

ENGINE**3.6 Liter - General, Technical Data - Engine Mechanical - Engine Code(s): BHK****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 components of the fuel injection system, pressure must be relieved to residual pressure.
- To reduce residual pressure, lay a clean cloth around connector and carefully loosen connector.

-- Procedures before opening high pressure fuel injection system **RELEASING FUEL PRESSURE ON HIGH PRESSURE SIDE.**

To Prevent Personal Injury and Damage to the Ignition System, Observe the Following:

- The ignition must be switched off before connecting or disconnecting injection and ignition system wiring or tester cables.
- 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.

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

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

-- Disconnect battery **BATTERY, DISCONNECTING AND CONNECTING** .

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.**

If It Is Necessary to Use Testing and Measuring Devices on Road Tests, Observe the Following:

WARNING: Risk of accident due to distraction and testing and measuring instruments not being sufficiently secured.

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.**

RELEASING FUEL PRESSURE ON HIGH PRESSURE SIDE

- The fuel injection system is separated into a high pressure side (max. approximately 120 bar) and a low pressure side (approximately 6 bar).
- Before opening the high pressure side, the fuel pressure must be reduced to a residual pressure of approximately 6 bar. The procedure for this is as follows.

Special tools and workshop equipment required

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

Procedure

-- Connect vehicle diagnosis, testing and information system VAS 5051B.

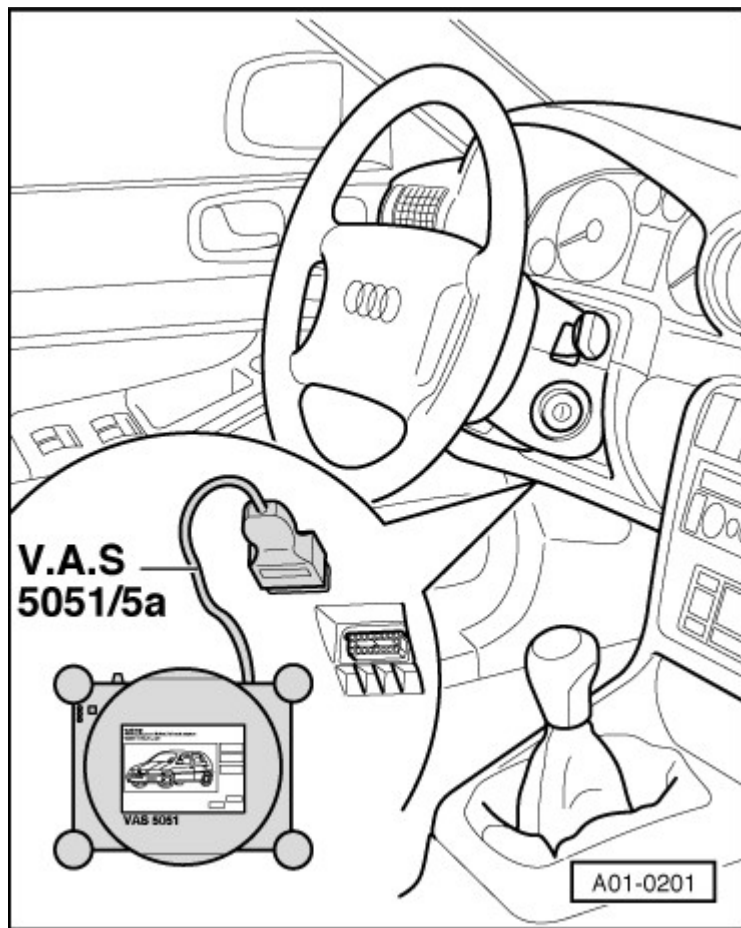


Fig. 1: Checking DTC Memory With VAS 5051
Courtesy of AUDI OF AMERICA, LLC

Display on VAS 5051B:

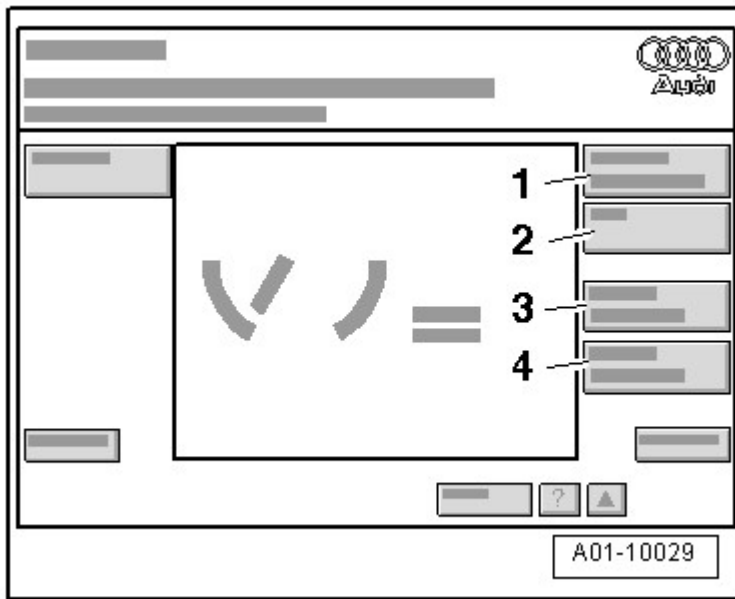


Fig. 2: Identifying Display On VAS 5051B - Vehicle Self-Diagnosis Button
 Courtesy of AUDI OF AMERICA, LLC

-- Start engine and let run at idle.

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

Display on VAS 5051B:

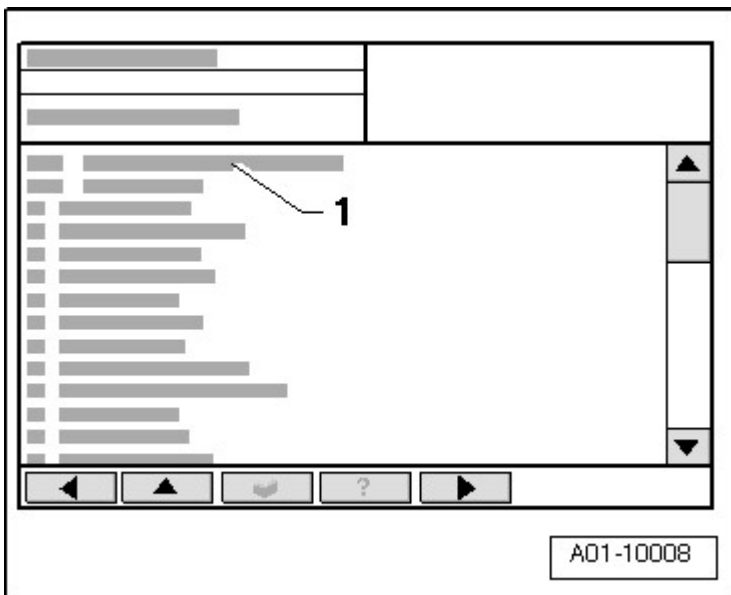


Fig. 3: Identifying Display On VAS 5051 - "01 - Engine Electronics"
 Courtesy of AUDI OF AMERICA, LLC

-- In selection -1-, press "01 - Engine Electronics" vehicle system and continue by pressing --> button.

Display on VAS 5051B:



Fig. 4: Identifying Display On VAS 5051 - "006 - Basic Setting"

Courtesy of AUDI OF AMERICA, LLC

-- In selection -1-, press "011 - Measured Values" and continue by pressing --> button.

Display on VAS 5051B:

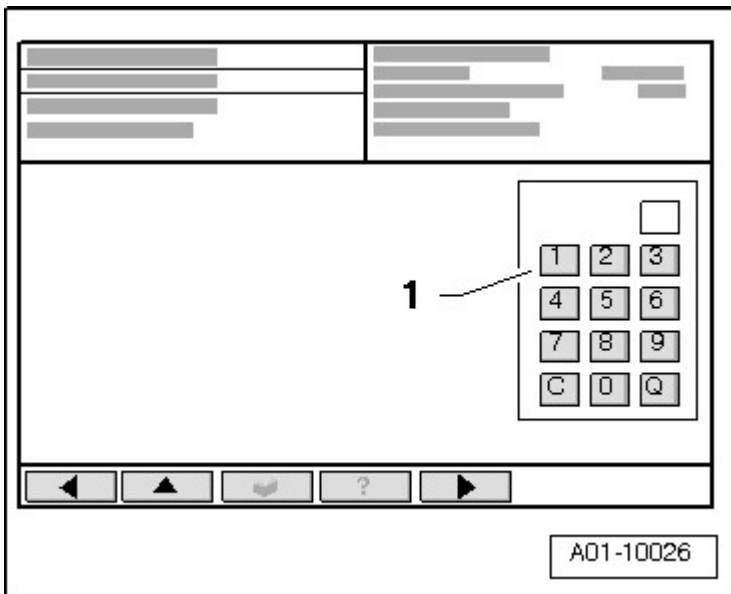


Fig. 5: Identifying Display On VAS 5051 - "Display Group 140"

Courtesy of AUDI OF AMERICA, LLC

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

Display on VAS 5051B:

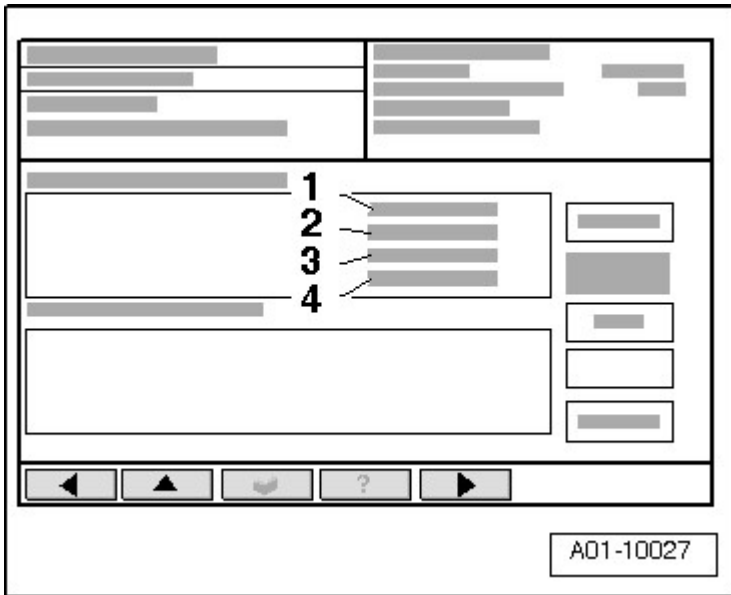


Fig. 6: Identifying Display On VAS 5051 - (42%, 39.76 Bar, 40.63 Bar, Inactive)
Courtesy of AUDI OF AMERICA, LLC

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

Example:

3 - 40.63 bar

-- Disconnect electrical connector -arrow- on fuel metering valve -N290- on lower left high pressure pump at rear of engine.

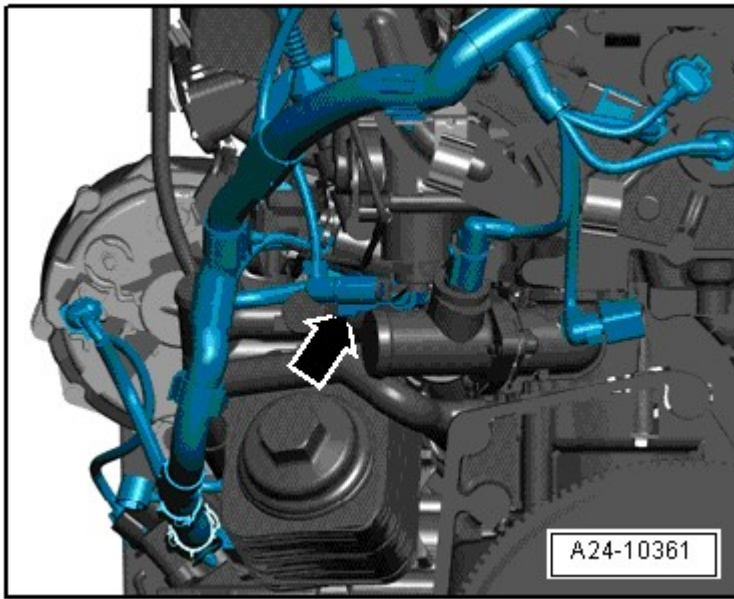


Fig. 7: Locating Fuel Metering Valve -N290-
Courtesy of AUDI OF AMERICA, LLC

NOTE: To provide a better illustration, component location is shown from behind with engine removed.

Display on VAS 5051B:

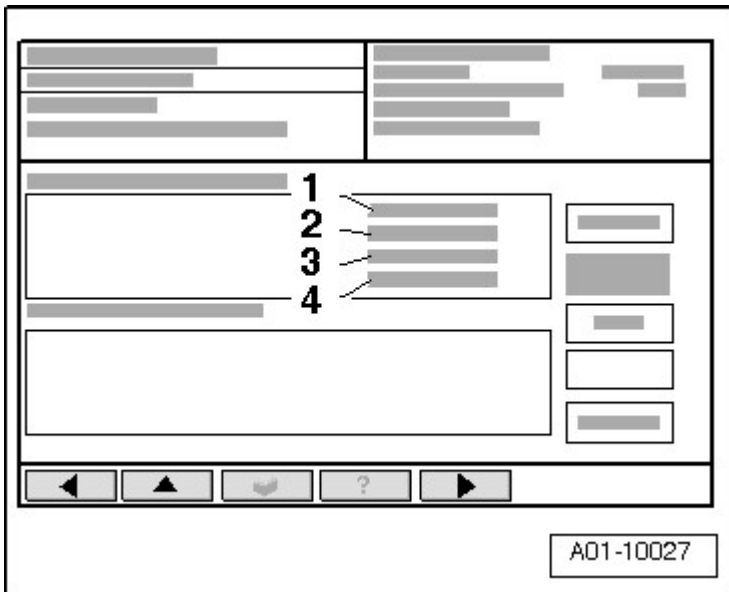


Fig. 8: Identifying Display On VAS 5051 - (42%, 39.76 Bar, 40.63 Bar, Inactive)
Courtesy of AUDI OF AMERICA, LLC

-- Check read out in display field -3- :

- Fuel pressure in fuel rail must sink to approximately 6 bar.

-- Switch off ignition.

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 eye wear 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 wire at connection immediately.

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

Final Procedures

-- Reconnect electrical connectors.

Faults are saved in ECM when electrical connectors are disconnected:

-- Connect vehicle diagnosis, testing and information system VAS 5051B.

-- Start "Guided Functions" operating mode.

-- Generate readiness code in ECM.

CLEAN WORKING CONDITIONS

Even a little contamination can lead to faults. When working on fuel supply and fuel injection system, observe the following rules of cleanliness:

- Before loosening, connections and surrounding areas must be cleaned thoroughly with engine or brake cleaner, and then cleaned area must be dried completely.
- Immediately seal off lines and connections with clean plugs or protective caps.
- Place removed parts on a clean surface and cover them with lint free cloths.
- Only install clean components: Only unpack replacement parts immediately prior to installation. Do not use parts that have been stored unpackaged (e.g. 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") is located at front near crankshaft ribbed belt pulley - arrow-.

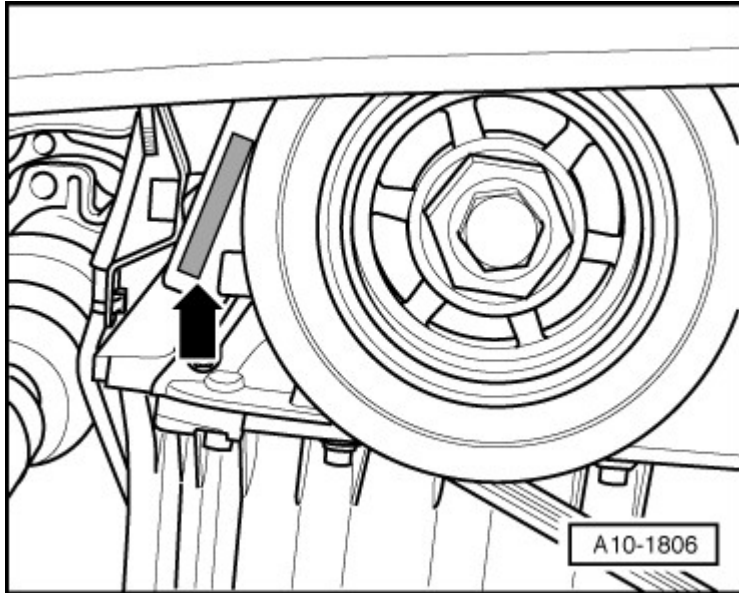


Fig. 9: Locating Engine Number
Courtesy of AUDI OF AMERICA, LLC

- In addition, a sticker with "engine code" and "serial number" is affixed to back of cylinder head cover.
- The engine code is also located on the vehicle data plate.

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

LINE ROUTING AND SECURING

If hydraulic lines, vacuum lines and electrical lines are loosened or removed and installed, make sketches or take photos. This ensures correct installation.

FUEL SUPPLY SYSTEM LEAK TEST

- Let engine run a few minutes at average RPM.
- Switch off ignition.
- Check entire fuel supply system for leaks.
- If there are leaks in spite of correct tightening torque, the corresponding component must be replaced.
- Afterwards, perform test drive, fully depressing the accelerator pedal at least once.
- Then, check high pressure areas for leaks again.

CONTACT CORROSION

Contact corrosion can occur if appropriate connecting elements (bolts, nuts, washers, etc.) are not 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 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.

SPECIFICATIONS

ENGINE DATA

Code letters		BHK
Displacement	ltr.	3.580
Output	kW at RPM	206 at 6200
Torque	Nm at RPM	360 at 2800
Bore	dia. mm	89.0
Stroke	mm	95.9
Compression ratio		12.0
RON	min.	98 ⁽¹⁾
Fuel injection and ignition system		Motronic
Ignition sequence		1-5-3-6-2-4
Exhaust gas recirculation		no
Charging		no
Oxygen sensor regulation		4 sensors
Variable valve timing		yes
Variable intake manifold		yes
Secondary Air Injection (AIR) system		no
Valves per cylinder		4

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

SPECIAL TOOLS

Special tools and workshop equipment required

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

ENGINE

3.6 Liter - Engine - Assembly - Engine Code(s): BHK

10 ENGINE - ASSEMBLY

GENERAL INFORMATION

ENGINE AND TRANSMISSION, SEPARATING

Special tools and workshop equipment required

- Bracket 30-211 A
- Support set VAS 6131/10 and supplementary set VAS 6131/12 and supplementary set VAS 6131/13
- M10 x 65 bolt

Procedure

- Engine/transmission assembly removed and placed on scissor lift table VAS 6131 A.

NOTE: **When installing, place all cable ties and protective boots in same locations.**

-- Equip scissor lift table VAS 6131 A with supplementary set VAS 6131/10 and additional parts from supplementary set VAS 6131/12 and supplementary set VAS 6131/13 as follows:

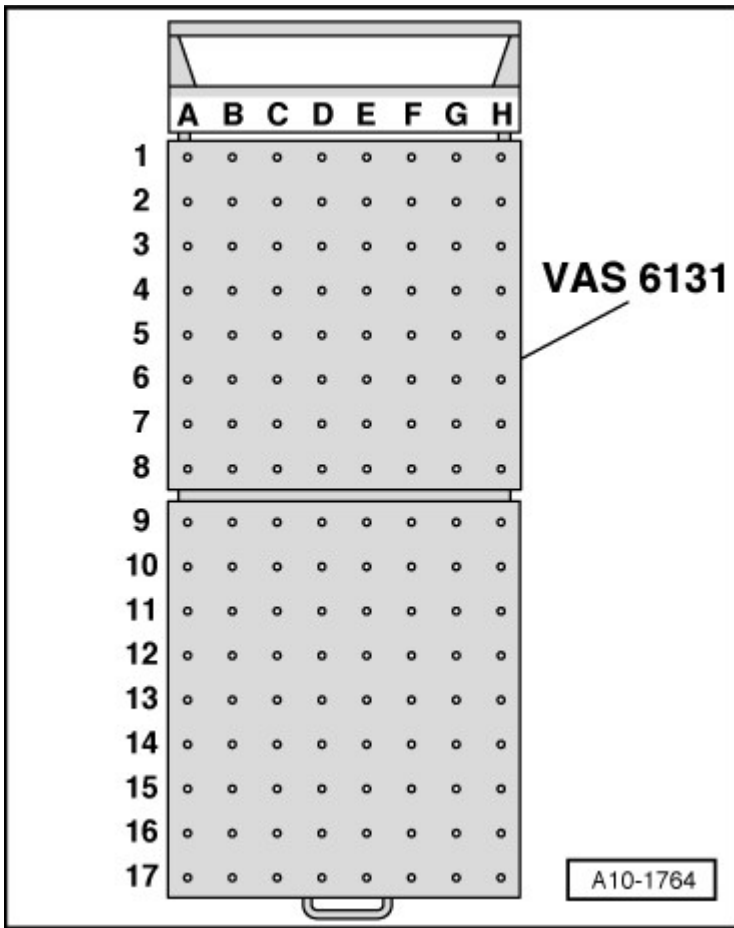


Fig. 1: Identifying Scissor Lift Platform VAS 6131

Courtesy of AUDI OF AMERICA, LLC

NOTE: The other attachments remain unchanged.

Platform coordinates	Parts from support set VAS 6131/10, supplementary set VAS 6131/12 and supplementary set VAS 6131/13			
F1	/13-7			
C10	/10-1	/12-2	/10-5	/13-2
E10	/10-1	/12-2	/10-5	/13-2
G10	/10-1	/12-2	/10-5	/13-3

-- Disengage electrical connector at bracket -arrow-.

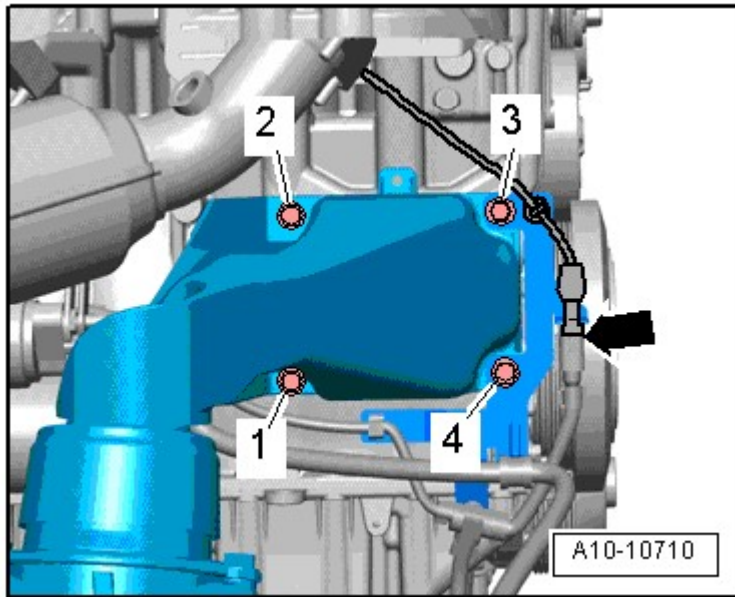


Fig. 2: Identifying Bolts -1 To 3- And Engine Supports With Engine Bracket
Courtesy of AUDI OF AMERICA, LLC

-- Remove bolt -4-.

NOTE: Ignore items -1, 2, 3-.

-- Secure joint support VAS 6131/13-7 at right front on engine support with bolt M10 x 65.

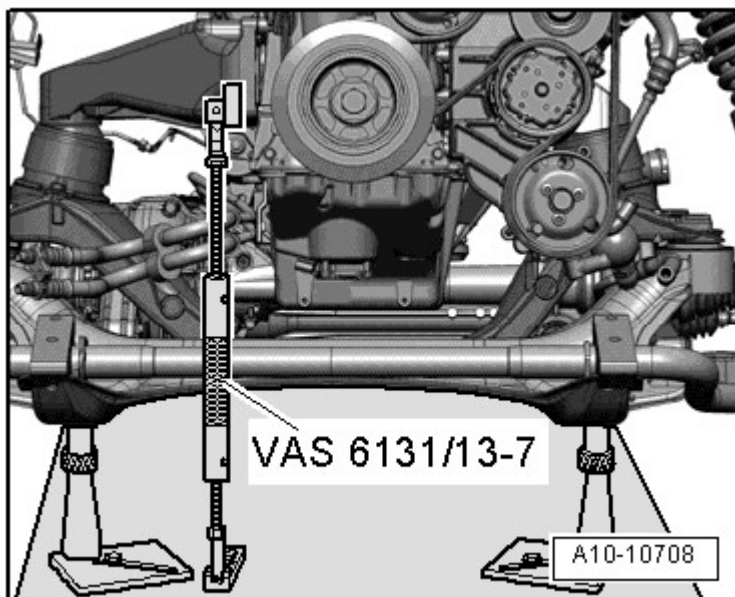


Fig. 3: Identifying Joint Support VAS 6131/13-7 From Engine
Courtesy of AUDI OF AMERICA, LLC

-- Secure joint support VAS 6131/13-7 on scissor lift table.

-- Attach mounting elements from VAS 6131/12 and VAS 6131/13 at front under transmission ATF oil pan as shown in illustration.

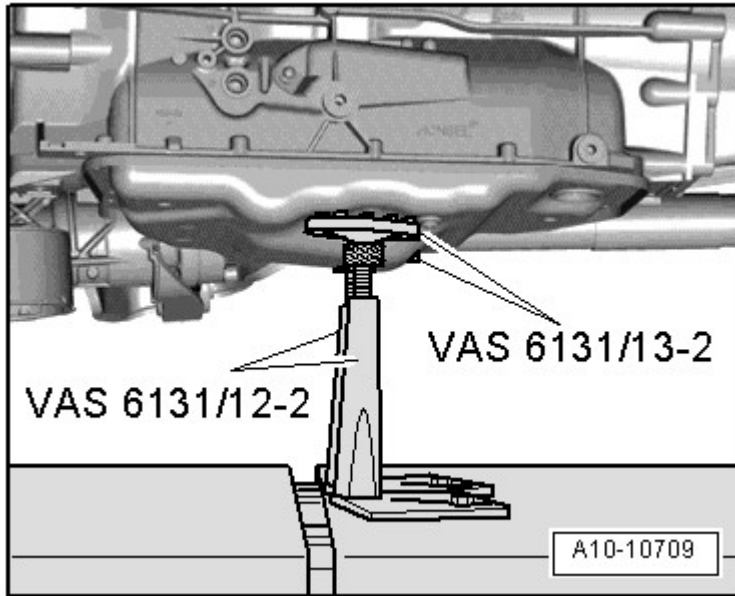


Fig. 4: Attaching Mounting Elements From VAS 6131/12 And VAS 6131/13 At Front Under Transmission ATF Oil Pan

Courtesy of AUDI OF AMERICA, LLC

-- Prepare mounting elements from VAS 6131/10, VAS 6131/12 and VAS 6131/13 for supporting driveshaft as shown in illustration.

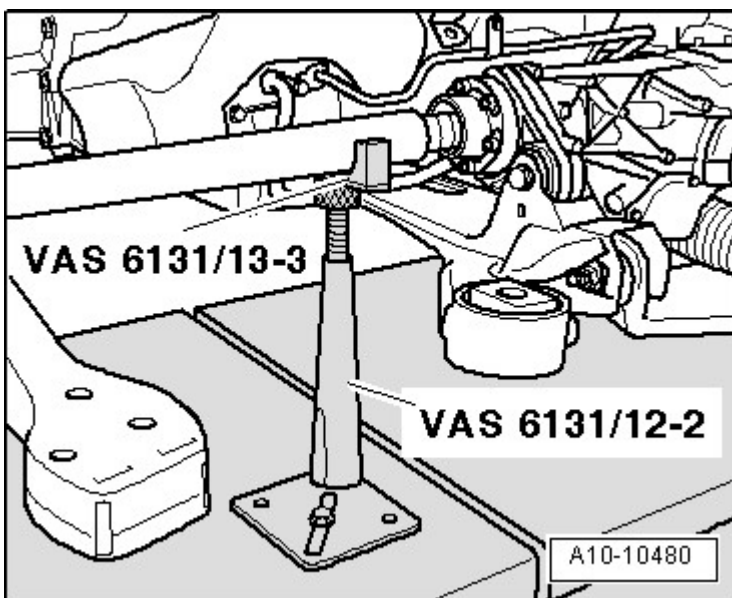


Fig. 5: Identifying Support Elements VAS6131/12 And VAS6131/13 To Support Driveshaft

Courtesy of AUDI OF AMERICA, LLC

-- Remove bolts -2- on main catalytic converter brackets.

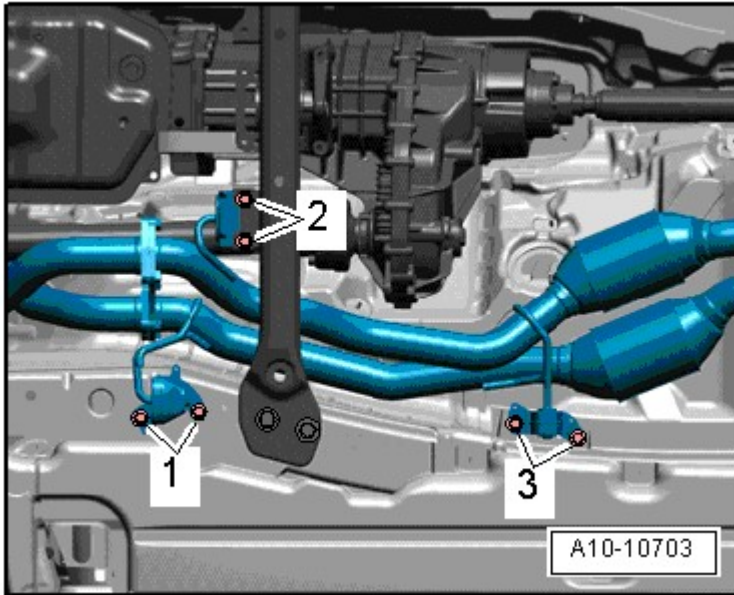


Fig. 6: Identifying Bolts -1, 2, 3- On Main Catalytic Converter Brackets
Courtesy of AUDI OF AMERICA, LLC

NOTE: Ignore items -1 and 3-.

Transmission carrier is shown installed in illustration.

-- Remove bolts -arrows- and remove main catalytic converters.

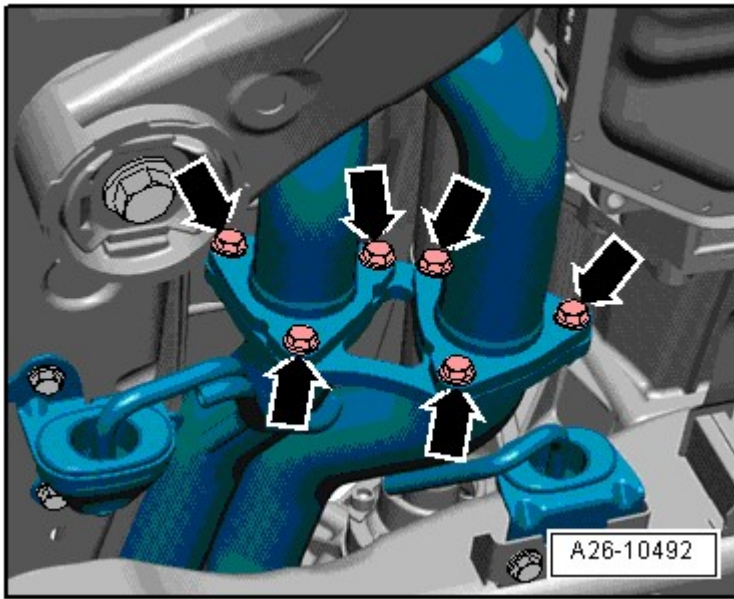


Fig. 7: Identifying Bolts -Arrows-, Primary Catalytic Converter Pipes, And Clamping Sleeves
Courtesy of AUDI OF AMERICA, LLC

-- Remove bolts -2- on primary converter brackets.

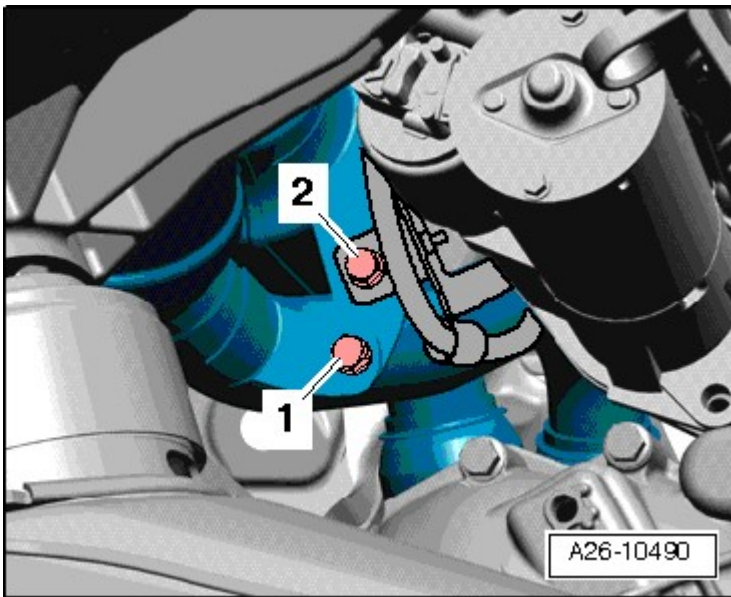


Fig. 8: Identifying Primary Catalytic Converter Bracket Bolts
Courtesy of AUDI OF AMERICA, LLC

NOTE: Ignore -1-.

-- Free up electrical wires to oxygen sensors.

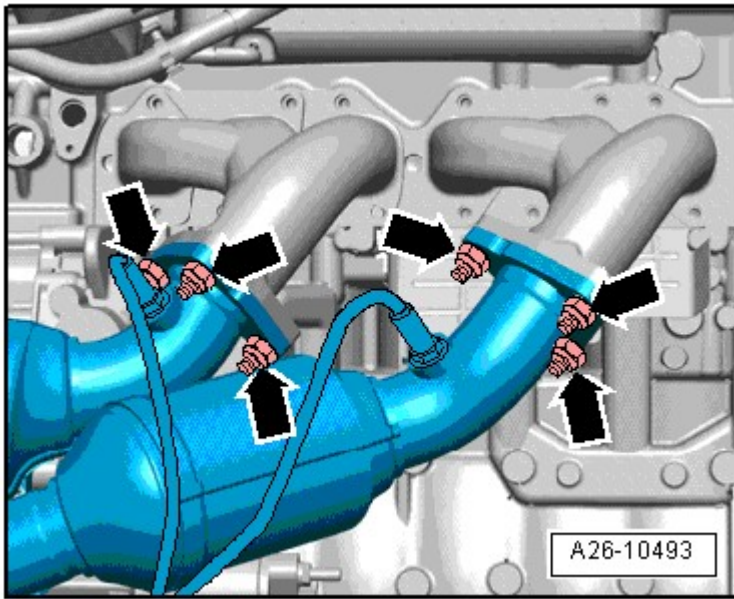


Fig. 9: Identifying Exhaust Pipe With Catalytic Converter To Exhaust Manifold Nuts -Arrows-
Courtesy of AUDI OF AMERICA, LLC

- Remove nuts -arrows- and remove primary catalytic converters.
- Remove bolts -arrows- at front driveshaft to transfer case connection.

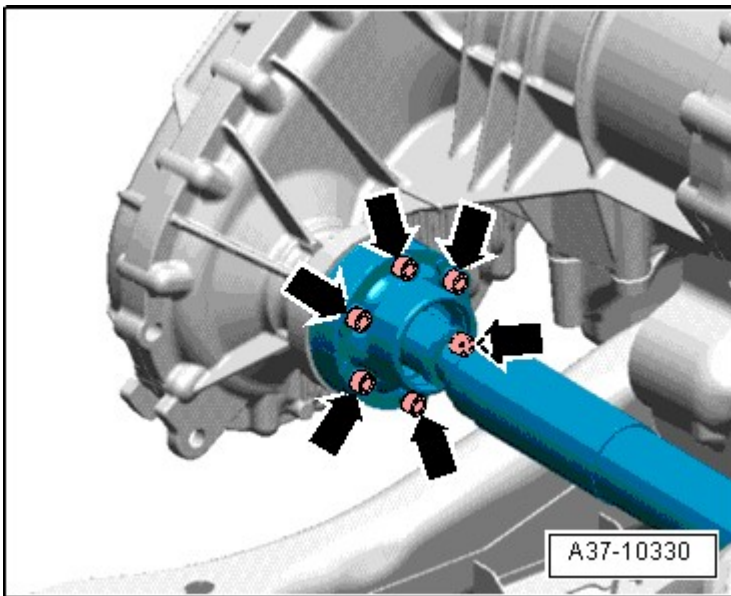


Fig. 10: Identifying Driveshaft Bolts -Arrows-
Courtesy of AUDI OF AMERICA, LLC

With 4 Zone Climate Control

- Remove rear coolant pipe bolts -1 and 2-.

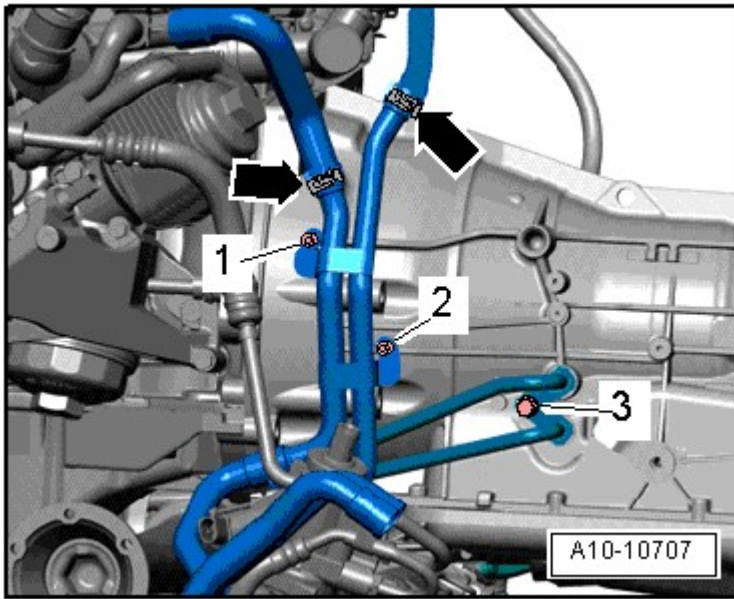


Fig. 11: Identifying Rear Coolant Pipe Bolts -1 To 2- And Bolt -3- For ATF Lines From Transmission
Courtesy of AUDI OF AMERICA, LLC

NOTE: Ignore -arrows-.

Continuation for All

NOTE: Place a cloth under separation point to catch escaping ATF.

Observe rules of cleanliness for working on automatic transmissions CLEAN WORKING CONDITIONS .

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

-- Remove bolt -arrow-.

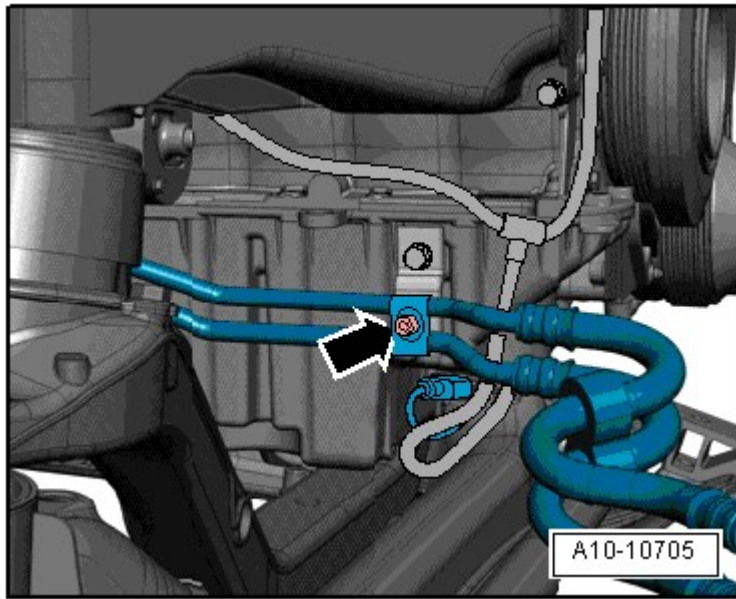


Fig. 12: Identifying Bolt -Arrow- To ATF Line Bracket
Courtesy of AUDI OF AMERICA, LLC

-- Leave ATF lines in installation location.

-- Remove B+ wire bolt -2- on bracket.

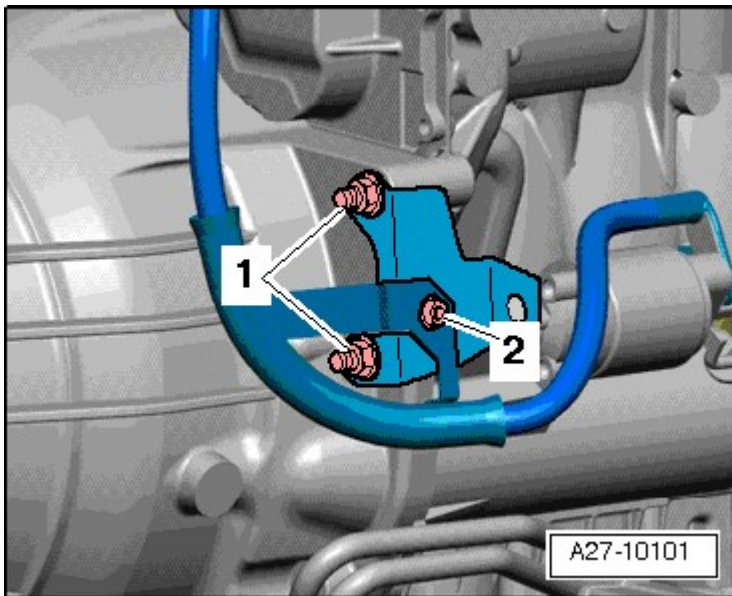


Fig. 13: Identifying Bolt -2- And Nuts -1-
Courtesy of AUDI OF AMERICA, LLC

-- Remove nuts -1- and bracket.

-- Remove heat insulation sleeve from starter.

-- Remove protective caps.

-- Remove electrical wires from starter:

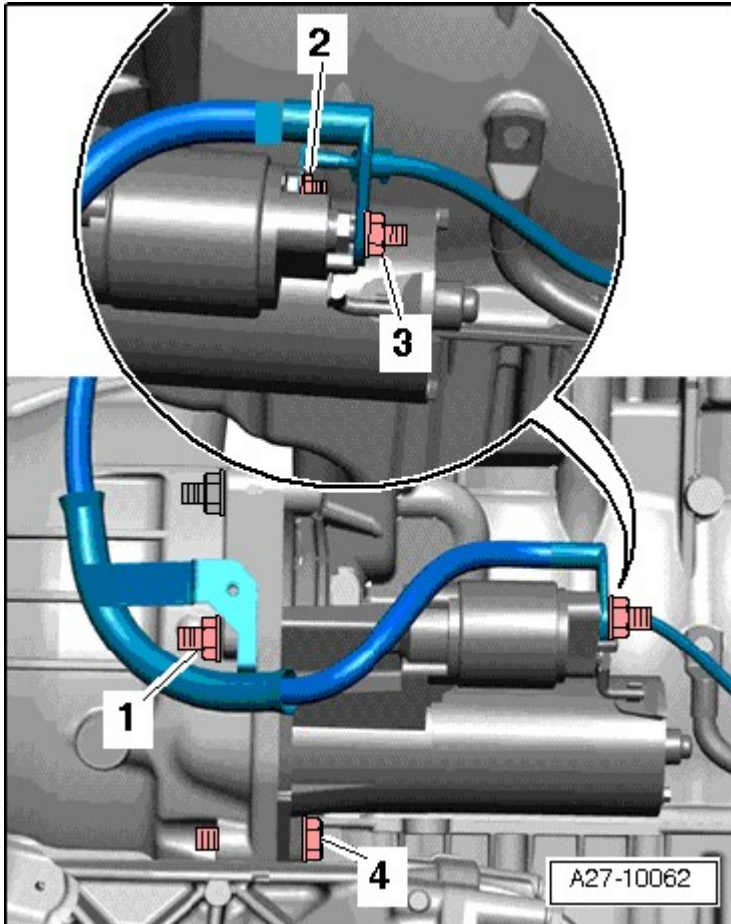


Fig. 14: Identifying Bolts -1 & 4- And Wire Brackets -2 & 3-
Courtesy of AUDI OF AMERICA, LLC

2 - Terminal 50

3 - B+ terminal

-- Disconnect threaded connections -1- and -4- and remove starter.

-- To loosen torque converter bolts, counter hold crankshaft at vibration damper bolt.

-- Remove 3 torque converter bolts -arrow- in opening for removed starter by rotating crankshaft $\frac{1}{3}$ further in direction of engine rotation.

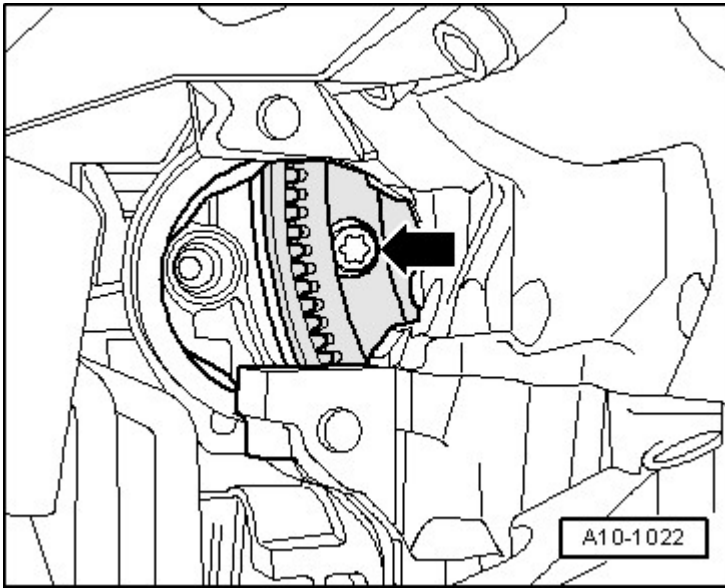


Fig. 15: Identifying Torque Converter Bolts
Courtesy of AUDI OF AMERICA, LLC

-- Disconnect remaining engine to transmission connection bolts.

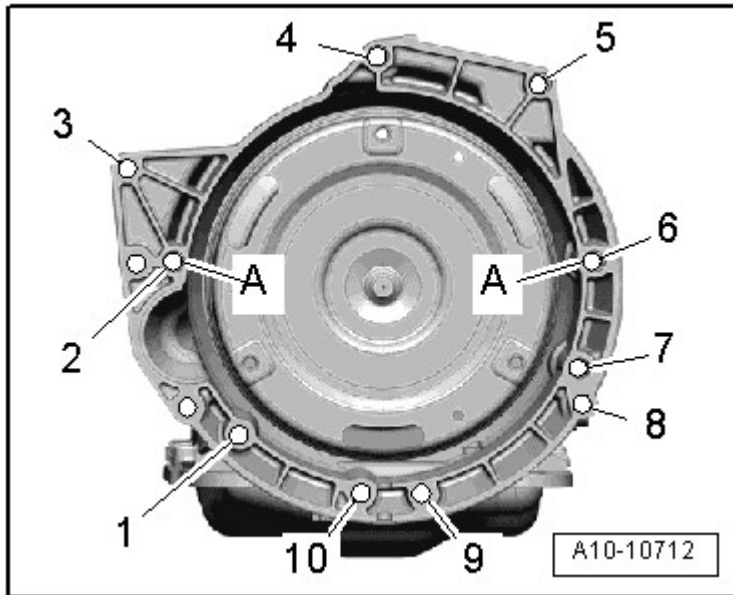


Fig. 16: Identifying Transmission To Engine Mounting Bolts
Courtesy of AUDI OF AMERICA, LLC

-- Loosen clamping bolts -1- on sides of scissor lift table VAS 6131 A and then pull rear table plate with transmission toward rear -arrow- and press torque converter off drive plate through opening for removed starter.

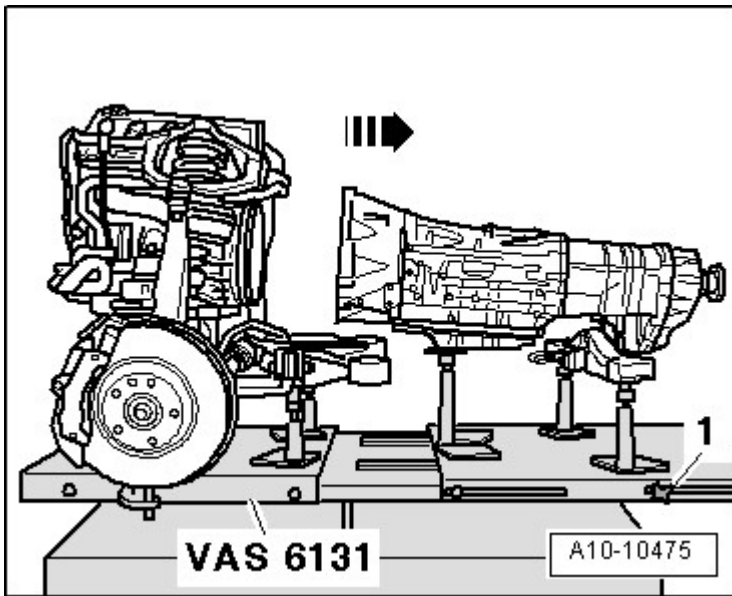


Fig. 17: Identifying Separation Of Engine And Transmission
Courtesy of AUDI OF AMERICA, LLC

-- Secure torque converter in transmission against falling out with Bracket 30-211 A.

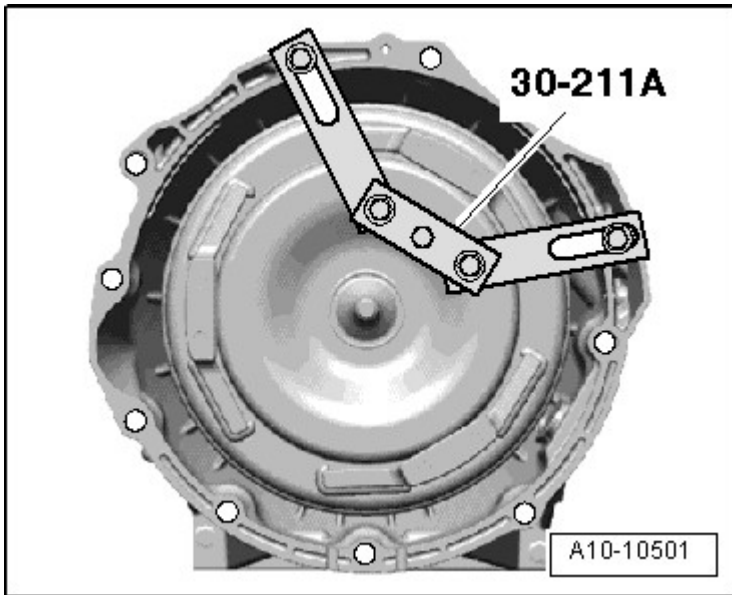


Fig. 18: Identifying Bracket -30-211A- Attached To Secure Torque Converter
Courtesy of AUDI OF AMERICA, LLC

ENGINE AND TRANSMISSION, SECURING TO HOLDER

Special tools and workshop equipment required

- Lifting tackle 3033
- Engine and transmission holder VAS 6095 with V8 FSI engine holder 6095/1-6A

- Shop crane VAS 6100
- Engine mount 3269
- Lift arm extension for workshop crane VAS 6101

Procedure

- Engine/transmission assembly removed and separated on scissor lift table VAS 6131 A **ENGINE AND TRANSMISSION, SEPARATING**.
- Engine secured with joint support VAS 6131/13-7.

NOTE: Place a cloth under separating point to catch dripping hydraulic fluid.

-- Remove power steering pressure line banjo bolt -1-.

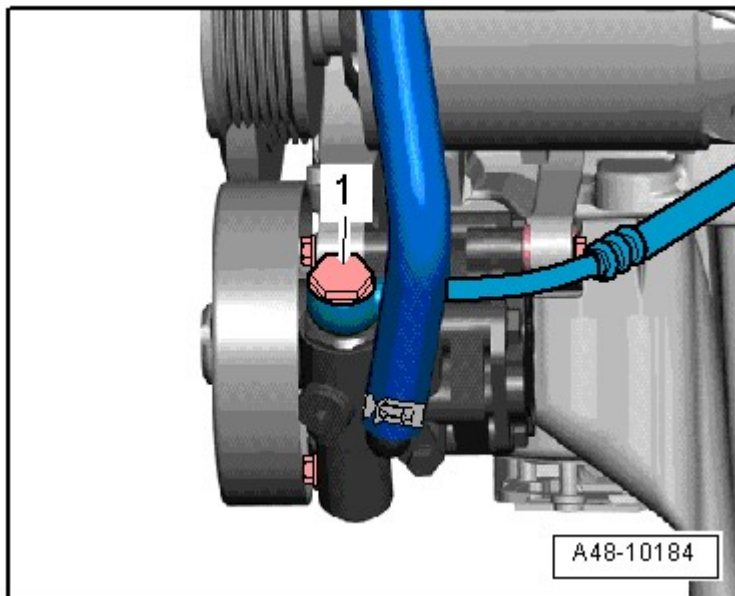


Fig. 19: Identifying Power Steering Pressure Line Banjo Bolt -1-
Courtesy of AUDI OF AMERICA, LLC

-- Remove engine bracket left and right bolts -arrows-.

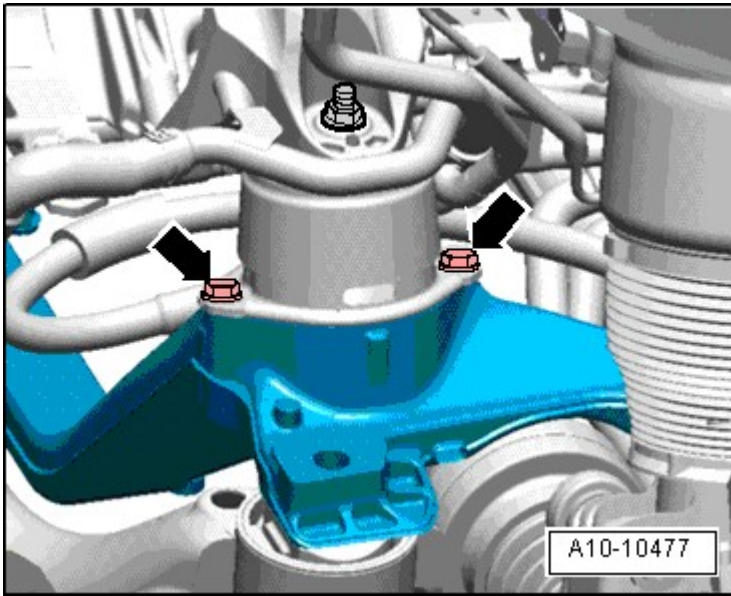


Fig. 20: Identifying Engine Bracket Bolts At Left And Right
Courtesy of AUDI OF AMERICA, LLC

NOTE: Engine carrier remains in installation location.

With 4 Zone Climate Control

-- Remove rear coolant pipes from coolant hoses -arrows--.

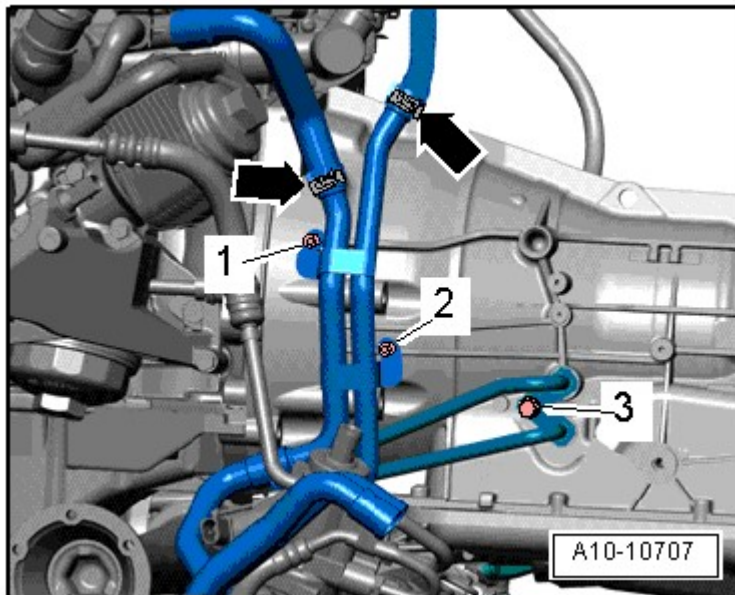


Fig. 21: Identifying Rear Coolant Pipe Bolts -1 To 2- And Bolt -3- For ATF Lines From Transmission
Courtesy of AUDI OF AMERICA, LLC

NOTE: Ignore items -1, 2, 3-.

The illustration shows location with automatic transmission.

Continuation for All

-- Engage lifting tackle 3033 in engine lifting eyes and in shop crane VAS 6100 with lift arm extension/workshop hoist VAS 6101 as shown in illustration.

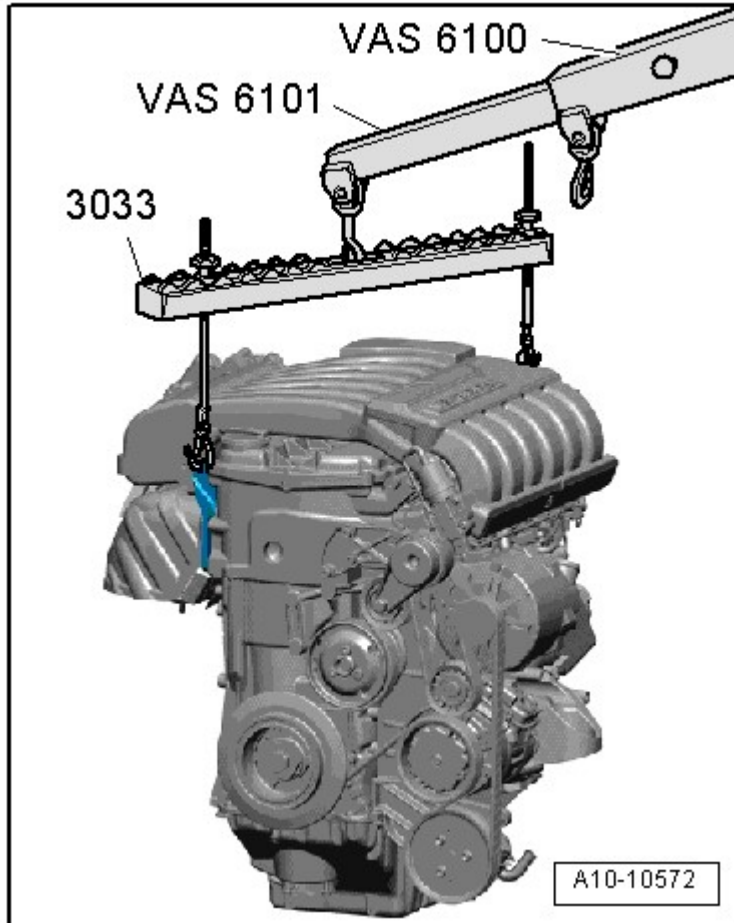


Fig. 22: Engaging Lifting Tackle 3033 With Engine Lifting Eyes In Shop Crane VAS 6100 And Hoist VAS 6101

Courtesy of AUDI OF AMERICA, LLC

-- Tension engine slightly with shop crane, do not raise.

-- Remove joint support VAS 6131/13-7 from engine.

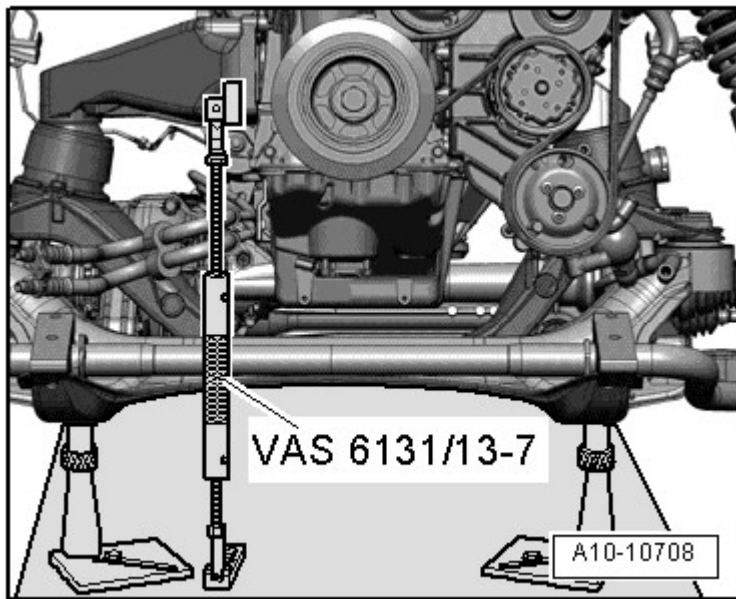


Fig. 23: Identifying Joint Support VAS 6131/13-7 From Engine
Courtesy of AUDI OF AMERICA, LLC

-- Raise engine from engine carrier.

Engine, Engaging at Rear

-- Secure engine on engine and transmission holder VAS 6095 as shown in illustration.

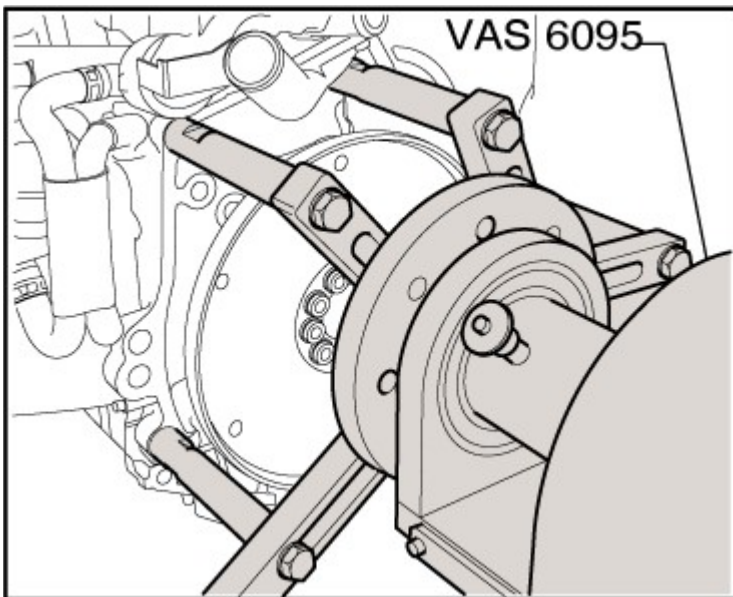


Fig. 24: Identifying Engine And Transmission Holder VAS 6095
Courtesy of AUDI OF AMERICA, LLC

Engine, Engaging at Sides

-- If engine support 3269 is to be used, remove bolts -1 to 3- and remove engine supports with engine bracket.

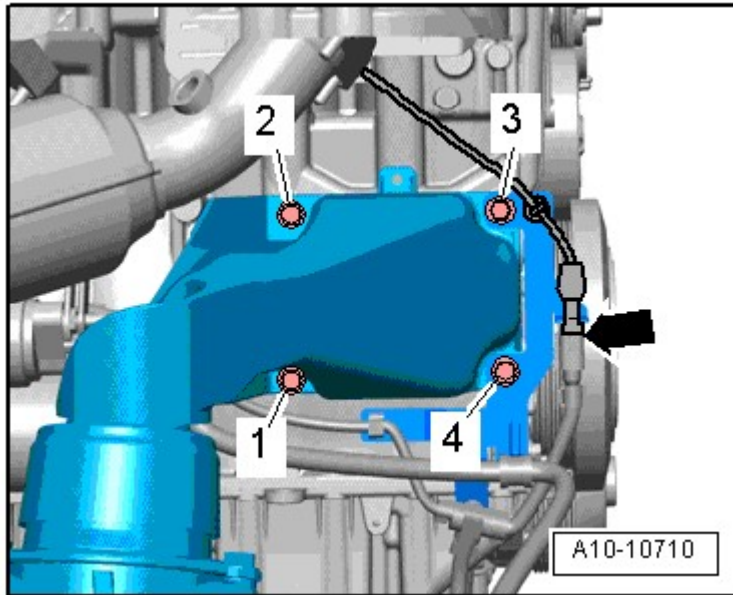


Fig. 25: Identifying Bolts -1 To 3- And Engine Supports With Engine Bracket
Courtesy of AUDI OF AMERICA, LLC

NOTE: Ignore -4 and arrow-.

-- Secure engine support 3269 to cylinder block as shown in illustration.

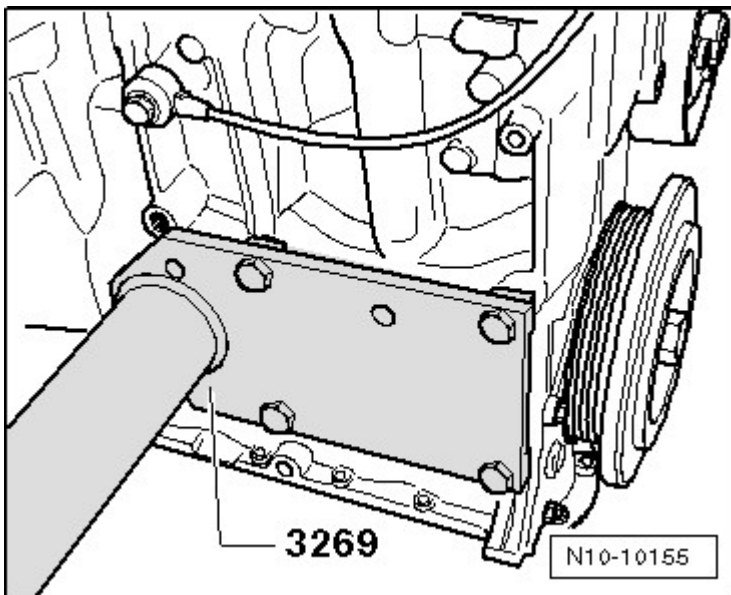


Fig. 26: Identifying Engine Support 3269 Tightly Bolted To Cylinder Block
Courtesy of AUDI OF AMERICA, LLC

DESCRIPTION AND OPERATION

SUBFRAME, ASSEMBLY OVERVIEW

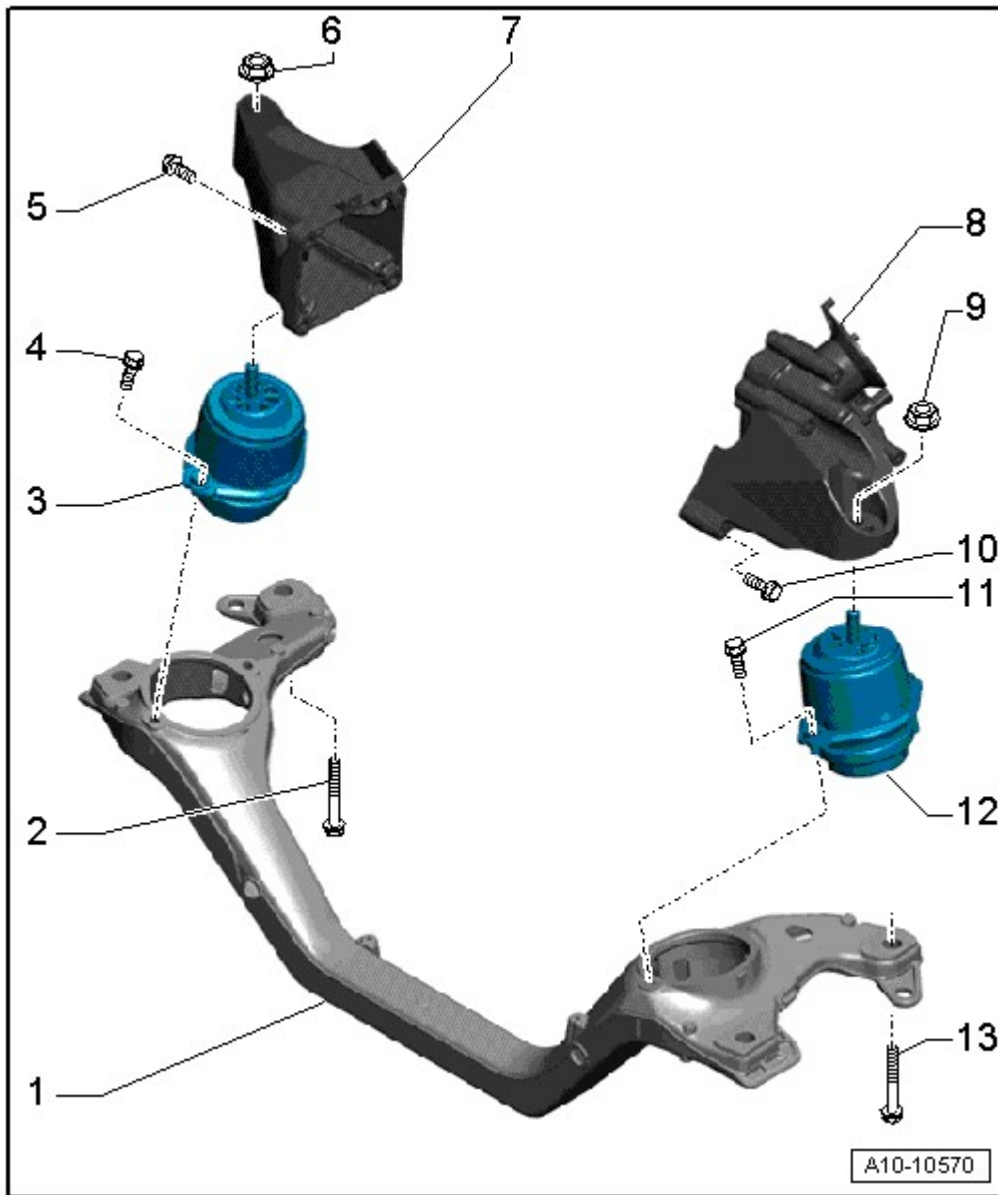


Fig. 27: Identifying Subframe, Assembly Overview
 Courtesy of AUDI OF AMERICA, LLC

1. Engine carrier
 - Removing and installing **ENGINE CARRIER**.
2. Bolt
 - Replace
 - 120 Nm + $\frac{1}{2}$ additional turn (180°).
3. Engine mount, right
 - Removing and installing **ENGINE MOUNT**.

2009 Audi Q7 3.6

ENGINE 3.6 Liter - Engine - Assembly - Engine Code(s): BHK

4. Bolt
 - 60 Nm
5. Bolt
 - 40 Nm
6. Nut
 - 75 Nm
7. Engine support, right
8. Engine support, left (with oil filter housing)
 - Removing and installing **LEFT ENGINE SUPPORT WITH OIL FILTER HOUSING** .
9. Nut
 - 75 Nm
10. Bolt
 - 23 Nm
11. Bolt
 - 60 Nm
12. Engine mount, left
 - Removing and installing **ENGINE MOUNT**.
13. Bolt
 - Replace
 - 120 Nm + $\frac{1}{2}$ additional turn (180°).

SPECIFICATIONS

FASTENER TIGHTENING SPECIFICATIONS

Components	Bolt Size	Nm
Bolts and Nuts		
	M6	10
	M7	15
	M8	22
	M10	40
	M12	65
Drive Plate to Torque Converter Bolt ⁽¹⁾		85
Noise Insulation Bracket to Body Bolt		9
(1) Always replace		

Transmission to Engine Bolt Location and Tightening Specifications

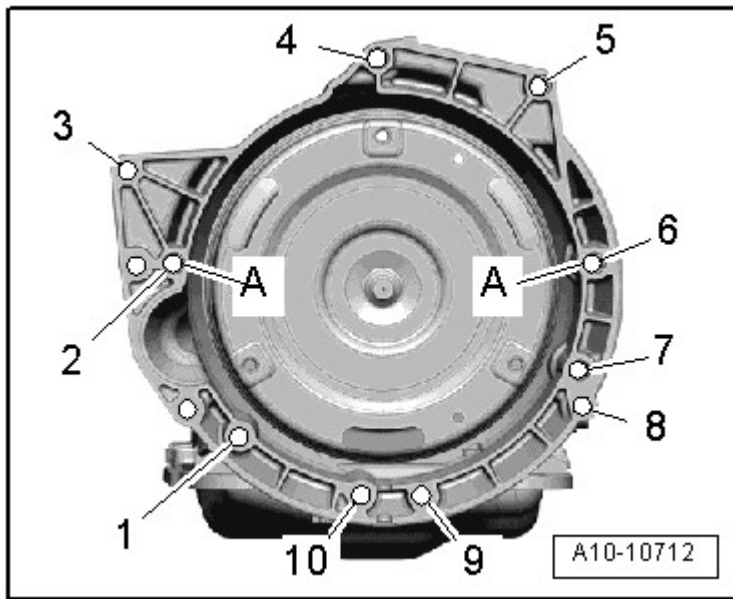


Fig. 28: Identifying Transmission To Engine Mounting Bolts
 Courtesy of AUDI OF AMERICA, LLC

Item	Bolt	Nm
1, 8, 9, 10	M10 x 50	45
2	M12 x 70	80
3 ⁽¹⁾ , 4, 5	M12 x 60	80
6 ⁽²⁾ , 7	M12 x 140	80
A	Alignment sleeves for centering	
(1) Double bolt.		
(2) Threaded fastener with nut.		

REMOVAL AND INSTALLATION

ENGINE, REMOVING

Special tools and workshop equipment required

- Old oil collecting and extracting device V.A.G 1782
- Hose clamp pliers V.A.G 1921
- Step ladder VAS 5085
- Scissor lift table VAS 6131 A with support set VAS 6131/10 as well as supplementary set VAS 6131/11, VAS 6131/13 supplementary set, VAS6131/13 and quantity. 3 tapered mounting pin VAS 6131/10-2
- Drip tray for workshop crane VAS 6208
- Pry lever - rmv outside mirror 80-200
- Hose clamp pliers VAS 6340

- Ball joint puller T10187

NOTE: If engine and transmission are to be separated after removal, the supplementary set VAS 6131/12 will also be required.

Procedure

NOTE: Remove engine downward together with transmission and subframe with lock carrier installed.

During installation, all cable ties must be reinstalled at the same location.

Collect drained coolant in a clean container for disposal or reuse.

-- On a vehicle with air suspension, activate vehicle lift mode Description and Operation .

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

- Before opening high pressure components of the fuel injection system, pressure must be relieved to residual pressure.

-- Reduce fuel pressure in high pressure area RELEASING FUEL PRESSURE ON HIGH PRESSURE SIDE .

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

- Observe measures when disconnecting battery.

NOTE: In order to be able to rotate the driveshaft freely, place selector lever in "N" position.

-- Position driver's seat as far back and high as possible by using entire seat adjustment range.

-- Switch off ignition.

-- Grasp under seat and release retaining clips on back side of cover -1- in direction of -arrow A-.

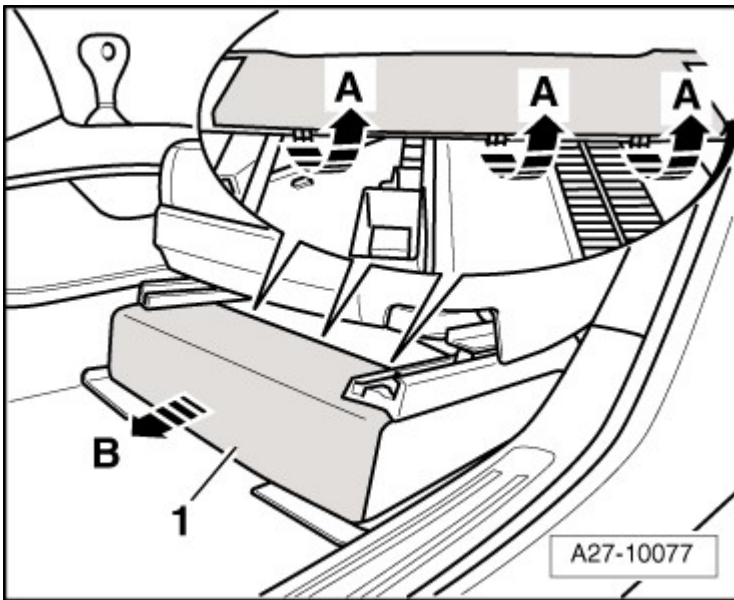


Fig. 29: Identifying Cover -1-

Courtesy of AUDI OF AMERICA, LLC

- Remove cover in direction of -arrow B- from driver's seat console.
- Pry cover -1- out of floor covering with pry lever - rmv outside mirror 80-200.

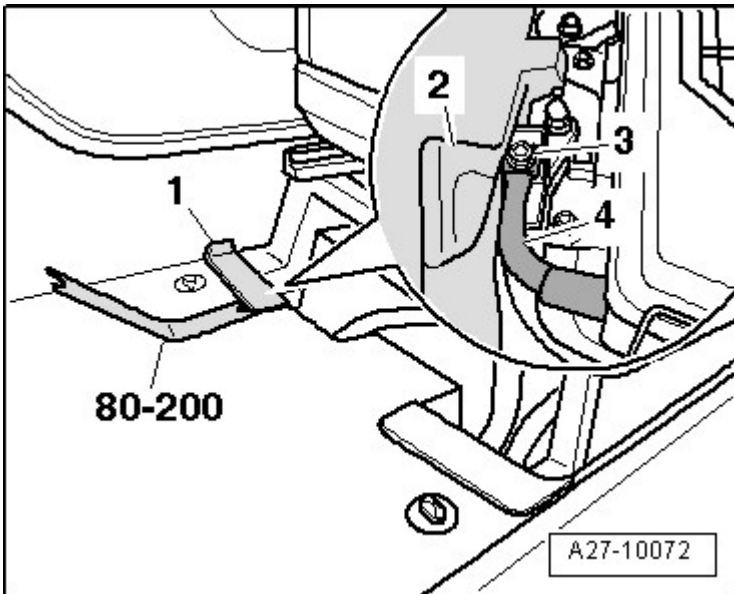


Fig. 30: Prying Cover -1- With 80-200 From Floor Covering

Courtesy of AUDI OF AMERICA, LLC

- Raise floor covering -2- in slightly in area of ground (GND) wire.
- Remove nut -3- and remove ground (GND) wire -4- from ground point.

-- Evacuate A/C system Air Conditioning .

-- Extract power steering fluid from reservoir with used oil collection and extraction device V.A.G 1782.

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.

-- Open coolant reservoir cap.

-- Remove both front wheels.

-- Remove bolts and front -1- and rear -2- noise insulation.

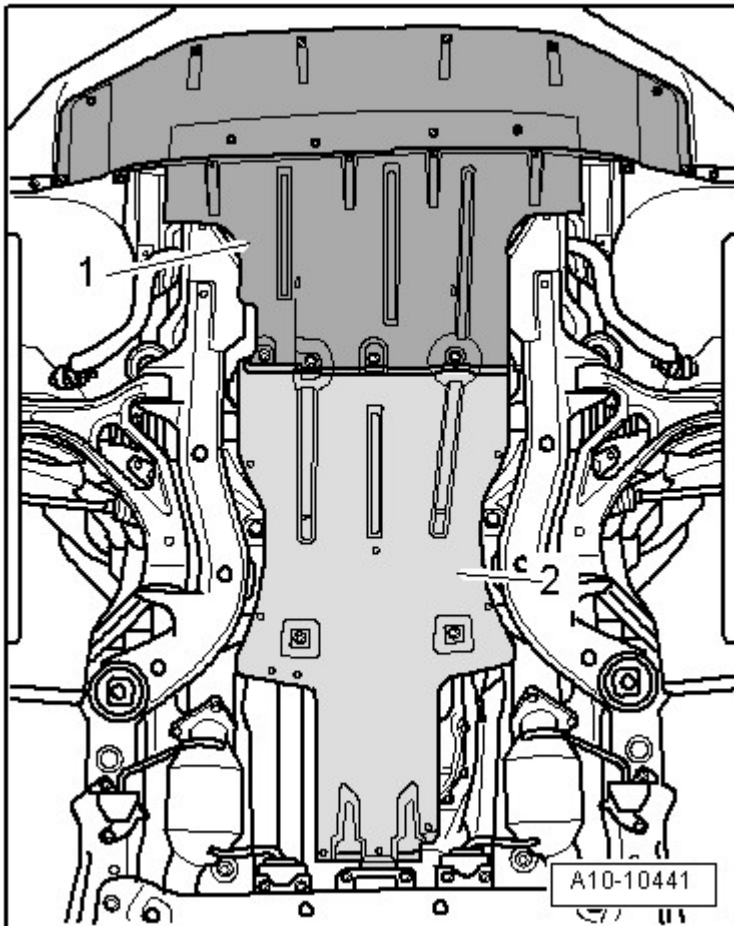


Fig. 31: Identifying Front/Rear Noise Insulation

Courtesy of AUDI OF AMERICA, LLC

-- Remove left and right front wheel housing liners Removal and Installation .

- Place drip tray VAS 6208 under engine.
- Remove coolant hose from front coolant pipe -arrow- and drain coolant.

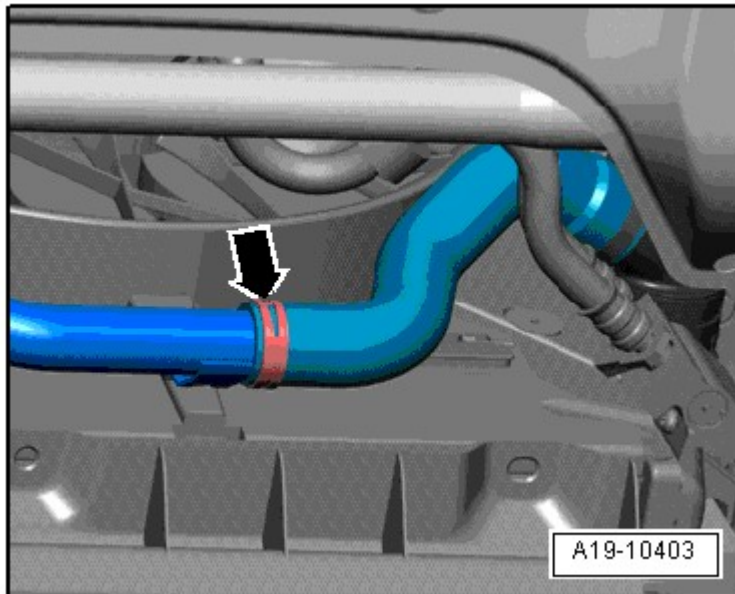


Fig. 32: Identifying Coolant Hose To Front Coolant Pipe -Arrow-
 Courtesy of AUDI OF AMERICA, LLC

With 2 Zone Climate Control

- Remove coolant hoses -1 and 2- to heat exchanger from bulkhead.

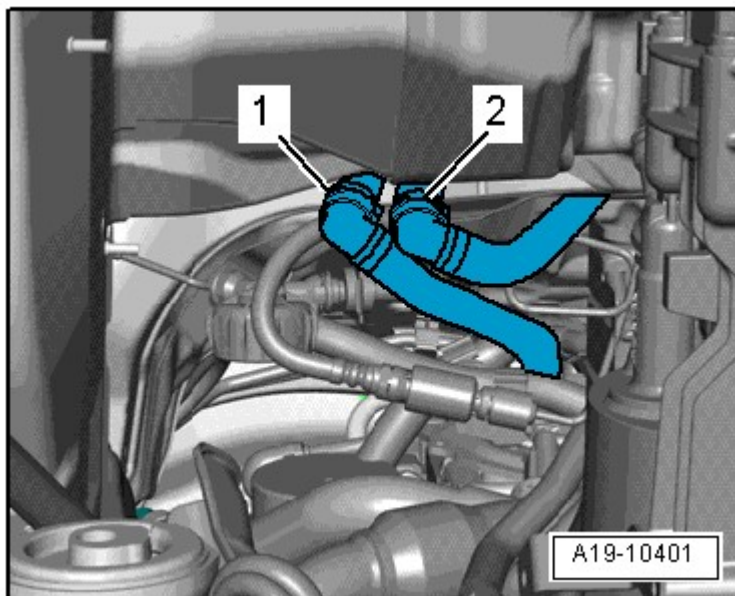


Fig. 33: Identifying Coolant Hoses -1 And 2- To Heat Exchanger
 Courtesy of AUDI OF AMERICA, LLC

With 4 Zone Climate Control

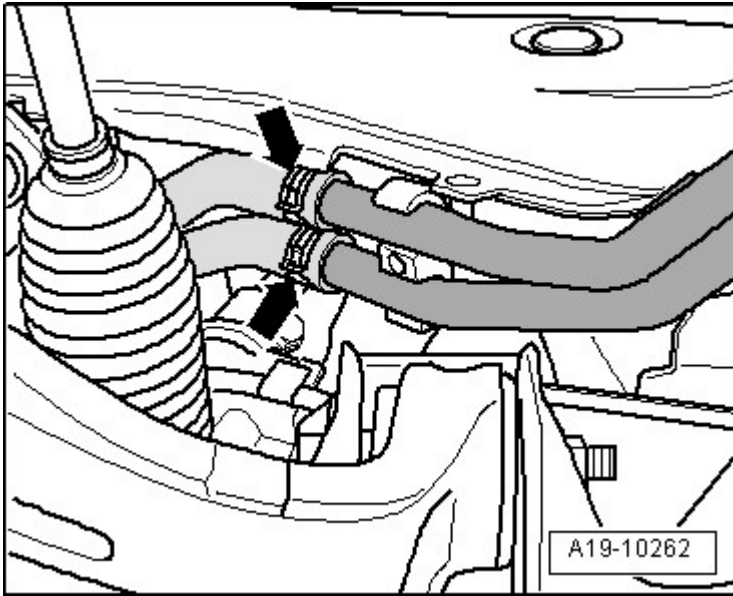


Fig. 34: Identifying Hose Connections To Heater Core
Courtesy of AUDI OF AMERICA, LLC

-- Remove coolant hoses -arrows- from coolant pipes and drain remaining coolant.

Continuation for All

-- If present, remove vacuum hose -1-.

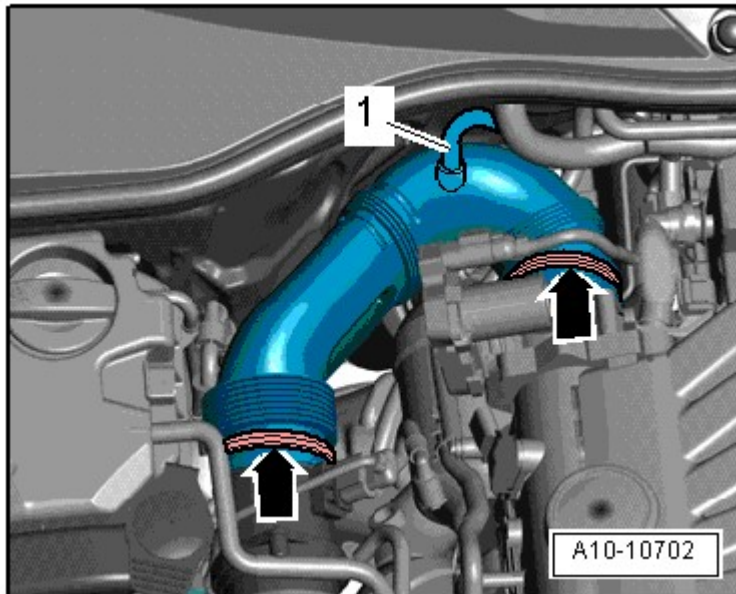


Fig. 35: Identifying Air Guide Pipe And Vacuum Hose
Courtesy of AUDI OF AMERICA, LLC

-- Remove air guide pipe -arrows-.

Without Mechanical Vacuum Pump

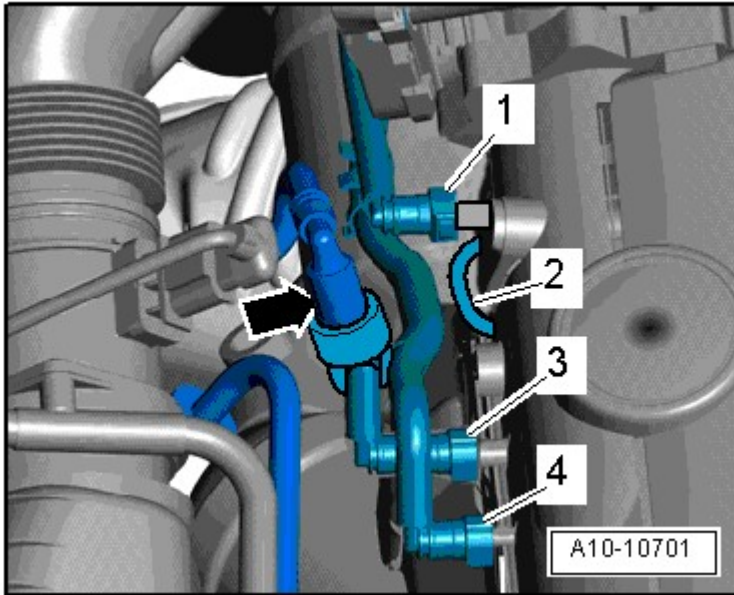


Fig. 36: Identifying Vacuum Lines On Intake Manifold
Courtesy of AUDI OF AMERICA, LLC

-- Disconnect brake booster vacuum line -arrow-.

-- Disconnect vacuum hose -4- to Leak Detection Pump (LDP) -V144- by pressing release buttons.

NOTE: Ignore items -1, 2, 3-.

-- Disconnect vacuum hose -1- to evaporative emission (EVAP) canister purge regulator valve -N80- by pressing release button.

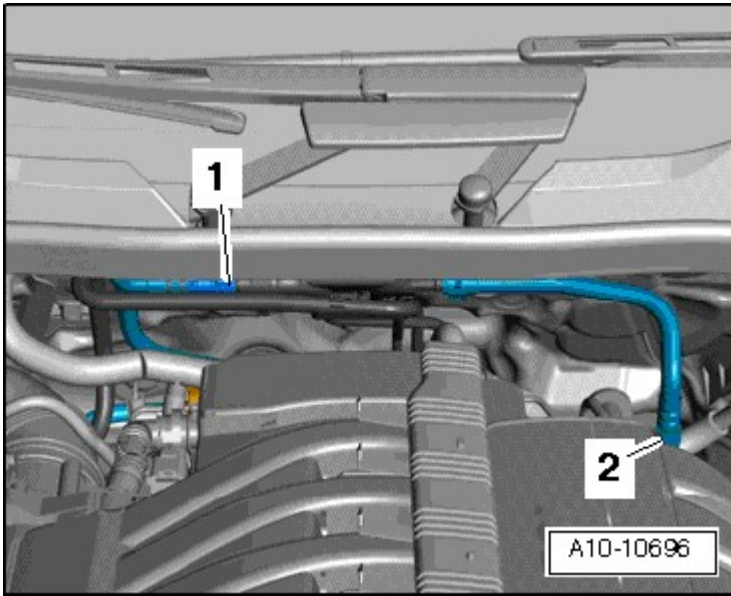


Fig. 37: Identifying Electrical Harness Connector -1-
Courtesy of AUDI OF AMERICA, LLC

-- Free up vacuum hose.

WARNING: Risk of injury from fuel.

- To reduce residual pressure in fuel system, lay a clean cloth around connector and carefully loosen connector.

-- Disconnect fuel supply line -2-.

With Mechanical Vacuum Pump

-- Disconnect brake booster vacuum line -arrow-.

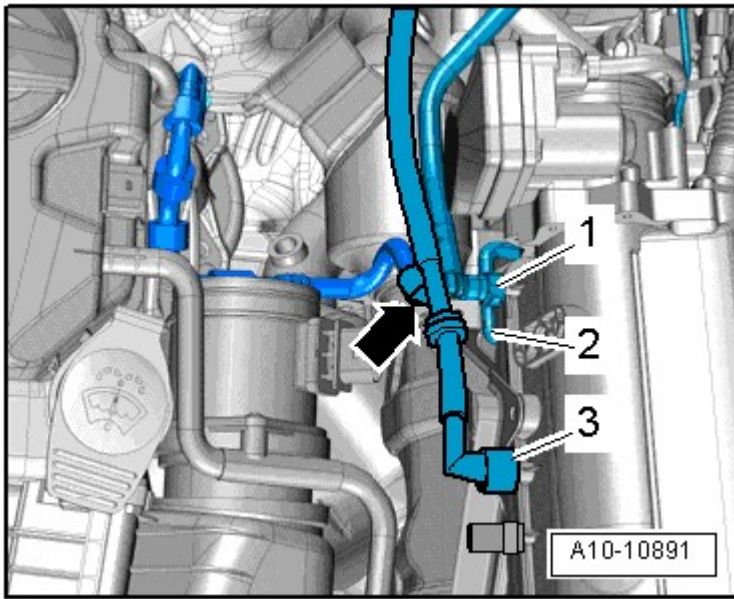


Fig. 38: Identifying Vacuum Lines From Intake Manifold
Courtesy of AUDI OF AMERICA, LLC

NOTE: Ignore items -1, 2, 3-.

-- Disconnect vacuum hose -1- to evaporative emission (EVAP) canister purge regulator valve -N80- by pressing release button.

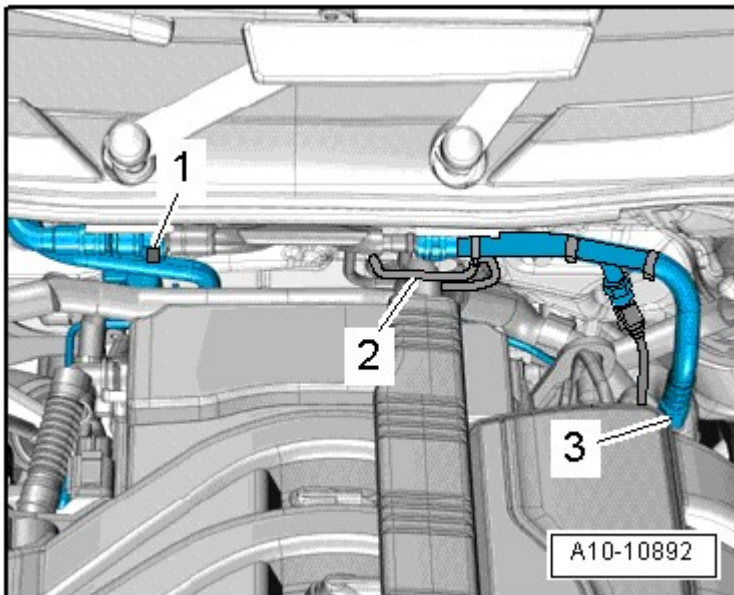


Fig. 39: Identifying Vacuum Hose -1- To Evaporative Emission (EVAP) Canister Purge Regulator Valve -N80-
Courtesy of AUDI OF AMERICA, LLC

-- Free up vacuum hose.

-- Disconnect vacuum hose -2- to Leak Detection Pump (LDP) -V144-.

WARNING: Risk of injury from fuel.

- To reduce residual pressure in fuel system, lay a clean cloth around connector and carefully loosen connector.

-- Disconnect fuel supply line -3-.

Continuation for All

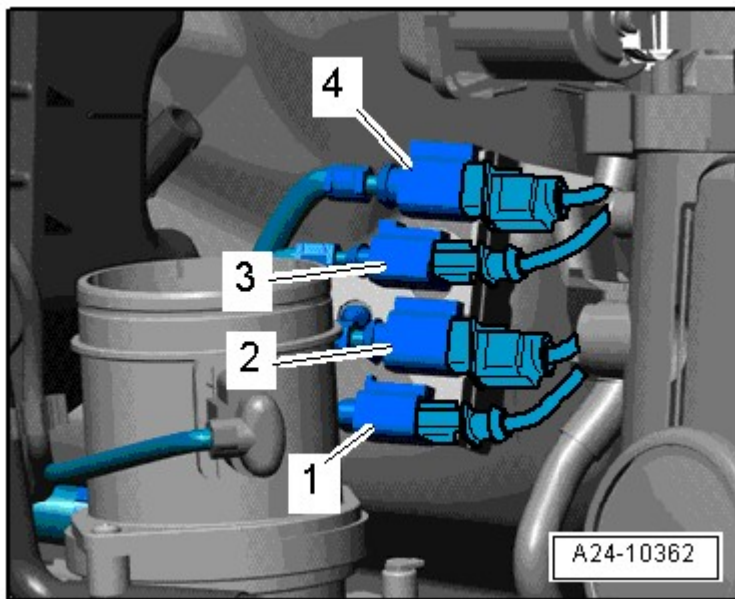


Fig. 40: Disconnecting Heated Oxygen Sensor Electrical Harness Connectors
Courtesy of AUDI OF AMERICA, LLC

-- Remove oxygen sensor connectors -1 to 4- from bracket on right strut tower and disconnect.

-- Unclip front differential vent hose from air filter housing -arrows-.

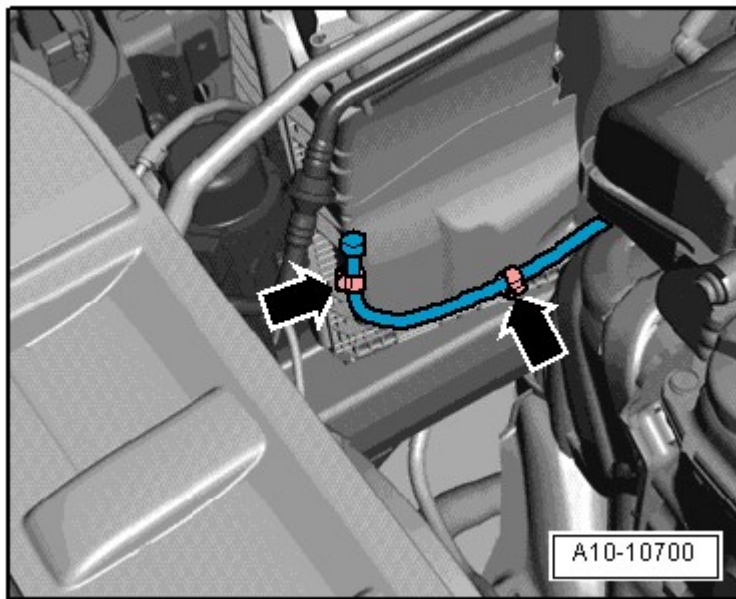


Fig. 41: Identifying Bleed Hose From Air Filter Housing -Arrows-
 Courtesy of AUDI OF AMERICA, LLC

-- Remove coolant hoses -1 and 2- from coolant reservoir.

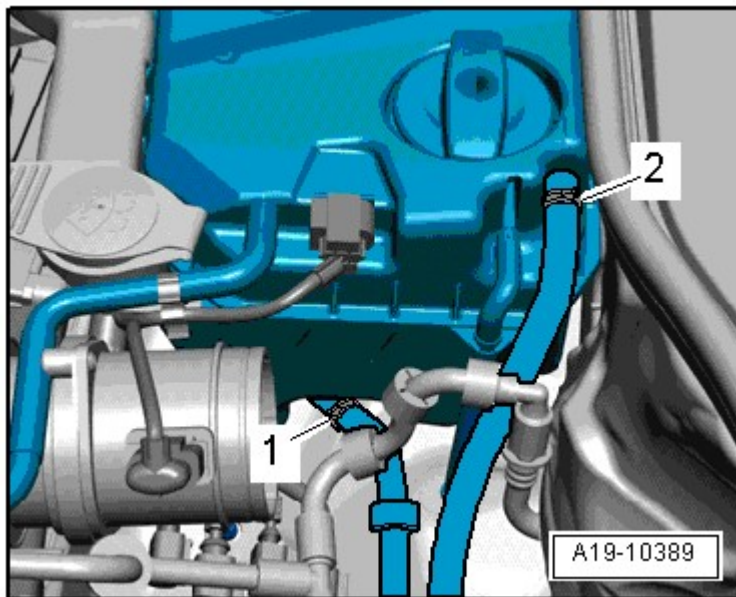


Fig. 42: Identifying Coolant Hoses -1 And 2- To Coolant Reservoir
 Courtesy of AUDI OF AMERICA, LLC

-- Remove coolant hoses -1 and 2-.

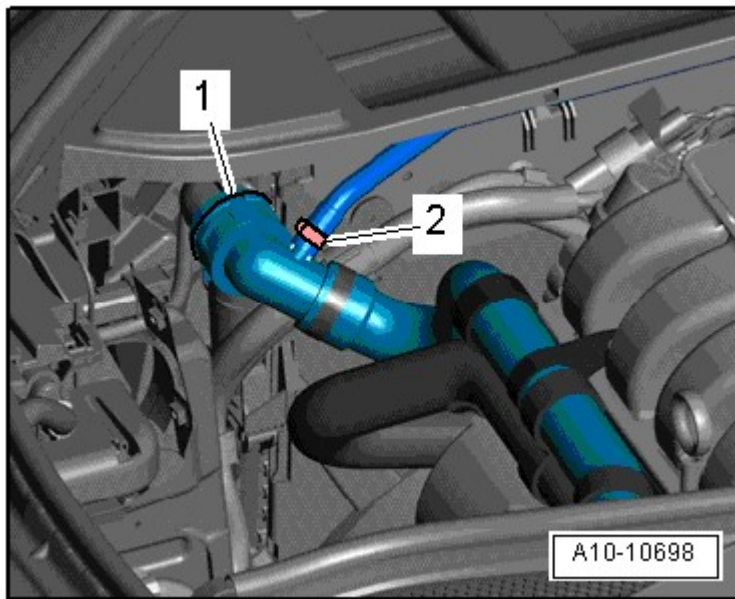


Fig. 43: Identifying Upper Coolant Hose -1-
Courtesy of AUDI OF AMERICA, LLC

-- Remove coolant hose -arrow- from front coolant pipe.

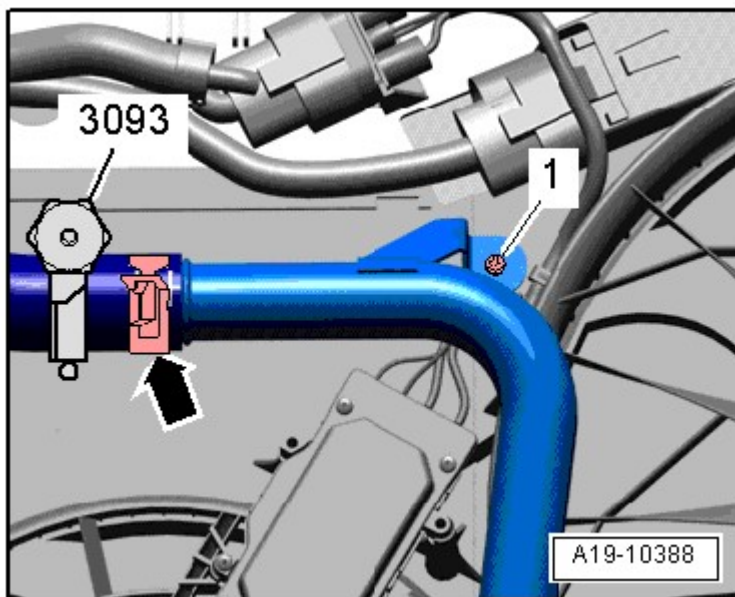


Fig. 44: Identifying Coolant Hose -Arrow- From Front Coolant Pipe
Courtesy of AUDI OF AMERICA, LLC

NOTE: Ignore item -1- hose clamps 3093.

-- Open cover over B+ distributor -arrow-.

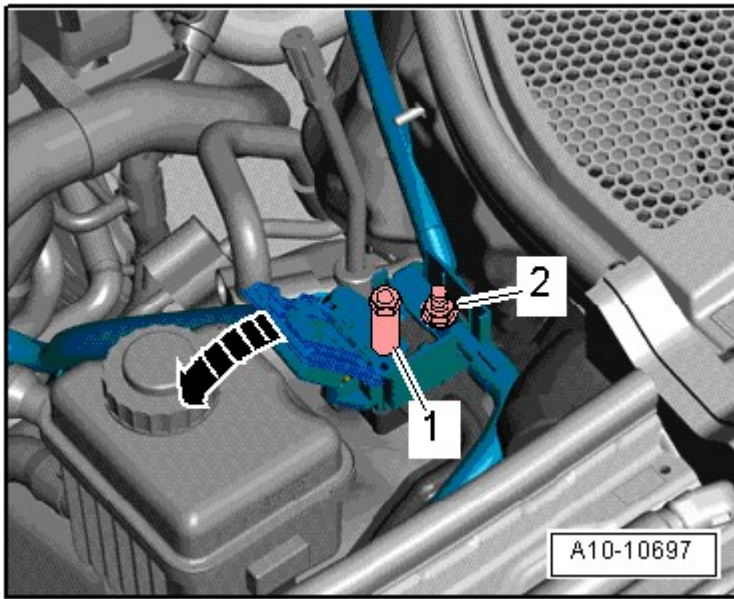


Fig. 45: Identifying B+ Wires

Courtesy of AUDI OF AMERICA, LLC

-- Remove positive wires:

1. To generator
2. To starter

-- Free up electrical wires.

NOTE: Place a cloth under separating point to catch dripping hydraulic fluid.

-- Remove hose from power steering reservoir -arrow-.

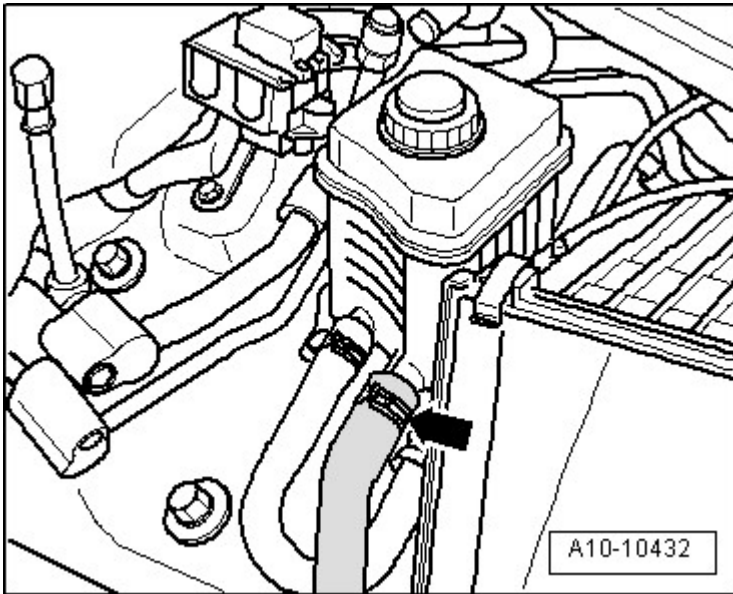


Fig. 46: Identifying Hose For Power Steering Fluid Reservoir
Courtesy of AUDI OF AMERICA, LLC

CAUTION: Risk of damaging coolant lines and hoses.

- Do not stretch, kink or bend coolant lines and hoses.

-- Remove coolant lines -2 and 3- from A/C compressor.

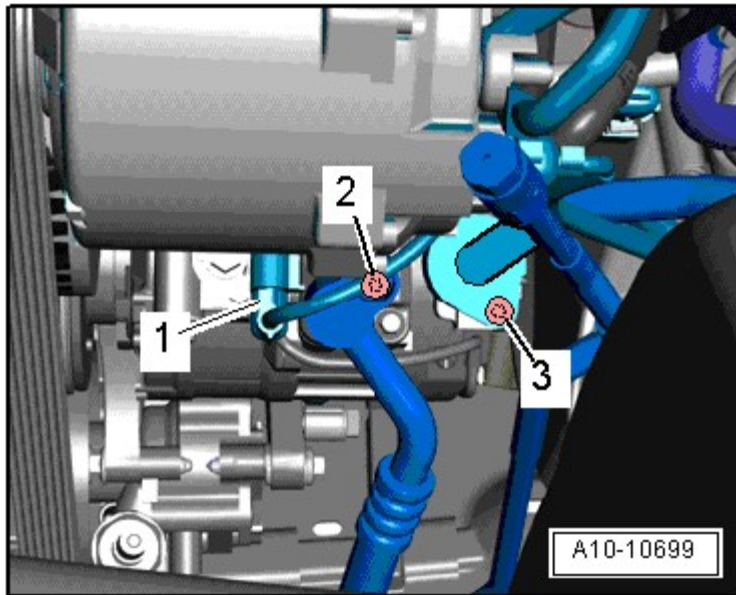


Fig. 47: Identifying A/C Compressor Lines
Courtesy of AUDI OF AMERICA, LLC

NOTE: To prevent dirt and moisture from entering, seal off open lines and connections

to A/C compressor with clean plugs or protective caps.

Ignore -1-.

-- Pry cover caps off windshield wiper arms with screwdriver.

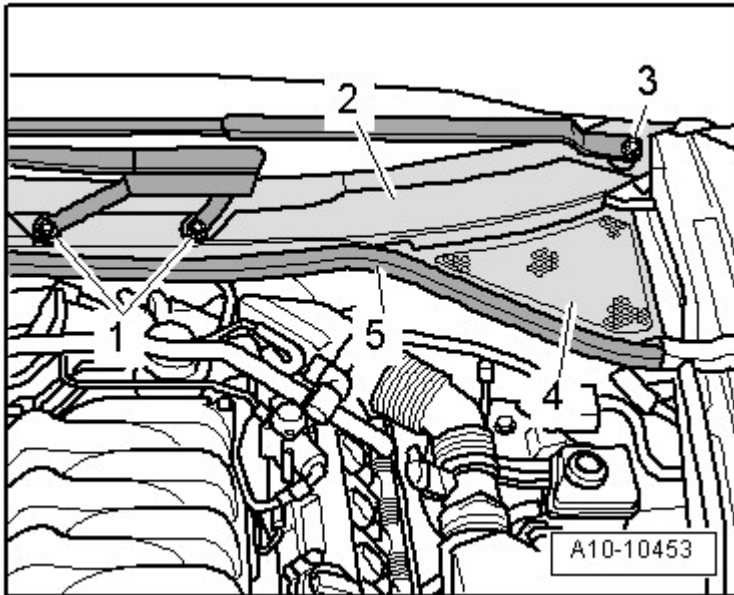


Fig. 48: Identifying Windshield Wiper, Driver Side, And Nut -3-, Plenum Chamber Cover -4- And Rubber Seal -5-

Courtesy of AUDI OF AMERICA, LLC

-- Loosen nuts -1 and 3- a few turns.

-- Loosen wiper arms in succession by tilting wiper axles slightly.

-- Remove nuts completely and remove wiper arms.

NOTE: If wiper arms cannot be removed in this way, use a standard puller.

-- Remove rubber seal -5-.

-- Carefully remove plenum chamber cover -2- from retainer on windshield.

NOTE: Ignore -4-.

-- Remove cover for E-box, plenum chamber -arrows-.

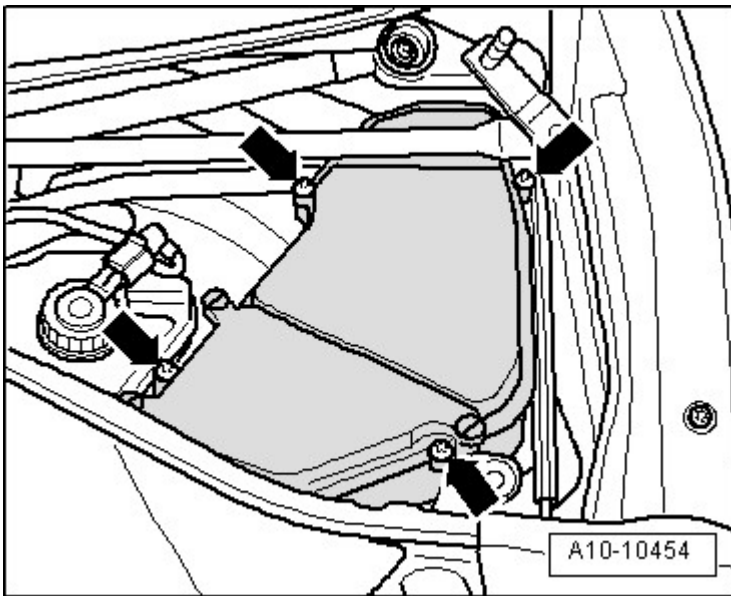


Fig. 49: Identifying Bolts To E-Box Plenum Chamber Cover -Arrows-
Courtesy of AUDI OF AMERICA, LLC

-- Disconnect electrical connectors -1, 2, 3- at E-box plenum chamber connector station.

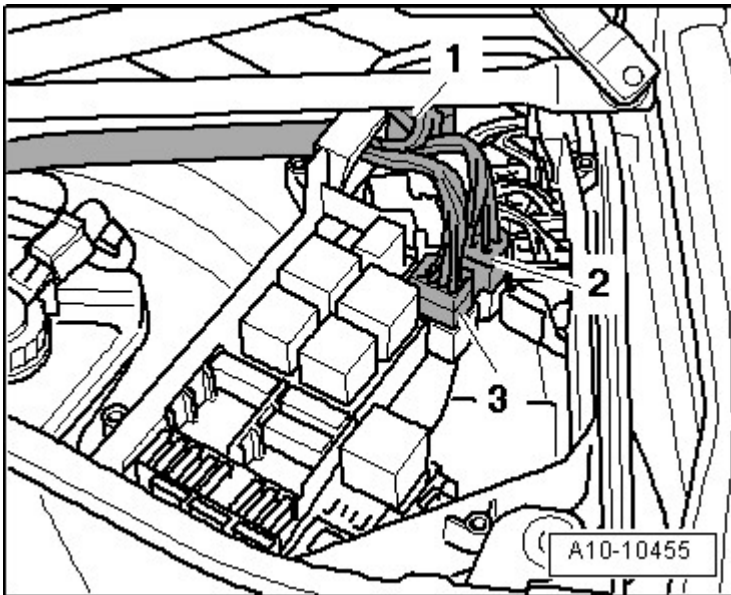


Fig. 50: Identifying Electrical Connectors -1 Through 3-
Courtesy of AUDI OF AMERICA, LLC

-- Free up electrical wiring harness.

-- Remove ground (GND) connection -2-.

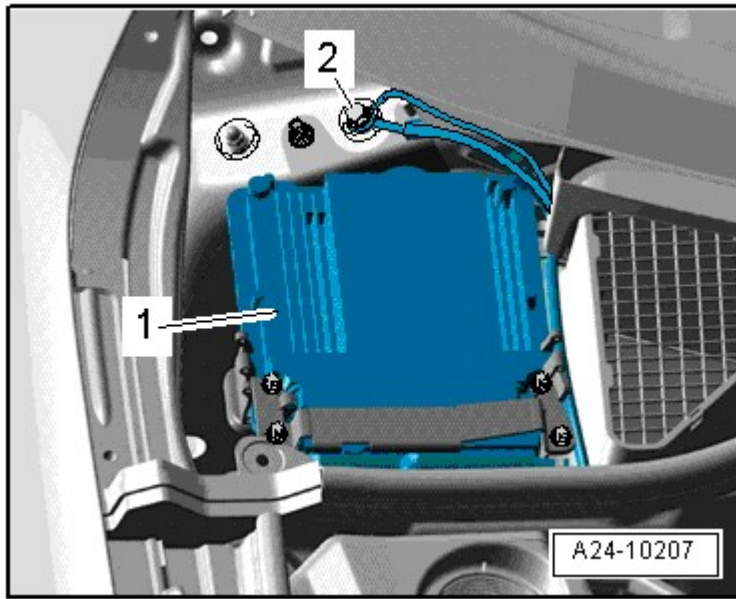


Fig. 51: Locating Engine Control Module (ECM) -J623- -1-
Courtesy of AUDI OF AMERICA, LLC

- Remove engine control module (ECM) -1- **Removal and Installation** .
- Free up electrical wiring harness to engine.
- Loosen upper control arm nut a few turns and pull joint off with ball joint puller T10187.

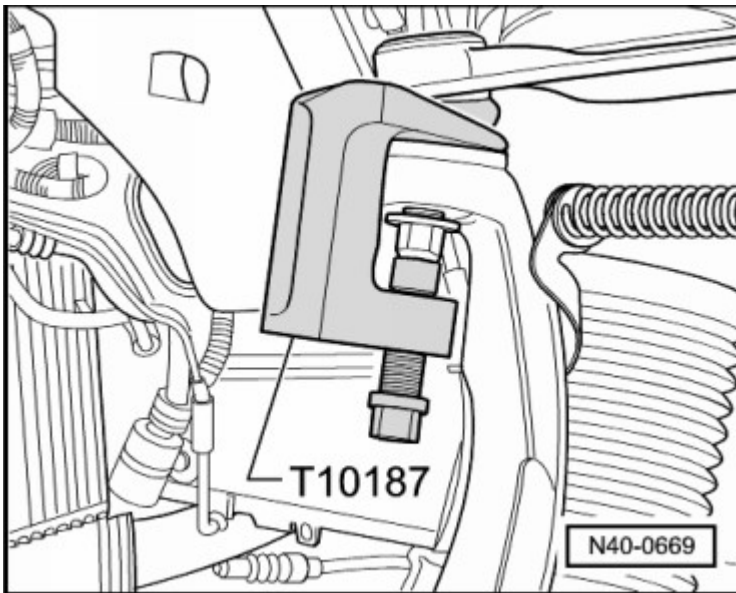


Fig. 52: Pressing Out Upper Control Arm
Courtesy of AUDI OF AMERICA, LLC

- Completely remove upper control arm nut.

-- Repeat procedure on opposite side of vehicle.

-- Disconnect electrical connectors -arrow- at left and right on front speed sensors.

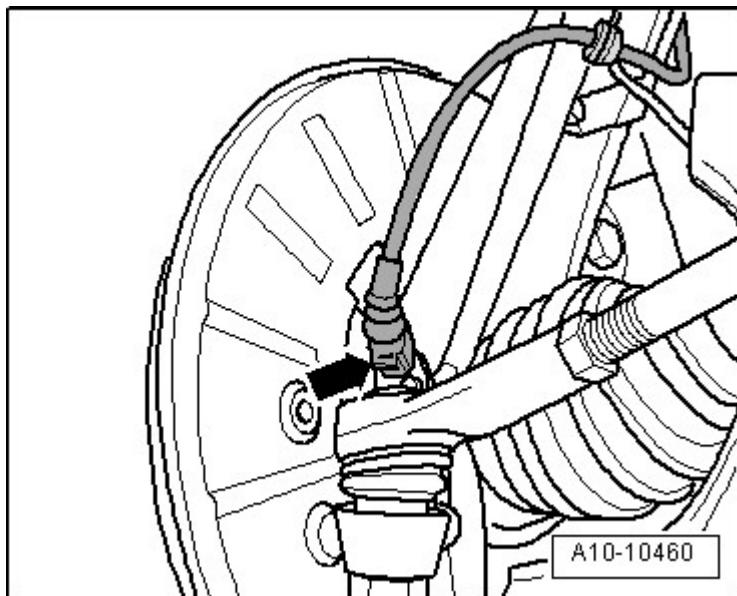


Fig. 53: Identifying Speed Sensor Connector
Courtesy of AUDI OF AMERICA, LLC

-- Remove wiring harness bolts -arrows-.

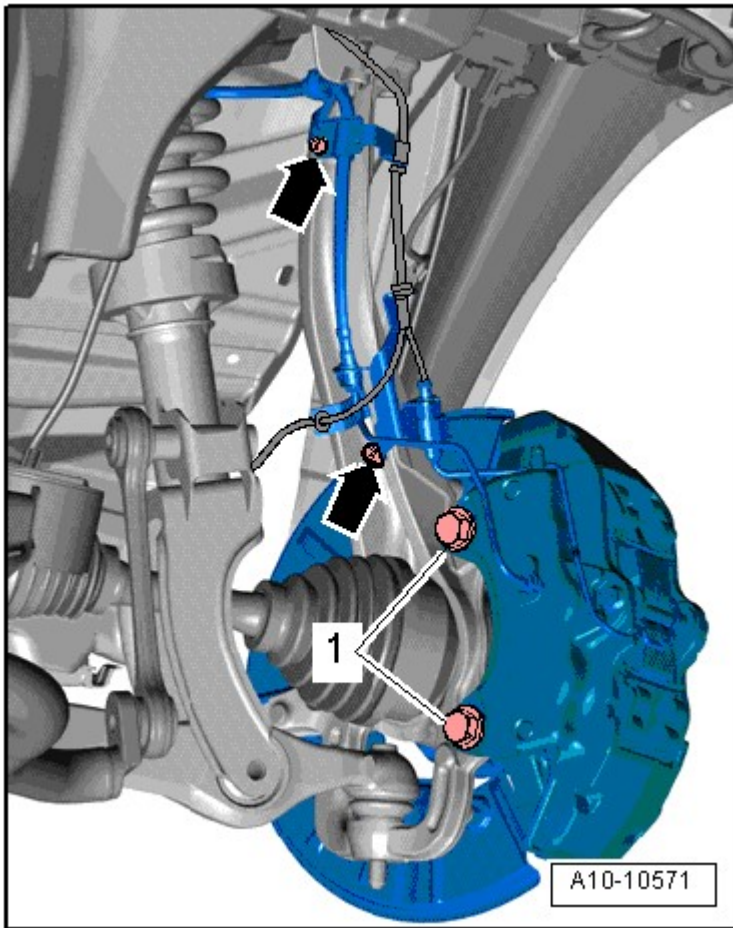


Fig. 54: Identifying Wire Harness Bolts
Courtesy of AUDI OF AMERICA, LLC

-- Remove brake caliper bolts -1-.

NOTE: Do not change brake line bent shape.

-- Engage brake caliper in wheel housing with wire.

CAUTION: Risk of damaging brake pistons.

- Do not operate brake pedal with brake caliper removed.

-- Repeat procedure on opposite side of vehicle.

-- Disconnect lower threaded connection -2- at left and right on stabilizer bar.

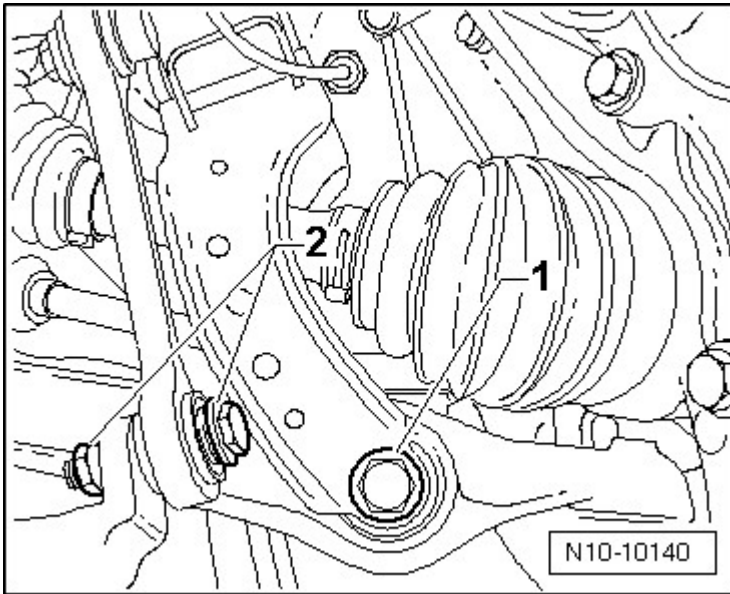


Fig. 55: Identifying Right/Left Lower Bolt On Stabilizer Bar
Courtesy of AUDI OF AMERICA, LLC

-- Remove nuts from bolts -1- at left and right on strut.

NOTE: Bolts -1- are removed later.

-- Remove bolts -arrows- at driveshaft connection at rear of transfer case.

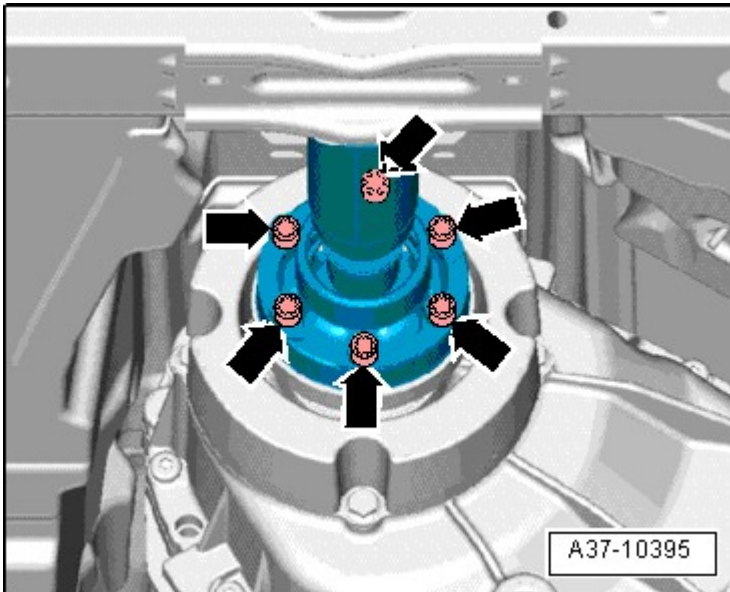


Fig. 56: Identifying Rear Driveshaft Bolts
Courtesy of AUDI OF AMERICA, LLC

-- Slide rear driveshaft toward rear final drive; constant velocity joints can move axially.

-- Remove noise insulation bracket -arrows-.

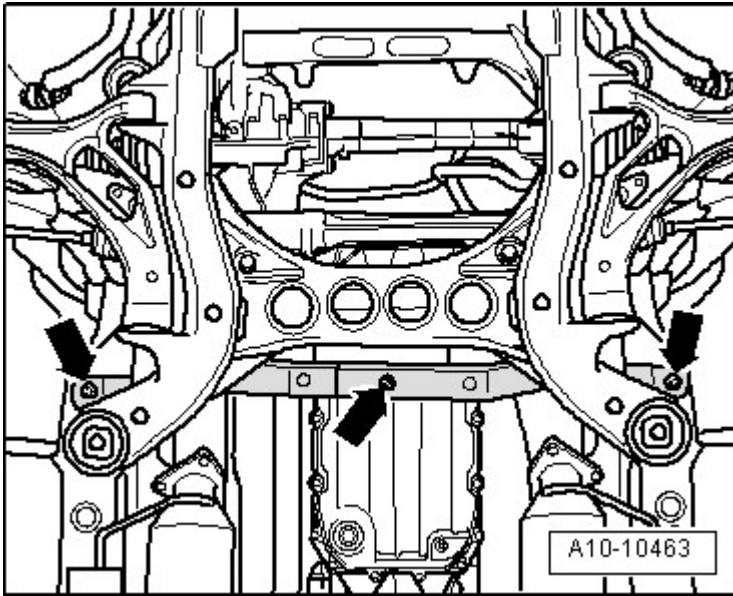


Fig. 57: Identifying Bracket For Noise Insulation
 Courtesy of AUDI OF AMERICA, LLC

CAUTION: Risk of damaging decoupling elements.

- Do not bend decoupling element in front exhaust pipe more than 10°.

-- Disconnect exhaust system at clamping sleeves -1 and 2-.

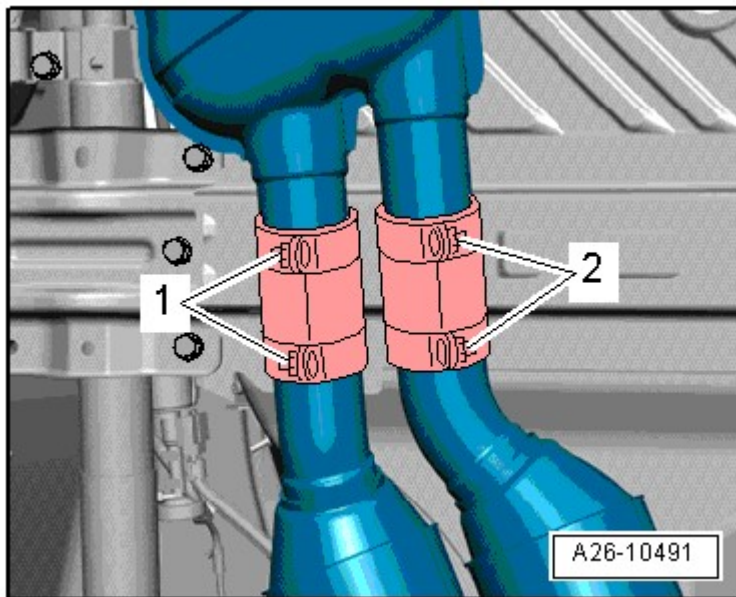


Fig. 58: Identifying Clamping Sleeves -1 And 2-
 Courtesy of AUDI OF AMERICA, LLC

-- Remove exhaust system brackets -1 and 3- from longitudinal member.

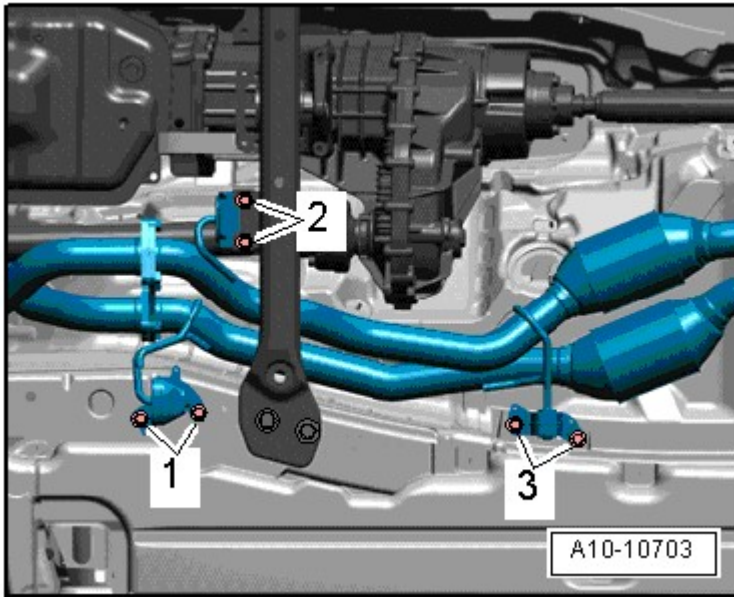


Fig. 59: Identifying Bolts -1, 2, 3- On Main Catalytic Converter Brackets

Courtesy of AUDI OF AMERICA, LLC

NOTE: Ignore -2-.

NOTE: Observe rules of cleanliness for working on automatic transmissions **CLEAN WORKING CONDITIONS** .

-- Place used oil collecting and extracting device V.A.G 1782 under separating point.

-- Remove bolt -arrow- and disconnect ATF lines from ATF thermostat.

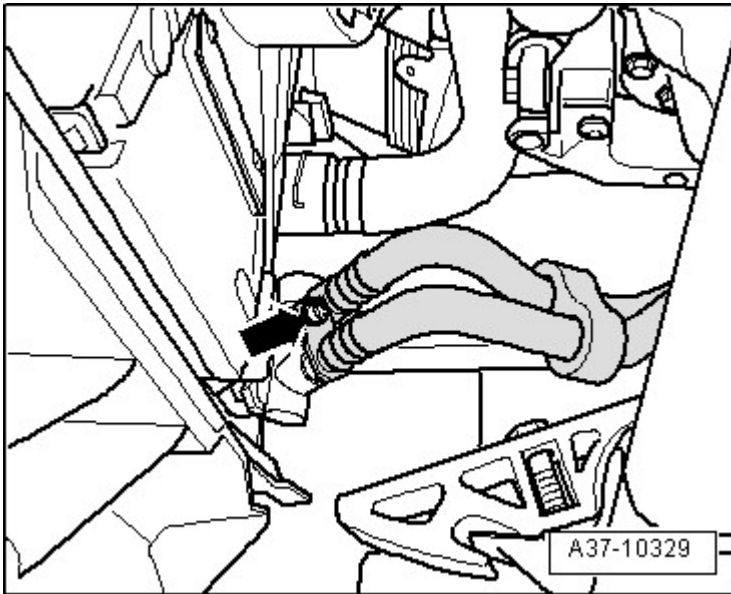


Fig. 60: Identifying Lines From Transmission Oil Cooler And Rear Mounting Bolts
 Courtesy of AUDI OF AMERICA, LLC

-- Remove selector lever cable ball head -2- from selector shaft lever with pry lever - rmv outside mirror 80-200.

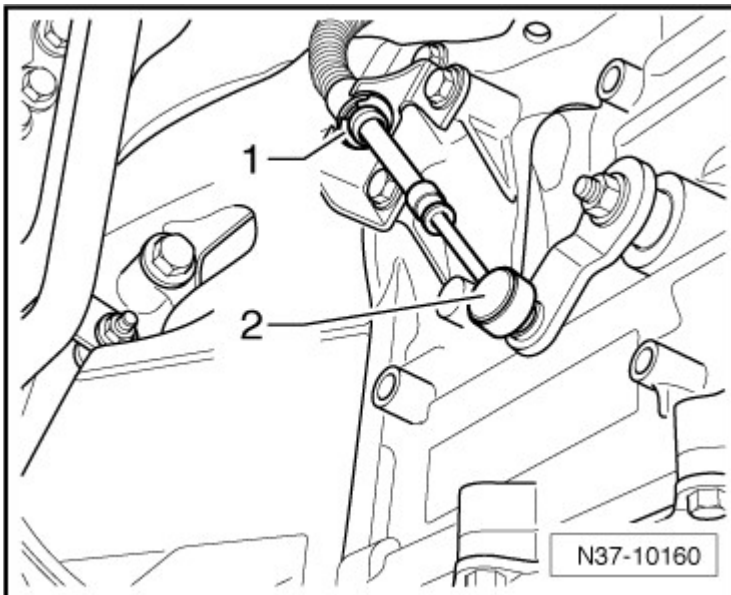


Fig. 61: Identifying Locking Washer & Selector Lever Cable
 Courtesy of AUDI OF AMERICA, LLC

-- Remove securing clips -1- and remove selector lever cable from transmission.

NOTE: Do not bend or kink selector lever cable.

CAUTION: Risk of destroying transmission control module (Mechatronic) with static discharge.

- Do not touch contacts in transmission connector with hands.

-- To discharge static electricity, touch vehicle ground with hand (without gloves).

-- Disconnect electrical connector on transmission by rotating twist lock counterclockwise -arrow-.

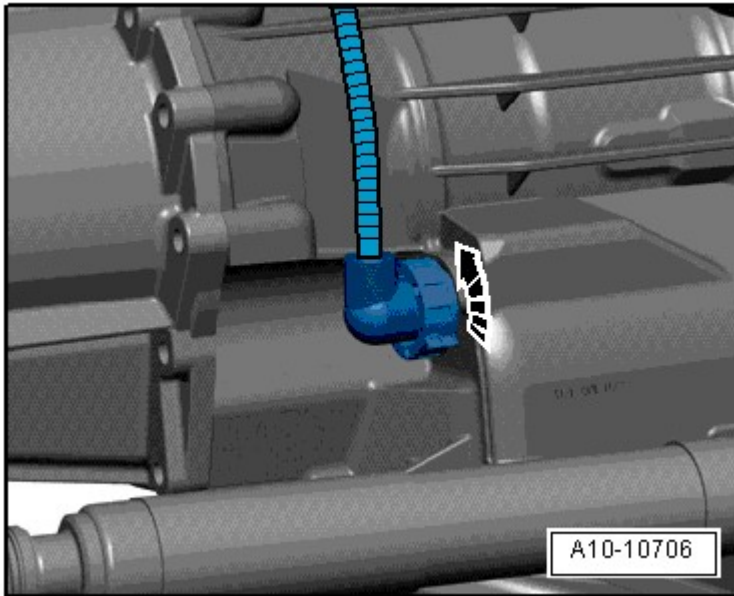


Fig. 62: Turning Screw Connection Counter-Clockwise -Arrow-
Courtesy of AUDI OF AMERICA, LLC

-- If engine and transmission are to be separated after removing engine/transmission assembly, remove ATF line -1- from transmission and remove lower bolts -arrows- in engine transmission connection.

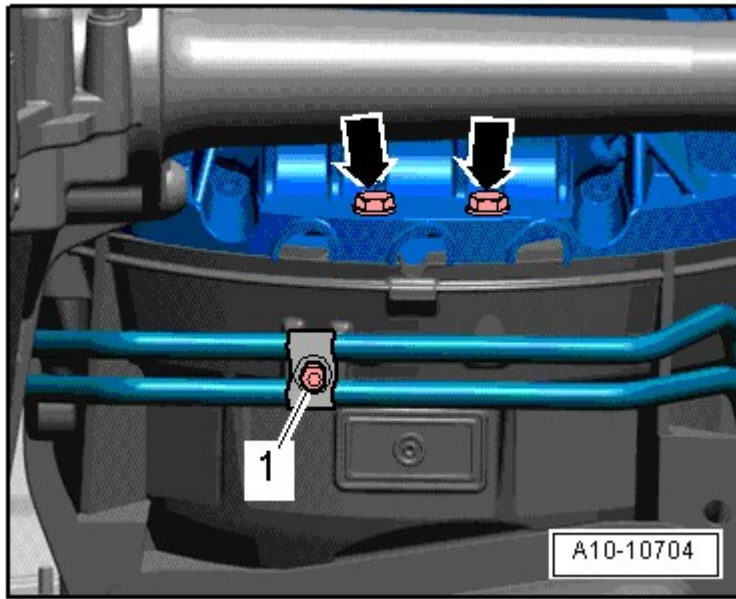


Fig. 63: Identifying Lower Bolts -Arrows- For Engine To Transmission Connection
Courtesy of AUDI OF AMERICA, LLC

-- Disconnect electrical connector -arrow- on steering gear.

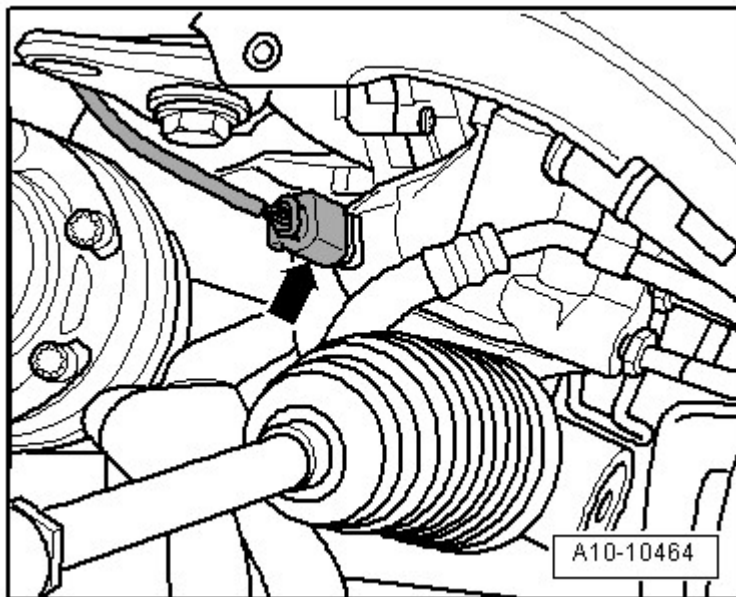


Fig. 64: Identifying Electrical Connector And Heat Shield
Courtesy of AUDI OF AMERICA, LLC

CAUTION: Risk of distorting airbag spiral spring.

- Separate universal joint from steering gear only when front wheels are in straight ahead position.

- Secure steering wheel with adhesive tape to prevent position of steering wheel and steering gear from changing.

-- Remove universal joint bolt -arrow- Description and Operation .

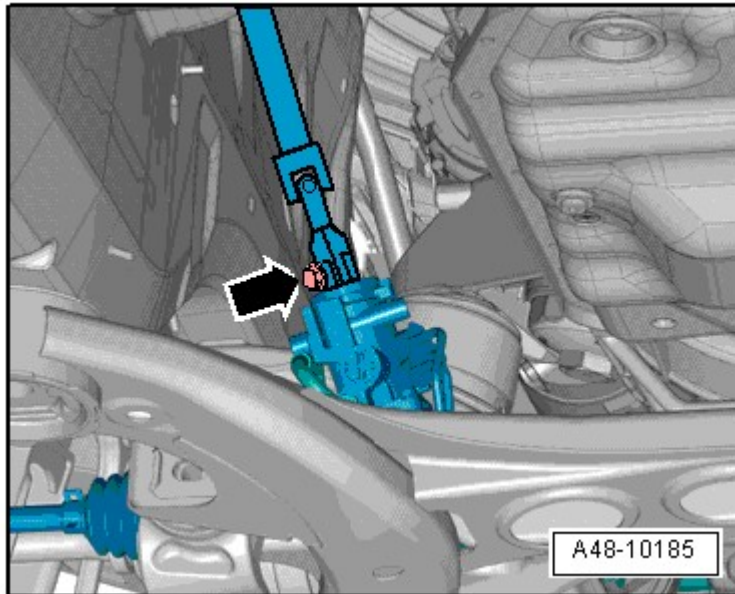


Fig. 65: Identifying Universal Joint Bolt -Arrow-
Courtesy of AUDI OF AMERICA, LLC

-- Remove universal joint from steering gear.

-- Place used oil collecting and extracting device V.A.G 1782 under separating point.

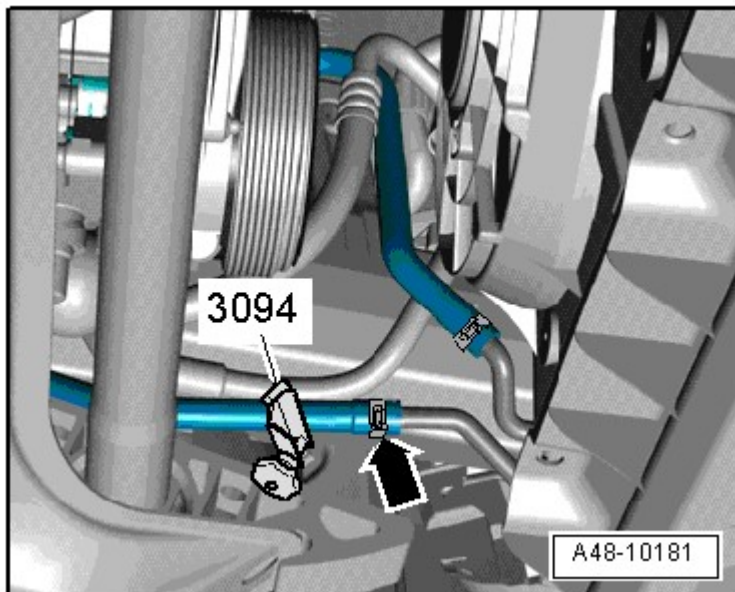


Fig. 66: Identifying Lock Carrier On Left Hydraulic Line -Arrow- To Left Power Steering Pump Cooler
Courtesy of AUDI OF AMERICA, LLC

-- Disconnect left hydraulic line -arrow- to left power steering pump cooler at lock carrier.

NOTE: Ignore hose clamps 3094.

-- Remove ground (GND) connection -1- from right longitudinal member.

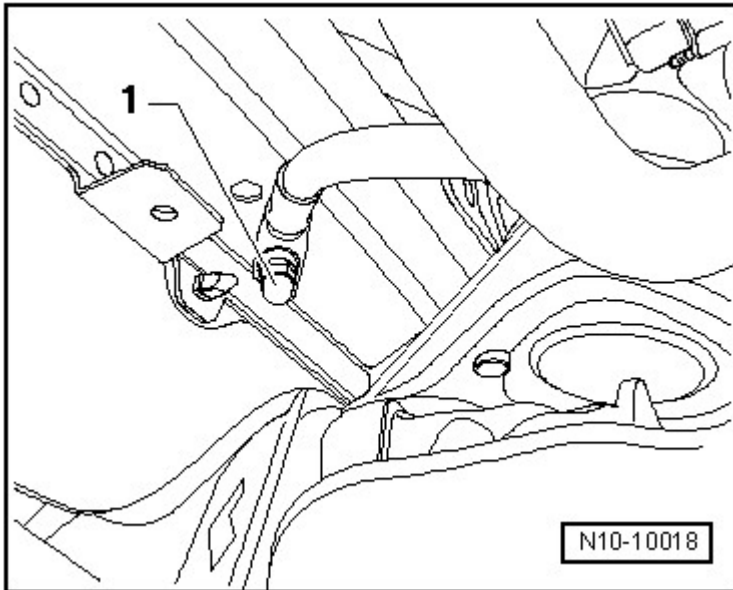


Fig. 67: Identifying Ground (GND) Cable On Longmember
Courtesy of AUDI OF AMERICA, LLC

Prepare Scissor Lift Platform

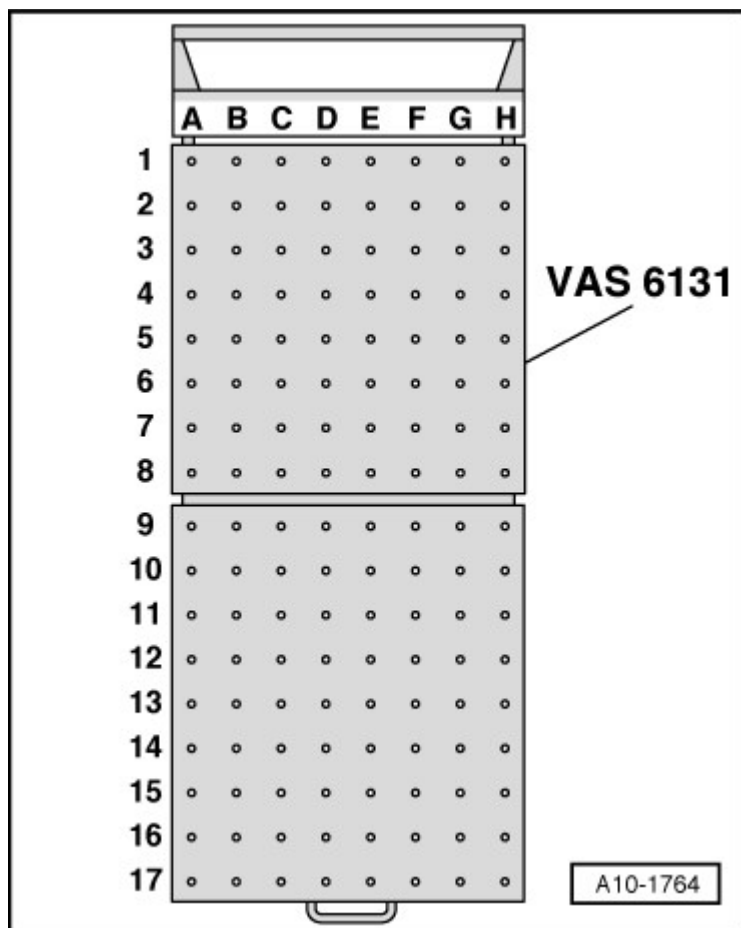


Fig. 68: Identifying Scissor Lift Platform VAS 6131

Courtesy of AUDI OF AMERICA, LLC

-- Equip scissor lift table VAS 6131 A with support set VAS 6131/10 and supplementary set VAS 6131/11 and supplementary set VAS 6131/13 as follows:

Platform coordinates	Parts from support set VAS 6131/10, supplementary set VAS 6131/11 and supplementary set VAS 6131/13			
B2	/10-1	/10-2	/10-5	/11-1
G2	/10-1	/10-2	/10-5	/11-1
A4 and C4	/13-5	-	-	/13-2
F4 and H4	/13-6	-	-	/13-2
B5	/13-4	/10-2	/10-5	/13-1
G5	/13-4	/10-2	/10-5	/13-1
C7	/10-1	/10-2	/10-5	/10-8
F7	/10-1	/10-2	/10-5	/10-8
B14	/10-1	/10-3	/10-5	/10-7
G14	/10-1	/10-3	/10-5	/10-7

-- Next secure mounting elements to scissor lift table by hand.

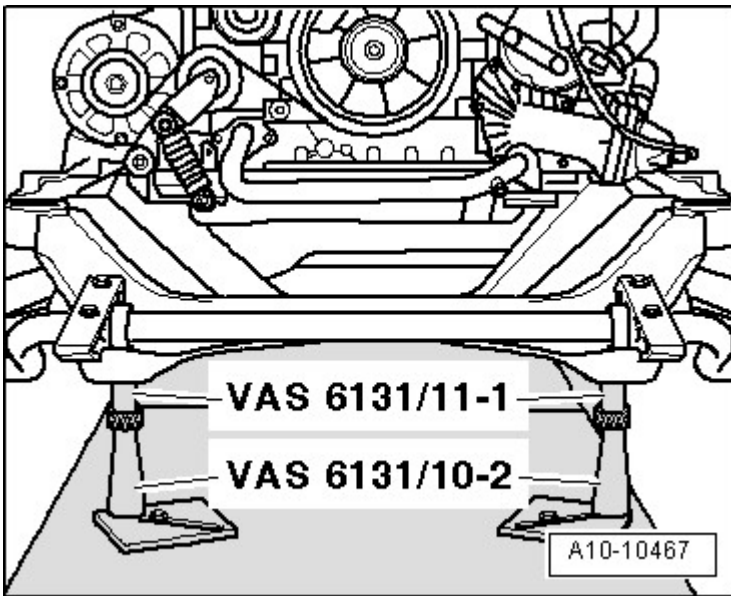


Fig. 69: Attaching Mounting Elements From VAS 6131/10 And VAS 6131/11 At Front Of Subframe
Courtesy of AUDI OF AMERICA, LLC

- Position scissor lift table VAS 6131 A horizontally.
 - Note bubble level (sight glass) on support platform.
- Guide scissor lift table under engine/transmission assembly.
- Attach mounting elements from support set VAS 6131/10 and supplementary set VAS 6131/11 at front of subframe as shown in illustration.
- Ensure threaded spindles are completely installed.
- Attach mounting elements from support set VAS 6131/10 and supplementary set VAS 6131/13 at left and right on transmission carrier as shown in the illustration.

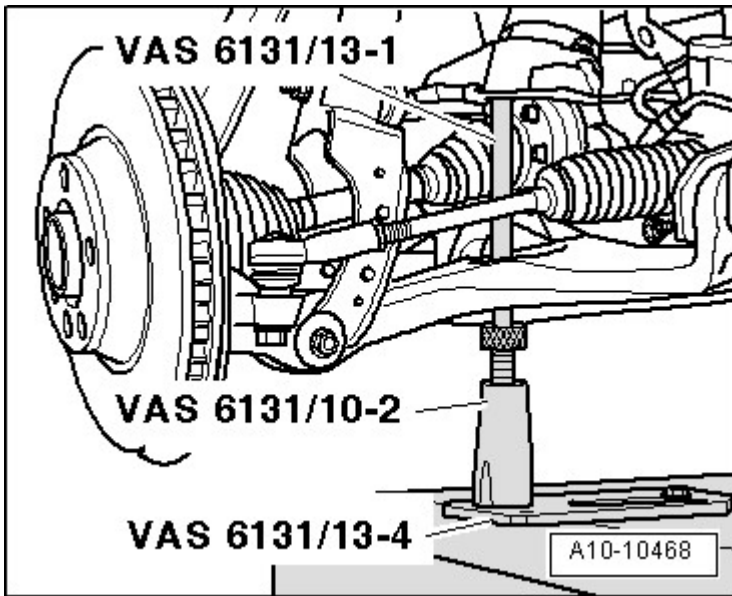


Fig. 70: Attaching Mounting Elements From VAS 6131/10 And VAS 6131/13
 Courtesy of AUDI OF AMERICA, LLC

-- Position mounting elements supplementary set VAS 6131/13 at left and right on suspension struts as shown in the illustration.

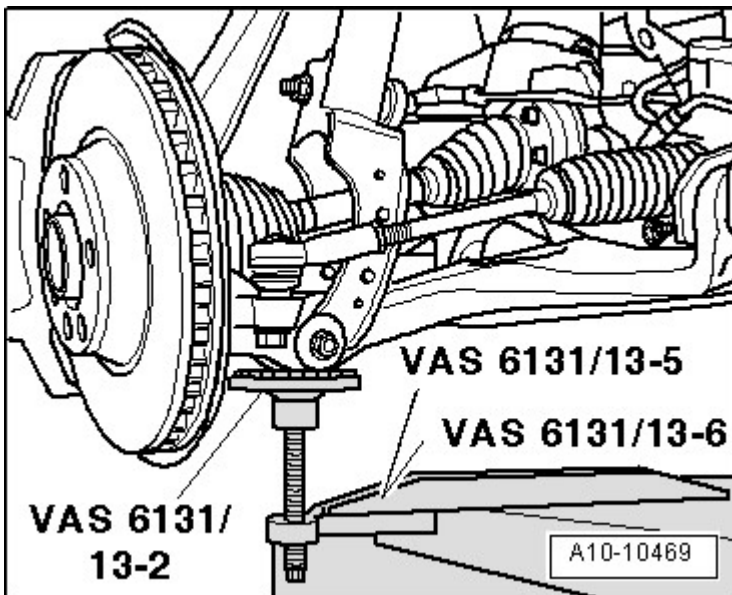


Fig. 71: Positioning Supporting Elements From VAS 6131/13 On Strut Supports
 Courtesy of AUDI OF AMERICA, LLC

-- Attach mounting elements from supplementary set VAS 6131/10 at left and right on subframe as shown in the illustration.

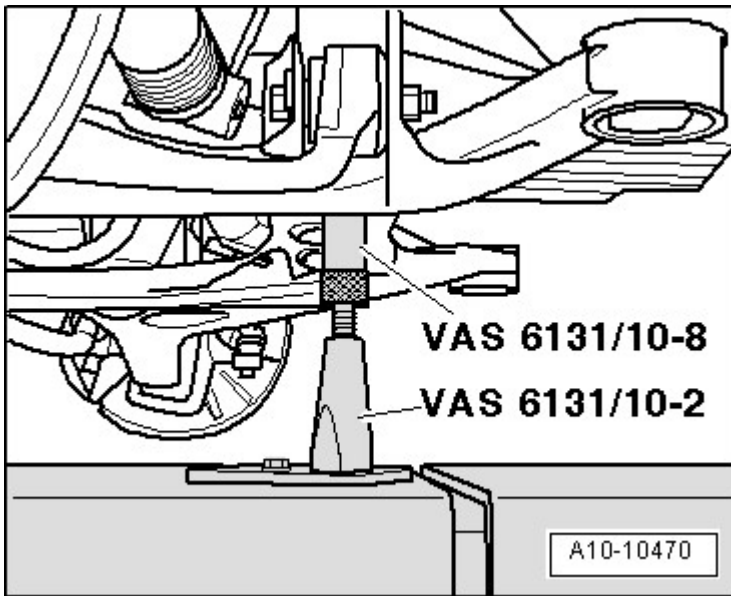


Fig. 72: Attaching Mounting Elements From VAS 6131/10 At Rear Of Subframe
 Courtesy of AUDI OF AMERICA, LLC

-- Attach mounting elements from support set VAS 6131/10 at left and right on transmission carrier as shown in illustration.

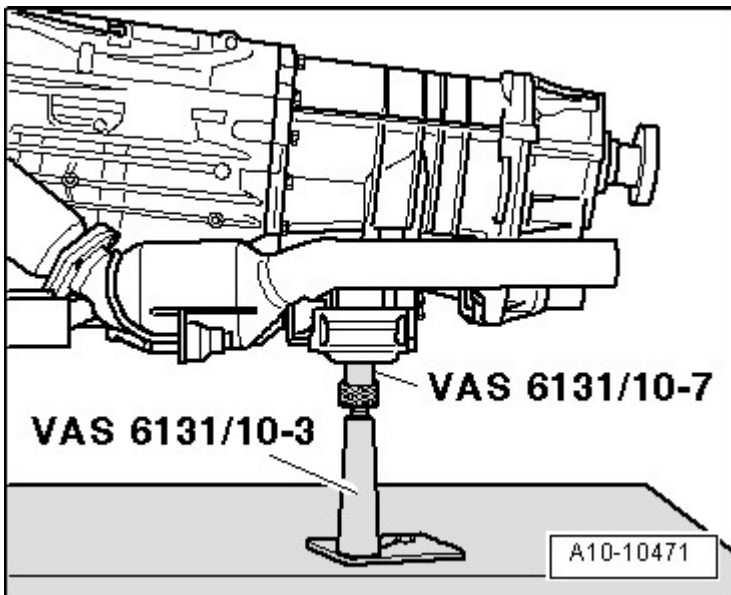


Fig. 73: Attaching Mounting Elements From VAS 6131/10 At Left And Right On Transmission Carrier
 Courtesy of AUDI OF AMERICA, LLC

- Rotate mounting element spindles upward until all mounting pins come in contact with mounting points.
- Attach mounting element base plates to scissor lift table VAS 6131 A and tighten to 20 Nm.
- Mark position of subframe, engine carrier and transmission carrier to long members with a felt tip pen.

-- Remove bolts -1 to 4- diagonally in stages.

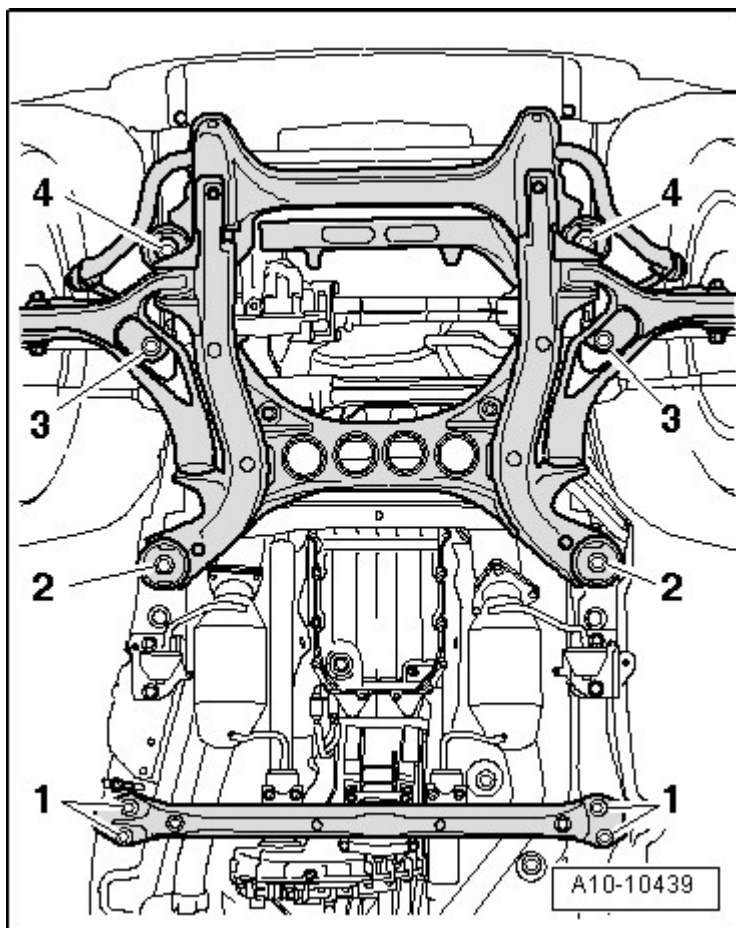


Fig. 74: Identifying Bolts -4- And Engine Carrier Bolts -3-
Courtesy of AUDI OF AMERICA, LLC

-- Remove bolt -1- at left and right.

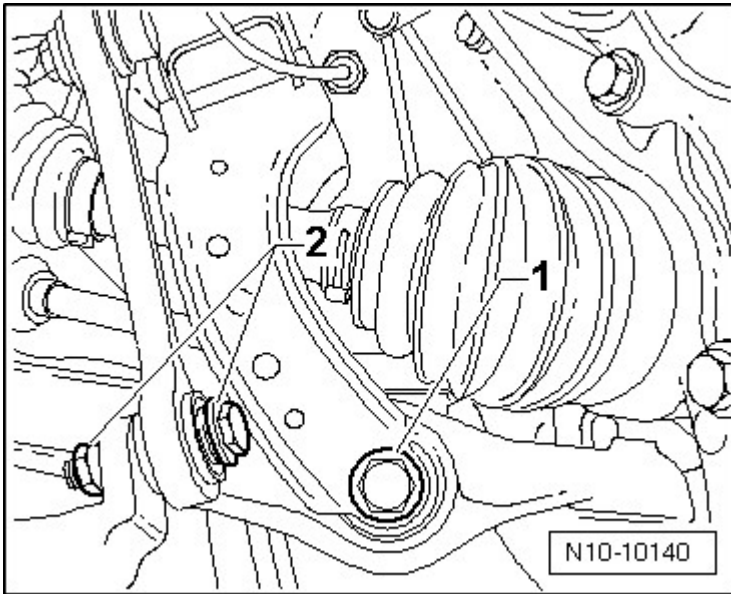


Fig. 75: Identifying Right/Left Lower Bolt On Stabilizer Bar
Courtesy of AUDI OF AMERICA, LLC

NOTE: Ignore -2-.

Verify that all hoses and lines between engine/transmission subassembly and body have been disconnected.

To avoid damage, carefully guide engine/transmission assembly out of engine compartment when lowering.

Carefully guide suspension struts onto long members.

-- Lower engine/transmission assembly.

-- Remove scissor lift table VAS 6131 A with engine/transmission assembly under vehicle.

-- Separate the engine from the transmission. **ENGINE AND TRANSMISSION, SEPARATING.**

-- Secure the engine and transmission to the holder. **ENGINE AND TRANSMISSION, SECURING TO HOLDER.**

ENGINE, INSTALLING

Tightening Specifications

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 $\pm 15\%$.

Tightening specifications SUBFRAME, ASSEMBLY OVERVIEW.

Additional Tightening Specifications

Component	Nm
Bolts and nuts	
M6	10
M7	15
M8	22
M10	40
M12	65
Exceptions:	
Drive plate to torque converter	85 ⁽¹⁾
Noise insulation bracket to body	9
(1) Replace bolts.	

TRANSMISSION TO ENGINE BOLTS

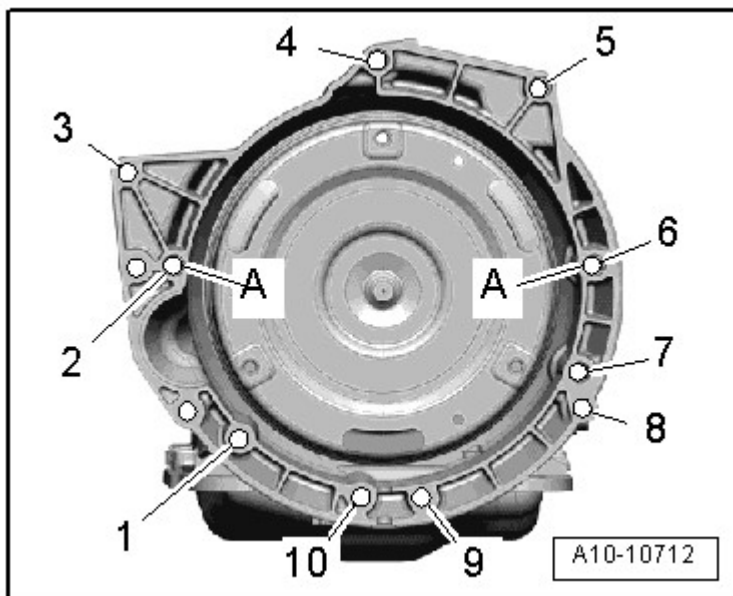


Fig. 76: Identifying Transmission To Engine Mounting Bolts
 Courtesy of AUDI OF AMERICA, LLC

2009 Audi Q7 3.6

ENGINE 3.6 Liter - Engine - Assembly - Engine Code(s): BHK

Item	Bolt	Nm
1, 8, 9, 10	M10 x 50	45
2	M12 x 70	80
3 ⁽¹⁾ , 4, 5	M12 x 60	80
6 ⁽²⁾ , 7	M12 x 140	80
A	Alignment sleeves for centering	
(1) Double bolt.		
(2) Threaded fastener with nut.		

PROCEDURE

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

NOTE: **Replace bolts which have been tightened to specifications.**

Replace sealing rings, seals and self locking nuts and bolts.

Replace bolts for securing torque converter to drive plate with new original bolts.

Secure all hose connections using hose clamps appropriate for the model type.

When installing, place all cable ties and heat insulating sleeves in same locations.

-- Install right engine support.

-- If no alignment sleeves for centering engine and transmission are present in cylinder block, insert sleeves.

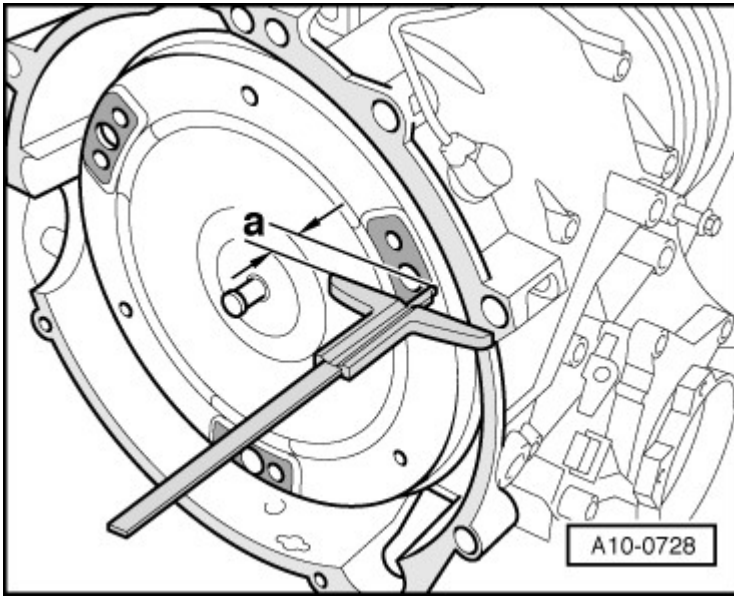


Fig. 77: Measuring Torque Converter
Courtesy of AUDI OF AMERICA, LLC

-- Check torque converter installation dimension.

- When torque converter is installed correctly, distance between lower contact surfaces of threaded holes at torque converter and contact surface of bell housing on automatic transmission is approximately 25 mm.
- If torque converter is not completely inserted, distance is approximately 10 mm.

-- Before guiding engine and transmission together, rotate torque converter and drive plate so that holes or threaded holes are same height as opening for removed starter -arrows-.

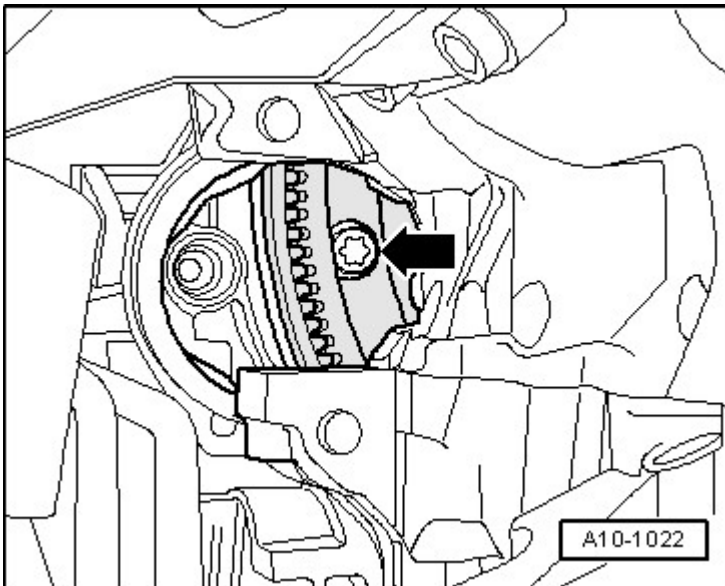


Fig. 78: Identifying Torque Converter Bolts
Courtesy of AUDI OF AMERICA, LLC

-- Attach transmission to engine.

CAUTION: Risk of destroying transmission due to torque converter inserted incorrectly.

- Keep checking whether the torque converter behind the drive plate can be turned before and during tightening of the bolts at engine/transmission connection.
- If torque converter cannot be rotated, the ATF pump coupling plate and therefore the transmission are destroyed when connections are tightened to final torque.

-- Install ATF lines ATF PIPES AND COOLER .

Continuation for All

-- Install power steering pressure line Description and Operation .

-- Install starter STARTER [for engine(s) BHK] .

With 4 Zone Climate Control

-- Install rear coolant pipes REAR COOLANT PIPES, WITH 4 ZONE CLIMATE CONTROL .

Continuation for All

-- Install front driveshaft to transfer case Removal and Installation .

-- Install primary catalytic converters PRIMARY CATALYTIC CONVERTERS .

-- Install main catalytic converters MAIN CATALYTIC CONVERTERS .

-- Slowly guide engine/transmission assembly with subframe into body from below using scissor lift table VAS 6131 A, ensuring drive shaft boots are not damaged.

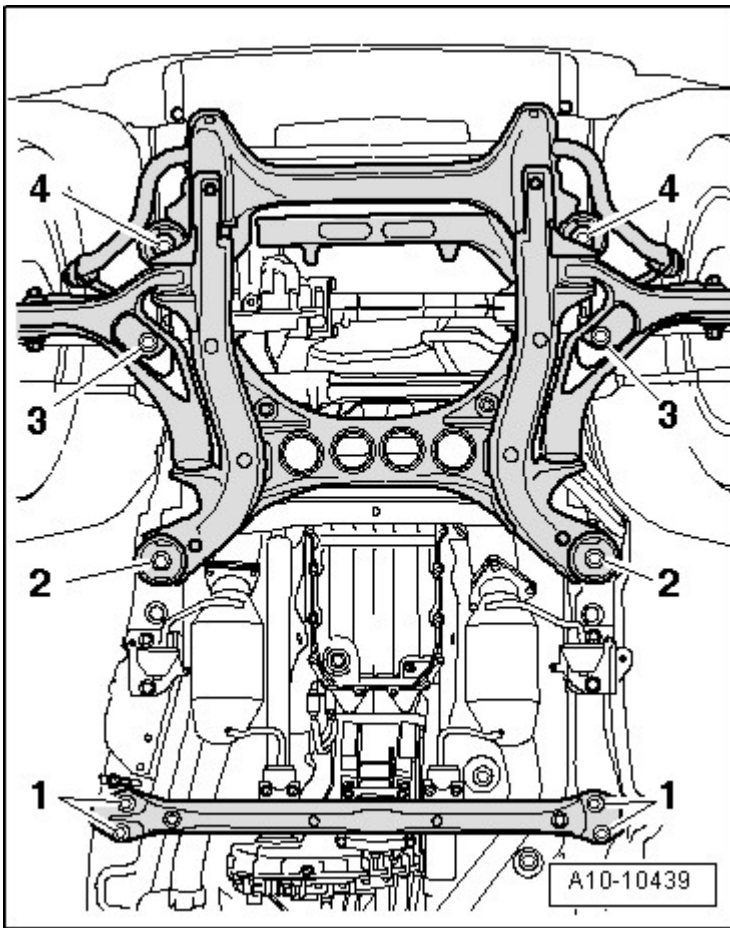


Fig. 79: Identifying Bolts -4- And Engine Carrier Bolts -3-
 Courtesy of AUDI OF AMERICA, LLC

-- Align subframe, engine carrier and transmission carrier using marks made on longitudinal members during removal.

-- Tighten bolts for subframe, engine carrier and transmission carrier only to specified torque **Description and Operation** . Do not tighten further (tighten bolts only after axle alignment).

WARNING: Risk of accident due to loose connections.

- **Vehicle must not be driven in this condition.**

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

- Install universal joint on steering gear **Description and Operation** .
- Install selector lever cable and check adjustment **Description and Operation** .
- Tighten driveshaft to rear of transfer case **Description and Operation** .

- Install stabilizer bar **Removal and Installation** .
- Install brake caliper **Removal and Installation** .
- Install struts (coil spring) **Removal and Installation** .
- Install struts (air suspension) **Removal and Installation** .
- Install Engine Control Module (ECM) **Removal and Installation** .
- Install refrigerant lines **Removal and Installation** .
- Electrical connections and routing.
- Follow measures after connecting battery **BATTERY, DISCONNECTING AND CONNECTING** .

CAUTION: Risk of destroying control modules with excess voltage.

- **Do not use a battery charger for starting assistance!**

- Install wiper arms and adjust **WINDSHIELD WIPER ARMS** .
- Fill engine oil and check oil level **ENGINE OIL LEVEL, CHECKING** .
- Before starting engine for the first time, check hydraulic oil in power steering reservoir **General Information** .

NOTE: Power steering pump must not run dry.

- Charge A/C system **Air Conditioning** .
- Fill with coolant **COOLING SYSTEM, DRAINING AND FILLING => Filling** .

NOTE: Do not use drained coolant in the following situations:

If the cylinder head or cylinder block was replaced.

If the coolant is contaminated.

- Align subframe and engine carrier **Description and Operation** .
- Align transmission carrier and tighten **Removal and Installation** .
- On a vehicle with air suspension, deactivate vehicle lift mode **Description and Operation** .
- Perform axle alignment **VEHICLE ALIGNMENT OVERVIEW** .

WARNING: Risk of accident due to loose connections.

- Tighten subframe bolts to final torque after axle alignment.

-- Install exhaust system free of stress EXHAUST SYSTEM, INSTALLING .

-- Check ATF level ATF LEVEL, CHECKING AND FILLING .

ENGINE MOUNT

Special tools and workshop equipment required

- Engine support bridge 10-222 A
- Bracket with spindle and hook 10-222 A /10, quantity: 2
- Adapter 10-222 A /22
- Lifting eyes 2024 A /2 from engine sling 2024 A
- M8 x 35 bolt
- Engine support basic set T40091
- Engine support supplement set T40093

Removing

-- Remove left and right bolts -1- and nuts -2-.

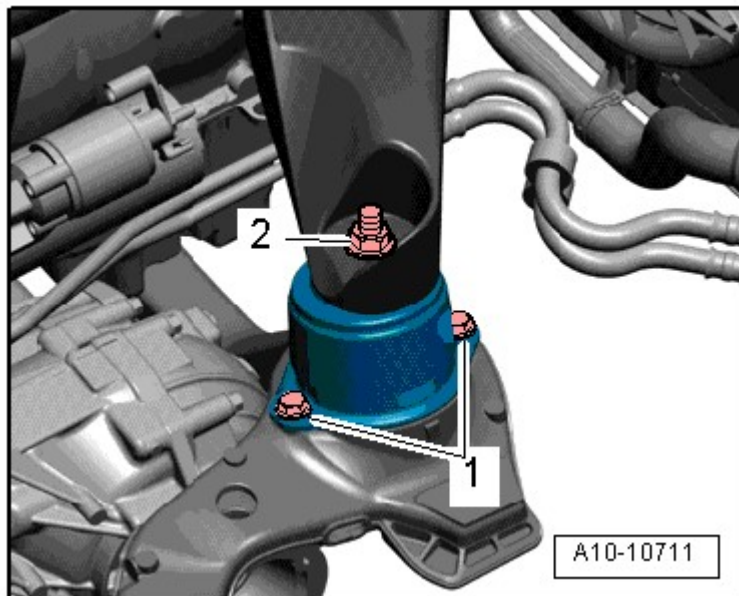


Fig. 80: Identifying Left And Right Bolts -1- And Nuts -2-
Courtesy of AUDI OF AMERICA, LLC

-- Remove bolt -1-.

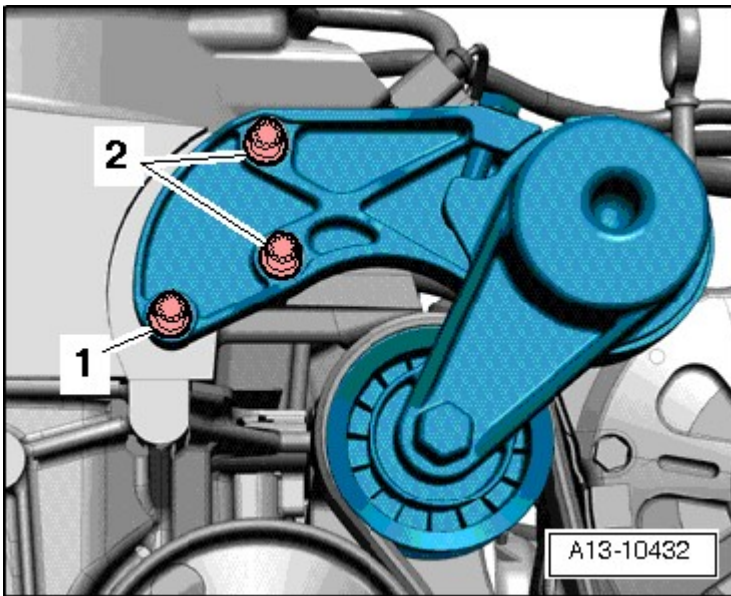


Fig. 81: Identifying Bolts -1 And 2- To Ribbed Belt Tensioner
Courtesy of AUDI OF AMERICA, LLC

NOTE: Ignore -2-.

-- Instead of using a bolt, tighten lifting eye 2024 A /2 with an M8 x 35 bolt -1-.

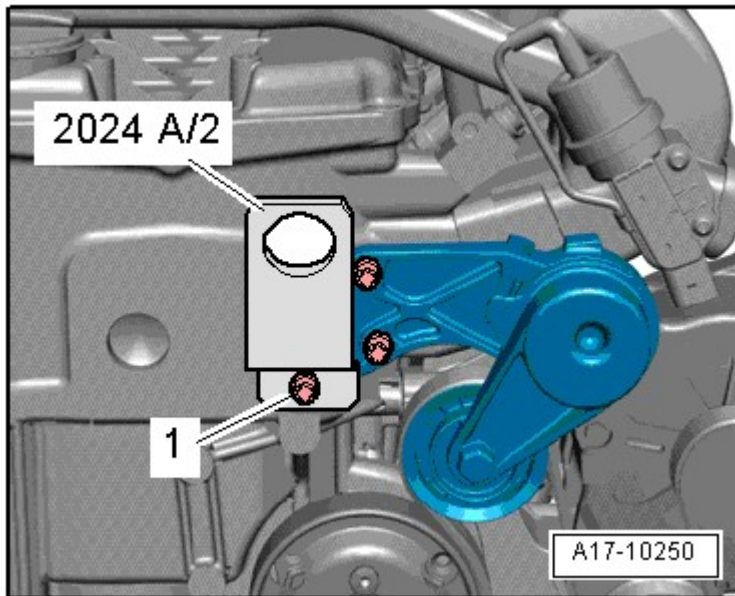


Fig. 82: Attaching 2024 A /2 With An M8 X 35 Bolt -1-
Courtesy of AUDI OF AMERICA, LLC

-- Position engine support bridge 10-222 A with adapters 10-222 A /22 and connectors T40091/3 on bolted fender flanges.

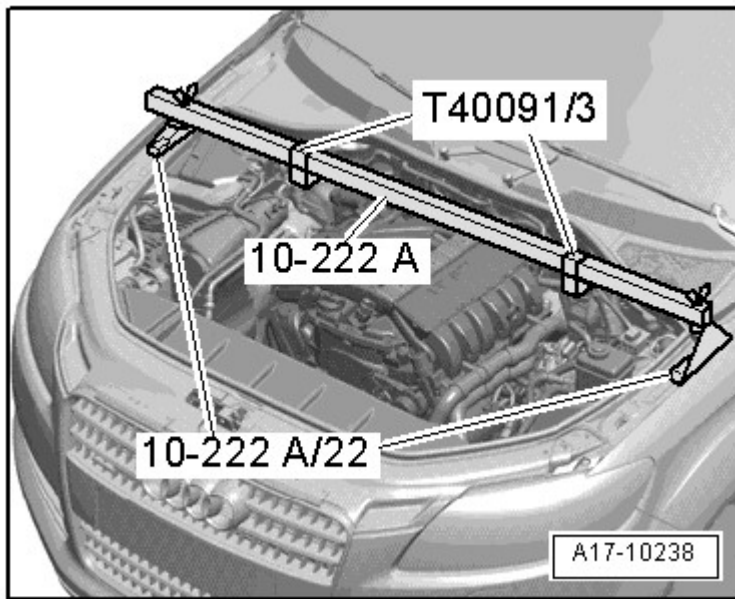


Fig. 83: Mounting 10-222 A, 10-222 A /22 And T40091/3 On Fender Bolting Edges
 Courtesy of AUDI OF AMERICA, LLC

-- Install parts of engine support basic set T40091 and engine support supplement set T40093 as shown in illustration.

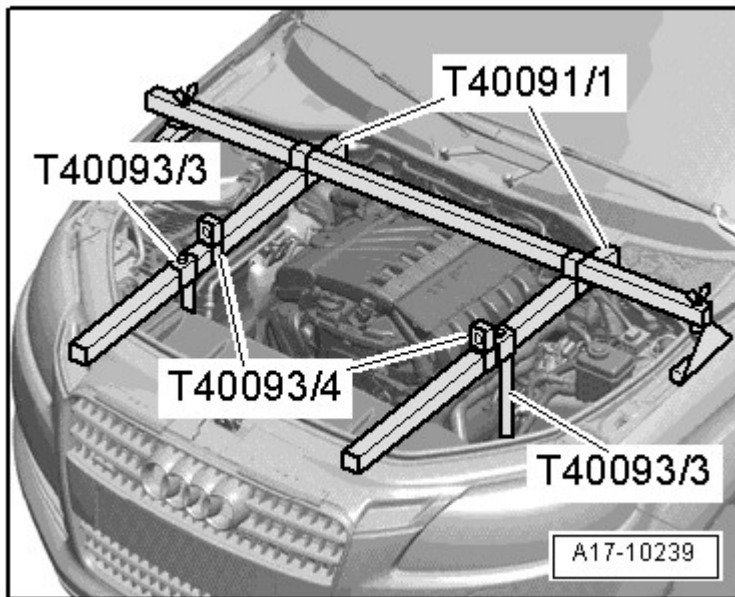


Fig. 84: Attaching Parts From T40091 And From T40093
 Courtesy of AUDI OF AMERICA, LLC

NOTE: To position adapter T40093/3 on longitudinal member notches, press refrigerant lines to left slightly.

-- Slide supports T40091/2 with both slides T40093/5 into both mounts T40093/4.

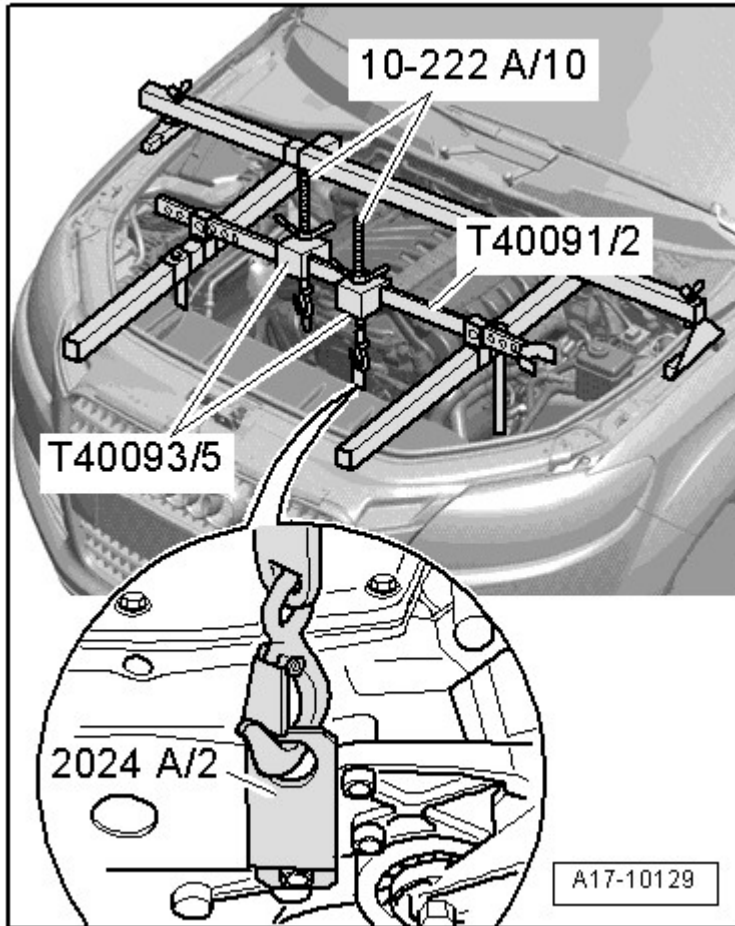


Fig. 85: Pushing Support T40091/2 With Both Slides T40093/5 Into Both Mounts T40093/4
 Courtesy of AUDI OF AMERICA, LLC

-- Install long engine support bridge 10-222 A spindles and engage hooks in front engine lifting eyes 2024 A /2 lifting eyes.

WARNING: Risk of accident due to loose engine support bridge spindles.

- Secure support T40091/2 with connector pins and splints T40093/4.

-- Raise engine until engine supports are above engine bracket threaded pins and evenly tension both spindles to achieve even weight distribution.

-- Remove left and right engine bracket.

Installing

- Tightening specifications SUBFRAME, ASSEMBLY OVERVIEW.

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

-- Install ribbed belt tensioner **RIBBED BELT TENSIONER** .

ENGINE CARRIER

Removing

-- On a vehicle with air suspension, activate vehicle lift mode **Description and Operation** .

-- Remove left and right engine bracket **ENGINE MOUNT**.

-- Remove screws and front -1- and rear -2- noise insulation.

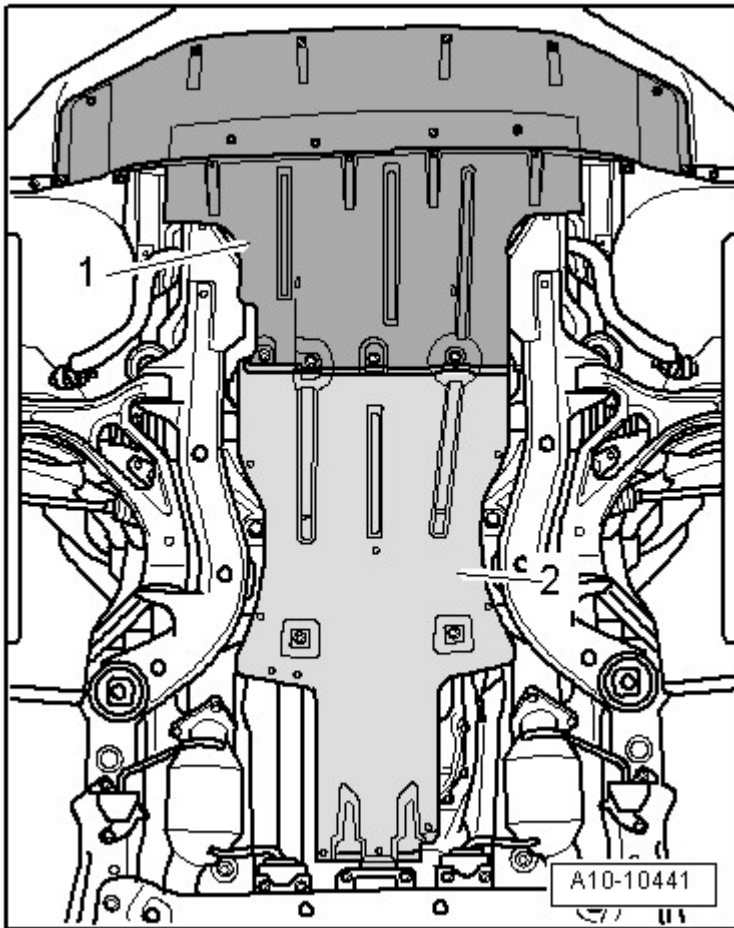


Fig. 86: Identifying Front/Rear Noise Insulation

Courtesy of AUDI OF AMERICA, LLC

CAUTION: Risk of distorting airbag spiral spring.

- Separate universal joint from steering gear only when front wheels are in straight ahead position.

- Secure steering wheel with adhesive tape to prevent position of steering wheel and steering gear from changing.

-- Remove universal joint bolt -arrow- **Description and Operation** .

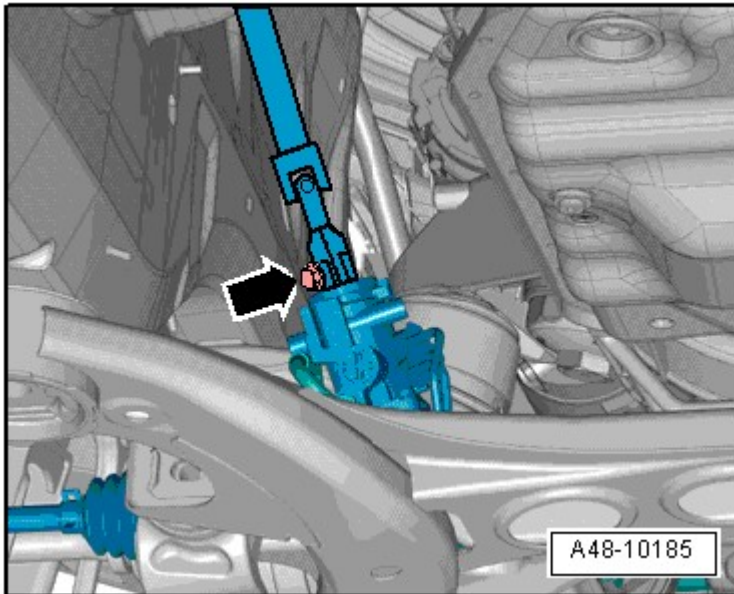


Fig. 87: Identifying Universal Joint Bolt -Arrow-
Courtesy of AUDI OF AMERICA, LLC

-- Remove universal joint from steering gear.

-- Remove coupling rods from left and right of stabilizer bar -arrow-.

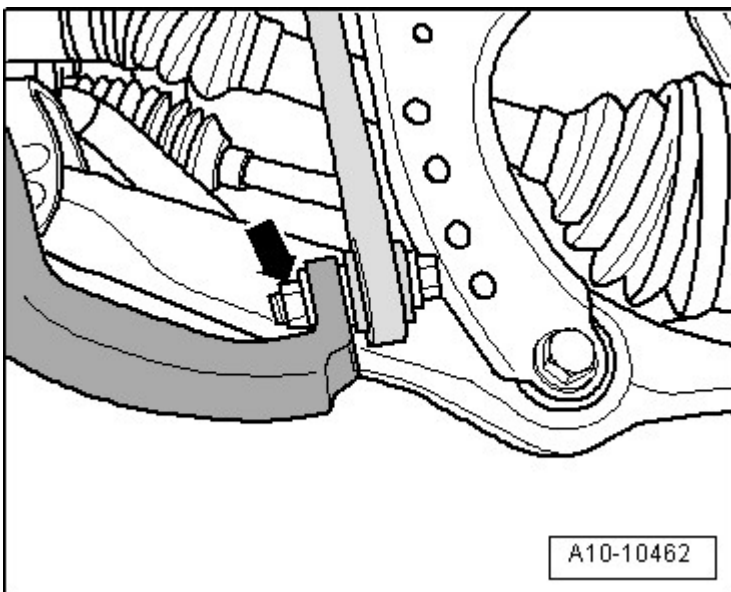


Fig. 88: Identifying Nut -Arrows- Securing Coupling Rod

Courtesy of AUDI OF AMERICA, LLC

-- Remove ground (GND) connection -1- from right longitudinal member.

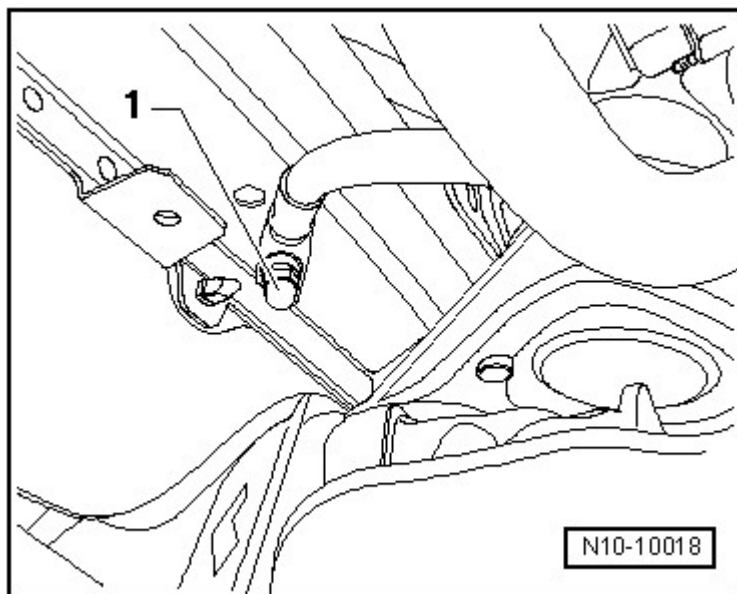


Fig. 89: Identifying Ground (GND) Cable On Longmember
Courtesy of AUDI OF AMERICA, LLC

-- Mark location of subframe and engine carrier to longitudinal members with a felt tip pen.

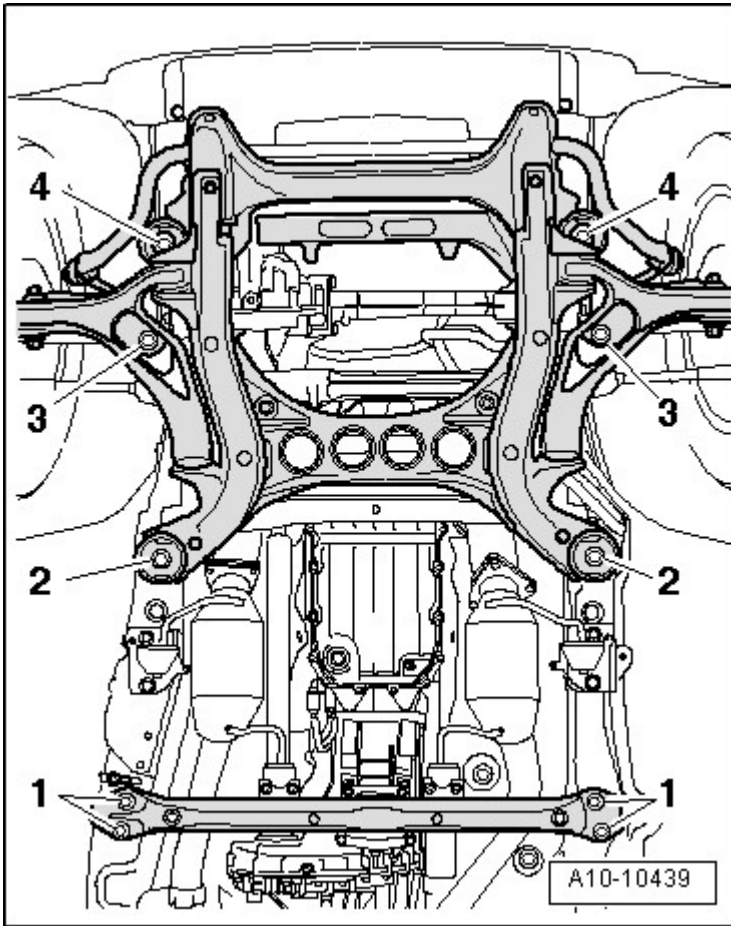


Fig. 90: Identifying Bolts -4- And Engine Carrier Bolts -3-
 Courtesy of AUDI OF AMERICA, LLC

WARNING: Risk of accident.

- Bolts -1 and 2- must remain installed.

- Remove bolts -3 and 4- and lower subframe with front engine carrier.
- Remove engine carrier forward.

Installing

- Tightening specifications SUBFRAME, ASSEMBLY OVERVIEW.

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

- Install subframe and engine carrier Removal and Installation .
- Install left and right engine bracket ENGINE MOUNT.

- Install stabilizer bar **Removal and Installation** .
- Install ribbed belt tensioner **RIBBED BELT TENSIONER** .
- Install universal joint on steering gear **Description and Operation** .
- On a vehicle with air suspension, deactivate vehicle lift mode **Description and Operation** .

SPECIAL TOOLS

Special tools and workshop equipment required

- M10 x 65 bolt
- Bracket 30-211 A

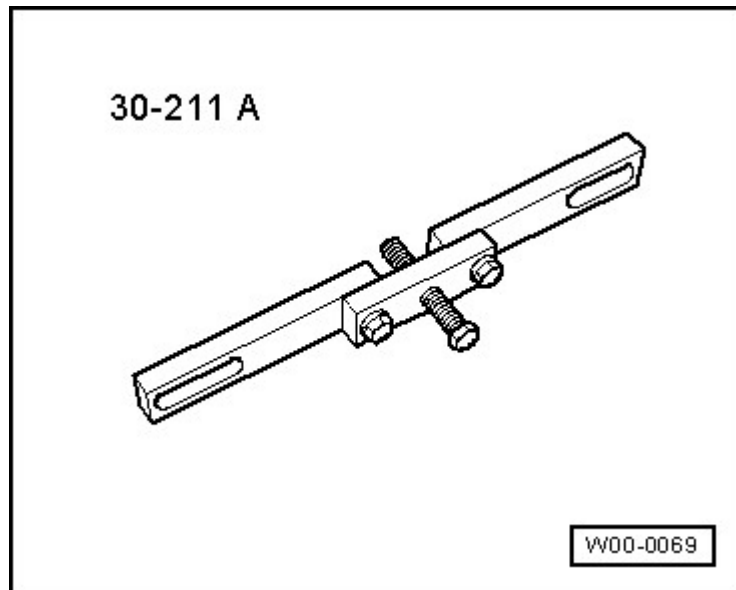


Fig. 91: Identifying Bracket 30 - 211 A
Courtesy of AUDI OF AMERICA, LLC

- Engine mount 3269

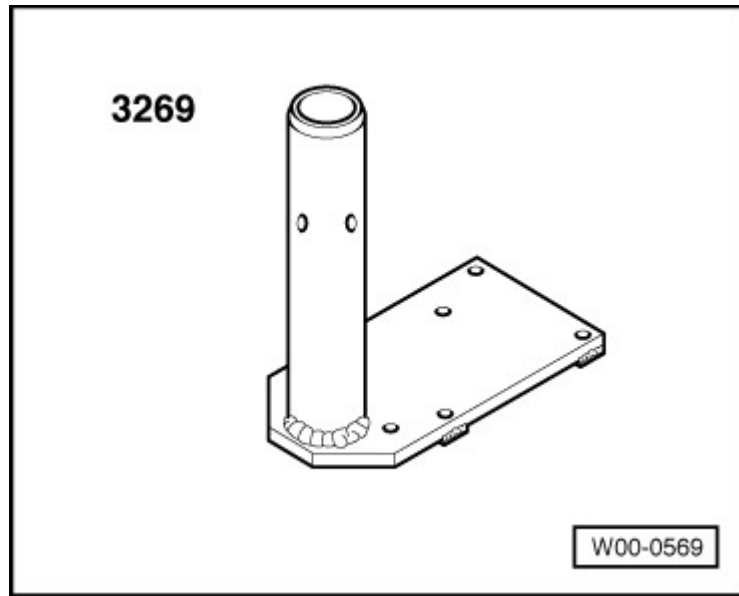


Fig. 92: Identifying Engine Support 3269
Courtesy of AUDI OF AMERICA, LLC

- Lift arm extension for workshop crane VAS 6101

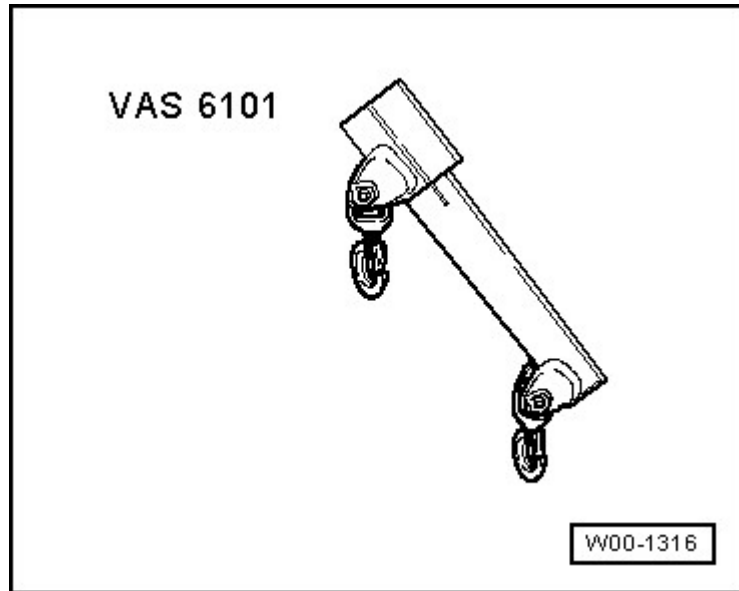


Fig. 93: Identifying Lift Arm Ext./Workshop Hoist VAS 6101
Courtesy of AUDI OF AMERICA, LLC

- Pry lever - rmv outside mirror 80-200

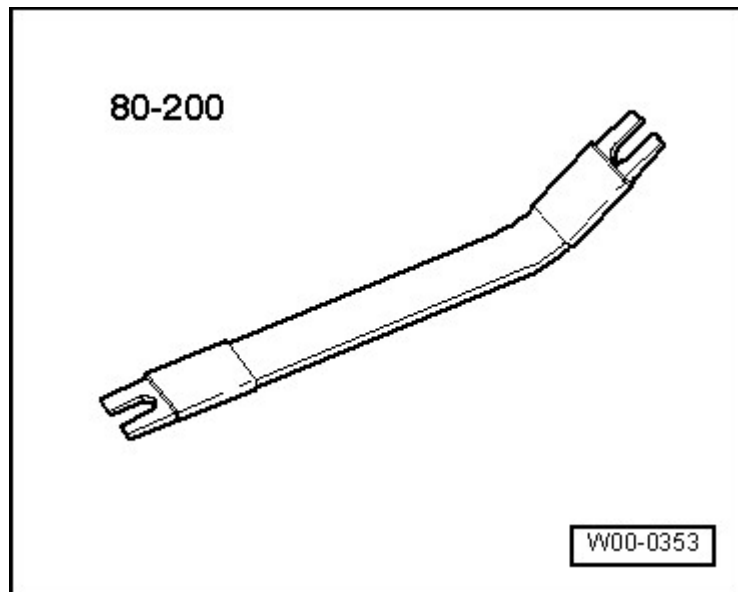


Fig. 94: Identifying Pry Lever 80-200
Courtesy of AUDI OF AMERICA, LLC

- Hose clamp pliers VAS 6340

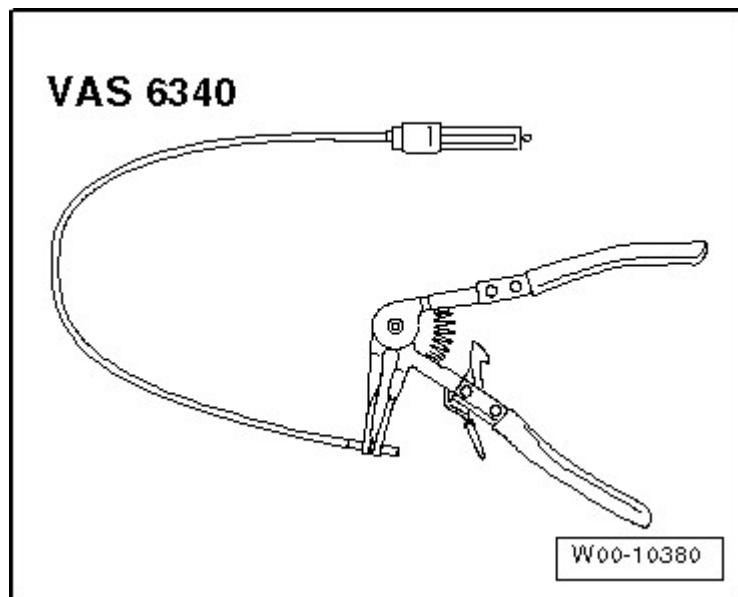


Fig. 95: Identifying Hose Clamp Pliers VAS 6340
Courtesy of AUDI OF AMERICA, LLC

- Ball joint puller T10187

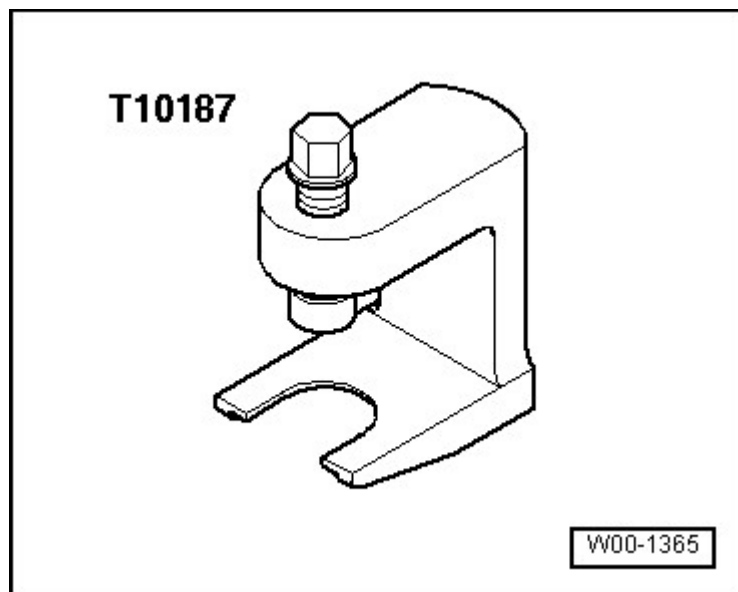


Fig. 96: Identifying Ball Joint Puller T10187
Courtesy of AUDI OF AMERICA, LLC

- Engine support bridge 10-222 A

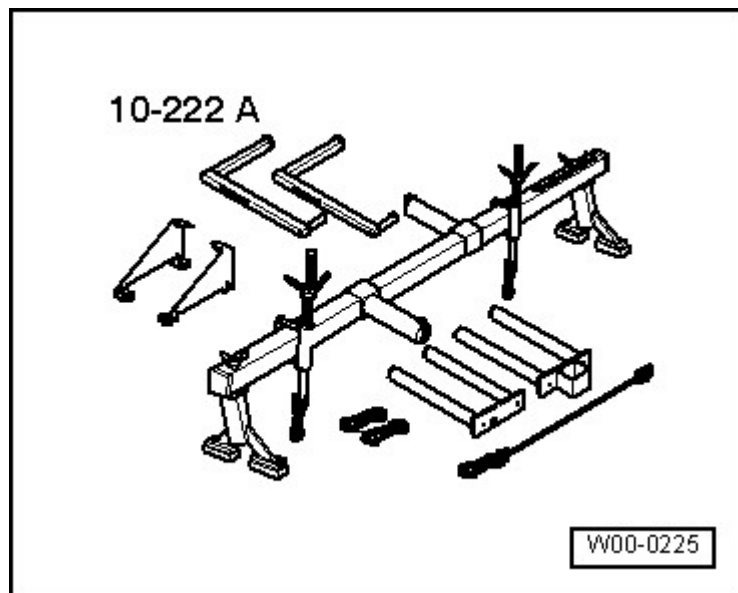


Fig. 97: Identifying Engine Support Bridge 10-222 A
Courtesy of AUDI OF AMERICA, LLC

- Bracket with spindle and hook 10-222 A /10

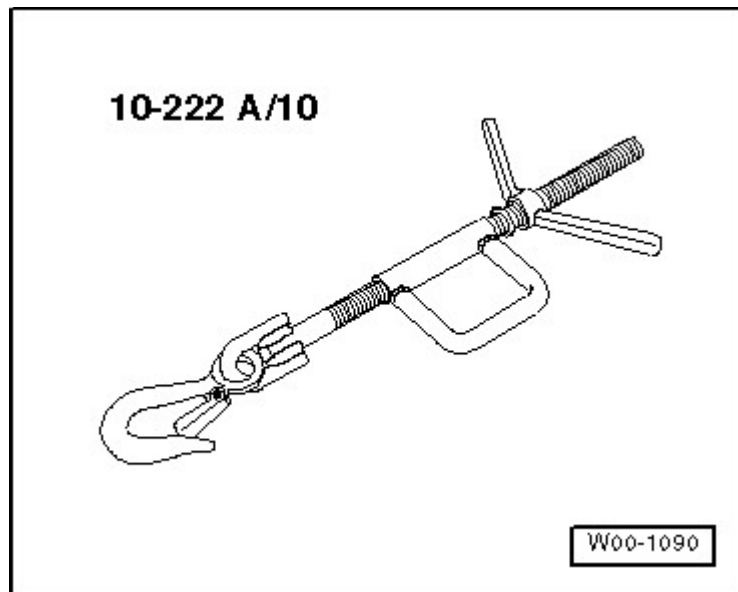


Fig. 98: Identifying Hook 10-222 A/10
Courtesy of AUDI OF AMERICA, LLC

- Adapter 10-222 A /22

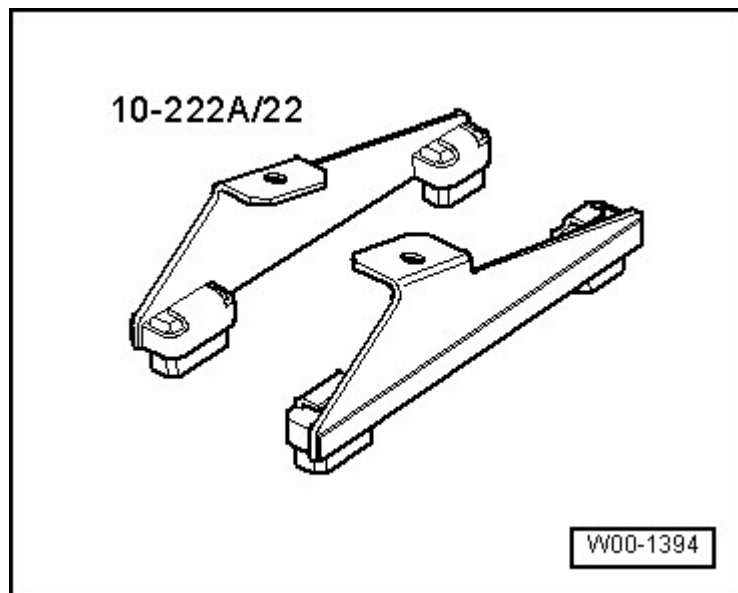


Fig. 99: Identifying Adapter 10-222 A /22
Courtesy of AUDI OF AMERICA, LLC

- Lifting eyes 2024 A /2 from engine sling 2024 A

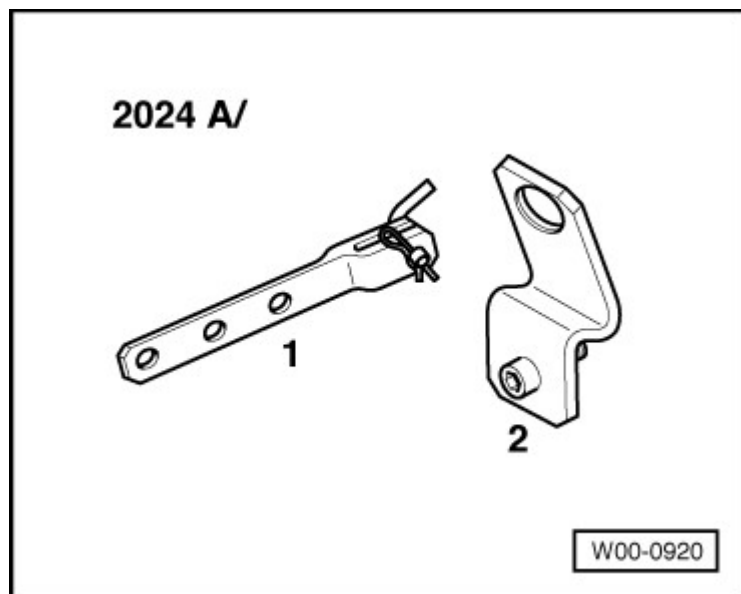


Fig. 100: Identifying Lifting Eyes 2024A /2 From Engine Sling 2024A
 Courtesy of AUDI OF AMERICA, LLC

- Engine support basic set T40091

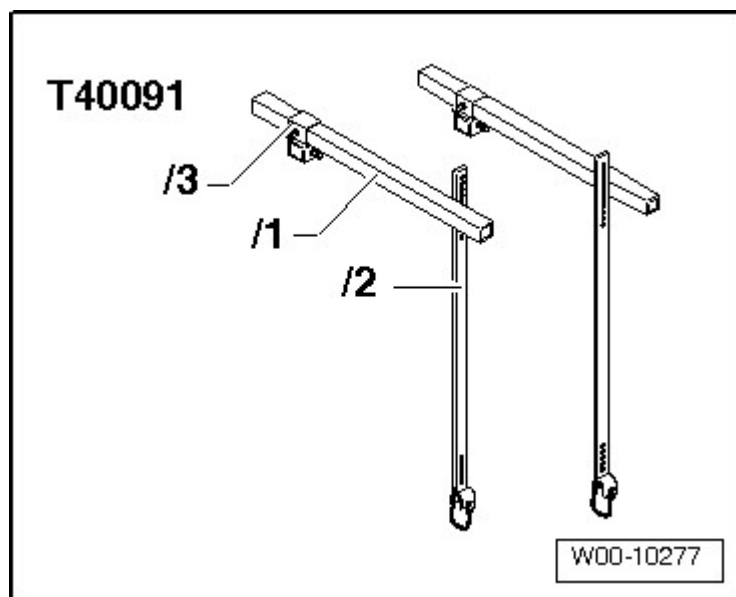


Fig. 101: Identifying Engine Support Basic Set T40091
 Courtesy of AUDI OF AMERICA, LLC

- Engine support supplement set T40093

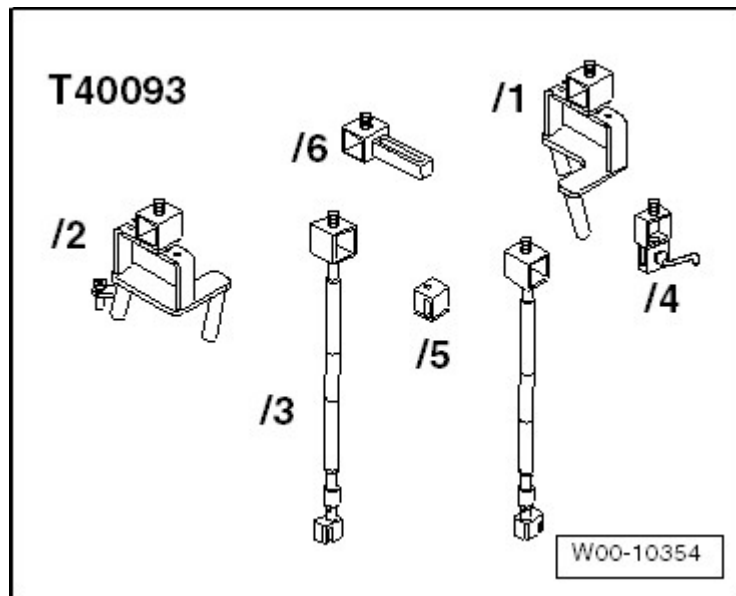


Fig. 102: Identifying Engine Support Supplement Set T40093
Courtesy of AUDI OF AMERICA, LLC

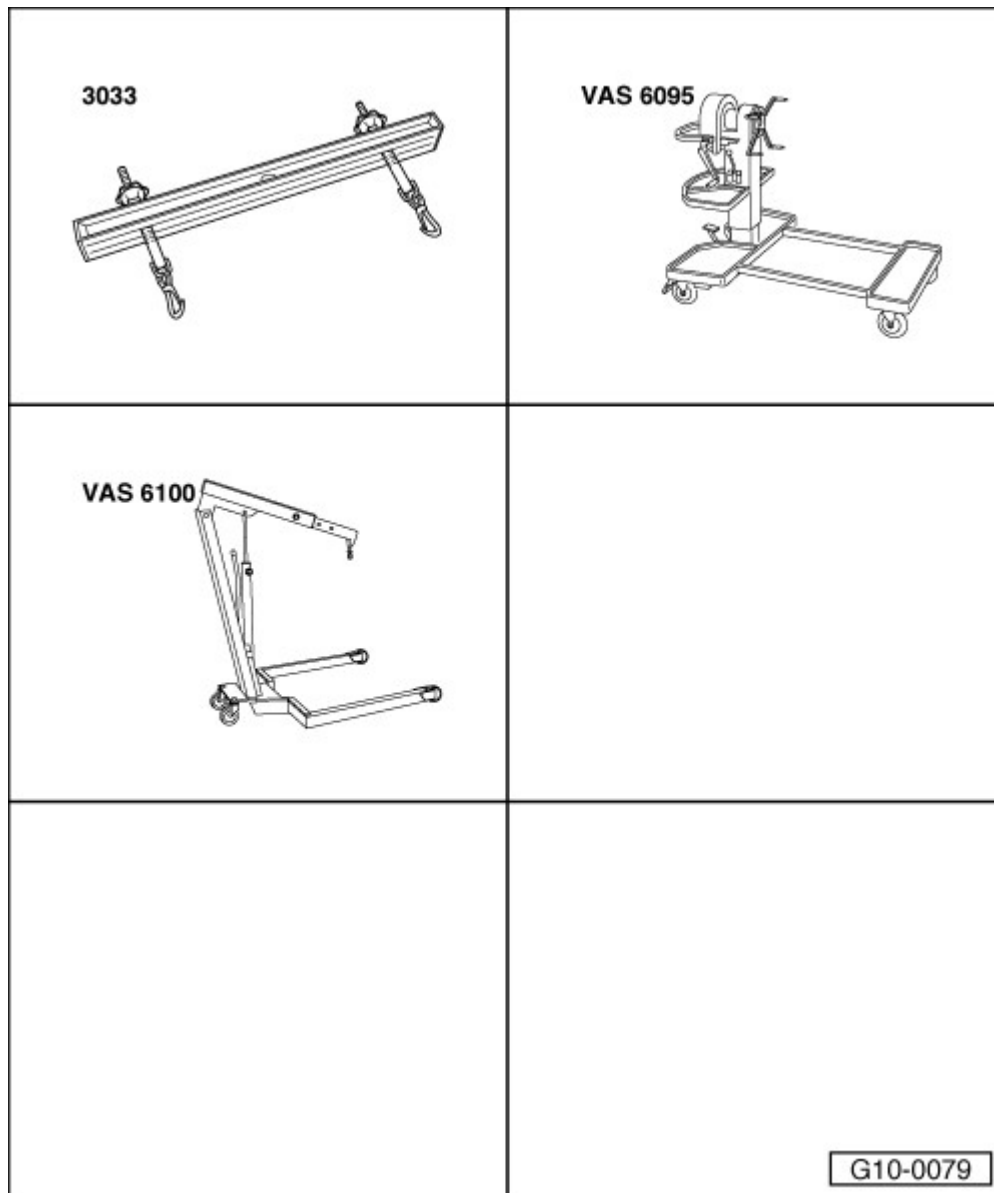


Fig. 103: Identifying Special Tools - Engine, Securing To Assembly Stand
 Courtesy of AUDI OF AMERICA, LLC

Special tools and workshop equipment required

- Lifting tackle 3033
- Engine and transmission holder VAS 6095
- V8 FSI engine holder 6095/1-6A
- Shop crane VAS 6100

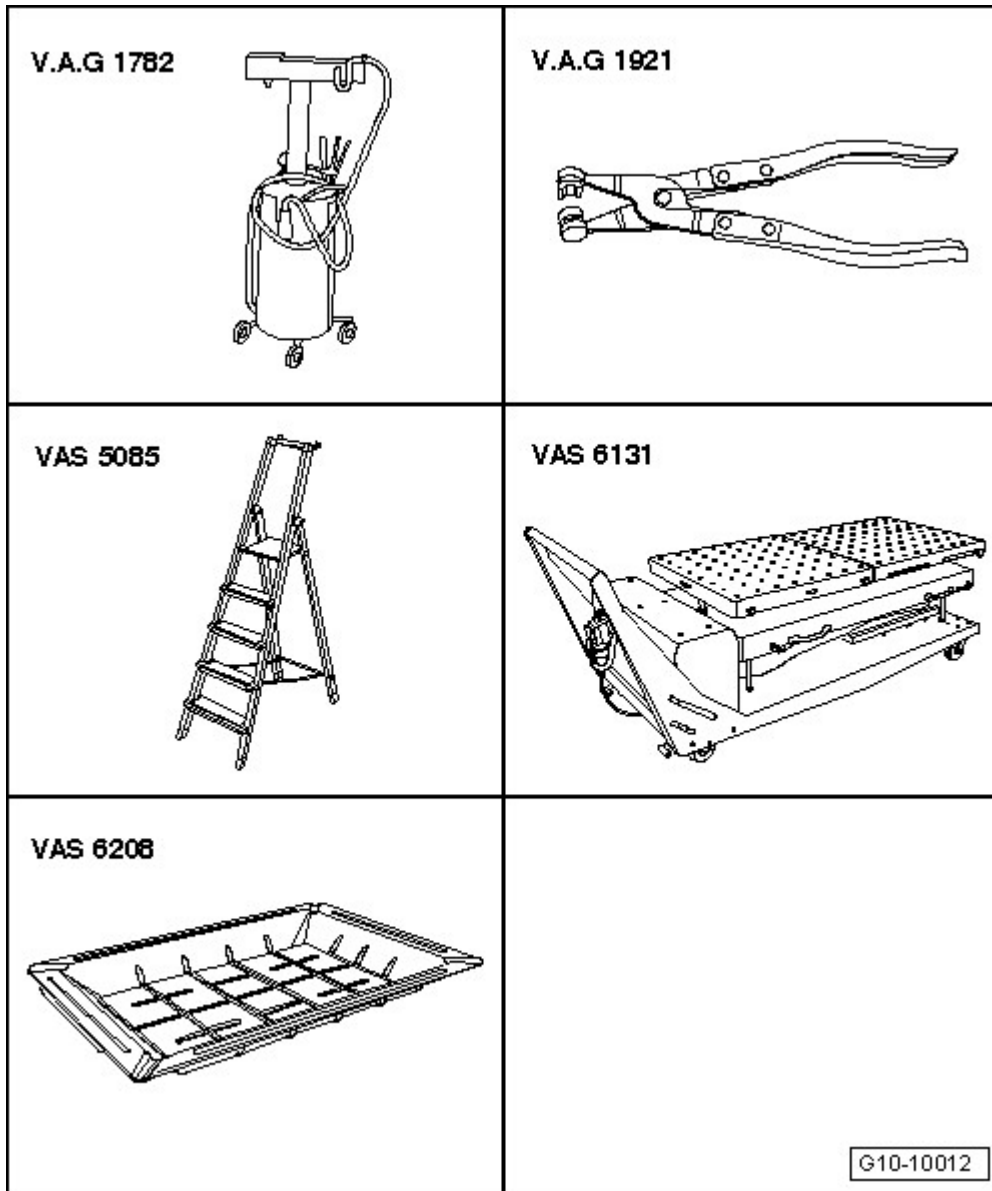


Fig. 104: Identifying Special Tools -- Engine, Removing
 Courtesy of AUDI OF AMERICA, LLC

Special tools and workshop equipment required

- Old oil collecting and extracting device V.A.G 1782
- Hose clamp pliers V.A.G 1921
- Step ladder VAS 5085
- Scissor lift table VAS 6131 A with support set VAS 6131/10 as well as supplementary set VAS 6131/11, VAS 6131/13 supplementary set, VAS6131/13 and quantity: 3 tapered mounting pin VAS 6131/10-2
- Drip tray for workshop crane VAS 6208

ENGINE

3.6 Liter - Engine - Crankshaft, Cylinder Block - Engine Code(s): BHK

13 ENGINE - CRANKSHAFT, CYLINDER BLOCK

DESCRIPTION AND OPERATION

RIBBED BELT DRIVE, ASSEMBLY OVERVIEW

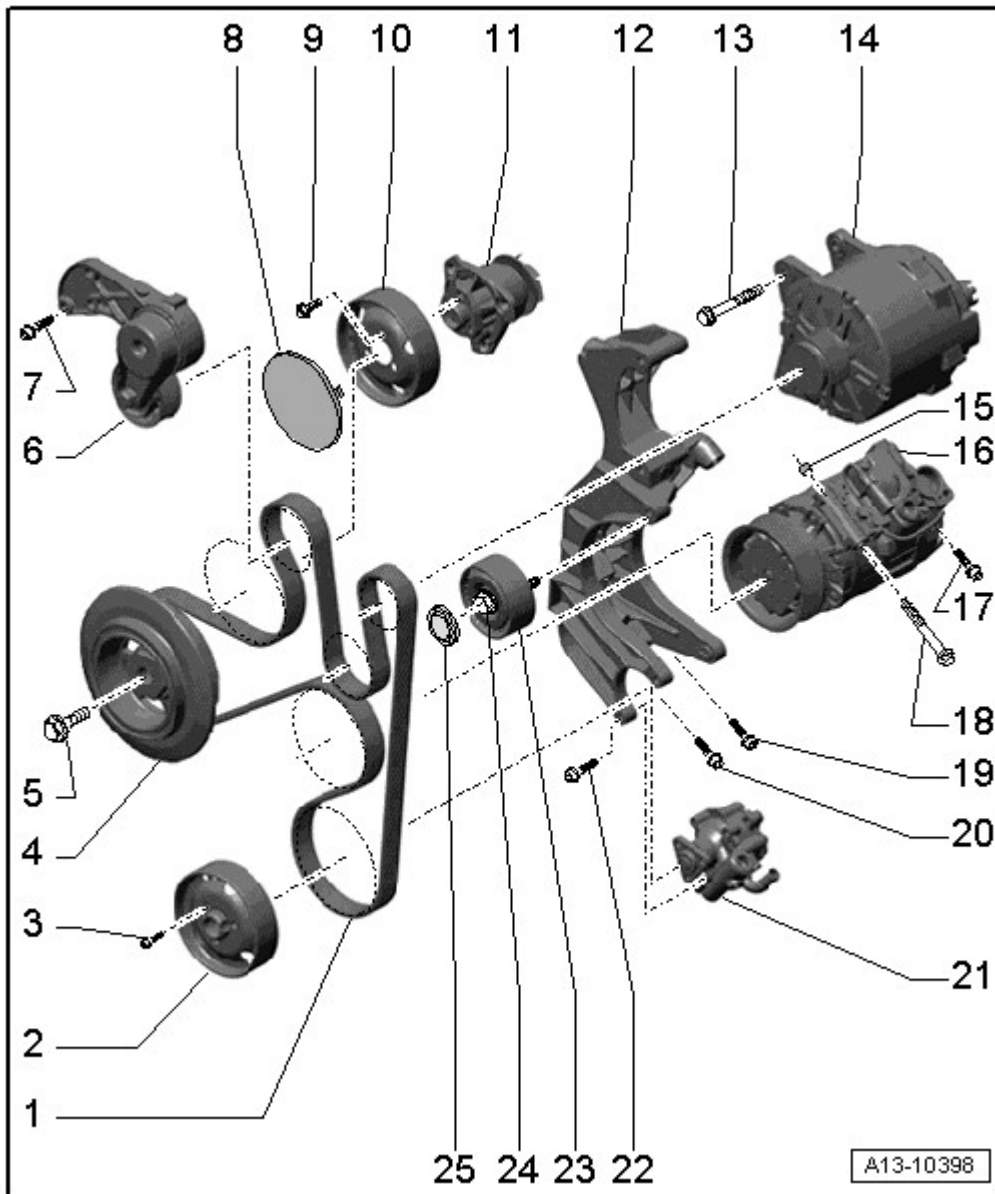


Fig. 1: Identifying Ribbed Belt Drive, Assembly Overview
 Courtesy of AUDI OF AMERICA, LLC

1. Ribbed belt

- Check for wear
- Do not kink

CAUTION: Risk of destroying due to reversed running direction on a used ribbed belt.

- Before removing ribbed belt, marking running direction with chalk or felt-tip pen for reinstallation later.

- Removing and installing **RIBBED BELT**.
- When installing, make sure it is seated correctly on pulleys

2. Power steering pump pulley**3. Bolt**

- Tightening specifications **Removal and Installation**

4. Vibration damper

- With ribbed belt pulley
- Removing and installing **VIBRATION DAMPER**.

5. Bolt

- Replace
- 100 Nm + $\frac{1}{2}$ additional turn (180°).
- Use counter-holder T10069 to loosen and tighten

6. Tension

- To release tension on ribbed belt, rotate using open-end wrench.
- Secure with M8 x 50 bolt
- Removing and installing **RIBBED BELT TENSIONER**.

7. Bolt

- 25 Nm

8. Cover cap**9. Bolt**

- Tightening specifications **COOLANT PUMP AND THERMOSTAT, ASSEMBLY OVERVIEW** .

10. Coolant pump pulley**11. Coolant pump****12. Accessory bracket**

- Removing and installing **ACCESSORY BRACKET**.

13. Bolt

- Tightening specifications **Removal and Installation**

14. Generator

- Removing and installing **GENERATOR [for engine(s) BHK]**
15. **A/C compressor fitting sleeve**
 16. **Air conditioner compressor**
 - Do not remove or disconnect refrigerant lines
 - Removing and installing **Removal and Installation**
 17. **Bolt**
 - Tightening specifications **Removal and Installation**
 18. **Bolt**
 - Tightening specifications **Removal and Installation**
 19. **Bolt**
 - 25 Nm
 20. **Fitting bolt**
 - 2 pieces
 - Tightening sequence **Fig. 2**
 21. **Power steering pump**
 - Removing and installing **Removal and Installation**
 22. **Bolt**
 - Tightening specifications **Removal and Installation**
 23. **Idler pulley**
 24. **Bolt**
 - 45 Nm
 25. **Cover cap**

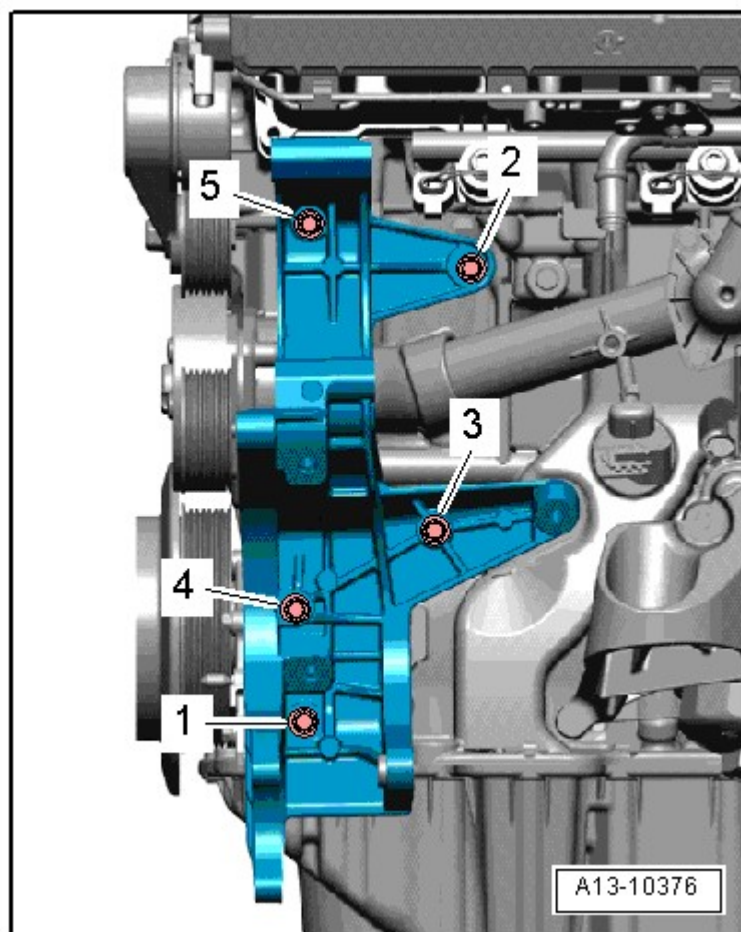


Fig. 2: Accessory Bracket Tightening Sequence

Courtesy of AUDI OF AMERICA, LLC

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

-- Tighten bolts by hand.-- Tighten bolts to 25 Nm.

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

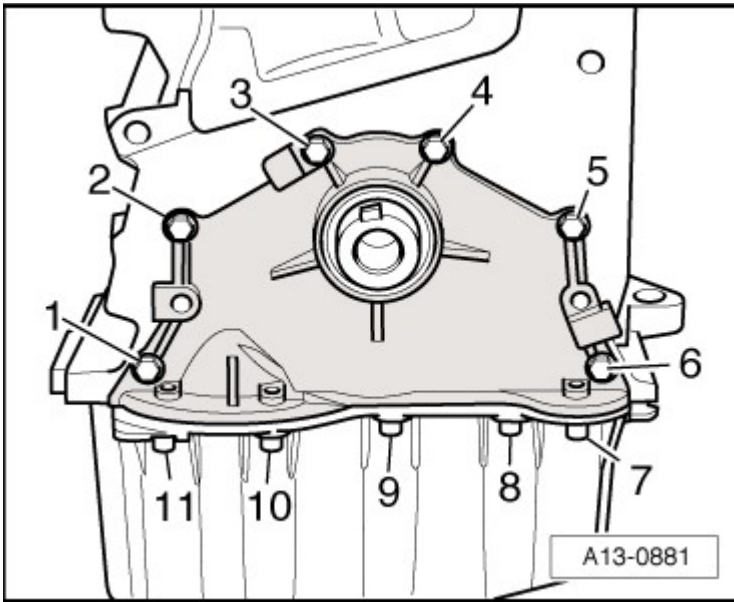


Fig. 3: Identifying Sealing Flange Bolts
Courtesy of AUDI OF AMERICA, LLC

-- Tighten bolts in 3 stages as follows:

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

DRIVE PLATE, ASSEMBLY OVERVIEW

NOTE: For assembly work, secure the engine on the engine and transmission holder
ENGINE AND TRANSMISSION, SECURING TO HOLDER .

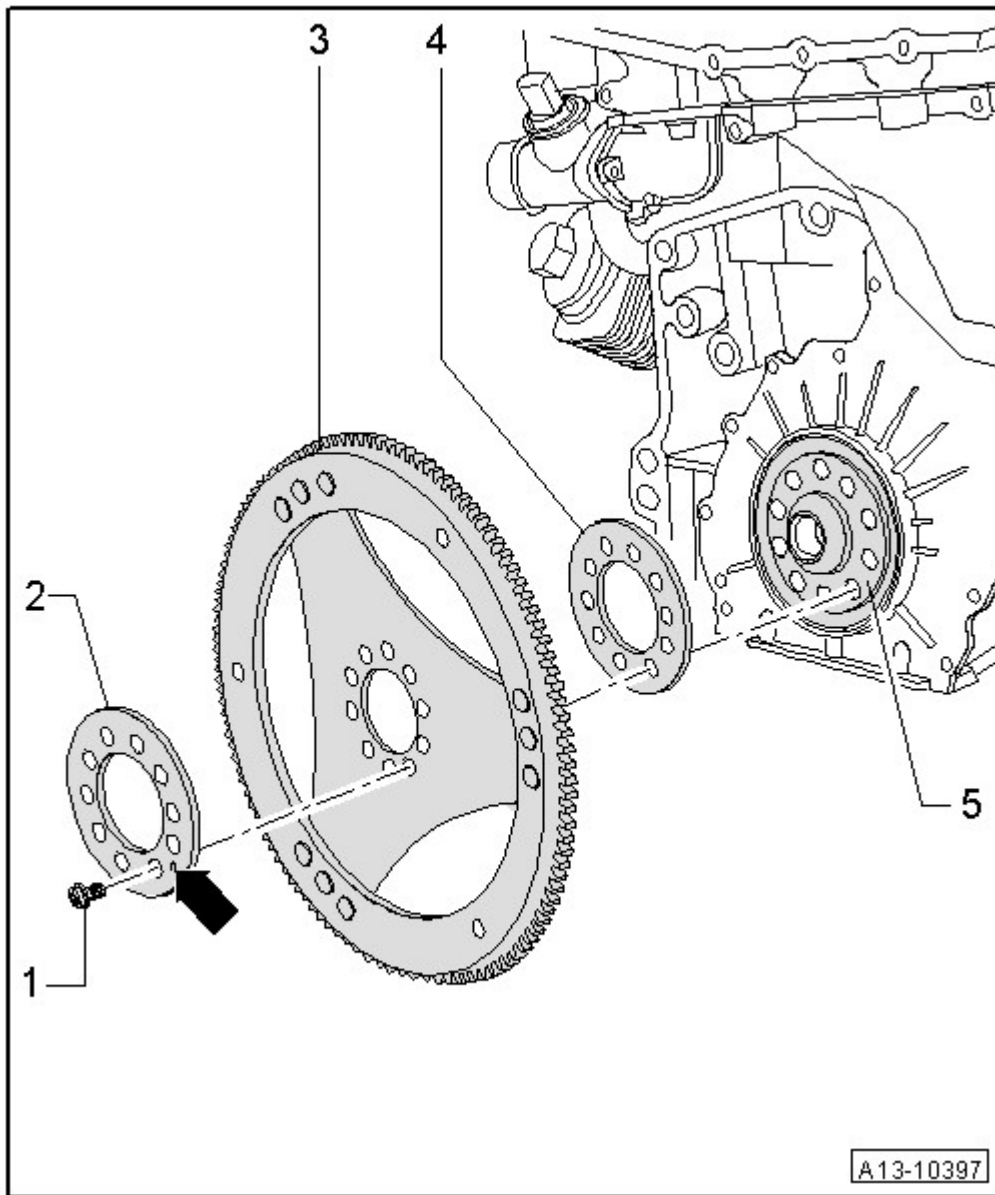


Fig. 4: Identifying Drive Plate, Assembly Overview
Courtesy of AUDI OF AMERICA, LLC

1. **Drive plate**

- Removing and installing **DRIVE PLATE**.

2. **Washer**

- Installed location: Dimple -arrow- faces toward transmission side

3. **Bolt**

- Replace
- 60 Nm + $\frac{1}{4}$ additional turn (90°).

4. **Crankshaft**

5. Spacer washer

- Installed location: One hole offset from center

CRANKSHAFT, ASSEMBLY OVERVIEW

NOTE: For assembly work, secure engine on the engine and transmission holder
ENGINE AND TRANSMISSION, SECURING TO HOLDER .

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

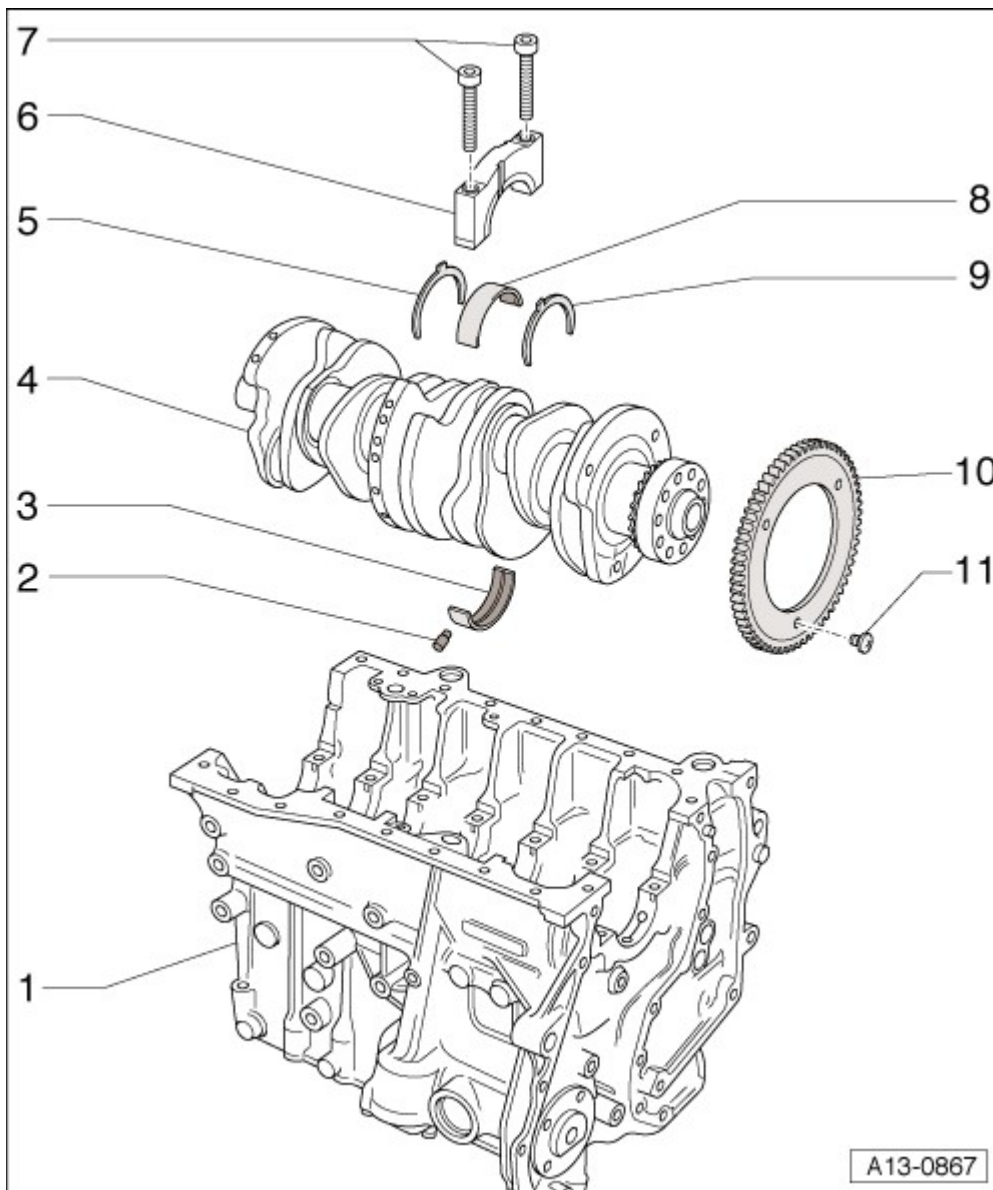


Fig. 5: Identifying Crankshaft, Component Overview

Courtesy of AUDI OF AMERICA, LLC

1. Cylinder block

- Cylinder bore, checking **CYLINDER BORE, CHECKING**.
- Piston and cylinder dimensions **PISTON AND CYLINDER DIMENSIONS**.

2. Oil spray jet for piston cooling

- For crankshaft bearing 2 to 7
- Opening pressure 2.0 bar pressure
- Removing and installing **Fig. 8**
- See note **OIL PAN, ASSEMBLY OVERVIEW** .

3. Bearing shell

- For cylinder block with oil groove
- Mark used bearing shells
- Replacement parts are only color coded "yellow"

4. Crankshaft

- After removal, place in such a way it does not rest on sensor wheel -10- and damage it
- Measuring axial play **CRANKSHAFT, MEASURING AXIAL PLAY**.
- Radial clearance, measuring **CRANKSHAFT, MEASURING RADIAL PLAY**.
- Crankshaft dimensions **CRANKSHAFT DIMENSIONS**.
- Timing chain wheel built into crankshaft

5. Thrust washer

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

6. Bearing cap

- Bearing cap 1: Belt pulley side
- Bearing cap 5: With cutouts for thrust washers
- Bearing shell retaining tabs in cylinder block and in bearing cap must align

7. Bolt

- Replace
- 30 Nm + $\frac{1}{2}$ additional turn (180°).
- Use old bolts for radial play measurement, tighten to 30 Nm but do not tighten further

8. Bearing shell

- For bearing cap without oil groove
- Mark used bearing shells
- Replacement parts are only color coded "yellow"

9. Thrust washer

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

10. Sensor wheel

- For Engine Speed (RPM) sensor -G28-
- Replace
- Installing **Fig. 6**

11. Bolt

- Replace
- If bolts were removed, replace sensor wheel
- Insert using locking compound; locking compound.
- Tightening sequence **Fig. 6**

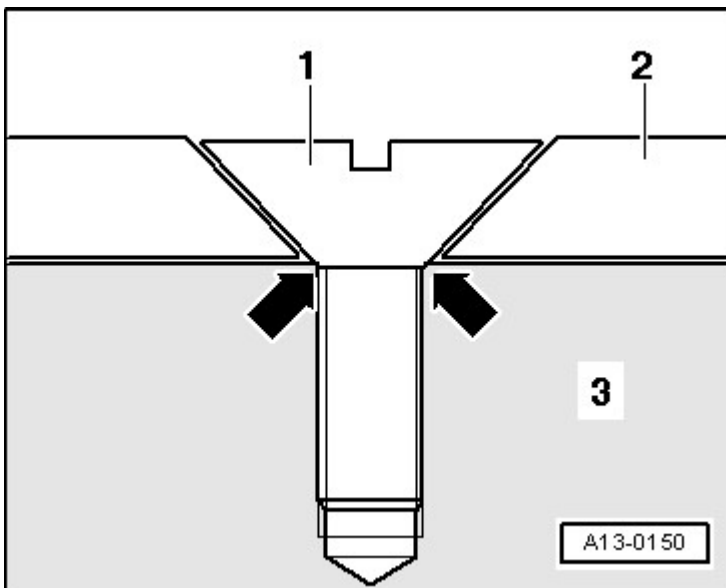


Fig. 6: Identifying Attachment Points, Countersunk Screws, Crankshaft & Sensor Wheel
Courtesy of AUDI OF AMERICA, LLC

NOTE: Sensor wheel may only be installed once, since attachment points -arrows- of countersunk screws -1- in sensor wheel -2- are so severely deformed after mounting the second time that bolt heads make contact on the crankshaft -3- and sensor wheel lies loosely under bolt heads.

-- Clean contact surface between crankshaft and sensor wheel, it must be free of oil and grease.

-- Lightly coat contact surface between crankshaft and sensor wheel with locking compound, locking compound.

Installed location:

- The mark "VR6" -2- must be positioned at bore of bolt -3-, that goes into crank pin of crankshaft (contour of crankshaft is shown by dashed line -1-)

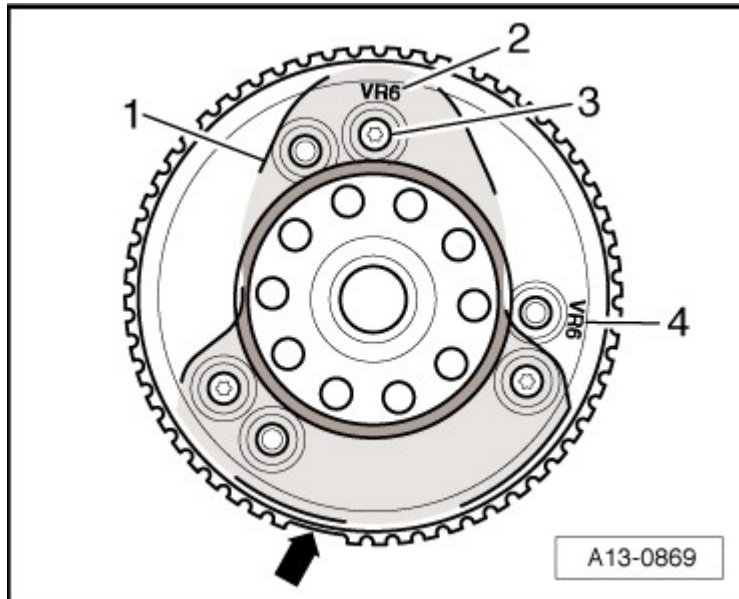


Fig. 7: Identifying "VR6" Marking Positioned At Bore Of Bolt That Goes Into Crankshaft Crankpin

Courtesy of AUDI OF AMERICA, LLC

- The gap -arrow- in ring gear lies across from designation.

NOTE: Ignore second "VR6" imprint -4-.

- Tighten sensor wheel bolts in 3 stages as follows:
- Insert bolts with locking compound and tighten by hand.
- Tighten bolt -3- to 10 Nm + $\frac{1}{4}$ additional turn (90°).
- Tighten both other bolts to 10 Nm + $\frac{1}{4}$ additional turn (90°).

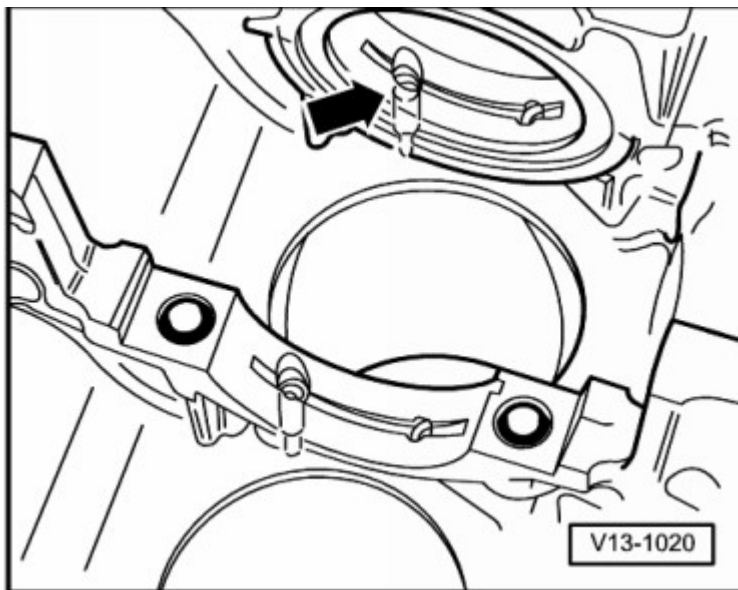


Fig. 8: Identifying Oil Spray Jet Application Area
Courtesy of AUDI OF AMERICA, LLC

PISTONS AND CONNECTING RODS, ASSEMBLY OVERVIEW

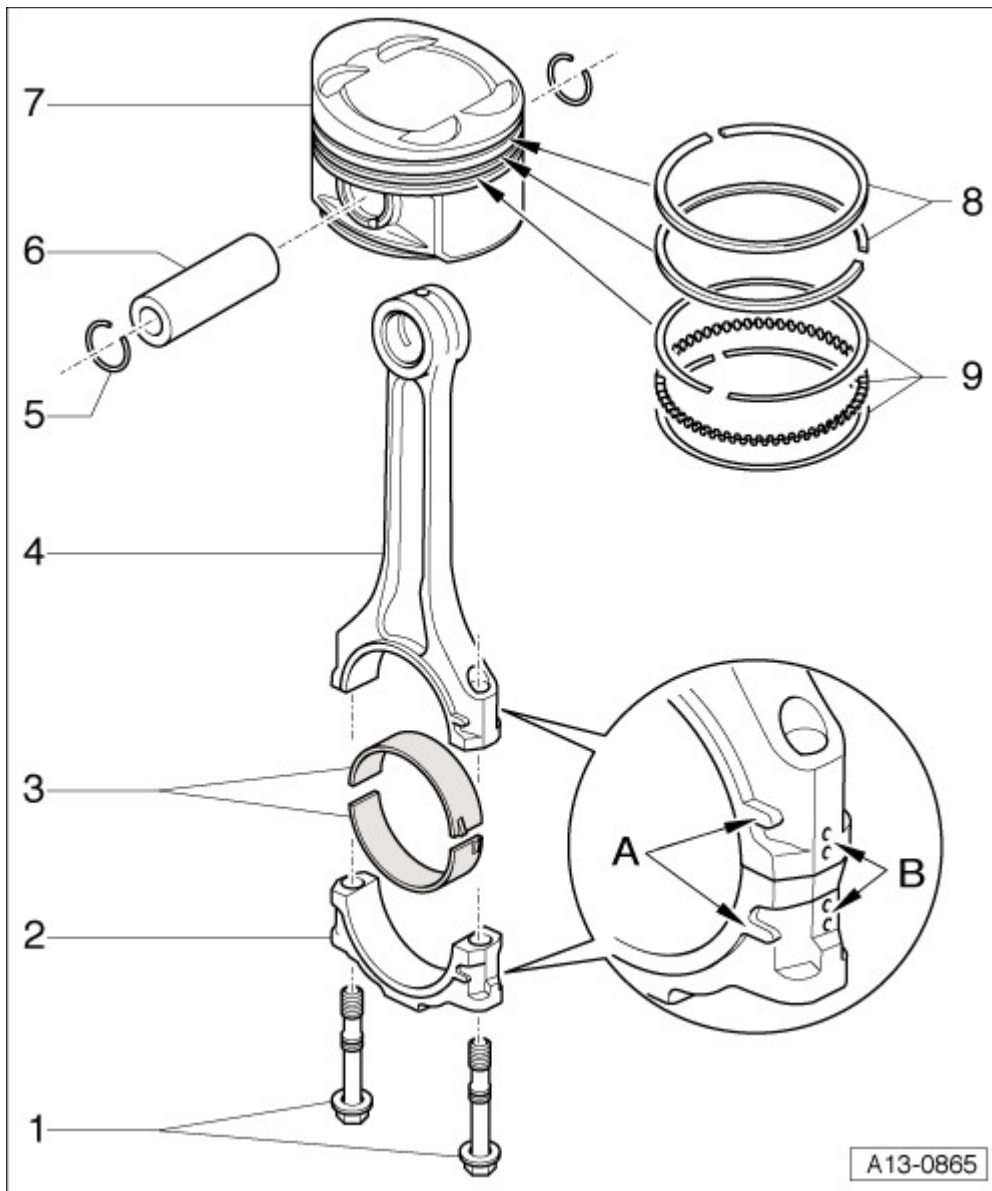


Fig. 9: Identifying Piston And Connecting Rod, Component Overview

Courtesy of AUDI OF AMERICA, LLC

1. Bolt

- Replace
- Lubricate threads and contact surface
- 30 Nm + $\frac{1}{4}$ additional turn (90°).
- Use old bolts for radial play measurement, tighten to 30 Nm but do not tighten further

2. Connecting rod bearing cap

- Affiliation to cylinder mark -B-
- Installed location: -A- markings face toward lower side of piston crown (to center of cylinder block)

3. Bearing shells

- Mark used bearing shells
- Bearing shell retaining tabs must be firmly seated in notches
- Installed location: Retaining tabs of both bearing shells lie on the same side of the connecting rod
- Measuring axial play **CONNECTING ROD AXIAL CLEARANCE, MEASURING.**
- Radial clearance, measuring **CONNECTING ROD RADIAL CLEARANCE, MEASURING.**
- 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 cylinder mark -B-
- Installed location: -A- markings face toward lower side of piston crown (to center of cylinder block)

5. Circlip

6. Piston pin

- If tight, heat piston to 60° C
- Removing and installing using a pilot drift VW 222 A

7. Piston

- Checking **PISTON, CHECKING.**
- Mark installed location to connecting rod and affiliation to cylinder
- Shallow side of piston head faces cylinder block center
- Piston and cylinder dimensions **PISTON AND CYLINDER DIMENSIONS.**
- Install using tool set T10133 **PISTON, INSTALLING.**

8. Piston rings

- Compression rings
- Offset gaps by 120 degrees
- Use piston ring pliers for removal and installation
- Mark "TOP" must face toward piston head
- Checking ring gap **PISTON RING GAP, CHECKING.**
- Check piston ring groove clearance **RING TO GROOVE CLEARANCE, CHECKING.**

9. Piston ring

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

SPECIFICATIONS

FASTENER TIGHTENING SPECIFICATIONS

Accessory Bracket Tightening Sequence

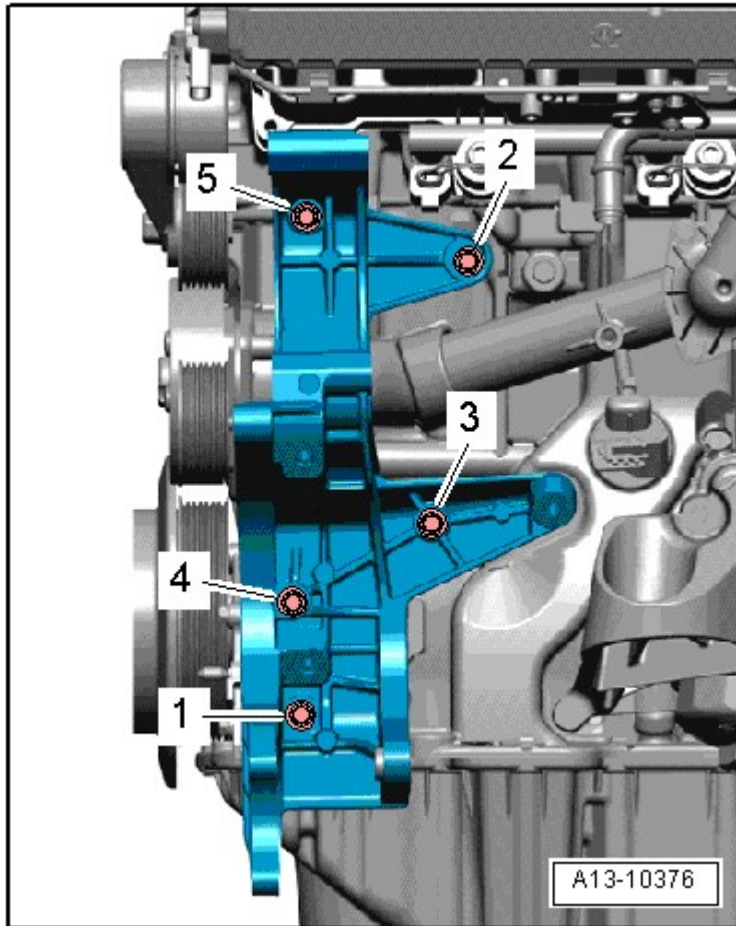


Fig. 10: Accessory Bracket Tightening Sequence
Courtesy of AUDI OF AMERICA, LLC

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

-- Tighten bolts by hand.-- Tighten bolts to 25 Nm.

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

Sealing Flange Tightening Sequence

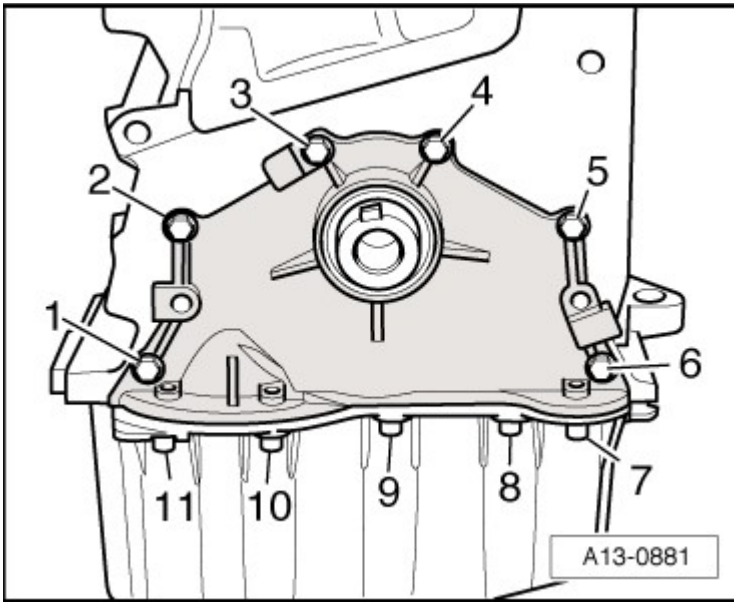


Fig. 11: Identifying Sealing Flange Bolts
 Courtesy of AUDI OF AMERICA, LLC

-- Tighten bolts in 3 stages as follows:

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

CRANKSHAFT DIMENSIONS

Reconditioning dimension, dimensions in mm	Crankshaft bearing pin diameter	Connecting rod bearing pin diameter
Basic dimension ⁽¹⁾	59.958 to 59.978	53.958 to 53.978
(1) Reworking is not permitted.		

PISTON AND CYLINDER DIMENSIONS

Reconditioning dimension, dimensions in mm	Piston diameter	Cylinder bore diameter
Basic dimension	88.965	89.010

DIAGNOSIS AND TESTING

CRANKSHAFT, MEASURING AXIAL PLAY

Special tools and workshop equipment required

- Dial gauge holder VW 387

- Dial gauge VAS 6079

Procedure

-- Attach dial indicator VAS 6079 together with dial gauge holder VW 387 to cylinder block and set indicator against crankshaft counterweight.

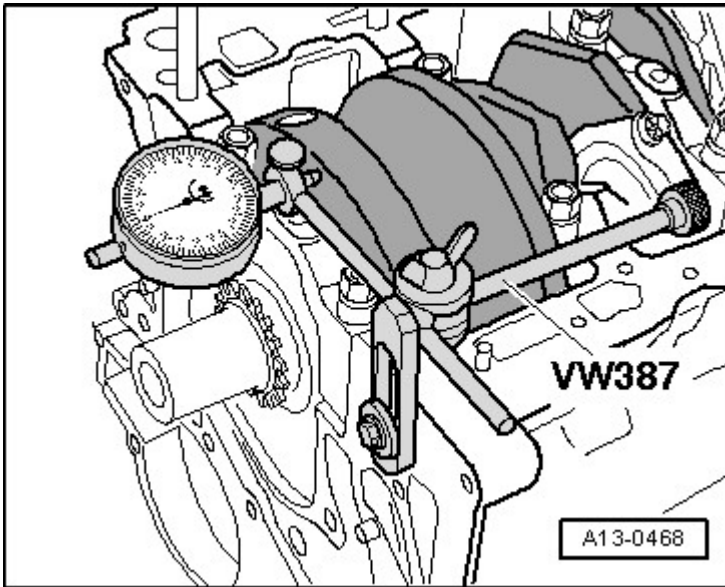


Fig. 12: Identifying Dial Indicator Attached Together With VW387 Dial Gauge Holder To Cylinder Block

Courtesy of AUDI OF AMERICA, LLC

- Press crankshaft against dial gauge by hand.
- Set dial gauge to "0".
- Press crankshaft off dial indicator and read off value.

Axial clearance:

- New: 0.07 to 0.23 mm.
- Wear limit: 0.30 mm.

CRANKSHAFT, MEASURING RADIAL PLAY**Special tools and workshop equipment required**

- Plastigage

Procedure

NOTE: Do not interchange used bearings.

Bearing shells worn down to nickel coating must be replaced.

- Remove bearing cap.
- Clean bearing cap and bearing journals.
- Place Plastigage over entire width of bearing journal or into bearing shells.
 - Plastigage must rest in center of bearing shell.
- Position bearing cap and tighten bolts to 30 Nm, do not rotate crankshaft when doing so.
- Reinstall bearing cap.
- Compare width of Plastigage with calibrated scale.

Radial clearance:

- New: 0.02 to 0.06 mm.
- Wear limit: 0.10 mm.

CONNECTING ROD AXIAL CLEARANCE, MEASURING

Special tools and workshop equipment required

- Feeler gauge

Procedure

- Measure with feeler gauge.

Axial clearance:

- New: 0.05 to 0.31 mm.
- Wear limit: 0.40 mm.

CONNECTING ROD RADIAL CLEARANCE, MEASURING

Special tools and workshop equipment required

- Plastigage

Procedure

- Remove bearing cap.
- Clean bearing cap and bearing journals.
- Place Plastigage over entire width of bearing journal or into bearing shells.
 - Plastigage must rest in center of bearing shell.
- Positioning bearing cap and tighten bolts to 30 Nm, do not rotate crankshaft when doing so.
- Reinstall bearing cap.
- Compare width of Plastigage with calibrated scale.

Radial clearance:

- New: 0.02 to 0.07 mm.
 - Wear limit: 0.10 mm.
- Replace connecting rod bolts.

PISTON RING GAP, CHECKING

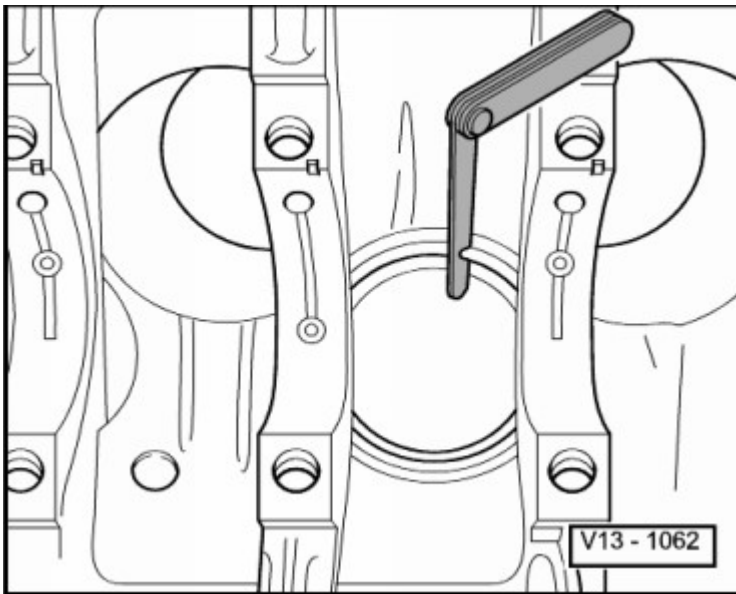


Fig. 13: Checking Piston Ring Gap
Courtesy of AUDI OF AMERICA, LLC

- Slide piston ring from above into lower cylinder opening as follows, using piston without piston ring.
- Right angle to cylinder wall.
 - Until approximately 15 mm from bottom edge of cylinder.

-- Measure with feeler gauge.

Piston ring dimensions in mm	New	Wear limit
Compression ring	0.20 to 0.40	1.00
Stepped compression ring	0.20 to 0.40	1.00
Oil scraping ring	0.25 to 0.50	1.00

RING TO GROOVE CLEARANCE, CHECKING

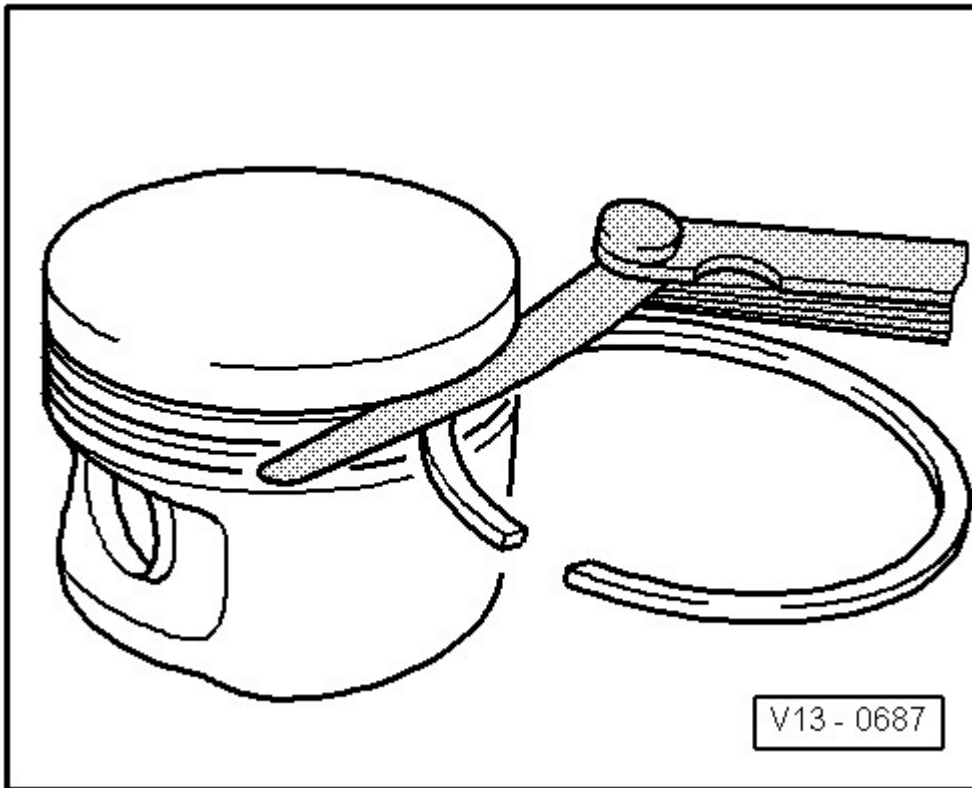


Fig. 14: Checking Piston Ring Gap
Courtesy of AUDI OF AMERICA, LLC

-- Clean piston ring groove.

-- Measure with feeler gauge.

Piston ring dimensions in mm	New	Wear limit
Compression ring	0.04 to 0.09	0.15
Stepped compression ring	0.03 to 0.06	0.15
Oil scraping ring	0.02 to 0.06	0.15

PISTON, CHECKING

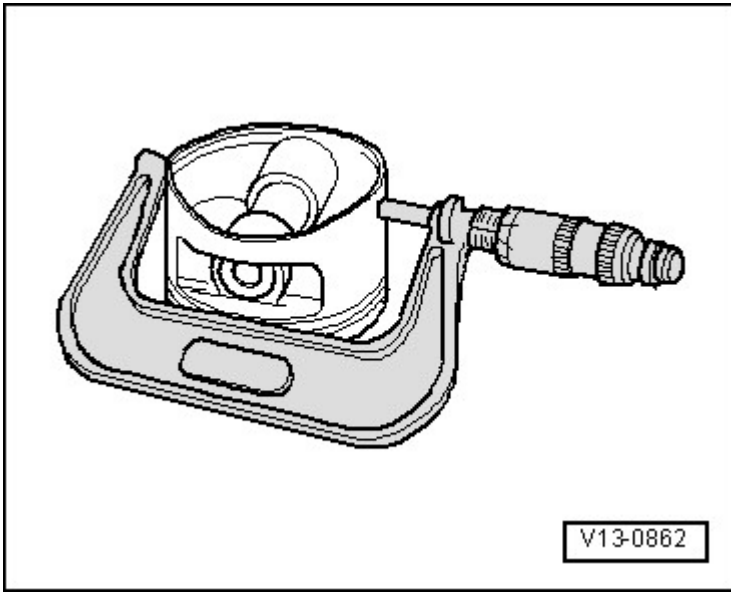


Fig. 15: Checking Piston

Courtesy of AUDI OF AMERICA, LLC

-- Measure with external micrometer 75 to 100 mm as follows:

- Approximately 6 mm from bottom edge.
- Offset 90 degrees to piston pin axle.

Deviation from nominal dimension:

- Maximum 0.04 mm.

Nominal dimension **PISTON AND CYLINDER DIMENSIONS.**

CYLINDER BORE, CHECKING

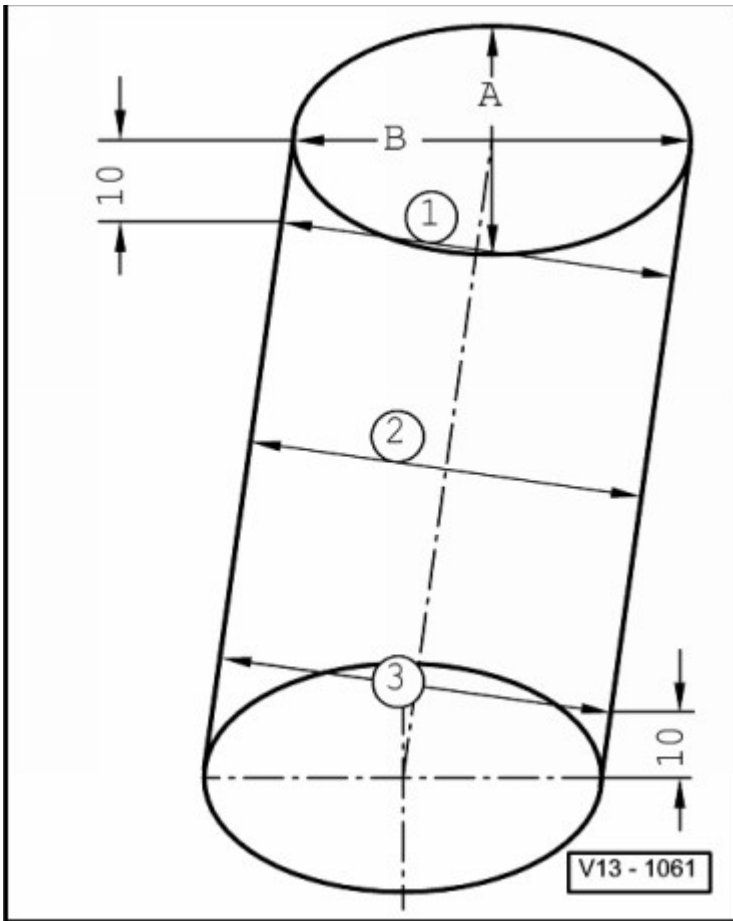


Fig. 16: Identifying Cylinder Bore Dimensions

Courtesy of AUDI OF AMERICA, LLC

-- Measure with internal dial gauge 50 to 100 mm as follows:

- Tighten diagonally in 3 places in direction -A- and direction -B-.

Deviation from nominal dimension:

- Maximum 0.08 mm.

Nominal dimension **PISTON AND CYLINDER DIMENSIONS.**

REMOVAL AND INSTALLATION

RIBBED BELT

Special tools and workshop equipment required

- M8 x 50 bolt

Removing

CAUTION: Risk of destroying due to reversed running direction on a used ribbed belt.

- Before removing ribbed belt, marking running direction with chalk or felt-tip pen for reinstallation later.

-- To release ribbed belt tension, rotate tensioner in direction of -arrow-.

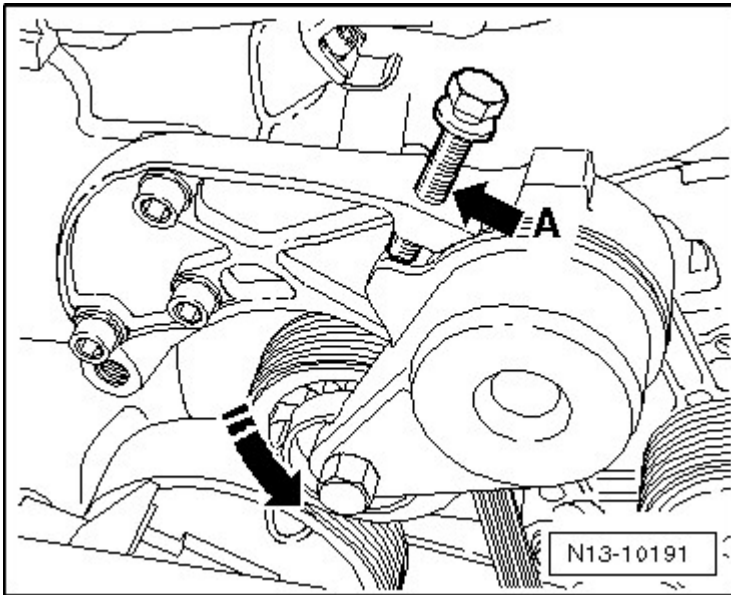


Fig. 17: Identifying M8x50 Bolt In Threaded Hole
Courtesy of AUDI OF AMERICA, LLC

CAUTION: Risk of destroying tensioner.

- Only install bolt for securing tensioner far enough so that ribbed belt can be removed.

-- Secure tensioner with M8 x 50 bolt -arrow A-.

-- Remove ribbed belt.

Installing

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

NOTE: Before installing ribbed belt, generator, A/C compressor and power steering pump must be securely installed.

-- Route ribbed belt as follows:

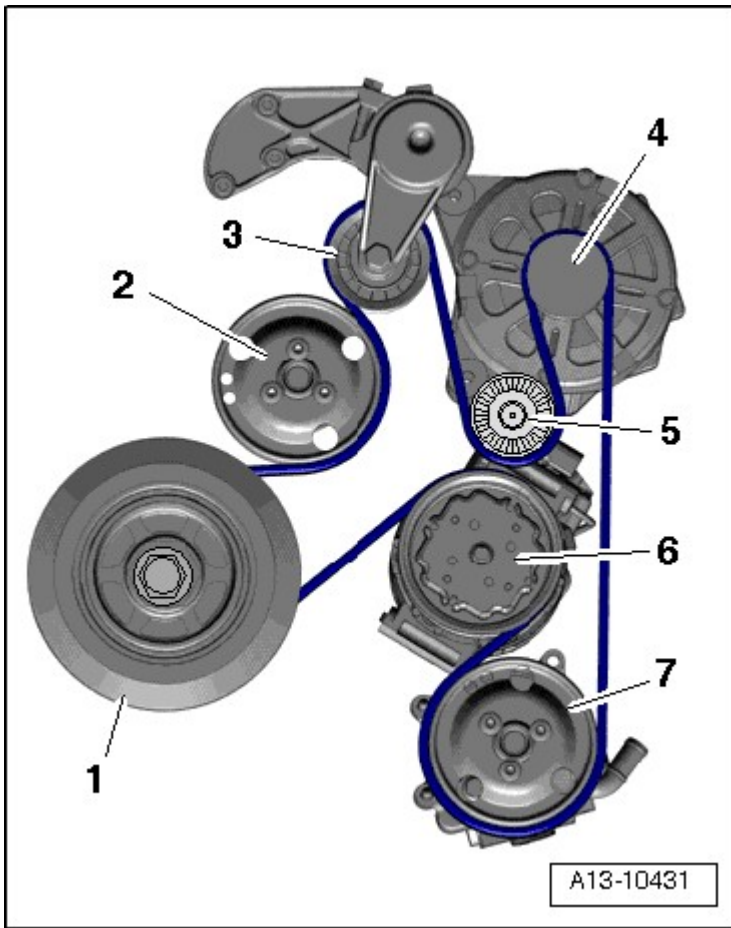


Fig. 18: Identifying Ribbed Belt Routing
Courtesy of AUDI OF AMERICA, LLC

1. **Vibration damper**
2. **Coolant pump**
3. **Tensioner**
4. **Generator**
5. **Idler pulley**
6. **Air conditioner compressor**
7. **Power steering pump**

NOTE: When installing ribbed belt, make sure it is seated correctly on the pulleys.

- Release tensioner by removing bolt.
- Check whether ribbed belt is routed correctly.
- Start engine and check whether ribbed belt runs correctly.

RIBBED BELT TENSIONER

Removing

-- Remove ribbed belt **RIBBED BELT**.

-- Remove bolts -1 and 2-.

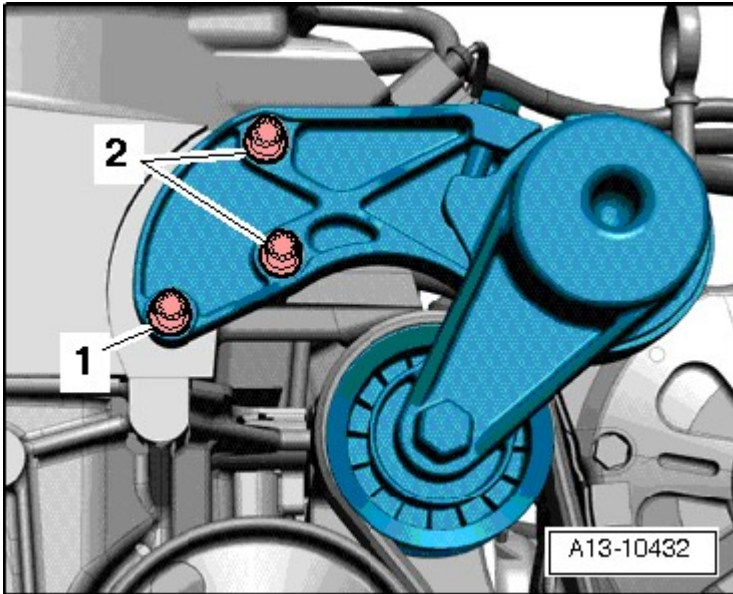


Fig. 19: Identifying Bolts -1 And 2- To Ribbed Belt Tensioner
 Courtesy of AUDI OF AMERICA, LLC

-- Remove ribbed belt tensioner.

Installing

- Tightening specifications **RIBBED BELT DRIVE, ASSEMBLY OVERVIEW**.

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

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

ACCESSORY BRACKET

Removing

-- Remove ribbed belt **RIBBED BELT**.

-- Remove generator **GENERATOR [for engine(s) BHK]** .

-- Remove air conditioner compressor **Removal and Installation** .

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

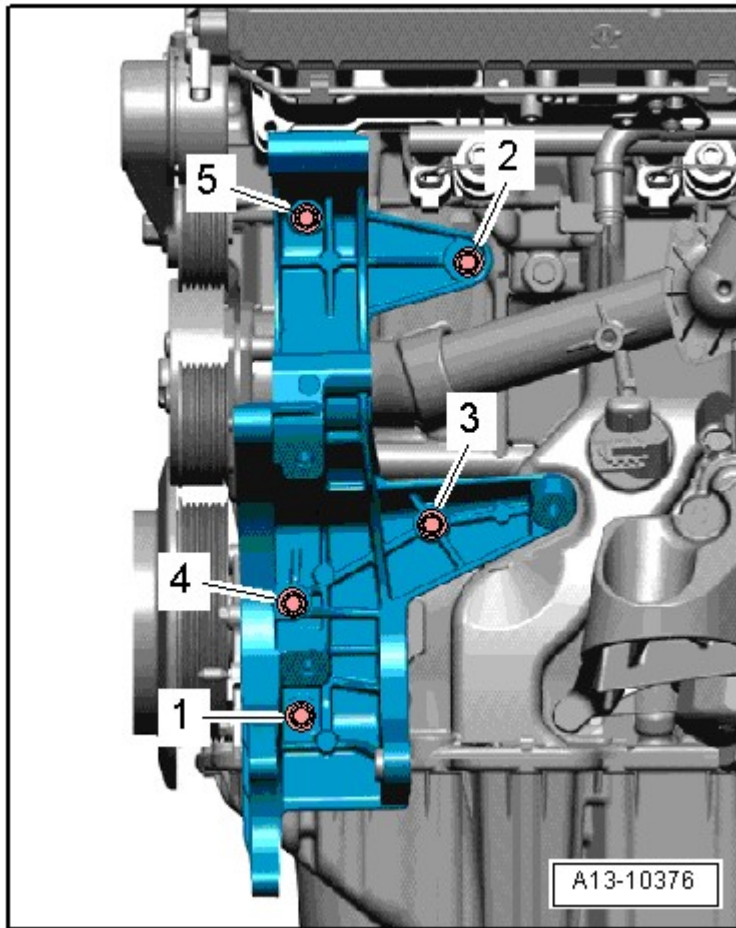


Fig. 20: Accessory Bracket Tightening Sequence
Courtesy of AUDI OF AMERICA, LLC

Installing

- Tightening specifications **RIBBED BELT DRIVE, ASSEMBLY OVERVIEW.**

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

- Tighten accessory bracket bolts **Fig. 2**
- Install A/C compressor **Removal and Installation** .
- Install power steering pump **Removal and Installation** .
- Install generator **GENERATOR [for engine(s) BHK]** .
- Install ribbed belt tensioner **RIBBED BELT TENSIONER.**
- Install ribbed belt **RIBBED BELT.**

VIBRATION DAMPER**Special tools and workshop equipment required**

- Counter-holder tool T10069

Removing

- Remove fan shroud **FAN SHROUD** .
- Remove ribbed belt **RIBBED BELT**.
- Remove vibration damper bolt using counter hold T10069.

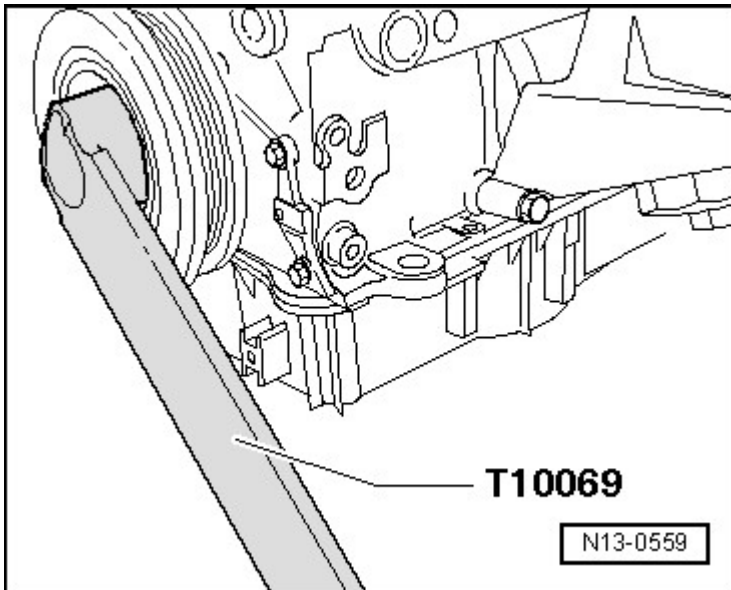


Fig. 21: Counter-Holder T10069 To Hold Vibration Damper
Courtesy of AUDI OF AMERICA, LLC

Installing

- Tightening specifications **RIBBED BELT DRIVE, ASSEMBLY OVERVIEW.**

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

- Install ribbed belt **RIBBED BELT**.
- Install fan shroud **FAN SHROUD** .

SEALING FLANGE**Special tools and workshop equipment required**

- Assembly tool T10215
- Hand drill with plastic brush attachment
- Protective glasses

Removing

- On a vehicle with air suspension, activate vehicle lift mode Description and Operation .
- Remove ribbed belt RIBBED BELT.
- Remove vibration damper VIBRATION DAMPER.
- Remove screws and remove front noise insulation -1-.

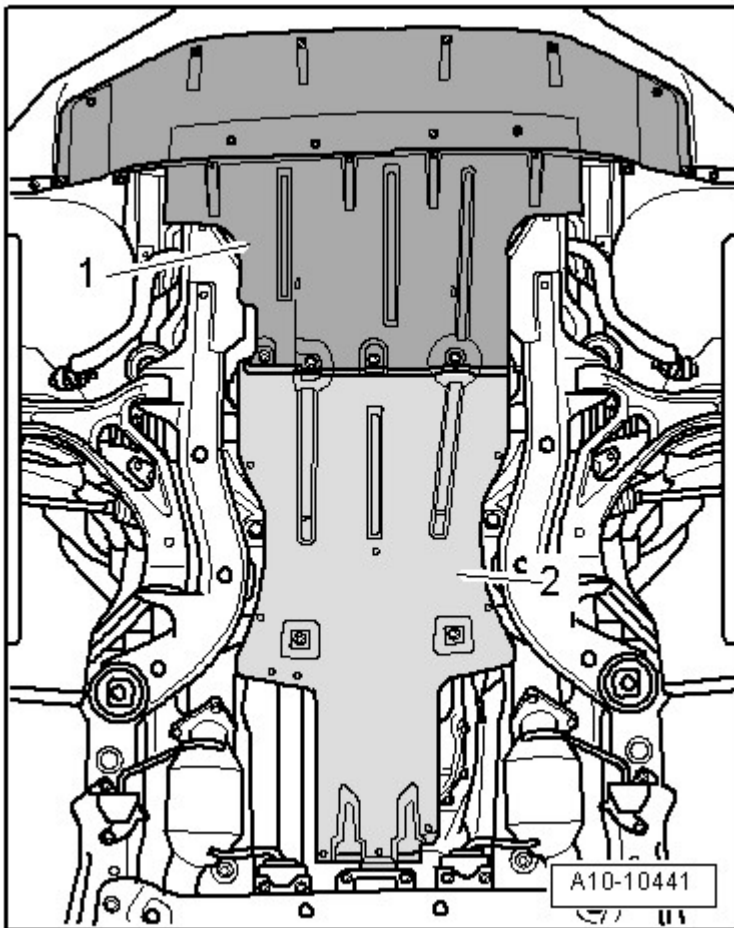


Fig. 22: Identifying Front/Rear Noise Insulation
Courtesy of AUDI OF AMERICA, LLC

- Remove bolts -1 to 11-.

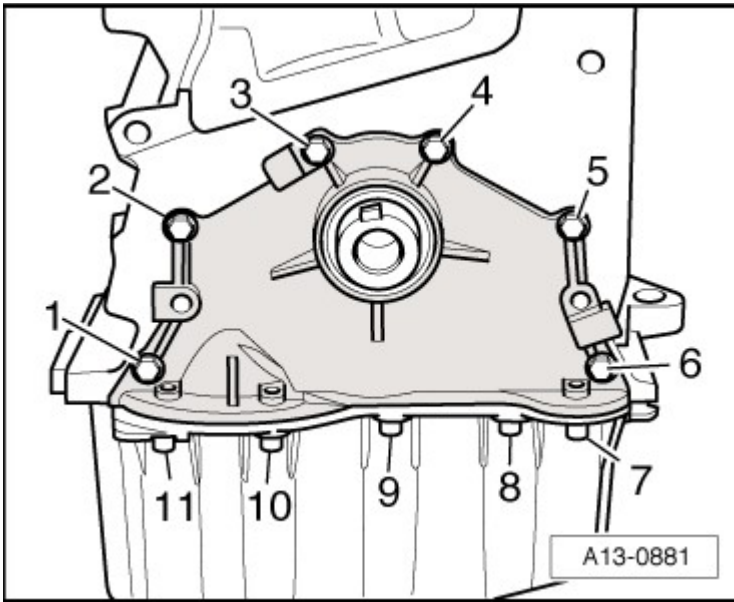


Fig. 23: Identifying Sealing Flange Bolts
Courtesy of AUDI OF AMERICA, LLC

-- Carefully pry up sealing flange.

Installing

- Tightening specifications **Fig. 3**

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

CAUTION: Risk of contaminating lubrication system with sealant residue.

- Lay clean cloth over open part of oil pan.

-- Carefully remove sealant residue on cylinder block and oil pan.

WARNING: Risk of eye injury.

- Wear safety glasses.

-- Remove sealant residue on sealant flange, e.g. with a rotating plastic brush.

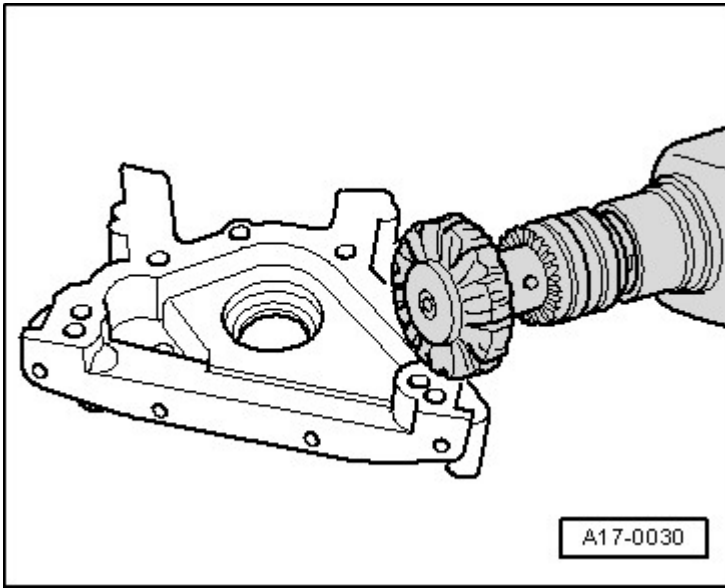


Fig. 24: Identifying Rotating Plastic Brush
Courtesy of AUDI OF AMERICA, LLC

- Clean sealing surfaces, must be free of oil and grease.
- Cut tube nozzle at front marking (diameter approximately 2 mm).

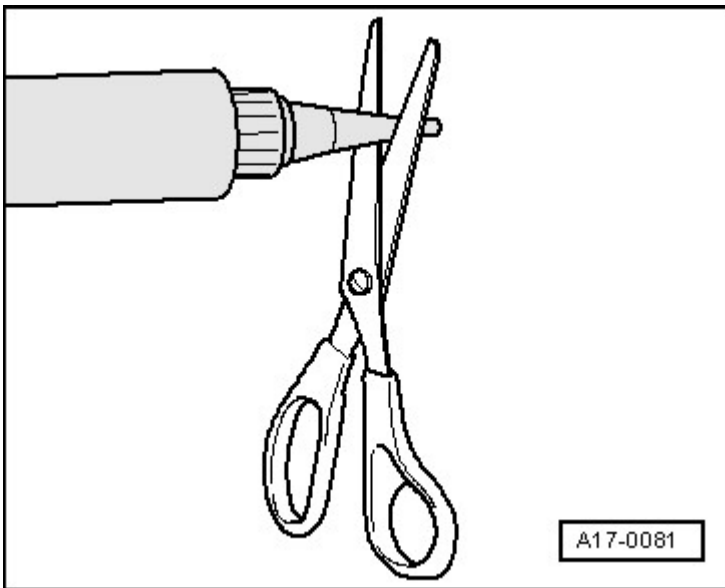


Fig. 25: Identifying Scissors To Cut Tube Nozzle At Front Marking (Nozzle Diameter Approx. 2 Mm)
Courtesy of AUDI OF AMERICA, LLC

- Apply a thin bead of sealant -arrows- on edge between cylinder block and oil pan.

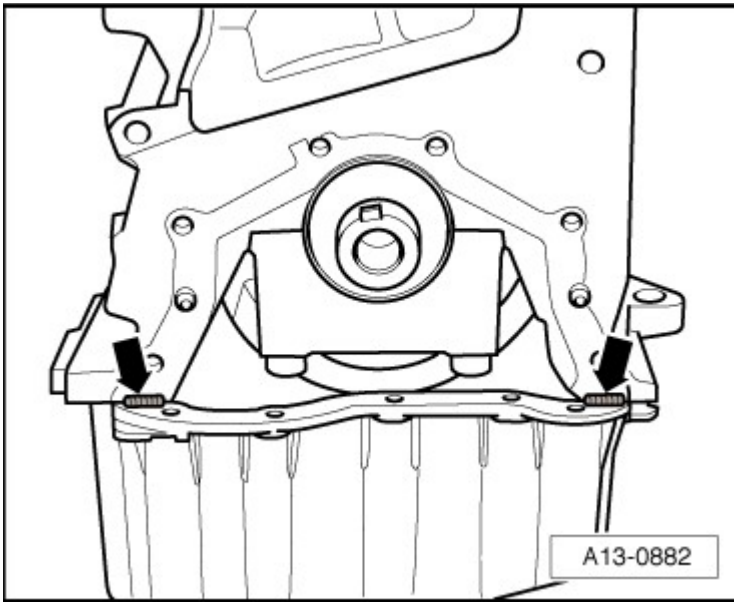


Fig. 26: Applying Thin Bead Of Sealant To Edge Between Cylinder Block And Oil Sump
 Courtesy of AUDI OF AMERICA, LLC

-- Lightly coat lower sealing surface -shaded- on sealing flange with sealant.

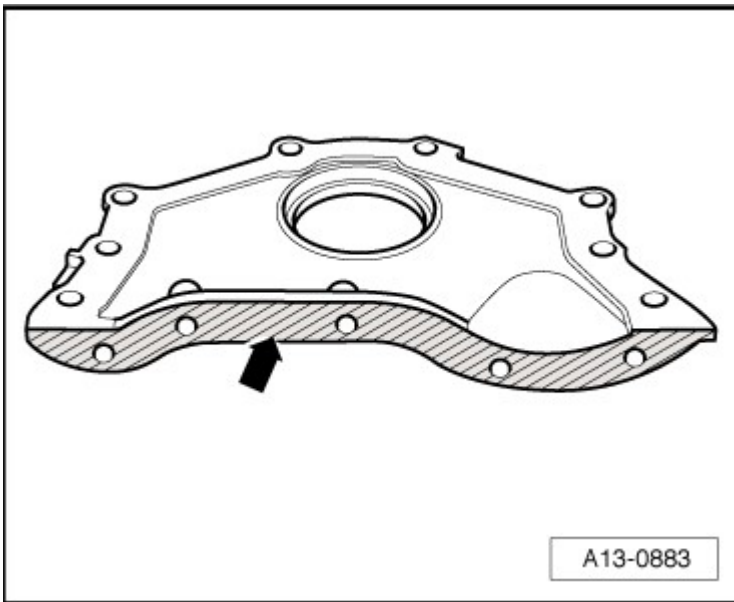


Fig. 27: Lightly Coating Lower Sealing Surface Of Sealing Flange With Sealant
 Courtesy of AUDI OF AMERICA, LLC

-- Apply sealant bead -arrow- to clean sealing flange sealing surface as shown in illustration.

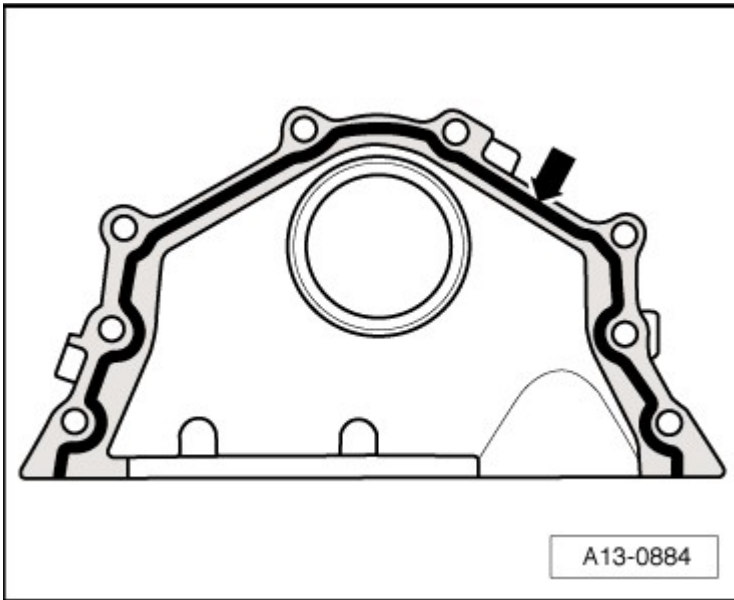


Fig. 28: Applying Thin Bead Of Sealant To Clean Sealing Surface Of Sealing Flange
Courtesy of AUDI OF AMERICA, LLC

- Thickness of sealant bead: 2 to 3 mm.

CAUTION: Risk of plugging oil pump strainer with excess sealant.

- Do not apply sealant bead thicker than indicated.

NOTE: Sealing flange must be installed within 5 minutes of applying sealant.

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

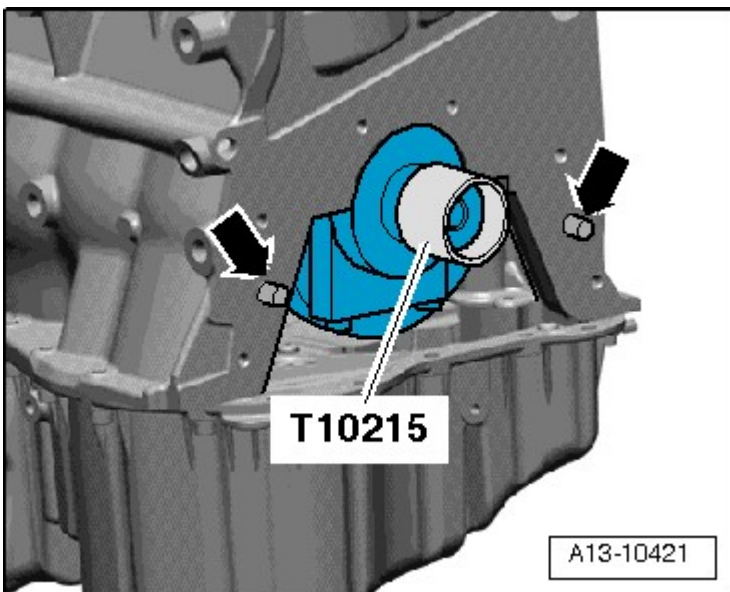


Fig. 29: Identifying Installation Of Sealing Flange On Guide Pins -Arrows- On Cylinder Block Using Assembly Tool T10215

Courtesy of AUDI OF AMERICA, LLC

-- Tighten sealing flange bolts **Fig. 3**

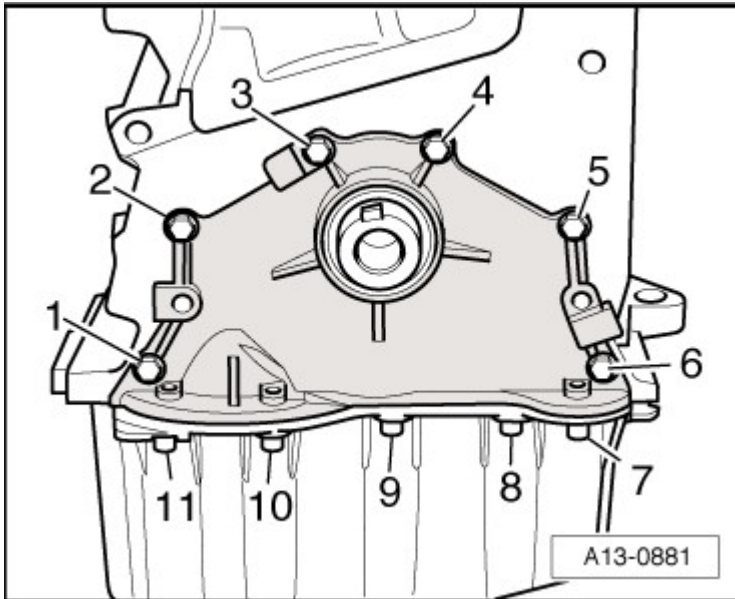


Fig. 30: Identifying Sealing Flange Bolts

Courtesy of AUDI OF AMERICA, LLC

-- Install vibration damper **VIBRATION DAMPER**.

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

-- On a vehicle with air suspension, deactivate vehicle lift mode **Description and Operation** .

DRIVE PLATE

Special tools and workshop equipment required

- Counter-holder tool 3067
- Depth gauge

Removing

- Transmission removed.
- Mark drive plate position to crankshaft for reinstallation.
- Insert counter hold 3067 to loosen drive plate bolts.

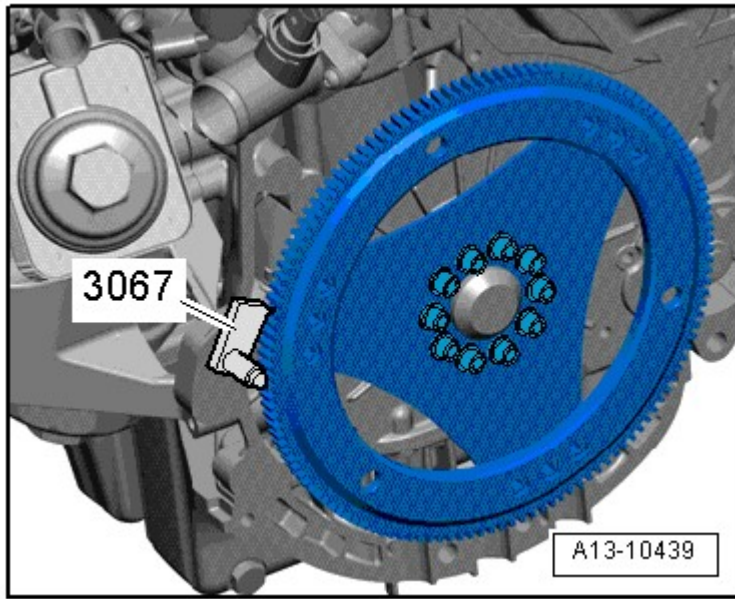


Fig. 31: Identifying Counter Hold 3067 To Loosen Drive Plate Bolts
Courtesy of AUDI OF AMERICA, LLC

- Loosen and tighten drive plate bolts diagonally.
- Remove drive plate with washer.
- Remove spacer washer behind.

Installing

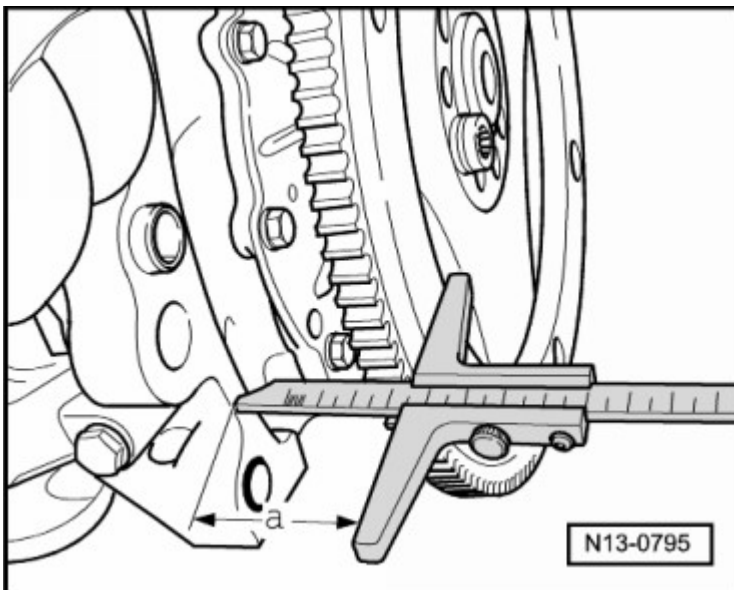


Fig. 32: Measuring Dimension Using Depth Gauge
Courtesy of AUDI OF AMERICA, LLC

- Tightening specifications **DRIVE PLATE, ASSEMBLY OVERVIEW.**

-- Fasten drive plate to crankshaft with at least 3 used bolts tightened to 30 Nm,

-- Measure dimension -a- with depth gauge.

- Specified dimension -a- : 21 to 23 mm.

-- If specified value is not met, remove drive plate again and use corresponding shim -2- with it.

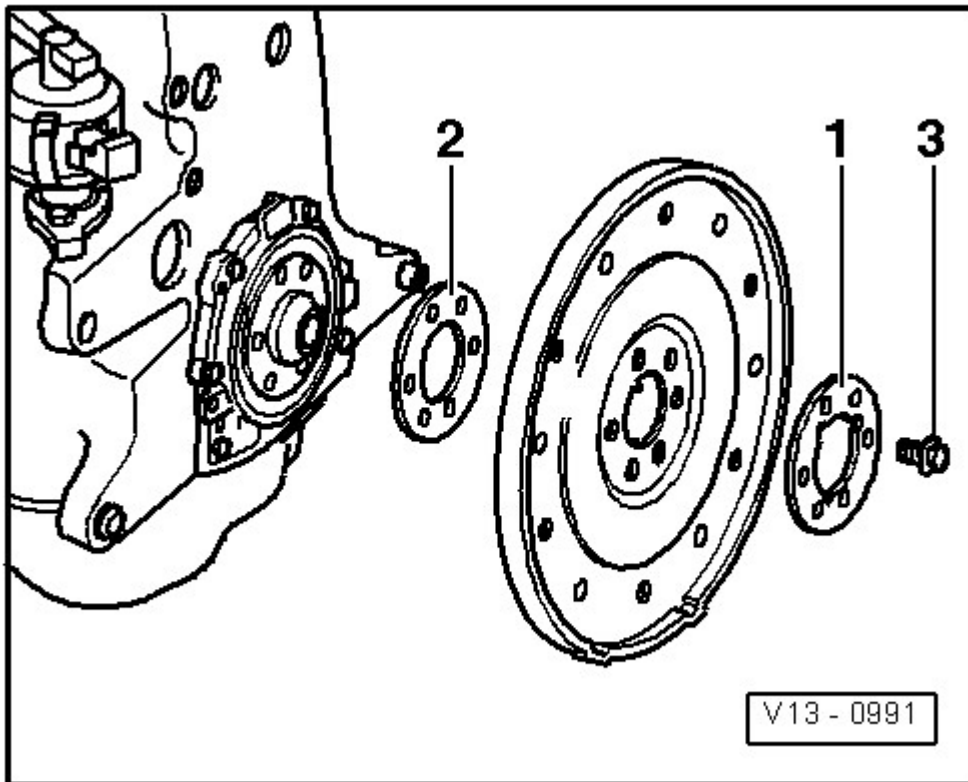


Fig. 33: Identifying Drive Plate, Grooved Washer & Bolts
Courtesy of AUDI OF AMERICA, LLC

-- If specified value is reached, install washer -1-.

- Dimple faces toward transmission side.

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

NOTE: **Replace bolts which have been tightened to specifications.**

-- Use counter hold 3067 to tighten drive plate bolts.

CRANKSHAFT SHAFT SEAL**Special tools and workshop equipment required**

- Pulling fixture T10122
- Extractor hook T20143

Removing

- Transmission removed.

-- On a vehicle with automatic transmission, remove drive plate **DRIVE PLATE**.

-- Position pulling hook T20143/2 behind sealing lip on shaft seal as shown in the illustration.

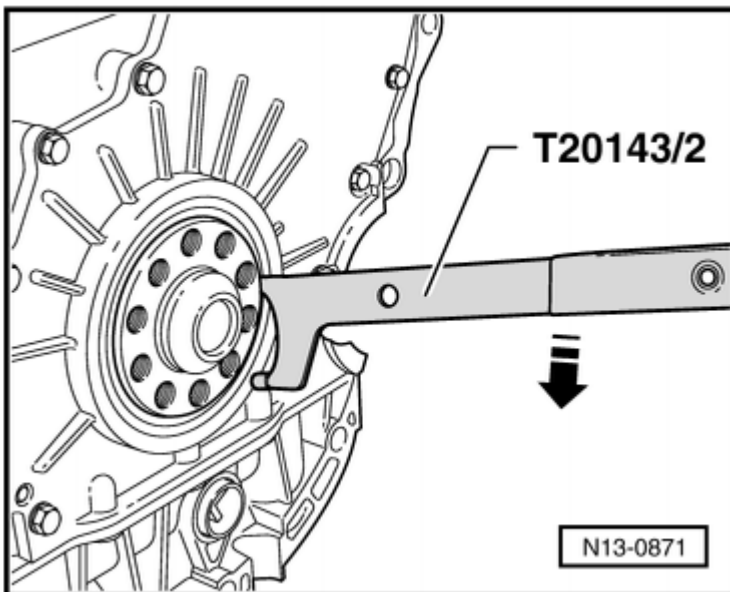


Fig. 34: Identifying Removal Hook T20143/2 Placed Behind Sealing Lip Of Oil Seal
Courtesy of AUDI OF AMERICA, LLC

-- Support pulling hook T20143/2 on sealing flange and pry out shaft seal.

-- Clean running and sealing surface.

-- Remove oil residue on crankshaft pins.

Installing

NOTE: **Do not lubricate the sealing ring before pressing it in.**

-- Slide new shaft seal -A- over fitting sleeve T10122/1 onto guide sleeve T10122/2.

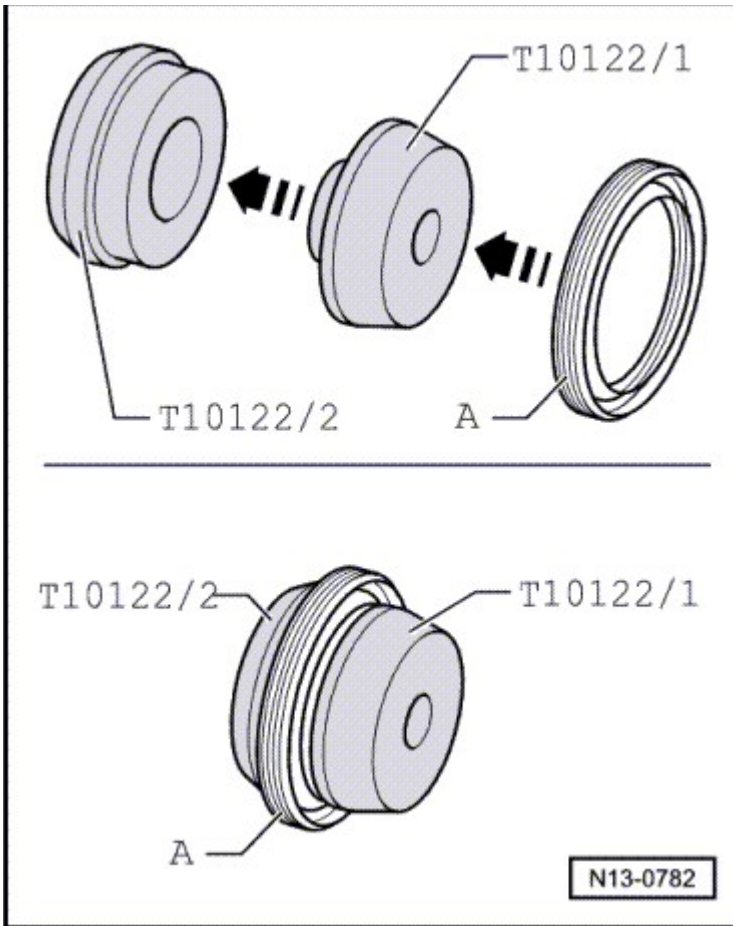


Fig. 35: Identifying Seal, Sleeve T10122/1 And Assembly Tool T10122/2
 Courtesy of AUDI OF AMERICA, LLC

- Installed location: Closed side faces toward fitting sleeve.
- Separate fitting sleeve and guide sleeve.
- Place guide sleeve T10122/2 with shaft seal on crankshaft.

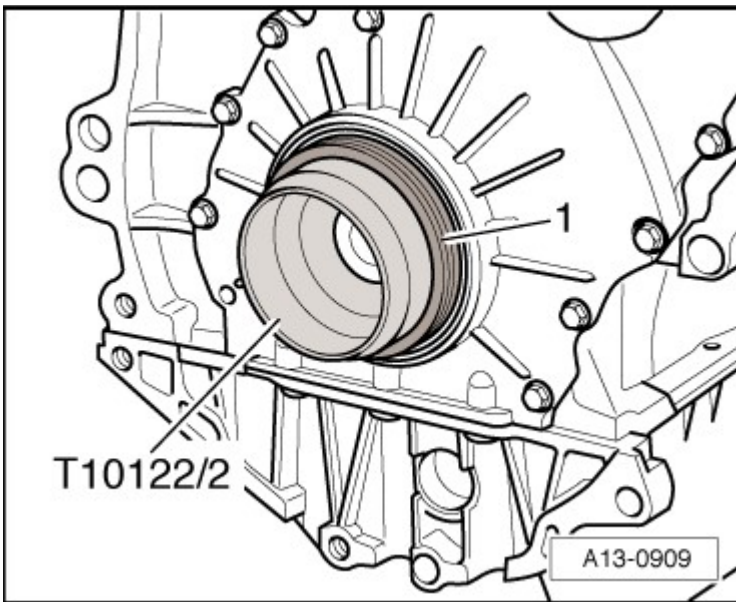


Fig. 36: Inserting Guide Sleeve T10122/2 With Oil Seal Onto Crankshaft
Courtesy of AUDI OF AMERICA, LLC

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

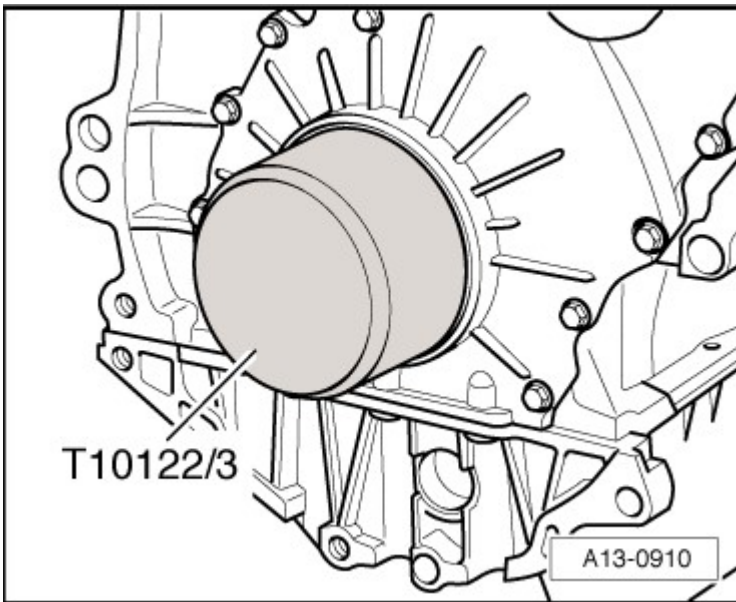


Fig. 37: Pressing In Oil Seal With Press Tool T10122/3 Evenly And Flush
Courtesy of AUDI OF AMERICA, LLC

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

-- Install drive plate **DRIVE PLATE**.

PISTON, INSTALLING

Special tools and workshop equipment required

- Funnel T10333

Procedure

-- Before installing pistons, remove fitting sleeve -arrow- from its hole.

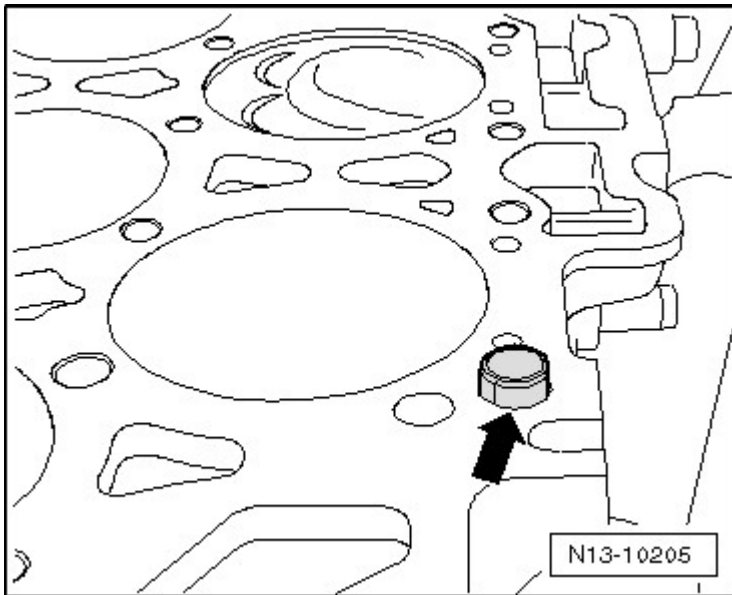


Fig. 38: Identifying Alignment Bushing
Courtesy of AUDI OF AMERICA, LLC

Location of cylinder 1, 3, 5 pistons:

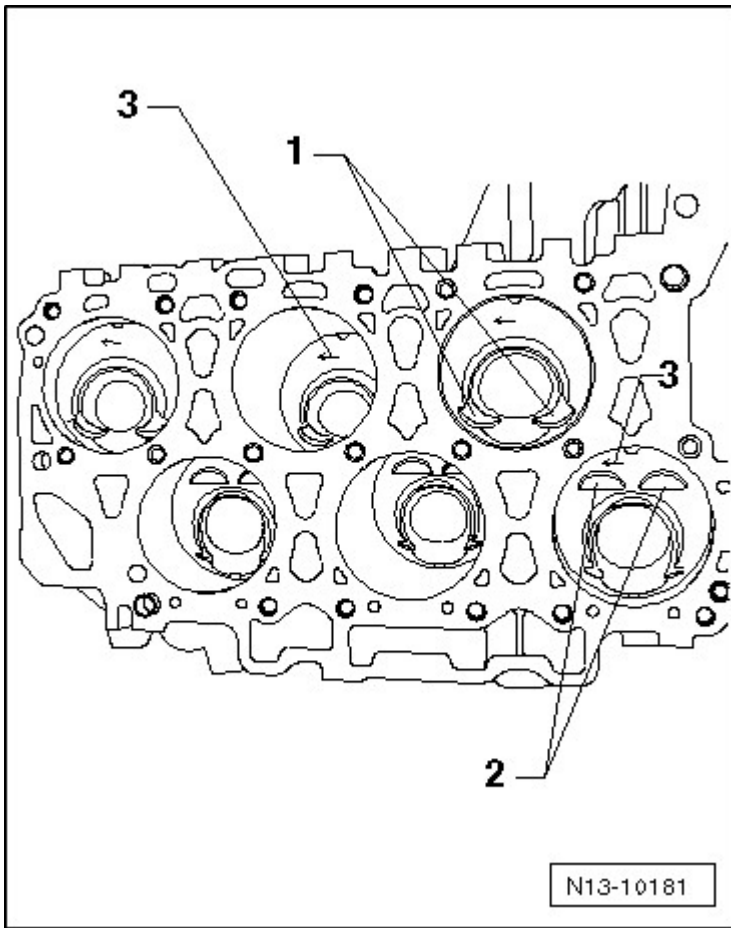


Fig. 39: Identifying Pistons Cylinders Positions

Courtesy of AUDI OF AMERICA, LLC

- Deep valve recesses -1- face toward center of cylinder block.
- Arrows -3- faced toward belt pulley side.

Location of cylinder 2, 4, 6 pistons:

- Deep valve recesses -2- face toward center of cylinder block.
- Arrows -3- faced toward belt pulley side.

-- Slide correct piston for each cylinder from above into piston installation tool T10333 until short side of piston -arrow- rests about 15 mm out of lower edge of installation tool.

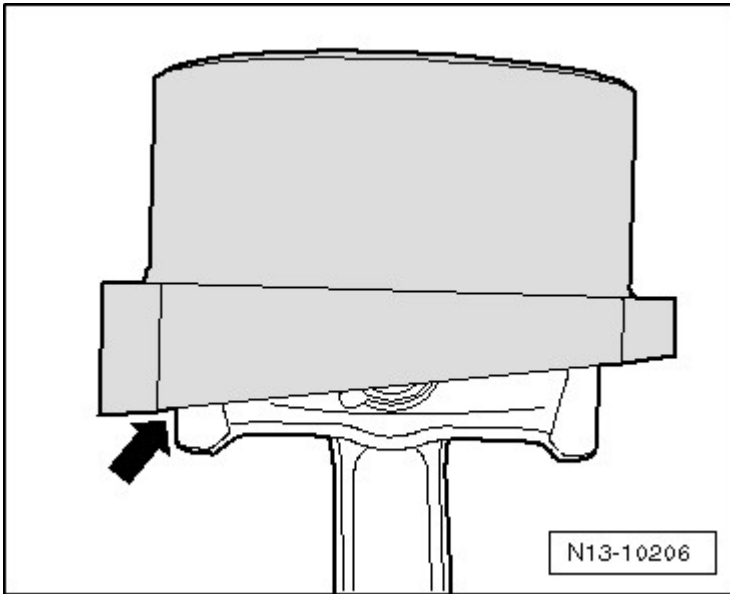


Fig. 40: Sliding Correct Piston For Each Cylinder From Above Into Piston Installation Tool
 Courtesy of AUDI OF AMERICA, LLC

-- Position pistons in appropriate cylinder hold with piston installation tool. High side of tool -arrow- must face toward center of cylinder block.

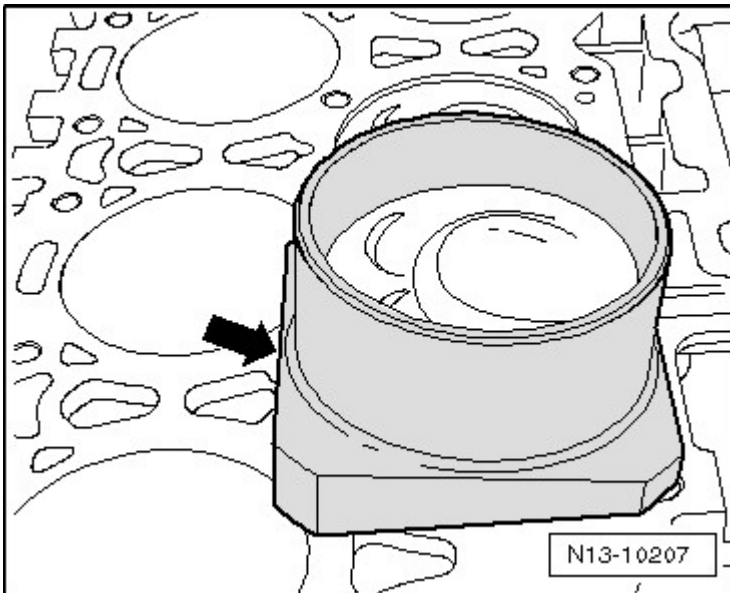


Fig. 41: Placing Funnel Securely On Cylinder Block And Slide Piston Completely Into Cylinder Bore
 Courtesy of AUDI OF AMERICA, LLC

-- Position piston installation tool securely on cylinder block and slide piston completely into cylinder hole.

-- After installing piston, reinsert fitting sleeve in hole -arrow-.

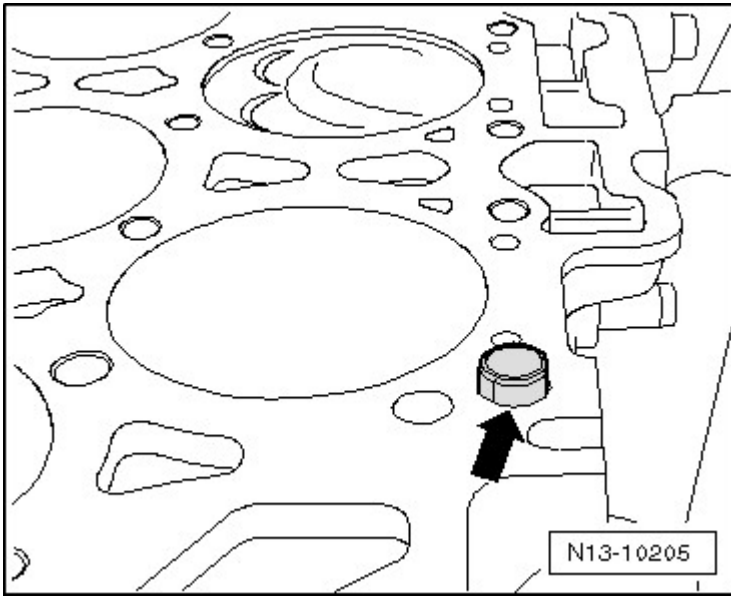


Fig. 42: Identifying Alignment Bushing
Courtesy of AUDI OF AMERICA, LLC

SPECIAL TOOLS

Special tools and workshop equipment required

- M8 x 50 bolt
- Plastigage
- Feeler gauge
- Hand drill with plastic brush attachment
- Protective glasses
- Depth gauge
- Sealant
- Dial gauge holder VW 387

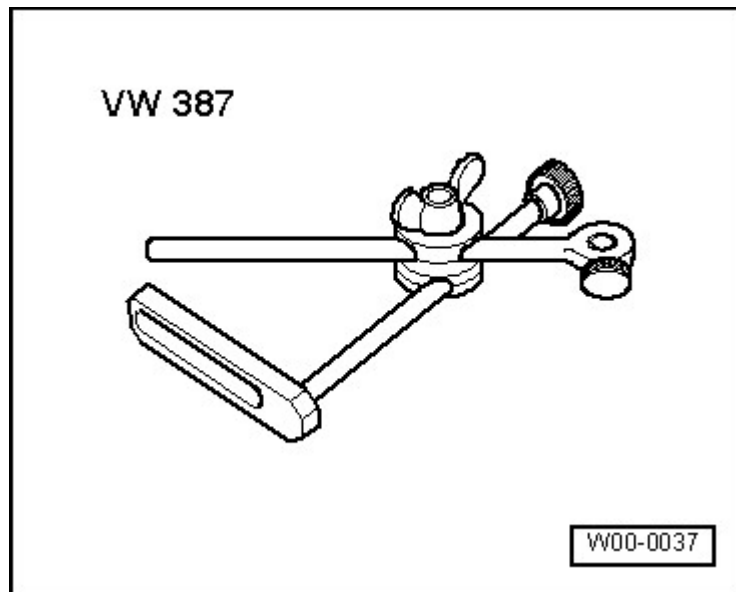


Fig. 43: Identifying Dial Gauge Holder VW 387
Courtesy of AUDI OF AMERICA, LLC

- Dial gauge VAS 6079

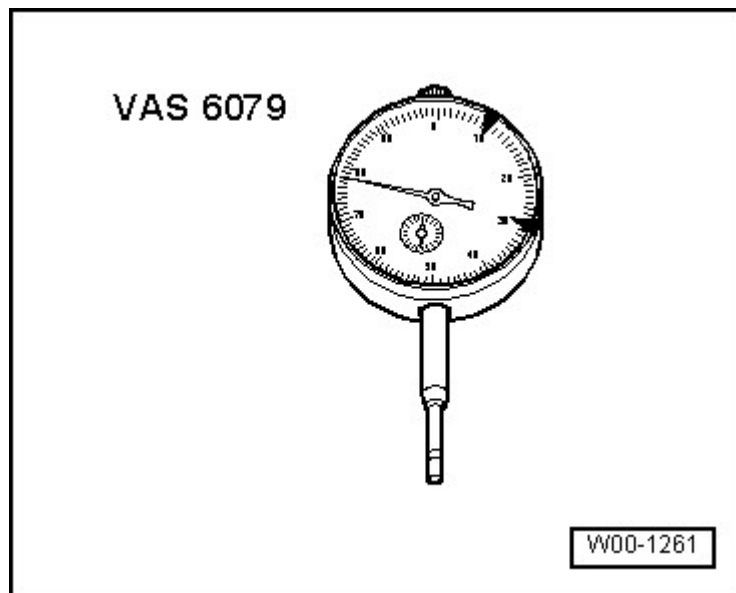


Fig. 44: Identifying Dial Gauge VAS 6079
Courtesy of AUDI OF AMERICA, LLC

- Counter-holder tool T10069

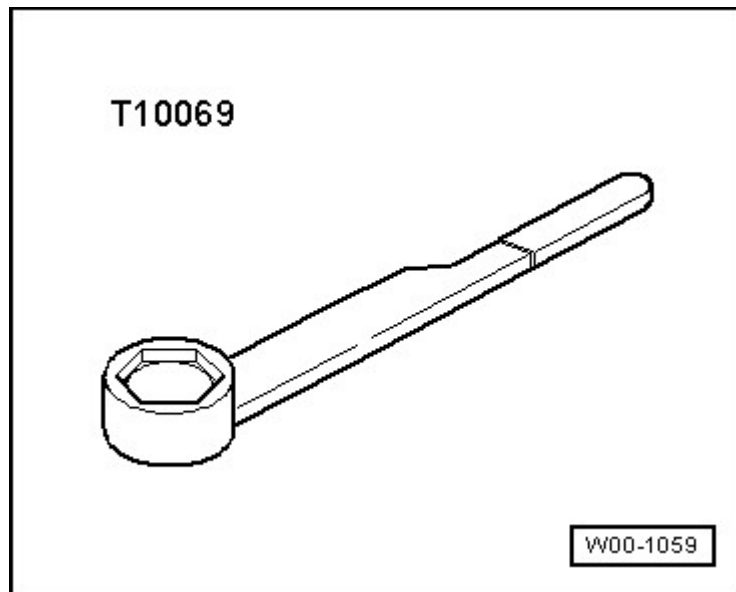


Fig. 45: Identifying Counter-Holder Tool T10069
Courtesy of AUDI OF AMERICA, LLC

- Assembly tool T10215

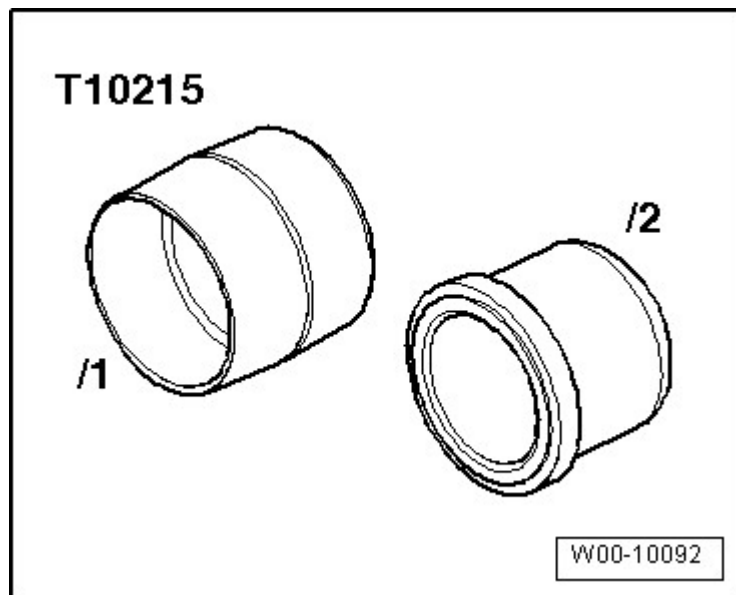


Fig. 46: Identifying Assembly Tool T10215 For Vehicles From 11.2005
Courtesy of AUDI OF AMERICA, LLC

- Counter-holder tool 3067

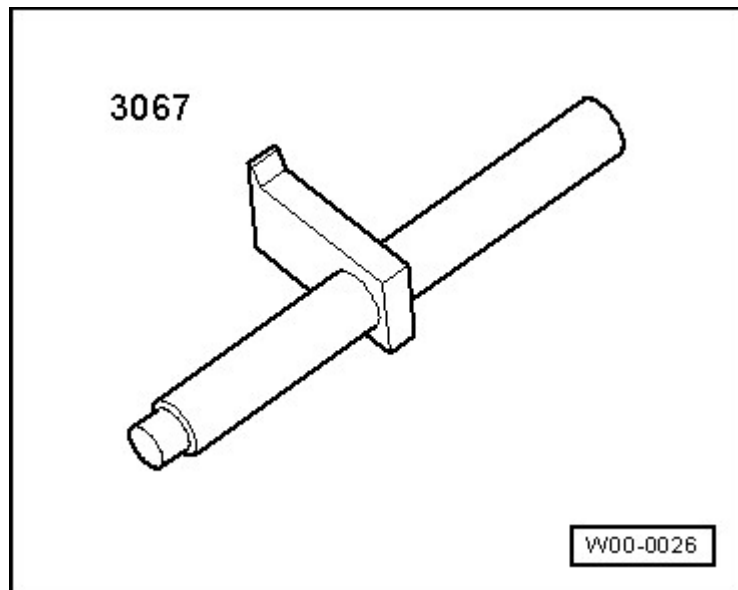


Fig. 47: Identifying Counter-Hold Tool 3067
Courtesy of AUDI OF AMERICA, LLC

- Pulling fixture T10122

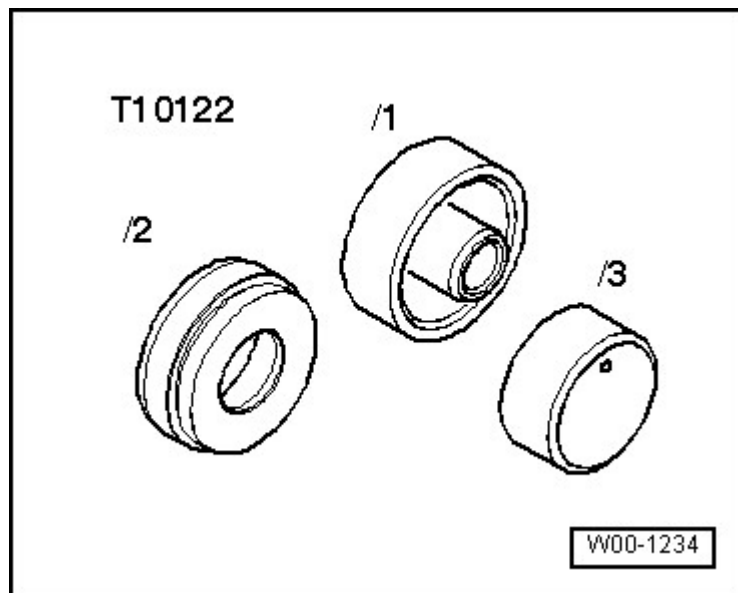


Fig. 48: Identifying Installation Tool T10122
Courtesy of AUDI OF AMERICA, LLC

- Extractor hook T20143

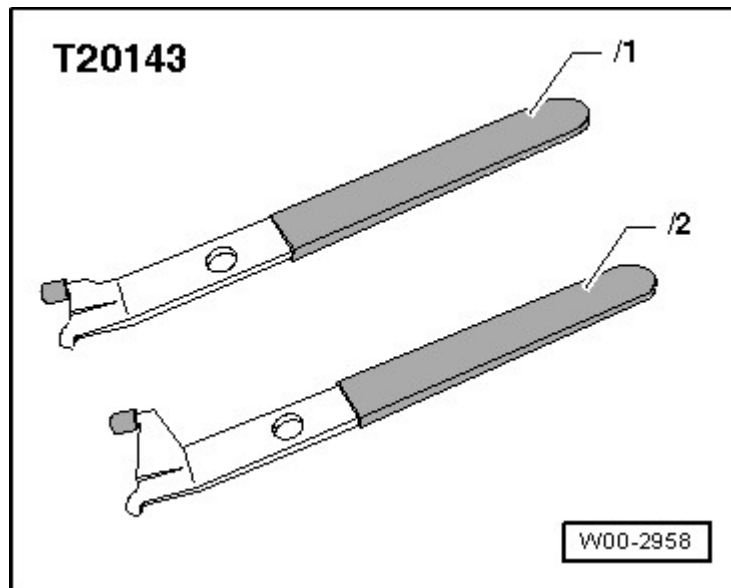


Fig. 49: Identifying Extractor Hook T20143
Courtesy of AUDI OF AMERICA, LLC

- Funnel T10333

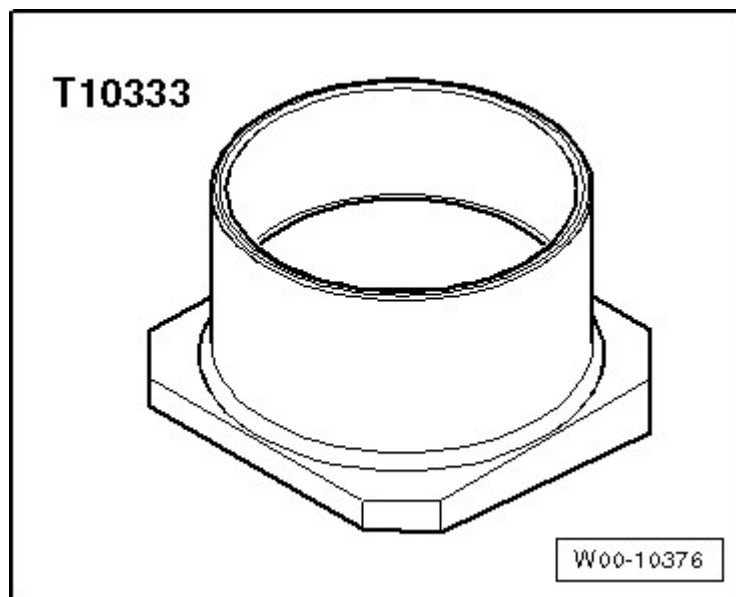


Fig. 50: Identifying Funnel T10333
Courtesy of AUDI OF AMERICA, LLC

ENGINE

3.6 Liter - Engine - Cylinder head, Valvetrain - Engine Code(s): BHK

15 ENGINE - CYLINDER HEAD, VALVETRAIN

DESCRIPTION AND OPERATION

TIMING CHAIN COVERS, ASSEMBLY OVERVIEW

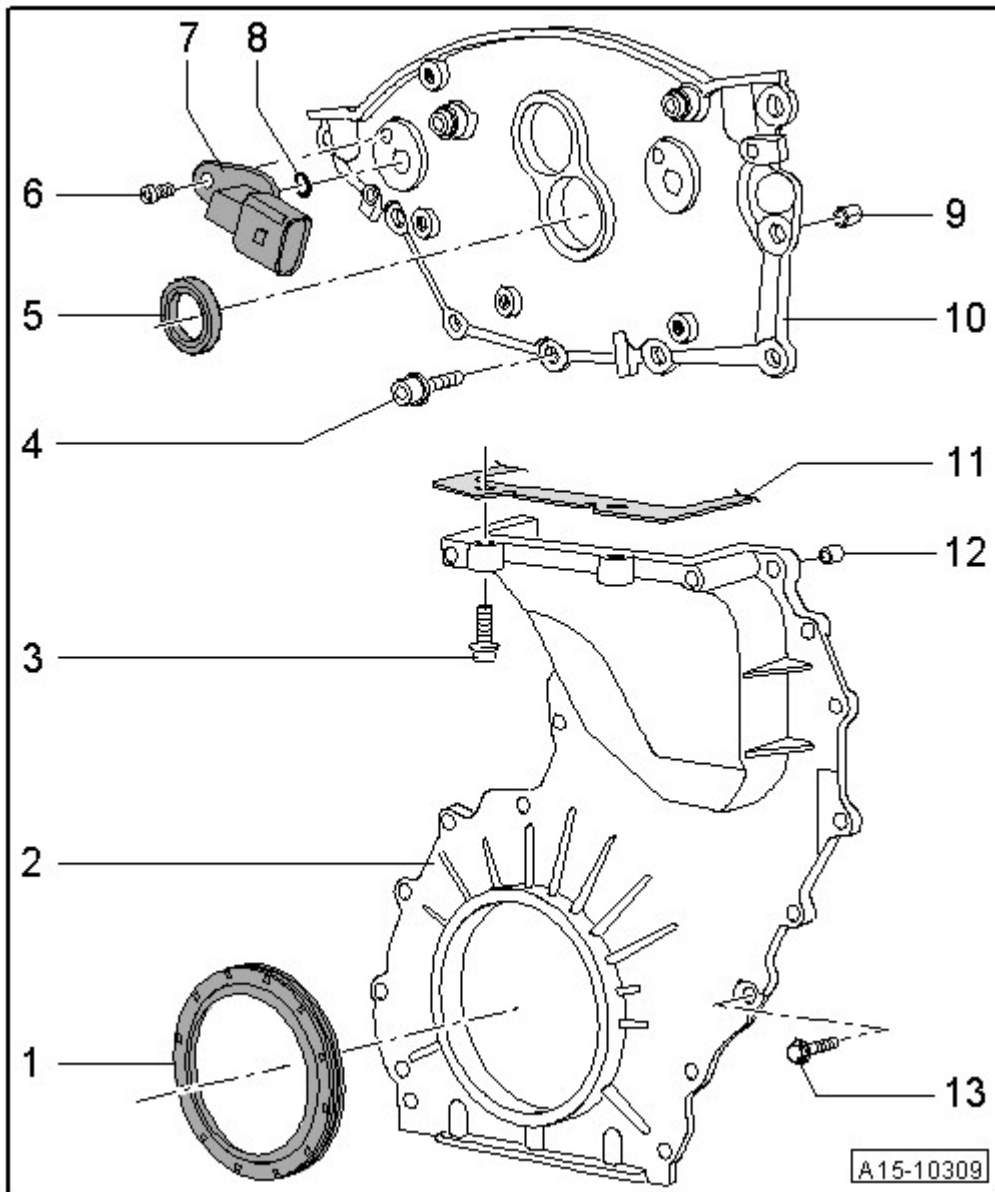


Fig. 1: Identifying Timing Chain Cover And Sealing Flange
Courtesy of AUDI OF AMERICA, LLC

1. Shaft seal
 - For crankshaft
 - Replacing **CRANKSHAFT SHAFT SEAL** .
2. Timing chain cover, lower
 - Removing and installing **LOWER TIMING CHAIN COVER**.
3. Bolt
 - Tightening sequence **Fig. 2**
4. Bolt
 - Tighten in diagonal sequence in steps
 - 9 Nm
5. Seal
 - 2 pieces
 - For camshaft adjustment valve 1 -N205- and camshaft adjustment valve 1 (exhaust) -N318-
 - Replace if leaking or damaged
 - Replacing **UPPER TIMING CHAIN COVER SEAL**.
6. Bolt
 - 9 Nm
7. Camshaft Position (CMP) sensor
 - Camshaft Position (CMP) sensor -G40- and Camshaft Position (CMP) sensor 2 -G163-
8. O-ring
 - 2 pieces
 - Replace
9. Alignment bushing
 - 2 pieces
10. Timing chain cover, upper
 - Removing and installing **UPPER TIMING CHAIN COVER**.
 - Vehicles without mechanical vacuum pump is shown
 - Vehicles with mechanical vacuum pump **MECHANICAL VACUUM PUMP, ASSEMBLY OVERVIEW**.
11. Cylinder head gasket
 - Clean holes and fill with sealant **INSTALLING**.
12. Guide pin
13. Bolt
 - Tightening sequence **Fig. 2**

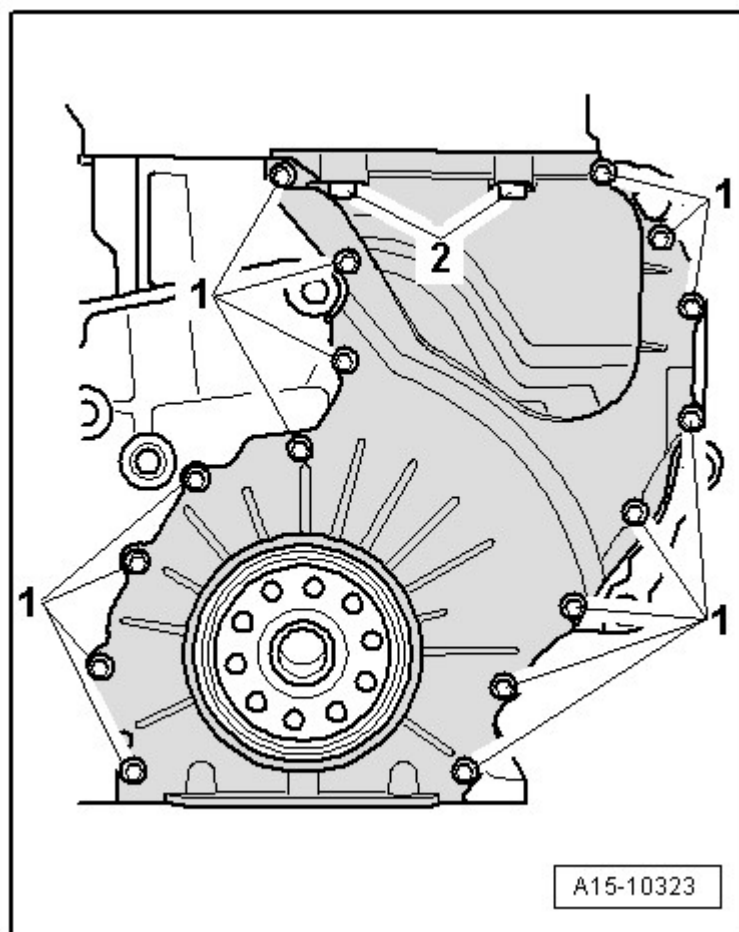


Fig. 2: Identifying Sealing Flange Bolts
Courtesy of AUDI OF AMERICA, LLC

-- Tighten bolts in 3 stages as follows:

-- Tighten bolts -1- to 5 Nm.

-- Tighten bolts -2- to 23 Nm.

-- Tighten bolts -1- to 9 Nm.

MECHANICAL VACUUM PUMP, ASSEMBLY OVERVIEW

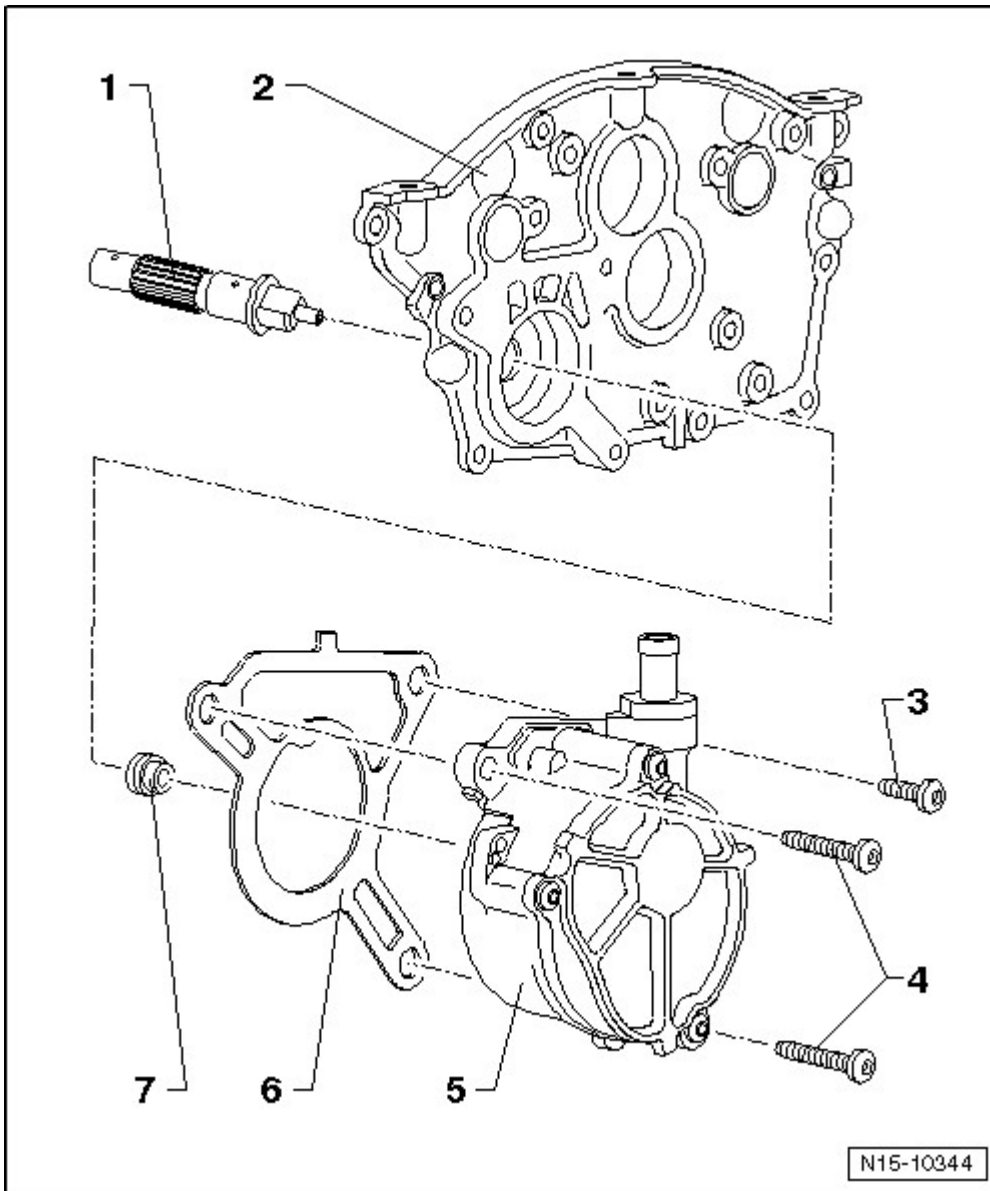


Fig. 3: Identifying Mechanical Vacuum Pump, Assembly Overview

Courtesy of AUDI OF AMERICA, LLC

1. Input shaft
 - For mechanical vacuum pump
2. Timing chain cover, upper
 - Removing and installing **UPPER TIMING CHAIN COVER.**
3. Bolt
 - Short
 - 10 Nm
4. Bolt
 - Long

- 10 Nm
- 5. Mechanical vacuum pump
 - For vehicles from approximately 11.2006
 - Removing and installing **MECHANICAL VACUUM PUMP.**
- 6. Gasket
 - Replace
- 7. Seal
 - Installed location **CHECK LOCATION OF SEALING RING -A-**.

CAMSHAFT TIMING CHAINS, ASSEMBLY OVERVIEW

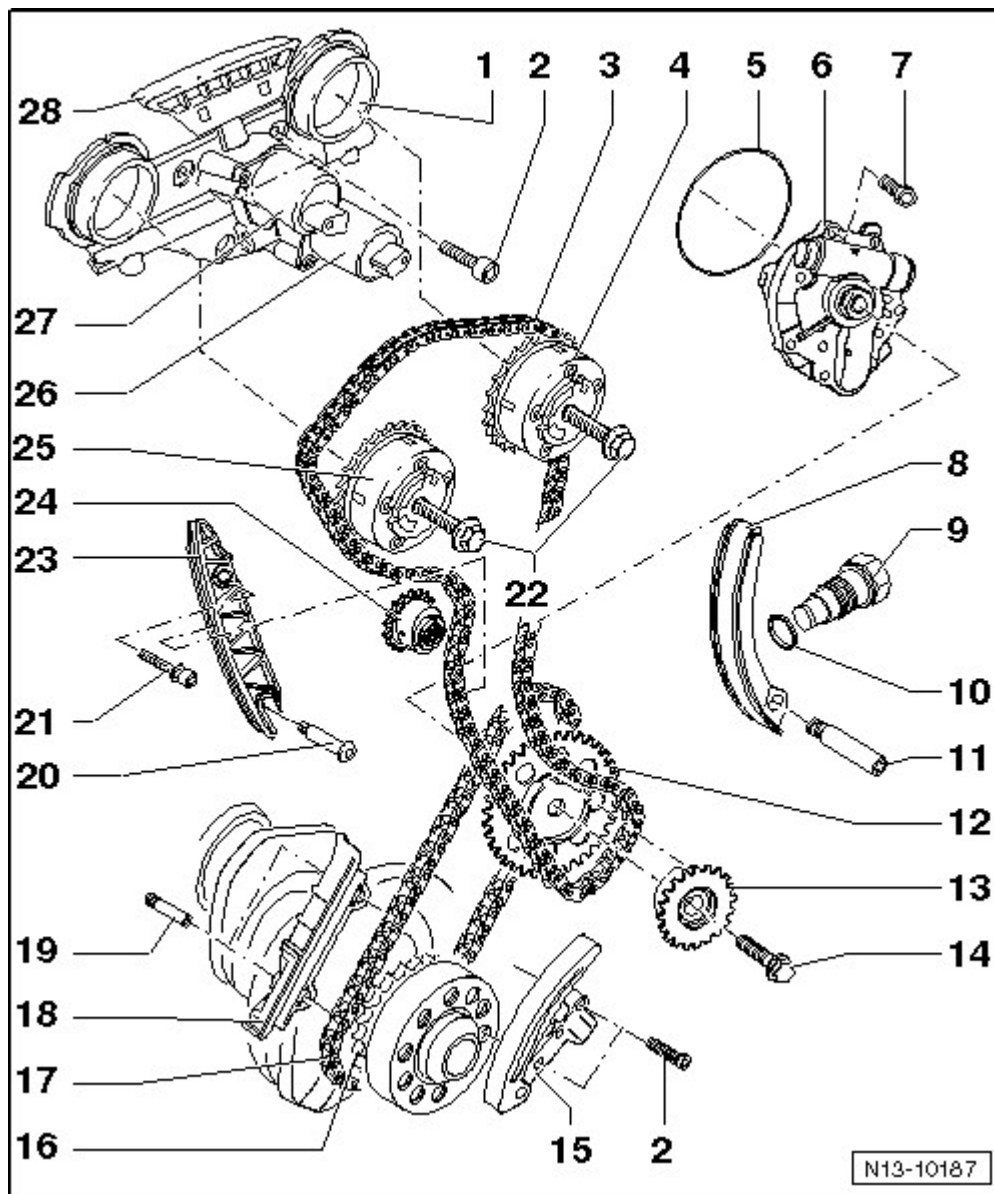


Fig. 4: Identifying Engine, Disassembling And Assembling Part I

Courtesy of AUDI OF AMERICA, LLC

1. Control housing
 - Removing and installing **CAMSHAFTS**.
 - Disassembling and assembling **Fig. 16**
 - Check screen for dirt **Fig. 17**
 - Lightly lubricate contact surfaces of oil seals before installing
2. Bolt
 - Replace
 - 8 Nm
3. Camshaft timing chain
 - Before removing, mark direction of rotation with paint **Fig. 5**
 - Remove from camshafts **CAMSHAFT TIMING CHAIN, REMOVING FROM CAMSHAFTS**.
 - Removing and installing **CAMSHAFT TIMING CHAIN**.
4. Camshaft adjuster, exhaust side
 - Identification: "32A"
 - Removing and installing **CAMSHAFT TIMING CHAIN, REMOVING FROM CAMSHAFTS**.
5. O-ring
 - Replace
6. Oil pump
 - Removing and installing **OIL PUMP** .
7. Bolt
 - Tightening specifications **OIL PUMP, ASSEMBLY OVERVIEW** .
8. Timing chain tensioning rail
 - Remove to remove and install timing chain upper and lower covers
9. Camshaft timing chain tensioner
 - Removing and installing **CAMSHAFT TIMING CHAIN, REMOVING FROM CAMSHAFTS**.
 - Only rotate engine with chain tensioner installed
 - 40 Nm
10. Seal
 - Replace if damaged or leaking
11. Mounting pin
 - Without collar
 - For tensioning rail -8-
 - 18 Nm
12. Timing mechanism drive chain sprocket
 - Removing and installing **TIMING MECHANISM DRIVE CHAIN**.
13. Camshaft timing chain sprocket

- Removing and installing **TIMING MECHANISM DRIVE CHAIN.**
14. Bolt
 - Use counter hold T10069 on vibration damper to loosen and tighten
 - Replace
 - 60 Nm + $\frac{1}{4}$ additional turn (90°).
 15. Chain tensioner with tensioning rail
 - For drive chain
 - Before installation release locking device in chain tensioner with a small screwdriver and press tensioning plate against chain tensioner
 - Only rotate engine with chain tensioner installed
 16. Drive sprocket
 - Integral part of crankshaft
 - Ground down tooth faces in "TDC" position toward bearing joint
 17. Drive chain for timing mechanism
 - Before removing, mark direction of rotation with paint **Fig. 5**
 - Removing and installing **TIMING MECHANISM DRIVE CHAIN.**
 18. Timing mechanism drive chain guide rail
 19. Mounting pin
 - Without collar
 - For guide rail -18-
 - 10 Nm
 20. Mounting pin
 - With collar
 - For guide rail -23-
 - 10 Nm
 21. Bolt
 - 23 Nm
 22. Bolt
 - To loosen and tighten, counter hold with open end wrench at camshaft wrench surface **CAMSHAFT TIMING CHAIN, REMOVING FROM CAMSHAFTS.**
 - Replace
 - Contact surface of sensor wheel at screw head must be dry when installing
 - 60 Nm + $\frac{1}{4}$ additional turn (90°).
 23. Camshaft timing chain guide rail
 - Removing and installing **CAMSHAFT TIMING CHAIN, REMOVING FROM CAMSHAFTS.**
 24. High pressure pump drive chain sprocket
 - On the version for vehicles without mechanical vacuum pump, lightly lubricate needle bearing side

before installing

25. Camshaft adjuster, intake side
 - Identification: "24E"
 - Removing and installing **CAMSHAFT TIMING CHAIN, REMOVING FROM CAMSHAFTS.**
26. Camshaft adjustment valve 1 (exhaust) -N318-
 - For exhaust camshaft
 - Mark electrical connector before disconnecting
27. Camshaft adjustment valve 1 -N205-
 - For intake camshaft
 - Mark electrical connector before disconnecting
28. Camshaft timing chain guide rail
 - Clipped in at control housing

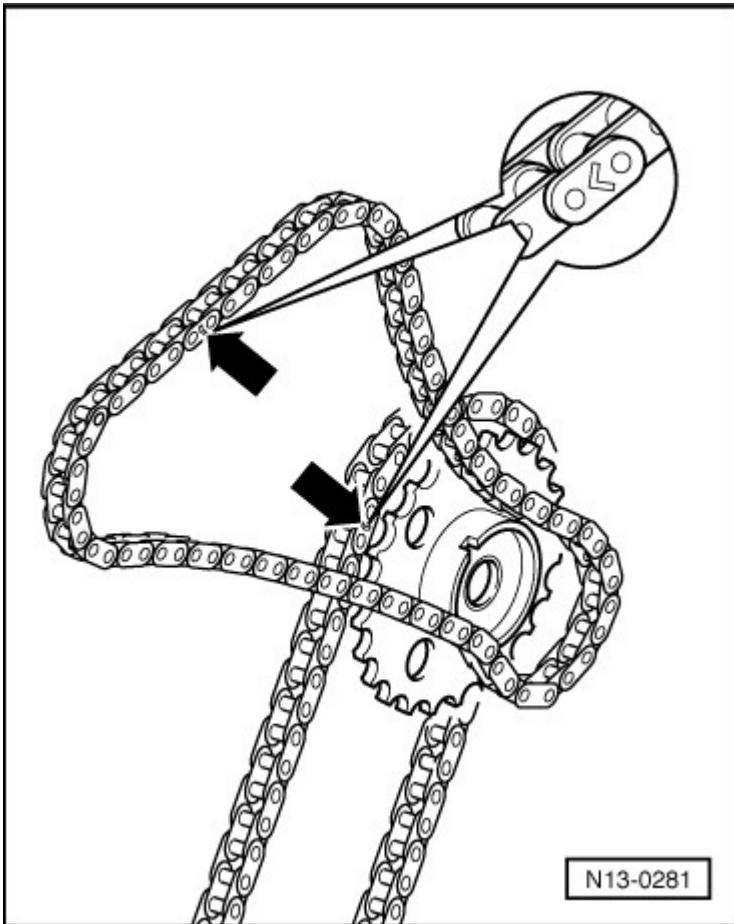


Fig. 5: Identifying Marks On Roller Chains
Courtesy of AUDI OF AMERICA, LLC

-- Mark timing chain running direction with arrows using paint -arrows- for reinstallation.

CAUTION: Risk of damaging timing chain.

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

CYLINDER HEAD AND COVER, ASSEMBLY OVERVIEW

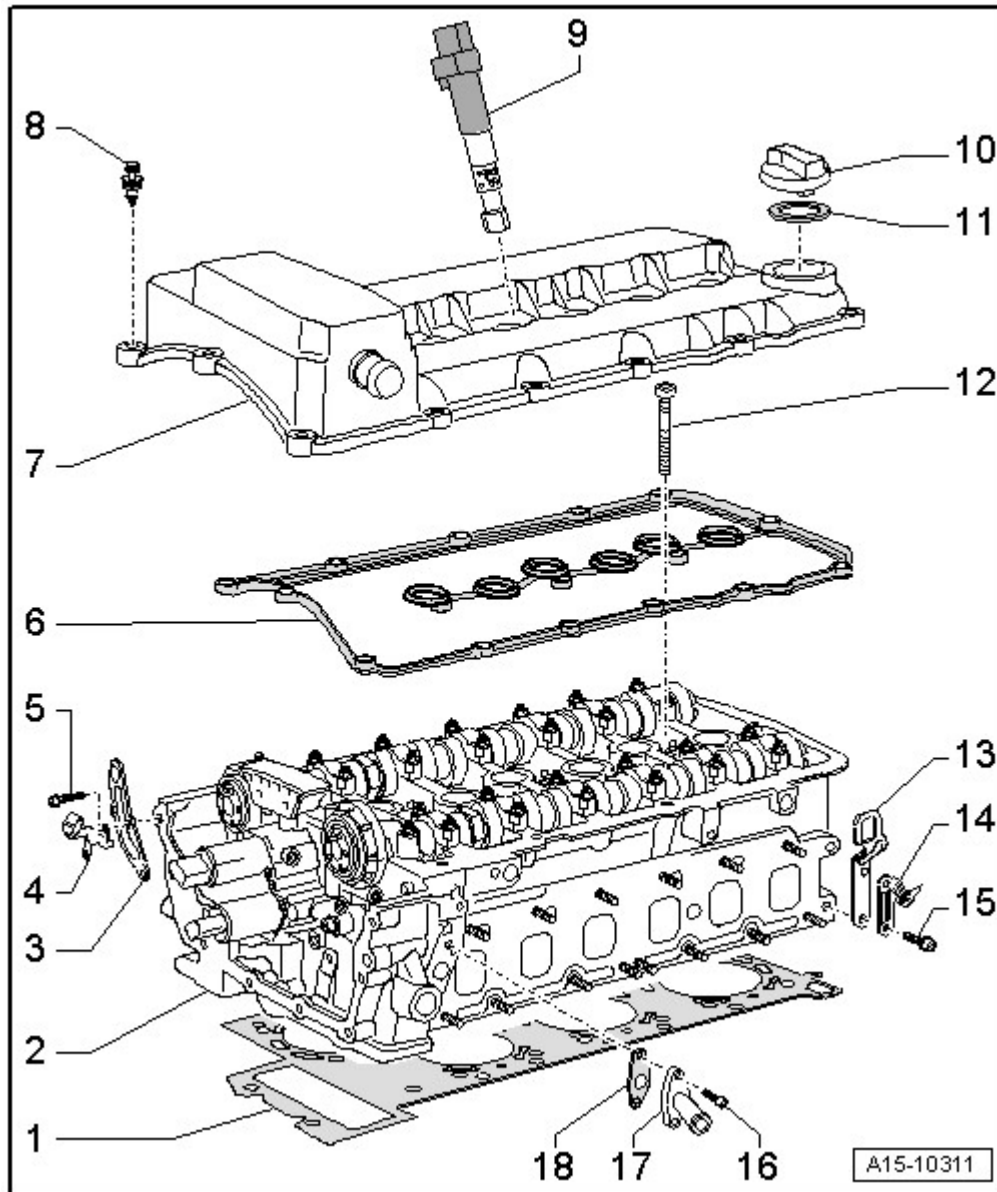


Fig. 6: Identifying Cylinder Head And Cover, Assembly Overview
Courtesy of AUDI OF AMERICA, LLC

1. Cylinder head gasket
 - Replace
 - After replacing, change engine oil and coolant
2. Cylinder head

- Removing and installing **CYLINDER HEAD.**
 - Check for distortion **Fig. 9**
 - After replacing, change engine oil and coolant
3. Lifting eye
 4. Bracket
 - For electrical wires
 5. Bolt
 - 23 Nm
 6. Cylinder head cover gaskets
 - Replace if damaged
 7. Cylinder head cover
 - Removing and installing **CYLINDER HEAD COVER.**
 8. Bolt
 - With spacer sleeve and seal
 - Replace if damaged
 - Tightening sequence **Fig. 7**
 9. Ignition coil
 - Removing and installing **Removal and Installation**
 10. Cap
 11. Seal for filler cap
 - Replace if damaged
 12. Bolt
 - Loosening sequence **LOOSEN AND TIGHTEN CYLINDER HEAD BOLTS IN -1 TO 20-SEQUENCE.**
 - Replace
 - Tightening sequence **Fig. 8**
 13. Lifting eye
 14. Bracket
 - For electrical wire
 15. Bolt
 - 23 Nm
 16. Bolt
 - 10 Nm
 17. Coolant connection
 18. Gasket
 - Replace

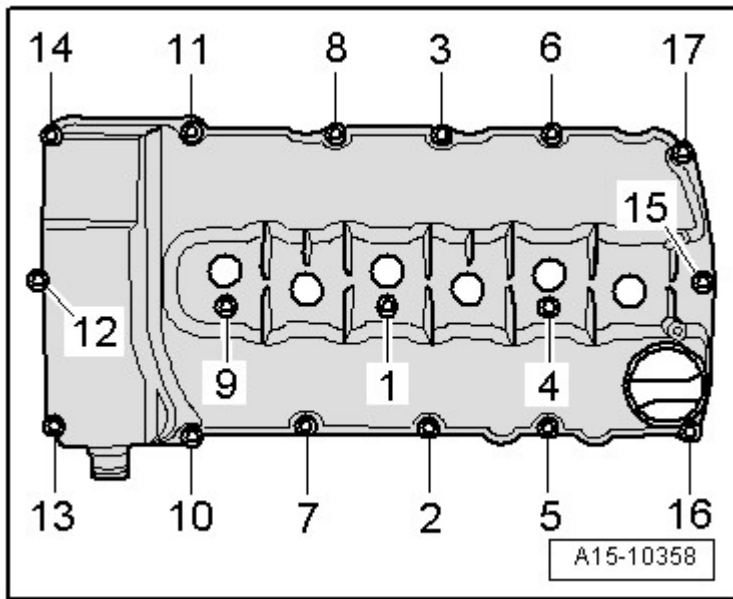


Fig. 7: Identifying Cylinder Head Cover Bolt Loosening Sequence
Courtesy of AUDI OF AMERICA, LLC

-- Tighten bolts to 10 Nm in -1 to 17- sequence.

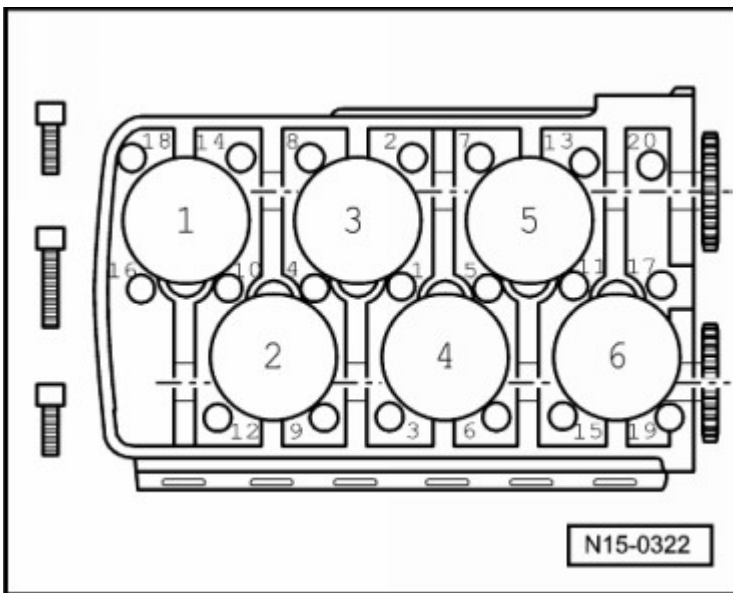


Fig. 8: Identifying Cylinder Head Tightening Sequence
Courtesy of AUDI OF AMERICA, LLC

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

-- Tighten bolts by hand.

-- Tighten bolts to 30 Nm.

-- Tighten bolts to 50 Nm.

-- Tighten an additional $1\frac{1}{2}$ turn (180°).

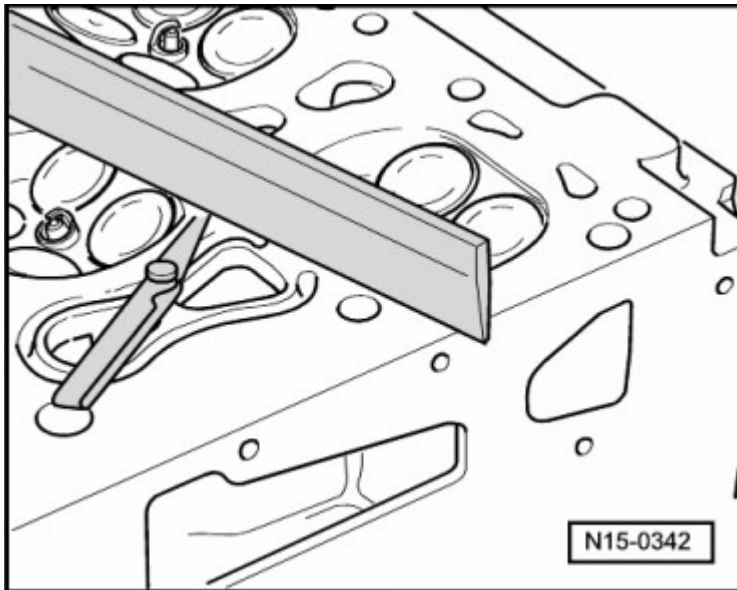


Fig. 9: Checking Cylinder Head For Distortion

Courtesy of AUDI OF AMERICA, LLC

-- Measure at several places with straight edge and feeler gauge.

Permissible distortion:

- Maximum 0.05 mm.

VALVETRAIN, ASSEMBLY OVERVIEW

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.

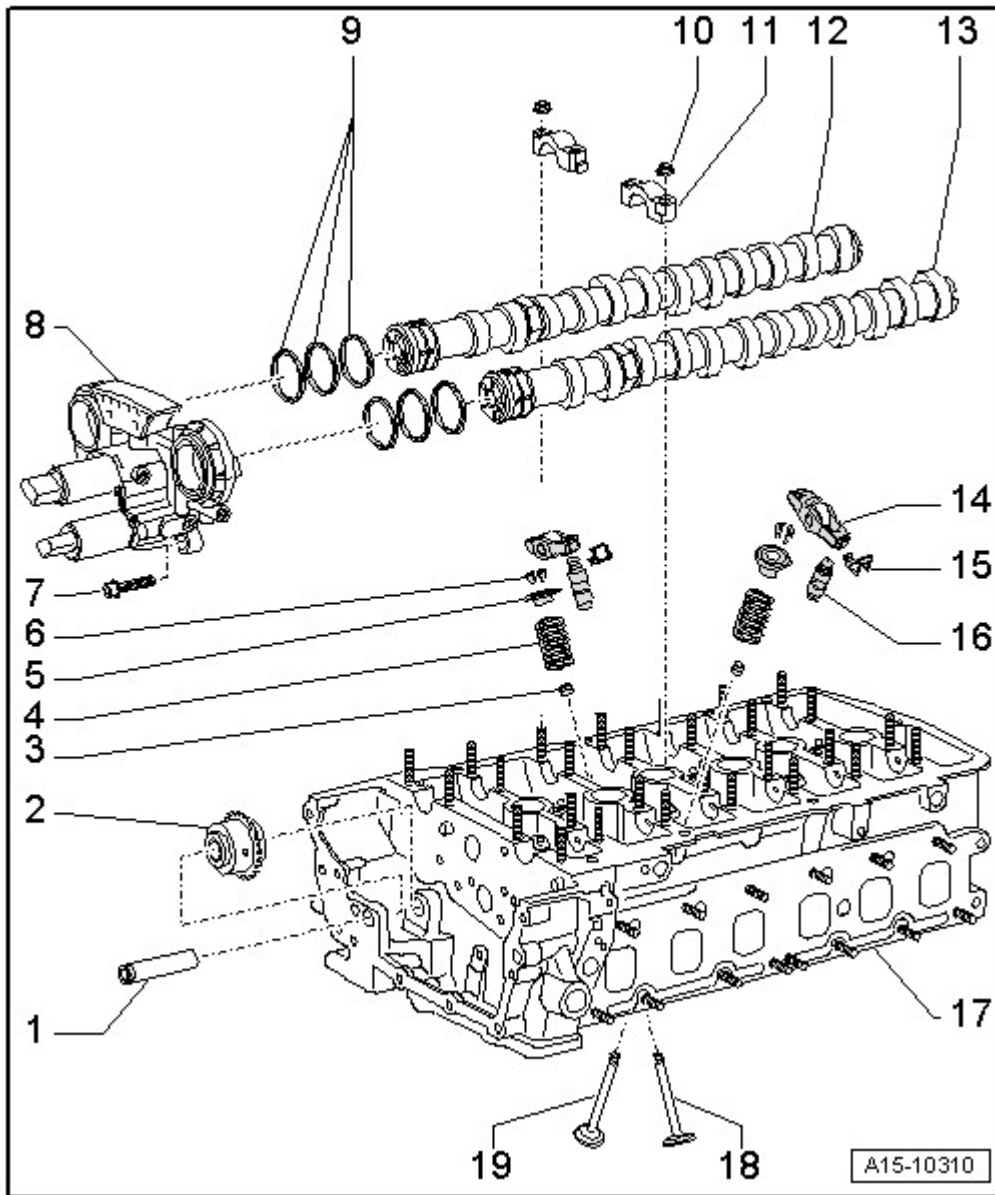


Fig. 10: Identifying Valvetrain, Assembly Overview

Courtesy of AUDI OF AMERICA, LLC

1. Mounting pins or input shaft
 - Vehicles without mechanical vacuum pump: Drive chain sprocket mounting pins
 - Vehicles with mechanical vacuum pump: Mechanical vacuum pump input shaft
2. High pressure pump drive chain sprocket
3. Valve stem seal
 - Replacing **VALVE STEM SEALS**.
4. Valve spring
 - Installed location: Larger diameter faces toward cylinder head
5. Valve spring plate

6. Valve keys
7. Bolt
 - 8 Nm
8. Control housing
 - Removing and installing **CAMSHAFTS**.
 - Check control housing strainer for soiling before installation **Fig. 17**
 - When installing, lightly lubricate compression ring contact surface in control housing
 - Disassembling and assembling **Fig. 16**
9. Compression ring
 - 3 per camshaft
 - Replace if leaking
 - When replacing compression rings, do not spread too widely
 - Install with gaps offset 120 degrees
 - When installing, lightly lubricate compression ring contact surface at camshafts and carefully slide control housing -8- over compression ring
10. Nut
 - Exhaust camshaft tightening sequence **Fig. 15**
 - Intake camshaft tightening sequence **Fig. 14**
11. Bearing cap
 - Installed location **Fig. 13**
 - Installation order **Fig. 13**
12. Intake camshaft
 - Identification **Fig. 11**
 - Removing and installing **CAMSHAFTS**.
 - Measuring axial play **CAMSHAFT, MEASURING AXIAL PLAY**.
 - Radial clearance, measuring **CAMSHAFT, MEASURING RADIAL PLAY**.
 - Run out maximum 0.01 mm
13. Exhaust camshaft
 - Identification **Fig. 11**
 - Removing and installing **CAMSHAFTS**.
 - Measuring axial play **CAMSHAFT, MEASURING AXIAL PLAY**.
 - Radial clearance, measuring **CAMSHAFT, MEASURING RADIAL PLAY**
 - Run out maximum 0.01 mm
14. Roller rocker lever
 - Do not interchange
 - Check roller bearing
 - Before installing, check axial play in camshafts **CAMSHAFT, MEASURING AXIAL PLAY**.
 - Lubricate contact surface

- For assembly, clip with to support element with securing clip -15-
- 15. Securing clip
 - Check for secure seat
- 16. Support element
 - With hydraulic valve clearance compensation
 - Do not interchange
 - Before installing, check axial play in camshafts **CAMSHAFT, MEASURING AXIAL PLAY.**
 - Lubricate contact surface
- 17. Cylinder head
 - Check valve guides **VALVE GUIDES, CHECKING.**
 - Rework valve seats **VALVE SEATS, REWORKING DIMENSIONS.**
- 18. Intake valve
 - Do not rework, only lapping is permitted
 - Valve dimensions **VALVE DIMENSIONS.**
 - Check valve guides **VALVE GUIDES, CHECKING.**
 - Rework valve seats **VALVE SEATS, REWORKING DIMENSIONS.**
- 19. Exhaust valve
 - Do not rework, only lapping is permitted
 - Valve dimensions **VALVE DIMENSIONS.**
 - Check valve guides **VALVE GUIDES, CHECKING.**
 - Rework valve seats **VALVE SEATS, REWORKING DIMENSIONS.**

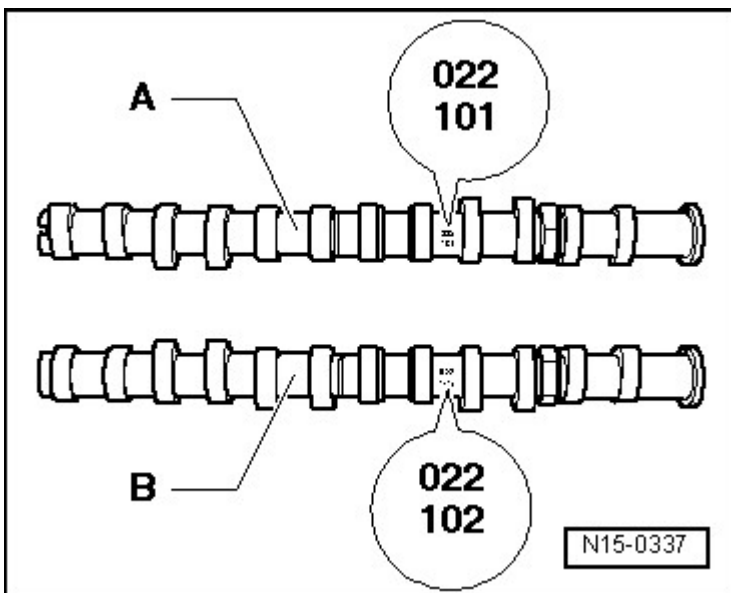


Fig. 11: Identifying Camshaft Identification, Valve Timing
 Courtesy of AUDI OF AMERICA, LLC

The camshaft marking is located between cylinder 4 and 5 cam pair.

A - Exhaust camshaft; Identification 022 - Index 101

B - Intake camshaft; Identification 022 - Index 102

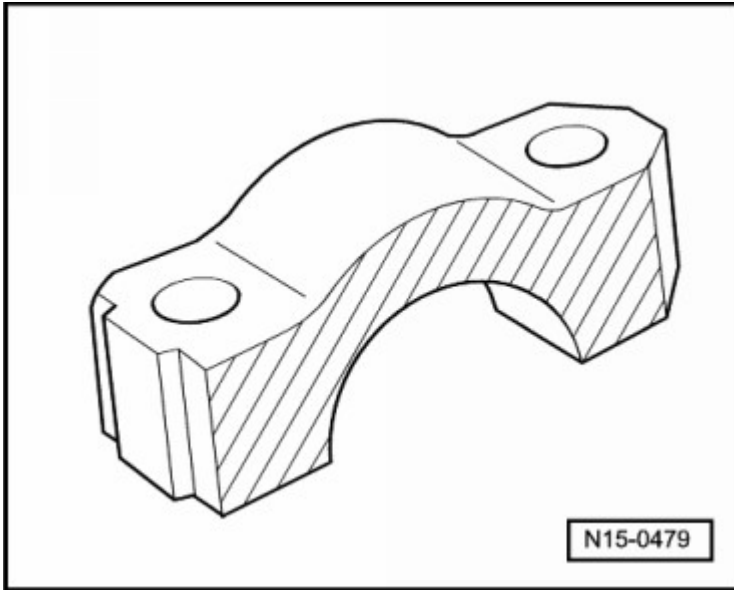


Fig. 12: Coating Bearing Caps 7 And 8 Contact Surface With Adhesive Lubricating Paste
Courtesy of AUDI OF AMERICA, LLC

-- Coat contact surface -shaded- on bearing cap 7 and 8 with adhesive lubricating paste.

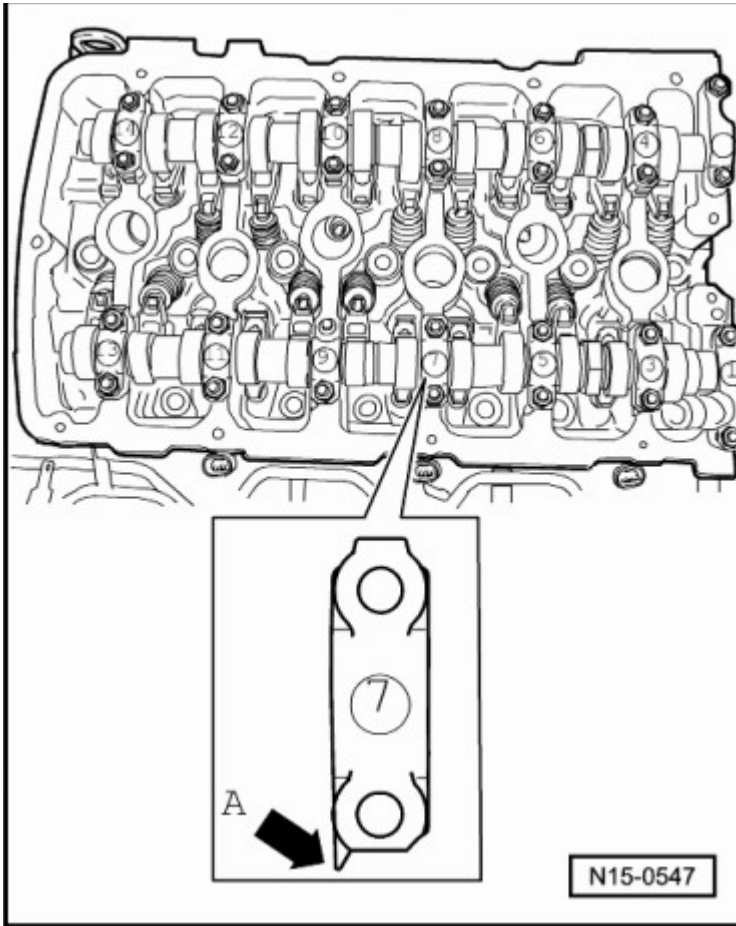


Fig. 13: Identifying Points Of Intake And Exhaust Camshaft Bearing Cap Face Outwards
Courtesy of AUDI OF AMERICA, LLC

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

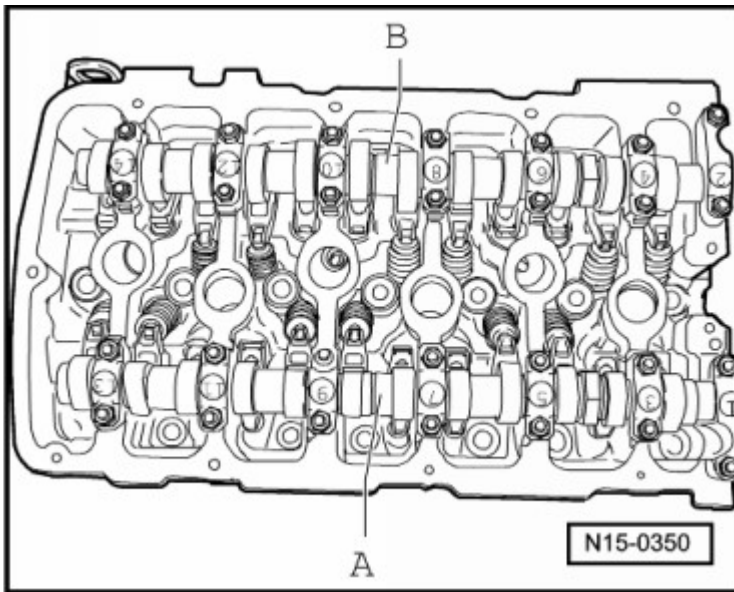


Fig. 14: Identifying Intake Camshaft And Exhaust Camshaft
Courtesy of AUDI OF AMERICA, LLC

-- Tighten nuts in 5 stages as follows:

1. Install bearing cap 5 and 9 nuts alternating and diagonally as far as stop.
2. Tighten bearing cap 5 and 9 nuts to $5 \text{ Nm} + \frac{1}{8}$ additional turn (45°).
3. Tighten bearing cap 1 and 13 nuts to $5 \text{ Nm} + \frac{1}{8}$ additional turn (45°).
4. Tighten bearing cap 7 nuts to $5 \text{ Nm} + \frac{1}{8}$ additional turn (45°).
5. Tighten bearing cap 3 and 11 nuts to $5 \text{ Nm} + \frac{1}{8}$ additional turn (45°).

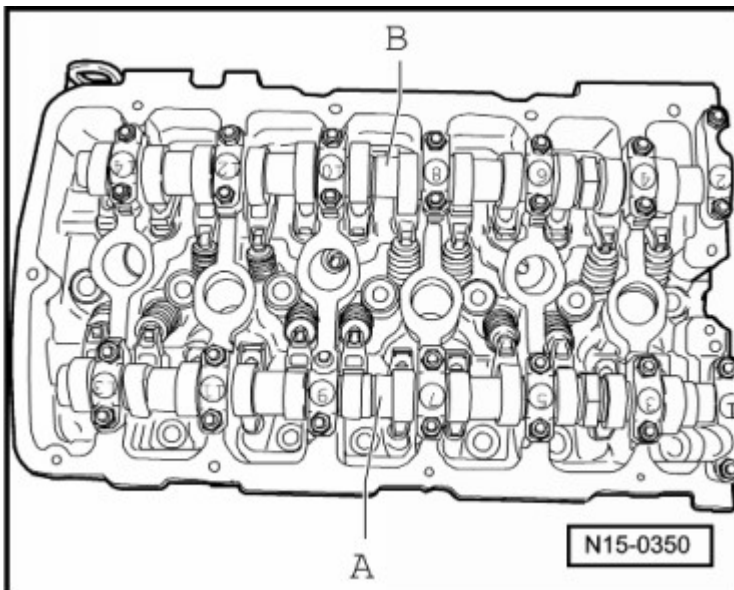
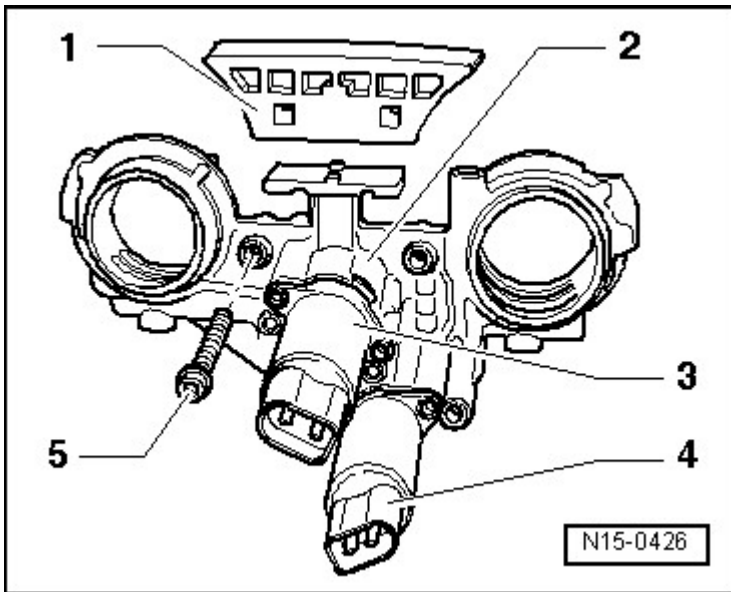


Fig. 15: Identifying Intake Camshaft And Exhaust Camshaft

Courtesy of AUDI OF AMERICA, LLC

-- Tighten nuts in 5 stages as follows:

1. Install bearing cap 6 and 10 nuts alternately and diagonally as far as stop.
2. Tighten bearing cap 6 and 10 nuts to 5 Nm + $\frac{1}{8}$ additional turn (45°).
3. Tighten bearing cap 2 and 14 nuts to 5 Nm + $\frac{1}{8}$ additional turn (45°).
4. Tighten bearing cap 8 nuts to 5 Nm + $\frac{1}{8}$ additional turn (45°).
5. Tighten bearing cap 4 and 12 nuts to 5 Nm + $\frac{1}{8}$ additional turn (45°).

**Fig. 16: Identifying Control Housing, Assembly Overview**

Courtesy of AUDI OF AMERICA, LLC

1. Guide rail, clipped in at control housing
2. Control housing
3. Camshaft adjustment valve 1 -N205-
4. Camshaft adjustment valve 1 (exhaust) -N318-
5. Bolt

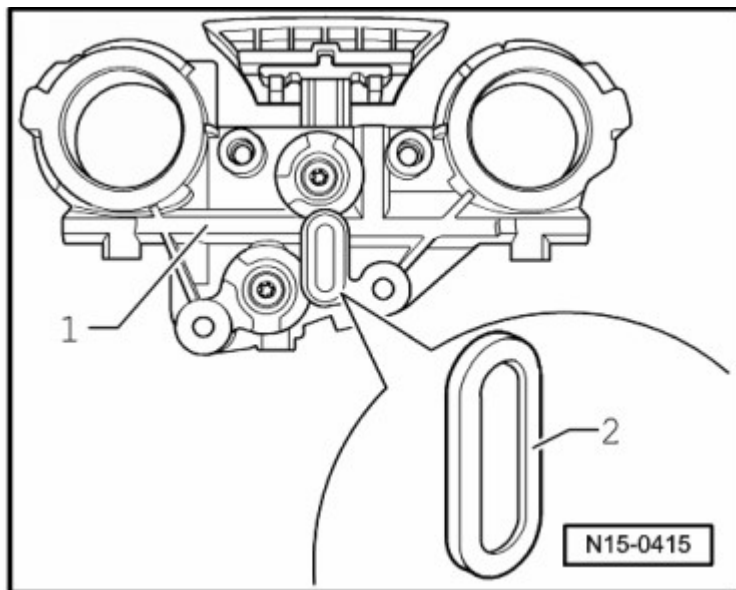


Fig. 17: Identifying Backside Of Control Housing & Screen
Courtesy of AUDI OF AMERICA, LLC

-- Unclip screen -2- on back side of control housing -1- and remove contaminates.

SPECIFICATIONS

FASTENER TIGHTENING SPECIFICATIONS

Lower Timing Chain Cover Tightening Sequence

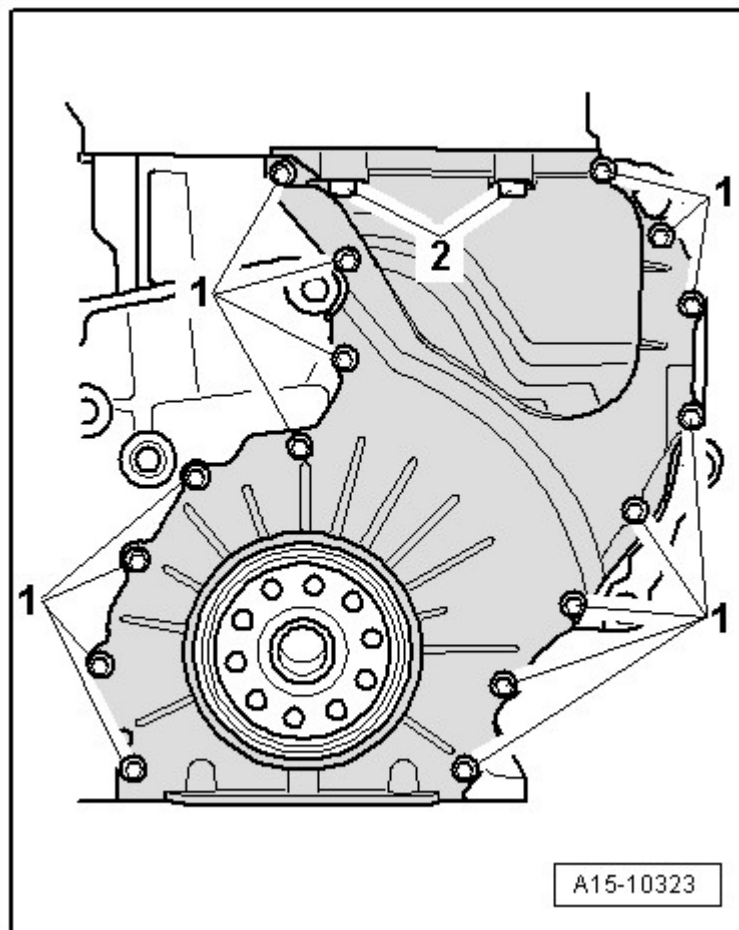


Fig. 18: Identifying Sealing Flange Bolts
Courtesy of AUDI OF AMERICA, LLC

-- Tighten bolts in 3 stages as follows:

-- Tighten bolts -1- to 5 Nm.

-- Tighten bolts -2- to 23 Nm.

-- Tighten bolts -1- to 9 Nm.

Cylinder Head Cover Tightening Sequence

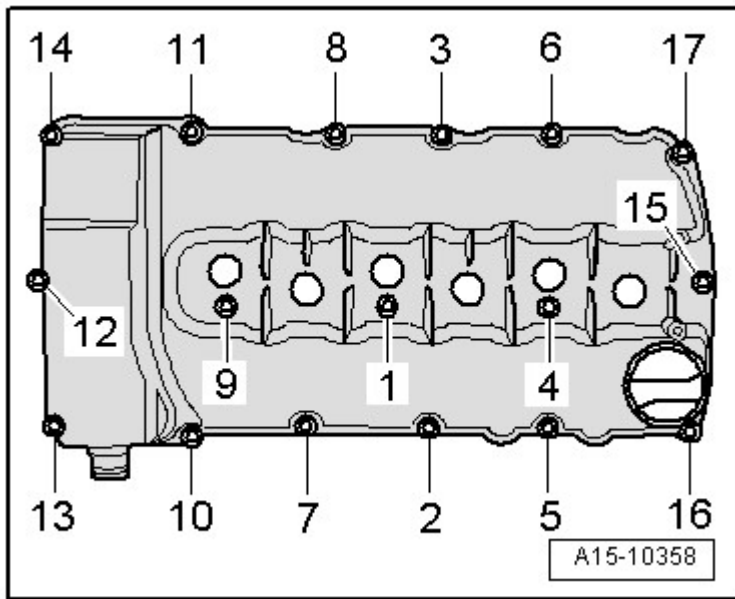


Fig. 19: Identifying Cylinder Head Cover Bolt Loosening Sequence
Courtesy of AUDI OF AMERICA, LLC

-- Tighten bolts to 10 Nm in -1 to 17- sequence.

Cylinder Head Tightening Sequence

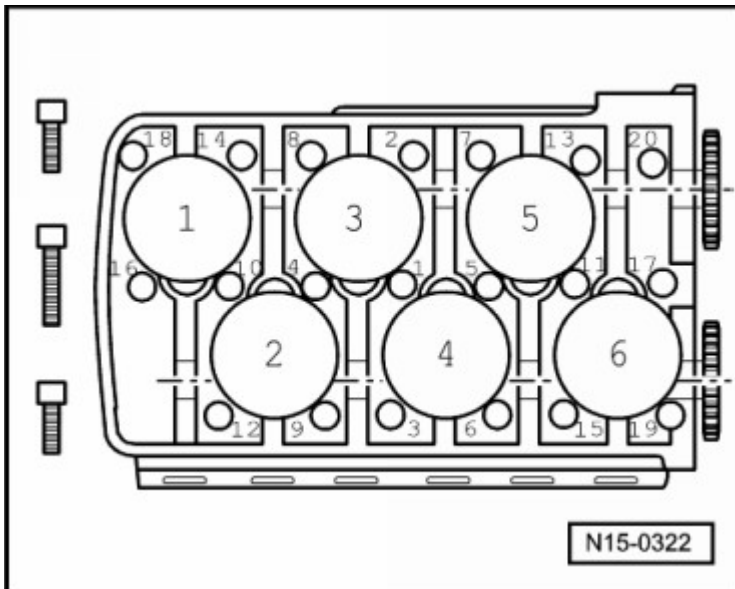


Fig. 20: Identifying Cylinder Head Tightening Sequence
Courtesy of AUDI OF AMERICA, LLC

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

-- Tighten bolts by hand.

- Tighten bolts to 30 Nm.
- Tighten bolts to 50 Nm.
- Tighten an additional $1\frac{1}{2}$ turn (180°).

Intake Camshaft -A- Tightening Sequence

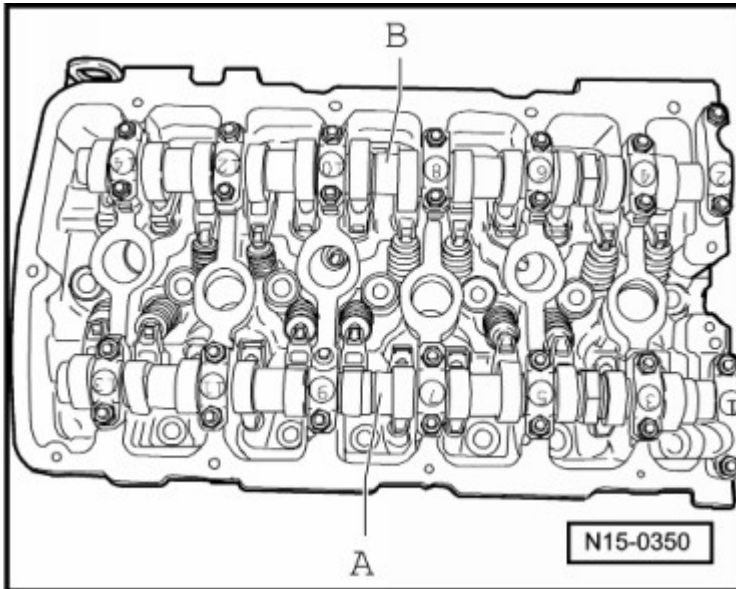


Fig. 21: Identifying Intake Camshaft And Exhaust Camshaft
Courtesy of AUDI OF AMERICA, LLC

- Tighten nuts in 5 stages as follows:
 1. Install bearing cap 5 and 9 nuts alternating and diagonally as far as stop.
 2. Tighten bearing cap 5 and 9 nuts to 5 Nm + $1\frac{1}{8}$ additional turn (45°).
 3. Tighten bearing cap 1 and 13 nuts to 5 Nm + $1\frac{1}{8}$ additional turn (45°).
 4. Tighten bearing cap 7 nuts to 5 Nm + $1\frac{1}{8}$ additional turn (45°).
 5. Tighten bearing cap 3 and 11 nuts to 5 Nm + $1\frac{1}{8}$ additional turn (45°).

Exhaust Camshaft -B- Tightening Sequence

- Tighten nuts in 5 stages as follows:
 1. Install bearing cap 6 and 10 nuts alternately and diagonally as far as stop.
 2. Tighten bearing cap 6 and 10 nuts to 5 Nm + $1\frac{1}{8}$ additional turn (45°).

3. Tighten bearing cap 2 and 14 nuts to $5 \text{ Nm} + \frac{1}{8}$ additional turn (45°).
4. Tighten bearing cap 8 nuts to $5 \text{ Nm} + \frac{1}{8}$ additional turn (45°).
5. Tighten bearing cap 4 and 12 nuts to $5 \text{ Nm} + \frac{1}{8}$ additional turn (45°).

VALVE DIMENSIONS

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

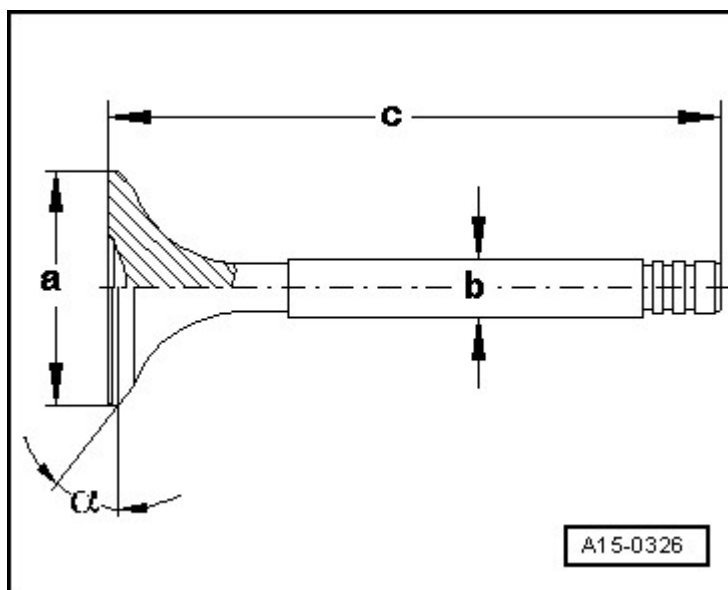


Fig. 22: Identifying Valve Dimensions
Courtesy of AUDI OF AMERICA, LLC

Dimension		Intake valve		Exhaust valve	
		Short	Long	Short	Long
Dia. a	mm	33.20	33.20	30.20	30.20
Dia. b	mm	5.98	5.98	5.97	5.97
c	mm	102.46	136.36	102.2	136.1
a	angle °	44°40'	44°40'	44°40'	44°40'

WARNING: Risk of injury if exhaust valves with sodium filling are disposed of improperly.

- Cut exhaust valve with sodium filling into 2 parts with a metal saw between shaft center and valve plate. While doing this, do not come into contact with water.
- Throw at the most 10 such sawed exhaust valves in a bucket filled with water and step back immediately.

- **When there is contact with water, a sudden chemical reaction occurs which burns the sodium filling.**
- **The treated parts may then be discarded through conventional disposal channels.**

VALVE SEATS, REWORKING DIMENSIONS

If a perfect contact pattern is not achieved by grinding the valve seats, rework them.

NOTE: If an engine with leaking valves is serviced, reworking or replacing valve seats and valves is not sufficient. The valve guides must be checked for wear, especially on engines with high mileage VALVE GUIDES, CHECKING.

Only rework valve seats enough to achieve a suitable contact pattern.

Calculate maximum permissible reworking dimension before reworking valve seats.

Special tools and workshop equipment required

- Depth gauge
- Valve seat reworking device

DETERMINING MAXIMUM ALLOWABLE REWORKING DIMENSION

NOTE: If valve is replaced during repair, use new valve for measurement.

-- Insert valve and press firmly against seat.

-- Using depth gauge, measure distance -a- between end of valve stem and upper cylinder head surface.

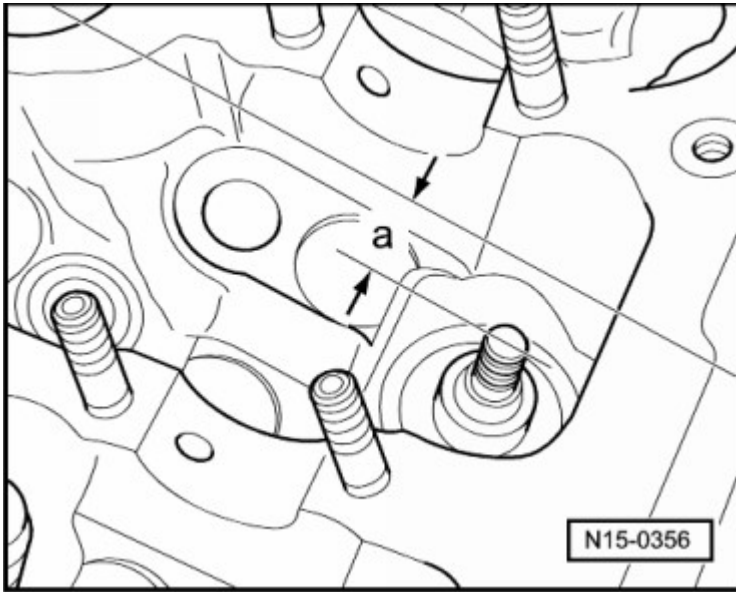


Fig. 23: Identifying Distance Between End Of Valve Stem And Upper Edge Of Cylinder Head
 Courtesy of AUDI OF AMERICA, LLC

-- Determine maximum allowable refacing dimension using distance measured and minimum dimension.

Measured distance minus minimum dimension = maximum permissible refaced dimension.

Intake valve minimum dimensions		Exhaust valve minimum dimensions	
Short	Long	Short	Long
31.8 mm	10.2 mm	31.8 mm	10.2 mm

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

-- If the maximum permissible refacing dimension is 0 mm or less, repeat measurement using new valve.

-- If maximum permissible reworking dimension is still 0 mm or less, replace cylinder head.

NOTE: If reworking dimension is too small, hydraulic valve clearance compensation

will not function properly.

REWORKING INTAKE VALVE SEAT

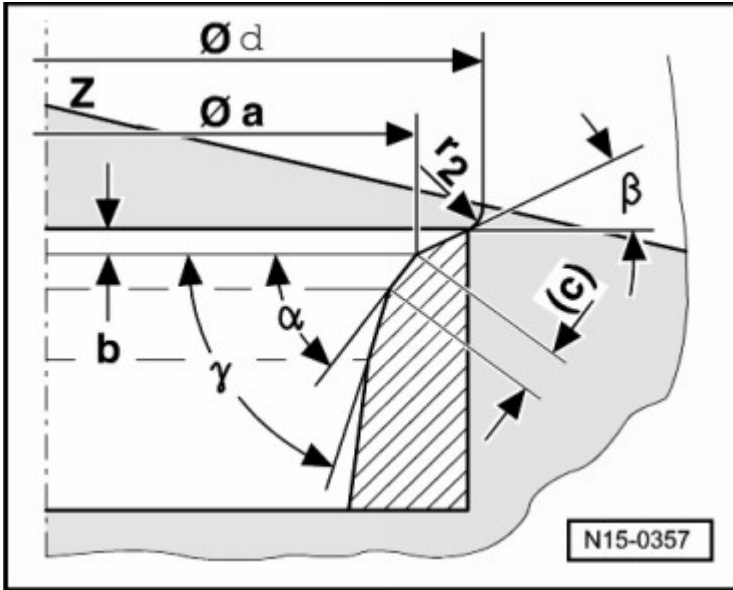


Fig. 24: Identifying Angles And Dimensions To Rework Exhaust Valve Seat
Courtesy of AUDI OF AMERICA, LLC

a - Dia. 30.6 mm

b - Maximum permissible reworking dimension **DETERMINING MAXIMUM ALLOWABLE REWORKING DIMENSION.**

c - 0.9 to 1.5 mm

d - Maximum dia. 35.0 mm

r2 - Radius 2.0 mm

Z - Cylinder head lower edge

a - 45° valve seat angle

β - 30° upper correction angle

gamma - 60° lower correction angle

REWORKING EXHAUST VALVE SEAT

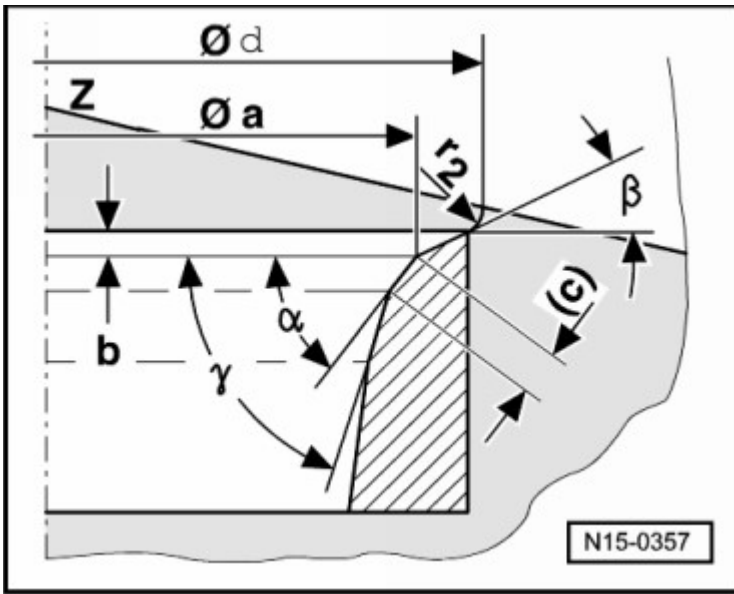


Fig. 25: Identifying Angles And Dimensions To Rework Exhaust Valve Seat
 Courtesy of AUDI OF AMERICA, LLC

a - Dia. 26.7 mm

b - Maximum permissible reworking dimension **DETERMINING MAXIMUM ALLOWABLE REWORKING DIMENSION.**

c - 1.2 to 1.7 mm

d - Maximum dia. 29.0 mm

r2 - Radius 2.0 mm

Z - Cylinder head lower edge

a - 45° valve seat angle

β - 30° upper correction angle

gamma - 60° lower correction angle

DIAGNOSIS AND TESTING

VALVE TIMING ADJUSTMENT, CHECKING

Special tools and workshop equipment required

- Camshaft bar T10068 A

Procedure

- Remove intake manifold **Removal and Installation** .
- Remove cylinder head cover **CYLINDER HEAD COVER**.
- Adjust crankshaft at vibration damper bolt in direction of engine rotation to "TDC" marking.

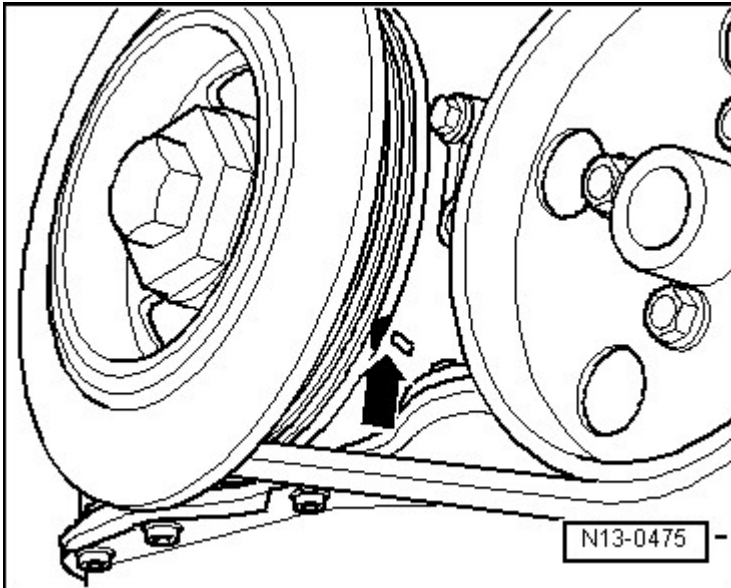


Fig. 26: Identifying Crankshaft At Vibration Damper Securing Bolt In Engine At TDC Cyl. 1
Courtesy of AUDI OF AMERICA, LLC

- Markings on vibration damper and sealing flange must align -arrow-.
- Camshaft bar T10068 A must engage in grooves on both camshafts at the same time.

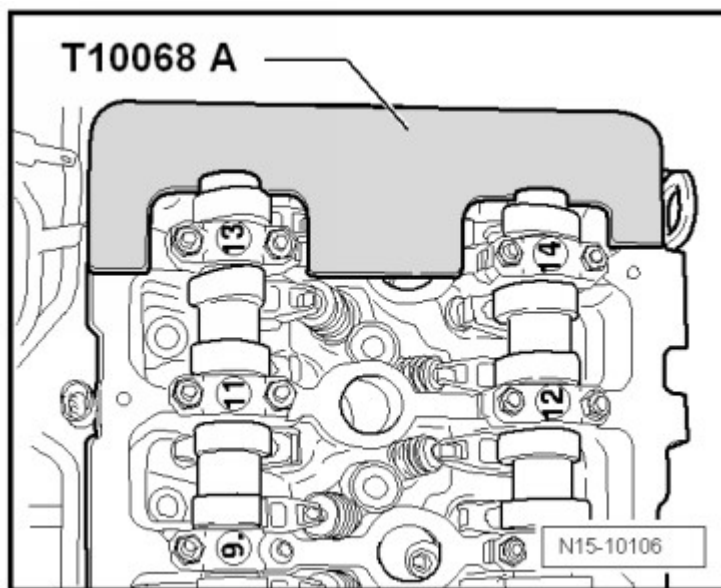


Fig. 27: Identifying Camshaft Bar T10068 A Engage In Shaft Grooves

Courtesy of AUDI OF AMERICA, LLC

NOTE: Due to the camshaft adjuster function, the camshaft grooves may not be perfectly horizontal. Therefore, turn camshaft back and forth slightly with an open end wrench -arrows- if necessary to insert the camshaft bar T10068 A.

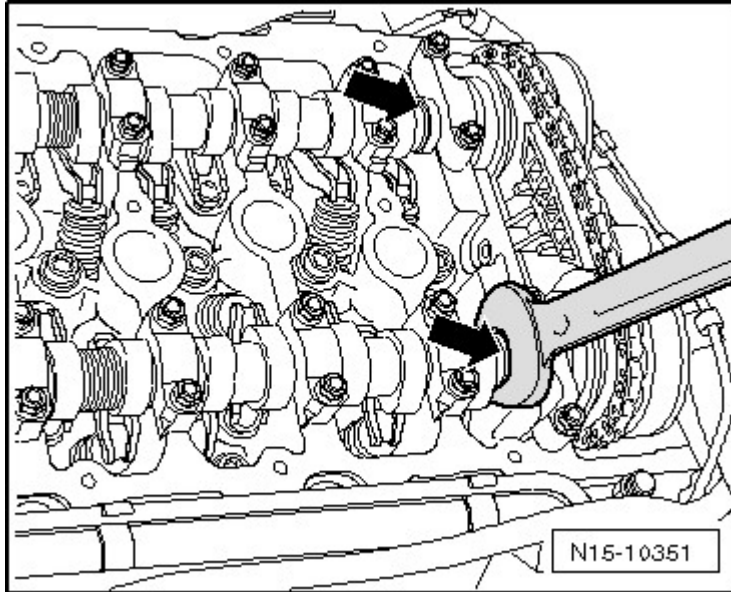


Fig. 28: Counter-Holding Camshaft Using Wrench
Courtesy of AUDI OF AMERICA, LLC

If camshaft bar T10068 A does not engage, rotate crankshaft 1 rotation further in direction of engine rotation.

-- Camshaft position, checking:

Intake Side

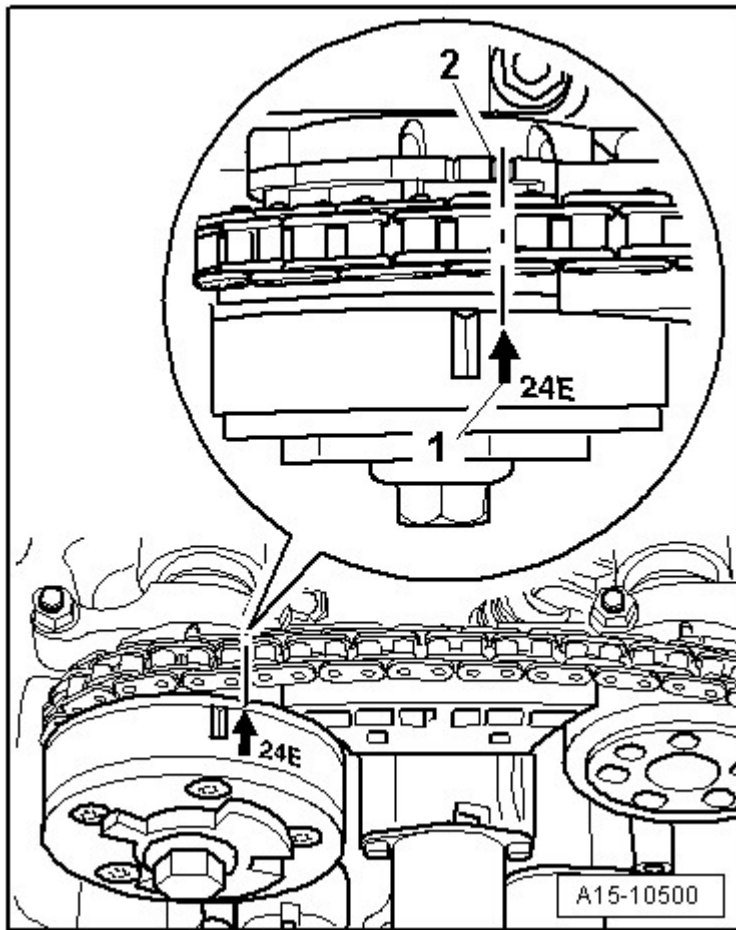


Fig. 29: Verifying Installation Marks Of Intake Camshaft Adjuster With Marks On Control Housing
Courtesy of AUDI OF AMERICA, LLC

- The "ARROW" -1- on intake camshaft adjuster must align with notch -2- on far right of control housing.

NOTE: A small offset between notch -2- and ARROW -1- is permitted.

Ignore notch on camshaft adjuster.

Exhaust Side

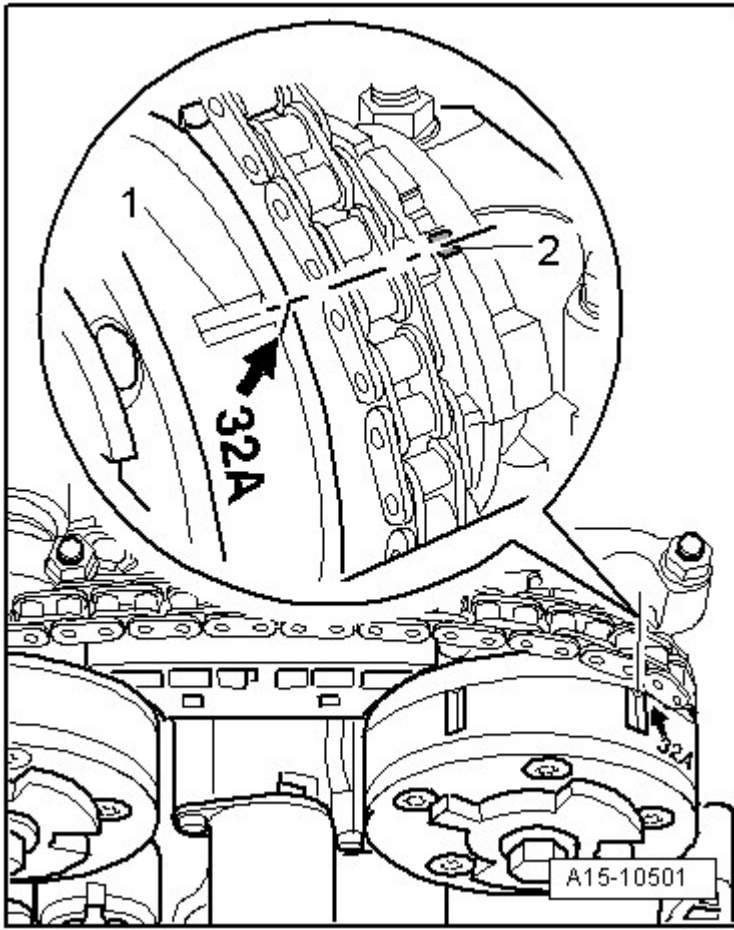


Fig. 30: Verifying Installation Marks Of Exhaust Camshaft Adjuster With Marks On Control Housing
Courtesy of AUDI OF AMERICA, LLC

- Marking -1- on camshaft adjuster which the "arrow" points to, must align with notch -2- at far right on control housing.

NOTE: A small offset between the marking -1- and notch -2- is permitted.

COMPRESSION, CHECKING

Special tools and workshop equipment required

- Spark plug removal tool 3122 B
- Compression tester V.A.G 1763

Procedure

- Engine oil temperature at least 30° C.
- Battery voltage at least 12.5 V.

- Switch off ignition.
- Disconnect electrical connector -arrow- for Engine Speed (RPM) sensor -G28-.

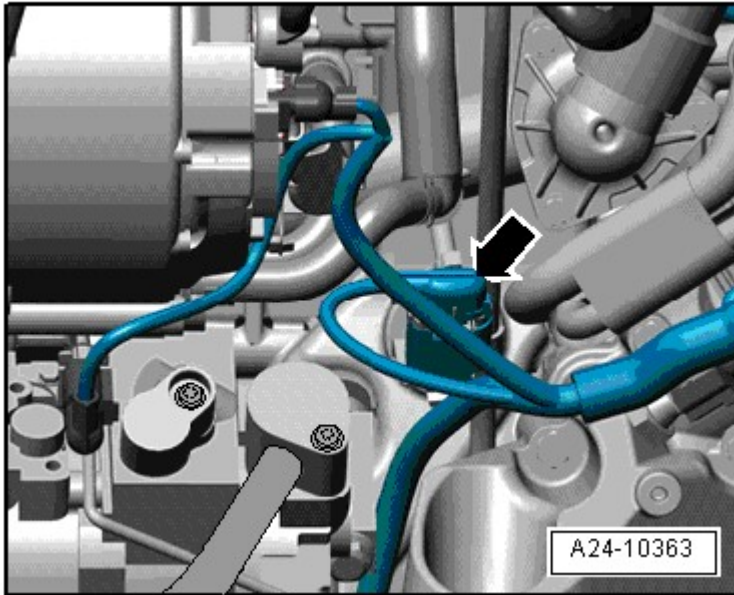


Fig. 31: Locating Engine Speed (RPM) Sensor -G28- Electrical Connector
 Courtesy of AUDI OF AMERICA, LLC

- Remove ignition coils **Removal and Installation** .
- Remove spark plugs with spark plug removal tool 3122 B.
- Check compression pressure with compression tester V.A.G 1763.
- Have a second person completely depress gas pedal and operate starter long enough until tester no longer indicates increase in pressure.
- Repeat procedure on each cylinder.

Compression pressure	Bar pressure
New	11.0 to 13.0
Wear limit	8.0
Maximum difference between cylinders	3.0

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

-- Install spark plugs.

-- Install ignition coils **Removal and Installation** .

If connectors and fuse were removed, malfunctions are saved in Engine Control Module (ECM).

-- Connect vehicle diagnosis, testing and information system VAS 5051B.

-- Start "Guided Functions" operating mode.

-- Generate readiness code in ECM.

CAMSHAFT, MEASURING AXIAL PLAY

Special tools and workshop equipment required

- Dial gauge holder VW 387
- Dial gauge VAS 6079

Procedure

-- Remove roller rocker lever and support elements **CAMSHAFTS**.

- The bearing cap of axial bearing for respective camshaft remains installed.

-- Secure dial gauge holder VW 387 with dial gauge VAS 6079 on cylinder head.

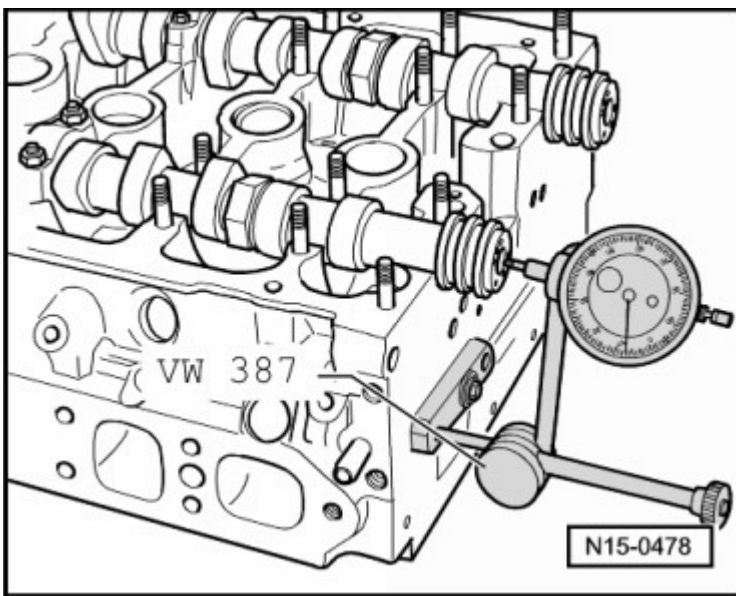


Fig. 32: Checking Camshafts Axial Clearance
Courtesy of AUDI OF AMERICA, LLC

Axial clearance:

- Wear limit: 0.1 mm.

CAMSHAFT, MEASURING RADIAL PLAY

Special tools and workshop equipment required

- Plastigage

Procedure

- Camshafts, removing **CAMSHAFTS**.
- Clean bearing cap and bearing journals.
- Removing cam follower **CAMSHAFTS**.
- Place Plastigage over entire width of bearing journal or into bearing.
 - Plastigage must rest in center of bearing.
- Position bearing cap and tighten to 5 Nm without rotating camshaft, refer to **Fig. 14**.
- 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 VAS 6079

Procedure

NOTE: If valve is replaced during repair, use new valve for measurement.

Due to different stem diameters, only use an intake valve in the intake guide and an exhaust valve in the exhaust guide.

- Place valve in valve guide.

- Valve stem tip must seal with valve guide.

-- Determine tilt clearance.

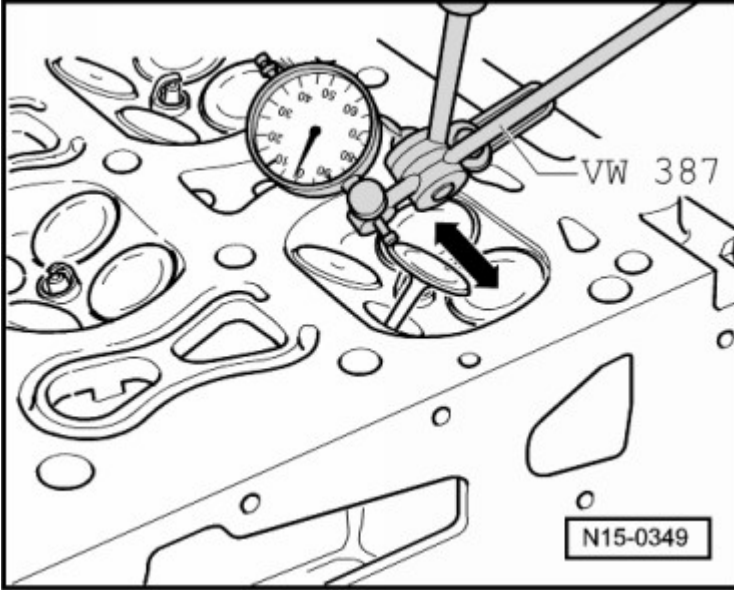


Fig. 33: Checking Valve Guides

Courtesy of AUDI OF AMERICA, LLC

- Wear limit: 0.8 mm.

-- If wear limit is exceeded, re-measure using new valves.

-- If wear limit is still exceeded, replace cylinder head.

NOTE: The valve guides cannot be replaced.

VALVES, CHECKING

-- Check valves at stem and seating surface for traces of wear.

-- If there are clear traces of wear, replace valve.

REMOVAL AND INSTALLATION

UPPER TIMING CHAIN COVER SEAL

Special tools and workshop equipment required

- Assembly tool 3253
- Fitting sleeve 3378

Removing

- Remove timing chain upper cover **UPPER TIMING CHAIN COVER**.
- Drive sealing ring out of timing chain upper cover with a drift.

Installing

- Installing sealing ring with fitting sleeve 3378 in timing chain upper cover -1-.

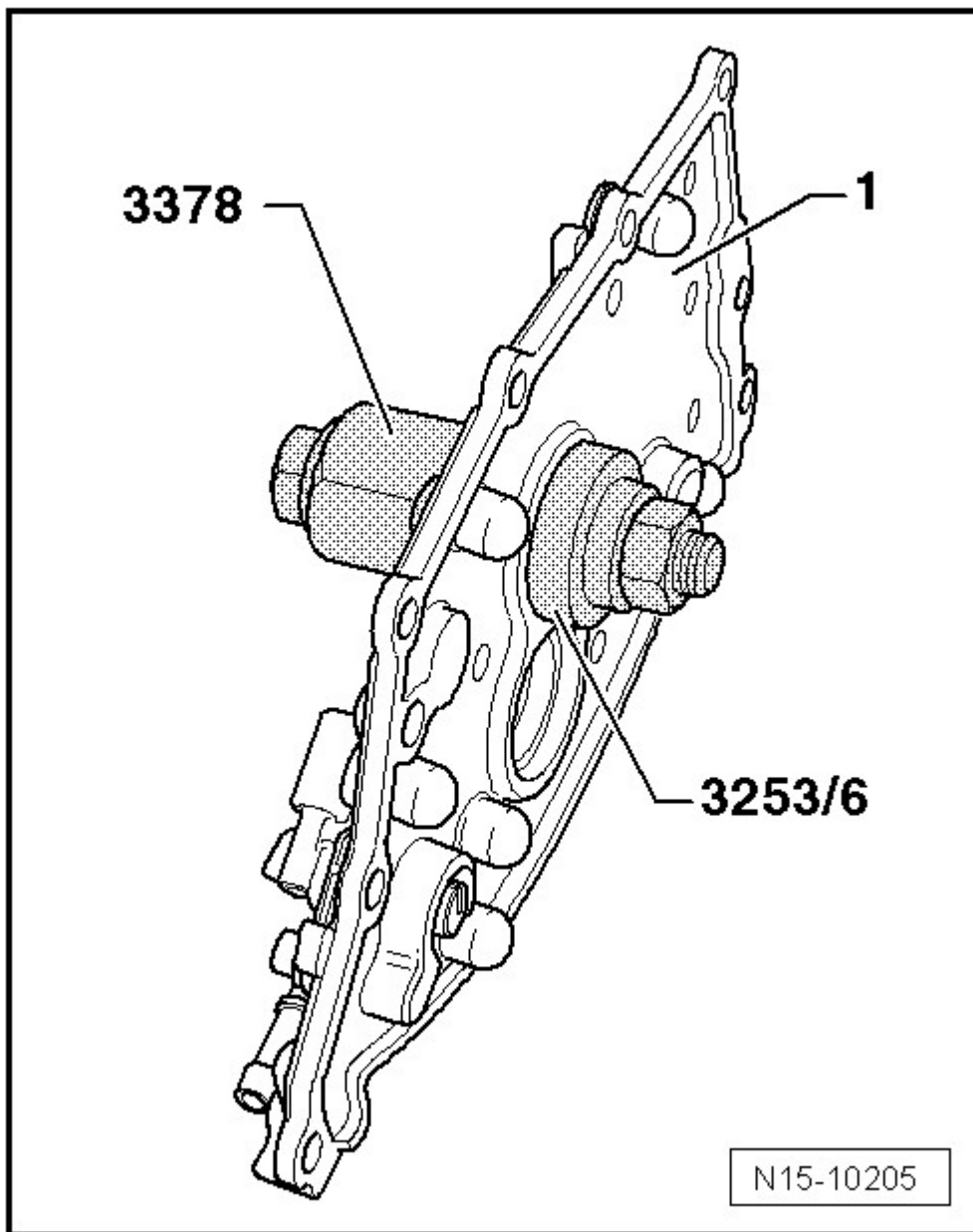


Fig. 34: Identifying Seal Installer 3378 In Cover Piece -1- And Seal Installer 3253/6 From Assembly Tool

3253

Courtesy of AUDI OF AMERICA, LLC

-- Pull sealing ring in flush with fitting sleeve 3253/6.

-- Install timing chain upper cover **UPPER TIMING CHAIN COVER**.

UPPER TIMING CHAIN COVER**Special tools and workshop equipment required**

- Hand drill with plastic brush attachment
- Protective glasses
- Sealant

Removing

-- Remove intake manifold **Removal and Installation** .

-- Remove cylinder head cover **CYLINDER HEAD COVER**.

-- If present, remove mechanical vacuum pump **MECHANICAL VACUUM PUMP**.

-- Disconnect electrical connector -arrow- on after-run coolant pump -V51-.

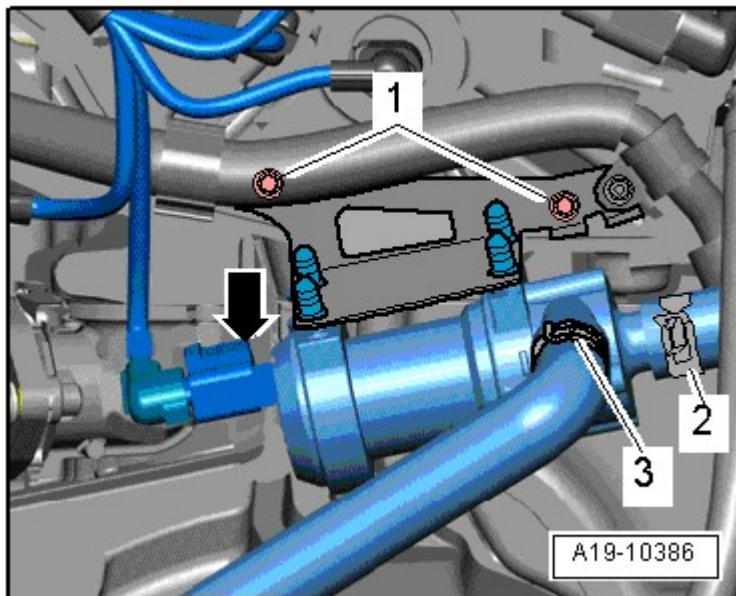


Fig. 35: Locating After Run Coolant Pump -V51-

Courtesy of AUDI OF AMERICA, LLC

-- Remove bolts -1-.

NOTE: Ignore -2 and 3-.

-- Mark and disconnect electrical connectors:

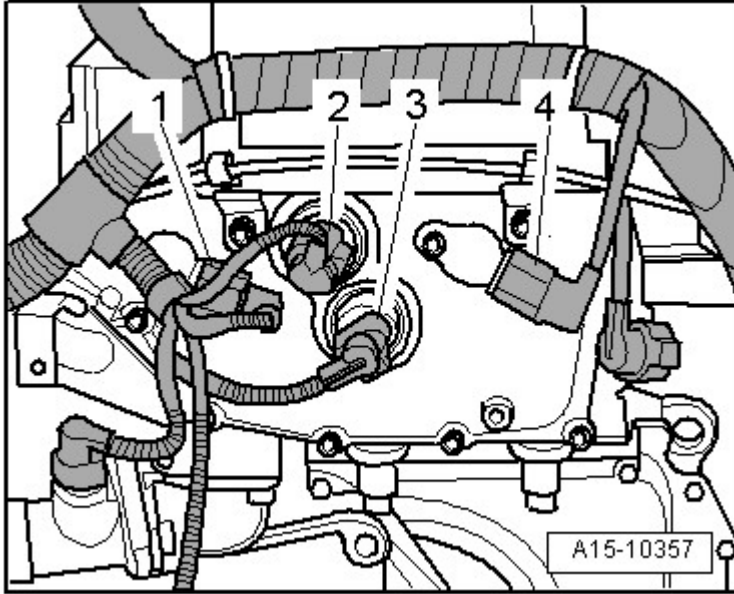


Fig. 36: Identifying Camshaft Position Sensors -1 & 4- And Camshaft Adjustment Valves -2 & 3-
Courtesy of AUDI OF AMERICA, LLC

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

-- Free up electrical wiring on timing chain upper cover.

-- Remove bolts -arrows- and remove timing chain upper cover.

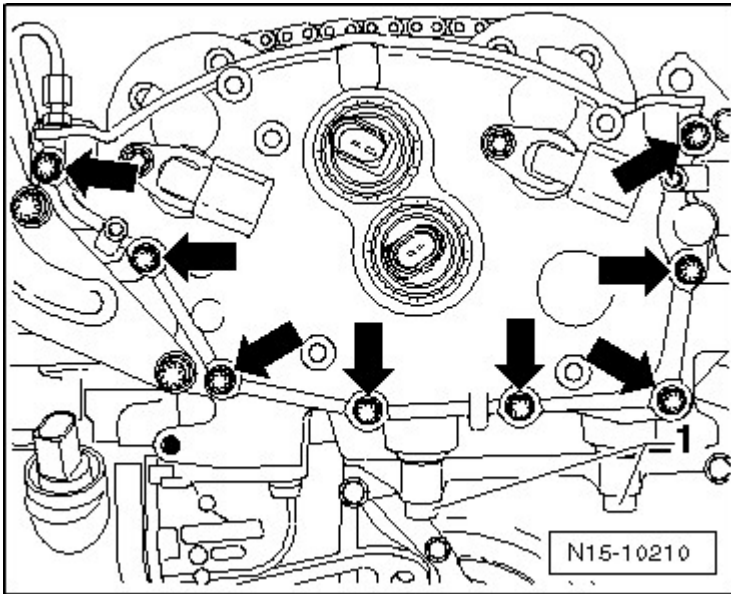


Fig. 37: Identifying Mounting Bolts For Sealing Flange And Cover Piece
 Courtesy of AUDI OF AMERICA, LLC

NOTE: Ignore -1-.

The illustration shows the version for vehicles without the mechanical vacuum pump.

Installing

- Tightening specifications **TIMING CHAIN COVERS, ASSEMBLY OVERVIEW.**

WARNING: Risk of eye injury.

- Wear safety glasses.

CAUTION: Risk of contaminating lubrication system with sealant residue.

- Place a clean cloth over open part of engine.

-- Remove remaining sealant on upper timing chain and cylinder head covers, e.g, with a rotating plastic brush.

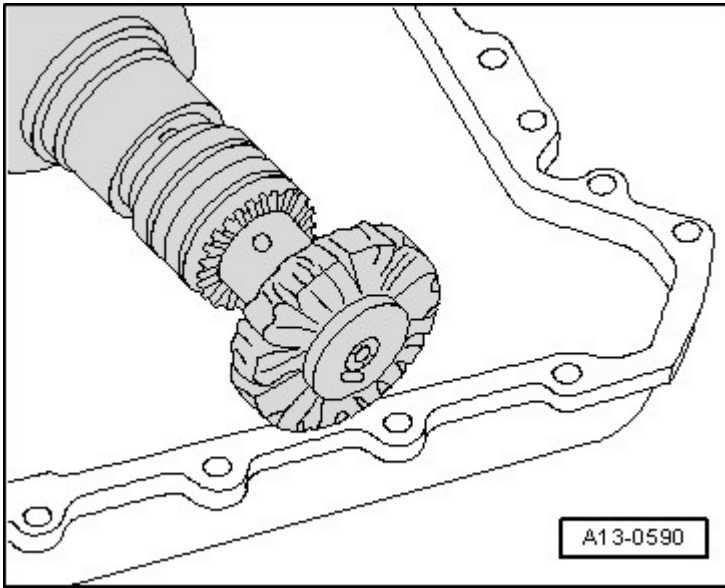


Fig. 38: Identifying Rotating Plastic Brush To Remove Sealant Residue From Sealing Flange, Cylinder Block And Upper Part Of Oil Pan
Courtesy of AUDI OF AMERICA, LLC

- Clean sealing surfaces, must be free of oil and grease.
- Cut tube nozzle at front marking (dia. approximately 2 mm).

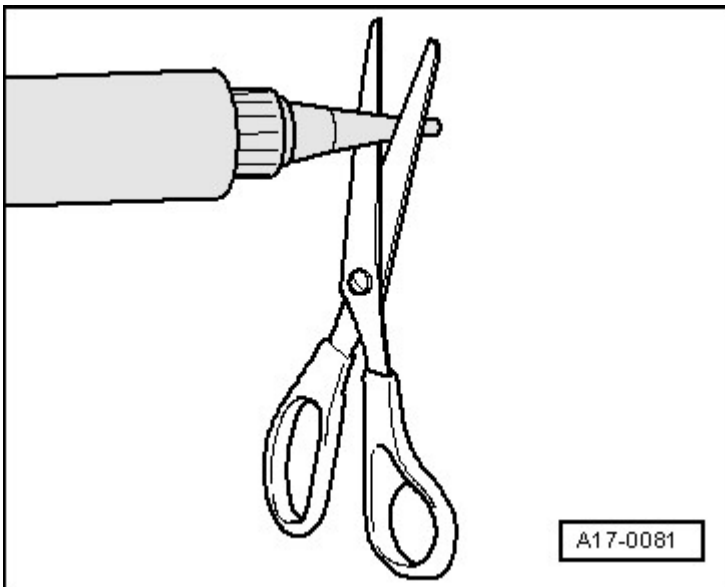


Fig. 39: Identifying Scissors To Cut Tube Nozzle At Front Marking (Nozzle Diameter Approx. 2 Mm)
Courtesy of AUDI OF AMERICA, LLC

- Check whether timing chain upper cover fitting sleeves are installed in cylinder head.

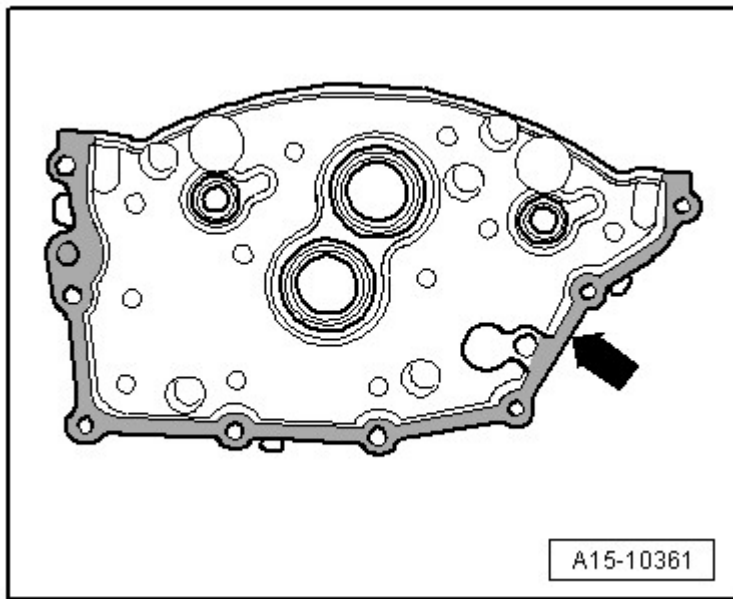


Fig. 40: Identifying Sealant Coat -Shaded- On Timing Chain Upper Cover
 Courtesy of AUDI OF AMERICA, LLC

-- Lightly coat sealing surface -shaded- on timing chain upper cover with sealant.

NOTE: Timing chain upper cover must be installed with 5 minutes of applying sealant.

-- Tighten timing chain upper cover bolts -arrows- diagonally in stages.

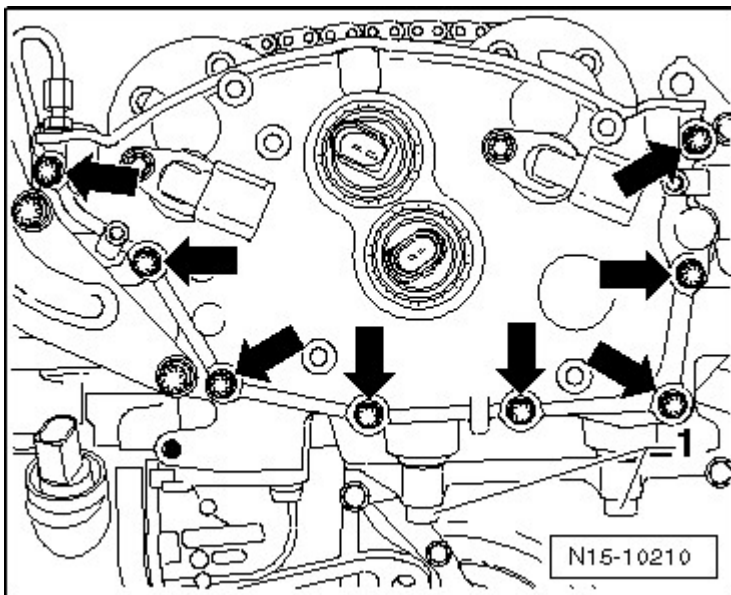


Fig. 41: Identifying Mounting Bolts For Sealing Flange And Cover Piece
 Courtesy of AUDI OF AMERICA, LLC

NOTE: Ignore -1-.

The illustration shows the version for vehicles without the mechanical vacuum pump.

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

- Install vacuum pump on vehicles with mechanical vacuum pump **MECHANICAL VACUUM PUMP**.
- Install after-run coolant pump -V51- **AFTER-RUN COOLANT PUMP** .
- Install cylinder head cover **CYLINDER HEAD COVER**
- Install intake manifold **Removal and Installation** .

MECHANICAL VACUUM PUMP

Removing

- Remove intake manifold **Removal and Installation** .
- Remove cylinder head cover **CYLINDER HEAD COVER**.
- Free up electrical wiring harness.
- Disconnect vacuum line -A-.

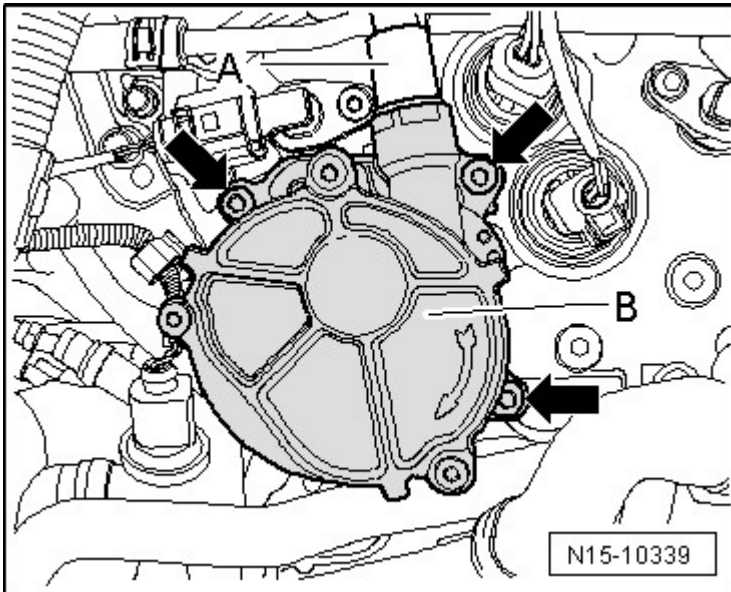


Fig. 42: Identifying Vacuum Line And Bolts
Courtesy of AUDI OF AMERICA, LLC

- Remove bolts -arrows-.

-- Carefully remove vacuum pump from cylinder head.

NOTE: If the sealing ring is still on the input shaft, it must be removed and placed on the vacuum pump.

A new vacuum pump is delivered with a sealing ring; 2 rings cannot be installed.

Installing

- Tightening specifications MECHANICAL VACUUM PUMP, ASSEMBLY OVERVIEW.

CHECK LOCATION OF SEALING RING -A-

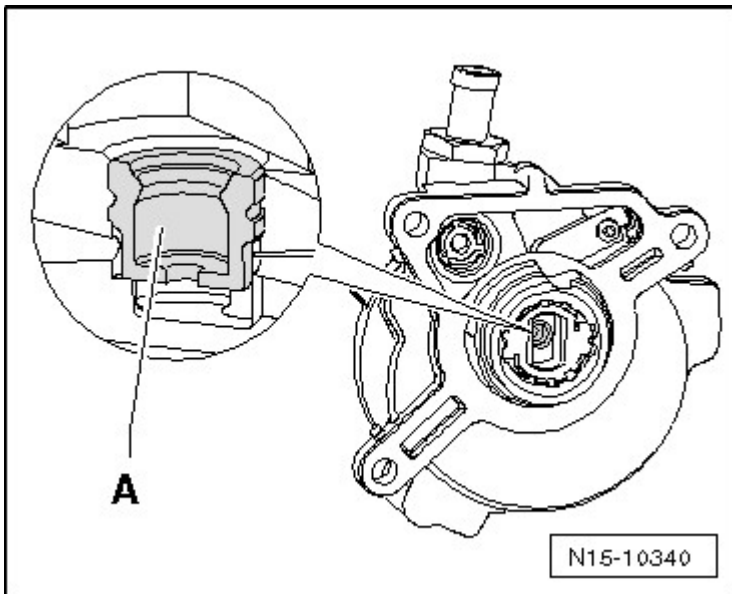


Fig. 43: Sealing Ring Installation Location

Courtesy of AUDI OF AMERICA, LLC

- The large opening must face outward after inserted in vacuum pump.
- The sealing ring must sit flush with chamfer in the rotor.

-- Turn rotor in the vacuum pump so that the flattened side of the input shaft slides into the rotor.

-- Slide vacuum pump evenly as far as stop into the upper timing chain cover hole.

NOTE: If the vacuum pump is removed from the input shaft again, check the sealing ring location again.

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

-- Install cylinder head cover CYLINDER HEAD COVER.

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

LOWER TIMING CHAIN COVER

Special tools and workshop equipment required

- Hand drill with plastic brush attachment
- Protective glasses
- Sealant

REMOVING

-- Removing engine **ENGINE, REMOVING** .

-- To separate engine and transmission **ENGINE AND TRANSMISSION, SEPARATING** .

-- Fasten engine on engine and transmission holder **ENGINE AND TRANSMISSION, SECURING TO HOLDER** .

-- Remove drive plate **DRIVE PLATE** .

-- Remove oil pan **OIL PAN** .

-- Remove timing chain lower cover bolts -1 and 2-.

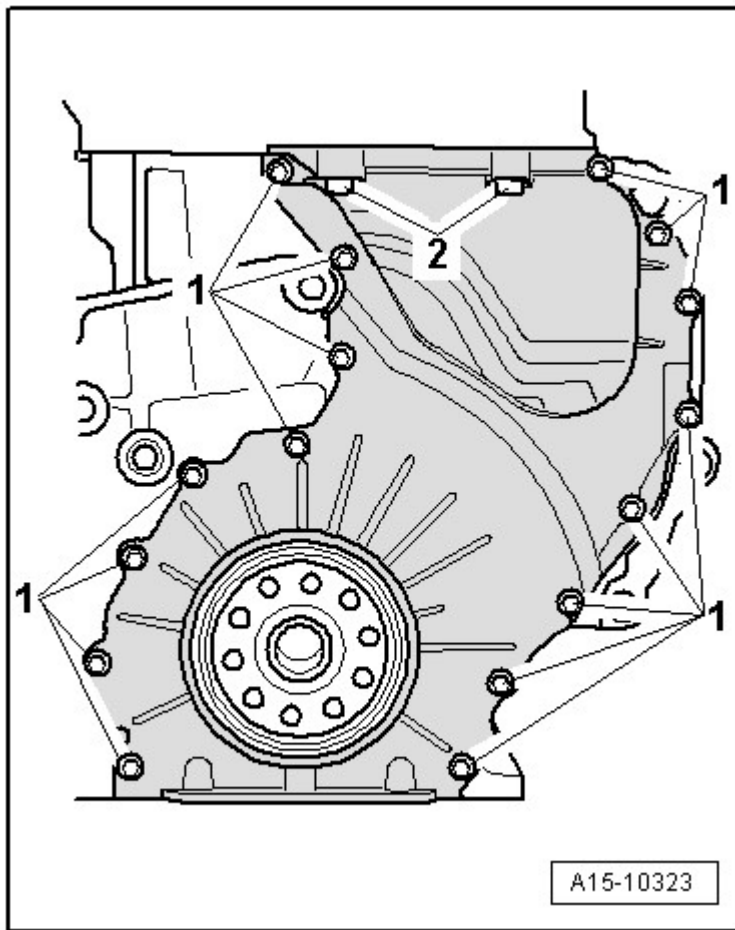


Fig. 44: Identifying Sealing Flange Bolts

Courtesy of AUDI OF AMERICA, LLC

CAUTION: Risk of damaging cylinder head seal.

- Remove timing chain lower cover horizontally from cylinder block.

-- Press crankshaft shaft seal out of lower timing chain cover.

INSTALLING

- Tightening specifications **Fig. 2**

WARNING: Risk of eye injury.

- Wear safety glasses.

CAUTION: Risk of contaminating lubrication system with sealant residue.

- Place a clean cloth over open part of engine.

-- Remove remaining sealant on lower timing chain and cylinder head covers and cylinder block, e.g. with a rotating plastic brush.

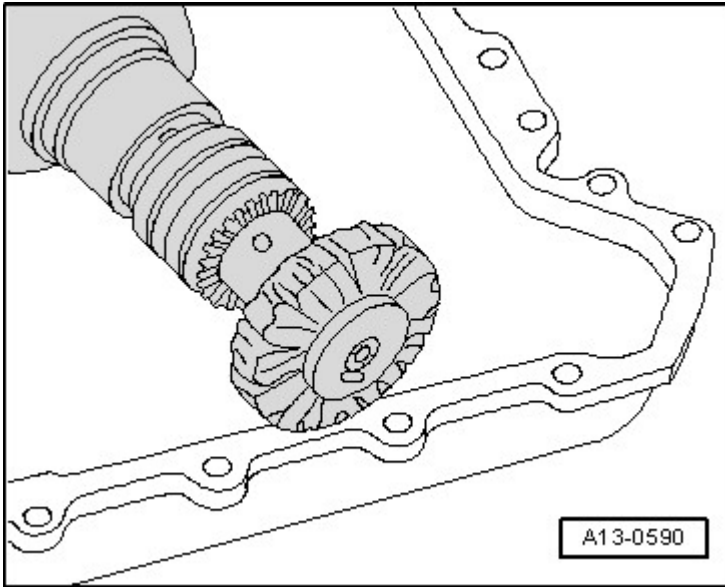


Fig. 45: Identifying Rotating Plastic Brush To Remove Sealant Residue From Sealing Flange, Cylinder Block And Upper Part Of Oil Pan

Courtesy of AUDI OF AMERICA, LLC

- Clean sealing surfaces, must be free of oil and grease.
- Clean holes -arrow- in cylinder head seal of old sealant.

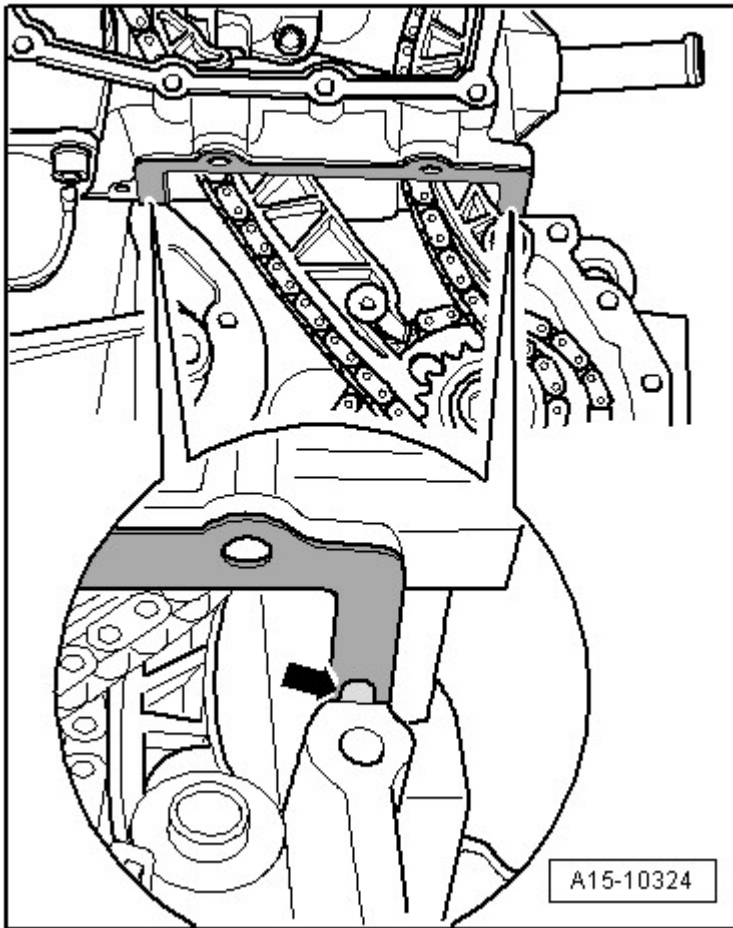


Fig. 46: Cleaning Holes -Arrow- In Cylinder Head Gasket Of Old Sealant
 Courtesy of AUDI OF AMERICA, LLC

NOTE: With cylinder head installed, holes in cylinder head seal are only half visible.

CAUTION: The cylinder head seal could be damaged.

- Do not kink cylinder head seal when bending.

NOTE: A kinked cylinder head seal must be replaced.

-- Bend end of cylinder head seal down slightly -arrows- until upper sealing surface on cylinder head seal and cylinder head can be cleaned.

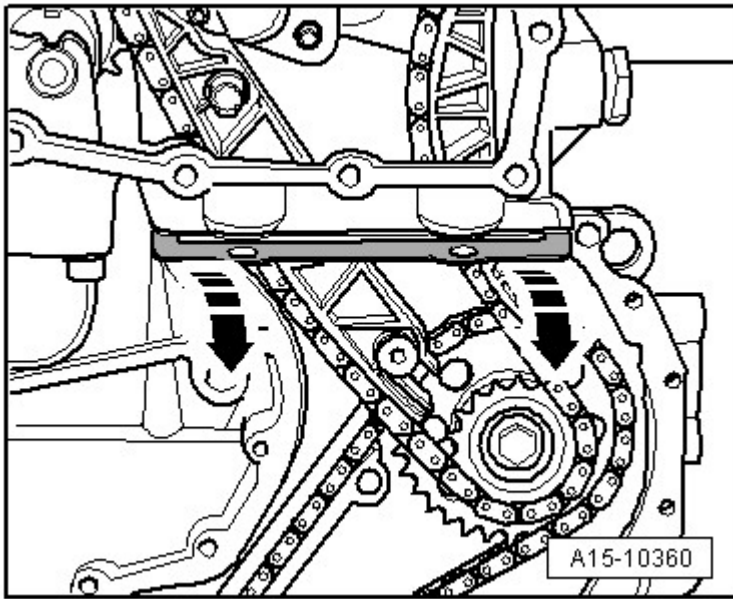


Fig. 47: Bending End Of Cylinder Head Gasket Down Slightly
Courtesy of AUDI OF AMERICA, LLC

- Clean top and bottom of cylinder head seal, it must be free of oil and grease.
- Cut tube nozzle at front marking (dia. approximately 2 mm).

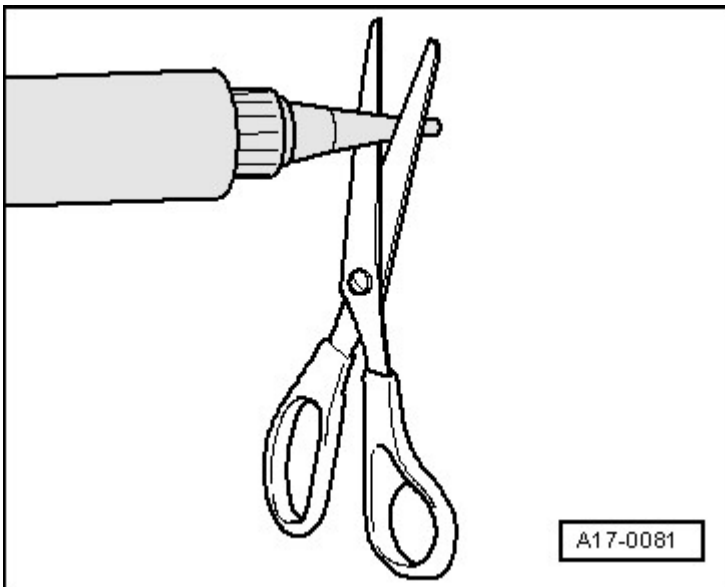


Fig. 48: Identifying Scissors To Cut Tube Nozzle At Front Marking (Nozzle Diameter Approx. 2 Mm)
Courtesy of AUDI OF AMERICA, LLC

CAUTION: The cylinder head seal could be damaged.

- Do not kink cylinder head seal when bending.

NOTE: A kinked cylinder head seal must be replaced.

-- Lightly coat top and bottom cylinder head seal sealing surfaces with lubricant by bending seal down slightly again -arrows-.

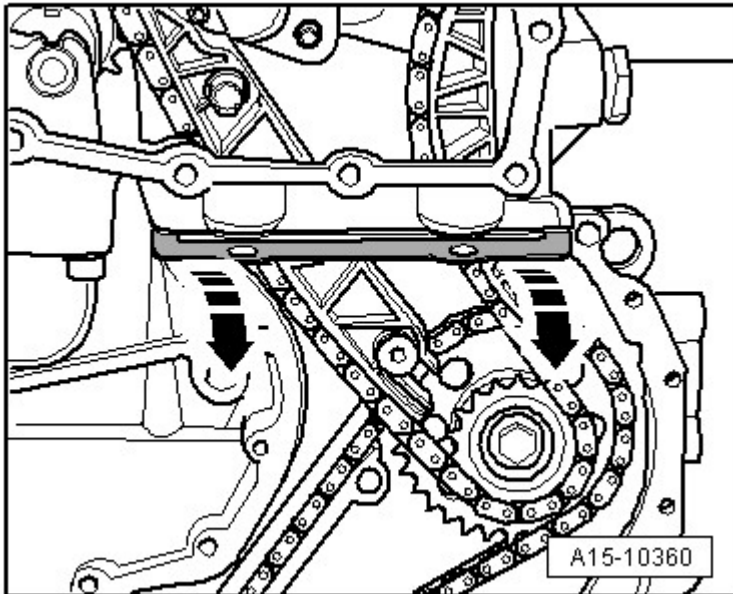


Fig. 49: Bending End Of Cylinder Head Gasket Down Slightly
Courtesy of AUDI OF AMERICA, LLC

-- To coat surface between cylinder head and seal, use a flat object, e.g. a feeler gauge.

-- Place a thin sealant bead -arrows- from below in both corners between cylinder head seal and cylinder block so that cylinder head seal holes are filled.

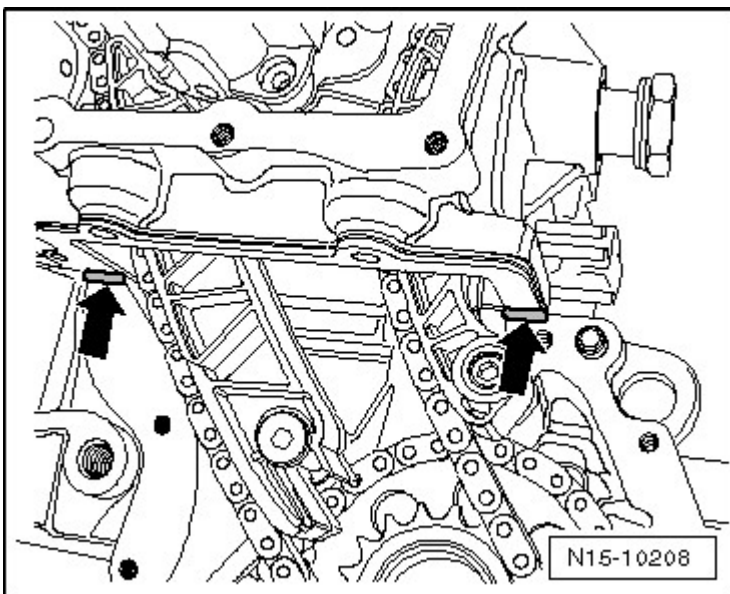


Fig. 50: Identifying Sealant Locations For Corners Of Cylinder Block/Cylinder Head
Courtesy of AUDI OF AMERICA, LLC

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

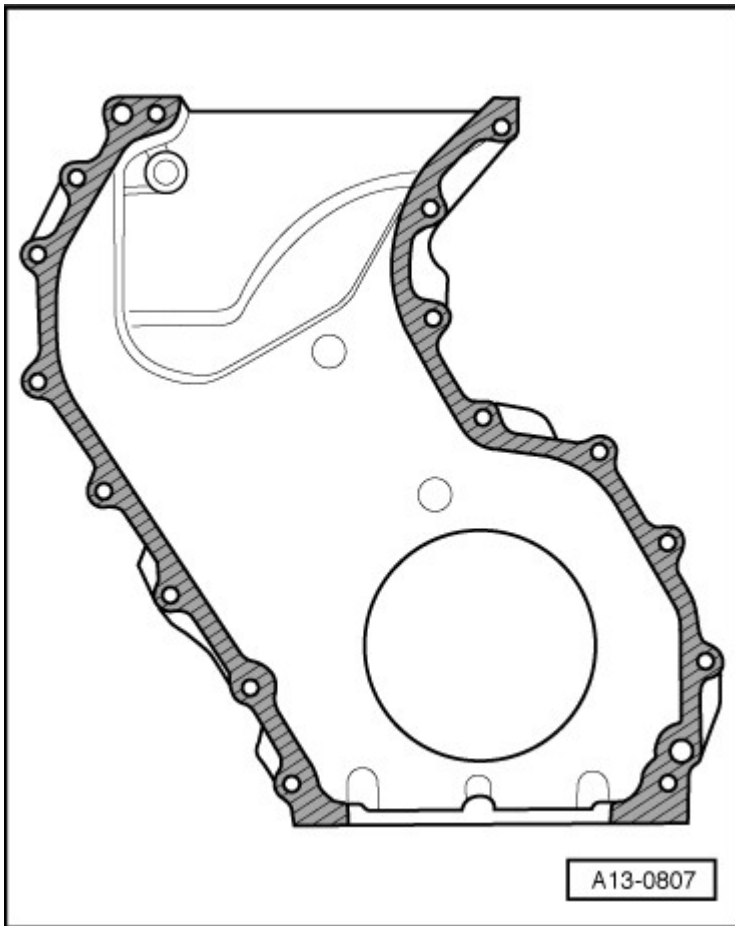


Fig. 51: Identifying Sealing Surfaces
Courtesy of AUDI OF AMERICA, LLC

-- Lightly coat clean sealing surfaces -shaded- on timing chain lower cover with sealant.

NOTE: Timing chain lower cover must be installed with 5 minutes of applying sealant.

-- Tighten timing chain lower cover bolts -1- and -2- Fig. 2

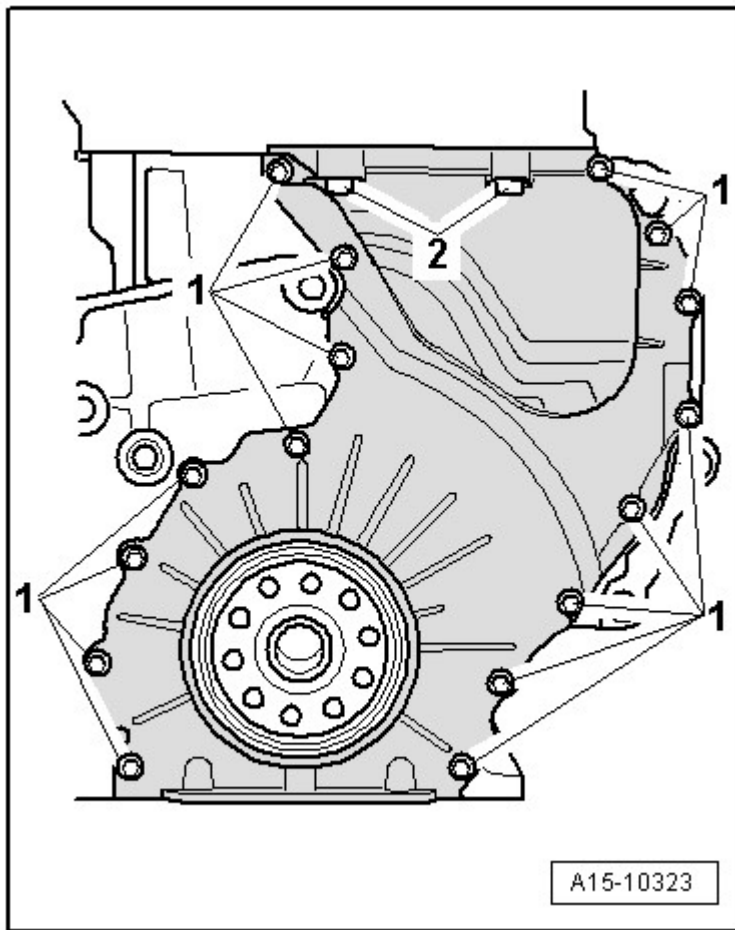


Fig. 52: Identifying Sealing Flange Bolts
 Courtesy of AUDI OF AMERICA, LLC

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

- Install transmission-side crankshaft shaft seal **CRANKSHAFT SHAFT SEAL** .
- Install oil pan **OIL PAN** .
- Install drive plate **DRIVE PLATE** .
- Install engine **ENGINE, INSTALLING** .

CAMSHAFT TIMING CHAIN, REMOVING FROM CAMSHAFTS

Special tools and workshop equipment required

- Camshaft bar T10068 A
- Adjustment tool T10332 for vehicles without mechanical vacuum pump
- Adjustment tool T10363 for vehicles with mechanical vacuum pump

- Sealant

REMOVING

- Engine installed.

- Remove intake manifold **Removal and Installation** .
- Remove cylinder head cover **CYLINDER HEAD COVER**.
- Remove timing chain upper cover **UPPER TIMING CHAIN COVER**.
- Adjust crankshaft at vibration damper bolt in direction of engine rotation to "TDC" marking.

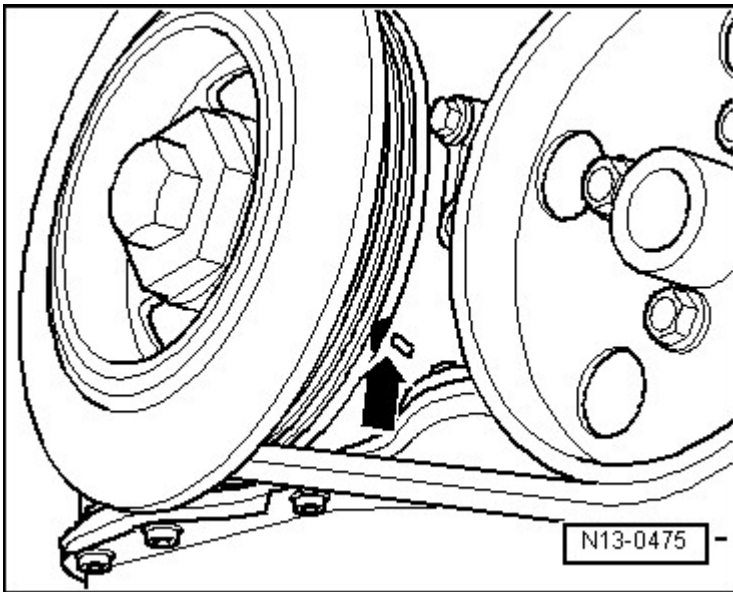


Fig. 53: Identifying Crankshaft At Vibration Damper Securing Bolt In Engine At TDC Cyl. 1
Courtesy of AUDI OF AMERICA, LLC

- Markings on vibration damper and sealing flange must align -arrow-.
- Camshaft bar T10068 A must engage in grooves on both camshafts at the same time.

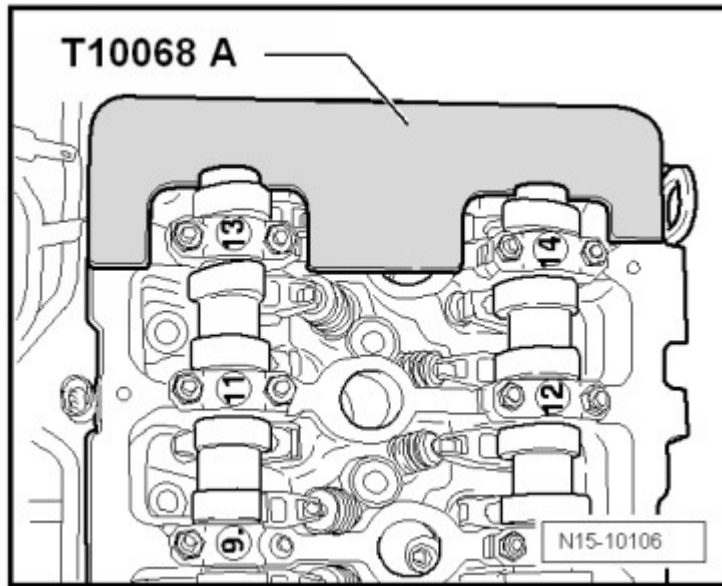


Fig. 54: Identifying Camshaft Bar T10068 A Engage In Shaft Grooves
 Courtesy of AUDI OF AMERICA, LLC

NOTE: Due to the camshaft adjuster function, the camshaft grooves may not be perfectly horizontal. Therefore, turn the camshaft back and forth slightly with an open end wrench -arrows- if necessary to insert camshaft bar T10068 A.

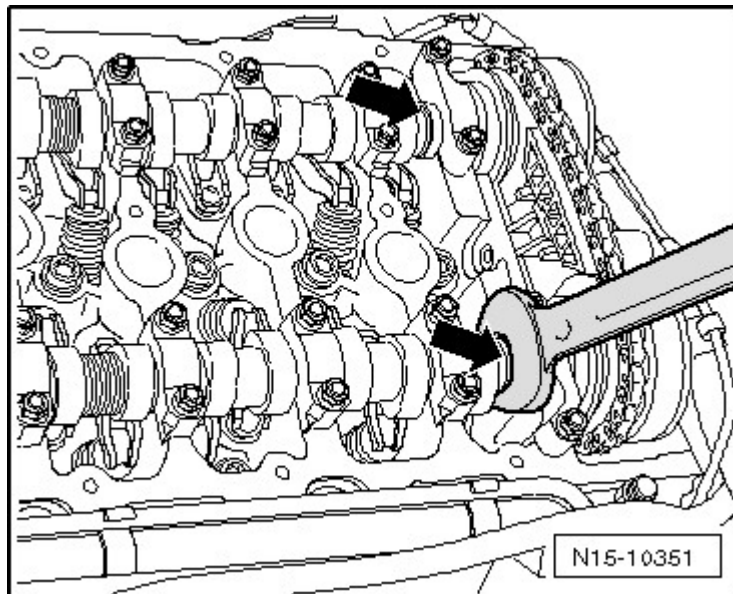


Fig. 55: Counter-Holding Camshaft Using Wrench
 Courtesy of AUDI OF AMERICA, LLC

If the camshaft bar T10068 A does not engage, rotate crankshaft 1 rotation further in direction of engine rotation.

-- Remove camshaft timing chain tensioner -arrow-.

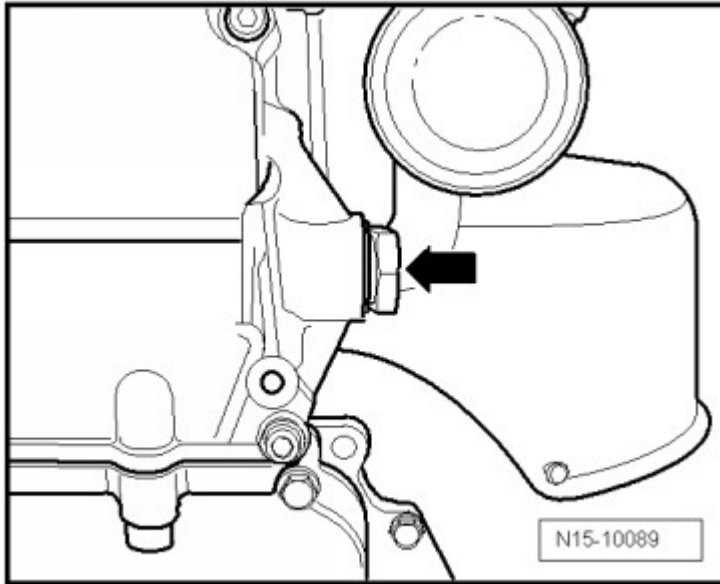


Fig. 56: Identifying Chain Tensioner For Camshaft Roller Chain
Courtesy of AUDI OF AMERICA, LLC

-- Remove guide rail bolt -arrow-.

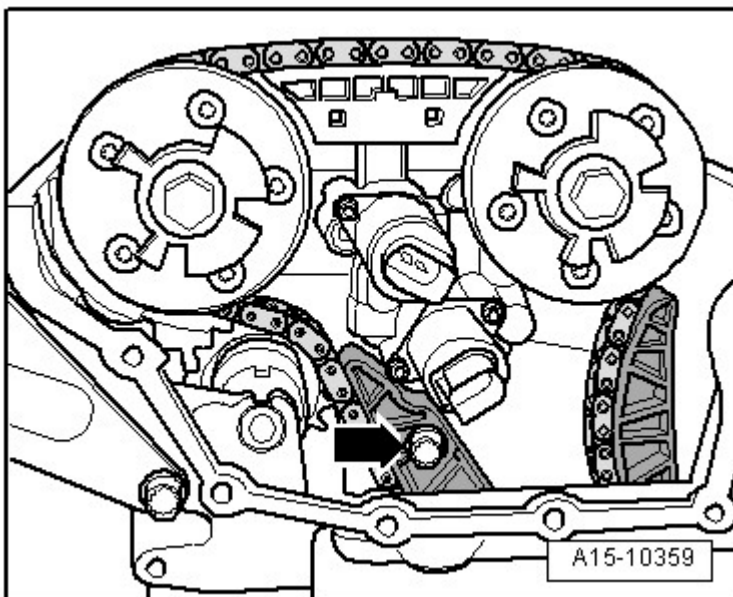


Fig. 57: Identifying Guide Rail Bolt -Arrow-
Courtesy of AUDI OF AMERICA, LLC

-- Remove camshaft bar T10068 A.

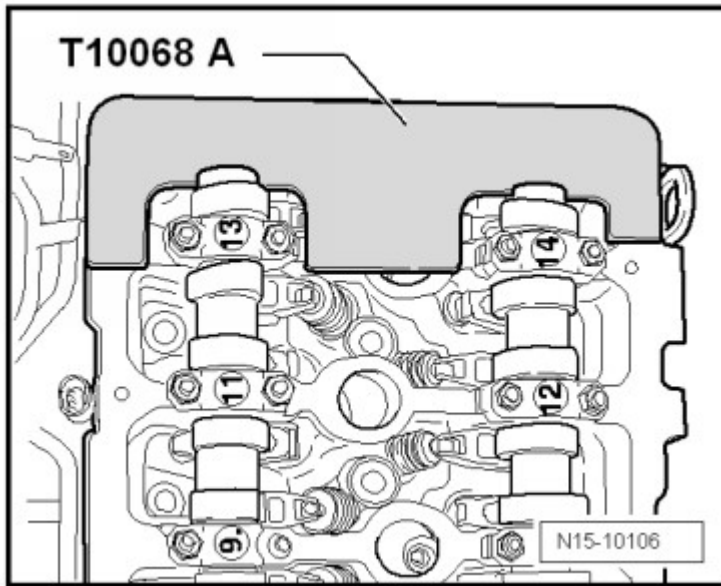


Fig. 58: Identifying Camshaft Bar T10068 A Engage In Shaft Grooves
 Courtesy of AUDI OF AMERICA, LLC

- camshaft bar T10068 A must not be inserted when loosening or tightening camshaft adjuster bolts.

-- Remove exhaust-side camshaft adjuster bolt while counter holding on camshaft wrench surface with open end wrench.

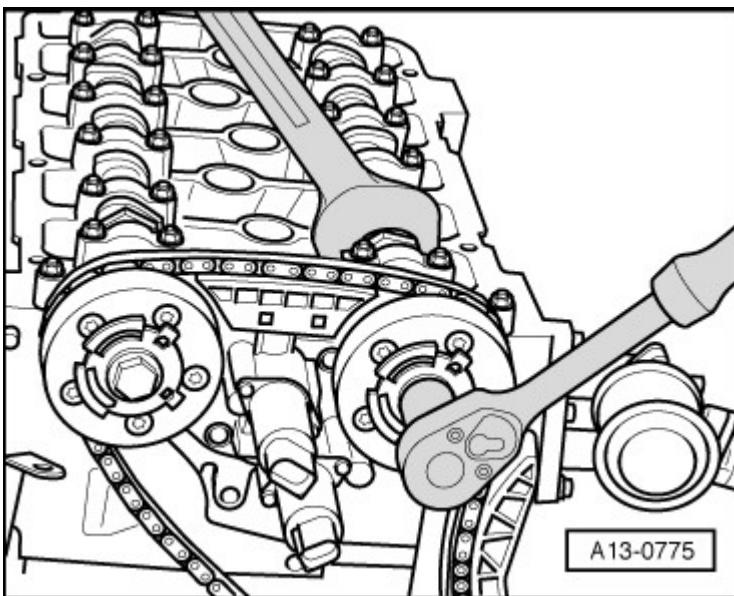


Fig. 59: Identifying Tools To Loosen Exhaust Camshaft Adjuster Bolt
 Courtesy of AUDI OF AMERICA, LLC

-- Remove exhaust-side camshaft adjuster.

-- Remove intake-side camshaft adjuster bolt while counter holding on camshaft wrench surface with open end

wrench.

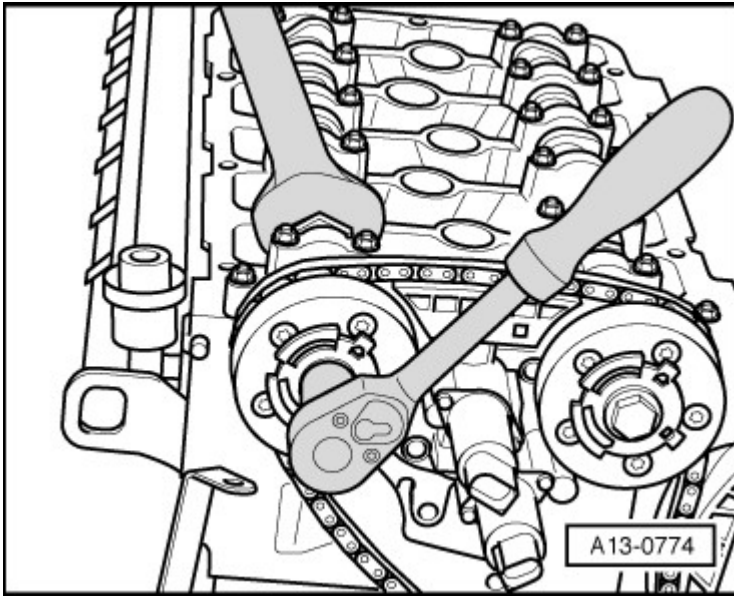


Fig. 60: Identifying Tools To Loosen Intake Camshaft Adjuster Bolt
Courtesy of AUDI OF AMERICA, LLC

- Remove intake-side camshaft adjuster.
- Place camshaft timing chain over upper guide rail.

INSTALLING (ADJUSTING VALVE TIMING)

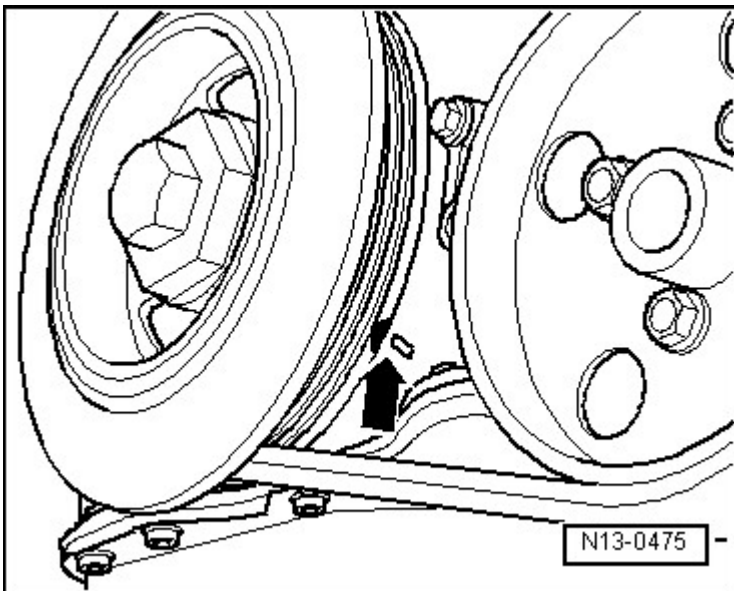


Fig. 61: Identifying Crankshaft At Vibration Damper Securing Bolt In Engine At TDC Cyl. 1
Courtesy of AUDI OF AMERICA, LLC

- Tightening specifications CAMSHAFT TIMING CHAINS, ASSEMBLY OVERVIEW.

NOTE: Replace bolts which have been tightened to specifications.

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

- Markings on vibration damper and sealing flange must align -arrow-.

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

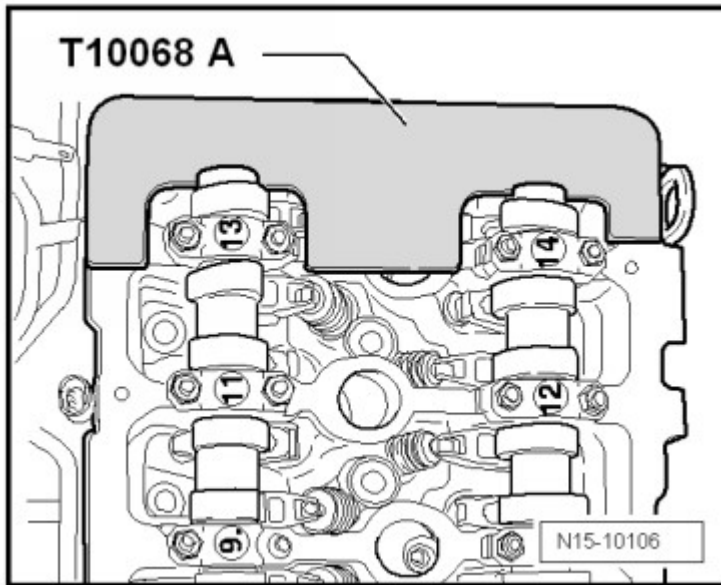


Fig. 62: Identifying Camshaft Bar T10068 A Engage In Shaft Grooves
Courtesy of AUDI OF AMERICA, LLC

- Camshaft bar T10068 A must be situated in grooves in both camshafts.

NOTE: Due to the camshaft adjuster function, the camshaft grooves may not be perfectly horizontal. Therefore, turn the camshaft back and forth slightly with an open end wrench -arrows- if necessary to insert camshaft bar T10068 A.

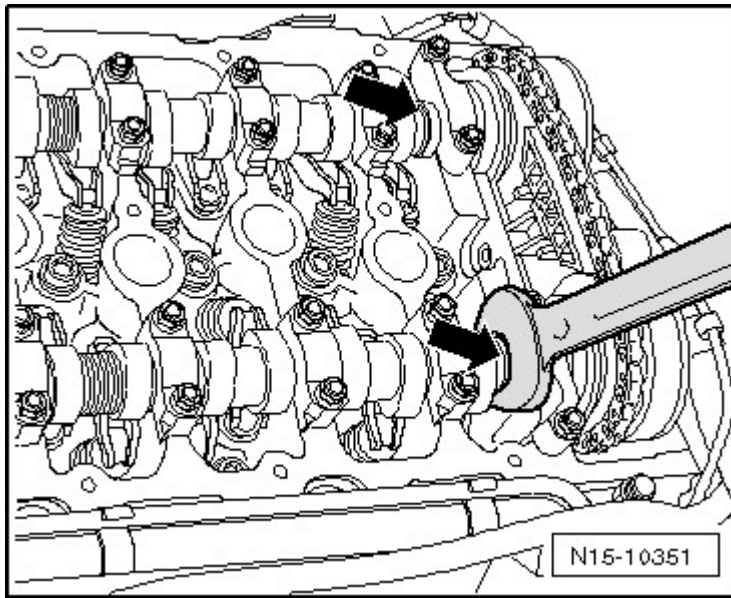


Fig. 63: Counter-Holding Camshaft Using Wrench
Courtesy of AUDI OF AMERICA, LLC

-- Check if fitting sleeve -1- for securing adjustment tool T10332 is inserted.

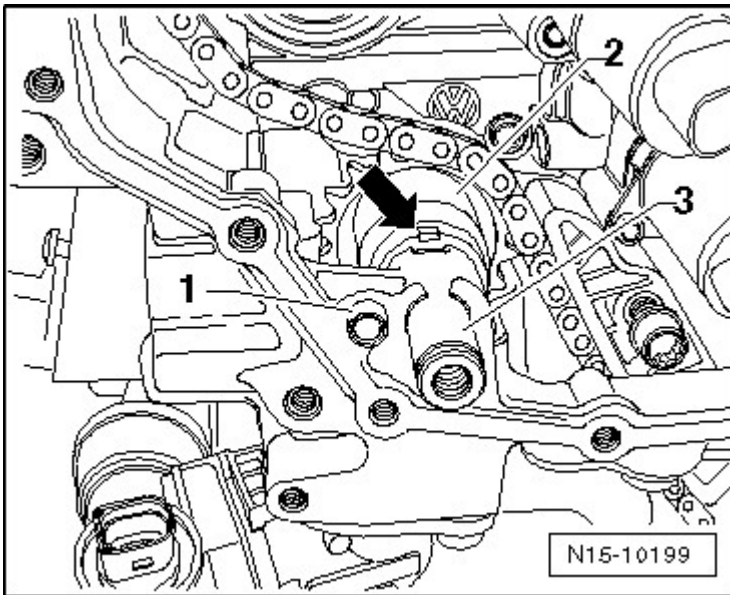


Fig. 64: Identifying Alignment Bushing Is Inserted
Courtesy of AUDI OF AMERICA, LLC

NOTE: Ignore items -2, 3 and arrows-.

Without Mechanical Vacuum Pump

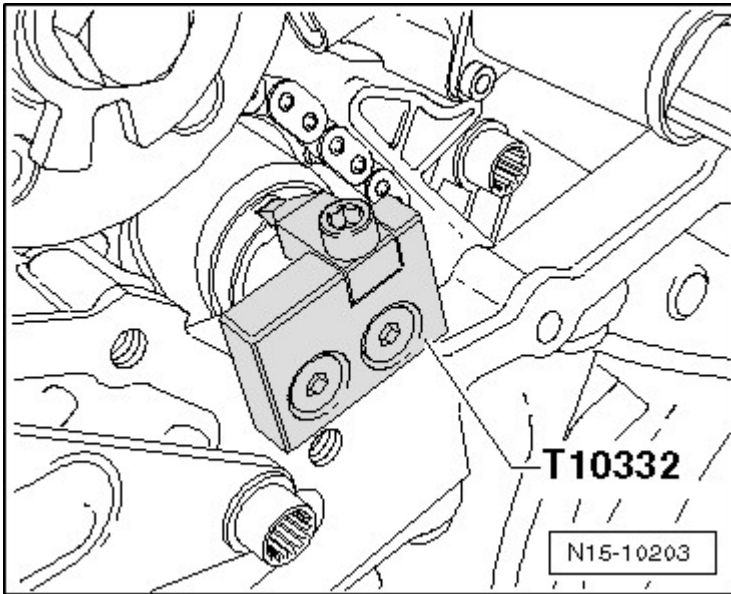


Fig. 65: Securing Position Of Drive Pinion For High Pressure Pump Using Adjustment Tool T10332
Courtesy of AUDI OF AMERICA, LLC

- Secure high pressure drive chain position with adjustment tool T10332.
- Lay camshaft timing chain tightly over drive chain sprocket.

With Mechanical Vacuum Pump

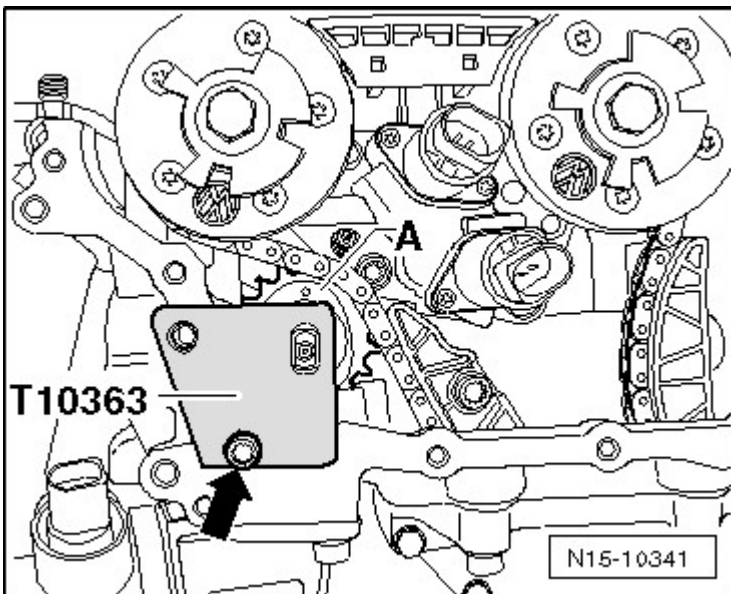


Fig. 66: Securing Position Of Drive Pinion For High Pressure Pump Using Adjustment Tool T10363
Courtesy of AUDI OF AMERICA, LLC

- Secure high pressure pump drive chain sprocket with adjustment tool T10363.

-- Lay camshaft timing chain tightly over drive chain sprocket.

Continuation for All

NOTE: Because of alignment pins -arrows-, both camshaft adjusters can only be installed in one position on front side of camshaft.

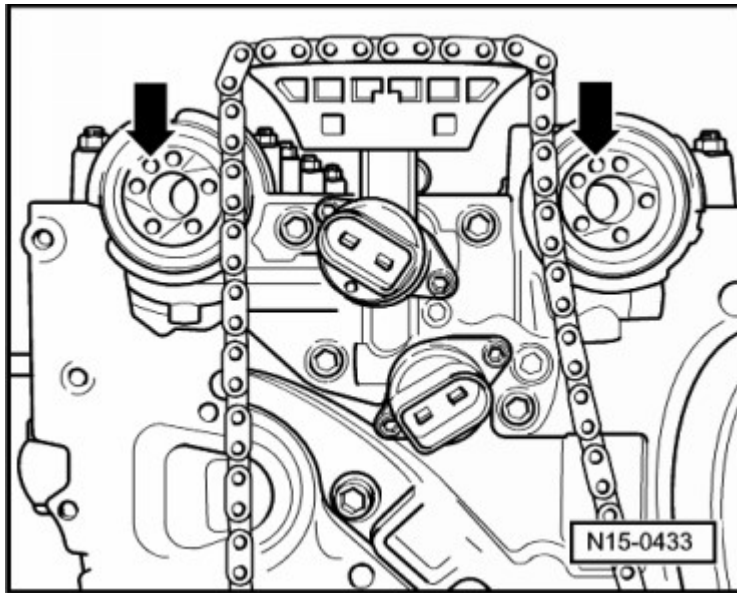


Fig. 67: Identifying Camshaft Timing Adjusters Positioned On The Camshaft Mountings

Courtesy of AUDI OF AMERICA, LLC

-- First install intake-side camshaft adjuster by rotating sensor wheel -1- in adjuster clockwise as far as stop - ARROW- and holding in this position.

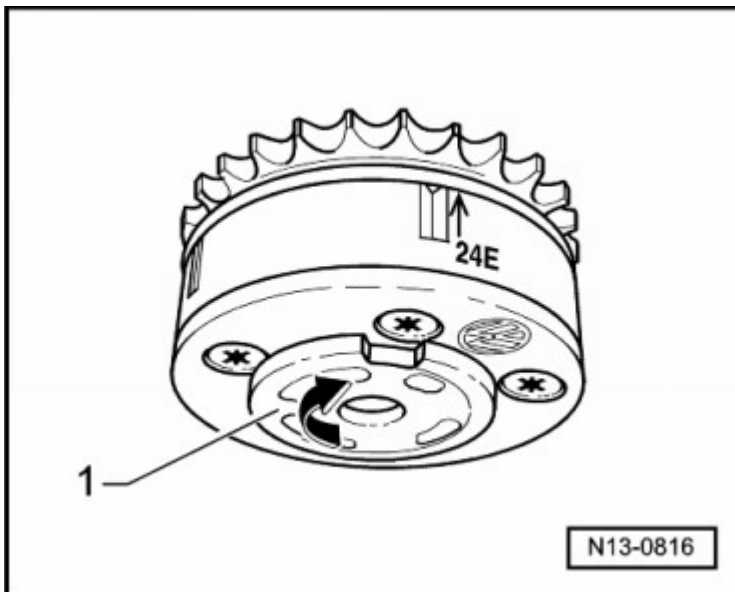


Fig. 68: Identifying Sensor Wheel Turned To The Right At Intake Camshaft Adjuster
 Courtesy of AUDI OF AMERICA, LLC

NOTE: On the front side of the camshaft adjuster, mark the location where the rear side of the alignment pin is located to aid in assembly.

-- Place camshaft adjuster "24E" with camshaft timing chain placed on top on intake camshaft.

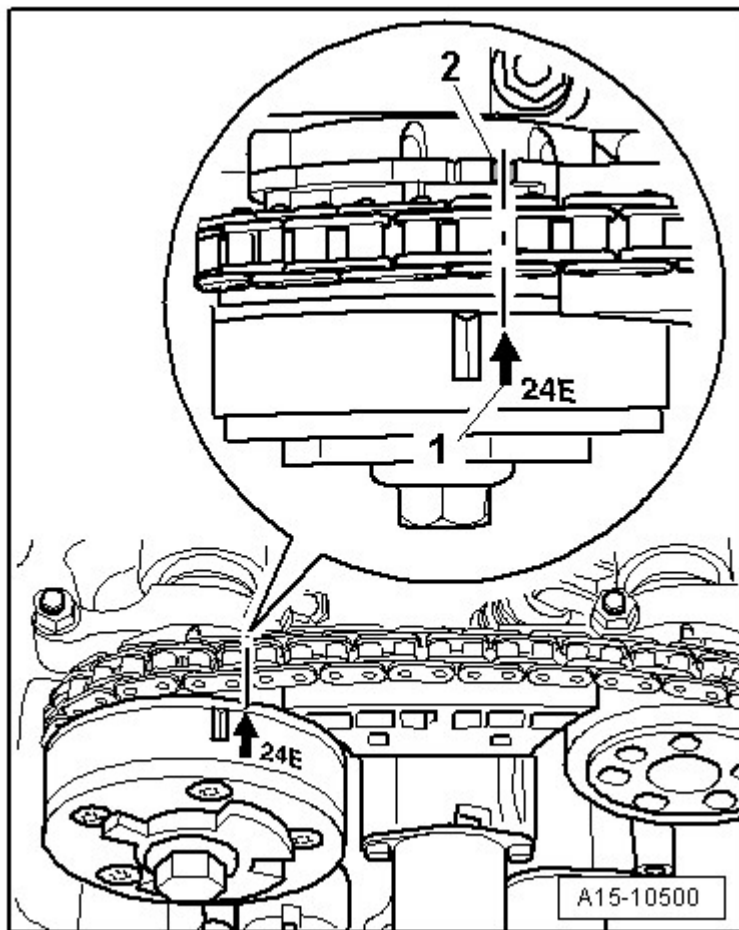


Fig. 69: Verifying Installation Marks Of Intake Camshaft Adjuster With Marks On Control Housing
 Courtesy of AUDI OF AMERICA, LLC

- It must be able to easily place camshaft adjuster with timing chain placed tightly on top on intake camshaft - note alignment pin.
- Camshaft timing chain must not hang through to high pressure pump drive chain sprocket.
- The "arrow" -1- on intake camshaft adjuster must align with notch -2- on far right of control housing.

NOTE: A small offset between notch -2- and arrow -1- is permitted.

Ignore notch on camshaft adjuster.

-- Install camshaft adjuster bolt in intake camshaft in this position and hand tighten.

- Contact surface of sensor wheel at screw head must be dry when installing.

NOTE: Do not use camshaft bar T10068 A as a counter hold.

-- From marking "24E" on intake side of camshaft adjuster, count exactly 16 rollers on timing chain toward exhaust-side direction.

-- Insert tooth at marking "32A" on exhaust side camshaft adjuster exactly behind 16th roller in chain.

- 16 chain rollers must now lie between the teeth.

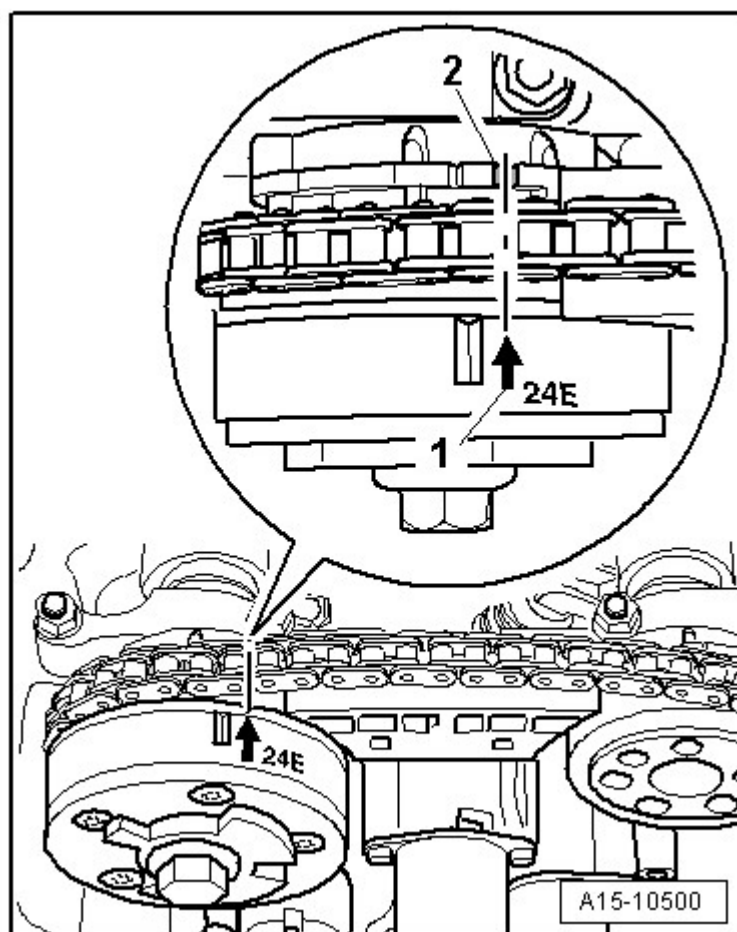


Fig. 70: Verifying Installation Marks Of Intake Camshaft Adjuster With Marks On Control Housing

Courtesy of AUDI OF AMERICA, LLC

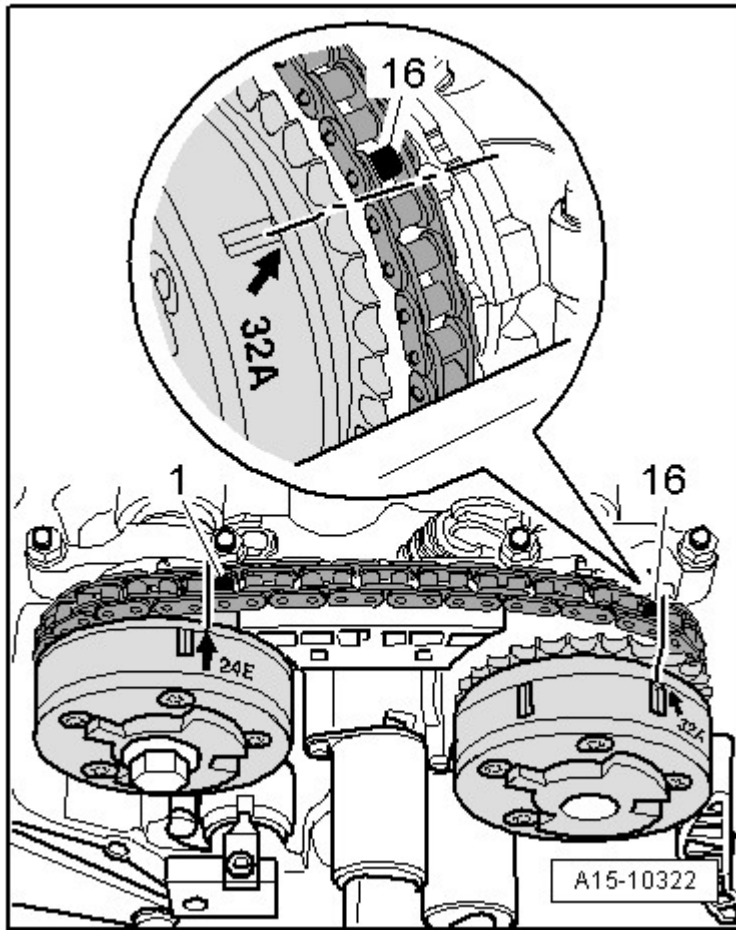


Fig. 71: Identifying Alignment Marks

Courtesy of AUDI OF AMERICA, LLC

NOTE: Because the exhaust side camshaft adjuster is locked in "rest state", the sensor wheel cannot rotate when adjusting the timing.

If locking mechanism in "rest state" is not engaged, exhaust side camshaft adjuster must be replaced.

When positioning exhaust side camshaft adjuster, ensure timing chain is lying on tensioning rail.

-- Place camshaft adjuster "32A" with camshaft timing chain installed on exhaust camshaft.

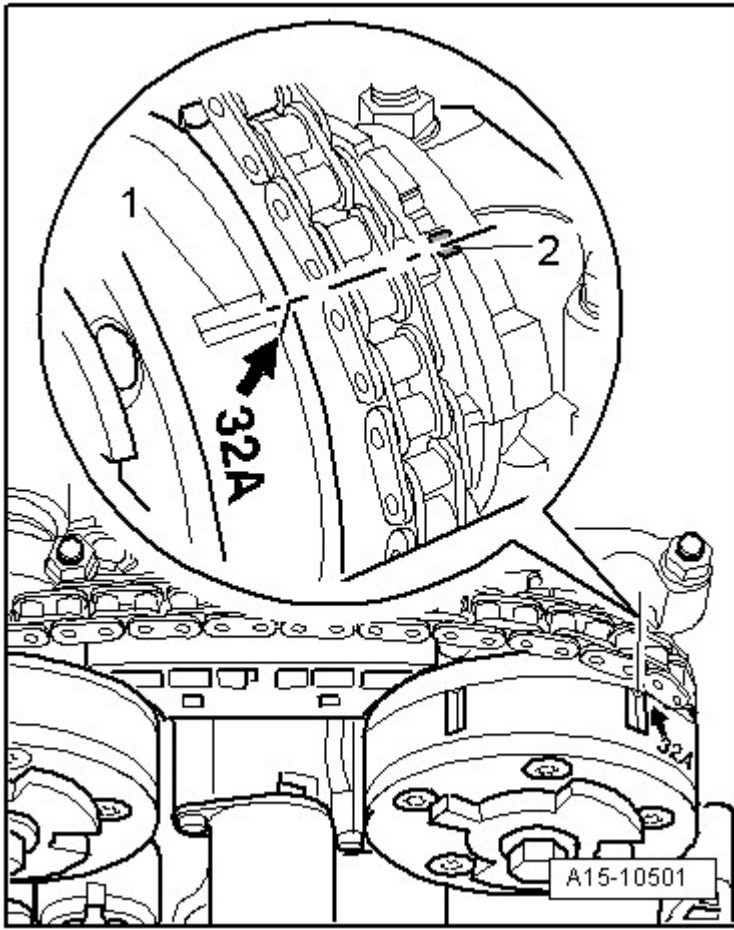


Fig. 72: Verifying Installation Marks Of Exhaust Camshaft Adjuster With Marks On Control Housing
 Courtesy of AUDI OF AMERICA, LLC

- It must be able to easily place camshaft adjuster with timing chain placed tightly on top on exhaust camshaft - note alignment pin.
- Marking -1- on camshaft adjuster which "arrow" points to must align with notch -2- at far right on control housing.

NOTE: A small offset between the marking -1- and notch -2- is permitted.

-- Install camshaft adjuster bolt in exhaust camshaft in this position and hand tighten.

- Contact surface of sensor wheel at bolt head must be dry when installing.

NOTE: Do not use camshaft bar T10068 A as a counter hold.

Without Mechanical Vacuum Pump

-- Remove adjustment tool T10332.

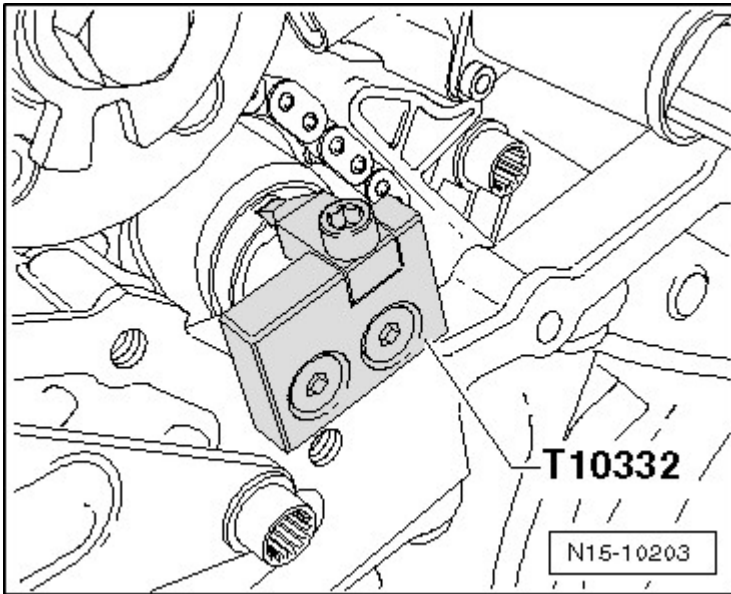


Fig. 73: Securing Position Of Drive Pinion For High Pressure Pump Using Adjustment Tool T10332
Courtesy of AUDI OF AMERICA, LLC

With Mechanical Vacuum Pump

-- Remove adjustment tool T10363.

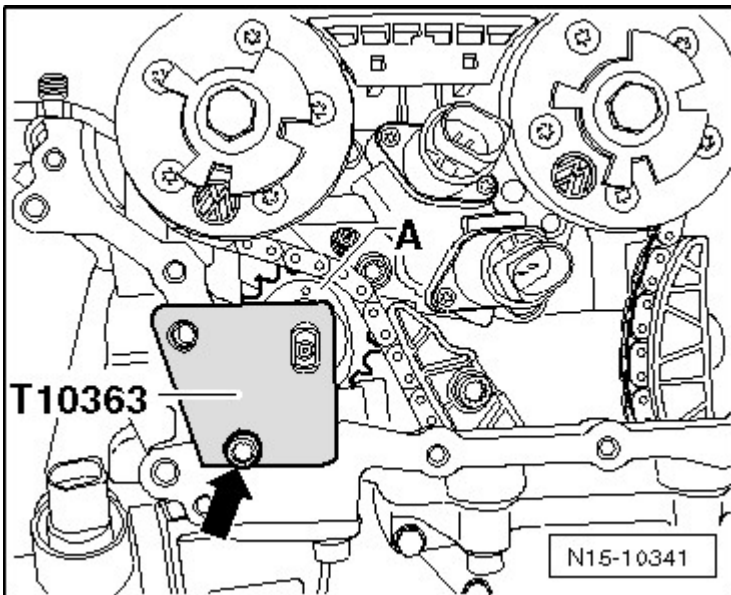


Fig. 74: Securing Position Of Drive Pinion For High Pressure Pump Using Adjustment Tool T10363
Courtesy of AUDI OF AMERICA, LLC

Continuation for All

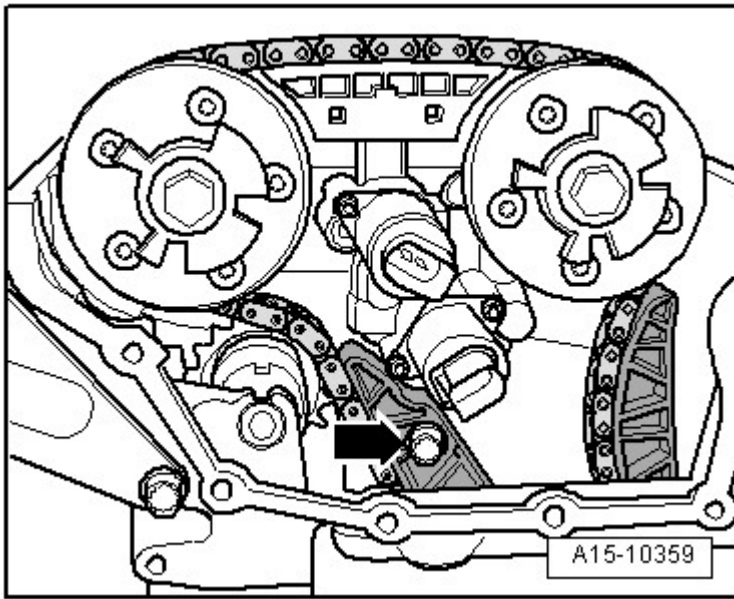


Fig. 75: Identifying Guide Rail Bolt -Arrow-
Courtesy of AUDI OF AMERICA, LLC

- Install guide rail bolt -arrow-.
- Install camshaft timing chain tensioner -arrow-.

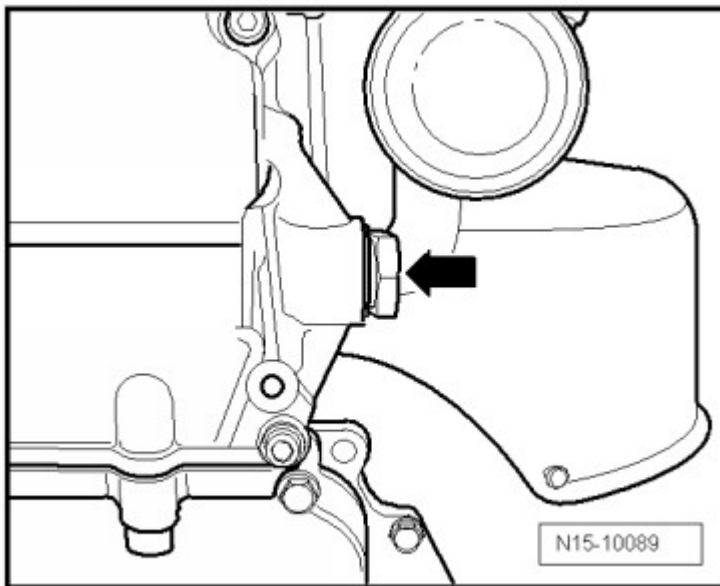


Fig. 76: Identifying Chain Tensioner For Camshaft Roller Chain
Courtesy of AUDI OF AMERICA, LLC

- Remove camshaft bar T10068 A.

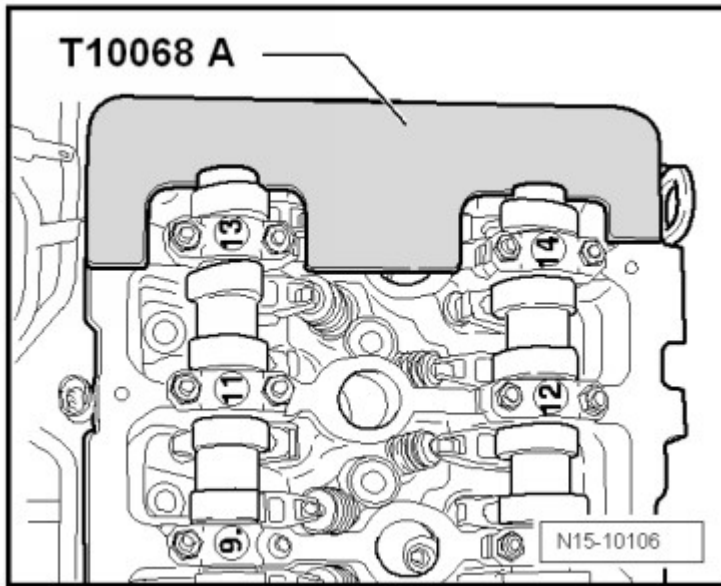


Fig. 77: Identifying Camshaft Bar T10068 A Engage In Shaft Grooves
 Courtesy of AUDI OF AMERICA, LLC

-- Install bolt on intake side camshaft adjuster while counter holding with open end wrench on camshaft wrench surface.

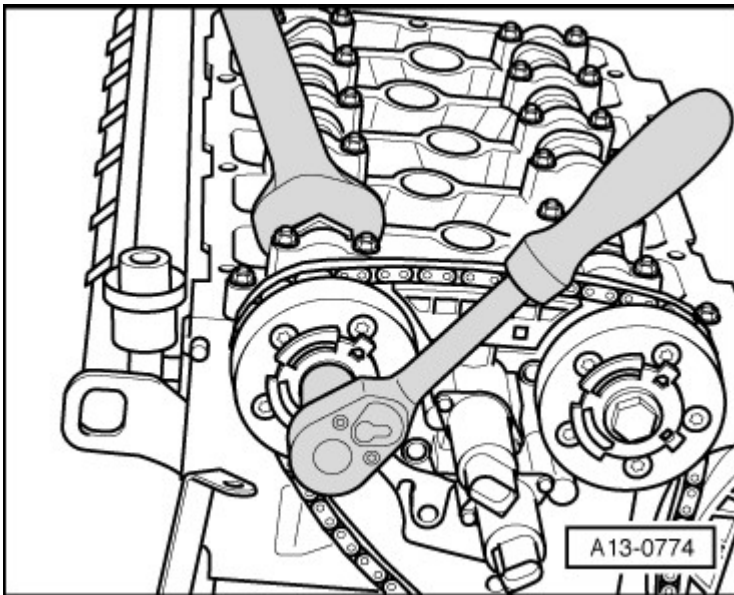


Fig. 78: Identifying Tools To Loosen Intake Camshaft Adjuster Bolt
 Courtesy of AUDI OF AMERICA, LLC

-- Install bolt on exhaust side camshaft adjuster while counter holding with open end wrench on camshaft wrench surface.

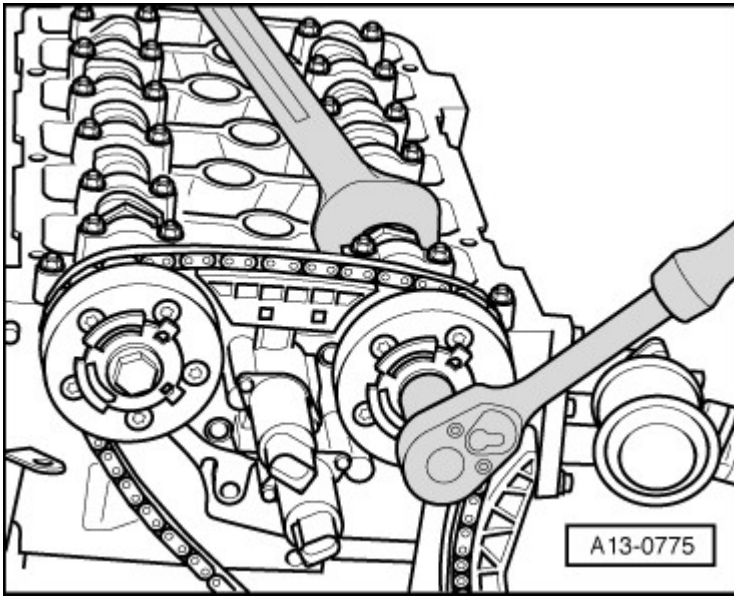


Fig. 79: Identifying Tools To Loosen Exhaust Camshaft Adjuster Bolt
 Courtesy of AUDI OF AMERICA, LLC

-- Rotate crankshaft 2 revolutions in direction of engine rotation at vibration damper bolt and place at "TDC" marking.

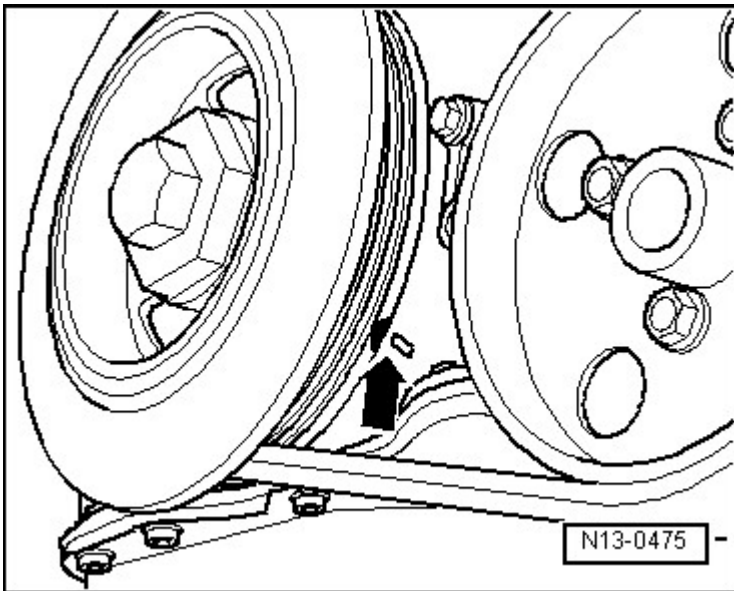


Fig. 80: Identifying Crankshaft At Vibration Damper Securing Bolt In Engine At TDC Cyl. 1
 Courtesy of AUDI OF AMERICA, LLC

- Markings on vibration damper and sealing flange must align -arrow-.
- Camshaft bar T10068 A must engage in grooves on both camshafts at the same time.

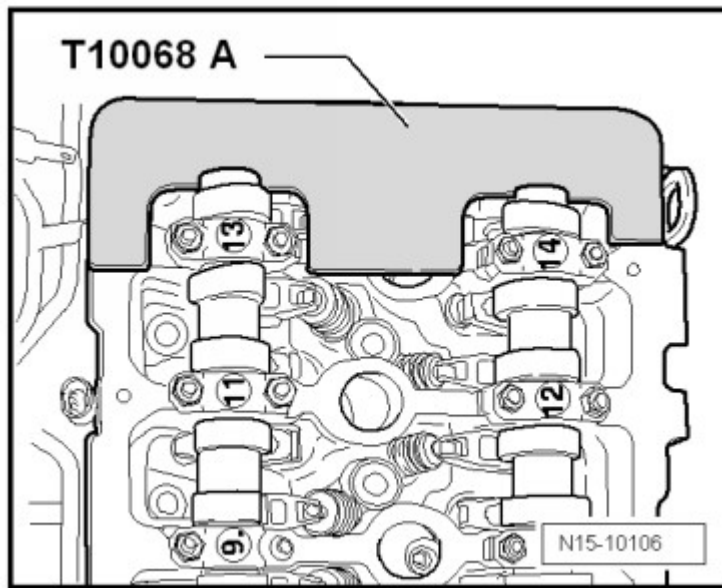


Fig. 81: Identifying Camshaft Bar T10068 A Engage In Shaft Grooves
 Courtesy of AUDI OF AMERICA, LLC

NOTE: Due to the camshaft adjuster function, the camshaft grooves may not be perfectly horizontal. Therefore, turn the camshaft back and forth slightly with an open end wrench -arrows- if necessary to insert the camshaft bar T10068 A.

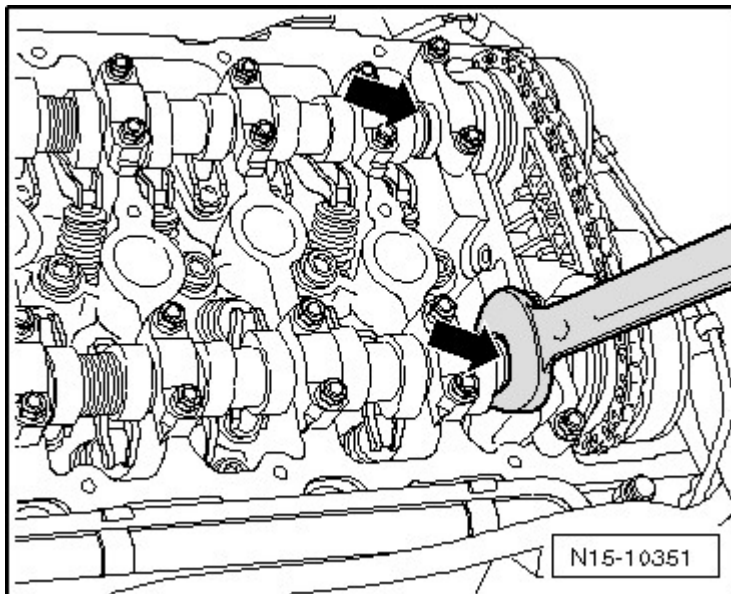


Fig. 82: Counter-Holding Camshaft Using Wrench
 Courtesy of AUDI OF AMERICA, LLC

If camshaft bar cannot be engaged, adjust timing again **INSTALLING (ADJUSTING VALVE TIMING)**.

- Replace timing chain upper cover sealing ring UPPER TIMING CHAIN COVER SEAL.
- Install timing chain upper cover UPPER TIMING CHAIN COVER.
- Install cylinder head cover CYLINDER HEAD COVER
- Install intake manifold Removal and Installation .

CAMSHAFT TIMING CHAIN**Removing**

- Removing engine ENGINE, REMOVING .
- To separate engine and transmission ENGINE AND TRANSMISSION, SEPARATING .
- Fasten engine on engine and transmission holder ENGINE AND TRANSMISSION, SECURING TO HOLDER .
- Remove cylinder head cover CYLINDER HEAD COVER.
- Remove drive plate DRIVE PLATE .
- Remove oil pan OIL PAN .
- Remove camshaft timing chain from camshafts CAMSHAFT TIMING CHAIN, REMOVING FROM CAMSHAFTS.
- Remove timing chain lower cover LOWER TIMING CHAIN COVER.
- Mark camshaft timing chain running direction with arrows using paint -upper arrow- for reinstallation.

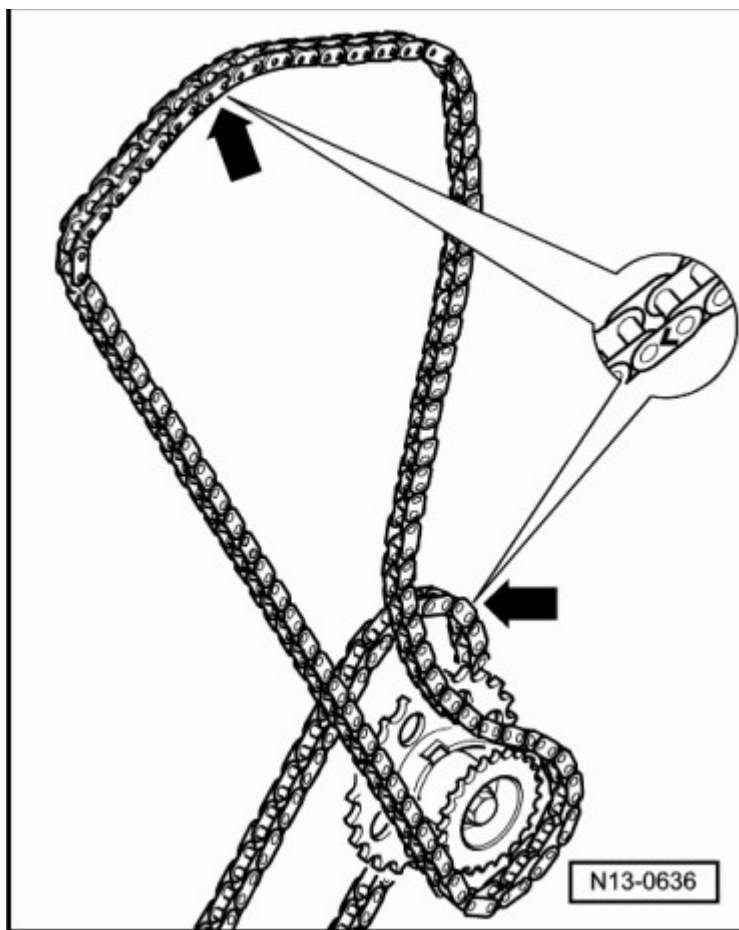


Fig. 83: Identifying Markings On Roller Chains
Courtesy of AUDI OF AMERICA, LLC

CAUTION: Risk of damaging camshaft timing chain.

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

-- Remove mounting pin -arrow- and remove guide rail -1-.

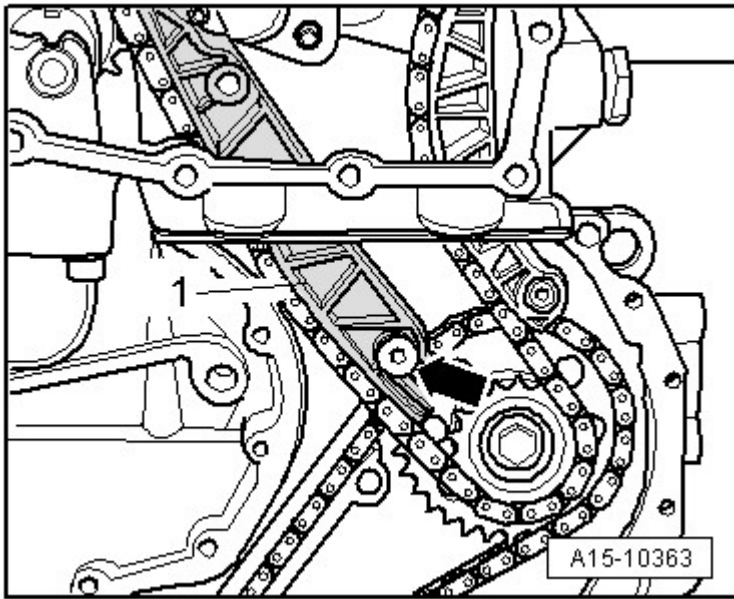


Fig. 84: Identifying Mounting Pin -Arrow- And Guide Rail -1-
Courtesy of AUDI OF AMERICA, LLC

-- Remove camshaft timing chain.

Installing

- Tightening specifications **CAMSHAFT TIMING CHAINS, ASSEMBLY OVERVIEW.**

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

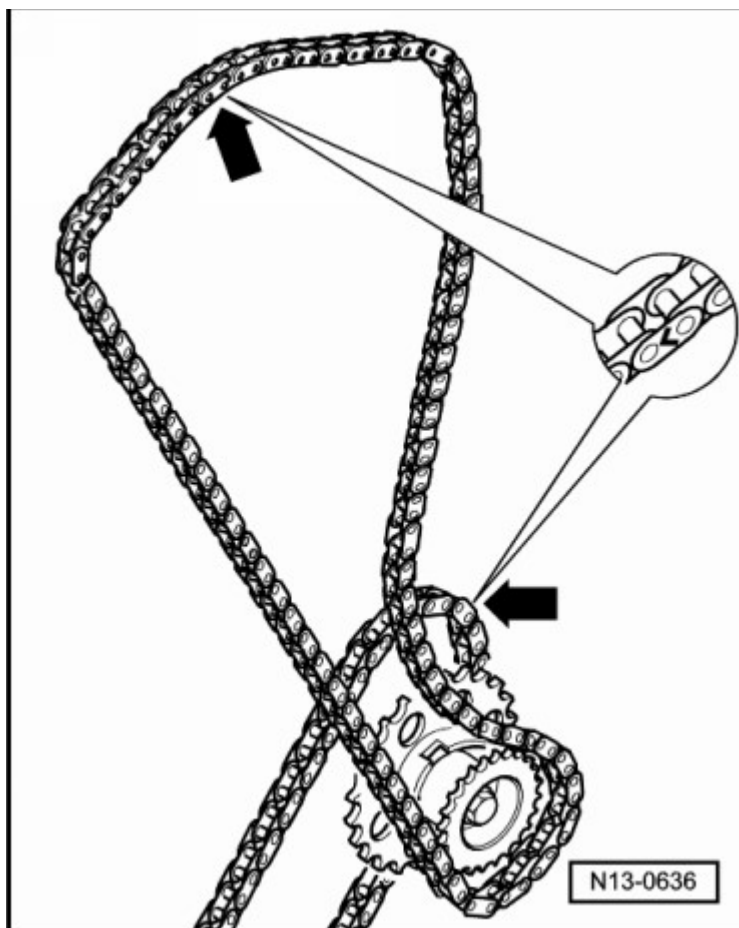


Fig. 85: Identifying Markings On Roller Chains
 Courtesy of AUDI OF AMERICA, LLC

- Place camshaft timing chain on chain sprocket.
- Insert guide rail -1- and tighten mounting pins -arrows-.

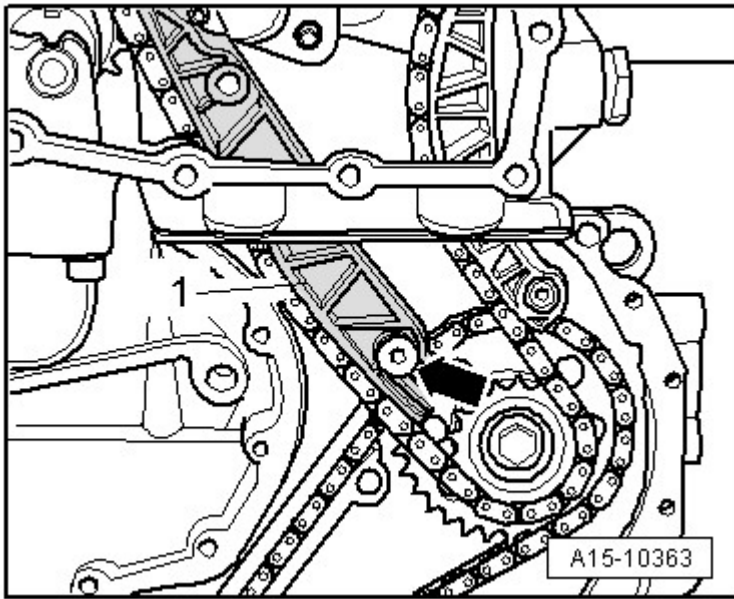


Fig. 86: Identifying Mounting Pin -Arrow- And Guide Rail -1-
 Courtesy of AUDI OF AMERICA, LLC

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

- Install timing chain lower cover **LOWER TIMING CHAIN COVER**.
- Install camshaft timing chain (adjusting timing) **INSTALLING (ADJUSTING VALVE TIMING)**.
- Install oil pan, refer to "Installing" under **OIL PAN** .
- Install drive plate **DRIVE PLATE** .
- Install cylinder head cove **CYLINDER HEAD COVER**
- Install engine **ENGINE, INSTALLING** .
- Fill engine oil and check oil level **ENGINE OIL LEVEL, CHECKING** .

TIMING MECHANISM DRIVE CHAIN

Removing

Proceed as follows:

- Removing engine **ENGINE, REMOVING** .
- To separate engine and transmission: **ENGINE AND TRANSMISSION, SEPARATING** .
- Fasten the engine on the engine and transmission holder **ENGINE AND TRANSMISSION, SECURING**

TO HOLDER .

- Remove cylinder head cover **CYLINDER HEAD COVER**.
- On a vehicle with automatic transmission, remove drive plate **DRIVE PLATE** .
- Remove oil pan **OIL PAN** .
- Remove camshaft timing chain from camshafts **CAMSHAFT TIMING CHAIN, REMOVING FROM CAMSHAFTS**.
- Remove timing chain lower cover **LOWER TIMING CHAIN COVER**.
- Mark camshaft timing chain running direction with arrows using paint -upper arrow- for reinstallation.

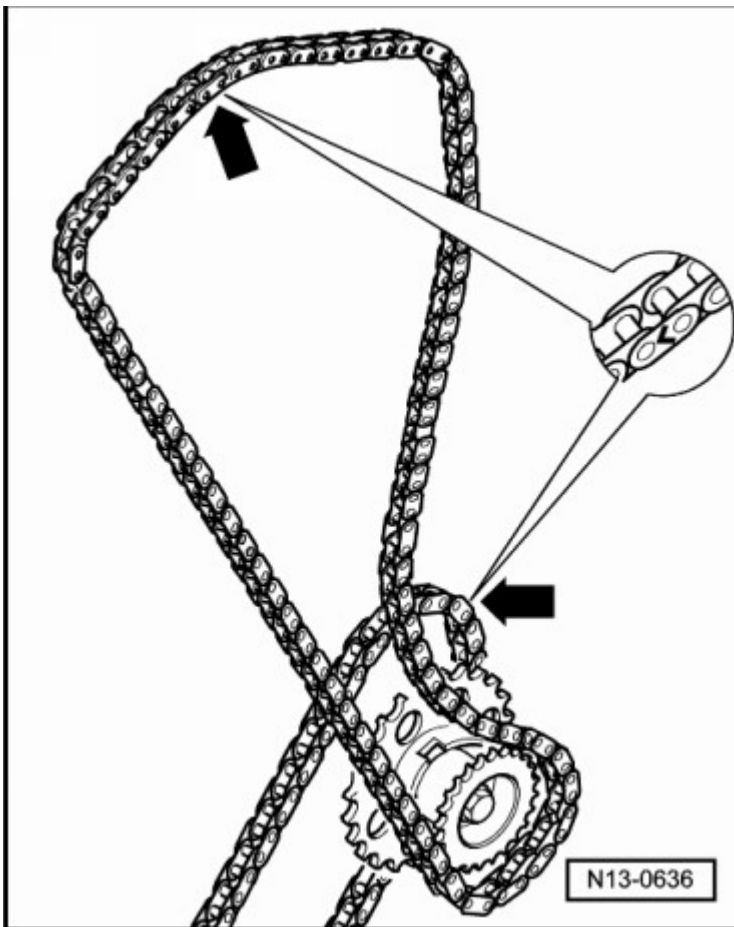


Fig. 87: Identifying Markings On Roller Chains
Courtesy of AUDI OF AMERICA, LLC

CAUTION: Risk of damaging timing mechanism drive chain.

- Do not mark timing mechanism with a chain punch, notch or

something similar.

-- Adjust crankshaft at vibration damper bolt in direction of engine rotation to "TDC" marking.

- Markings on vibration damper and sealing flange must align -arrow-.

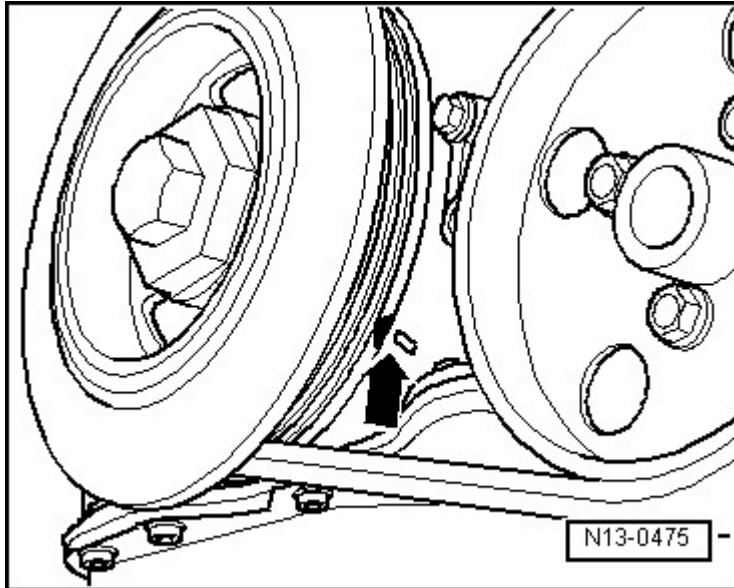


Fig. 88: Identifying Crankshaft At Vibration Damper Securing Bolt In Engine At TDC Cyl. 1
Courtesy of AUDI OF AMERICA, LLC

- Camshaft bar T10068 A must engage in grooves on both camshafts at the same time.

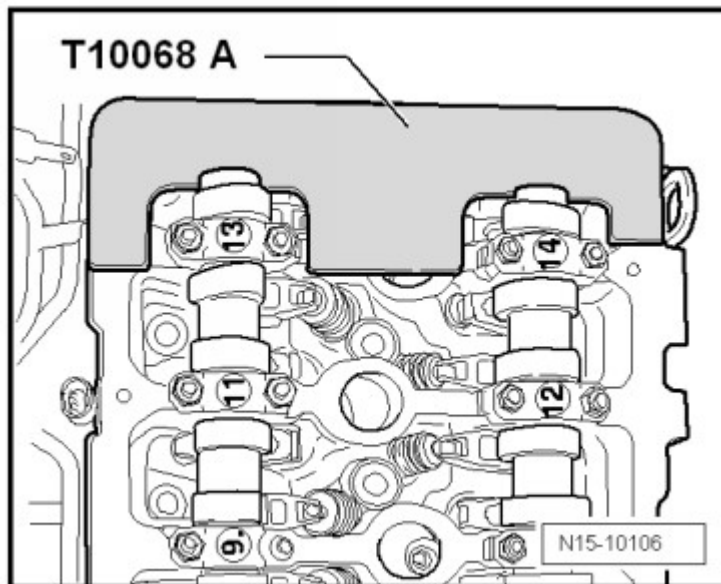


Fig. 89: Identifying Camshaft Bar T10068 A Engage In Shaft Grooves
Courtesy of AUDI OF AMERICA, LLC

NOTE: Due to the camshaft adjuster function, the camshaft grooves may not be perfectly horizontal. Therefore, turn the camshaft back and forth slightly with an open end wrench -arrows- if necessary to insert the camshaft bar T10068 A.

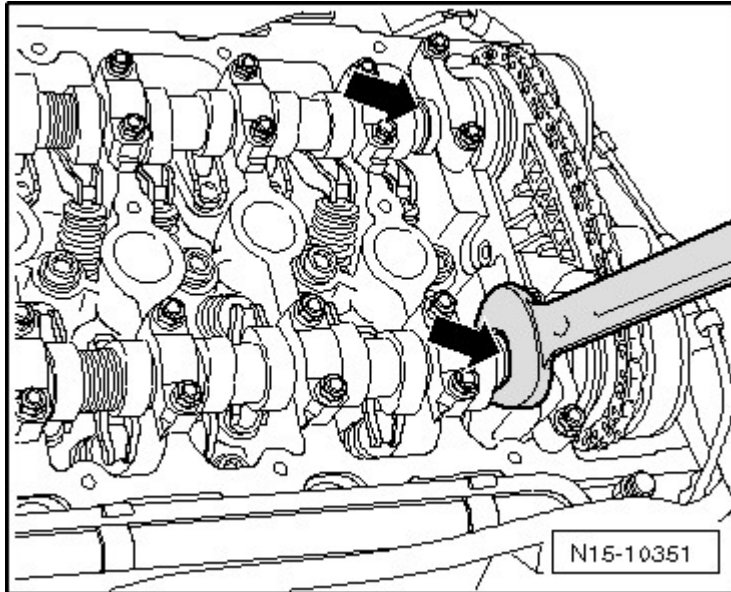


Fig. 90: Counter-Holding Camshaft Using Wrench
Courtesy of AUDI OF AMERICA, LLC

If the camshaft bar T10068 A does not engage, rotate the crankshaft 1 rotation further in direction of engine rotation.

-- Remove camshaft timing chain tensioner -arrow--.

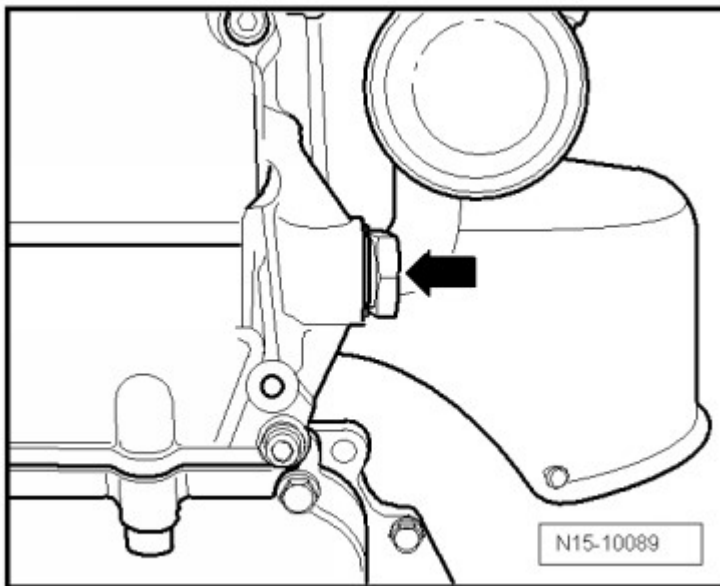


Fig. 91: Identifying Chain Tensioner For Camshaft Roller Chain

Courtesy of AUDI OF AMERICA, LLC

-- Counter hold with counter hold T10069 at vibration damper bolt.

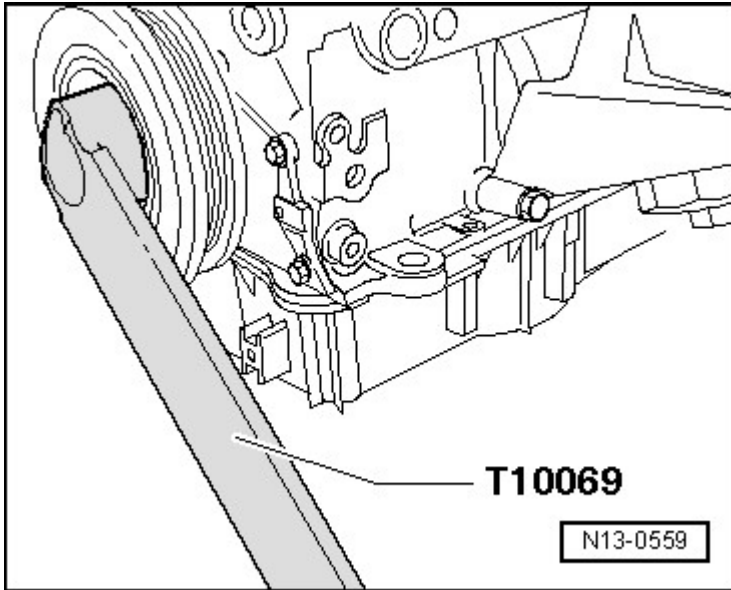


Fig. 92: Loosening/Tightening Securing Bolt Using Counter-Holder T10069 To Hold Vibration Damper
Courtesy of AUDI OF AMERICA, LLC

-- Loosen chain sprocket bolt -arrow- approximately 1 turn.

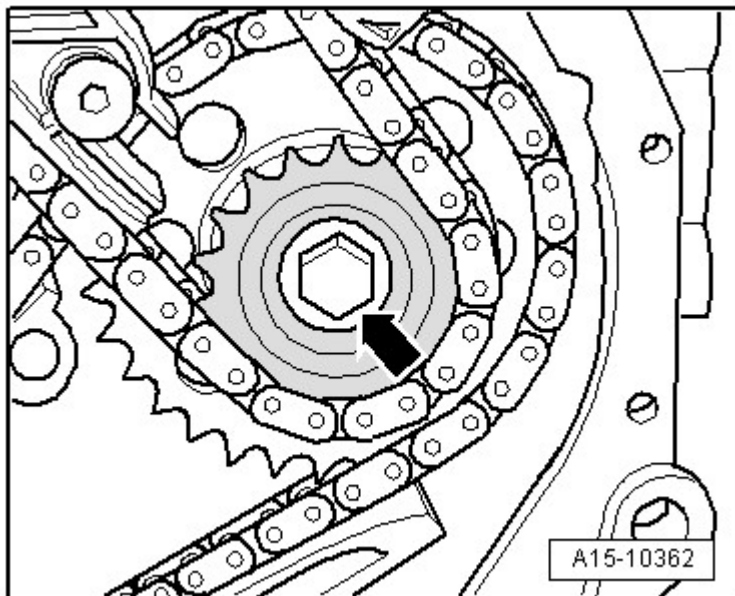


Fig. 93: Identifying Sprocket Bolt
Courtesy of AUDI OF AMERICA, LLC

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

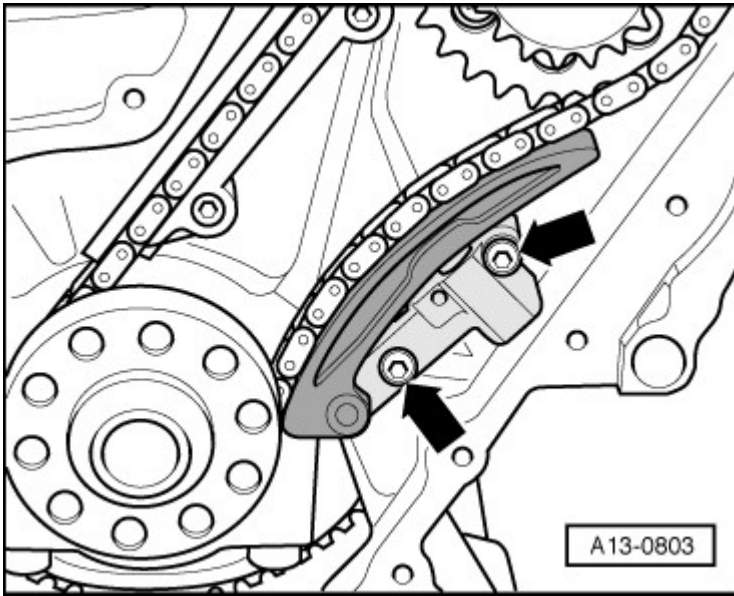


Fig. 94: Identifying Chain Tensioner Bolts
Courtesy of AUDI OF AMERICA, LLC

-- Remove chain sprocket bolt -arrow-.

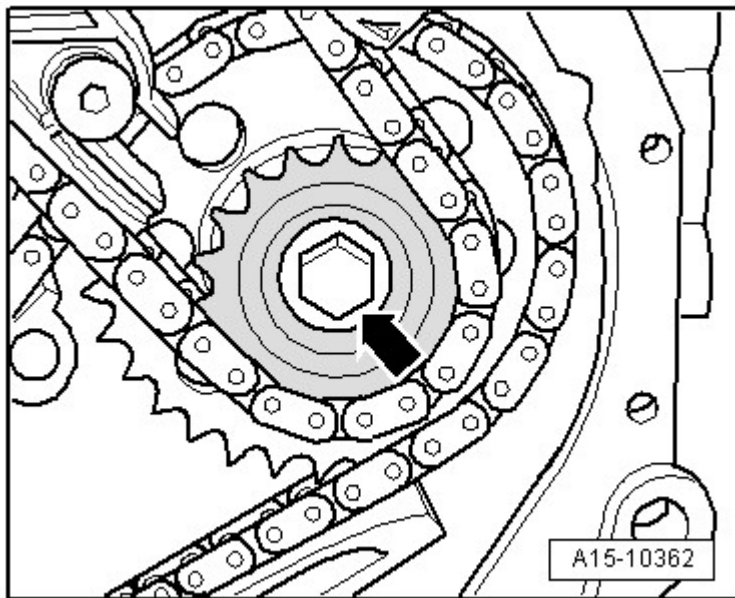


Fig. 95: Identifying Sprocket Bolt
Courtesy of AUDI OF AMERICA, LLC

-- Remove camshaft timing chain sprocket with timing chain from timing mechanism drive chain sprocket - arrow- and pivot to side.

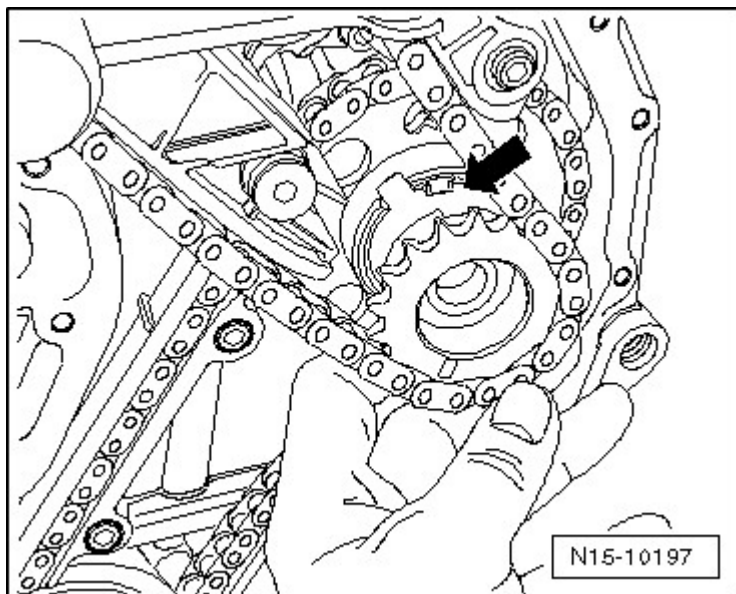


Fig. 96: Inserting Small Drive Pinion With Installed Chain Into Recess And Bolt It On Hand-Tight
Courtesy of AUDI OF AMERICA, LLC

-- Remove timing mechanism drive chain sprocket with drive chain.

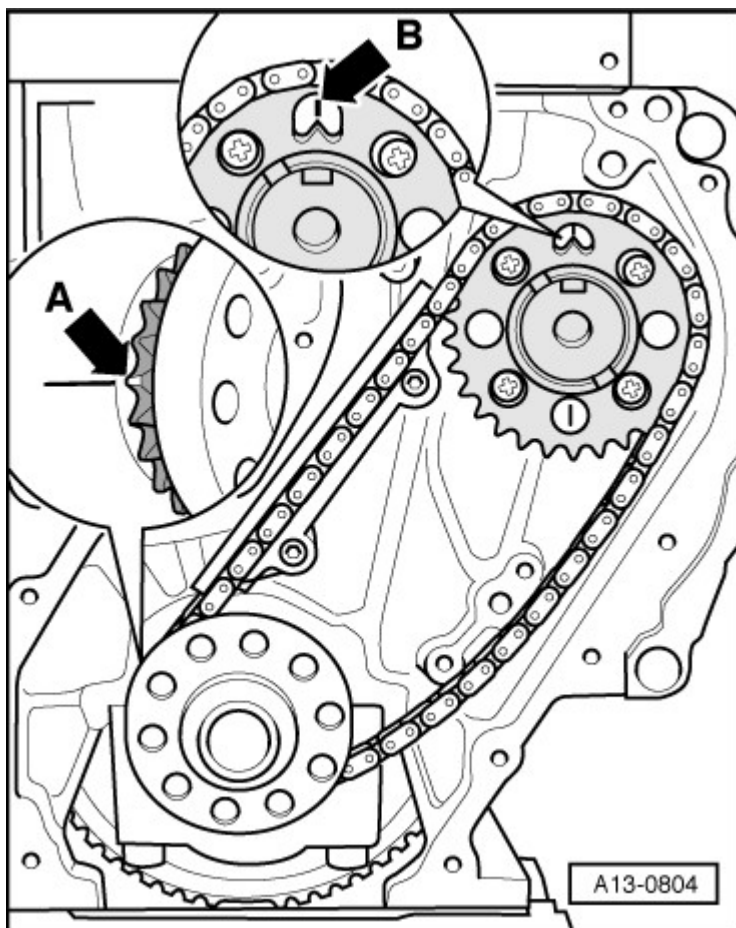


Fig. 97: Identifying Large Sprocket Installed Into Timing Chain With Tab Aligned To Mark On Cylinder Block

Courtesy of AUDI OF AMERICA, LLC

NOTE: Ignore -A and B-.

Installing

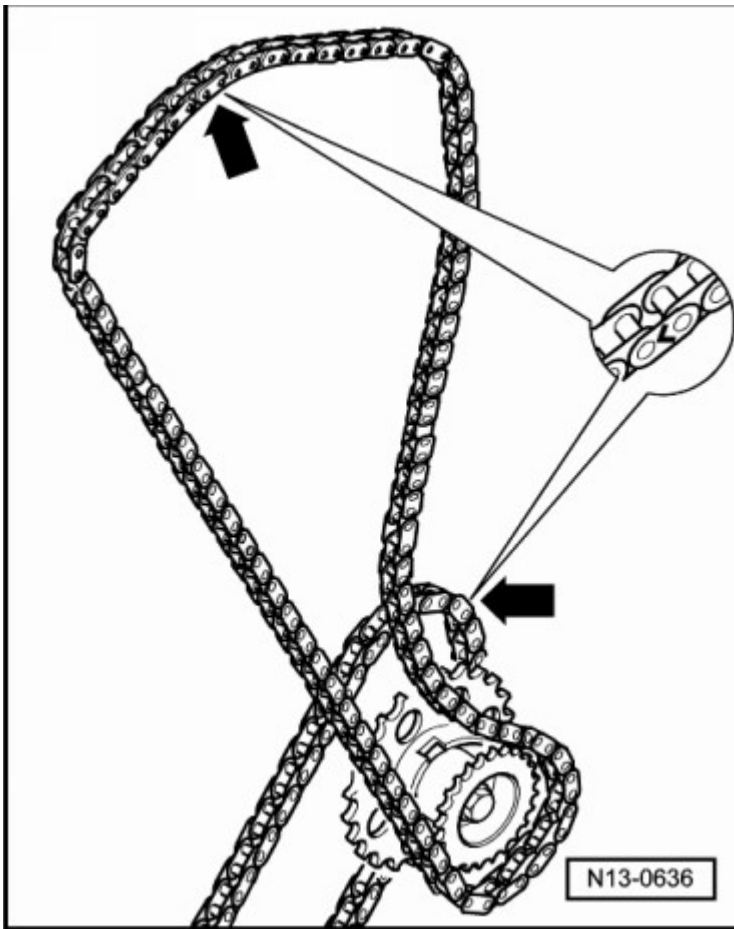


Fig. 98: Identifying Markings On Roller Chains

Courtesy of AUDI OF AMERICA, LLC

- Tightening specifications CAMSHAFT TIMING CHAINS, ASSEMBLY OVERVIEW.

NOTE: Replace bolts which have been tightened to specifications.

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

-- Install timing mechanism drive chain together with chain sprocket on oil pump.

- Installation only possible in one position.

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

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

- Milled drive chain sprocket tooth must align with bearing joint -arrow A-.

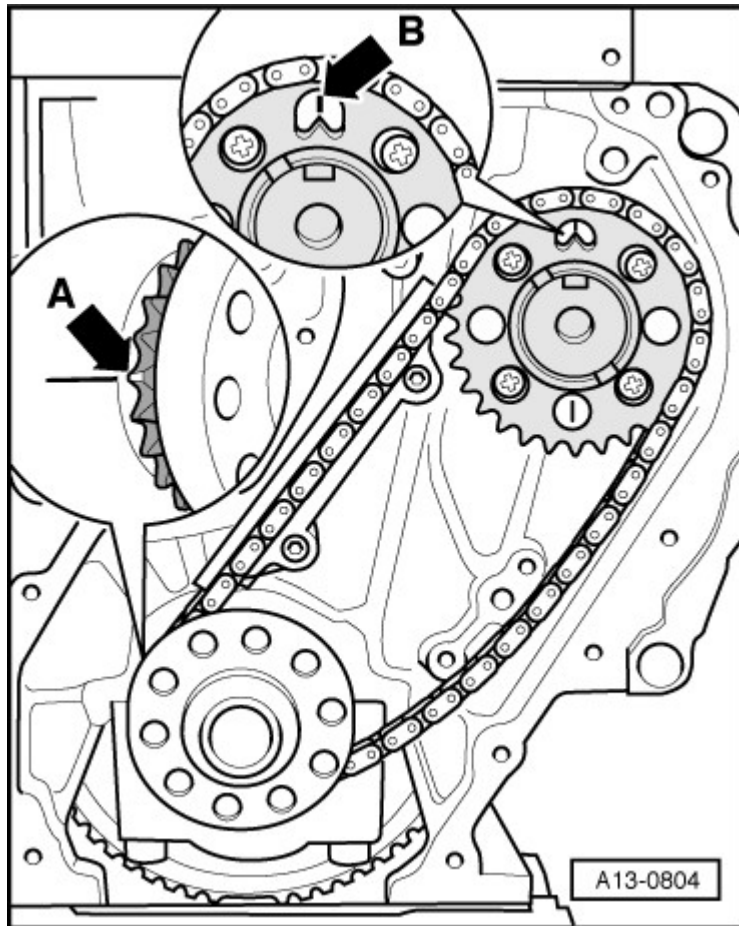


Fig. 99: Identifying Large Sprocket Installed Into Timing Chain With Tab Aligned To Mark On Cylinder Block

Courtesy of AUDI OF AMERICA, LLC

- Tab on chain sprocket must align with tab -arrow B- on oil pump housing.

-- Install camshaft timing chain sprocket with timing chain in place.

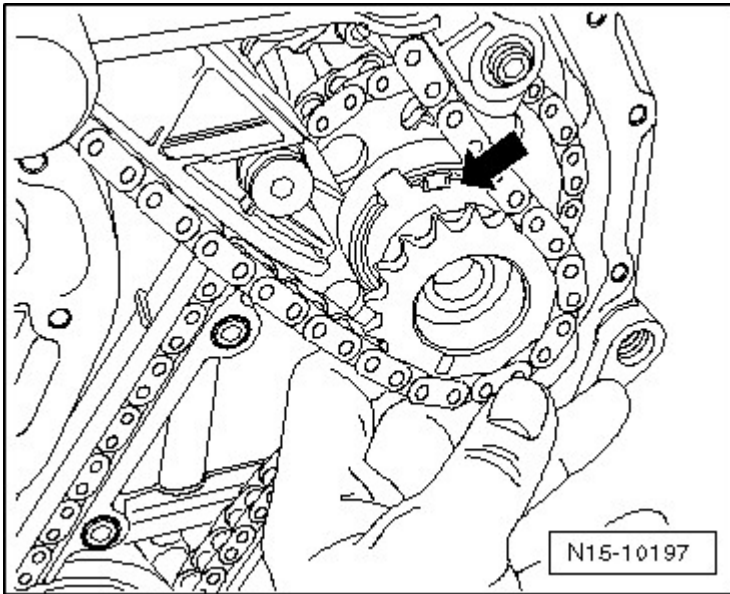


Fig. 100: Inserting Small Drive Pinion With Installed Chain Into Recess And Bolt It On Hand-Tight
 Courtesy of AUDI OF AMERICA, LLC

- Pins on back side of chain sprocket must engage in cut outs -arrow-.

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

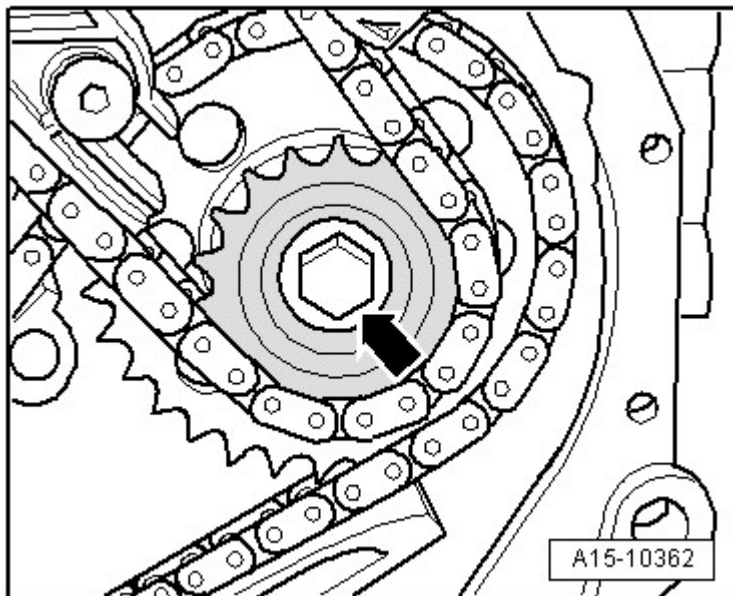


Fig. 101: Identifying Sprocket Bolt
 Courtesy of AUDI OF AMERICA, LLC

-- Release locking splines in chain tensioner with a small screwdriver -arrow- and press tensioning rail against chain tensioner.

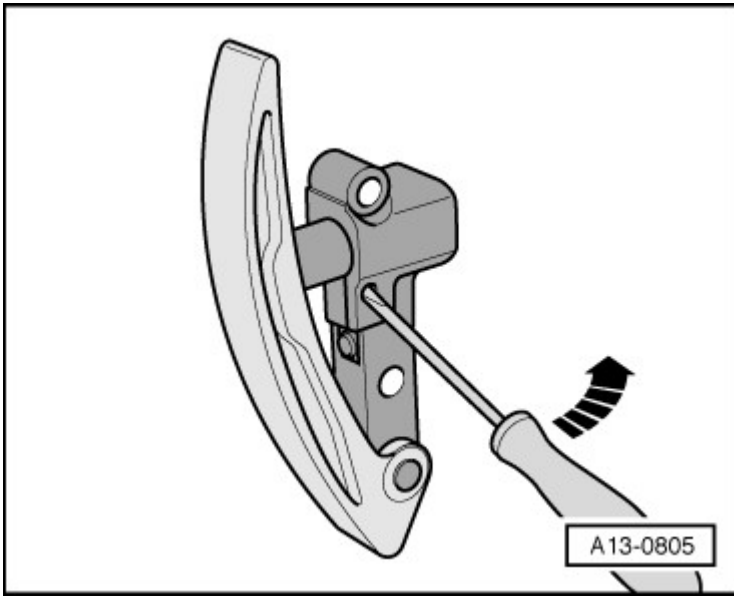


Fig. 102: Identifying Small Screwdriver To Release Locking Splines Of Chain Tensioner
 Courtesy of AUDI OF AMERICA, LLC

-- Tighten chain tensioner while pressed down -arrows-.

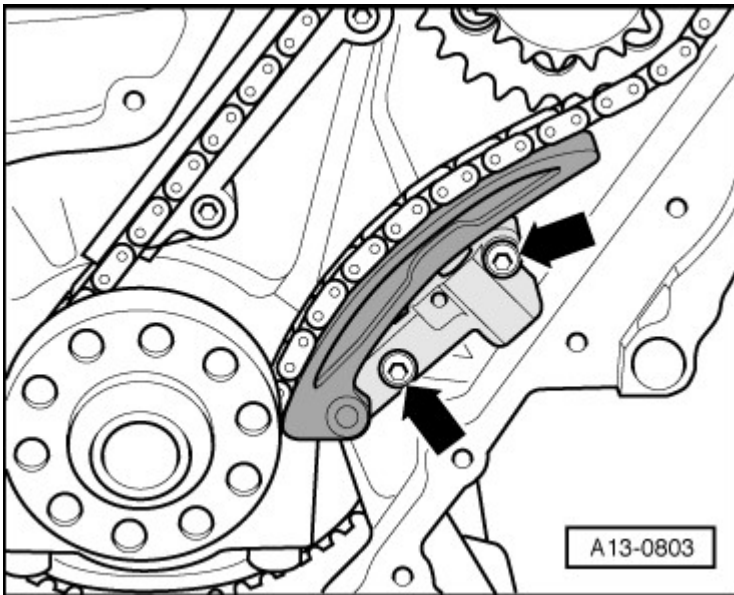


Fig. 103: Identifying Chain Tensioner Bolts
 Courtesy of AUDI OF AMERICA, LLC

-- Counter hold with counter hold T10069 at vibration damper bolt.

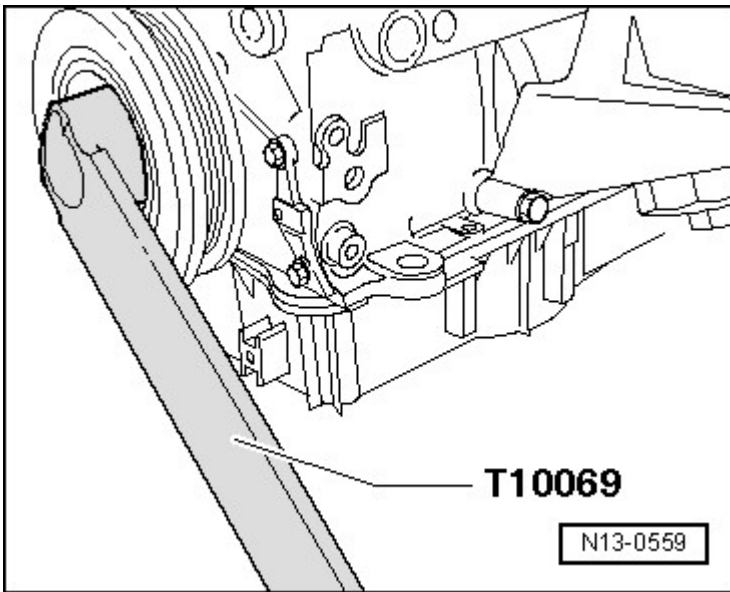


Fig. 104: Loosening/Tightening Securing Bolt Using Counter-Holder T10069 To Hold Vibration Damper
Courtesy of AUDI OF AMERICA, LLC

-- Tighten chain sprocket bolt -arrow-.

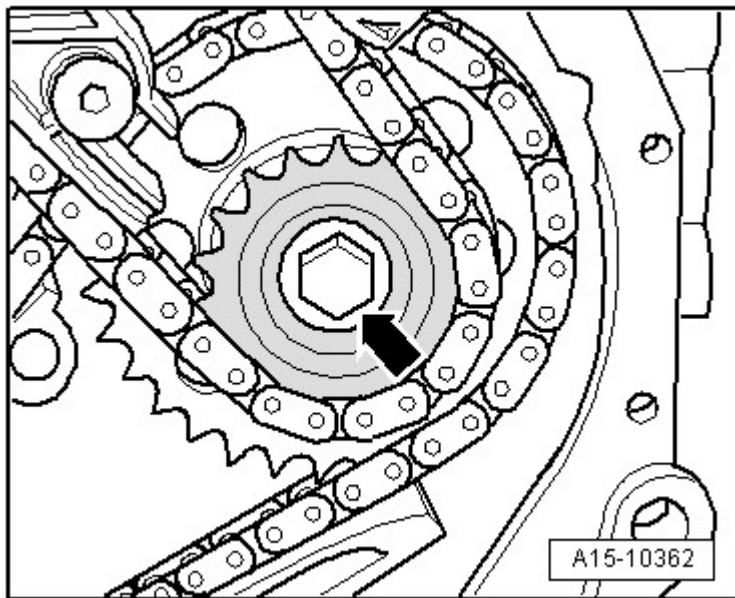


Fig. 105: Identifying Sprocket Bolt
Courtesy of AUDI OF AMERICA, LLC

-- Install camshaft timing chain tensioner -arrow-.

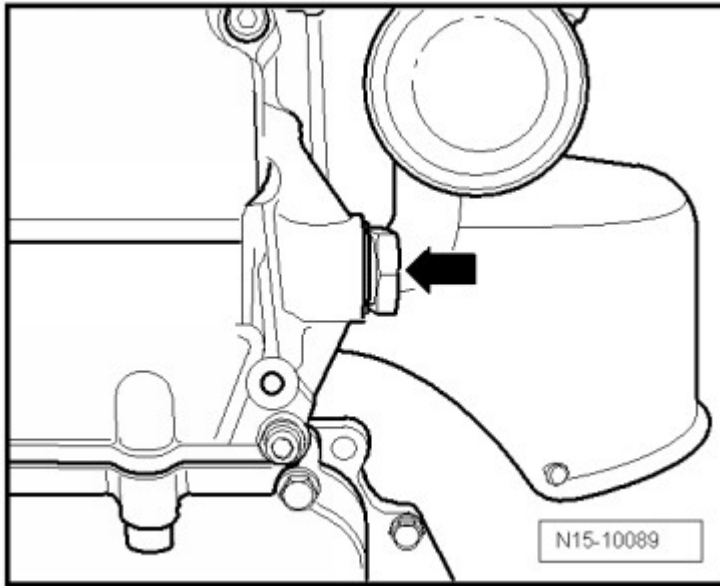


Fig. 106: Identifying Chain Tensioner For Camshaft Roller Chain
Courtesy of AUDI OF AMERICA, LLC

-- Remove camshaft bar T10068 A.

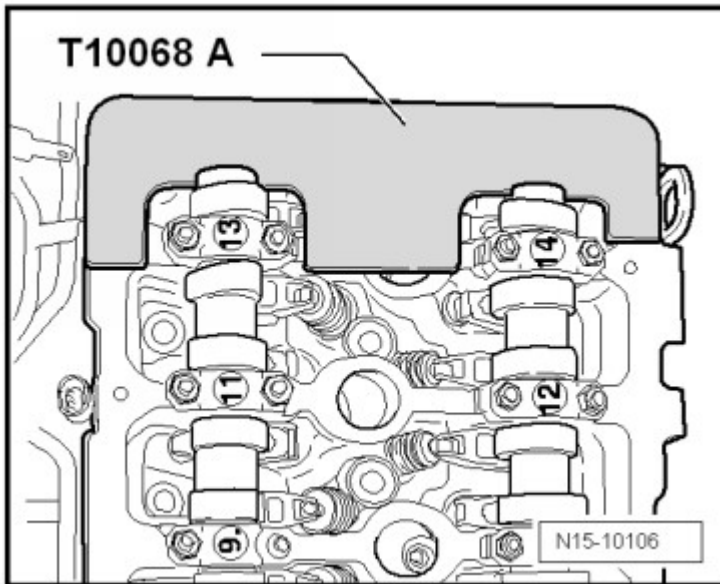


Fig. 107: Identifying Camshaft Bar T10068 A Engage In Shaft Grooves
Courtesy of AUDI OF AMERICA, LLC

-- Rotate crankshaft 2 revolutions in direction of engine rotation at vibration damper bolt and place at "TDC" marking.

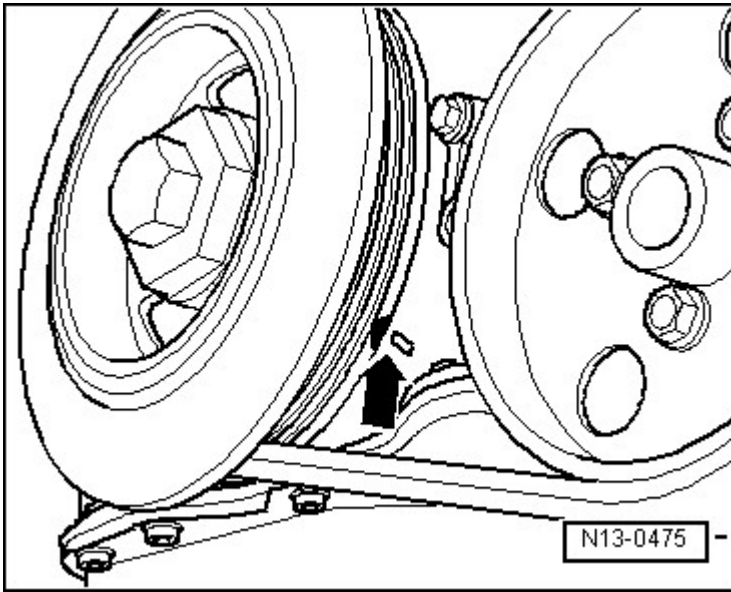


Fig. 108: Identifying Crankshaft At Vibration Damper Securing Bolt In Engine At TDC Cyl. 1
Courtesy of AUDI OF AMERICA, LLC

- Markings on vibration damper and sealing flange must align -arrow-.
- Camshaft bar T10068 A must engage in grooves on both camshafts at the same time.

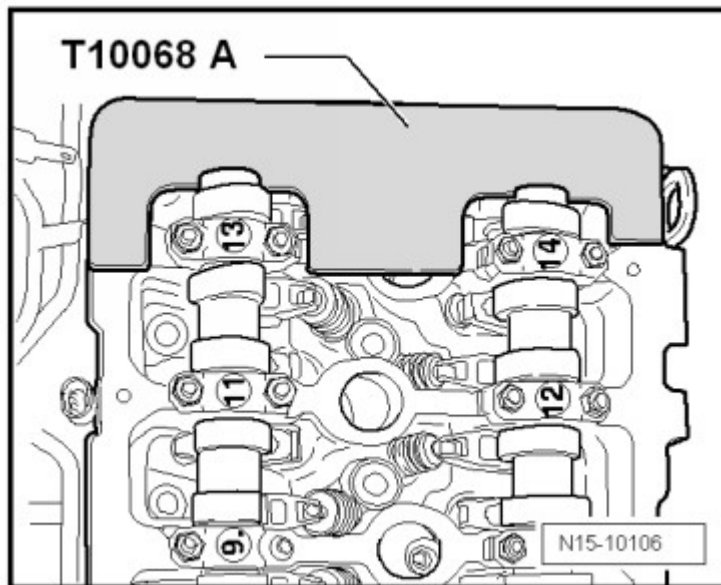


Fig. 109: Identifying Camshaft Bar T10068 A Engage In Shaft Grooves
Courtesy of AUDI OF AMERICA, LLC

NOTE: Due to the camshaft adjuster function, the camshaft grooves may not be perfectly horizontal. Therefore, turn the camshaft back and forth slightly with an open end wrench -arrows- if necessary to insert the camshaft bar T10068 A.

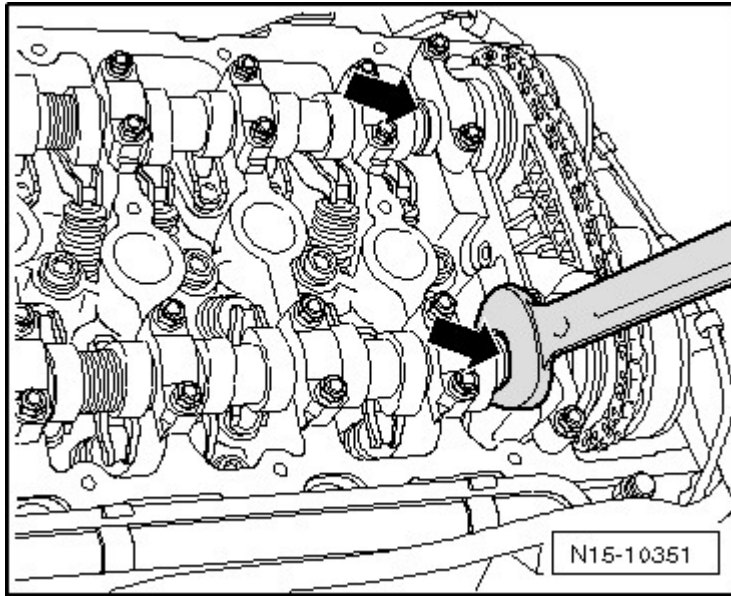


Fig. 110: Counter-Holding Camshaft Using Wrench
 Courtesy of AUDI OF AMERICA, LLC

If camshaft bar cannot be engaged, adjust timing again.

Rotate crankshaft 2 revolutions in direction of engine rotation at vibration damper bolt and place at "TDC" marking.

Check timing again.

- Install timing chain lower cover LOWER TIMING CHAIN COVER.
- Install oil pan OIL PAN .
- Install drive plate DRIVE PLATE .
- Install cylinder head cover CYLINDER HEAD COVER
- Install engine ENGINE, INSTALLING .
- Fill engine oil and check oil level ENGINE OIL LEVEL, CHECKING .

CYLINDER HEAD COVER

Removing

- Drain coolant COOLING SYSTEM, DRAINING AND FILLING .
- Remove ignition coils Removal and Installation .

- Remove intake manifold **Removal and Installation** .
- Loosen cylinder head cover bolts in -17 to 1- sequence.

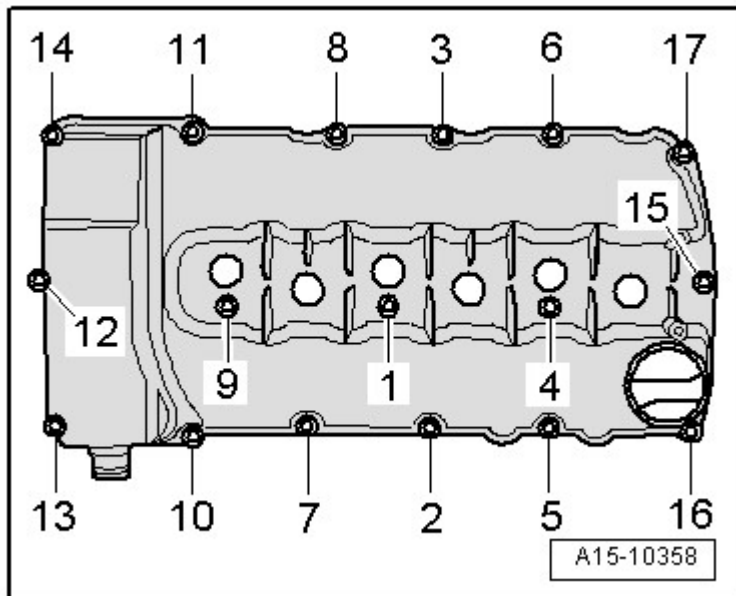


Fig. 111: Identifying Cylinder Head Cover Bolt Loosening Sequence
 Courtesy of AUDI OF AMERICA, LLC

- Remove bolts and remove cylinder head cover.

Installing

- Tightening specifications **Fig. 7**

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

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

- Tighten cylinder head cover bolts **Fig. 7**
- Install intake manifold **Removal and Installation** .
- Install ignition coils **Removal and Installation** .
- Fill with coolant **COOLING SYSTEM, DRAINING AND FILLING => Filling** .

CYLINDER HEAD

Special tools and workshop equipment required

- Lifting tackle 3033

- Shop crane VAS 6100
- Sealant

Removing

- Engine installed.

NOTE: During installation, all cable ties must be reinstalled at the same location.

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

- Before opening high pressure components of the fuel injection system, pressure must be relieved to residual pressure.

- Reduce fuel pressure in high pressure area **RELEASING FUEL PRESSURE ON HIGH PRESSURE SIDE** .
- Drain coolant **COOLING SYSTEM, DRAINING AND FILLING** .
- Remove intake manifold **Removal and Installation** .
- Remove cylinder head cover **CYLINDER HEAD COVER**.
- Remove timing chain upper cover **UPPER TIMING CHAIN COVER**.
- Remove camshaft timing chain from camshafts **CAMSHAFT TIMING CHAIN, REMOVING FROM CAMSHAFTS**.
- Remove ribbed belt tensioner **RIBBED BELT TENSIONER** .

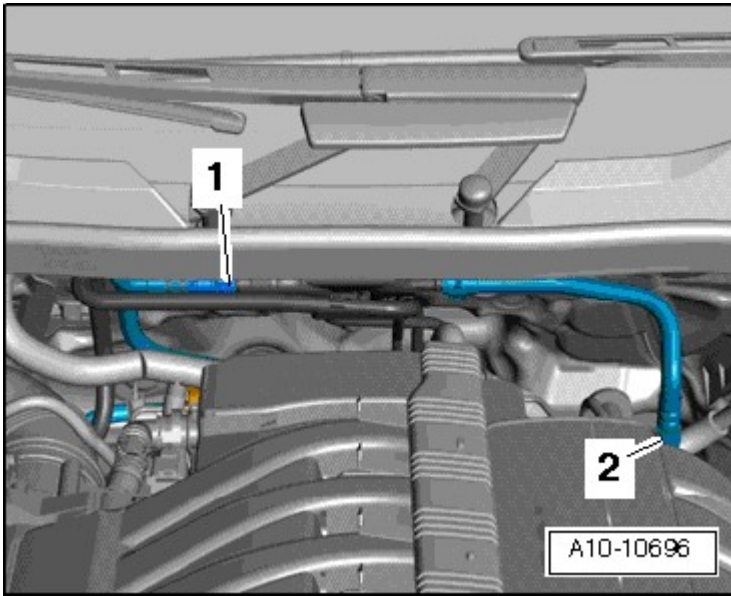


Fig. 112: Identifying Electrical Harness Connector -1-
Courtesy of AUDI OF AMERICA, LLC

WARNING: Risk of injury from fuel.

- To reduce residual pressure in fuel system, lay a clean cloth around connector and carefully loosen connector.

-- Remove fuel supply line -2-.

NOTE: Ignore -1-.

-- Disconnect electrical connector -2- for low fuel pressure sensor -G410- at top of high pressure pump.

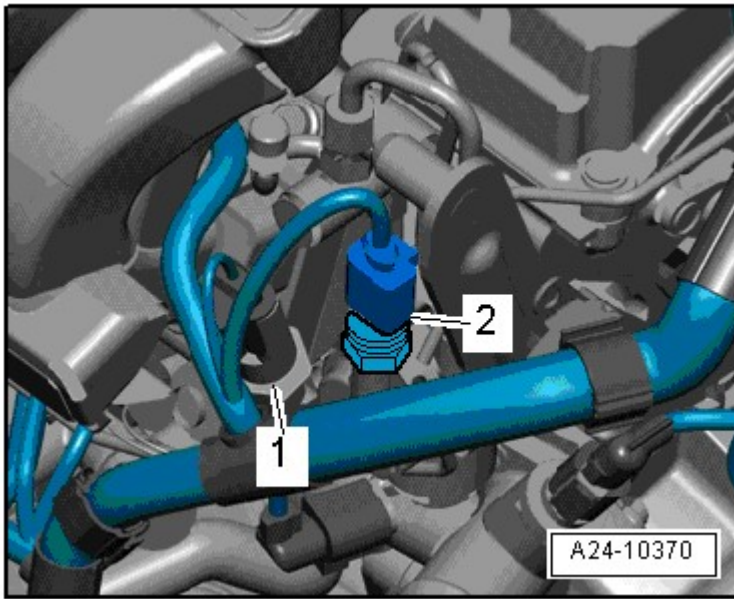


Fig. 113: Locating Fuel Pressure Sensor -G247- And Low Fuel Pressure Sensor -G410-
 Courtesy of AUDI OF AMERICA, LLC

NOTE: Ignore -1-.

Depending on version, the low fuel pressure sensor -G410- sits on the bulkhead.

-- Disconnect electrical connector -arrow- for fuel metering valve -N290- at bottom of high pressure pump.

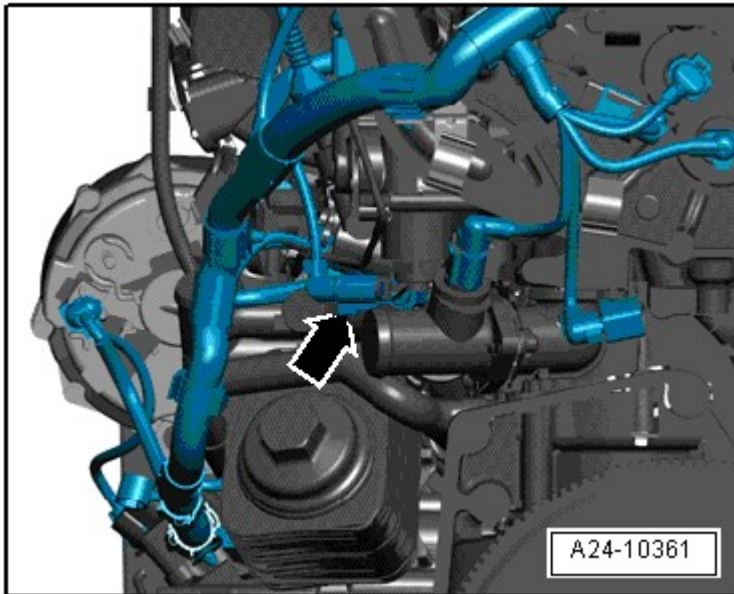


Fig. 114: Locating Fuel Metering Valve -N290-
 Courtesy of AUDI OF AMERICA, LLC

-- Disconnect electrical connectors -arrows- on fuel injectors.

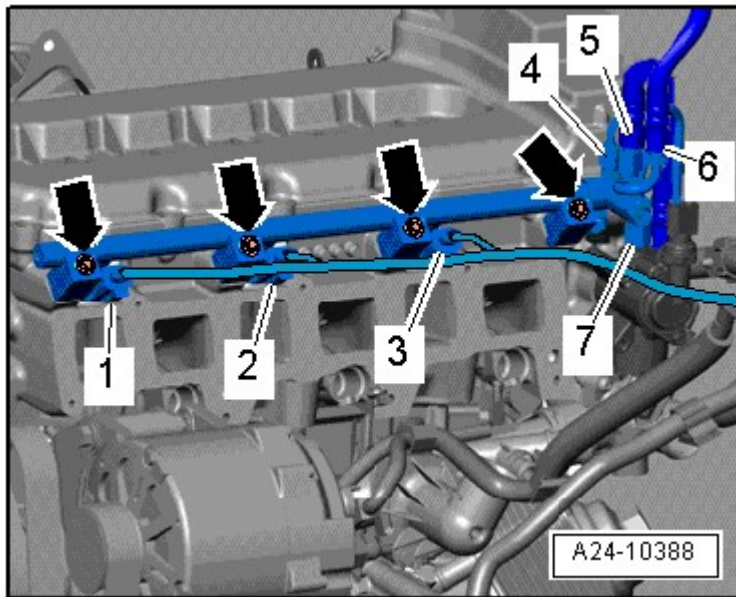


Fig. 115: Identifying Electrical Connectors -Arrows- On Fuel Injectors
Courtesy of AUDI OF AMERICA, LLC

NOTE: Ignore -1 through 7-.

-- Free up B+ wire to starter on left rear engine lifting eye.

-- Remove bolts -arrows- on coolant connecting pieces.

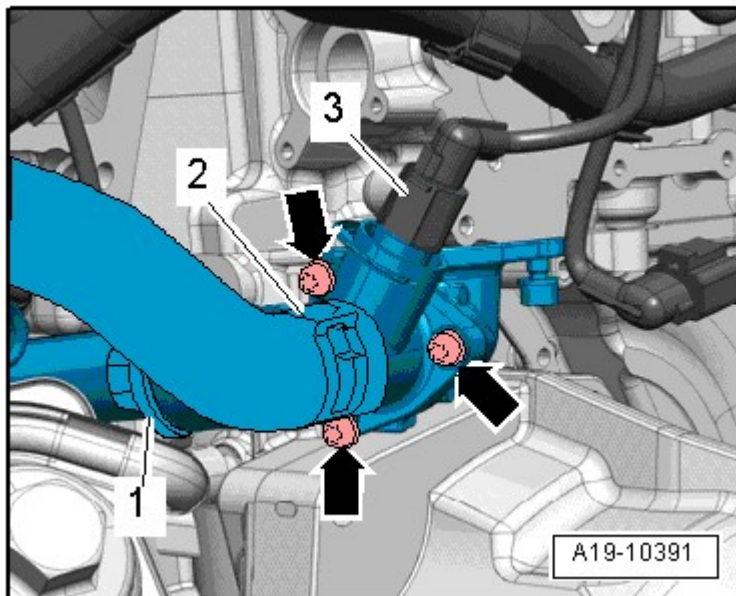


Fig. 116: Identifying Bolts -Arrows- On Coolant Connecting Pieces

Courtesy of AUDI OF AMERICA, LLC

NOTE: Ignore -1, 2, 3-

-- Remove bolts -arrows- and remove heat shield.

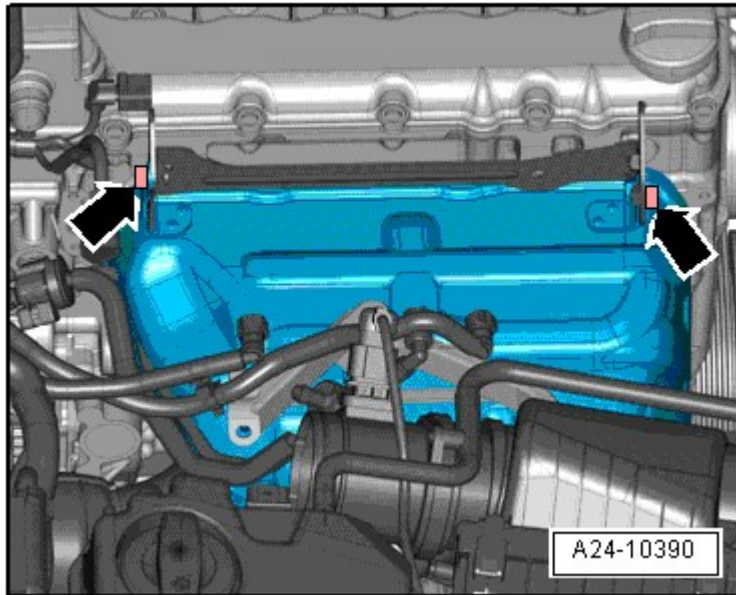


Fig. 117: Identifying Bolts -Arrows- And Heat Shield
Courtesy of AUDI OF AMERICA, LLC

-- Remove bolt -arrow- and remove ground (GND) wire.

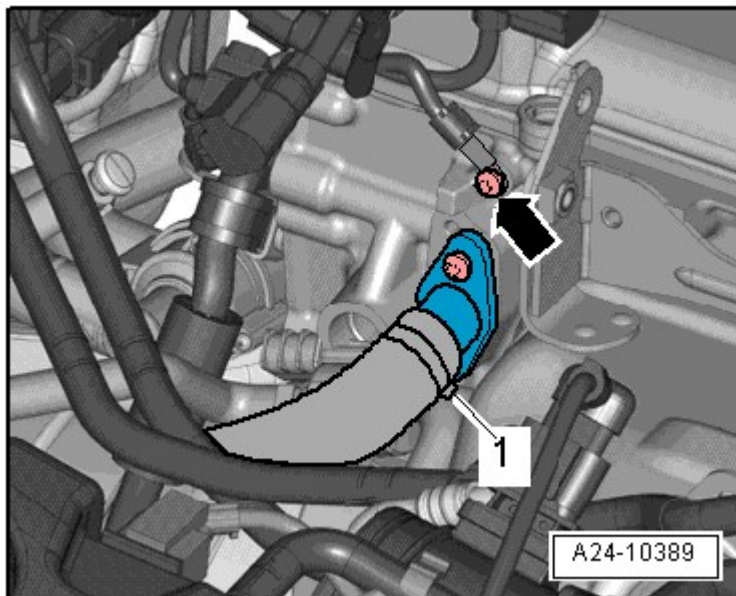


Fig. 118: Identifying Bolt -Arrow- And Ground (GND) Wire

Courtesy of AUDI OF AMERICA, LLC

-- Roll up heat insulation sleeve -1- and remove coolant hose from cylinder head.

-- Remove bolts -2- on main primary converter brackets.

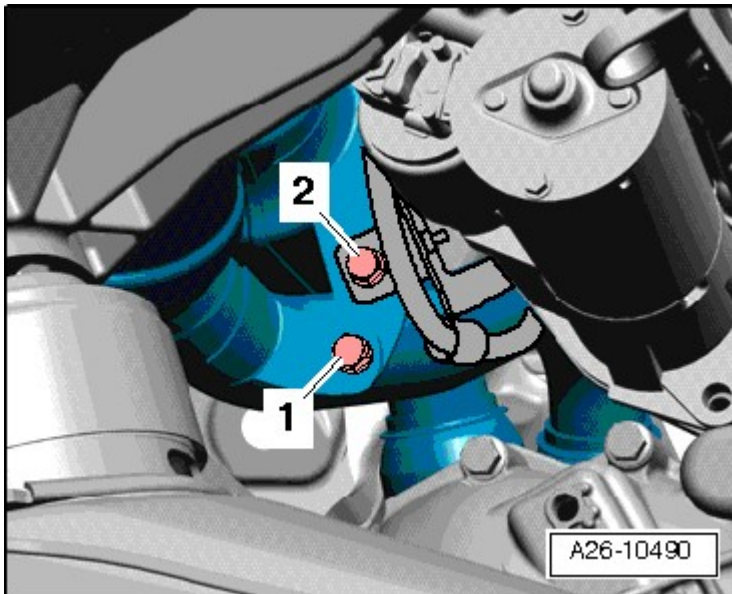


Fig. 119: Identifying Primary Catalytic Converter Bracket Bolts
Courtesy of AUDI OF AMERICA, LLC

NOTE: Ignore -1-.

-- Remove nuts -arrows- and remove primary catalytic converters from threaded pins.

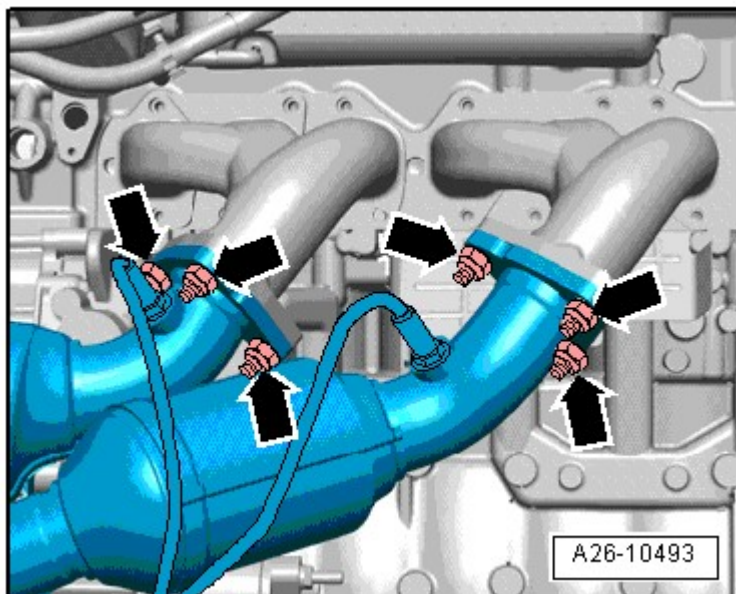


Fig. 120: Identifying Exhaust Pipe With Catalytic Converter To Exhaust Manifold Nuts -Arrows-
Courtesy of AUDI OF AMERICA, LLC

LOOSEN AND TIGHTEN CYLINDER HEAD BOLTS IN -1 TO 20- SEQUENCE

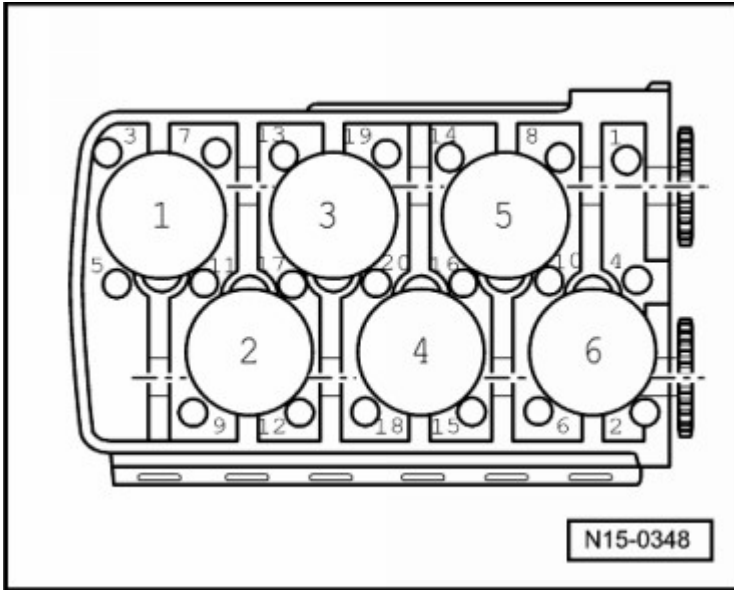


Fig. 121: Identifying Cylinder Head Bolts Removal Sequence
Courtesy of AUDI OF AMERICA, LLC

-- Engage lifting tackle 3033 as follows:

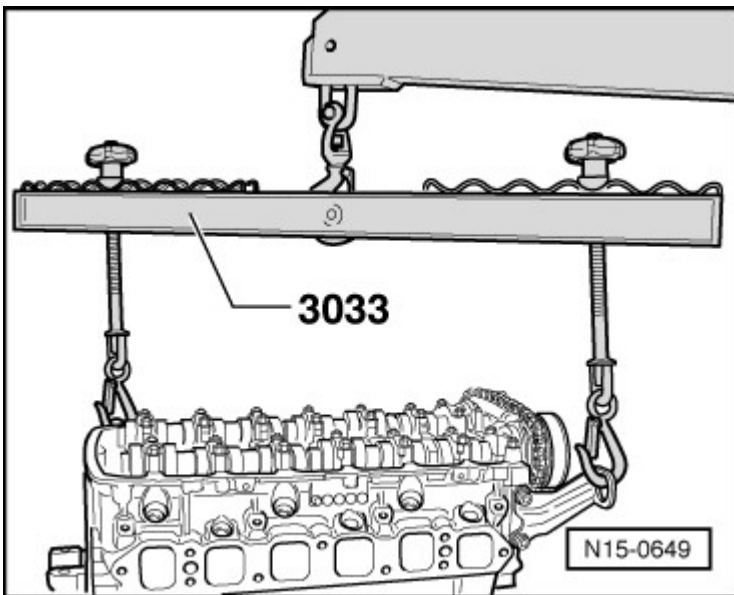


Fig. 122: Attaching Lifting Tackle 3033
Courtesy of AUDI OF AMERICA, LLC

- Belt pulley side: Position "3".

- Transmission side: Position "11".

-- Carefully raise cylinder head.

CAUTION: Risk of contaminating cylinder wall and piston.

- Place clean cloths in cylinder.

Installing

- Tightening specifications **Fig. 8, EXHAUST MANIFOLD, ASSEMBLY OVERVIEW** .

CAUTION: Risk of damaging sealing surfaces.

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

Risk of damaging cylinder block.

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

Risk of cylinder head seal leaking.

- Carefully remove all grinding and sanding residue.
- Only unpack new cylinder head gasket immediately prior to installation.
- To prevent cylinder head seal silicone layer and recessed area from being damaged, always handle seal extremely carefully.

Risk of damaging open valves.

- If a replacement cylinder is installed, only remove plastic base right before cylinder head is installed to protect open valves.

Risk of damaging valves and piston heads after working on valvetrain.

- To ensure valves do not strike pistons when starting, carefully rotate engine at least 2 full revolutions.

NOTE: Replace bolts which have been tightened to torque.

Replace sealing rings, seals and self-locking nuts.

Note different sealant for cylinder head sealing surfaces and bolts.

If a replacement cylinder is installed, contact surfaces between bearing elements, roller rocker levers and cam running surfaces must be lubricated before installing cylinder head cover.

Secure all hose connections using hose clamps appropriate for the model type.

-- Position camshafts at "TDC" before cylinder head is installed.

- Camshaft bar T10068 A must be situated in grooves in both camshafts.

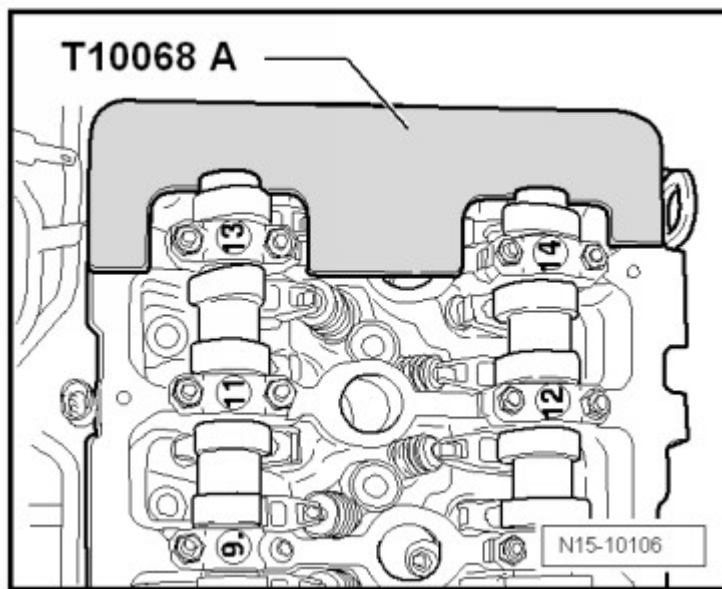


Fig. 123: Identifying Camshaft Bar T10068 A Engage In Shaft Grooves
Courtesy of AUDI OF AMERICA, LLC

-- Check again if crankshaft is at "TDC" marking.

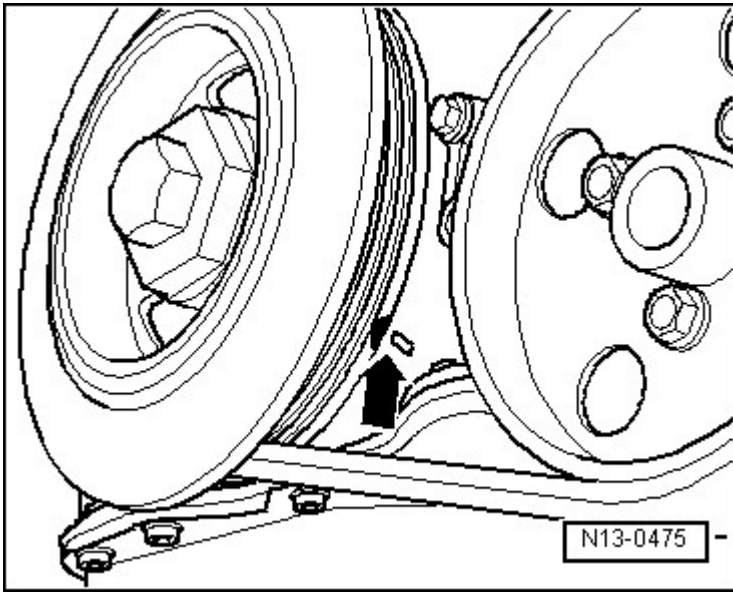


Fig. 124: Identifying Crankshaft At Vibration Damper Securing Bolt In Engine At TDC Cyl. 1
Courtesy of AUDI OF AMERICA, LLC

- Markings on vibration damper and sealing flange must align -arrow-.

-- Check whether fitting sleeves are inserted in cylinder block -arrows-.

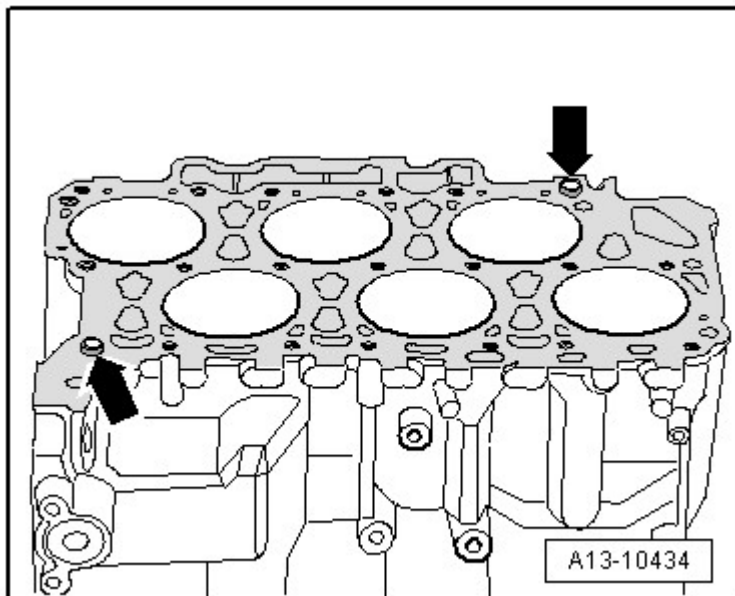


Fig. 125: Identifying Fitting Sleeves Inserted In Cylinder Block -Arrows-
Courtesy of AUDI OF AMERICA, LLC

-- Apply a sealant bead -arrows- to clean sealing surfaces on cylinder block joint and timing chain cover.

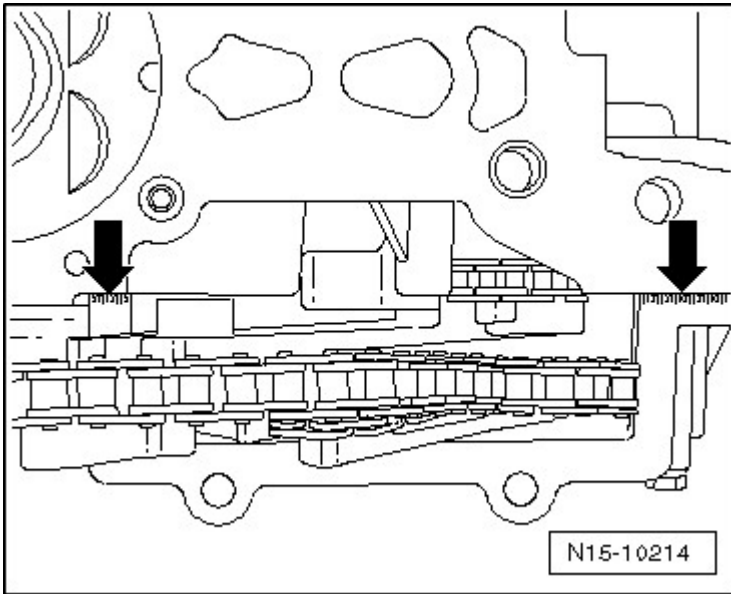


Fig. 126: Identifying Sealant Location For Cylinder Block/Sealing Flange
Courtesy of AUDI OF AMERICA, LLC

- Thickness of sealant beads: 2.0 mm.

CAUTION: Risk of plugging oil pump strainer with excess sealant.

- **Do not apply sealant bead thicker than indicated.**

-- Immediately apply cylinder head seal.

- Installed location: Part no. must be visible.

-- Always put some sealant in both of 3 mm holes that lie on sealant bead.

-- Set cylinder head in place.

-- Apply sealant in area -1- of cylinder head bolts.

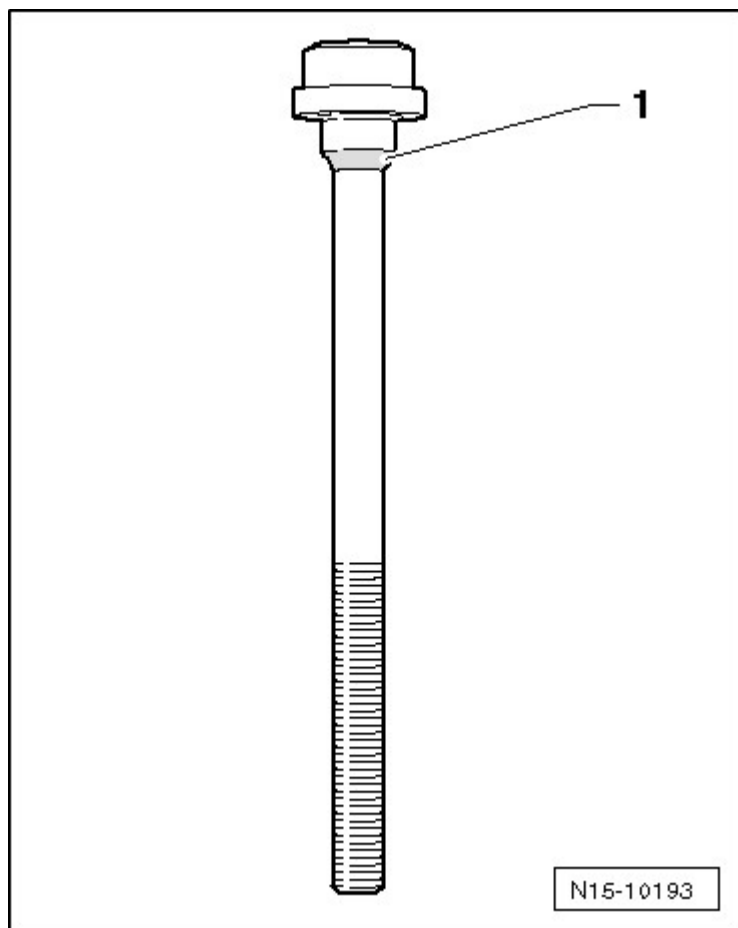


Fig. 127: Identifying Sealant Location For Cylinder Head Bolt
 Courtesy of AUDI OF AMERICA, LLC

-- Insert long bolts in center bores in cylinder head.

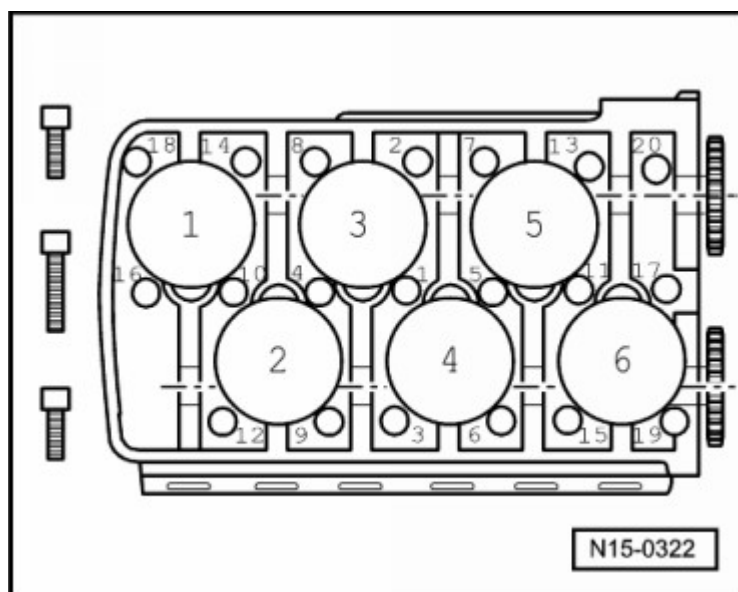


Fig. 128: Identifying Cylinder Head Tightening Sequence**Courtesy of AUDI OF AMERICA, LLC**

-- Tighten cylinder head bolts **Fig. 8**

NOTE: **Do not retighten cylinder head bolts after repairs.**

-- Install camshaft timing chain **INSTALLING (ADJUSTING VALVE TIMING)**.

-- Install cylinder head cover **CYLINDER HEAD COVER**

-- Install primary catalytic converters **PRIMARY CATALYTIC CONVERTERS** .

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

-- Change engine oil.

-- Replace coolant **COOLING SYSTEM, DRAINING AND FILLING** .

CAMSHAFTS**Special tools and workshop equipment required**

- Adhesive lubricating paste

Removing

NOTE: **During installation, all cable ties must be reinstalled at the same location.**

-- Remove camshaft timing chain from camshafts **CAMSHAFT TIMING CHAIN, REMOVING FROM CAMSHAFTS**.

-- Remove control housing -arrows- carefully remove from camshaft compression rings.

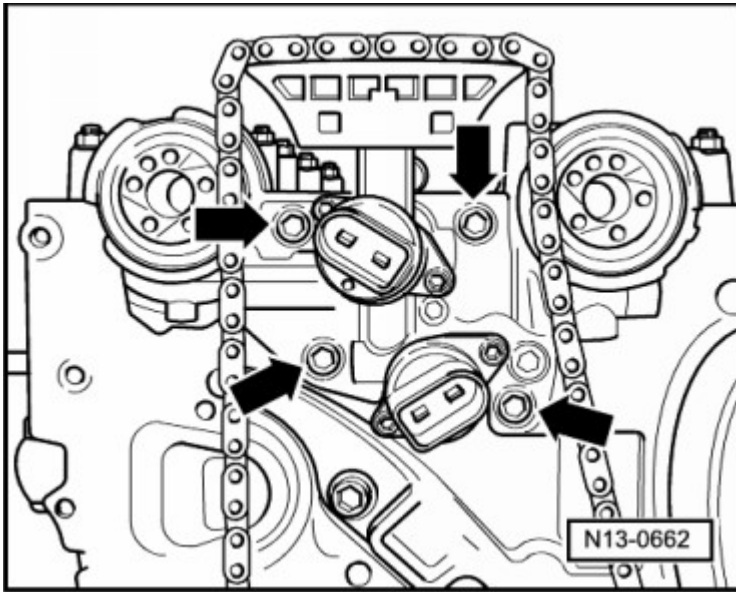


Fig. 129: Locating Control Housing-To-Cylinder Head Bolts
Courtesy of AUDI OF AMERICA, LLC

-- Lay aside camshaft timing chain.

-- Remove intake camshaft -A- as follows:

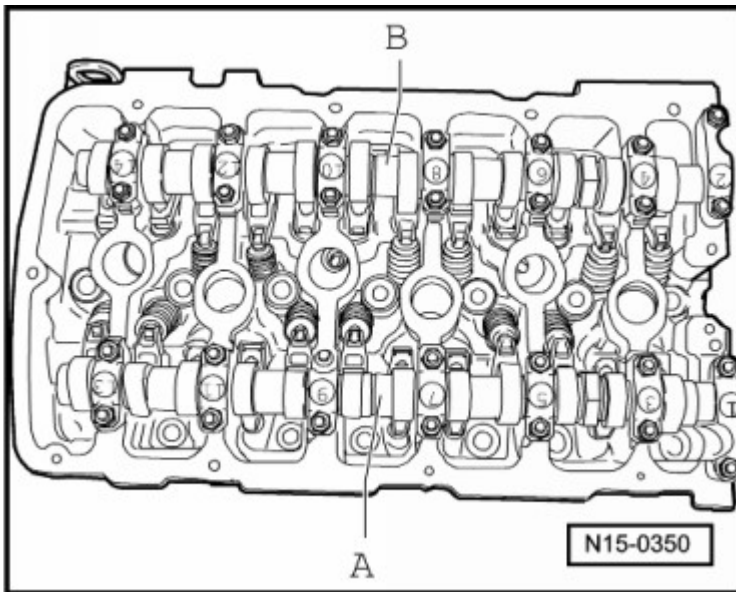


Fig. 130: Identifying Intake Camshaft And Exhaust Camshaft
Courtesy of AUDI OF AMERICA, LLC

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 alternating and in diagonal sequence, and remove.

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

Installing

- Tightening specifications **VALVETRAIN, ASSEMBLY OVERVIEW, Fig. 14**

CAUTION: Risk of damaging valves and piston crowns.

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

-- Insert support elements in cylinder head.

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

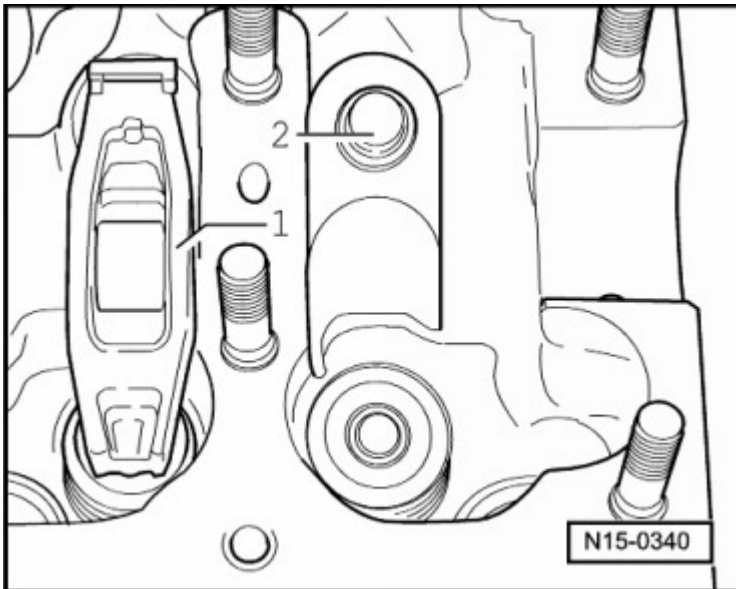


Fig. 131: Identifying Roller Cam Followers And Support Elements
Courtesy of AUDI OF AMERICA, LLC

-- Oil running surfaces of both camshafts.

-- Camshaft marking between cylinder 4 and 5 cam pair:

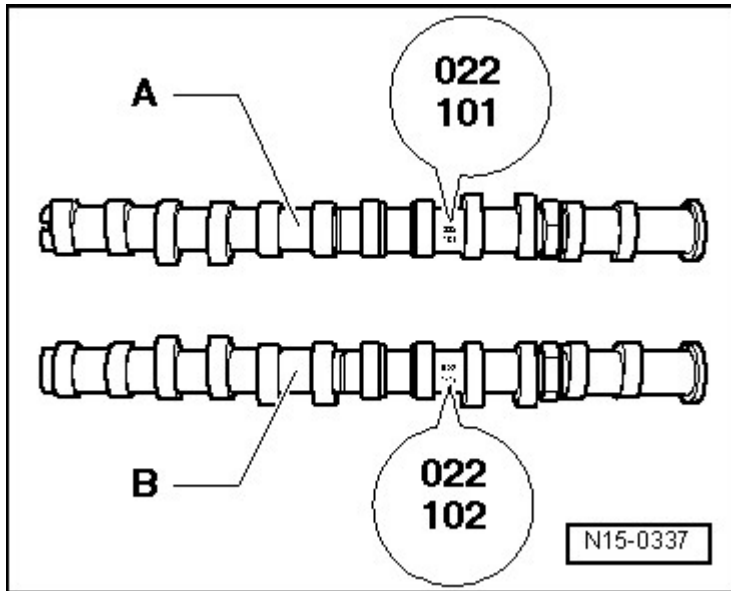


Fig. 132: Identifying Camshaft Identification, Valve Timing
Courtesy of AUDI OF AMERICA, LLC

A - Exhaust camshaft - Identification 022 - Index 101

B - Intake camshaft - Identification 022 - Index 102

-- Place camshafts in cylinder head camshaft bearing so that they stand at "TDC".

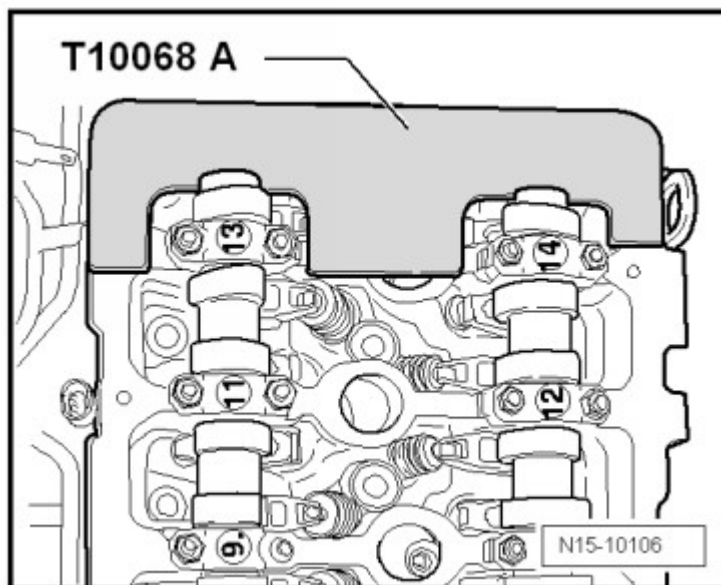


Fig. 133: Identifying Camshaft Bar T10068 A Engage In Shaft Grooves
Courtesy of AUDI OF AMERICA, LLC

- Camshaft bar T10068 A must be situated in grooves in both camshafts.

-- Remove camshaft bar T10068 A.

Bearing cap location:

- Points -arrow A- of intake and exhaust camshaft bearing caps face outwards.

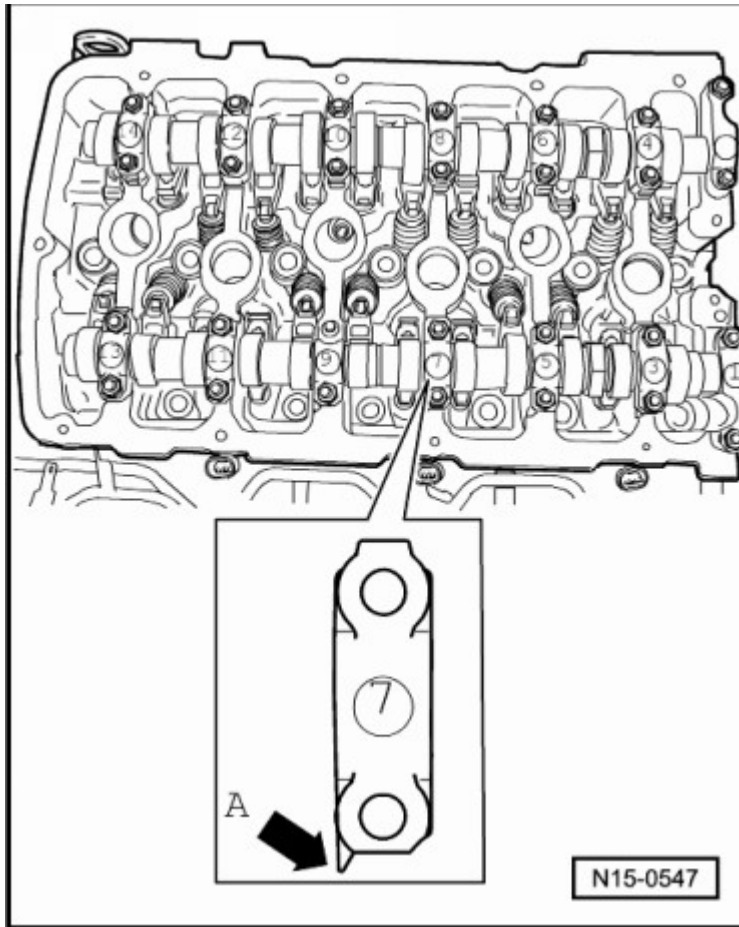


Fig. 134: Identifying Points Of Intake And Exhaust Camshaft Bearing Cap Face Outwards
Courtesy of AUDI OF AMERICA, LLC

- Identification on bearing caps is legible when read from intake side.

-- Coat contact surface -shaded- on bearing cap 7 and 8 with adhesive lubricating paste.

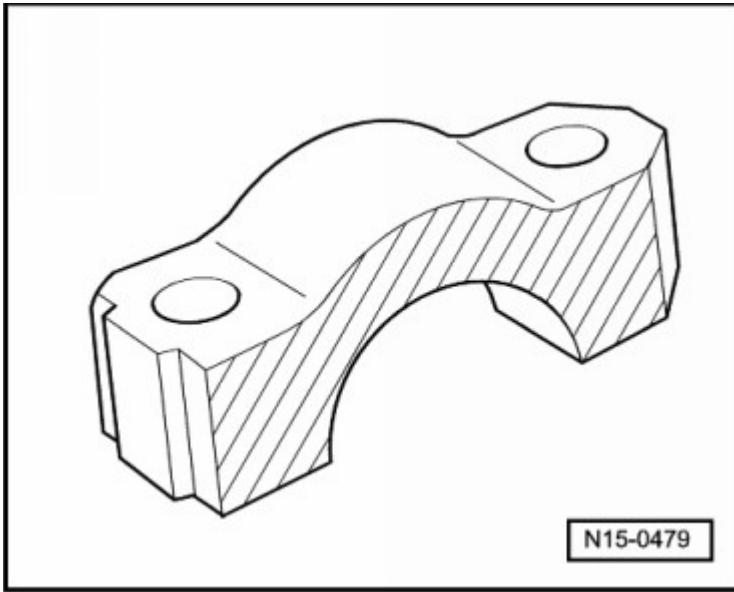


Fig. 135: Coating Bearing Caps 7 And 8 Contact Surface With Adhesive Lubricating Paste
Courtesy of AUDI OF AMERICA, LLC

-- Tighten camshaft bearing cap **Fig. 14**

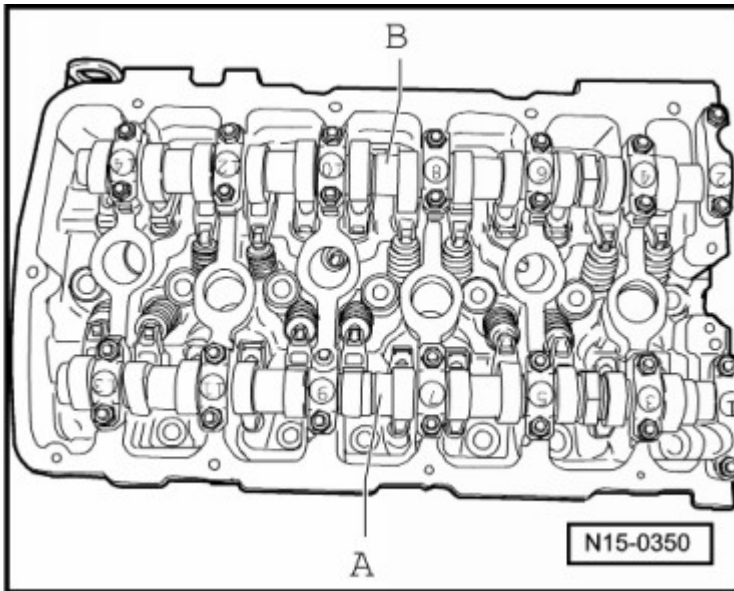


Fig. 136: Identifying Intake Camshaft And Exhaust Camshaft
Courtesy of AUDI OF AMERICA, LLC

-- Position camshafts at "TDC".

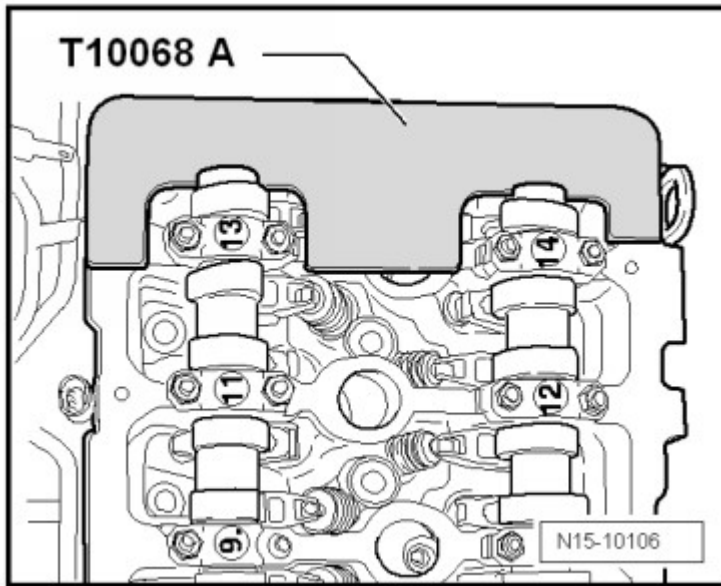


Fig. 137: Identifying Camshaft Bar T10068 A Engage In Shaft Grooves
 Courtesy of AUDI OF AMERICA, LLC

- Camshaft bar T10068 A must be situated in grooves in both camshafts.

NOTE: Turn camshaft back and forth slightly with an open end wrench -arrows- if necessary to insert camshaft bar T10068 A.

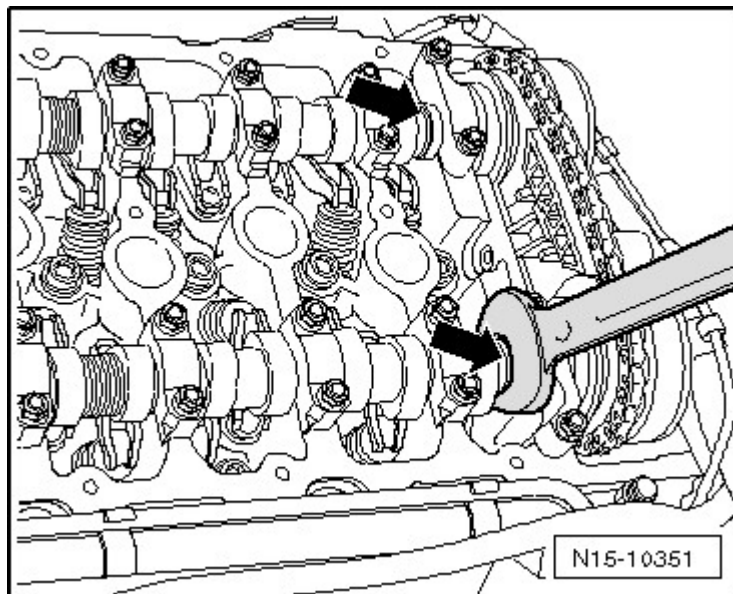


Fig. 138: Counter-Holding Camshaft Using Wrench
 Courtesy of AUDI OF AMERICA, LLC

-- Unclip screen -2- on back side of control housing -1- and clean.

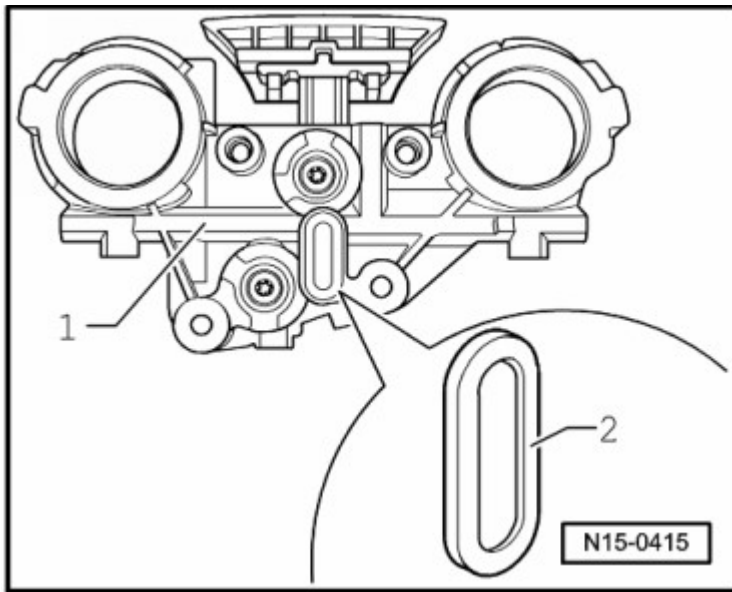


Fig. 139: Identifying Backside Of Control Housing & Screen
Courtesy of AUDI OF AMERICA, LLC

- Lightly lubricate camshaft compression ring contact surface in control housing.
- Lightly oil camshaft compression ring contact surfaces and carefully slide control housing over camshaft compression rings.
- Tighten control housing -arrows-.

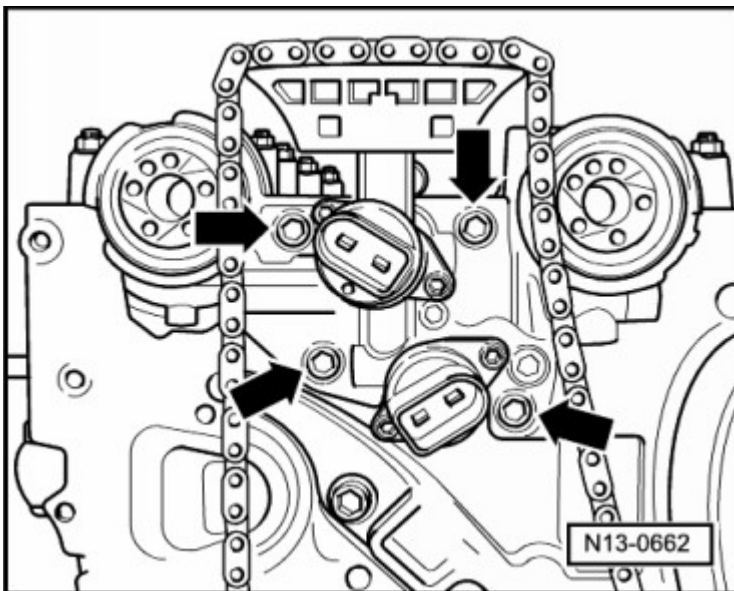


Fig. 140: Locating Control Housing-To-Cylinder Head Bolts
Courtesy of AUDI OF AMERICA, LLC

- Install camshaft timing chain (adjusting timing) **INSTALLING (ADJUSTING VALVE TIMING)**.

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

Special tools and workshop equipment required

- Spark plug removal tool 3122 B
- Valve seal removal tool 3364
- Valve stem seal driver 3365
- Valve cotter disassembly and assembly device VAS 5161 with guide plate VAS 5161/26
- Adapter T40012

Procedure

- Engine removed.

-- Camshafts, removing **CAMSHAFTS**.

-- Mark the allocation of the roller rocker lever and hydraulic adjusting elements so they can be installed again.

-- If necessary, remove roller rocker levers with hydraulic adjusting elements and place them on a clean surface.

-- Remove ignition coils **Removal and Installation** .

-- Remove spark plugs with spark plug removal tool 3122 B.

-- Move piston for respective cylinder to "Bottom Dead Center " (BDC) position.

-- Position drift VAS 5161/3 on valve spring plate.

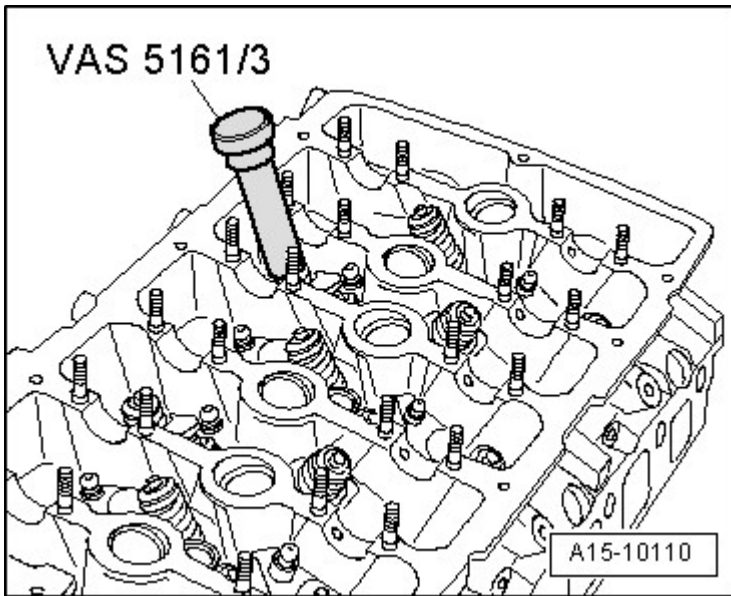


Fig. 141: Placing Drift VAS 5161/3 On Valve Plate
 Courtesy of AUDI OF AMERICA, LLC

- Loosen stuck valve keepers with a plastic hammer.
- Position guide plate VAS 5161/26 on cylinder head.

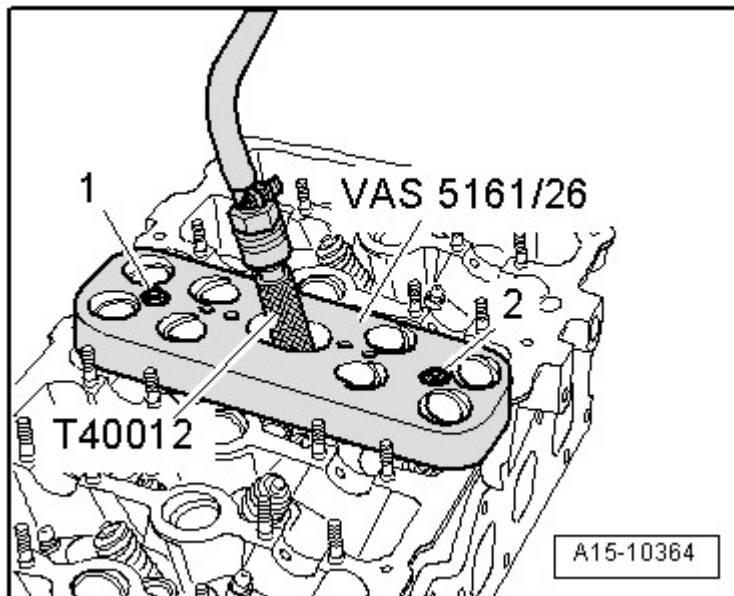


Fig. 142: Identifying Guide Plate VAS 5161/26 Installed On Cylinder Head And Installation Of Adapter T40012
 Courtesy of AUDI OF AMERICA, LLC

- Tighten guide plate with nuts -1 and 2- on cylinder head.

- Install adapter T40012 with sealing ring in respective spark plug thread and hand tighten.
- Connect hose to compressed air.
 - Minimum pressure: 6 bar positive pressure.

Outer Valve Row

- Install engaging device VAS 5161/6 with installation fork VAS 5161/5 in guide plate as shown in illustration.

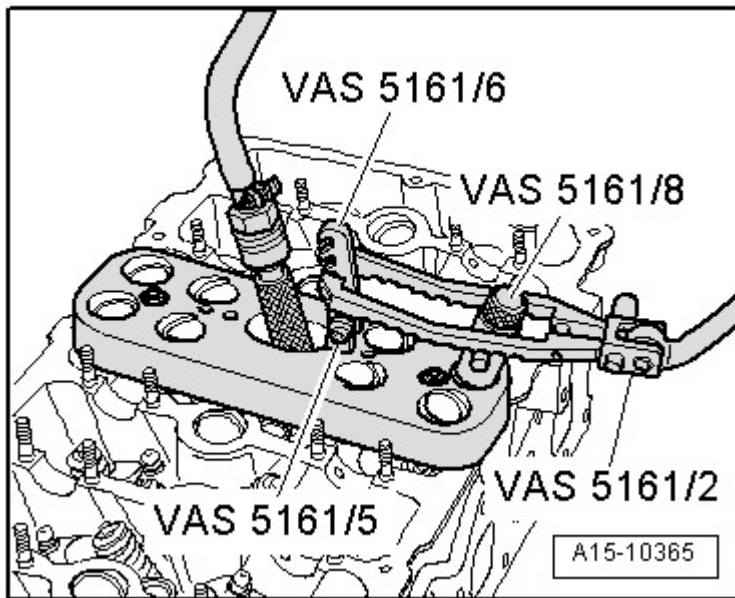


Fig. 143: Identifying VAS 5161/8, VAS 5161/2, And VAS5161/6 With VAS 5161/5 Installed In Guide Plate
Courtesy of AUDI OF AMERICA, LLC

- Slide installation cartridge VAS 5161/8 in guide plate.
- Engage pressure fork VAS 5161/2 on engaging device and press installation cartridge down.
- At the same time, rotate installation cartridge knurled screw right until points engage in valve keeper.
- Move knurled screw back and forth slightly.
 - Valve keepers are pressed against each other and capture in the installation cartridge.
- Release pressure fork.
- Remove installation cartridge.
- Unfasten guide plate and turn it aside.
 - Pressurized air hose remains connected.

-- Remove valve spring with valve spring plate.

Inner Valve Row

-- Install engaging device VAS 5161/6 with installation fork VAS 5161/5 in guide plate as shown in illustration.

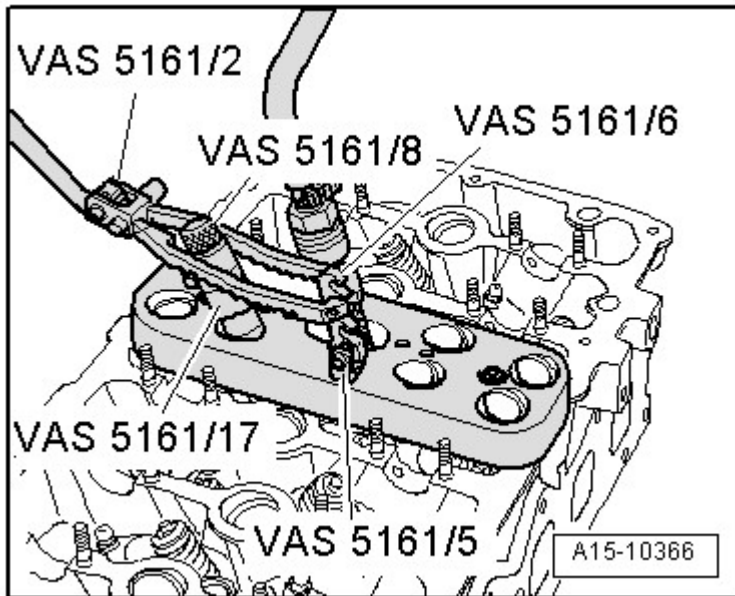


Fig. 144: Identifying VAS 5161/8, VAS 5161/2, And VAS5161/6 With VAS 5161/5 Installed In Guide Plate
Courtesy of AUDI OF AMERICA, LLC

-- Slide installation cartridge VAS 5161/8 in guide plate.

-- Slide knurled spacer ring VAS 5161/17 onto installation cartridge VAS 5161/8.

-- Slide installation cartridge in guide plate.

-- At the same time, rotate installation cartridge knurled screw right until points engage in valve keeper.

-- Move knurled screw back and forth slightly.

- Valve keepers are pressed against each other and capture in the installation cartridge.

-- Release pressure fork.

-- Remove 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

-- Remove valve stem seals using valve seal removal tool 3364.

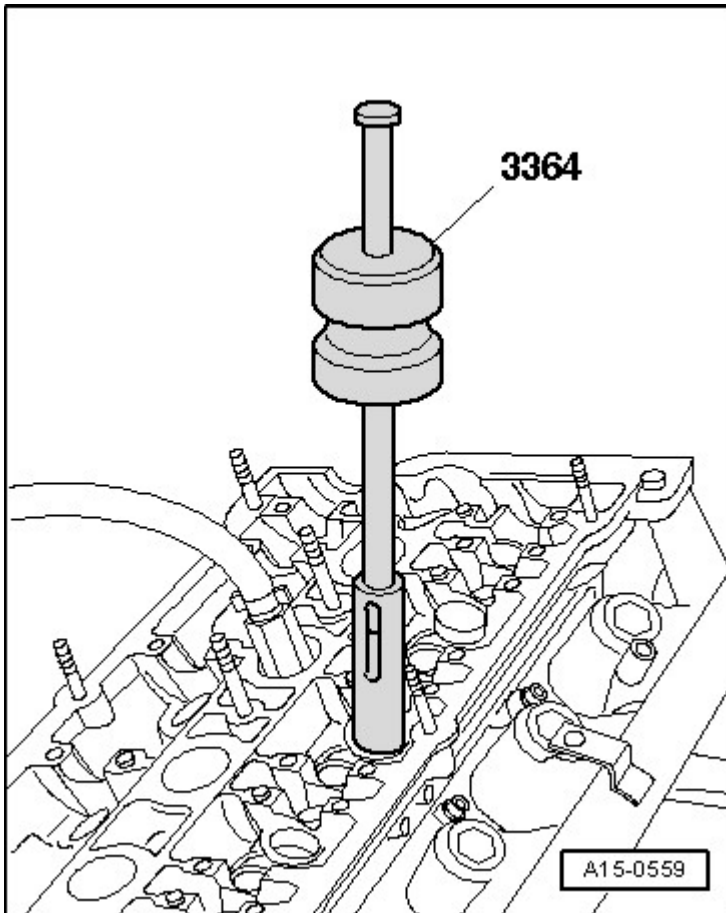


Fig. 145: Identifying Valve Seal Removal Tool 3364
Courtesy of AUDI OF AMERICA, LLC

CAUTION: Risk of damage when installing valve stem seals.

- Place plastic sleeve -A- that is attached to valve stem seals -B- on valve stem.

-- Lightly oil valve stem seal.

-- Slide valve shaft seal onto plastic sleeve.

-- Carefully press valve stem seal onto valve guide with valve stem seal drive 3365.

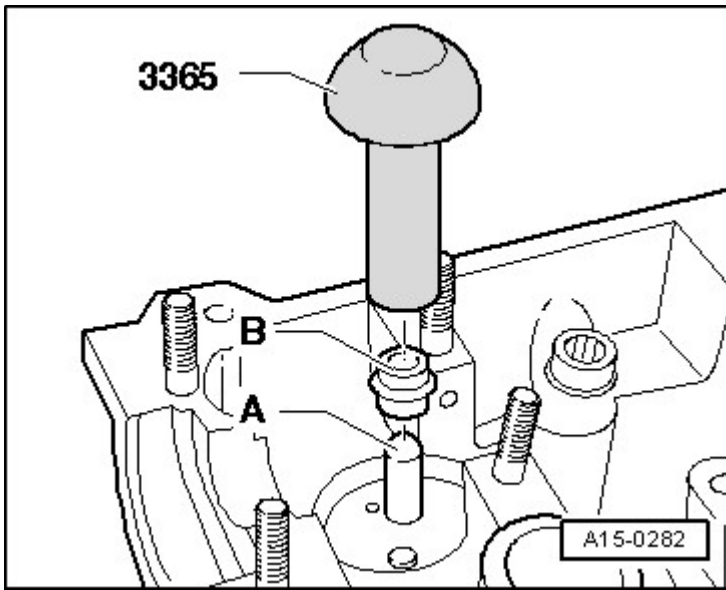


Fig. 146: Identifying Plastic Sleeve, New Valve Stem Oil Seals & Valve Stem Seal Driver 3365
 Courtesy of AUDI OF AMERICA, LLC

-- Remove plastic sleeve.

If valve keepers were removed from installation cartridge, they must next be inserted in valve keeper inserting tool VAS 5161/18:

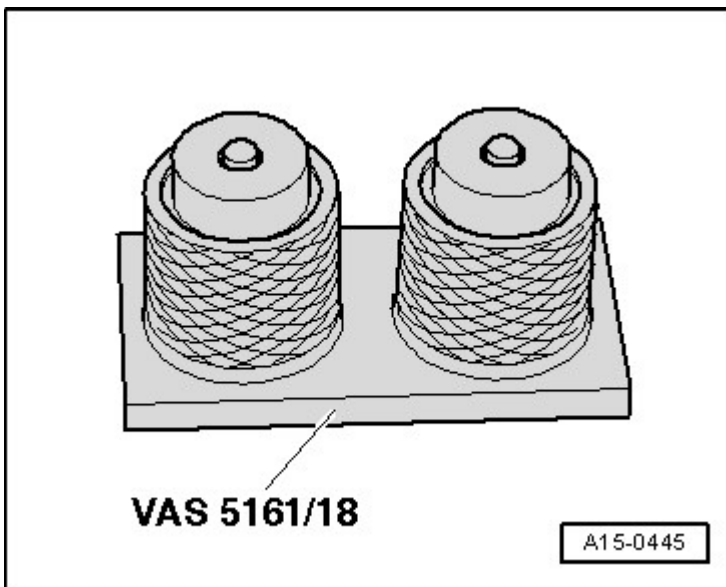


Fig. 147: Identifying Installation Cartridge VAS 5161/8
 Courtesy of AUDI OF AMERICA, LLC

- The large diameter of valve keeper point upward.

-- Press installation cartridge from above onto valve keeper inserting tool and capture keepers.

-- Insert valve spring and valve spring plate.

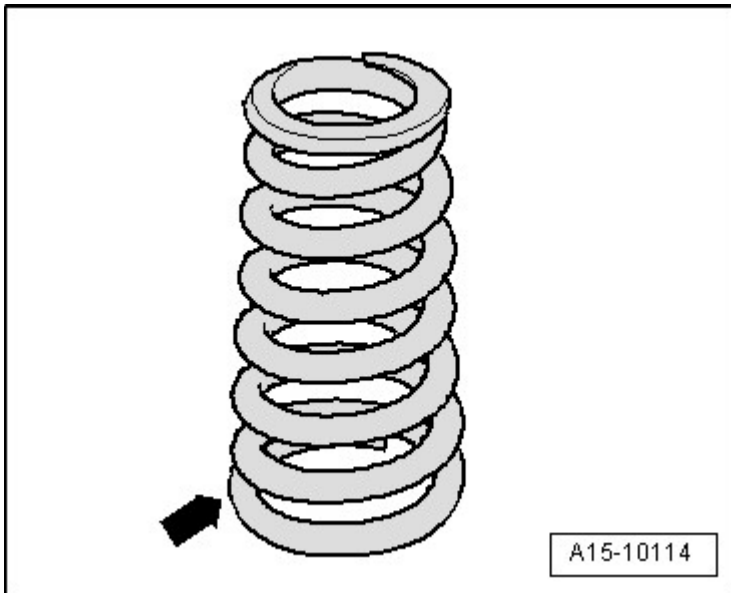


Fig. 148: Identifying Valve Spring And Valve Plate
Courtesy of AUDI OF AMERICA, LLC

- Installed location: Large diameter -arrow- on valve spring faces toward cylinder head.

-- Fasten guide plate on cylinder head again as shown in illustration.

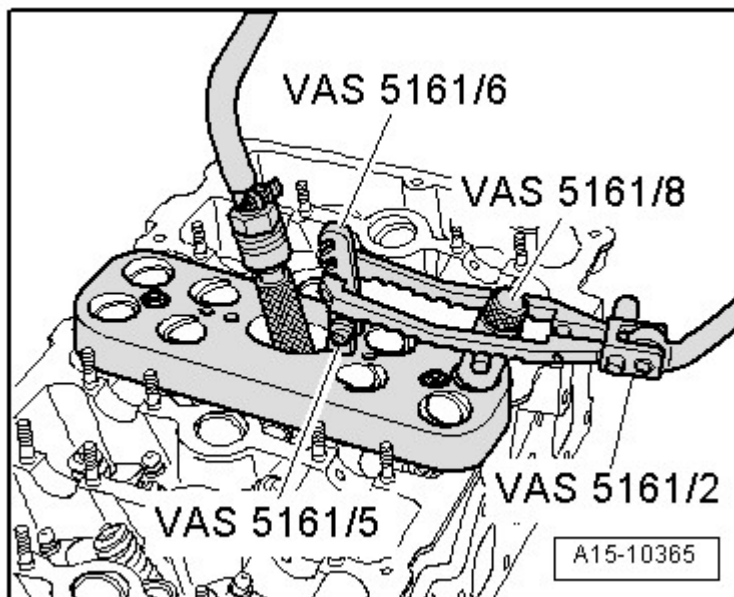


Fig. 149: Identifying VAS 5161/8, VAS 5161/2, And VAS5161/6 With VAS 5161/5 Installed In Guide Plate
Courtesy of AUDI OF AMERICA, LLC

Outer Valve Row

- Insert installation cartridge in guide plate.
- Press pressure fork down and pull knurled screw up, turning left and right.
 - The valve keepers are inserted in this manner.
- Release pressure fork with knurled screw still raised.

Inner Valve Row

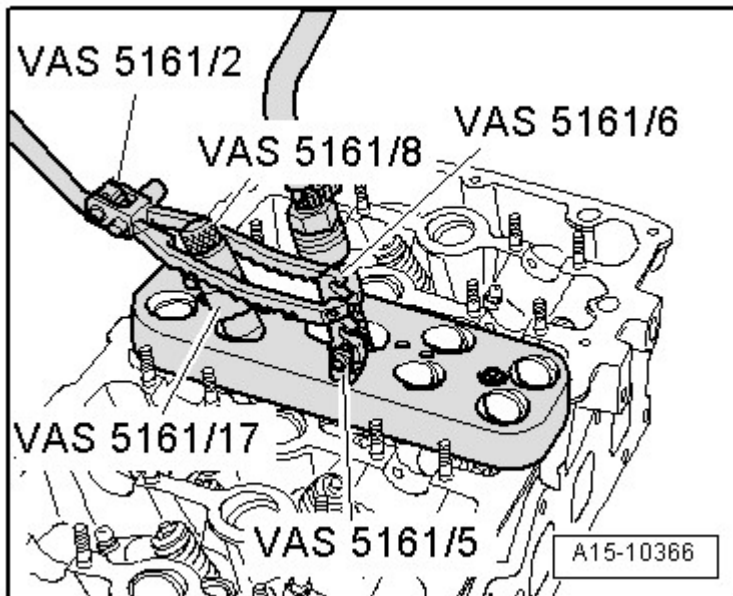


Fig. 150: Identifying VAS 5161/8, VAS 5161/2, And VAS5161/6 With VAS 5161/5 Installed In Guide Plate
Courtesy of AUDI OF AMERICA, LLC

- Insert installation cartridge in guide plate.
- Press pressure fork down and pull knurled screw up, turning left and right.
 - The valve keepers are inserted in this manner.
- Release pressure fork with knurled screw still raised.
- Repeat procedure on each valve.

Assembling

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

- Install camshafts CAMSHAFTS.
- Install spark plugs.

-- Install ignition coils **Removal and Installation** .

CAUTION: Risk of damaging valves and piston heads after working on valvetrain.

- To ensure valves do not strike pistons when starting, carefully rotate engine at least 2 full revolutions.

SPECIAL TOOLS

Special tools and workshop equipment required

- Hand drill with plastic brush attachment
- Depth gauge
- Valve seat reworking device
- Adhesive lubricating paste
- Protective glasses
- Sealant
- Camshaft bar T10068 A

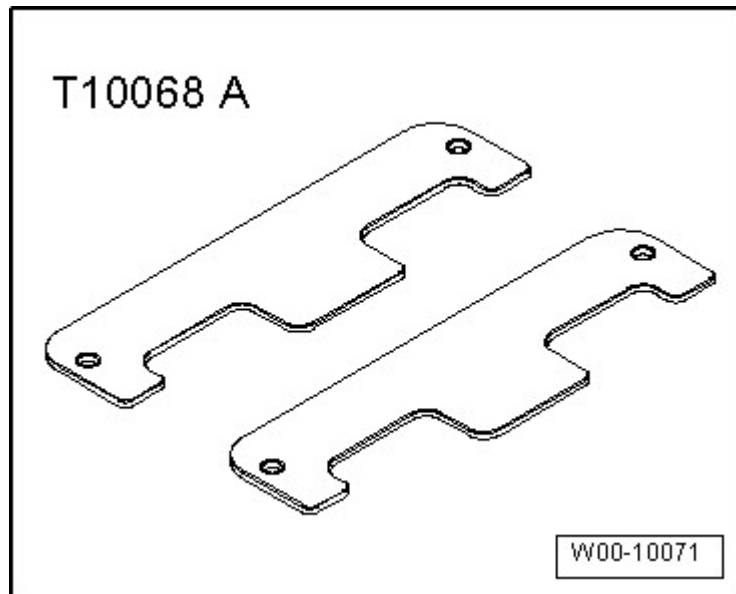


Fig. 151: Identifying Camshaft Bar T10068 A
Courtesy of AUDI OF AMERICA, LLC

- Spark plug removal tool 3122 B

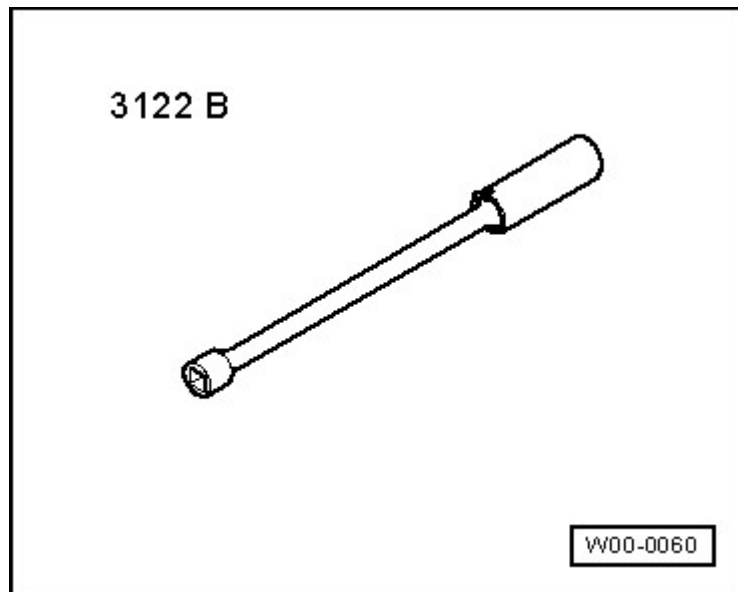


Fig. 152: Identifying Spark Plug Wrench 3122 B
Courtesy of AUDI OF AMERICA, LLC

- Compression tester V.A.G 1763

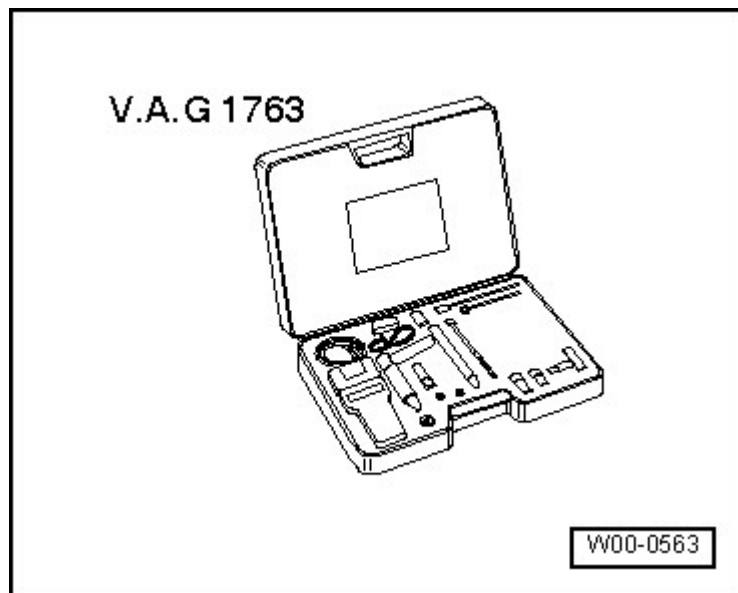


Fig. 153: Identifying Compression Tester V.A.G 1763
Courtesy of AUDI OF AMERICA, LLC

- Dial gauge holder VW 387

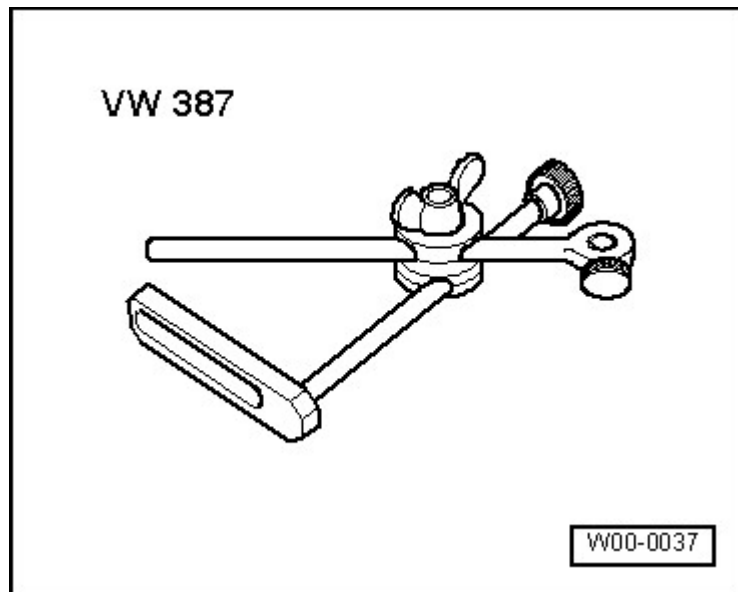


Fig. 154: Identifying Dial Gauge Holder VW 387
Courtesy of AUDI OF AMERICA, LLC

- Dial gauge VAS 6079

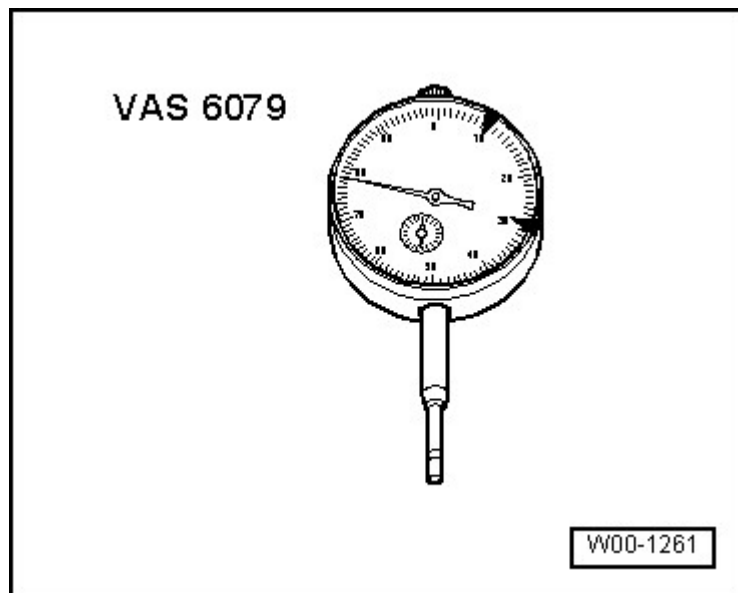


Fig. 155: Identifying Dial Gauge VAS 6079
Courtesy of AUDI OF AMERICA, LLC

- Assembly tool 3253

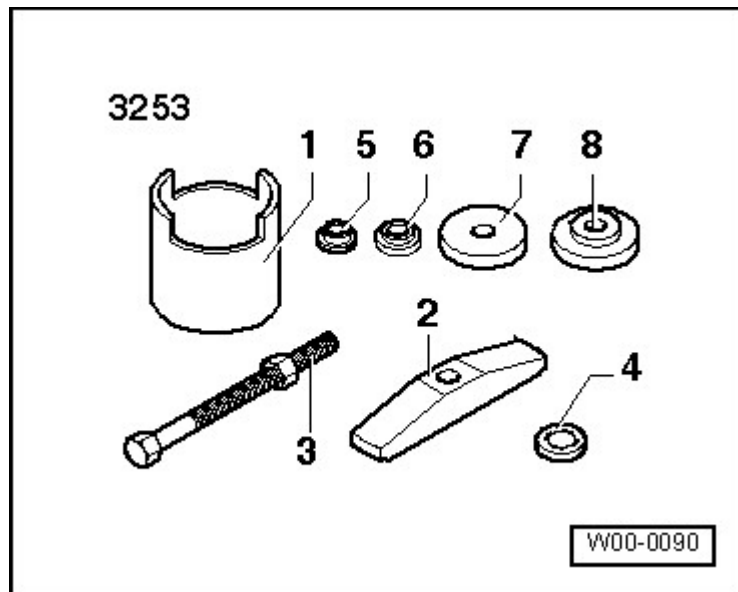


Fig. 156: Identifying Assembly Tool 3253
Courtesy of AUDI OF AMERICA, LLC

- Fitting sleeve 3378

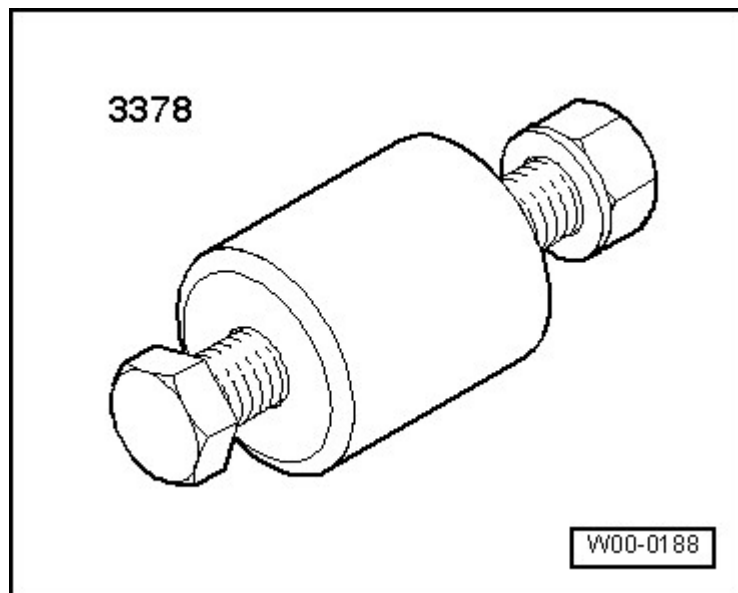


Fig. 157: Identifying Fitting Sleeve 3378
Courtesy of AUDI OF AMERICA, LLC

- Camshaft bar T10068 A

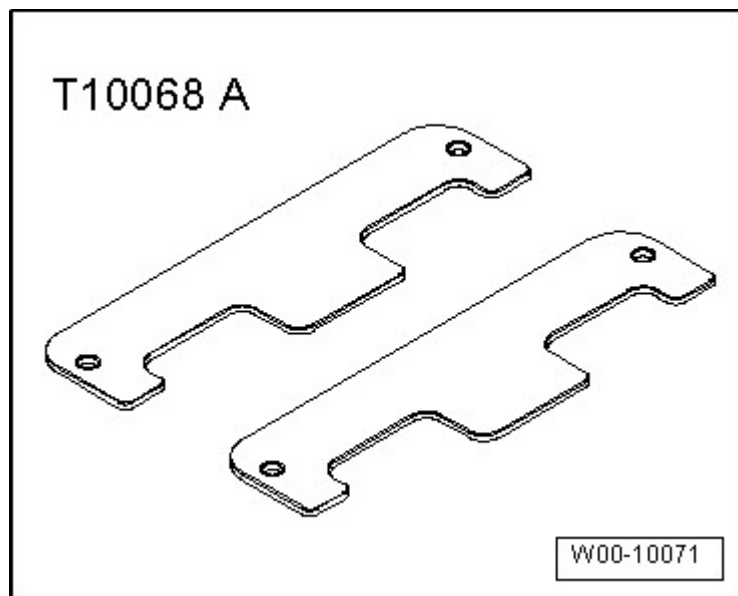


Fig. 158: Identifying Camshaft Bar T10068 A
Courtesy of AUDI OF AMERICA, LLC

- Adjustment tool T10332

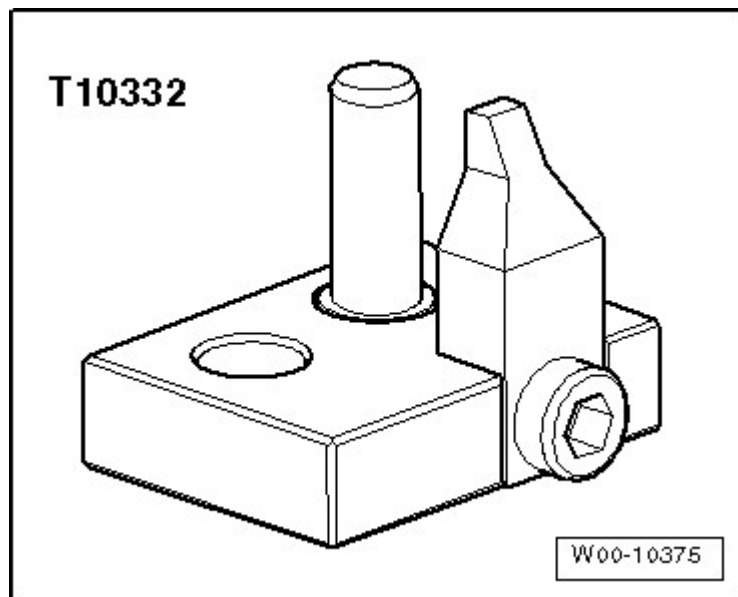


Fig. 159: Identifying Adjustment Tool T10332
Courtesy of AUDI OF AMERICA, LLC

- Adjustment tool T10363

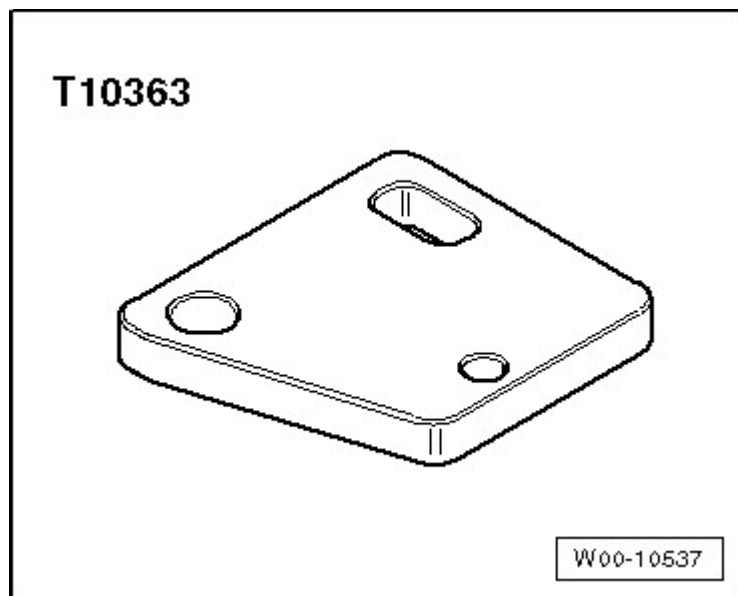


Fig. 160: Identifying Adjustment Tool T10363
Courtesy of AUDI OF AMERICA, LLC

- Lifting tackle 3033

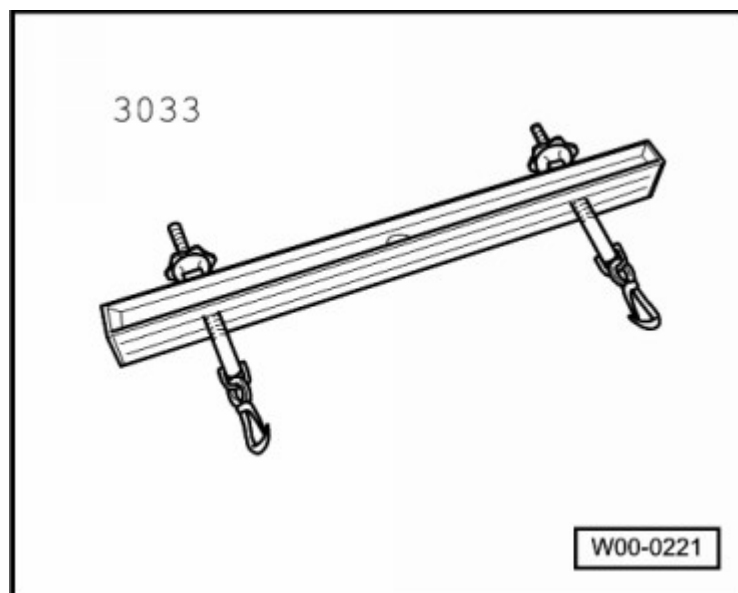


Fig. 161: Identifying Lifting Tackle 3033
Courtesy of AUDI OF AMERICA, LLC

- Shop crane VAS 6100

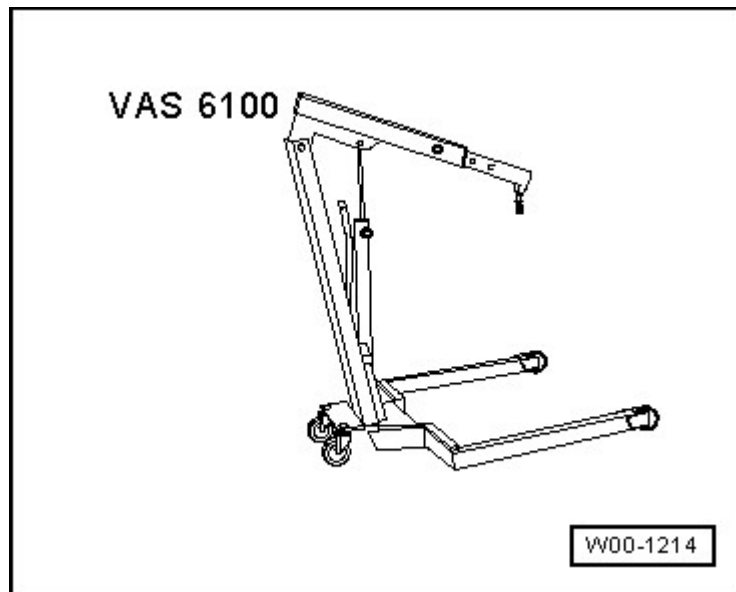


Fig. 162: Identifying Shop Crane VAS 6100
Courtesy of AUDI OF AMERICA, LLC

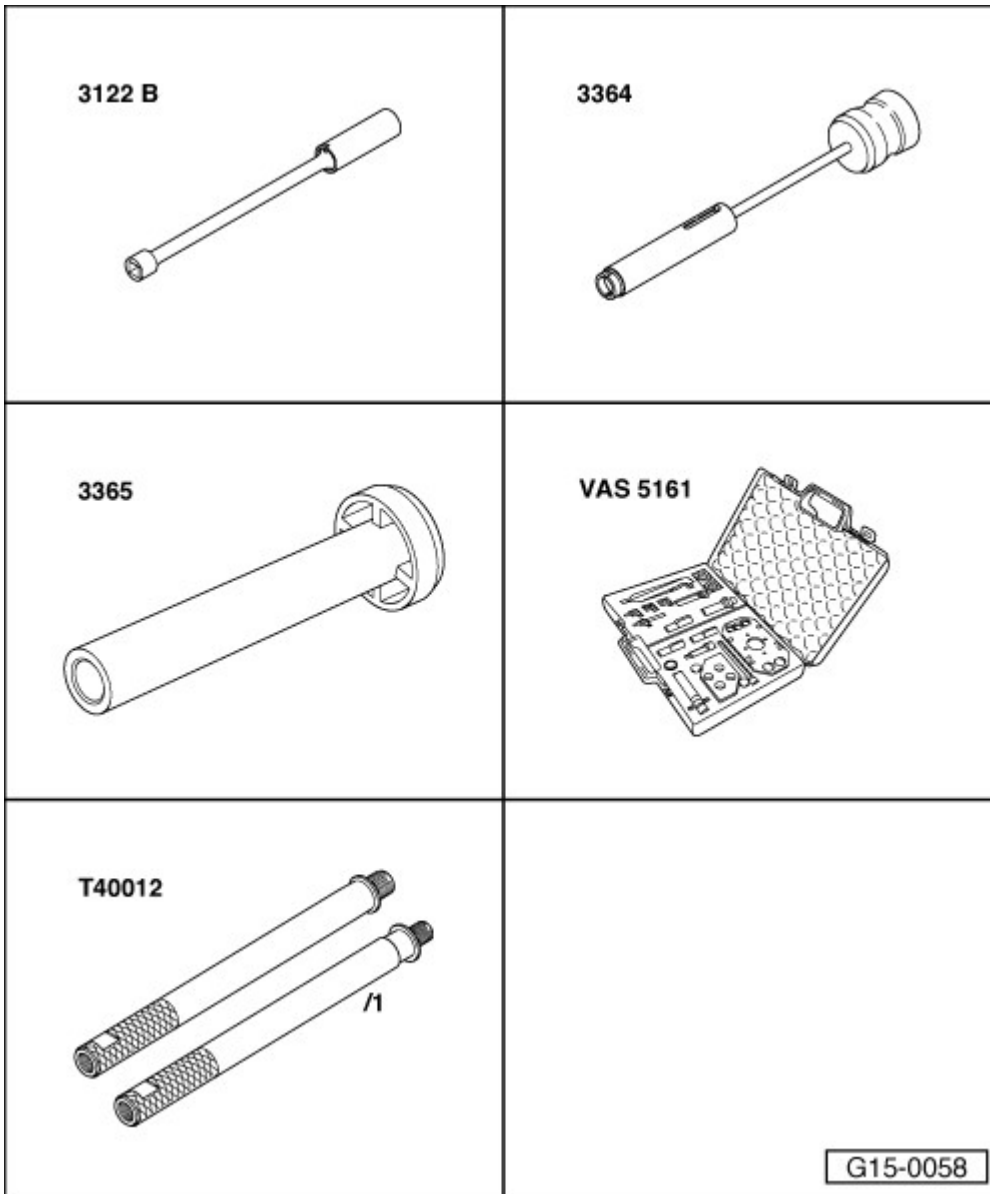


Fig. 163: Identifying Special Tools -- Valve Stem Seals, Cylinder Head Installed, Replacing
 Courtesy of AUDI OF AMERICA, LLC

Special tools and workshop equipment required

- Spark plug removal tool 3122 B
- Valve seal removal tool 3364
- Valve stem seal driver 3365
- Valve cotter disassembly and assembly device VAS 5161 with guide plate VAS 5161/26
- Adapter T40012

ENGINE**3.6 Liter - Ignition/Glow plug System - Engine Code(s): BHK****28 IGNITION/GLOW PLUG SYSTEM****GENERAL INFORMATION****SAFETY PRECAUTIONS**

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

- The ignition must be switched off before connecting or disconnecting the ignition system wiring or tester cables.
- 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 5051.

-- Start "Guided Functions" operating mode.

-- Generate readiness code in ECM.

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

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

If it is necessary to use testing and measuring devices on road tests, observe the following

WARNING: There is a risk of injury from the passenger airbag deploying in an accident.

- **Always secure testing and measuring equipment on the rear seat and have a second person operate it from there.**

DESCRIPTION AND OPERATION**IGNITION, ASSEMBLY OVERVIEW**

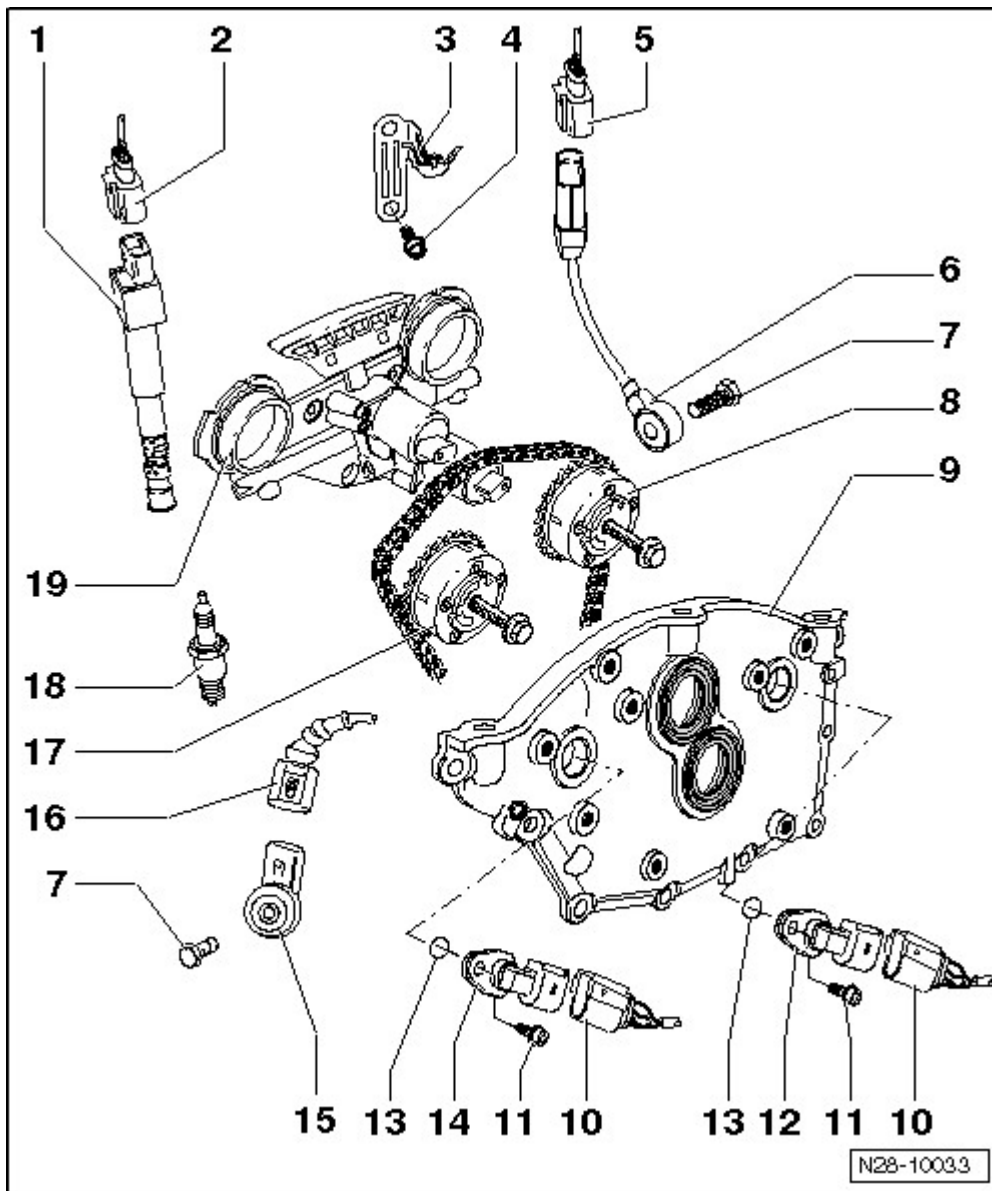


Fig. 1: Identifying Assembly Overview: Ignition

Courtesy of AUDI OF AMERICA, LLC

1. Ignition coils with power output stages
 - Cylinder 1 ignition coil 1 with power output stage -N70-
 - Cylinder 2 ignition coil 2 with power output stage -N127-
 - Cylinder 3 ignition coil 3 with power output stage -N291-
 - Cylinder 4 ignition coil 4 with power output stage -N292-
 - Cylinder 5 ignition coil 5 with power output stage -N323-
 - Cylinder 6 ignition coil 6 with power output stage -N324-
 - Removing and installing **IGNITION COILS**.
2. 4-pin harness connector

- For ignition coils with power output stage
- 3. Bracket
 - For Knock Sensor (KS) 1 -G61- connector
- 4. Bolt
 - 10 Nm
- 5. 3-pin harness connector
 - Black
 - With gold-plated terminals
- 6. Knock sensor 1 -G61-
- 7. Bolt
 - 20 Nm
 - Follow exact tightening specification for proper knock sensor function
- 8. Camshaft adjuster
 - Exhaust side
 - With sensor wheel for Camshaft Position (CMP) sensor 2 -G163-
- 9. Camshaft timing chain upper cover
- 10. 3-pin harness connector
 - Black
 - With gold-plated terminals
 - Mark before removing
- 11. Bolt
 - 10 Nm
- 12. Camshaft Position (CMP) sensor 2 -G163-
 - For exhaust camshaft
- 13. Seal
 - Replace
- 14. Camshaft Position (CMP) sensor -G40-
 - For intake camshaft
- 15. Knock sensor 2 -G66-
- 16. 2-pin harness connector
 - Black
 - With gold-plated terminals
- 17. Camshaft adjuster
 - Intake side
 - With sensor wheel for Camshaft Position (CMP) sensor -G40-
- 18. Spark plug
- 19. Control housing
 - For camshaft adjustment

2009 Audi Q7 3.6

ENGINE 3.6 Liter - Ignition/Glow plug System - Engine Code(s): BHK

SPECIFICATIONS

TECHNICAL DATA

Test data	3.6L / 4V / 206 kW-Motor
Idle speed (not adjustable)	600 to 800/min ⁽¹⁾
Engine speed limitation via fuel injector shut off	approximately 6200 RPM
Ignition timing	Not adjustable, regulated by control module
Ignition system	Single coil ignition system with 6 ignition coils (output stages integrated) that are connected directly to spark plugs via the ignition cables.
Spark plugs Tightening specifications	-
Ignition sequence	1-5-3-6-2-4
(1) Depending on Engine Control Module (ECM) requirements.	

REMOVAL AND INSTALLATION

IGNITION COILS

Special tools and workshop equipment required

- Puller for ignition coil T10095 A

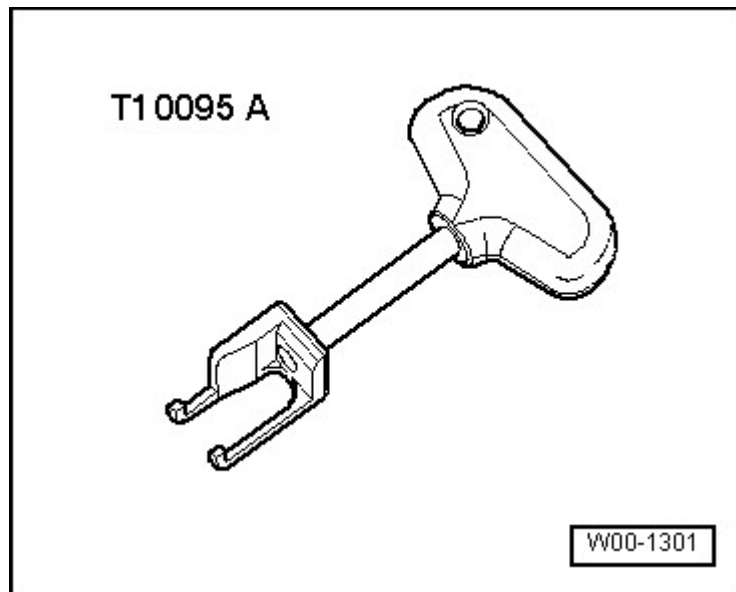


Fig. 2: Identifying Puller For Ignition Coil T10095 A
Courtesy of AUDI OF AMERICA, LLC

- Assembly tool T10118

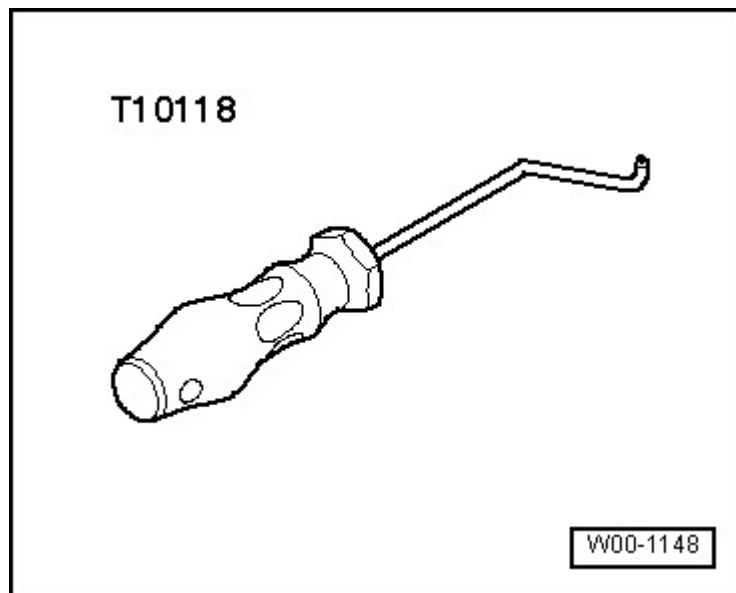


Fig. 3: Identifying Assembly Tool T10118
Courtesy of AUDI OF AMERICA, LLC

Removing

-- Disconnect electrical connectors at ignition coils by placing assembly tool T10118 on release button -arrow- and carefully removing connector.

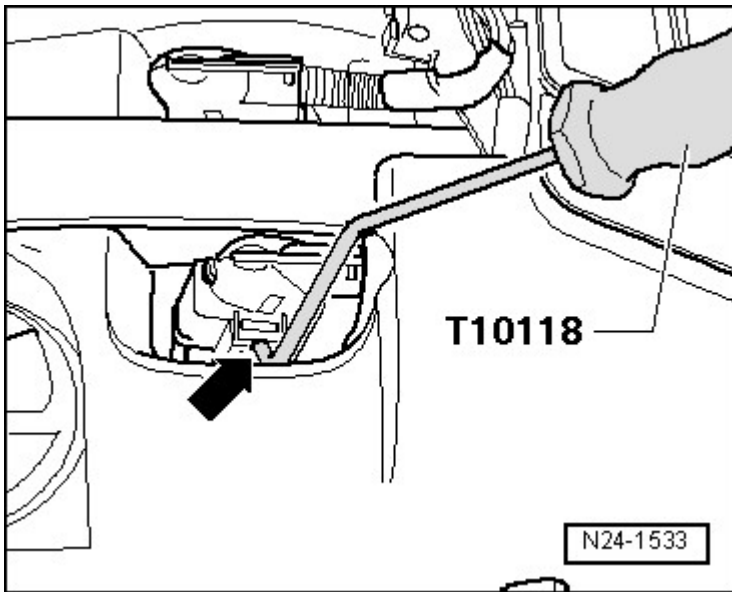


Fig. 4: Disconnecting Electrical Harness Connectors To Ignition Coils
Courtesy of AUDI OF AMERICA, LLC

-- Place puller for ignition coil T10095 A on ignition coils -arrow-, as shown in illustration, and pull out ignition coils one after another.

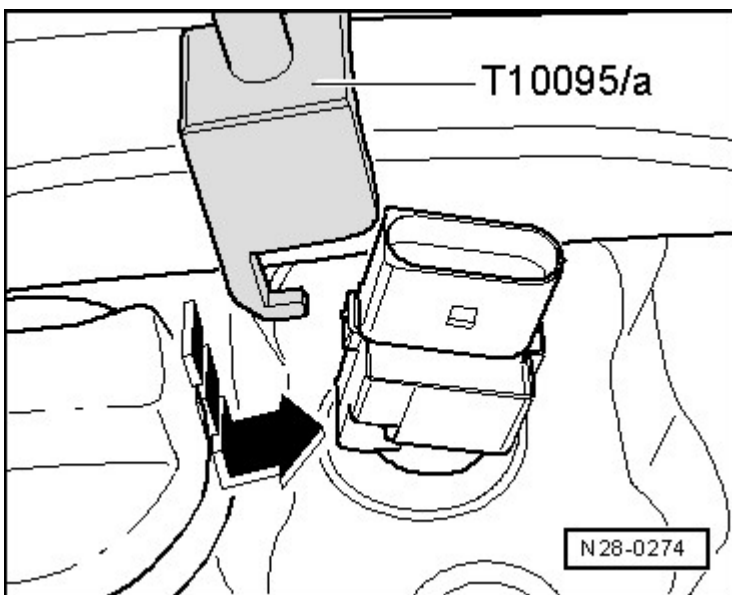


Fig. 5: Attaching Puller For Ignition Coil T10095 A On Ignition Coils And Pulling Out Ignition Coils In Succession
Courtesy of AUDI OF AMERICA, LLC

Installing

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

-- Place ignition coils in respective spark plug shaft so the straight connector sides fit with each other -arrows-.

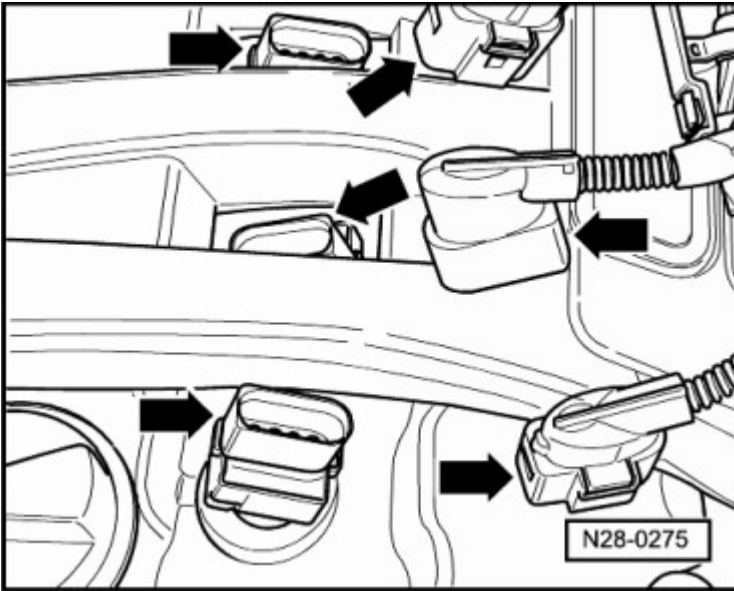


Fig. 6: Identifying Ignition Coil With Power Output Stage
Courtesy of AUDI OF AMERICA, LLC

SPECIAL TOOLS

Special tools and workshop equipment required

- Puller for ignition coil T10095 A

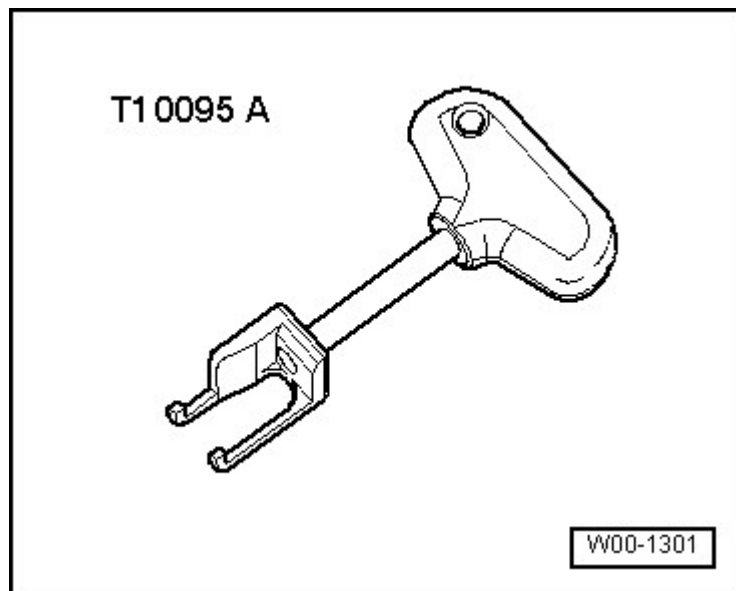


Fig. 7: Identifying Puller For Ignition Coil T10095 A
Courtesy of AUDI OF AMERICA, LLC

- Assembly tool T10118

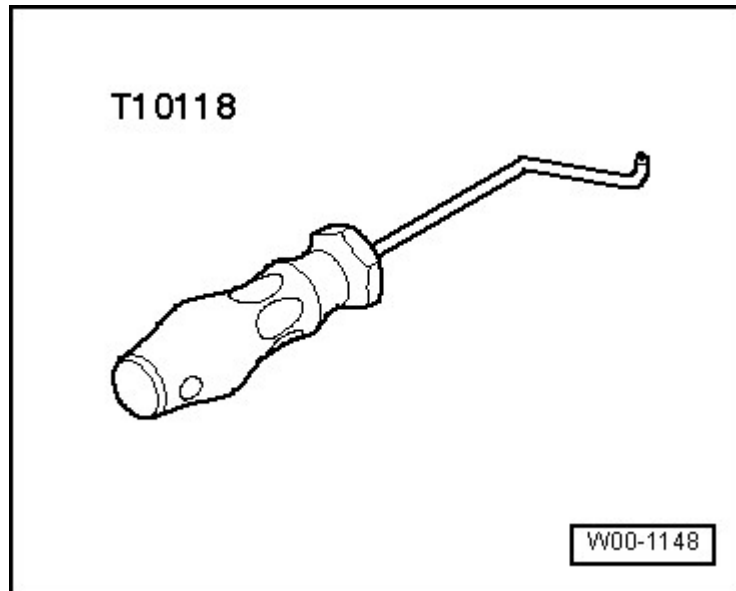


Fig. 8: Identifying Assembly Tool T10118
Courtesy of AUDI OF AMERICA, LLC