

2009 Audi Q5 Quattro

ENGINE 3.2 Liter - Crankshaft, Cylinder Block - Engine Code(s): CALB

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13 CRANKSHAFT, CYLINDER BLOCK

DESCRIPTION AND OPERATION

CRANKSHAFT OVERVIEW

NOTE: To perform assembly work, secure the engine using the bracket for V6 FSI engine, Audi A6 VAS 6095/1-5 on the engine and transmission holder VAS 6095. Refer to ENGINE, SECURING TO ENGINE AND TRANSMISSION HOLDER .

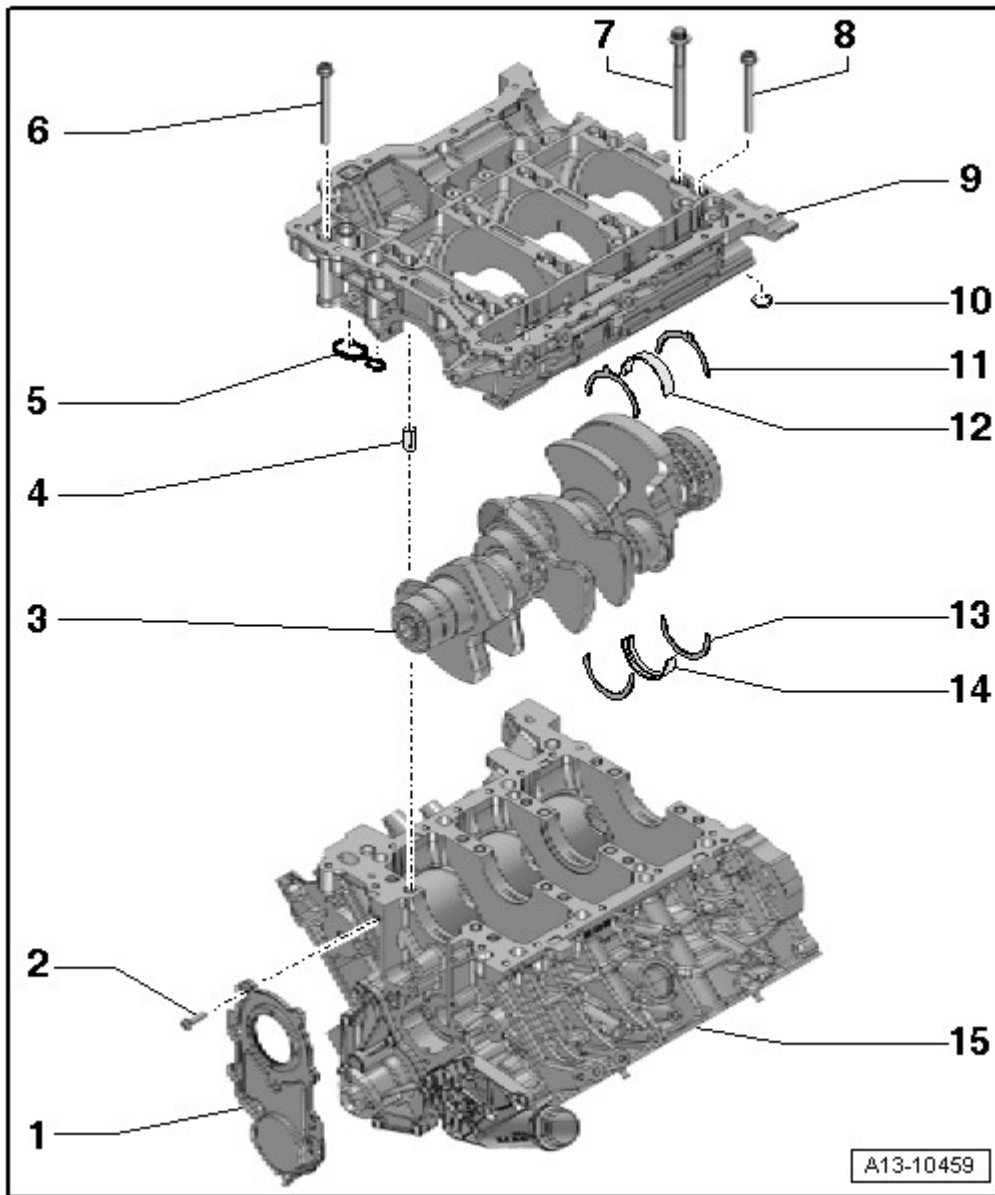


Fig. 1: Identifying Crankshaft Overview

Courtesy of AUDI OF AMERICA, LLC

1. Sealing Flange (belt pulley side)
 - Removing and installing, refer to **SEALING FLANGE WITH CRANKSHAFT SEAL, BELT PULLEY SIDE**
2. Bolt
 - Tightening specification, refer to **Fig. 15**
3. Crankshaft
 - Measuring axial play, refer to **AXIAL CLEARANCE, MEASURING**
 - Radial clearance, measuring, refer to **RADIAL CLEARANCE, MEASURING**
 - Crankshaft dimensions, refer to **CRANKSHAFT DIMENSIONS**

4. Alignment Bushing
 - Quantity: 4
 - Insert into guide frame, refer to **Fig. 4**
5. Gasket
 - Replace
6. Bolt
 - For guide frame to cylinder block sealing surfaces
 - Varying bolt lengths and bolt heads
 - Tightening sequence, refer to **Fig. 5**
7. Long Bolt, Large Shoulder
 - For inner row of guide frame
 - Tightening sequence, refer to **Fig. 5**
8. Short Bolt, Small Shoulder
 - For outer row of guide frame
 - Tightening sequence, refer to **Fig. 5**
9. Guide Frame
 - With oil pressure regulation valve -N428-, refer to **Fig. 3**
 - To remove, remove timing chain guide rail, refer to item 8: **TIMING MECHANISM DRIVE CHAIN OVERVIEW**
 - Sealant application, refer to **Fig. 4**
 - Oil pressure regulation valve, removing and installing, refer to **Oil Pressure Regulation Valve - N428-**
10. Seal
 - Replace
11. Thrust Washer
 - Only at 3rd crankshaft bearing
 - Installed position: lubricating grooves face outward
 - Note locating point in guide frame
12. Bearing Shell
 - For guide frame without lubricating groove
 - Mark used bearing shells for reinstallation but not on the running surface
 - Replace bearing shells that have worn down to the nickel layer
 - Pay attention to the installed position
 - Insert new bearing shells for guide frame with proper color marking, refer to **Fig. 7**
13. Not Installed
14. Bearing Shell
 - For cylinder block with oil groove
 - Mark used bearing shells for reinstallation but not on the running surface

- Replace bearing shells that have worn down to the nickel layer
- Pay attention to the installed position
- Insert new bearing shells for cylinder block with proper color marking, refer to **Fig. 6**

15. Cylinder Block

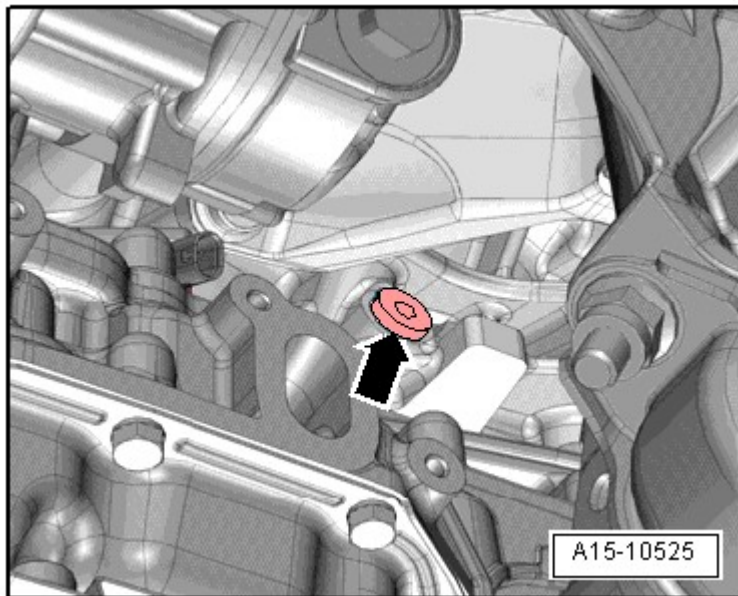


Fig. 2: Identifying Locking Bolt -Arrow-
Courtesy of AUDI OF AMERICA, LLC

NOTE: Replace the O-ring.

-- Tighten the locking bolt -arrow- to 14 Nm.

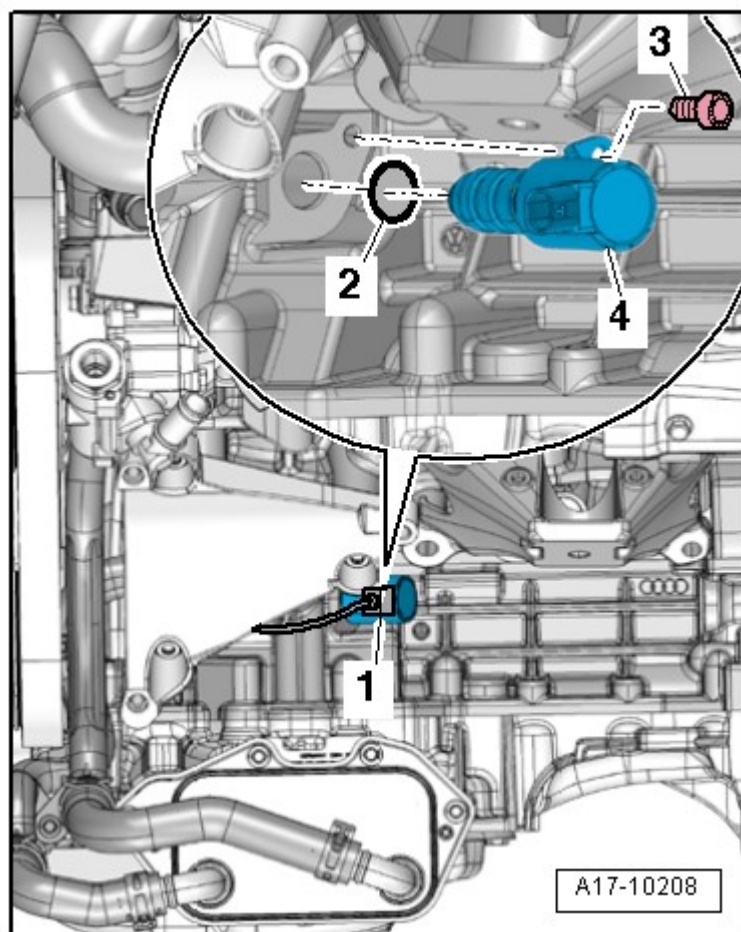


Fig. 3: Identifying Oil Pressure Regulation Valve -N428-
Courtesy of AUDI OF AMERICA, LLC

1. Electrical harness connector
2. O-ring - replace
3. Bolt - 9 Nm
4. Oil pressure regulation valve -N428-

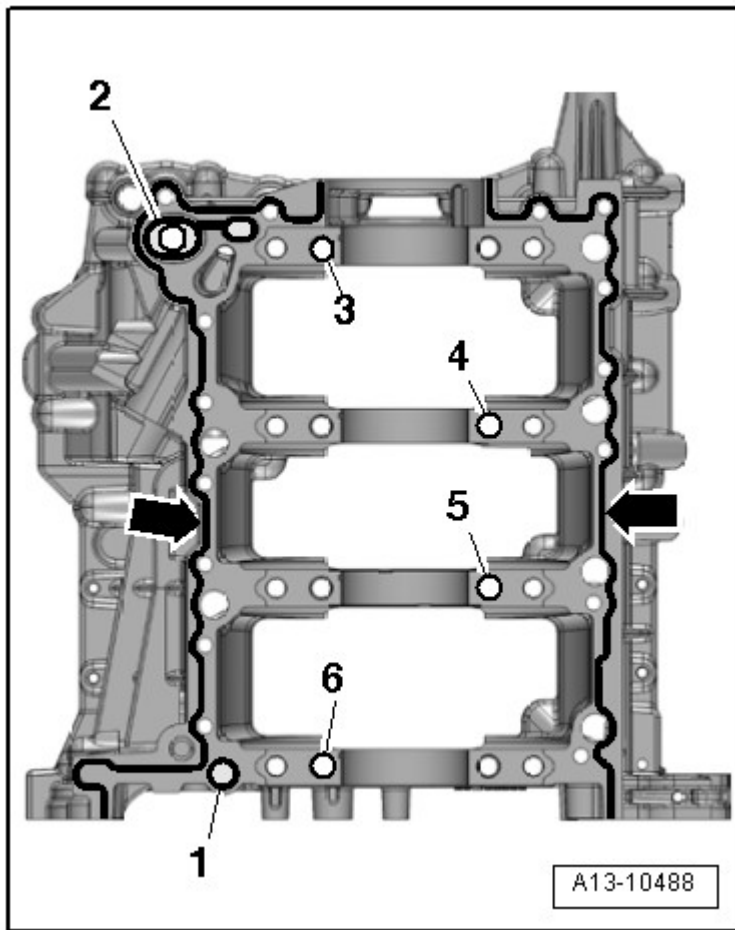


Fig. 4: Identifying Sealant Application For Guide Frame And Position Of Alignment Bushings
 Courtesy of AUDI OF AMERICA, LLC

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

-- Apply sealant beads -arrows- to the clean sealing surfaces on the guide frame as shown in the illustration.

- The groove of the sealing surface must be completely filled with sealant.
- The sealant beads must be 1.5 to 2.0 mm above the sealing surface.

-- Position seals -1 and 2-.

-- Check if the alignment bushings -3 through 6- are inserted at the locations in the guide frame as shown in the illustration.

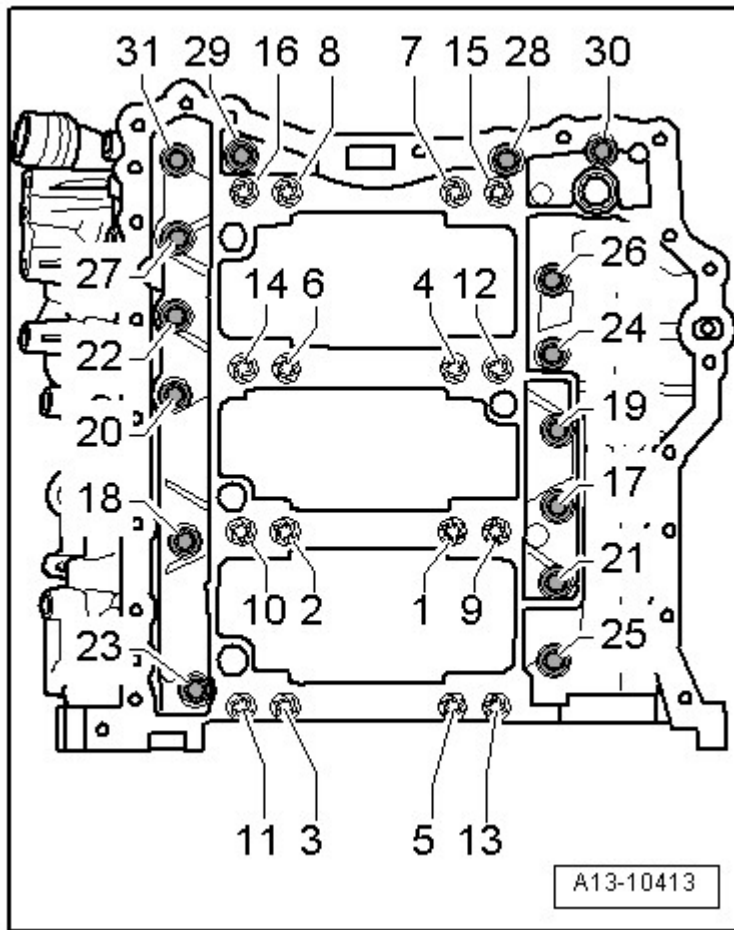


Fig. 5: Identifying Guide Frame Bolts Tightening Sequence
 Courtesy of AUDI OF AMERICA, LLC

- Replace the guide frame bolts.
- Insert the long bolts in the inner row of the guide frame.
- Tighten the bolts -1 through 31- in 3 stages as follows:
- Tighten the bolts to 50 Nm in the following sequence: -1 to 16-.
- Tighten the bolts an additional 90° in the following sequence: -1 to 16-.
- Tighten the bolts for the guide frame sealing surfaces on the cylinder block to 23 Nm in the following sequence: -17 to 31-.

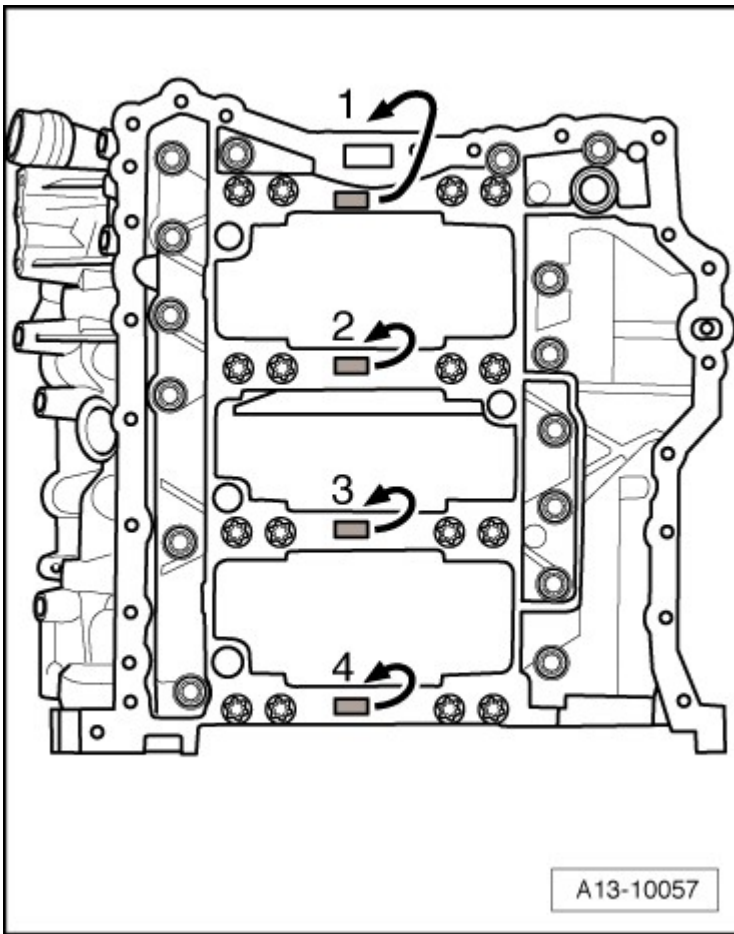


Fig. 6: Identifying Allocation Of Crankshaft Bearing Shells For Cylinder Block
 Courtesy of AUDI OF AMERICA, LLC

- Bearing shells with the correct thickness are allocated to the cylinder block in the factory. Colored dots on sides of bearing shells serve for identifying bearing shell thickness.
- Allocation of bearing shells to cylinder block is marked by a letter on the respective bearing on guide frame

Letter on Guide Frame	Color of Bearing
R=	Red
G=	Yellow
B=	Blue
S=	Black

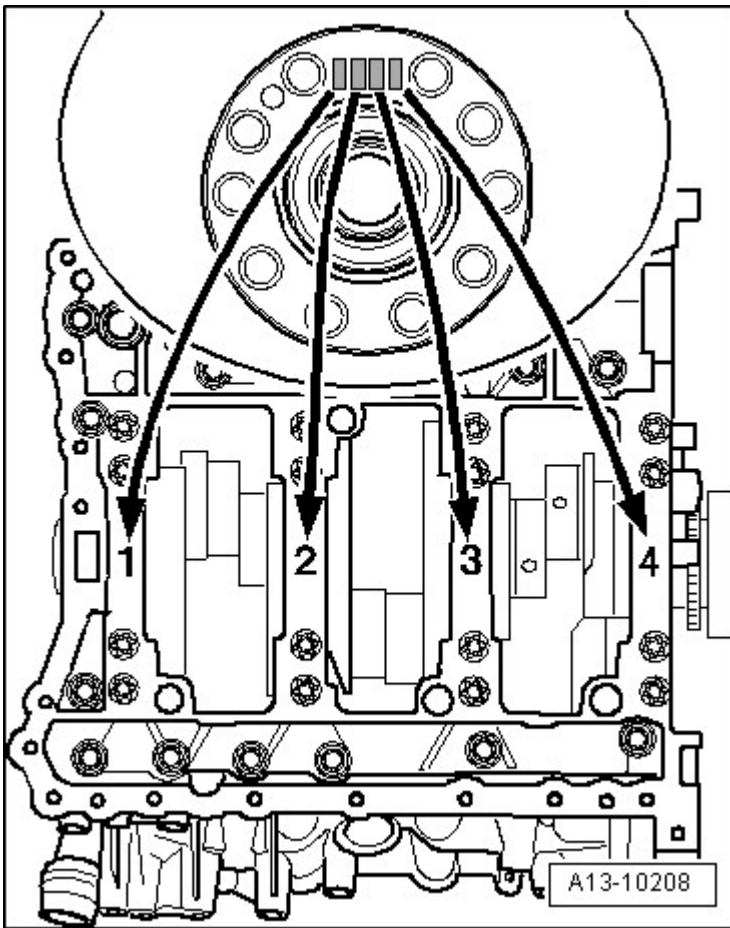


Fig. 7: Identifying Allocation Of Crankshaft Bearing Shells For Guide Frame

Courtesy of AUDI OF AMERICA, LLC

- Bearing shells with the correct thickness are allocated to the guide frame in the factory. Colored dots on the sides of the bearing shells serve for identifying bearing shell thickness.
- Allocation of bearing shells to guide frame is marked on flywheel flange of crankshaft by a row of letters. The first letter of the row of letters represents bearing "1", the second letter is for bearing "2", etc.

Letter on Crankshaft	Color of Bearing
R=	Red
G=	Yellow
B=	Blue
S=	Black

DRIVE PLATE OVERVIEW

NOTE: To perform assembly work, secure the engine using the bracket for V6 FSI engine, Audi A6 VAS 6095/1-5 on the engine and transmission holder VAS 6095. Refer to ENGINE, SECURING TO ENGINE AND TRANSMISSION HOLDER .

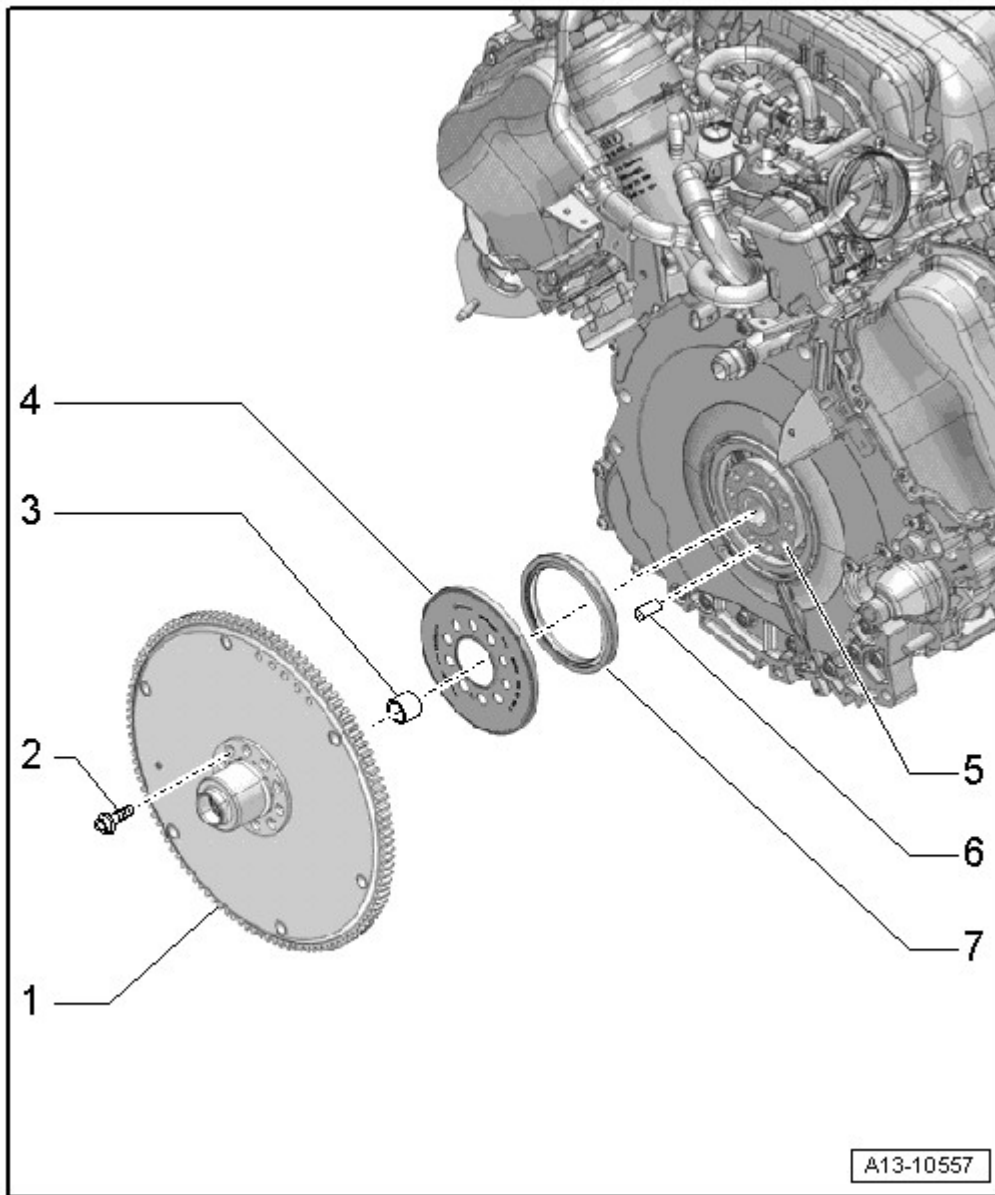


Fig. 8: Identifying Drive Plate Overview
 Courtesy of AUDI OF AMERICA, LLC

1. Drive Plate
 - With the bearing flange
 - Check the running surfaces on the bearing flange and the clutch module holes or torque converter for cracks and signs of wear.
 - Removing and installing, refer to **DRIVE PLATE**
2. Bolt
 - 60 Nm plus an additional 90° turn
 - Replace
3. Needle Bearing

- Removing, refer to **NEEDLE BEARING ON DRIVE PLATE**
- 4. Sensor Wheel
 - For the Engine Speed (RPM) sensor -G28-
- 5. Crankshaft
- 6. Fitting Pin
- 7. Crankshaft Shaft Seal, Transmission Side
 - Removing and installing, refer to **CRANKSHAFT SEAL, TRANSMISSION SIDE**

PISTONS AND CONNECTING ROD OVERVIEW

NOTE: Oil injector jet for piston cooling, refer to **Fig. 13**.

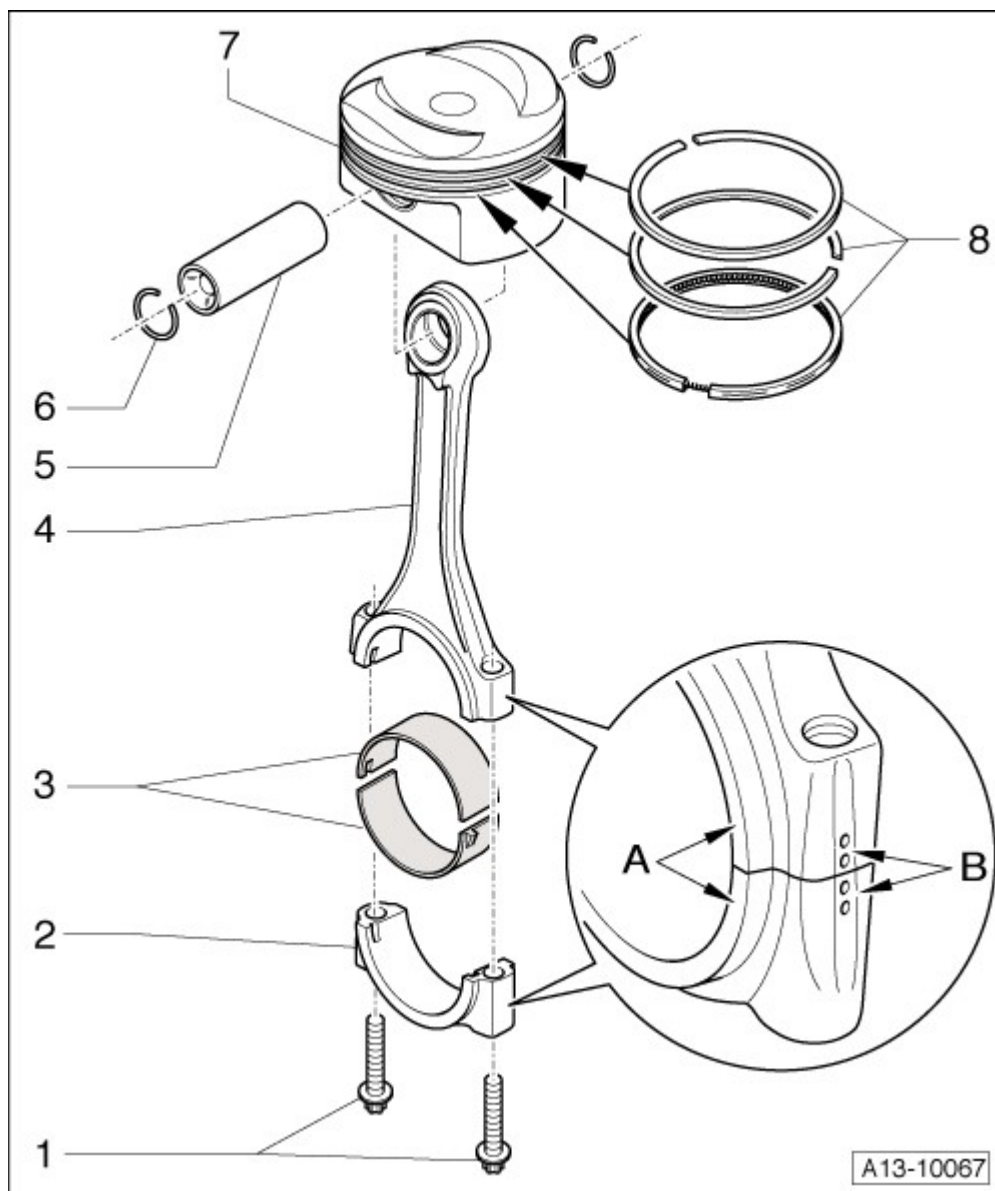


Fig. 9: Identifying Piston And Connecting Rod, Component Overview
Courtesy of AUDI OF AMERICA, LLC

1. Bolts
 - 30 Nm plus an additional 90° turn
 - Replace
 - Lubricate the threads and contact surface
2. Connecting Rod Bearing Cap
 - Mark for installation later
 - Mark allocation to cylinder with paint -B-, refer to **Fig. 11**
 - When installing the bearing cap, observe: The wide thrust flange -A- must point to the same side on connecting rod and connecting rod bearing cap
 - Installation position of connecting rod pairs, refer to **Fig. 12**
3. Bearing Shell
 - Check that the retaining tabs are secured
 - Mark used bearing shells for reinstallation but not on the running surface
 - Replace the bearing shells worn down to the base layer
 - Radial clearance, measuring; refer to **CONNECTING ROD, MEASURING RADIAL CLEARANCE**
4. Connecting Rod
 - Only replace as a set
 - Mark allocation to the cylinder with paint -B-, refer to **Fig. 11**
 - When installing the bearing cap, observe: The wide thrust flange -A- must point to the same side on the connecting rod and connecting rod bearing cap
 - Installation position of connecting rod pairs, refer to **Fig. 12**
5. Piston Pin
 - Heat piston to 60 °C (140 °F) if it is difficult to move.
 - Removing and installing using a pilot drift VW 222 A
6. Locking Ring
 - Replace
7. Piston
 - Mark the installation position and cylinder allocation, refer to **Fig. 10**
 - Arrow on piston face points toward belt pulley side
 - Checking, refer to **Fig. 21**
 - Install with piston ring compressor
 - Measuring cylinder bore, refer to **Fig. 24**
8. Piston Rings
 - Offset gaps by 120°
 - Use piston ring pliers for removing and installing

- Installed position: The "TOP" marking or side with writing faces the piston crown.
- Gap, measuring, refer to **Fig. 22**
- Measuring side clearance, refer to **Fig. 23**

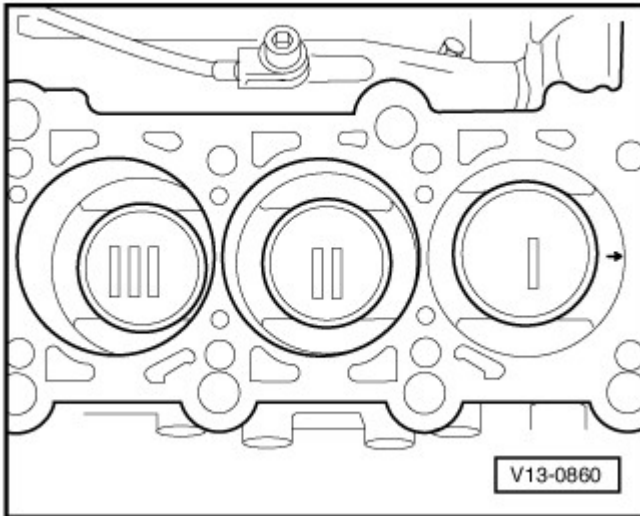


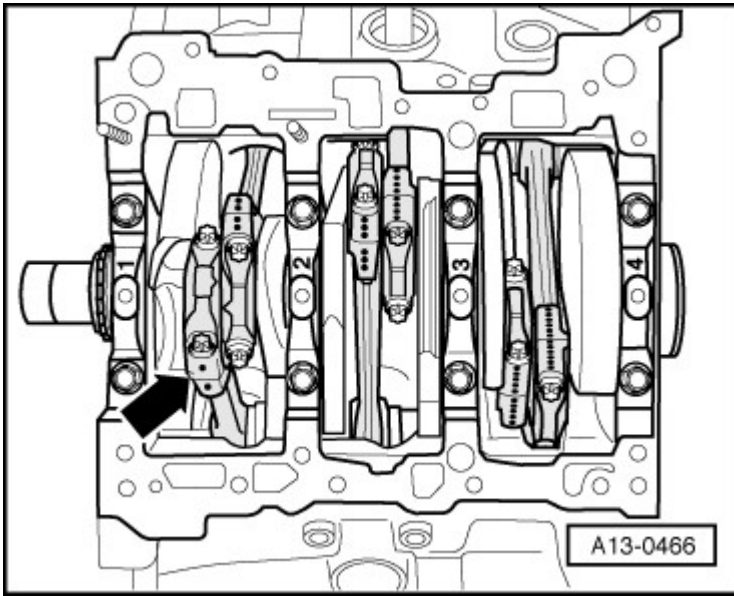
Fig. 10: Identifying Installed Position Of Piston And Piston/Cylinder Allocation
Courtesy of AUDI OF AMERICA, LLC

CAUTION: The coating on the piston crown could be destroyed.

- **Mark the allocation to the cylinder on the piston crown with paint to install used pistons. Do not mark the piston crown with a punch, notch or similar object.**

Installed position:

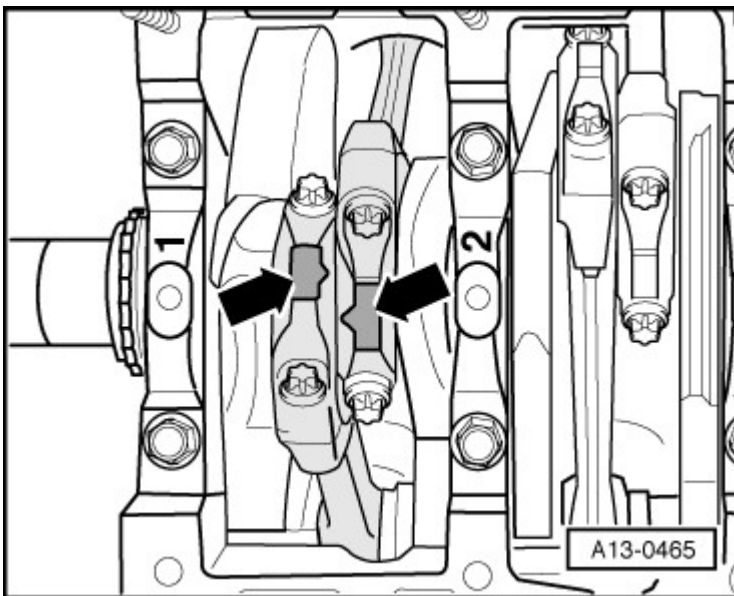
- The arrows on the piston heads point to the belt pulley side.

**Fig. 11: Marking Connecting Rod**

Courtesy of AUDI OF AMERICA, LLC

NOTE: Only replace the connecting rods as a set.

-- Mark the connecting rod and connector rod bearing caps to each other and to the cylinder -arrow- with paint for installation.

**Fig. 12: Identifying Connecting Rod, Installed Location**

Courtesy of AUDI OF AMERICA, LLC

- The molded tabs -arrows- on the beveled surfaces of the connecting rod pairs "1 and 2", "3 and 4" and "5 and 6" must face each other.

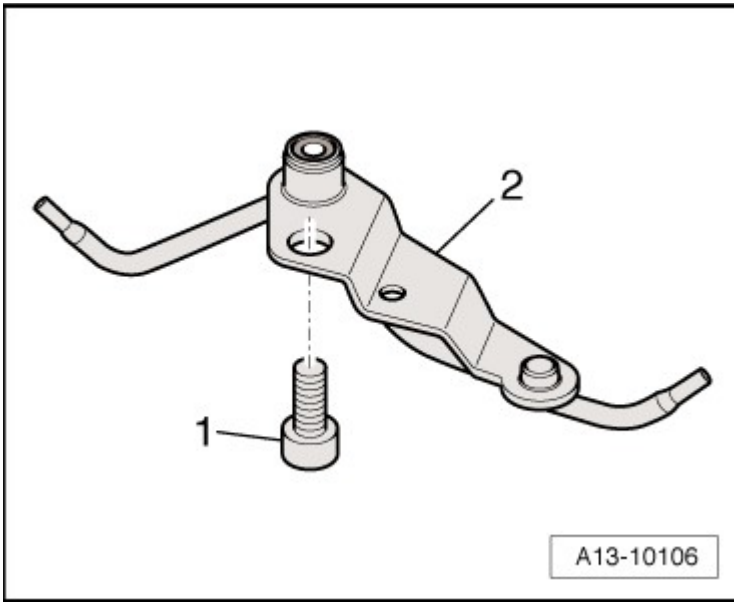


Fig. 13: Identifying Oil Spray Jet And Bolt
Courtesy of AUDI OF AMERICA, LLC

1. Insert the bolt with locking compound and tighten to 9 Nm.
2. Oil spray jet with spray nozzle valve (opening pressure 2 to 2.4 bar (29 to 34.80 psi))

NOTE: Do not bend the oil spray nozzles.

Replace the oil spray nozzles if they are bent.

RIBBED BELT DRIVE OVERVIEW

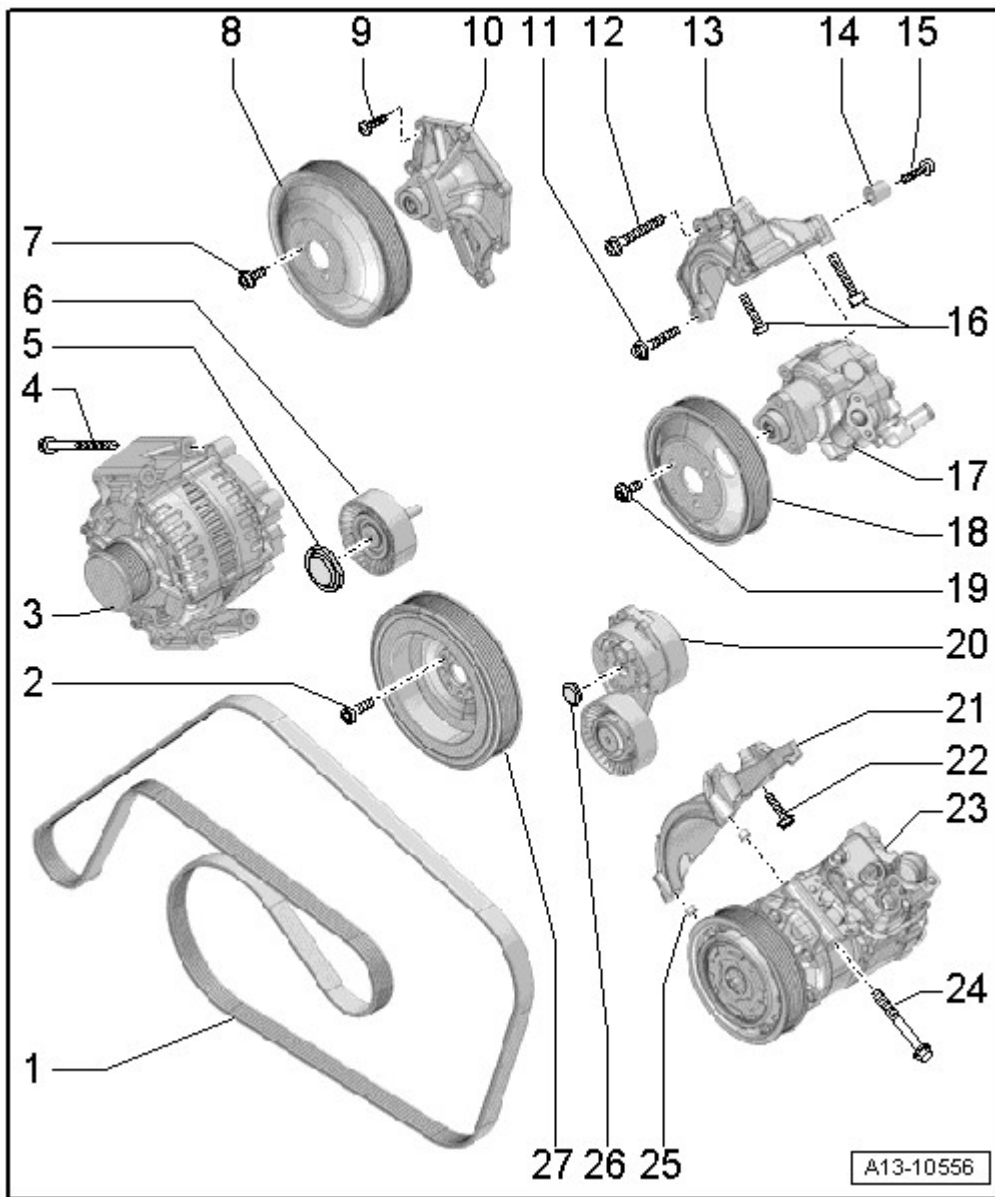


Fig. 14: Identifying Ribbed Belt Drive Overview

Courtesy of AUDI OF AMERICA, LLC

1. Ribbed Belt

- Check for wear
- Before removing, mark the direction of rotation using chalk or a felt-tip pen.
- Removing and installing, refer to **RIBBED BELT**
- Do not kink
- When installing, make sure it is seated correctly on the ribbed belt pulleys

2. Bolt

- 20 Nm plus an additional 90° turn
- Replace

3. Generator
 - Removing and installing, refer to **Removal and Installation**
4. Bolt
 - Tightening specification, refer to **Specifications**
5. Idler Roller Cover
6. Idler Roller for Ribbed Belt
 - 40 Nm
7. Bolt
 - Tightening specification, refer to item 2: **COOLANT PUMP, COOLANT THERMOSTAT AND CONNECTING PIECE OVERVIEW**
8. Coolant Pump Ribbed Belt Pulley
9. Bolt
 - Tightening specification, refer to item 4: **COOLANT PUMP, COOLANT THERMOSTAT AND CONNECTING PIECE OVERVIEW**
10. Coolant Pump
 - Removing and installing, refer to **COOLANT PUMP**
11. Bolt
 - Tightening specification, refer to **Specifications**
12. Bolt
 - Tightening specification, refer to **Specifications**
13. Power Steering Pump Mount
14. Slide Bushing
15. Bolt
 - Tightening specification, refer to **Specifications**
16. Bolt
 - Tightening specification, refer to **Specifications**
17. Power Steering Pump
 - Removing and installing, refer to **Removal and Installation**
18. Power Steering Pump Ribbed Belt Pulley for the Power Steering
 - Removing and installing, refer to **Removal and Installation**
19. Bolt
 - Tightening specification, refer to **Specifications**
20. Ribbed Belt Tensioning Damper
 - 40 Nm
 - Removing and installing, refer to **RIBBED BELT TENSIONER**
21. Air Conditioning (A/C) Compressor Bracket
 - Be careful of the alignment bushings when installing
22. Bolt

- 20 Nm
23. A/C Compressor
- Do not remove or disconnect refrigerant lines
 - Removing and installing, refer to **Removal and Installation**
 - Be careful of the alignment sleeves -25- when installing
24. Bolt
- Tightening specification, refer to **Specifications**
25. Alignment Bushing
- Quantity: 2
26. Tensioner Cover
27. Vibration Damper with Ribbed Belt Pulley
- Removing and installing, refer to **VIBRATION DAMPER WITH RIBBED BELT PULLEY**

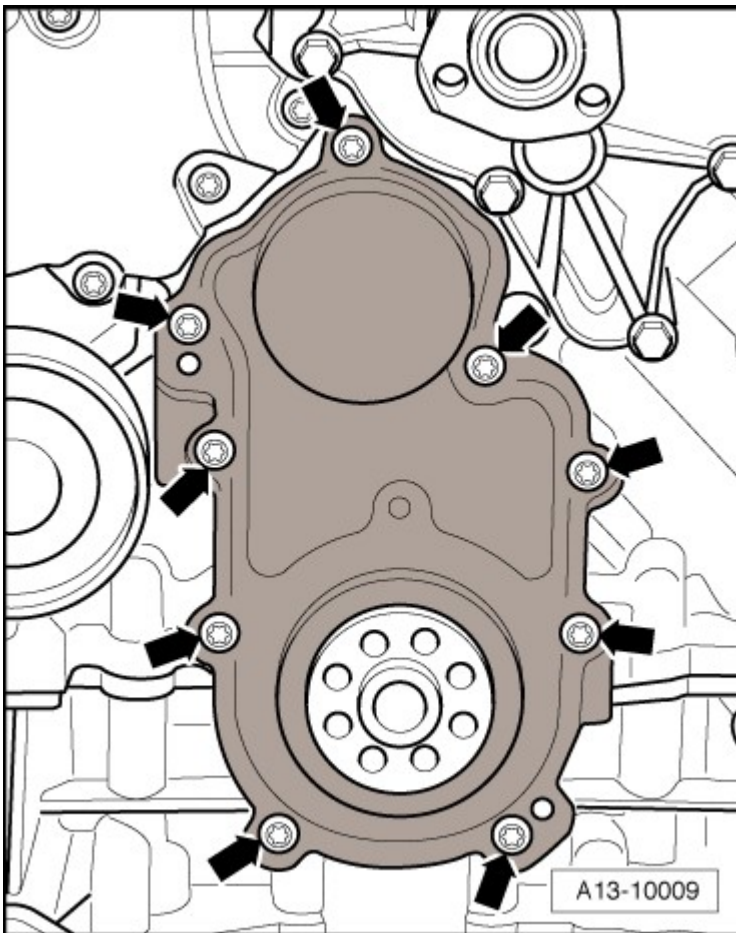


Fig. 15: Identifying Bolts & Front Sealing Flange, Removal
Courtesy of AUDI OF AMERICA, LLC

-- Tighten the bolts -arrows- in a diagonal sequence in stages to 9 Nm.

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ENGINE 3.2 Liter - Crankshaft, Cylinder Block - Engine Code(s): CALB

SPECIFICATIONS**CRANKSHAFT DIMENSIONS**

Honing Dimension	Crankshaft Bearing Pin Diameter mm	Crankshaft Connecting Rod Journal Diameter mm
Basic dimension	65.000 - 0.022 - 0.042	56.000 - 0.022 - 0.042

FASTENER TIGHTENING SPECIFICATIONS

Component	Bolt Size	Nm
Connecting Rod Bearing Cap ¹	-	30 + 90°
Drive Plate ¹	-	60 + 90°
Idler Roller for Ribbed Belt	-	40
Oil Spray Jet ²	-	9
Ribbed Belt Tensioning Damper	-	20
Vibration Damper with Ribbed Belt Pulley ¹	-	20 + 90°
¹ Replace ² Insert the bolt with locking compound		

Ribbed Belt Pulley Side Sealing Flange - Tightening Specifications and Sequence

-- Tighten the bolts -arrows- in a diagonal sequence in stages to 9 Nm.

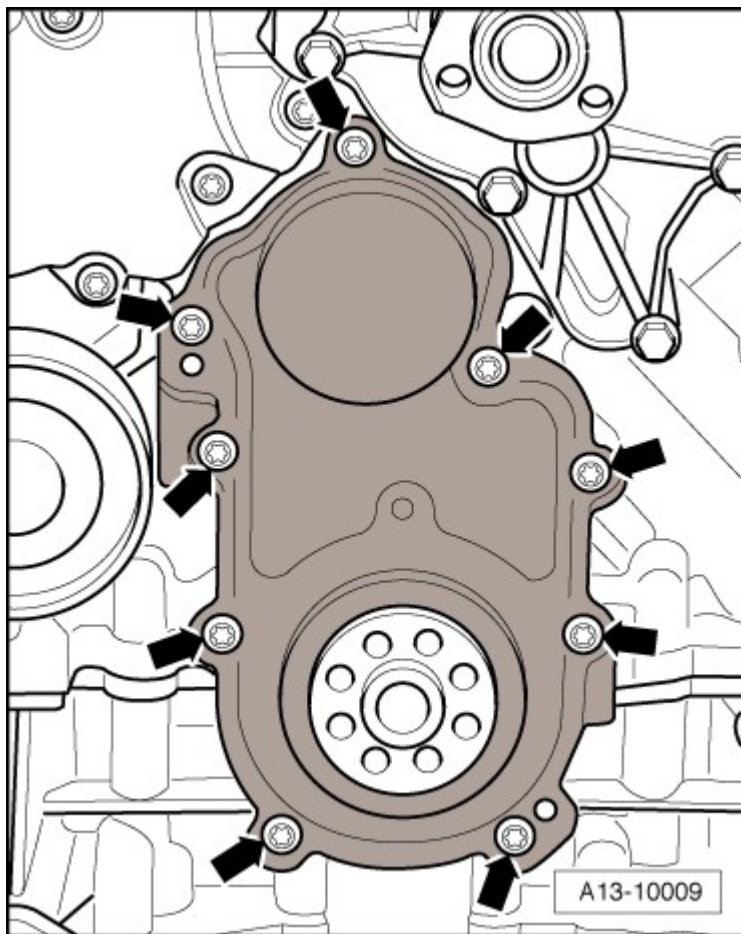


Fig. 16: Identifying Bolts & Front Sealing Flange, Removal
Courtesy of AUDI OF AMERICA, LLC

"TDC" Marking Locking Bolt - Tightening Specification

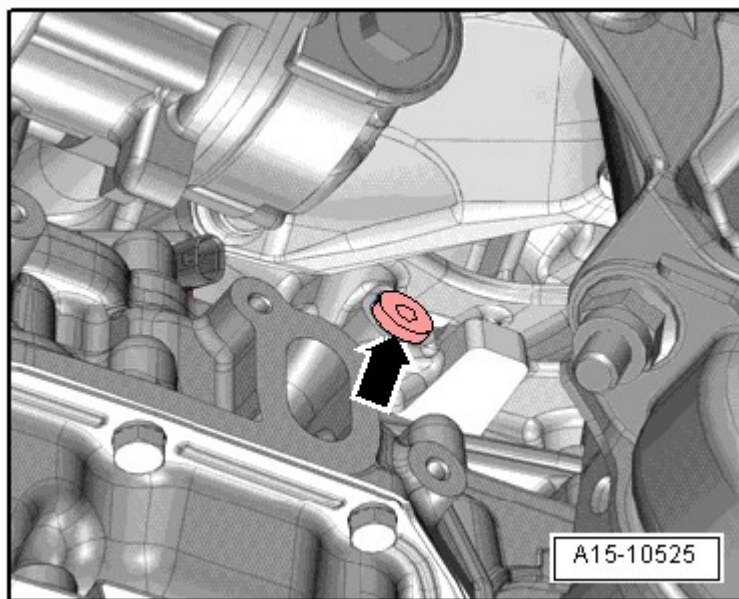


Fig. 17: Identifying Locking Bolt -Arrow-
Courtesy of AUDI OF AMERICA, LLC

NOTE: Replace the O-ring.

-- Tighten the locking bolt -arrow- to 14 Nm.

Oil Pressure Regulation Valve -N428-

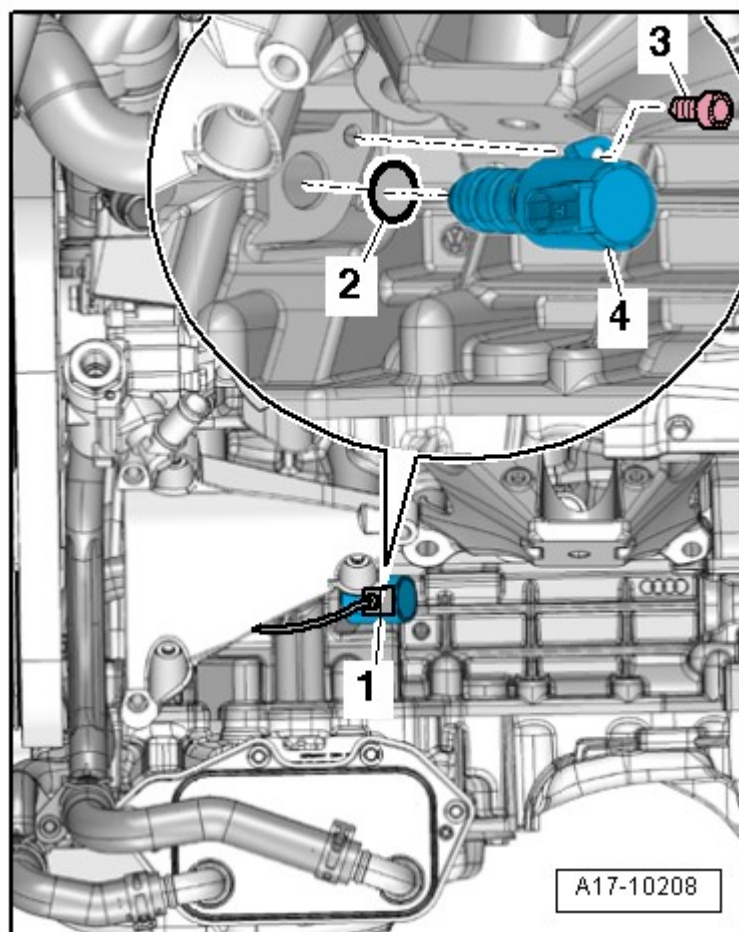


Fig. 18: Identifying Oil Pressure Regulation Valve -N428-
 Courtesy of AUDI OF AMERICA, LLC

1. Electrical harness connector
2. O-ring - replace
3. Bolt - 9 Nm
4. Oil pressure regulation valve -N428-

Installing Guide Frame

- Replace the guide frame bolts.
- Insert the long bolts in the inner row of the guide frame.
- Tighten the bolts -1 through 31- in 3 stages as follows:

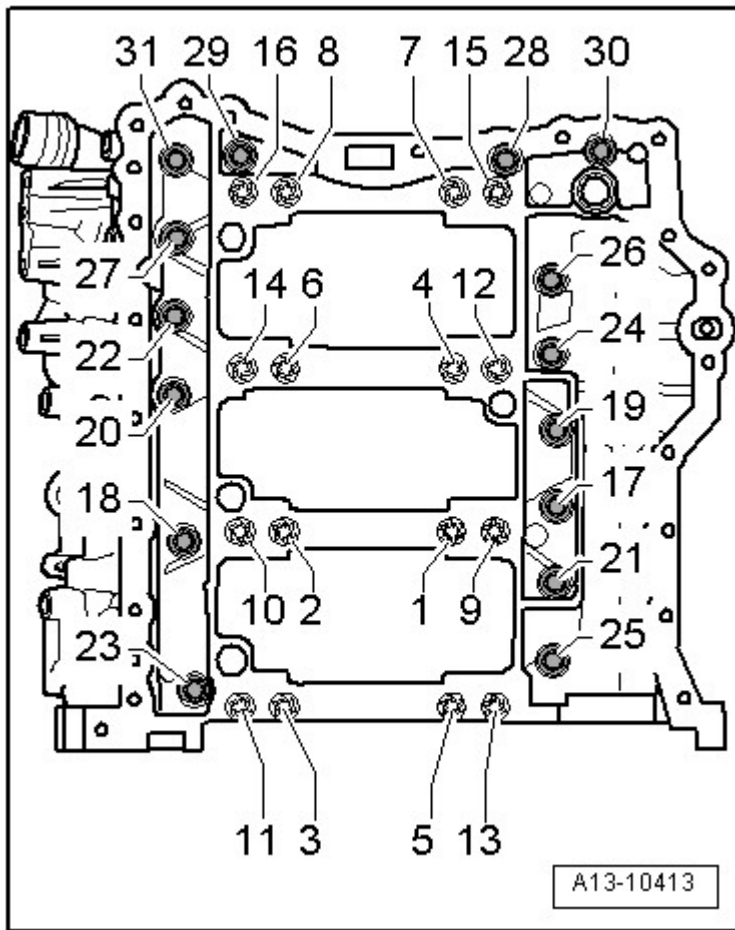


Fig. 19: Identifying Guide Frame Bolts Tightening Sequence
 Courtesy of AUDI OF AMERICA, LLC

-- Tighten the bolts to 50 Nm in the following sequence: -1 to 16-.

-- Tighten the bolts an additional 90° in the following sequence: -1 to 16-.

-- Tighten the bolts for the guide frame sealing surfaces on the cylinder block to 23 Nm in the following sequence: -17 to 31-.

DIAGNOSIS AND TESTING

AXIAL CLEARANCE, MEASURING

Special tools and workshop equipment required

- Dial Gauge Holder VW 387
- Dial Gauge 0-10 mm VAS 6079

Procedure

-- Install the VAS 6079 with the VW 387 on the cylinder block as shown in the illustration.

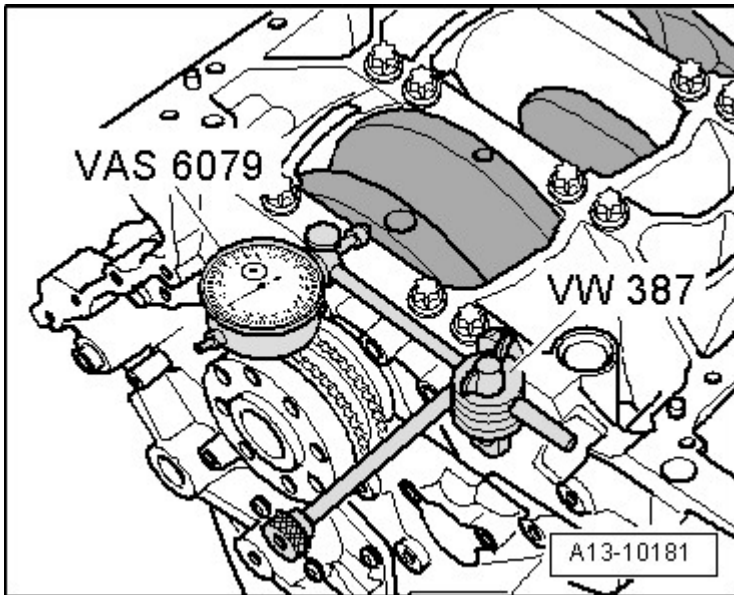


Fig. 20: Attaching Dial Indicator VAS 6079 Together With Dial Gauge Holder VW 387 To Cylinder Block And Setting Indicator Against Crankshaft Counterweight
Courtesy of AUDI OF AMERICA, LLC

- Place the dial gauge against the crankshaft counterweight.
- Press the crankshaft against the dial gauge by hand and set the gauge to "0".
- Press the crankshaft off the dial gauge and read the measurement.
 - Axial clearance: 0.15 to 0.25 mm.

CONNECTING ROD, MEASURING RADIAL CLEARANCE

Special tools and workshop equipment required

- Plastigage

Procedure

- Remove connecting rod bearing cap.
- Clean the bearing cap and journal.
- Place the Plastigage over the entire width of the bearing journal or into the bearing shells.
- Install connecting rod bearing cap and tighten to 30 Nm. Do not turn crankshaft.
- Remove rod bearing cap.

- Reinstall connecting rod cover.
- Compare width of Plastigage with calibrated scale.

Radial clearance:

- New: 0.010 to 0.052 mm.
- Wear limit: 0.120 mm.

- Replace connecting rod bolts.

RADIAL CLEARANCE, MEASURING**Special tools and workshop equipment required**

- Plastigage

Procedure

NOTE: **Marked the used bearing for installation later, but not on the running surface.**

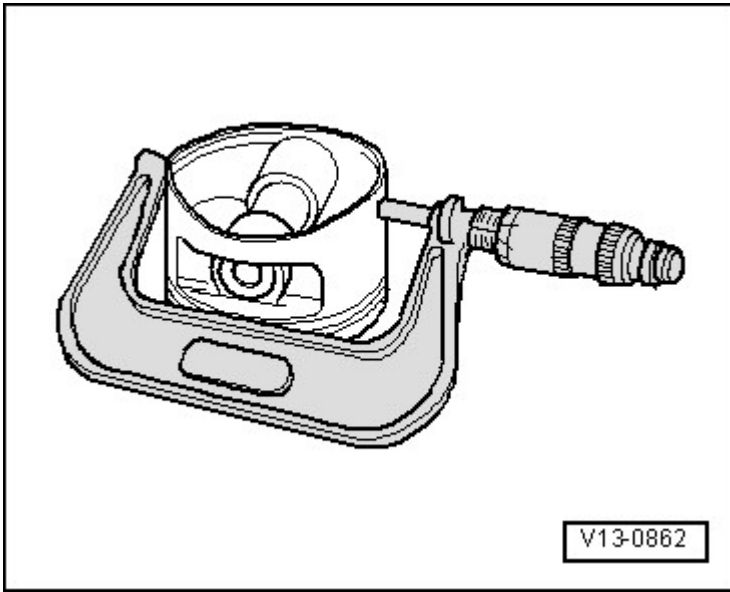
If the bearing shells are worn down to the nickel layer, they must be replaced.

- Remove the guide frame and clean the bearing journals.
- Place the Plastigage over the entire width of the bearing journal or into the bearing shells.
 - Plastigage must rest in center of bearing shell.
- Install guide frame and tighten to 30 Nm. Do not turn crankshaft.
- Remove the guide frame.
- Compare width of Plastigage with calibrated scale.

Radial clearance:

- New: 0.015 to 0.055 mm.
- Wear limit: 0.080 mm.

PISTON AND CYLINDER BORE, CHECKING

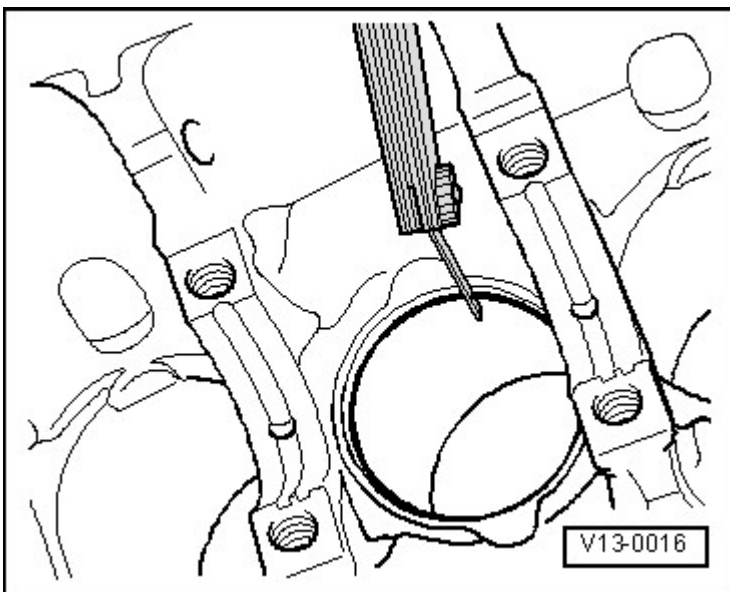
**Fig. 21: Checking Piston**

Courtesy of AUDI OF AMERICA, LLC

-- Measure approximately 15 mm from the lower edge at a 90° angle to the piston pin axis using a 75 to 100 mm external micrometer.

- Maximum deviation from nominal dimension: 0.04 mm.

		Piston Diameter
Basic dimension	mm	84.49 ¹⁾
• ¹⁾ Measurement with coating (thickness = 0.02 mm). The coating wears off.		

**Fig. 22: Checking Piston Ring Gap**

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Courtesy of AUDI OF AMERICA, LLC

- Push the piston ring squarely from above down to approximately 15 mm from the bottom end of the cylinder.
- Use a piston without a piston ring for sliding in.

Piston Ring	New mm	Wear Limit mm
1st Compression ring	0.35 to 0.50	0.8
2nd Compression ring	0.60 to 0.80	1.0
Oil scraping ring	0.25 to 0.50	0.8

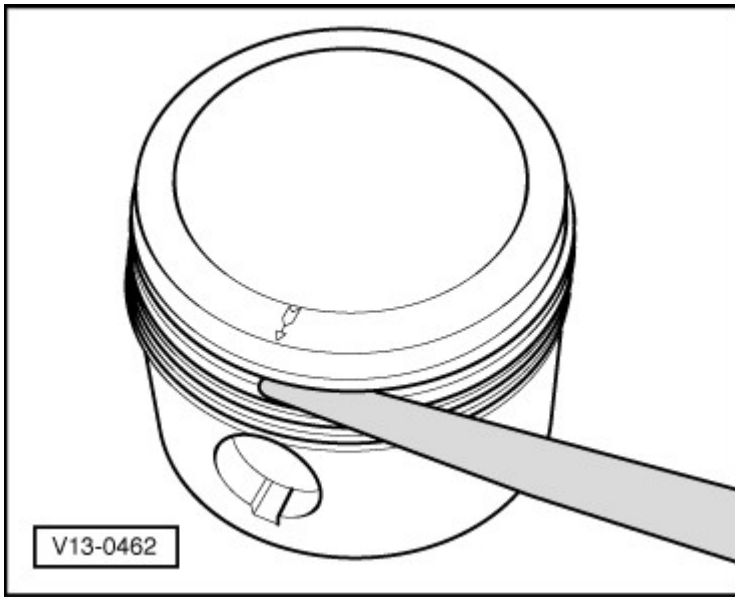
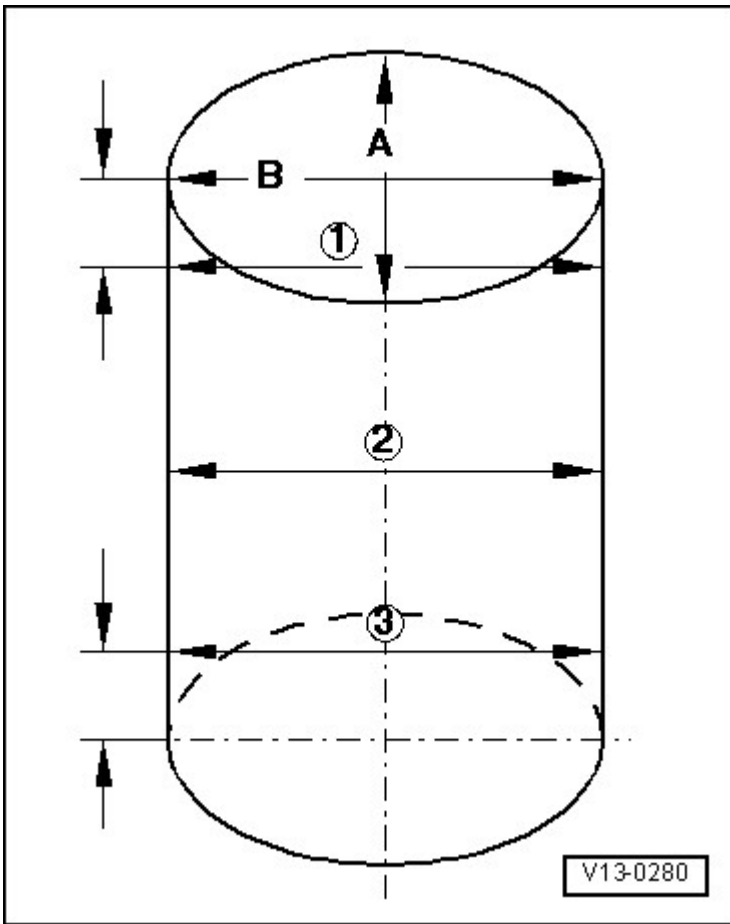


Fig. 23: Checking Piston Ring Side Clearance
Courtesy of AUDI OF AMERICA, LLC

- Clean the piston ring groove before checking.

Piston Ring	New mm	Wear Limit mm
Compression rings	0.02 to 0.08	0.20
Oil scraping ring	0.02 to 0.08	0.15

**Fig. 24: Checking Cylinder Bores**

Courtesy of AUDI OF AMERICA, LLC

Special tools and workshop equipment required

- Internal Dial Gauge VAS 6078 or Inside Micrometer Set 18-100 mm US1033/S

-- Using a cylinder gauge VAS 6078 measure in a diagonal sequence at 3 positions transversely -A- and longitudinally -B-.

- Maximum deviation from nominal dimension: 0.08 mm.

		Cylinder Bore Diameter
Basic dimension	mm	84.51

REMOVAL AND INSTALLATION**CRANKSHAFT SEAL, TRANSMISSION SIDE****Special tools and workshop equipment required**

- Assembly Tool T10122
- Pulling Hook T20143/2
- Assembly Device T10122/1
- Pull Sleeve T10122/2
- Thrust Piece T10122/3

Procedure

- Transmission removed.

-- Remove the drive plate. Refer to **DRIVE PLATE**.

-- Pry out the with a T20143/2.

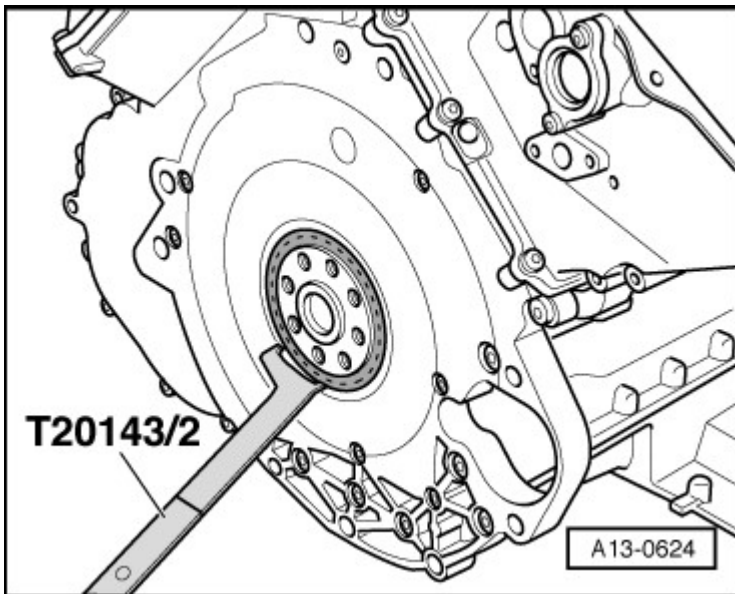


Fig. 25: Prying Out Sealing Ring Using Extractor Lever T20143/2
Courtesy of AUDI OF AMERICA, LLC

-- Clean running and sealing surface.

-- Place the T10122/1 on the T10122/2 and slide the shaft seal -A- onto the pull sleeve.

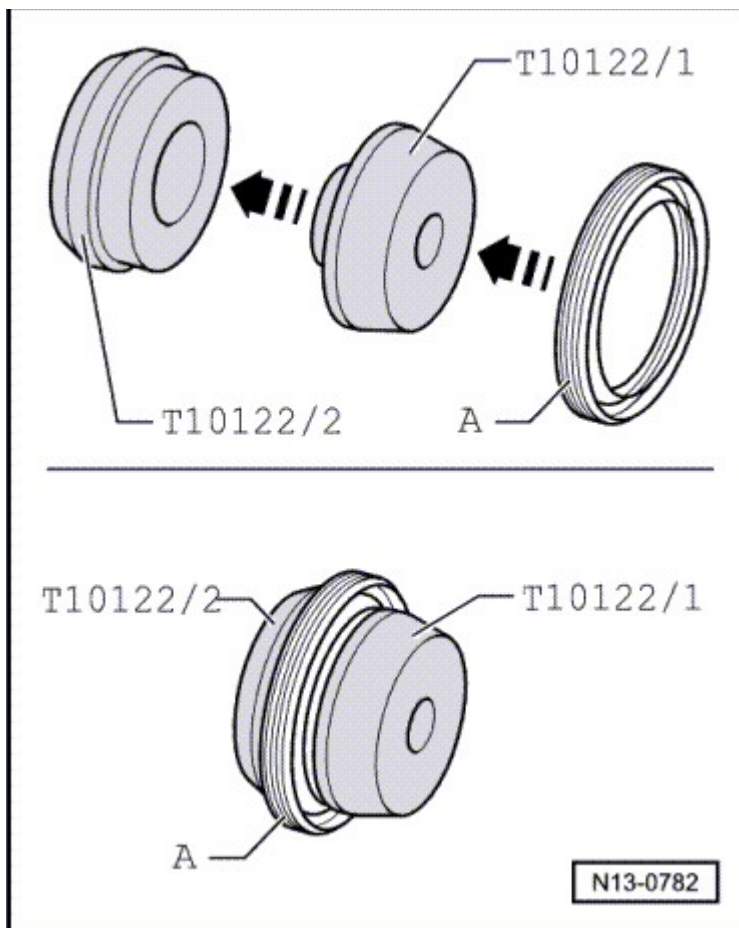


Fig. 26: Identifying Seal, Sleeve T10122/1 And Assembly Tool T10122/2
Courtesy of AUDI OF AMERICA, LLC

- Remove the assembly device.
- Position the T10122/2 with shaft seal -1- on the crankshaft.

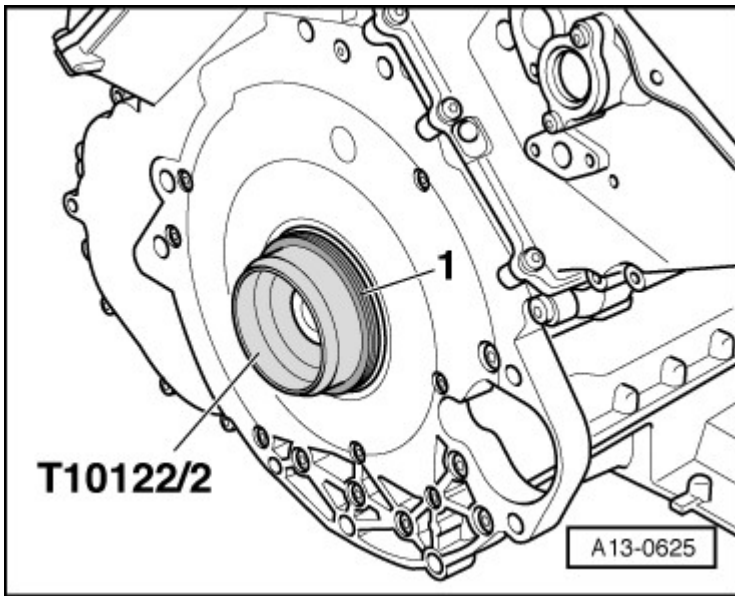


Fig. 27: Identifying Pull Sleeve T10122/2 With Sealing Ring On Crankshaft
Courtesy of AUDI OF AMERICA, LLC

-- Press the shaft seal in evenly all around with the T10122/3 until flush.

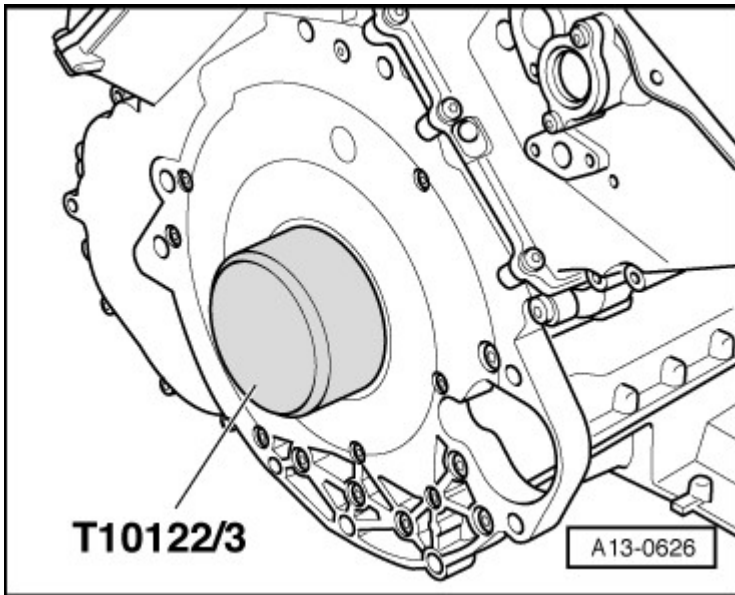


Fig. 28: Pressing In Seal Evenly All Around Until It Reaches Stop Using T10122/3
Courtesy of AUDI OF AMERICA, LLC

-- Installing drive plate. Refer to **DRIVE PLATE**.

DRIVE PLATE

Special tools and workshop equipment required

- Counter Hold Tool 10 - 201

Removing

- Transmission removed.

-- Insert 10 - 201 to loosen the bolts.

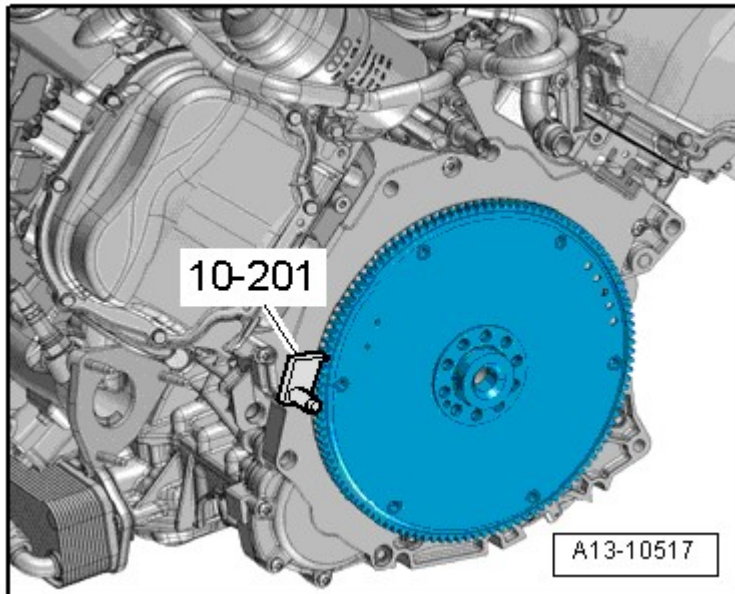


Fig. 29: Identifying Drive Plate Overview
Courtesy of AUDI OF AMERICA, LLC

CAUTION: The outer surface of the bearing flange at the drive plate could be damaged.

- Use a multipoint socket wrench with a shaft at least 40 mm long to loosen and tighten the drive plate bolts.

-- Remove the bolts, drive plate and sensor wheel.

Installing

- Tightening specification, refer to **DRIVE PLATE OVERVIEW**.

Install in reverse order, paying attention to the following:

NOTE: Replace the drive plate bolts.

The drive plate in the vehicles automatic transmission 0B6 must not have any needle bearings. Check if a needle bearing is inserted before installing. Remove

the needle bearing in the drive plate NEEDLE BEARING ON DRIVE PLATE.

-- Be careful of the alignment bushings during installation.

-- Position 10 - 201 to tighten the bolts.

NEEDLE BEARING ON DRIVE PLATE**Special tools and workshop equipment required**

- Thrust Plate VW 402
- Tube 31.5 mm Dia. VW 418 A
- Tube 28 mm Dia. 100 mm VW 421
- Sleeve 40 - 103

Procedure

- Transmission removed.

-- Remove the drive plate. Refer to **DRIVE PLATE.**

-- Place the 40 - 103 under the drive plate to remove and install.

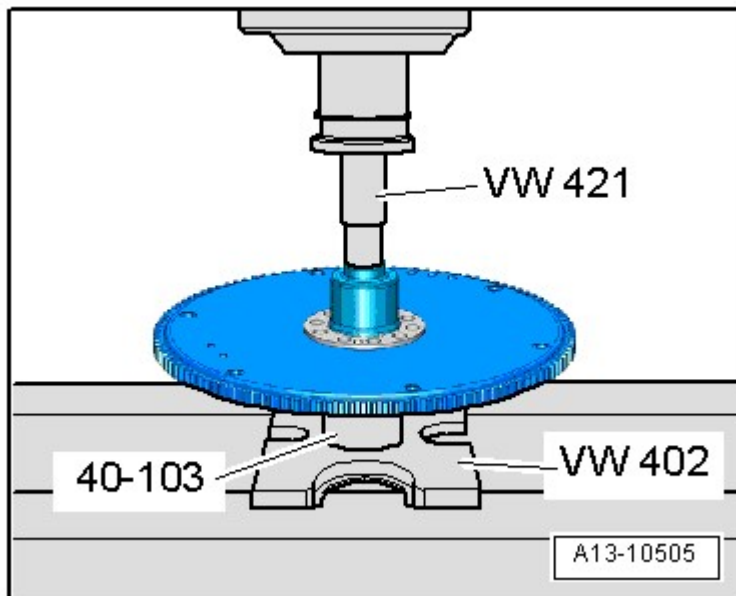


Fig. 30: Identifying Drive Plate, Removal
Courtesy of AUDI OF AMERICA, LLC

-- Press the bearing sleeve out using the VW 421 and workshop press.

- The smaller diameter of the VW 421 faces the drive plate.

-- Carefully press the needle bearing in as far as the stop using the VW 418 A and shop press.

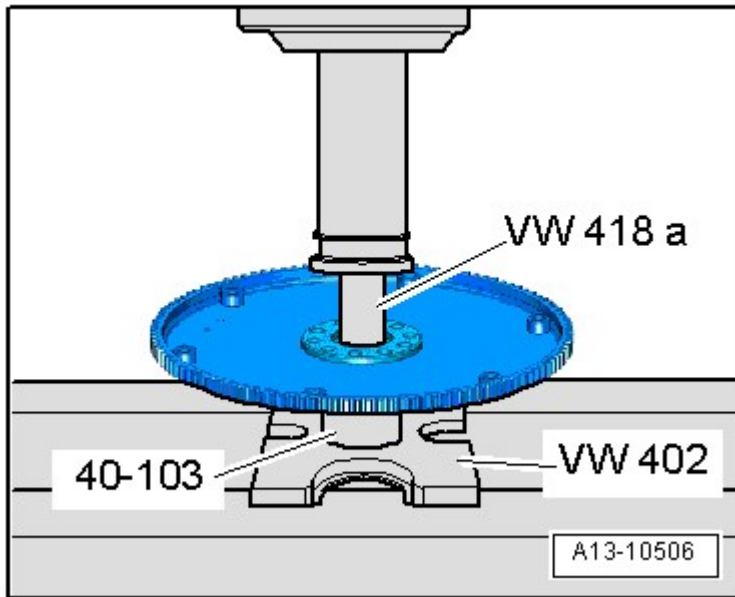


Fig. 31: Identifying Drive Plate, Removal
Courtesy of AUDI OF AMERICA, LLC

- Installed position: the closed side of the needle bearing faces the engine.

-- Installing drive plate. Refer to **DRIVE PLATE**.

PISTON

Special tools and workshop equipment required

- Pilot Drift VW 222 A
- Piston ring compressor, commercially available

Removing

-- Remove engine. Refer to **ENGINE, REMOVING**

-- For information on securing the engine on the engine stand. Refer to **ENGINE, SECURING TO ENGINE AND TRANSMISSION HOLDER**.

-- Cylinder head, removing. Refer to **CYLINDER HEADS**.

-- Remove the upper oil pan. Refer to **UPPER OIL PAN**.

NOTE: Due to the separation procedure (cracking) of the connecting rod, the connecting rod bearing cap only fits in one position and only to the

corresponding connecting rod.

Mark installed position and cylinder allocation.

CAUTION: The coating on the piston crown could be destroyed.

- **Mark the allocation to the cylinder on the piston crown with paint to install used pistons. Do not mark the piston crown with a punch, notch or similar object.**

-- Mark installed position and cylinder allocation

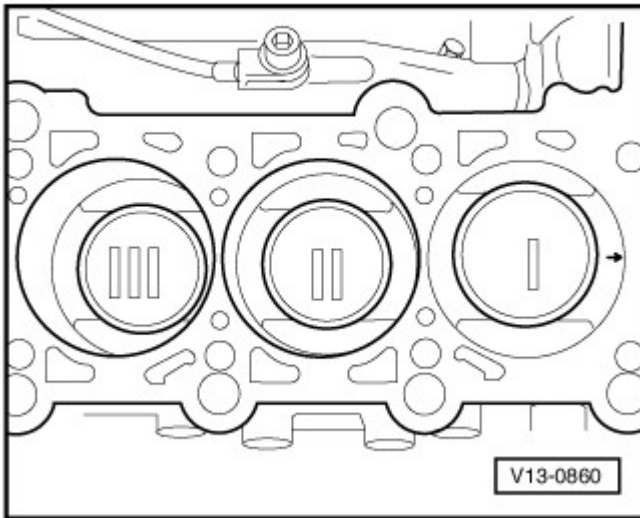


Fig. 32: Identifying Installed Position Of Piston And Piston/Cylinder Allocation
Courtesy of AUDI OF AMERICA, LLC

CAUTION: The coating on the piston crown could be destroyed.

- **Mark the allocation to the cylinder on the piston crown with paint to install used pistons. Do not mark the piston crown with a punch, notch or similar object.**

-- Mark the connecting rod and connector rod bearing caps to each other and to the cylinder -arrow- with paint for installation.

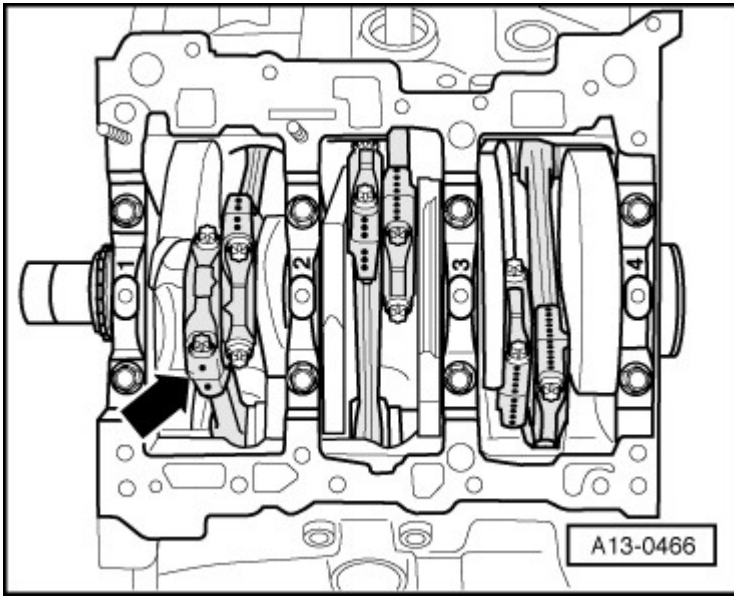


Fig. 33: Marking Connecting Rod

Courtesy of AUDI OF AMERICA, LLC

NOTE: Only replace the connecting rods as a set.

-- Remove the connecting rod bearing cap and pull the piston and connecting rod upward.

NOTE: If difficult to move, heat pistons to approximately 60 °C (140 °F).

-- Remove the locking ring from the eye of the piston bolt and remove the piston bolt with the VW 222 A.

Installing

Installation is carried out in the reverse order while noting the following:

- Tightening specification, refer to **PISTONS AND CONNECTING ROD OVERVIEW**.

NOTE: Arrow on piston face points toward belt pulley side.

Offset the piston ring gap by 120°.

-- Coat the contact surfaces on the bearing shells with oil.

-- Install the piston with a commercially available piston ring compressor. Pay attention to the installed position.

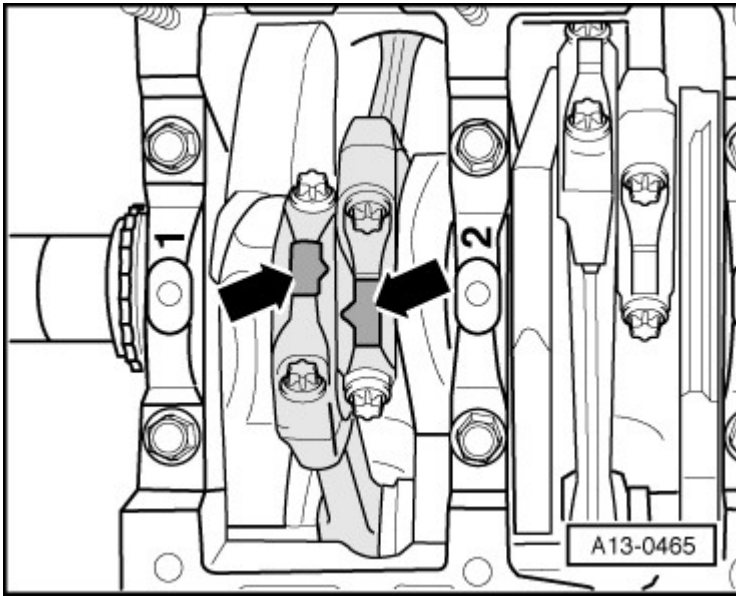


Fig. 34: Identifying Connecting Rod, Installed Location
Courtesy of AUDI OF AMERICA, LLC

- The molded tabs -arrows- on the beveled surfaces of the connecting rod pairs "1 and 2", "3 and 4" and "5 and 6" must face each other.

-- Install the connecting rod bearing cap. Pay attention to the installed position.

-- Install cylinder heads. Refer to **CYLINDER HEADS** .

-- Install the upper oil pan. Refer to **UPPER OIL PAN** .

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

RIBBED BELT

Removing

-- Remove the front noise insulation -1-. Refer to **Removal and Installation** .

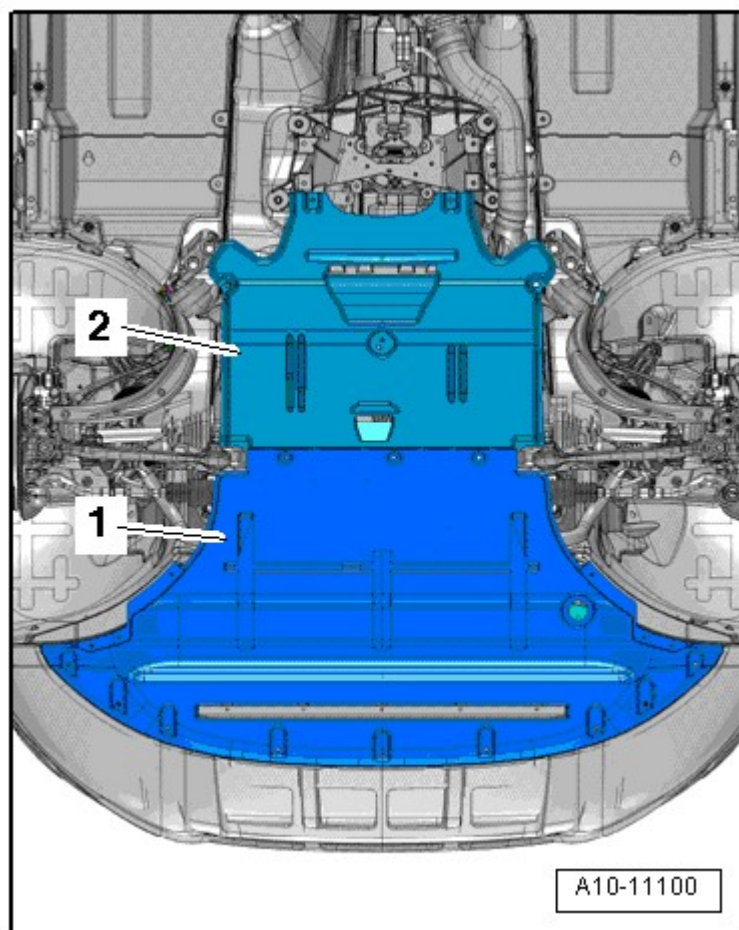


Fig. 35: Identifying Noise Insulation

Courtesy of AUDI OF AMERICA, LLC

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.

-- Pivot the tensioner clockwise -arrow- to release the tension on the ribbed belt.

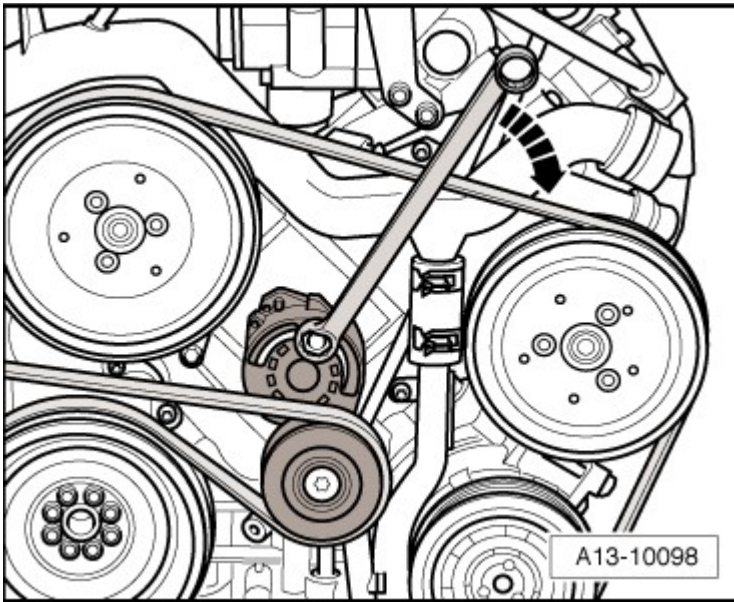


Fig. 36: Pivoting Tensioning Device To Relieve Tension On Ribbed Belt
 Courtesy of AUDI OF AMERICA, LLC

-- Remove ribbed belt and release tensioning device.

Installing

Install in reverse order, paying attention to the following:

-- Route the ribbed belt over the ribbed belt pulley in the sequence specified.

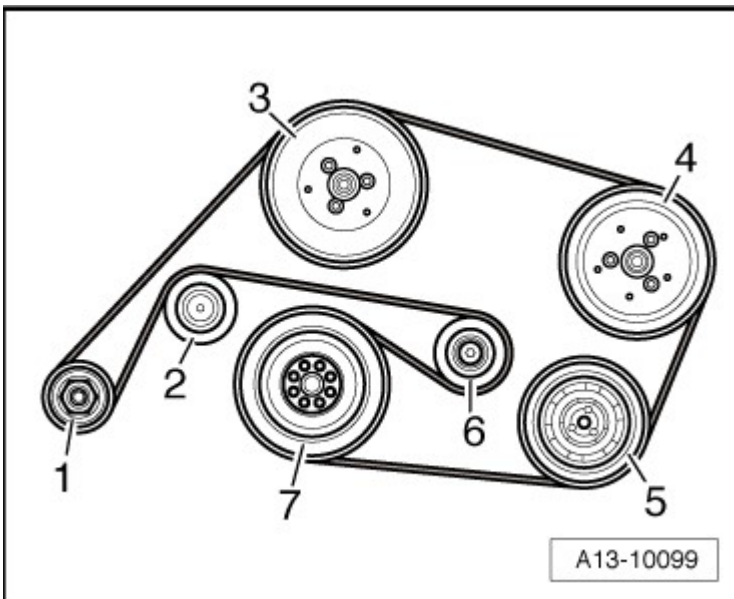


Fig. 37: Placing Ribbed Belt Over Belt Pulley
 Courtesy of AUDI OF AMERICA, LLC

1. Generator
2. Idler roller
3. Coolant pump
4. Power steering pump
5. A/C Compressor
6. Ribbed belt tensioning damper
7. Vibration damper with ribbed belt pulley

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

- Start the engine and check the belt routing.
- Install the noise insulation. Refer to **Removal and Installation** .

RIBBED BELT TENSIONER

Removing

- Remove ribbed belt. Refer to **RIBBED BELT**.
- Remove the cover -1- and the bolt below it.

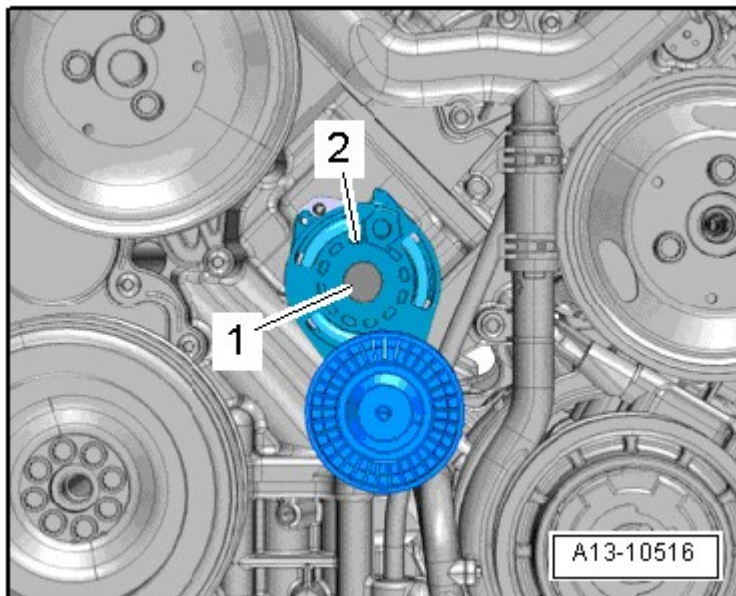


Fig. 38: Identifying Cover -1- And Ribbed Belt Tensioner -2-
Courtesy of AUDI OF AMERICA, LLC

- Remove the ribbed belt tensioner -2- from the cylinder block.

Installing

- Tightening specification, refer to **RIBBED BELT DRIVE OVERVIEW**.

Install in reverse order, paying attention to the following:

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

SEALING FLANGE WITH CRANKSHAFT SEAL, BELT PULLEY SIDE

Special tools and workshop equipment required

- Spanner Wrench 3212
- Assembly Device T40048
- Assembly Device T40048/1
- Pull Sleeve T40048/2
- Hand drill with plastic brush attachment
- Protective goggles
- Sealant

Procedure

-- Remove the front engine cover -bottom arrows-.

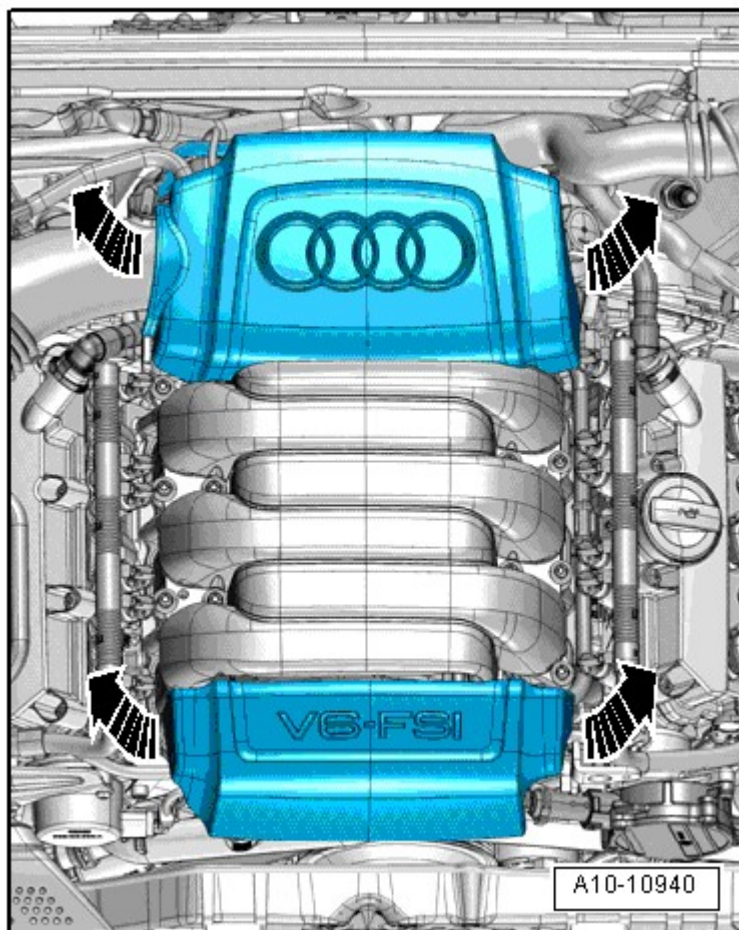


Fig. 39: Identifying Engine Cover

Courtesy of AUDI OF AMERICA, LLC

-- Remove the vibration damper with the ribbed belt pulley. Refer to **VIBRATION DAMPER WITH RIBBED BELT PULLEY**.

-- Remove the bolts for the coolant pump ribbed belt pulley, using a 3212 to counter hold.

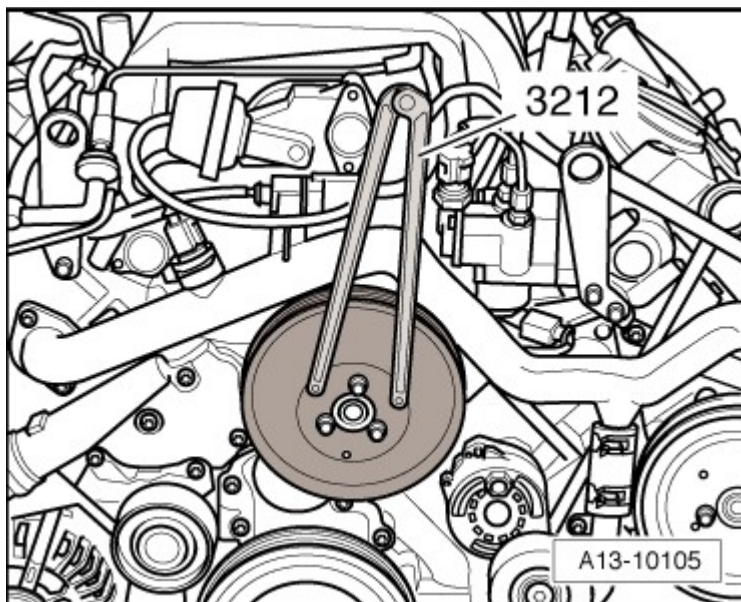


Fig. 40: Loosening Bolts Use Spanner Wrench 3212 To Counter-Hold
Courtesy of AUDI OF AMERICA, LLC

-- Remove the bolts -arrows- and the ribbed belt side sealing flange.

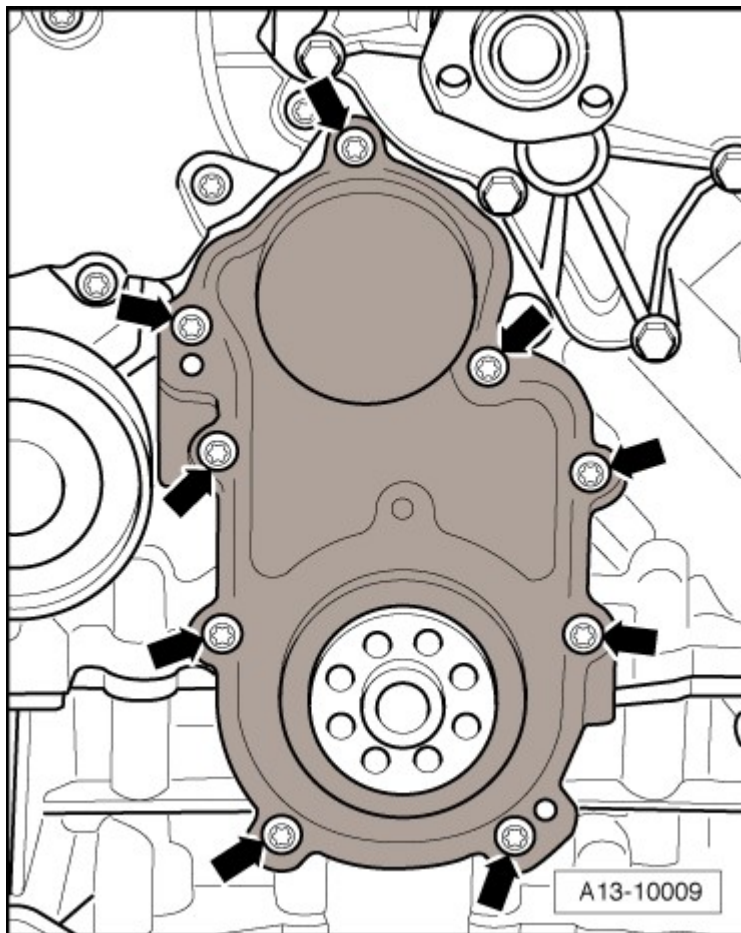


Fig. 41: Identifying Bolts & Front Sealing Flange, Removal

Courtesy of AUDI OF AMERICA, LLC

NOTE: Replace the ribbed belt side sealing flange.

CAUTION: Risk of contaminating lubricating system.

- Cover open parts of engine.

WARNING: Danger of eye injury.

- Wear protective goggles.

-- Remove the sealant residue on the cylinder block and the upper section of the oil pan, for example using a rotating plastic brush.

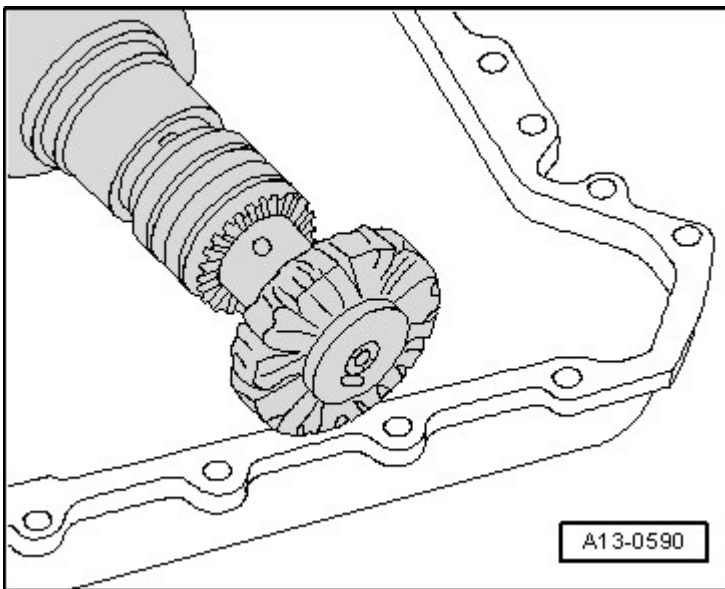


Fig. 42: Identifying Rotating Plastic Brush

Courtesy of AUDI OF AMERICA, LLC

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

NOTE: Note the expiration date of the sealing compound.

-- Cut the tube nozzle at the front marking (nozzle diameter approximately 1.5 mm).

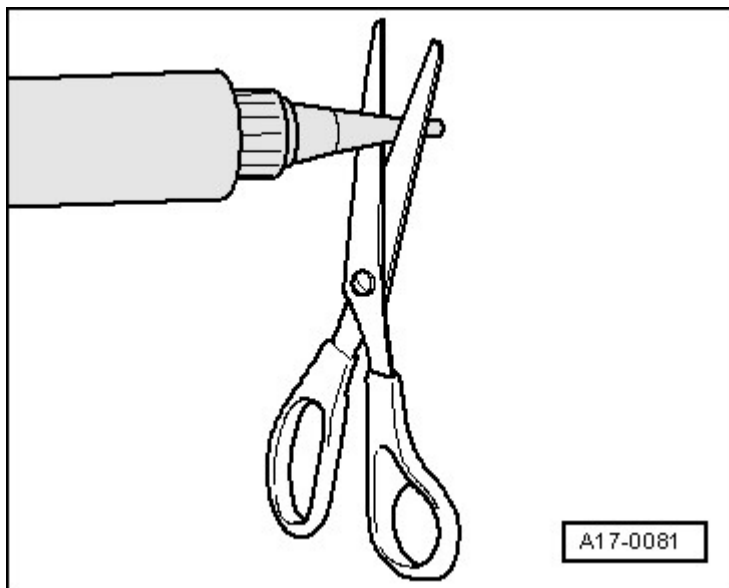


Fig. 43: Cutting Tube Nozzle At Front Marking (Nozzle Diameter Approx. 1.5 mm)

Courtesy of AUDI OF AMERICA, LLC

CAUTION: The lubrication system could be plugged with excess sealant.

- **Do not apply sealant bead thicker than indicated.**

-- Apply the sealant bead -arrow- to the clean sealing surface on the ribbed belt side sealing flange as shown in the illustration.

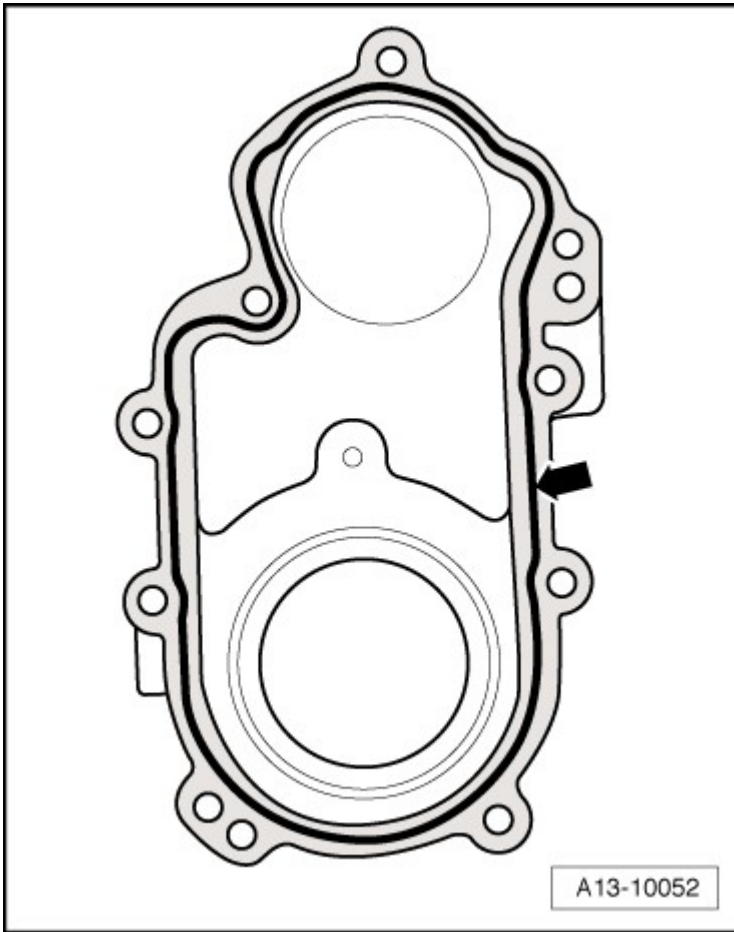


Fig. 44: Applying Bead Of Sealant To Clean Sealing Surface Of Sealing Flange
Courtesy of AUDI OF AMERICA, LLC

- The groove of sealing surface must be completely filled with sealant.
- The sealant bead must be 1.5 to 2.0 mm above the sealing surface.

NOTE: **The ribbed belt side sealing flange must be installed within 5 minutes of applying the sealant.**

-- Place the T40048/1 on the T40048/2 and slide the sealing flange -1- onto the pull sleeve.

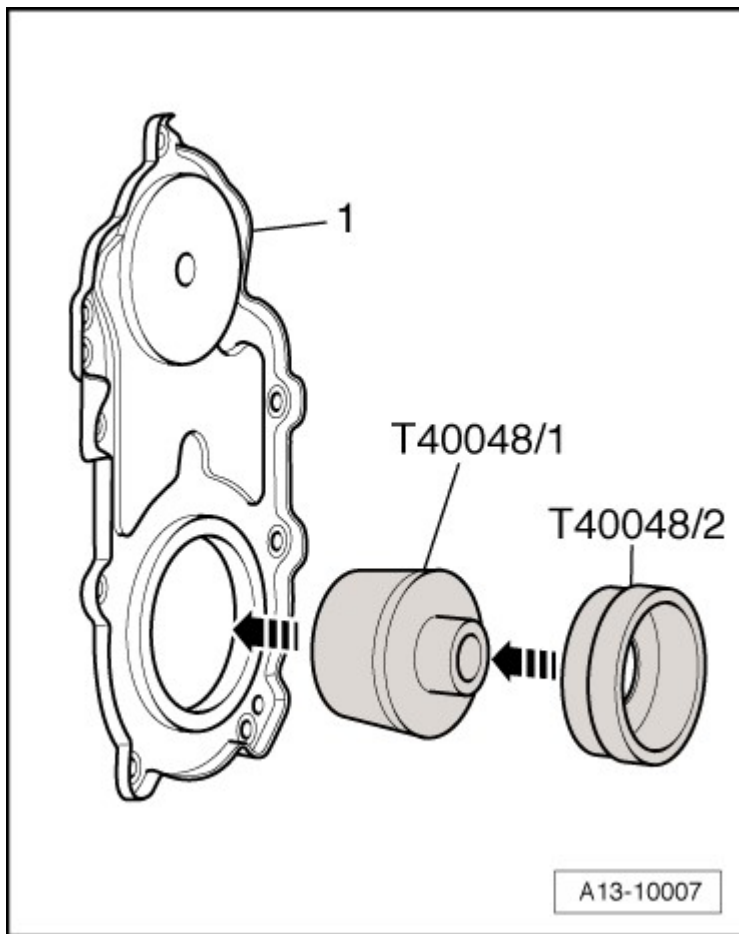


Fig. 45: Inserting Assembly Device T40048/1 Onto Pull Sleeve T40048/2 And Sliding Sealing Flange Onto Pull Sleeve

Courtesy of AUDI OF AMERICA, LLC

-- Remove the assembly device.

-- Then position the sealing flange with the T40048/2 installed on the crankshaft.

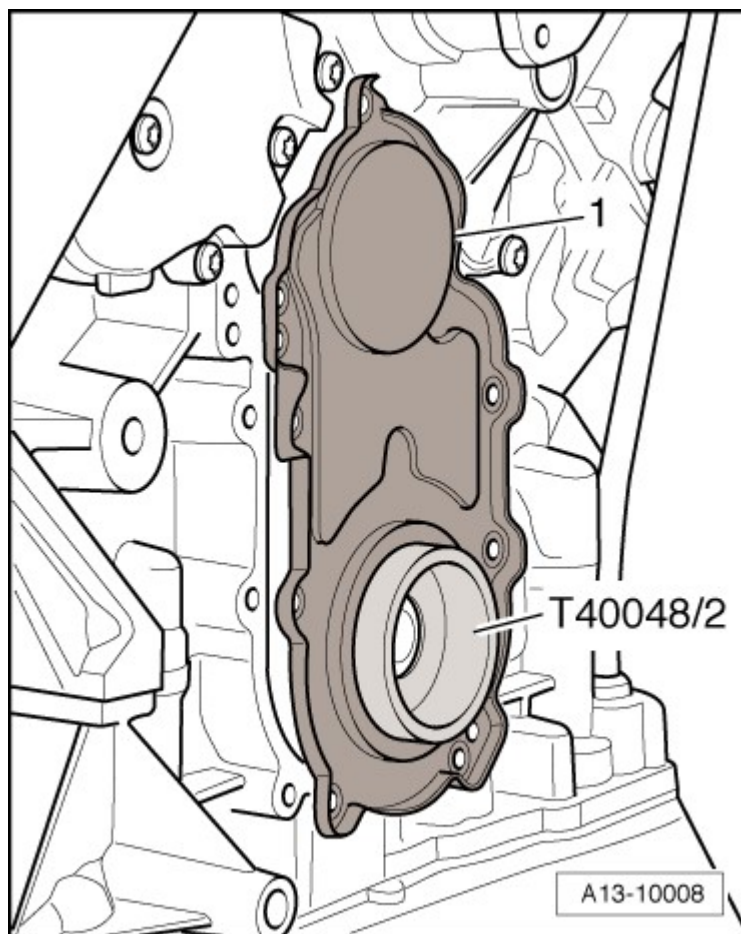


Fig. 46: Placing Sealing Flange With Inserted Pull Sleeve T40048/2 Onto Crankshaft
Courtesy of AUDI OF AMERICA, LLC

-- Without tipping, push the sealing flange onto engine sealing surface and fasten. Refer to **Fig. 15**.

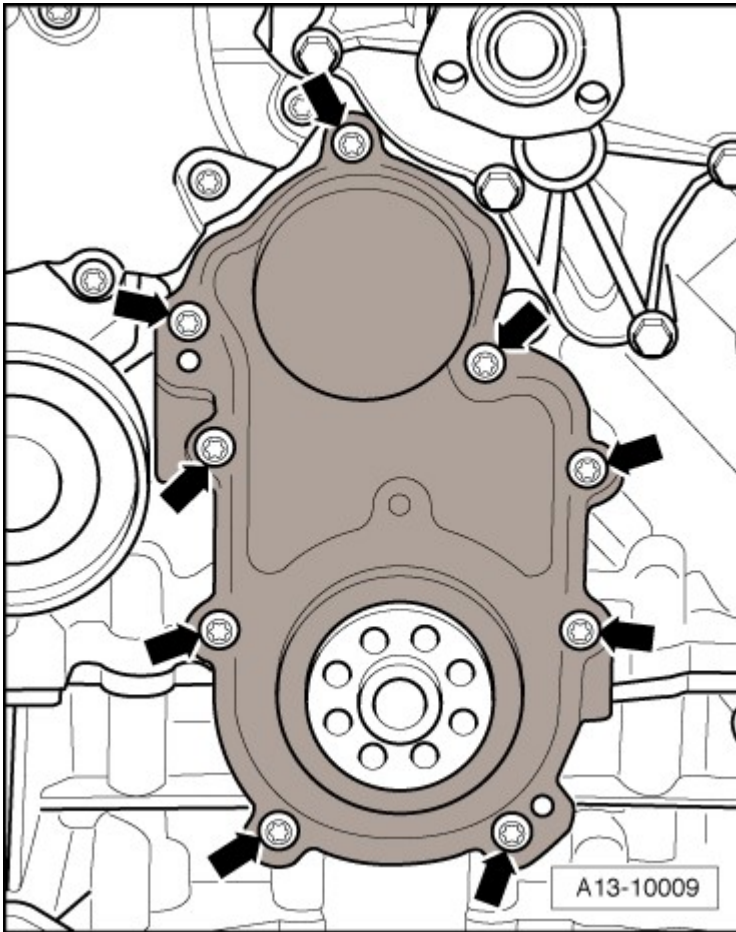


Fig. 47: Identifying Bolts & Front Sealing Flange, Removal
 Courtesy of AUDI OF AMERICA, LLC

Install in reverse order of removal paying attention to the following:

-- Install the coolant pump ribbed belt pulley. Refer to **COOLANT PUMP, COOLANT THERMOSTAT AND CONNECTING PIECE OVERVIEW** .

-- Install the vibration damper with ribbed belt pulley. Refer to **VIBRATION DAMPER WITH RIBBED BELT PULLEY**.

VIBRATION DAMPER WITH RIBBED BELT PULLEY

Removing

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

-- Remove the bolts -1- and the vibration damper with the ribbed belt pulley.

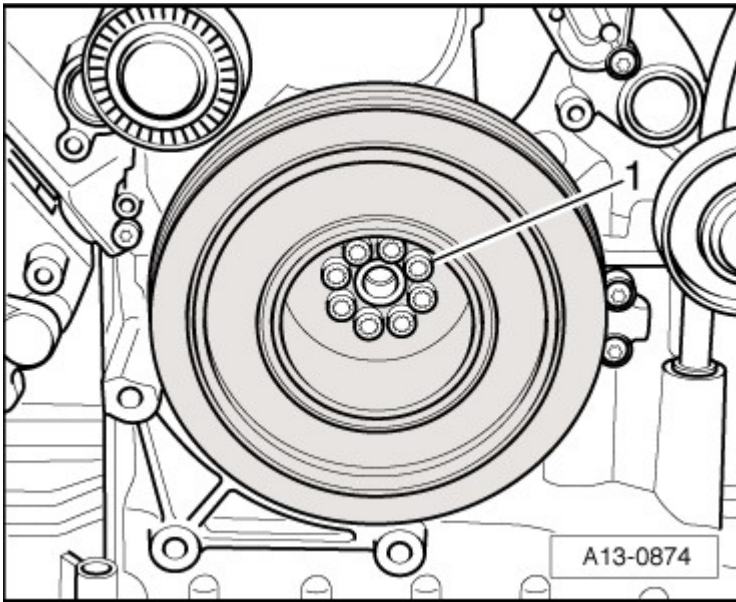


Fig. 48: Identifying Vibration Damper
Courtesy of AUDI OF AMERICA, LLC

Installing

- Tightening specification, refer to **RIBBED BELT DRIVE OVERVIEW**.

Install in reverse order, paying attention to the following:

NOTE: **Replace the vibration damper bolts.**

Installation is only possible in one position because of the offset holes.

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

SPECIAL TOOLS

Special tools and workshop equipment required

- Dial Gauge Holder VW 387

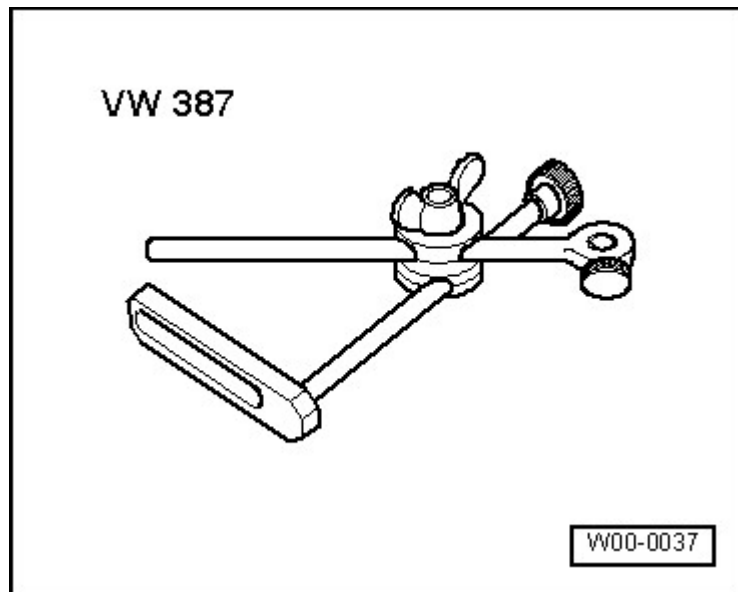


Fig. 49: Identifying Dial Gauge Holder VW 387
Courtesy of AUDI OF AMERICA, LLC

- Dial Gauge 0-10 mm VAS 6079

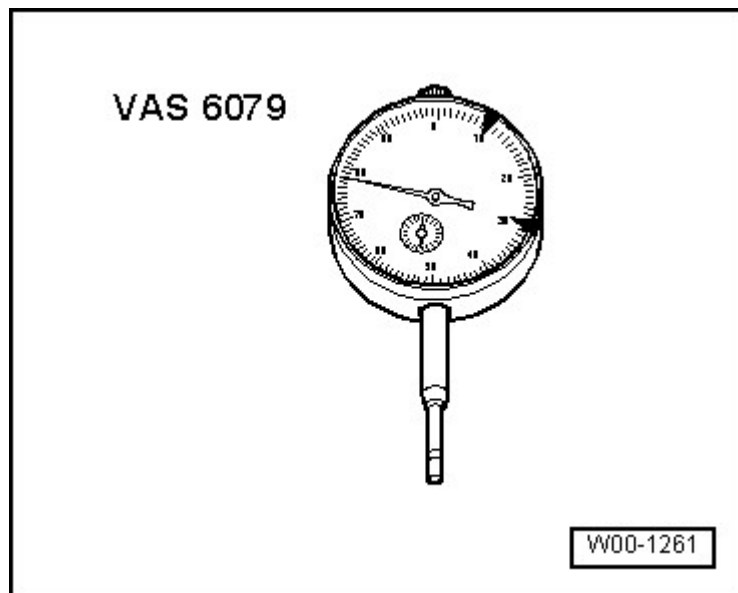


Fig. 50: Identifying Dial Gauge 0-10 mm VAS 6079
Courtesy of AUDI OF AMERICA, LLC

- Spanner Wrench 3212

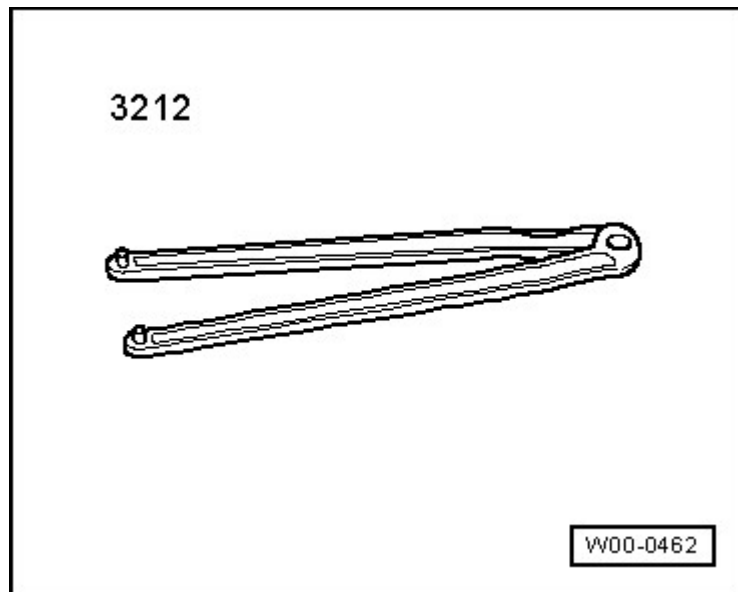


Fig. 51: Identifying Pin Wench VAS 3212A (Or Equivalent)
Courtesy of AUDI OF AMERICA, LLC

- Assembly Device T40048

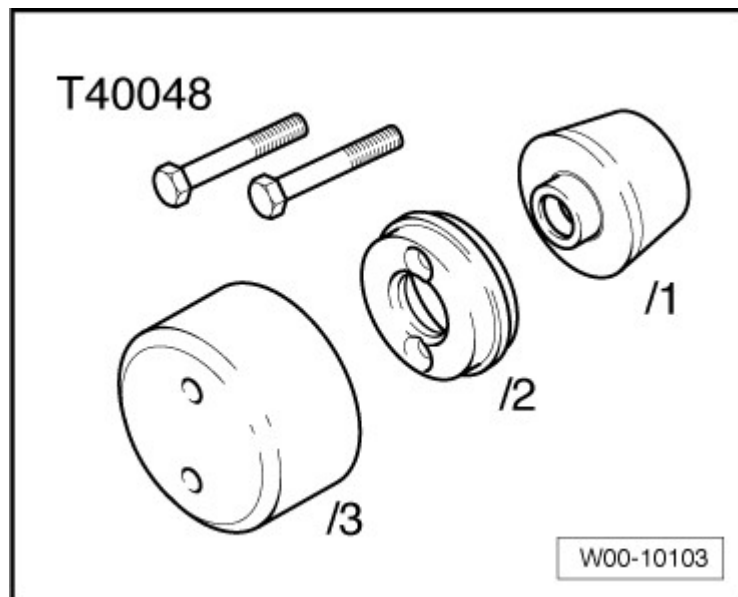


Fig. 52: Identifying Assembly Tool T40048
Courtesy of AUDI OF AMERICA, LLC

- Counter Hold Tool 10 - 201

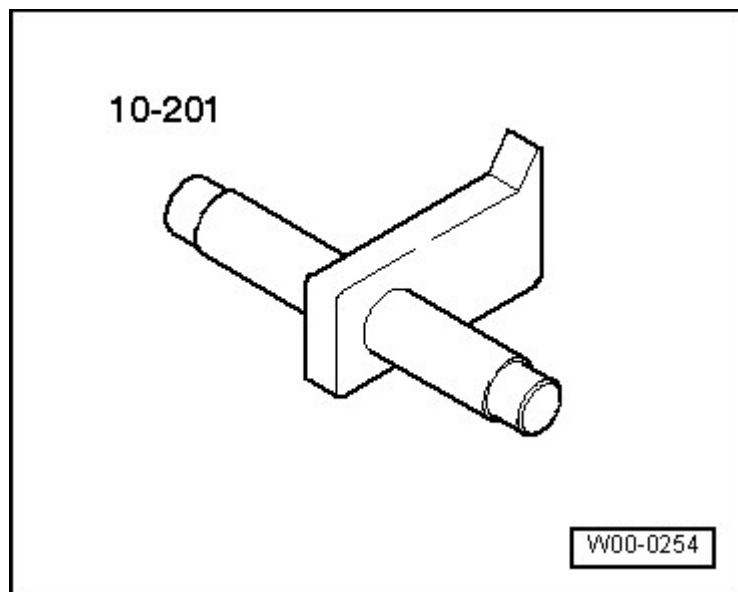


Fig. 53: Identifying Counter-Holder Tool 10 - 201
Courtesy of AUDI OF AMERICA, LLC

- Thrust Plate VW 402

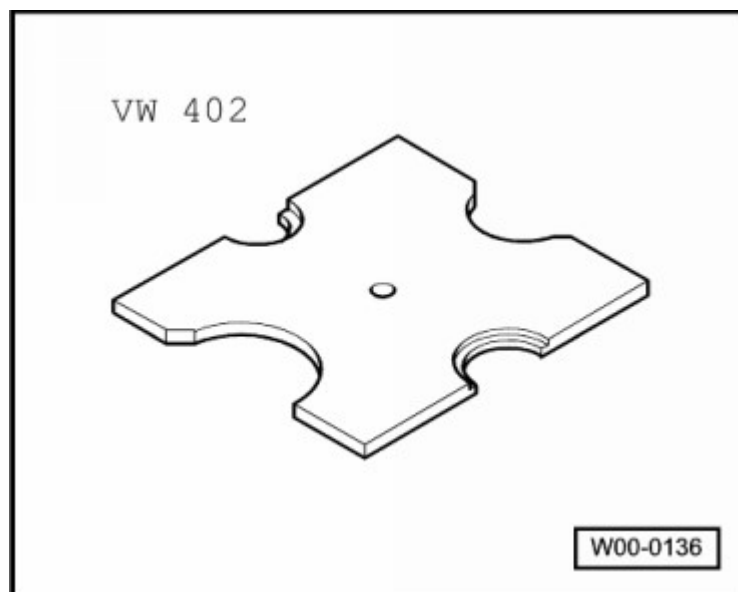


Fig. 54: Identifying Thrust Plate VW 402
Courtesy of AUDI OF AMERICA, LLC

- Tube 31.5 mm Dia. VW 418 A

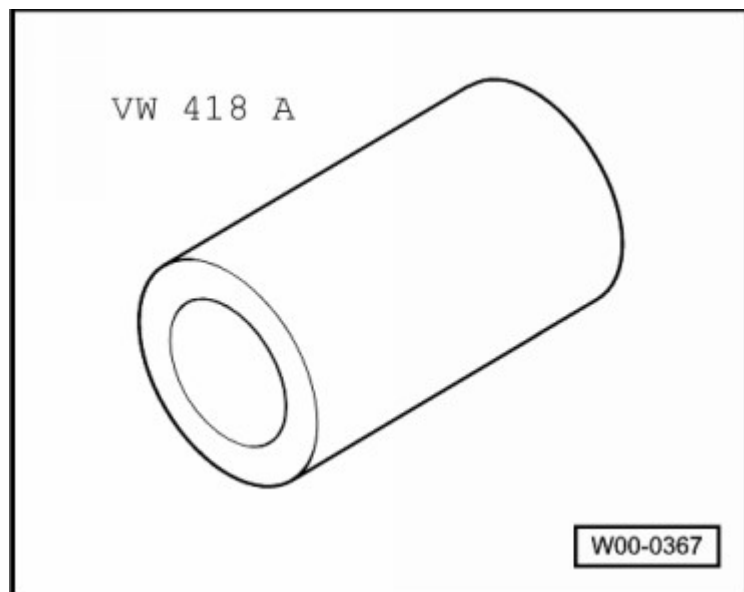


Fig. 55: Identifying Sleeve VW 418 A
Courtesy of AUDI OF AMERICA, LLC

- Tube 28 mm Dia. 100 mm VW 421

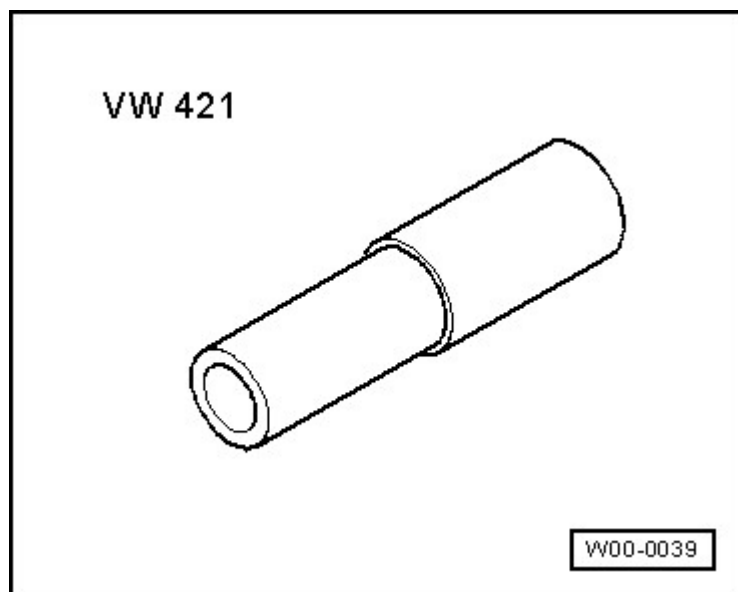


Fig. 56: Identifying Tube 28 mm Dia. 100 mm VW 421
Courtesy of AUDI OF AMERICA, LLC

- Sleeve 40 - 103

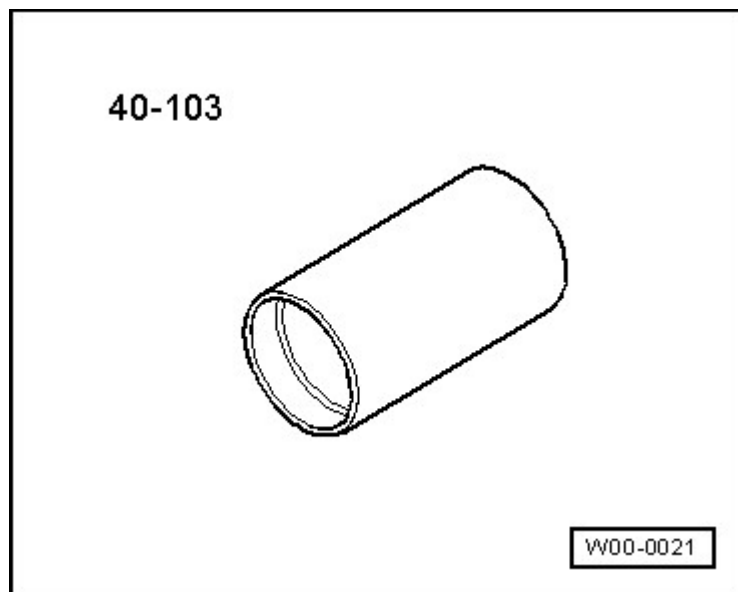


Fig. 57: Identifying Sleeve 40 - 103
Courtesy of AUDI OF AMERICA, LLC

- Assembly Tool T10122

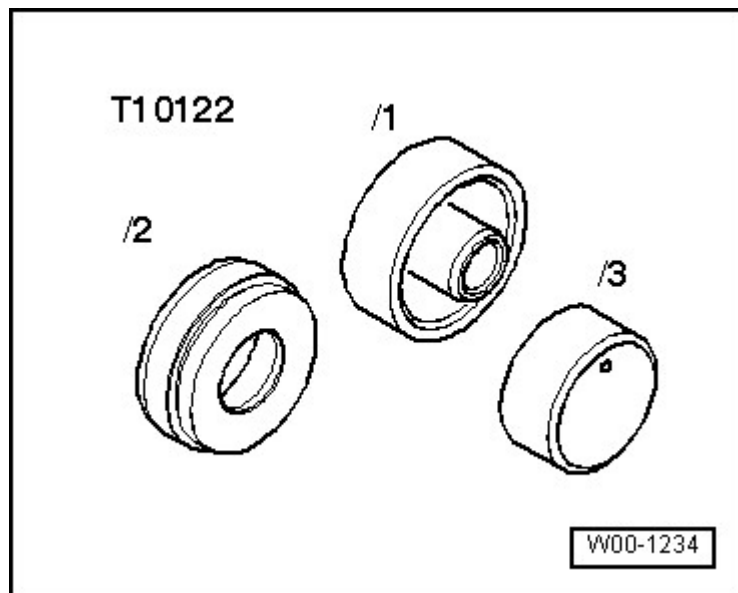


Fig. 58: Identifying Assembly Tool T10122
Courtesy of AUDI OF AMERICA, LLC

- Pulling Hook T20143/2

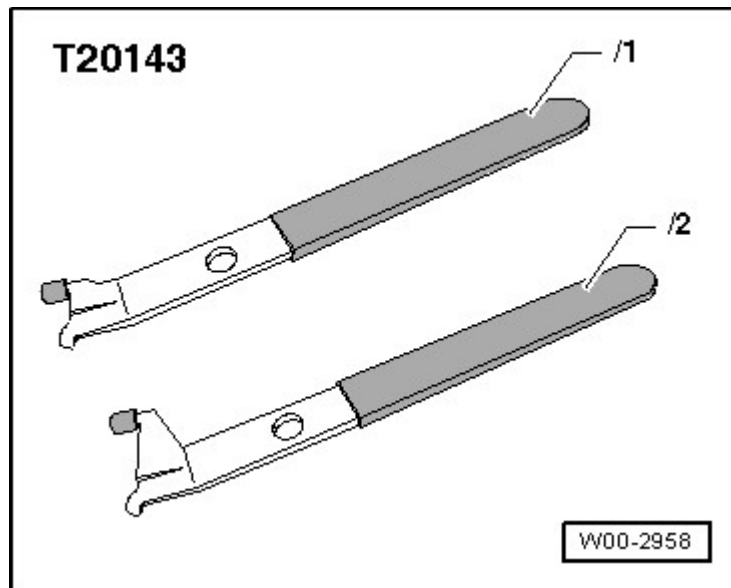


Fig. 59: Identifying Extractor Hook T20143
Courtesy of AUDI OF AMERICA, LLC

- Pilot Drift VW 222 A

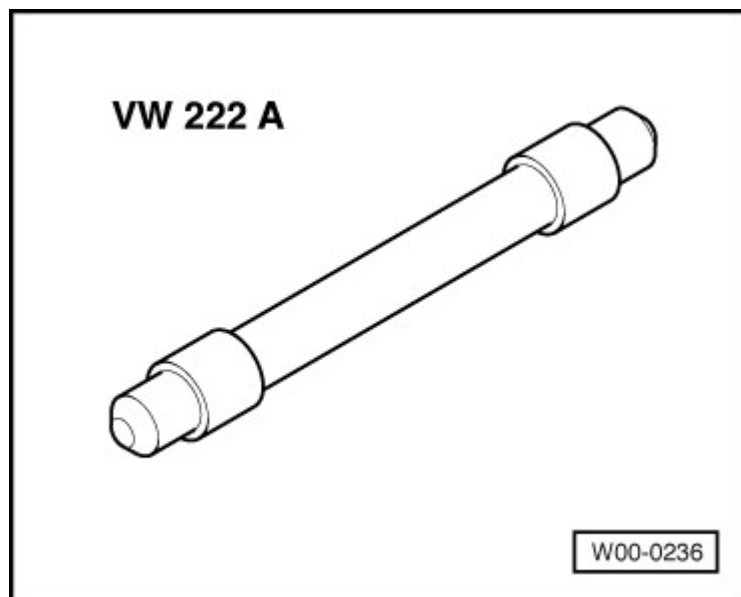


Fig. 60: Identifying Drift VW 222 A
Courtesy of AUDI OF AMERICA, LLC

- Not illustrated:
- Assembly Device T10122/1
- Pull Sleeve T10122/2
- Thrust Piece T10122/3
- Assembly Device T40048/1

2009 Audi Q5 Quattro

ENGINE 3.2 Liter - Crankshaft, Cylinder Block - Engine Code(s): CALB

- Pull Sleeve T40048/2
- Internal Dial Gauge VAS 6078 or Inside Micrometer Set 18-100 mm US1033/S

ENGINE

3.2 Liter - Cylinder Head, Valvetrain - Engine Code(s): CALB

15 CYLINDER HEAD, VALVETRAIN

DESCRIPTION AND OPERATION

BALANCE SHAFT OVERVIEW

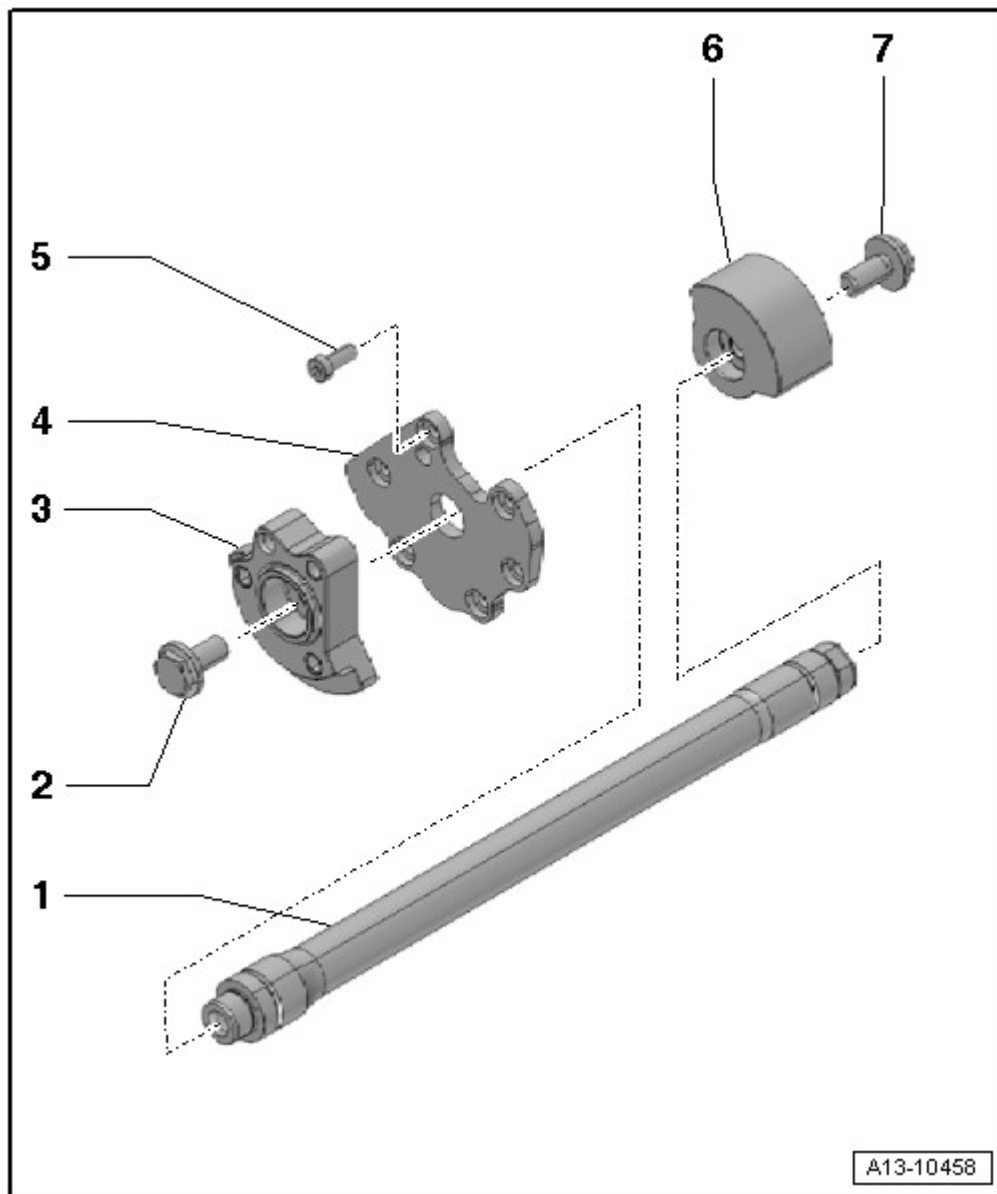


Fig. 1: Balance Shaft Overview
Courtesy of AUDI OF AMERICA, LLC

1. Balance Shaft
 - Removing and installing, refer to **BALANCE SHAFT**
2. Bolt
 - 60 Nm
 - To loosen and fasten, use a 8 mm drill bit as a counter-holder
3. Balance Shaft Transmission Side
 - Can only be placed on the balance shaft in one position
4. Bearing End Bracket
5. Bolt
 - 13 Nm
6. Balance Shaft Belt Pulley Side
 - Can only be placed on the balance shaft in one position
7. Bolt
 - 60 Nm
 - To loosen and fasten, use drill 8 mm as counter-holder

CAMSHAFT TIMING CHAINS OVERVIEW**Left Camshaft Timing Chain**

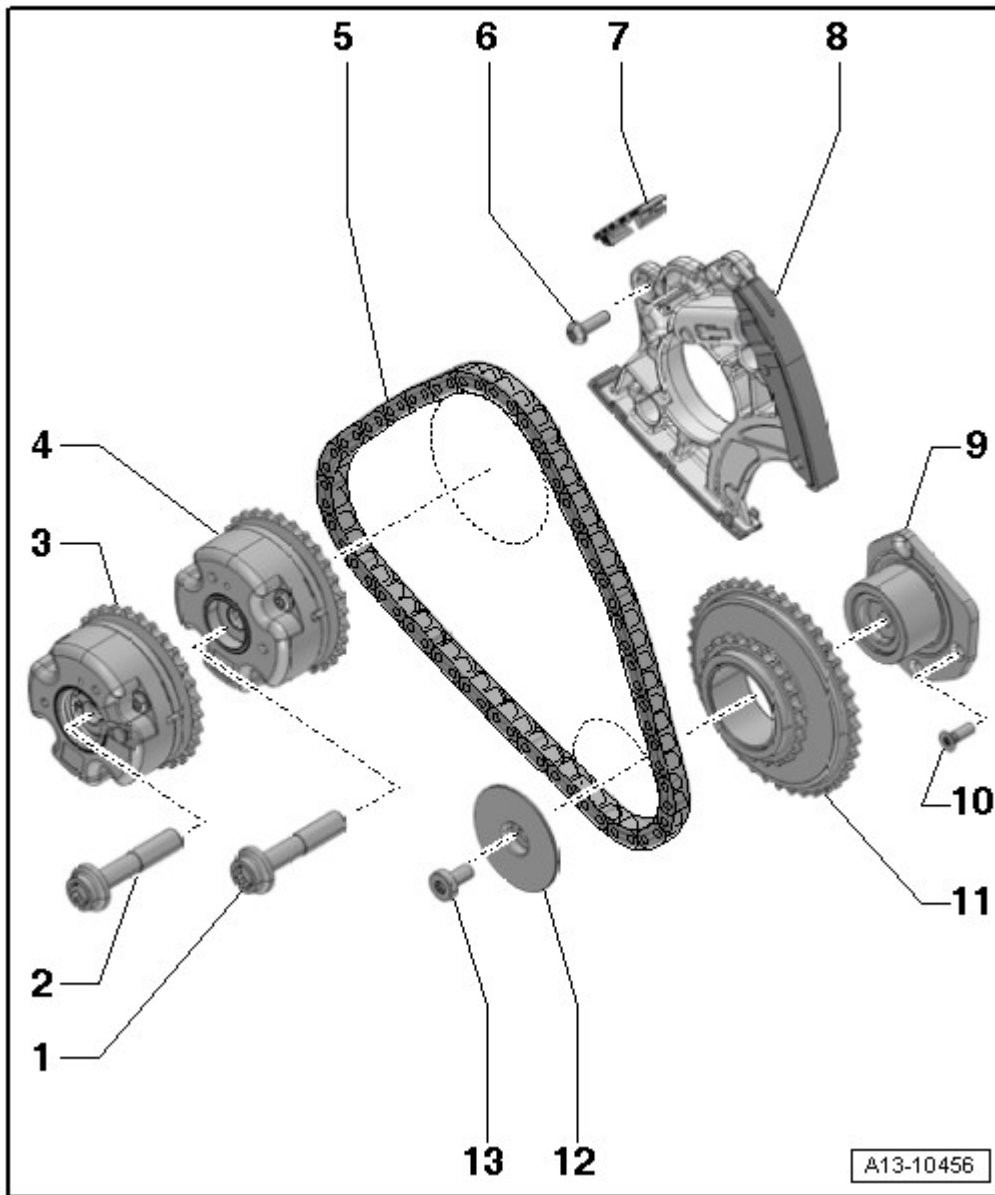


Fig. 2: Identifying Left Camshaft Timing Chain Assembly
 Courtesy of AUDI OF AMERICA, LLC

1. Bolt
 - 80 Nm plus an additional 90° turn
 - Replace
2. Bolt
 - 80 Nm plus an additional 90° turn
 - Replace
3. Camshaft Adjuster for Exhaust Camshaft
 - Identification "Exhaust"
 - Removing and installing, refer to **CAMSHAFT TIMING CHAINS, REMOVING FROM**

CAMSHAFTS

4. Camshaft Adjuster for Intake Camshaft
 - Identification "Intake"
 - Removing and installing, refer to **CAMSHAFT TIMING CHAINS, REMOVING FROM CAMSHAFTS**
5. Left Camshaft Timing Chain
 - Remove from camshafts, refer to **CAMSHAFT TIMING CHAINS, REMOVING FROM CAMSHAFTS**
 - Before removing, mark the direction of rotation with paint
 - Removing and installing, refer to **CAMSHAFT TIMING CHAINS, REMOVING FROM CAMSHAFTS**
6. Bolt
 - 9 Nm
7. Gliding Piece
8. Left Camshaft Timing Chain Tensioner
 - Removing and installing, refer to **CAMSHAFT TIMING CHAINS, REMOVING FROM CAMSHAFTS**
9. Drive Sprocket Mounting Bracket
10. Bolt
 - 8 Nm plus an additional 45° turn
 - Replace
11. Left Camshaft Timing Chain Drive Sprocket
12. Thrust Washer for Drive Sprocket
13. Bolt
 - 6 Nm plus an additional 60° turn
 - Replace

Right Camshaft Timing Chain

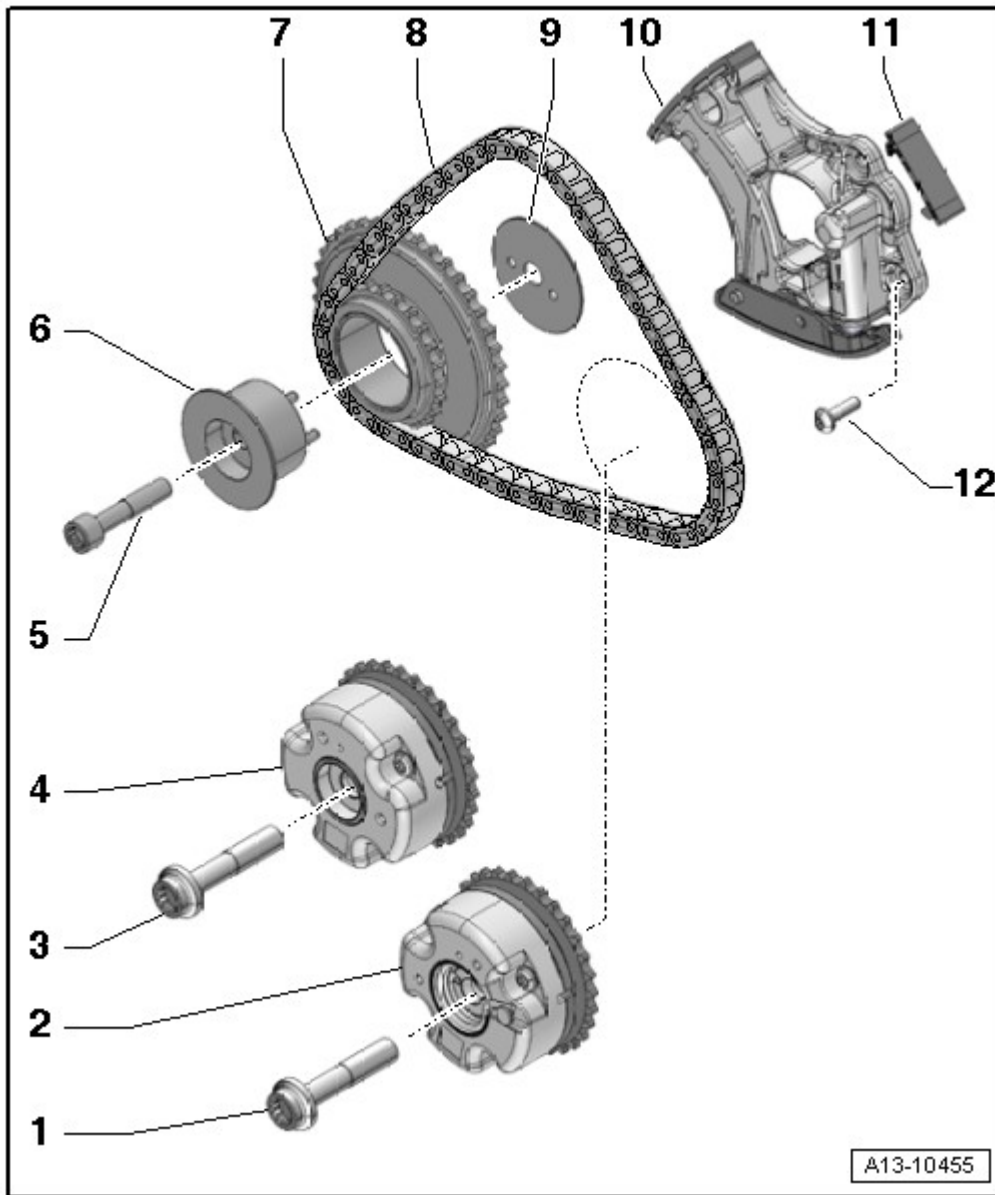


Fig. 3: Identifying Right Camshaft Timing Chain Assembly
 Courtesy of AUDI OF AMERICA, LLC

1. Bolt
 - 80 Nm plus an additional 90° turn
 - Replace
2. Camshaft Adjuster For Exhaust Camshaft
 - Identification "Exhaust"
 - Removing and installing, refer to **CAMSHAFT TIMING CHAINS, REMOVING FROM CAMSHAFTS**
3. Bolt
 - Replace

- 80 Nm plus an additional 90° turn
- 4. Camshaft Adjuster for Intake Camshaft
 - Identification "Intake"
 - Removing and installing, refer to **CAMSHAFT TIMING CHAINS, REMOVING FROM CAMSHAFTS**
- 5. Bolt
 - 30 Nm plus an additional 90° turn
 - Replace
- 6. Pivot Pin for Drive Sprocket
 - For the right camshaft timing chain
 - Asymmetrical version
 - Installed position, refer to **Fig. 16**
- 7. Right Camshaft Timing Chain Drive Sprocket
 - Installed position, refer to **Fig. 16**
- 8. Right Camshaft Timing Chain
 - Remove from camshafts, refer to **CAMSHAFT TIMING CHAINS, REMOVING FROM CAMSHAFTS**
 - Before removing, mark the direction of rotation with paint
 - Removing and installing, refer to **CAMSHAFT TIMING CHAINS, REMOVING FROM CAMSHAFTS**
- 9. Thrust Washer for Drive Sprocket
 - For the right camshaft timing chain
 - Asymmetrical version
 - Installed position, refer to **Fig. 16**
- 10. Right Camshaft Timing Chain Tensioner
 - Removing and installing, refer to **CAMSHAFT TIMING CHAINS, REMOVING FROM CAMSHAFTS**
- 11. Gliding Piece
- 12. Bolt
 - 9 Nm

CYLINDER HEAD OVERVIEW

NOTE: **The illustration shows the cylinder bank 2 cylinder head (left).**

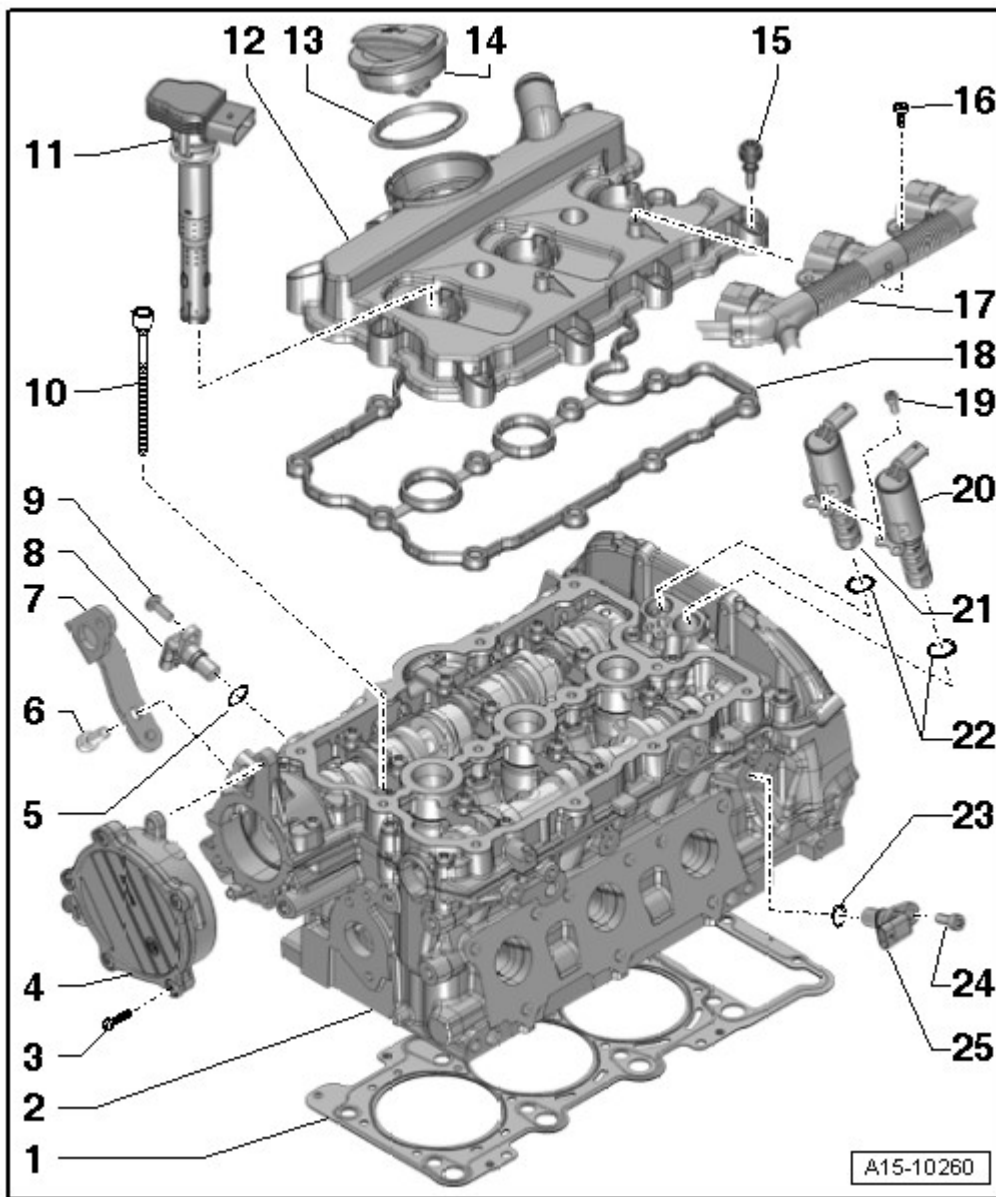


Fig. 4: Cylinder Head Overview

Courtesy of AUDI OF AMERICA, LLC

1. Cylinder Head Gasket

- Removing and installing, refer to **CYLINDER HEADS**
- Installed position: Parts number to cylinder head
- after replacing, change coolant and engine oil

2. Cylinder Head

- Removing **CYLINDER HEADS**
- Check for distortion **Fig. 7**
- Reworking dimension **Fig. 8**
- Installing **CYLINDER HEADS**

- After replacing, change coolant and engine oil
- 3. Bolt
 - Tightening specification, refer to **DESCRIPTION AND OPERATION**
- 4. Vacuum Pump
 - Removing and installing, refer to **REMOVAL AND INSTALLATION**
- 5. O-ring
 - Replace
- 6. Bolt
 - 20 Nm
- 7. Engine Lifting Eye
- 8. Camshaft Position Sensor, Intake Camshaft
 - Cylinder bank 1 (right) Camshaft Position (CMP) Sensor -G40-
 - Cylinder bank 2 (left) Camshaft Position (CMP) Sensor 2 -G163-
- 9. Bolt
 - 9 Nm
- 10. Bolt
 - Tighten in 3 stages:
 - Tighten to 40 Nm.
 - Tighten an additional 90°.
 - Tighten an additional 90°.
 - Loosening procedure **CYLINDER HEADS**
 - Replace
 - Loosening procedure **CYLINDER HEADS**
- 11. Ignition Coil
 - Use puller for ignition coil T40039 for removal
- 12. Cylinder Head Cover
 - Removing and installing, refer to **LEFT CYLINDER HEAD COVER**, right **RIGHT CYLINDER HEAD COVER**
- 13. Gasket
 - Replace if damaged or leaking
- 14. Cover
- 15. Bolt
 - Replace if the seal is damaged
 - Tightening specifications, refer to **Fig. 5** and **Fig. 6**.
- 16. Bolt

- Tightening specification, refer to **REMOVAL AND INSTALLATION**
- 17. Connector Strip
 - For ignition coils
- 18. Cylinder Head Cover Gasket
 - Replace if damaged or leaking
- 19. Bolt
 - 2.5 Nm
- 20. Solenoid Valve for Camshaft Adjustment - Exhaust Side
 - Cylinder bank 1 (right) Exhaust camshaft control valve 1 -N318-
 - Cylinder bank 2 (left) Camshaft Adjustment Valve 2 (exhaust) -N319-
- 21. Solenoid Valve for Camshaft Adjustment - Intake Side
 - Cylinder bank 1 (right) Camshaft Adjustment Valve 1 -N205-
 - Cylinder bank 2 (left) Camshaft Adjustment Valve 2 -N208-
- 22. O-rings
 - Replace
- 23. O-ring
 - Replace
- 24. Bolt
 - 9 Nm
- 25. Camshaft Position Sensor, Exhaust Camshaft
 - Cylinder bank 1 (right) Camshaft Position (CMP) Sensor 3 -G300-
 - Cylinder bank 2 (left) Camshaft Position (CMP) Sensor 4 -G301-

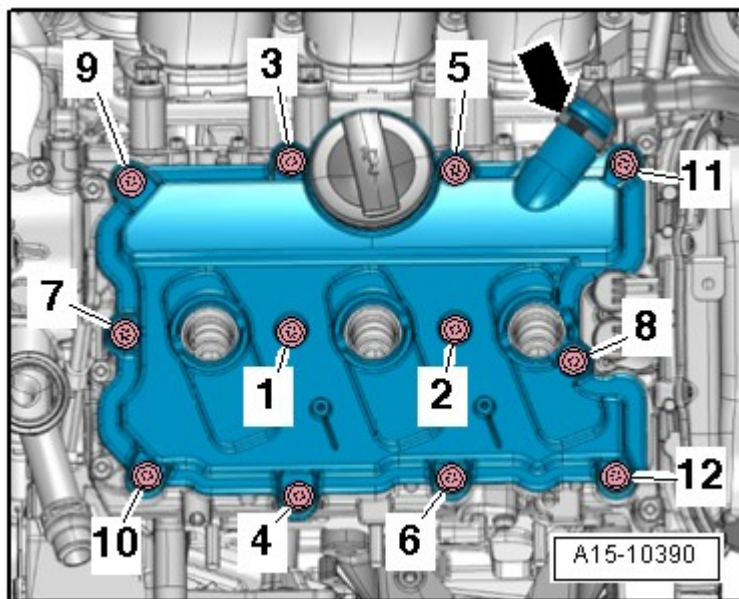


Fig. 5: Identifying Left Cylinder Head Cover Bolt, Tightening Sequence

Courtesy of AUDI OF AMERICA, LLC

-- Tighten the bolts to 9 Nm in the following sequence: -1 to 12-.

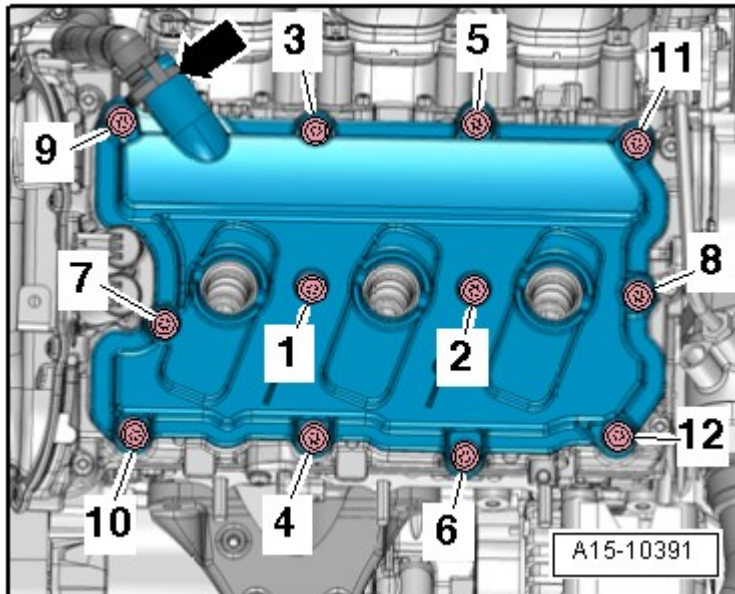


Fig. 6: Identifying Right Cylinder Head Cover Bolt, Tightening Sequence
Courtesy of AUDI OF AMERICA, LLC

-- Tighten the bolts to 9 Nm in the following sequence: -1 to 12-.

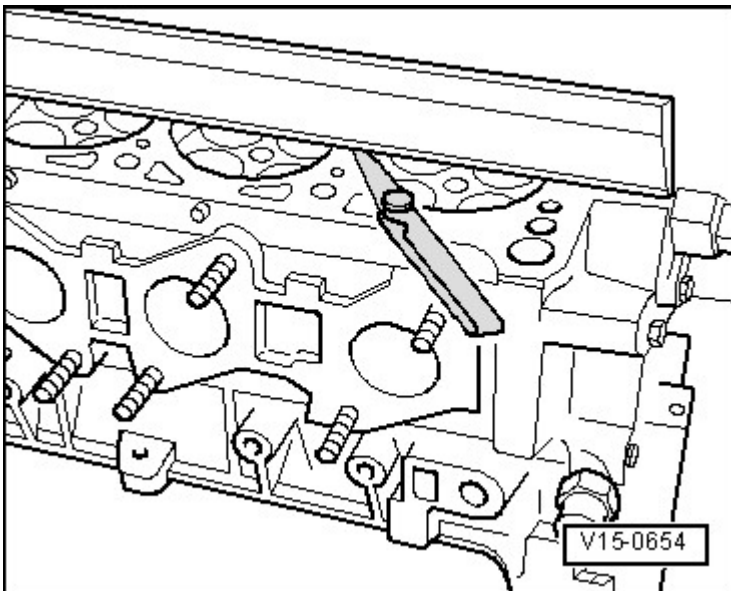


Fig. 7: Checking Cylinder Head For Distortion
Courtesy of AUDI OF AMERICA, LLC

-- Check the cylinder head in several places for distortion using a straight edge and a feeler gauge.

- Maximum warp: 0.05 mm.

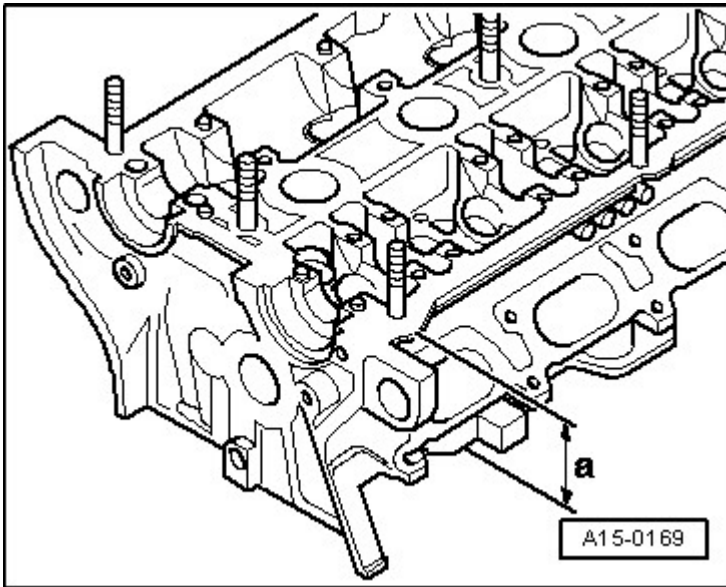


Fig. 8: Identifying Cylinder Head Refacing Dimension
Courtesy of AUDI OF AMERICA, LLC

Resurfacing cylinder head (face grinding) is only permissible to minimum dimension -a-.

- Minimum dimension -a- = 139.20 mm.

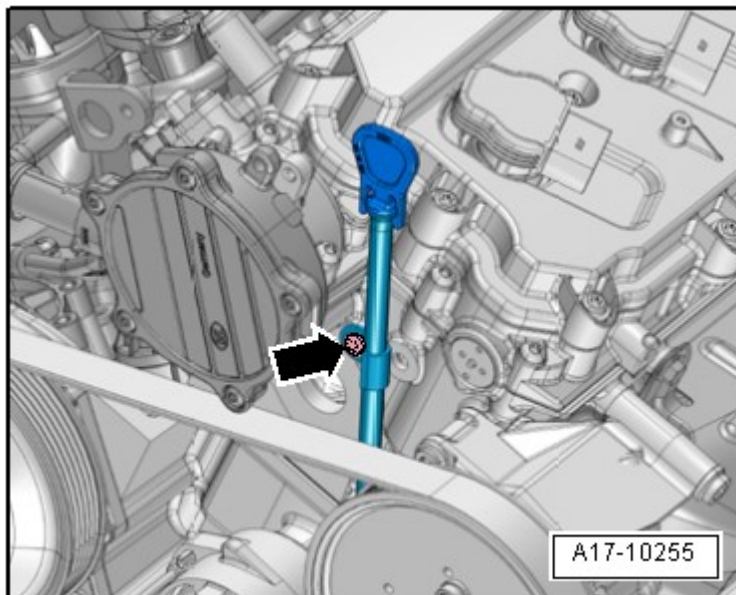


Fig. 9: Identifying Oil Dipstick Guide Tube Bolt
Courtesy of AUDI OF AMERICA, LLC

-- Tighten the bolt -arrow- to 9 Nm.

POWER TAKE-OFF DRIVE CHAIN OVERVIEW

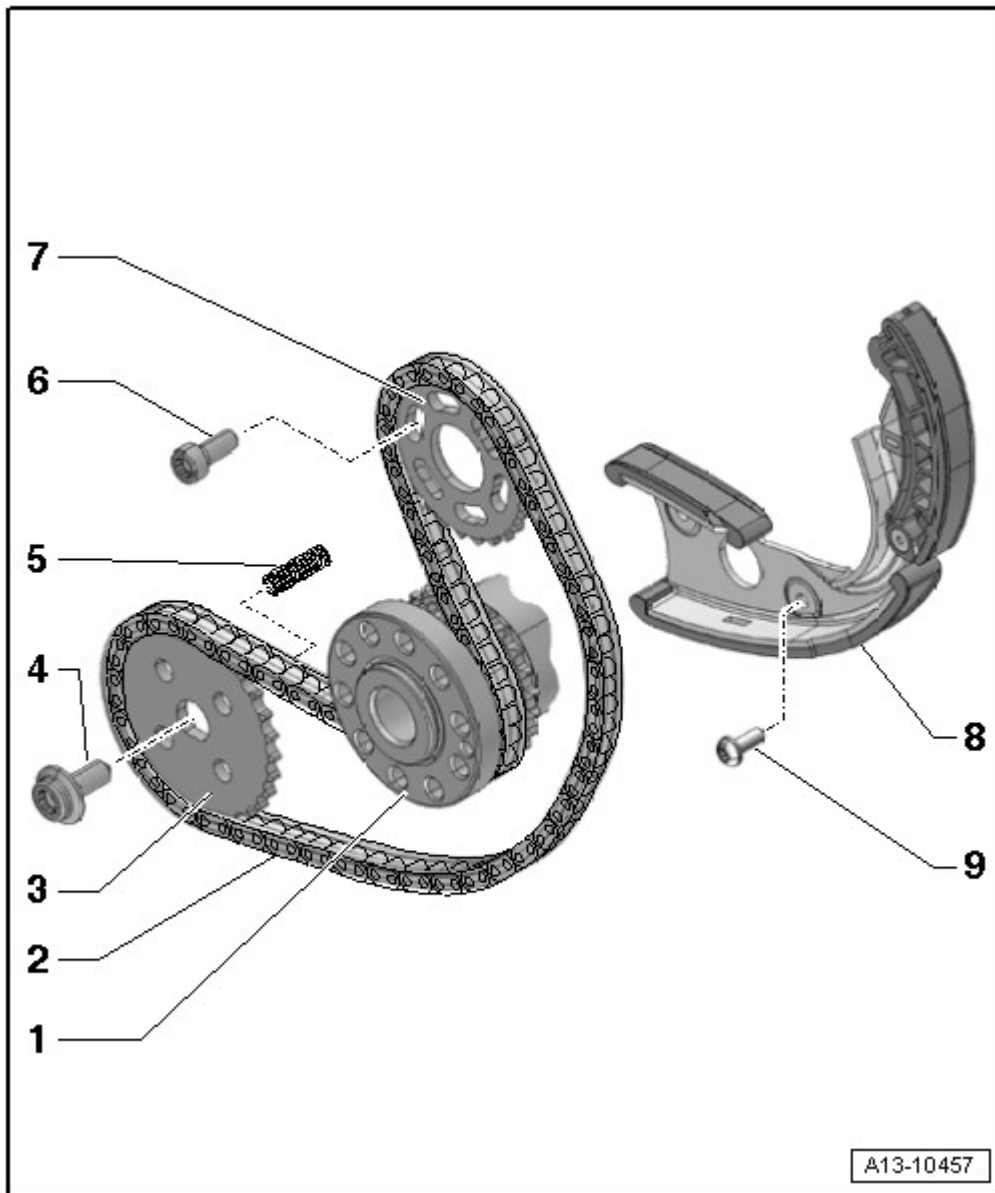


Fig. 10: Power Take-Off Drive Chain Overview
Courtesy of AUDI OF AMERICA, LLC

1. Crankshaft
2. Power Take-Off Drive Chain
 - Before removing, mark the direction of rotation with paint
 - Removing and installing, refer to **POWER TAKE-OFF DRIVE CHAIN**
3. Drive Sprocket for Oil Pump
 - Installed position: The labeled side faces the engine
4. Bolt

- 30 Nm plus an additional 90° turn
 - Replace
5. Pressure Spring
 6. Bolt
 - 15 Nm plus an additional 90° turn
 - Replace
 7. Balance Shaft Chain Sprocket
 - Installed position: The labeled side faces the transmission
 8. Chain Tensioner
 - With glide track
 9. Bolt
 - 10 Nm plus an additional 45° turn
 - Replace

TIMING CHAIN COVERS OVERVIEW

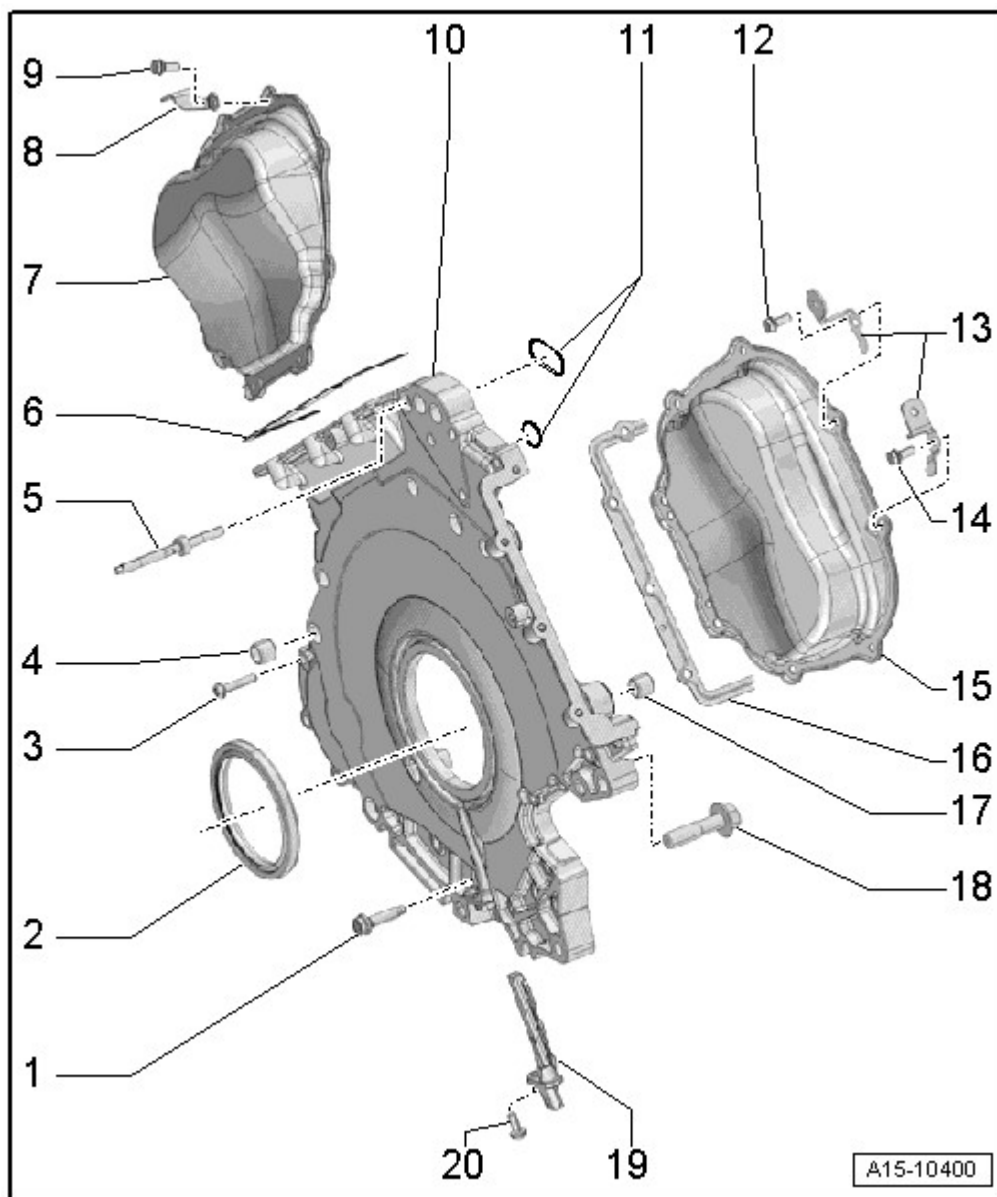


Fig. 11: Timing Chain Covers Overview

Courtesy of AUDI OF AMERICA, LLC

1. Bolt
 - Tightening specification and sequence, refer to **Fig. 14**
2. Crankshaft Shaft Seal, Transmission Side
 - Removing and installing, refer to **CRANKSHAFT SEAL, TRANSMISSION SIDE**
3. Bolt
 - Tightening specification and sequence, refer to **Fig. 14**
4. Alignment Bushing
 - Quantity: 2
5. Bolt

- Tightening specification, refer to item -13- Stud Bolt in **OIL FILTER HOUSING AND OIL PRESSURE SWITCH OVERVIEW**
- 6. Left Cylinder Head Gasket
- 7. Left Timing Chain Cover
 - Removing and installing, refer to **LEFT AND RIGHT TIMING CHAIN COVERS**
- 8. Bracket
 - For wiring harness
- 9. Bolt
 - Replace
 - Tightening specification and sequence, refer to **Fig. 12**
- 10. Lower Timing Chain Cover
 - Removing and installing, refer to **LOWER TIMING CHAIN COVER**
- 11. Seals
 - Replace
- 12. Bolt
 - Tightening specification and sequence, refer to **Fig. 13**
- 13. Bracket
 - for the electrical connectors
- 14. Bolt
 - Replace
 - Tightening specification and sequence, refer to **Fig. 13**
- 15. Right Timing Chain Cover
 - Removing and installing, refer to **LEFT AND RIGHT TIMING CHAIN COVERS**
- 16. Right Cylinder Head Gasket
- 17. Alignment Bushing
 - Quantity: 2
- 18. Bolt
 - Tightening specification and sequence, refer to **Fig. 14**
- 19. Engine Speed (RPM) Sensor -G28-
 - Removing and installing, refer to **REMOVAL AND INSTALLATION**
- 20. Bolt
 - Tightening specification, refer to **REMOVAL AND INSTALLATION**

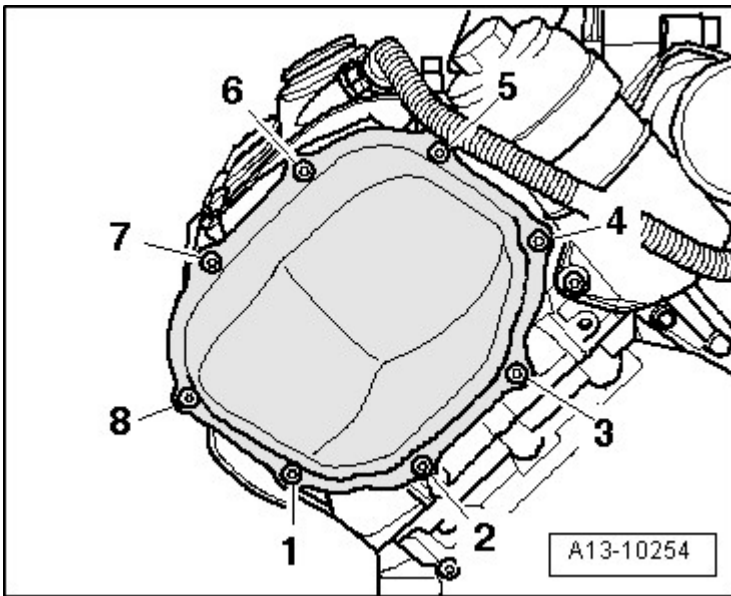


Fig. 12: Identifying Sequence Of Left Timing Chain Cover Bolts
 Courtesy of AUDI OF AMERICA, LLC

NOTE: Replace the bolts for the left timing chain cover.

-- Tighten bolts in 2 stages in sequence -1 through 8- as follows:-- Tighten to 5 Nm.-- Tighten an additional 90°.

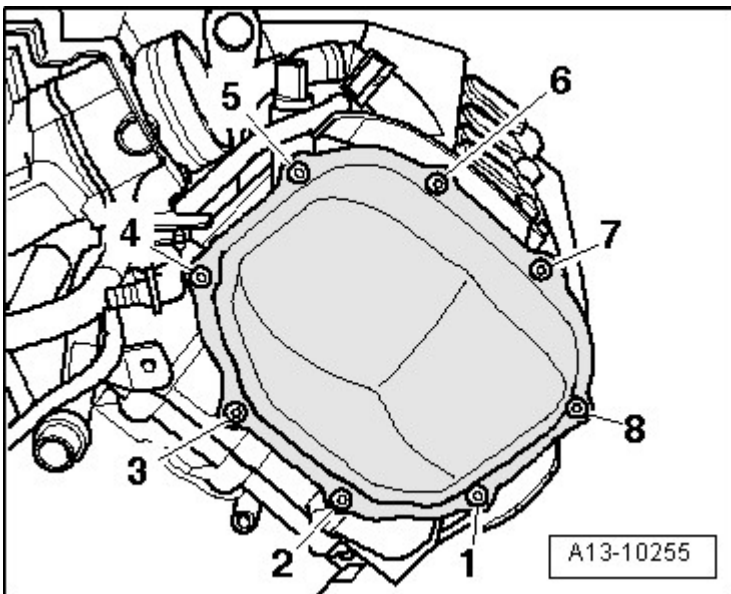


Fig. 13: Identifying Sequence Of Right Timing Chain Cover Bolts
 Courtesy of AUDI OF AMERICA, LLC

NOTE: Replace the bolts for the right timing chain cover.

-- Tighten bolts in 2 stages in sequence -1 through 8- as follows:-- Tighten to 5 Nm.-- Tighten an additional 90°.

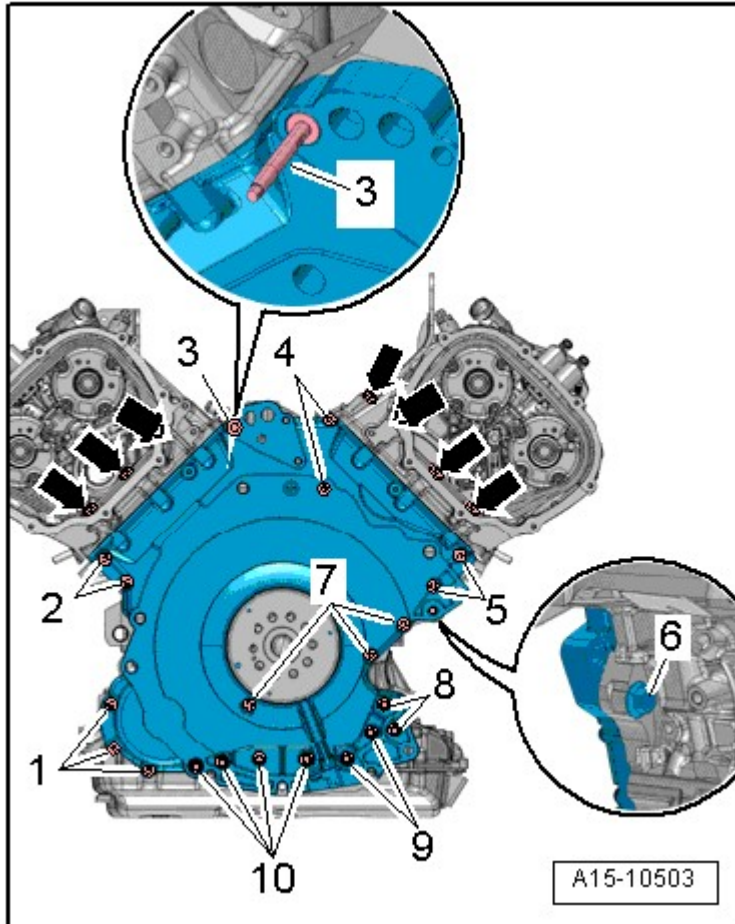


Fig. 14: Identifying Lower Timing Chain Cover Bolt, Tightening Sequence
 Courtesy of AUDI OF AMERICA, LLC

-- Tighten bolts in 6 stages as follows:-- Insert the bolts -arrows- and tighten them to 5 Nm.-- Tighten the bolts -1 through 10- diagonally to 9 Nm.-- Tighten bolts -arrows- to 9 Nm.-- Tighten the bolts -8, 9 and 10- to 22 Nm.-- Tighten the bolt -3- to 16 Nm.-- Tighten the bolt -6- to 70 Nm.

TIMING MECHANISM DRIVE CHAIN OVERVIEW

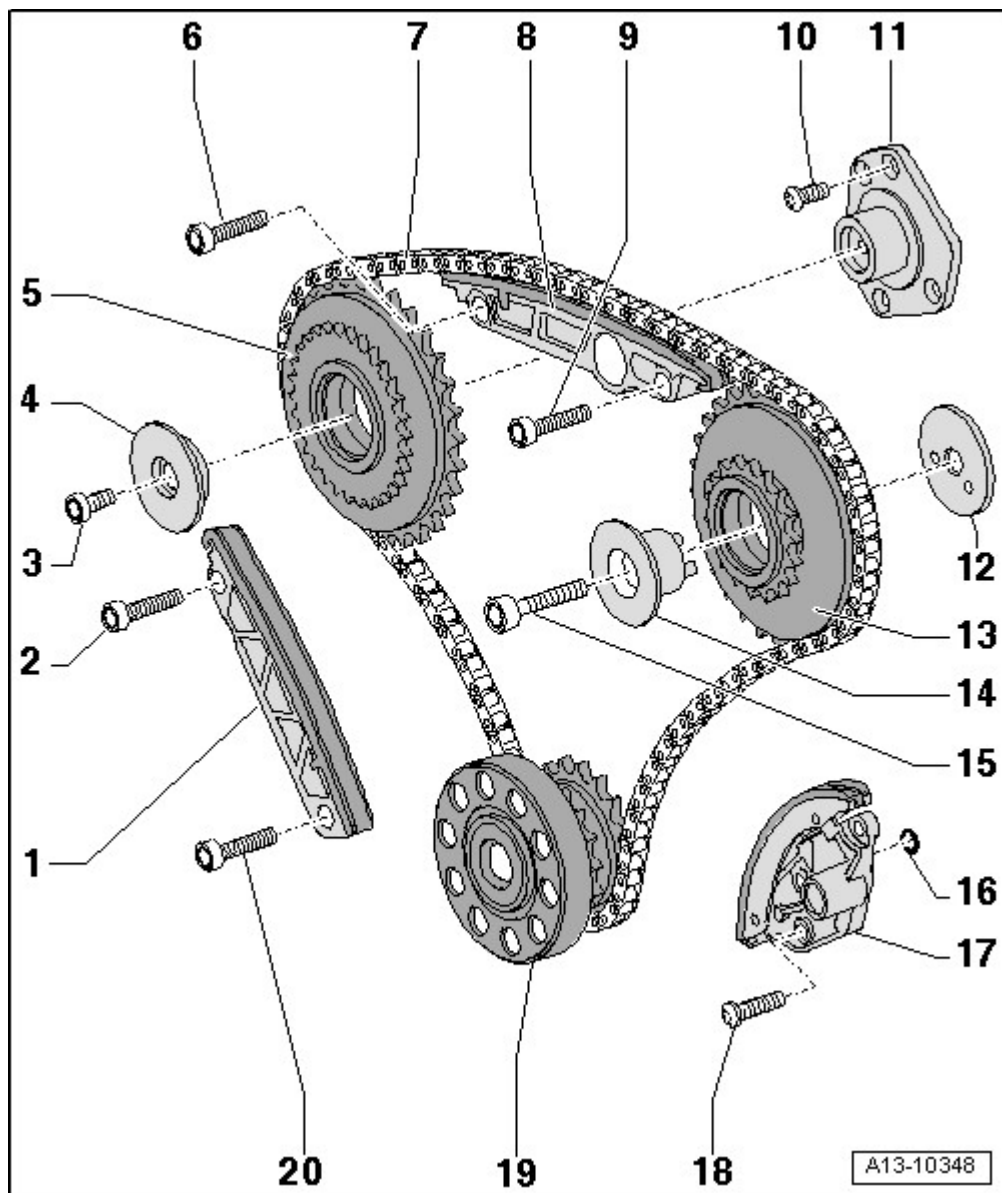


Fig. 15: Timing Mechanism Drive Chain Overview

Courtesy of AUDI OF AMERICA, LLC

1. Guide Rail
2. Bolt
 - 10 Nm plus an additional 90° turn
 - Replace
3. Bolt
 - Tightening specification, refer to item 13
4. Thrust Washer for Drive Sprocket
5. Drive Sprocket for Left Timing Chain
6. Bolt

- 10 Nm plus an additional 90° turn
 - Replace
7. Power Take-Off Drive Chain
 - Before removing, mark the direction of rotation with paint
 - Removing and installing, refer to **TIMING MECHANISM DRIVE CHAIN**
 8. Guide Rail
 9. Bolt
 - 10 Nm plus an additional 90° turn
 - Replace
 10. Bolt
 - Tightening specification, refer to item 10
 11. Mounting Bracket for Drive Sprocket
 - For the right camshaft timing chain
 - Asymmetrical version
 - Installed position, refer to **Fig. 16**
 12. Thrust Washer
 - Asymmetrical version
 - Installed position, refer to **Fig. 16**
 13. Drive Sprocket for Right Timing Chain
 - Installed position, refer to **Fig. 16**
 14. Pivot Pin for Drive Sprocket
 - Asymmetrical version
 - Installed position, refer to **Fig. 16**
 15. Bolt
 - Tightening specification, refer to item 5
 16. O-ring
 - Replace
 17. Chain Tensioner
 18. Bolt
 - 9 Nm
 19. Crankshaft
 20. Bolt
 - Replace
 - 10 Nm plus an additional 90° turn

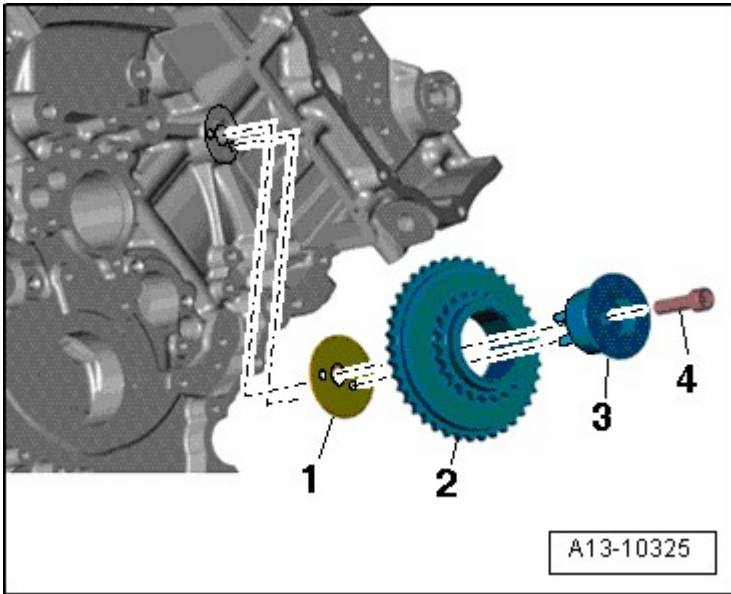


Fig. 16: Locating Camshaft Timing Chain Drive Sprocket Mounting Pins
 Courtesy of AUDI OF AMERICA, LLC

- The alignment bushings in the right camshaft timing chain drive sprocket mounting pins -3- must engage in the holes in the thrust washer -1- and cylinder block.

2 - Right camshaft timing chain drive sprocket

4 - Bolt

VALVETRAIN OVERVIEW

CAUTION: Risk of damaging valves and piston heads after working on the valve train.

- The motor must not be started for about 30 minutes after installing the camshafts because the hydraulic equalization elements must seat themselves.
- To ensure the valves do not strike the pistons when starting, carefully rotate the engine at least 2 full revolutions.

NOTE: Cylinder heads with cracks between the valve seats, or between the valve seat and the spark plug threads, can continue to be used without reducing the service life, as long as the cracks have a width of max. 0.3 mm, or only the first 4 threads of the spark plug threads are cracked.

NOTE: Cylinder head for cylinder bank 2 (left) is shown in illustration.

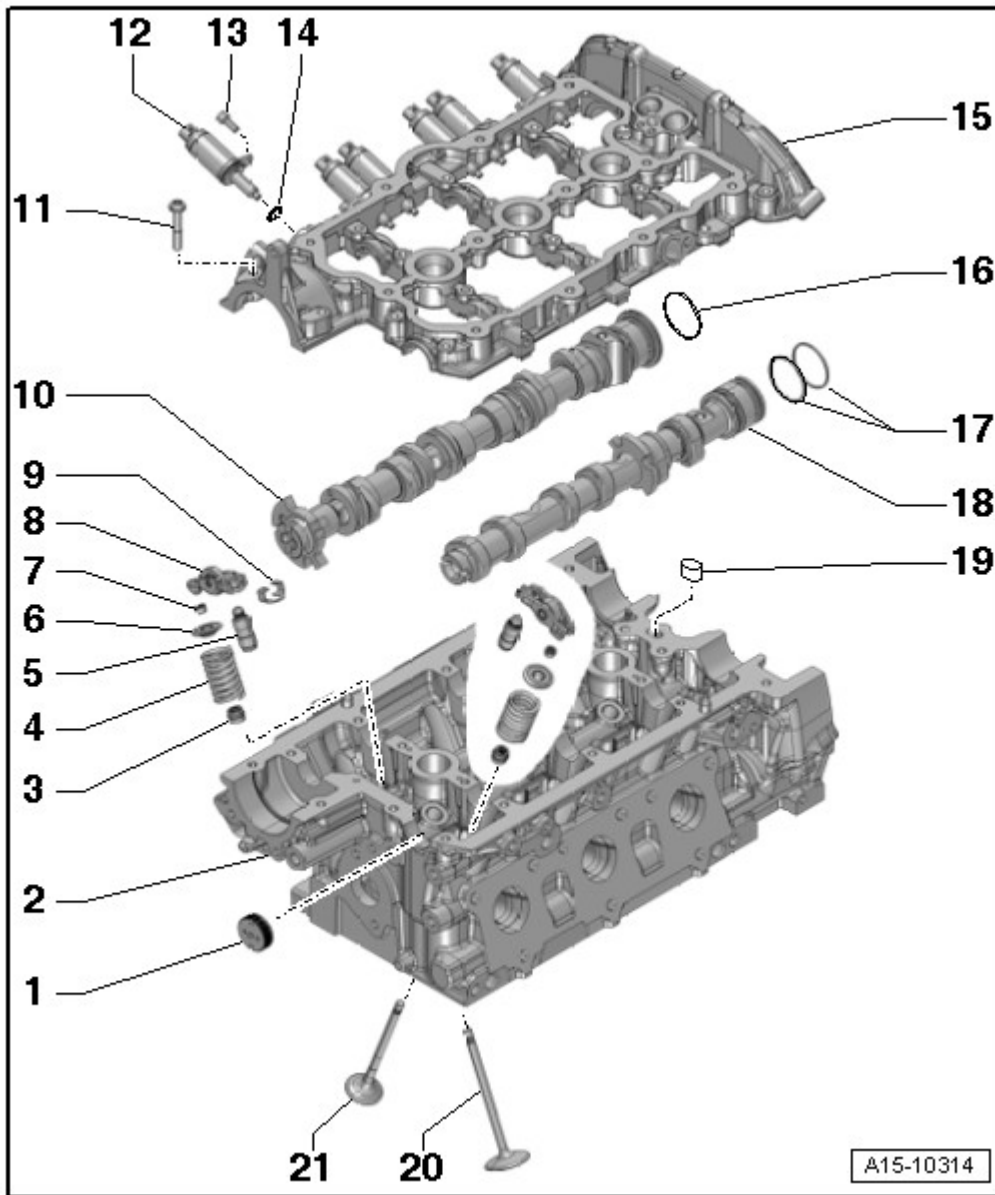


Fig. 17: Valvetrain Overview

Courtesy of AUDI OF AMERICA, LLC

1. Sealing Plug
 - Install with sealant
2. Cylinder Head
 - Valve guides, checking, refer to **VALVE GUIDES, CHECKING**
3. Valve Stem Seal
 - Replacing with the cylinder head installed, refer to **VALVE STEM SEALS, CYLINDER HEAD INSTALLED**
 - Replacing with the cylinder head removed, refer to **VALVE STEM SEALS WITH CYLINDER HEAD REMOVED**

4. Valve Spring
 - Installed position, refer to **Fig. 19**
5. Hydraulic Adjusting Elements
 - Checking, refer to **HYDRAULIC ADJUSTING ELEMENTS, CHECKING**
 - Mark the installation position with paint for reinstallation
 - Lubricate the running surfaces before installing
6. Valve Spring Plate
7. Valve Retainers
8. Roller Rocker Lever
 - Different versions for the intake and exhaust side, do not interchange them
 - Check roller for easy movement
 - Lubricate the running surfaces before installing
 - Clip to the hydraulic adjusting element -5- with the clip -9-
9. Clip
 - Different versions for the intake and exhaust side, do not interchange them
 - Make sure it is secure
10. Intake Camshaft
 - With 3 camshaft sliders
 - Do not disassemble
 - Measuring axial play, refer to **CAMSHAFT, MEASURING AXIAL PLAY**
 - Removing and installing, refer to **CAMSHAFTS**
 - Measure radial clearance using Plastigage (roller rocker lever removed)
 - Radial clearance at bearing - 24 mm diameter: 0.024 to 0.066 mm
 - Radial clearance at bearing - 36 mm diameter: 0.032 to 0.078 mm
 - Maximum run out: 0.04 mm
11. Bolt
 - Replace
 - Tightening sequence, refer to **Fig. 18**
12. Camshaft Adjuster Actuator
13. Bolt
 - 5 Nm
14. O-ring
 - Replace
15. Guide Frame
 - With integrated camshaft bearings
 - Removing and installing, refer to **CAMSHAFTS**
16. Compression Ring
17. Compression Ring

18. Exhaust Camshaft

- Measuring axial play, refer to **CAMSHAFT, MEASURING AXIAL PLAY**
- Removing and installing, refer to **CAMSHAFTS**
- Measure radial clearance using Plastigage (roller rocker lever removed)
- Radial clearance at bearing - 24 mm diameter: 0.024 to 0.066 mm
- Radial clearance at bearing - 36 mm diameter: 0.032 to 0.078 mm
- Maximum run out: 0.04 mm

19. Oil Strainer

20. Intake Valve

- Do not rework, only lapping is permitted
- Mark the installed position for installation later
- For the correct valve dimensions, refer to **VALVE DIMENSIONS**
- Valve guides, checking, refer to **VALVE GUIDES, CHECKING**

21. Exhaust Valve

- Do not rework, only lapping is permitted
- Mark the installed position for installation later
- For the correct valve dimensions, refer to **VALVE DIMENSIONS**
- Valve guides, checking, refer to **VALVE GUIDES, CHECKING**

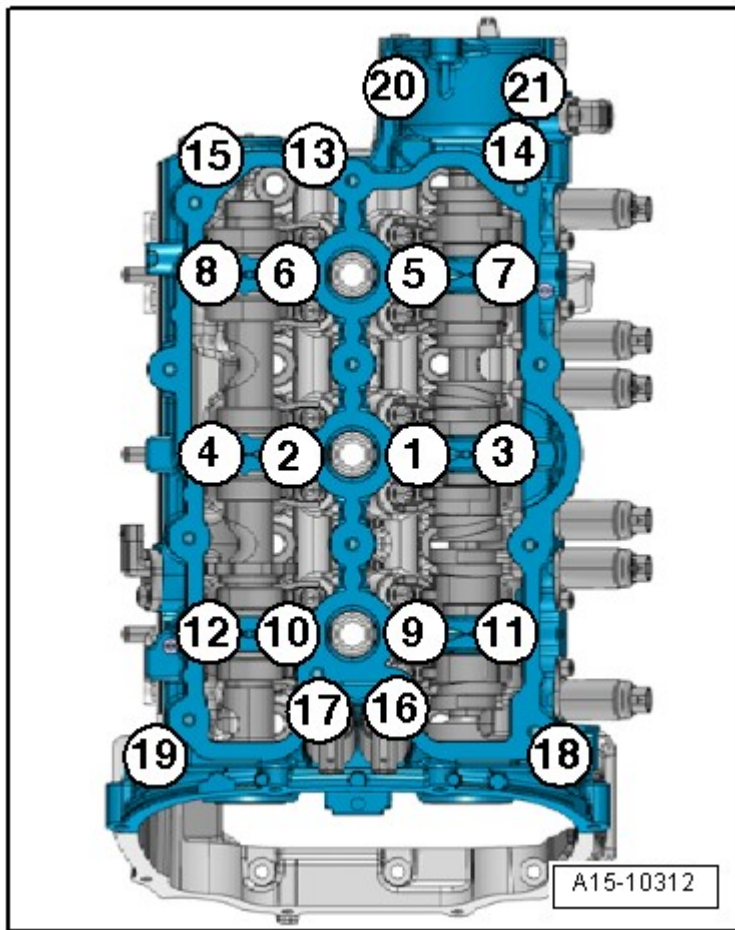


Fig. 18: Identifying Sequence Of Guide Frame Bolts

Courtesy of AUDI OF AMERICA, LLC

NOTE: The illustration shows the guide frame for the left cylinder head.

- Replace the guide frame bolts.
- Tighten the bolts in 3 steps in the following sequence: -1 to 21- :
- Install bolts by hand as far as the stop.
 - The guide frame must be touching the entire contact surface of the cylinder head.
- Tighten to 8 Nm.
- Tighten an additional 90°.

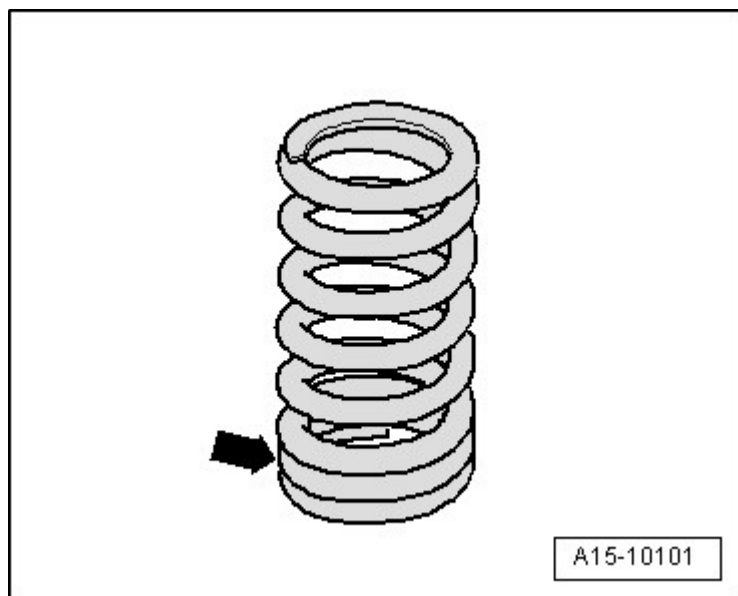


Fig. 19: Identifying Tight Spring Coils
 Courtesy of AUDI OF AMERICA, LLC

- The tight spring coils -arrow- face toward the cylinder head.

SPECIFICATIONS

FASTENER TIGHTENING SPECIFICATIONS

Component	Bolt Size	Nm
Balance Shaft	-	60
Balance Shaft Chain Sprocket	-	15 + 90°
Bearing End Bracket	-	13
Camshaft Adjuster For Exhaust Camshaft ¹	-	80 + 90°
Camshaft Adjuster Actuator	-	5
Camshaft Adjuster for Intake Camshaft ¹	-	80 + 90°
Camshaft Position Sensor, Exhaust Camshaft	-	9
Camshaft Position Sensor, Intake Camshaft	-	9
Chain Tensioner	-	9
Chain Tensioner with Glide Track ¹	-	10 + 45°
Cylinder Head		
Tighten in 3 stages:-- Tighten to 40 Nm.-- Tighten an additional 90°.-- Tighten an additional 90°.		
Drive Sprocket Mounting Bracket ¹	-	8 + 45°
Drive Sprocket for Oil Pump ¹	-	30 + 90°
Engine Lifting Eye	-	20
Guide Rail ^{1, 2}	-	10 + 90°
	-	6 + 60°

Left Camshaft Timing Chain Drive Sprocket ¹		
Left Camshaft Timing Chain Tensioner	-	9
Pivot Pin for Drive Sprocket	-	30 + 90°
Right Camshaft Timing Chain Tensioner	-	9
Solenoid Valve for Camshaft Adjustment	-	2.5
¹ Replace ² For bolt tightening clarification, refer to <u>TIMING MECHANISM DRIVE CHAIN OVERVIEW</u> and see items -1 and 8-		

Left Timing Chain Cover, Tightening Specifications and Sequence

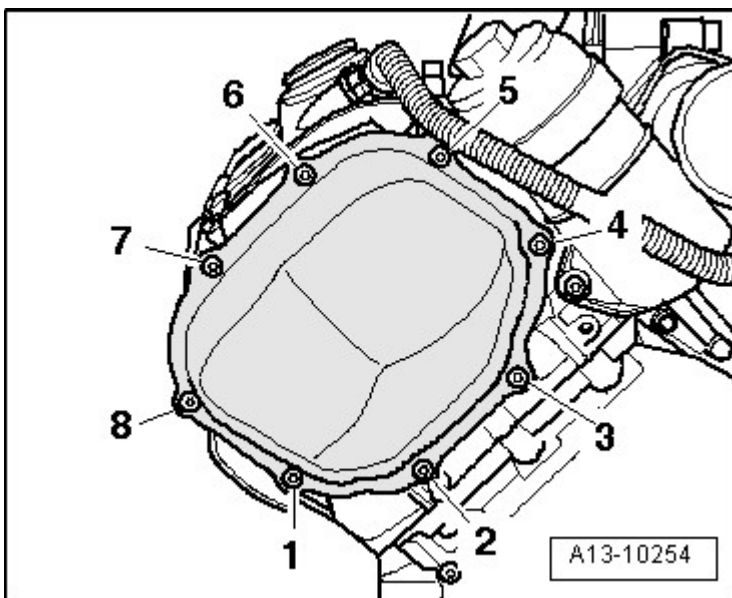


Fig. 20: Identifying Sequence Of Left Timing Chain Cover Bolts
 Courtesy of AUDI OF AMERICA, LLC

NOTE: Replace the bolts for the left timing chain cover.

-- Tighten bolts in 2 stages in sequence -1 through 8- as follows:-- Tighten to 5 Nm.-- Tighten an additional 90°.

Right Timing Chain Cover, Tightening Specifications and Sequence

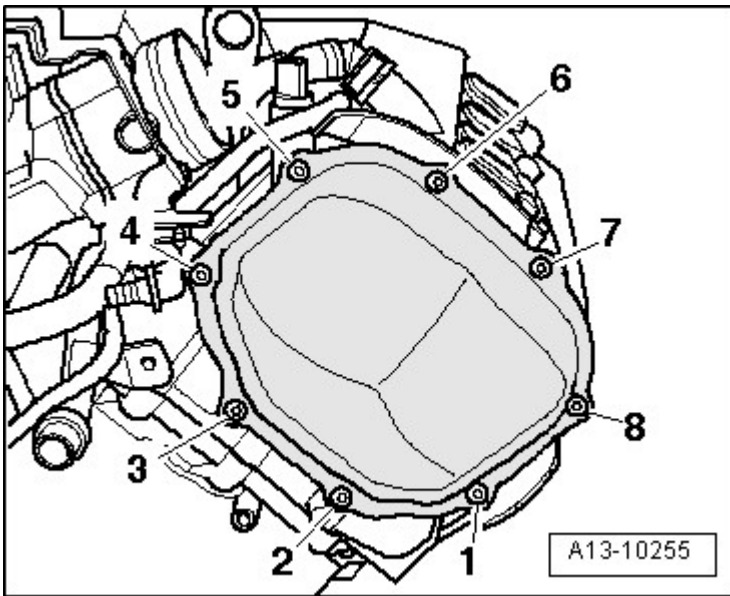


Fig. 21: Identifying Sequence Of Right Timing Chain Cover Bolts
Courtesy of AUDI OF AMERICA, LLC

NOTE: Replace the bolts for the right timing chain cover.

-- Tighten bolts in 2 stages in sequence -1 through 8- as follows:-- Tighten to 5 Nm.-- Tighten an additional 90°.

Lower Timing Chain Cover, Tightening Specifications and Sequence

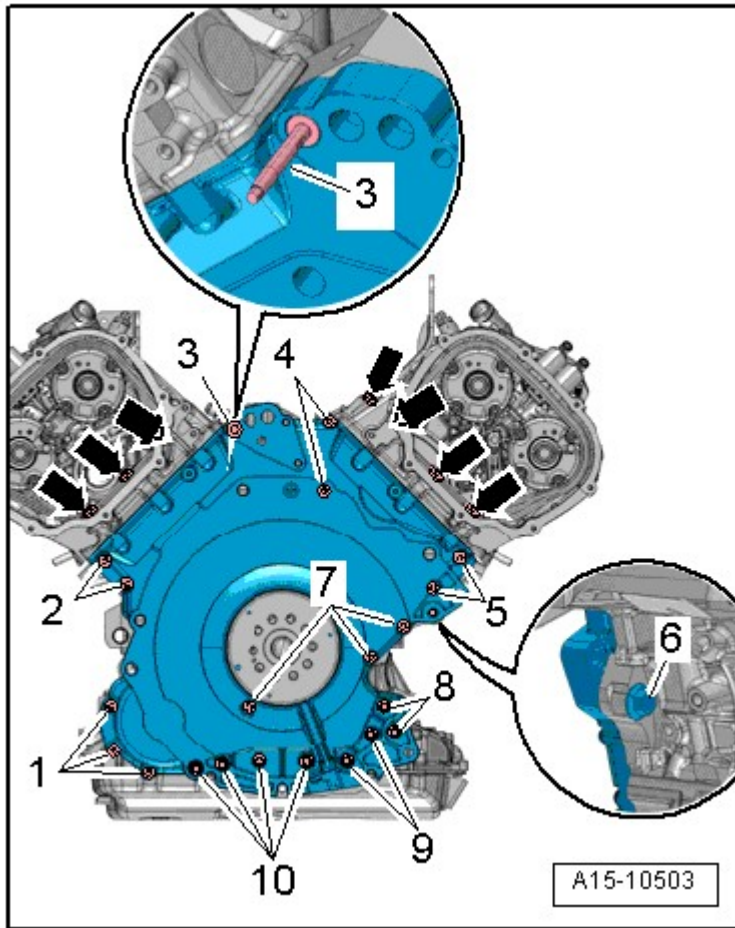


Fig. 22: Loosening/Tightening Bolt Sequence - Lower Timing Chain Cover
 Courtesy of AUDI OF AMERICA, LLC

-- Tighten bolts in 6 stages as follows:-- Insert the bolts -arrows- and tighten them to 5 Nm.-- Tighten the bolts -1 through 10- diagonally to 9 Nm.-- Tighten bolts -arrows- to 9 Nm.-- Tighten the bolts -8, 9 and 10- to 22 Nm.-- Tighten the bolt -3- to 16 Nm.-- Tighten the bolt -6- to 70 Nm.

Right Cylinder Head Cover, Tightening Specifications and Sequence

-- Tighten the bolts to 9 Nm in the following sequence: -1 to 12-.

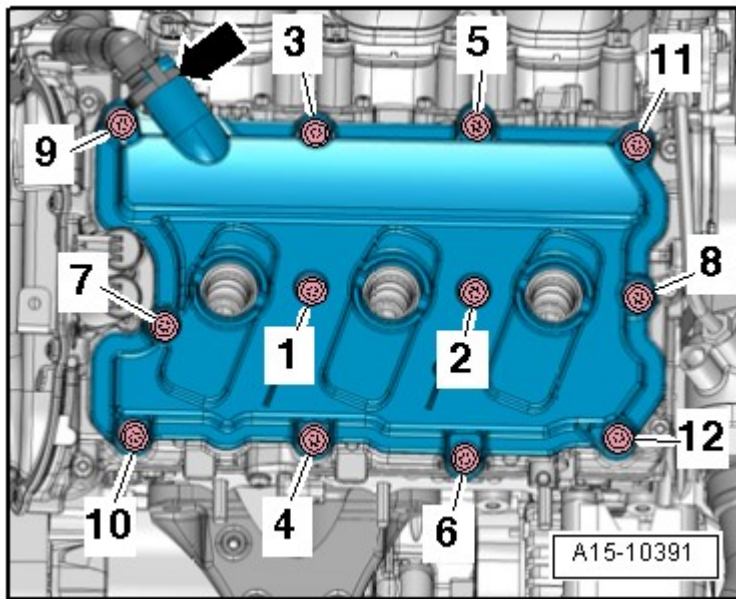


Fig. 23: Loosening/Tightening Bolt Sequence - Right Cylinder Head Cover
Courtesy of AUDI OF AMERICA, LLC

Oil Dipstick Guide Tube - Tightening Specifications

-- Tighten the bolt -arrow- to 9 Nm.

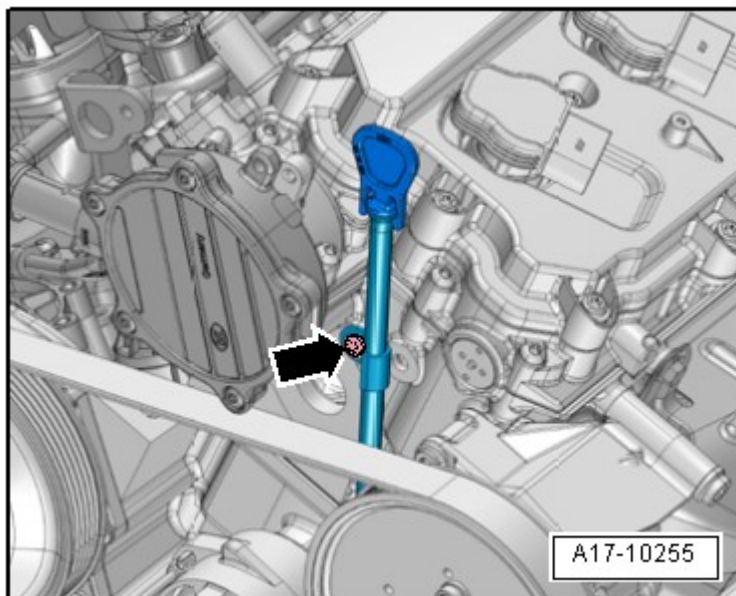


Fig. 24: Identifying Oil Dipstick Guide Tube Bolt
Courtesy of AUDI OF AMERICA, LLC

Camshaft Guide Frame Tightening Specifications and Sequence

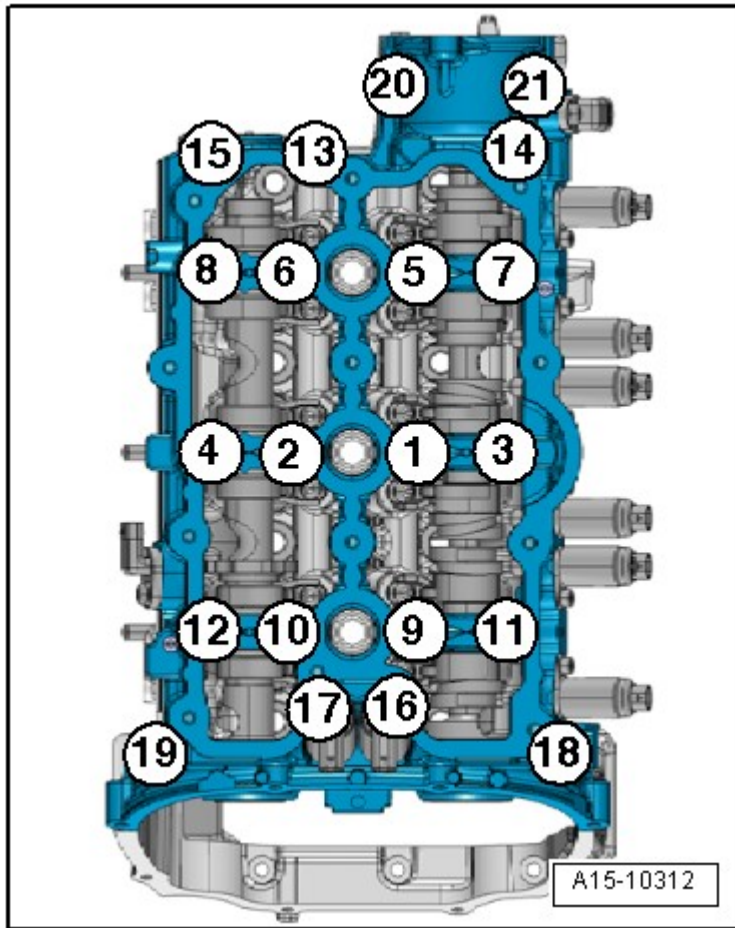


Fig. 25: Identifying Sequence Of Guide Frame Bolts
 Courtesy of AUDI OF AMERICA, LLC

NOTE: The illustration shows the guide frame for the left cylinder head.

- Replace the guide frame bolts.
- Tighten the bolts in 3 steps in the following sequence: -1 to 21- :
- Install bolts by hand as far as the stop.
 - The guide frame must be touching the entire contact surface of the cylinder head.
- Tighten to 8 Nm.
- Tighten an additional 90°.

VALVE DIMENSIONS

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

permitted.

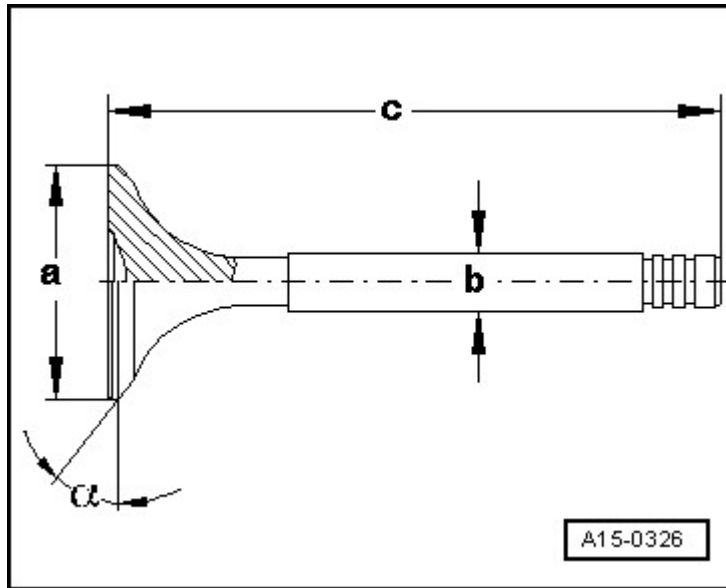


Fig. 26: Identifying Valve Dimensions
Courtesy of AUDI OF AMERICA, LLC

Dimension		Intake Valve	Exhaust Valve
Diameter a	mm	33.85 ± 0.10	28.0 ± 0.1
Diameter b	mm	5.98 ± 0.01	5.96 ± 0.01
c	mm	104.0 ± 0.2	101.9 ± 0.2
a	Angle°	45	45

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.

DIAGNOSIS AND TESTING

CAMSHAFT, MEASURING AXIAL PLAY

Special tools and workshop equipment required

- Dial Gauge Holder VW 387
- Dial Gauge 0-3 mm VAS 6080

Procedure

- Remove the camshafts. Refer to **CAMSHAFTS**.
- Mark the allocation of the roller rocker lever and the hydraulic adjusting elements so they can be installed again.
- If necessary, remove the roller rocker levers with the hydraulic adjusting elements and place them on a clean surface.
- Secure the VW 387 with the VAS 6080 on the cylinder head as shown in the illustration.

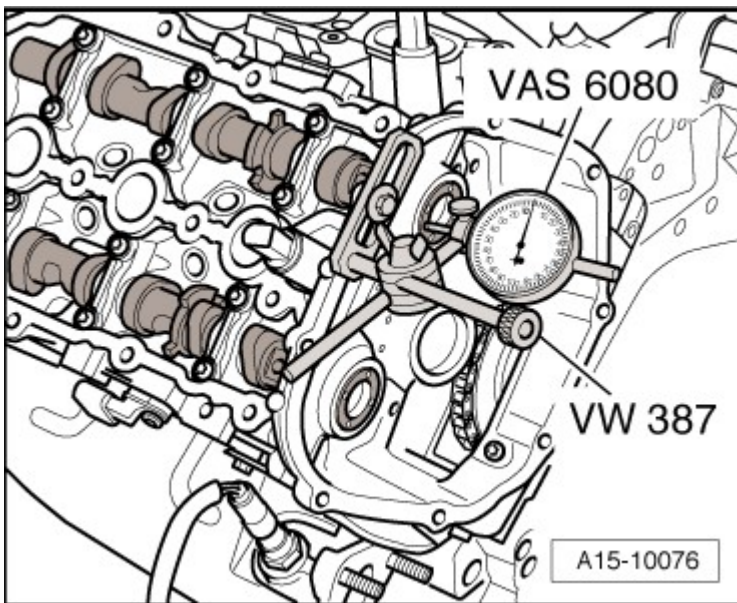


Fig. 27: Securing Dial Gauge Holder VW 387 To Dial Gauge VAS 6080 On Cylinder Head
Courtesy of AUDI OF AMERICA, LLC

- Determine the axial play.
 - Axial clearance: 0.100 to 0.191 mm.

COMPRESSION, CHECKING**Special tools and workshop equipment required**

- Spark Plug Removal Tool 3122 B
- Compression Tester V.A.G 1763
- Ignition Coil Puller T40039

Procedure

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

-- Remove the rear engine cover -top arrows-.

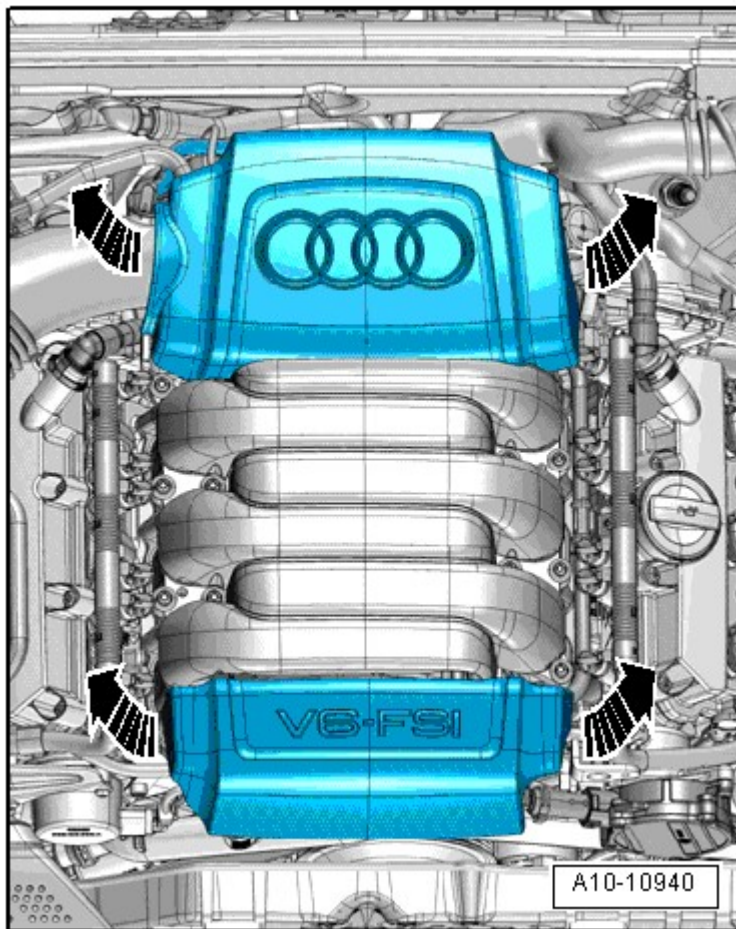


Fig. 28: Identifying Engine Cover
Courtesy of AUDI OF AMERICA, LLC

-- Remove the strut tower brace. Refer to **REMOVAL AND INSTALLATION** .

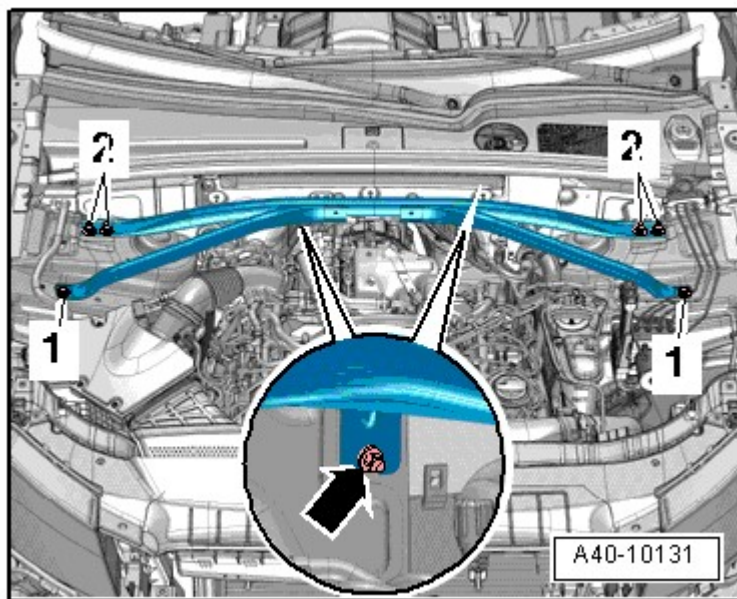


Fig. 29: Removing Strut Tower Brace Bolts
Courtesy of AUDI OF AMERICA, LLC

-- Remove the bolts -arrows-.

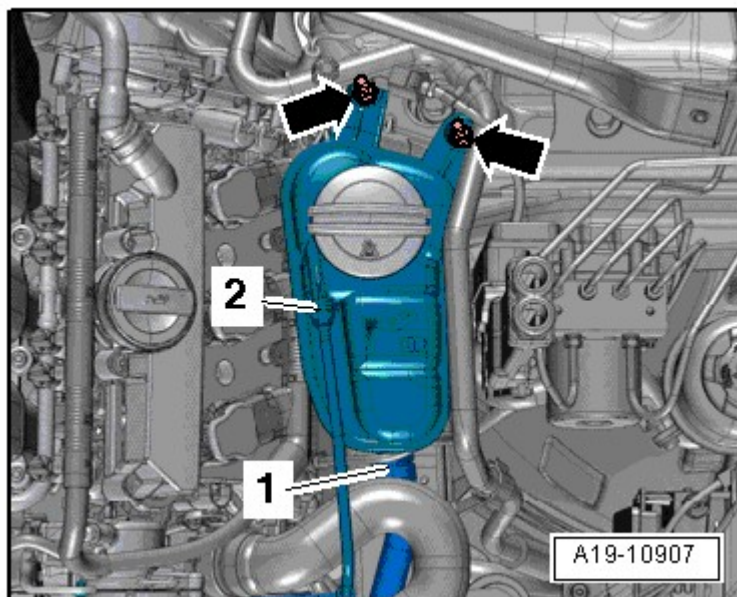


Fig. 30: Identifying Coolant Overflow Reservoir
Courtesy of AUDI OF AMERICA, LLC

-- Disconnect the electrical connector on the Engine Coolant Level (ECL) warning switch -F66- and lay the coolant reservoir aside with the coolant hoses -1 and 2- connected.

NOTE: Be careful not to bend the coolant hose -2-.

-- Remove the bolts -arrows- and disconnect the electrical connectors to the ignition coils on the left cylinder head.

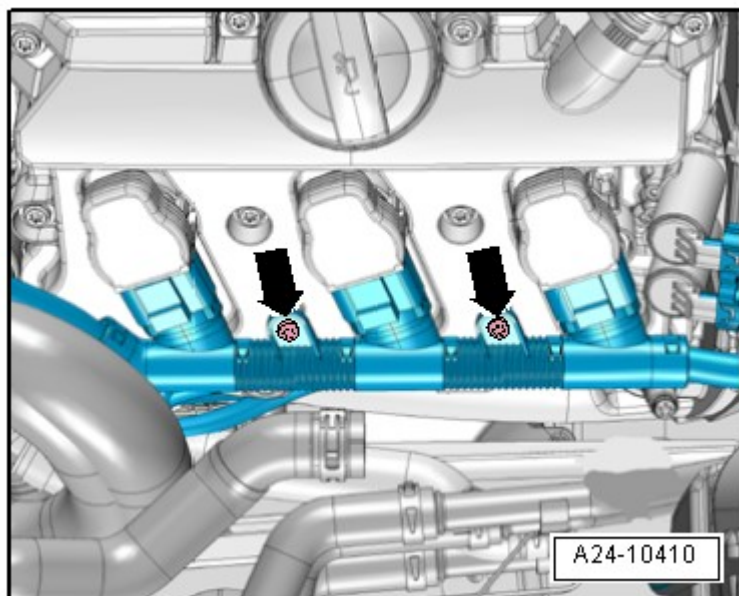


Fig. 31: Identifying Screws From Ignition Coil Wiring Harness
Courtesy of AUDI OF AMERICA, LLC

-- Press the electrical wiring harness down slightly.

-- Disconnect the electrical connector -3- to the fuel injectors on the rear of the left cylinder head.

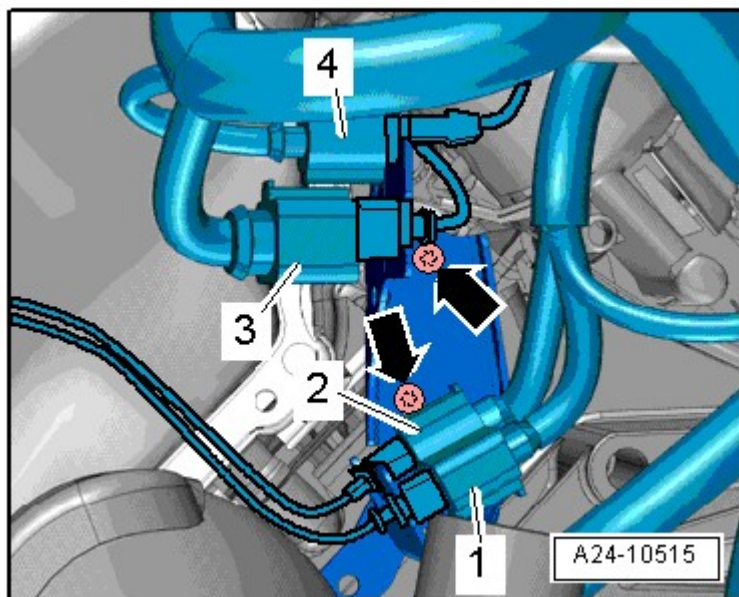


Fig. 32: Identifying Left Cylinder Head Electrical Connectors
Courtesy of AUDI OF AMERICA, LLC

NOTE: Ignore -1, 2 and 4- and -arrows-.

-- Remove the air filter housing. Refer to **REMOVAL AND INSTALLATION** .

-- Remove the bolts -arrows- and disconnect the electrical connectors to the ignition coils on the right cylinder head.

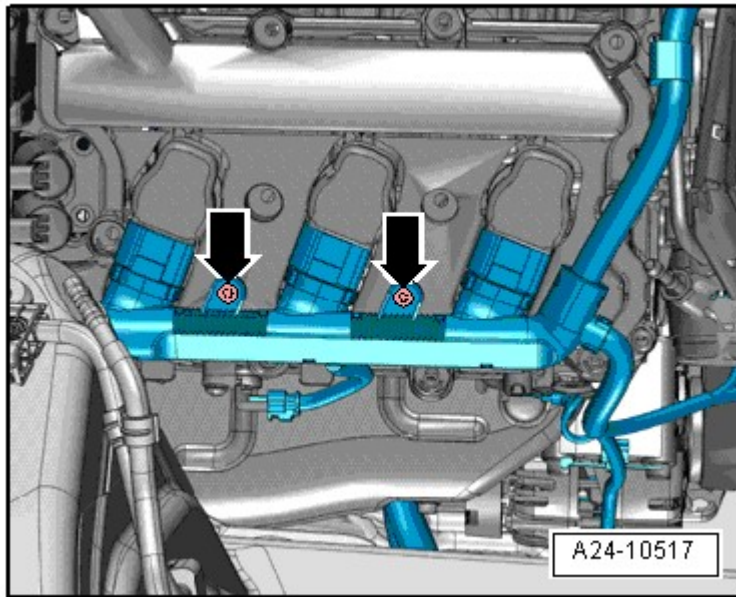


Fig. 33: Identifying Right Cylinder Head Bolts
Courtesy of AUDI OF AMERICA, LLC

-- Press the electrical wiring harness to the side.

-- Disconnect the electrical connector -3- to the fuel injectors on the rear of the right cylinder head.

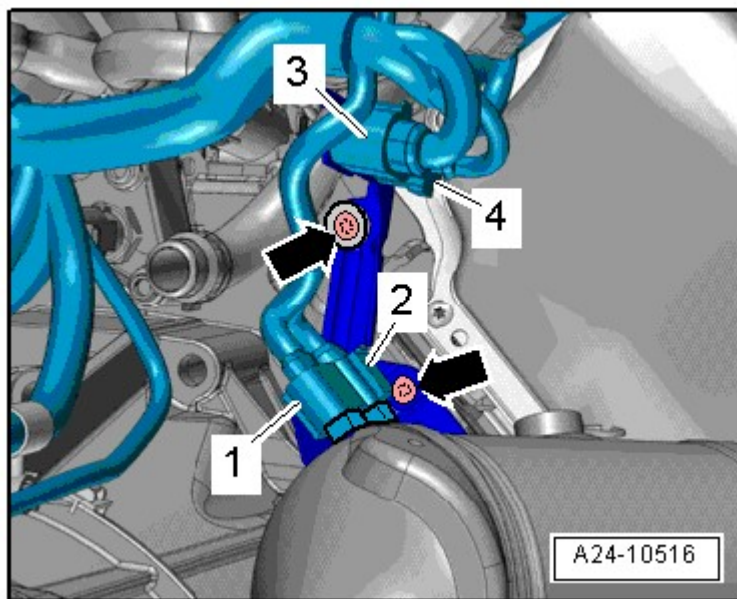


Fig. 34: Identifying Right Cylinder Head Electrical Connectors
Courtesy of AUDI OF AMERICA, LLC

NOTE: Ignore -1, 2 and 4- and -arrows-.

-- Remove all the ignition coils with the T40039.

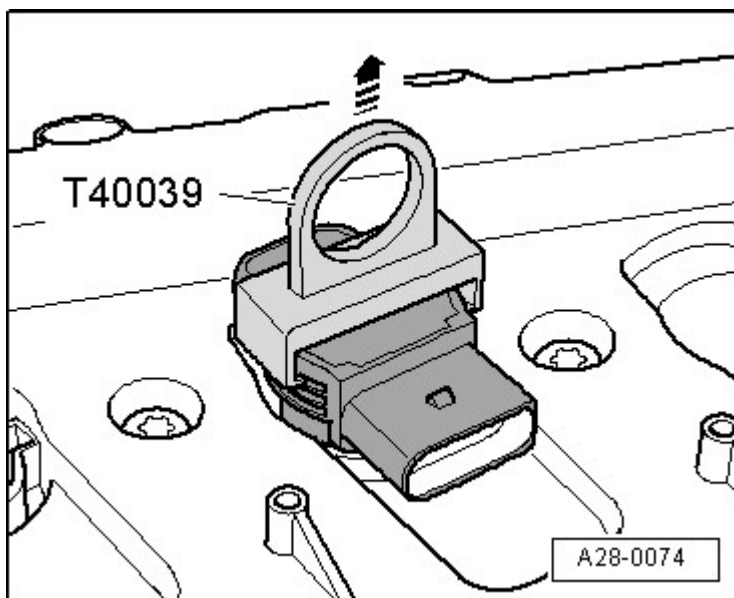


Fig. 35: Removing Ignition Coils With Special Tool Ignition Coil Puller T40039
Courtesy of AUDI OF AMERICA, LLC

-- Remove the spark plugs with the 3122 B.

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

NOTE: **Using tester see operating instructions.**

-- Have a second technician press the accelerator pedal down all the way while operating the starter until the pressure increase is no longer displayed on the tester.

Compression Pressure	Bar Pressure
New	10.0 to 14.0 (145 to 203 psi)
Wear limit	9.0 (130.53 psi)
Maximum difference between cylinders	3.0 (43.51 psi)

Assembling

- For the correct tightening specifications, refer to **CYLINDER HEAD OVERVIEW**.

Assemble in reverse order of disassembling. Note the following:

-- Install spark plugs.

-- Install the air filter housing. Refer to **REMOVAL AND INSTALLATION** .

-- Install the tower brace. Refer to **REMOVAL AND INSTALLATION** .

-- If the electrical connectors were disconnected and the engine was started, then the malfunctions have been stored in the engine control module. "Generate readiness code" in "Guided Functions" using the vehicle diagnostic tester.

HYDRAULIC ADJUSTING ELEMENTS, CHECKING

- NOTE:**
- **The hydraulic adjusting elements cannot be repaired.**
 - **Irregular valve noises are normal while starting the engine.**

Special tools and workshop equipment required

- Feeler gauge

Procedure

-- Start the engine and let it run until the coolant fan switches on once.

-- Increase engine speed for about 2 minutes to approximately 2500 RPM, perform a road test if necessary.

-- If the hydraulic adjusting elements are still loud, determine which one is faulty as follows:

-- Remove the cylinder head cover. Refer to **LEFT CYLINDER HEAD COVER**, **RIGHT CYLINDER HEAD COVER**.

-- Rotate the crankshaft until the cam lobes on the adjusting element that will be checked face upward. To do this, move the vehicle forward with the 4th gear engaged and the ignition switched off.

-- To determine the play between cam lobes and roller rocker lever, press the lever down -arrow-.

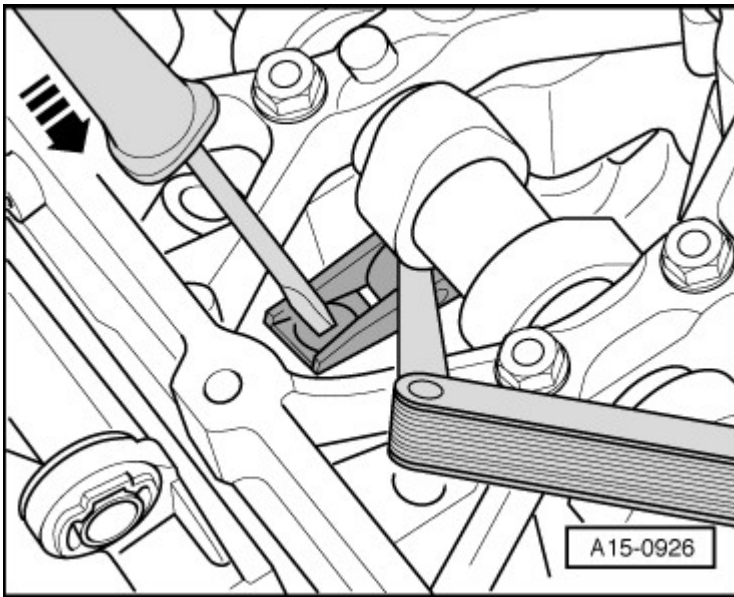


Fig. 36: Checking Play Between Cam Lobes And Roller Rocker Lever
Courtesy of AUDI OF AMERICA, LLC

-- If a 0.20 mm feeler gauge can slide between the cam lobes and roller rocker lever, replace the hydraulic adjusting element. Refer to **CAMSHAFTS**.

Final Procedures

-- Install the cylinder head cover. Refer to **LEFT CYLINDER HEAD COVER, RIGHT CYLINDER HEAD COVER**.

VALVES, CHECKING

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

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

VALVE GUIDES, CHECKING

Special tools and workshop equipment required

- Dial Gauge Holder VW 387
- Dial Gauge 0-10 mm VAS 6079

Procedure

NOTE:

- If the valve is replaced during repair, use a 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 tip clearance.

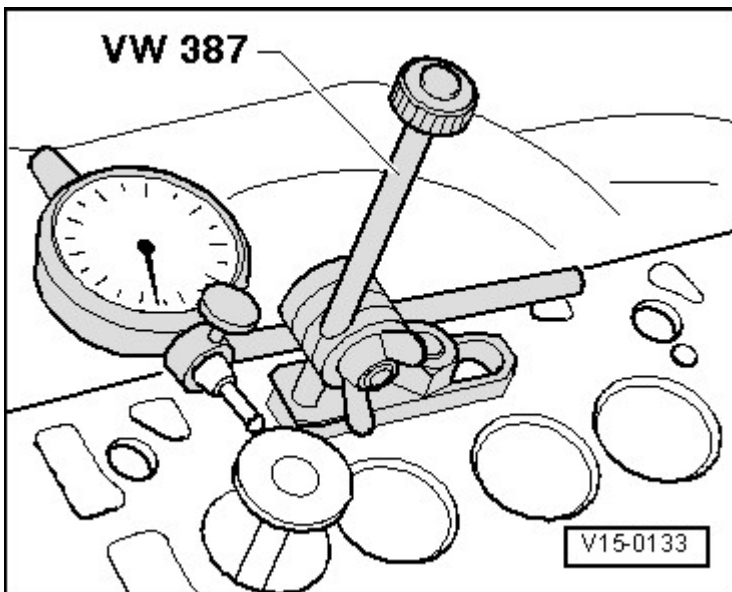


Fig. 37: Identifying Special Tool - Dial Gauge Holder VW 387
Courtesy of AUDI OF AMERICA, LLC

- Wear limit: 0.8 mm.

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

-- Replace the cylinder head if the wear limit is still exceeded.

NOTE:

The valve guides cannot be replaced.

REMOVAL AND INSTALLATION**BALANCE SHAFT****Special tools and workshop equipment required**

- Locking Pin T40069

Removing

- Transmission removed.

-- Remove the belt pulley side sealing flange. Refer to **SEALING FLANGE WITH CRANKSHAFT SEAL, BELT PULLEY SIDE** .

-- Remove lower timing chain cover. Refer to **LOWER TIMING CHAIN COVER**.

-- Remove the power take-off drive chain. Refer to **POWER TAKE-OFF DRIVE CHAIN**.

-- To protect against cuts, wrap the point and the cutting edges on a 8 mm drill bit with insulating tape.

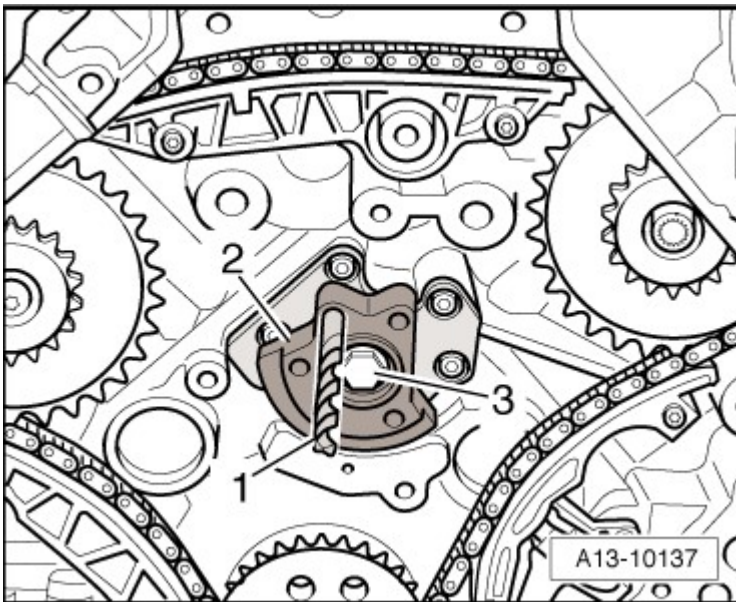


Fig. 38: Securing Balance Weight

Courtesy of AUDI OF AMERICA, LLC

-- Secure the balance weight -2- at rear of the engine with an 8 mm diameter drill bit -1-.

-- Remove the bolt -3- and remove the balance weight from the balance shaft.

-- Remove the bolt -2- while counter holding the balance weight using the drift and remove the balance weight -1- from the balance shaft at the front of the engine.

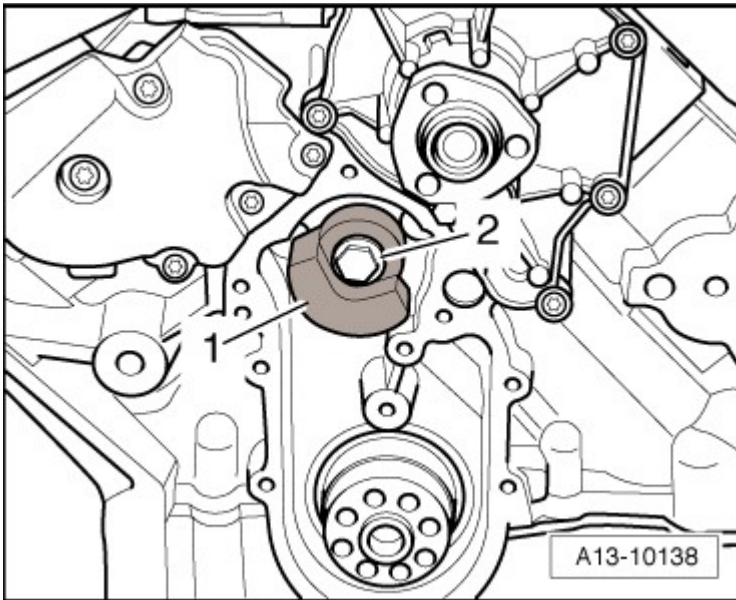


Fig. 39: Identifying Balance Weight Components
Courtesy of AUDI OF AMERICA, LLC

-- Remove the bolts -arrows- and the balance shaft and bearing end bracket at the rear of the engine.

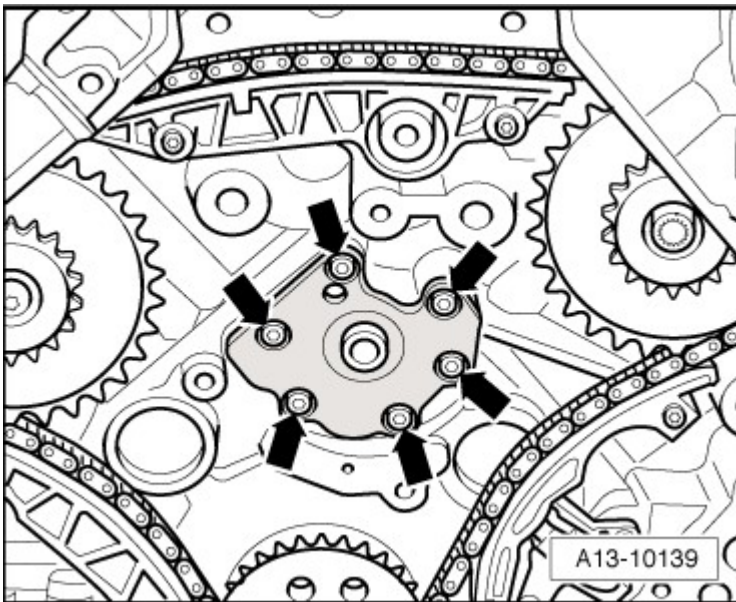


Fig. 40: Identifying Bearing End Bracket Bolts
Courtesy of AUDI OF AMERICA, LLC

-- Remove the balance shaft back out of the cylinder block.

Installing

- For the correct tightening specifications, refer to **BALANCE SHAFT OVERVIEW**.

- Secure crankshaft -1- in "TDC" position using T40069.

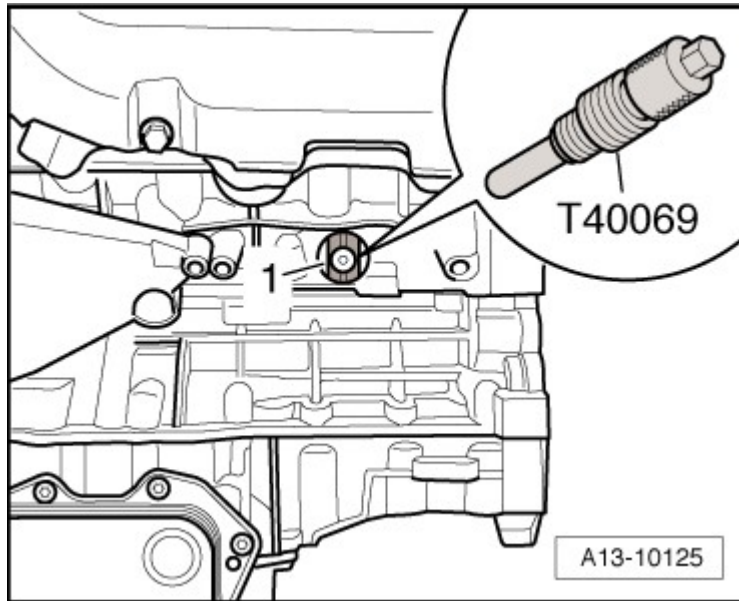


Fig. 41: Identifying Special Tool - Crankshaft Holder T40069
Courtesy of AUDI OF AMERICA, LLC

Install in reverse order, paying attention to the following:

NOTE: The balance weights can only be positioned one way on balance shaft.

-- Install the power take-off drive chain. Refer to POWER TAKE-OFF DRIVE CHAIN.

-- Install timing chain lower cover. Refer to LOWER TIMING CHAIN COVER.

-- Install the belt pulley side sealing flange. Refer to SEALING FLANGE WITH CRANKSHAFT SEAL, BELT PULLEY SIDE .

CAMSHAFTS

Special tools and workshop equipment required

- Impact Puller T10133/3 from the Tool Set T10133
- Locating Pins T40116
- Camshaft Clamp T40133
- Locking Pin T40069
- Hand drill with plastic brush attachment
- Protective goggles
- Sealant

Removing

-- Remove the camshaft timing chains from the camshafts. Refer to **CAMSHAFT TIMING CHAINS, REMOVING FROM CAMSHAFTS.**

-- To remove the camshafts in the left cylinder head, remove the brake booster vacuum pump. Refer to **REMOVAL AND INSTALLATION** .

-- To remove the camshafts in the right cylinder head, remove the high pressure pump and pump motor housing. Refer to **REMOVAL AND INSTALLATION** .

-- Remove the bolts -arrows- and the camshaft adjuster valves.

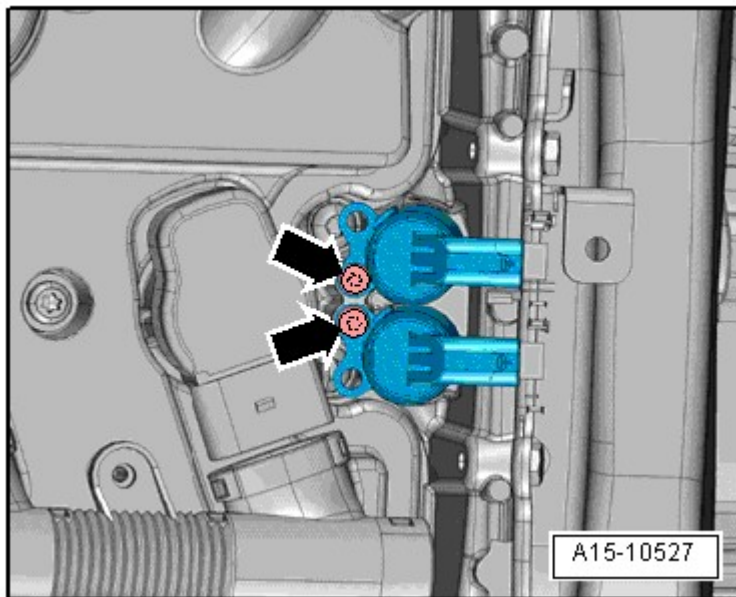


Fig. 42: Identifying Camshaft Adjuster Valve Components
Courtesy of AUDI OF AMERICA, LLC

-- Loosen the guide frame bolts in the following sequence: -21 to 1-.

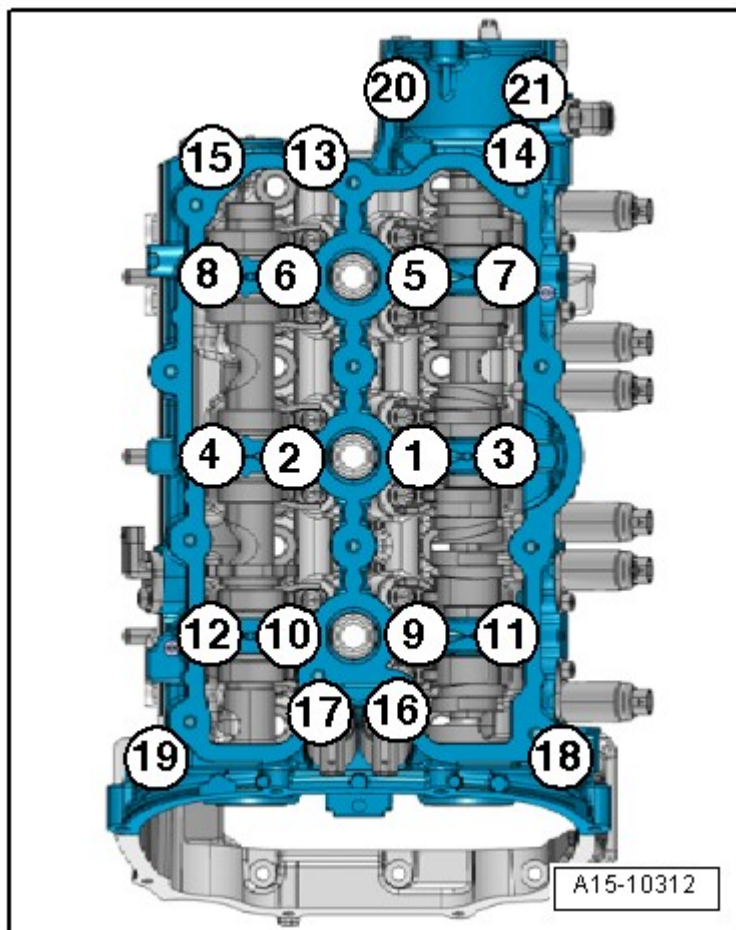


Fig. 43: Identifying Sequence Of Guide Frame Bolts
 Courtesy of AUDI OF AMERICA, LLC

NOTE: The illustration shows the guide frame for the left cylinder head.

-- Carefully remove the guide frame and lay it on a soft surface on the workbench.

-- Remove the T40133.

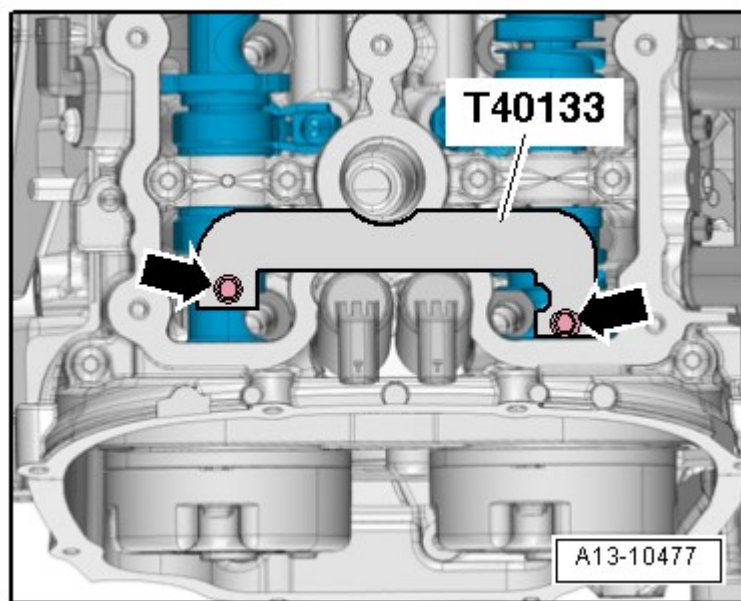


Fig. 44: Identifying Special Tool - Camshaft Adjuster T40133
Courtesy of AUDI OF AMERICA, LLC

-- Mark the camshafts and then remove them.

Installing

- Secure crankshaft -1- using T40069.

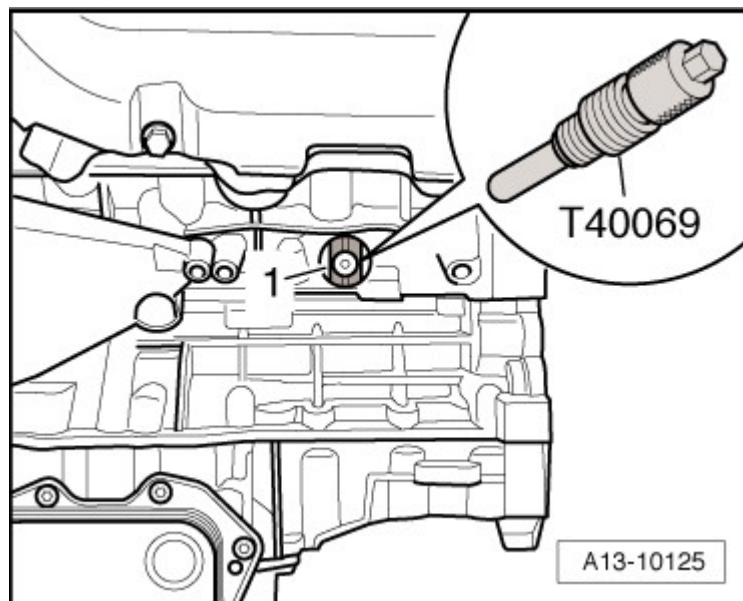


Fig. 45: Identifying Special Tool - Crankshaft Holder T40069
Courtesy of AUDI OF AMERICA, LLC

NOTE: Replace the seals and gaskets.

CAUTION: Risk of contaminating lubricating system and bearing.

- Cover open parts of engine.

WARNING: Danger of eye injury.

- Wear protective goggles.

- Using a rotating plastic brush, remove any remaining sealant from the cylinder head and guide frame.
- Clean the sealing surfaces; they must be free of oil and grease.
- Check the screen -arrow- for dirt and clean it if necessary.

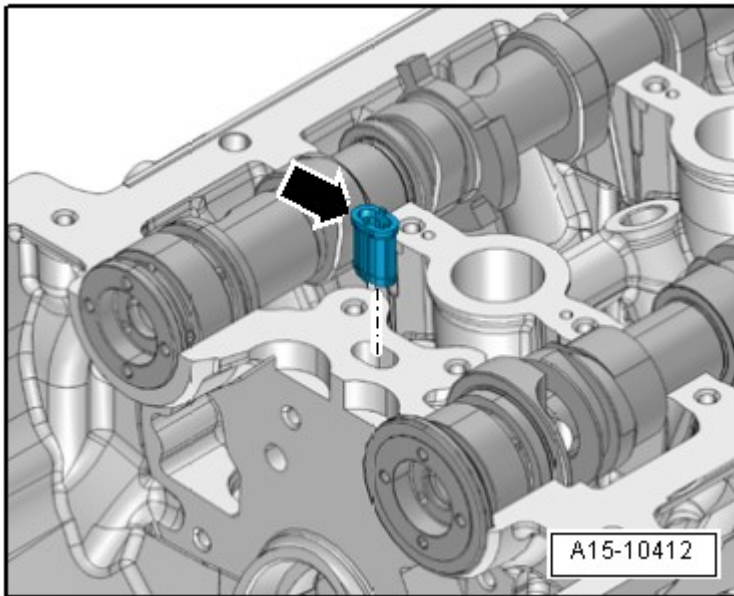


Fig. 46: Identifying Screen

Courtesy of AUDI OF AMERICA, LLC

- Oil running surfaces of both camshafts.
- Insert the camshafts in the guide frame.

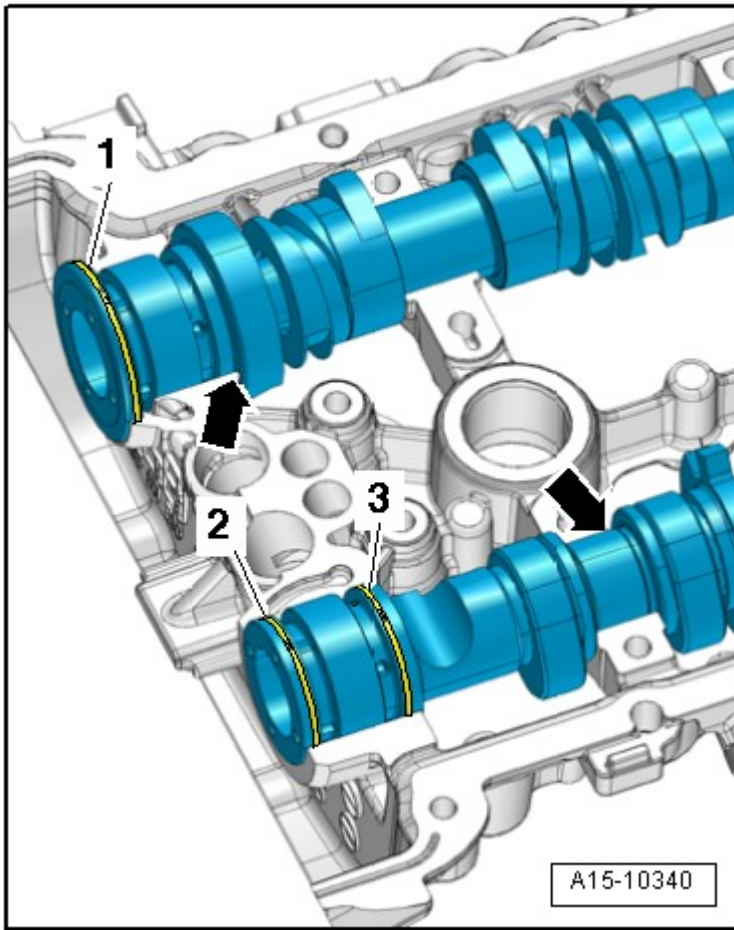


Fig. 47: Identifying Compression Ring Ends
 Courtesy of AUDI OF AMERICA, LLC

- The placement of the camshafts must be exactly within the axial bearings -arrows- of the guide frame.
- The compression ring ends -1, 2 and 3- must face upward or downward and must never face sideways.

-- Rotate the guide frame with the camshafts inserted while holding them securely in the frame.

-- Rotate the camshafts until the threaded holes -arrows- face upward.

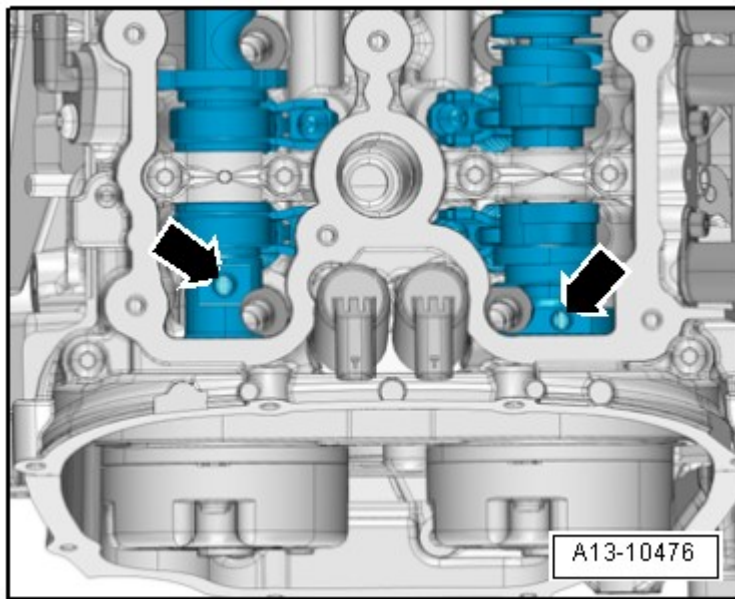


Fig. 48: Identifying Camshaft Threaded Holes
Courtesy of AUDI OF AMERICA, LLC

- Check if the camshafts still lie in the guide frame axial bearings.
- Install the T40133 and tighten the bolts -arrows- to 25 Nm.

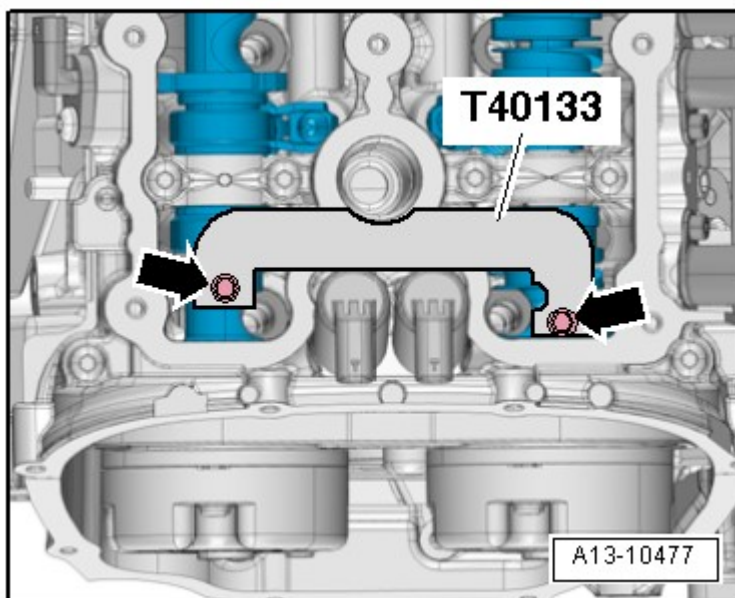


Fig. 49: Identifying Special Tool - Camshaft Adjuster T40133
Courtesy of AUDI OF AMERICA, LLC

NOTE: Note the expiration date of the sealing compound.

-- Cut the tube nozzle at the front marking (nozzle diameter approximately 2.0 mm).

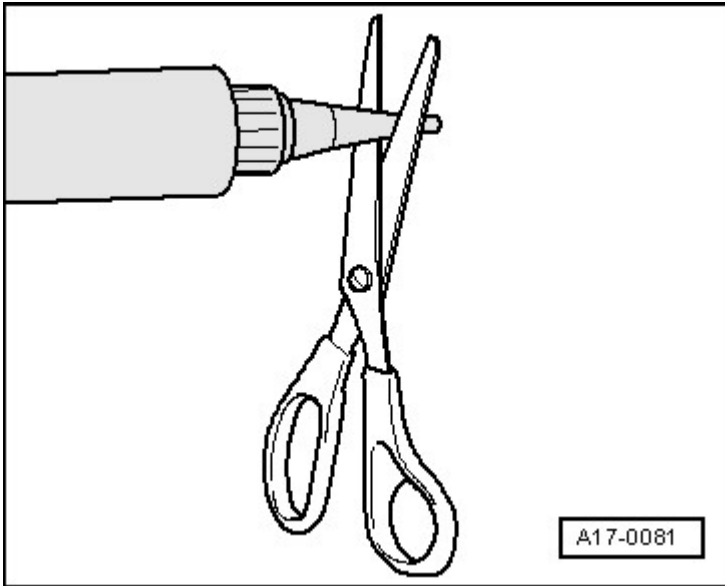


Fig. 50: Cutting Tube Nozzle

Courtesy of AUDI OF AMERICA, LLC

-- Rotate the guide frame again.

CAUTION: The lubrication system could be plugged with excess sealant.

- **Do not apply sealant beads thicker than specified.**

-- Apply sealant beads -4 through 8- to the clean sealing surfaces on the guide frame as shown in the illustration.

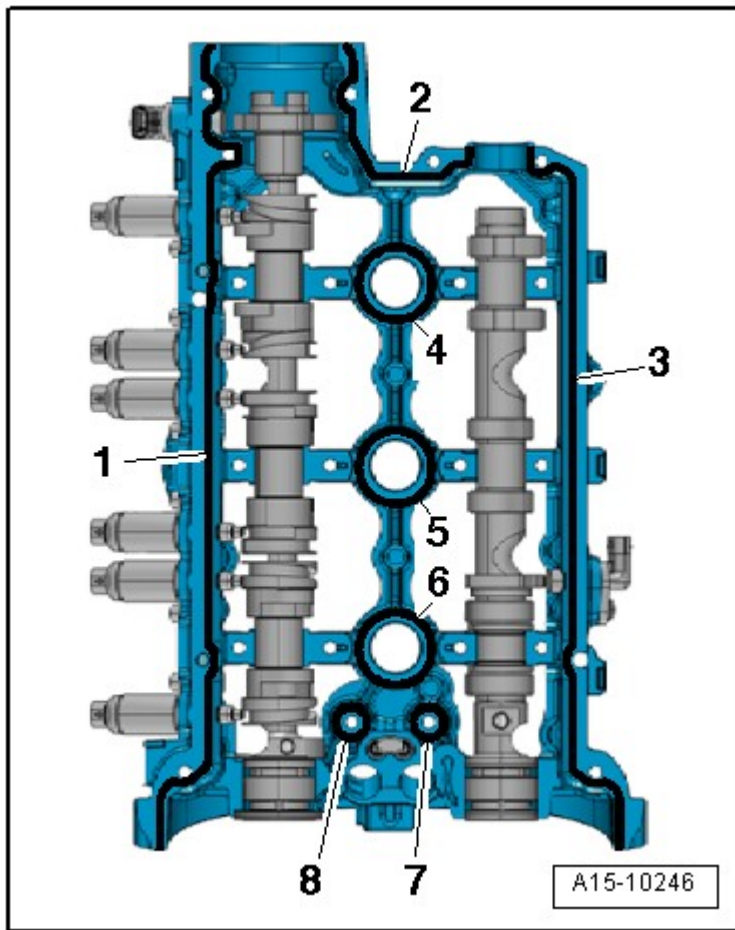


Fig. 51: Identifying Sealant Beads

Courtesy of AUDI OF AMERICA, LLC

- Thickness of sealant bead: 2.0 mm.

-- Apply sealant beads -1 through 3- to the clean sealing surfaces on the guide frame as shown in the illustration.

- Thickness of sealant bead: 2.5 mm.

NOTE: Because the sealant begins hardening immediately, guide frame must be promptly positioned and tightened.

-- Place the guide frame on the cylinder head.

-- Insert the T40116 in the guide frame and cylinder head.

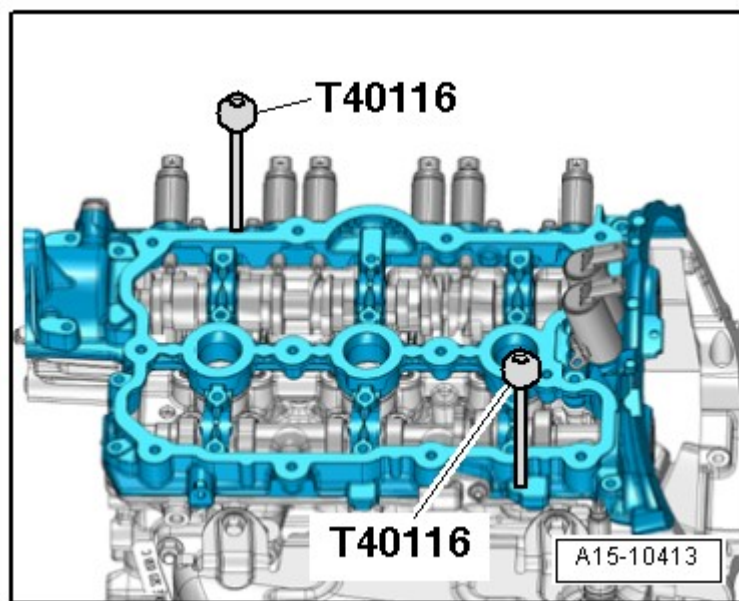


Fig. 52: Identifying T40116

Courtesy of AUDI OF AMERICA, LLC

NOTE: The sealant must harden for approximately 30 minutes after installing the guide frame.

-- Tighten the guide frame bolts. Refer to **Fig. 18**.

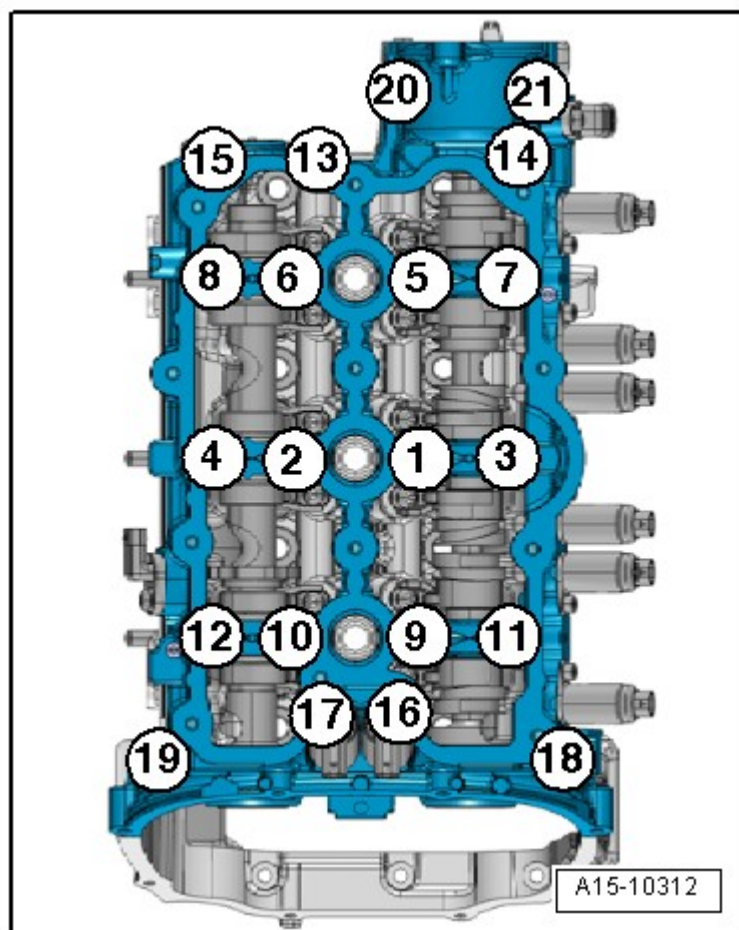


Fig. 53: Identifying Sequence Of Guide Frame Bolts
 Courtesy of AUDI OF AMERICA, LLC

- Clean the bores in the cylinder head for the sealing plugs; they must be free from oil and grease.
- Coat the outer circumference of the sealing plug -arrow- with sealant.

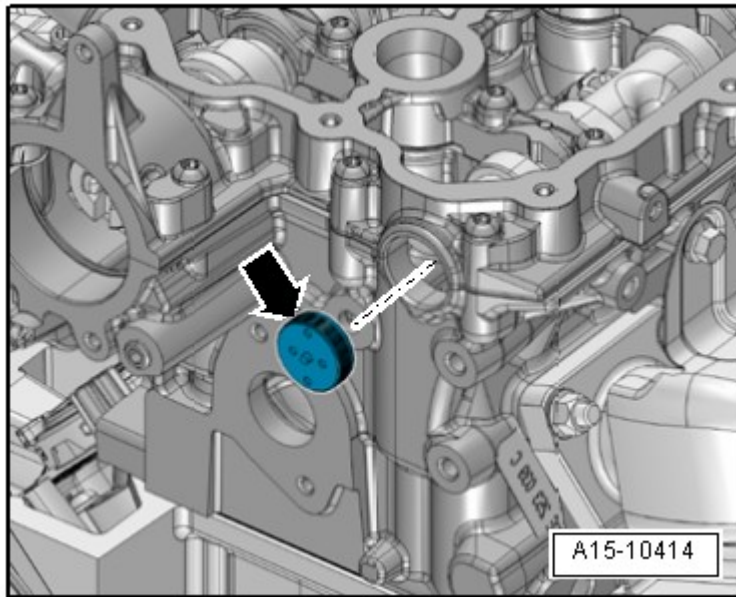


Fig. 54: Identifying Sealing Plug

Courtesy of AUDI OF AMERICA, LLC

-- Drive in the sealing plugs until they are flush.

-- Remove the T40116 with the T10133/3.

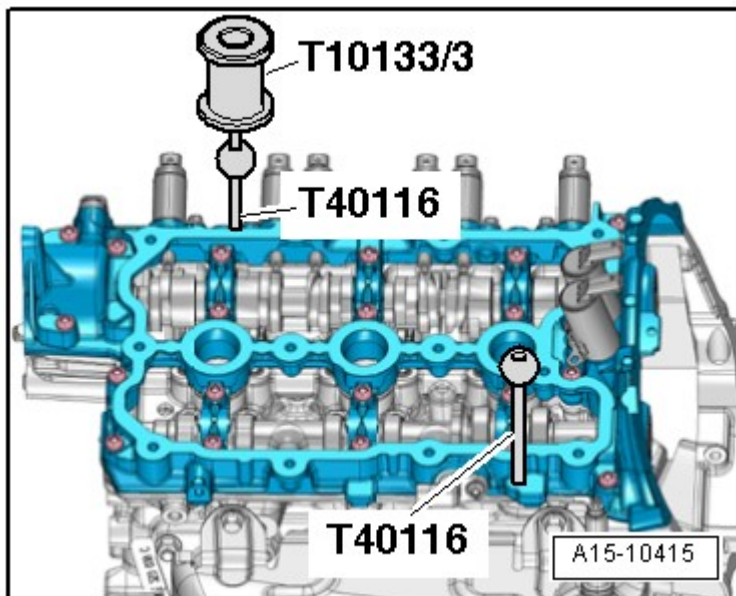


Fig. 55: Removing Special Tool T40116 With T10133/3

Courtesy of AUDI OF AMERICA, LLC

Install in reverse order of removal paying attention to the following:

-- Install the camshaft adjustment valves. Refer to **CYLINDER HEAD OVERVIEW**.

- Install the brake booster vacuum pump. Refer to **REMOVAL AND INSTALLATION** .
- Install the high pressure pump motor housing and the high pressure pump. Refer to **REMOVAL AND INSTALLATION** .
- Position the camshaft timing chain on the camshafts **INSTALLING**.

CAUTION: Risk of damaging valves and piston heads after working on the valve train.

- 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.

CAMSHAFT TIMING CHAINS

Removing

- Transmission removed.
- Remove timing chain lower cover. Refer to **LOWER TIMING CHAIN COVER**.
 - Remove the camshaft timing chains from the camshafts. Refer to **CAMSHAFT TIMING CHAINS, REMOVING FROM CAMSHAFTS**.

CAUTION: If the running direction is reversed on a used camshaft timing chain, it could be destroyed.

- Paint arrows to mark the left and right camshaft timing chain running direction so they can be installed again. Do not mark camshaft timing chain with punch, notch or something similar.
- Remove the T40071 and left camshaft timing chain.

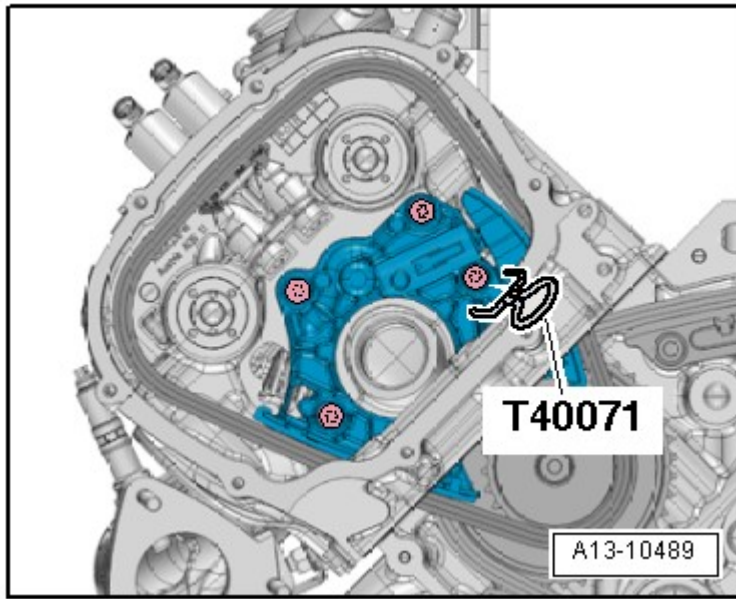


Fig. 56: Identifying Special Tool - T40071
Courtesy of AUDI OF AMERICA, LLC

-- Remove the bolts -1 and 2- and the right chain tensioner.

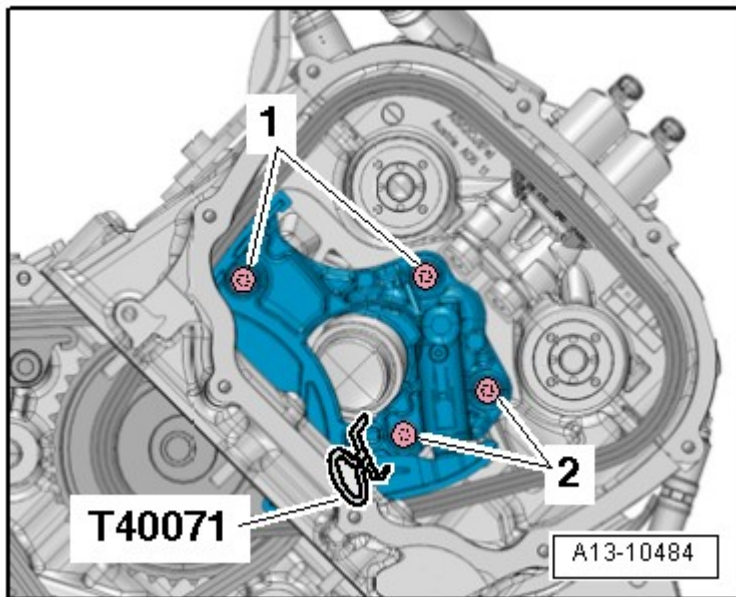


Fig. 57: Identifying Chain Tensioner Components
Courtesy of AUDI OF AMERICA, LLC

-- Press the timing mechanism chain tensioner guide rail in the direction of the -arrow- and secure the chain tensioner using a T40071.

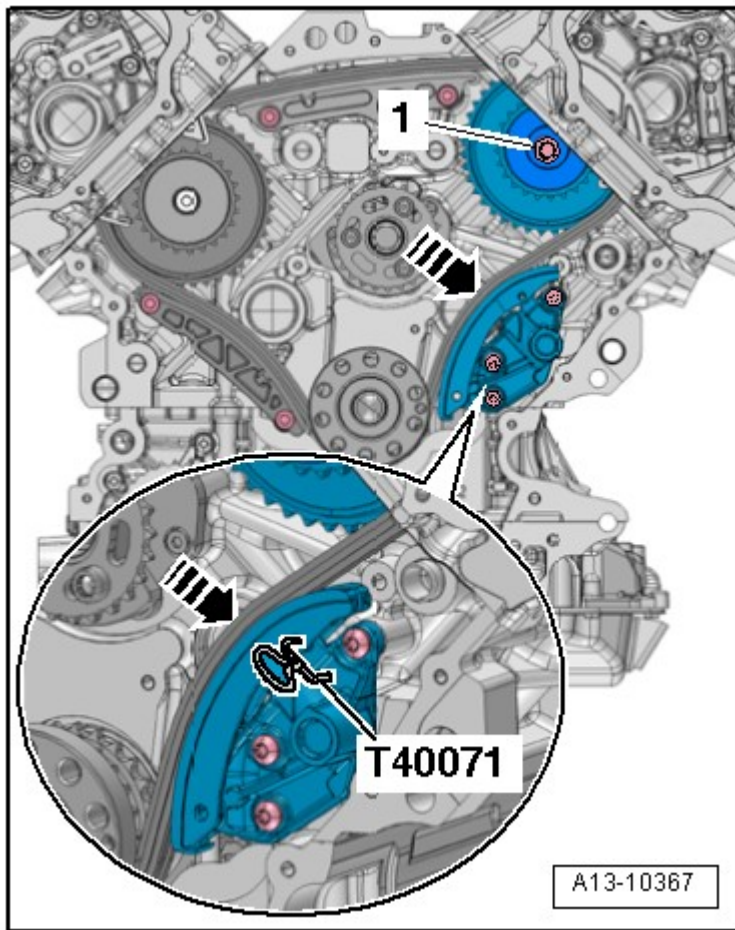


Fig. 58: Securing Chain Tensioner Using T40071

Courtesy of AUDI OF AMERICA, LLC

-- Loosen the drive chain sprocket bolt -1- 1 turn.

-- Tilt the drive chain sprocket with the mounting pins to the side slightly and remove the right camshaft timing chain upward.

Installing

- Tightening specification, refer to CAMSHAFT TIMING CHAINS OVERVIEW.

NOTE:

- If the tensioning element was removed from the chain tensioner, note installation position: Hole in the housing floor faces toward chain tensioner, piston faces toward tensioning rail.
- Replace the bolts which are being tightened with an additional turn.

CAUTION: Risk of damaging valves and piston crowns.

- If the camshafts are rotated, crankshaft may not rest with any piston

at "TDC".

-- Position the left camshaft timing chain according to the markings made during removal as shown in the illustration.

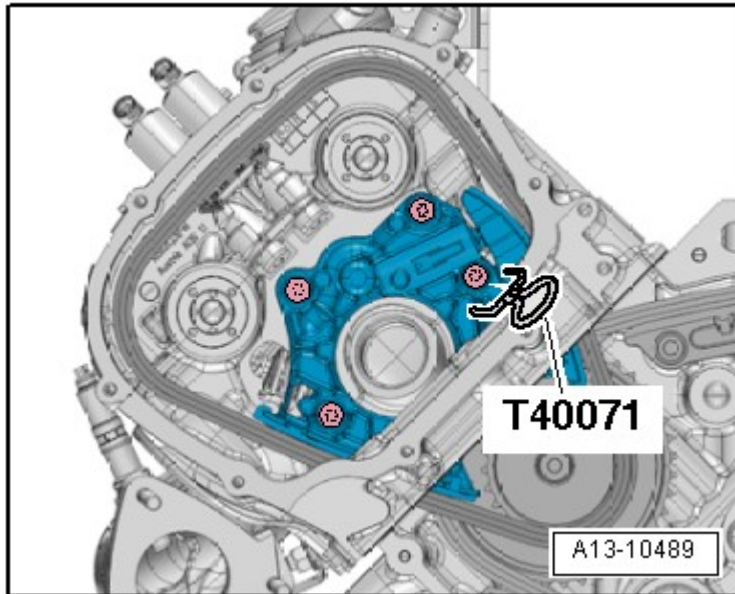


Fig. 59: Identifying Special Tool - T40071
Courtesy of AUDI OF AMERICA, LLC

-- Press the guide rail for the left camshaft timing chain tensioner down and secure the chain tensioner using a T40071.

-- Guide the right camshaft timing chain on the drive sprocket mounting pins while noting the markings made during removal.

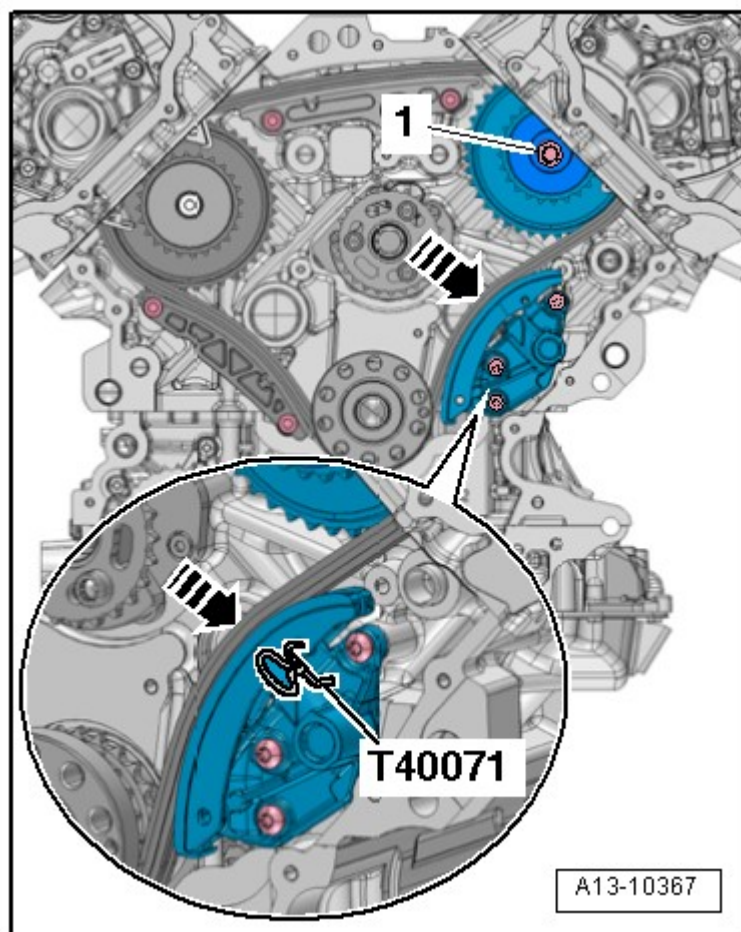


Fig. 60: Securing Chain Tensioner Using T40071
Courtesy of AUDI OF AMERICA, LLC

- Tighten the mounting pin bolts -1-.
- Remove the T40071.
- Insert the chain tensioner at the right cylinder head and position the camshaft timing chain.

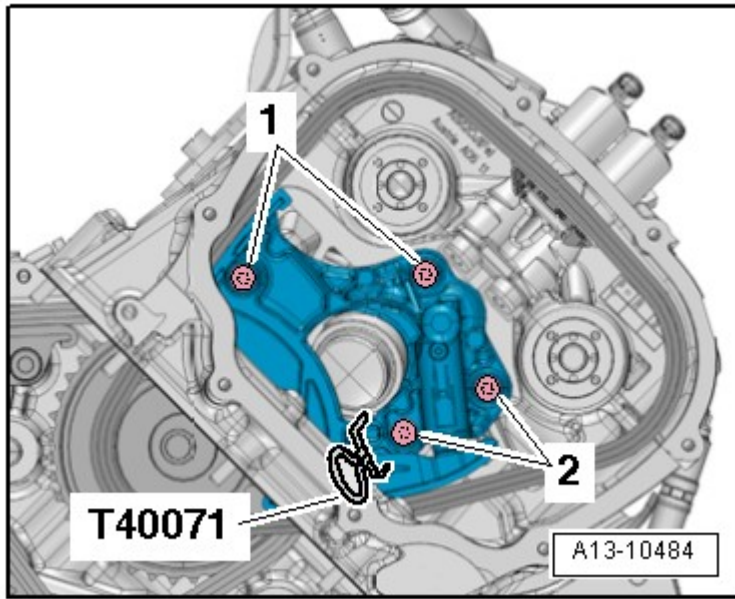


Fig. 61: Identifying Chain Tensioner Components
 Courtesy of AUDI OF AMERICA, LLC

-- Fasten the bolts -1 and 2-.

Install in reverse order of removal paying attention to the following:

-- Position the camshaft timing chain on the camshafts **INSTALLING**.

-- Install timing chain lower cover. Refer to **LOWER TIMING CHAIN COVER**.

CAMSHAFT TIMING CHAINS, REMOVING FROM CAMSHAFTS

Special tools and workshop equipment required

- Torque Wrench 40-200 Nm V.A.G 1332
- Open Ring Spanner Insert, AF 24 mm V.A.G 1332/9
- Multipoint Socket T10035
- Counterhold Tool Touareg V10 T10172
- Adapter T10172/2
- Socket T40058
- Locking Pin T40069
- Oil Collecting and Extracting Device V.A.G 1782
- Locking Pin T40071, quantity: 2
- Camshaft Clamp T40133, quantity: 2

REMOVING

NOTE: The camshaft timing chains remain on the engine in the following description.

-- Remove the respective cylinder head cover. Refer to **LEFT CYLINDER HEAD COVER, RIGHT CYLINDER HEAD COVER**.

-- Remove the left and right timing chain covers. Refer to **LEFT AND RIGHT TIMING CHAIN COVERS**.

-- Remove the noise insulation -1 and 2-. Refer to **REMOVAL AND INSTALLATION** .

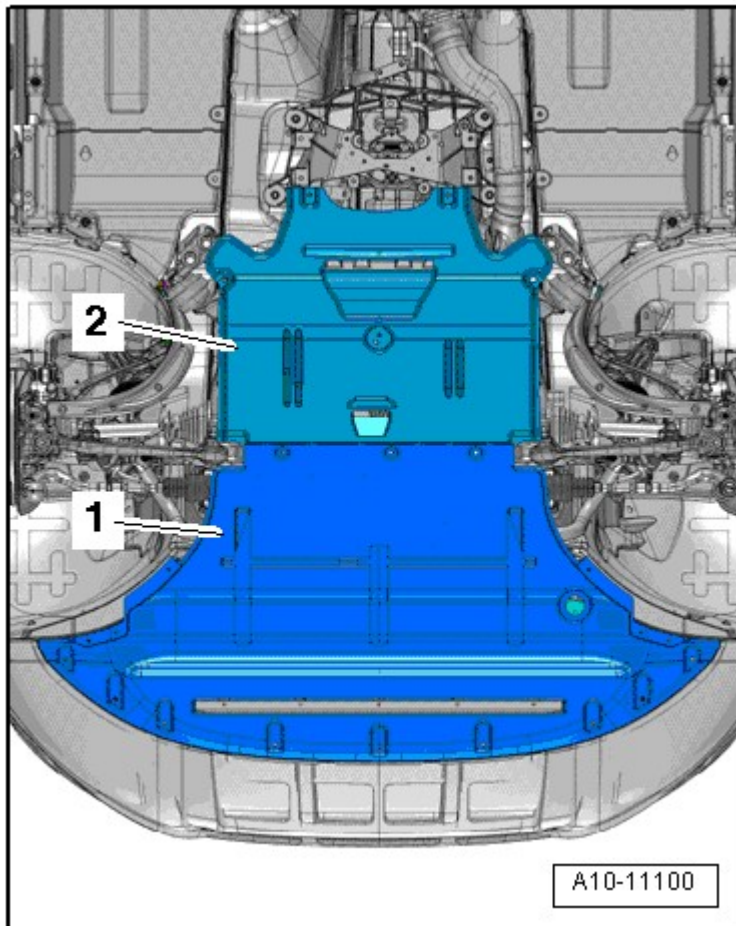


Fig. 62: Identifying Noise Insulation

Courtesy of AUDI OF AMERICA, LLC

Vehicles without the After-Run Coolant Pump -V51-

-- Remove the bolt -1- and nut -3- and the lock carrier left brace -2-.

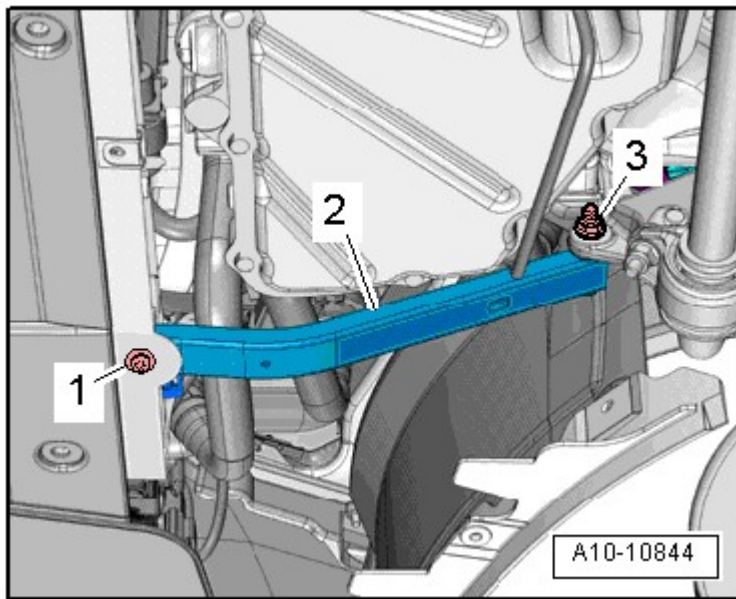


Fig. 63: Identifying Carrier Left Brace Components
Courtesy of AUDI OF AMERICA, LLC

-- Place the V.A.G 1782 under the engine.

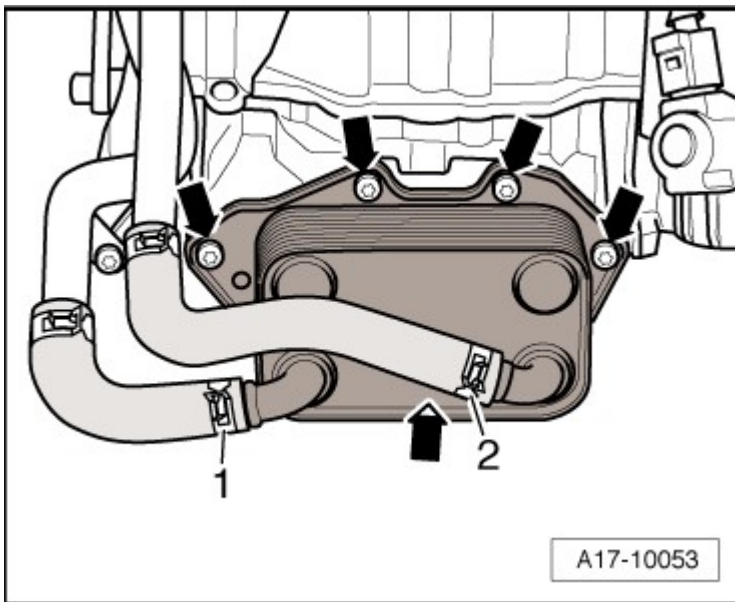


Fig. 64: Identifying Oil Cooler Components
Courtesy of AUDI OF AMERICA, LLC

-- Remove the bolts -arrows- and lay aside the oil cooler with the coolant hoses -1 and 2- connected.

Vehicles with the After-Run Coolant Pump -V51-

-- Remove the after-run coolant pump. Refer to **AFTER-RUN COOLANT PUMP -V51-** and the oil cooler

ENGINE OIL COOLER .**All Vehicles**

-- Insert the T40058 guide pins as follows:

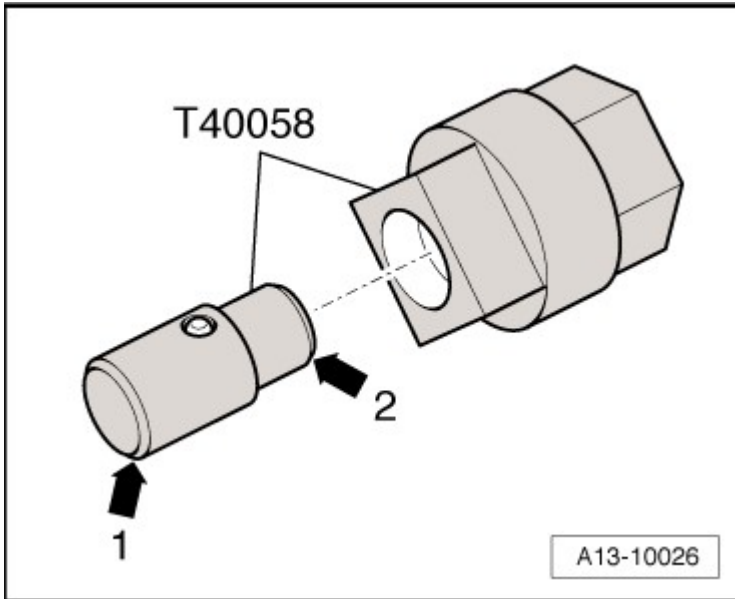


Fig. 65: Identifying Guide Pin And Adapter T40058
Courtesy of AUDI OF AMERICA, LLC

- The large diameter -arrow 1- faces the engine.
- The small diameter -arrow 2- faces the adapter.

-- Turn the crankshaft in the direction of engine rotation -arrow- to "TDC" using the T40058.

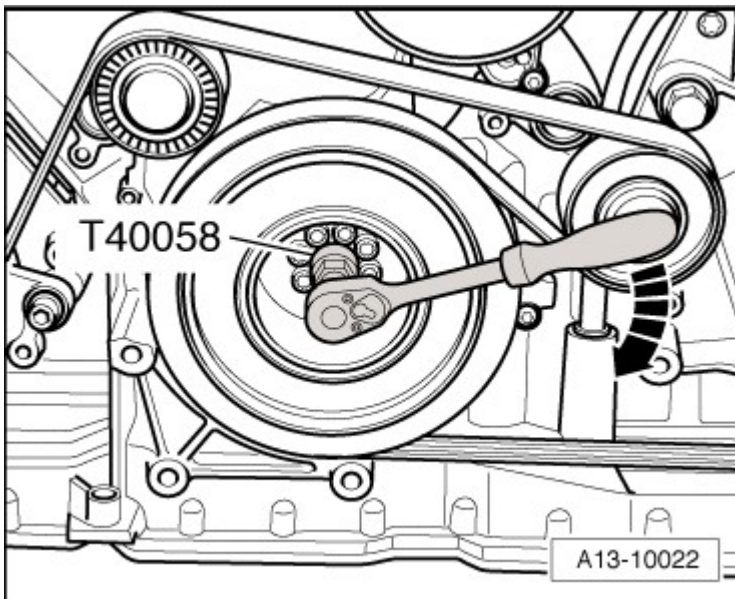
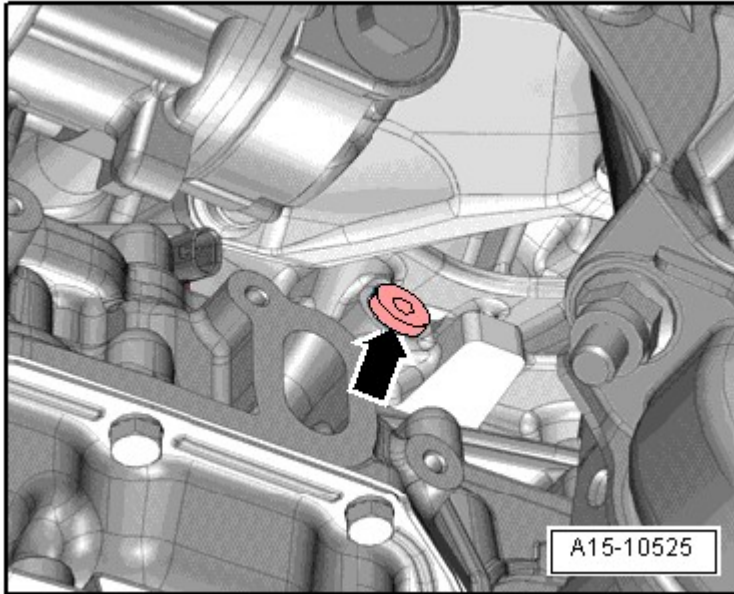


Fig. 66: Identifying TDC With Special Tool Adapter T40058

Courtesy of AUDI OF AMERICA, LLC

-- Remove the locking bolt -arrow- for the "TDC" marking from the cylinder block.

**Fig. 67: Identifying Locking Bolt**

Courtesy of AUDI OF AMERICA, LLC

NOTE: The crankshaft locating hole is difficult to find when the engine is installed.

Rotate the engine until the small notch -1- on the vibration damper aligns at the left of the housing separation point -2- between the cylinder block and the guide frame. This makes it easier to install the T40069.

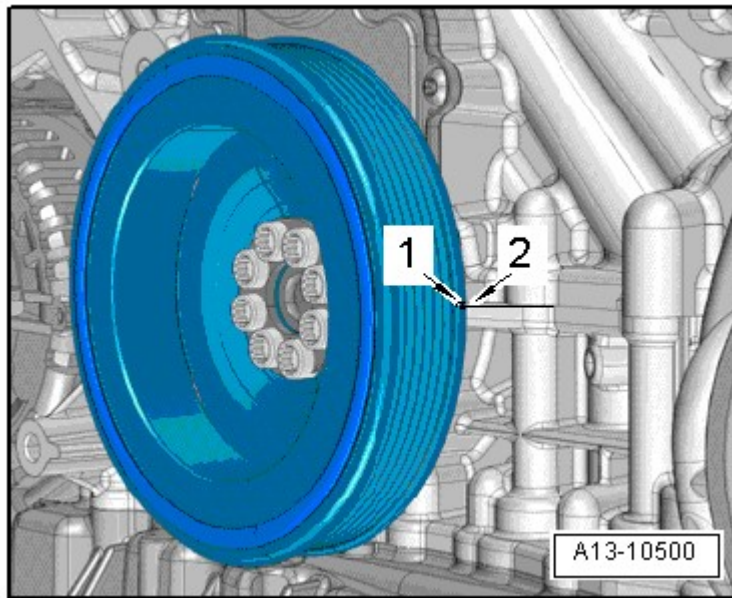


Fig. 68: Identifying Vibration Damper Alignment Notch
Courtesy of AUDI OF AMERICA, LLC

The marking on the vibration damper is only there to help. The exact "TDC" location is only reached by installing the T40069.

- The threaded holes -arrows- in the camshafts must face upward.

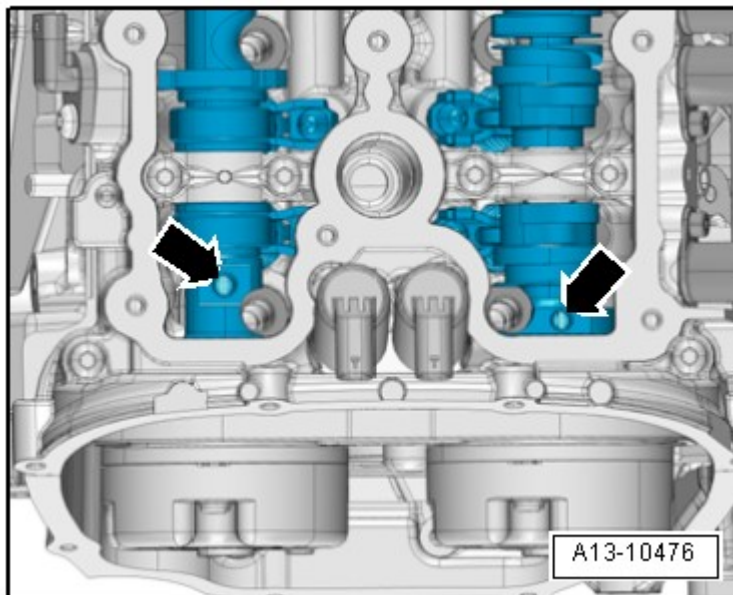


Fig. 69: Identifying Camshaft Threaded Holes
Courtesy of AUDI OF AMERICA, LLC

-- Install the T40069 in the hole and tighten to 20 Nm. Turn the crankshaft back slightly to completely center

the bolt, if necessary.

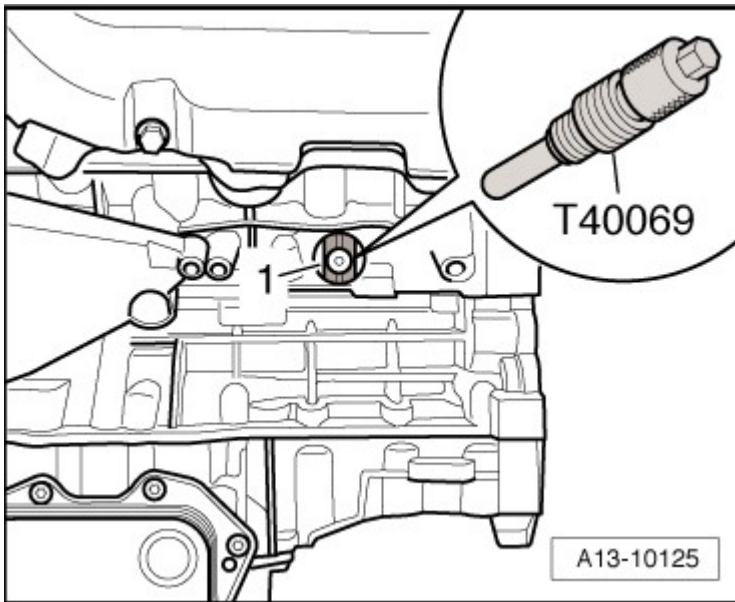


Fig. 70: Identifying Special Tool - Crankshaft Holder T40069
 Courtesy of AUDI OF AMERICA, LLC

-- Install the T40133 in both cylinder heads and tighten the bolts -arrows- to 25 Nm.

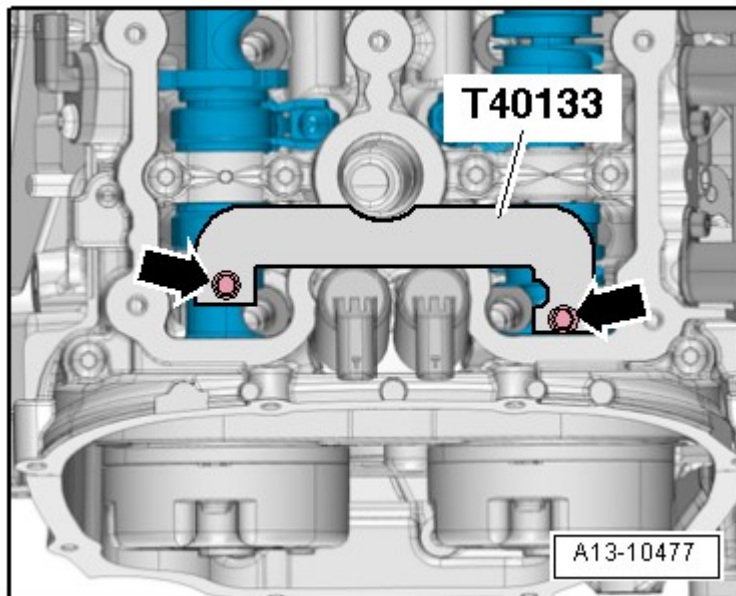


Fig. 71: Identifying Special Tool - Camshaft Adjuster T40133
 Courtesy of AUDI OF AMERICA, LLC

NOTE: The illustration shows the left cylinder head.

-- Press the left camshaft timing chain tensioner guide rails in as far as the stop using a screwdriver -1- and

secure the chain tensioner with a T40071.

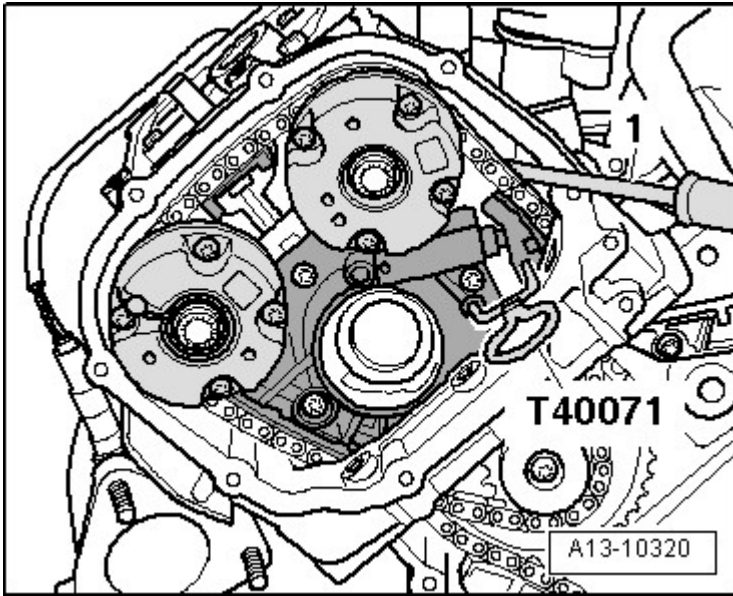


Fig. 72: Securing Left Camshaft Timing Chain Tensioner With Special Tool T40071

Courtesy of AUDI OF AMERICA, LLC

NOTE: The toothed belt tensioner is lubricated with oil and should only be compressed slowly by applying constant pressure.

-- Press the right camshaft timing chain tensioner guide rails in as far as the stop using a screwdriver -1- and secure the chain tensioner with a T40071.

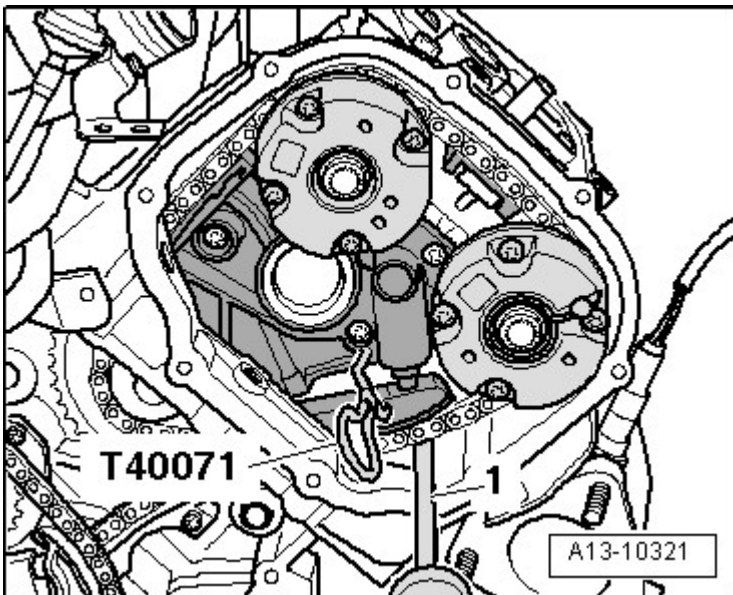


Fig. 73: Securing Right Camshaft Timing Chain Tensioner With Special Tool T40071

Courtesy of AUDI OF AMERICA, LLC

NOTE: The toothed belt tensioner is lubricated with oil and should only be compressed slowly by applying constant pressure.

CAUTION: The camshaft could be damaged.

- Do not use the T40133 to counterhold when loosening the camshaft adjuster bolts -1-.

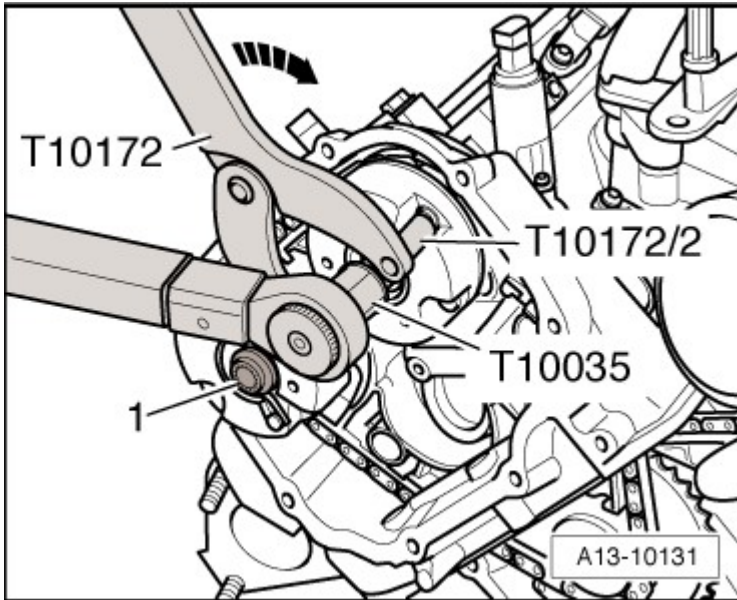


Fig. 74: Removing/ Installing Left Camshaft Adjuster
Courtesy of AUDI OF AMERICA, LLC

-- To counterhold at the affected camshaft adjuster, position the T10172 with the T10172/2 and loosen using the T10035.

-- Mark the installation position of the camshaft adjuster with paint for installation later.

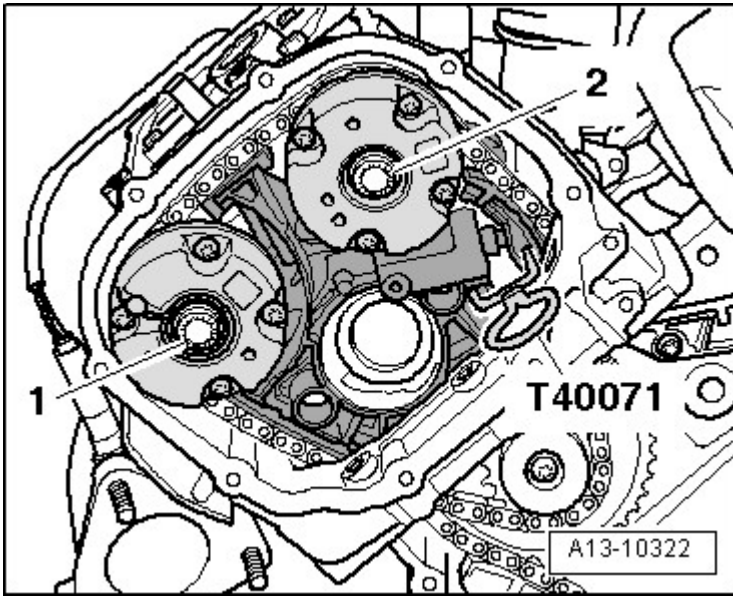


Fig. 75: Identifying Camshaft Adjuster Bolts
Courtesy of AUDI OF AMERICA, LLC

CAUTION: The engine could be destroyed.

- To prevent small parts from accidentally entering the engine through the opening in the timing chain compartment, cover the opening with a clean cloth.

- Remove bolts -1 and 2- on the left cylinder head and remove both camshaft adjusters.
- Mark the installation position of the camshaft adjuster with paint for installation later.
- Remove the bolts -1 and 2- on the right cylinder head and remove both camshaft adjusters.

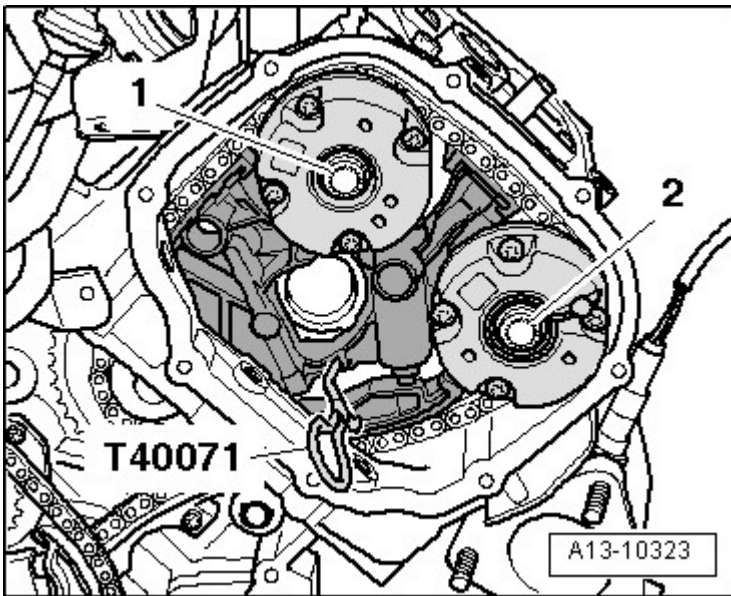


Fig. 76: Identifying Camshaft Adjuster Bolts
Courtesy of AUDI OF AMERICA, LLC

INSTALLING

- For the correct tightening specifications, refer to **CAMSHAFT TIMING CHAINS OVERVIEW.**

NOTE:

- Replace the bolts which are being tightened with an additional turn.
- Replace the O-ring for the Top Dead Center (TDC) marking locking bolt.

CAUTION: Risk of damaging valves and piston crowns.

- If camshafts are rotated, crankshaft may not rest with any piston at "TDC".
- Drive chain for timing mechanism installed. Refer to **TIMING MECHANISM DRIVE CHAIN.**

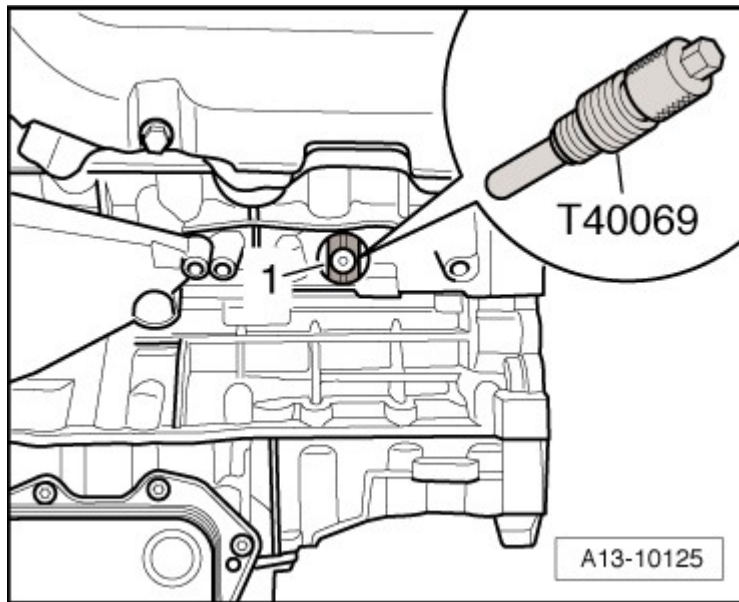


Fig. 77: Identifying Special Tool - Crankshaft Holder T40069
Courtesy of AUDI OF AMERICA, LLC

- Secure the crankshaft in the "TDC" position using T40069.
- T40133 mounted on both cylinder heads and fastened to 25 Nm -arrows-.

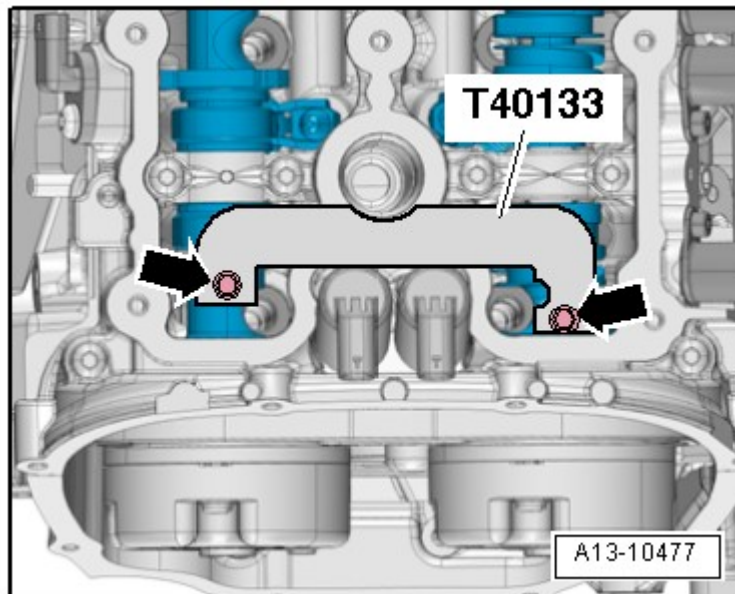


Fig. 78: Identifying Special Tool - Camshaft Adjuster T40133
Courtesy of AUDI OF AMERICA, LLC

NOTE: The illustration shows the left cylinder head.

CAUTION: The engine could be damaged.

- For the following steps, only install the camshaft adjuster so the grooves -1 and 4- are aligned with the windows (beveled surfaces) -2 and 3-.

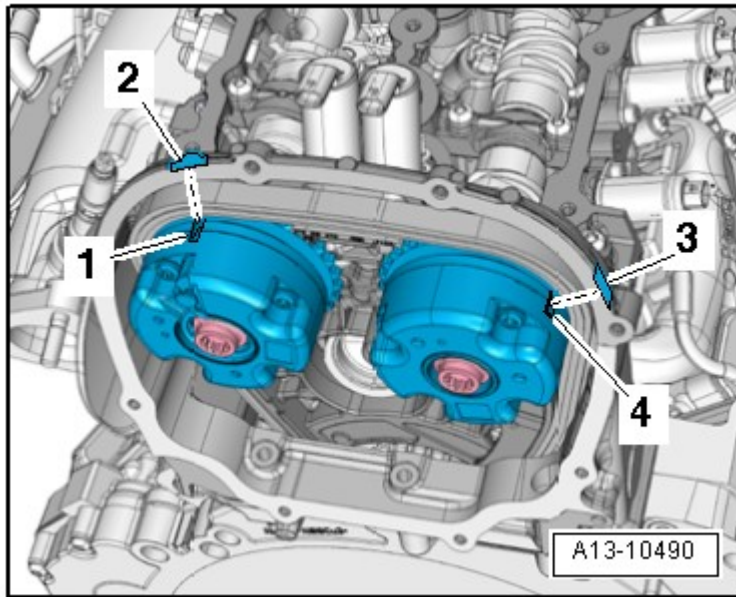


Fig. 79: Identifying Camshaft Adjuster Alignment
Courtesy of AUDI OF AMERICA, LLC

NOTE: Reinstall camshaft adjuster on the left cylinder head according to the mark applied during removal.

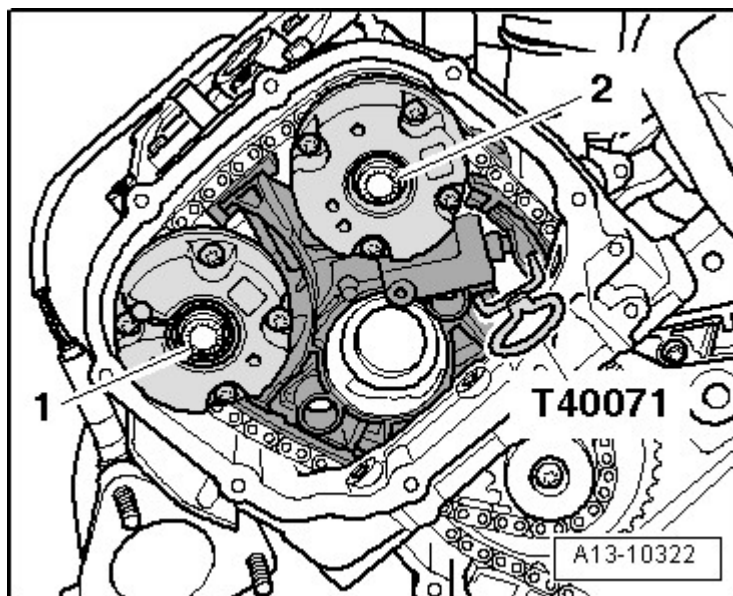


Fig. 80: Identifying Camshaft Adjuster Bolts

Courtesy of AUDI OF AMERICA, LLC

-- Position the left camshaft timing chain on the drive sprocket and the camshaft adjuster and loosely install bolts -1 and 2-

- Both camshaft adjusters must be able to still be rotated on camshaft and must not tip.

-- Remove the T40071.

NOTE: Reinstall camshaft adjuster on the right cylinder head according to the mark applied during removal.

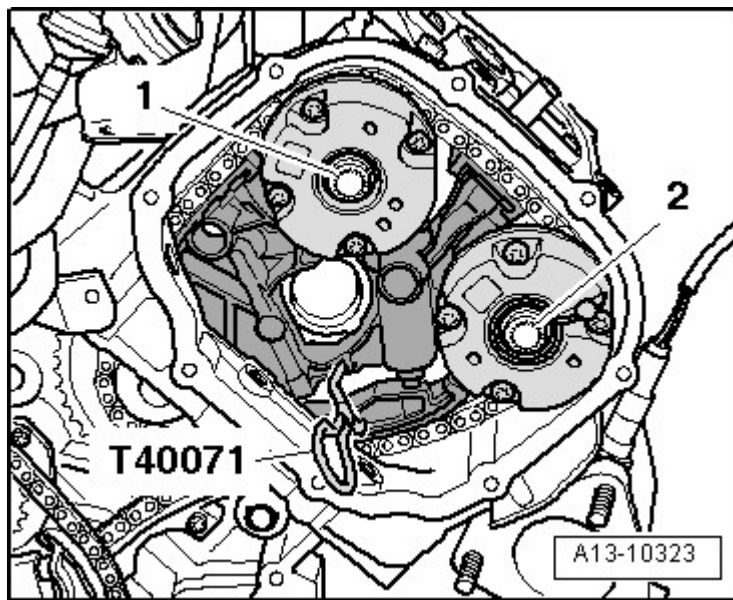


Fig. 81: Identifying Camshaft Adjuster Bolts
Courtesy of AUDI OF AMERICA, LLC

-- Position the right camshaft timing chain on the drive sprocket and the camshaft adjuster and loosely install bolts -1 and 2-

- Both camshaft adjusters must be able to still be rotated on the camshaft and must not tip.

-- Remove the T40071.

-- Position the T10172 with the T10172/2 on the left intake camshaft adjuster.

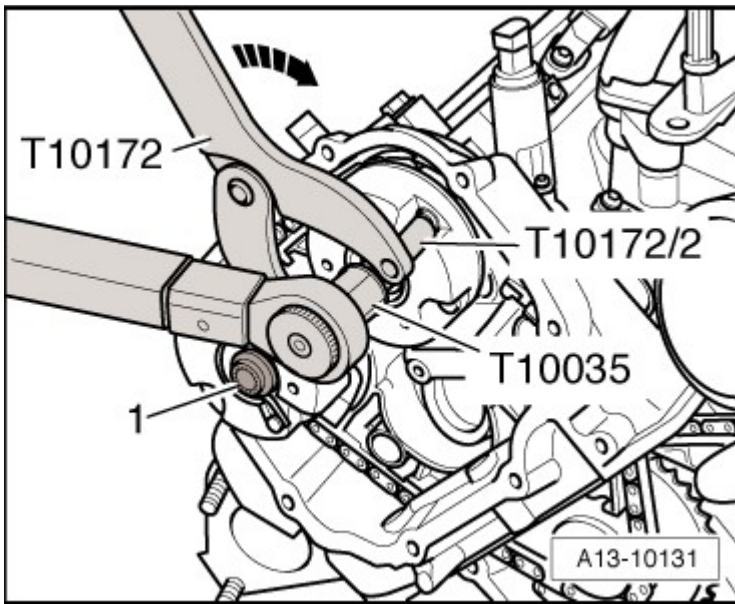


Fig. 82: Removing/ Installing Left Camshaft Adjuster
Courtesy of AUDI OF AMERICA, LLC

-- Have a second technician hold the camshaft timing chain tensioned by pressing the counter hold tool in the direction of the -arrow-.

-- Tighten the bolts as follows while the camshaft adjuster is still held under tension.

-- Tighten the bolt on the intake camshaft to 80 Nm.-- Tighten bolt -1- to exhaust camshaft to 80 Nm.

-- Position the T10172 with the T10172/2 on the right exhaust camshaft adjuster.

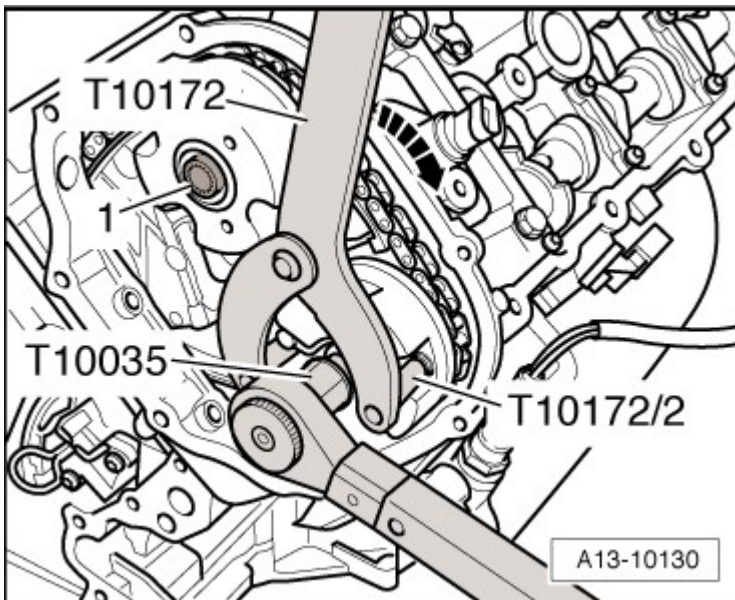


Fig. 83: Removing/ Installing Right Camshaft Adjuster

Courtesy of AUDI OF AMERICA, LLC

-- Have a second technician hold the camshaft timing chain tensioned by pressing the counter hold tool in the direction of the -arrow-.

-- Tighten the bolts as follows while the camshaft adjuster is still held under tension.

-- Tighten the bolt on the exhaust camshaft to 80 Nm.-- Tighten bolt -1- to the intake camshaft to 80 Nm.

-- Remove the T40133 on both cylinder heads -arrows-.

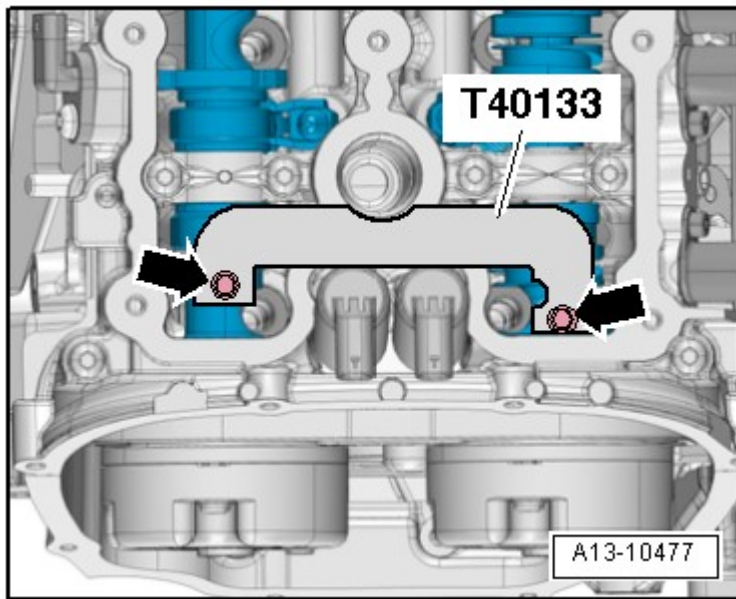


Fig. 84: Identifying Special Tool - Camshaft Adjuster T40133
Courtesy of AUDI OF AMERICA, LLC

NOTE: The illustration shows the left cylinder head.

-- Tighten the camshaft adjuster bolts on the left cylinder head as follows:

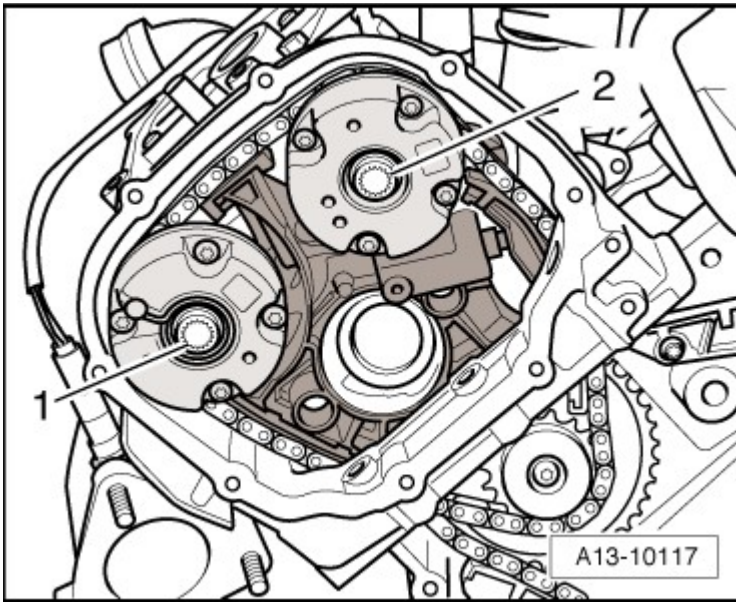


Fig. 85: Identifying Left Camshaft Adjuster Screws
Courtesy of AUDI OF AMERICA, LLC

-- Tighten bolt -1- to intake camshaft to final torque.-- Tighten bolt -2- to exhaust camshaft to final torque.

-- Tighten the camshaft adjuster bolts on the right cylinder head as follows:

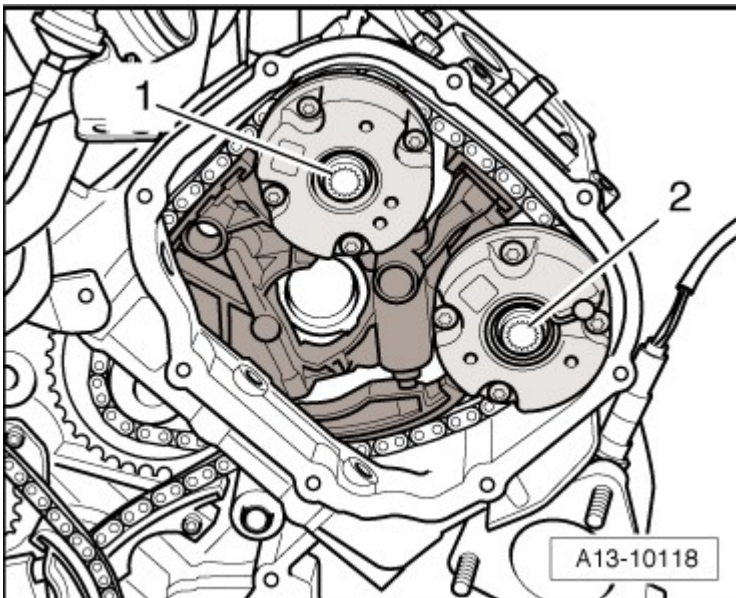


Fig. 86: Identifying Right Camshaft Adjuster Screws
Courtesy of AUDI OF AMERICA, LLC

-- Tighten bolt -1- to intake camshaft to final torque.-- Tighten bolt -2- to exhaust camshaft to final torque.

-- Remove the T40069.

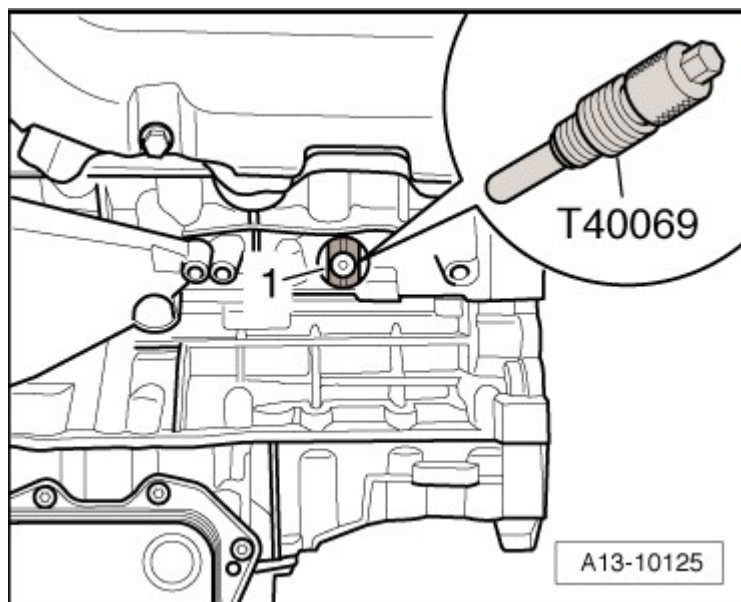


Fig. 87: Identifying Special Tool - Crankshaft Holder T40069

Courtesy of AUDI OF AMERICA, LLC

-- Using the T40058, turn the crankshaft two turns in the direction of engine rotation -arrow- until it is back at "TDC".

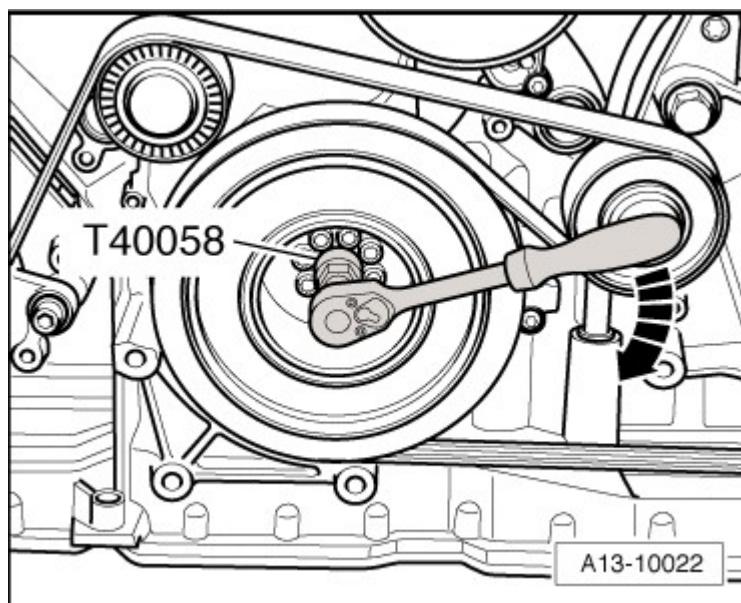


Fig. 88: Identifying TDC With Special Tool Adapter T40058

Courtesy of AUDI OF AMERICA, LLC

NOTE: If it is accidentally rotated beyond "TDC", rotate it back approximately 30° and set it to "TDC" again.

- The threaded holes -arrows- in the camshafts must face upward.

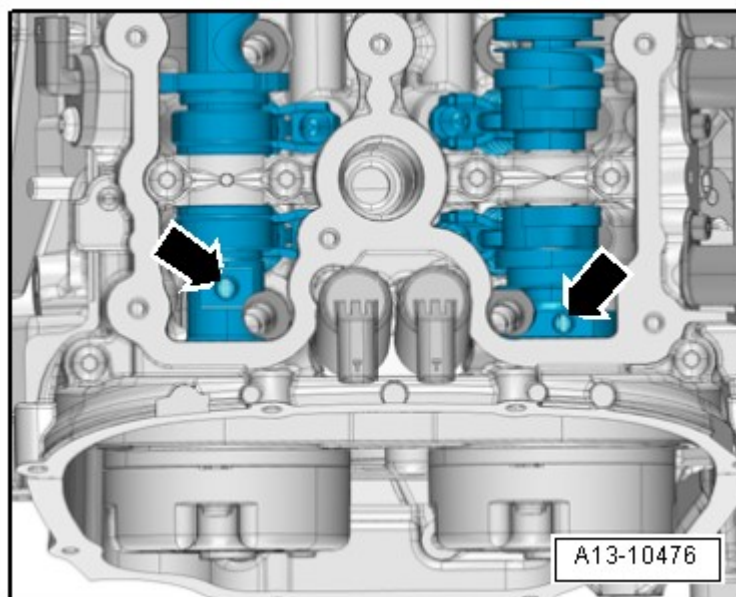


Fig. 89: Identifying Camshaft Threaded Holes
Courtesy of AUDI OF AMERICA, LLC

-- Install the T40133 in both cylinder heads and tighten the bolts -arrows- to 25 Nm.

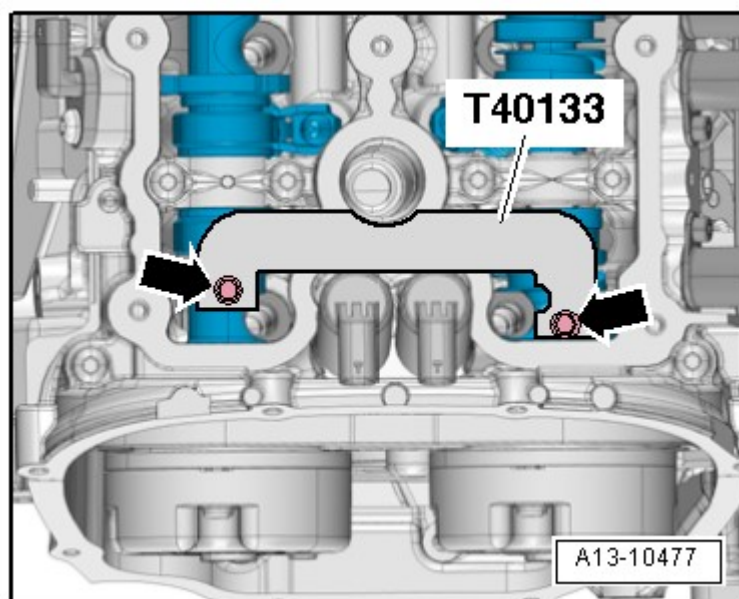


Fig. 90: Identifying Special Tool - Camshaft Adjuster T40133
Courtesy of AUDI OF AMERICA, LLC

-- Install the T40069 directly in the hole.

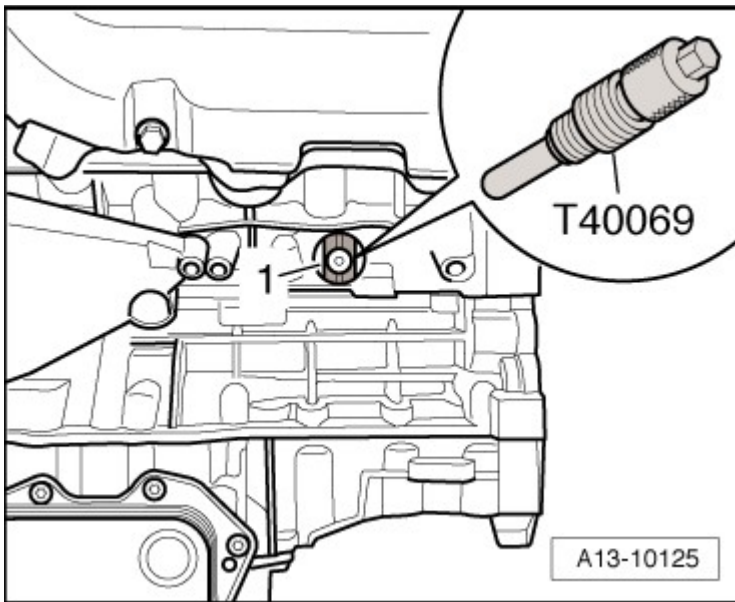


Fig. 91: Identifying Special Tool - Crankshaft Holder T40069
 Courtesy of AUDI OF AMERICA, LLC

- The T40069 must engage in the locating hole of the crankshaft -1-, otherwise repeat the adjustment.

-- Remove the camshaft locating pins on both cylinder heads.

-- Remove the T40069.

Install in reverse order of removal paying attention to the following:

-- Install the "TDC" marking locking bolt. Refer to **Fig. 92**.

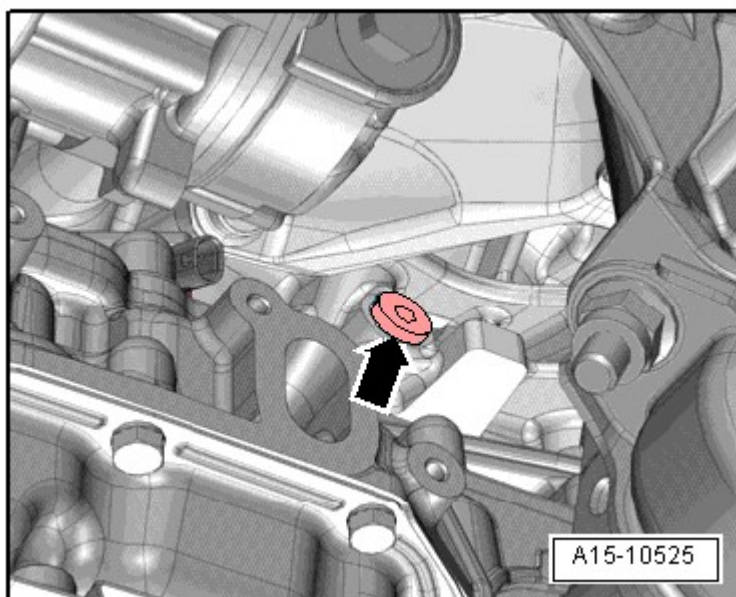


Fig. 92: Identifying Locking Bolt**Courtesy of AUDI OF AMERICA, LLC**

- Install the left and right timing chain covers. Refer to **LEFT AND RIGHT TIMING CHAIN COVERS**.
- Install the cylinder head covers. Refer to **LEFT CYLINDER HEAD COVER**, **RIGHT CYLINDER HEAD COVER**.
- Install the oil cooler. Refer to **ENGINE OIL COOLER** .
- Install after-run coolant pump -V51-. Refer to **AFTER-RUN COOLANT PUMP -V51-** .
- Install the lock carrier brace. Refer to **REMOVAL AND INSTALLATION** .
- Install the noise insulation. Refer to **REMOVAL AND INSTALLATION** .

CYLINDER HEADS**Special tools and workshop equipment required**

- Spanner Wrench 3212
- Socket T40058
- Locking Pin T40069
- Camshaft Clamp 40133

REMOVING

- Engine installed.

NOTE:

- The following information describes how to remove both cylinder heads at the same time.
- If only one cylinder head will be removed, follow the applicable instructions in the following description.

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

- Reduce the fuel pressure down to residual pressure before opening high pressure area of the fuel injection system.

- Reduce fuel pressure in high pressure area. Refer to **GENERAL INFORMATION** .
- Remove the upper coolant pipe. Refer to **UPPER COOLANT PIPE** .
- Remove ribbed belt. Refer to **RIBBED BELT** .

-- Remove the lower section of the intake manifold. Refer to **REMOVAL AND INSTALLATION**.

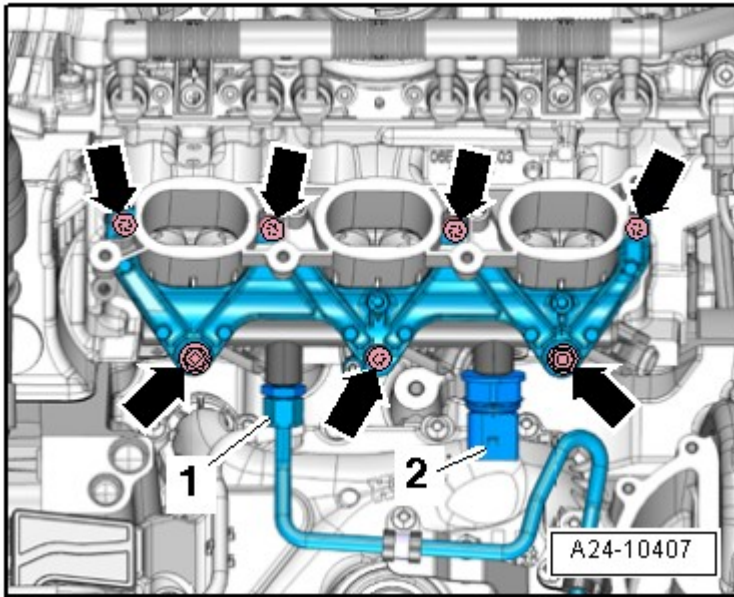


Fig. 93: Disconnecting Fuel Injector Connectors

Courtesy of AUDI OF AMERICA, LLC

-- Disconnect the electrical connectors on the fuel injectors.

-- Remove the left and right timing chain covers. Refer to **LEFT AND RIGHT TIMING CHAIN COVERS**.

-- Remove the bolts -arrows- for the coolant pump ribbed belt pulley for power steering pump using a 3212 to counter hold.

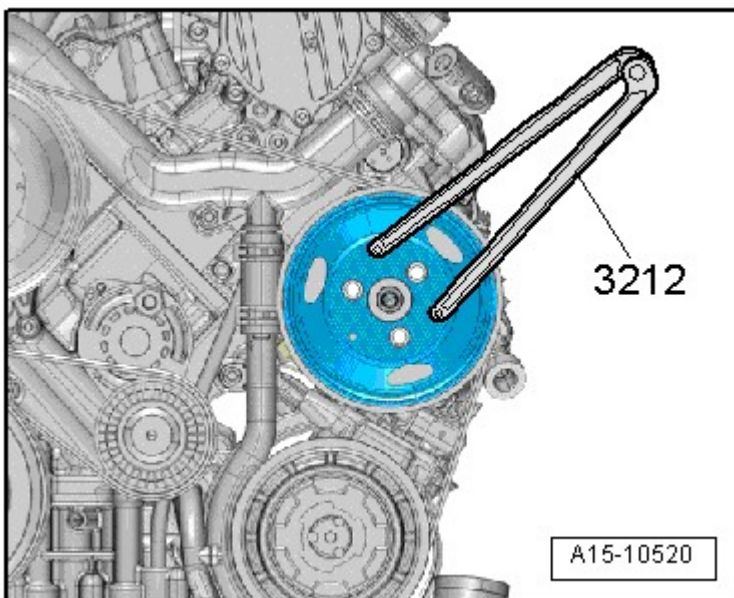


Fig. 94: Identifying Coolant Pump Pulley Bolts

Courtesy of AUDI OF AMERICA, LLC

-- Remove the bolts -1 and 2- and lay the power steering pump to the side.

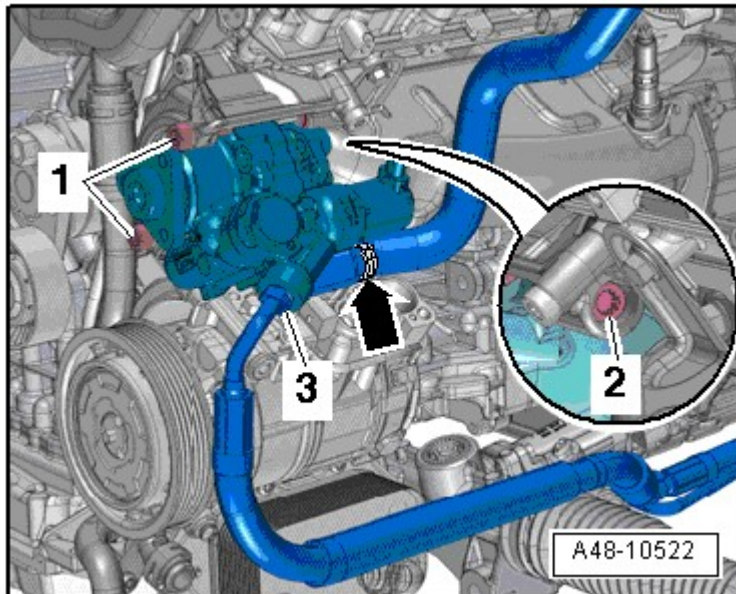


Fig. 95: Identifying Power Steering Pump Components
Courtesy of AUDI OF AMERICA, LLC

NOTE: Ignore -3- and -arrow-.

-- Disconnect electrical connector -3- for Engine Coolant Temperature (ECT) Sensor -G62-.

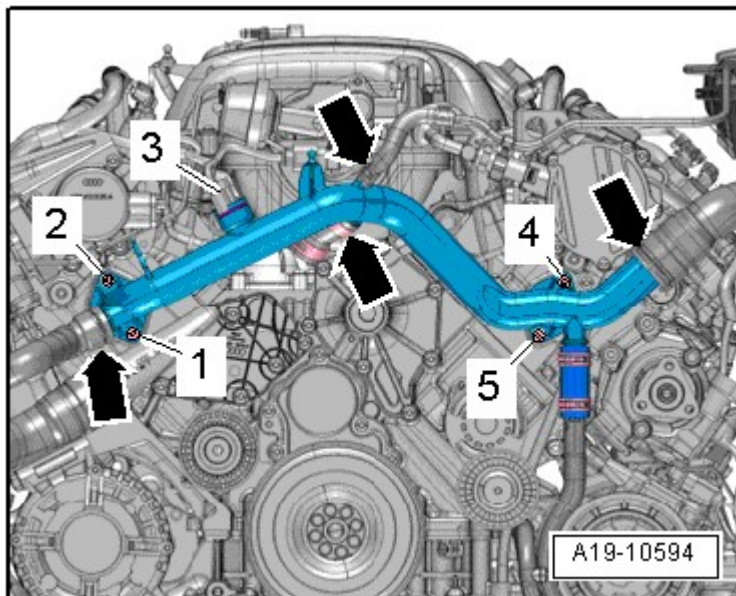


Fig. 96: Identifying Front Coolant Pipe Components

Courtesy of AUDI OF AMERICA, LLC

-- Remove the bolts -1, 2, 4 and 5- on the front coolant pipe.

NOTE: Ignore -arrows-.

-- Remove the nuts -arrows- and the high pressure line protective plate -1-.

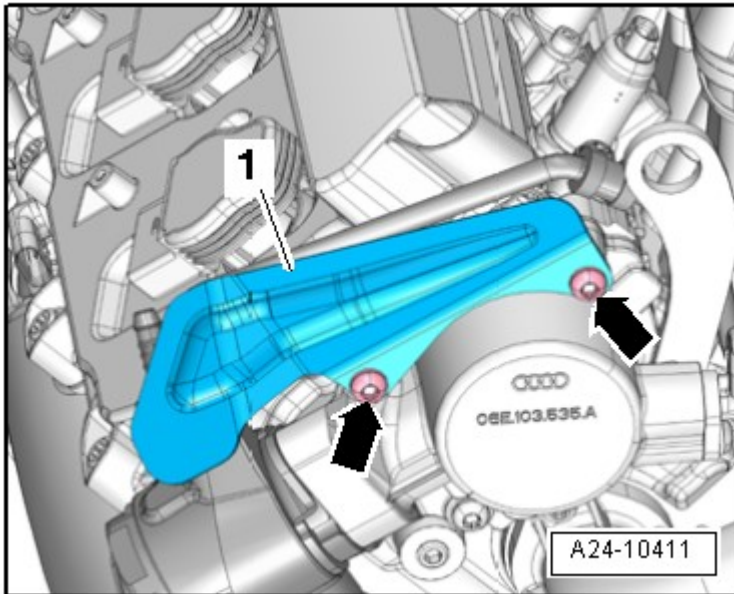


Fig. 97: Identifying Nuts -Arrows- And Protective Plate -1-
Courtesy of AUDI OF AMERICA, LLC

-- Remove the threaded connection -2- and move the fuel supply line to the side.

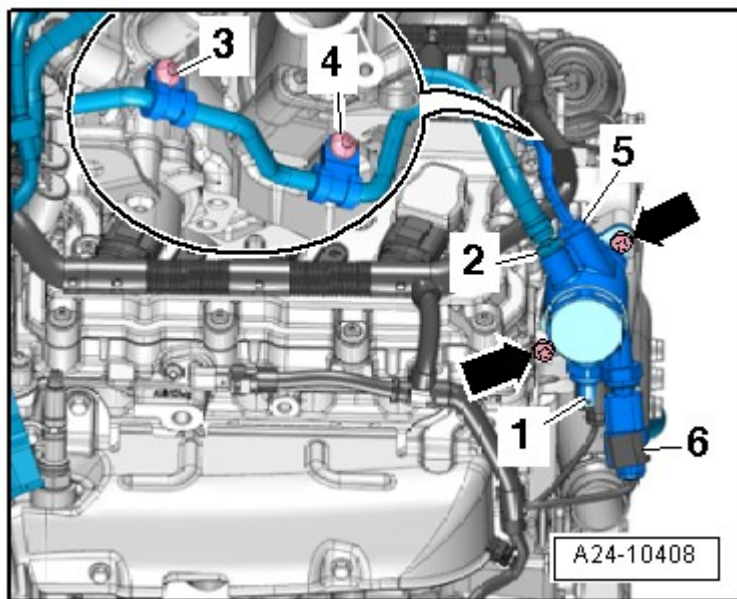


Fig. 98: Identifying High-Pressure Fuel Pump Components
Courtesy of AUDI OF AMERICA, LLC

-- Disconnect the connectors -1 and 6--.

NOTE: Ignore -3, 4, 5 and arrows--.

-- Disconnect the right and left electrical connectors -arrows- on the camshaft adjuster actuators.

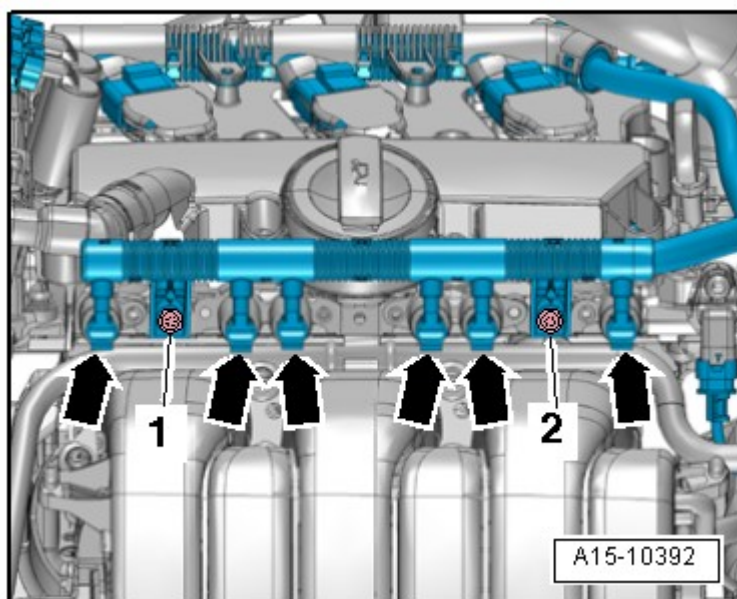


Fig. 99: Disconnecting Right And Left Electrical Connectors On Camshaft Adjuster Actuators
Courtesy of AUDI OF AMERICA, LLC

-- Remove the bolts -1 and 2- and free up the electrical wiring harness.

-- Remove the cylinder head cover. Refer to **LEFT CYLINDER HEAD COVER**, **RIGHT CYLINDER HEAD COVER**.

-- Disconnect the electrical connector -3- on the Camshaft Position (CMP) sensor -G40-.

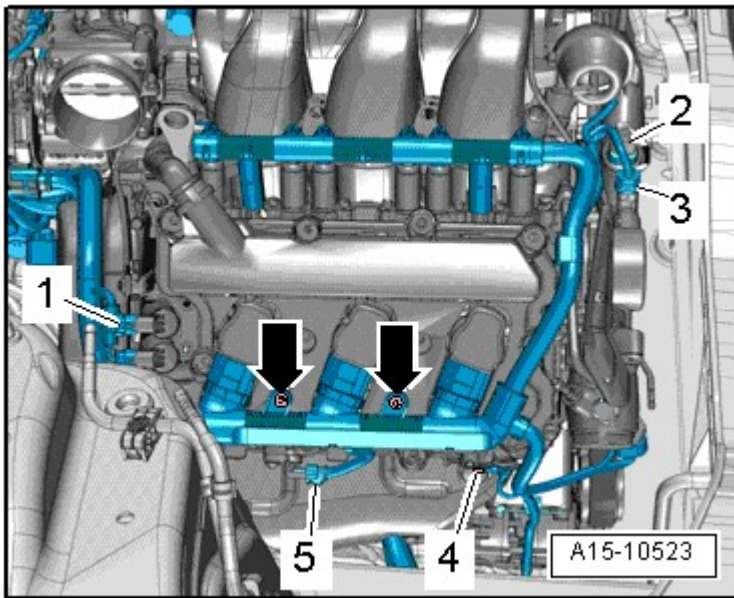


Fig. 100: Identifying Electrical Wiring Harness Components
Courtesy of AUDI OF AMERICA, LLC

-- Remove the Ground (GND) wire bolt -4-.

NOTE: Ignore -1, 2 and 5-.

-- Remove the bolts -arrows- and the bracket for the left connectors.

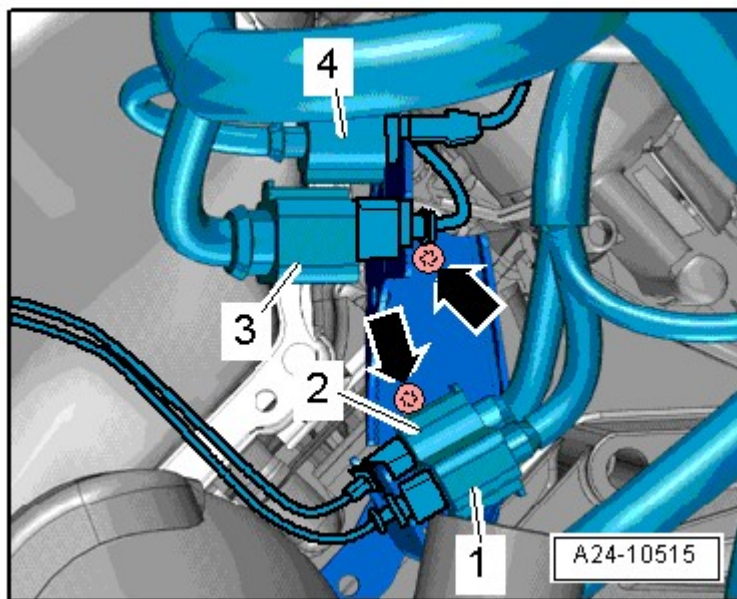


Fig. 101: Identifying Left Cylinder Head Electrical Connectors
Courtesy of AUDI OF AMERICA, LLC

NOTE: Ignore -1 to 4-.

-- Remove the bolts -arrows- and the bracket for the right connectors.

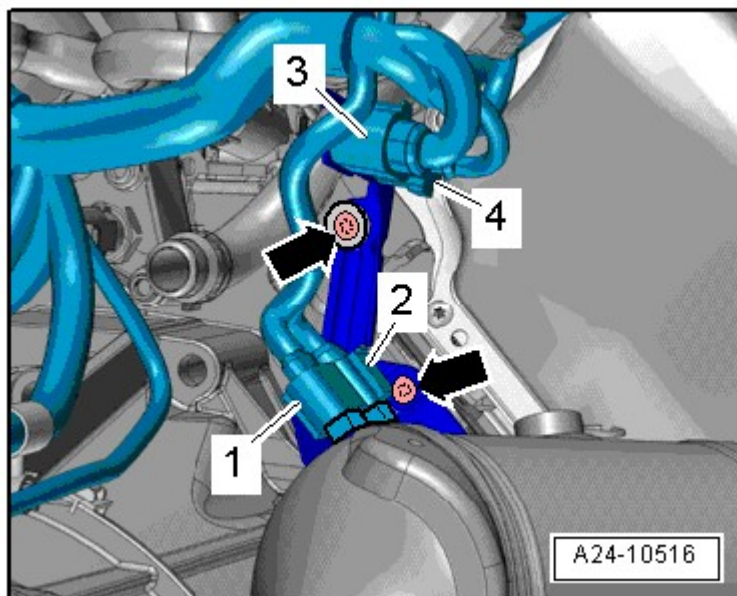


Fig. 102: Identifying Right Cylinder Head Electrical Connectors
Courtesy of AUDI OF AMERICA, LLC

NOTE: Ignore -1 to 4-.

-- Remove the bolt -arrow- and remove the oil dipstick with the guide tube.

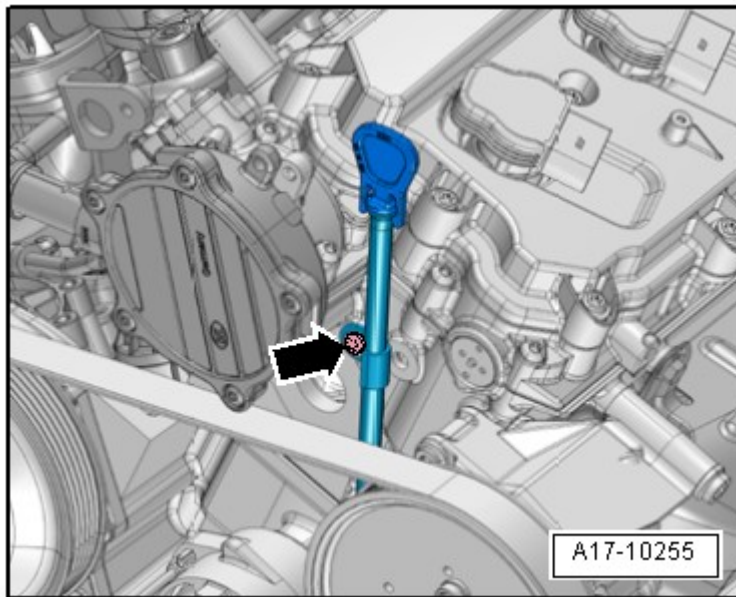


Fig. 103: Identifying Oil Dipstick Guide Tube Bolt
Courtesy of AUDI OF AMERICA, LLC

-- Open the clamp and remove the vacuum hose from the vacuum pump -arrow-.

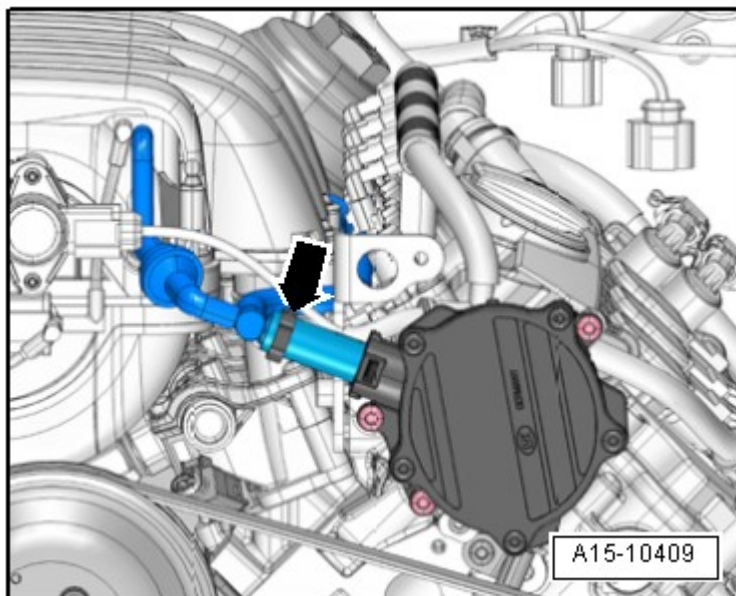


Fig. 104: Identifying Vacuum Pump Hose
Courtesy of AUDI OF AMERICA, LLC

-- Free up vacuum hose.

-- Remove the bolts -arrows- on the rear of the cylinder head.

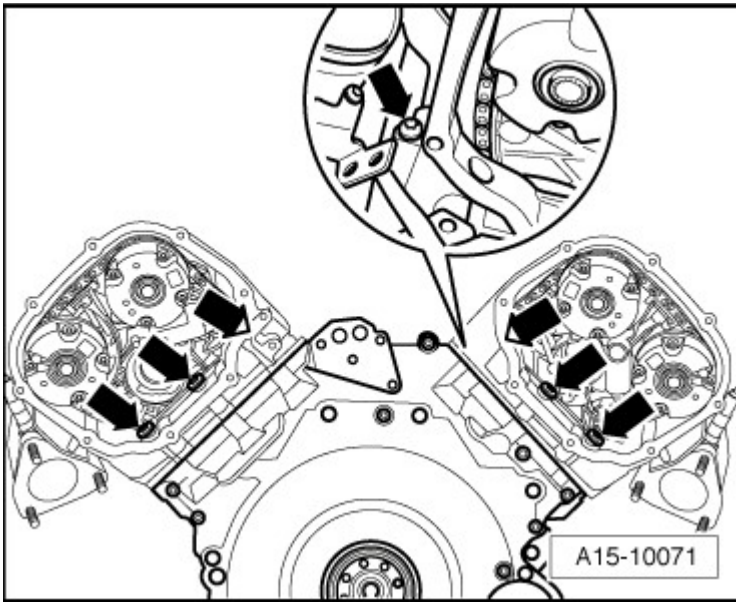


Fig. 105: Identifying Rear Cylinder Head Bolts
Courtesy of AUDI OF AMERICA, LLC

- Left cylinder head: 3 bolts.
- Right cylinder head: 4 bolts.

NOTE: The cams on the intake camshaft partially restrict access to the cylinder head bolts, such as bolts -1 and 2- shown in this example..

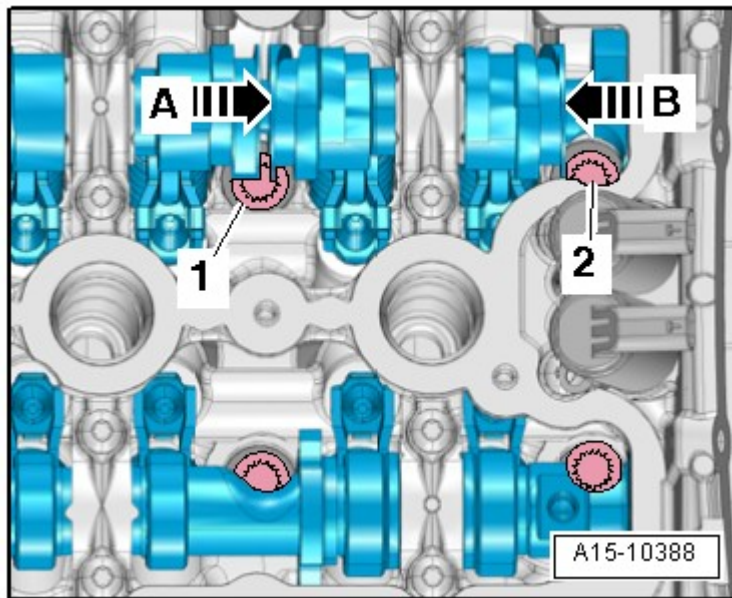


Fig. 106: Pressing Intake Camshaft Sliders
Courtesy of AUDI OF AMERICA, LLC

The slider on the camshaft must be pressed in the direction of -arrow A- using a

plastic wedge to remove the bolt -1-.

The slider on the camshaft must be pressed in the direction of -arrow B- using a plastic wedge to remove the bolt -2-.

CAUTION: Risk of damage.

- The camshaft slider must only slide in the base-circle phase, that is the rocker arm on the slider that will be moved must not be loaded with a cam. When loosening the cylinder head bolts, follow the sequence described in the following instruction.

There is a risk it could break.

- The camshaft sliders must not slide on the thin ribs.

-- Insert the T40058 guide pins as follows:

- The large diameter -arrow 1- faces the engine.

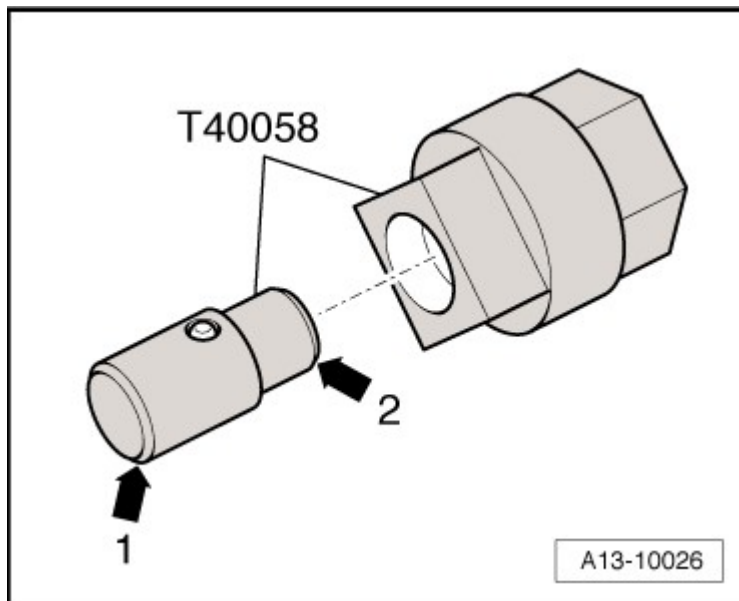


Fig. 107: Identifying Guide Pin And Adapter T40058
Courtesy of AUDI OF AMERICA, LLC

- The small diameter -arrow 2- faces the adapter.

-- Rotate the crankshaft in the direction of engine rotation -arrow- using the T40058 until the camshaft position shown in the following illustration is reached.

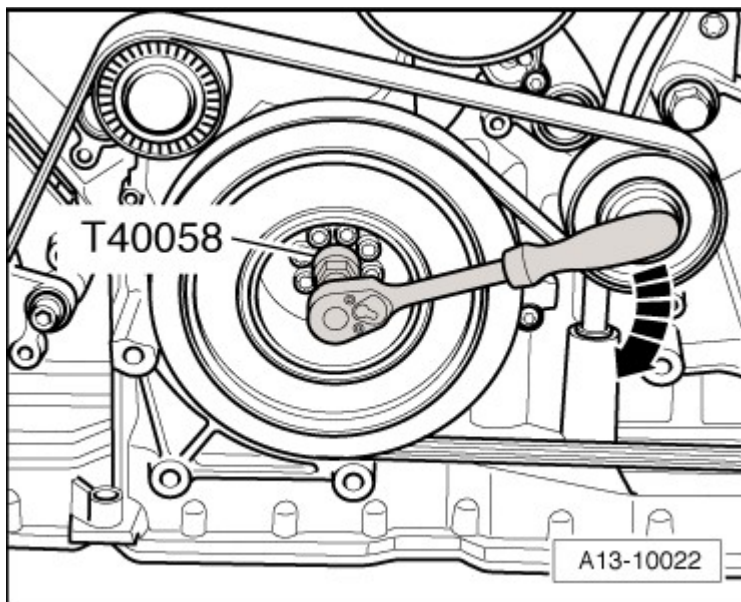


Fig. 108: Identifying TDC With Special Tool Adapter T40058
Courtesy of AUDI OF AMERICA, LLC

- The openings -arrows- on the exhaust camshafts must face toward the outer side of the engine as shown in the illustration.

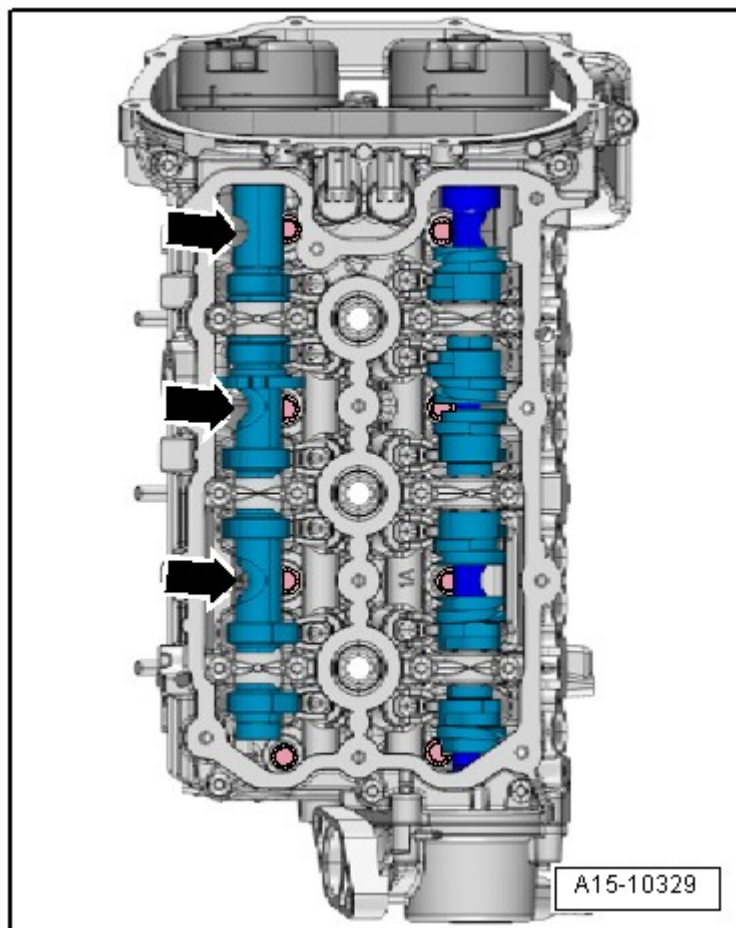


Fig. 109: Identifying Exhaust Camshaft Openings Alignment
Courtesy of AUDI OF AMERICA, LLC

Left Cylinder Head

-- Slide the unloaded camshaft slider -B- as far as the stop in the direction of the -arrow-.

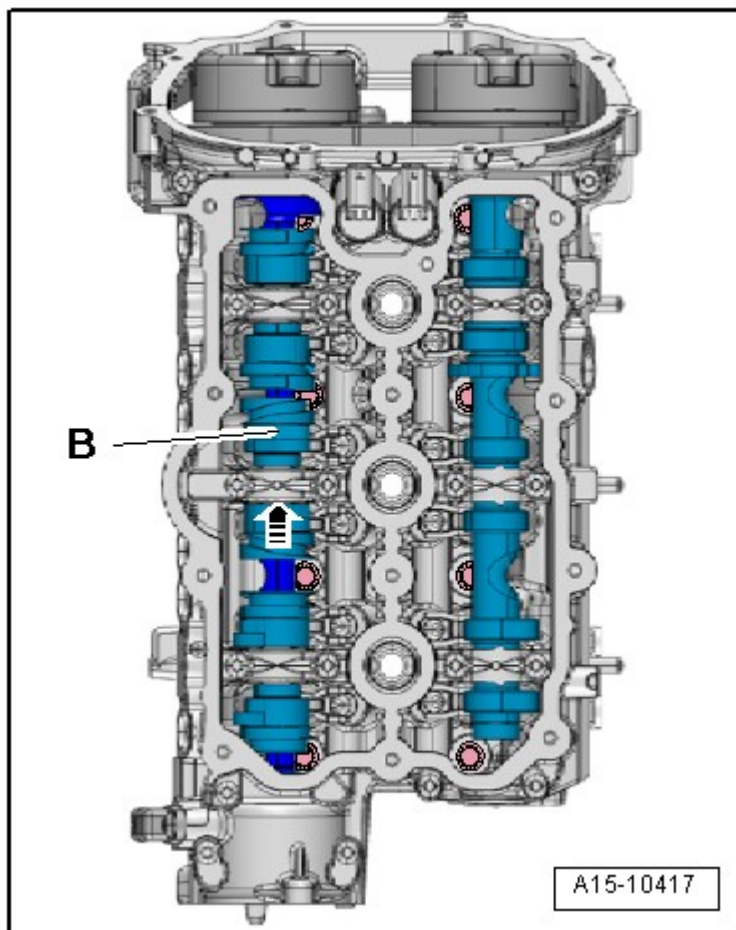


Fig. 110: Sliding Unloaded Camshaft Sliders (Left Cylinder Head)
Courtesy of AUDI OF AMERICA, LLC

Right Cylinder Head

-- Slide the unloaded camshaft slider -F- as far as the stop in the direction of the -arrow-.

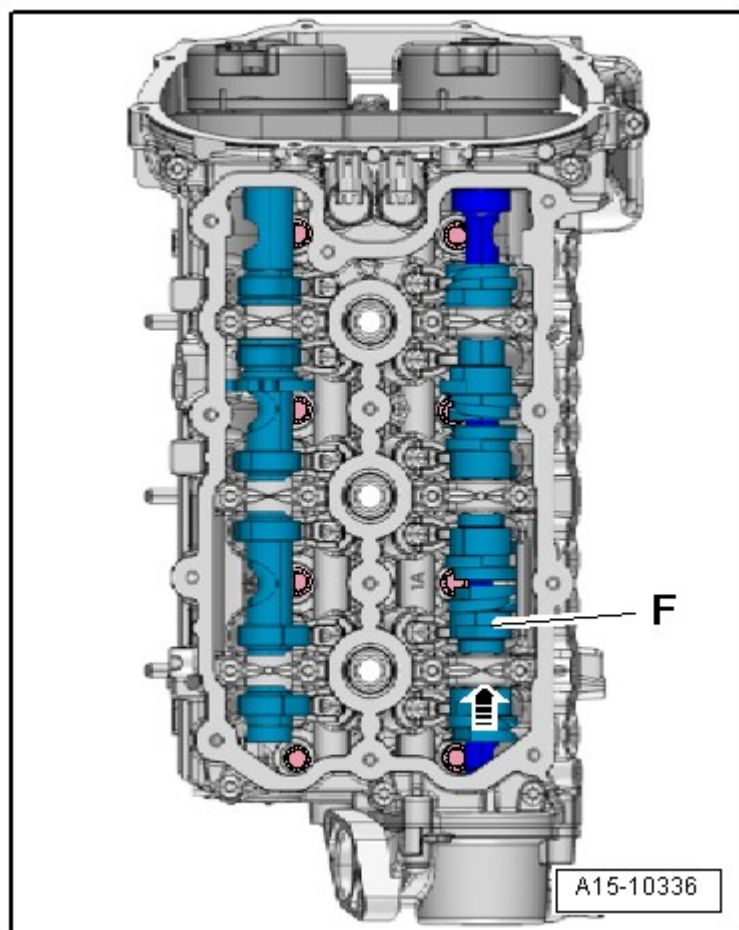


Fig. 111: Sliding Unloaded Camshaft Sliders (Right Cylinder Head)

Courtesy of AUDI OF AMERICA, LLC

Continuation for Both Cylinder Heads

-- Turn the crankshaft one full revolution (360°) in the direction of engine rotation -arrow- using the T40058.

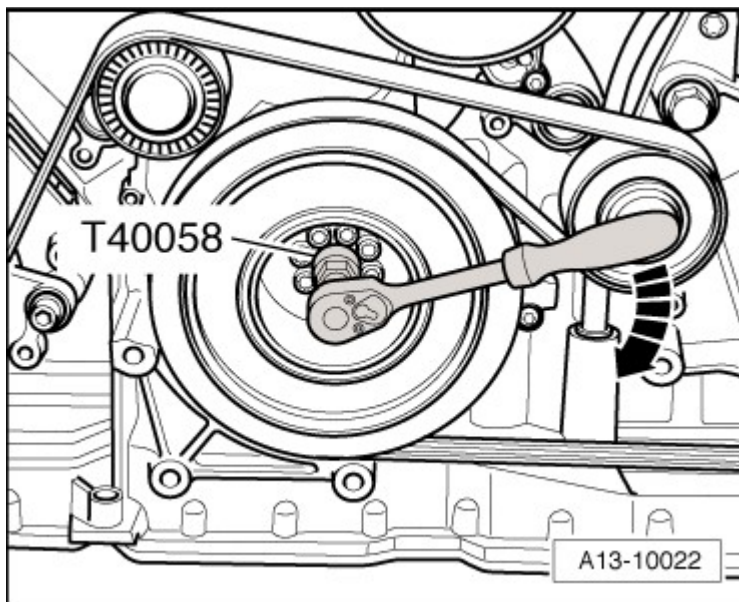


Fig. 112: Identifying TDC With Special Tool Adapter T40058
Courtesy of AUDI OF AMERICA, LLC

- The threaded holes -arrows- in the camshafts must face upward.

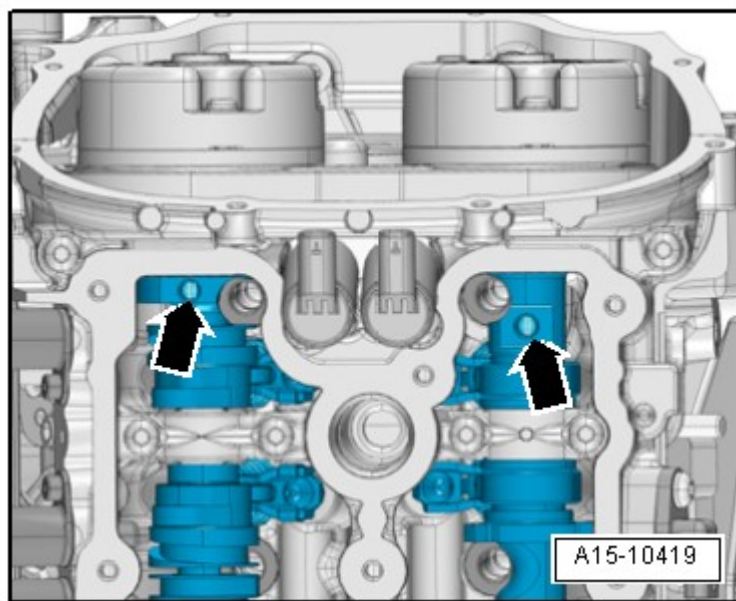


Fig. 113: Identifying Camshaft Threaded Hole Alignment
Courtesy of AUDI OF AMERICA, LLC

Left Cylinder Head

-- Remove the bolt -1-.

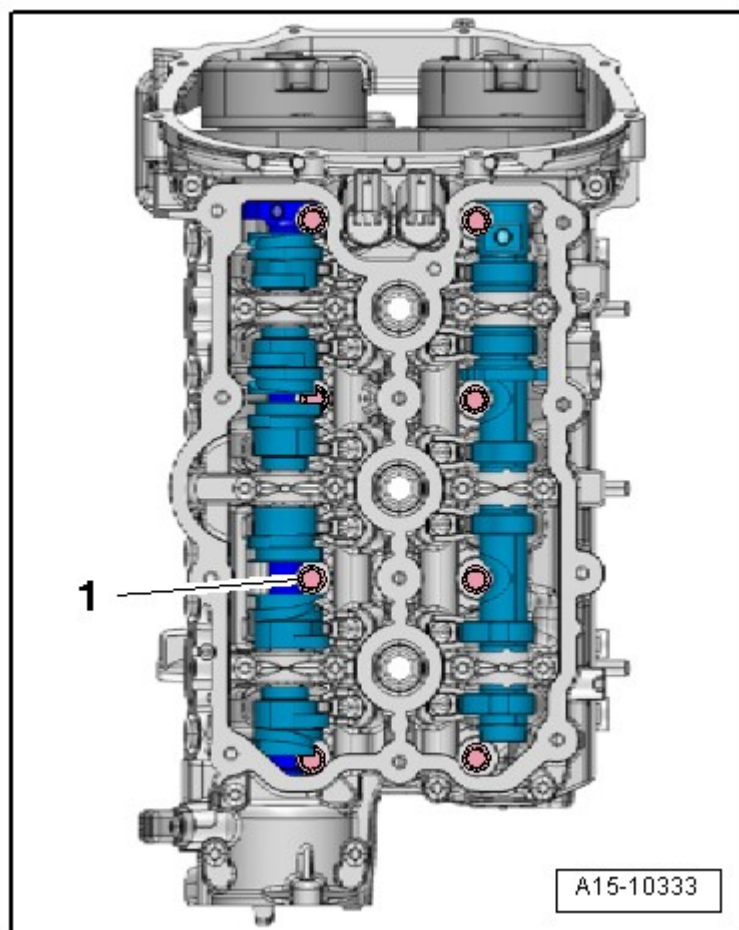


Fig. 114: Identifying Bolt (Left Cylinder Head)

Courtesy of AUDI OF AMERICA, LLC

Right Cylinder Head

-- Remove the bolt -2-.

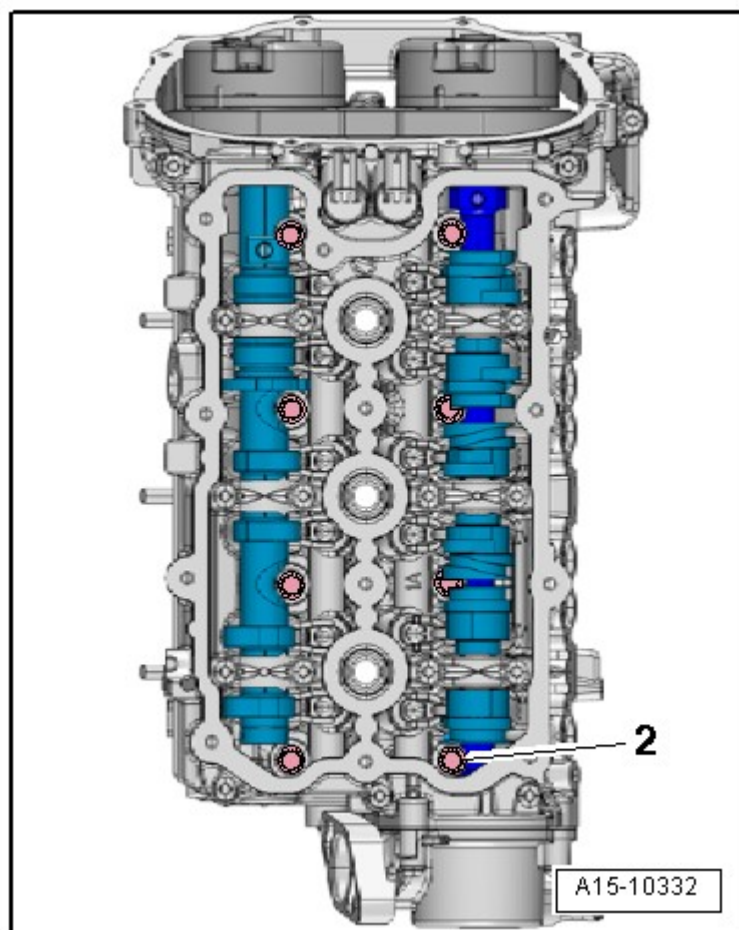


Fig. 115: Identifying Bolt (Right Cylinder Head)

Courtesy of AUDI OF AMERICA, LLC

Continuation for Both Cylinder Heads

-- Turn the crankshaft one full revolution (360°) in the direction of engine rotation -arrow- using the T40058.

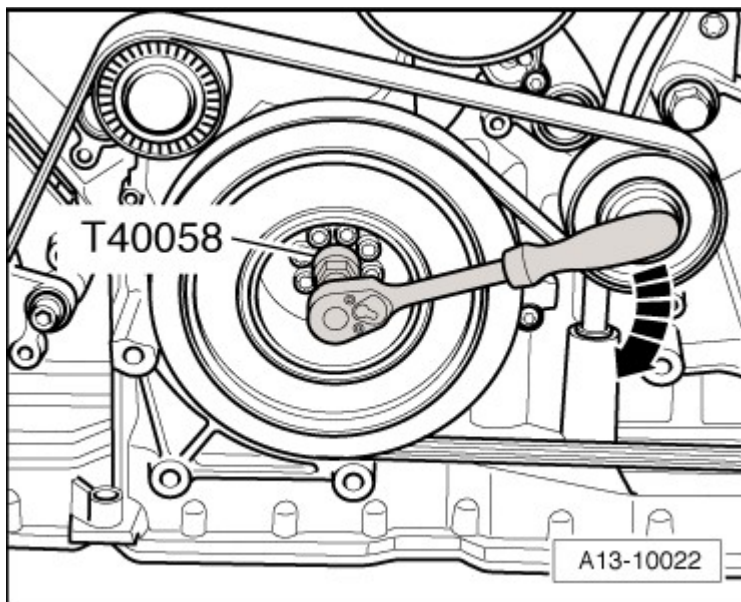


Fig. 116: Identifying TDC With Special Tool Adapter T40058
Courtesy of AUDI OF AMERICA, LLC

- The openings -arrows- on the exhaust camshafts must face toward the outer side of the engine.

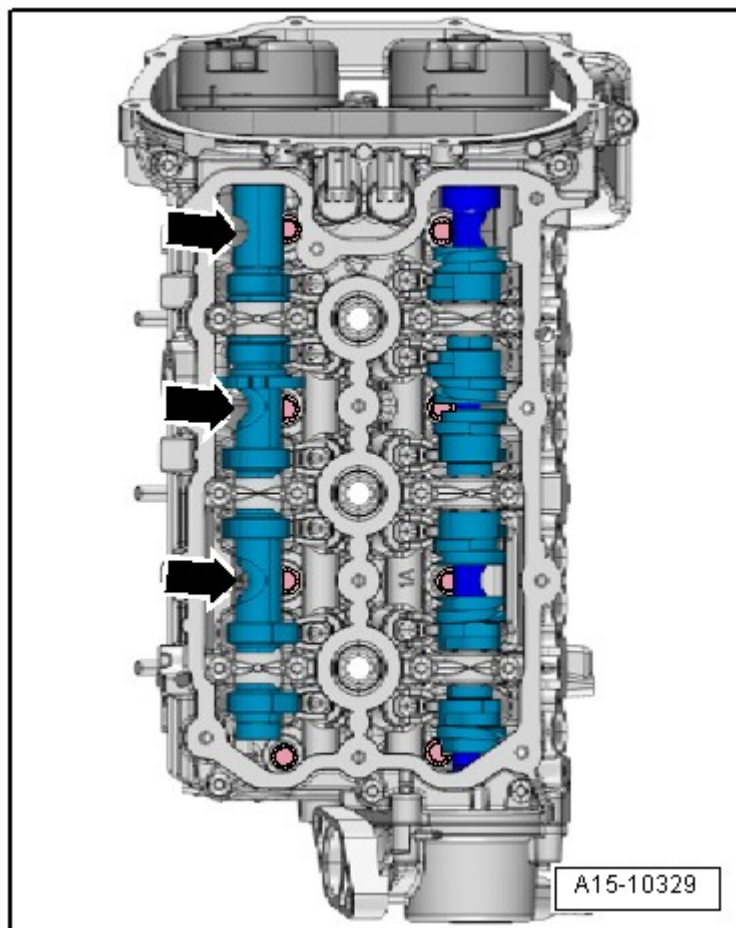


Fig. 117: Identifying Exhaust Camshaft Openings Alignment
Courtesy of AUDI OF AMERICA, LLC

Left Cylinder Head

-- Slide the unloaded camshaft sliders -B and C- as far as the stop in the direction of the -arrow-.

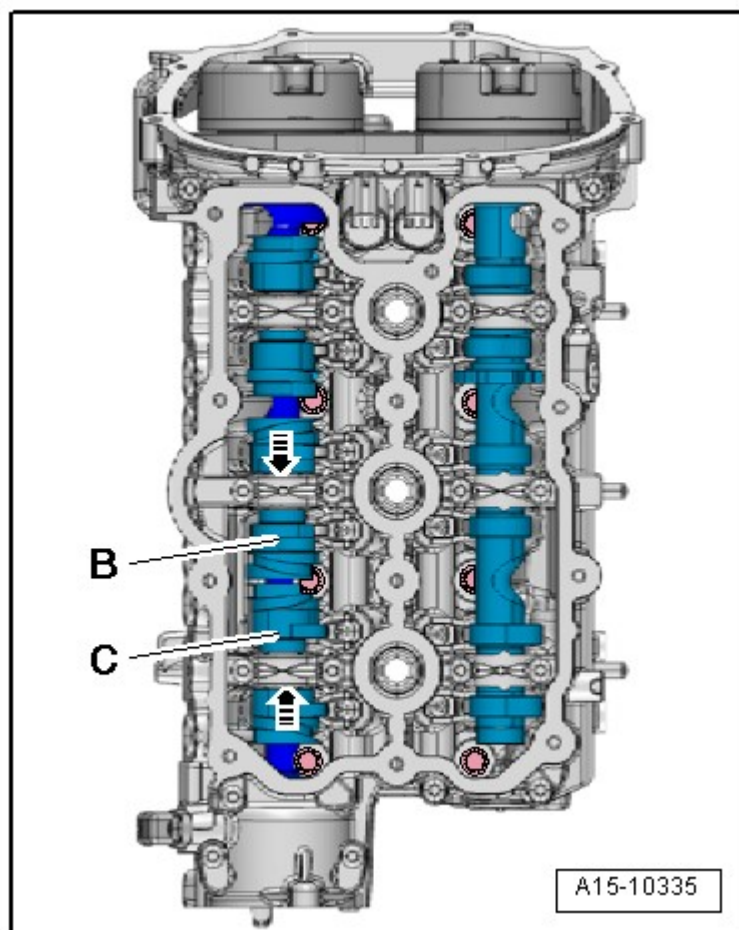


Fig. 118: Sliding Unloaded Camshaft Sliders (Left Cylinder Head)

Courtesy of AUDI OF AMERICA, LLC

Right Cylinder Head

-- Slide the unloaded camshaft slider -F- as far as the stop in the direction of the -arrow-.

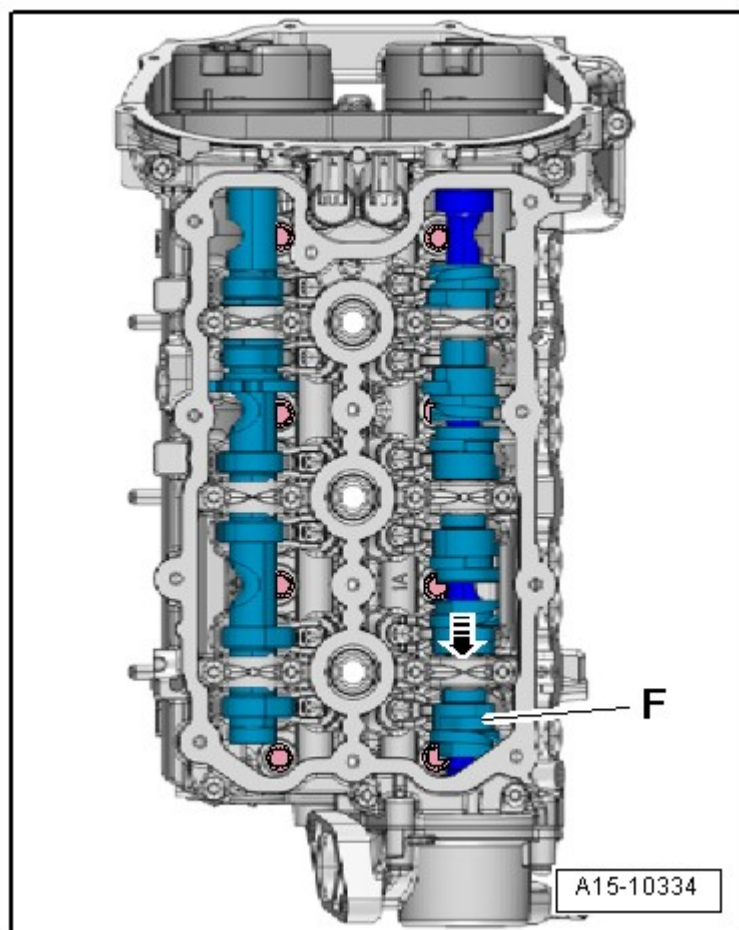


Fig. 119: Sliding Unloaded Camshaft Sliders (Right Cylinder Head)
Courtesy of AUDI OF AMERICA, LLC

Continuation for Both Cylinder Heads

-- Turn the crankshaft one full revolution (360°) in the direction of engine rotation -arrow- using the T40058.

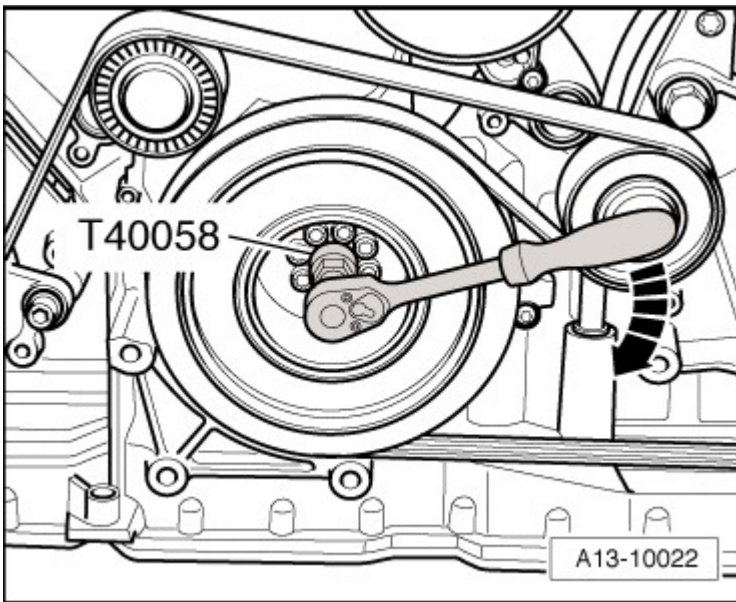


Fig. 120: Identifying TDC With Special Tool Adapter T40058
Courtesy of AUDI OF AMERICA, LLC

- The threaded holes -arrows- in the camshafts must face upward.

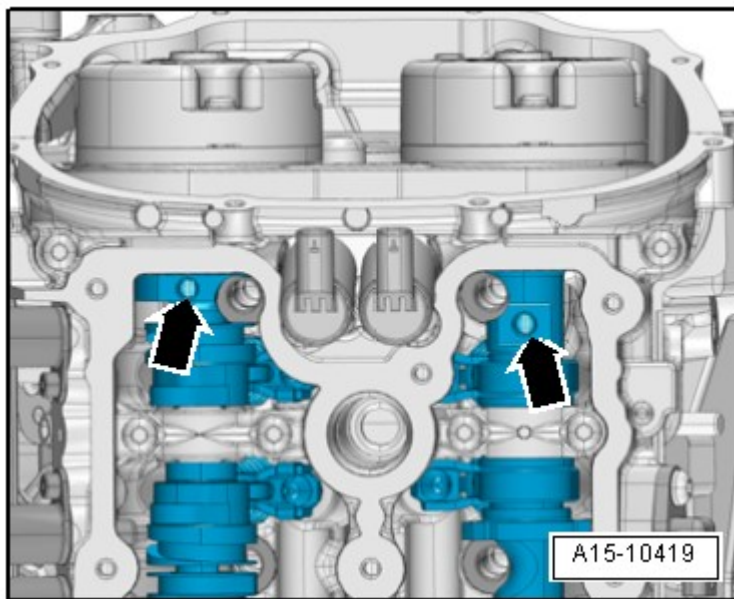


Fig. 121: Identifying Camshaft Threaded Hole Alignment
Courtesy of AUDI OF AMERICA, LLC

-- Remove the camshaft timing chains from the camshafts. Refer to **CAMSHAFT TIMING CHAINS, REMOVING FROM CAMSHAFTS.**

CAUTION: Risk of damaging valves and piston crowns.

- If the camshaft timing chain was also only removed on one cylinder head, the crankshaft must not be rotated any more.

Left Cylinder Head

-- Remove the bolts -3 through 9- while sliding the unloaded camshaft slider -A- accordingly.

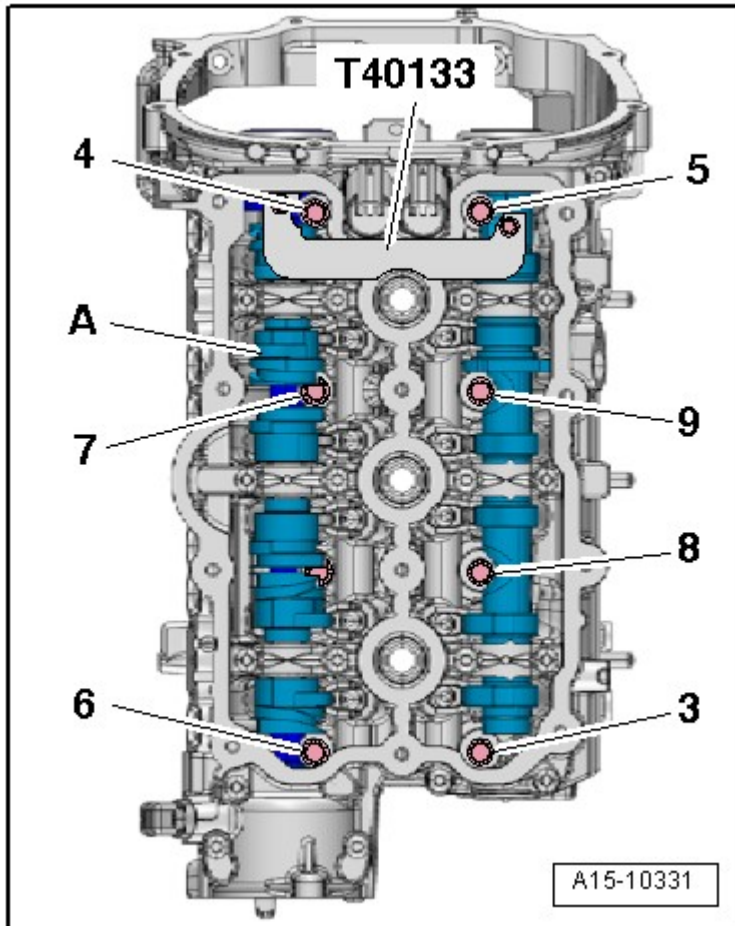


Fig. 122: Identifying Unloaded Camshaft Slider & Bolts (Left Cylinder Head)
Courtesy of AUDI OF AMERICA, LLC

-- Remove the cylinder head.

Right Cylinder Head

-- Remove the bolts -10 through 16- while sliding the unloaded camshaft sliders -D and E- accordingly.

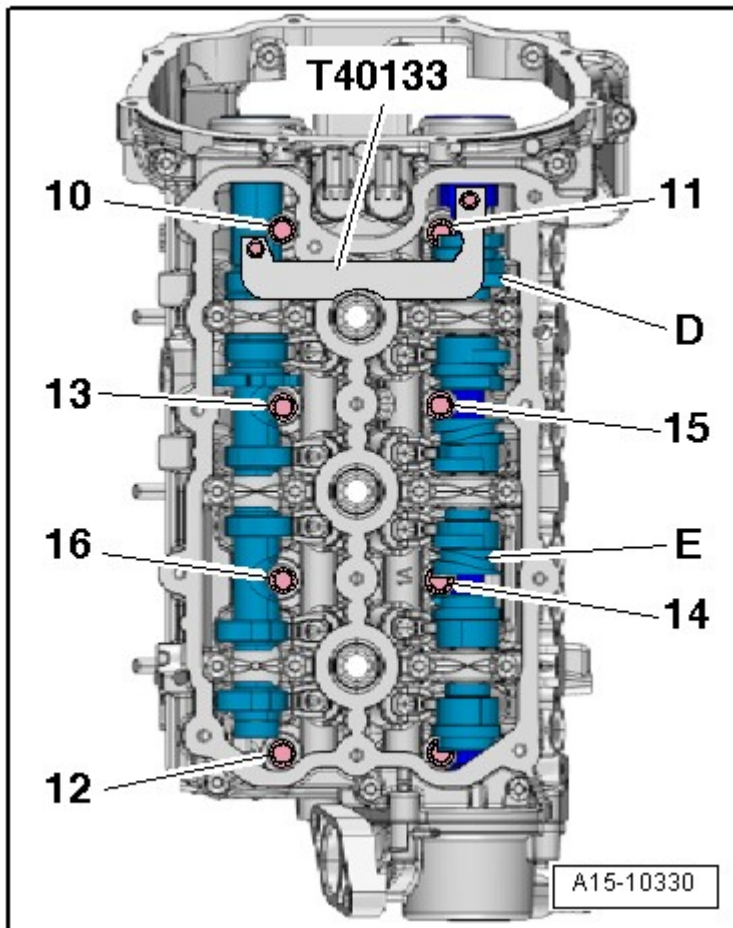


Fig. 123: Identifying Unloaded Camshaft Slider & Bolts (Right Cylinder Head)

Courtesy of AUDI OF AMERICA, LLC

-- Remove the cylinder head.

INSTALLING

- For the correct tightening specifications, refer to **CYLINDER HEAD OVERVIEW**.

CAUTION: The sealing surfaces could be damaged.

- 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 valve train.

- To ensure valves do not strike the pistons when starting, carefully rotate engine at least 2 full revolutions.

NOTE:

- Replace the bolts which are being tightened with an additional turn.
- Replace self-locking nuts, sealing rings, seals and O-rings.
- Note different sealant for cylinder head sealing surfaces and bolts.
- If a replacement cylinder is installed, the contact surfaces between the hydraulic adjusting elements, roller rocker levers and cam running surfaces must be lubricated before installing the cylinder head cover.
- Secure all hose connections with hose clamps of the same type as those equipped by the factory.
- The engine oil and coolant must be changed if the cylinder head or cylinder head seal are replaced.

-- Before installing the cylinder head, set the crankshaft and camshafts to "TDC" and install the T40133 on both cylinder heads and tighten to 25 Nm -arrows-.

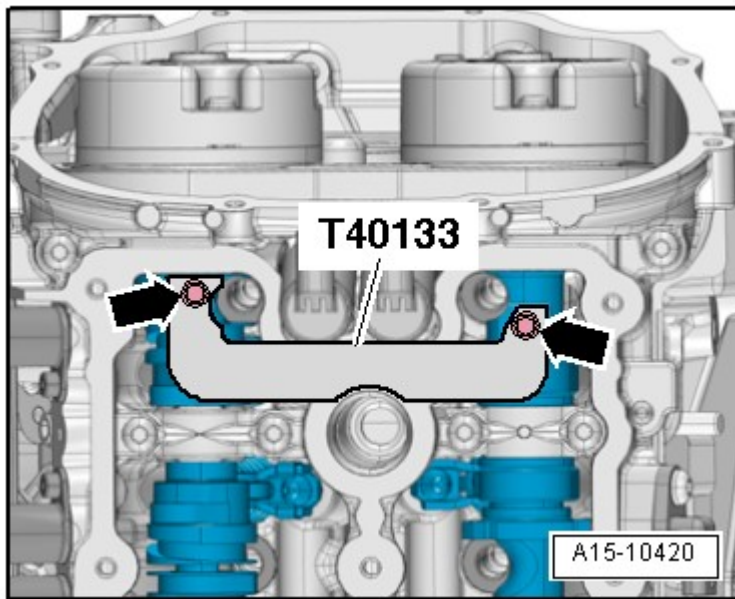


Fig. 124: Identifying Special Tool - T40133
Courtesy of AUDI OF AMERICA, LLC

- The T40133 is correctly positioned when the holes for the cylinder head bolts remain free.
- T40069 must be screwed into the crankshaft.

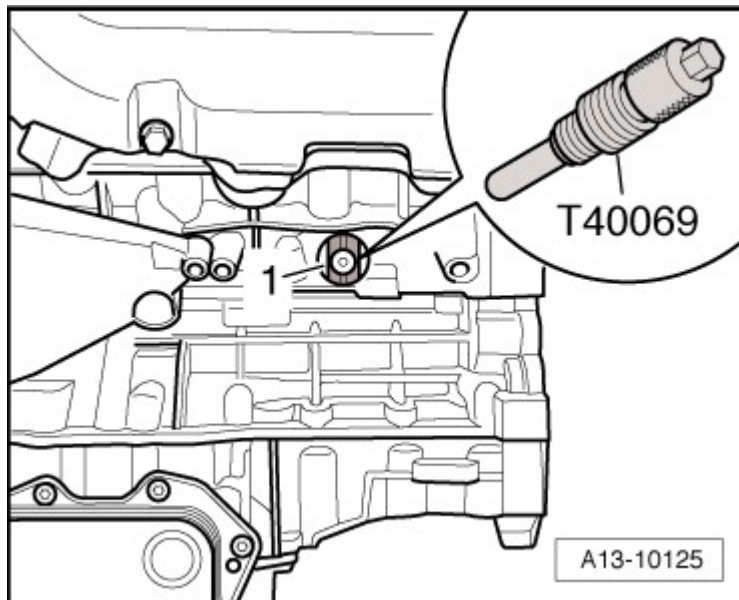


Fig. 125: Identifying Special Tool - Crankshaft Holder T40069
Courtesy of AUDI OF AMERICA, LLC

-- Set cylinder head gasket in place.

- Pay close attention to centering pins -arrows- in cylinder block.

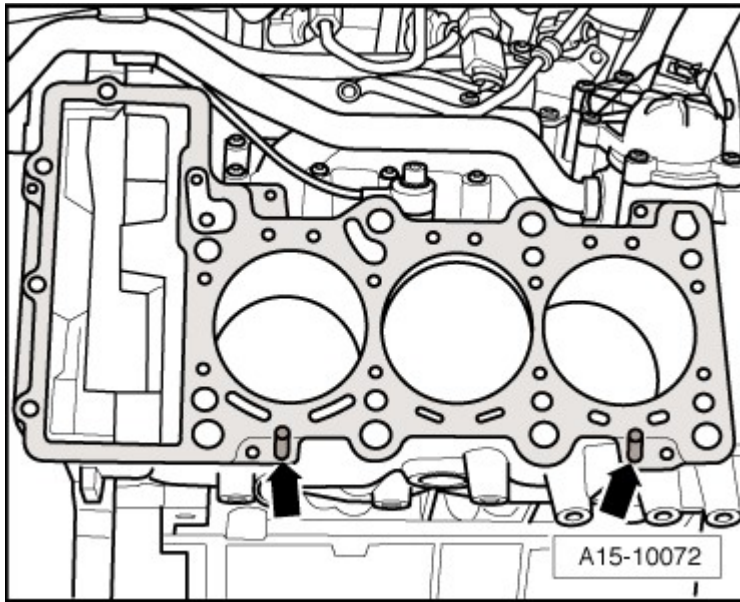


Fig. 126: Identifying Cylinder Block Centering Pins
Courtesy of AUDI OF AMERICA, LLC

- Cylinder head seal installation position: Identification "oben" (top) or the cylinder head part number.

-- Position the cylinder head.

Left Cylinder Head

-- Insert the bolts -1 through 7- while sliding the unloaded camshaft slider -A- accordingly.

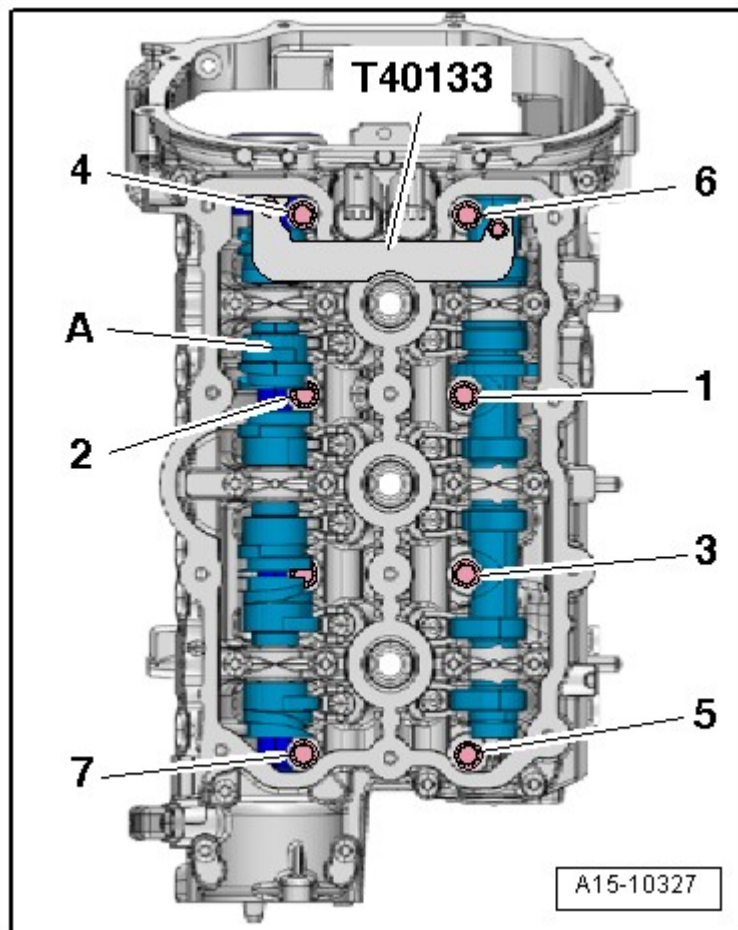


Fig. 127: Identifying Unloaded Camshaft Slider & Bolts (Left Cylinder Head)

Courtesy of AUDI OF AMERICA, LLC

-- Tighten the bolts in 3 steps following the sequence -1 to 7-. Refer to **CYLINDER HEAD OVERVIEW**.

Right Cylinder Head

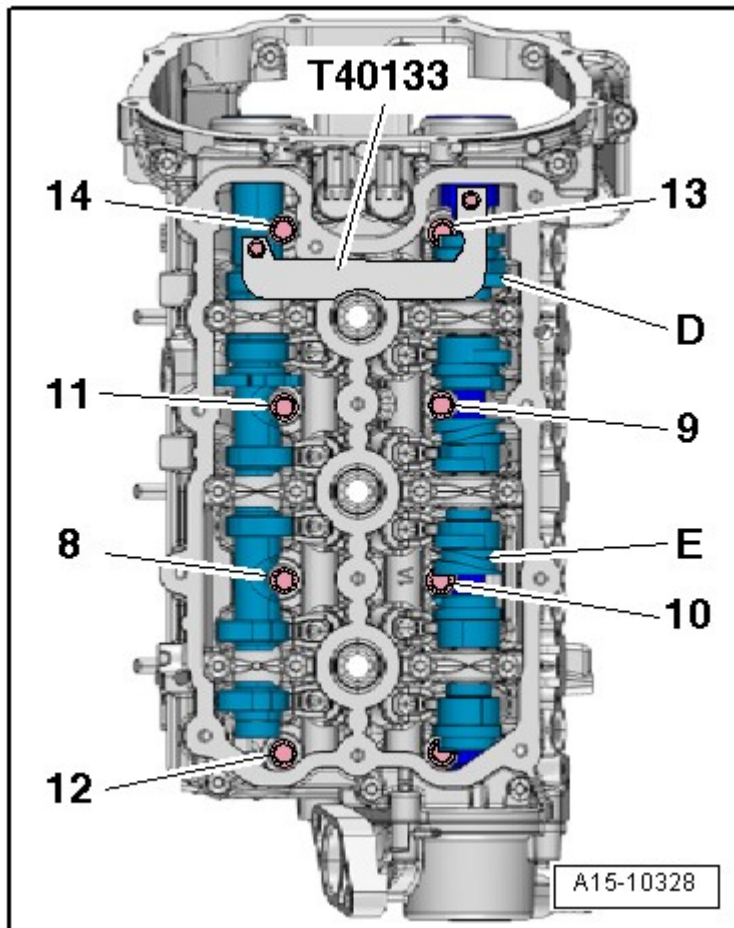


Fig. 128: Identifying Unloaded Camshaft Slider & Bolts (Right Cylinder Head)

Courtesy of AUDI OF AMERICA, LLC

-- Insert the bolts -8 through 14- while sliding the unloaded camshaft sliders -D and E- accordingly.

-- Tighten the bolts in 3 steps following the sequence -8 to 14-, refer to item 10.

Continuation for Both Cylinder Heads

-- Position the camshaft timing chain on the camshafts **CAMSHAFT TIMING CHAINS, REMOVING FROM CAMSHAFTS.**

-- Remove the T40133 and the T40069.

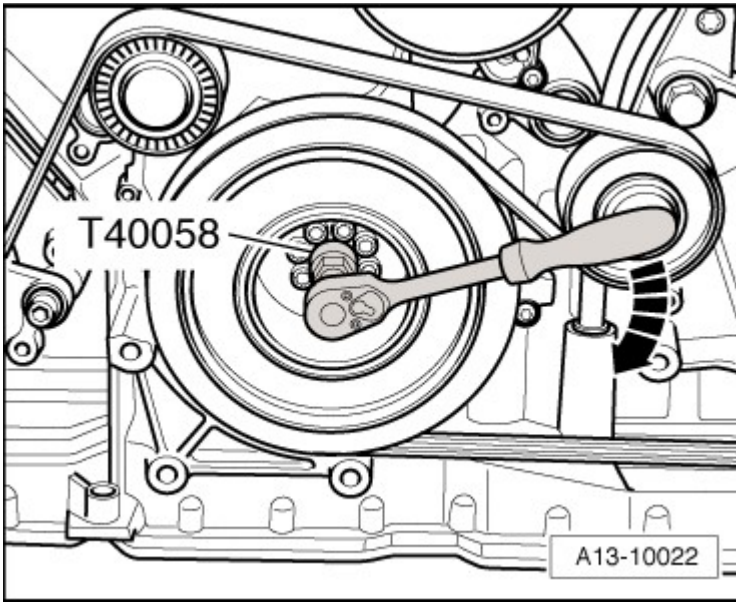


Fig. 129: Identifying TDC With Special Tool Adapter T40058
Courtesy of AUDI OF AMERICA, LLC

-- Turn the crankshaft one full revolution (360°) in the direction of engine rotation -arrow- using the T40058.

- The openings -arrows- on the exhaust camshafts must face toward the outer side of the engine.

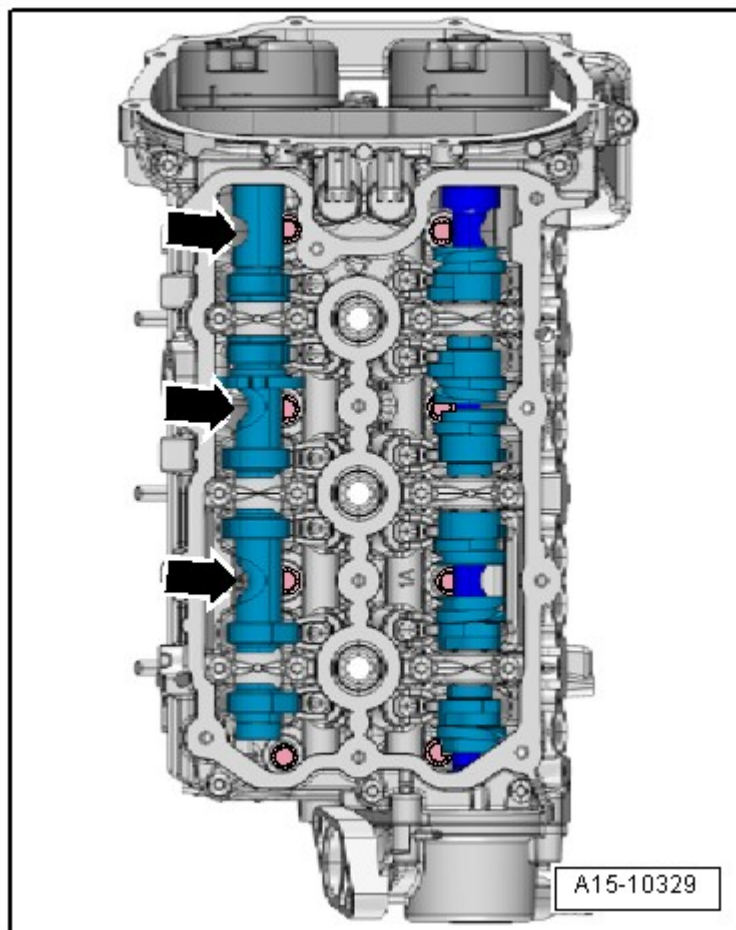


Fig. 130: Identifying Exhaust Camshaft Openings Alignment
Courtesy of AUDI OF AMERICA, LLC

Left Cylinder Head

-- Slide the unloaded camshaft sliders -B and C- as far as the stop in the direction of the -arrow-.

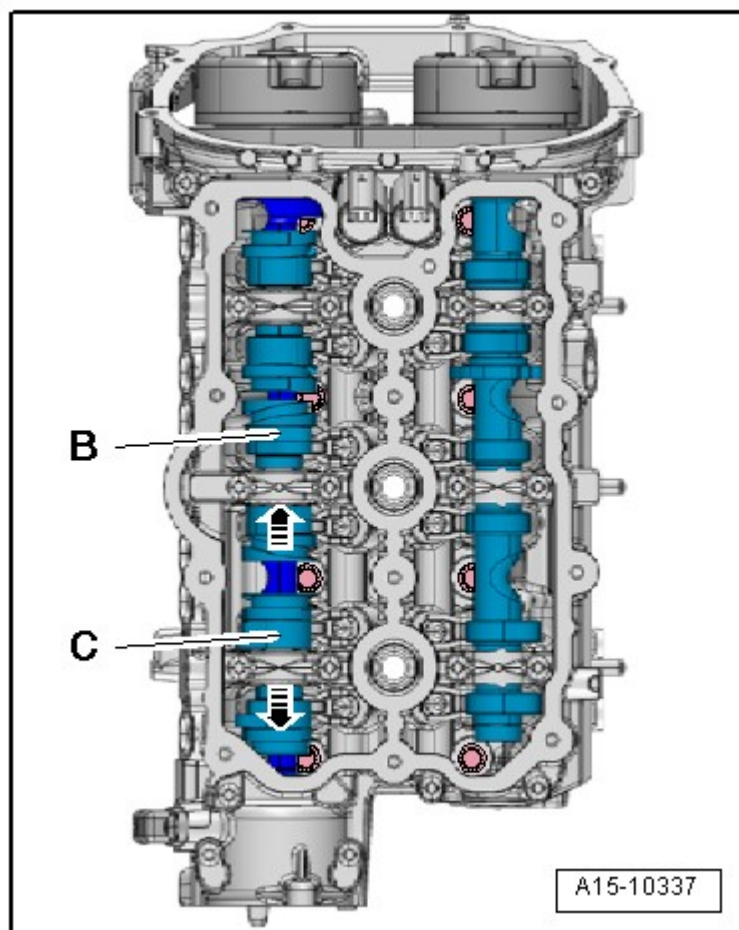


Fig. 131: Sliding Unloaded Camshaft Sliders (Left Cylinder Head)

Courtesy of AUDI OF AMERICA, LLC

Right Cylinder Head

-- Slide the unloaded camshaft slider -F- as far as the stop in the direction of the -arrow-.

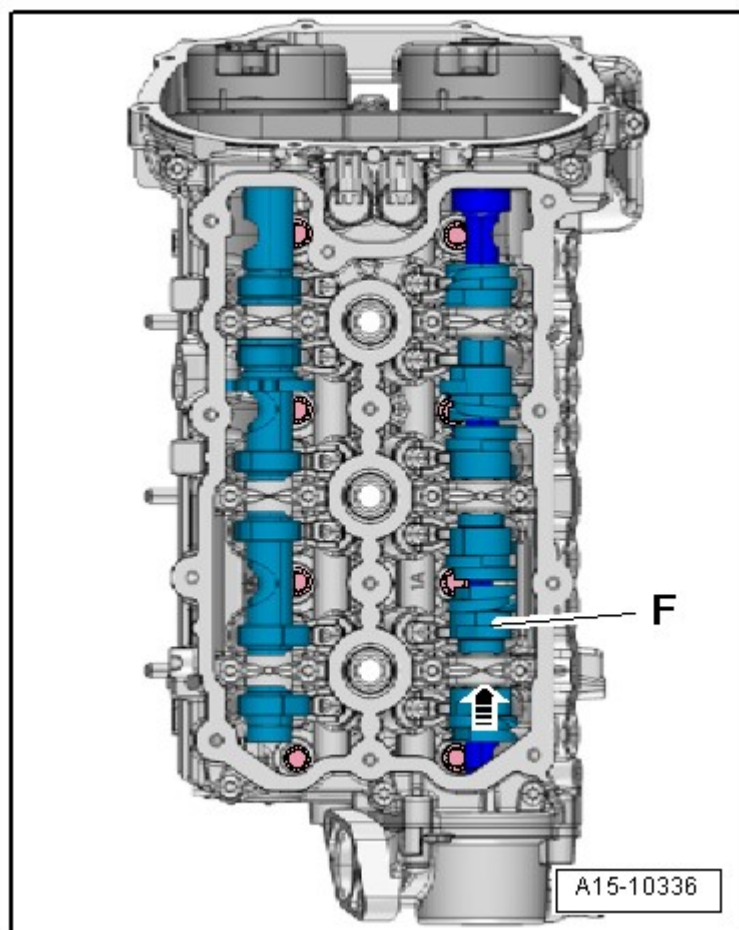


Fig. 132: Sliding Unloaded Camshaft Sliders (Right Cylinder Head)

Courtesy of AUDI OF AMERICA, LLC

Continuation for Both Cylinder Heads

-- Turn the crankshaft one full revolution (360°) in the direction of engine rotation -arrow- using the T40058.

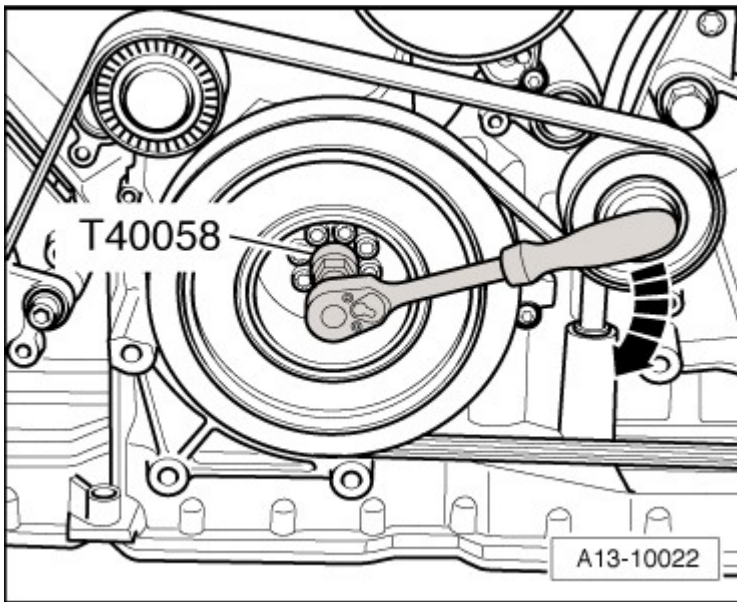


Fig. 133: Identifying TDC With Special Tool Adapter T40058
Courtesy of AUDI OF AMERICA, LLC

- The threaded holes -arrows- in the camshafts must face upward.

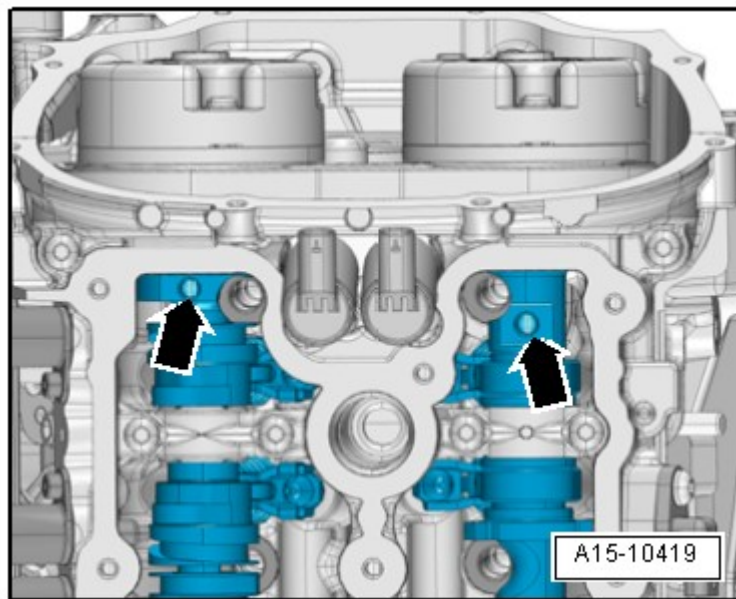


Fig. 134: Identifying Camshaft Threaded Hole Alignment
Courtesy of AUDI OF AMERICA, LLC

Left Cylinder Head

-- Insert the bolt -15- and tighten it in 3 steps **CYLINDER HEAD OVERVIEW.**

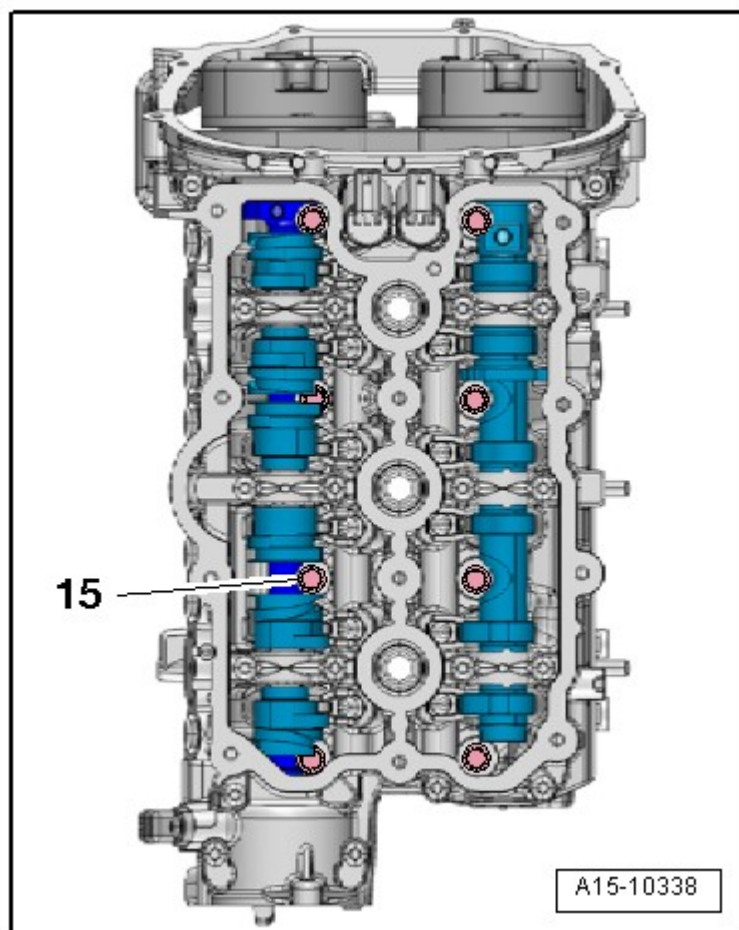


Fig. 135: Identifying Left Cylinder Head Bolt
Courtesy of AUDI OF AMERICA, LLC

Right Cylinder Head

-- Insert the bolt -16- and tighten it in 3 steps **CYLINDER HEAD OVERVIEW.**

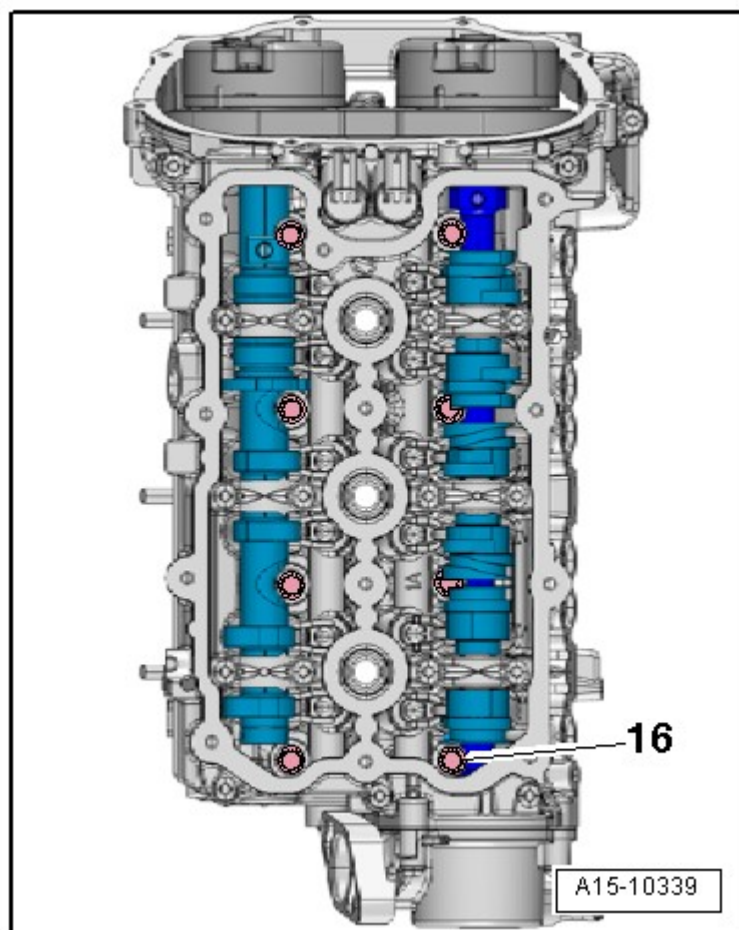


Fig. 136: Identifying Right Cylinder Head Bolt
Courtesy of AUDI OF AMERICA, LLC

Continuation for Both Cylinder Heads

-- Turn the crankshaft one full revolution (360°) in the direction of engine rotation -arrow- using the T40058.

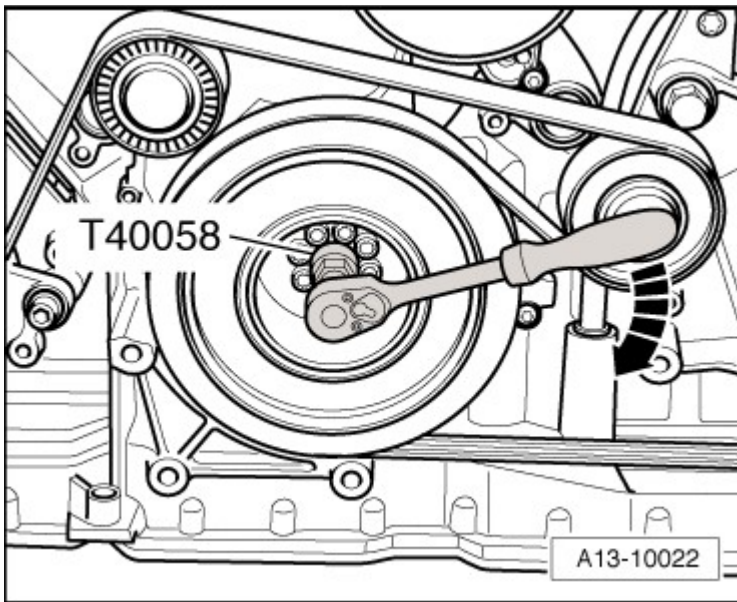


Fig. 137: Identifying TDC With Special Tool Adapter T40058
Courtesy of AUDI OF AMERICA, LLC

- The openings -arrows- on the exhaust camshafts must face toward the outer side of the engine.

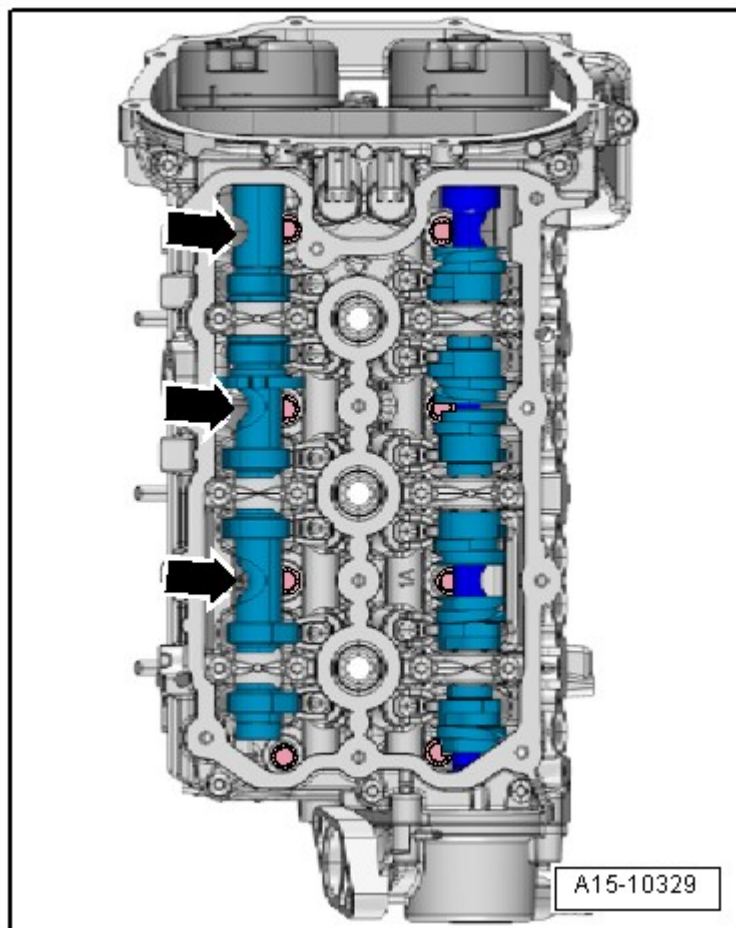


Fig. 138: Identifying Exhaust Camshaft Openings Alignment
Courtesy of AUDI OF AMERICA, LLC

Left Cylinder Head

-- Slide the unloaded camshaft slider -B- as far as the stop in the direction of the -arrow-.

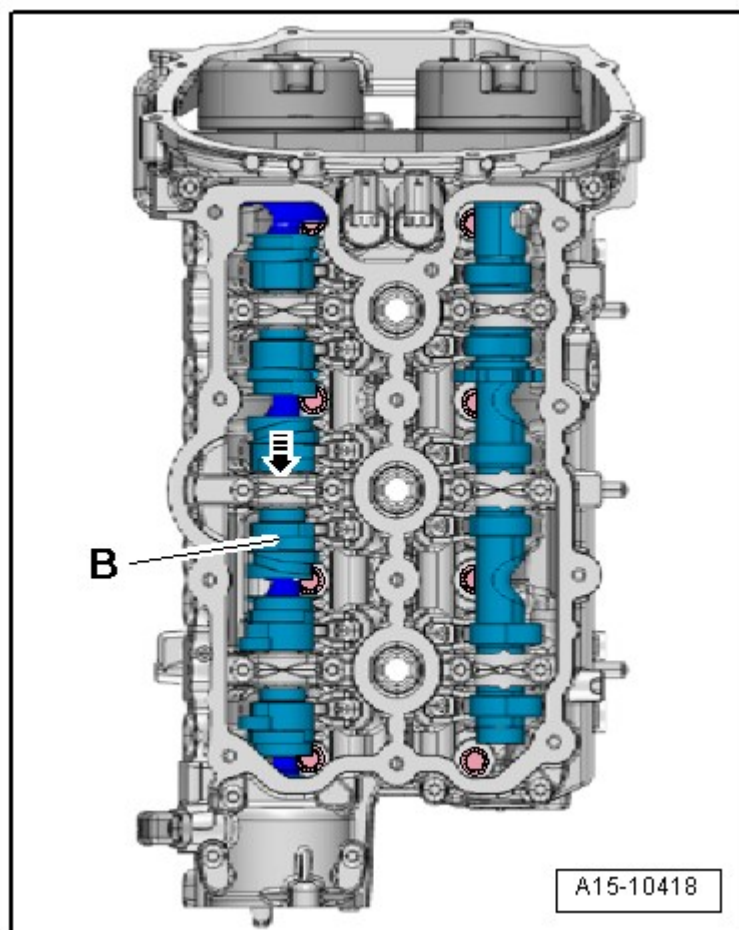


Fig. 139: Sliding Unloaded Camshaft Sliders (Left Cylinder Head)

Courtesy of AUDI OF AMERICA, LLC

Right Cylinder Head

-- Slide the unloaded camshaft slider -F- as far as the stop in the direction of the -arrow-.

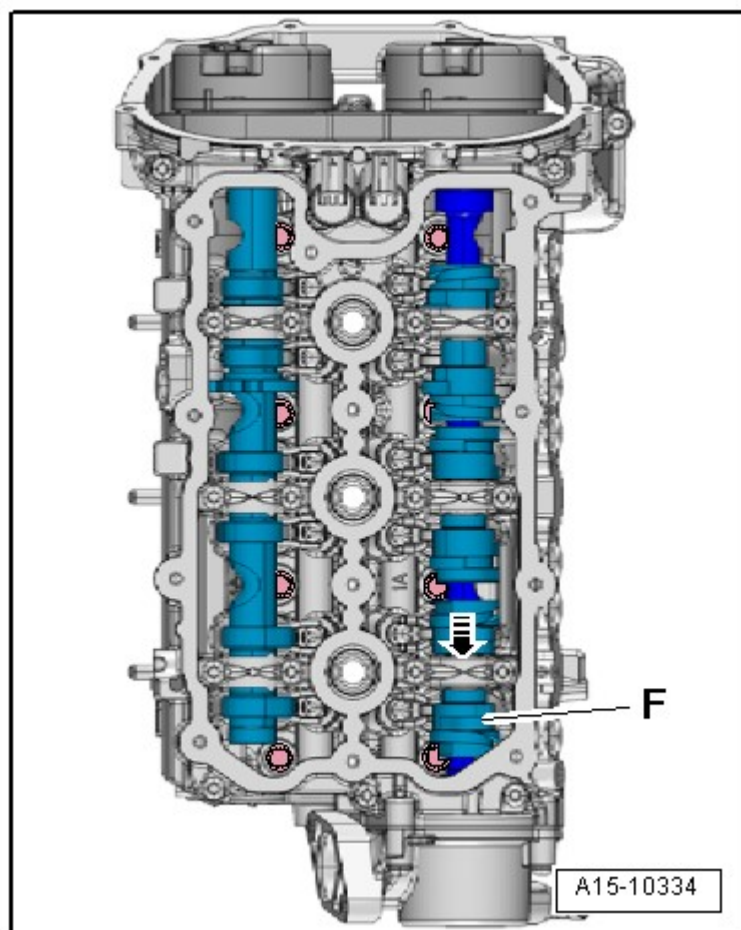


Fig. 140: Sliding Unloaded Camshaft Sliders (Right Cylinder Head)
Courtesy of AUDI OF AMERICA, LLC

Continuation for Both Cylinder Heads

-- Tighten the bolts -arrows-.

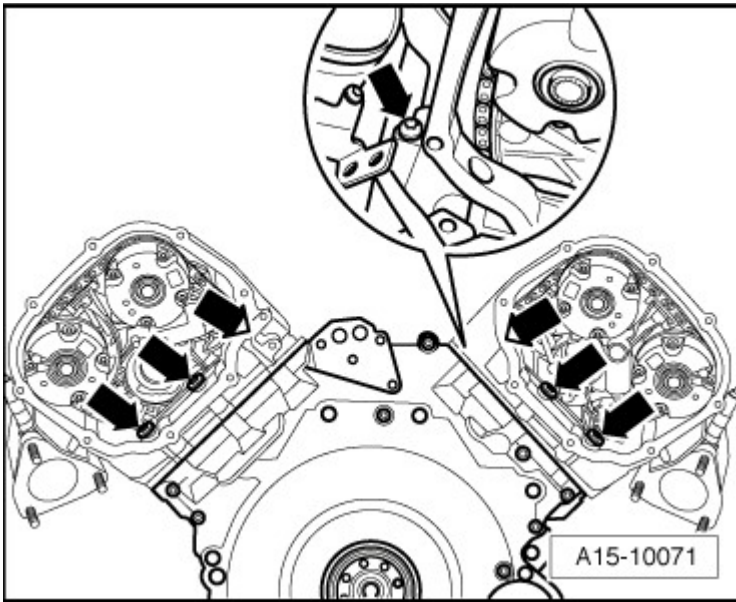


Fig. 141: Identifying Rear Cylinder Head Bolts
Courtesy of AUDI OF AMERICA, LLC

- Left cylinder head: 3 bolts.
- Right cylinder head: 4 bolts.

NOTE: Do not tighten the cylinder head bolts.

Install in reverse order of removal paying attention to the following:

- Install oil dipstick guide tube. Refer to **Fig. 9**.
- Position the camshaft timing chain on the camshafts **CAMSHAFT TIMING CHAINS, REMOVING FROM CAMSHAFTS Installing**.
- Install the cylinder head cover. Refer to **LEFT CYLINDER HEAD COVER, RIGHT CYLINDER HEAD COVER**.
- Install front coolant pipe. Refer to **FRONT COOLANT PIPE** .
- Install power steering pump. Refer to **REMOVAL AND INSTALLATION** .
- Install the front muffler. Refer to **FRONT MUFFLER** .
- Install the fuel supply line and the lower section of the intake manifold. Refer to **REMOVAL AND INSTALLATION** .
- Install the ribbed belt. Refer to **RIBBED BELT** .
- Install the upper coolant pipe. Refer to **UPPER COOLANT PIPE** .

-- Change engine oil.

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

LEFT CYLINDER HEAD COVER

Special tools and workshop equipment required

- Ignition Coil Puller T40039

Removing

-- Remove the engine covers -arrows-.

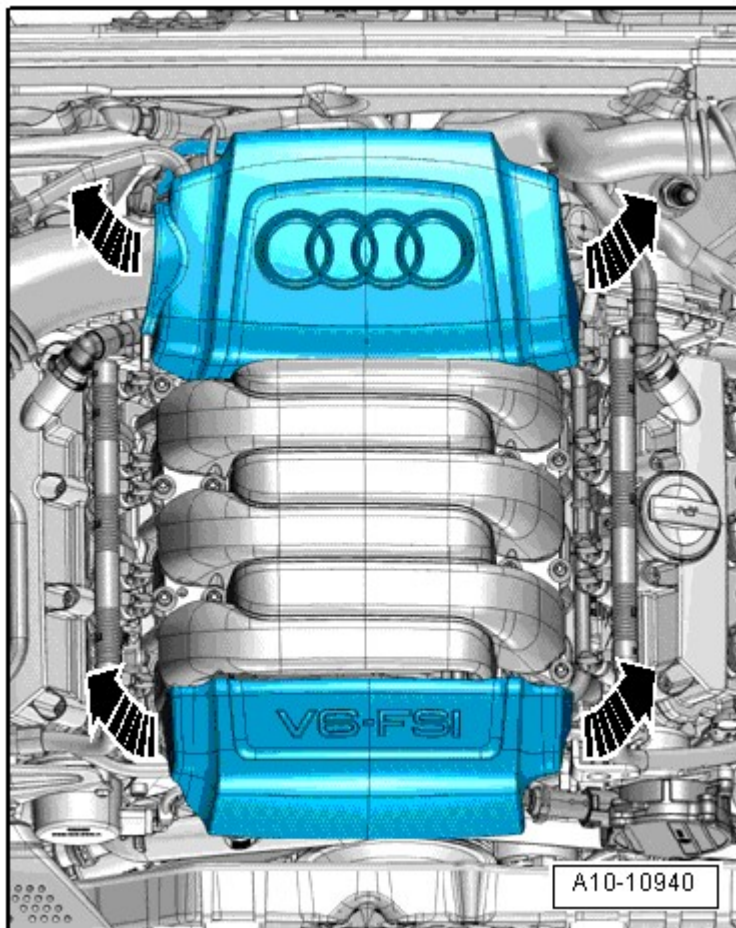


Fig. 142: Identifying Engine Cover
Courtesy of AUDI OF AMERICA, LLC

-- Remove the bolts -arrows-.

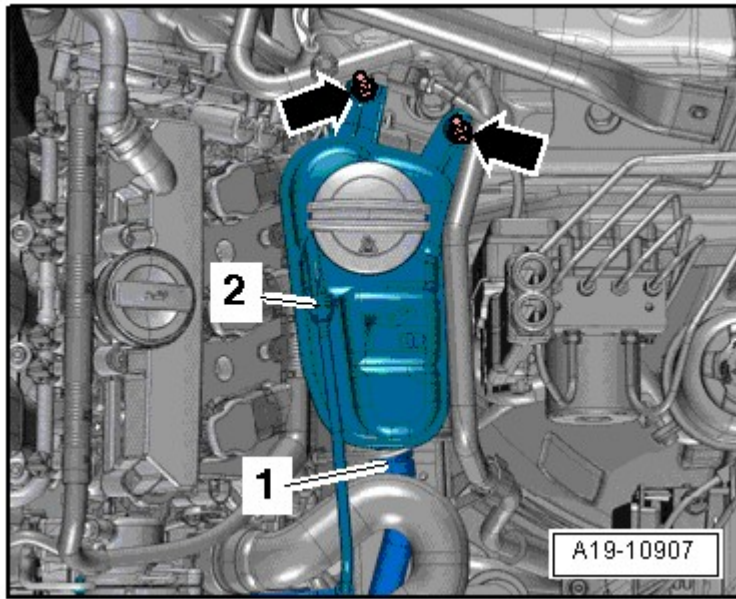


Fig. 143: Identifying Coolant Overflow Reservoir
Courtesy of AUDI OF AMERICA, LLC

-- Disconnect the electrical connector on the Engine Coolant Level (ECL) warning switch -F66- and lay the coolant reservoir aside with the coolant hoses -1 and 2- connected.

NOTE: Be careful not to bend the coolant hose -2-.

-- Remove the bolts -arrows- and disconnect the electrical connectors to the ignition coils on the left cylinder head.

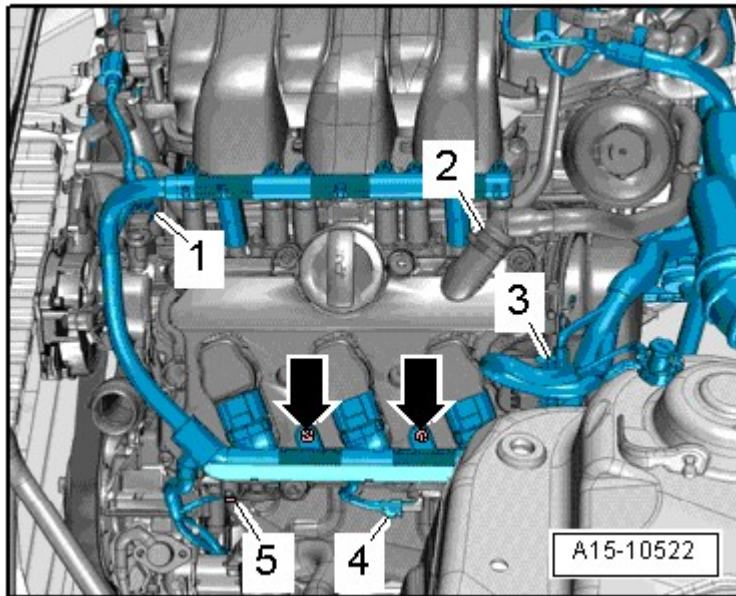


Fig. 144: Identifying Left Cylinder Head Bolts

Courtesy of AUDI OF AMERICA, LLC

-- Disconnect the electrical connector -1- on the Camshaft Position (CMP) sensor 2 -G163- and -4- on the CMP sensor 4 -G301-.

-- Press the connector release catches and disconnect the connector -3- on the camshaft adjustment valve 2 -N208- and exhaust camshaft adjustment valve 2 -N319-.

-- Remove the ground wire bolt -5-.

-- Move the electrical wiring harness to the side.

NOTE: Ignore -2-.

-- Remove the ignition coils with the T40039.

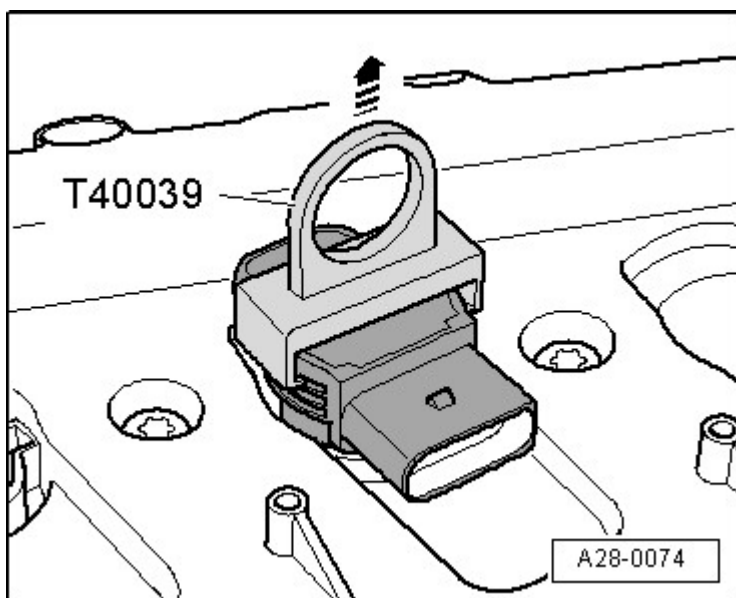


Fig. 145: Removing Ignition Coils With Special Tool Ignition Coil Puller T40039

Courtesy of AUDI OF AMERICA, LLC

CAUTION: Risk of violating emissions legislation.

- **Do not open the hose connection -arrow-.**

-- Remove the bolts in the following sequence -12 to 1- and lay the left cylinder head aside with the crankcase ventilation hose -arrow- connected.

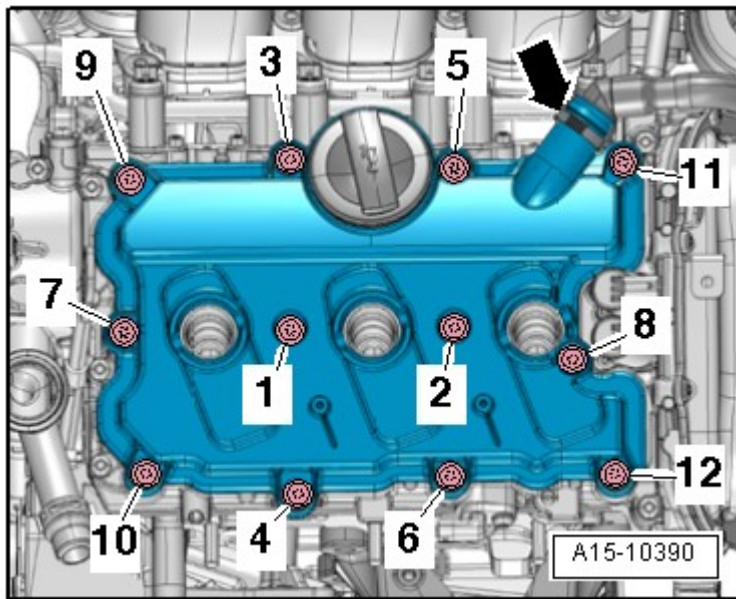


Fig. 146: Identifying Left Cylinder Head Cover Bolt, Tightening Sequence
 Courtesy of AUDI OF AMERICA, LLC

Installing

Install in reverse order, paying attention to the following:

NOTE:

- Replace the O-ring.
- Replace the cylinder head seal if it is damaged.
- Replace the cylinder head cover bolts when replacing the damaged seal.

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

-- Tighten the left cylinder head cover bolts. Refer to **Fig. 5**.

LEFT AND RIGHT TIMING CHAIN COVERS

Special tools and workshop equipment required

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

REMOVING

NOTE: When installing, bring all the cable ties back to the same positions.

-- Remove the rear engine cover -top arrows-.

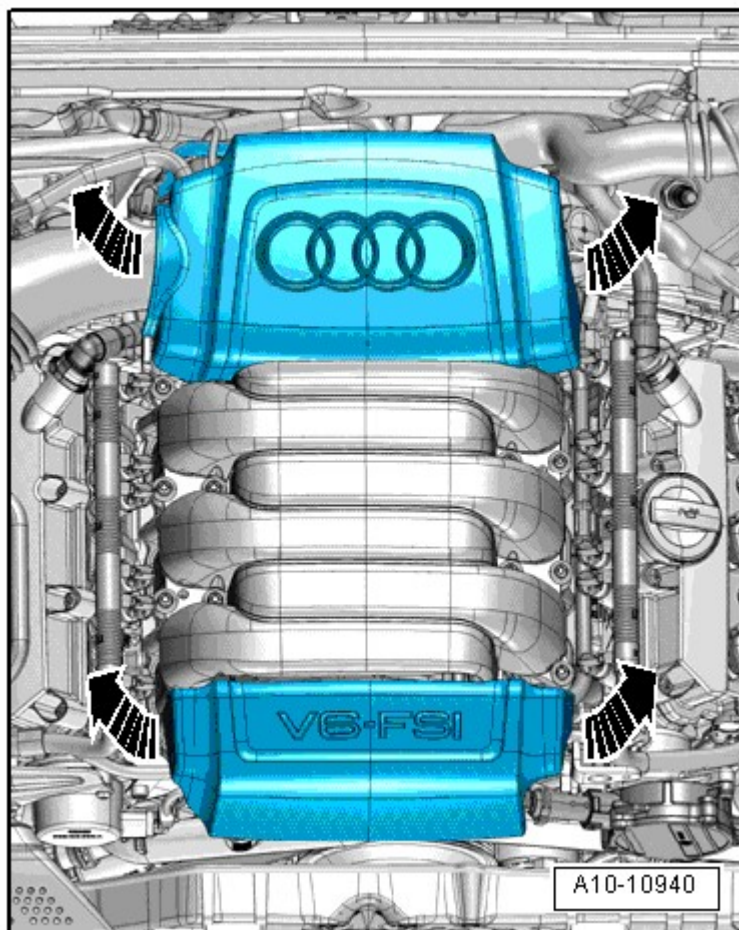


Fig. 147: Identifying Engine Cover

Courtesy of AUDI OF AMERICA, LLC

-- Remove the affected secondary air injection combination valve. Refer to **LEFT SECONDARY AIR COMBINATION VALVE** , **RIGHT SECONDARY AIR COMBINATION VALVE** .

Left Timing Chain Cover

-- Remove the electrical connectors -1 through 4- from the bracket and press to the side.

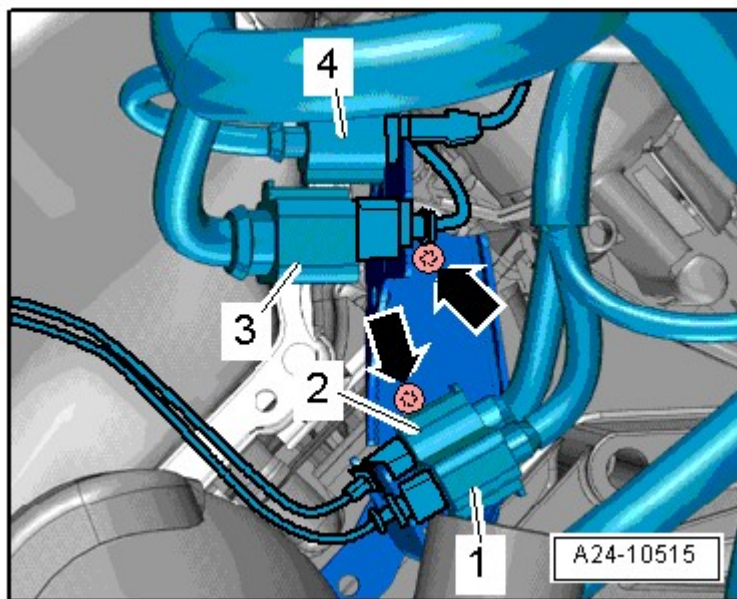


Fig. 148: Identifying Left Cylinder Head Electrical Connectors
Courtesy of AUDI OF AMERICA, LLC

NOTE: Ignore -arrows-.

-- Free up electrical wires.

-- Remove the bolts -1 through 8- and remove the left timing chain cover.

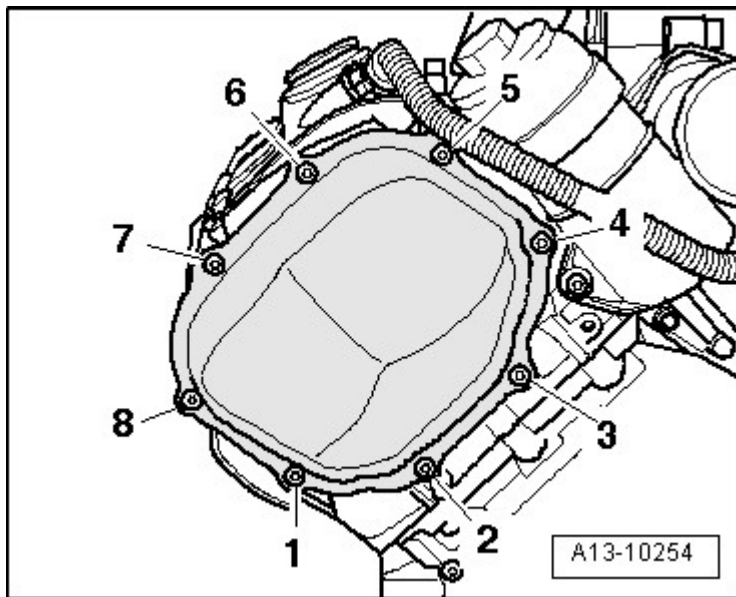


Fig. 149: Identifying Sequence Of Left Timing Chain Cover Bolts
Courtesy of AUDI OF AMERICA, LLC

Right Timing Chain Cover

-- Remove the electrical connectors -1 through 4- from the bracket and press to the side.

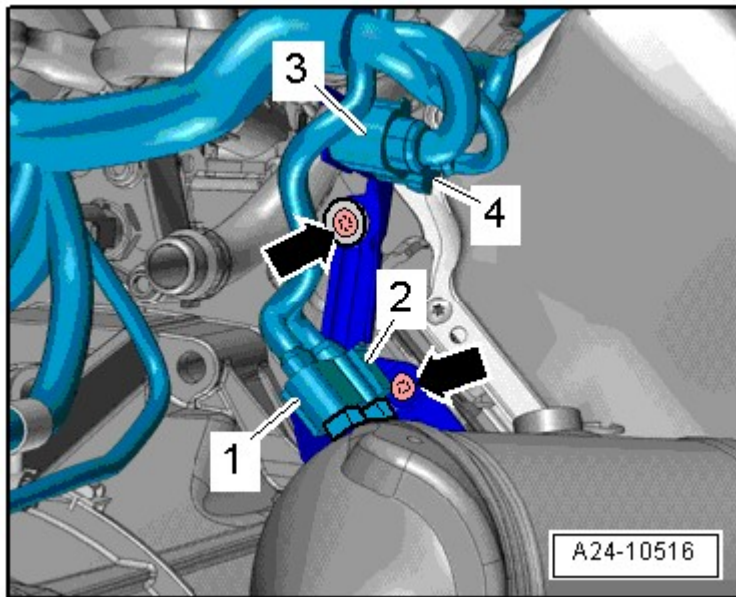


Fig. 150: Identifying Right Cylinder Head Electrical Connectors

Courtesy of AUDI OF AMERICA, LLC

NOTE: Ignore -arrows-.

-- Remove the bolts -1 through 8- and remove the right timing chain cover.

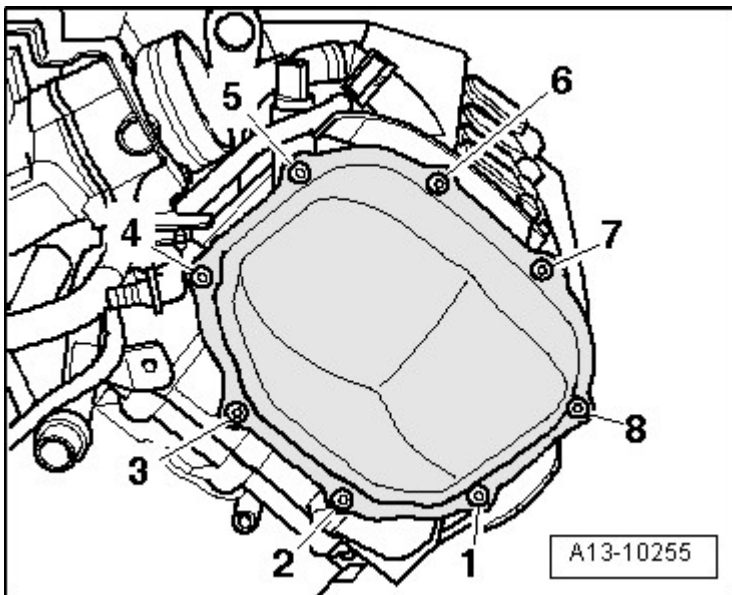


Fig. 151: Identifying Sequence Of Right Timing Chain Cover Bolts

Courtesy of AUDI OF AMERICA, LLC

INSTALLING

CAUTION: Risk of contaminating lubricating system.

- Cover open parts of the engine.

WARNING: Danger of eye injury.

- Wear protective goggles.

-- Remove the sealant residue on the covers for the timing chain, cylinder block and cylinder head, for example using a rotating plastic brush.

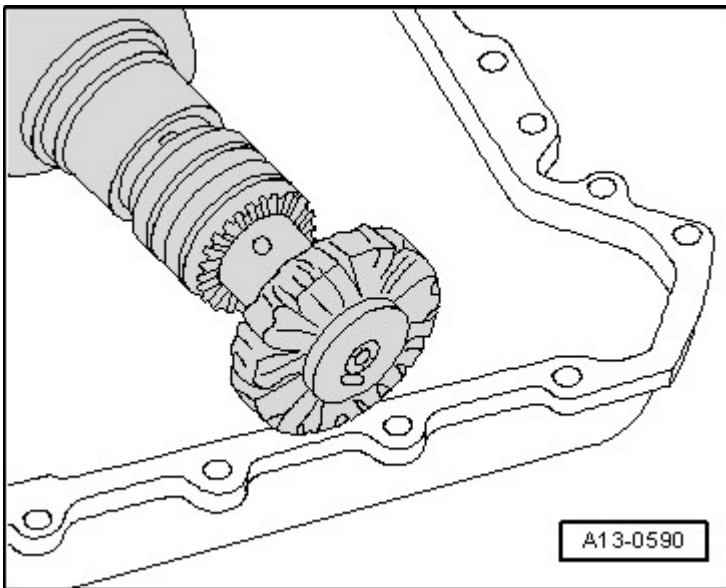


Fig. 152: Identifying Rotating Plastic Brush
Courtesy of AUDI OF AMERICA, LLC

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

NOTE: **Note the expiration date of the sealing compound.**

-- Cut the tube nozzle at the front marking (nozzle diameter approximately 2 mm).

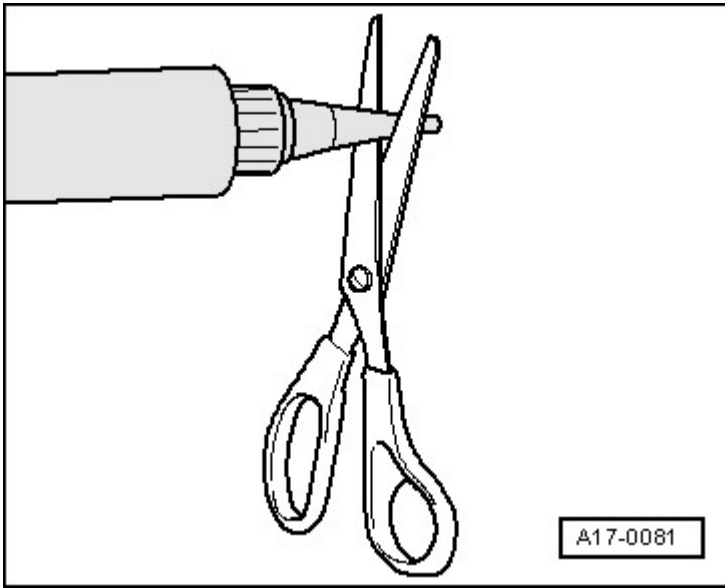


Fig. 153: Cutting Tube Nozzle

Courtesy of AUDI OF AMERICA, LLC

CAUTION: The lubrication system could be plugged with excess sealant.

- Do not apply sealant bead thicker than indicated.

-- Apply the sealant bead -arrow- to the clean sealing surfaces on the left timing chain cover as shown in the illustration.

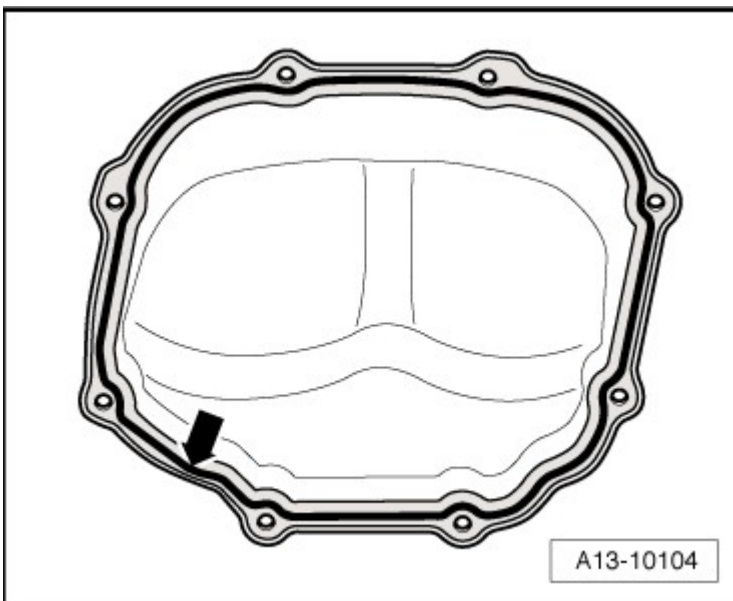


Fig. 154: Identifying Sealant Bead (Timing Chain Left Cover)

Courtesy of AUDI OF AMERICA, LLC

- Thickness of sealant bead: 2.5 mm.

NOTE: Covers for the timing chain must be installed within 5 minutes after applying the sealant.

-- Position the left timing chain cover and tighten the bolts. Refer to **Fig. 12**.

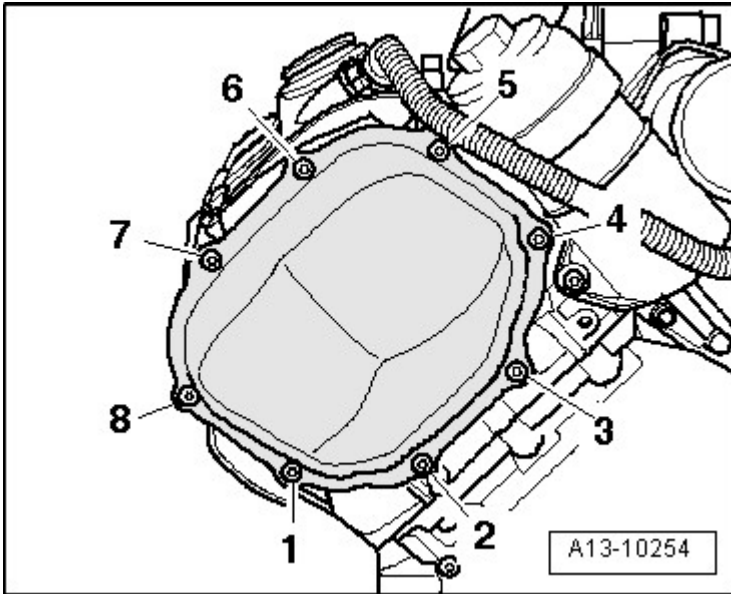


Fig. 155: Identifying Sequence Of Left Timing Chain Cover Bolts
Courtesy of AUDI OF AMERICA, LLC

-- Apply the sealant bead -arrow- to the clean sealing surfaces on the right timing chain cover as shown in the illustration.

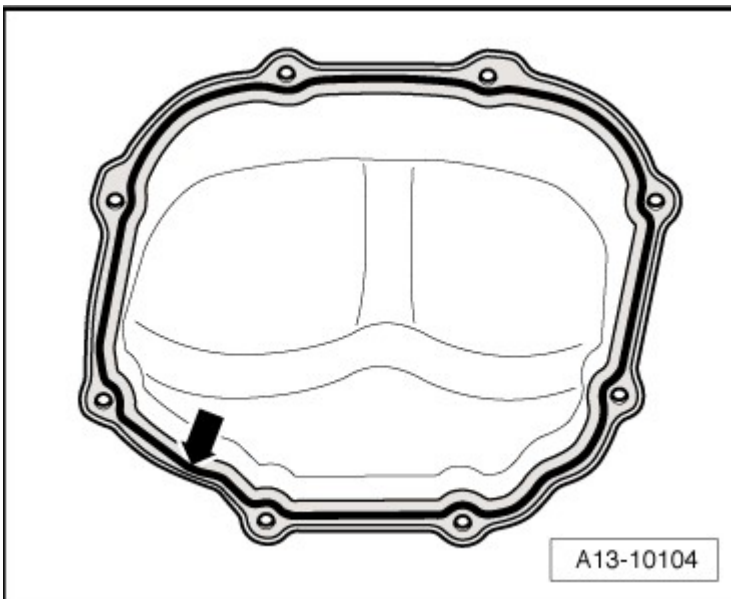


Fig. 156: Identifying Sealant Bead (Timing Chain Left Cover)
Courtesy of AUDI OF AMERICA, LLC

- Thickness of sealant bead: 2.5 mm.

-- Position the right timing chain cover and tighten the bolts. Refer to **Fig. 13**.

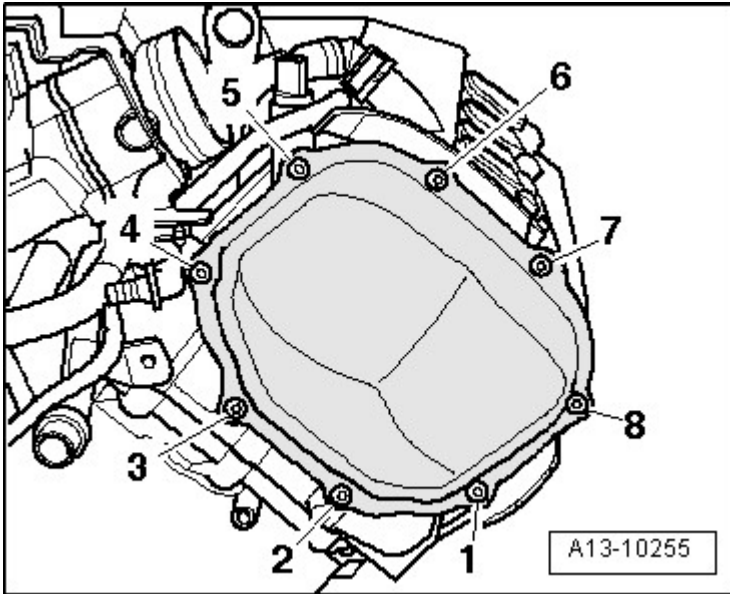


Fig. 157: Identifying Sequence Of Right Timing Chain Cover Bolts
Courtesy of AUDI OF AMERICA, LLC

Install in reverse order of removal paying attention to the following:

NOTE: **Secure all the hose connections with the hose clamps of the same type as those equipped by the factory.**

-- Install the secondary air injection combination valve. Refer to **LEFT SECONDARY AIR COMBINATION VALVE** , **RIGHT SECONDARY AIR COMBINATION VALVE** .

LOWER TIMING CHAIN COVER

Special tools and workshop equipment required

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

Removing

- Transmission removed.

NOTE: **When installing, bring all cable ties back to same positions.**

CAUTION: Risk of destroying electrical components.

- **Observe measures for disconnecting battery.**

- Disconnect the battery. Refer to **REMOVAL AND INSTALLATION** .
- Remove the drive plate. Refer to **DRIVE PLATE** .
- Remove the left and right timing chain covers. Refer to **LEFT AND RIGHT TIMING CHAIN COVERS**.
- Remove the oil filter housing. Refer to **OIL FILTER HOUSING** .
- Remove generator. Refer to **REMOVAL AND INSTALLATION** .
- Remove the left and right bolts -arrows- and the electrical connector bracket.

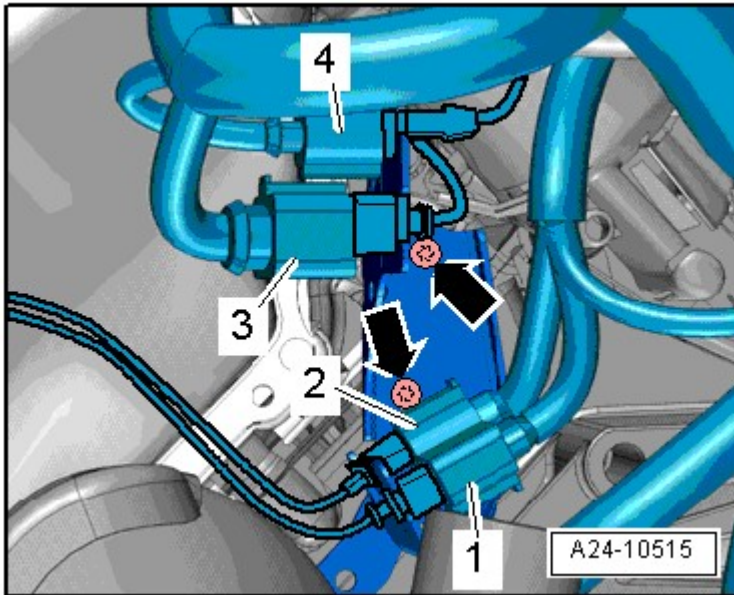


Fig. 158: Identifying Left Cylinder Head Electrical Connectors
Courtesy of AUDI OF AMERICA, LLC

NOTE: Ignore -1 to 4-.

- Disconnect the starter electrical connector -3- by sliding the retainer back and pressing the release down.

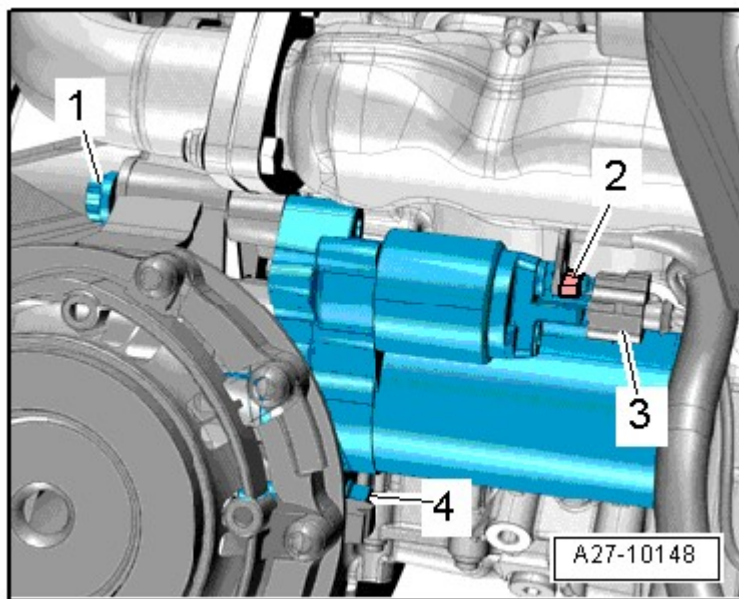


Fig. 159: Identifying Starter Components
Courtesy of AUDI OF AMERICA, LLC

-- Remove the electrical wire nut -2- and starter.

NOTE: Ignore -1 and 4-.

-- Remove the bolts -arrows-.

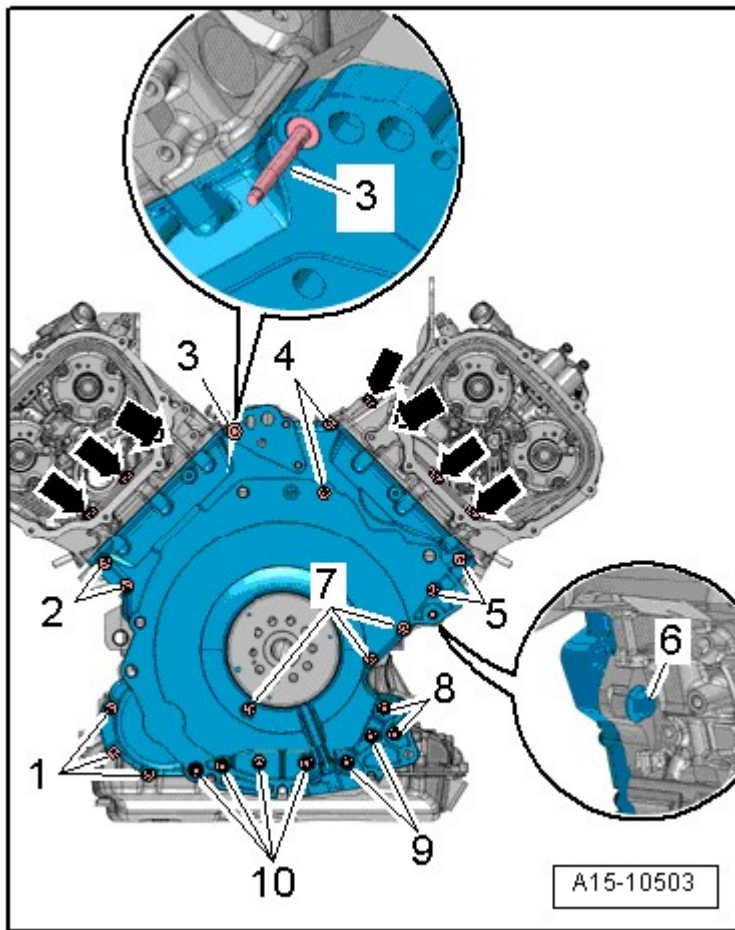


Fig. 160: Identifying Lower Timing Chain Cover Bolt, Tightening Sequence
 Courtesy of AUDI OF AMERICA, LLC

- Remove the bolts -1 through 10- and remove the lower timing chain cover.
- Press the transmission side of the crankshaft shaft seal out of the lower timing chain cover.

Installing

- For the correct tightening specifications, refer to **Fig. 14**.

NOTE: Replace seals, gaskets and O-rings.

- Remove the upper right alignment bushing from the cylinder block.
- Grind the alignment bushing down at an angle as shown in the illustration.

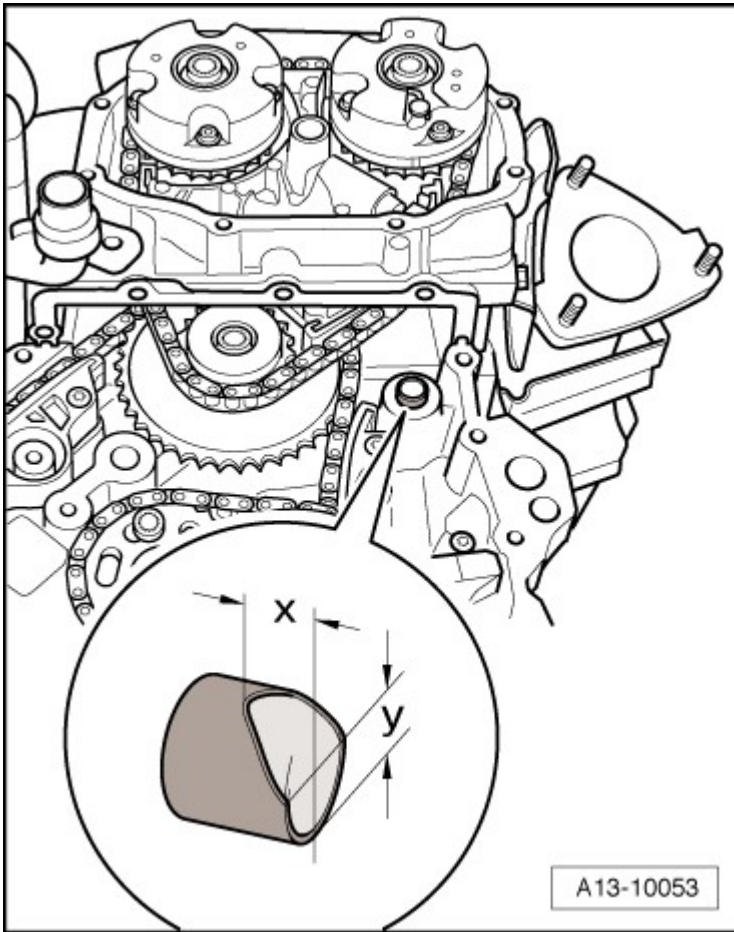


Fig. 161: Identifying Alignment Bushing Chamfer
Courtesy of AUDI OF AMERICA, LLC

- Dimension -x- = 6.5 mm.
- Dimension -y- = 8 mm.

-- Insert the alignment bushing in the cylinder block so the angled side faces up.

NOTE: Because of the chamfer, the lower timing chain cover can be positioned more easily when the cylinder head is installed.

CAUTION: Risk of contaminating lubricating system.

- Cover open parts of engine.

WARNING: Danger of eye injury.

- Wear protective goggles.

-- Remove the sealant residue on the cover for the timing chain, cylinder block and cylinder head, for example

using a rotating plastic brush.

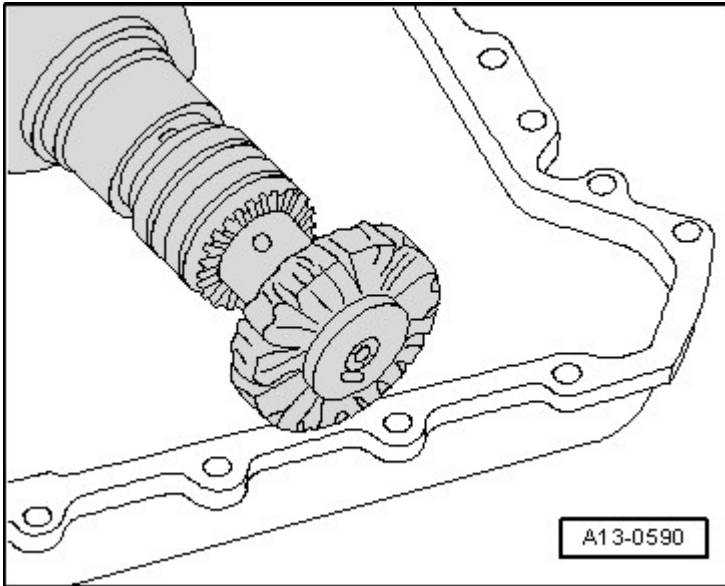


Fig. 162: Identifying Rotating Plastic Brush

Courtesy of AUDI OF AMERICA, LLC

- Clean the sealing surfaces; they must be free of oil and grease.
- Clean the threaded holes in the cylinder block for connecting the engine and transmission using a thread tap before installing the transmission.
- Clean old sealant out of the holes -arrow- in the cylinder head seals.

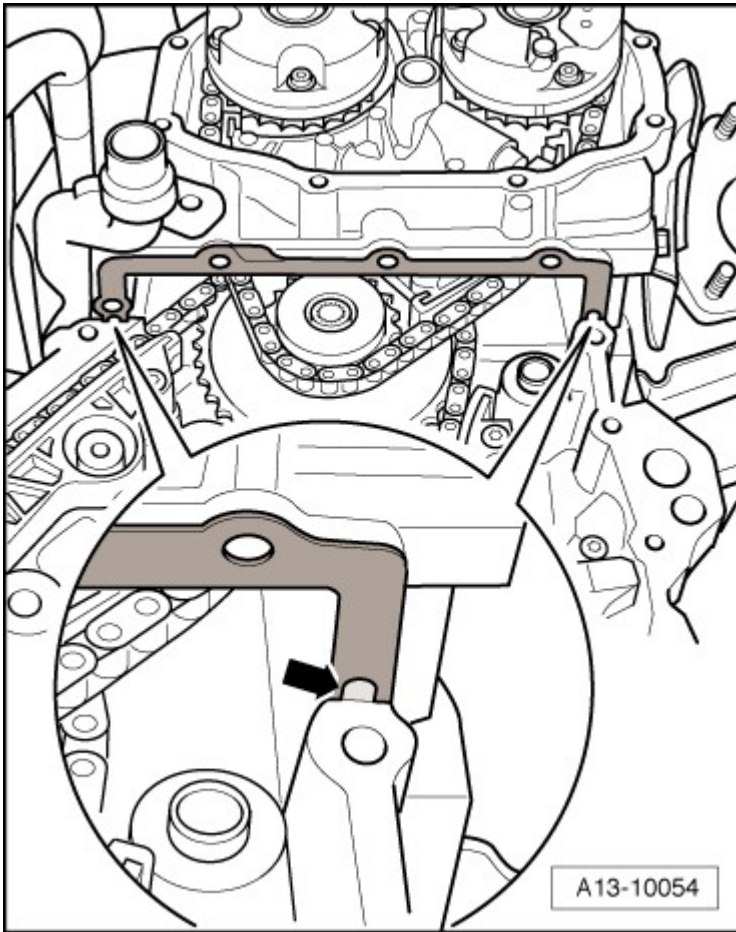


Fig. 163: Identifying Cylinder Head Holes

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.

- Only bend the ends of the cylinder head seals slightly, do not kink.

NOTE: A kinked cylinder head seal must be replaced.

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

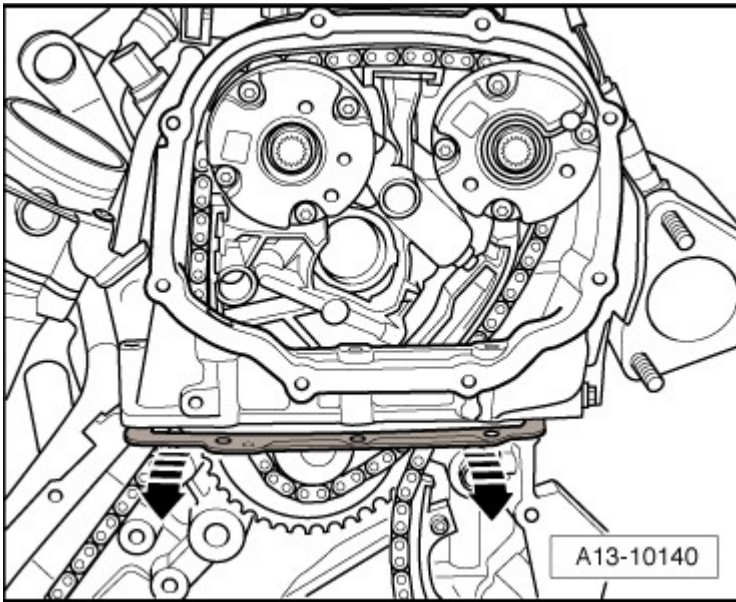


Fig. 164: Bending Cylinder Head Gasket Ends Down
Courtesy of AUDI OF AMERICA, LLC

-- Clean the upper and lower cylinder head gaskets; they must be free from oil and grease.

NOTE: **Note the expiration date of the sealing compound.**

-- Cut the tube nozzle at the front marking (nozzle diameter approximately 2 mm).

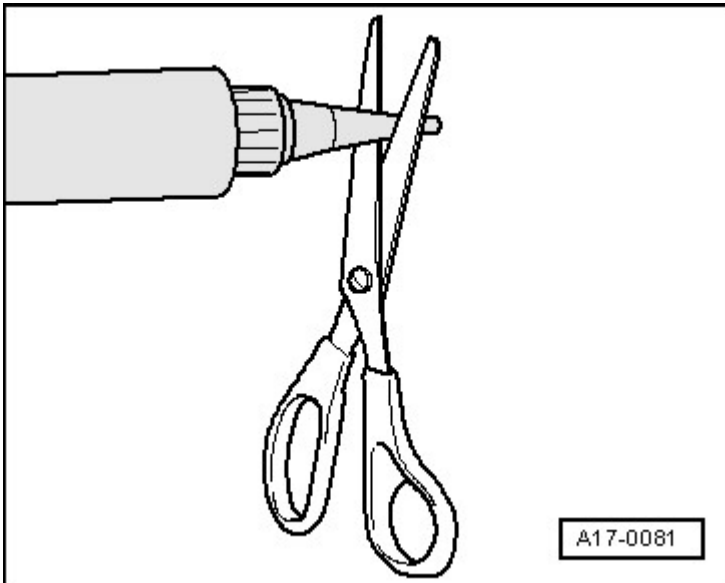


Fig. 165: Cutting Tube Nozzle
Courtesy of AUDI OF AMERICA, LLC

NOTE: **The sealant must be applied to several places on the engine, as described in the**

following.

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

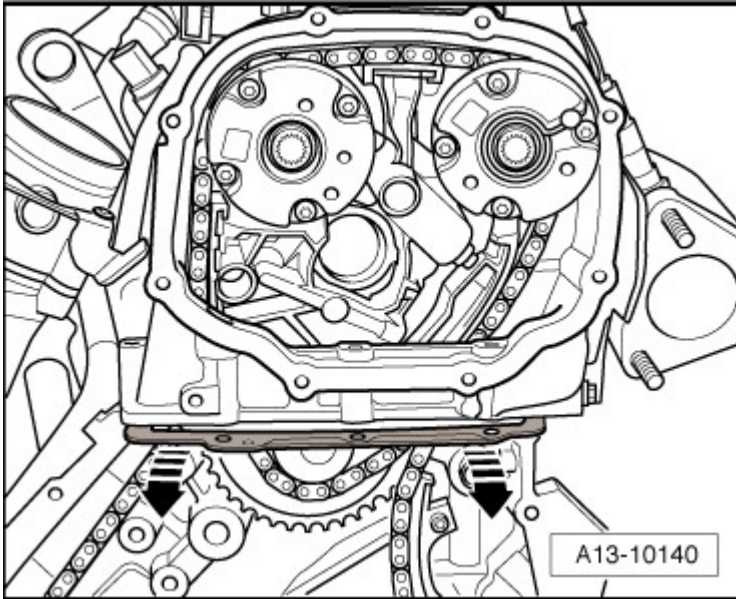


Fig. 166: Bending Cylinder Head Gasket Ends Down
Courtesy of AUDI OF AMERICA, LLC

-- Use a flat object such as a feeler gauge to coat the surface between the cylinder head and seal.

-- Fill the cleaned cylinder head seal holes -arrow- with sealant.

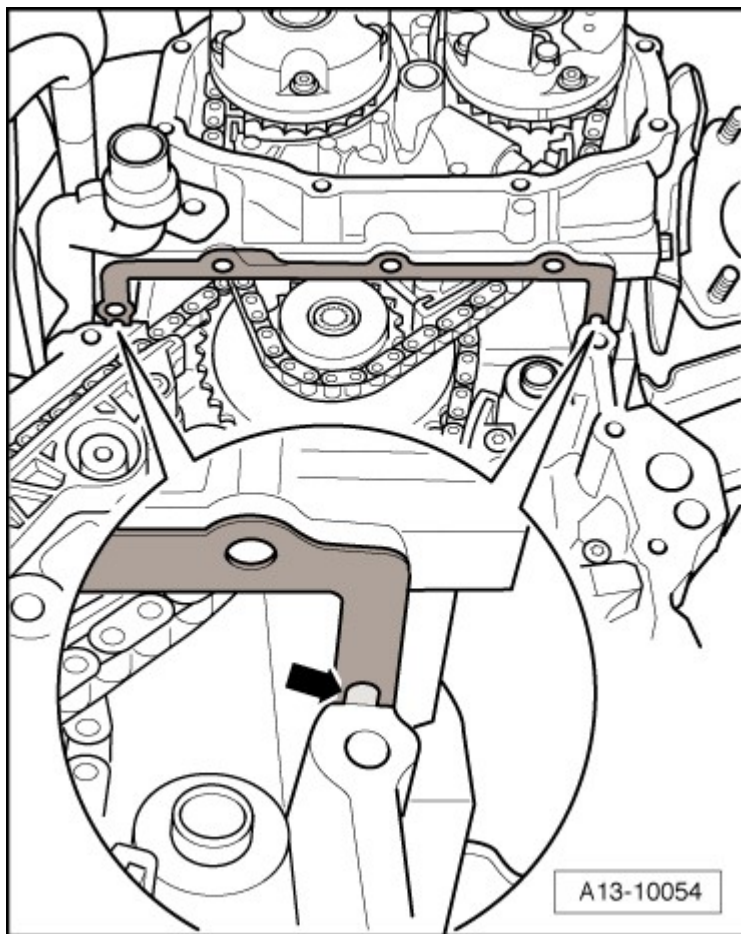


Fig. 167: Identifying Cylinder Head Holes

Courtesy of AUDI OF AMERICA, LLC

CAUTION: The lubrication system could be plugged with excess sealant.

- Do not apply sealant bead thicker than indicated.

-- Apply sealant beads -1 through 4- on the clean lower timing chain cover sealing surfaces as shown in the illustration.

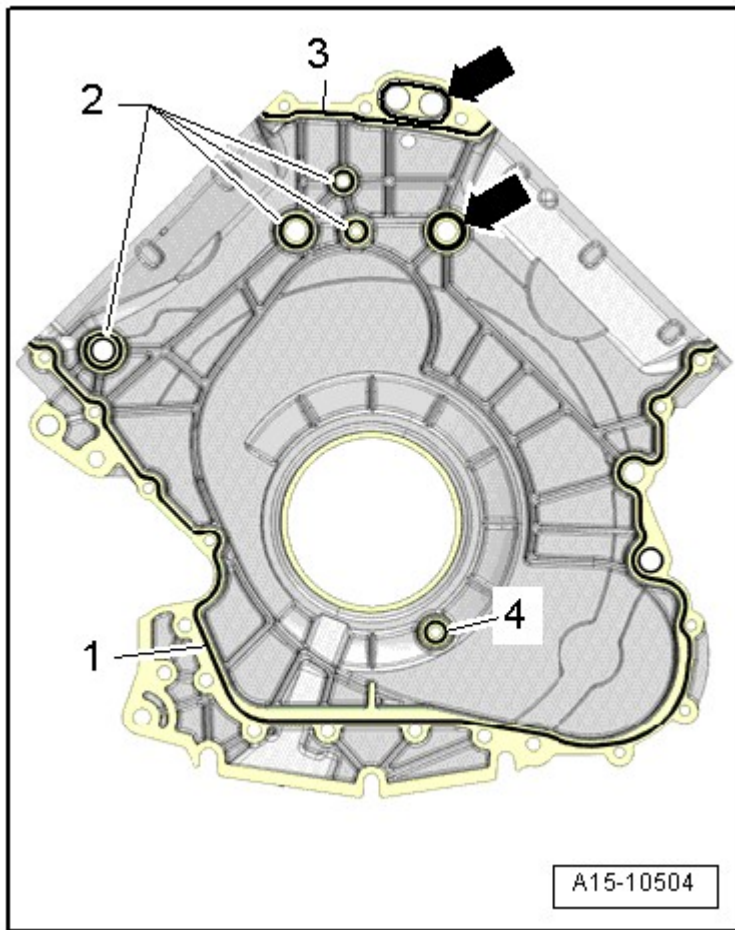


Fig. 168: Identifying Sealant Beads -1 Through 4-
 Courtesy of AUDI OF AMERICA, LLC

- The groove of sealing surface must be completely filled with sealant.
- The sealant beads must be 1.5 to 2.0 mm above the sealing surface.
- The sealant bead -2- must be drawn through as shown in the illustration even though the groove is intermittent.

NOTE: The sealant only needs to cure for approximately 5 minutes after applying.

-- Insert the seals -arrows- in the grooves on the lower timing chain cover.

-- Position the lower timing chain cover, guiding it diagonally from below to the sealing surface on the cylinder block and cylinder head.

-- When positioning, ensure the cylinder head seals are not damaged.

-- Tighten the bolts for the lower timing chain cover. Refer to **Fig. 14**.

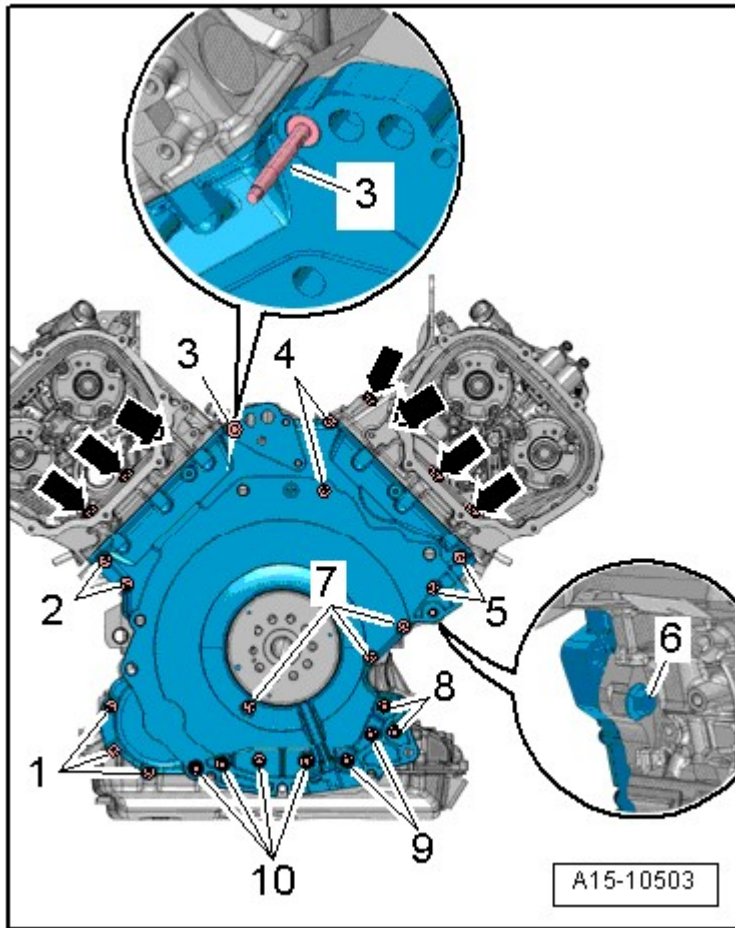


Fig. 169: Identifying Lower Timing Chain Cover Bolt, Tightening Sequence
 Courtesy of AUDI OF AMERICA, LLC

Install in reverse order of removal paying attention to the following:

- Install starter. Refer to **REMOVAL AND INSTALLATION** .
- Install generator. Refer to **REMOVAL AND INSTALLATION** .
- Install the oil filter housing. Refer to **OIL FILTER HOUSING** .
- Install the left and right timing chain covers. Refer to **LEFT AND RIGHT TIMING CHAIN COVERS Installing**.
- Install the transmission-side crankshaft shaft seal. Refer to **CRANKSHAFT SEAL, TRANSMISSION SIDE** .
- Installing the drive plate. Refer to **DRIVE PLATE** .

POWER TAKE-OFF DRIVE CHAIN

Special tools and workshop equipment required

- Key T40049
- Locking Pin T40071
- Locking Pin T40069
- 8 mm drill bit

Removing

- Transmission removed.

-- Remove timing chain lower cover. Refer to **LOWER TIMING CHAIN COVER**.

CAUTION: The drive chain could be destroyed.

- Place a washer under the bolt heads to prevent the bolts from pinching the drive chain.

-- Install the T40049 at the rear of the crankshaft using two old drive plate bolts -arrows-.

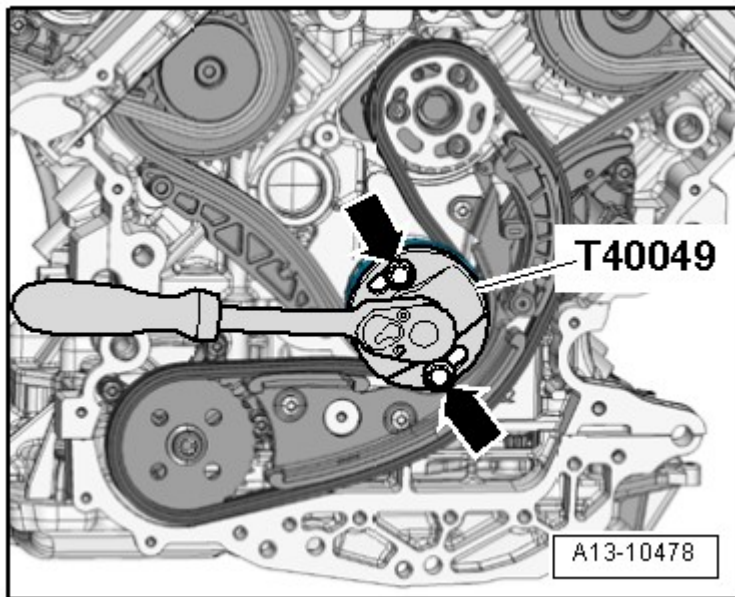


Fig. 170: Identifying Special Tool - T40049

Courtesy of AUDI OF AMERICA, LLC

-- Remove the locking bolt -arrow- for the Top Dead Center (TDC) marking from the cylinder block.

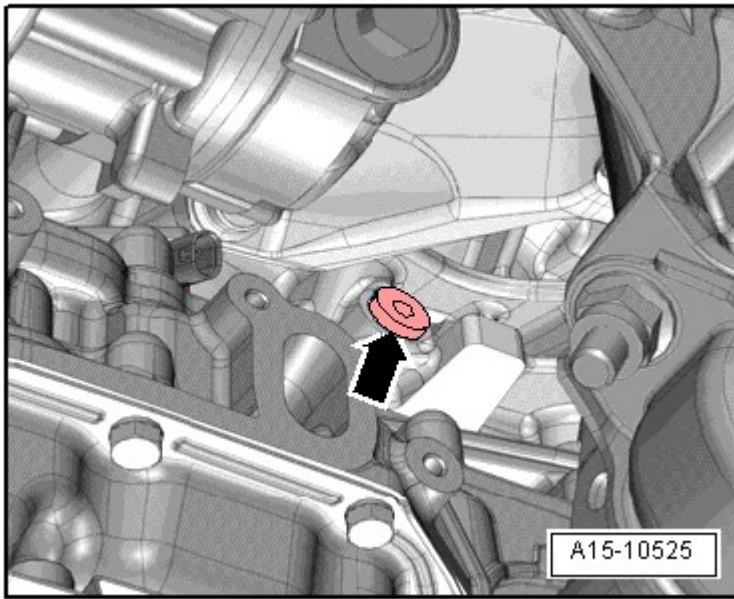


Fig. 171: Identifying Locking Bolt

Courtesy of AUDI OF AMERICA, LLC

-- Rotate the crankshaft in the direction of engine rotation to "TDC".

NOTE:

- The crankshaft locating hole is difficult to find when the engine is installed.
- Rotate the engine until the small notch -1- on the vibration damper aligns at the left of the housing separation point -2- between the cylinder block and the guide frame. This makes it easier to install the T40069.

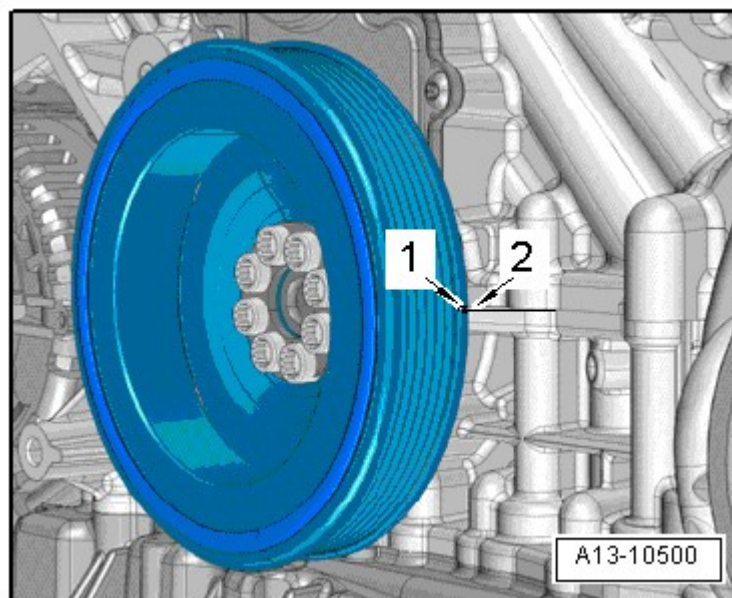


Fig. 172: Identifying Vibration Damper Alignment Notch

Courtesy of AUDI OF AMERICA, LLC

- The marking on the vibration damper is only there to help. The exact "TDC" location is only reached by installing the T40069.

-- Install the T40069 in the hole and tighten to 20 Nm. Turn the crankshaft -1- back and slightly to completely center the bolt, if necessary.

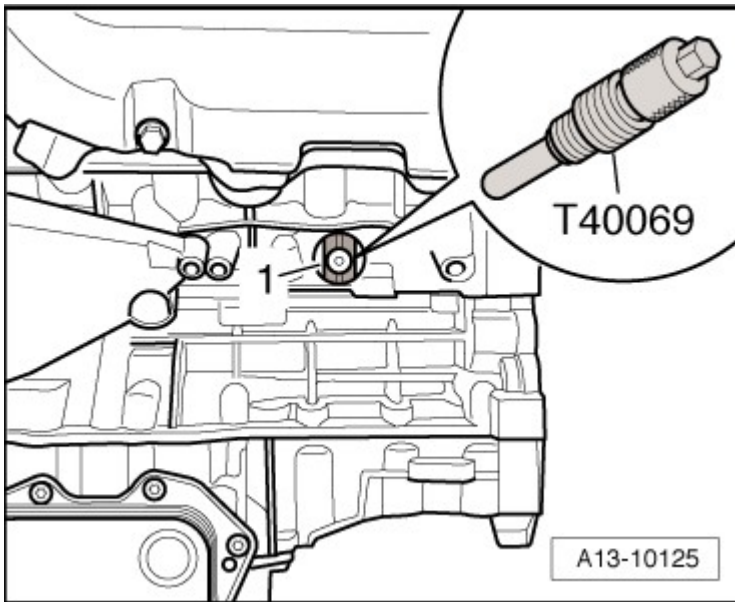


Fig. 173: Identifying Special Tool - Crankshaft Holder T40069

Courtesy of AUDI OF AMERICA, LLC

-- Press the chain tensioner guide rail in direction of -arrow- and secure chain tensioner using a T40071.

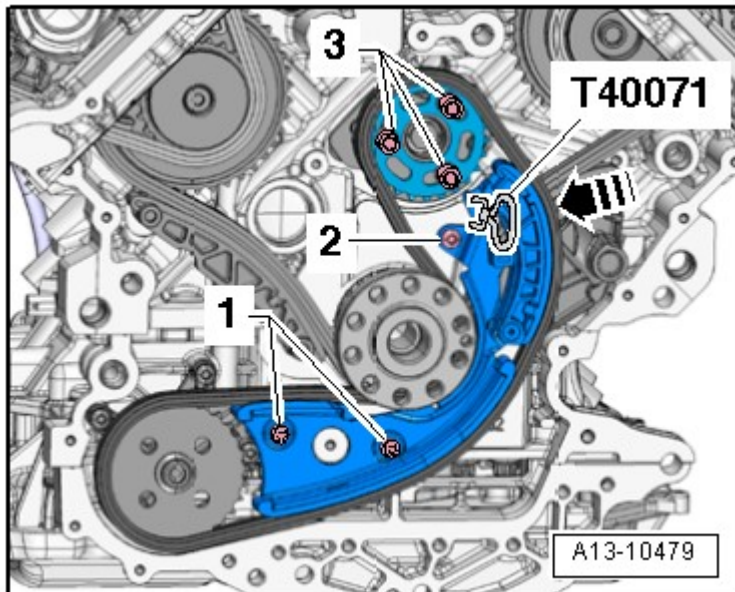


Fig. 174: Pressing & Securing Chain Tensioner Using Locking Pin T40071

Courtesy of AUDI OF AMERICA, LLC

CAUTION: Risk of destroying due to the reversed running direction on a used drive chain.

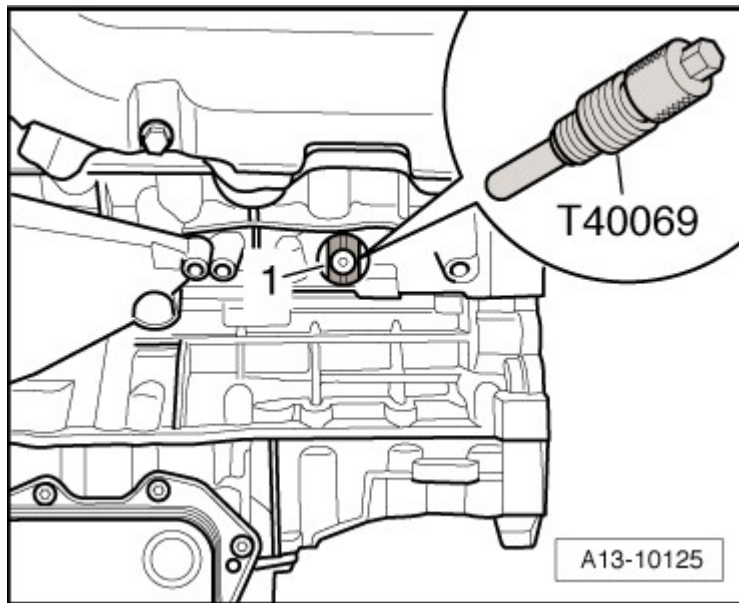
- Mark the drive chain running direction with arrows using paint for installation later. Do not mark the chain using a punch, notch or similar.

-- Remove the bolts -3- and the balance shaft chain sprocket.

-- Remove the bolts -1 and 2- and the chain tensioner with the drive chain.

Installing

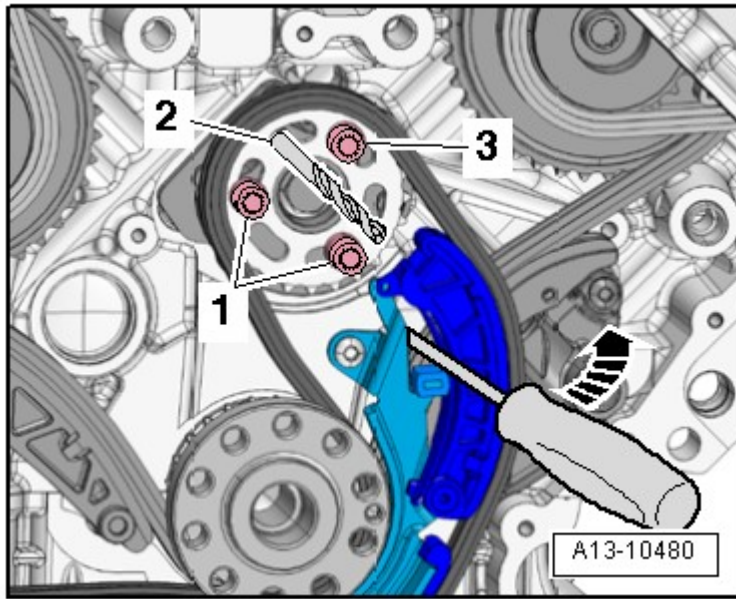
- For the correct tightening specifications, refer to **POWER TAKE-OFF DRIVE CHAIN OVERVIEW**.
- Secure crankshaft -1- in "TDC" position using T40069.

**Fig. 175: Identifying Special Tool - Crankshaft Holder T40069**

Courtesy of AUDI OF AMERICA, LLC

NOTE: Replace the O-ring for the "TDC" marking locking bolt.

-- Install the chain tensioner with the drive chain and the balance shaft chain sprocket.

**Fig. 176: Securing Balance Shaft**

Courtesy of AUDI OF AMERICA, LLC

- To protect against cuts, wrap the point and the cutting edges on a 8 mm drill bit with insulating tape.
- Secure the balance shaft in the "TDC" position using an 8 mm diameter drill bit -2-.
 - The slots in the balance shaft sprocket must be at the middle position in relation to the threaded holes of the balance shaft. If necessary, adjust chain by one tooth.
- Tighten the chain tensioner bolts.
- Loosely install the chain sprocket bolts -1 and 3-.
 - It must still be possible to rotate the chain sprocket on the balance shaft and it must not tip.
- Remove the T40071 to release the chain tensioner.
- Press against the chain tensioner guide rail -arrow- using a screwdriver while tightening the chain sprocket bolts -1 and 3-.
- Remove the drill bit -2- from the balance shaft.

Install in reverse order of removal paying attention to the following:

- Install the "TDC" marking locking bolt. Refer to. **Fig. 92**.

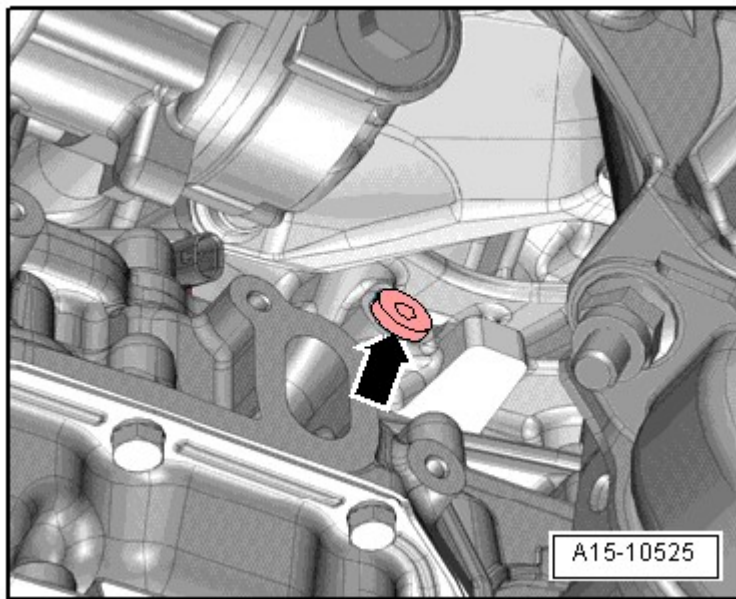


Fig. 177: Identifying Locking Bolt

Courtesy of AUDI OF AMERICA, LLC

-- Install timing chain lower cover. Refer to **LOWER TIMING CHAIN COVER**.

RIGHT CYLINDER HEAD COVER

Special tools and workshop equipment required

- Ignition Coil Puller T40039

Removing

-- Remove the engine covers -arrows-.

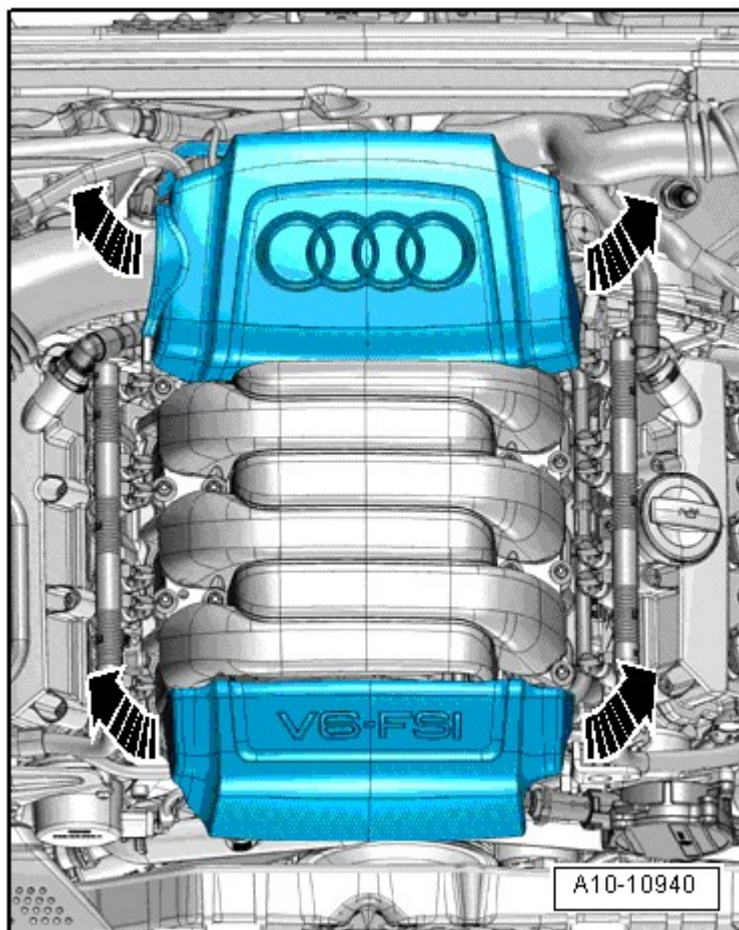


Fig. 178: Identifying Engine Cover

Courtesy of AUDI OF AMERICA, LLC

-- Remove the air filter housing. Refer to **REMOVAL AND INSTALLATION** .

-- Remove the bolts -arrows- and disconnect the electrical connectors to the ignition coils on the right cylinder head.

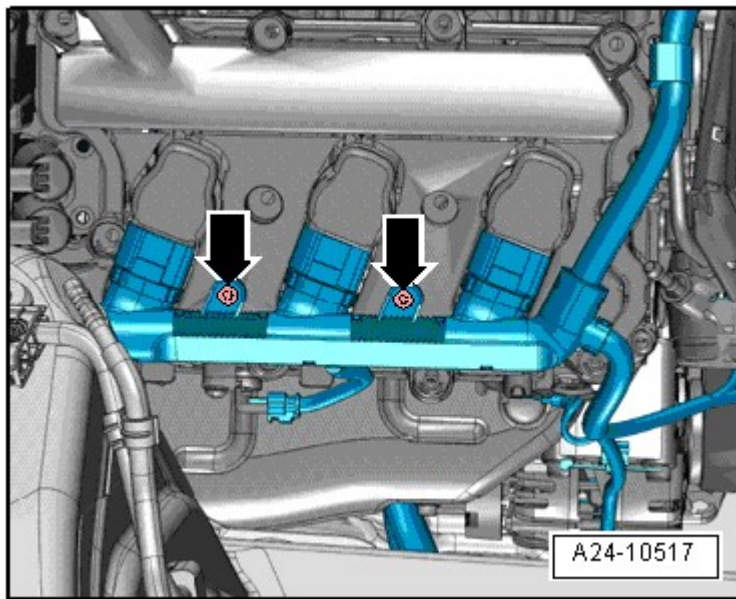


Fig. 179: Identifying Right Cylinder Head Bolts
Courtesy of AUDI OF AMERICA, LLC

-- Disconnect the electrical connector -5- on the Camshaft Position (CMP) sensor 3 -G300-.

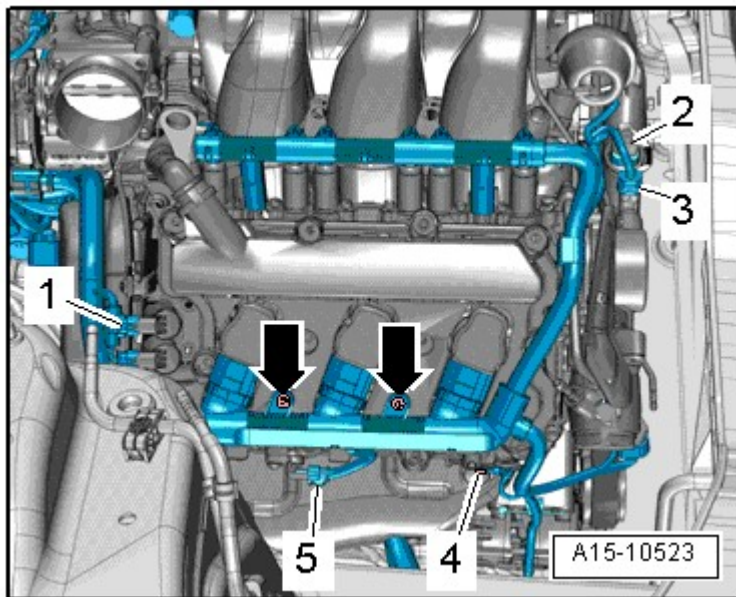


Fig. 180: Identifying Electrical Wiring Harness Components
Courtesy of AUDI OF AMERICA, LLC

-- Press the connector release catches and disconnect the connector -1- on the camshaft adjustment valve 1 - N205- and camshaft adjustment valve 1 (exhaust) -N318-.

-- Press the electrical wiring harness to the side.

NOTE: Ignore -2, 3 and 4-.

-- Remove the ignition coils with the T40039.

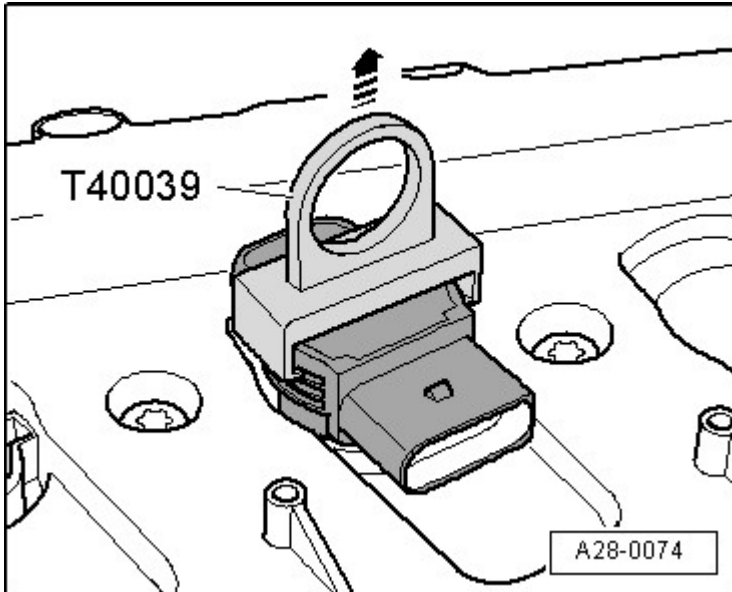


Fig. 181: Removing Ignition Coils With Special Tool Ignition Coil Puller T40039

Courtesy of AUDI OF AMERICA, LLC

CAUTION: Risk of violating emissions legislation.

- Do not open the hose connection -arrow-.

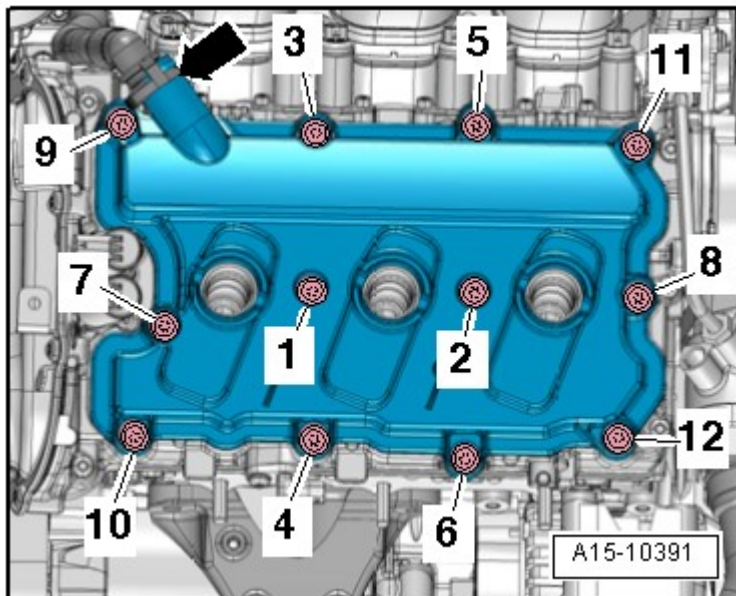


Fig. 182: Identifying Right Cylinder Head Cover Bolt, Tightening Sequence

Courtesy of AUDI OF AMERICA, LLC

-- Remove the bolts in the following sequence -12 to 1- and lay the right cylinder head aside with the crankcase ventilation hose -arrow- connected.

Installing

Install in reverse order, paying attention to the following:

NOTE:

- **Replace the O-ring.**
- **Replace the cylinder head seal if it is damaged.**
- **Replace the cylinder head cover bolts when replacing the damaged seal.**

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

-- Tighten the right cylinder head cover bolts. Refer to **Fig. 6**.

-- Install the air filter housing. Refer to **REMOVAL AND INSTALLATION** .

TIMING MECHANISM DRIVE CHAIN

Special tools and workshop equipment required

- Locking pin T40071

Removing

- Transmission removed.

-- Remove timing chain lower cover. Refer to **LOWER TIMING CHAIN COVER**.

-- Remove the camshaft timing chains from the camshafts. Refer to **CAMSHAFT TIMING CHAINS, REMOVING FROM CAMSHAFTS**.

-- Remove the power take-off drive chain. Refer to **POWER TAKE-OFF DRIVE CHAIN**.

-- Press the drive chain tensioner guide rail in the direction of the -arrow- and secure the chain tensioner with a T40071.

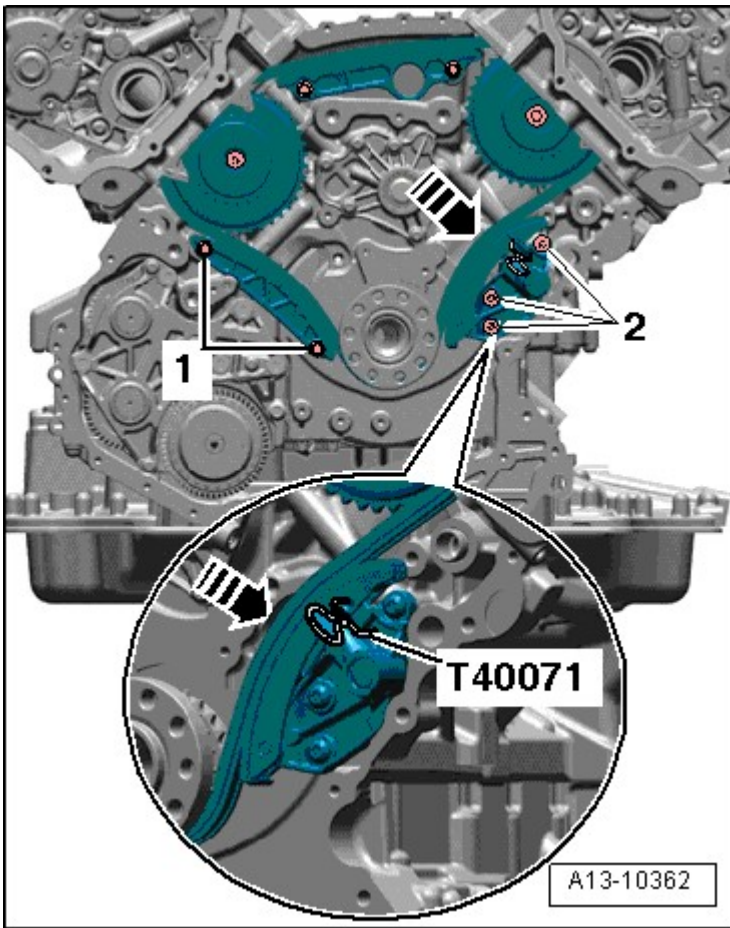


Fig. 183: Installing Chain Tensioner
Courtesy of AUDI OF AMERICA, LLC

CAUTION: Risk of destroying due to reversed running direction on a used drive chain.

- Mark the drive chain running direction with arrows using paint for installation later. Do not mark the chain using a punch, notch or similar.

- Remove the bolts -1- and the guide rail.
- Remove the bolts -2- and the chain tensioner.
- Remove the timing mechanism drive chain.

Installing

- For the correct tightening specifications, refer to **TIMING MECHANISM DRIVE CHAIN OVERVIEW**.

Install in reverse order, paying attention to the following:

NOTE: Replace the bolts which are being tightened with an additional turn.

-- Position the timing mechanism drive chain according to the markings made on the drive chain sprockets during removal.

-- Install the guide rail and tighten the bolts -1-.

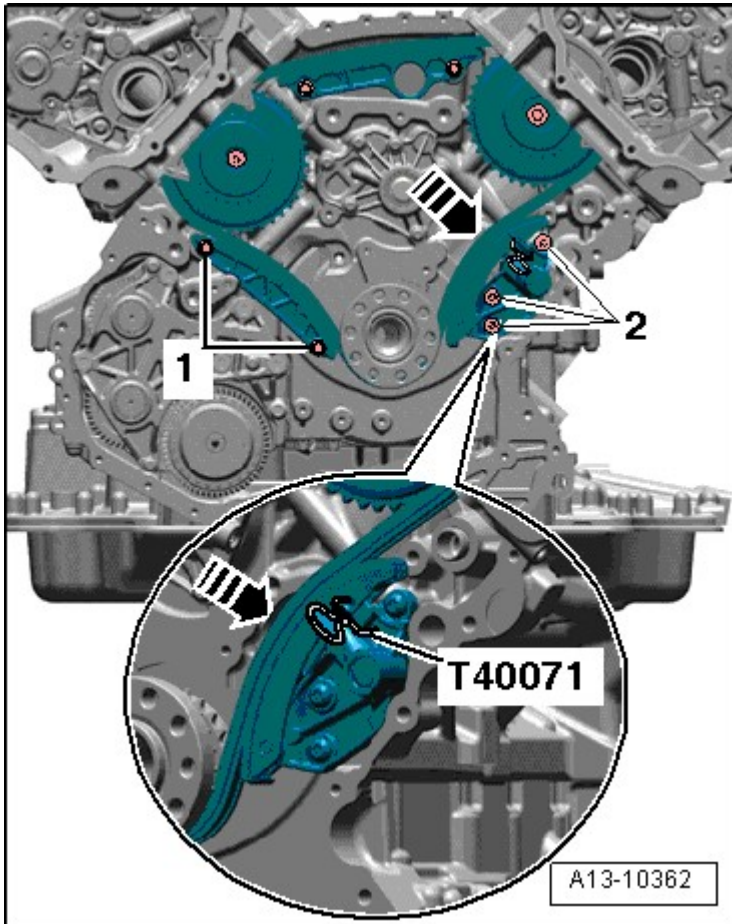


Fig. 184: Installing Chain Tensioner

Courtesy of AUDI OF AMERICA, LLC

-- Install the chain tensioner and tighten the bolts -2-.

-- Press the drive chain tensioner guide rail in direction of -arrow- and pull T40071 out of the chain tensioner.

-- Install the power take-off drive chain. Refer to **POWER TAKE-OFF DRIVE CHAIN**.

-- Position the camshaft timing chain on the camshafts **CAMSHAFT TIMING CHAINS, REMOVING FROM CAMSHAFTS**.

-- Install timing chain lower cover. Refer to **LOWER TIMING CHAIN COVER**.

VALVE STEM SEALS, CYLINDER HEAD INSTALLED

Special tools and workshop equipment required

- Spark Plug Removal Tool 3122 B
- Valve Seal Removal Tool 3364
- Valve Stem Seal Driver 3365
- Valve Cotters Asm/Dis-Asm Device VAS 5161 with Guide Plate for FSI Engine VAS 5161/19B
- Pressure Fork VAS 5161/2
- Knurled Screws VAS 5161/12
- Drift VAS 5161/3
- Installation Fork VAS 5161/5
- Engaging Device VAS 5161/6
- Installation Cartridge VAS 5161/8
- Valve Retainer Inserting Tool VAS 5161/18
- Adapter T40012

Removing

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

-- Mark the allocation of the roller rocker lever and the hydraulic adjusting elements so they can be installed again.

-- If necessary, remove the roller rocker levers with the hydraulic adjusting elements and place them on a clean surface.

-- Remove the spark plugs with 3122 B.

-- Move piston for respective cylinder to "Bottom Dead Center (BDC) position".

-- Position the VAS 5161/3 on the valve spring plate and loosen the stuck valve retainers with a plastic mallet.

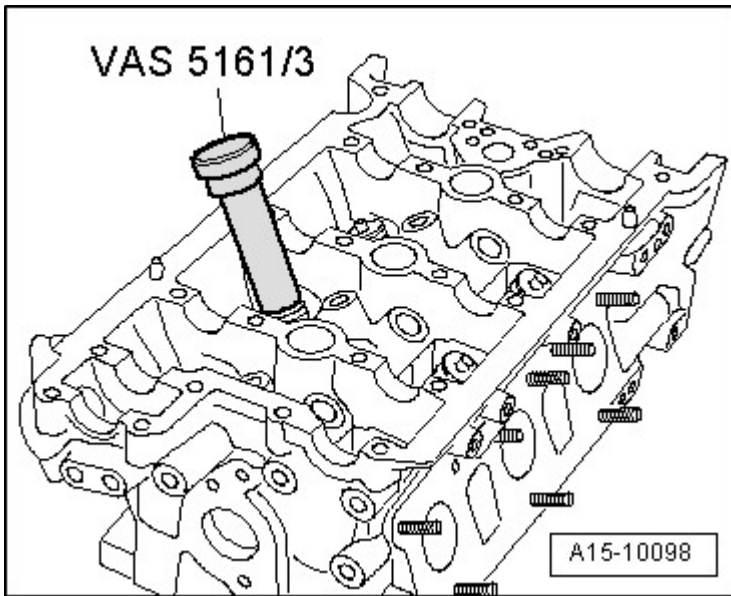


Fig. 185: Identifying Special Tool - Drift VAS 5161/3
Courtesy of AUDI OF AMERICA, LLC

-- Place the VAS 5161/19B from the VAS 5161 on the cylinder head.

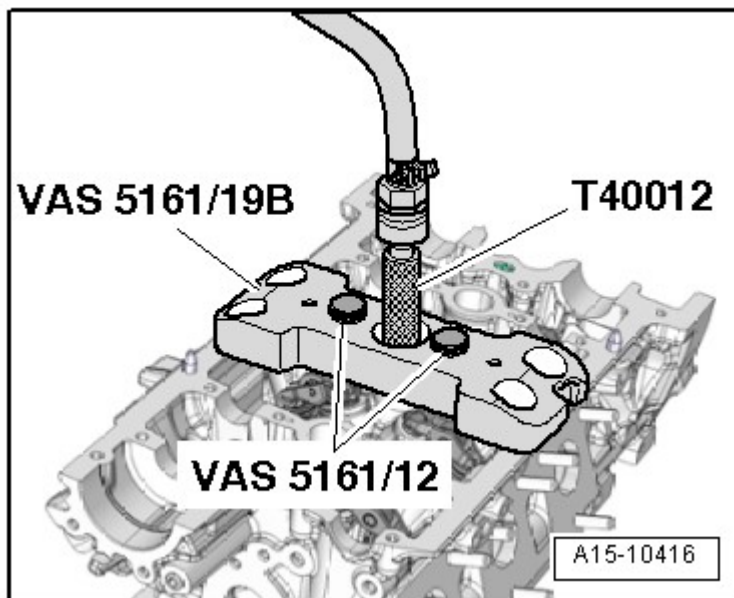


Fig. 186: Identifying Special Tool - VAS 5161/19B
Courtesy of AUDI OF AMERICA, LLC

-- Secure the guide plate with the VAS 5161/12.

-- Install T40012 with the sealing ring in respective spark plug thread and hand tighten.

-- Connect the adapter to the compressed air using a commercially available intermediate piece and give steady

pressure.

- Minimum pressure: 6 bar (87 psi) positive pressure.

-- Install VAS 5161/6 with VAS 5161/5 in guide plate.

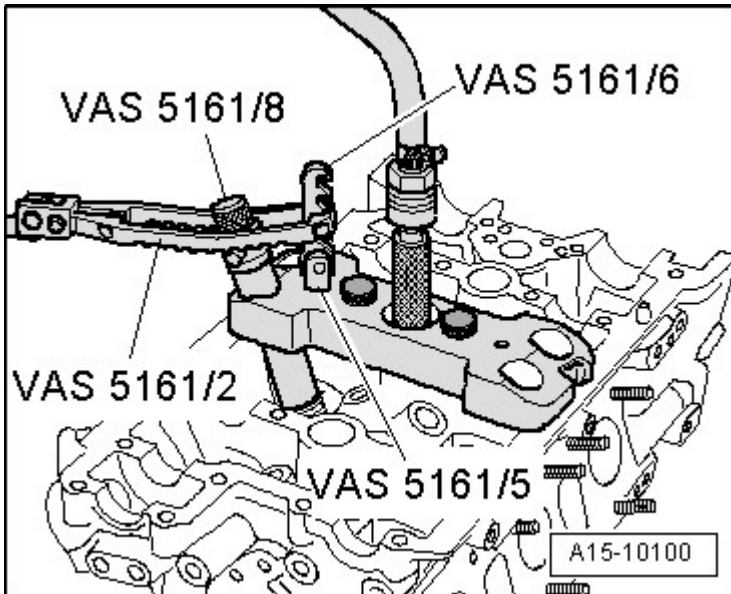


Fig. 187: Identifying Engaging Device VAS 5161/6 With Installation Fork VAS 5161/5
Courtesy of AUDI OF AMERICA, LLC

-- Slide VAS 5161/8 in guide plate.

-- Engage 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 the valve retainers.

-- Move the knurled wheel left and right slightly. This presses the valve retainers apart and captures them in the installation cartridge.

-- Release the pressure fork.

-- Remove installation cartridge.

-- Unfasten guide plate and turn it aside.

- Pressurized air hose remains connected.

-- Remove the valve spring and the valve spring plate.

-- Remove the valve stem seal with the 3364.

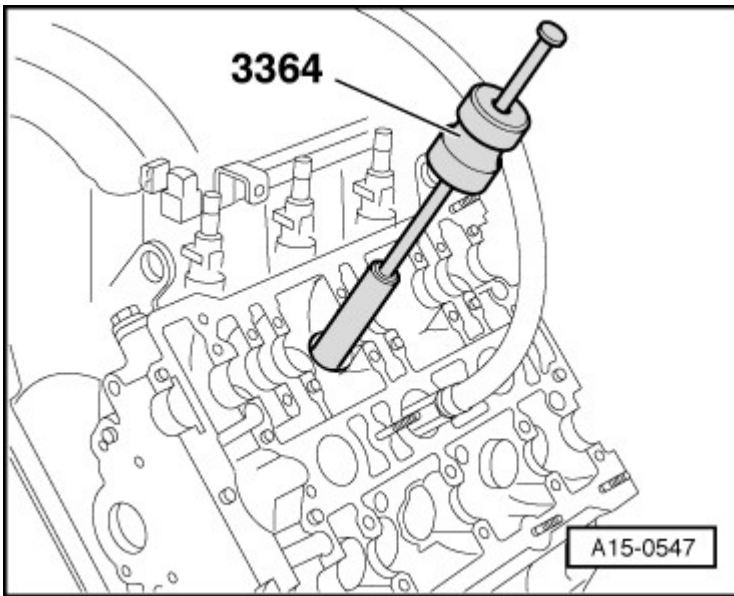


Fig. 188: Identifying 3364

Courtesy of AUDI OF AMERICA, LLC

If the 3364 cannot be used, on several valve stem seals due to restricted clearance, proceed as follows:

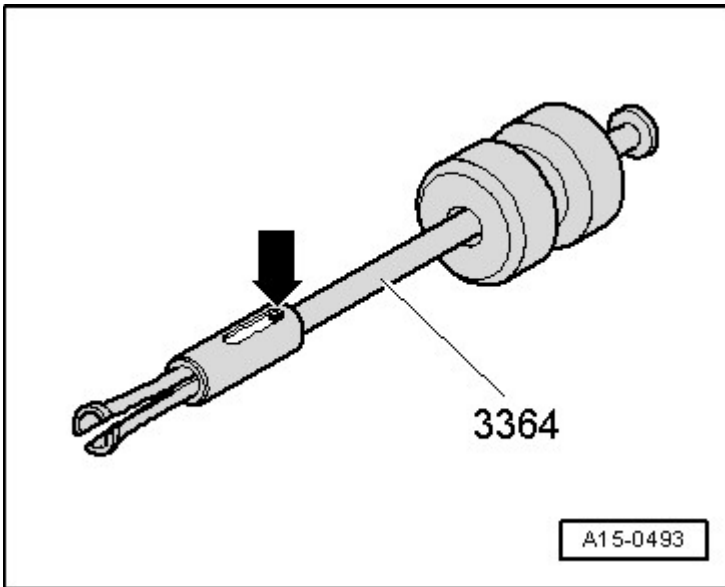


Fig. 189: Driving Out Roll Pin

Courtesy of AUDI OF AMERICA, LLC

-- Drive out the roll pin -arrow- on the puller with a drift and remove the impact puller attachment.

-- Position the lower part of the 3364 on the valve stem seal.

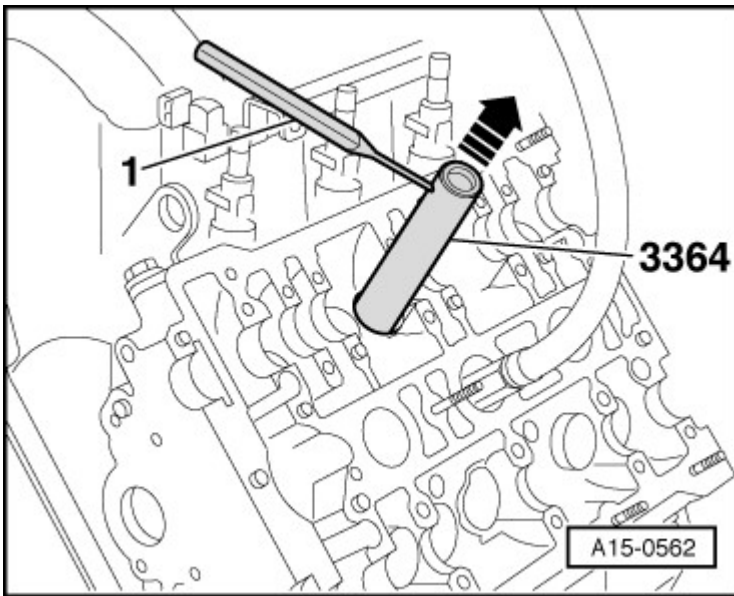


Fig. 190: Positioning 3364 Valve Stem Removal Tool At Valve Stem Oil Seal
 Courtesy of AUDI OF AMERICA, LLC

- Secure the puller with a drift or cotter pin drive -1- as shown in the illustration.
- Position the valve lever on the puller and remove the valve stem seal -arrow-.

CAUTION: Risk of damage when installing the valve stem seals.

- Place plastic sleeve -A- that is attached to valve stem seals -B- on valve stem.

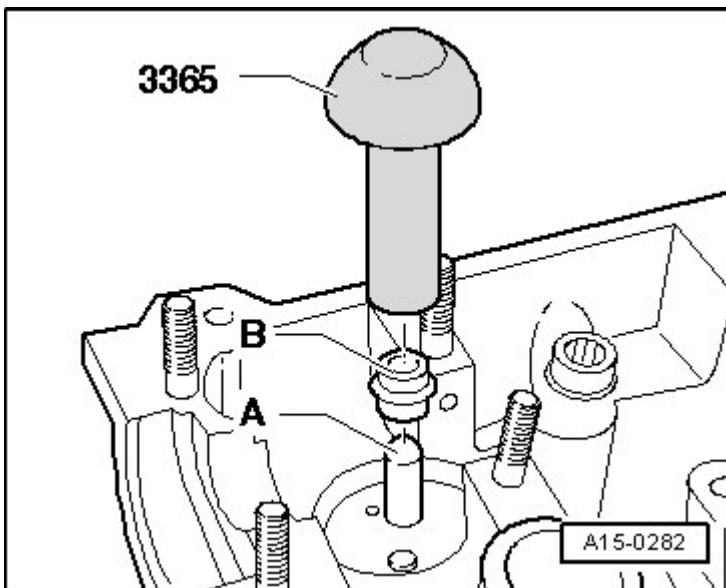


Fig. 191: Identifying Plastic Sleeve, New Valve Stem Oil Seals & Valve Stem Seal Driver 3365
 Courtesy of AUDI OF AMERICA, LLC

- Lightly oil valve stem seal.
- Slide valve shaft seal onto plastic sleeve.
- Carefully press valve stem seal onto valve guide with 3365.
- Remove plastic sleeve again.

When the valve retainers were removed from the installation cartridge, they must be inserted in the VAS 5161/18 next.

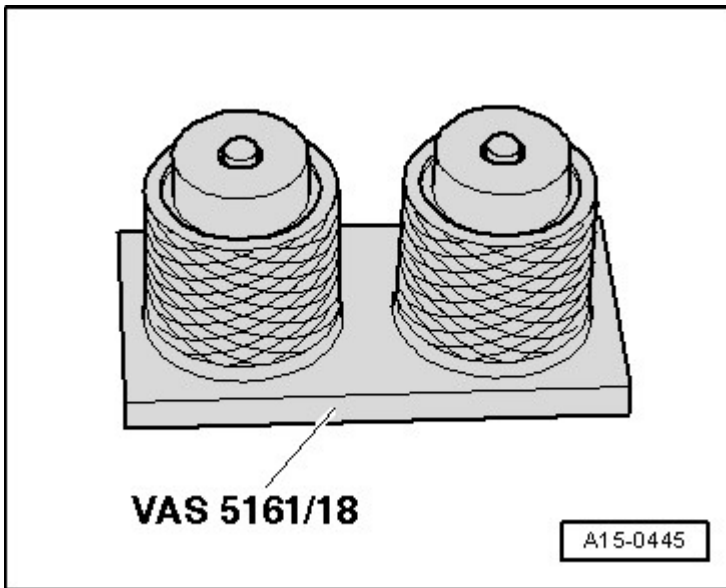
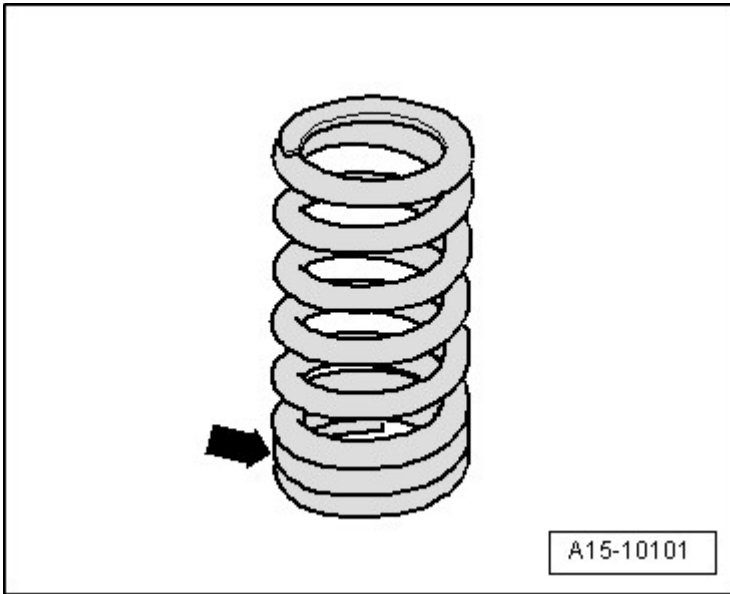


Fig. 192: Identifying Installation Cartridge VAS 5161/8
Courtesy of AUDI OF AMERICA, LLC

- The large diameter of the valve retainers point upward.
- Press installation cartridge from above onto valve retainer inserting tool and capture keepers.
 - Insert the valve spring and the valve spring plate. Refer to **Fig. 19**.



A15-10101

Fig. 193: Identifying Tight Spring Coils
Courtesy of AUDI OF AMERICA, LLC

-- Install the guide plate on the cylinder head.

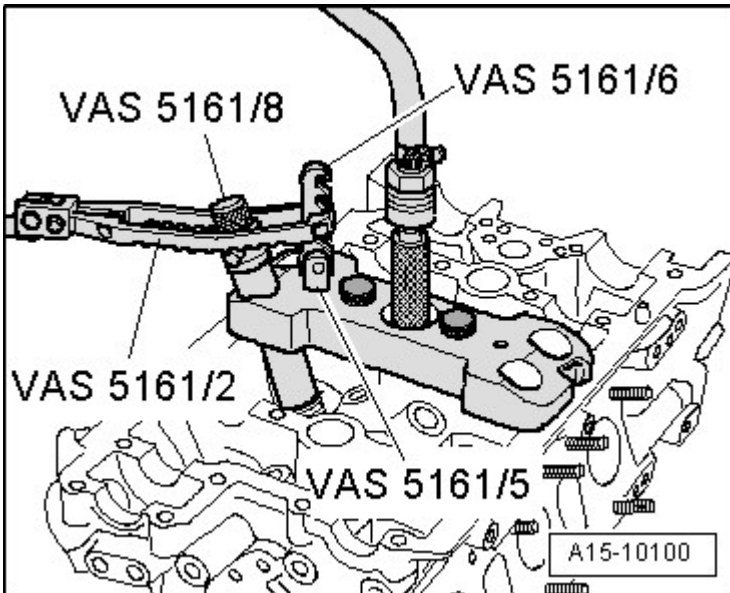


Fig. 194: Identifying Engaging Device VAS 5161/6 With Installation Fork VAS 5161/5 Installed Into Guide Plate
Courtesy of AUDI OF AMERICA, LLC

-- Insert installation cartridge in guide plate.

-- Press the pressure fork down and pull the knurled screw up while turning left and right. This inserts the valve retainers.

-- Release the pressure fork with the knurled screw still raised.

-- Repeat the procedure on each valve.

Installing

Installing is in reverse order of removing. Note the following:

-- Make sure all the roller rocker levers lie on the ends of the valve stems correctly and are clipped onto the respective hydraulic adjusting elements.

-- Install the camshafts. Refer to **CAMSHAFTS**.

-- Install spark plugs.

VALVE STEM SEALS WITH CYLINDER HEAD REMOVED

Special tools and workshop equipment required

- Valve Seal Removal Tool 3364
- Valve Stem Seal Driver 3365
- Valve Cotters Asm/Dis-Asm Device VAS 5161 with Guide Plate for FSI Engine VAS 5161/19B
- Pressure Fork VAS 5161/2
- Drift VAS 5161/3
- Installation Fork VAS 5161/5
- Engaging Device VAS 5161/6
- Installation Cartridge VAS 5161/8
- Knurled Screws VAS 5161/12
- Valve Retainer Inserting Tool VAS 5161/18
- Engine and Transmission Holder VAS 6095
- Cylinder Head Tensioning Device VAS 6419

Removing

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

-- Mark the allocation of the roller rocker lever and the hydraulic adjusting elements so they can be installed again.

-- If necessary, remove the roller rocker levers with the hydraulic adjusting elements and place them on a clean surface.

-- Mount the VAS 6419 into the VAS 6095.

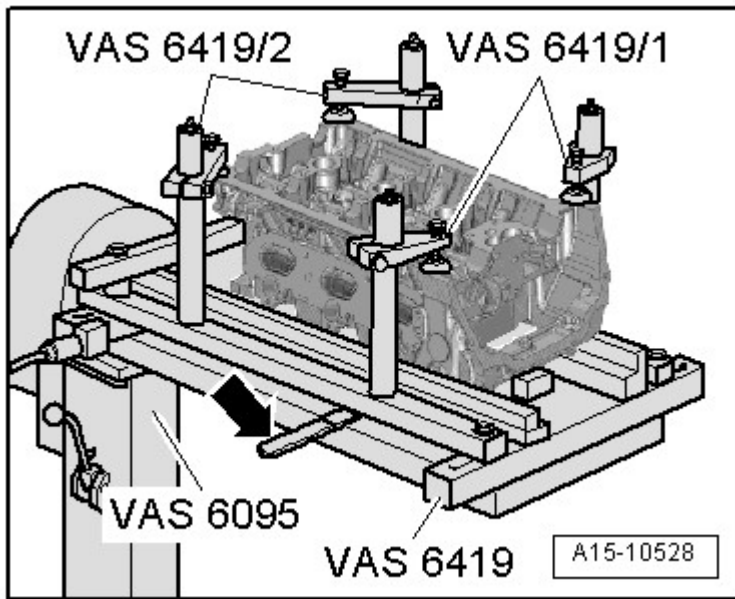


Fig. 195: Tensioning Cylinder Head On Tensioning Element VAS 6419
Courtesy of AUDI OF AMERICA, LLC

- Tension the cylinder head on the cylinder head tensioning device, as illustrated.
- Connect the cylinder head tensioning device to the compressed air.
- Slide the air cushion with the lever -arrow- under the combustion chamber onto the valve stem seals that will be removed.
- Let enough compressed air flow into the air cushion until it contacts the valve plate.
- Position the VAS 5161/3 on the valve spring plate and loosen the stuck valve retainers with a plastic mallet.

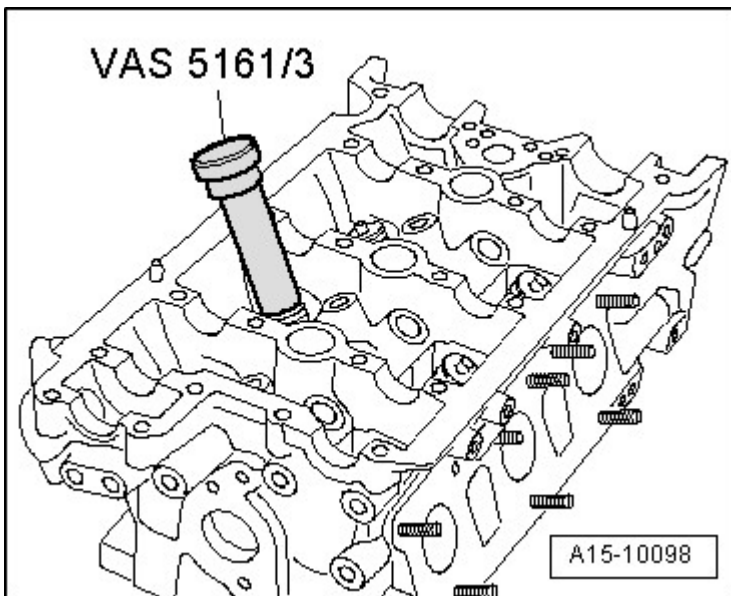


Fig. 196: Identifying Special Tool - Drift VAS 5161/3
Courtesy of AUDI OF AMERICA, LLC

-- Place the VAS 5161/19B from the VAS 5161 on the cylinder head.

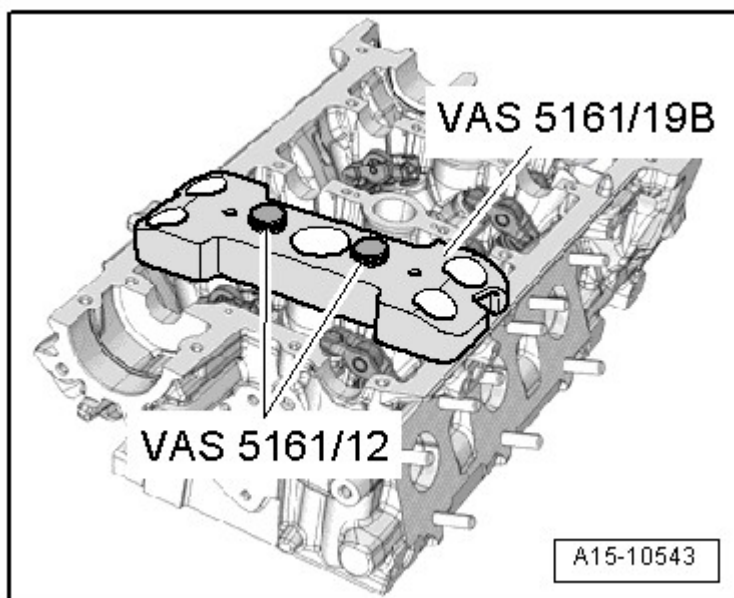


Fig. 197: Identifying Guide Plate VAS 5161/19B Positioned On Cylinder Head
Courtesy of AUDI OF AMERICA, LLC

-- Secure the guide plate with the VAS 5161/12.

-- Install VAS 5161/6 with VAS 5161/5 in guide plate.

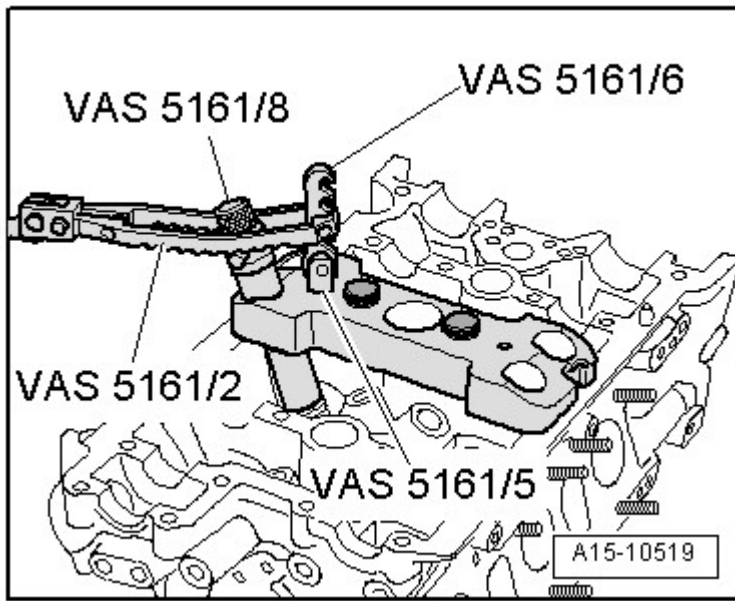


Fig. 198: Identifying Engaging Device VAS 5161/6, Installation Fork VAS 5161/5 And Guide Plate, Removal/Installation

Courtesy of AUDI OF AMERICA, LLC

- Slide VAS 5161/8 in guide plate.
- Engage 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 retainers.
- Move the knurled wheel left and right slightly. This presses the valve retainers apart and captures them in the installation cartridge.
- Release the pressure fork.
- Remove installation cartridge.
- Unfasten guide plate and turn it aside.
- Remove the valve spring and the valve spring plate.
- Remove the valve stem seal with the 3364.

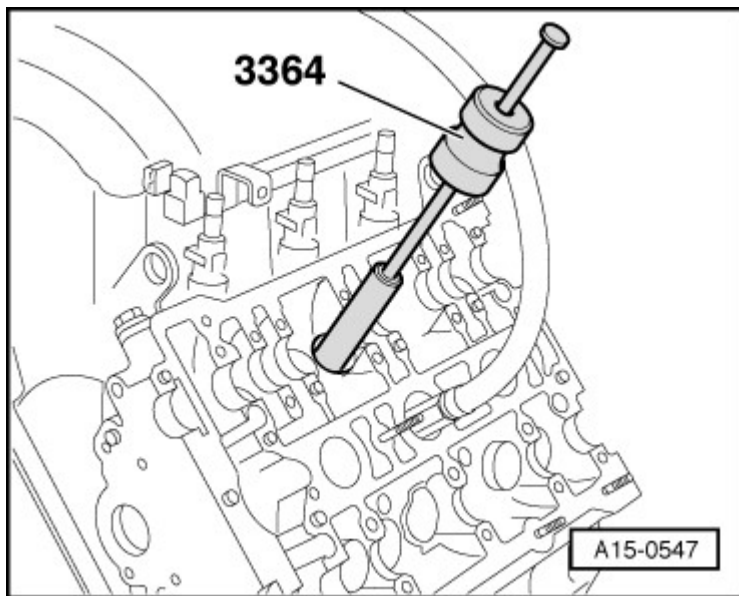


Fig. 199: Identifying 3364

Courtesy of AUDI OF AMERICA, LLC

-- Position the valve lever on the puller and remove the valve stem seal -arrow-.

CAUTION: Risk of damage when installing valve stem seals.

- Place a plastic sleeve -A- that is attached to the valve stem seals -B- on valve stem.

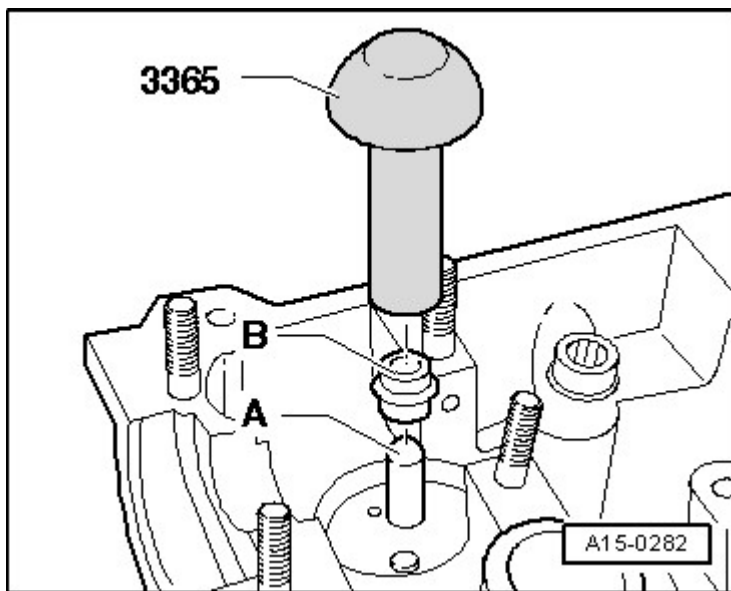


Fig. 200: Identifying Plastic Sleeve, New Valve Stem Oil Seals & Valve Stem Seal Driver 3365

Courtesy of AUDI OF AMERICA, LLC

-- Lightly oil valve stem seal.

- Slide valve shaft seal onto plastic sleeve.
- Carefully press valve stem seal onto valve guide with 3365.
- Remove plastic sleeve again.

When the valve retainers were removed from the installation cartridge, they must be inserted in the VAS 5161/18 next.

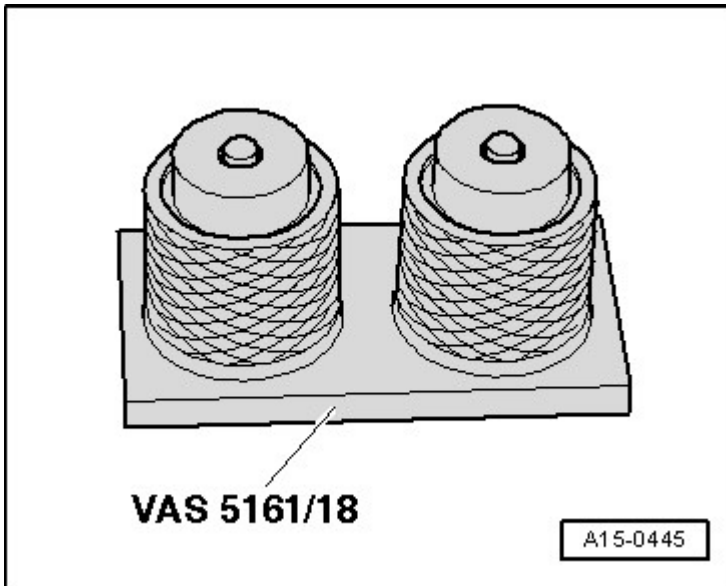


Fig. 201: Identifying Installation Cartridge VAS 5161/8
Courtesy of AUDI OF AMERICA, LLC

- The large diameter of the valve retainers point upward.
- Press installation cartridge from above onto valve retainer inserting tool and capture keepers.
 - Insert the valve spring and the valve spring plate. Refer to **Fig. 19**.

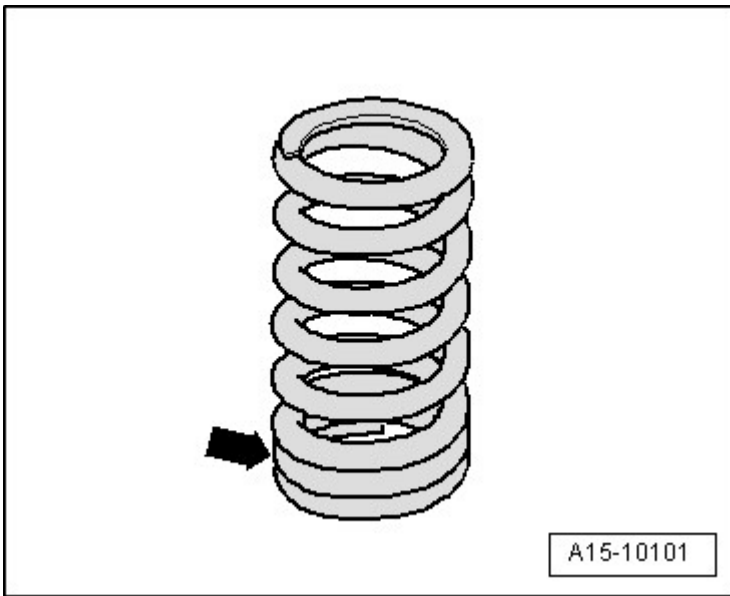


Fig. 202: Identifying Tight Spring Coils
Courtesy of AUDI OF AMERICA, LLC

-- Install the guide plate on the cylinder head.

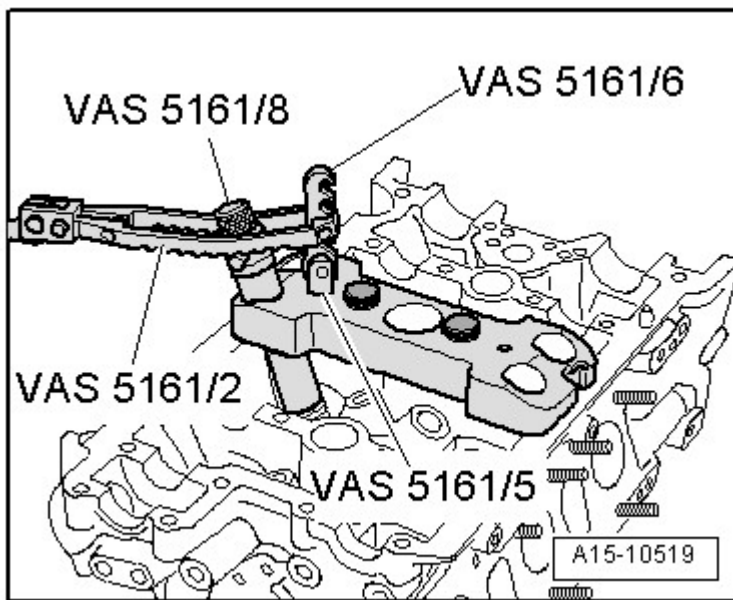


Fig. 203: Identifying Engaging Device VAS 5161/6, Installation Fork VAS 5161/5 And Guide Plate, Removal/Installation
Courtesy of AUDI OF AMERICA, LLC

-- Insert installation cartridge in guide plate.

-- Press the pressure fork down and pull the knurled screw up while turning left and right. This inserts the valve retainers.

2009 Audi Q5 Quattro

ENGINE 3.2 Liter - Cylinder Head, Valvetrain - Engine Code(s): CALB

-- Release the pressure fork with the knurled screw still raised.

-- Repeat the procedure on each valve.

Installing

Assemble in reverse order of disassembling. Note the following:

-- Make sure all the roller rocker levers lie on the ends of the valve stems correctly and are clipped onto the respective hydraulic adjusting elements.

-- Install the camshafts. Refer to **CAMSHAFTS**.

SPECIAL TOOLS

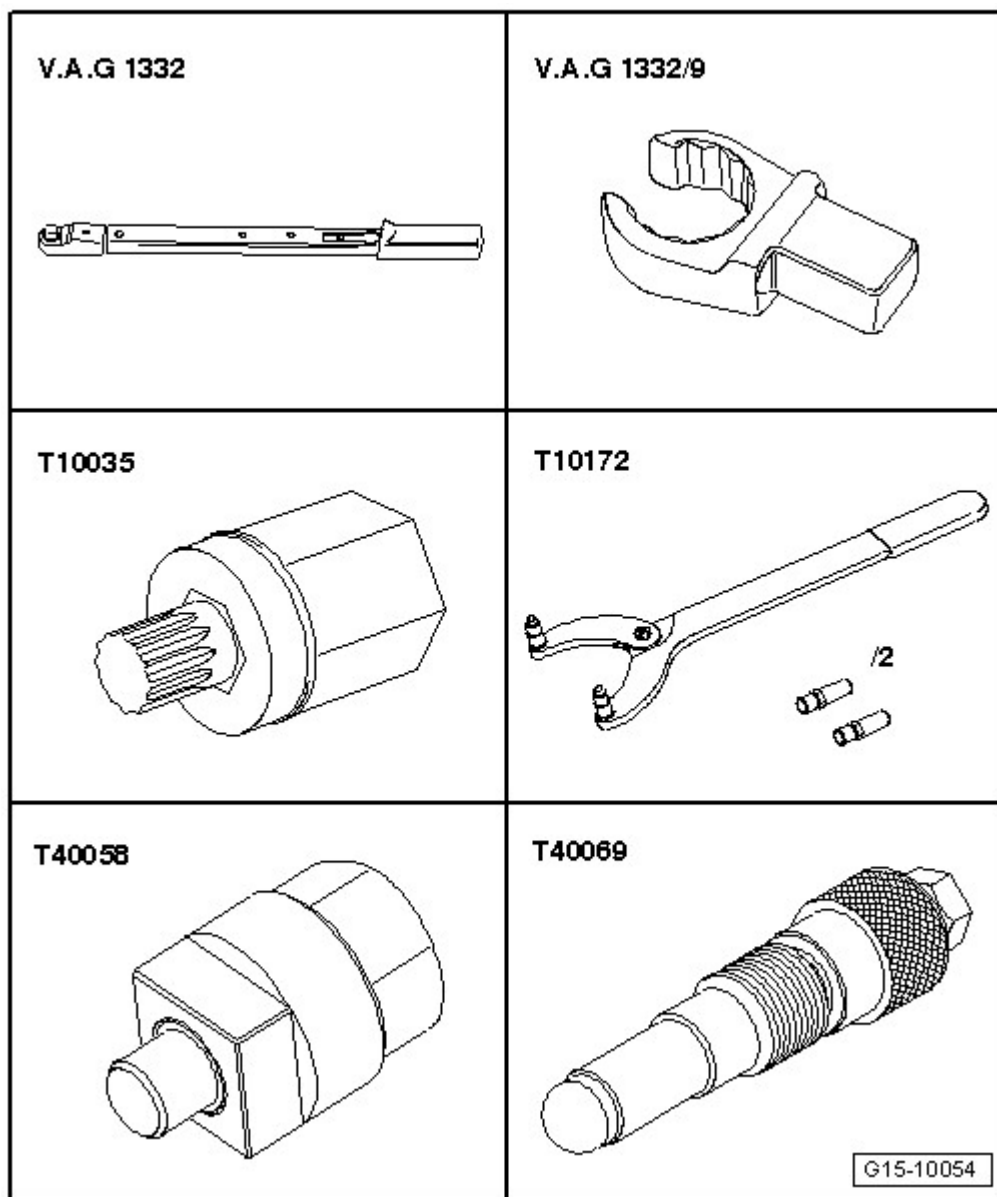


Fig. 204: Identifying Special Tools -- Camshaft Timing Chains, Removing From Camshafts
 Courtesy of AUDI OF AMERICA, LLC

Special tools and workshop equipment required

- Torque Wrench 40-200 Nm V.A.G 1332
- Open Ring Spanner Insert, AF 24 mm V.A.G 1332/9
- Multipoint Socket T10035
- Counterhold Tool Touareg V10 T10172
- Socket T40058
- Locking Pin T40069

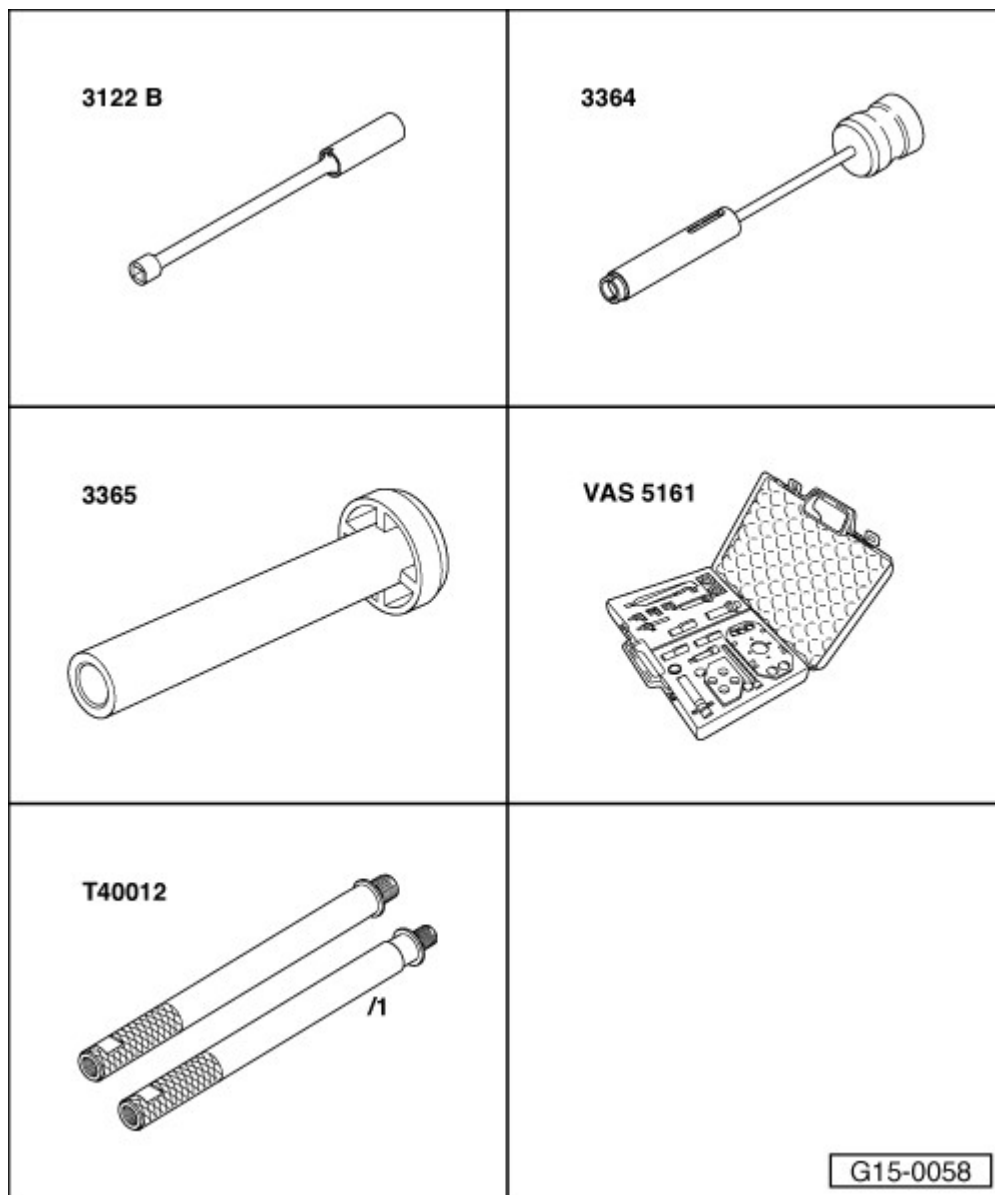


Fig. 205: Identifying Special Tools - Valve
Courtesy of AUDI OF AMERICA, LLC

Special tools and workshop equipment required

- Spark Plug Removal Tool 3122 B
- Valve Seal Removal Tool 3364
- Valve Stem Seal Driver 3365
- Valve Couters Asm/Dis-Asm Device VAS 5161 with Guide Plate for FSI Engine VAS 5161/19B
- Adapter T40012

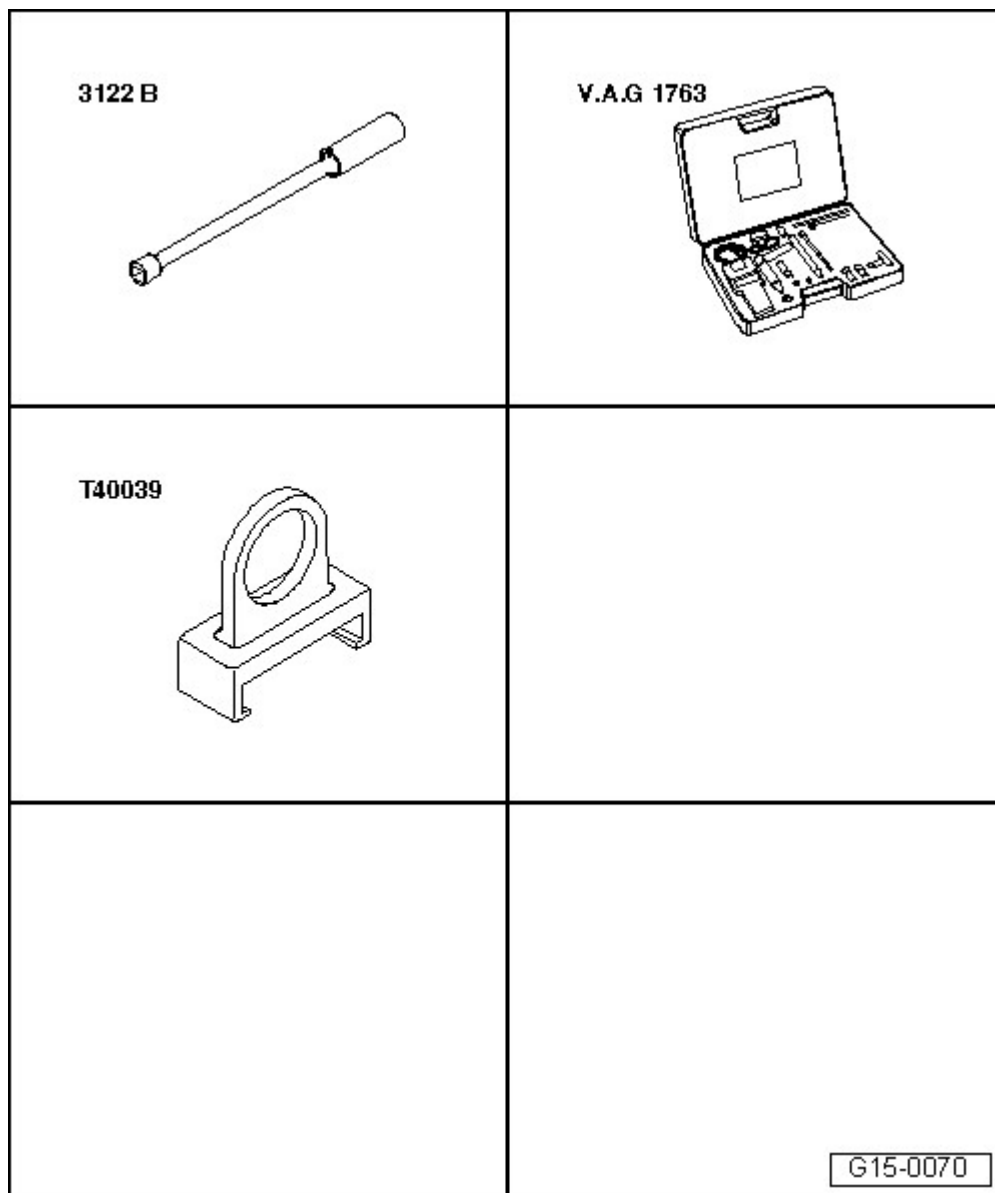


Fig. 206: Identifying Special Tools - Pressures, Checking
 Courtesy of AUDI OF AMERICA, LLC

Special tools and workshop equipment required

- Spark Plug Removal Tool 3122 B
- Compression Tester V.A.G 1763
- Ignition Coil Puller T40039

Special tools and workshop equipment required

- Spanner Wrench 3212

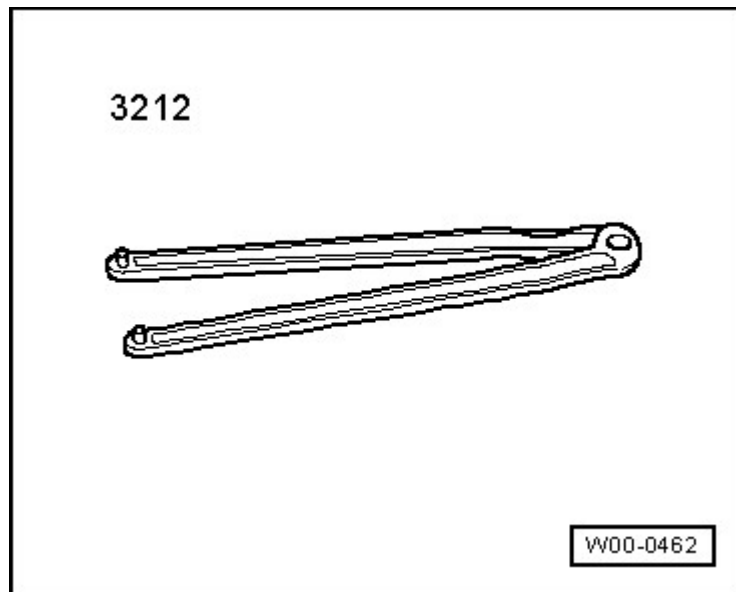


Fig. 207: Identifying Spanner Wrench 3212
Courtesy of AUDI OF AMERICA, LLC

- Impact Puller T10133/3 from the Tool Set T10133

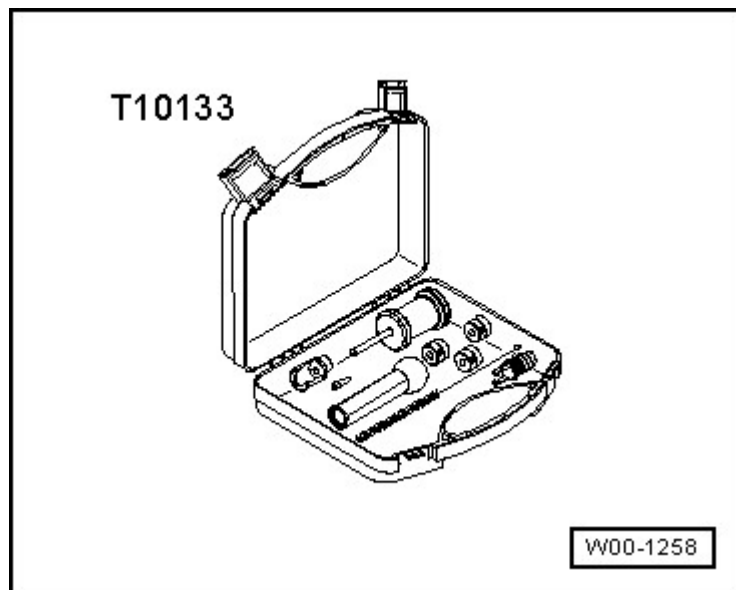


Fig. 208: Identifying Impact Puller T10133/3 from the Tool Set T10133
Courtesy of AUDI OF AMERICA, LLC

- Key T40049

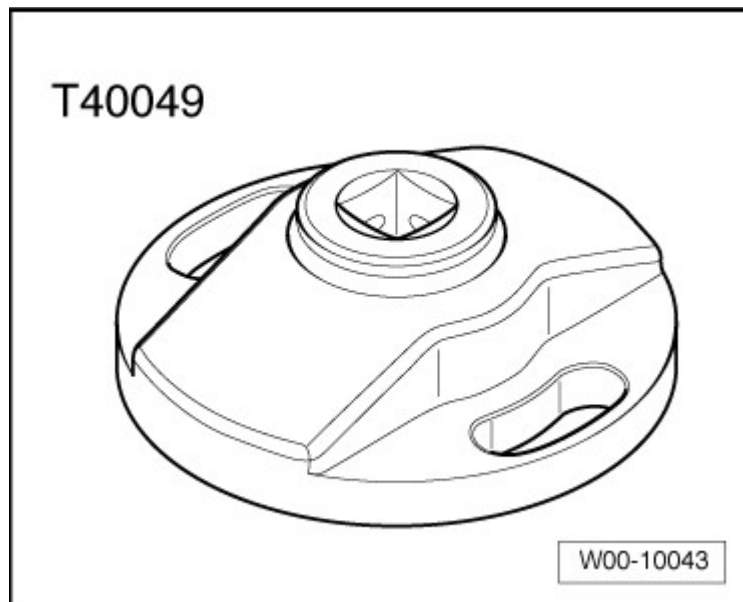


Fig. 209: Identifying Key T40049
Courtesy of AUDI OF AMERICA, LLC

- Locking Pin T40071, quantity: 2

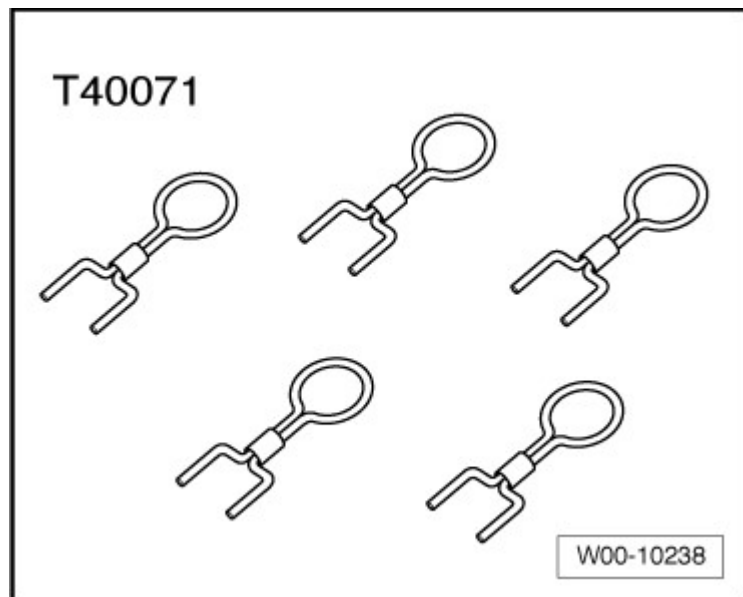


Fig. 210: Identifying Securing Pin T40071
Courtesy of AUDI OF AMERICA, LLC

- Locating Pins T40116

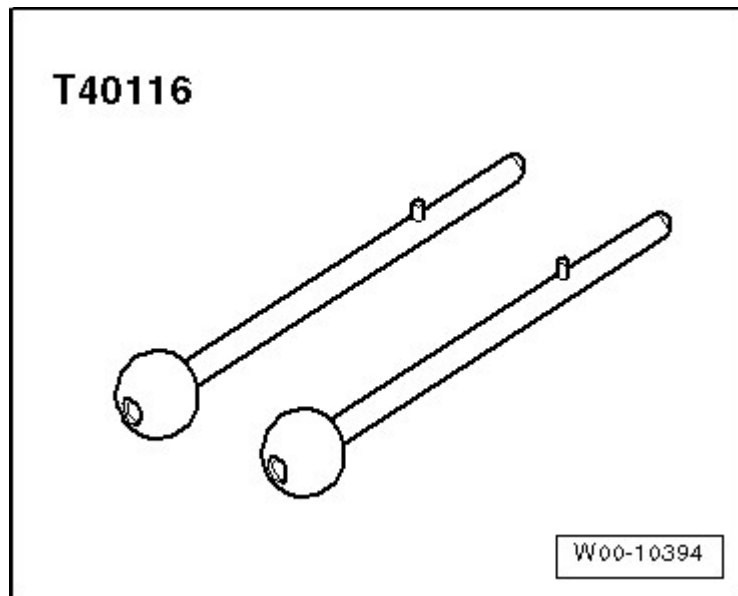


Fig. 211: Identifying Securing Pins
Courtesy of AUDI OF AMERICA, LLC

- Camshaft Clamp T40133, quantity: 2

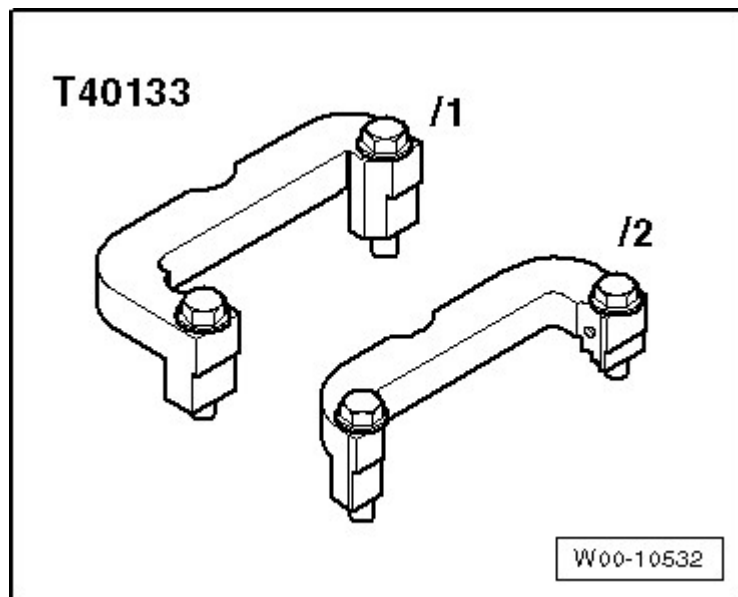


Fig. 212: Identifying Camshaft Clamp T40133
Courtesy of AUDI OF AMERICA, LLC

- Oil Collecting and Extracting Device V.A.G 1782

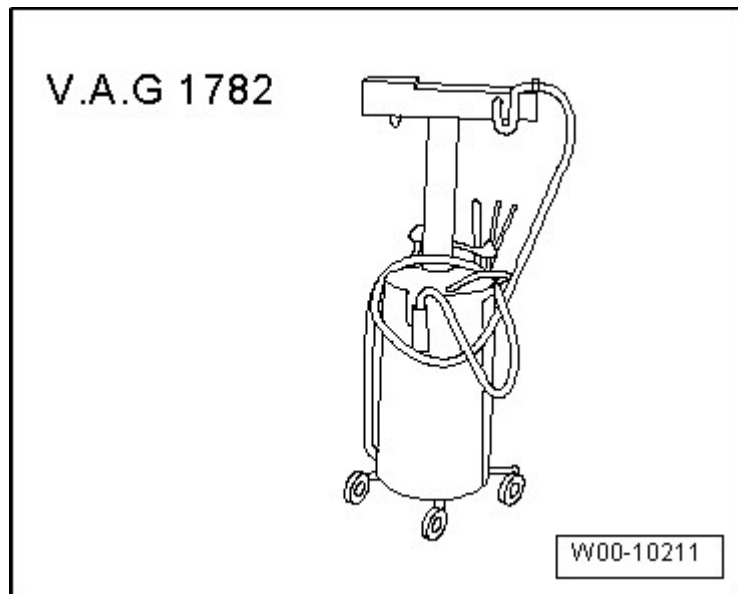


Fig. 213: Identifying Oil Collecting And Extracting Device V.A.G 1782
Courtesy of AUDI OF AMERICA, LLC

- Dial Gauge 0-10 mm VAS 6079

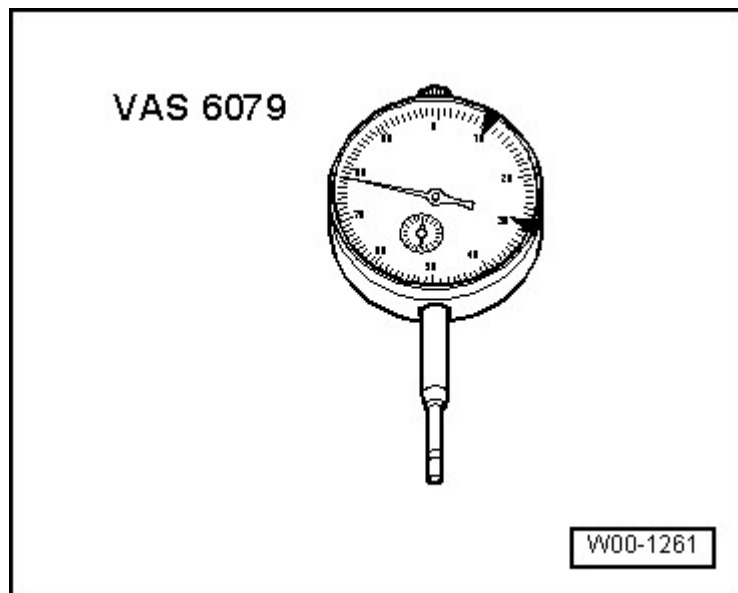


Fig. 214: Identifying Dial Gauge 0-10 mm VAS 6079
Courtesy of AUDI OF AMERICA, LLC

- Dial Gauge 0-3 mm VAS 6080

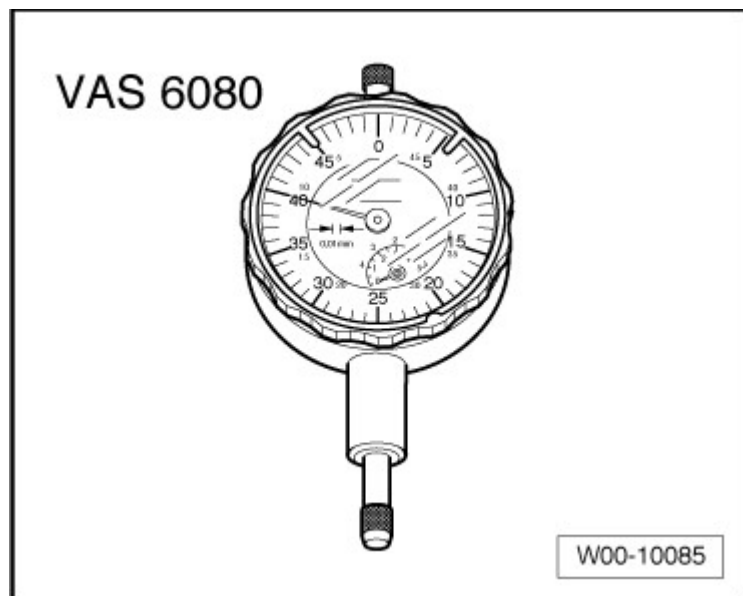


Fig. 215: Identifying Dial Gauge VAS 6080
Courtesy of AUDI OF AMERICA, LLC

- Engine and Transmission Holder VAS 6095

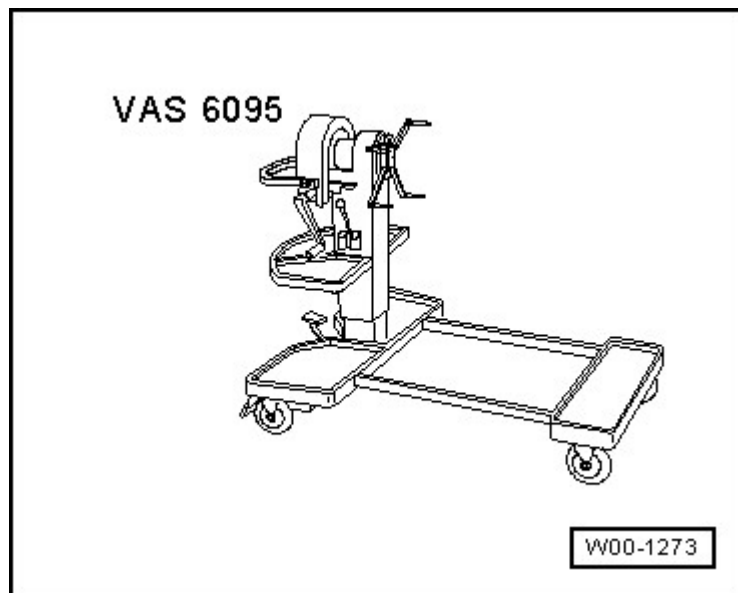


Fig. 216: Identifying Engine And Transmission Holder VAS 6095
Courtesy of AUDI OF AMERICA, LLC

- Dial Gauge Holder VW 387

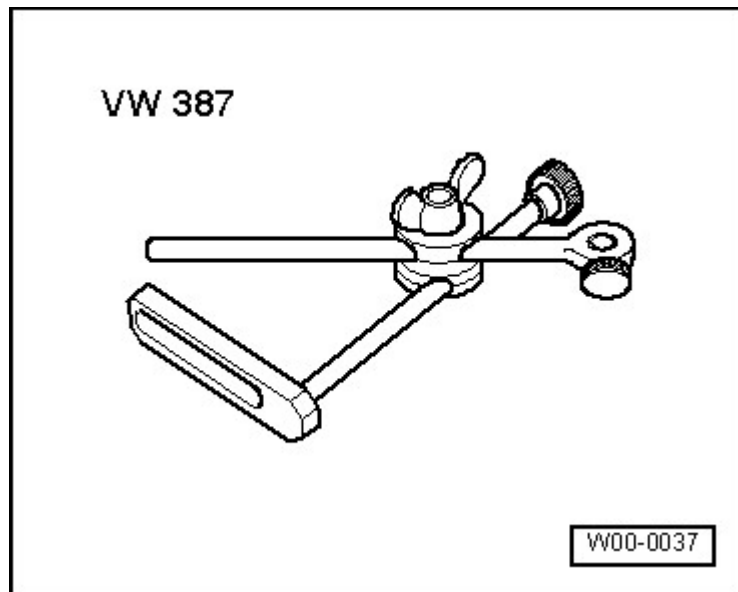


Fig. 217: Dial Gauge Holder VW 387
Courtesy of AUDI OF AMERICA, LLC

- Not illustrated:
- Adapter T10172/2
- Drift VAS 5161/3
- Pressure Fork VAS 5161/2
- Installation Fork VAS 5161/5
- Engaging Device VAS 5161/6
- Installation Cartridge VAS 5161/8
- Knurled Screws VAS 5161/12
- Valve Retainer Inserting Tool VAS 5161/18 Cylinder Head Tensioning Device VAS 6419

ENGINE

3.2 Liter - Engine Assembly - Engine Code(s): CALB

10 ENGINE ASSEMBLY

DESCRIPTION AND OPERATION

SUBFRAME MOUNT OVERVIEW

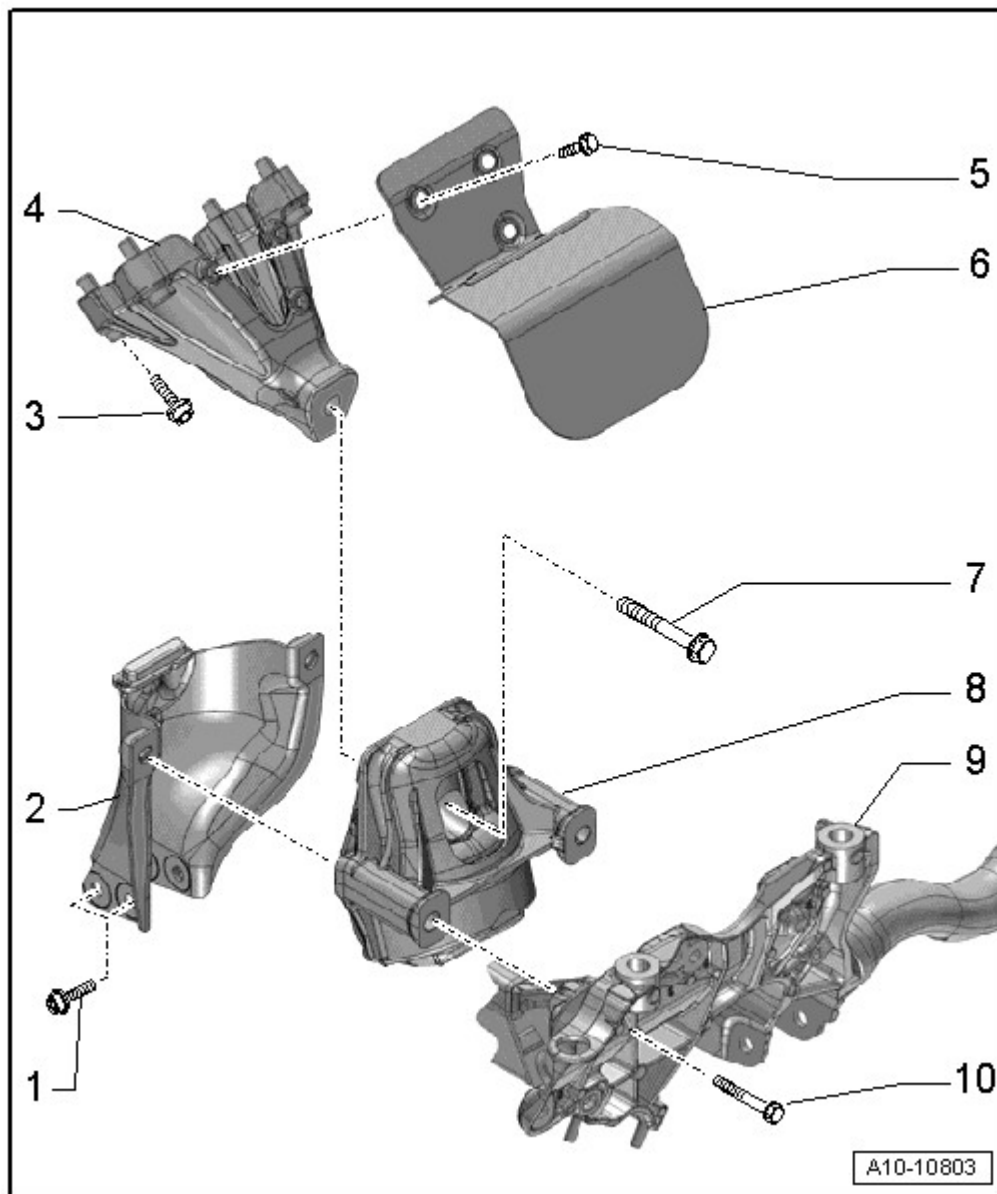


Fig. 1: Identifying Subframe Mount Assembly Overview
Courtesy of AUDI OF AMERICA, LLC

1. Bolt
 - 20 Nm
2. Retaining Plate
 - For the engine mount
 - If the engine mount is faulty, replace the retaining plate
 - Check the retaining plate on the opposite side; replace if necessary
3. Bolt
 - 40 Nm
4. Engine Support
5. Bolt
 - 10 Nm
6. Heat Shield
7. Bolt
 - Replace
 - 90 Nm plus an additional 90° turn
8. Engine Mount
 - Removing and installing, refer to **LEFT ENGINE MOUNT**, **RIGHT ENGINE MOUNT**
 - Replace in pairs
9. Subframe
10. Bolt
 - 55 Nm

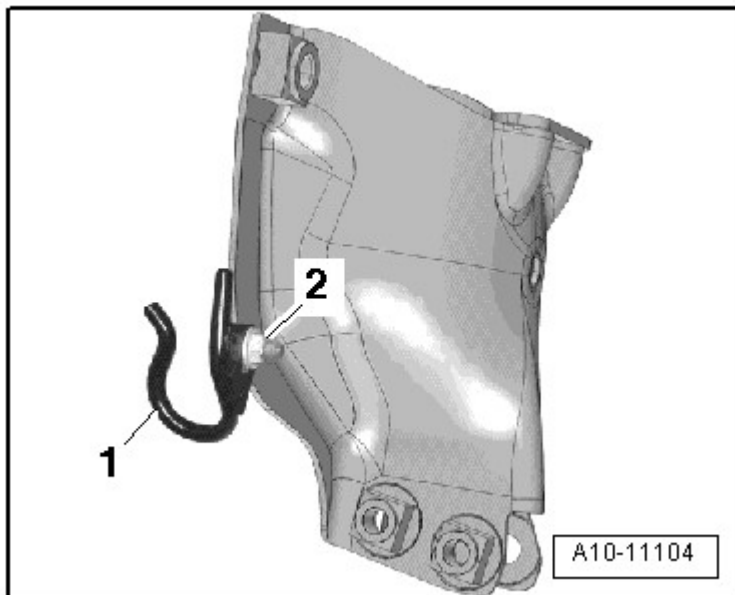


Fig. 2: Identifying Hydraulic Oil Hose Bracket -1- & Nut -2-
Courtesy of AUDI OF AMERICA, LLC

2009 Audi Q5 Quattro

ENGINE 3.2 Liter - Engine Assembly - Engine Code(s): CALB

-- Tighten the nut -2- for the hydraulic oil hose bracket -1- to 9 Nm.

SPECIFICATIONS

FASTENER TIGHTENING SPECIFICATIONS

Component	Bolt Size	Nm
Engine Mount ¹	-	90 + 90°
Engine Support	-	40
Heat Shield	-	10
Retaining Plate for the Engine Mount	-	20
Subframe	-	55
Bolts and Nuts		
	M6	9
	M7	15
	M8	20
	M10	40
	M12	65
• ¹ Replace		

Hydraulic Oil Hose Bracket - Tightening Specification

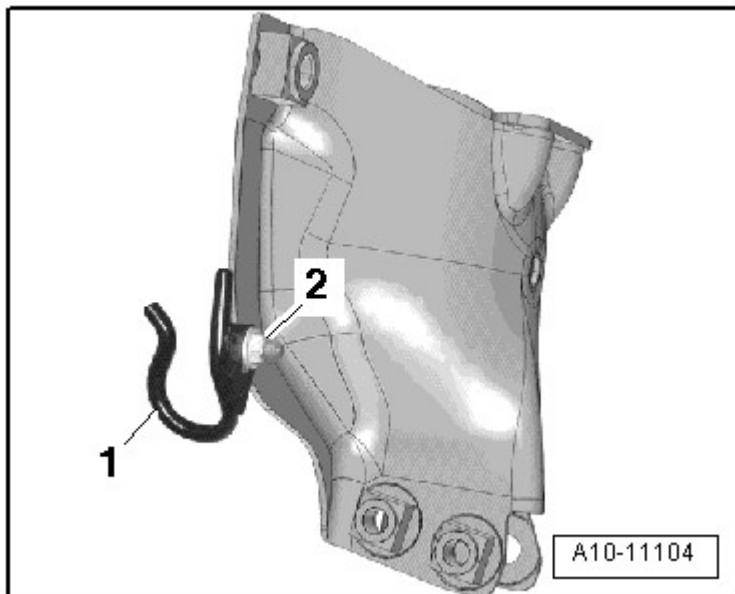
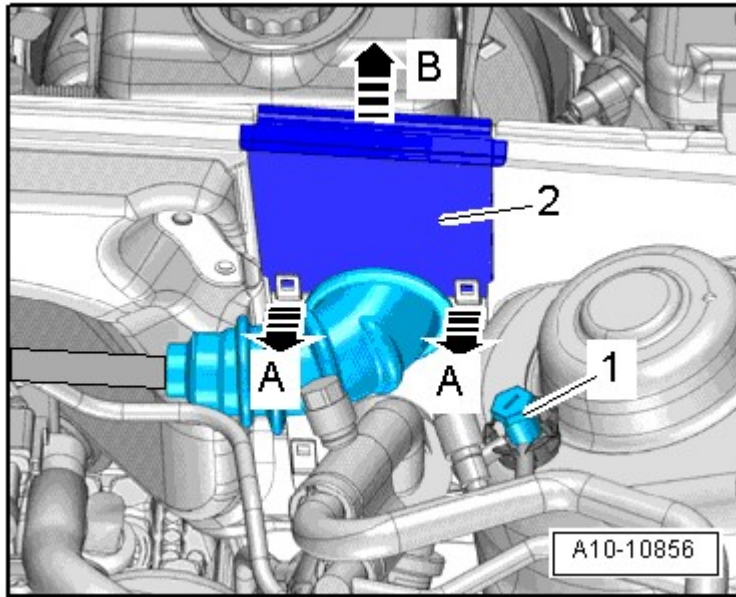


Fig. 3: Identifying Hydraulic Oil Hose Bracket -1- & Nut -2-
Courtesy of AUDI OF AMERICA, LLC

-- Tighten the nut -2- for the hydraulic oil hose bracket -1- to 9 Nm.

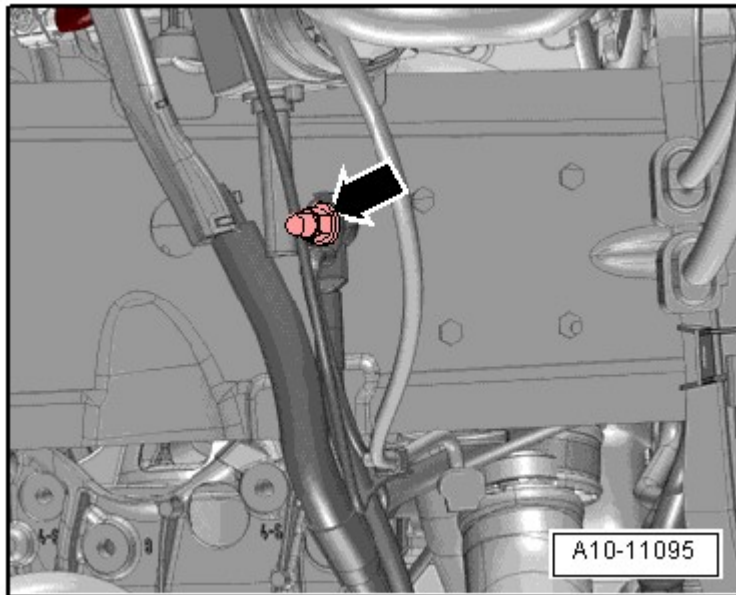
Ground (GND) Bolt to Strut Tower - Tightening Specification



**Fig. 4: Releasing Retainers -A Arrows- & Remove Wiring Bushing -2- Upward -Arrow B-
Courtesy of AUDI OF AMERICA, LLC**

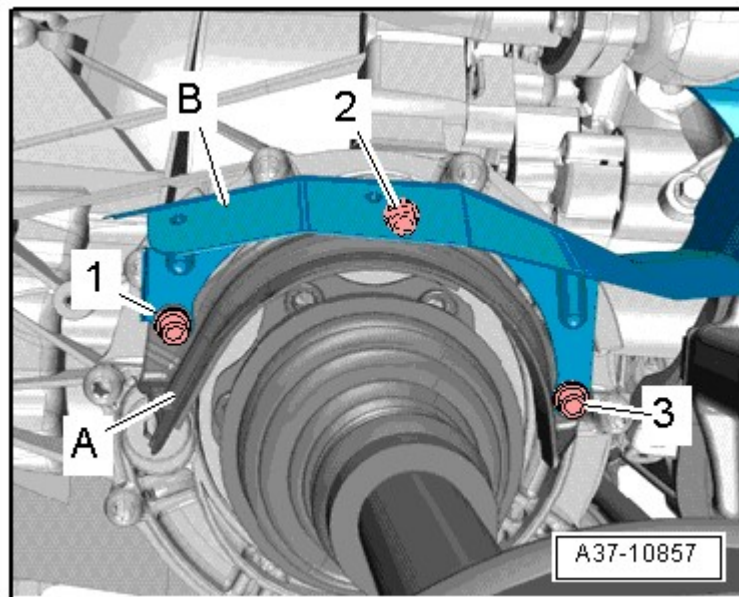
-- Tighten the GND bolt -1- to 9 Nm.

Ground (GND) Wire to Longitudinal Member - Tightening Specification



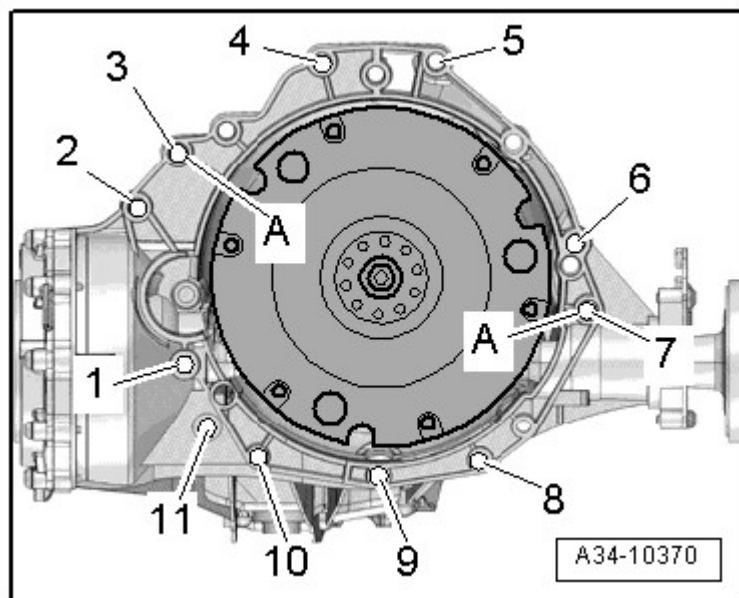
**Fig. 5: Ground (GND) Wire to Longitudinal Member - Tightening Specification
Courtesy of AUDI OF AMERICA, LLC**

-- Tighten the nut -arrow- to 9 Nm.

Drive Axle Heat Shield - Tightening Specification**Fig. 6: Identifying Heat Shield**

Courtesy of AUDI OF AMERICA, LLC

-- Tighten the bolts -1, 2 and 3- to 23 Nm.

Engine to Automatic Transmission 0B6**Fig. 7: Engine To Transmission Bolts**

Courtesy of AUDI OF AMERICA, LLC

2009 Audi Q5 Quattro

ENGINE 3.2 Liter - Engine Assembly - Engine Code(s): CALB

Item	Bolt	Nm
1	M10 x 50 ¹⁾	65
2 to 6	M12 x 100 ²⁾	30 + 90°
7	M12 x 125 ²⁾	30 + 90°
8, 11	M10 x 60 ²⁾	15 + 90°
9	M10 x 75 ²⁾	15 + 90°
10	M10 x 95 ²⁾	15 + 90°
A	Alignment sleeves for centering	
• ¹⁾ Bolt class 10.9, the steel bolt may be used again unlimited number of times. • ²⁾ The aluminum bolts can be used 2 times ENGINE, INSTALLING.		

REMOVAL AND INSTALLATION

ENGINE, REMOVING

Special tools and workshop equipment required

- Oil collecting and Extracting Device V.A.G 1782
- Hose Clip Pliers V.A.G 1921
- Step Ladder VAS 5085
- Scissor-Type Assembly Platform VAS 6131 A with Support Set VAS 6131/10 and Supplementary Set, Audi A8 VAS 6131/11 and Supplementary Set, Audi Q7 VAS 6131/13
- Drip Tray VAS 6208
- Pry Lever - Rmv Outside Mirror 80 - 200
- Engine Bung Set VAS 6122
- Counterhold Tool Touareg V10 T10172 with Adapter T10172/5

NOTE: With the lock carrier installed, the engine is removed downward together with the transmission and the subframe.

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

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

Procedure

WARNING: Risk of vehicle tipping over with the engine removed.

- Secure vehicle. Luggage compartment must be empty for this.

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

- Reduce the fuel pressure down to residual pressure before opening high pressure area of the fuel injection system.

-- Reduce fuel pressure in high pressure area. Refer to General Information .

CAUTION: Risk of destroying electrical components.

- Observe measures for disconnecting battery.

-- Position the front wheels so they are straight.

NOTE: Release the electrical parking brake before disconnecting the battery so the drive axle can be rotated to remove it.

-- Turn off the ignition and remove the ignition key.

-- Remove the luggage compartment cargo floor -3-.

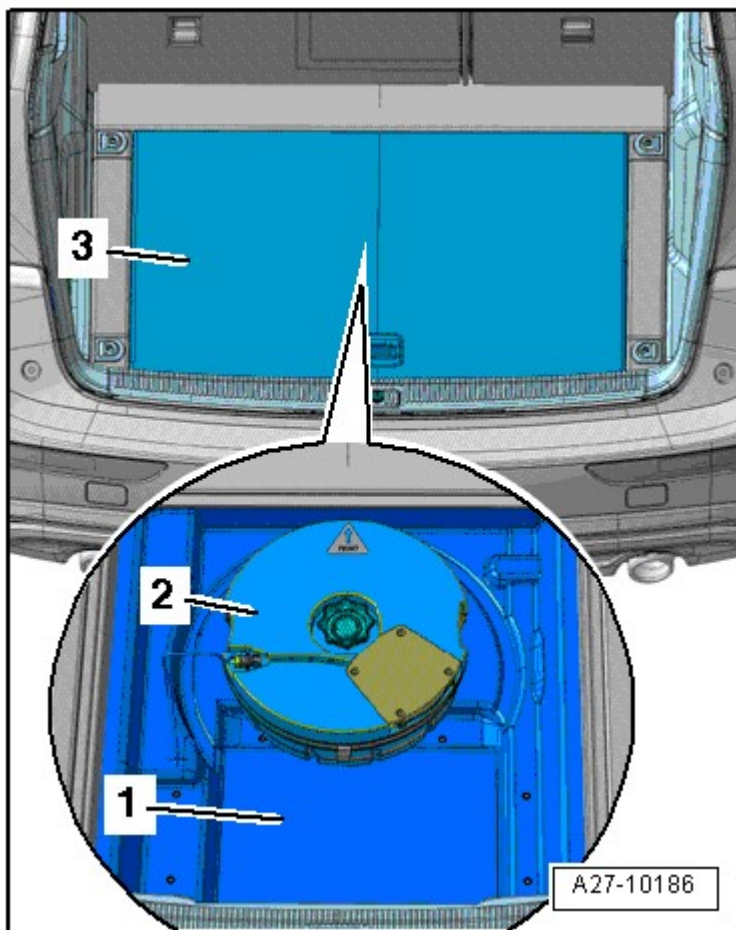


Fig. 8: Removing Luggage Compartment Cargo Floor

Courtesy of AUDI OF AMERICA, LLC

- Remove the bass box -2-. Refer to **Removal and Installation** if applicable.
- Fold back the carpet -1- over the flap.
- Press the release tabs -arrows- and open the flap -1-.

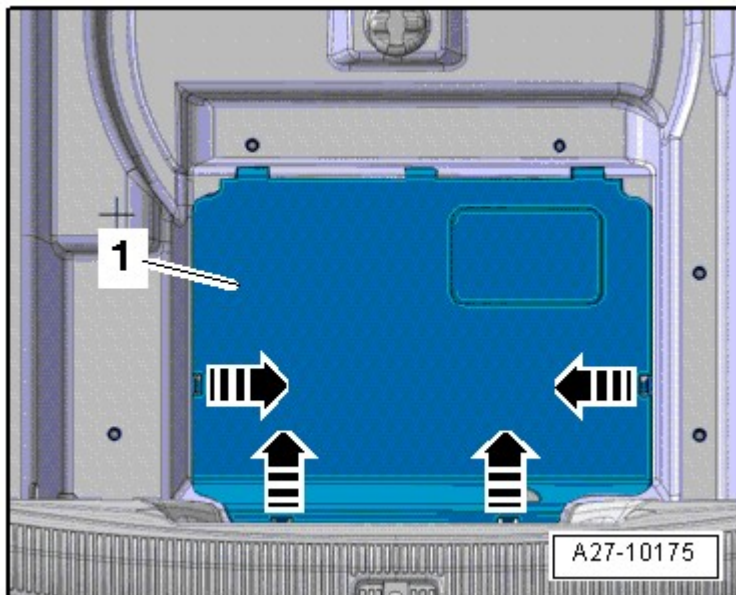


Fig. 9: Pressing Release Tabs And Open Flap
Courtesy of AUDI OF AMERICA, LLC

- Open the cover -1- over the battery Ground (GND) terminal post.

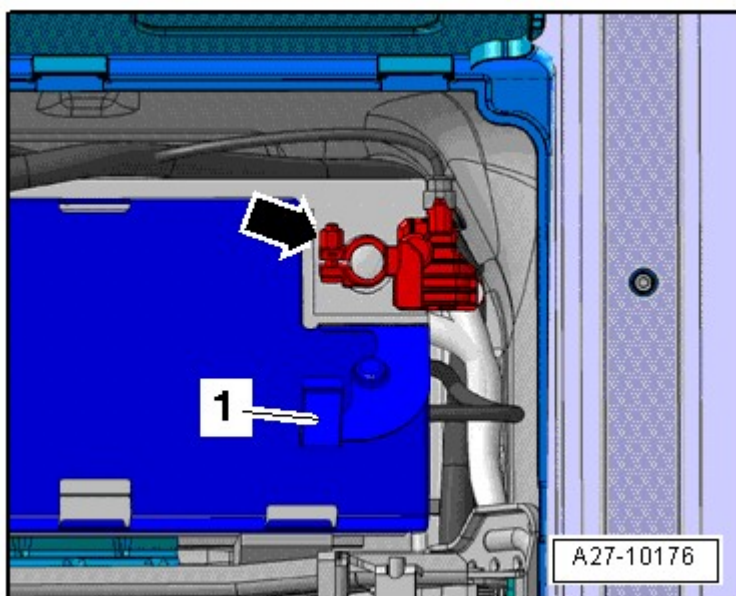


Fig. 10: Opening Cover Over Battery Ground (GND) Terminal Post
Courtesy of AUDI OF AMERICA, LLC

- Disconnect the GND wire -arrow- from the battery terminal. Refer to **Removal and Installation** .
- Empty coolant circuit. Refer to **Description and Operation** .
- Extract the power steering oil from the reservoir with the V.A.G 1782.
- Remove the engine covers -arrows-.

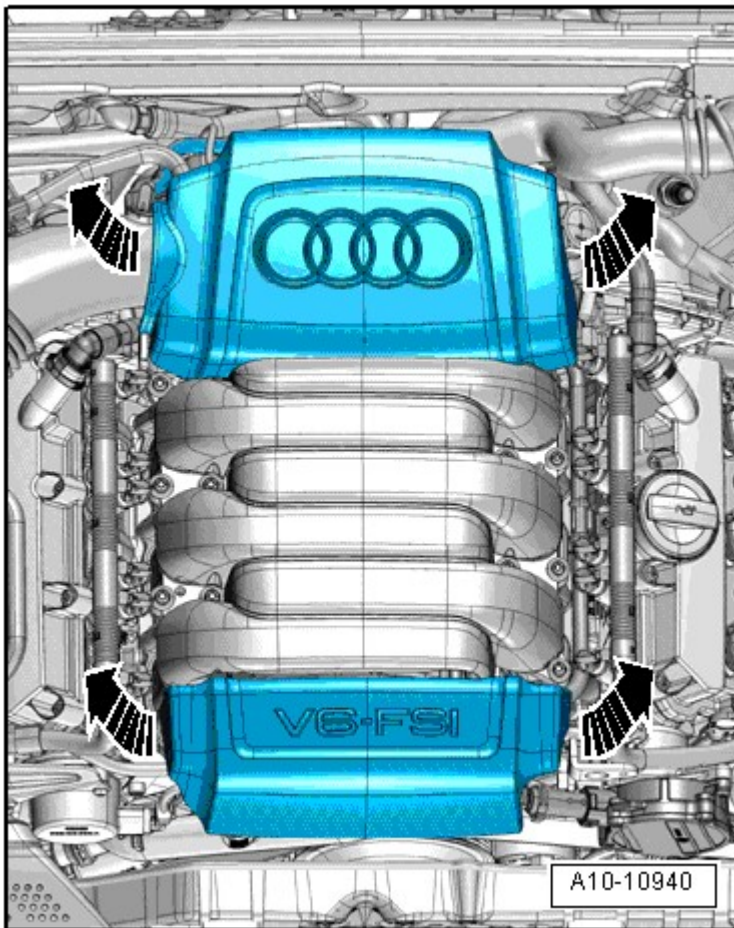


Fig. 11: Identifying Engine Cover
Courtesy of AUDI OF AMERICA, LLC

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

- The coolant system is under pressure when the engine is warm.
- Cover the coolant reservoir cap with a cloth and then open it slowly to release the pressure in the system.

- Open the coolant reservoir cap.
- Remove the left and right front wheels.
- Remove left and right front wheel housing liners. Refer to **Removal and Installation** .
- Remove the noise insulation -1 and 2-. Refer to **Removal and Installation** .

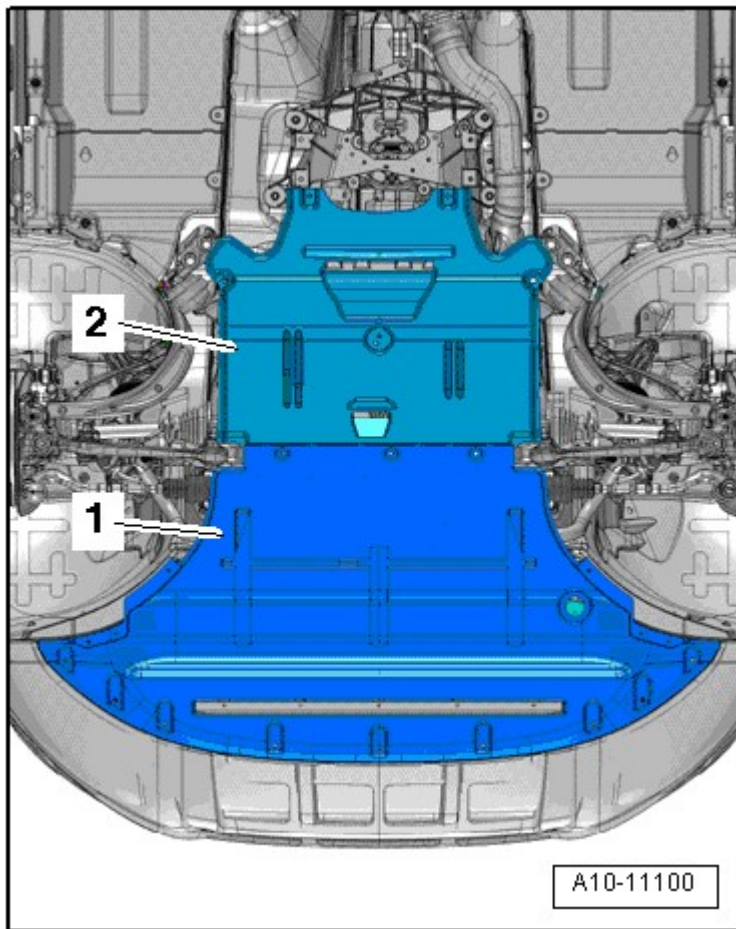


Fig. 12: Identifying Noise Insulation
Courtesy of AUDI OF AMERICA, LLC

- Place the VAS 6208 under the engine.
- Remove the drain plug -1- and drain the coolant.

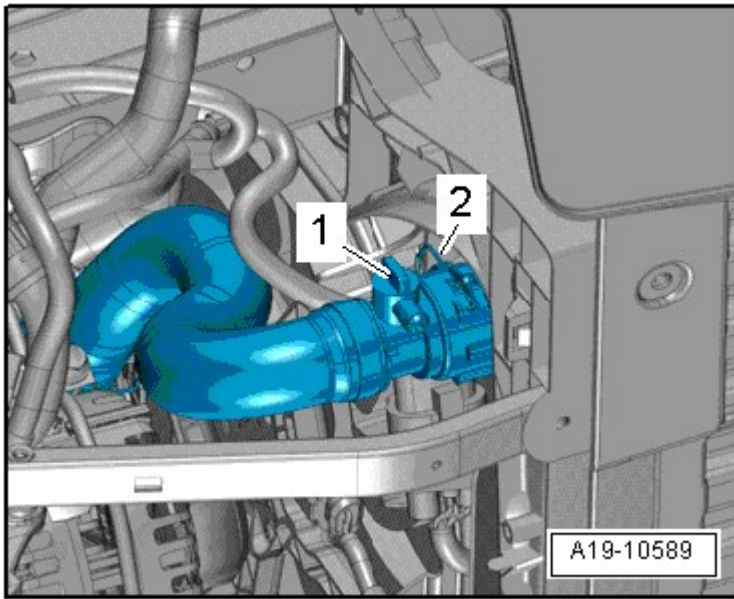


Fig. 13: Identifying Drain Plug And Draining Coolant
Courtesy of AUDI OF AMERICA, LLC

-- Remove the coolant hose -2- from the radiator by raising the retaining clip.

-- Remove the coolant hose from the engine oil cooler by loosening the hose clamp -arrow- and letting the remaining coolant drain out.

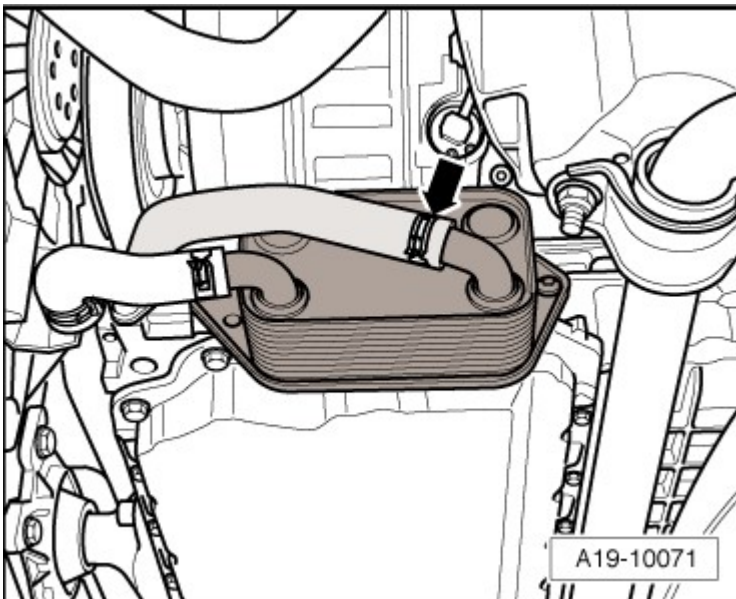


Fig. 14: Disconnecting Coolant Hose From Oil Cooler
Courtesy of AUDI OF AMERICA, LLC

-- Place the V.A.G 1782 under the disconnection point.

-- Disconnect the power steering hydraulic oil supply line -2- and return line -1- in the left front wheel housing and free them up.

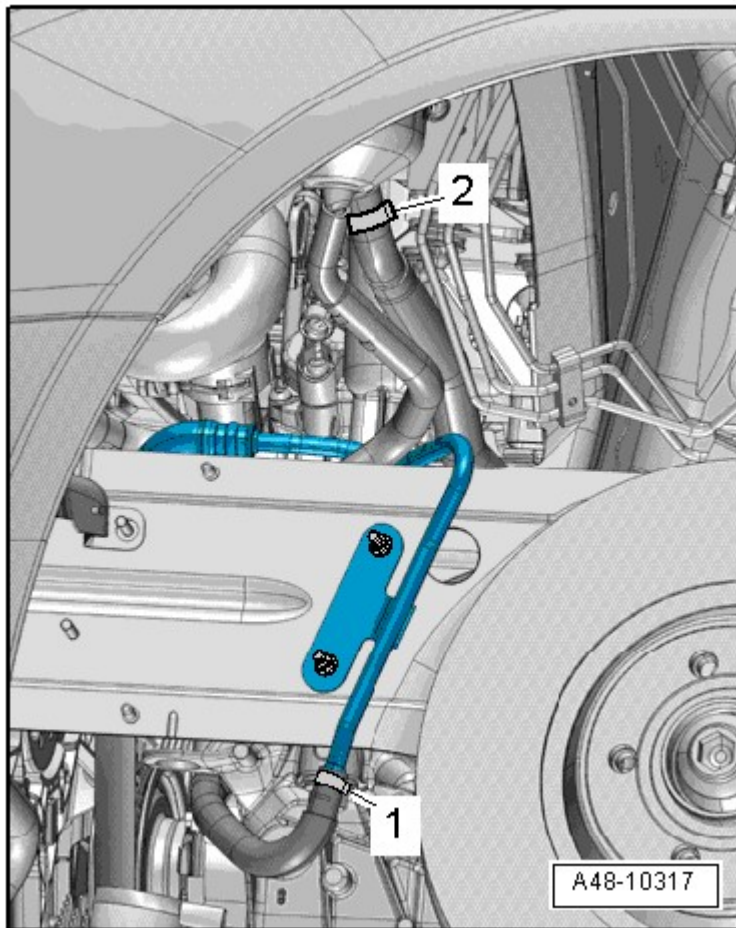


Fig. 15: Disconnecting Power Steering Hydraulic Oil Supply Line
Courtesy of AUDI OF AMERICA, LLC

- Seal any open lines and connections with a clean plug from the VAS 6122.
- Place the V.A.G 1782 under the disconnection point.
- Mark the locations of the ATF lines -1 and 2- so they can be installed later and then disconnect them.

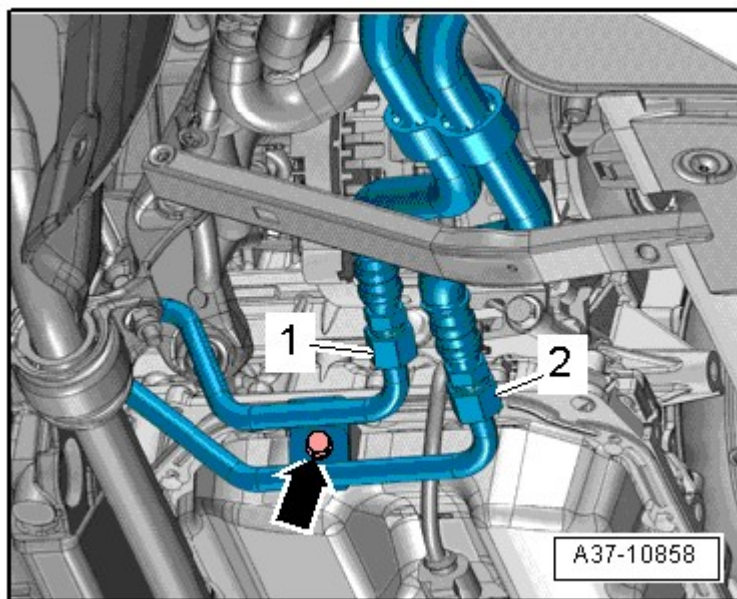


Fig. 16: Identifying ATF Lines -1 & 2-
Courtesy of AUDI OF AMERICA, LLC

NOTE: Ignore -arrow-.

-- Seal any open lines and connections with a clean plug from the VAS 6122.

Vehicles with a Coolant Recirculation Pump -V50-.

-- Disconnect the connector -1-.

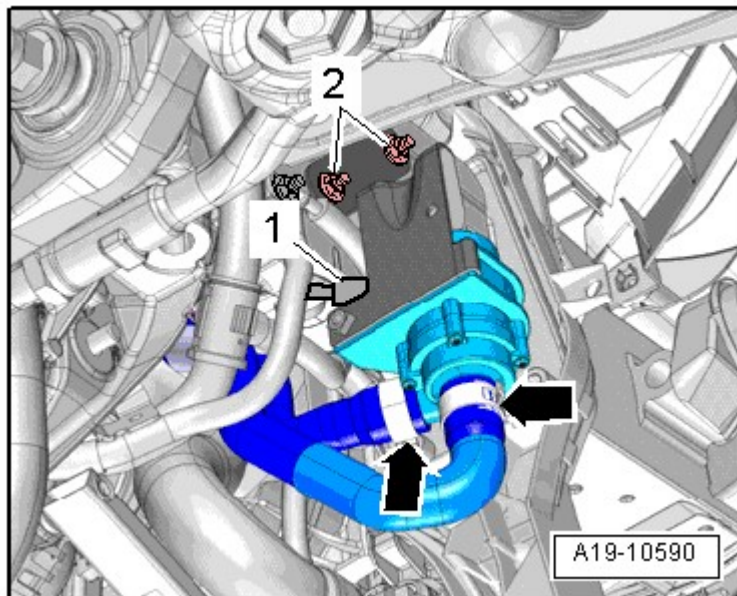


Fig. 17: Disconnecting Electrical Connector -1-

Courtesy of AUDI OF AMERICA, LLC

-- Place the VAS 6208 under the engine.

-- Remove the coolant hose from the coolant recirculation pump -right arrow-.

NOTE: Ignore -2- and -left arrow-.

All Vehicles

-- Disconnect the coolant fan electrical connector -1- by sliding the retainer back -arrow- and pressing the release down.

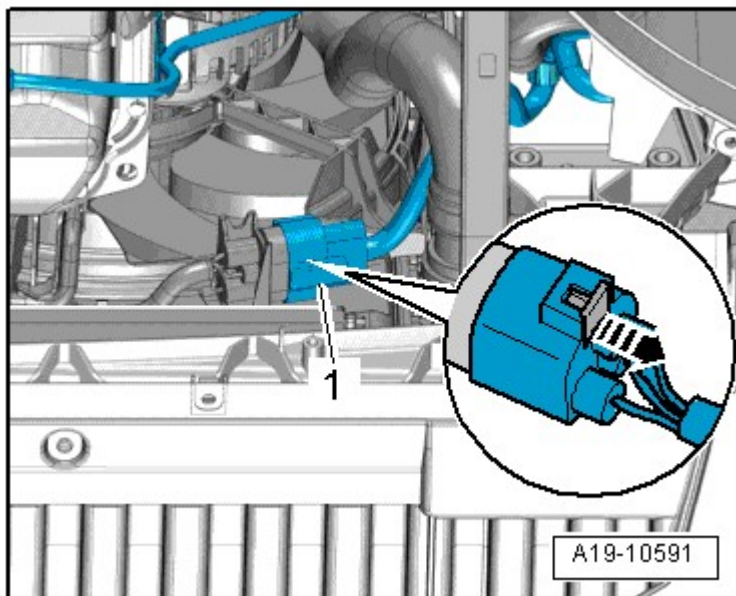


Fig. 18: Identifying Coolant Fan Electrical Connector
Courtesy of AUDI OF AMERICA, LLC

-- Free up electrical wiring harness.

-- Disconnect electrical connector -3- at Secondary Air Injection (AIR) pump motor -V101- and free up the electrical wiring.

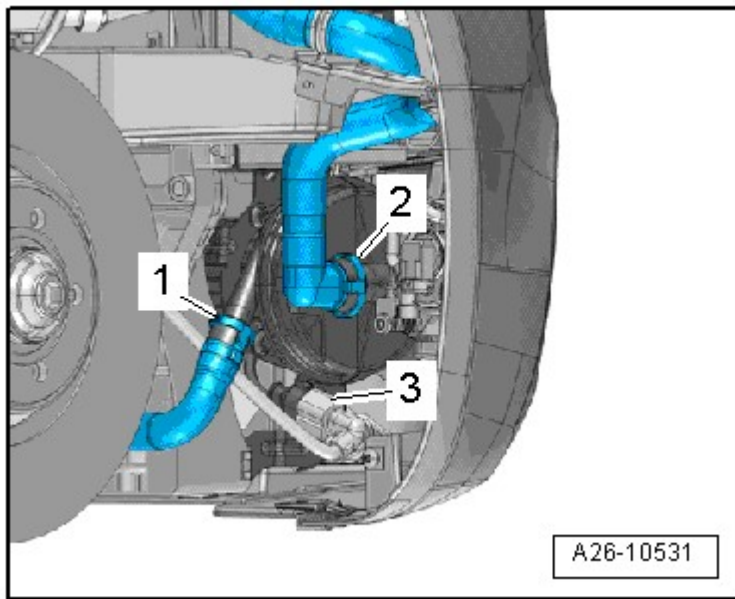


Fig. 19: Component Location Of Secondary Air Injection (AIR) Pump Motor -V101-
Courtesy of AUDI OF AMERICA, LLC

NOTE: Ignore -1 and 2-.

-- Remove the left and right bolt -1- and nut -3- and the lock carrier brace -2-.

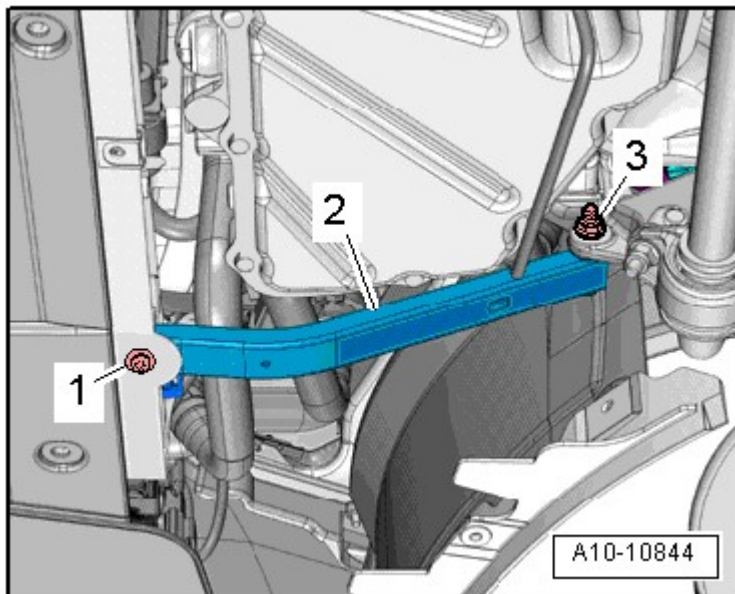


Fig. 20: Identifying Carrier Left Brace Components
Courtesy of AUDI OF AMERICA, LLC

-- Remove the nut -arrow- on the right longitudinal member and free up the Ground (GND) wire.

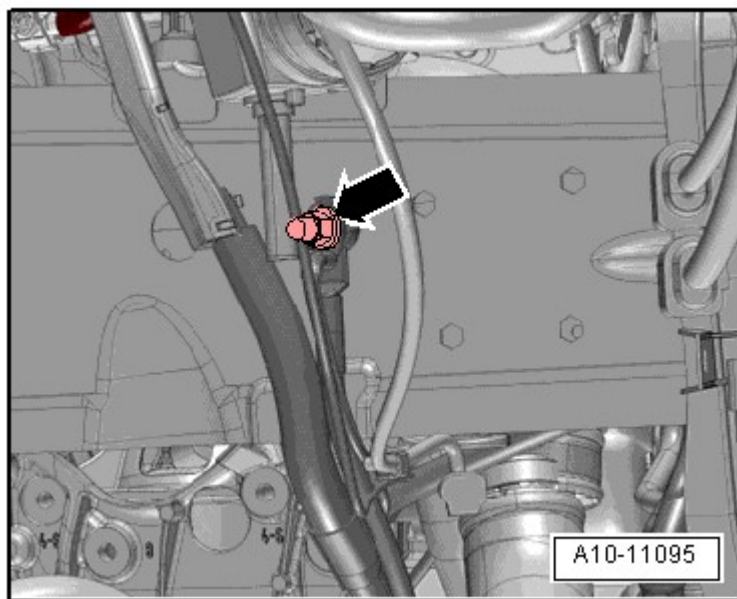


Fig. 21: Ground (GND) Wire to Longitudinal Member - Tightening Specification
 Courtesy of AUDI OF AMERICA, LLC

-- Remove the bolts -1- and nuts -2- and -arrow- and remove the strut tower brace.

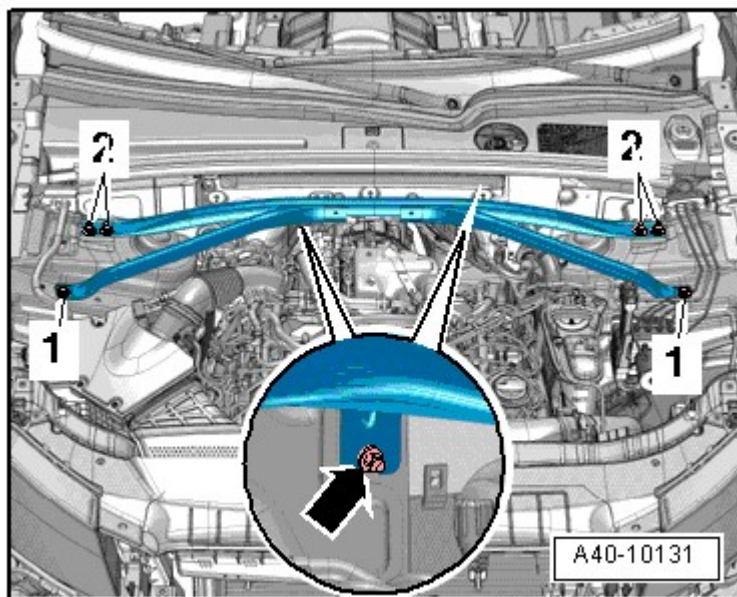


Fig. 22: Removing Strut Tower Brace Bolts
 Courtesy of AUDI OF AMERICA, LLC

-- Remove gasket -3-.

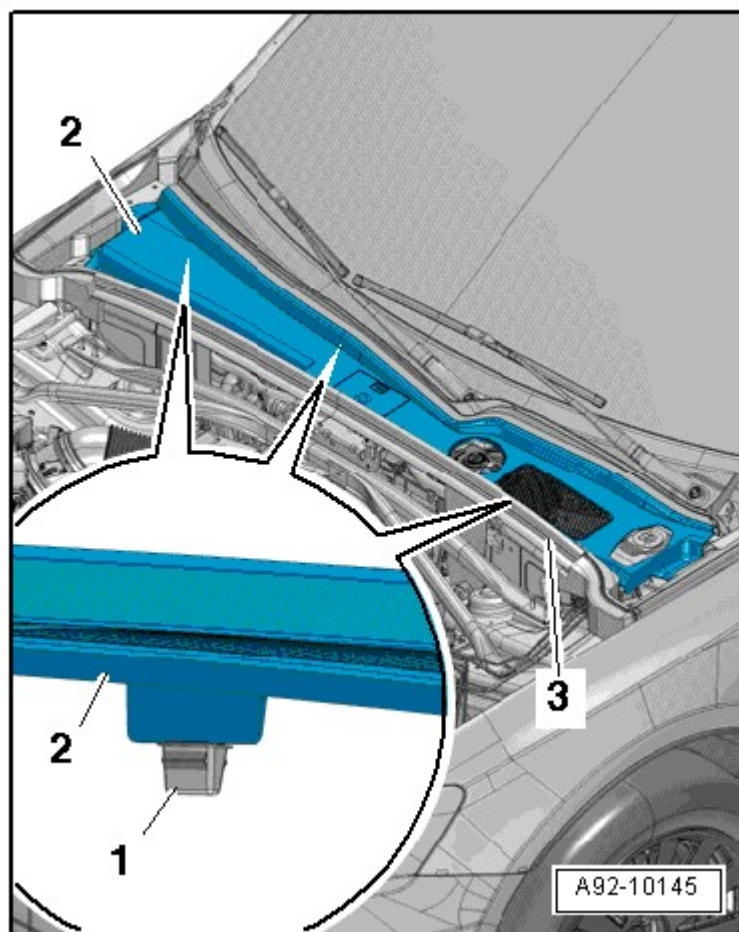


Fig. 23: Identifying Plenum Chamber Cover -2- & Clips -1-
 Courtesy of AUDI OF AMERICA, LLC

- Open the clips -1- and remove the plenum chamber cover -2-.
- Disconnect the vacuum hose -arrow- to the leak detection pump -V144-.

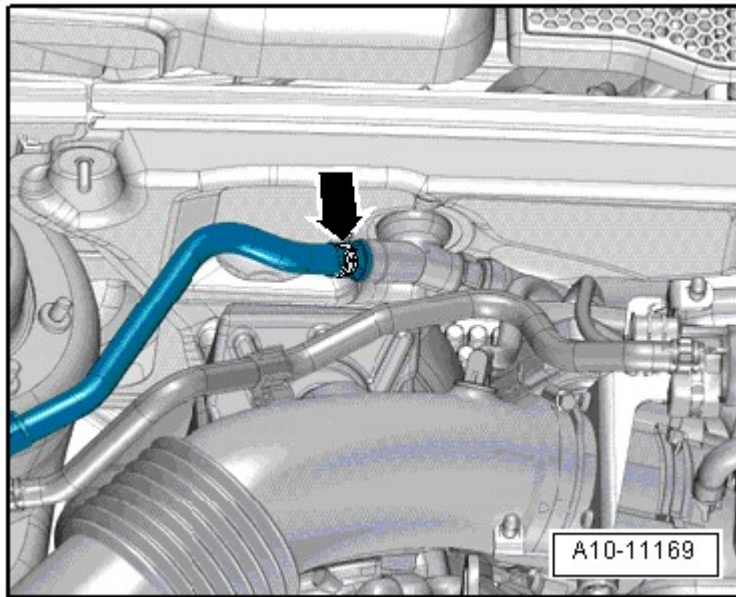


Fig. 24: Disconnecting Vacuum Hose
Courtesy of AUDI OF AMERICA, LLC

-- Remove the vacuum connection -2- from the bulkhead by pulling the vacuum hose -1- on the rear side.

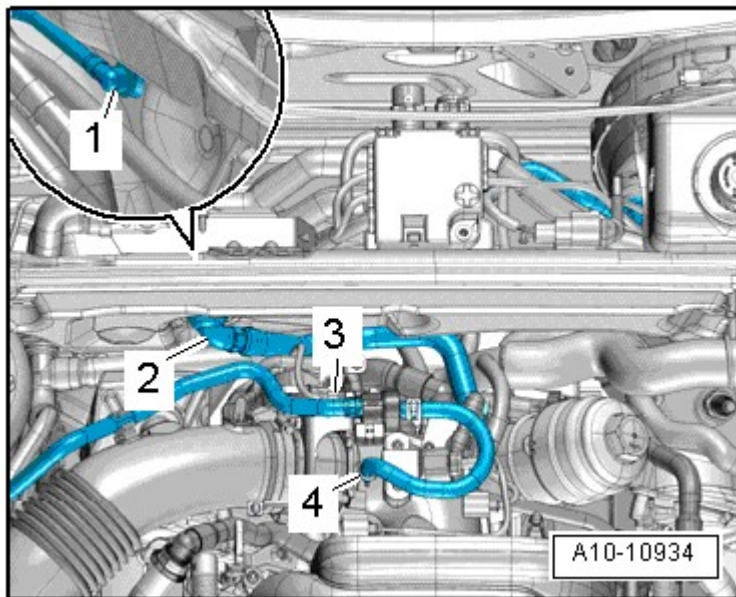


Fig. 25: Removing Vacuum Connection -2- From Bulkhead By Pulling Vacuum Hose -1-
Courtesy of AUDI OF AMERICA, LLC

-- Free up the fuel line and wire to the EVAP canister at the air guide pipe.

NOTE: Ignore -3 and 4-.

-- Remove the air duct -arrows-.

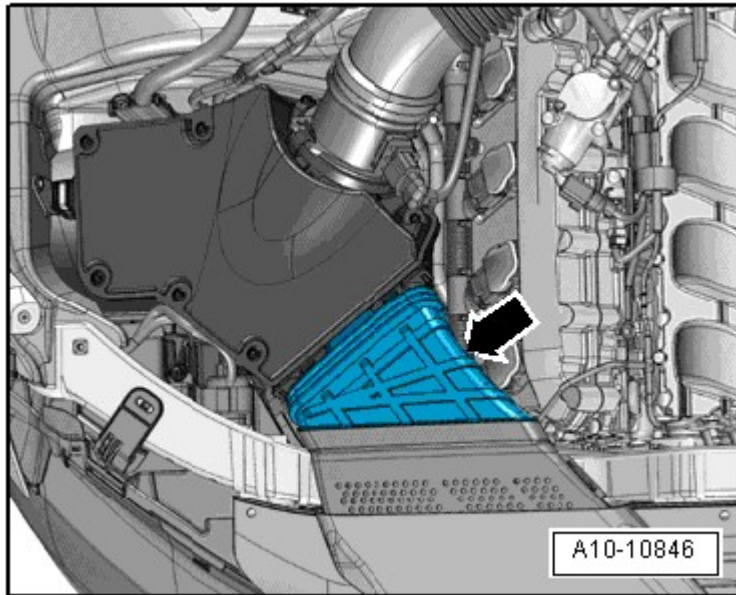


Fig. 26: Identifying Air Duct

Courtesy of AUDI OF AMERICA, LLC

-- Remove the vacuum hose -3- from the connection on the air guide pipe.

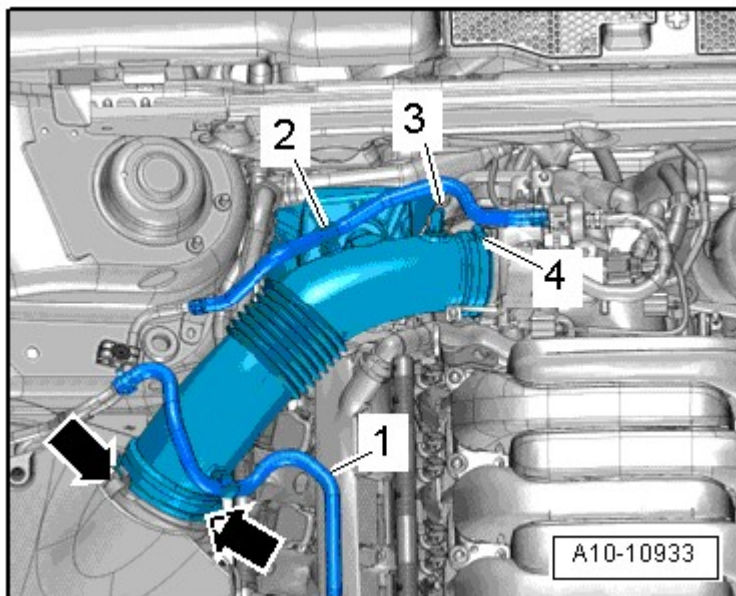


Fig. 27: Removing Air Guide Pipe By Loosening Hose Clamp -4- & Opening Clips -Arrows-

Courtesy of AUDI OF AMERICA, LLC

-- Remove the air guide pipe by loosening the hose clamp -4- and opening the clips -arrows-.

-- Free up the fuel hose -1- on the air duct pipe.

NOTE: Ignore -2-.

-- Press the release buttons, remove the air filter housing and remove the secondary air hose -arrow-.

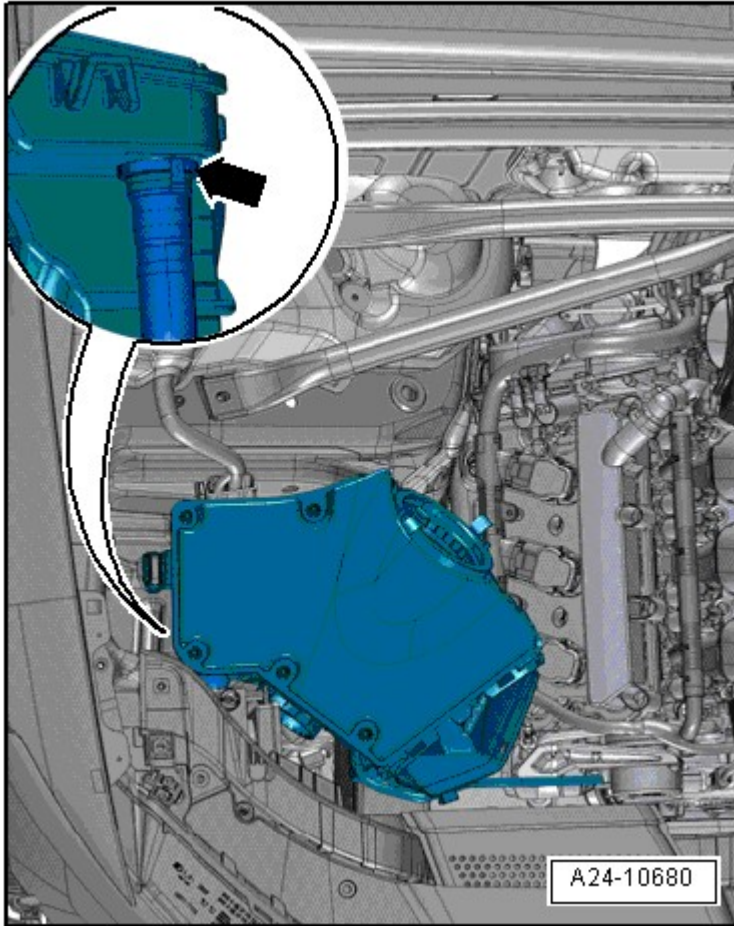


Fig. 28: Identifying Secondary Air Hose -Arrow-
Courtesy of AUDI OF AMERICA, LLC

WARNING: Risk of injury from fuel.

- To reduce fuel pressure, lay cloths around connecting point before opening fuel system and carefully loosen.

CAUTION: Risk of contamination to the fuel system.

- Note the rules of cleanliness for working on the fuel injection system. Refer to **CLEAN WORKING CONDITIONS** .

-- Remove the fuel supply line from the high pressure pump -arrow- and lay it aside.

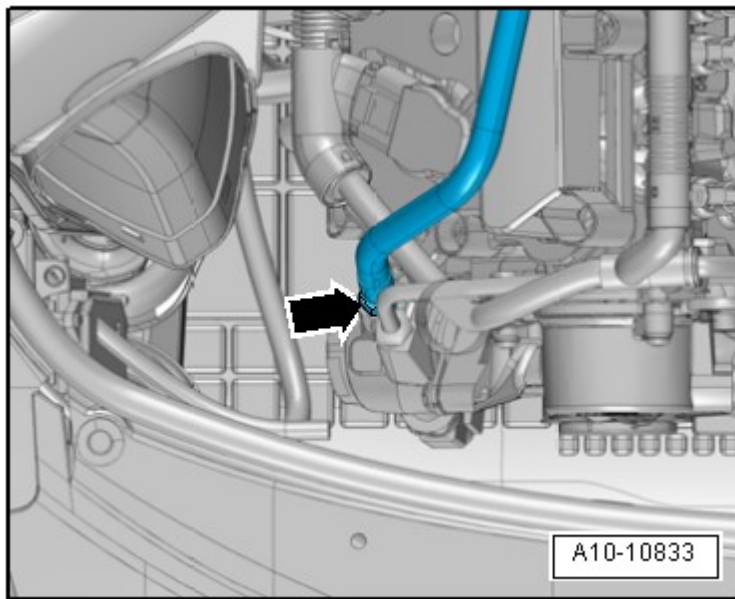


Fig. 29: Identifying Fuel Supply Hose
Courtesy of AUDI OF AMERICA, LLC

-- Disconnect the vacuum hose -1- and free it up.

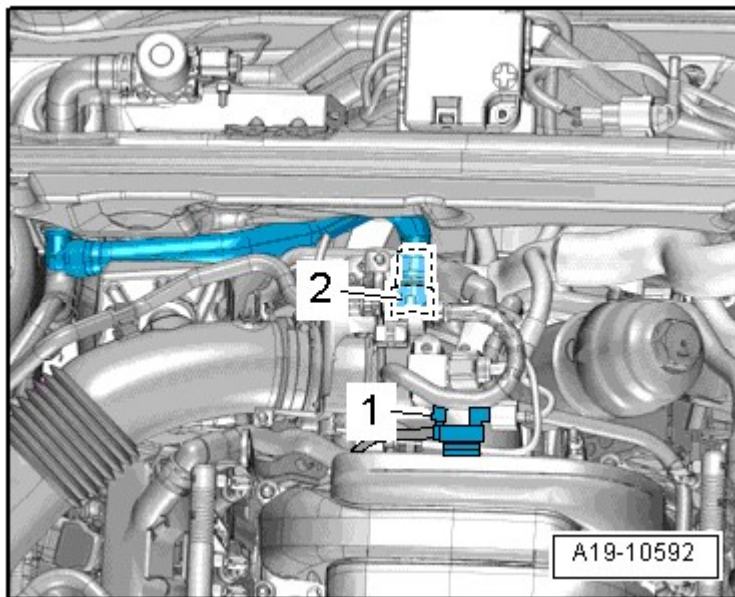


Fig. 30: Disconnecting Vacuum Hose
Courtesy of AUDI OF AMERICA, LLC

-- Remove the coolant hose -2- from the upper coolant pipe by lifting the retaining clamp.

-- Remove the front secondary air hose -arrow- from its bracket and disconnect it; to do this press the release buttons.

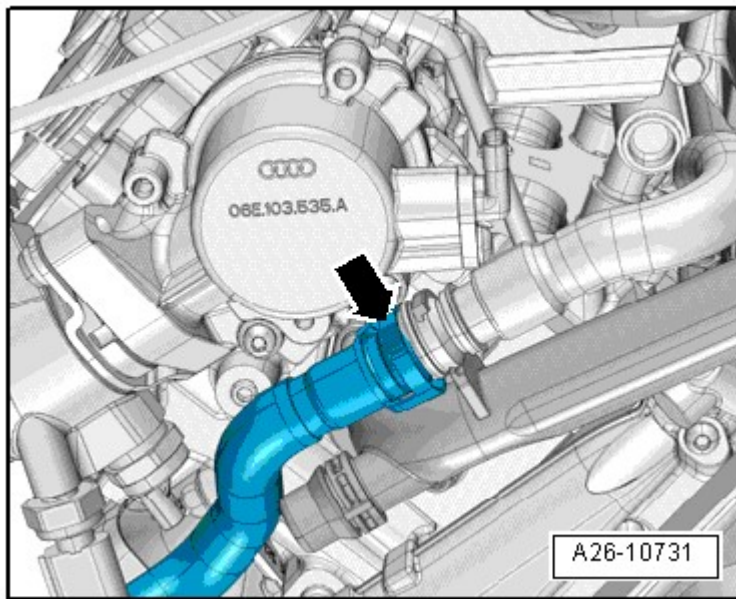


Fig. 31: Identifying Front Air Hose -Arrow
Courtesy of AUDI OF AMERICA, LLC

-- Vehicles without the coolant recirculation pump -V50- : Open the clamp and remove the right front coolant hose -arrow- from the front coolant pipe.

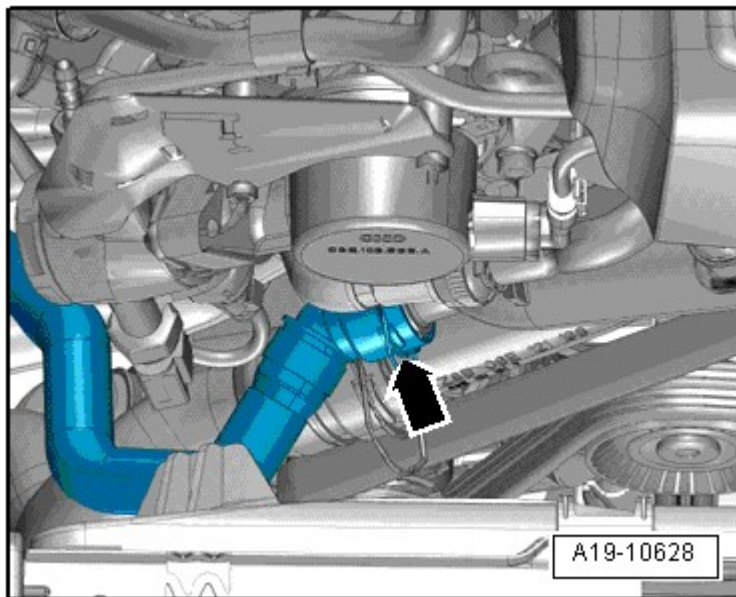


Fig. 32: Identifying Clamp And Right Front Coolant Hose -Arrow- To Front Coolant Pipe
Courtesy of AUDI OF AMERICA, LLC

-- Remove the coolant hose from the front coolant pipe by lifting the retaining clamp -arrow-.

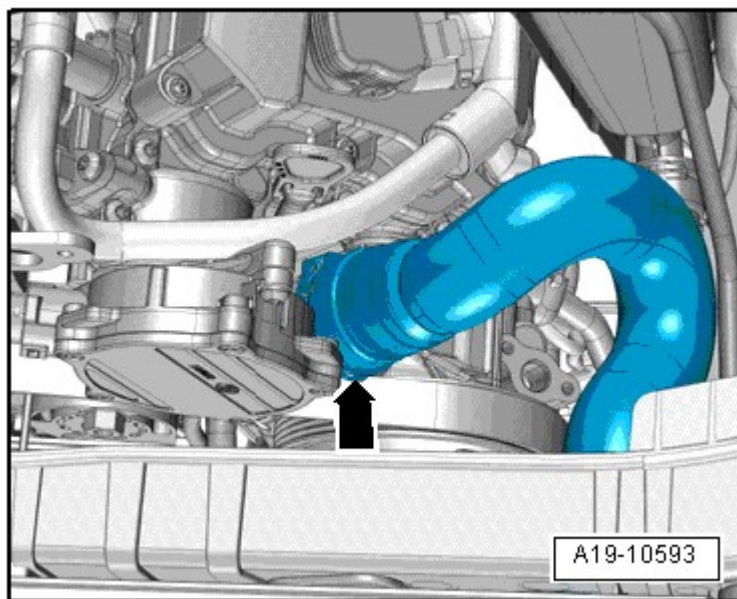


Fig. 33: Identifying Coolant Hose From Front Coolant Pipe By Lifting Retaining Clamp
Courtesy of AUDI OF AMERICA, LLC

-- Loosen the clamp -arrow- and remove the coolant hose.

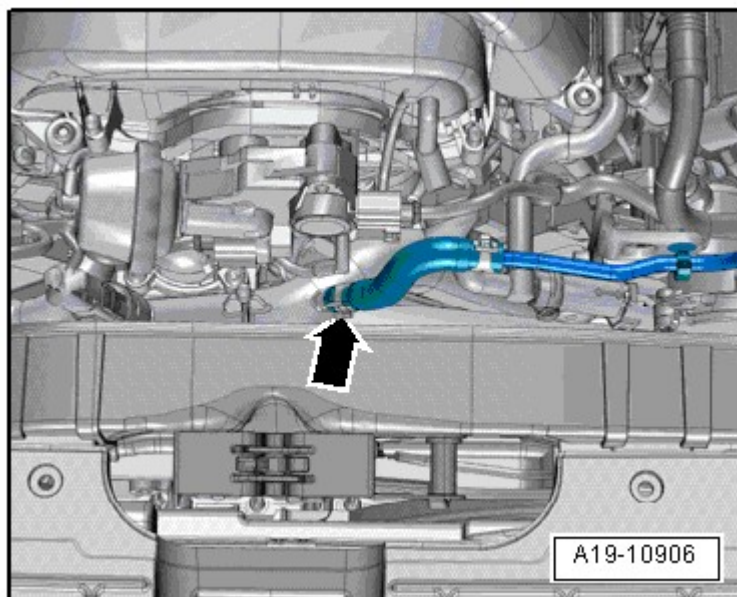


Fig. 34: Loosening Clamp & Remove Coolant Hose
Courtesy of AUDI OF AMERICA, LLC

-- Disconnect the coolant hose -2- from the coolant overflow reservoir.

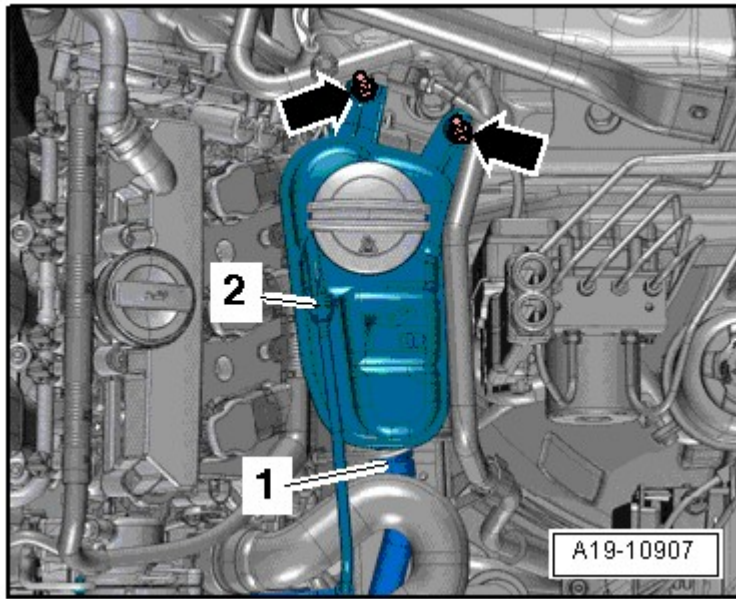


Fig. 35: Identifying Coolant Overflow Reservoir
Courtesy of AUDI OF AMERICA, LLC

- Remove the bolts -arrows-, disconnect the connector -1- on the engine coolant level warning switch -F66- and move the coolant reservoir to the side with the coolant hose still connected.
- Disconnect the electrical connector -arrow- on the power steering pump, if applicable.

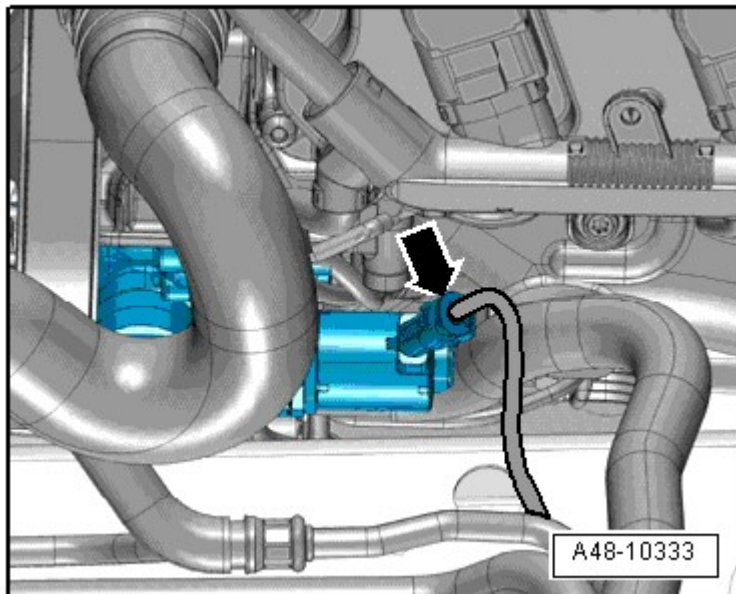


Fig. 36: Disconnecting Connector -Arrow- From Power Steering Pump
Courtesy of AUDI OF AMERICA, LLC

- Press the hydraulic hose down slightly.

CAUTION: Risk of damaging refrigerant lines and hoses.

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

-- Remove the bolts -arrows- and the refrigerant lines from the A/C compressor.

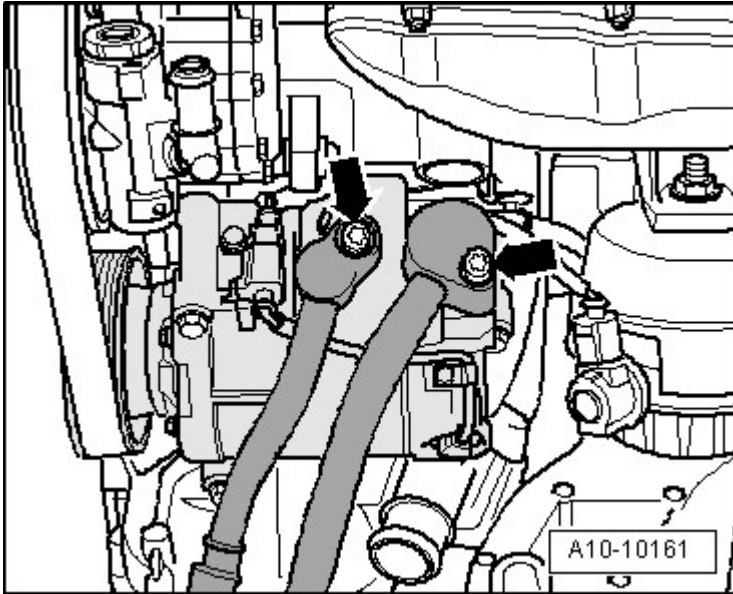


Fig. 37: Identifying Bolts

Courtesy of AUDI OF AMERICA, LLC

-- Seal any open lines and connections with a clean plug from the VAS 6122.

-- Release the retainer -arrow A- and open the cover -arrow B-.

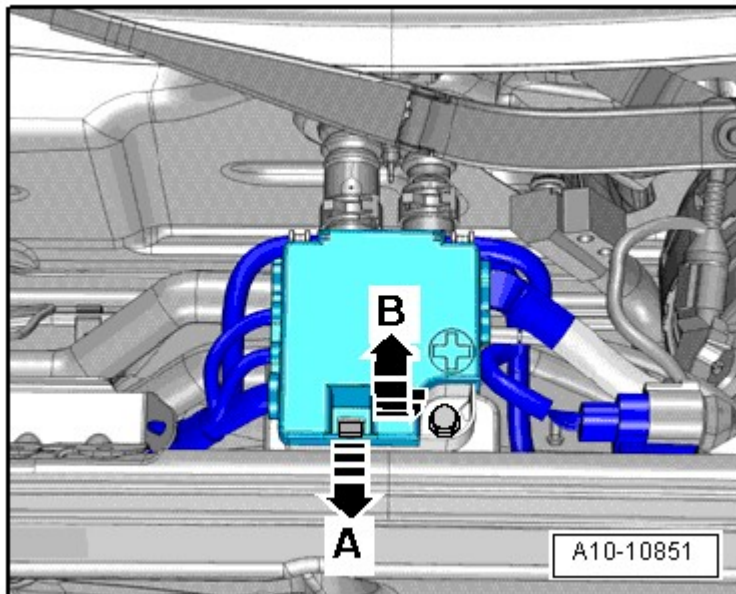
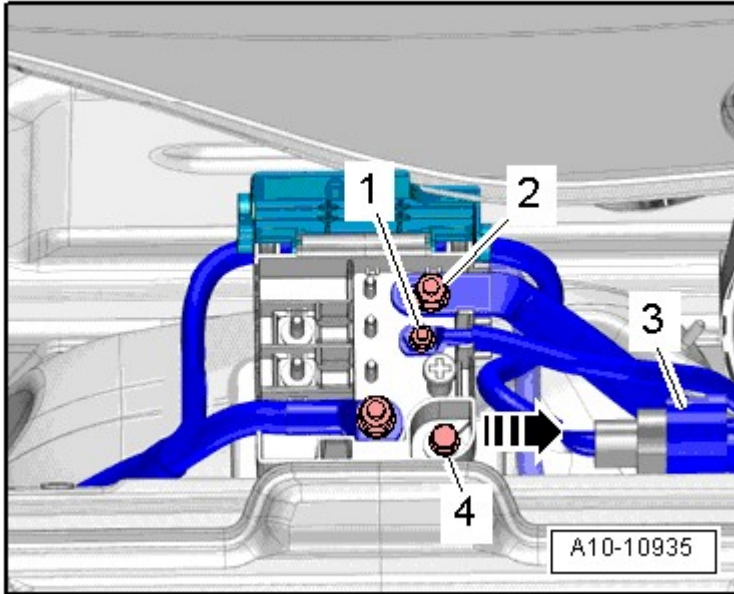


Fig. 38: Opening Terminal Box Cover

Courtesy of AUDI OF AMERICA, LLC

-- Remove the nuts -1 and 2- for the electrical wires.

**Fig. 39: Identifying Nut And Electrical Wires**

Courtesy of AUDI OF AMERICA, LLC

-- Remove the electrical connector -3- from the bracket and disconnect it.

-- Remove the bolt -4- and the terminal 30 wire junction 2 -TV22- from the tower brace -arrow-.

-- Remove the foam piece -1-.

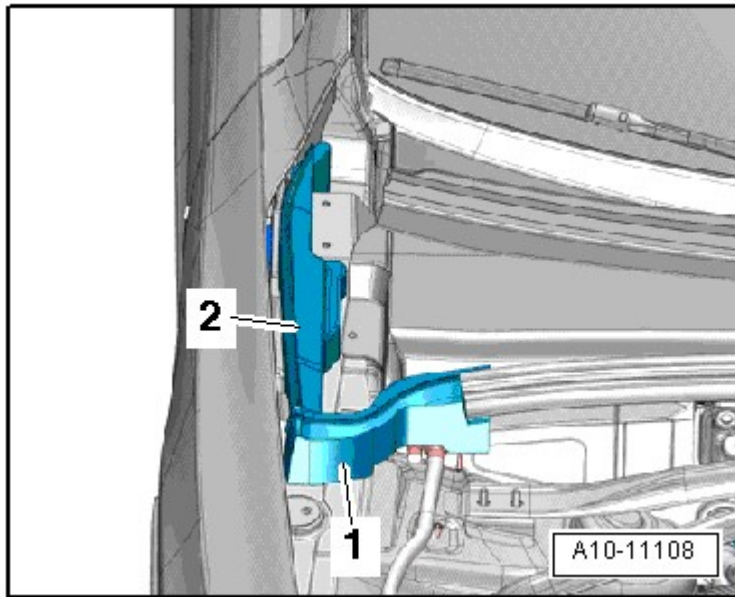


Fig. 40: Removing Left And Right Foam Block
Courtesy of AUDI OF AMERICA, LLC

NOTE: Ignore -2-.

-- Release the retainers from the wheel housing side using a 5.5 mm open end wrench -1- and remove the wiring bushing -2- upward.

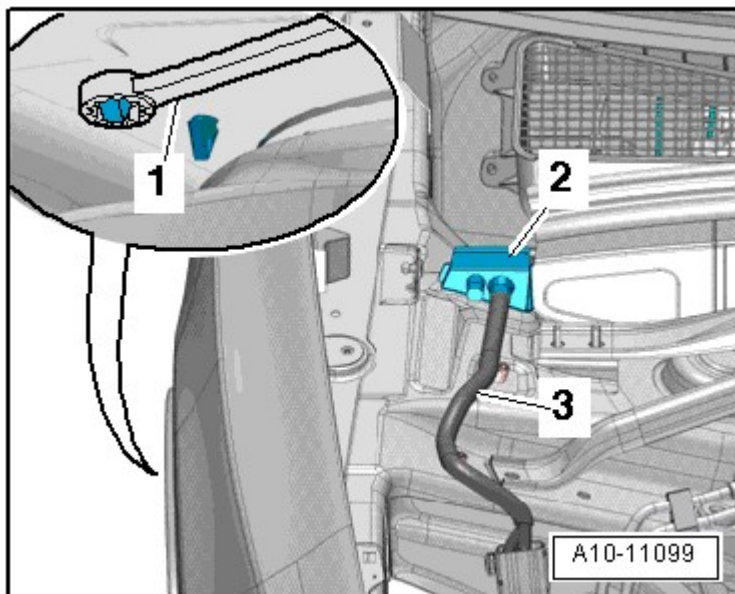


Fig. 41: Releasing Retainers From Wheel Housing Side Using A 5.5 Mm Open End Wrench & Remove Wiring Bushing Upward
Courtesy of AUDI OF AMERICA, LLC

- Free up the wiring harness -3- to the generator and starter using the 80 - 200.
- Open the catch -arrow-, free up the wiring harness and open the wiring duct -1-.

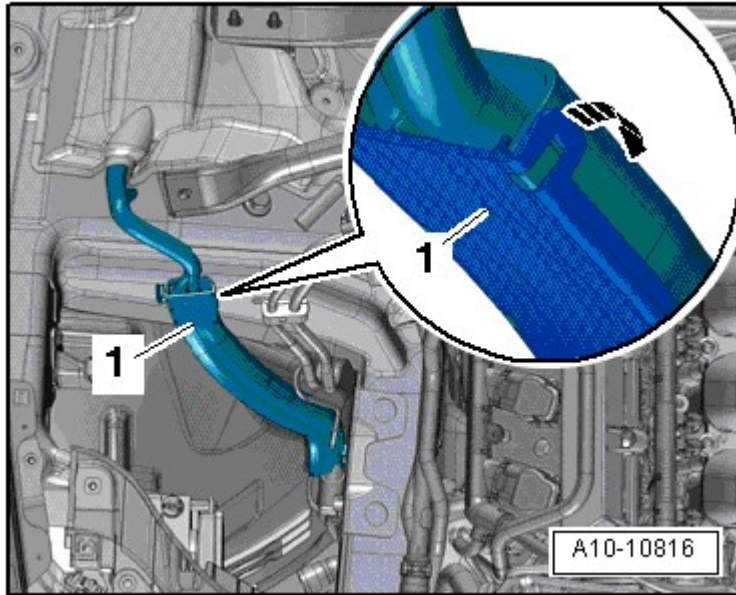


Fig. 42: Freeing Up Wiring Harness And Open Wiring Duct
Courtesy of AUDI OF AMERICA, LLC

- Remove the nut -3- and the bolt -2-.

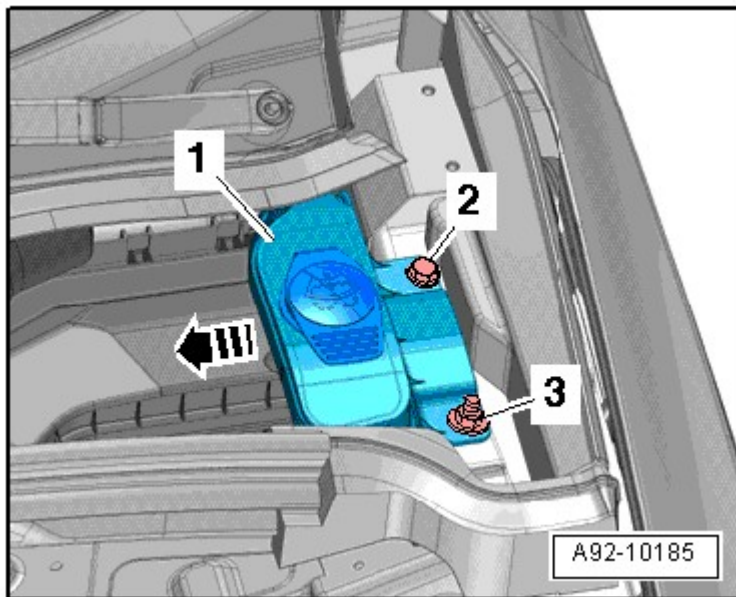


Fig. 43: Removing Nut And Screw
Courtesy of AUDI OF AMERICA, LLC

- Remove the filler neck -1- with the filler tube from the washer fluid reservoir and the opening in the body -

arrow-.

-- Remove the bolts -1, 2 and 4- and remove the E-box cover -3- in the engine compartment.

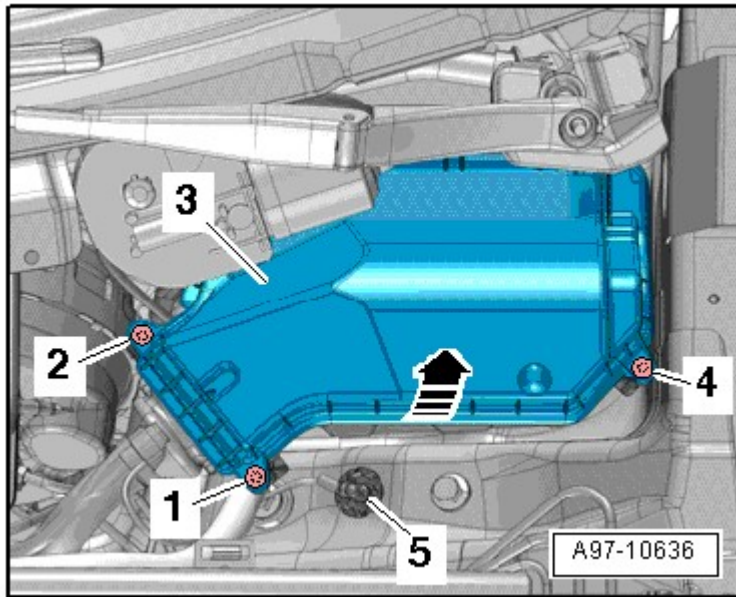


Fig. 44: Removing Bolts And Remove E-Box Cover In Engine Compartment
Courtesy of AUDI OF AMERICA, LLC

-- Remove the nut -5- and free up the GND wire.

-- Release the retainers -A arrows- and remove the engine control module -arrow B-.

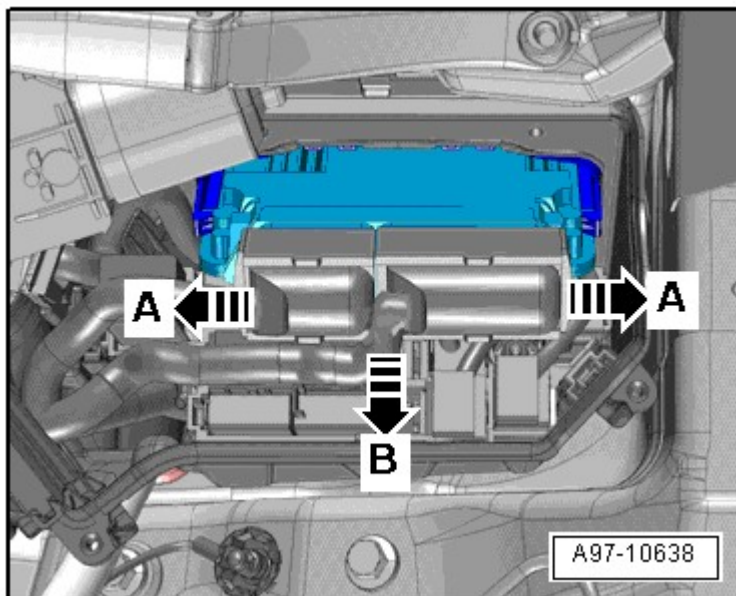


Fig. 45: Releasing Retainers And Remove Engine Control Module
Courtesy of AUDI OF AMERICA, LLC

-- Disconnect the electrical connector -2- if applicable.

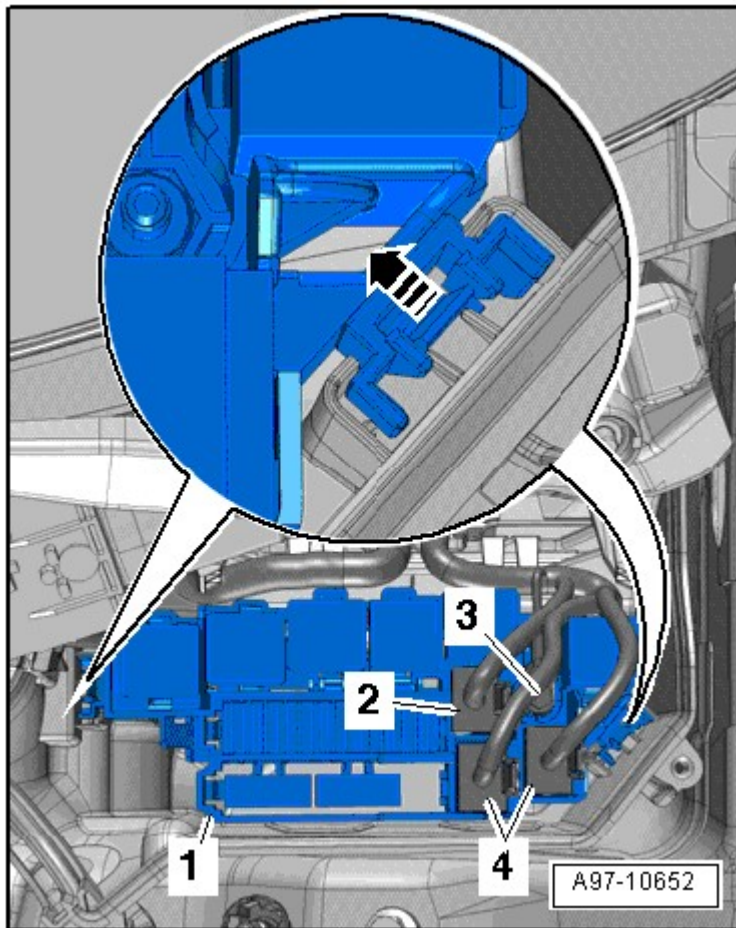


Fig. 46: Disconnecting Electrical Connector
Courtesy of AUDI OF AMERICA, LLC

- Disconnect the connectors -4- and the wire -3-.
- Open the retaining tabs -arrow- and remove fuse holder B -SB- -1-.
- Disengage the engine wiring harness on the E-box and free it up.
- Release the retainers -A arrows- and remove the wiring bushing -2- upward -arrow B-.

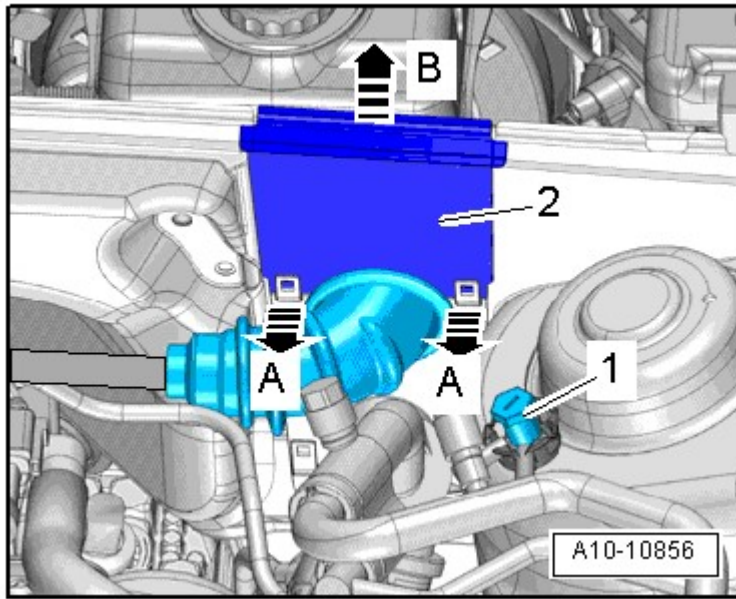


Fig. 47: Releasing Retainers -A Arrows- & Remove Wiring Bushing -2- Upward -Arrow B-
 Courtesy of AUDI OF AMERICA, LLC

- Remove the GND pin -1- and free up the electrical wire.
- Lay the wiring harness on the engine and secure the engine control module so that it cannot fall.
- Disconnect the electrical connectors -arrow- at the left and right on the front speed sensors.

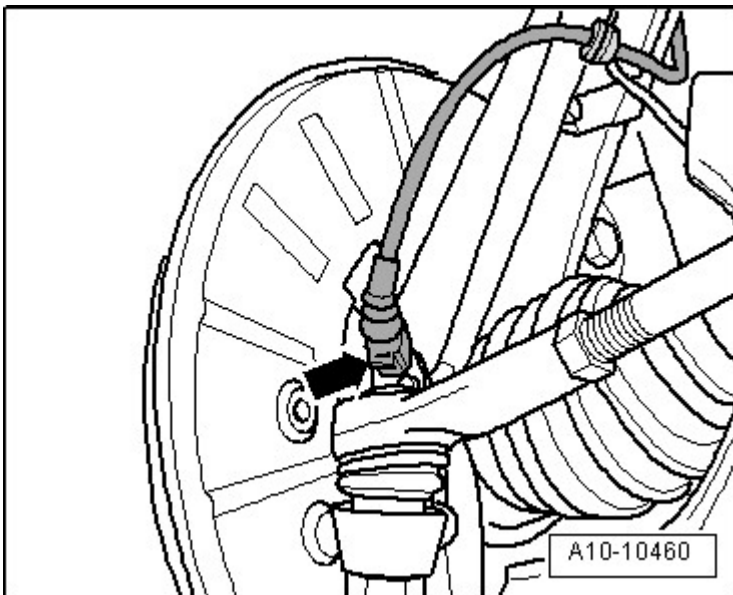


Fig. 48: Identifying Speed Sensor Connector
 Courtesy of AUDI OF AMERICA, LLC

- Disconnect the electrical connector -1- on the left front level control system sensor -G78- and right front level

control system sensor -G289- and free up the electrical wiring -arrow-.

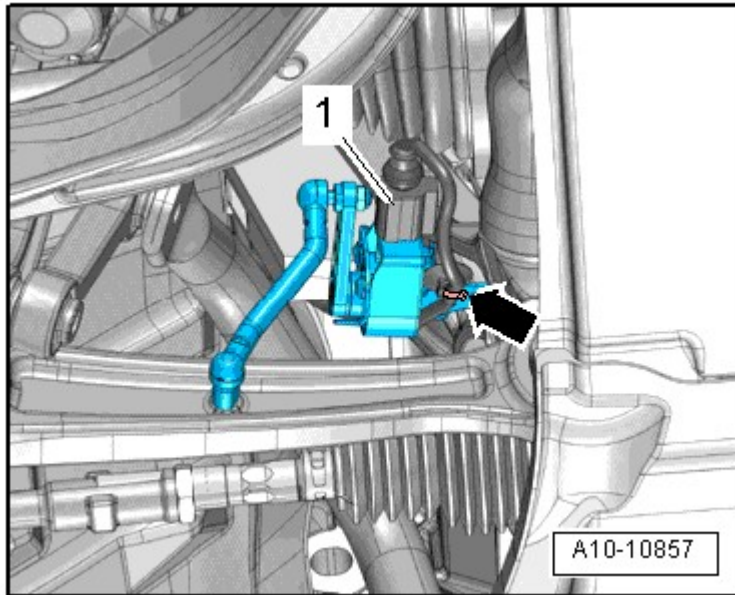


Fig. 49: Disconnecting Electrical Connector On Left Front Level Control System Sensor
Courtesy of AUDI OF AMERICA, LLC

-- Free up the electrical connector -2- on the bracket by pulling the retainer back -arrow A- and turning the connector approximately 90° in the direction of -arrow B-.

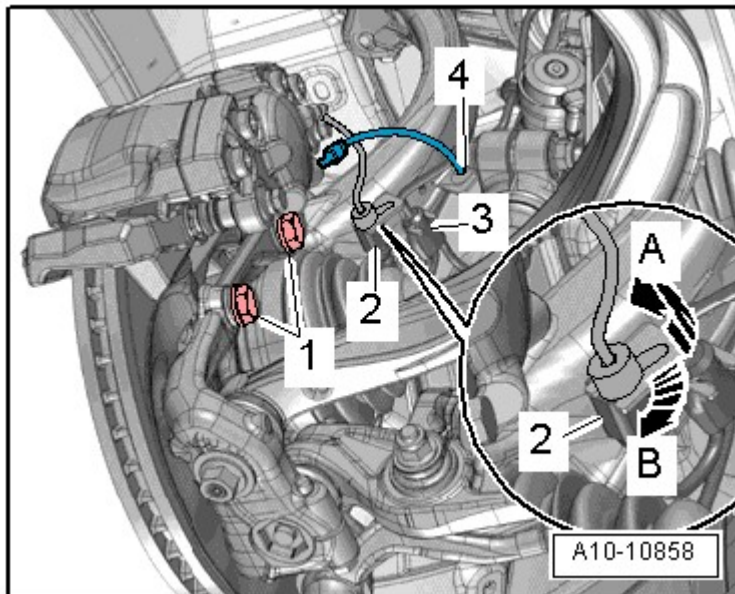


Fig. 50: Freeing Up Electrical Connector
Courtesy of AUDI OF AMERICA, LLC

-- Free up the electrical wiring -3- and brake line -4- on the bracket.

-- Remove the bolts -1- and secure the brake caliper, with the brake line still connected, inside the wheel housing using wire.

CAUTION: Risk of damaging brake pistons.

- **Do not operate brake pedal with brake caliper removed.**

-- Remove nut -2- and bolt -1-.

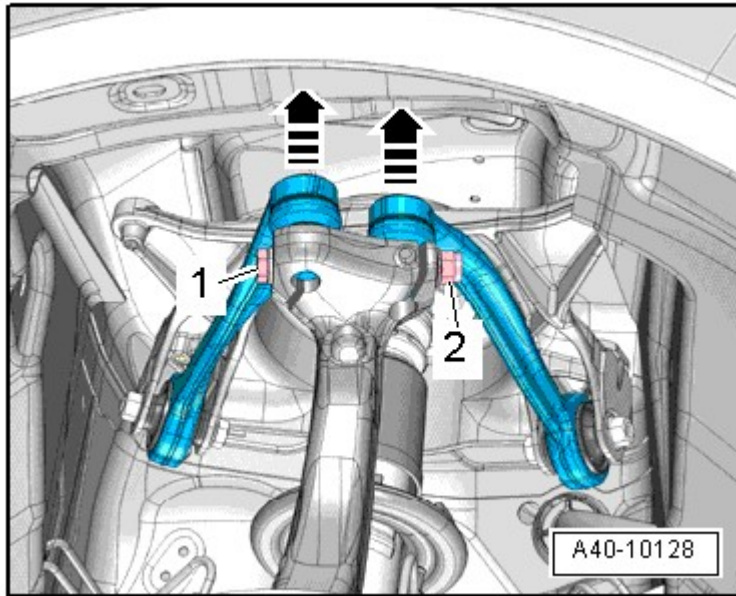


Fig. 51: Identifying Nut And Bolt
Courtesy of AUDI OF AMERICA, LLC

-- Remove the upper control arm upward from the wheel bearing housing -arrows-.

-- Repeat the procedure on the other side of the vehicle.

-- Remove the left and right stabilizer bar bolt -1-.

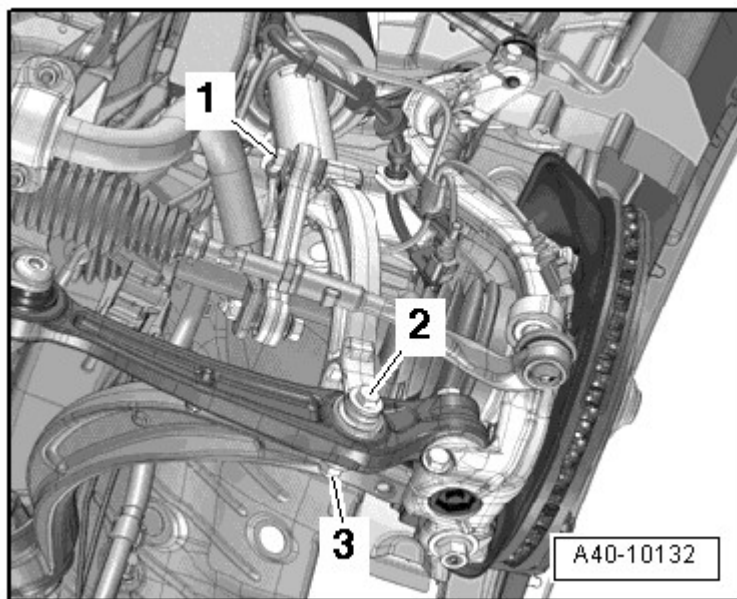


Fig. 52: Identifying Left And Right Stabilizer Bar Bolt
Courtesy of AUDI OF AMERICA, LLC

-- Remove the left and right nuts -3-.

NOTE: The bolt -2- will be removed later.

-- Remove the nut -1- for the power steering hydraulic fluid line bracket.

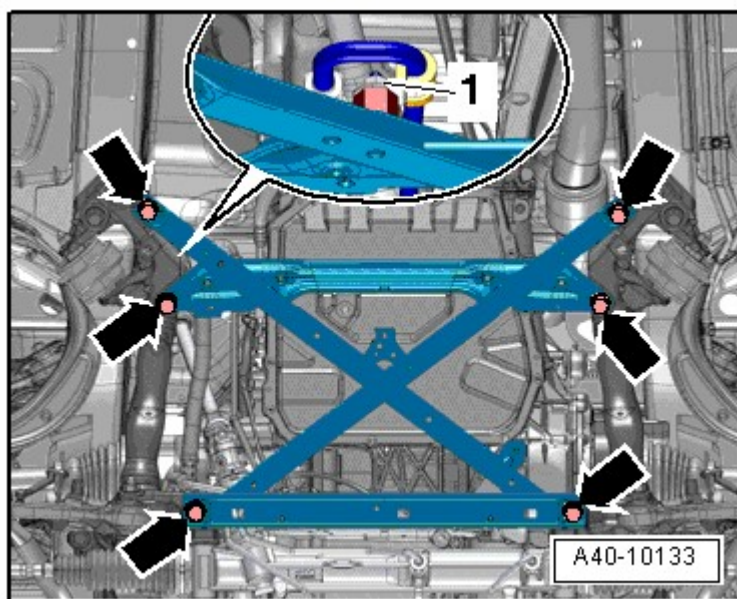


Fig. 53: Locating Power Steering Hydraulic Line
Courtesy of AUDI OF AMERICA, LLC

CAUTION: The suspension components could be damaged.

- Do not rest the vehicle on its wheels if the subframe mount, the steering gear or the subframe crossbrace are not installed correctly.
- Do not support the vehicle on the subframe or the subframe crossbrace (for example by a floor jack or similar device).

-- Remove the bolts -arrows- and the subframe crossbrace.

CAUTION: The airbag spiral spring could be damaged.

- Separate universal joint from steering gear only when front wheels are in the straight ahead position.
- Do not change the position of the steering wheel or the steering gear.

-- Remove universal joint bolt -arrow-. Refer to **Removal and Installation** .

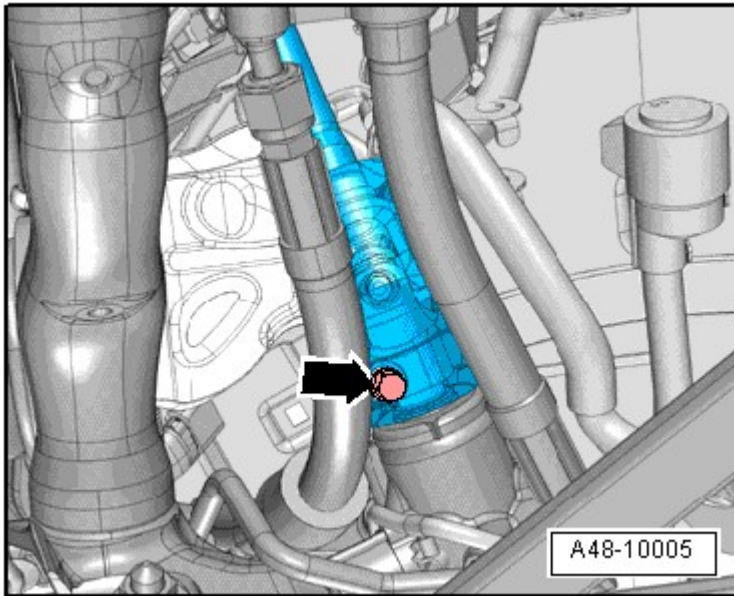


Fig. 54: Locating Universal Joint Bolt
Courtesy of AUDI OF AMERICA, LLC

-- Press the CV joint off the steering gear and slide it all the way up.

-- Remove the left front muffler nuts -arrows-.

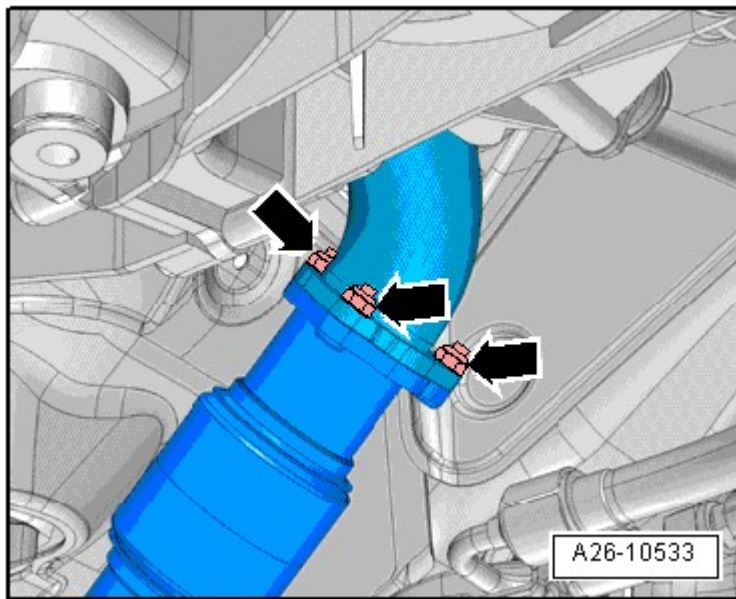


Fig. 55: Identifying Left Front Muffler Nuts
Courtesy of AUDI OF AMERICA, LLC

-- Remove the right front muffler nuts -arrows-.

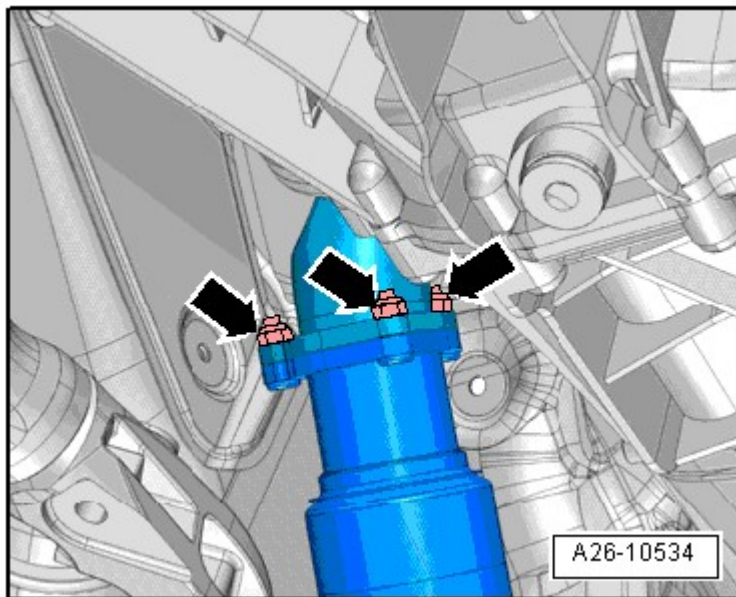


Fig. 56: Identifying Right Front Muffler Nuts
Courtesy of AUDI OF AMERICA, LLC

CAUTION: Risk of damaging the flex joints in the front muffler.

- Do not bend the flex joints more than 10°.

-- Loosen the clamping sleeves -1 and 2-, slide them back and remove the left and right front mufflers.

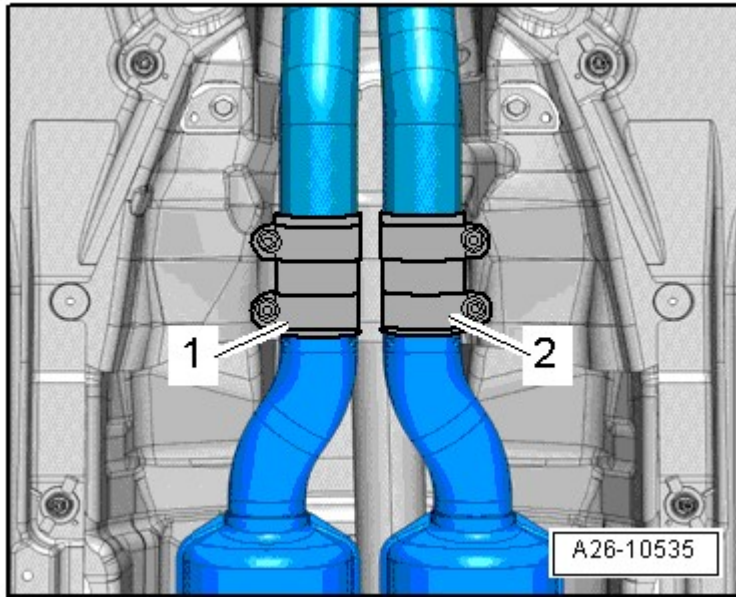


Fig. 57: Identifying Bolts Vehicles With Dual Exhaust System
 Courtesy of AUDI OF AMERICA, LLC

-- Remove the bolts -arrows- and the driveshaft heat shield -1-, if applicable.

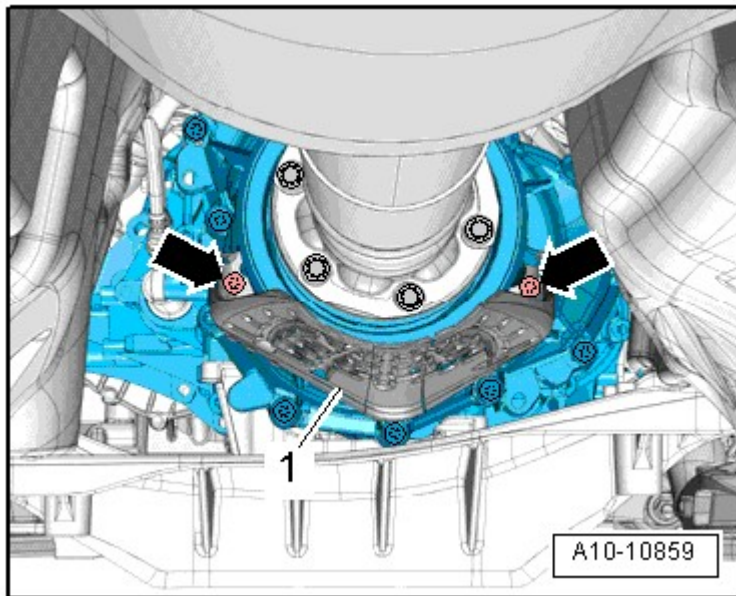


Fig. 58: Identifying Bolts -Arrows- And Driveshaft Heat Shield -1-
 Courtesy of AUDI OF AMERICA, LLC

-- Remove the bolts connecting the driveshaft to the transmission while holding using a T10172 with the T10172/5.

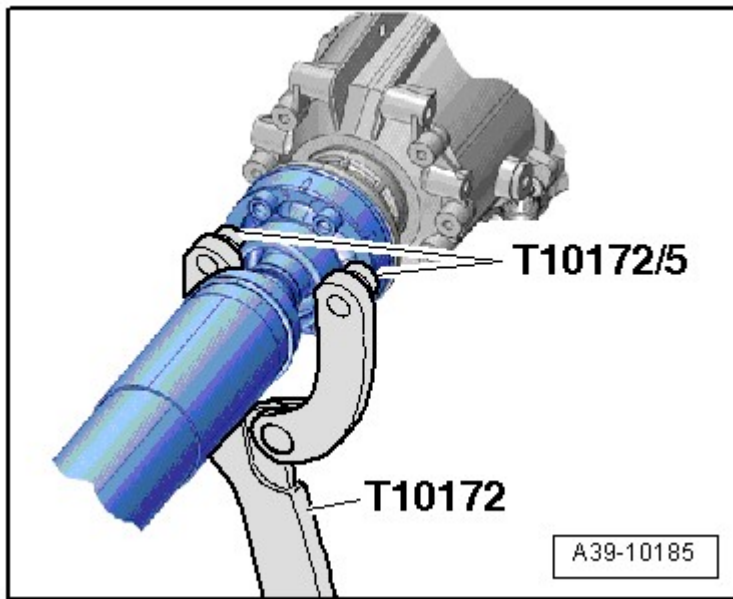


Fig. 59: Counterholding Driveshaft Using T10172 And T10172/5
 Courtesy of AUDI OF AMERICA, LLC

- Slide the driveshaft toward the rear final drive; the CV joints can move axially.
- Secure the driveshaft to the side.
- Remove the ball socket -1- on the selector lever cable from the selector shaft lever using the 80 - 200.

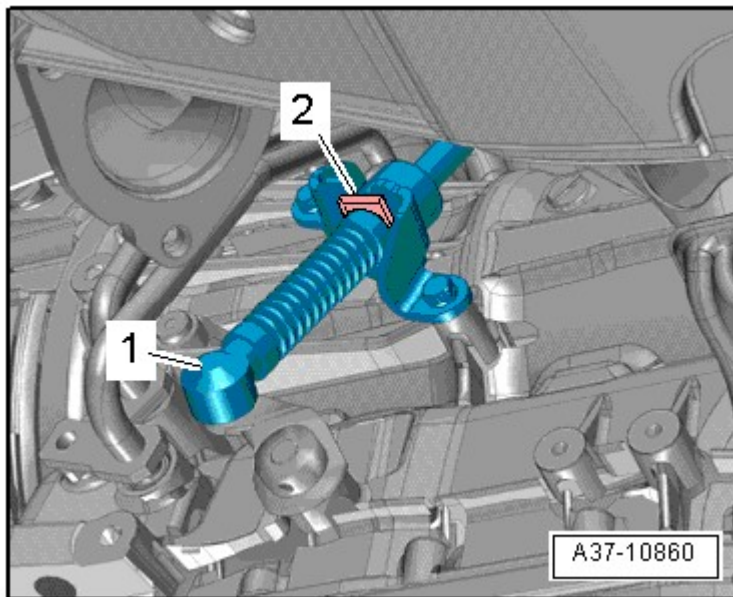


Fig. 60: Identifying Selector Lever Cable
 Courtesy of AUDI OF AMERICA, LLC

- Press the securing clips -2- off and remove the selector lever cable from the transmission.

NOTE: Do not bend or kink the selector lever cable.

Prepare Scissor Lift Platform

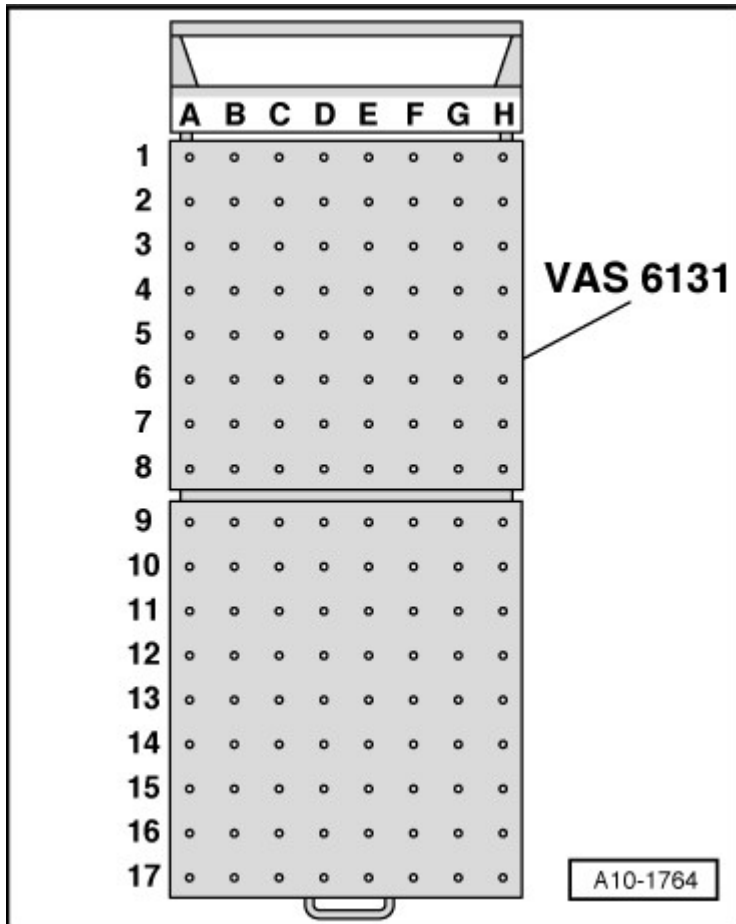


Fig. 61: Identifying Scissor Lift Platform VAS 6131
Courtesy of AUDI OF AMERICA, LLC

-- Equip the VAS 6131 A with the VAS 6131/10, VAS 6131/11 and VAS 6131/13 as follows:

Platform Coordinates	Parts from Support Set VAS 6131/10, Supplementary Set VAS 6131/11 and VAS 6131/13			
B4	/13-4	/10-4	/10-5	/13-1
G4	/13-4	/10-4	/10-5	/13-1
B6	/10-1	/10-2	/10-5	/10-11
G6	/10-1	/10-2	/10-5	/10-11
A8+C8	/13-6	-	-	/13-2
F8+H8	/13-6	-	-	/13-2
C14	/10-1	/10-4	/10-5	/10-7
F14	/10-1	/10-4	/10-5	/11-1

- Next secure mounting elements to scissor lift table by hand.
- Position the scissor lift table horizontally.
 - Note bubble level (sight glass) on support platform.
- Guide scissor lift table under the engine/transmission subassembly.

WARNING: The subframe could cause an accident if it is not secured.

- Do not loosen the subframe bolts -2 and 3-.

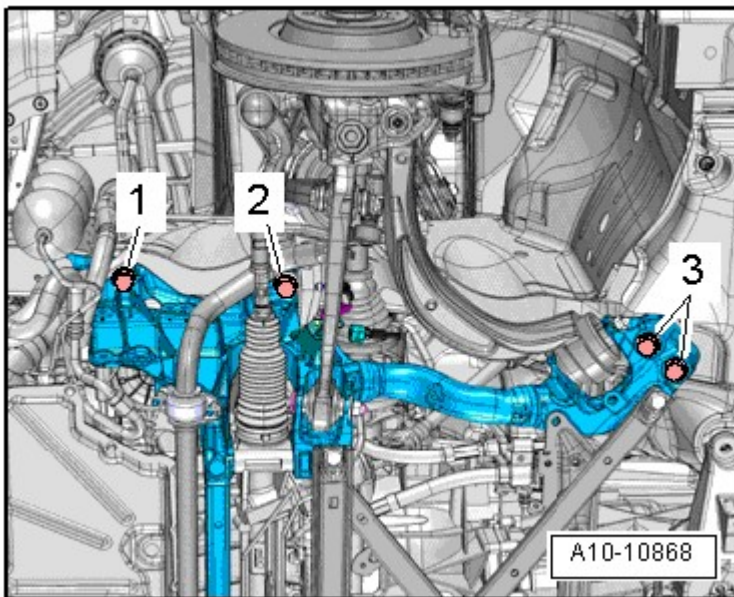


Fig. 62: Identifying Subframe Bolts (Tighten To Specifications)
Courtesy of AUDI OF AMERICA, LLC

- Remove the left and right subframe bolt -1-.
- Attach the mounting elements from the VAS 6131/10 and VAS 6131/13 at the left and right front of the subframe as shown in the illustration.

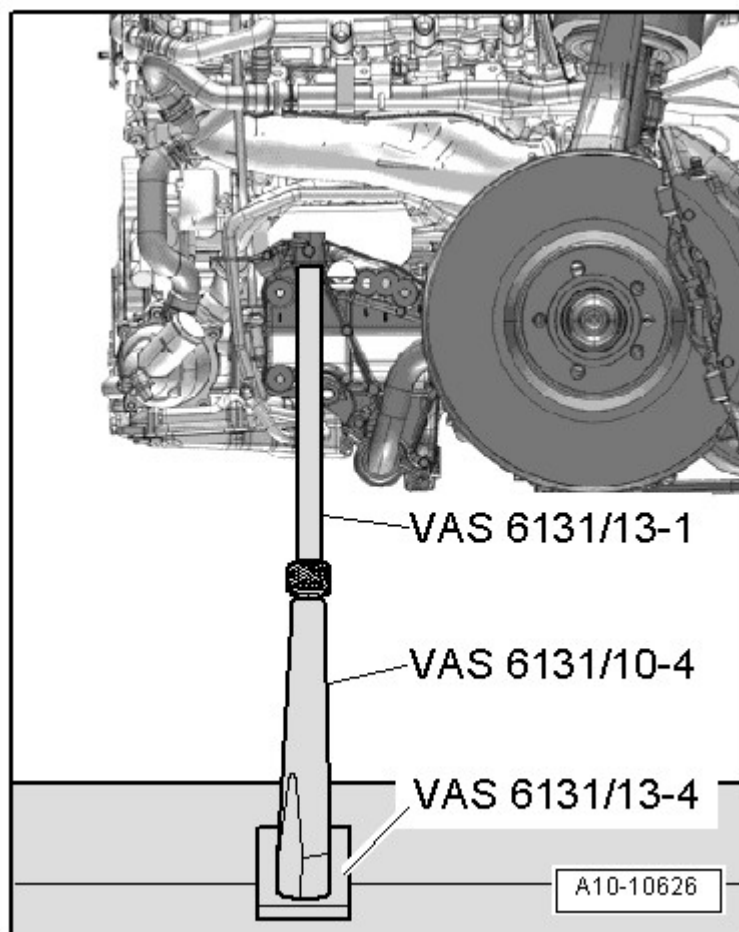


Fig. 63: Attaching VAS 6131/10 And VAS 6131/13 At Left And Right Front Of Subframe
Courtesy of AUDI OF AMERICA, LLC

-- Ensure threaded spindles are completely installed.

-- Attach the mounting elements from the VAS 6131/10 at the left and right rear on the subframe crossbrace front connecting points as shown in the illustration.

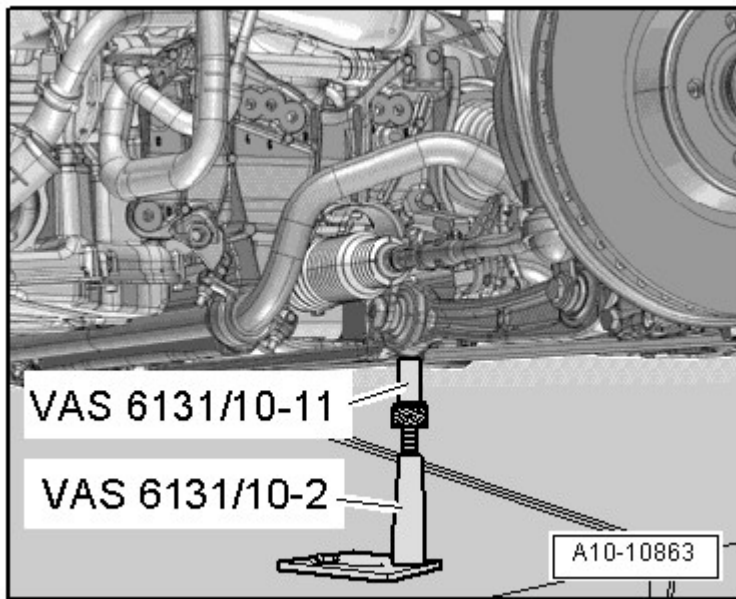


Fig. 64: Attaching VAS 6131/10 At Left And Right Rear On Subframe Crossbrace Front Connecting Points

Courtesy of AUDI OF AMERICA, LLC

-- Attach mounting elements from the VAS 6131/13 at the lower left and right of the wheel bearing housing as shown in the illustration.

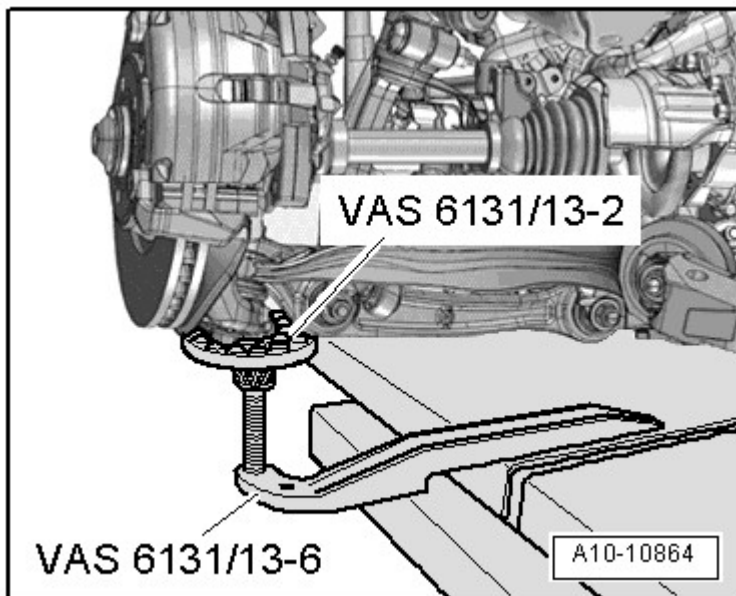


Fig. 65: Attaching VAS 6131/13 At Lower Left And Right Of Wheel Bearing Housing

Courtesy of AUDI OF AMERICA, LLC

-- Attach the mounting elements from the VAS 6131/10 and VAS 6131/11 at the left and right rear of the tunnel crossmember as shown in the illustration.

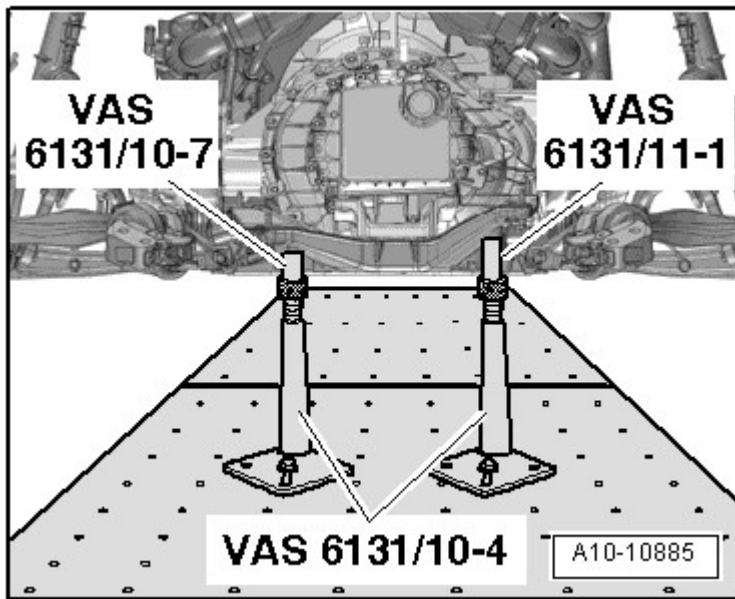


Fig. 66: Attaching VAS 6131/10 And VAS 6131/11 At Left And Right Rear Of Tunnel Crossmember
 Courtesy of AUDI OF AMERICA, LLC

- Rotate the mounting element spindles upward until all the mounting pins come into contact with the mounting points.
- Attach mounting element base plates to the VAS 6131 A and tighten to 20 Nm.
- Mark the location of the subframe and engine carrier to the longitudinal members using a felt-tip pen.

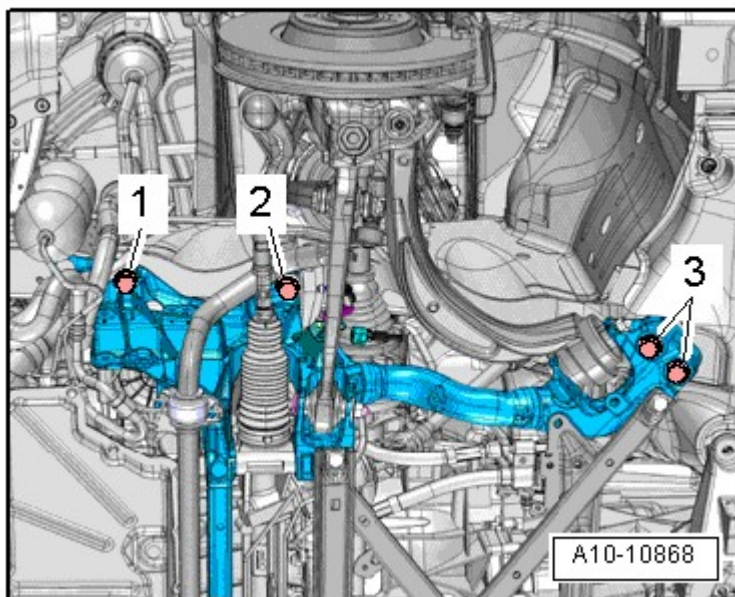


Fig. 67: Identifying Subframe Bolts (Tighten To Specifications)
 Courtesy of AUDI OF AMERICA, LLC

-- Remove the left and right subframe bolts -2 and 3- in a diagonal sequence in stages.

NOTE: Bolt -1- is already removed.

-- Remove the bolts -arrows- on the tunnel crossmember.

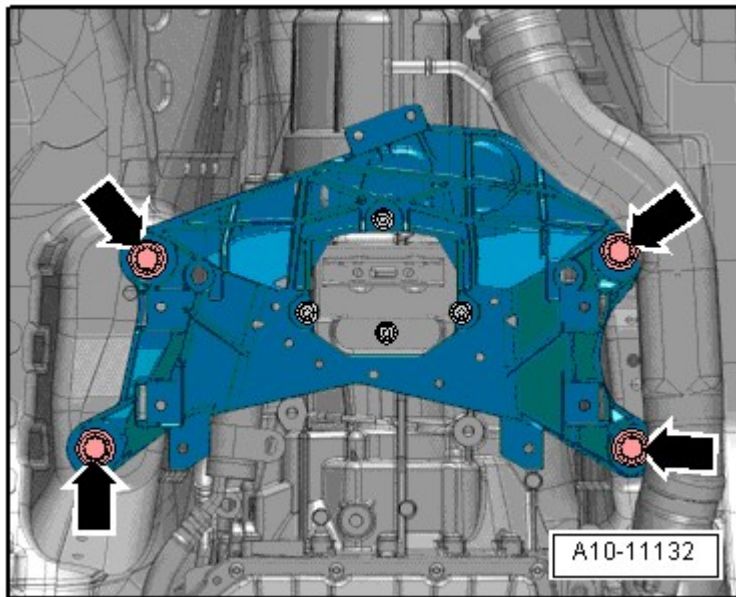


Fig. 68: Identifying Crossmember & Bolts
Courtesy of AUDI OF AMERICA, LLC

-- Remove the left and right bolts -2-.

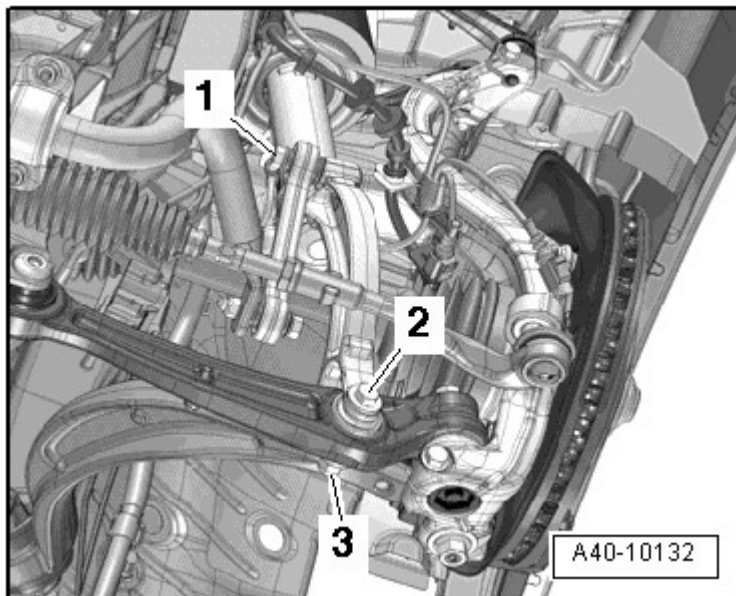


Fig. 69: Identifying Left And Right Stabilizer Bar Bolt

Courtesy of AUDI OF AMERICA, LLC

NOTE: The nut -1- and bolt -3- have already been removed.

CAUTION: Risk of damaging hose and wiring connections as well as the engine compartment.

- Make sure all the hoses and lines between the engine, transmission, subframe and body have been disconnected.
- Carefully guide engine-transmission assembly with subframe out of engine compartment while lowering.

-- Lower the engine/transmission subassembly using the VAS 6131 A.

-- Remove scissor lift table with engine/transmission assembly from under vehicle.

ENGINE AND AUTOMATIC TRANSMISSION, SEPARATING

Special tools and workshop equipment required

- Transmission Support VAS 6131/14
- Socket T40058
- Scissor-Type Assembly Platform VAS 6131 A with Support Set VAS 6131/10 and Supplementary Set, Audi A8 VAS 6131/11 and Supplementary Set, Audi Q7 VAS 6131/13
- Joint Support VAS 6131/13-7
- Drip Tray VAS 6208
- Engine Plug Set VAS 6122

Procedure

- Engine/transmission assembly removed and placed on the VAS 6131 A.

-- Remove the electrical connector bolts -arrows- for the Oxygen Sensor (O2S) 2 after catalytic converter - G131- from the bracket, disconnect it and lay it aside.

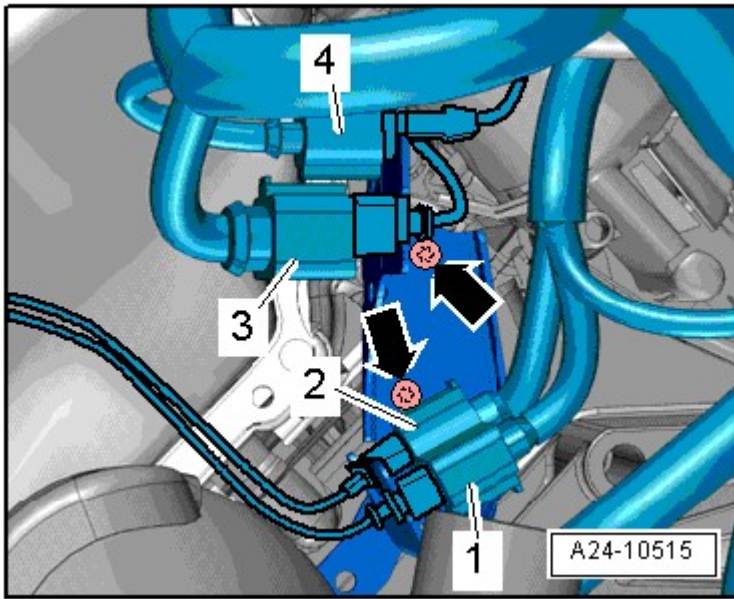


Fig. 70: Cylinder Bank 2 Oxygen Sensor Electrical Connectors
Courtesy of AUDI OF AMERICA, LLC

NOTE: Ignore -2, 3 and 4- and -arrows-.

-- Remove the nuts -arrows- and the bolt -1- and the left catalytic converter.

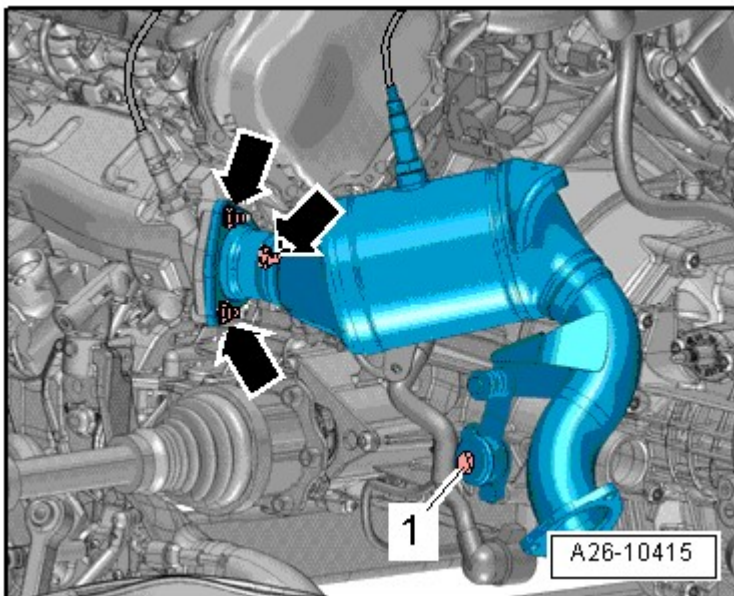


Fig. 71: Identifying Nuts, Bolt And Left Catalytic Converter
Courtesy of AUDI OF AMERICA, LLC

-- Remove the electrical connector -1- for the Oxygen Sensor (O2S) after Three Way Catalytic Converter (TWC) -G130- from the bracket and disconnect it.

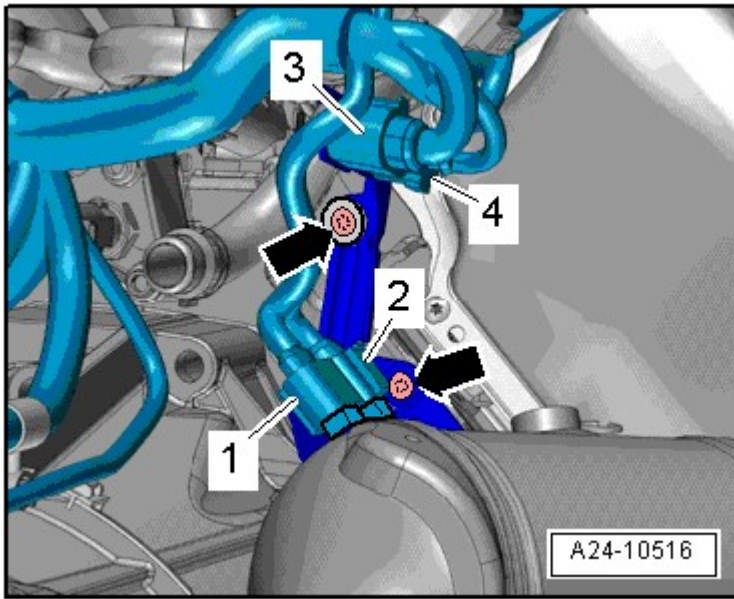


Fig. 72: Identifying Bolts -Arrows- And Right Connector Bracket
 Courtesy of AUDI OF AMERICA, LLC

- Remove the electrical connector -2- from the bracket.
- Remove the bolts -arrow- and lay aside the bracket with electrical connectors -3 and 4-.
- Remove the nuts -arrows- and the bolt -1- and remove the right catalytic converter.

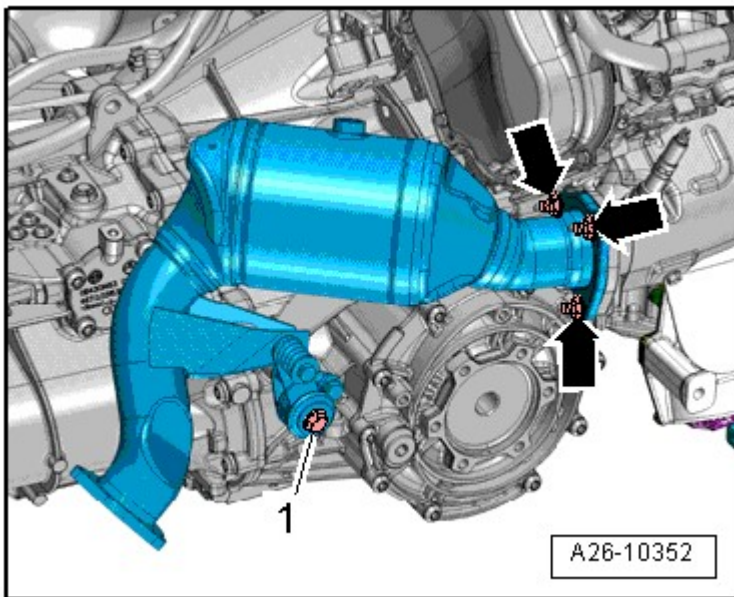


Fig. 73: Identifying Nuts, Bolts And Right Catalytic Converter
 Courtesy of AUDI OF AMERICA, LLC

- Disconnect the electrical connector -2- on the Engine Speed (RPM) sensor -G28- and free up the electrical

wiring.

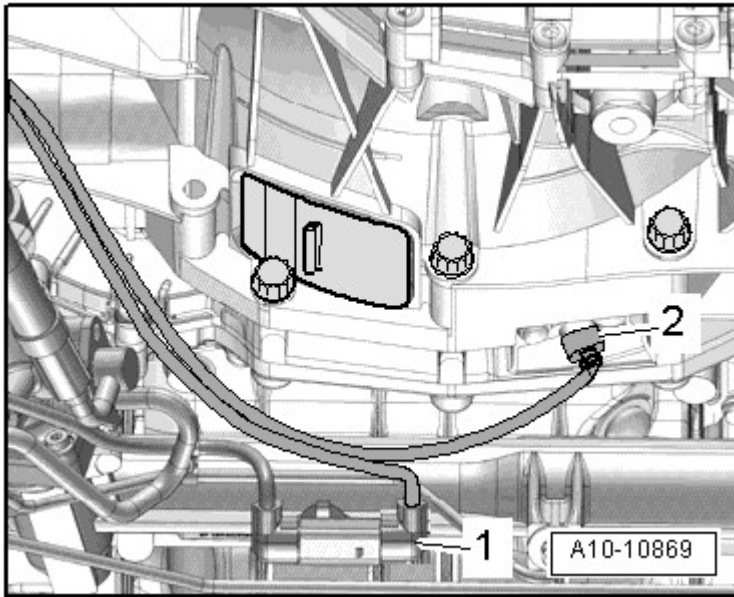


Fig. 74: Disconnecting Connector From Engine Speed (RPM) Sensor -G28-
Courtesy of AUDI OF AMERICA, LLC

NOTE: Ignore -1-.

CAUTION: There is a risk of destroying the transmission control module (Mechatronic) with static discharge.

- Do not touch contacts in transmission connector with hands.

-- Touch the transmission housing (when not wearing gloves) to discharge the static electricity.

-- Disconnect the connector on transmission by rotating screw connections counterclockwise -arrow-.

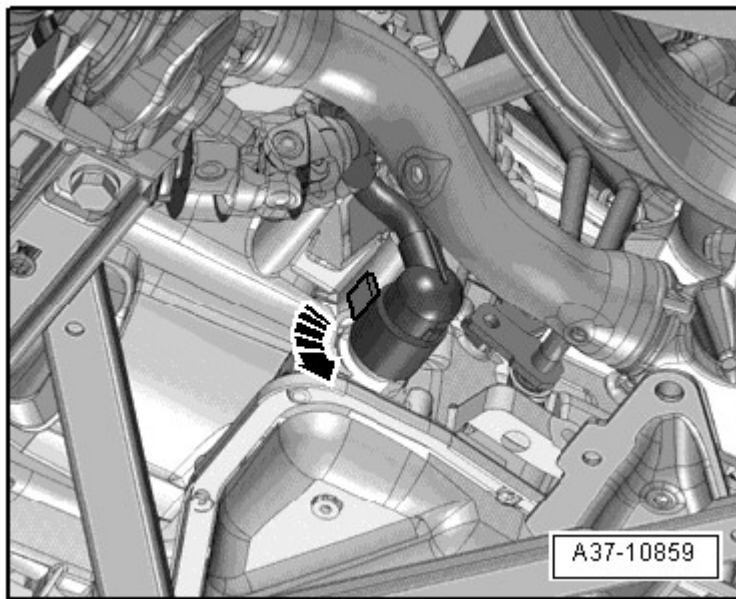


Fig. 75: Identifying Transmission Connector
Courtesy of AUDI OF AMERICA, LLC

- Free up the electrical wiring harness on the transmission.
- Remove the bolts -1, 2 and 3- and remove the right drive axle heat shield -A-.

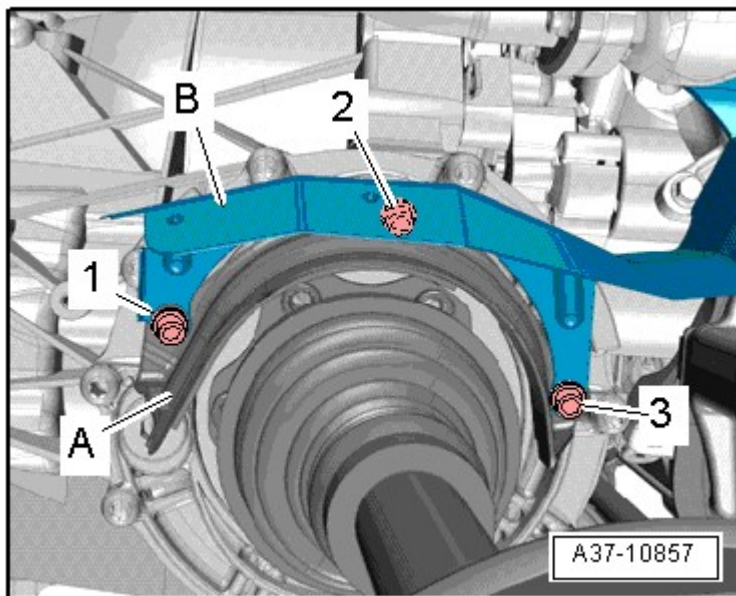


Fig. 76: Identifying Heat Shield
Courtesy of AUDI OF AMERICA, LLC

- Move the heat shields -B- to the side.
- Remove the left and right drive axles from the transmission flange shafts.

-- Remove the lower cover -1- from the transmission -arrow-.

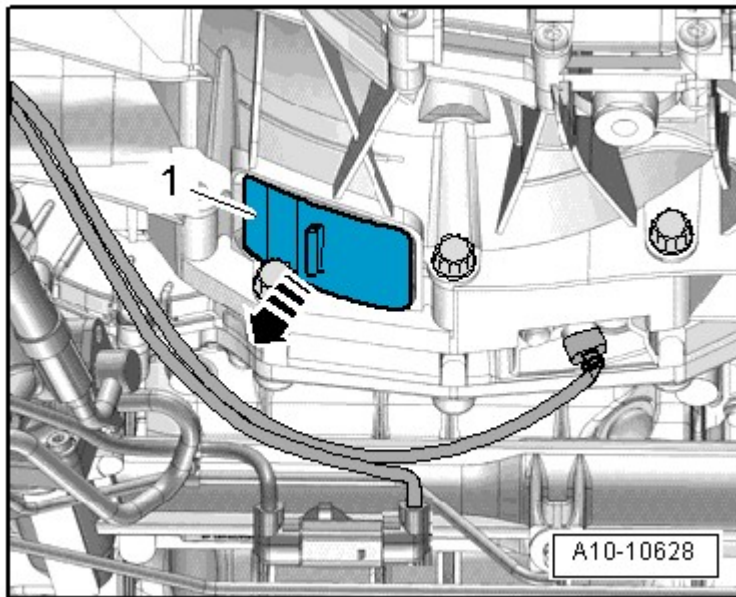


Fig. 77: Identifying Transmission Lower Cover
Courtesy of AUDI OF AMERICA, LLC

-- Insert the T40058 guide pins as follows:

- The large diameter -arrow 1- faces the engine.

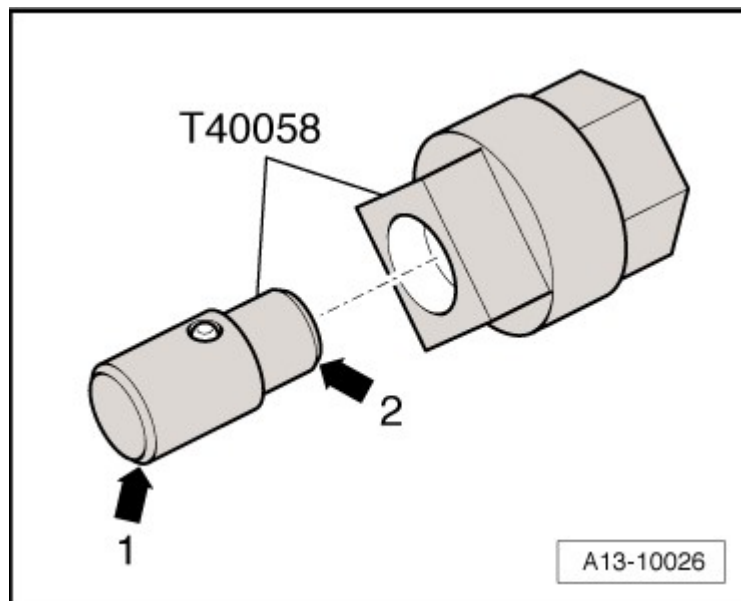


Fig. 78: Identifying Guide Pin And Adapter T40058
Courtesy of AUDI OF AMERICA, LLC

- The small diameter -arrow 2- faces the adapter.

-- To loosen the torque converter bolts, counter hold the crankshaft using the T40058.

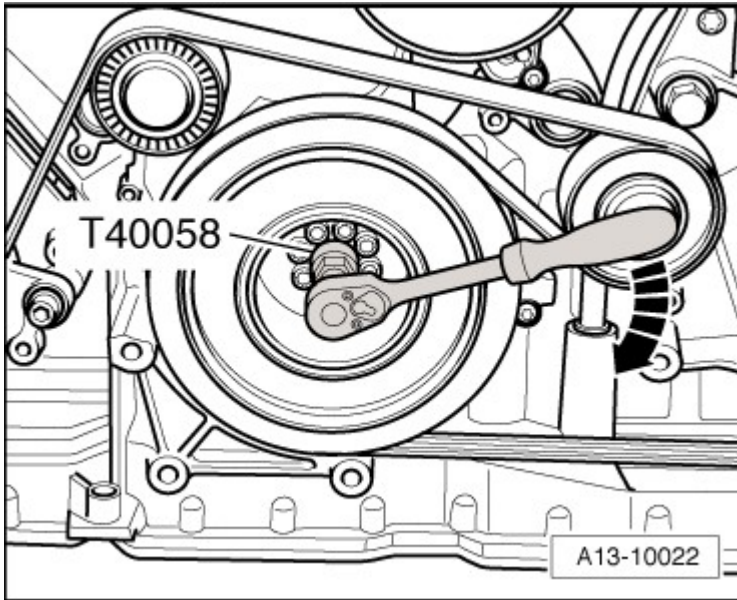


Fig. 79: Identifying Torque Converter Bolts And Adapter T40058

Courtesy of AUDI OF AMERICA, LLC

NOTE: When mounting, turn the crankshaft only in the direction of engine rotation - arrow-.

-- Remove the 6 torque converter bolts -arrow- by turning the crankshaft 60° in the direction of engine rotation.

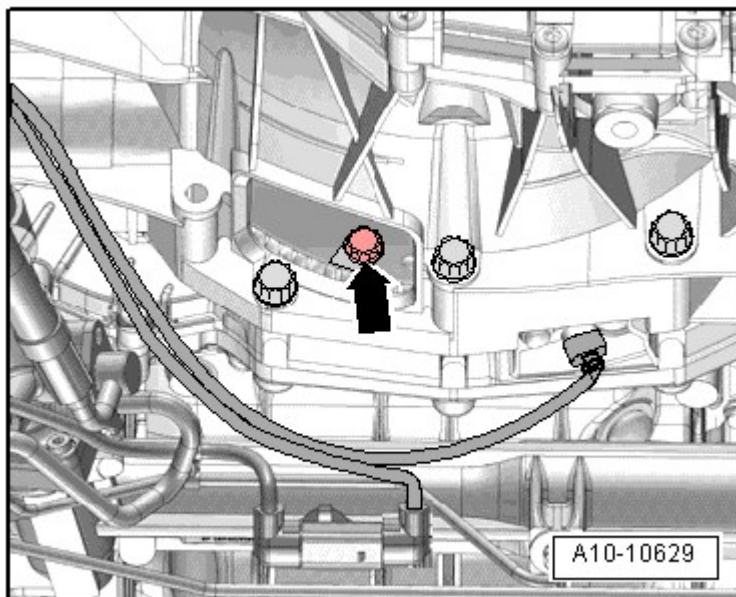


Fig. 80: Identifying Clutch Module First Bolt Installation Location

Courtesy of AUDI OF AMERICA, LLC

-- Remove the bolt -arrow- for the ATF line bracket.

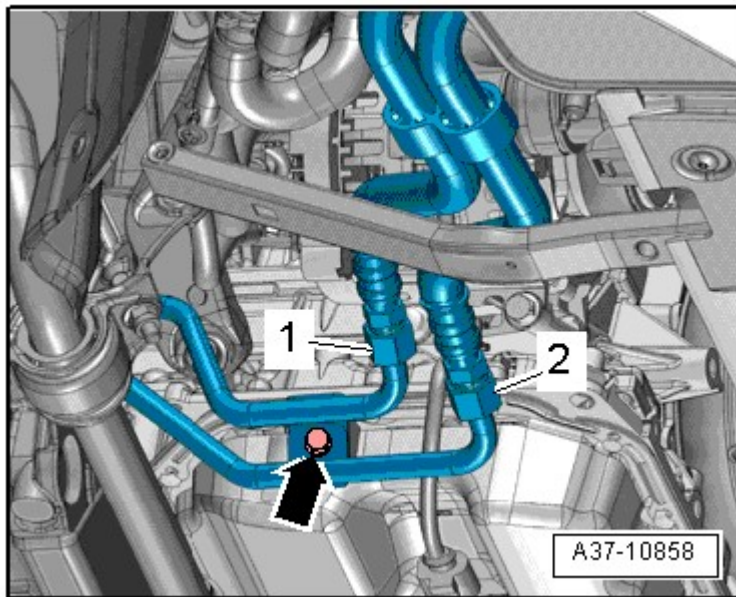


Fig. 81: Identifying ATF Lines -1 & 2-
Courtesy of AUDI OF AMERICA, LLC

NOTE: Ignore -1 and 2-.

NOTE: Place a cloth underneath to soak up any escaping ATF.

-- Remove the bolts -1 and 2- and remove the ATF line -1- from the transmission and secure them at the top.

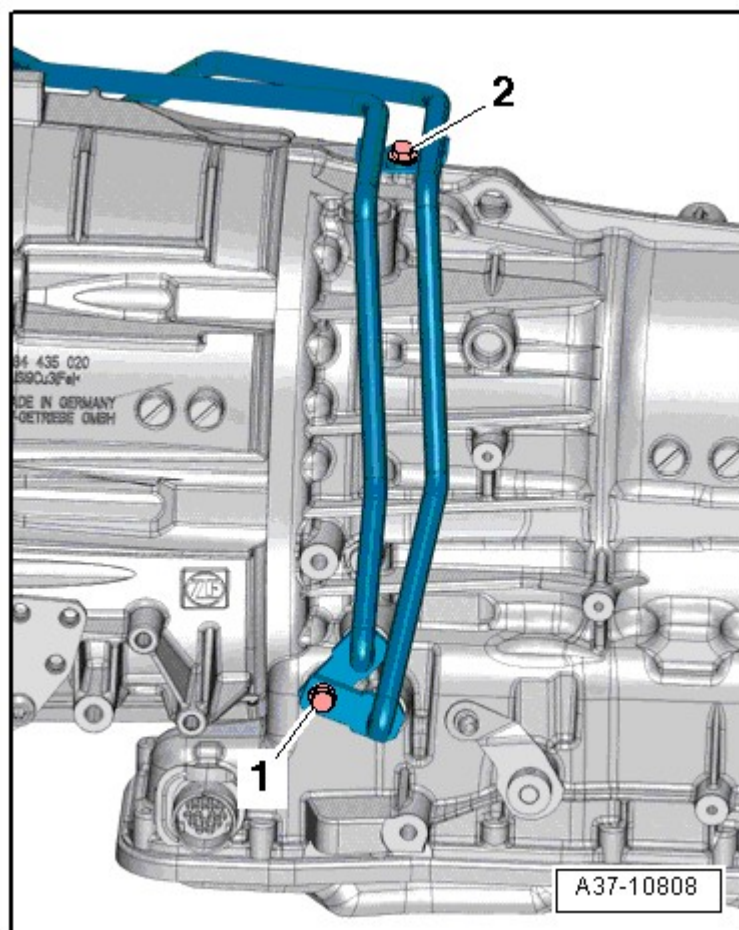


Fig. 82: Identifying Bolts And ATF Lines From Transmission
Courtesy of AUDI OF AMERICA, LLC

- Seal any open lines and connections with a clean plug from the VAS 6122.
- Equip the VAS 6131 A with the VAS 6131/10, VAS 6131/13 and VAS 6131/14 as follows:

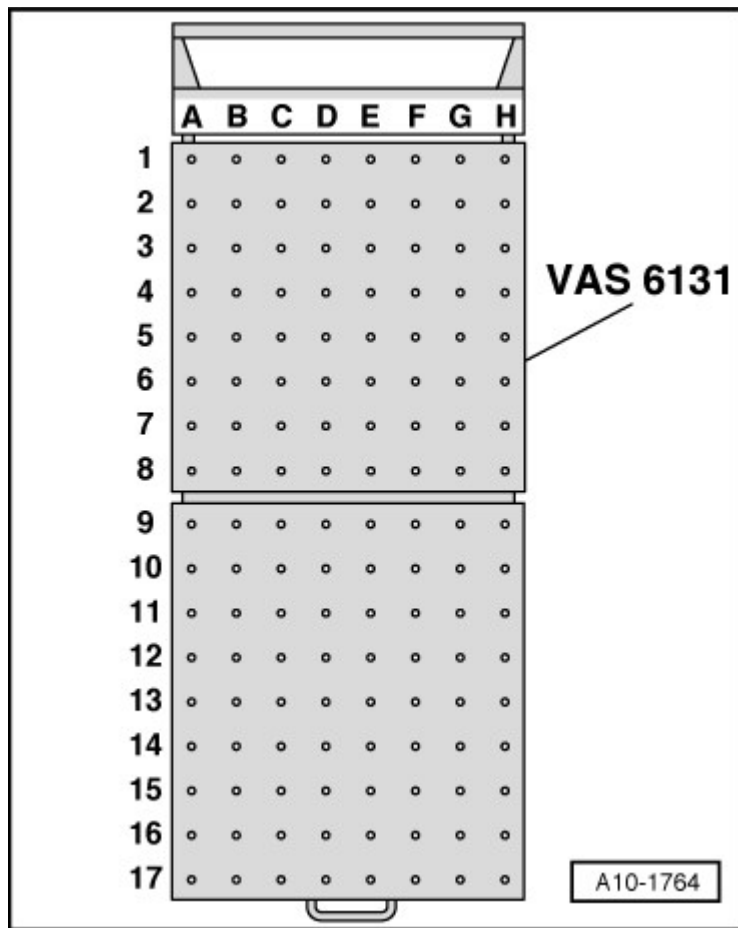


Fig. 83: Identifying Scissor Lift Platform VAS 6131

Courtesy of AUDI OF AMERICA, LLC

NOTE: The other attachments remain unchanged.

Platform Coordinates	Parts from the VAS 6131/10, VAS 6131/13 and VAS 6131/14			
F2	/13-7			
B10	/10-1	/10-2	/10-5	/14
G10	/10-1	/10-2	/10-5	

-- Install the VAS 6131/13-7 at the right front of the engine in the threaded hole as shown in the illustration.

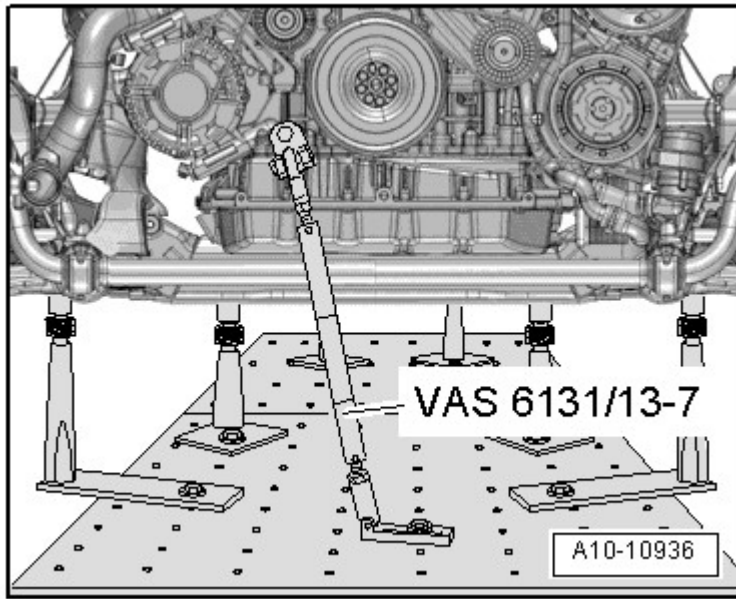


Fig. 84: Install Joint Support VAS 6131/13-7 On Scissor Lift Table And Tighten It To 20 Nm
Courtesy of AUDI OF AMERICA, LLC

- Install the VAS 6131/13-7 on the scissor lift table and tighten it to 20 Nm.
- Remove the starter bolts -1 and 2-.

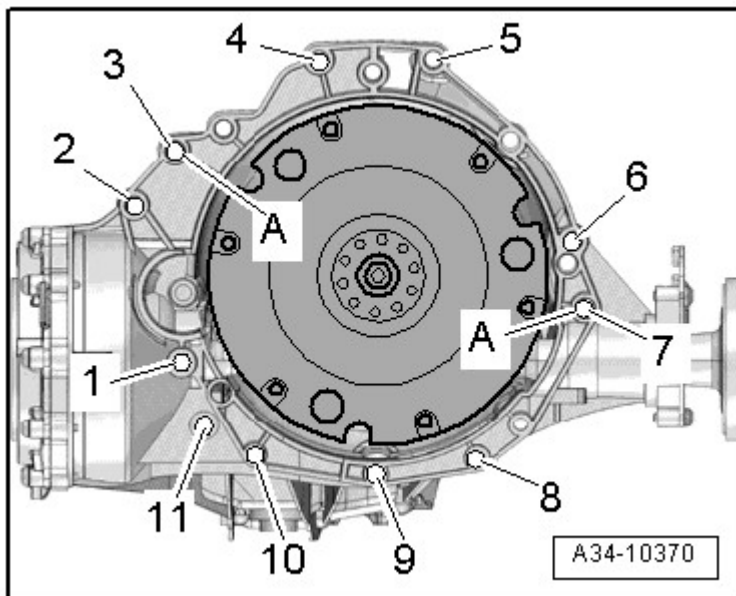


Fig. 85: Identifying Starter Bolts -1 & 2-
Courtesy of AUDI OF AMERICA, LLC

- Press the starter off the transmission and leave it in the installation position.
- Remove the remaining bolts -3 through 11- that attach the engine to the transmission.

NOTE: Ignore -A-.

CAUTION: Risk of leakage on the ATF oil pan.

- Do not lay the VAS 6131/14 on the ATF oil pan.

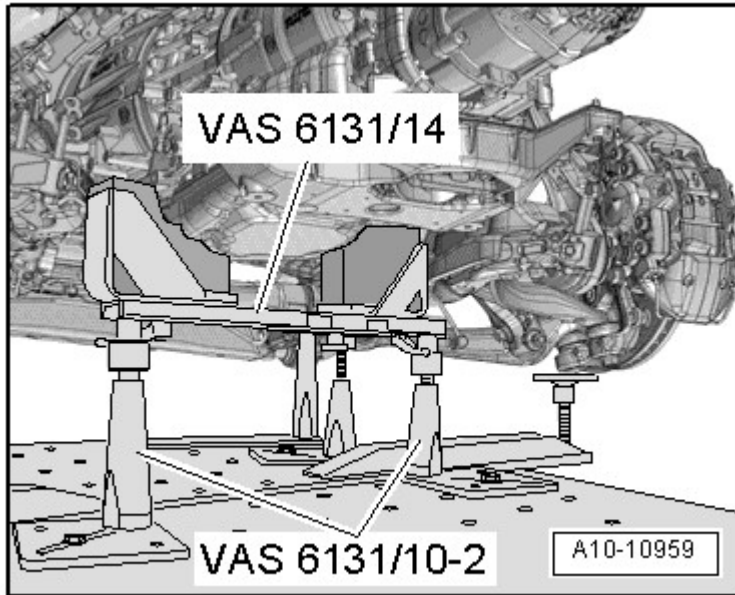


Fig. 86: Attaching Mounting Elements From VAS 6131/10 And Transmission Support
Courtesy of AUDI OF AMERICA, LLC

- Attach the mounting elements from the VAS 6131/10 and VAS 6131/14 at the front of the transmission as shown in the illustration.
- Rotate the left and right spindles up until the VAS 6131/14 rests firmly against the transmission.
- Attach mounting element base plates to the VAS 6131 A and tighten to 20 Nm.
- Loosen clamping bolts -1- on sides of VAS 6131 A and pull the rear table plate with transmission toward the rear -arrow-.

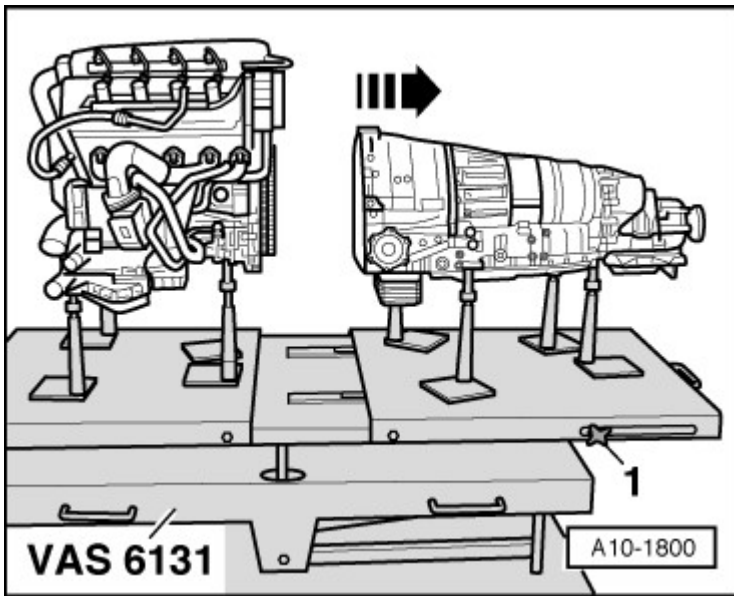


Fig. 87: Loosening Bolts -1- On Sides Of VAS 6131 A And Pull Rear Table Plate With Transmission Toward Rear -Arrow-
 Courtesy of AUDI OF AMERICA, LLC

ENGINE, SECURING TO ENGINE AND TRANSMISSION HOLDER

Special tools and workshop equipment required

- Engine Sling 2024 A
- Engine and Transmission Holder VAS 6095 with Bracket for V6 FSI Engine, Audi A6 VAS 6095/1-5
- Shop Crane VAS 6100
- Lift Arm Ext./Workshop Hoist VAS 6101
- Joint Support VAS 6131/13-7
- Engine Bung Set VAS 6122

Procedure

- Engine/transmission assembly is removed, engine and transmission are separated. Refer to **ENGINE AND AUTOMATIC TRANSMISSION, SEPARATING.**
- Engine secured with the VAS 6131/13-7.

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

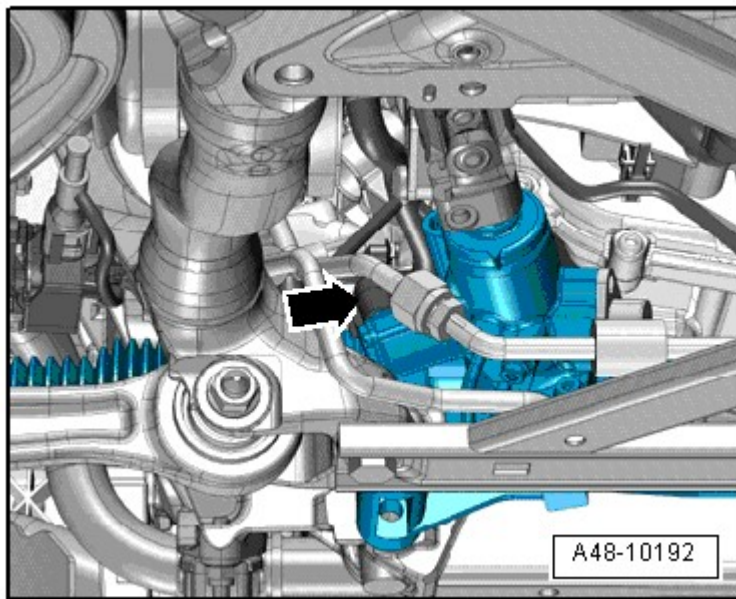


Fig. 88: Disconnecting Electrical Connector On Steering Gear
Courtesy of AUDI OF AMERICA, LLC

NOTE: Place a cloth underneath to soak up any escaping power steering fluid.

-- Remove the threaded connection -3-.

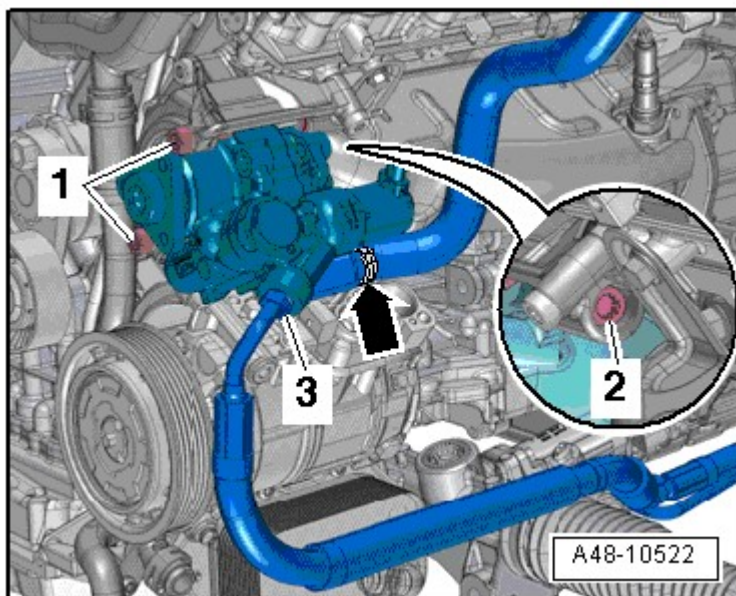


Fig. 89: Removing Threaded Connection -3-
Courtesy of AUDI OF AMERICA, LLC

NOTE: The illustration shows the installation location on a vehicle with dynamic steering.

Ignore -1 and 2- and -arrows-.

- Seal any open lines and connections with a clean plug from the VAS 6122.
- Remove the nut -1- and remove the bracket with the wiring harness from the subframe.

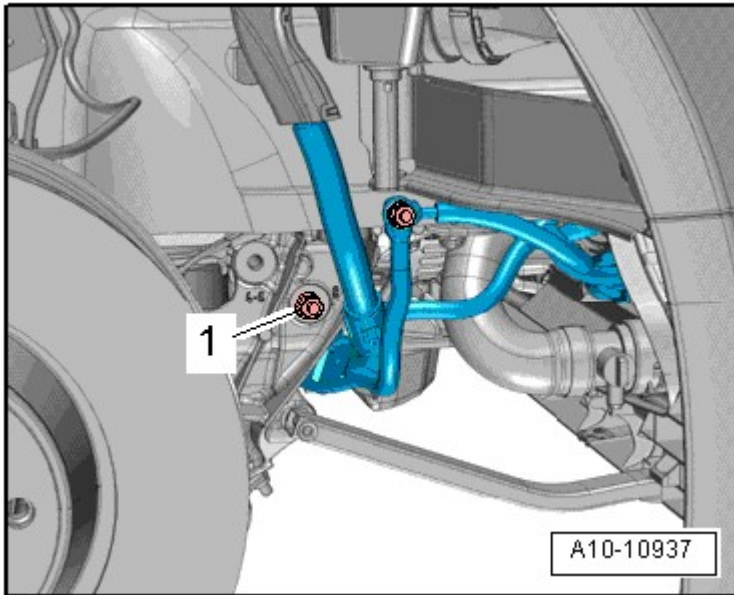


Fig. 90: Identifying Nut And Bracket With Wiring Harness From Subframe
Courtesy of AUDI OF AMERICA, LLC

NOTE: The illustration shows the installation position with the engine installed.

- Engage 2024 A in engine lifting eyes and in VAS 6100 with VAS 6101 as shown in illustration.

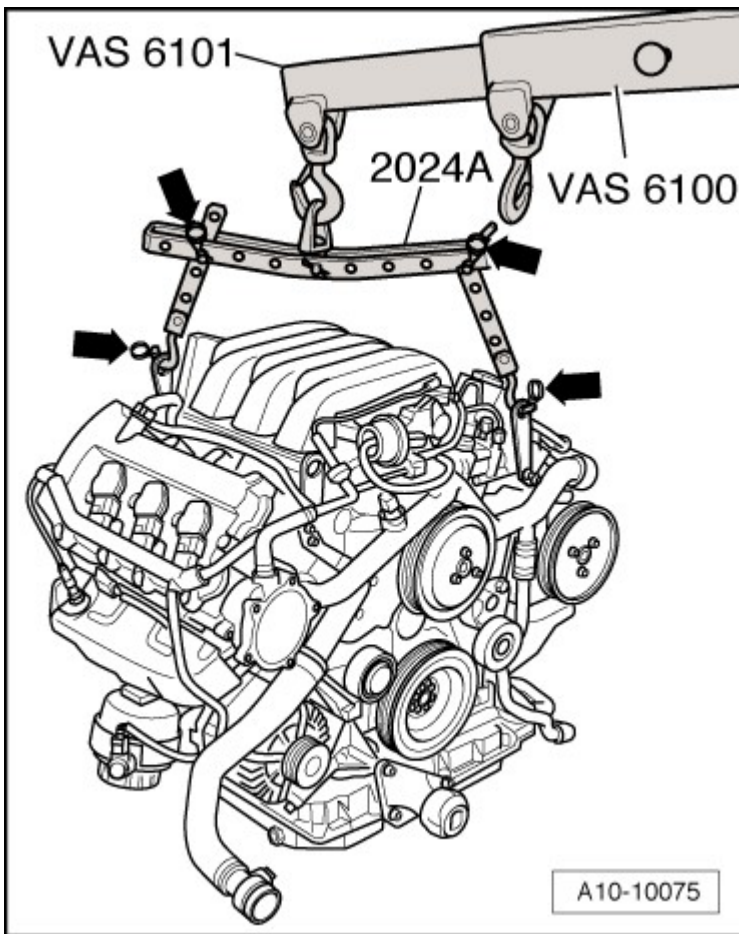


Fig. 91: Hooking Engine Sling 2024 A Onto Engine And Onto Workshop Crane VAS 6100 With Lift Arm Extension For Workshop Crane VAS 6101

Courtesy of AUDI OF AMERICA, LLC

NOTE: To be aligned to the center of gravity of the engine assembly, the hole rails of the lifting hook must be inserted as shown in the illustration.

WARNING: There is the risk of an accident.

- Lifting hooks and alignment pins on lifting tackle must be secured with securing pins -arrows-.

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

-- Remove the left engine mount bolt -3-.

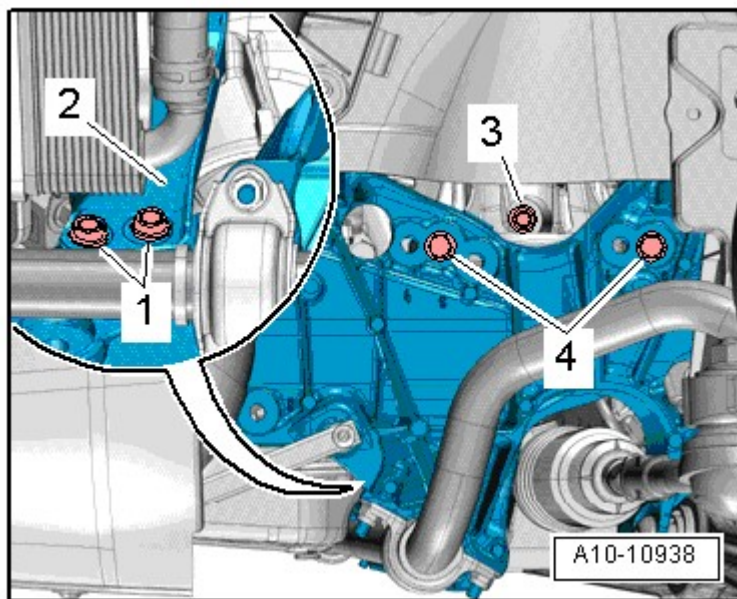


Fig. 92: Identifying Left Engine Mount Bolts -1-, -3- And -4-
 Courtesy of AUDI OF AMERICA, LLC

NOTE: The illustration shows the installation position with the engine installed.

Ignore -1, 2 and 4-.

-- Remove the right engine mount bolt -2-.

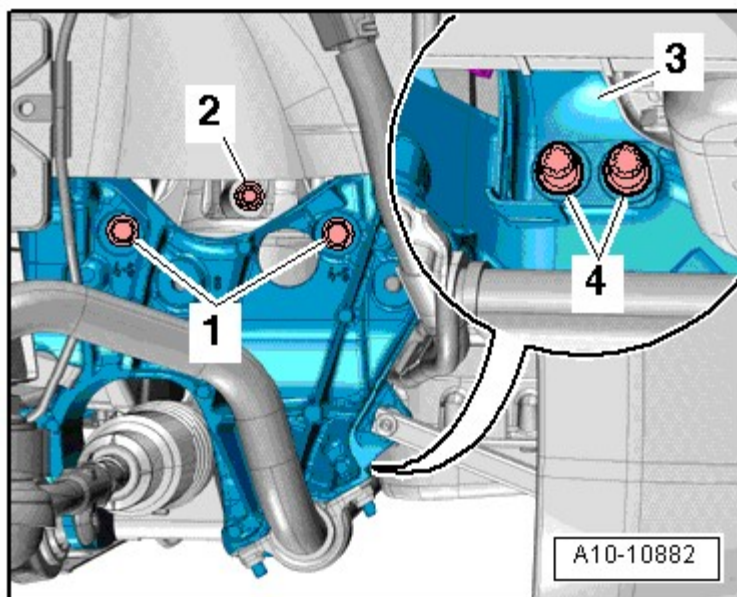


Fig. 93: Identifying Bolts And Right Engine Mount Retaining Plate
 Courtesy of AUDI OF AMERICA, LLC

NOTE: The illustration shows the installation position with the engine installed.

Ignore -1, 3 and 4-

-- Remove VAS 6131/13-7 from the engine.

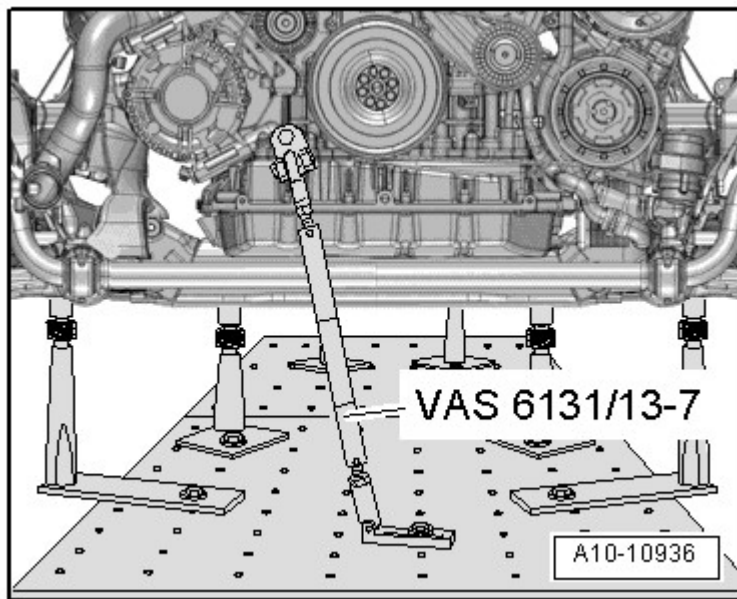


Fig. 94: Identifying Joint Support VAS 6131/13-7
Courtesy of AUDI OF AMERICA, LLC

-- Raise the engine from the engine carrier.

-- Remove the bolts -arrows- and the left engine support.

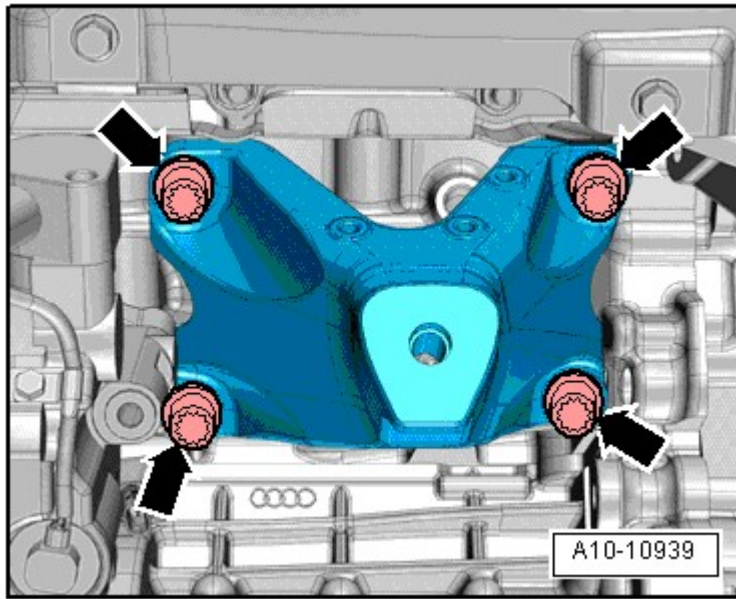


Fig. 95: Identifying Bolts -Arrows- & Left Engine Support
 Courtesy of AUDI OF AMERICA, LLC

-- Remove the nut -1- and free up the Ground (GND) wire at the engine support.

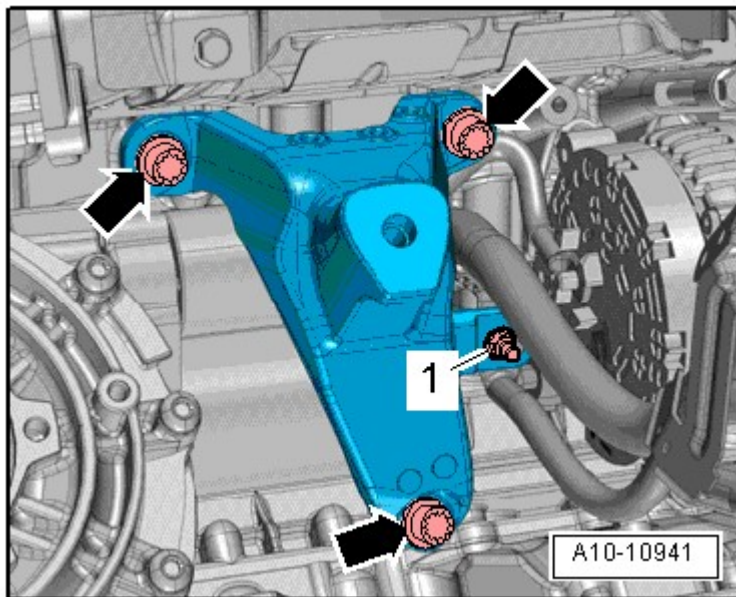


Fig. 96: Identifying Bolts & Right Engine Support
 Courtesy of AUDI OF AMERICA, LLC

-- Remove the bolts -arrows- and the right engine support.

-- Secure the starter on the engine.

-- Secure the engine to the VAS 6095 using the VAS 6095/1-5 and tighten to 40 Nm, as shown in the

illustration.

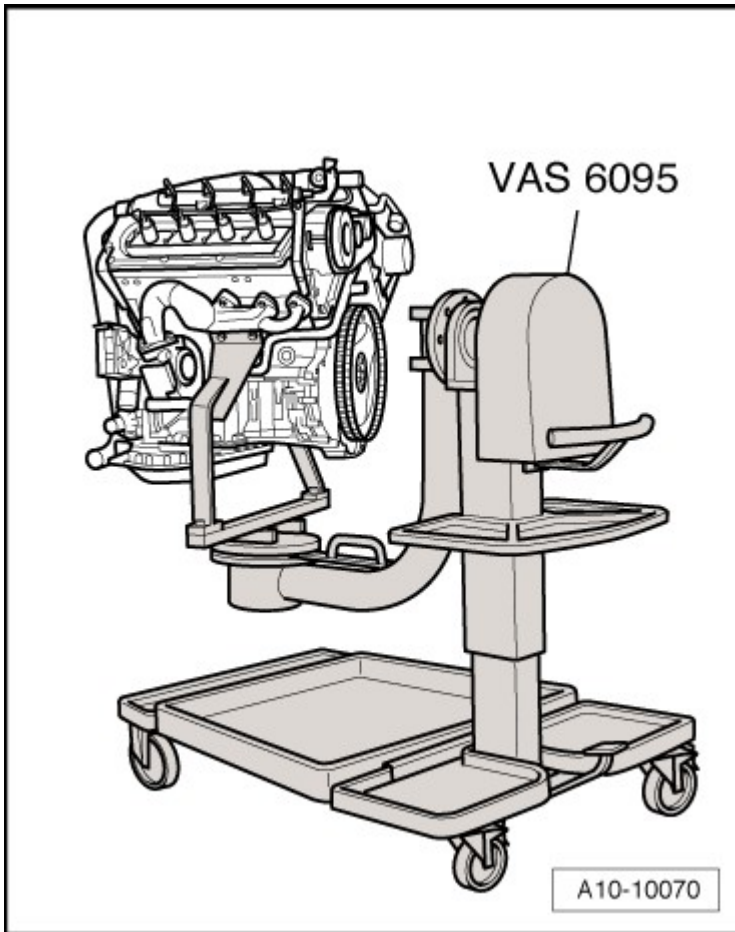


Fig. 97: Identifying Engine, Holder VAS 6095 And Bracket For V6 FSI Engine VAS 6095/1-5
Courtesy of AUDI OF AMERICA, LLC

ENGINE, INSTALLING

Special tools and workshop equipment required

- Ring Spanner Insert AF 16 V.A.G 1332/14
- Transport Lock T40170
- Socket T40058
- Scissor-Type Assembly Platform VAS 6131 A with Support Set VAS 6131/10 and Supplementary Set, Audi A8 VAS 6131/11 and Supplementary Set, Audi Q7 VAS 6131/13

Tightening Specifications

NOTE: The tightening specifications apply only to lightly greased, oiled, phosphated or blackened nuts and bolts.

2009 Audi Q5 Quattro

ENGINE 3.2 Liter - Engine Assembly - Engine Code(s): CALB

Additional lubricant such as engine or transmission oil may be used, but do not use graphite lubricant.

Do not use any parts that have had the lubrication removed.

Tightening specification tolerance +/- 15%.

Component	Nm
Bolts and nuts	M6 9
	M7 15
	M8 20
	M10 40
	M12 65

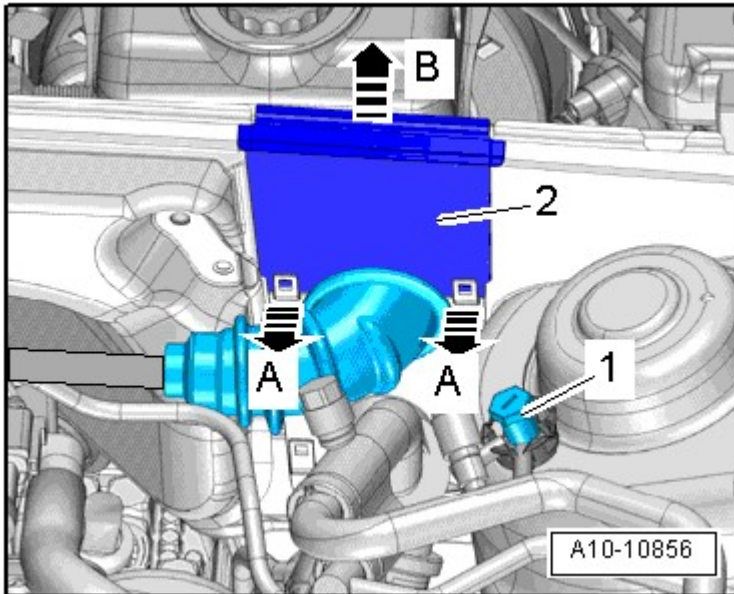


Fig. 98: Releasing Retainers -A Arrows- & Remove Wiring Bushing -2- Upward -Arrow B-
Courtesy of AUDI OF AMERICA, LLC

-- Tighten the GND bolt -1- to 9 Nm.

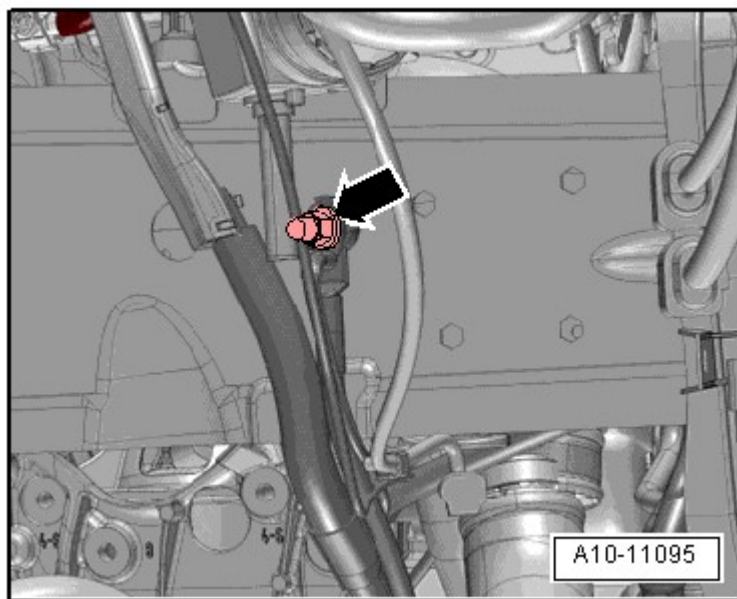


Fig. 99: Ground (GND) Wire to Longitudinal Member - Tightening Specification
 Courtesy of AUDI OF AMERICA, LLC

-- Tighten the nut -arrow- to 9 Nm.

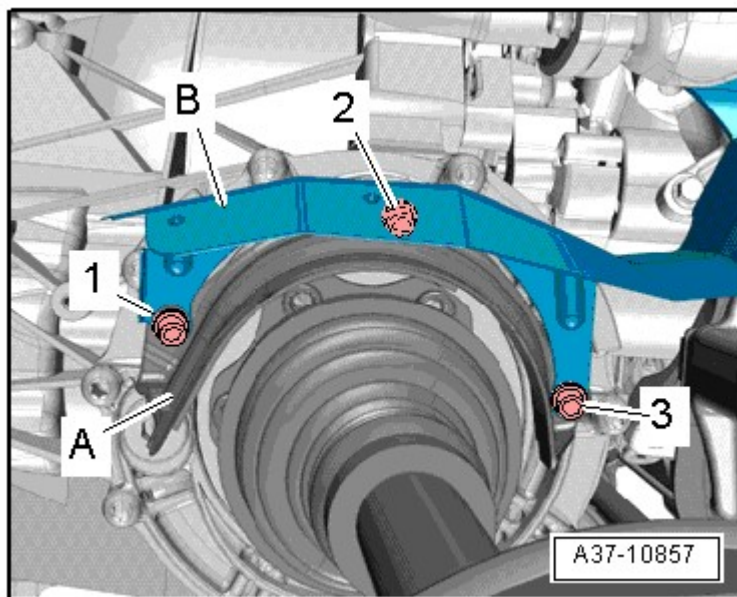


Fig. 100: Identifying Heat Shield
 Courtesy of AUDI OF AMERICA, LLC

-- Tighten the bolts -1, 2 and 3- to 23 Nm.

Engine to Automatic Transmission 0B6

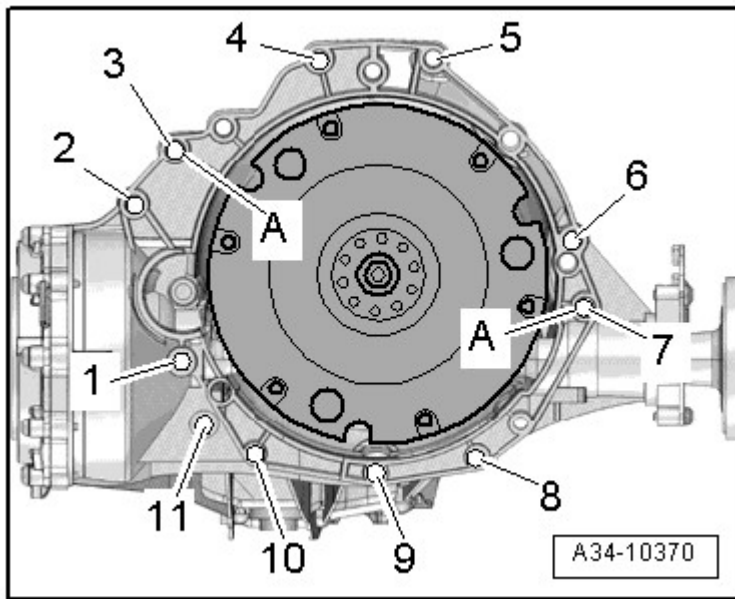


Fig. 101: Engine To Transmission Bolts
 Courtesy of AUDI OF AMERICA, LLC

Item	Bolt	Nm
1	M10 x 50 ¹⁾	65
2 to 6	M12 x 100 ²⁾	30 + 90°
7	M12 x 125 ²⁾	30 + 90°
8, 11	M10 x 60 ²⁾	15 + 90°
9	M10 x 75 ²⁾	15 + 90°
10	M10 x 95 ²⁾	15 + 90°
A	Alignment sleeves for centering	
• ¹⁾ Bolt class 10.9, the steel bolt may be used again unlimited number of times. • ²⁾ The aluminum bolts can be used 2 times <u>ENGINE, INSTALLING.</u>		
(1) To prevent damaging the bolts when marking them, do not clamp them in a vise. Insert the bolt using a 14 mm socket with a 1/2 drive, which is inserted in to the vise, as illustrated.		

- The aluminum bolts -2 through 11- may be used two times. Therefore, the bolts must be marked with two notches "X" made by a chisel after they have been used the first time -arrow-.

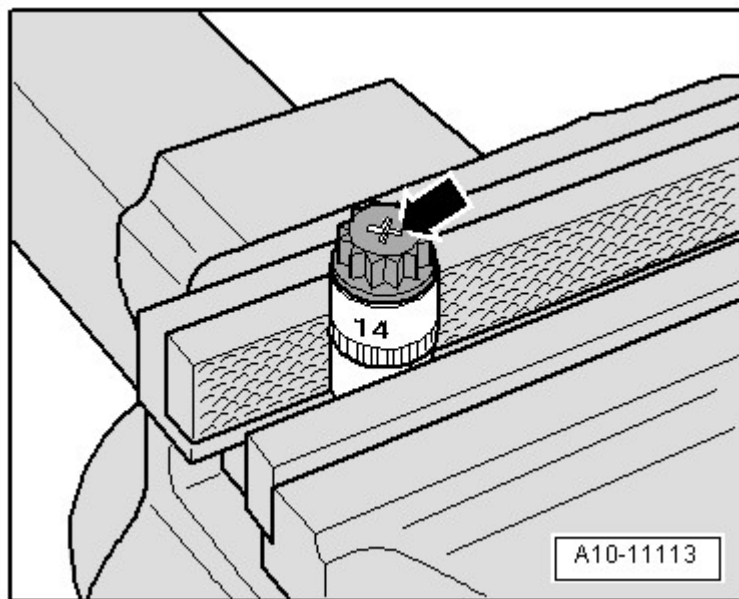


Fig. 102: Identifying Bolts Marked With An "X" May Not Be Used Again
Courtesy of AUDI OF AMERICA, LLC

- Bolts marked with an "X" may not be used again.

Procedure

NOTE: Replace the bolts which are being tightened with an additional turn.

Replace self-locking nuts and bolts and seals, gaskets and O-rings.

The drive plate in the vehicles with the automatic transmission 0B6 must not have any needle bearings. Check if a needle bearing is inserted before installing. Remove the needle bearing in the drive plate. Refer to NEEDLE BEARING ON DRIVE PLATE .

Secure all hose connections with hose clamps of the same type as those equipped by the factory.

In order to be able to securely mount the air guide hoses on their connectors, spray the screws on the previously used clamps with a rust remover.

When installing, bring all cable ties back to the same positions.

-- When joining the engine and subframe, hold the ATF lines in their installation position.

-- Clean the threaded holes in the cylinder block for connecting the engine and transmission using a thread tap before installing the transmission.

-- The following preparations must be made before connecting the engine and transmission:

-- Turn the torque converter so that the hole next to the notch -arrow- is visible in the transmission housing in the lower cut-out, as illustrated.

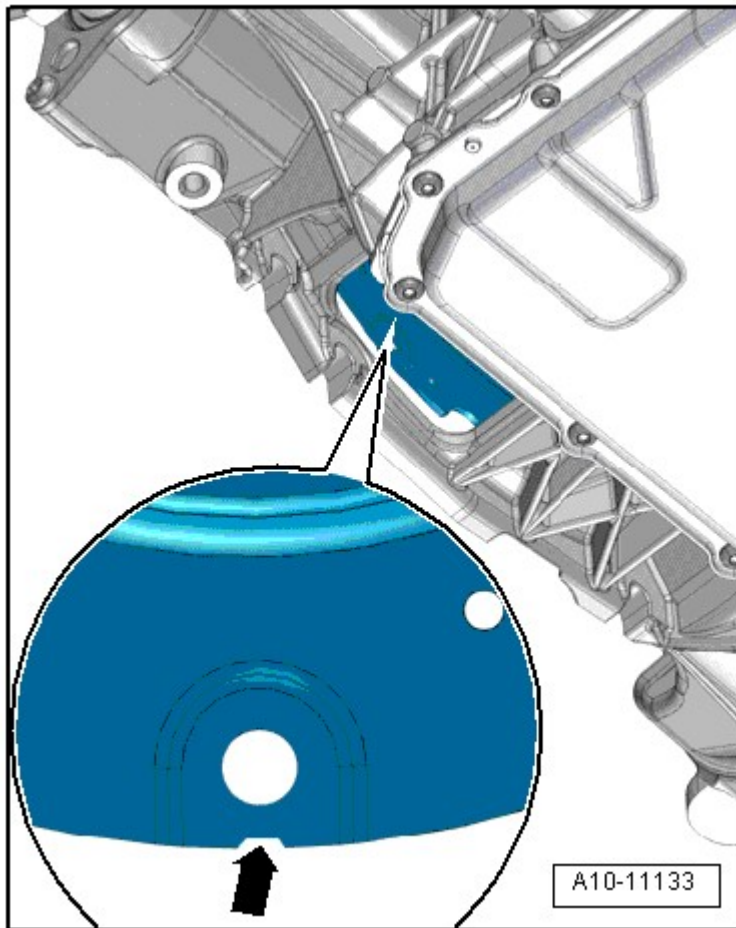


Fig. 103: Locating Hole Next To Notch
Courtesy of AUDI OF AMERICA, LLC

NOTE: The notch is only in one location on the circumference, so rotate the torque converter as needed.

-- Insert the T40170 in the transmission housing from below and secure it on the flange shaft -1-.

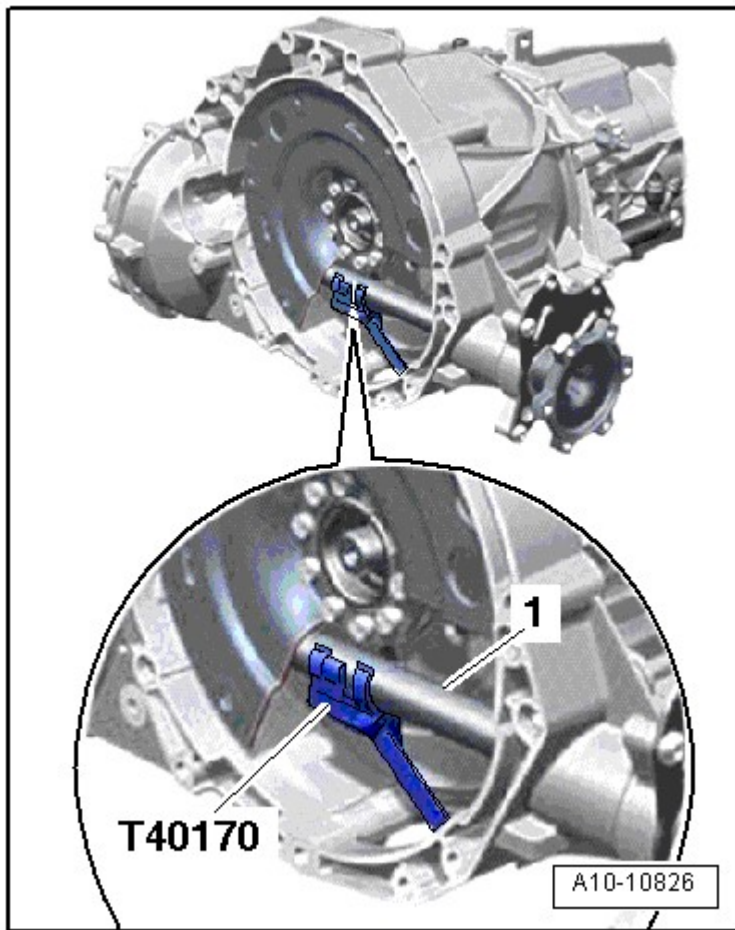


Fig. 104: Identifying Transportation Lock T40170

Courtesy of AUDI OF AMERICA, LLC

-- Inspect the aluminum bolts used to connect the engine to the transmission to see if they can be used again and mark them, if necessary **ENGINE, INSTALLING.**

-- Check if the alignment sleeves -A- for centering the engine/transmission are in the cylinder block and insert them if they are not.

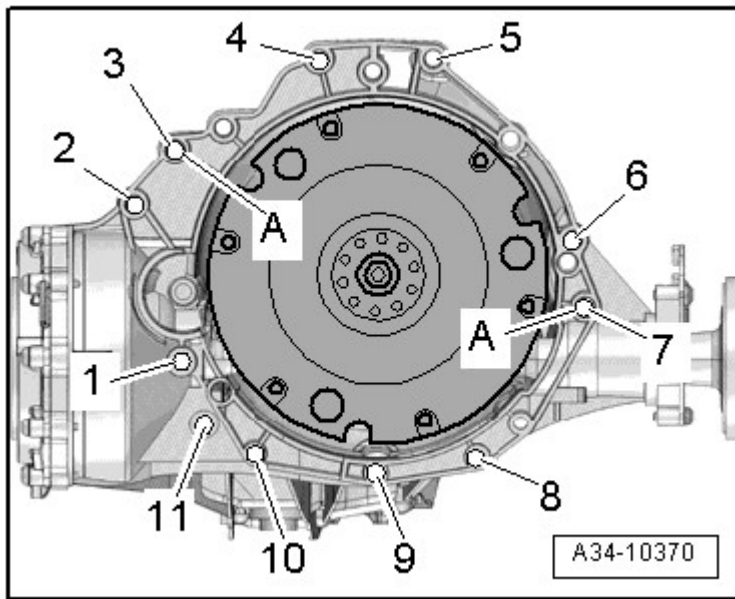


Fig. 105: Ensuring Alignment Sleeves -A- For Centering Engine And Transmission In Cylinder Block Are Present

Courtesy of AUDI OF AMERICA, LLC

- Position the transmission on the engine and tighten the bolts -1 through 11-.
- Remove the T40170.
- Install the engine supports and engine mount. Refer to **SUBFRAME MOUNT OVERVIEW**.

NOTE: The following procedure is necessary to assure that the torque converter contacts the drive plate evenly and does not get bent.

- Press the torque converter -2- slightly against the drive plate -3- using a pry bar -1- in direction of -arrow-.

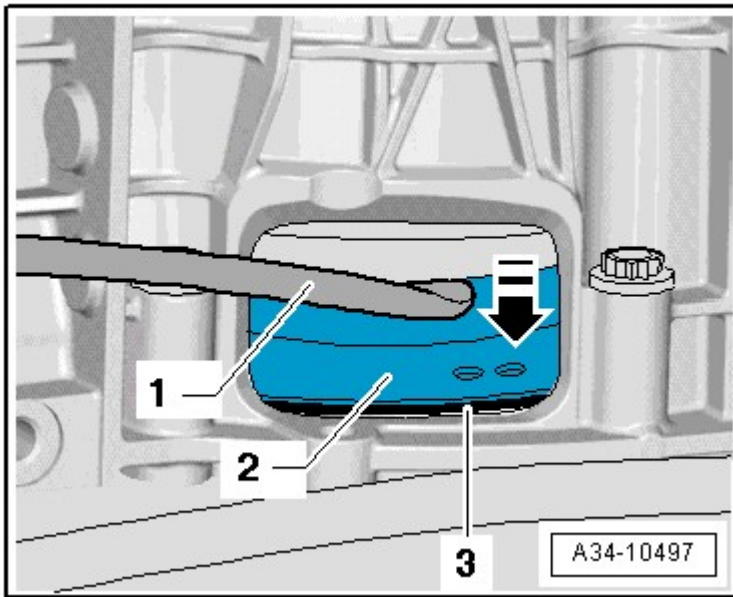


Fig. 106: Pressing Torque Converter
Courtesy of AUDI OF AMERICA, LLC

-- Secure the torque converter to the drive plate as follows:

NOTE: Use the V.A.G 1332/14 to tighten the bolt.

-- Install the first bolt -arrow- and tighten by hand (2 Nm).

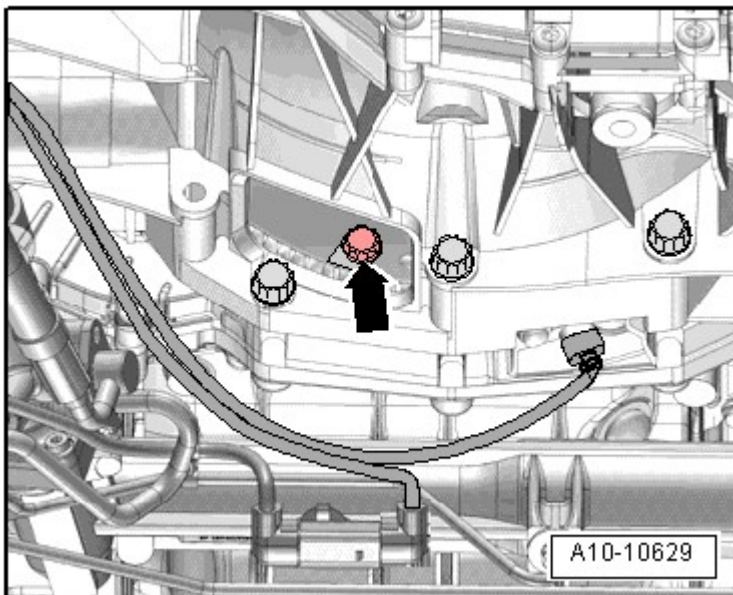


Fig. 107: Identifying Clutch Module First Bolt Installation Location
Courtesy of AUDI OF AMERICA, LLC

-- Insert the T40058 guide pins as follows:

- The large diameter -arrow 1- faces the engine.

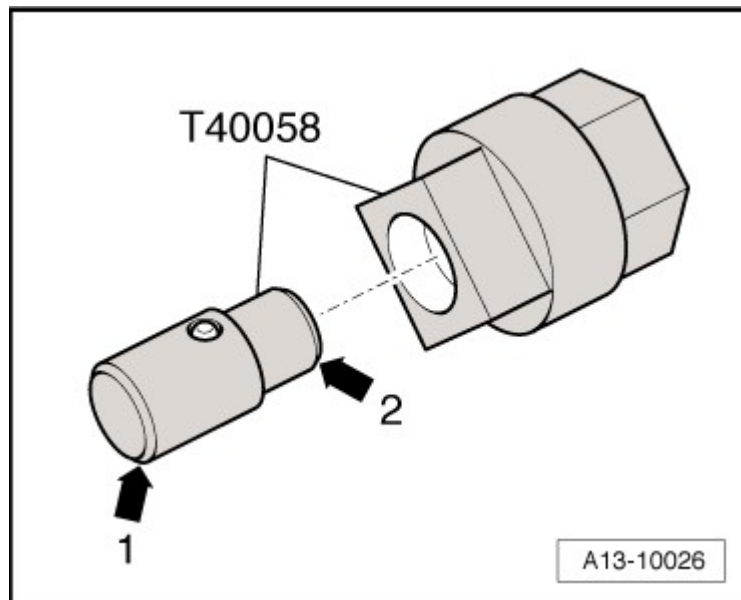


Fig. 108: Identifying Guide Pin And Adapter T40058
Courtesy of AUDI OF AMERICA, LLC

- The small diameter -arrow 2- faces the adapter.

-- Rotate the crankshaft with the T40058 180° in direction of engine rotation -arrow-.

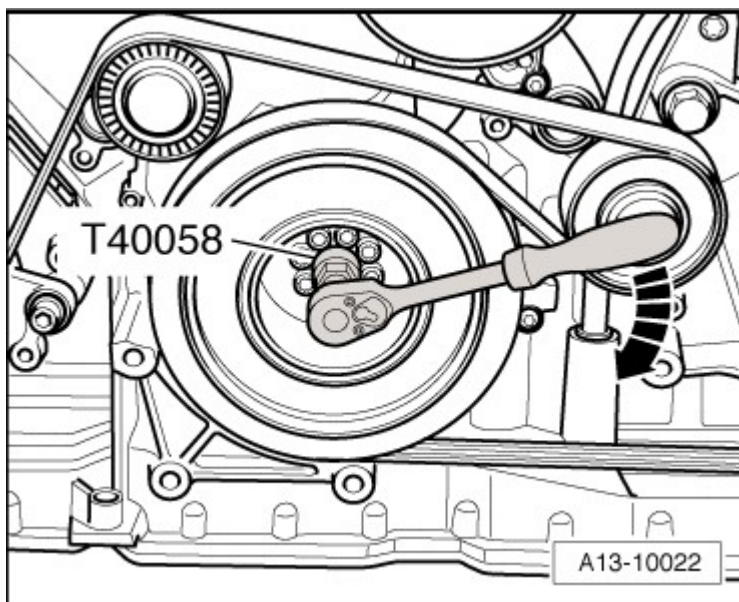


Fig. 109: Identifying Torque Converter Bolts And Adapter T40058
Courtesy of AUDI OF AMERICA, LLC

-- With the crankshaft in this position, tighten the bolts -arrow- which are now accessible to the tightening specification. Refer to **Removal and Installation** or to **Removal and Installation** .

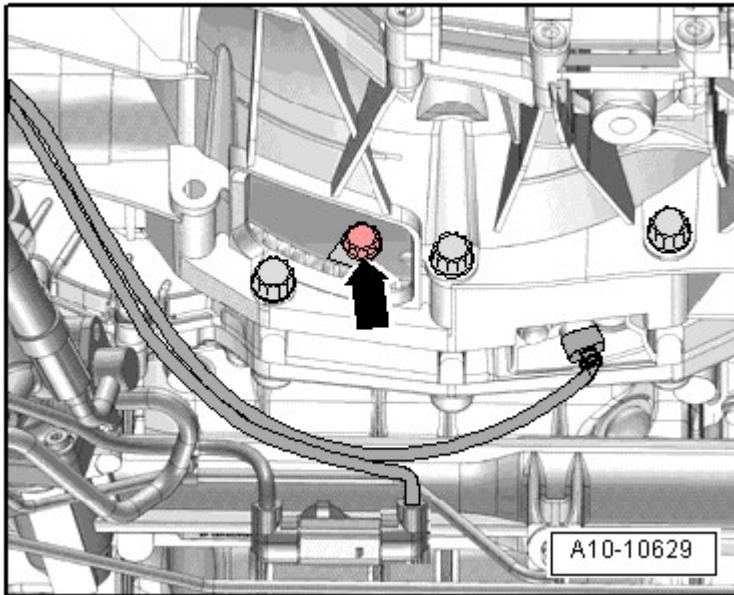


Fig. 110: Identifying Clutch Module First Bolt Installation Location
Courtesy of AUDI OF AMERICA, LLC

- Turn the crankshaft 60° further and tighten the remaining 5 bolts to the tightening specification. Refer to **Removal and Installation** or to **Removal and Installation** .
- Install the power steering hydraulic oil lines. Refer to **Removal and Installation** .
- Install the left and right drive axles on the transmission flange shafts. Refer to **Removal and Installation** .
- Install the drive axle heat shield, refer to **Fig. 100**.
- Install the catalytic converters. Refer to **LEFT CATALYTIC CONVERTER** , **RIGHT CATALYTIC CONVERTER** .
- Raise the engine/transmission assembly using the VAS 6131 A.
- Align the subframe and transmission carrier using the marks made on the longitudinal members during removal.
- Tighten the subframe bolts only to the tightening specifications, do not tighten them further (tighten the bolts only after axle alignment). Refer to **Specifications** .

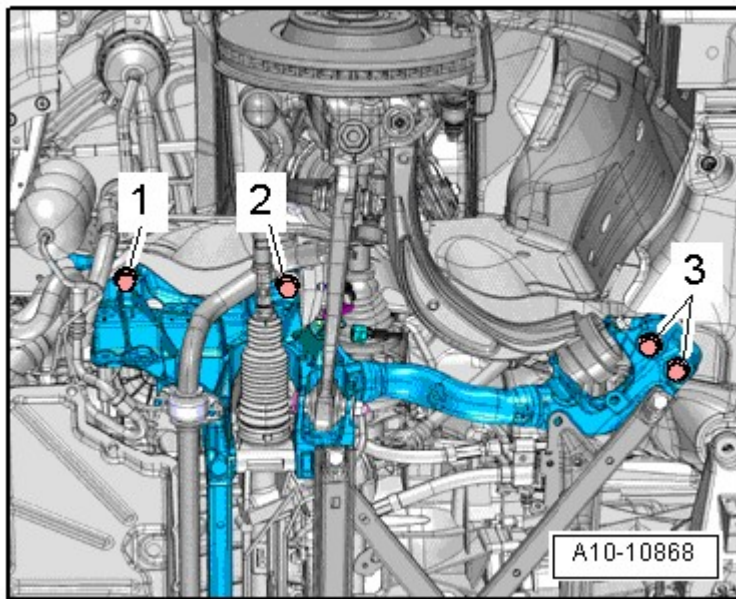


Fig. 111: Identifying Subframe Bolts (Tighten To Specifications)
Courtesy of AUDI OF AMERICA, LLC

WARNING: Risk of accident due to loose connections.

- If the bolts in the subframe are not tightened to final torque, vehicle must not be driven.

-- Tighten the tunnel crossmember bolts -arrow-. Refer to **Removal and Installation** or to **Removal and Installation** .

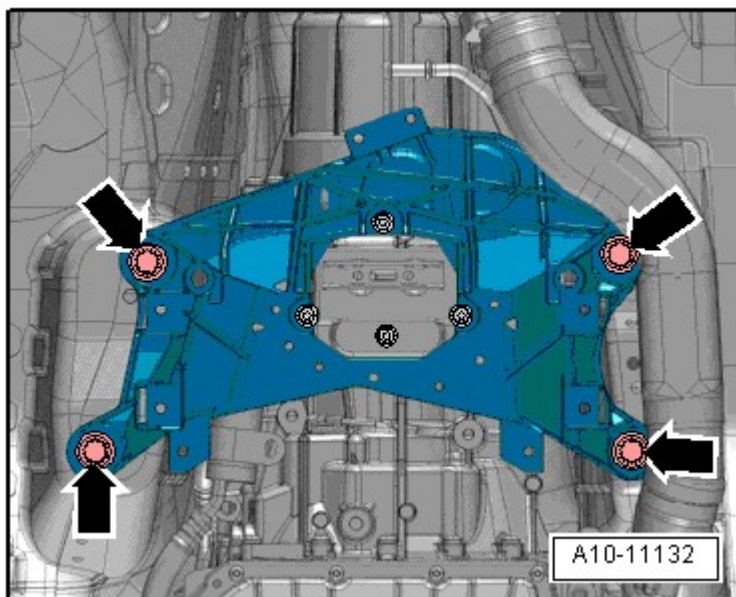


Fig. 112: Identifying Crossmember & Bolts

Courtesy of AUDI OF AMERICA, LLC

Install in reverse order of removal paying attention to the following:

- Install ATF lines. Refer to **Description and Operation** or to **Description and Operation** .
- Install the universal joint on the steering gear. Refer to **Removal and Installation** .
- Install the driveshaft. Refer to **Removal and Installation** .
- Install selector lever cable. Refer to **Description and Operation** or to **Description and Operation** .
- Install the front muffler. Refer to **FRONT MUFFLER** .
- Install the subframe crossbrace, upper control arm and stabilizer bar and tighten the suspension strut on the control arm. Refer to **Removal and Installation** .
- Install the brake caliper. Refer to **Removal and Installation** .
- Install the Engine Control Module (ECM). Refer to **Removal and Installation** .
- Electrical connectors and wiring routing. Refer to appropriate SYSTEM WIRING DIAGRAM.
- Install the wires, terminal 30 wire junction 2 -TV22- and the engine compartment E-box cover. Refer to **Fig. 98, Fig. 99** and **Removal and Installation** .
- Install the tower brace. Refer to **Removal and Installation** .
- Install the washer fluid reservoir filler tube. Refer to **Removal and Installation** .
- Install the refrigerant lines. Refer to **Removal and Installation** .
- Follow the measures after connecting battery. Refer to **Removal and Installation** .

CAUTION: There is a risk of destroying the control modules with excess voltage.

- **Do not use a charger as a starting aid.**

- Install the fuel supply hose and air filter housing. Refer to **Removal and Installation** .
- Install the lock carrier braces. Refer to **Removal and Installation** .
- Fill engine oil and check oil level. Refer to the Maintenance Procedures.
- Before starting engine for the first time, check the fluid level in the power steering reservoir. Refer to **General Information** .

NOTE: Do not run the power steering pump when it is dry.

-- Connect the coolant hose to the coupling. Refer to **Fig. 113**.

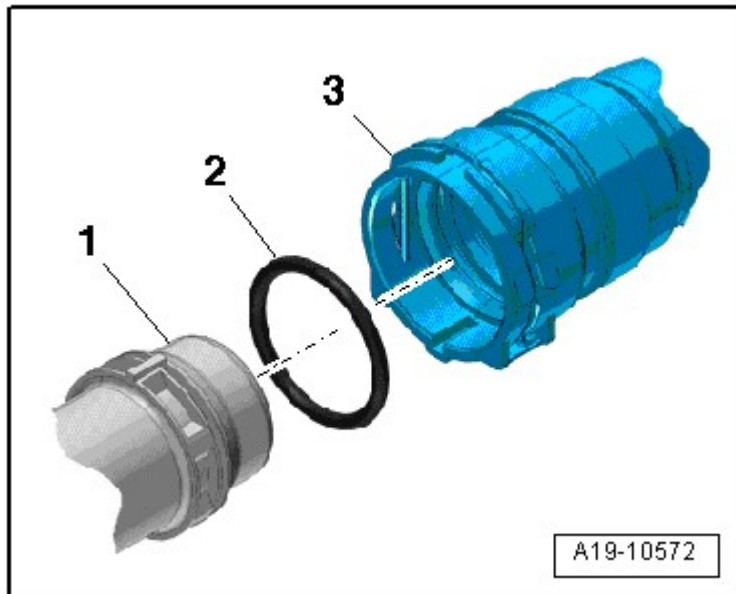


Fig. 113: Connecting Coolant Hose To Coupling
Courtesy of AUDI OF AMERICA, LLC

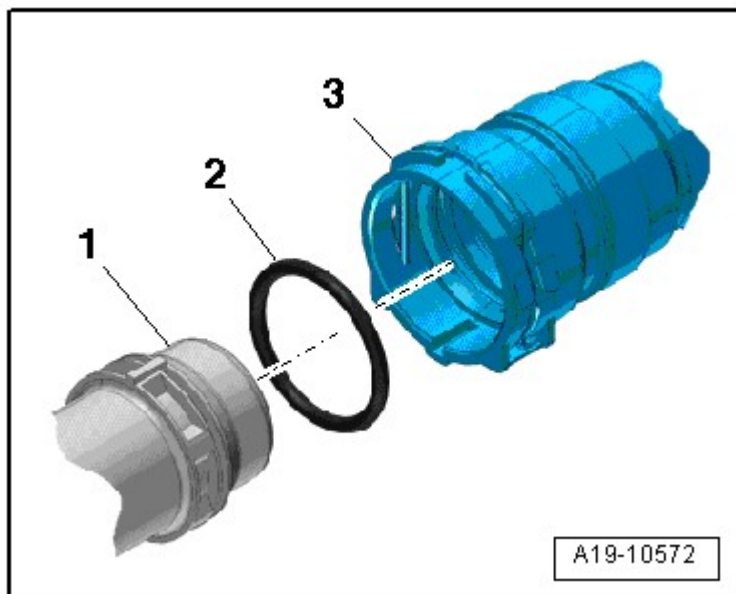


Fig. 114: Connecting Coolant Hose To Coupling
Courtesy of AUDI OF AMERICA, LLC

-- Fill the engine 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.

-- Fill the refrigerant circuit. Refer to Description and Operation .

-- Install the front wheels and perform an alignment. Refer to Description and Operation .

WARNING: Risk of accident due to loose connections.

- Tighten the subframe bolts to the specification after performing the axle alignment.

-- Check the ATF level. Refer to General Information or to General Information .

-- Install the noise insulation and the wheel housing liners. Refer to Removal and Installation .

LEFT ENGINE MOUNT

NOTE: To avoid repeat repairs, do the following if the engine mount is faulty:

Replace the faulty engine mount and its retaining plate.

Likewise replace the engine mount on the opposite side, check the retaining plate and replace it if necessary.

Special tools and workshop equipment required

- Engine Support Bridge 10 - 222 A
- Spindle 10 - 222 A /11
- Oil Collecting and Extracting Device V.A.G 1782
- Engine Support Supplement Set T40093

Removing

-- Place the V.A.G 1782 under the engine.

-- Remove the bolts -arrows- and lay aside the oil cooler with the coolant hoses -1 and 2- connected.

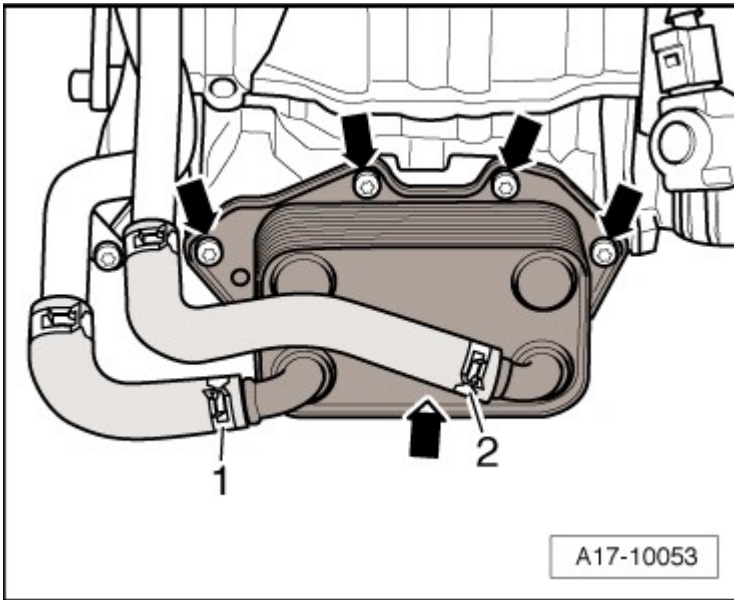


Fig. 115: Connecting/Disconnecting Coolant Hoses With Hose Clamps
Courtesy of AUDI OF AMERICA, LLC

-- Vehicles with an after-run coolant pump: Remove the after-run coolant pump -V51-. Refer to **After-Run Coolant Pump -V51-** and **ENGINE OIL COOLER** .

-- Remove Air Conditioning (A/C) compressor. Refer to **Removal and Installation** .

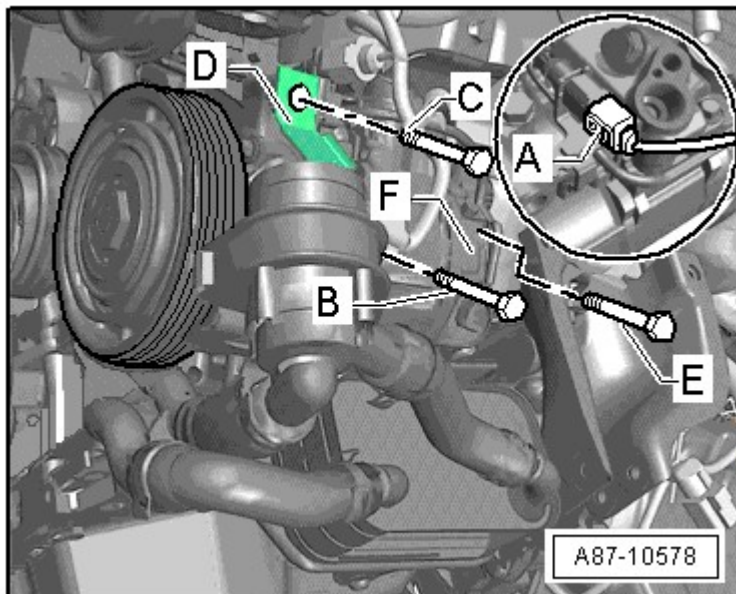


Fig. 116: Identifying A/C Compressor & Bolts
Courtesy of AUDI OF AMERICA, LLC

-- Remove the rear engine cover -top arrows-.

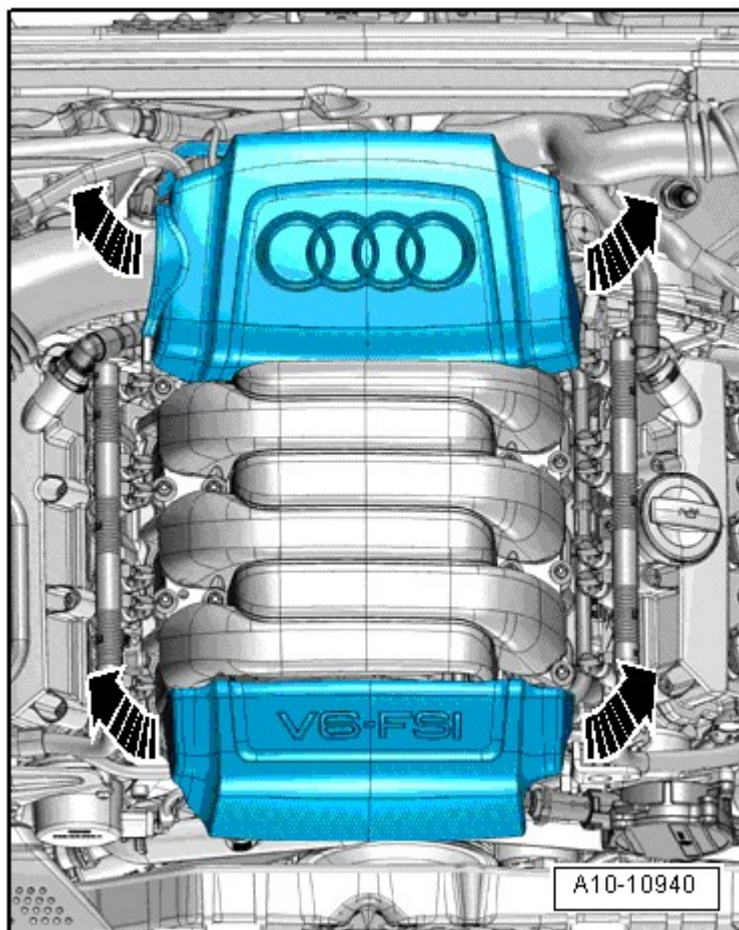


Fig. 117: Identifying Engine Cover

Courtesy of AUDI OF AMERICA, LLC

-- Position the 10 - 222 A on the left and right suspension strut tower with the T40091/3 as shown in the illustration.

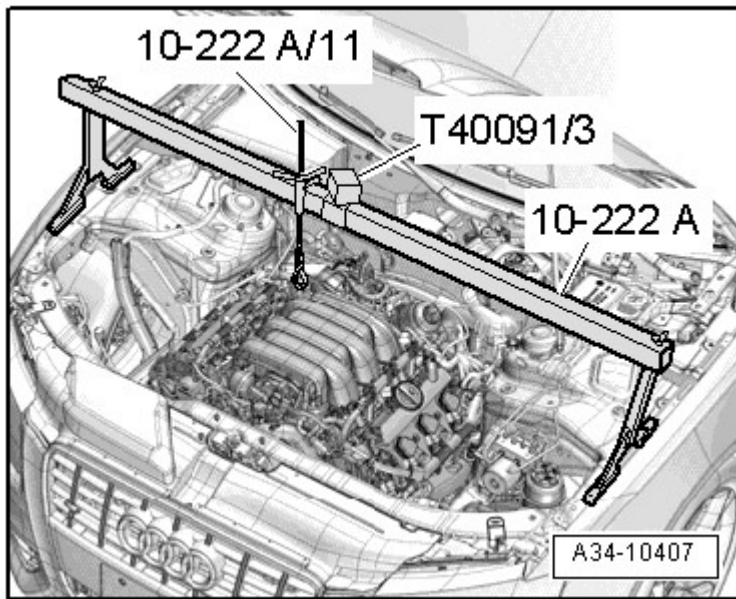


Fig. 118: Positioning Engine Support Bridge 10-222 A
Courtesy of AUDI OF AMERICA, LLC

-- Engage the 10 - 222 A /11 on the right engine lifting eye.

-- Install additional 10 - 222 A components as shown in the illustration. Position the supports T40093/3 on the notches on the longitudinal members.

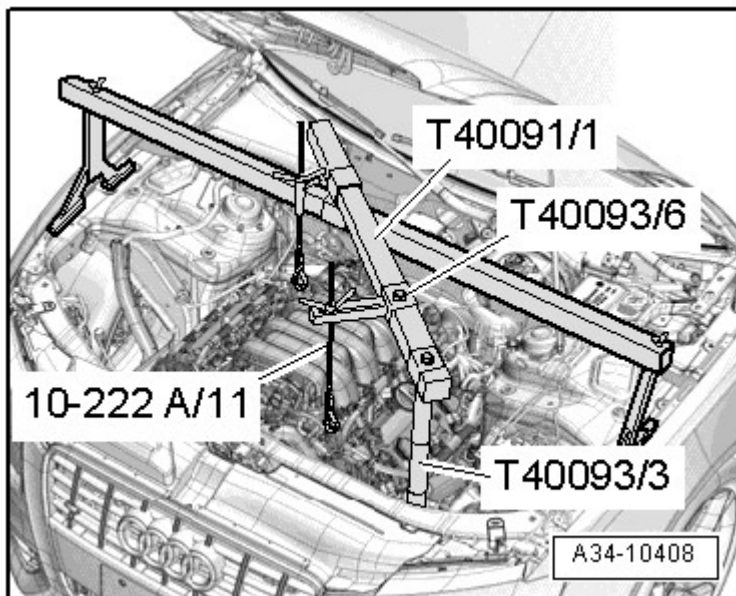


Fig. 119: Identifying Additional Engine Support Bridge 10 - 222 A
Courtesy of AUDI OF AMERICA, LLC

-- Engage the 10 - 222 A /11 on the left engine lifting eye.

- Lightly pretension engine with spindles.
- Remove the nut -2- and free up the bracket -1-.

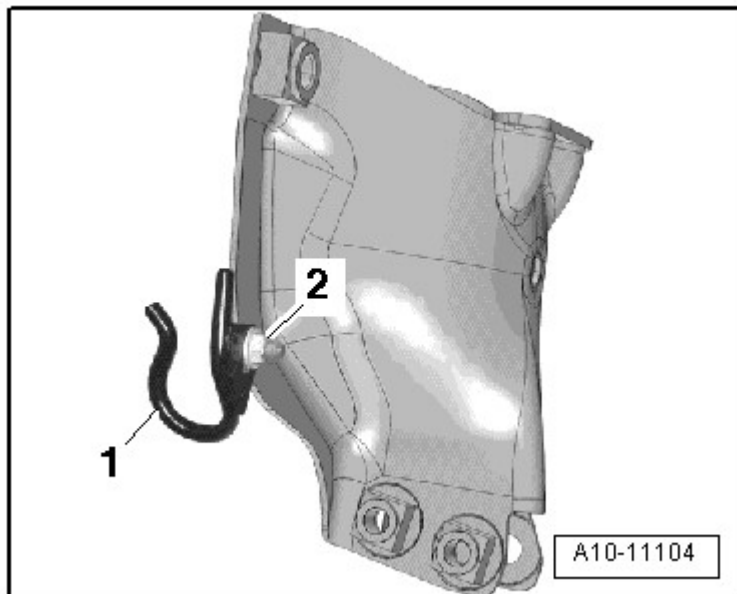


Fig. 120: Identifying Hydraulic Oil Hose Bracket -1- & Nut -2-
 Courtesy of AUDI OF AMERICA, LLC

- Remove the left subframe bolt -2-.

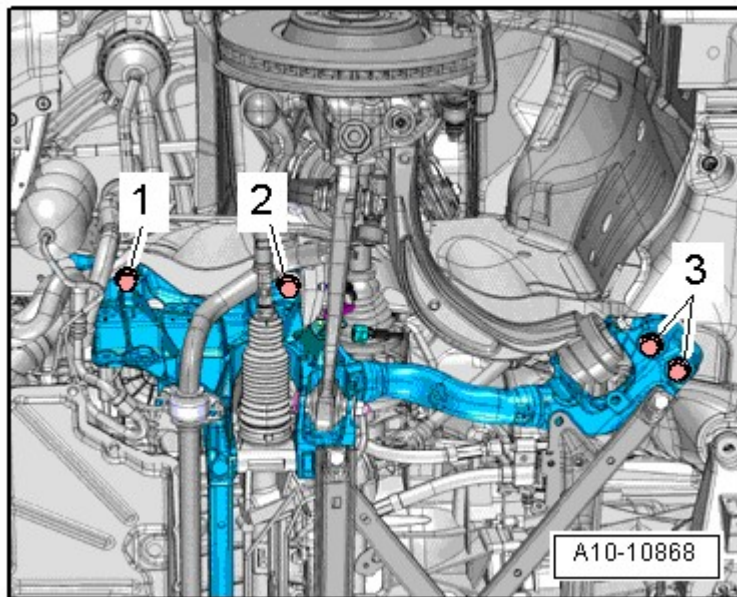


Fig. 121: Identifying Subframe Bolts (Tighten To Specifications)
 Courtesy of AUDI OF AMERICA, LLC

NOTE: The left subframe bolts -1 and 3- and all the right subframe bolts remain installed.

-- Remove the left engine mount bolts -1, 3 and 4-.

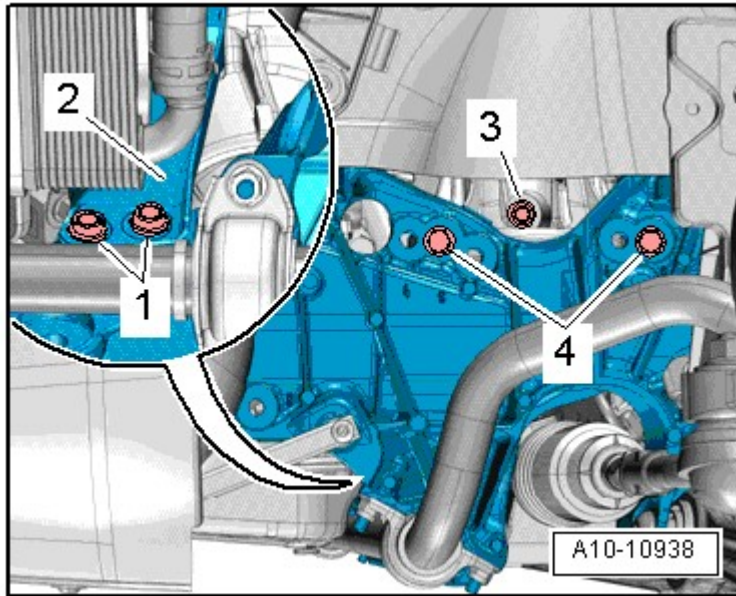


Fig. 122: Identifying Left Engine Mount Bolts -1-, -3- And -4-
Courtesy of AUDI OF AMERICA, LLC

-- Move the left engine mount retaining plate -2- to the side.

-- Remove the left engine mount.

Installing

- Tightening specifications, refer to SUBFRAME MOUNT OVERVIEW and Fig. 2.

Install in reverse order, paying attention to the following:

NOTE: Replace the bolts which are being tightened with an additional turn.

-- Tighten the subframe. Refer to Removal and Installation .

-- Install the oil cooler. Refer to ENGINE OIL COOLER .

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

-- Install the after-run coolant pump. Refer to After-Run Coolant Pump -V51- .

RIGHT ENGINE MOUNT

NOTE: To avoid repeat repairs, do the following if the engine mount is faulty:

Replace the faulty engine mount and its retaining plate.

Likewise replace the engine mount on the opposite side, check the retaining plate and replace it if necessary.

Special tools and workshop equipment required

- Engine Support Bridge 10 - 222 A
- Spindle 10 - 222 A /11

Removing

-- Remove the rear engine cover -top arrows-.

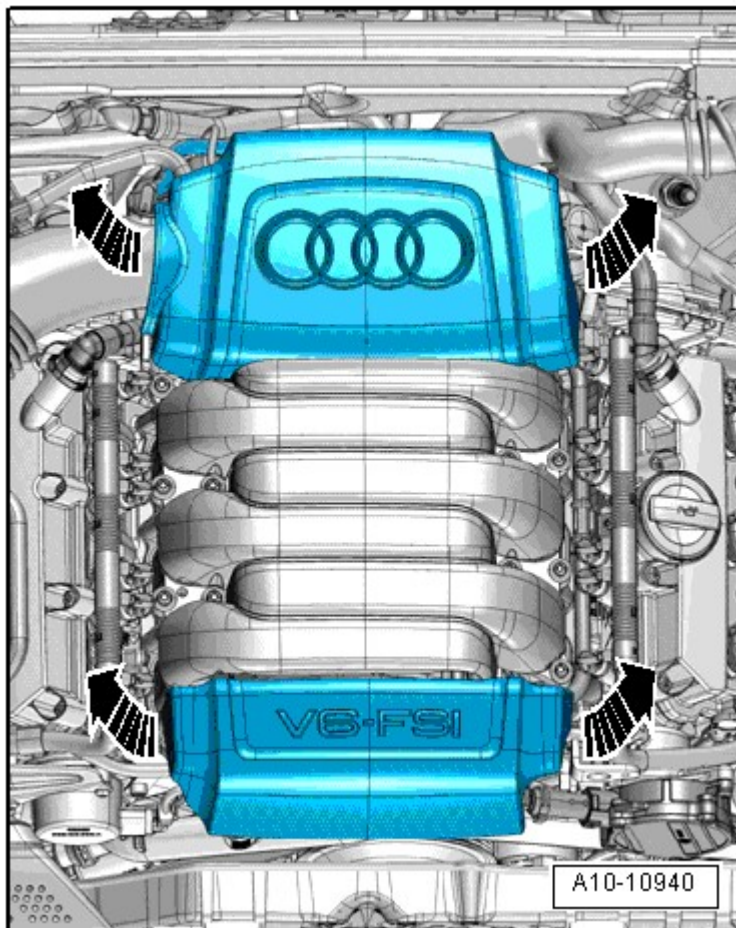


Fig. 123: Identifying Engine Cover
Courtesy of AUDI OF AMERICA, LLC

-- Position the 10 - 222 A on the left and right suspension strut tower as shown in the illustration.

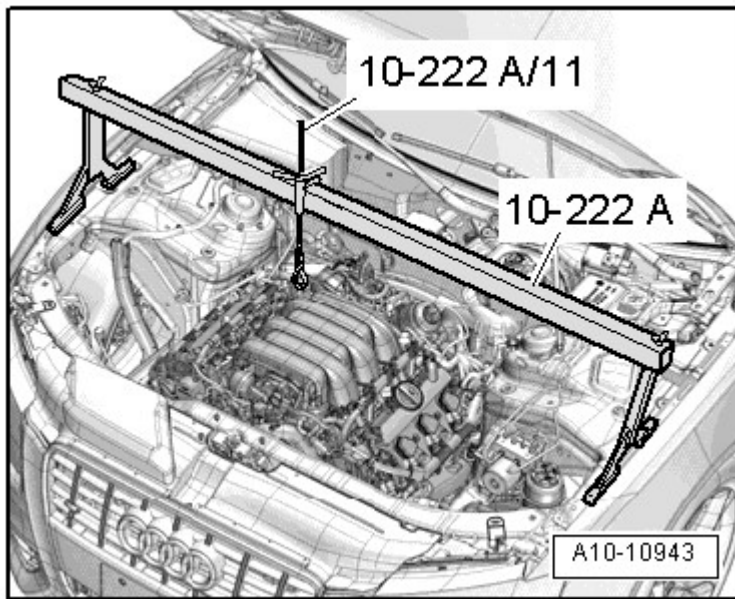


Fig. 124: Positioning Engine Support Bridge On Left And Right Suspension Strut Tower
 Courtesy of AUDI OF AMERICA, LLC

- Engage the 10 - 222 A /11 on the right engine lifting eye and tension it slightly.
- Remove the right front wheel.
- Remove the right front wheel housing liner. Refer to **Removal and Installation** .
- Remove the noise insulation -1 and 2-. Refer to **Removal and Installation** .

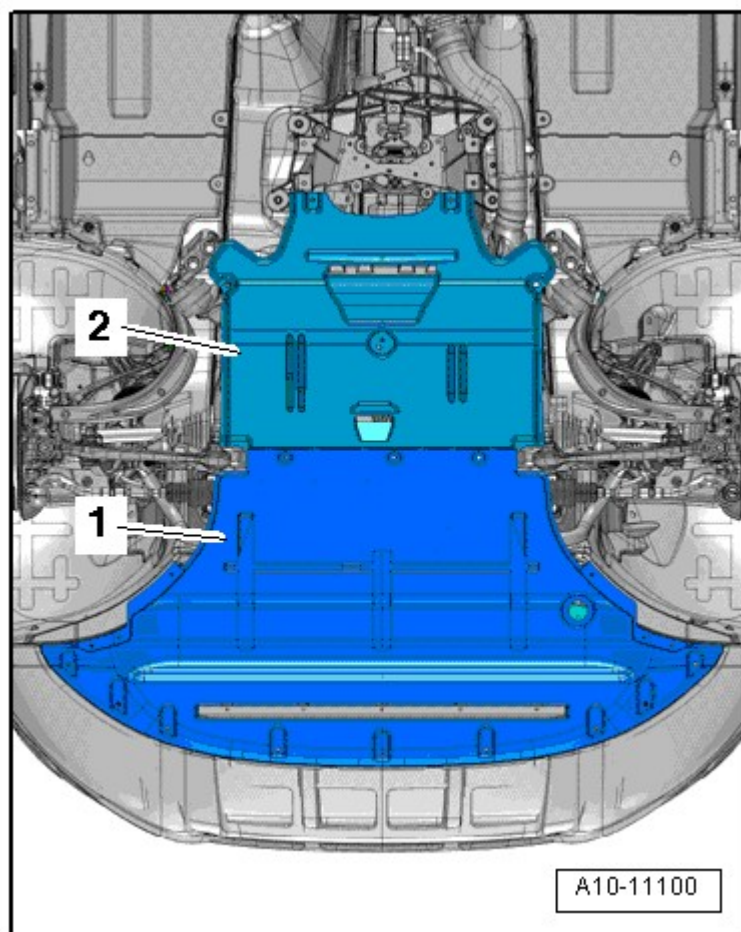


Fig. 125: Identifying Noise Insulation
Courtesy of AUDI OF AMERICA, LLC

-- Remove the nut -1- and remove the bracket with the wiring harness from the subframe.

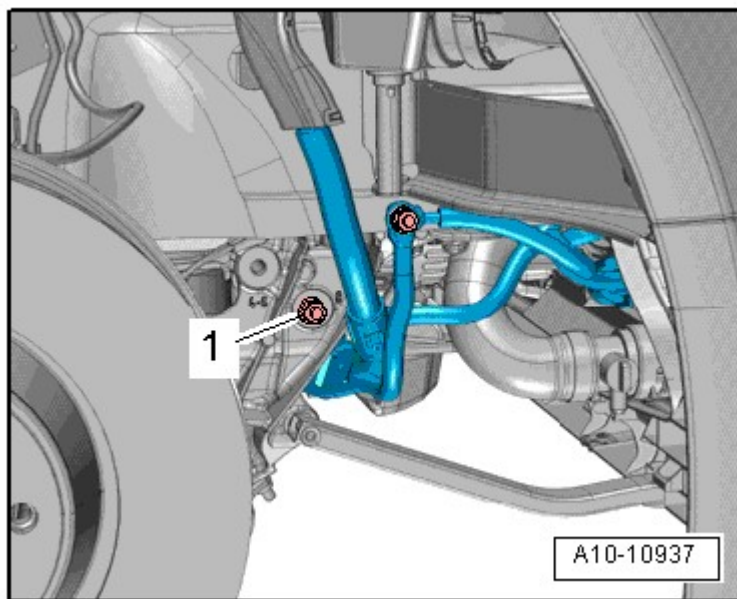


Fig. 126: Identifying Nut And Bracket With Wiring Harness From Subframe
 Courtesy of AUDI OF AMERICA, LLC

-- Remove the bolts -1, 2 and 4- and move the right engine mount retaining plate -3- to the side.

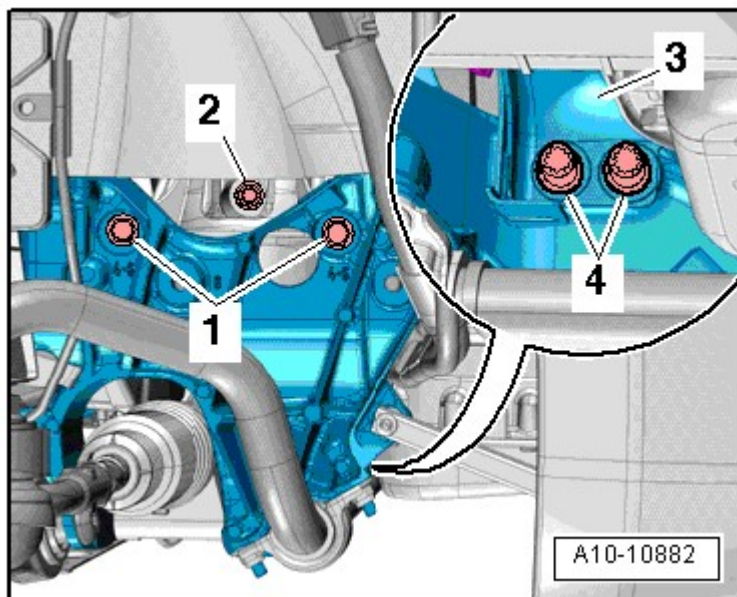


Fig. 127: Identifying Bolts And Right Engine Mount Retaining Plate
 Courtesy of AUDI OF AMERICA, LLC

-- Remove the bolt -arrow- on the ATF line bracket.

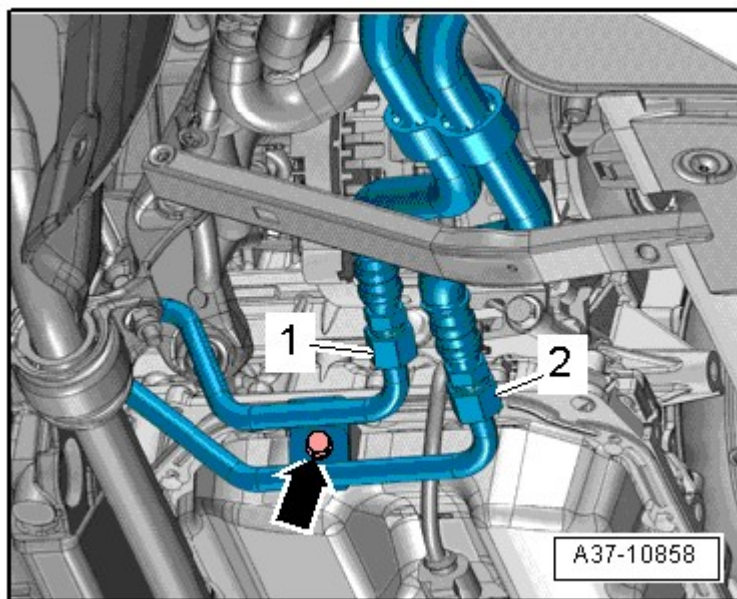


Fig. 128: Identifying ATF Lines -1 & 2-
Courtesy of AUDI OF AMERICA, LLC

-- Raise the engine by dimension -a- using the 10 - 222 A /11.

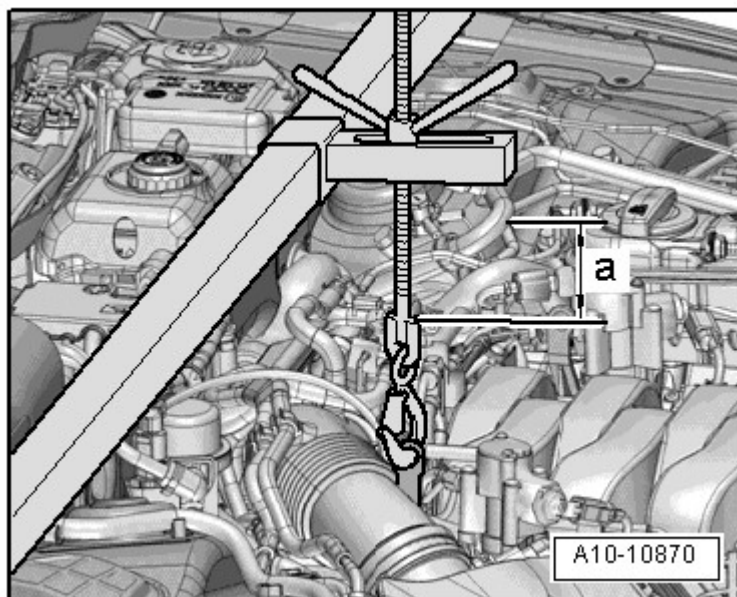


Fig. 129: Raising Engine By Dimension Using Spindle 10 - 222 A /11
Courtesy of AUDI OF AMERICA, LLC

- Dimension -a- = approximately 20 mm.

-- Remove the right engine mount.

Installing

- For the correct tightening specifications, refer to **SUBFRAME MOUNT OVERVIEW**.

Install in reverse order, paying attention to the following:

- Install the ATF lines. Refer to **Removal and Installation** or to **Removal and Installation** .
- Install the wheel housing liner and noise insulation. Refer to **Removal and Installation** .
- Mount the front wheel. Refer to **Removal and Installation** .

SPECIAL TOOLS

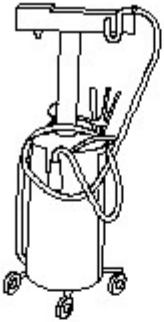
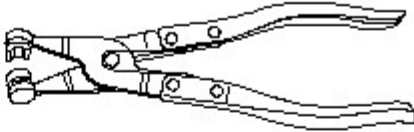
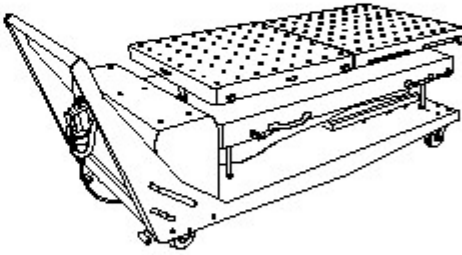
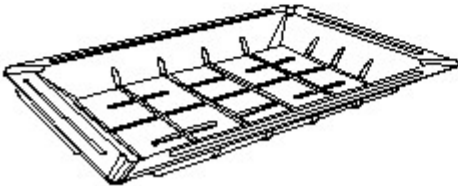
V.A.G 1782 	V.A.G 1921 
VAS 5085 	VAS 6131 
VAS 6208 	G10-10012

Fig. 130: Identifying Special Tools -- Engine, Removing
 Courtesy of AUDI OF AMERICA, LLC

Special tools and workshop equipment required

- Oil collecting and Extracting Device V.A.G 1782
- Hose Clip Pliers V.A.G 1921
- Step Ladder VAS 5085
- Scissor-Type Assembly Platform VAS 6131 A with Support Set VAS 6131/10 and Supplementary Set, Audi A8 VAS 6131/11 and Supplementary Set, Audi Q7 VAS 6131/13
- Drip Tray VAS 6208

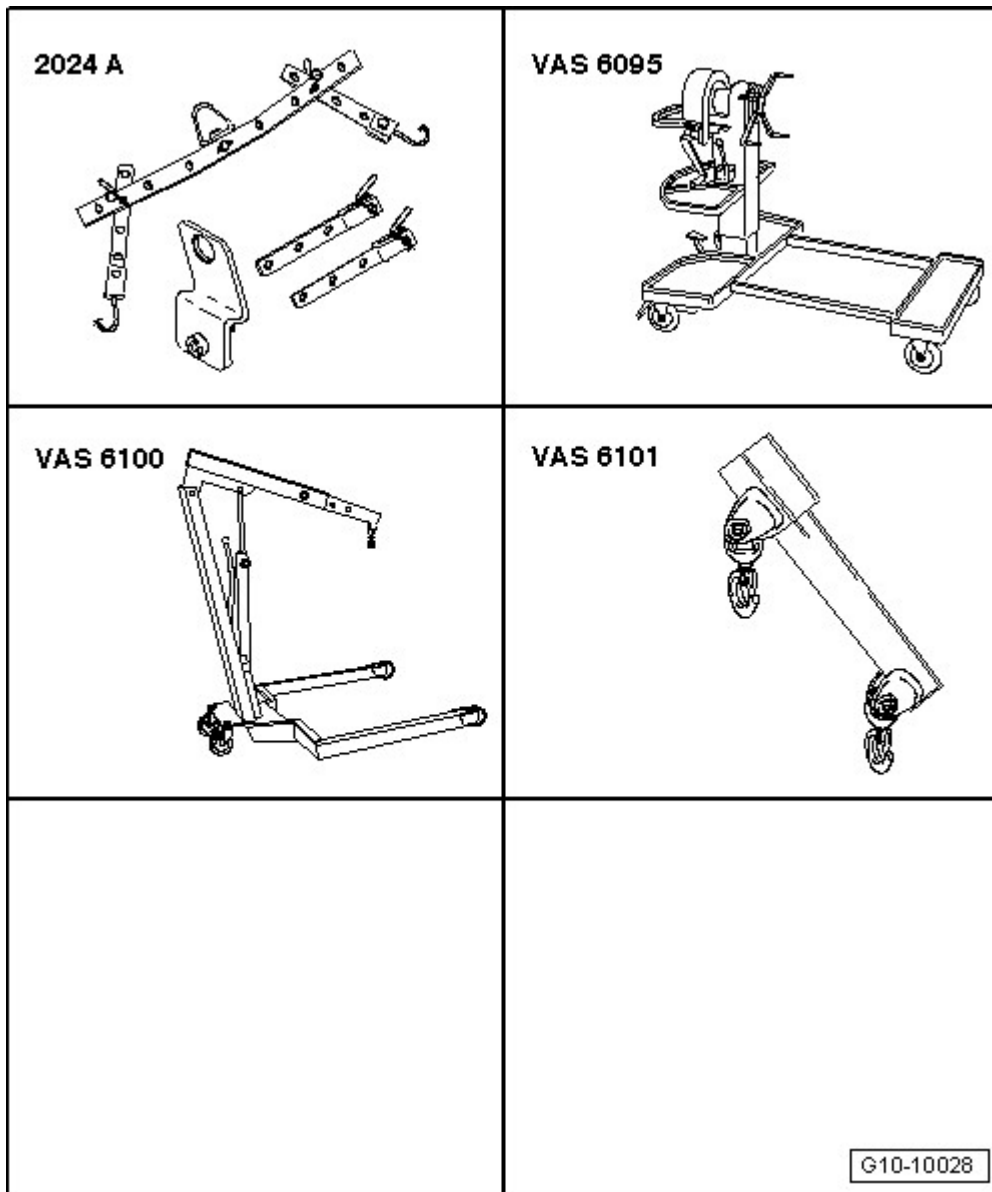


Fig. 131: Identifying Special Tools -- Engine, Securing To Engine And Transmission Holder
 Courtesy of AUDI OF AMERICA, LLC

Special tools and workshop equipment required

- Engine Sling 2024 A
- Engine and Transmission Holder VAS 6095 with Bracket for V6 FSI Engine, Audi A6 VAS 6095/1-5
- Shop Crane VAS 6100
- Lift Arm Ext./Workshop Hoist VAS 6101

Special tools and workshop equipment required

- Engine Support Bridge 10 - 222 A

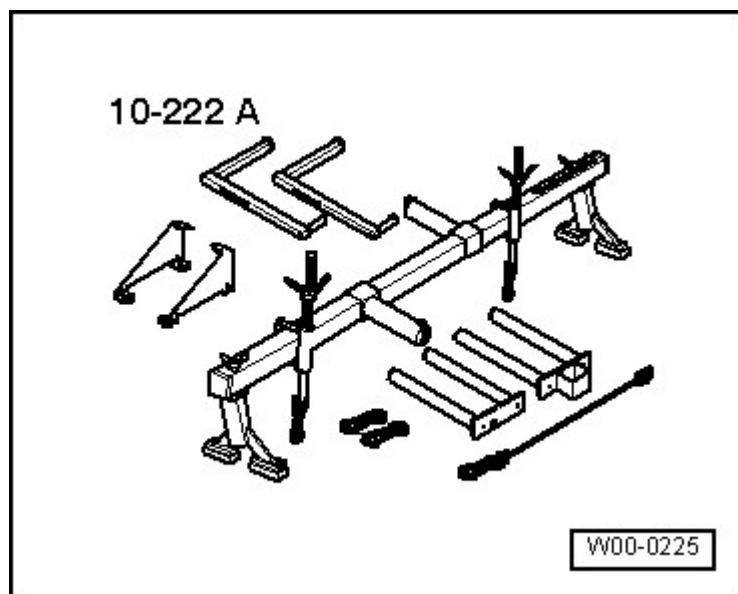


Fig. 132: Engine Support Bridge 10 - 222 A
Courtesy of AUDI OF AMERICA, LLC

- Pry Lever - Rmv Outside Mirror 80 - 200

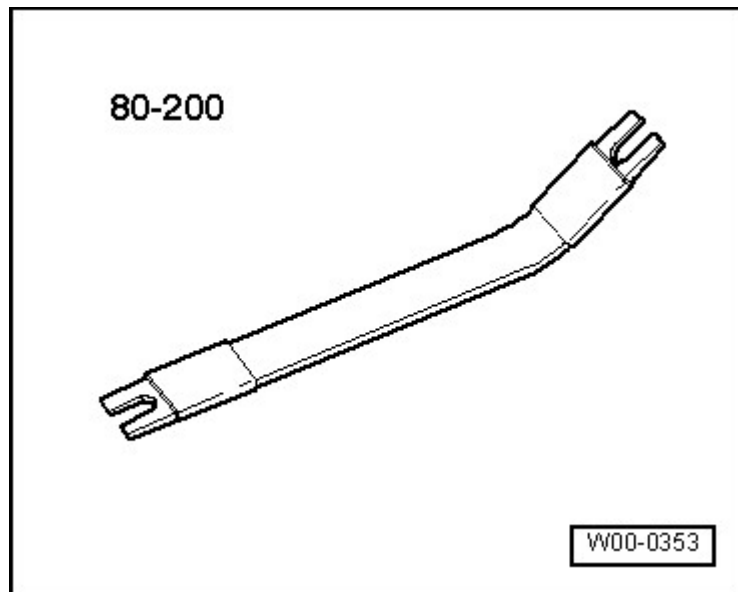


Fig. 133: 80-200 Pry Lever

Courtesy of AUDI OF AMERICA, LLC

- Counterhold Tool Touareg V10 T10172 with Adapter T10172/5

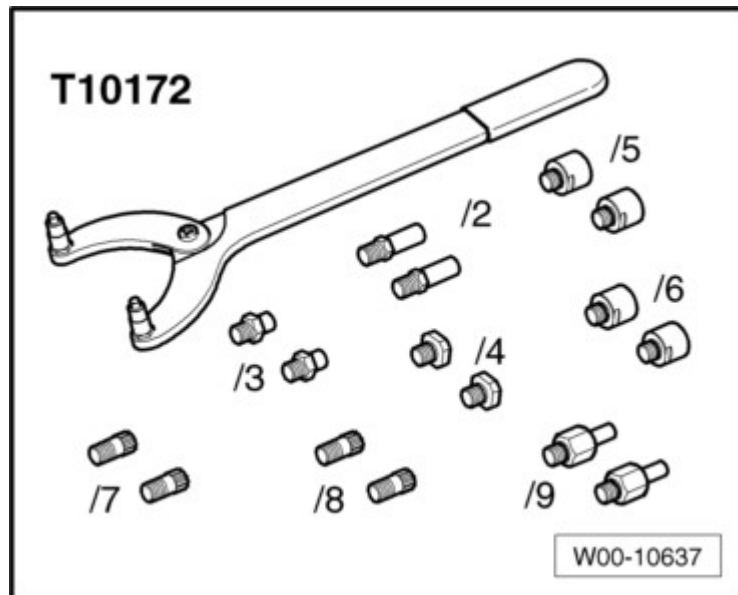


Fig. 134: Counterhold Tool T10172

Courtesy of AUDI OF AMERICA, LLC

- Socket T40058

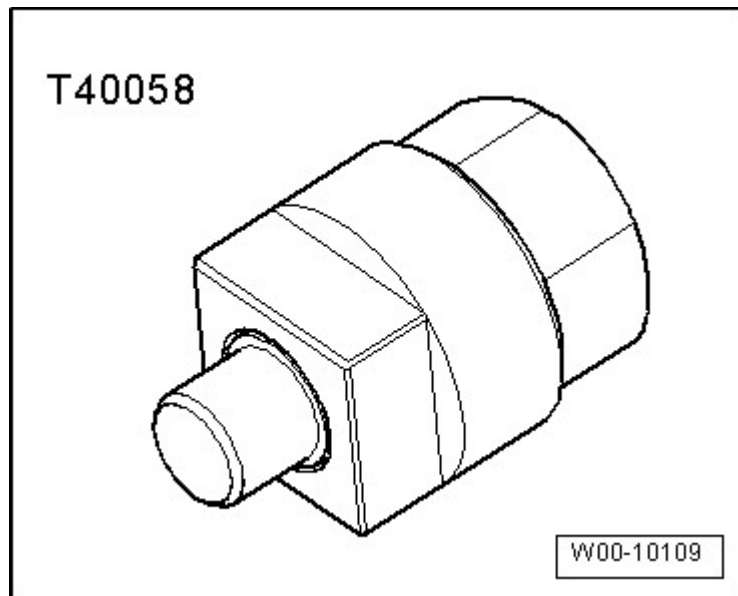


Fig. 135: Adapter (Socket) T40058
Courtesy of AUDI OF AMERICA, LLC

- Engine Support Supplement Set T40093

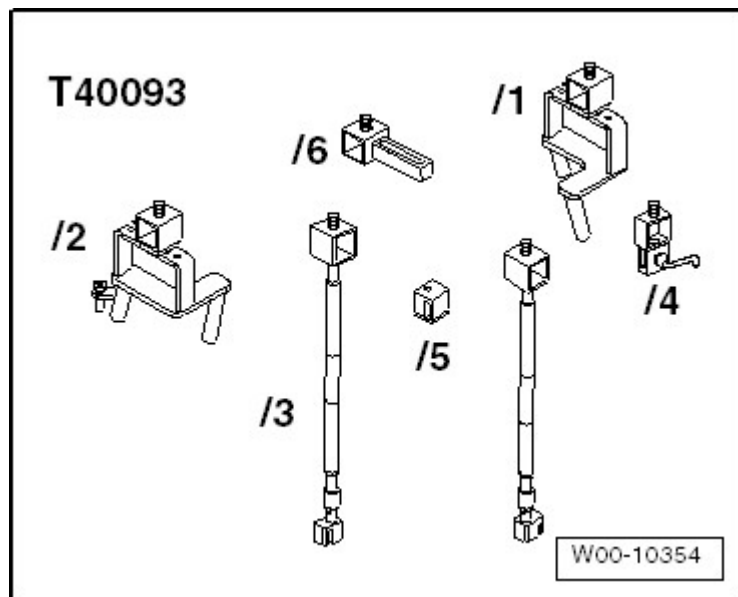


Fig. 136: Engine Support Supplement Set T40093
Courtesy of AUDI OF AMERICA, LLC

- Transport Lock T40170

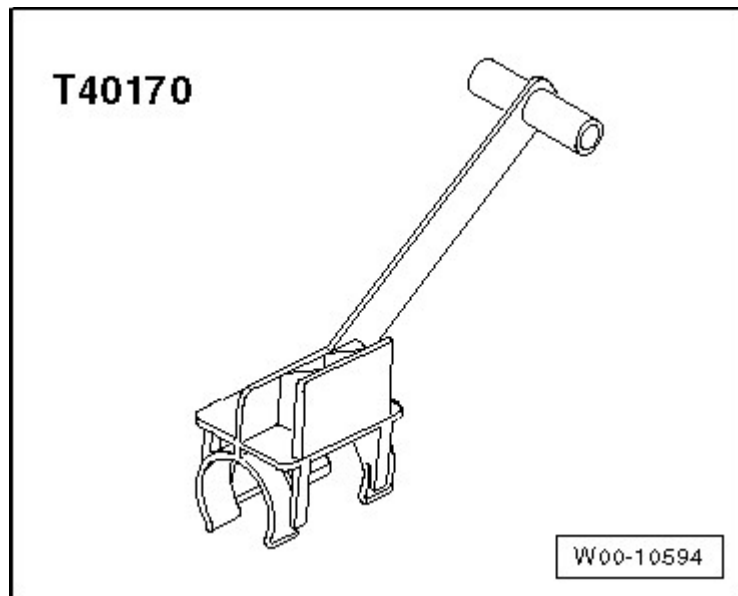


Fig. 137: Identifying Transportation Lock T40170
Courtesy of AUDI OF AMERICA, LLC

- Ring Spanner Insert AF 16 V.A.G 1332/14

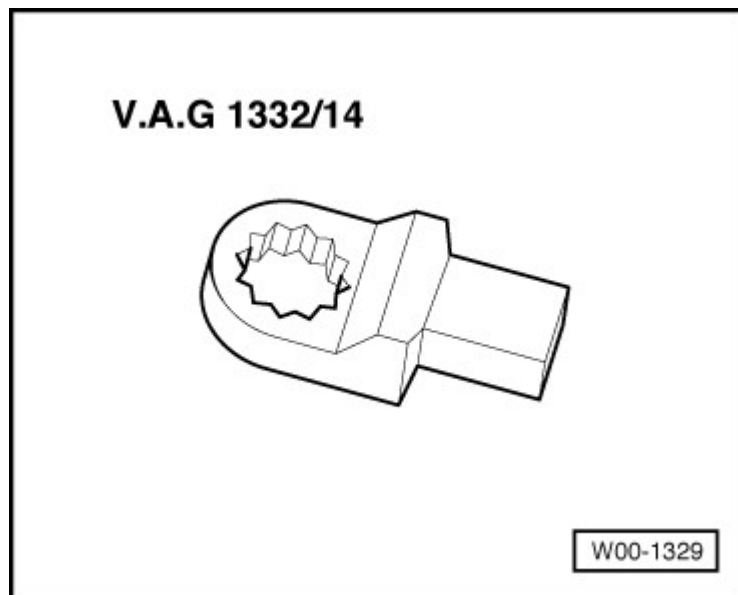


Fig. 138: Identifying Ring Spanner Insert AF 16 V.A.G 1332/14
Courtesy of AUDI OF AMERICA, LLC

- Engine Bung Set VAS 6122

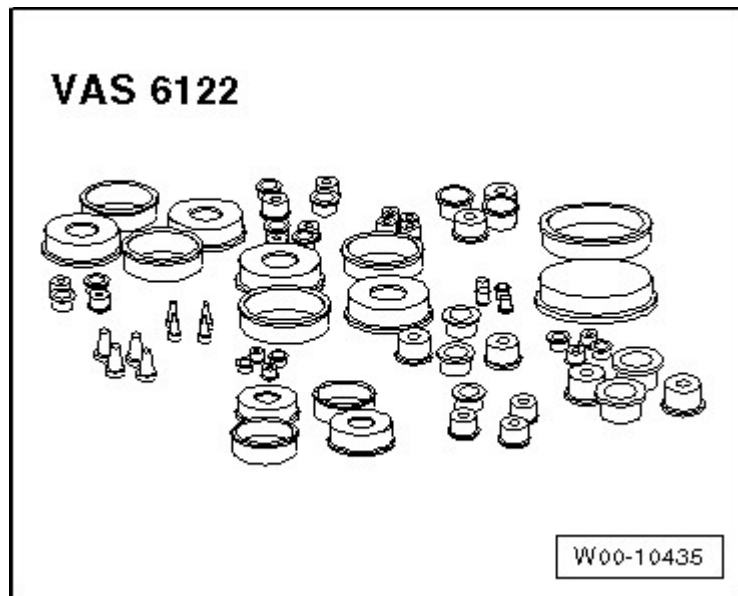


Fig. 139: Engine Bung Set Plugs VAS 6122
Courtesy of AUDI OF AMERICA, LLC

- Not illustrated:
- Spindle 10 - 222 A /11
- Transmission Support VAS 6131/14
- Joint Support VAS 6131/13-7

ENGINE**3.2 Liter - General, Technical Data - Engine Mechanical - Engine Code(s): CALB****00 GENERAL, TECHNICAL DATA****GENERAL INFORMATION****CLEAN WORKING CONDITIONS**

Even a little contamination can lead to faults. When working on the fuel supply and on the fuel injection system, observe the following guidelines for a clean working environment:

- Before loosening, connections and the surrounding areas must be cleaned thoroughly with engine or brake cleaner, and then cleaned area must be dried completely.
- Seal the open lines and connections immediately with clean plugs, for example, from the engine bung set VAS 6122.
- Place removed parts on a clean surface and cover them with lint-free cloths.
- Carefully cover over opened components or seal them, if repairs are not performed immediately.
- Only install clean components: Remove the replacement parts from their packaging just prior to installing them. Do not use parts that have been stored out of their original packaging (for example in tool boxes etc.).
- If the system is open, do not work with compressed air and do not move the vehicle.
- Make sure no fuel gets onto the fuel hoses. If necessary, wipe off the fuel hoses immediately. Replace any corroded fuel hoses.
- Protect the disconnected connectors from dirt and moisture and only connect them when they are dry.

CONTACT CORROSION

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

For this reason, only connecting elements with a special surface coating are installed.

In addition, rubber or plastic parts and adhesive are made of materials that do not conduct electricity.

If you are not sure about the suitability of parts, install new parts.

NOTE: **Only original replacement parts are recommended, they are checked and compatible with aluminum.**

It is recommended to use Audi accessories.

Damage resulting from contact corrosion is not covered by the warranty.

COOLERS AND CONDENSERS

The radiator and condenser may have small indentations on the fins even when installed correctly. It is not damage. Radiators or condensers should not be replaced because of slight impressions like these.

ENGINE CONTAMINANTS

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

ENGINE NUMBER

NOTE: The engine number is only visible if the front engine cover is removed.

- The engine number ("engine code" and "serial number") is located at front on cylinder block at top -arrow 1-.

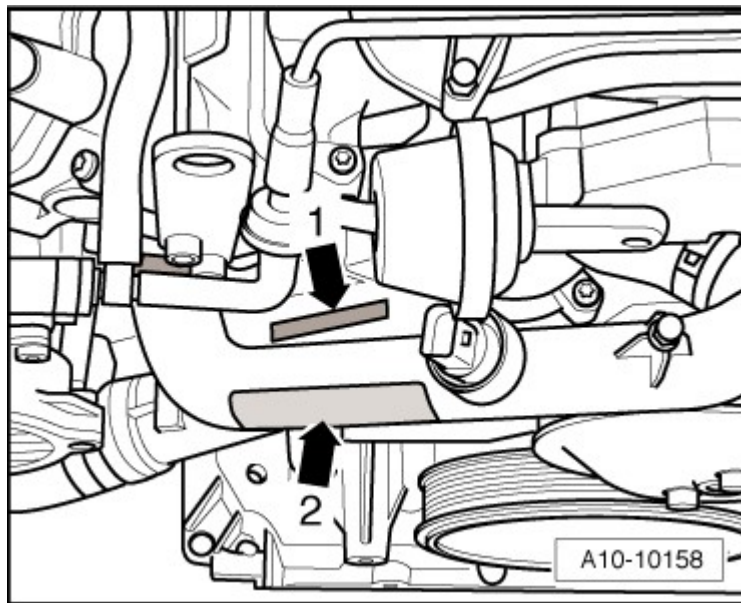


Fig. 1: Identifying "Engine Code" And "Serial Number"
Courtesy of AUDI OF AMERICA, LLC

- Engine codes beginning with "C" are four-digit.
- The first 3 digits of the engine code stand for displacement and the mechanical structure of the engine. They are stamped in the cylinder block, including the serial number.
- The fourth digit describes the engine output and torque and depends on the engine control module.

NOTE: Ignore -arrow 2-.

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

Locations of the type plate and vehicle data label. Refer to the Maintenance Procedures.**LINES, ROUTING AND SECURING**

- Mark the individual fuel, hydraulic and vacuum lines for the Evaporative Emission (EVAP) canister system as well as the electrical wires before disconnecting and/or removing them. This will prevent a mix-up when reconnecting them. If necessary, draw sketches or take pictures.
- Due to the limited space inside the engine compartment, be especially careful when working near moving or hot parts. This will also prevent damaging the lines.

SAFETY PRECAUTIONS**BEFORE OPENING HIGH PRESSURE FUEL INJECTION SYSTEM****WARNING:**

- The injection system is separated into a high-pressure section (maximum approximately 120 bar (1740 psi)) and a low-pressure section (approximately 6 bar (87 psi)).
- Before opening the high pressure area, the fuel pressure must be reduced to a residual pressure of approximately 6 bar (87 psi). Refer to General Information .

COOLING SYSTEM

Note the following when working on the cooling system:

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

- The coolant system is under pressure when the engine is warm.
- Cover the coolant reservoir cap with a cloth and then open it slowly to release the pressure in the system.

CAUTION: The vehicle could overheat if the cap is installed incorrectly.

- The cap must engage noticeably when sealing.

EXHAUST SYSTEM

Note the following when working on the exhaust system:

CAUTION: Danger of damaging the decoupling element.

- Decoupling element must not be bent more than 10°.
- Do not load decoupling element on cable.
- Do not damage wire mesh at decoupling element.

TEST DRIVES WITH THE USE OF TEST AND MEASURING DEVICES

If testing equipment must be used during a road test, observe the following:

WARNING: Distraction and testing equipment that is not secured properly can cause accidents.

The passenger airbag could pose a risk if it deploys in a collision.

- Operating testing equipment while driving causes it to shift position.
- There is an increased risk of injury due to unsecured testing equipment.
- Always secure testing equipment on the rear seat using a strap and have a second person in the rear seat operate it.

FUEL SYSTEM

Note the following when working on the fuel system:

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

- Reduce the fuel pressure down to residual pressure before opening the high pressure area of the fuel injection system.
- To reduce remaining residual pressure, place a clean cloth around the connector and carefully loosen the connector.

-- Procedures before opening high pressure fuel injection system. Refer to General Information .

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

- Turn off the ignition before disconnecting and connecting the wiring for the injection and ignition system. This includes tester cables as well.
- Only clean the engine with the ignition switched off.
- If electrical connectors were disconnected and the engine was started, then malfunctions have been stored in the engine control modules. "Generate readiness code" in "Guided Functions" using a vehicle diagnosis tester.

CAUTION: Risk of destroying electronic components when disconnecting the battery.

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

-- Disconnect the battery. Refer to Removal and Installation .

2009 Audi Q5 Quattro

ENGINE 3.2 Liter - General, Technical Data - Engine Mechanical - Engine Code(s): CALB

SUBFRAME

Note the following whenever working on the subframe:

CAUTION: The suspension components could be damaged.

- Do not rest the vehicle on its wheels if the subframe mount, the steering gear or the subframe crossbrace are not installed correctly.
- Do not support the vehicle on the subframe or the subframe crossbrace, for example, by a floor jack or similar device.

SPECIFICATIONS

ENGINE DATA

Identification Codes	CALB
Displacement	liter
Output	kW at RPM
Torque	Nm at RPM
Bore	diameter mm
Stroke	mm
Compression ratio	
RON	at least
Fuel injection and ignition system	
Ignition sequence	
Turbocharger	
Knock control	
Oxygen sensor regulation	
Variable valve timing	
Variable intake manifold	
Secondary Air Injection (AIR) System	
Valve per cylinder	
• ¹⁾ Unleaded RON 91 is also permitted, but performance is reduced.	

DIAGNOSIS AND TESTING

FUEL SYSTEM, CHECKING FOR LEAKS

- Let the engine run a few minutes at a moderate speed.
- Turn off the ignition.
- Check the entire fuel system for leaks.

- If there are leaks in spite of correct tightening specifications, the corresponding component must be replaced.
- Then perform a road test and depress the accelerator pedal all the way at least one time.
- Then check the high pressure area again for leaks.

VACUUM SYSTEM, CHECKING**Special tools and workshop equipment required**

- Hand Vacuum Pump VAS 6213

Procedure

- Check all vacuum lines in the vacuum system for:
 - Cracks
 - Damage caused by animals
 - Crimps
 - Leaks
- Check the vacuum line leading to and from the solenoid valve.
- If there is a fault, check the vacuum lines for the named component, but also all the vacuum lines.
- If using the VAS 6213 does not produce any vacuum or if the vacuum drops again right away, then check the hand vacuum pump and the connection hoses for leaks.

SPECIAL TOOLS**Special tools and workshop equipment required**

- Hand Vacuum Pump VAS 6213

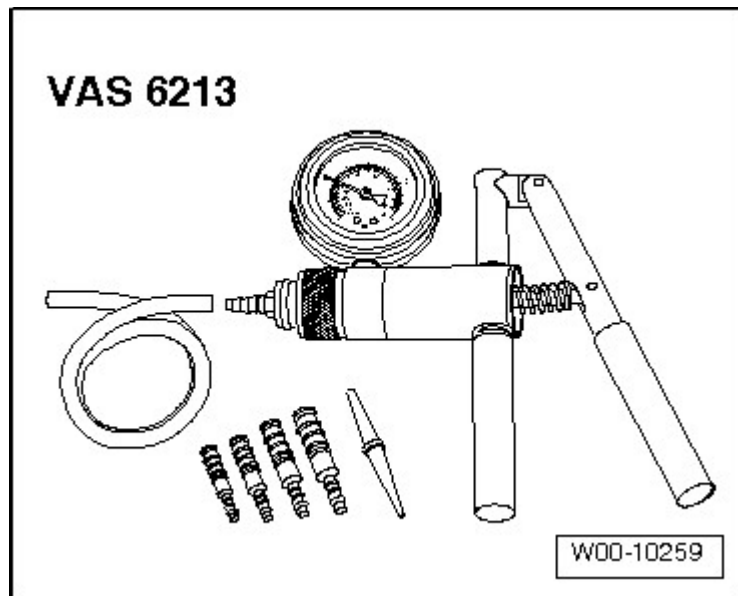


Fig. 2: Hand Vacuum Pump VAS 6213
Courtesy of AUDI OF AMERICA, LLC