

ENGINE

2.5 Liter - Crankshaft, Cylinder Block - Engine Code(s): BPR & BPS (Convertible)

CRANKSHAFT, CYLINDER BLOCK

GENERAL INFORMATION

GENERAL REPAIR INFORMATION

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

Carefully clean the oil passages.

Replace the oil injection jets.

Replace the oil cooler.

Replace the oil filter.

NOTE: Clutch servicing, refer to [For transmission(s) 02J] Removal and Installation or to [For transmission(s) 0A4] Removal and Installation or to [For transmission(s) 02M] Removal and Installation .

NOTE: Engine is to be secured to the engine lateral bracket T03001 when performing service work.

NEW CONNECTING ROD, SEPARATING

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

-- Mark which cylinder the connecting rod belongs to, see -item 6- in **PISTON AND CONNECTING ROD ASSEMBLY OVERVIEW**.

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

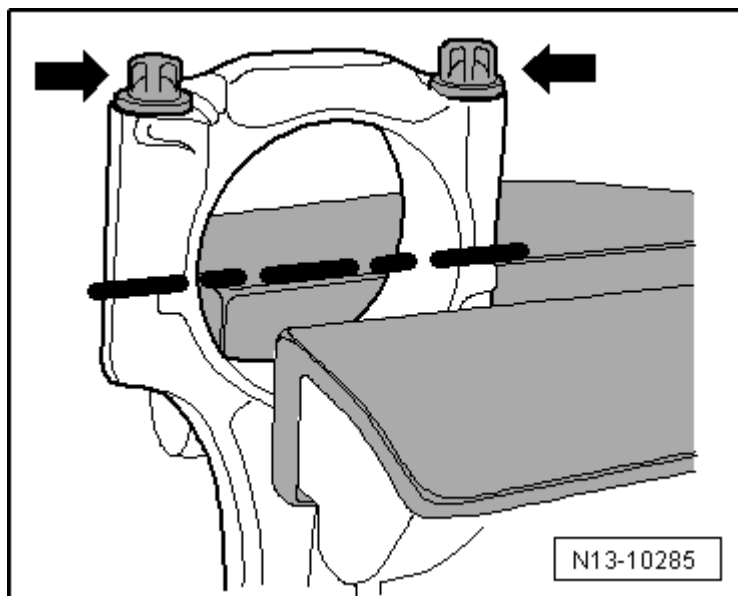


Fig. 1: Clamping Connecting Rod In Vise Equipped With Aluminum Protective Pads
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

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.

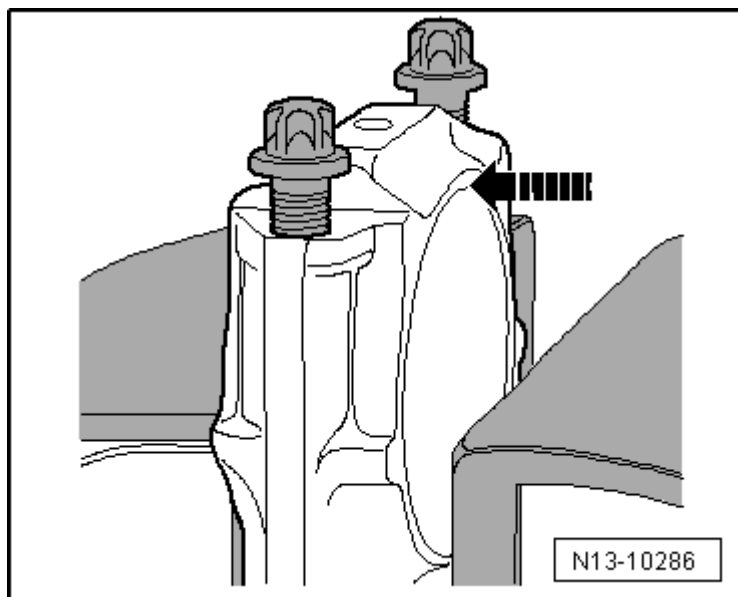


Fig. 2: Carefully Tapping Against Connecting Rod Bearing Cap
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

DESCRIPTION AND OPERATION

ACCESSORY DRIVE ASSEMBLY OVERVIEW

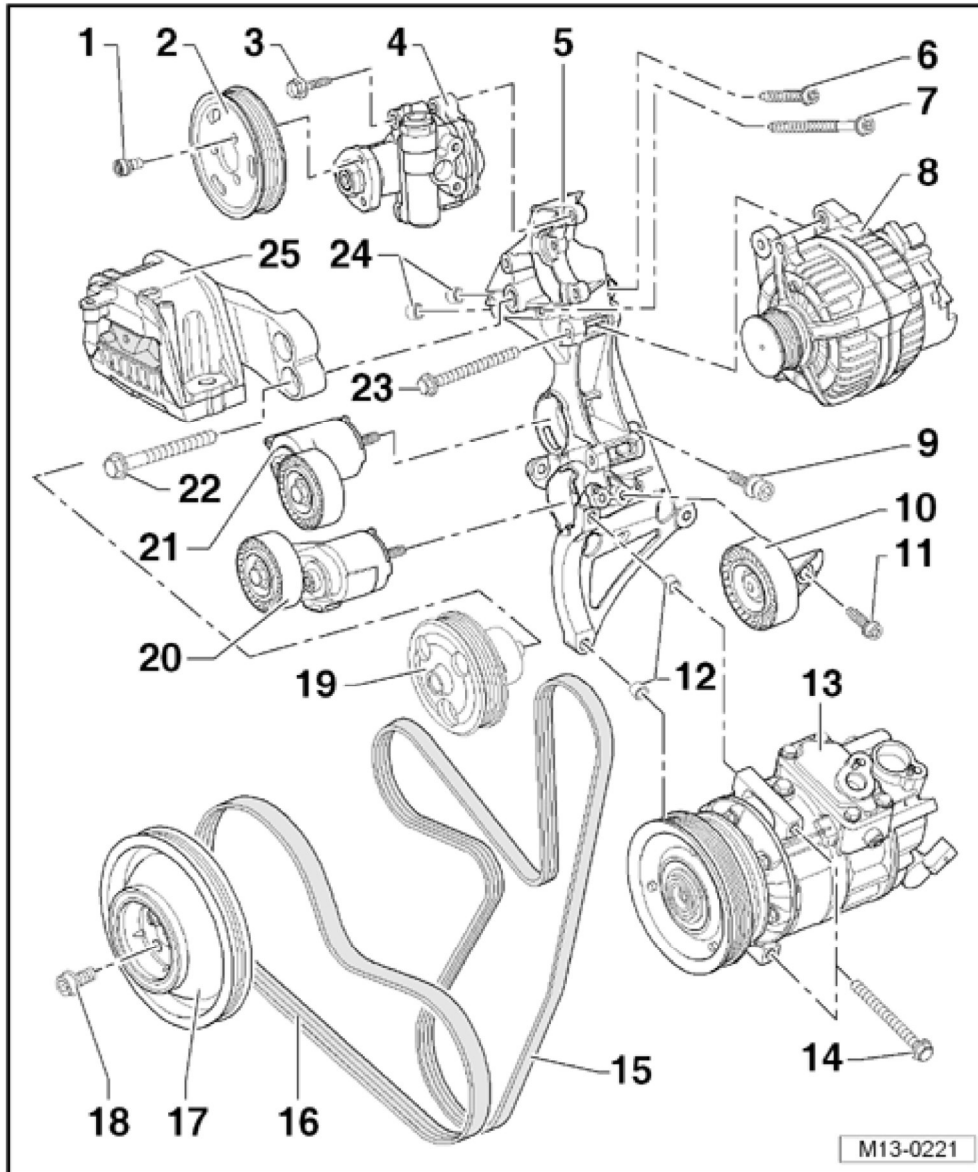


Fig. 3: Attachments, Assembly Overview (Part I - Ribbed Belt)
 Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

1. Bolt
 - Tightening specification, refer to Specifications .
2. Power Steering Pump Pulley
3. Bolt
 - Tightening specification, refer to Specifications .
4. Power Steering Pump

5. Accessory Bracket
6. Bolt, 25 Nm
7. Bolt, 25 Nm
8. Generator
 - Removal and installation, refer to **Removal and Installation** .
 - To facilitate installing the generator, slightly drive back the threaded bushings for the generator bolts.
9. Bolt, 25 Nm
10. Idler Pulley with Bracket
 - For the ribbed belt for the generator, power steering pump and coolant pump.
 - Do not remove the pulley.
11. Bolt, 25 Nm
12. Bushing
 - Quantity: 2
13. Air Conditioning (A/C) Compressor
 - Removal and installation, refer to **Description and Operation** .
14. Bolt, 25 Nm
15. Ribbed Belt, for the Generator, Power Steering Pump and Coolant Pump
 - Ribbed belt routing, refer to **Fig. 4**.
 - Before removing, mark the direction of rotation using chalk or a felt tip pen.
 - Check for wear.
 - Do not kink.
 - Removal and installation, refer to **RIBBED BELT**.
16. Ribbed Belt, for the A/C Compressor
 - Ribbed belt routing, refer to **Fig. 4**.
 - Before removing, mark the direction of rotation using chalk or a felt tip pen.
 - Check for wear.
 - Do not kink.
 - Removal and installation, refer to **RIBBED BELT**.
17. Crankshaft Pulley/Vibration Damper
 - To remove and install, lock the crankshaft. Refer to **CRANKSHAFT, LOCKING**.
18. Bolt, 50 Nm + 90° (1/4) additional turn
 - Quantity: 5
 - Replace
 - Only use N 907 630 04 bolts (strength category 10.9).
19. Coolant Pump
 - In the cylinder block.
 - Removal and installation, refer to **COOLANT PUMP** .

20. Ribbed Belt Tensioner, for the A/C Compressor Belt, 35 Nm
 - Do not remove the pulley.
21. Ribbed Belt Tensioner, for the Generator, Power Steering Pump and Coolant Pump Belt, 35 Nm
 - Do not remove the pulley.
22. Bolt, 40 Nm + 90° (1/4) additional turn
 - Replace
23. Bolt, 25 Nm
24. Bushing
 - Quantity: 2
25. Engine Mount

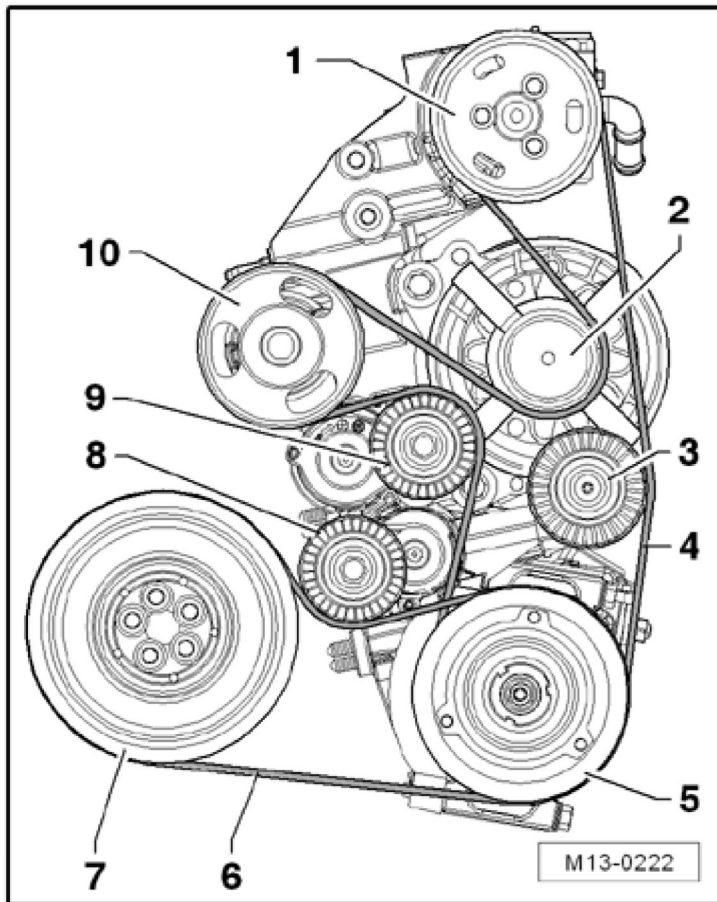


Fig. 4: Placing Ribbed Belt For Generator, Vane Pump And Coolant Pump On To Belt Pulleys & On To Idler Pulley

Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

1. Power steering pump
2. Generator pulley
3. Lower idler pulley

4. Ribbed belt, for the generator, power steering pump and coolant pump
5. A/C compressor pulley
6. Ribbed belt, for the A/C compressor
7. Crankshaft pulley/vibration damper
8. Ribbed belt tensioner pulley, for the A/C compressor belt
9. Ribbed belt tensioner pulley, for the generator, power steering pump and coolant pump belt
10. Coolant pump pulley

CYLINDER BLOCK COMPONENTS, FRONT AND SIDE

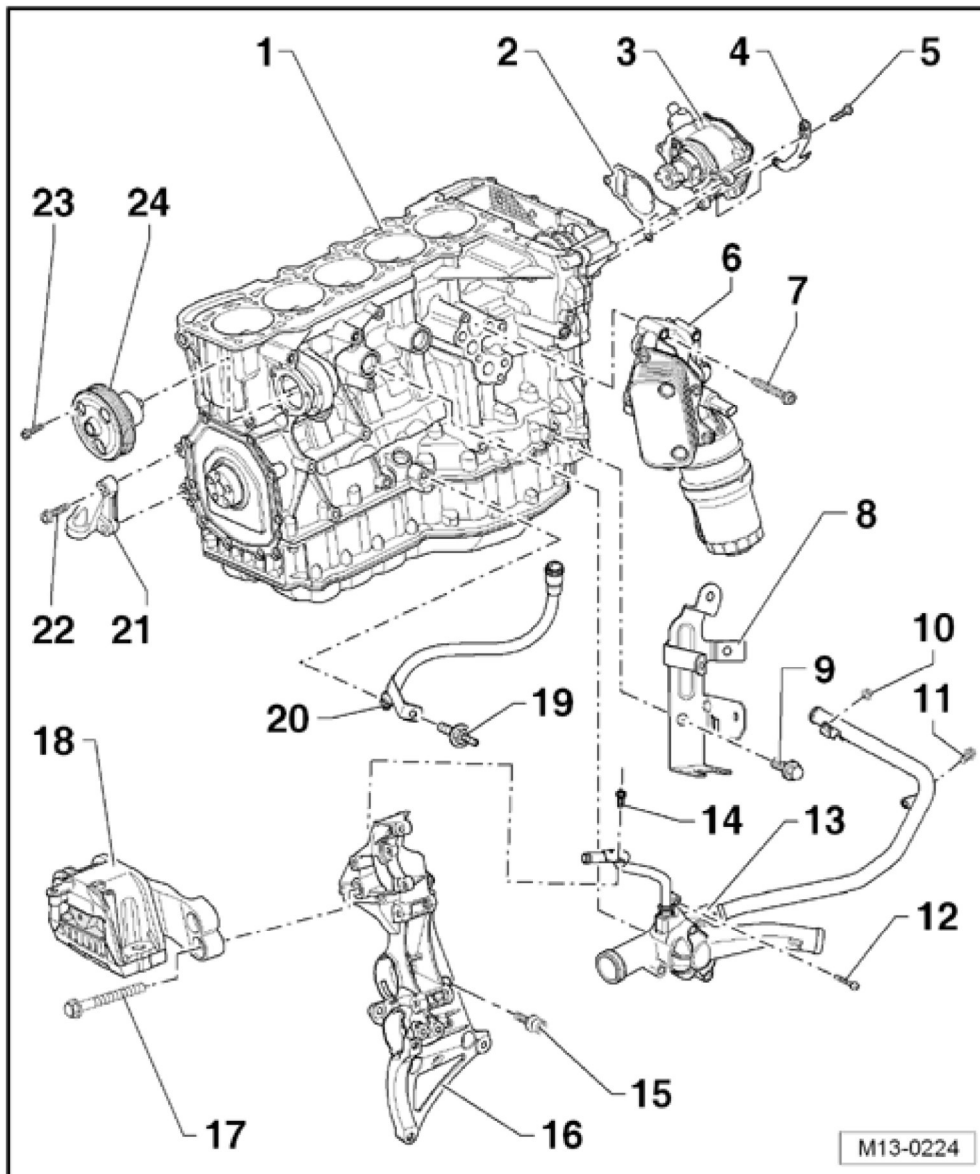


Fig. 5: Attachments, Assembly Overview (Part II - Engine Front/Side)
 Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

1. Cylinder Block
2. Gasket
 - Replace
3. Brake Booster Vacuum Pump
 - Do not open.
 - Removal and installation, refer to **BRAKE BOOSTER VACUUM PUMP**.
4. Bracket
5. Bolt, 10 Nm
6. Oil Filter Bracket
 - Assembly overview, refer to **OIL FILTER BRACKET ASSEMBLY OVERVIEW** .
7. Bolt, 25 Nm
8. Bracket
 - For the wiring harness.
 - For the harness connector of the engine speed (RPM) sensor -G28-.
9. Bolt, 25 Nm
10. Nut, 10 Nm
11. Bolt, 10 Nm
12. Bolt, 10 Nm
13. Thermostat Housing
 - With the thermostat and coolant pipe.
14. Bolt, 10 Nm
15. Bolt, 25 Nm
16. Accessory Bracket
17. Bolt, 40 Nm + 90° (1/4) additional turn
 - Replace
18. Engine Mount
19. Stud Bolt, 25 Nm
20. Guide Tube
 - For the oil dipstick.
21. Transport Strap
 - Not needed for service.
22. Bolt, 25 Nm
23. Bolt, 10 Nm
24. Coolant Pump
 - Removal and installation, refer to **COOLANT PUMP** .

CYLINDER BLOCK COMPONENTS, REAR

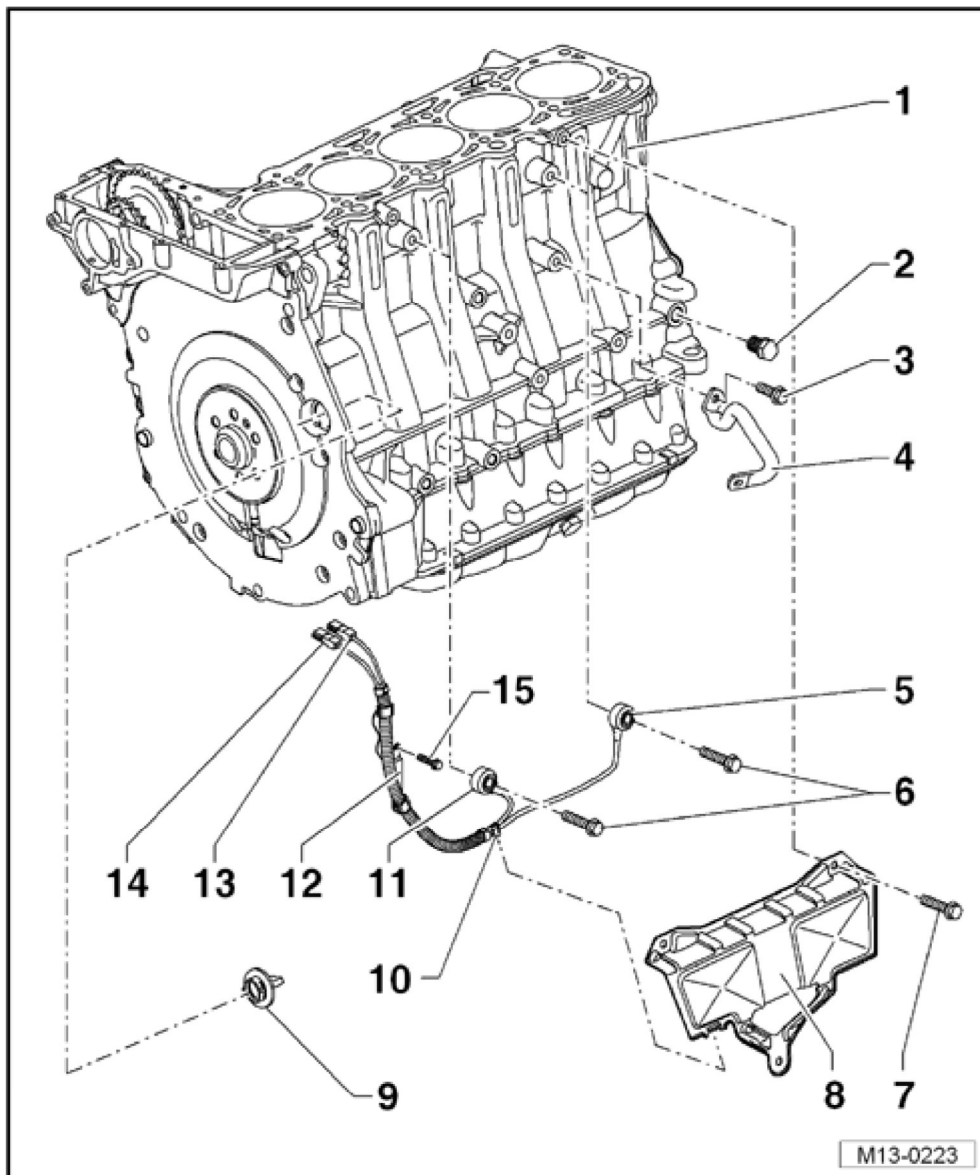


Fig. 6: Attachments, Assembly Overview (Part III - Engine Rear)

Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

1. Cylinder Block
2. Locking Bolt, 30 Nm
 - With a rolled up seal.
 - The bore in the cylinder block is used for securing the crankshaft using the locking pin T40069.
3. Bolt, 25 Nm
4. Brace
 - For the exhaust manifold.
5. Knock Sensor (KS) 1-G61-
 - Note the installed position: Wire connection points downward vertically.

6. Bolt, 20 Nm
 - Tightening specification affects the function of the KS.
7. Bolt 10 Nm
8. Shield
9. Bayonet Connection
10. Wire Clip
 - Clipped to the shield.
11. Knock Sensor (KS) 2 -G66-
 - Note the installed position: Wire connection points 45° toward the outside right.
12. Wire Bracket
 - Bolted to the Secondary Air Injection (AIR) valve.
13. Connector
 - Green for the KS 1.
 - Installed location, refer to **Fig. 7**.
 - Contacts are gold plated.
14. Connector
 - Gray for the KS 2.
 - Installed location, refer to **Fig. 7**.
 - Contacts are gold plated.
15. Bolt, 10 Nm

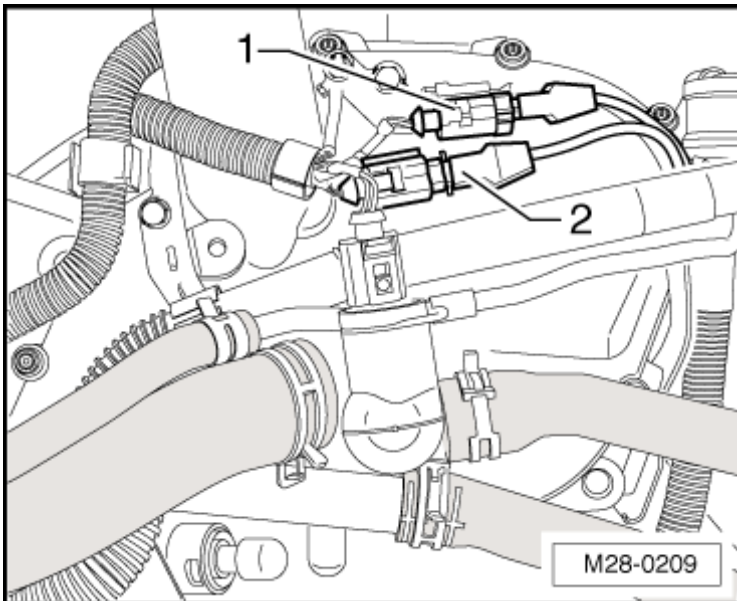


Fig. 7: Installation Position Of Harness Connectors For Knock Sensors
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

1. Green for the KS 1

2. Gray for the KS 2

TIMING AND OIL PUMP DRIVE CHAIN OVERVIEW

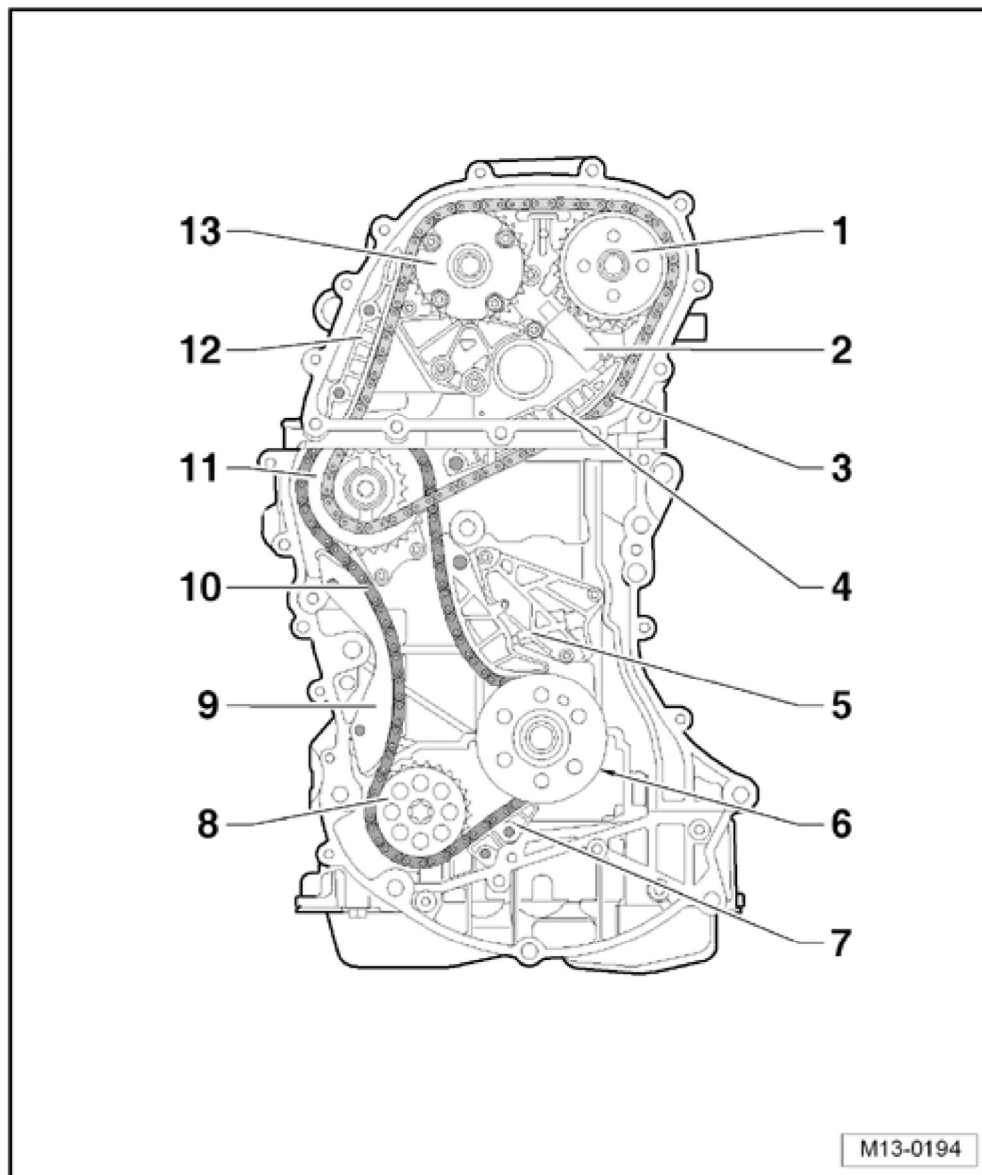


Fig. 8: Chain Drive, Assembly Overview
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

1. Exhaust Camshaft Sprocket
2. Timing Chain Tensioner
 - At the top with a sliding insert.
3. Timing Chain
4. Tensioning Rail
 - For the timing chain tensioner.

- Secured to the cylinder block.
- 5. Oil Pump Drive Chain Tensioner
 - With tensioning rail.
- 6. Crankshaft Sprocket
 - Part of the crankshaft.
- 7. Oil Pump Drive Chain Guide Rail
 - Secured to the upper oil pan.
- 8. Oil Pump Sprocket
 - Removal and Installation, refer to one of the following:
 - **OIL PUMP, THROUGH MY 2007 .**
 - **OIL PUMP, FROM MY 2008 .**
- 9. Oil Pump Drive Chain Guide Rail
- 10. Oil Pump Drive Chain
 - Beginning with Model Year (MY) 2008 the roller chain has been changed to a tooth chain.
- 11. Double Wheel Sprocket
- 12. Timing Chain Guide Rail
- 13. Intake Camshaft Adjuster
 - With the sprocket

TIMING CHAIN ASSEMBLY OVERVIEW

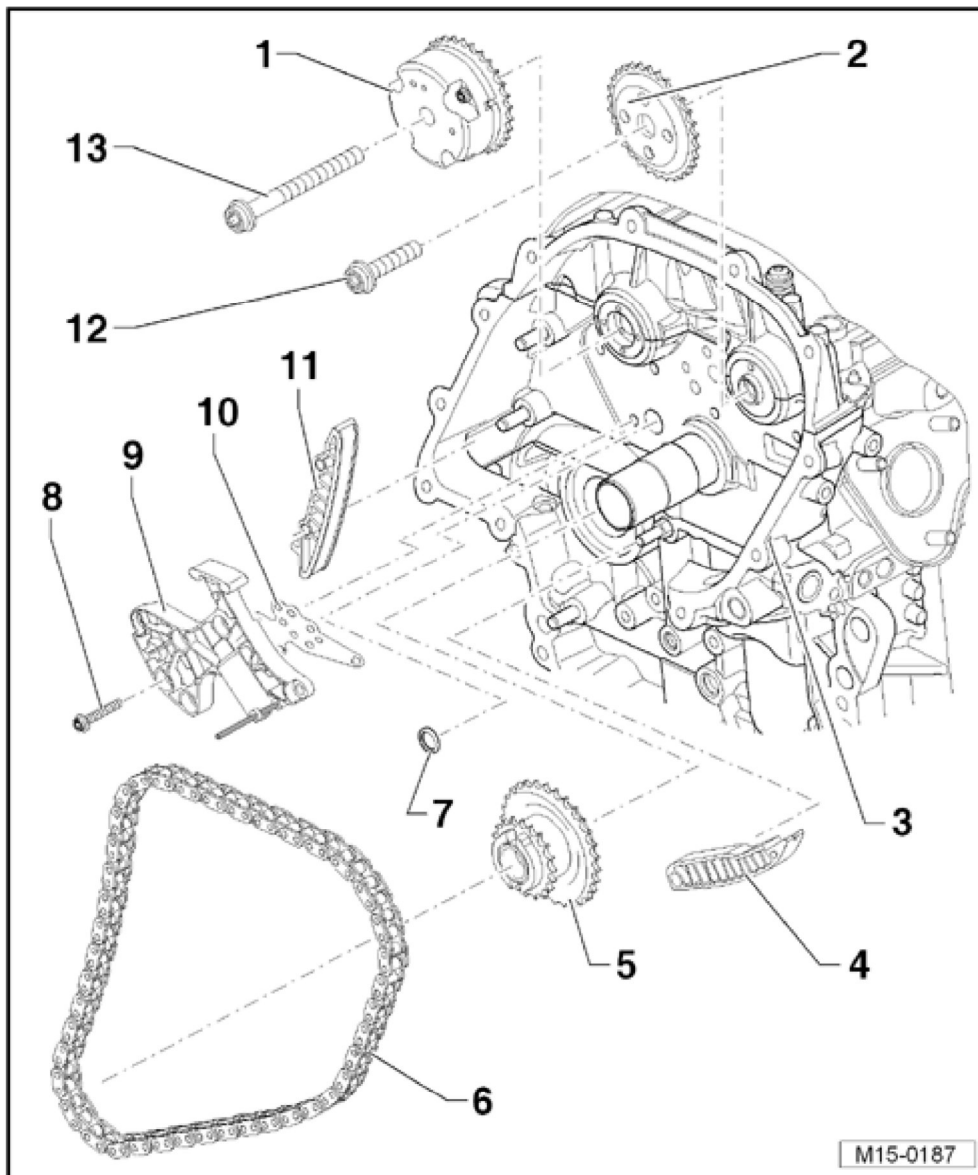


Fig. 9: Chain Drive, Assembly Overview - Timing Chain
 Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

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

- Secured to the cylinder block.
 - Oil before installing the pin.
5. Double Wheel Sprocket
- Securing, refer to **OIL PUMP DRIVE CHAIN ASSEMBLY OVERVIEW**.
6. Timing Chain
- Beginning with Model Year (MY) 2008 the roller chain has been changed to a tooth chain.
 - **Removing:**
 - Work procedure same as for "Adjust valve timing". Refer to **VALVE TIMING, ADJUSTING** .
 - Remove the vacuum pump. Refer to **BRAKE BOOSTER VACUUM PUMP**.
 - Mark direction of travel.
 - **Note when installing:**
 - Install in original direction of rotation.
 - Chain must lie correctly in the tensioning and guide rails.
 - Adjust the valve timing. Refer to **VALVE TIMING, ADJUSTING** .
7. Strainer
- Replace
8. Bolt, 10 Nm
9. Timing Chain Tensioner
- Secure with locking pin T03006.
10. Gasket
- Replace
11. Timing Chain Guide Rail
- Oil before installing the pin.
12. Bolt, 60 Nm + 90° (1/4) additional turn
- Replace
13. Bolt, 60 Nm + 90° (1/4) additional turn
- Replace

OIL PUMP DRIVE CHAIN ASSEMBLY OVERVIEW

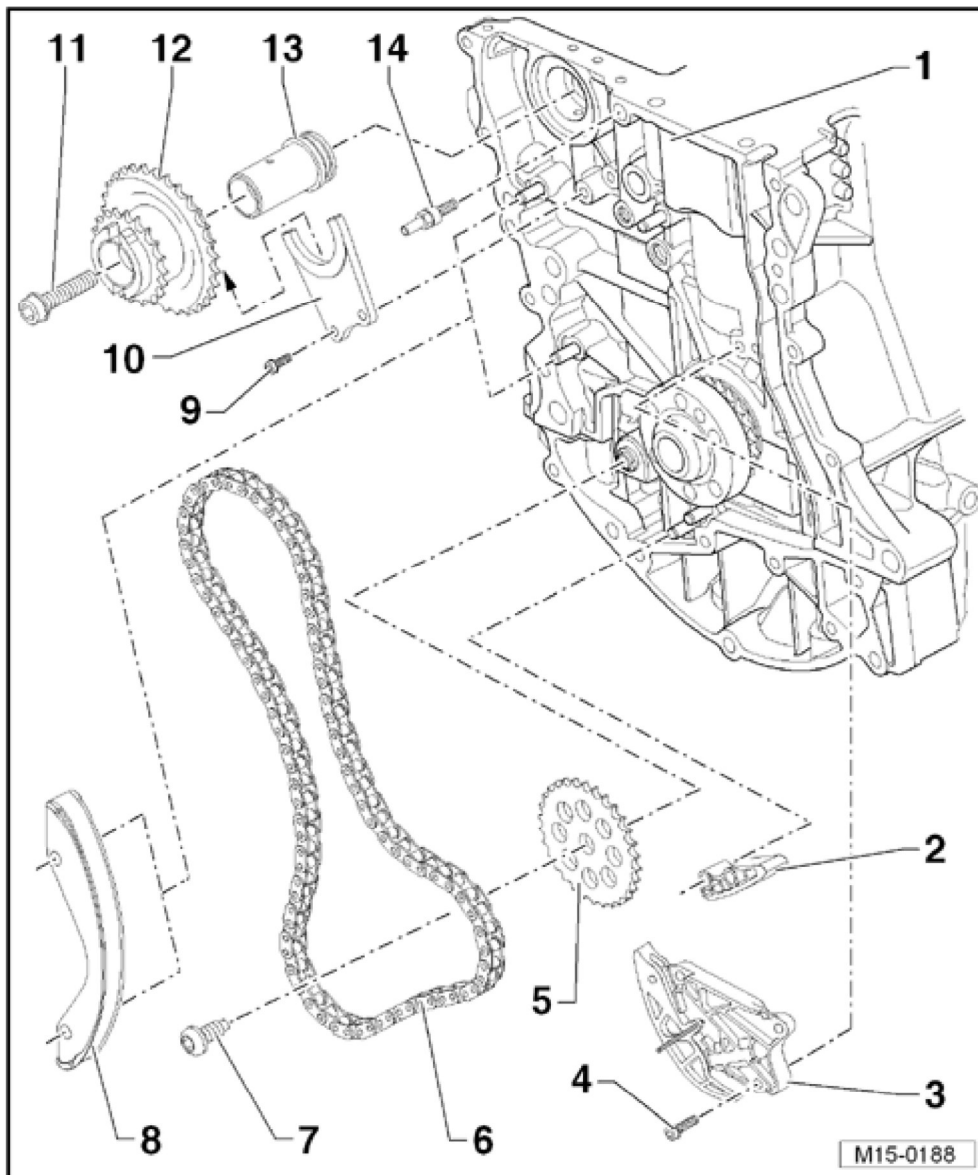


Fig. 10: Chain Drive, Assembly Overview - Drive Chain For Timing Mechanism
 Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

1. Cylinder Block
2. Oil Pump Drive Chain Guide Rail
 - Secured to the upper oil pan.
 - Oil before installing the pin.
3. Oil Pump Drive Chain Tensioner
 - Secure with locking pin T10115.
4. Bolt, 10 Nm
5. Oil Pump Sprocket
 - **Removal and Installation, refer to one of the following:**

- **OIL PUMP, THROUGH MY 2007 .**
- **OIL PUMP, FROM MY 2008 .**

6. Oil Pump Drive Chain

- Removing:
 - Remove the engine.
 - Remove the control housing cover.
 - Remove the timing chain.
 - Remove the chain tensioner.
 - Mark direction of travel.
- **Note when installing:**
 - Install in the original direction of rotation.
 - Chain must lie correctly in the tensioning and guide rails.
 - Adjust the valve timing. Refer to **VALVE TIMING, ADJUSTING .**

7. Bolt, 20 Nm + 90° (1/4) additional turn

- Replace

8. Oil Pump Drive Chain Guide Rail

- Oil before installing the pin

9. Bolt, 10 Nm**10. Axial Bearing Disc**

- Engages in the groove in the double wheel sprocket.

11. Bolt, 60 Nm + 90° (1/4) additional turn

- Replace

12. Double Wheel Sprocket

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

13. Double Wheel Sprocket Journal**14. Tensioning Rail Pin, 40 Nm**

- For the timing chain tensioner.

SEALING FLANGE AND DRIVE PLATE/FLYWHEEL ASSEMBLY OVERVIEW



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5. Cylinder Block
6. 60 Nm + 90° (1/4) additional turn
 - Replace
7. Drive Plate/Flywheel
 - To remove, secure the crankshaft using the locking pin T40069.
 - Drive plate, removal and installation. Refer to **DRIVE PLATE**.
8. Sensor Wheel
 - For the engine speed (RPM) sensor -G28-.
 - With position holder.
9. Crankshaft Seal, Transmission Side
 - Removal and installation, refer to **CRANKSHAFT SEAL, TRANSMISSION SIDE**.
10. Control Housing Cover
 - Removal and installation, refer to **CONTROL HOUSING COVER**.
11. O-ring
 - Replace
12. Bolt, 25 Nm
13. Alignment Bushings
14. Bolt, 5 Nm
15. Engine Speed (RPM) Sensor -G28-
16. Seal
 - Replace

CRANKSHAFT ASSEMBLY OVERVIEW

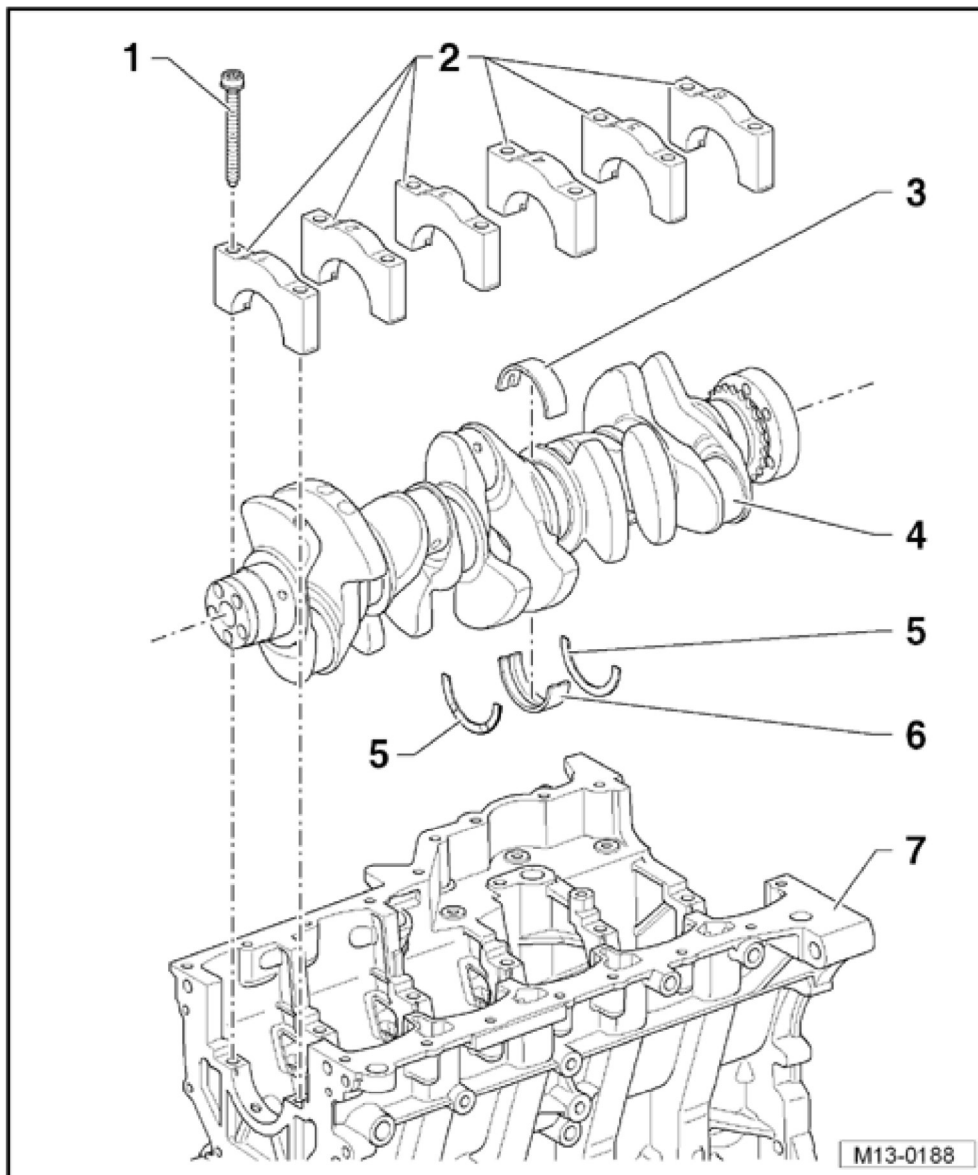


Fig. 12: Crankshaft, Assembly Overview

Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

1. Bolt, 40 Nm + 90° (1/4) additional turn
 - Replace
 - Fully threaded
 - Tighten to 40 Nm (but not any further) 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 lie above one another.
3. Bearing Shell, for the Bearing Cap
 - Without a lubricating groove.

- Do not interchange used bearing shells (mark them).

4. Crankshaft

- Axial play new: 0.07 to 0.21 millimeter (mm).

Wear limit: 0.30 mm

- Measure radial clearance with Plastigage.

New: 0.023 to 0.043 mm wear limit: 0.07 mm

- Do not turn crankshaft when measuring radial play.
- Crankshaft dimensions, refer to **CRANKSHAFT DIMENSIONS**.
- Crankshaft locking, refer to **CRANKSHAFT, LOCKING**.

5. Thrust Washers

- For bearing 3.
- Side lubricating grooves face outward.

6. Bearing Shell, for the Cylinder Block

- With a lubricating groove.
- Classification for replacement part ordering, refer to **Fig. 13**.
- Do not interchange used bearing shells (mark them).

7. Cylinder Block

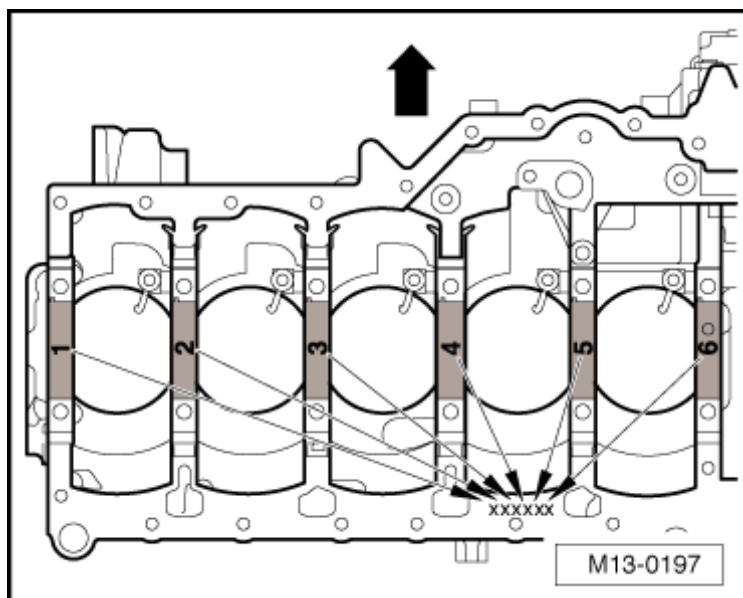


Fig. 13: Identification Of Top Crankshaft Bearing Shells
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

From the factory, the upper bearing shells are allocated to the cylinder block with the correct thickness. Colored spots serve to identify the bearing thicknesses.

2010 Volkswagen New Beetle

ENGINE 2.5 Liter - Crankshaft, Cylinder Block - Engine Code(s): BPR & BPS (Convertible)

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

G - Yellow

B - Blue

W - White

NOTE: -Arrow- points in direction of travel.

If colored marks can no longer be seen, use the blue bearing shell.

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

CRANKSHAFT, LOCKING

Special tools and workshop equipment required

- Torque wrench (5-50 Nm) VAG 1331
- Crankshaft adapter T03003
- Locking pin T40069

Locking the crankshaft for checking/adjusting valve timing. Refer to **CRANKSHAFT, LOCKING TO CHECK/ADJUST VALVE TIMING.**

Procedure

- Remove the noise insulation. Refer to **Description and Operation** .
- Remove the front part of the right front wheel housing liner. Refer to **Removal and Installation** .
- Install the T03003 onto the crankshaft pulley/vibration damper.

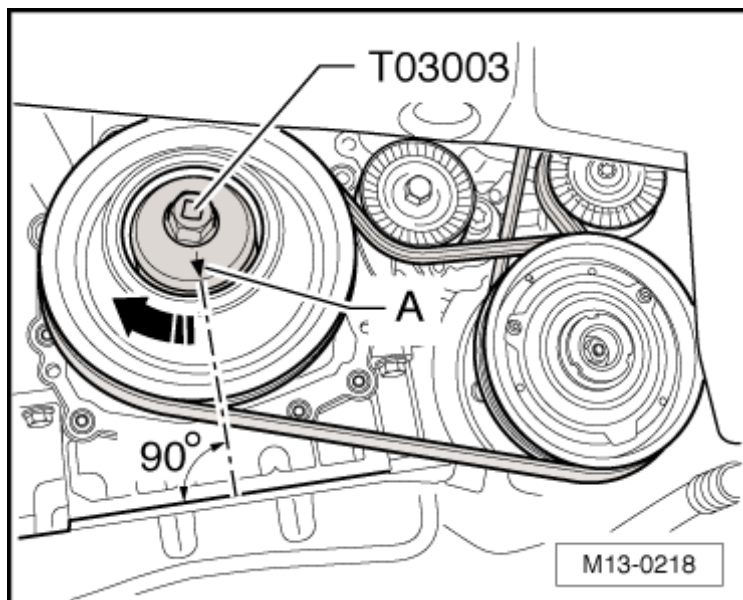


Fig. 14: Turning Crankshaft Only In Direction Of Engine Rotation
 Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

T03003 can only be installed correctly in one position.

-- Rotate the crankshaft in the direction of engine rotation -arrow- far enough until arrow -A- on the T03003 points downward vertically, relative to the 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 marking can also be seen on the belt pulley and belt pulley side sealing flange. Notches -A and B- must align.

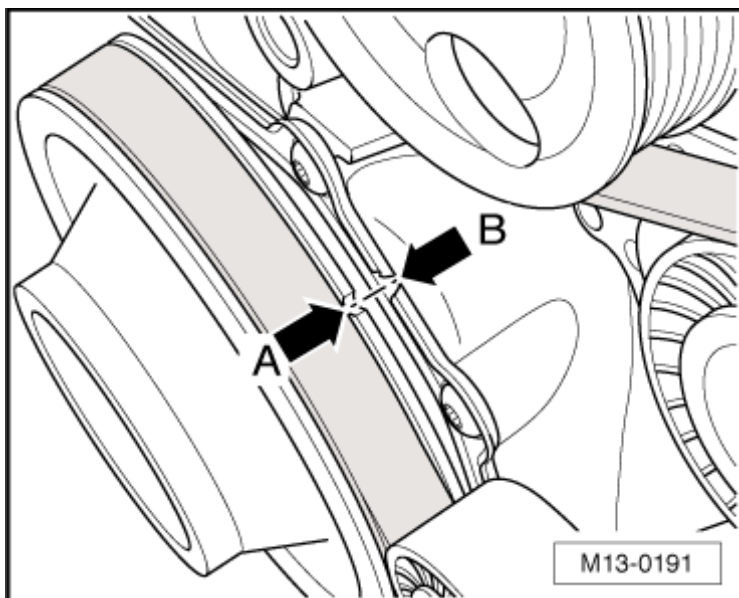


Fig. 15: Identifying Belt Pulley And Sealing Flange At TDC

Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

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

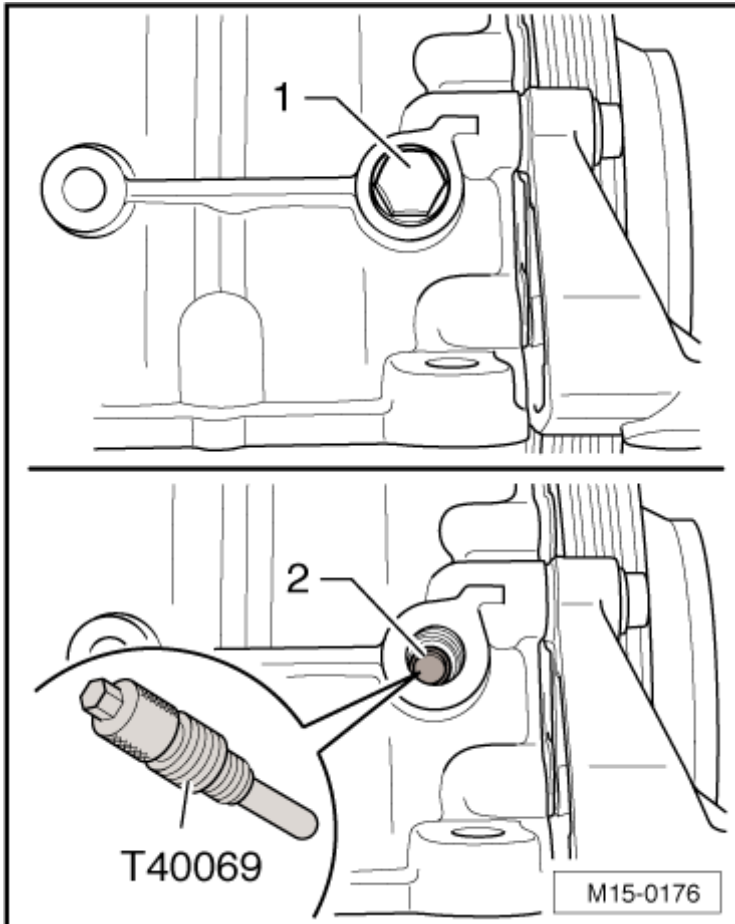


Fig. 16: Identifying Crankshaft Must Not Be Rotated Out Over TDC Marking
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- 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.

-- Rotate the crankshaft slightly if necessary.

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

-- Check whether the crankshaft can be rotated.

After Disassembly and Assembly Work

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

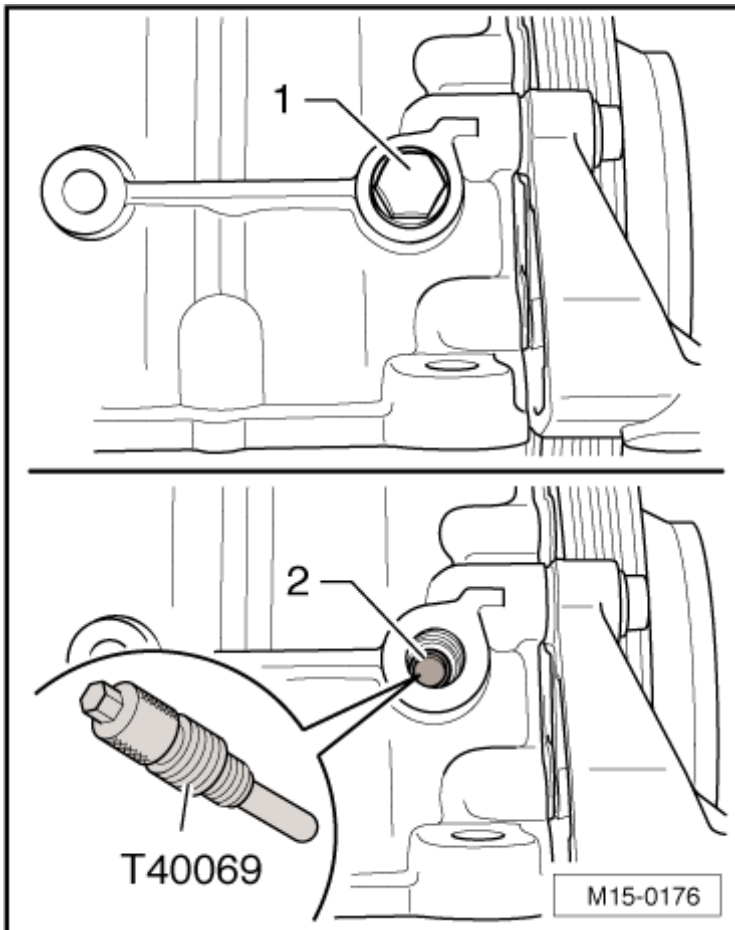


Fig. 17: Identifying Crankshaft Must Not Be Rotated Out Over TDC Marking
 Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

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

Tightening Specifications

Component	Nm
Locking bolt to cylinder block	30 Nm

CRANKSHAFT, LOCKING TO CHECK/ADJUST VALVE TIMING

- Remove the cylinder head cover. Refer to **CYLINDER HEAD COVER** .
- Perform the same work steps as for "Crankshaft, Locking". Refer to **CRANKSHAFT, LOCKING**.

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

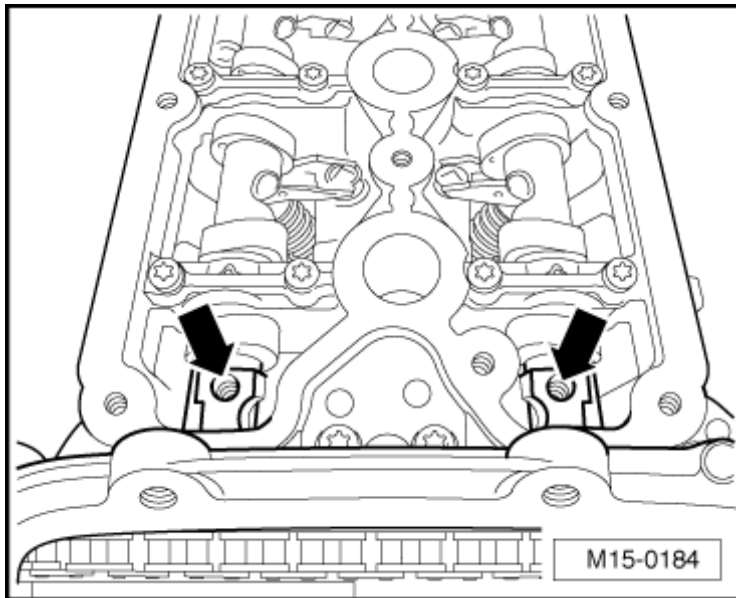


Fig. 18: Identifying Threaded Holes
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

In order to be able to precisely check and adjust valve timing, always note the following:

- Turn the crankshaft only in the direction of engine rotation -arrow-. Do not rotate the crankshaft back, not even slightly!

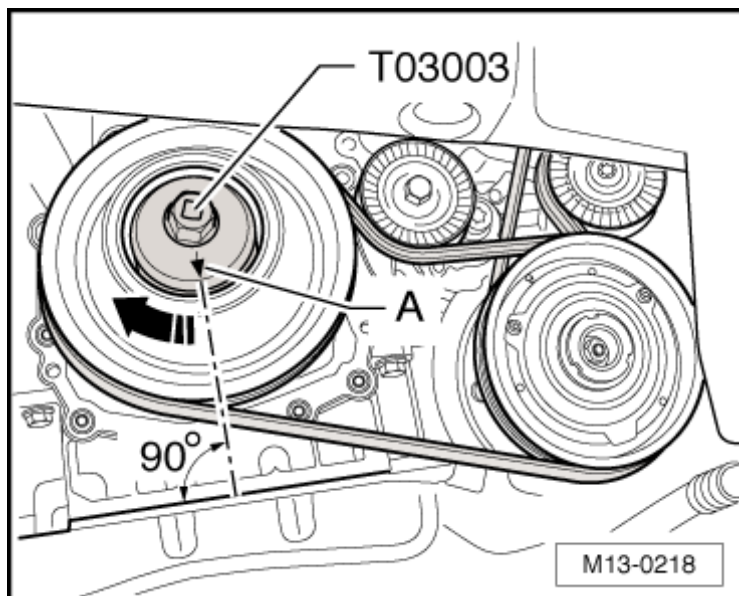


Fig. 19: Turning Crankshaft Only In Direction Of Engine Rotation
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

- The crankshaft must not be rotated past the Top Dead Center (TDC) mark. This means the bore -2- in the crankshaft must not rest above the threaded opening.

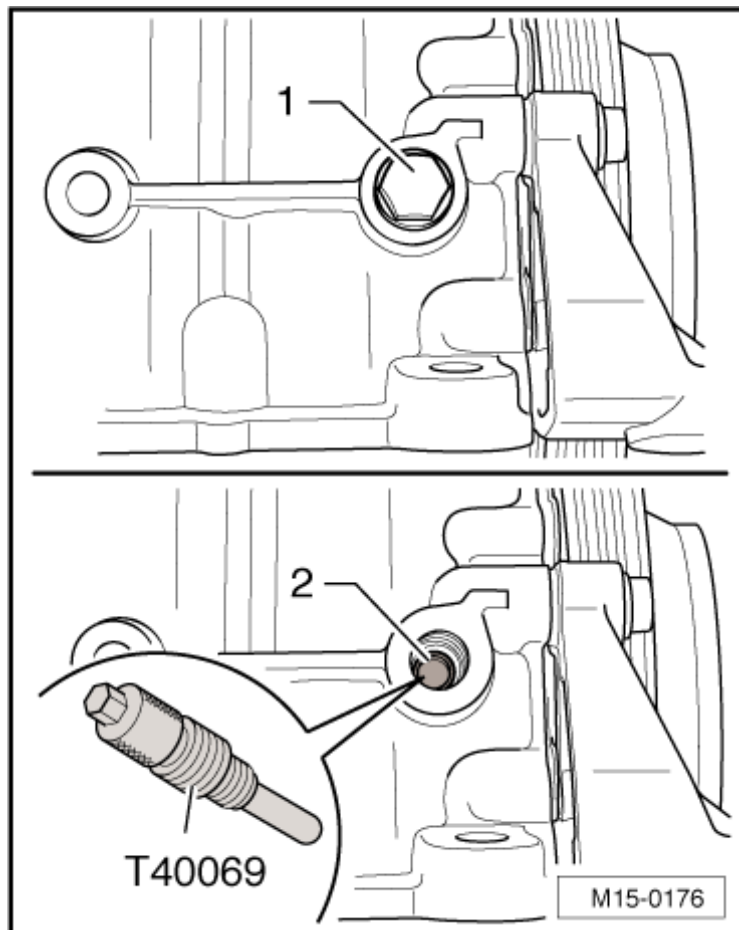


Fig. 20: Identifying Crankshaft Must Not Be Rotated Out Over TDC Marking
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

If the crankshaft was rotated past the TDC marking:

- Rotate the crankshaft back 45° in the opposite direction of engine rotation.
- Then rotate the crankshaft again into the TDC position in the direction of engine rotation.

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

PISTON AND CONNECTING ROD ASSEMBLY OVERVIEW

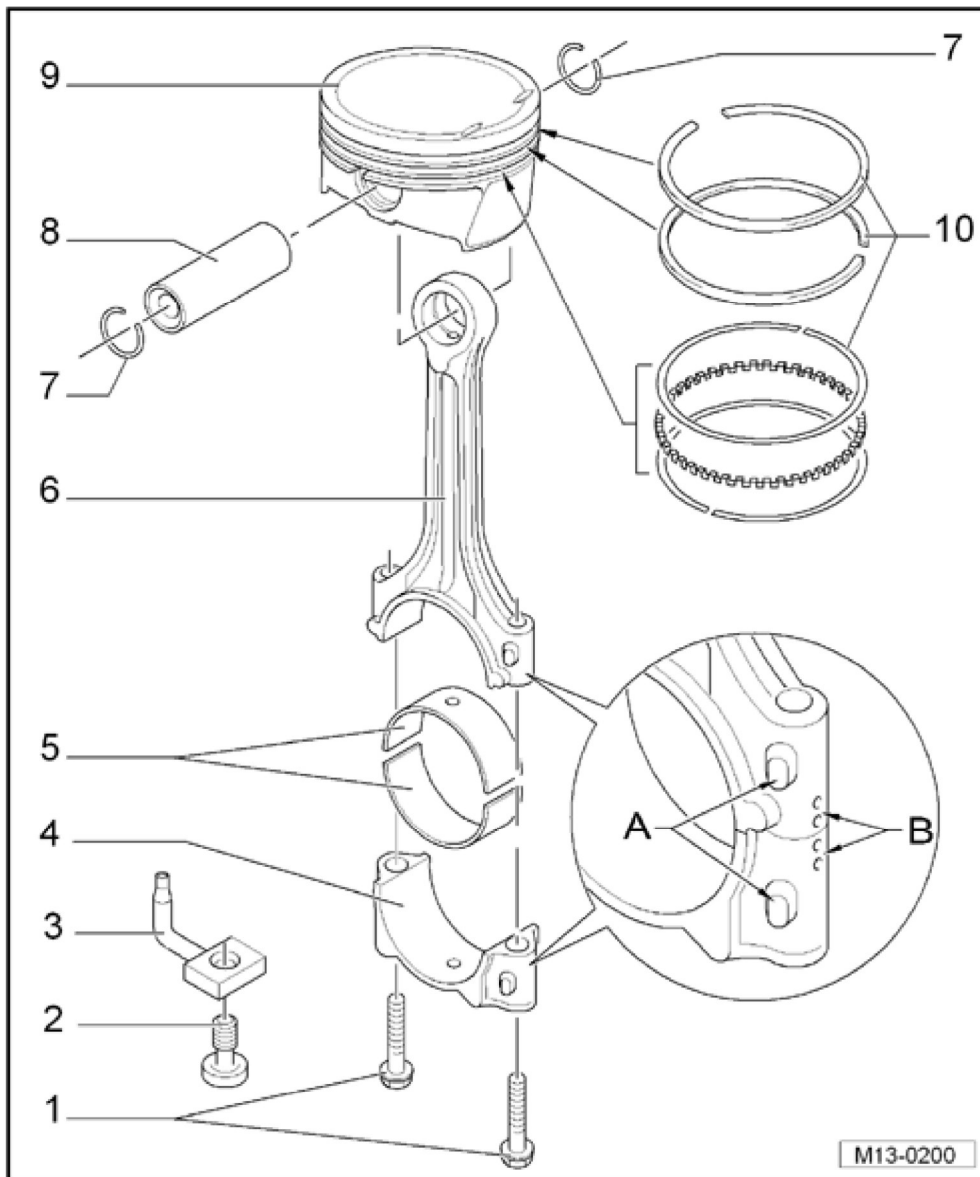


Fig. 21: Piston And Connecting Rod, Assembly Overview
 Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

1. Bolt, 30 Nm + 90° ($\frac{1}{4}$ additional turn)
 - Replace
 - Lubricate the threads and contact surfaces.
 - Tighten to 30 Nm to measure radial play, do not turn further.
2. 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

- Note the installed position.
- Due to the way the separated connecting rod breaks (cracks), the cap fits only in one position and only onto the respective connecting rod.
- Affiliation to the cylinder mark -B-.
- Installed position: Marks -A- point to the belt pulley side.

5. Bearing Shell

- Note the installed position, refer to **Fig. 22**.
- Do not interchange used bearing shells.
- Axial play new: 0.10 to 0.35 millimeter (mm).

Wear limit: 0.4 mm

- Measure radial clearance with Plastigage:

New: 0.02 to 0.06 mm

Wear limit: 0.09 mm

Do not turn the crankshaft when measuring radial play.

6. Connecting Rod

- With a cracked bearing cap.
- Separate new connecting rods. Refer to **NEW CONNECTING ROD, SEPARATING**.
- Only replace as a set.
- Affiliation to the cylinder mark -B-.
- Installed position: Marks -A- point to belt pulley side.

7. Circlip

8. Piston Pin

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

9. Piston

- Checking, refer to **Fig. 25**.
- Mark the installed position and cylinder allocation.
- Arrow on piston face points toward the belt pulley side.
- Install with a piston ring compressor.
- Checking cylinder bore, refer to **Fig. 26**.
- Piston and cylinder dimensions. Refer to **PISTON AND CYLINDER DIMENSIONS**.

10. Piston Rings

- Offset gaps by 120°
- Use piston ring pliers for removal and installation.

- Marks face toward the piston crown.
- Checking ring gap, refer to **Fig. 23**.
- Checking piston ring groove clearance, refer to **Fig. 24**.

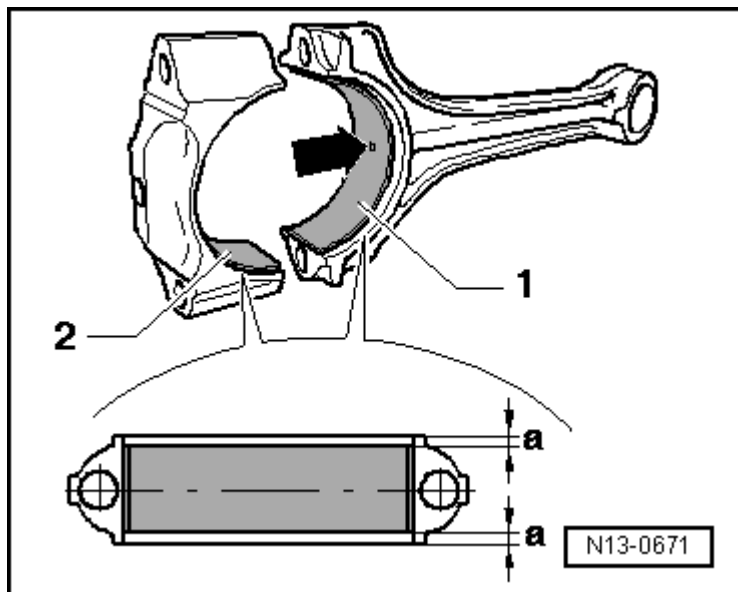


Fig. 22: Bearing Shells - Installed Positions

Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

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

Bearing shell -2- without oil bore for connecting rod cover.

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

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

SPECIFICATIONS

CRANKSHAFT DIMENSIONS

(Dimensions in millimeters (mm))

Honing dimension	Crankshaft bearing pins-diameter		Connecting rod bearing pins-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

PISTON AND CYLINDER DIMENSIONS

2010 Volkswagen New Beetle

ENGINE 2.5 Liter - Crankshaft, Cylinder Block - Engine Code(s): BPR & BPS (Convertible)

Honing dimension	Piston diameter	Cylinder bore diameter
Basic dimension millimeter (mm)	82.465 ⁽¹⁾	82.51
(1) Measurement does not include graphite coating (thickness = 0.02 mm). The graphite coating wears off.		

FASTENER TIGHTENING SPECIFICATIONS

Component	Fastener Size	Nm
Accessory Bracket Bolt	-	25
Air Conditioning (A/C) Compressor Bolt	-	25
Axial Bearing Disc Bolt	-	10
Belt Tensioner to Accessory Bracket Bolt	-	35
Brake Booster Vacuum Pump to Control Housing Cover Bolt	-	10
Connecting Rod Bearing Cap Bolt ⁽¹⁾	-	30 + 90° turn
Control Housing Cover Bolt	-	25
Coolant Pipe Bolt/Nut	-	10
Coolant Pump to Cylinder Block Bolt	-	10
Crankshaft Bearing Cap Bolt ⁽¹⁾	-	40 + 90° turn
Crankshaft Pulley/Vibration Damper Bolt ⁽¹⁾	-	50 + 90° turn
Double Wheel Sprocket Bolt ⁽¹⁾	-	60 + 90° turn
Drive Plate/Flywheel Bolt ⁽¹⁾	-	60 + 90° turn
Engine Mount to Accessory Bracket Bolt ⁽¹⁾	-	40 + 90° turn
Engine Speed Sensor Bolt	-	5
Exhaust Camshaft Sprocket Bolt ⁽¹⁾	-	60 + 90° turn
Exhaust Manifold Brace to Cylinder Block Bolt	-	25
Generator to Accessory Bracket Bolt	-	25
Generator, Power Steering and Coolant Pump Belt Idler Pulley with Bracket to Accessory Bracket Bolt	-	25
Heat Shield to Cylinder Block Bolt	-	10
Idler Pulley with Bracket to Accessory Bracket Bolt	-	25
Intake Camshaft Adjuster Bolt ⁽¹⁾	-	60 + 90° turn
Knock Sensor (KS) Bolt	-	20
Knock Sensor Wiring Harness Bracket Bolt	-	10
Locking Bolt	-	30
Oil Dipstick Guide Tube Stud Bolt	-	25
Oil Filter Bracket to Cylinder Block Bolt	-	25
Oil Pump Drive Chain Tensioner Bolt	-	10
Oil Pump Sprocket Bolt ⁽¹⁾	-	20 + 90° turn
Pressure Relief Valve	-	27

2010 Volkswagen New Beetle

ENGINE 2.5 Liter - Crankshaft, Cylinder Block - Engine Code(s): BPR & BPS (Convertible)

Sealing Flange Bolt	-	10
Thermostat Housing with Coolant Pipe Bolt/Nut	-	10
Timing Chain Tensioner Bolt	-	10
Timing Chain Tensioner Pin	-	40
Transport Strap to Cylinder Block Bolt	-	25
Wire Bracket to Cylinder Block Bolt	-	25
(1) Always replace		

DIAGNOSIS AND TESTING

PISTON, RINGS AND CYLINDER BORE, CHECKING

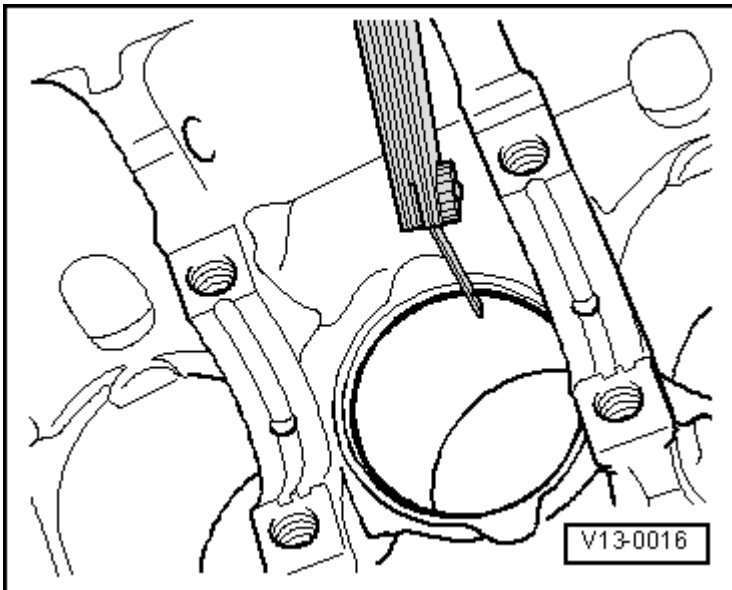


Fig. 23: Checking Piston Ring Gap

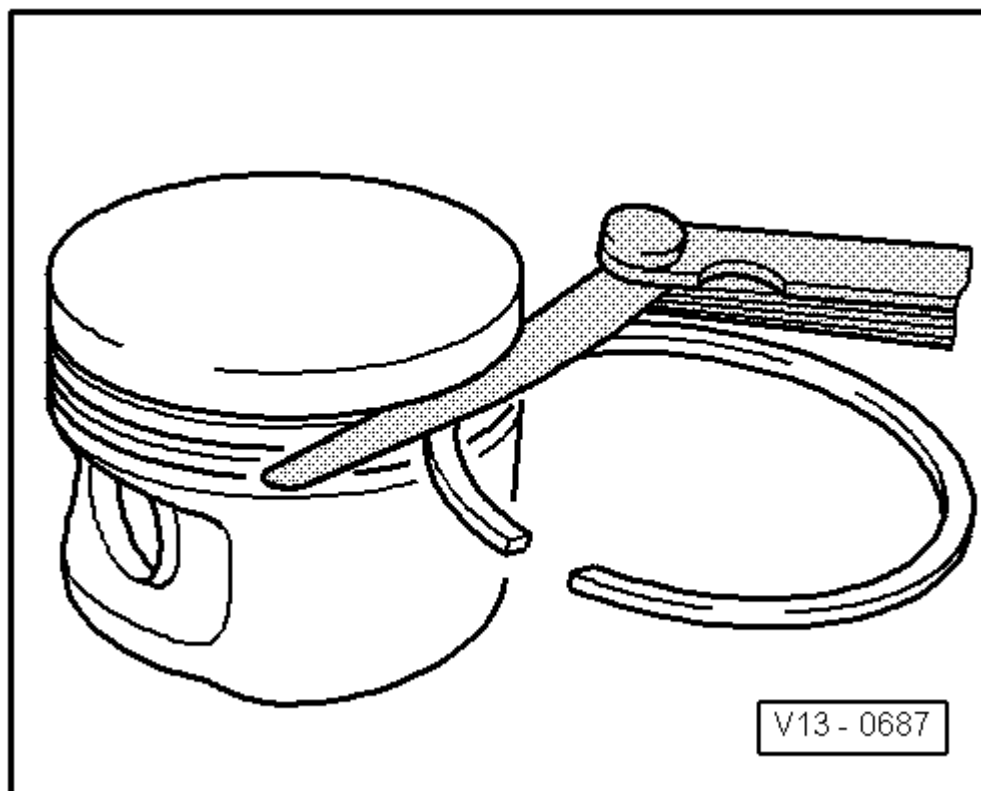
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

Special tools and workshop equipment required

- Feeler gauge

-- Insert the ring into the bottom of the cylinder opening at a right angle from above, approximately 15 millimeter (mm) from cylinder edge.

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

**Fig. 24: Checking Piston Ring Gap**

Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

Special tools and workshop equipment required

- Feeler gauge

-- Before measuring, clean the ring groove.

Piston ring		Ring to groove clearance	
		New	Wear limit
Compression rings	mm	0.06 to 0.09	0.20
Oil scraping ring	mm	0.03 to 0.06	0.15

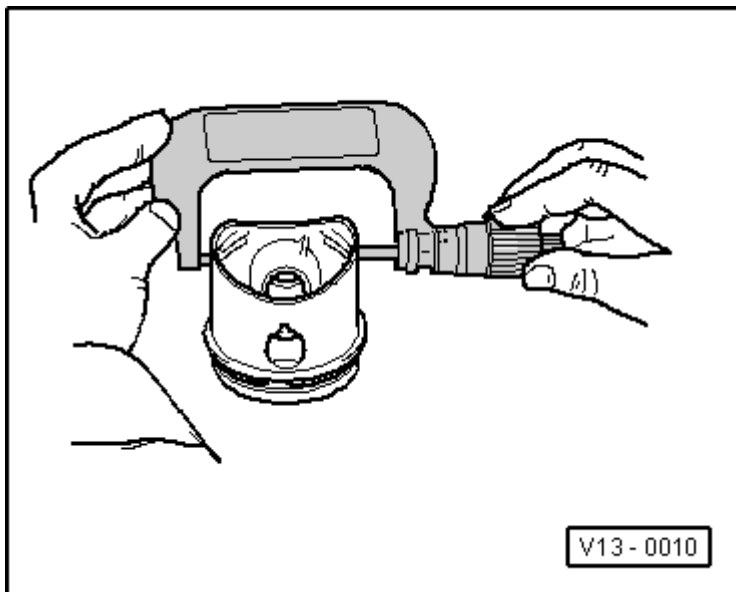


Fig. 25: Checking Piston

Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

Special tools and workshop equipment required

- External micrometer 75 to 100 mm

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

Deviations from nominal dimension: Max. 0.04 mm

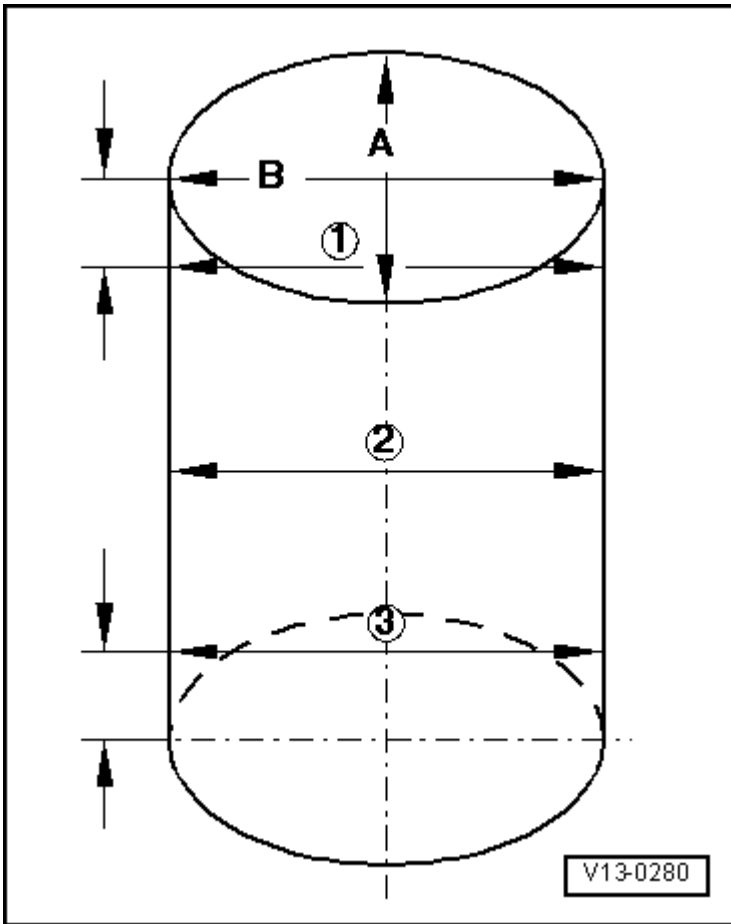


Fig. 26: Checking Cylinder Bores

Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

Special tools and workshop equipment required

- Internal dial gauge 50 to 100 mm

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

Deviation from nominal size: Max. 0.08 mm.

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

REMOVAL AND INSTALLATION

RIBBED BELT

Special tools and workshop equipment required

- Locking pin T10060A

Removing

- Remove the right main headlamp. Refer to **Removal and Installation** .
- Remove the noise insulation. Refer to **Description and Operation** .
- Remove the right front wheel housing liner. Refer to **Removal and Installation** .

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

- Mark the direction of rotation of the ribbed belt.
- Rotate the belt tensioner -1- as shown using a 15 millimeter (mm) box end wrench -A- in the -direction of the arrow- and secure using T10060A.

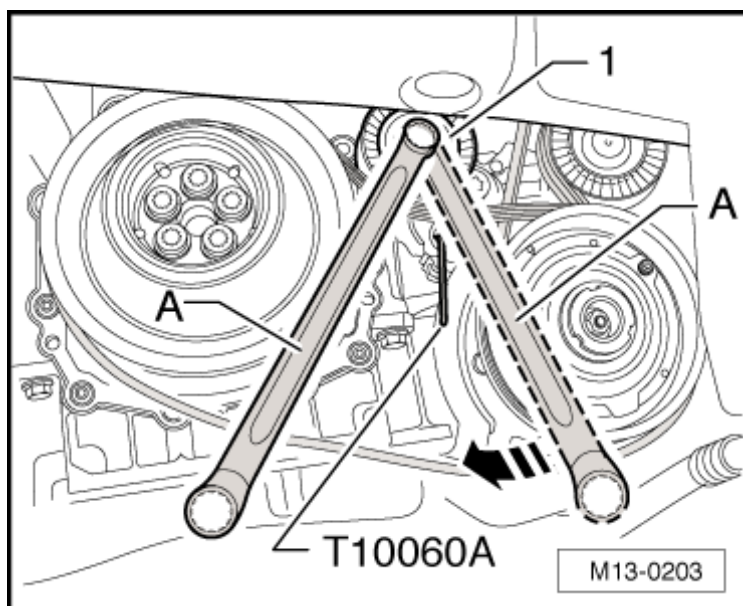


Fig. 27: Locking Tensioner In Position With Locking Pin T10060A
 Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

- Remove the ribbed belt for the A/C compressor.

Removing the Ribbed Belt for the Generator, Power Steering and Coolant Pumps

- Relieve the tension on the belt tensioner -1- for the A/C compressor belt (pull out the T10060A).
- Mark the running direction of the ribbed belt for the generator, power steering and coolant pumps.
- Insert the T10060A into the belt tensioner -2-.

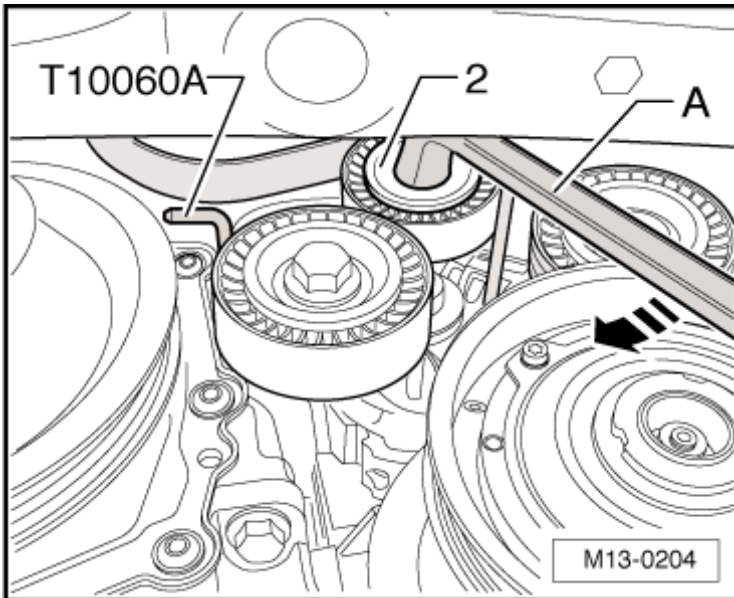


Fig. 28: Inserting Locking Pin T10060A Into Tensioning Element
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Rotate the belt tensioner -2- using a 15 mm box end wrench -A- in the -direction of the arrow- and secure using T10060A.

-- Remove the ribbed belt for the generator, power steering and coolant pumps.

Installing

Installation is performed in reverse order. When doing this note the following:

-- Place the ribbed belt for the generator, power steering and coolant pumps onto the pulleys, then lastly onto the idler pulley -3-.

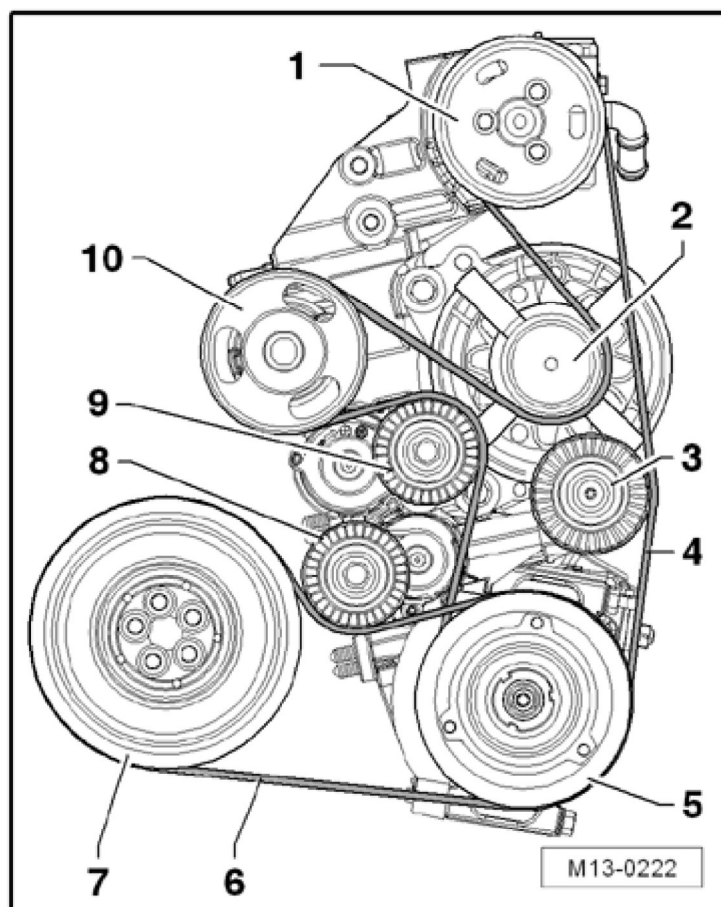


Fig. 29: Placing Ribbed Belt For Generator, Vane Pump And Coolant Pump On To Belt Pulleys & On To Idler Pulley

Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Before tensioning the ribbed belt for the generator, power steering and coolant pumps, rotate the A/C compressor belt tensioner and check the belt for correct seating in the pulley.

-- Before installing the ribbed belt for the A/C compressor, secure the tensioner using T10060A.

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

-- Start the engine and check the belt running.

BRAKE BOOSTER VACUUM PUMP

Special tools and workshop equipment required

- Torque wrench (5-50 Nm) VAG 1331

NOTE: Due to installation conditions, the transmission must be removed on vehicles

with a automatic transmission.

Removing

- Remove the engine cover.
- Remove the intake hose -1- and disconnect the connector -2- from the Mass Air Flow (MAF) sensor.

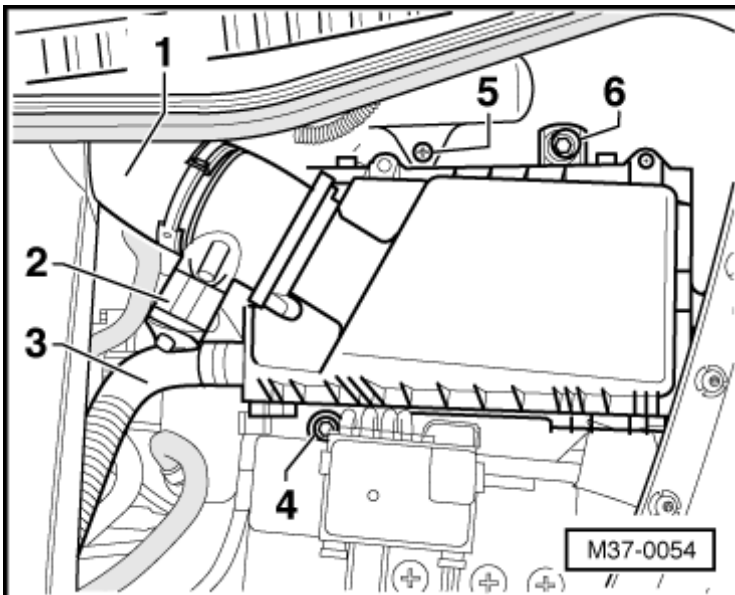
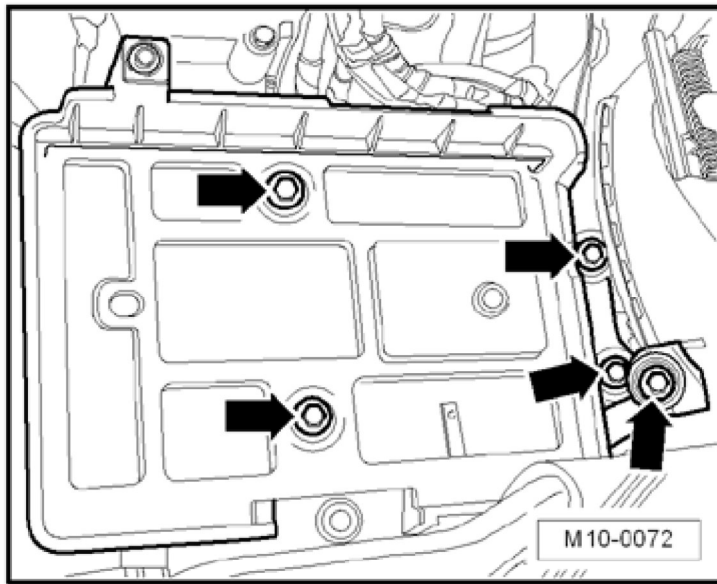


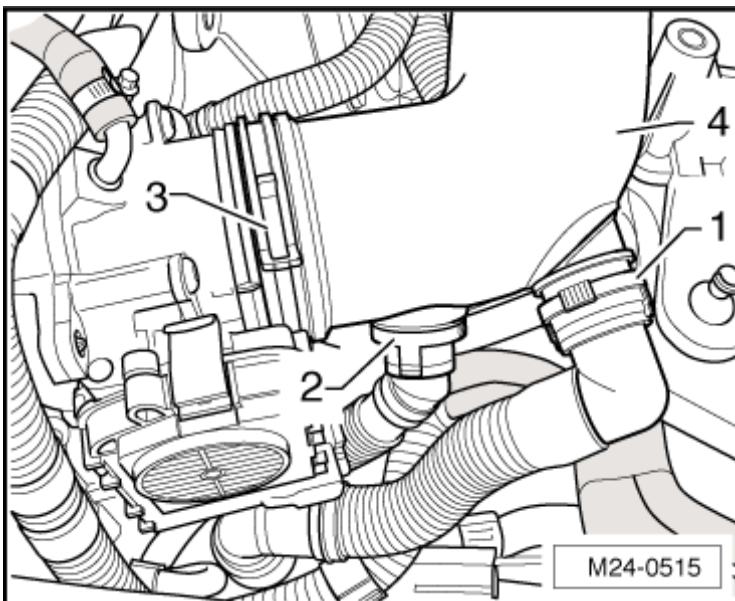
Fig. 30: Removing Bolts And Air Filter Housing
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

- Disconnect the hose -3- from the air filter housing.
- Remove the bolts -4 and 6- and remove the air filter housing.
- Remove the battery. Refer to **Removal and Installation** .
- Remove the battery holder bolts -arrows- and remove the battery holder from the vehicle.

**Fig. 31: Removing Battery Holder**

Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Remove the intake hose -4-. To do so, disconnect air hoses -1 and 2- (compress the securing ring) and remove the spring clamp -3-.

**Fig. 32: Identifying Air Hoses And Are Fitted Securely**

Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Unclip the wiring harness from the bracket -2-.

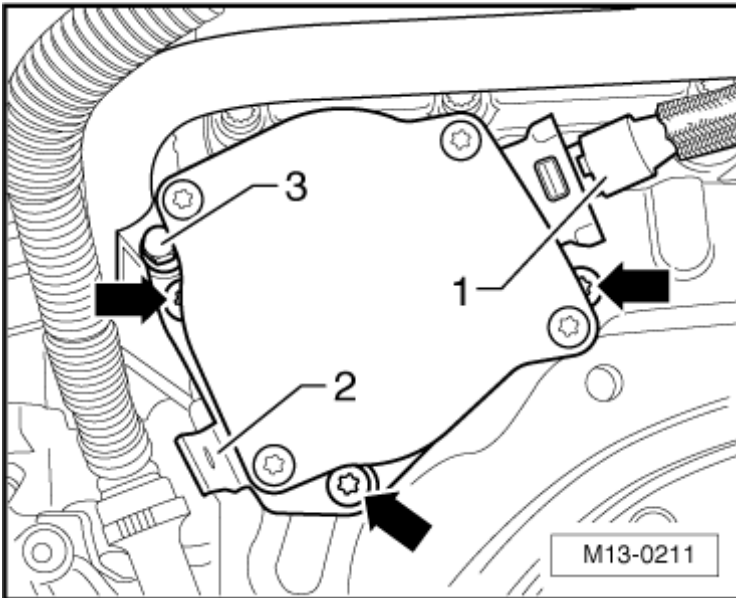


Fig. 33: Removing 3 Bolts And Vacuum Pump

Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

- Remove the bolt -3- for the coolant pipe.
- Disconnect the vacuum hose -1-.
- Remove the 3 bolts -arrows- and remove the vacuum pump.

NOTE: **The 4 bolts for the cover must not be loosened under any circumstances!**

- Remove the old gasket.

Installing

- Place new gasket -2- onto the vacuum pump.

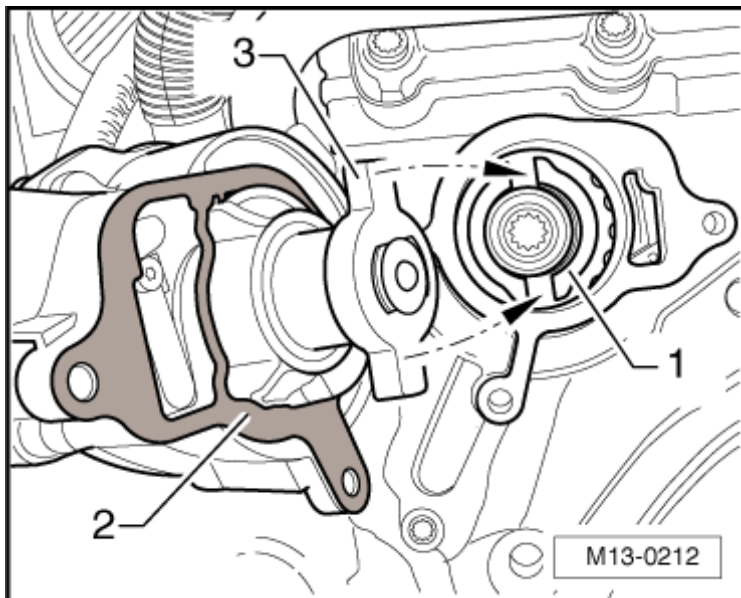


Fig. 34: Placing New Gasket On To Vacuum Pump
 Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Place the vacuum pump coupling plate -3- so that it engages into the symmetrical groove of the double wheel sprocket -1- -arrows- when installing the vacuum pump.

-- Install and tighten the bolts.

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

Tightening Specifications

Component	Nm
Vacuum pump to control housing cover	10
Coolant pipe to bracket	10

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

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

-- Remove the pulley from the crankshaft.

-- Remove the belt tensioner -1-.

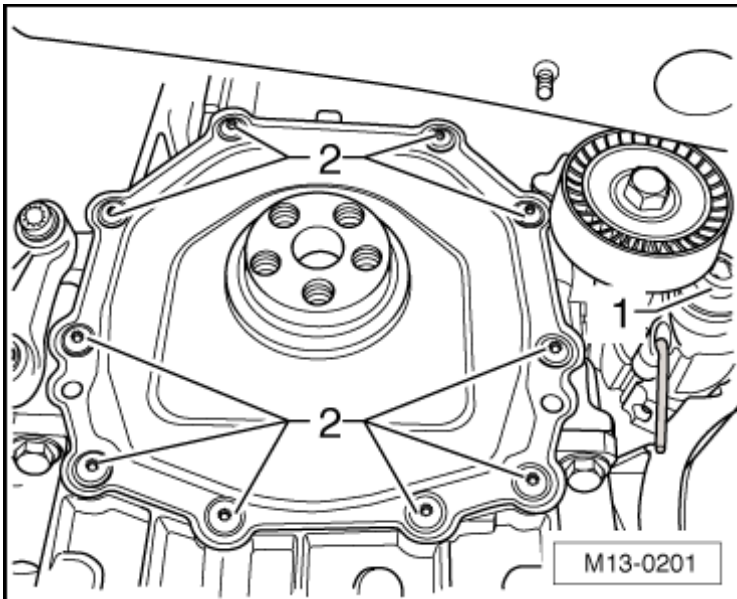


Fig. 35: Removing Tensioning Element & Bolts

Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Remove the bolts -2-.

-- Begin at the alignment bushings -arrows- in order to pry off the sealing flange -1- using a suitable screwdriver -A-.

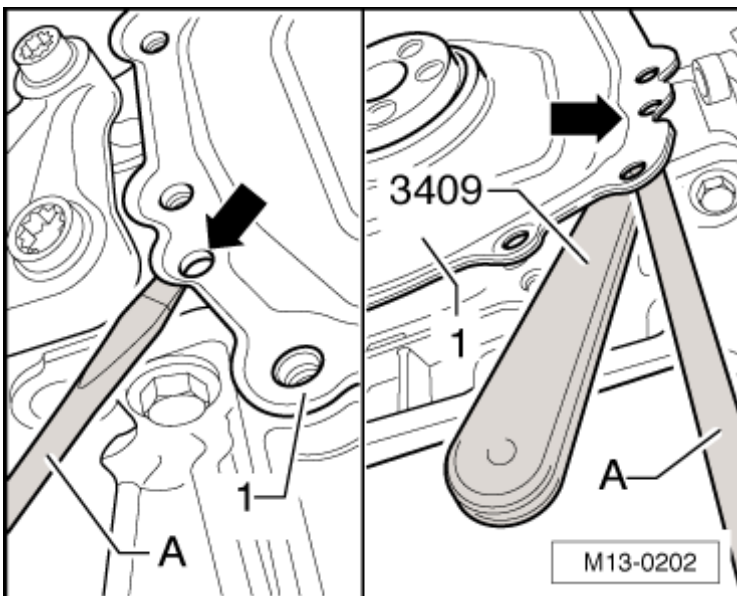


Fig. 36: Pressing Off Sealing Flange Using Suitable Screwdriver
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Use the 3409 to support the screwdriver in order to prevent damage to the sealing flange of the cylinder block.

Sealing flange is damaged while removing.

-- Pry off the sealing flange completely.

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

Installing

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

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

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

-- Clean the sealing surface of the cylinder block and crankshaft journals; 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 T03004.

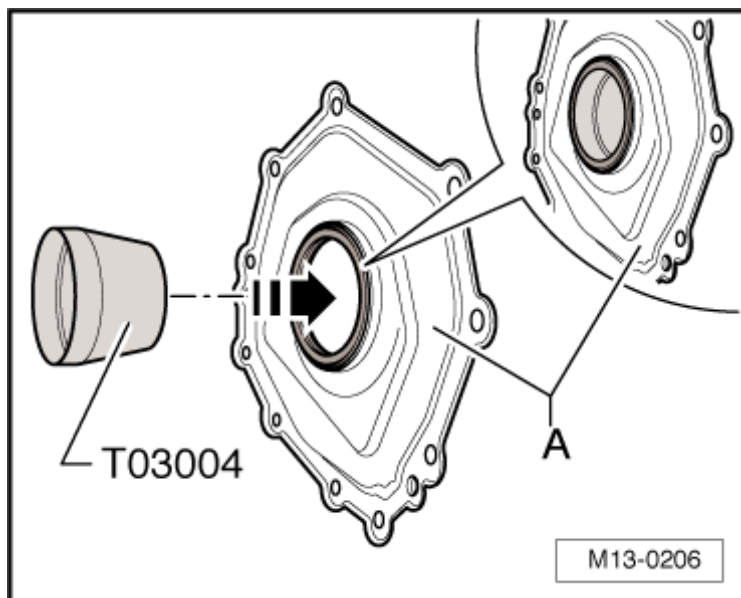


Fig. 37: Widening Sealing Lip Of New Sealing Flange Using Assembly Sleeve T03004
 Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

The surface -A- is the outer side.

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

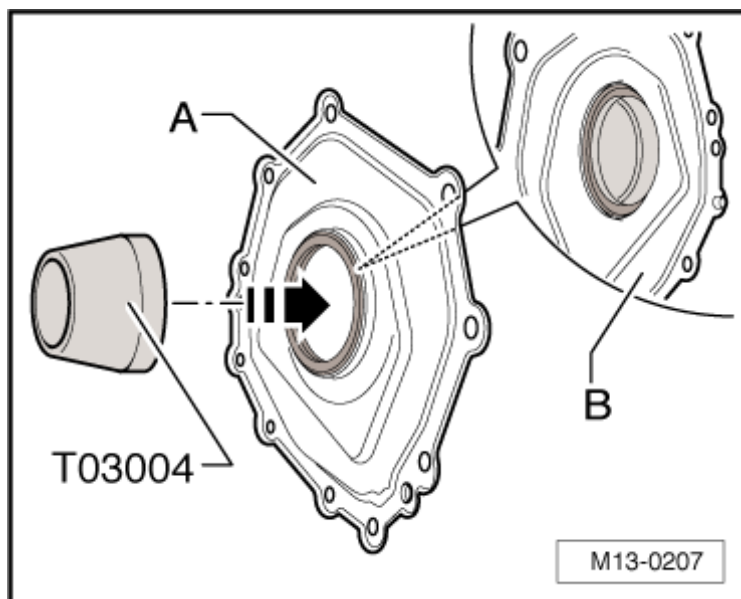


Fig. 38: Sliding Assembly Sleeve T03004 Into Sealing Ring
 Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

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

-- Cut the tube nozzle at the front mark (jet nozzle approximately 2 mm).

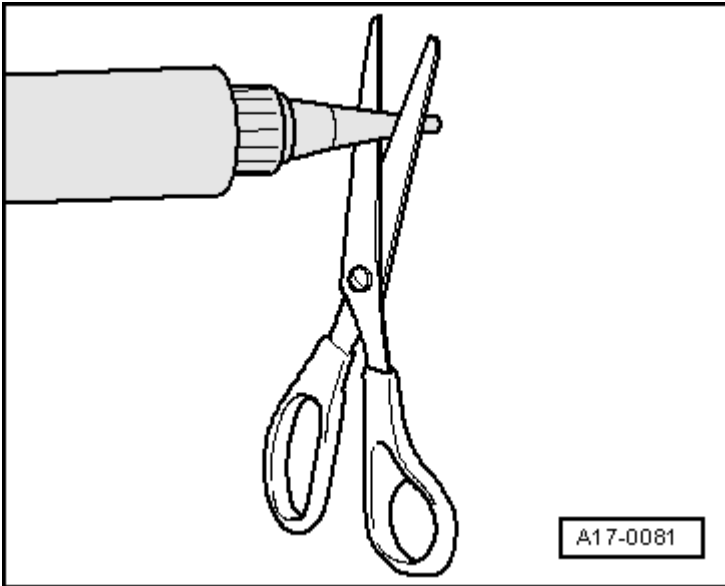


Fig. 39: Cutting Tube Nozzle At Front Marking (Nozzle Diameter Approx. 3 Mm)
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

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

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

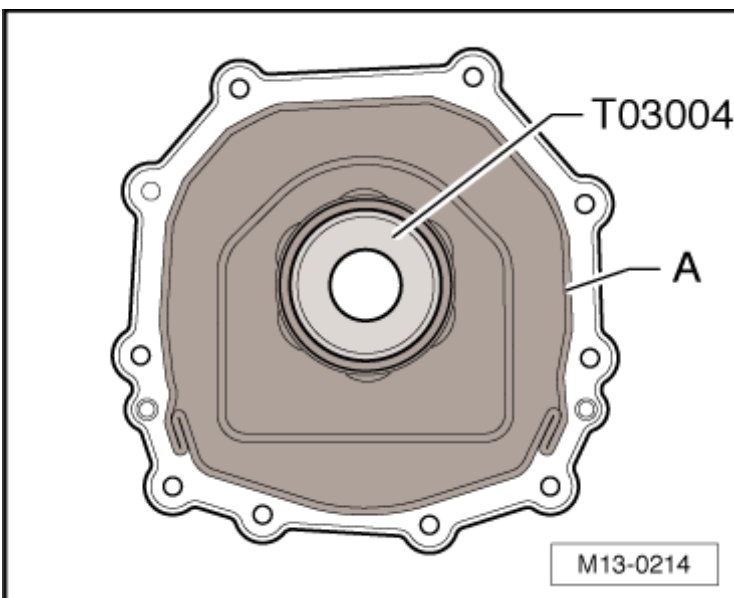


Fig. 40: Applying Sealant Bead Into Groove Of Sealing Flange
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

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

-- Install the sealing flange using T03004 onto the crankshaft and press uniformly onto the cylinder block.

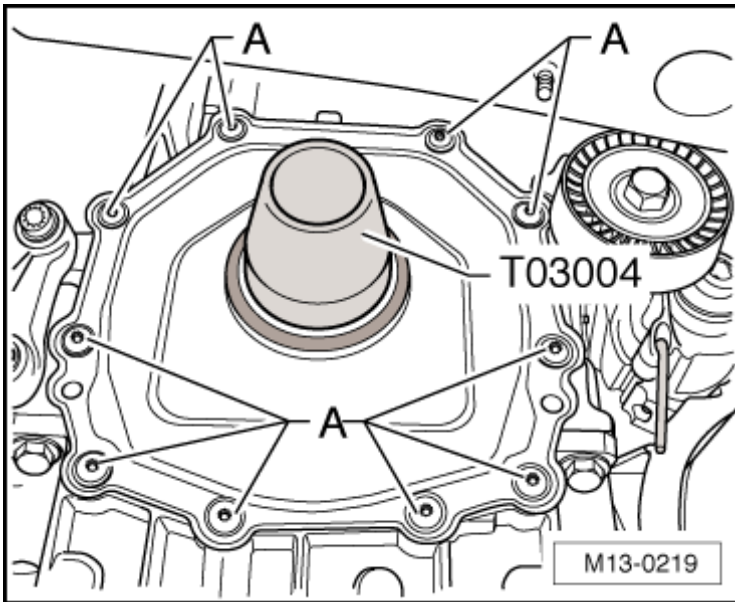


Fig. 41: Inserting Sealing Flange Using Assembly Sleeve T03004 On Crankshaft Journals And Pressing Uniformly On Cylinder Block
 Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

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

The rest of the installation follows the reverse of the removal procedures. When doing this note the following:

- Remove the T40069 from cylinder block and install the locking bolt.

Tightening Specifications

Component	Nm
Crankshaft pulley	-item 2- in Fig. 11 .
Belt tensioner to accessory bracket	35
Sealing flange to cylinder block	10
Locking bolt to cylinder block	30

CONTROL HOUSING COVER

Special tools and workshop equipment required

- Torque wrench (5-50 Nm) VAG 1331
- Torque wrench (40-200 Nm) VAG 1332
- Hand drill with plastic brush attachment
- Protective eyewear
- Silicone sealant D 174 003 A2

Removing

- Engine removed, transmission disconnected from flange.
- Remove the chain compartment cover. Refer to **CHAIN COMPARTMENT COVER** .
- Remove the flywheel or drive plate and remove the sensor wheel for the engine speed (RPM) sensor -G28- from the crankshaft.
- Remove the cylinder head. Refer to **CYLINDER HEAD** .
- Disengage the wiring harness -arrow- and remove the engine speed (RPM) sensor -G28- -1- and vacuum pump -2-.

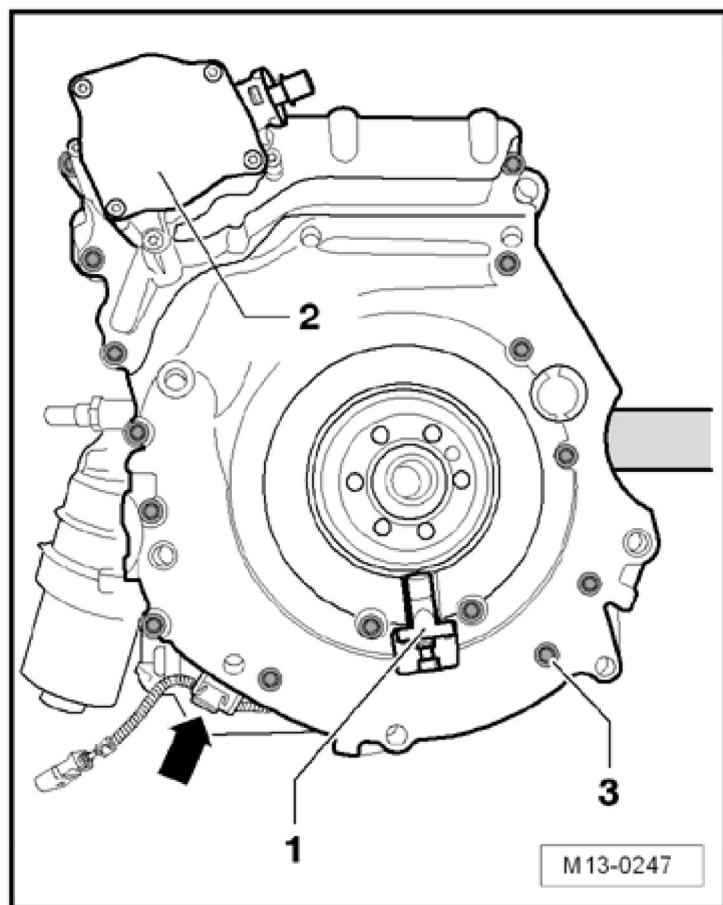


Fig. 42: Identifying Control Housing Cover
 Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

- Remove the bolts -3-.
- Pry off the control housing cover -1- from the cylinder block -2- or from the upper oil pan -3- at the positions designated at the top and bottom using a suitable screwdriver -A-.

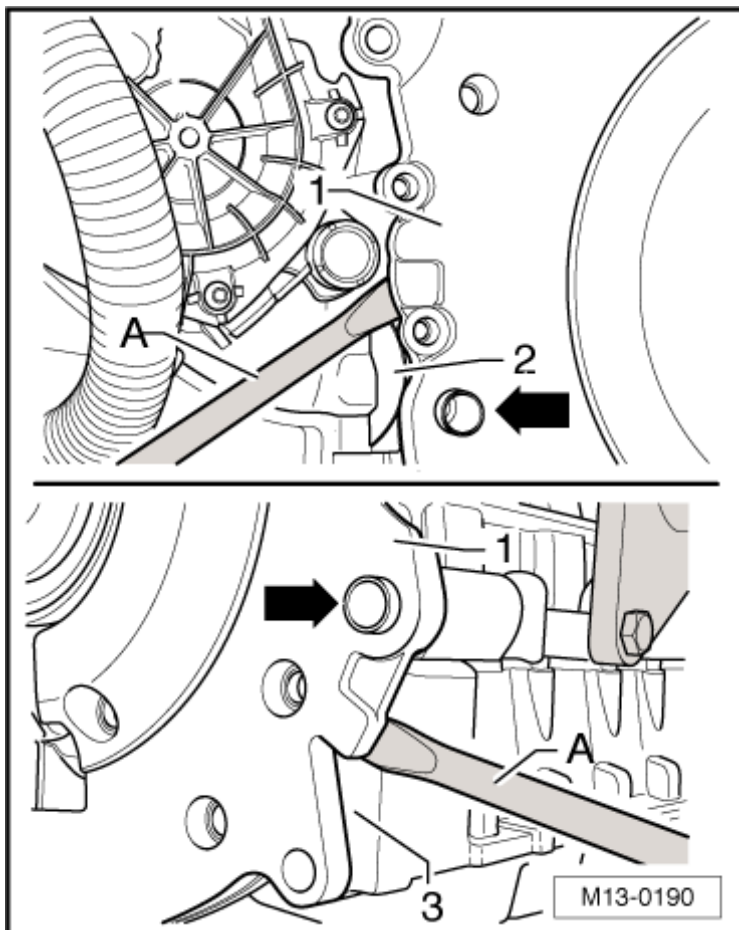


Fig. 43: Pressing Off Control Housing Cover From Cylinder Block Or From Upper Section Of Oil Pan At Positions Designated At Top And Bottom Using Suitable Screwdriver
 Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

Start in the area of the alignment bushings -arrows-.

NOTE: Make sure the sealing surfaces are not damaged.

-- Drive out the seal with the control housing cover removed.

Installing

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

-- Remove the remainder of the sealant from the cylinder block, upper oil pan and control housing cover using a rotating plastic brush.

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

-- Clean the sealing surfaces of the cylinder block, upper oil pan and control housing cover, they must be free of oil and grease.

-- Replace the seals -1 and 2-

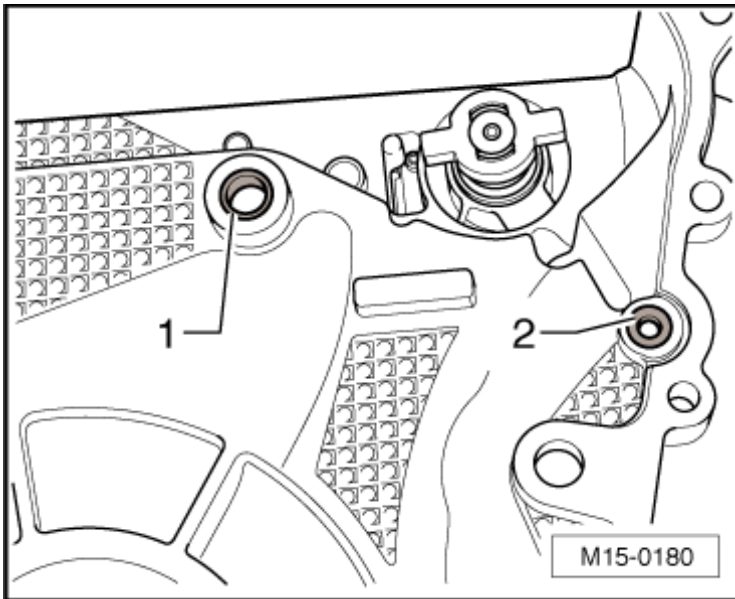


Fig. 44: Replacing Sealing Rings

Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Cut the tube nozzle at the front mark (jet nozzle diameter approximately 1 mm).

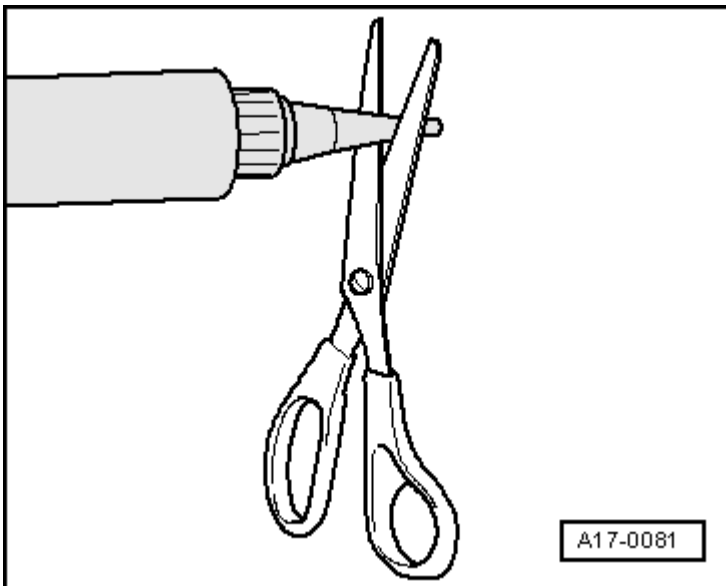


Fig. 45: Cutting Tube Nozzle At Front Marking (Nozzle Diameter Approx. 3 Mm)

Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

NOTE: The control housing cover must be installed within 5 minutes after application

of sealant.

-- Apply the sealant bead -A- onto the control housing cover as shown.

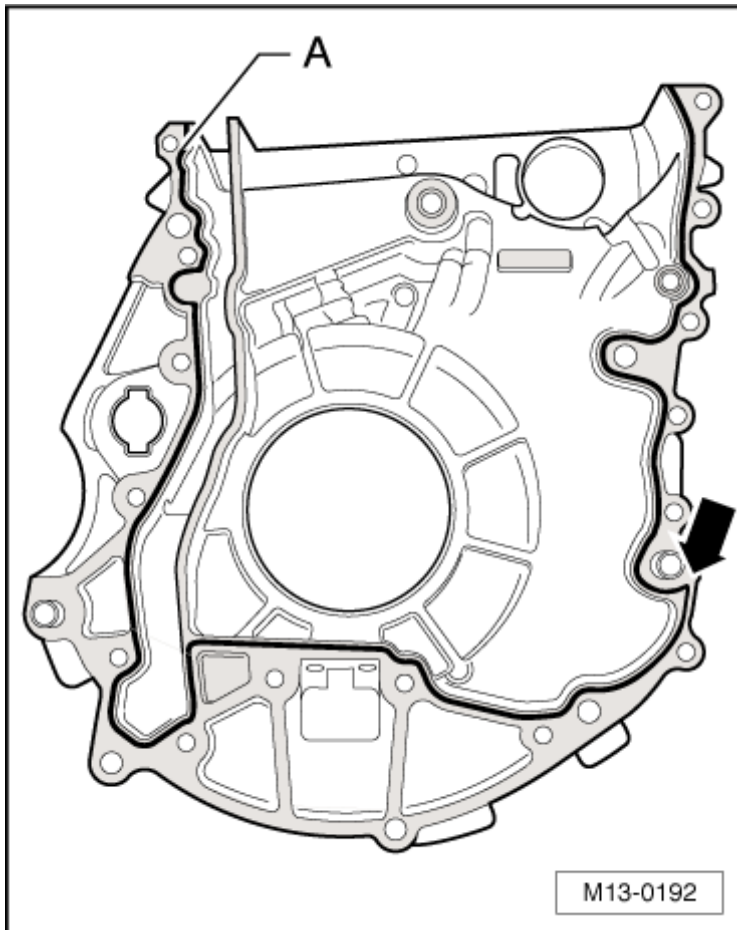


Fig. 46: Applying Sealant Bead On To Control Housing Cover
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

- The sealant bead must be 1.5 to 2.0 millimeter (mm) thick.
- Pay special attention to the course of the sealant bead in the area -arrow-.

-- Install the control housing cover so that the alignment bushings engage in the bores in the cylinder block.

-- Install all bolts hand tight.

-- First tighten all the bolts -3- to the cylinder block and upper oil pan to 10 Nm.

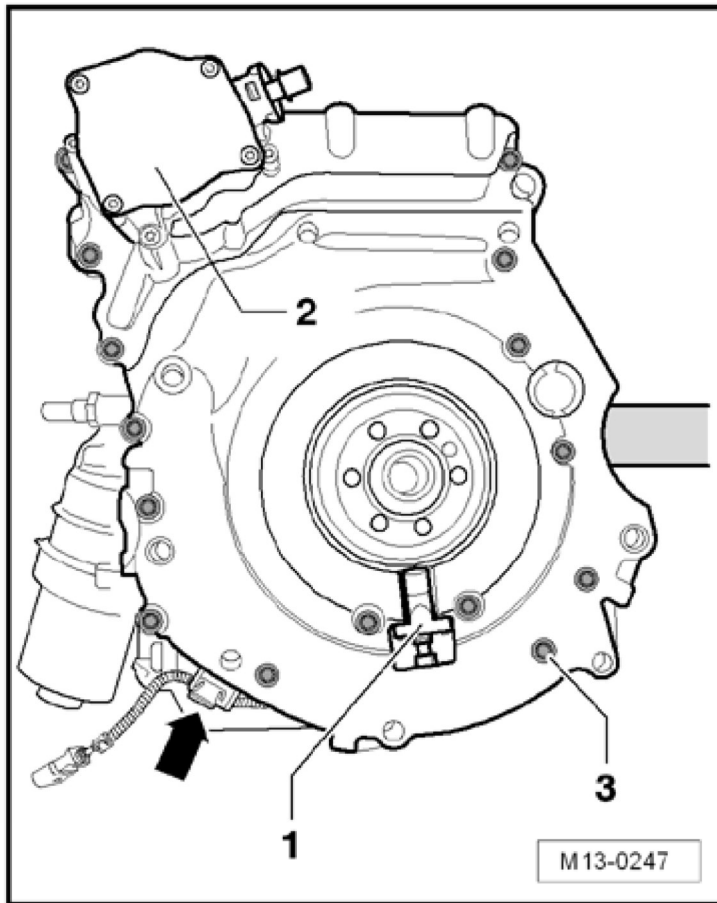


Fig. 47: Identifying Control Housing Cover

Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

- Finally, tighten the bolts to the cylinder block and upper oil pan to 25 Nm.
- Wipe off any sealant, which has leaked out.
- Drive the alignment bushings in until seated, if necessary.
- Install a new seal. Refer to **CRANKSHAFT SEAL, TRANSMISSION SIDE**.

The rest of the installation follows the reverse of the removal procedures. When doing this note the following:

- Install the brake booster vacuum pump. Refer to **BRAKE BOOSTER VACUUM PUMP**.
- Install the cylinder head. Refer to **CYLINDER HEAD**.
- Install the drive plate. Refer to **DRIVE PLATE**.
- Remove the T40069 from the cylinder block and install the locking bolt.
- Fill with coolant. Refer to **DRAINING AND FILLING**.

Tightening Specifications

2010 Volkswagen New Beetle

ENGINE 2.5 Liter - Crankshaft, Cylinder Block - Engine Code(s): BPR & BPS (Convertible)

Component	Nm
Flywheel/drive plate to crankshaft <ul style="list-style-type: none">• Replace bolts	60 Nm + 90°
Locking bolt to cylinder block	30

CRANKSHAFT SEAL, TRANSMISSION SIDE

Special tools and workshop equipment required

- Assembly tool T10122
- Pulling hook T20143

Removing

-- Remove the transmission.

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

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

-- Pull out the seal using T20143/2.

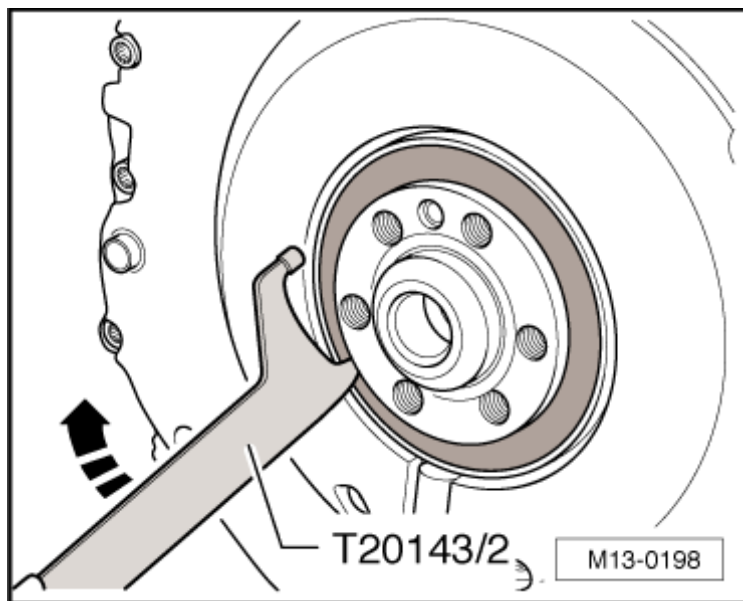


Fig. 48: Pulling Out Sealing Ring Using Pulling Hook T20143/2
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

Do not damage the crankshaft sealing surface when doing this.

Installing

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

- Clean the sealing surfaces. They must be free of oil and grease.
- Before installing, remove any remaining oil from the end of the crankshaft with a clean cloth.
- Insert the T10122/1 onto the pT10122/2 and slide the seal -A- onto the T10122/2.

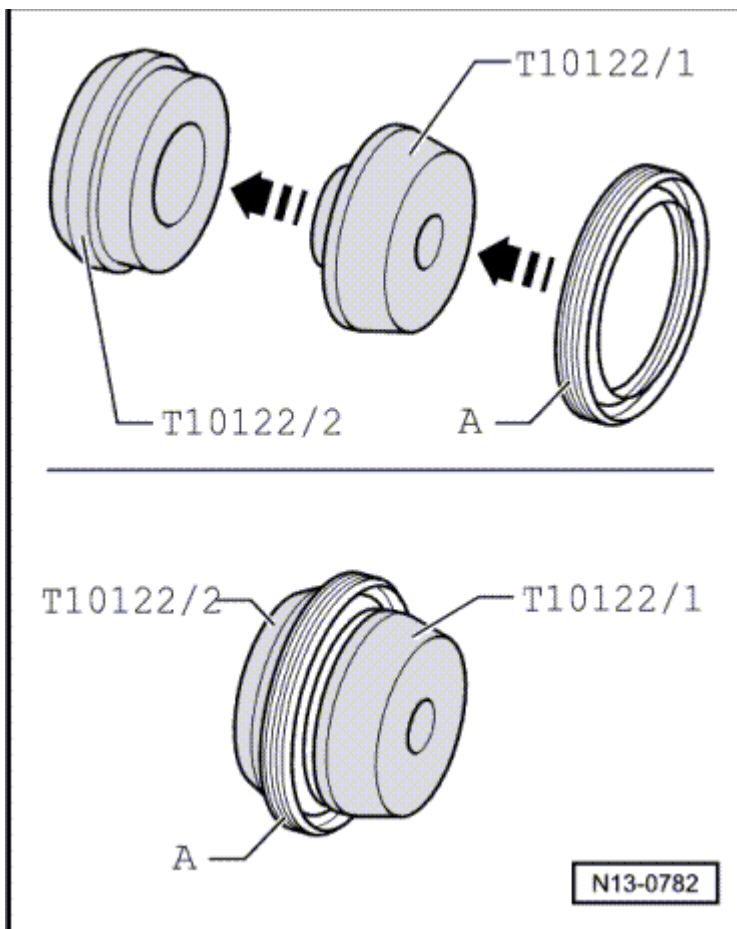


Fig. 49: Identifying Seal, Sleeve T10122/1 And Assembly Tool T10122/2
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

- Remove the T10122/1.
- Install the T10122/2 with seal -A- onto the crankshaft.

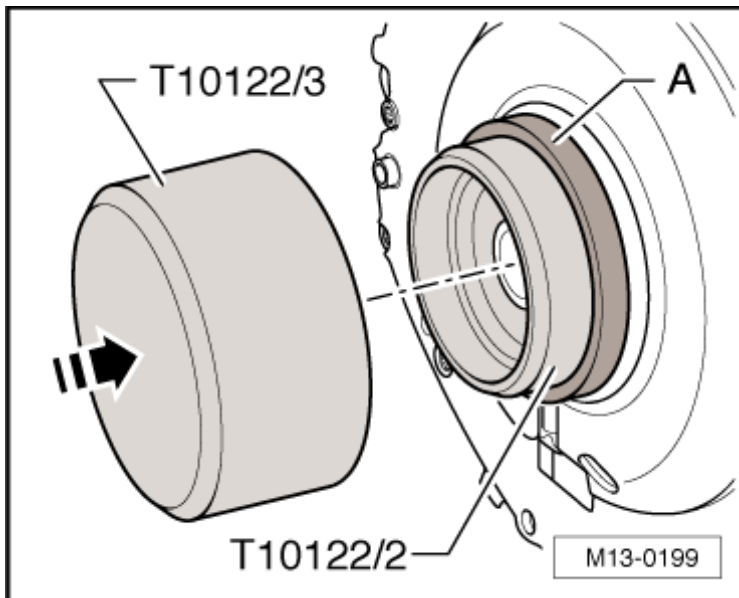


Fig. 50: Installing Pull Sleeve T10122/2 With Sealing Ring Onto Crankshaft
 Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

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

The rest of the installation follows the reverse of the removal procedures. When doing this note the following:

- Remove the T40069 from the cylinder block and install the locking bolt

Tightening Specifications

Component	Nm
Flywheel/drive plate to crankshaft	60 Nm + 90°
<ul style="list-style-type: none"> • Replace bolts 	
Locking bolt to cylinder block	30

DRIVE PLATE

Special tools and workshop equipment required

- Depth gauge

Removing

-- Remove the transmission.

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

Installing

-- Install the drive plate only by using the washer with recesses -1- (without compensating shim -2-).

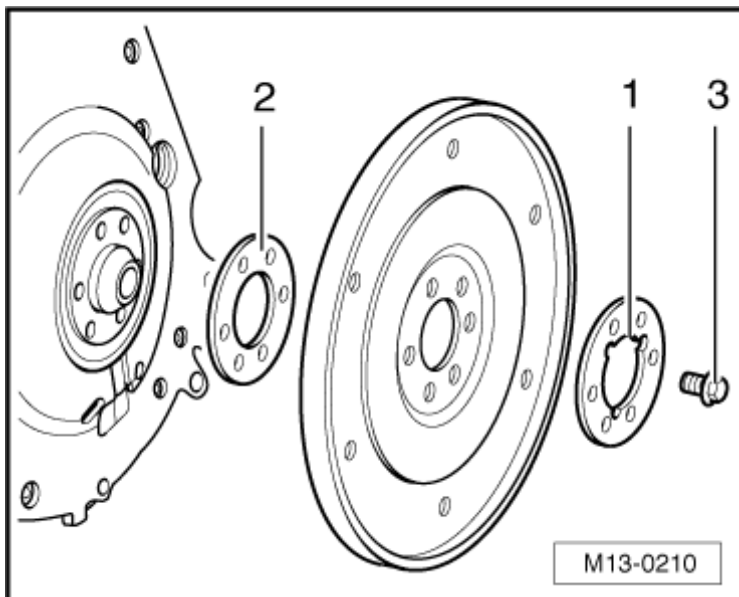


Fig. 51: Installing Drive Plate Only By Using Washer With Recesses
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Install new bolts -3- and tighten to 30 Nm.

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

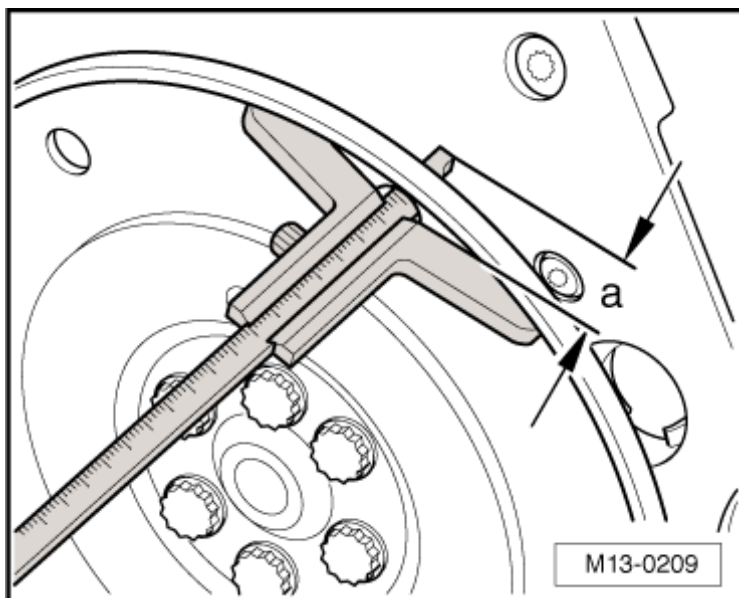


Fig. 52: Checking Dimension
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

Specified value: 18.8 to 20.4 millimeter (mm)

NOTE: Measure through the drive plate hole to a surface on the control housing cover.

If the specification is not obtained:

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

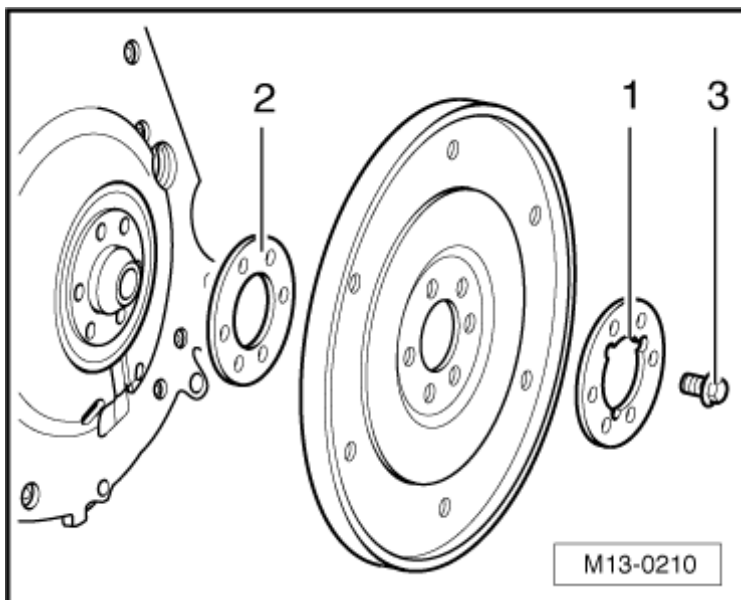


Fig. 53: Installing Drive Plate Only By Using Washer With Recesses
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

If the specified value is OK:

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

The rest of the installation follows the reverse of the removal procedures. When doing this note the following:

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

SPECIAL TOOLS

Special tools and workshop equipment required

- Locking pin T10060A

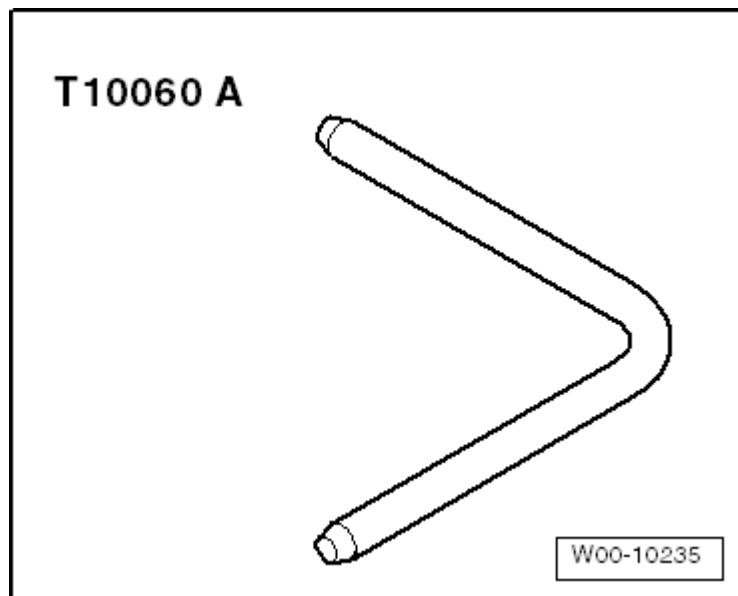


Fig. 54: Identifying Locking Pin T10060 A
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

- Trim removal wedge 3409

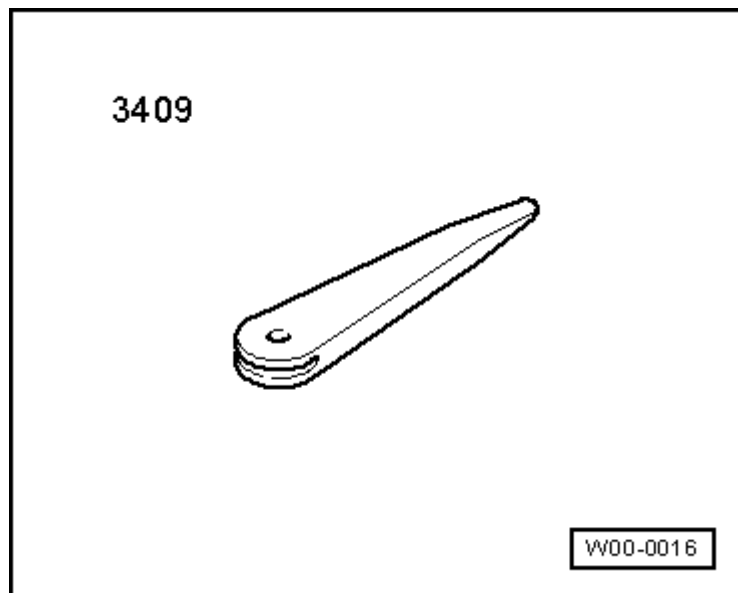


Fig. 55: 3409 Wedge
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

- Oil seal guide sleeve T03004

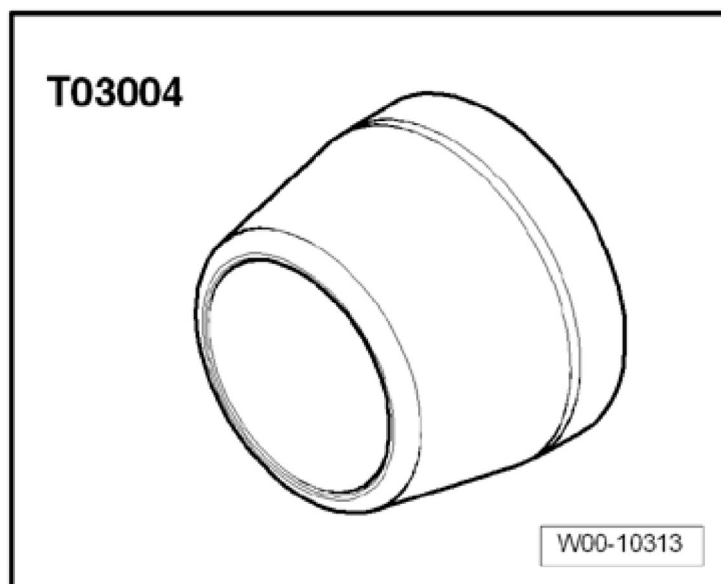


Fig. 56: Identifying Assembly Sleeve T03004

Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

- Torque wrench (40-200 Nm) VAG 1332

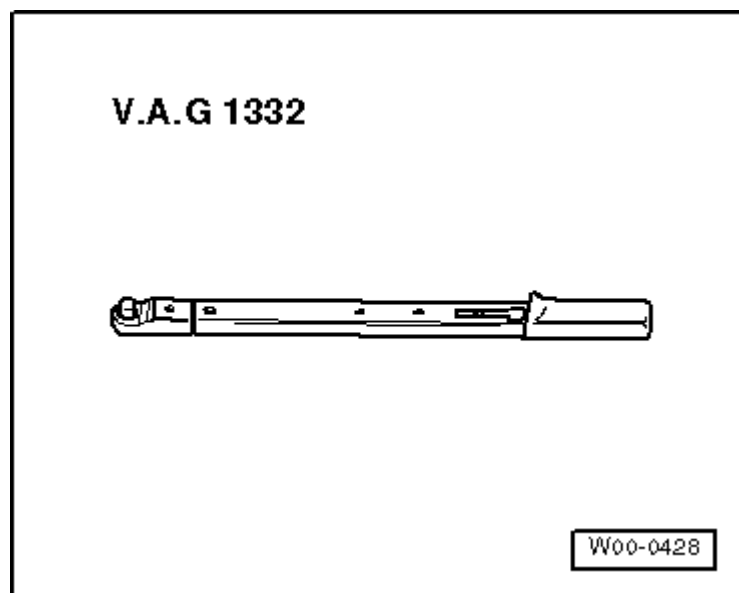


Fig. 57: Identifying Torque Wrench 40-200 Nm VAG 1332

Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

- Assembly tool T10122

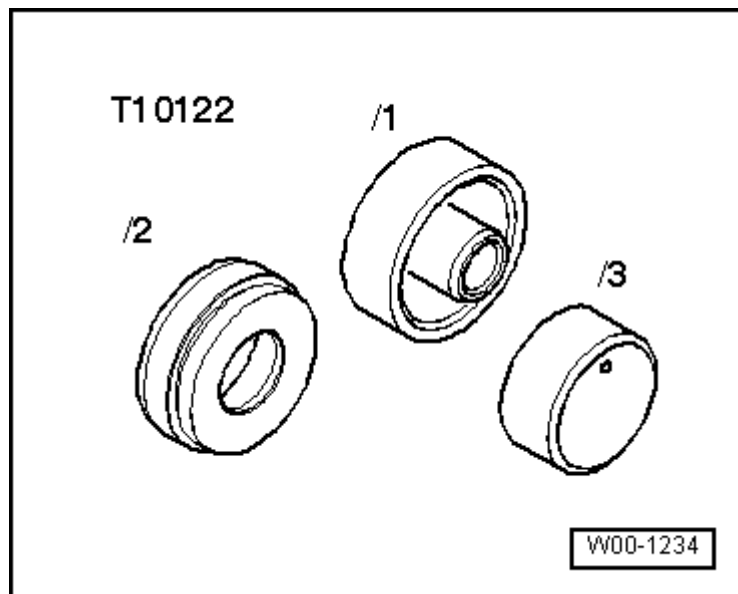


Fig. 58: Identifying Pulling Fixture T10122

Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

- Pulling hook T20143

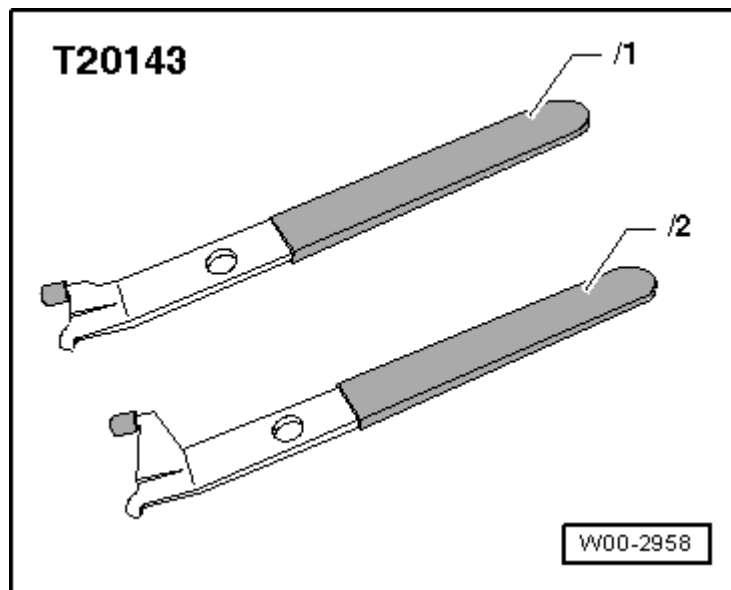


Fig. 59: Extractor Hook T20143

Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

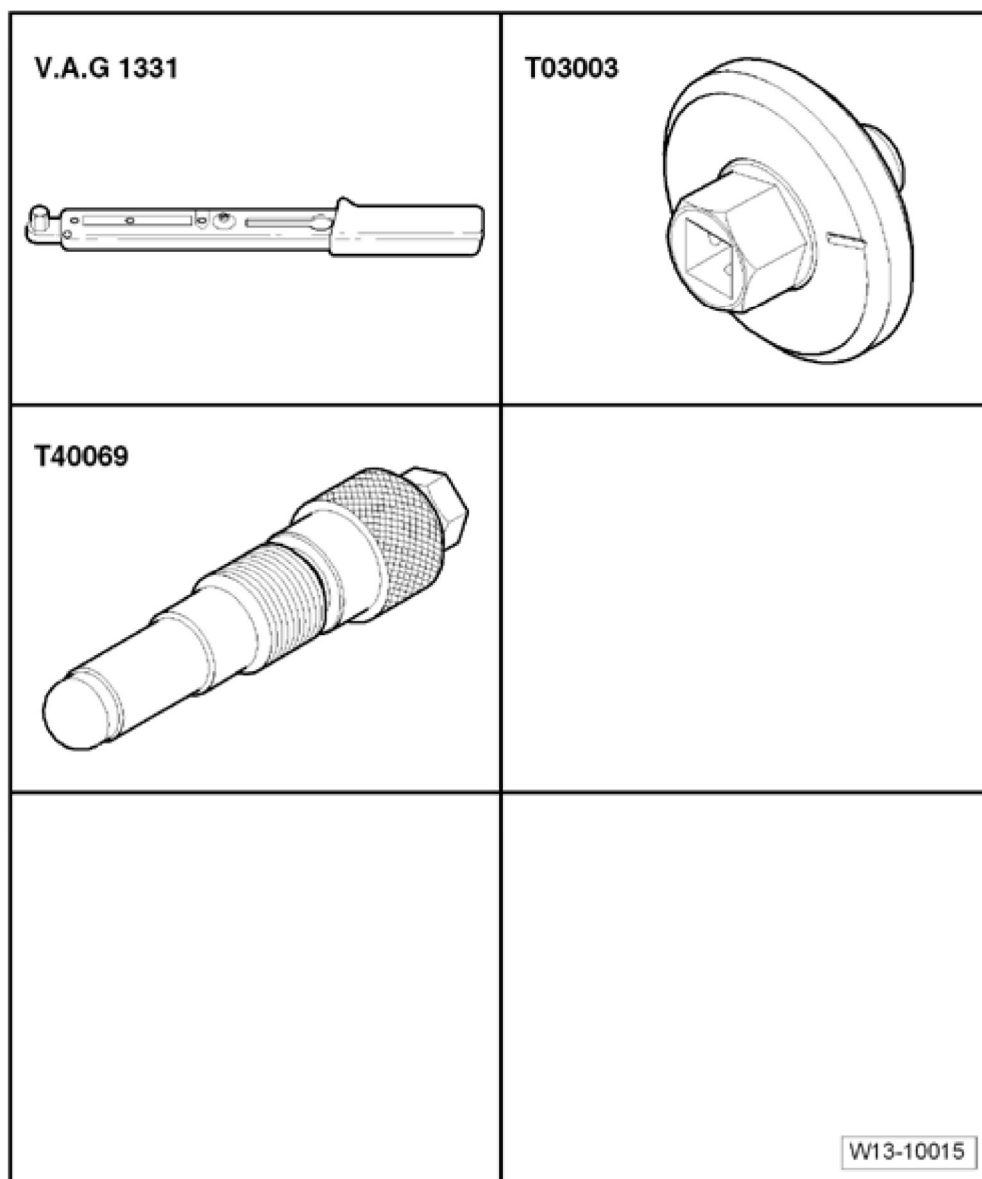


Fig. 60: Identifying Special Tools -- Crankshaft, Securing
 Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

Special tools and workshop equipment required

- Torque wrench (5-50 Nm) VAG 1331
- Crankshaft adapter T03003
- Locking pin T40069

ENGINE**2.5 Liter - Cylinder Head, Valvetrain - Engine Code(s): BPR & BPS (Convertible)****15 CYLINDER HEAD, VALVETRAIN****GENERAL INFORMATION****GENERAL REPAIR INFORMATION**

NOTE: If a replacement cylinder head is installed, several contact surfaces between the support elements, roller cam followers and cam lubricating surfaces of the camshaft must be oiled before installing the cylinder head cover.

The plastic protectors installed to protect the open valves must only be removed 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.

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 0.3 millimeters (mm), or only the first 4 threads of the spark plug threads are cracked.

The cylinder head and guide frame may only be replaced together.

Do not grind the valve seats in the cylinder head, only lapping the valves is permitted.

After installing the camshafts, the engine may not be started for approximately 30 minutes. The hydraulic adjusting elements must seat themselves (otherwise the valves will seat themselves on the pistons).

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

Always replace gaskets and seals.

VALVE TIMING, ADJUSTING

Special tools and workshop equipment required

- Torque wrench (5-50 Nm) VAG 1331
- Torque wrench (40-200 Nm) VAG 1332
- Locking pin T03006
- Multipoint socket T10035
- Counterhold tool T10172
- Camshaft clamp T40070
- 2 bolts M8 x 16

Modifying T10172

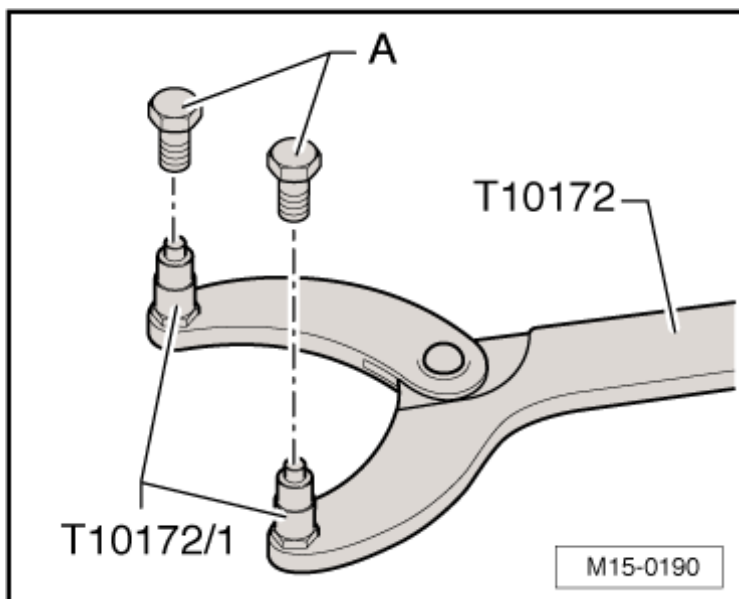


Fig. 1: Removing Adapter T10172/1 And Installing Bolts
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Remove the T10172/1 and install 2 M8 x 16 bolts -A-.

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

Securing the Camshafts if the Valve Timing is Correct

-- Remove the chain compartment cover. Refer to **CHAIN COMPARTMENT COVER**.

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

-- Lock the crankshaft for adjusting the valve timing. Refer to **CRANKSHAFT, LOCKING TO CHECK/ADJUST VALVE TIMING**.

-- Install the T40070 as shown onto the camshafts and tighten the bolts to 20 Nm.

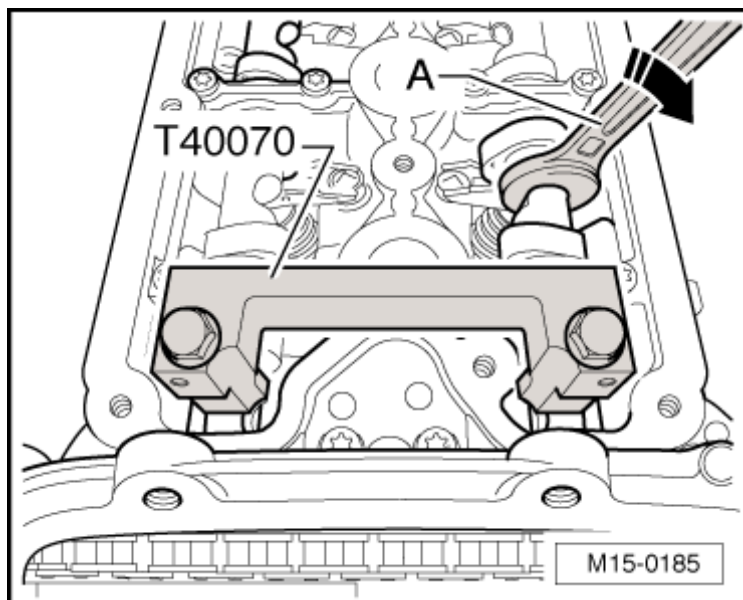


Fig. 2: Installing Camshaft Clamp T40070 On To Camshafts
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

If the bolts could not be installed easily, attempt to rotate the exhaust camshaft at the recess using an open end wrench -A- (18 or 19 millimeter (mm), depending on the wrench width) slightly in the -direction of the arrow- in order to eliminate any play in the chain drive.

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

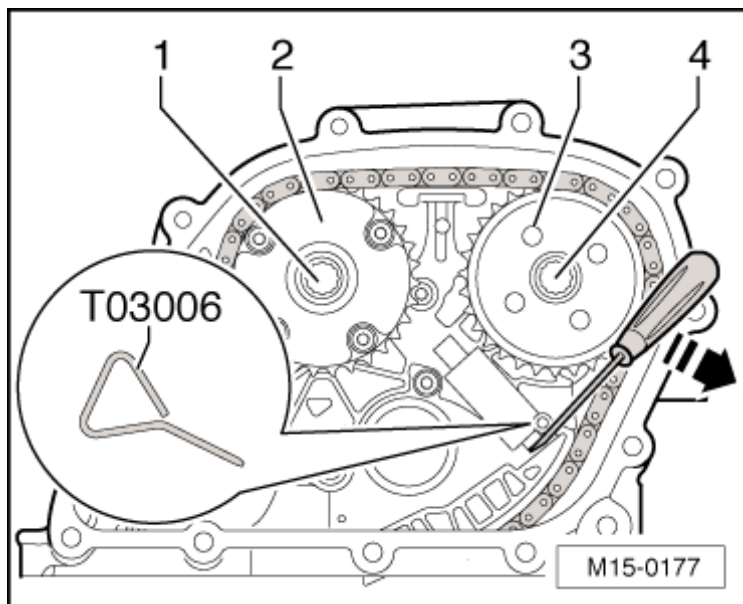


Fig. 3: Placing Chain Sprockets And Into Timing Chain
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

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

Securing the Camshafts if the Valve Timing is Not Correct

- Remove the chain compartment cover. Refer to **CHAIN COMPARTMENT COVER**.
- Rotate the crankshaft to Top Dead Center (TDC) for cylinder 5, refer to **CRANKSHAFT, LOCKING TO CHECK/ADJUST VALVE TIMING** , however do not peg the crankshaft using T40069.
- Rotate the crankshaft so that T40070 can be installed easily onto the camshafts as shown.

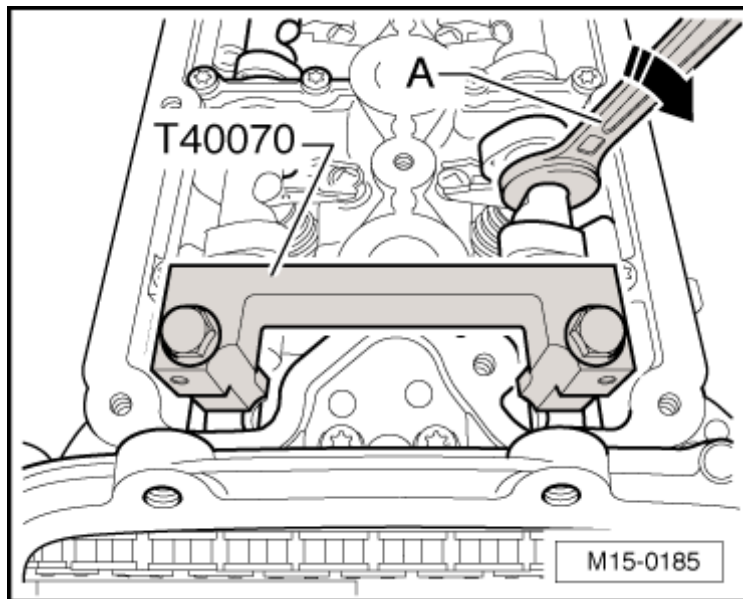


Fig. 4: Installing Camshaft Clamp T40070 On To Camshafts
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

- Tighten the bolts for the T40070 to 20 Nm.

Removing the Camshaft Sprocket/Actuator

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

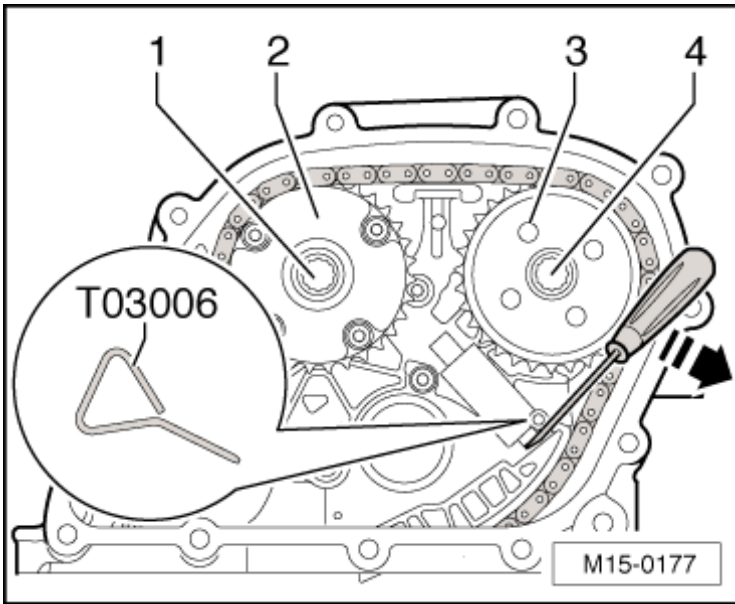


Fig. 5: Placing Chain Sprockets And Into Timing Chain
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

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

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

If necessary, the sprocket -3- must be pried off slightly using a screwdriver.

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

Valve Timing, Adjusting

- Crankshaft secured by the T40069
- Camshafts secured by the T40070
- Chain tensioner is tensioned

-- Place the actuator -2- and sprocket -3- into the timing chain, place them onto the camshafts and hand tighten the new bolts -1- and 4-.

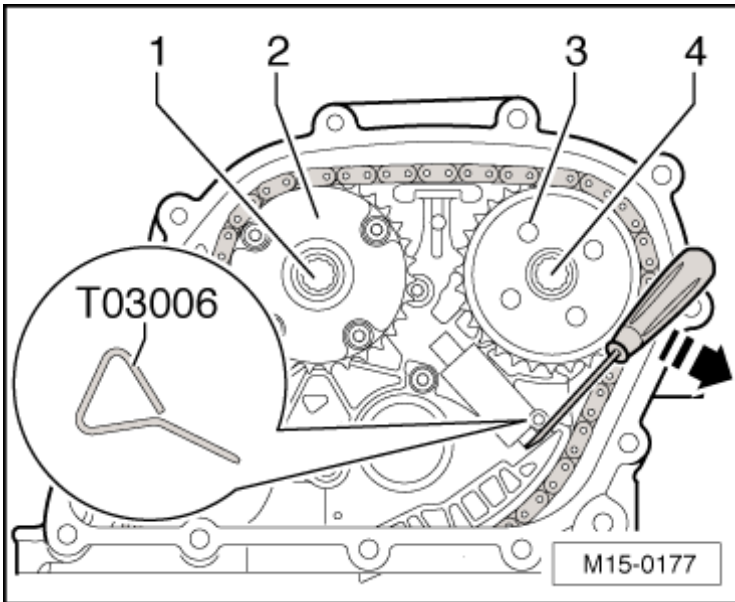


Fig. 6: Placing Chain Sprockets And Into Timing Chain
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

Sprockets must still be able to be rotated, however they must not tilt.

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

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

-- Install the modified T10172 to the exhaust camshaft sprocket -4-.

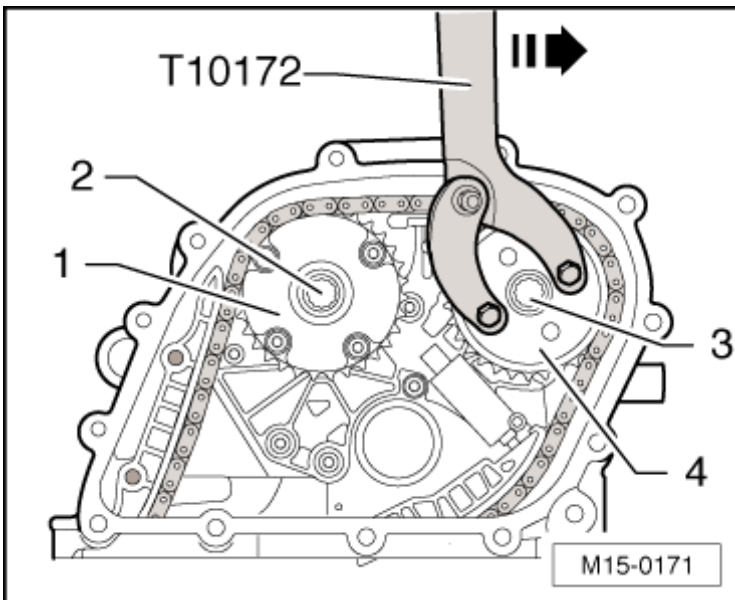


Fig. 7: Attaching Modified Counterhold Tool Touareg V10 T10172 On To Chain Sprocket For Exhaust Camshaft

Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

NOTE: A second mechanic is required for the following steps.

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

-- Simultaneously tighten the camshaft actuator bolt -2- first and then the exhaust camshaft sprocket bolt -3- to 60 Nm.

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

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

-- Remove the T40070.

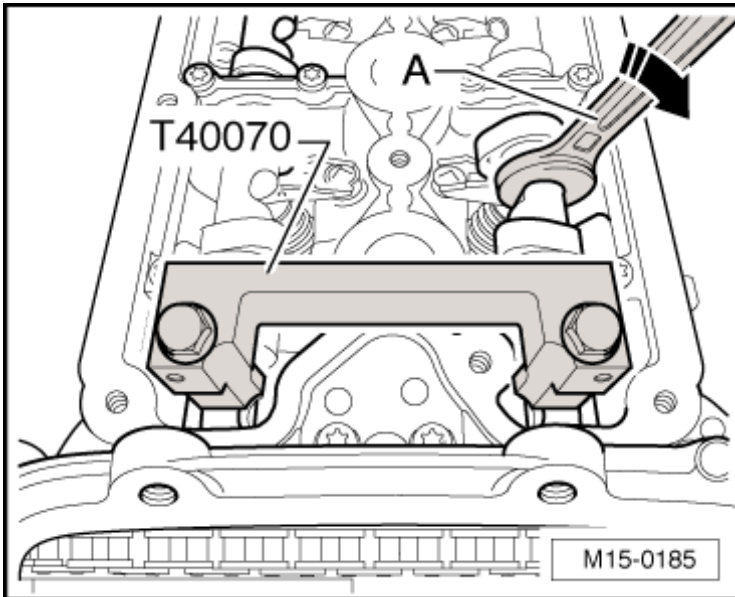


Fig. 8: Installing Camshaft Clamp T40070 On To Camshafts
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Remove the T40069.

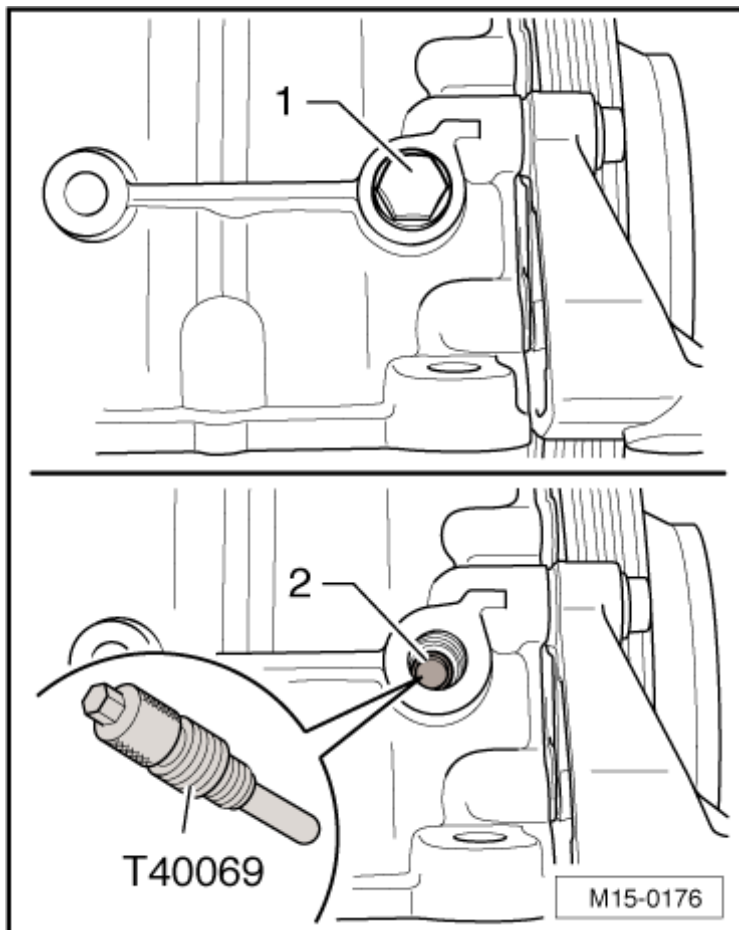


Fig. 9: Identifying Crankshaft Must Not Be Rotated Out Over TDC Marking
 Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Turn the crankshaft 2 revolutions in the engine running direction and lock the crankshaft **CRANKSHAFT, LOCKING TO CHECK/ADJUST VALVE TIMING** .

-- Check the valve timing. Refer to **VALVE TIMING, CHECKING**.

If the valve timing is not correct:

-- Loosen the sprocket/actuator bolts again and adjust the valve timing again (replace the camshaft bolts).

The rest of the installation follows the reverse of the removal procedures. When doing this note the following:

- Remove the T40069 from the cylinder block and install the locking bolt.
- Fill with coolant. Refer to **DRAINING AND FILLING** .

DESCRIPTION AND OPERATION

CYLINDER HEAD ASSEMBLY OVERVIEW

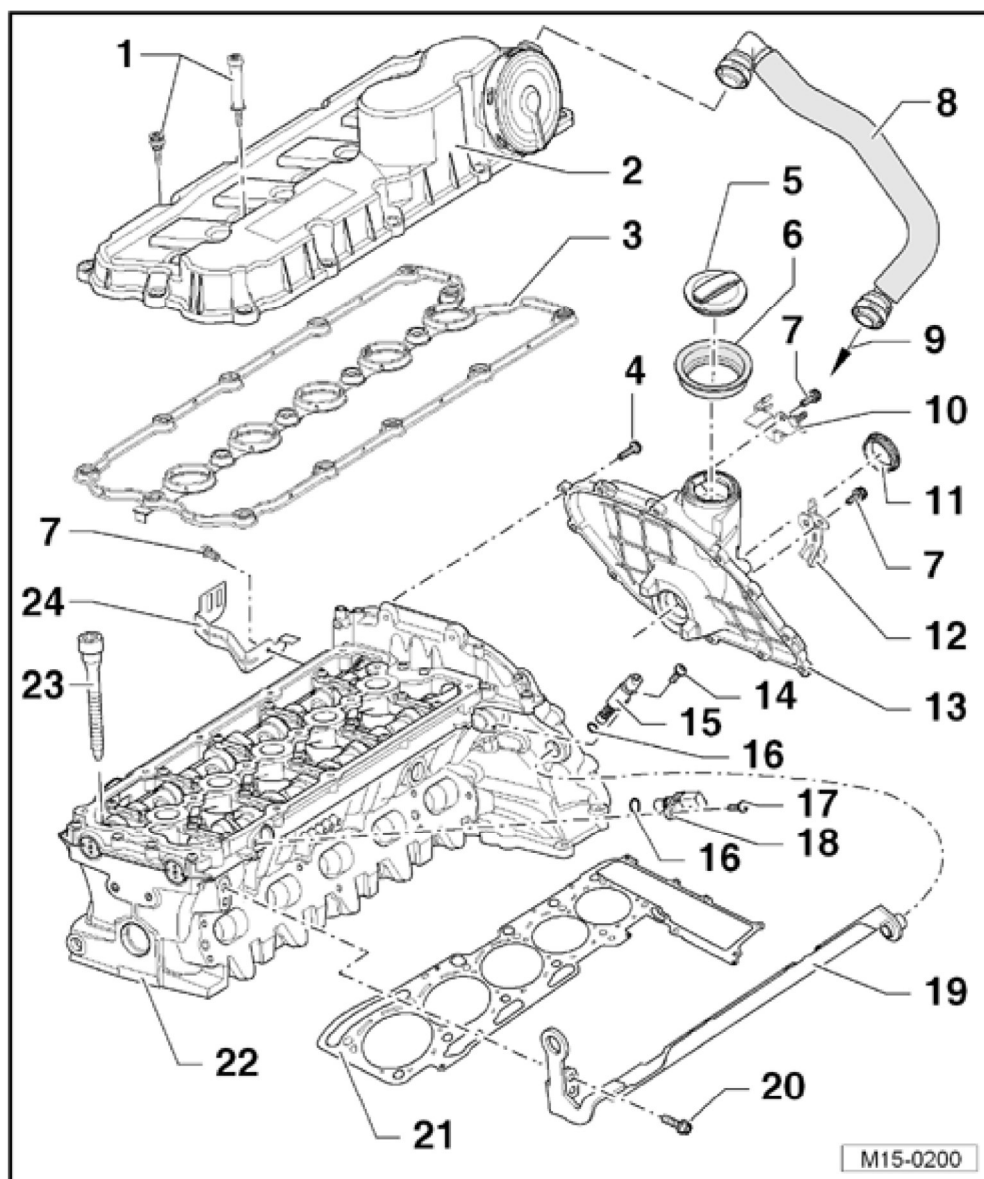


Fig. 10: Cylinder Head, Assembly Overview

Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

1. Bolt, 10 Nm
2. Cylinder Head Cover
 - With pressure regulator valve for the crankshaft housing ventilation.
 - Bleeder hose to intake manifold, see **INTAKE MANIFOLD AND ATTACHMENTS ASSEMBLY OVERVIEW => Hose for Crankcase Ventilation** .
 - Tightening sequence, refer to **Fig. 11**.
 - Removal and installation, refer to **CYLINDER HEAD COVER**.
3. Cylinder Head Cover Gasket
 - Replace if damaged or leaking.

4. Bolt, 10 Nm
5. Oil Filler Cap
6. Gasket
 - Replace if damaged or leaking
7. Bolt, 10 Nm
8. Bleeder Hose for Crankcase Ventilation
 - Ensure the hose is securely seated.
 - To disengage, squeeze together the securing ring.
9. to Intake Hose/Intake Manifold
10. Wire Bracket
11. Seal
 - Replacing, refer to **CHAIN COMPARTMENT COVER SEAL**.
12. Wire Bracket
13. Chain Compartment Cover
 - Removal and installation, refer to **CHAIN COMPARTMENT COVER**.
14. Bolt, 2 Nm
15. Camshaft Adjustment Valve 1 -N205-
 - Checking, refer to vehicle diagnostic tester VAS 5051B "Guided Fault Finding".
16. O-ring
 - Replace if damaged
17. Bolt 10 Nm
18. Camshaft Position (CMP) Sensor -G40-
19. Transport Strap
20. Bolt, 25 Nm
21. Cylinder Head Gasket
 - Replace
 - After replacing, replace the entire amount of coolant.
22. Cylinder Head
 - Removal and installation, refer to **CYLINDER HEAD**.
 - Checking cylinder head for warpage, refer to **Fig. 12**.
 - It is not permitted to rework the sealing surface
 - With the coolant pipe connection pressed in.
 - If necessary, remove coolant deposits using a copper wire brush or fine sandpaper (minimum 100 grit).
 - If the pipe connection is worn, replace it using locking fluid D 000600 A2.
23. Bolt, 40 Nm + 180° (1/2) additional turn

- Replace
- Follow the sequence for loosening and tightening. Refer to **CYLINDER HEAD**.

24. Wire Bracket

- For the Heated Oxygen Sensor (HO2) -G39-.

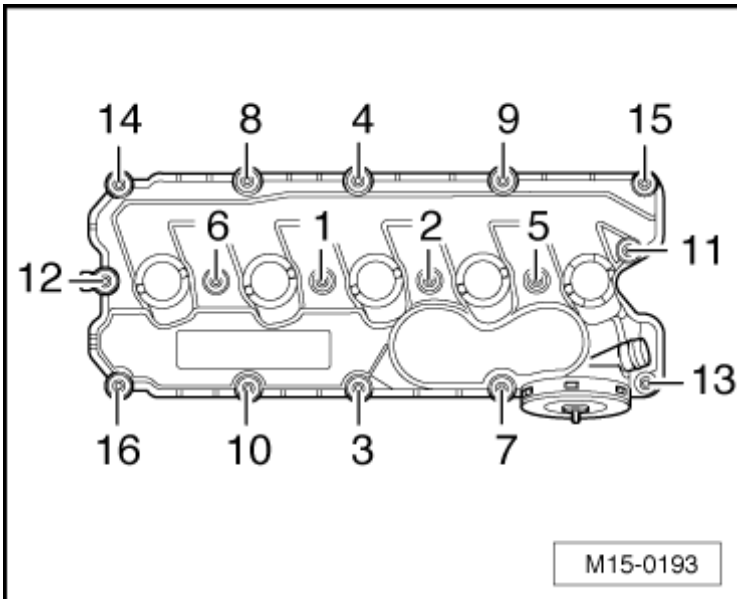


Fig. 11: Removing Bolts For Cylinder Head Cover In Sequence
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

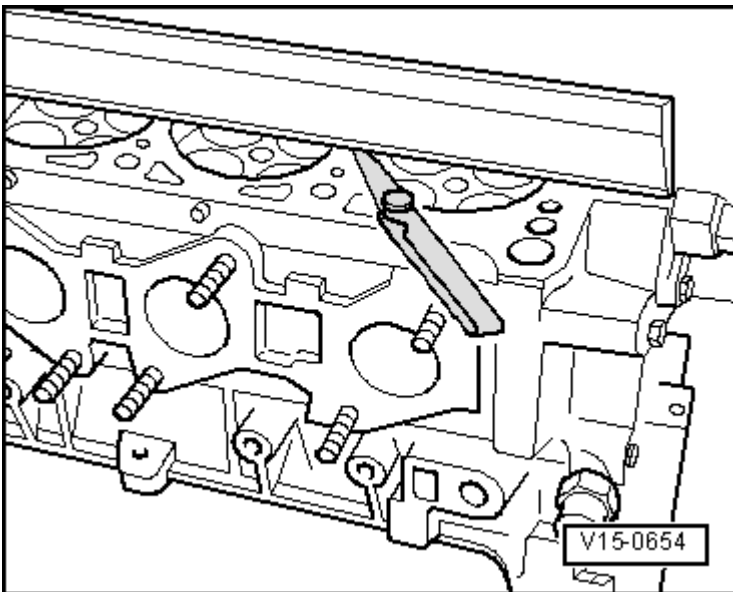


Fig. 12: Checking Cylinder Head For Distortion
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Check the cylinder head at multiple points for distortion with a straight edge 500 mm VAS 6075 and feeler gauges.

- Max. permissible distortion: 0.05 millimeters (mm)

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

VALVETRAIN ASSEMBLY OVERVIEW

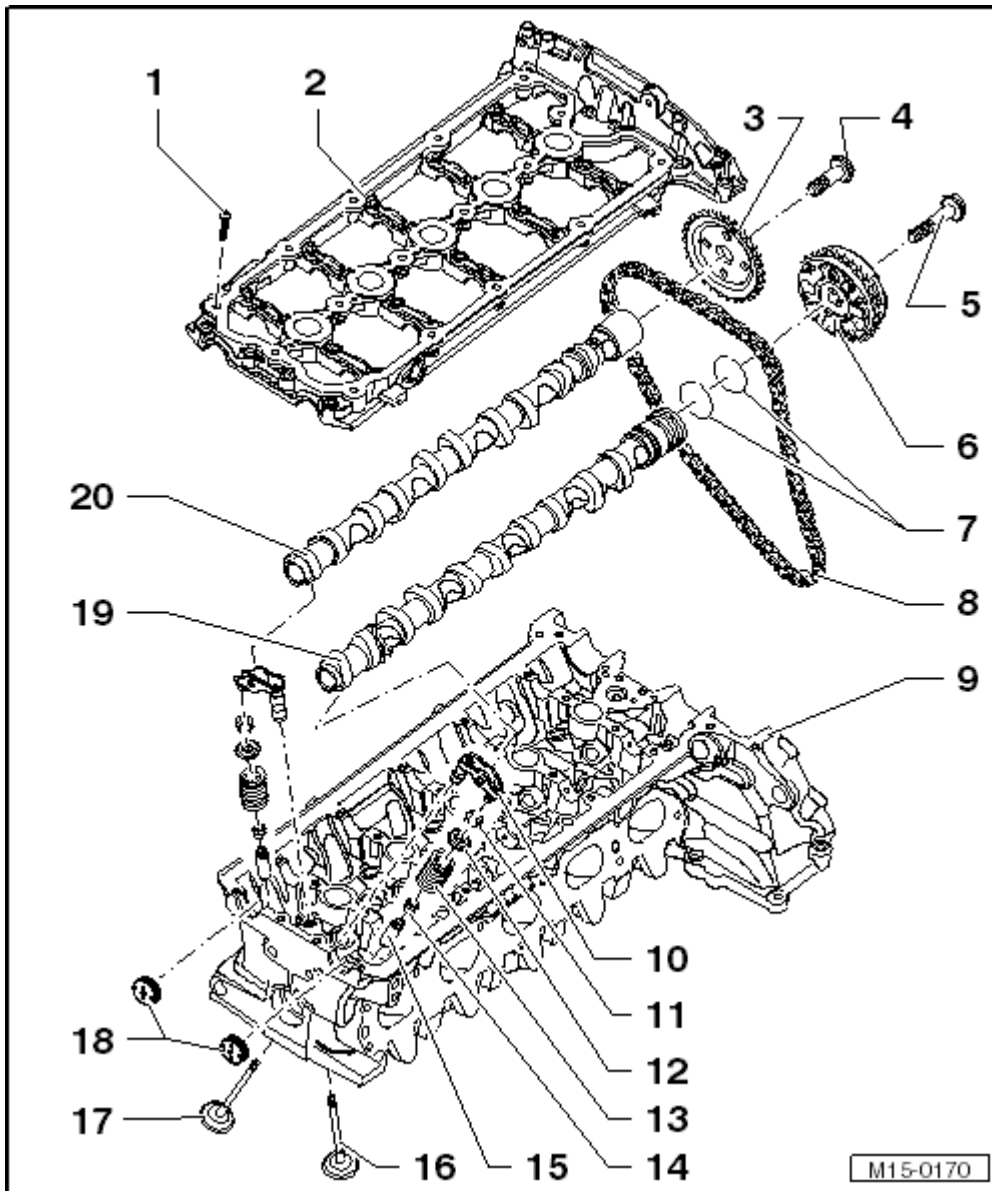


Fig. 13: Valvetrain, Assembly Overview
 Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

1. Bolt, 8 Nm + 90° (1/4) additional turn
 - Replace
2. Guide Frame
 - Removal and installation, refer to CAMSHAFTS.

- With integrated camshaft bearings.
 - Clean the sealing surface, reworking is not permitted.
 - Remove old sealant residue.
3. Exhaust Camshaft Sprocket
 4. Bolt, 60 Nm + 90° (1/4) additional turn
 - Replace
 5. Bolt, 60 Nm + 90° (1/4) additional turn
 - Replace
 6. Intake Camshaft Adjuster
 7. Seals
 - For the camshaft adjuster.
 - Note the installed position, refer to **CAMSHAFTS**.
 8. Timing Chain
 - Removing from the sprocket/actuator, refer to **VALVE TIMING, ADJUSTING**.
 9. Cylinder Head
 - Do not grind the valve seats, only lapping is permitted.
 10. Hydraulic Valve Play Balancing Element
 - Do not interchange
 - Lubricate the contact surface.
 11. Valve Keepers
 12. Top Valve Spring Retainer
 13. Valve Spring
 14. Valve Stem Seal
 - Replacing, refer to **VALVE STEM SEALS**.
 15. Valve Guide
 - Checking, refer to **VALVE GUIDES, CHECKING**.
 16. Intake Valve
 - Do not grind, only lapping is permitted.
 - Valve dimensions, refer to **VALVE DIMENSIONS**.
 - Checking valve guides, refer to **VALVE GUIDES, CHECKING**.
 17. Exhaust Valve
 - Do not grind, only lapping is permitted.
 - Valve dimensions, refer to **VALVE DIMENSIONS**.
 - Checking valve guides, refer to **VALVE GUIDES, CHECKING**.
 18. Sealing Plugs
 - Replace
 - Installing, refer to **CAMSHAFTS**.
 19. Intake Camshaft

- Removal and installation, refer to **CAMSHAFTS**.
- Check radial clearance using Plastigage (roller rocker lever removed).

Wear limit: 0.1 millimeter (mm)

- Runout: Max. 0.035 mm
- Axial clearance: Max. 0.17 mm

20. Exhaust Camshaft

- Removal and installation, refer to **CAMSHAFTS**.
- Check radial clearance using Plastigage (roller rocker lever removed).

Wear limit: 0.1 mm

- Runout: Max. 0.035 mm
- Axial clearance: Max. 0.17 mm

SPECIFICATIONS

VALVE DIMENSIONS

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

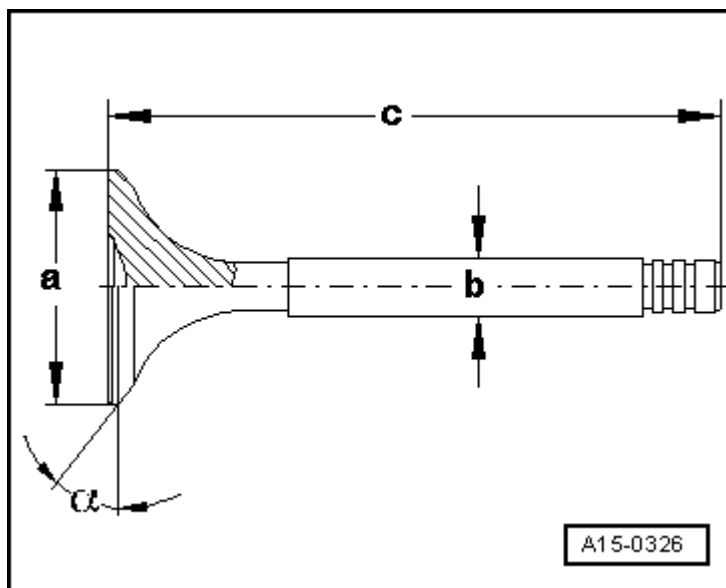


Fig. 14: Identifying Valve Dimensions
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

Dimension		Intake valve	Exhaust valve
Diameter a	mm	26.80 to 27.00	29.80 to 30.00

2010 Volkswagen New Beetle

ENGINE 2.5 Liter - Cylinder Head, Valvetrain - Engine Code(s): BPR & BPS (Convertible)

Diameter b	mm	5.95 to 5.97	5.94 to 5.95
c	mm	104.84 to 105.34	103.64 to 104.14
a	Angle°	45	45

FASTENER TIGHTENING SPECIFICATIONS

Component	Fastener Size	Nm
Camshaft Adjustment Valve 1 Bolt	-	2
Camshaft Clamp T40070 to Camshaft Bolt	-	20
Camshaft Position Sensor Bolt	-	10
Chain Compartment Cover to Cylinder Head Bolt	-	10
Thermostat Housing to Chain Compartment Cover Bolt	-	10
Exhaust Camshaft Sprocket Bolt ⁽¹⁾	-	60 + 90° turn
Intake Camshaft Adjuster Bolt ⁽¹⁾	-	60 + 90° turn
Locking Bolt	-	30
Secondary Air Injection Connecting Pipe at Cylinder Head Bolt	-	10
Transport Strap Bolt	-	25
Wire Bracket Bolt	-	10
(1) Always replace		

Cylinder Head Cover Bolt Tightening Sequence and Specification

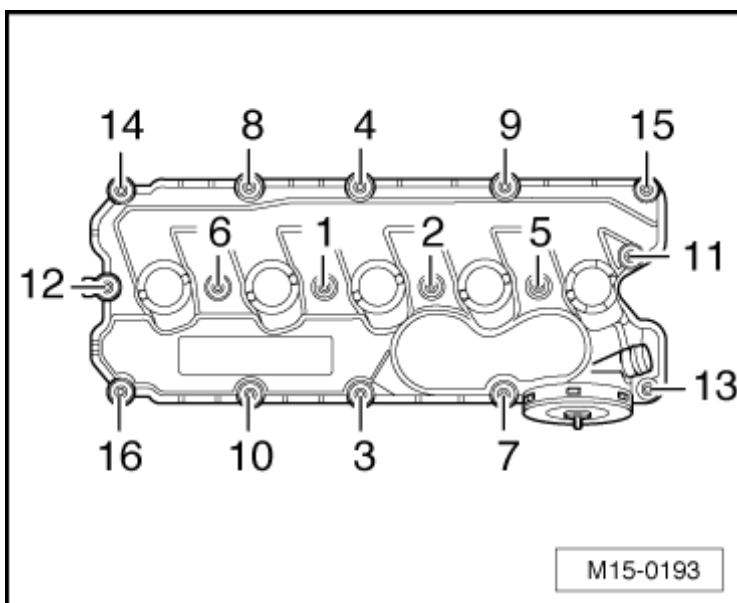


Fig. 15: Removing Bolts For Cylinder Head Cover In Sequence
 Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Tighten the cylinder head cover bolts -1 through 16- in the sequence shown to 10 Nm.

Cylinder Head Bolt Tightening Sequence and Specification

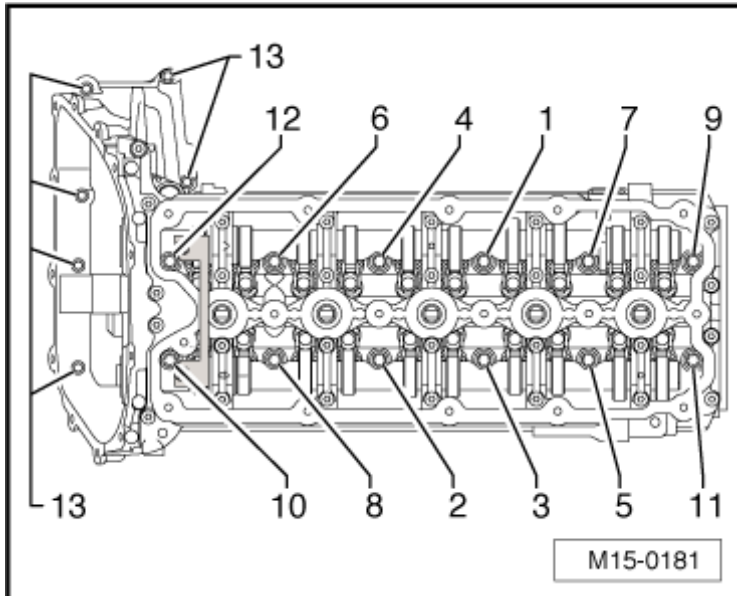


Fig. 16: Identifying Cylinder Head Bolts Tightening Sequence
 Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

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

Step	Tighten
1	-- Tighten the bolts to 40 Nm.
2	-- Tighten the bolts an additional 90° (1/4) turn.
3	-- Tighten the bolts an additional 90° (1/4) turn.

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

Guide Frame Bolt Tightening Sequence and Specification

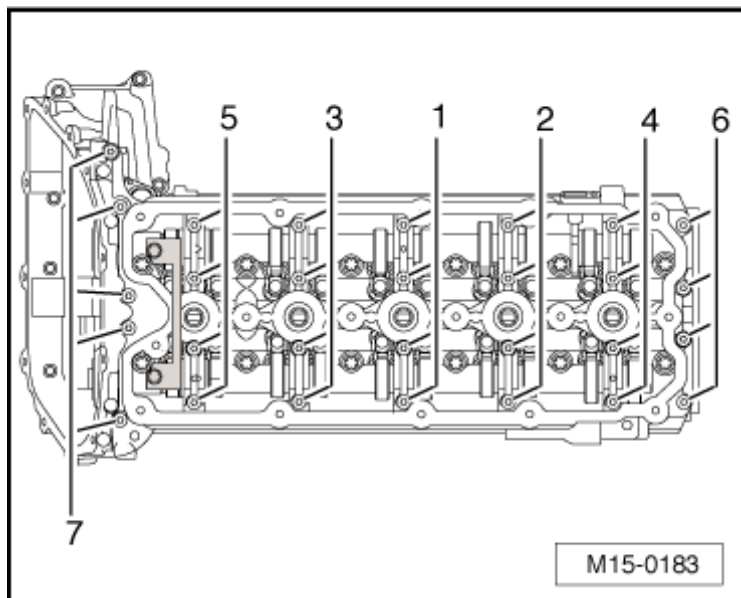


Fig. 17: Identifying Tightening Bolts Sequence

Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Tighten the NEW bolts -1 through 7- to 8 Nm in the sequence shown.

-- After that, continue to tighten all bolts an additional 90° (1/4) turn.

DIAGNOSIS AND TESTING

VALVE TIMING, CHECKING

Special tools and workshop equipment required

- Camshaft clamp T40070

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

-- Lock the crankshaft for checking the valve timing. Refer to **CRANKSHAFT, LOCKING TO CHECK/ADJUST VALVE TIMING** .

Valve Timing is Correct

Valve timing is correct when the bolts for the T40070 can be installed easily into camshafts as shown. Support surfaces of the T40070 must lie flat on the flats of the camshafts when doing this.

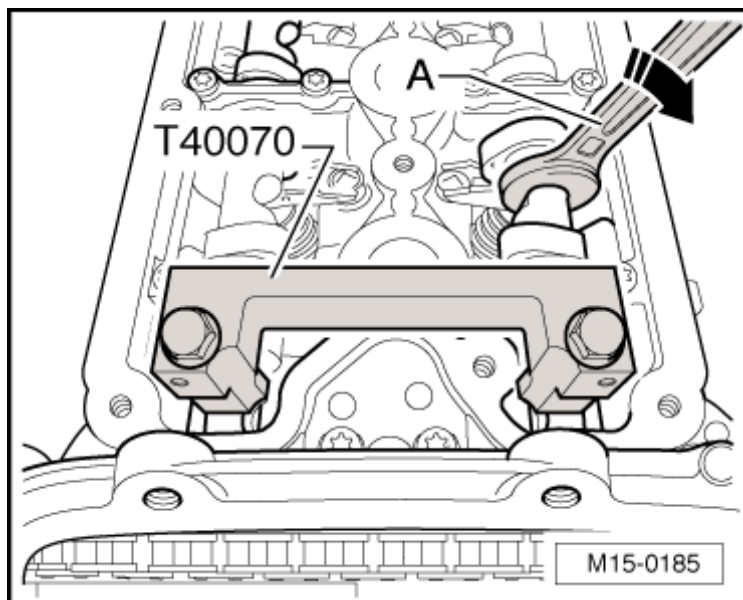


Fig. 18: Installing Camshaft Clamp T40070 On To Camshafts
 Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- If the bolts could not be installed easily, attempt to rotate the exhaust camshaft at the recess using an open end wrench -A- (18 or 19 millimeter (mm), depending on wrench width) slightly in the -direction of the arrow- in order to eliminate any play in the chain drive.

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

Valve Timing is Not Correct

Valve timing is not correct when the bolts for the T40070 cannot be installed easily into the camshafts despite the tensioned chain drive.

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

Assembly

Assembly is performed in the reverse order of removal. When doing this note the following:

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

COMPRESSION, CHECKING

Special tools and workshop equipment required

- Spark plug removal tool 3122B
- Ignition coil puller T40039
- Torque wrench (5-50 Nm) VAG 1331

- Compression tester VAG 1763
- Adapter VAG 1381/5A

Conditions

- Engine oil temperature must be at least 30 °C (86 °F).
- Voltage supply OK.

-- Remove the engine cover.

-- Disconnect the connectors from the fuel injectors.

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

-- Remove the spark plugs using 3122B.

-- Check the compression using VAG 1763 and VAG 1381/5A.

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

-- Have a second technician operate the starter.

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

Compression Pressure

new bar positive pressure	Wear limit bar positive pressure	Difference between cylinders bar positive pressure
9.0 to 13.0	8.0	Max. 3.0

-- To conclude work, erase the Diagnostic Trouble Code (DTC) memory of the Engine Control Module (ECM) since malfunctions were stored by disconnecting the connectors. Refer to **ENGINE CONTROL MODULE DTC MEMORY, CHECKING AND ERASING** .

VALVE GUIDES, CHECKING**Special tools and workshop equipment required**

- Dial gauge holder MP 3-447
- Dial gauge

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

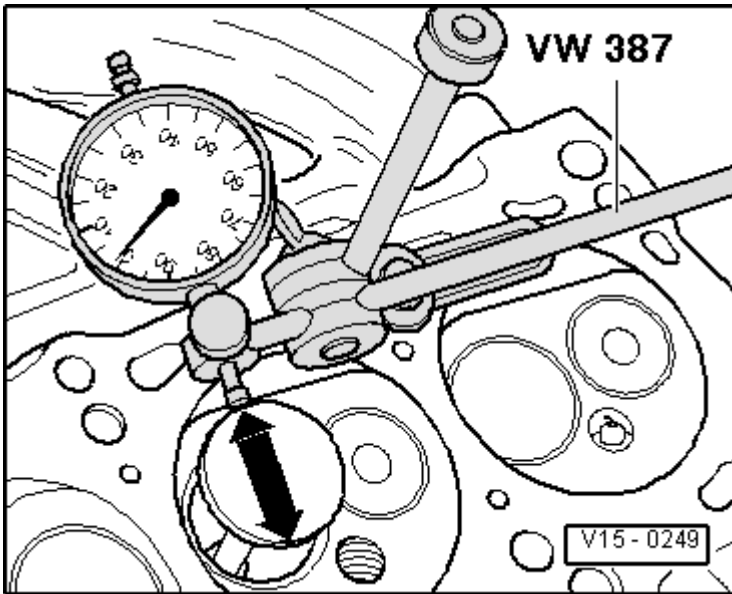


Fig. 19: Determining Tilt Clearance

Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Determine tilt clearance.

Wear limit: 0.8 millimeter (mm)

If tilt clearance is exceeded:

-- Replace the cylinder head.

REMOVAL AND INSTALLATION

CYLINDER HEAD COVER

Special tools and workshop equipment required

- Torque wrench (5-50 Nm) VAG 1331

Removing

-- Remove the engine cover.

-- Disconnect the air hose for the crankshaft housing ventilation -arrow-.

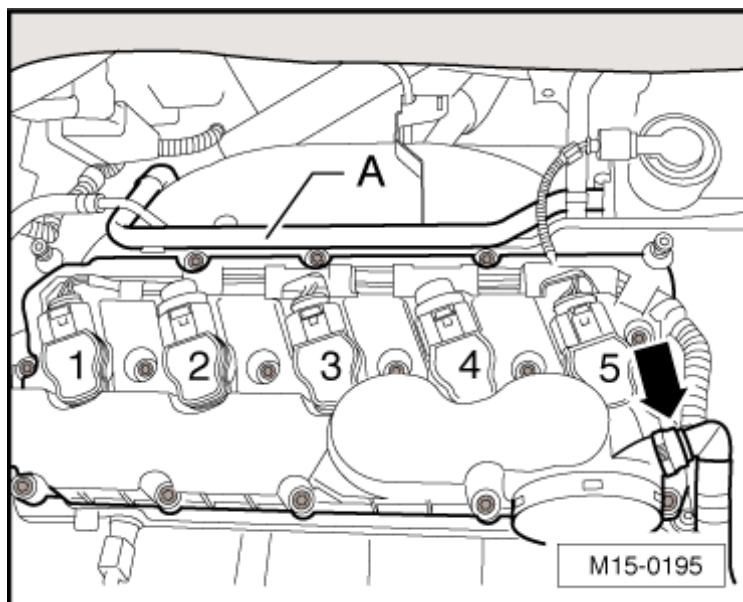


Fig. 20: Disconnecting Air Hose Of Crankshaft Housing Ventilation
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

- Remove the Secondary Air Injection (AIR) connecting pipe -A-.
- Remove the ignition coils -1 through 5-. Refer to **IGNITION COILS WITH POWER OUTPUT STAGES** .
- Remove the cylinder head cover bolts in sequence -16 through 1-.

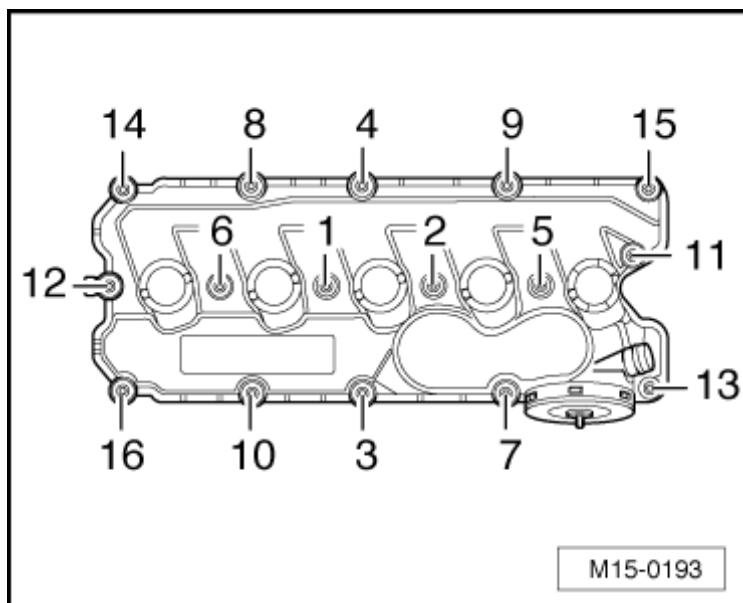


Fig. 21: Removing Bolts For Cylinder Head Cover In Sequence
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

Installing

Install in reverse order of removal. When doing this 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-.

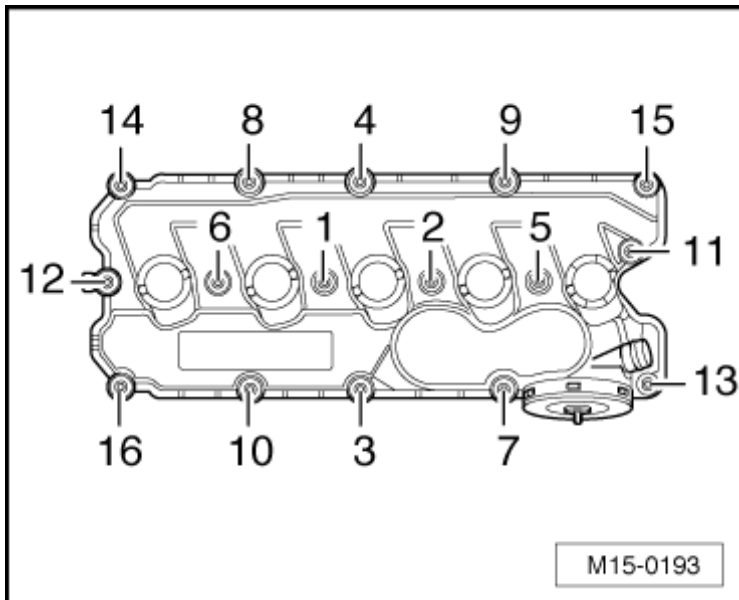


Fig. 22: Removing Bolts For Cylinder Head Cover In Sequence
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Observe the tightening sequence when installing the AIR connecting pipe -A-. Refer to **Fig. 23**.

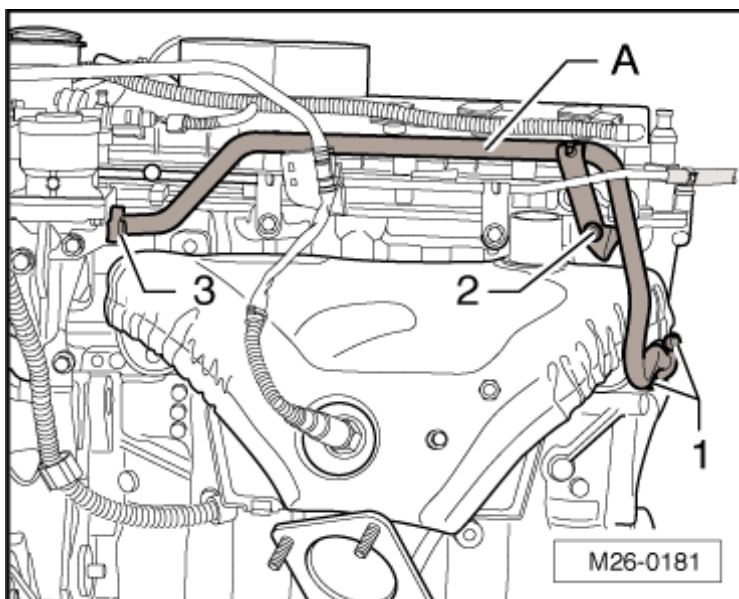


Fig. 23: Connecting Tube - Tightening Sequence

Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

Tightening Specifications

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

CHAIN COMPARTMENT COVER**Special tools and workshop equipment required**

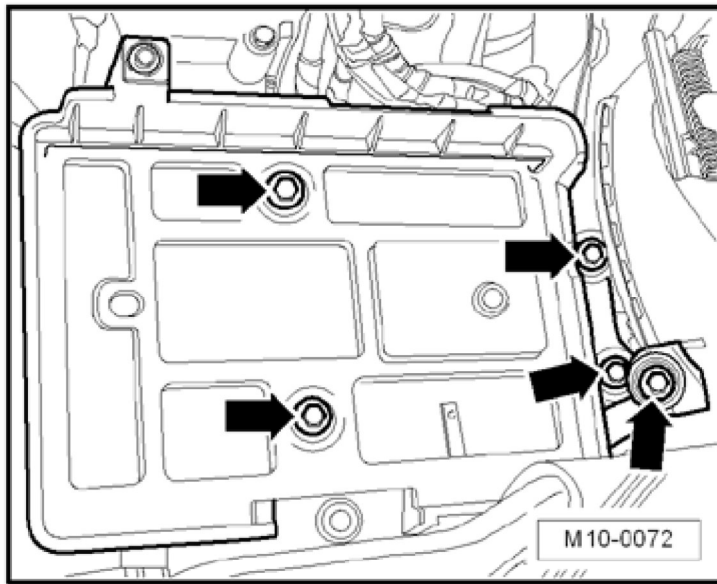
- Trim removal wedge 3409
- Torque wrench (5-50 Nm) VAG 1331
- Hand drill with plastic brush attachment
- Protective eyewear
- Silicone sealant D 174 003 A2

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

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

Removing

- Remove the engine cover.
- Remove the battery. Refer to **Removal and Installation** .
- Remove the battery holder bolts -arrows- and remove the battery holder from the vehicle.

**Fig. 24: Removing Battery Holder**

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 open very carefully.

- Drain the coolant. Refer to **DRAINING AND FILLING** .
- Remove the intake manifold. Refer to **INTAKE MANIFOLD** .
- Remove the coolant pipe at the coolant thermostat housing and vacuum pump bracket.
- Remove the retaining clip -arrow- and remove the coolant pipe -A-.

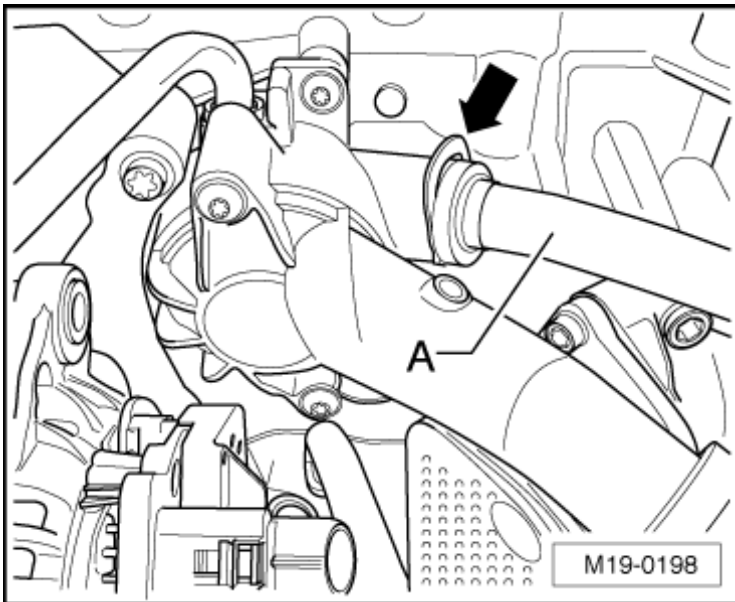


Fig. 25: Pulling Out Retaining Clip And Removing Coolant Pipe
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Disconnect connectors -1 and 3--.

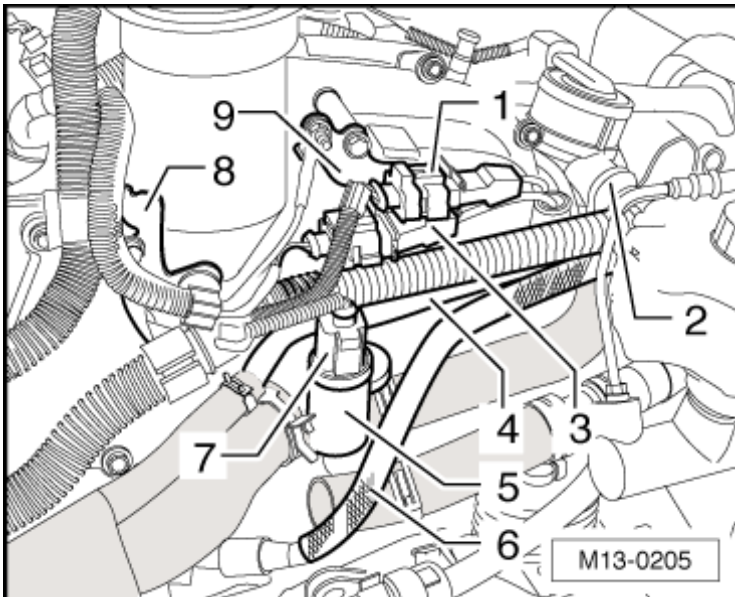


Fig. 26: Disconnecting Vacuum Hose From Vacuum Pump And Connector
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Disconnect the pressure pipe -2- from the Secondary Air Injection (AIR) valve.

-- Remove the rear coolant pipe -4--.

-- Disconnect the vacuum hose -6- from the vacuum pump and disconnect the connector -7--.

- Remove the brackets -8 and 9- and set the wiring harness with pressure pipe aside.
- Press the bracket for the knock sensor wiring harness at the AIR valve slightly toward the rear.
- Remove the coolant distribution housing -5- and set it aside with the coolant hoses connected.
- Remove all the bolts for the chain compartment cover.
- Pry off the chain compartment cover -1- uniformly from the cylinder head -2- at the top and bottom recesses.

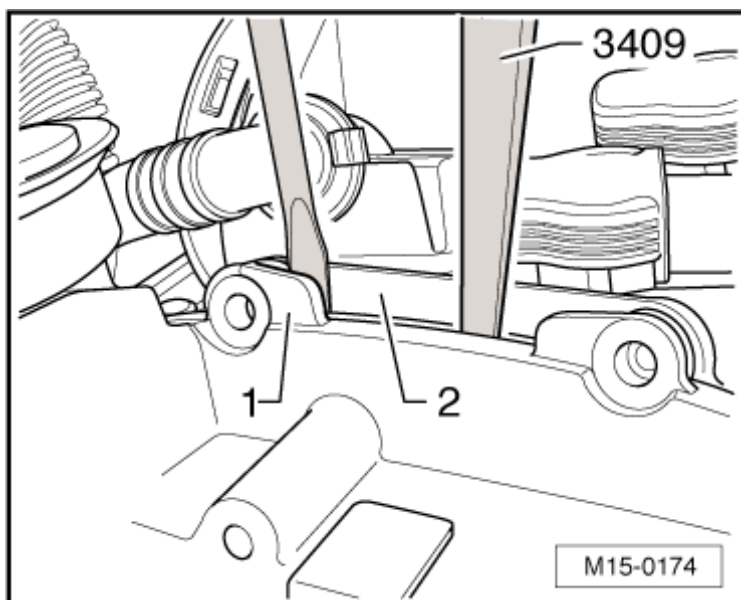


Fig. 27: Pressing Off Chain Case Cover Uniformly From Cylinder Head At Top And Bottom Recesses
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

NOTE: Sealing surfaces must not be damaged under any circumstances. If necessary, use the 3409.

After removing the chain compartment cover, clean the 3409 which is intended for the removal of interior parts.

Installing

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

- Remove the remainder of sealant from the chain compartment cover and from the cylinder head using a rotating plastic brush.

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

- Clean the coolant connection on the cylinder head, see **COOLING SYSTEM COMPONENTS, ENGINE SIDE => Coolant Connection** . If necessary, remove coolant deposits with a copper wire brush or fine sandpaper (minimum 100 grit). If the connection is worn, replace it using locking fluid D 000600 A2.
- Replace the seal in the chain compartment cover. Refer to **CHAIN COMPARTMENT COVER SEAL**.
- Replace the seal in the coolant thermostat housing.
- Clean the sealing surfaces so they are completely free of any oil or grease.
- Cut the tube nozzle at the front mark (nozzle diameter approximately 1 millimeter (mm)).

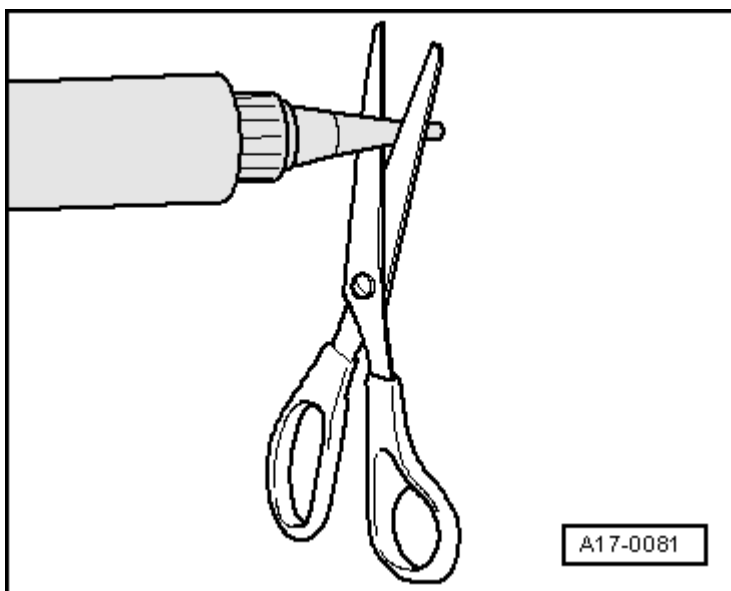


Fig. 28: Cut Tube Nozzle At Front Marking (Nozzle Diameter Approx. 3 Mm)
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

NOTE: **The chain compartment cover must be installed within 5 minutes after application of sealant.**

- Apply the sealant bead -A- as shown to a clean sealing surface of chain compartment cover.

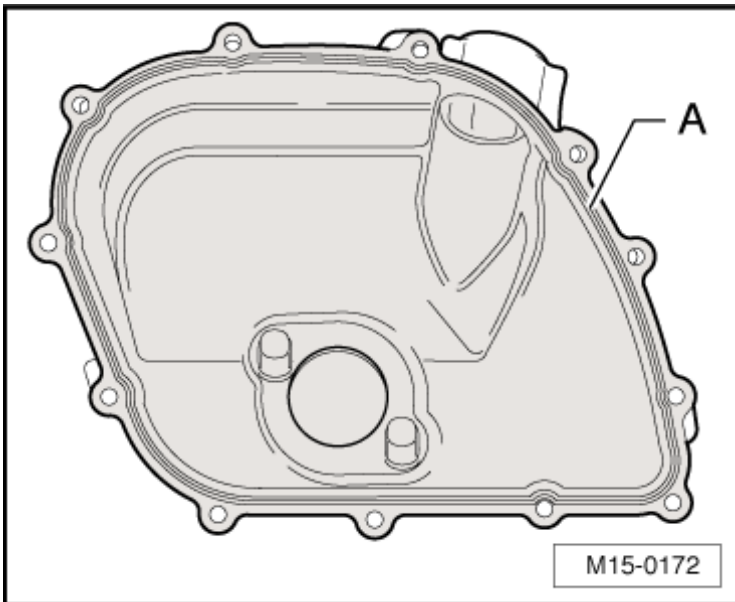


Fig. 29: Applying Sealant Bead As Depicted On To Clean Sealing Surface Of Chain Case Cover
 Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

- The sealant bead must be 1.5 to 2.0 mm thick.

-- Coat the seal of the chain compartment cover lightly with engine oil and slide the chain compartment cover onto the coolant connection.

-- Install all bolts and tighten them in a diagonal sequence.

The rest of the installation follows the reverse of the removal procedures. When doing this note the following:

- Install the battery. Refer to **Removal and Installation** .
- Fill with coolant. Refer to **DRAINING AND FILLING** .

Tightening Specifications

Component	Nm
Chain compartment cover to cylinder head	10
Coolant distribution housing to chain compartment cover	10

CHAIN COMPARTMENT COVER SEAL

Special tools and workshop equipment required

- Arbor VW 195
- Tube 60 mm dia. VW 415A
- Fitting sleeve 3241/4

Conditions

- Chain compartment cover removed

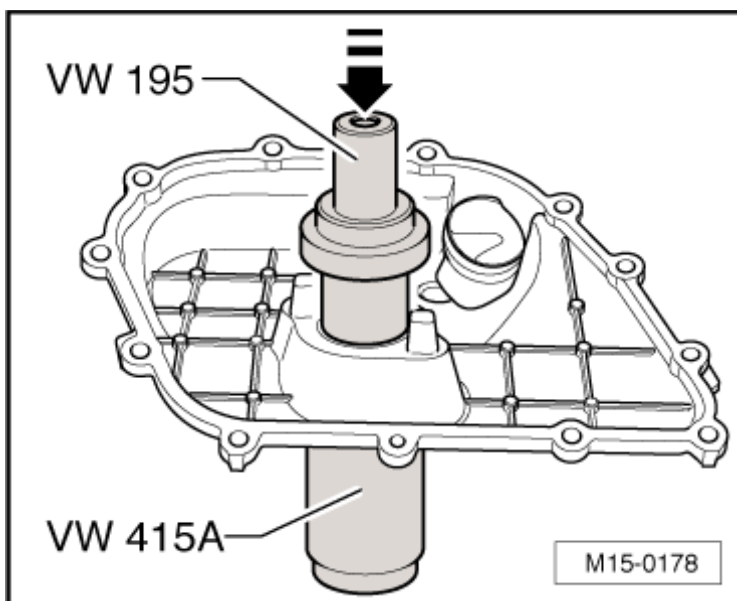


Fig. 30: Driving Out Sealing Ring

Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

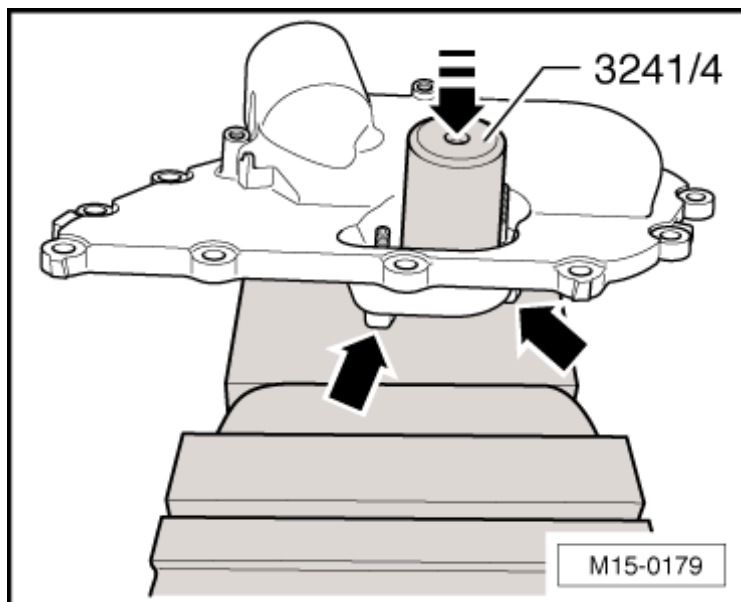


Fig. 31: Driving In Seal

Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Support the chain compartment cover with supports -arrows- on a firm surface and press in the new seal until seated.

CYLINDER HEAD

Special tools and workshop equipment required

- Drip tray VAG 1306 or drip tray for VAS 6100 VAS 6208
- Torque wrench (5-50 Nm) VAG 1331
- Torque wrench (40-200 Nm) VAG 1332
- Spring type clip pliers VAS 5024A or hose clip pliers VAS 6340
- Polydrive bit and drive socket T10070 or Polydrive key 3452
- 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 lines of all types (for example, fuel, hydraulic, Evaporative Emission (EVAP), coolant, refrigerant, brake fluid and vacuum) and electrical wiring so that the original path is followed.
- To prevent damage to the lines, make sure there is sufficient clearance to all moving or hot components.

Removing

- Drain the coolant. Refer to **DRAINING AND FILLING** .
- Remove the engine cover.
- Remove the plenum chamber cover. Refer to **Removal and Installation** .
- Remove the battery. Refer to **Removal and Installation** .
- Remove the battery holder bolts -arrows- and remove the battery holder from the vehicle.

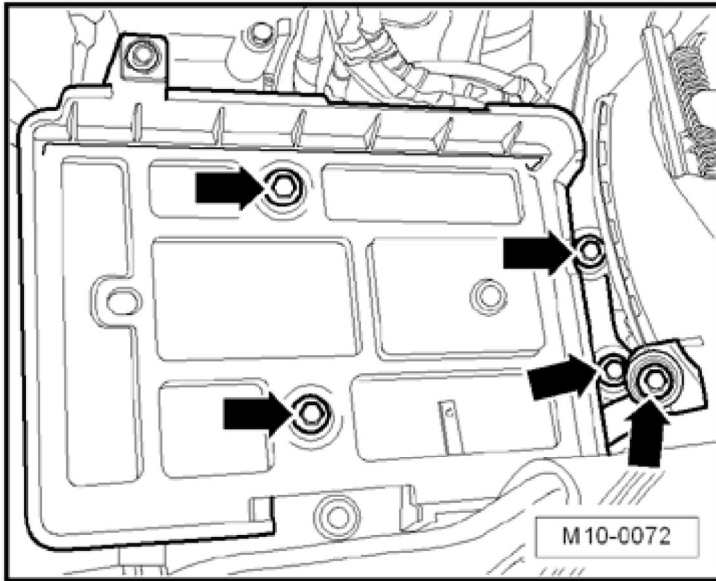


Fig. 32: Removing Battery Holder

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 open very carefully.

- Remove the intake manifold. Refer to **INTAKE MANIFOLD** .
- Install the transport strap again onto the cylinder head to be able to hold the cylinder head during removal.
- Remove the chain compartment cover. Refer to **CHAIN COMPARTMENT COVER**.
- Remove the cylinder head cover. Refer to **CYLINDER HEAD COVER**.
- Secure the camshafts and remove the sprocket and actuator from the camshafts. Refer to **VALVE TIMING, ADJUSTING**.
- Hold the timing chain -A- as shown to be able to lay it under the coolant connection -arrow-.

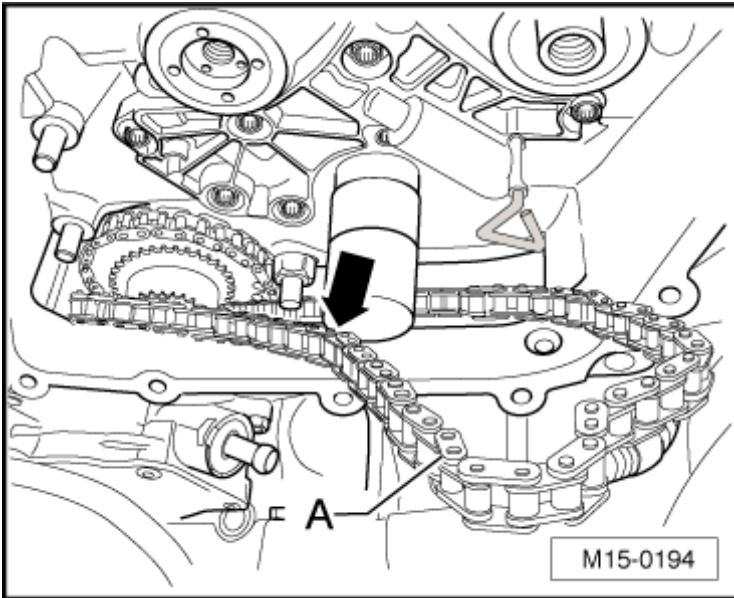


Fig. 33: Holding Timing Chain To Be Able To Lay It Under Pipe Connection
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Remove the bolts -1- and 3- and remove the exhaust manifold brace -2-.

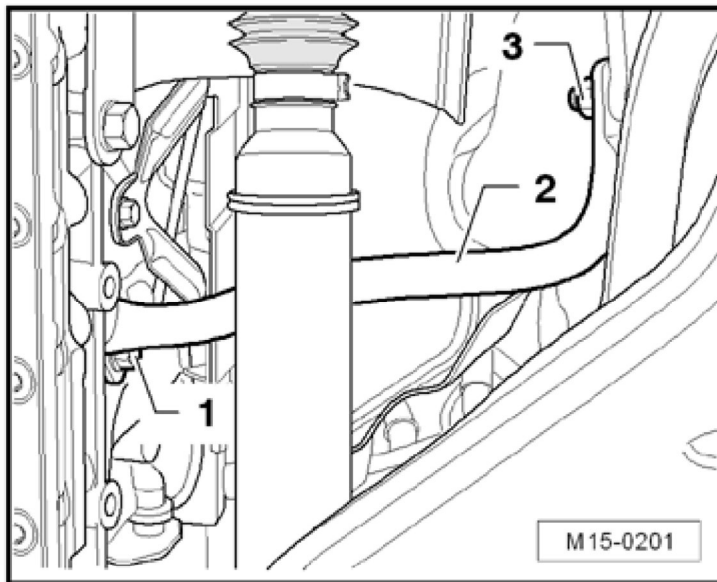


Fig. 34: Removing Bolt And Brace For Exhaust Manifold
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Loosen the nuts for the double clamp.

-- Remove the 4 front exhaust pipe to the exhaust manifold nuts -1- and the suspended mount bolts -3-.

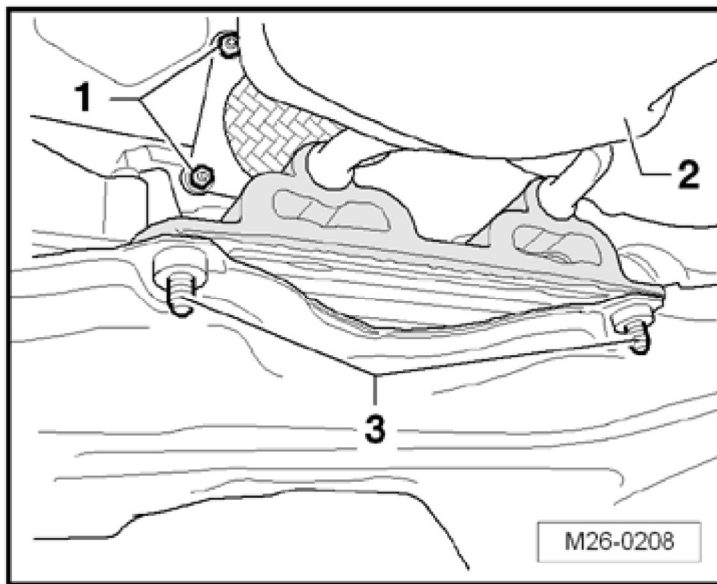


Fig. 35: Pulling Off Front Exhaust Pipe From Double Clamp And From Manifold
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Remove the front exhaust pipe -2- from the manifold and tie up firmly to the side.

NOTE: The flex joint in the front exhaust pipe must not be bent more than 10 degrees, otherwise it may be damaged.

-- Disconnect the harness connector -2- for the oxygen sensor in the exhaust manifold.

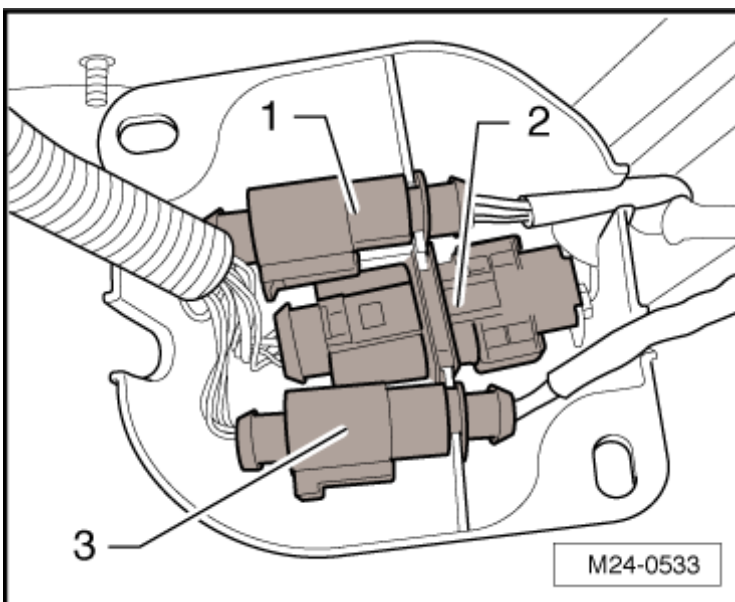


Fig. 36: Disconnecting Harness Connector For Oxygen Sensor
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Remove the heat shield at the top of the front exhaust pipe and free up the wiring harness of the oxygen sensor in the exhaust manifold to the engine.

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

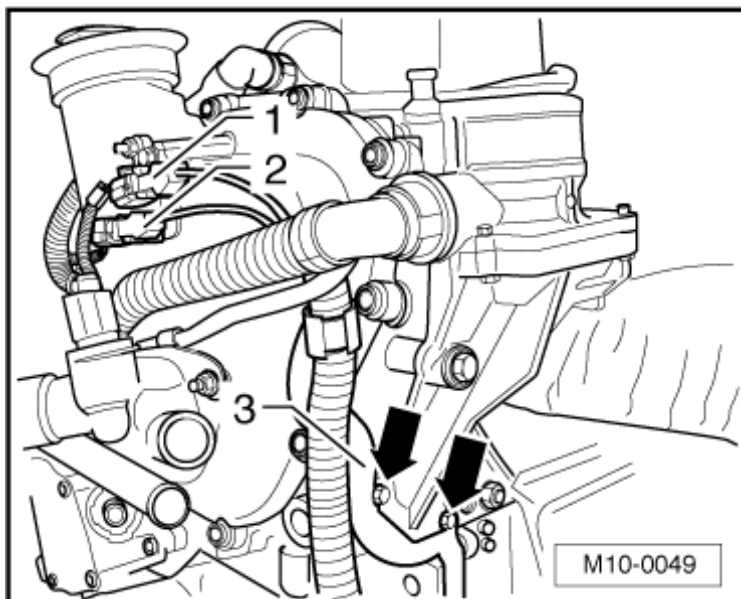


Fig. 37: Disconnecting Harness Connectors And & Removing Bracket
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

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

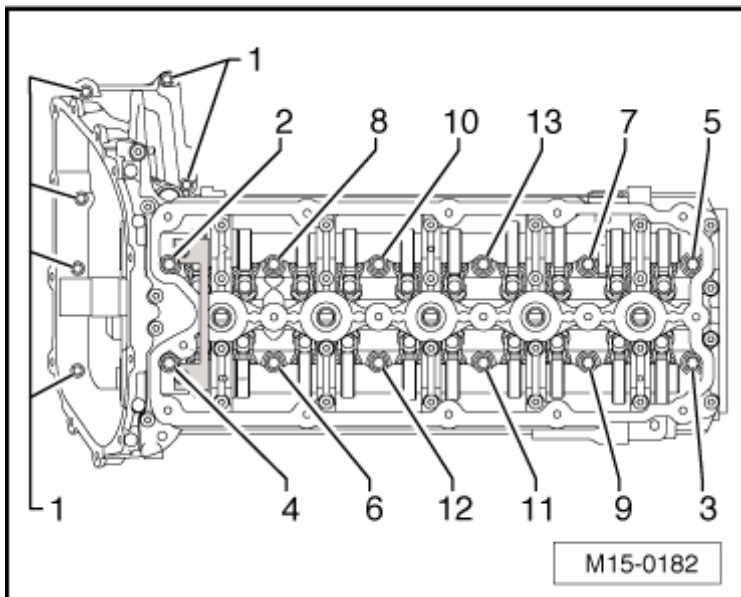


Fig. 38: Removing Cylinder Head Bolts In Sequence Specified
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

NOTE: If the bolt -2- was not able to be pulled out using a magnet, loosen the bolts for

the T40070 one rotation, slide the T40070 toward the right front (seen in direction of travel) and tighten the bolts again.

A second mechanic 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.

-- Stuff clean cloths into the cylinders and chain compartment so that no dirt or abrasive powder can penetrate between the cylinder wall and piston and into the chain compartment.

-- Do not allow dirt or abrasive powder to get into coolant either.

-- Carefully clean the cylinder head and cylinder block sealing surfaces. Avoid introducing scratches or scoring (do not use sandpaper below 100 grit).

-- Carefully remove any metal particles, emery remains and the cloths.

-- Cut the tube nozzle at the front mark (nozzle diameter approximately 1 millimeter (mm)).

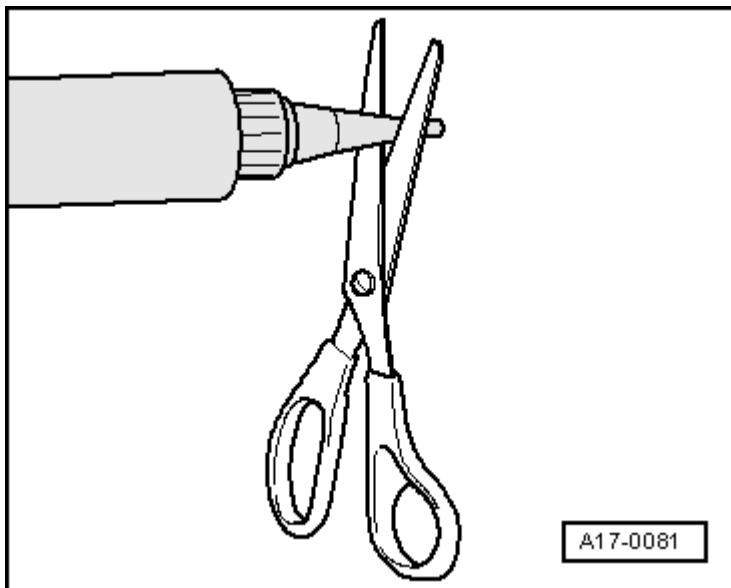
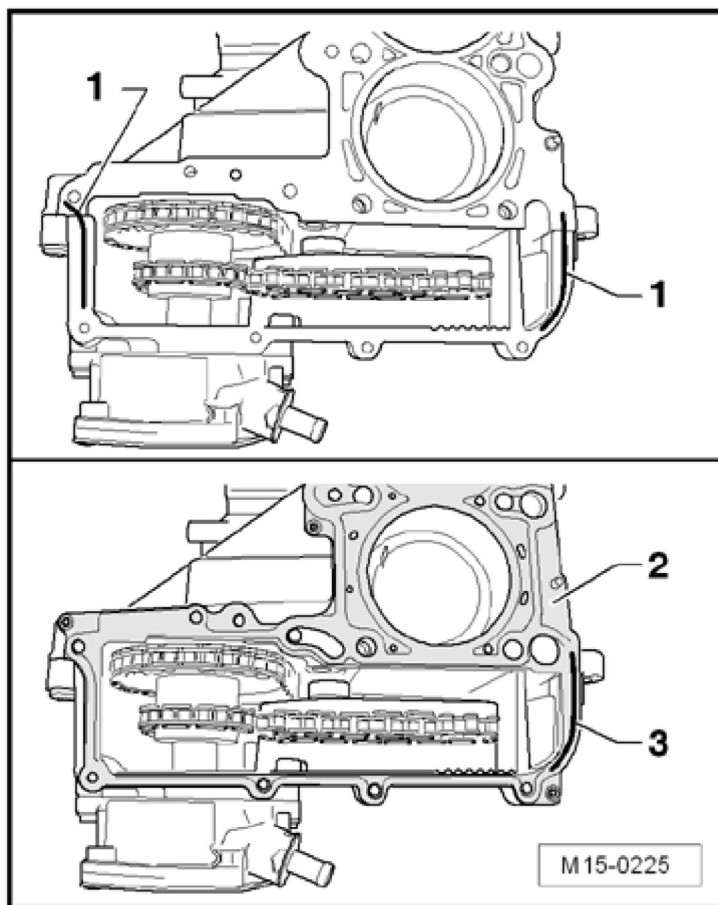


Fig. 39: Cut Tube Nozzle At Front Marking (Nozzle Diameter Approx. 3 Mm)
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

Note the shelf life date.

-- Apply a bead of sealant -1- (front and rear) on the clean sealing surfaces as shown in figure.

**Fig. 40: Sealant Bead Locations**

Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

- The sealant bead must be 2.0 to 2.5 mm thick.

-- Install the new cylinder head gasket -2-.

-- Note the alignment pins in the cylinder block -arrows-.

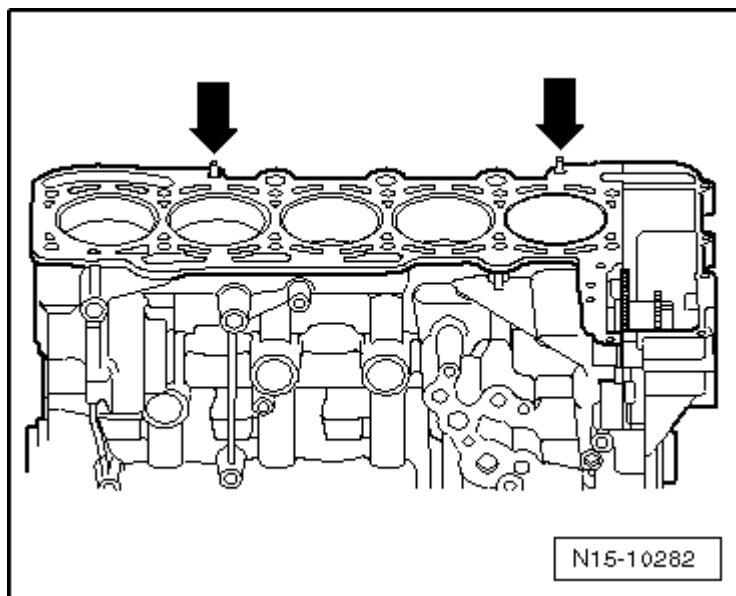


Fig. 41: Identifying Centering Pins In Cylinder Block
 Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Apply a bead of sealant -3- (rear only), as shown in figure, on the cylinder head gasket.

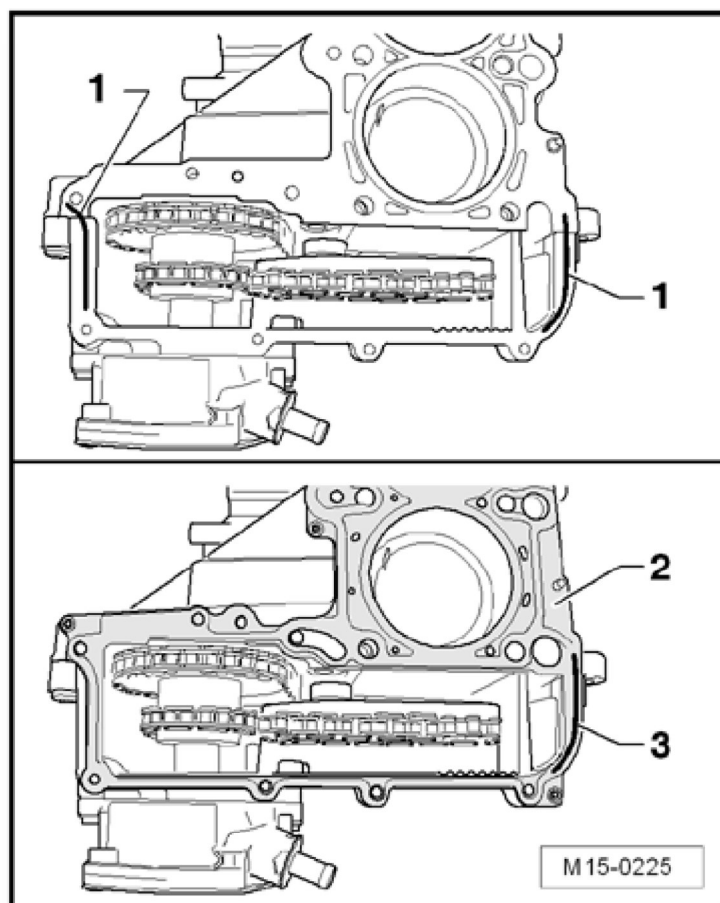


Fig. 42: Sealant Bead Locations

Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

- The sealant bead must be 2.0 to 2.5 mm thick.

NOTE: The cylinder head must be installed within 5 minutes of applying the sealant.

- Install the cylinder head.
- Guide the timing chain over the coolant connection.
- Install the cylinder head bolts and tighten them hand tight.
- Tighten the cylinder head bolts -1 through 12- in the sequence shown as follows:

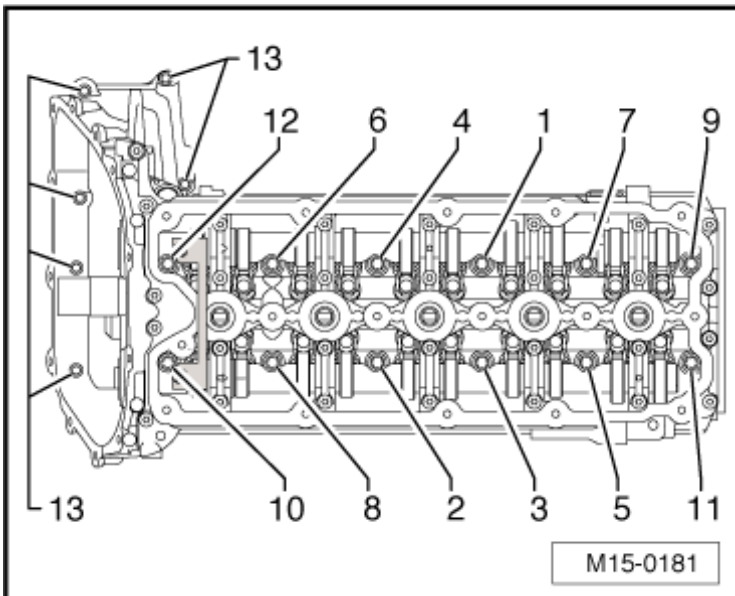


Fig. 43: Identifying Cylinder Head Bolts Tightening Sequence

Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

Step	Tighten
1	-- Tighten to 40 Nm using a torque wrench.
2	-- Tighten an additional 90° (1/4) further using a ratchet.
3	-- Tighten an additional 90° (1/4) further using a ratchet.

- Then tighten the bolts -13- to 10 Nm.
- Wipe off any sealant, which has leaked out.

The rest of the installation follows the reverse of the removal procedures. When doing this note the following:

- Remove the T40069 from the cylinder block and install the locking bolt.
- Install the battery. Refer to **Removal and Installation** .
- Replace and fill coolant. Refer to **DRAINING AND FILLING** .

VALVE STEM SEALS

(with 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) VAG 1331
- Valve cotters asm/disasm device VAS 5161
- Guide plate for FSI engine VAS 5161/19B

Removing

To remove the valve stem oil seals, the following components must be removed as follows:

- Intake valves cylinder 1: Transport strap
- Intake valves cylinder 5: Camshaft adjustment valve 1 -N205-
- Exhaust valves cylinder 5: Secondary Air Injection (AIR) solenoid valve -N112-

-- Remove the plenum chamber cover **Removal and Installation** .

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

-- Remove the roller cam follower and set it down on a clean surface. Make sure that the roller cam followers are not interchanged.

-- Using the 3122B, remove the spark plugs.

-- Install the VAS 5161/19B with the VAS 5161/12 onto the cylinder head as shown.

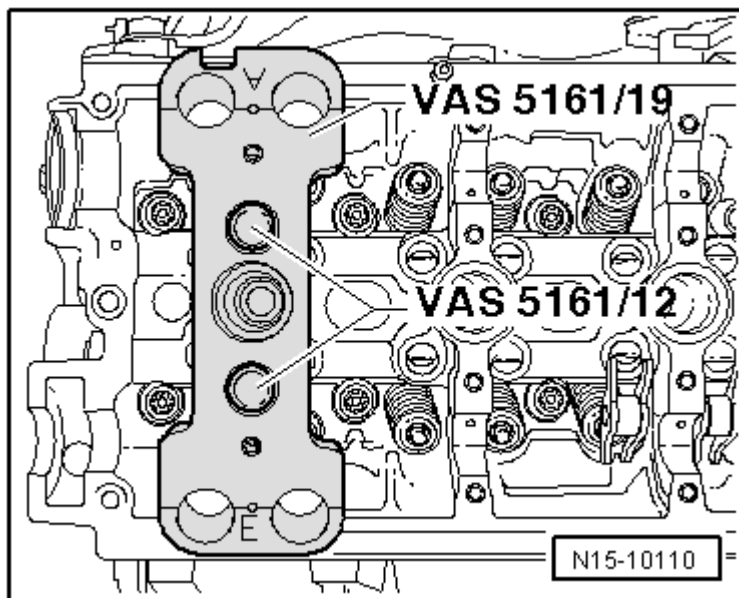


Fig. 44: Identifying Install Guide Plate VAS 5161/19 With Knurled Bolts VAS 5161/12 On Cylinder Head
 Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

- Adjust the piston of the respective cylinder to the Bottom Dead Center (BDC) position.
- Install T40012 into the spark plug hole and connect a compressed air hose of at least 6 bar positive pressure.
- Using the VAS 5161/3 and a plastic mallet, tap loose any stuck valve keepers.

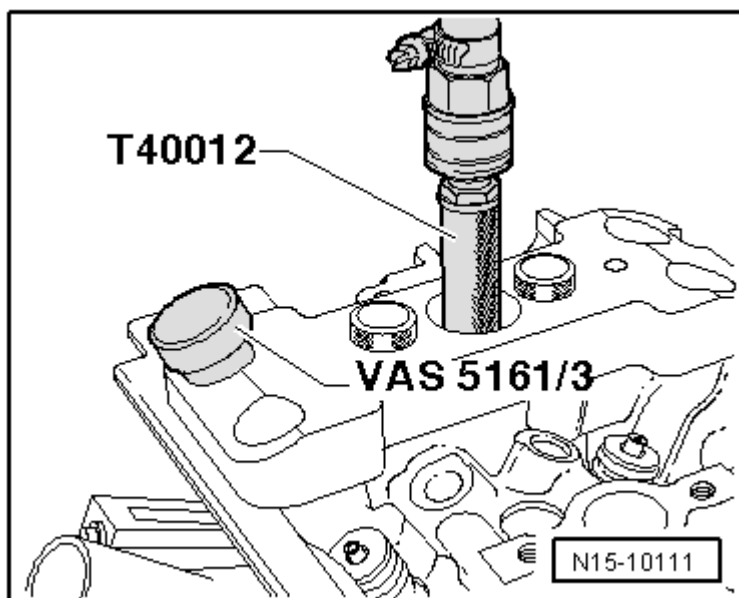


Fig. 45: Identifying Drift VAS 5161/3 And Plastic Mallet T40012 To Loosen Stuck Valve Keepers
 Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

- Install the VAS 5161/6 with the VAS 5161/5 into the VAS 5161/19B.

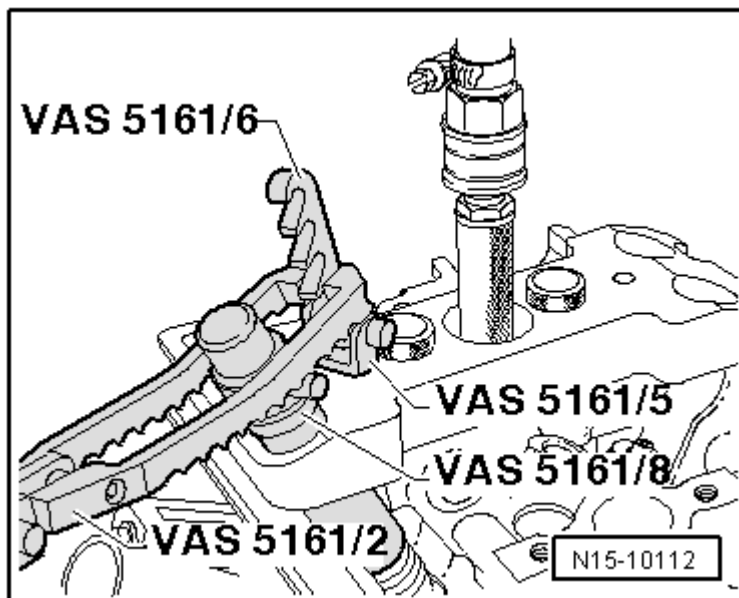


Fig. 46: Identifying Engaging Device VAS 5161/6 With Installation Forks VAS 5161/5 Installed Into Guide Plate VAS 5161/19

Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Insert the VAS 5161/8 into the VAS 5161/19B.

-- Engage the VAS 5161/2 on the VAS 5161/6.

NOTE: On the exhaust side, VAS 5161/2 must be engaged as shown.

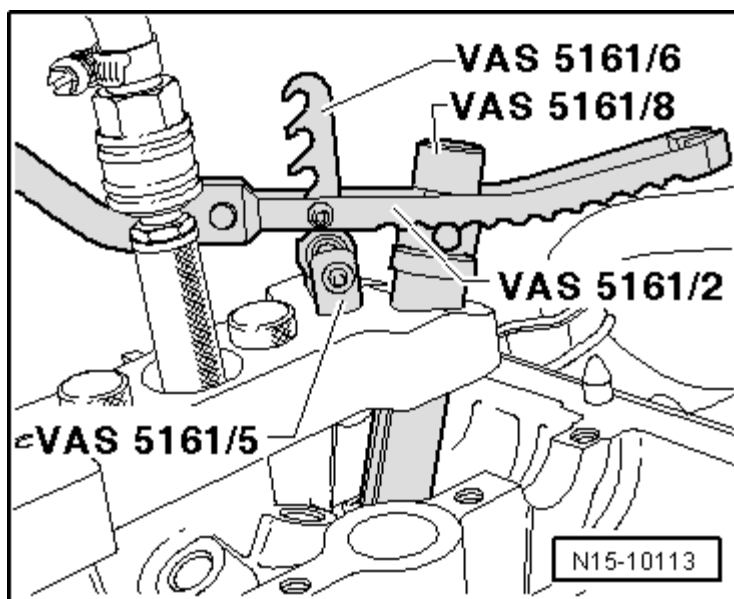


Fig. 47: Identifying Pressure Forks VAS 5161/2 Engaged

Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

- Press down the VAS 5161/8. At the same time, turn the knurled bolt for the VAS 5161/8 clockwise until the points engage in the valve keepers.
- Lightly move the knurled bolt of the VAS 5161/8 back and forth, this causes the valve keepers to be pressed apart and captured in the VAS 5161/8.
- Release the VAS 5161/2.
- Remove the VAS 5161/8, valve spring retainers and valve springs.
- Remove the valve stem seal using 3364.

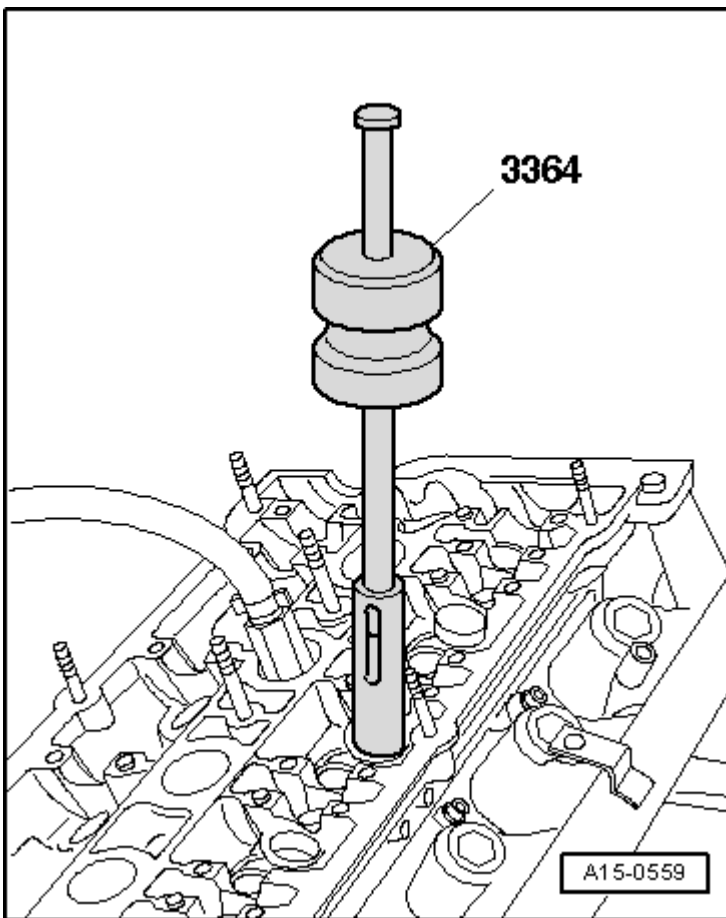


Fig. 48: Identifying Valve Seal Removal Tool 3364
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

- In the event the 3364 cannot be used due to limited space constraints, drive out the spring dowel sleeve - arrow- using a drift and remove the impact device.

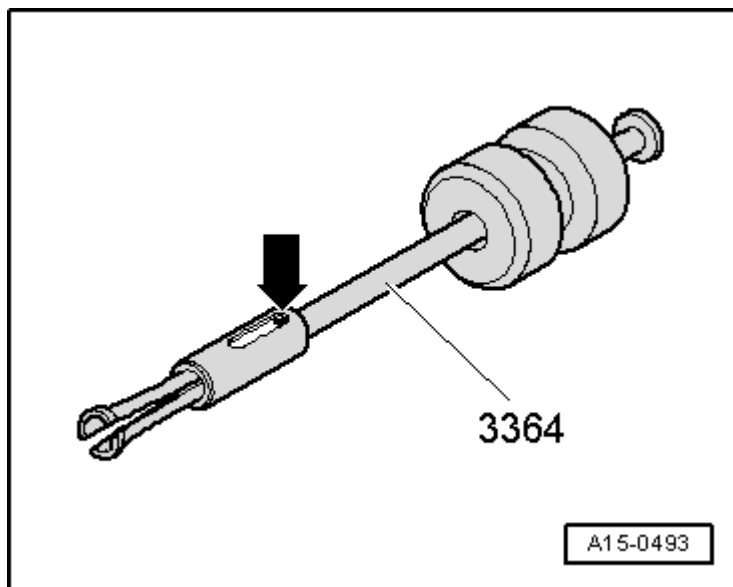


Fig. 49: Driving Out Spring Dowel Sleeve

Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Place the lower part of the 3364 onto the valve stem oil seal.

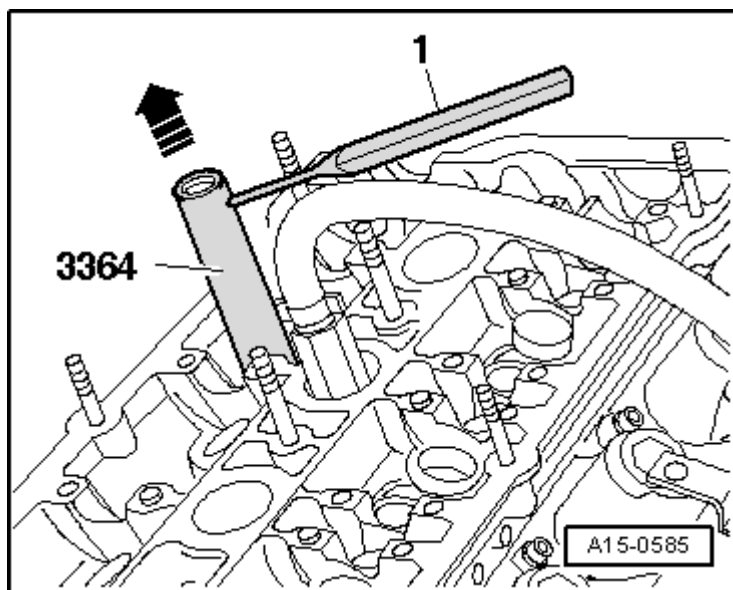


Fig. 50: Identifying Placement Of Lower Part Of Valve Seal Removal Tool 3364 On To Valve Stem Oil Seal

Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Insert a drift -1- into bore in 3364.

-- Using the drift -1- as a lever, pull out the valve stem oil seal -arrow-.

Installing

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

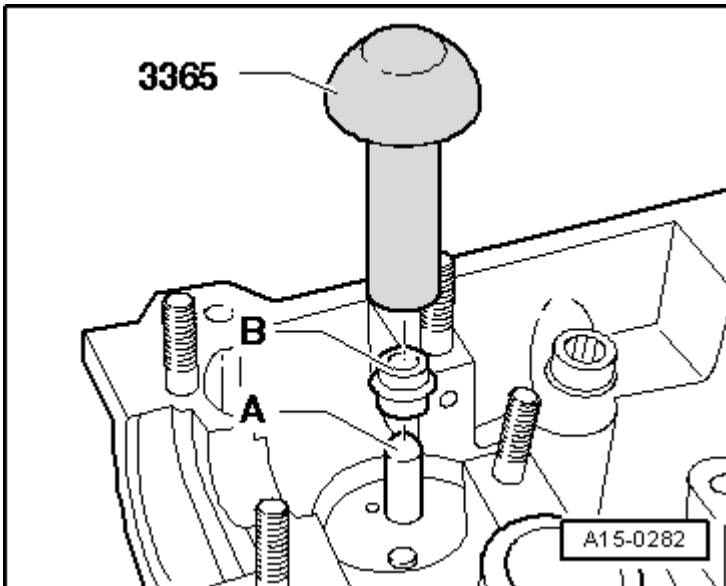


Fig. 51: Identifying Plastic Sleeve, New Valve Stem Oil Seals & Valve Stem Seal Driver 3365
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

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

-- Remove the plastic sleeve -A-.

-- Install the valve spring and valve spring retainer.

-- Install the VAS 5161 as shown.

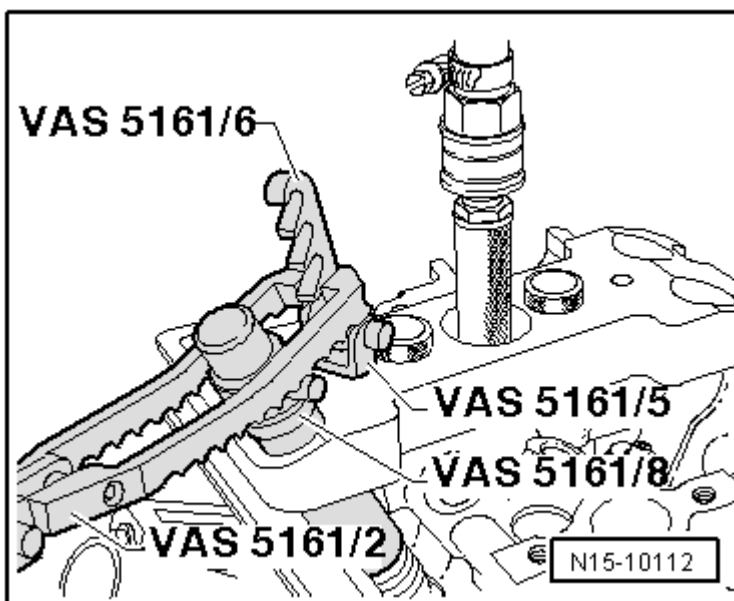


Fig. 52: Identifying Engaging Device VAS 5161/6 With Installation Forks VAS 5161/5 Installed Into

Guide Plate VAS 5161/19

Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

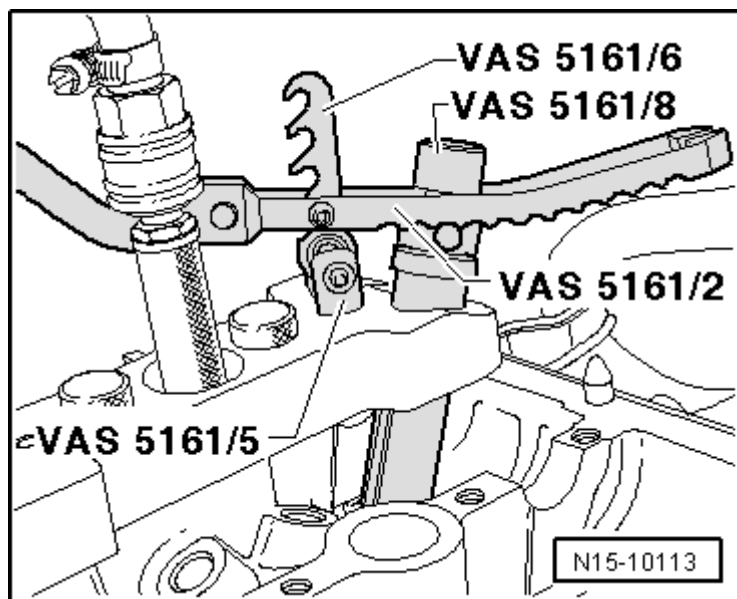


Fig. 53: Identifying Pressure Forks VAS 5161/2 Engaged

Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

NOTE: If the valve keepers were removed from the VAS 5161/18, they must be inserted into the VAS 5161/18 next.

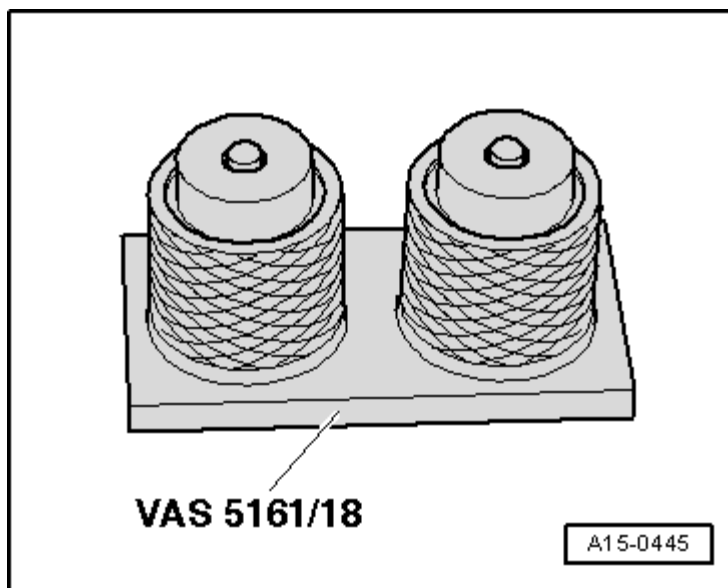


Fig. 54: Identifying Installation Cartridge VAS 5161/8

Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

Press the VAS 5161/8 onto the insertion device from above and take up valve keepers.

-- Press down the VAS 5161/8 using VAS 5161/2, tap lightly against the VAS 5161/8 in the lower area, rotate the knurled bolt for the VAS 5161/8 back and forth and pull upward while doing this.

-- Release the VAS 5161/2 with the knurled bolt pulled.

-- Remove the VAS 5161.

The rest of the installation follows the reverse of the removal procedures. When doing this note the following:

- Remove the T40069 from the cylinder block and install the locking bolt.
- Fill with coolant. Refer to **DRAINING AND FILLING** .

CAMSHAFTS

Special tools and workshop equipment required

- Torque wrench (5-50 Nm) VAG 1331
- Hand drill with plastic brush attachment
- **Protective eyewear**
- Sealant D 154 103 A1

Removing

NOTE: **Sealing surfaces on the bottom of the guide frame and top of the cylinder head must not be reworked.**

Camshaft bearings are integrated in cylinder head or in guide frame. Before removing guide frame, chain sprockets of camshafts must be removed.

If the guide frame was loosened, the sealing plugs must be replaced.

-- Secure the camshafts and remove the sprocket and actuator from the camshafts. Refer to **VALVE TIMING, ADJUSTING**.

-- Remove the T40070.

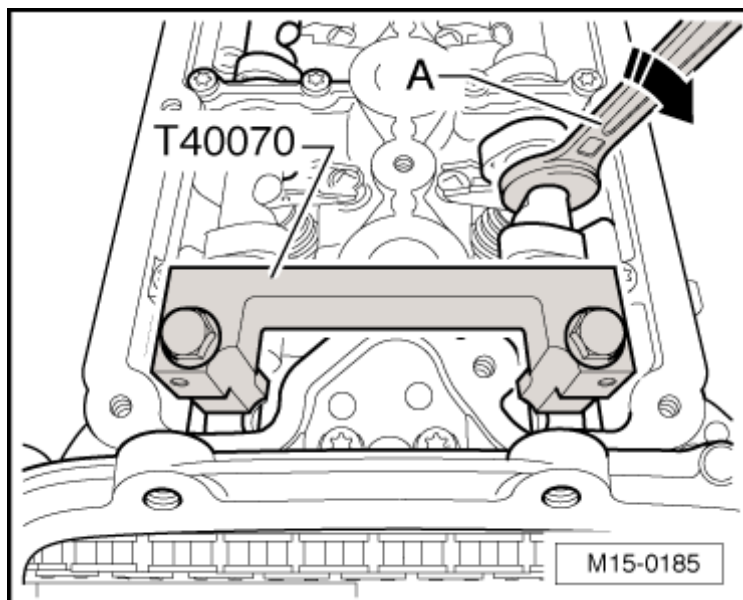


Fig. 55: Installing Camshaft Clamp T40070 On To Camshafts
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

- Remove the guide frame bolts evenly from the outside toward the inside and remove the guide frame.
- Carefully remove the camshaft and place it on a clean surface.

Installing

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

- Remove the remainder of sealant from the guide frame (out of the grooves as well) and from the cylinder head using a rotating plastic brush.

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

- Clean the sealing surfaces, they must be free of oil and grease.
- Oil the journal surfaces of the camshafts.
- Place the guide frame on a soft surface.
- Install the camshafts correctly into the guide frame.

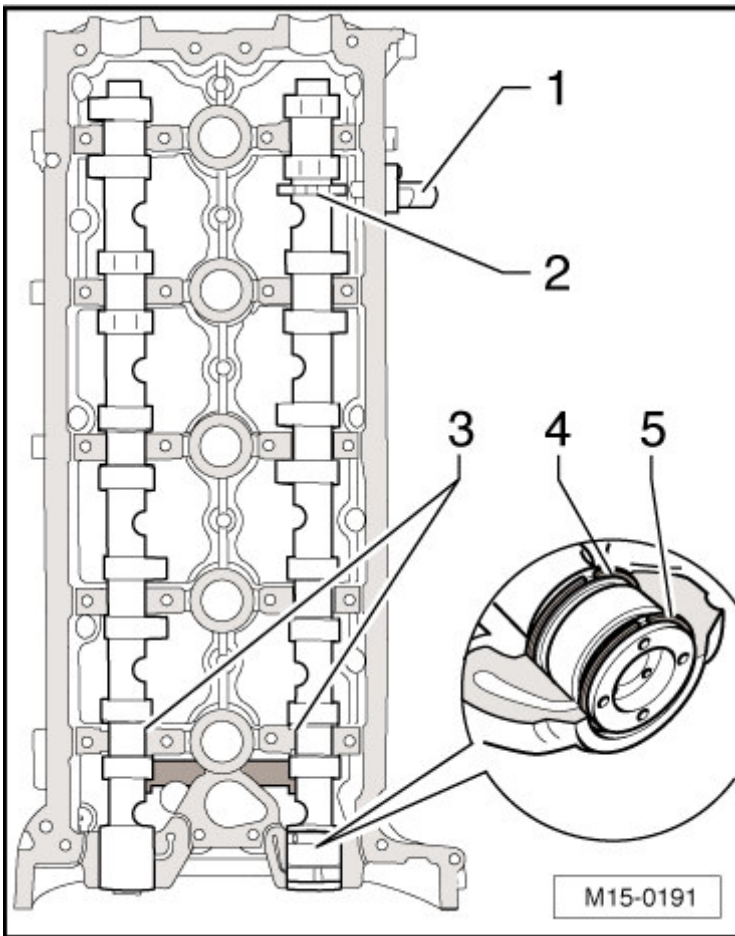


Fig. 56: Inserting Camshafts Correctly Into Guide Frame
 Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

- Intake camshaft with sensor wheel -2- points toward the Camshaft Position (CMP) sensor -G40- -1-.
- Camshafts must lie exactly in the axial bearings -3- in the guide frame.
- Seal ends -4 and 5- must point upward or downward, they must not point to the side under any circumstances.

-- With the camshafts installed in the guide frame, hold the camshafts firmly in place and turn over and install the guide frame.

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

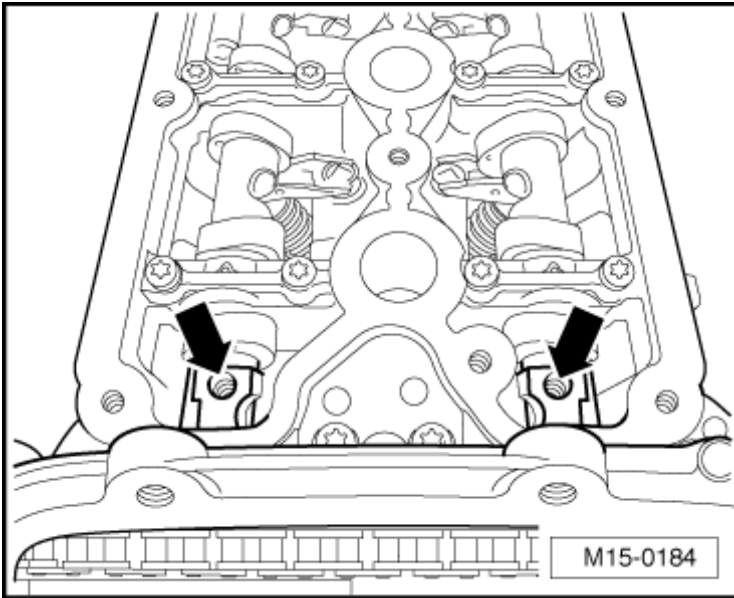


Fig. 57: Identifying Threaded Holes

Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

- Check whether the camshafts still lie exactly in the axial bearings of the guide frame.
- Install the T40070 as shown to the camshafts and tighten the bolts to 20 Nm.

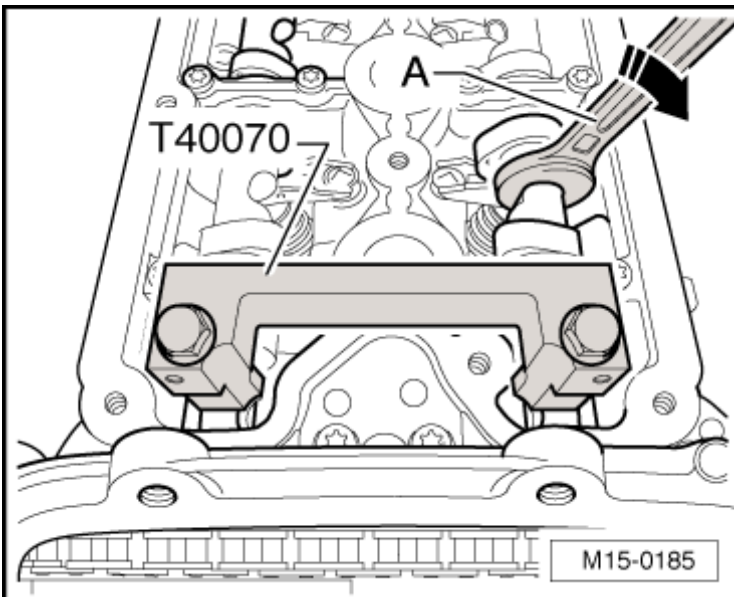


Fig. 58: Installing Camshaft Clamp T40070 On To Camshafts

Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

- Turn over the guide frame again.
- Cut the tube nozzle at the front mark (nozzle diameter approximately 1 millimeter (mm)).

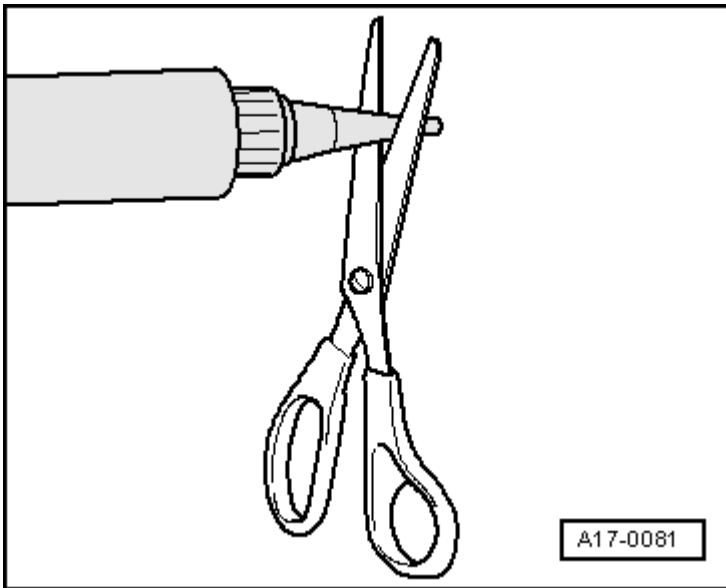


Fig. 59: Cut Tube Nozzle At Front Marking (Nozzle Diameter Approx. 3 Mm)
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Lightly apply an even bead of sealant into the clean grooves of the guide frame -1 through 8-.

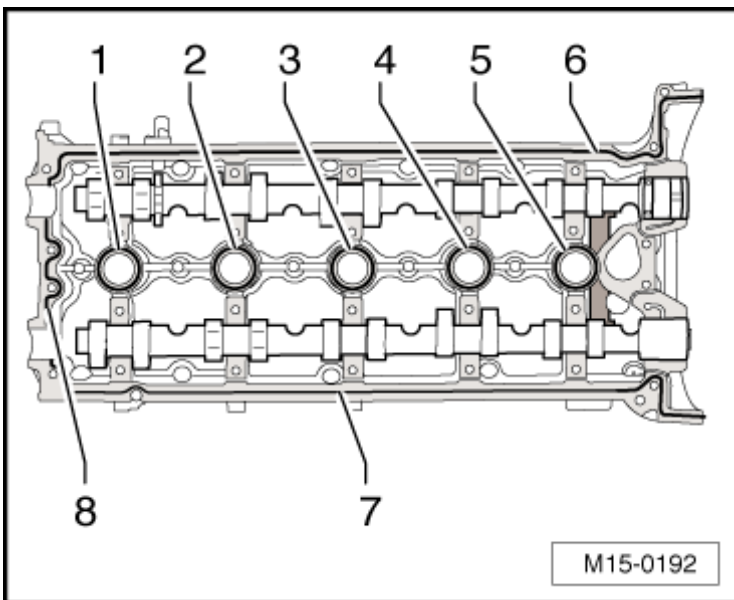


Fig. 60: Lightly Applying Bead Of Sealant Into Clean Grooves Of Guide Frame
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

Width of sealant bead:

- Grooves -1 through 5- : approximately 3.0 mm
- Grooves -6 through 8- : approximately 4.0 mm

NOTE: Sealant beads must be applied according to exact specifications, otherwise

excess sealant could get into the camshaft bearings.

Installing and securing the guide frame should be performed without interruption because the sealant begins to harden immediately as soon as it contacts the sealing surfaces.

Note the expiration date of the sealing compound.

- Install the guide frame onto the cylinder head immediately.
- Gently tighten the bolts from the inside working toward the outside in several stages.
- Then tighten the bolts to 8 Nm in the sequence indicated.

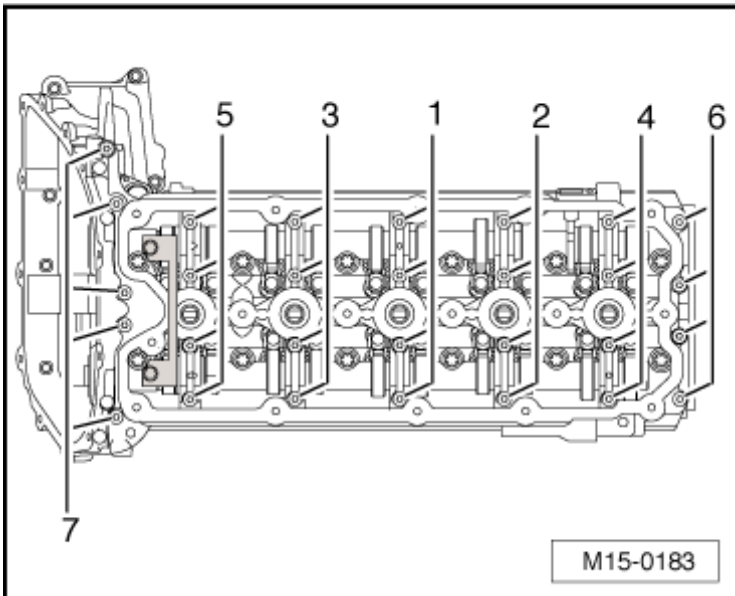


Fig. 61: Identifying Tightening Bolts Sequence

Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

- After that, continue to tighten all bolts an additional 90° (1/4) further.
- Sealant must bulge outward slightly, even in the area of chain compartment -arrows-.

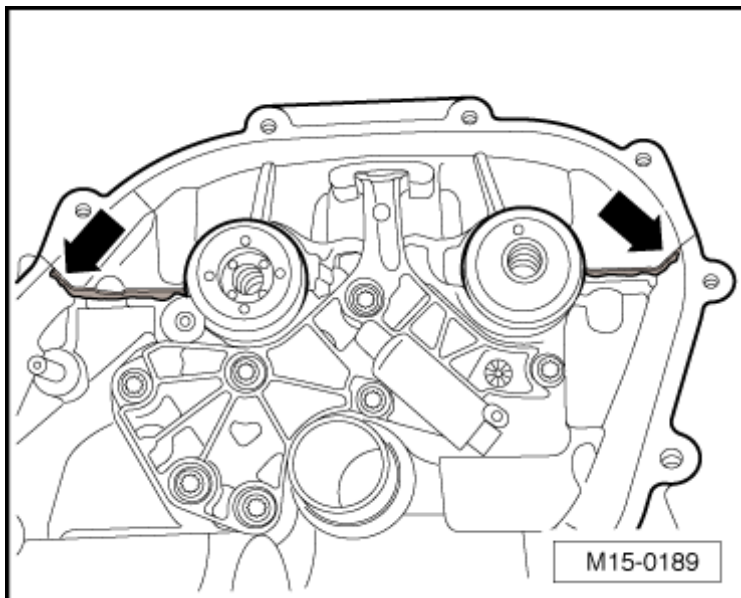


Fig. 62: Identifying Chain Compartment Sealant Locations
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

- Wipe off the sealant on the sealing surface facing the chain compartment cover.
- Carefully press in the sealing plugs -A- until they reach the end of the chamfer -arrows-.

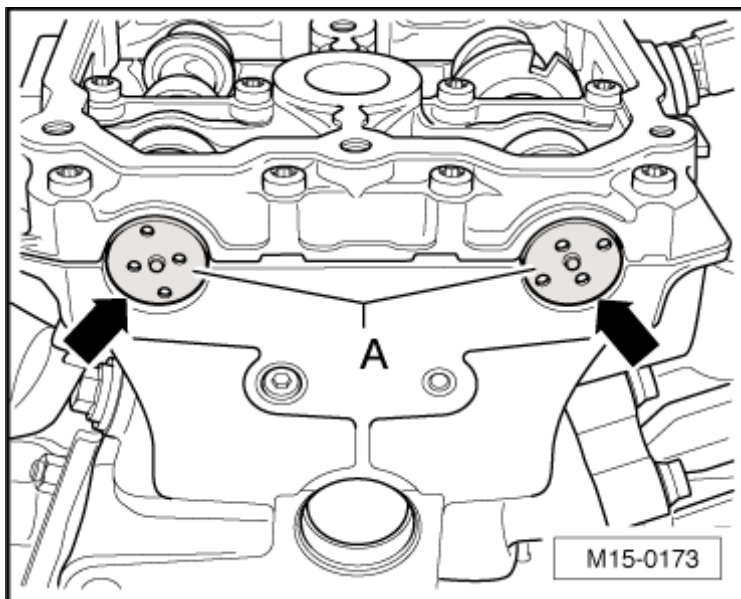


Fig. 63: Identifying Sealing Plugs
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

NOTE: If the sealing plug was pressed in too far, it must be pressed through and pressed in again up to the mark.

The rest of the installation follows the reverse of the removal procedures. When doing this note the following:

- Remove the T40069 from the cylinder block and install the locking bolt (30 Nm).
- Fill with coolant. Refer to **DRAINING AND FILLING** .

SPECIAL TOOLS

Special tools and workshop equipment required

- Spark plug removal tool 3122B
- Ignition coil puller T40039
- Compression tester VAG 1763
- Spark plug removal tool 3122 B
- 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
- Drip tray VAG 1306 or drip tray for VAS 6100 VAS 6208
- Spring type clip pliers VAS 5024A or hose clip pliers VAS 6340
- Polydrive bit and drive socket T10070 or Polydrive key 3452
- Trim removal wedge 3409

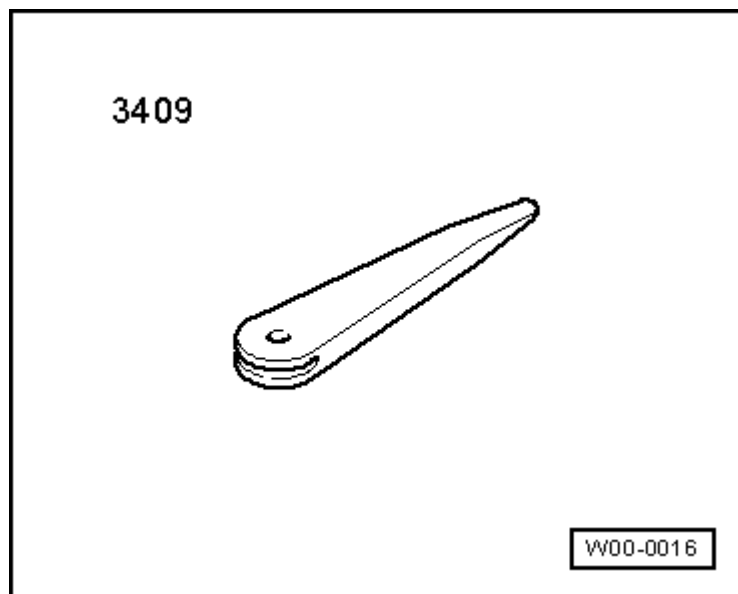


Fig. 64: 3409 Wedge

Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

- Adapter VAG 1381/5A

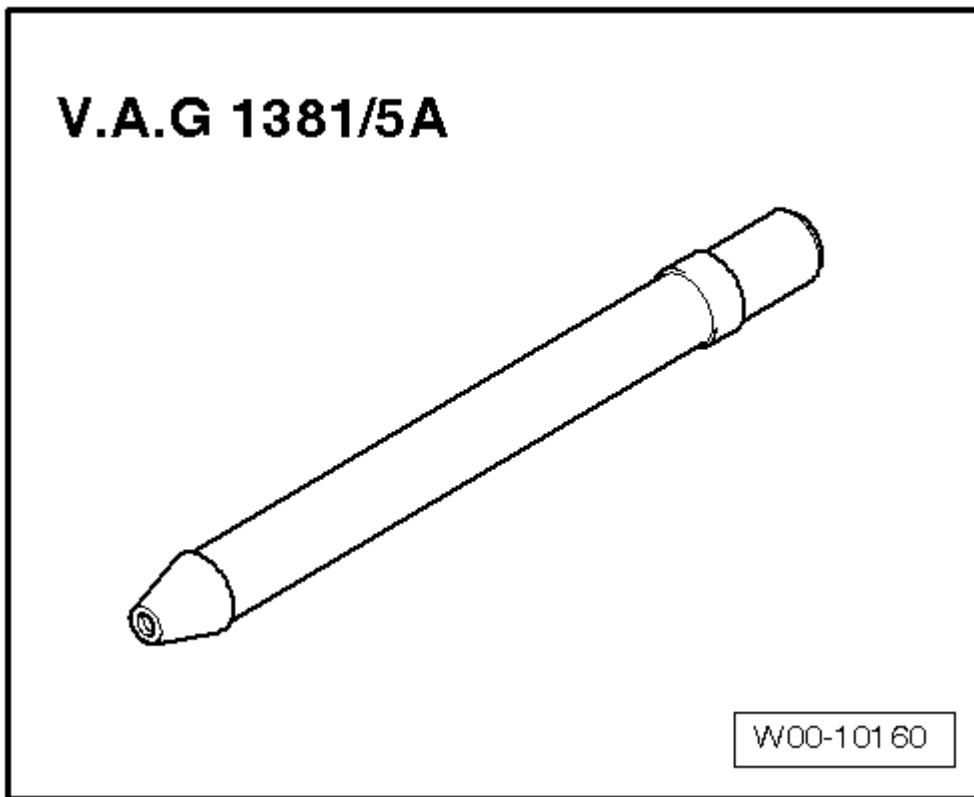


Fig. 65: Identifying Adapter V.A.G 1381/5A

Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

2010 Volkswagen New Beetle

ENGINE 2.5 Liter - Cylinder Head, Valvetrain - Engine Code(s): BPR & BPS (Convertible)

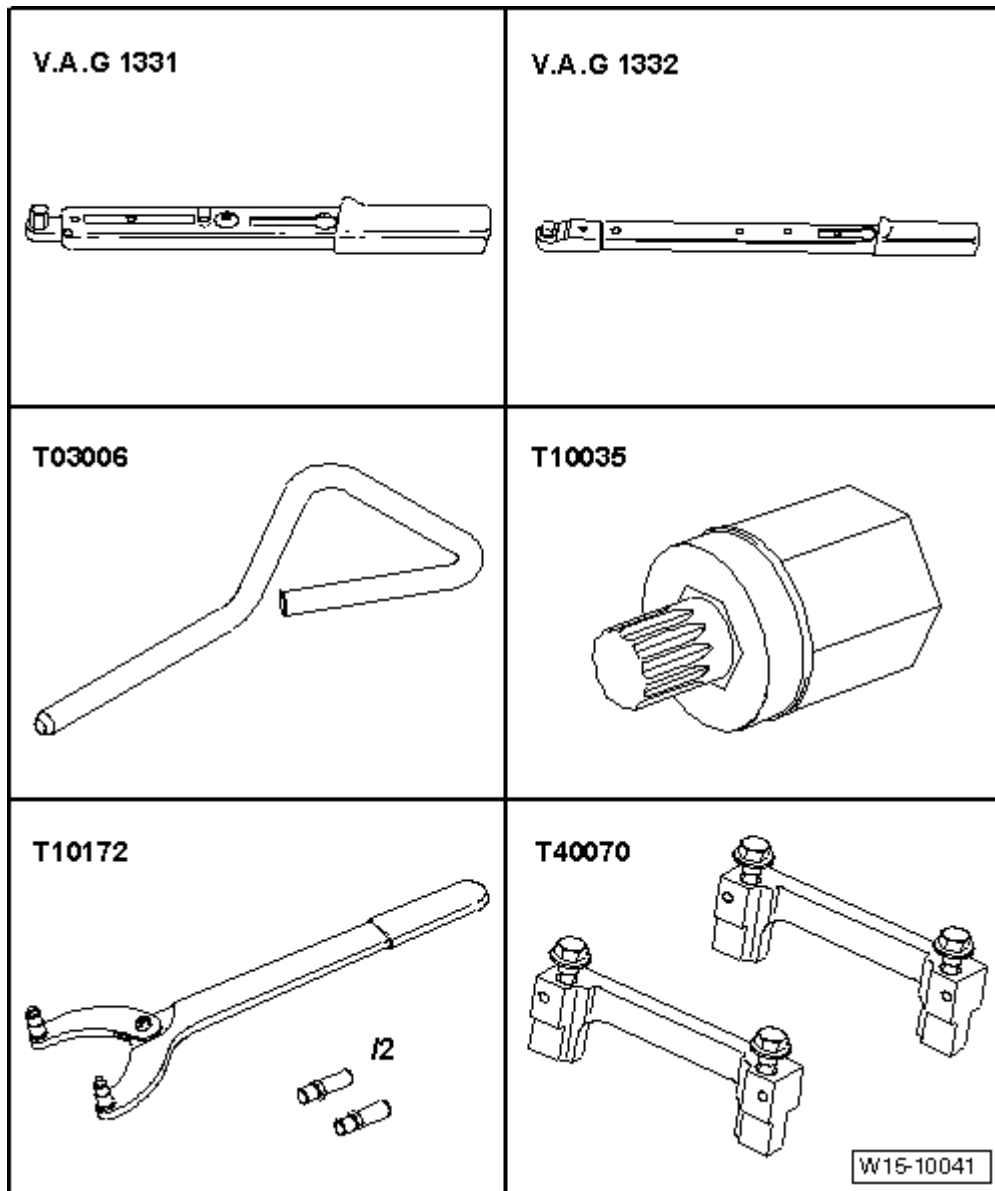


Fig. 66: Identifying Special Tools -- Valve Timing, Adjusting
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

Special tools and workshop equipment required

- Torque wrench (5-50 Nm) VAG 1331
- Torque wrench (40-200 Nm) VAG 1332
- Locking pin T03006
- Multipoint socket T10035
- Counter hold tool T10172
- Camshaft clamp T40070

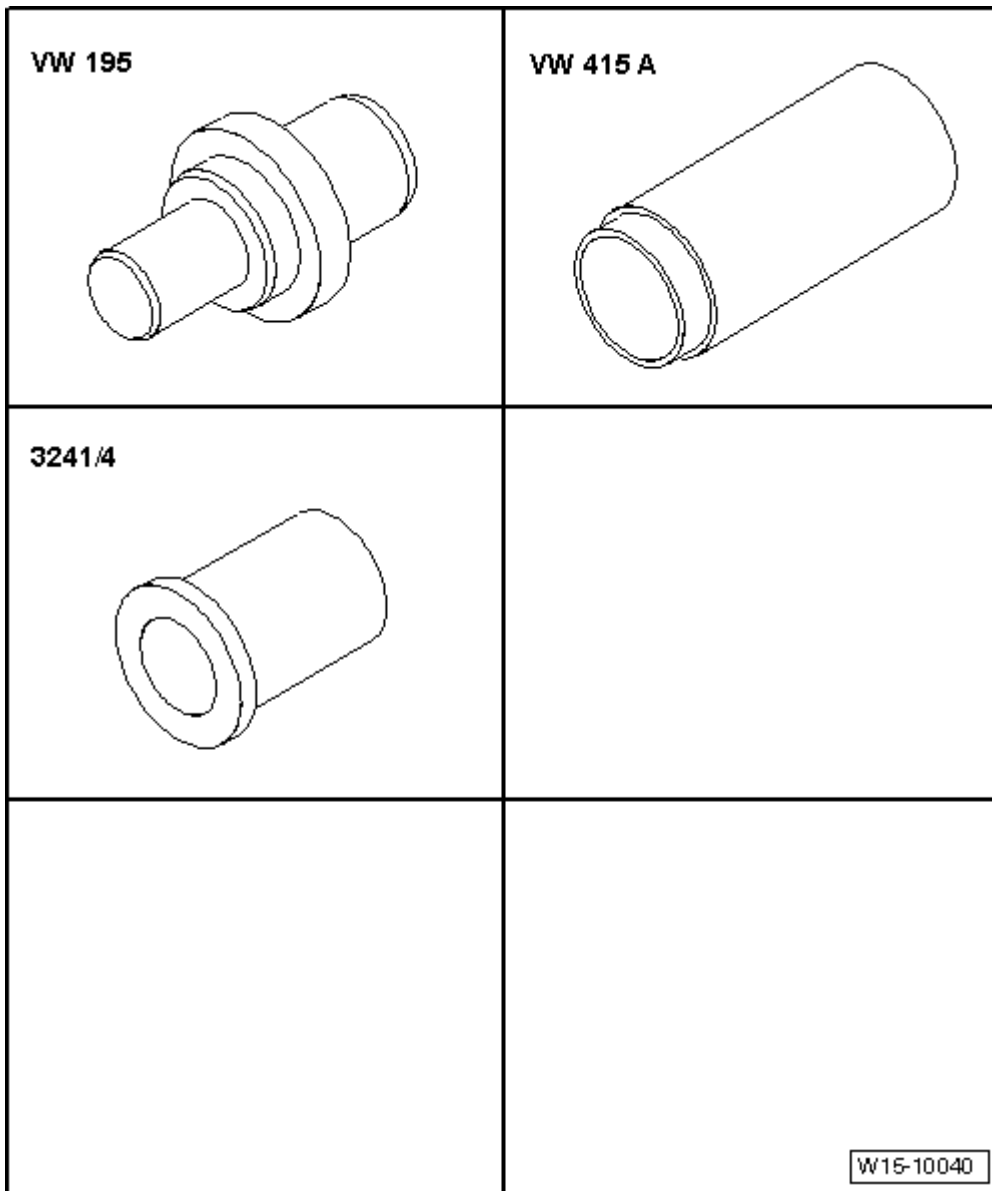


Fig. 67: Identifying Special Tools -- Chain Case Cover Sealing Ring, Replacing
 Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

Special tools and workshop equipment required

- Arbor VW 195
- Tube 60 mm dia. VW 415A
- Fitting sleeve 3241/4