ENGINE

Crankshaft, Cylinder Block

13 CRANKSHAFT, CYLINDER BLOCK

GENERAL INFORMATION

CRANKSHAFT BEARING SHELL, ALLOCATING

The bearing shells are allocated to the cylinder block with the correct thickness by the factory. Colored dots identify the bearing thicknesses.

The code letters on the lower contact surface or on the top of the cylinder block identify which bearing shell and where it must be installed on the cylinder block (upper bearing shell).

The code letters on the crankshaft identify which bearing shells and where they must be installed in the bearing cap (lower bearing shell).

The first letter is for bearing cap one, the second for bearing cap two, etc.

Cylinder Block

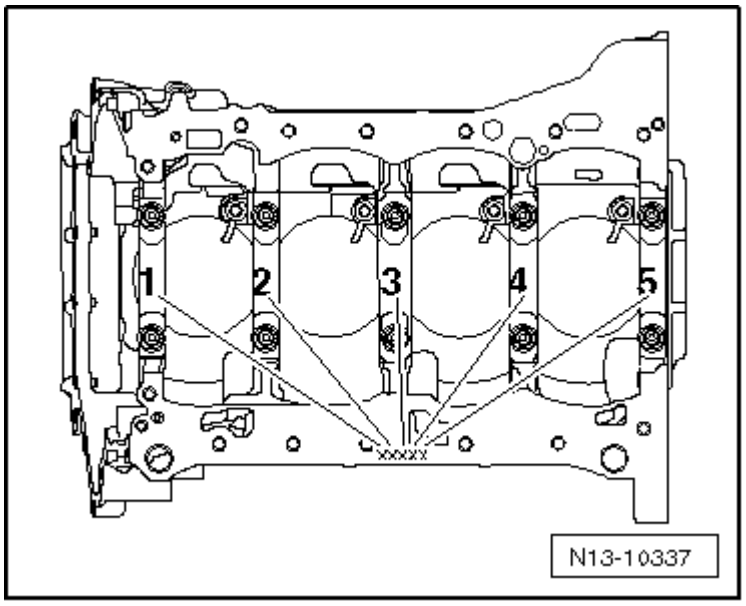

Fig. 1: Locating Cylinder Block Identification On Top (Transmission Side) Of Cylinder Block
Courtesy of AUDI OF AMERICA, LLC

The cylinder block identification may be located either on the oil pan sealing surface or on the top (transmission side) of the cylinder block.

The identification on the cylinder block is for the upper bearing shell.

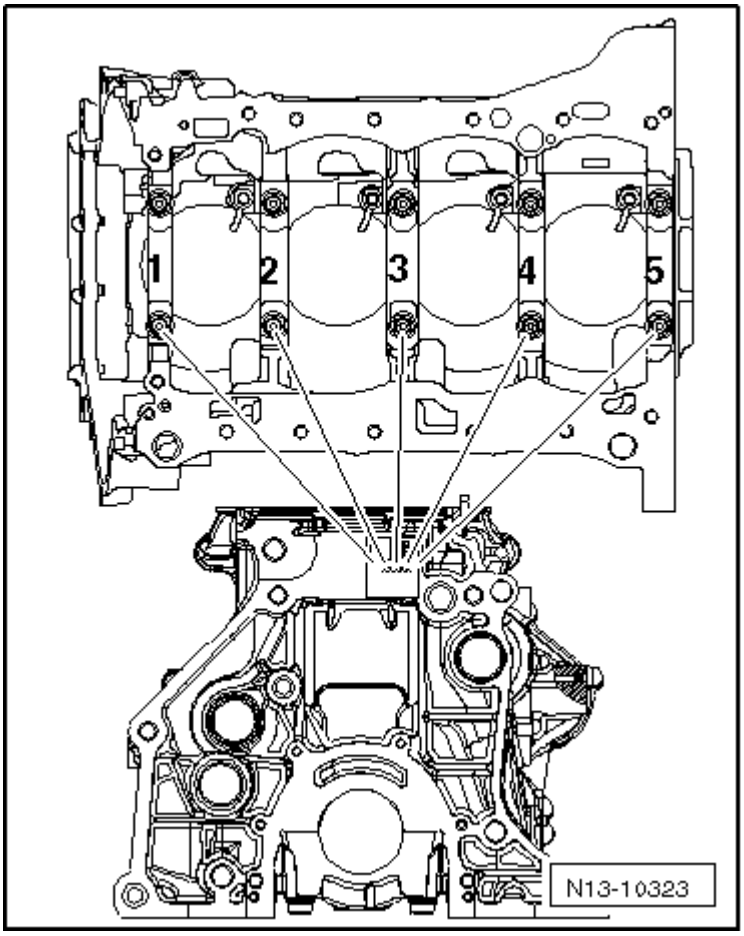

Fig. 2: Locating Identification On Cylinder Block
Courtesy of AUDI OF AMERICA, LLC

-- Note the letters and then match them to the color identification in the table.

Crankshaft

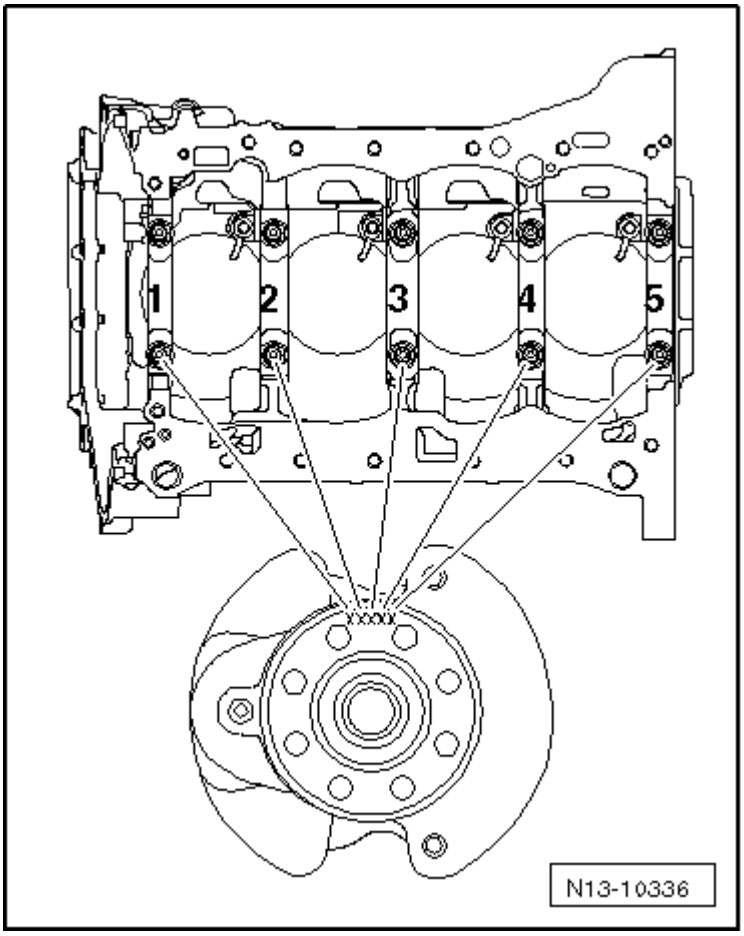

Fig. 3: Locating Identification On Crankshaft
Courtesy of AUDI OF AMERICA, LLC

The identification on the crankshaft is for the lower bearing shell.

-- Note the letters and then match them to the color identification in the table.

S	=	Black
R	=	Red
G	=	Yellow
B	=	Blue
W	=	White

NEW CONNECTING ROD, SEPARATING

New connecting rods may not be separated at the location where they should be. If the connecting rod bearing cap cannot be removed by hand, proceed as follows:

-- Mark which cylinder the connecting rod belongs to, see -item 11- in the **PISTON AND CONNECTING ROD OVERVIEW**.

-- Lightly clamp the connecting rod in a vise equipped with aluminum jaw pads.

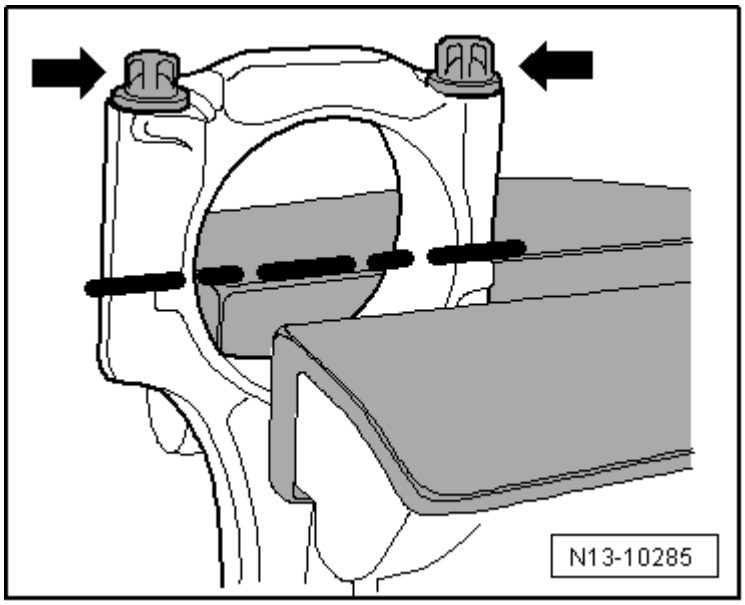

Fig. 4: Clamping Connecting Rod In Vise Equipped With Aluminum Protective Pads
Courtesy of AUDI OF AMERICA, LLC

NOTE: Only clamp the connecting rod lightly, to avoid damaging it.

Clamp the connecting rod below the dotted line.

-- Loosen both bolts -arrows- about five turns.

-- Carefully tap against the connecting rod bearing cap in the -direction of the arrow- with a plastic mallet until the cap is loose.

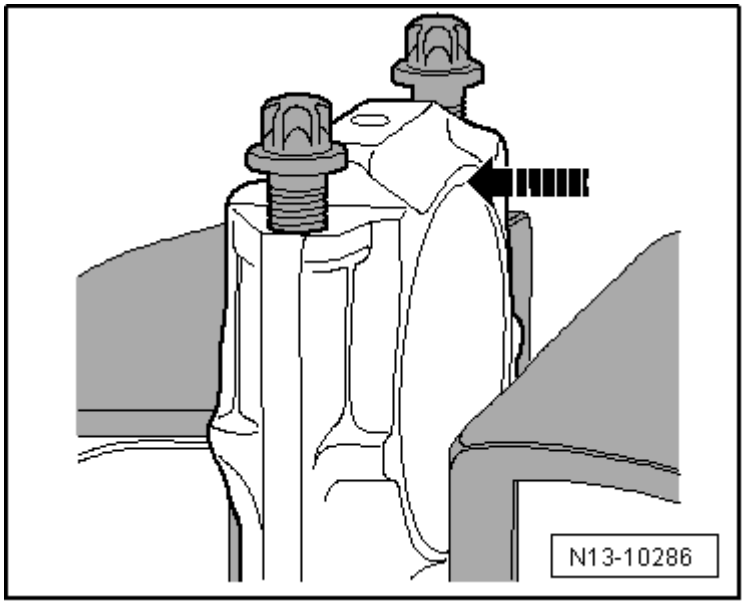

Fig. 5: Carefully Taping Against Connecting Rod Bearing Cap
Courtesy of AUDI OF AMERICA, LLC

DESCRIPTION AND OPERATION

RIBBED BELT DRIVE OVERVIEW

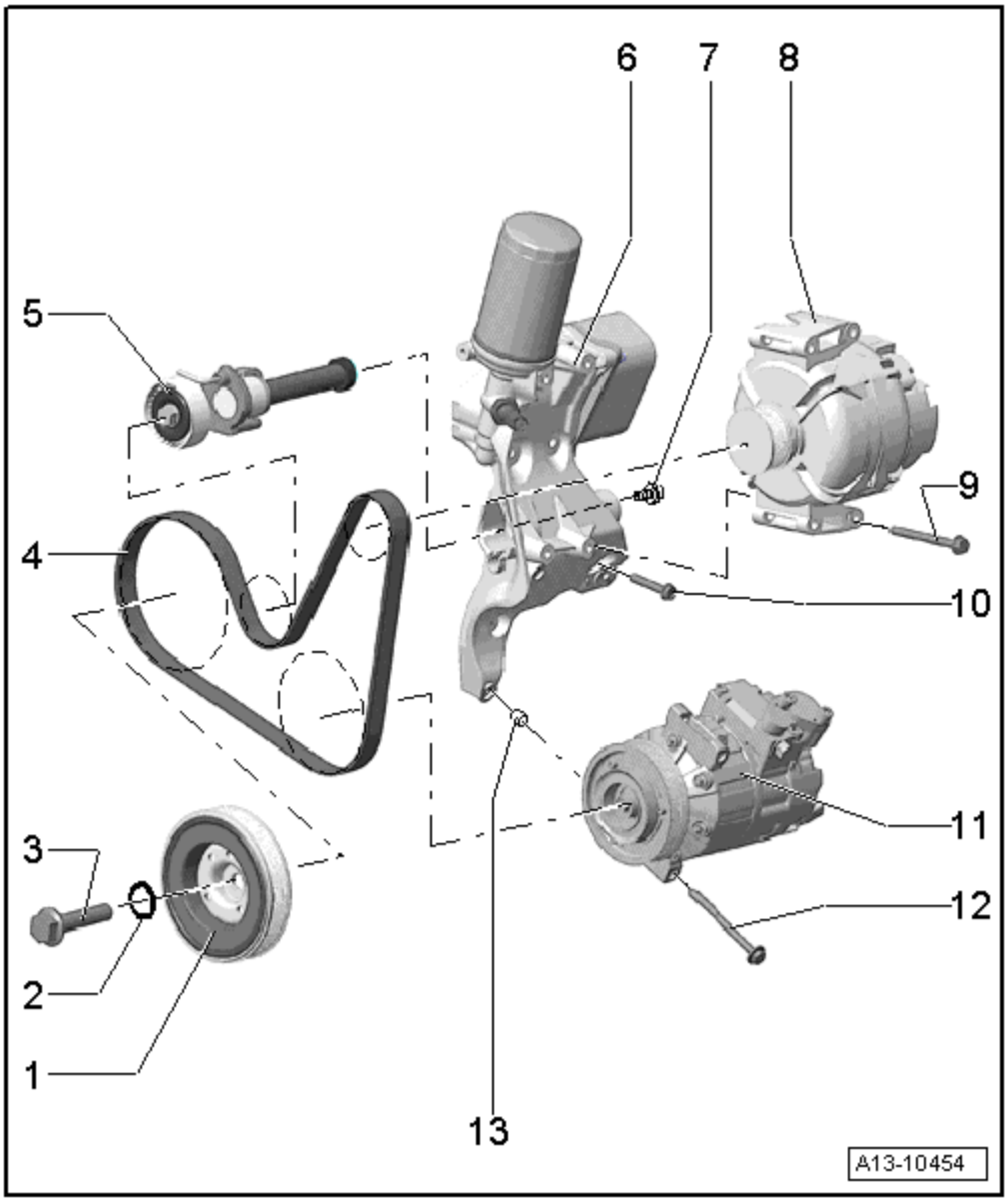

Fig. 6: Identifying Ribbed Belt Drive Assembly Overview
Courtesy of AUDI OF AMERICA, LLC

1. Vibration Damper
   - With a ribbed pulley.
   - Removing and installing, refer to **VIBRATION DAMPER**.

2. O-ring
   - Always replace.
3. Bolt
   - 150 Nm + an additional 90° (1/4) turn.
   - Always replace.
   - Use the counter hold tool T10355 to loosen and tighten.
4. Ribbed Belt
   - Check for wear.
   - Do not kink.

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

- **Before removing the ribbed belt, mark the running direction with chalk or a felt-tip pen for reinstallation later.**

   - Removing and installing, refer to **RIBBED BELT**.
   - When installing, make sure it is seated correctly on the pulleys.
5. Belt Tensioner
   - Rotate the tenisoner using a box end wrench to release the tension on the ribbed belt.
   - Secure using the locking pin T10060 A.
   - Tensioner overview, refer to **Fig. 7**.
   - Removing and installing, refer to one of the following:

     GTI and Eos, refer to .

     Passat and CC, refer to .

     Tiguan, refer to **RIBBED BELT TENSIONER**.

6. Accessory Bracket
   - With the oil pressure switch, oil filter and engine oil cooler.
   - Removing and installing, refer to **ACCESSORY BRACKET**.
   - Engine oil cooler removing and installing. Refer to **ENGINE OIL COOLER** .
7. Bolt
   - 10 Nm
8. Generator
   - Removing and installing,
9. Bolt
   - 23 Nm

10. Bolt
    - Tightening sequence, refer to **Fig. 8**.
11. Air Conditioning (A/C) Compressor
    - DO NOT remove or disconnect the refrigerant lines.
    - Removing and installing, refer to **Removal and Installation** .
12. Bolt
    - 25 Nm
13. Alignment Sleeve
    - For the A/C compressor.

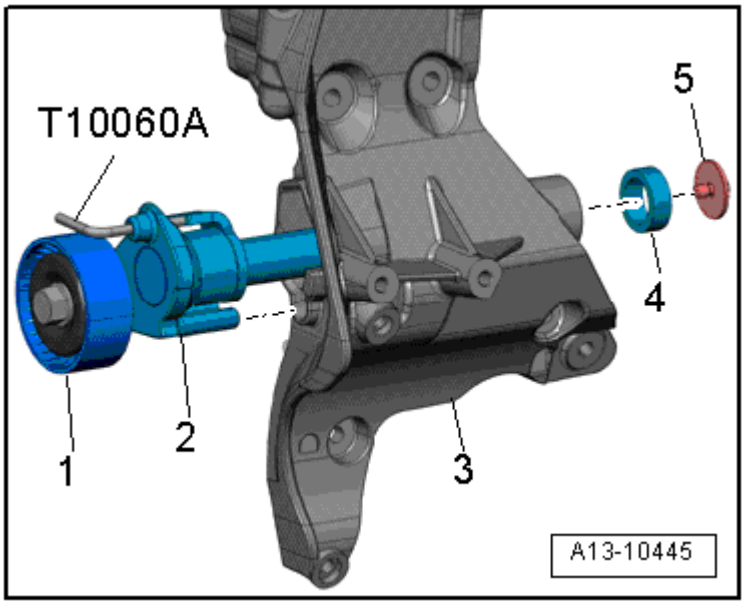

Fig. 7: Identifying Tensioning Device For Ribbed Belt
Courtesy of AUDI OF AMERICA, LLC

1. Belt tensioner
2. Support
3. Accessory bracket
4. Centering sleeve
5. Bolt

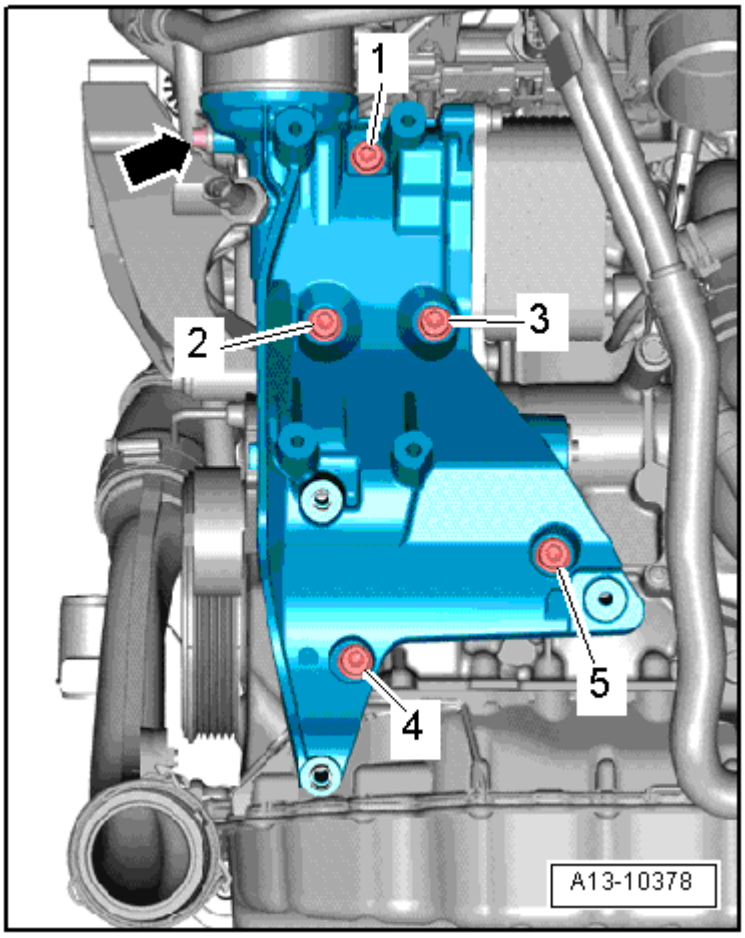

Fig. 8: Accessory Assembly Bracket Tightening Sequence
Courtesy of AUDI OF AMERICA, LLC

-- Position the accessory bracket and install the bolt -4-.

-- Then, install the other bolts and tighten them all in 3 stages in sequence -1 through 5- as follows:

-- Tighten the bolts hand tight.-- Tighten the bolts to 20 Nm.-- Tighten the bolts an additional 90° (1/4) turn.

SEALING FLANGE AND DUAL MASS FLYWHEEL/DRIVE PLATE OVERVIEW

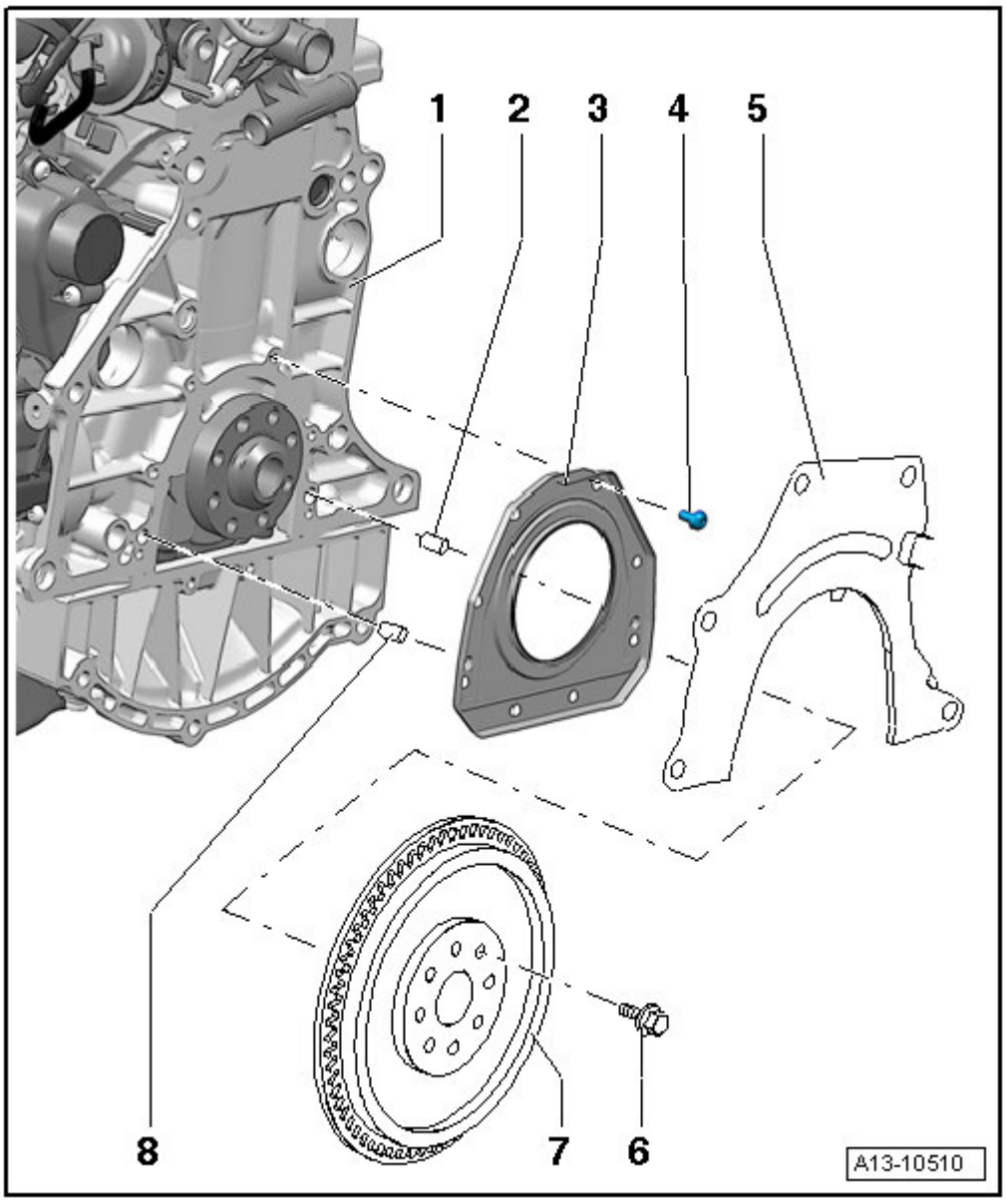

Fig. 9: Identifying Sealing Flange And Dual Mass Flywheel Assembly Overview
Courtesy of AUDI OF AMERICA, LLC

1. Cylinder Block
   - Crankshaft overview. Refer to **CRANKSHAFT OVERVIEW**.
   - Piston and connecting rod overview. Refer to **PISTON AND CONNECTING ROD OVERVIEW**.
2. Alignment Pin
   - Not installed.
3. Sealing Flange
   - With the seal.
   - Always replace as a complete unit.

- Removing and installing, refer to **SEALING FLANGE, TRANSMISSION SIDE**.

4. Bolt
   - Tightening sequence, refer to **Fig. 10**.
5. Intermediate Plate
   - Must be located on the alignment sleeves.
   - Be careful not to damage or bend it when installing.
   - Is hooked in at the sealing flange, refer to **Fig. 11**.
6. Bolt
   - 60 Nm + an additional 90° (1/4) turn.
   - Always replace.
   - For the dual mass flywheel/drive plate.
7. Dual Mass Flywheel/Drive Plate
   - Dual mass flywheel removing and installing. Refer to **DUAL MASS FLYWHEEL**.
   - Drive plate removing and installing. Refer to **DRIVE PLATE**.
   - Drive plate installed position: The flange faces the engine.
   - Only possible to install in one position - the bores are offset.
8. Alignment Pin
   - Not installed.

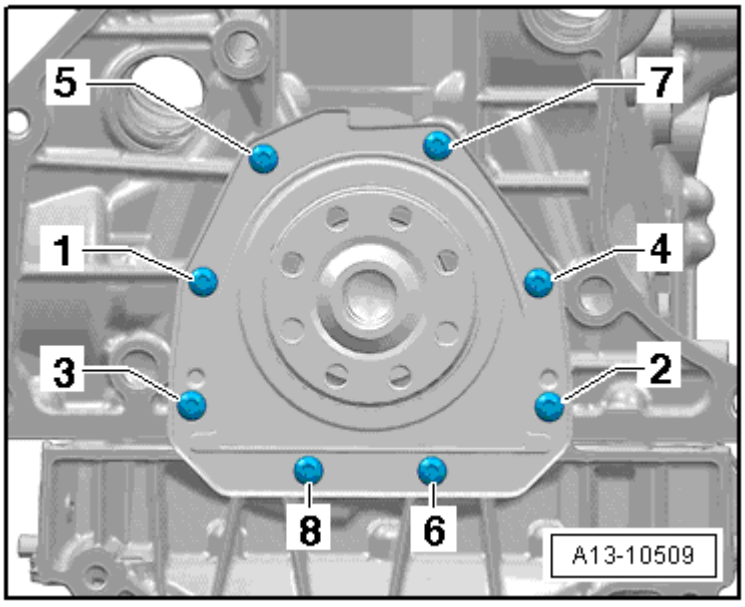

Fig. 10: Identifying Sealing Flange Tightening Sequence
Courtesy of AUDI OF AMERICA, LLC

-- Tighten the bolts -1 through 8- in the sequence shown:

-- 1. Install the bolts and tighten them hand tight.

-- 2. Tighten the bolts to 9 Nm.

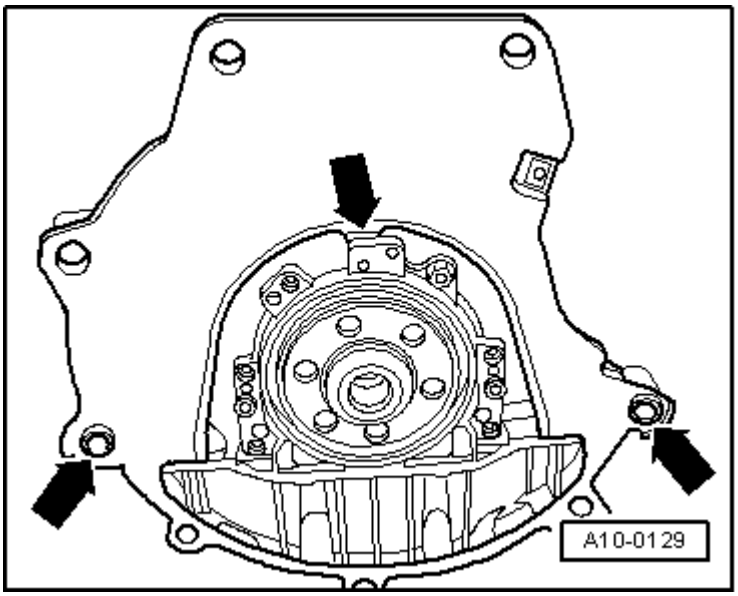

Fig. 11: Identifying Intermediate Plate Alignment Bushings
Courtesy of AUDI OF AMERICA, LLC

-- Hook in the intermediate plate at the sealing flange and push it onto the alignment sleeves -arrows-.

CRANKSHAFT OVERVIEW

NOTE: Secure the engine to the assembly stand using the engine and transmission holder VAS 6095 when performing repair work. Refer to ENGINE, SECURING TO THE ENGINE/TRANSMISSION HOLDER .

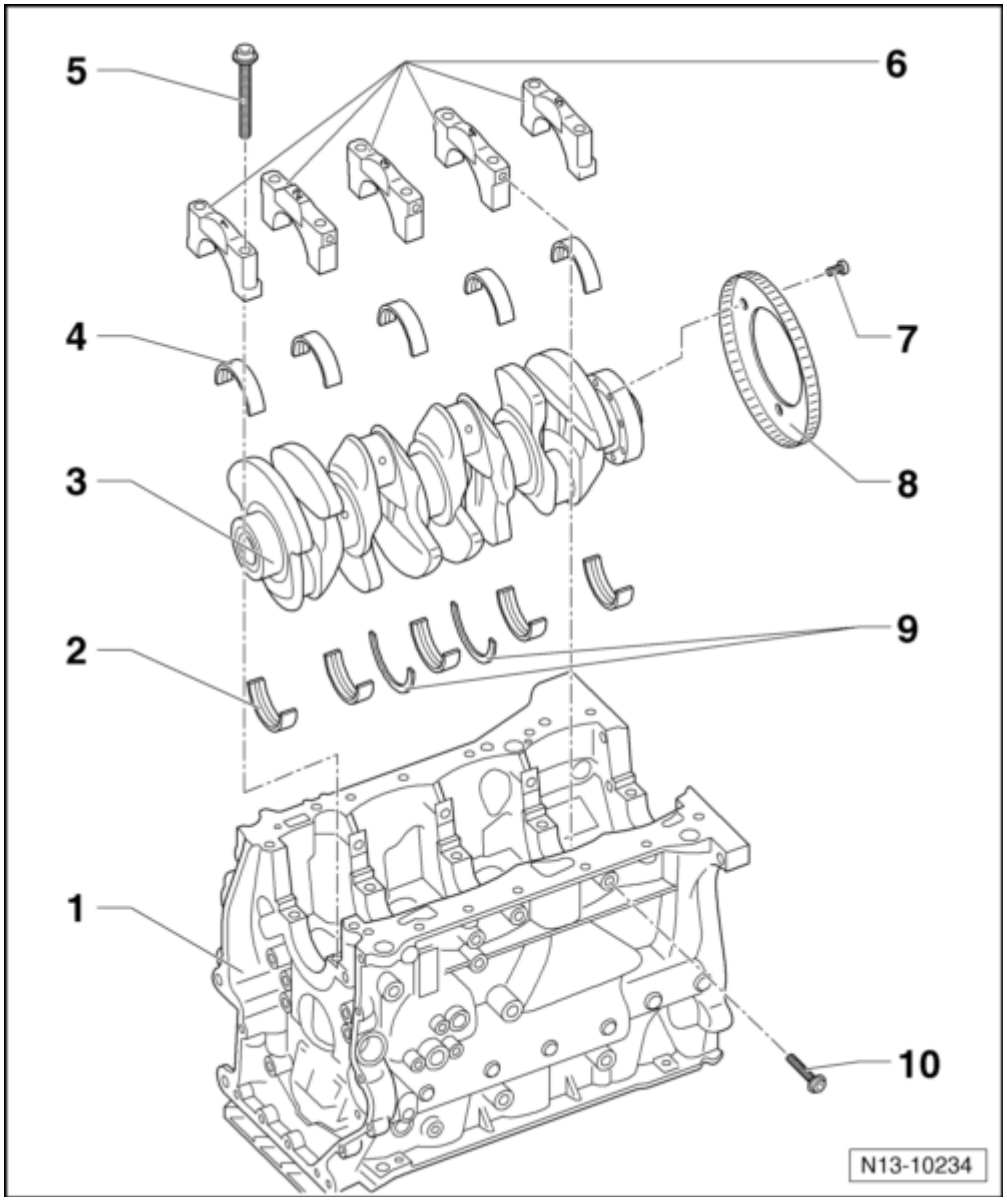

Fig. 12: Identifying Assembly Overview: Crankshaft
Courtesy of AUDI OF AMERICA, LLC

1. Cylinder Block
   - If the cylinder block is being replaced, then the bearing shells must be allocated. Refer to **CRANKSHAFT BEARING SHELL, ALLOCATING**.
2. Bearing Shell for the Cylinder Block
   - With a lubricating groove.
   - Do not interchange used bearing shells (mark them).
   - Crankshaft bearing shell allocating. Refer to **CRANKSHAFT BEARING SHELL, ALLOCATING**.
3. Crankshaft

- After removal, place in such a way that it does not rest on the sensor wheel -item 8- and damage it
- If the crankshaft is being replaced, then the bearing shells must be allocated to the bearing cap. Refer to **CRANKSHAFT BEARING SHELL, ALLOCATING**.
- Measuring the axial clearance. Refer to **CRANKSHAFT AXIAL CLEARANCE, MEASURING**.
- Measuring the radial clearance. Refer to **CRANKSHAFT RADIAL CLEARANCE, MEASURING**.
- Do not rotate the crankshaft when measuring the radial play.
- Crankshaft dimensions, refer to **CRANKSHAFT DIMENSIONS**.
- For removal and installation, refer to **SENSOR WHEEL**.

4. Bearing Shell
   - Without a lubricating groove.
   - Do not interchange used bearing shells (mark them).
   - Crankshaft bearing shell allocating. Refer to **CRANKSHAFT BEARING SHELL, ALLOCATING**.
5. Bolt
   - Follow the tightening sequence, refer to **Fig. 13**.
   - Always replace.
6. Bearing Cap
   - Bearing cap 1: Belt pulley side.
   - Retaining tabs on the bearing shells and cylinder block/bearing caps must align with one another.
7. Screw
   - 10 Nm + an additional 90° (1/4) turn.
   - Always replace.
   - Replace the sensor wheel every time the screws are loosened. Refer to **SENSOR WHEEL**.
8. Sensor Wheel
   - For the engine speed sensor.
   - Only possible to install in one position - the bores are offset.
   - Replace the sensor wheel every time the screws are loosened.
   - Removing and installing, refer to **SENSOR WHEEL**.
9. Thrust Washers
   - For bearing 3.
10. Bolt
    - Follow the tightening sequence, refer to **Fig. 13**.
    - Always replace.

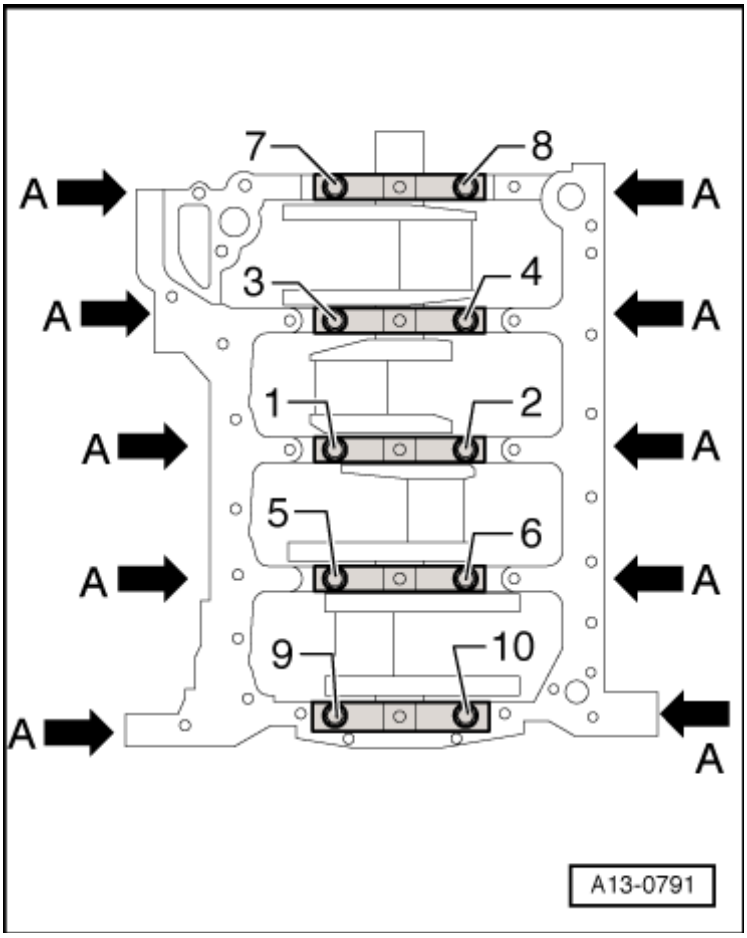

Fig. 13: Crankshaft Bearing Cap, Installing
Courtesy of AUDI OF AMERICA, LLC

-- Tighten the crankshaft bearing cap bolts in sequence -1 through 10- :

1. Tighten the bolts -1 through 10- and -arrows- hand tight.
2. Tighten the bolts -1 through 10- to 65 Nm.
3. Tighten the bolts -1 through 10- an additional 90° (1/4) turn using a ratchet.
4. Tighten the bolts -arrows- to 20 Nm.
5. Tighten the bolts -arrows- an additional 90° (1/4) turn using a ratchet.

PISTON AND CONNECTING ROD OVERVIEW

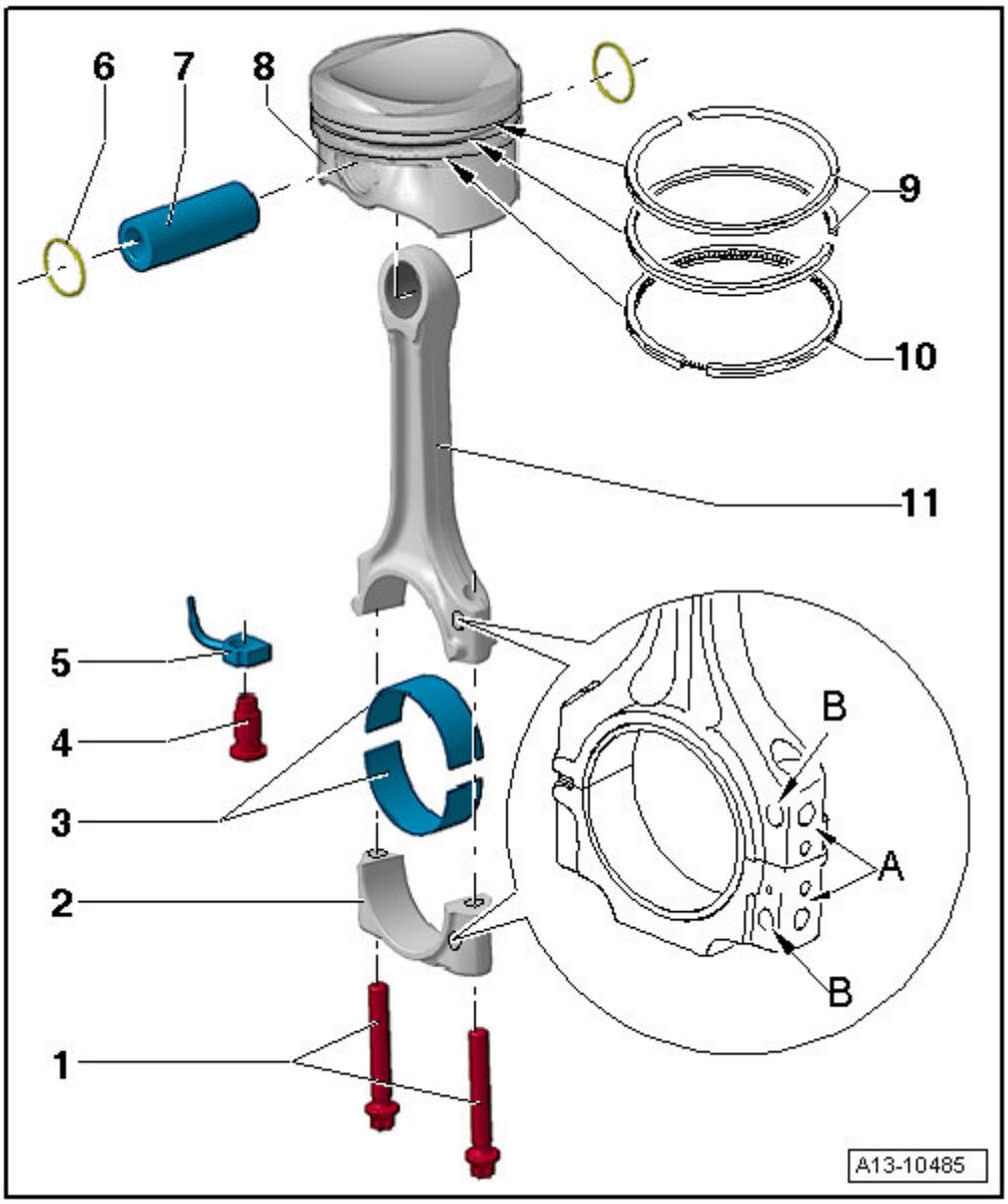

Fig. 14: Identifying Assembly Overview: Pistons And Connecting Rod
Courtesy of AUDI OF AMERICA, LLC

1. Bolt
   - 45 Nm + an additional 90° (1/4) turn.
   - Always replace.
   - Lubricate the threads and contact surface.
   - Use the old bolts to measure the radial play.
   - Do not tighten the additional 90° (1/4) turn when measuring the radial play.
2. Connecting Rod Bearing Cap
   - Pay attention to the installed position.
   - Due to the separation procedure (cracking) for the connecting rod, the cap only fits in one position

and only on the correct connecting rod.
- Mark the affiliation to the cylinder -A-.
- Installed position: The marks -B- point to the belt pulley side.

3. Bearing Shell
   - Installed position, refer to **Fig. 15**.
   - Do not interchange used bearing shells (mark them).
   - Axial play:

     New: 0.10 to 0.35 mm

     Wear limit: 0.40 mm

   - Measure the radial clearance using Plastigage®:

     New: 0.02 to 0.06 mm

     Wear limit: 0.09 mm

   - Do not rotate the crankshaft when measuring the radial clearance.
4. Pressure Relief Valve
   - 27 Nm
   - Opening pressure 1.6 to 1.9 bar
5. Oil Spray Jet
   - For piston cooling.
6. Lock Ring
7. Piston Pin
   - If tight, heat the piston to 60 °C (140 °F).
   - Remove and install using the pilot drift VW 222 A.
8. Piston
   - Removing and installing, refer to **PISTON**.
   - Checking, refer to **PISTON AND CYLINDER BORE, CHECKING**.
   - Mark the installed position and cylinder allocation.
   - The arrow on the piston face points toward the belt pulley side.
   - Install using a piston ring compressor.
   - Checking the cylinder bore. Refer to **PISTON AND CYLINDER BORE, CHECKING**.
9. Compression Rings
   - Offset the gaps by 120°.
   - Use piston ring pliers for removal and installation.
   - "TOP" or the manufacturer identification must face the piston crown.
   - Checking the ring gap. Refer to **Fig. 20**

- Checking the piston ring groove clearance. Refer to **Fig. 21**.

10. Oil Scraping Ring
    - 2 piece
    - Install the upper steel ring so the gap is offset by 120° to the neighboring compression ring.
    - Offset all oil scraping ring component gaps to each other.
    - Checking the ring gap. Refer to **Fig. 20**.
    - The side clearance cannot be measured.
11. Connecting Rod
    - Always replace as a set.
    - Mark the affiliation to the cylinder -A-.
    - Installed position: The marks -B- point to the belt pulley side.

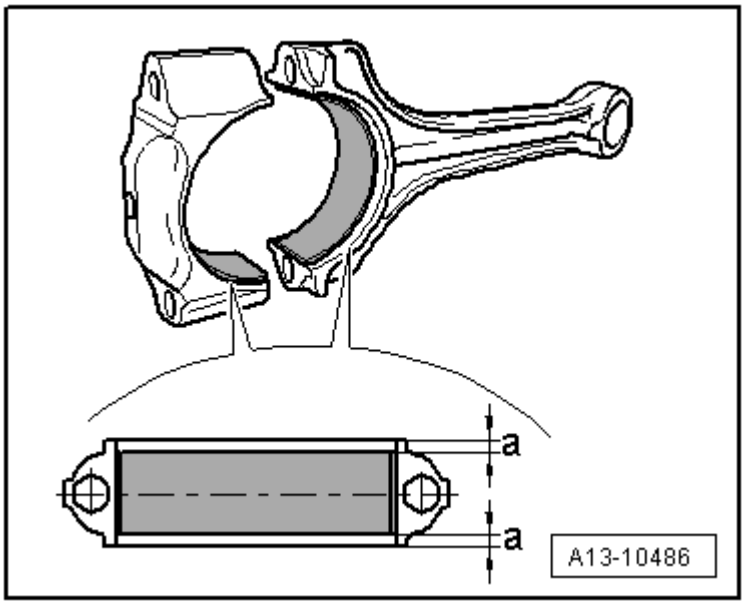

Fig. 15: Dimension -A- Must Be Same At Left And Right
Courtesy of AUDI OF AMERICA, LLC

-- Place the bearing shells centrally into the connecting rod and connecting rod bearing cap.

Dimension -a- must be the same on the left and right sides.

SPECIFICATIONS

CRANKSHAFT DIMENSIONS

(Dimensions are in mm)

Reconditioning Dimension (1)	Crankshaft Bearing Journal Diameter	Connecting Rod Bearing Journal Diameter

Basic dimension		58.00		47.80	

(1) The preparation of worn crankshafts is not provided.

FASTENER TIGHTENING SPECIFICATIONS

Component	Fastener Size	Nm
Air Conditioning Compressor to Accessory Bracket Bolt	-	25
Connecting Rod Bearing Cap to Connecting Rod Bolt (1)	-	45 + 90°
Dual Mass Flywheel/Drive Plate to Crankshaft Bolt (1)	-	60 + 90°
Generator to Accessory Bracket Bolt	-	23
Pressure Relief Valve	-	27
Ribbed Belt Tensioner to Accessory Bracket Bolt	-	10
Sensor Wheel to Crankshaft Screw (1)	-	10 + 90°
Vibration Damper to Crankshaft Bolt (1)	-	150 + 90°
(1) Always replace		

Accessory Bracket Bolt Tightening Sequence and Specification

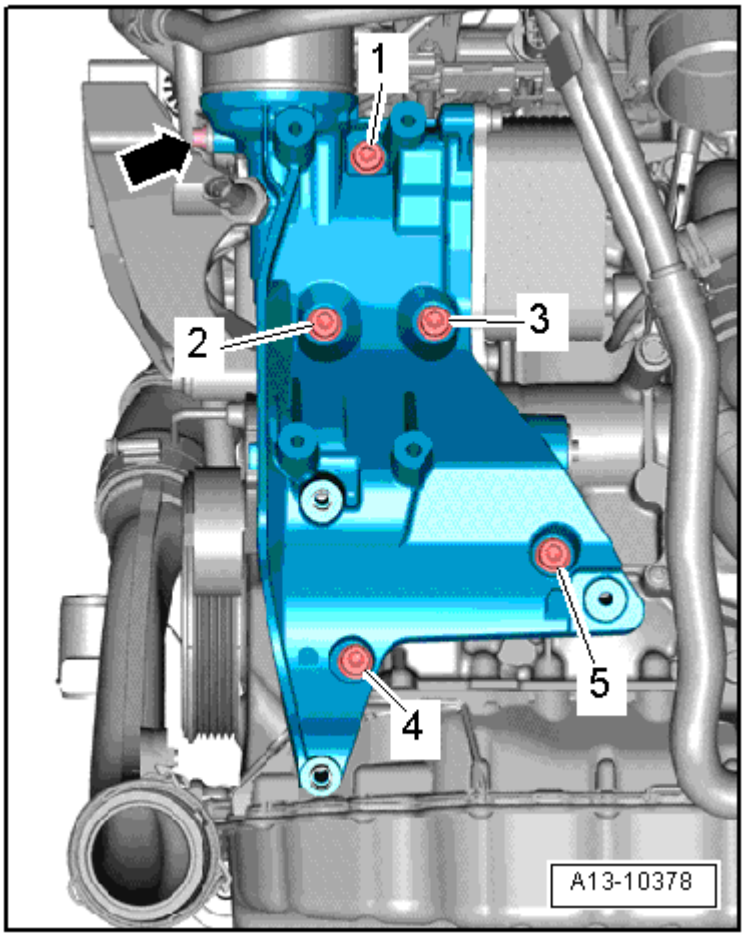

Fig. 16: Accessory Assembly Bracket Tightening Sequence
Courtesy of AUDI OF AMERICA, LLC

-- Tighten the bolts in 3 passes in sequence -1 through 5- as follows:

-- 1st pass, tighten the bolts hand tight.

-- 2nd pass, tighten the bolts to 20 Nm.

-- 3rd pass, tighten the bolts an additional 90° (1/4) turn.

Sealing Flange Bolt Tightening Sequence and Specification

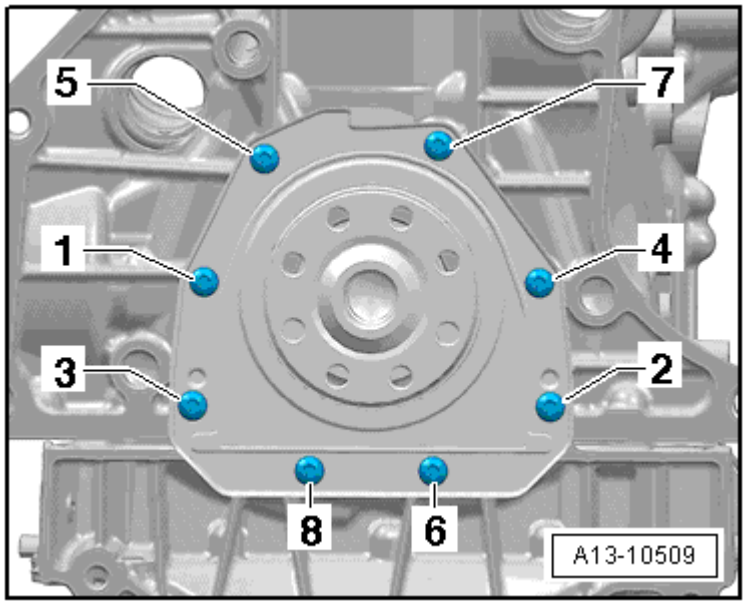

Fig. 17: Identifying Sealing Flange Tightening Sequence
Courtesy of AUDI OF AMERICA, LLC

-- Tighten the bolts in sequence -1 through 8- as follows:

-- 1. Tighten the bolts hand tight.

-- 2. Tighten the bolts to 9 Nm.

Crankshaft Bearing Cap Bolt Tightening Sequence and Specification

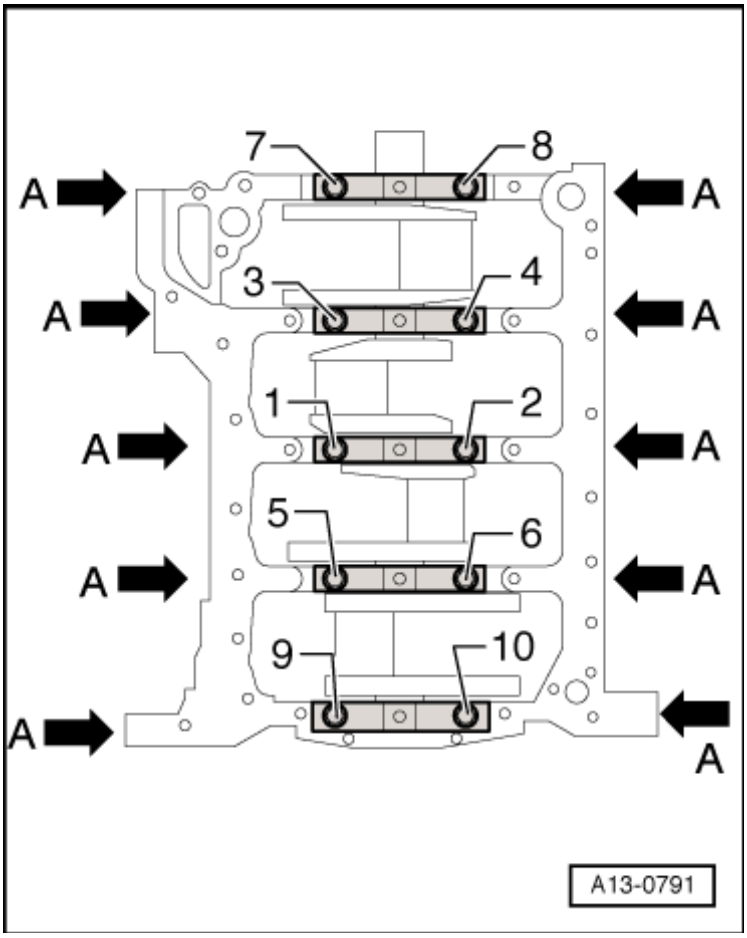

Fig. 18: Crankshaft Bearing Cap, Installing
Courtesy of AUDI OF AMERICA, LLC

-- Tighten the crankshaft bearing cap bolts -1 through 10- and -arrows- in sequence as follows:

1. Tighten the bolts -1 through 10- and - arrows- hand tight.
2. Tighten the bolts -1 through 10- to 65 Nm.
3. Tighten the bolts -1 through 10- an additional 90° (1/4) turn using a ratchet.
4. Tighten the bolts -arrows- to 20 Nm.
5. Tighten the bolts -arrows- an additional 90° (1/4) turn using a ratchet.

DIAGNOSIS AND TESTING

CRANKSHAFT AXIAL CLEARANCE, MEASURING

Special tools and workshop equipment required

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

Procedure

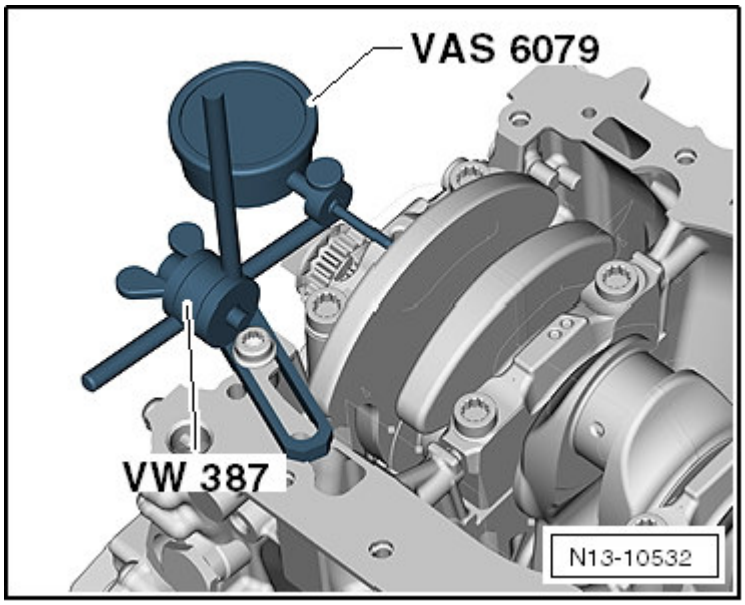

Fig. 19: Identifying VAS 6079 & VW 387
Courtesy of AUDI OF AMERICA, LLC

-- Bolt the dia gauge 0-10 mm VAS 6079 and the dial gauge holder VW 387 to the cylinder block and place the dial gauge against the crankshaft counterweight with 2 mm of pretension.

-- Press the crankshaft by hand, against the dial gauge and set the gauge to "0".

-- Press the crankshaft off the gauge and read the value.

Axial clearance:

New: 0.07 to 0.23 mm

Wear limit: 0.30 mm

CRANKSHAFT RADIAL CLEARANCE, MEASURING

Special tools and workshop equipment required

- Plastigage®

Procedure

NOTE: Do not interchange used bearing shells.

Bearing shells that are worn down to the nickel layer must be replaced.

-- Remove the main bearing cap and clean the bearing cap and journal.

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

- The Plastigage® must rest in the center of the bearing cap.

-- Install the main bearing cap and tighten the bolts to 60 Nm. Do not rotate the crankshaft when doing so.

-- Remove the main bearing cap bolts and cap again.

-- Compare the width of the Plastigage® with the measuring scale.

Radial clearance:

New: 0.017 to 0.037 mm

Wear limit: 0.15 mm

PISTON AND CYLINDER BORE, CHECKING

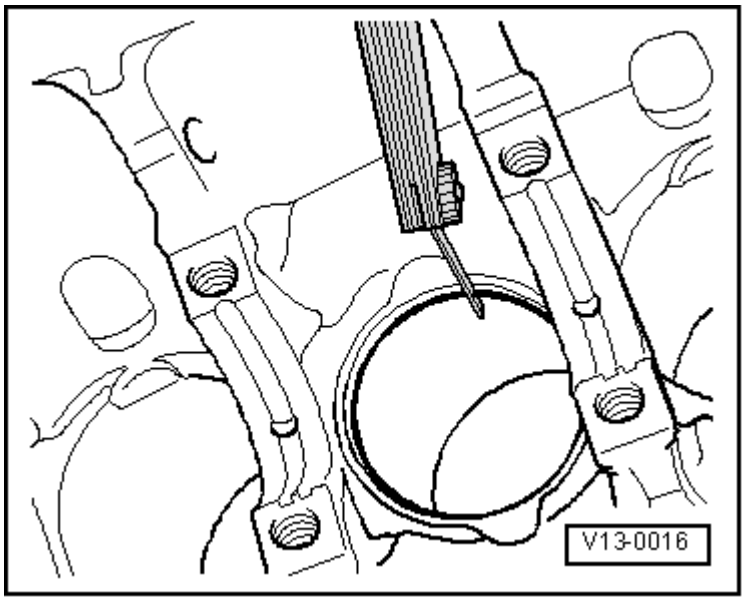

Fig. 20: Checking Piston Ring Gap
Courtesy of AUDI OF AMERICA, LLC

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

Piston Ring Dimensions are in mm	New	Wear Limit
Compression ring	0.20 ••• 0.40	0.8
Oil scraping ring	0.25 ••• 0.50	0.8

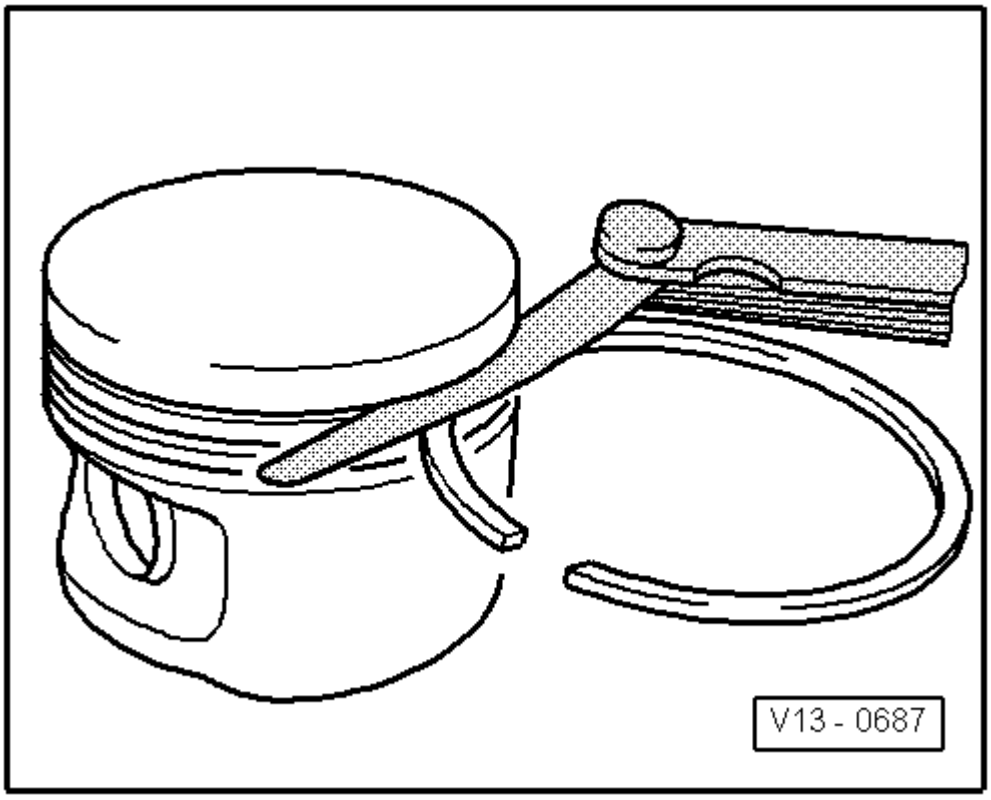

Fig. 21: Checking Piston Ring Gap
Courtesy of AUDI OF AMERICA, LLC

-- Clean the ring groove of the piston before checking.

Piston Ring Dimensions are in mm	New	Wear Limit
1. Compression ring	0.06 ••• 0.09	0.20
2. Compression ring	0.03 ••• 0.06	0.15
Oil scraping rings	cannot be measured	

Piston, Checking

Special tools and workshop equipment required

- Micrometer 75-100 mm VAS 6071

-- Measure the piston approximately 10 mm from the bottom edge and at points offset 90° to the piston pin axis.

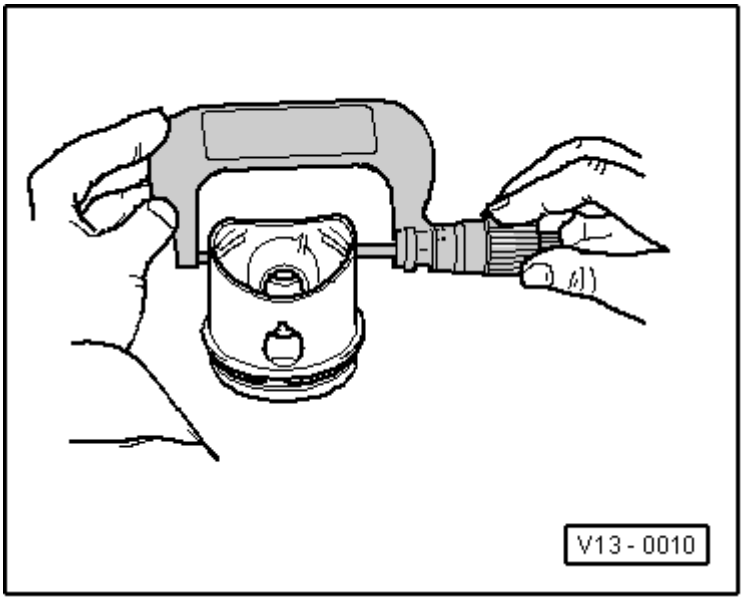

Fig. 22: Checking Piston
Courtesy of AUDI OF AMERICA, LLC

- Deviation from nominal dimension: Max. 0.04 mm

Cylinder Bore, Checking

NOTE: Measurement of the cylinder bore must not be performed when the cylinder block is mounted on the engine and transmission holder VAS 6095, false measurements are possible.

Special tools and workshop equipment required

- Cylinder Gauge VAS 6078
- Inside Micrometer Set 18-100 mm US1033/S

CAUTION: Do not bore, hone, grind or rework the cylinder bores with shop tools. Reworking damages the surface of the cylinder bore.

-- Measure diagonally at 3 positions transversely -A- and longitudinally -B-.

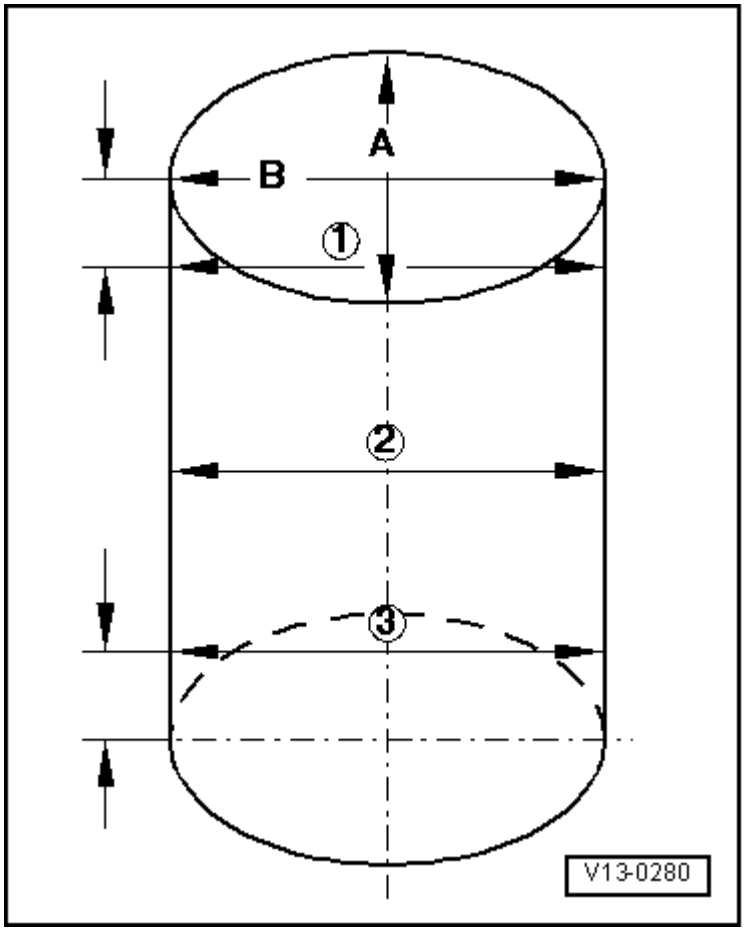

Fig. 23: Checking Cylinder Bores
Courtesy of AUDI OF AMERICA, LLC

- Deviation from nominal dimension: Max. 0.08 mm

	Piston Diameter	Cylinder Bore Diameter
Basic dimension mm	82.465 (1)	82.51
(1) Dimensions without the graphite coating (0.02 mm thick). The graphite coating wears off.		

REMOVAL AND INSTALLATION

RIBBED BELT

Removing

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

- **Before removing the ribbed belt, mark the running direction with chalk or a felt-tip pen for reinstallation later.**

-- Remove the noise insulation. Refer to one of the following:

GTI and Tiguan, refer to **Description and Operation**

Eos and Passat, refer to "Noise Insulation" in **Removal and Installation** .

CC, refer to "Noise Insulation" in **Description and Operation**

-- Remove the right charge air hose -arrows-.

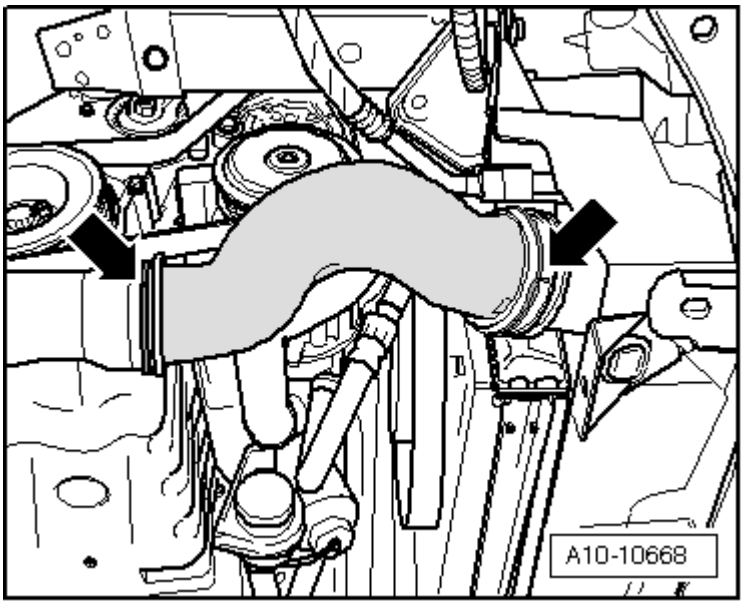

Fig. 24: Air Guide Hose
Courtesy of AUDI OF AMERICA, LLC

-- To release the tension on the ribbed belt, turn the tensioner in the -direction of the arrow- from underneath.

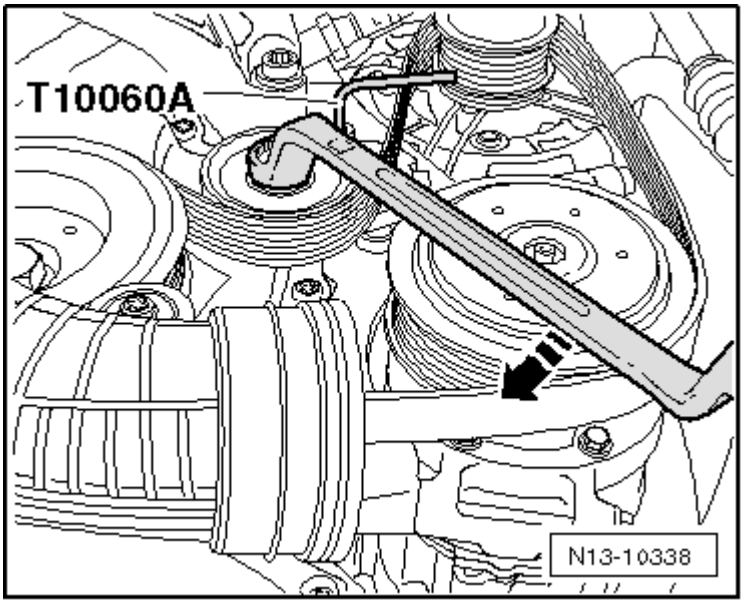

Fig. 25: Identifying Wrench And Locking Pin -T10060 A-
Courtesy of AUDI OF AMERICA, LLC

-- Secure the tensioner using the locking tool T10060 A.

-- Remove the ribbed belt.

Installing

Install in the reverse order of removal. Note the following:

NOTE: Before installing the ribbed belt, the generator and Air Conditioning (A/C) compressor must be installed securely.

-- First, install the ribbed belt on the vibration damper, then on the A/C compressor and generator.

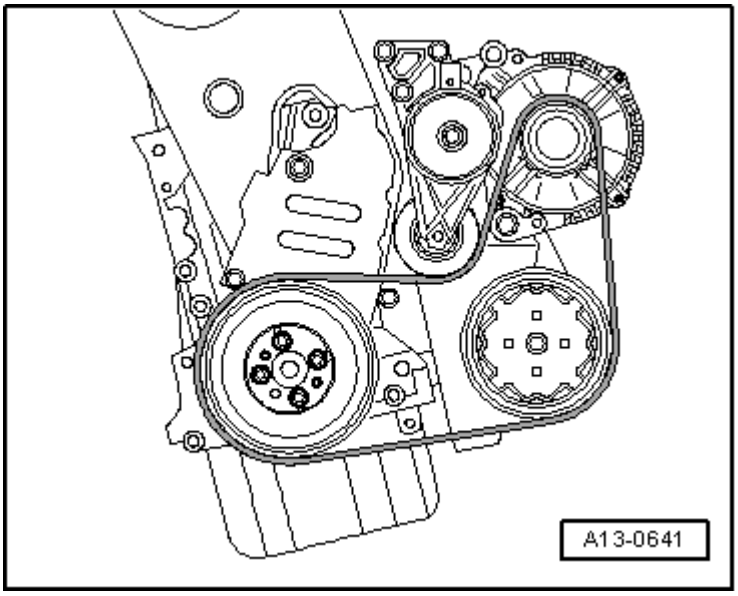

Fig. 26: Identifying Ribbed Belt Routing
Courtesy of AUDI OF AMERICA, LLC

-- Turn the tensioner using a box end wrench and remove the locking pin T10060 A.

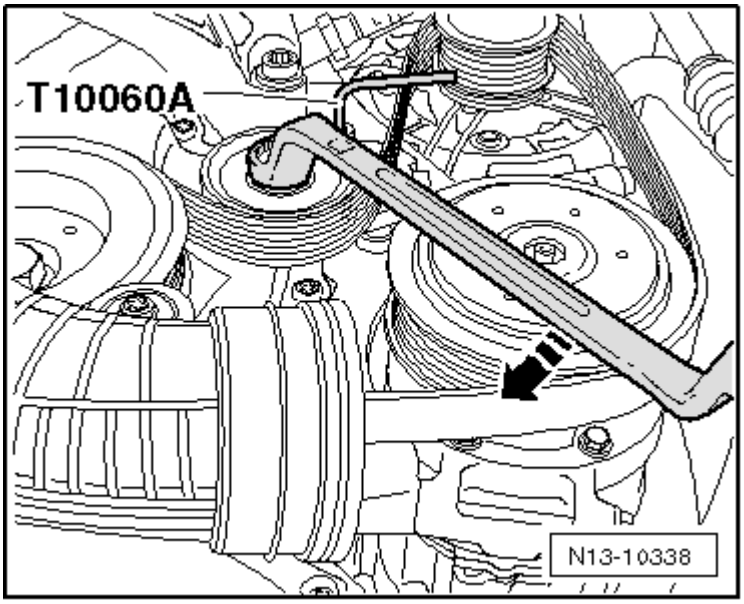

Fig. 27: Identifying Wrench And Locking Pin -T10060 A-
Courtesy of AUDI OF AMERICA, LLC

-- Release the tensioner.

-- Check whether ribbed belt is routed correctly.

-- Start the engine and check whether the ribbed belt runs correctly.

RIBBED BELT TENSIONER

NOTE: Always use two bracket with spindle and hook 10-222 A/10. Otherwise the engine support bridge 10-222 A will have a tendency to tip.

Special tools and workshop equipment required

- Engine Support Bridge 10-222 A
- Engine Support Adapter 10-222 A/3, (Qty: 2)
- Bracket with Spindle and Hook 10-222 A/10, (Qty: 2)
- Shackle 10-222 A/12
- Adapter 10-222 A/22
- Lifting Eyebolt 3368 (for automatic transmissions only)

Removing

-- Remove the noise insulation. Refer to **Description and Operation** .

-- Remove the front right wheel housing liner. Refer to **Removal and Installation** .

-- First, remove the bolt -1- and then the bolts -2 and 3-, then remove the pendulum support.

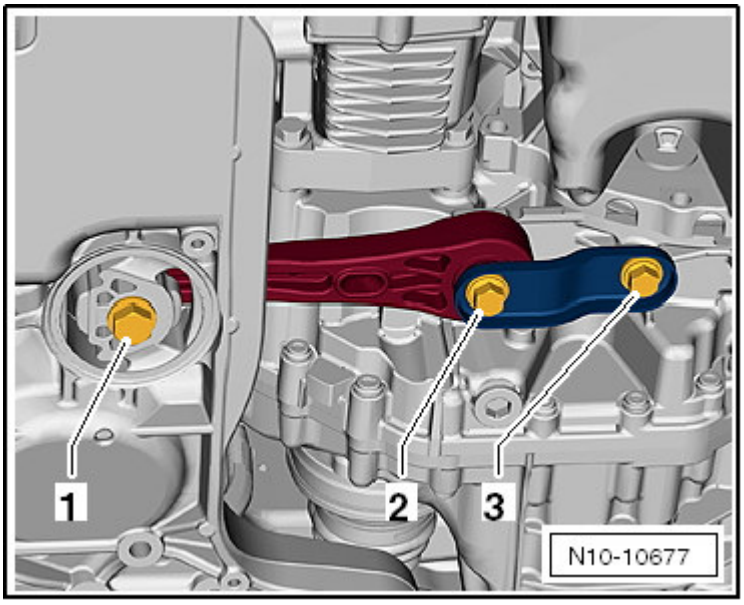

Fig. 28: Identifying Support Bracket, Pendulum And Bolts
Courtesy of AUDI OF AMERICA, LLC

with All Wheel Drive (AWD)

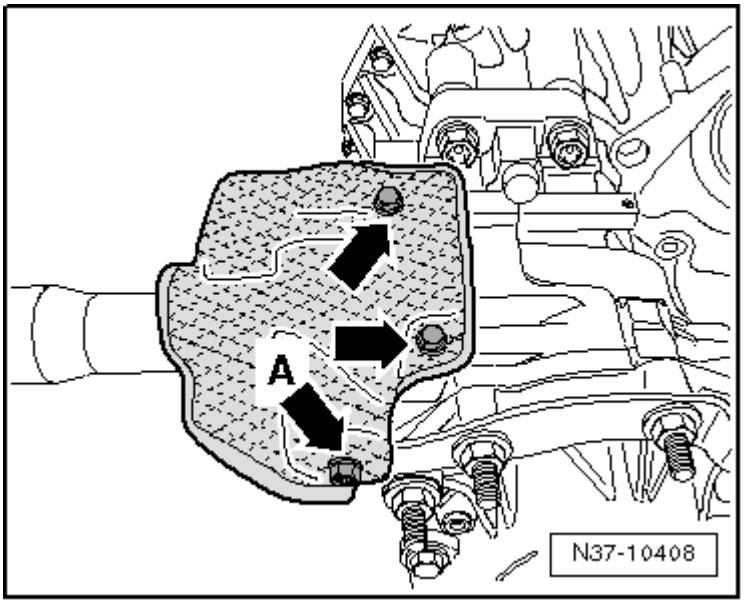

Fig. 29: Identifying Flexible Disc Shield Bolts
Courtesy of AUDI OF AMERICA, LLC

-- Remove the flexible disc heat shield bolts -arrows- and shield.

-- Mark the position of the driveshaft flexible disc to the bevel box input flange.

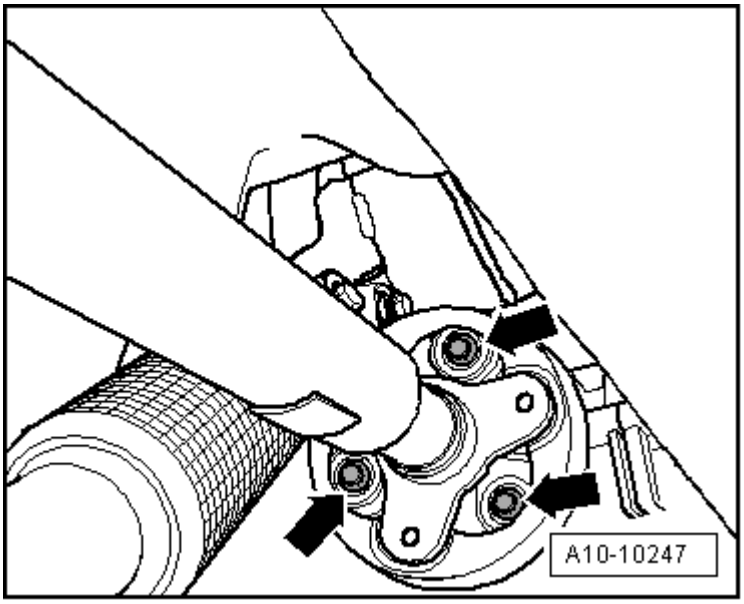

Fig. 30: Driveshaft Flexible Disc
Courtesy of AUDI OF AMERICA, LLC

-- Remove the driveshaft flexible disc bolts -arrows- and remove it from the bevel box input flange.

To loosen or tighten, counter hold the driveshaft on the back of the final drive.

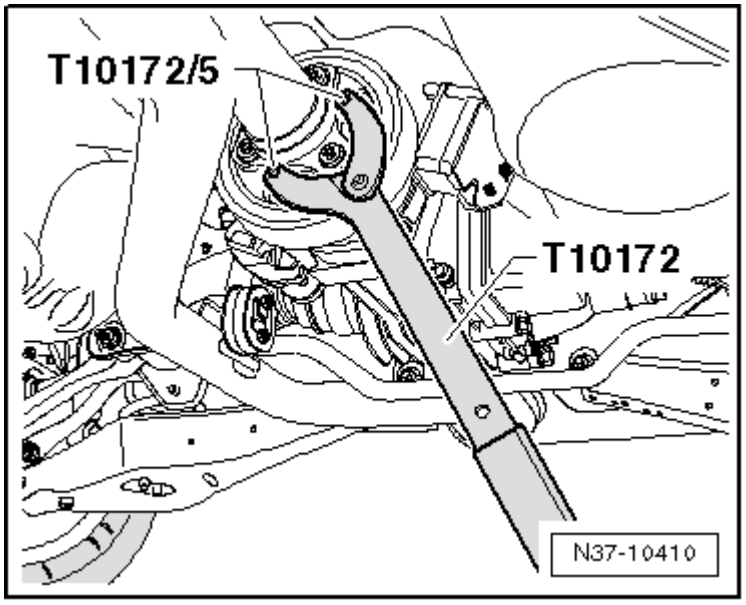

Fig. 31: Counterholding Rear Final Drive To Loosen/Tighten Rear Flexible Disc Bolts
Courtesy of AUDI OF AMERICA, LLC

Continuation for All

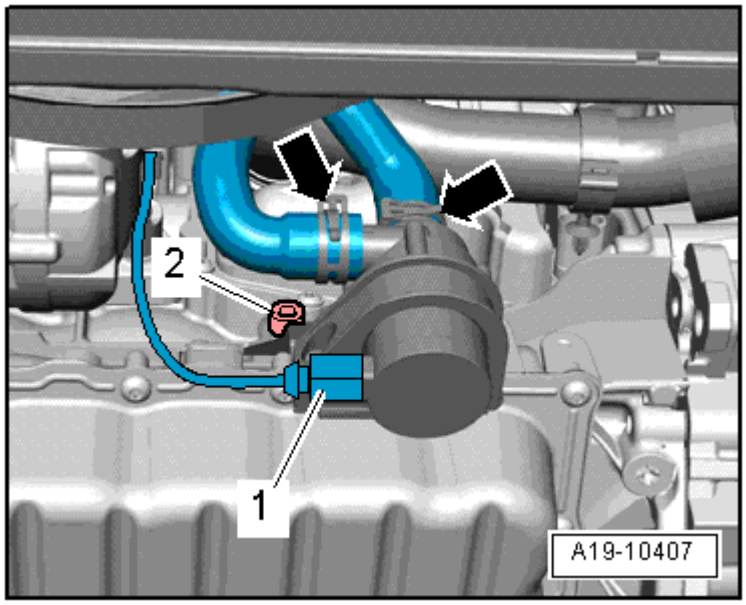

Fig. 32: After-Run Coolant Pump V51 Bracket Bolt
Courtesy of AUDI OF AMERICA, LLC

-- Remove the after-run coolant pump bracket bolt -2-.

-- Remove the engine cover. Refer to **ENGINE COVER** .

-- Remove the air filter housing. Refer to **AIR FILTER HOUSING** .

CAUTION: Danger of causing damage to other electronic components when disconnecting the battery.

- **Complete the steps for disconnecting the battery.**

-- With the ignition turned off, remove the ground wire -arrow- from the battery.

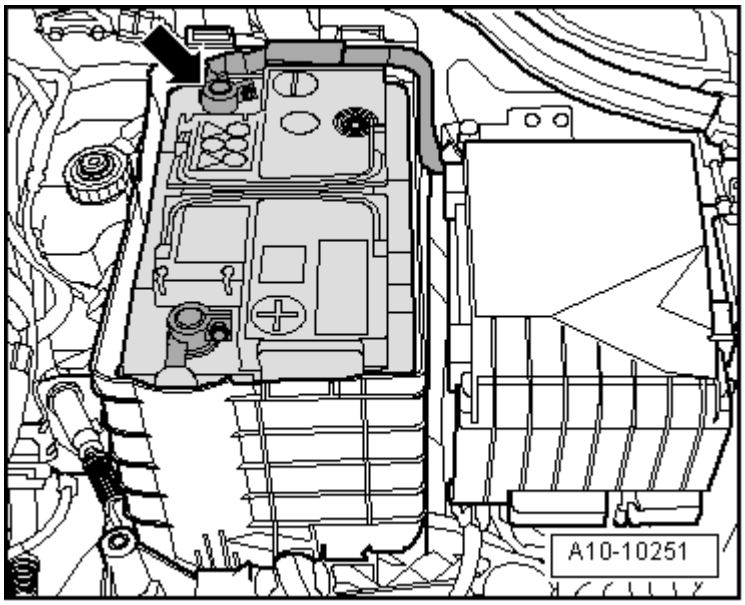

Fig. 33: Battery Ground Strap
Courtesy of AUDI OF AMERICA, LLC

-- Remove the battery. .

-- Remove the battery tray bolts -arrows- and tray.

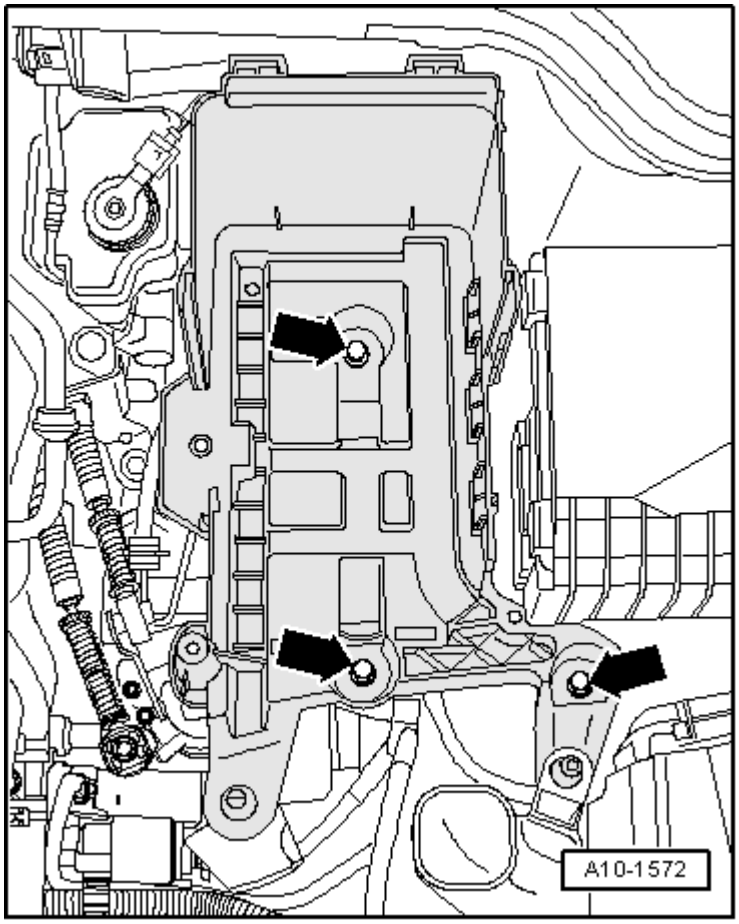

Fig. 34: Battery Carrier Nuts
Courtesy of AUDI OF AMERICA, LLC

with a Automatic Transmission

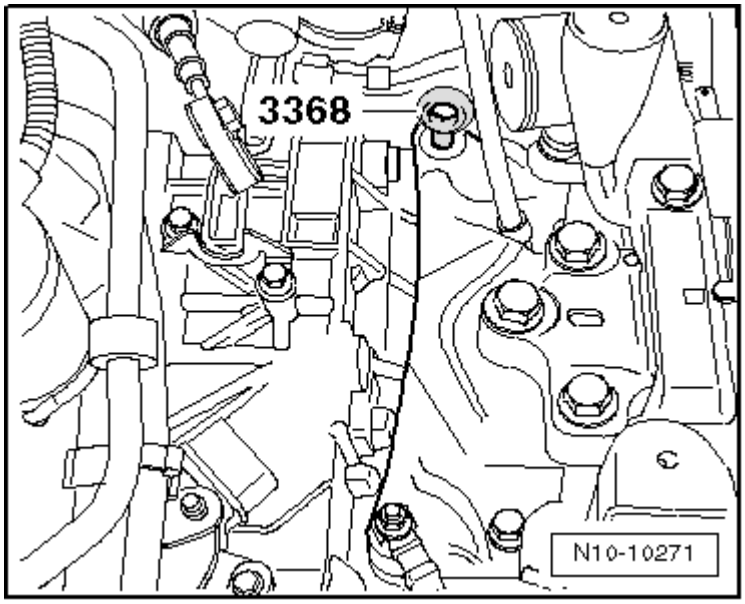

Fig. 35: Identifying Lifting Eyebolt -3368-
Courtesy of AUDI OF AMERICA, LLC

-- Install the lifting eyebolt 3368 into the transmission mount bracket as shown.

-- Install the engine support bridge 10-222 A using the following special tools:

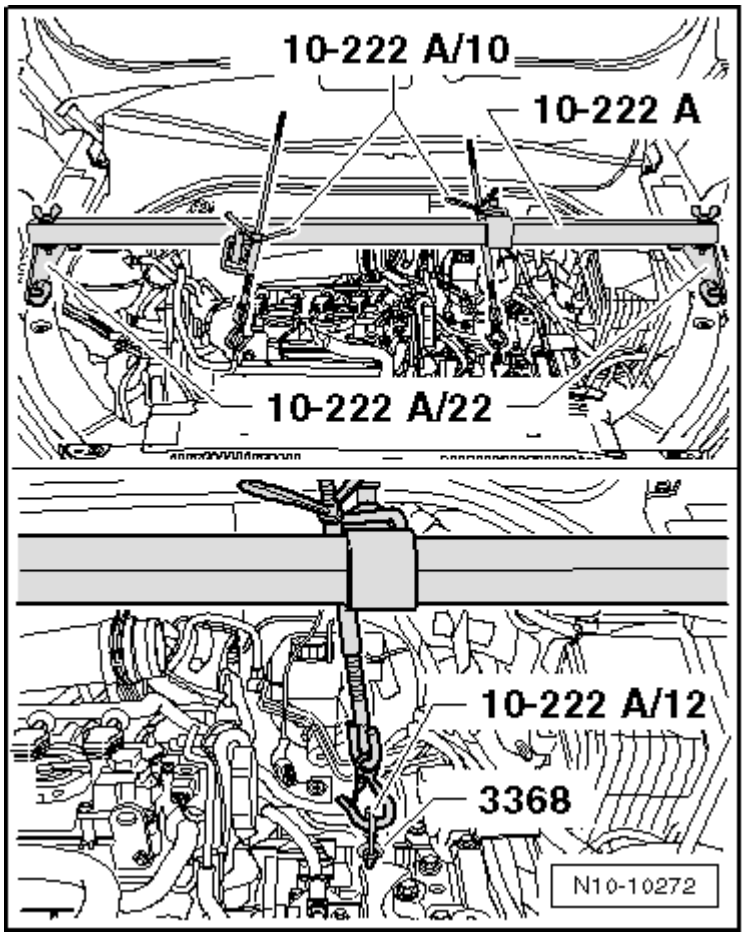

Fig. 36: Identifying Engine Support Bridge 10-222 A And Special Tools
Courtesy of AUDI OF AMERICA, LLC

- Adapter 10-222 A/22, Qty. 2
- Engine support adapter 10-222 A/3. Qty. 2
- Bracket with spindle and hook 10-222 A/10, Qty. 2
- Shackle 10-222 A/12

with a Manual Transmission

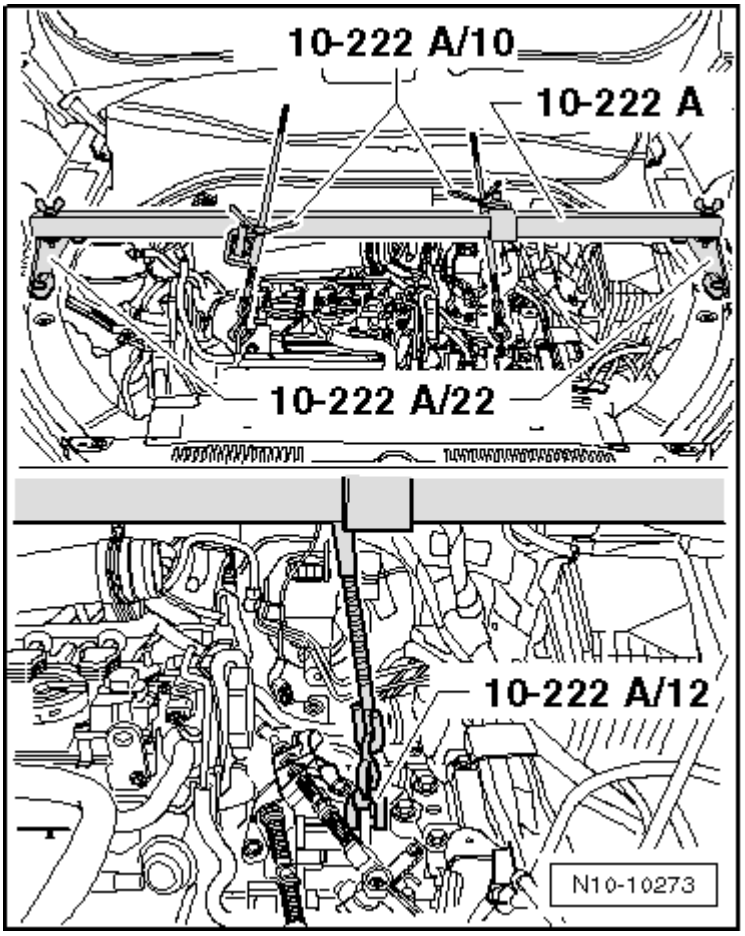

Fig. 37: Identifying Engine Support Bridge 10-222 A And Special Tools
Courtesy of AUDI OF AMERICA, LLC

-- Remove the shift mechanism from the transmission. Refer to **[For transmission(s) 0A6] Removal and Installation** .

-- Install the engine support bridge 10-222 A using the following special tools:

- Adapter 10-222 A/22, Qty. 2
- Engine support adapter 10-222 A/3, Qty. 2
- Bracket with spindle and hook 10-222 A/10, Qty. 2
- Shackle 10-222 A/12

Continuation for All

-- Tension the engine with the spindle.

-- Remove the engine mount to engine mount bracket bolts -arrows-.

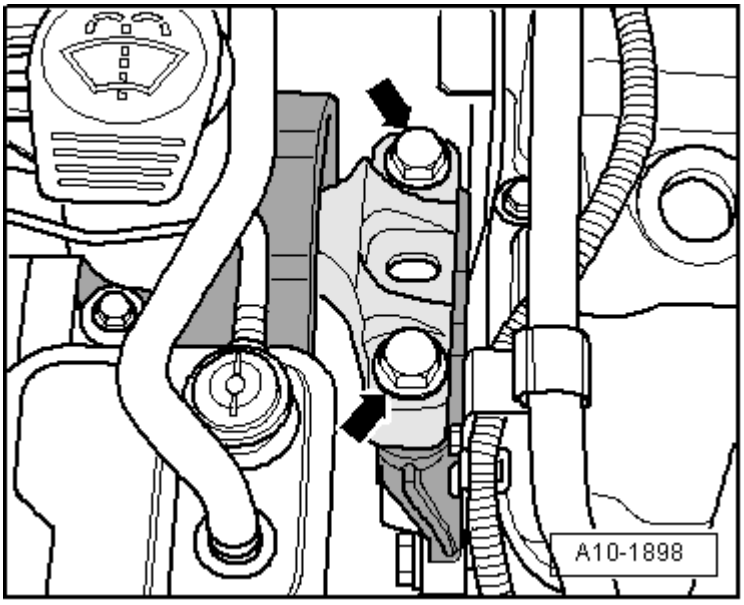

Fig. 38: Identifying Engine Mount To Engine Mount Bracket Bolts
Courtesy of AUDI OF AMERICA, LLC

-- Lower the engine approximately 55 mm.

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

-- Free up the wiring harness -arrow-.

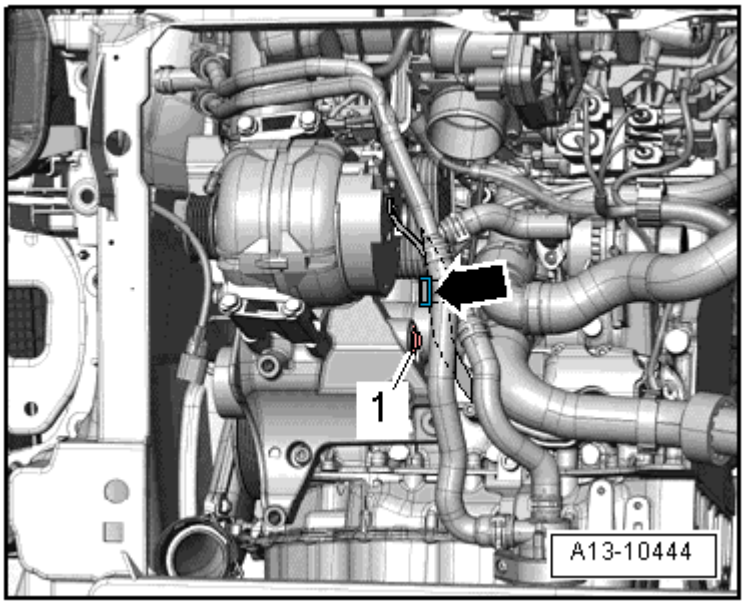

Fig. 39: Identifying Ribbed Belt Tensioner Bolt And Locating Electrical Wiring Harness
Courtesy of AUDI OF AMERICA, LLC

-- Remove the bolt -1- and remove the ribbed belt tensioner from the accessory bracket.

Installing

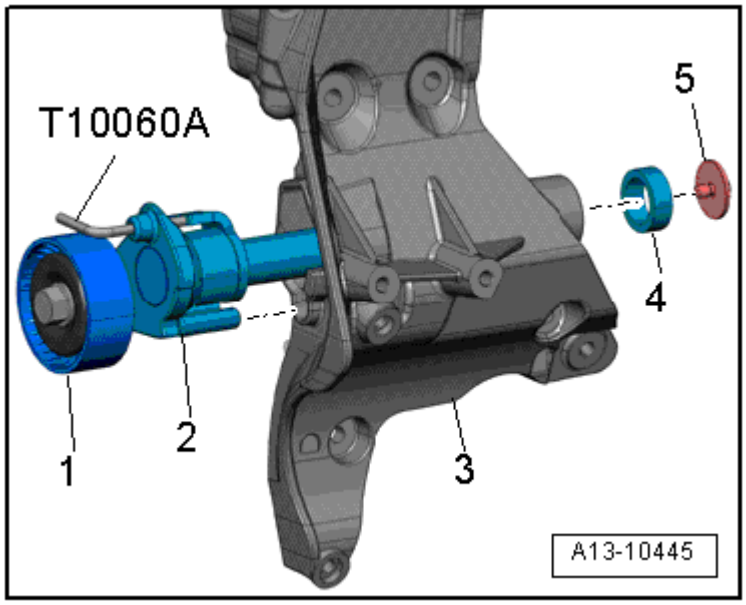

Fig. 40: Identifying Tensioning Device For Ribbed Belt
Courtesy of AUDI OF AMERICA, LLC

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

Install in the reverse order of removal. Note the following:

-- Insert the ribbed belt tensioner -1- into the accessory bracket -3- and tighten the bolt -5-.

- Note the support -2- installed position, insert the support into the hole in the accessory bracket.
- Note the centering sleeve -4-.

-- Adjust the engine mount. Refer to **ENGINE/TRANSMISSION MOUNT, ADJUSTING** .

ACCESSORY BRACKET

Removing

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

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

-- Remove the generator. .

-- Disconnect the connector -1- from the Air Conditioning (A/C) compressor regulator valve.

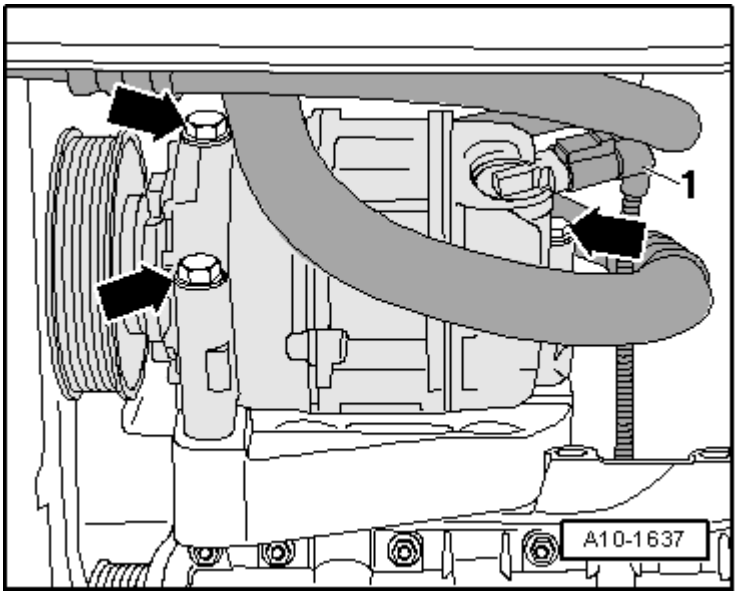

Fig. 41: A/C Compressor Bolts And Solenoid Clutch Electrical Connector
Courtesy of AUDI OF AMERICA, LLC

WARNING: Refrigerant can cause serious personal injury.

- **Do not open the A/C refrigerant circuit.**

-- Remove the A/C compressor bolts -arrows-.

CAUTION: Risk of damaging refrigerant lines and hoses.

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

-- Secure the A/C compressor with the refrigerant lines attached to the longitudinal member.

-- Remove the bolt -arrow- for the oil dipstick guide tube.

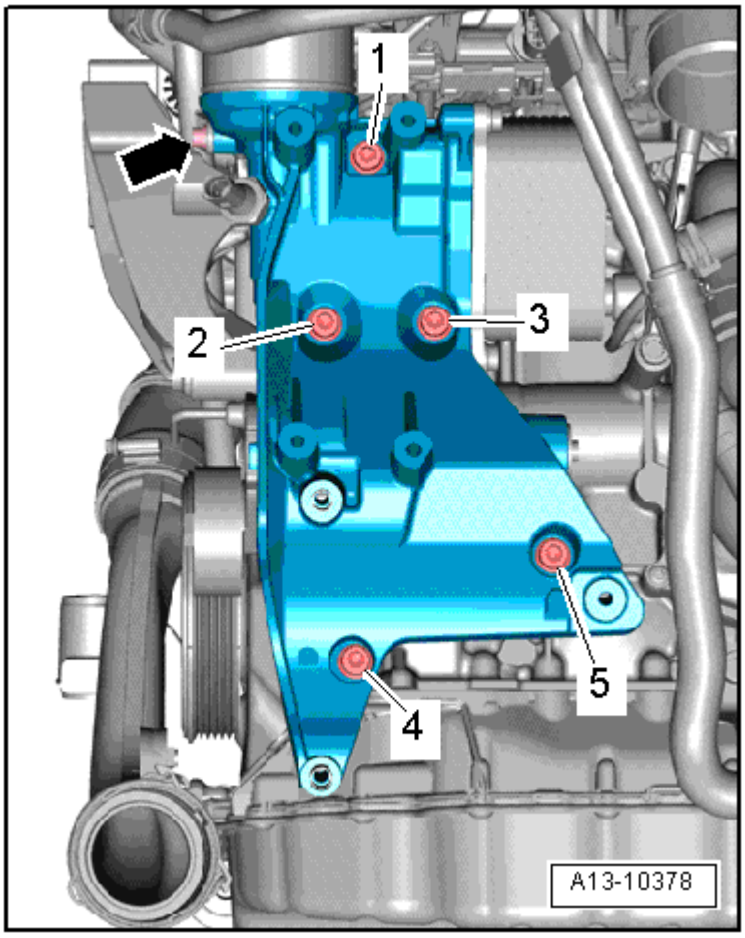

Fig. 42: Accessory Assembly Bracket Tightening Sequence
Courtesy of AUDI OF AMERICA, LLC

-- Remove the bolts -1 through 5- and pull off the accessory bracket from the coolant pump housing.

Installing

NOTE: Replace any bolts that were tightened to an additional torque angle.

Replace the O-rings and seals.

-- Coat the O-rings -4- with coolant.

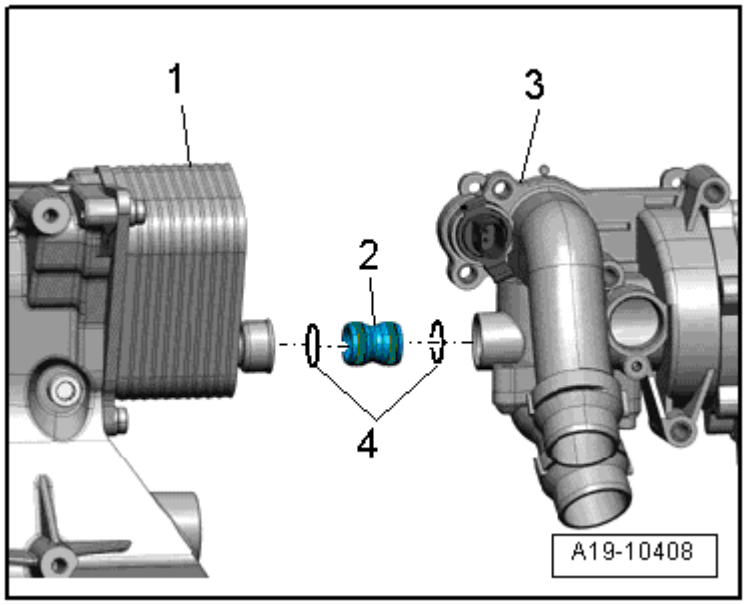

Fig. 43: Accessory Assembly Bracket, Coolant Pump Housing, Connection And O-Rings
Courtesy of AUDI OF AMERICA, LLC

-- Install the union -2- into the coolant pump housing -3-.

-- Slide the accessory bracket -1- onto the union -2-.

-- Position the accessory bracket to the cylinder block and then install the bolt -4-.

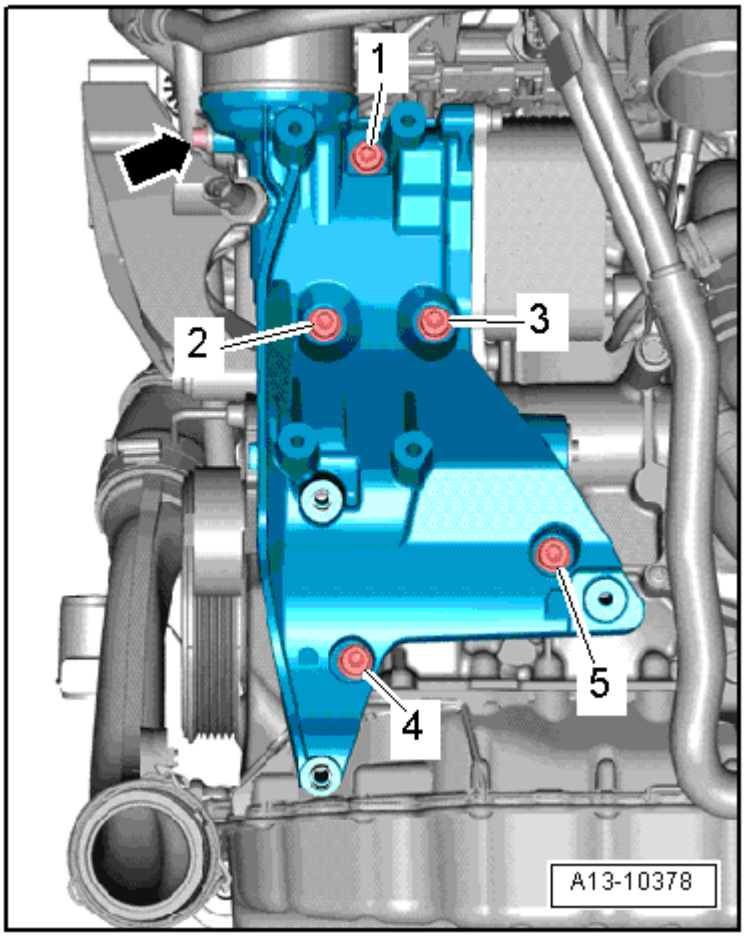

Fig. 44: Accessory Assembly Bracket Tightening Sequence
Courtesy of AUDI OF AMERICA, LLC

-- Install and tighten all the bolts in 3 stages in sequence -1 through 5- as follows:

-- Tighten the bolts hand tight.-- Tighten the bolts to 20 Nm.-- Tighten the bolts an additional 90° (1/4) turn.

The rest of the installation is basically a reverse of the removal procedure, when doing this, note the following:

- Tightening specifications, refer to **RIBBED BELT DRIVE OVERVIEW**.
- Install the A/C compressor. Refer to **Removal and Installation** .
- Install the generator. .

VIBRATION DAMPER

Special tools and workshop equipment required

- Locking Pin T10060 A
- Counter Hold Tool T10355

- Thrust Piece T10368

Removing

-- Remove the noise insulation. Refer to one of the following:

GTI and Tiguan, refer to **Description and Operation**

Eos and Passat, refer to "Noise Insulation" in **Removal and Installation** .

CC, refer to "Noise Insulation" in **Description and Operation**

-- Remove the front part of the right wheel housing liner and/or the entire right front wheel housing liner. Refer to **Removal and Installation** .

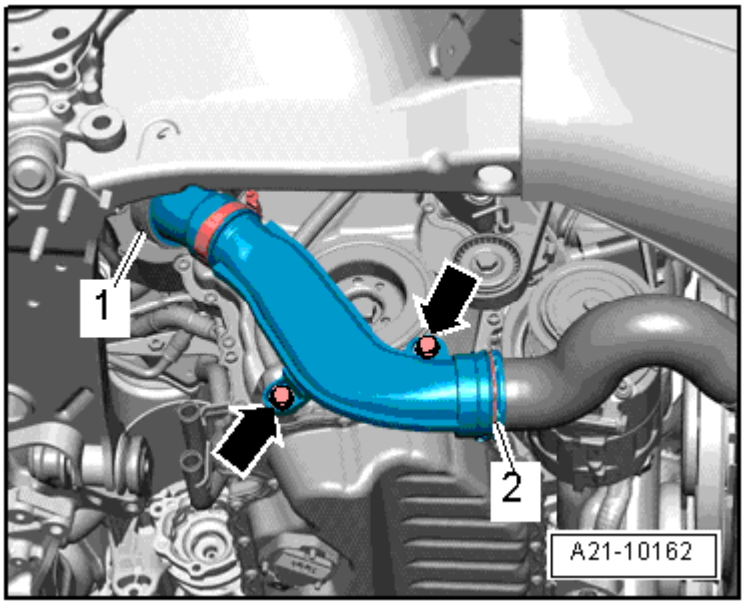

Fig. 45: Air Guide Pipe And Bolts
Courtesy of AUDI OF AMERICA, LLC

-- Remove the bolts -arrows-.

-- Lift the clamps -1 and 2- and remove the charge air pipe.

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

-- Rotate the vibration damper using the counter hold tool T10355 into the Top Dead Center (TDC) position -arrow-.

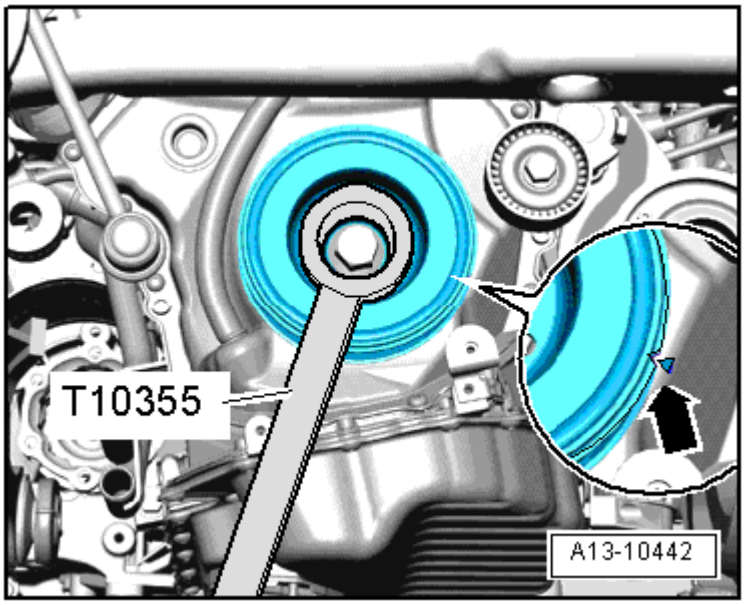

Fig. 46: Identifying Vibration Damper Rotated Into "OT" Position Using Counter Hold Tool T10355
Courtesy of AUDI OF AMERICA, LLC

- The notch on the vibration damper must line up with the arrow mark on the lower timing chain cover.

-- Remove the vibration damper bolt using the counter hold tool T10355.

CAUTION: Danger of causing damage to the engine.

- **In order not to change the valve timing, the crankshaft must not be moved out of the TDC position when the vibration damper is removed.**

-- Remove the vibration damper.

-- If the vibration damper is not immediately reinstalled, install the bolt with the thrust piece T10368.

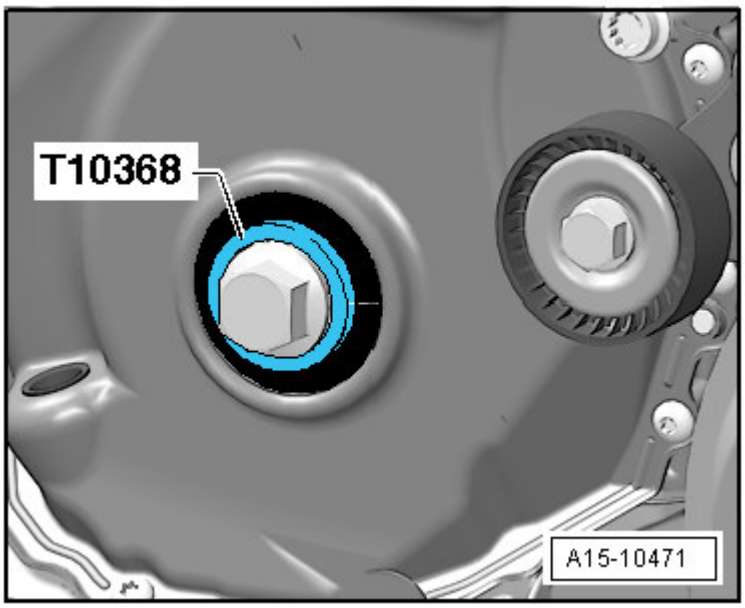

Fig. 47: Identifying Vibration Damper Bolt And Thrust Piece T10368
Courtesy of AUDI OF AMERICA, LLC

Installing

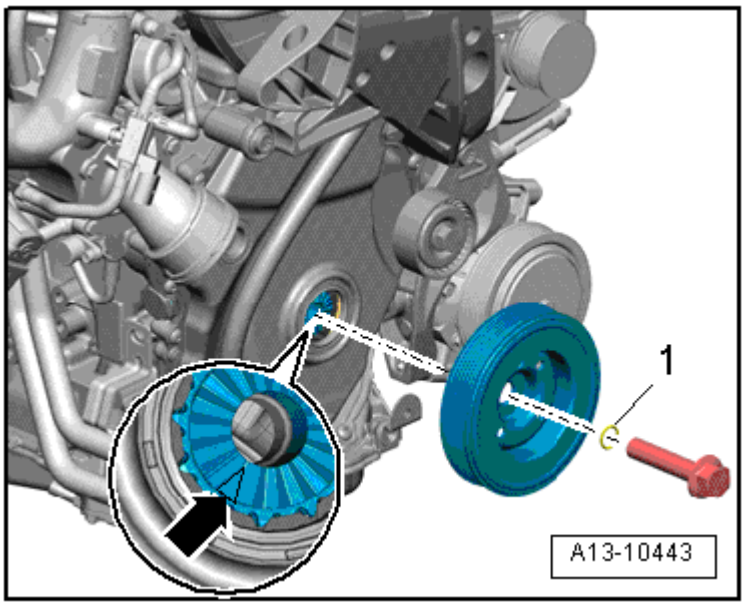

Fig. 48: Identifying O-Ring And Tooth Contour
Courtesy of AUDI OF AMERICA, LLC

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

Install in the reverse order of removal. Note the following:

NOTE: Replace the vibration damper bolt.

Replace O-ring -1-.

-- Coat the sealing lip on the O-ring with engine oil.

-- Mount the vibration damper, when doing this, pay attention to the tooth contour -arrow-.

DUAL MASS FLYWHEEL

Special tools and workshop equipment required

- Flywheel Retainer 3067

Removing

-- Remove the transmission. Refer to one of the following:

TRANSMISSION, REMOVING .

.

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

-- Rotate the dual mass flywheel -A- so that the bolts -B- are centered in the holes -arrows-.

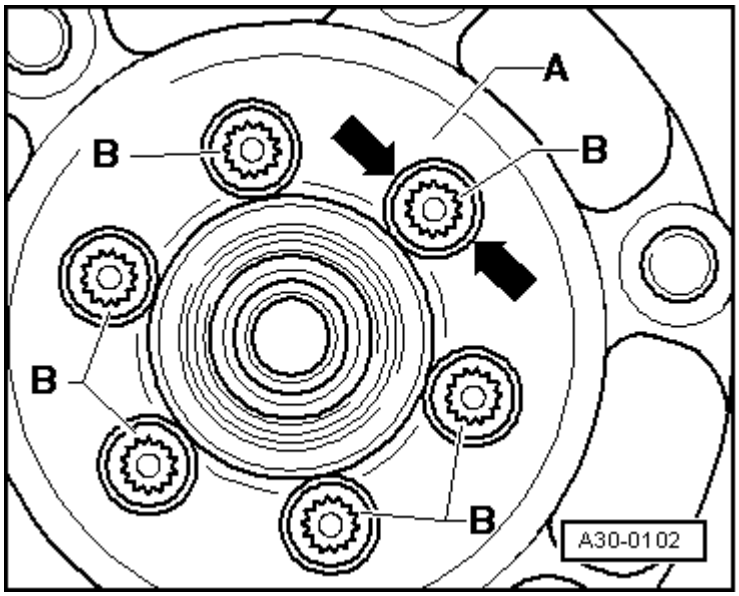

Fig. 49: Identifying Dual-Mass Flywheel & Bolts
Courtesy of AUDI OF AMERICA, LLC

-- When removing the bolts -B-, make sure the bolt head does not come into contact with the dual mass flywheel -arrows- or the flywheel could be damaged when removing the bolt.

-- Install the flywheel retainer 3067 into the hole in the cylinder block -B-.

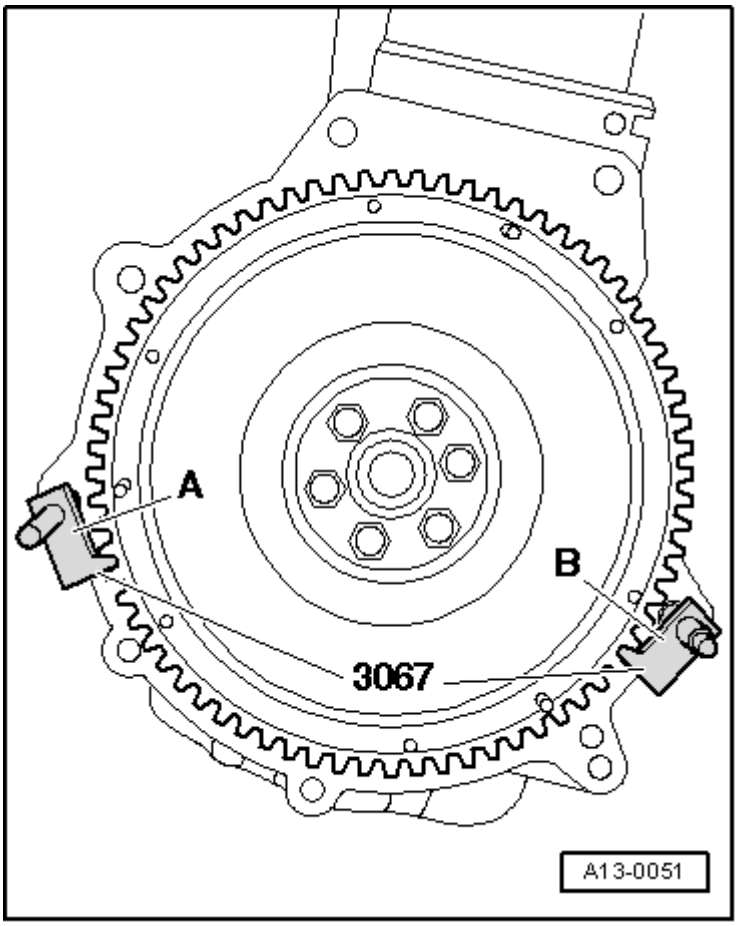

Fig. 50: Identifying Retainer -3067- Inserted In Hole On Cylinder Block
Courtesy of AUDI OF AMERICA, LLC

-- Remove the dual mass flywheel.

Installing

Install in the reverse order of removal. Note the following:

- Tightening specification, see -item 6- in the **SEALING FLANGE AND DUAL MASS FLYWHEEL/DRIVE PLATE OVERVIEW**.

-- Secure with new bolts.

-- Install the flywheel retainer 3067 into the hole in the cylinder block -A-.

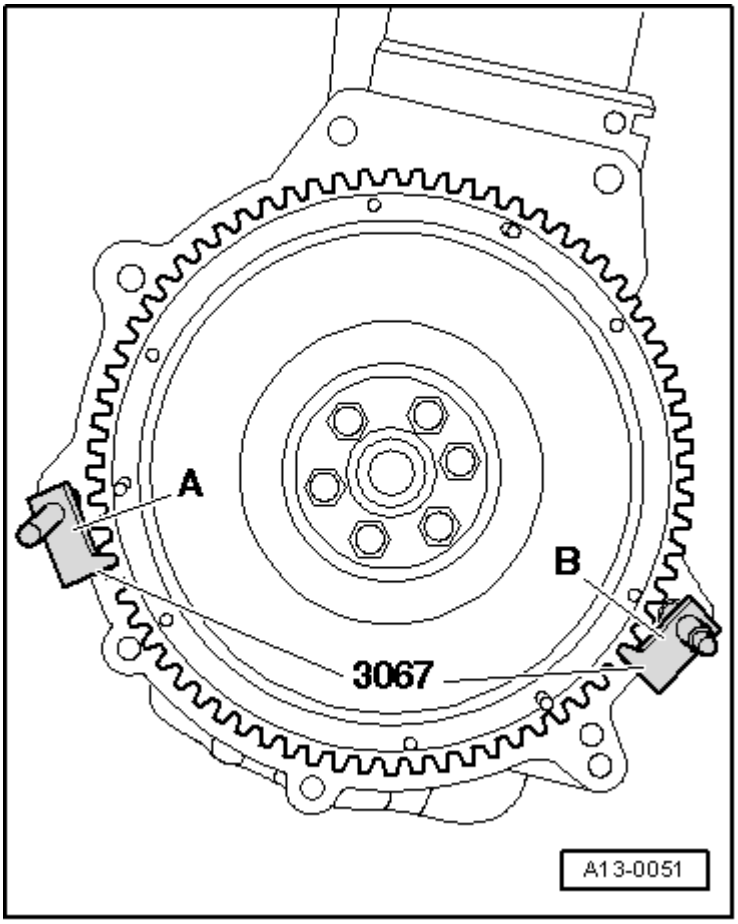

Fig. 51: Identifying Retainer -3067- Inserted In Hole On Cylinder Block
Courtesy of AUDI OF AMERICA, LLC

DRIVE PLATE

Special tools and workshop equipment required

- Flywheel Lock Adapter VW 558
- Depth Gauge
- M8 x 40 Bolt and M8 Nut

-- Remove the transmission. Refer to **Removal and Installation** .

Preparing the flywheel lock adapter VW 558

-- Install a M8 x 40 bolt -A- with a M8 nut into the flywheel lock adapter VW 558.

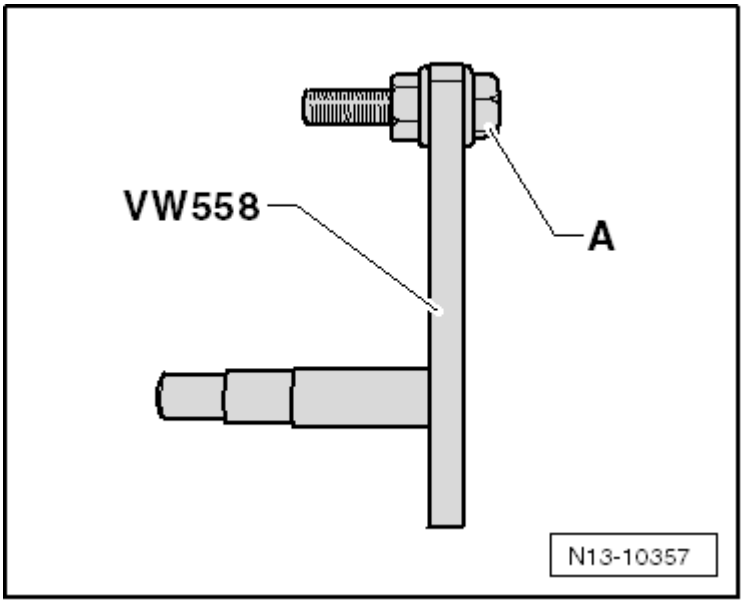

Fig. 52: Identifying Flywheel Lock Adapter -VW 558- And Bolt
Courtesy of AUDI OF AMERICA, LLC

Loosening and Tightening the Drive Plate

-- Install the flywheel lock adapter VW 558 to the cylinder block and drive plate as illustrated.

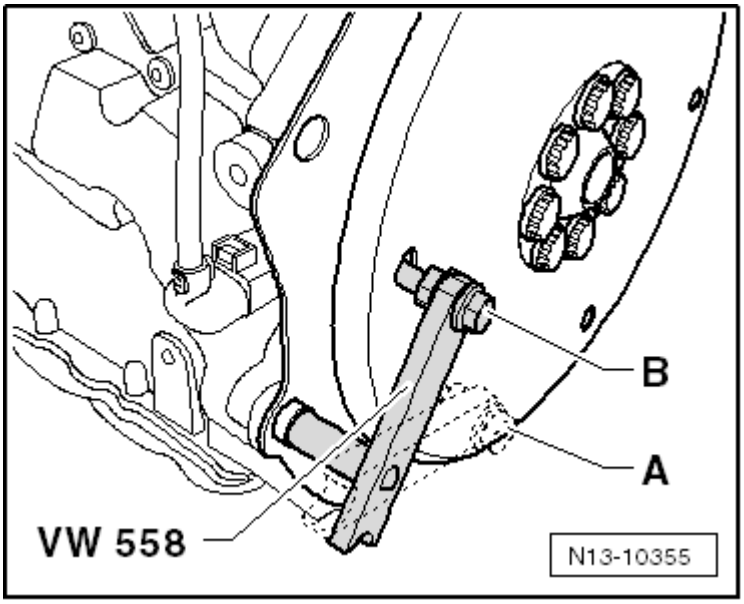

Fig. 53: Identifying Flywheel Lock Adapter -VW 558- Installed To Cylinder Block And Drive Plate
Courtesy of AUDI OF AMERICA, LLC

Installed position of the flywheel lock adapter VW 558: -A- to loosen, -B- to tighten.

Installing the Drive Plate

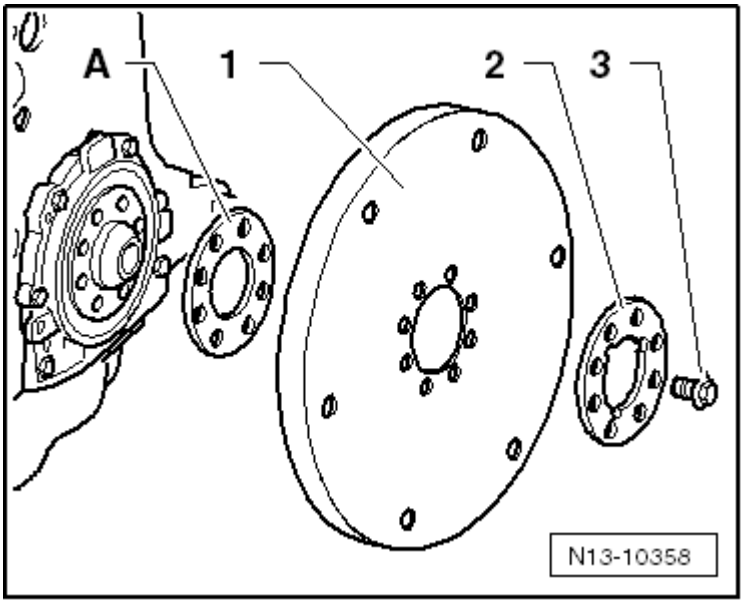

Fig. 54: Identifying Shim -A- And Bolts
Courtesy of AUDI OF AMERICA, LLC

-- First, install the drive plate without the shim -A-.

-- Install the used bolts -3- and tighten them to 30 Nm.

-- Calculate the dimension between the drive plate and cylinder block at three locations.

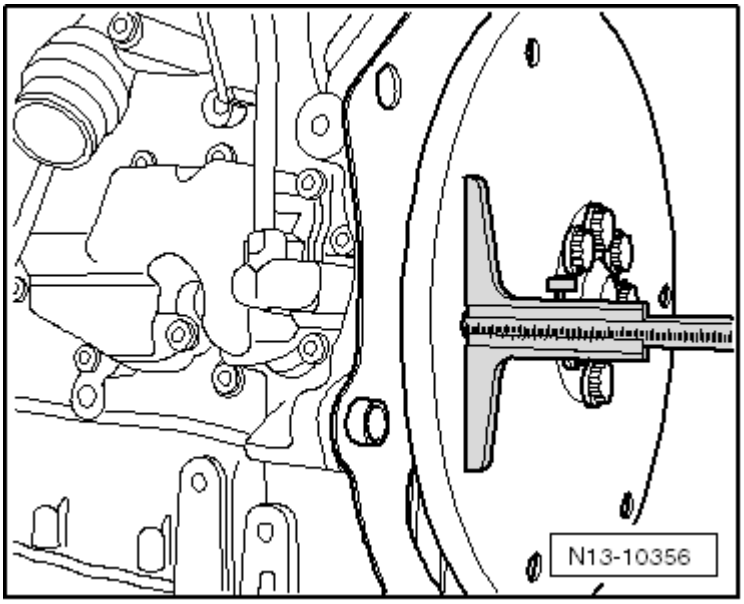

Fig. 55: Identifying Dimension Between Drive Plate And Cylinder Block
Courtesy of AUDI OF AMERICA, LLC

NOTE: This is measured through the holes in the drive plate to the machined surface of the cylinder block. When measuring on the intermediate plate, take the

thickness of the plate into consideration.

- Specified value measured without the intermediate plate: 19.5 to 21.1 mm
- Specified value measured with the intermediate plate: 18.8 to 20.4 mm

If the specified value is reached, replace all the bolts and tighten them to specification.

If the specified value is not obtained:

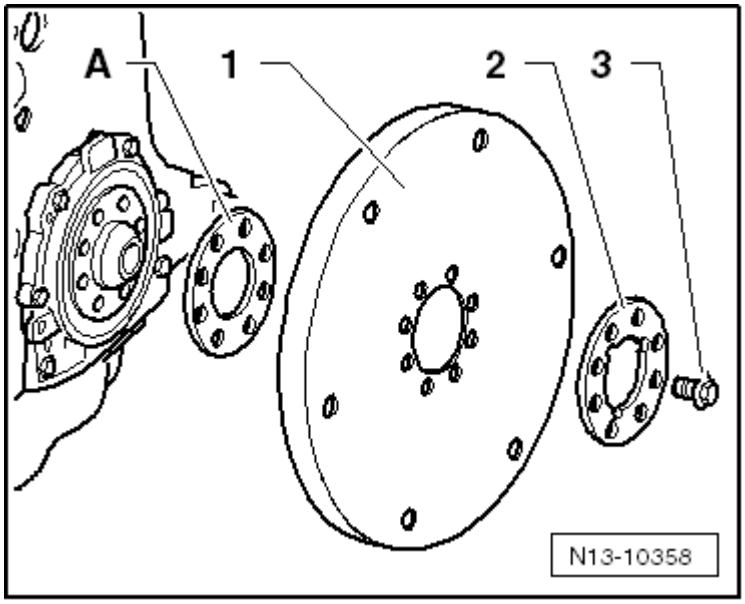

Fig. 56: Identifying Shim -A- And Bolts
Courtesy of AUDI OF AMERICA, LLC

-- Remove the drive plate and install the shim -A-. Install and tighten bolts -3- again to 30 Nm.

-- Repeat the measurement. If the specified value is now reached, replace all the bolts and tighten them to specification.

- Tightening specification, see -item 6- in the **SEALING FLANGE AND DUAL MASS FLYWHEEL/DRIVE PLATE OVERVIEW**.

SEALING FLANGE, TRANSMISSION SIDE

Special tools and workshop equipment required

- Guide Sleeve T20097
- Hand Drill with Plastic Brush Attachment
- Protective Eyewear
- Silicone Sealant D 174 003 A2

Requirement

- The dual mass flywheel is removed. Refer to **DUAL MASS FLYWHEEL** or the drive plate is removed. Refer to **DRIVE PLATE**.

Removing

-- Unhook the intermediate plate at the sealing flange and at the alignment sleeves -arrows-.

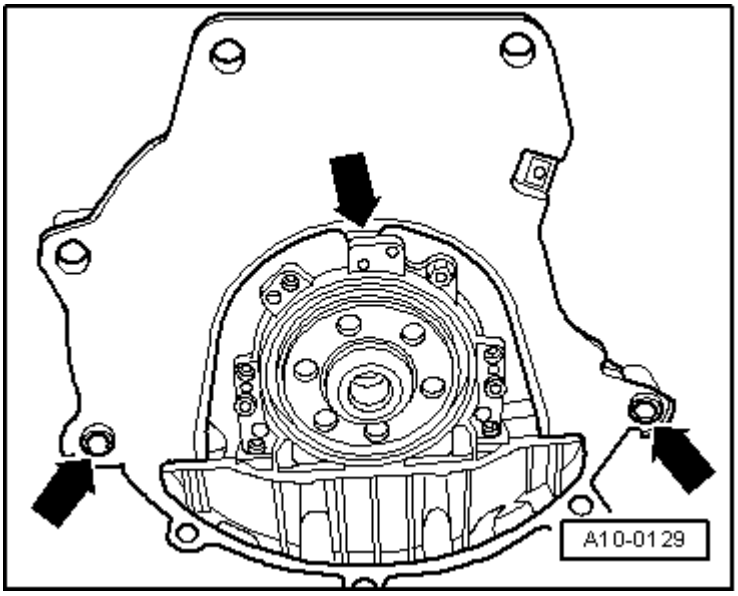

Fig. 57: Identifying Intermediate Plate Alignment Bushings
Courtesy of AUDI OF AMERICA, LLC

-- Remove the sealing flange bolts -1 through 8-

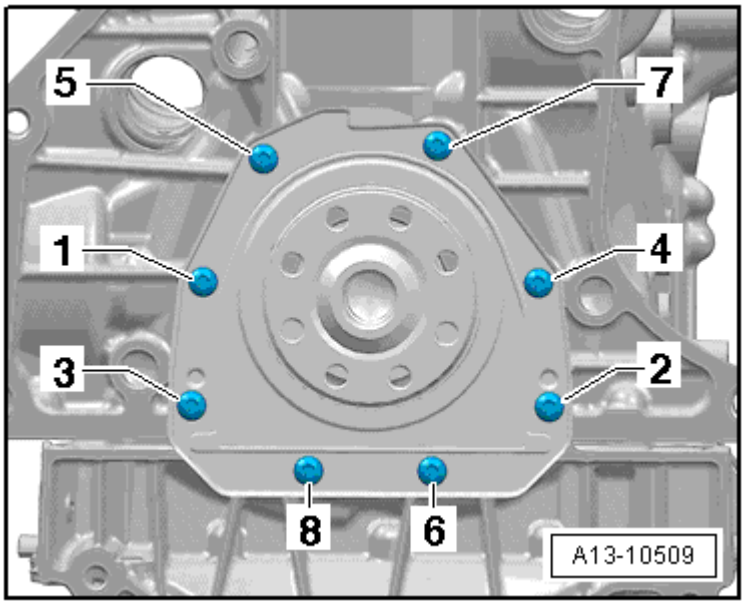

Fig. 58: Identifying Sealing Flange Tightening Sequence
Courtesy of AUDI OF AMERICA, LLC

-- Remove the sealing flange.

Installing

NOTE: Note the expiration date of the silicone sealant.

The sealing flange must be installed within 5 minutes after application of the silicone sealant.

The sealant bead may not be thicker than specified, otherwise the excess sealant could enter the oil pan and clog the oil suction pipe.

After installing the sealing flange, the sealant must dry for approximately 30 minutes. Only after then may the engine oil be added.

-- Remove any sealant residue on the cylinder block using a flat blade scraper.

WARNING: Wear protective eyewear.

-- Remove any remaining sealant on the sealing flange using, for example, a rotating plastic brush.

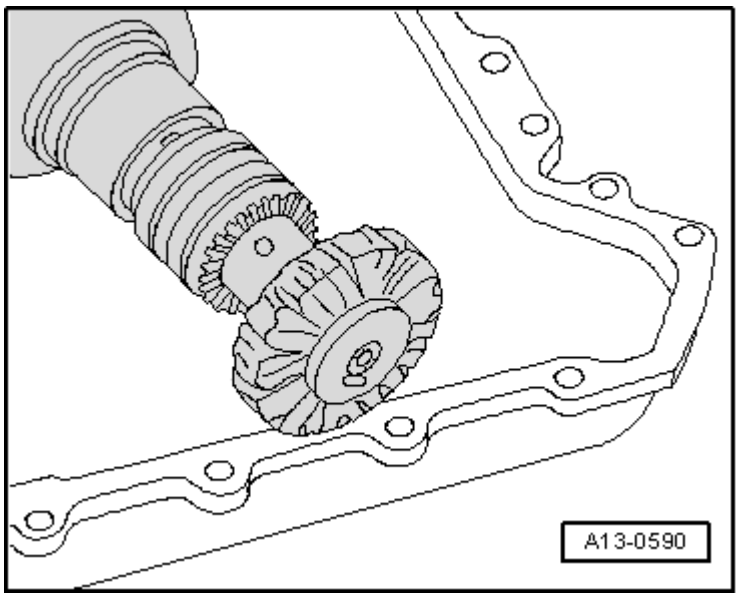

Fig. 59: Identifying Rotating Plastic Brush
Courtesy of AUDI OF AMERICA, LLC

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

-- Cut the sealant tube nozzle at the front mark (nozzle diameter: approximately 2 mm).

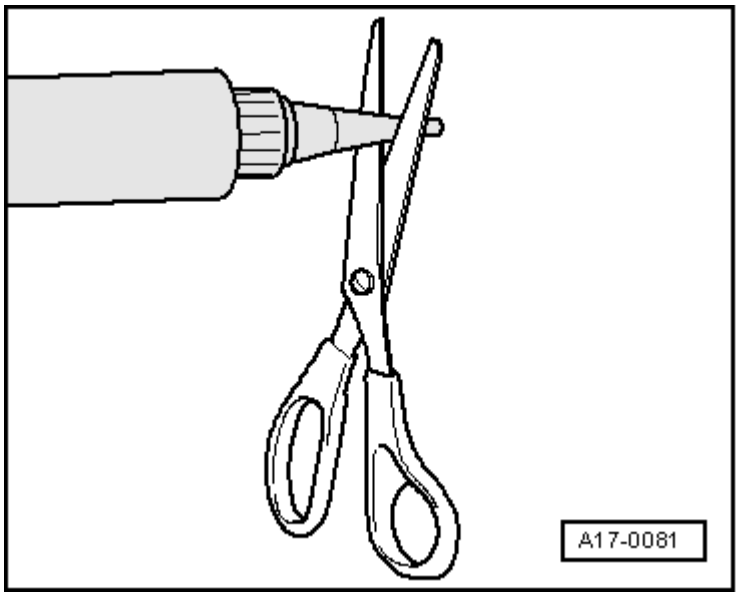

Fig. 60: Cut Tube Nozzle At Front Marking (Nozzle Diameter Approx. 3 Mm)
Courtesy of AUDI OF AMERICA, LLC

-- Apply the silicone sealant to the clean sealing surface on the sealing flange as illustrated.

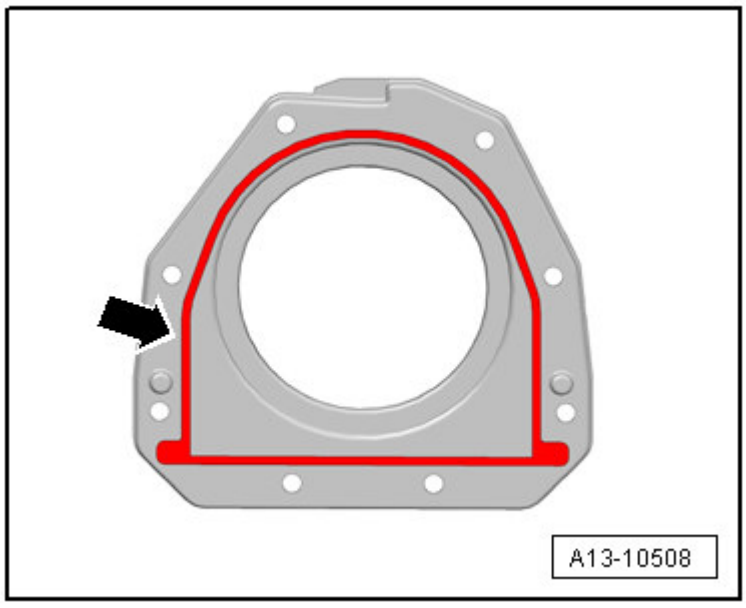

Fig. 61: Identifying Silicone Sealant Applied On Cover Sealing Surface
Courtesy of AUDI OF AMERICA, LLC

- Thickness of sealant bead: 2 to 3 mm

-- Install the guide sleeve T20097 on the crankshaft journal.

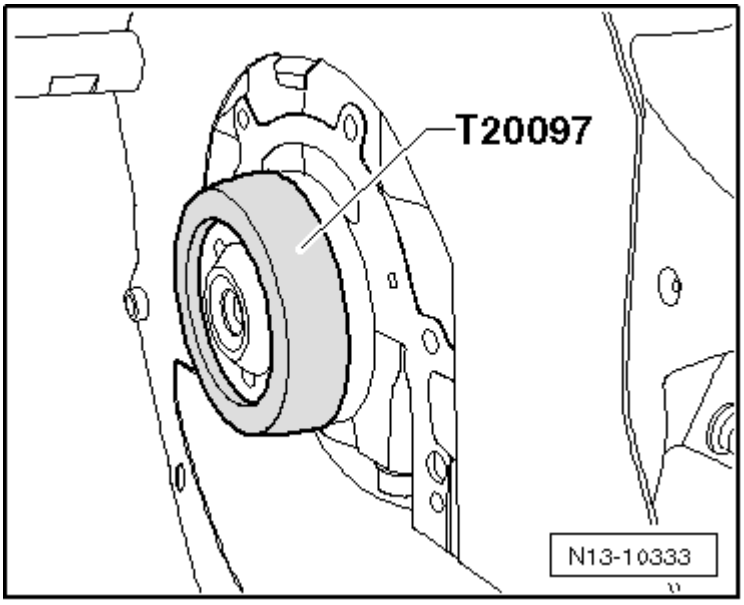

Fig. 62: Identifying Guide Sleeve On Crankshaft
Courtesy of AUDI OF AMERICA, LLC

-- Slide the sealing flange onto the crankshaft journal and guide sleeve T20097.

-- Install and tighten the bolts -1 through 8- in sequence:

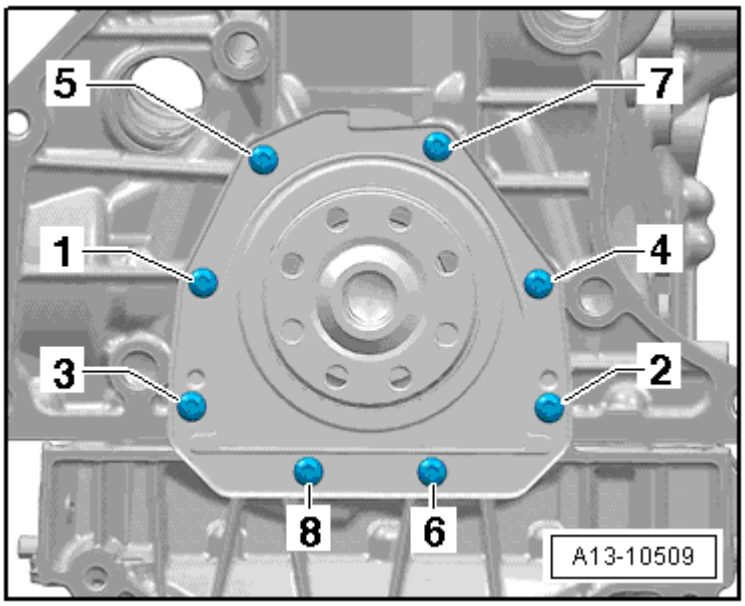

Fig. 63: Identifying Sealing Flange Tightening Sequence
Courtesy of AUDI OF AMERICA, LLC

-- 1. Tighten the bolts hand tight.

-- 2. Tighten the bolts to 9 Nm.

The rest of the installation is performed in the reverse order of removal.

SENSOR WHEEL

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

-- Remove the transmission side sealing flange. Refer to **SEALING FLANGE, TRANSMISSION SIDE**.

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

-- Remove the balance shaft timing chain. Refer to **BALANCE SHAFT TIMING CHAIN** .

-- Remove the connecting rod bearing caps.

-- Remove the crankshaft bearing caps.

-- Remove the crankshaft and the sensor wheel.

-- Always replace the sensor wheel -2- any time the screws -1- are loosened.

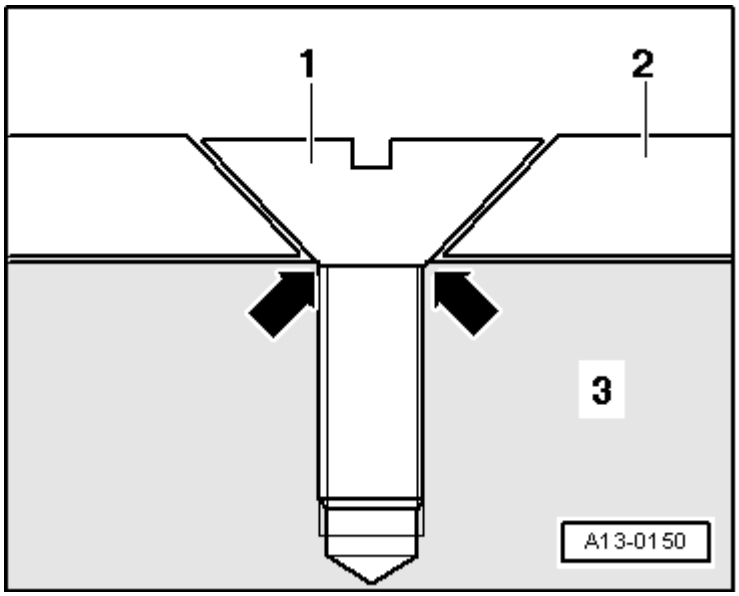

Fig. 64: Identifying Attachment Points, Countersunk Screws, Crankshaft & Sensor Wheel
Courtesy of AUDI OF AMERICA, LLC

NOTE: After tightening for the second time, the point where the heads of the countersunk screws make contact with the sensor wheel become so deformed that the screw heads at the crankshaft -3- -arrows- and the sensor wheel lies "loosely" under the screws.

The sensor wheel can only be installed in one position. The holes are offset.

- Tightening specification, refer to **CRANKSHAFT OVERVIEW**.

CRANKSHAFT NEEDLE BEARINGS

Only for vehicles equipped with a Direct Shift Gearbox (DSG®)

Special tools and workshop equipment required

- Counter Support, for example, Kukko Support 22/1
- Internal Puller, for example, Kukko Extractor 14.5-18.5 mm 21/2
- Drift VW 207 C

Removing

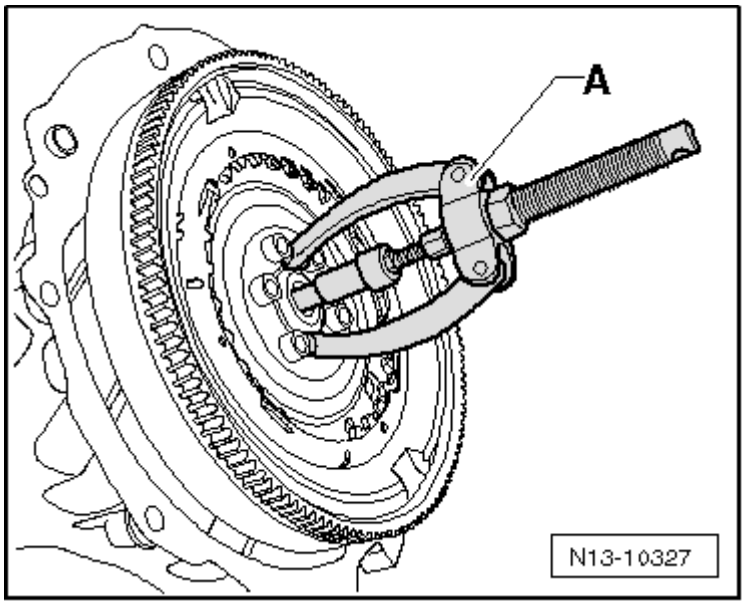

Fig. 65: Identifying Kukko Support 22/1 -A-
Courtesy of AUDI OF AMERICA, LLC

-- Use a commercial grade internal puller, for example, Kukko extractor 14.5-18.5 mm21/2 and a counter support, for example, Kukko support 22/1 -A- pull the needle bearings out.

Installing

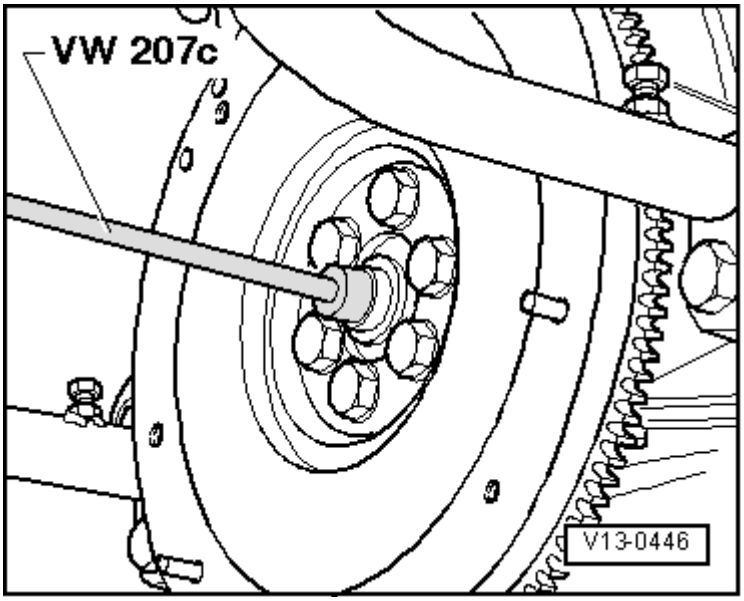

Fig. 66: Driving In Needle Bearing Using Drift VW 207 C
Courtesy of AUDI OF AMERICA, LLC

-- Drive in the needle bearing using the drift VW 207 C.

Installed depth dimension -a- = 2.0 mm

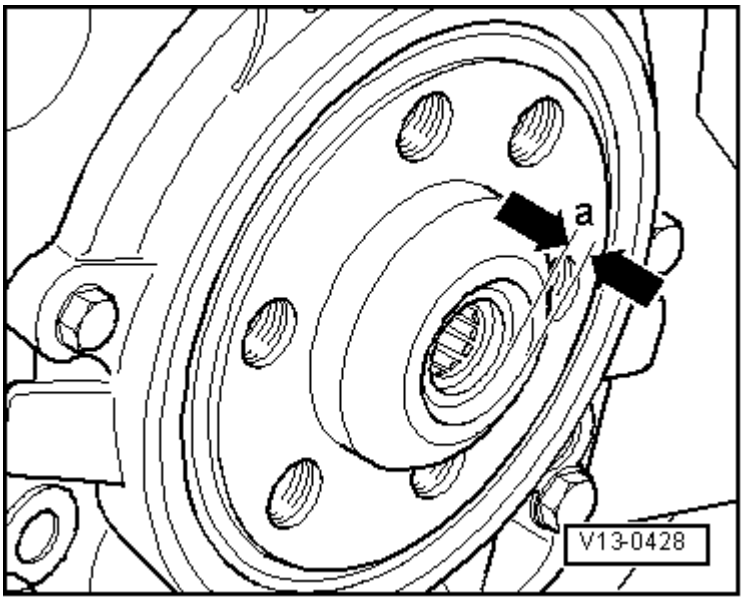

Fig. 67: Identifying Installation Depth Dimension
Courtesy of AUDI OF AMERICA, LLC

PISTON

Special tools and workshop equipment required

- Pilot Drift VW 222 A
- Piston Installation Tool 82.5 mm Bore SET 850

Removing

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

-- Separate the transmission from the engine. Refer to **ENGINE/TRANSMISSION, SEPARATING AND ASSEMBLING** .

-- Secure the engine to the engine and transmission holder VAS 6095. Refer to **ENGINE, SECURING TO THE ENGINE/TRANSMISSION HOLDER** .

-- Remove the cylinder head. Refer to **CYLINDER HEAD** .

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

-- Mark the installed position and cylinder allocation of the piston.

-- Mark the installed position and cylinder affiliation, see -item 11- in the **PISTON AND CONNECTING ROD OVERVIEW**.

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

NOTE: Heat the piston to approximately 60 °C (140 °F) if it is difficult to move the piston pin.

-- Remove the lock ring from the eye of the piston pin.

-- Remove the piston pin using the pilot drift VW 222 A.

Installing

Install in the reverse order of removal. Note the following:

- Tightening specifications, refer to **PISTON AND CONNECTING ROD OVERVIEW**.

NOTE: Replace any bolts that were tightened to an additional torque angle.

The arrow on the piston face points toward the belt pulley side.

Offset the piston ring gap by 120°.

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

-- Oil the pistons and the piston rings.

-- Install the piston using the piston installation tool 82.5 mm bore SET 850. Pay attention to the installed position, see -item 8- in the **PISTON AND CONNECTING ROD OVERVIEW**.

-- Install the connecting rod bearing cap. Pay attention to the installed position, see -item 2- in the **PISTON AND CONNECTING ROD OVERVIEW**.

-- Install the cylinder head. Refer to **CYLINDER HEAD** .

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

SPECIAL TOOLS

Special tools and workshop equipment required

- Micrometer 75-100 mm VAS 6071
- Cylinder Gauge VAS 6078
- Inside Micrometer Set 18-100 mm US1033/S
- Guide Sleeve T20097
- Piston Installation Tool 82.5 mm Bore SET 850
- Thrust Piece T10368
- Dial Gauge Holder VW 387

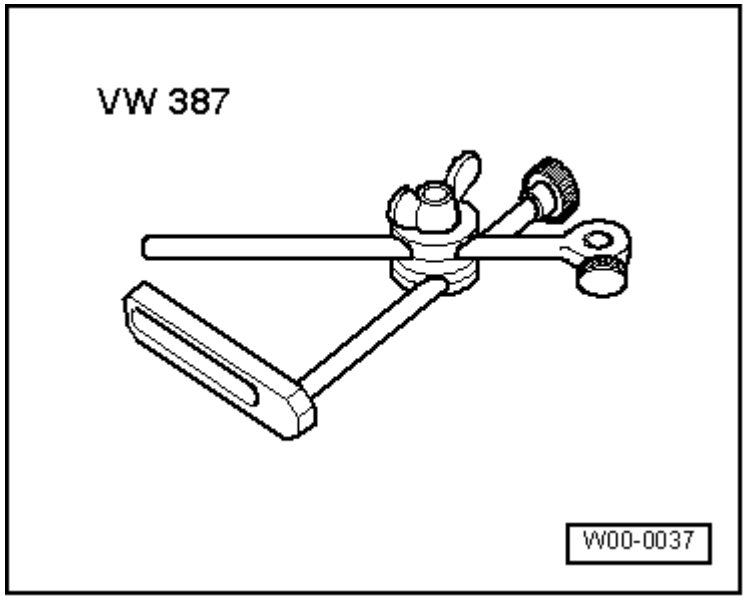

Fig. 68: Dial Gauge Holder VW 387
Courtesy of AUDI OF AMERICA, LLC

- Dial Gauge 0-10 mm VAS 6079

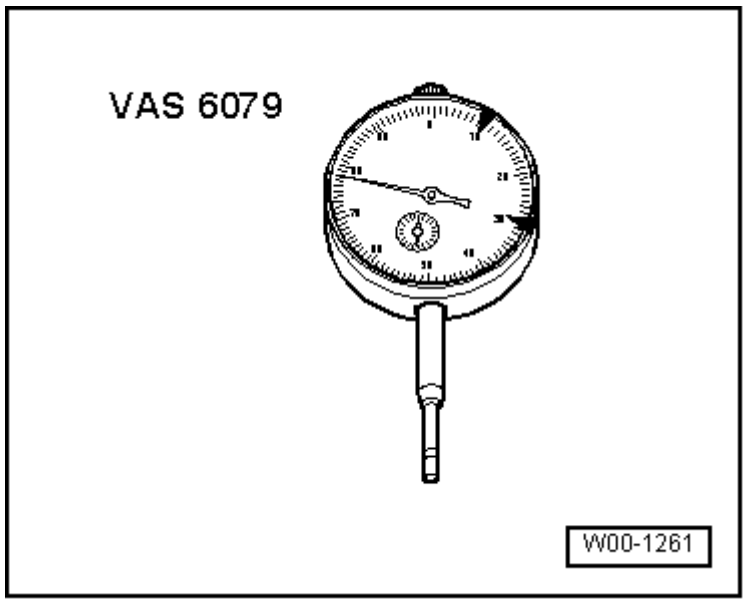

Fig. 69: Dial Gauge 0-10 mm VAS 6079
Courtesy of AUDI OF AMERICA, LLC

- Locking Pin T10060 A

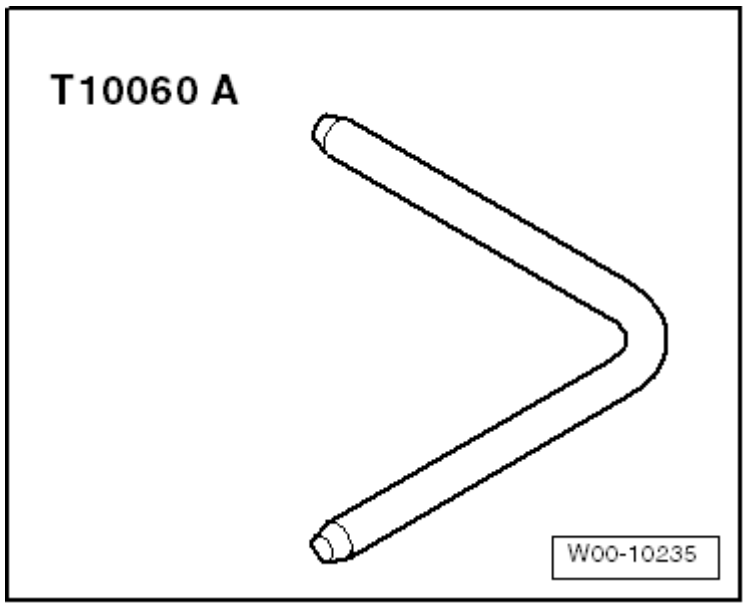

Fig. 70: Identifying Locking Pin T10060 A
Courtesy of AUDI OF AMERICA, LLC

- Counter Hold Tool T10355

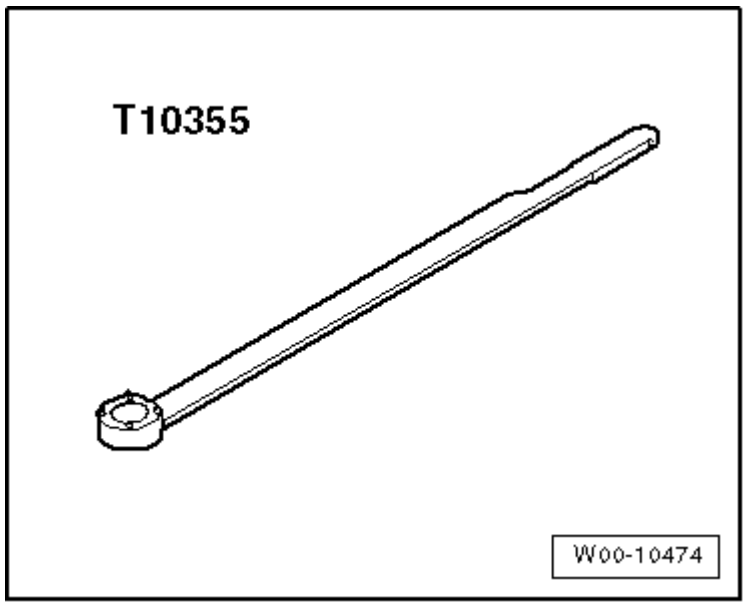

Fig. 71: Counter-Holder Tool T10355
Courtesy of AUDI OF AMERICA, LLC

- Flywheel Retainer 3067

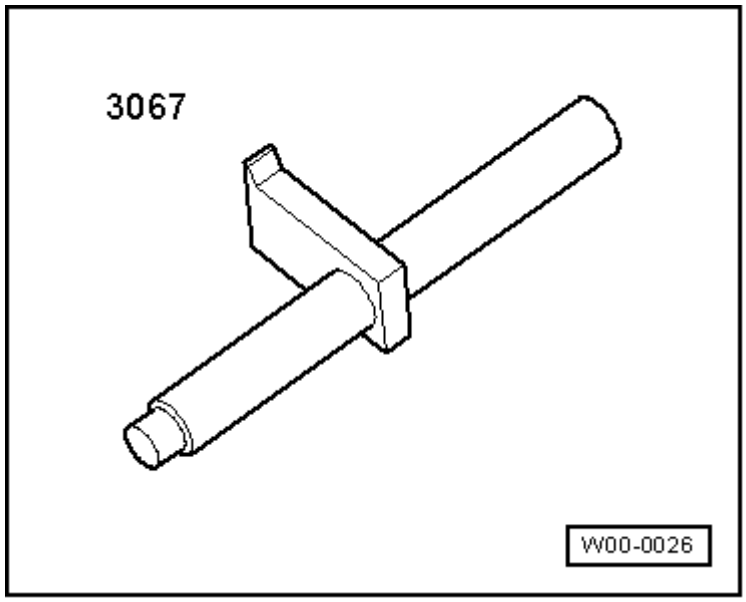

Fig. 72: 3067 Counter-Hold Tool
Courtesy of AUDI OF AMERICA, LLC

- Flywheel Lock Adapter VW 558

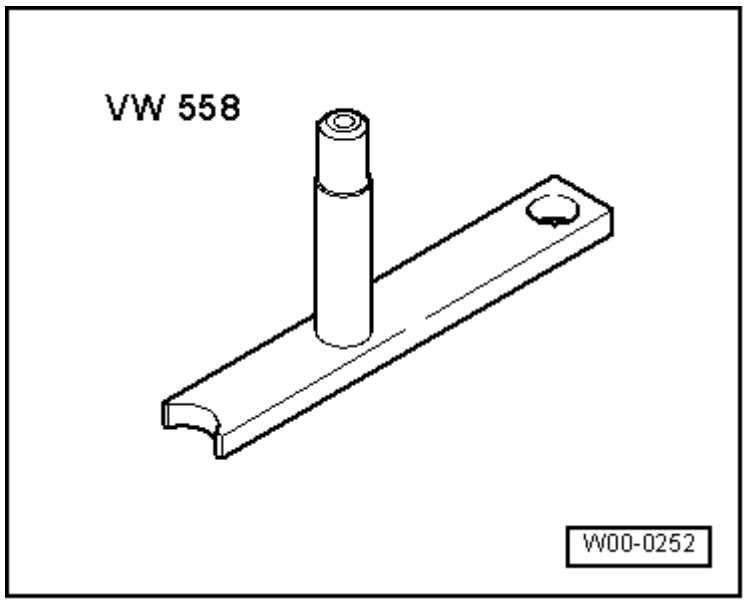

Fig. 73: Counter hold VW 558
Courtesy of AUDI OF AMERICA, LLC

- Pilot Drift VW 222 A

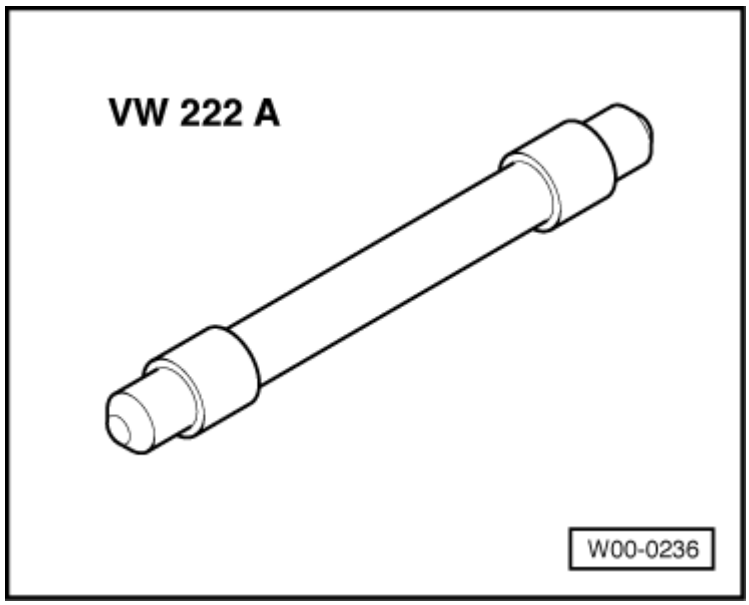

Fig. 74: Drift VW 222 A
Courtesy of AUDI OF AMERICA, LLC

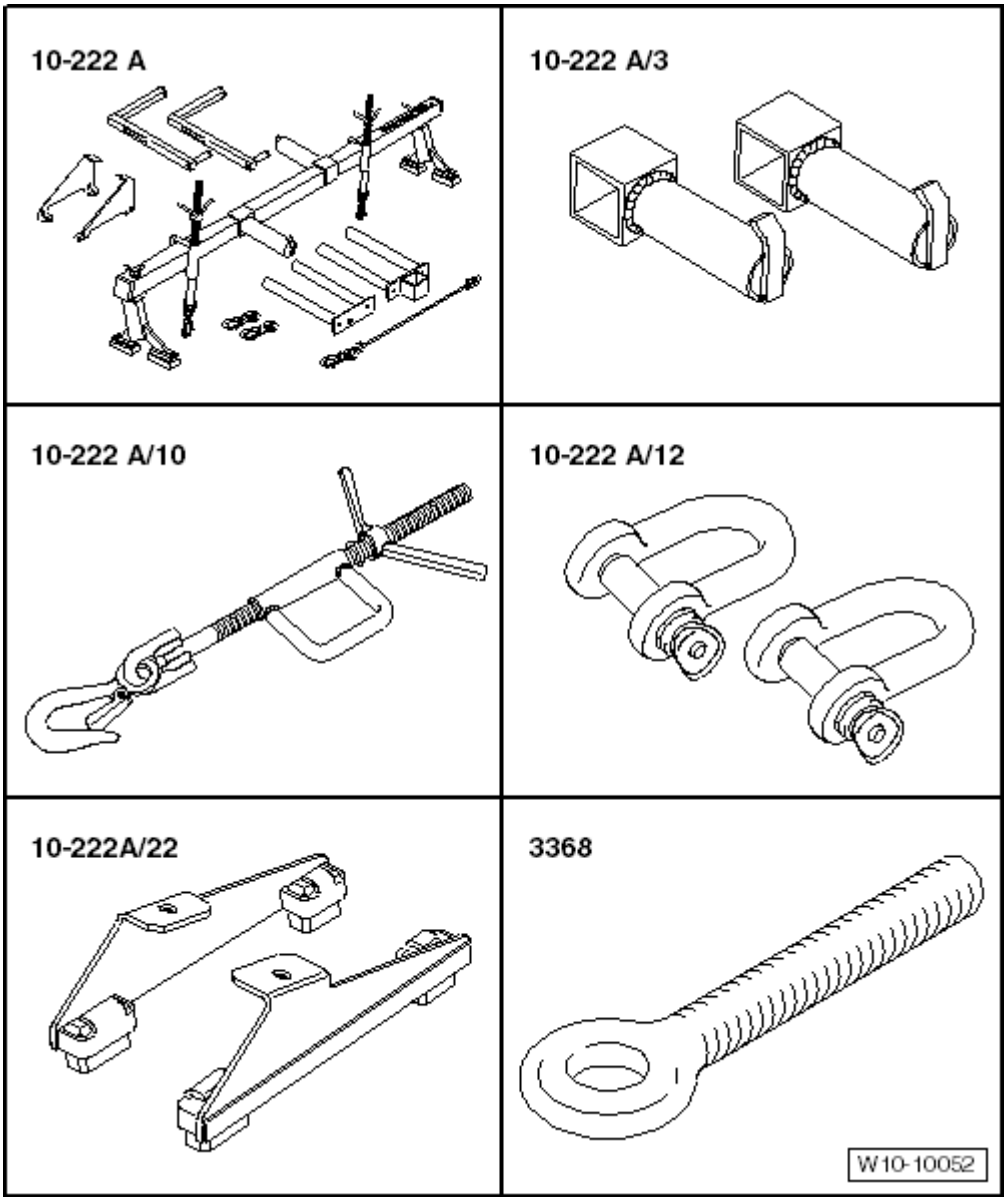

Fig. 75: Identifying Engine Support Bridge And Special Tools
Courtesy of AUDI OF AMERICA, LLC

Special tools and workshop equipment required

- Engine Support Bridge 10-222 A
- Engine Support Adapter 10-222 A/3
- Bracket with Spindle and Hook 10-222 A/10
- Shackle 10-222 A/12
- Adapter 10-222 A/22
- Lifting Eyebolt 3368

ENGINE

Cylinder Head, Valvetrain

15 CYLINDER HEAD, VALVETRAIN

DESCRIPTION AND OPERATION

CYLINDER HEAD OVERVIEW

NOTE: **Replace the cylinder head bolts.**

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

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

When replacing the cylinder head or cylinder head gasket, the coolant must be completely replaced.

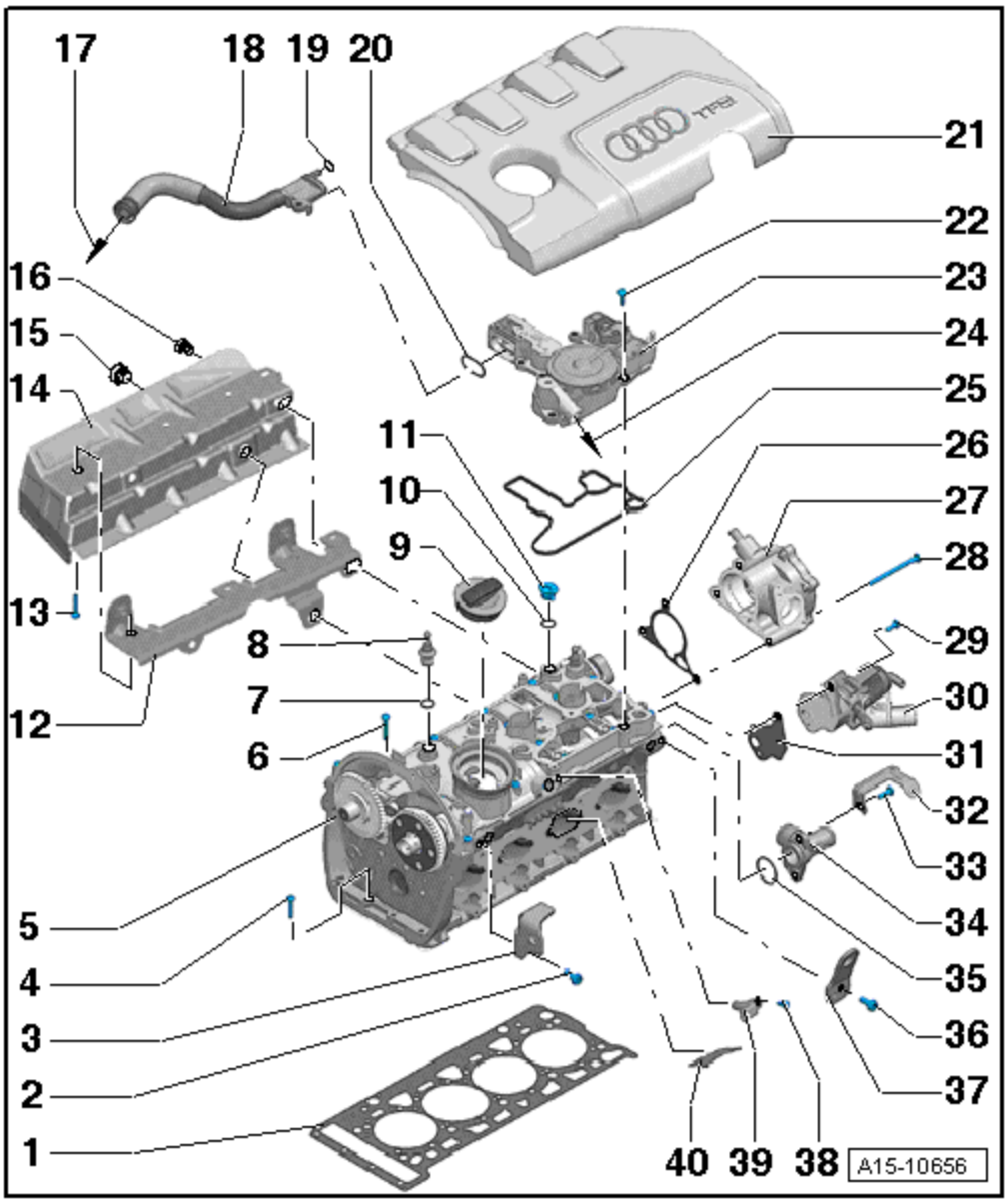

Fig. 1: Cylinder Head Assembly Overview

1. Cylinder Head Gasket
   - Always replace.
   - Note the installed position: Parts number to the cylinder head.
2. Bolt
   - 25 Nm
3. Transport Strap
4. Bolt
   - Tightening sequence, refer to **Fig. 4**.
5. Cylinder Head

- Removing and installing, refer to **CYLINDER HEAD**.
- Checking for distortion, refer to **Fig. 5**.

6. Bolt
   - Always replace.
   - Follow the sequence when loosening, refer to **Fig. 3**.
   - Observe the sequence for tightening, refer to **Fig. 4**.
7. O-ring
   - Always replace.
   - Lubricate with engine oil.
8. Ball Stud
   - 5 Nm
   - With ball head for the engine cover.
9. Cap
   - With a seal.
10. O-ring
    - Always replace.
    - Lubricate with engine oil.
11. Sealing Plug
12. Bracket
13. Bolt
    - 9 Nm
14. Heat Shield
15. Bolt
    - 20 Nm
16. Bolt
    - 20 Nm
17. to the Intake Hose/Turbocharger
18. Ventilation Pipe
19. O-ring
    - No replacement part.
20. Seal
    - No replacement part.
21. Engine Cover
22. Bolt
    - Tightening sequence, refer to **Fig. 2**.
23. Crankcase Ventilation
    - Observe the sequence for tightening, refer to **Fig. 2**.
24. to the Intake Manifold

25. Gasket
    - No replacement part.
26. Gasket
    - Replace if damaged.
27. Vacuum Pump
    - Removing and installing, refer to **VACUUM PUMP**.
28. Bolt
    - 9 Nm
29. Bolt
    - 9 Nm
    - For engine code CBFA only.
30. Secondary Air Injection Solenoid Valve -N112-
    - For engine code CBFA only.
31. Gasket
    - Always replace.
    - For engine code CBFA only.
32. Mounting Plate
33. Bolt
    - 9 Nm
34. Connection
35. O-ring
    - Always replace.
    - Coat with coolant.
36. Bolt
    - 25 Nm
37. Transport Strap
38. Bolt
    - 9 Nm
39. Camshaft Position Sensor -G40-
40. Partition Plate

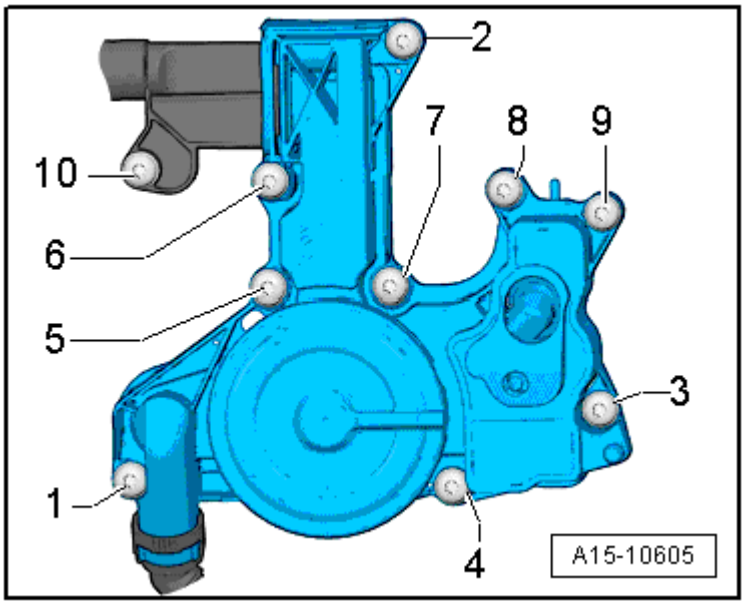

Fig. 2: Identifying Crankcase Ventilation - Tightening Sequence

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

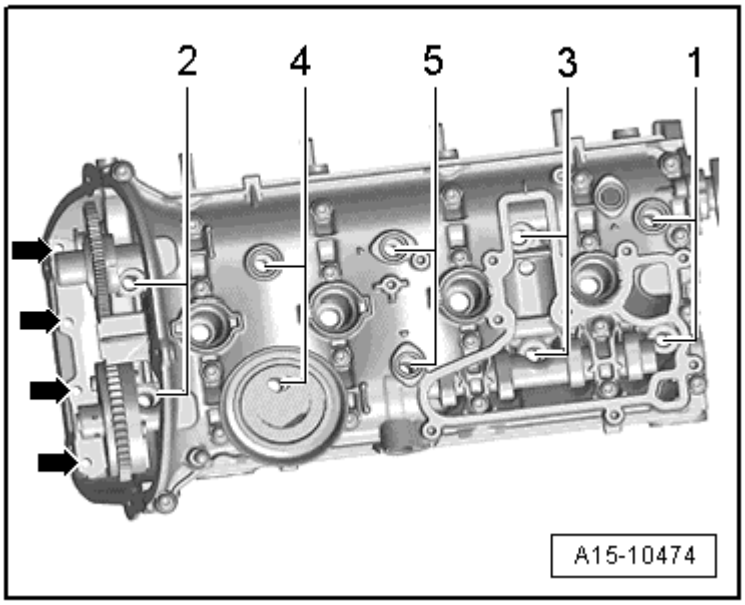

Fig. 3: Cylinder Head Loosening Sequence

-- Remove the bolts -arrows- .

-- Loosen the cylinder head bolts in sequence -1 through 5- .

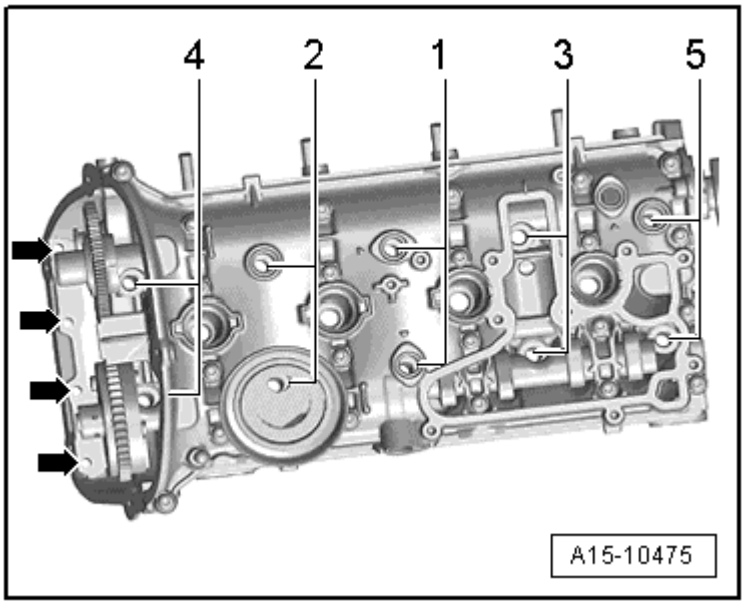

Fig. 4: Cylinder Head Tightening Sequence

-- Tighten the cylinder head bolts in sequence -1 through 5- .

-- Tighten the bolts to 40 Nm.

-- Tighten the bolts an additional 90° (1/4) turn.

-- Tighten the bolts an additional 90° (1/4) turn.

-- Tighten the bolts -arrows- to 8 Nm.

-- Tighten the bolts -arrows- an additional 90° (1/4) turn.

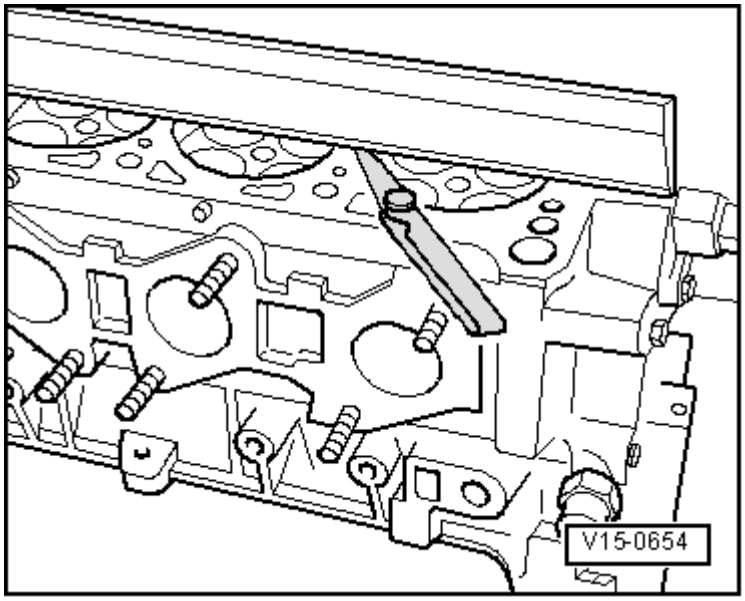

Fig. 5: Checking Cylinder Head For Distortion

-- Check the cylinder head at several locations for distortion using the straight edge 500 mmVAS 6075 and a feeler gauge.

- Maximum permissible distortion: 0.05 mm

TIMING CHAIN COVER OVERVIEW

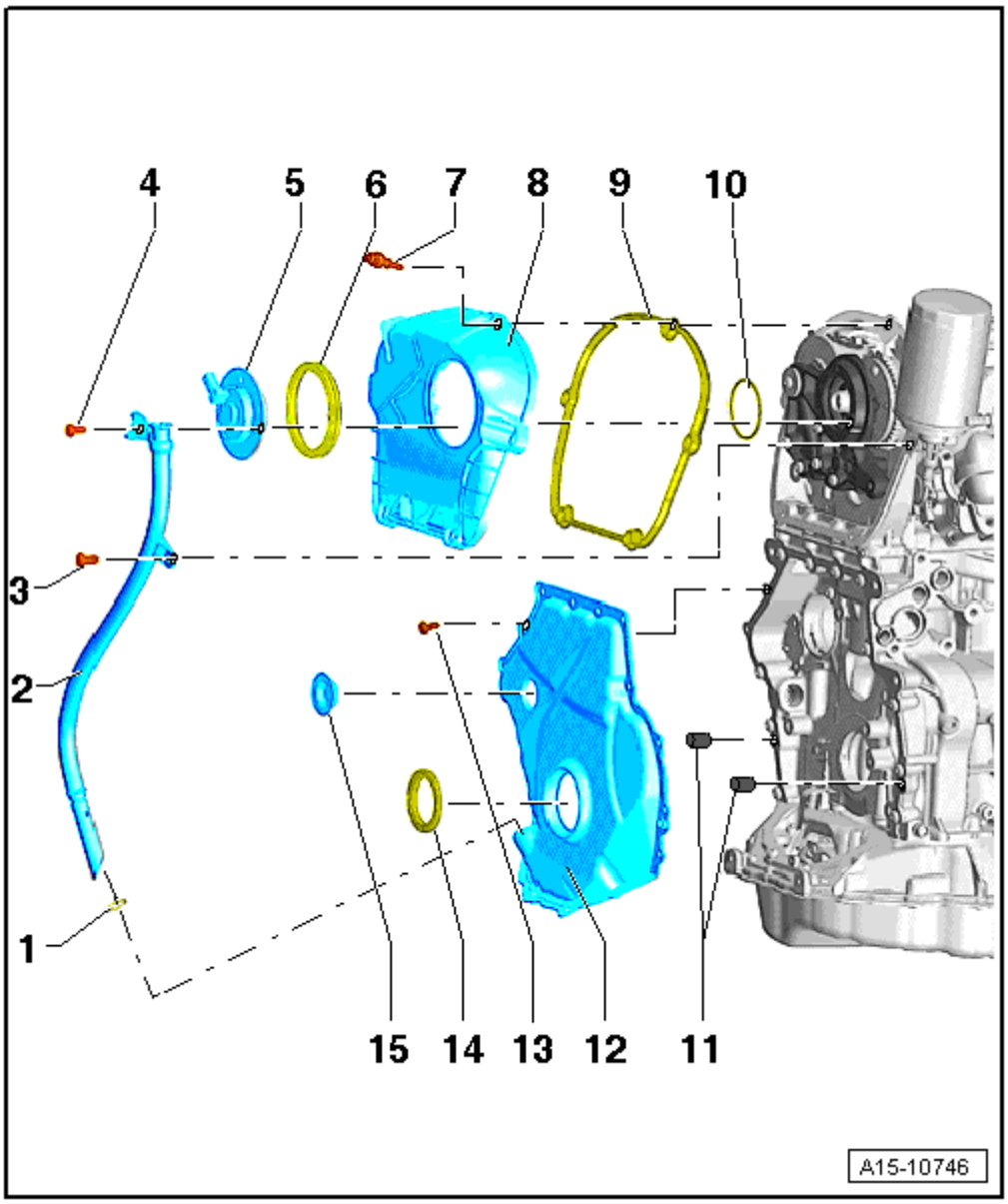

Fig. 6: Identifying Assembly Overview: Timing Chain Covers

1. O-ring
   - Always replace.
   - Coat with oil before installing.
2. Oil Dipstick Guide Tube
3. Bolt
   - 9 Nm
4. Bolt
   - 9 Nm
5. Camshaft Adjustment Valve 1 -N205-

- Removing and installing, refer to **CAMSHAFT ADJUSTMENT VALVE 1 N205**.

6. Seal
   - Coat with oil before installing.
   - Replace if damaged.
7. Bolt
   - Tightening sequence, refer to **UPPER TIMING CHAIN COVER**.
8. Upper Timing Chain Cover
   - Removing and installing, refer to **UPPER TIMING CHAIN COVER**.
   - Tightening sequence, refer to **Fig. 7**.
9. Seal
   - Replace if damaged.
10. O-ring
    - Always replace.
    - Coat with oil before installing.
11. Alignment Sleeve
    - For centering the lower cover.
12. Lower Timing Chain Cover
    - Tightening sequence with 15 bolts, refer to **Fig. 8**.
    - Tightening sequence with 8 bolts, refer to **Fig. 9**.
    - Removing and installing, refer to one of the following:

      GTI and Eos, refer to .

      Passat and CC, refer to .

      Tiguan, refer to **LOWER TIMING CHAIN COVER**.

13. Bolt
    - Always replace.
    - Tightening sequence with 15 bolts, refer to **Fig. 8**.
    - Tightening sequence with 8 bolts, refer to **Fig. 9**.
14. Seal
    - For the vibration damper.
    - Replacing, refer to **VIBRATION DAMPER SEAL**.
15. Sealing Plug
    - Always replace.

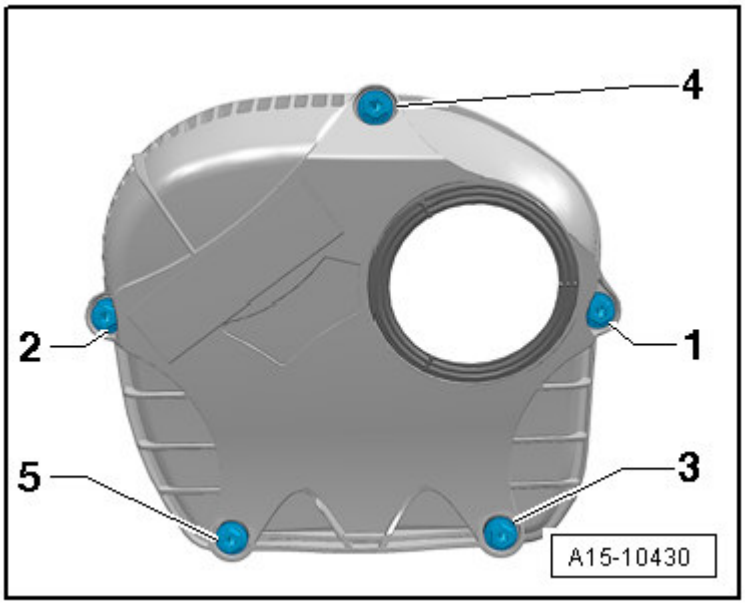

Fig. 7: Identifying Upper Timing Chain Cover - Tightening Sequence

-- Tighten the bolts in 2 stages in sequence -1 through 5- :

1. Tighten the bolts hand tight
2. Tighten the bolts to 9 Nm

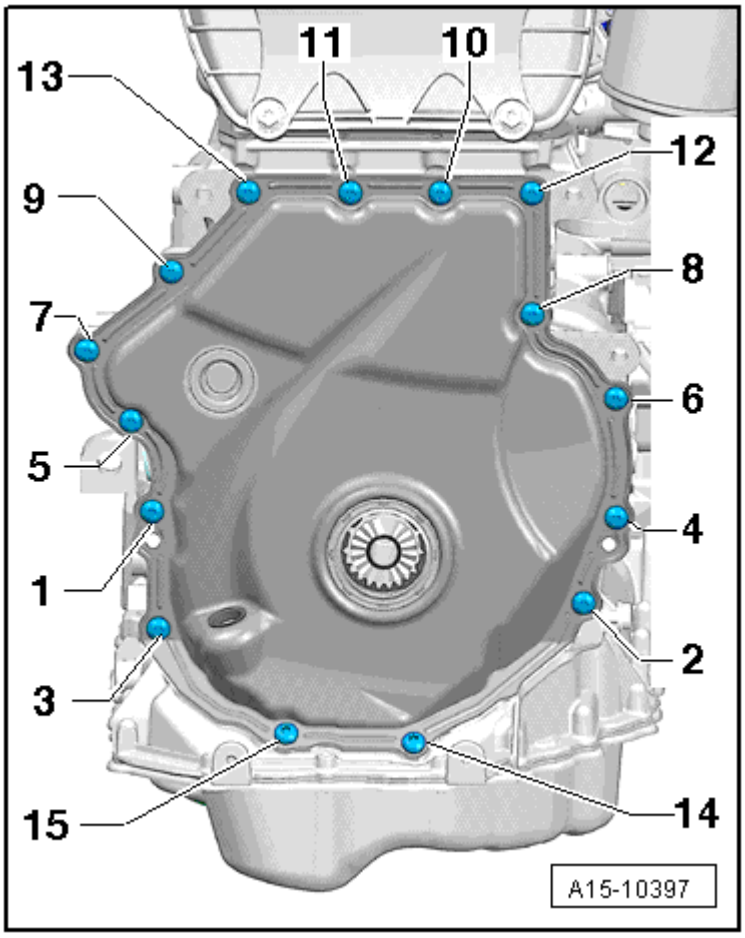

Fig. 8: Identifying Timing Chain Lower Cover Tightening Sequence

-- Tighten the bolts in 2 stages in sequence -1 through 15- :

-- 1. Tighten the bolts to 8 Nm.

-- 2. Tighten the bolts an additional 45° (1/8) turn.

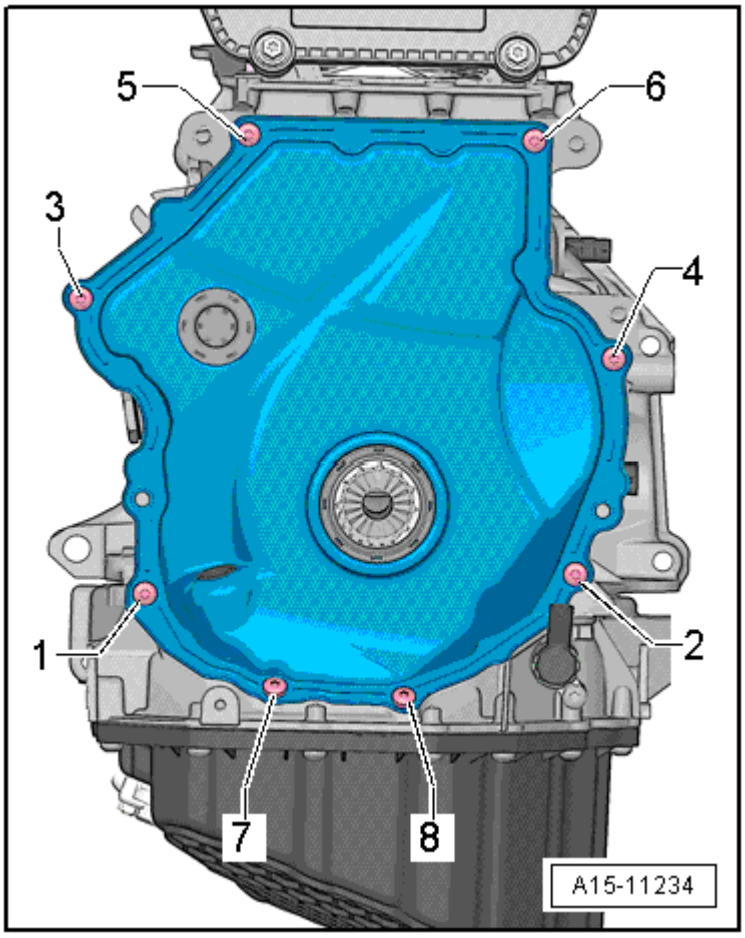

Fig. 9: Identifying Timing Chain Guard Lower Section - Tightening Sequence for 8 Bolts

-- Tighten the bolts in 2 stages in sequence -1 through 8- :

-- 1. Tighten the bolts to 4 Nm.

-- 2. Tighten the bolts an additional 45° (1/8) turn.

CAMSHAFT TIMING CHAIN OVERVIEW

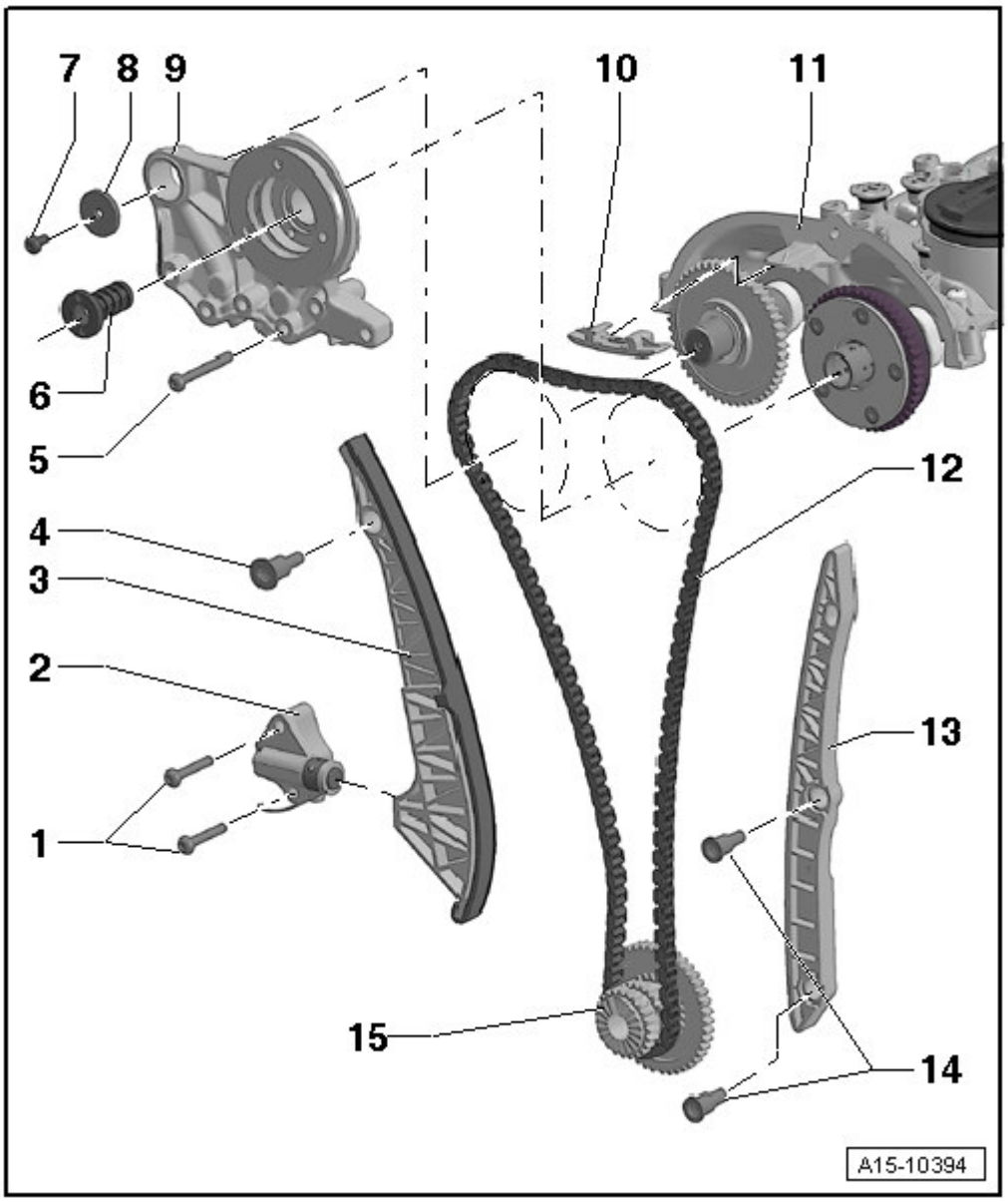

Fig. 10: Camshaft Timing Chain Assembly Overview

1. Bolt
    - 9 Nm
2. Chain Tensioner
    - Is under tension
    - Secure using the locking pinT40011 or locking toolT40267 depending on the version.
3. Timing Chain Tensioning Rail
4. Guide Pin
    - 20 Nm
5. Bolt

- 9 Nm

6. Control Valve
   - 35 Nm
   - Has left hand threads.
   - Remove using the assembly toolT10352.
7. Bolt
   - M6 - 8 Nm + an additional 90° (1/4) turn.
   - M8 - 20 Nm + an additional 90° (1/4) turn.
   - Always replace.
8. Washer
9. Bearing Bracket
10. Camshaft Timing Chain Guide Rail
11. Camshaft Housing
12. Camshaft Timing Chain
    - Before removing, mark the rotation direction with paint.
    - Removing and installing, refer to **CAMSHAFT TIMING CHAIN (WITH NEW TOOLS)**.
13. Camshaft Timing Chain Guide Rail
14. Guide Pin
    - 20 Nm
15. Chain Sprocket
    - To the crankshaft.
    - Installed position, refer to **Fig. 11**.

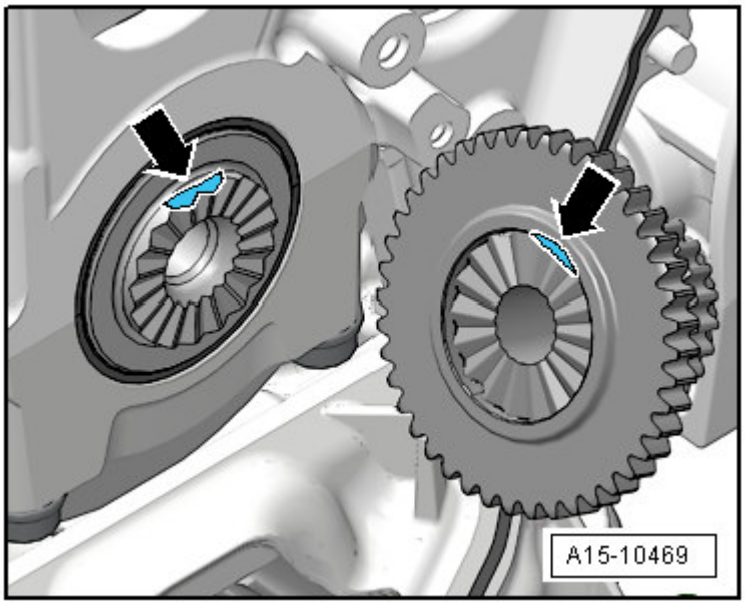

Fig. 11: Chain Sprocket Crankshaft, Installation Position

- Both surfaces must -arrows- must line up across from each other.

BALANCE SHAFT TIMING CHAIN OVERVIEW

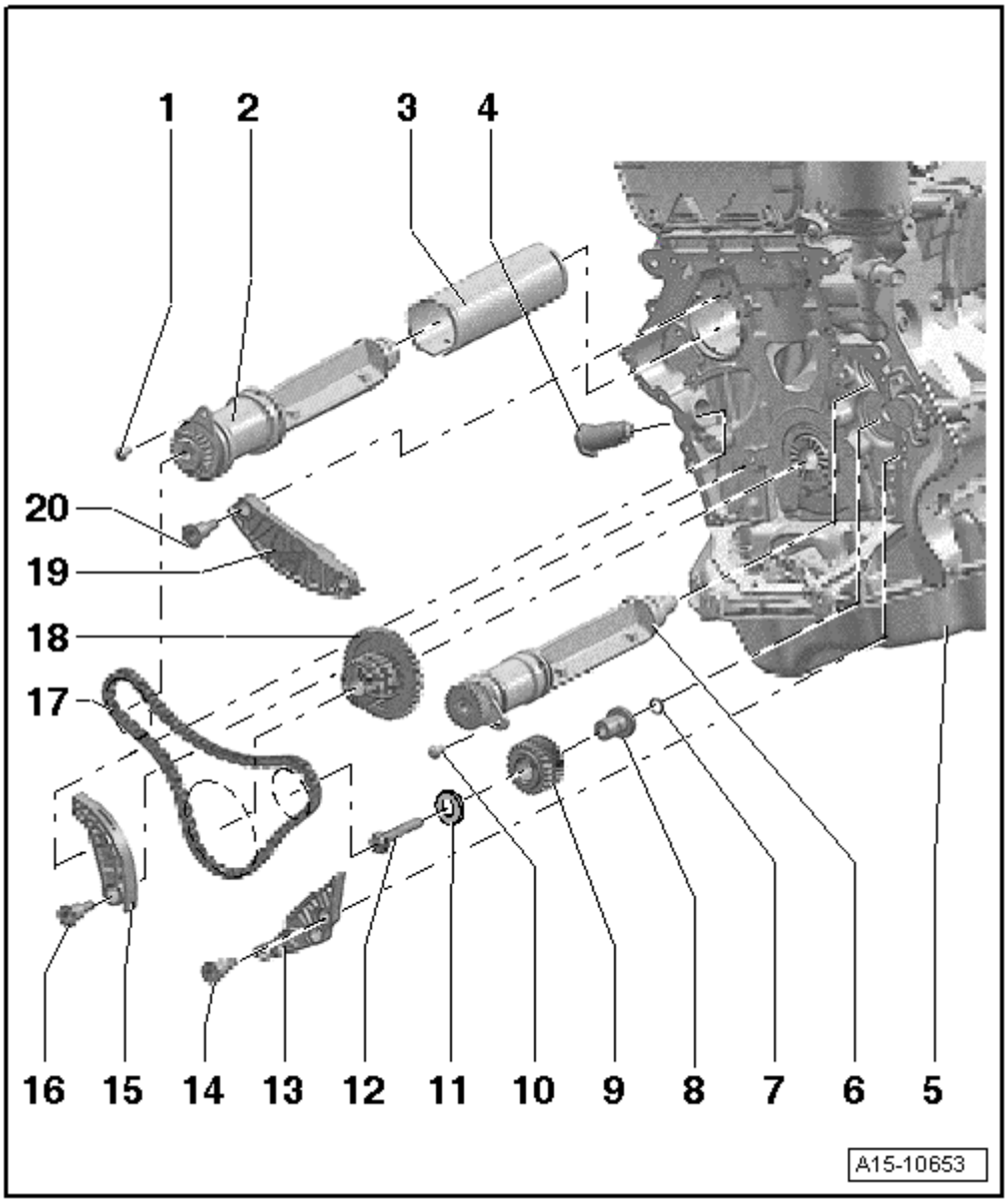

Fig. 12: Balance Shaft Timing Chain Component Overview

1. Bolt
    - 9 Nm
2. Balance Shaft
    - Exhaust side
    - Replace after removing.
    - Lubricate the bearing with engine oil.

- Removing and installing, refer to **BALANCE SHAFT, EXHAUST SIDE**.

3. Balance Shaft Pipe
    - Installed position, refer to **Fig. 13**.
4. Chain Tensioner
    - 85 Nm
5. Cylinder Block
6. Balance Shaft
    - Intake side.
    - Replace after removing.
    - Lubricate the bearing with engine oil.
    - Removing and installing, refer to **BALANCE SHAFT, INTAKE SIDE**.
7. O-ring
    - Lubricate with engine oil.
8. Bearing Pin
    - Lubricate with engine oil.
    - Installed position, refer to **Fig. 14**.
9. Intermediate Shaft Sprocket
    - For the balance shaft.
    - The intermediate shaft sprocket must be replaced if the bolt is loosened.
10. Bolt
    - 9 Nm
11. Washer
12. Bolt
    - The intermediate shaft sprocket must be replaced if the bolt is loosened.
    - Tightening sequence, refer to **Fig. 15**.
13. Guide Rail
    - For the timing chain.
14. Guide Pin
    - 20 Nm
15. Tensioning Rail
    - For the timing chain.
16. Guide Pin
    - 20 Nm
17. Timing Chain
    - Removing and installing, refer to **BALANCE SHAFT TIMING CHAIN**.
18. Chain Sprocket
    - Installed position, refer to **Fig. 11**.
19. Guide Rail

- For the balance shaft timing chain.

20. Guide Pin
    - 20 Nm

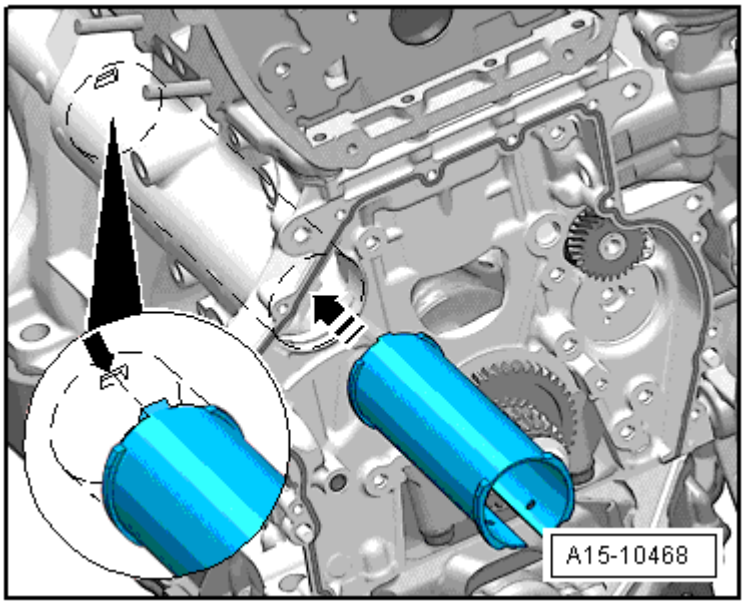

Fig. 13: Identifying Pipe For Balance Shaft - Installation Position

- The pin from the balance shaft tube must fit into the groove -arrow-

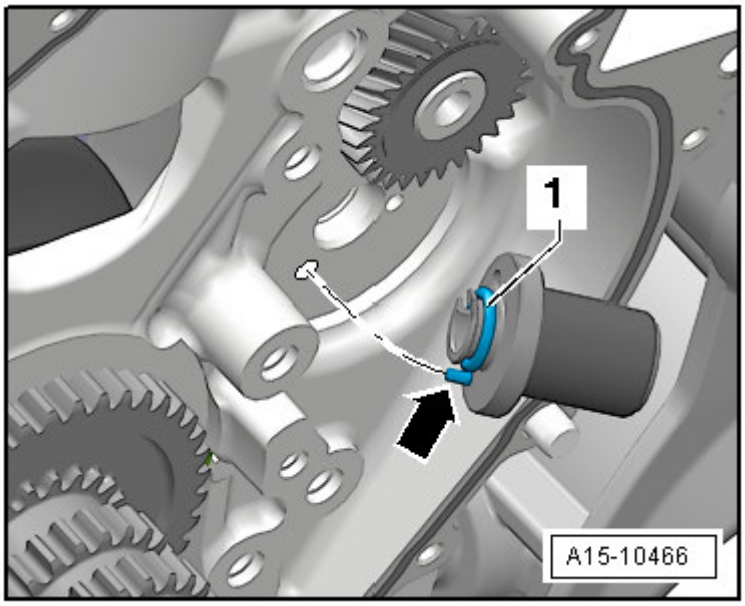

Fig. 14: Bearing Pins, Installation Position

- Replace and lubricate the O-ring -1-

- The pin -arrow- on the bearing pin must engage in the hole in the cylinder block.
- Lubricate the bearing pin

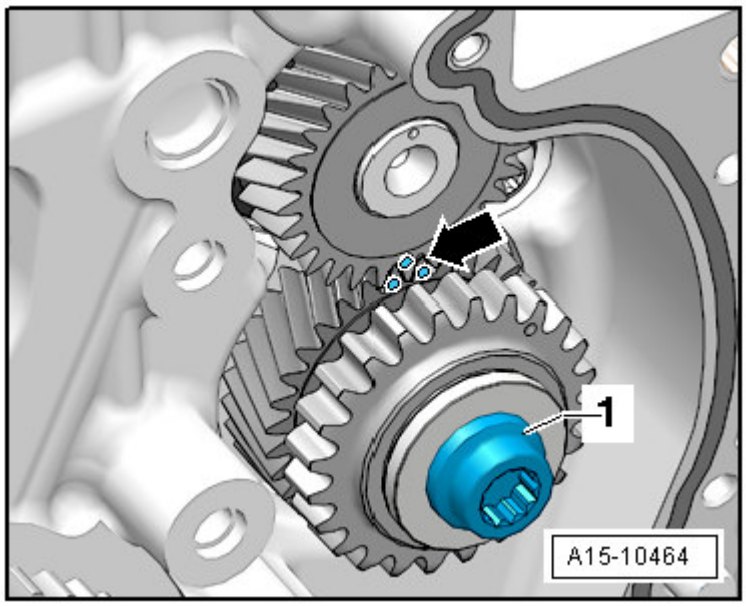

Fig. 15: Identifying Intermediate Shaft Sprocket

CAUTION: Always replace the intermediate shaft sprocket. Otherwise the backlash will not adjust itself and it could result in engine damage. The new intermediate shaft sprocket has an anti-friction coating that wears off after a short period of use, which automatically adjusts the backlash.

-- Tighten the bolt as follows:

-- Tighten the bolt to 10 Nm.

-- Turn the sprocket.

The sprocket may not have any play; if so, loosen and retighten again.

-- Tighten the bolt to 30 Nm.

-- Tighten the bolt an additional 90° (1/4) turn.

VALVETRAIN OVERVIEW

NOTE: The cylinder head and the cylinder head cover must be replaced together.

Do not start the engine for approximately 30 minutes after installing the camshafts. The hydraulic equalization elements must seat themselves (otherwise the valves will crash into the pistons).

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

Always replace the gaskets and seals.

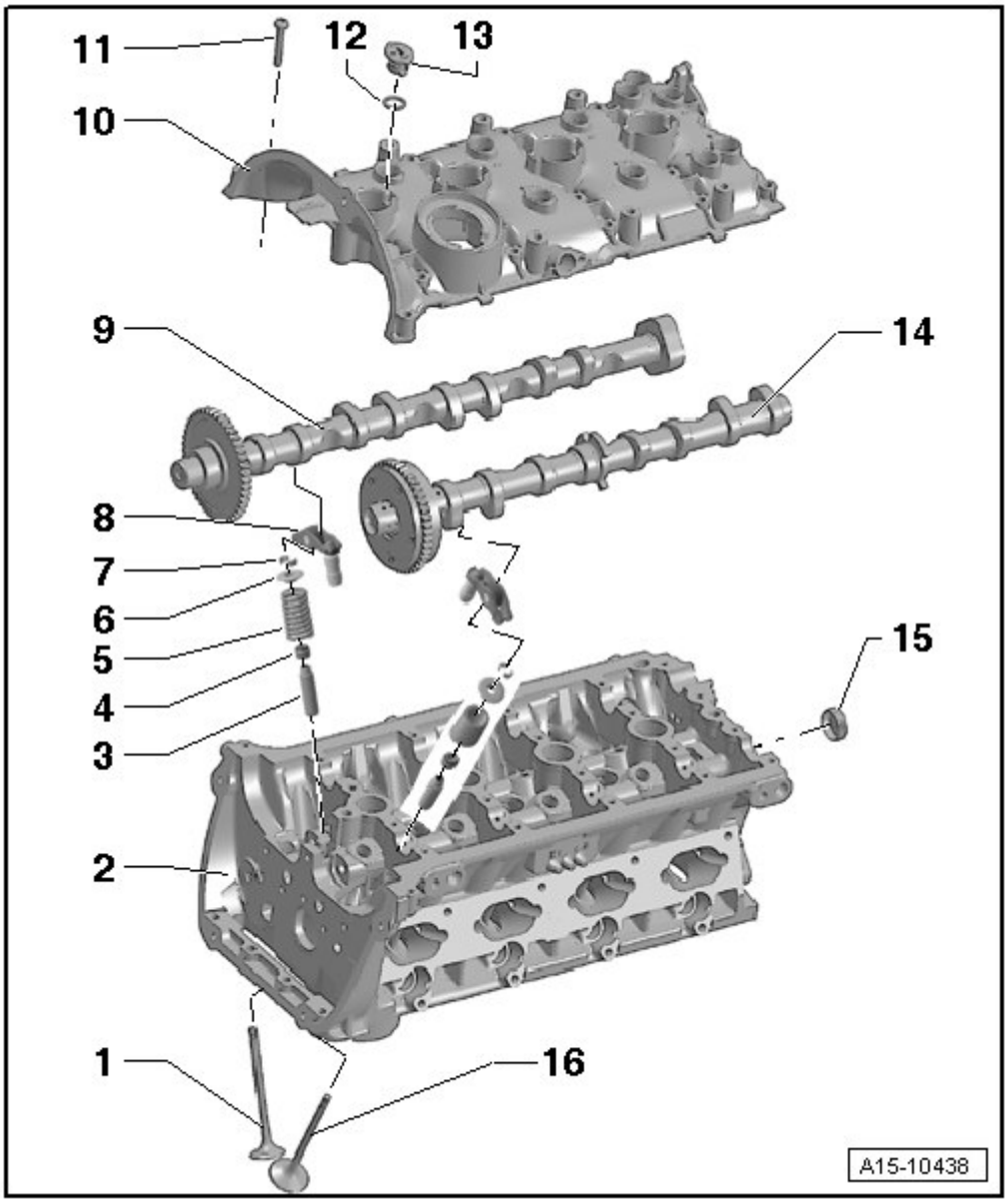

Fig. 16: Identifying Assembly Overview: Valvetrain

1. Exhaust Valve
   - Do not grind, only hand lapping is permitted.
   - Valve dimensions, refer to **Fig. 18**.
   - Checking the valve guides. Refer to **VALVE GUIDE, CHECKING**.

2. Cylinder Head
3. Valve Guide
    - Checking, refer to **VALVE GUIDE, CHECKING**.
4. Valve Stem Seal
5. Valve Spring
6. Valve Spring Plate
7. Valve Retainers
8. Roller Rocker Arm with Hydraulic Lash Adjuster
    - Do not interchange.
    - Lubricate the contact surfaces.
9. Exhaust Camshaft
    - Check the radial clearance using Plastigage® (roller rocker arms are removed).
    - Radial clearance at bearing - 24 mm diameter:

      0.024 to 0.066 mm

    - Radial clearance at bearing - 32 mm diameter:

      0.030 to 0.051 mm

    - Run out: maximum:

      0.04 mm

    - Removing and installing, refer to **CAMSHAFT**.
10. Cylinder Head Cover
    - With integrated camshaft bearings.
    - Clean the sealing surface, reworking is not permitted.
    - Remove any old sealant residue.
11. Bolt
    - Always replace.
    - Tightening sequence, refer to **Fig. 17**.
12. O-ring
    - Always replace.
    - Coat with engine oil.
13. Plug
14. Intake Camshaft
    - Check the radial clearance using Plastigage® (roller rocker arms are removed).
    - Radial clearance at bearing - 24 mm diameter:

0.024 to 0.066 mm

- Run out: maximum:

  0.04 mm

- Removing and installing, refer to **CAMSHAFT**.

15. Cap
    - Always replace.
    - Removing: With the cylinder head cover installed, pierce through one side of the cap with an awl and pry it out.
    - Installing: Without sealant, press in 1 to 2 mm using the thrust piece3334.
16. Intake valve
    - Do not grind, only hand lapping is permitted.
    - Valve dimensions, refer to **Fig. 18**.
    - Checking the valve guides, refer to **VALVE GUIDE, CHECKING**.

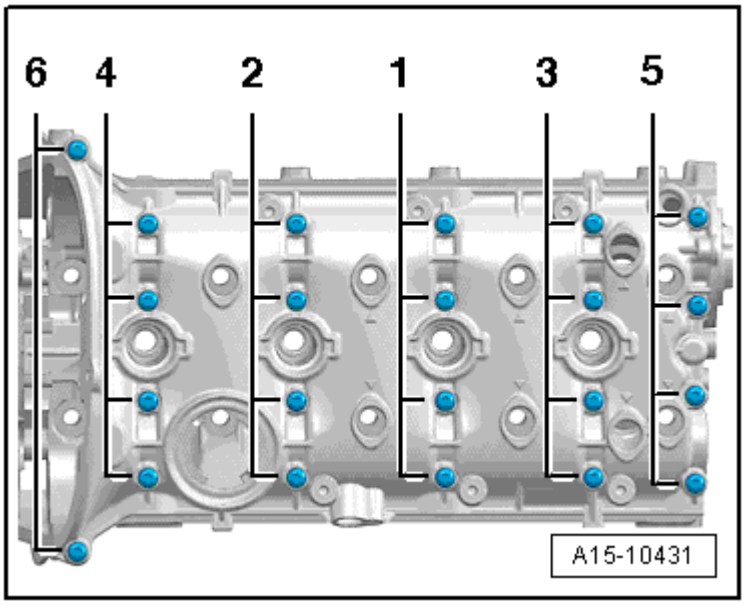

Fig. 17: Identifying Cylinder Head Cover - Tightening Sequence

-- Replace the bolts.

-- Hand tighten the bolts in several steps in sequence -1 through 6- .

-- Tighten the bolts in sequence -1 through 6- to 8 Nm.

-- Tighten the bolts in sequence -1 through 6- an additional 90° (1/4) turn.

NOTE: Ensure the cylinder head cover is not tilted.

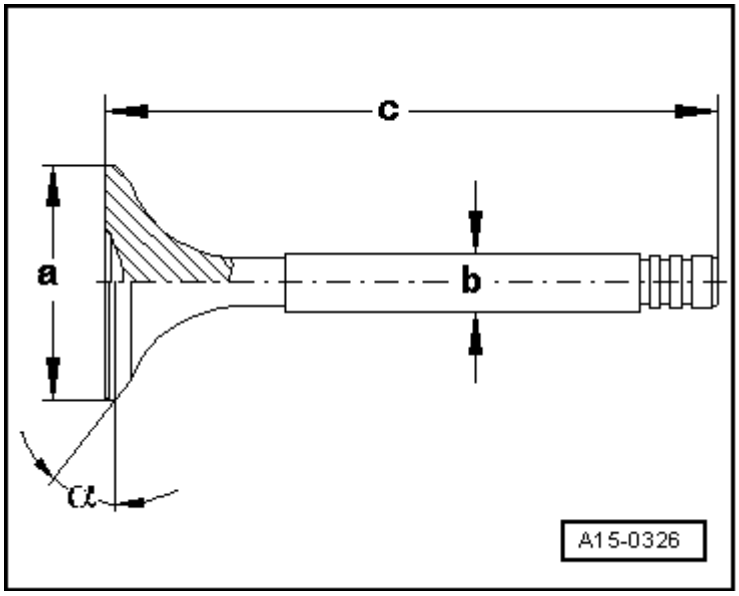

Fig. 18: Identifying Valve Dimensions

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

Dimension		Intake Valve	Exhaust Valve
Diameter a	mm	33.85 ± 0.10	28.0 ± 0.1
Diameter b	mm	5.98 ± 0.007	5.955 ± 0.007
c	mm	103.97	101.87
a	Angle°	45	45

SPECIFICATIONS

FASTENER TIGHTENING SPECIFICATIONS

Component	Fastener Size	Nm
Balance Shaft to Cylinder Block Bolt	-	9
Balance Shaft Timing Chain Guide Rail to Cylinder Block Guide Pin	-	20
Balance Shaft Timing Chain, Chain Tensioner to Cylinder Block	-	85
Balance Shaft Timing Chain Tensioning Rail to Cylinder Block Guide Pin	-	20
Ball Stud to Cylinder Head Cover	-	5
Bearing Bracket to Cylinder Head Bolt	-	9
Bearing Bracket to Exhaust Camshaft Bolt (1)		

	M6	8 + 90°
	M8	20 + 90°
Camshaft Adjustment Valve 1 to Upper Timing Chain Cover Bolt	-	9
Camshaft Position Sensor to Cylinder Block Bolt	-	9
Camshaft Timing Chain, Chain Tensioner to Cylinder Block Bolt	-	9
Camshaft Timing Chain Guide Rail to Cylinder Block Guide Pin	-	20
Camshaft Timing Chain Tensioning Rail to Cylinder Block Guide Pin	-	20
Control Valve to Intake Camshaft (3)	-	35
Heat Shield to Bracket Bolt	-	9
Heat Shield to Cylinder Head Bolt	-	20
Mounting Plate/Connection Piece to Cylinder Head Bolt	-	9
Oil Dipstick Guide Tube/Camshaft Adjustment Valve 1 to Upper Timing Chain Cover Bolt	-	9
Oil Dipstick Guide Tube to Cylinder Head Bolt	-	9
Secondary Air Injection Solenoid Valve to Cylinder Head Bolt (2)	-	9
Transport Strap to Cylinder Head Bolt	-	25
Vacuum Pump to Cylinder Head Bolt	-	9
(1) Always replace (2) Engine code CBFA only (3) Left hand threads		

Crankcase Ventilation Bolt Tightening Sequence and Specification

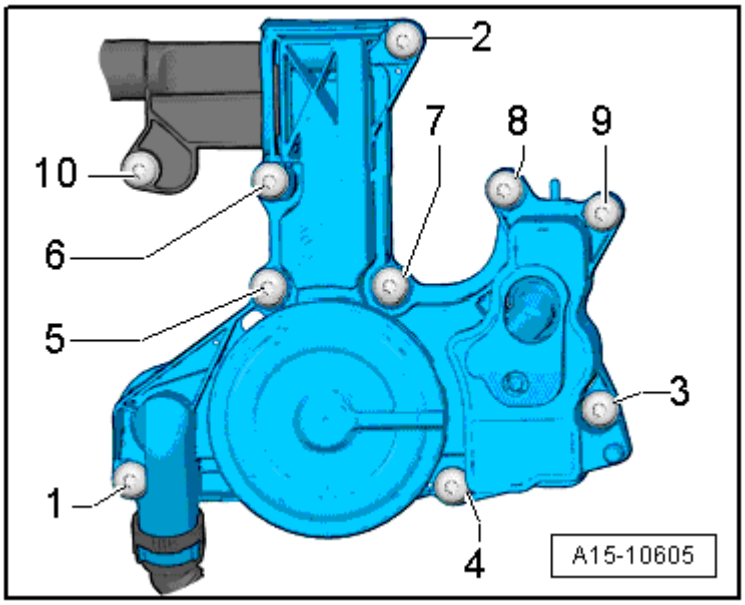

Fig. 19: Identifying Crankcase Ventilation - Tightening Sequence

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

Cylinder Head Cover Bolt Tightening Sequence and Specification

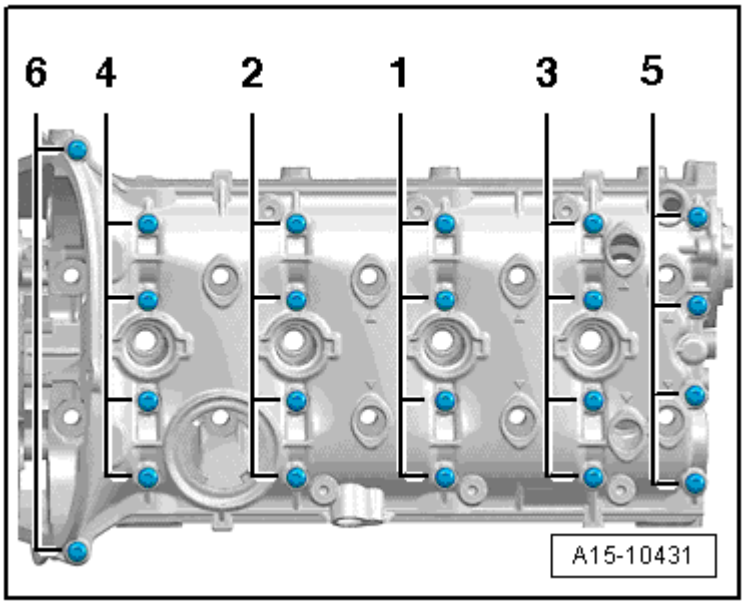

Fig. 20: Identifying Cylinder Head Cover - Tightening Sequence

-- Replace the bolts.

- Hand tighten the bolts in several passes in sequence -1 through 6- .
- Tighten the bolts in sequence -1 through 6- to 8 Nm.

- Tighten the bolts in sequence -1 through 6- an additional 90° (1/4) turn.

Cylinder Head Bolt Tightening Sequence and Specification

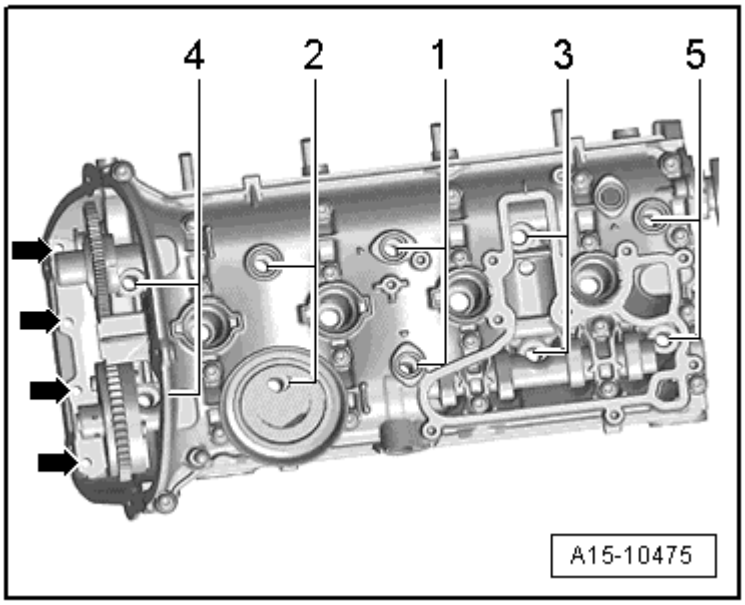

Fig. 21: Cylinder Head Tightening Sequence

-- Tighten the cylinder head bolts in sequence -1 through 5- .

- Tighten the bolts to 40 Nm.
- Tighten the bolts an additional 90° (1/4) turn.
- Tighten the bolts an additional 90° (1/4) turn.
- Tighten the bolts -arrows- to 8 Nm.
- Tighten the bolts -arrows- an additional 90° (1/4) turn.

Upper Timing Chain Cover Bolt Tightening Sequence and Specification

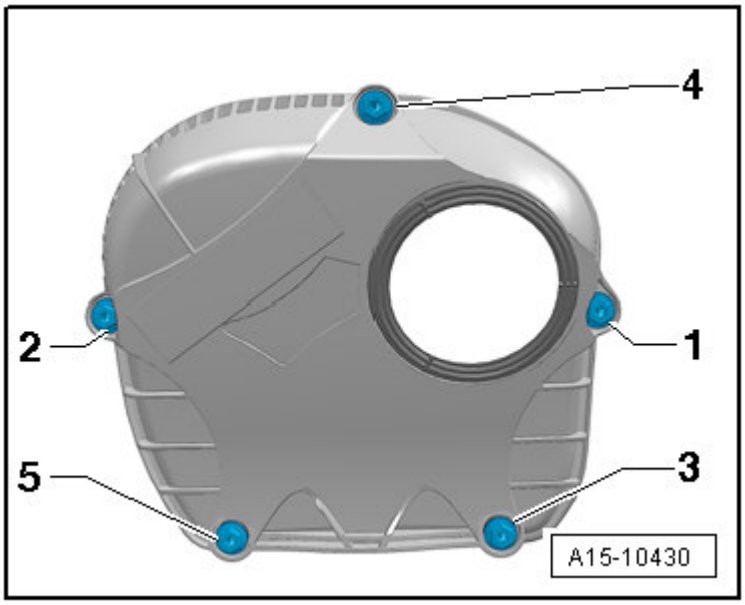

Fig. 22: Identifying Upper Timing Chain Cover - Tightening Sequence

-- Tighten the bolts in 2 passes in sequence -1 through 5- :

1. Tighten the bolts hand tight.
2. Tighten the bolts to 9 Nm.

Lower Timing Chain Cover Bolt Tightening Sequence and Specification, with 15 Bolts

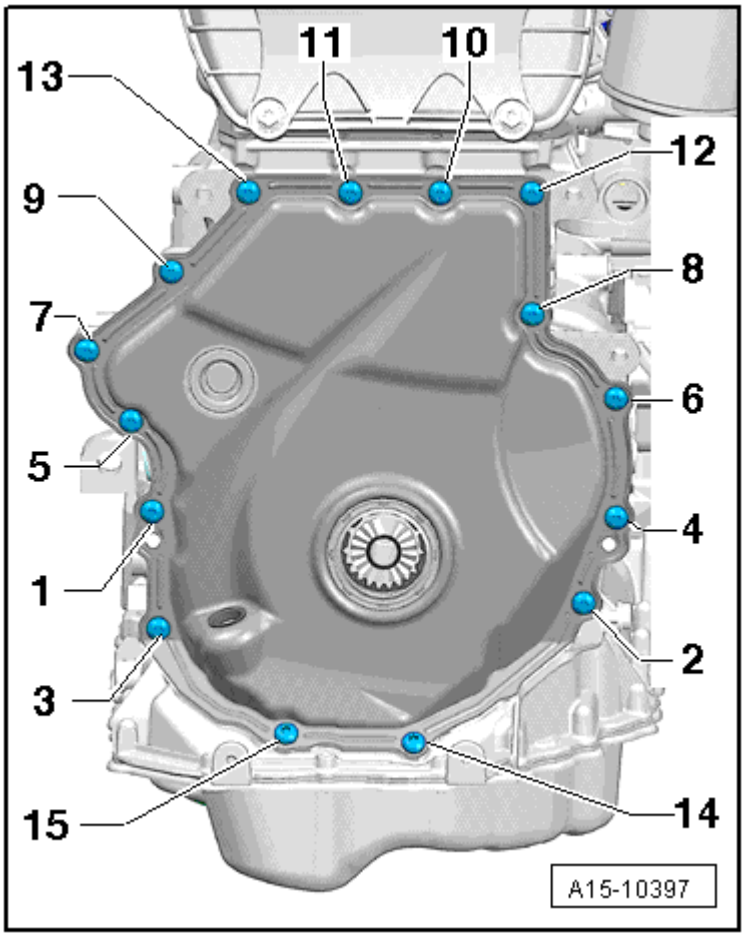

Fig. 23: Identifying Timing Chain Lower Cover Tightening Sequence

-- Tighten the bolts in 2 stages in sequence -1 through 15- :

-- 1. Tighten the bolts to 8 Nm.

-- 2. Tighten the bolts an additional 45° (1/8) turn.

Lower Timing Chain Cover Bolt Tightening Sequence and Specification, with 8 Bolts

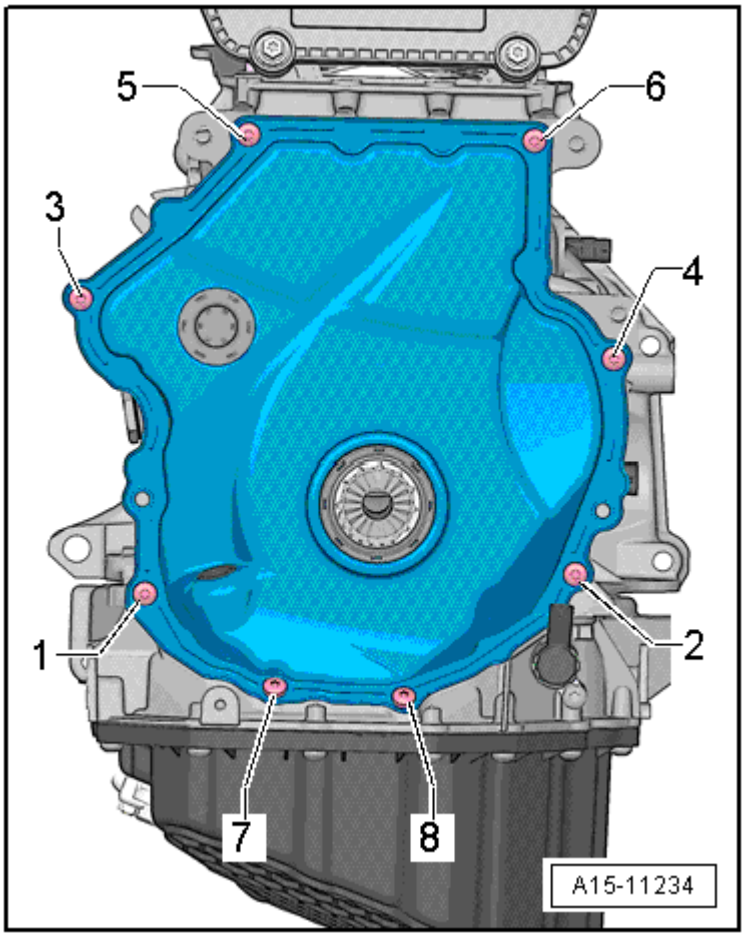

Fig. 24: Identifying Timing Chain Guard Lower Section - Tightening Sequence for 8 Bolts

-- Tighten the bolts in 2 stages in sequence -1 through 8- :

-- 1. Tighten the bolts to 4 Nm.

-- 2. Tighten the bolts an additional 45° (1/8) turn.

Intermediate Shaft Sprocket Bolt Tightening Sequence and Specification

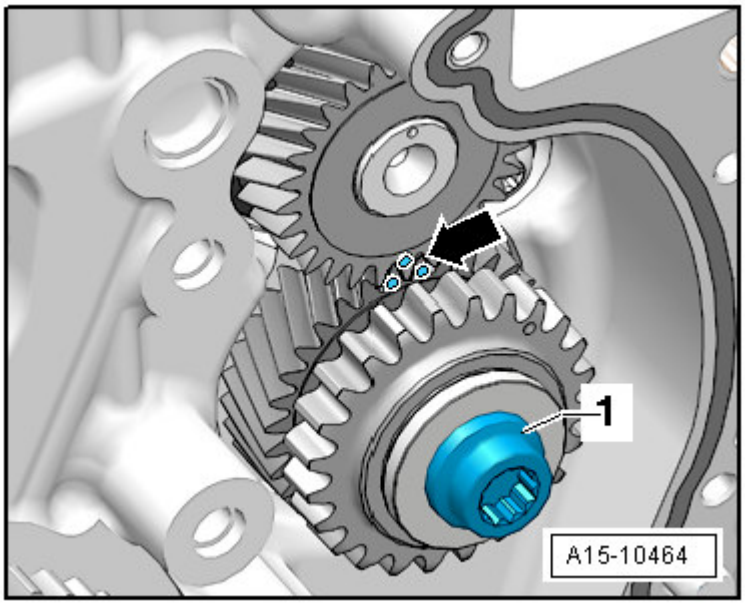

Fig. 25: Identifying Intermediate Shaft Sprocket

WARNING: Always replace the intermediate shaft sprocket. Otherwise the backlash will not adjust itself and it could result in engine damage. The new intermediate shaft sprocket has an anti-friction coating that wears off after a short period of use, which automatically adjusts the backlash.

-- Tighten the bolt to 10 Nm.

-- Turn the chain sprocket.

The chain sprocket may not have any play; if so, loosen and tighten again.

-- Tighten the bolt to 30 Nm.

-- Tighten the bolt an additional 90° (1/4) turn.

DIAGNOSIS AND TESTING

VALVE TIMING, CHECKING

Special tools and workshop equipment required

- Dial Gauge 0-10 mmVAS 6079
- Dial Gauge AdapterT10170 or T10170 A
- Caliper Gauge

-- Remove the upper timing chain cover. Refer to **UPPER TIMING CHAIN COVER**.

-- Rotate the crankshaft from above, using the vibration damper bolt and the socket SW 24, in engine rotation direction until the marks -arrows- are almost on top.

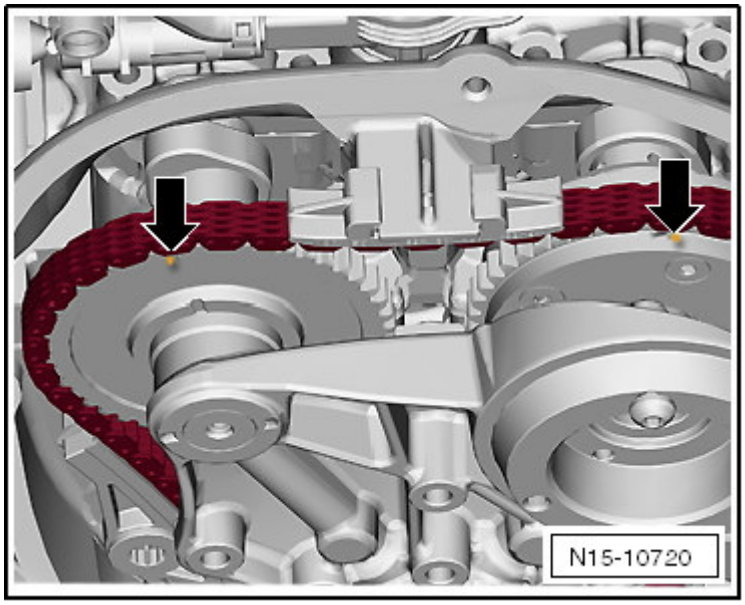

Fig. 26: Identifying Mark Points On Intake And Exhaust Camshafts

-- Remove the spark plug from cylinder 1.

-- Install the dial gauge adapterT10170/A all the way into the spark plug threads.

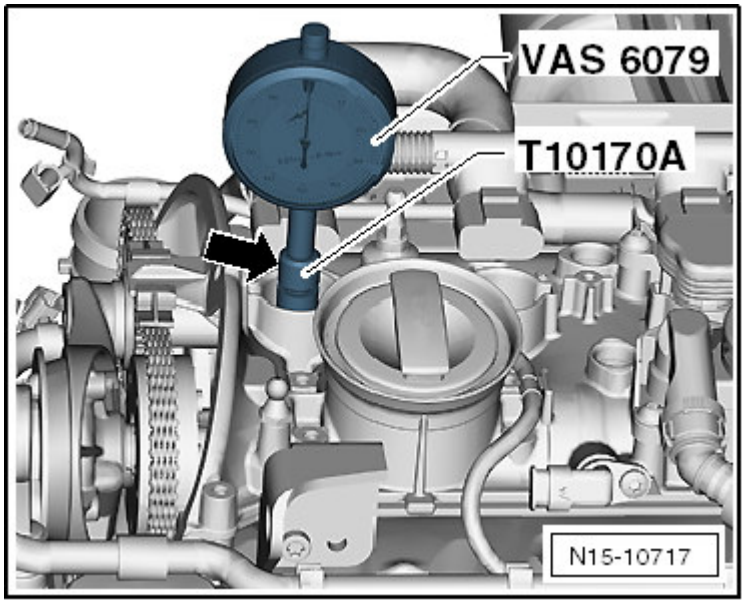

Fig. 27: Identifying Dial Gauge -VAS 6079- With Extending Piece -T10170A/1-

-- Insert the dial gauge 0-10 mmVAS 6079 with the extending pieceT10170A/1 all the way and secure it with the locking nut -arrow- .

-- Rotate the crankshaft slowly to the maximum dial reading in engine rotation direction. When the maximum dial reading is reached (Bottom Dead Center (BDC) of the gauge) the piston is at TDC.

NOTE: If the crankshaft was turned past TDC, turn the crankshaft two more turns in engine rotation direction. Do not turn the engine in the opposite direction of engine rotation.

-- Measure the distance from the left outer edge -A- to the mark -B- on the intake camshaft.

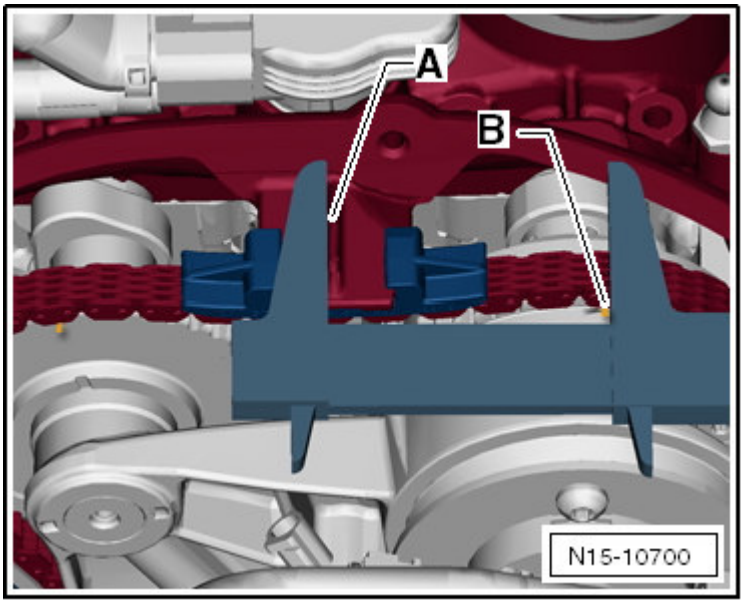

Fig. 28: Identifying Measurement Points From Outer Edge -A- To Mark -B-

- Specified value: 61 to 64 mm.

-- Once the specified value is reached, measure the distance between the mark on the intake camshaft -B- and the mark on the exhaust camshaft -C- .

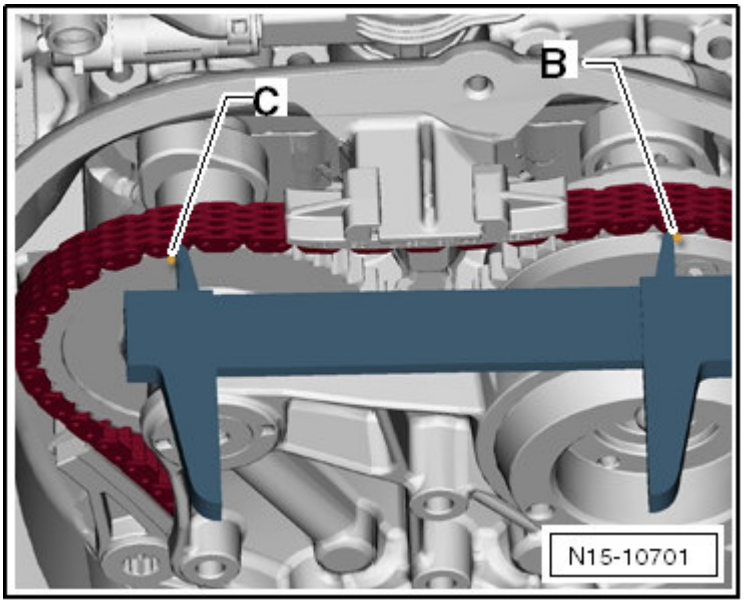

Fig. 29: Identifying Measurement Points From Mark On Intake Camshaft -B- To Mark On Exhaust Camshaft -C-

- Specified value: 124 to 126 mm

NOTE: **If one tooth has an offset, there will be a deviation of approximately 6 mm from the specified value. Install the timing chain once again if there is an offset.**

COMPRESSION PRESSURE, CHECKING

Special tools and workshop equipment required

- Spark Plug Removal Tool3122 B
- Ignition Coil PullerT40039
- Torque Wrench (5-50 Nm)V.A.G 1331
- Compression TesterV.A.G 1763
- AdapterV.A.G 1381/5A
- AdapterV.A.G 1381/1

Sequence

NOTE: **Follow all safety precautions. Refer to SAFETY PRECAUTIONS .**

Engine oil temperature is a minimum of 30 °C (86 °F).

Battery voltage is at least 12.7 volts

Procedure

-- Remove the engine cover. Refer to **ENGINE COVER**.

-- Remover the ignition coils with the power output stages. Refer to **IGNITION COIL WITH POWER OUTPUT STAGE** .

-- Remove the spark plugs using the spark plug removal tool3122 B.

-- Check the compression using the compression testerV.A.G 1763 and the adaptersV.A.G 1381/1 and V.A.G 1381/5A.

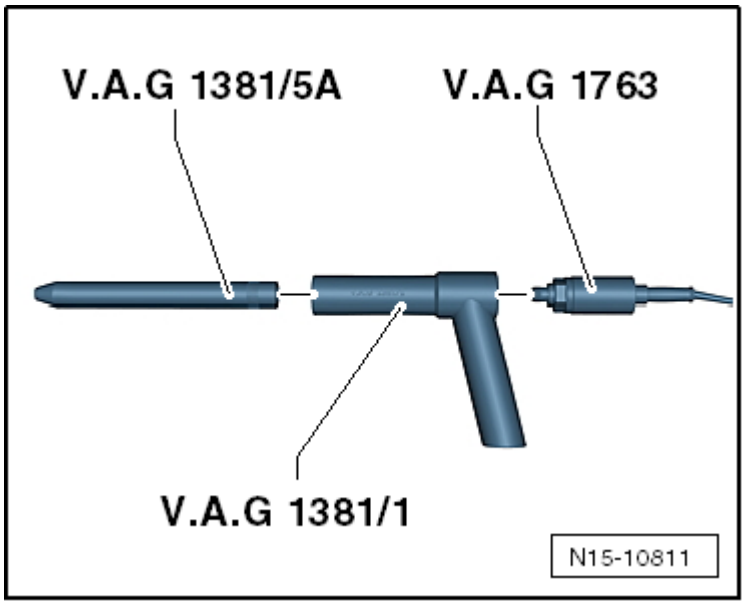

Fig. 30: NO CONTENT

NOTE: Using the compression tester, refer to the operating instructions.

-- Operate the starter until the tester no longer indicates that the pressure is increasing.

Compression Pressure

New Bar Positive Pressure	Wear Limit Bar Positive Pressure	Difference Between Cylinders Bar Positive Pressure
11.0 ••• 14.0	7.0	Max. 3.0

-- Install the sparks plugs, tightening specification, refer to **IGNITION SYSTEM COMPONENT OVERVIEW** .

-- Install the ignition coils with power output stage. Refer to **IGNITION COIL WITH POWER OUTPUT STAGE** .

NOTE: By disconnecting the connections, Diagnostic Trouble Codes (DTCs) are stored

to memory. After the test, check the DTC memory and erase, if necessary.

-- Read the Engine Control Module (ECM) DTC memory. Refer to the vehicle diagnostic tester.

CAMSHAFT AXIAL CLEARANCE, CHECKING

Special tools and workshop equipment required

- Dial Gauge HolderVW 387
- Dial Gauge 0-10 mmVAS 6079

Sequence

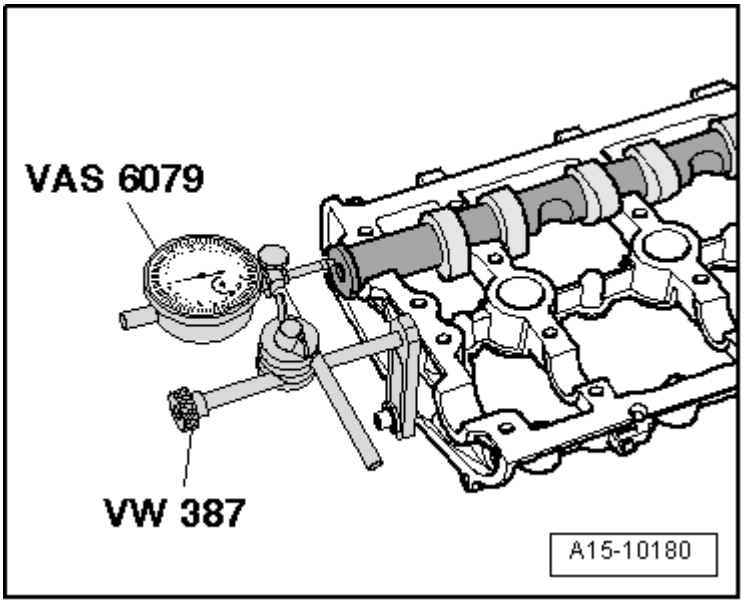

Fig. 31: Dial Gauge VAS 6079 Secured To Cylinder Head With Universal Dial Gauge Holder VW 387

-- Perform the measurement with the cylinder head cover removed.

-- Place the camshaft to be checked in the cylinder head.

-- Secure the dial gauge 0-10 mmVAS 6079 to the cylinder head using the dial gauge holderVW 387.

-- Press the camshaft against the dial gauge by hand.

-- Set the dial gauge to "0" .

-- Press the camshaft off the dial gauge and read the value:

- Axial clearance: 0.05 to 0.17 mm.

VALVE GUIDE, CHECKING

Special tools and workshop equipment required

- Dial Gauge HolderVW 387
- Dial Gauge 0-10 mmVAS 6079

Sequence

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

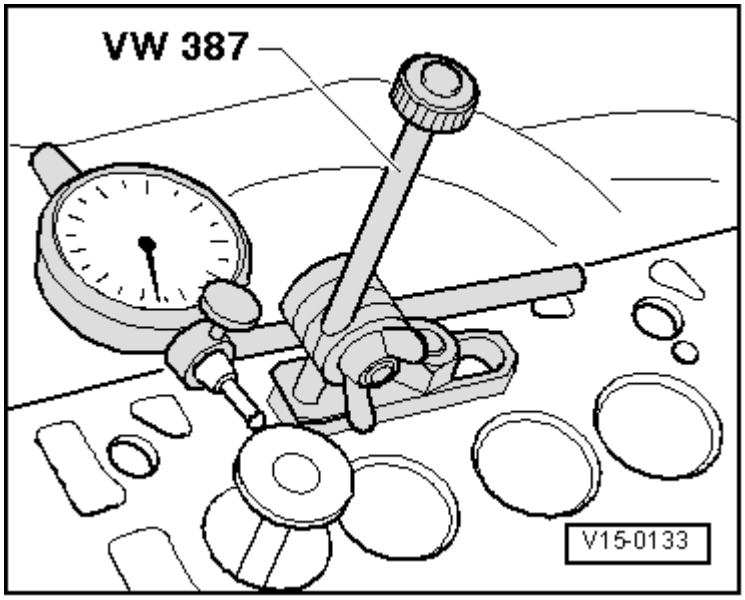

Fig. 32: Determining Valve Rock (Wear Limit)

-- Determine the tip clearance.

Wear Limit

Intake Valve Guide	Exhaust Valve Guide
0.80 mm	0.80 mm

NOTE: **If the wear limit is exceeded, measure again using a new valve. If the wear limit is still exceeded, replace the cylinder head.**

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

REMOVAL AND INSTALLATION

ENGINE COVER

Removing

-- Pull the engine cover at its attachment points -arrows- upward.

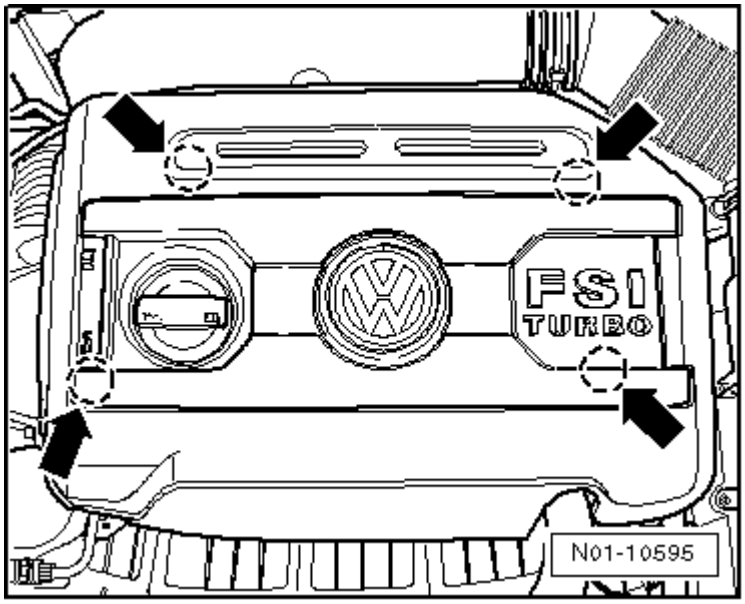

Fig. 33: Identifying Engine Cover Attachment Points

Installing

-- Make sure the rubber grommets fit correctly in their mounts when installing.

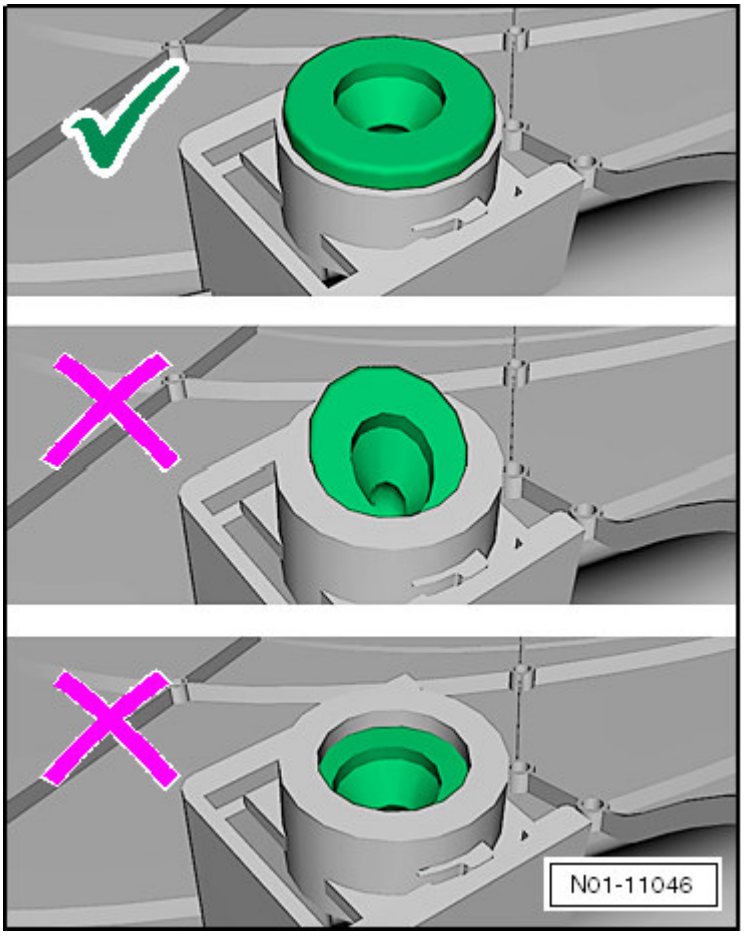

Fig. 34: Identifying Correct Installation Of Rubber Insulators

-- Carefully press the engine cover onto the ball studs.

-- In order to prevent causing damage, do not hit the engine cover with your fist or tool.

CYLINDER HEAD

Special tools and workshop equipment required

- Assembly ToolT10352
- Counter Hold ToolT10355
- Locking PinT40011
- LeverT40243
- Locking ToolT40267
- Camshaft LocatorT40271
- Torque Wrench (5-50 Nm)V.A.G 1331
- Torque Wrench (40-200 Nm)V.A.G 1332
- Shop Crane - Load Cap = 700-1200 KGVAS 6100

- Engine Bung SetVAS 6122
- Drip Tray for VAS 6100VAS 6208
- Polydrive Bit and Drive SocketT10070
- Engine Sling2024 A
- Engine SupportT10014
- Ignition Coil PullerT40039

Removing

NOTE: During installation, cable ties must be installed at the same location.

-- Remove the engine cover. Refer to **ENGINE COVER**.

-- Remove the air filter housing. Refer to **AIR FILTER HOUSING** .

-- Loosen the hose clamp -2- .

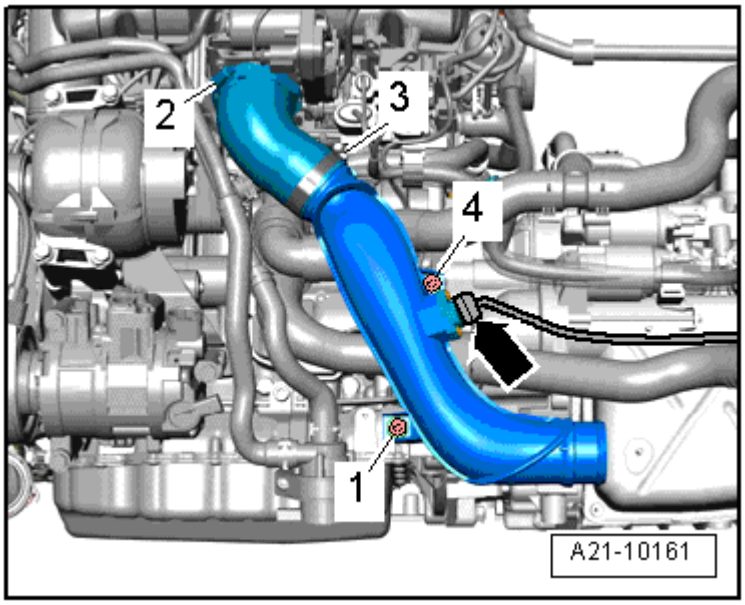

Fig. 35: Air Guide Hose Bolts, Air Guide Pipe Hose Clamps & Electrical Harness Connector

-- Remove the bolt -4- .

-- Disconnect the connector -arrow- and free up the electrical wire.

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

The coolant system is under pressure when the engine is warm.

Reduce pressure by covering the coolant expansion tank cap with a cloth

and open carefully.

-- Open the coolant expansion tank cap.

-- Remove the front exhaust pipe with catalytic converter. Refer to one of the following:

Tiguan, refer to **FRONT EXHAUST PIPE WITH CATALYTIC CONVERTER** .

-- Remove the right front wheel.

-- Remove the noise insulation. Refer to one of the following:

GTI and Tiguan, refer to **Description and Operation**

Eos and Passat, refer to "Noise Insulation" in **Removal and Installation** .

CC, refer to "Noise Insulation" in **Description and Operation**

-- Remove the front right wheel housing liner. Refer to **Removal and Installation** .

-- Loosen the charge air hose clamps -1 and 2- and remove the charge air hose.

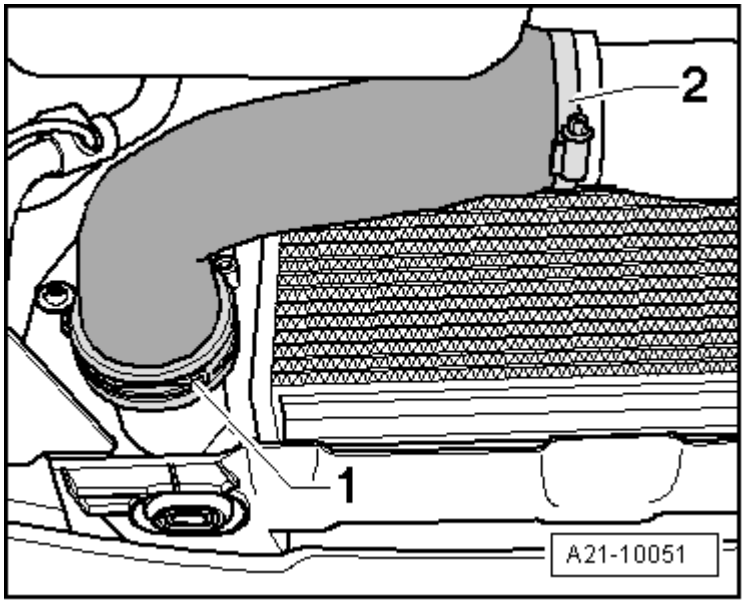

Fig. 36: Air Cooler Air Duct

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

-- Remove the bolt -1- and remove the charge air pipe downward.

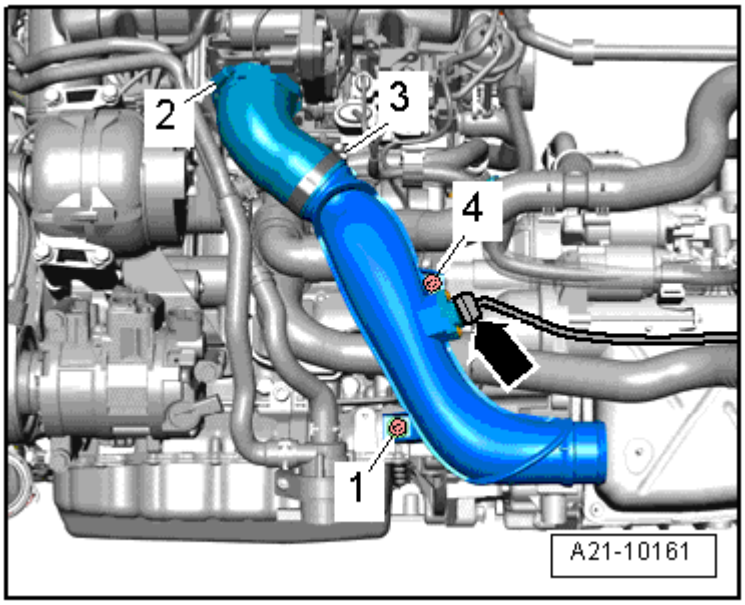

Fig. 37: Air Guide Hose Bolts, Air Guide Pipe Hose Clamps & Electrical Harness Connector

-- Remove the charge air pipe bolts -arrows- .

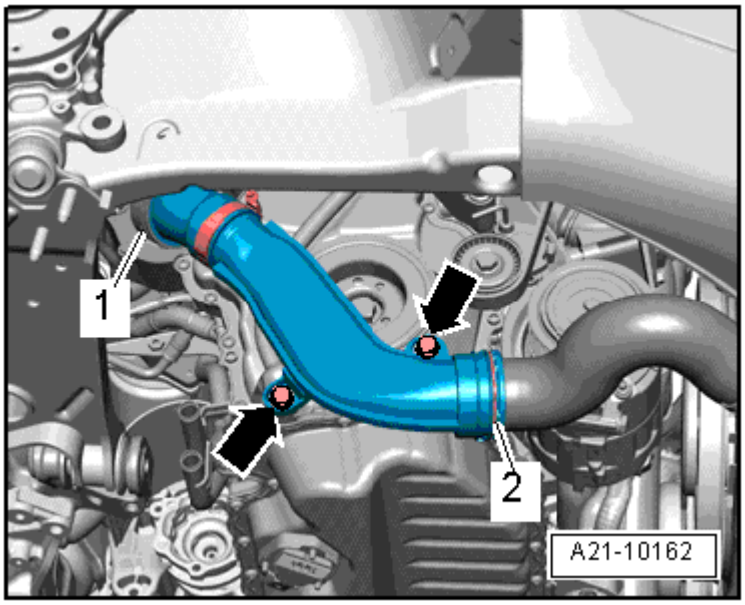

Fig. 38: Air Guide Pipe And Bolts

-- Lift the clamps -1 and 2- and remove the chare air pipe.

-- Disconnect the connectors -1 and 2- and free up the wire -arrows- .

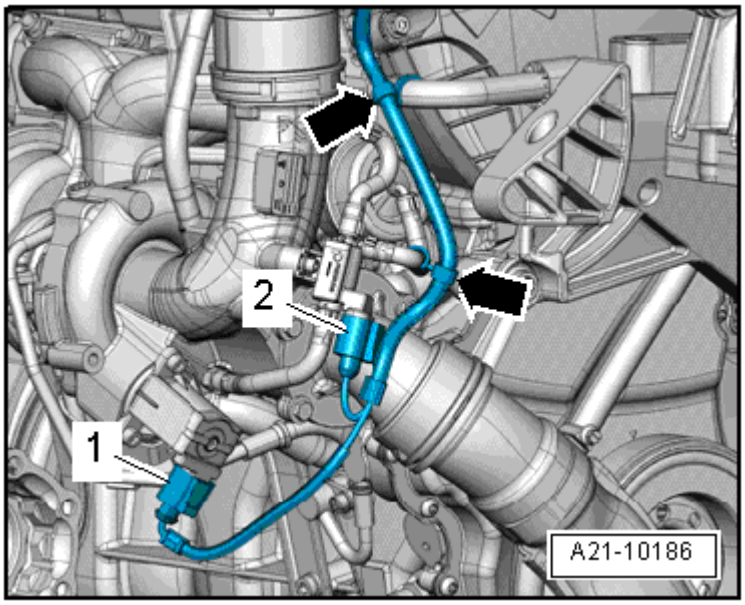

Fig. 39: Identifying Turbocharger Electrical Connectors

with All Wheel Drive (AWD)

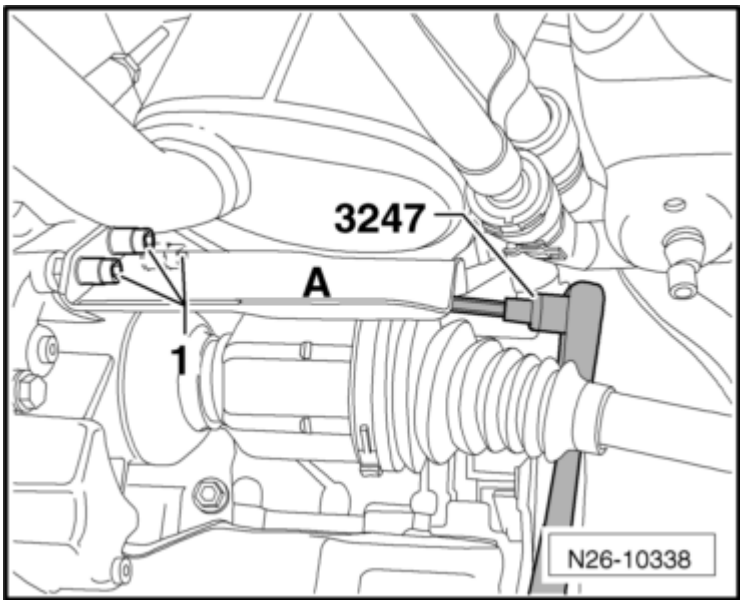

Fig. 40: Identifying, Tool -3247-, Bolts -1- And Heat Shield -A-

-- Remove the right drive axle heat shield -A- bolts -1- using the hex ball socket3247.

Continuation for All

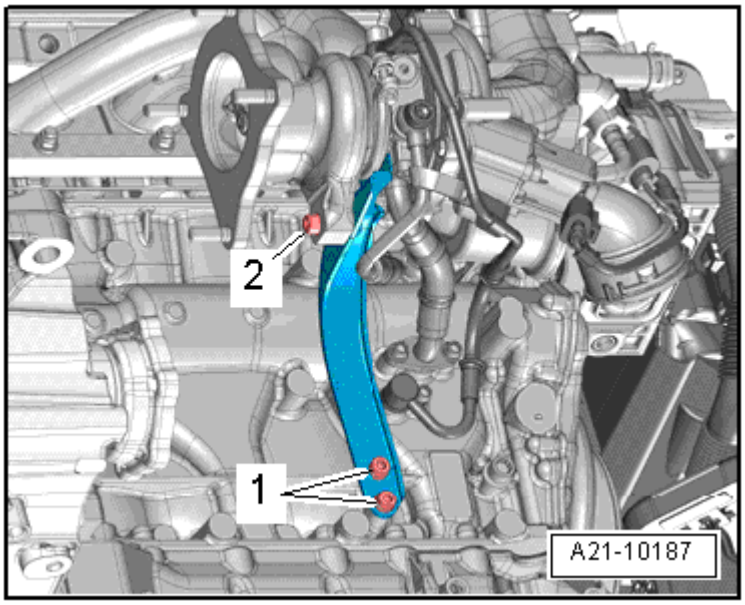

Fig. 41: Identifying Turbocharger Support And Bolts

-- Remove the bolts -1 and 2- and remove the turbocharger support.

-- Remove the banjo bolt -2- and move the coolant line to the side.

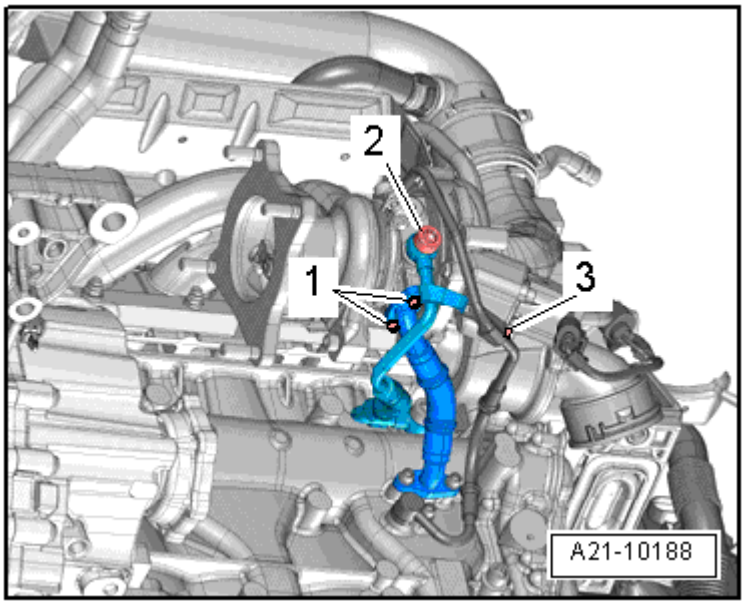

Fig. 42: Identifying Oil Return Line, Coolant Line And Oil Supply Line Fasteners

with Front Wheel Drive (FWD)

-- Remove the bolts -1- for the oil return line.

with AWD

-- Remove the oil return line bolts at the crankcase.

Continuation for All

-- Remove the bolt -3- for the oil supply line.

-- For vehicles with a noise generator, remove the charge air pipe from the noise generator.

-- Disconnect the connector from the camshaft adjustment valve 1 (-1-).

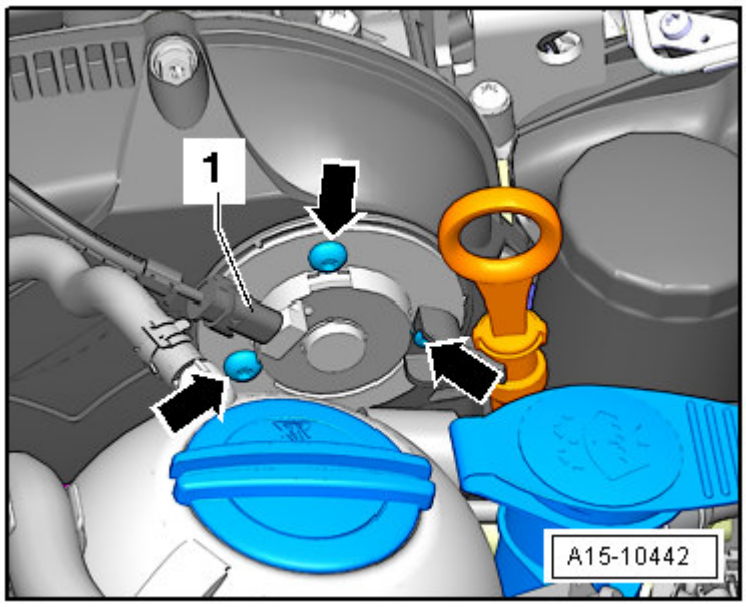

Fig. 43: Camshaft Adjustment Valve And Bolts

-- Disconnect the connectors from the ignition coils and free up the wiring harness.

-- Remove the ignition coils using the ignition coil pullerT40039.

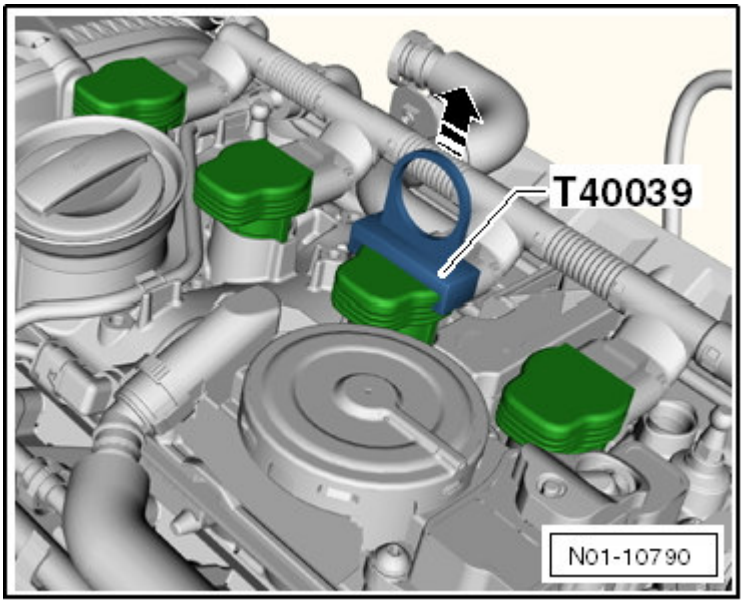

Fig. 44: Identifying Position And Direction To Use Ignition Coil Puller

-- Remove the crankcase ventilation bolts -arrows- .

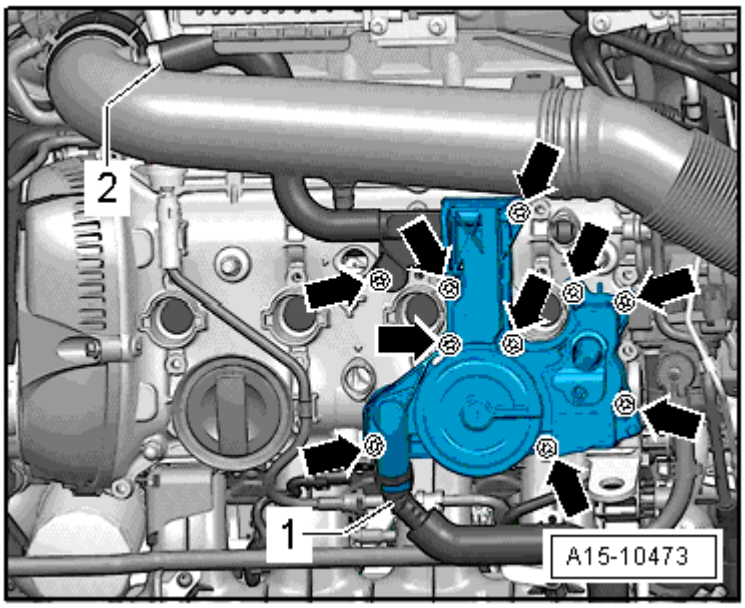

Fig. 45: Crankcase Ventilation, Tightening Sequence

-- Disconnect the hose for the crankcase ventilation - 1 - .

-- Remove the charge air pipe bolt -arrow- .

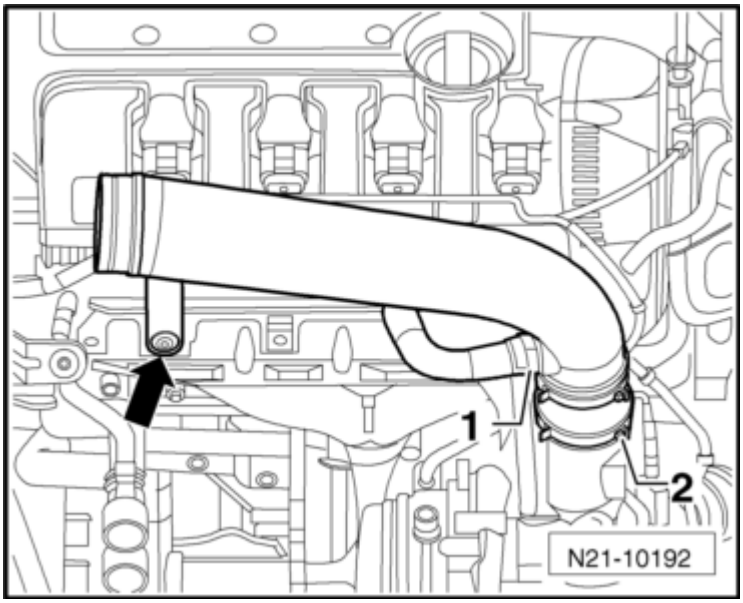

Fig. 46: Identifying Charge Air Pipe Bolt -Arrow- And Hose Clamp -2-

-- Loosen the hose clamp -2- and remove the charge air pipe together with the crankcase ventilation.

WARNING: The fuel supply line is under pressure. Always wear protective eyewear and protective clothing to prevent injuries and fuel from coming in contact with your skin. Wrap a cloth around the connection before removing a fuel hose. Remove the hose connection carefully to release the pressure.

-- Disconnect the lines - 1 through 3- at the bracket.

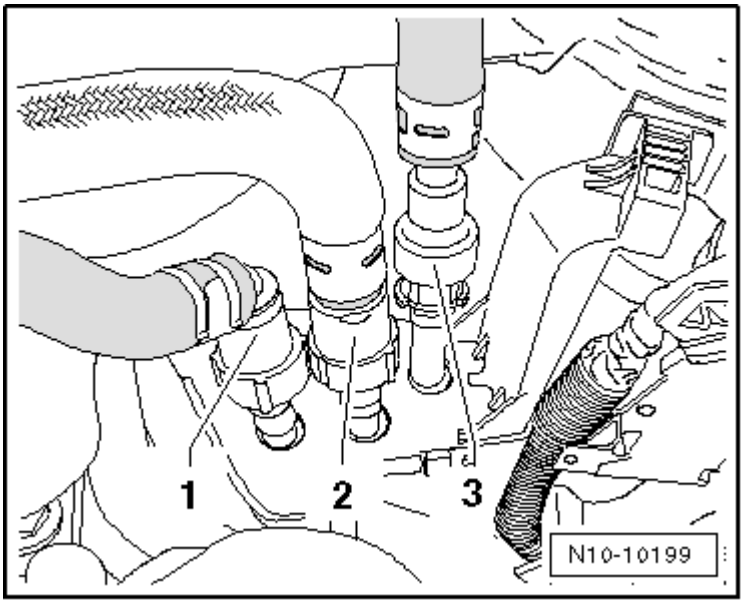

Fig. 47: Identifying Breather Line, Vacuum Line & Fuel Supply Line

1 - Vent line

2 - Vacuum line

3 - Fuel supply line

-- Disconnect the coolant line -arrow- from the expansion tank.

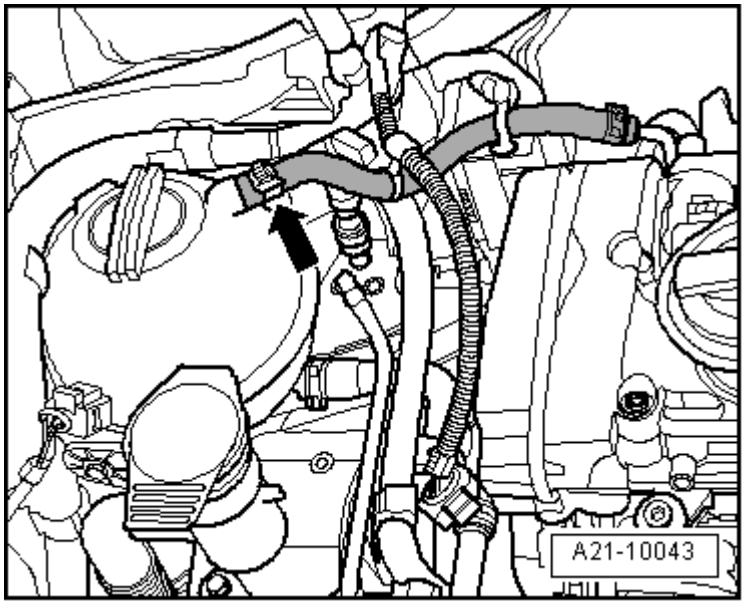

Fig. 48: Disconnecting Coolant Line To Coolant Expansion Tank

-- Remove the coolant hoses -arrows- from the coolant pipe.

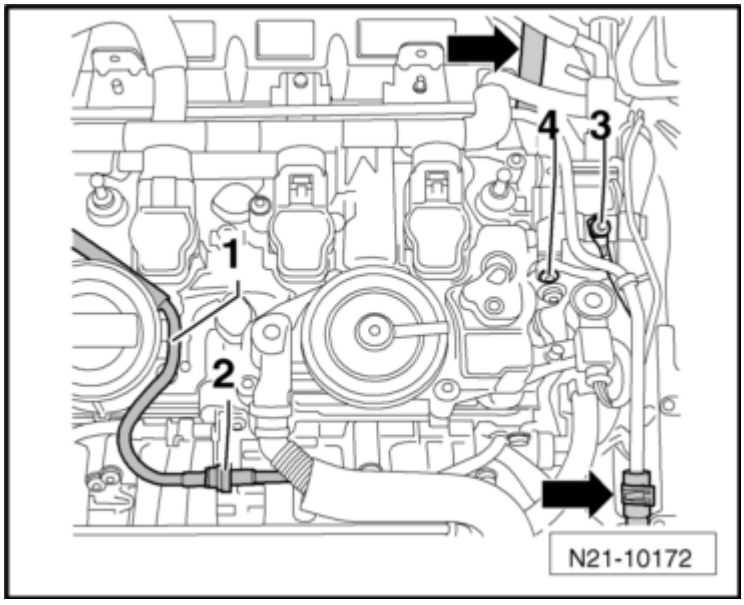

Fig. 49: Identifying Vacuum Line -1-, Ground Wire -3- And Bolt -4-

-- Remove the nut -3- and ground wire (GND), remove the bolt -4- .

-- Disconnect the vacuum hoses -arrows- .

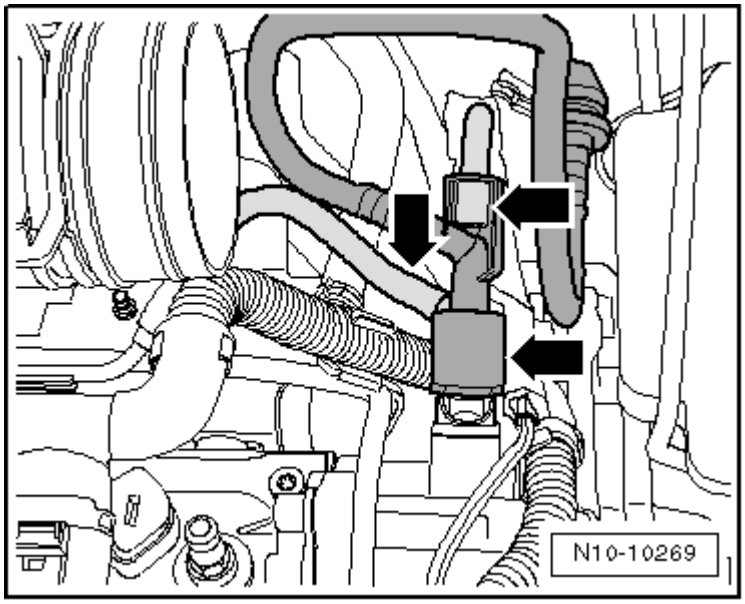

Fig. 50: Identifying Vacuum Hoses

-- Remove the bolts -1 though 3- and remove the heat shield together with the coolant pipe.

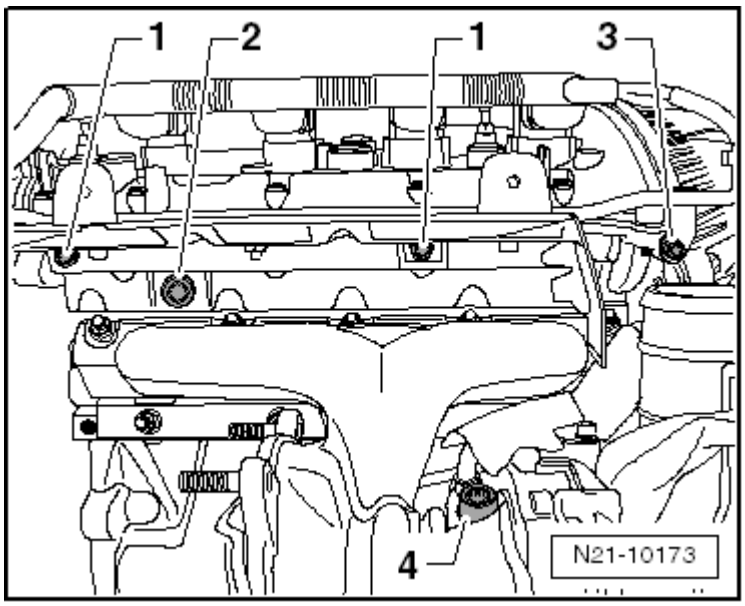

Fig. 51: Identifying Heat Shield Bolts

-- Remove the oil supply line banjo bolt -4- from the turbocharger.

NOTE: Remove the bolt -2- from the heat shield using a 6 mm -A- hex socket. The hex socket must be at least 5 cm long -B- . A socket that tapers to 6 mm at the tip is

too wide.

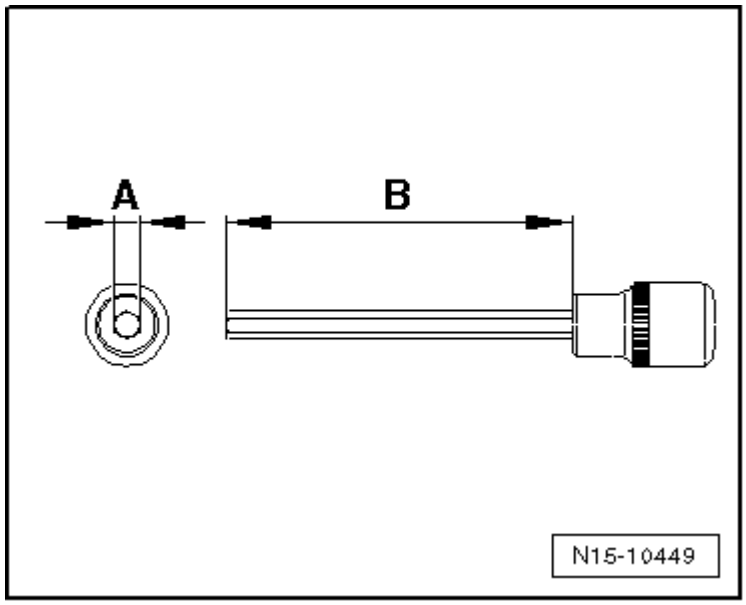

Fig. 52: Identifying 6mm Hex Socket -A-, 5cm Long -B-

-- Disconnect the connector -2- from the fuel pressure regulator valve.

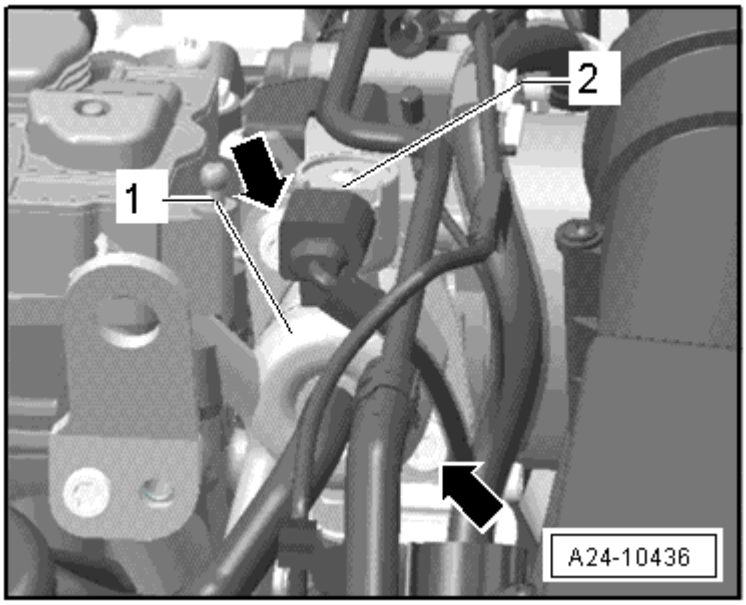

Fig. 53: Fuel High Pressure Pump & Fuel Pressure Regulator Valve Electrical Harness Connector

Engine Code CBFA

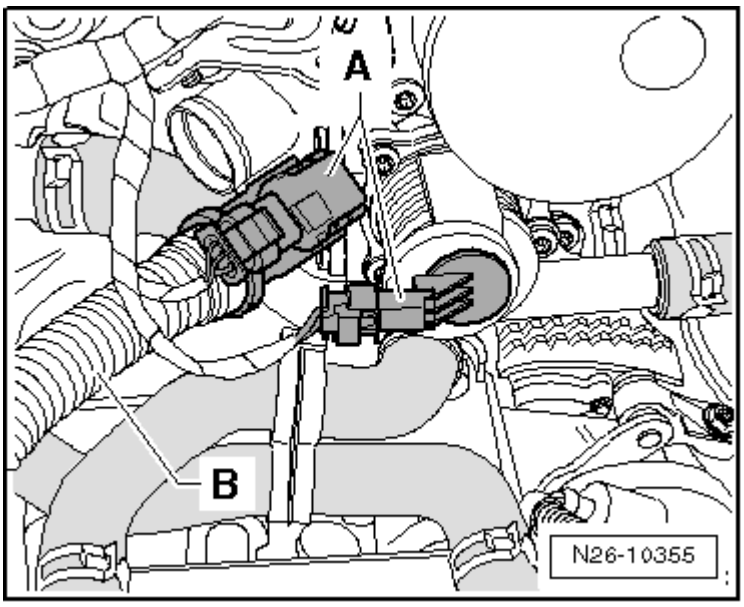

Fig. 54: Identifying Secondary Air Injection (Air) Solenoid Valve N112 Connector And Hose

-- Disconnect the connector -A- and hose -B- from the Secondary Air Injection (AIR) solenoid valve.

-- Loosen the coolant pipe, remove the bolts -arrows- .

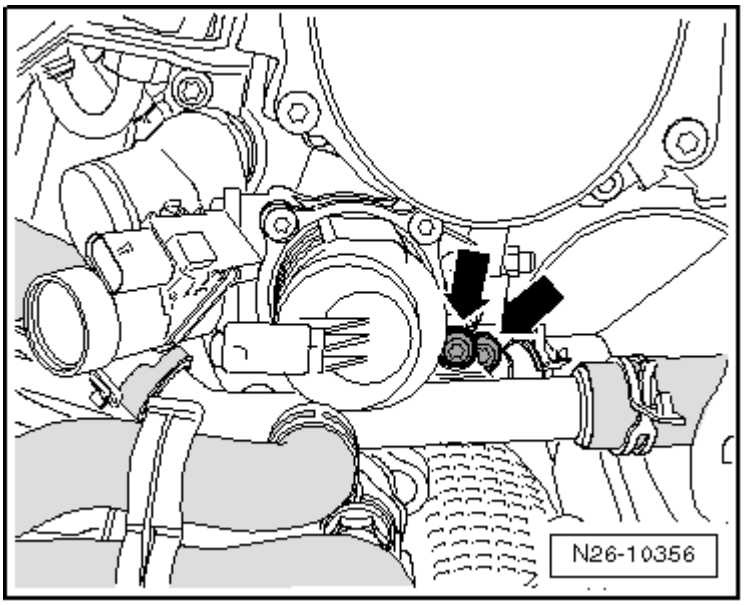

Fig. 55: Coolant Pipe And Bolts

Continuation for All

-- Disconnect the coolant hose from the connection on the cylinder head.

-- Disconnect the connectors -1 through 4- .

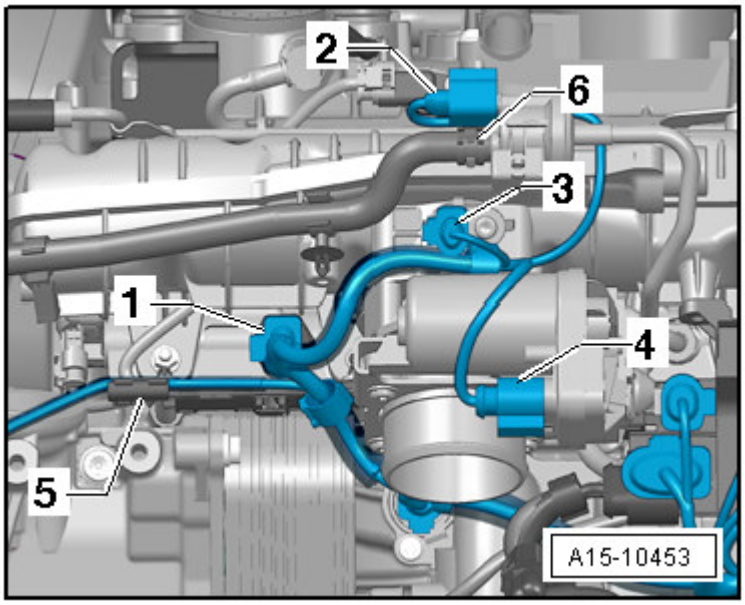

Fig. 56: EVAP Filter Vacuum Hose, Electrical Connectors And Electrical Cable

-- Free up the wire -5- .

-- Disconnect the vacuum hose -6- leading to the Evaporative Emission (EVAP) filter.

GTI

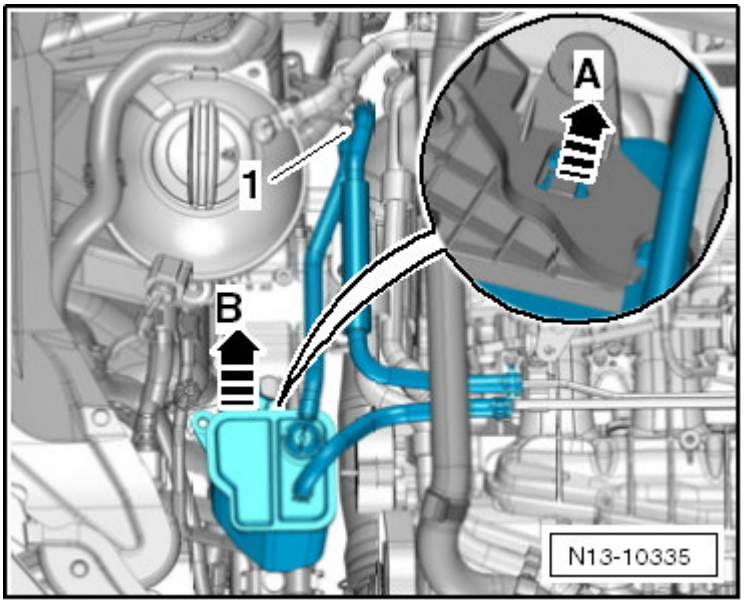

Fig. 57: Identifying Vent Line, Canister And Canister Catch

-- Disconnect the vent line -1- , unlock the EVAP canister -A- and remove it -B- .

Continuation for All

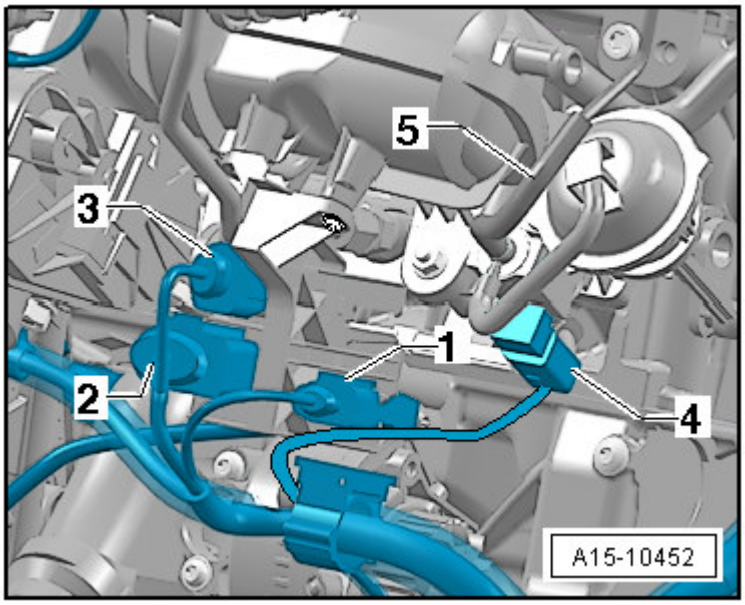

Fig. 58: Identifying Vacuum Line And Electrical Connectors

-- Disconnect the connector -1 - and pull the connector out of the retainer.

-- Disconnect the connectors -2 through 4- .

-- Disconnect the coolant line from the intake manifold, when doing this, remove the bolts -arrows- .

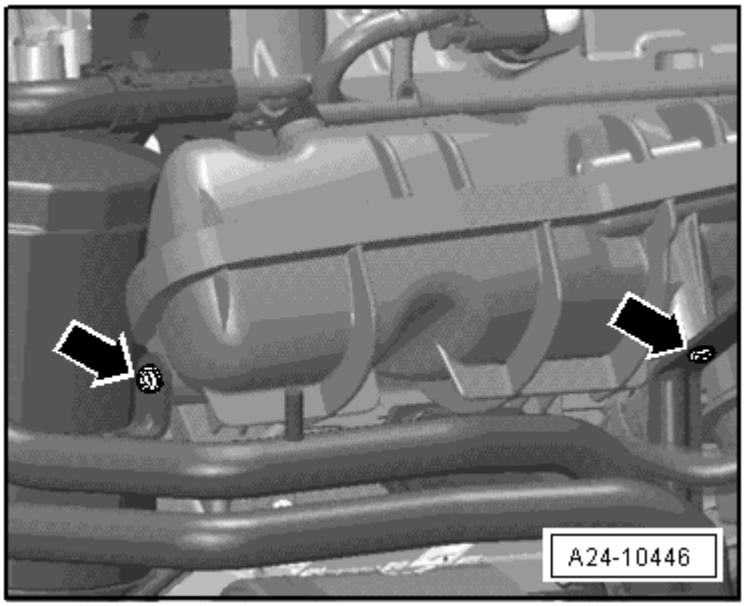

Fig. 59: Bracket Bolts

-- Remove the intake manifold bracket by removing the nut -1- and bolt -2- .

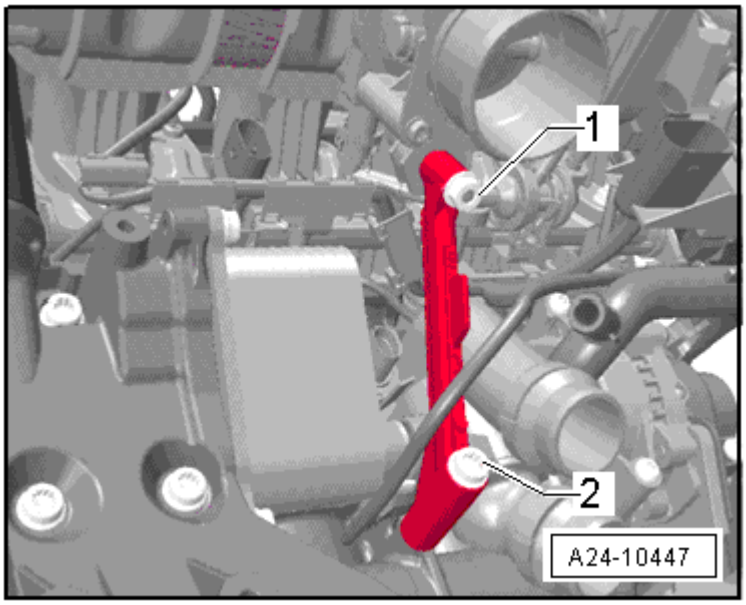

Fig. 60: Identifying Intake Manifold Bracket Mounting Nut And Bolt

-- Remove the oil filter.

-- Disconnect the coolant hoses -arrows- and move them to the side.

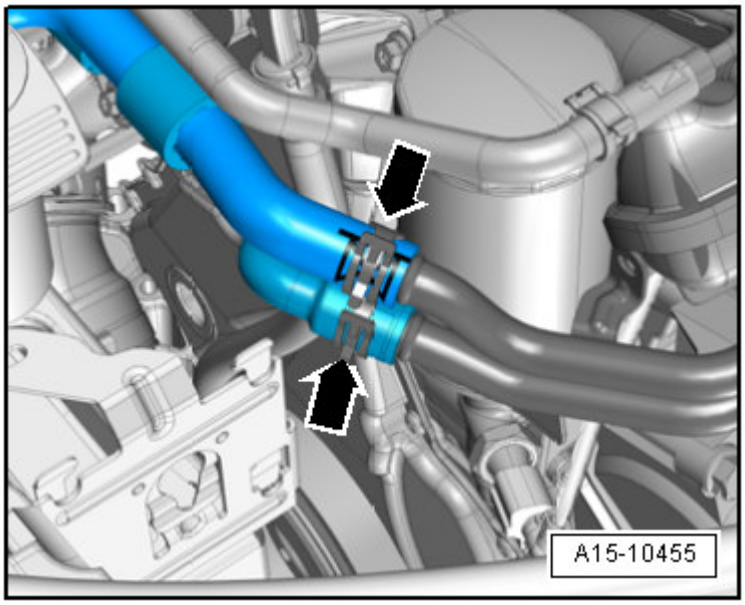

Fig. 61: Coolant Hoses

-- Remove the bolts -arrows- and then the camshaft adjustment valve 1.

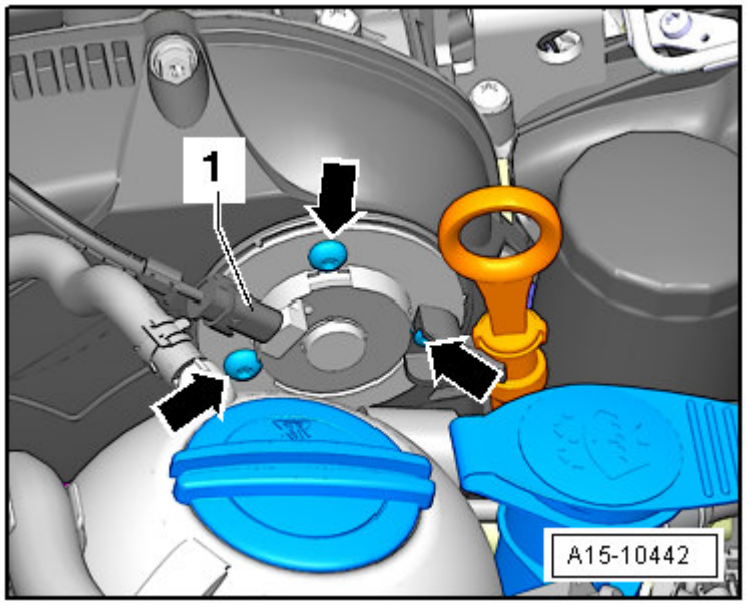

Fig. 62: Camshaft Adjustment Valve And Bolts

-- Remove the upper timing chain cover. Refer to **UPPER TIMING CHAIN COVER**.

CAUTION: The control valve has a left hand threads.

-- Remove the control valve in the -direction of the arrow- using the assembly toolT10352.

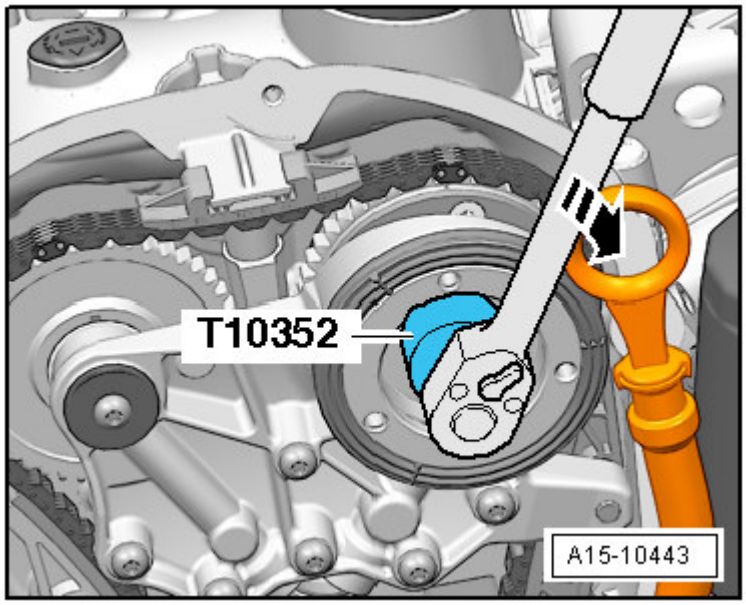

Fig. 63: Identifying Assembly Tool T10352 To Remove Control Valve

-- Remove the bolts -arrows- and remove the bearing bracket.

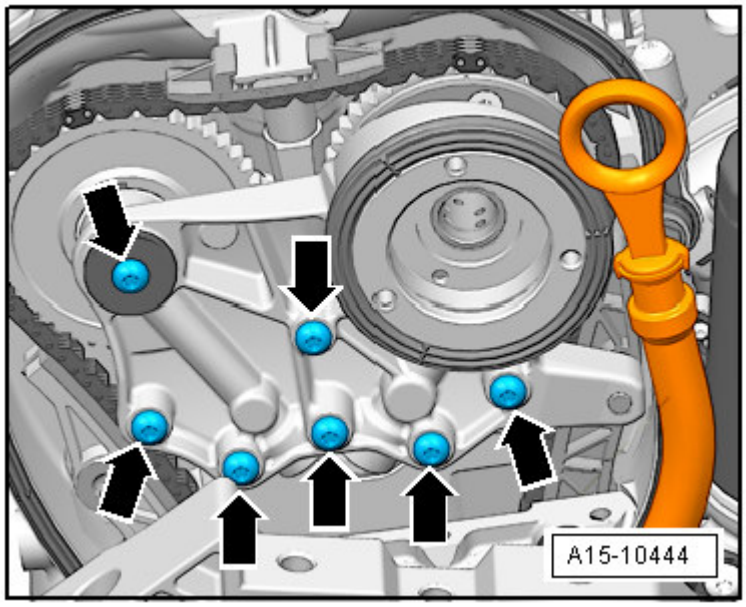

Fig. 64: Bearing Bracket Bolts

-- Rotate the vibration damper using the counter hold toolT10355 into the Top Dead Center (TDC) position -arrow- .

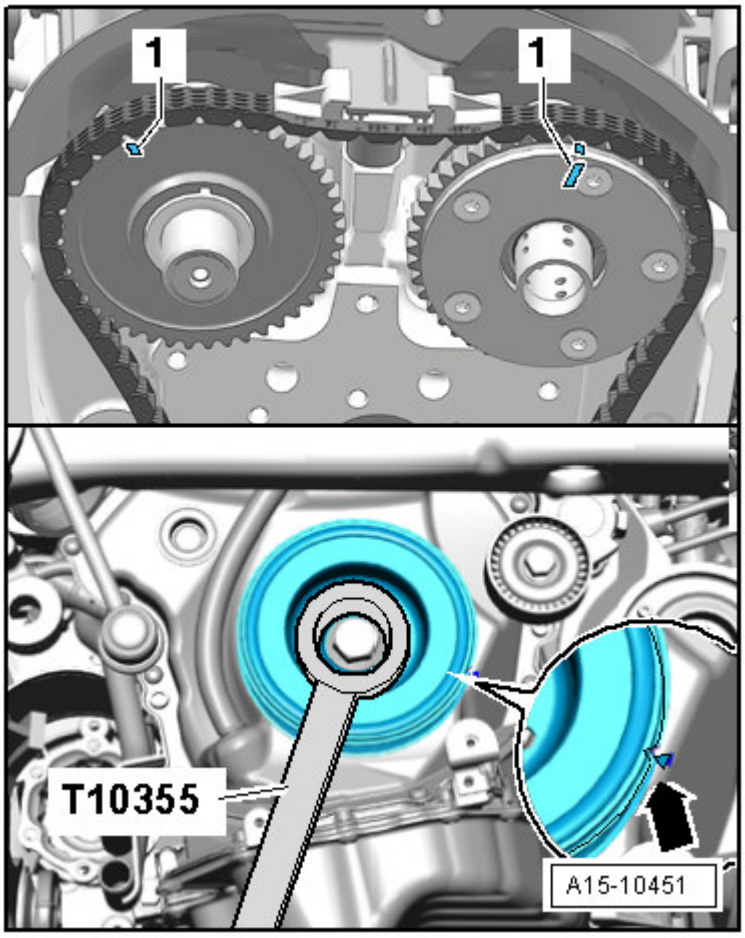

Fig. 65: Identifying Markings -1- On Camshafts Aligned To Point Upward

- The notch on the vibration damper must line up with the arrow mark on the lower timing chain cover.
- The marks -1- on the camshafts must point upward.

-- Apply marks on the camshaft timing chain and the cylinder head -arrows- to match the marks on the sprockets -1- using a waterproof marker.

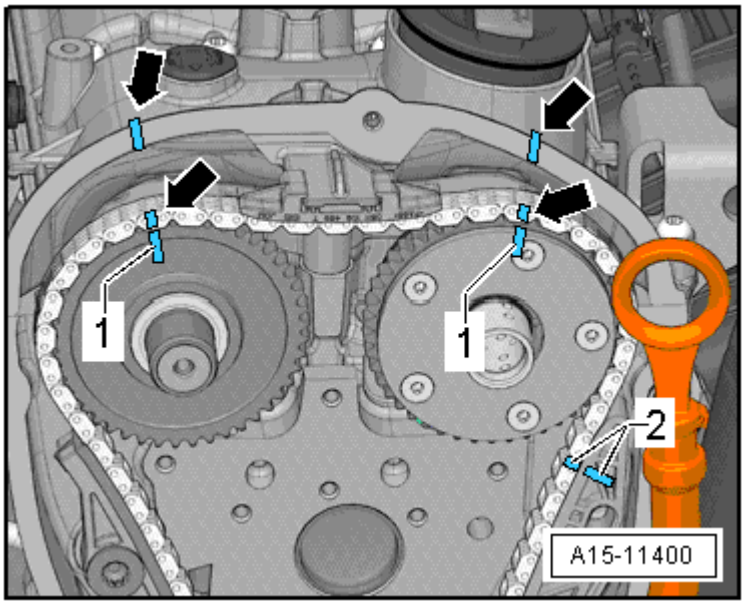

Fig. 66: Mark camshaft timing chain and the cylinder head

-- In addition, apply marks on the camshaft timing chain to the camshaft timing chain guide rail -2- with a waterproof marker.

-- Remove the plug -arrow- .

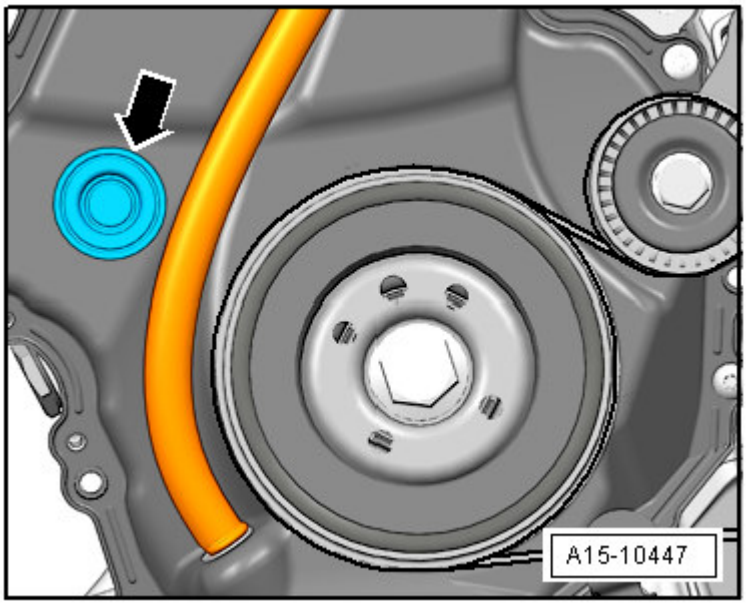

Fig. 67: Locating Plug

-- Remove the bolts -arrows- .

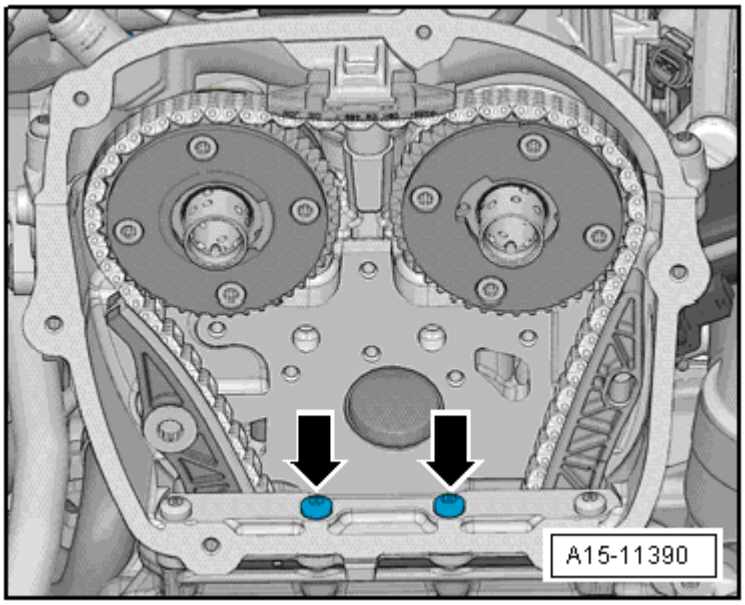

Fig. 68: Identifying Bolts

-- Remove the bolt -arrow- .

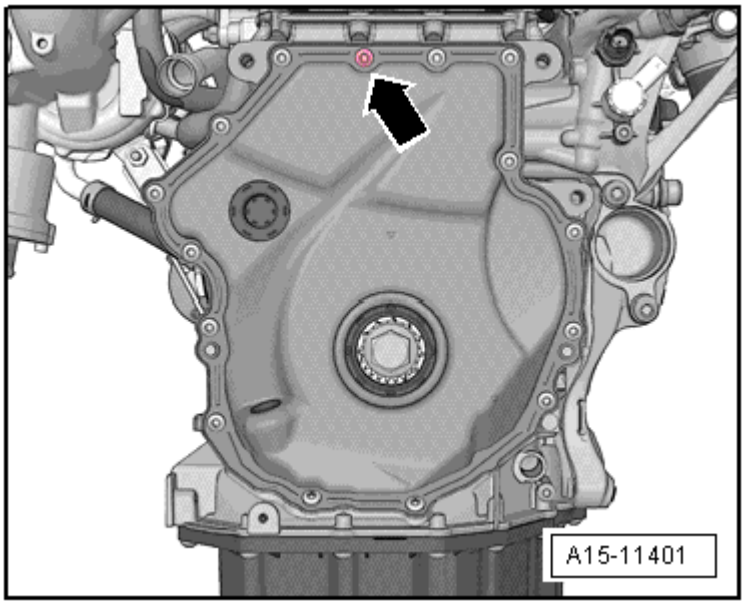

Fig. 69: Identifying Bolt

Two different chain tensioners may be installed.

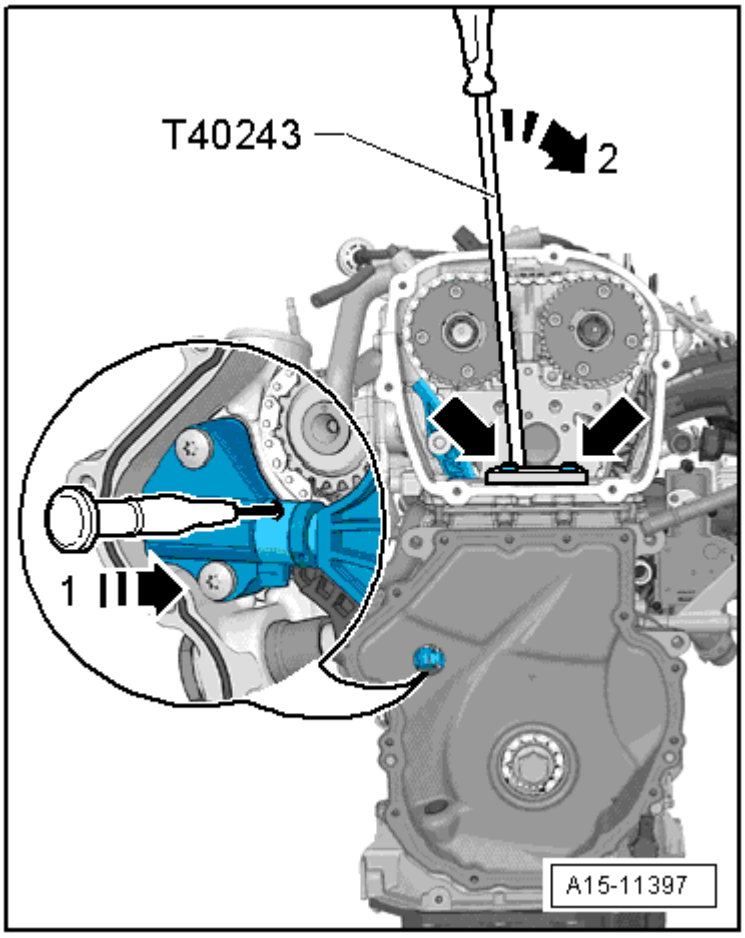

Fig. 70: Identifying Version 1

Version 1:

-- Install the leverT40243 -arrows- .

-- Lift up the locking wedge for the chain tensioner -arrow 1- . Sand the end of the locking pinT40011 down to a point. A screwdriver with a head approximately 1.5 mm wide can also be used.

CAUTION: There is a risk of damaging the chain tensioner. Proceed very carefully.

-- Slowly press and hold the leverT40243 in the -direction of arrow 2- .

-- Secure the chain tensioner using the locking pinT40011.

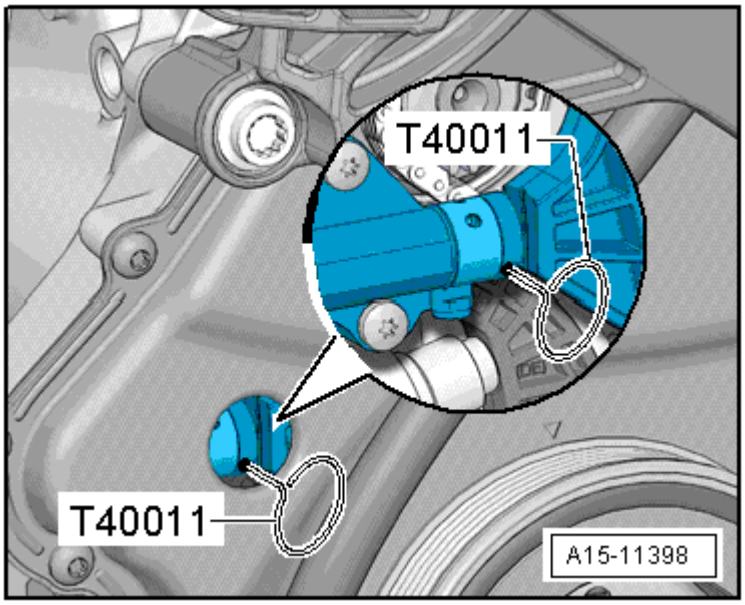

Fig. 71: Securing Chain Tensioner

Version 2:

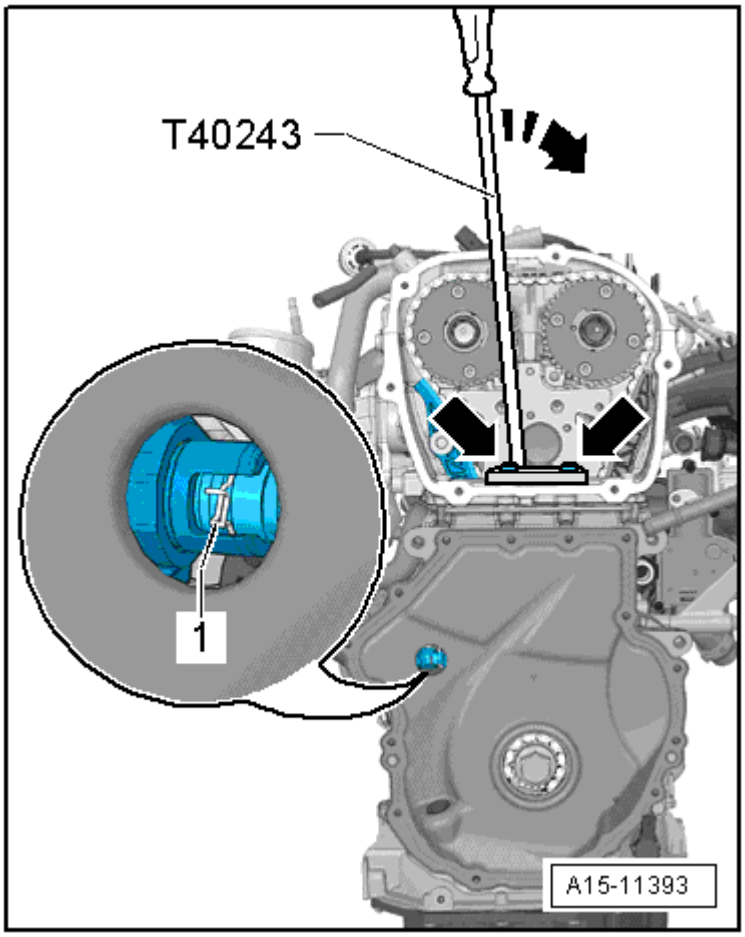

Fig. 72: Identifying Version 2

-- Install the leverT40243 -arrows- .

-- Press the chain tensioner lock ring -arrow- together and slowly press and hold the leverT40243 in the -direction of the arrow- .

-- Secure the chain tensioner using the locking toolT40267.

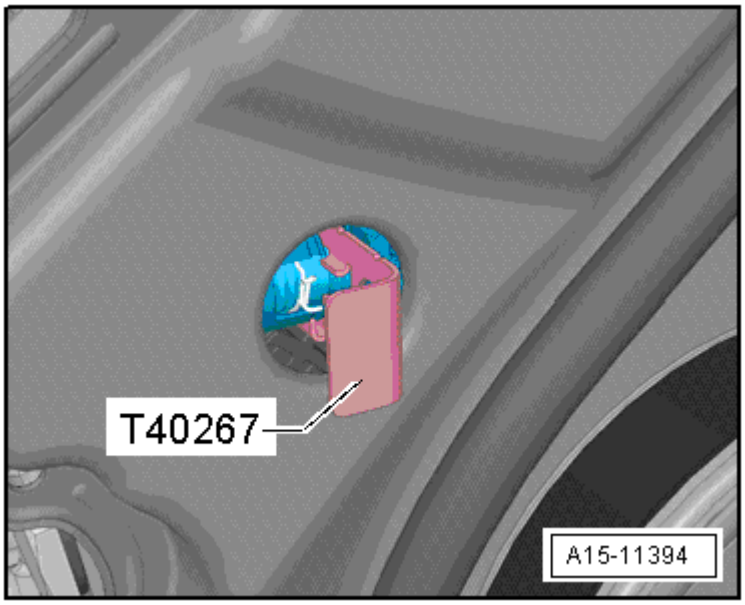

Fig. 73: Securing Chain Tensioner

Continuation for All

-- Remove the leverT40243.

-- Bolt the camshaft locating toolT40271/2 to the cylinder head and push the tool into the sprocket splines in the -direction of arrow 2- . If necessary, rotate the intake camshaft in the -direction of arrow 1- using a wrench.

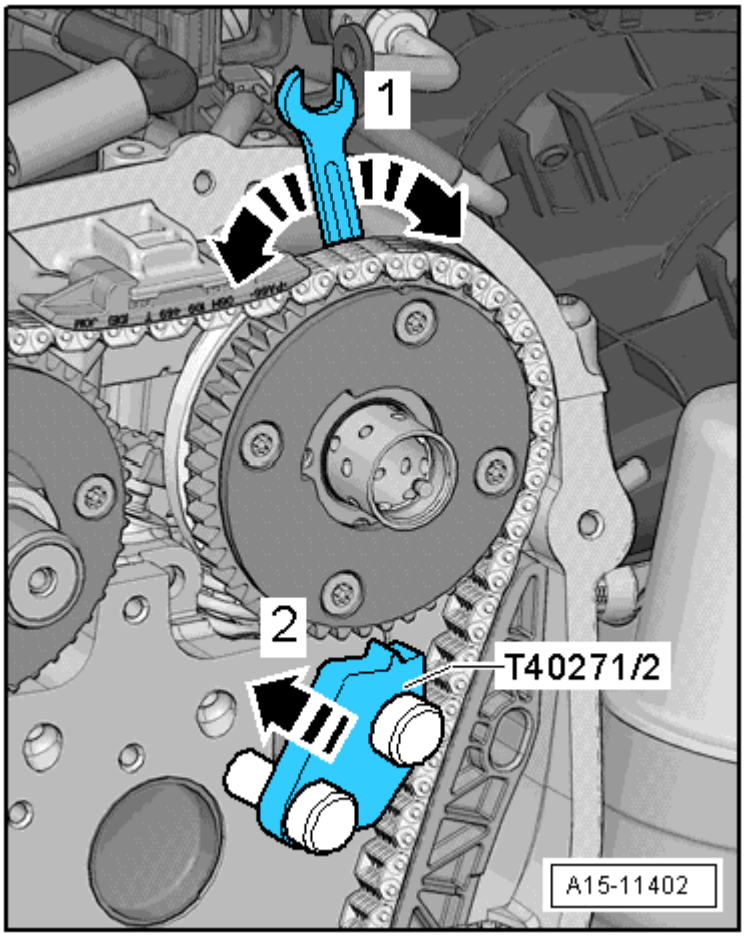

Fig. 74: Bolt Camshaft Locating Tool

-- Bolt the camshaft locating toolT40271/1 to the cylinder head. Counter hold the camshaft with a wrench in a clockwise direction -arrow- .

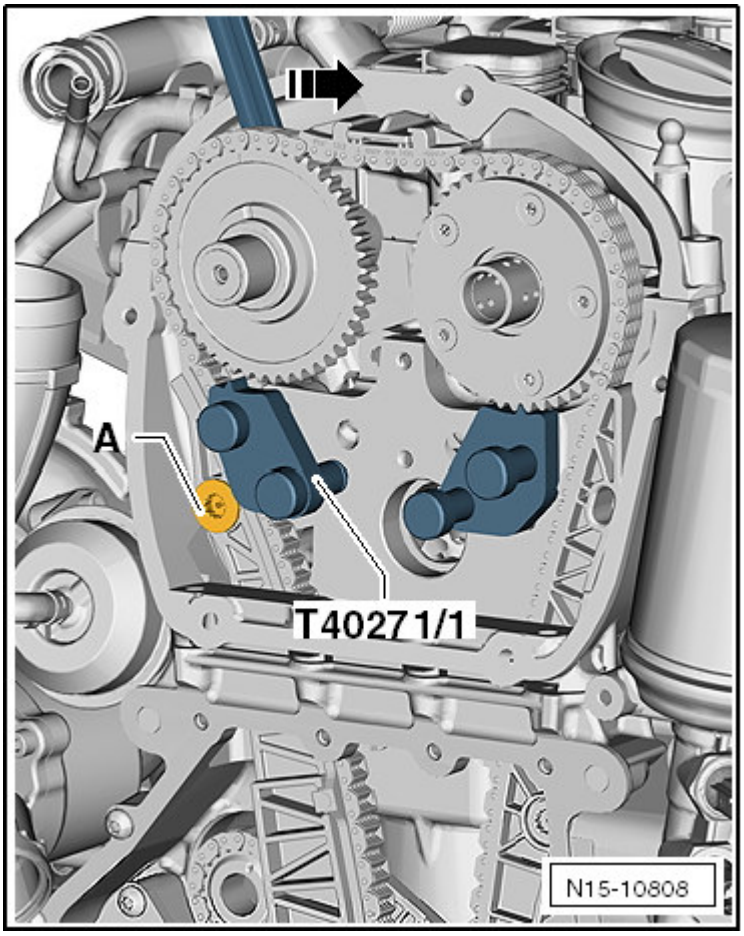

Fig. 75: NO CONTENT

-- Remove the guide pin -A- and slide the tensioning rail down. Continue to counter hold the camshaft.

-- Rotate the exhaust camshaft further in a clockwise direction -1- until the camshaft locating toolT40271/1 can be pushed into the sprocket splines in the -direction of arrow 2- .

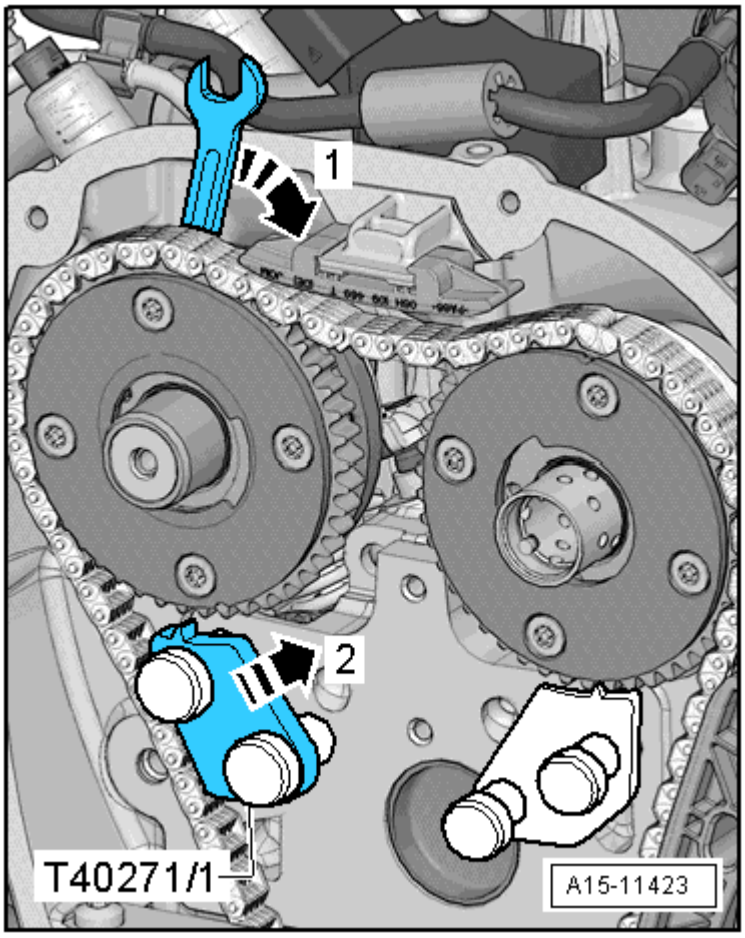

Fig. 76: Attach T40271/1 To Cylinder Head

-- Remove the guide rail -1- by unlatching the latch with a screwdriver and pushing the guide rail forward. Mark the position of the sprockets -arrow- to the camshaft locating tools.

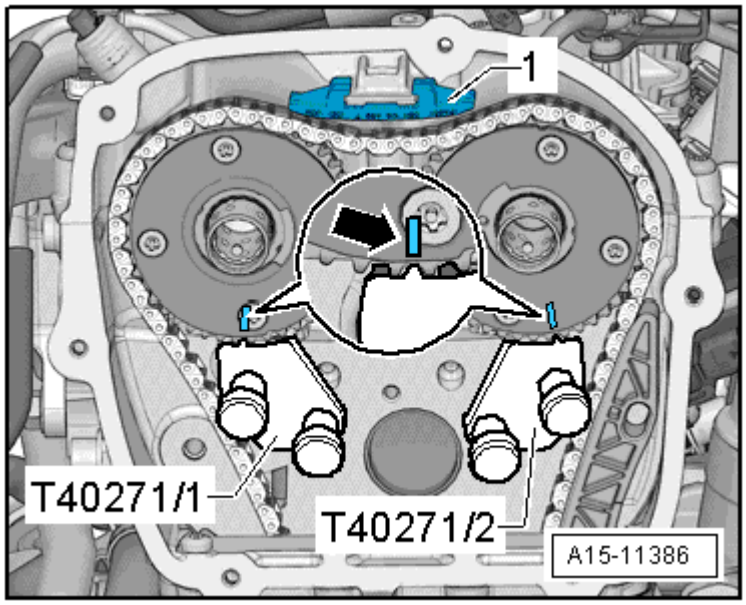

Fig. 77: Mark The Camshaft Sprocket

-- Remove the camshaft timing chain from the sprockets.

CAUTION: Risk of damaging valves and piston crowns.

- **If the camshaft timing chain was removed from the cylinder head, then the crankshaft must not be turned further.**

-- Turn the plugs -arrows- counterclockwise 90° (1/4 turn) in the -direction of the arrow- and remove them.

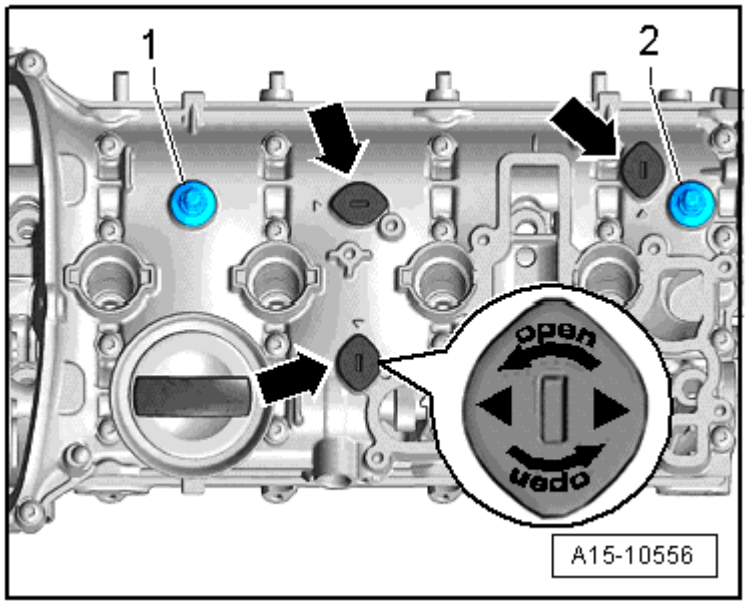

Fig. 78: Ball Head And Sealing Plug

-- Remove the ball studs -1 through 2- .

-- Remove the cap.

-- Remove the bolts -arrows- .

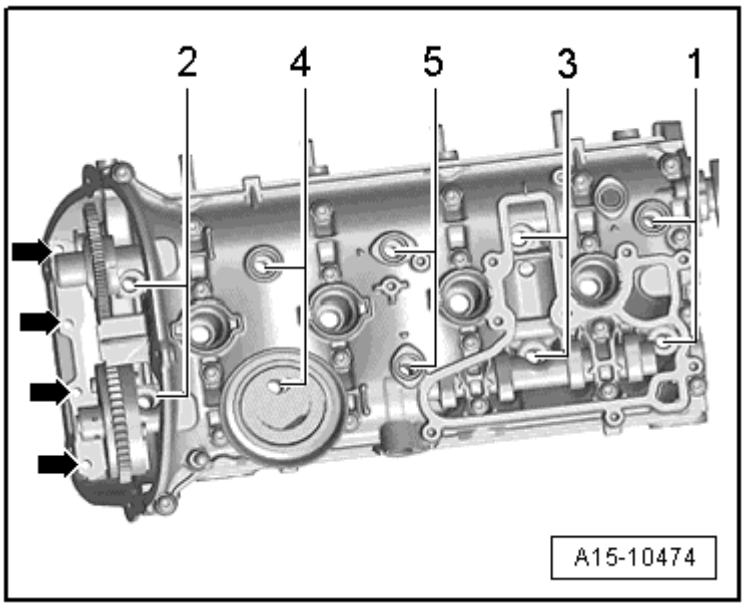

Fig. 79: Cylinder Head Loosening Sequence

-- Remove the cylinder head bolts in sequence -1 through 5- using the polydrive bit and drive socketT10070.

NOTE: Make sure all wires and lines are disconnect!

Pay attention to the tensioning and guide rails when lifting the cylinder head.

-- Remove the cylinder head.

-- Lay the cylinder head on a soft surface, such as foam.

Install the cylinder head. Refer to **CYLINDER HEAD => Installing**.

If the camshafts are replaced, the previous marks must be transferred. For this reason, the following steps are important:

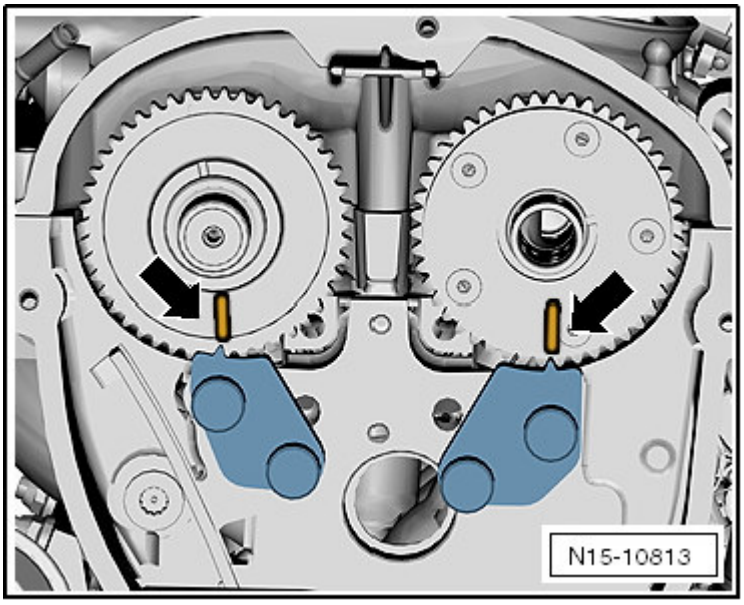

Fig. 80: NO CONTENT

-- Mark the camshaft sprockets to the camshaft locating toolsT40271/1 and T40271/2 -arrow- on the removed cylinder head.

NOTE: The following distance gauge indicates whether the marks were transferred correctly later on.

-- Measure the distance from the left outer edge of the bar -A- to the mark -B- on the intake camshaft sprocket and write down the value.

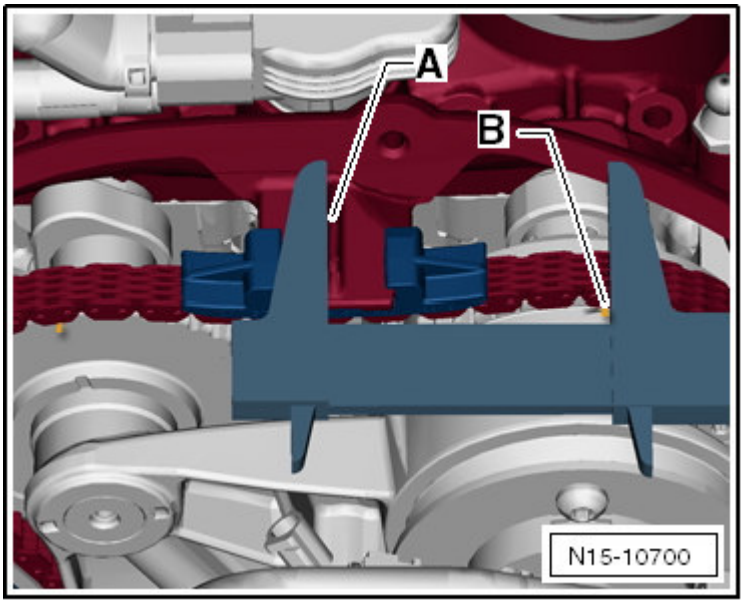

Fig. 81: Identifying Measurement Points From Outer Edge -A- To Mark -B-

-- Measure the distance between the mark on the intake camshaft sprocket -B- and the mark on the exhaust

camshaft sprocket -C- and write down the value.

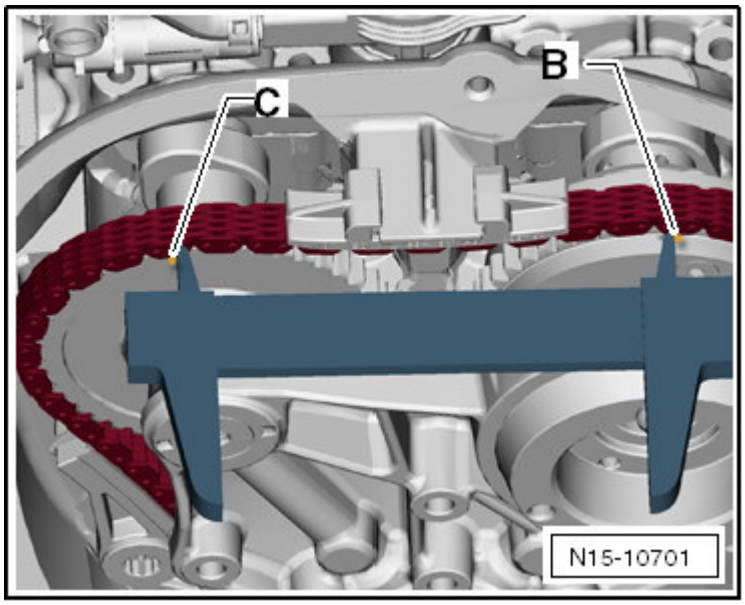

Fig. 82: Identifying Measurement Points From Mark On Intake Camshaft -B- To Mark On Exhaust Camshaft -C-

-- Rotate the intake camshaft using a wrench in the -direction of arrow 1- , slide the camshaft locating toolT40271/2 out of the sprocket splines in the -direction of arrow 2- and bring the camshaft into the rest position.

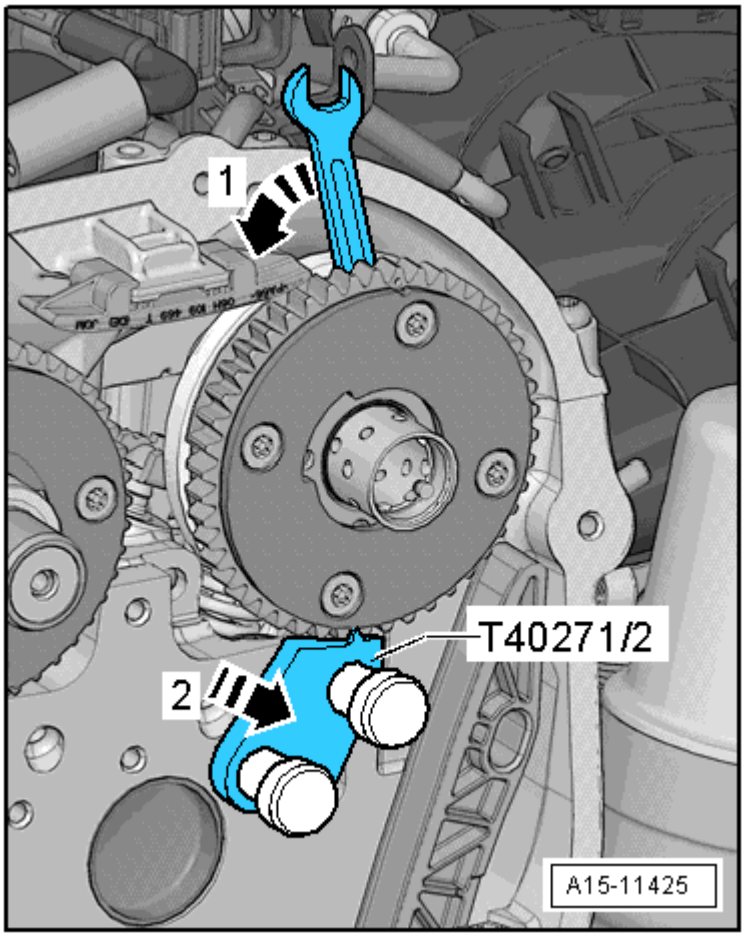

Fig. 83: Turn Intake Camshaft With A Wrench In Direction Of Arrow

-- Remove the camshaft locating toolT40271/2.

-- Rotate the exhaust camshaft using a wrench in the -direction of arrow 1- , push the camshaft locating toolT40271/1 out of the sprocket splines in the -direction of arrow 2- and bring the camshaft into the rest position.

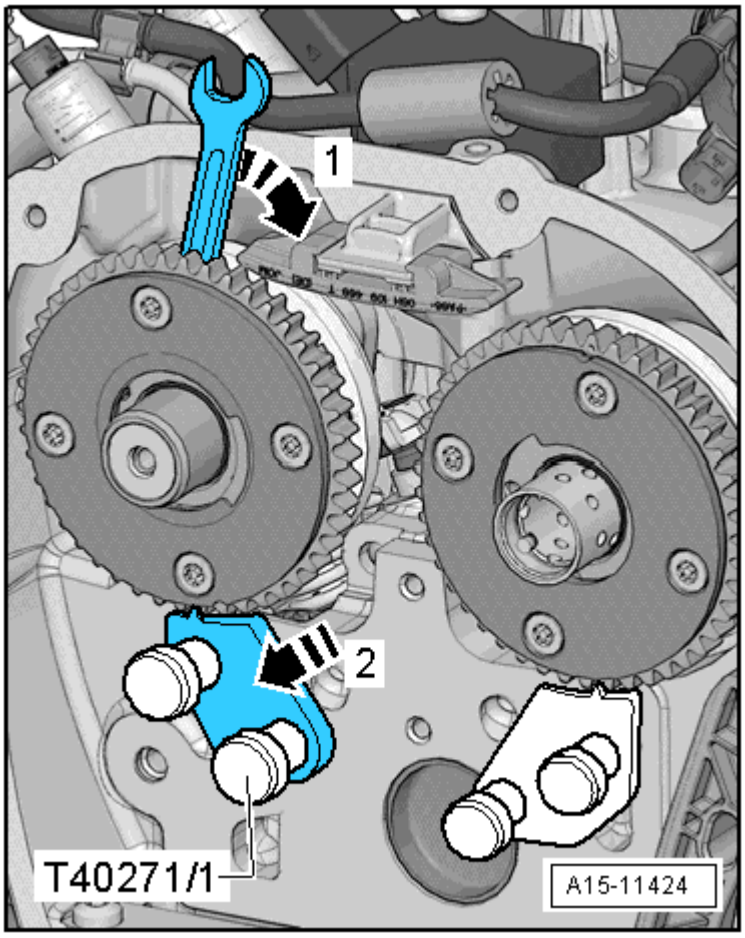

Fig. 84: Turn Exhaust Camshaft With A Wrench In Direction Of Arrow

-- Remove the camshaft locating toolT40271/1.

Now install the cylinder head and transfer the marks that were made when it was removed.

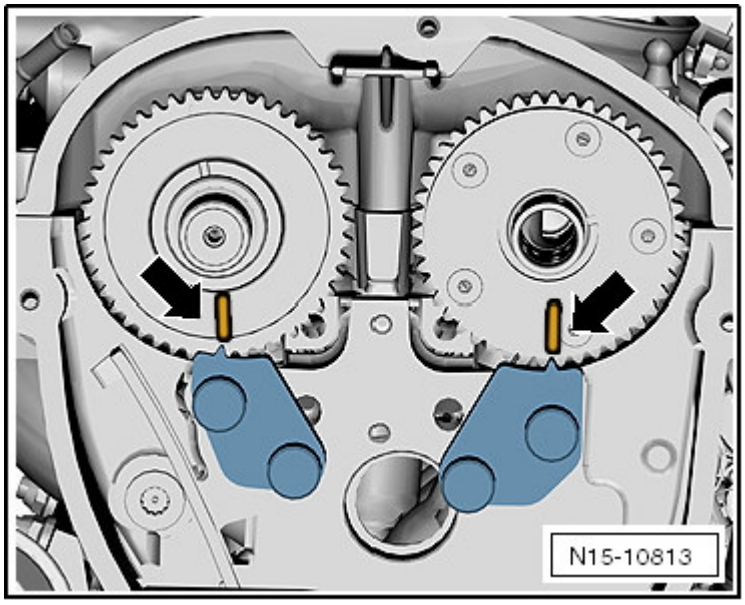

Fig. 85: NO CONTENT

-- Bolt the camshaft locating toolT40271/2 to the installed cylinder head.

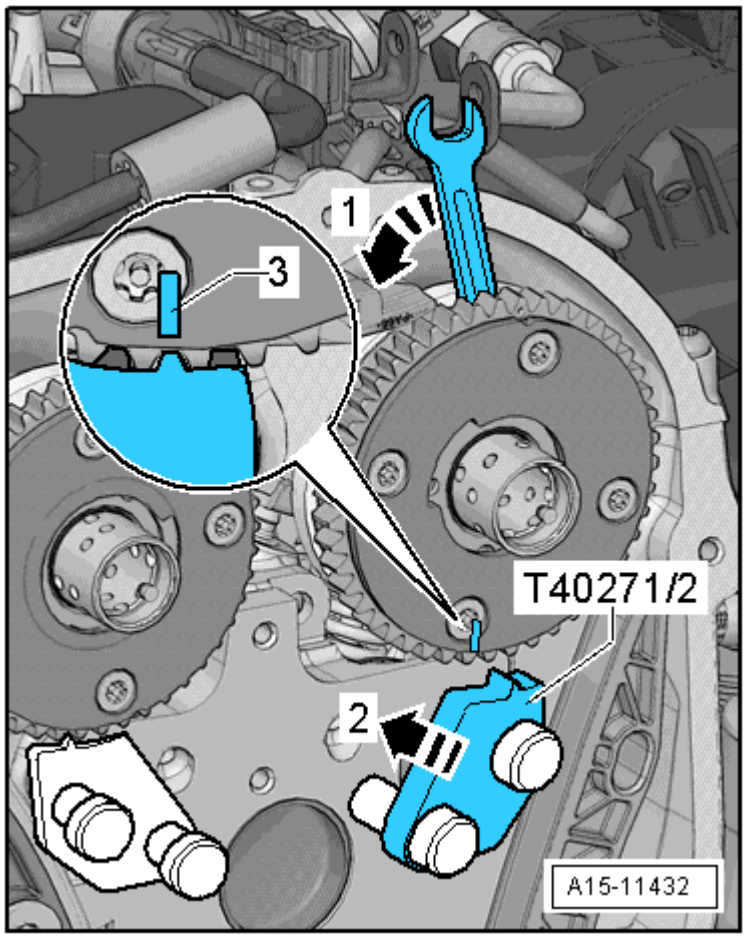

Fig. 86: Attach T40271/2 To Cylinder Head

-- Rotate the intake camshaft in the -direction of arrow 1- until the mark -3- on the sprocket aligns with the camshaft locating toolT40271/2.

-- Push the camshaft locating toolT40271/2 into the sprocket splines in the -direction of arrow 2- .

-- Compare the distance from the left outer edge of the bar -A- to the mark -B- with the previously noted value.

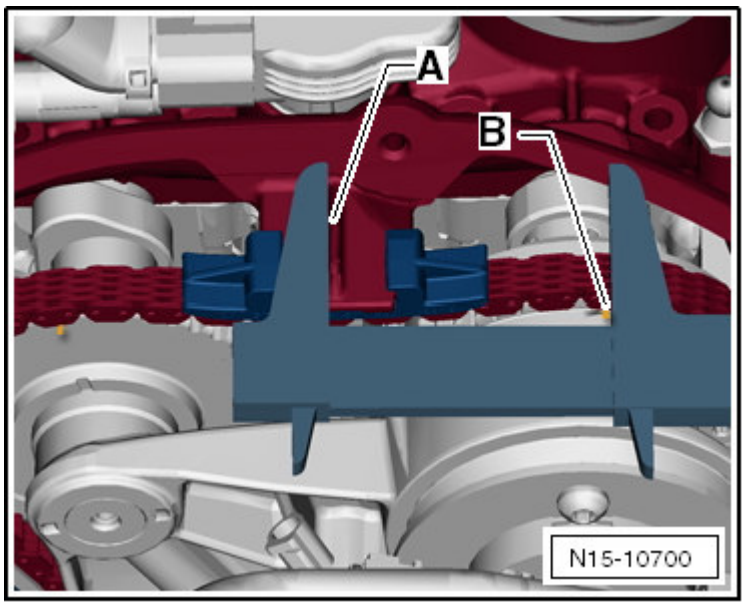

Fig. 87: Identifying Measurement Points From Outer Edge -A- To Mark -B-

-- Bolt the camshaft locating toolT40271/1 to the cylinder head.

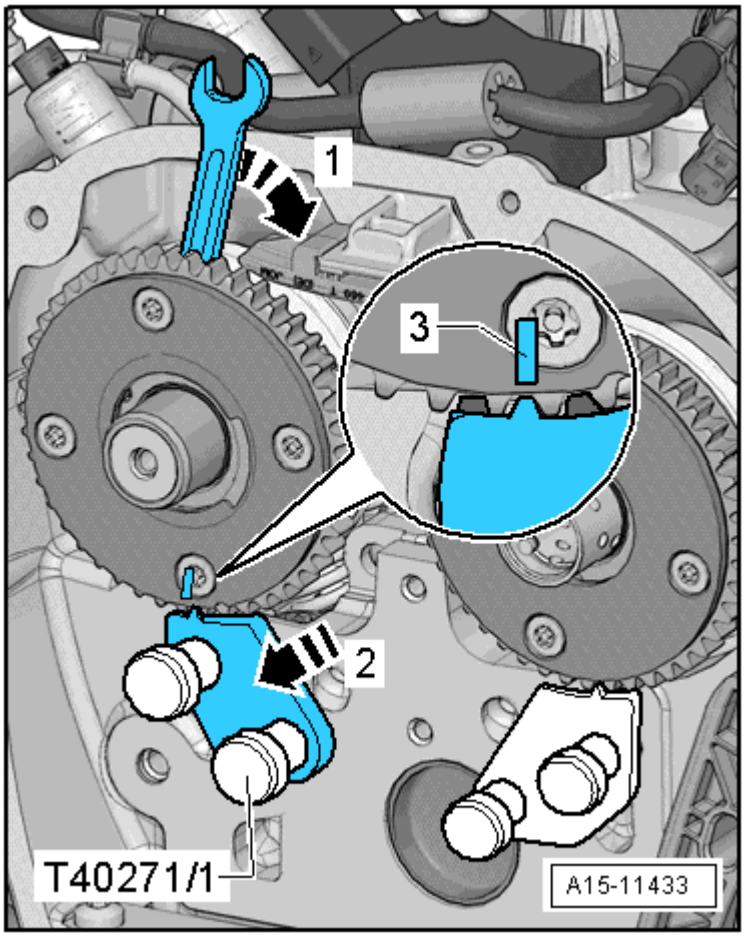

Fig. 88: Attach T40271/1 To Cylinder Head

-- Rotate the exhaust camshaft in the -direction of arrow 1- until the mark -3- on the sprocket aligns with the camshaft locating toolT40271/1.

-- Push the camshaft locating toolT40271/1 out of the sprocket splines in the -direction of arrow 2- .

-- Compare the distance between the mark on the intake camshaft -B- to the mark on the exhaust camshaft -C- with the previously noted value.

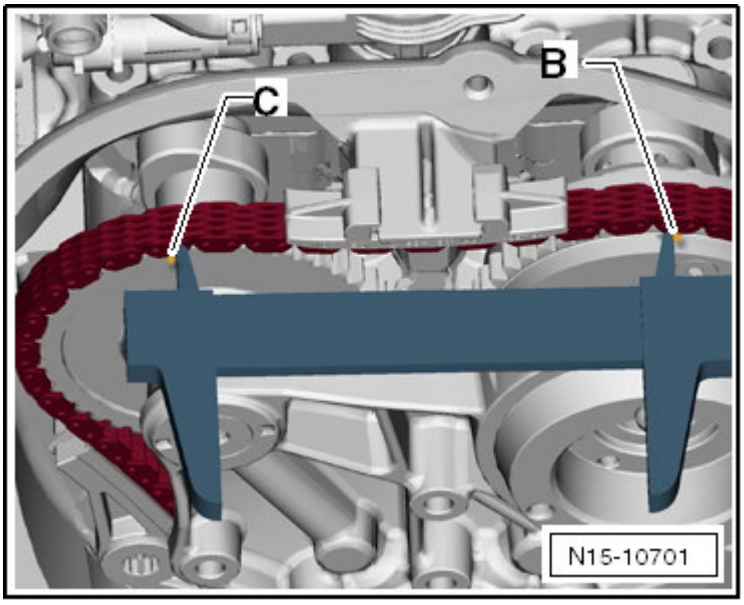

Fig. 89: Identifying Measurement Points From Mark On Intake Camshaft -B- To Mark On Exhaust Camshaft -C-

Installing

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

CAUTION: The sealing surfaces could be damaged.

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

Risk of damaging the 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 gasket leaking.

- **Carefully remove all grinding and sanding residue.**
- **Only unpack the new cylinder head gasket immediately prior to installation.**
- **To prevent the cylinder head gasket silicone layer and recessed areas from being damaged, always handle the gasket extremely carefully.**

Risk of damaging open valves.

- **If a replacement cylinder is installed, only remove the plastic base right before the cylinder head is installed to protect the open valves.**

Risk of damaging valves and piston heads after working on the valvetrain.

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

NOTE: **Replace the bolts which have been tightened to an additional torque angle.**

Replace self-locking nuts, sealing rings, seals and O-rings.

If a replacement cylinder is installed, the contact surfaces between the hydraulic lash adjusters, roller rocker arms and cam running surfaces must be lubricated before installing the camshafts.

The hose supports, charge air pipes and hoses must be free of oil and grease before installing.

Secure all hose connections with hose clamps of the same type as those equipped by the factory. Refer to the Parts Catalog.

To mount the charge hoses on their connectors securely, spray the bolts on the used clamps with rust remover before installing.

It is necessary to replace all the coolant and engine oil whenever the cylinder head or the cylinder head gasket are replaced.

-- Set the cylinder head gasket in place.

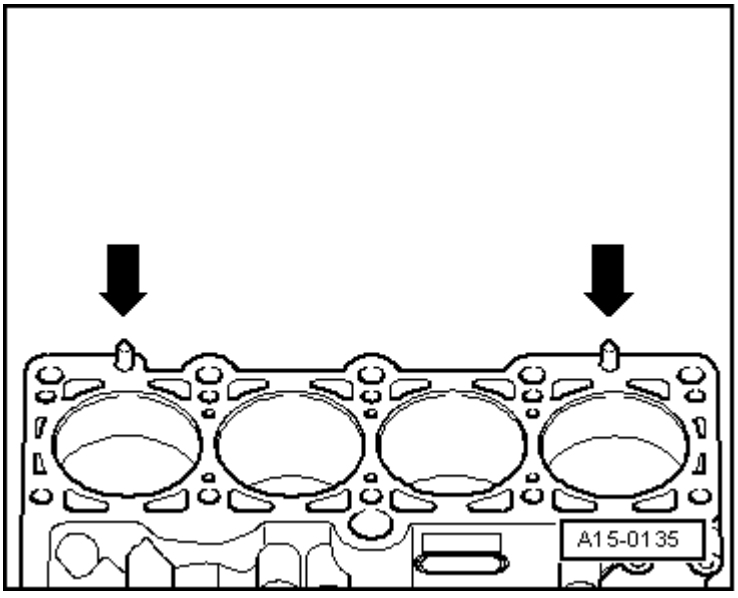

Fig. 90: Cylinder Block Centering Pins

- Pay attention to centering pins -arrows- in cylinder block.
- Observe he cylinder head gasket location, identification: The part number must be visible from the intake side.

CAUTION: By rotating the crankshaft, the timing chain tightens upward so that it does not jam.

-- In the event the crankshaft has been rotated in the meantime: Set the cylinder 1 piston to TDC and rotate crankshaft back again slightly.

-- Set the cylinder head in place.

-- Install the cylinder head bolts and tighten them hand tight.

-- Cylinder head bolt tightening sequence, refer to **Fig. 4**.

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

CAUTION: By rotating the crankshaft, the timing chain tightens upward so that it does not jam.

-- Rotate the vibration damper using the counter hold toolT10355 into the TDC position -arrow- .

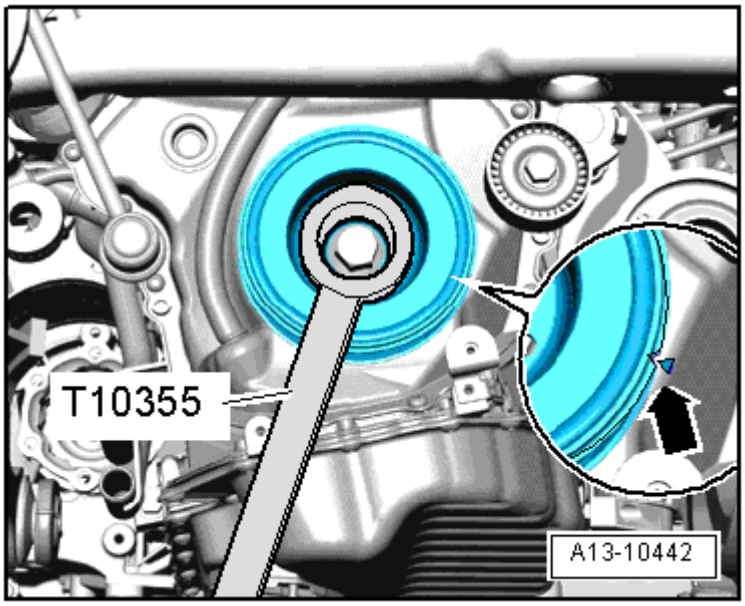

Fig. 91: Identifying Vibration Damper Rotated Into "OT" Position Using Counter Hold Tool T10355

- The notch on the vibration damper must line up with the arrow mark on the lower timing chain cover.

-- Position the marks on the chain links -arrows- at the sprockets -1- to install the camshaft timing chain.

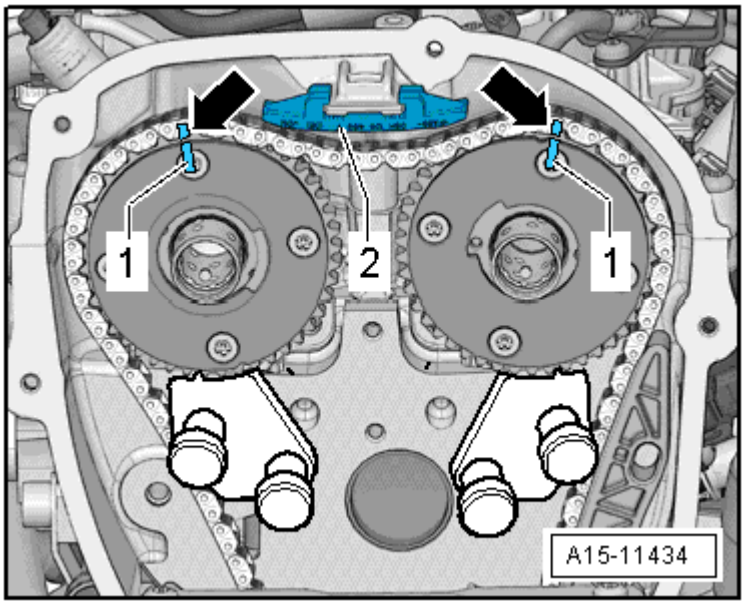

Fig. 92: Position Markings On Chain Links

-- Install the upper guide rail -2- .

NOTE: Use the help of a second mechanic to hold the exhaust camshaft in place.

-- Slowly rotate the exhaust camshaft in the -direction of arrow 1- until the camshaft locating toolT40271/1 can be pushed out from the sprocket splines in the -direction of arrow 2- .

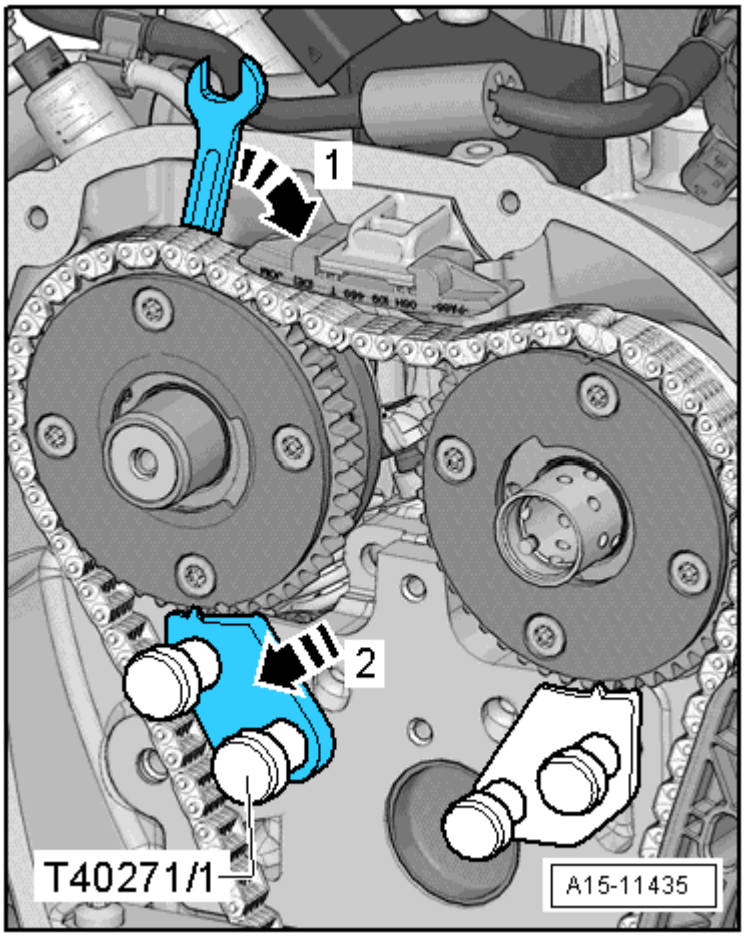

Fig. 93: Turn Exhaust Camshaft In Direction Of Arrow

-- Carefully release the camshaft, until the camshaft timing chain is laying on the upper guide rail. Hold the camshaft in this position.

-- Continue to hold the camshaft and install the camshaft timing chain tensioning rail. Install and tighten the guide pin -A- .

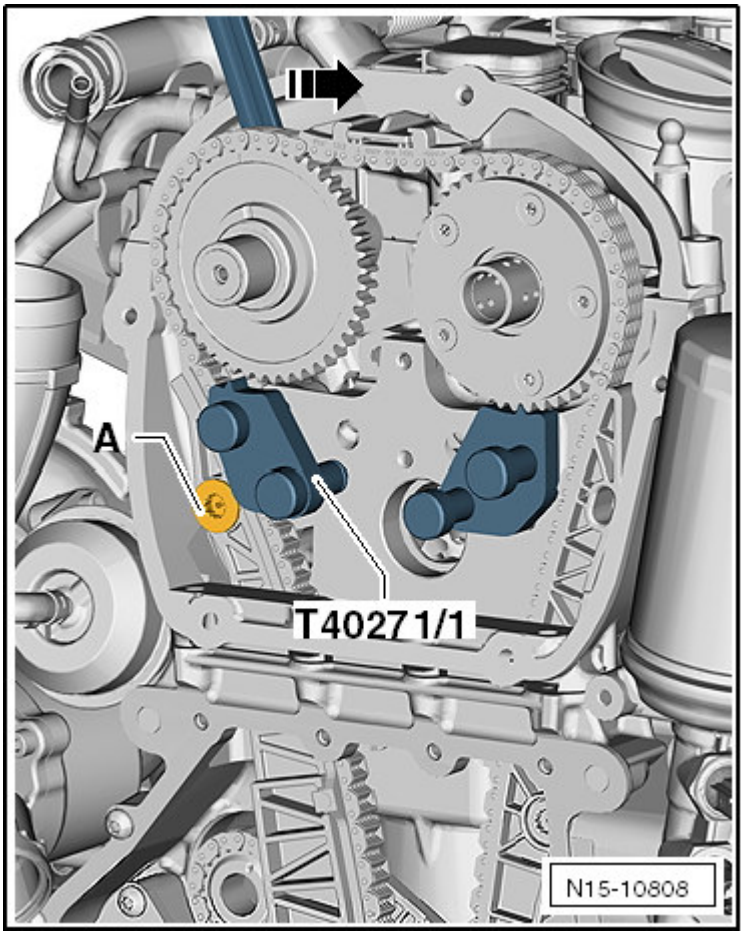

Fig. 94: NO CONTENT

-- Remove the camshaft locating toolT40271/1.

-- Slide the camshaft locating toolT40271/2 out of the sprocket splines in the -direction of arrow 2- . If necessary, slightly rotate the intake camshaft in the -direction of arrow 1- using a wrench.

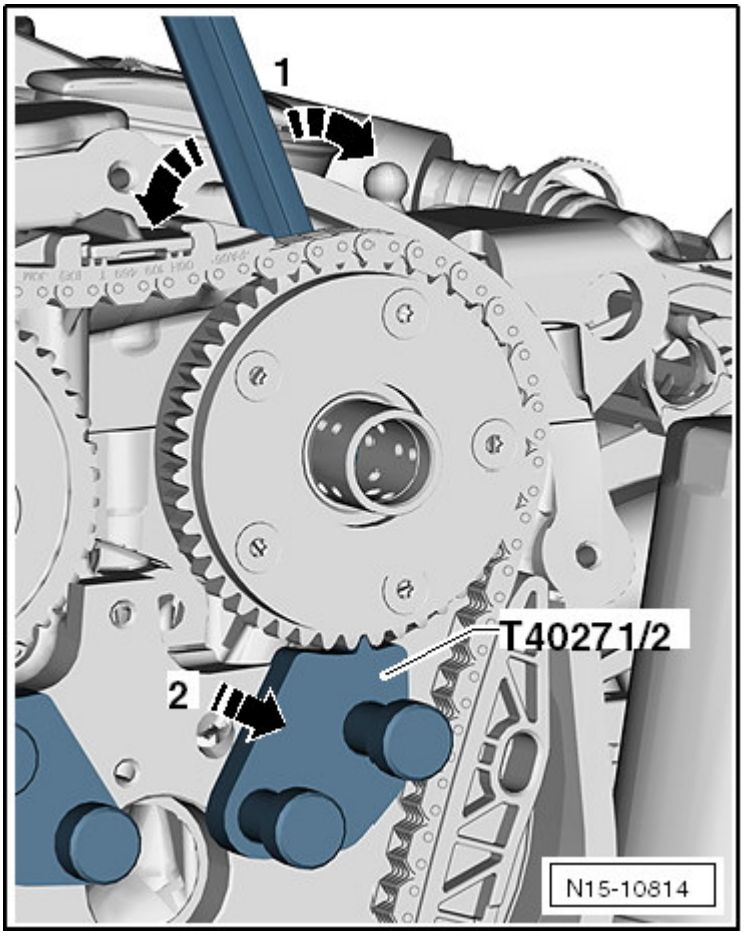

Fig. 95: NO CONTENT

-- Remove the camshaft locating toolT40271/2.

-- Check the valve timing. The camshaft timing chain and cylinder head -arrows- must align with the marks on the sprockets -1- .

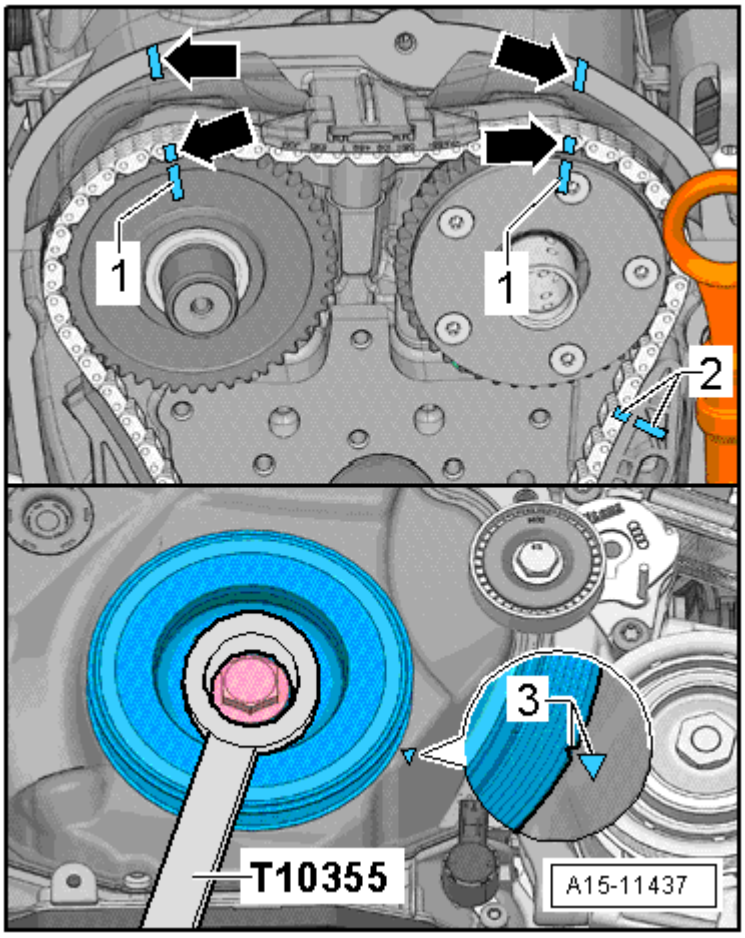

Fig. 96: Check Valve Timing

-- The marks on the camshaft timing chain and the camshaft timing chain guide rail -2- must align with one another.

-- The notch on the vibration damper must be opposite the mark on the lower timing chain cover -3- .

NOTE: If the self-made marks are no longer visible, check the valve timing, refer to VALVE TIMING, CHECKING.

-- Install the bearing bracket evenly. Do not tilt it and install the bolts -arrows- hand tight.

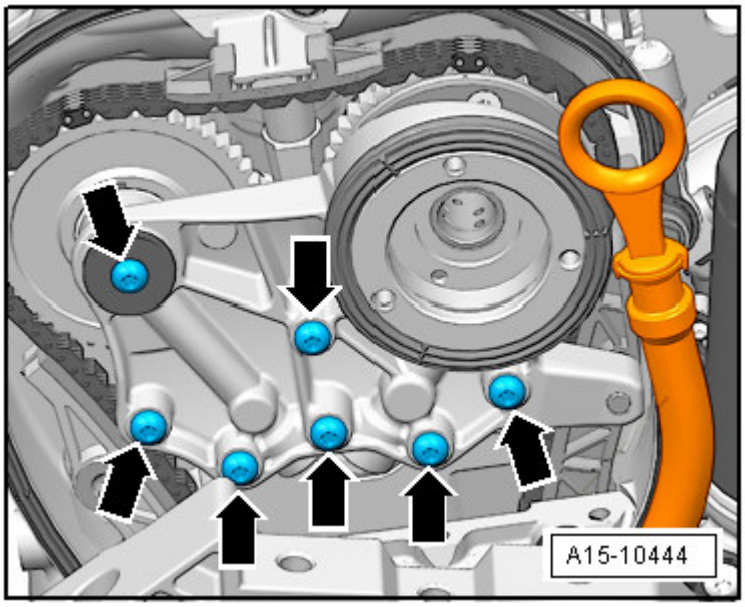

Fig. 97: Bearing Bracket Bolts

-- Remove the locking pinT40011 or the locking toolT40267, depending on the version.

-- Tighten the bolts -arrows- . Refer to **CAMSHAFT TIMING CHAIN OVERVIEW**.

-- Install the bolt -arrow- .

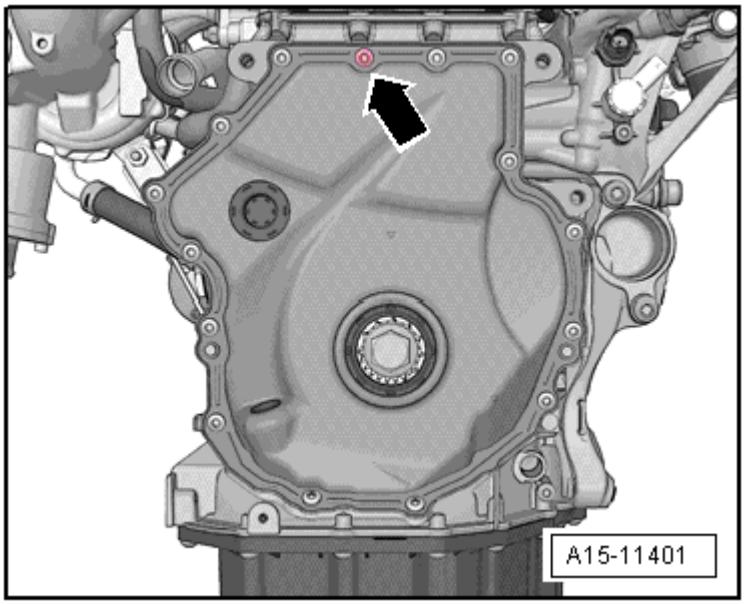

Fig. 98: Identifying Bolt

-- Install the control valve, see -item 6- in the **CAMSHAFT TIMING CHAIN OVERVIEW**.

-- Rotate the intake camshaft using a wrench and mount the timing chain.

Further installation is in the reverse order of removal. Note the following:

-- Change the engine oil.

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

VACUUM PUMP

Removing

-- Remove the engine cover. Refer to **ENGINE COVER**.

-- Remove the air filter housing. Refer to **AIR FILTER HOUSING** .

-- Remove the high pressure pump. Refer to **HIGH PRESSURE PUMP** .

-- Remove the nut -3- and ground wire (GND) and remove the bolt -4- .

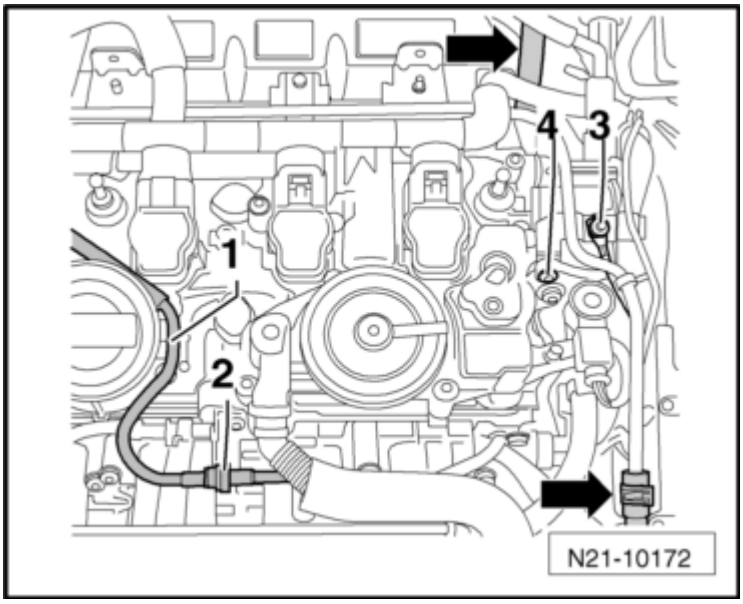

Fig. 99: Identifying Vacuum Line -1-, Ground Wire -3- And Bolt -4-

-- Disconnect the vacuum hose -1- from the vacuum pump.

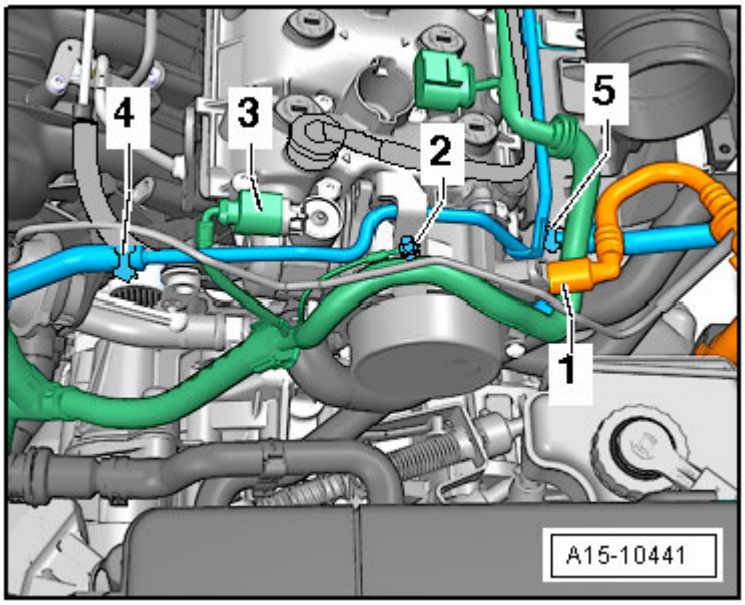

Fig. 100: Identifying Vacuum Pump, Ground Cable, Electrical Connector And Coolant Hoses

-- Remove the bolts -arrows- and remove the vacuum pump.

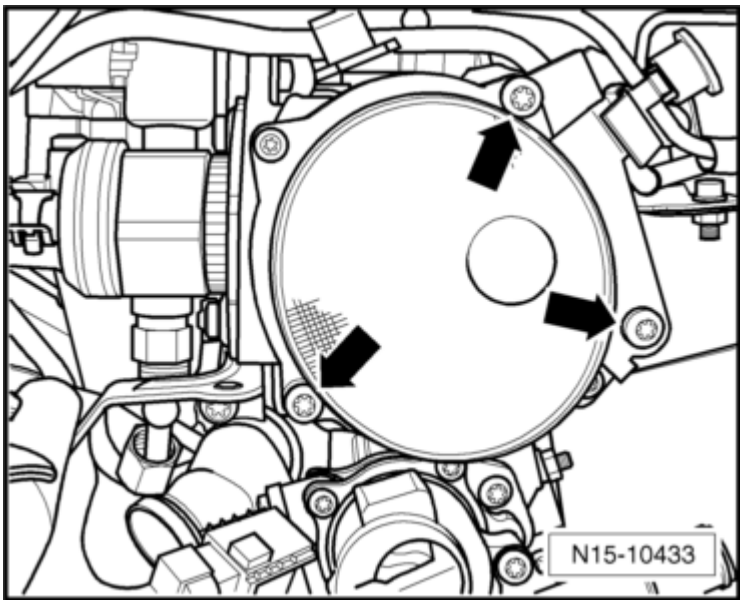

Fig. 101: Identifying Vacuum Pump Bolts

NOTE: Do not disassemble the vacuum pump.

Installing

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

Installation is the reverse of removal, noting the following:

-- Clean the sealing surfaces.

-- Install the seal on the vacuum pump, install 2 bolts and then mount it on the cylinder head.

CAMSHAFT ADJUSTMENT VALVE 1 N205

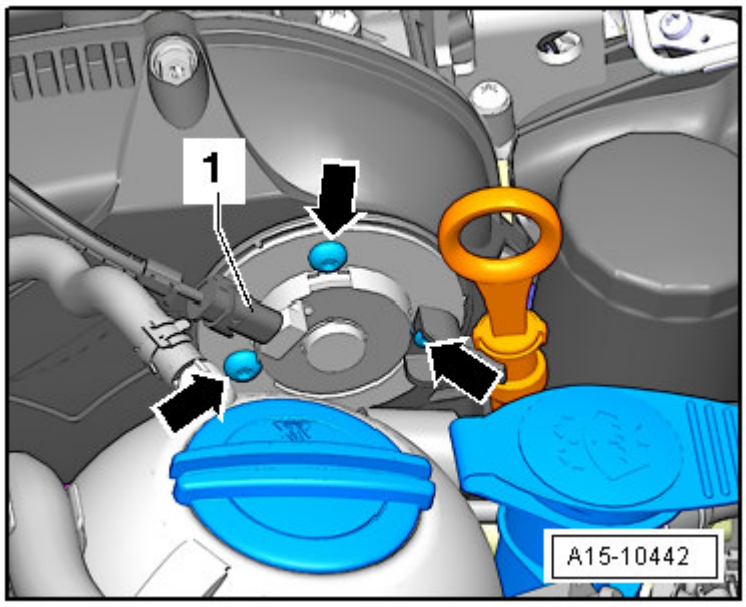

Fig. 102: Camshaft Adjustment Valve And Bolts

-- Disconnect the connector from the camshaft adjustment valve 1 (-1-).

-- Remove the bolts -arrows- and then the camshaft adjustment valve 1.

Installing

- Tightening specification, refer to **TIMING CHAIN COVER OVERVIEW**.

Install in the reverse order of removal. Note the following:

-- Coat the seal and the O-ring with engine oil.

CAMSHAFT

Special tools and workshop equipment required

- Assembly ToolT10352
- Counter Hold ToolT10355
- Locking PinT40011
- LeverT40243
- Locking ToolT40267

- Camshaft LocatorT40271
- Thrust PieceT10174
- Ignition Coil PullerT40039
- Silicone SealantD 154 103 A1

NOTE: **The sealing surfaces of the cylinder head cover and the cylinder head must not be reworked.**

The camshaft bearings are integrated in the cylinder head and cylinder head cover. The tension must be released from the camshaft timing chain before removing the cylinder head cover.

If the cylinder head cover was removed, the sealing cap must be replaced.

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

Removing

-- Remove the engine cover. Refer to **ENGINE COVER**.

-- Remove the vacuum pump. Refer to **VACUUM PUMP**.

-- Remove the noise insulation. Refer to one of the following:

GTI and Tiguan, refer to **Description and Operation**

Eos and Passat, refer to "Noise Insulation" in **Removal and Installation** .

CC, refer to "Noise Insulation" in **Description and Operation**

-- Remove the right wheel housing liner. Refer to **Removal and Installation** .

-- Remove the bolts -arrows- .

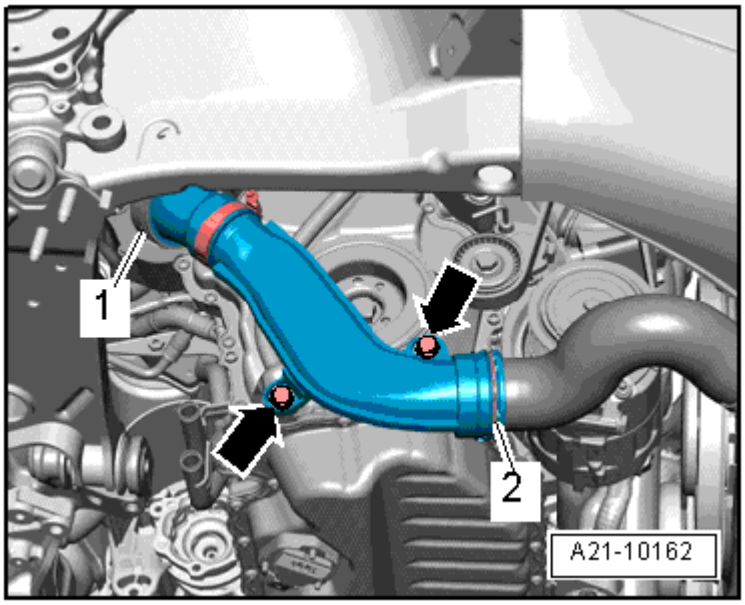

Fig. 103: Air Guide Pipe And Bolts

-- Lift the clamps -1 and 2- and remove the charge air pipe.

-- Disconnect the connector -1- from the camshaft adjustment valve 1.

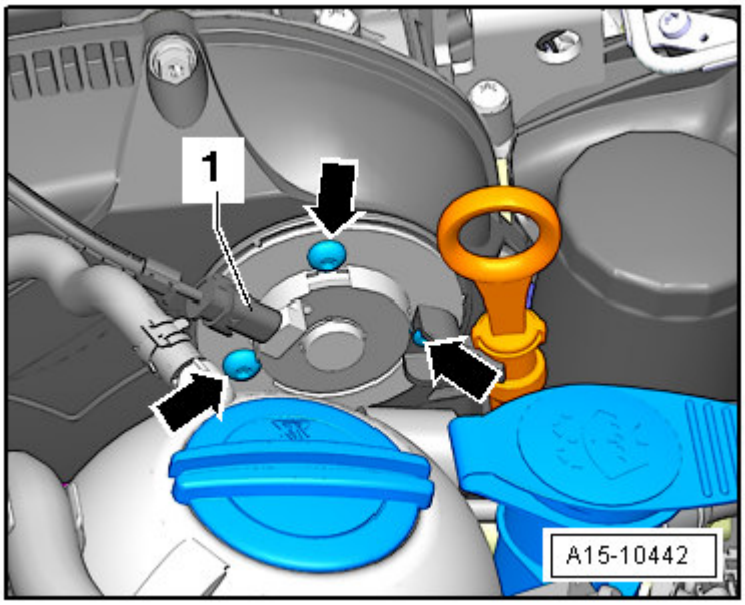

Fig. 104: Camshaft Adjustment Valve And Bolts

-- Remove the bolts -arrows- and then the camshaft adjustment valve 1.

-- Remove the upper timing chain cover. Refer to **UPPER TIMING CHAIN COVER**.

-- Remove the control valve in the -direction of the arrow- using the assembly toolT10352.

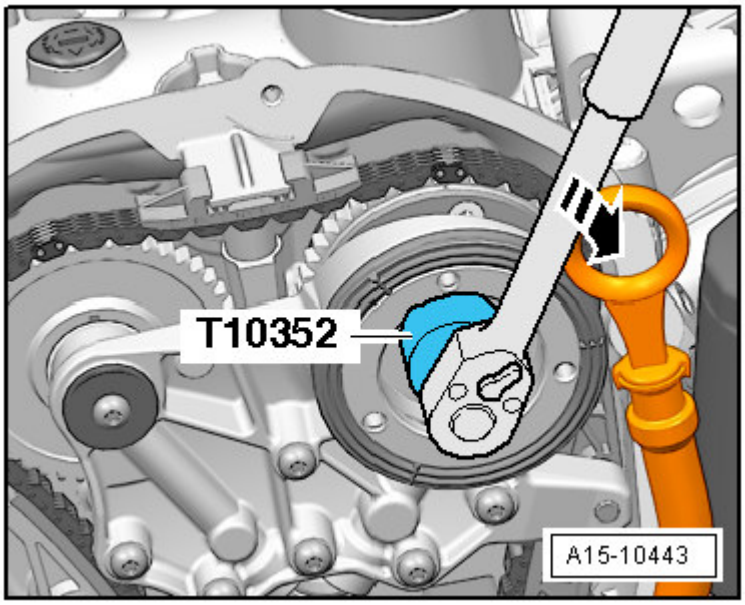

Fig. 105: Identifying Assembly Tool T10352 To Remove Control Valve

CAUTION: The control valve has a left hand threads.

-- Remove the bolts -arrows- and remove the bearing bracket.

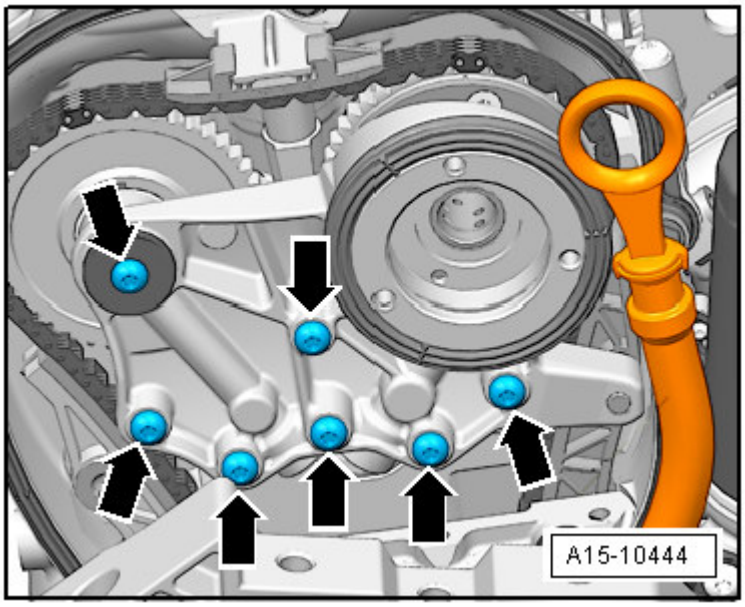

Fig. 106: Bearing Bracket Bolts

-- Rotate the vibration damper using the counter hold toolT10355 into the Top Dead Center (TDC) position -arrow- .

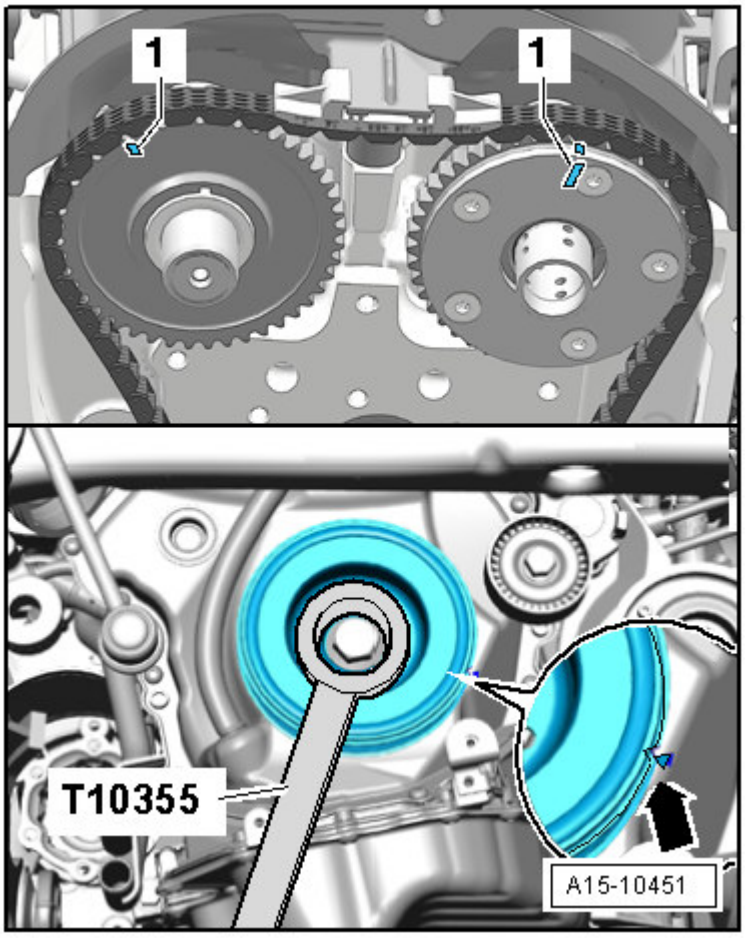

Fig. 107: Identifying Markings -1- On Camshafts Aligned To Point Upward

- The notch on the vibration damper must line up with the arrow mark on the lower timing chain cover.
- The marks -1- on the camshafts must point upward.

-- Apply marks on the camshaft timing chain and the cylinder head -arrows- to match the marks on the sprockets -1- using a waterproof marker.

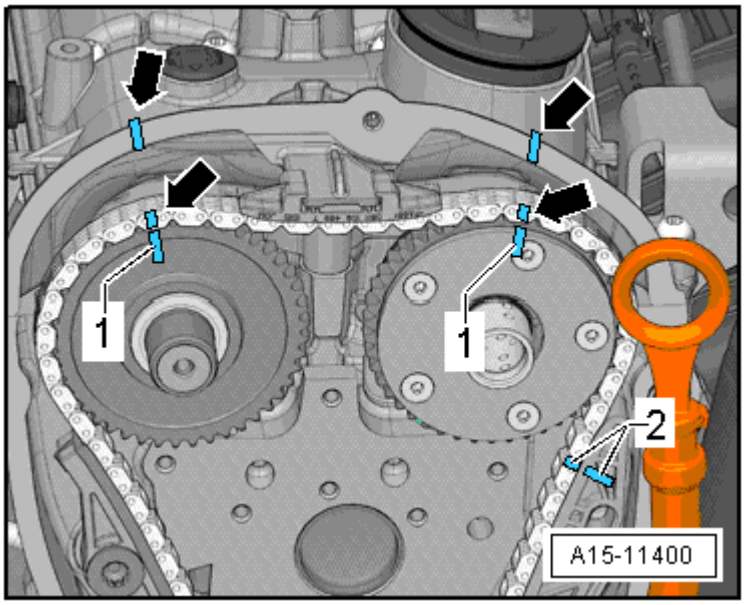

Fig. 108: Mark camshaft timing chain and the cylinder head

-- In addition, apply marks on the camshaft timing chain and the camshaft timing chain guide rail -2- using a waterproof marker.

-- Remove the plug -arrow- .

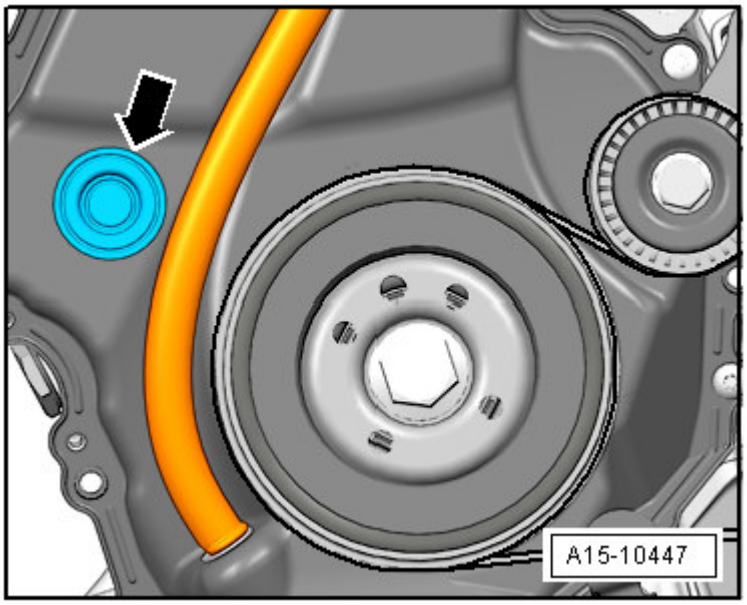

Fig. 109: Locating Plug

-- Remove the bolts -arrows- .

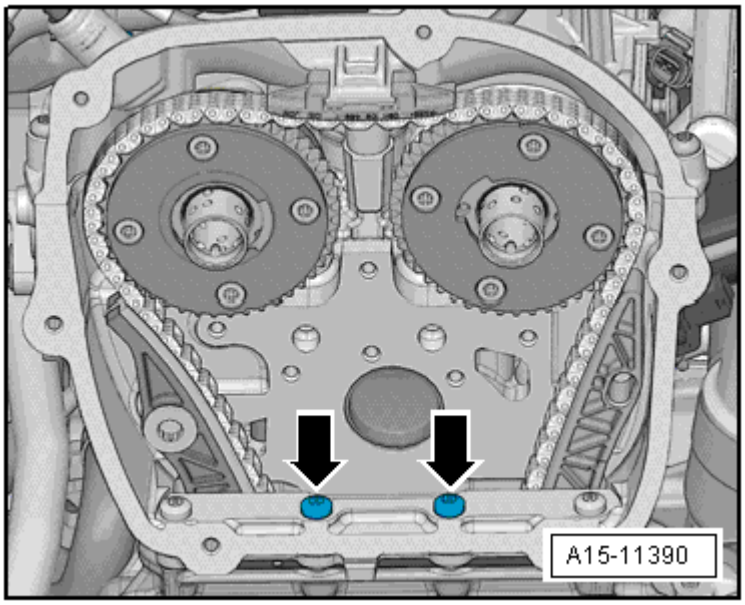

Fig. 110: Identifying Bolts

-- Remove the bolt -arrow- .

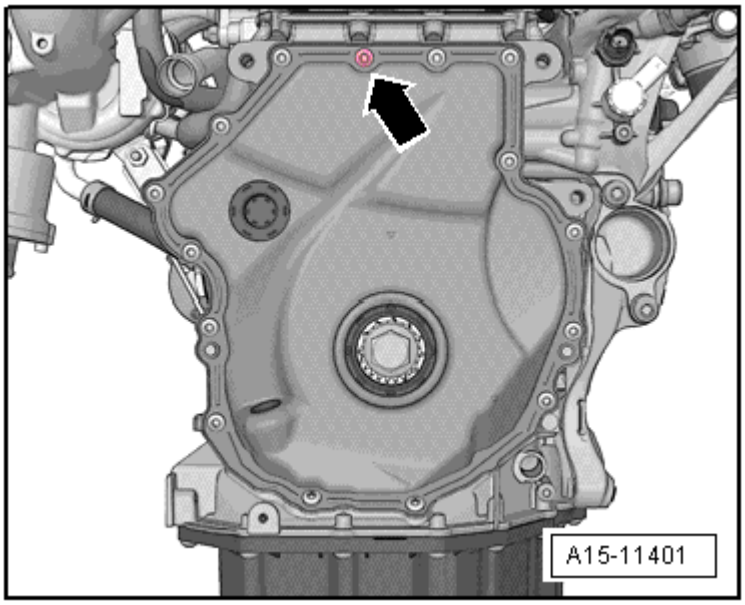

Fig. 111: Identifying Bolt

Two different chain tensioners may be installed.

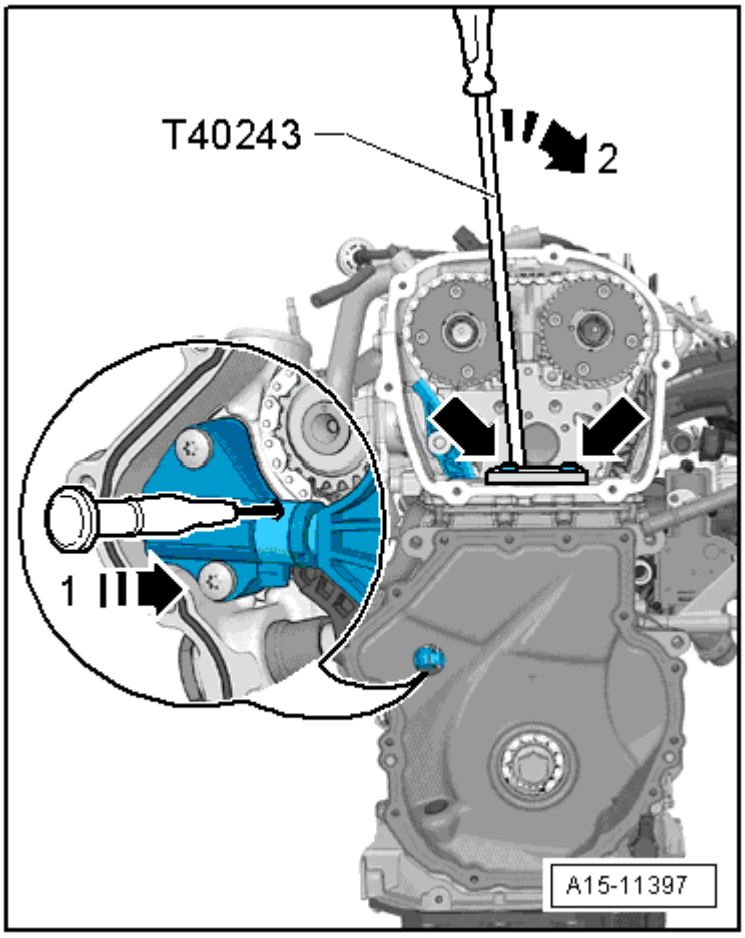

Fig. 112: Identifying Version 1

Version 1:

-- Install the leverT40243 -arrows- .

-- Lift up the locking wedge for the chain tensioner -arrow 1- . Sand the end of the locking pinT40011 down to a point. A screwdriver with a head approximately 1.5 mm wide can also be used.

CAUTION: There is a risk of damaging the chain tensioner. Proceed very carefully.

-- Slowly press and hold the leverT40243 in the -direction of arrow 2- .

-- Secure the chain tensioner using the locking pinT40011.

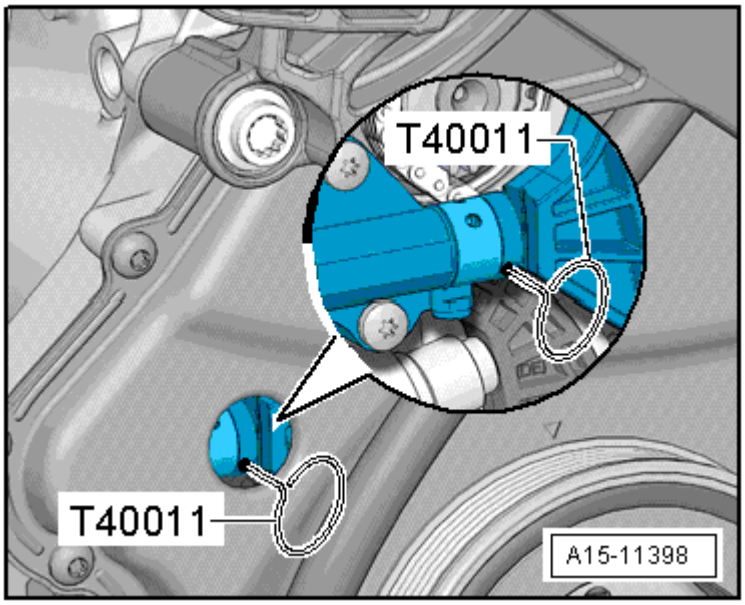

Fig. 113: Securing Chain Tensioner

Version 2:

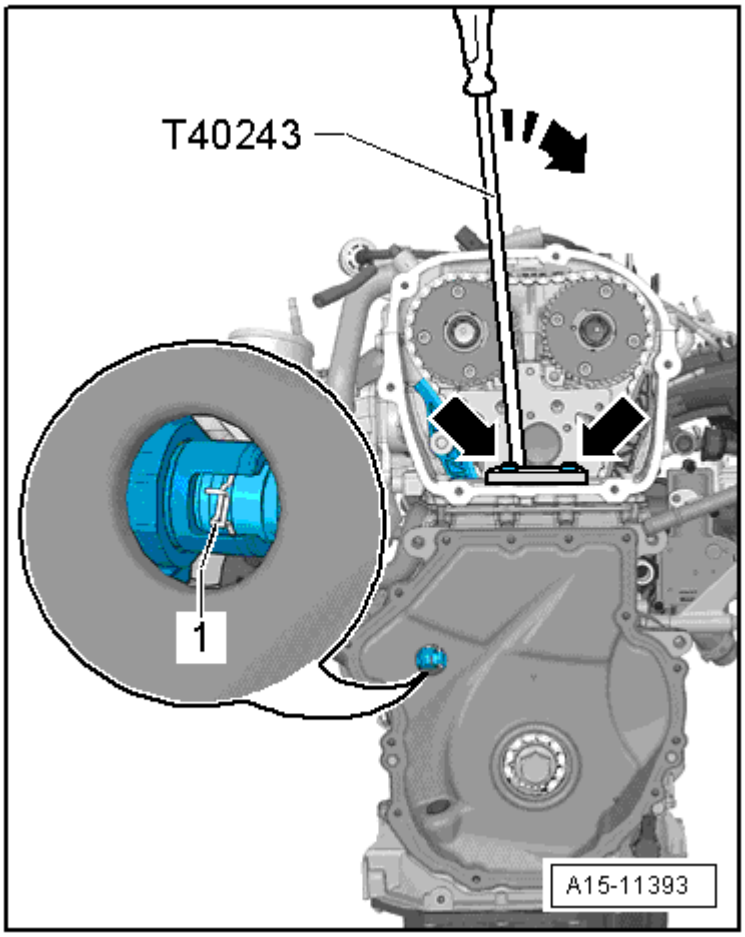

Fig. 114: Identifying Version 2

-- Install the leverT40243 -arrows- .

-- Press the chain tensioner lock ring -arrow- together and slowly press and hold the leverT40243 in the -direction of the arrow- .

-- Secure the chain tensioner using the locking toolT40267.

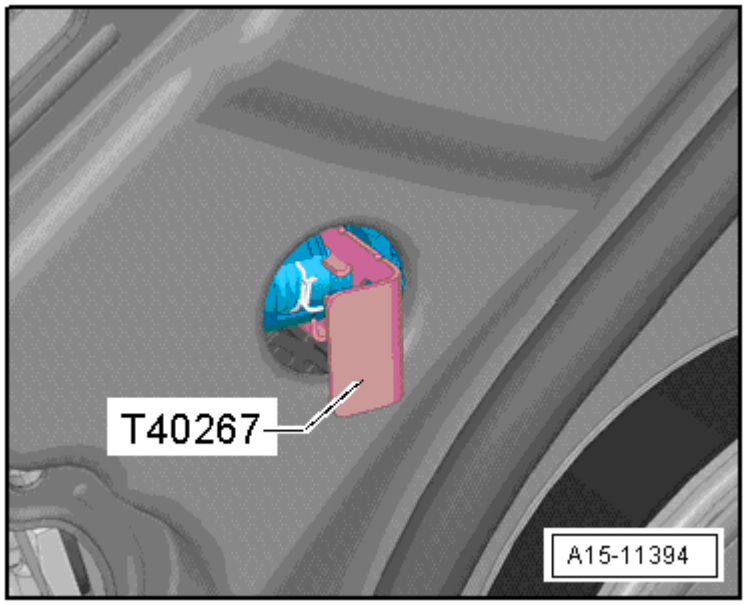

Fig. 115: Securing Chain Tensioner

Continuation for All

-- Remove the leverT40243.

-- Bolt the camshaft locating toolT40271/2 to the cylinder head and push the tool into the sprocket splines in the -direction of arrow 2- . If necessary, slightly rotate the intake camshaft in the -direction of arrow 1- using a wrench.

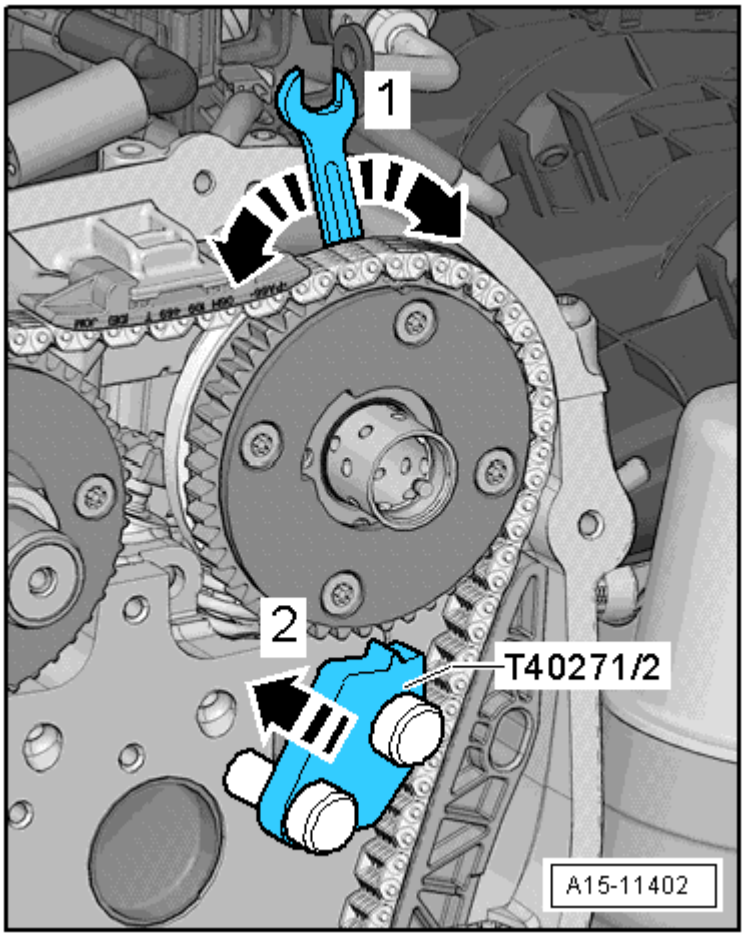

Fig. 116: Bolt Camshaft Locating Tool

-- Bolt the camshaft locating toolT40271/1 to the cylinder head. Counter hold the camshaft with a wrench in a clockwise direction -arrow- .

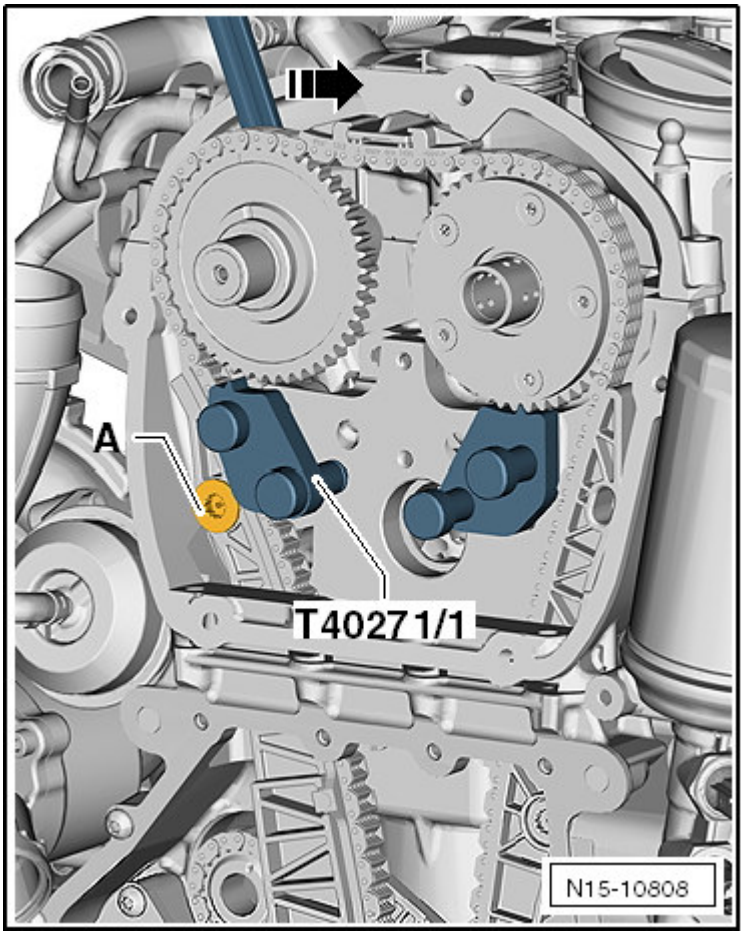

Fig. 117: NO CONTENT

-- Remove the guide pin -A- and slide the tensioning rail down. Continue to counter hold the camshaft.

-- Rotate the exhaust camshaft further in a clockwise direction -1- until the camshaft locating toolT40271/1 can be pushed into the sprocket splines.

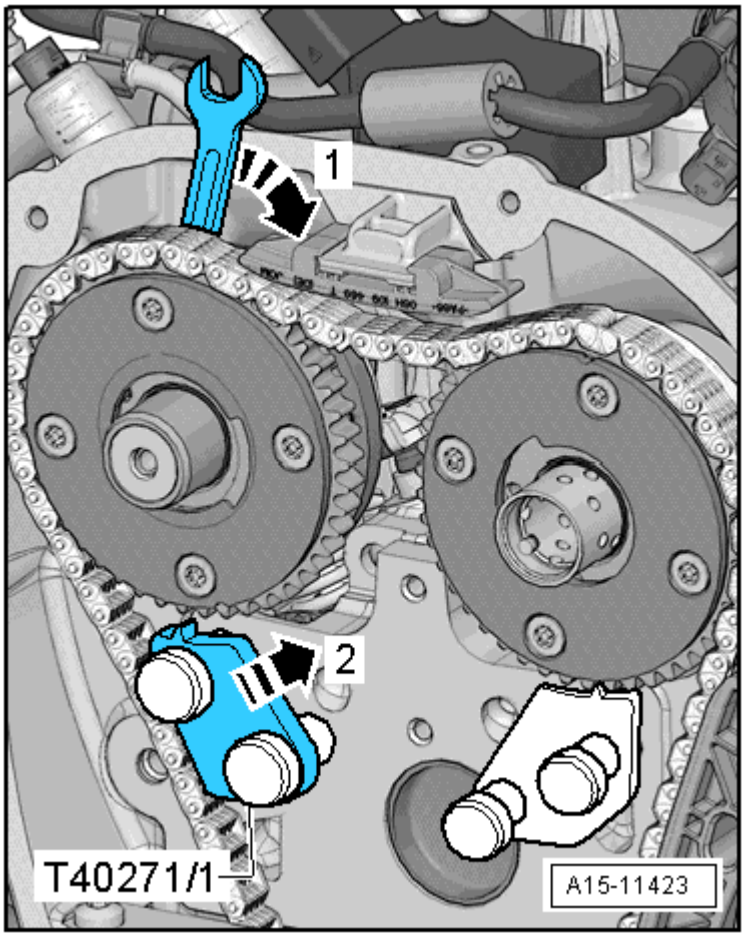

Fig. 118: Attach T40271/1 To Cylinder Head

-- Remove the upper guide rail -1- by unlatching the latch with a screwdriver and pushing the guide rail forward. Mark the position of the sprockets -arrow- to the camshaft locating tools.

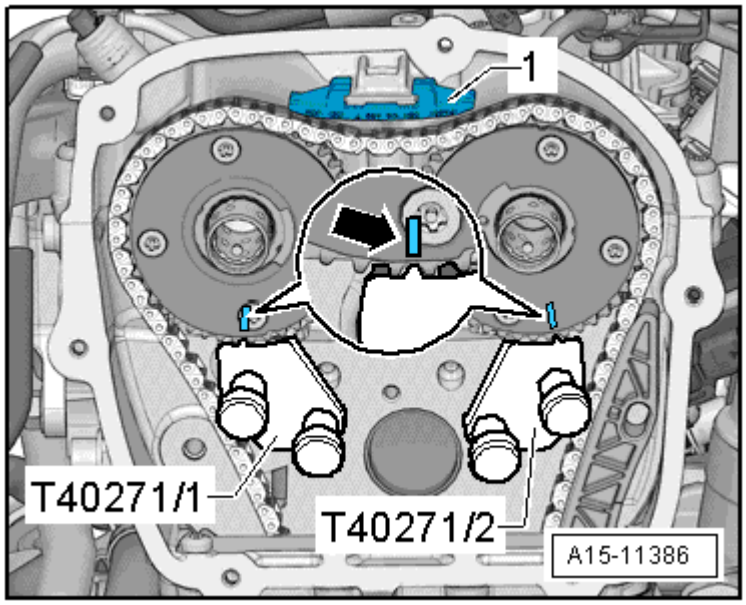

Fig. 119: Mark The Camshaft Sprocket

-- Remove camshaft timing chain from the chain sprockets.

CAUTION: Danger of damaging the valves, piston head and lower timing chain cover.

- **Make certain that the timing chain remains tensioned when rotating the crankshaft by hand.**
- **Panels are installed on the lower timing chain cover to prevent the chain from falling down. The panels can bend if the crankshaft is rotated when the chain is loose.**

If the camshafts are replaced, the previous marks must be transferred. For this reason, the following steps are important:

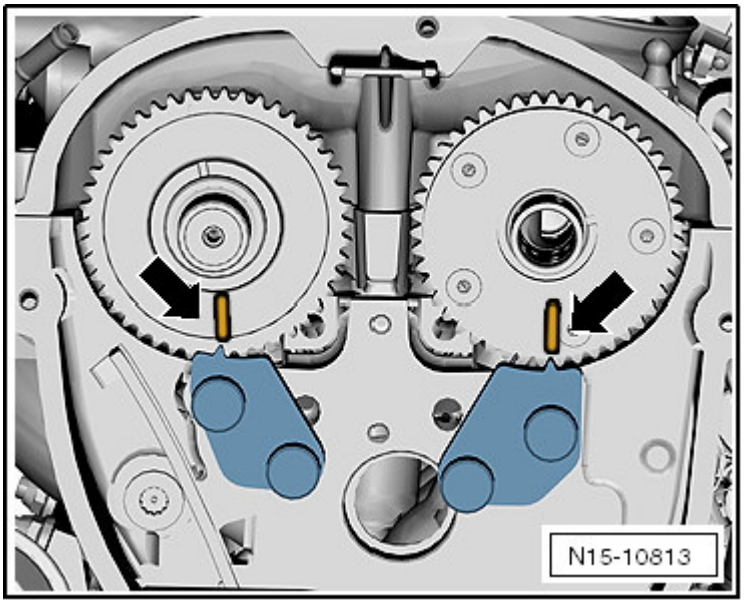

Fig. 120: NO CONTENT

-- Mark the camshaft sprockets to the camshaft locating tools T40271/1 and T40271/2 -arrow- before removing the camshafts.

NOTE: The following distance gauge indicates whether the marks were transferred correctly later on.

-- Measure the distance from the left outer edge of the bar -A- to the mark -B- on the intake camshaft sprocket and write down the value.

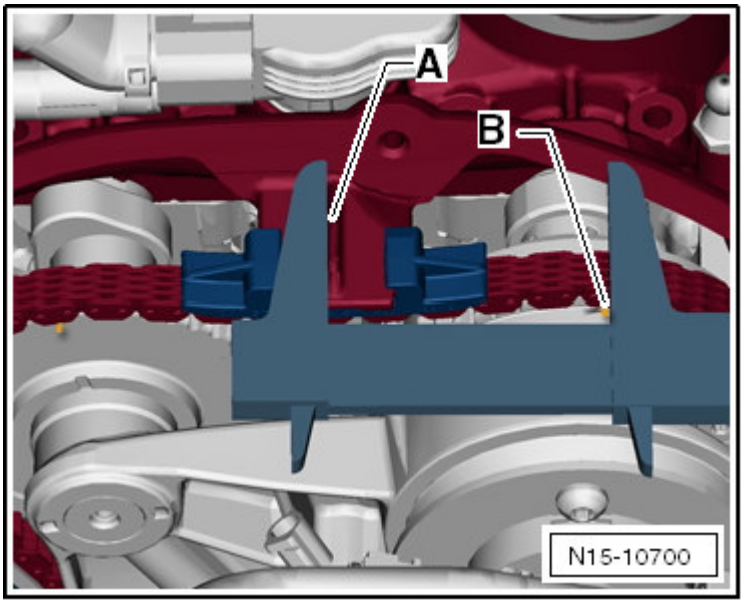

Fig. 121: Identifying Measurement Points From Outer Edge -A- To Mark -B-

-- Measure the distance between the mark on the intake camshaft sprocket -B- and the mark on the exhaust

camshaft sprocket -C- and write down the value.

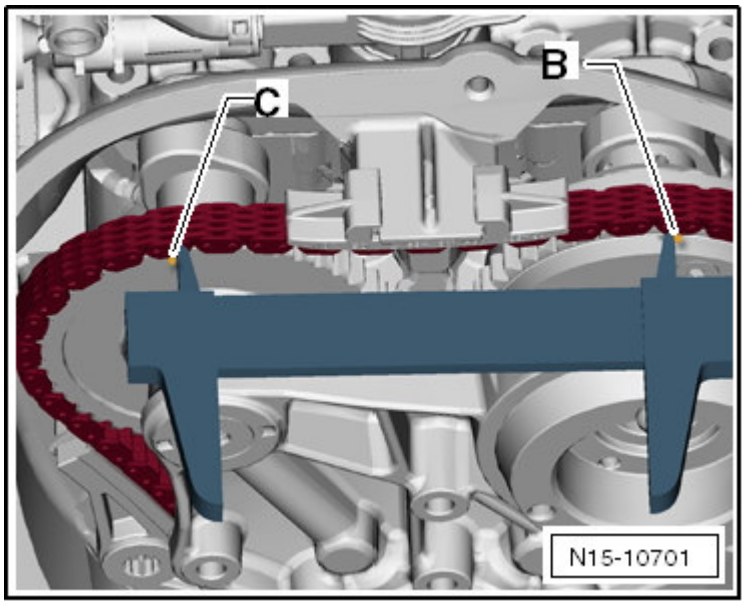

Fig. 122: Identifying Measurement Points From Mark On Intake Camshaft -B- To Mark On Exhaust Camshaft -C-

-- Rotate the intake camshaft in the -direction of arrow 1- using a wrench, push the camshaft locating toolT40271/2 out of the sprocket splines in the -direction of arrow 2- and bring the camshaft into the rest position.

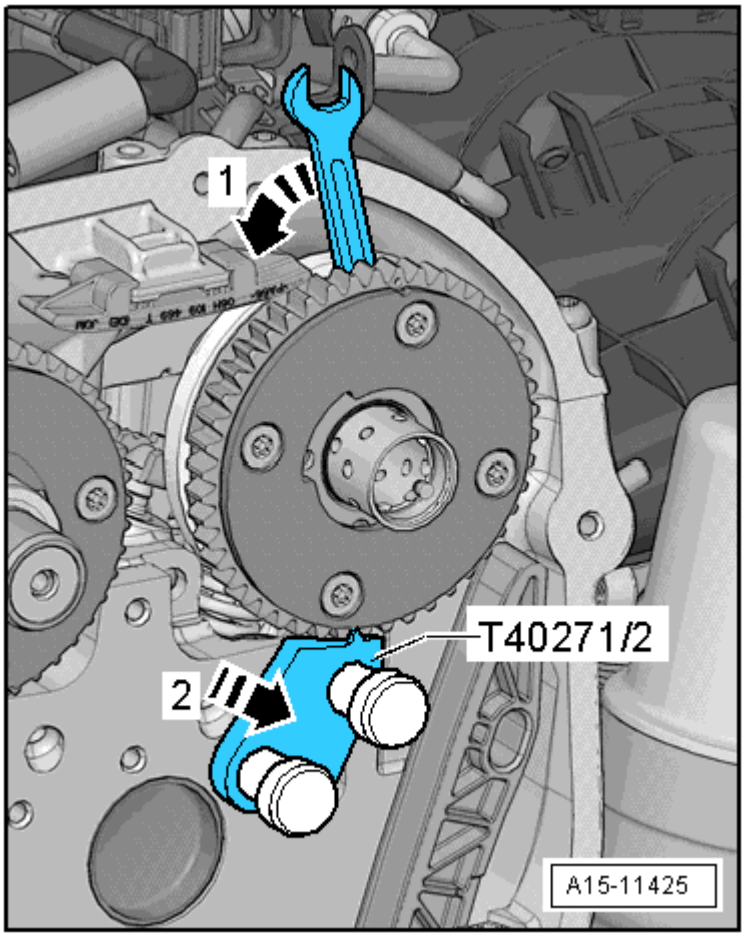

Fig. 123: Turn Intake Camshaft With A Wrench In Direction Of Arrow

-- Rotate the exhaust camshaft in the -direction of arrow 1- using a wrench, push the camshaft locating toolT40271/1 out of the sprocket splines if the -direction of arrow 2- and bring the camshaft into the rest position.

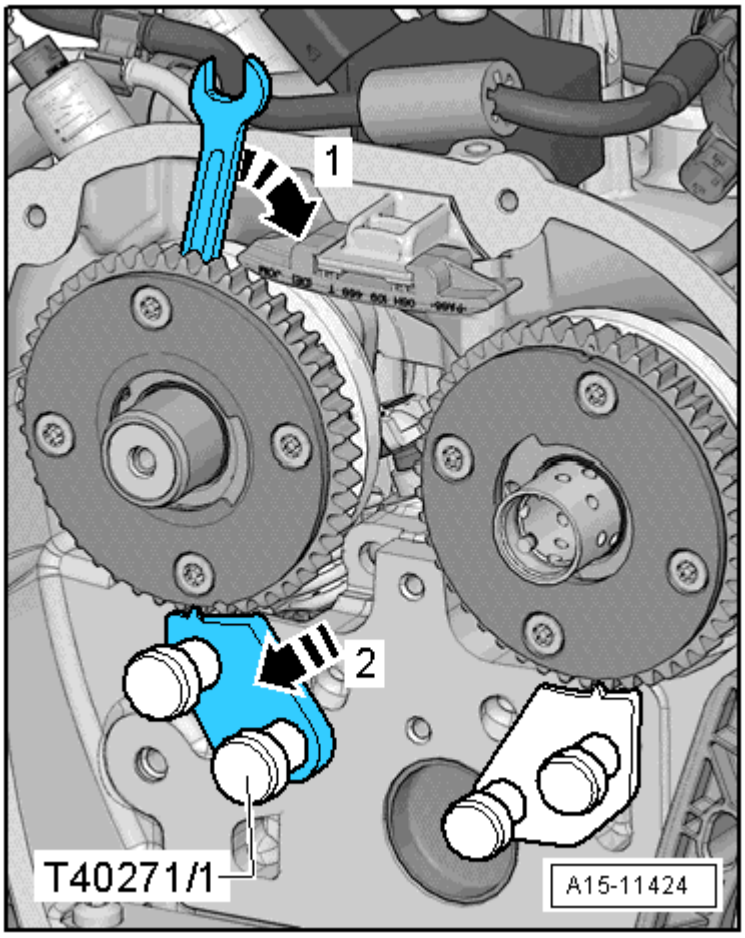

Fig. 124: Turn Exhaust Camshaft With A Wrench In Direction Of Arrow

-- Remover the ignition coils with the power output stages. Refer to **IGNITION COIL WITH POWER OUTPUT STAGE** .

-- Remove the crankcase ventilation bolts -arrows- .

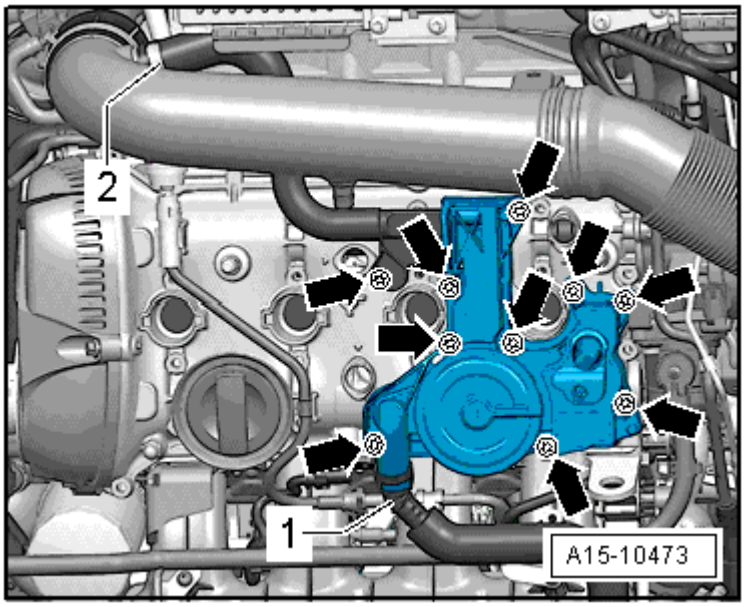

Fig. 125: Crankcase Ventilation, Tightening Sequence

-- Disconnect the hose for the crankcase ventilation - 1 - .

-- Remove the charge air pipe bolt -arrow- .

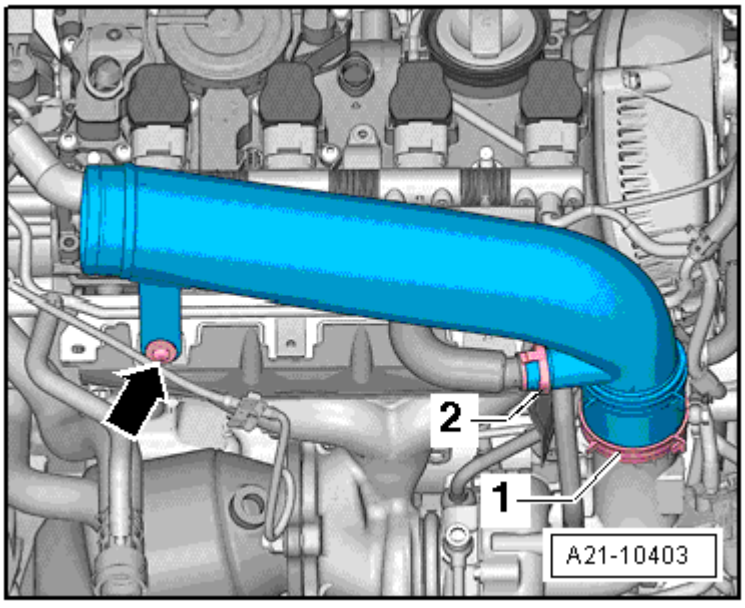

Fig. 126: Locating Air Guide Pipe Bolt

-- Loosen the hose clamp -1- and remove the charge air pipe together with the crankcase ventilation.

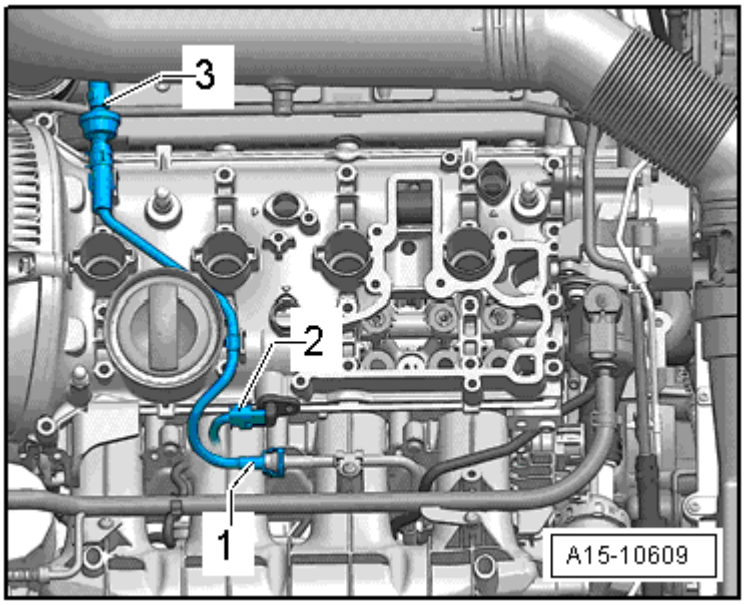

Fig. 127: Camshaft Position Sensor Electrical Harness Connector

-- Disconnect the vacuum line -1- and free up the line.

-- Disconnect the connector -2- from the camshaft position sensor.

-- Remove the cylinder head cover bolts in sequence -1 through 6- .

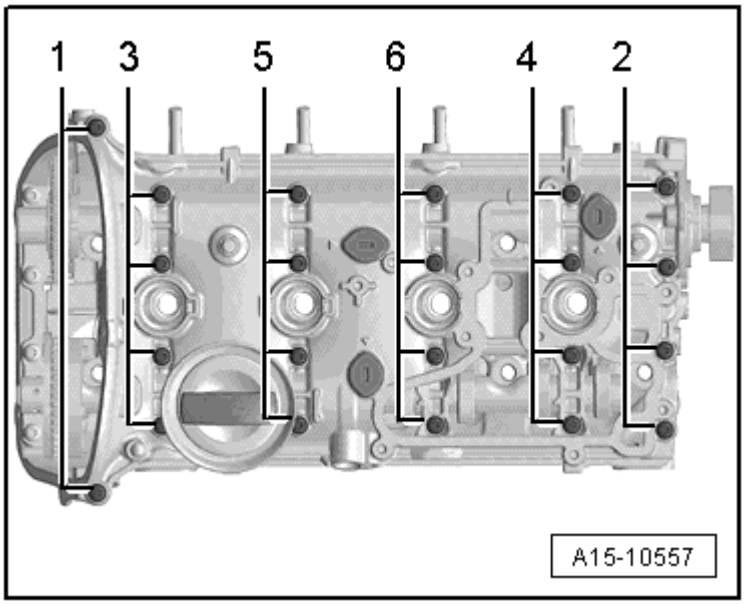

Fig. 128: Cylinder Head Cover Loosening

-- Remove the cylinder head cover.

-- Remove the camshafts.

-- Prevent dirt and adhesive residue from entering the cylinder head.

Installing

Transfer the self applied marks from the removed camshaft to the new camshaft.

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

NOTE: **Do not start the engine for approximately 30 minutes after installing the camshafts. The hydraulic lash adjusters must seat themselves (otherwise the valves will crash into the pistons).**

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

The sealing surfaces must be completely free of oil and grease.

The pistons must not be positioned at TDC.

Make sure that all roller rocker arms make contact correctly on the valve stem tips.

Note the expiration date of the sealant.

The cover must be installed within 5 minutes after application of the sealant.

Prevent dirt and adhesive residue from entering the cylinder head.

-- Remove any sealant residue on the cylinder head using a flat blade scraper.

WARNING: **Wear protective eyewear.**

-- Remove any sealant out of the groove in the cylinder head cover as well as from any sealing surface using, for example, a rotating plastic brush.

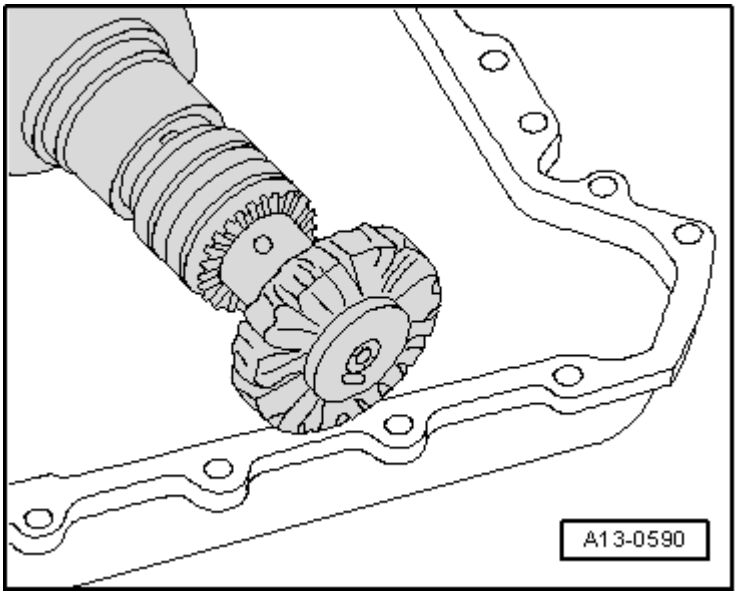

Fig. 129: Identifying Rotating Plastic Brush

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

-- Cut the sealant tube nozzle at the front mark (nozzle diameter: approximately 2 mm).

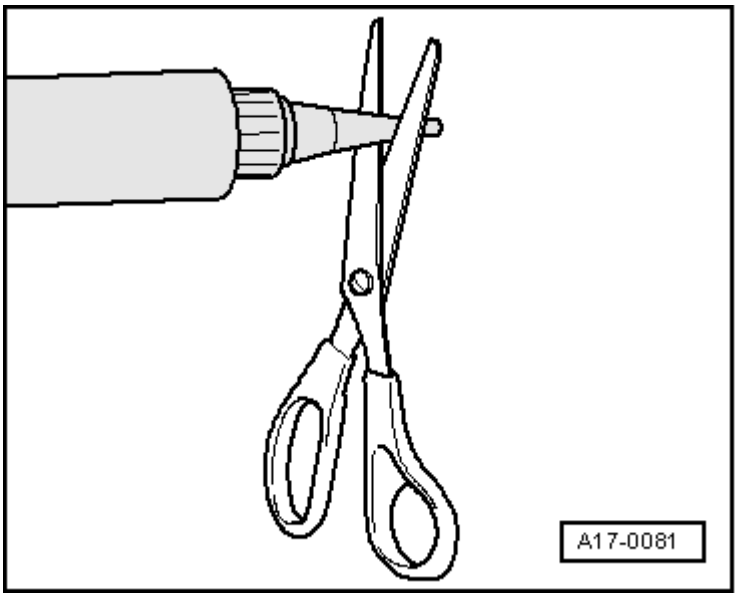

Fig. 130: Cut Tube Nozzle At Front Marking (Nozzle Diameter Approx. 3 Mm)

-- Lubricate the running surfaces of both camshafts.

-- Place the camshaft into the cylinder head, the recesses -arrows- must be perpendicular to each other.

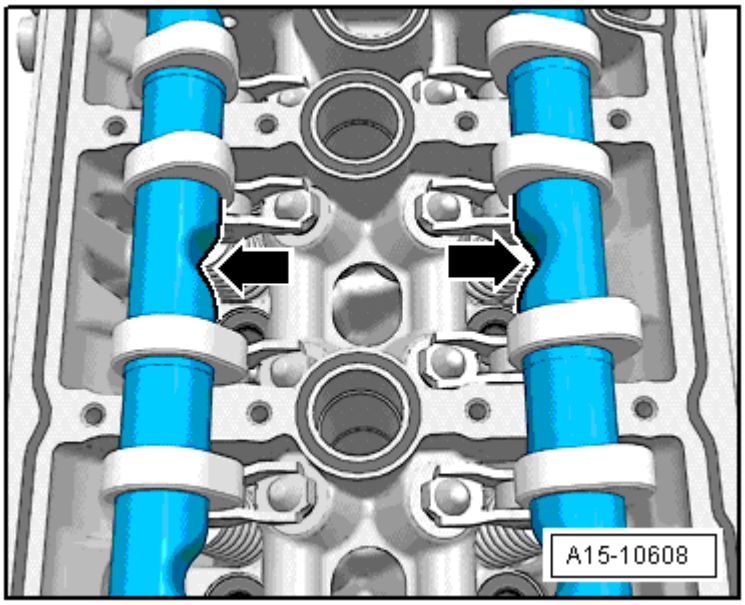

Fig. 131: Camshaft Recesses

-- Replace the cylinder head cover bolts.

-- Apply the sealantD 154 103 A1 on the clean sealing surface of the cylinder head cover as shown -arrows- .

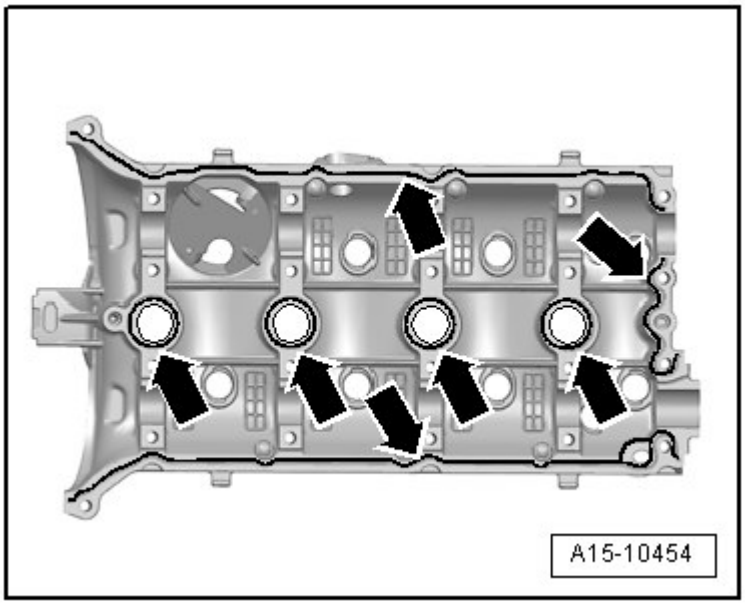

Fig. 132: Clean Cylinder Head Cover Sealing Surface Silicone Sealant Locations

- Thickness of sealant bead: 2 to 3 mm.

NOTE: The cylinder head cover must be installed within 5 minutes after application of the sealant.

The sealant bead may not be thicker than specified, otherwise the excess sealant could enter the oil pan and clog the oil suction pipe.

Note the expiration date of the sealant.

-- Tighten the bolts in several stages in sequence, refer to **Fig. 17**.

NOTE: Make sure the cylinder head cover is not tilted.

Insert the cap -1- without sealant using the thrust pieceT10174.

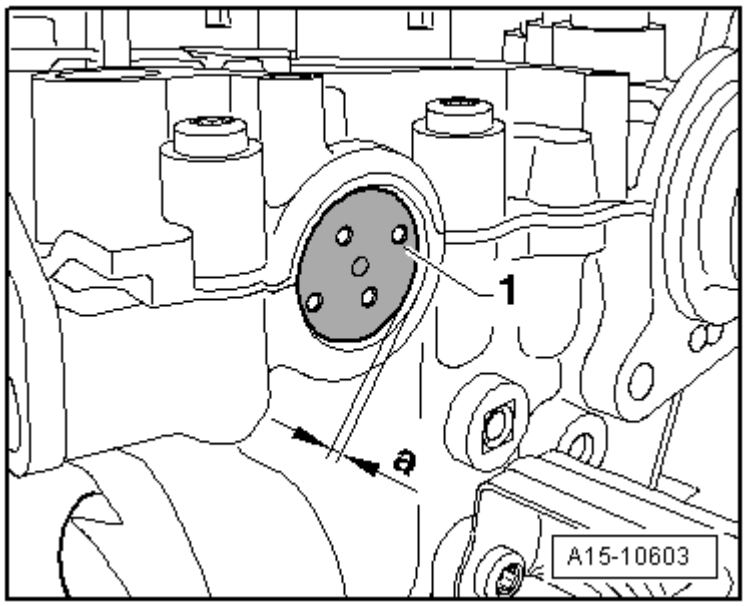

Fig. 133: Driving Cap In Using Thrust Piece T10174

Dimension -a- : 1 to 2 mm

CAUTION: Danger of damaging the valves, piston head and lower timing chain cover.

- **Make certain that the timing chain remains tensioned when rotating the crankshaft by hand.**
- **Panels are installed on the lower timing chain cover to prevent the chain from falling down. The panels can bend if the crankshaft is rotated when the chain is loose.**

-- Rotate the vibration damper using the counter hold toolT10355 into the TDC position -arrow- .

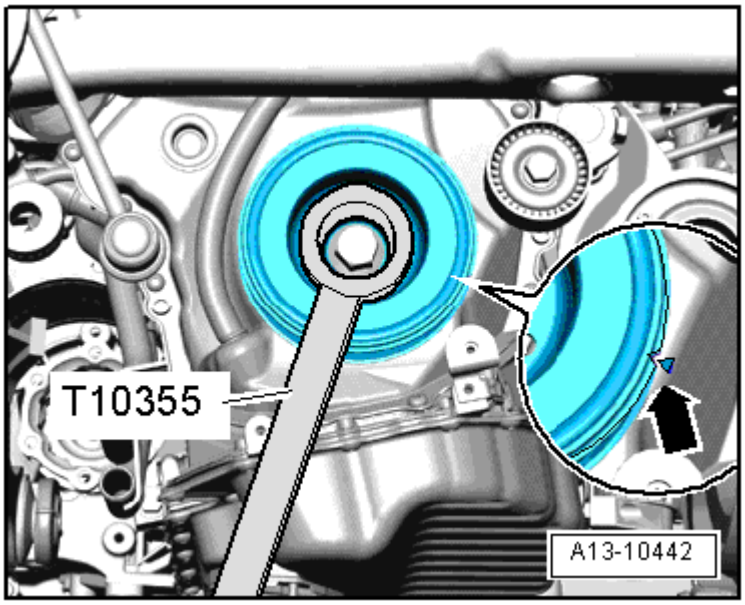

Fig. 134: Identifying Vibration Damper Rotated Into "OT" Position Using Counter Hold Tool T10355

- The notch on the vibration damper must line up with the arrow mark on the lower timing chain cover.

-- Rotate the intake camshaft in the -direction of arrow 1- using a wrench until the mark -3- on the sprocket aligns with the camshaft locating toolT40271/2.

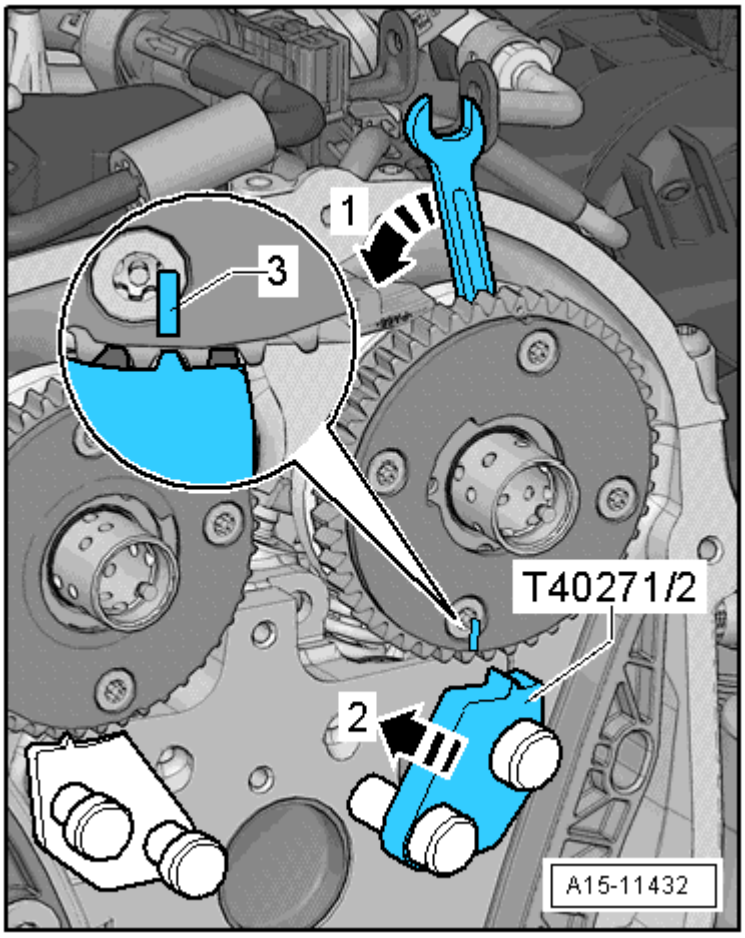

Fig. 135: Attach T40271/2 To Cylinder Head

-- Push the camshaft locating toolT40271/2 into the sprocket splines in the -direction of arrow 2- .

-- Rotate the exhaust camshaft in the -direction of arrow 1- using a wrench, until the mark -3- on the sprocket aligns with the camshaft locating toolT40271/1.

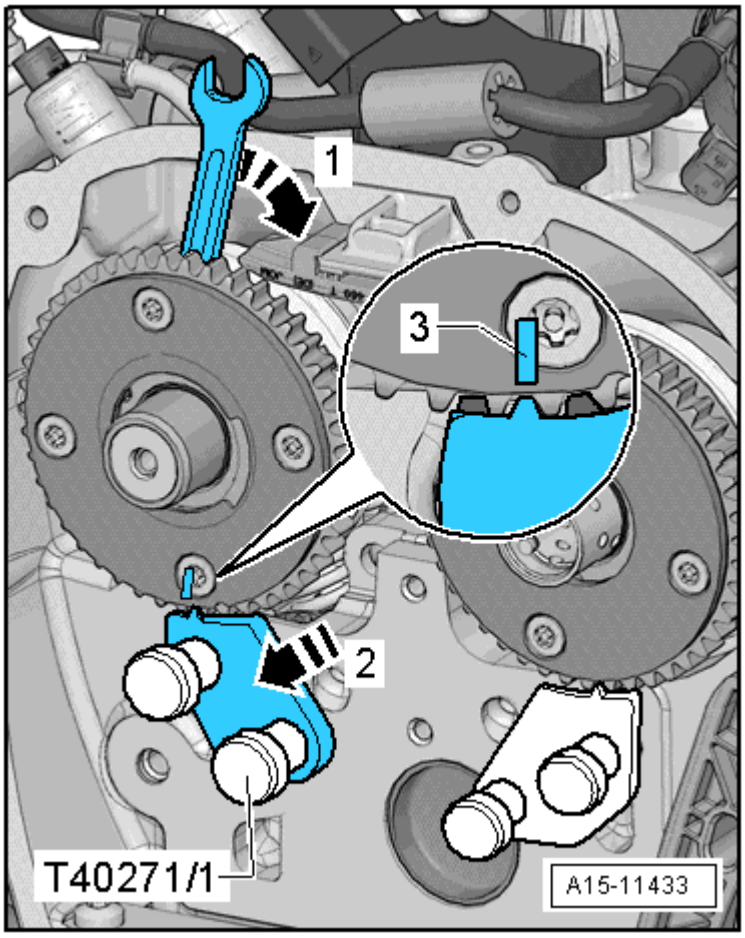

Fig. 136: Attach T40271/1 To Cylinder Head

-- Push the camshaft locating toolT40271/1 into the sprocket splines in the -direction of arrow 2- .

For New Camshafts:

-- Compare the distance from the left outer edge of the bar -A- to the mark -B- on the intake camshaft sprocket with the previously noted value.

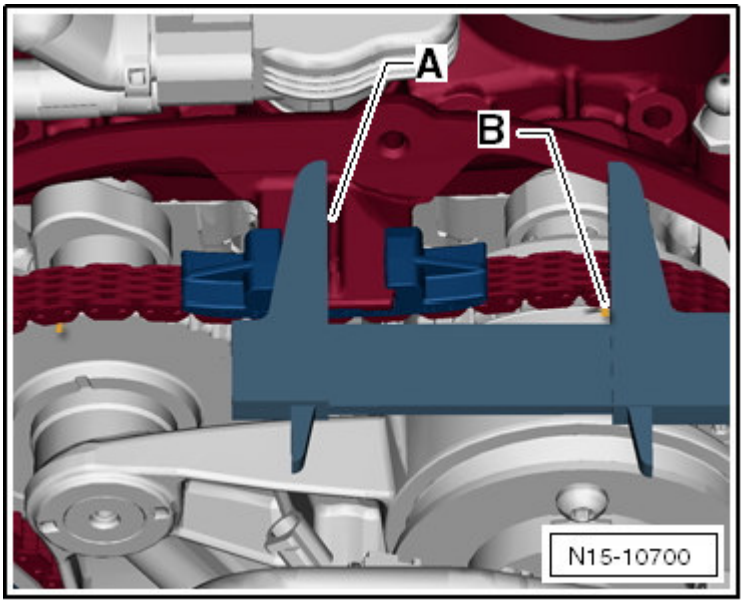

Fig. 137: Identifying Measurement Points From Outer Edge -A- To Mark -B-

-- Compare the distance between the mark on the intake camshaft sprocket -B- to the mark on the exhaust camshaft sprocket -C- with the previously noted value.

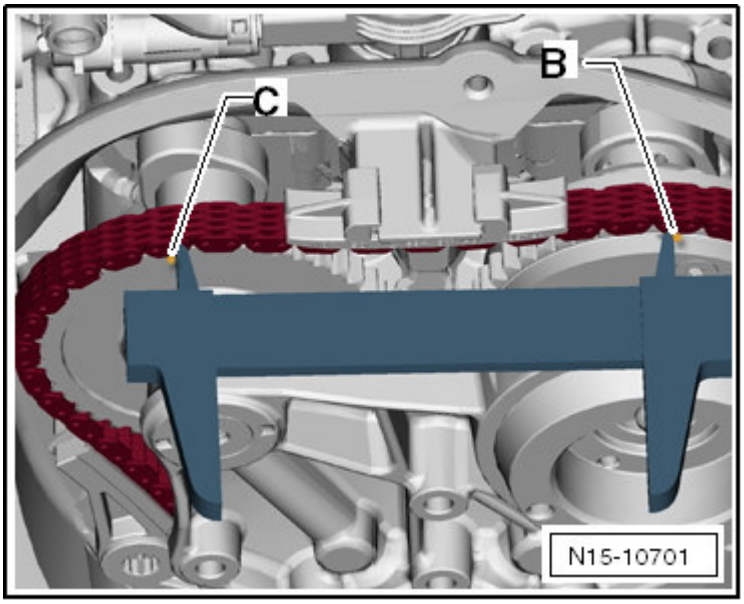

Fig. 138: Identifying Measurement Points From Mark On Intake Camshaft -B- To Mark On Exhaust Camshaft -C-

Continuation for All

-- Position the marks on the chain links -arrows- to the marks -1- on the sprockets and install the camshaft timing chain.

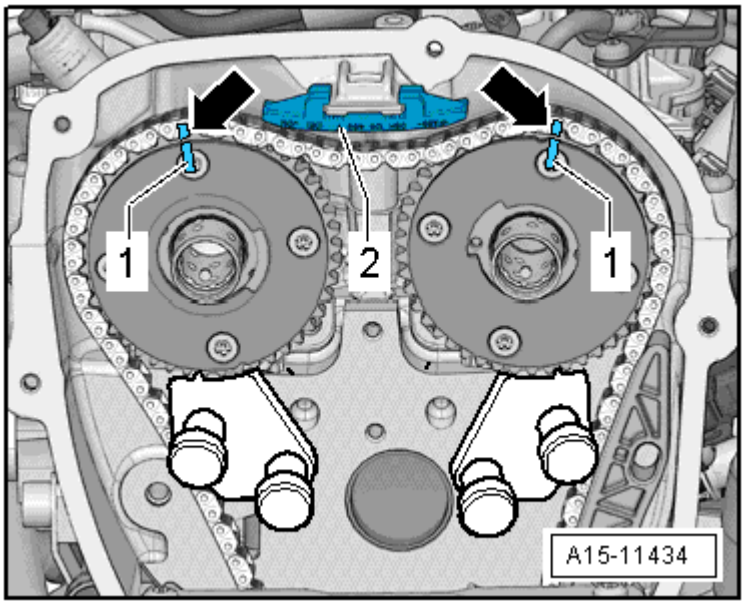

Fig. 139: Position Markings On Chain Links

-- Install the upper guide rail -2- .

NOTE: Use the help of a second mechanic to hold the exhaust camshaft in place.

-- Slowly rotate the exhaust camshaft in the -direction of arrow 1- using a wrench, until the camshaft locating toolT40271/1 can be pushed from the sprocket splines in the -direction of arrow 2- .

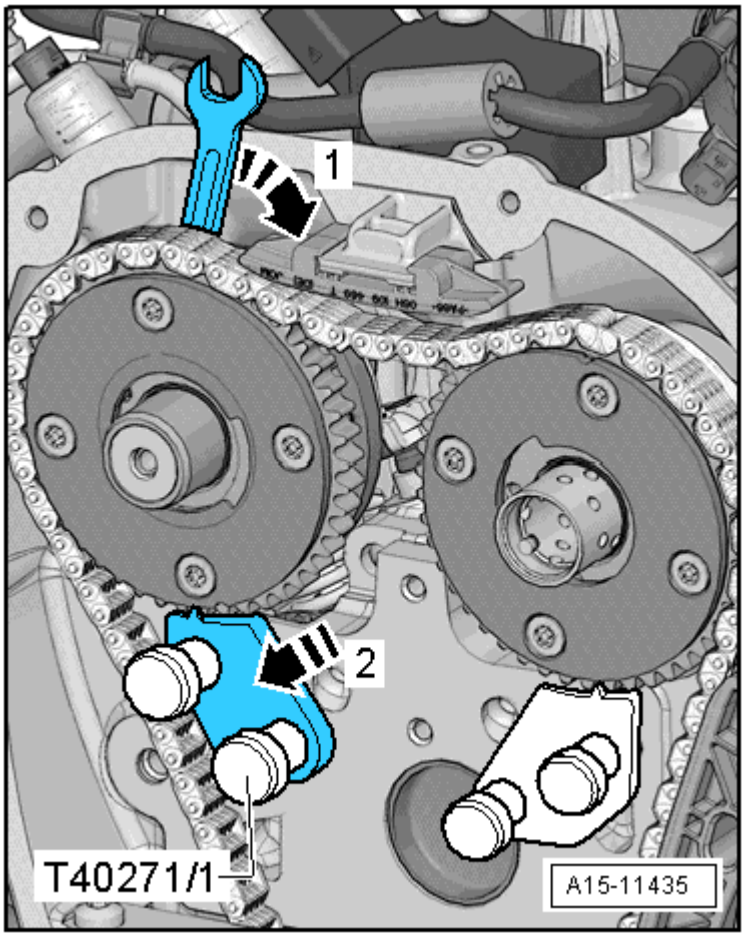

Fig. 140: Turn Exhaust Camshaft In Direction Of Arrow

-- Carefully release the camshaft, until the camshaft timing chain is laying on the upper guide rail. Hold the camshaft in this position.

-- Continue to hold the camshaft and install the camshaft timing chain tensioning rail. Tighten the guide pin -A-.

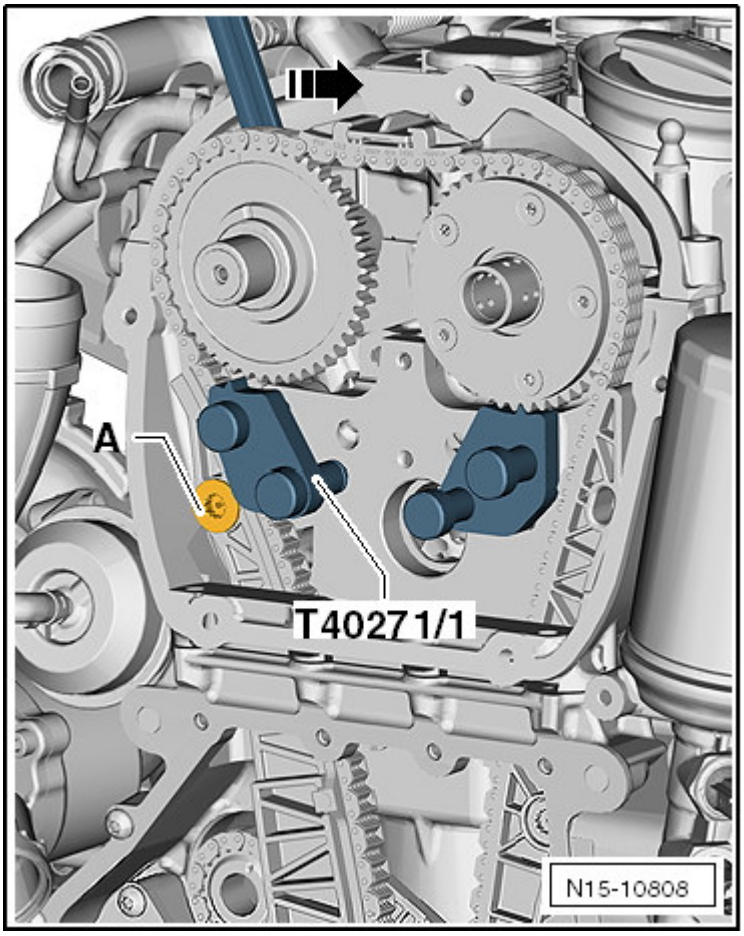

Fig. 141: NO CONTENT

-- Remove the camshaft locating toolT40271/1.

-- Push the camshaft locating toolT40271/2 out of the sprocket splines in the -direction of arrow 2- , slightly rotate the intake camshaft in the -direction of arrow 1- using wrench.

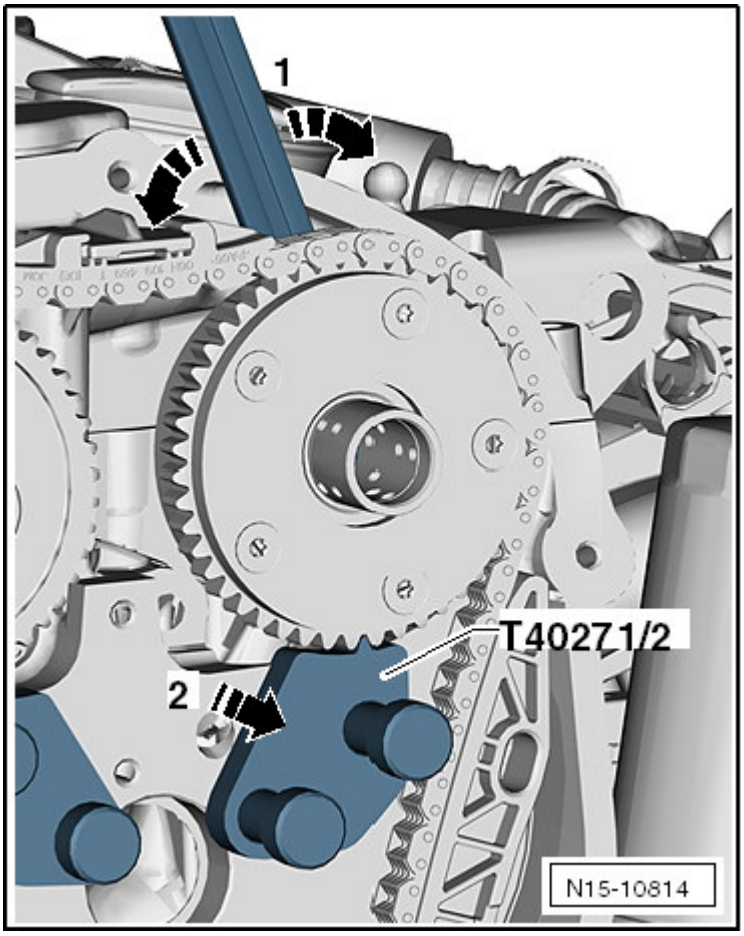

Fig. 142: NO CONTENT

-- Remove the camshaft locating toolT40271/2.

-- Check the valve timing. The camshaft timing chain and cylinder head marks -arrows- must align with the marks -1- on the sprockets.

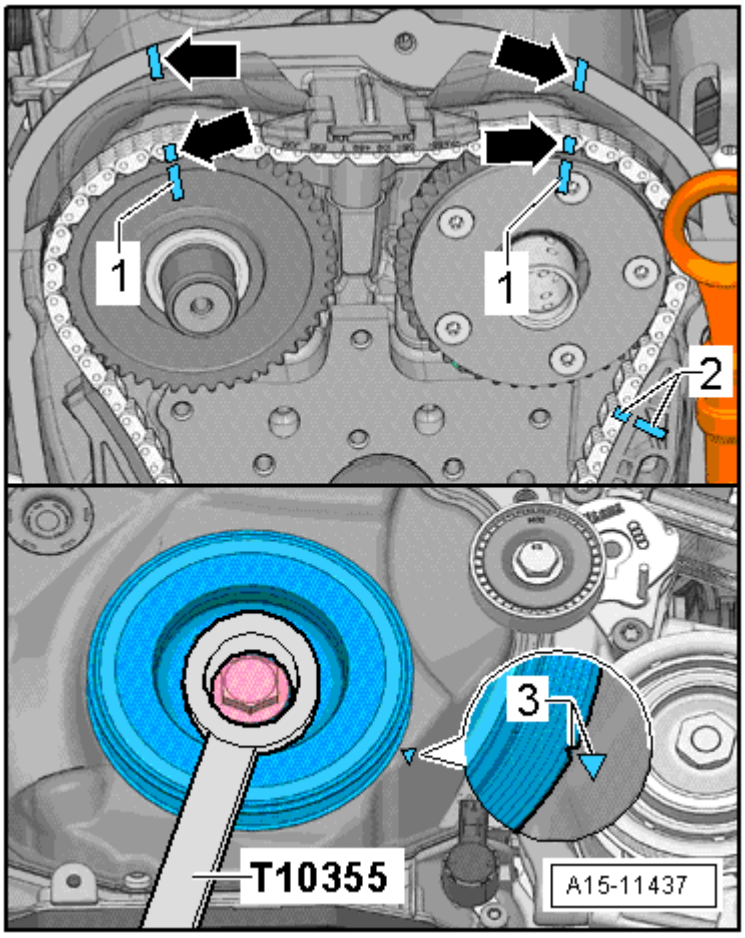

Fig. 143: Check Valve Timing

-- The marks for the camshaft timing chain and the camshaft timing chain guide rail -2- must also align with one another.

-- The notch on the vibration damper must align with the mark on the lower timing chain cover -3- .

NOTE: If the self-made marks are no longer visible, check the valve timing, refer to VALVE TIMING, CHECKING.

-- Install the bearing bracket. Do not tilt it and install the bolts -arrows- hand tight.

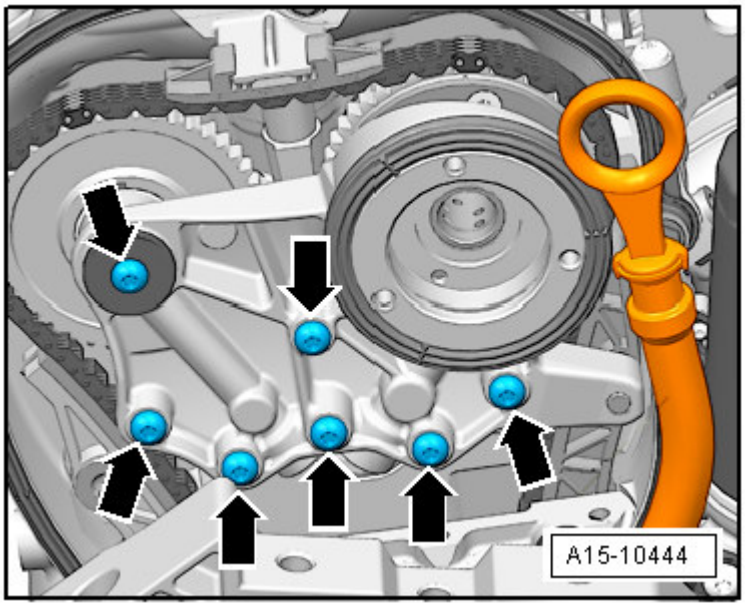

Fig. 144: Bearing Bracket Bolts

-- Remove the locking pinT40011 or the locking toolT40267, depending on the version.

-- Tighten the bolts -arrows- . Refer to **CAMSHAFT TIMING CHAIN OVERVIEW**.

-- Install the bolt -arrow- .

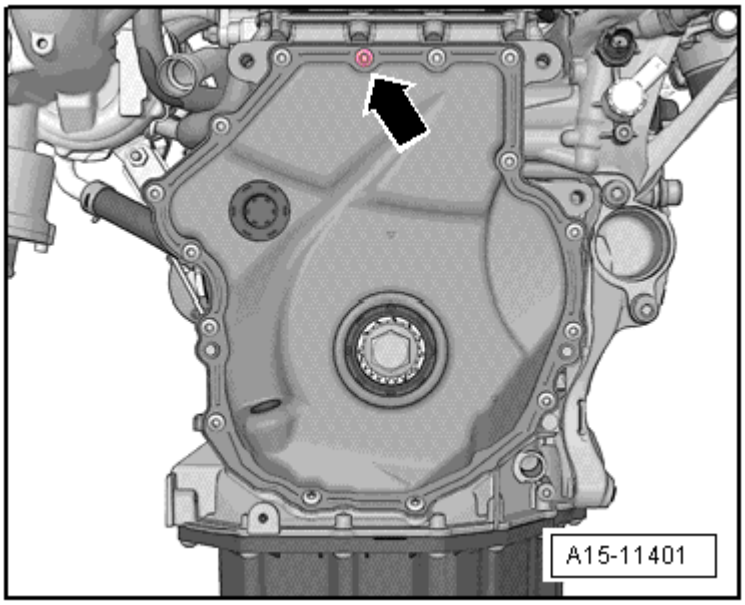

Fig. 145: Identifying Bolt

-- Install the control valve, see -item 6- in the **CAMSHAFT TIMING CHAIN OVERVIEW**.

NOTE: **If the mark on the drive chain and guide rail -2- do not align even though the engine is at TDC, the drive chain has skipped on the crankshaft sprocket. Check the valve timing. Refer to VALVE TIMING, CHECKING. If the timing does not agree, the camshaft timing chain must be positioned again. Refer to CAMSHAFT TIMING CHAIN (WITH NEW TOOLS).**

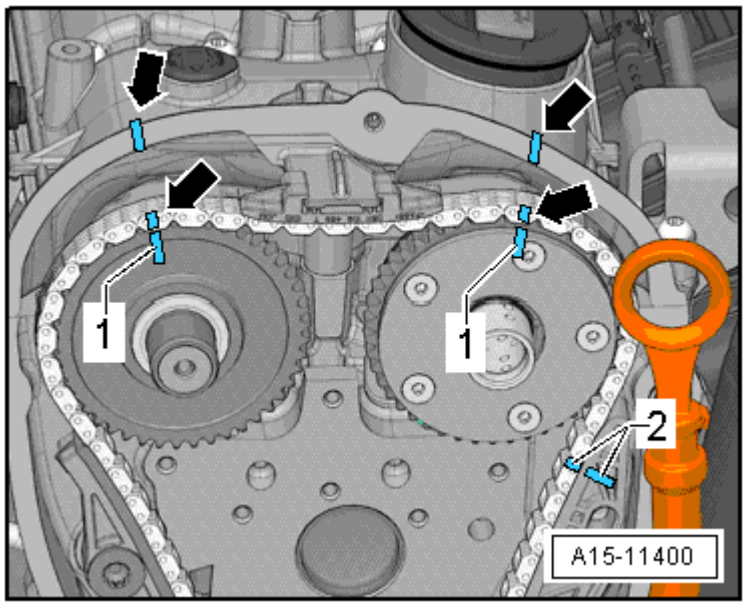

Fig. 146: Mark camshaft timing chain and the cylinder head

Further installation is in the reverse order of removal.

VALVE STEM SEALS

(with the cylinder head installed)

Special tools and workshop equipment required

- Spark Plug Removal Tool3122 B
- Valve Seal Removal Tool3364
- Valve Stem Seal Driver3365
- AdapterT40012
- Torque Wrench (5-50 Nm)V.A.G 1331
- Valve Cotters Asm/Disasm DeviceVAS 5161
- Guide Plate for FSI EngineVAS 5161/19 B

Removing

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

-- Remove the roller rocker arms and place them on a clean surface. Make sure that the roller rocker arms are not interchanged.

-- Remove the spark plugs using the spark plug removal tool3122 B.

-- Secure the guide plate for FSI enginesVAS 5161/19B to the cylinder head as shown, using the knurled thumb screwsVAS 5161/12.

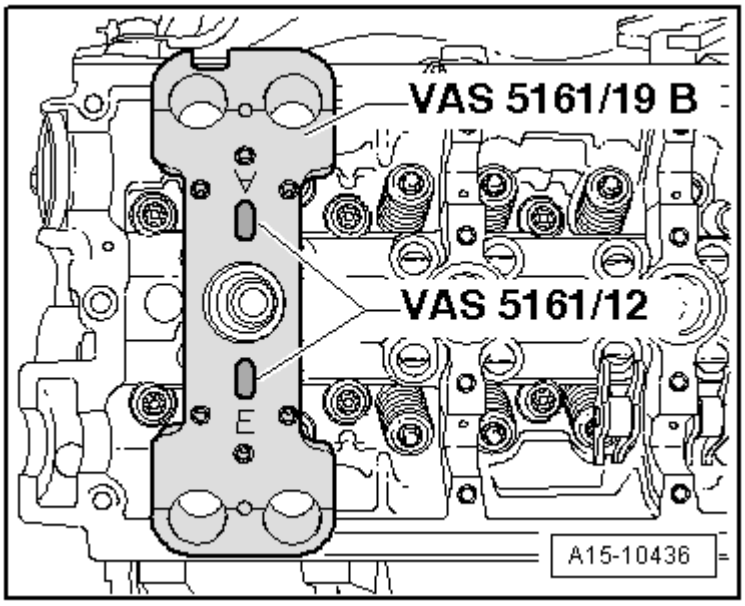

Fig. 147: FSI Engine VAS 5161/19B Guide Plate Tightened On Cylinder Head Using Knurled Bolts VAS 5161/12

-- Adjust the piston of the respective cylinder to Bottom Dead Center (BDC).

-- Install the adapterT40012 into the spark plug threads and connect the compressed air (minimum 6 bar).

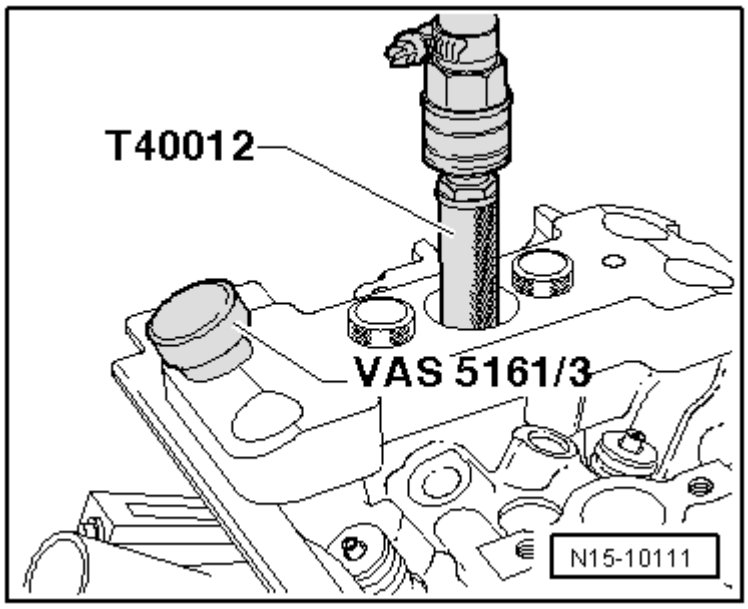

Fig. 148: Identifying Drift VAS 5161/3 And Plastic Mallet To Loosen Stuck Valve Keepers

-- Loosen any stuck valve retainers using the punchVAS 5161/3 and a plastic mallet.

Intake Side

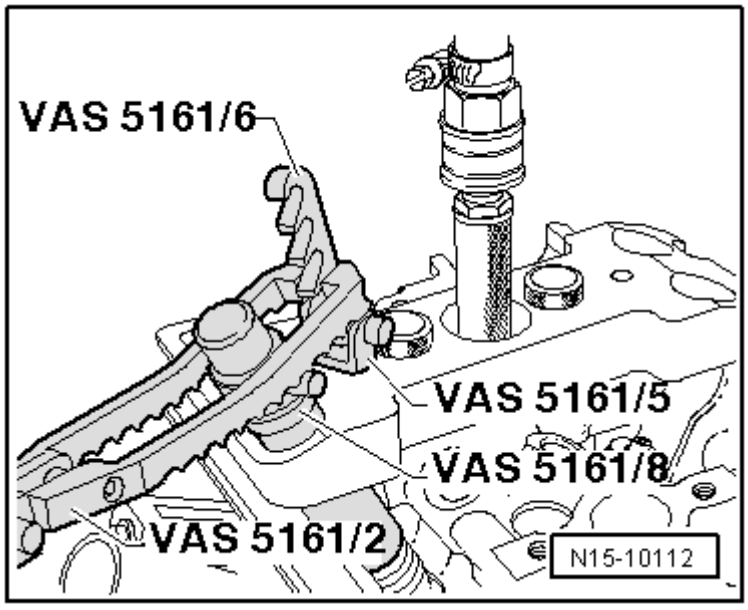

Fig. 149: Identifying Engaging Device VAS 5161/6 With Installation Forks VAS 5161/5 Installed Into Guide Plate VAS 5161/19

-- Install the retainerVAS 5161/6 using the guide forks M6/M8 with threaded studsVAS 5161/5 into the center threads of the guide plate for FSI engineVAS 5161/19B.

-- Insert the assembly cartridgeVAS 5161/8 into the guide plate for FSI engineVAS 5161/19B.

-- Install the pressure fork with lever for assembly cartridgeVAS 5161/2 to the retainerVAS 5161/6.

Exhaust Side

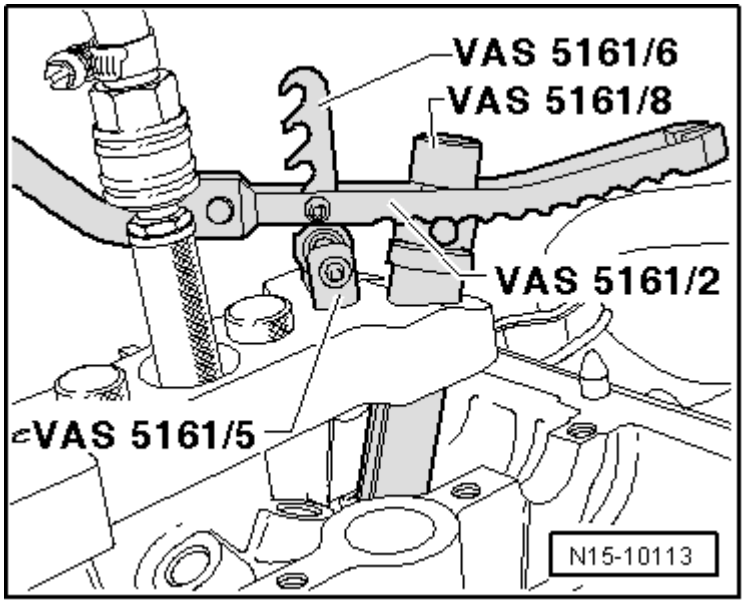

Fig. 150: Identifying Pressure Forks VAS 5161/2 Engaged

-- Install the retainerVAS 5161/6 using the guide forks M6/M8 with threaded studsVAS 5161/5 into the outer threads in the guide plate for FSI engineVAS 5161/19B.

-- Press down the assembly cartridgeVAS 5161/8. At the same time, turn the knurled thumb screw on the assembly cartridgeVAS 5161/8 clockwise until the points engage in the valve retainers.

-- Lightly move the knurled thumb screw back and forth, this causes the valve retainers to be pressed apart and captured in the assembly cartridge.

-- Release the pressure fork with lever for assembly cartridgeVAS 5161/2.

-- Take out the assembly cartridgeVAS 5161/8.

-- Remove the valve stem seal using the valve seal removal tool3364.

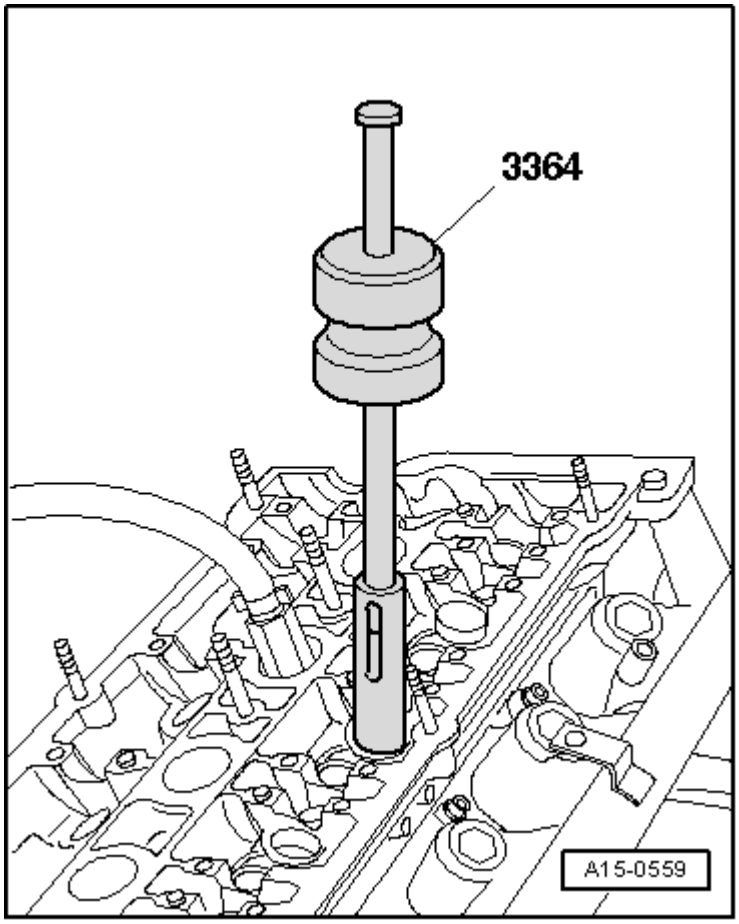

Fig. 151: Identifying Valve Seal Removal Tool 3364

-- If the valve seal removal tool3364 cannot be used due to restricted clearance, drive the roll pin -arrow- out with a drift and remove the impact attachment.

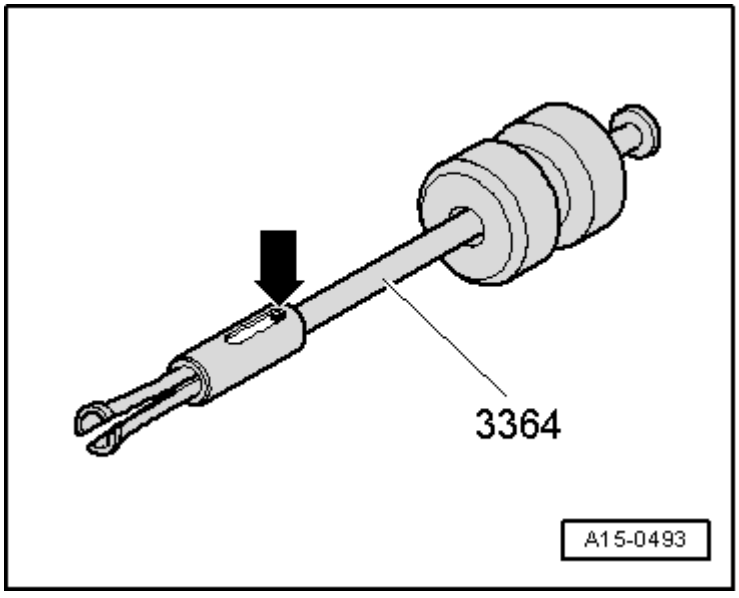

Fig. 152: Driving Out Roll Pin -Arrow-

-- Place the lower part of the valve seal removal tool3364 onto the valve stem seal.

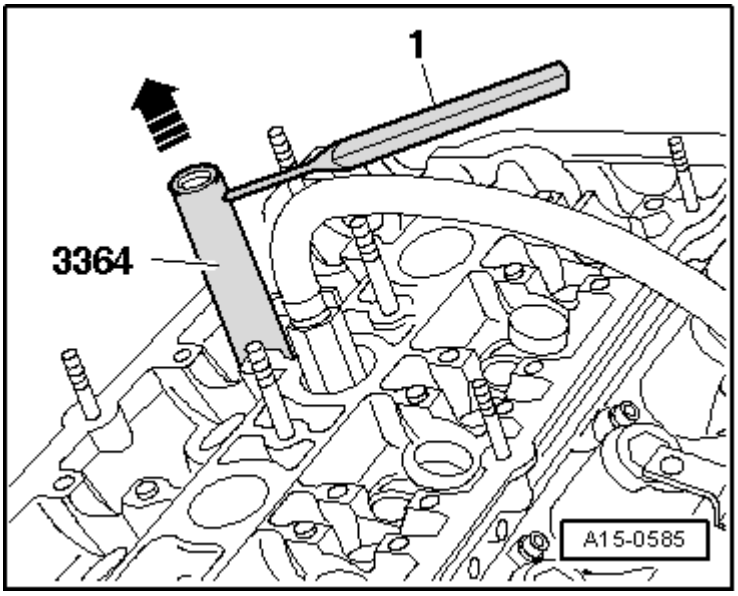

Fig. 153: Identifying Placement Of Lower Part Of Valve Seal Removal Tool 3364 On To Valve Stem Oil Seal

-- Insert a drift -1- into the bore in the lower part of the tool.

-- Using the drift -1- as a lever, remove the valve stem seal in the -direction of the arrow- .

Installing

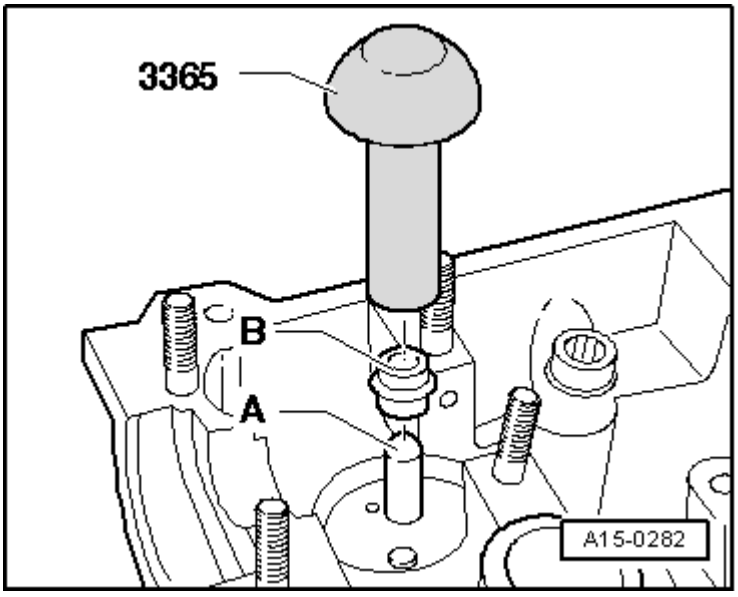

Fig. 154: Identifying Plastic Sleeve, New Valve Stem Oil Seals & Valve Stem Seal Driver 3365

-- Place the plastic sleeve -A- on the valve stem to prevent damage to the new valve stem seal -B- .

-- Oil the sealing lip of the valve stem seal -B- , insert it into valve stem seal driver3365 and carefully slide it onto the valve guide.

-- Remove the plastic sleeve -A- .

-- Insert the valve spring and valve spring plate.

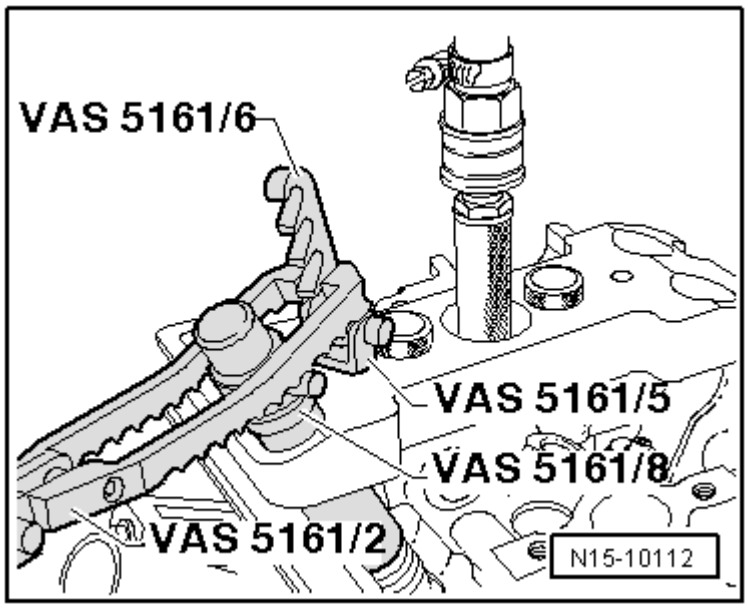

Fig. 155: Identifying Engaging Device VAS 5161/6 With Installation Forks VAS 5161/5 Installed Into Guide Plate VAS 5161/19

-- Install the valve cotters asm/disasm deviceVAS 5161 components as shown.

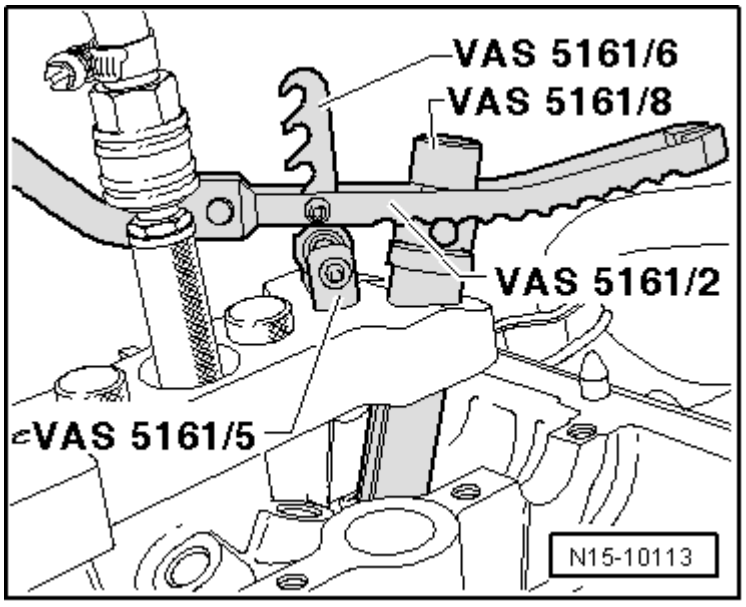

Fig. 156: Identifying Pressure Forks VAS 5161/2 Engaged

-- Install valve cotters asm/disasm deviceVAS 5161 components as shown.

NOTE: If the valve retainers were removed from the assembly cartridge, they must be inserted into the valve insertion deviceVAS 5161/18 next.

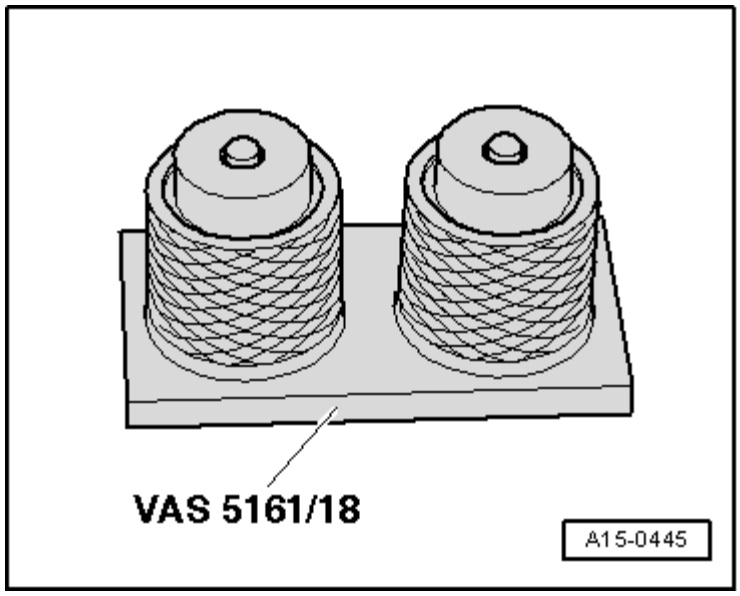

Fig. 157: Identifying Installation Cartridge VAS 5161/8

Press the assembly cartridgeVAS 5161/8 onto the valve insertion device from above and capture the valve retainers.

-- Press down the assembly cartridgeVAS 5161/8 using the pressure fork with lever for assembly cartridgeVAS 5161/2 and turn the knurled thumb screw on the assembly cartridge back and forth while pulling it upward at the same time.

-- Release the pressure fork with lever for assembly cartridgeVAS 5161/2 with the knurled thumb screw pulled.

-- Remove the valve cotters asm/disasm deviceVAS 5161 components.

Further installation is in the reverse order of removal.

UPPER TIMING CHAIN COVER

Special tools and workshop equipment required

- Torque WrenchV.A.G 1783
- Open End Spanner Insert AF 10V.A.G 1783/1

Removing

-- Remove the engine cover. Refer to **ENGINE COVER**.

-- If equipped with a noise generator, open the clip -1- , unclip the fuel lines -2- and loosen the bolt -3- on the Evaporative Emission (EVAP) canister. Move the charge air pipe aside.

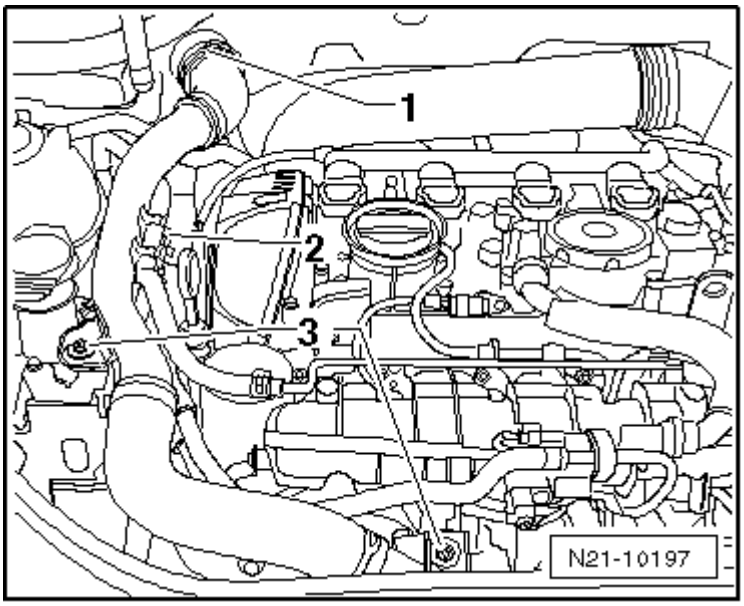

Fig. 158: Identifying Latch, Fuel Lines And Bolts

with a EVAP Canister Inside the Engine Compartment

-- Disconnect the vent line -1- , unlock the EVAP canister -A- and remove it -B- . Move the EVAP canister to the side.

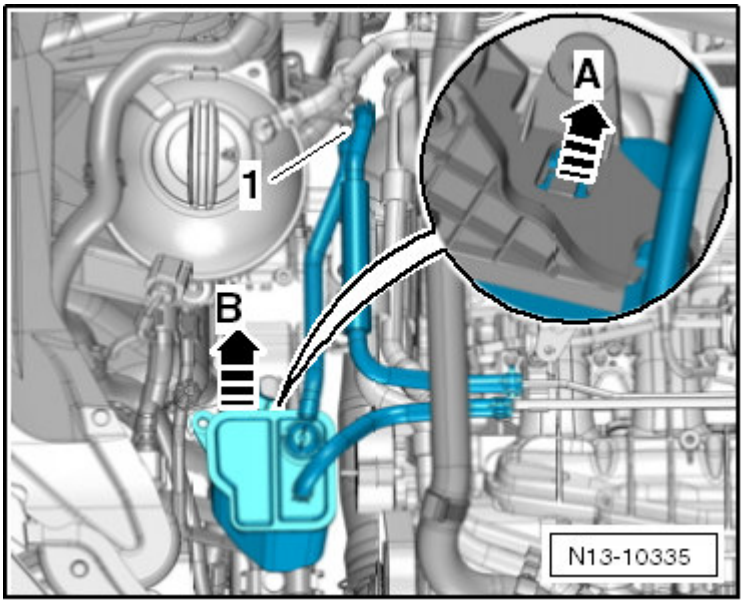

Fig. 159: Identifying Vent Line, Canister And Canister Catch

Continuation for All

-- Remove the coolant pipe bolts -arrows- from the intake manifold.

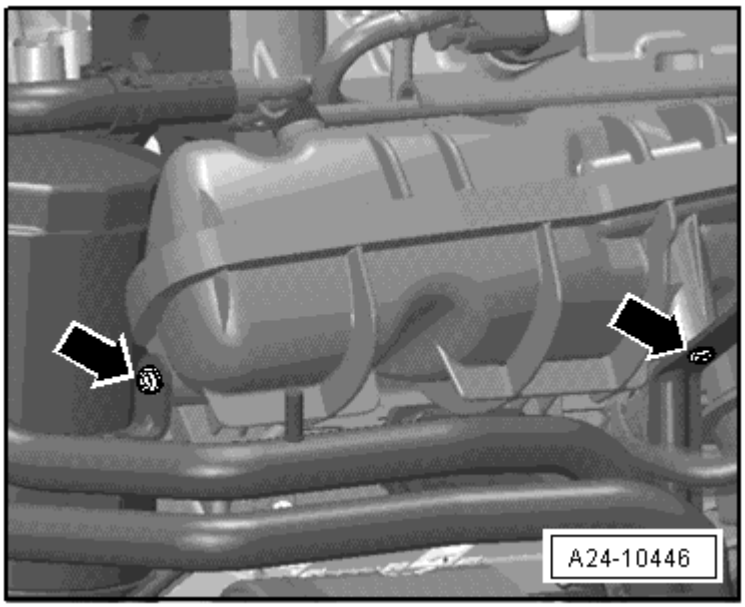

Fig. 160: Bracket Bolts

-- Press the coolant hoses to the side and secure them with a cable tie.

-- Remove the camshaft adjustment valve 1.

-- Remove the bolts -1 through 5- and remove the upper timing chain cover.

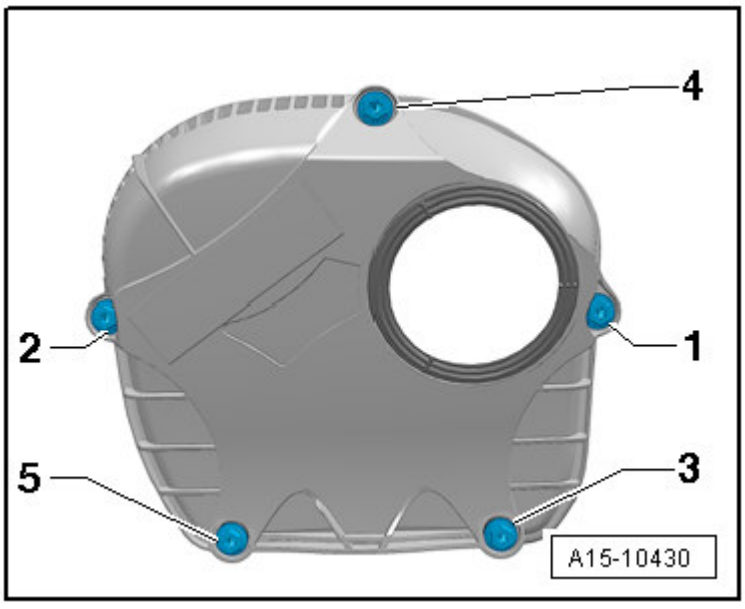

Fig. 161: Identifying Upper Timing Chain Cover - Tightening Sequence

NOTE: Remove the lower bolts -3 and 5- with an open end wrench.

Installing

-- Coat the seal and the O-ring with engine oil.

-- Place the cover on the engine making sure the seal fits correctly.

-- Tighten the bolts in sequence -1 through 5- hand tight.

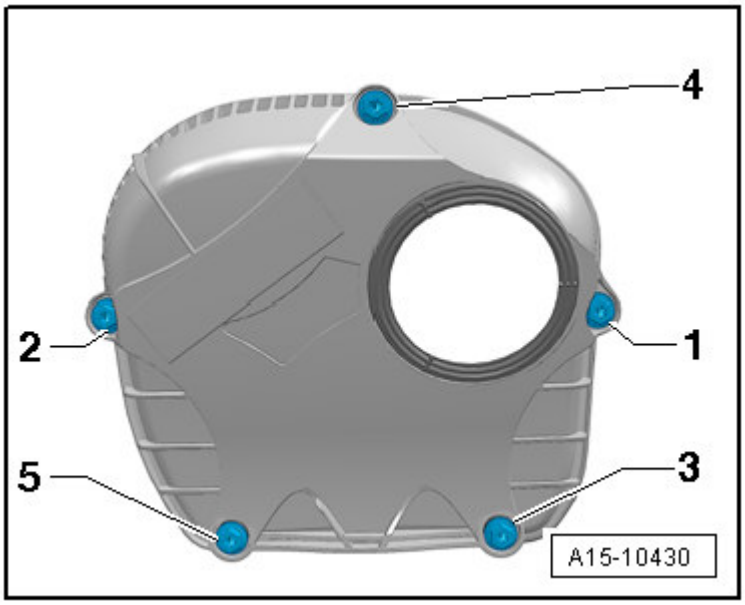

Fig. 162: Identifying Upper Timing Chain Cover - Tightening Sequence

-- Tighten the bolt to 9 Nm using the torque wrenchV.A.G 1783 and the open end spanner insert AF 10V.A.G 1783/1 for bolts -3 and 5- .

-- Install the camshaft adjustment valve 1. Refer to **CAMSHAFT ADJUSTMENT VALVE 1 N205**.

-- Tighten the bolts -arrows- for the guide tube.

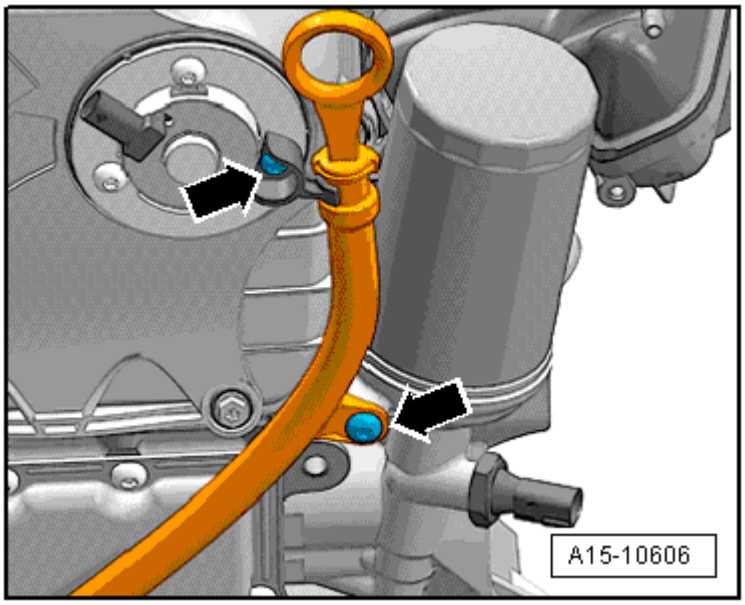

Fig. 163: Identifying Oil Dipstick Guide Tube And Bolts

NOTE: If the attachment points do not line up, check whether the guide tube is inserted all the way into the lower timing chain cover.

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

Further installation is in the reverse order of removal.

LOWER TIMING CHAIN COVER

Special tools and workshop equipment required

- Engine Support Bridge10-222 A
- Adapter10-222 A/22
- Engine Support Adapter10-222 A/3, (Qty. 2)
- Bracket with Spindle and Hook10-222 A/10, (Qty. 2)
- Locking PinT10060 A
- Counter Hold ToolT10355
- Thrust PieceT10368
- BitsT10099
- Shackle10-222 A/12
- Lifting Eyebolt3368 (for automatic transmissions only)

Removing

-- Remove the noise insulation. Refer to **Description and Operation** .

-- Remove the front right wheel housing liner. Refer to **Removal and Installation** .

-- Drain engine oil.

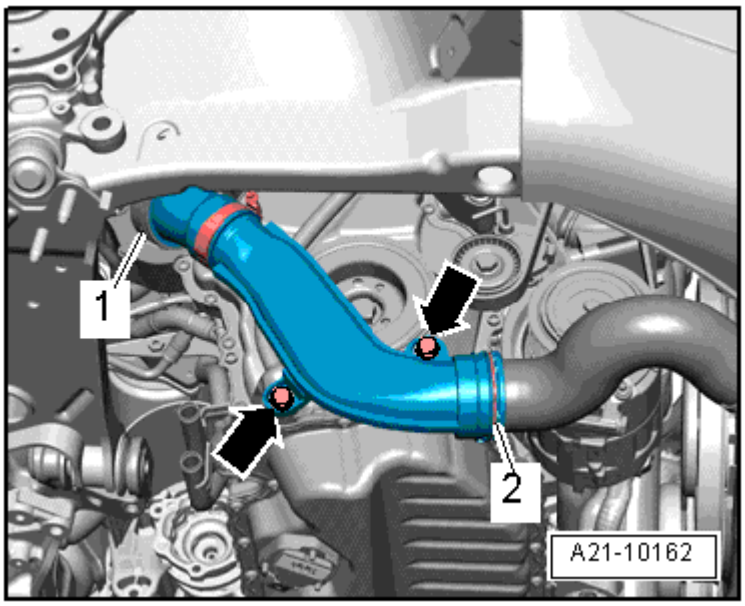

Fig. 164: Air Guide Pipe And Bolts

-- Remove the bolts -arrows- .

-- Lift the clamps -1 and 2- and remove the charge air pipe.

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

- **Before removing the ribbed belt, mark the running direction with chalk or a felt-tip pen for reinstallation later.**

-- Remove the right charge air hose -arrows- .

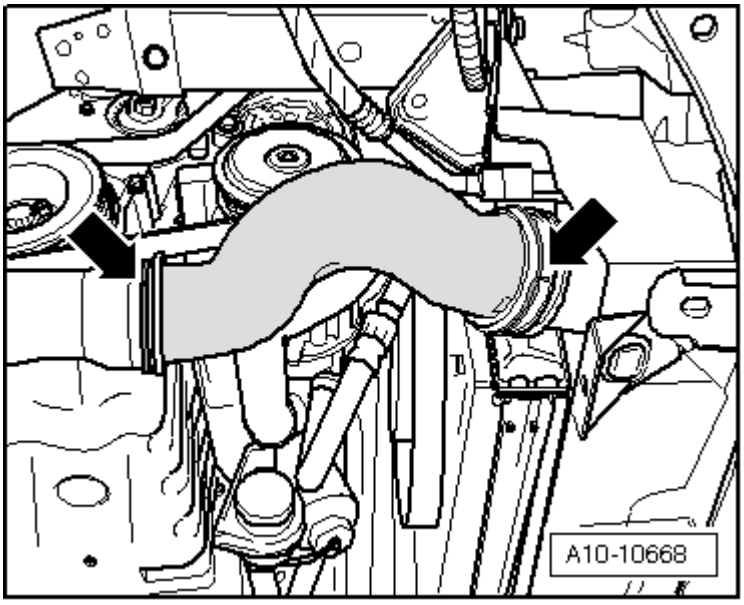

Fig. 165: Air Guide Hose

-- To release the tension on the ribbed belt, turn the tensioner in the -direction of the arrow- from underneath.

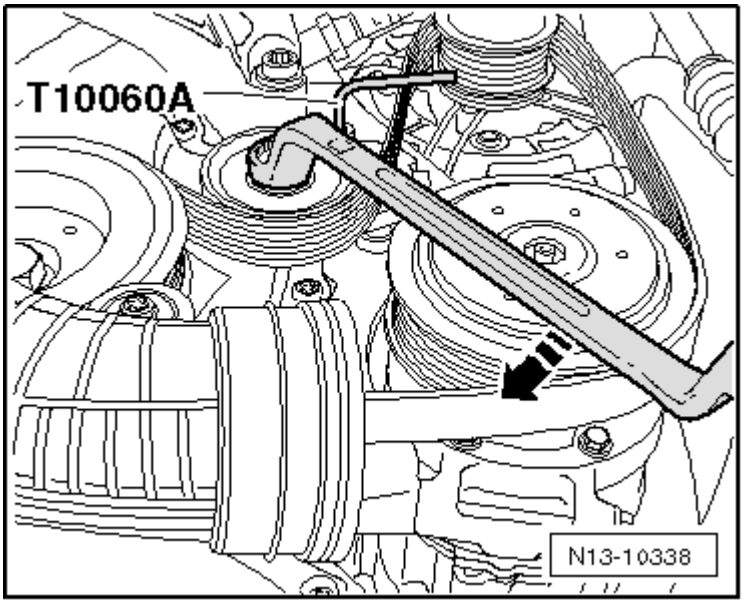

Fig. 166: Identifying Wrench And Locking Pin -T10060 A-

-- Secure the tensioner using the locking pinT10060 A.

-- Remove the ribbed belt from the vibration damper.

-- Rotate the vibration damper using the counter hold toolT10355 into the Top Dead Center (TDC) position -arrow- .

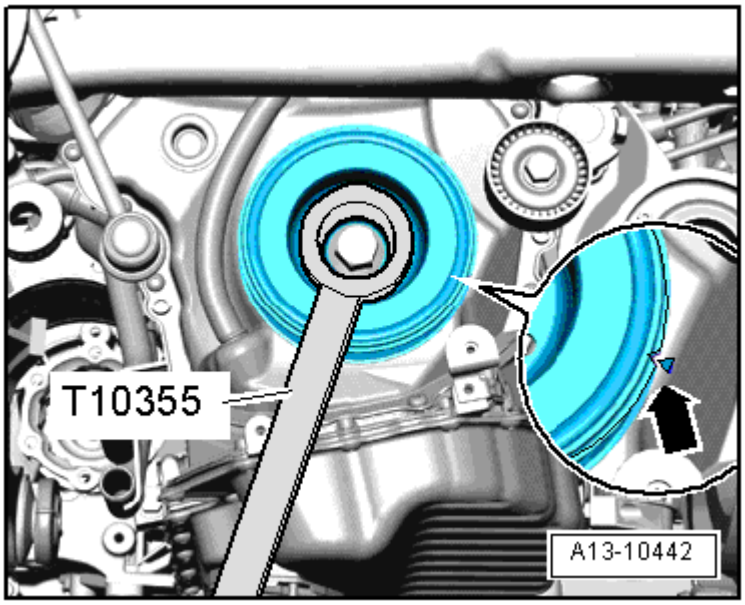

Fig. 167: Identifying Vibration Damper Rotated Into "OT" Position Using Counter Hold Tool T10355

- The notch on the vibration damper must line up with the arrow mark on the lower timing chain cover.

CAUTION: Danger of causing damage to the engine.

- **In order not to change the valve timing, the crankshaft must not be moved out of the TDC position when the vibration damper bolt is removed.**

-- Remove the vibration damper bolt using the counter hold toolT10355.

-- Remove the vibration damper.

CAUTION: To avoid damaging the splines, only use the thrust pieceT10368 to install the vibration damper bolt.

-- Install the vibration damper bolt again with the thrust pieceT10368 and tighten it hand tight.

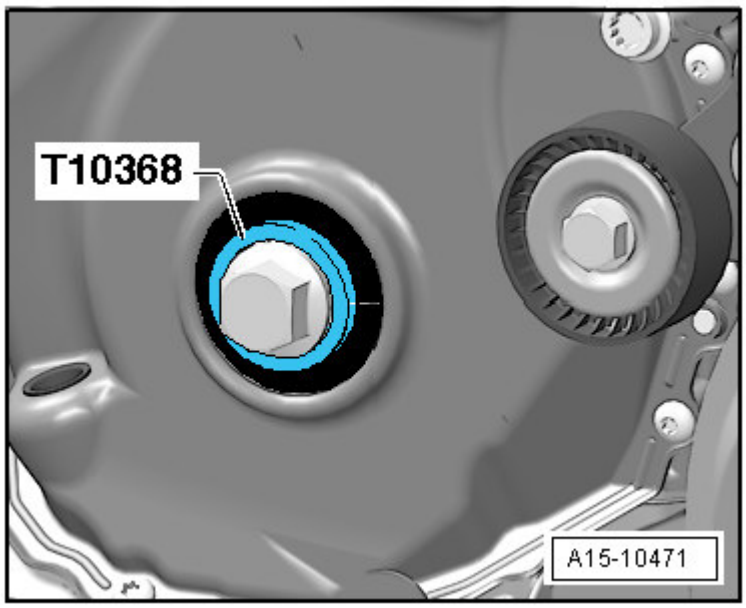

Fig. 168: Identifying Vibration Damper Bolt And Thrust Piece T10368

-- Remove the engine cover. Refer to **ENGINE COVER**.

-- Remove the air filter housing. Refer to **AIR FILTER HOUSING** .

CAUTION: Danger of causing damage to other electronic components when disconnecting the battery.

- **Complete the steps for disconnecting the battery.**

-- With the ignition turned off, remove the ground wire -arrow- from the battery.

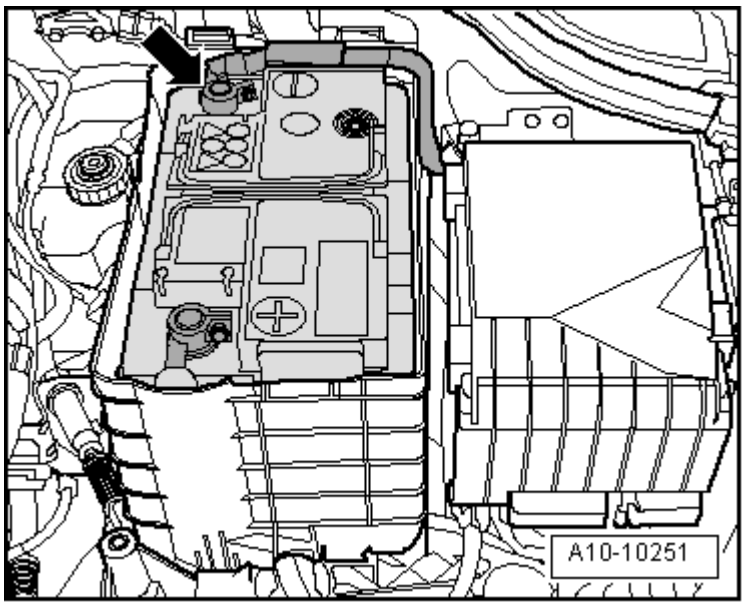

Fig. 169: Battery Ground Strap

-- Remove the battery. Refer to [[Editorial:Find destination]] .

-- Remove the battery tray bolts -arrows- and tray.

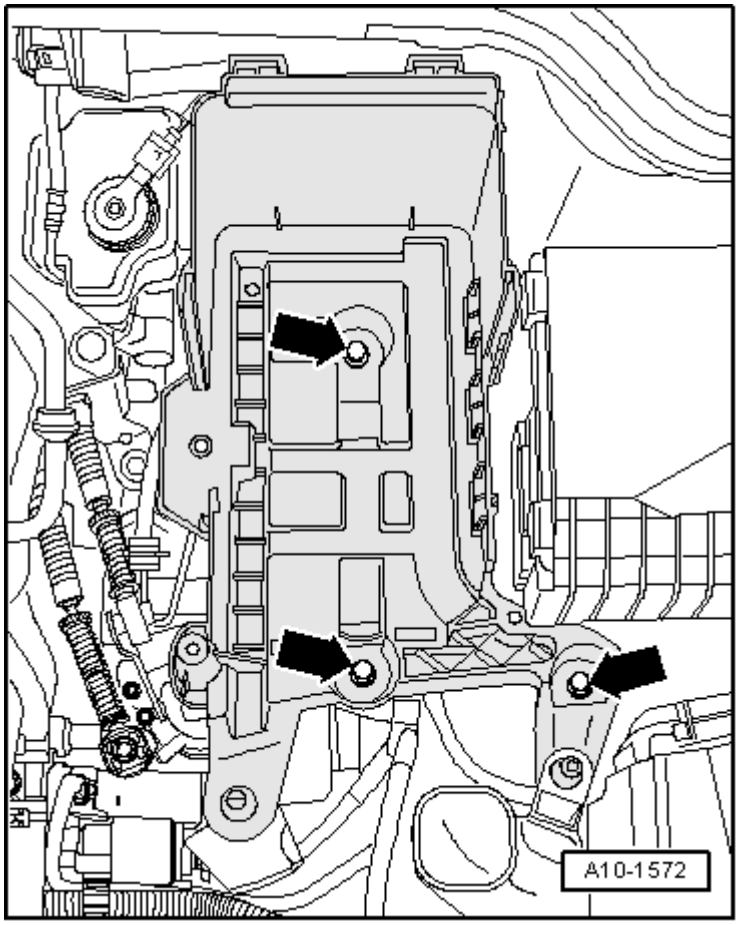

Fig. 170: Battery Carrier Nuts

with a Automatic Transmission

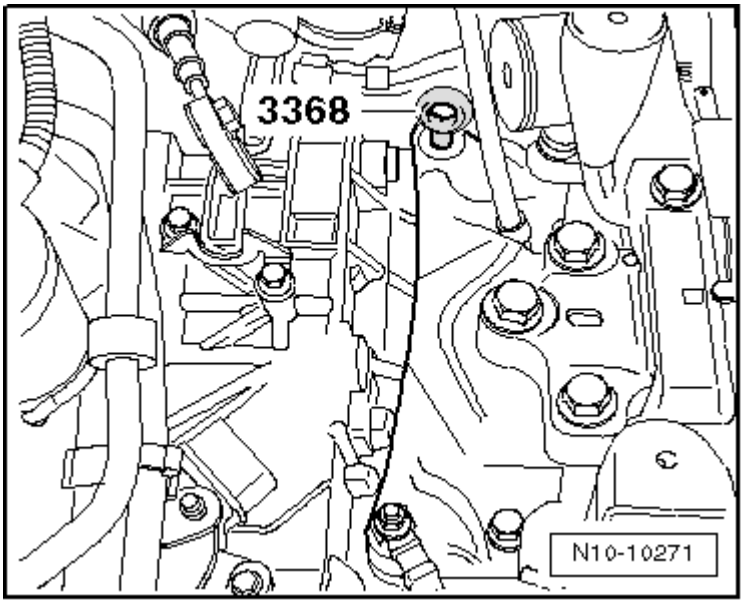

Fig. 171: Identifying Lifting Eyebolt -3368-

-- Install the lifting eyebolt3368 into the transmission mount bracket as shown.

-- Install the engine support bridge10-222 A using the following special tools:

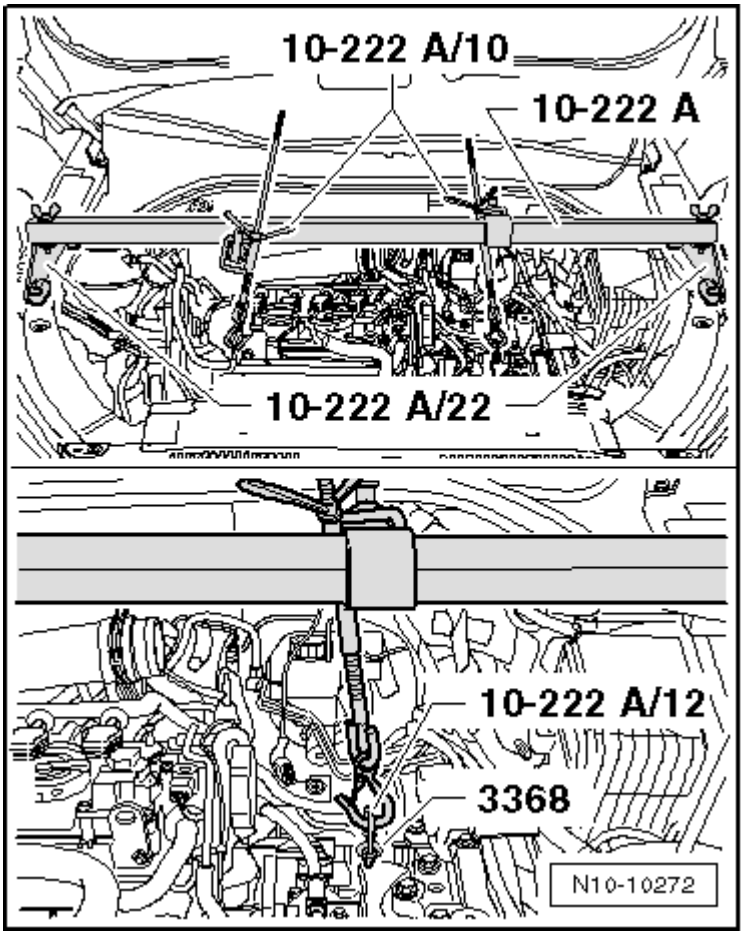

Fig. 172: Identifying Engine Support Bridge 10-222 A And Special Tools

- Adapter10-222 A/22, (Qty. 2)
- Engine support adapter10-222 A/3, (Qty. 2)
- Bracket with spindle and hook10-222 A/10, (Qty; 2)
- Shackle10-222 A/12

with a Manual Transmission

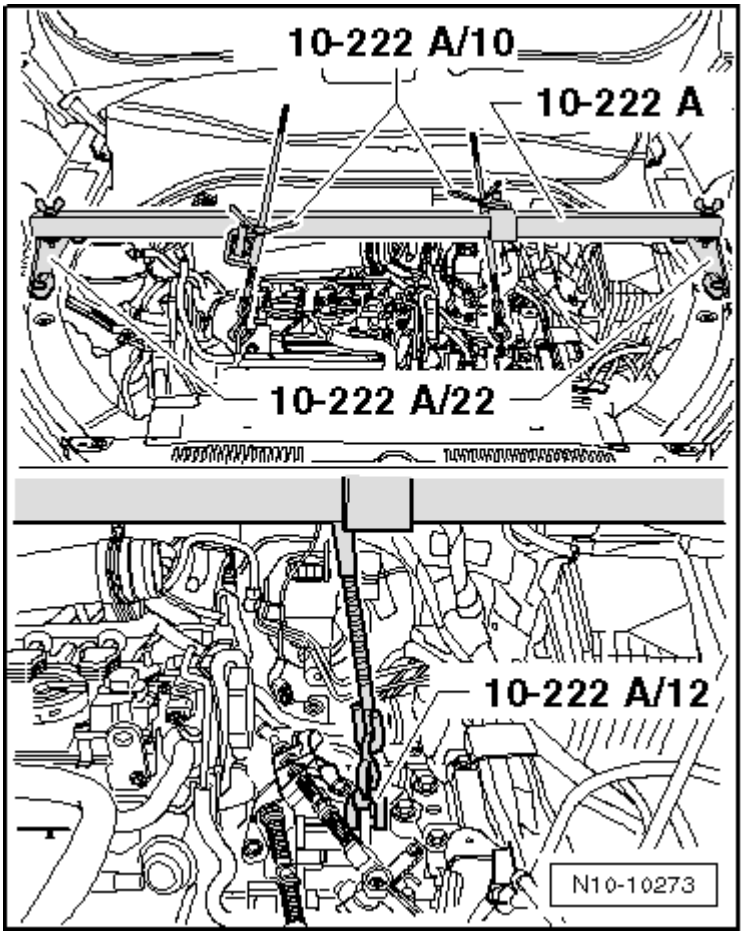

Fig. 173: Identifying Engine Support Bridge 10-222 A And Special Tools

-- Remove the shift mechanism from the transmission. Refer to **[For transmission(s) 0A6] Removal and Installation** .

- Adapter10-222 A/22, (Qty, 2)
- Engine support adapter10-222 A/3, (Qty. 2)
- Bracket with spindle and hook10-222 A/10, (Qty. 2)
- Shackle10-222 A/12

Continuation for All

-- Tension the engine with the spindle.

-- Remove the engine mount to engine mount bracket bolts -arrows- .

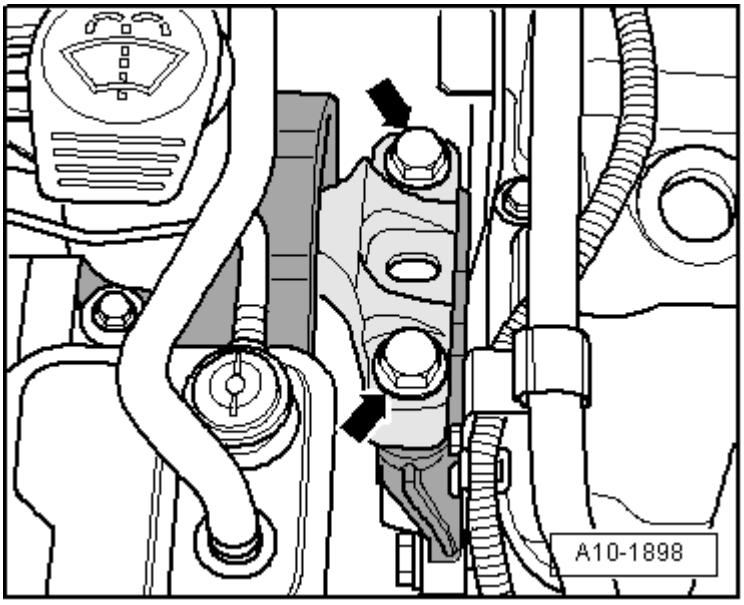

Fig. 174: Identifying Engine Mount To Engine Mount Bracket Bolts

-- Lift the engine approximately 50 mm and loosen the upper bolt for the engine mount bracket.

-- Now, lower the engine approximately 100 mm.

-- Free up the wiring harness -arrow- .

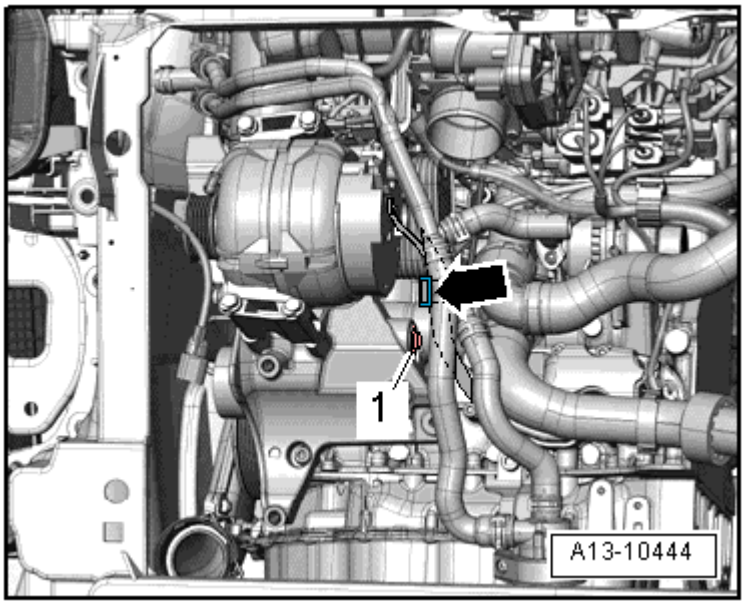

Fig. 175: Identifying Ribbed Belt Tensioner Bolt And Locating Electrical Wiring Harness

-- Remove the bolt -1- and remove the ribbed belt tensioner from the accessory bracket.

-- Loosen the lower bolts on the engine mount bracket using the bitsT10099.

-- Remove the engine mount bracket and the bolts.

-- Remove the bolts -arrows- and remove the oil dipstick guide tube from the upper timing chain cover.

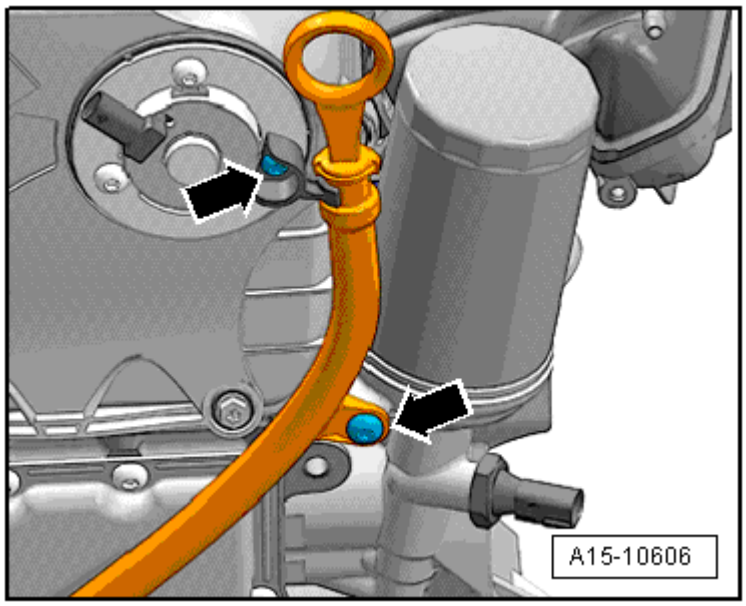

Fig. 176: Identifying Oil Dipstick Guide Tube And Bolts

-- Remove the wastegate bypass regulator valve bolts -arrows- and valve from the turbocharger.

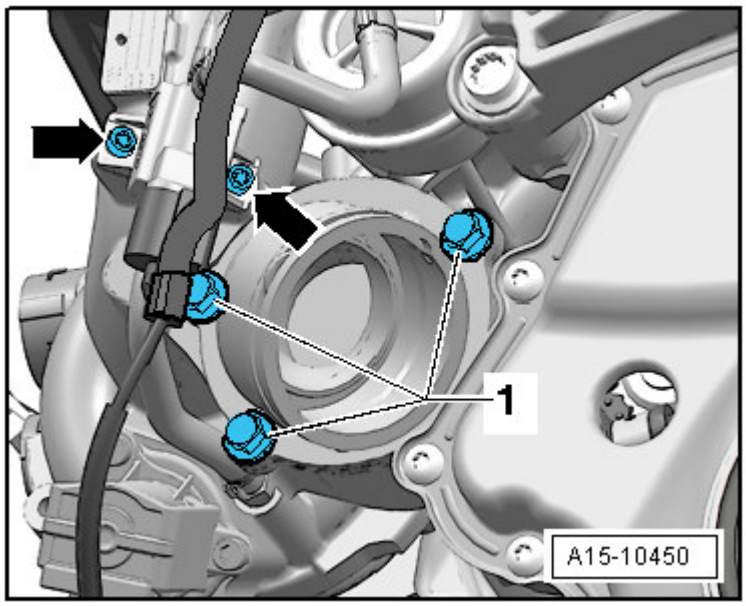

Fig. 177: Identifying Turbocharger And Supports

-- Remove the connection bolts -1- and connection from the turbocharger.

-- Remove the bolts -1 through 15- .

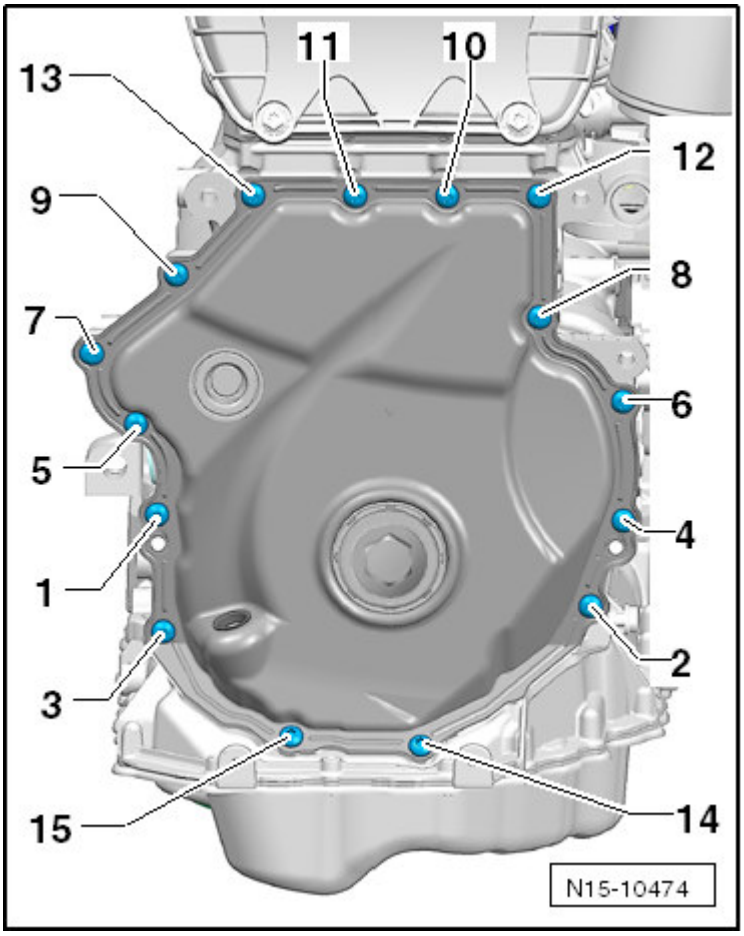

Fig. 178: Identifying Lower Timing Chain Cover Bolts

NOTE: There may be 8 bolts installed, depending on the version.

CAUTION: The lower timing chain cover could be damaged. To avoid deformation, do not hold between the bolting points.

-- Pry the lower timing chain cover off, when doing this, begin at -1 and 2- .

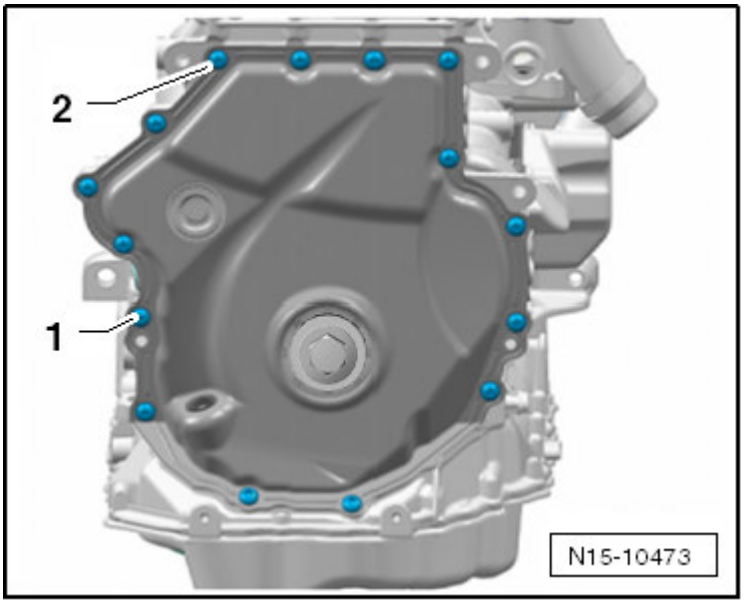

Fig. 179: Identifying Lower Timing Chain Cover And Bolt Removal Start Sequence

Installing

- For the correct tightening specifications, refer to **TIMING CHAIN COVER OVERVIEW**.
- Sealant, use silicone sealantD 174 003 A2.

NOTE: **If the cover was bent while it was being removed, it must be replaced.**

Note the expiration date of the silicone sealant.

The cover must be installed within 5 minutes after application of the silicone sealant.

Replace the bolts which have been tightened to an additional torque angle

Replace the sealing rings, seals and self-locking nuts.

CAUTION:
- **Risk of contaminating the lubricating system. Cover open parts of engine.**
- **Wear protective eyewear.**

-- Remove any sealant residue on the cylinder block using a flat blade scraper.

-- Seal off both sides of the seal with tape to prevent contamination.

-- Use a rotating plastic brush to remove any remaining sealing on the cover.

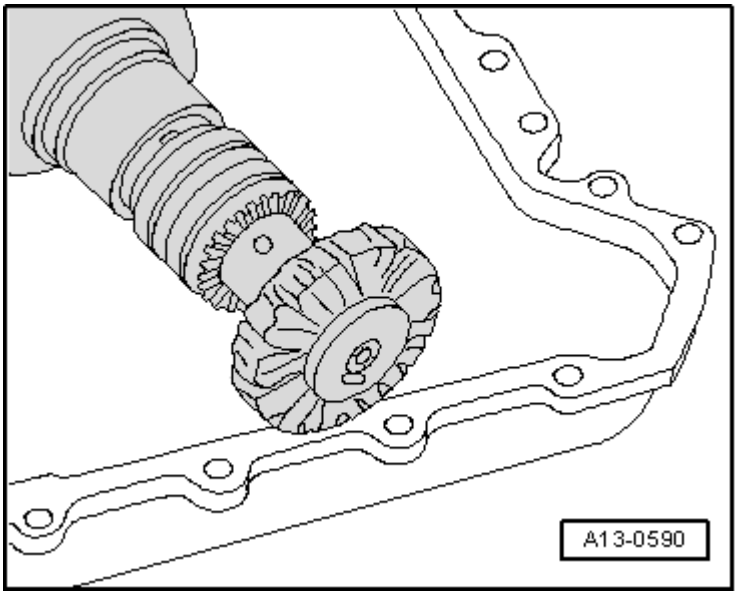

Fig. 180: Identifying Rotating Plastic Brush

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

Checking the Cover for Distortion

-- Install the cover using the old bolts and tighten them to 8 Nm.

-- Check between the cover and housing using a feeler gauge, the gap must not exceed 0.2 mm.

NOTE: If the gap exceeds 0.2 mm, replace the cover.

It is not possible to measure between the cover the upper oil pan, however check the sealing surface for evenness.

-- Make sure both alignment sleeves -arrows- for centering the cover are present.

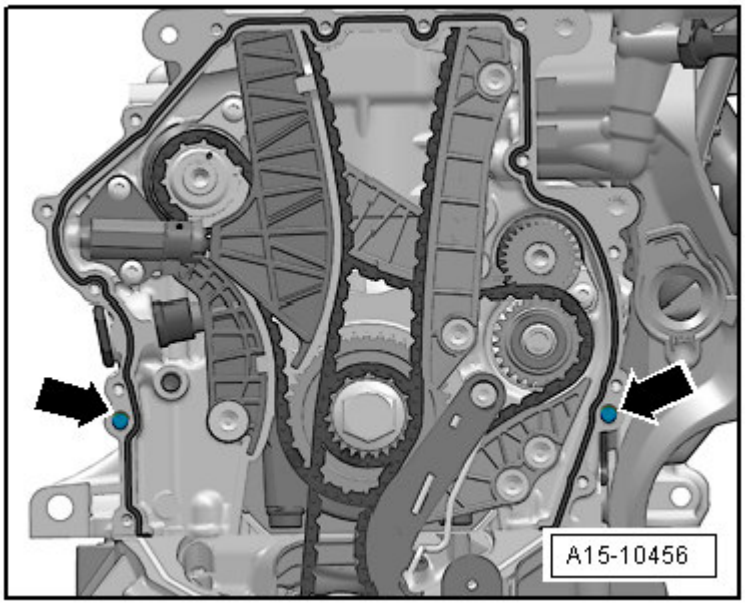

Fig. 181: Centering Cover Alignment Bushings

-- Cut the sealant tube nozzle at the front mark (nozzle diameter: approximately 2 mm).

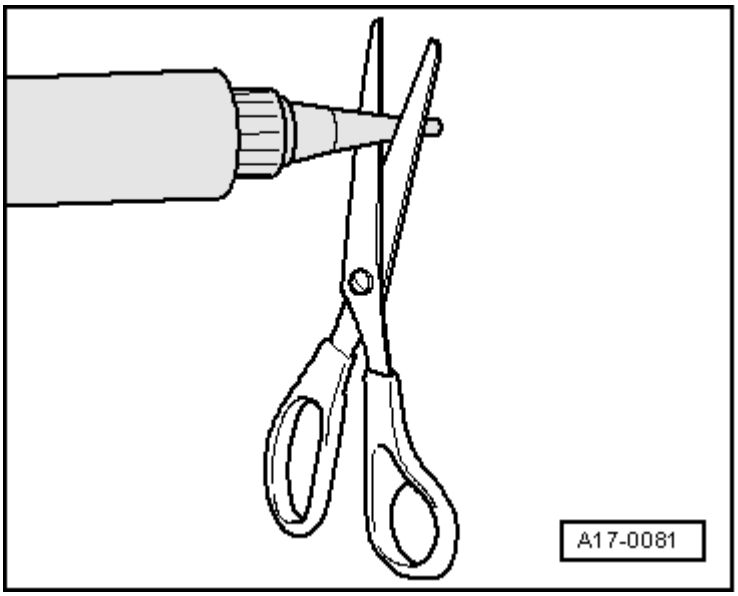

Fig. 182: Cut Tube Nozzle At Front Marking (Nozzle Diameter Approx. 3 Mm)

Cover with 15 Bolts

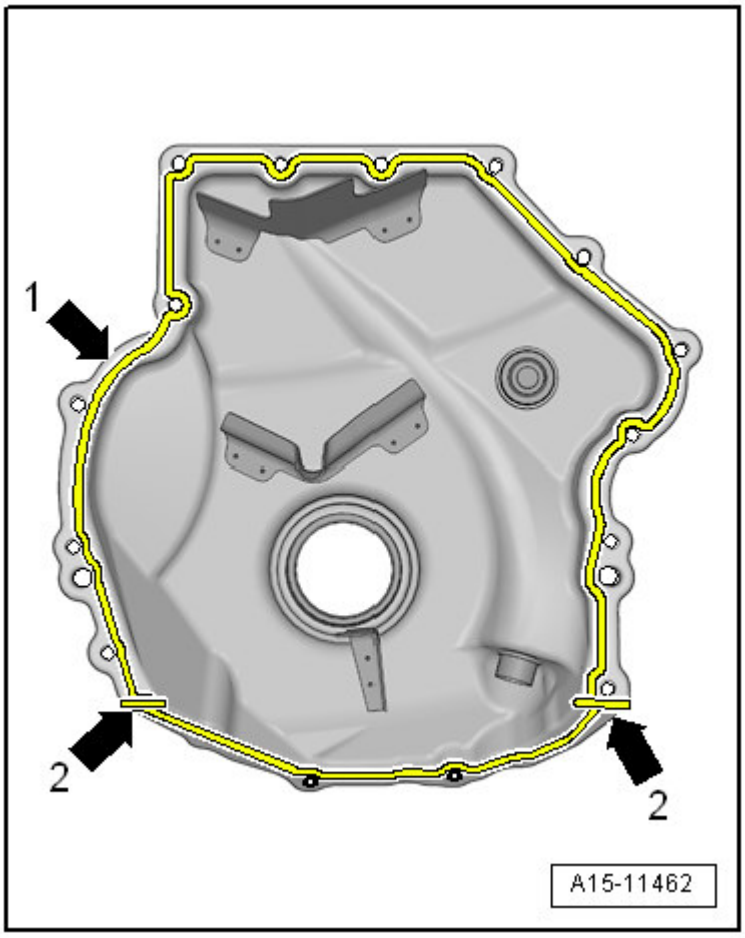

Fig. 183: Identifying Silicon Sealing Compound To Clean Sealing Surface -Arrow 1- And On Edges -Arrows 2- Of New Cover

-- Apply the silicone sealantD 174 003 A2 on the clean sealing surface -arrow 1- and on the edges -arrows 2- of the new cover as shown in the illustration.

- Thickness of sealant bead: 2 to 3 mm

Cover with 8 Bolts

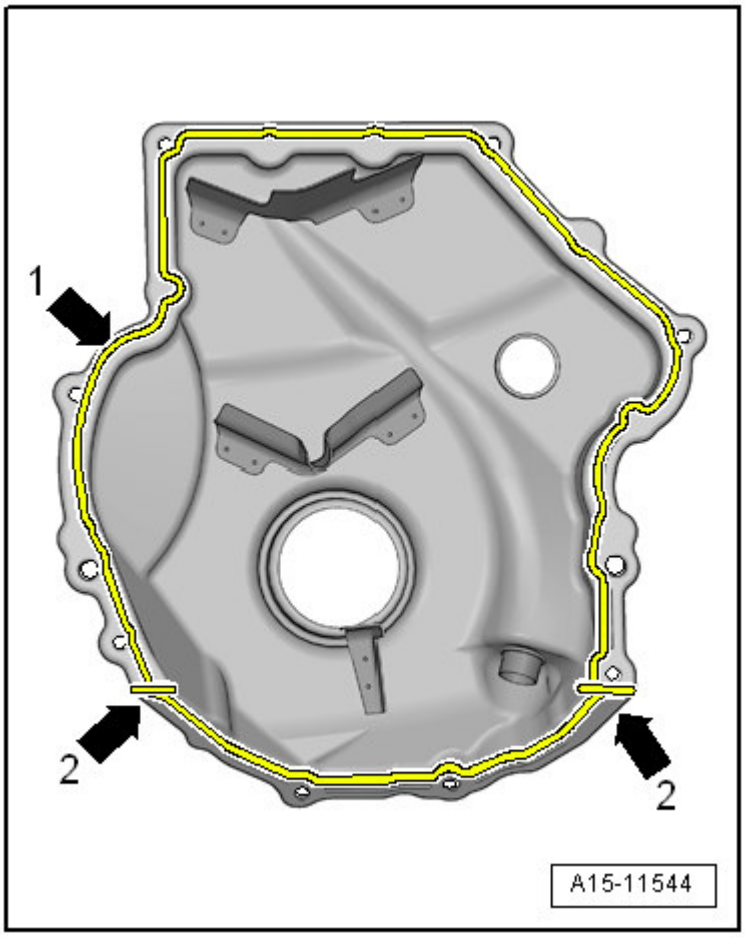

Fig. 184: Identifying Silicon Sealing Compound To Clean Sealing Surface -Arrow 1- And On Edges -Arrows 2- Of New Cover

-- Apply the silicone sealantD 174 003 A2 on the clean sealing surface -arrow 1- and on the edges -arrows 2- of the new cover as shown in the illustration.

- Thickness of sealant bead: 2 to 3 mm

NOTE: The cover must be installed within 5 minutes after application of the silicone sealant.

The sealant bead may not be thicker than specified, otherwise the excess sealant could enter the oil pan and clog the oil suction pipe.

-- Immediately install the cover and tighten the bolts:

- Cover with 15 bolts, refer to **Fig. 8**.
- Cover with 8 bolts, refer to **Fig. 9**.

NOTE: After installing the cover, allow the sealant to dry for approximately 30 minutes.

Only after then may the engine oil be added.

-- Fill the engine oil.

-- Check the oil level.

Further installation is in the reverse order of removal.

VIBRATION DAMPER SEAL

Special tools and workshop equipment required

- Thrust PieceT10354
- Pulling HookT20143/2

Removing

-- Remove the vibration damper. Refer to **VIBRATION DAMPER** .

-- Remove the vibration damper and install the thrust pieceT10368.

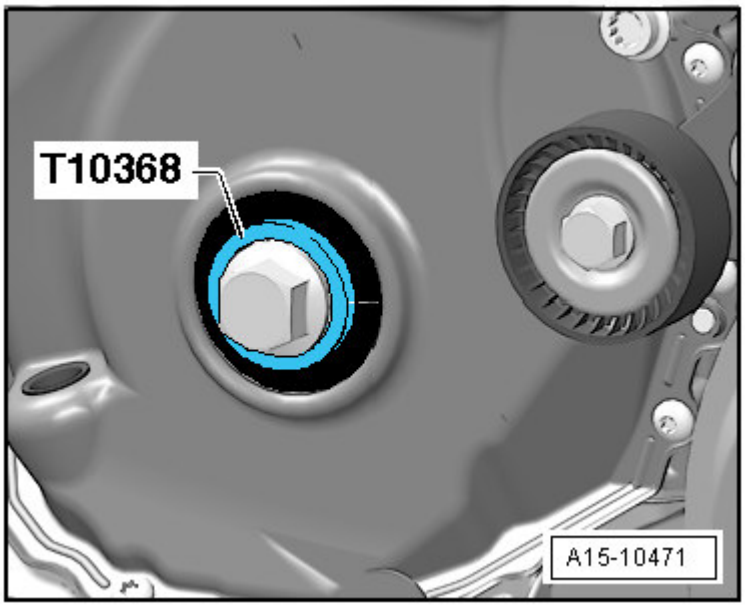

Fig. 185: Identifying Vibration Damper Bolt And Thrust Piece T10368

-- Remove the seal using the pulling hookT20143/2.

Installing

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

-- Clean the running and sealing surface.

-- Remove the thrust pieceT10368.

-- Pull the seal -arrow- in using the thrust pieceT10354 and the vibration damper bolt.

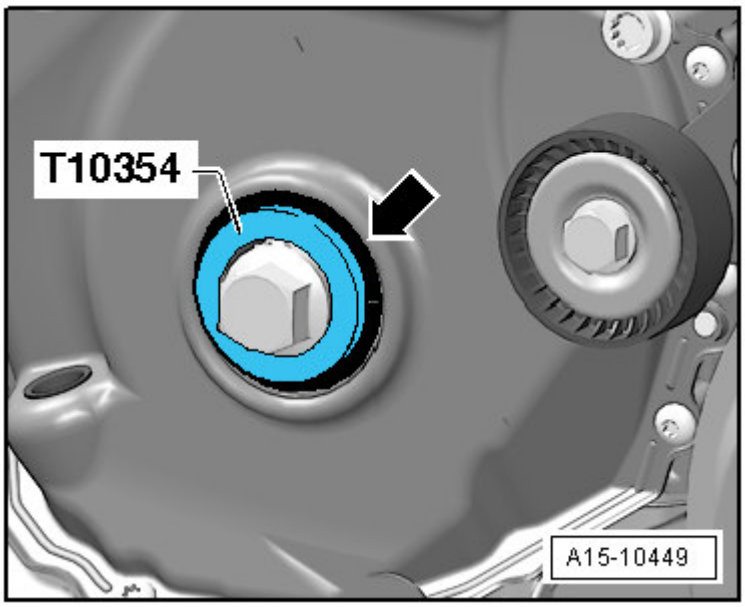

Fig. 186: Identifying Thrust Piece T10354

NOTE: Replace the vibration damper bolt.

Replace the O-ring.

Further installation is in the reverse order of removal.

CAMSHAFT TIMING CHAIN (WITHOUT NEW TOOLS)

Special tools and workshop equipment required

- Counter Hold ToolT10355
- Assembly ToolT10352
- Locking PinT40011
- Thrust PieceT10368
- Torque Wrench (5-50 Nm)V.A.G 1331

Removing

-- Remove the upper timing chain cover. Refer to **UPPER TIMING CHAIN COVER**.

-- Rotate the vibration damper to the Top Dead Center (TDC) position -arrow- using the counter hold

toolT10355.

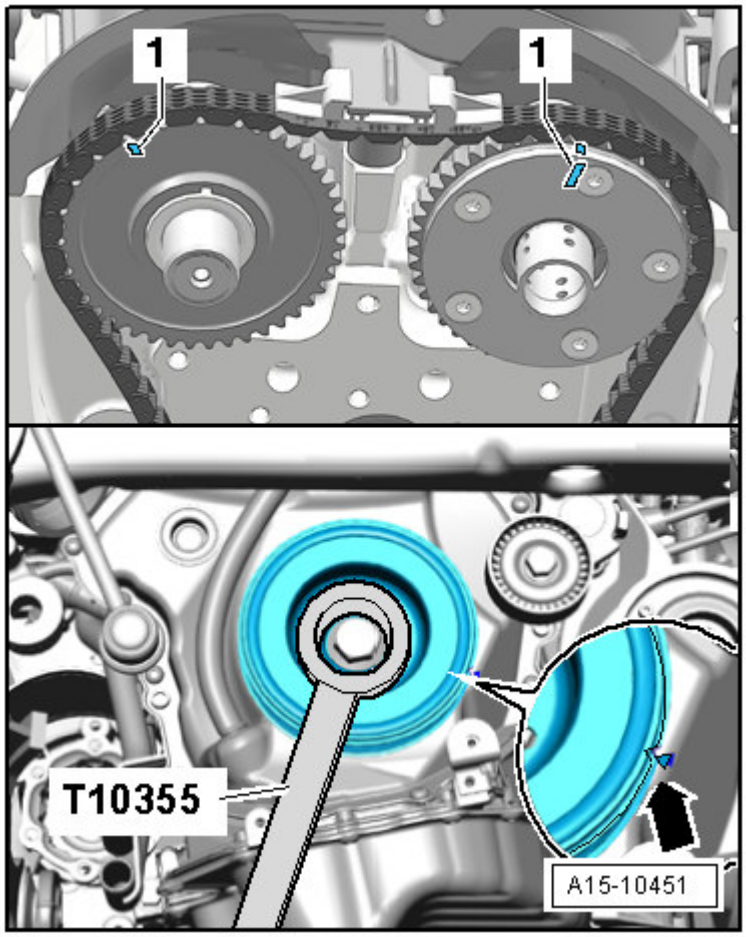

Fig. 187: Identifying Markings -1- On Camshafts Aligned To Point Upward

- The notch on the vibration damper must line up with the arrow mark -arrow- on the lower timing chain cover.
- The marks -1- on the camshafts must point upward.

-- Remove the lower timing chain cover, refer to one of the following:

- Passat and CC, refer to .
- GTI and Eos, refer to .
- Tiguan, refer to **LOWER TIMING CHAIN COVER**.

CAUTION: The control valve has left hand threads.

-- Remove the control valve in the -direction of the arrow- using the assembly toolT10352.

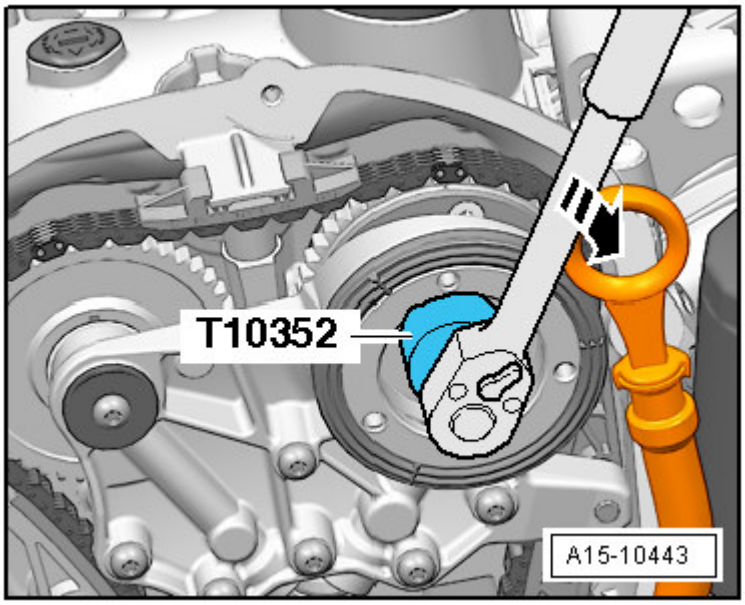

Fig. 188: Identifying Assembly Tool T10352 To Remove Control Valve

-- Remove the bolts -arrows- and remove the bearing bracket.

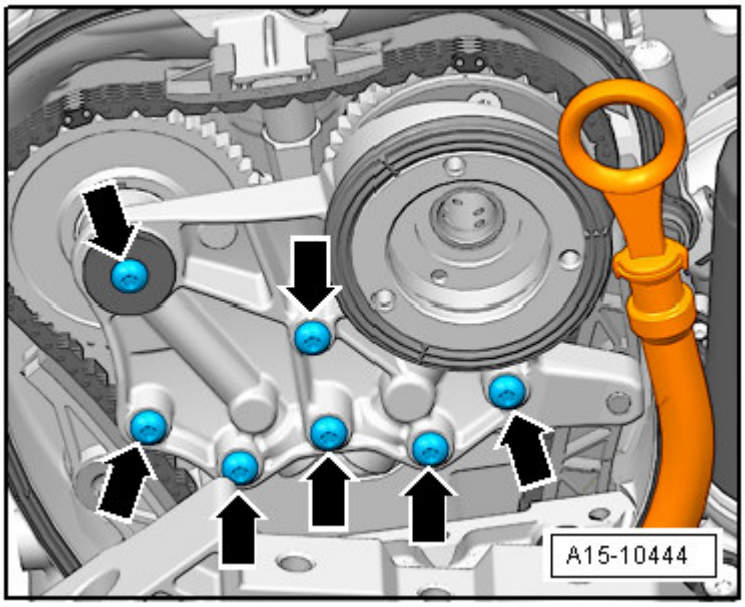

Fig. 189: Bearing Bracket Bolts

-- Press the oil pump chain tensioner in the -direction of the arrow- and secure it using the locking pinT40011.

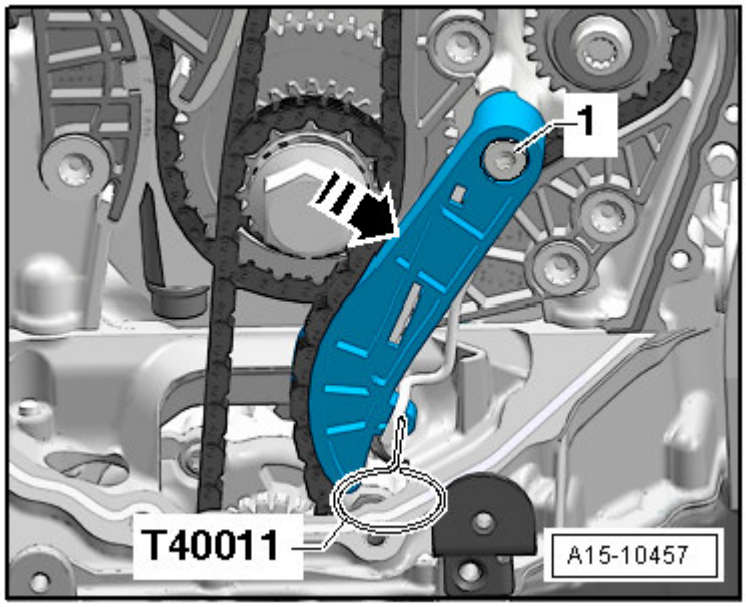

Fig. 190: Identifying Oil Pump Chain Tensioner And Locking Pin T40011

-- Remove the oil pump chain tensioner guide pin -1- .

-- Remove the oil pump chain tensioner.

The locking wedge in the chain tensioner must be lifted in order to release the tension from the chain tensioner. Sand the end of the locking pinT40011 down to a point. A screwdriver with a head approximately 1.5 mm wide can also be used.

CAUTION: There is a risk of damaging the chain tensioner. Proceed very carefully.

-- Lift the chain tensioner locking wedge in the -direction of arrow 1- , press the timing chain tensioning rail in the -direction of arrow 2- and secure it using the locking pinT40011.

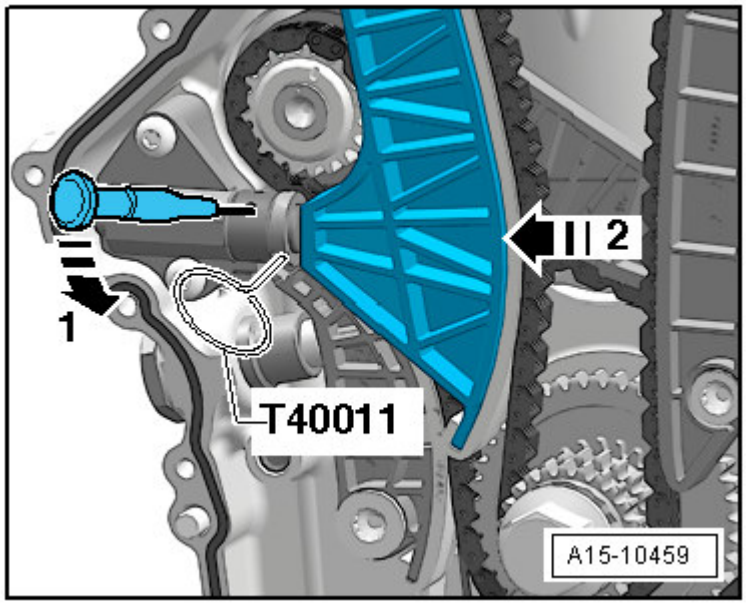

Fig. 191: Identifying Directions: (Lift) Chain Tensioner Locking Wedge And (Press) Timing Chain Tensioning Rail

-- Remove the timing chain tensioning rail guide pin -2- and tensioning rail.

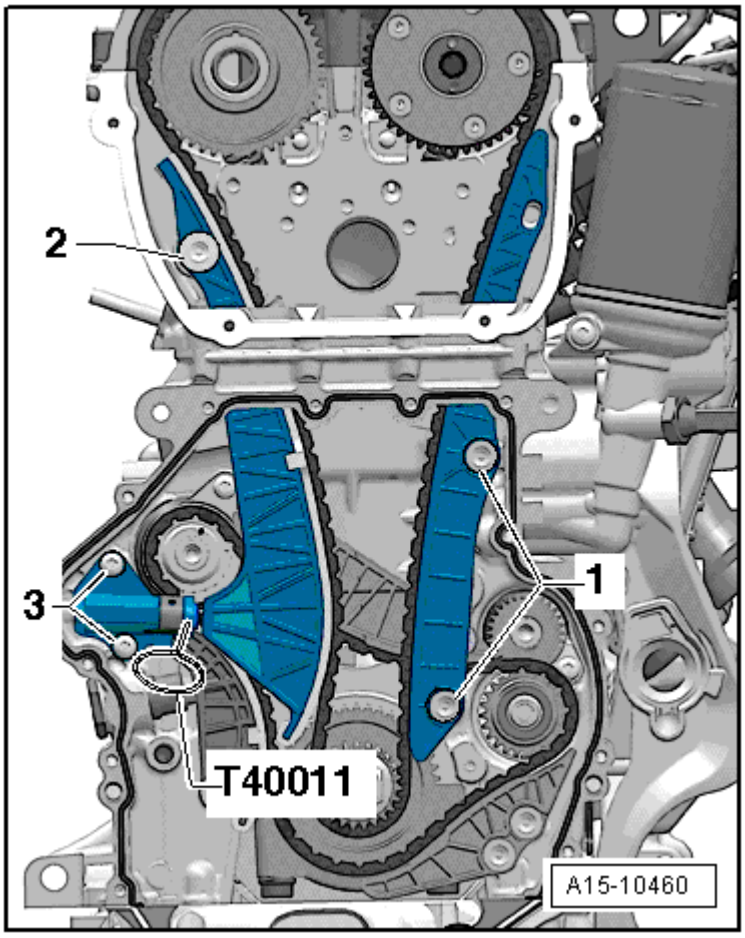

Fig. 192: Identifying Camshaft Timing Chain Tensioner Bolts, Camshaft Timing Chain Guide Rail And Guide Pins

NOTE: The intake camshaft switches in the engine rotation direction.

-- Remove the timing chain guide rail guide pins -1- and guide rail.

-- Remove the timing chain.

Installing

- Tightening specifications, refer to **CAMSHAFT TIMING CHAIN OVERVIEW**.
- The chain tensioner for the tensioning rail is installed and secured with the locking pinT40011.
- The sprocket for the crankshaft is secured using the thrust pieceT10368.

NOTE: The following procedure must be performed in one step. A second technician is needed.

The painted links on the timing chain must be positioned on the marks on the sprockets.

Hold the wrench tight until the tensioning rail and guide rail are installed.

-- Position the crankshaft to TDC, as shown in the illustration. It is in TDC when the marks on the balance shafts are aligned with the balance shaft bolts.

NOTE: The marks must match up with the painted chain links each 16th turn.

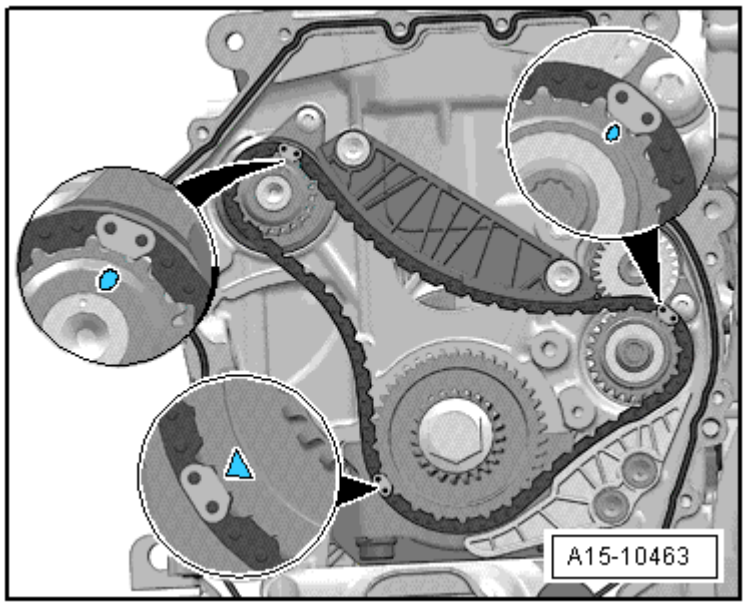

Fig. 193: Identifying Timing Chain Markings

-- Mount the timing chain on the exhaust camshaft. Align the colored chain links with the marks.

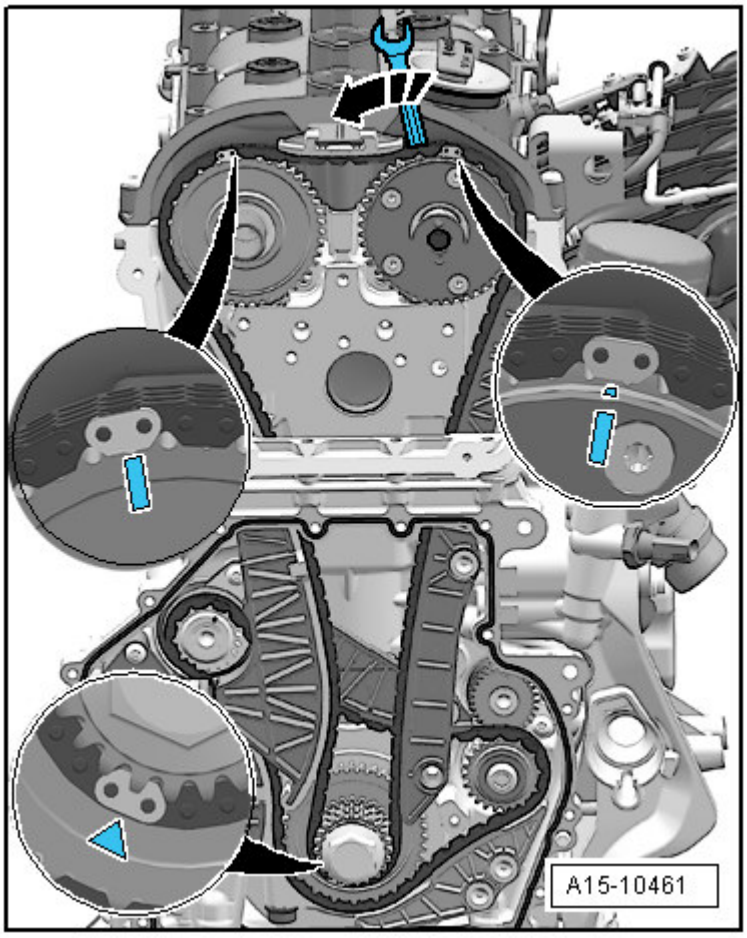

Fig. 194: Identifying Intake Camshaft Turned Using Wrench

-- Mount the timing chain on the crankshaft. Align the colored chain link with the mark.

-- Rotate the intake camshaft using the wrench in the -direction of the arrow- and mount the timing chain. Continue to hold the camshaft with the wrench.

-- Install the timing chain tensioning rail and tighten the guide pin -2- .

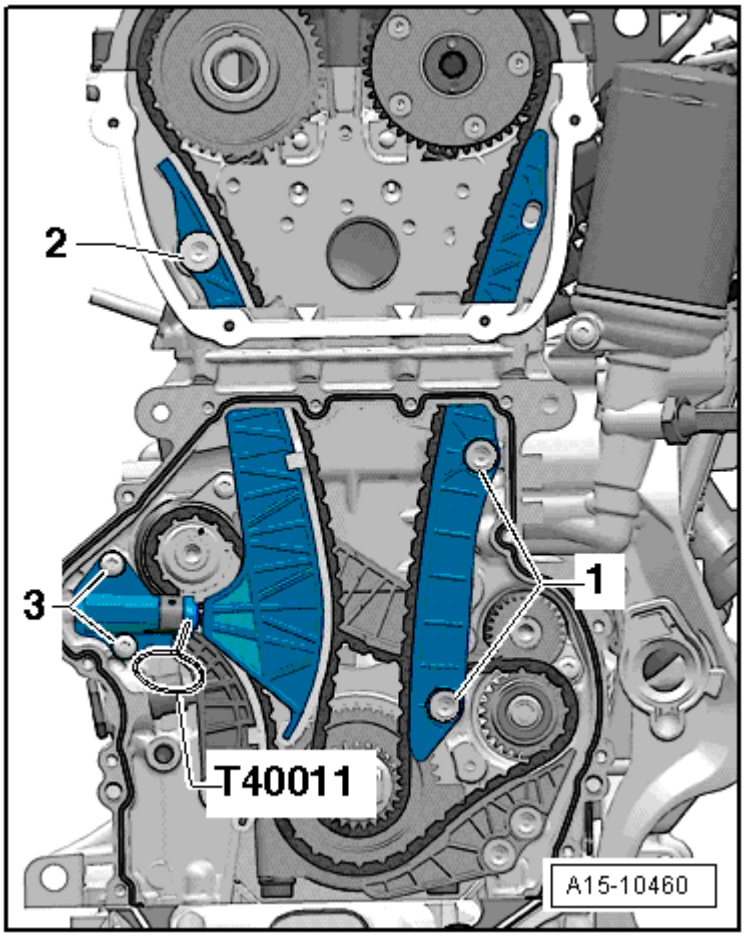

Fig. 195: Identifying Camshaft Timing Chain Tensioner Bolts, Camshaft Timing Chain Guide Rail And Guide Pins

-- Install the timing chain guide rail and tighten the guide pins -1- .

-- Install the bearing bracket and tighten the bolts -arrows- hand tight.

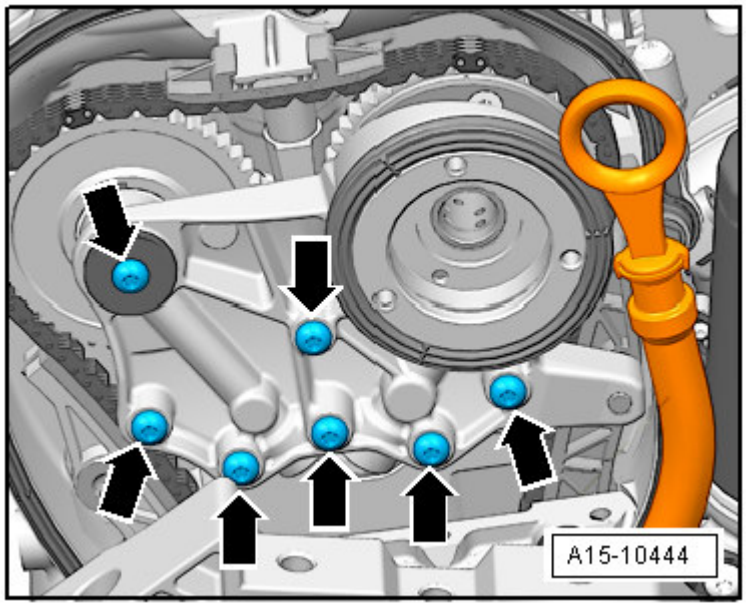

Fig. 196: Bearing Bracket Bolts

-- Remove the locking pinT40011 from the chain tensioner.

-- Tighten the bolts -arrows- to specification, refer to **CAMSHAFT TIMING CHAIN OVERVIEW**.

The rest of the installation is basically a reverse of the removal sequence.

CAMSHAFT TIMING CHAIN (WITH NEW TOOLS)

Special tools and workshop equipment required

- Assembly ToolT10352
- Counter Hold ToolT10355
- Locking PinT40011
- LeverT40243
- Locking ToolT40267
- Camshaft LocatorT40271

Removing

-- Remove the upper timing chain cover. Refer to **UPPER TIMING CHAIN COVER**.

-- Rotate the vibration damper using the counter hold toolT10355 into the Top Dead Center (TDC) position -arrow- .

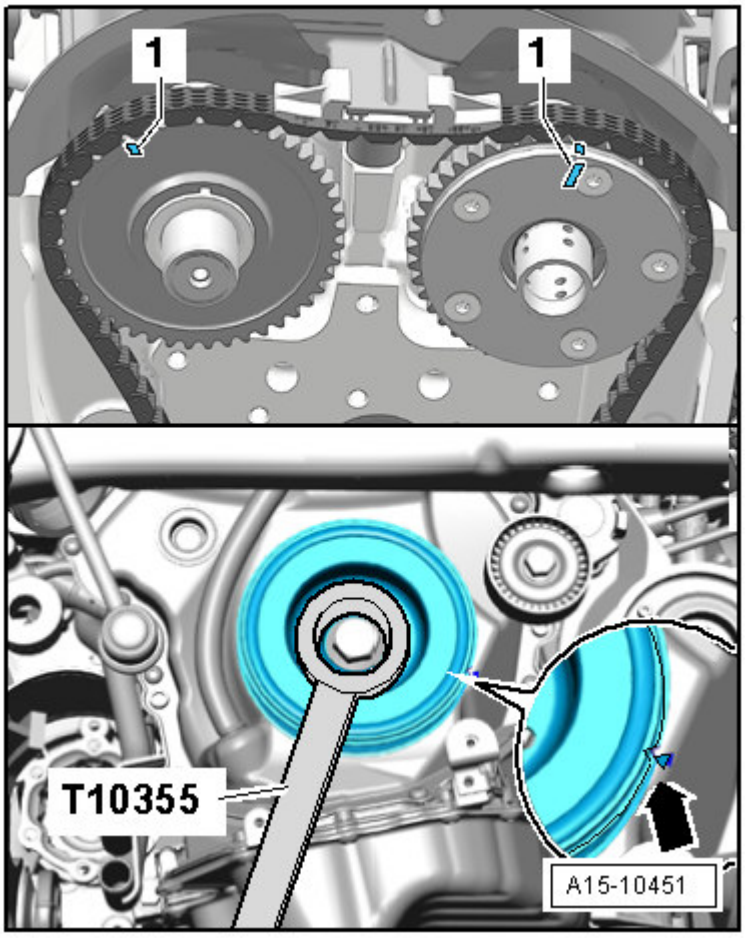

Fig. 197: Identifying Markings -1- On Camshafts Aligned To Point Upward

- The notch on the vibration damper must line up with the arrow mark on the lower timing chain cover.
- The marks -1- on the camshafts must point upward.

-- Remove the vibration damper. Refer to **VIBRATION DAMPER** .

-- Install the vibration damper bolt again with the thrust pieceT10368 and tighten it hand tight.

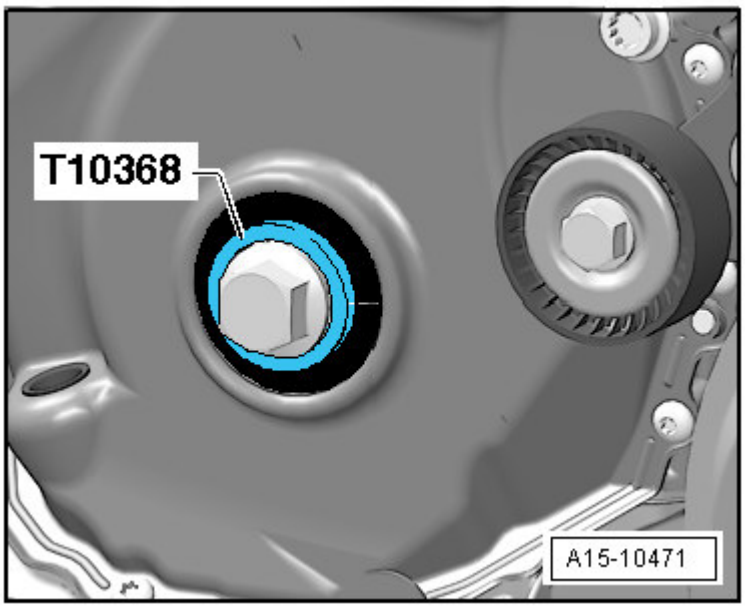

Fig. 198: Identifying Vibration Damper Bolt And Thrust Piece T10368

-- Remove the lower timing chain cover. Refer to one of the following:

GTI and Eos, refer to .

Passat and CC, refer to .

Tiguan, refer to **LOWER TIMING CHAIN COVER**.

-- Remove the control valve in the -direction of arrow- using the assembly toolT10352.

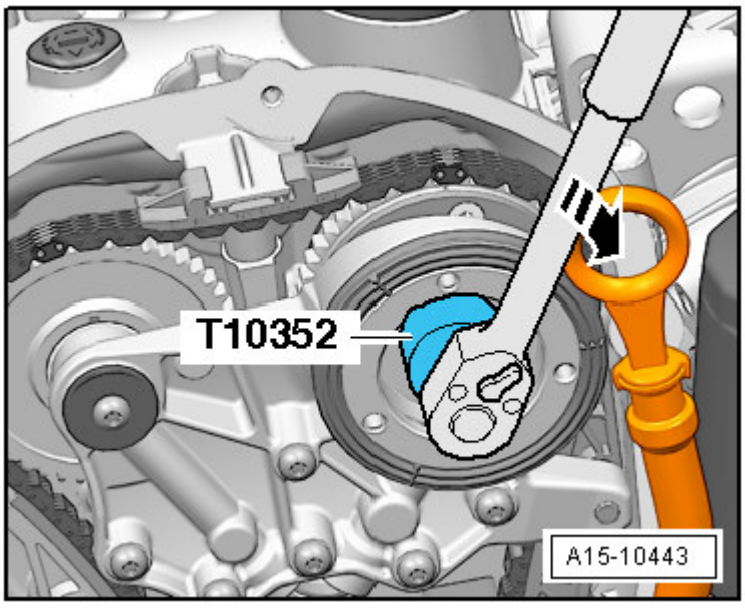

Fig. 199: Identifying Assembly Tool T10352 To Remove Control Valve

CAUTION: The control valve has a left hand threads.

-- Remove the bolts -arrows- and remove the bearing bracket.

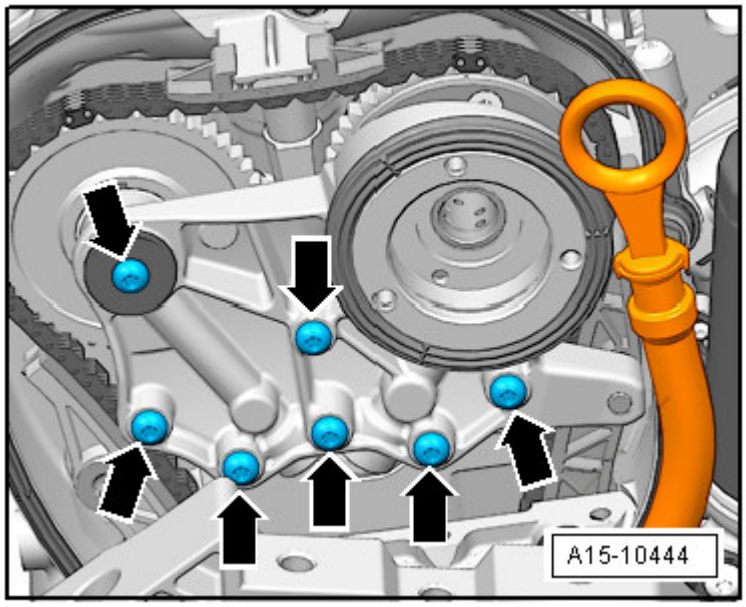

Fig. 200: Bearing Bracket Bolts

-- Press the oil pump chain tensioner in the -direction of the arrow- and secure it using a locking pinT40011.

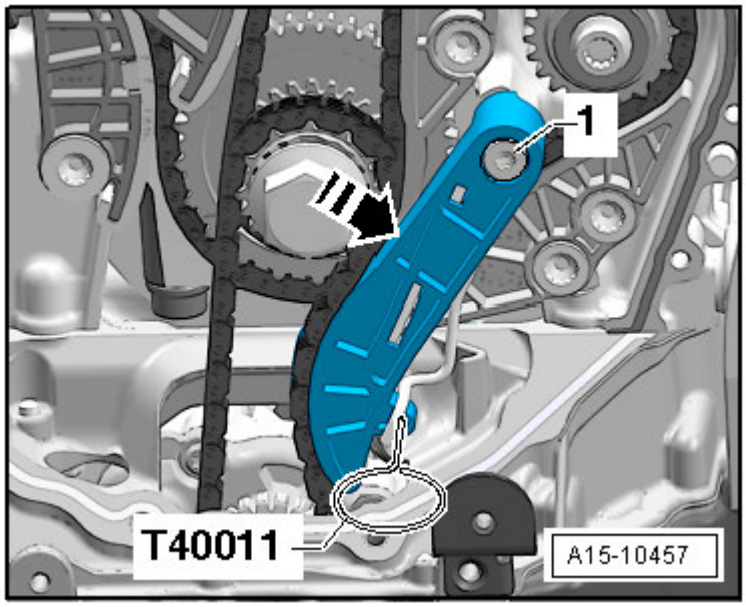

Fig. 201: Identifying Oil Pump Chain Tensioner And Locking Pin T40011

-- Remove the oil pump chain tensioner guide pin -1- .

-- Remove the oil pump chain tensioner.

-- Remove the bolts -arrows- .

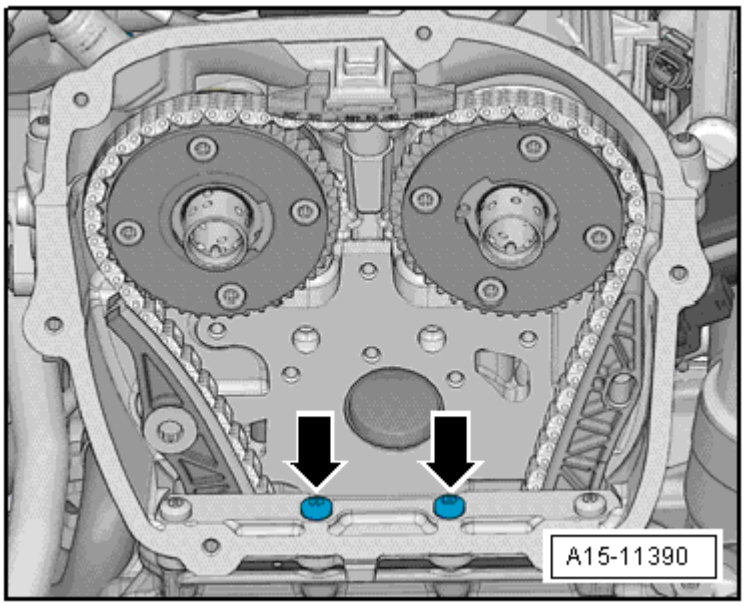

Fig. 202: Identifying Bolts

2 different chain tensioners may be installed.

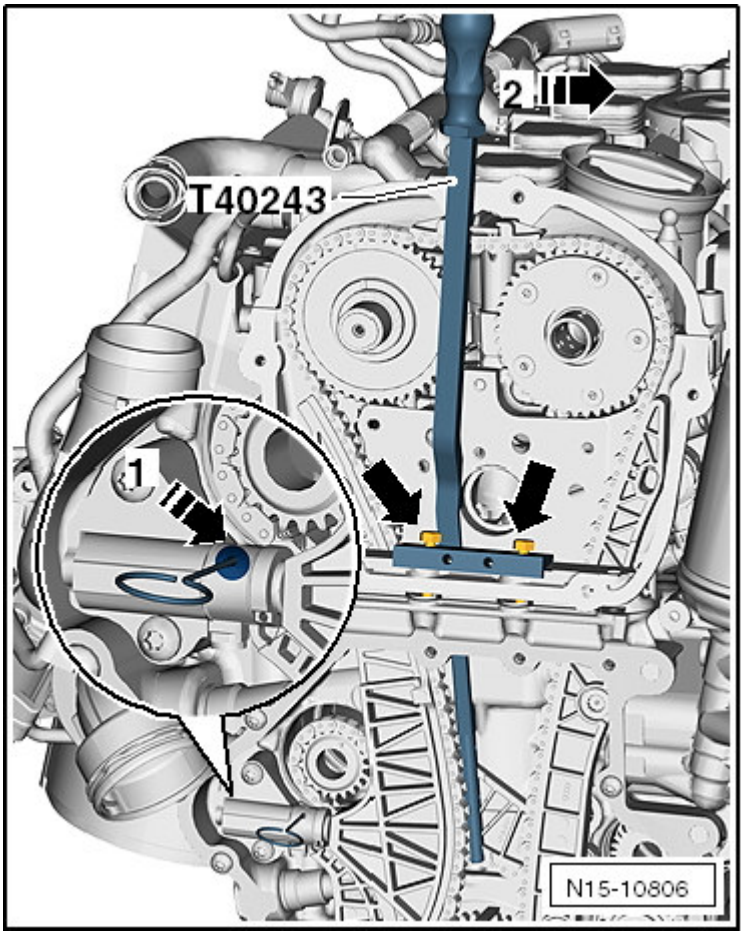

Fig. 203: NO CONTENT

Version 1:

-- Install the leverT40243 -arrows- .

-- Lift up the locking wedge for the chain tensioner -arrow 1- . Sand the end of the locking pinT40011 down to a point. A screwdriver with a head approximately 1.5 mm wide can also be used.

CAUTION: There is a risk of damaging the chain tensioner. Proceed very carefully.

-- Slowly press and hold the leverT40243 in the -direction of arrow 2- .

-- Secure the chain tensioner using the locking pinT40011.

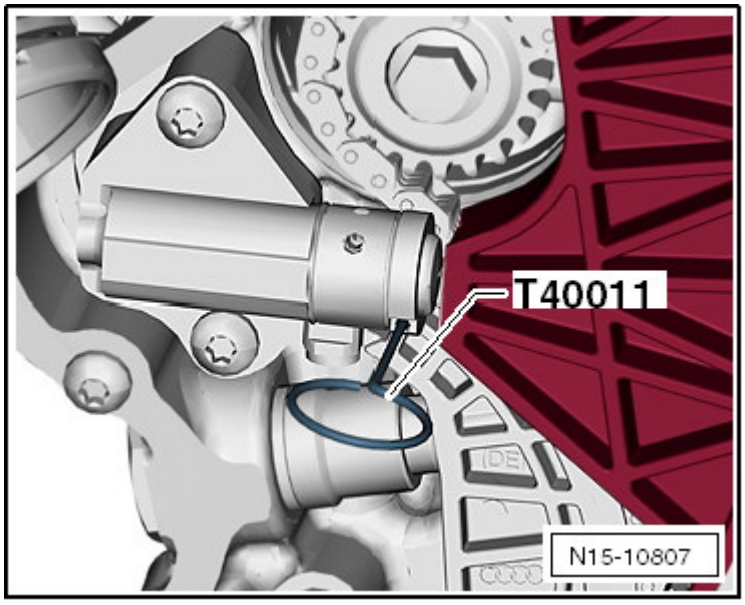

Fig. 204: NO CONTENT

Version 2:

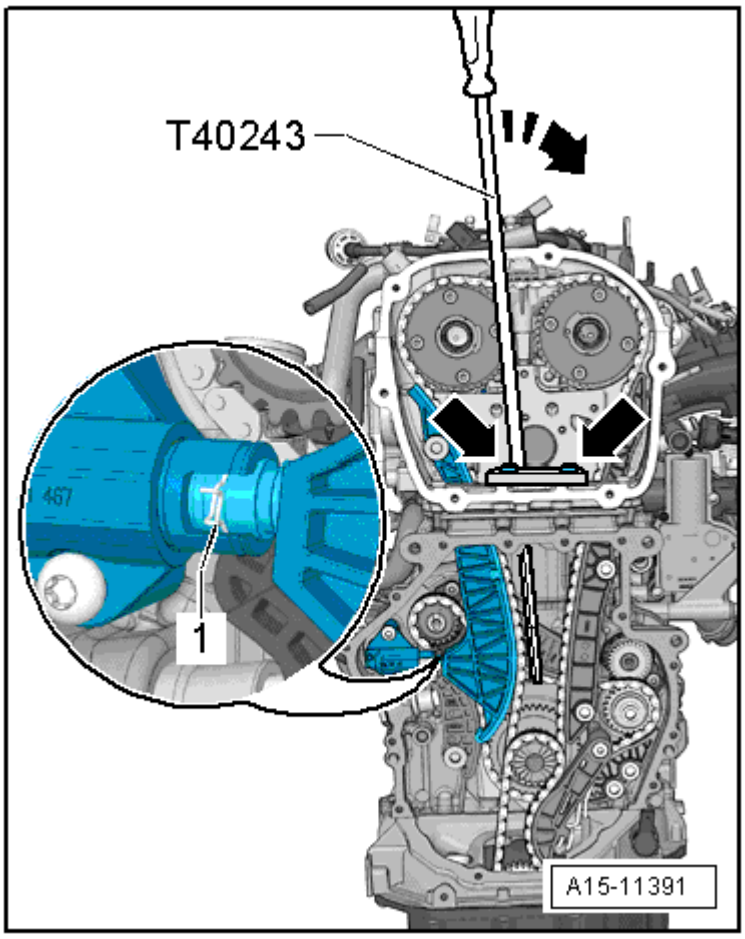

Fig. 205: Identifying Lever T40243 -Arrows-, Installation

-- Install the leverT40243 -arrows- .

-- Press the chain tensioner lock ring -1- together and hold it.

-- Slowly press and hold the leverT40243 in the -direction of the arrow- .

-- Secure the chain tensioner using the locking toolT40267.

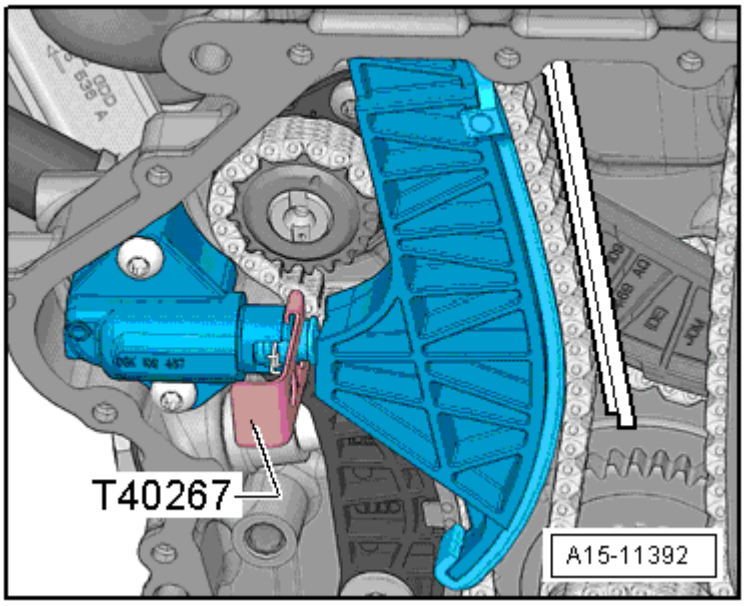

Fig. 206: Securing Chain Tensioner With T40267

Continuation for All

-- Remove the leverT40243.

-- Bolt the camshaft locating toolT40271/2 to the cylinder head and push the tool into the sprocket splines in the -direction of arrow 2- . If necessary, slightly rotate the intake camshaft in the -direction of arrow 1- using a wrench.

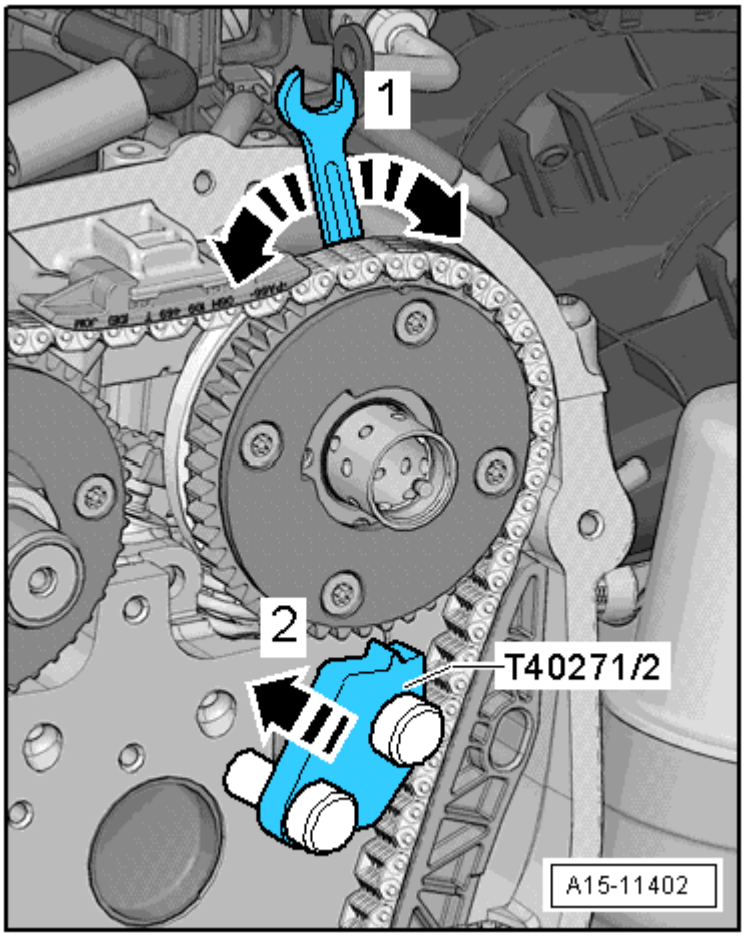

Fig. 207: Bolt Camshaft Locating Tool

-- Bolt the camshaft locating toolT40271/1 to the cylinder head. Hold the camshaft with a wrench in a clockwise direction -arrow- .

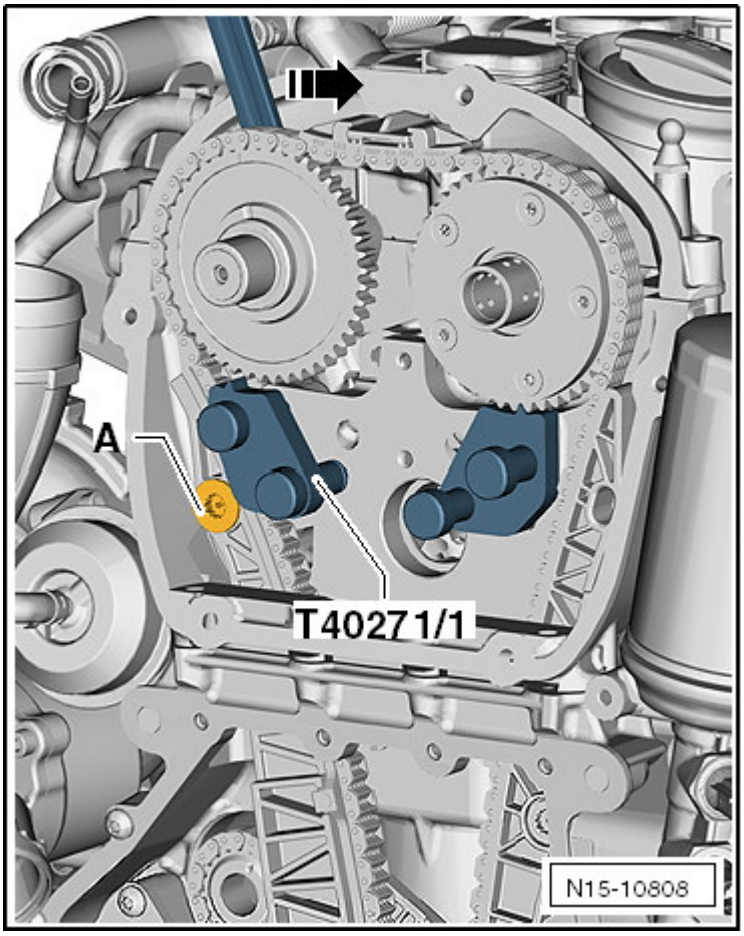

Fig. 208: NO CONTENT

-- Remove the guide pin -A- and slide the tensioning rail down. Continue to hold the camshaft.

-- Slide the camshaft locating toolT40271/1 into the splines for the sprocket in the -direction of arrow 2- . If necessary, turn the exhaust camshaft clockwise in the -direction of arrow 1- further, until the camshaft locating tool can be pushed in. The camshaft timing chain must be loose between the sprockets.

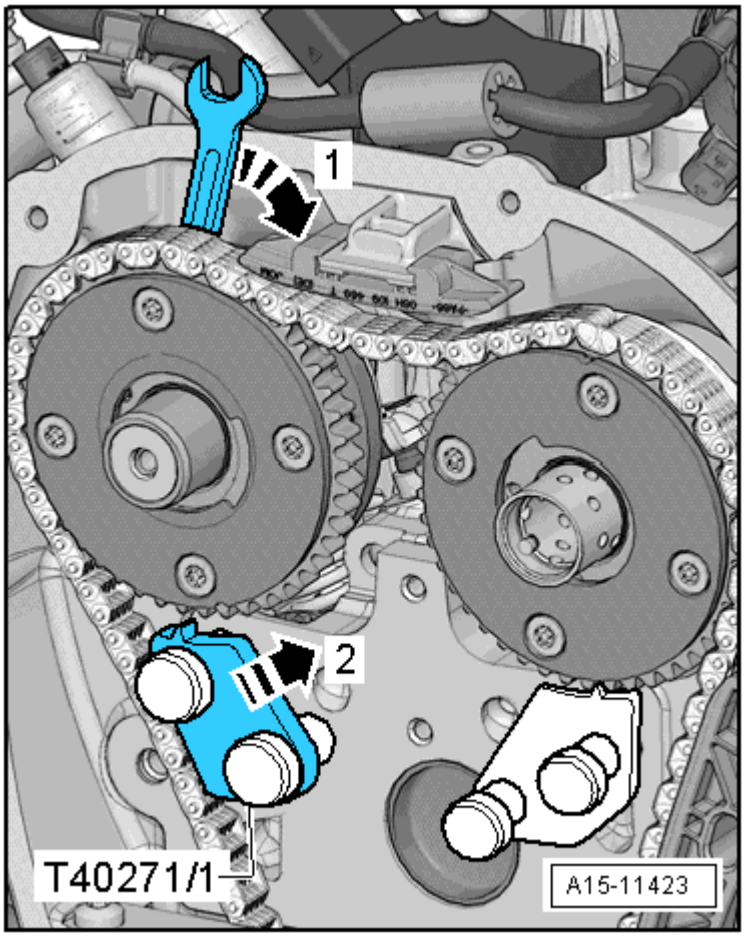

Fig. 209: Attach T40271/1 To Cylinder Head

-- Remove the guide rail guide pins -A- and the guide rail.

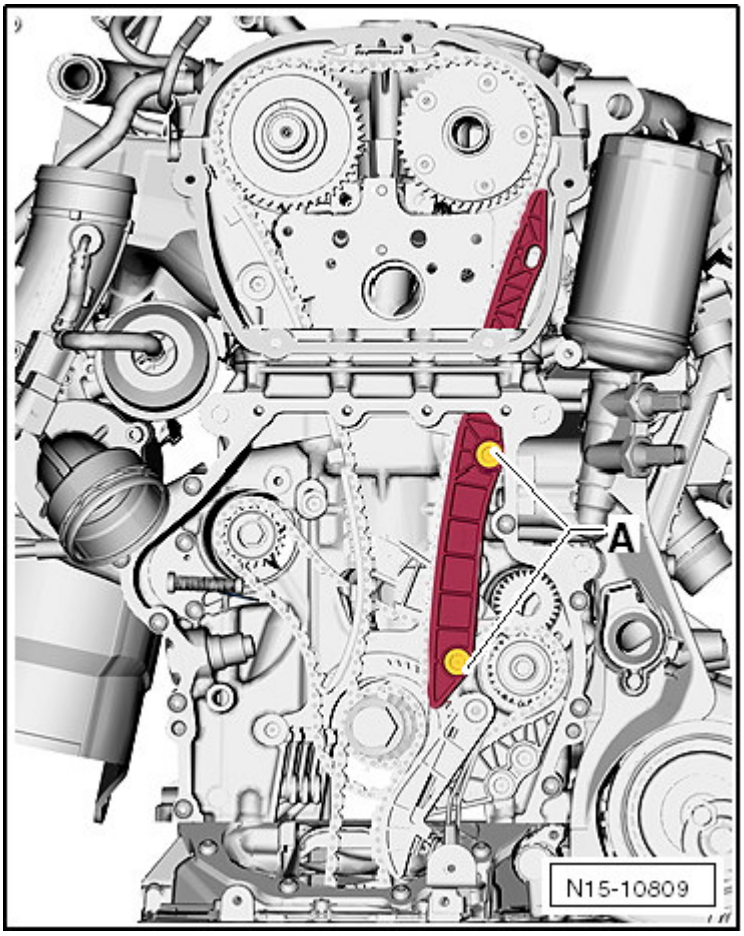

Fig. 210: NO CONTENT

-- Remove the timing chain.

Installing

- Tightening specifications, refer to **CAMSHAFT TIMING CHAIN OVERVIEW**.

NOTE: The help of a second mechanic is needed to install the timing chain.

The painted links of the timing chain must be positioned on the marks on the sprockets.

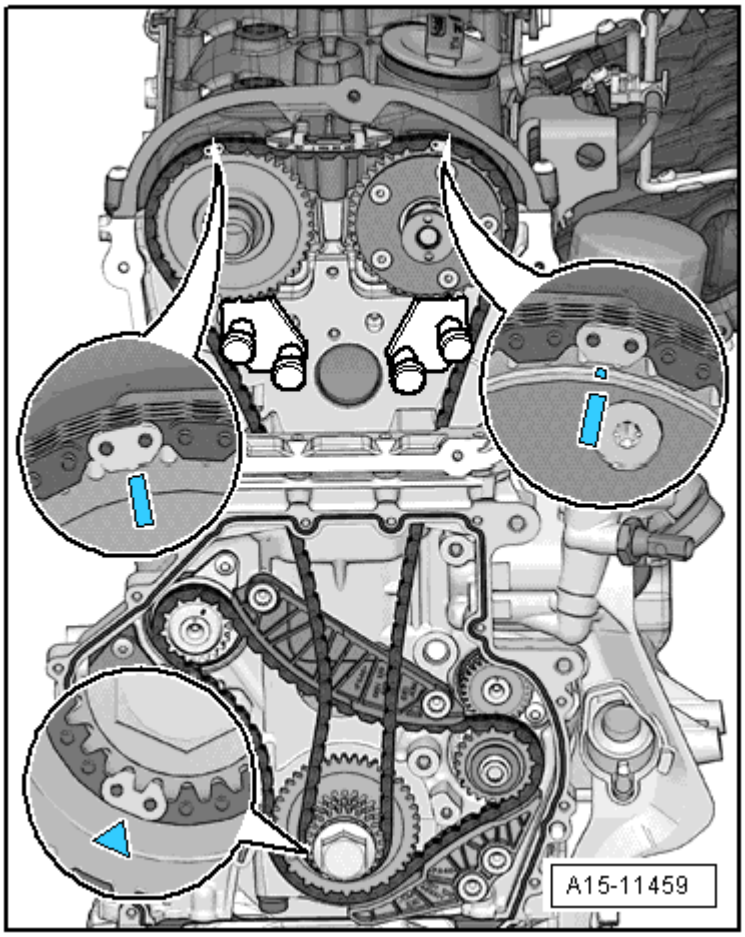

Fig. 211: Camshaft Timing Chain Overview

-- Mount the timing chain on the intake camshaft.

-- Mount the timing chain on the exhaust camshaft.

-- Lay the timing chain on the crankshaft and hold it there.

-- Install the camshaft timing chain guide rail and tighten the guide pins -A- .

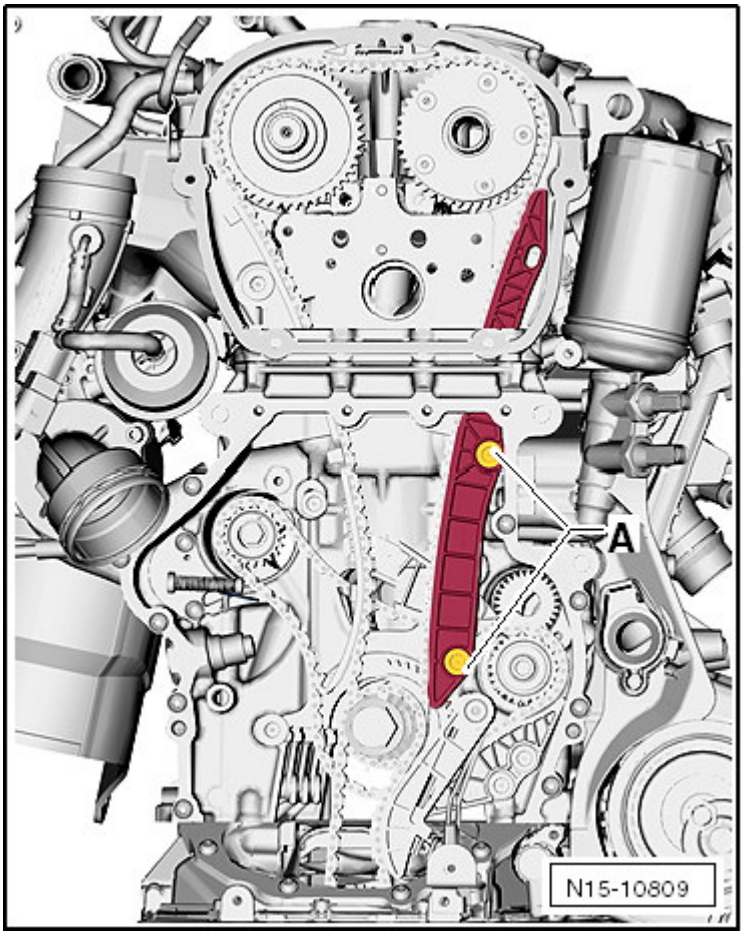

Fig. 212: NO CONTENT

NOTE: Use the help of a second mechanic to hold the exhaust camshaft in place.

-- Slowly rotate the exhaust camshaft in the -direction of arrow 1- until the camshaft locating toolT40271/1 can be pushed out of the sprocket splines.

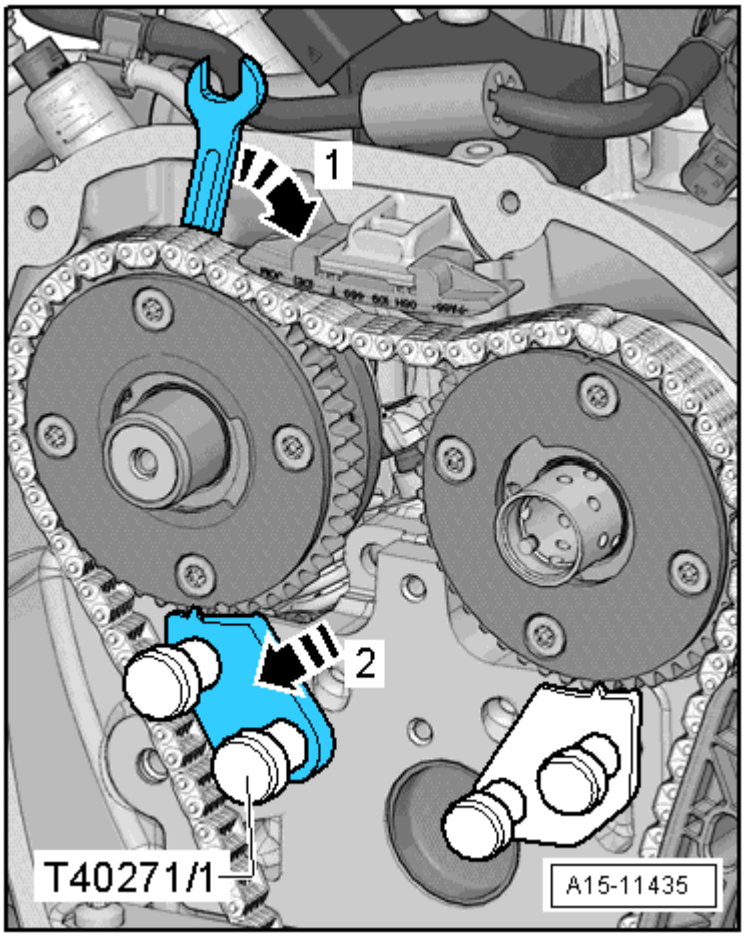

Fig. 213: Turn Exhaust Camshaft In Direction Of Arrow

-- Carefully release the camshaft, until the camshaft timing chain is laying on the upper guide rail. Hold the camshaft in this position.

CAUTION: Always check before installing the tensioning rail, whether the colored chain link is still aligned to the mark on the camshaft!

-- Continue to hold the camshaft and install the camshaft timing chain tensioning rail. Tighten guide pin -A- .

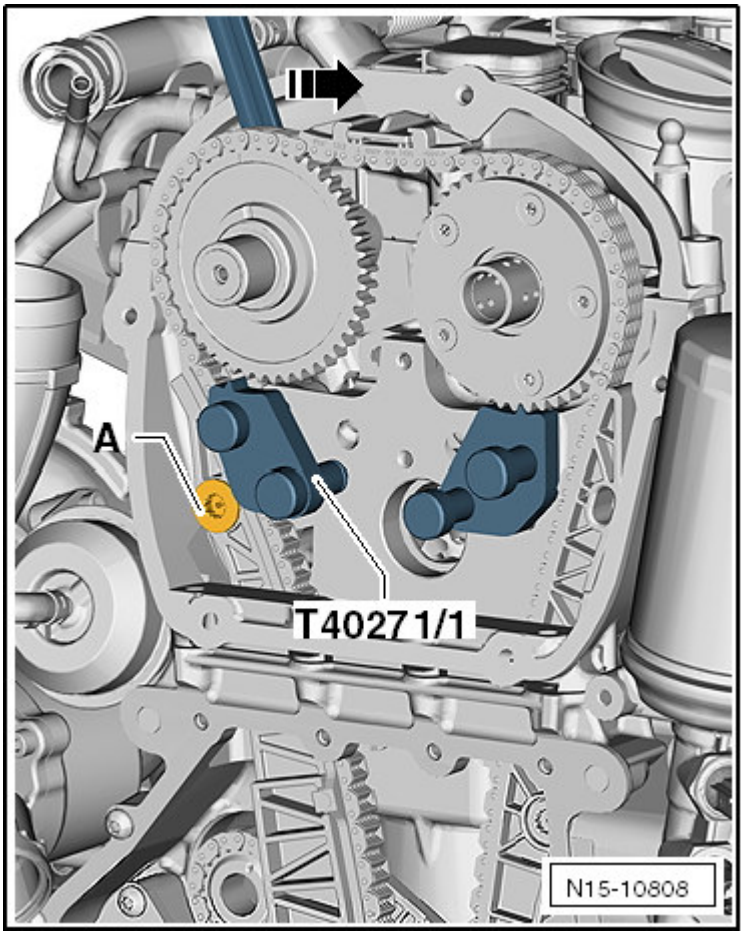

Fig. 214: NO CONTENT

-- Remove the camshaft locating toolT40271/1.

-- Push the camshaft locating toolT40271/2 out of the sprocket splines in the -direction of arrow 2- , If necessary, slightly rotate the intake camshaft in the -direction of arrow 1- using a wrench.

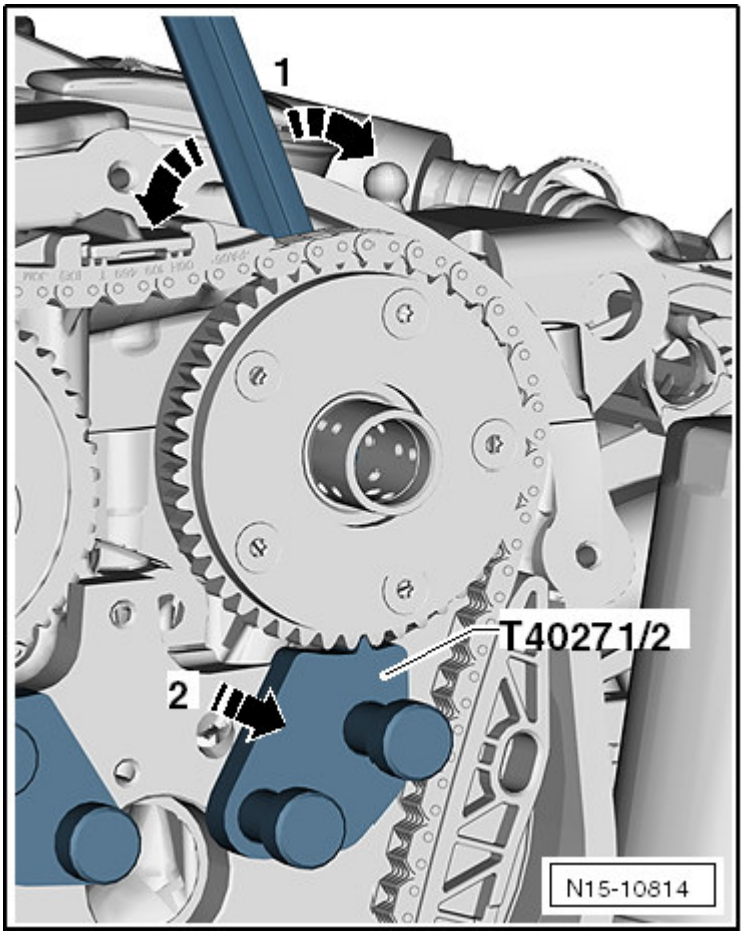

Fig. 215: NO CONTENT

-- Remove the camshaft locating toolT40271/2.

-- Remove the locking pinT40011 or the locking toolT40267, depending on the version.

-- Check that the position of the colored chain links are aligned with the marks on the sprockets.

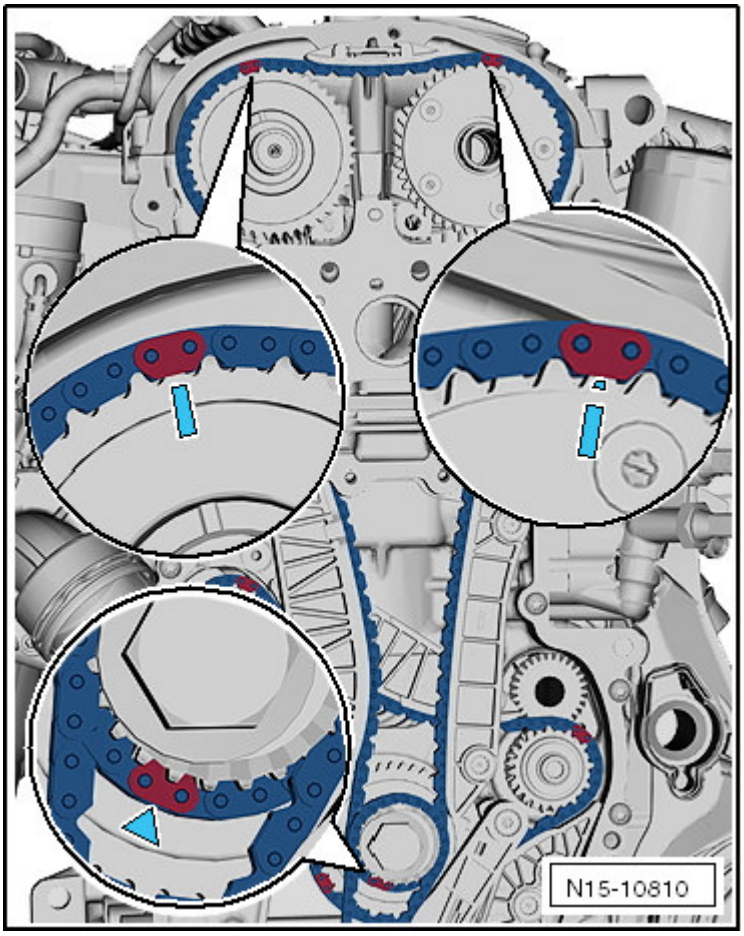

Fig. 216: NO CONTENT

-- Install the drive chain for the oil pump and the chain tensioner. Tighten the guide pin -1- and remove the locking pinT40011.

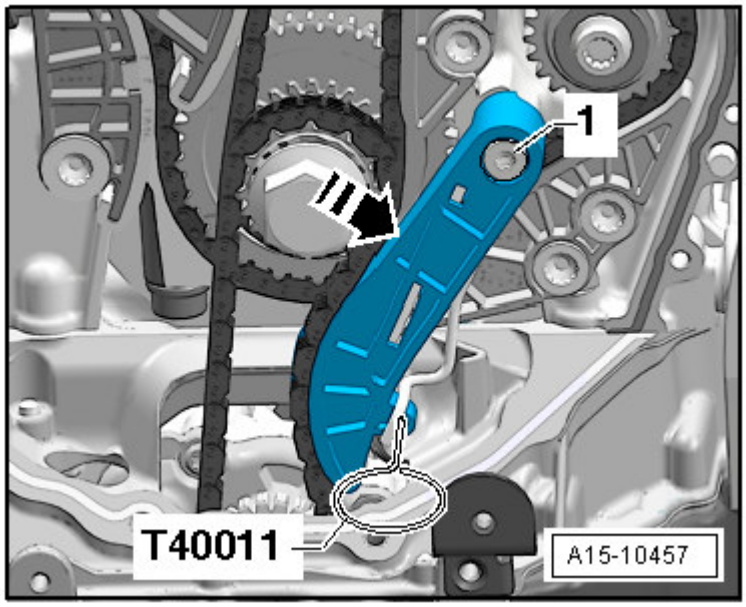

Fig. 217: Identifying Oil Pump Chain Tensioner And Locking Pin T40011

-- Install the bolts -arrows- and tighten them.

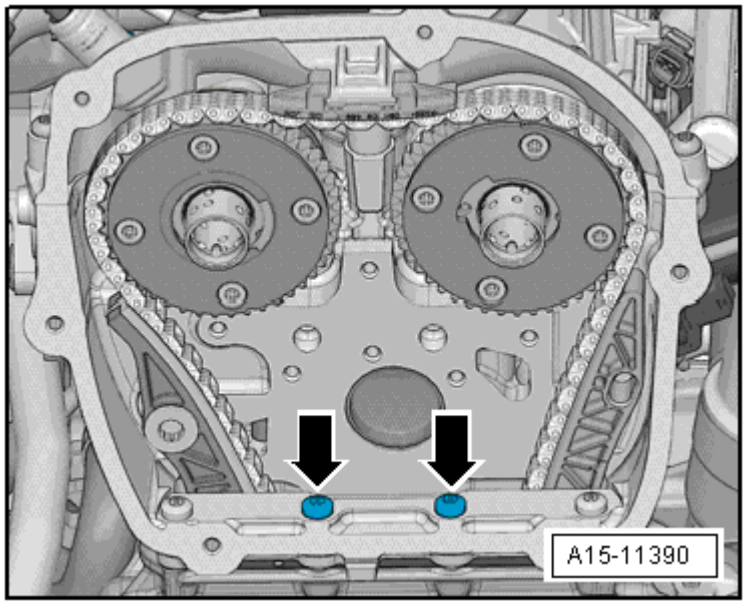

Fig. 218: Identifying Bolts

-- Carefully install the bearing mount. Do not tilt it when doing this. Hand tighten the bolts -arrows-

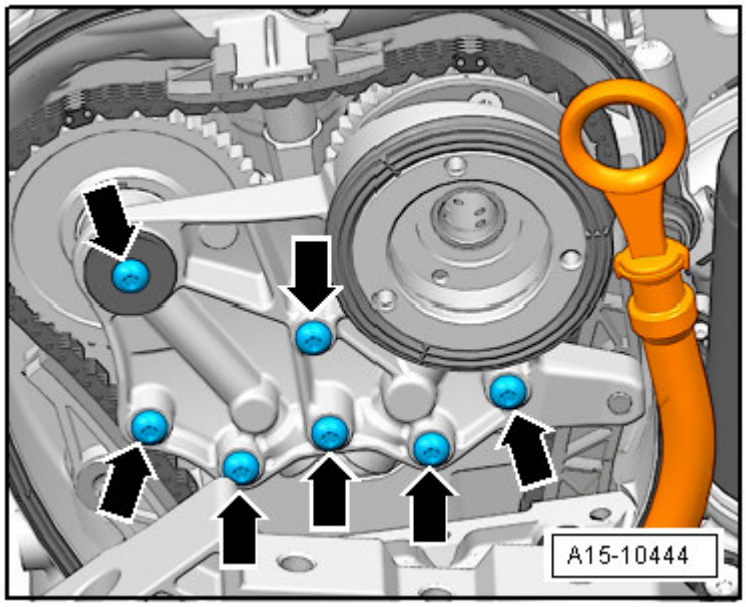

Fig. 219: Bearing Bracket Bolts

-- Tighten the bolts -arrows- to specifications, refer to **CAMSHAFT TIMING CHAIN OVERVIEW**.

-- Install the control valve, see -item 6- in the **CAMSHAFT TIMING CHAIN OVERVIEW**.

NOTE: Due to the ratio, the painted chain links no longer match up after the engine has been turned. For this reason, the valve timing must be checked again with the gauge.

-- Rotate the crankshaft 2 revolutions in engine rotation direction and check the valve timing. Refer to **VALVE TIMING, CHECKING**.

Further installation is in the reverse order of removal.

BALANCE SHAFT TIMING CHAIN

Removing

-- Remove the camshaft timing chain. Refer to **CAMSHAFT TIMING CHAIN (WITH NEW TOOLS)**.

-- Remove the guide pins -1- and guide rail.

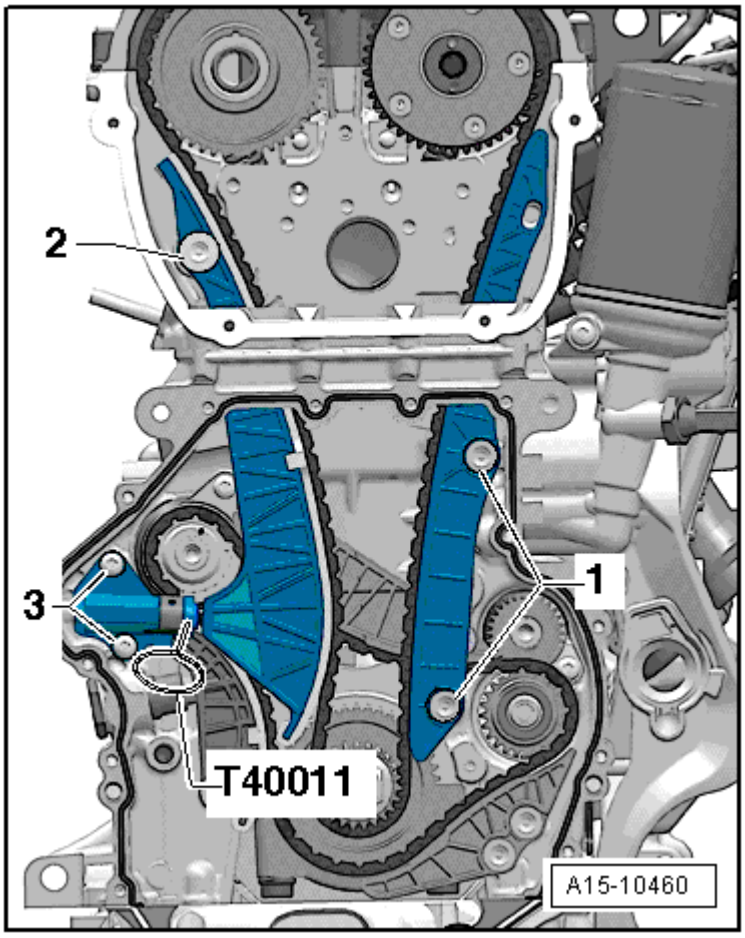

Fig. 220: Identifying Camshaft Timing Chain Tensioner Bolts, Camshaft Timing Chain Guide Rail And Guide Pins

-- Remove the camshaft timing chain tensioner bolts -3- and tensioner.

-- Remove the balance shaft chain tensioner -1- .

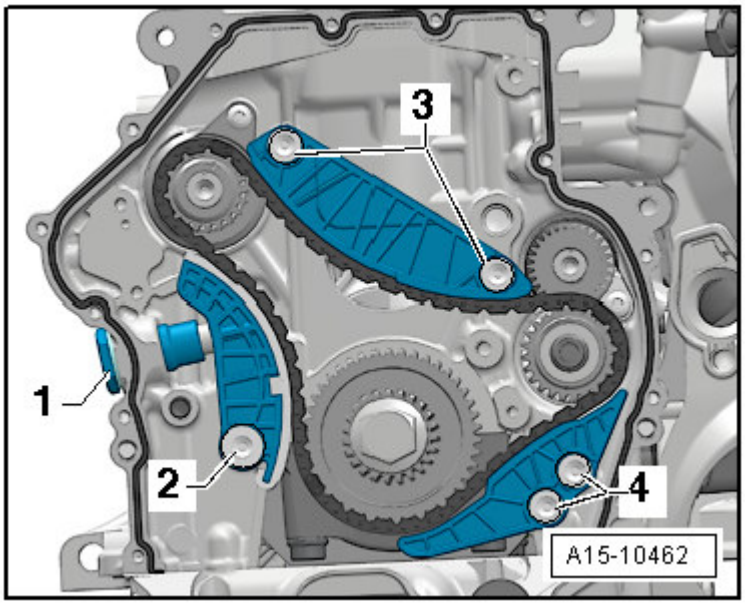

Fig. 221: Balance Shaft Timing Chain, Tensioning Rail And Guide Rails

-- Remove the tensioning rail guide pin -2- and rail.

-- Remove the guide rail guide pins -3- and rail.

-- Remove the guide rail guide pins -4- and rail.

-- Remove the balance shaft timing chain.

Installing

- Tightening specifications, refer to **BALANCE SHAFT TIMING CHAIN OVERVIEW**.

-- Turn the intermediate shaft sprocket/balance shaft to the marks -arrow- .

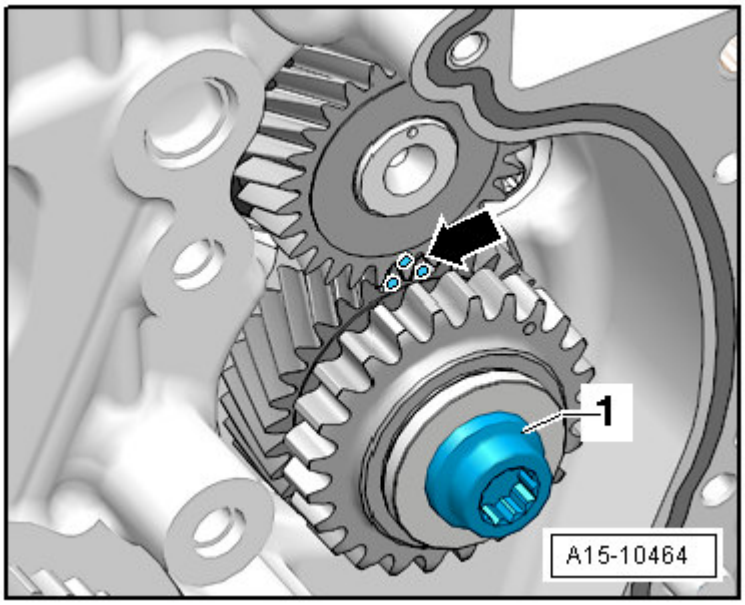

Fig. 222: Identifying Intermediate Shaft Sprocket

NOTE: Due to the ratio, the marks align only every 7th turn.

-- Mount the timing chain; the painted links of the timing chain must be positioned on the marks on the balance shaft sprockets.

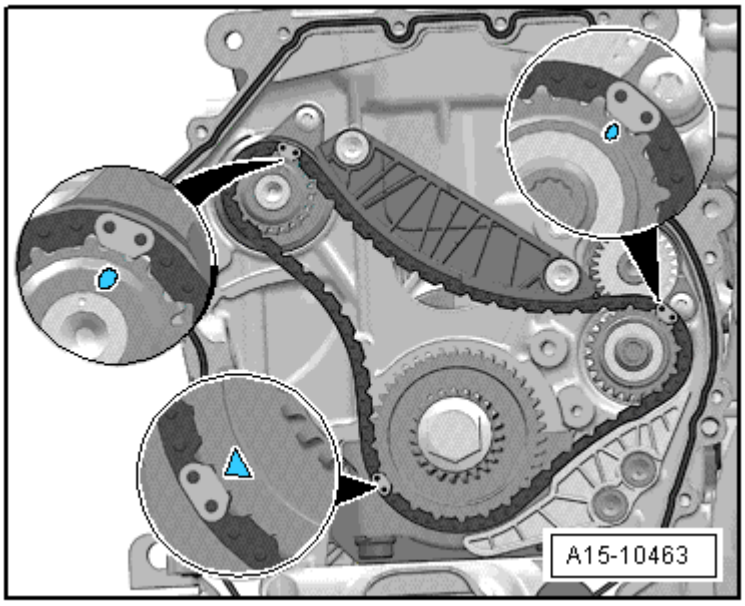

Fig. 223: Identifying Timing Chain Markings

-- Install the timing chain tensioning rail and tighten the guide pin -2- .

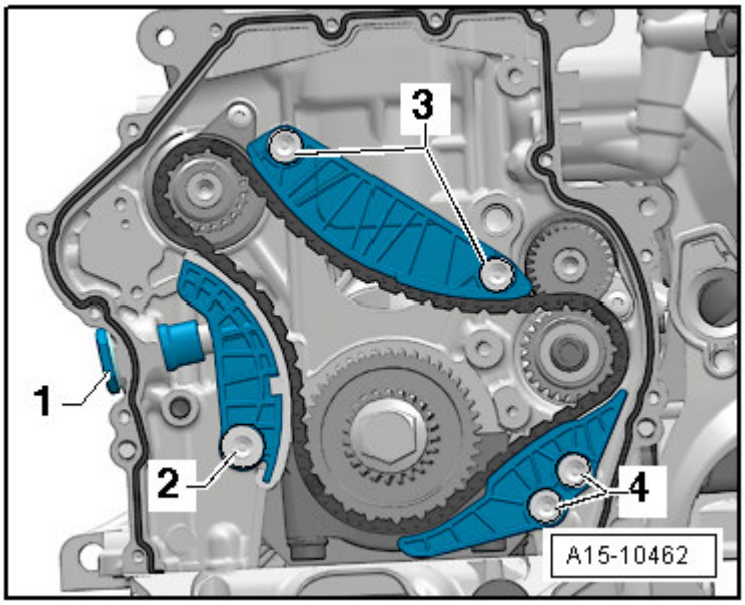

Fig. 224: Balance Shaft Timing Chain, Tensioning Rail And Guide Rails

-- Install the timing chain guide rail and tighten the guide pins -4- .

-- Install the timing chain guide rail and tighten the guide pins -3- .

-- Insert the timing chain tensioner -1- with liquid locking fluid. Refer to the Parts Catalog.

-- Check this adjustment one more time.

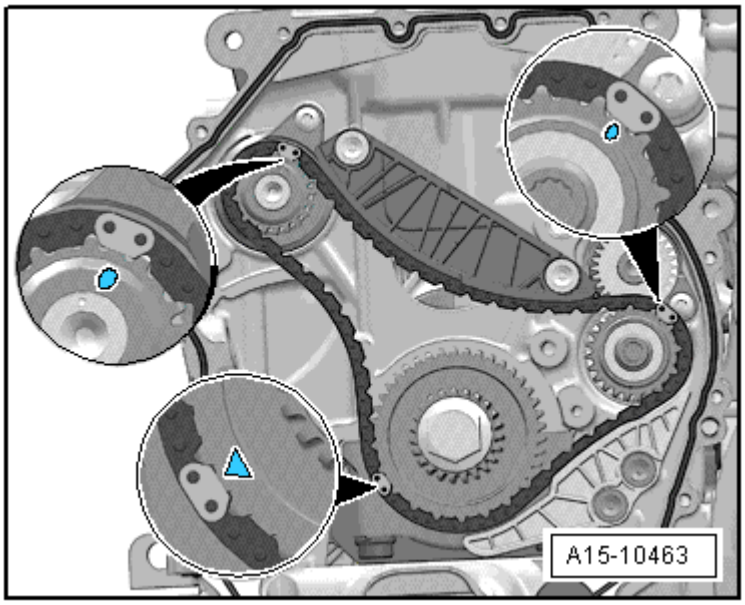

Fig. 225: Identifying Timing Chain Markings

-- Check the marks -arrow- on the intermediate shaft sprocket/balance shaft.

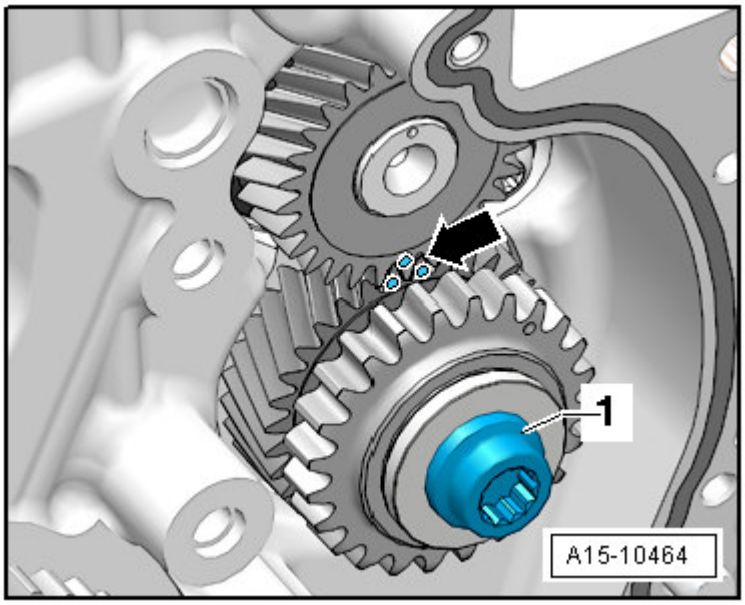

Fig. 226: Identifying Intermediate Shaft Sprocket

NOTE: The marks on the intermediate shaft sprocket/balance shaft is shown with the chain removed.

Further installation is in the reverse order of removal.

BALANCE SHAFT, INTAKE SIDE

Special tools and workshop equipment required

- PullerT10394
- PullerT10055

NOTE: Always replace the balance shaft after removing it.

Removing

-- Remove the toothed belt from the coolant pump. Refer to **COOLANT PUMP TOOTHED BELT** .

-- Remove the balance shaft timing chain. Refer to **BALANCE SHAFT TIMING CHAIN**.

-- Remove the intermediate sprocket bolt -1- and sprocket.

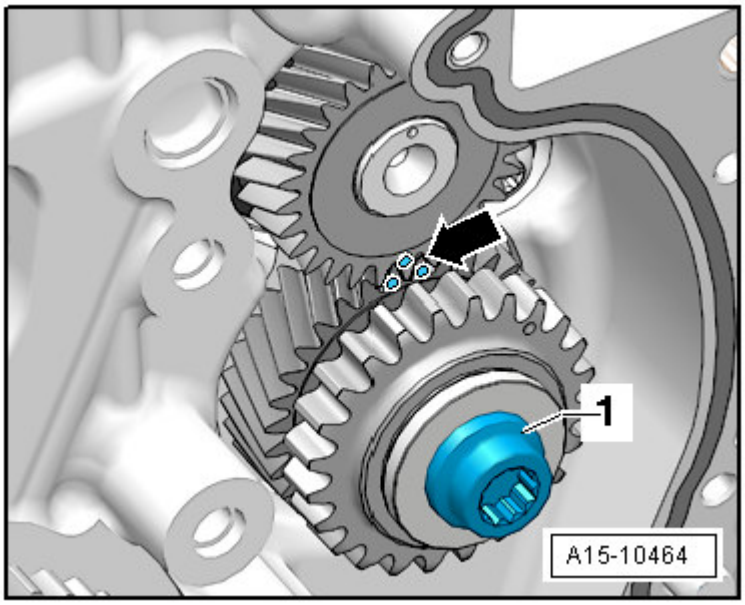

Fig. 227: Identifying Intermediate Shaft Sprocket

-- Remove the intake camshaft balance shaft bolt -2- and remove the balance shaft.

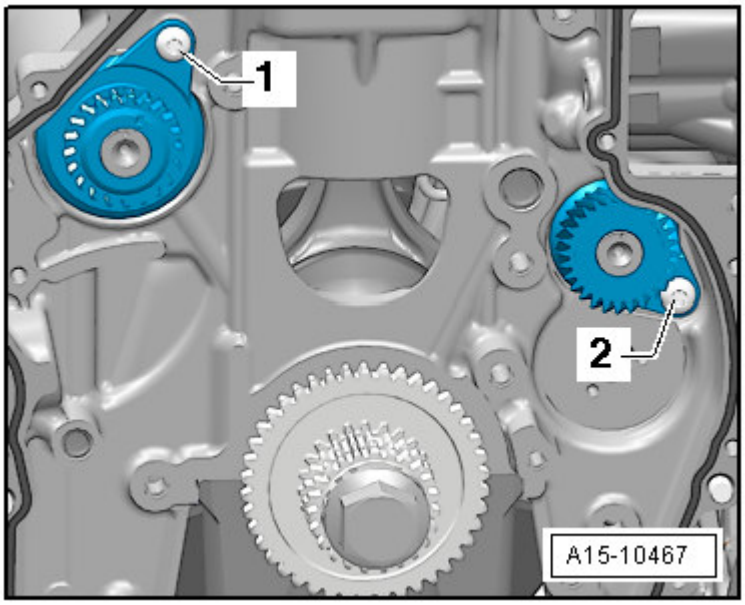

Fig. 228: Identifying Intake Camshaft Balance Shaft

If the balance shaft cannot be removed by hand, use the pullerT10394.

-- Install the half shellT10394/1 from the pullerT10394 and turn it upward in the -direction of the arrow- .

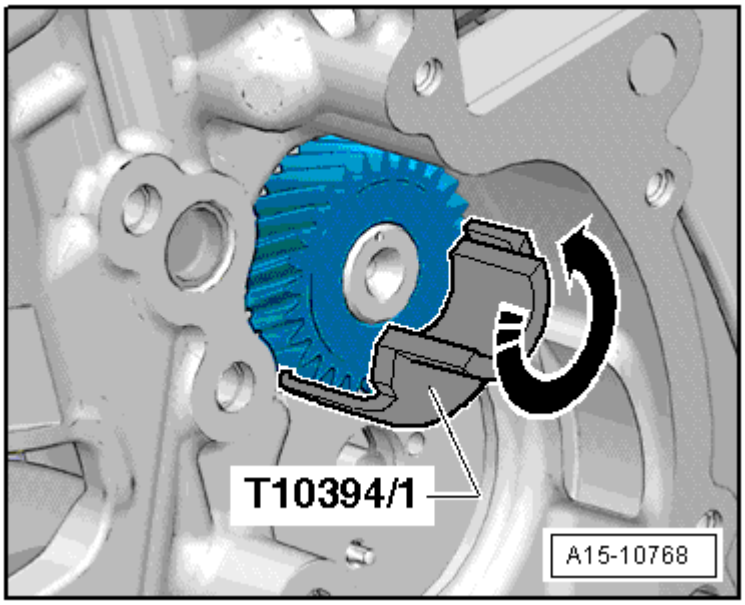

Fig. 229: Identifying Half Shell -T10394/1-

-- Install the pullerT10394 and push the sliding sleeve in the -direction of the arrow- .

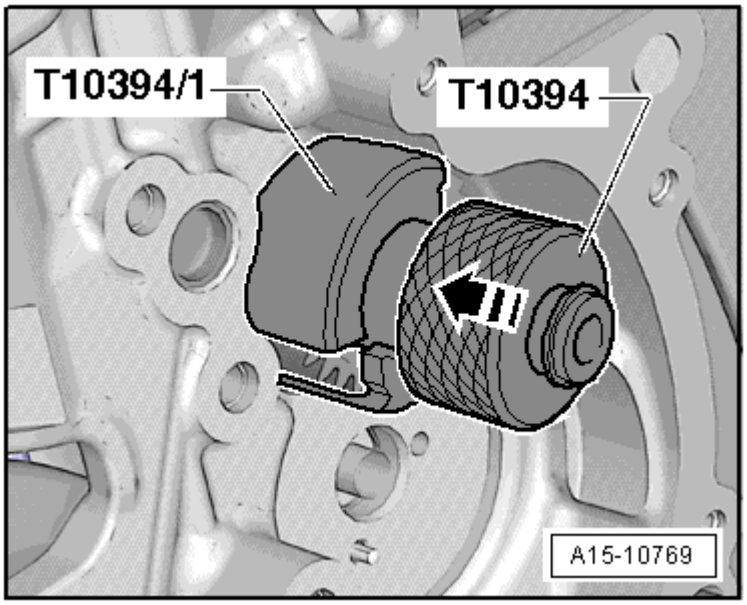

Fig. 230: Identifying Installation Of Puller Pieces -T10394- And -T10394/1-

-- Install the pullerT10055 to the pullerT10394 and remove the balance shaft in the -direction of the arrow- .

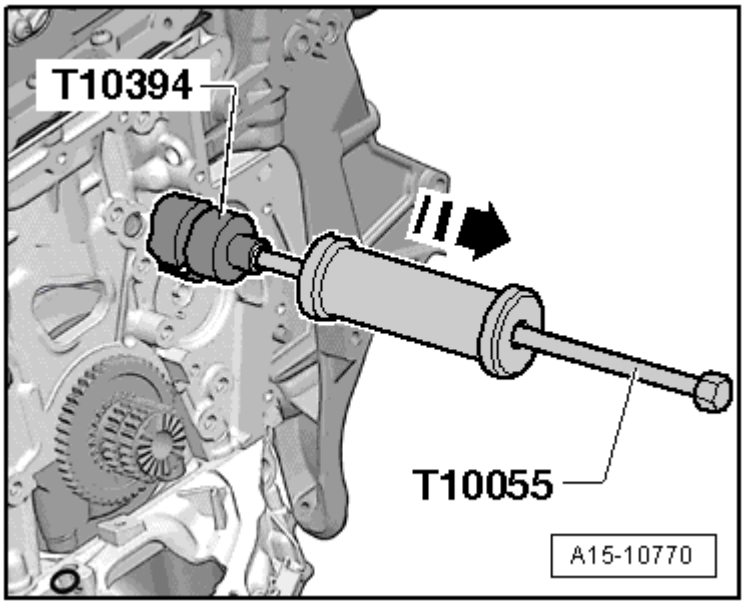

Fig. 231: Identifying Installation And Operation Of Puller -T10055-

Installing

NOTE: Because of the small clearance between the balance shaft and cylinder block, the balance shaft may need to be cooled in order to install it. Check if the balance shaft can be inserted into the cylinder block without forcing it in. If it cannot, the balance shaft must be cooled before installing it.

- Tightening specifications, refer to **BALANCE SHAFT TIMING CHAIN OVERVIEW**.

-- Place the new balance shaft in a freezer for 30 minutes or spray it with commercially available cooling spray.

-- Lubricate the balance shaft bearings with engine oil.

-- Install the new intake camshaft balance shaft and tighten the bolt -2- .

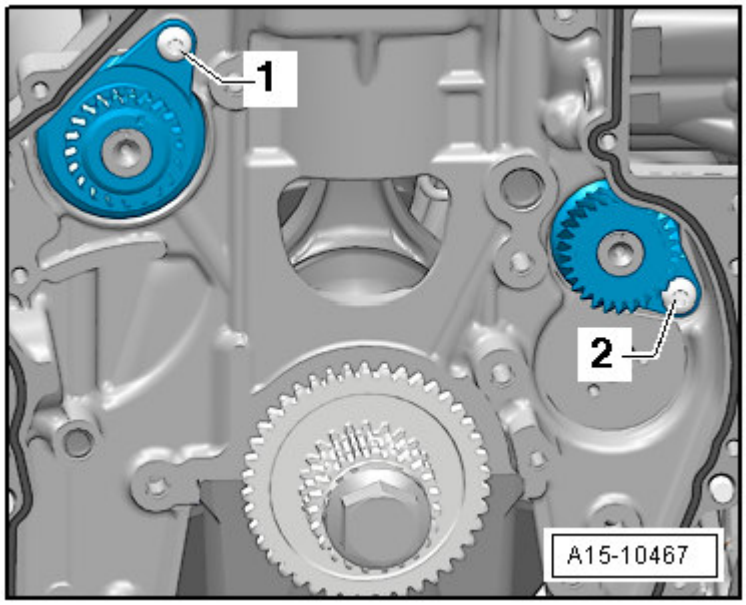

Fig. 232: Identifying Intake Camshaft Balance Shaft

-- Replace the O-ring -1- on the bearing pin and coat it with engine oil.

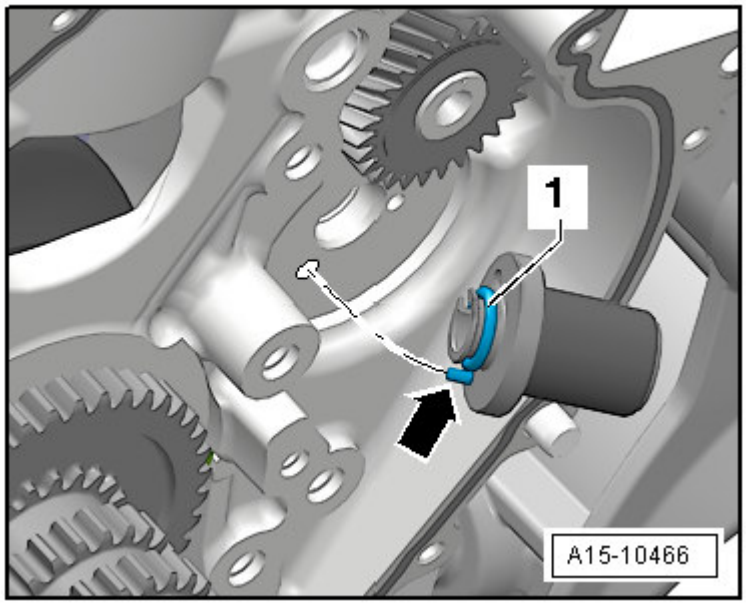

Fig. 233: Bearing Pins, Installation Position

-- Coat the alignment pin -arrow- with engine oil and install the bearing pin, the alignment pin must engage in the hole in the cylinder block.

CAUTION: Always replace the intermediate shaft sprocket. Otherwise the backlash will not adjust itself and it could result in engine damage. The new intermediate shaft sprocket has an anti-friction coating that wears off after

a short period of use, which automatically adjusts the backlash.

-- Mark the tooth face on the intermediate sprocket -arrows- .

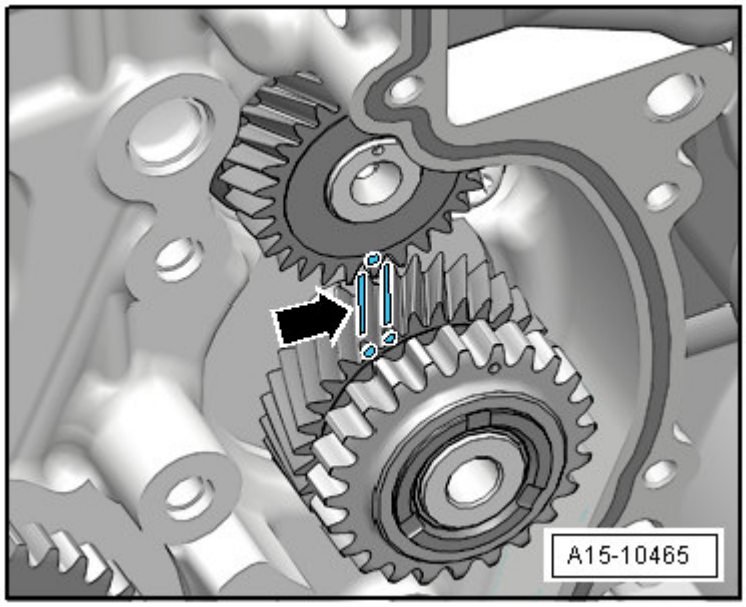

Fig. 234: Identifying Tooth Face On Intermediate Shaft Sprocket Marked With Paint

-- Install the intermediate sprocket, the mark on the balance shaft must be between the marks on the tooth faces.

-- Tighten the sprocket bolt -1- , tightening sequence, refer to **Fig. 15**.

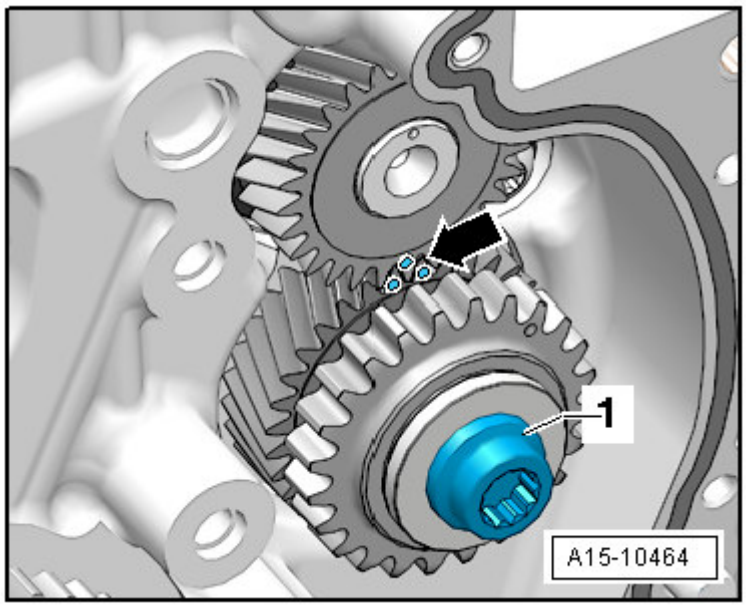

Fig. 235: Identifying Intermediate Shaft Sprocket

-- Check the marks -arrow- on the intermediate shaft sprocket/balance shaft.

NOTE: Due to the ratio, the marks align only every 7th turn.

-- Install the balance shaft timing chain. Refer to **BALANCE SHAFT TIMING CHAIN => Installing**.

The rest of the installation is basically a reverse of the removal procedure, note the following:

-- Replace the coolant pump drive seal. Refer to **COOLANT PUMP DRIVESHAFT SEAL** .

BALANCE SHAFT, EXHAUST SIDE

Special tools and workshop equipment required

- PullerT10394
- PullerT10055

NOTE: Always replace the balance shaft after removing it.

Removing

-- Remove the balance shaft timing chain. Refer to **BALANCE SHAFT TIMING CHAIN**.

-- Remove the exhaust camshaft balance shaft bolt -1- and the balance shaft.

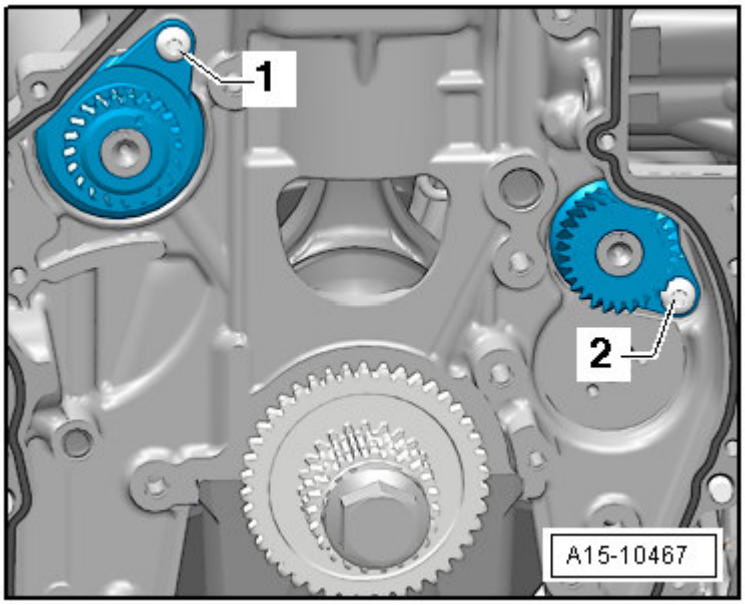

Fig. 236: Identifying Intake Camshaft Balance Shaft

If the balance shaft cannot be removed by hand, use the pullerT10394.

-- Install the half shell T10394/1 from the pullerT10394.

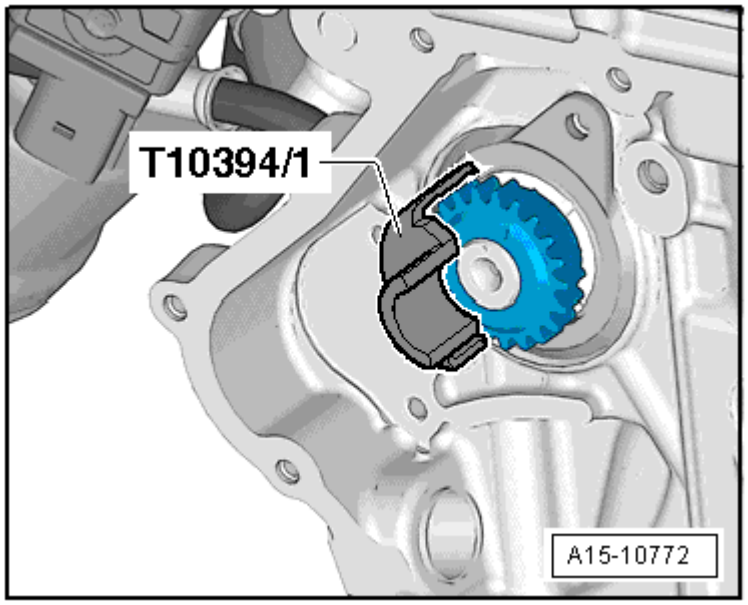

Fig. 237: Identifying Half Shell -T10394/1-

-- Install the pullerT10394 and push the sliding sleeve in the -direction of the arrow- .

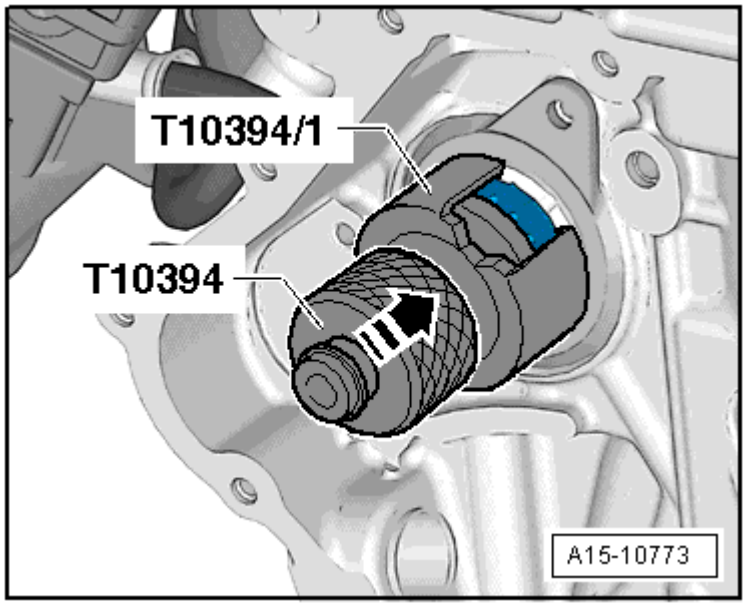

Fig. 238: Identifying Installation Of Puller Pieces -T10394- And -T10394/1-

-- Install the pullerT10055 to the pullerT10394 and remove the balance shaft.

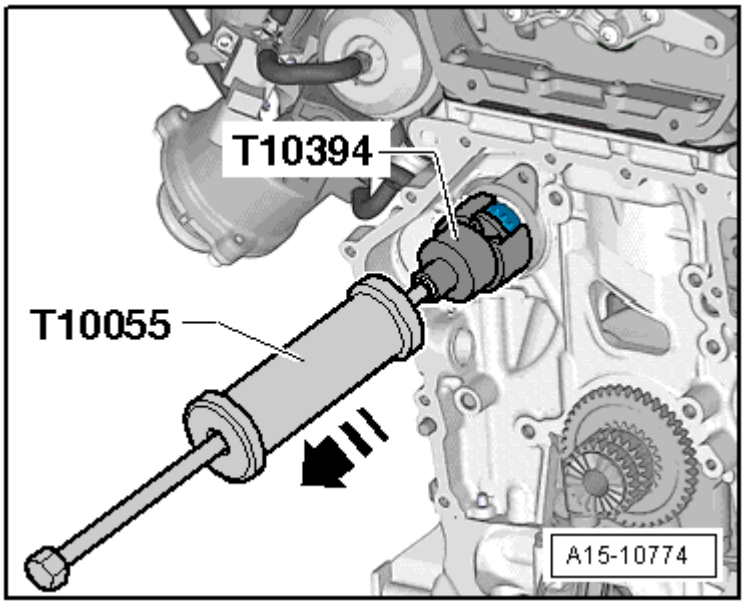

Fig. 239: Identifying Installation And Operation Of Puller -T10055-

Installing

NOTE: Because of the small clearance between the balance shaft and cylinder block, the balance shaft may need to be cooled in order to install it. Check if the balance shaft can be inserted into the cylinder block without forcing it in. If it cannot, the balance shaft must be cooled before installing it.

- Tightening specifications, refer to **BALANCE SHAFT TIMING CHAIN OVERVIEW**.

-- Check the installed position of the balance shaft tube -arrow- .

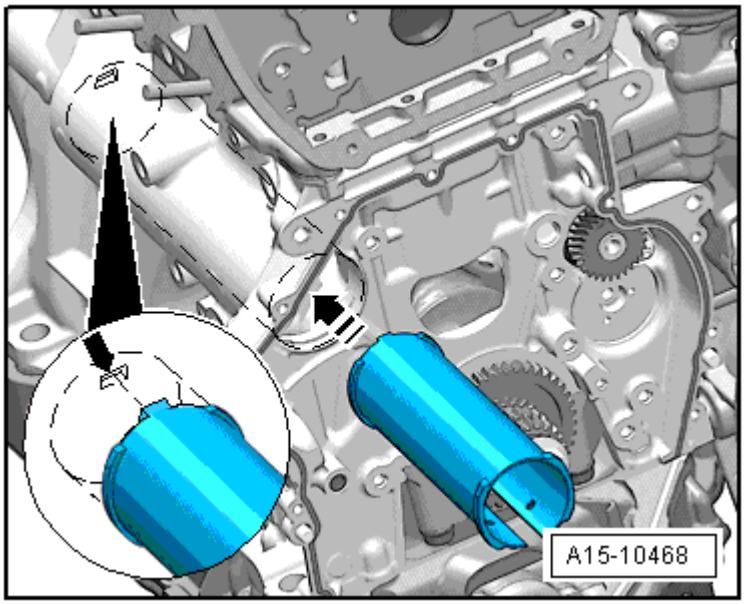

Fig. 240: Identifying Pipe For Balance Shaft - Installation Position

The tab -arrow- must be at the top. This prevents it from turning.

NOTE: Squeeze the tube together slightly to position it in the installed position. Insert the spanner wrench3212 into the two holes at the front of the tube, then insert the tube using the spanner wrench3212.

-- Place the new balance shaft in a freezer for 30 minutes or spray it with commercially available cooling spray.

-- Lubricate the balance shaft bearings with engine oil.

-- Install the exhaust camshaft balance shaft.

-- Before tightening the bolt -1- make sure the balance shaft lies level with the crankshaft.

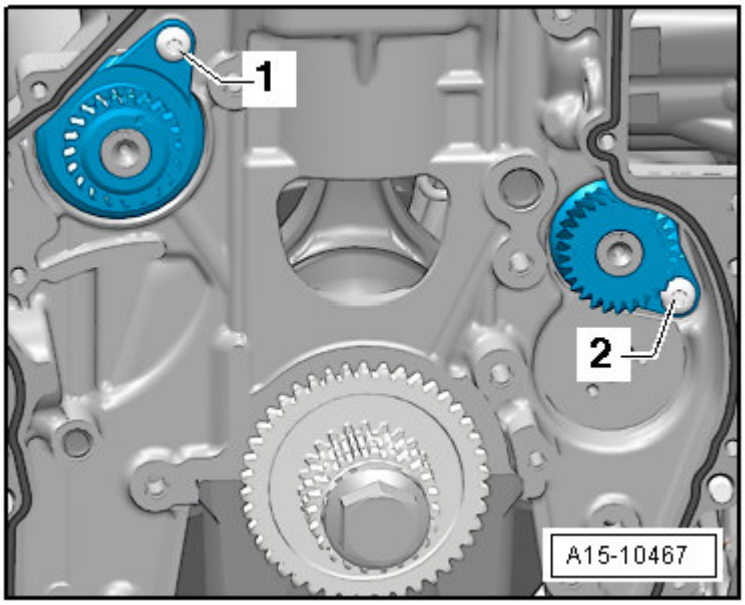

Fig. 241: Identifying Intake Camshaft Balance Shaft

NOTE: If the balance shaft is not level, then the balance shaft tube must be installed again.

-- Install the balance shaft timing chain. Refer to **BALANCE SHAFT TIMING CHAIN => Installing**.

Further installation is in the reverse order of removal.

SPECIAL TOOLS

Special tools and workshop equipment required

- Open End Spanner Insert AF 10V.A.G 1783/1
- Compression TesterV.A.G 1763
- AdapterV.A.G 1381/5A
- AdapterV.A.G 1381/1
- Spark Plug Removal Tool3122 B
- Valve Seal Removal Tool3364
- Valve Stem Seal Driver3365
- AdapterT40012
- Valve Cotters Asm/Disasm DeviceVAS 5161
- Guide Plate for FSI EngineVAS 5161/19B
- Engine Support Bridge10-222 A
- Adapter10-222 A/22
- Engine Support Adapter10-222 A/3

- Bracket with Spindle and Hook10-222 A/10
- Locking PinT10060 A
- Thrust PieceT10368
- BitsT10099
- Dial Gauge 0-10 mmVAS 6079

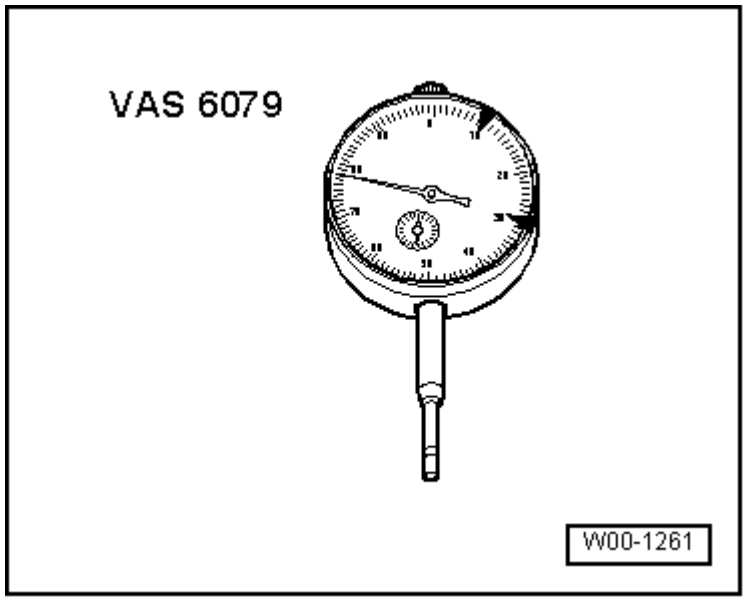

Fig. 242: Dial Gauge 0-10 mm VAS 6079

- Dial Gauge AdapterT10170 or T10170 A

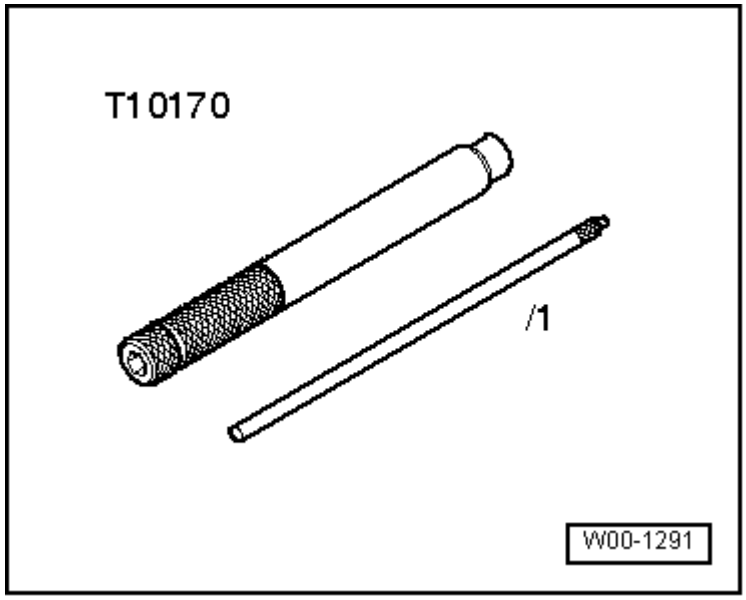

Fig. 243: Identifying Dial Gauge Adapter -T10170- or -T10170 A-

- Dial Gauge HolderVW 387

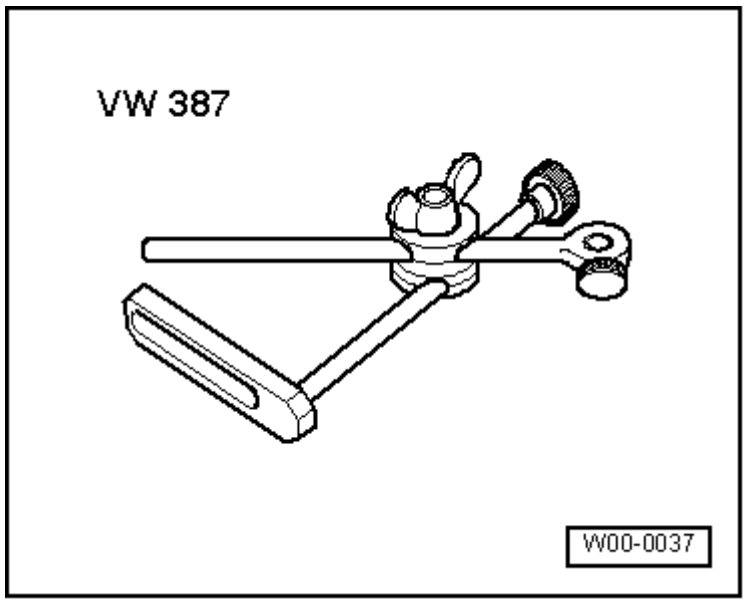

Fig. 244: Dial Gauge Holder VW 387

- Engine Sling2024 A

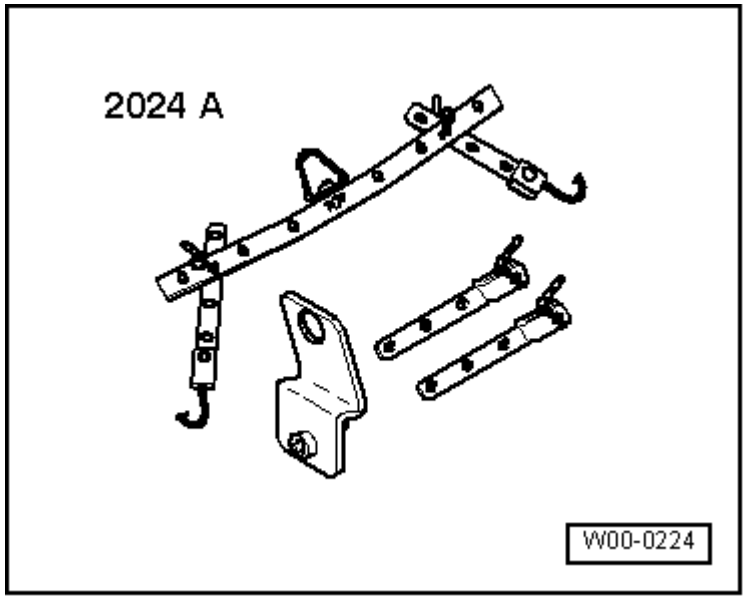

Fig. 245: Engine Sling 2024 A

- Engine SupportT10014

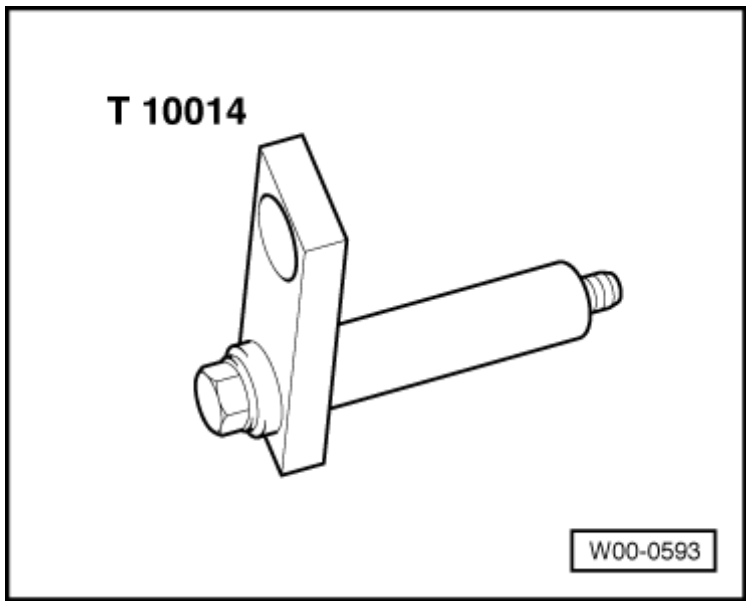

Fig. 246: Identifying Engine Support T10014

- Ignition Coil PullerT40039

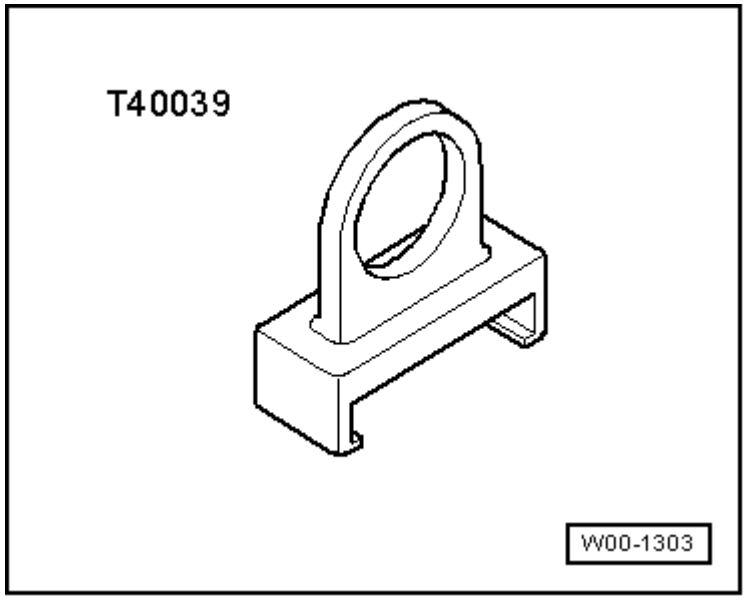

Fig. 247: Identifying Extractor T40039

- Thrust PieceT10174

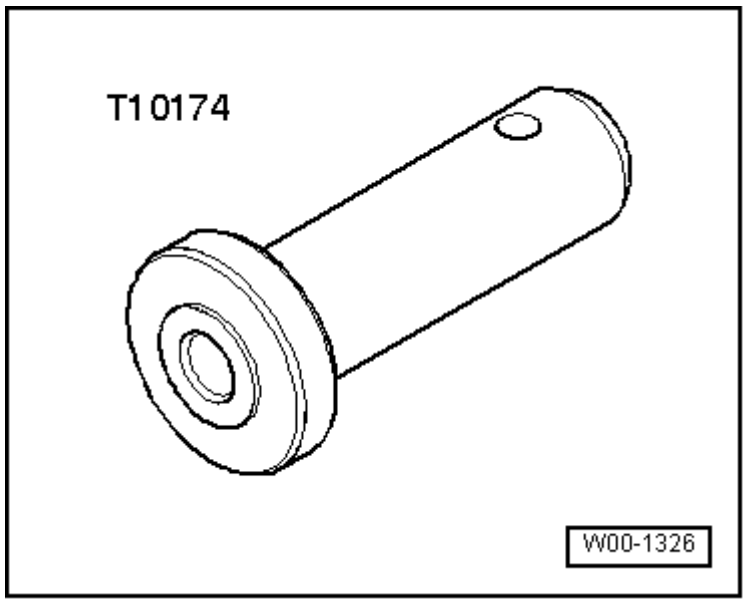

Fig. 248: Identifying Thrust Piece T10174

- Torque WrenchV.A.G 1783

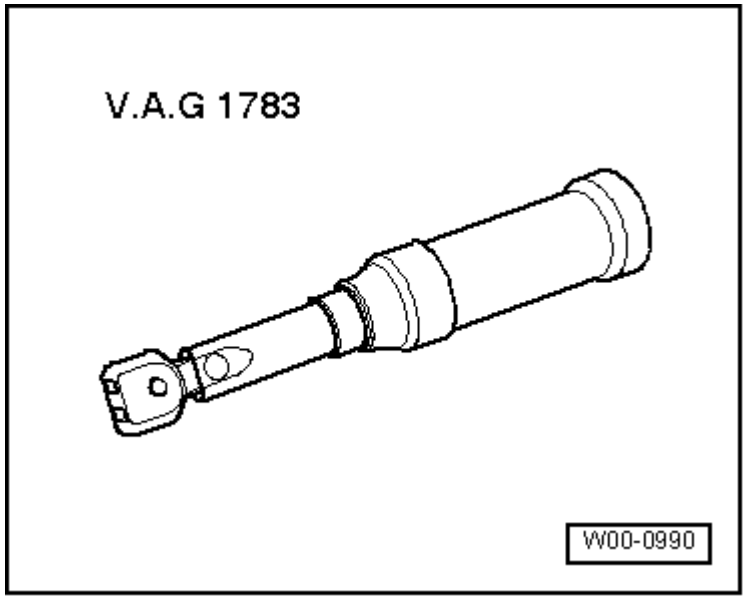

Fig. 249: Identifying Torque Wrench V.A.G 1783

- Shackle10-222 A/12

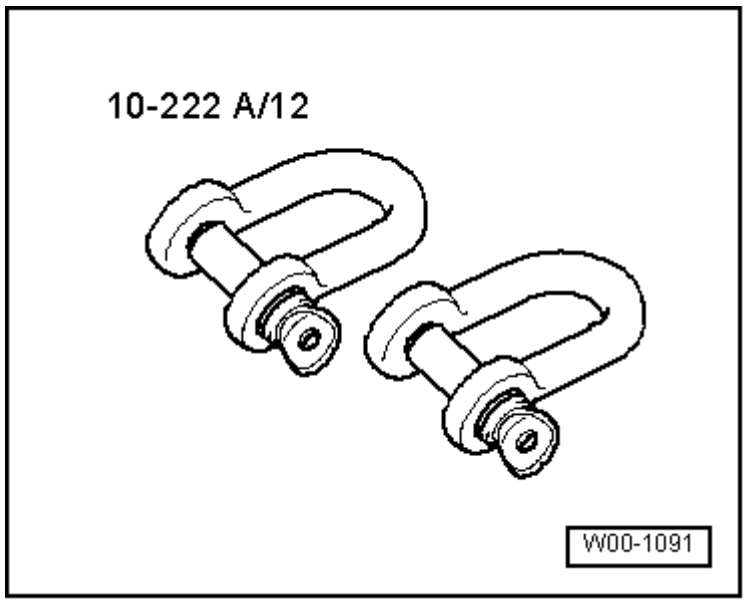

Fig. 250: Identifying Shackle 10 - 222 A/12

- Lifting Eyebolt3368

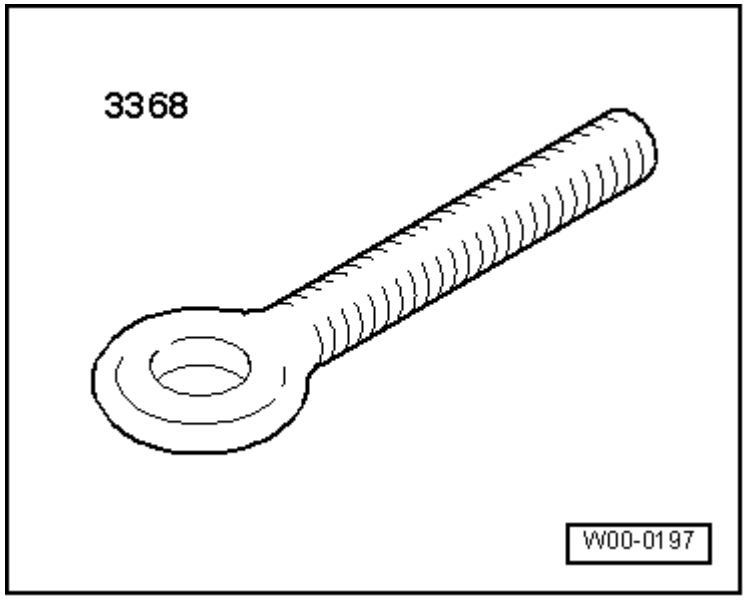

Fig. 251: Identifying Lifting Eyebolt 3368

- Thrust PieceT10354

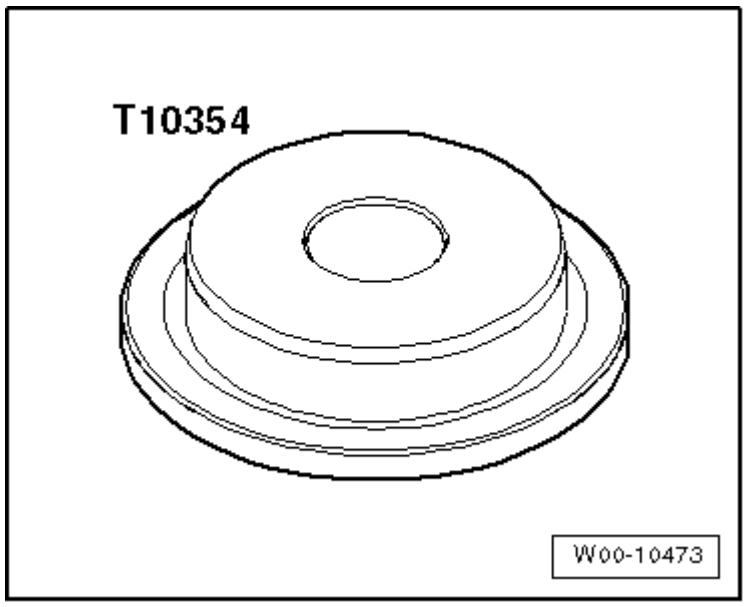

Fig. 252: Identifying Thrust Piece T10354

- Pulling HookT20143/2

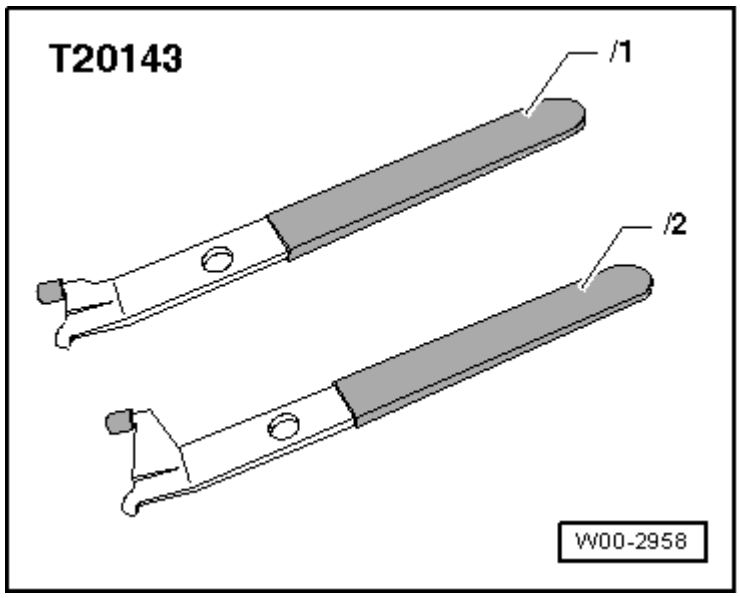

Fig. 253: Extractor Hook T20143

- PullerT10394

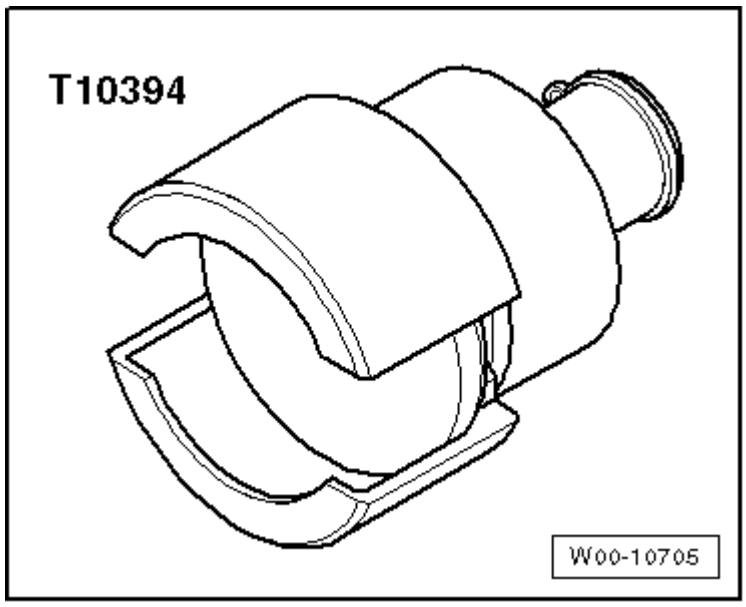

Fig. 254: Identifying Puller T10055

- PullerT10055

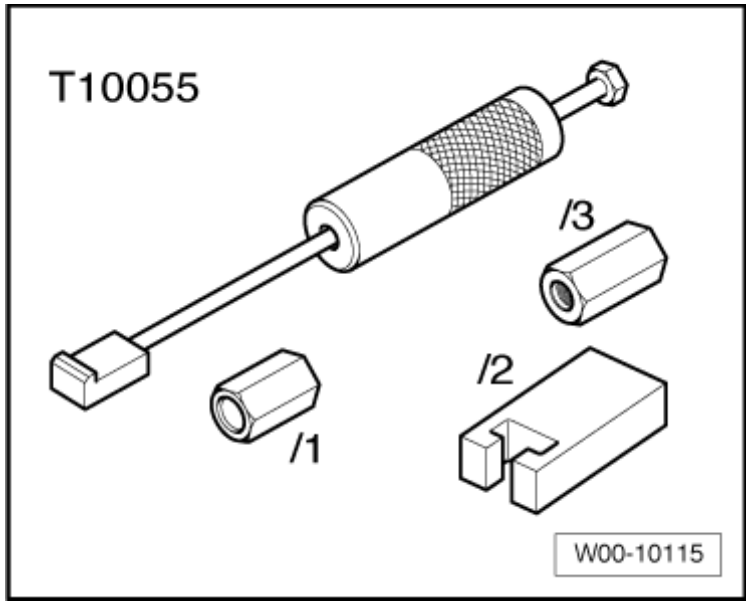

Fig. 255: Identifying Puller T10055 With Adapter T10055/3

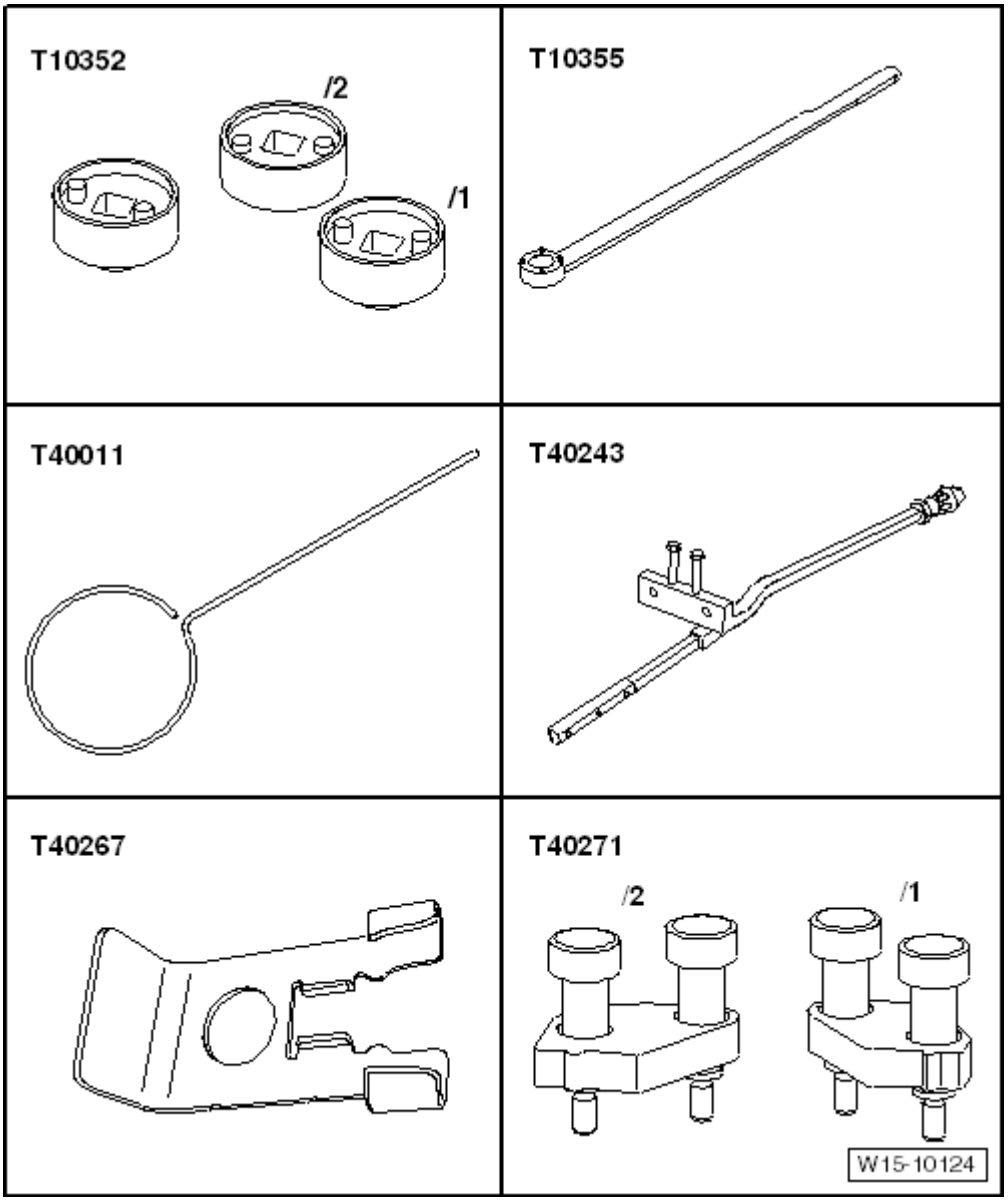

Fig. 256: Identifying Special Tools -- Camshaft Timing Chain (With New Tools)

Special tools and workshop equipment required

- Assembly ToolT10352
- Counter Hold ToolT10355
- Locking PinT40011
- LeverT40243
- Locking ToolT40267
- Camshaft LocatorT40271

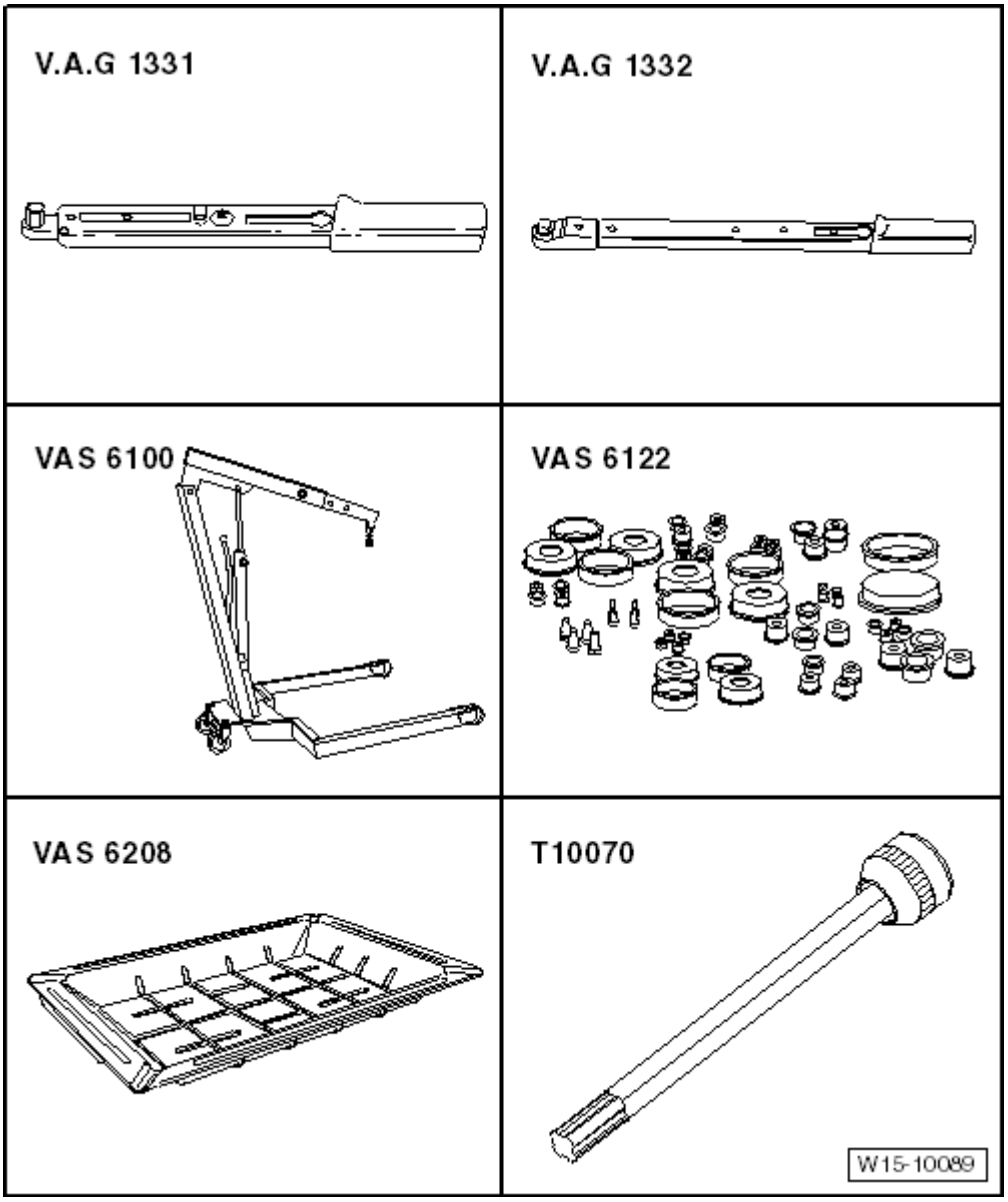

Fig. 257: Identifying Torque Wrench V.A.G 1331 And Special Tools

Special tools and workshop equipment required

- Torque Wrench (5-50 Nm)V.A.G 1331
- Torque Wrench (40-200 Nm)V.A.G 1332
- Shop Crane - Load Cap = 700-1200 KGVAS 6100
- Engine Bung SetVAS 6122
- Drip Tray for VAS 6100VAS 6208
- Polydrive Bit and Drive SocketT10070

