

ENGINE**2.5 Liter - Crankshaft, Cylinder Block - Engine Code(s): BGP, BGQ, CBTA & CBUA****13 CRANKSHAFT, CYLINDER BLOCK****GENERAL INFORMATION****NEW CONNECTING ROD, SEPARATING**

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

- Mark which cylinder the connecting rod belongs to.
- Lightly clamp the connecting rod in a vise equipped with aluminum protective jaw pads.

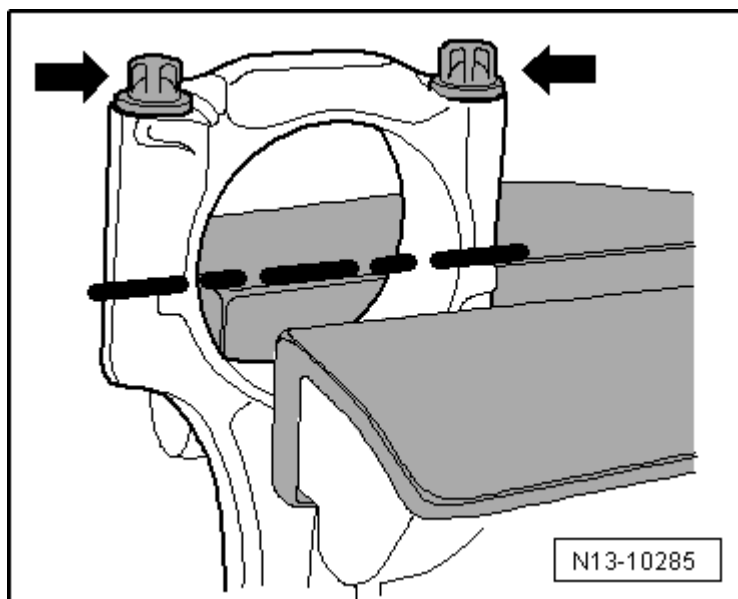


Fig. 1: Clamping Connecting Rod In Vise Equipped With Aluminum Protective Pads
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

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

Clamp the connecting rod below the dotted line.

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

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

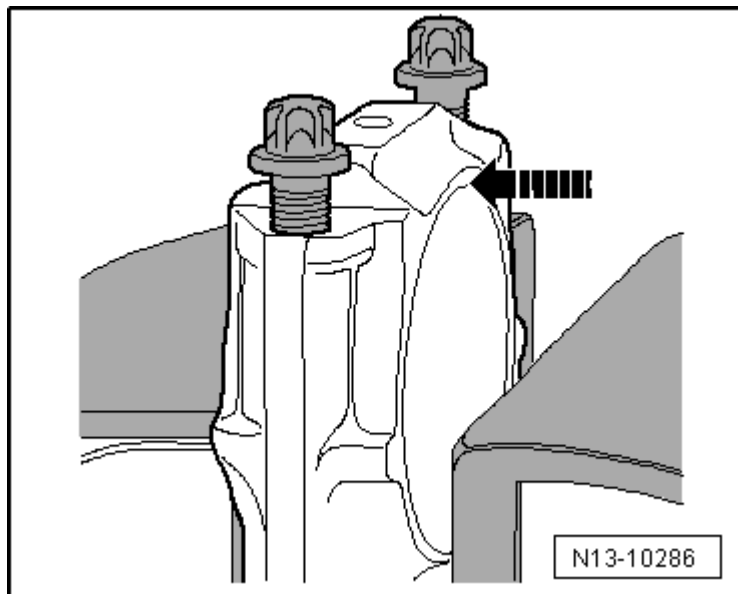


Fig. 2: Carefully Tapping Against Connecting Rod Bearing Cap
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

DESCRIPTION AND OPERATION

RIBBED BELT OVERVIEW

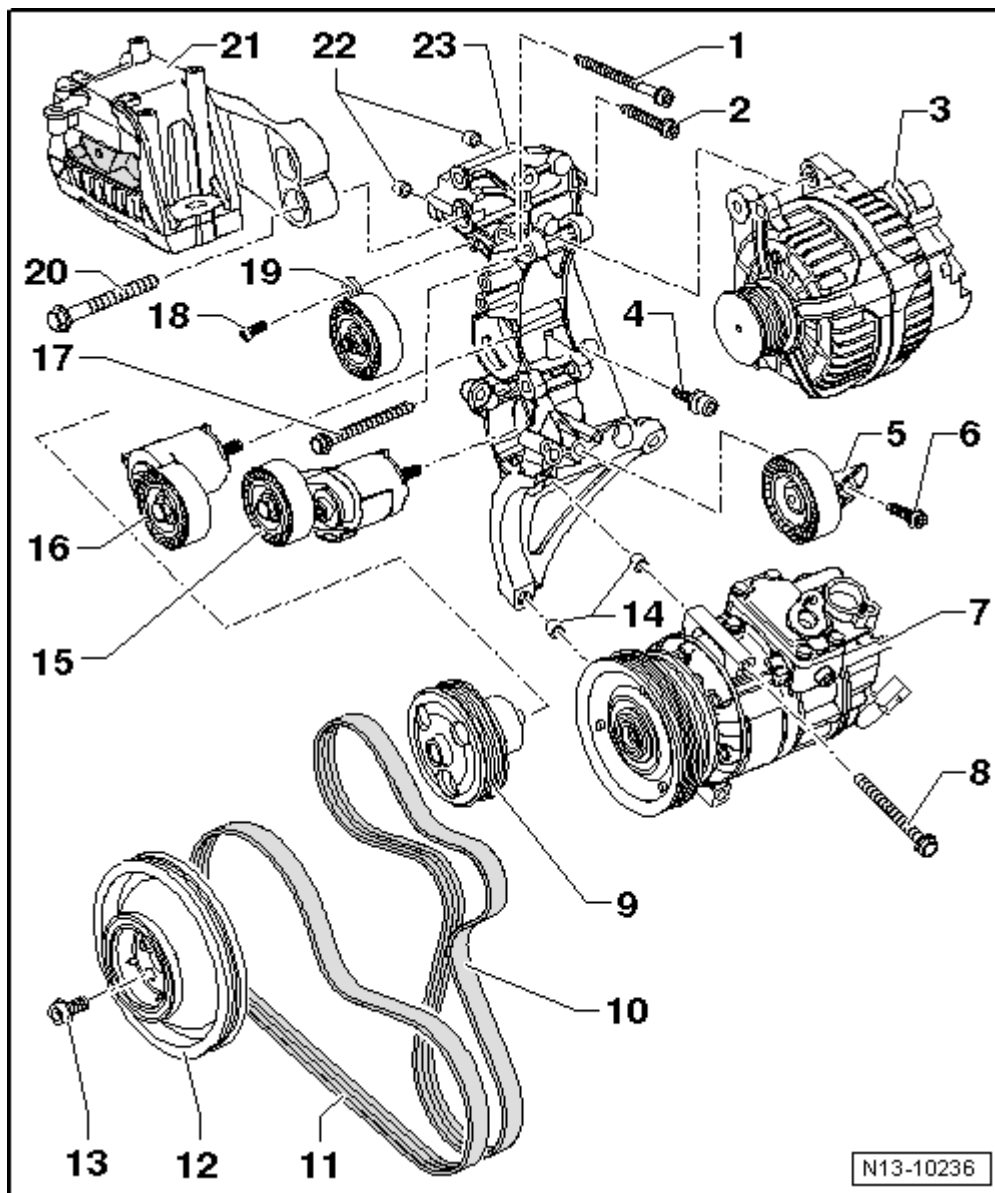


Fig. 3: Ribbed Belt Overview

Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

1. Bolt
 - 25 Nm
2. Bolt
 - 25 Nm
3. Generator
 - Removing and installing, refer to **Removal and Installation**.
 - To make it easier to position the generator, drive the threaded bushing for the generator bolt back slightly.
4. Bolt

- 25 Nm
- 5. Lower Idler Pulley with Bracket
 - For the Air Conditioning (A/C) compressor ribbed belt.
 - Do not remove the pulley.
- 6. Bolt
 - 25 Nm
- 7. A/C Compressor
 - Removing and installing, refer to "Refrigerant Circuit Components" in **Removal and Installation** .
- 8. Bolt
 - 25 Nm
- 9. Coolant Pump
 - In the cylinder block.
 - Removing and installing, refer to **COOLANT PUMP** .
- 10. Ribbed Belt, Generator, Power Steering Pump and Coolant Pump
 - Belt routing, refer to **Fig. 4**.
 - 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**.
- 11. Ribbed Belt, A/C Compressor
 - Belt routing, refer to **Fig. 4**.
 - 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**.
- 12. Vibration Damper
 - To remove and install, lock the crankshaft. Refer to **CRANKSHAFT, LOCKING**.
- 13. Bolt
 - 50 Nm + an additional 90° (1/4 turn).
 - Always replace.
 - Only use strength category 10.9 bolts.
 - Quantity: 5
- 14. Bushing
 - Quantity: 2
- 15. Ribber Belt Tensioner, A/C Compressor Belt
 - 35 Nm
 - Do not remove the tensioning roller, remove the entire tensioner. Refer to **RIBBED BELT TENSIONER, A/C COMPRESSOR**.

16. Ribbed Belt Tensioner, Generator, Power Steering Pump and Coolant Pump Belt
 - 35 Nm
 - Do not remove the tensioning roller, remove the entire tensioner. Refer to **RIBBED BELT TENSIONER, GENERATOR, POWER STEERING PUMP AND COOLANT PUMP**.
17. Bolt
 - 25 Nm
18. Bolt
 - 8 Nm
19. Upper Idler Pulley with Bracket
 - For the generator, power steering pump and coolant pump ribbed belt.
 - Do not remove the pulley.
20. Bolt
 - 40 Nm + an additional 90° (1/4) turn.
21. Engine Mount
22. Bushing
 - Quantity: 2
23. Accessory Bracket

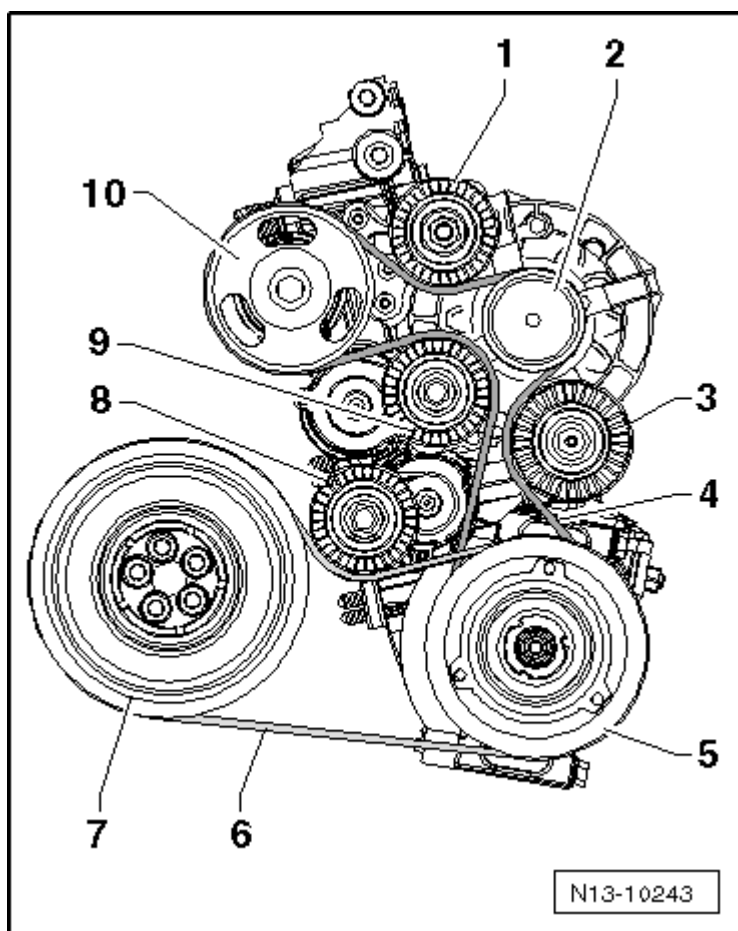


Fig. 4: Ribbed Belt Routing**Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.**

1. Upper idler pulley
2. Generator
3. Lower idler pulley
4. Ribbed belt, generator, power steering pump and coolant pump
5. A/C compressor
6. Ribbed belt, A/C compressor
7. Vibration damper
8. Belt tensioner, A/C compressor ribbed belt
9. Belt tensioner, generator, power steering pump and coolant pump ribbed belt
10. Coolant pump

RIBBED BELT DRIVE OVERVIEW

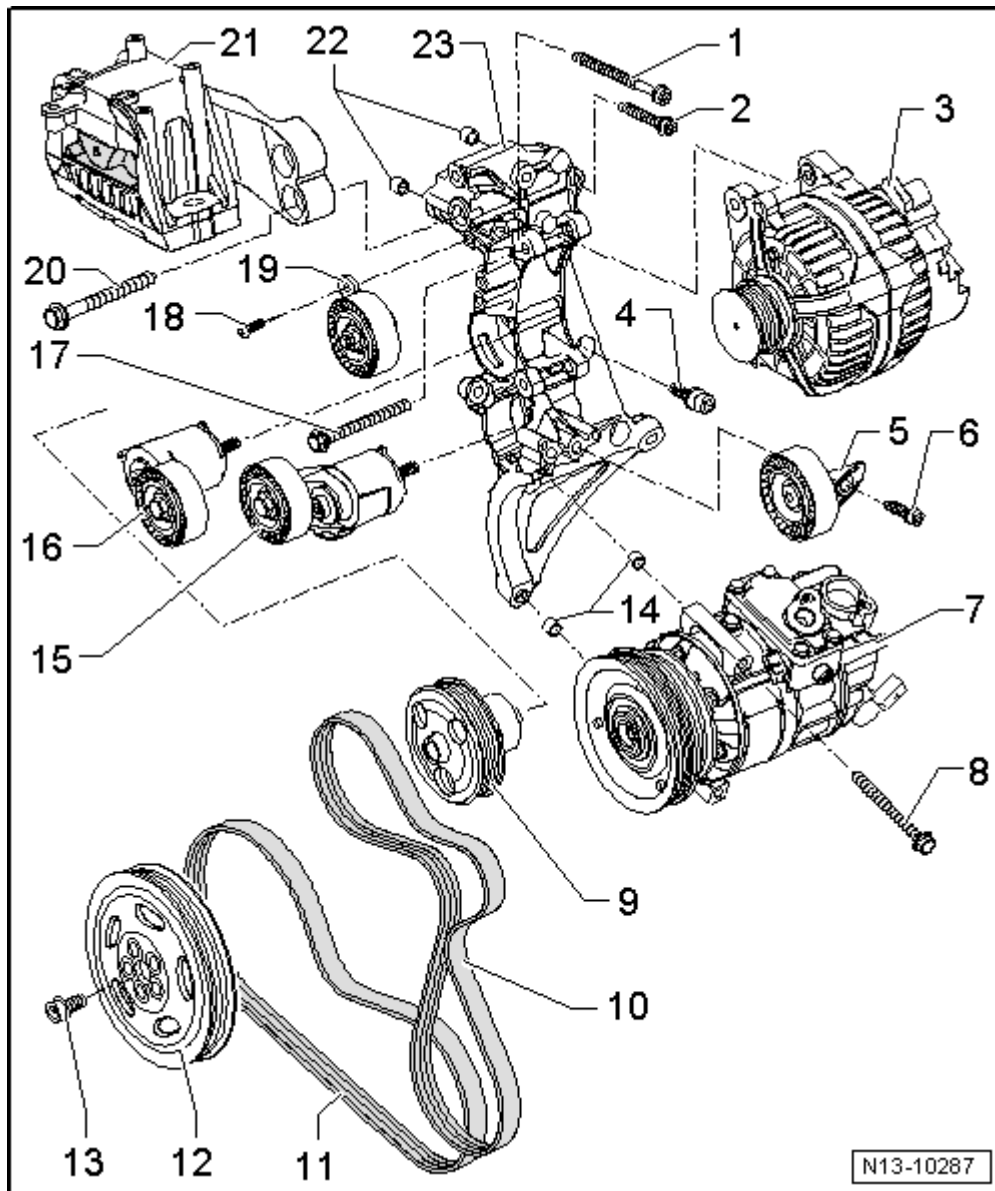


Fig. 5: Ribbed Belt Drive Overview

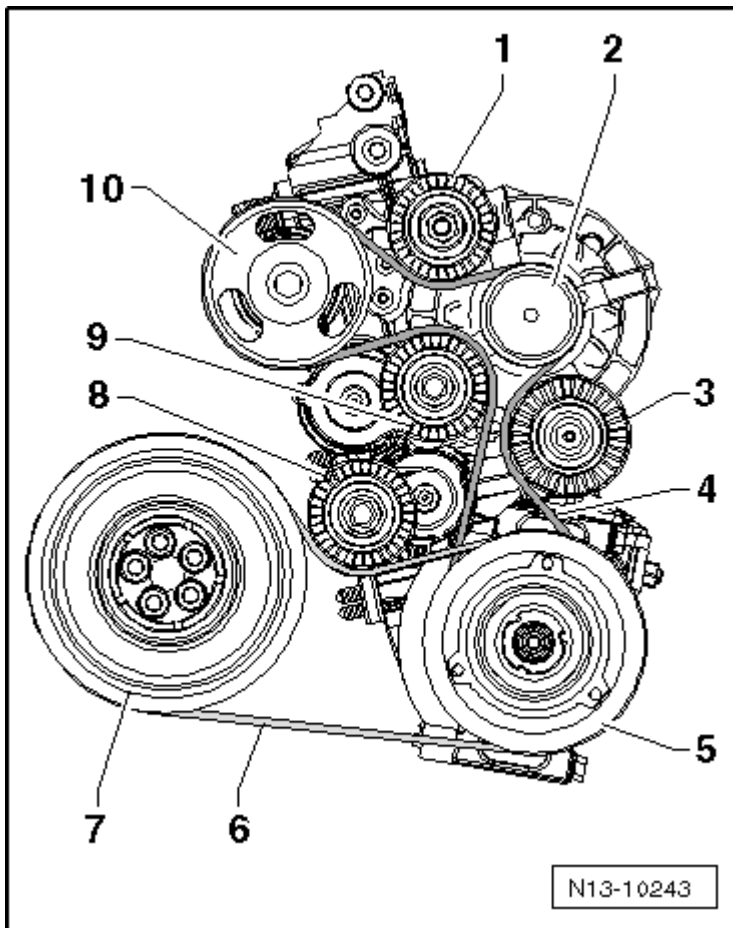
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

1. Bolt
 - 25 Nm
2. Bolt
 - 25 Nm
3. Generator
 - Removing and installing, refer to **Removal and Installation**.
 - To make it easier to position the generator, drive the threaded bushing for the generator bolt back slightly.
4. Bolt

- 25 Nm
- 5. Lower Idler Pulley with Bracket
 - For the Air Conditioning (A/C) compressor ribbed belt
 - Do not remove the pulley.
- 6. Bolt
 - 25 Nm
- 7. A/C Compressor
 - Removing and installing, refer to "Refrigerant Circuit Components" in **Removal and Installation** .
- 8. Bolt
 - 25 Nm
- 9. Coolant Pump
 - In the cylinder block.
 - Removing and installing, refer to **COOLANT PUMP** .
- 10. Ribbed Belt, Generator, Power Steering Pump and Coolant Pump
 - Belt routing, refer to **Fig. 6**.
 - 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**.
- 11. Ribbed Belt, A/C Compressor
 - Belt routing, refer to **Fig. 6**.
 - 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**.
- 12. Vibration Damper
 - There are different versions
 - To remove and install, lock secure the crankshaft. Refer to **CRANKSHAFT, LOCKING**.
- 13. Bolts
 - 50 Nm + an additional 90° (1/4) turn.
 - Always replace.
 - Use a strength category 10.9 bolt only.
 - Quantity: 5
- 14. Bushing
 - Quantity: 2
- 15. Belt Tensioner, A/C Compressor
 - 35 Nm
 - Do not remove the tensioning roller, remove the entire tensioner. Refer to **RIBBED BELT**

TENSIONER, A/C COMPRESSOR.

16. Belt Tensioner, Generator, Power Steering Pump and Coolant Pump
 - 35 Nm
 - Do not remove the tensioning roller, remove the entire tensioner. Refer to **RIBBED BELT TENSIONER, GENERATOR, POWER STEERING PUMP AND COOLANT PUMP.**
17. Bolt
 - 25 Nm
18. Bolt
 - 8 Nm
19. Upper Idler Pulley with Bracket
 - For the generator, power steering pump and coolant pump ribbed belt.
 - Do not remove the pulley.
20. Bolt
 - 40 Nm + an additional 90° (1/4) turn.
21. Engine Mount
22. Bushing
 - Quantity: 2
23. Accessory Bracket

**Fig. 6: Ribbed Belt Routing**

Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

1. Upper idler pulley
2. Generator
3. Lower idler pulley
4. Ribbed belt, generator, power steering pump and coolant pump
5. A/C compressor
6. Ribbed belt, A/C compressor
7. Vibration Damper
8. Belt tensioner, A/C compressor ribbed belt
9. Belt tensioner, generator, power steering pump and coolant pump ribbed belt
10. Coolant pump

ENGINE OVERVIEW, REAR

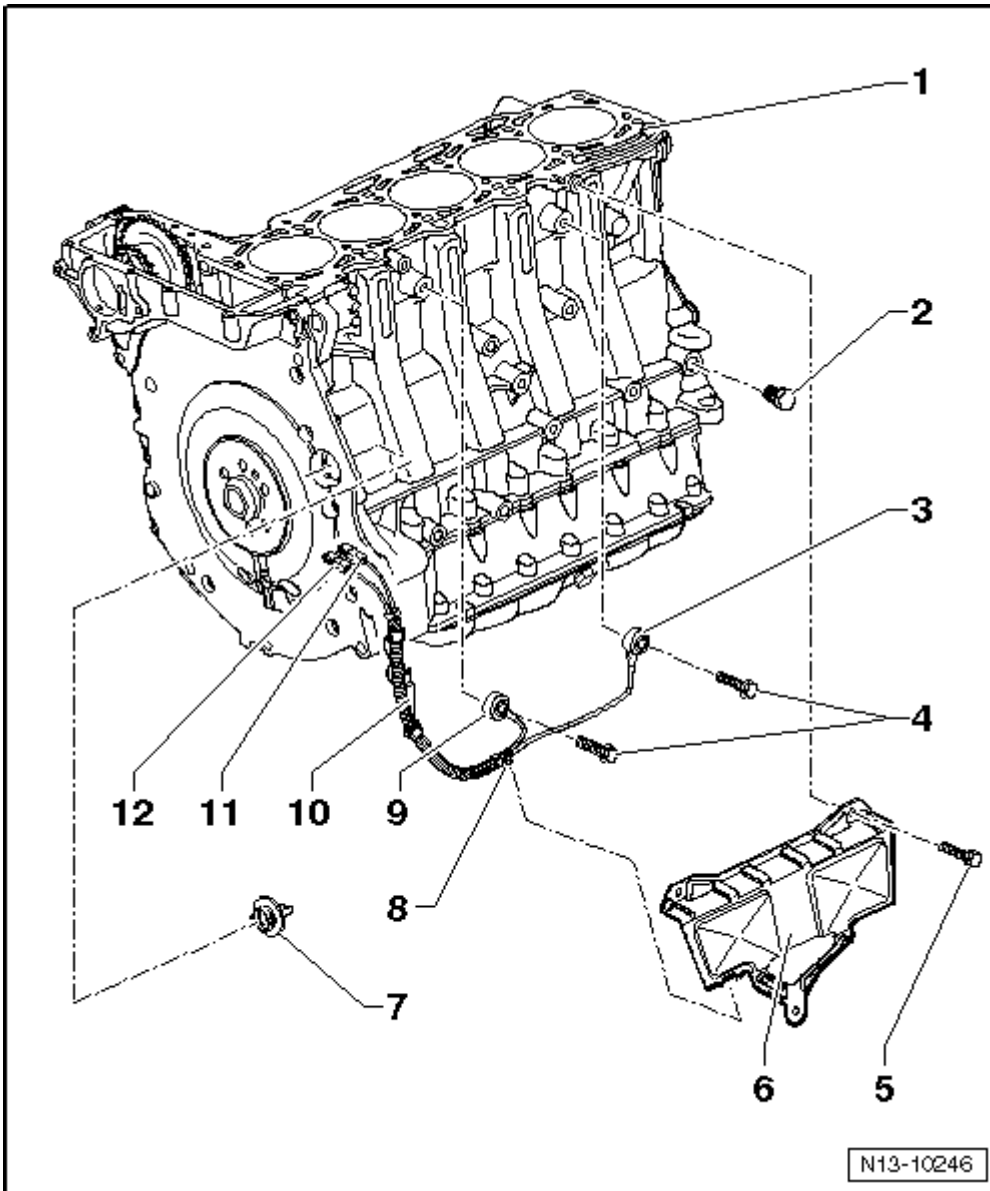


Fig. 7: Attachments, Assembly Overview - Part III - Engine Rear
 Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

1. Cylinder Block
2. Locking Bolt
 - 30 Nm
 - With a rolled seal.
 - The bore in the cylinder block is used for locking the crankshaft using the locking pin T40069.
3. Knock Sensor 1 -G61-
 - Note the installed position: The wire connection points downward vertically.
4. Bolt
 - 20 Nm

- Tightening specification affects the function of the knock sensor.
5. Bolt
 - 10 Nm
 6. Cover
 7. Plug
 8. Wire Clip
 - Clipped to the cover plate.
 9. Knock Sensor 2 -G66-
 - Note the installed position: The wire connection points 45° toward the right on the outside.
 10. Wire Bracket
 - Bolted to the Secondary Air Injection (AIR) valve.
 11. Connector
 - Green for knock sensor 1.
 - Installed position, refer to **Fig. 8**.
 - Contacts are gold plated.
 12. Connector
 - Gray for knock sensor 2.
 - Installed position, refer to **Fig. 8**.
 - Contacts are gold plated.

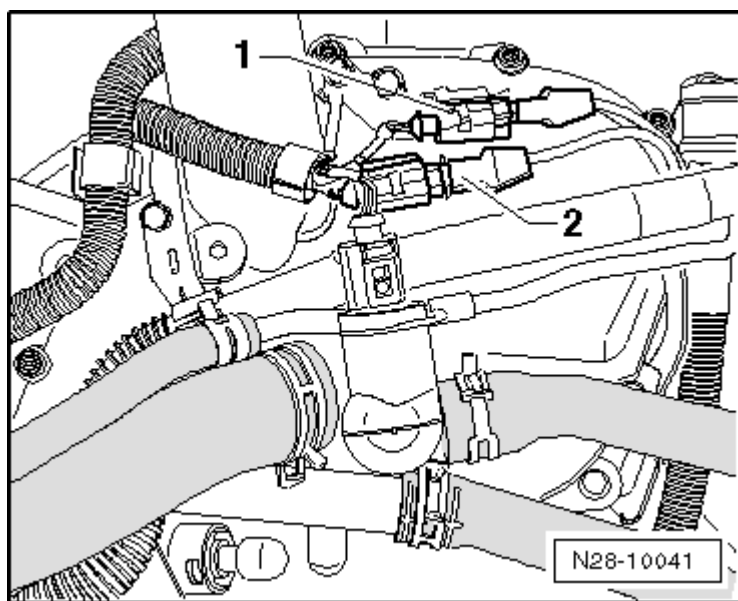


Fig. 8: Installation Position Of Harness Connectors For Knock Sensors
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

1. Green for knock sensor 1
2. Gray for knock sensor 2

ENGINE OVERVIEW, FRONT/SIDE

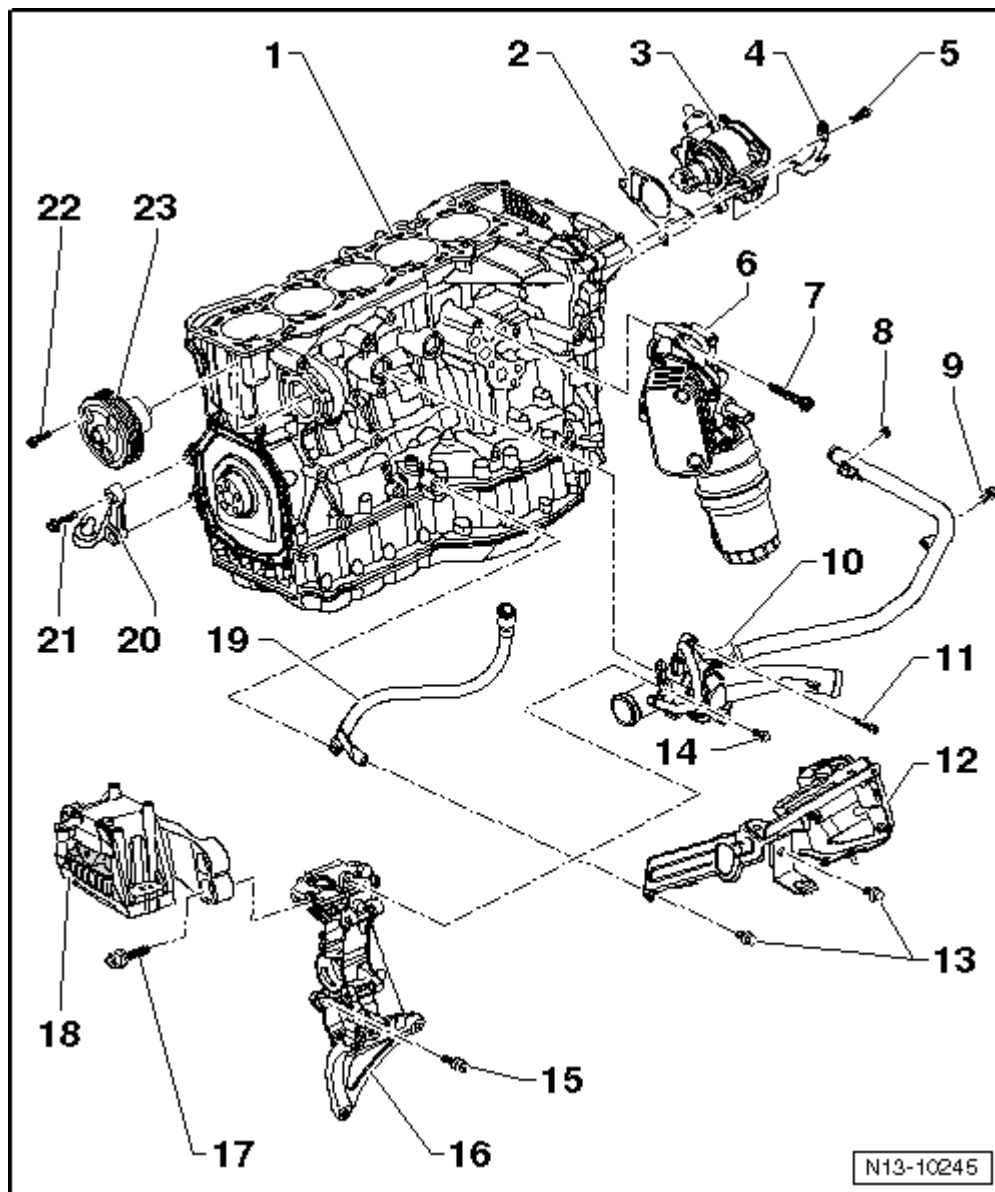


Fig. 9: Attachments, Assembly Overview - Part II - Engine Front/Side
 Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

1. Cylinder Block
2. Gasket
 - Always replace.
3. Brake Booster Vacuum Pump
 - Do not open.
 - Removing and installing, refer to **VACUUM PUMP** .
4. Bracket

5. Bolt
 - 10 Nm
6. Oil Filter Adapter
 - Overview, refer to **OIL FILTER ADAPTER OVERVIEW** .
7. Bolt
 - 25 Nm
8. Nut
 - 10 Nm
9. Bolt
 - 10 Nm
10. Thermostat Housing
 - With thermostat and coolant pipe.
11. Bolt
 - 10 Nm
12. Intake Manifold Support
 - Only for engines with a Secondary Air Injection (AIR) system.
13. Bolt
 - 25 Nm
14. Bolt
 - 10 Nm
15. Bolt
 - 25 Nm
16. Accessory Bracket
17. Bolt
 - 40 Nm + an additional 90° (1/4) turn.
18. Engine Mount
19. Guide Tube
 - For the oil dipstick.
20. Bracket
21. Bolt
 - 25 Nm
22. Bolt
 - 10 Nm
23. Coolant Pump
 - Removing and installing, refer to **COOLANT PUMP** .

SEALING FLANGE AND DRIVE PLATE/FLYWHEEL OVERVIEW

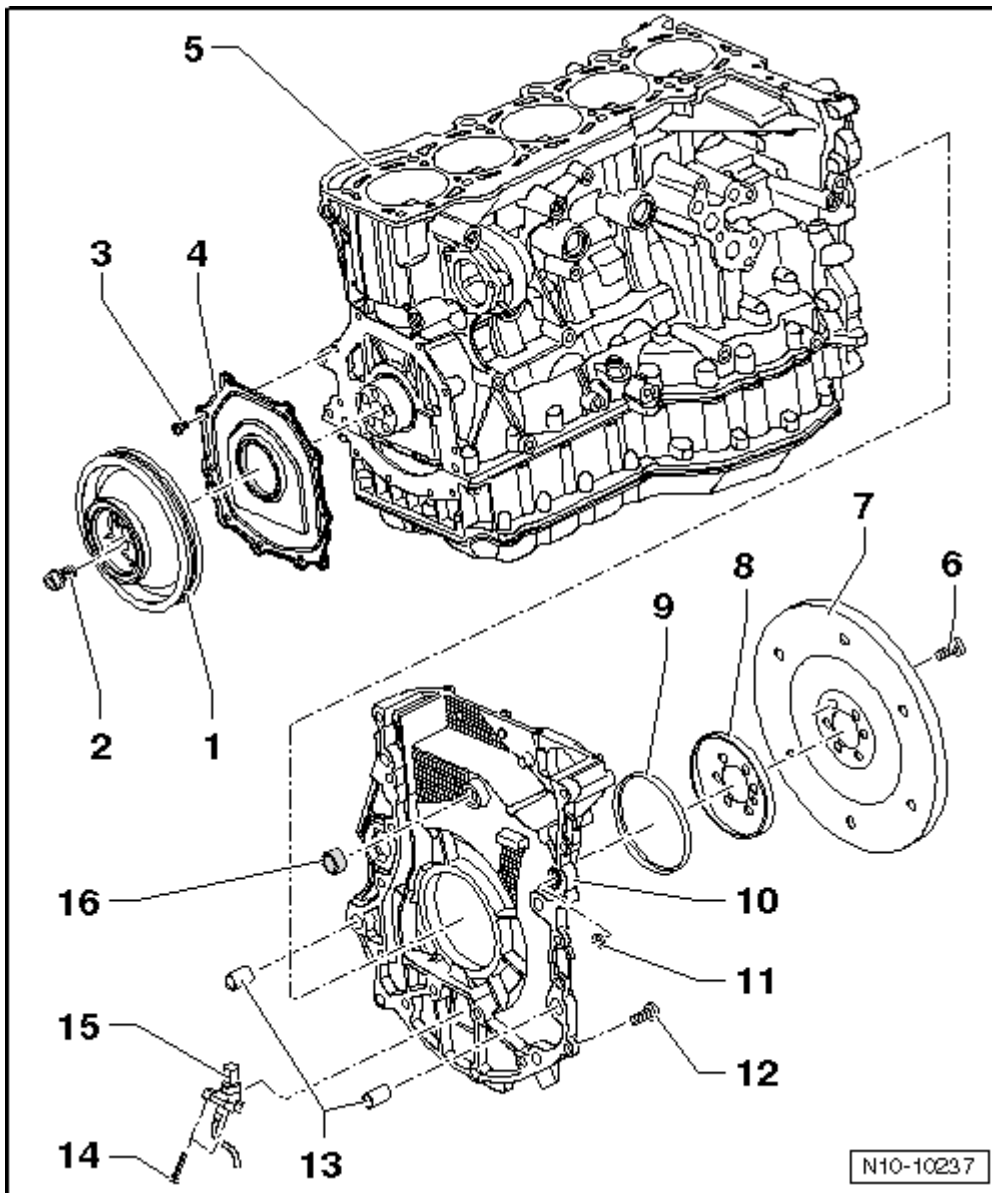


Fig. 10: Sealing Flanges And Flywheel/Drive Plate Assembly Overview
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

1. Vibration Damper
 - There are different versions.
2. Bolts
 - 50 Nm + an additional 90° (1/4) turn.
 - Always replace.
 - Use a strength category 10.9 bolt only.
 - Quantity: 5
3. Bolt
 - 10 Nm

4. Sealing Flange, Belt Pulley Side
 - With an integrated seal.
 - Removing and installing, refer to **SEALING FLANGE, BELT PULLEY SIDE**.
5. Cylinder Block
6. Bolt
 - 60 Nm + an additional 90° (1/4) turn.
 - Always replace.
7. Drive Plate/Flywheel
 - To remove, lock the crankshaft using the locking pin T40069.
 - The flywheel must not be pried out or the sealing flange will be damaged.
 - Drive plate removing and installing. Refer to **DRIVE PLATE**.
 - Flywheel removing and installing, refer to **FLYWHEEL**.
8. Sensor Wheel
 - For the engine speed sensor.
 - With a position holder.
9. Seal, Transmission Side
 - Removing and installing, refer to **SEAL, TRANSMISSION SIDE**.
10. Sealing Flange, Transmission Side
 - Removing and installing, refer to **SEALING FLANGE, TRANSMISSION SIDE**.
11. O-ring
 - Always replace.
12. Bolt
 - 25 Nm
13. Alignment Sleeves
14. Bolt
 - 5 Nm
15. Engine Speed Sensor -G28-
16. Seal
 - Always replace.

FLYWHEEL OVERVIEW

NOTE: **Servicing the clutch, refer to GENERAL INFORMATION .**

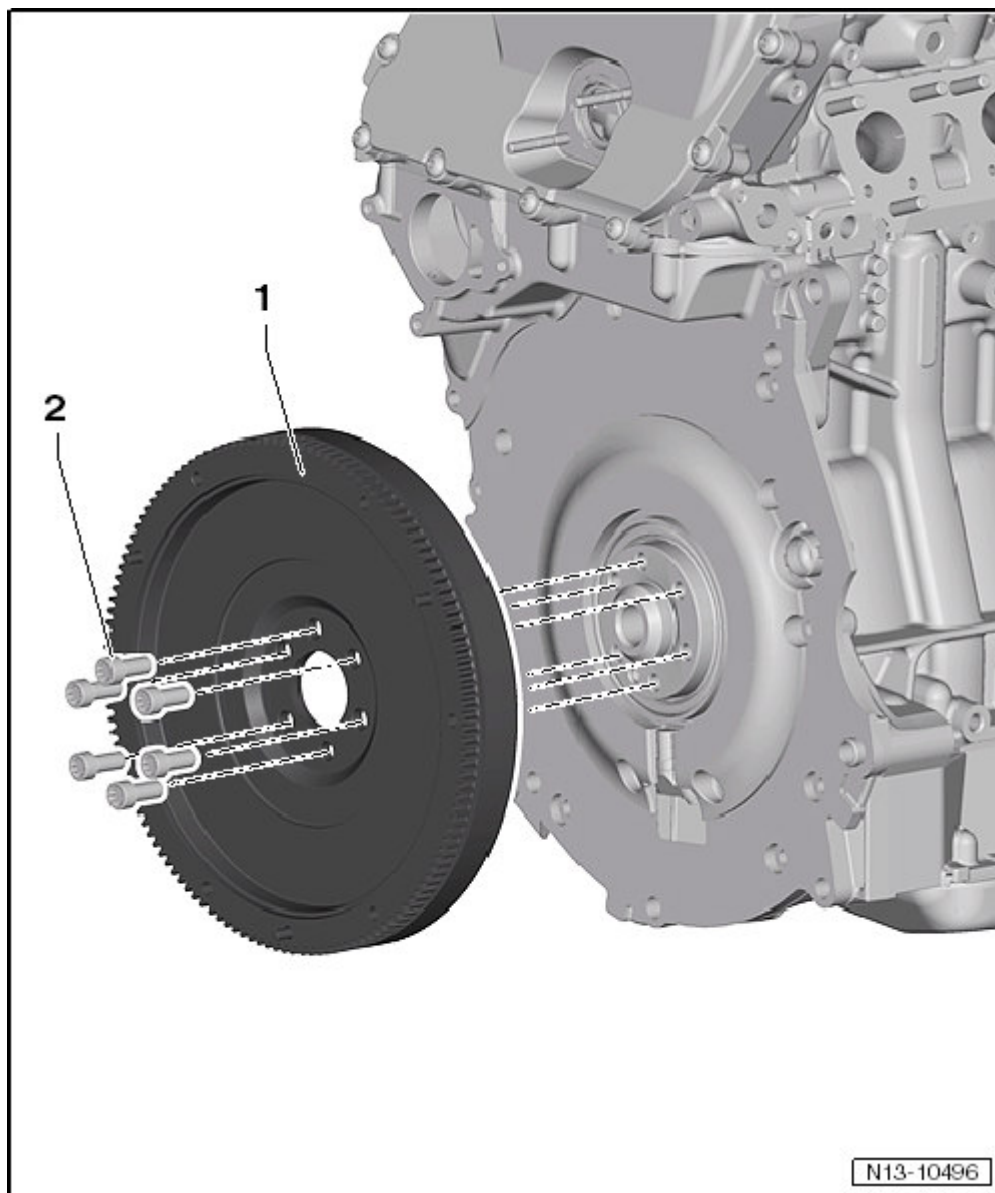


Fig. 11: Flywheel Overview

Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

1. Flywheel
2. Bolts
 - 60 Nm + an additional 90° (1/4) turn.
 - Always replace.

CRANKSHAFT OVERVIEW

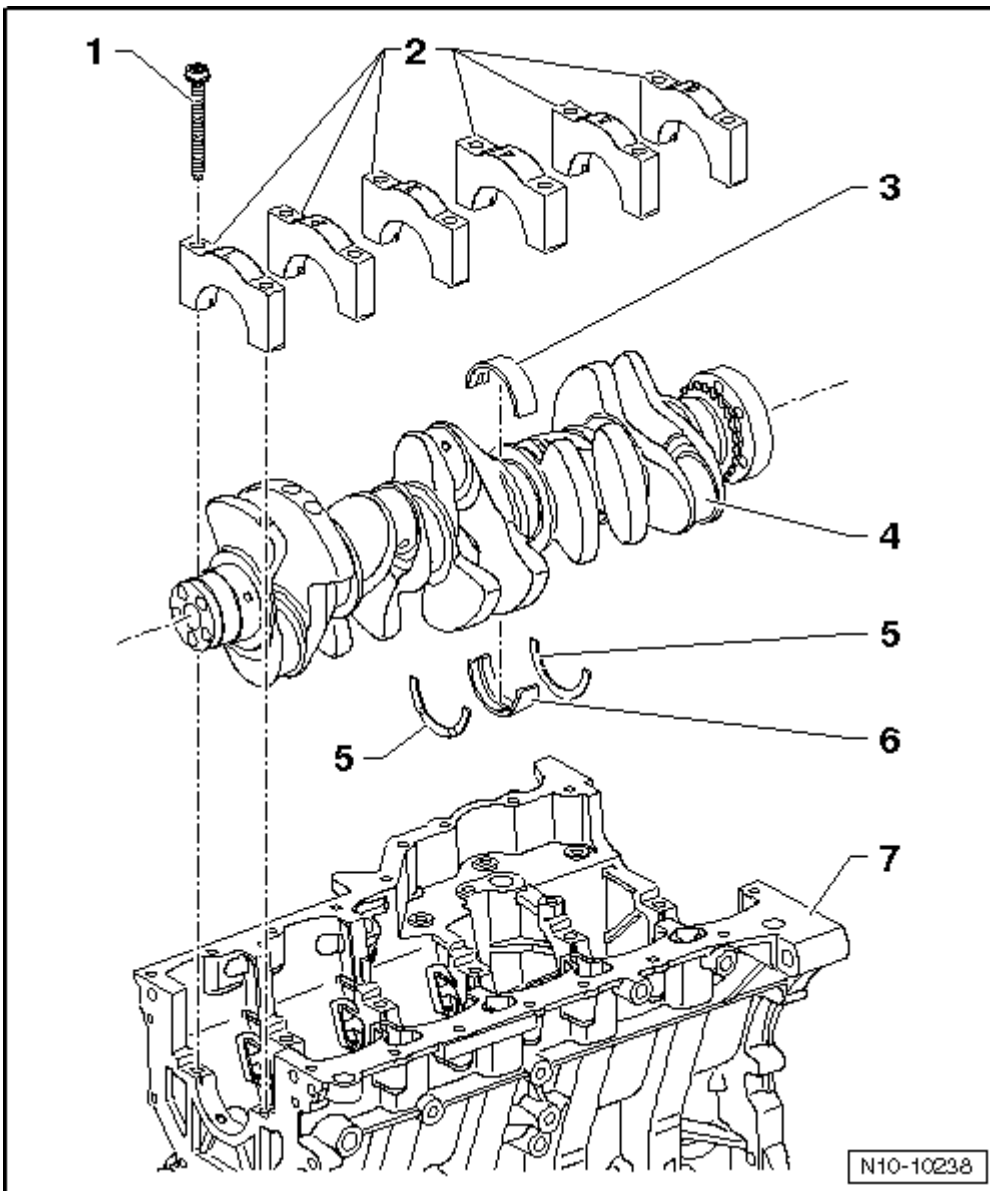


Fig. 12: Crankshaft, Assembly Overview

Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

1. Bolt

- 40 Nm + an additional 90° (1/4) turn.
- Always replace.
- Fully threaded.
- Tighten to 40 Nm (but not the additional 90°) to measure the radial play in the crankshaft.

2. Bearing Cap

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

3. Bearing Shell for the Bearing Cap

- Crankshaft bearing shell, allocating. Refer to **Fig. 14**.
 - Without a lubricating groove.
 - Do not interchange used bearing shells (mark them).
4. Crankshaft
 - Axial play, checking. Refer to **CRANKSHAFT AXIAL CLEARANCE, CHECKING**.
 - Radial clearance, checking. Refer to **CRANKSHAFT RADIAL CLEARANCE, CHECKING**.
 - Crankshaft dimensions, refer to **CRANKSHAFT DIMENSIONS**.
 - Locking the crankshaft. Refer to **CRANKSHAFT, LOCKING**.
 5. Thrust Washers
 - For bearing 3.
 - The side lubricating grooves face outward.
 6. Bearing Shell for the Cylinder Block
 - With a lubricating groove.
 - Crankshaft bearing shell, allocating. Refer to **Fig. 13**.
 - Do not interchange used bearing shells (mark them).
 7. Cylinder Block

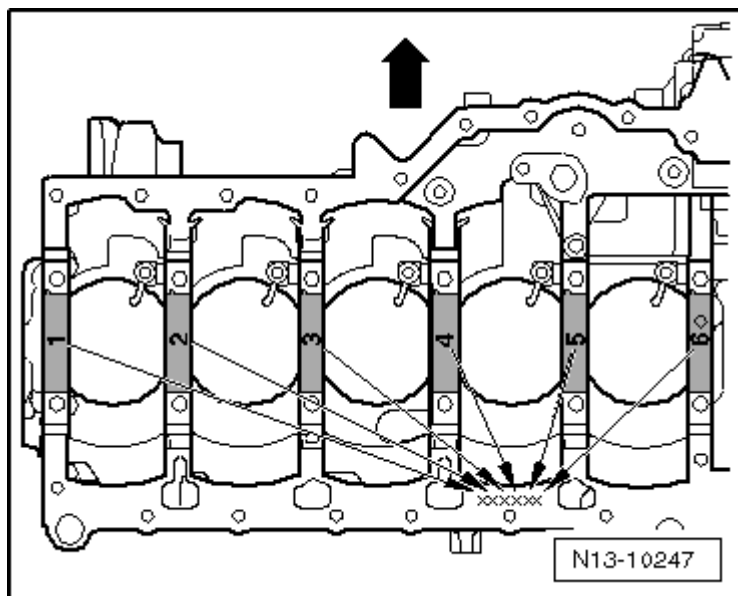


Fig. 13: Identification Of Top Crankshaft Bearing Shells
 Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

From the factory, the upper bearing shells are allocated to the cylinder block with the correct thickness. 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.

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Letter on Cylinder Block	Colored Dot on the Bearing Shell
G=	Yellow
B=	Blue
R=	Red

NOTE: The -arrow- points in the direction of travel.

If the colored dot is not visible, use the blue bearing shell.

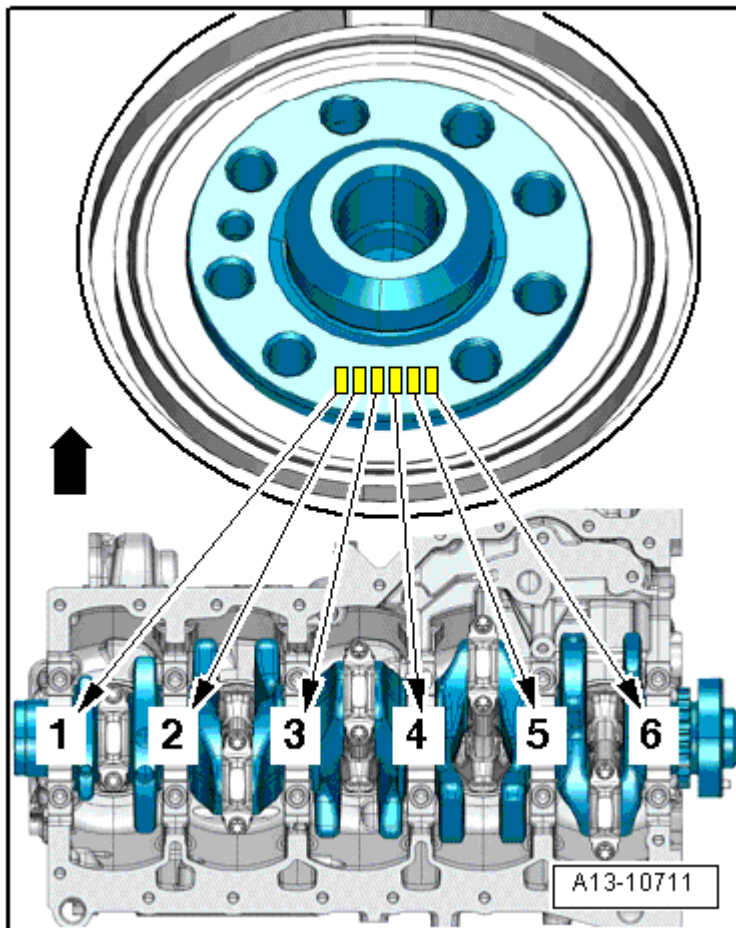


Fig. 14: Allocation, Lower Bearing Shells (Bearing Cap)
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

- From the factory, the lower bearing shells are allocated to the bearing cap with the correct thickness. Colored dots on the sides of the bearing shells serve to identify bearing shell thickness.
- The allocation of the bearing shells for the bearing cap is identified by a series of letters on the vibration damper. The first letter in the row of letters represents bearing "1", the second letter is for bearing "2",

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ENGINE 2.5 Liter - Crankshaft, Cylinder Block - Engine Code(s): BGP, BGQ, CBTA & CBUA

etc.

Letter on Vibration Damper	Colored Dot
R =	Red
G =	Yellow
B =	Blue
W =	White

NOTE: The -arrow- points in the direction of travel.

CRANKSHAFT, LOCKING

Special tools and workshop equipment required

- Torque Wrench (5-50 Nm) V.A.G 1331
- Crankshaft Adapter T03003
- Locking Pin T40069

Procedure

- Remove the noise insulation. Refer to Description and Operation .
- Remove the front section of the right wheel housing liner. Refer to FRONT WHEEL HOUSING LINER .
- Install the crankshaft adapter T03003 onto the bolts of the vibration damper.

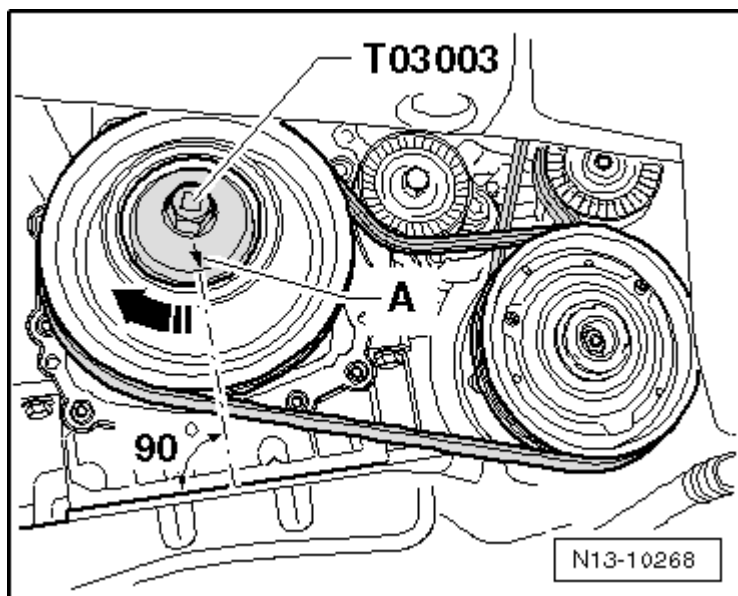


Fig. 15: Attaching Wrench T03003 On To Bolts Of Belt Pulley
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

The crankshaft adapter T03003 can only be installed correctly in one position.

-- Rotate the crankshaft in engine rotation direction until the arrow -A- on the crankshaft adapter T03003 faces downward vertically in comparison to the engine axis.

This position corresponds approximately to the Top Dead Center (TDC) position of the crankshaft at cylinder 5.

-- Remove the locking bolt -1- from the rear of the cylinder block.

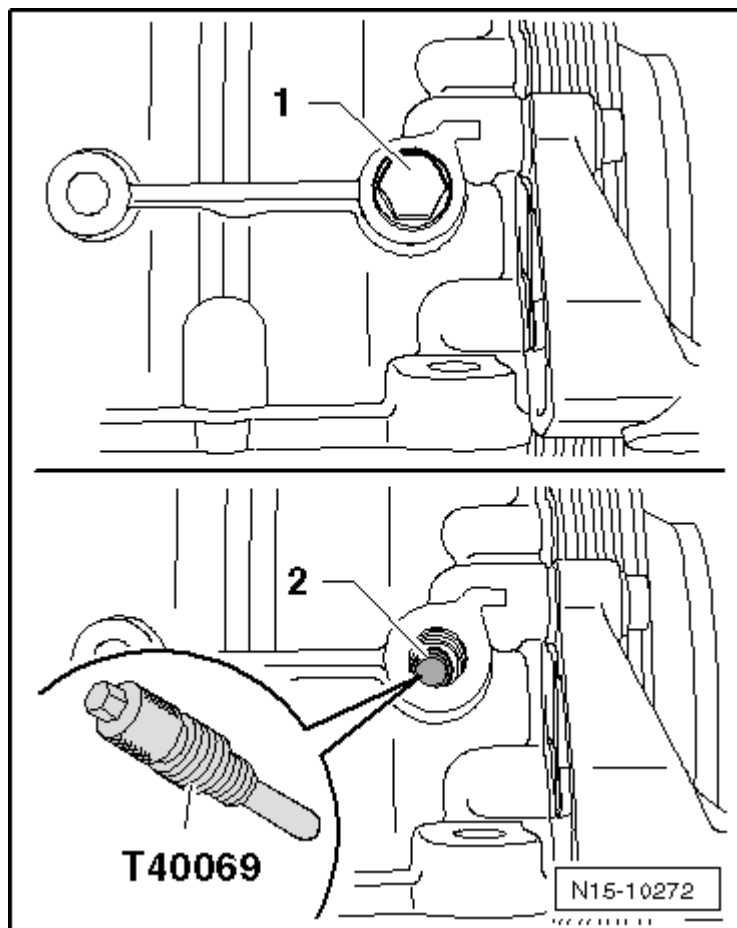


Fig. 16: Identifying Locking Pin T40069 And Installing Plug
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Look through the threaded hole and check whether the bore -2- in the crankshaft aligns with the threaded hole.

Use a mirror to do so, if necessary.

-- Rotate the crankshaft slightly if necessary.

-- If the bore and the hole align, install the locking pin T40069 completely into the threaded hole and tighten it to 10 Nm.

NOTE: With the engine removed, the TDC mark can also be seen on the vibration damper and sealing flange. The notches -A and B- must align.

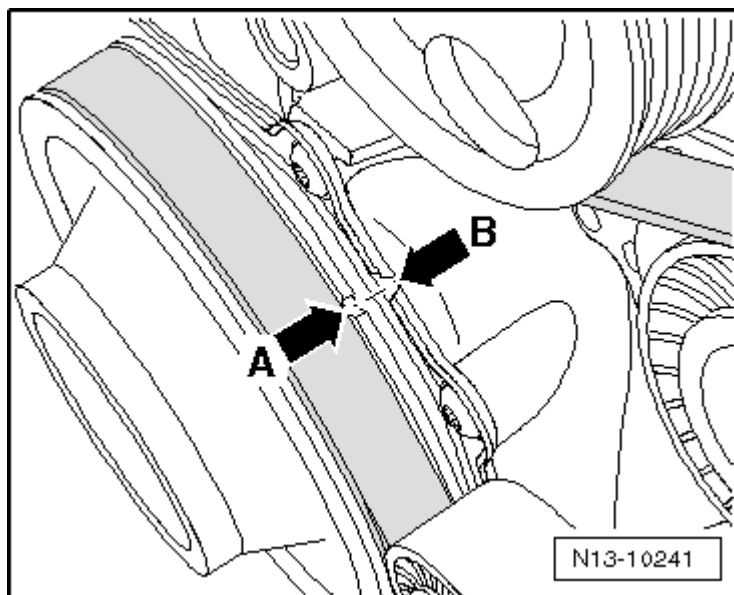


Fig. 17: Aligning Belt Pulley And Sealing Flange
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Check whether the crankshaft can be rotated.

After Disassembly and Assembly Work

-- Remove the locking pin T40069 and install the locking bolt -1-.

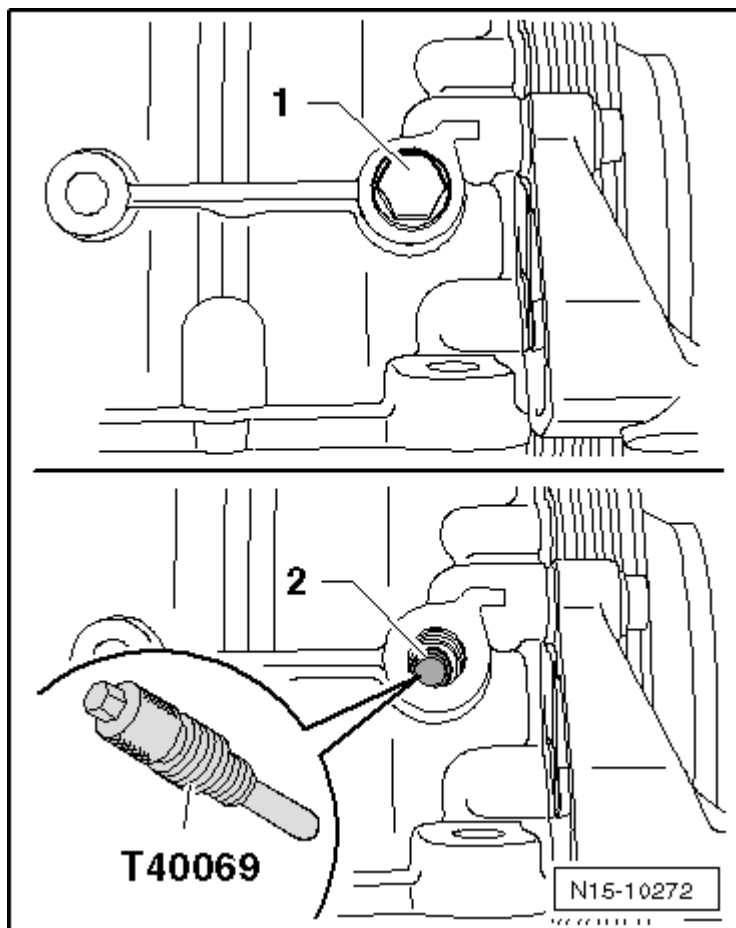


Fig. 18: Identifying Locking Pin T40069 And Installing Plug
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

The rest of the installation follows the reverse of the removal procedure.

Tightening Specifications

Component	Nm
Locking bolt to rear of cylinder block	30 Nm

PISTONS AND CONNECTING ROD OVERVIEW

NOTE: The engine is to be secured to the engine lateral bracket T03001 when performing assembly work.

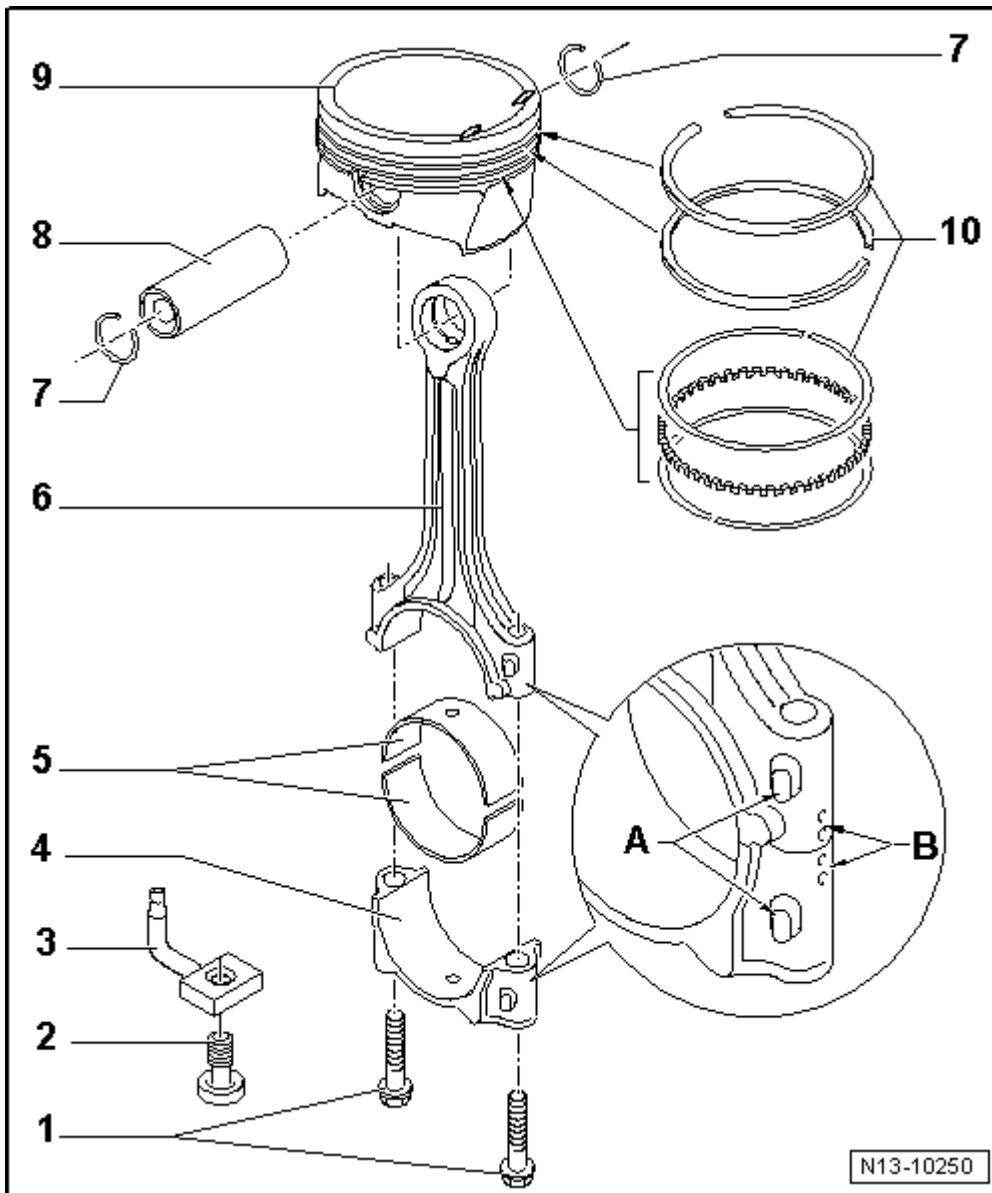


Fig. 19: Piston And Connecting Rod, Assembly Overview
 Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

1. Bolt
 - 30 Nm + an additional 90° (1/4) turn.
 - Always replace.
 - Lubricate the threads and contact surface.
 - Tighten to 30 Nm to measure radial play, do not tighten the additional 90° turn.
2. Pressure Relief Valve
 - 27 Nm
 - Opening pressure: 1.3 to 1.6 bar excess 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) for the connecting rod, the connecting rod bearing cap only fits in one position and only on the appropriate connecting rod.
- Mark which cylinder the cap belongs to.
- Installed position: the marks -A- point to the belt pulley side.

5. Bearing Shell

- Note the installed position, refer to **Fig. 20**.
- Do not interchange used bearing shells (mark them).
- Axial play:

New: 0.10 to 0.35 mm

Wear limit: 0.4 mm

- Measure radial clearance using Plastigage®:

New: 0.02 to 0.06 mm

Wear limit: 0.09 mm

Do not rotate the crankshaft when measuring radial play.

6. Connecting Rod

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

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. 24**.
- 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.
- Piston and cylinder bore, checking. Refer to **PISTONS AND CYLINDER BORE, CHECKING**.

10. Piston Rings

- Offset gaps by 120°.
- Use piston ring pliers for removal and installation.
- Marks face toward the piston crown.
- Checking the ring gap. Refer to **Fig. 22**.
- Checking the piston ring groove clearance. Refer to **Fig. 23**.

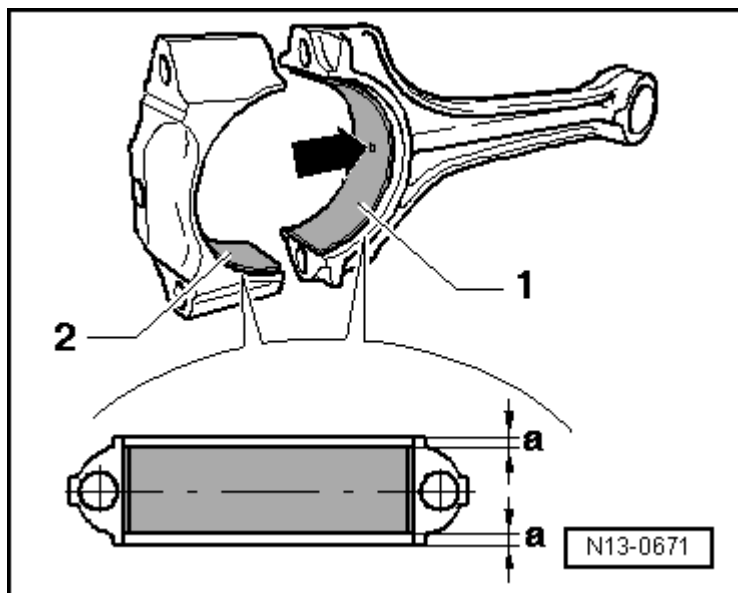


Fig. 20: Bearing Shells - Installed Positions

Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

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

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.

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

SPECIFICATIONS

CRANKSHAFT DIMENSIONS

(Dimensions are in mm)

Honing Dimension	Crankshaft Bearing Pin Diameter		Connecting Rod Bearing Pin Diameter	
Basic dimension	58.00	-0.022 -0.042	47.80	-0.022 -0.042
1st oversize	57.75	-0.022 -0.042	47.55	-0.022 -0.042
2nd oversize	57.50	-0.022 -0.042	47.30	-0.022 -0.042
Stage III	57.25	-0.022 -0.042	47.05	-0.022 -0.042

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FASTENER TIGHTENING SPECIFICATIONS

Component	Fastener Size	Nm
Accessory Bracket to Cylinder Block Bolt	-	25
Air Conditioning Compressor to Accessory Bracket Bolt	-	25
Air Conditioning Compressor Ribbed Belt Tensioner to Accessory Bracket Bolt	-	35
Bracket to Cylinder Block Bolt	-	25
Brake Booster Vacuum Pump to Control Housing Cover Bolt	-	10
Connecting Rod Bearing Cap to Connecting Rod Bolt 1, 4	-	30 + 90°
Coolant Pipe Bolt/Nut	-	10
Coolant Pump to Cylinder Block Bolt	-	10
Cover Plate to Cylinder Block Bolt	-	10
Crankshaft Bearing Cap to Cylinder Block Bolt ⁽¹⁾	-	40 + 90°
Drive Plate/Flywheel to Crankshaft Bolt ⁽¹⁾	-	60 + 90°
Engine Mount to Accessory Bracket Bolt	-	40 + 90°
Engine Speed Sensor to Sealing Flange, Transmission Side Bolt	-	5
Generator and Coolant Pump Ribbed Belt Tensioner to Accessory Bracket Bolt	-	35
Intake Manifold Support/Oil Dipstick Guide Tube to Cylinder Block Bolt	-	25
Knock Sensor to Cylinder Block Bolt ⁽³⁾	-	20
Locking Bolt to Cylinder Block	-	30
Lower Idler Pulley with Bracket to Accessory Bracket Bolt	-	25
Oil Filter Bracket to Cylinder Block Bolt	-	25
Pressure Relief Valve	-	27
Sealing Flange, Belt Pulley Side to Cylinder Block Bolt	-	10
Sealing Flange, Transmission Side to Cylinder Block Bolt	-	25
Thermostat Housing to Cylinder Block Bolt	-	10
Upper Idler Pulley with Bracket to Accessory Bracket Bolt	-	8
Vibration Damper Pulley to Crankshaft Bolt ^{1, 2}		50 + 90°
(1) Always replace		
(2) Only use a strength category 10.9 bolt		

(3) Tightening specification affects the function of the knock sensor

(4) Lubricate the threads and contact surface

DIAGNOSIS AND TESTING

CRANKSHAFT AXIAL CLEARANCE, CHECKING

Special tools and workshop equipment required

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

Procedure

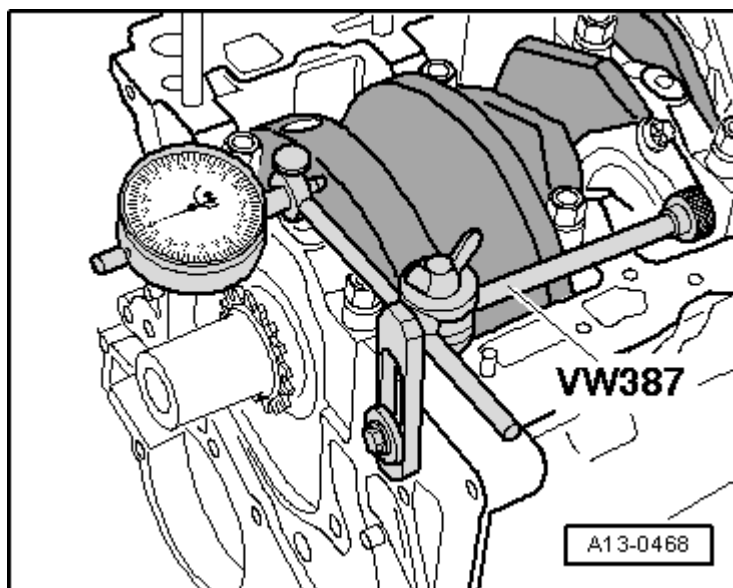


Fig. 21: Identifying Dial Indicator Attached Together With VW387 Dial Gauge Holder To Cylinder Block

Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Install the dial gauge VAS 6079 with the dial gauge holder VW 387 onto the cylinder block as shown in the illustration.

-- Place the dial gauge against the crankshaft counterweight.

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

-- Press the crankshaft off the dial gauge and read the measurement.

Axial clearance:

New: 0.07 to 0.21 mm

Wear limit: 0.30 mm

CRANKSHAFT RADIAL CLEARANCE, CHECKING

Special tools and workshop equipment required

- Plastigage®

Procedure

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

Replace bearing shells that are worn down to the base layer.

- Remove the bearing cap.
- Clean the bearing cap and bearing journals.
- Place the Plastigage® over the entire width of the bearing journal or into the bearing shell.
 - The Plastigage® must rest in the center of the bearing shell.
- Install the bearing cap and tighten the bolts to 40 Nm without rotating the crankshaft.
- Remove the bearing cap.
- Compare the width of the Plastigage® with the calibrated scale.

Radial clearance:

New: 0.023 to 0.043 mm

Wear limit: 0.07 mm

PISTONS AND CYLINDER BORE, CHECKING

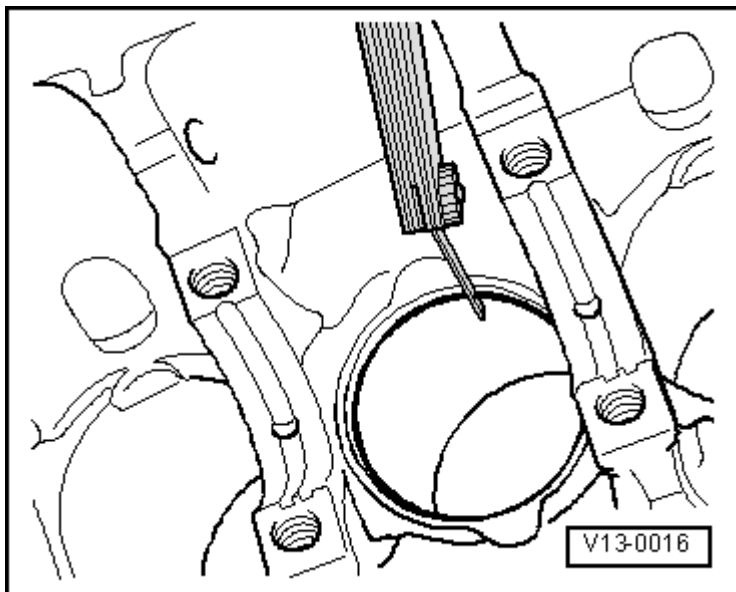


Fig. 22: Checking Piston Ring Gap

Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

Special tools and workshop equipment required

- Feeler Gauge

-- Insert the ring at a right angle from above, to the lower end of cylinder 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

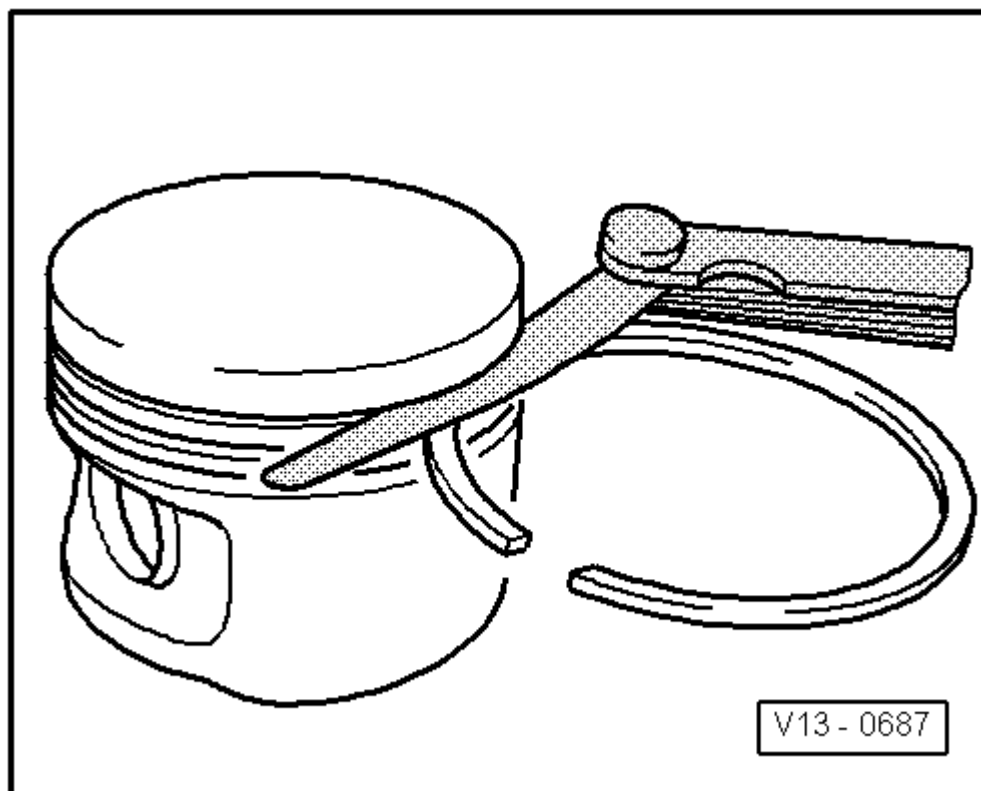


Fig. 23: Checking Piston Ring Gap

Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

Special tools and workshop equipment required

- Feeler Gauge

-- Clean the groove in the ring 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

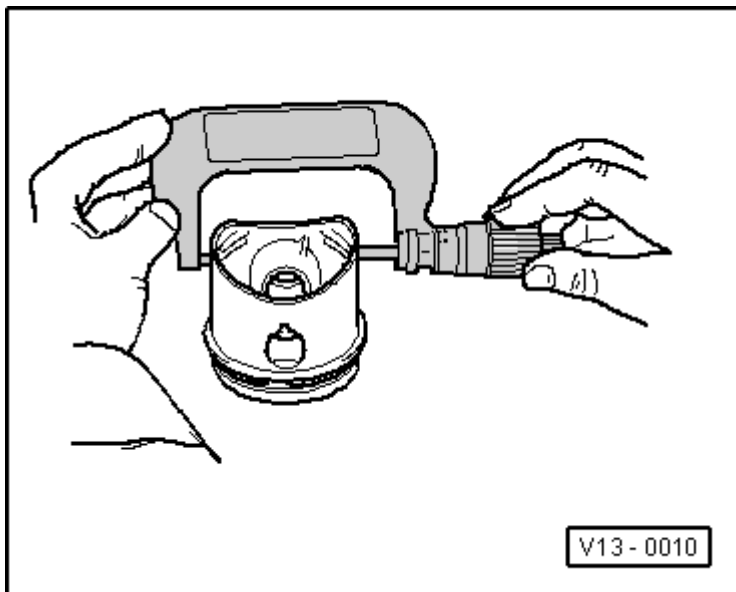


Fig. 24: Checking Piston

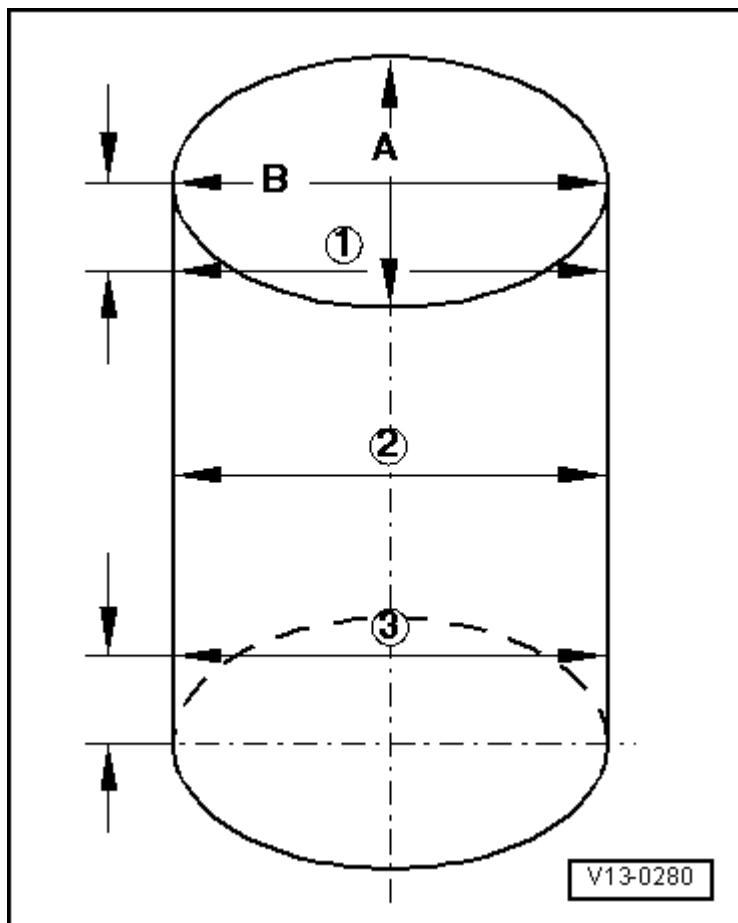
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

Special tools and workshop equipment required

- Micrometer 75-100 mm VAS 6071

-- Take the measurement approximately 10 mm from the lower edge of the piston skirt and offset 90° to the piston axis.

Deviation from nominal dimension: Max. 0.04 mm

**Fig. 25: Checking Cylinder Bores**

Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

NOTE: The cylinder bore must not be measured if the cylinder block is secured to the engine stand with the engine lateral bracket T03001, or else results may be incorrect.

Special tools and workshop equipment required

- Cylinder Gauge VAS 6078

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

Deviation from nominal size: Max. 0.08 mm.

Piston and Cylinder Reconditioning Dimension

Honing Dimension	Piston Diameter	Cylinder Bore Diameter
Basic dimension mm	82.465 ⁽¹⁾	82.51
(1) The measurement does not include the graphite coating, which is 0.02 mm thick. The graphite		

coating wears off.

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 .
- Remove the front section of the right wheel housing liner. Refer to FRONT WHEEL HOUSING LINER .

Removing the Air Conditioning (A/C) Compressor Ribbed Belt

- Mark the rotation direction on the ribbed belt.
- Rotate the belt tensioner -1- in the -direction of the arrow- using a 15 mm box end wrench -A- as illustrated, and then lock it into place using the locking pin T10060 A.

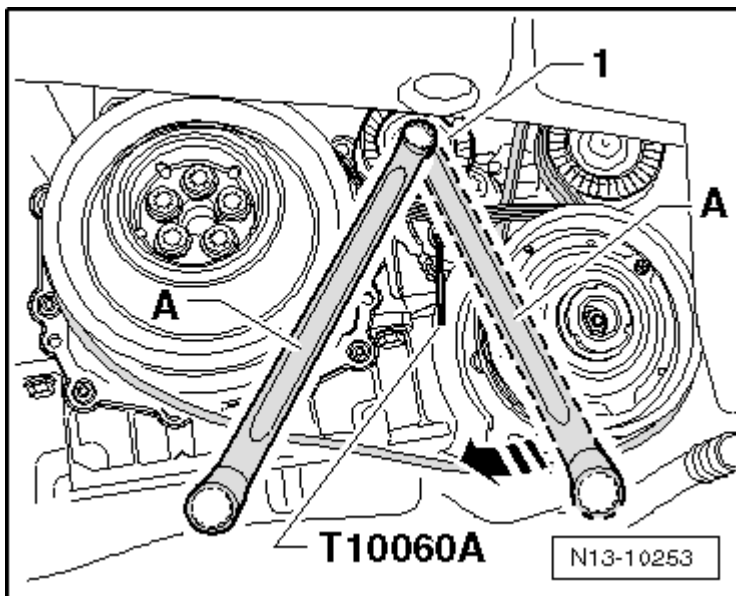


Fig. 26: Swiveling Tensioning Element Using Open End Wrench And Securing Using Locking Pin T10060A

Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

- Remove the A/C compressor ribbed belt.

Removing Generator, Power Steering Pump and Coolant Pump Ribbed Belt

- Relieve the tension on the belt tensioner -1- for the A/C compressor ribbed belt (remove the locking pin T10060 A).
- Mark the running direction of the generator, power steering pump and coolant pump ribbed belt.
- Insert the locking pin T10060 A into the belt tensioner -2-.

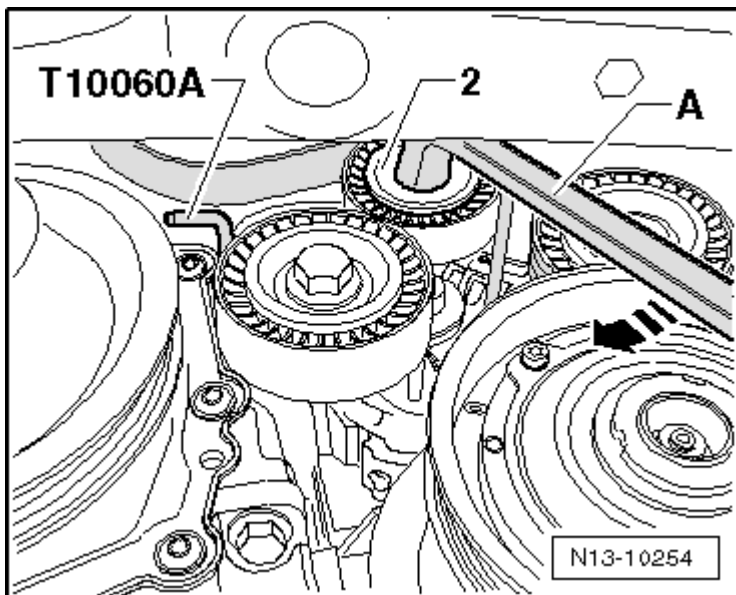


Fig. 27: Swiveling Tensioning Element Using Open End Wrench And Securing Using Locking Pin T10060A

Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

- Rotate the belt tensioner -2- in the -direction of the arrow- using a 15 mm box end wrench -A- and then lock it into place using the locking pin T10060 A.
- Remove the generator, power steering pump and coolant pump ribbed belt.

Installing

Install in reverse order of removal. Note the following:

- Place the generator, power steering pump and coolant pump belt around the pulleys, then lastly around the idler pulley -3-.

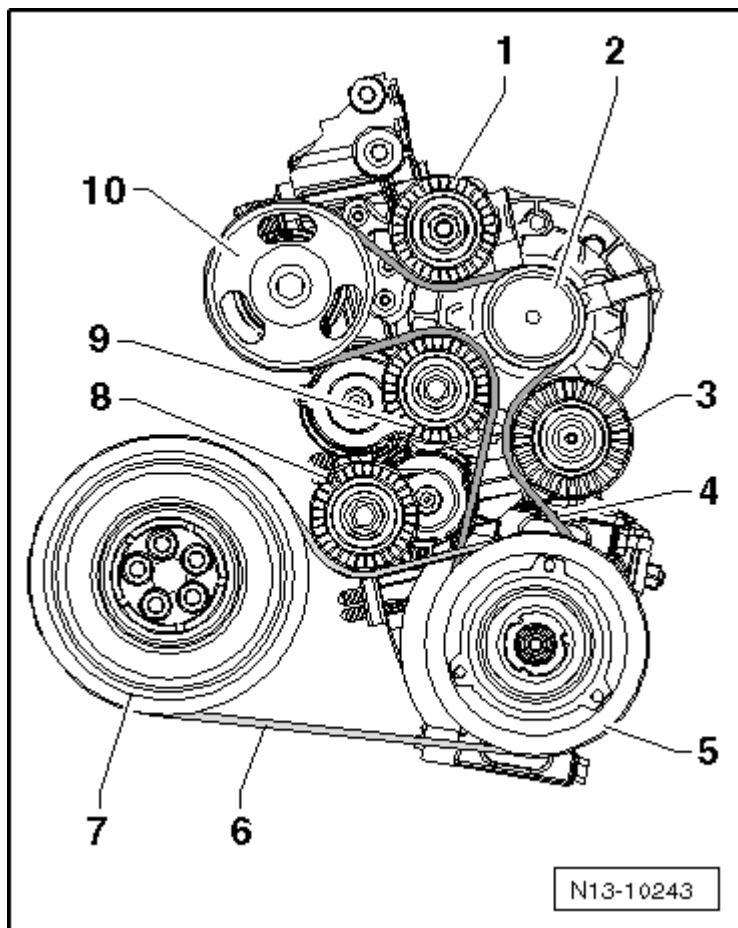


Fig. 28: Ribbed Belt Routing

Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Rotate the A/C compressor pulley before tensioning the generator, power steering pump and coolant pump ribbed belt. Make sure the ribbed belt is seated correctly on the pulleys.

-- Before installing the A/C compressor ribbed belt, secure the belt tensioner using the locking pin T10060 A.

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

-- Start the engine and check the belt running direction.

RIBBED BELT TENSIONER, A/C COMPRESSOR

CAUTION: Note the following whenever working inside the engine compartment due to limited space:

- Route all lines and wires in their original locations.
- Ensure sufficient clearance to all moving or hot components.

2007 Volkswagen Rabbit

ENGINE 2.5 Liter - Crankshaft, Cylinder Block - Engine Code(s): BGP, BGQ, CBTA & CBUA

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

-- Loosen the bolt -2- for the belt tensioner -1- and remove the tensioner.

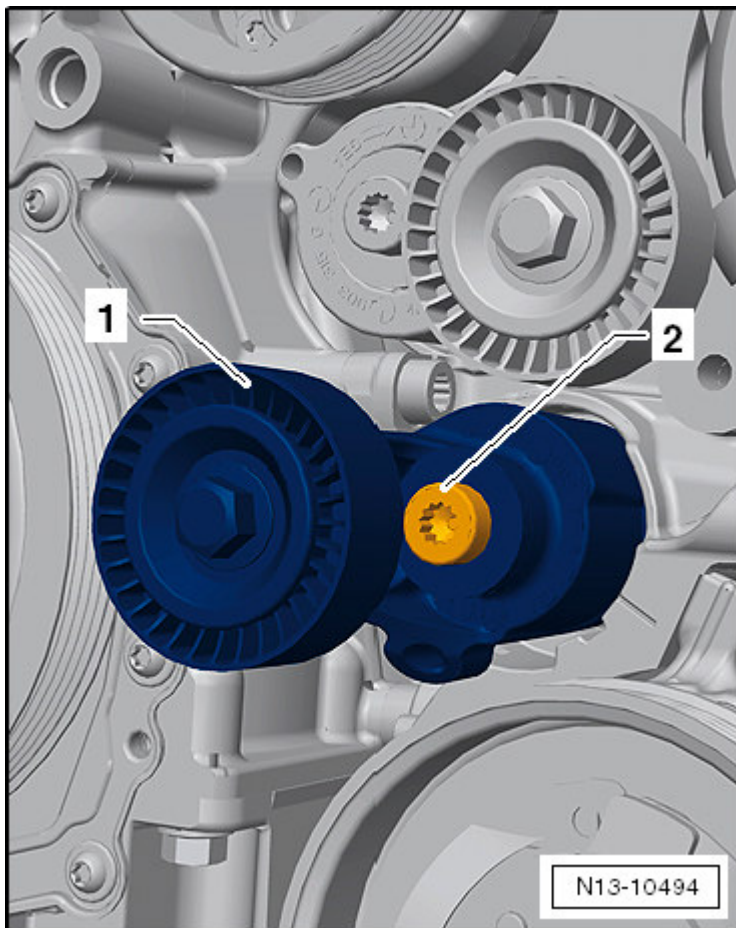


Fig. 29: Belt Tensioner And Bolt

Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

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

Tightening Specification

Component	Nm
Belt tensioner to accessory bracket	35

RIBBED BELT TENSIONER, GENERATOR, POWER STEERING PUMP AND COOLANT PUMP

CAUTION: Note the following whenever working inside the engine compartment due to limited space:

- Route all lines and wires in their original locations.
- Ensure sufficient clearance to all moving or hot components.

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

-- Loosen the bolt -2- for the belt tensioner -1- and remove the tensioner.

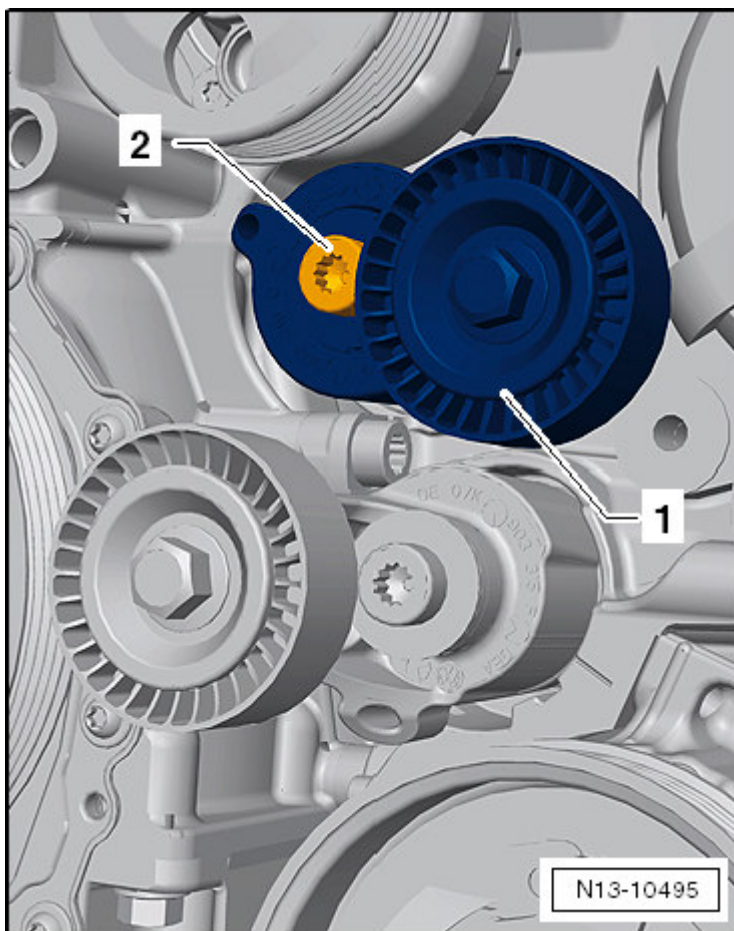


Fig. 30: Belt Tensioner And Bolt

Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

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

Tightening Specification

Component	Nm
Belt tensioner to accessory bracket	35

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

- Torque Wrench (5-50 Nm) V.A.G 1331
- Crankshaft Adapter T03003
- Locking Pin T40069

CAUTION: Note the following whenever working inside the engine compartment due to limited space:

- Route all lines and wires in their original locations.
- Ensure sufficient clearance to all moving or hot components.

Procedure

- Remove the noise insulation. Refer to Description and Operation .
- Remove the right front wheel housing liner. Refer to FRONT WHEEL HOUSING LINER .
- Install the crankshaft adapter T03003 onto the bolts for the vibration damper.

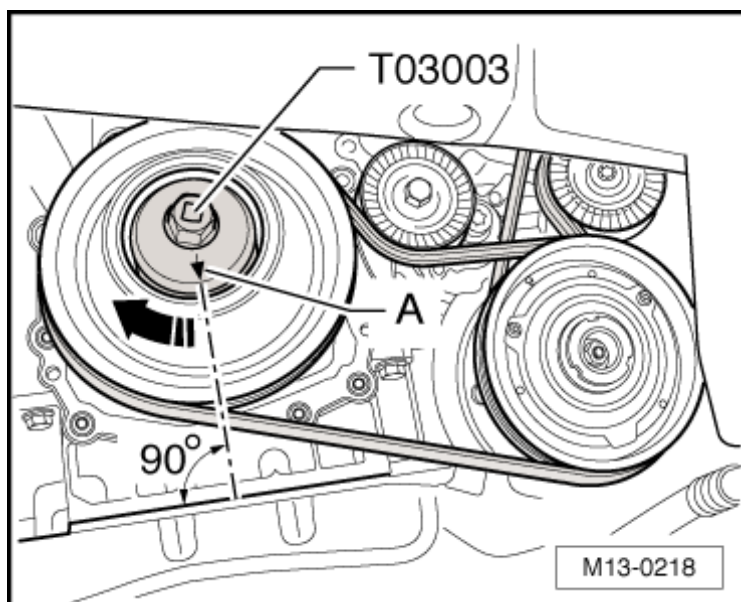


Fig. 31: Turning Crankshaft Only In Direction Of Engine Rotation
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

The crankshaft adapter T03003 can only be installed correctly in one position.

- Rotate the crankshaft in engine rotation direction -arrow- far enough the until arrow -A- on the crankshaft adapter T03003 points downward vertically, relative to engine axis.

This position corresponds approximately to the Top Dead Center (TDC) position of the crankshaft at cylinder 5.

NOTE: With the engine removed, The TDC mark can also be seen on the vibration damper and sealing flange. The notches -A and B- must align.

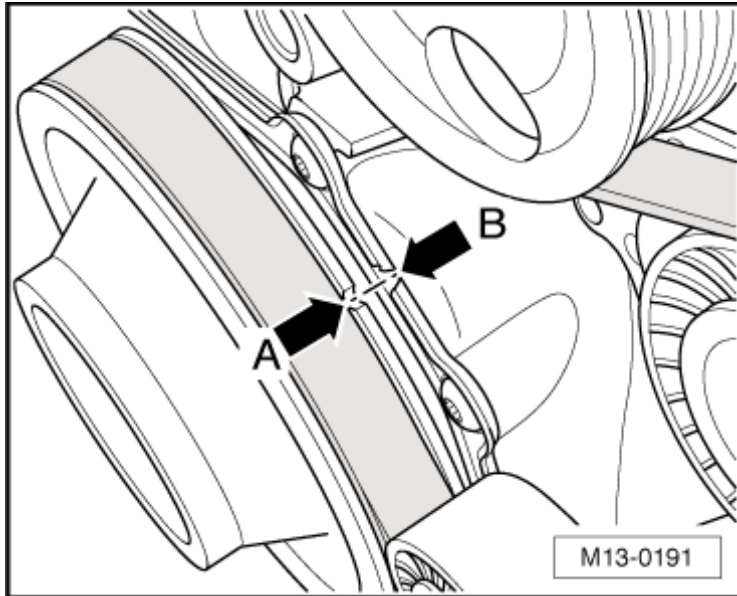


Fig. 32: Identifying Belt Pulley And Sealing Flange At TDC
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Remove the locking bolt -1- from the back of the cylinder block.

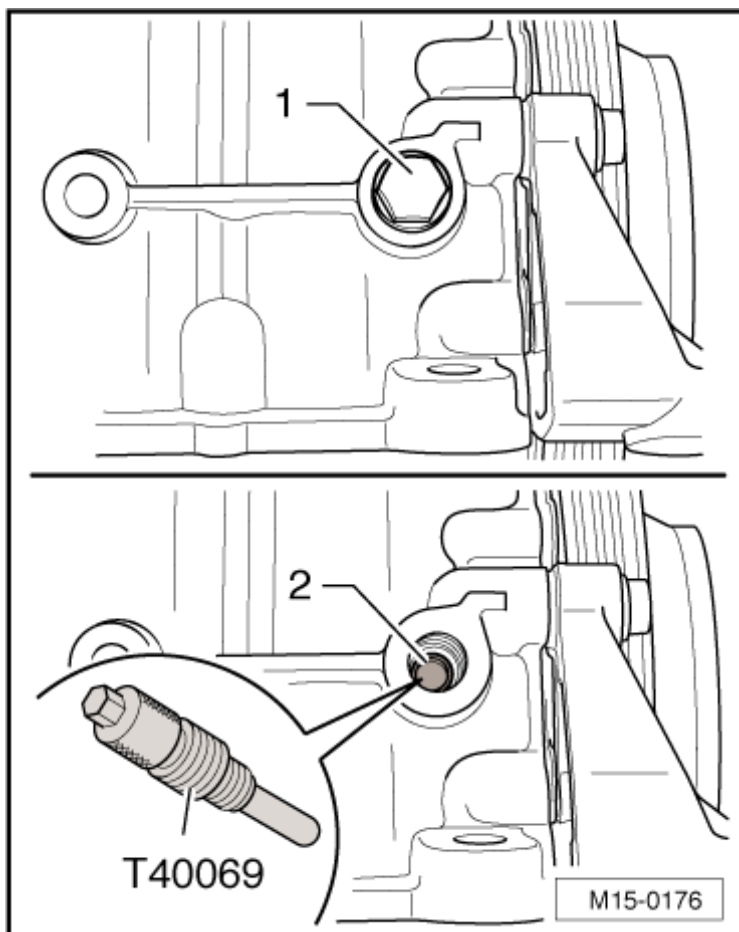


Fig. 33: Identifying Crankshaft Must Not Be Rotated Out Over TDC Marking
 Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Look through the threaded hole. Make sure the bore -2- in the crankshaft is lined up with the threaded hole.

Use a mirror for this, if necessary

-- Rotate the crankshaft slightly, if necessary.

-- When the bore and hole line up, install the locking pin T40069 all the way into the threaded hole and tighten it to 10 Nm. Make sure the crankshaft cannot be rotated.

-- Remove the Air Conditioning (A/C) compressor ribbed belt. Refer to **RIBBED BELT**.

-- Loosen the bolts for the vibration damper and remove the vibration damper.

- Replace the bolts
- Use strength category 10.9 bolts only
- 50 Nm + an additional 90° (1/4) 1 turn

After Disassembly and Assembly Work

-- Remove the locking pin T40069 and install the locking bolt -1-.

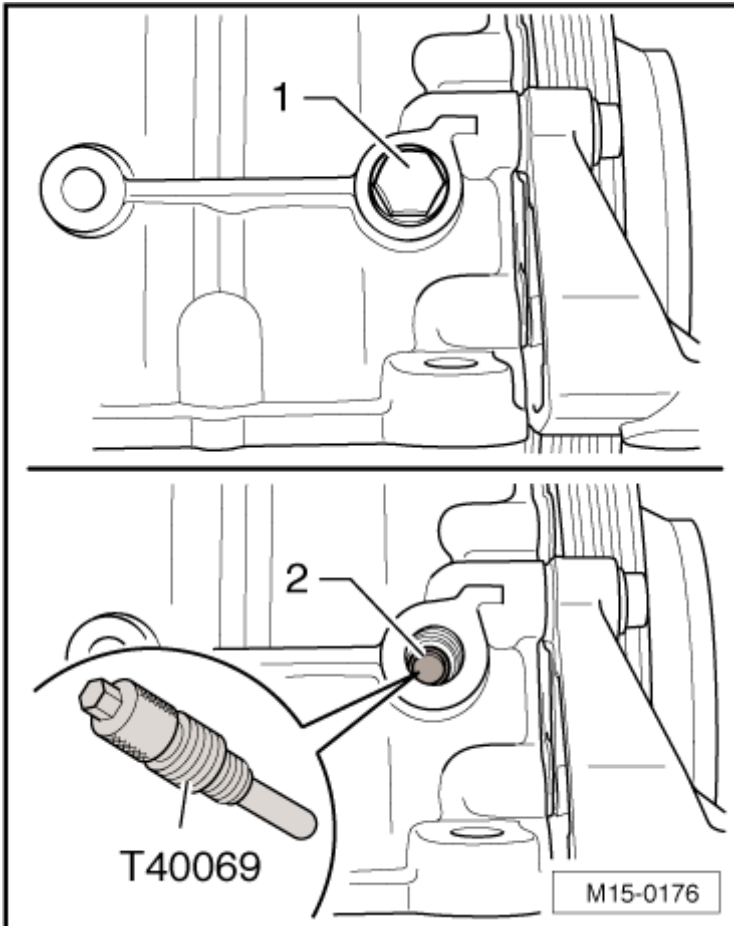


Fig. 34: Identifying Crankshaft Must Not Be Rotated Out Over TDC Marking
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

The rest of the installation follows the reverse of the removal procedure.

Tightening Specifications

Component	Nm
Locking bolt to rear of cylinder block	30

SEALING FLANGE, BELT PULLEY SIDE

Special tools and workshop equipment required

- Trim Removal Wedge 3409
- Oil Seal Guide Sleeve T03004
- Hand Drill with Plastic Brush Attachment
- Protective Eyewear

- Silicone Sealant D 174 003 A2

Removing

- Remove the Air Conditioning (A/C) compressor ribbed belt. Refer to **RIBBED BELT**.
- Lock the crankshaft. Refer to **CRANKSHAFT, LOCKING**.
- Remove the vibration damper.
- Remove the belt tensioner -1-.

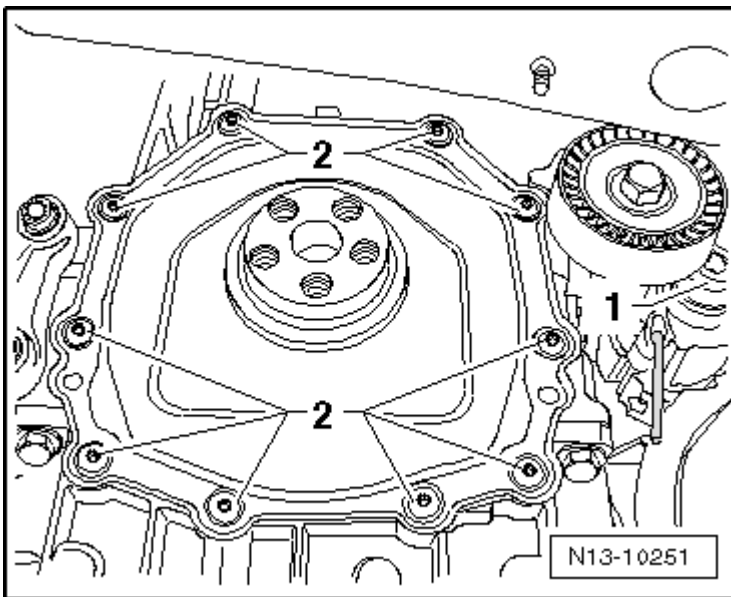


Fig. 35: Identifying Tensioning Element & Bolts

Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

- Remove the bolts -2-.
- Beginning at the alignment bushings -arrows-, pry off the sealing flange -1- using a suitable screwdriver -A-.

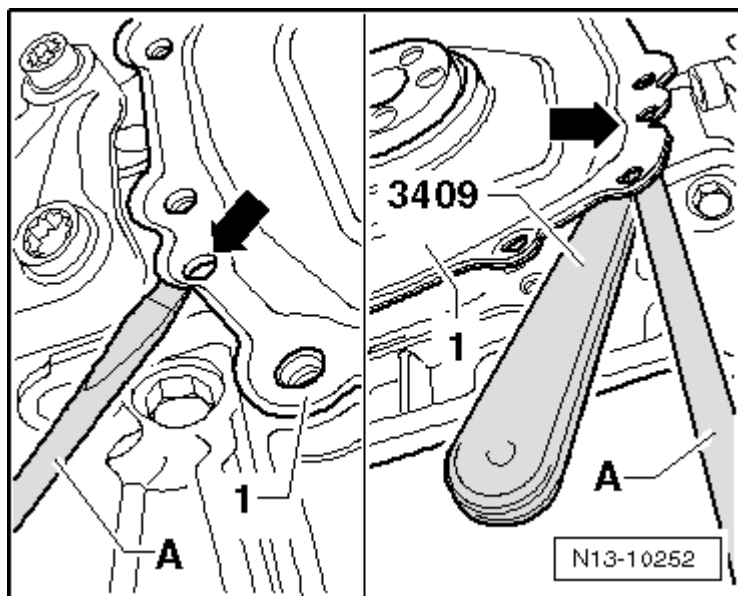


Fig. 36: Pressing Off Sealing Flange Using Suitable Screwdriver
 Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Use the trim removal wedge 3409 to support the screwdriver in order to prevent damage to the sealing surface on the cylinder block.

The sealing flange is damaged while removing.

-- Pry off the sealing flange completely.

NOTE: After removing the sealing flange, clean the trim removal wedge 3409 which is intended for the removal of interior equipment parts.

Installing

WARNING: To prevent injuries from shavings, wear protective goggles and protective clothing.

-- Remove the remainder of the sealant from the cylinder block, using a rotating plastic brush, for example.

CAUTION: Make sure that no sealant residue enters the engine.

-- Clean the sealing surfaces on the cylinder block and crankshaft journal. They must be free of oil and grease.

NOTE: Do not additionally oil or grease the sealing lip of the sealing flange!

The following steps must be followed so that the sealing lip of the sealing

flange does not roll itself up when installing.

-- Widen the sealing lip of the new sealing flange as shown using the oil seal guide sleeve T03004.

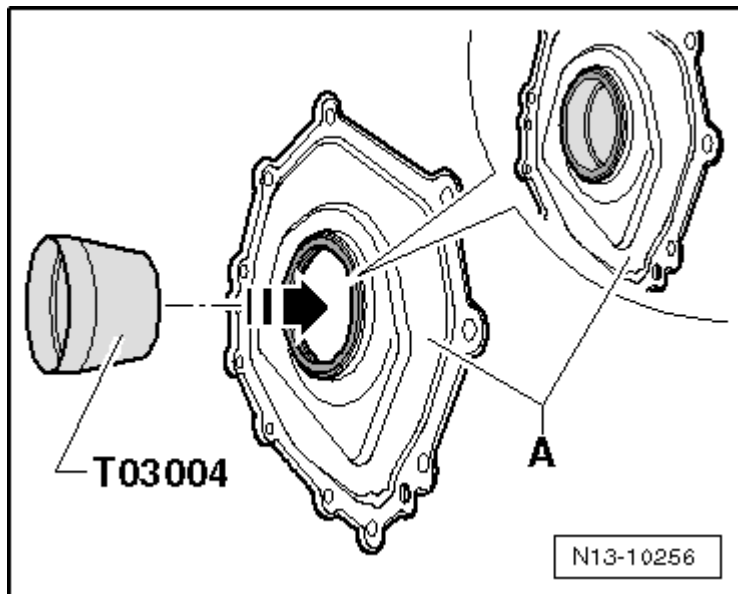


Fig. 37: Widening Sealing Lip Of New Sealing Flange Using Assembly Sleeve T03004
 Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

The surface -A- is the outer side.

-- After a short time, remove the oil seal guide sleeve T03004 and slide it rotated 180° into the seal.

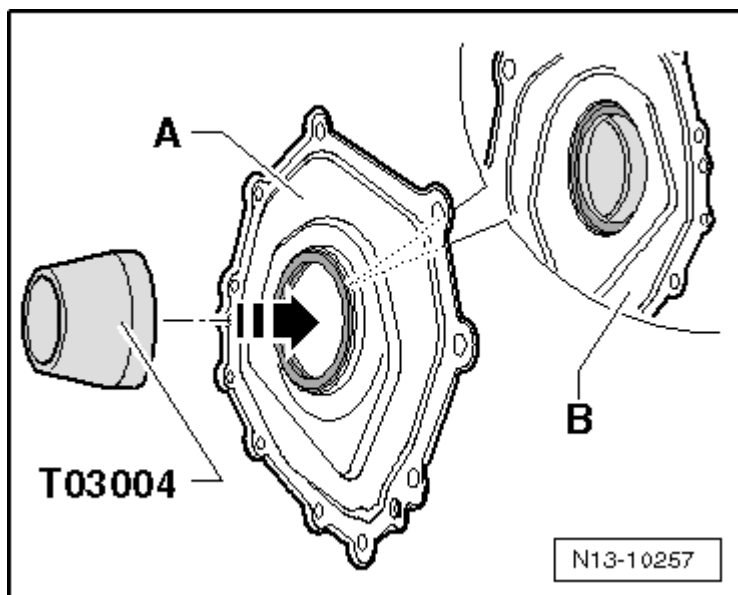


Fig. 38: Removing Assembly Sleeve T03004 And Sliding It Into Sealing Ring
 Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

the oil seal guide sleeve T03004 must stand out approximately 3 mm on the inner side -B-. The surface -A- is the outer side. The surface -B- is the inner side (sealing surface).

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

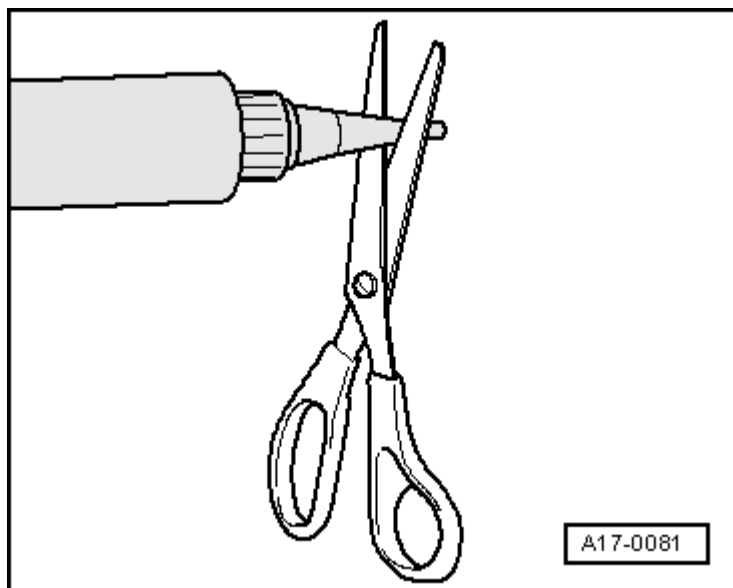


Fig. 39: Cut Tube Nozzle At Front Marking (Nozzle Diameter Approx. 3 Mm)

Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

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

-- Apply the sealant bead -A- as shown into the groove in the sealing flange.

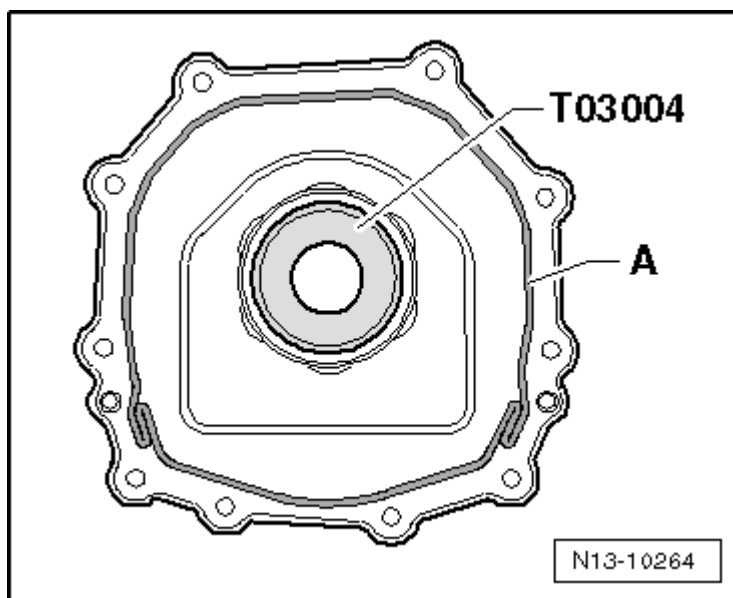


Fig. 40: Applying Sealant Bead Into Groove Of Sealing Flange

Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

- Width of sealant bead: 2.5 to 3.0 mm
- Height of sealant bead above the sealing surface: approximately 1.0 mm

-- Insert the sealing flange using the oil seal guide sleeve T03004 on the crankshaft journal and press the sealing flange uniformly onto the cylinder block.

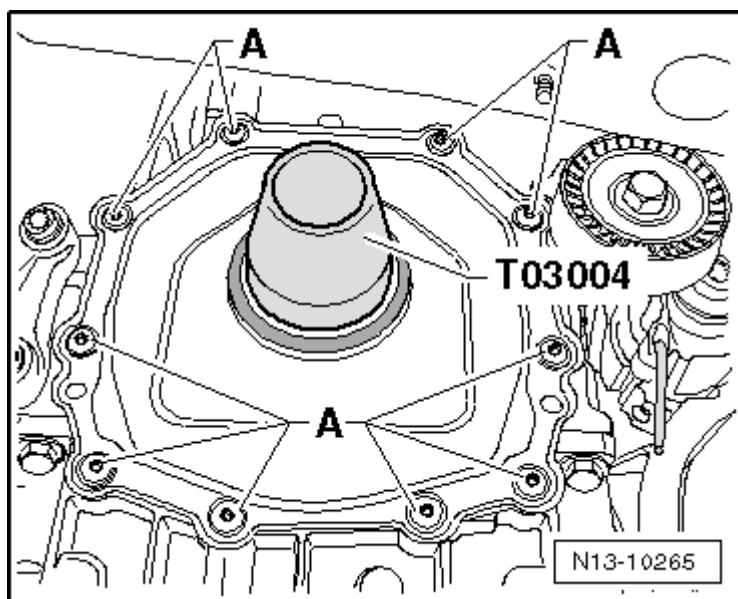


Fig. 41: Inserting Sealing Flange Using Assembly Sleeve T03004 On Crankshaft Journals
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Tighten the bolts -A- uniformly in a diagonal sequence.

The rest of the installation follows the reverse of the removal procedures. Note the following:

- Remove the locking pin T40069 from the cylinder block and install the plug.

Tightening Specifications

Component	Nm
Vibration damper to crankshaft	50 Nm + an additional 90° (1/4) turn (replace the bolts)
Belt tensioner to accessory bracket	35
Sealing flange to cylinder block	10
Locking bolt to rear of cylinder block	30

SEAL, TRANSMISSION SIDE

Special tools and workshop equipment required

- Assembly Tool T10122
- Pulling Hook T20143

Removing

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

Manual: **[For transmission(s) 0A4] Removing** .

Automatic: **[For transmission(s) 09G] Removing** .

-- Lock the crankshaft. Refer to **CRANKSHAFT, LOCKING**.

-- Remove the flywheel or drive plate and remove the sensor wheel for the engine speed sensor -G28- from the crankshaft.

-- Pull out the seal using the pulling hook T20143/2.

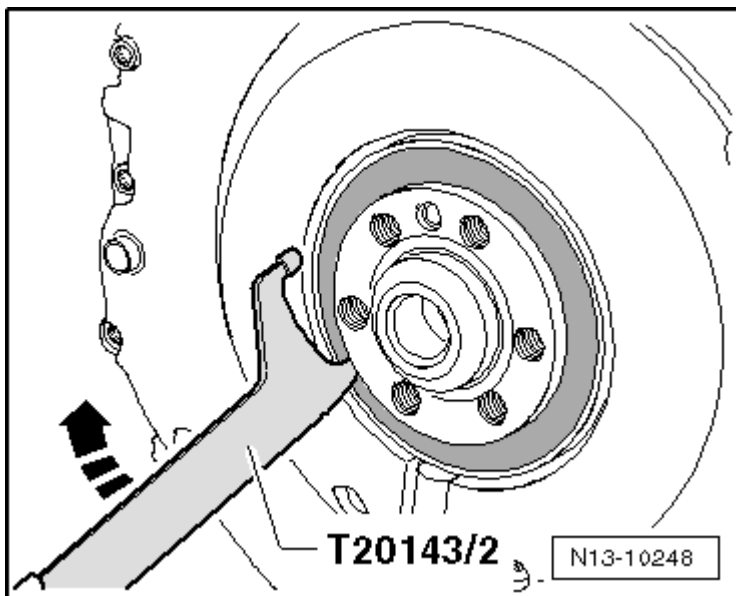


Fig. 42: Pulling Out Sealing Ring Using Pulling Hook T20143/2
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

Be careful not to damage the sealing surface on the crankshaft.

Installing

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

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

-- Before installing, remove any remaining oil from the crankshaft journal with a clean cloth.

-- Insert the assembly device T10122/1 onto the pull sleeve T10122/2 and slide the seal -A- onto the pull sleeve.

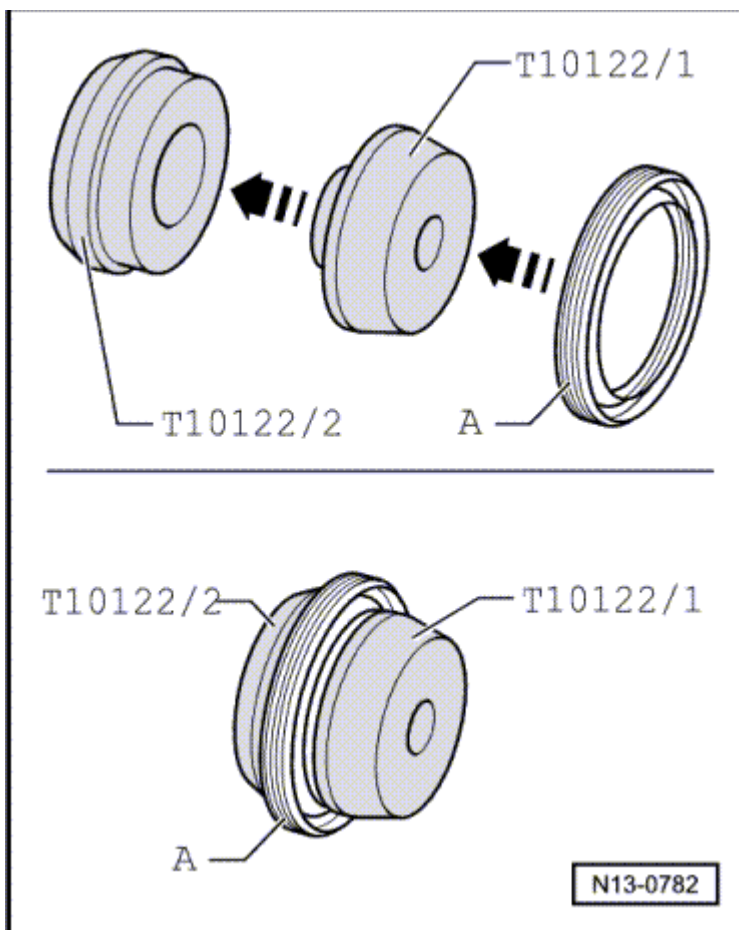


Fig. 43: Identifying Seal, Sleeve T10122/1 And Assembly Tool T10122/2
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Remove the assembly device T10122/1.

-- Install the pull sleeve T10122/2 with the seal -A- onto the crankshaft.

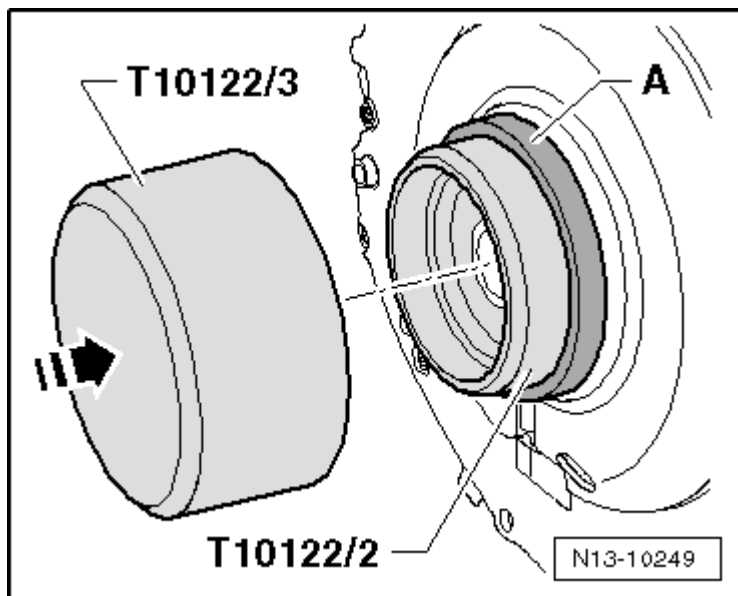


Fig. 44: Installing Pull Sleeve T10122/2 With Sealing Ring Onto Crankshaft
 Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Press in the seal all around evenly and flush using the pressure sleeve T10122/3.

The rest of the installation follows the reverse of the removal procedure. Note the following:

- Remove the locking pin T40069 from the cylinder block and install the plug.

Tightening Specifications

Component	Nm
Flywheel/drive plate to crankshaft	60 + an additional 90° (1/4) turn
• Replace bolts	
Locking bolt to rear of cylinder block	30

DRIVE PLATE

Special tools and workshop equipment required

- Depth Gauge

Removing

-- Remove the transmission. Refer to **Removing** .

-- Lock the crankshaft **CRANKSHAFT, LOCKING** and remove the drive plate.

Installing

-- Install the drive plate only using the washer with openings -1- and without a shim -2-.

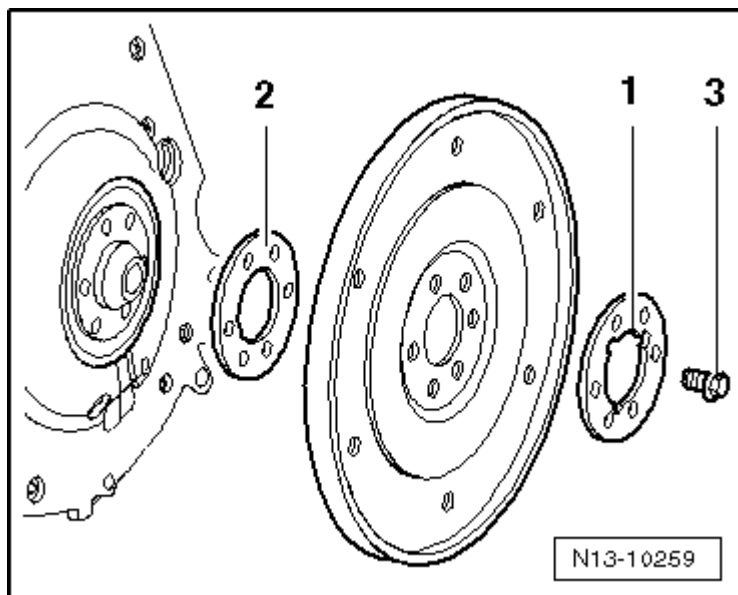


Fig. 45: Installing Drive Plate Only By Using Washer With Recesses
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Insert the new bolts -3- and tighten them to 30 Nm.

-- Check the dimension -a- at three points and calculate the average value.

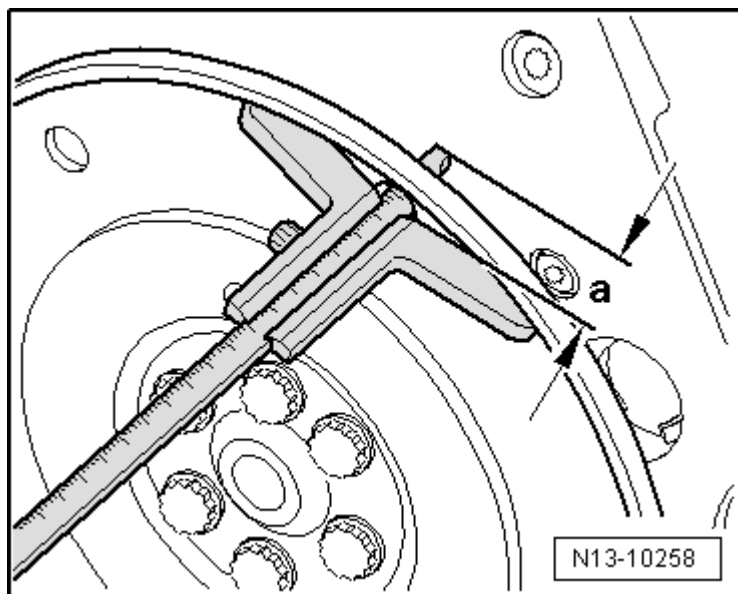


Fig. 46: Checking Dimension Three Points And Calculate Mean Value
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

Specified value: 18.8 to 20.4 mm

NOTE: Measure through the drive plate hole to the surface of sealing flange.

If the specification is not obtained:

-- Remove the drive plate and install the shim -2-. Tighten the bolts -3- to 30 Nm again and repeat the measurement.

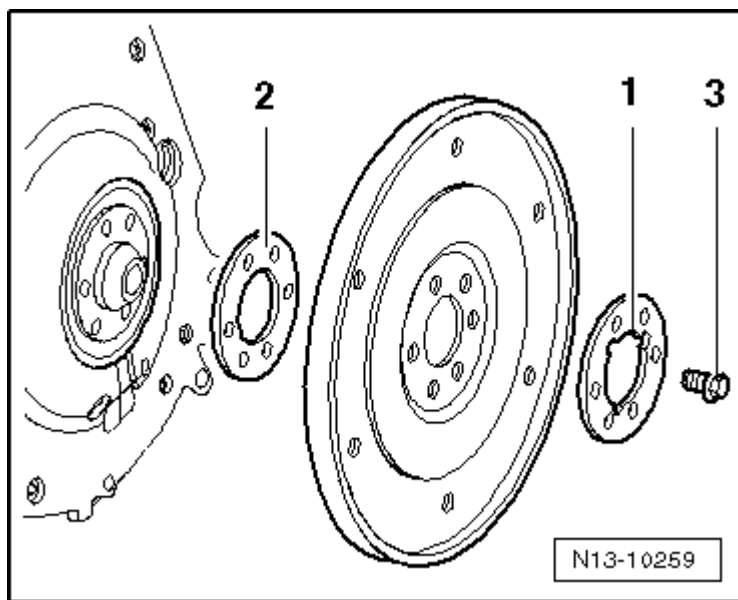


Fig. 47: Installing Drive Plate Only By Using Washer With Recesses
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

If the specified value is OK:

-- Tighten the bolts to 60 Nm + an additional 90° (1/4) turn (the additional 90° turn may occur in several stages).

The rest of the installation follows the reverse of the removal procedure. Note the following:

- Remove the locking pin T40069 from the cylinder block and install the plug (30 Nm).

FLYWHEEL

Special tools and workshop equipment required

- Torque Wrench (5-50 Nm) V.A.G 1331
- Crankshaft Adapter T03003
- Locking Pin T40069

Removing

-- Remove the transmission. Refer to **TRANSMISSION**.

-- Lock the crankshaft. Refer to **CRANKSHAFT, LOCKING**.

-- Mark the flywheel to the engine.

-- Remove the bolts and the flywheel.

Installing

Install in reverse order of removal. Note the following:

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

-- Use new bolts.

SEALING FLANGE, TRANSMISSION SIDE

Special tools and workshop equipment required

- Torque Wrench (5-50 Nm) V.A.G 1331
- Torque Wrench (40-200 Nm) V.A.G 1332
- Hand Drill with Plastic Brush Attachment
- Protective Eyewear
- Silicone Sealant D 174 003 A2

CAUTION: Note the following whenever working inside the engine compartment due to limited space:

- Route all lines and wires in their original locations.
- Ensure sufficient clearance to all moving or hot components.

Removing

- The engine is removed, and the transmission is separated from the engine.

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

-- Remove the flywheel or drive plate and then remove the sensor wheel for the engine speed sensor -G28- from the crankshaft.

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

-- Disengage the wiring harness -arrow- and remove the engine speed sensor -1- and vacuum pump -2-.

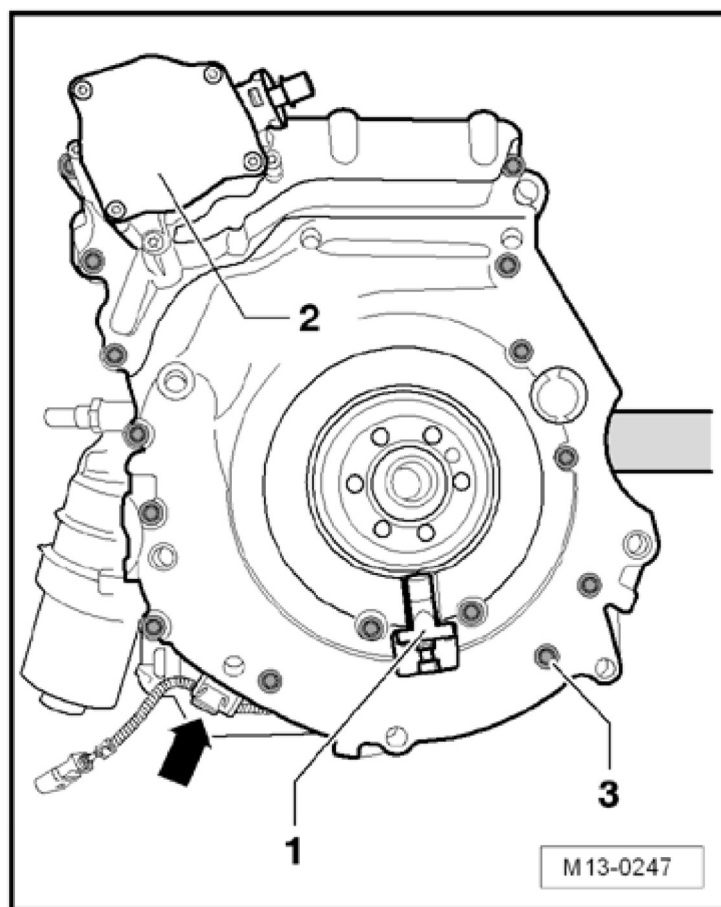


Fig. 48: Engine Speed Sensor, Vacuum Pump And Bolt
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Remove the bolts -3-.

-- Remove the sealing flange -1- from the cylinder block -2- and from the lower oil pan -3- at the upper and lower marked locations using a screwdriver -A-.

ENGINE

2.5 Liter - Cylinder Head, Valvetrain - Engine Code(s): BGP, BGQ, CBTA & CBUA

15 CYLINDER HEAD, VALVETRAIN

DESCRIPTION AND OPERATION

CYLINDER HEAD OVERVIEW

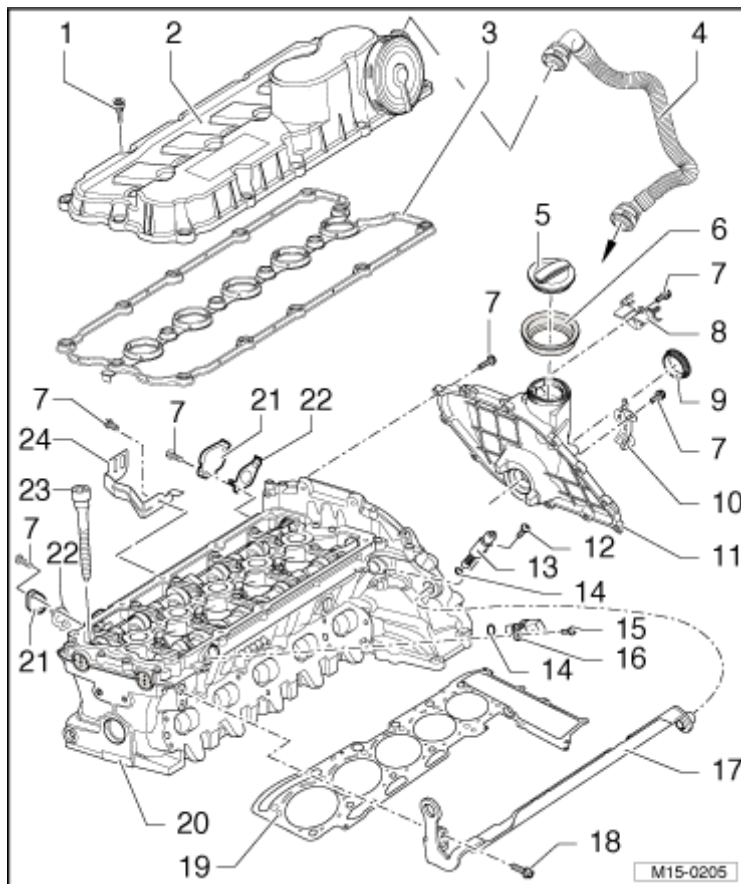


Fig. 1: Cylinder Head, Assembly Overview

Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

1. Bolt
 - 10 Nm
2. Cylinder Head Cover
 - With the pressure regulator valve for the crankshaft housing ventilation.
 - Tightening sequence, refer to **Fig. 2**.
 - Removing and installing, refer to **CYLINDER HEAD COVER**.
3. Cylinder Head Cover Gasket
 - Replace if damaged or leaking.

4. Crankcase Ventilation Hose
 - To the intake manifold.
5. Cap
6. Gasket
 - Replace if damaged or leaking.
7. Bolt
 - 10 Nm
8. Wire Bracket
9. Seal
 - Removing and installing, refer to **TIMING CHAIN COVER SEAL**.
10. Wire Bracket
11. Timing Chain Cover
 - Removing and installing, refer to **TIMING CHAIN COVER**.
12. Bolt
 - 2 Nm
13. Camshaft Adjustment Valve 1 -N205-
 - Check using the vehicle diagnostic tester.
14. O-ring
 - Replace if damaged.
15. Bolt
 - 10 Nm
16. Camshaft Position Sensor -G40-
17. Transport Strap
18. Bolt
 - 25 Nm
19. Cylinder Head Gasket
 - Always replace.
 - After replacing, replace the entire amount of coolant.
20. Cylinder Head
 - Removing and installing, refer to **CYLINDER HEAD**.
 - Checking the cylinder head for warpage, refer to **Fig. 3**.
 - It is not permitted to rework the sealing surface.
 - With the coolant pipe connection pressed in.
 - If necessary, remove any coolant deposits with a brass wire brush or with a fine sandpaper (minimum 100 grit).
 - If the pipe connection is worn, replace it using liquid locking fluid D 000 600 A2.

21. Cap
 - Only on engines with Secondary Air Injection (AIR).
 - AIR system overview. Refer to **SECONDARY AIR INJECTION SYSTEM OVERVIEW**.
22. Gasket
 - Always replace.
23. Bolt
 - 40 Nm + an additional 180° (1/2) additional turn.
 - Always replace.
 - Follow the loosening and tightening sequence. Refer to **CYLINDER HEAD**.
24. Wire Bracket
 - For the heated oxygen sensor -G39-.

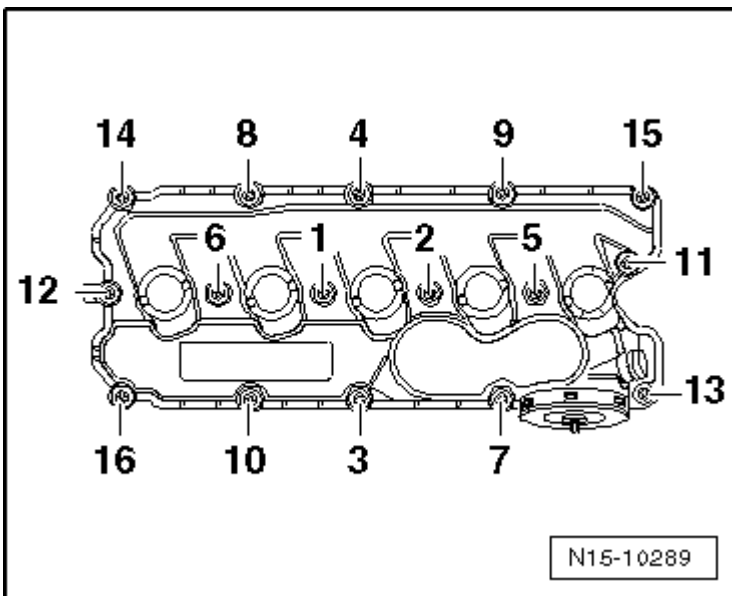


Fig. 2: Cylinder Head Cover Bolts Removal Sequence
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

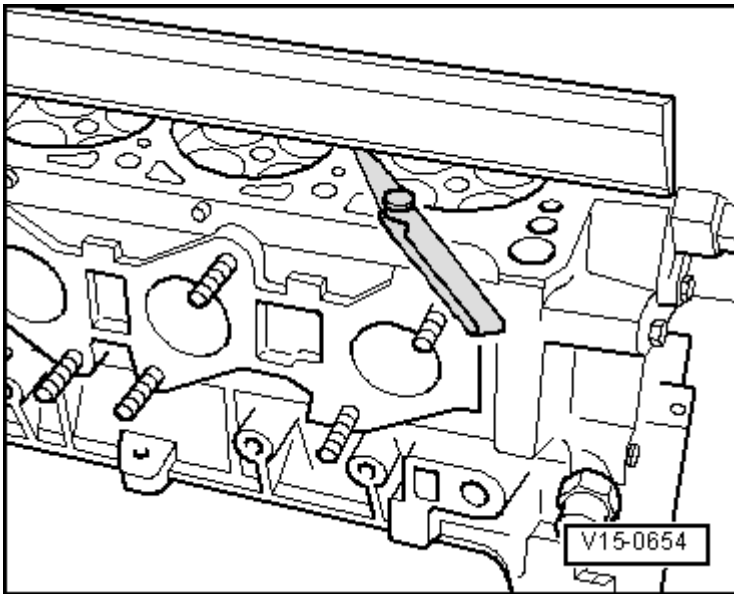


Fig. 3: Checking Cylinder Head For Distortion

Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

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

- Maximum permissible distortion: 0.05 mm

If this value is exceeded, the cylinder head must be replaced. It is not permissible to rework the sealing surface.

TIMING CHAIN ROUTING OVERVIEW

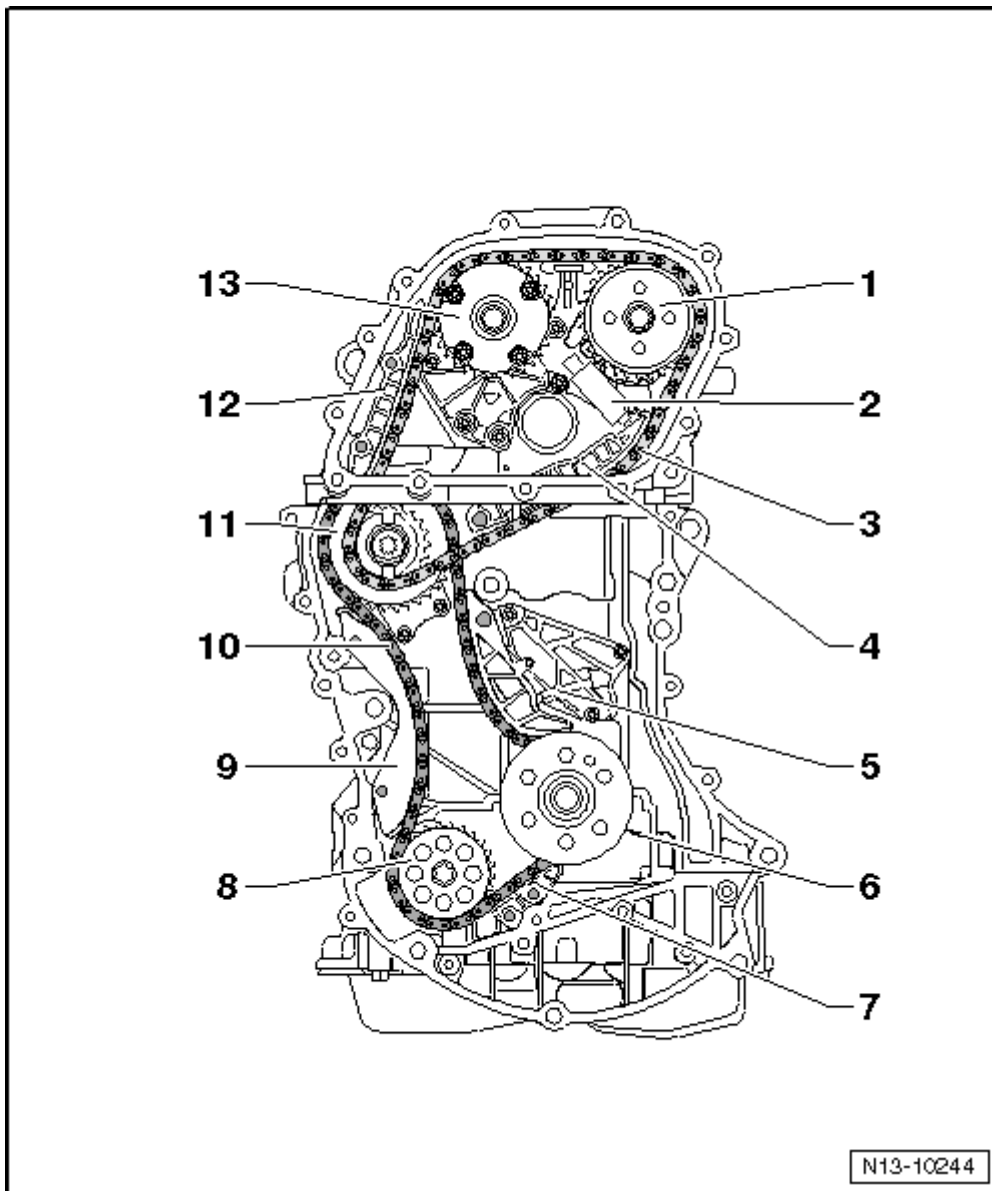


Fig. 4: Chain Drive, Assembly Overview
 Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

1. Exhaust Camshaft Sprocket
2. Camshaft Timing Chain, Chain Tensioner
 - At the top, with a sliding insert.
3. Camshaft Timing Chain
4. Camshaft Timing Chain Tensioning Rail
 - For the chain tensioner for the timing chain.
 - Secured to the cylinder block.
5. Oil Pump Timing Chain, Chain Tensioner
 - With the tensioning rail.

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6. Crankshaft Sprocket
 - Component of the crankshaft.
7. Oil Pump Timing Chain Guide Rail
 - Secured to the upper oil pan.
8. Oil Pump Sprocket
 - Removing and installing, refer to one of the following:

Engine codes BGP and BGQ, refer to **OIL PUMP** .

Engine codes CBTA and CBUA, refer to **OIL PUMP** .

9. Oil Pump Timing Chain Guide Rail
10. Oil Pump Timing Chain
 - From MY 2008 the roller chain has been changed to a toothed chain.
11. Camshaft and Oil Pump Timing Chains Double Sprocket
12. Camshaft Timing Chain Guide Rail
13. Intake Camshaft Adjuster
 - With a chain sprocket.

CAMSHAFT TIMING CHAIN OVERVIEW

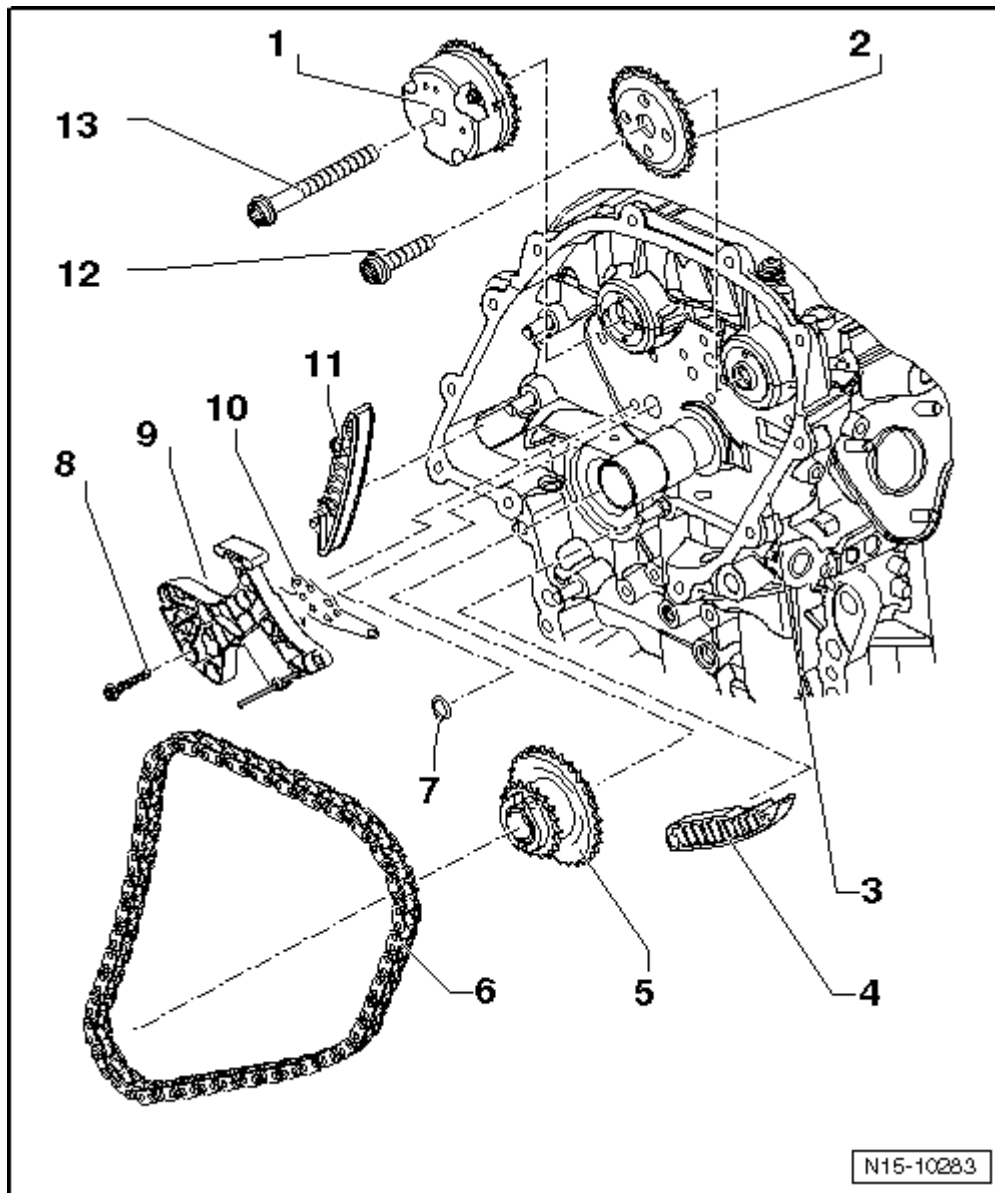


Fig. 5: Camshaft Timing Chain Overview

Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

1. Intake Camshaft Adjuster
 - With the chain sprocket.
 - Do not disassemble.
2. Exhaust Camshaft Sprocket
 - Not pressed on the camshaft.
 - When removing, pry off lightly, if necessary.
3. Cylinder Head
4. Tensioning Rail
 - For the chain tensioner for the camshaft timing chain.

- Secured to the cylinder block.
 - Oil before installing on the pin.
5. Double Sprocket
- Securing, refer to **OIL PUMP TIMING CHAIN OVERVIEW**.
6. Timing Chain
- Removing:
 - Follow the procedure for the "valve timing, adjusting". Refer to **VALVE TIMING, ADJUSTING**.
 - Remove the vacuum pump. Refer to **VACUUM PUMP**.
 - Mark the direction of travel.
 - Note when installing:
 - Install in the original direction of rotation.
 - The chain must lie correctly in the tensioning and guide rails.
 - Adjust the valve timing. Refer to **VALVE TIMING, ADJUSTING**.
7. Strainer
- Always replace.
8. Bolt
- 10 Nm
9. Chain Tensioner
- Secure using a locking pin T03006.
10. Gasket
- Always replace.
11. Guide Rail
- Oil before installing on the pin.
12. Bolt
- 60 Nm + an additional 90° (1/4) additional turn.
 - Always replace.
13. Bolt
- 60 Nm + an additional 90° (1/4) additional turn.
 - Always replace.

OIL PUMP TIMING CHAIN OVERVIEW

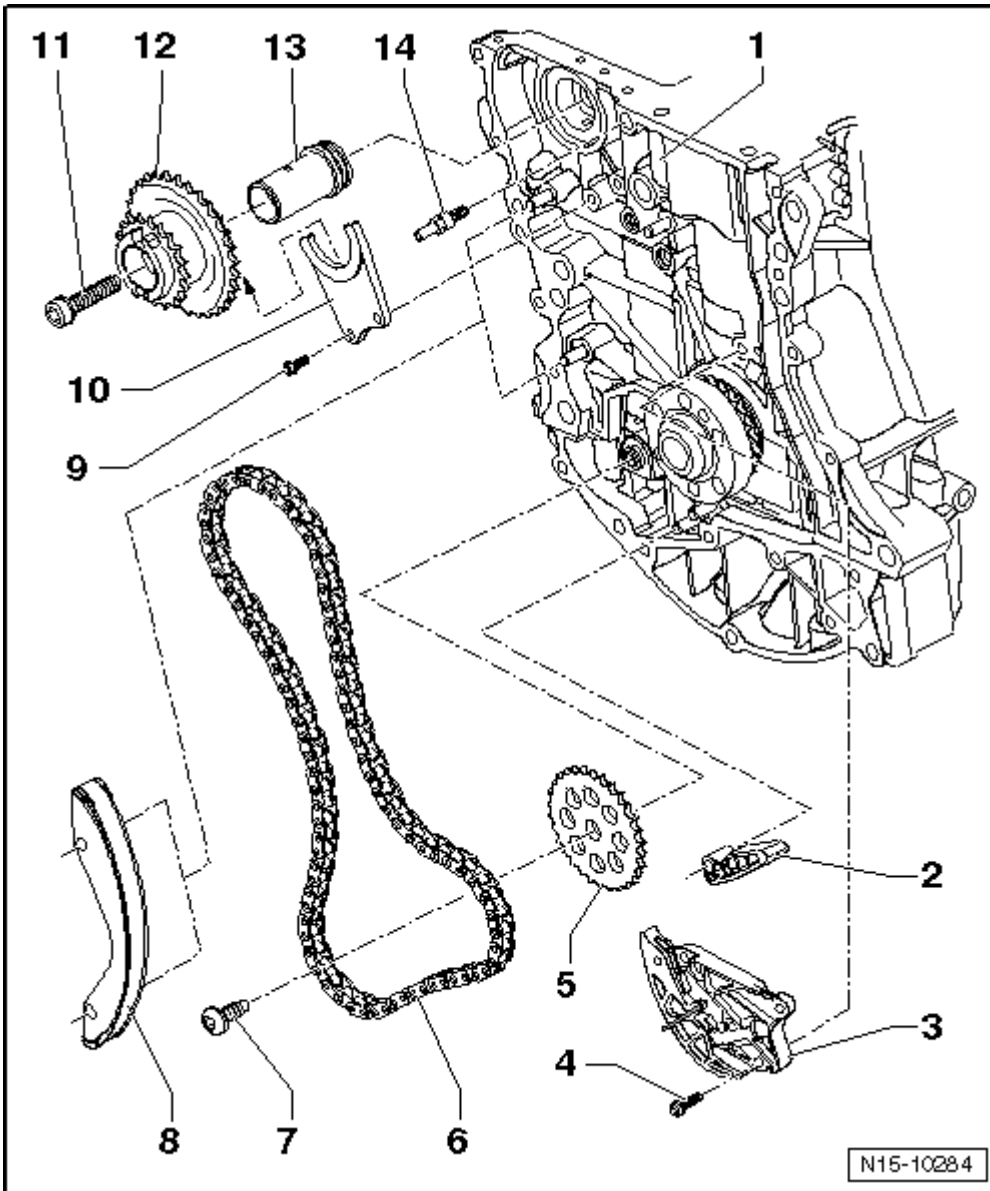


Fig. 6: Oil Pump Timing Chain Overview

Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

1. Cylinder Block
2. Guide Rail
 - Secured to the upper oil pan.
 - Oil before installing on the pin.
3. Chain Tensioner
 - Secure using a locking pin T10115.
4. Bolt
 - 10 Nm
5. Oil Pump Sprocket

- Removing and installing, refer to one of the following:

Engine codes BGP and BGQ, refer to **OIL PUMP** .

Engine codes CBTA and CBUA, refer to **OIL PUMP** .

6. Oil Pump Timing Chain

- From MY 2008 the roller chain has been changed to a toothed chain.
- Removing:
 - Remove the engine.
 - Remove sealing flange, transmission side.
 - Remove the timing chain.
 - Remove the chain tensioner -item 3-.
 - Mark the direction of travel.
- Note when installing:
 - Install in the original direction of rotation.
 - The chain must lie correctly in the tensioning and guide rails.
 - Adjust the valve timing. Refer to **VALVE TIMING, ADJUSTING**.

7. Bolt

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

8. Guide Rail

- Oil before installing on the pin.

9. Bolt

- 10 Nm

10. Axial Bearing Disc

- Engages in the groove in the double sprocket -item 12-.

11. Bolt

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

12. Camshaft and Oil Pump Timing Chains Double Sprocket

- Oil the journal before installing.
- Lubricate the axial bearing disc groove.

13. Gear Shaft
14. Threaded Pin
 - 40 Nm
 - For the camshaft timing chain tensioning rail.

VALVETRAIN OVERVIEW

NOTE: **Cylinder heads with cracks between the valve seats, or between the valve seat and the spark plug threads, can continue to be used without reducing the service life, as long as the cracks have a 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 grind the valve seats in the cylinder head. Only hand lapping the valves is permitted.

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

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

Always replace the gaskets and seals.

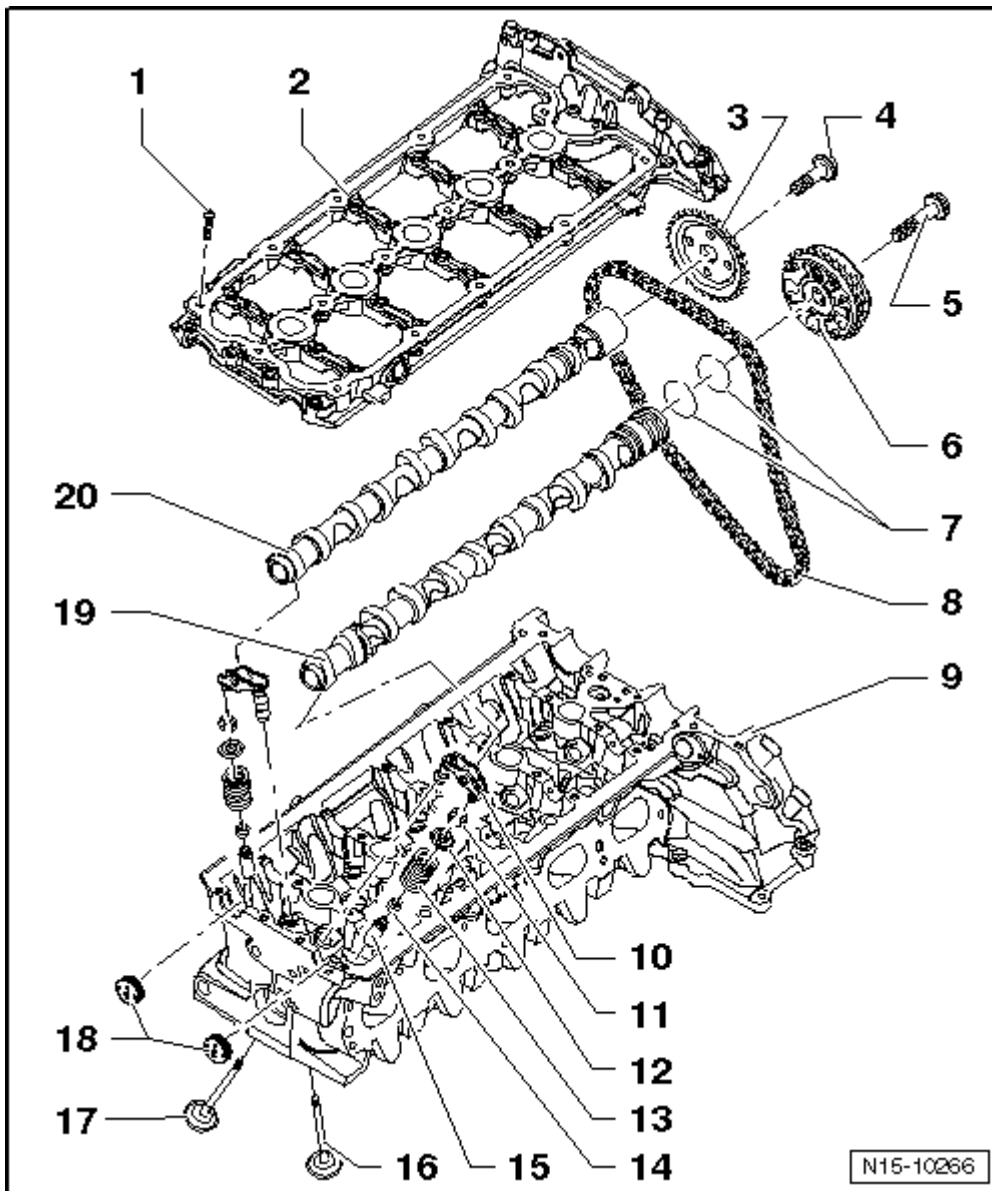


Fig. 7: Valvetrain, Assembly Overview

Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

1. Bolt
 - 8 Nm + an additional 90° (1/4) additional turn.
 - Always replace.
2. Guide Frame
 - Removing and installing, refer to **CAMSHAFT**.
 - With integrated camshaft bearings.
 - Clean the sealing surface, reworking is not permitted.
 - Remove any old sealant residue.
3. Exhaust Camshaft Sprocket

4. Bolt
 - 60 Nm + an additional 90° (1/4) additional turn.
 - Always replace.
5. Bolt
 - 60 Nm + an additional 90° (1/4) additional turn.
 - Always replace.
6. Intake Camshaft Adjuster
7. Seals
 - For the camshaft adjuster.
 - Note the installed position, refer to **CAMSHAFT**.
8. Timing Chain
 - Removing from the sprockets, refer to **VALVE TIMING, ADJUSTING**.
9. Cylinder Head
 - Do not grind the valve seats, only hand lapping is permitted.
10. Roller Rocker Arm with Hydraulic Lash Adjuster
 - Do not interchange.
 - Lubricate the contact surface.
11. Valve Retainers
12. Upper Spring Seat
13. Valve Spring
14. Valve Stem Seal
 - Removing and installing, refer to **VALVE SHAFT SEALS**.
15. Valve Guide
 - Checking, refer to **VALVE GUIDE, CHECKING**.
16. Intake Valve
 - Do not grind, only hand lapping is permitted.
 - Valve dimensions, refer to **VALVE DIMENSIONS**.
 - Valve guide, checking. Refer to **VALVE GUIDE, CHECKING**.
17. Exhaust Valve
 - Do not grind, only hand lapping is permitted.
 - Valve dimensions, refer to **VALVE DIMENSIONS**.
 - Valve guide, checking. Refer to **VALVE GUIDE, CHECKING**.
18. Sealing Plug
 - Always replace.
 - Installing, refer to **CAMSHAFT**.
19. Intake Camshaft
 - Removing and installing, refer to **CAMSHAFT**.
 - Check the radial clearance using Plastigage® (roller rocker arm is removed).

Wear limit: 0.1 mm

Run out: maximum 0.035 mm

Axial clearance: maximum 0.17 mm

20. Exhaust Camshaft

- Removing and installing, refer to **CAMSHAFT**.
- Check the radial clearance using Plastigage® (roller rocker arm is removed).

Wear limit: 0.1 mm

Run out: maximum 0.035 mm

Axial clearance: maximum 0.17 mm

SPECIFICATIONS

VALVE DIMENSIONS

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

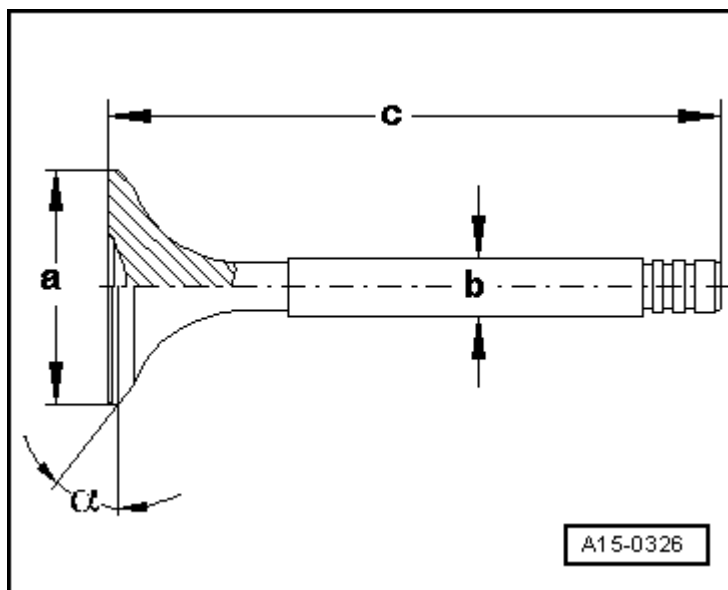


Fig. 8: Identifying Valve Dimensions
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

Dimension		Intake Valve	Exhaust Valve
Diameter a	mm	26.80 •• 27.00	29.80 •• 30.00
Diameter b	mm	5.95 •• 5.97	5.94 •• 5.95

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c	mm	104.84 ••• 105.34	103.64 ••• 104.14
a	Angle°	45	45

FASTENER TIGHTENING SPECIFICATIONS

Component	Fastener Size	Nm
Adjuster to Intake Camshaft Bolt ⁽¹⁾	-	60 + 90°
Axial Bearing Disc to Cylinder Block Bolt	-	10
Camshaft Adjustment Valve 1 to Cylinder Head Bolt	-	2
Camshaft Clamp T40070 to Camshaft Bolt	-	20
Camshaft Position Sensor to Cylinder Head Bolt	-	10
Camshaft Timing Chain Tensioner to Cylinder Head Bolt	-	10
Cap to Cylinder Head Bolt	-	10
Coolant Flange to Chain Compartment Cover Bolt	-	10
Coolant Pipe to Bracket Bolt	-	10
Double Sprocket to Gear Shaft Bolt ⁽¹⁾	-	60 + 90°
Guide Frame to Cylinder Head Bolt ^{1, 2}	-	8 + 90°
Locking Bolt to Cylinder Block	-	30
Oil Pump Sprocket to Oil Pump Bolt ⁽¹⁾	-	20 + 90°
Oil Pump Timing Chain Tensioner to Cylinder Block Bolt	-	10
Secondary Air Injection Pipe to Cylinder Head Bolt	-	10
Sprocket to Exhaust Camshaft Bolt ⁽¹⁾	-	60 + 90°
Threaded Pin to Cylinder Block	-	40
Timing Chain Cover to Cylinder Head Bolt	-	10
Transport Strap to Cylinder Head Bolt	-	25
Vacuum Pump to Sealing Flange, Transmission Side Bolt	-	10
Wire Bracket to Timing Chain Cover Bolt	-	10
Wire Bracket to Cylinder Head Bolt	-	10
(1) Always replace		
(2) Tighten the bolts working from the inside toward the outside in several stages		

Cylinder Head Cover Bolt Tightening Sequence and Specification

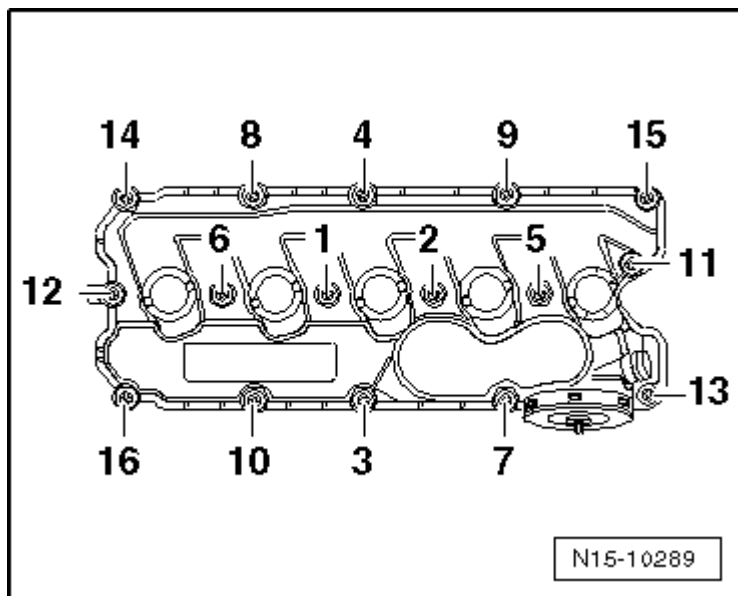


Fig. 9: Cylinder Head Cover Bolt Tightening Sequence
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Tighten the bolts in the sequence shown to 10 Nm.

Cylinder Head Bolt Tightening Sequence and Specification

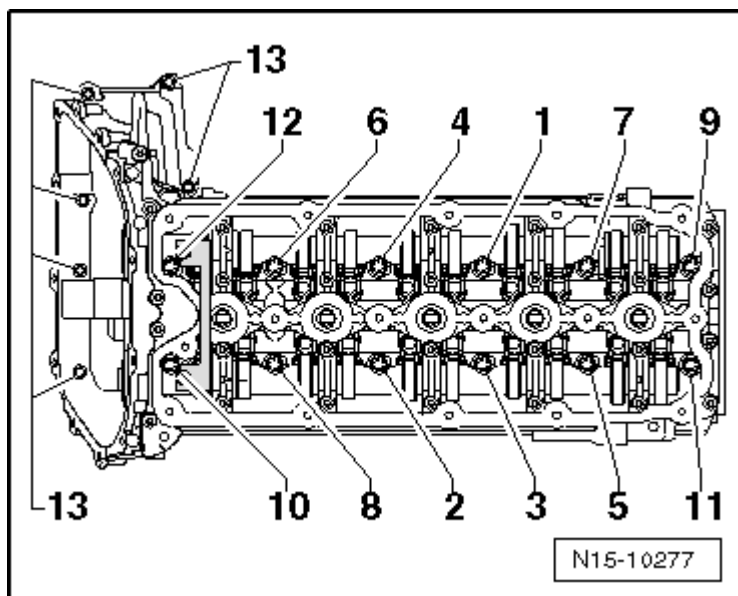


Fig. 10: Cylinder Head Bolts Tighten Sequence
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

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

-- Tighten the cylinder head bolts -1 through 12- in the sequence shown as follows:

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Step	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.

-- Then tighten bolts -13- to 10 Nm.

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.

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

-- Disconnect the connectors from all the fuel injectors.

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

-- 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 compression tester, refer to the operating instructions.**

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

Compression Pressure

New Bar Positive Pressure	Wear Limit Bar Positive Pressure	Difference Between Cylinders Bar Positive Pressure
9.0 ••• 13.0	8.0	Max. 3.0

NOTE: By disconnecting the connectors, Diagnostic Trouble Codes (DTCs) are stored to memory. After the test, check the DTC memory and erase, if necessary.

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

VALVE TIMING, CHECKING

Special tools and workshop equipment required

- Torque Wrench (5-50 Nm) V.A.G 1331
- Crankshaft Adapter T03003
- Locking Pin T40069
- Camshaft Clamp T40070

Procedure

- Remove the cylinder head cover. Refer to CYLINDER HEAD COVER.
- Remove the noise insulation. Refer to Description and Operation .
- Remove the front section of the right wheel housing liner. Refer to FRONT WHEEL HOUSING LINER .
- Install the crankshaft adapter T03003 onto the vibration damper bolts.

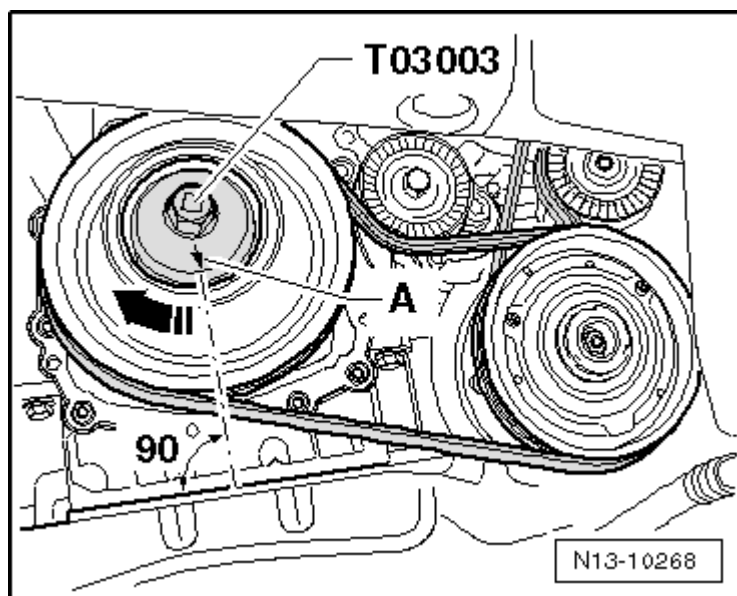


Fig. 11: Attaching Wrench T03003 Onto The Vibration Damper Bolts
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

The crankshaft adapter T03003 can only be installed correctly in one position.

- Rotate the crankshaft in engine rotation direction until the arrow -A- on the crankshaft adapter T03003 faces

downward vertically in comparison to the engine axis. This position corresponds approximately to the crankshaft Top Dead Center (TDC) position.

NOTE: If the threaded holes in the camshafts -arrows- do not point upward, the crankshaft must be rotated one rotation (360°) in engine rotation direction.

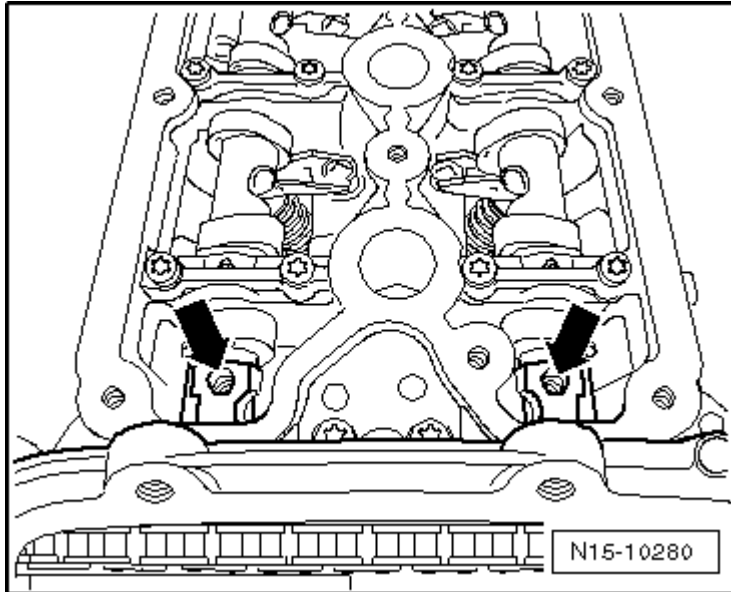


Fig. 12: Identifying Camshafts Threaded Holes
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Remove the locking bolt -1- from the rear of the cylinder block.

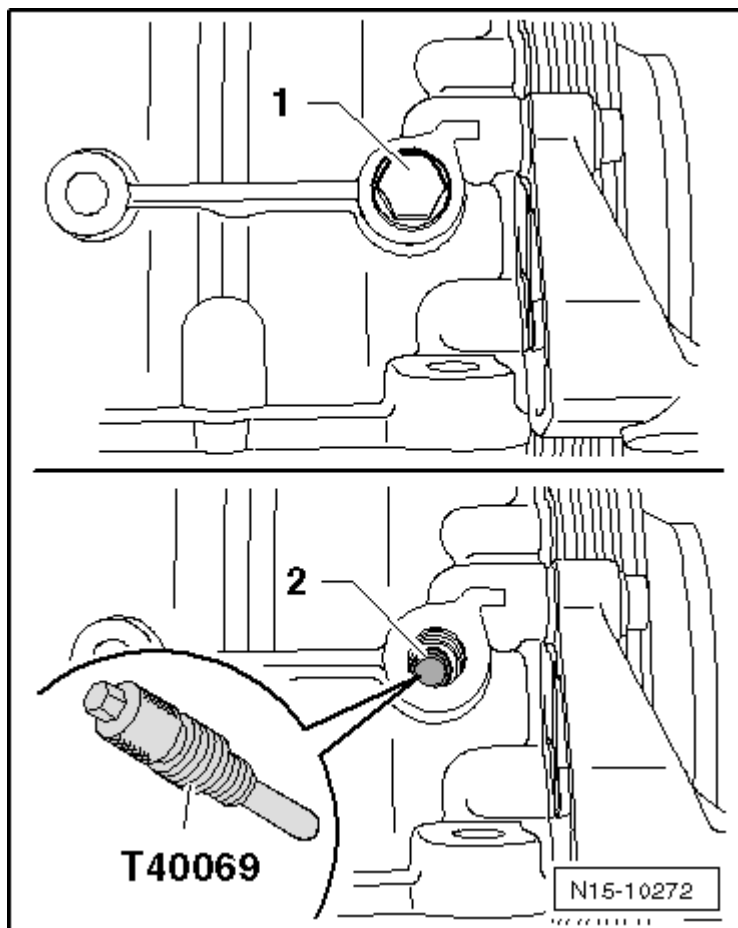


Fig. 13: Identifying Locking Pin T40069 And Installing Plug
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Look the through threaded hole and check whether the bore -2- in the crankshaft aligns with the threaded hole.

Use a mirror to do so.

-- If the hole and bore align, install the locking pin T40069 completely into the threaded hole and tighten it to 10 Nm.

If the crankshaft was rotated out past the TDC mark:

-- Rotate the crankshaft back 45° in the opposite direction of engine rotation.

-- Then, rotate the crankshaft again into the TDC position in engine rotation direction.

When the crankshaft is positioned slightly in front of the TDC position (the bore in the crankshaft is 90% visible), the locking pin T40069 can be installed, although slightly more difficult.

NOTE: With the engine removed, the TDC mark can also be seen on the vibration

damper and belt pulley side sealing flange. The notches -A and B- must align.

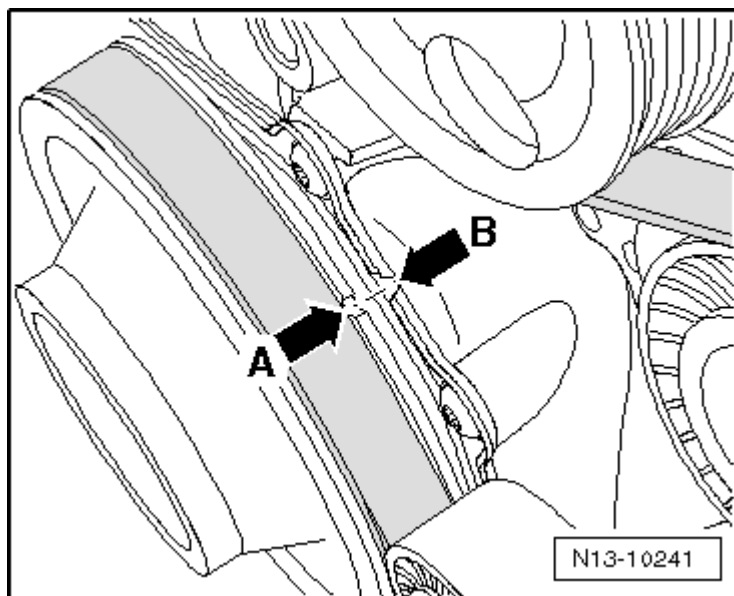


Fig. 14: Aligning Belt Pulley And Sealing Flange
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Check whether the crankshaft can be rotated.

The valve timing is correct when the camshaft clamp T40070 bolts can be installed easily into the ends of the camshafts as shown. The support surfaces of the camshaft clamp T40070 must lie flat on the flats of the camshafts when doing this.

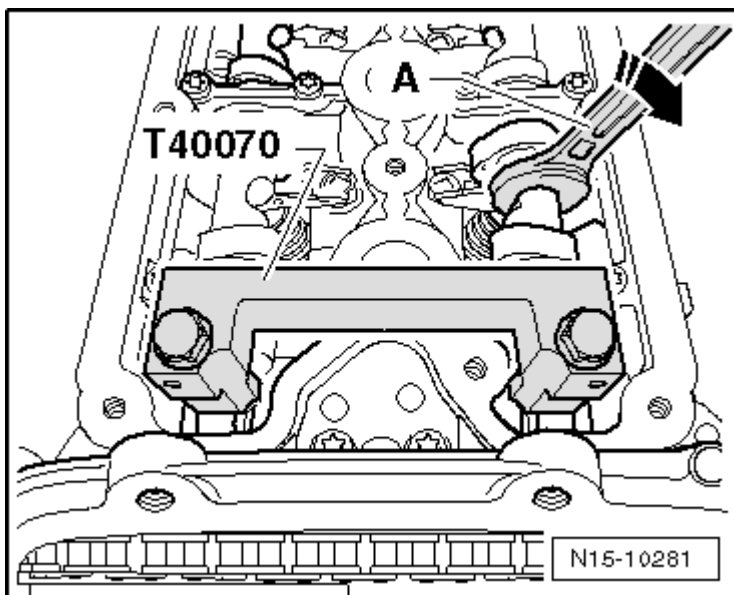


Fig. 15: Attempting To Rotate Exhaust Camshaft At Recess Using An Open-End Wrench
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- If the bolts are difficult to install, install an 18 or 19 mm open end wrench -A- onto the flat on the exhaust camshaft and rotate the camshaft slightly in the -direction of the arrow- to remove any play in the chain.

If the bolts for the camshaft clamp T40070 can now be installed easily with the chain tensioned in this manner, the valve timing is also correct. Possibly the crankshaft was not secured correctly.

If the camshaft clamp T40070 cannot be installed

The valve timing is incorrect when the camshaft clamp T40070 bolts cannot be installed easily into the ends of the camshafts despite the tensioned chain.

- In this case, the valve timing must be adjusted. Refer to **VALVE TIMING, ADJUSTING**.

After disassembly and assembly work

-- Remove the locking pin T40069 and install the locking bolt -1- to the rear of the cylinder block.

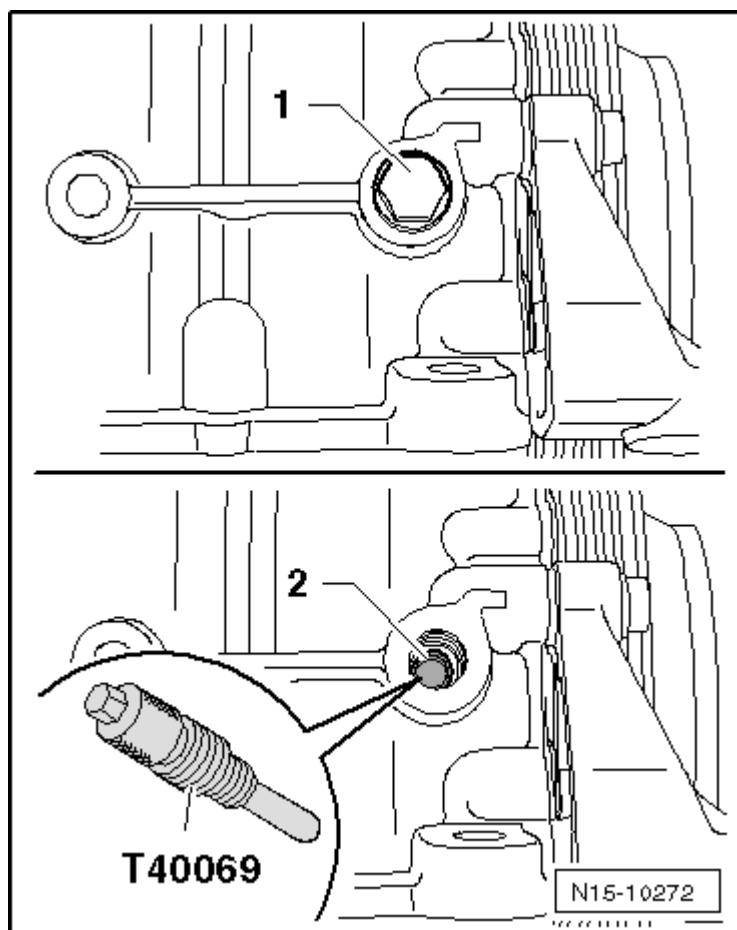


Fig. 16: Identifying Locking Pin T40069 And Installing Plug
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

The rest of the installation follows the reverse of the removal procedure.

Tightening Specifications

Component	Nm
Locking bolt to rear of cylinder block	30 Nm

VALVE TIMING, ADJUSTING

Special tools and workshop equipment required

- Torque Wrench (5-50 Nm) V.A.G 1331
- Torque Wrench (40-200 Nm) V.A.G 1332
- Locking Pins T03006
- Multipoint Socket T10035
- Counterhold Tool T10172
- Camshaft Clamp T40070
- 2 M8 x 16 Bolts

Modifying the Counterhold Tool T10172

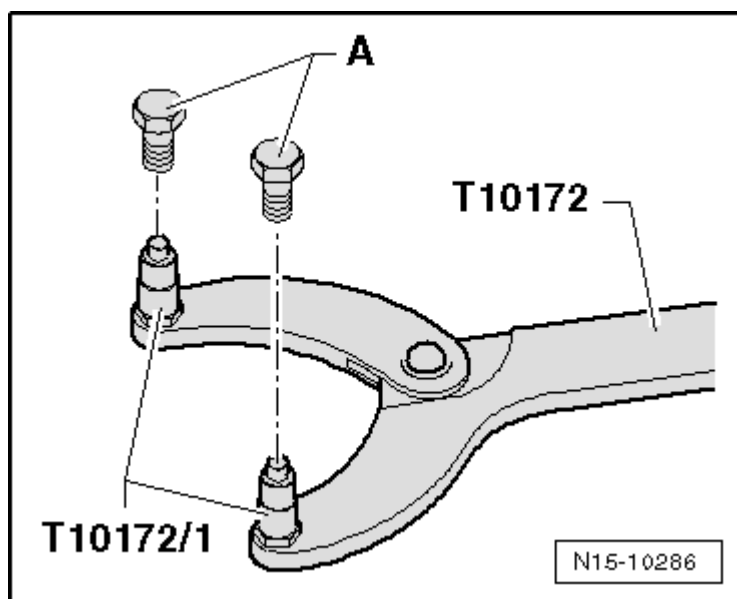


Fig. 17: Removing Adapter T10172/1 And Install Bolts
 Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Unscrew the adapter T10172/1 and screw in the 2 M8 x 16 bolts -A-.

NOTE: The valve timing must be adjusted if the camshaft sprocket or adjuster were loosened during repairs or if the valve timing is not set.

Securing the Camshafts if the Valve Timing is Correct

- Remove the timing chain cover. Refer to **TIMING CHAIN COVER**.
- Remove the cylinder head cover. Refer to **CYLINDER HEAD COVER**.
- Secure the crankshaft as described in the "valve timing, checking" procedure. Refer to **VALVE TIMING, CHECKING**.
- Install the camshaft clamp T40070 as shown onto the camshafts and tighten the bolts to 20 Nm.

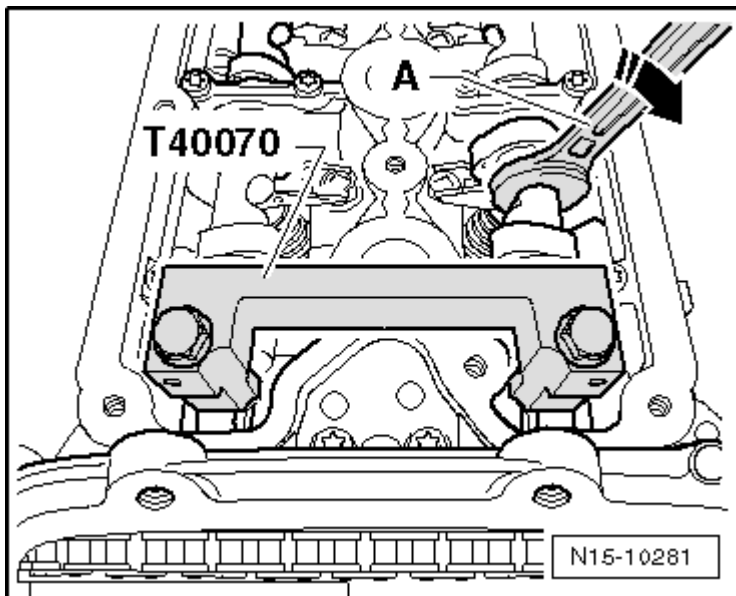


Fig. 18: Attempting To Rotate Exhaust Camshaft At Recess Using An Open-End Wrench
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

If the bolts are difficult to install, install an 18 or 19 mm open end wrench -A- to the opening on the exhaust camshaft and rotate the camshaft slightly in the -direction of the arrow- to remove any play in the chain.

- Relieve the tension on the timing chain. To do so, insert a screwdriver of appropriate size between the piston for the chain tensioner and tensioning rail and press the screwdriver in the -direction of arrow-.

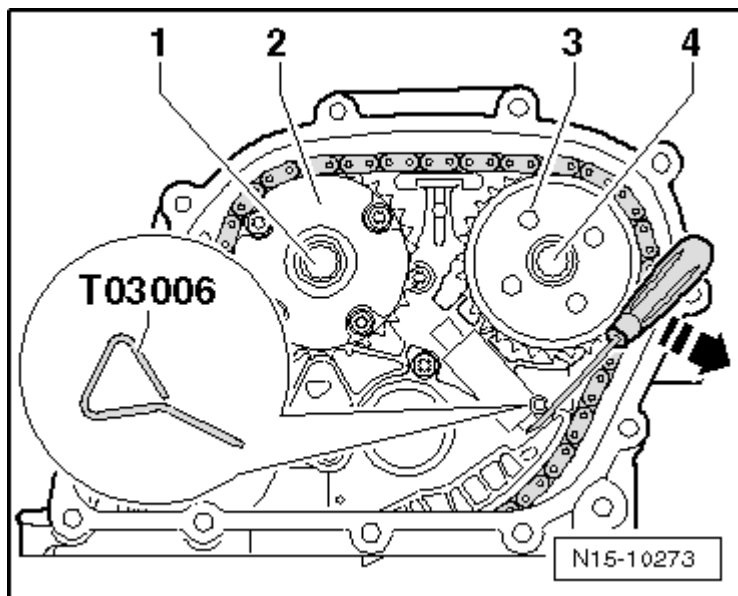


Fig. 19: Placing Chain Sprockets Into Timing Chain
 Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Secure the completely pressed in piston using the locking pin T03006. the pin must be inserted until it stops.

Securing the Camshafts if the Valve Timing is not Correct

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

-- Rotate the crankshaft to Top Dead Center (TDC) for cylinder 5. Refer to **CRANKSHAFT, LOCKING** . Do not lock the crankshaft using the locking pin T40069.

-- Rotate the crankshaft so that the camshaft clamp T40070 can be installed easily onto the camshafts as shown.

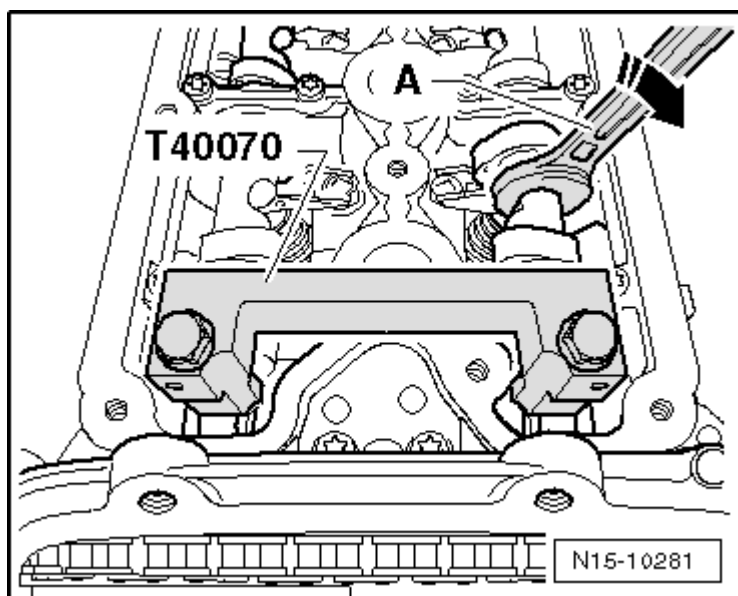


Fig. 20: Attempting To Rotate Exhaust Camshaft At Recess Using An Open-End Wrench
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Tighten bolts for the camshaft clamp T40070 to 20 Nm.

Remove the Camshaft Sprocket or Adjuster

-- Relieve the tension on the timing chain. To do so, insert a screwdriver of appropriate size between the piston of the chain tensioner and tensioning rail and press the screwdriver in the -direction of the arrow-.

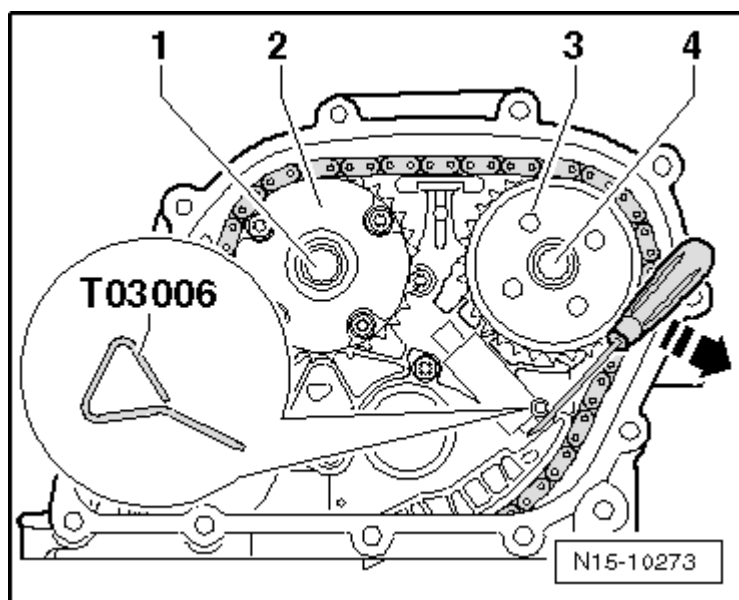


Fig. 21: Placing Chain Sprockets Into Timing Chain
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Secure the completely pressed in piston using the locking pin T03006. The pin must be inserted until it stops.

-- Remove the bolts -1 and 4- using the multipoint socket T10035 and remove the actuator -2- and the sprocket -3-.

If necessary, the sprocket -3- must be pryed off lightly using a screwdriver.

NOTE: Lock the crankshaft, refer to **CRANKSHAFT, LOCKING** if not yet locked. The crankshaft must only be rotated slightly around the TDC point for this. Otherwise there is a risk the valves will rest on the pistons.

Adjusting the Timing

- The crankshaft is locked using the locking pin T40069
- The camshafts are secured by the camshaft clamp T40070
- The chain tensioner is tensioned

-- Place the adjuster -2- and sprocket -3- in the timing chain as illustrated. Position the adjuster and sprocket onto the camshafts and install new bolts -1 and 4- and tighten them by hand.

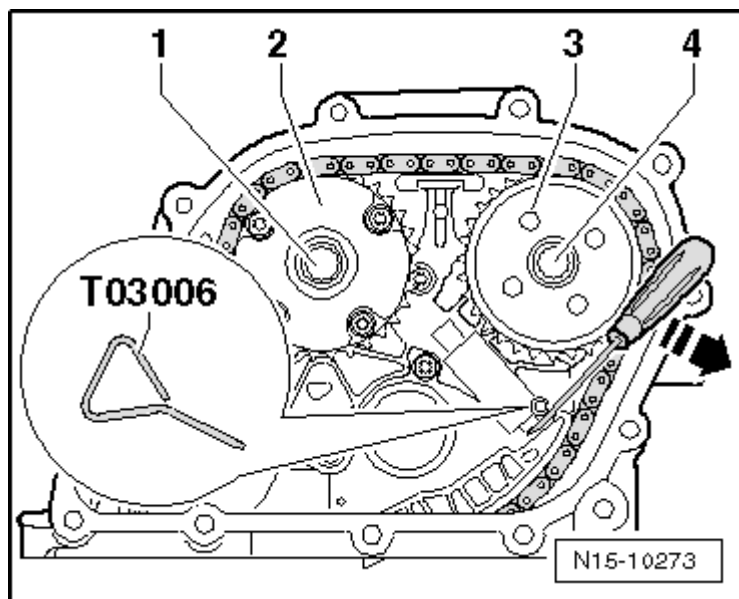


Fig. 22: Placing Chain Sprockets Into Timing Chain
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

The adjuster and sprocket must still be able to be rotated, however they must not tilt.

NOTE: Make sure that timing chain lies correctly in the tensioning and guide rails.

-- Relieve the tension on the chain tensioner by pressing in the piston and pulling out the locking pin T03006.

-- Attach the modified counterhold tool T10172 to the exhaust camshaft sprocket -4-.

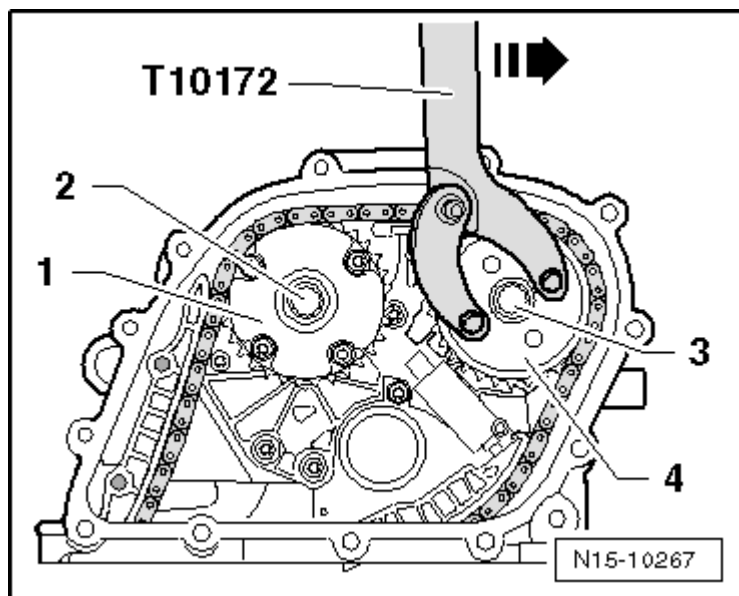


Fig. 23: Attaching Modified Counterhold Tool Touareg V10 T10172 On To Chain Sprocket For Exhaust Camshaft

Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

NOTE: A second technician is needed for the following steps.

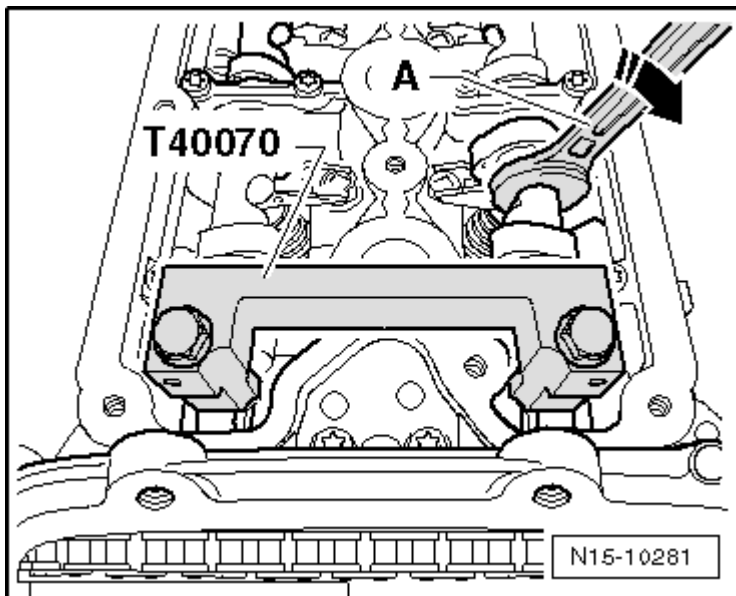
-- Hold the timing chain at preload by pressing the counterhold tool T10172 in the -direction of the arrow-.

-- Tighten the bolt -2- for the intake camshaft adjuster and then the bolt -3- for the exhaust camshaft sprocket to 60 Nm.

Then, tighten the bolts -2 and 3- an additional 90° (1/4) turn.

NOTE: When applying the additional 90° torque angle, the timing chain must no longer be held at preload.

-- Remove the camshaft clamp T40070.

**Fig. 24: Attempting To Rotate Exhaust Camshaft At Recess Using An Open-End Wrench**

Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Remove the locking pin T40069 for securing the crankshaft.

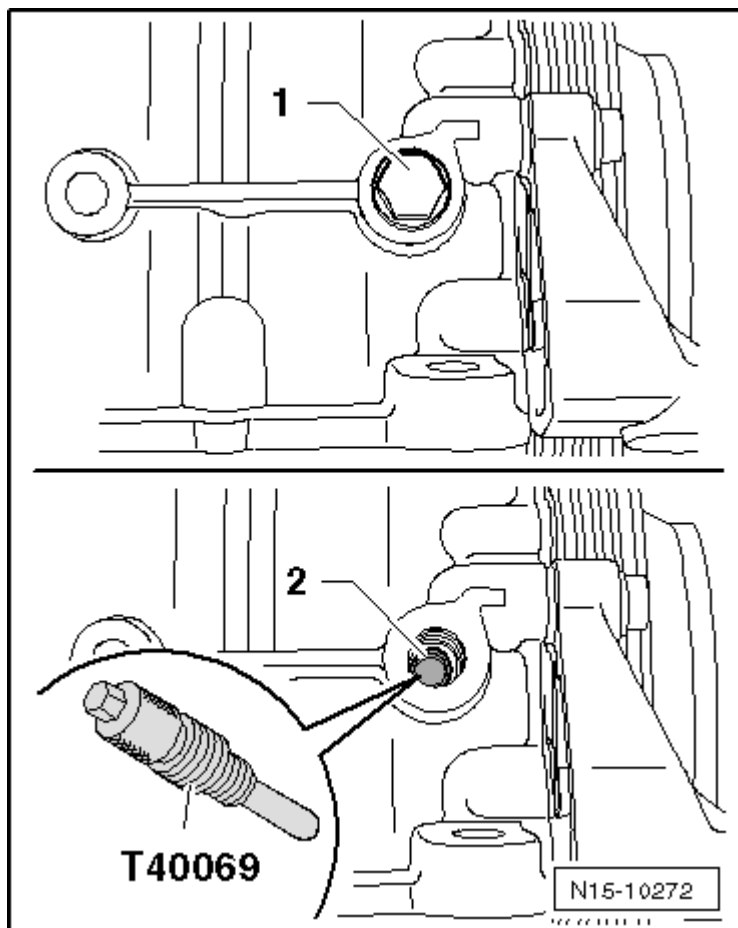


Fig. 25: Identifying Locking Pin T40069 And Installing Plug
 Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Turn the crankshaft 2 turns in engine rotation direction and check the valve timing. Refer to **VALVE TIMING, CHECKING**.

If the valve timing is not correct:

-- Loosen the intake camshaft adjuster and exhaust camshaft sprocket bolts again and adjust the valve timing again (replace the bolts).

The rest of the installation follows the reverse of the removal procedure. Note the following:

- Remove the locking pin T40069 from the rear of the cylinder block and install the locking bolt.
- Fill the coolant. Refer to **COOLANT, DRAINING AND FILLING** .

VALVE GUIDE, CHECKING

Special tools and workshop equipment required

- Universal Dial Gauge Mount MP 3-447

- Dial Gauge

-- Insert the new valve into the guide. The tip of the valve stem must seal with the guide. Due to differences in valve stem diameter, make sure that only intake valves are used to check intake valve guides, and only exhaust valves are used to check exhaust valve guides.

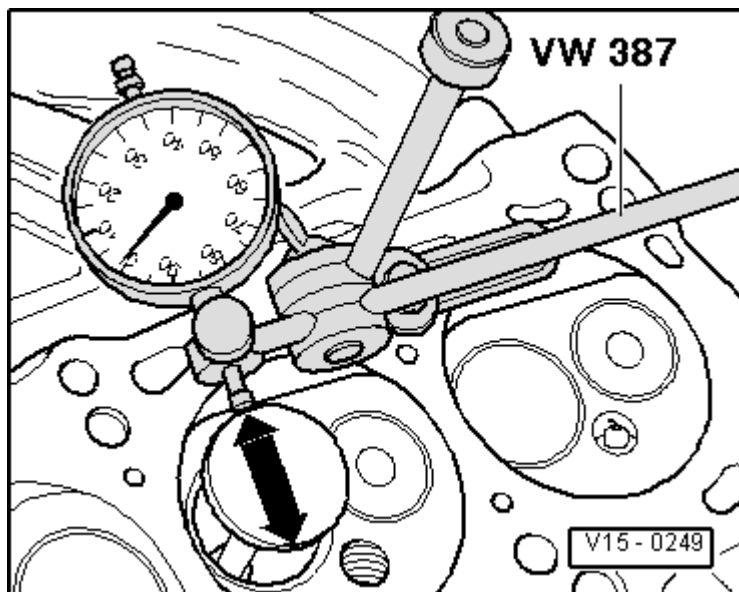


Fig. 26: Determining Tilt Clearance

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

- Torque Wrench V.A.G 1331

Removing

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

-- Disconnect crankcase ventilation hose -arrow-.

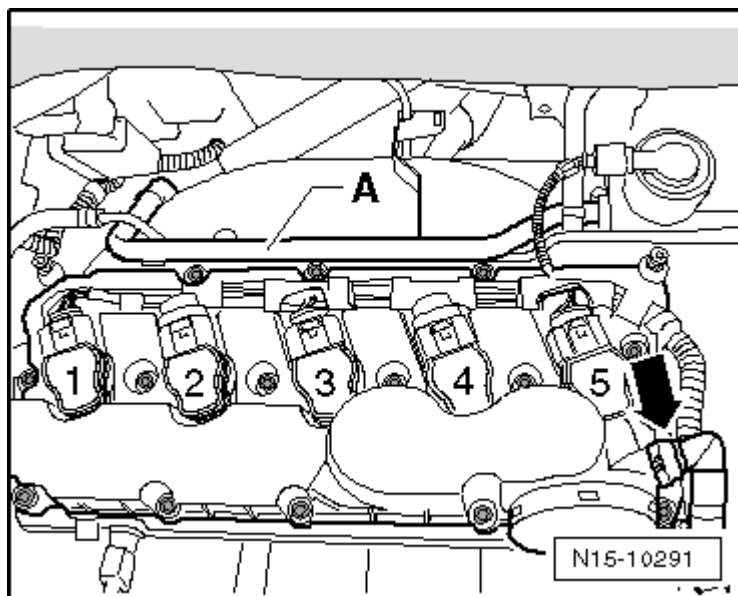


Fig. 27: Identifying Air Hose Of Crankshaft Housing Ventilation, Connecting Pipe & Ignition Coils
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

- Remove the Secondary Air Injection (AIR) pipe -A-, if equipped.
- Remove the ignition coils -1 through 5-. Refer to **IGNITION COIL WITH POWER OUTPUT STAGE** .
- Remove the cylinder head cover bolt in sequence -16 through 1-.

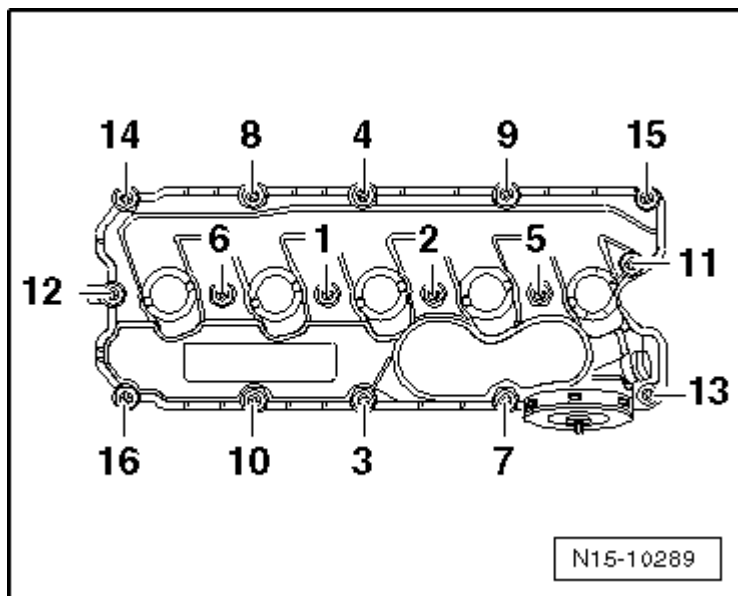


Fig. 28: Cylinder Head Cover Bolts Removal Sequence
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

Installing

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

NOTE: Replace the cylinder head cover if damaged or leaking.

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

-- Tighten the cylinder head cover bolts in sequence -1 through 16-.

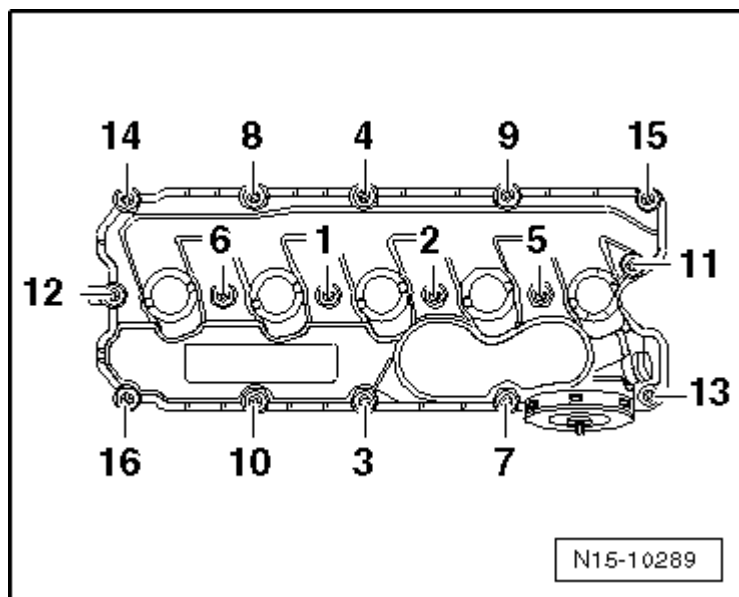


Fig. 29: Cylinder Head Cover Bolts Removal Sequence
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Follow the correct tightening sequence when installing the AIR pipe -A-, if necessary. Refer to **Fig. 30**.

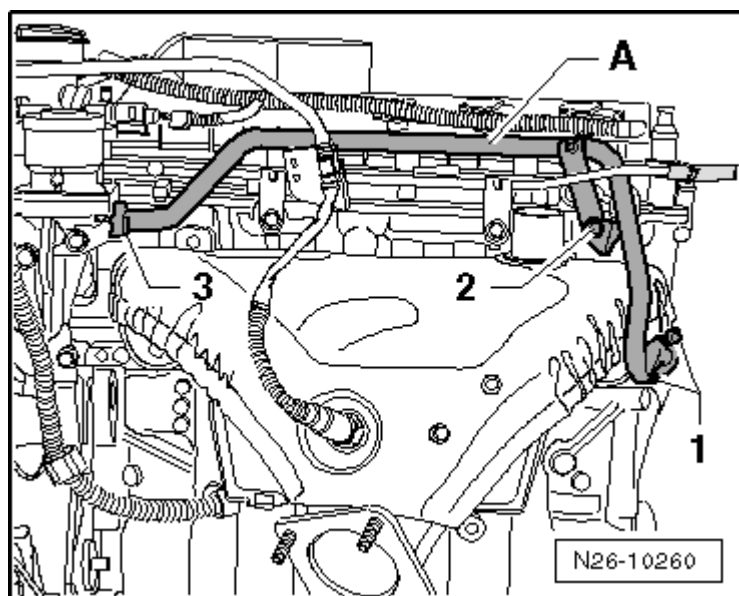


Fig. 30: Connecting Tube - Tightening Sequence

2007 Volkswagen Rabbit

ENGINE 2.5 Liter - Cylinder Head, Valvetrain - Engine Code(s): BGP, BGQ, CBTA & CBUA

Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

Component	Nm
Cylinder head cover to cylinder head	10
AIR pipe at cylinder head	10

CYLINDER HEAD

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 fitting the cylinder head.

Replace the cylinder head bolts.

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

Special tools and workshop equipment required

- Drip Tray for VAS 6100 VAS 6208
- Torque Wrench (5-50 Nm) V.A.G 1331
- Torque Wrench (40-200 Nm) V.A.G 1332
- Spring Type Clip Pliers VAS 6499
- Polydrive Bit and Drive Socket T10070
- Ignition Coil Puller T40039
- Silicone Sealant D 174 003 A2

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

- Route all lines and wires in their original locations.
- Make sure there is enough clearance to moving or hot components to prevent damage to the lines.

Removing

- Drain the coolant. Refer to **COOLANT, DRAINING AND FILLING** .
- Remove the engine cover with air filter. Refer to **ENGINE COVER WITH AIR FILTER** .
- Remove the battery. Refer to **Removal and Installation** .
- Remove the cover -1- for the E-box and remove the wire -2-.

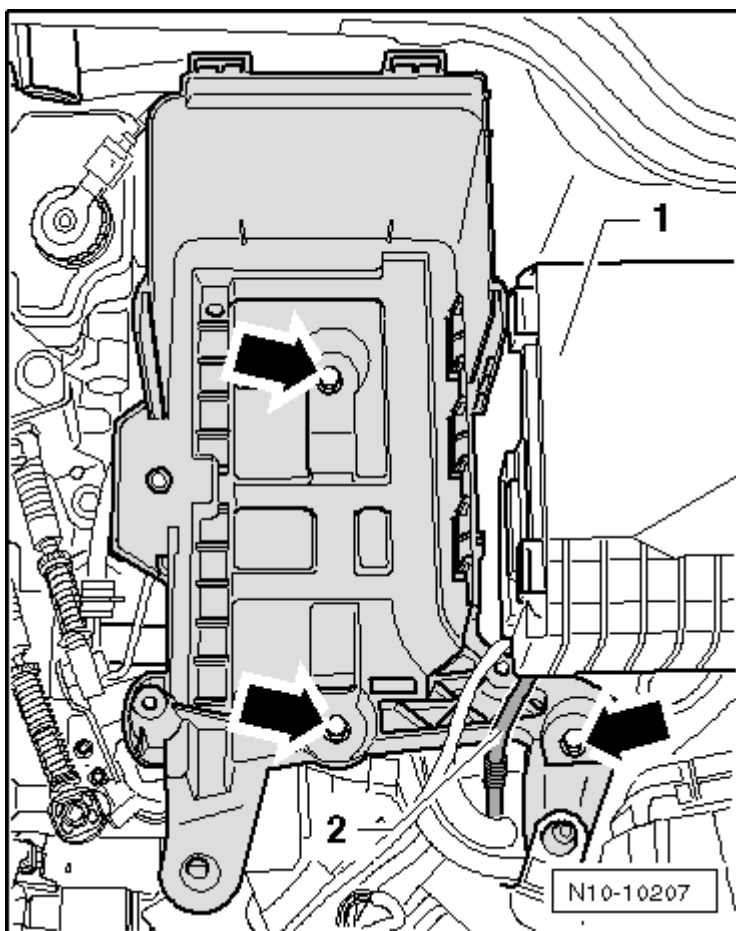


Fig. 31: Identifying Battery Holder & Bolts

Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

- Remove the bolts -arrows- and remove the battery tray from the vehicle.

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 open very carefully.

- Remove the intake manifold. Refer to **INTAKE MANIFOLD** .
- Install the transport strap back onto the cylinder head in order to better hold the cylinder head during removal.

- Remove the timing chain cover. Refer to **TIMING CHAIN COVER**.
- Remove the cylinder head cover. Refer to **CYLINDER HEAD COVER**.
- Secure the camshafts and remove the adjuster and sprocket from the camshafts. Refer to **VALVE TIMING, ADJUSTING**.
- Hold the timing chain -A- as shown, so it can be routed below the coolant pipe connection -arrow-.

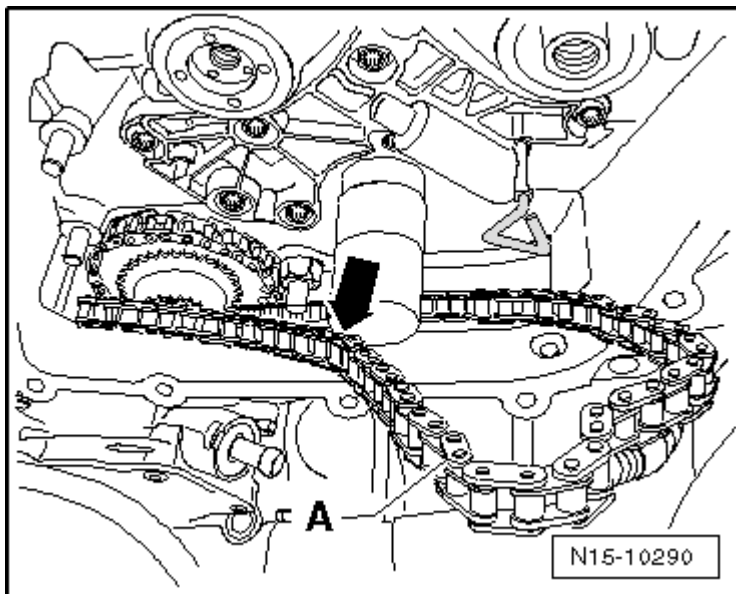


Fig. 32: Holding Timing Chain To Be Able To Lay It Under Pipe Connection
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

- Remove the 4 exhaust pipe with catalytic converter to exhaust manifold nuts -2- and the suspended mount bolts -3-.

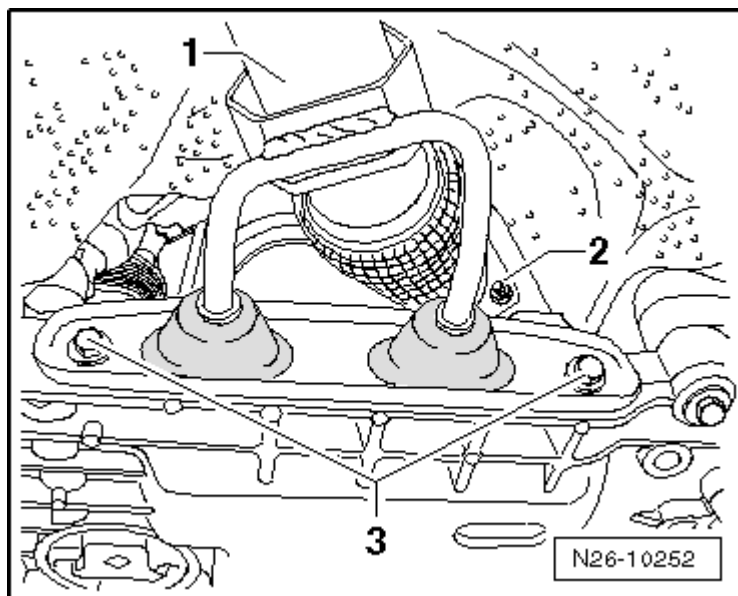


Fig. 33: Identifying Front Exhaust Pipe, Nuts & Bolts
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Remove the exhaust pipe with catalytic converter -1- from the manifold and tie it up firmly to the side. Refer to **EXHAUST PIPE WITH CATALYTIC CONVERTER** .

NOTE: The coupling element in the exhaust pipe with catalytic converter must not be bent more than 10°, otherwise it may be damaged.

-- Disconnect the connector for the heated oxygen sensor -G39- at the bulkhead.

-- Remove the wire bracket -3- bolts -arrows- at the Secondary Air Injection (AIR) valve.

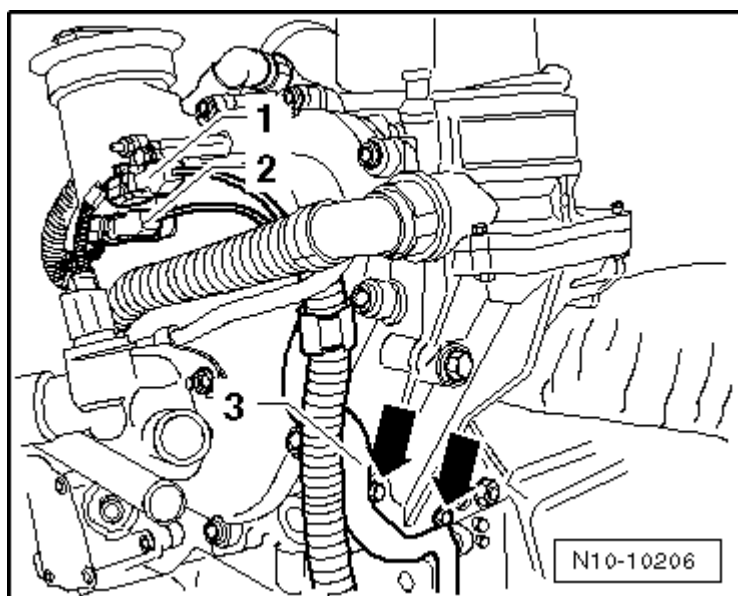


Fig. 34: Disconnecting Harness Connectors And Removing Bracket

Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Remove the cylinder head bolts in the specified sequence.

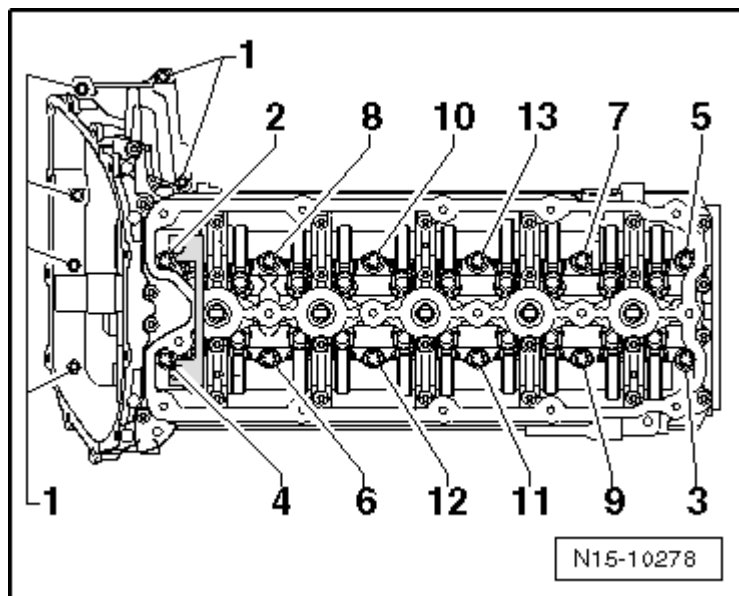


Fig. 35: Cylinder Head Bolts Removal Sequence

Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

NOTE: If the bolt -2- cannot be removed with a magnet, loosen the camshaft clamp T40070 bolts one turn. Slide the camshaft clamp T40070 forward and to the right and tighten the bolts again.

A second technician is required to remove and install the cylinder head.

-- Carefully 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 cylinder bores and chain compartment so that no dirt or abrasive powder can penetrate between the cylinder wall and piston and into the chain compartment.