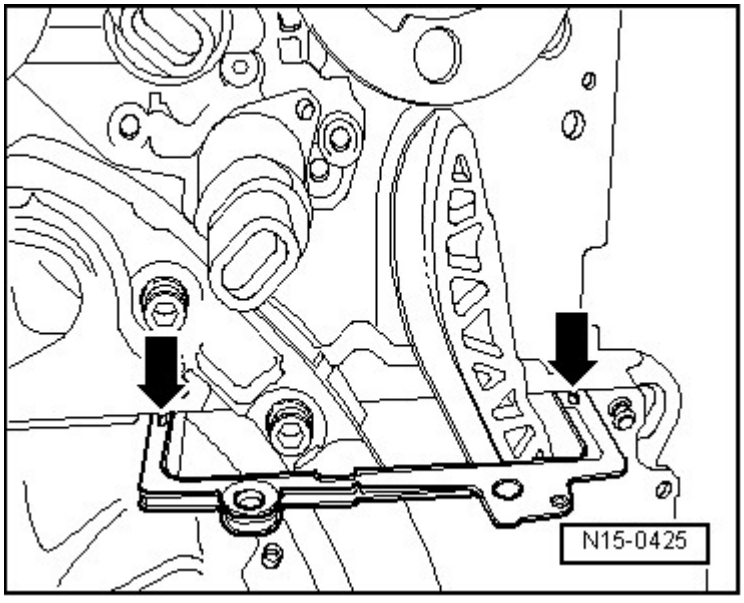

Fig. 139: Locating 3 mm Holes In Cylinder Head Gasket
Courtesy of AUDI OF AMERICA, LLC

-- Replace seal in upper timing chain cover. Refer to **UPPER TIMING CHAIN COVER SEAL, REPLACING**.

-- Check whether alignment sleeves -2- and -3- are inserted in upper timing chain cover.

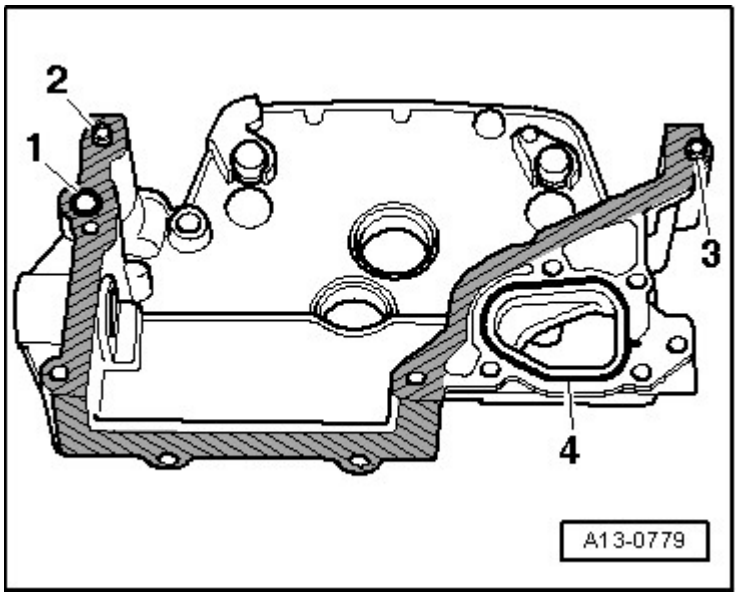

Fig. 140: Checking Dowel Sleeves And Are Inserted In Upper Cover For Camshaft Timing Chain
Courtesy of AUDI OF AMERICA, LLC

-- Insert a new gasket -1- and a new seal -4-.

- Lightly coat clean upper timing chain cover sealing surfaces -shown hatched- with sealing paste.

-- Set upper timing chain cover in place and tighten bolts as follows:

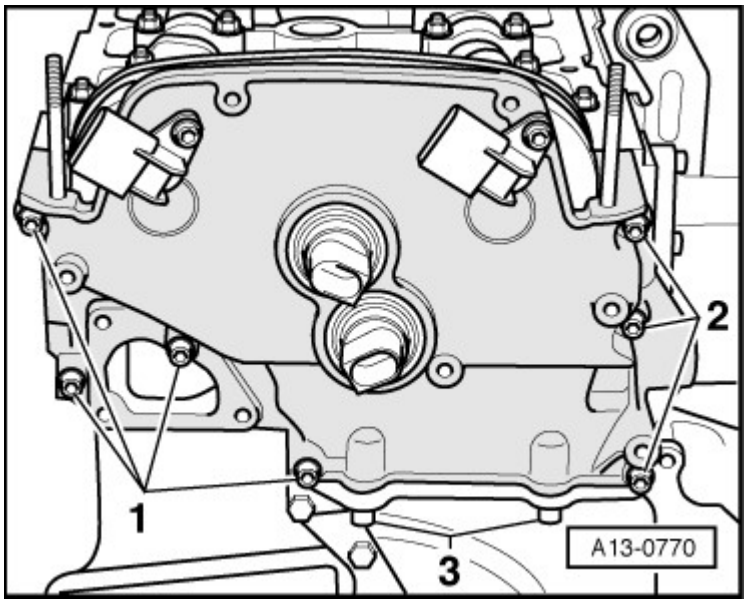

Fig. 141: Identifying Cylinder Head Cover Bolts
Courtesy of AUDI OF AMERICA, LLC

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

-- Tighten camshaft timing chain tensioner -arrow-.

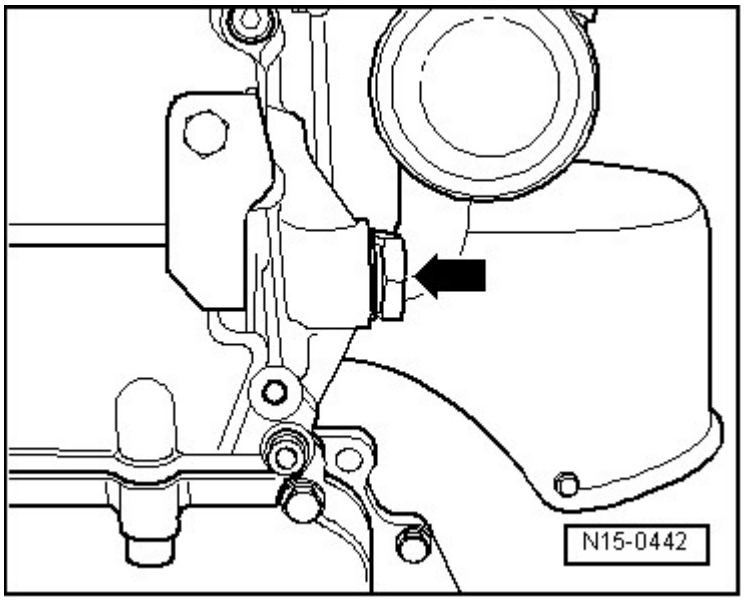

Fig. 142: Camshaft Timing Chain Tensioner
Courtesy of AUDI OF AMERICA, LLC

-- Turn crankshaft 2 times in direction of engine rotation and check valve timing again.

-- Install crankshaft seal, timing chain side. Refer to **CRANKSHAFT SEAL, REPLACING** .

-- Install cylinder head cover. Refer to **CYLINDER HEAD COVER**.

-- Install intake manifold. Refer to **Removal and Installation** .

-- Install coolant thermostat housing. Refer to **COOLANT THERMOSTAT HOUSING** .

-- Install oil pan **OIL PAN** .

-- Install dual-mass flywheel. Refer to **DUAL MASS FLYWHEEL** .

-- Install engine. Refer to **ENGINE, INSTALLING** .

-- Add engine oil and check oil level. Refer to **OIL LEVEL, CHECKING** .

CAMSHAFTS

Special tools and workshop equipment required

- Camshaft Bar T10068 A
- Adhesive lubricating paste.

Removing

- Engine installed.

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

Heat shield boots that were removed should be installed in the same location during installation.

-- Remove camshaft timing chain from camshafts. Refer to **CAMSHAFT TIMING CHAIN**.

-- Remove control housing -arrows-.

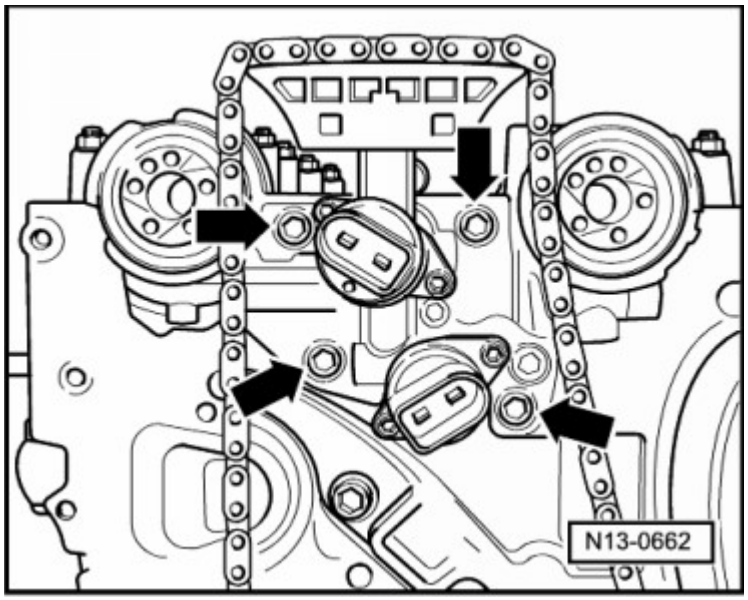

Fig. 143: Locating Control Housing-To-Cylinder Head Bolts
Courtesy of AUDI OF AMERICA, LLC

-- Carefully pull control housing off camshaft seals.

-- Remove intake camshaft -A- as follows:

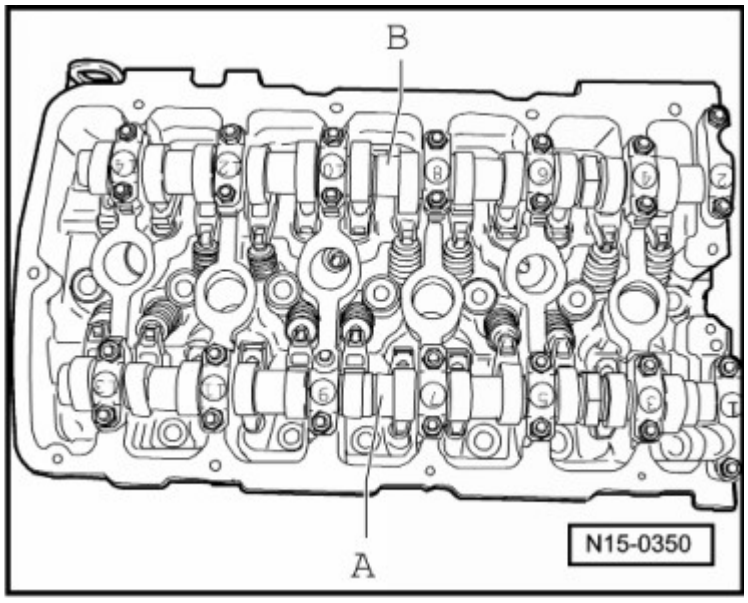

Fig. 144: Identifying Intake Camshaft And Exhaust Camshaft
Courtesy of AUDI OF AMERICA, LLC

1. Remove bearing caps 1 and 13.
2. Remove bearing caps 3 and 11.
3. Remove bearing cap 7.

4. Loosen bearing caps 5 and 9 alternately and in diagonal sequence, and remove.

-- Remove exhaust camshaft -B- as follows:

1. Remove bearing caps 2 and 14.
2. Remove bearing caps 4 and 12.
3. Remove bearing cap 8.
4. Loosen bearing caps 6 and 10 alternately and in diagonal sequence, and remove.

-- Carefully remove camshafts and place on a clean surface.

Installing

- Tightening specifications, refer to **VALVETRAIN COMPONENT OVERVIEW**, **Fig. 15**.

NOTE: When installing camshafts, crankshaft must not be at TDC with any piston. Valves and/or pistons may be damaged.

After installing the camshafts, the engine may not be started for approximately 30 minutes. The hydraulic adjusting elements must seat themselves (otherwise the valves will seat themselves on the pistons).

After working on the valvetrain and lifters, carefully rotate the crankshaft by hand at least 2 full revolutions before starting to be sure that valves do not strike the pistons.

-- Install the hydraulic adjusting elements into the cylinder head.

-- Lay roller rocker lever -1- on valve stem ends and clip in the hydraulic adjusting elements -2-.

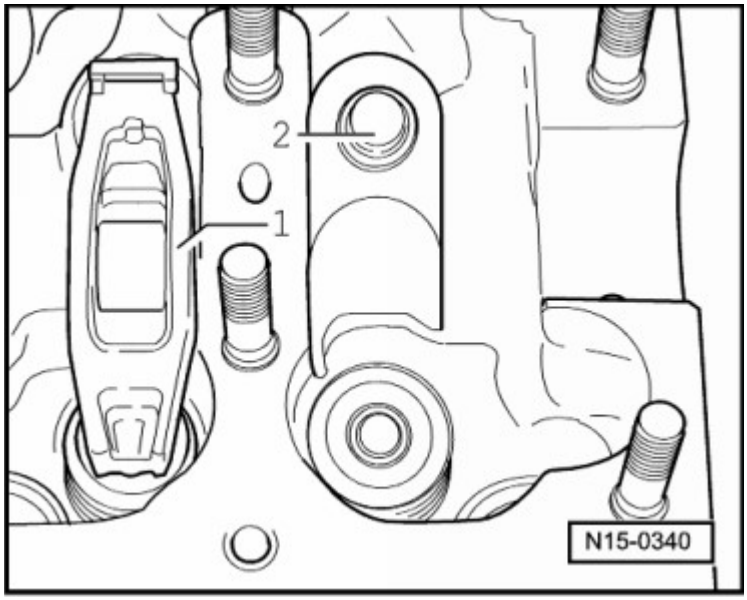

Fig. 145: Identifying Roller Cam Followers And Support Elements
Courtesy of AUDI OF AMERICA, LLC

-- Oil journal surfaces of camshafts.

-- Place respective camshaft into camshaft bearings of cylinder head.

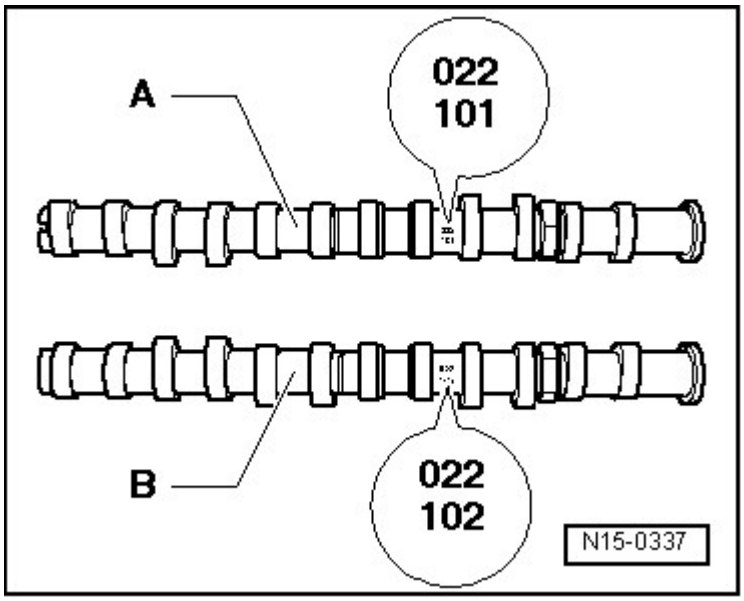

Fig. 146: Camshaft Identification, Valve Timing
Courtesy of AUDI OF AMERICA, LLC

-- Note camshaft identification between cylinder 4 and cylinder 5 cam pair:

A - Exhaust camshaft - Identification 022 - Index 101

B - Intake camshaft - Identification 022 - Index 102

-- Install the camshafts into the cylinder head in such a way so that the cams -A- on cylinder 1 are pointing toward each other.

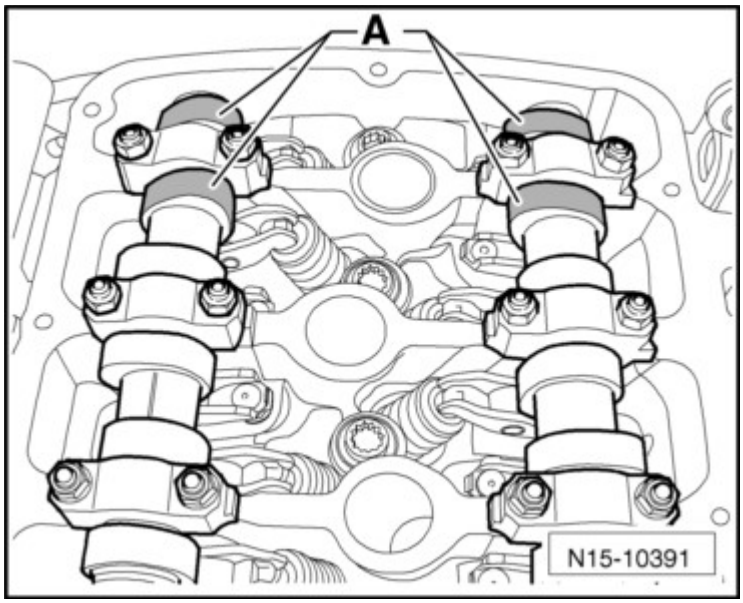

Fig. 147: Camshaft Lobes For Cylinder Facing Each Other
Courtesy of AUDI OF AMERICA, LLC

-- Observe installed position of bearing caps:

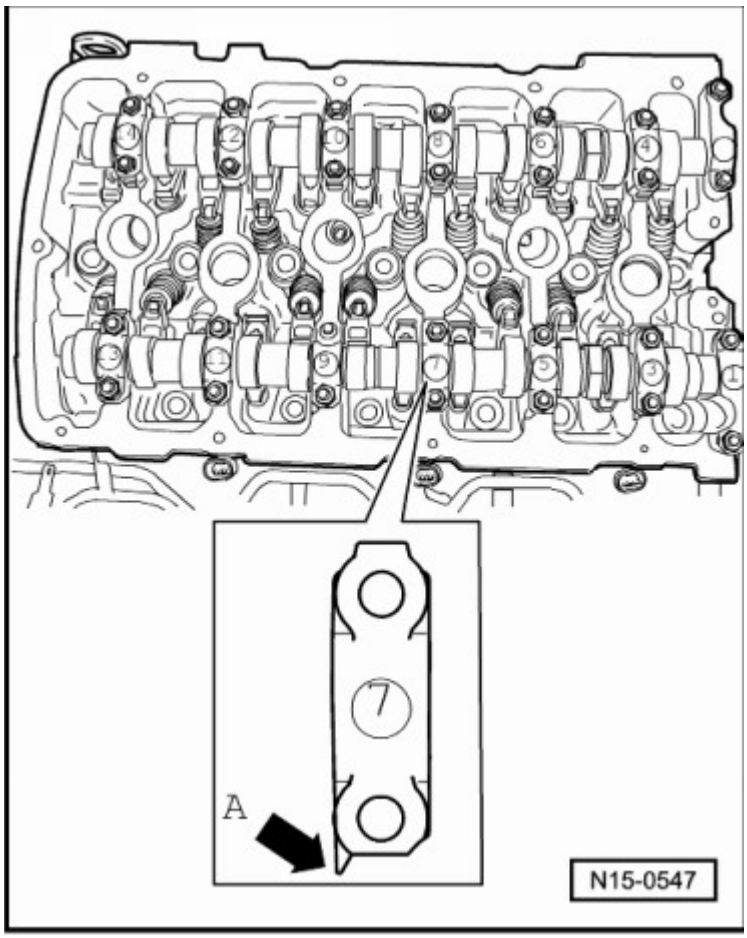

Fig. 148: Identifying Points Of Intake And Exhaust Camshaft Bearing Cap Face Outwards
Courtesy of AUDI OF AMERICA, LLC

- Points -arrow A- of intake and exhaust camshaft bearing caps face outwards.
- Identification on bearing caps is legible when read from intake side.

- Lightly coat bearing cap 7 and 8 contact surface -hatched area- with adhesive lubricating paste.

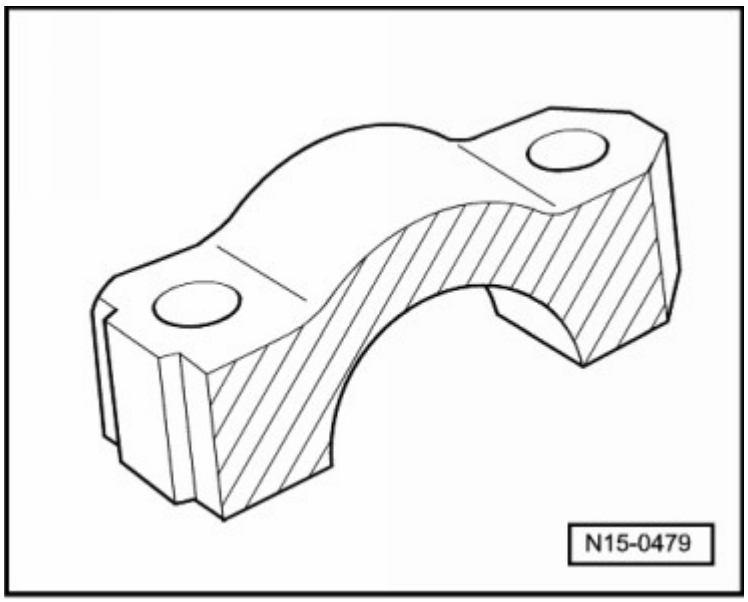

Fig. 149: Coating Bearing Caps 7 And 8 Contact Surface With Adhesive Lubricating Paste
Courtesy of AUDI OF AMERICA, LLC

-- Install intake camshaft -A- as follows:

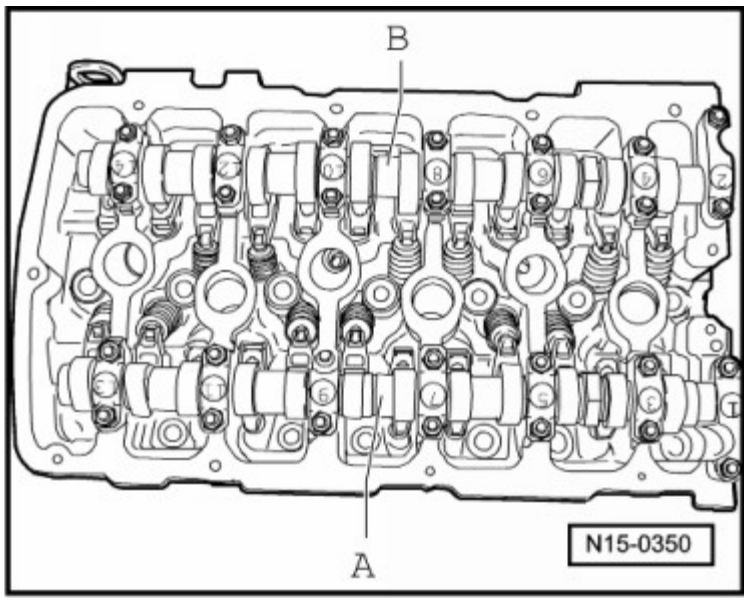

Fig. 150: Identifying Intake Camshaft And Exhaust Camshaft

Courtesy of AUDI OF AMERICA, LLC

1. Fasten bearing caps 5 and 9 alternately and diagonally and then tighten to specified torque.
2. Fasten bearing caps 1 and 13.
3. Fasten bearing cap 7.
4. Fasten bearing caps 3 and 11.

-- Install exhaust camshaft -B- as follows:

1. Fasten bearing caps 6 and 10 alternately and diagonally and then tighten to specified torque.
2. Fasten bearing caps 2 and 14.
3. Fasten bearing cap 8.
4. Fasten bearing caps 4 and 12.

-- Position camshafts in cylinder head to TDC.

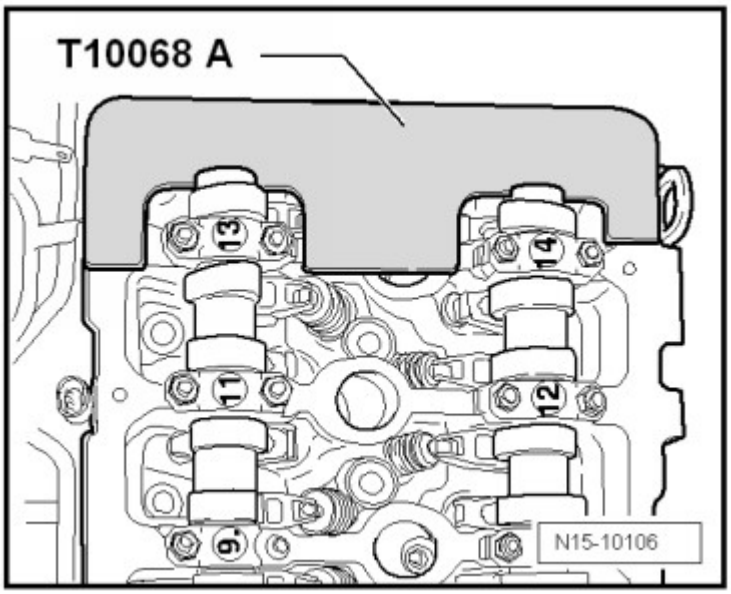

Fig. 151: Identifying Camshaft Bar T10068 A Engage In Shaft Grooves
Courtesy of AUDI OF AMERICA, LLC

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

-- If necessary, turn camshafts at hex head surfaces -arrows- to correct position using open end wrench SW 32.

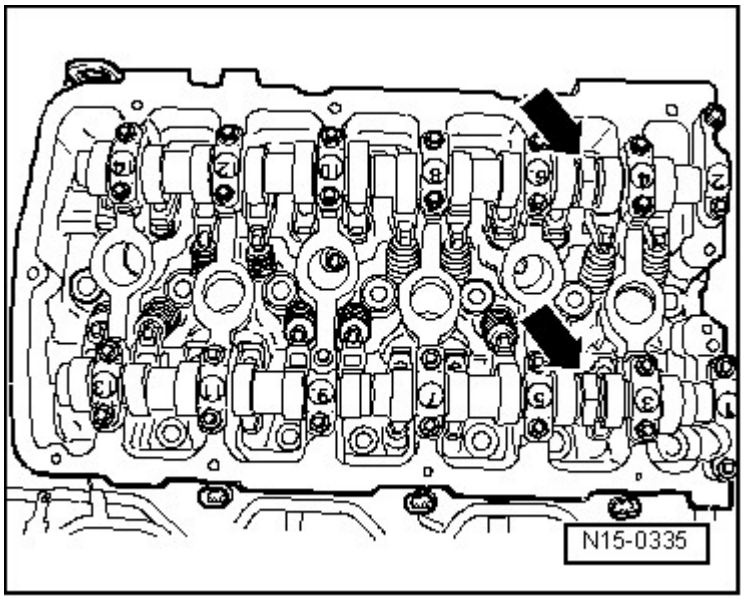

Fig. 152: Locating Counter-Hold Area On Camshaft
Courtesy of AUDI OF AMERICA, LLC

NOTE: When turning camshafts, crankshaft must not be at TDC with any piston. Valves and/or pistons may be damaged.

-- Unclip screen -2- at backside of control housing -1- and remove any contaminants.

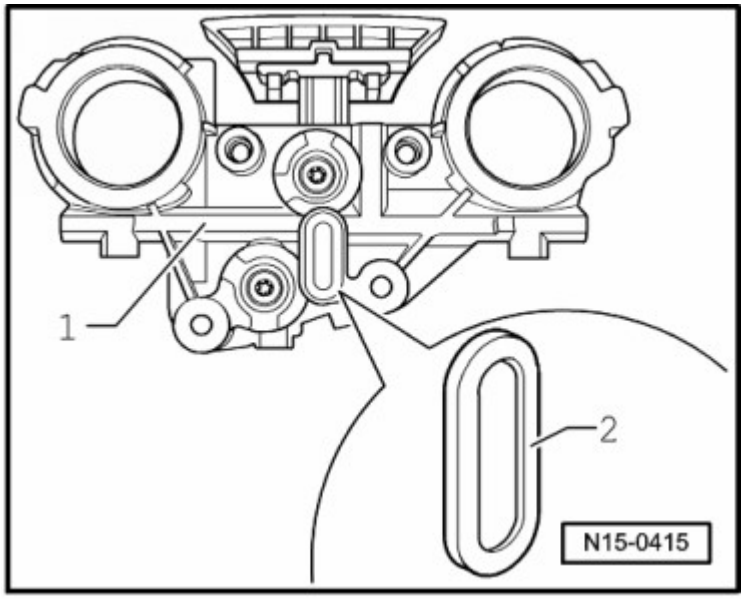

Fig. 153: Backside Of Control Housing & Screen
Courtesy of AUDI OF AMERICA, LLC

-- Lightly oil camshaft seal contact surfaces in control housing.

-- Lightly oil sealing ring contact surfaces of camshafts and carefully slide control housing over camshaft

sealing rings.

-- Tighten control housing -arrows-.

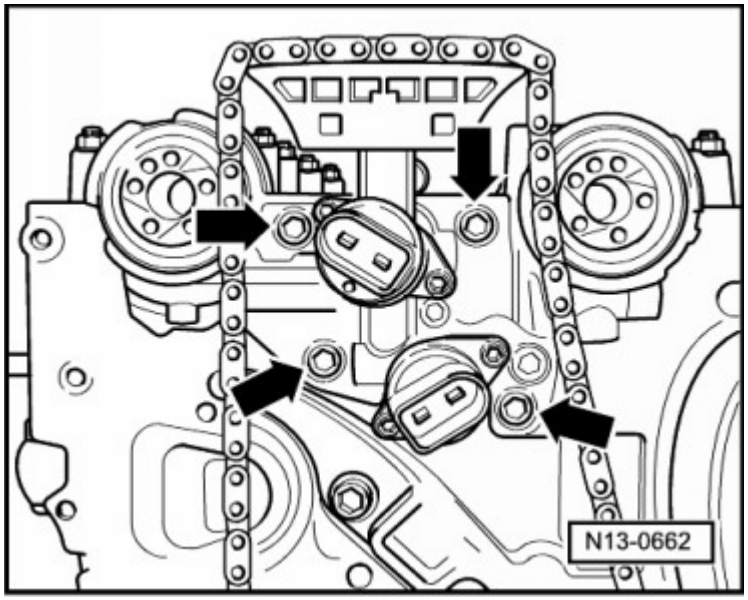

Fig. 154: Locating Control Housing-To-Cylinder Head Bolts
Courtesy of AUDI OF AMERICA, LLC

-- Install camshaft timing chain (adjust valve timing) **CAMSHAFT TIMING CHAIN**.

1. 45° corresponds to $^{1}/_{8}$ turn.

VALVE STEM SEALS WITH CYLINDER HEAD INSTALLED, REPLACING

Special tools and workshop equipment required

- Spark Plug Removal Tool 3122 B
- Valve Seal Removal Tool 3364
- Valve Stem Seal Driver 3365
- Valve Cotters Asm/Dis-Asm Device VAS 5161 with Guide Plate F/Vr6 And W12 Engine VAS 5161/25
- Adapter T40012

Procedure

- Engine removed.

-- Remove camshafts. Refer to **CAMSHAFTS**.

-- Using 3122 B, remove spark plugs.

-- Place VAS 5161/3 on valve spring plate and loosen stuck valve retainers using a plastic hammer.

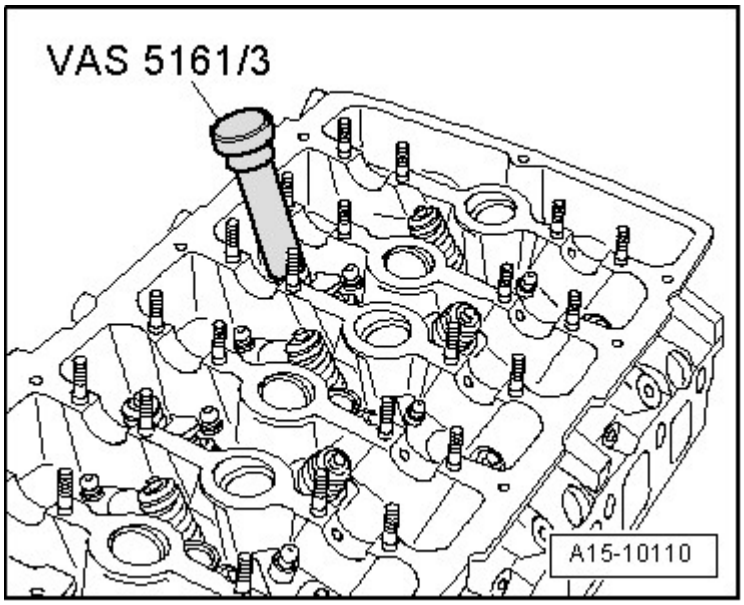

Fig. 155: Placing Drift VAS 5161/3 On Valve Plate
Courtesy of AUDI OF AMERICA, LLC

-- Place VAS 5161/25 from VAS 5161 on cylinder head.

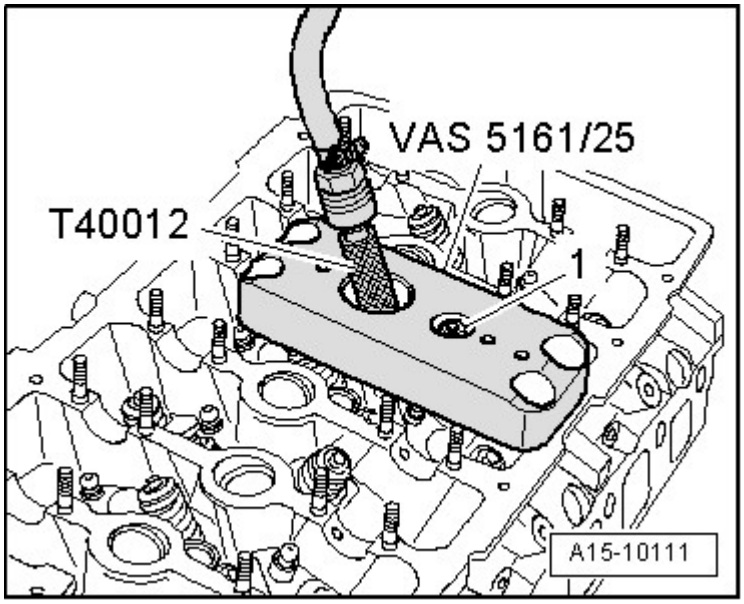

Fig. 156: Placing Guide Plate VAS 5161/25 From Valve Keeper Disassembly And Assembly Device VAS 5161 On Cylinder Head
Courtesy of AUDI OF AMERICA, LLC

-- Secure guide plate with a nut -1-.

-- Screw T40012 with gasket by hand into respective spark plug thread and apply constant pressure.

- Minimum pressure: 6 bar positive pressure.

Rear valve row procedure:

-- Screw VAS 5161/6 with VAS 5161/5 into guide plate.

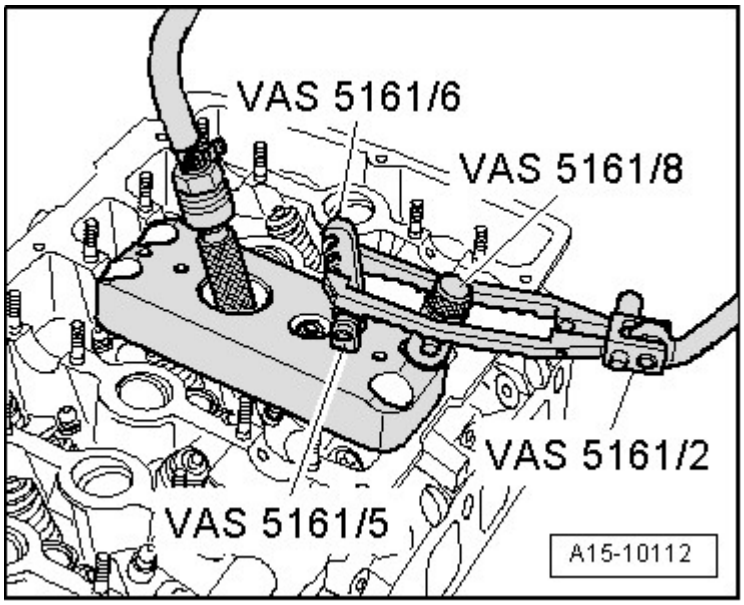

Fig. 157: Procedure For Outer Rows Of Valves
Courtesy of AUDI OF AMERICA, LLC

-- Push VAS 5161/8 into guide plate.

-- Hook in VAS 5161/2 at engaging device and press down installation cartridge.

-- At the same time, turn knurled bolt of installation cartridge to the right, until the points engage in the valve retainers.

-- Lightly move knurled bolt back and forth, causing the valve keepers to be pressed apart and be captured in the installation cartridge.

-- Release pressure fork.

-- Take out installation cartridge.

-- Unfasten guide plate and turn it aside.

- Pressurized air hose remains connected.

-- Remove valve spring with valve spring plate.

Front valve row procedure:

-- Screw VAS 5161/6 with VAS 5161/5 onto cylinder head.

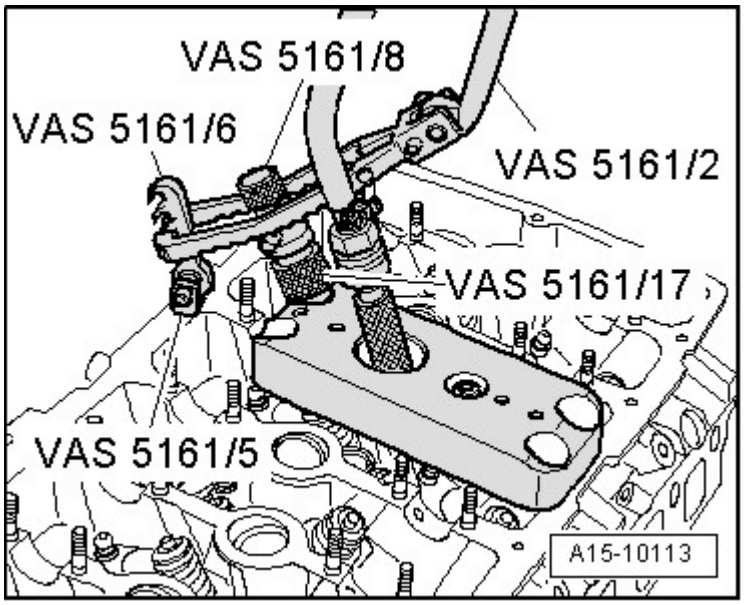

Fig. 158: Procedure For Inner Rows Of Valves
Courtesy of AUDI OF AMERICA, LLC

-- Push the VAS 5161/17 onto the VAS 5161/8.

-- Push installation cartridge into guide plate.

-- Hook in VAS 5161/2 at engaging device and press down installation cartridge.

-- At the same time, turn knurled bolt of installation cartridge to the right, until the points engage in the valve retainers.

-- Lightly move knurled bolt back and forth, causing the valve retainers to be pressed apart and be captured in the installation cartridge.

-- Release pressure fork.

-- Take out installation cartridge.

-- Unfasten guide plate and turn it aside.

- Pressurized air hose remains connected.

-- Remove valve spring with valve spring plate.

Procedure for both valve rows:

-- Pull off valve stem oil seals using 3364.

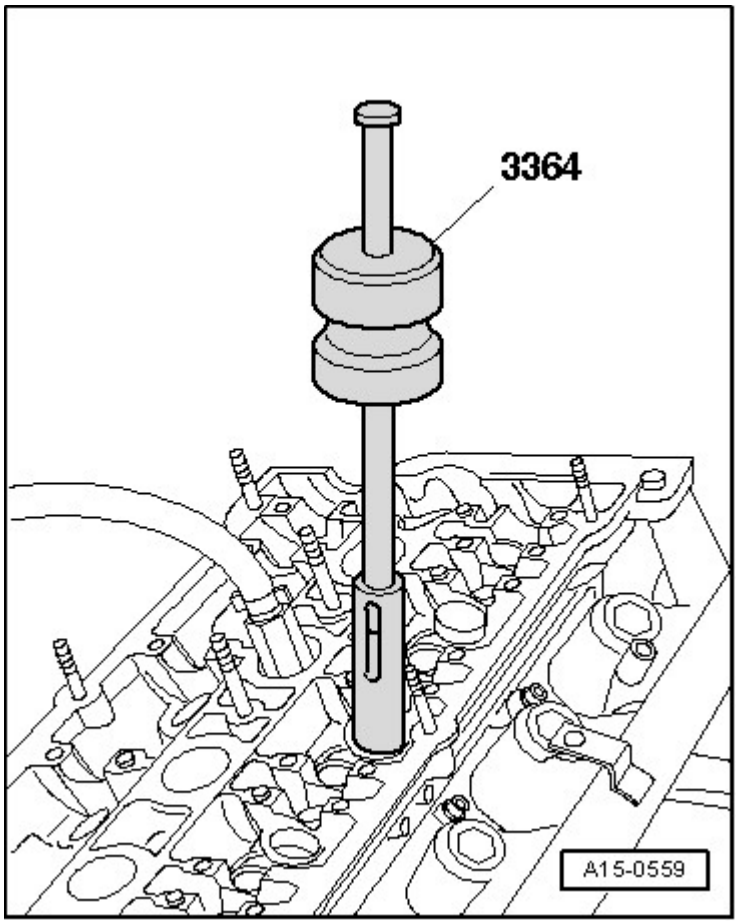

Fig. 159: Identifying Valve Seal Removal Tool 3364
Courtesy of AUDI OF AMERICA, LLC

NOTE: **For pressing on green-colored valve stem seals from delivery program, the 3365 must be drilled to 10.5 mm in dia.**

Mark the drilled driver for later reuse.

A plastic sleeve -A- is supplied with new valve shaft seals.

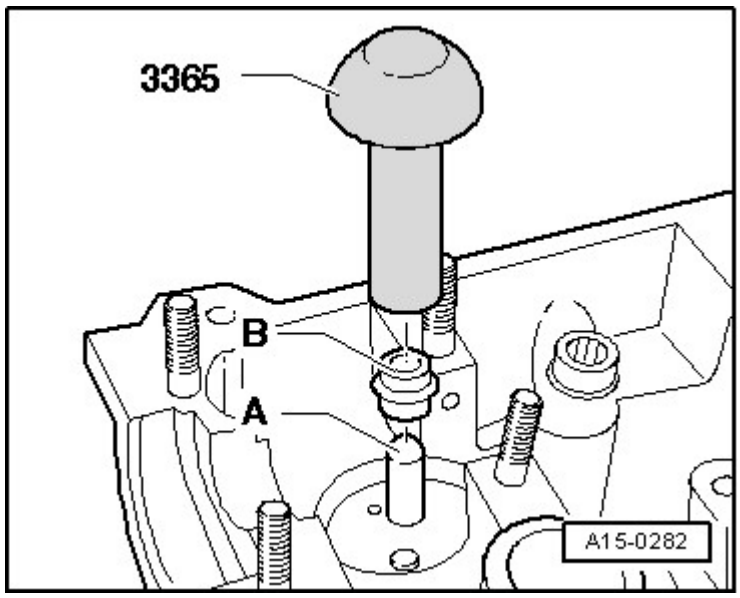

Fig. 160: Identifying Plastic Sleeve, New Valve Stem Oil Seals & Valve Stem Seal Driver 3365
Courtesy of AUDI OF AMERICA, LLC

-- Place plastic sleeve -A- on valve stem to prevent damage to new valve stem seals -B-.

-- Lightly coat sealing lips of valve stem seal with oil.

-- Push valve stem seal onto plastic sleeve.

-- Carefully press valve stem oil seal onto valve guide using 3365.

-- Remove plastic sleeve again.

If the valve keys were removed from the installation cartridge, they must be inserted into VAS 5161/18 next.

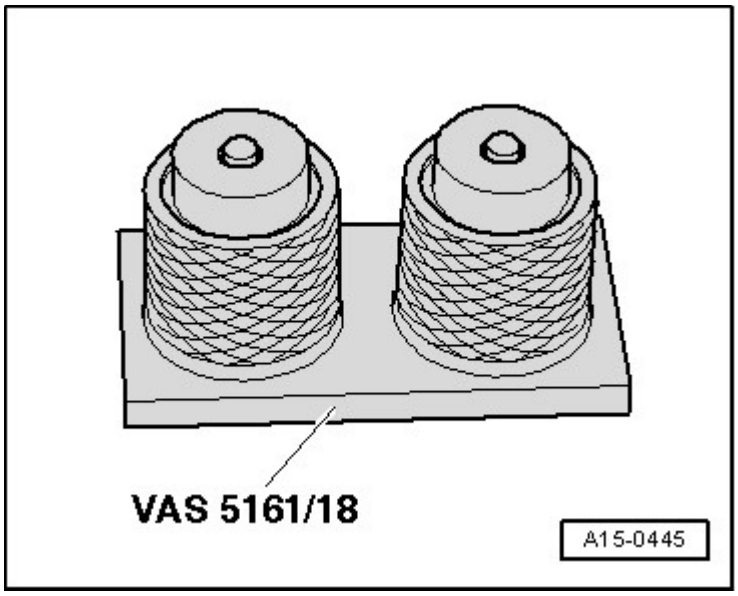

Fig. 161: Identifying Installation Cartridge VAS 5161/8
Courtesy of AUDI OF AMERICA, LLC

- The large diameter of the valve keepers point upward.

-- Install valve spring and valve spring plate.

Installed position of valve spring:

- The larger dia. -arrow- faces toward cylinder head.

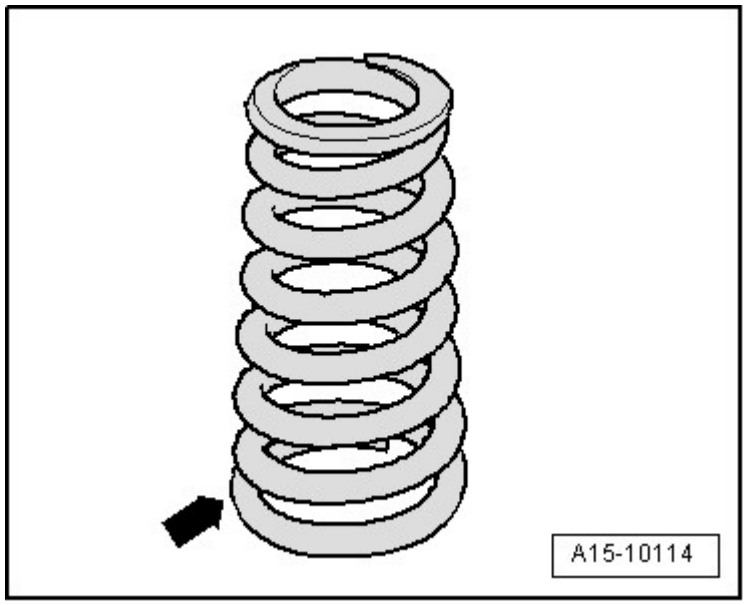

Fig. 162: Valve Spring And Valve Plate
Courtesy of AUDI OF AMERICA, LLC

Rear valve row procedure:

-- Fasten the guide plate to cylinder head again as shown in illustration.

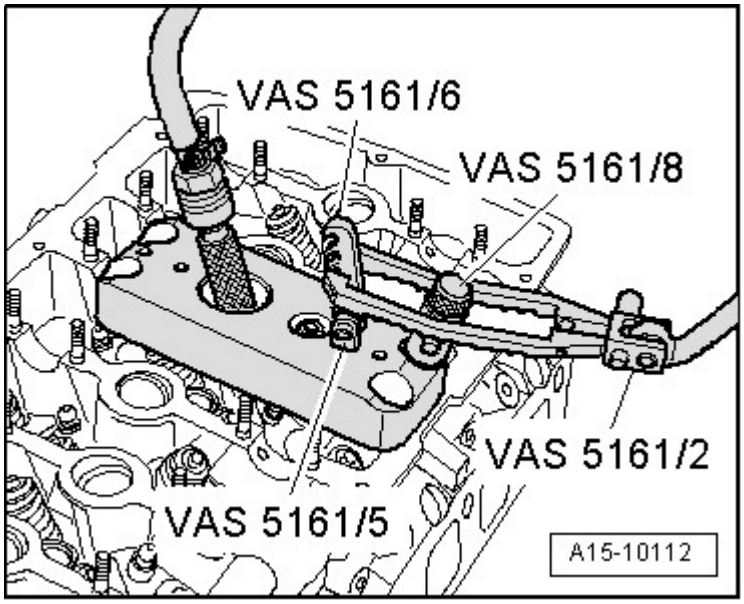

Fig. 163: Procedure For Outer Rows Of Valves
Courtesy of AUDI OF AMERICA, LLC

-- Insert installation cartridge into guide plate.

-- Press the pressure fork down and pull the knurled bolt upward while turning it left and right to insert the valve keepers.

-- Release pressure fork with the knurled bolt still pulled.

Front valve row procedure:

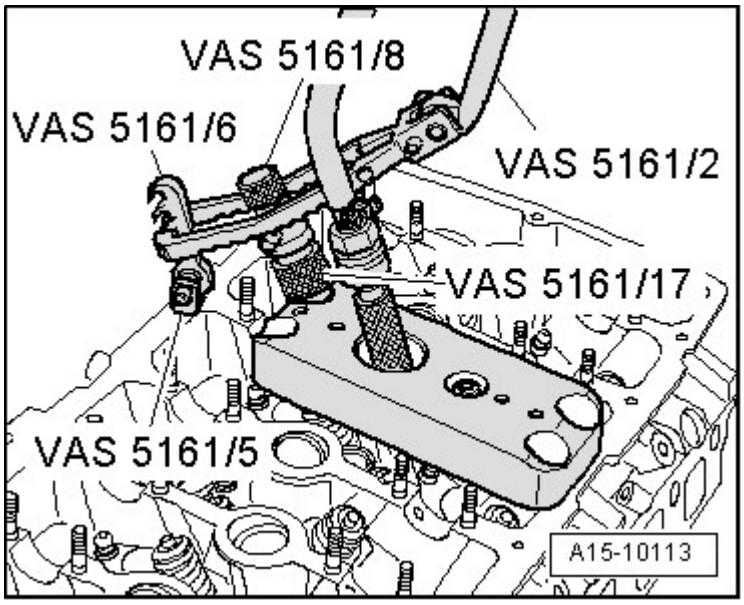

Fig. 164: Procedure For Inner Rows Of Valves
Courtesy of AUDI OF AMERICA, LLC

-- Insert installation cartridge with knurled spacer wheel into guide plate.

-- Press the pressure fork down and pull the knurled bolt upward while turning it left and right to insert the valve keepers.

-- Release pressure fork with the knurled bolt still pulled.

-- Install camshafts **CAMSHAFTS**.

- Install sparks plugs.

CAUTION: Risk of damaging valves and piston heads after working on valvetrain.

- **The motor must not be started for about 30 minutes after installing camshafts because the hydraulic equalization elements must seat themselves.**
- **To ensure valves do not strike pistons when starting, carefully rotate engine at least 2 full revolutions.**

VALVE STEM SEALS WITH CYLINDER HEAD REMOVED

Special tools and workshop equipment required

- Valve seal removal tool 3364
- Valve stem seal driver 3365
- Valve retainer disassembly and assembly device VAS 5161 with guide plate VAS 5161/25

- Engine and transmission holder VAS 6095
- Cylinder head tension device VAS 6419

Procedure

-- Remove camshafts. Refer to **CAMSHAFTS**.

-- Mark the location of the roller rocker lever and the hydraulic adjusting elements so they can be installed again.

-- If necessary, remove the roller rocker levers with the hydraulic adjusting elements and place them on a clean surface.

-- Insert the VAS 6419 in the VAS 6095.

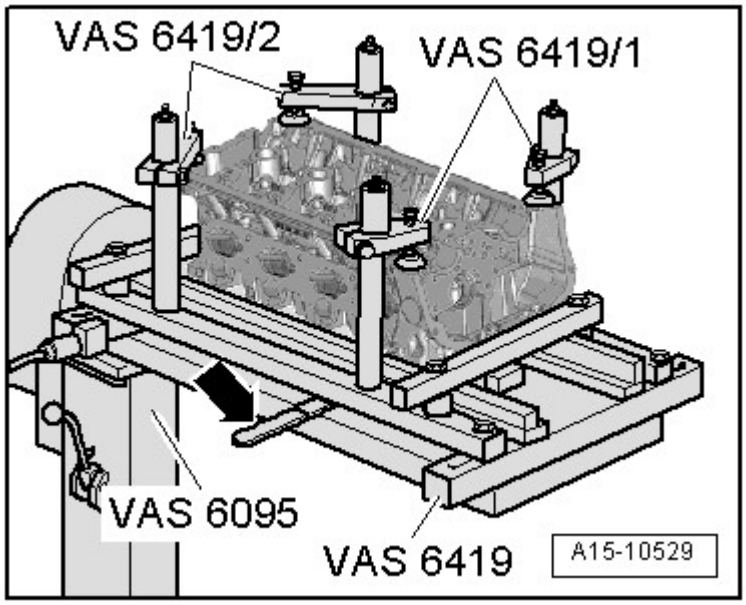

Fig. 165: VAS 6419
Courtesy of AUDI OF AMERICA, LLC

-- Tension the cylinder head on the VAS 6419 as shown in the illustration.

-- Connect the VAS 6419 to compressed air.

-- Slide the air cushion with the lever -arrow- under the combustion chamber onto the valve stem seals that will be removed.

-- Let enough compressed air flow into the air cushion until it contacts the valve plate.

-- Place VAS 5161/3 on valve spring plate and loosen stuck valve keepers using a plastic hammer.

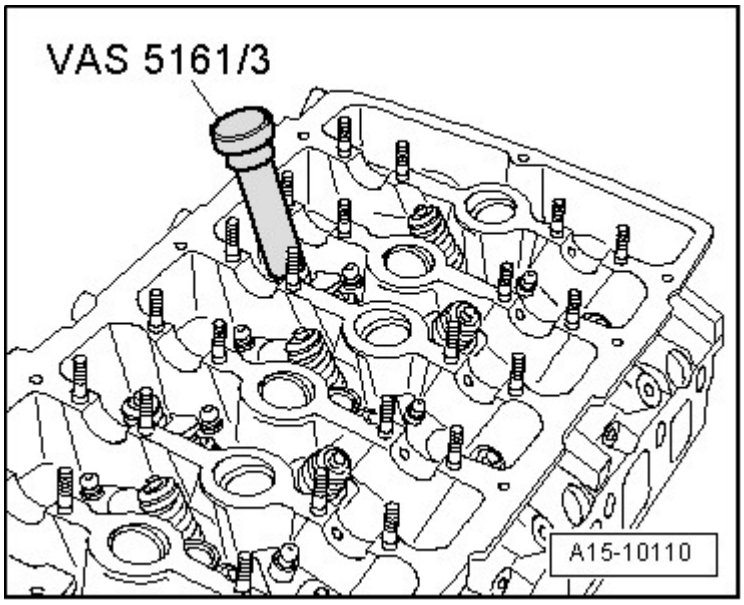

Fig. 166: Placing Drift VAS 5161/3 On Valve Plate
Courtesy of AUDI OF AMERICA, LLC

-- Place VAS 5161/25 from VAS 5161 on cylinder head.

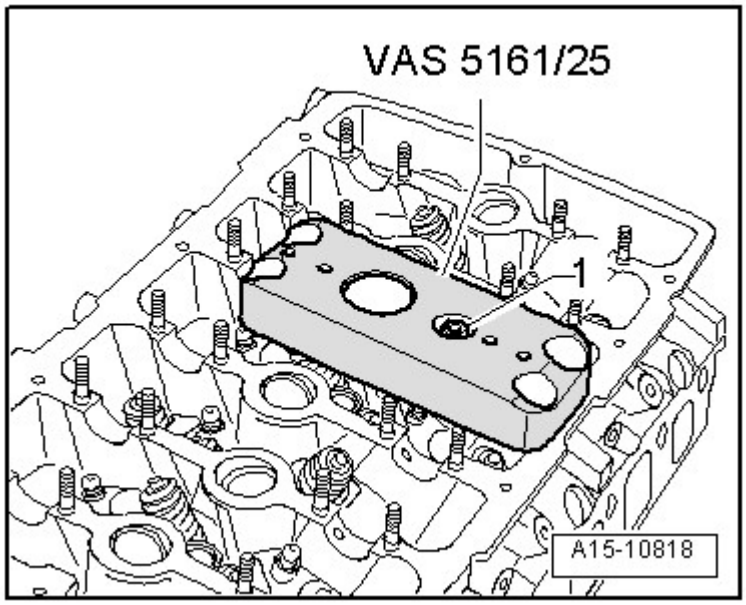

Fig. 167: Place VAS 5161/25 From VAS 5161 On Cylinder Head.
Courtesy of AUDI OF AMERICA, LLC

-- Secure guide plate with a nut -1-.

Rear valve row procedure:

-- Screw VAS 5161/6 with VAS 5161/5 into guide plate.

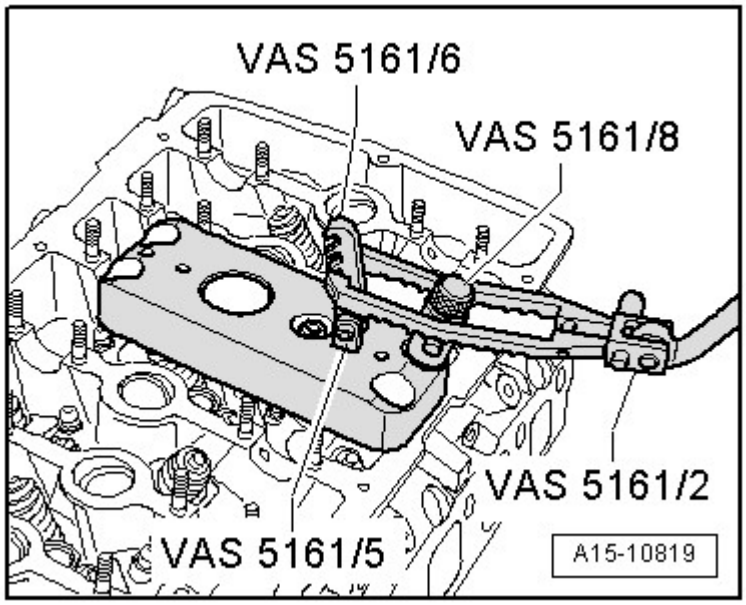

Fig. 168: Screw VAS 5161/6 With VAS 5161/5 Into Guide Plate.
Courtesy of AUDI OF AMERICA, LLC

-- Push VAS 5161/8 into guide plate.

-- Hook in VAS 5161/2 at engaging device and press down installation cartridge.

-- At the same time, turn knurled bolt of installation cartridge to the right, until the points engage in the valve keepers.

-- Lightly move knurled bolt back and forth, causing the valve keepers to be pressed apart and be captured in the installation cartridge.

-- Release pressure fork.

-- Take out installation cartridge.

-- Unfasten guide plate and turn it aside.

-- Remove valve spring with valve spring plate.

Front valve row procedure:

-- Screw VAS 5161/6 with VAS 5161/5 onto cylinder head.

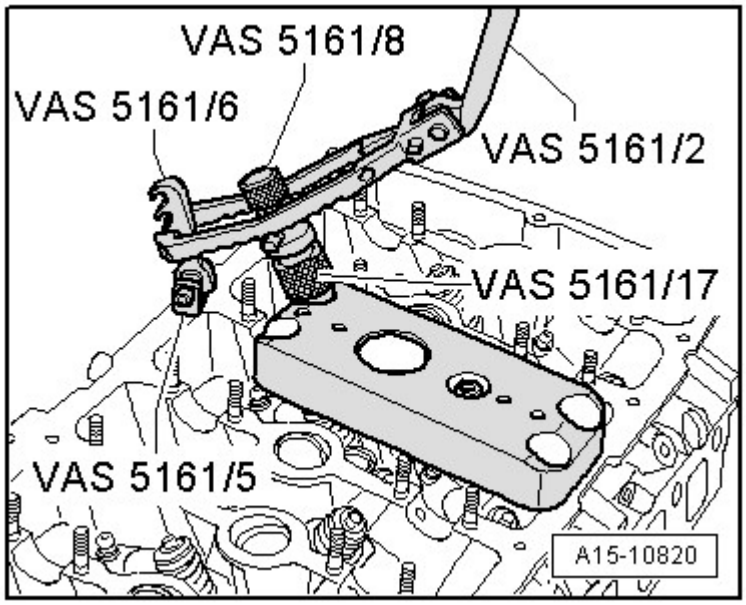

Fig. 169: Screw VAS 5161/6 With VAS 5161/5 Onto Cylinder Head.
Courtesy of AUDI OF AMERICA, LLC

-- Push the VAS 5161/17 onto the VAS 5161/8.

-- Push installation cartridge into guide plate.

-- Hook in VAS 5161/2 at engaging device and press down installation cartridge.

-- At the same time, turn knurled bolt of installation cartridge to the right, until the points engage in the valve keepers.

-- Lightly move knurled bolt back and forth, causing the valve keepers to be pressed apart and be captured in the installation cartridge.

-- Release pressure fork.

-- Take out installation cartridge.

-- Unfasten guide plate and turn it aside.

-- Remove valve spring with valve spring plate.

Procedure for both valve rows:

-- Pull off valve stem oil seals using 3364.

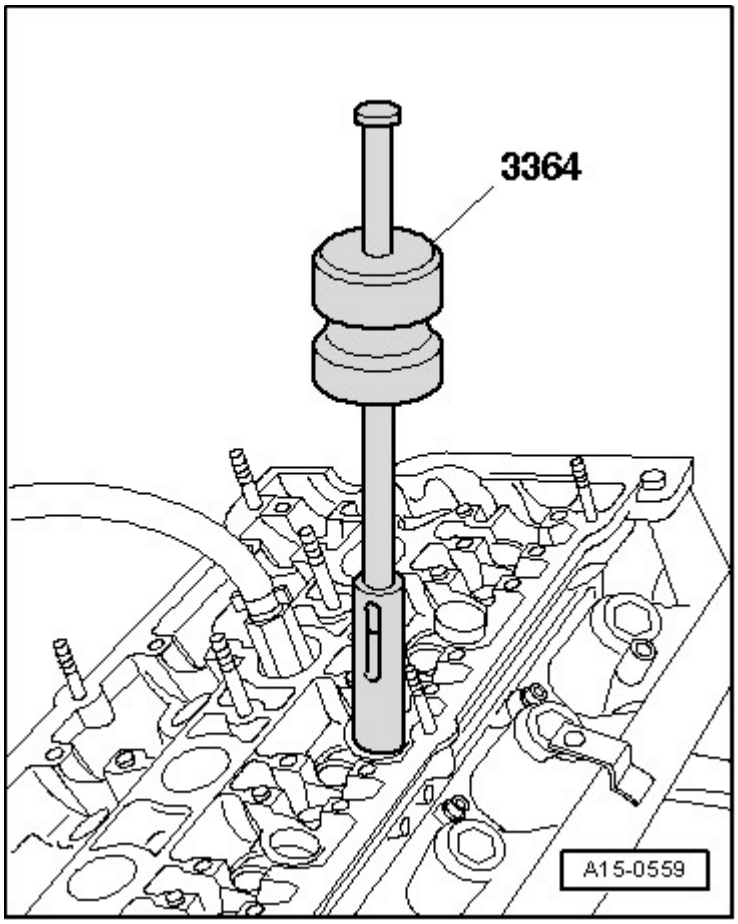

Fig. 170: Identifying Valve Seal Removal Tool 3364
Courtesy of AUDI OF AMERICA, LLC

NOTE: For pressing on green-colored valve stem seals from delivery program, the 3365 must be drilled to a dia. of 10.5 mm.

Mark the drilled driver for later reuse.

A plastic sleeve -A- is supplied with new valve shaft seals.

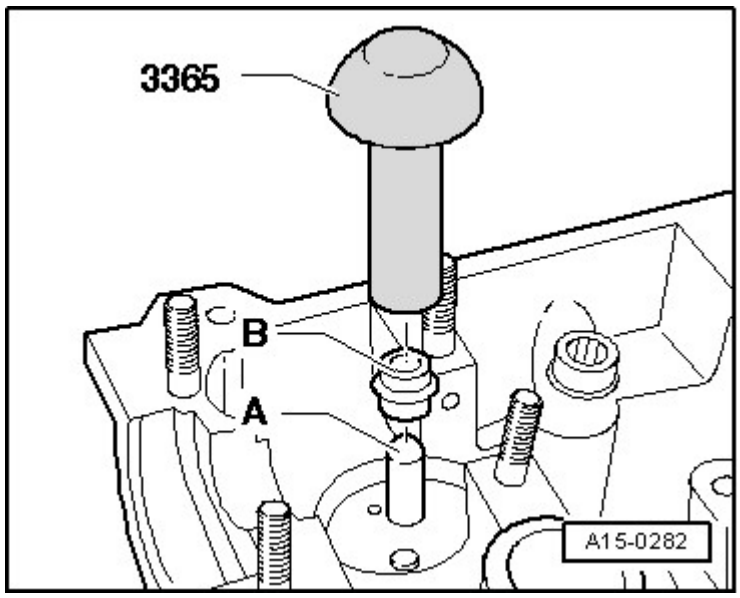

Fig. 171: Identifying Plastic Sleeve, New Valve Stem Oil Seals & Valve Stem Seal Driver 3365
Courtesy of AUDI OF AMERICA, LLC

-- Place plastic sleeve -A- on valve stem to prevent damage to new valve stem seals -B-.

-- Lightly coat sealing lips of valve stem seal with oil.

-- Push valve stem seal onto plastic sleeve.

-- Carefully press valve stem oil seal onto valve guide using 3365.

-- Remove plastic sleeve again.

If the valve keepers were removed from the installation cartridge, they must be inserted into VAS 5161/18 next.

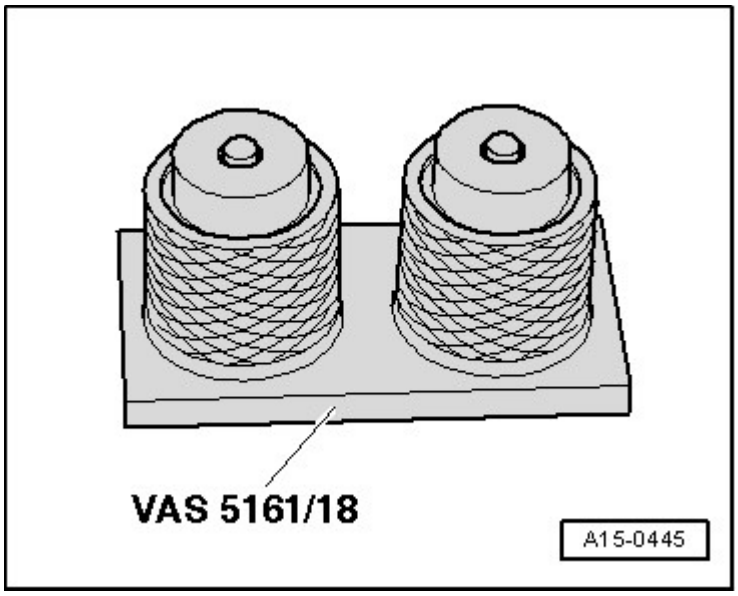

Fig. 172: Identifying Installation Cartridge VAS 5161/8
Courtesy of AUDI OF AMERICA, LLC

- The large diameter of the valve keepers point upward.

-- Install valve spring and valve spring plate.

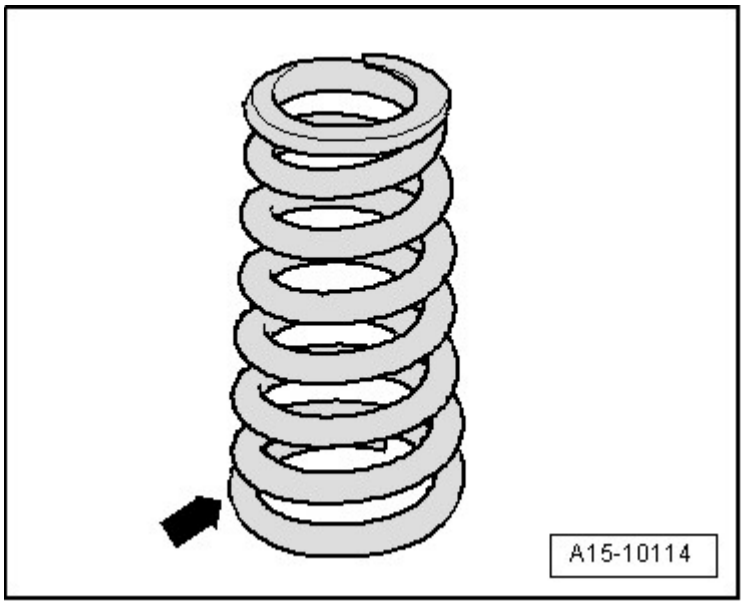

Fig. 173: Valve Spring And Valve Plate
Courtesy of AUDI OF AMERICA, LLC

Installed position of valve spring:

- The larger dia. -arrow- faces toward cylinder head.

Rear valve row procedure:

-- Fasten the guide plate to cylinder head again as shown in illustration.

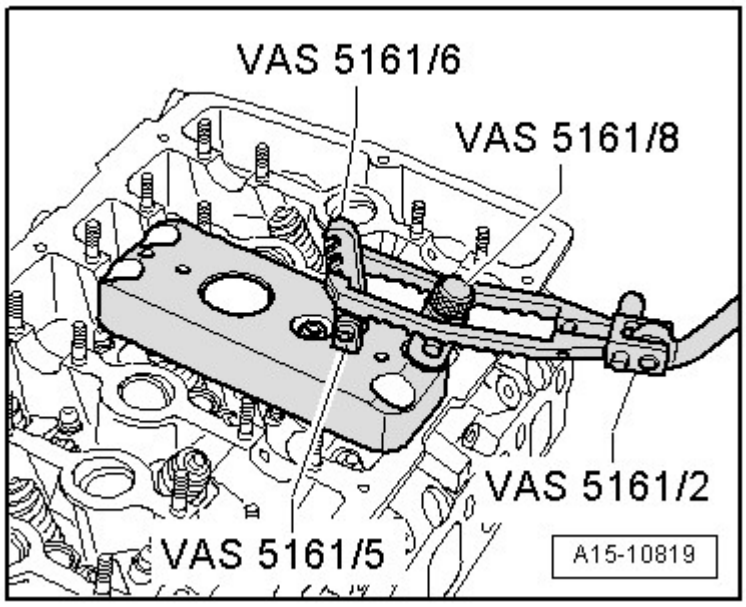

Fig. 174: Screw VAS 5161/6 With VAS 5161/5 Into Guide Plate.
Courtesy of AUDI OF AMERICA, LLC

-- Insert installation cartridge into guide plate.

-- Press the pressure fork down and pull the knurled bolt upward while turning it left and right to insert the valve keepers.

-- Release pressure fork with the knurled bolt still pulled.

Front valve row procedure:

-- Insert installation cartridge with knurled spacer wheel into guide plate.

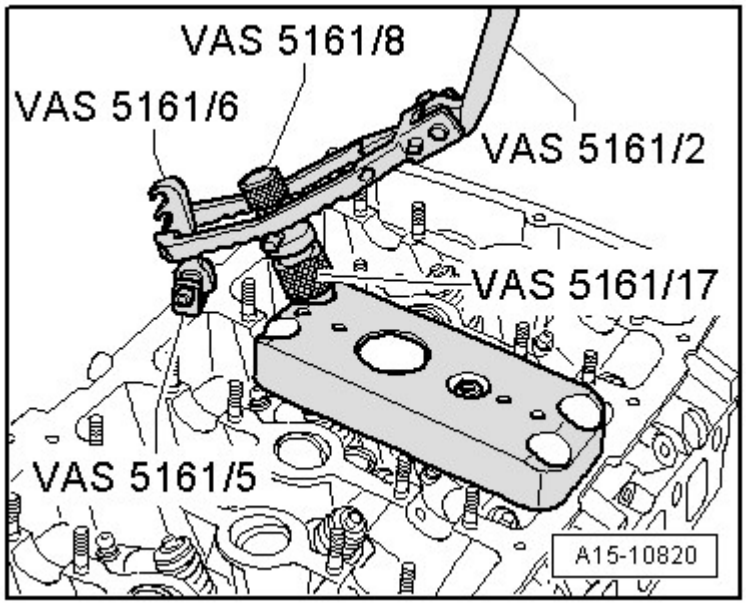

Fig. 175: Insert Installation Cartridge With Knurled Spacer Wheel Into Guide Plate.
Courtesy of AUDI OF AMERICA, LLC

-- Press the pressure fork down and pull the knurled bolt upward while turning it left and right to insert the valve keepers.

-- Release pressure fork with the knurled bolt still pulled.

-- Install camshafts **CAMSHAFTS**.

- Install sparks plugs.

NOTE: **After installing the camshafts, the engine may not be started for approximately 30 minutes. The hydraulic adjusting elements must seat themselves (otherwise the valves will seat themselves on the pistons).**

After working on the valvetrain and lifters, carefully rotate the crankshaft by hand at least 2 full revolutions before starting to be sure that valves do not strike the pistons.

SPECIAL TOOLS

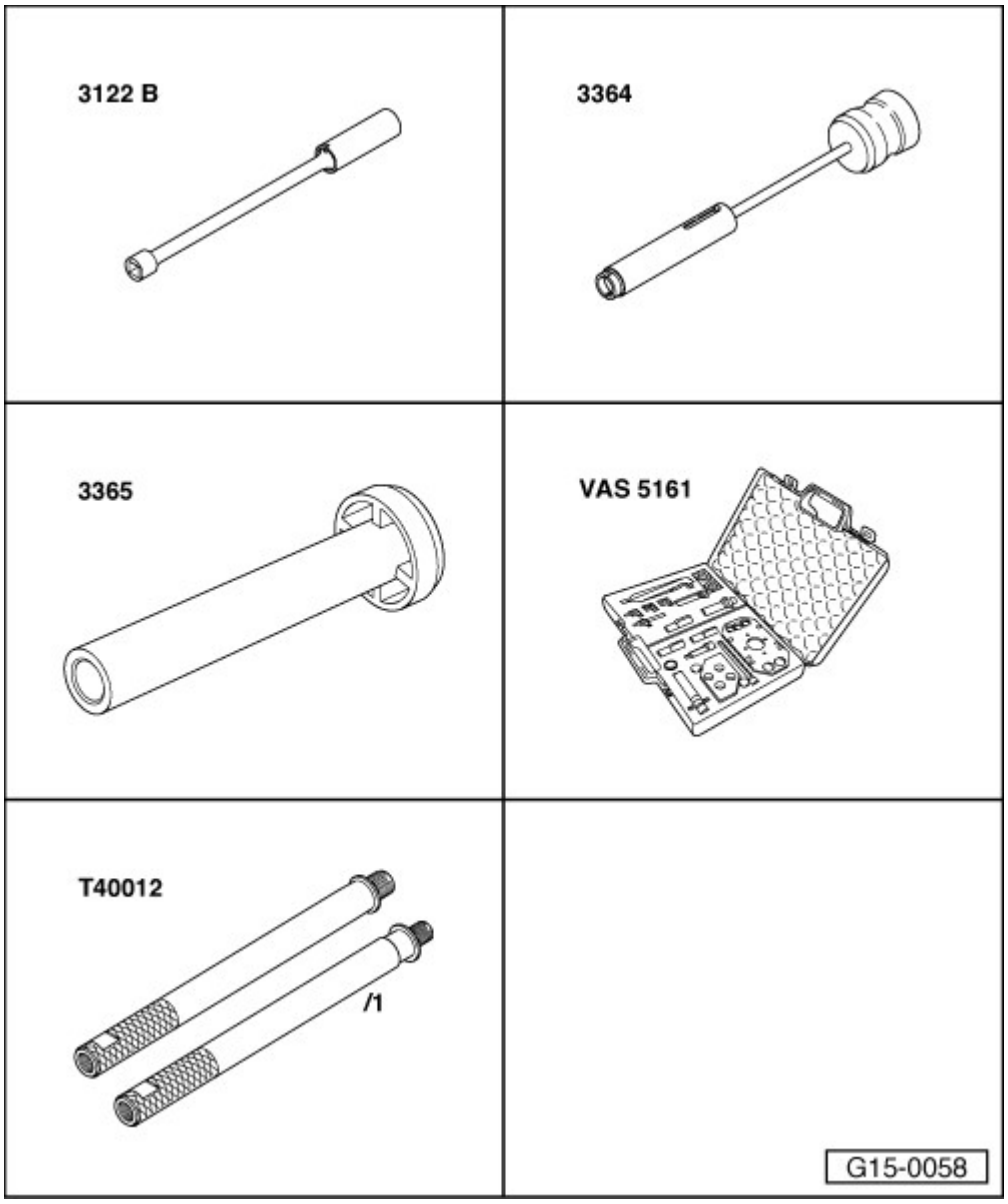

Fig. 176: Identifying Special Tools -- Valve Stem Seals, Cylinder Head Installed, Replacing
Courtesy of AUDI OF AMERICA, LLC

Special tools and workshop equipment required

- Spark Plug Removal Tool 3122 B
- Valve Seal Removal Tool 3364
- Valve Stem Seal Driver 3365
- Valve Cotters Asm/Dis-Asm Device VAS 5161 with Guide Plate F/Vr6 And W12 Engine VAS 5161/25
- Adapter T40012

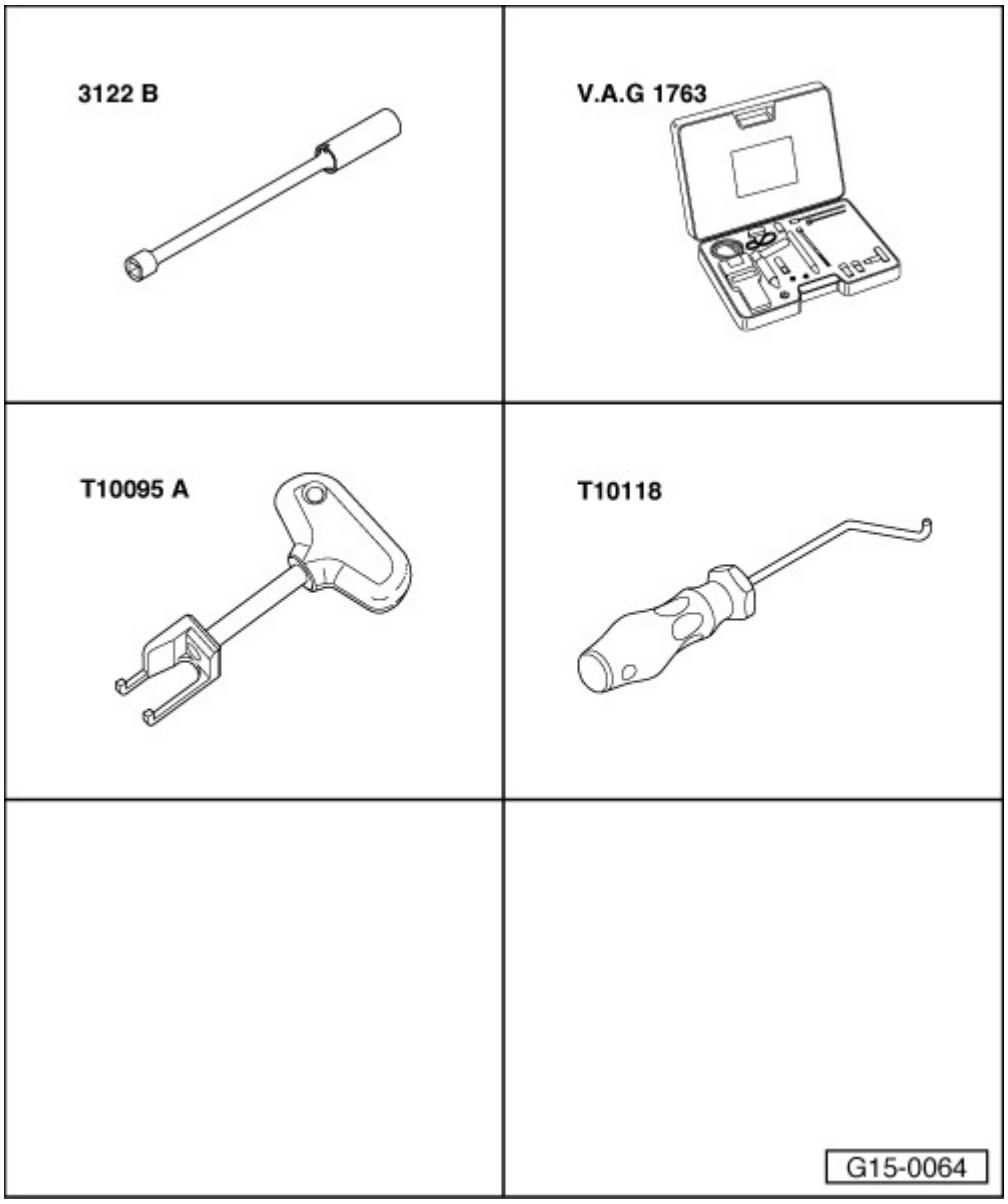

Fig. 177: Compression, Checking - Special Tools, Testers And Auxiliary Items Required
Courtesy of AUDI OF AMERICA, LLC

Special tools and workshop equipment required

- Spark Plug Removal Tool 3122 B
- Compression Tester V.A.G 1763
- Puller For Ignition Coil T10095 A
- Assembly Tool T10118

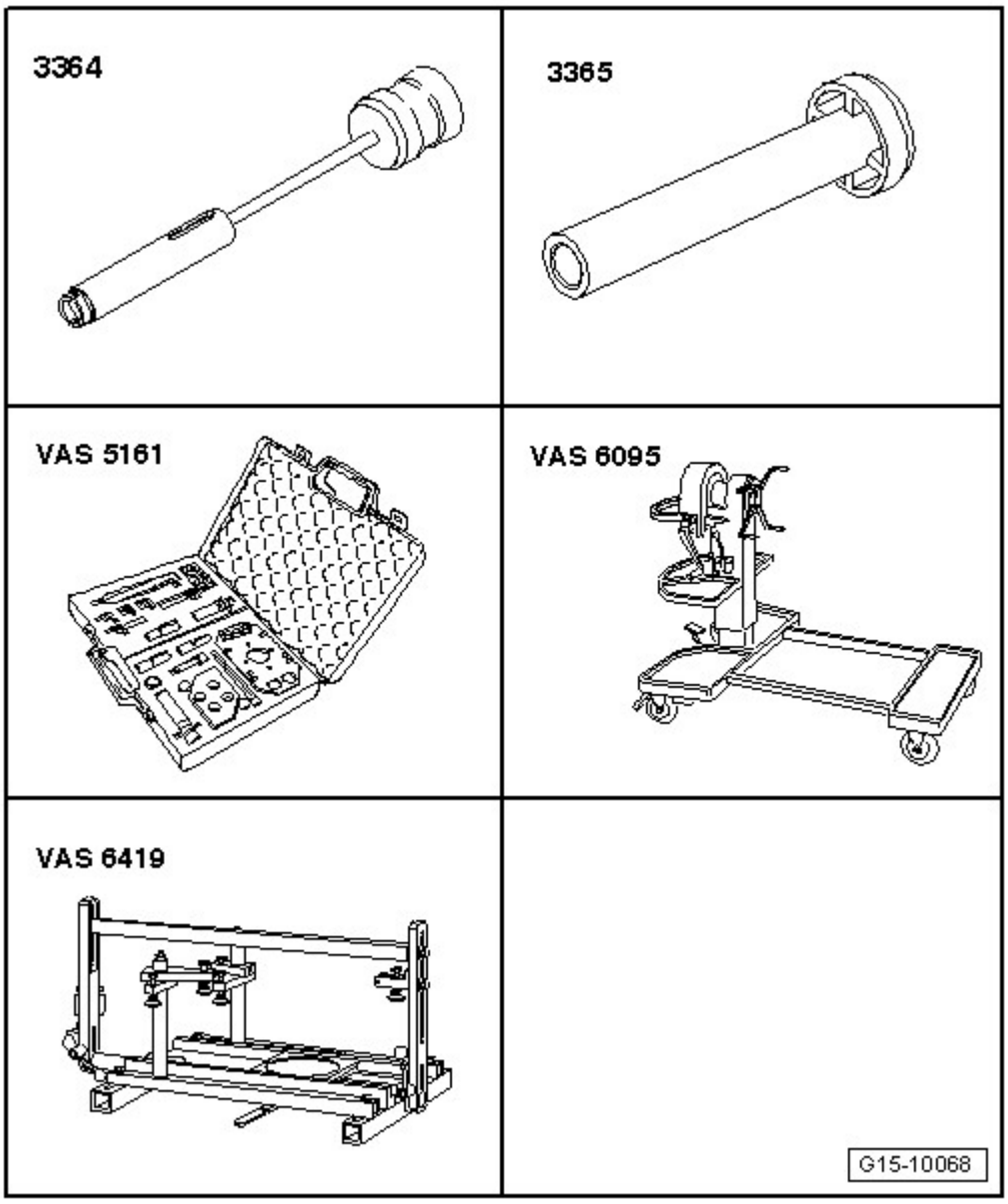

Fig. 178: Special Tools And Workshop Equipment (7 Of 8)
Courtesy of AUDI OF AMERICA, LLC

Special tools and workshop equipment required

- Valve seal removal tool 3364
- Valve stem seal driver 3365
- Valve retainer disassembly and assembly device VAS 5161 with guide plate VAS 5161/25
- Engine and transmission holder VAS 6095
- Cylinder head tension device VAS 6419

Special tools and workshop equipment required

- Dial Gauge Holder VW 387

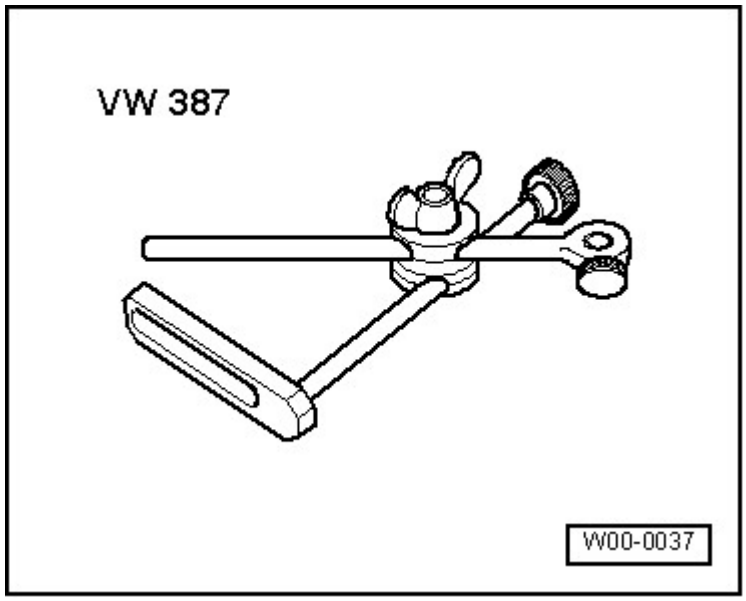

Fig. 179: Dial Gauge Holder VW 387
Courtesy of AUDI OF AMERICA, LLC

- Locking Pin T10060 A

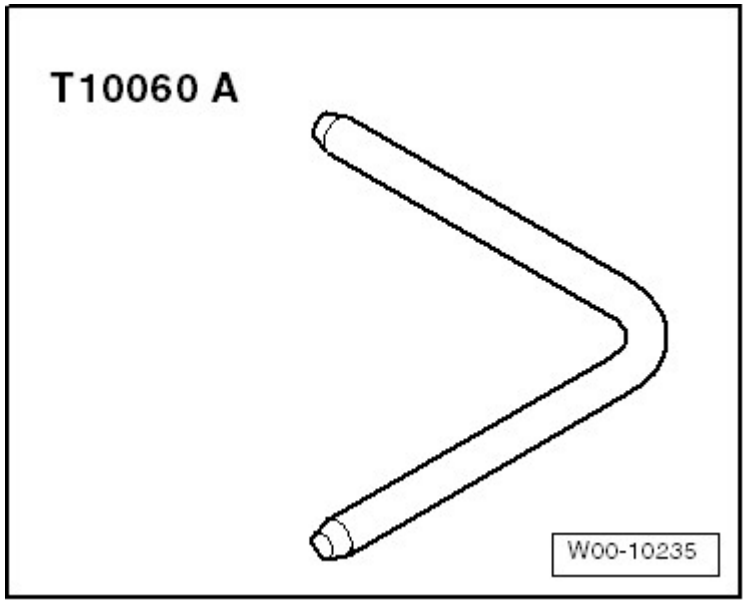

Fig. 180: Identifying Locking Pin T10060 A
Courtesy of AUDI OF AMERICA, LLC

- Lifting Tackle 3033

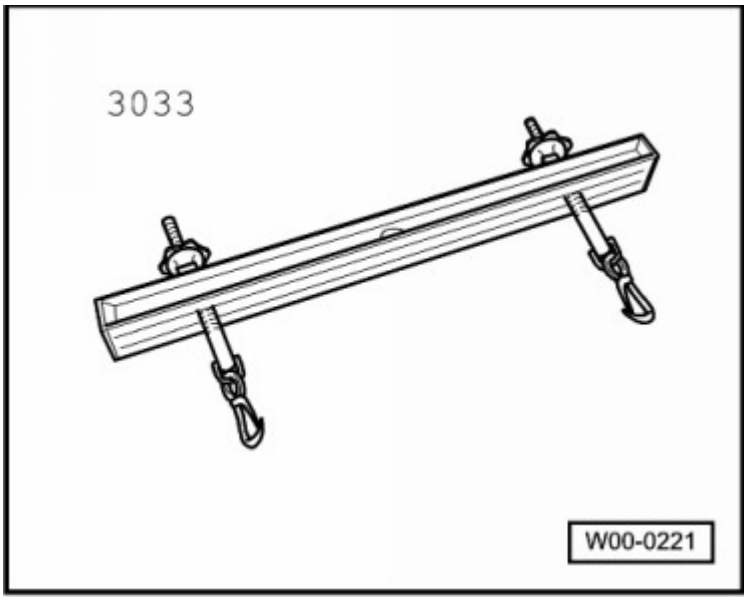

Fig. 181: Identifying Lifting Tackle 3033
Courtesy of AUDI OF AMERICA, LLC

- Shop Crane VAS 6100

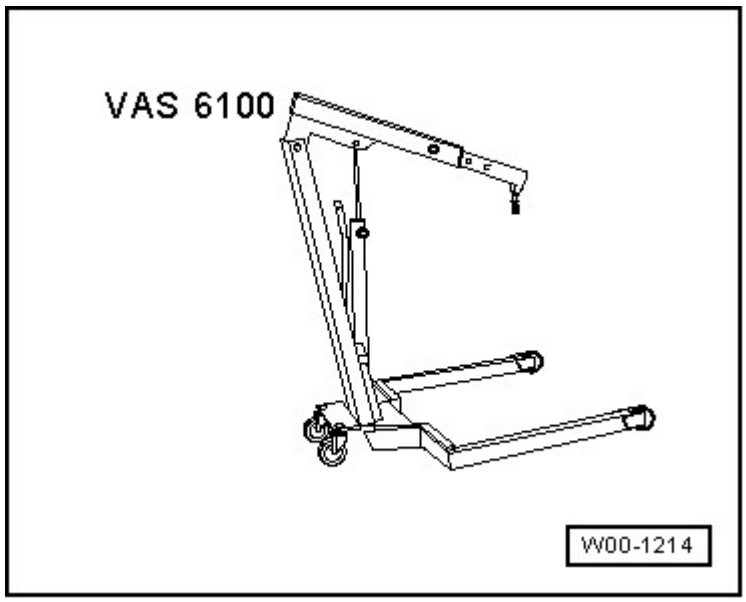

Fig. 182: Identifying Shop Crane VAS 6100
Courtesy of AUDI OF AMERICA, LLC

- Camshaft Bar T10068 A

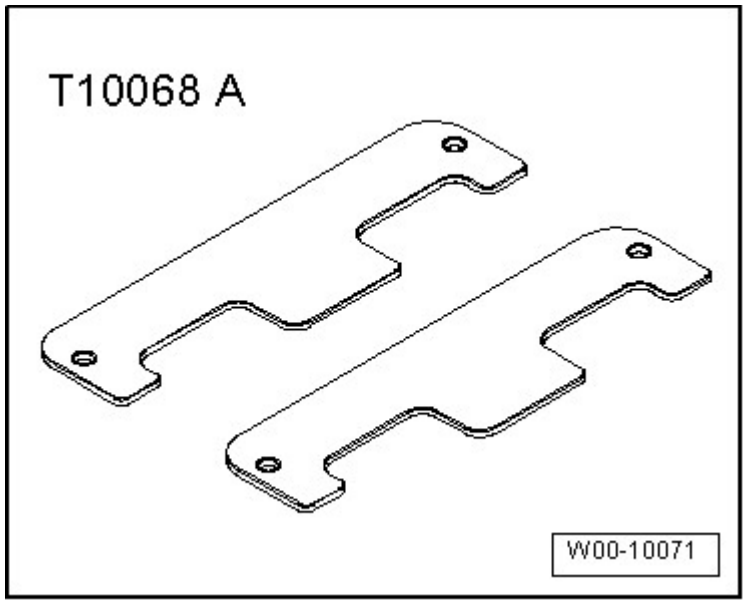

Fig. 183: Identifying Camshaft Bar T10068 A
Courtesy of AUDI OF AMERICA, LLC

- Wheel Bearing Assembly Set 3253

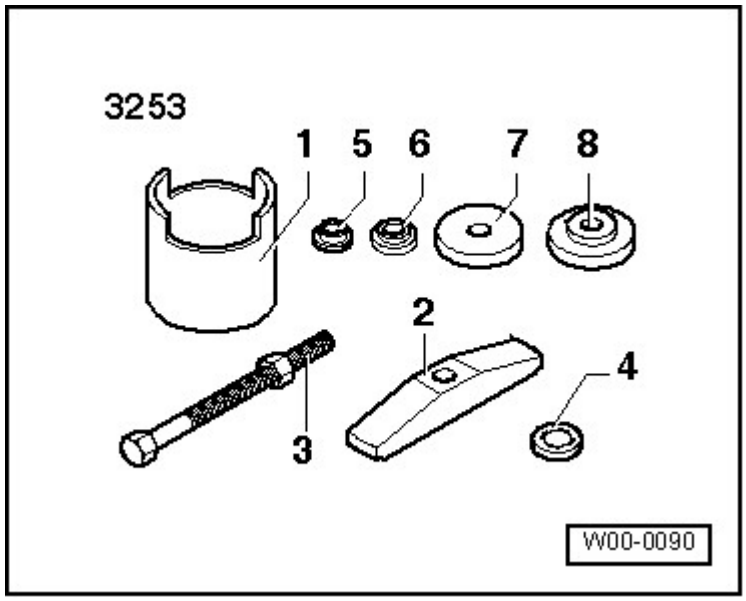

Fig. 184: Assembly Tool 3253
Courtesy of AUDI OF AMERICA, LLC

- Fitting Sleeve 3378

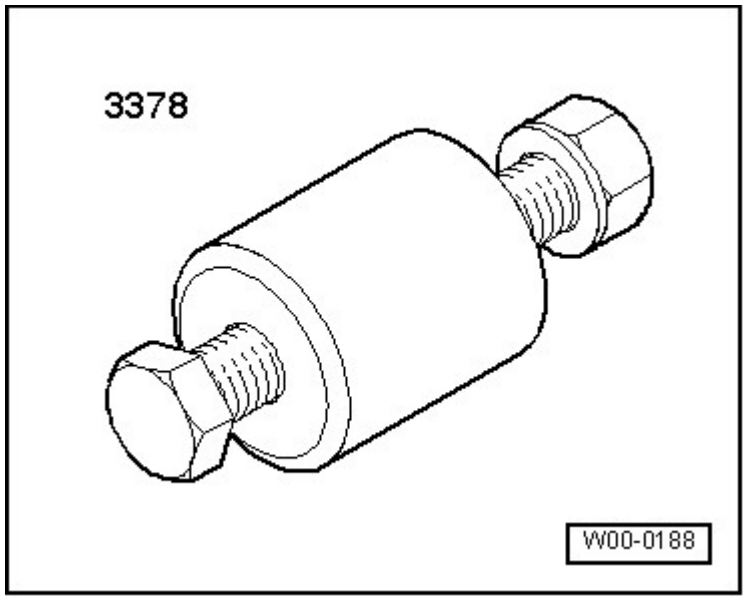

Fig. 185: Fitting Sleeve 3378
Courtesy of AUDI OF AMERICA, LLC

- Counter-Holder Tool T10069

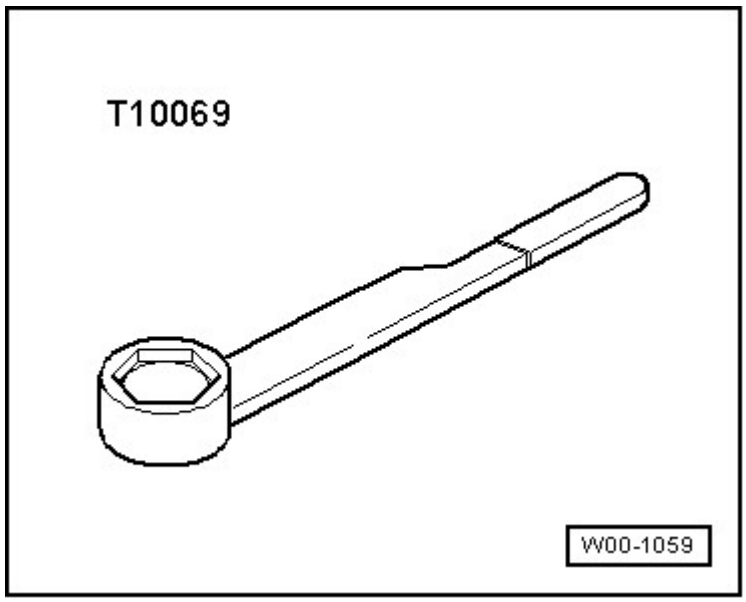

Fig. 186: Counter-Holder Tool T10069
Courtesy of AUDI OF AMERICA, LLC

ENGINE

3.2 Liter - Engine Assembly - Engine Code(s): BUB & CBRA

10 ENGINE ASSEMBLY

GENERAL INFORMATION

ENGINE, SECURING TO ENGINE AND TRANSMISSION HOLDER

Special tools and workshop equipment required

- Lifting Tackle 3033
- Engine Support 3269
- Engine and Transmission Holder VAS 6095
- Shop Crane VAS 6100

Procedure

-- Hook 3033 onto engine and onto VAS 6100 as shown in the illustration.

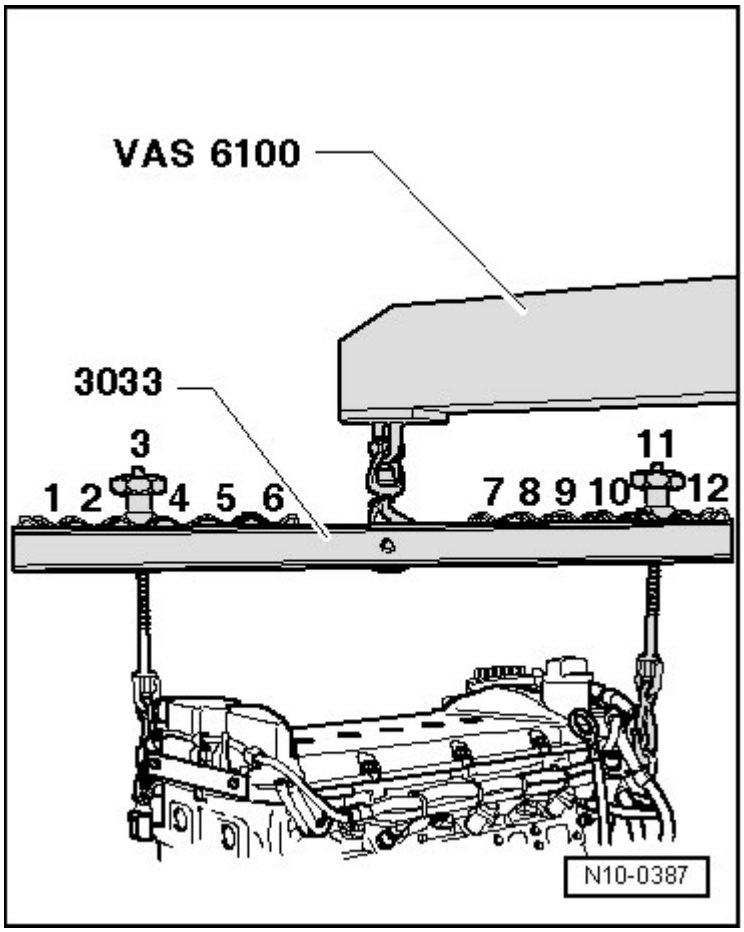

Fig. 1: Hooking Engine Sling 3033 Onto Engine And Onto Workshop Crane VAS 6100
Courtesy of AUDI OF AMERICA, LLC

-- Lift engine off from VAS 6100 using workshop crane.

Engine, engaging on transmission side

-- Secure transmission side of VAS 6095 on cylinder block as shown in illustration.

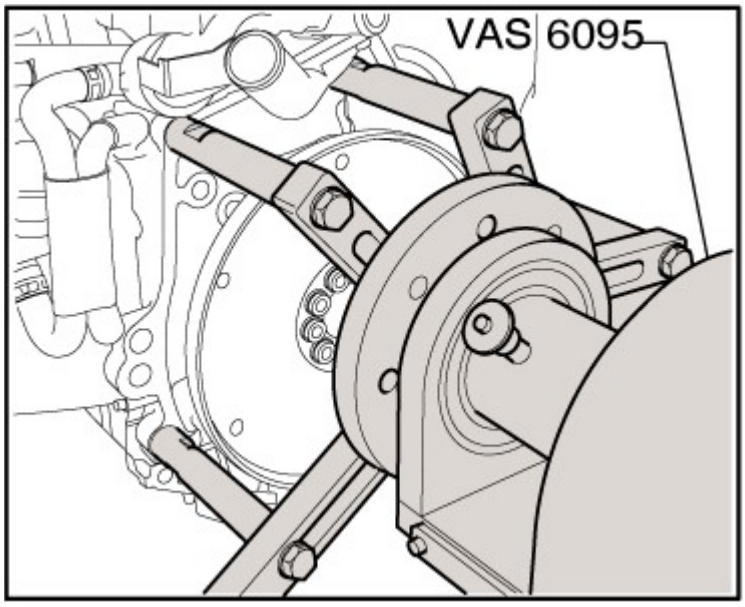

Fig. 2: Identifying Engine And Transmission Holder VAS 6095
Courtesy of AUDI OF AMERICA, LLC

Engine, engaging at sides

-- Secure sides of 3269 to cylinder block as shown in illustration.

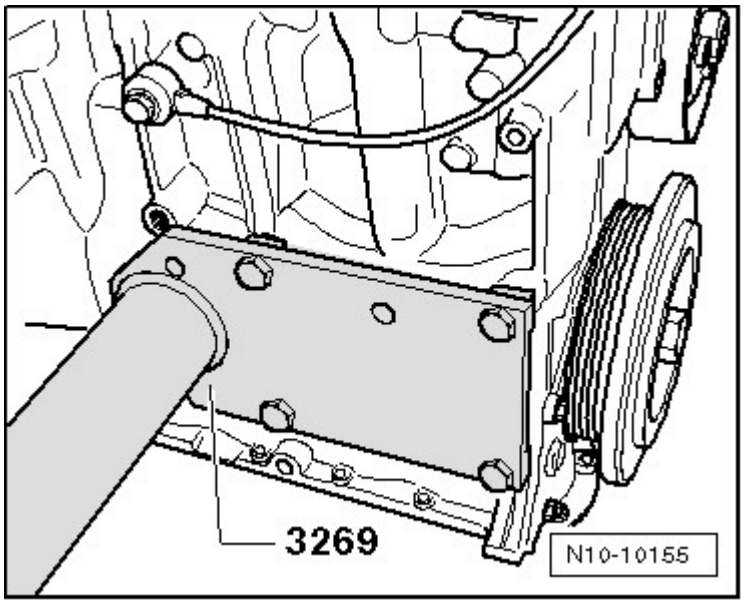

Fig. 3: Identifying Engine Support 3269 Tightly Bolted To Cylinder Block
Courtesy of AUDI OF AMERICA, LLC

-- Secure engine to VAS 6095 with 3269.

DESCRIPTION AND OPERATION

SUBFRAME MOUNTING ASSEMBLY OVERVIEW

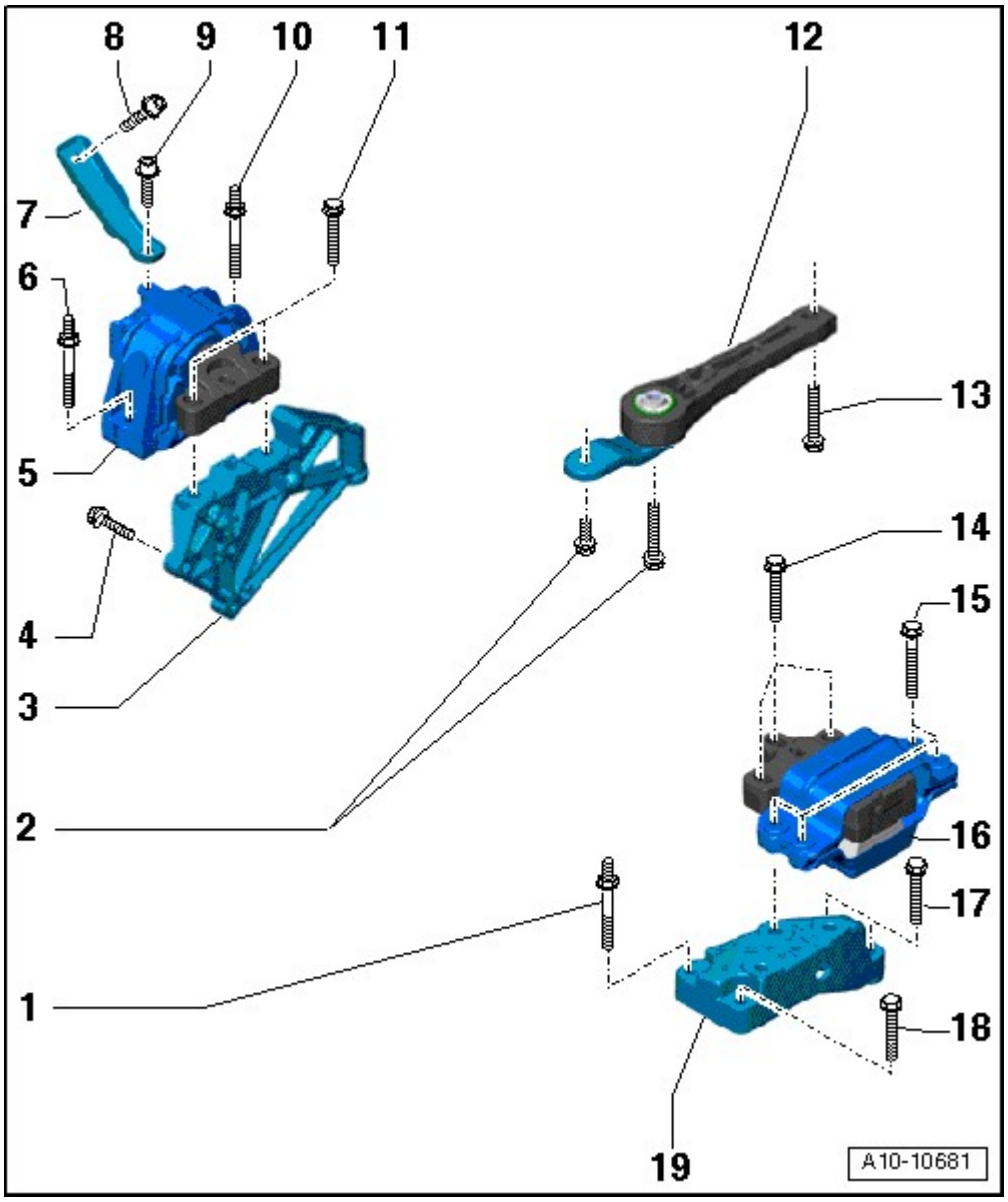

Fig. 4: Subframe Assembly Overview
Courtesy of AUDI OF AMERICA, LLC

1. Bolt
   - Transmission support to transmission
   - Tightening specifications, refer to -item 15- in **SUBFRAME MOUNT OVERVIEW**
2. 40 Nm plus an additional 90° ($^{1}/_{4}$) turn.
   - Pendulum supports to transmission
   - Replace
3. Engine Support
4. 45 Nm
   - Engine support to engine

5. Engine Mount
6. 40 Nm plus an additional 90° ($^1/_4$) turn.
   - Engine mount to body
   - Replace
7. Bracket
8. 20 Nm plus an additional 90° ($^1/_4$) turn.
   - Bracket to engine mount
   - Replace
9. 20 Nm plus an additional 90° ($^1/_4$) turn.
   - Bracket to body
   - Replace
10. 40 Nm plus an additional 90° ($^1/_4$) turn.
    - Engine mount to body
    - Replace
11. 60 Nm plus an additional 90° ($^1/_4$) turn.
    - Engine mount to engine support
    - Replace
12. Pendulum Supports
13. Bolt
    - Pendulum supports to subframe
    - Replace
14. Bolt
    - Transmission mount to transmission support
    - Tightening specifications, refer to -item 14- in **SUBFRAME MOUNT OVERVIEW**
15. 100 Nm plus an additional 90° ($^1/_4$) turn.
    - Transmission mount to body
    - Tightening specifications, refer to -item 1- in **SUBFRAME MOUNT OVERVIEW**
16. Transmission Mount
    - Illustration shows version for direct shift automatic transmission.
17. Bolt
    - Transmission support to transmission
    - Tightening specifications, refer to -item 17- in **SUBFRAME MOUNT OVERVIEW**
18. Bolt
    - Transmission support to transmission
    - Tightening specifications, refer to -item 18- in **SUBFRAME MOUNT OVERVIEW**

19. Transmission Support

SPECIFICATIONS

FASTENER TIGHTENING SPECIFICATIONS

Component	Bolt Size	Nm
Bracket		20 + 90°
Engine Mount		
		40 + 90°[1, 2]
		60 + 90°[1, 2]
Engine Support to Engine		45
Pendulum Supports		40 + 90°[1]
Transmission Mount		100 + 90°
Bolts/Nuts		
	M6	10
	M7	15
	M8	20
	M10	40
	M12	65
Exceptions:		
Pendulum Supports to Transmission		40 + 90° [1]
Pendulum Supports to Subframe		100 + 90° [1]
Flexible Disc to Flange		60
Front Exhaust Pipe to Exhaust Manifold		40 [1]
Driveshaft Heat Shield to Bevel Box		23
Clamp B+ to Starter		16
Ground (GND) Strap to Transmission		22

- [1] Always replace
- [2] For bolt tightening clarification, refer to **SUBFRAME MOUNTING ASSEMBLY OVERVIEW** and see items -6, 10 and 11-

Securing engine/DSG transmission

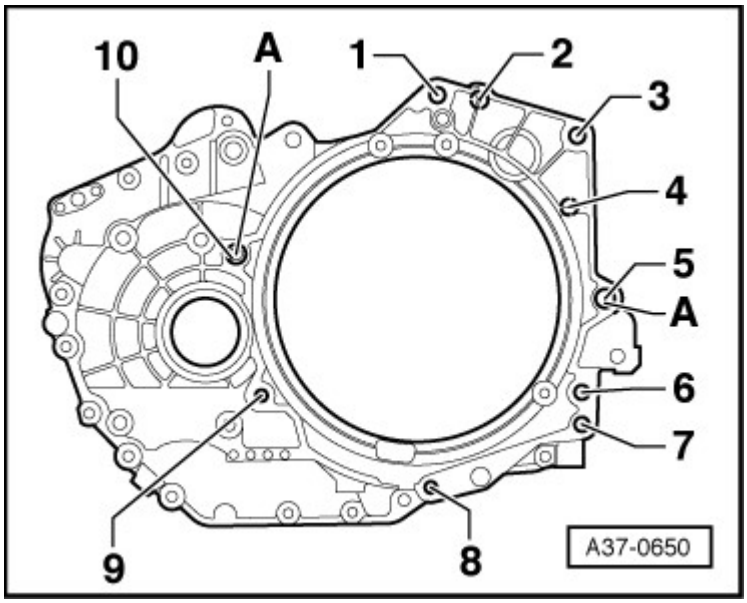

Fig. 5: Identifying Bolts On Engine/Transmission Flange
Courtesy of AUDI OF AMERICA, LLC

Item	Bolt	Nm
1	M12x55	80
2 [1, 2)]	M10x40	40
3 [(1)], 6	M12x55	80
4 [2)] , 9	M10x45	40
5	M12x65	80
7, 8	M10x50	40
10	M12x70	80
A	Alignment sleeves for centering	
(1) Bolt with threaded pin M8.		

2) Screw only serves to secure starter to transmission.

DIAGNOSIS AND TESTING

SUBFRAME MOUNT, CHECKING ADJUSTMENT

-- Check following dimensions at engine/right transmission mounting:

- Both bolts -2- must be parallel to edge of support arm -3-.

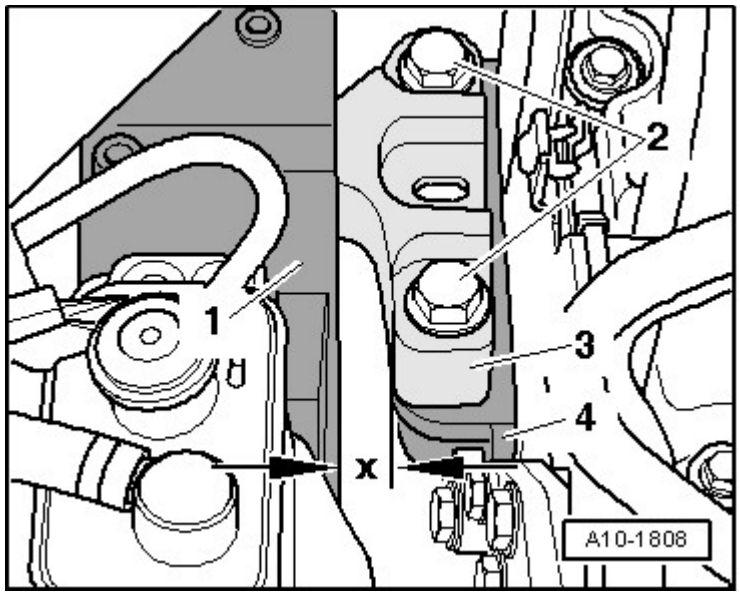

Fig. 6: Checking Dimensions At Engine/Transmission Assembly Mounting
Courtesy of AUDI OF AMERICA, LLC

- A distance of -x- = 16 mm must be present between engine mount -1- and engine support -4-.

NOTE: Distance -x- = 16 mm can also be checked with a suitable cylindrical rod.

If dimension is too small or large, engine mount must be adjusted. Refer to **SUBFRAME MOUNT, ADJUSTING**.

SUBFRAME MOUNT, ADJUSTING

Special tools and workshop equipment required

- Engine Support Bridge 10-222 A

Adjusting

If an insufficient or an excessive distance is measured, proceed as follows:

-- If equipped, remove vacuum hose -2- to air guide hose.

-- Disconnect air guide hose -1- at throttle valve control module -J338-.

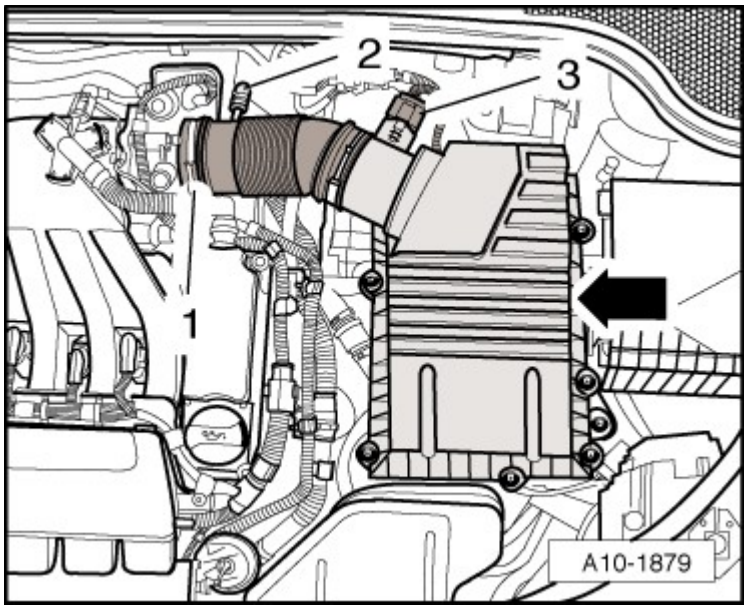

Fig. 7: Identifying Mass Air Flow (MAF) Sensor G70 Electrical Harness Connector
Courtesy of AUDI OF AMERICA, LLC

-- Disconnect mass air flow (MAF) sensor -G70- electrical connector -3-.

-- Unbolt upper section of air filter housing -arrows-.

-- Remove filter element.

-- Pull off air guide cover -1-, disengage clips sideways to do so.

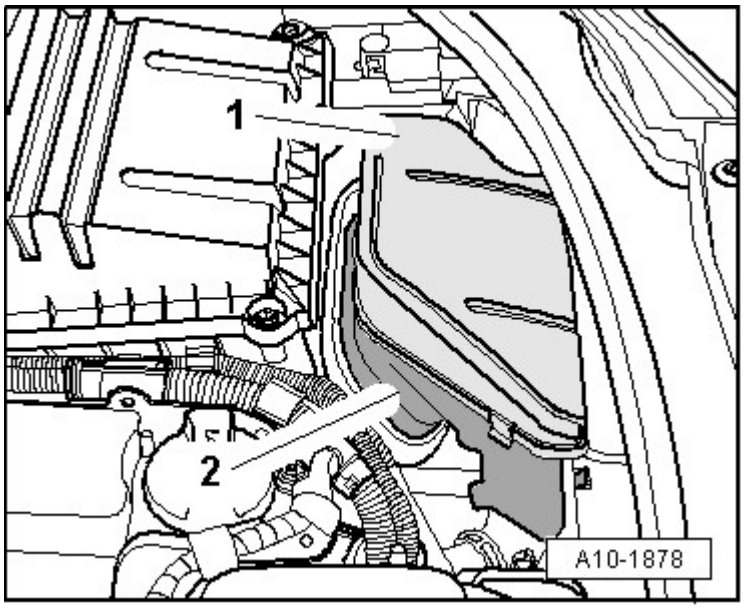

Fig. 8: Air Duct Cover & Air Duct
Courtesy of AUDI OF AMERICA, LLC

-- Unclip air duct -2-.

-- Remove lower section of air filter housing -arrows-.

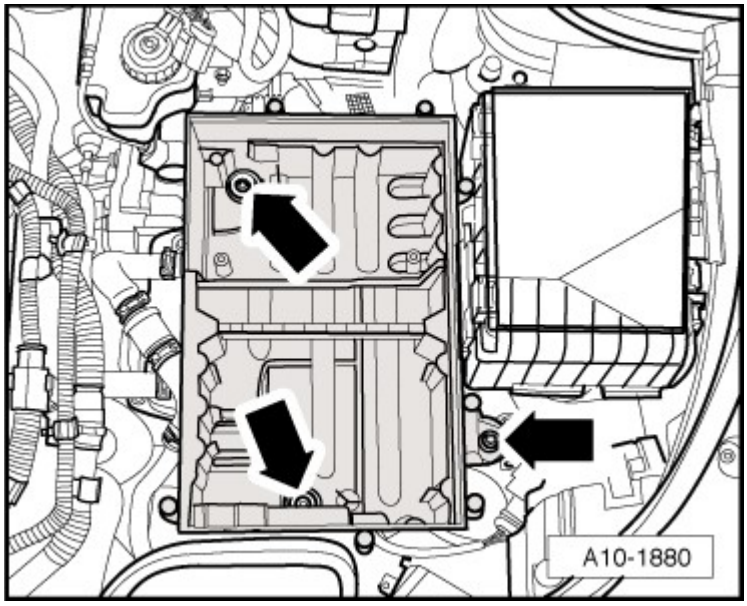

Fig. 9: Identifying Screws For Lower Portion Of Air Cleaner Housing
Courtesy of AUDI OF AMERICA, LLC

-- Remove air filter housing bracket -arrows-.

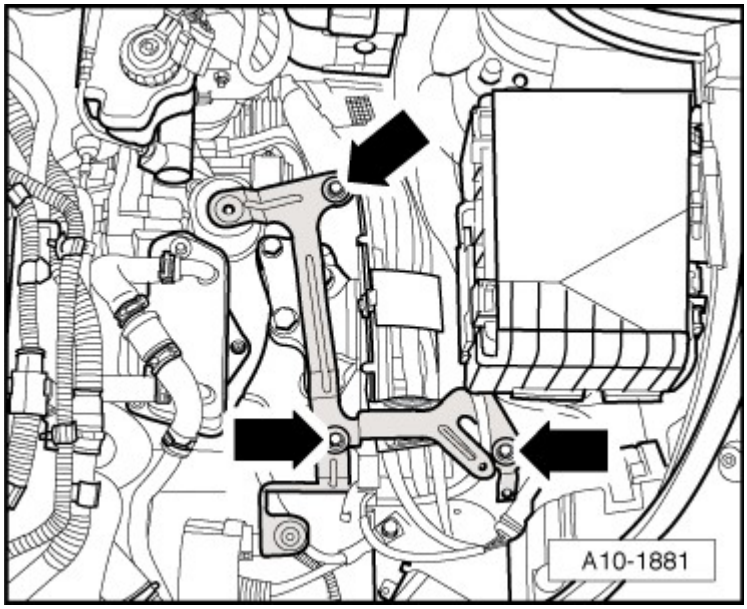

Fig. 10: Air Filter Housing Bracket
Courtesy of AUDI OF AMERICA, LLC

-- Secure shackle 10-222 A/12 at right rear engine lifting eye.

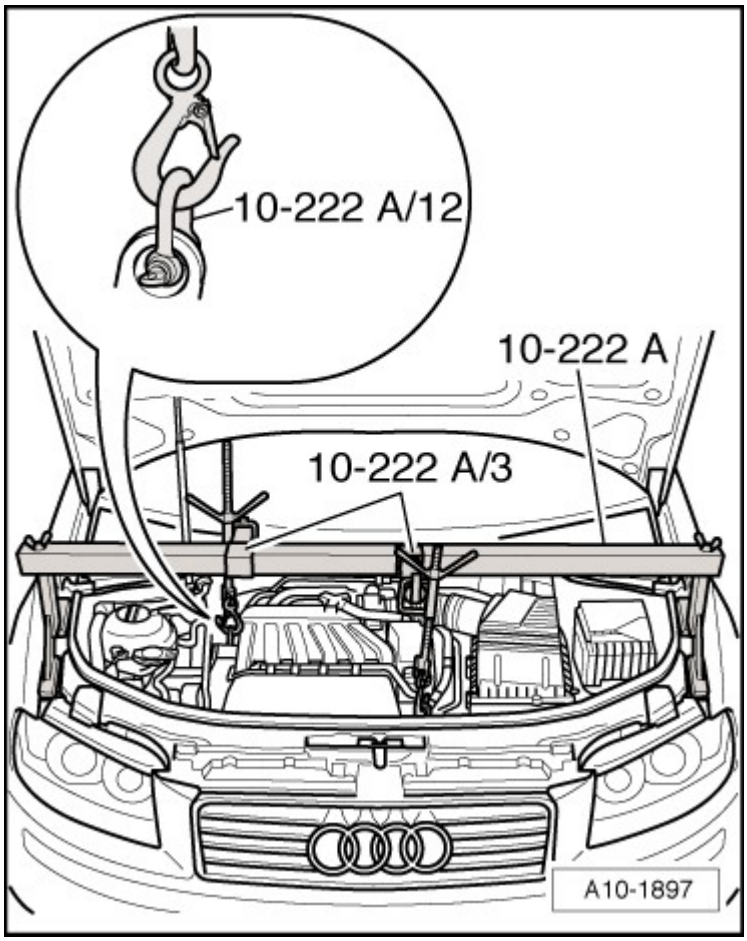

Fig. 11: Securing Shackle 10-222 A/12 At Right Rear Engine Lifting Eye
Courtesy of AUDI OF AMERICA, LLC

-- Position 10-222 A with adapters 10-222 A/3 on fender attachment edge.

-- Engage spindles at lifting eye or shackle.

-- Raise engine slightly with spindles even.

-- Remove subframe mounting bolts at engine -arrows-.

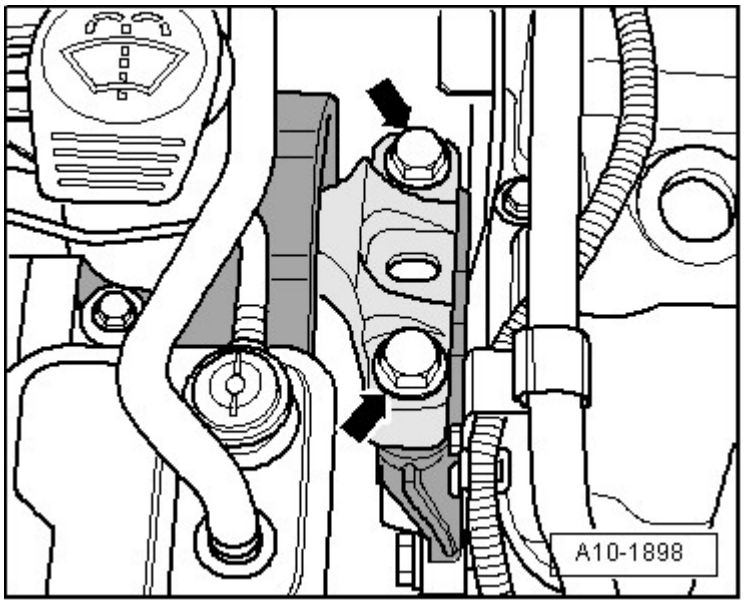

Fig. 12: Identifying Engine Mount To Engine Mount Bracket Bolts
Courtesy of AUDI OF AMERICA, LLC

-- Remove subframe mounting bolts at transmission -arrows-.

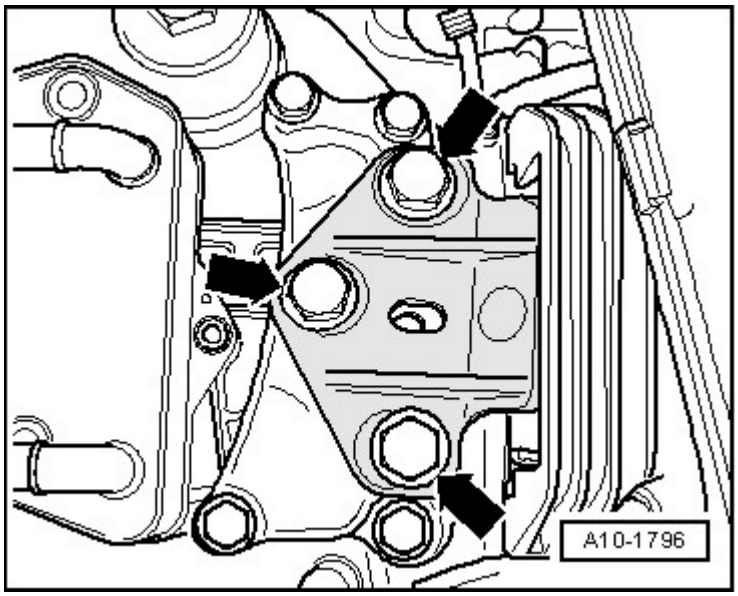

Fig. 13: Identifying Engine Mount To Engine Mount Bracket Bolts
Courtesy of AUDI OF AMERICA, LLC

-- Replace all 5 bolts in succession (if not already done when installing engine) and hand tighten.

-- Loosen left and right support arm bolts approximately 2 turns.

-- Using a pry bar between the engine support -4- and engine mount -1-, move the engine so far until the following dimensions are set:

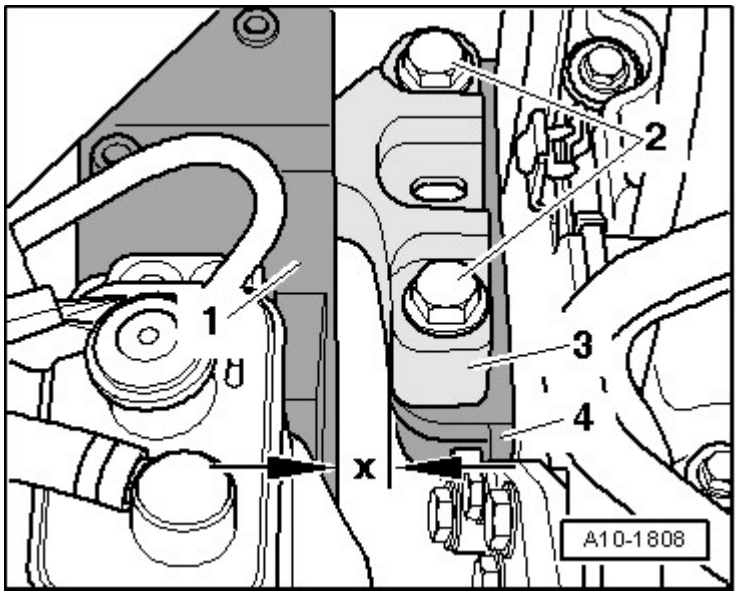

Fig. 14: Checking Dimensions At Engine/Transmission Assembly Mounting
Courtesy of AUDI OF AMERICA, LLC

- Both bolts -2- must be parallel to edge of support arm -3-.
- A distance of -x- = 16 mm must be present between engine mount -1- and engine support -4-.

NOTE: Distance -x- = 16 mm can also be checked with a suitable cylindrical rod.

-- Tighten engine-side assembly mounting bolts.

-- On transmission side, make sure edges of support arm -1- and transmission mount -2- are parallel.

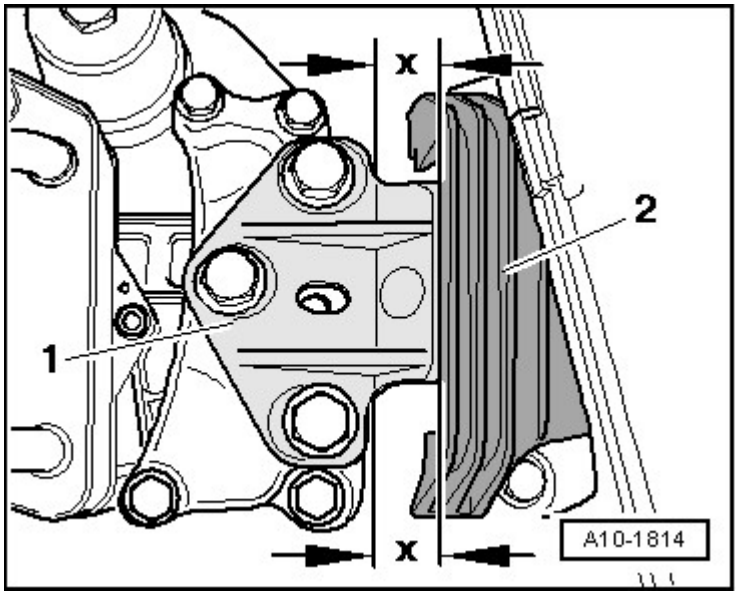

Fig. 15: Ensuring Edges On Support Arm And Transmission Mount Are Parallel
Courtesy of AUDI OF AMERICA, LLC

- Dimension -x- same size on both sides of bracket.

-- Tighten transmission-side assembly mounting bolts.

Further installation is in reverse order.

Tightening Specifications

Component	Nm
Support Arm to Engine Support	60 + 90° (1)(2)
Support Arm to Transmission Support	60 + 90° (1)(2)
(1) Replace bolts. (2) 90° corresponds to one quarter rotation.	

REMOVAL AND INSTALLATION

ENGINE, REMOVING

Pry Lever - Rmv Outside Mirror 80 - 200

Engine/Transmission Jack V.A.G 1383 A

Step Ladder VAS 5085

Drip Tray for VAS 6100 VAS 6208

Mandrel T10060 A

Assembly Tool T10118

Torque Wrench SAT 8010/3

NOTE: The engine is removed downward together with the transmission.

All cable ties which are opened or cut open when removing engine, must be replaced in the same position when installing engine.

Heat insulation sleeves removed during engine removal should be reinstalled in the same location when installing engine.

Drained coolant must be stored in a clean container for disposal or reuse.

CAUTION: Observe safety precautions when disconnecting the battery. Refer to GENERAL INFORMATION .

-- Remove tool formed insert under luggage compartment floor covering.

-- Remove cover -arrow- for battery compartment

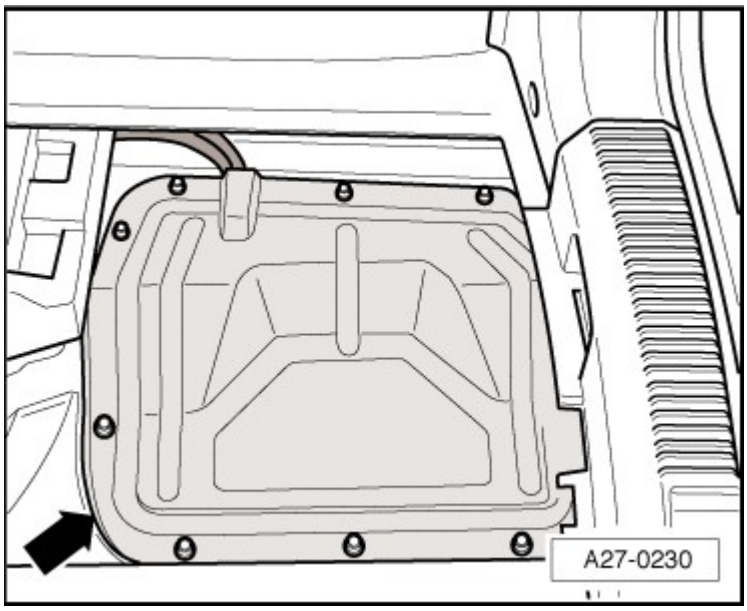

Fig. 16: Battery Compartment Cover
Courtesy of AUDI OF AMERICA, LLC

-- Remove formed insert from over the battery.

-- With ignition switched off, disconnect Battery Ground (GND) cable -arrow-.

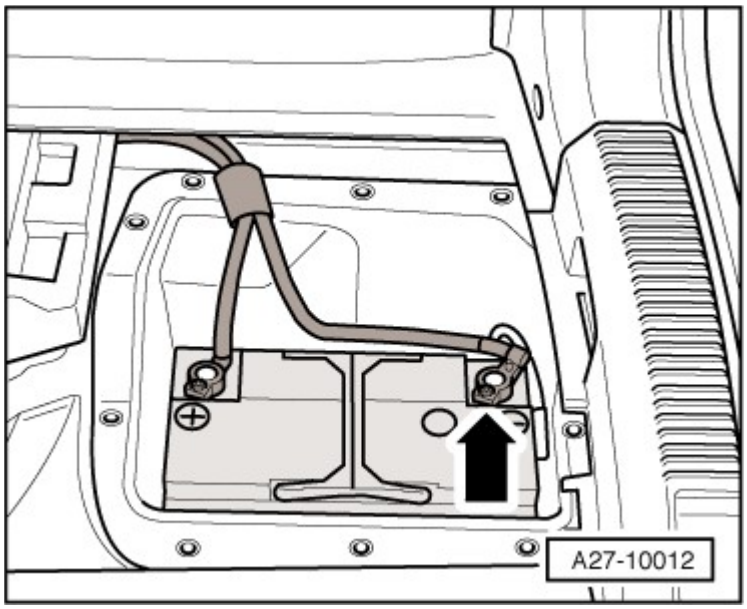

Fig. 17: Battery Ground (GND) Cable
Courtesy of AUDI OF AMERICA, LLC

WARNING: Risk of scalding due to hot steam and hot coolant.

- **When the engine is warm the cooling system is under pressure.**
- **Reduce pressure by covering coolant reservoir cap with a cloth and carefully opening.**

-- Open cap of coolant expansion tank.

-- Remove both front wheels.

-- Remove center noise insulation fasteners -1 to 3-.

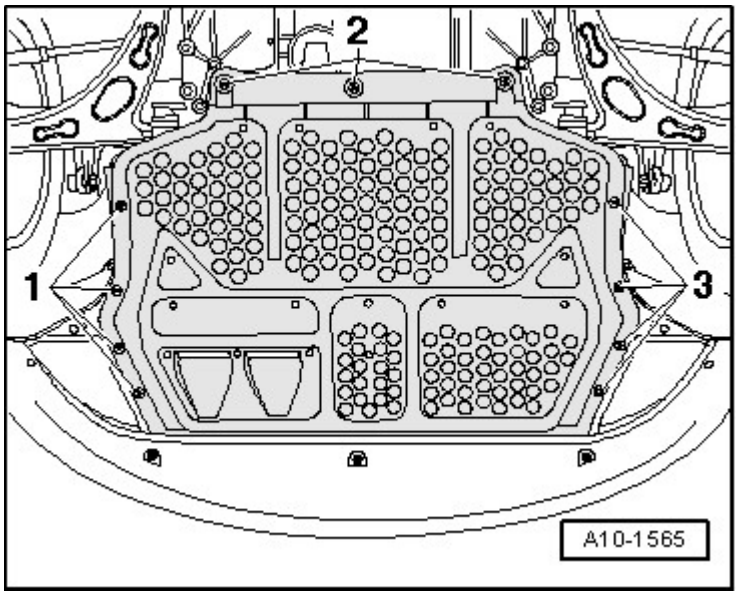

Fig. 18: Center Noise Insulation Bolts
Courtesy of AUDI OF AMERICA, LLC

-- Remove the left and right noise insulation fasteners -1 to 3-.

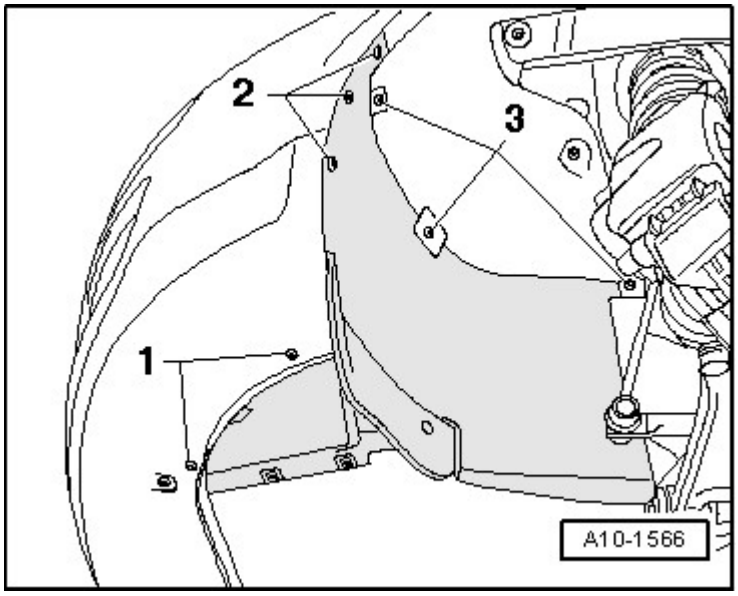

Fig. 19: Identifying Removal Of Left And Right Front Part Of Wheel Housing Liner
Courtesy of AUDI OF AMERICA, LLC

-- Disconnect electrical connector -1- at engine coolant temperature (ECT) sensor (on radiator) -G83-.

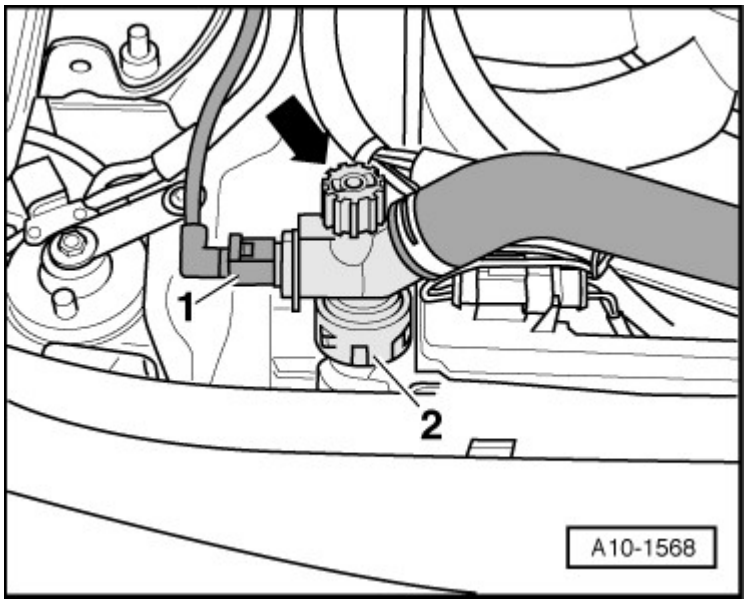

Fig. 20: Identifying Engine Coolant Temperature (ECT) Sensor (On Radiator) Electrical Harness Connector
Courtesy of AUDI OF AMERICA, LLC

-- Place VAS 6208 under engine.

Vehicles with drain plug:

-- Turn drain plug -arrow- on radiator left, place assisting hose on supports if necessary.

All Vehicles

-- Remove lower coolant hose -2- from radiator by removing retaining clamps.

-- Drain coolant.

-- Also remove lower coolant hose to after-run coolant pump -V51- -arrow- and allow remaining coolant to drain.

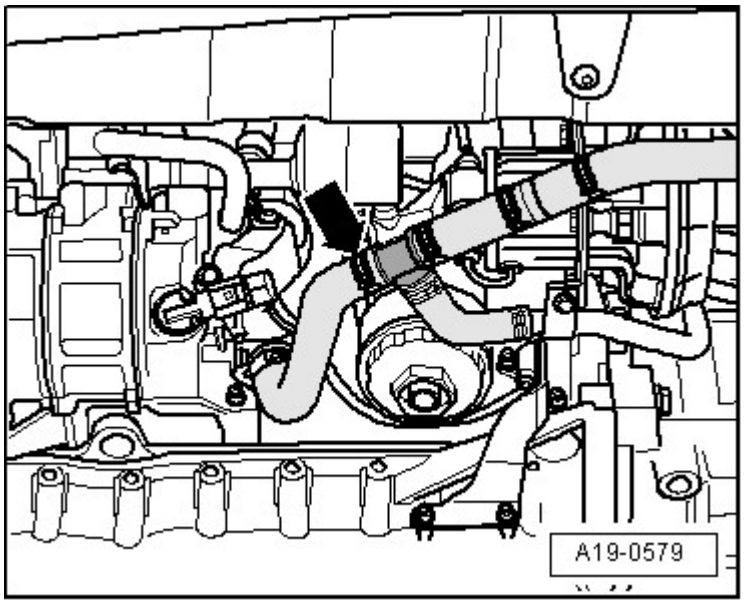

Fig. 21: After-Run Coolant Pump -V51
Courtesy of AUDI OF AMERICA, LLC

NOTE: Shown in illustration on vehicle with Direct Shift Gearbox transmission.

-- If equipped, remove vacuum hose -2- to air guide hose.

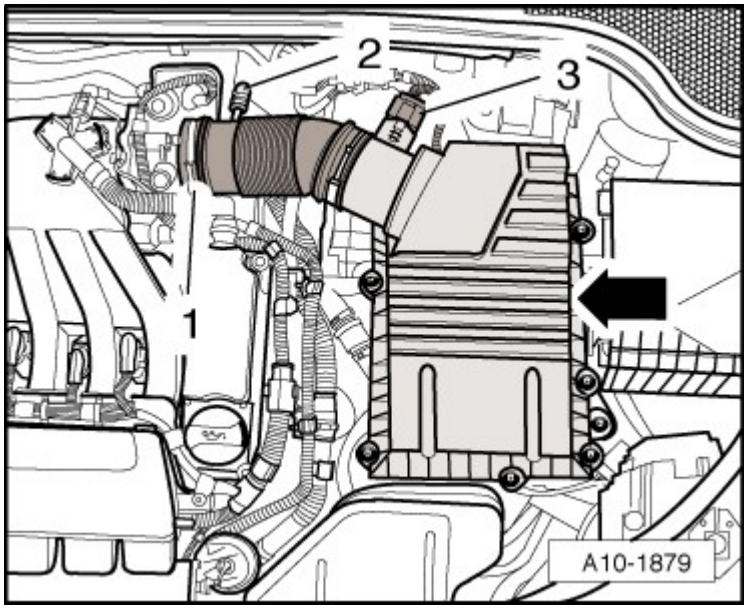

Fig. 22: Identifying Mass Air Flow (MAF) Sensor G70 Electrical Harness Connector
Courtesy of AUDI OF AMERICA, LLC

-- Disconnect air guide hose -1- at throttle valve control module -J338-.

-- Disconnect mass air flow (MAF) sensor -G70- electrical connector -3-.

-- Remove upper section of air filter housing -arrows-.

-- Remove filter element.

-- Pull off air guide cover -1-, disengage clips sideways to do so.

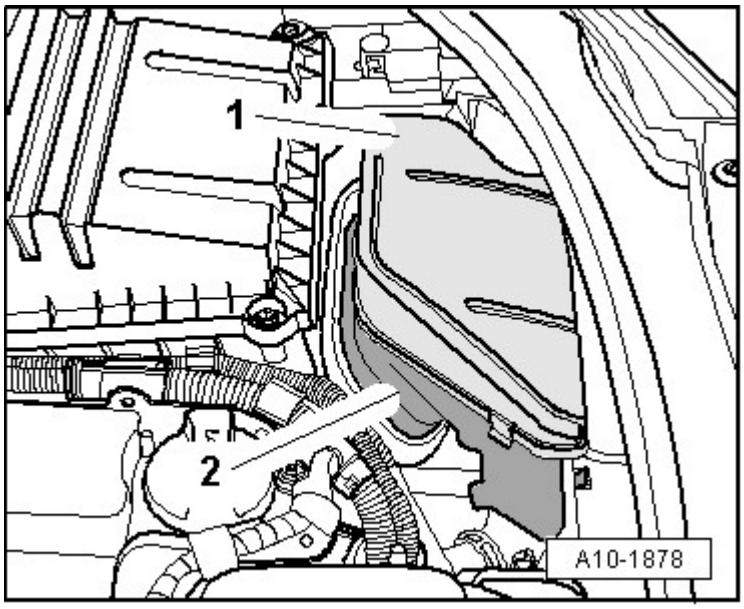

Fig. 23: Air Duct Cover & Air Duct
Courtesy of AUDI OF AMERICA, LLC

-- Unclip air duct -2-.

-- Remove lower section of air filter housing -arrows-.

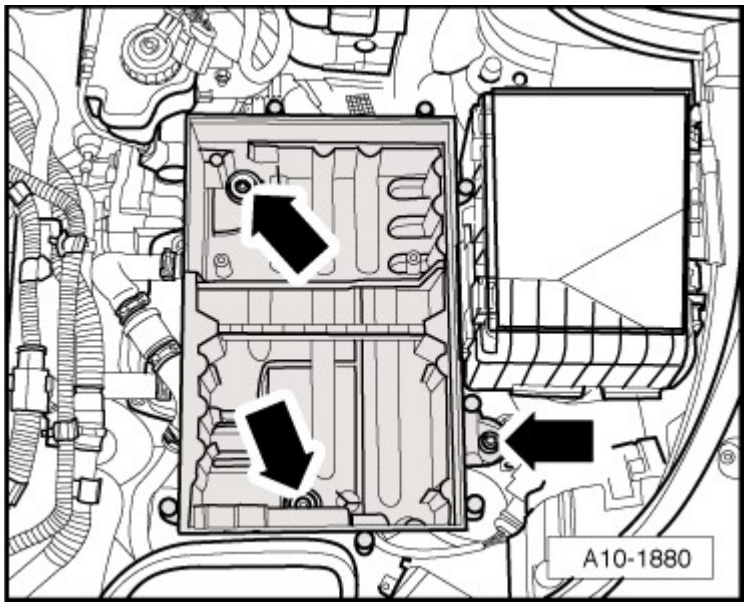

Fig. 24: Identifying Screws For Lower Portion Of Air Cleaner Housing

Courtesy of AUDI OF AMERICA, LLC

-- Remove air filter housing bracket -arrows-.

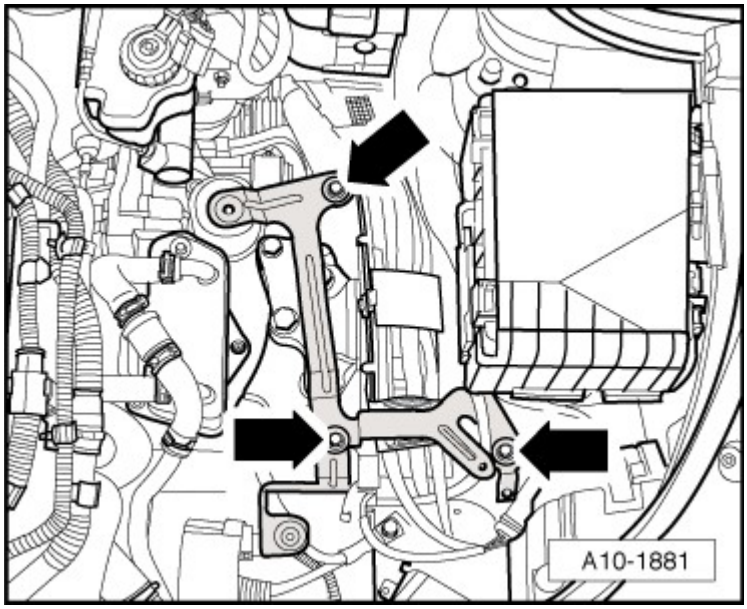

Fig. 25: Air Filter Housing Bracket
Courtesy of AUDI OF AMERICA, LLC

-- Disconnect electrical connector -1- for heated oxygen sensor (HO2S) 2 -G108- and -2- for heated oxygen sensor (HO2S) -G39-.

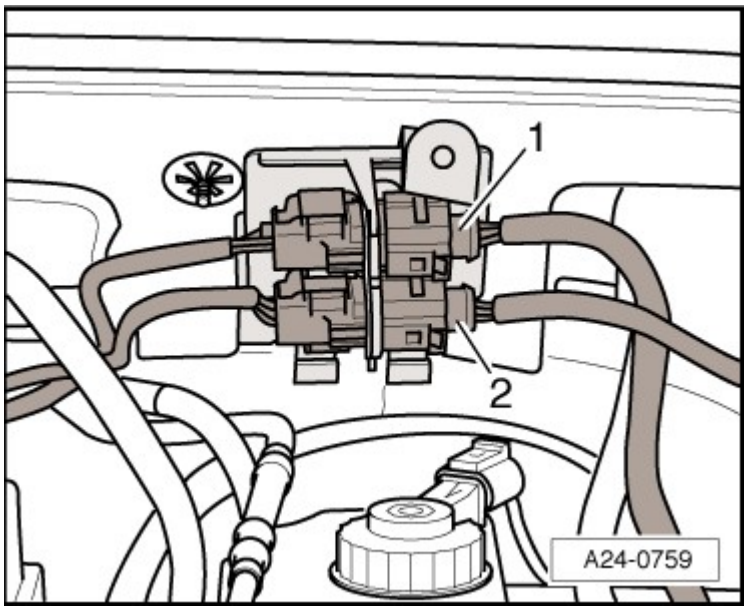

Fig. 26: Heated Oxygen Sensor (HO2S) 2 G108 & Heated Oxygen Sensor (HO2S) G39 Electrical Connector
Courtesy of AUDI OF AMERICA, LLC

-- Free up electrical wiring to oxygen sensors.

-- Pry off the caps on the wiper arms using a screwdriver.

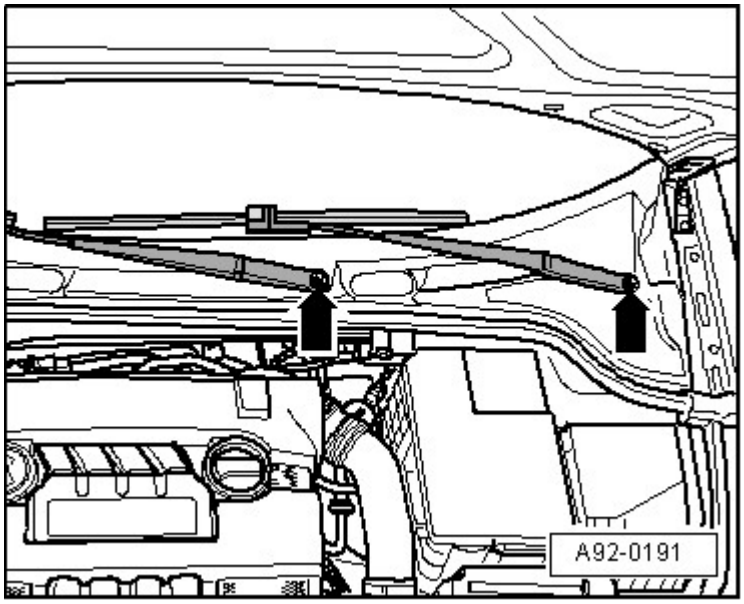

Fig. 27: Identifying Wiper Arm Nuts
Courtesy of AUDI OF AMERICA, LLC

-- Loosen the nuts -arrows- by several turns.

-- Loosen the wiper arms by gently rocking the wiper arm. Remove the nuts and remove the wiper arms.

-- Unclip the spray nozzles -arrow-.

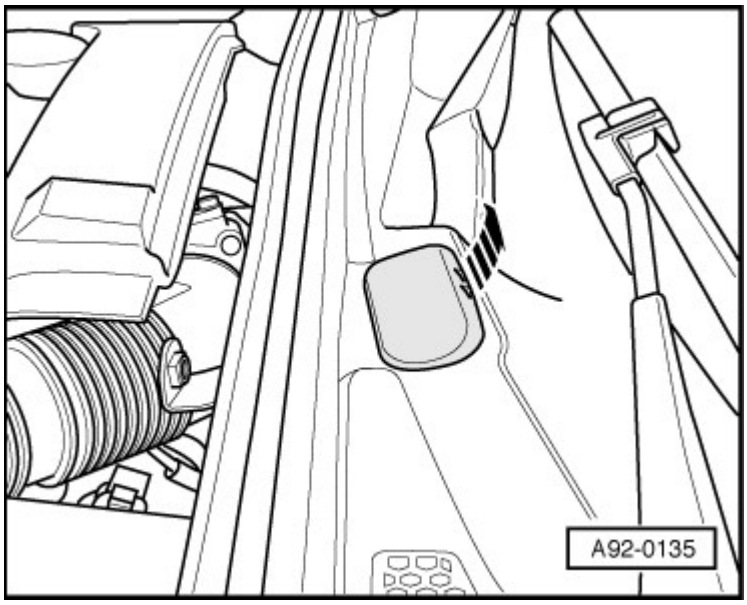

Fig. 28: Removing Spray Nozzle

Courtesy of AUDI OF AMERICA, LLC

-- Push spray nozzle with lines still attached back through opening and into plenum chamber.

-- Remove rubber seal -1- for plenum chamber cover.

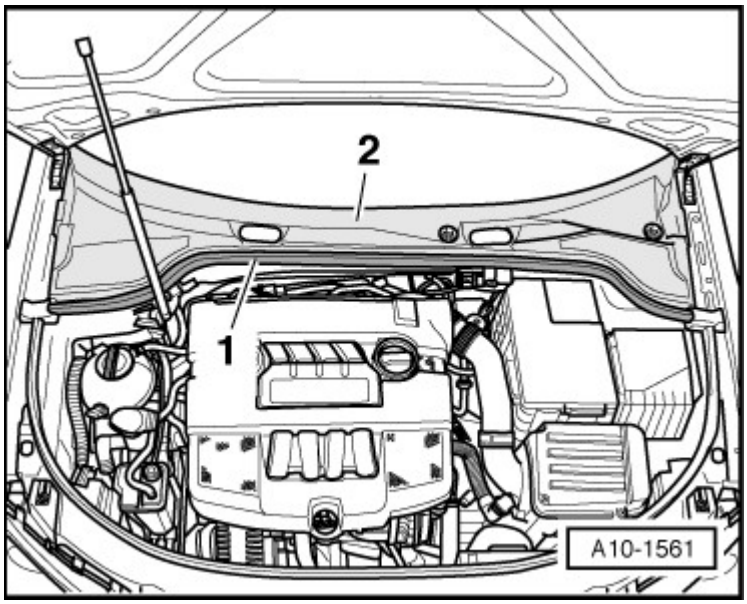

Fig. 29: Plenum Chamber Cover And Rubber Seal
Courtesy of AUDI OF AMERICA, LLC

-- Remove the plenum chamber cover -2-.

-- Free up the rear engine wiring harness at the partition for plenum chamber.

-- Remove partition for plenum chamber -arrows-.

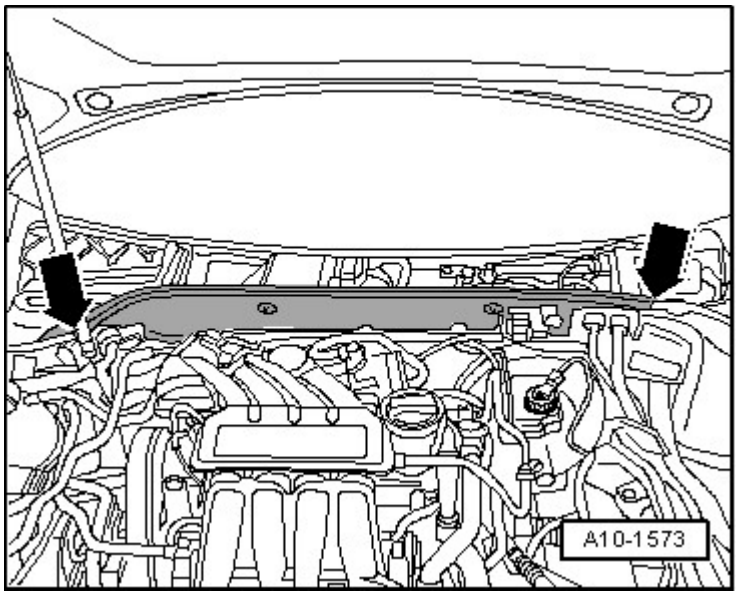

Fig. 30: Plenum Chamber Partition
Courtesy of AUDI OF AMERICA, LLC

-- Remove Engine Control Module (ECM). Refer to **Removal and Installation** .

-- Separate the electrical connector -2- for engine wiring harness.

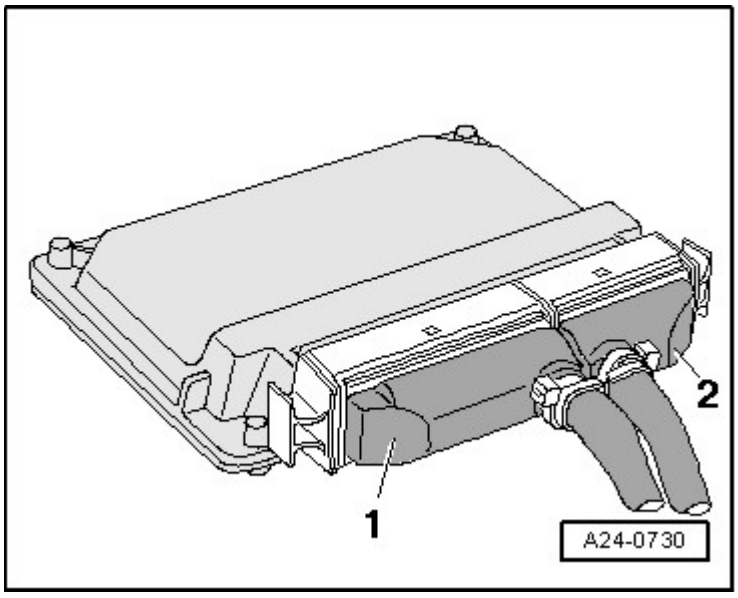

Fig. 31: Engine Wiring Harness Connector
Courtesy of AUDI OF AMERICA, LLC

NOTE: Electrical connector -1- remains connected.

-- Release pass-through for engine wiring harness -arrow- and pull off upward.

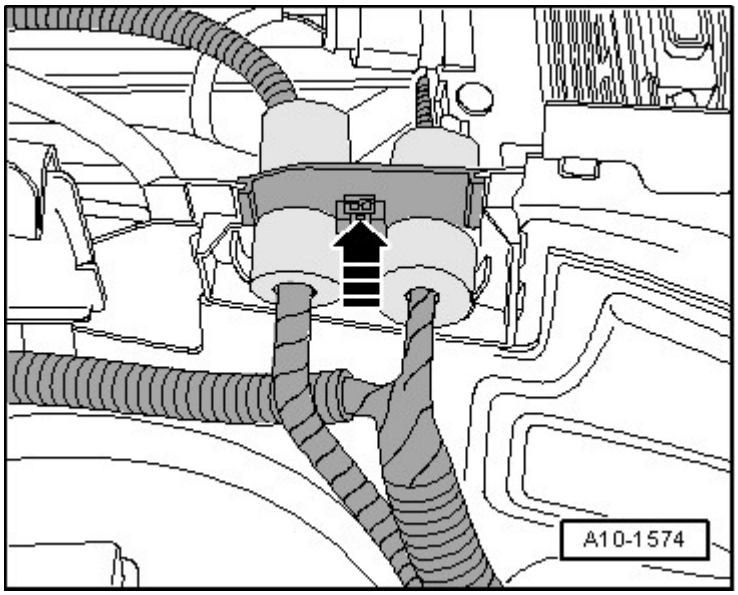

Fig. 32: Engine Wiring Harness
Courtesy of AUDI OF AMERICA, LLC

Vehicle with E-box, old version:

-- Press retaining clamps in direction of -arrow- and remove engine compartment E-box cover.

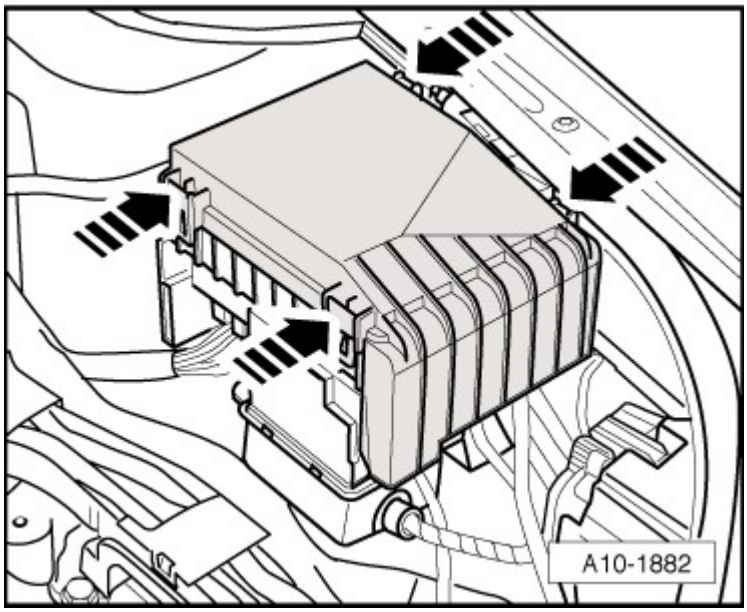

Fig. 33: Pressing Retaining Clamps And Removing Engine Compartment E-Box Cover
Courtesy of AUDI OF AMERICA, LLC

Vehicle with E-box, new version:

-- Press both latches in direction of -arrow- and remove engine compartment E-box cover.

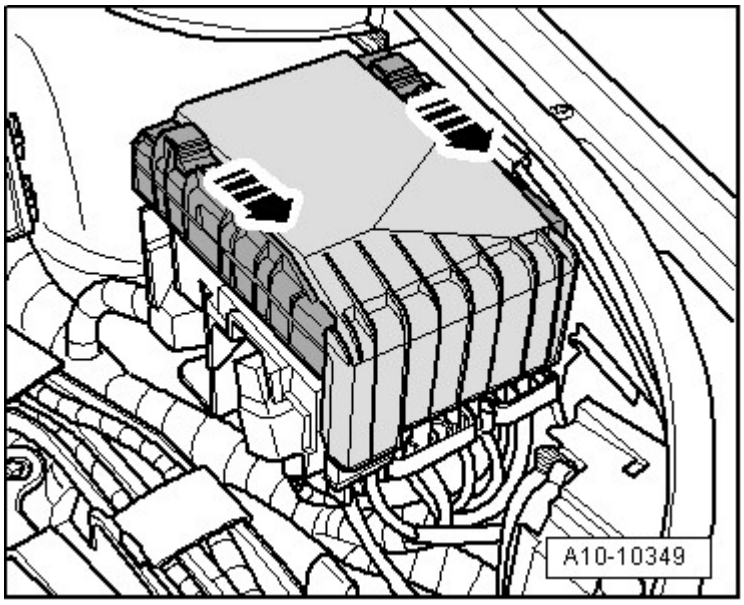

Fig. 34: Identifying E-Box Cover And Latches
Courtesy of AUDI OF AMERICA, LLC

-- Remove terminal 30 wiring -arrow- at engine compartment E-box and free up.

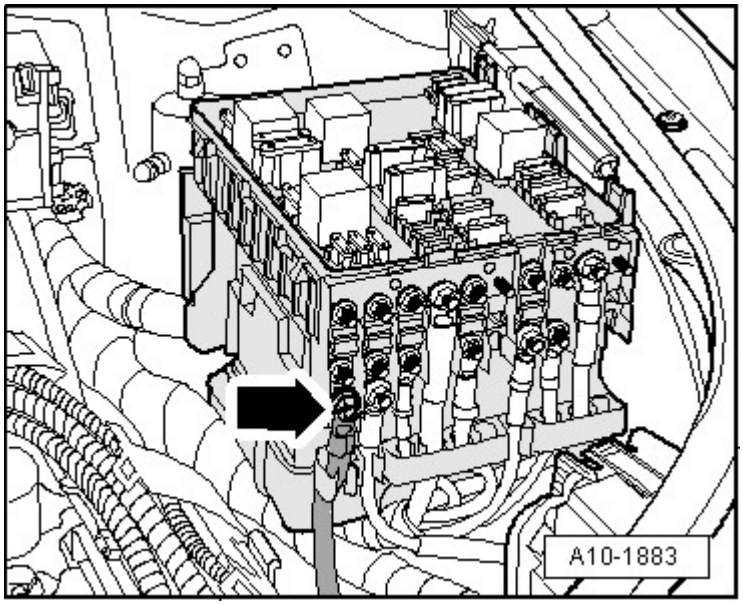

Fig. 35: Engine Compartment E-Box, Terminal 30
Courtesy of AUDI OF AMERICA, LLC

-- Open bracket of wiring -arrows-.

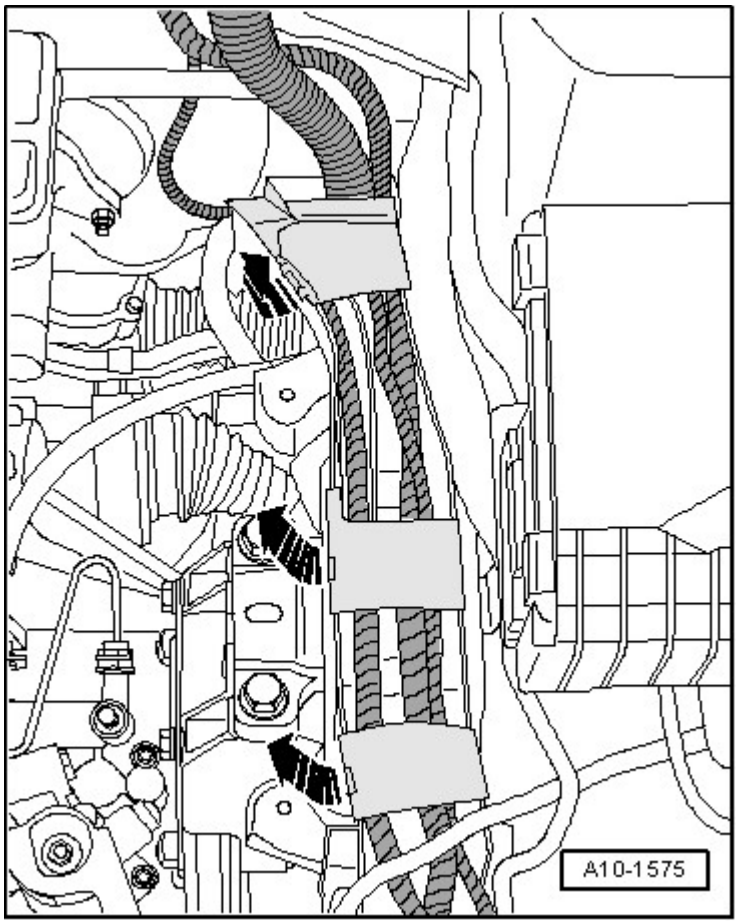

Fig. 36: Engine Wiring Harness Bracket
Courtesy of AUDI OF AMERICA, LLC

-- Free up electrical connector -1- and disconnect.

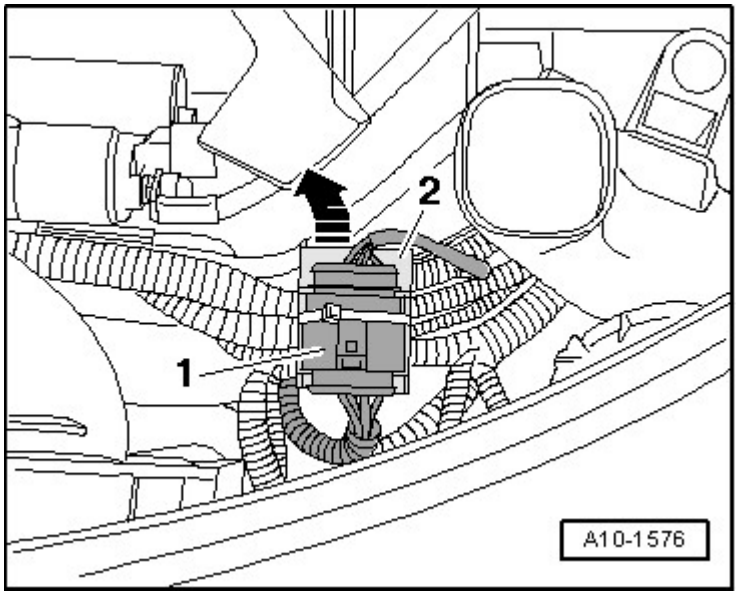

Fig. 37: Identifying Electrical Connector -1- And Wiring Guide Bracket -2-
Courtesy of AUDI OF AMERICA, LLC

-- Open the underlying wiring guide bracket -2-.

-- Remove engine wiring harness to control module from wiring.

NOTE: To unclip spiral clip, use 80-200.

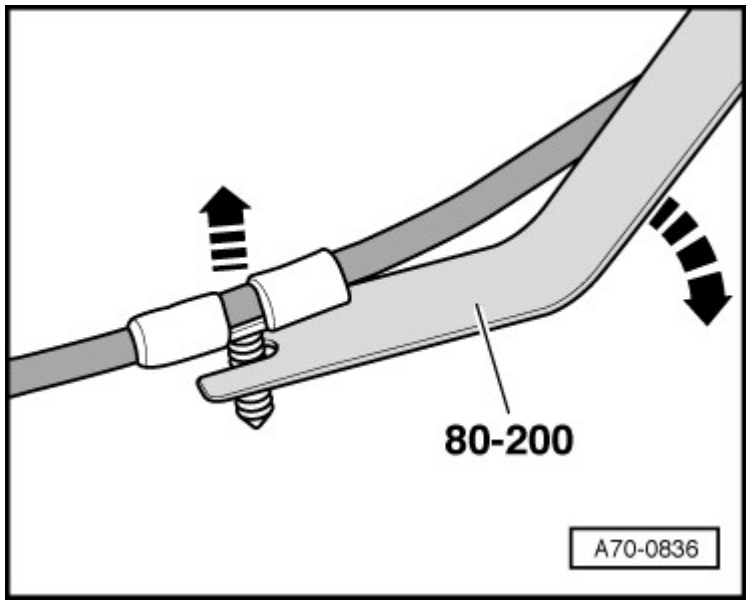

Fig. 38: Free Electrical Wiring Up To Generator Using Pry Lever - Rmv Outside Mirror 80-200
Courtesy of AUDI OF AMERICA, LLC

-- Disconnect secondary air hose at position indicated by -arrow-.

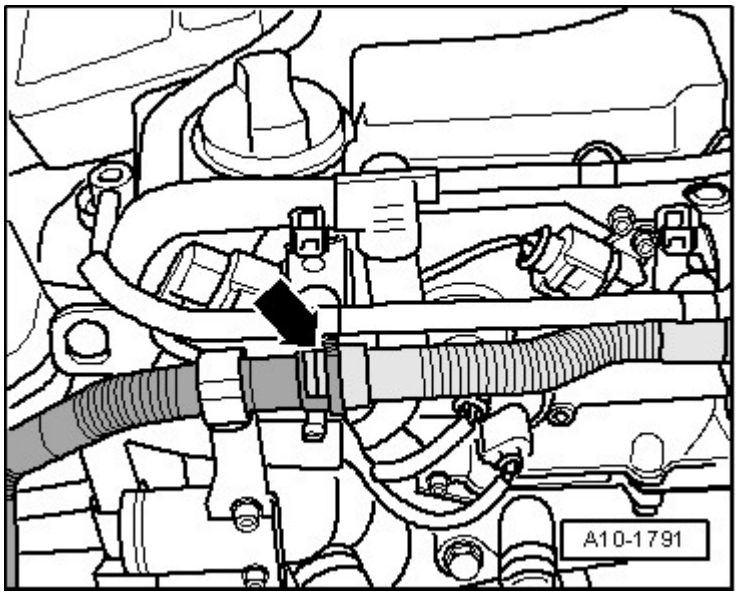

Fig. 39: Disconnecting Secondary Air Hose
Courtesy of AUDI OF AMERICA, LLC

-- Free up air hose to Secondary Air Injection (AIR) pump.

-- Disconnect electrical harness connectors -1-, -3- and -5-.

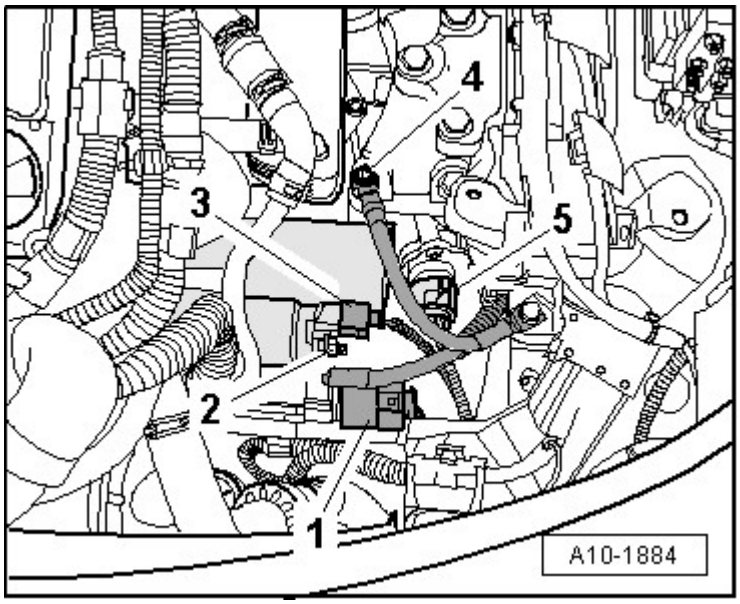

Fig. 40: Electrical Connectors, Starter Solenoid Switch And Ground Cable
Courtesy of AUDI OF AMERICA, LLC

-- Remove protective boot and remove electrical wiring -2- at starter solenoid switch.

-- Remove Ground (GND) cable -4-.

-- Remove bolts -1- for bracket -D-.

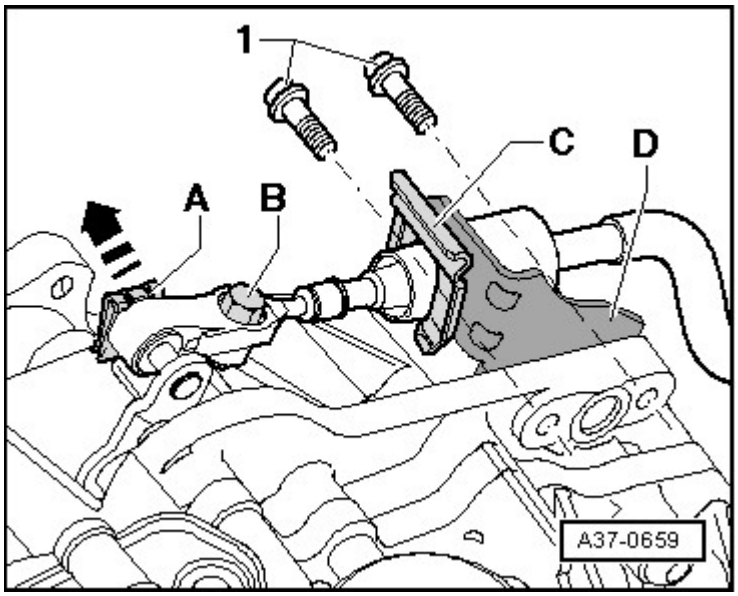

Fig. 41: Bolts For Support Bracket, Pulling Off Retaining Clip Upward & Disconnecting Selector Lever Cable From Transmission
Courtesy of AUDI OF AMERICA, LLC

-- Remove retaining clip -A- upward -arrow- and remove selector lever cable from transmission.

NOTE: Ignore items -B- and -C-.

-- Remove coolant hoses to heater core on bulkhead -arrows-.

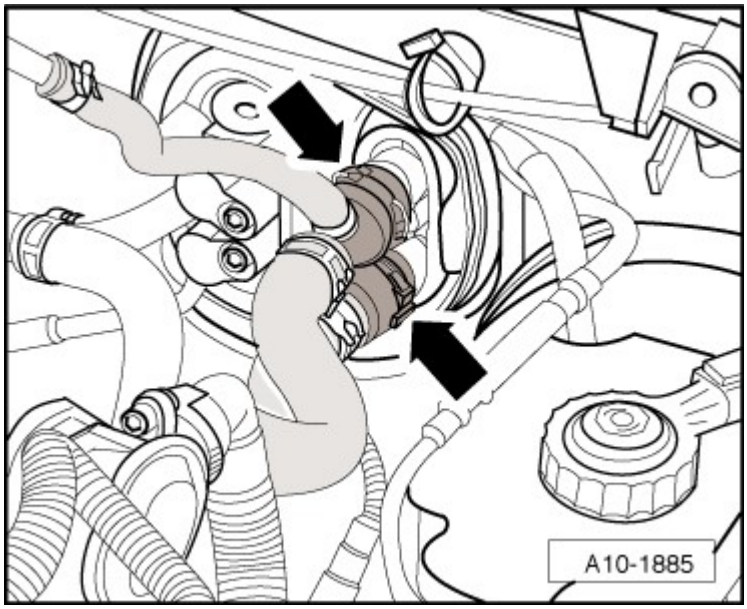

Fig. 42: Coolant Hoses To Heater Core On Bulkhead
Courtesy of AUDI OF AMERICA, LLC

-- Disconnect coolant hoses at positions indicated by -arrows-.

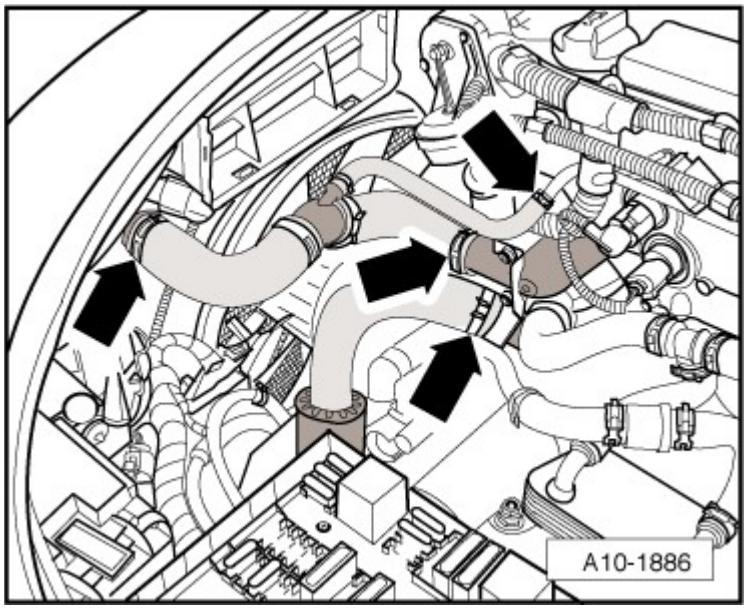

Fig. 43: Coolant Hose Disconnect Positions
Courtesy of AUDI OF AMERICA, LLC

-- Disconnect electrical connection -1- at throttle valve control module -J338-.

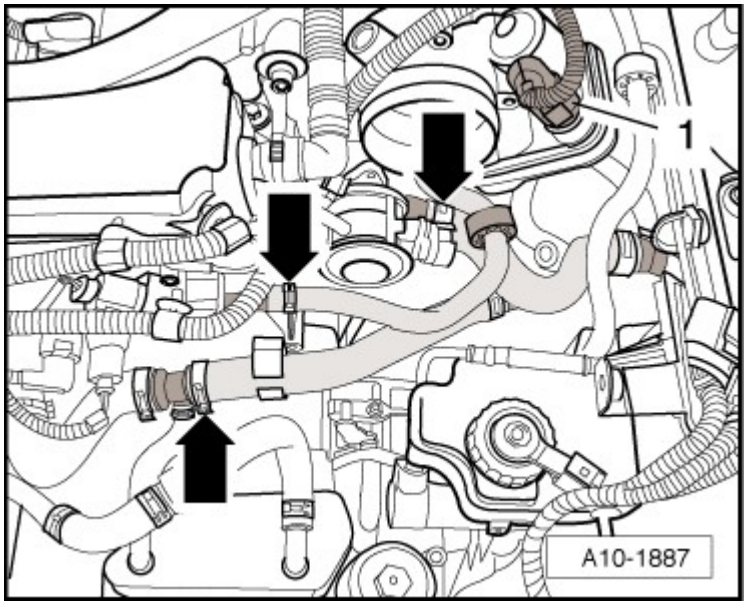

Fig. 44: Throttle Valve Control Module J338 Electrical Connection & Coolant Hose Disconnect Positions
Courtesy of AUDI OF AMERICA, LLC

-- Disconnect coolant hoses at positions indicated by -arrows-.

-- Remove throttle valve control module -J338- from intake manifold -arrows-.

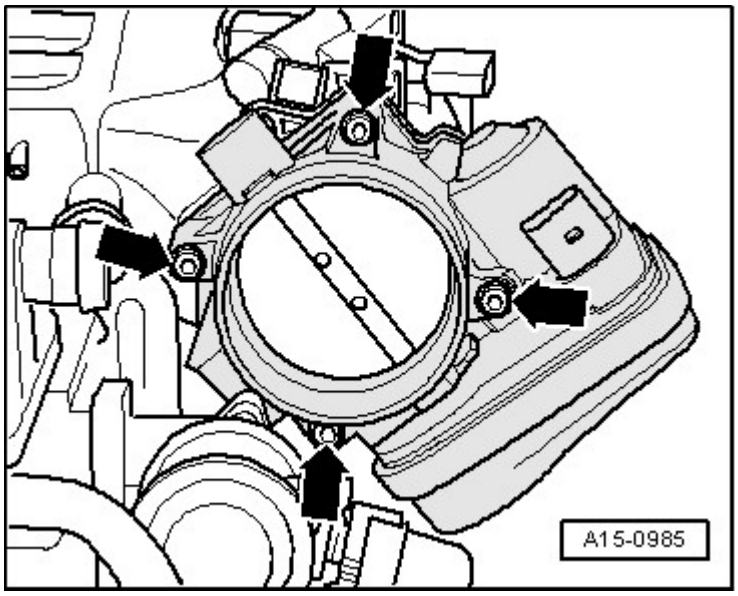

Fig. 45: Identifying Bolts And Throttle Valve Control Module -J338- To Intake Manifold
Courtesy of AUDI OF AMERICA, LLC

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

-- Disconnect following hose connections:

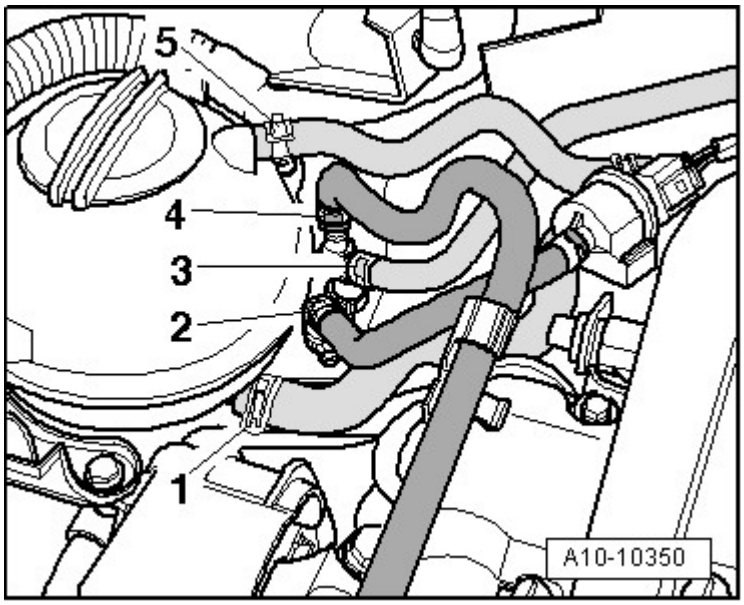

Fig. 46: Identifying Fuel Supply Line, Vent Line & Vacuum Line
Courtesy of AUDI OF AMERICA, LLC

1. Coolant hose to reservoir
2. Vacuum hose to Evaporative Emission (EVAP) Canister

3. Vacuum hose to Leak Detection Pump
4. Fuel supply line
5. Coolant hose to reservoir

NOTE: Depending on the construction version, low pressure connectors were used in the version shown. To disconnect, slide back rubber cap -1- and slide release button -2- to the rear.

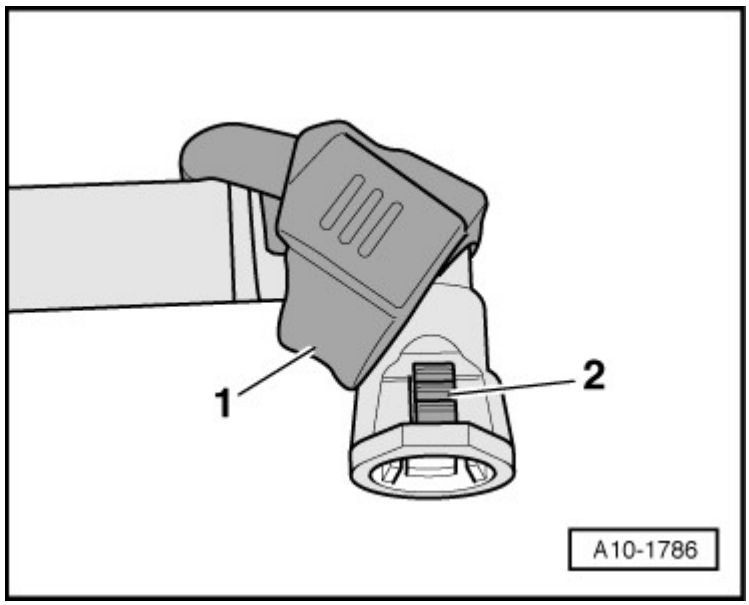

Fig. 47: Identifying Vacuum Connections Back Rubber Cap & Retaining Tab
Courtesy of AUDI OF AMERICA, LLC

-- Remove hoses and electrical connectors at indicated places:

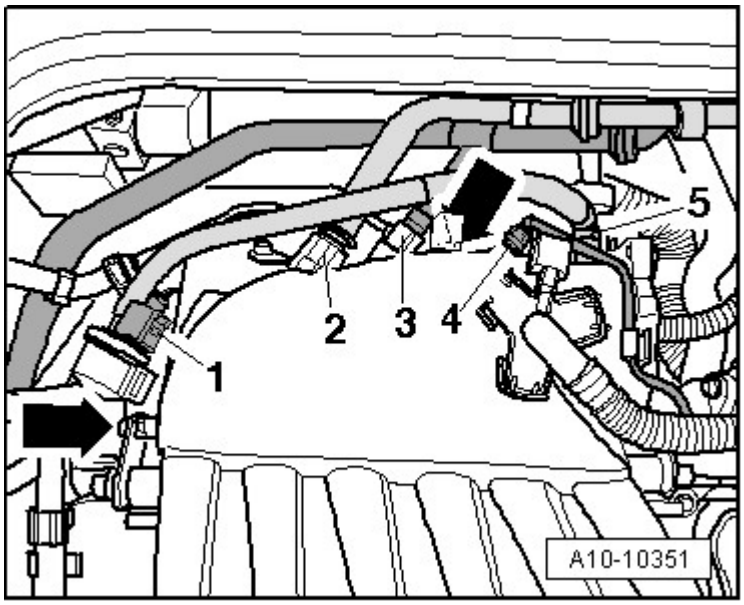

Fig. 48: Electrical Connector To Evaporative Emission (EVAP) Canister Purge Regulator Valve N80 & Vacuum Hoses
Courtesy of AUDI OF AMERICA, LLC

1 - Electrical connector to evaporative emission (EVAP) canister purge regulator valve -N80-

2 - Vacuum hose to brake booster

3 - Vacuum hose to exhaust flap, also to Leak Detection Pump

5 - Vacuum hose to evaporative emission (EVAP) canister purge regulator valve -N80-

NOTE: Ignore -4-.

-- Remove wiring connection -arrows-.

-- Remove wiring connections with coolant and vacuum hoses.

-- Remove heated oxygen sensor (HO2S) 2 -G108- -1- and heated oxygen sensor (HO2S) -G39- -2-.

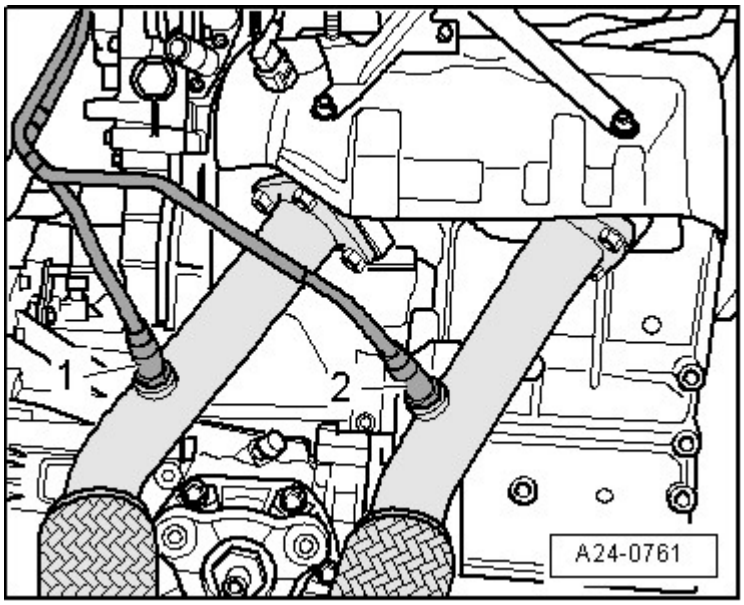

Fig. 49: Heated Oxygen Sensor (HO2S) 2 G108 & Heated Oxygen Sensor (HO2S) G39
Courtesy of AUDI OF AMERICA, LLC

-- Remove bolts -1- and -3- and remove front exhaust pipe support -2-.

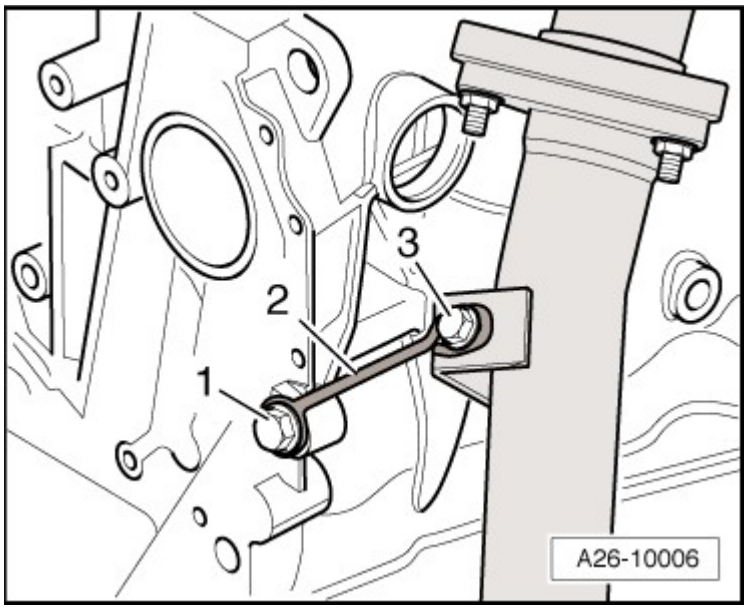

Fig. 50: Front Exhaust Pipe Support & Bolts
Courtesy of AUDI OF AMERICA, LLC

-- Remove front exhaust pipe nuts and exhaust manifolds -arrows-.

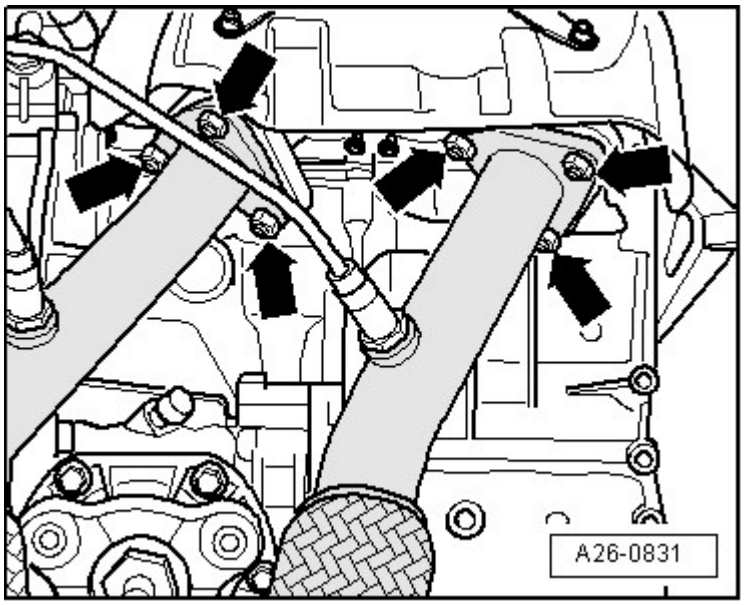

Fig. 51: Front Exhaust Pipe Nuts And Exhaust Manifolds
Courtesy of AUDI OF AMERICA, LLC

-- Remove top mounting bolts for fan shroud -top arrows-.

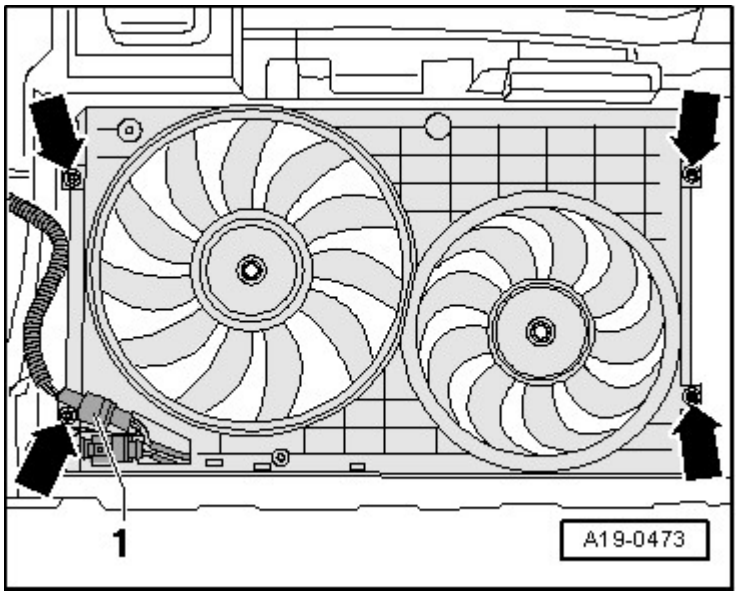

Fig. 52: Coolant Fan Control (FC) Control Module J293
Courtesy of AUDI OF AMERICA, LLC

NOTE: Before removing the ribbed belt, mark the turning direction on it with chalk or a felt tip pen. A reversed direction of rotation can cause damage to the belt under operating conditions.

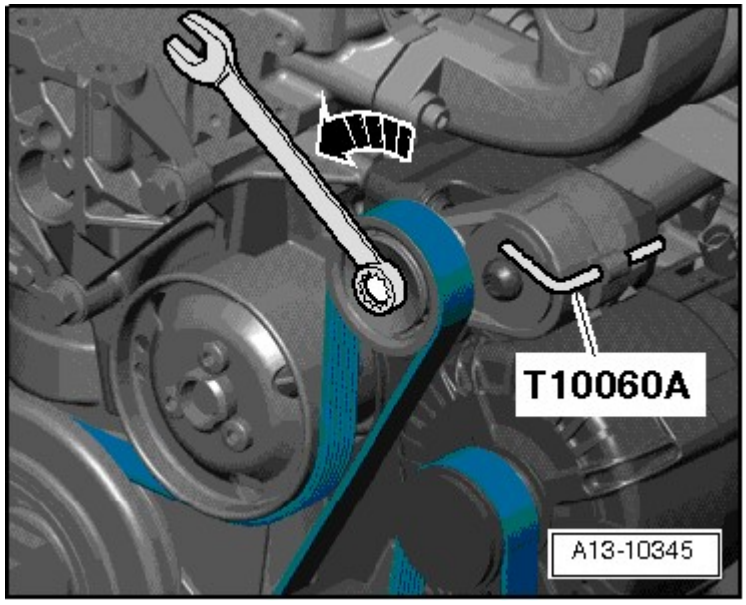

Fig. 53: Relieving Tension On Ribbed Belt
Courtesy of AUDI OF AMERICA, LLC

-- Swing tensioning device in direction of -arrow- to relieve tension on the ribbed belt and then lock it in place using the T10060 A.

-- Remove ribbed belt.

-- Loosen subframe mounting bolts to engine -arrows- approximately 2 turns.

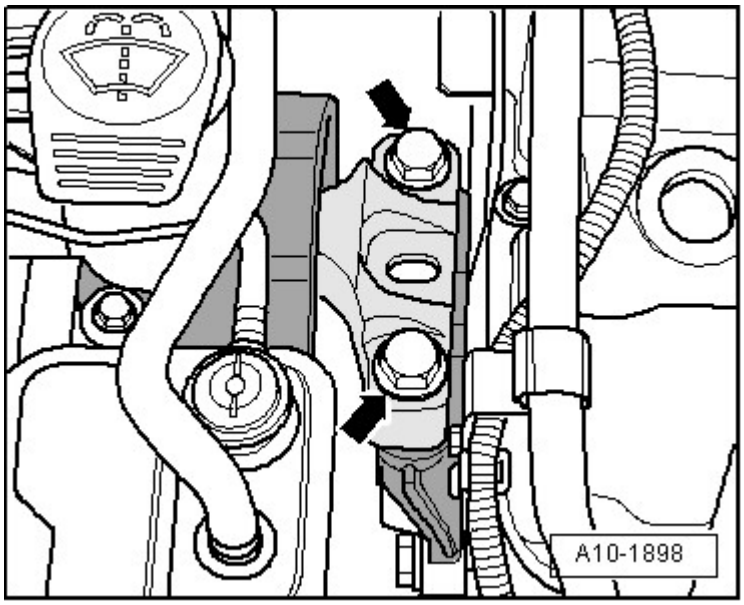

Fig. 54: Identifying Engine Mount To Engine Mount Bracket Bolts
Courtesy of AUDI OF AMERICA, LLC

-- Loosen subframe mounting bolts to transmission -arrows- approximately 2 turns.

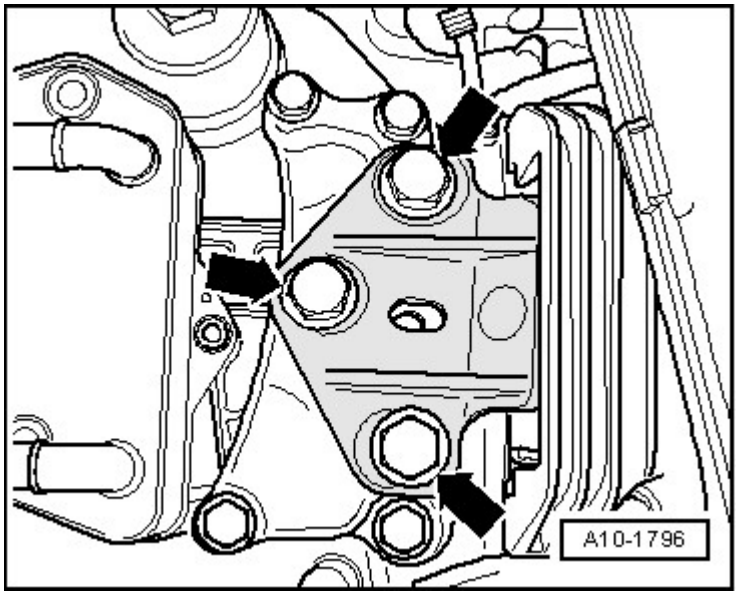

Fig. 55: Identifying Engine Mount To Engine Mount Bracket Bolts
Courtesy of AUDI OF AMERICA, LLC

-- Remove the right vehicle underbody cover -arrows-.

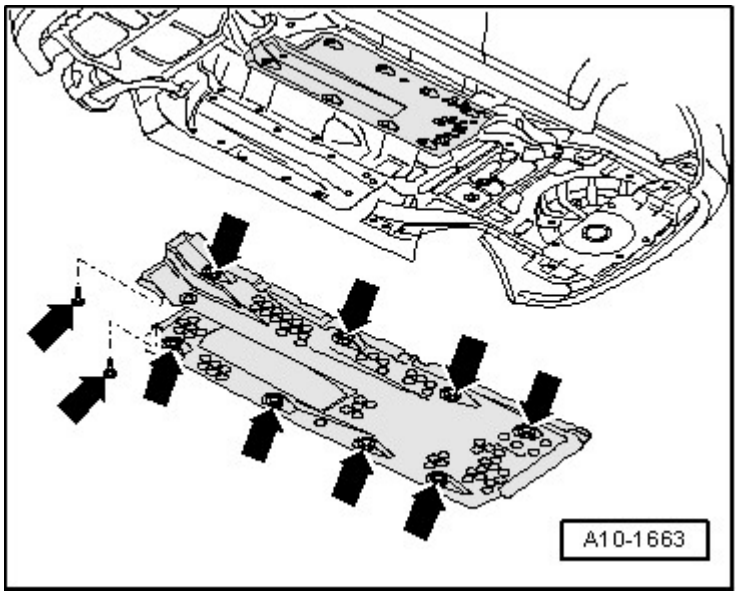

Fig. 56: Identifying Right Vehicle Floor Cover
Courtesy of AUDI OF AMERICA, LLC

-- Disconnect electrical connector -1- to oxygen sensor (O2S) behind three way catalytic converter (TWC) -G130- and -2- to oxygen sensor (O2S) 2 behind three way catalytic Converter (TWC) -G131-.

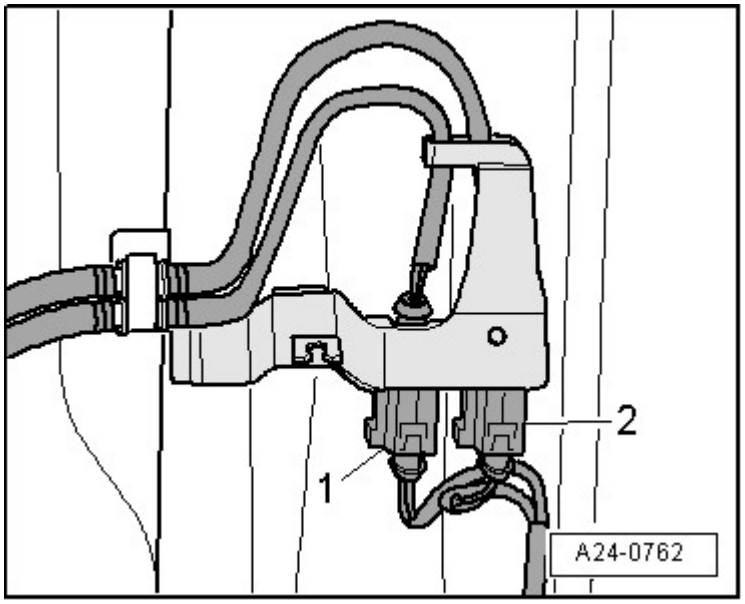

Fig. 57: Disconnecting Electrical Connectors And At Right Of Vehicle Floor
Courtesy of AUDI OF AMERICA, LLC

-- Remove connector coupling from bracket and free up wiring to oxygen sensors.

-- Remove front vehicle floor crossmember by removing nuts -1- and -2-.

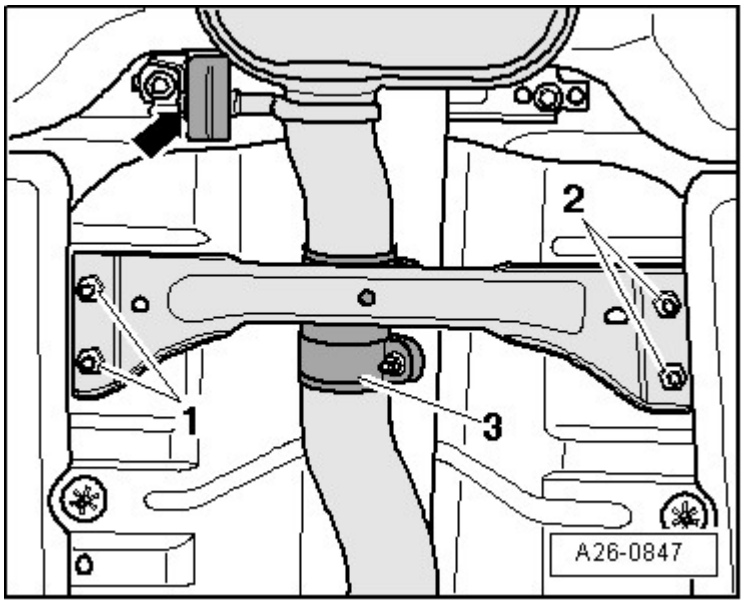

Fig. 58: Front Vehicle Floor Crossmember Nuts
Courtesy of AUDI OF AMERICA, LLC

NOTE: Do not bend the flex joints in front of the exhaust pipe more than 30° or they may be damaged.

-- Separate exhaust system at clamping sleeve -3-.

-- Remove exhaust system bracket -arrows- and remove exhaust system.

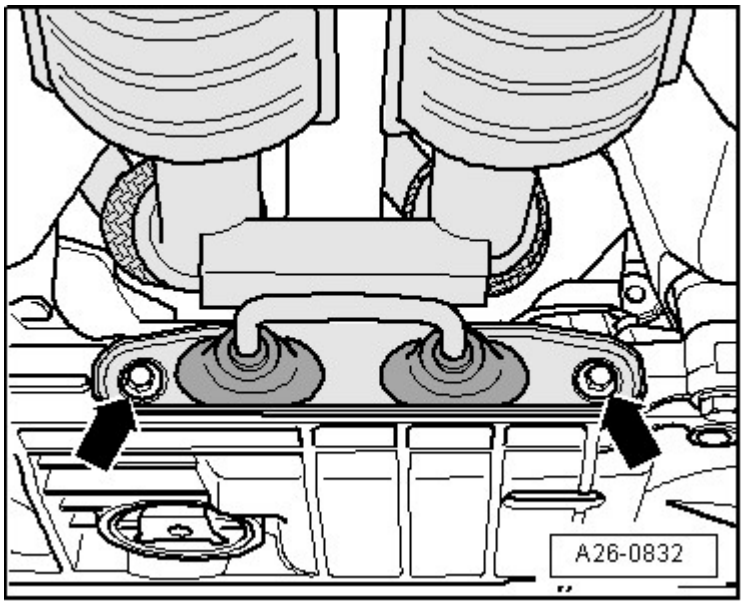

Fig. 59: Exhaust System Bracket
Courtesy of AUDI OF AMERICA, LLC

-- Free up coolant hose at bottom on fan shroud.

-- Disconnect electrical connector -3- at secondary air injection (AIR) pump motor -V101- and free up electrical wiring.

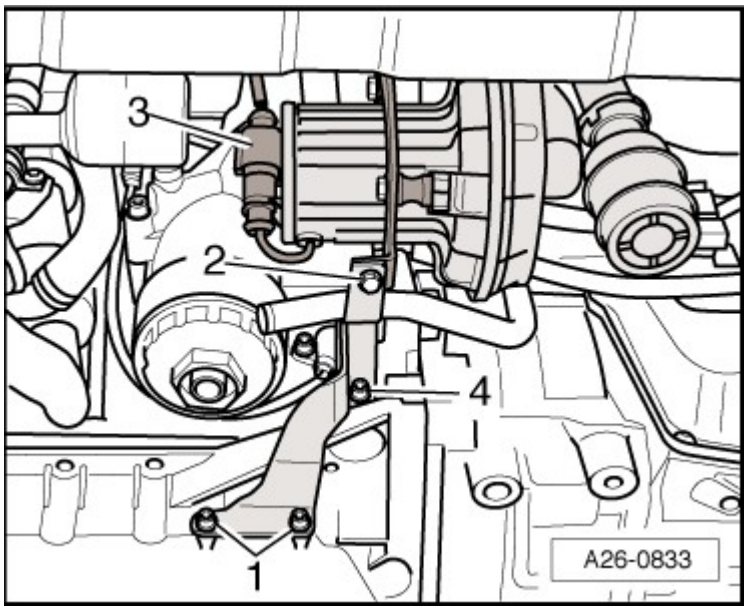

Fig. 60: Identifying Secondary Air Injection (AIR) Pump Motor V101 Electrical Harness Connector
Courtesy of AUDI OF AMERICA, LLC

-- On vehicles with DSG transmission, remove coolant pipe bracket -2- to transmission oil cooler.

-- Remove bolts -1-.

-- Loosen bolt -4- and remove Secondary Air Injection (AIR) pump with bracket.

-- Disconnect electrical harness connectors -1- for coolant fans at bottom on fan shroud.

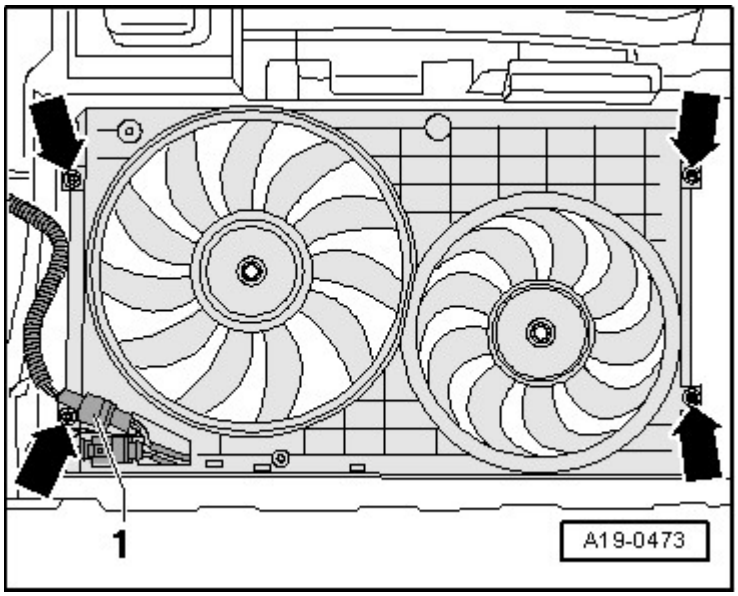

Fig. 61: Coolant Fan Control (FC) Control Module J293
Courtesy of AUDI OF AMERICA, LLC

-- Remove mounting bolts for fan shroud at bottom -bottom arrows-.

-- Pull out fan shroud downward with both fans.

-- Disconnect electrical harness connector -1- for A/C clutch on A/C compressor and free up electrical wire.

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

-- Remove bolts -arrow- for A/C compressor.

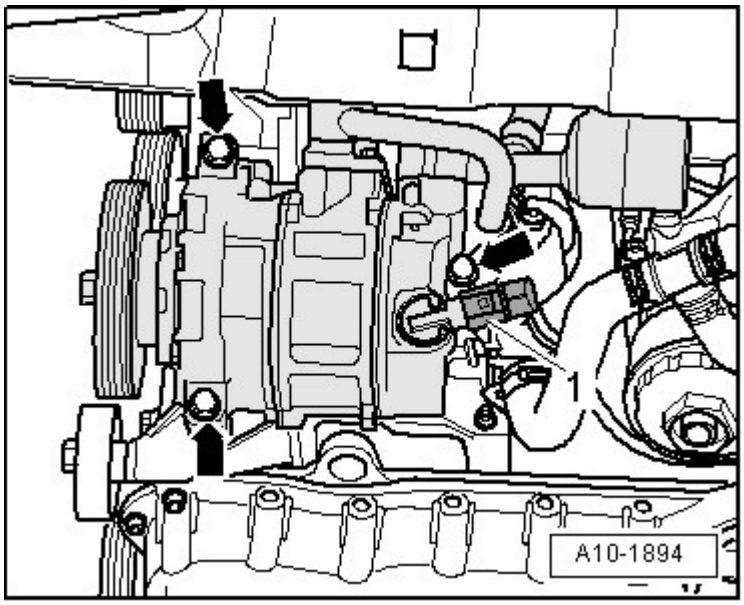

Fig. 62: Electrical Harness Connector For A/C Clutch On A/C Compressor
Courtesy of AUDI OF AMERICA, LLC

-- Securely tie the A/C compressor with connected coolant hoses at front on the longitudinal member.

-- Remove electrical wire -1- on generator.

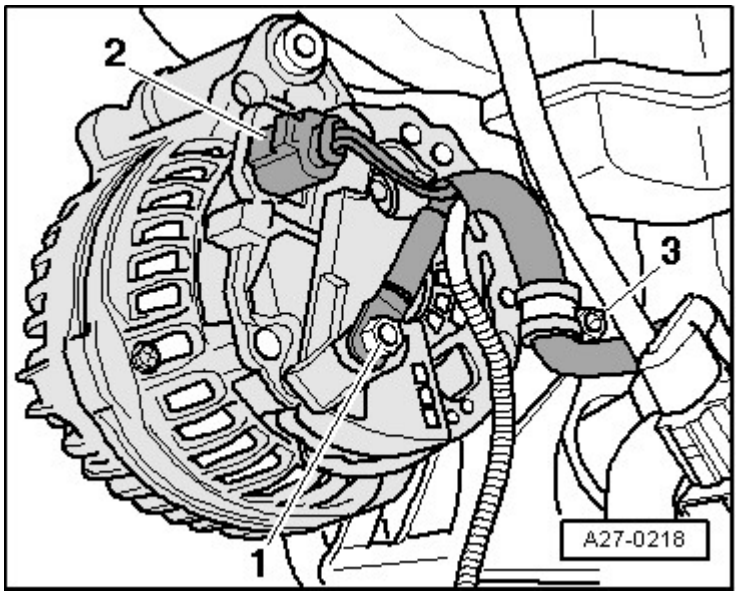

Fig. 63: Identifying Connector, Electrical Wire And Wiring Clamp On Generator
Courtesy of AUDI OF AMERICA, LLC

-- Separate the electrical connector -2-.

NOTE: Ignore -3-.

-- Remove upper idler roller -1-.

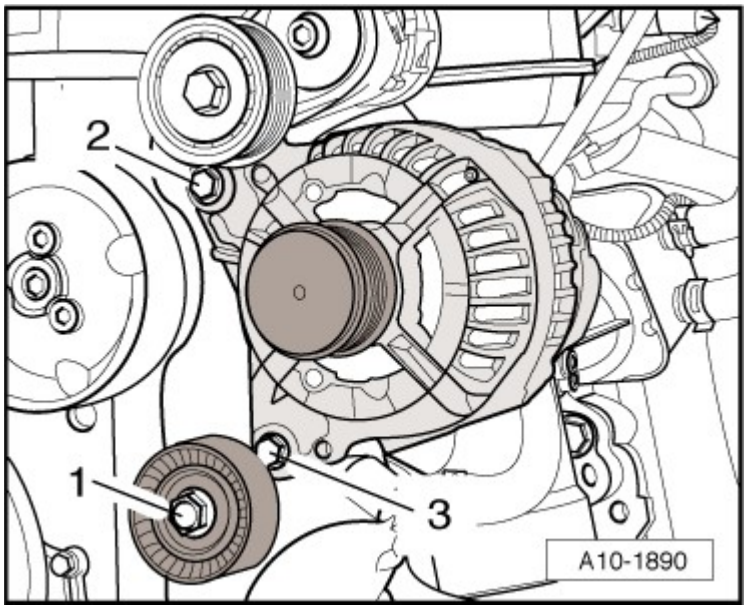

Fig. 64: Identifying Upper Idler Roller And Bolts
Courtesy of AUDI OF AMERICA, LLC

-- Remove mounting bolts -2- and -3- for generator.

NOTE: Generator can be removed from bracket only with the upper mounting bolt still installed.

-- Remove generator from accessory assembly bracket.

-- Remove generator downward and to the left.

-- Disconnect electrical connector -arrow- to secondary air injection (AIR) solenoid valve -N112-.

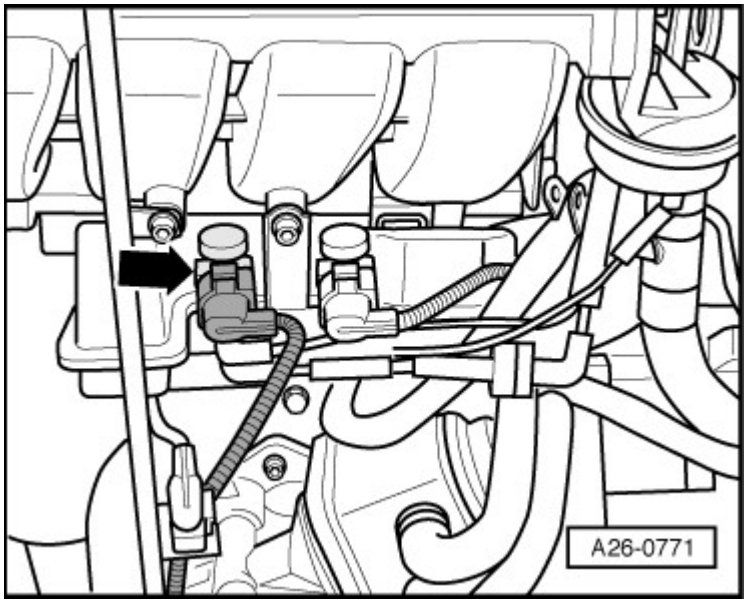

Fig. 65: Disconnecting Electrical Connector At Secondary Air Injection (AIR) Solenoid Valve -N112-
Courtesy of AUDI OF AMERICA, LLC

CAUTION: To loosen collar bolt for drive axle, the wheel bearing must not be under load (vehicle must not be standing on its wheels).

-- Have a second technician press brake pedal.

-- Remove collar bolt -2- at right drive axle -1-.

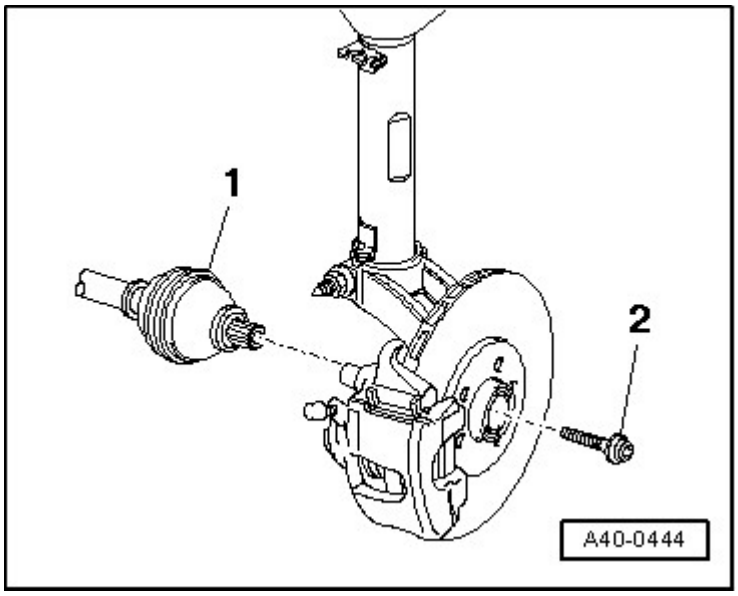

Fig. 66: Identifying Collar Bolt For Left/Right Drive Axle
Courtesy of AUDI OF AMERICA, LLC

-- Remove right drive axle heat shield from bevel box -arrows-.

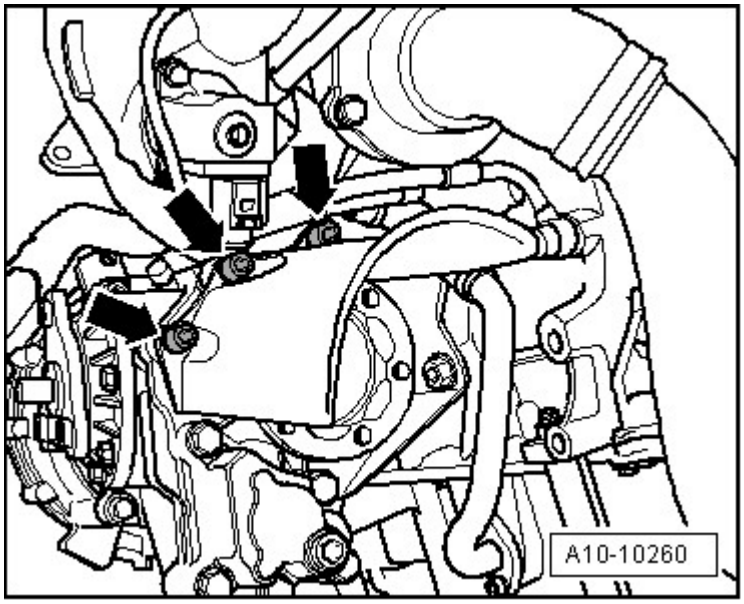

Fig. 67: Drive Axle Heat Shield
Courtesy of AUDI OF AMERICA, LLC

-- Remove right drive axle. Refer to **Removal and Installation** .

-- Remove left drive axle from transmission flange shaft.

-- Position of flexible disc and bevel box flange are marked to each other.

-- Remove driveshaft flexible disc at bevel box -arrows-.

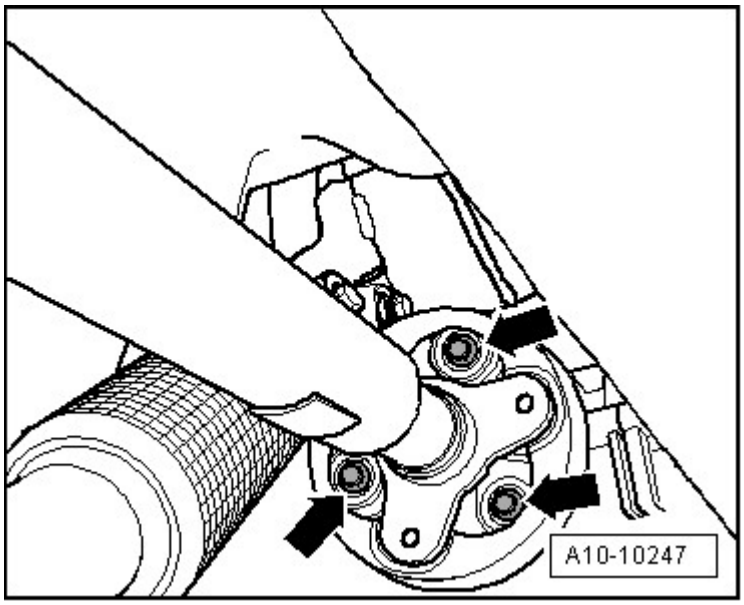

Fig. 68: Driveshaft Flexible Disc
Courtesy of AUDI OF AMERICA, LLC

NOTE: To loosen bolts, counterhold at driveshaft flange/final drive with a lever.

-- Press driveshaft horizontally as far back as possible.

CAUTION:

- **Seal -arrow- in driveshaft flange must not be damaged when removing engine/transmission assembly. If seal is damaged, driveshaft must be replaced.**
- **Engine/transmission swings forward slightly when pendulum support/subframe bolts are loosened.**

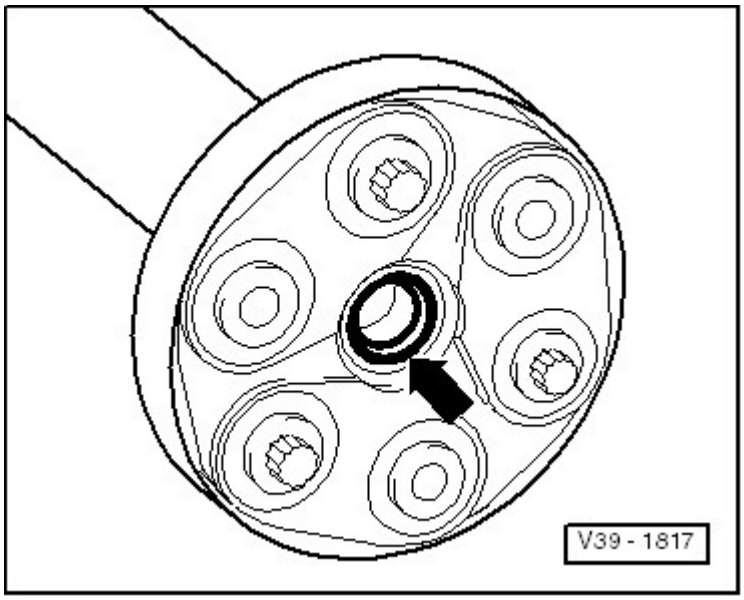

Fig. 69: Identifying Sealing Ring In Driveshaft Flange
Courtesy of AUDI OF AMERICA, LLC

-- Remove bolts -1 to 3- and remove pendulum support.

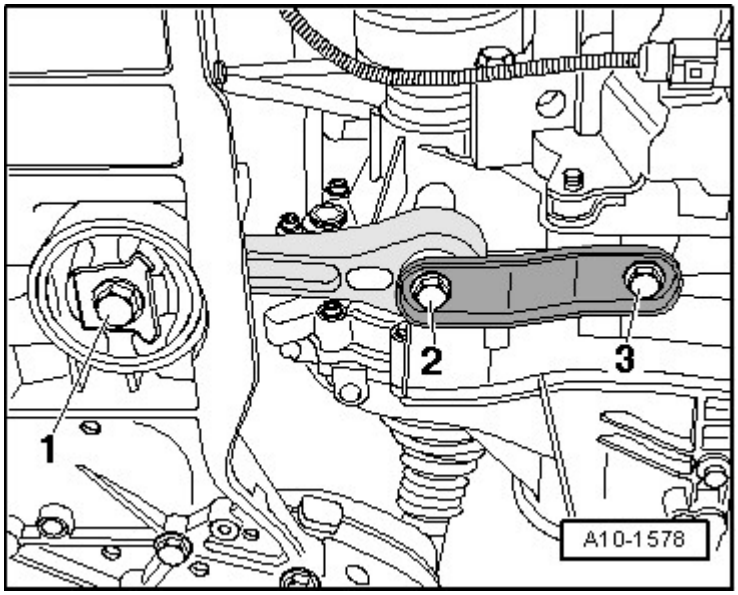

Fig. 70: Identifying Pendulum Support & Bolts
Courtesy of AUDI OF AMERICA, LLC

-- Disconnect electrical connector -1- at oil level thermal sensor -G266-.

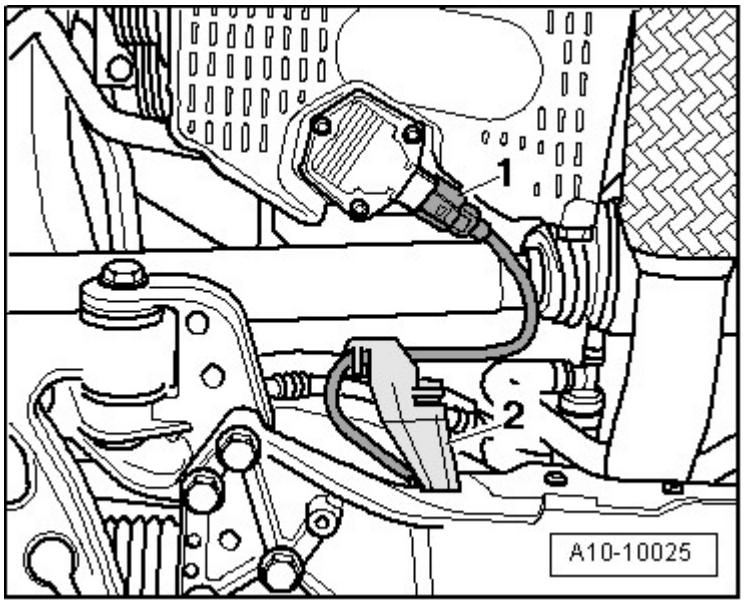

Fig. 71: Identifying Oil Level Thermal Sensor G266 Wire On Subframe
Courtesy of AUDI OF AMERICA, LLC

-- Unclip bracket -2- for electrical wire to oil level thermal sensor -G266- at subframe.

-- Disconnect electrical harness connector -arrow- at after-run coolant pump -V51-.

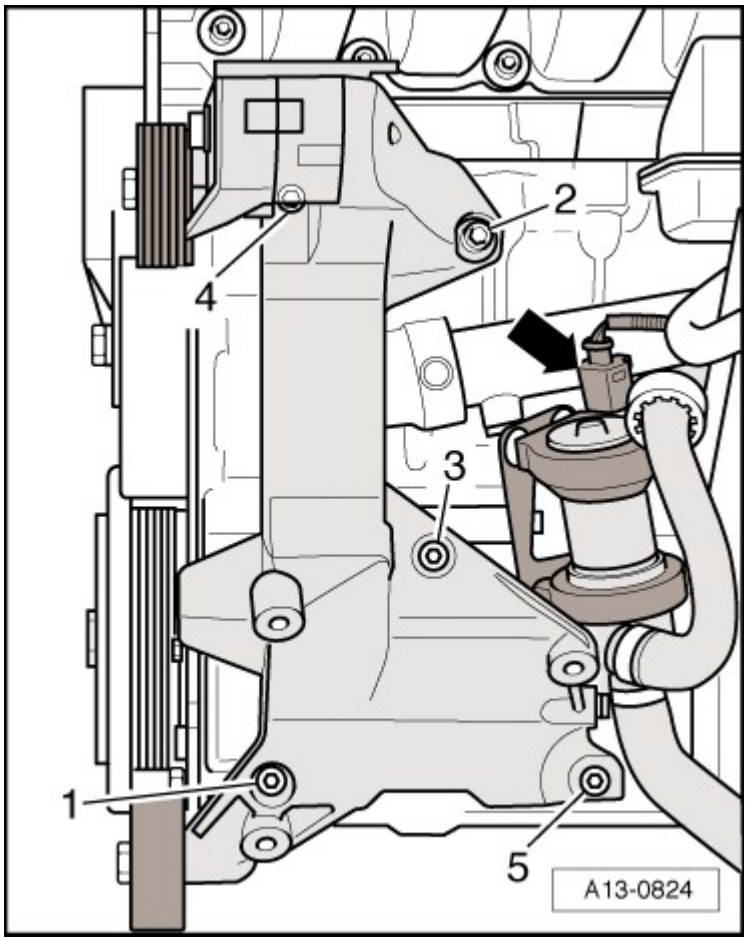

Fig. 72: Accessory Assembly Bracket Bolts & After-Run Coolant Pump V51 Electrical Harness Connector
Courtesy of AUDI OF AMERICA, LLC

-- Pull after-run coolant pump -V51-, with coolant hoses connected, downward out of rubber loops of retainer. Spray rubber loops with silicon-free lubricant if necessary.

NOTE: Coolant pump remains on the engine with coolant hoses connected.

-- Remove bolts -1 to 5- and remove accessory assembly bracket.

-- Screw T40074 to cylinder block -arrows- and tighten to 20 Nm.

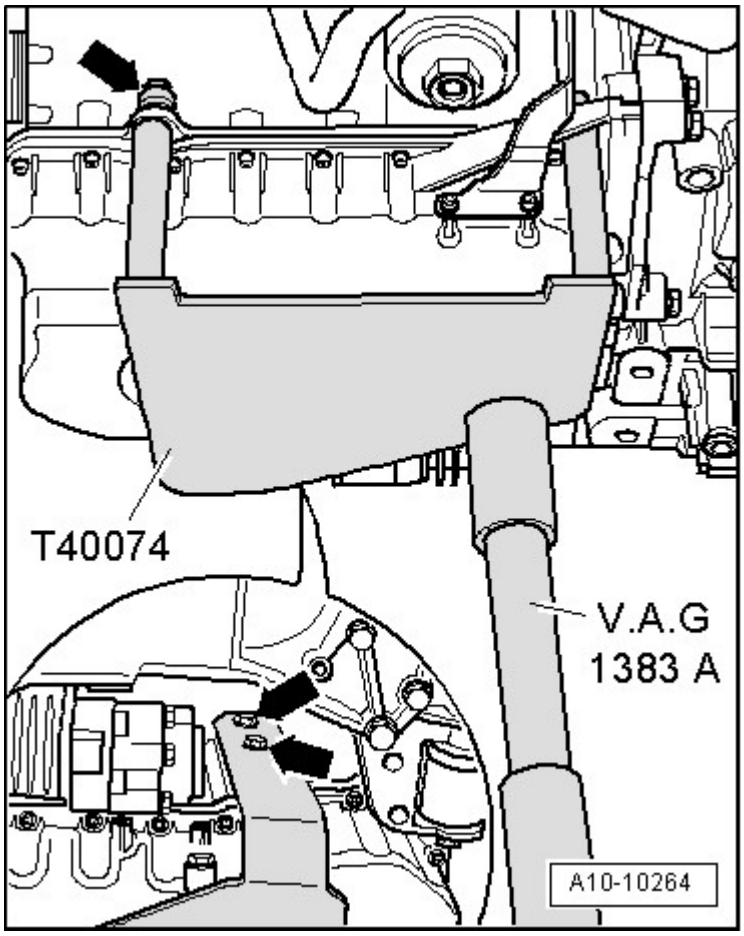

Fig. 73: Engine Mount T40074 To Cylinder Block Bolts
Courtesy of AUDI OF AMERICA, LLC

-- Insert V.A.G 1383 A at T40074 and raise engine/transmission slightly.

NOTE: Use VAS 5085 to remove bolts for assembly mounting.

-- Remove subframe mounting bolts at engine -arrows-.

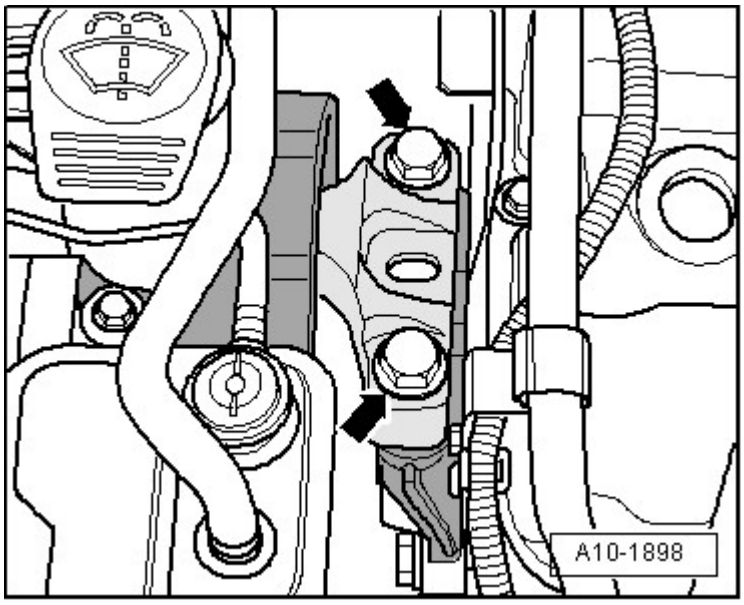

Fig. 74: Identifying Engine Mount To Engine Mount Bracket Bolts
Courtesy of AUDI OF AMERICA, LLC

-- Remove subframe mounting bolts at transmission -arrows-.

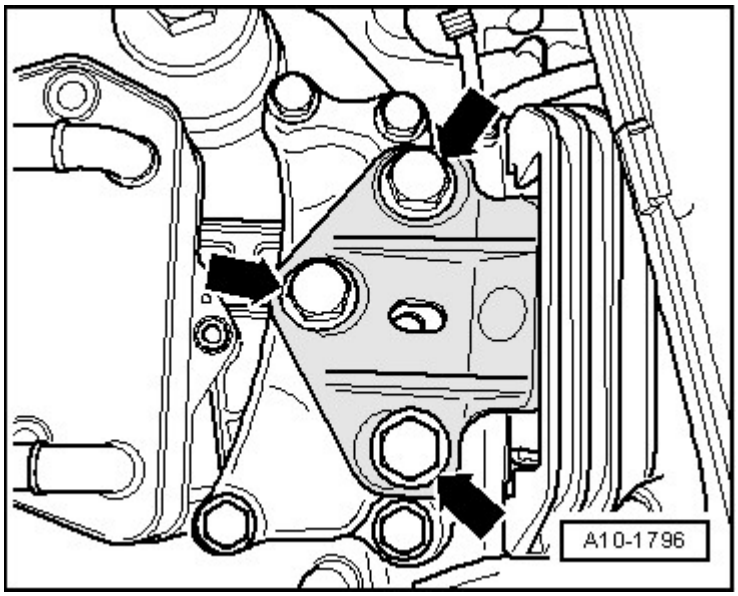

Fig. 75: Identifying Engine Mount To Engine Mount Bracket Bolts
Courtesy of AUDI OF AMERICA, LLC

NOTE: Verify that all hose and line connections between engine, transmission and body have been disconnected.

While lowering, carefully guide engine/transmission assembly in order to prevent damages.

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

ENGINE AND DSG TRANSMISSION, SEPARATING

Special tools and workshop equipment required

- Shop Crane VAS 6100
- Bracket T10013
- Bolt M8x40 with nut and washer exterior dia. 30 mm

Procedure

- Engine/transmission assembly removed and mounted on engine mount.

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

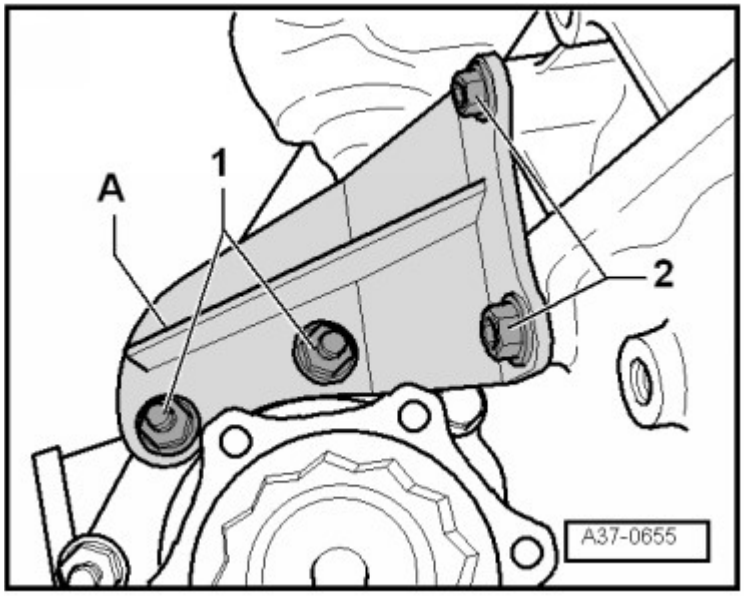

Fig. 76: Bevel Box Bracket & Bolts
Courtesy of AUDI OF AMERICA, LLC

-- Disconnect coolant hoses -arrows- at transmission oil cooler.

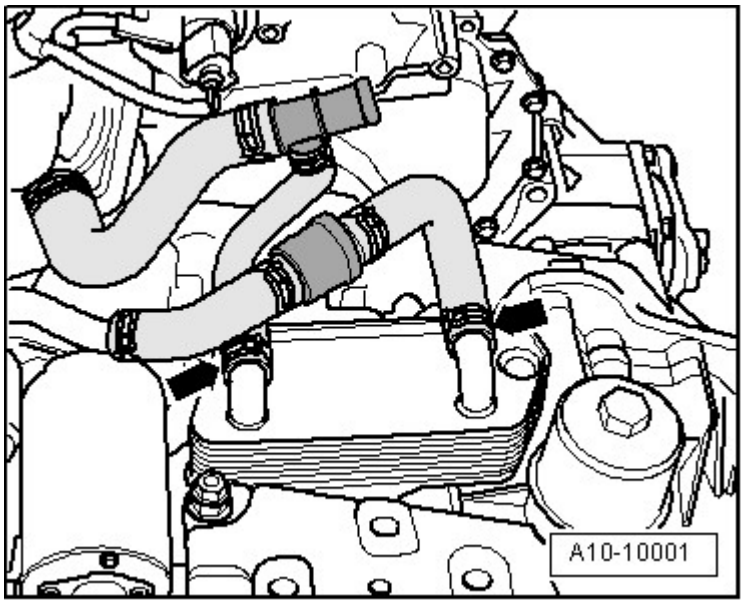

Fig. 77: Transmission Oil Cooler Coolant Hoses
Courtesy of AUDI OF AMERICA, LLC

-- Remove bolts from T10013 by releasing circlip.

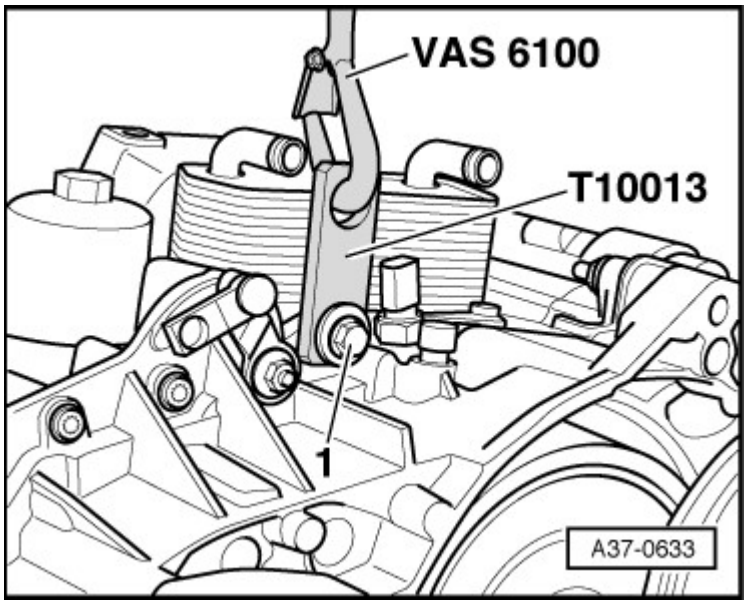

Fig. 78: Attaching Workshop Crane VAS 6100 To Bracket T10013
Courtesy of AUDI OF AMERICA, LLC

-- Secure T10013 with bolt M8x40 and a washer exterior dia. 30 mm to transmission lifting eye.

-- Engage VAS 6100 at T10013.

-- Remove bolts -1-, -2- and -5 to 10- at engine/transmission flange.

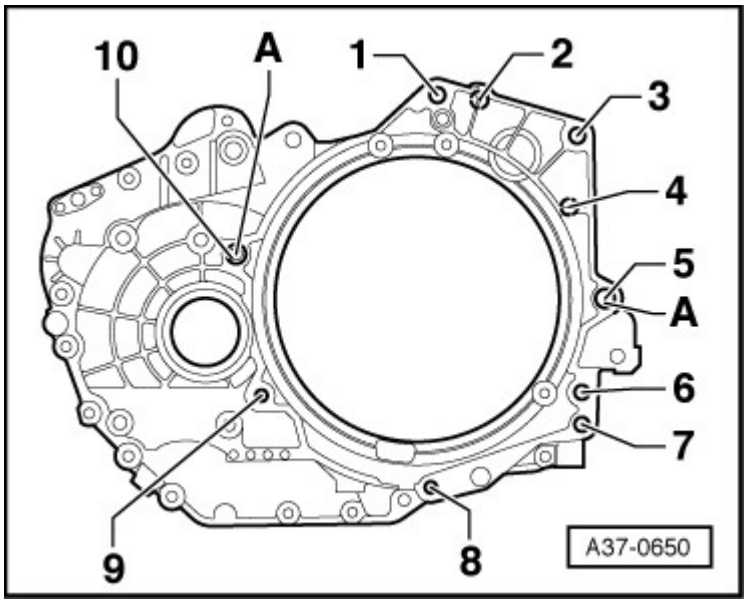

Fig. 79: Identifying Bolts On Engine/Transmission Flange
Courtesy of AUDI OF AMERICA, LLC

-- Pull transmission off from engine.

ENGINE, INSTALLING

Installation is in reverse order of removal, note the following:

NOTE: Always replace self-locking nuts, bolts which have been tightened to tightening specifications as well as gaskets and O-rings.

Secure all hose connections with hose clamps appropriate for the model.

-- Make sure alignment sleeves for engine to transmission are installed in cylinder block. Install if necessary.

-- A pilot needle bearing must be installed in the crankshaft in engines for vehicles with DSG transmission. Install needle bearing if necessary. Refer to **NEEDLE BEARING IN CRANKSHAFT** .

-- Bolt transmission to engine.

-- Secure with new bolts.

NOTE: Tightening specifications only apply to lightly greased, oiled, phosphated or blackened nuts and bolts.

Additional lubricants, such as engine or transmission oil are permissible, although lubricants containing graphite are not.

Do not use any degreased parts.

Tolerance for tightening specifications ±15%.

Securing engine/DSG transmission

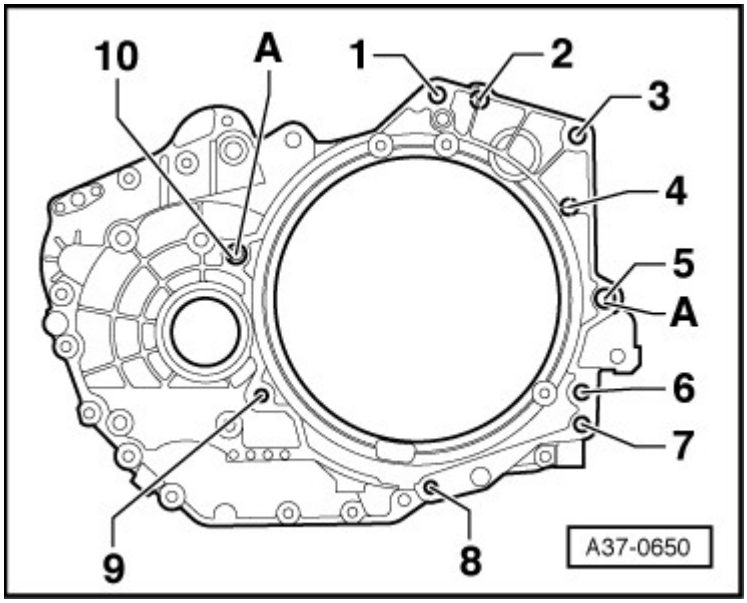

Fig. 80: Identifying Bolts On Engine/Transmission Flange
Courtesy of AUDI OF AMERICA, LLC

Item	Bolt	Nm
1	M12x55	80
2 (1)(2)	M10x40	40
3 (1), 6	M12x55	80
4 (2), 9	M10x45	40
5	M12x65	80
7, 8	M10x50	40
10	M12x70	80
A	Alignment sleeves for centering	

(1) Bolt with threaded pin M8.

(2) Screw only serves to secure starter to transmission.

-- Remove bevel box bracket -A- while observing the following installation sequence:

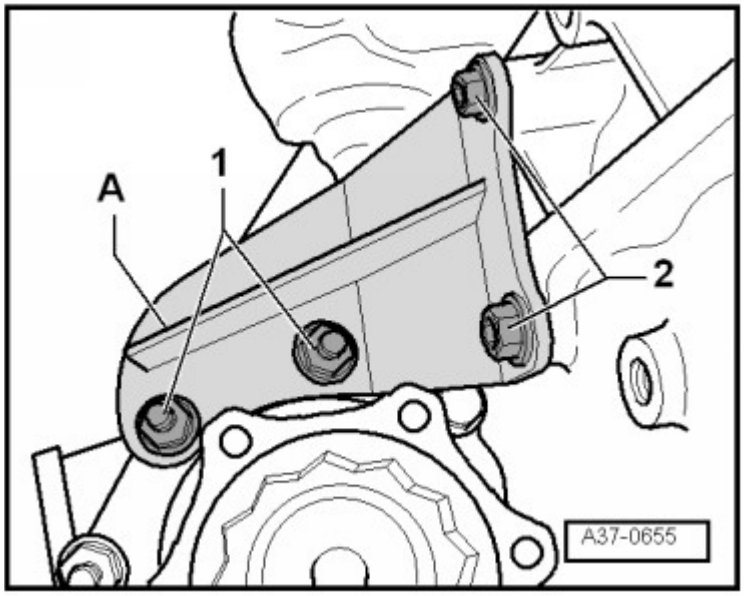

Fig. 81: Bevel Box Bracket & Bolts
Courtesy of AUDI OF AMERICA, LLC

-- First tighten bolts -1- to 3 Nm.

-- Tighten the bolts -2- to 35 Nm.

-- Finally tighten bolts -1- to 45 Nm.

-- Guide the engine/transmission assembly into the body.

-- Next, hand tighten the engine support bolts to the engine mounts -arrows-.

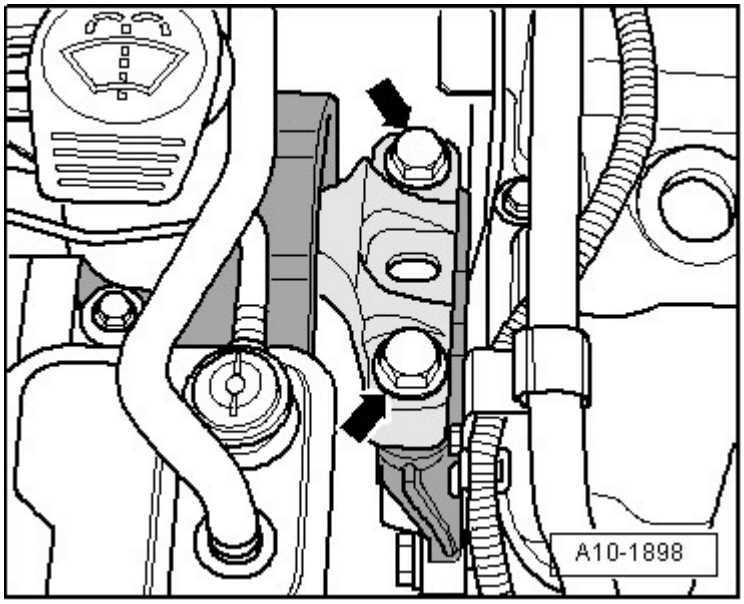

Fig. 82: Identifying Engine Mount To Engine Mount Bracket Bolts

Courtesy of AUDI OF AMERICA, LLC

-- Next tighten the transmission mount bolts to the transmission support -arrows-.

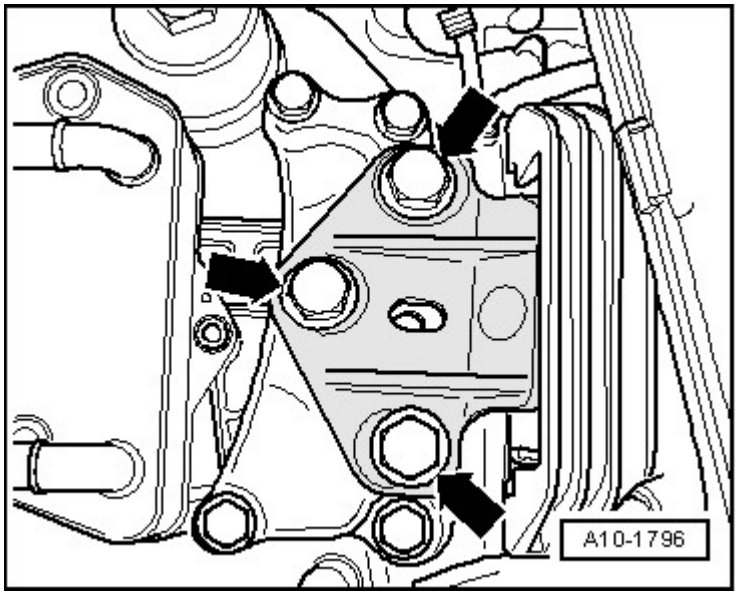

Fig. 83: Identifying Engine Mount To Engine Mount Bracket Bolts
Courtesy of AUDI OF AMERICA, LLC

-- Secure with new bolts.

NOTE: The bolts are first tightened to final torque after the engine mounts have been adjusted. Refer to SUBFRAME MOUNT, ADJUSTING.

-- Remove engine/transmission support from engine.

-- Install drive axles. Refer to **Removal and Installation** .

NOTE: Drive axles must be installed before any further installation.

-- Fasten pendulum support to transmission with new bolts items -2 and 3-.

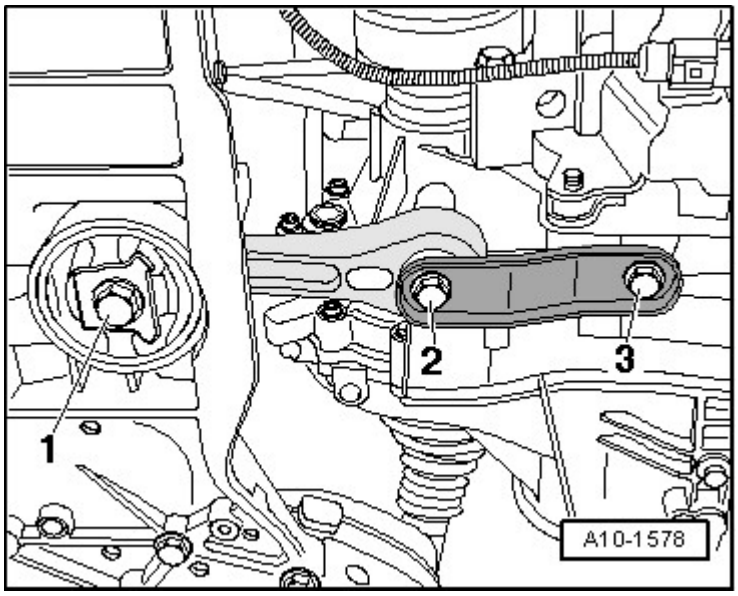

Fig. 84: Identifying Pendulum Support & Bolts
Courtesy of AUDI OF AMERICA, LLC

-- Press engine/transmission assembly toward bulkhead, bevel box pins must be carefully guided into driveshaft flange when doing so.

CAUTION: Seal -arrow- in driveshaft flange must not be damaged when installing engine/transmission assembly. If seal is damaged, driveshaft must be replaced.

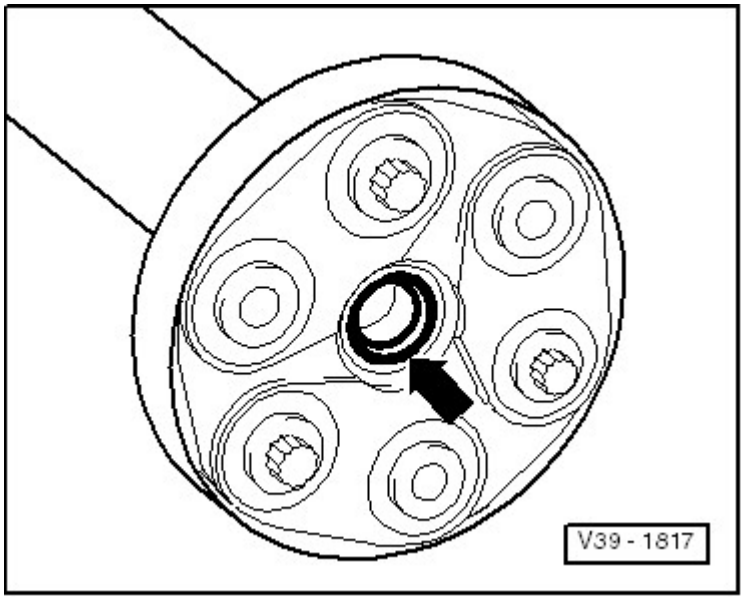

Fig. 85: Identifying Sealing Ring In Driveshaft Flange
Courtesy of AUDI OF AMERICA, LLC

-- Fasten pendulum support to subframe with new bolt -1-.

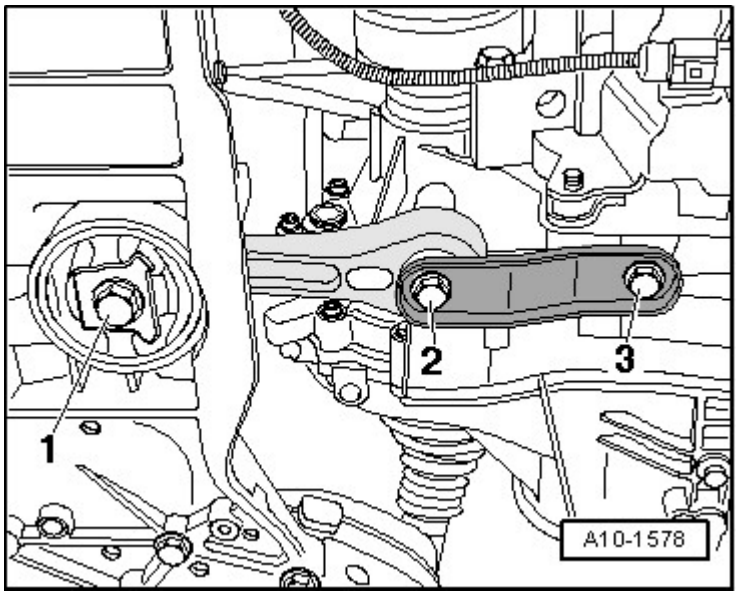

Fig. 86: Identifying Pendulum Support & Bolts
Courtesy of AUDI OF AMERICA, LLC

-- Fasten driveshaft with flexible disc to bevel box flange -arrows-.

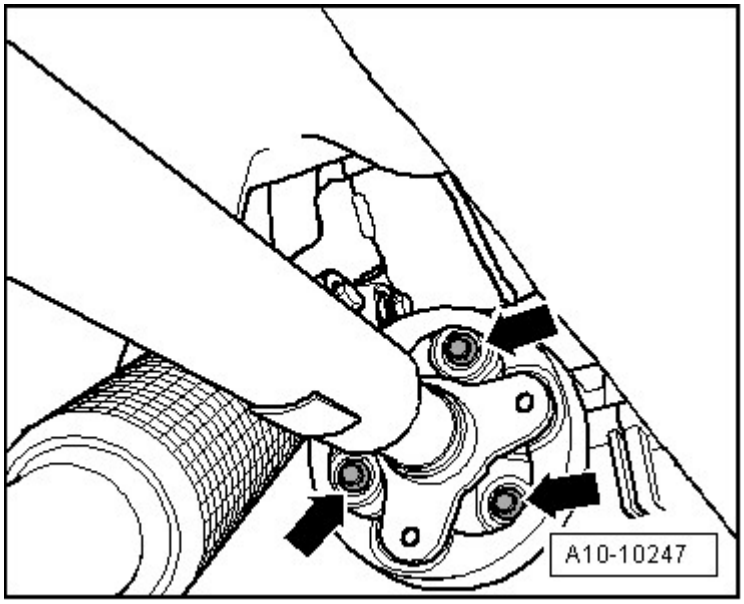

Fig. 87: Driveshaft Flexible Disc
Courtesy of AUDI OF AMERICA, LLC

Further installation is in reverse order of removal, note the following:

-- Install exhaust system and align it free of stress. Refer to **EXHAUST SYSTEM, INSTALLING** .

-- Install selector lever cable. Refer to **SELECTOR LEVER CABLE** .

-- Install bracket for assemblies. Refer to **ACCESSORY ASSEMBLY BRACKET** .

-- To make it easier to install the generator, drive the bushings for the retaining bolts back slightly.

-- Install generator. Refer to **Removal and Installation** .

-- Install air conditioning compressor.

-- Install fan shroud. Refer to **COOLANT FAN AND COOLANT FAN 2** .

-- Install Secondary Air Injection (AIR) pump. Refer to **SECONDARY AIR INJECTION PUMP** .

-- Install ribbed belt. Refer to **RIBBED BELT** .

-- Adjust the engine mounts. Refer to **SUBFRAME MOUNT, ADJUSTING**.

-- Install windshield wiper arms. Refer to **WINDSHIELD WIPER ARMS** .

-- Electrical connections and routing. Refer to appropriate SYSTEMS WIRING DIAGRAM.

-- Connect Ground (GND) wire to battery. Refer to **REMOVAL AND INSTALLATION** .

-- Check oil level. Refer to **OIL LEVEL, CHECKING** .

CAUTION: Do not use a battery charger for starting assistance! There is the risk that the vehicle control modules could be damaged.

-- Fill with coolant: **FILLING** .

NOTE: Only reuse drained coolant if cylinder head or engine block was not replaced.

Dirty coolant must not be re-used.

Tightening Specifications

Component		Nm
Bolts/nuts	M6	10
	M7	15
	M8	20
	M10	40
	M12	65
Exceptions:		
Pendulum Supports to Transmission		40 + 90° (2)(1)

Pendulum Supports to Subframe	100 + 90° (2)(1)
Flexible Disc to Flange	60
Front Exhaust Pipe to Exhaust Manifold	40 (2)
Driveshaft Heat Shield to Bevel Box	23
Clamp B+ to Starter	16
Ground (GND) Strap to Transmission	22
(1) 90° corresponds to a 1/4 turn (2) Replace bolts and nuts.	

SPECIAL TOOLS

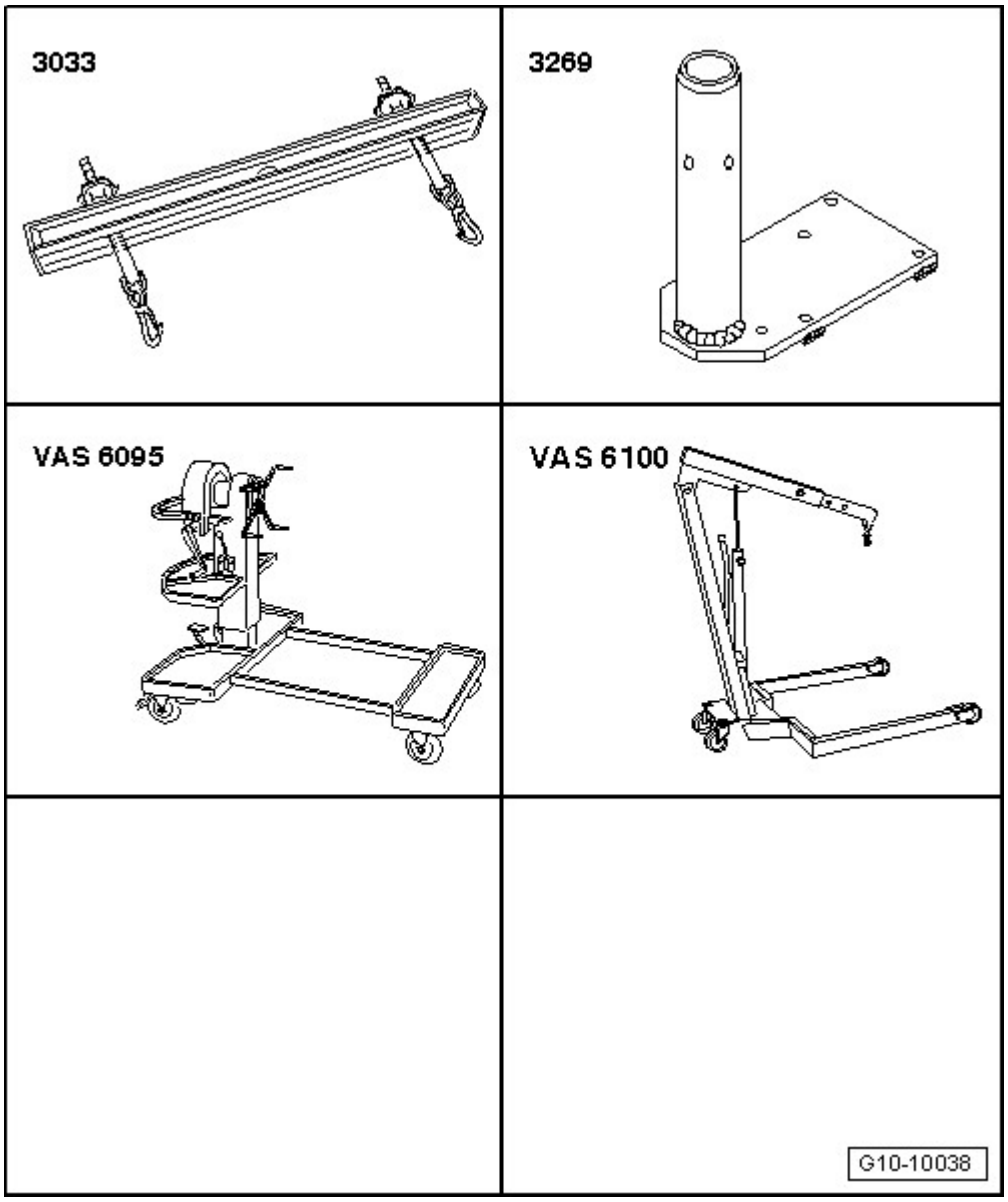

Fig. 88: Engine, Securing To Engine And Transmission Holder - Special Tools, Testers And Auxiliary Items Required
Courtesy of AUDI OF AMERICA, LLC

Special tools and workshop equipment required

- Lifting Tackle 3033
- Engine Support 3269
- Engine and Transmission Holder VAS 6095
- Shop Crane VAS 6100

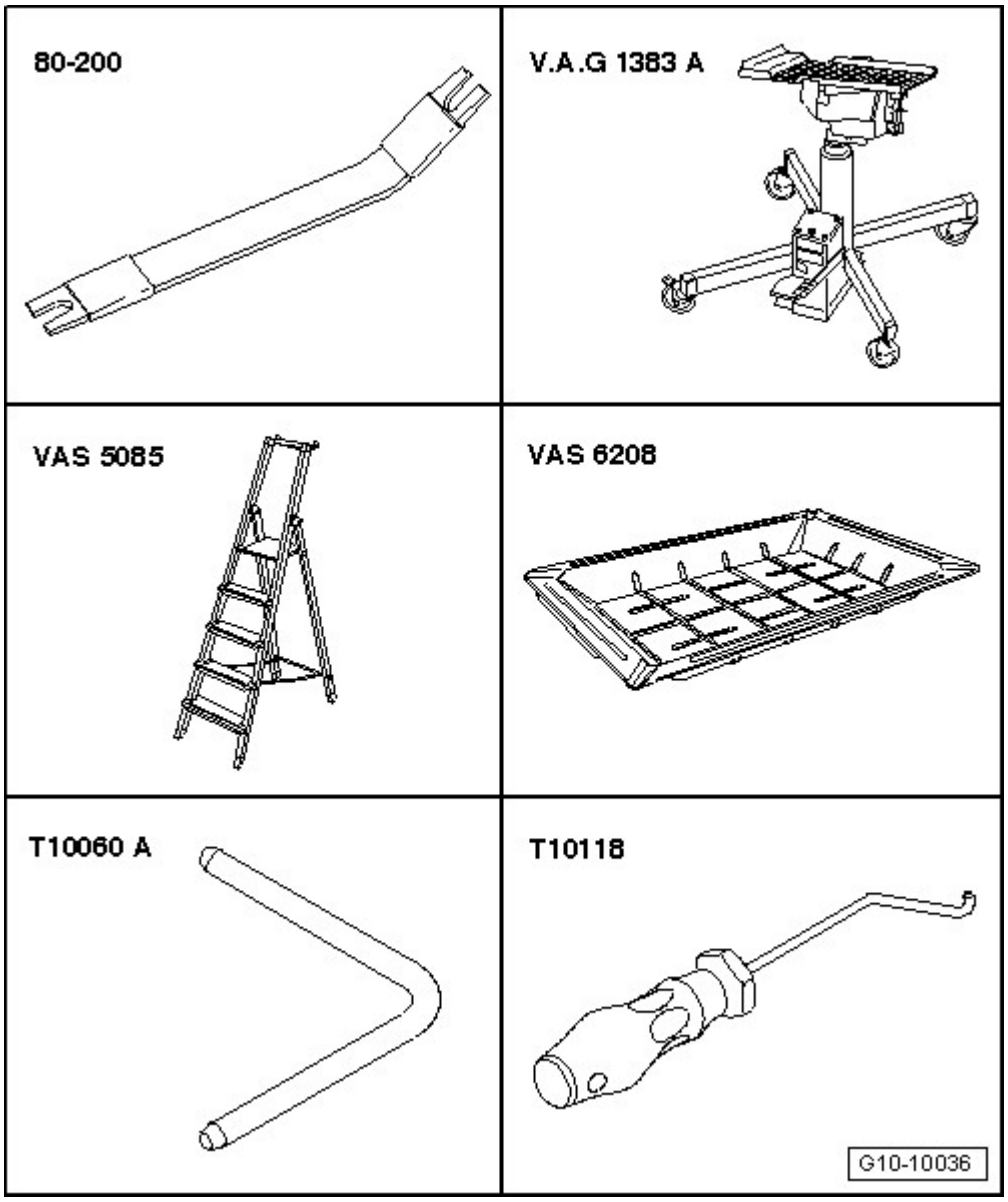

Fig. 89: Engine, Removing And Installing - Special Tools, Testers And Auxiliary Items Required
Courtesy of AUDI OF AMERICA, LLC

Special tools and workshop equipment required

- Pry Lever - Rmv Outside Mirror 80 - 200
- Engine/Transmission Jack V.A.G 1383 A
- Step Ladder VAS 5085
- Drip Tray for VAS 6100 VAS 6208
- Mandrel T10060 A
- Assembly Tool T10118

Special tools and workshop equipment required

- Torque Wrench SAT 8010/3

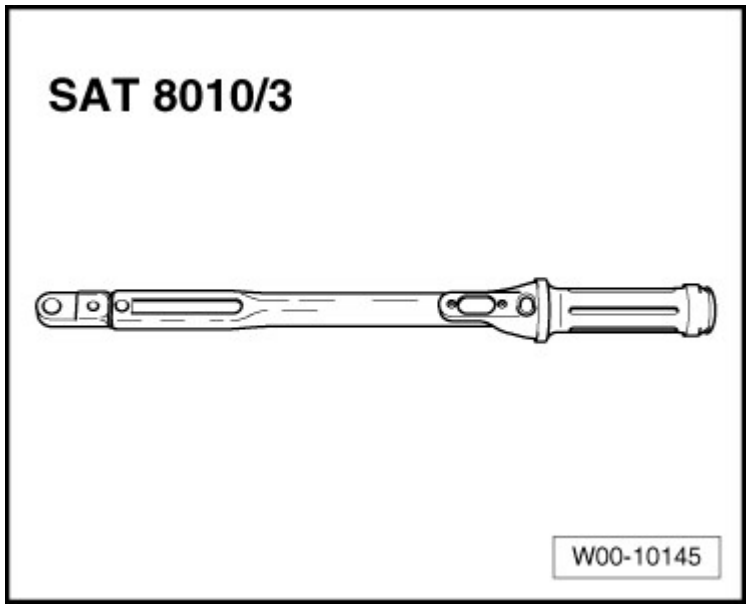

Fig. 90: Engine Mount T40074
Courtesy of AUDI OF AMERICA, LLC

- Engine Support Bridge 10-222 A

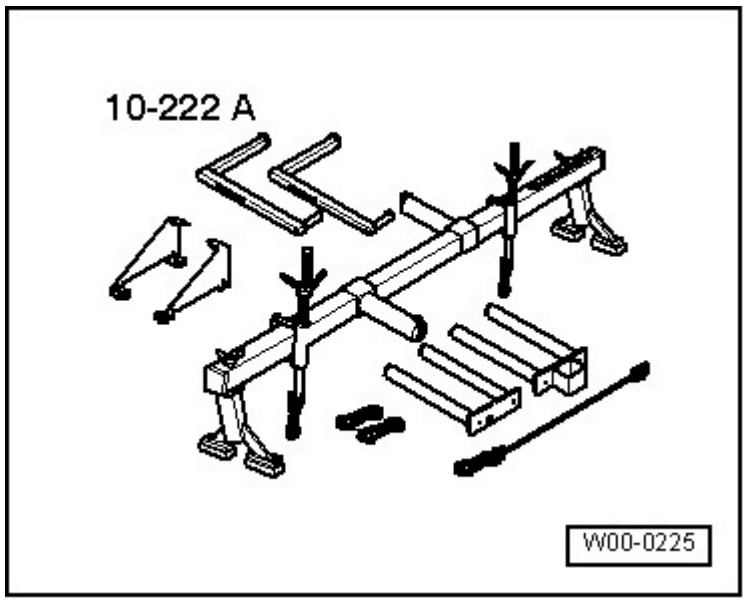

Fig. 91: Engine Support Bridge 10 - 222 A
Courtesy of AUDI OF AMERICA, LLC

- Shop Crane VAS 6100

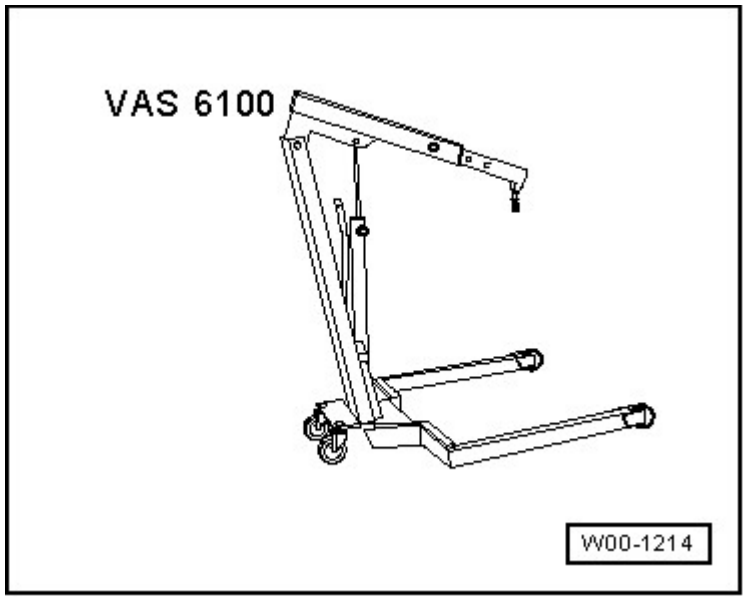

Fig. 92: Identifying Shop Crane VAS 6100
Courtesy of AUDI OF AMERICA, LLC

- Bracket T10013

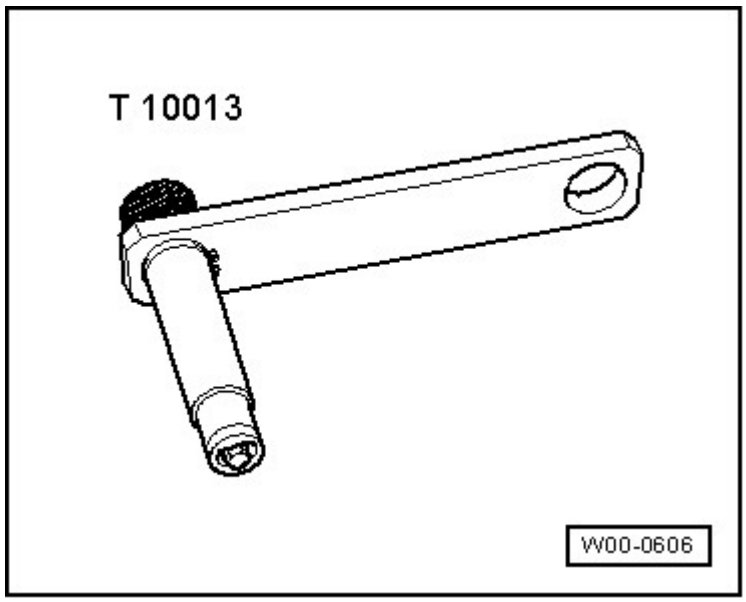

Fig. 93: Bracket T10013
Courtesy of AUDI OF AMERICA, LLC

