

ENGINE**2.0 Liter - Crankshaft, Cylinder Block - Engine Code(s): CRZA****13 CRANKSHAFT, CYLINDER BLOCK****GENERAL INFORMATION****UPPER CRANKSHAFT BEARING IDENTIFICATION**

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

The letters marked on the lower sealing surface of the cylinder block identify which bearing thickness must be installed in which location.

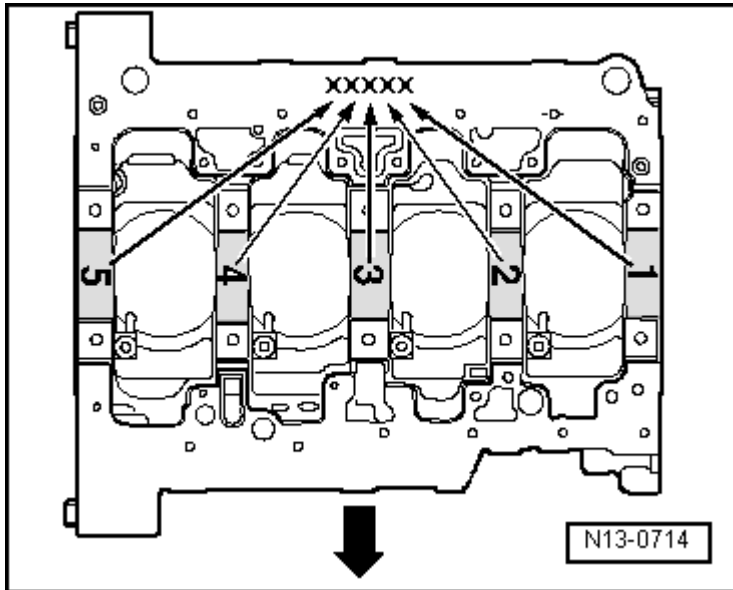


Fig. 1: Identification Of Crankshaft Bearing Shells For Cylinder Block (Gradual Introduction) - Engine Codes AEG, AVH, AZG, BEV

Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

G	=	Yellow
B	=	Blue
W	=	White

NOTE: The arrow points in the direction of travel.

If the colored dot can no longer be read, use the blue bearing shell.

The lower crankshaft bearing shells are always shipped as a replacement part with a "yellow" dot.

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 the cylinder to which the connecting rod belongs. Refer to -item 6- in the **PISTON AND CONNECTING ROD OVERVIEW**

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

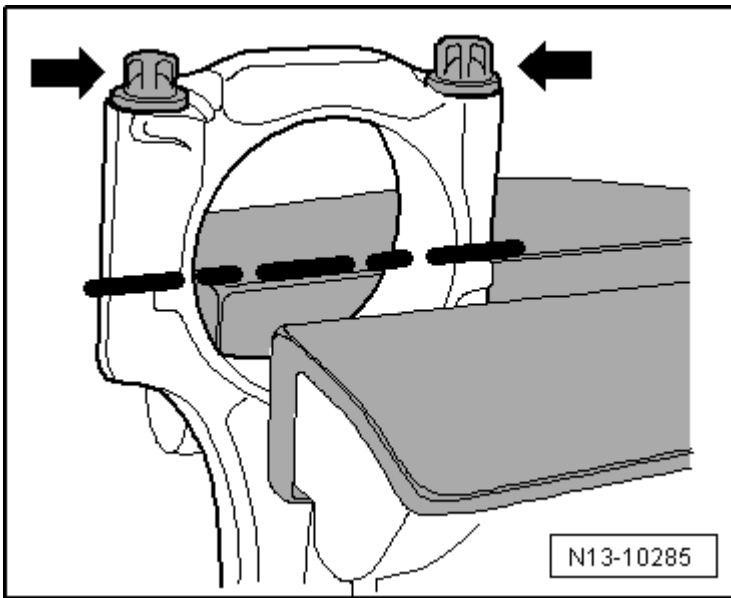


Fig. 2: Identifying Connecting Rod Clamped In Vise Equipped With Aluminum Protective Pads
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

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

Clamp the connecting rod below the dotted line.

-- Loosen the bolts -arrows- approximately 5 turns.

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

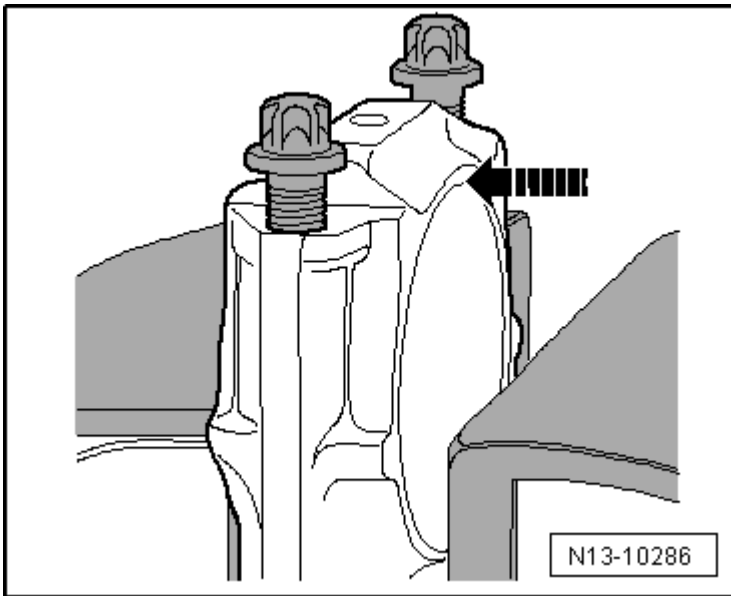


Fig. 3: Identifying Connecting Rod Bearing Cap
 Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

BEARING SHELL, INSTALLED POSITION

Bearing shell -1- with a connecting rod oil bore -arrow-.

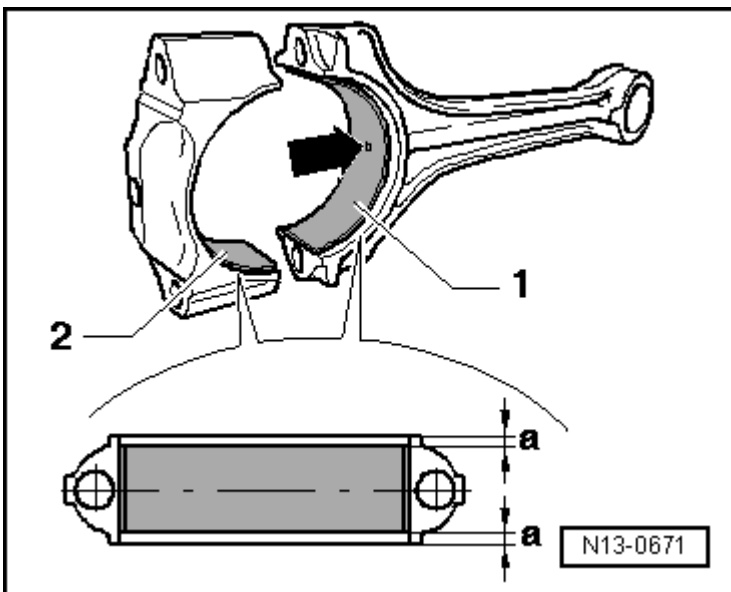


Fig. 4: Identifying Bearing Shells - Installed Positions
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Bearing shell -2- without a oil bore for the connecting rod cap.

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

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

DESCRIPTION AND OPERATION

ENGINE COMPONENT OVERVIEWS

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

NOTE: If large quantities of metal particles or abraded material are detected during engine repairs, it may mean the crankshaft or rod bearings are damaged. To prevent further damage, perform the following steps after the repair:

Clean the oil passages carefully.

Replace the oil spray jets.

Replace the engine oil cooler.

Replace the oil filter element.

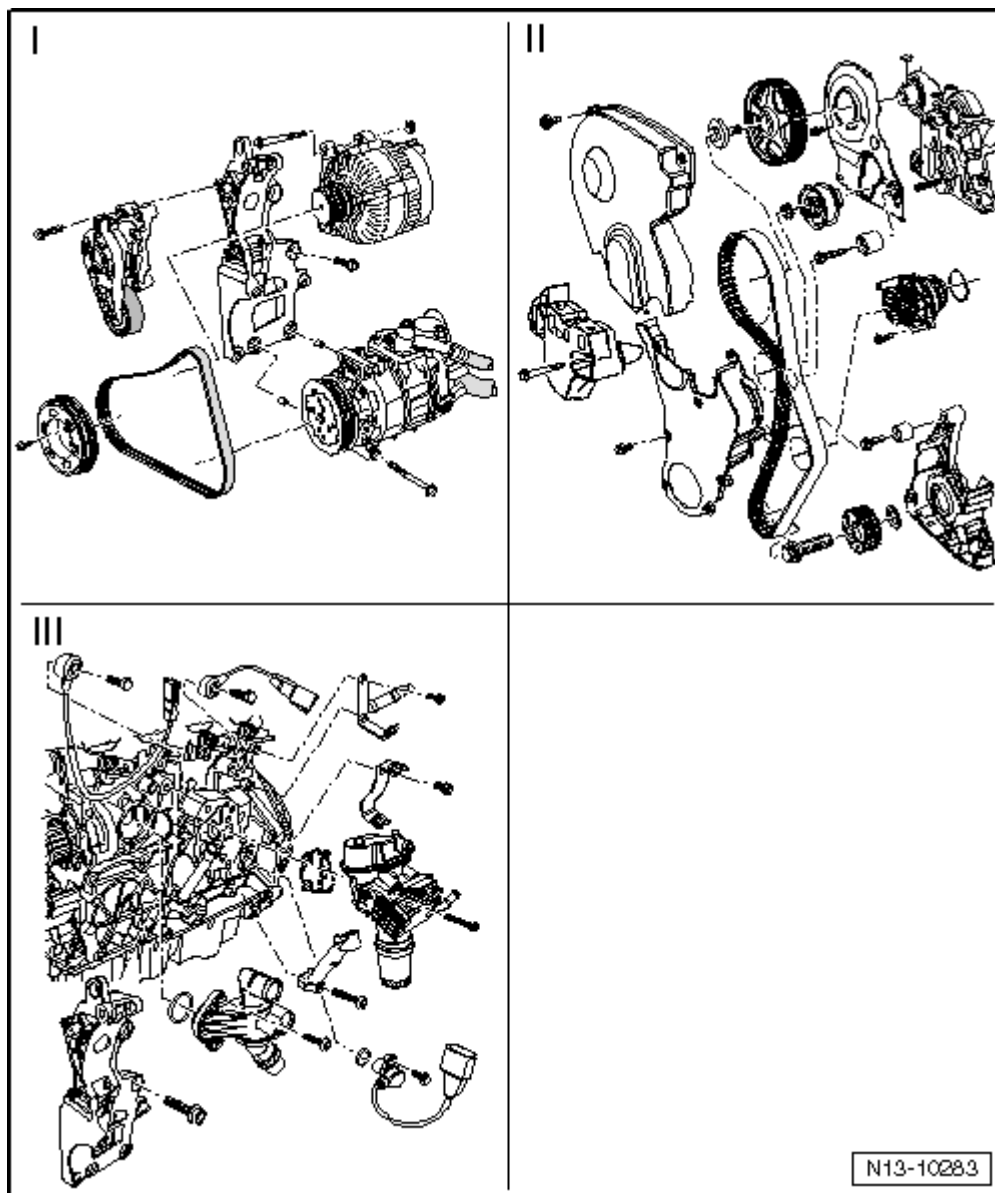


Fig. 5: Identifying Engine Component Overviews

Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

1. I - RIBBED BELT
2. II - TOOTHED BELT
3. III - CYLINDER BLOCK

RIBBED BELT

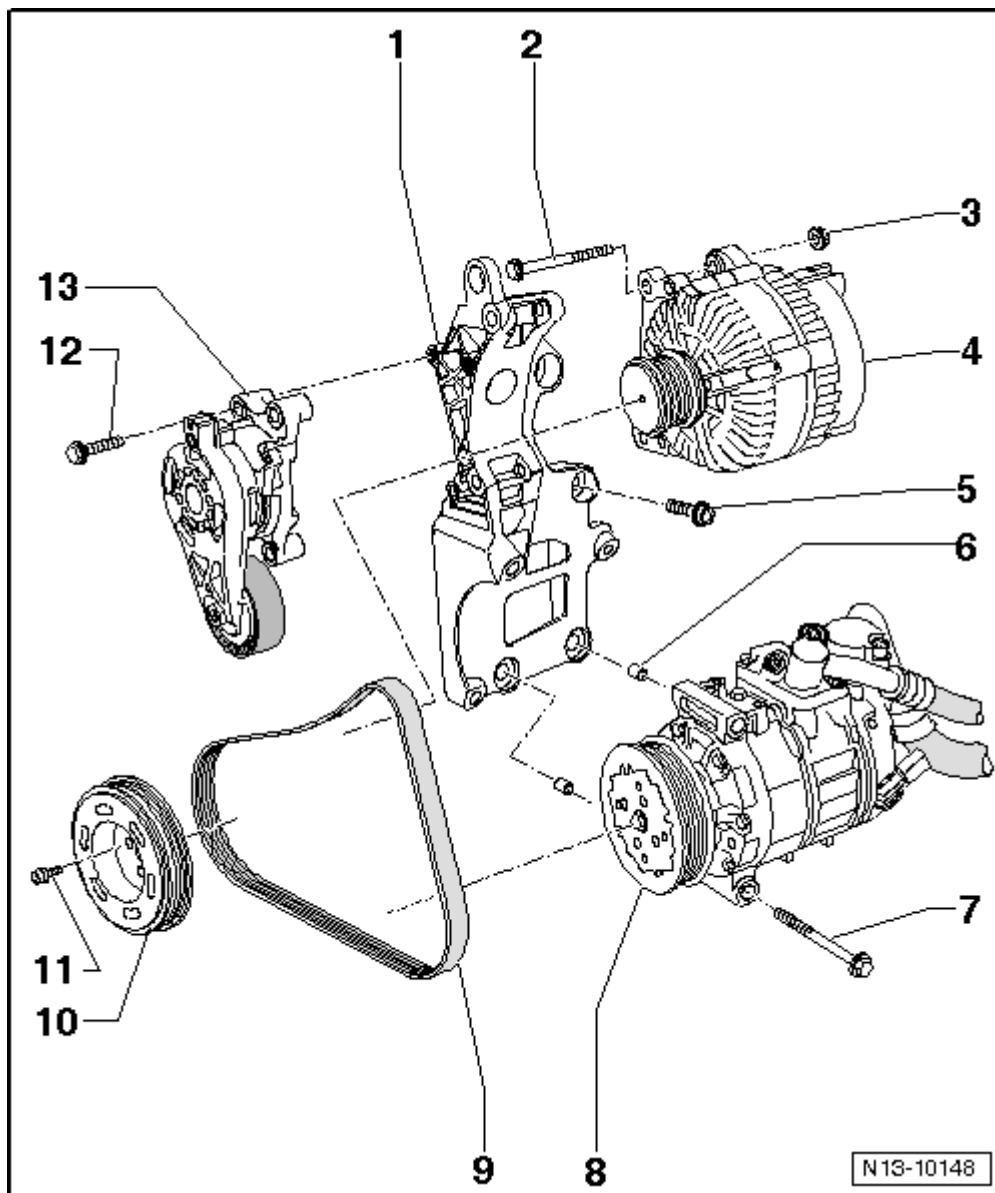


Fig. 6: Identifying Engine Assembly Overview Part I

Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

1. Accessory Bracket

- Follow the tightening sequence, refer to **Fig. 7**.

2. Bolt

- 23 Nm

3. Nut

- 23 Nm

4. Generator

- Removing and installing, refer to **[For transmission(s) 0A4, 02E, 09G, 02Q] [For engine(s) CBTA, CJAA, CBUA, CCTA, CBFA] Removal and Installation**.

- To make it easier to position the generator, push the threaded bushing for the generator bolt back slightly.
5. **Bolt**
 - 40 Nm
 - Follow the tightening sequence, refer to **Fig. 7**.
 6. **Bushing**
 - Quantity: 2
 7. **Bolt**
 - 25 Nm
 8. **Air Conditioning (A/C) Compressor**
 - Removing and installing, refer to "Refrigerant Circuit Components" in **Removal and Installation** .
 9. **Ribbed Belt**
 - Before removing, mark the rotation direction using chalk or a felt tip pen.
 - Check for wear.
 - Do not kink.
 - Removing and installing, refer to **RIBBED BELT**.
 10. **Vibration Damper**
 11. **Bolt**
 - 20 Nm + an additional 90° (1/4) turn.
 - Always replace.
 12. **Bolt**
 - 23 Nm
 13. **Ribbed Belt Tensioner**
 - Rotate the tensioner using an open end wrench to release the tension on the ribbed belt.

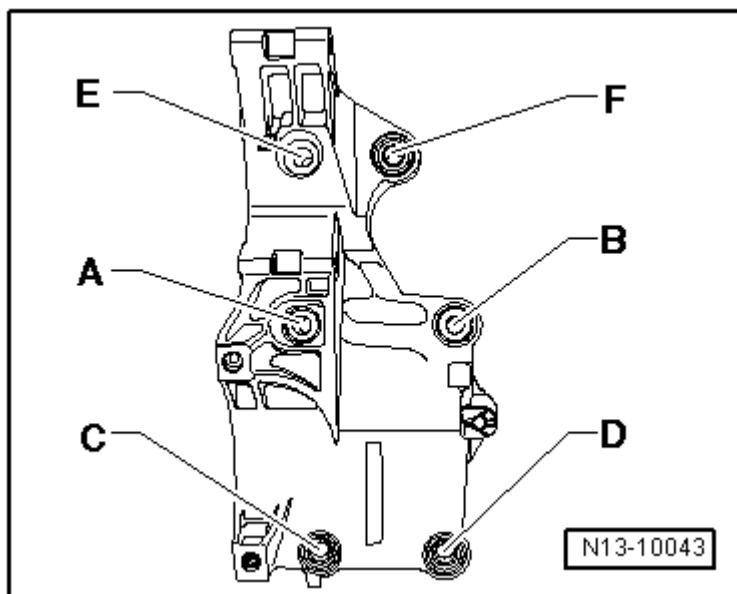


Fig. 7: Identifying Accessory Assembly Bracket Tightening Sequence
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

TOOTHED BELT

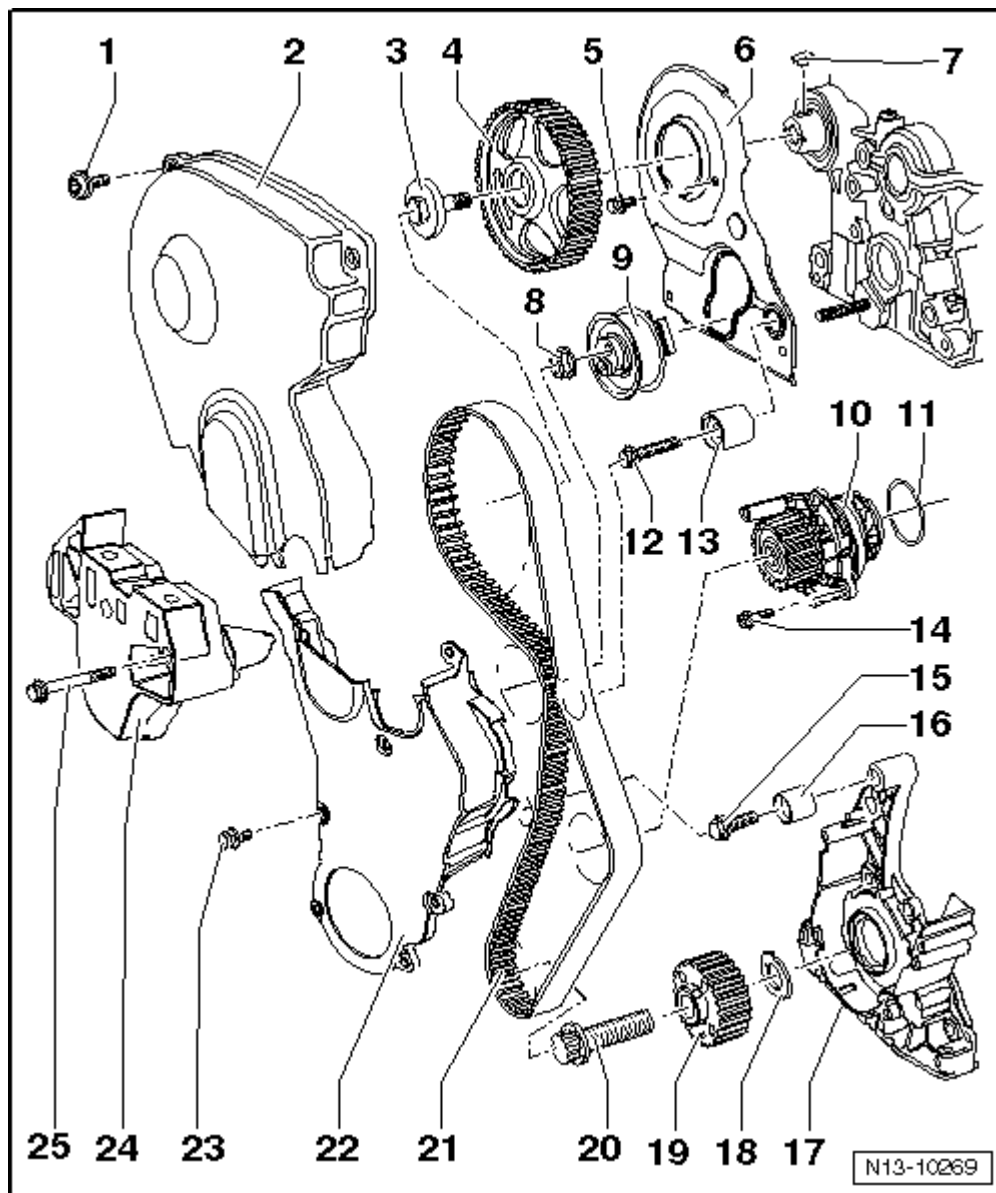


Fig. 8: Identifying Engine Assembly Overview Part III, With Divided Toothed Belt Guard
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

1. Bolt
 - 10 Nm
2. Upper Toothed Belt Guard
3. Bolt
 - 50 Nm + an additional 180° (1/2) turn.

- Always replace.
 - Use the retainer 3036 to loosen and tighten.
4. **Camshaft Sprocket**
 - Installed position: secured by a woodruff key.
 5. **Bolt**
 - 10 Nm
 - Install using locking fluid.
 6. **Rear Toothed Belt Guard**
 7. **Woodruff Key**
 - Make sure it is secure.
 8. **Nut**
 - 25 Nm
 9. **Toothed Belt Tensioner**
 10. **Coolant Pump**
 - Removing and installing, refer to COOLANT PUMP .
 11. **O-ring**
 - Always replace.
 12. **Bolt**
 - 25 Nm
 13. **Idler Roller**
 14. **Bolt**
 - 15 Nm
 15. **Bolt**
 - 35 Nm
 16. **Idler Roller**
 17. **Sealing Flange**
 18. **Disc (Diamond Coated)**
 - Replace
 19. **Crankshaft Toothed Belt Gear**
 - The contact surfaces between the toothed belt gear, diamond disc and crankshaft must be free of oil.
 - Only possible to install in one position.
 20. **Bolt**
 - 90 Nm + an additional 90° (1/4) turn.
 - Always replace.
 - Do not lubricate.
 - Use the counter support 3415 to loosen and tighten.
 21. **Toothed Belt**

- Before removing, mark the rotation direction using chalk or a felt tip pen.
- Check for wear.
- Removing and installing, refer to **TOOTHED BELT** .

22. Lower Toothed Belt Guard**23. Bolt**

- 8 Nm
- For the lower toothed belt guard.
- Quantity: 7

24. Engine Mount Bracket**25. Bolt**

- 45 Nm

CYLINDER BLOCK

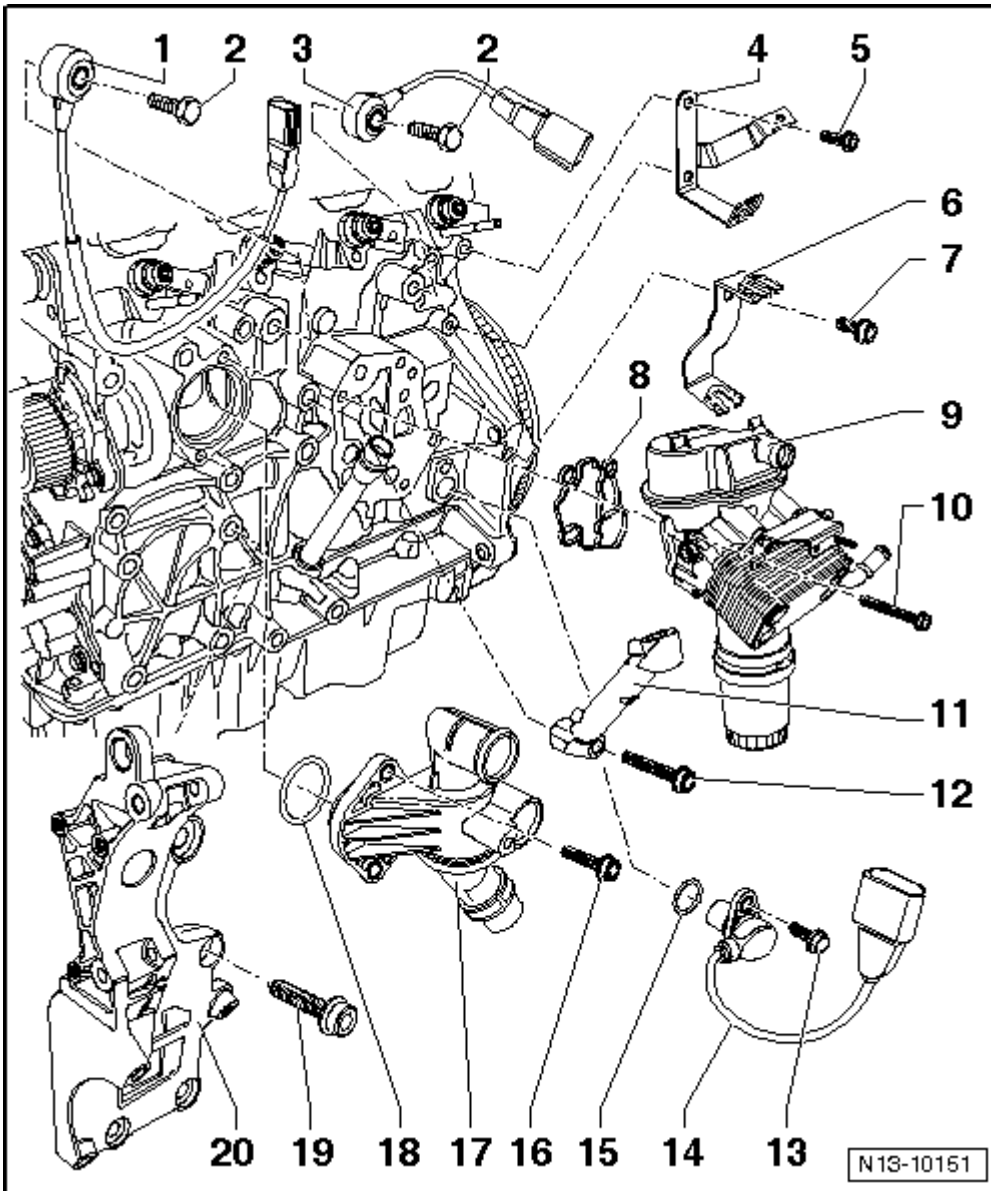


Fig. 9: Identifying Cylinder Block And Components Overview

Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

1. Knock Sensor 1 -G61-

- It is necessary to remove the thermostat first in order to remove the sensor. Refer to **COOLANT THERMOSTAT HOUSING WITH THERMOSTAT**.
- Contacts are gold plated.

2. Bolt

- 20 Nm
- The tightening specification affects the function of the knock sensor.

3. Knock Sensor 2 -G66-

- It is necessary to remove the oil filter bracket first in order to remove knock sensor 2. Refer to **OIL**

FILTER ADAPTER .

- Contacts are gold plated.
- 4. **Wire Bracket**
- 5. **Bolt**
- 6. **Wire Bracket**
- 7. **Bolt**
- 8. **Gasket**
 - Always replace.
- 9. **Oil Filter Adapter**
 - Overview, refer to **OIL FILTER ADAPTER .**
- 10. **Bolt**
 - 15 Nm + an additional 90° (1/4) turn.
 - Always replace.
- 11. **Intake Manifold Support**
- 12. **Bolt**
 - 23 Nm
- 13. **Bolt**
 - 10 Nm
- 14. **Engine Speed Sensor -G28-**
- 15. **Seal**
 - Always replace.
- 16. **Bolt**
 - 15 Nm
- 17. **Coolant Thermostat Housing with Thermostat**
 - Removing and installing, refer to **COOLANT THERMOSTAT HOUSING WITH THERMOSTAT .**
- 18. **O-ring**
 - Always replace.
- 19. **Bolt**
 - 40 Nm
- 20. **Accessory Bracket**
 - Tightening sequence, refer to **Fig. 7.**

SEALING FLANGE OVERVIEW

NOTE: **Servicing the clutch. Refer to [For transmission(s) 02Q] Clutch .**

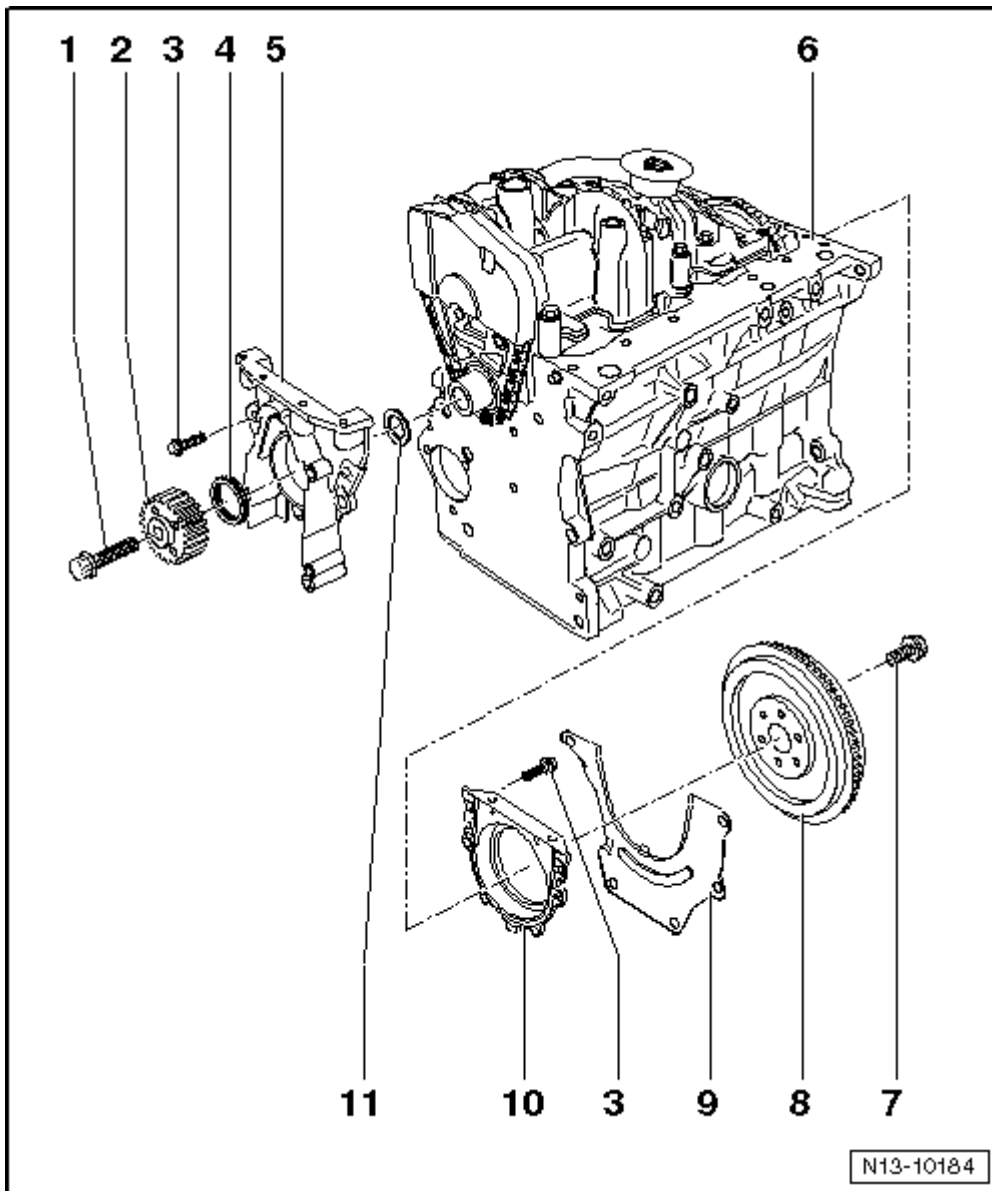


Fig. 10: Identifying Sealing Flange, Assembly Overview
 Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

1. Bolt

- 90 Nm + an additional 90° (1/4) turn.
- Always replace.
- Do not lubricate.
- Use the counter support 3415 to loosen and tighten.

2. Crankshaft Toothed Belt Gear

- There must be no oil on the contact surfaces between the toothed belt gear and crankshaft.
- Only possible to install in one position.

3. Bolt

- 15 Nm
4. **Seal**
 - Do not lubricate or grease the sealing lip on the seal.
 - Removing and installing, refer to **CRANKSHAFT SEAL, BELT PULLEY SIDE.**
 5. **Sealing Flange, Belt Pulley Side**
 - Must be seated on the alignment pins.
 - Removing and installing, refer to **SEALING FLANGE, BELT PULLEY SIDE.**
 - To remove and install, remove the oil pan.
 6. **Cylinder Block**
 - Oil pump with differential shaft gear removing and installing. Refer to
 - Crankshaft overview. Refer to **CRANKSHAFT OVERVIEW.**
 - Piston and connecting rod overview. Refer to **PISTON AND CONNECTING ROD OVERVIEW.**
 7. **Bolt**
 - 60 Nm + an additional 90° (1/4) turn.
 - Always replace.
 8. **Flywheel**
 - Removing and installing, refer to **FLYWHEEL.**
 9. **Intermediate Plate**
 - Must be located on the alignment sleeves.
 - Be careful not to damage or bend the plate when installing it.
 10. **Sealing Flange with Seal**
 - Always replace as a complete unit.
 - Removing and installing, refer to **SEALING FLANGE AND SEAL, TRANSMISSION SIDE.**
 11. **Disc (Diamond Coated)**
 - Always replace.

CRANKSHAFT OVERVIEW

NOTE: Before removing the crankshaft, prepare for appropriate storage, so that the sensor wheel -item 4- does not make contact or become damaged.

Secure the engine to the engine and transmission holder VAS 6095 when working on it.



- 65 Nm + an additional 90° (1/4) turn.
- Always replace.
- Fully threaded.
- Tighten to 65 Nm to measure the radial play in the crankshaft; do not tighten the additional torque.

- Bearing cap 1: Belt pulley side
- Retaining tabs on the bearing shells and cylinder block/bearing caps must align above one another.

- 10 Nm + an additional 90° (1/4) turn.
- Always replace.

4. Sensor Wheel

- For the engine speed sensor -G28-.
- Replace the sensor wheel every time the screws are loosened.
- Only possible to install in one position - the bores are offset.
- Removing and installing, refer to **CRANKSHAFT SENSOR WHEEL**.

5. Crankshaft

- Axial play:

New: 0.07 to 0.23 mm

Wear limit: 0.30 mm

- Measure the radial clearance using Plastigage®:

New: 0.017 to 0.037 mm

Wear limit: 0.07 mm

- Do not rotate the crankshaft when measuring the radial play.
- Crankshaft dimensions. Refer to **CRANKSHAFT DIMENSIONS**.

6. Thrust Washers

- For bearing 3

7. Bearing Shell, for the Cylinder Block

- With a lubricating groove.
- Identification for replacement part ordering. Refer to **UPPER CRANKSHAFT BEARING IDENTIFICATION**.
- Do not interchange used bearing shells (mark them).

8. Sprocket

- For the oil pump drive.

9. Bearing Shell, for the Bearing Cap

- Without a lubricating groove.
- Do not interchange used bearing shells (mark them).

PISTON AND CONNECTING ROD OVERVIEW

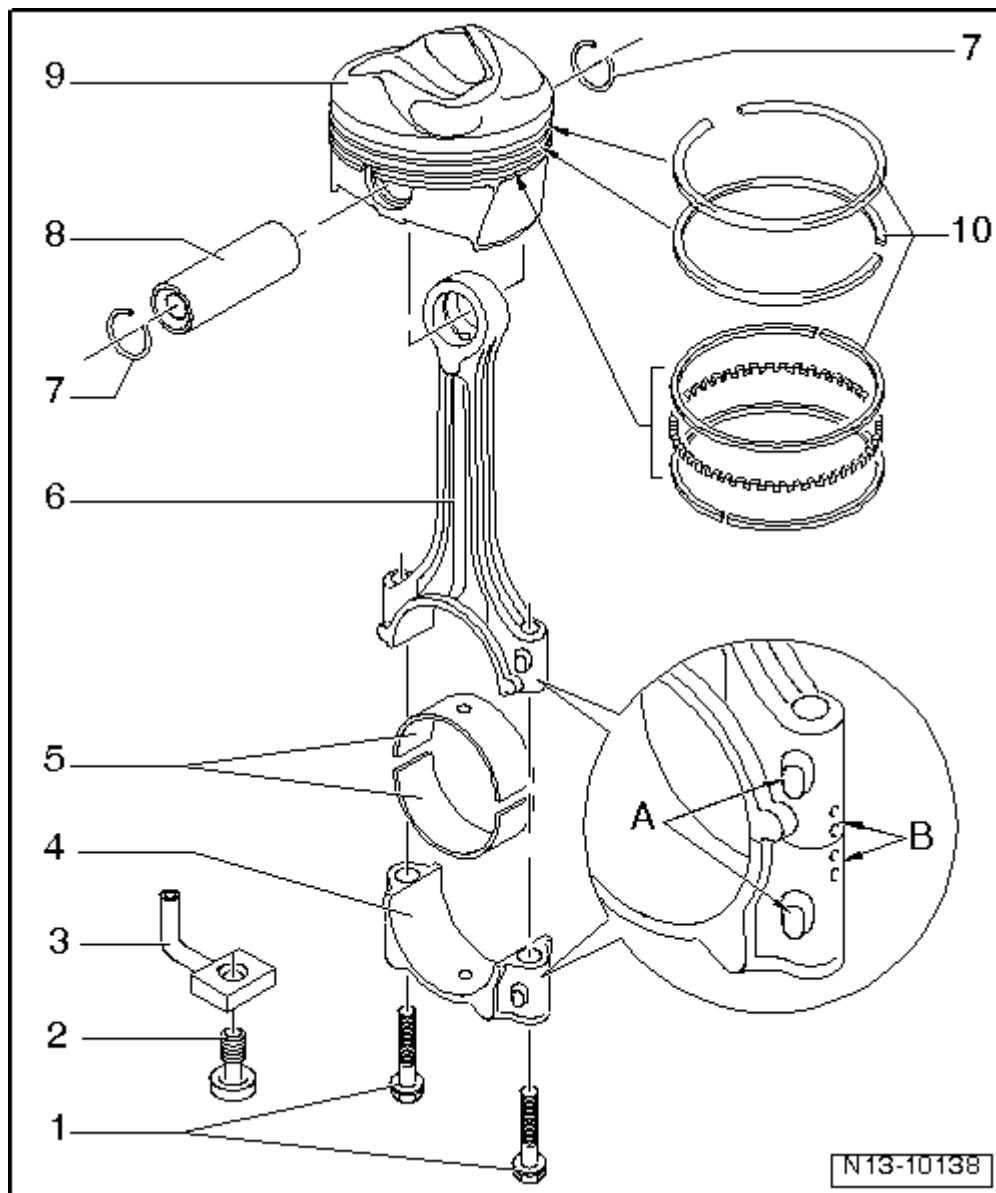


Fig. 12: Identifying Piston And Connecting Rod, Assembly Overview
 Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

1. Bolt

- 45 Nm + an additional 90° (1/4) turn.
- Always replace.
- Lubricate the threads and contact surfaces.
- Tighten to 30 Nm to measure the radial play, do not tighten the additional torque.

2. Bolt with Pressure Relief Valve

- 27 Nm
- Opening pressure: 1.3 to 1.6 bar pressure.

3. Oil Spray Jet

- For piston cooling.

4. Connecting Rod Bearing Cap

- Pay attention to the installed position.
- Due to the separation procedure (cracking) of the connecting rod, the cap only fits in one position and only to the corresponding connecting rod.
- Mark which cylinder to which it belongs -B-.
- Installed position: The marks -A- point to the belt pulley side.

5. Bearing Shell

- Note the installed position, refer to **BEARING SHELL, INSTALLED POSITION**.
- Do not interchange used bearing shells (mark them).
- Axial play:

New: 0.10 to 0.35 mm

Wear limit: 0.4 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 play.

6. Connecting Rod

- With a cracked bearing cap.
- Always replace as a set.
- Mark which cylinder to which it belongs -B-.
- Installed position: The marks -A- point to the belt pulley side.
- Separating the new connecting rod. Refer to **NEW CONNECTING ROD, SEPARATING**.

7. Circlip**8. Piston Pin**

- If difficult to move, heat the piston to 60 °C (140 °F).
- Remove and install using a pilot drift VW 222 A.

9. Piston

- Checking, refer to **Fig. 16**.
- 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.
- Cylinder bore checking, refer to **Fig. 17**.
- For the correct piston and cylinder dimensions, refer to **PISTON AND CYLINDER**

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DIMENSIONS.

10. Piston Rings

- Offset gaps by 120°.
- Use piston ring pliers for removal and installation.
- Marks face toward the piston crown.
- Ring gap checking, refer to **Fig. 14**.
- Piston ring groove clearance checking, refer to **Fig. 15**.

SPECIFICATIONS

CRANKSHAFT DIMENSIONS

(Dimensions are in mm)

Honing Dimension	Crankshaft Bearing Pin Diameter		Connecting Rod Bearing Pin Diameter	
Basic dimension	54.00	-0.017 -0.037	47.80	-0.022 -0.042
1st oversize	53.75	-0.017 -0.037	47.55	-0.022 -0.042
2nd oversize	53.50	-0.017 -0.037	47.30	-0.022 -0.042
Stage III	53.25	-0.017 -0.037	47.05	-0.022 -0.042

PISTON AND CYLINDER DIMENSIONS

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

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

FASTENER TIGHTENING SPECIFICATIONS

Component	Fastener Size	Nm
Air Conditioning Compressor to Accessory Bracket Bolt	-	25
Bolt with Pressure Relief Valve	-	27
Coolant Pump to Cylinder Block Bolt	-	15
Coolant Thermostat Housing to Cylinder Block Bolt	-	15
Connecting Rod Bearing Cap to Connecting Rod Bolt ⁽¹⁾	-	45 + 90°
	-	65 + 90°

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Crankshaft Bearing Cap to Cylinder Block Bolt ⁽¹⁾		
Crankshaft Toothed Belt Gear to Crankshaft Bolt (1)	-	90 + 90°
Dual Mass Flywheel to Crankshaft Bolt ⁽¹⁾	-	60 + 90°
Engine Mount Bracket to Cylinder Block Bolt	-	45
Engine Speed Sensor to Cylinder Block Bolt	-	10
Generator to Accessory Bracket Bolt/Nut	-	23
Idler Roller to Cylinder Head Bolt	-	25
Idler Roller to Sealing Flange Bolt	-	35
Intake Manifold Support to Cylinder Block Bolt	-	23
Knock Sensor to Cylinder Block Bolt ⁽³⁾	-	20
Lower Toothed Belt Guard to Cylinder Block Bolt	-	8
Oil Filter Adapter to Cylinder Block Bolt ⁽¹⁾	-	15 + 90°
Rear Toothed Belt Guard to Cylinder Head Bolt ⁽²⁾	-	10
Ribbed Belt Tensioner to Accessory Bracket Bolt	-	23
Sealing Flange to Cylinder Block Bolt	-	15
Sensor Wheel to Crankshaft Screw ⁽¹⁾	-	10 + 90°
Sprocket to Camshaft Bolt ⁽¹⁾	-	50 + 90°
Toothed Belt Tensioner to Cylinder Head Stud Bolt Nut	-	25
Upper Toothed Belt Guard to Cylinder Head Bolt	-	10
Vibration Damper to Crankshaft Bolt ⁽¹⁾	-	20 + 90°
(1) Always replace		
(2) Install using locking fluid		
(3) The tightening specification affects the function of the knock sensor		

Accessory Bracket Bolt Tightening Sequence and Specification

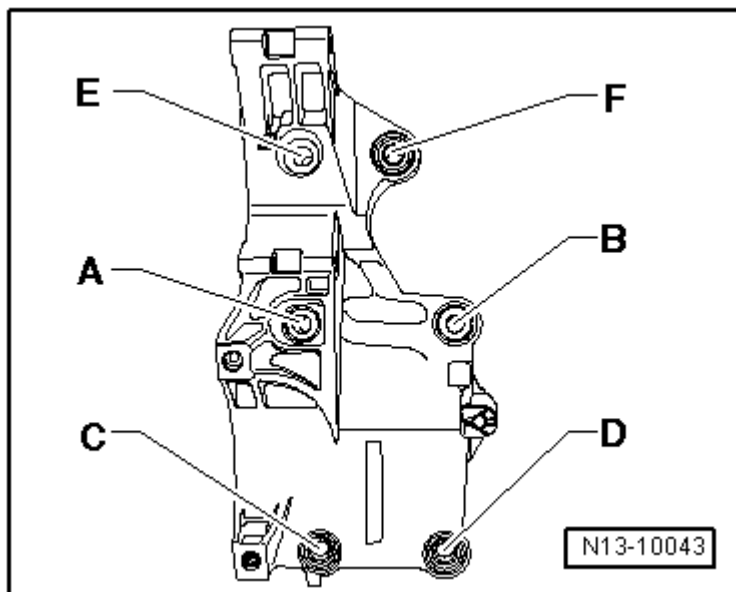


Fig. 13: Identifying Accessory Assembly Bracket Tightening Sequence
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Tighten the bolts in the sequence shown to 40 Nm.

DIAGNOSIS AND TESTING

PISTON, PISTON RINGS AND CYLINDER BORE, CHECKING

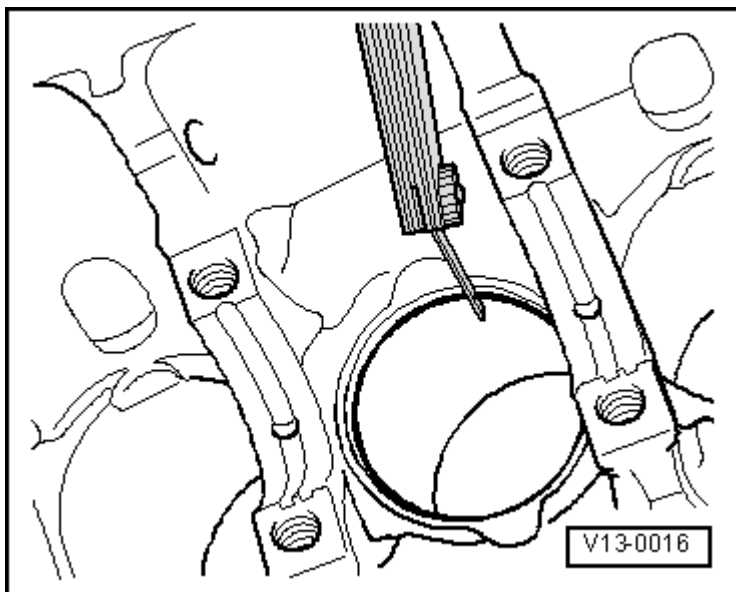


Fig. 14: Identifying Check Of Piston Ring Gap
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

Special tools and workshop equipment required

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- Feeler Gauge

-- Insert the ring from above, down to the lower end of the cylinder bore at a right angle, approximately 15 mm from the cylinder edge.

Piston Ring		Gap	
		New	Wear limit
Compression rings	mm	0.20•••0.40	0.8
Oil scraping ring	mm	0.25•••0.50	0.8

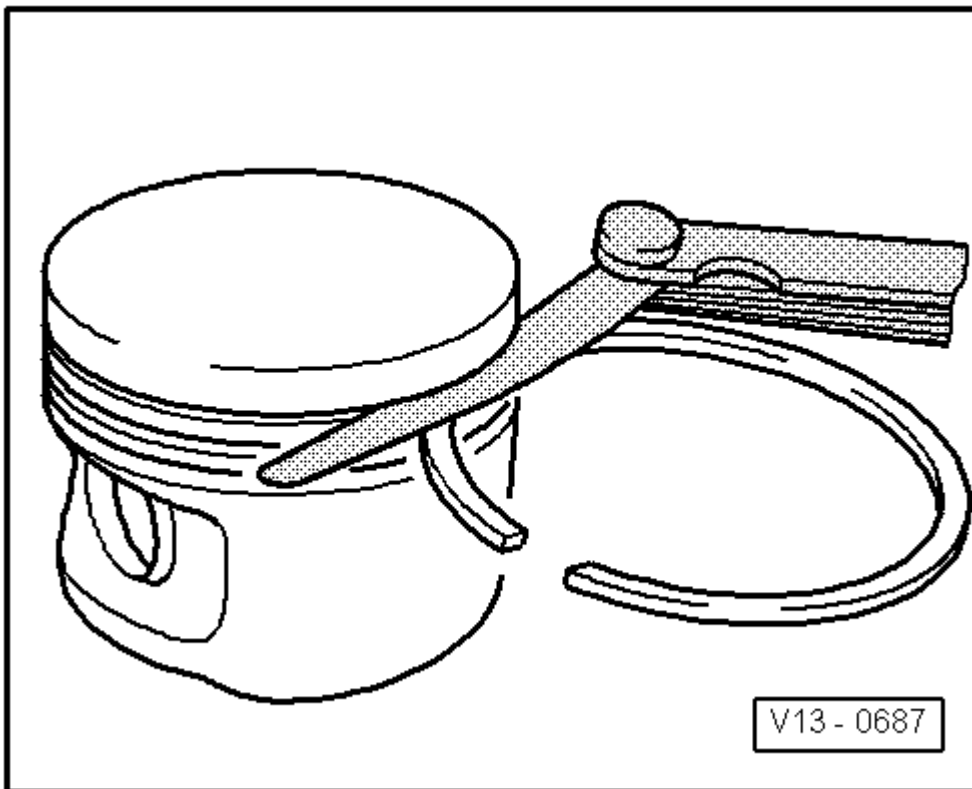


Fig. 15: Identifying Check Of Piston Ring Gap
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

Special tools and workshop equipment required

- Feeler Gauge

-- Clean the ring groove before checking.

Piston Ring		Ring to Groove Clearance	
		New	Wear limit
Compression rings	mm	0..06•••0.09	0.20

Oil scraping ring	mm	0.03...0.06	0.15
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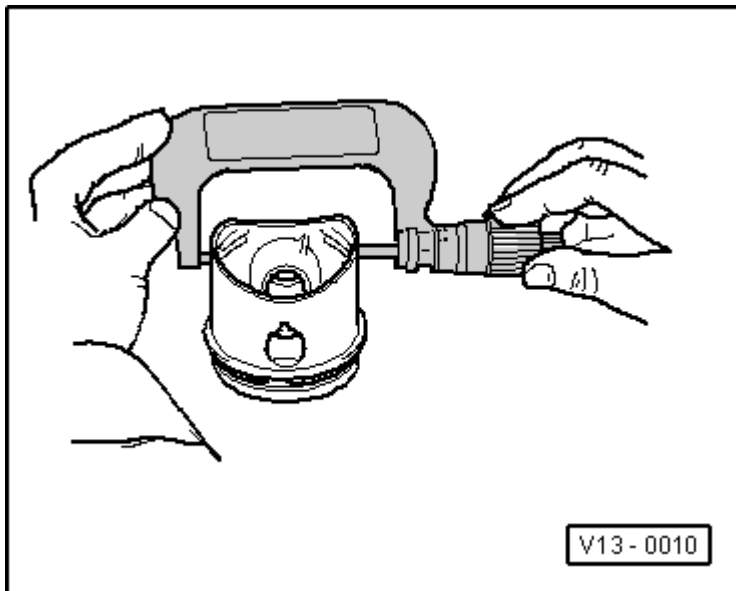


Fig. 16: Identifying Check Of Piston

Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

Special tools and workshop equipment required

- Micrometer 75-100 mm VAS 6071

-- Measure approximately 10 mm from the lower edge of the piston skirt, offset 90° to the piston axis.

Deviation from nominal dimension: Max. 0.04 mm

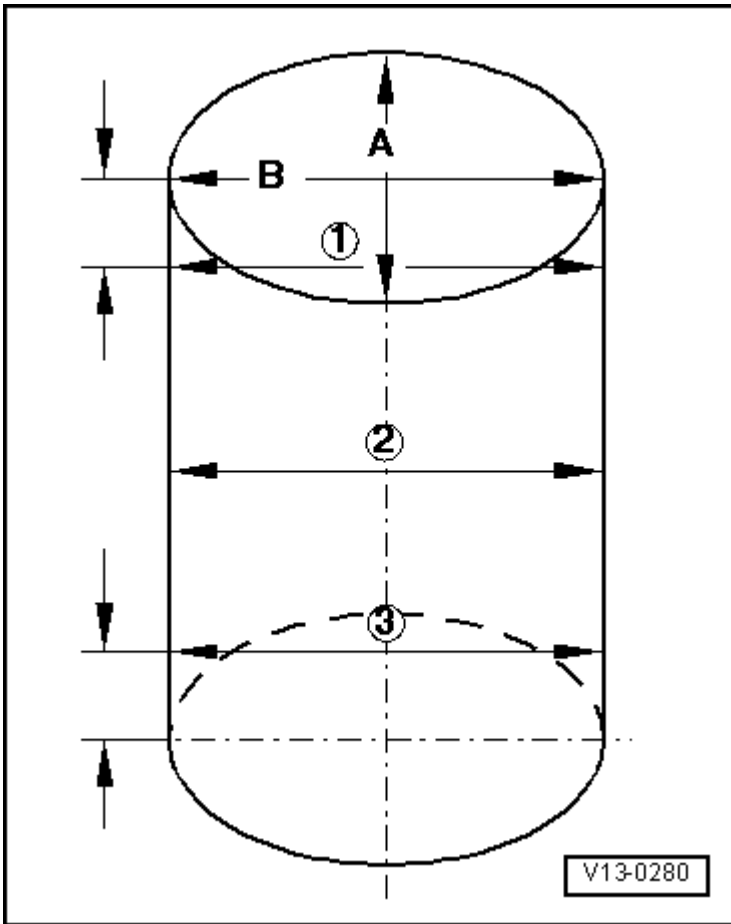


Fig. 17: Identifying Check Of Cylinder Bores

Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

Special tools and workshop equipment required

- Cylinder Gauge VAS 6078

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

-- Deviation from nominal dimension: Max. 0.08 mm

NOTE: The cylinder bore measurement must not be performed if the cylinder block is installed on the engine and transmission holder VAS 6095, since inaccurate measurements are possible.

REMOVAL AND INSTALLATION

RIBBED BELT

Special tools and workshop equipment required

- Locking Pin T10060 A

Removing

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

-- Mark the rotation direction of the ribbed belt.

with an Evaporative Emission (EVAP) Canister inside the Engine Compartment

-- Release the EVAP canister and remove it upward -arrow- out of the mount with the lines still connected.

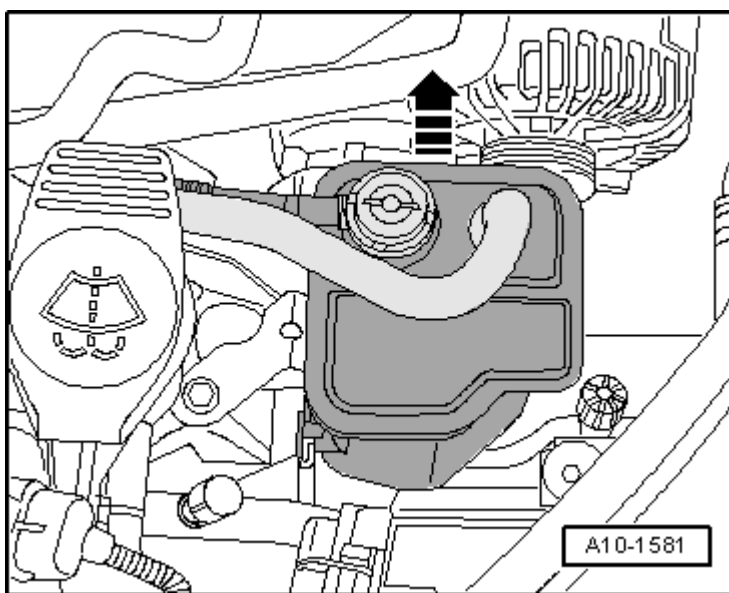


Fig. 18: Identifying EVAP Canister

Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

Continuation for All

-- Rotate the tensioner, in the -direction of the arrow- to release the tension on the belt.

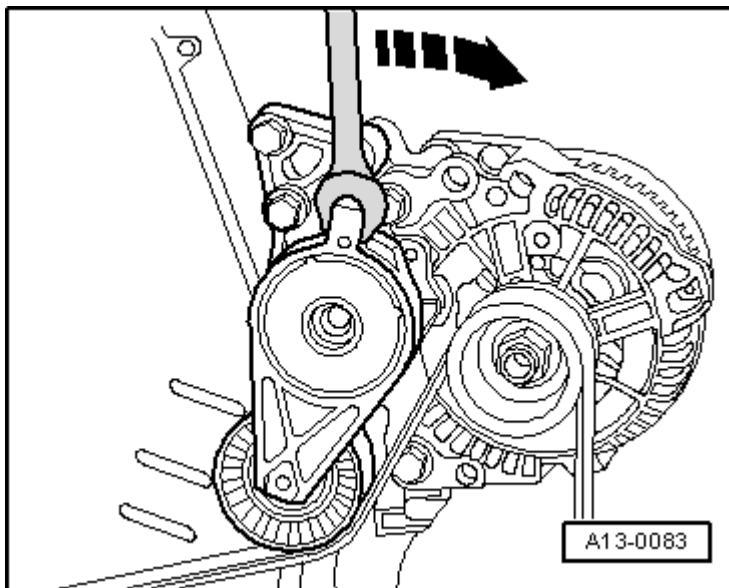


Fig. 19: Identifying Method To Relieve Tension On Poly V-Belt
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

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

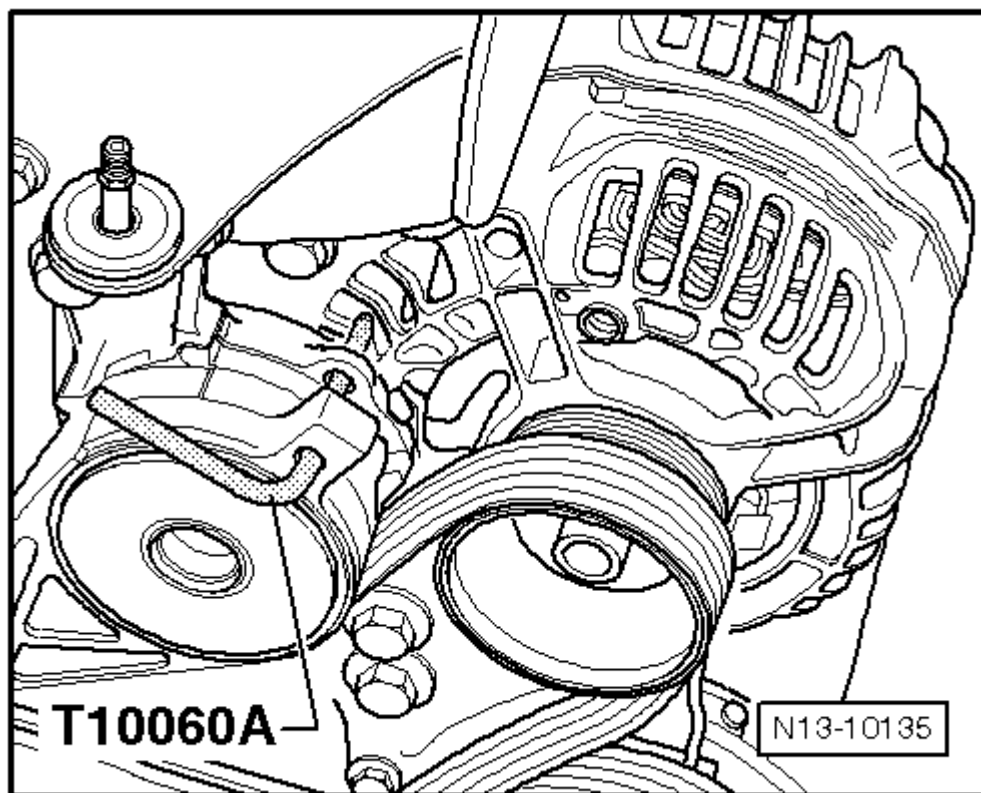


Fig. 20: Identifying Lock Tensioner With Locking Pin T10060 A
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Remove the ribbed belt.

Installing

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

NOTE: When installing the ribbed belt, note the rotation direction of the belt and be sure that the belt is seated correctly on the pulleys.

Route the ribbed belt over the Air Conditioning (A/C) compressor as last.

After installing the ribbed belt, start the engine and make sure the ribbed belt is running correctly.

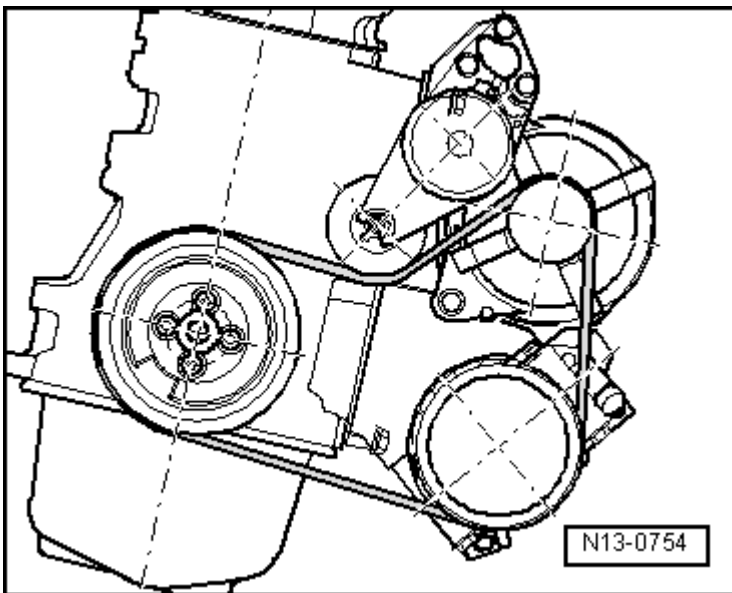


Fig. 21: Identifying Belt Seated correctly
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

CRANKSHAFT SEAL, BELT PULLEY SIDE

Special tools and workshop equipment required

- Seal Remover 3203
- Counter Support 3415
- Assembly Tool T10053
- Torque Wrench (5-50 Nm) V.A.G 1331
- Torque Wrench (40-200 Nm) V.A.G 1332

Removing

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

- Remove the toothed belt. Refer to **TOOTHED BELT** .
- Loosen the crankshaft toothed belt gear bolt by holding the gear using the counter support 3415.

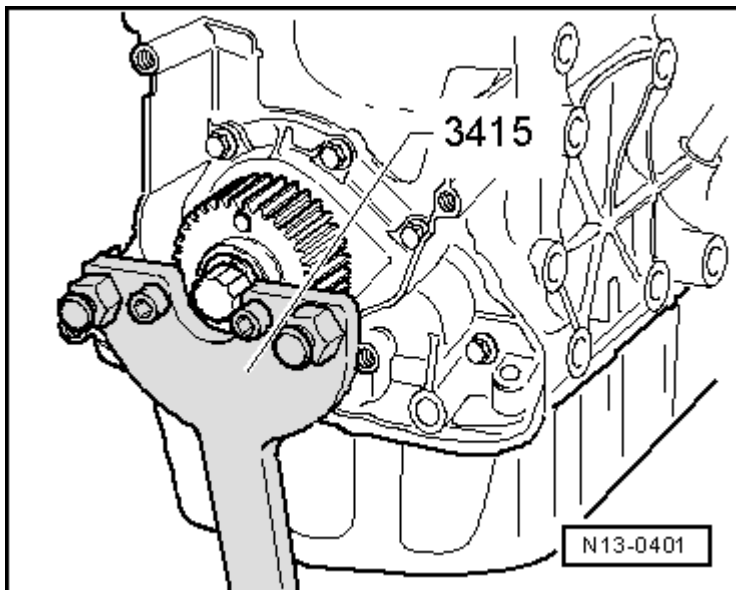


Fig. 22: Identifying Counter-Hold 3415 On Crankshaft Toothed Belt Sprocket
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

- To guide the seal remover 3203, install the bolt back into the crankshaft by hand until seated.

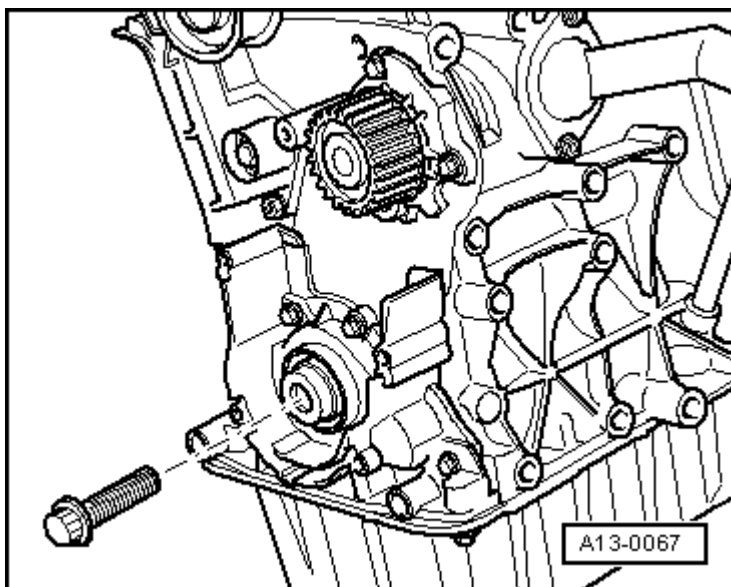


Fig. 23: Identifying Center Bolt & Crankshaft
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

- Remove the inner portion of the seal remover 3203 9 rotations (approximately 20 mm) from the outer portion and secure it using the with knurled thumb screw.

-- Grease the threaded head of the seal remover 3203, position it and forcefully screw it as far as possible into the seal.

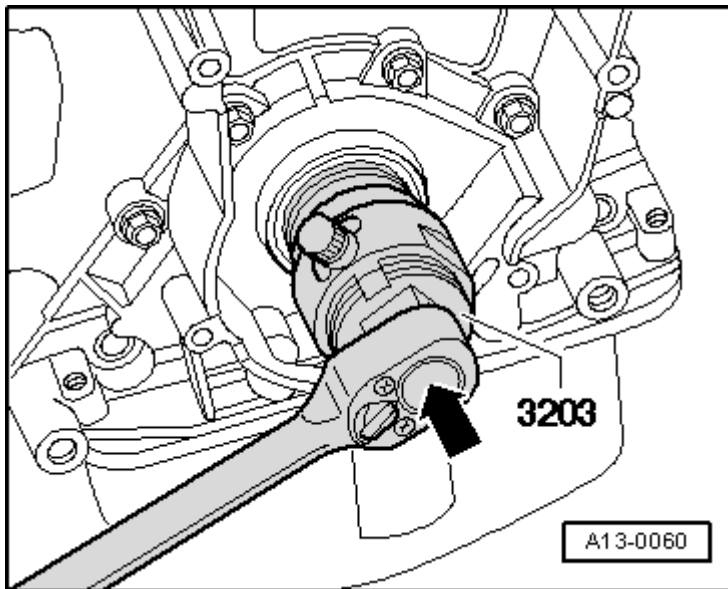


Fig. 24: Identifying Firm Pressure Exerted To Oil Seal Extractor 3203 Into Oil Seal
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

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

Installing

-- Remove any oil residue on the crankshaft journal with a clean cloth.

-- Position the guide sleeve T10053/1 on the crankshaft journal.

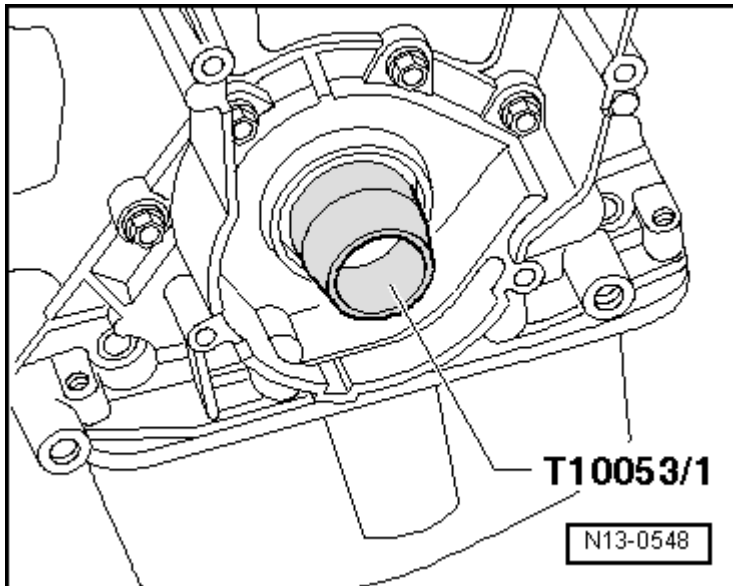


Fig. 25: Identifying Guide Sleeve T10053/1 Fitted Onto Crankshaft Journal
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

- Slide the dry seal over the guide sleeve onto the crankshaft.
- Press in the seal using the assembly tool T10053 and the bolt T10053/2 (M16 x 1.5 x 60) until seated.

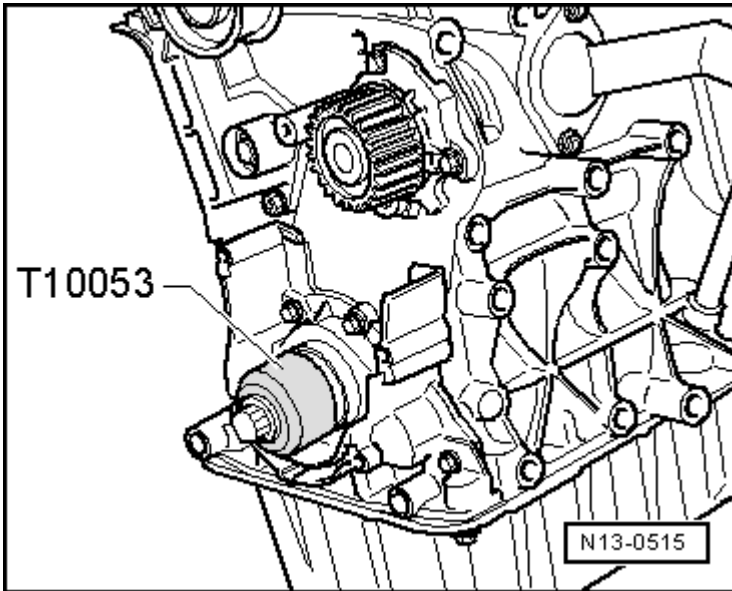


Fig. 26: Identifying Press Sleeve T10053 & Bolt Mounted
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

NOTE: The contact surfaces between the toothed belt gear, diamond disc and crankshaft must be free of oil.

The crankshaft toothed belt gear bolt must be replaced.

The threads and shoulder must be free of oil and grease.

- Install the crankshaft toothed belt gear -2- with the disc -3- and tighten the bolt -1- hand tight.

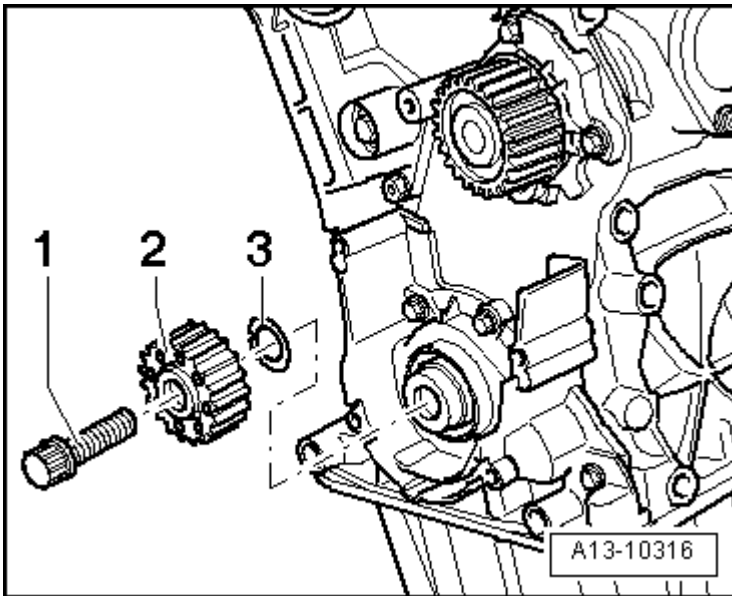


Fig. 27: Identifying Center Bolt, Crankshaft Toothed Belt Gear & Diamond Disc
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Secure the crankshaft toothed belt gear using the counter support 3415.

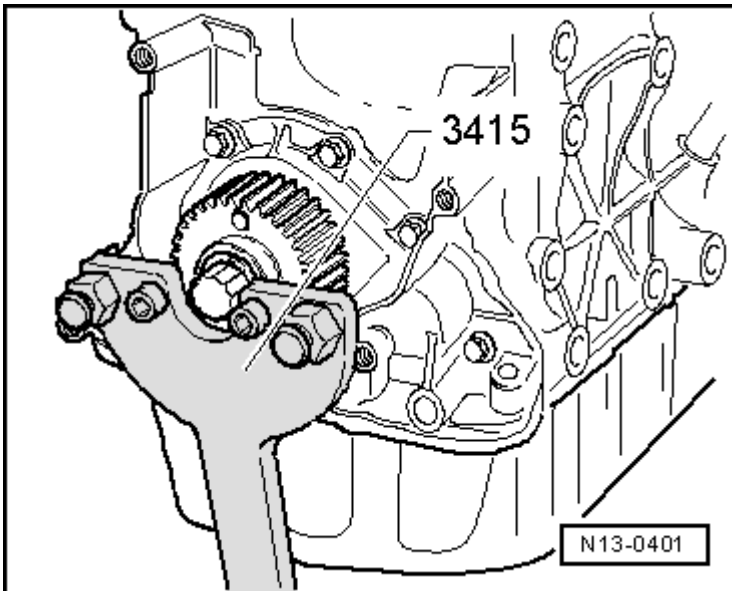


Fig. 28: Identifying Counter-Hold 3415 On Crankshaft Toothed Belt Sprocket
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Tighten new bolt to 90 Nm + an additional 90° (1/4) turn, the additional turn may occur in several stages.

Further installation is in the reverse order of the removal procedure.

Install the toothed belt and adjust the timing. Refer to **TOOTHED BELT** .

SEALING FLANGE, BELT PULLEY SIDE**Special tools and workshop equipment required**

- Counter Support 3415
- Assembly Tool T10053
- Torque Wrench (5-50 Nm) V.A.G 1331
- Torque Wrench (40-200 Nm) V.A.G 1332
- Hand Drill with Plastic Brush Attachment
- Silicone Sealant D 176 404 A2
- Flat Scraper

Removing

- Remove the ribbed belt. Refer to **RIBBED BELT**.
- Remove the toothed belt. Refer to **TOOTHED BELT**.
- Rotate the crankshaft slightly backward.
- Loosen the crankshaft toothed belt gear bolt by holding the gear using the counter support 3415.

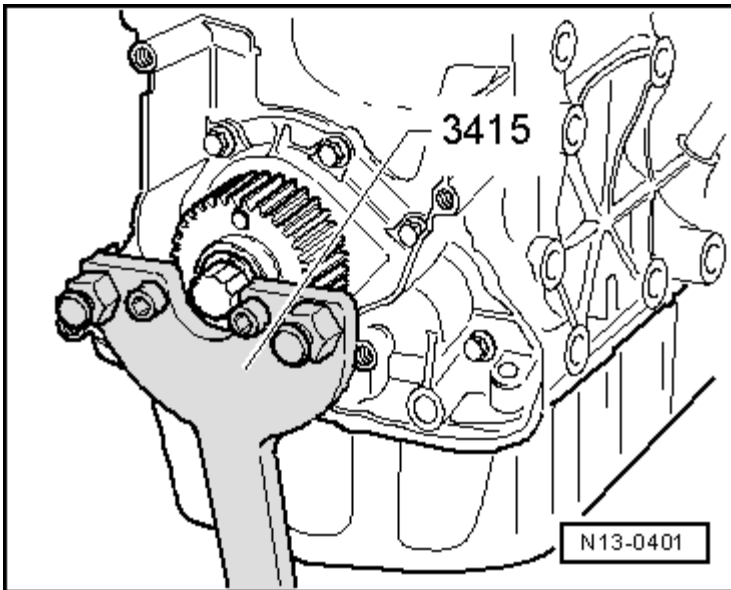


Fig. 29: Identifying Counter-Hold 3415 On Crankshaft Toothed Belt Sprocket
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

- Drain the engine oil.
- Remove the oil pan. Refer to **OIL PAN**.

- Remove the sealing flange, belt pulley side.
- Remove the sealing flange, if necessary use a rubber mallet and tap it gently.
- Remove any sealant residue on the cylinder block using a flat blade scraper.
- Cover the seal with a clean cloth.
- Remove any sealant still on the sealing flange using a rotating plastic brush. Wear protective eyewear.

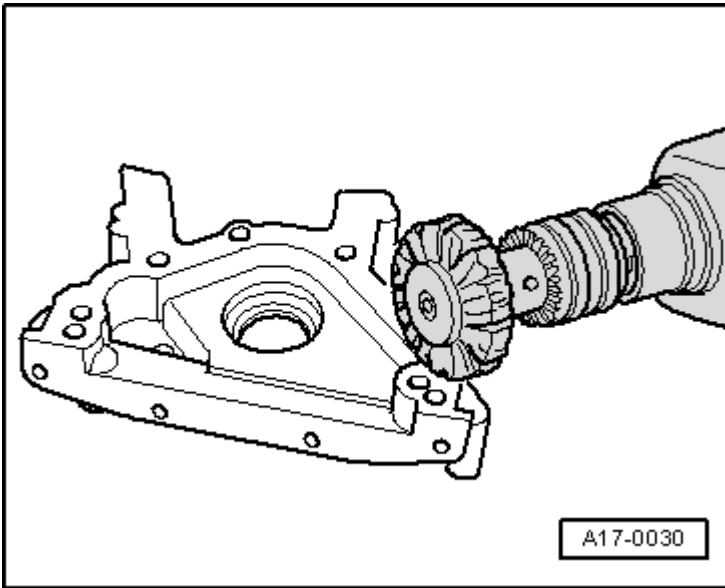


Fig. 30: Identifying Rotating Plastic Brush

Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

- Clean the sealing surface so that it is free of oil and grease.

Installing

- Cut the sealant tube nozzle at the front mark (nozzle diameter: approximately 0.12 in).

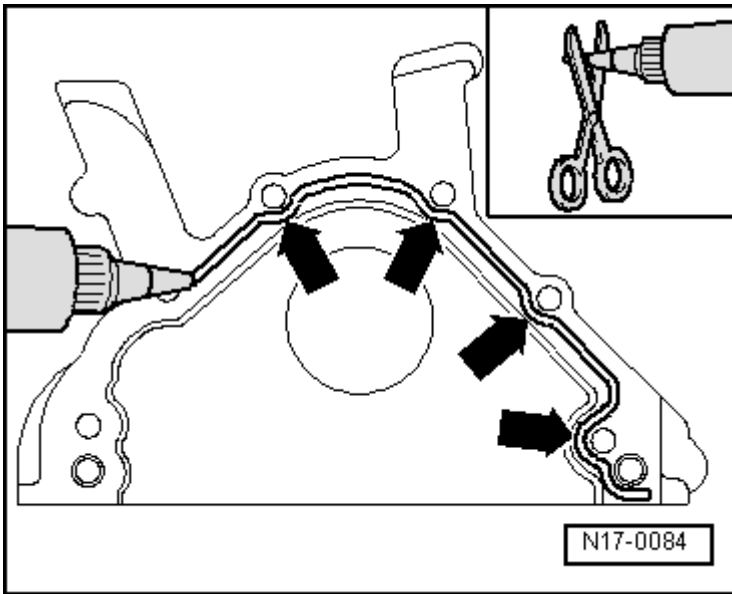


Fig. 31: Identifying Silicone Sealing Compound Bead

Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Apply a sealant bead with a diameter of about 2 to 3 mm to the clean sealing surface of the sealing flange as shown -arrows-.

NOTE: **Cover the seal with a clean cloth before applying the sealant bead.**

The sealant bead must not be thicker than 2 to 3 mm. Otherwise excess sealant could enter the oil pan and clog the oil intake tube.

Note the expiration date of the sealant.

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

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

After installing, allow the sealant to dry for approximately 30 minutes. Only after then may the engine oil be added.

-- Position the sealing flange immediately and tighten all the bolts -arrows- hand tight.

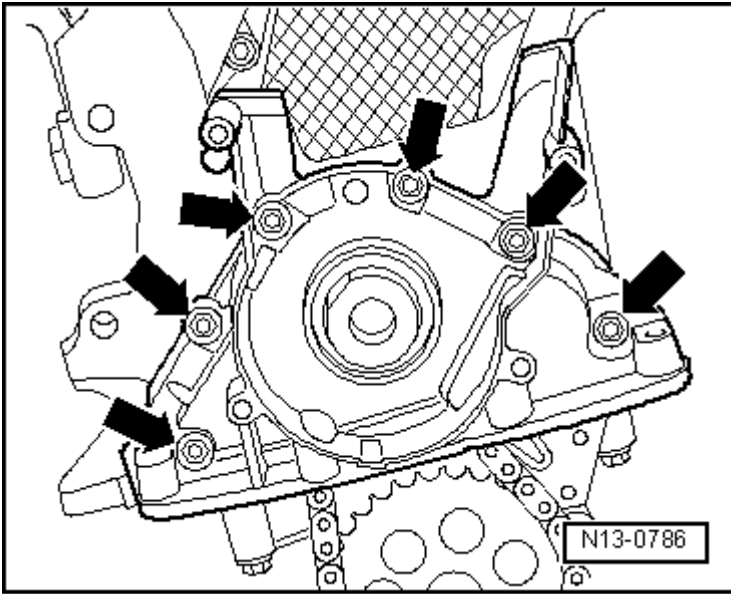


Fig. 32: Identifying Sealing Flange Bolts

Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Tighten the sealing flange bolts in a diagonal sequence.

Tightening specification: 15 Nm

-- Remove any excess sealant.

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

-- If necessary, install the seal. Refer to **CRANKSHAFT SEAL, BELT PULLEY SIDE**.

NOTE: **The contact surface between the crankshaft toothed belt gear, diamond disc and crankshaft must be free of oil.**

The crankshaft toothed belt gear bolt must be replaced.

The threads and shoulder must be free of oil and grease.

-- Install the crankshaft toothed belt gear -2- with the disc -3- and tighten the bolt -1- hand tight.

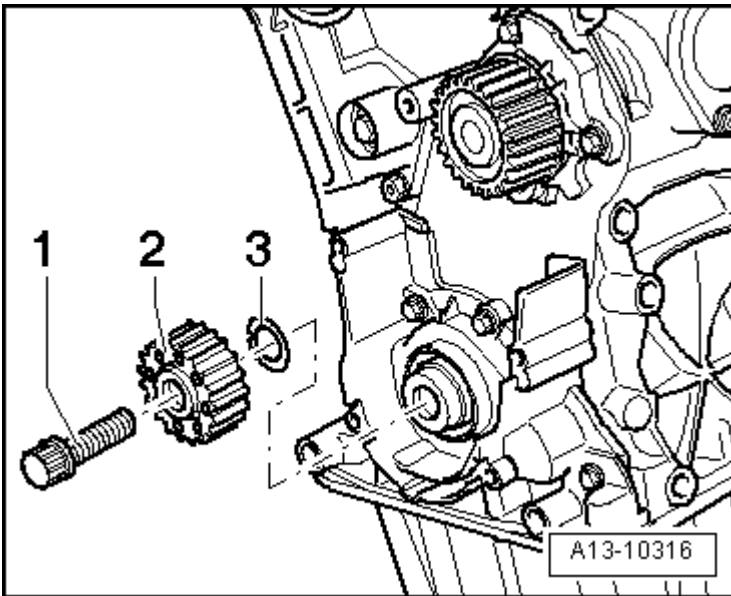


Fig. 33: Identifying Center Bolt, Crankshaft Toothed Belt Gear & Diamond Disc
 Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Secure the crankshaft toothed belt gear using the counter support 3415.

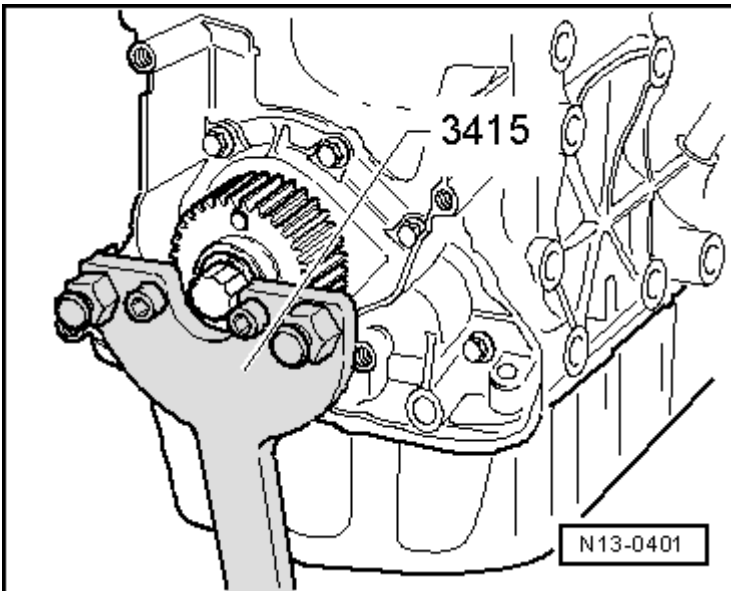


Fig. 34: Identifying Counter-Hold 3415 On Crankshaft Toothed Belt Sprocket
 Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Tighten the new bolt to 90 Nm + an additional 90° (1/4) turn, the additional turn may occur in several stages.

Further installation is in the reverse order of removal.

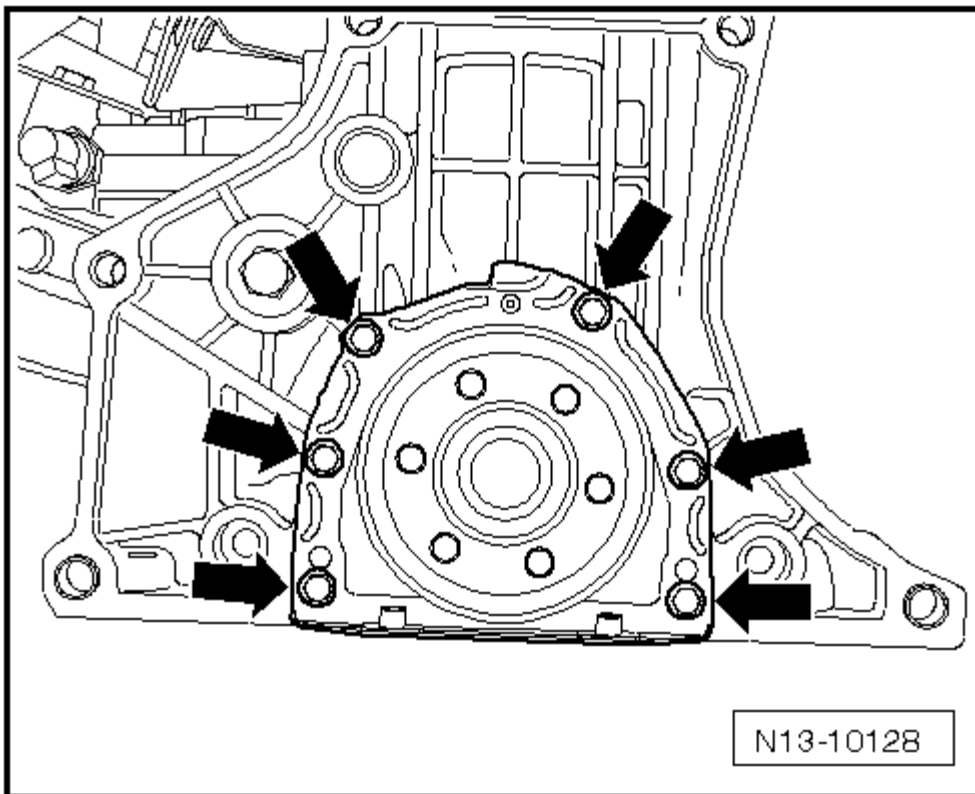
Install the toothed belt and adjust the timing. Refer to **TOOTHED BELT** .

SEALING FLANGE AND SEAL, TRANSMISSION SIDE**Special tools and workshop equipment required**

- Hand Drill with Plastic Brush Attachment
- Flat Scraper
- Protective Eyewear
- Silicone Sealant D 176 404 A2

Removing

- Remove the flywheel. Refer to **FLYWHEEL**.
- Remove the oil pan. Refer to **OIL PAN**.
- Remove the sealing flange bolts -arrows- and flange.

**Fig. 35: Identifying Mounting Bolts**

Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

Installing

NOTE: **Do not lubricate or grease the sealing lip on the seal.**

- Clean the sealing surfaces so that they are free of oil and grease.
- Remove any oil residue on the crankshaft with a clean cloth.
- Use the alignment sleeves to install.
- The alignment sleeves may only be removed after the sealing flange has been slid onto the crankshaft. The sealing flange is positioned on the alignment sleeves.
- Tighten the sealing flange bolts -arrows- to 15 Nm.

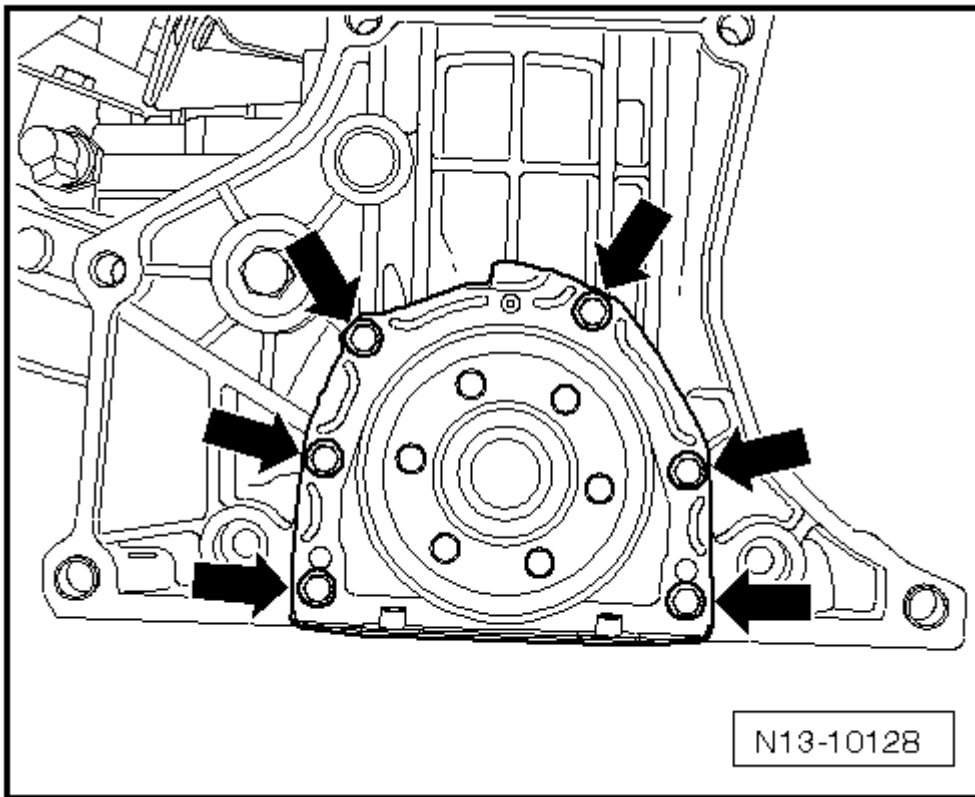


Fig. 36: Identifying Mounting Bolts

Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

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

Further installation is in the reverse order of removal.

FLYWHEEL

Special tools and workshop equipment required

- Flywheel Retainer 3067

Removing

CAUTION: The dual mass flywheel can be damaged by removing the bolts -B- with an air powered or impact wrench.

Only remove the bolts for the dual mass flywheel by hand.

Remove the transmission. .

-- Rotate the flywheel -A- until the bolts -B- line up with the holes -arrows-.

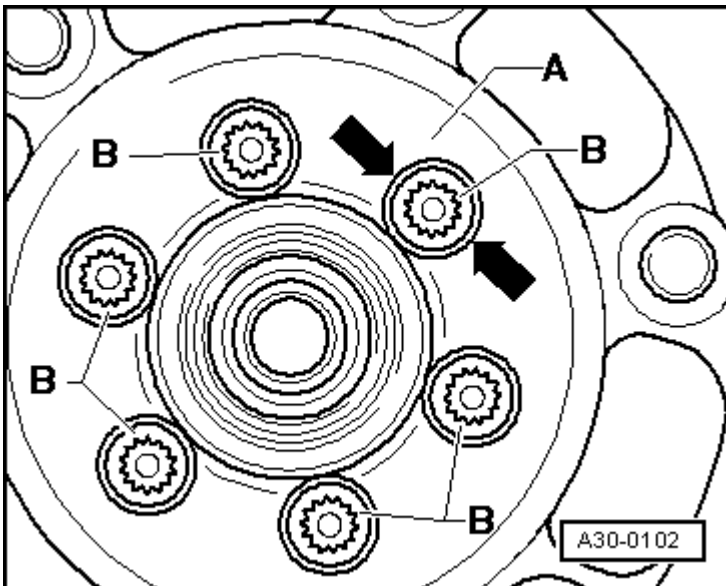


Fig. 37: Identifying Dual-Mass Flywheel & Bolts

Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Be careful the bolt heads do not get caught on the flywheel when removing them -B-.

-- Insert the flywheel retainer 3067 in the hole on the cylinder block.

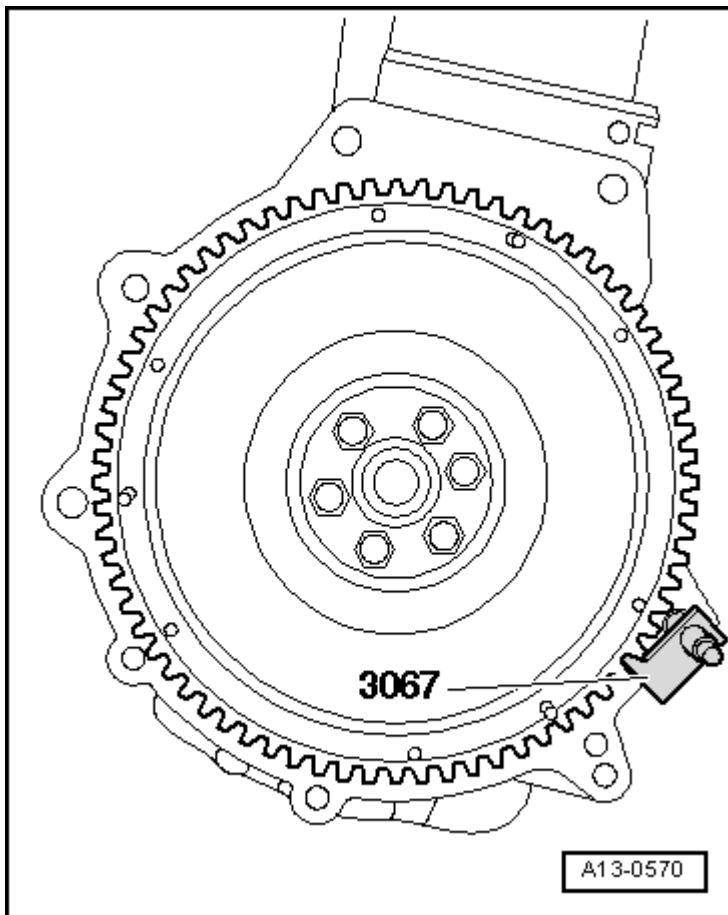


Fig. 38: Identifying Flywheel Retainer 3067

Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

- Mark the flywheel position to the engine.
- Remove the flywheel.

Installing

Install in reverse order of removal. Note the following:

- Replace the bolts.

Tightening specification

Component	Nm
Dual mass flywheel to crankshaft	60 + 90° ⁽¹⁾
(1) 90° corresponds to 1/4 turn.	

CRANKSHAFT SENSOR WHEEL

-- Always replace the sensor wheel -2- each time the screws -1- are removed.

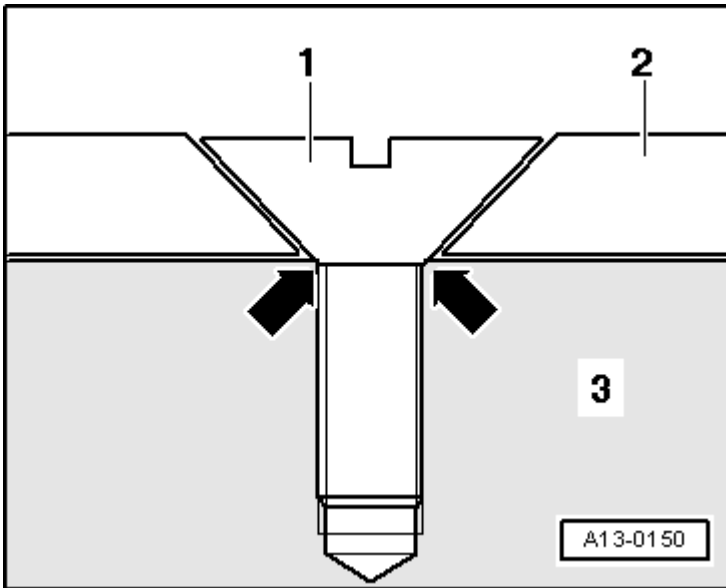


Fig. 39: Identifying Attachment Points, Countersunk Screws, Crankshaft & Sensor Wheel
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

NOTE: After tightening a second time, the attachment point of the countersunk screws of the sensor wheel are so deformed that the screw heads -3- lie on the crankshaft -arrows- and the sensor wheel is loose underneath the screws.

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

Tightening specification, refer to CRANKSHAFT OVERVIEW.

SPECIAL TOOLS

Special tools and workshop equipment required

- Micrometer 75-100 mm VAS 6071
- Cylinder Gauge VAS 6078
- Locking Pin T10060 A

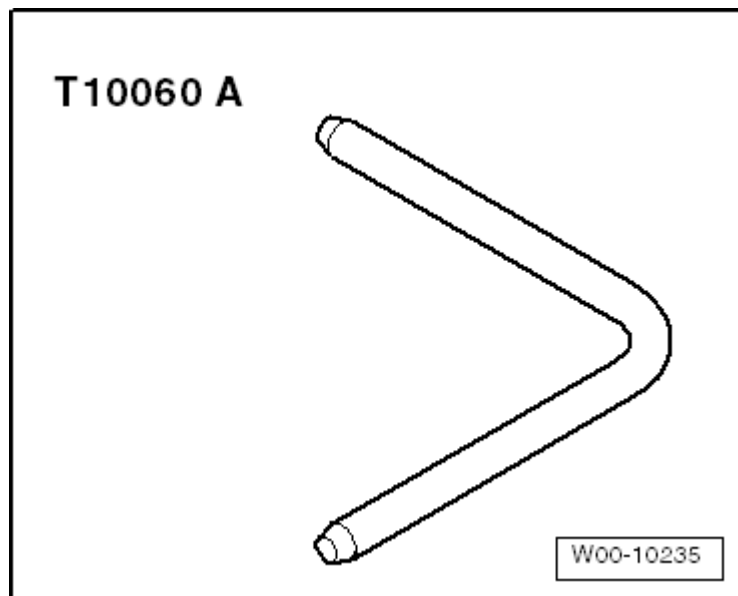


Fig. 40: Identifying Locking Pin T10060 A
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

- Flywheel Retainer 3067

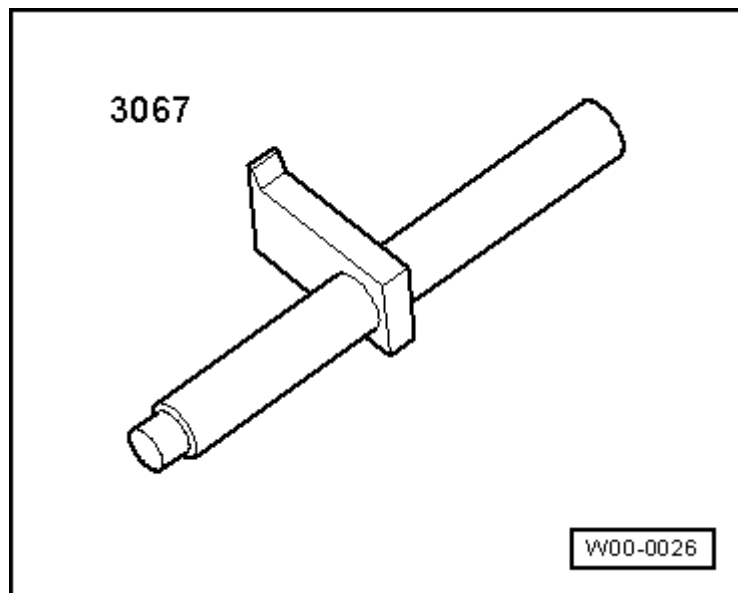


Fig. 41: Identifying Counter-Hold Tool 3067
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

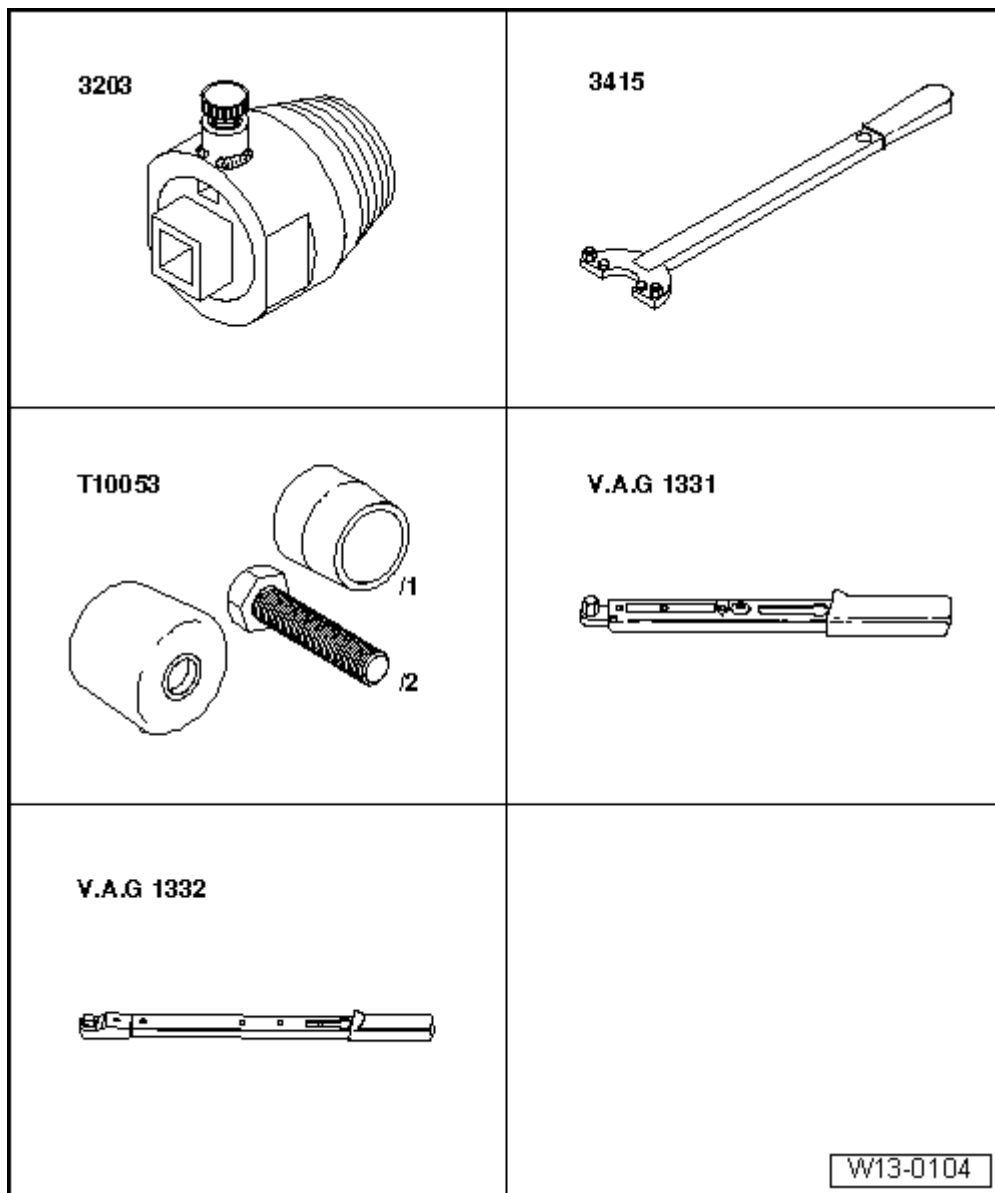


Fig. 42: Identifying Special Tools -- Crankshaft Seal, Ribbed Belt Side, Replacing
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

Special tools and workshop equipment required

- Seal Remover 3203
- Counter Support 3415
- Assembly Tool T10053
- Torque Wrench (5-50 Nm) V.A.G 1331
- Torque Wrench (40-200 Nm) V.A.G 1332

ENGINE**2.0 Liter - Cylinder Head, Valvetrain - Engine Code(s): CRZA****15 CYLINDER HEAD, VALVETRAIN****DESCRIPTION AND OPERATION****CYLINDER HEAD AND COVER OVERVIEW**

NOTE: When installing a replacement cylinder head, all of the contact surfaces between the hydraulic lash adjusters, roller rocker arms and cam running surfaces on the camshaft must be lubricated before installing the cylinder head cover.

Only remove the plastic protectors installed to protect the open valves immediately before installing the cylinder head.

Replace the cylinder head bolts.

If the cylinder head is going to be replaced, then it is also necessary to replace all the coolant.

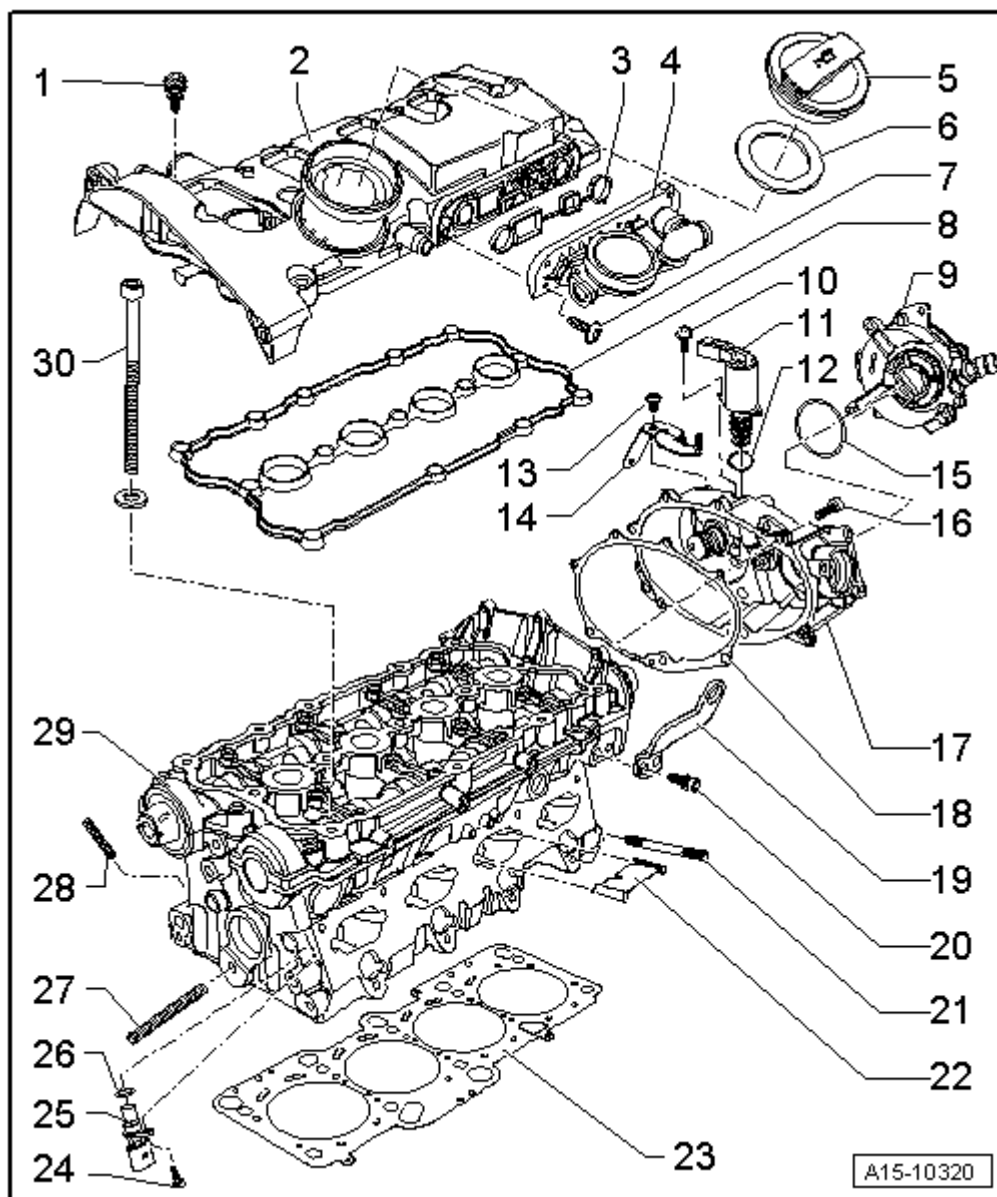


Fig. 1: Identifying Cylinder Head And Cover Overview

Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

1. Bolt

- 10 Nm
- Tightening sequence, refer to CYLINDER HEAD COVER.

2. Cylinder Head Cover

- Removing and installing, refer to CYLINDER HEAD COVER.

3. Gasket

- Replace if damaged or leaking.

4. Crankcase Ventilation Valve

5. Cap

6. **Gasket**
 - Replace if damaged or leaking.
7. **Bolt**
 - 4 Nm
8. **Cylinder Head Cover Gasket**
 - Replace if damaged or leaking.
9. **Vacuum Pump**
10. **Bolt**
 - 4 Nm
11. **Camshaft Adjustment Valve 1 -N205-**
 - Removing and installing, refer to Camshaft Adjustment Valve 1 -N205-.
12. **Seal**
 - Always replace.
13. **Bolt**
 - 10 Nm
14. **Wire Bracket**
15. **Seal**
 - Replace if damaged or leaking.
16. **Bolt**
 - 10 Nm
17. **Housing**
18. **Gasket**
 - Always replace.
19. **Transport Strap**
20. **Bolt**
 - 25 Nm
21. **Stud Bolt**
 - 10 Nm
 - For the intake manifold.
22. **Partition**
23. **Cylinder Head Gasket**
 - Always replace.
 - Note the installed position: The part number faces the cylinder head.
24. **Bolt**
 - 10 Nm
25. **Camshaft Position Sensor -G40-**
26. **Seal**
27. **Stud Bolt**

- 10 Nm
- For the toothed belt tensioner.

28. Stud Bolt

- 20 Nm
- For the exhaust manifold.

29. Cylinder Head

- Checking for distortion, refer to **Fig. 2**.

30. Bolt

- 40 Nm + an additional 180° (1/2) turn.
- Always replace.
- Follow the loosening and tightening sequence. Refer to **CYLINDER HEAD**.

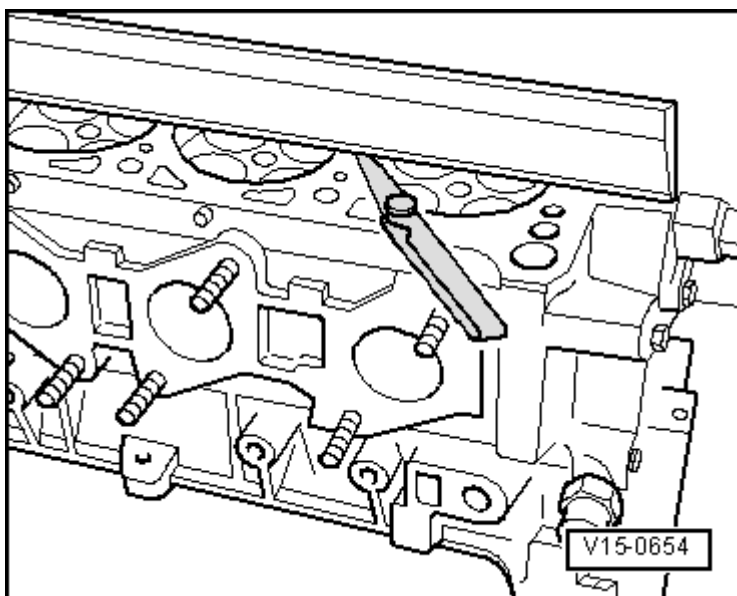


Fig. 2: Identifying Check Of Cylinder Head For Distortion
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

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

- Maximum permissible distortion: 0.05 mm

-- Replace the cylinder head if the maximum distortion is exceeded.

VALVETRAIN OVERVIEW

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

The cylinder head and guide frame must be replaced together.

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 hydraulic lash adjusters, 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.

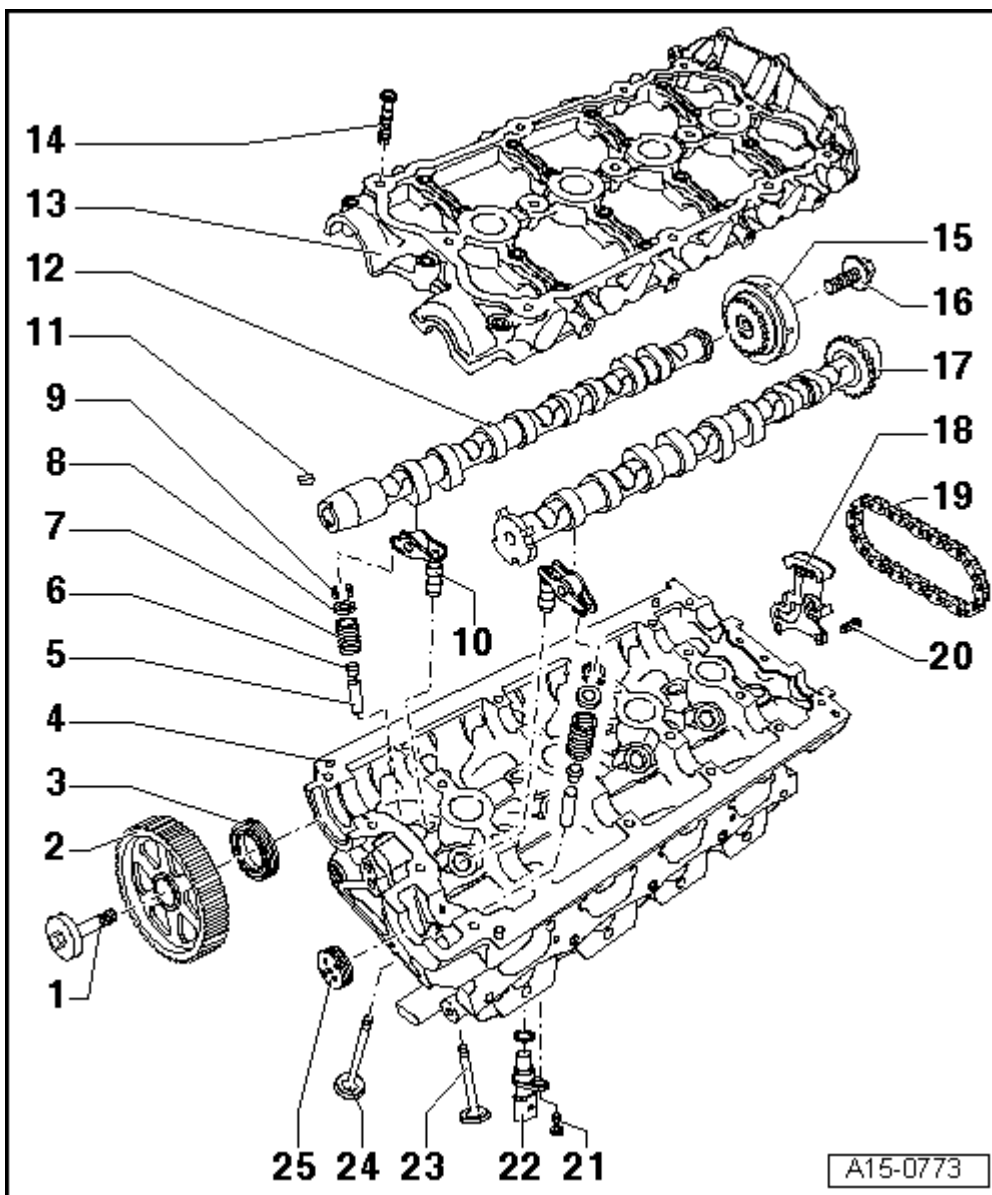


Fig. 3: Identifying Valvetrain, Assembly Overview

Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

1. **Bolt**
 - 50 Nm + an additional 180° (1/2) turn.
 - Always replace.
 - Use the retainer 3036 to loosen and tighten.
2. **Camshaft Sprocket**
 - Use the retainer 3036 to loosen and tighten.
3. **Seal**
 - Removing and installing, refer to EXHAUST CAMSHAFT SEAL.
4. **Cylinder Head**
5. **Valve Guide**
 - Checking, refer to VALVE GUIDE, CHECKING.
6. **Valve Stem Seal**
 - Removing and installing, refer to VALVE STEM SEALS.
7. **Valve Spring**
8. **Spring Seat**
9. **Valve Retainer**
10. **Hydraulic Lash Adjuster**
 - Do not interchange.
 - Lubricate the contact surfaces.
11. **Woodruff Key**
 - Make sure it is secure.
12. **Exhaust Camshaft**
 - Check the radial clearance using Plastigage® (the roller rocker arms are removed);

Wear limit: 0.1 mm

Run out: maximum 0.035 mm
13. **Guide Frame**
 - With integrated camshaft bearings.
 - Clean the sealing surface, reworking is not permitted.
 - Remove any old sealant residue.
14. **Bolt**
 - 8 Nm + an additional 90° (1/2) turn.
 - Always replace.
15. **Camshaft Adjuster**
 - Removing and installing, refer to CAMSHAFT ADJUSTER.

16. Bolt

- 20 Nm + an additional 45° (1/8) turn.
- Use the retainer 3036 to loosen and tighten.

17. Intake Camshaft

- Check the radial clearance using Plastigage®:

Wear limit: 0.1 mm

Run out: maximum 0.035 mm

18. Chain Tensioner

- Secure using the locking pin T10115 before removing.

19. Timing Chain

- Removing and installing, refer to CAMSHAFT ADJUSTER.
- Check for wear.

20. Bolt

- 10 Nm

21. Bolt

- 10 Nm

22. Camshaft Position Sensor -G40-**23. Exhaust Valve**

- Do not grind, only hand lapping is permitted.
- Valve dimensions, refer to VALVE DIMENSIONS.
- Valve guide, checking. Refer to VALVE GUIDE, CHECKING.

24. Intake Valve

- Do not grind, only hand lapping is permitted.
- Valve dimensions, refer to VALVE DIMENSIONS.
- Valve guide, checking. Refer to VALVE GUIDE, CHECKING.

25. Sealing Cap

- Always replace.
- Removing: Insert a screwdriver into the center of the cap and pry out.
- Installing: Do not use sealant, press in 1 to 2 mm using the thrust piece 3334.

SPECIFICATIONS**VALVE DIMENSIONS**

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

2012 Volkswagen Golf R

ENGINE 2.0 Liter - Cylinder Head, Valvetrain - Engine Code(s): CRZA

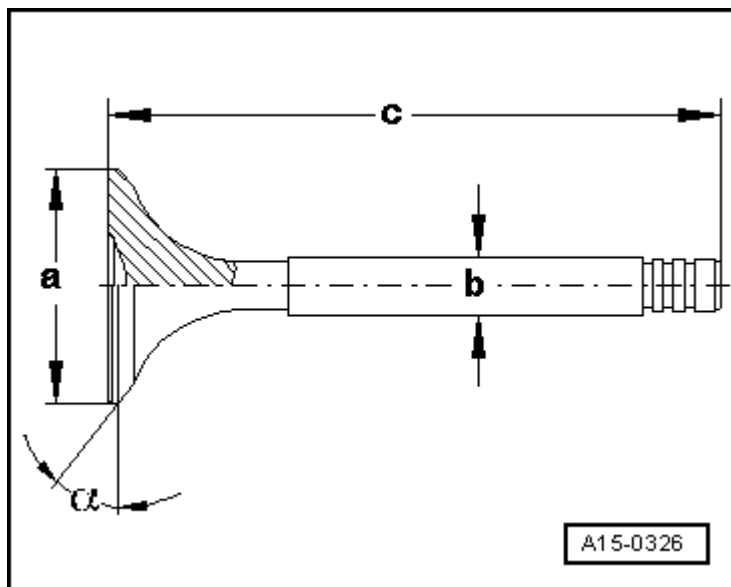


Fig. 4: Identifying Valve Dimensions

Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

Dimension		Intake Valve	Exhaust Valve
Diameter a	mm	33.75•••33.95	27.90•••28.10
Diameter b	mm	5.98	5.95
c	mm	103.97	101.87
a	Angle°	45	45

FASTENER TIGHTENING SPECIFICATIONS

Component	Fastener Size	Nm
Camshaft Adjuster to Camshaft Bolt	-	20 + 45°
Camshaft Adjustment Valve 1 to Housing Bolt	-	4
Camshaft Position Sensor to Cylinder Head Bolt	-	10
Camshaft Timing Chain, Chain Tensioner to Cylinder Block Bolt	-	10
Crankcase Ventilation Valve to Cylinder Head Cover Bolt	-	4
Exhaust Manifold Stud Bolt to Cylinder Head	-	20
Guide Frame to Cylinder Head Bolt, see ⁽¹⁾	-	8 + 90°
Housing to Cylinder Head Cover Bolt	-	10
Intake Manifold Stud Bolt to Cylinder Head	-	10
Sprocket to Camshaft Bolt, see ⁽¹⁾	-	50 + 180°
Toothed Belt Tensioner Stud Bolt to Cylinder Head	-	10
Transport Strap to Cylinder Head Bolt	-	25
Wire Bracket to Housing Bolt	-	10

(1) Always replace

Cylinder Head Cover Bolt Tightening Sequence and Specification

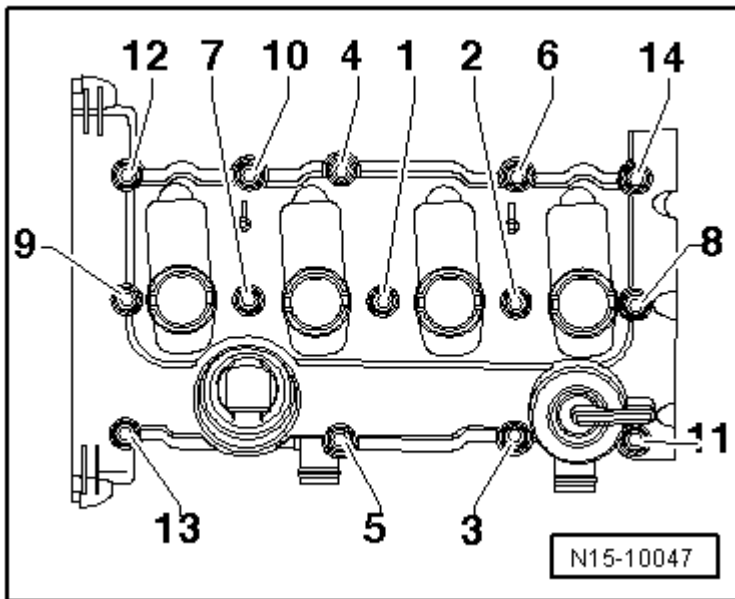


Fig. 5: Identifying Cylinder Head Cover Bolts Tightening Sequence
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Tighten the cylinder head cover bolts in multiple steps and in the sequence shown to 10 Nm.

Cylinder Head Bolt Tightening Sequence and Specification

-- Tighten the cylinder head bolt in the sequence as follows:

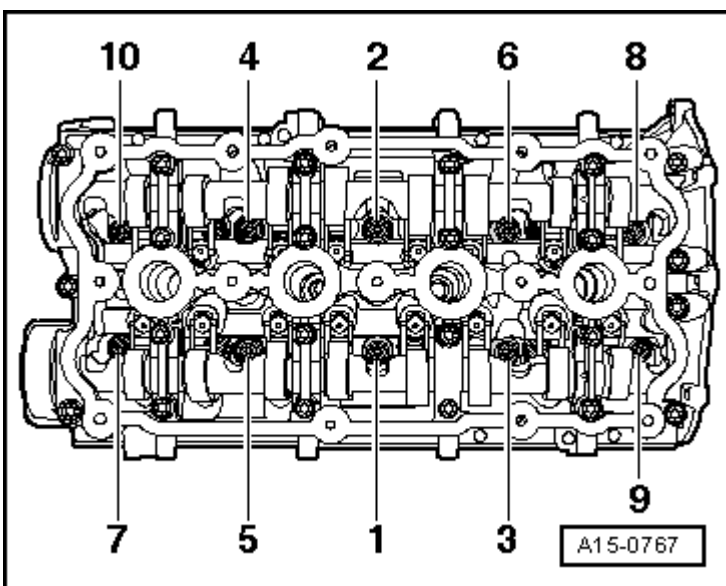


Fig. 6: Identifying Cylinder Head Bolts Tightening Sequence
 Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

Stage	Tighten
1	-- Tighten the bolts to 40 Nm using a torque wrench.
2	-- Tighten the bolts an additional 90° (1/4) turn using a ratchet.
3	-- Tighten the bolts an additional 90° (1/4) turn using a ratchet.

DIAGNOSIS AND TESTING

COMPRESSION PRESSURE, CHECKING

Special tools and workshop equipment required

- Spark Plug Removal Tool 3122 B
- Ignition Coil Puller T40039
- Torque Wrench (5-50 Nm) V. A. G 1331
- Compression Tester V. A. G 1763
- Adapter V. A. G 1381/5A

Test Conditions

- The engine oil temperature must be at least 30 °C (86 °F).
- The voltage supply is OK.

Procedure

-- Remove the engine cover with air filter. Refer to **ENGINE COVER WITH AIR FILTER** .

-- Remove the ignition coils with the power output stage. Refer to **IGNITION COILS WITH POWER OUTPUT STAGES** .

-- Remove the spark plugs using the spark plug removal tool 3122 B.

-- Check the compression using the compression tester V. A. G 1763 and the adapter V. A. G 1381/5A.

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

-- Have a second technician operate the starter.

-- Operate the starter until the tester shows no further pressure increase.

Compression Pressure

	Wear Limit Bar Positive	Difference between Cylinders
--	--------------------------------	-------------------------------------

2012 Volkswagen Golf R

ENGINE 2.0 Liter - Cylinder Head, Valvetrain - Engine Code(s): CRZA

New Bar Positive Pressure	Pressure	Bar Positive Pressure
11.0•••14.0	7.0	Max. 3.0

-- To complete the procedure, check the Engine Control Module (ECM) Diagnostic Trouble Code (DTC) memory and erase any DTCs that may have been stored when testing and making repairs.

NOTE: If the DTC memory was erased, the readiness code must be generated again. Refer to "Guided Fault Finding" in the vehicle diagnostic tester.

VALVE GUIDE, CHECKING

Special tools and workshop equipment required

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

Test Sequence

-- Insert the new valve into the guide. The valve stem tip must seal 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.

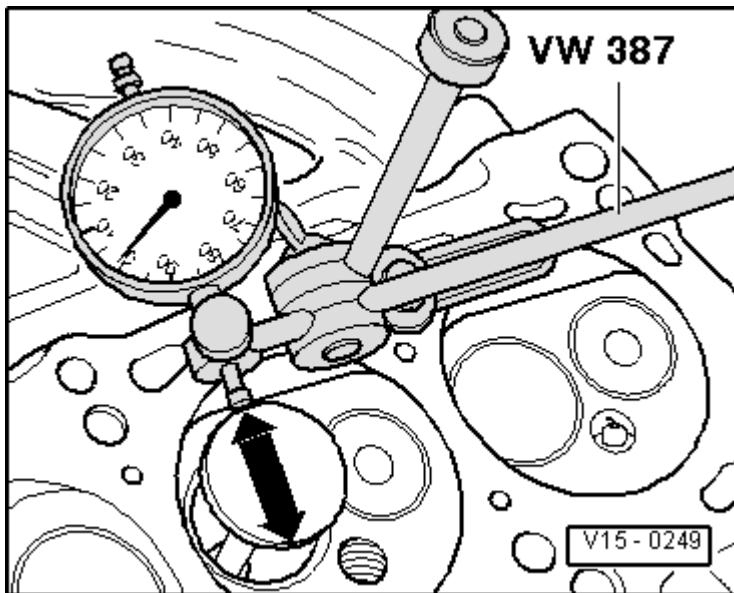


Fig. 7: Identifying Dial Gauge Holder -VW 387- To Determine Tilt Clearance
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Determine the tilt clearance. Wear limit: 0.8 mm

If the tilt clearance is exceeded:

-- Replace the cylinder head.

REMOVAL AND INSTALLATION**CYLINDER HEAD COVER****Special tools and workshop equipment required**

- Spring Type Clip Pliers VAS 5024 A
- Ignition Coil Puller T40039

Removing

-- Remove the engine cover with air filter. Refer to **ENGINE COVER WITH AIR FILTER** .

-- Remove the bolts -arrows-.

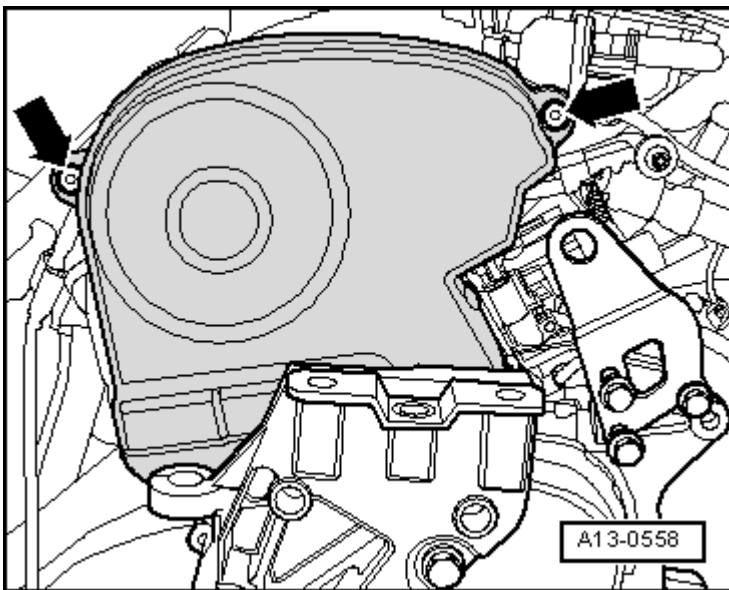


Fig. 8: Identifying Toothed Belt Guard Bolts

Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Remove the ignition coils with the power output stage. Refer to **IGNITION COILS WITH POWER OUTPUT STAGES** .

-- Disconnect the lines -2, 3 and 4- from the cylinder head cover.

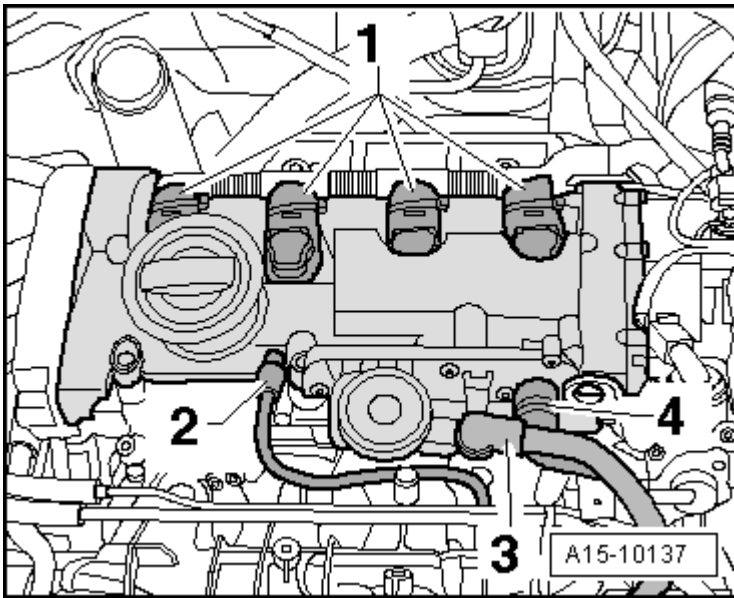


Fig. 9: Identifying Crankcase Ventilation Line Between High Pressure Pump And Cylinder Crankcase
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Disconnect the crankcase vent tube and remove the turbocharger heat shield bolts -1-.

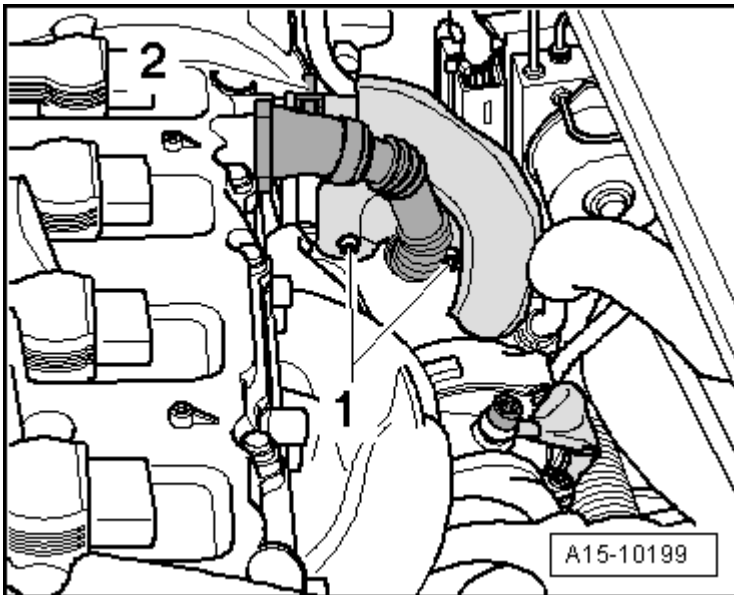


Fig. 10: Identifying Line For Crankcase Ventilation With Heat Shield From Turbocharger
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Disconnect the vent hose -2- from the cylinder head cover to the turbocharger.

-- Loosen the cylinder head cover bolt working from the outside towards the inside.

-- Remove the cylinder head cover.

Installing

Install in reverse order of removal. Note the following:

NOTE: Replace the seals and the cylinder head cover gasket if they are damaged.

-- Tighten the cylinder head cover bolts in multiple steps and in the sequence shown.

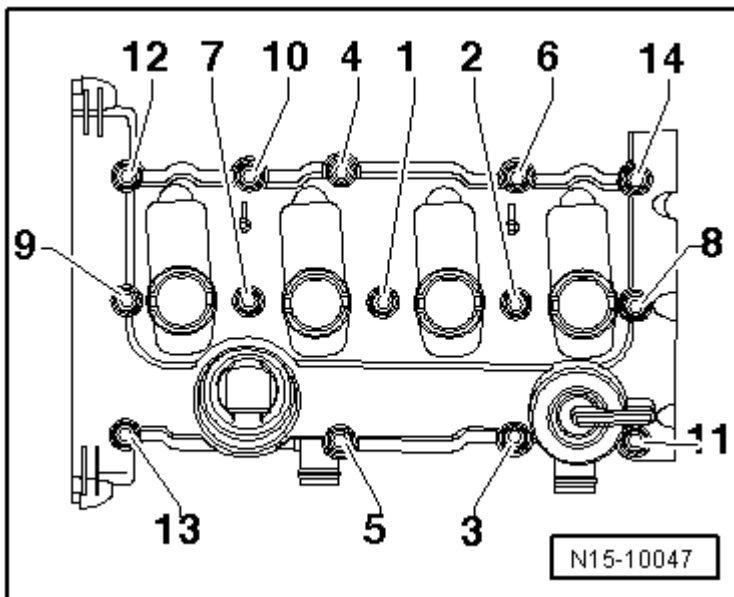


Fig. 11: Identifying Cylinder Head Cover Bolts Tightening Sequence
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Make sure the upper toothed belt guard is installed correctly.

Tightening Specifications

-- Refer to CYLINDER HEAD AND COVER OVERVIEW.

Component	Nm
Cylinder head cover to cylinder head	10
Toothed belt guard to cylinder block	10see, see ⁽¹⁾
(1) use locking fluid	

CYLINDER HEAD

Special tools and workshop equipment required

- Drip Tray V. A. G 1306 or Drip Tray for VAS 6100VAS 6208
- Torque Wrench (5-50 Nm) V. A. G 1331

- Torque Wrench V. A. G 1332
- Spring Type Clip Pliers VAS 5024 A
- Polydrive Bit and Drive Socket T10070
- Ignition Coil Puller T40039

CAUTION: When doing any repair work, especially in the engine compartment, pay attention to the following due to clearance issues:

- Route lines of all types (for example, fuel, hydraulic, Evaporative Emission (EVAP), coolant, refrigerant, brake fluid and vacuum) and electrical wiring so that the original routing is followed.
- To prevent damage to the lines, make sure there is sufficient clearance to all moving or hot components.

Removing

- The engine must be no more than warm to touch.

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

Do an oil change if the oil is dirty.

-- First, check to, see if a coded radio is installed. If so obtain the anti-theft code.

-- Disconnect the battery ground cable with the ignition turned off. Refer to [For transmission(s) 0A4, 02E, 09G, 02Q] [For engine(s) CBTA, CJAA, CBUA, CCTA, CBFA] Removal and Installation .

-- Remove the plenum chamber bulkhead. Refer to Description and Operation .

-- Remove the intake manifold. Refer to INTAKE MANIFOLD .

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

-- Remove the left wheel housing liner, front section and the right front wheel housing liner. Refer to Removal and Installation .

-- Remove the exhaust pipe with catalytic converter. Refer to EXHAUST PIPE WITH CATALYTIC CONVERTERS .

-- Reposition the charge air hose clamp -arrow- and disconnect the hose from charge air cooler.

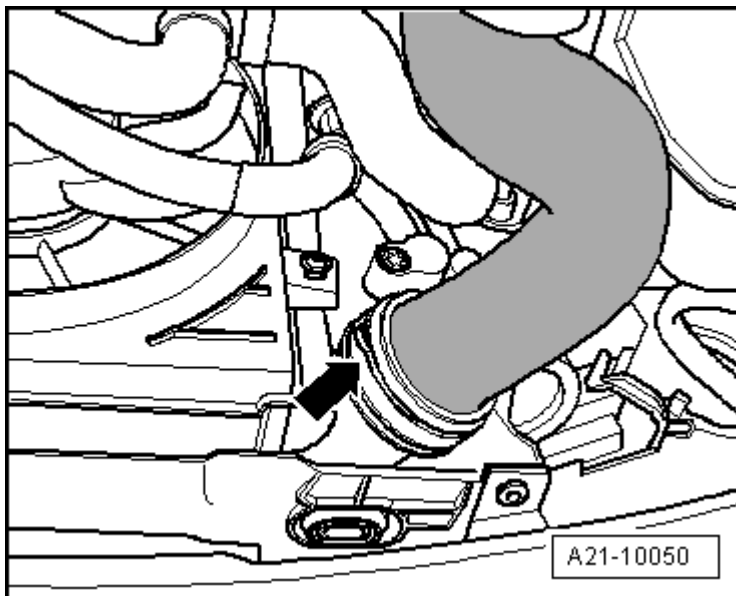


Fig. 12: Identifying Charge Air Hose From Charge Air Cooler
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

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

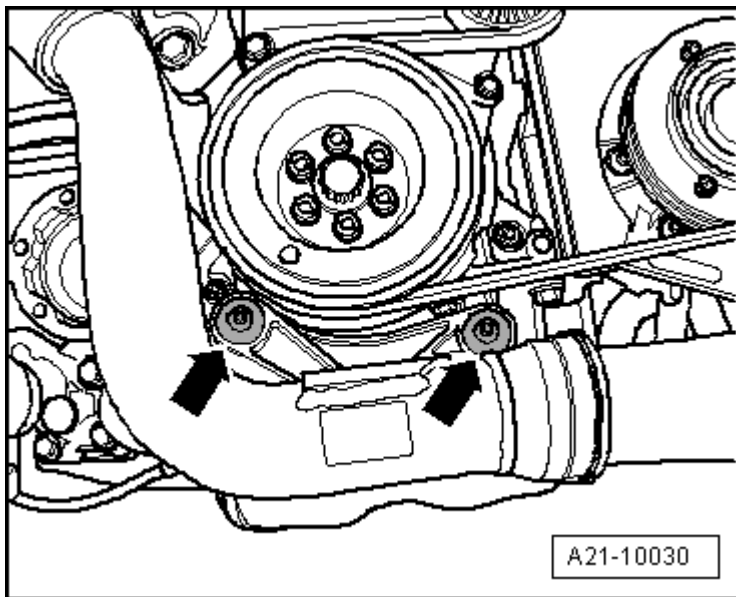


Fig. 13: Identifying Charge Air Pipe Bolts
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Disconnect all electrical wires from turbocharger and set aside.

-- Remove the oil supply pipe and the coolant supply pipe bolts -arrows- from the turbocharger.

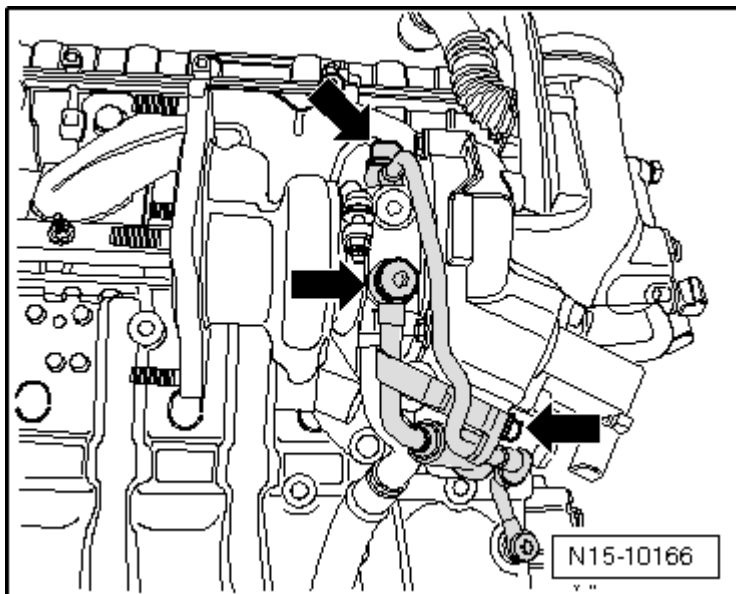


Fig. 14: Identifying Oil Supply Line And Coolant Supply Line At Turbocharger
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Remove the oil return pipe bolts -arrows- from the turbocharger.

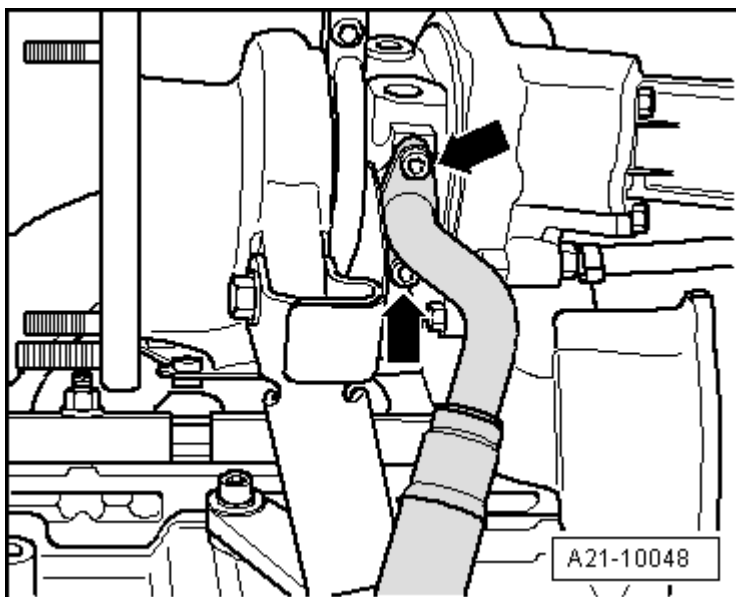


Fig. 15: Identifying Oil Return Line
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

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

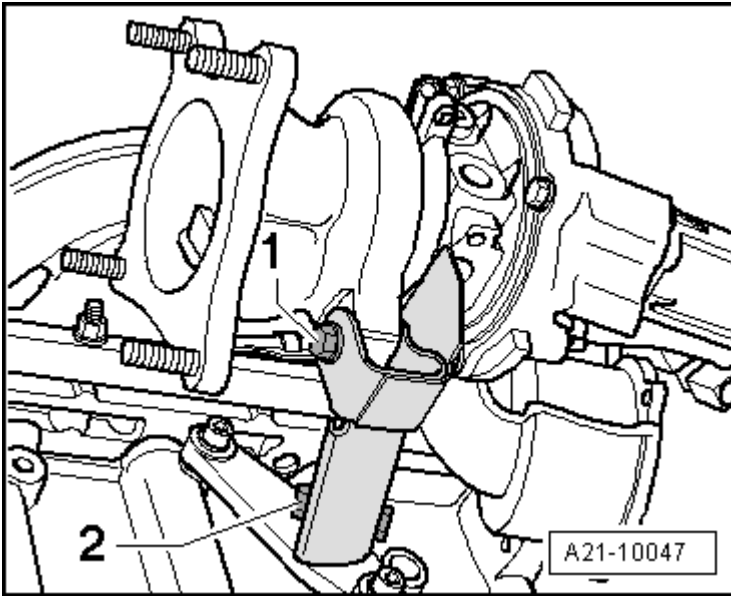


Fig. 16: Identifying Bolts And Support For Turbocharger
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Remove the battery. Refer to [For transmission(s) 0A4, 02E, 09G, 02Q] [For engine(s) CBTA, CJAA, CBUA, CCTA, CBFA] Removal and Installation .

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

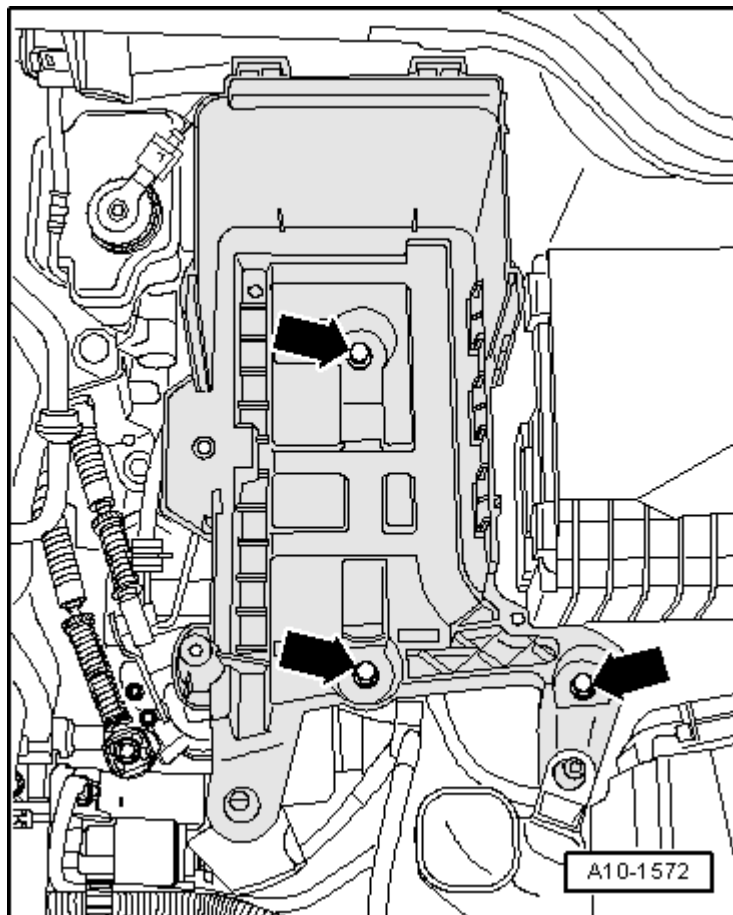


Fig. 17: Identifying Battery Holder Bolts

Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Remove the coolant hoses -1 and 2--.

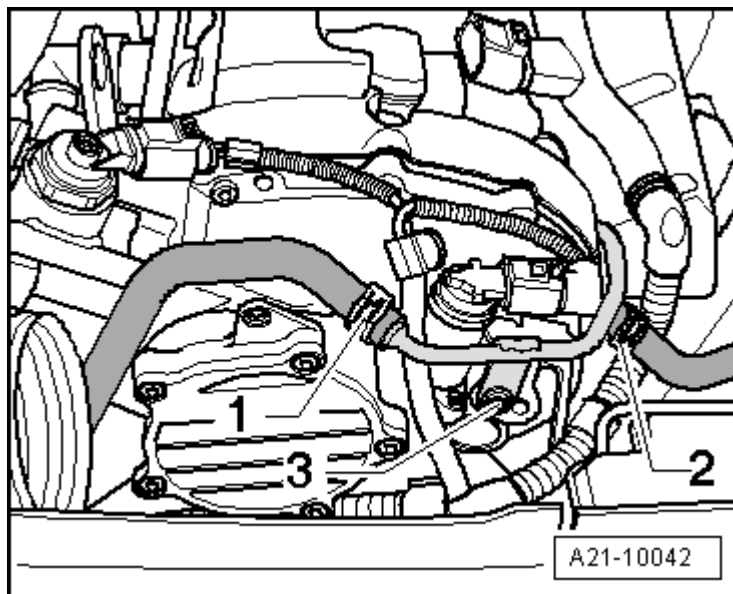
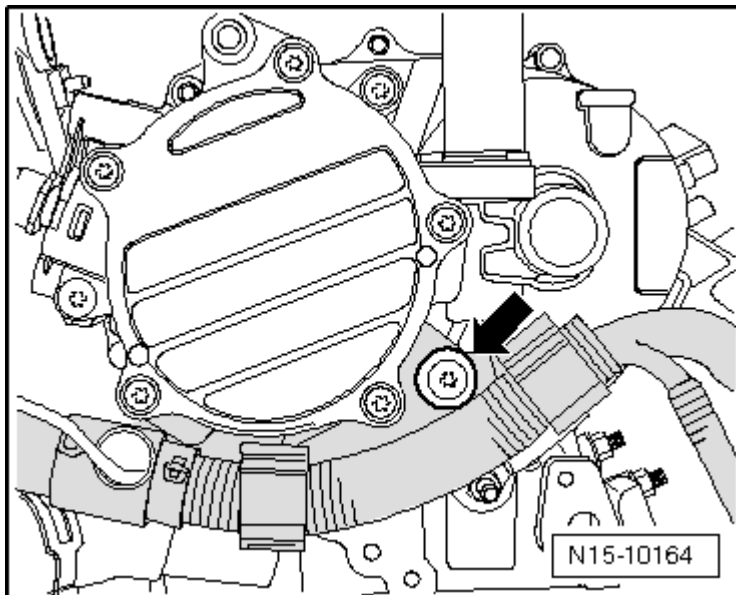


Fig. 18: Identifying Coolant Hoses

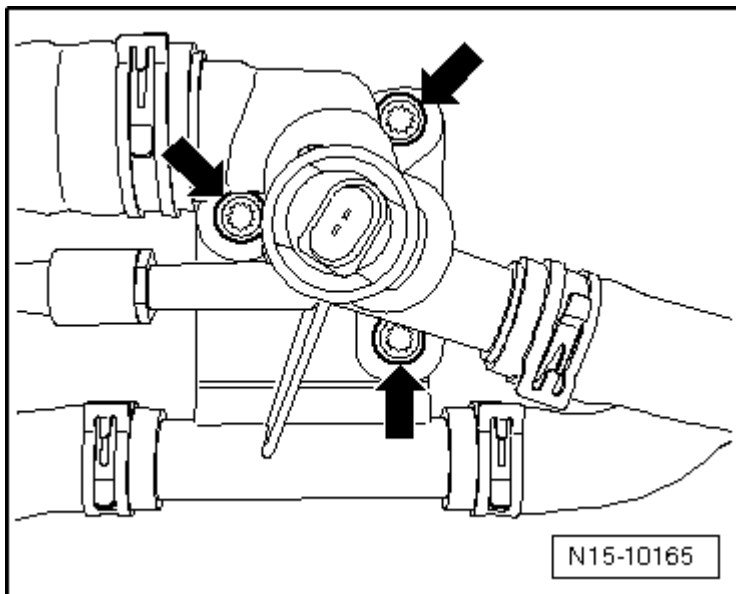
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

- Disconnect all electrical wires required from the cylinder head and set aside.
- Remove the wire bracket and set the wiring harness to the side.

**Fig. 19: Identifying Cable Bracket Bolt**

Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

- Remove the coolant flange bolts -arrows-.

**Fig. 20: Identifying Coolant Flange Bolt**

Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

- Remove the ribbed belt. Refer to **RIBBED BELT** .
- Remove the locking pin T10060 A from the ribbed belt tensioner.
- Remove the toothed belt. Refer to **TOOTHED BELT**.
- Remove the cylinder head cover. Refer to **CYLINDER HEAD COVER**.
- Follow the sequence shown for loosening the cylinder head bolts.

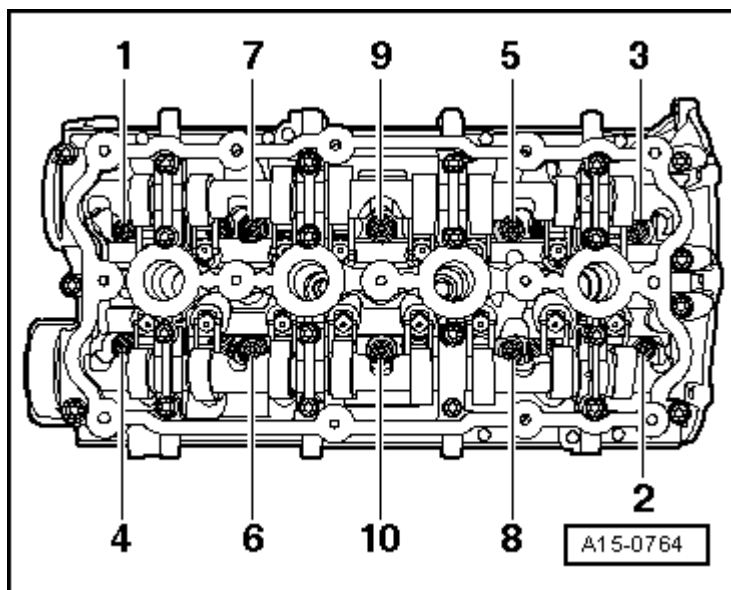


Fig. 21: Identifying Cylinder Head Bolts Loosening Sequence
 Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

NOTE: Verify that all hose and wire connections for the engine, the transmission and the body have been disconnected.

- Remove the cylinder head.

Installing

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

Only remove the new cylinder head gasket from its packaging immediately before installing.

Handle the new gasket with extreme care. Damaging will lead to leaks.

Replace the cylinder head bolts.

- Insert clean cloths into the cylinders so that no dirt or abrasive powder can get between the cylinder wall and piston.
- Do not allow dirt or abrasive powder to get into the coolant either.
- Carefully clean the sealing surfaces on the cylinder head and cylinder block. Avoid introducing scratches or scoring (do not use sandpaper with grit below 100).
- Carefully remove any metal particles, emery remains and the cloths.
- In the event the crankshaft has been rotated in the meantime: Set the piston for cylinder 1 to Top Dead Center (TDC) and rotate the crankshaft back again slightly.
- Install the new cylinder head gasket. The part number must be legible.
- Pay attention to the alignment pins -arrows- in the cylinder block.

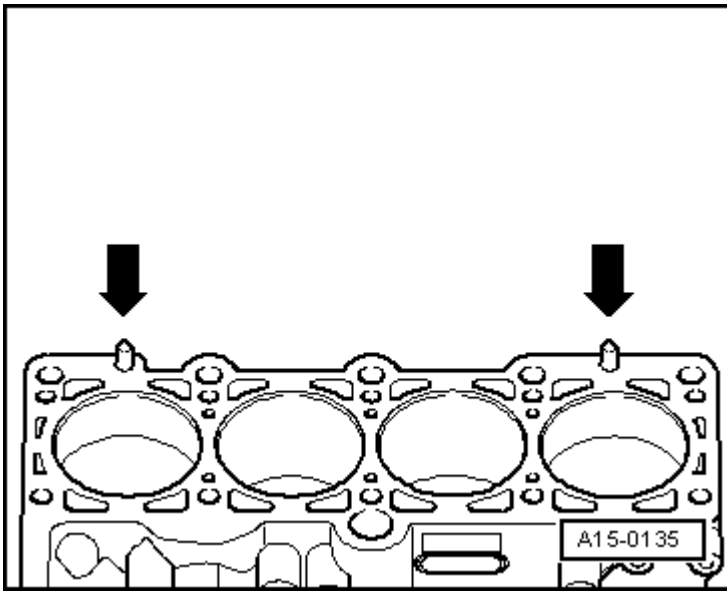


Fig. 22: Identifying Cylinder Block Centering Pins
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

- Set the cylinder head in place.
- Insert the cylinder head bolts and tighten them hand tight.
- Tighten the cylinder head bolt in the sequence as follows:

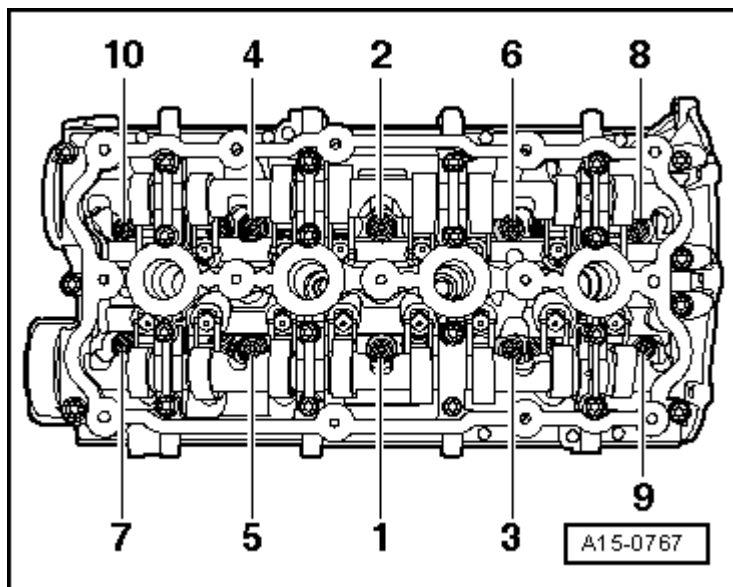


Fig. 23: Identifying Cylinder Head Bolts Tightening Sequence
 Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

Stage	Tighten
1	-- Tighten the bolts to 40 Nm using a torque wrench.
2	-- Tighten the bolts an additional 90° (1/4) turn using a ratchet.
3	-- Tighten the bolts an additional 90° (1/4) turn using a ratchet.

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

-- Install the toothed belt. Refer to **TOOTHED BELT**.

Further installation is in the reverse order of removal.

Fill with new coolant. Refer to **COOLANT, DRAINING AND FILLING** .

TOOTHED BELT

Special tools and workshop equipment required

- Engine Support Bracket T10339
- Adapter 10-222 A/18
- Torque Wrench (40-200 Nm) V. A. G 1332
- Engine Support Bridge 10-222 A
- Engine Support Feet 10-222 A/8

Removing

-- Remove the engine cover with air filter. Refer to **ENGINE COVER WITH AIR FILTER** .

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.
- For safety reasons, remove the fuel pump control module -J538- fuse from the fuse panel before opening the fuel system. This prevents the fuel pump from being activated by the drivers door contact switch. Fuse assignment, refer to appropriate **SYSTEM WIRING DIAGRAMS**.

-- Disconnect the vent line -1- and the fuel supply line -2-.

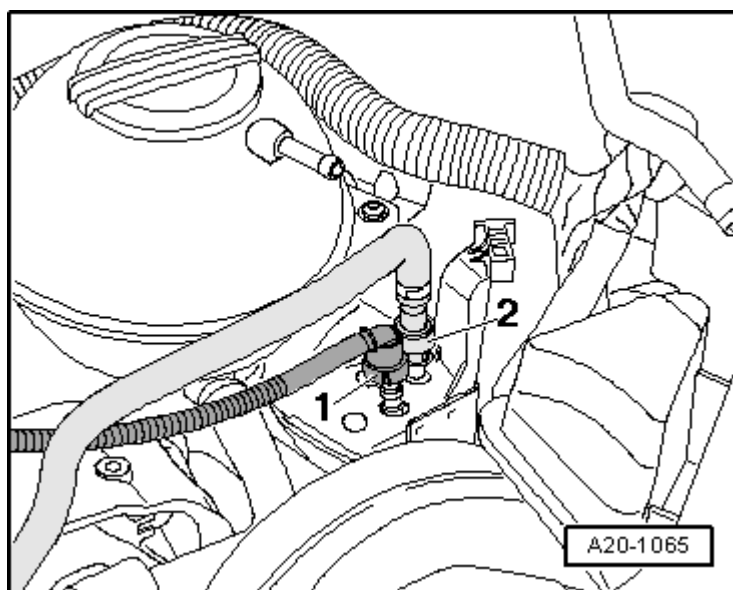


Fig. 24: Identifying Fuel Supply Line

Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Disconnect the vent line -2- and remove the Evaporative Emission (EVAP) canister -A- with the hoses upward out of the mount.

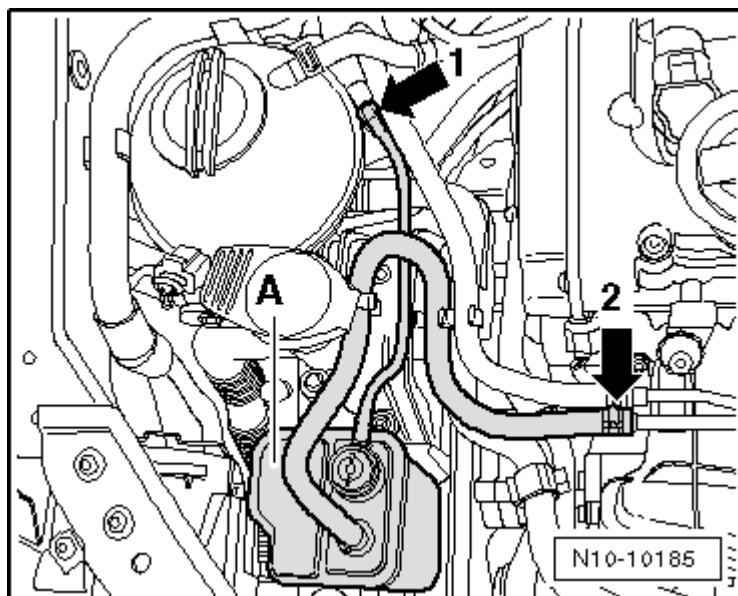


Fig. 25: Identifying Ventilation Line & EVAP Canister
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

WARNING: Hot steam may escape when opening the expansion tank cap. Wear protective goggles and protective clothing to prevent damage to eyes and scalding. Cover the cap with a cloth and carefully open the cap.

- Open and close the coolant expansion tank cap to reduce the pressure.
- Loosen the clamps -arrow- and disconnect the coolant hose. Collect any leaking coolant with a cloth.

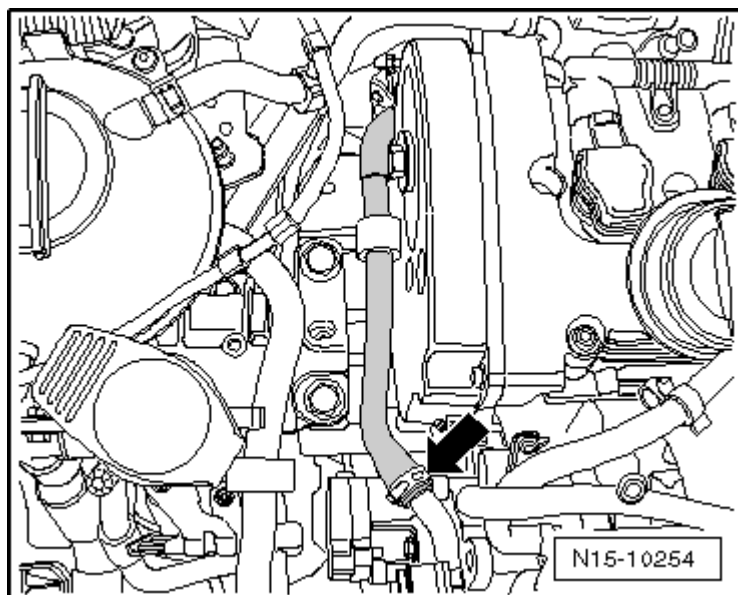


Fig. 26: Identifying Coolant Hose Clamp
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Disconnect the connector -1-, remove the bolts -arrows- and set the coolant expansion tank aside.

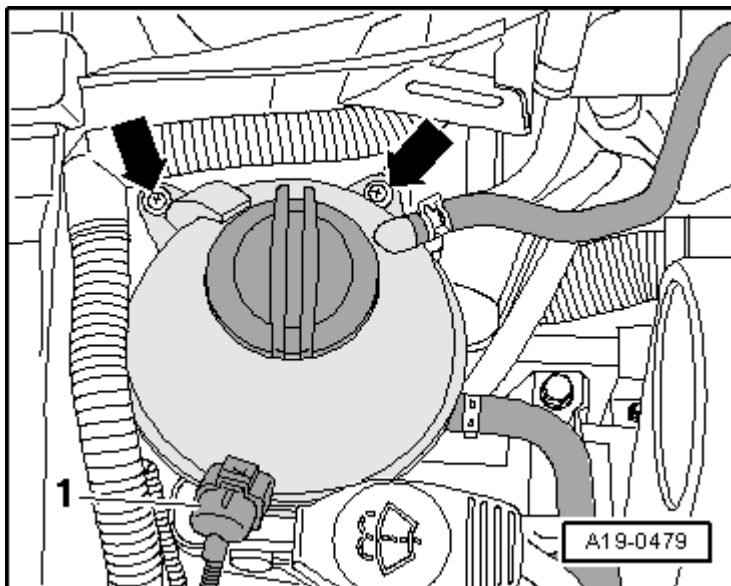


Fig. 27: Identifying Coolant Reservoir Connector & Bolts
 Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

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

-- Remove the ribbed belt tensioner -A- and install the engine support bracket T10339 to both of the upper threaded holes.

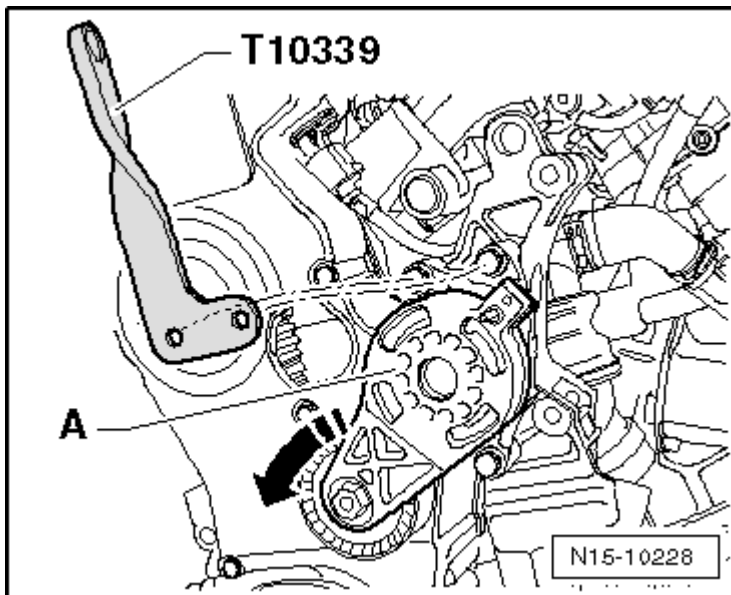


Fig. 28: Identifying Ribbed Belt Tensioner And Engine Support Bracket T10339
 Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Cover both of the engine support feet 10-222 A/8 in the lower area with electrical tape -arrow-.

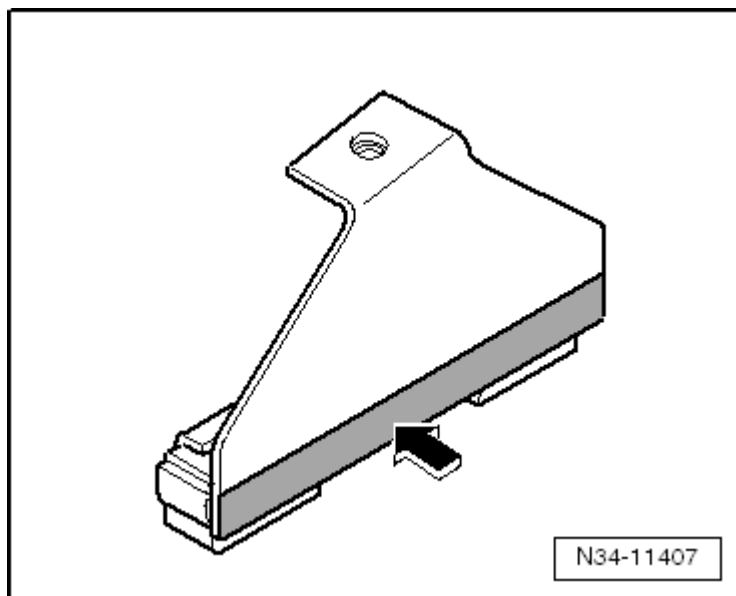


Fig. 29: Identifying Electrical Tape On Lower Area Engine Support Feet 10-222 A/8
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Install the engine support bridge 10-222 A with the engine support feet 10-222 A/8 and the adapter 10-222 A/18 onto the longitudinal member.

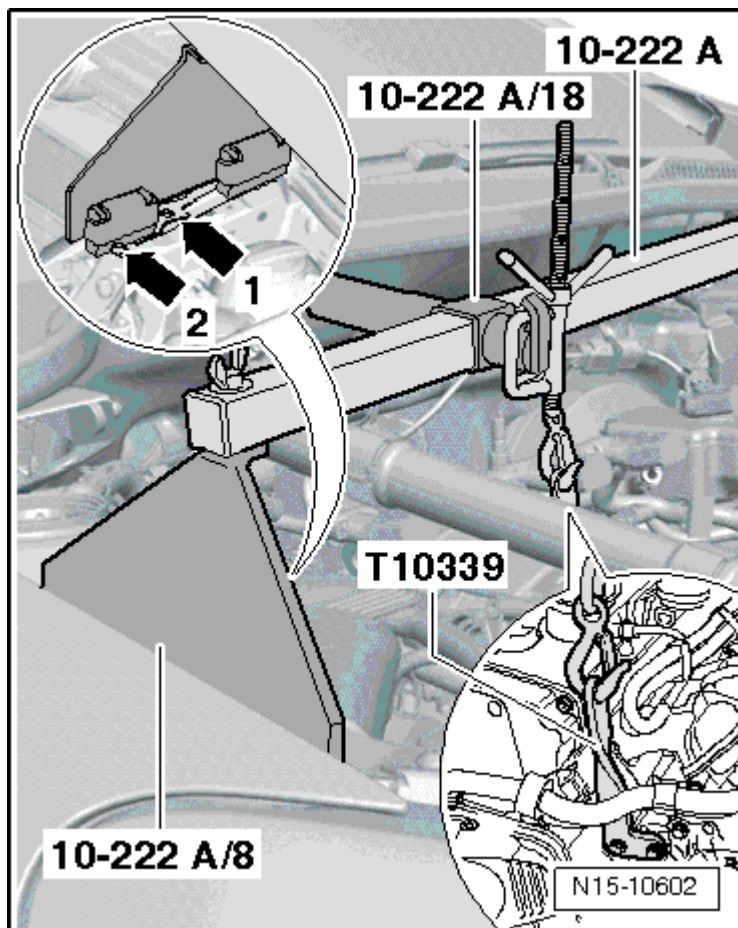
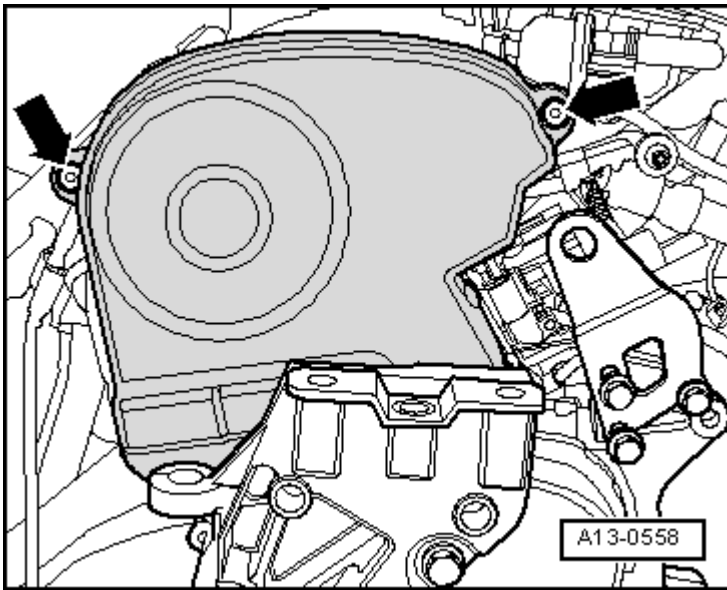


Fig. 30: Identifying Installation Of Engine Support Feet And Adapter Onto Longitudinal Member
 Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

NOTE: Install the engine support feet 10-222 A/8 next to the bolt -arrow 2- just before the raised section -arrow 1-.

-- Remove the bolts -arrows- and remove the toothed belt guard.

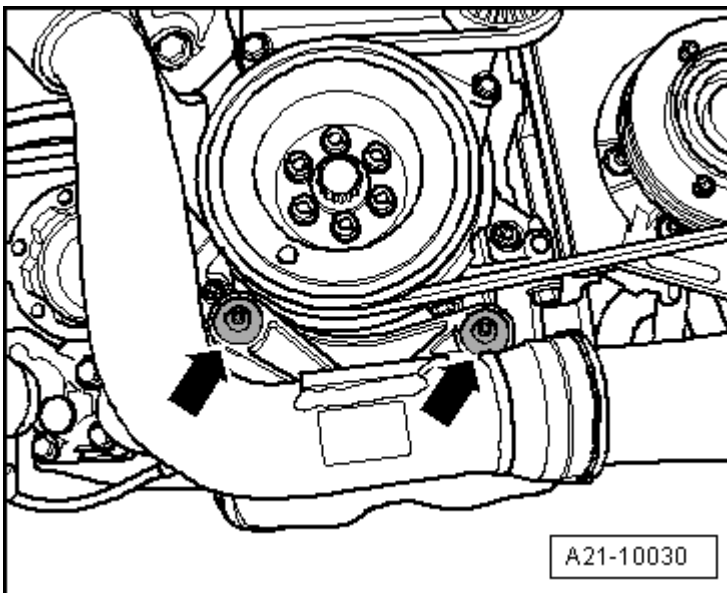
**Fig. 31: Identifying Toothed Belt Guard Bolts**

Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

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

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

-- Remove the bolts -arrows- and remove the charge air pipe and hose.

**Fig. 32: Identifying Charge Air Pipe Bolts**

Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Set the camshaft sprocket to the mark for Top Dead Center (TDC) by turning the crankshaft. The mark on the

camshaft sprocket must align with the arrow on the toothed belt guard.

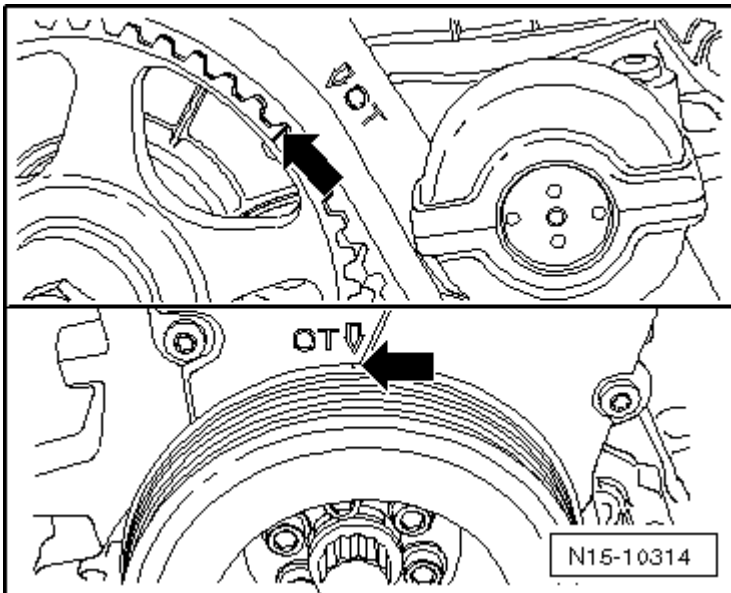


Fig. 33: Identifying Camshaft Gear Moved To Marking For TDC Cylinder 1
 Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Remove the vibration damper bolts and damper.

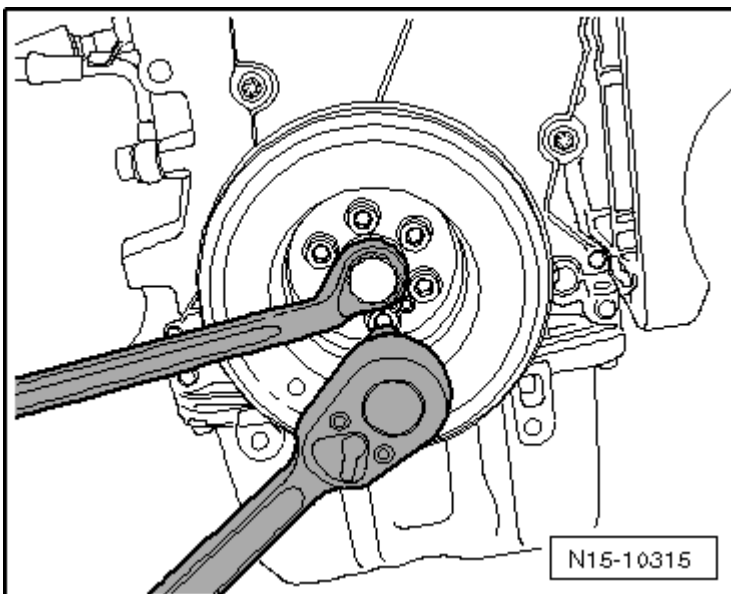


Fig. 34: Identifying Vibration Damper/Belt Pulley
 Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

NOTE: The TDC marks must align before removing the vibration damper.

The crankshaft must not be rotated any more until the TDC position is marked with an assisting mark.

-- Remove the lower toothed belt guard -arrows- bolts.

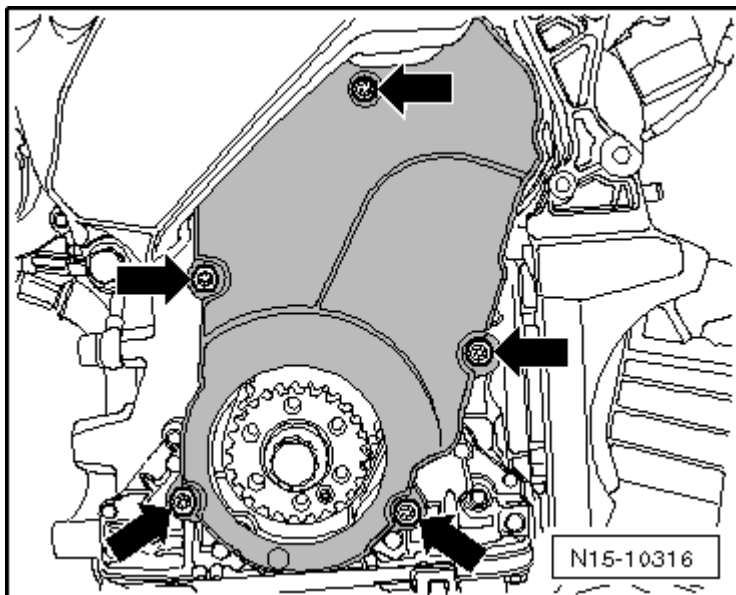


Fig. 35: Identifying Toothed Belt Guard

Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Mark the TDC position -arrow-.

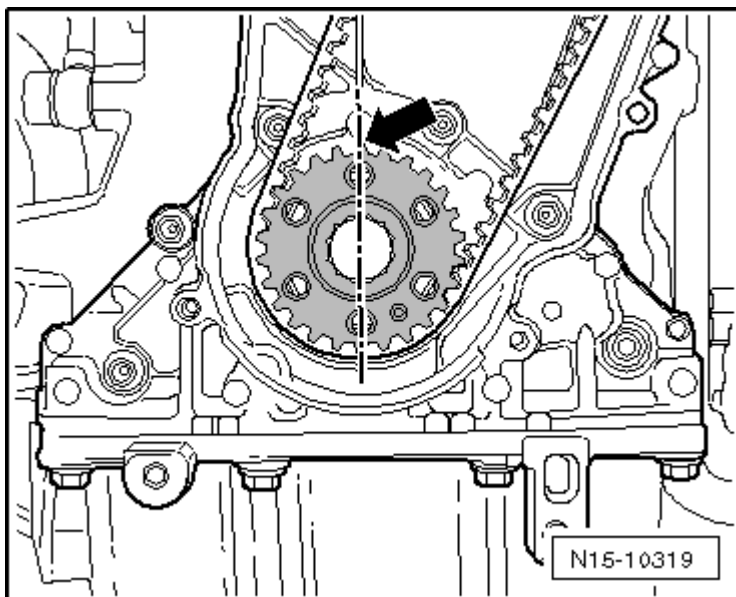


Fig. 36: Identifying TDC Position

Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Remove the engine mount bracket bolt -3-.

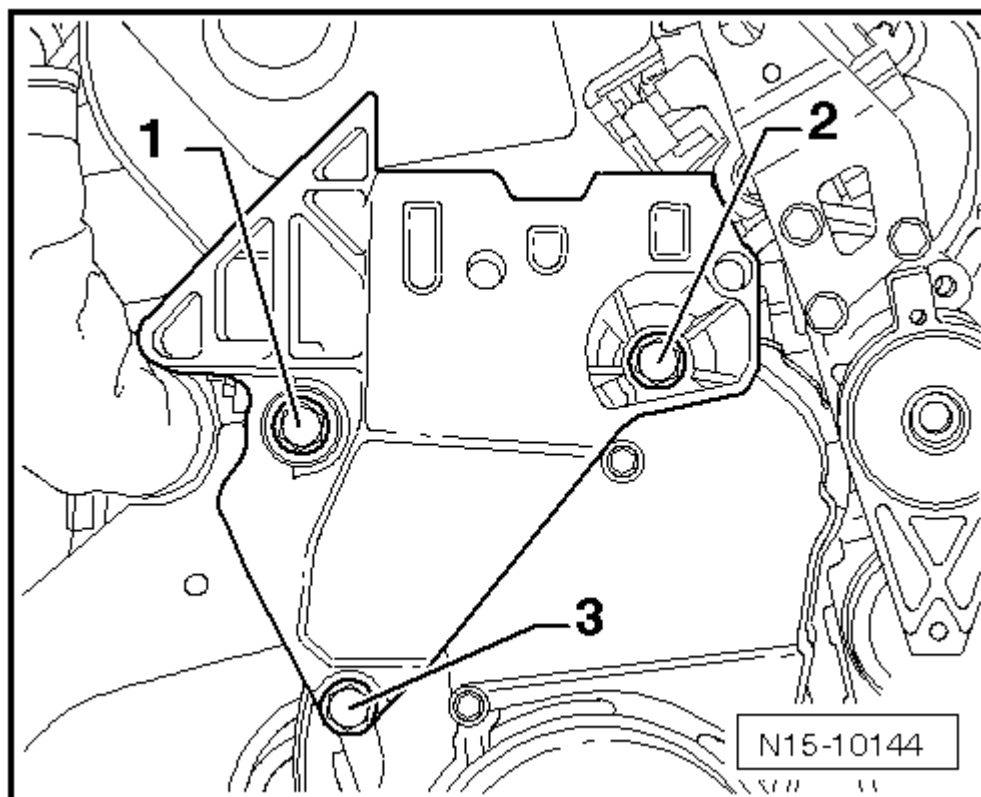


Fig. 37: Identifying Engine Bracket Bolt

Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

NOTE: The next step is necessary in order to be able to raise the engine far enough.

-- Remove the pendulum support bolts -2 and 3--.

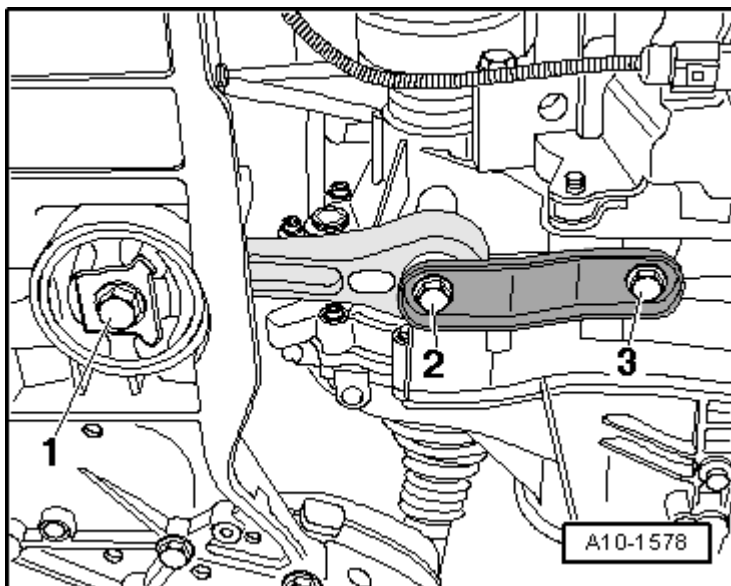
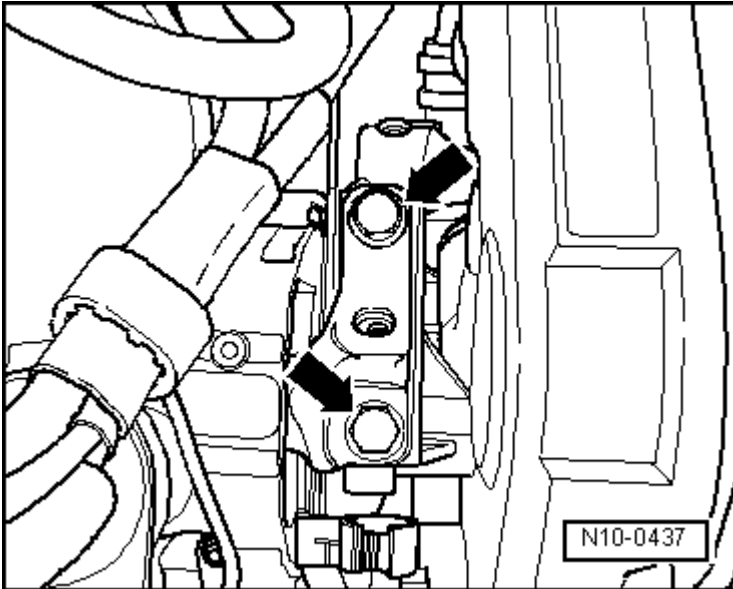


Fig. 38: Identifying Pendulum Support & Bolts

Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Remove the engine mount to engine mount bracket bolts -arrows- and remove the mount completely.

**Fig. 39: Identifying Mounting Bolts Of Subframe Mount/Engine Bracket**

Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

CAUTION: Make sure that no components/hoses are damaged, overstretched or torn when lifting the engine using engine support bridge 10-222 A.

-- Loosen the upper engine mount bracket bolts -1 and 2- and remove them, while lifting the engine using the engine support bridge 10-222 A.

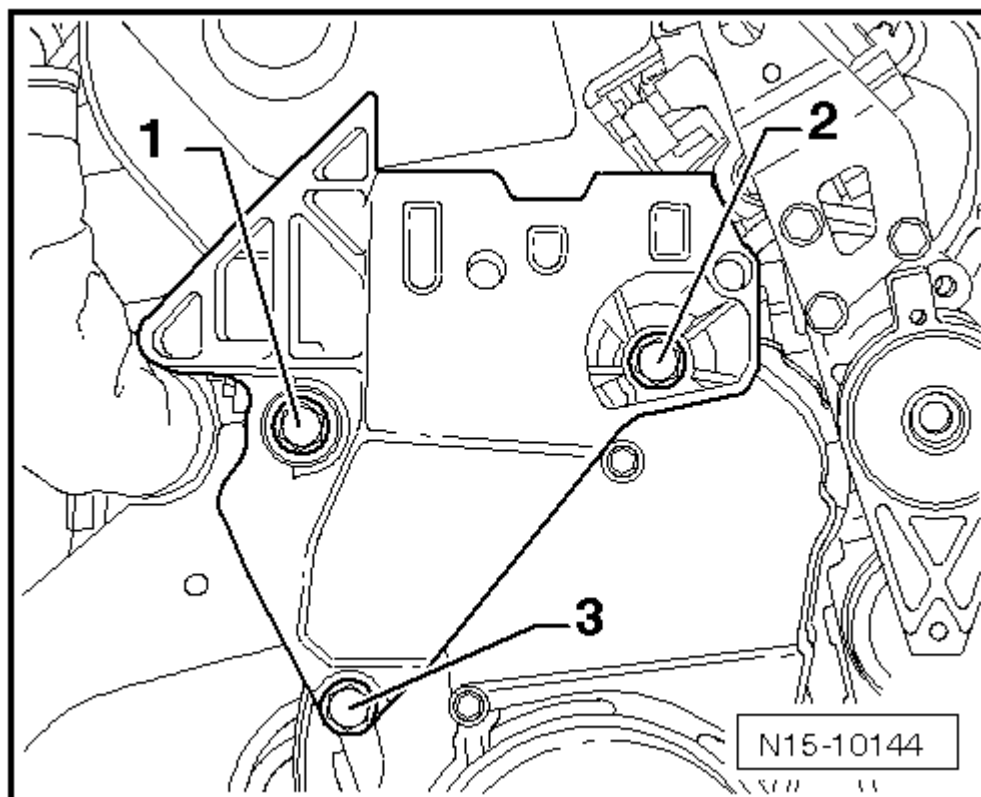


Fig. 40: Identifying Engine Bracket Bolt

Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Remove both of the upper toothed belt guard bolts -arrows- and remove the toothed belt guard downward from the engine.

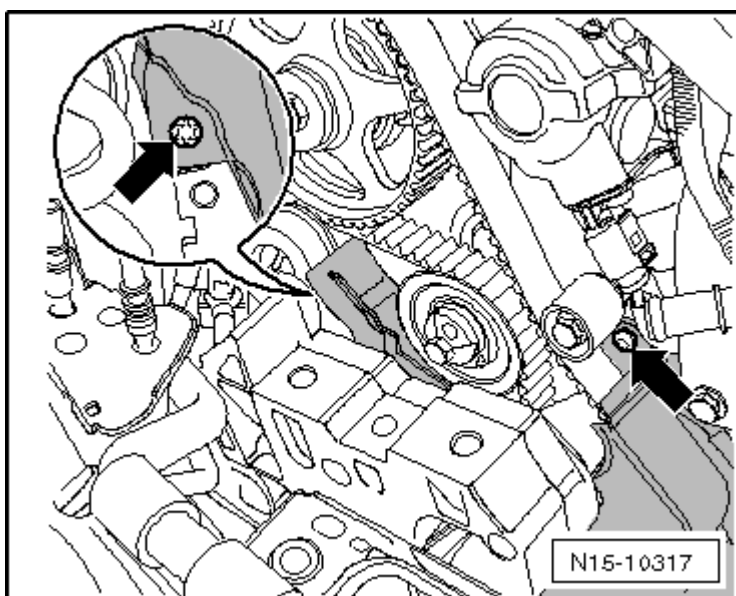


Fig. 41: Identifying Toothed Belt Guard Upper Bolts

Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

- Remove the engine mount bracket upward from the engine.
- Mark the rotation direction of the toothed belt.
- Loosen the belt tensioner and remove the toothed belt.
- Turn the crankshaft slightly backward.

Installing

NOTE: The crankshaft may not be at TDC by turning the camshaft (there is a risk of damaging the vents/piston crowns).

The engine must be no more than warm to touch.

- Position the camshaft and crankshaft onto the TDC marks.

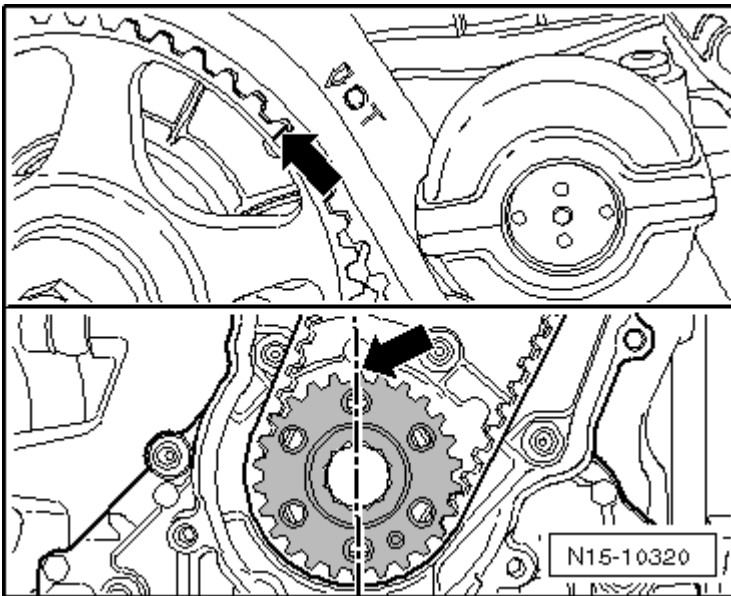


Fig. 42: Identifying Check Of Valve Timing

Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

- Place the toothed belt onto the crankshaft toothed belt gear (observe the rotation direction).
- Install the toothed belt in the following sequence; belt tensioner, camshaft sprocket, coolant pump and lastly the idler roller -arrow-.

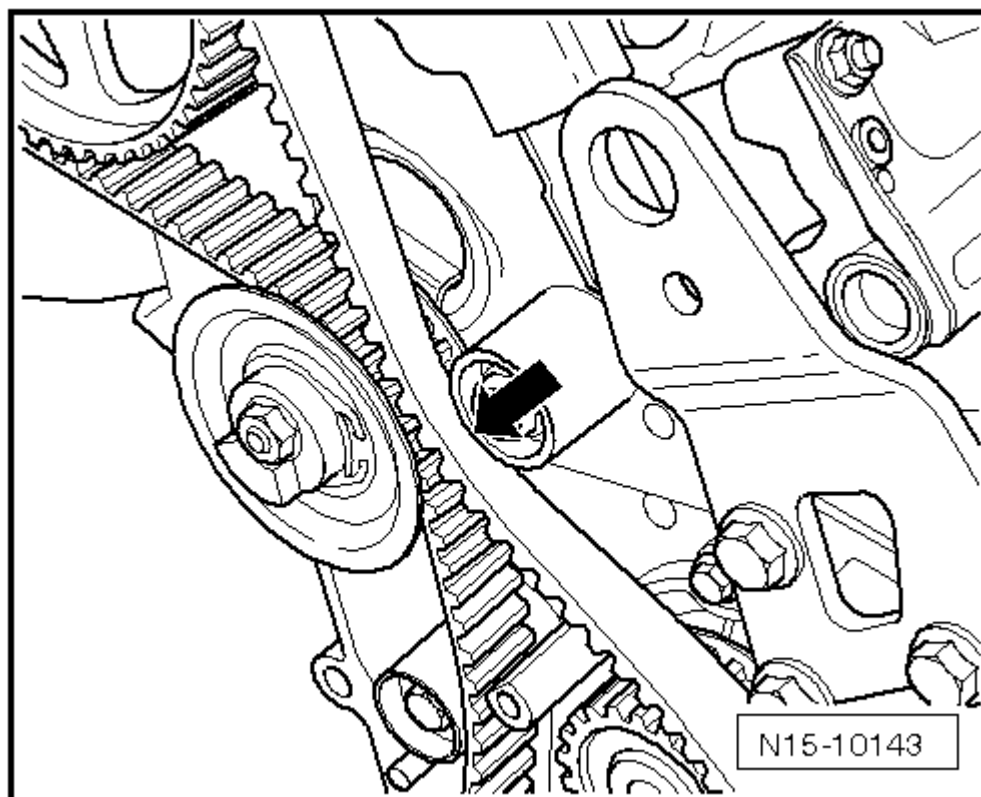


Fig. 43: Identifying Routing Of Toothed Belt

Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

NOTE: Be sure the belt tensioner is properly seated in the cylinder head -arrow-.

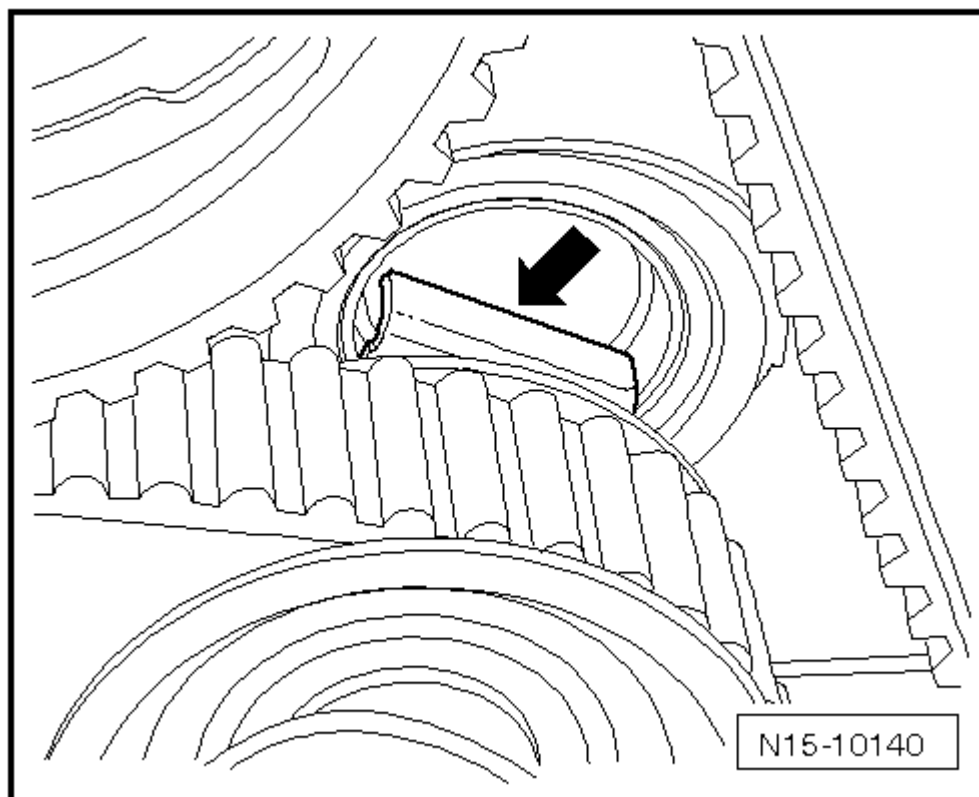


Fig. 44: Identifying Tensioning Roller Is Properly Seated In Cylinder Head
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Using a hex wrench, turn the tensioner toward the right in the -direction of the arrow- to tension the toothed belt until the notch is above the tab (toothed belt is over tensioned).

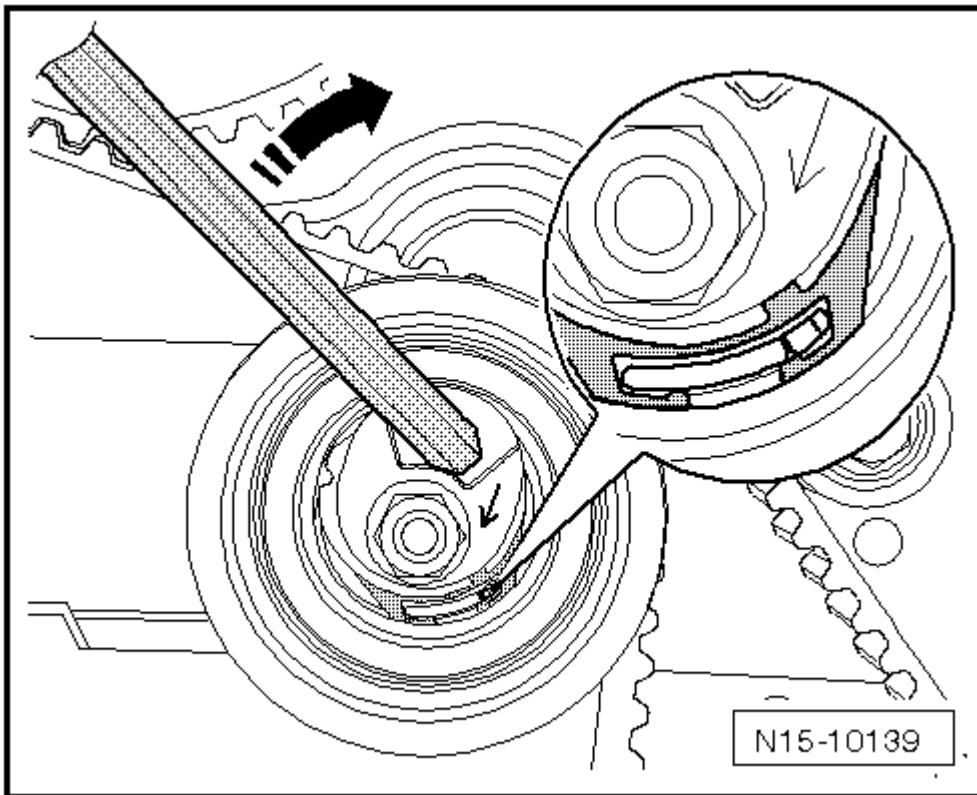
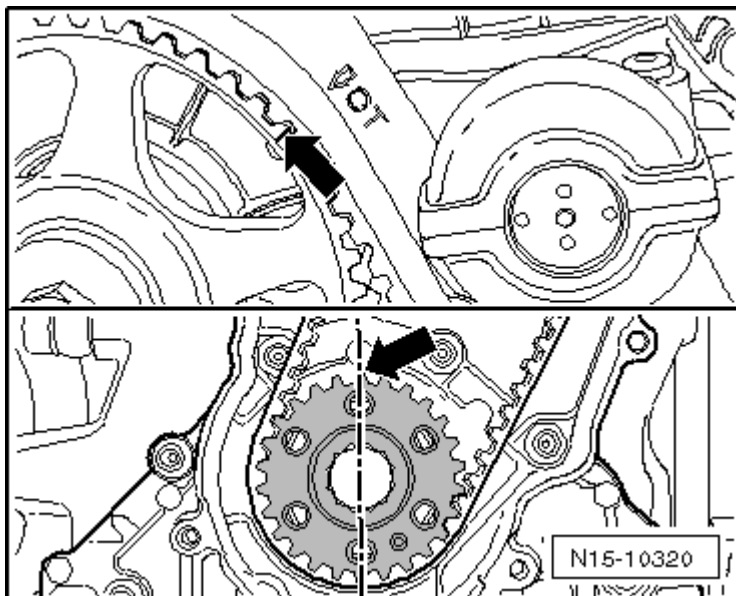


Fig. 45: Identifying Tensioning Of Toothed Belt

Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

- Relieve the tension on the toothed belt again.
- Tension the toothed belt until the notch is across from the tab.
- Tight the tensioner nut to 25 Nm.
- Rotate the crankshaft 2 additional revolutions in engine rotation direction until the engine is again at TDC. For this it is necessary that the last 45° (1/8) rotation is turned without interruption.
- Check the toothed belt tension. Specified value: Tab and notch align.
- Check the valve timing. The marks must correspond -arrows-.

**Fig. 46: Identifying Check Of Valve Timing**

Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

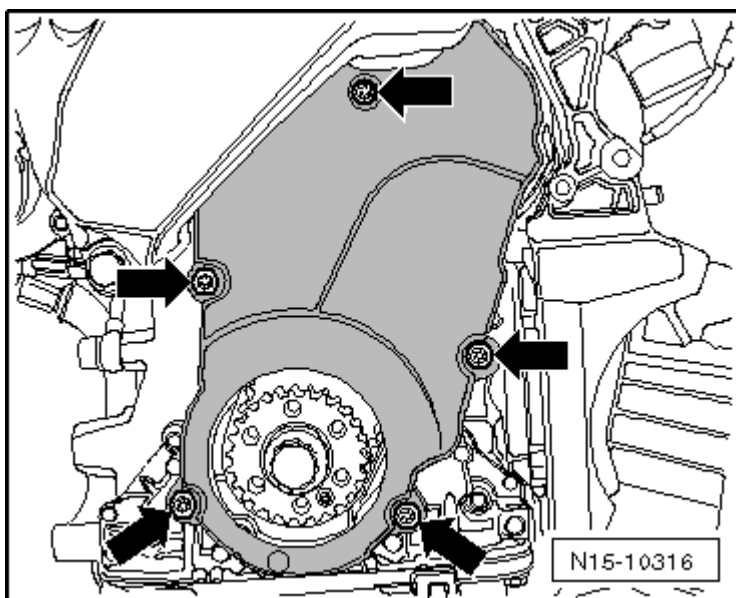
If the marks do not match:

-- Repeat the adjustment for the valve timing.

If the marks match:

-- Position the engine mount bracket to the engine.

-- Install the lower toothed belt guard bolts -arrows-.

**Fig. 47: Identifying Toothed Belt Guard**

Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

- Install the vibration damper with new bolts. Tightening specification: 10 Nm + an additional 90° (1/4) turn.
- Check the valve timing. The marks must correspond -arrows-.

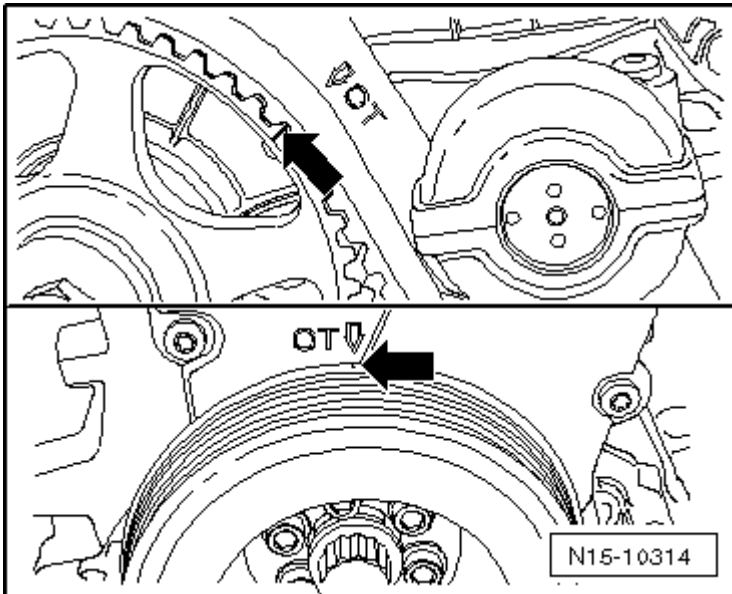


Fig. 48: Identifying Camshaft Gear Moved To Marking For TDC Cylinder 1
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

- Tighten the both of the upper toothed belt guard bolts -arrows-.

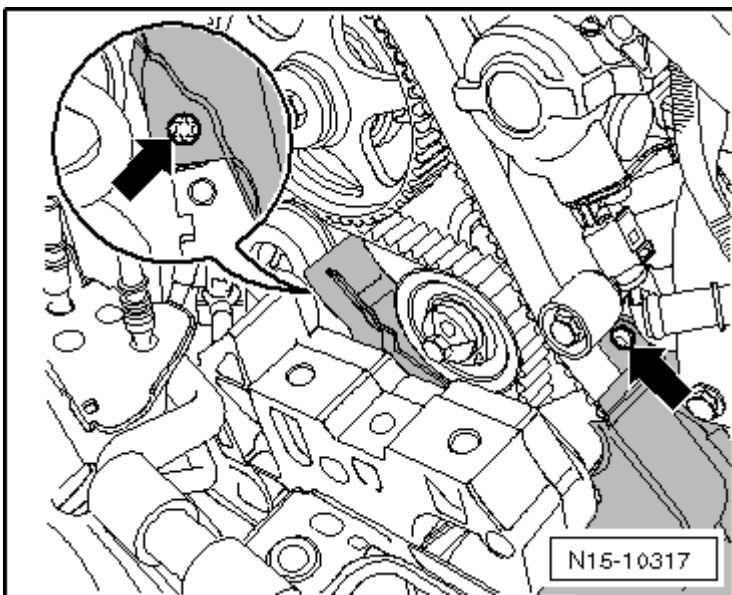


Fig. 49: Identifying Toothed Belt Guard Upper Bolts
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Secure the engine mount bracket to the cylinder block and tighten the bolts hand tight.

NOTE: Note the different lengths of the bolts. Bolt -3- is approximately 25 mm shorter than bolts -1 and 2-.

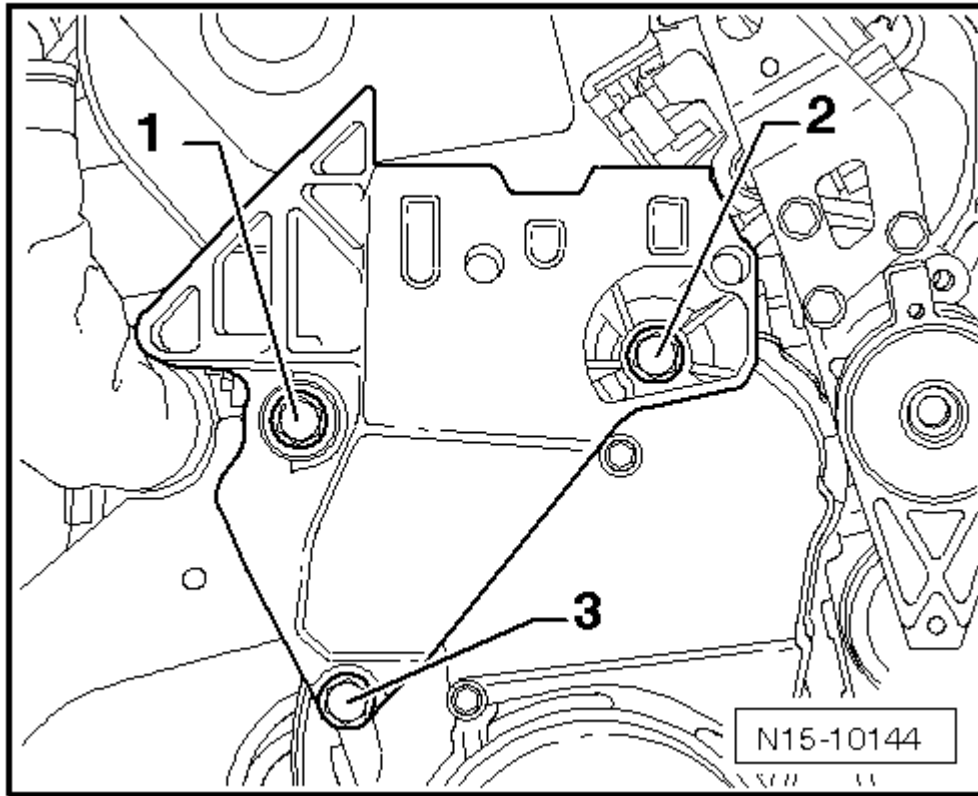


Fig. 50: Identifying Engine Bracket Bolt
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Lower the engine using the engine support bridge 10-222 A to tighten the lower bolt -3-.

-- Tighten all the bolts to 45 Nm.

-- Install the engine mount. Tightening specification, refer to **FASTENER TIGHTENING SPECIFICATIONS** .

-- Bring the contact surfaces together using the engine support bridge 10-222 A to tighten the bolts -arrows- for the engine mount to engine mount bracket.

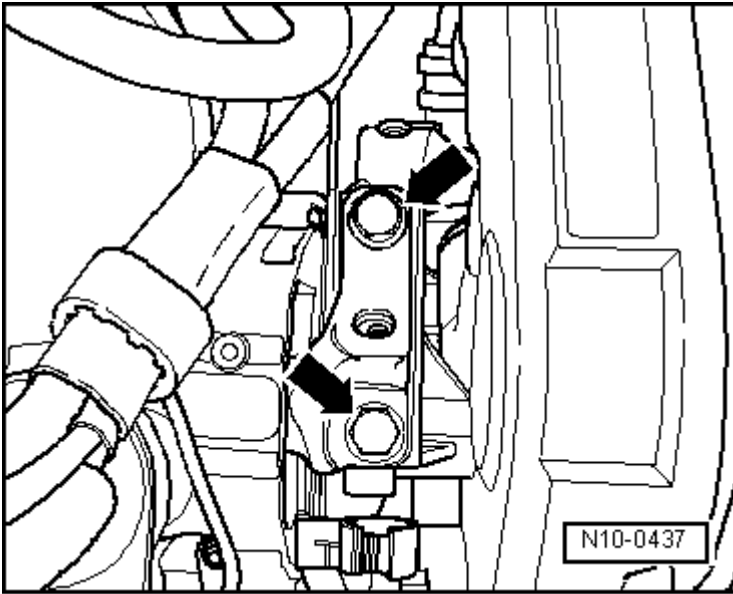


Fig. 51: Identifying Mounting Bolts Of Subframe Mount/Engine Bracket
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Align the engine mount as follows:

- There must be a distance of at least 10 mm -a- present between the engine mount bracket -2- and the right longitudinal member.

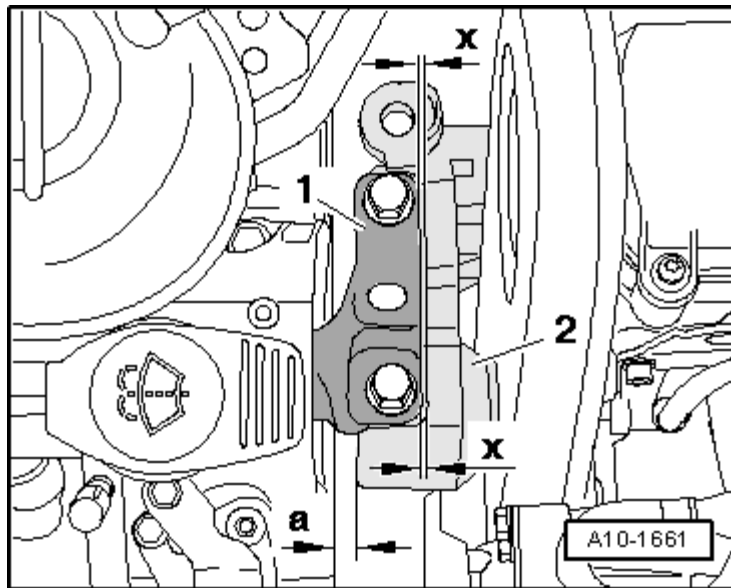


Fig. 52: Identifying Casting Edge On Engine Support Location
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

- The casting edge on the engine mount bracket -2- must be parallel to the engine mount support arm -1-.

-- Tighten the bolts for the engine mount and engine mount bracket. Tightening specification, refer to

FASTENER TIGHTENING SPECIFICATIONS .

- Remove the engine support bridge 10-222 A.
- Remove the engine support bracket T10339 and install the ribbed belt tensioner.
- Install the ribbed belt. Refer to **RIBBED BELT** .
- Reconnect the fuel, and vent lines making sure that the couplings are stable and secure.
- Install the coolant expansion tank.
- Install the noise insulation. Refer to **Description and Operation**
- Place the fuse for the fuel pump control module back into the fuse panel.
- Install the engine cover with air filter.

VALVE STEM SEALS

(With the cylinder head installed)

Special tools and workshop equipment required

- Spark Plug removal Tool 3122 B
- Valve Seal Removal Tool 3364
- Valve Stem Seal Driver 3365
- Adapter T40012
- Torque Wrench (5-50 Nm) V. A. G 1331
- Valve Cotters Asm/Disasm Device VAS 5161
- Guide Plate for FSI Engine VAS 5161/19B

Removing

- Remove the camshafts. Refer to **CAMSHAFTS**.
- Remove the roller rocker arms and lay them on a clean surface while making sure not to switch the roller rocker arms.
- Remove the spark plugs using spark plug removal tool 3122 B.
- Install the guide plate for FSI engine VAS 5161/19B onto the cylinder head as shown using the knurled thumb screws VAS 5161/12.

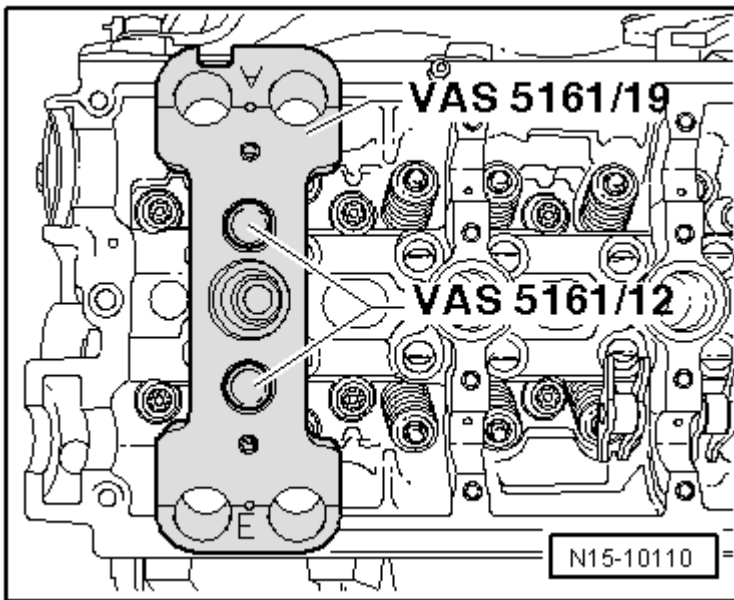


Fig. 53: Identifying Install Guide Plate VAS 5161/19 With Knurled Bolts VAS 5161/12 On Cylinder Head
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

- Move the piston for the respective cylinder to the Bottom Dead Center (BDC) position.
- Install theadapter T40012 into the spark plug threads and apply a constant pressure of at least 6 bar positive pressure.
- Loosen any stuck valve retainers using the punch VAS 5161/3 and a plastic mallet.

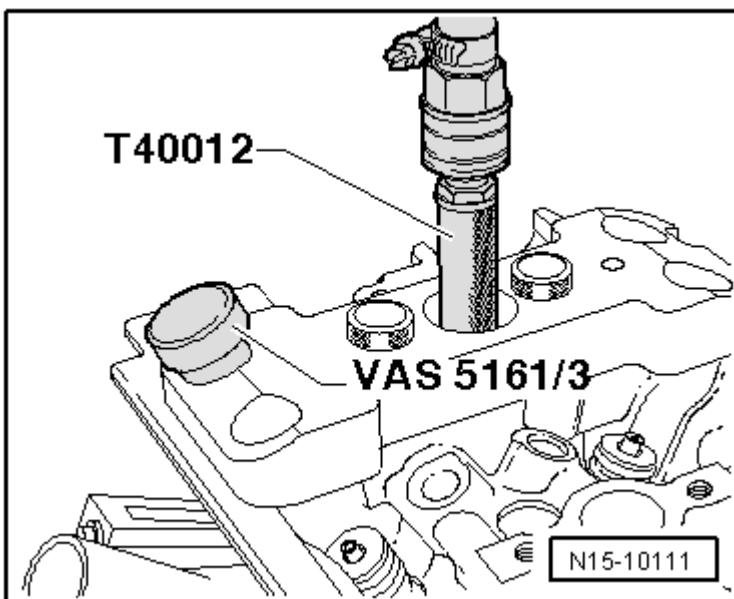


Fig. 54: Identifying Drift VAS 5161/3 And Plastic Mallet To Loosen Stuck Valve Keepers
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

- Install the retainer VAS 5161/6 with the guide fork M6/M8 with threaded studs VAS 5161/5 in the guide

plate for FSI engine VAS 5161/19B.

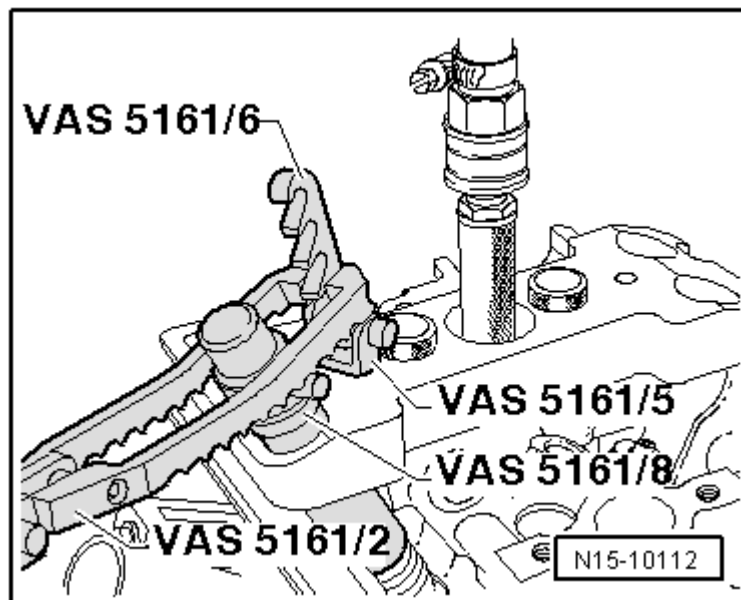


Fig. 55: Identifying Engaging Device VAS 5161/6 With Installation Forks VAS 5161/5 Installed Into Guide Plate VAS 5161/19

Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Insert the assembly cartridge VAS 5161/8 into the guide plate for FSI engine VAS 5161/19B.

-- Engage the pressure fork with lever for assembly cartridge VAS 5161/2 on the retainer VAS 5161/6.

NOTE: The pressure fork with lever for assembly cartridge VAS 5161/2 must engage on the exhaust side as illustrated.

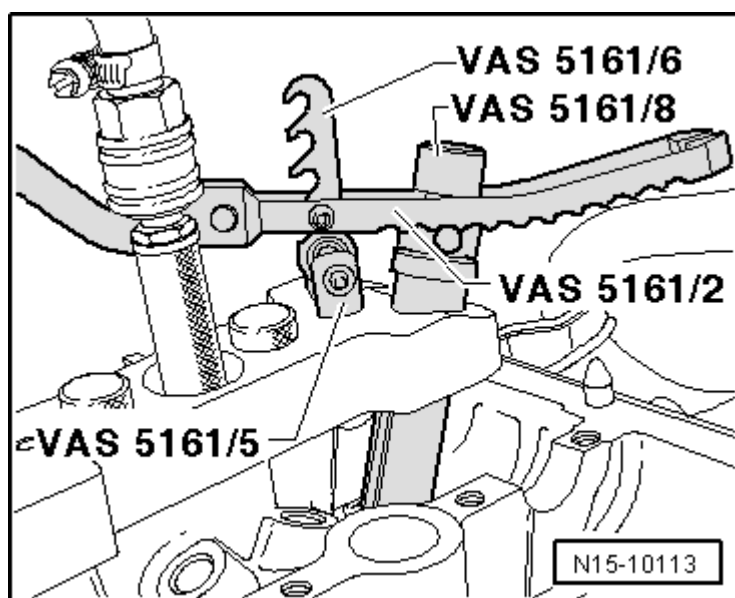


Fig. 56: Identifying Pressure Forks VAS 5161/2 Engaged
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

- Press the assembly cartridge VAS 5161/8 down while rotating its knurled thumb screw to the right until the points engage in the valve retainers.
- Move the knurled thumb screw back and forth slightly. This presses the valve retainers apart and captures them in the assembly cartridge.
- Release the pressure fork with lever for assembly cartridge VAS 5161/2.
- Remove the assembly cartridge VAS 5161/8.
- Remove the valve stem seals using the valve seal removal tool 3364.

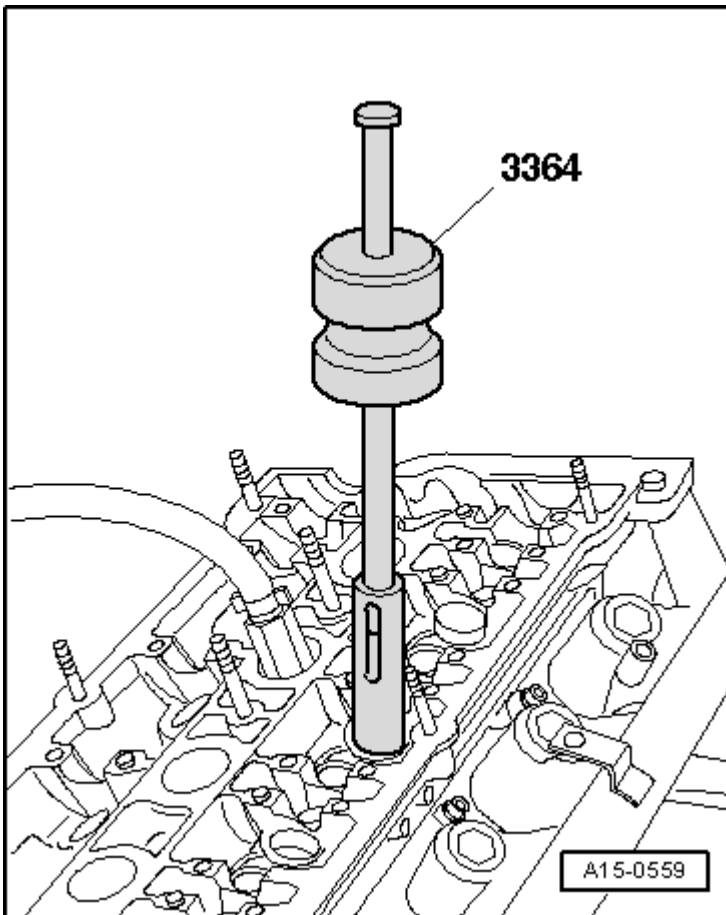


Fig. 57: Identifying Valve Seal Removal Tool 3364
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

- If the valve seal removal tool 3364 cannot be used because there is not enough space, drive out the roll pin - arrow- using a drift and remove the impact attachment.

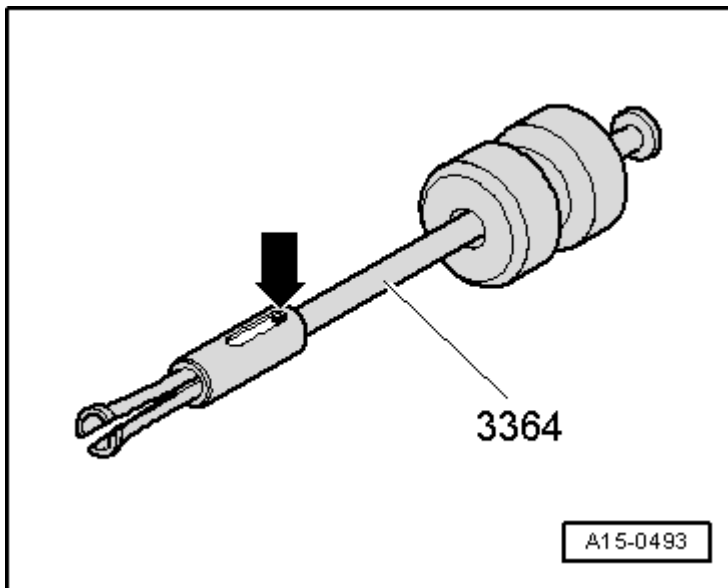


Fig. 58: Identifying Valve Seal Removal Tool 3364

Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

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

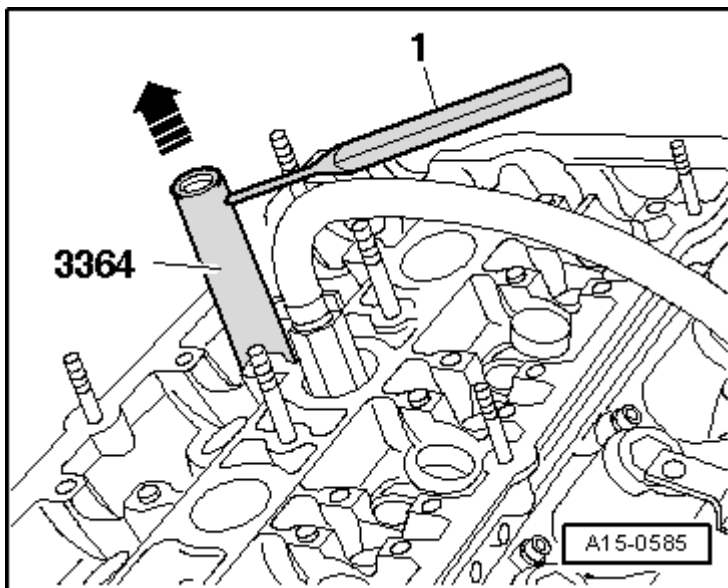


Fig. 59: Identifying Placement Of Lower Part Of Valve Seal Removal Tool 3364 On To Valve Stem Oil Seal

Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Insert a drift -1- in the hole in the lower section of the removal tool.

-- Using the drift as a lever, remove the valve stem seal -arrow-.

Installing

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

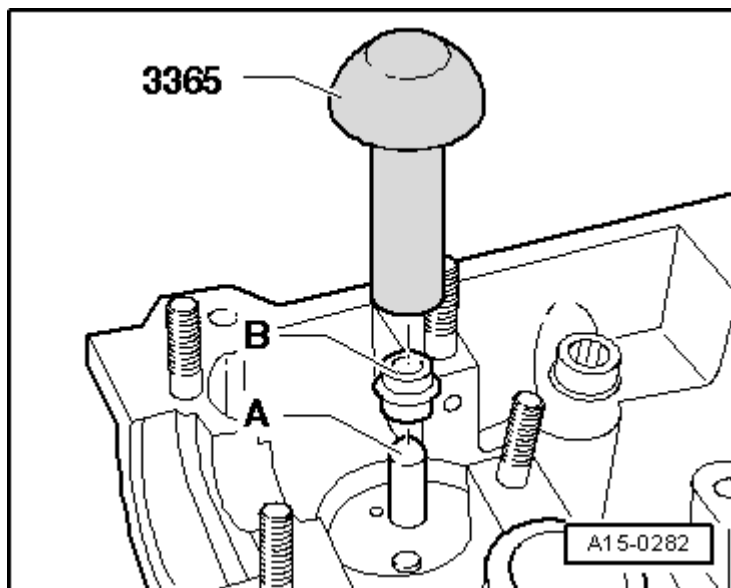


Fig. 60: Identifying Plastic Sleeve, New Valve Stem Oil Seals & Valve Stem Seal Driver 3365
 Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Oil the sealing lip of valve stem seal -B-, insert it onto the valve stem seal driver 3365 and carefully slide it onto the valve guide.

-- Remove the plastic sleeve -A-.

-- Insert the valve spring and spring plate.

-- Install the valve cotters asm/disasm device VAS 5161 components as illustrated.

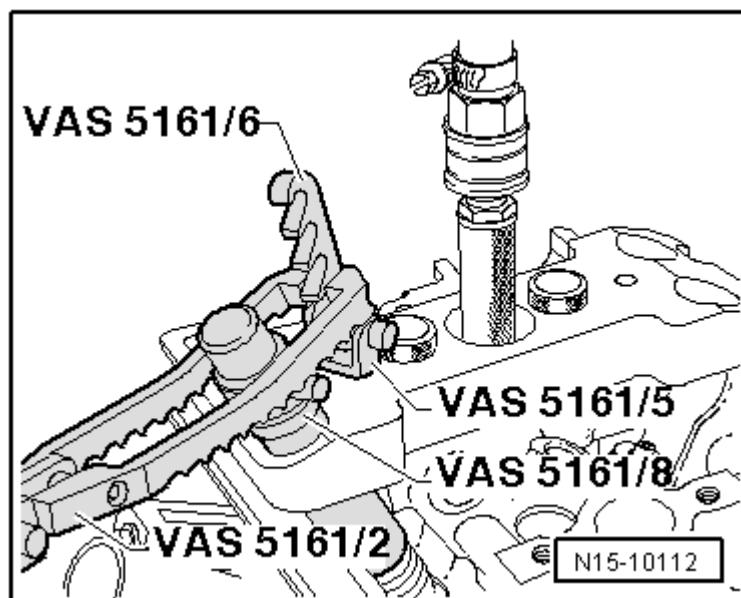


Fig. 61: Identifying Engaging Device VAS 5161/6 With Installation Forks VAS 5161/5 Installed Into Guide Plate VAS 5161/19

Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

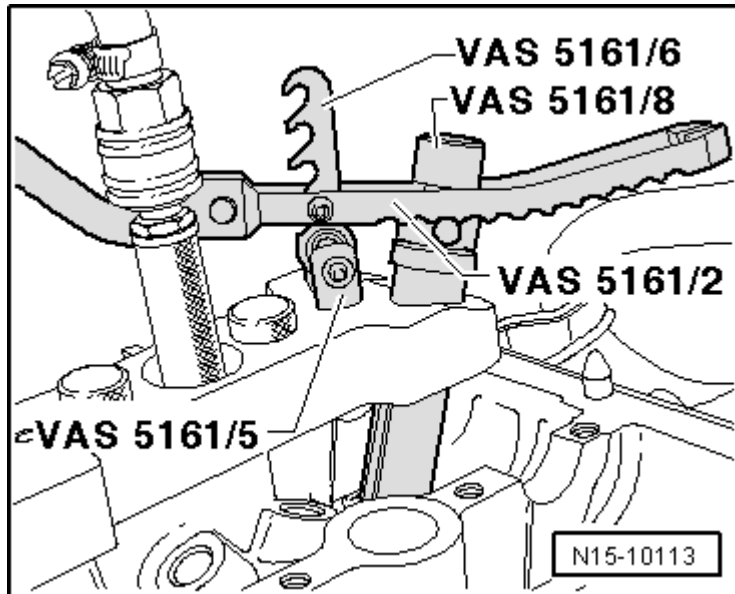


Fig. 62: Identifying Pressure Forks VAS 5161/2 Engaged

Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

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

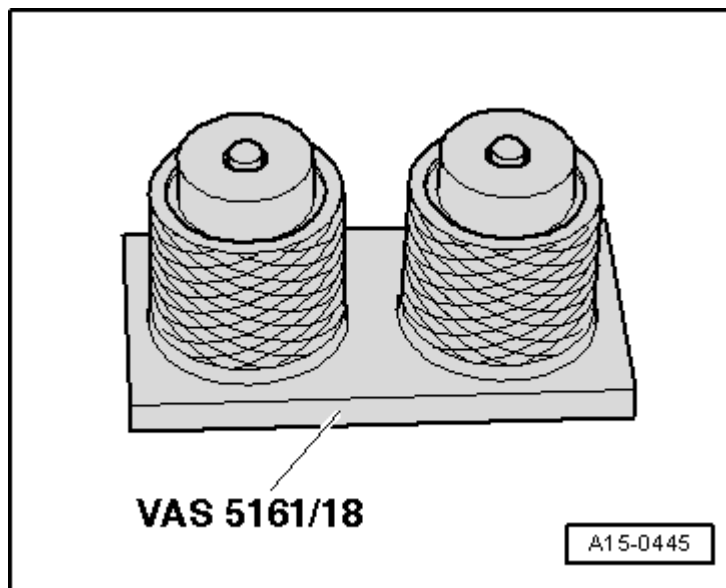


Fig. 63: Identifying Installation Cartridge VAS 5161/8

Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

Press the assembly cartridge VAS 5161/8 onto the valve insertion device from

above and take up the valve retainers.

- Press the assembly cartridge VAS 5161/8 down with the pressure fork with lever for assembly cartridge VAS 5161/2 and rotate the cartridge knurled thumb screw back and forth while pulling up.
- Release the pressure fork with lever for assembly cartridge VAS 5161/2 with the knurled thumb screw pulled.
- Remove the valve cotters asm/disasm device VAS 5161 components.

Further installation is in the reverse order of removal.

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

EXHAUST CAMSHAFT SEAL**Special tools and workshop equipment required**

- Seal Puller - General Usage 2085
- Adapter 2085/2
- Retainer 3036
- Assembly Tool T10071
- Torque Wrench (40-200 Nm) V. A. G 1332
- Puller T40001 with Claws T40001/6 and T40001/7
- Thrust Piece T10353

Removing

- Remove the toothed belt. Refer to **TOOTHED BELT**.
- Loosen the camshaft sprocket bolt approximately 10 mm (use the retainer 3036).

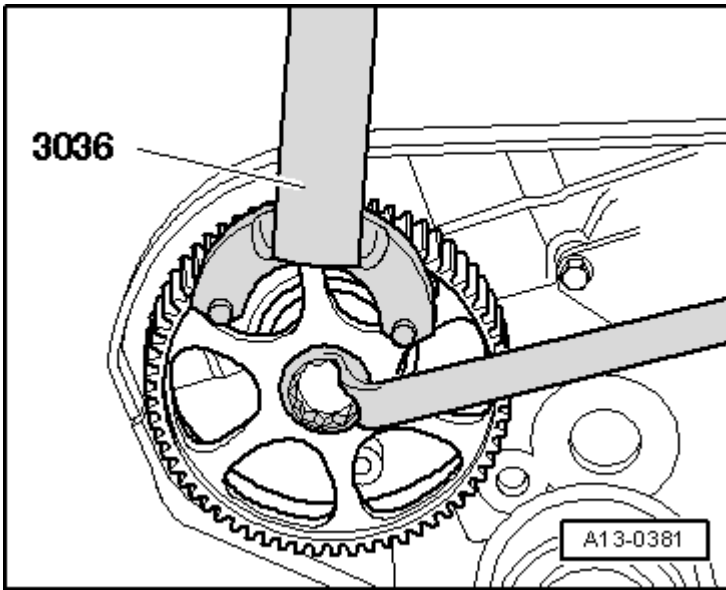


Fig. 64: Identifying Use Of Counterhold On Camshaft Gear Using 3036 Retainer
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Remove the camshaft sprocket using the puller T40001, the claws T40001/6 and T40001/7.

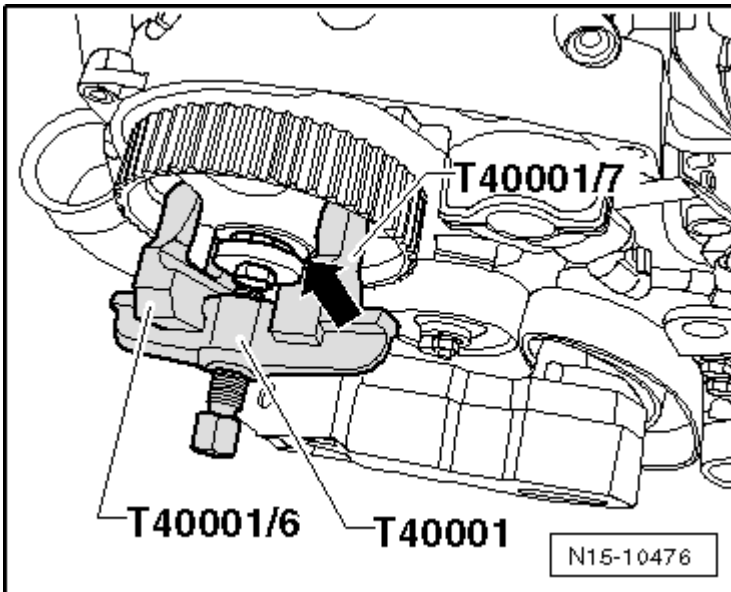


Fig. 65: Identifying Tools To Pull Off Camshaft Sprocket
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

The puller T40001 supports itself on the bolt -arrow-.

-- Remove the bolt and the camshaft sprocket.

-- To guide the seal puller, thread the adapter 2085/2 into the camshaft by hand until seated.

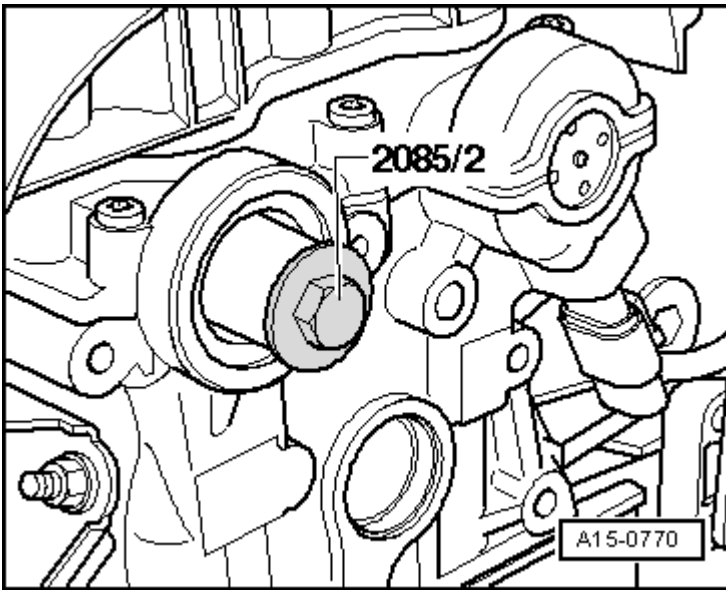


Fig. 66: Identifying Thread Adapter 2085/2

Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Remove the inner portion of the seal puller - general usage 2085 2 rotations (approximately 3 mm) from the outer portion and secure it with the knurled thumb screw.

-- Grease the threaded head of the seal puller - general usage 2085, position and forcefully screw it as far as possible into the seal.

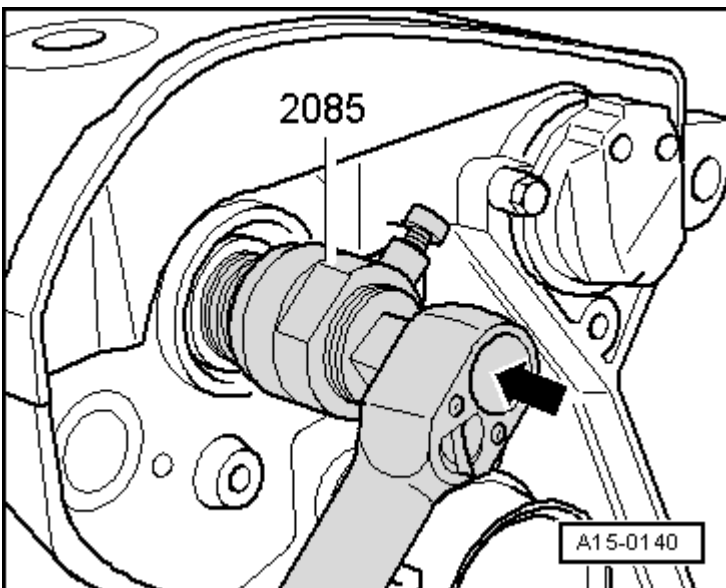


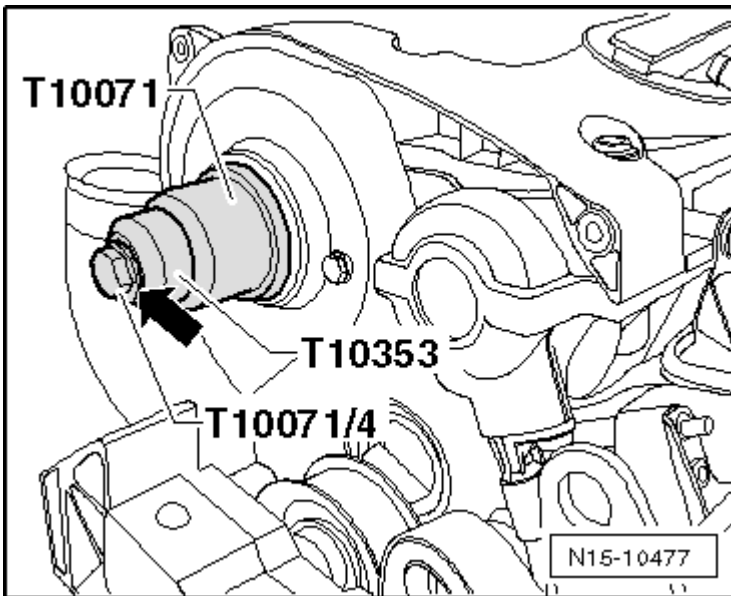
Fig. 67: Identifying Positioning And Screwing Of Bolt Into Oil Seal As Far As Possible With Forced Pressure

Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Loosen the knurled thumb screw and turn the inner part against the camshaft until the seal is removed.

Installing

- Remove any oil residue on the camshaft using a clean cloth.
- Tape over the groove on the taper of the camshaft with commercially available adhesive tape (for example, scotch tape).
- Carefully slide the seal onto the camshaft.
- Use the bolt T10071/4 to press the seal with the assembly tool T10071, the thrust piece T10353 and the washer -arrow- all the way until they are seated.

**Fig. 68: Identifying Tools To Press-In Seal**

Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

NOTE: The thrust piece T10353 is needed to compensate for the length of the bolt T10071/4. Washers can also be used.

- Insert the woodruff key into the camshaft.
- Insert the camshaft sprocket. To tighten the bolt, counter hold the camshaft sprocket using the retainer 3036.

Tightening specification, refer to **VALVETRAIN OVERVIEW**.

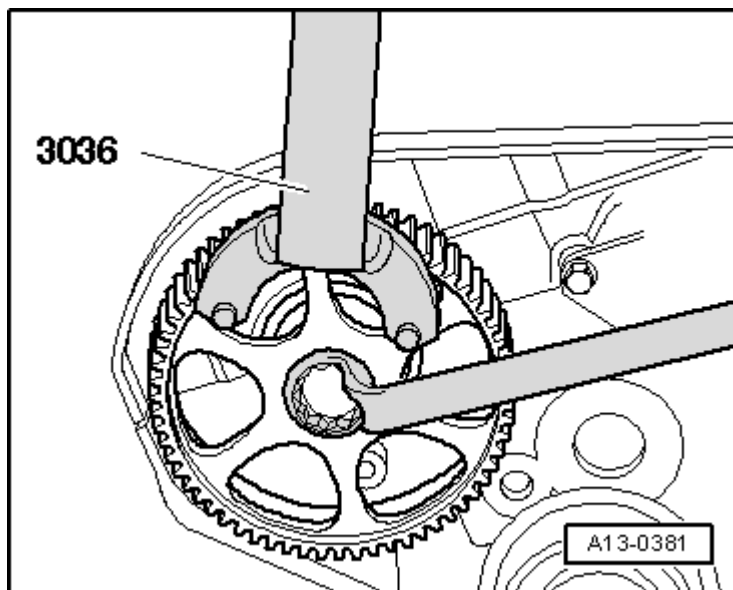


Fig. 69: Identifying Use Of Counterhold On Camshaft Gear Using 3036 Retainer
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

NOTE: When turning the camshaft, the pistons may not be at Top Dead Center (TDC) for any cylinder. Valves/pistons may be damaged.

Be sure the woodruff key is properly seated.

-- Install the toothed belt. Refer to **TOOTHED BELT**.

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

Further installation is in the reverse order of removal.

-- Fill with new coolant. Refer to **COOLANT, DRAINING AND FILLING**.

CAMSHAFT ADJUSTER

Special tools and workshop equipment required

- Socket T40080
- Camshaft Clamp T10252
- Toothed Belt Tensioner T10020
- Locking Pin T10115
- Torque Wrench (40-200 Nm) V. A. G 1332

Removing

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

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

-- Remove the refrigerant hoses -1 and 2-, remove the bolt -3- and loosen the coolant pipe from the heat shield.

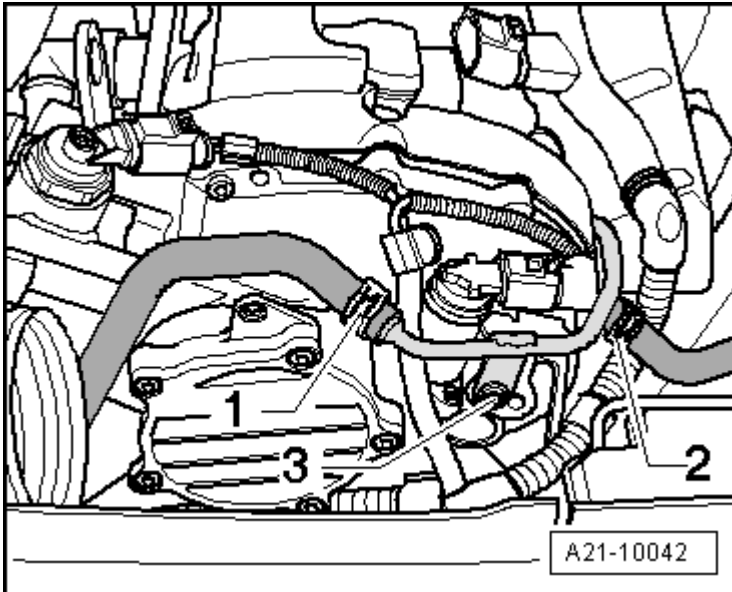


Fig. 70: Identifying Coolant Hoses

Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Remove the wire bracket bolt -arrow-.

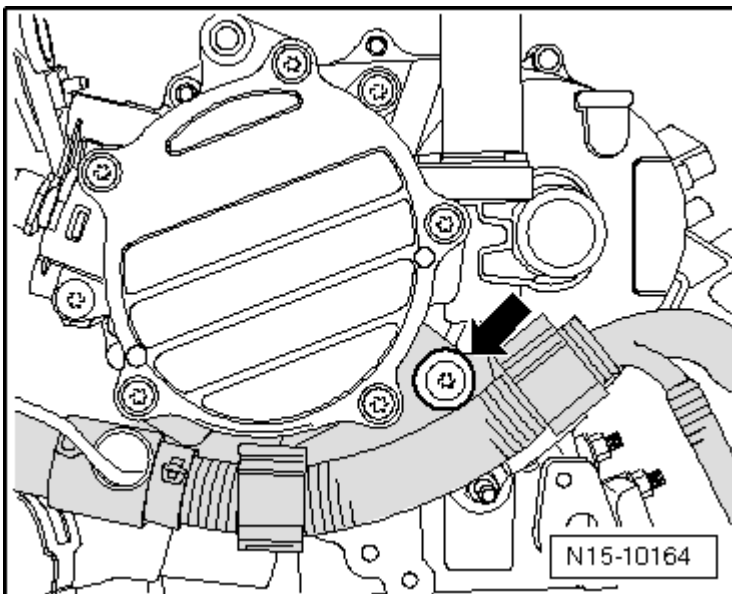


Fig. 71: Identifying Cable Bracket Bolt

Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Remove the vacuum pump.

-- Remove the housing bolts -arrows- from the camshaft adjuster.

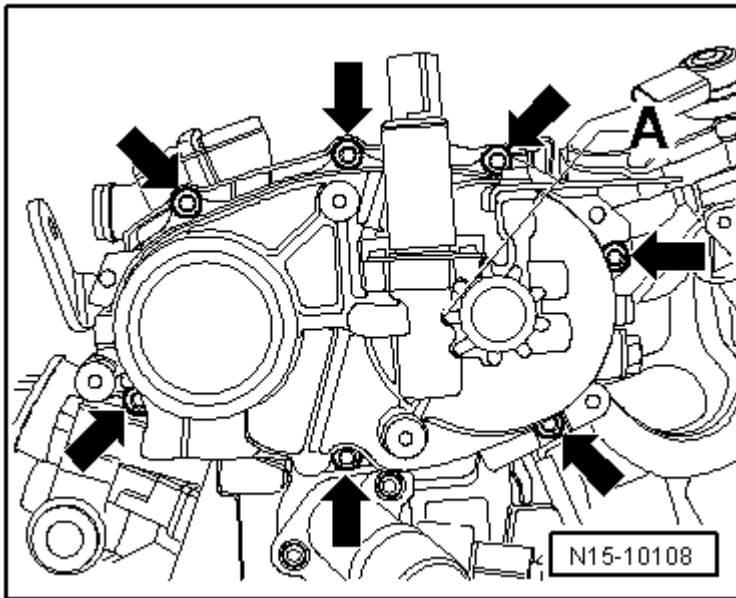


Fig. 72: Identifying Cover From Camshaft Adjuster
 Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Bring the mark on the camshaft sprocket to alignment with the mark on the toothed belt guard. The notches in the camshafts -arrows- now face toward each other vertically.

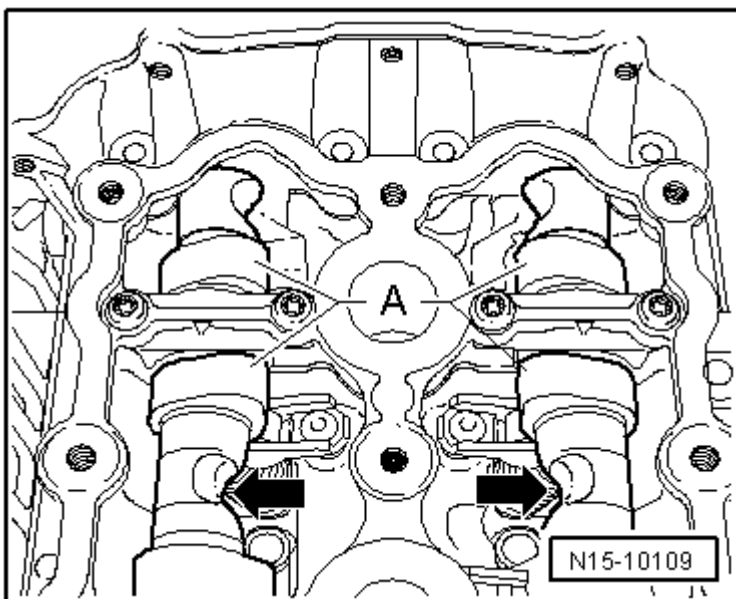


Fig. 73: Identifying Marking On Camshaft Gear Aligned With Marking On Toothed Belt Guard
 Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Install the camshaft clamp T10252 as shown and secure using the bolts -arrows-.

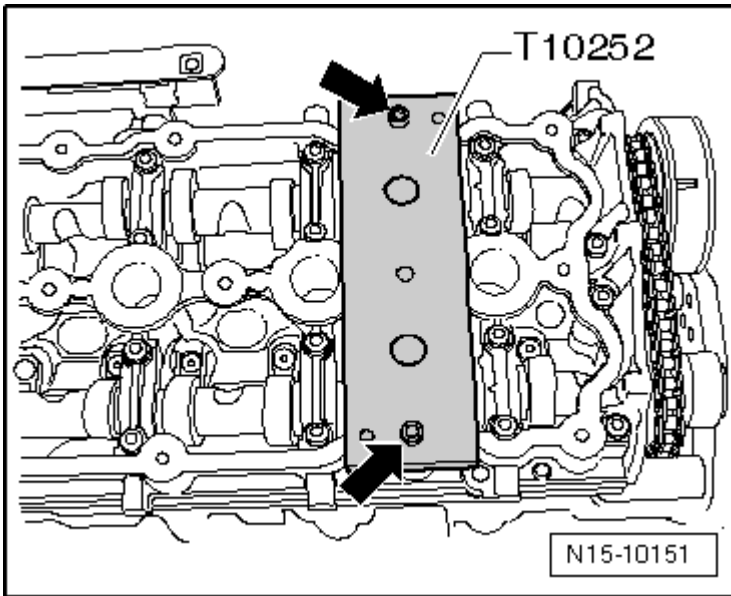


Fig. 74: Identifying Camshafts Secured Using Camshaft Locator T10252
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

- Loosen the bolt from the camshaft adjuster using the socket T40080.
- Press the chain tensioner together -arrow A- and secure it using the locking pin T10115 -arrow B-.

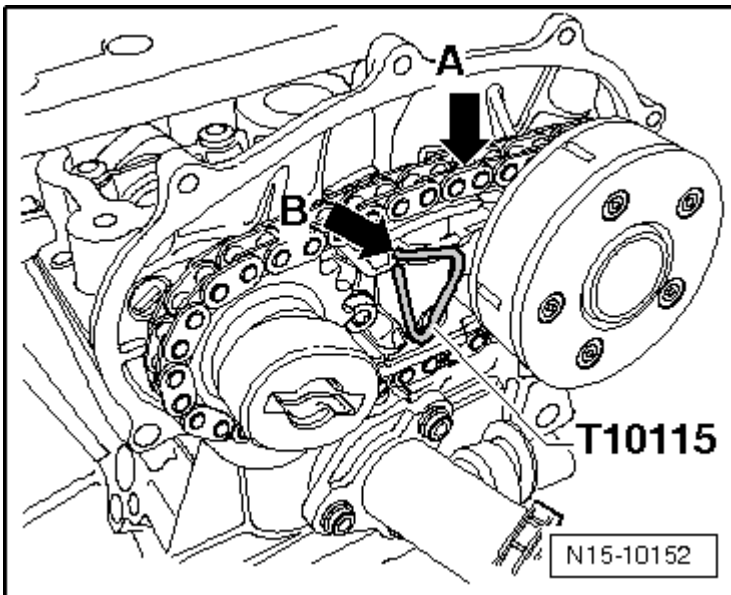


Fig. 75: Identifying Chain Tensioner Compressed And Secured Using Locking Pin T10115
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

- Remove the bolt from the camshaft adjuster and remove it with the chain.

Installing

- Camshafts are secured using the camshaft clamp T10252.

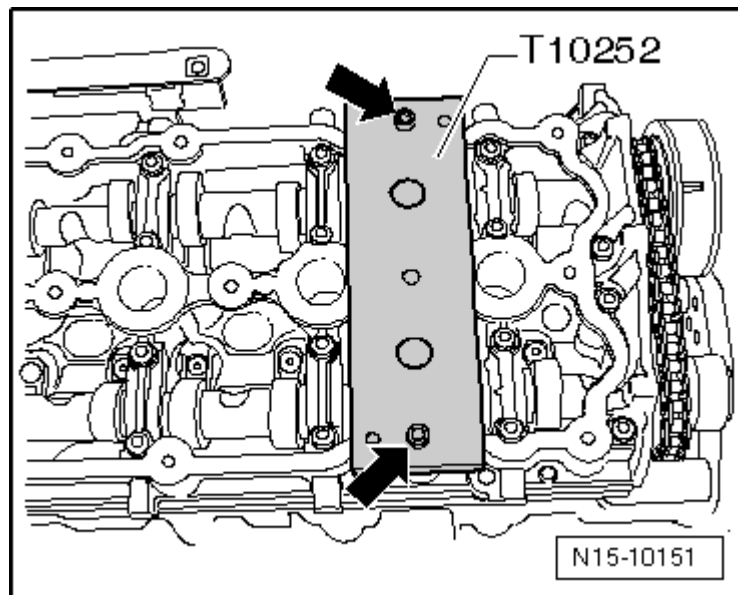


Fig. 76: Identifying Camshafts Secured Using Camshaft Locator T10252
 Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Lay the chain onto the camshaft adjuster.

-- Hold the camshaft adjuster in front of the exhaust camshaft so that the notch -A- and the pin -B- are positioned across from one another.

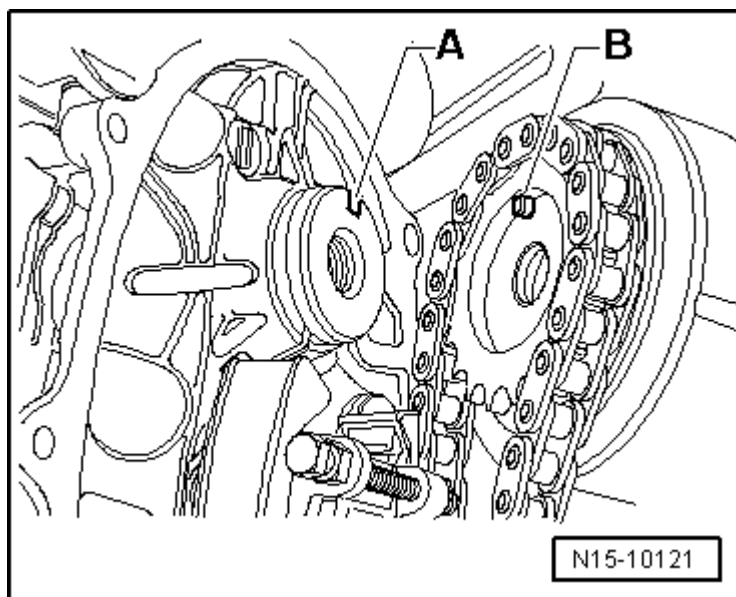


Fig. 77: Identifying Camshaft Adjuster & Exhaust Camshaft Notch And Pin
 Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- With the chain in this position, first route it on the intake camshaft sprocket at the top -arrow-.

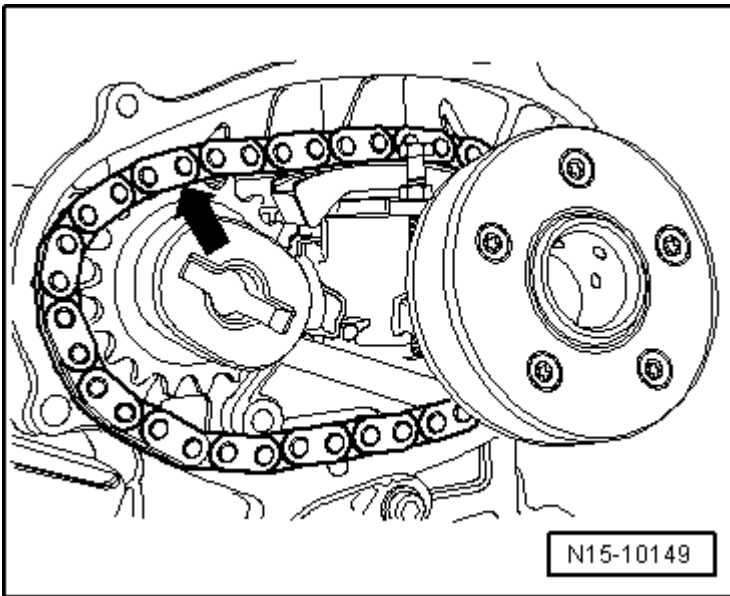


Fig. 78: Identifying Intake Camshaft Chain Position
 Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Rotate the intake camshaft in the - direction of arrow A- slowly using the toothed belt tensioner T10020 until the camshaft adjuster fits on the camshaft.

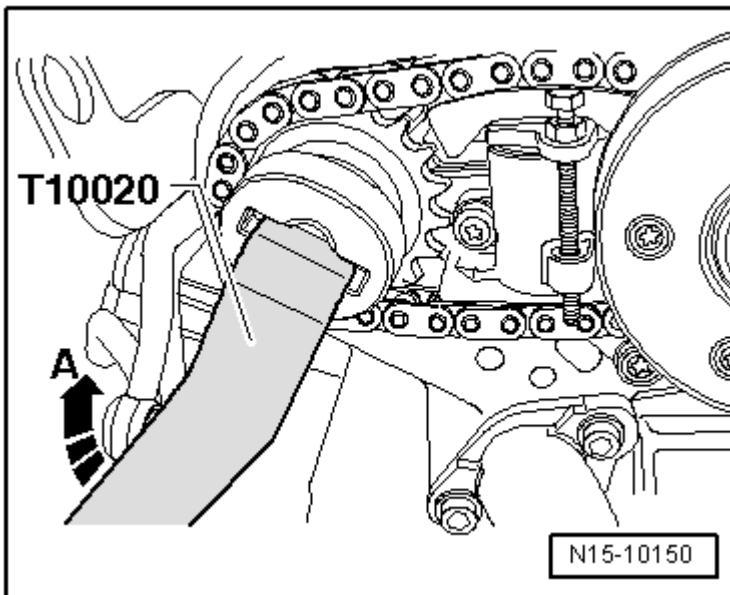


Fig. 79: Identifying Intake Camshaft Slowly Turned With Toothed Belt Tensioner T10020
 Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

NOTE: If the pin does not fit into the notch: Remove it and lay the new chain on top.

-- Use the socket T40080 to tighten the new bolt. Tightening specification: 20 Nm + an additional 45° (1/8) turn.

-- Remove the locking pin T10115 -arrow B-.

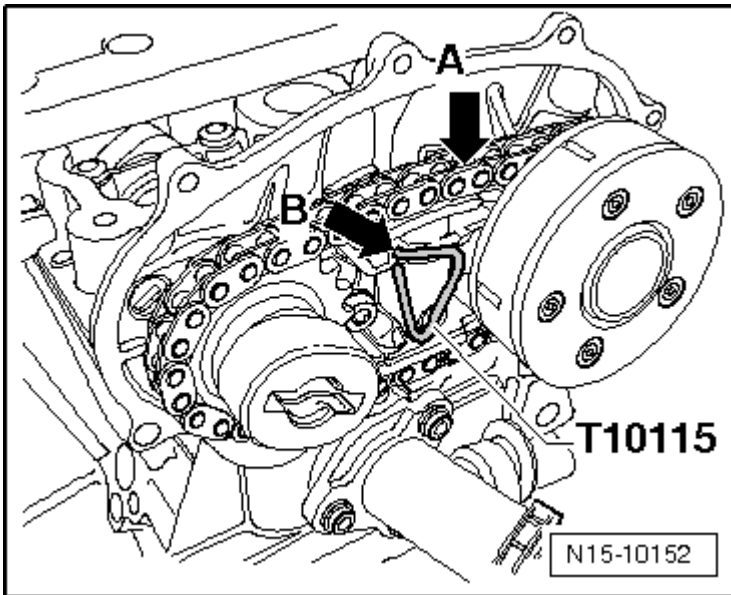


Fig. 80: Identifying Chain Tensioner Compressed And Secured Using Locking Pin T10115
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

Further installation is in the reverse order of removal.

-- Install the vacuum pump. Refer to CYLINDER HEAD AND COVER OVERVIEW.

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

-- Install the high pressure pump. Refer to HIGH PRESSURE PUMP .

Camshaft Adjustment Valve 1 -N205-

Special tools and workshop equipment required

- Ratchet Insert 1/4" VAS 6234
- TORX® Bit Set V. A. G 1766
- Spring Type Clip Pliers VAS 5024 A
- Torque Wrench V. A. G 1783

Removing

-- Remove the engine cover with air filter. Refer to ENGINE COVER WITH AIR FILTER .

-- Disconnect the connector -1-.

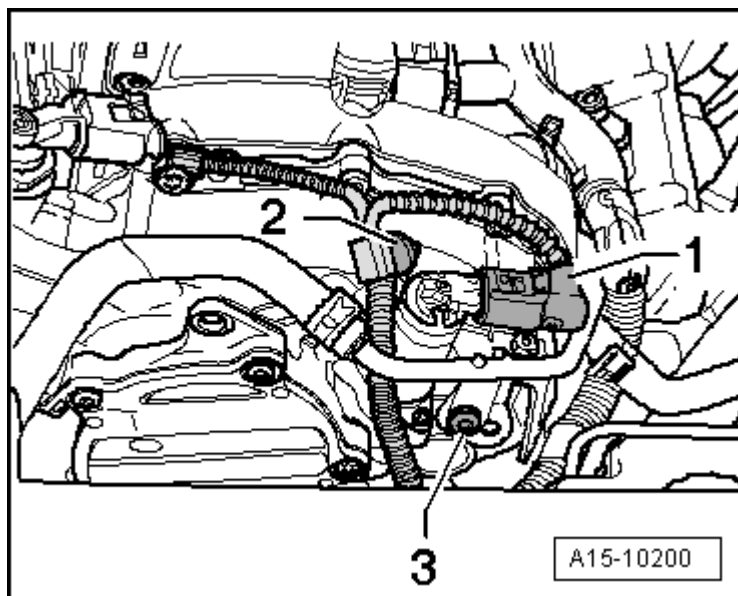


Fig. 81: Identifying Camshaft Adjustment Valve 1 Connector, Wiring Harness & Bolts
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Loosen the wiring harness bracket -2-.

-- Remove the bolt -3-.

NOTE: Do not pull out the camshaft adjustment valve 1 at the connector.

-- Remove the bolts -arrows- and the camshaft adjustment valve 1 from the housing.

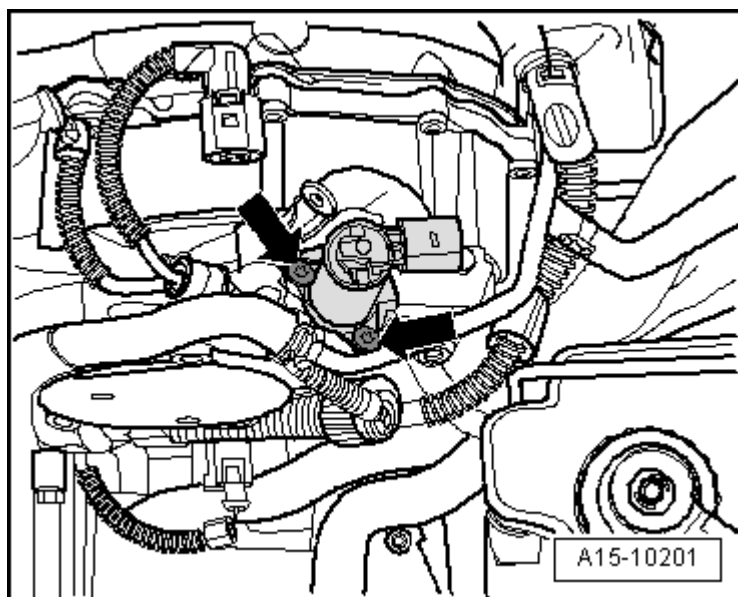


Fig. 82: Identifying Camshaft Adjustment Valve 1 N205 Bolts
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

Installing

NOTE: The camshaft adjustment valve 1 as well as the housing must be free of dirt and contaminants.

Remove the new camshaft adjustment valve 1 from packaging only prior to installation.

CAUTION: • The camshaft adjustment valve 1 must not be subjected to knocks and impacts.

-- Coat the seal with engine oil.

-- Install the camshaft adjustment valve 1 carefully into the housing and push it all the way in by hand perpendicular to the valve axis.

-- Tighten the bolts to 4 Nm.

Further installation is in reverse order of removal

-- Install the engine cover with air filter. Refer to **ENGINE COVER WITH AIR FILTER** .

CAMSHAFTS**Special tools and workshop equipment required**

- Puller T40001
- Retainer 3036
- Thrust Piece 3334

Removing

NOTE: The sealing surfaces on the bottom of the guide frame and on the top of the cylinder head must not be worked.

Camshaft bearings are integrated in the cylinder head and in the guide frame. Before removing the guide frame, tension on the toothed belt must be released.

If the guide frame was loosened, the camshaft seal and the sealing cap must be replaced.

-- Remove the camshaft adjuster. Refer to **CAMSHAFT ADJUSTER**.

-- Remove the toothed belt. Refer to **TOOTHED BELT**.

-- Loosen the camshaft sprocket bolt approximately 10 mm (use the retainer 3036).

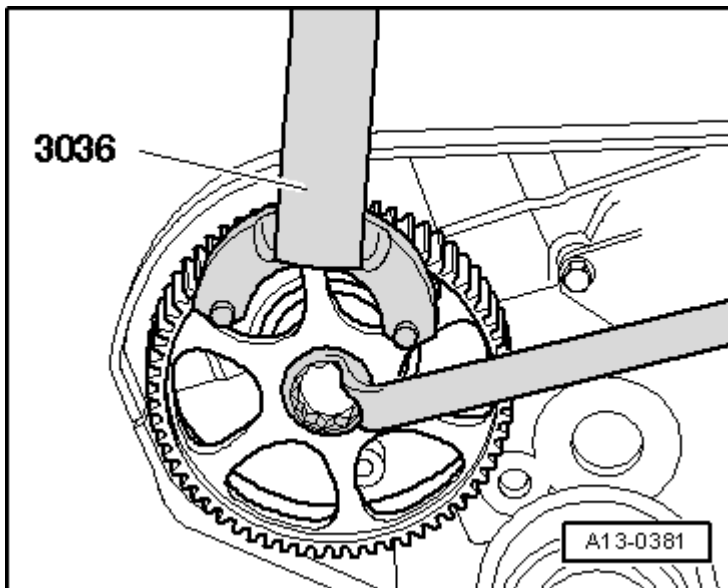


Fig. 83: Identifying Use Of Counterhold On Camshaft Gear Using 3036 Retainer
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Remove the camshaft sprocket using the puller T40001 and the claws T40001/6 and T40001/7.

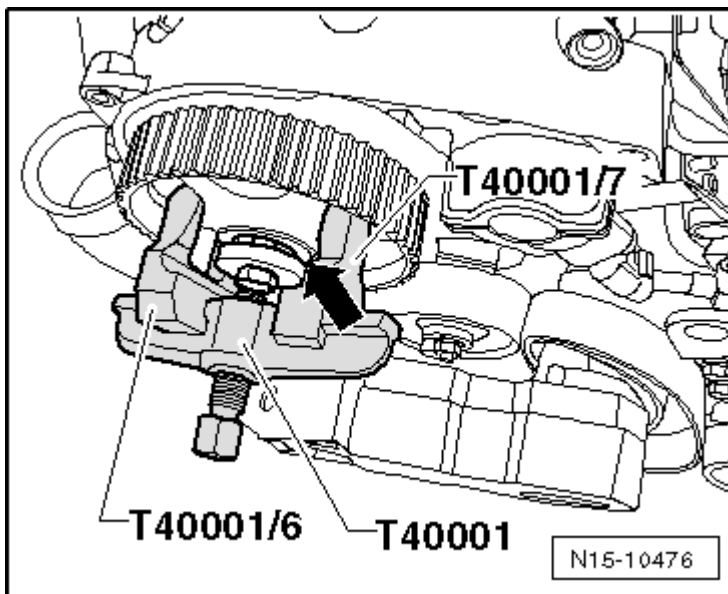


Fig. 84: Identifying Tools To Pull Off Camshaft Sprocket
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

The puller T40001 supports itself on the bolt -arrow-.

-- Remove the bolt and camshaft sprocket.

- Remove the rear toothed belt guard from the cylinder head.
- Loosen the bolts for the guide frame evenly working from the outside towards the inside and remove the guide frame.
- Carefully remove the camshafts upward and place them on a clean surface.
- Remove any old sealant from the groove in the guide frame as well as from the sealing surfaces.

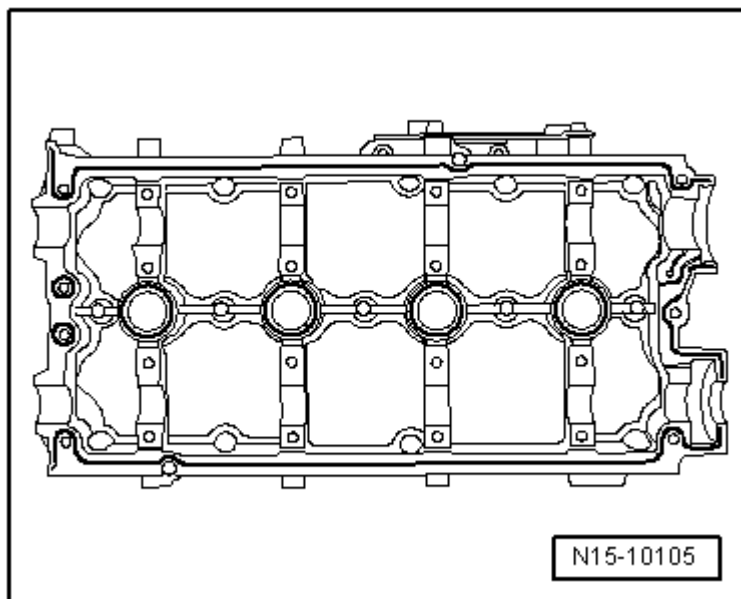


Fig. 85: Identifying Old Sealant On Guide Frame Groove And From Sealing Surfaces
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

- Make sure that no dirt or sealant residue can get into the cylinder head.

Installing

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

The pistons must not be positioned at Top Dead Center (TDC).

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

- Lubricate the running surfaces of both camshafts.
- Place the camshaft carefully into the camshaft bearings in the cylinder head. The camshaft lobes -A- for cylinder 4 must face each other.

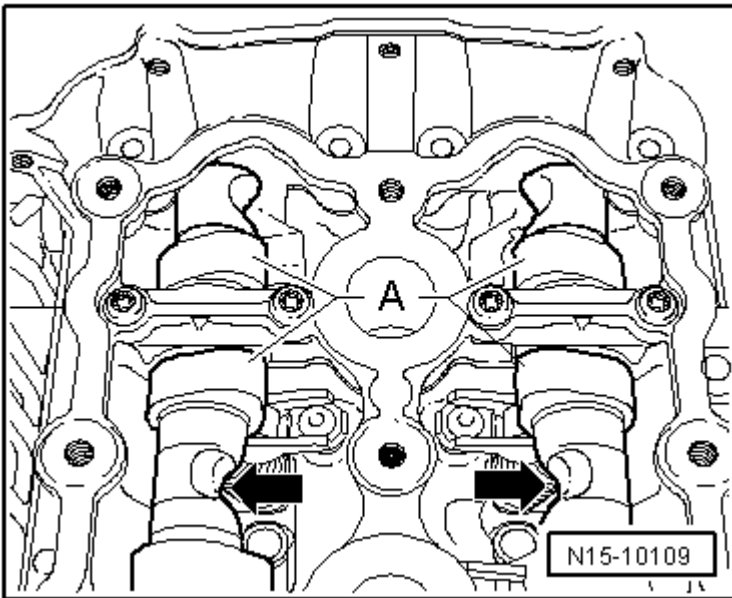


Fig. 86: Identifying Marking On Camshaft Gear Aligned With Marking On Toothed Belt Guard
 Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Apply a light sealant bead of sealant D 154 103 A1 evenly in the groove in the guide frame as shown in the illustration.

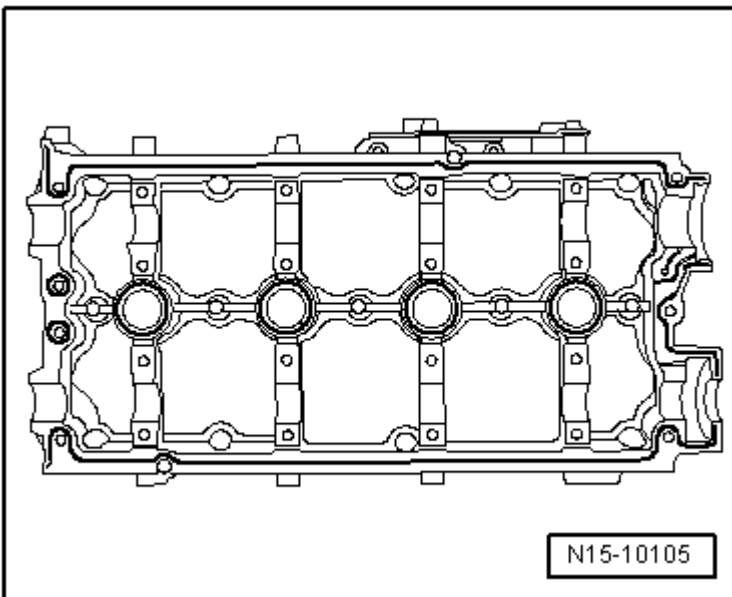


Fig. 87: Identifying Old Sealant On Guide Frame Groove And From Sealing Surfaces
 Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

NOTE: The sealant must not be applied too thick. Wipe off any excess sealant with a lint-free cloth, if necessary.

Placing the guide frame in place and tightening the bolts it should occur

without interruption, since the sealant begins to harden immediately when the sealing surfaces come into contact.

Note the expiration date of the sealant.

- Place the guide frame onto the cylinder head.
- Gently tighten the new bolts from working from the inside toward the outside in several stages.
- Tighten the bolts to 8 Nm + an additional 90° turn in the sequence shown.

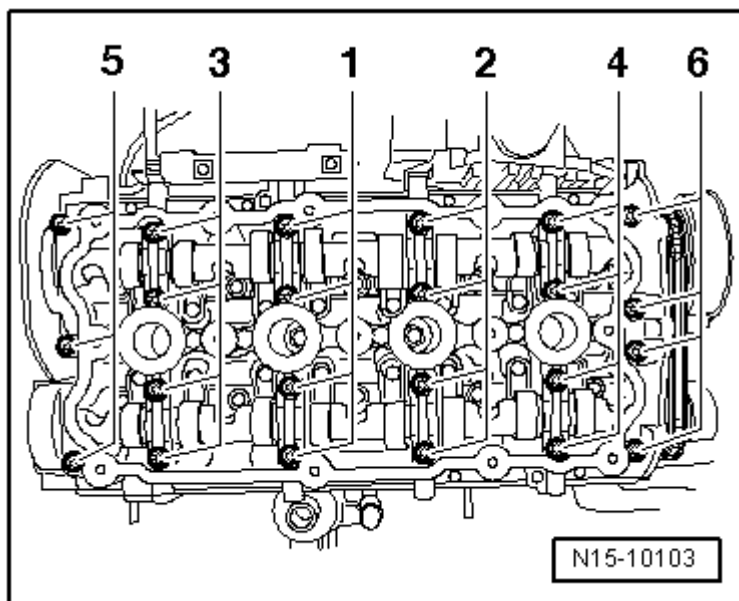


Fig. 88: Identifying Cylinder Head Bolts Tightening Sequence
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

- Drive the sealing cap in approximately 1 to 2 mm using the thrust piece 3334.
- Install the camshaft seal. Refer to **EXHAUST CAMSHAFT SEAL**.
- Install the rear toothed belt guard.
- Insert the woodruff key into the camshaft.
- Insert the camshaft sprocket. To tighten the bolt, counter hold the camshaft sprocket using the retainer 3036.

Tightening specification: Refer to **VALVETRAIN OVERVIEW**.

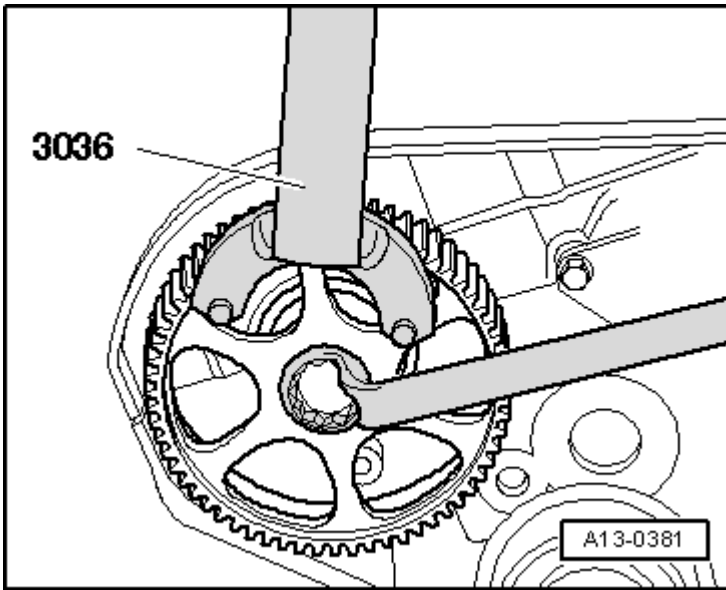


Fig. 89: Identifying Use Of Counterhold On Camshaft Gear Using 3036 Retainer
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

NOTE: When turning the camshaft, the pistons may not be at TDC for any cylinder. Valves/pistons may be damaged.

Be sure the woodruff key is properly seated.

- Install the toothed belt. Refer to **TOOTHED BELT**.
- Install the camshaft adjuster. Refer to **CAMSHAFT ADJUSTER**.
- Install the cylinder head cover. Refer to **CYLINDER HEAD COVER**.

Further installation is in the reverse order of removal.

SPECIAL TOOLS

Special tools and workshop equipment required

- Spark Plug Removal Tool 3122 B
- Compression Tester V. A. G 1763
- Adapter V. A. G 1381/5A
- Drip Tray for VAS 6100 VAS 6208
- Engine Support Bracket T10339
- Adapter 10-222 A/18
- Engine Support Bridge 10-222 A
- Valve Seal Removal Tool 3364

- Valve Stem Seal Driver 3365
- Adapter T40012
- Valve Cotters Asm/Disasm Device VAS 5161
- Guide Plate for FSI Engine VAS 5161/19B
- Seal Puller - General Useage 2085
- Adapter 2085/2
- Assembly Tool T10071
- Claws T40001/6 and T40001/7
- Ratchet Insert 1/4" VAS 6234
- TORX® Bit Set V. A. G 1766
- Torque Wrench V. A. G 1783
- Dial Gauge Holder VW 387

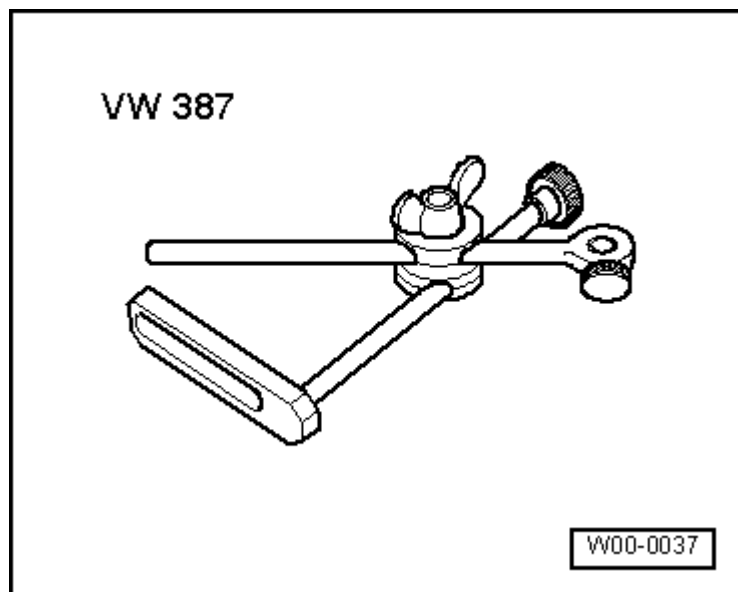


Fig. 90: Identifying Dial Gauge Holder VW 387

Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

- Dial Gauge 0-10 mm VAS 6079

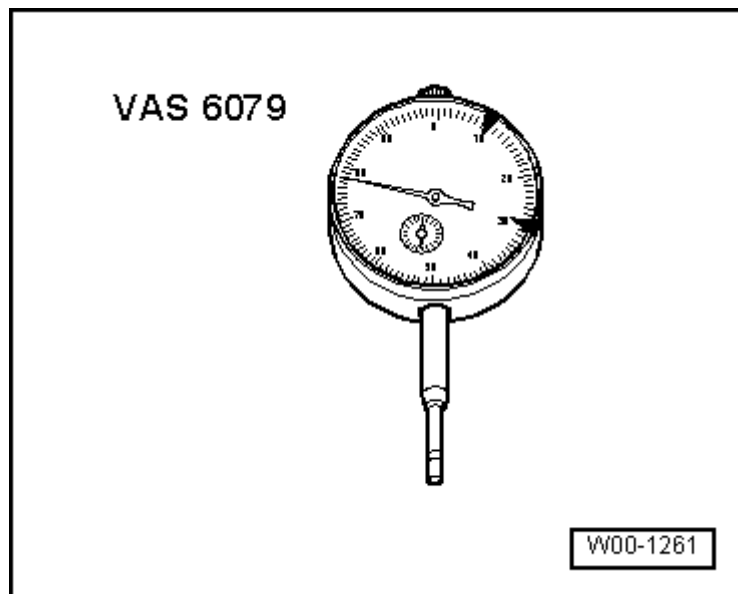


Fig. 91: Identifying Dial Gauge VAS 6079

Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

- Spring Type Clip Pliers VAS 5024 A

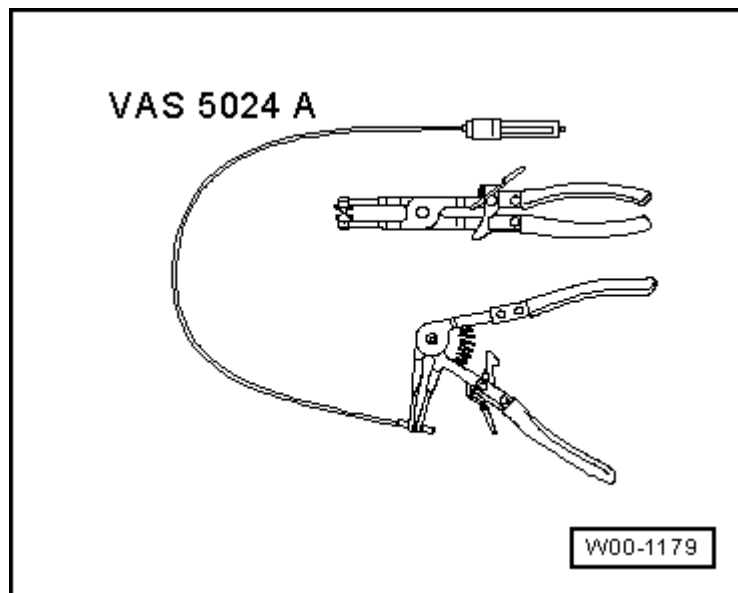


Fig. 92: Identifying Spring Clamps VAS 5024A

Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

- Engine Support Feet 10-222 A/8

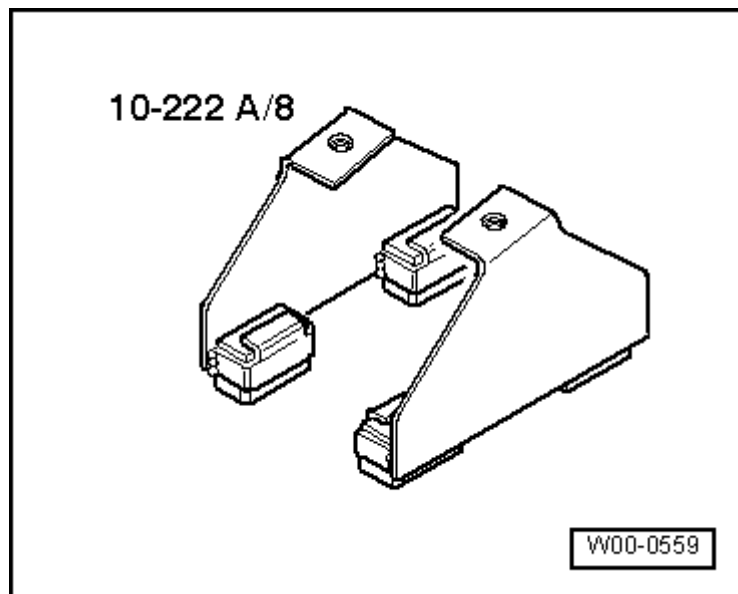


Fig. 93: Identifying Engine Support Feet 10-222 A/8
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

- Thrust Piece T10353

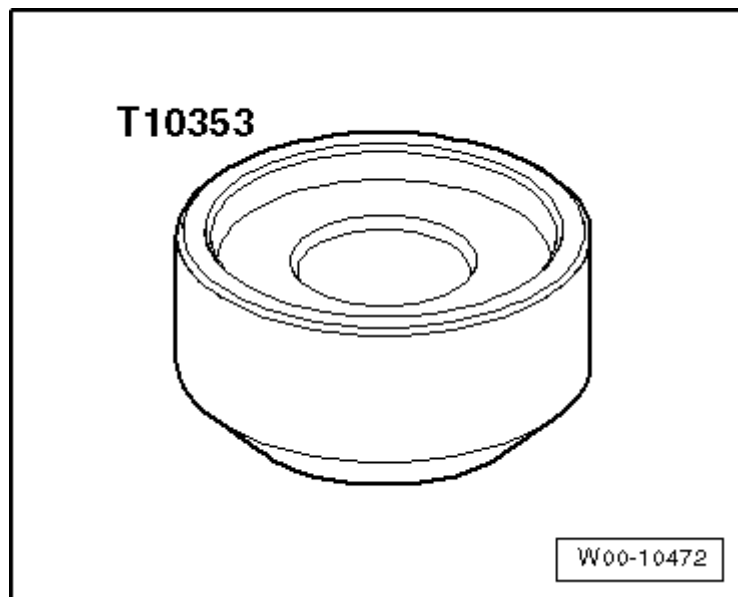


Fig. 94: Identifying Thrust Piece T10353
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

- Puller T40001

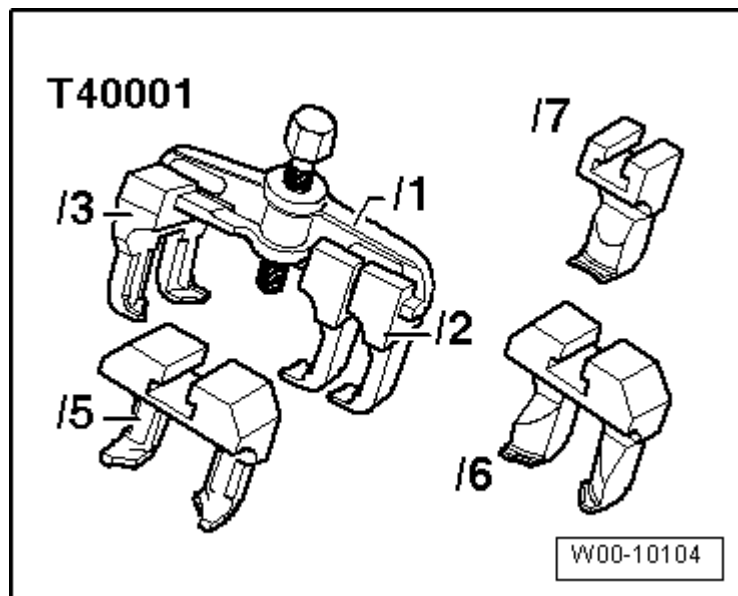


Fig. 95: Identifying Puller T40001

Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

- Retainer 3036

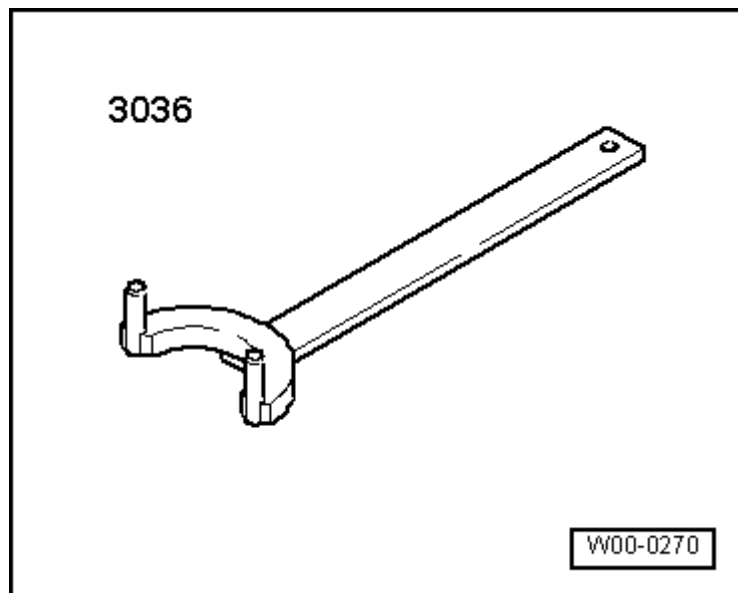


Fig. 96: Identifying Retainer 3036

Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

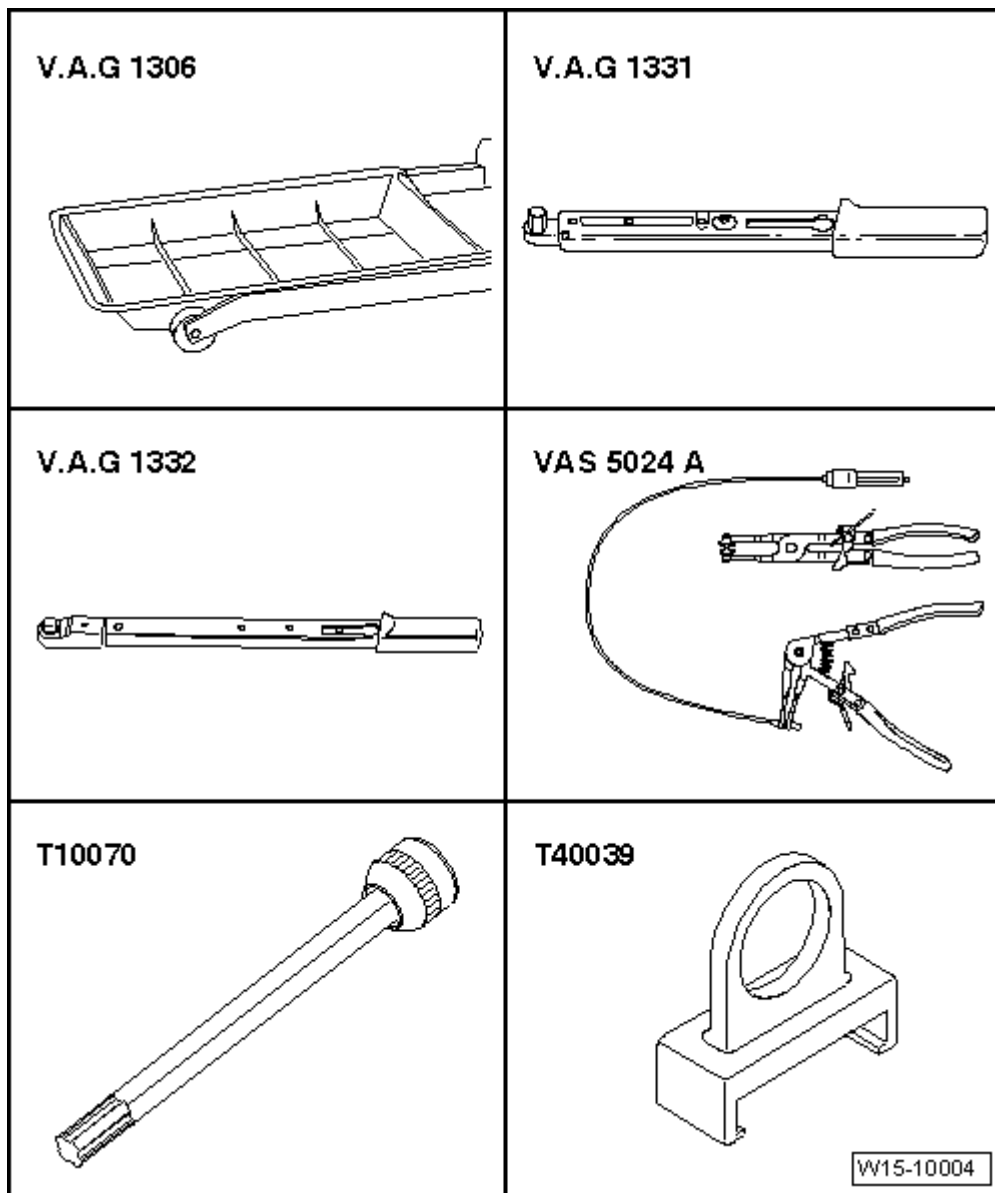


Fig. 97: Identifying Special Tools -- Cylinder Head, Removing And Installing
 Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

Special tools and workshop equipment required

- Drip Tray V. A. G 1306
- Torque Wrench (5-50 Nm) V. A. G 1331
- Torque Wrench V. A. G 1332
- Spring Type Clip Pliers VAS 5024 A
- Polydrive Bit and Drive Socket T10070
- Ignition Coil Puller T40039

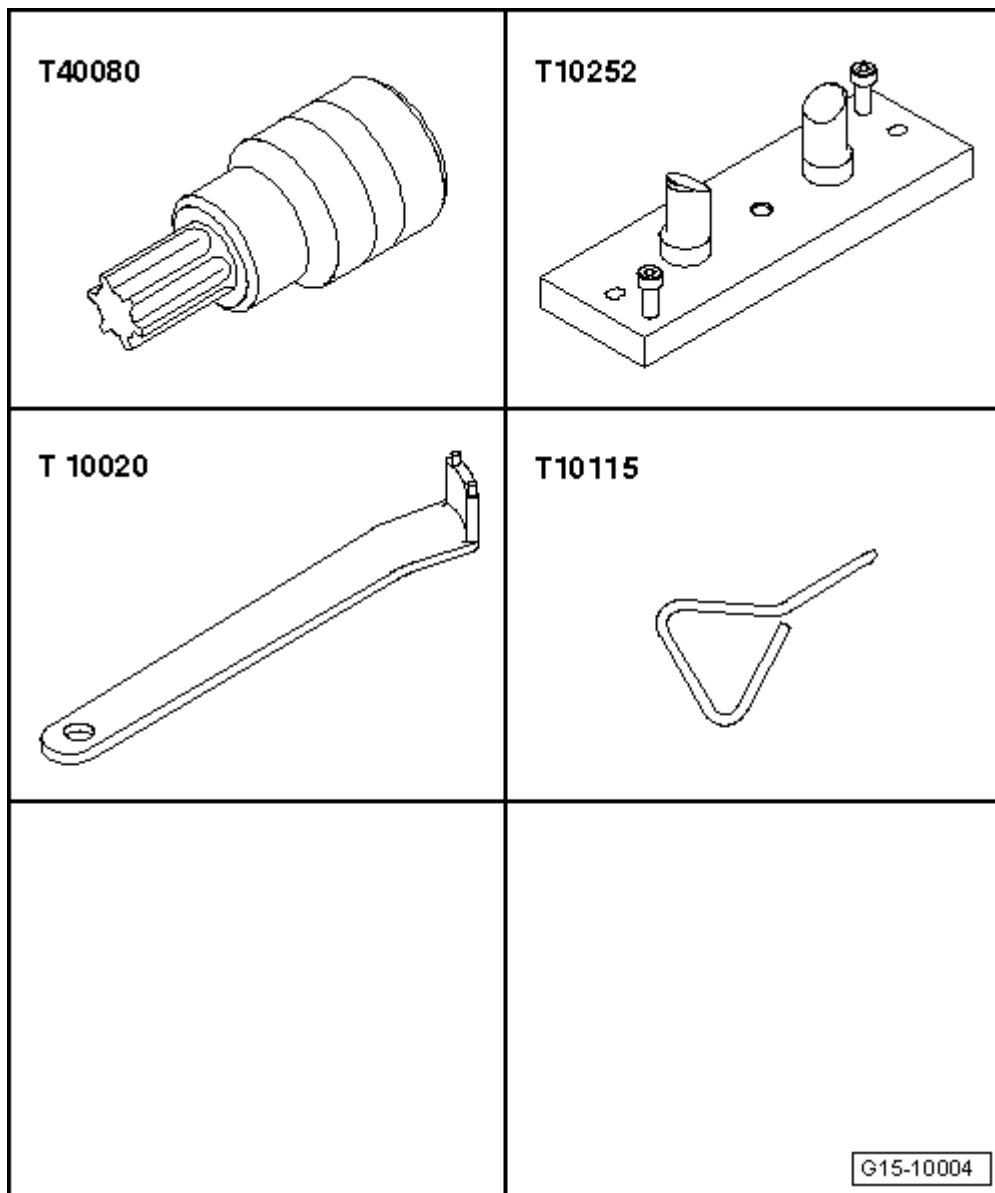


Fig. 98: Identifying Special Tools -- Camshaft Adjuster, Removing And Installing
 Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

Special tools and workshop equipment required

- Socket T40080
- Camshaft Clamp T10252
- Toothed Belt Tensioner T10020
- Locking Pin T10115
- Torque Wrench (40-200 Nm) V. A. G 1332