

13 - ENGINE - CRANKSHAFT, CYLINDER BLOCK

ENGINE, DISASSEMBLING AND ASSEMBLING

Ribbed belt drive for generator

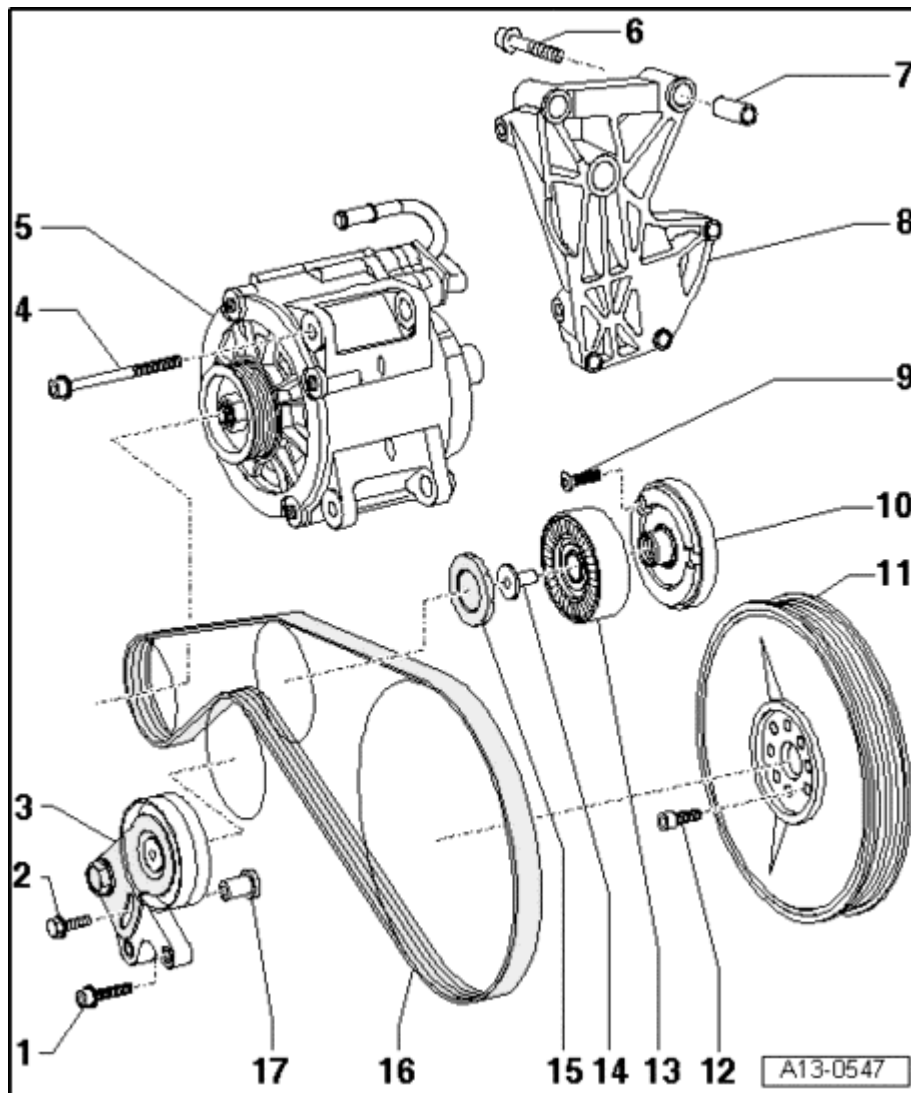


Fig. 85: Ribbed Belt Drive For Generator, Component Overview
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - 22 Nm

2 - 22 Nm

3 - Tensioning device for ribbed belt

4 - 22 Nm

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5 - Generator

- Removing and installing --> **27 - STARTER, GENERATOR, CRUISE CONTROL**

6 - M8 - 22 Nm; M10 - 46 Nm

7 - Alignment bushing

- For generator bracket
- 2 pieces

8 - Bracket

- For generator

9 - 10 Nm

10 - Bracket

- For idler pulley

11 - Vibration damper

- Removing and installing --> **Vibration damper, removing and installing**

12 - 22 Nm plus an additional $\frac{1}{8}$ turn (45°)

- Replace

13 - Idler roller

- For ribbed belt

14 - 22 Nm

15 - Cover cap

16 - Ribbed belt

- Check for wear
- Do not kink
- Before removing, mark direction of rotation using chalk or felt-tip marker. Reversing direction of rotation of a run-in belt can destroy the belt
- Removing and installing --> **Ribbed belt, removing and installing**

17 - Threaded bushing

Ribbed belt, removing and installing

Special tools, testers and auxiliary items required

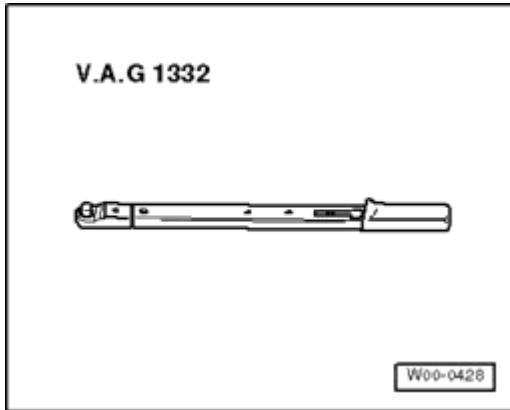


Fig. 86: Torque Wrench V.A.G 1332

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Torque wrench V.A.G 1332

Removing

- Bring lock carrier into service position --> **50 - BODY - FRONT** .

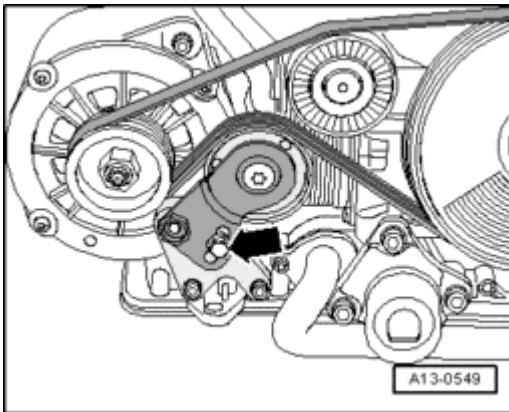


Fig. 87: Loosening Tensioning Bolt And Ribbed Belt

Courtesy of VOLKSWAGEN UNITED STATES, INC.

NOTE:

- Before removing ribbed belt, mark the turning direction on it with chalk or a felt tip pen. A reversed direction of rotation can cause damage to the belt under operating conditions.
- Loosen tensioning bolt - **arrow** - and remove ribbed belt.

Installing

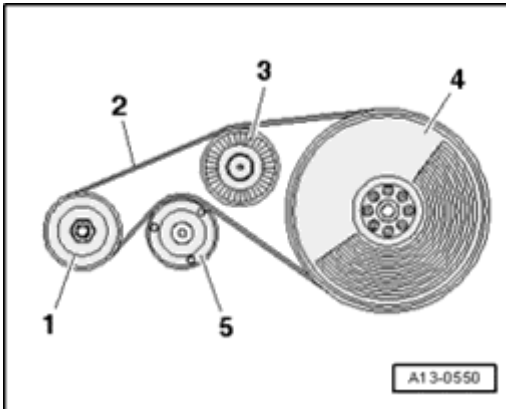


Fig. 88: Placing Ribbed Belt Over Belt Pulley In Specified Sequence
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Place ribbed belt over belt pulley in specified sequence.

1. Generator
2. Ribbed belt
3. Idler roller
4. Vibration damper
5. Tensioning roller

NOTE:

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

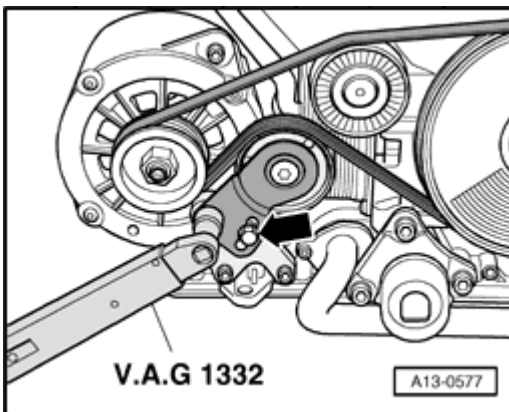


Fig. 89: Positioning Torque Wrench On Belt Tensioner Hex Bolt
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Position torque wrench on belt tensioner hex bolt and pre-tighten ribbed belt to 70 Nm.
- At the same time, tighten tensioning bolt - **arrow** - to 22 Nm.

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Further installation is in reverse order of removal, note the following:

- Install lock carrier with attachments --> **50 - BODY - FRONT** .
- Start engine and check belt running.

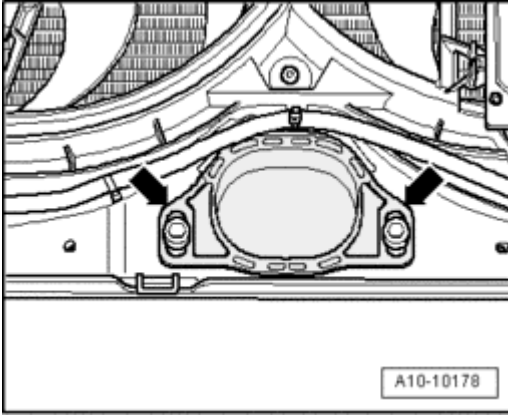


Fig. 90: Placing Torque Support On Rubber Buffer For Torque Support And Tightening Bolts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Place torque support on rubber buffer for torque support and tighten bolts - **arrows** -.
- Install front bumper --> **63 - BUMPERS** .
- Adjust headlights --> **01 - MAINTENANCE** .

Torque specifications

Component	Nm
Tensioning bolt for tensioning roller	22
Torque support stop to lock carrier	40

Vibration damper, removing and installing

Removing

- Bring lock carrier into service position --> **50 - BODY - FRONT** .

NOTE:

- To loosen and tighten vibration damper, counter hold on center nut of generator belt pulley using open end wrench.

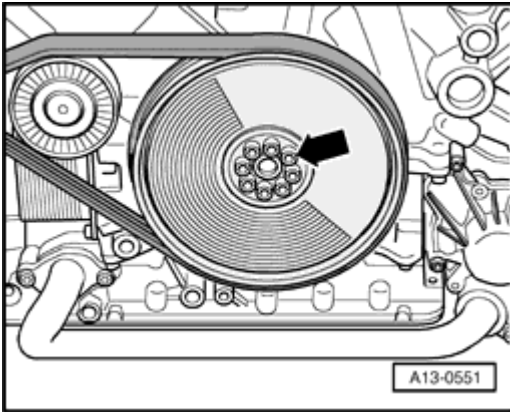


Fig. 91: Loosening Mounting Bolts On Vibration Damper Few Turns
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Loosen 8 mounting bolts - **arrow** - on vibration damper a few turns.

NOTE:

- Before removing ribbed belt, mark turning direction on it with chalk or a felt tip pen. A reversed direction of rotation can cause damage to the belt under operating conditions.

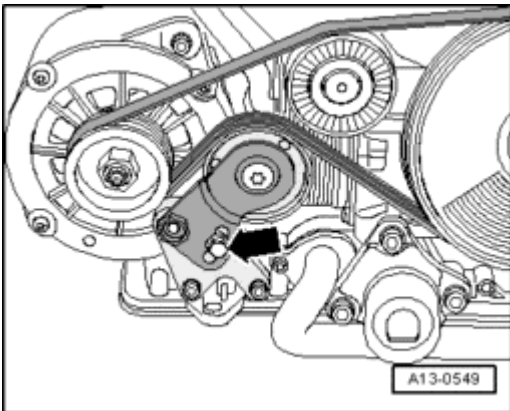


Fig. 92: Loosening Tensioning Bolt And Ribbed Belt
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Loosen tensioning bolt - **arrow** - and remove ribbed belt.
- Remove vibration damper.

Installing

Installation is in reverse order of removal, note the following:

- Install vibration damper using only original equipment bolts .
- Installation of vibration damper is only possible in one position - note alignment bushing.

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- Install ribbed belt --> **Ribbed belt, removing and installing**.
- Install lock carrier with attachments --> **50 - BODY - FRONT** .

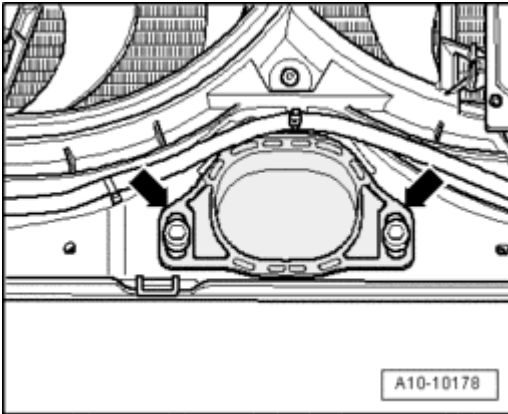


Fig. 93: Placing Torque Support On Rubber Buffer For Torque Support And Tightening Bolts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Place torque support on rubber buffer for torque support and tighten bolts - **arrows** -.
- Install front bumper --> **63 - BUMPERS** .
- Adjust headlights --> **01 - MAINTENANCE** .

Torque specifications

Component	Nm
Vibration damper to crankshaft	22 + 45° * See note* See note
Torque support stop to lock carrier	40

* 45° corresponds to a 1/8 turn

*Replace bolts.

Seal for crankshaft (ribbed belt side), replacing

Special tools, testers and auxiliary items required

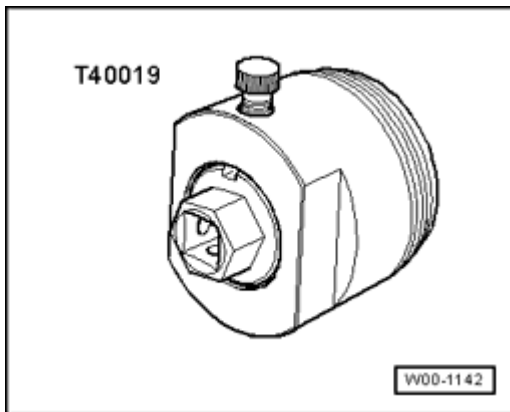


Fig. 94: Seal Remover T40019

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Seal remover T40019

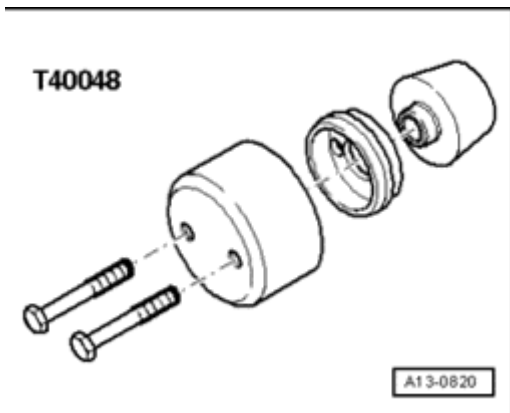


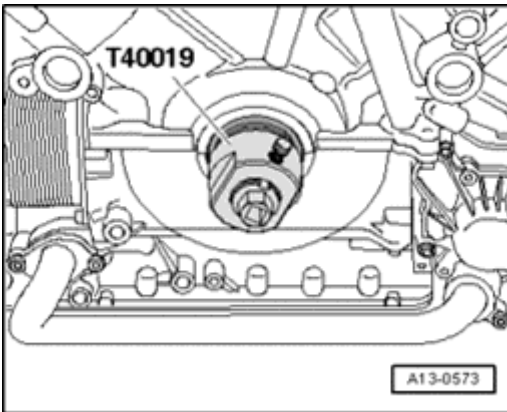
Fig. 95: Assembly Tool T40048

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Assembly tool T40048
- Bolt M8x55

Removing

- Bring lock carrier into service position --> **50 - BODY - FRONT** .
- Remove vibration damper --> **Vibration damper, removing and installing.**
- Place inner part of seal extractor T40019 flush with outer part and secure using knurled-head screw.

**Fig. 96: Installing Oil Seal Extractor T40019**

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Lubricate threaded head of seal extractor, position and with forced pressure screw into oil seal as far as possible.
- Loosen knurled thumb screw and turn inner portion against crankshaft until seal is pulled out.
- Secure seal remover in a vise at the flat spots. Remove seal using pliers

Installing

- Clean running and sealing surface.

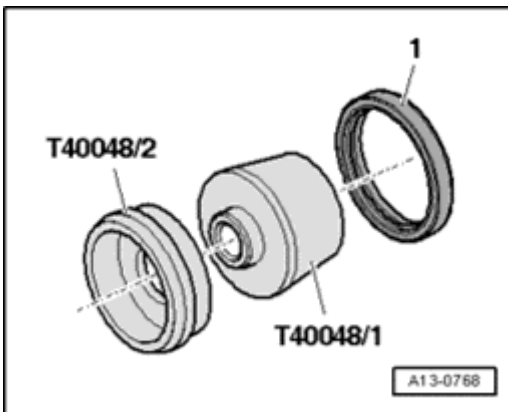


Fig. 97: Inserting Assembly Device T40048/1 Onto Pull Sleeve T40048/2 And Slide Seal Onto Pull Sleeve
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Insert assembly device T40048/1 onto pull sleeve T40048/2 and slide seal - 1 - onto pull sleeve.
- Remove assembly device.

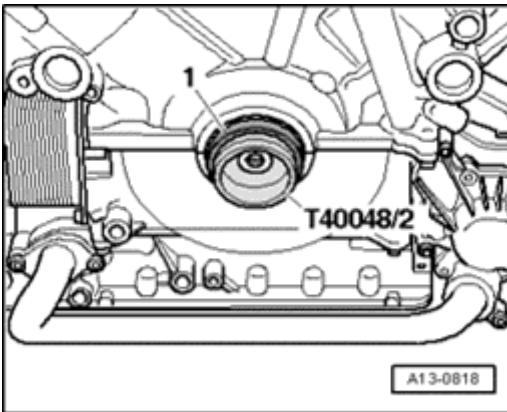


Fig. 98: Placing Pull Sleeve T40048/2 On Crankshaft And Sliding Seal Into Sealing Surface On Engine
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Place pull sleeve T40048/2 on crankshaft and slide seal - 1 - into sealing surface on engine.

NOTE:

- Pull sleeve T40048/2 remains on crankshaft for pressing on.

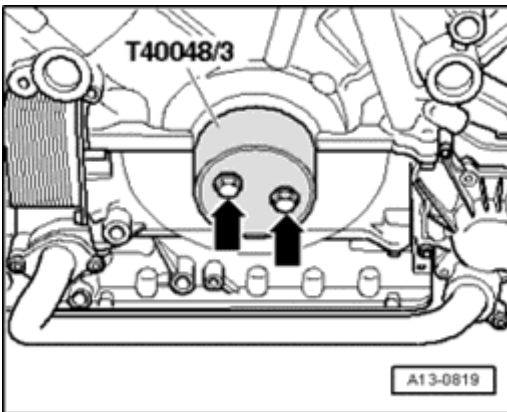


Fig. 99: Positioning Pressure Sleeve T40048/3 With Bolts On Crankshaft
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Position pressure sleeve T40048/3 with bolts M8x55 mm - **arrows** - on crankshaft.
- Then install bolts by hand.
- Tighten bolts each $\frac{1}{2}$ rotation by alternating sides to press in seal until it reaches stop.

Further installation is in reverse order of removal, note the following:

- Install vibration damper --> **Vibration damper, removing and installing.**
- Install lock carrier with attachments --> **50 - BODY - FRONT** .

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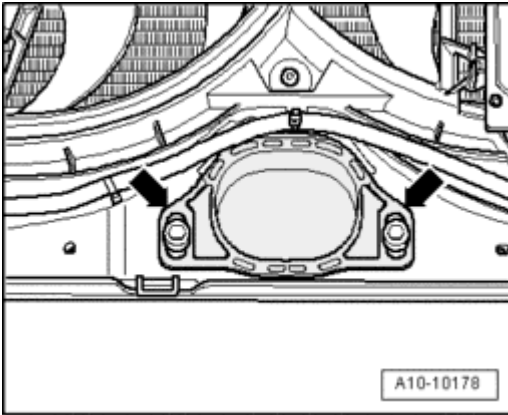


Fig. 100: Placing Torque Support On Rubber Buffer For Torque Support And Tightening Bolts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Place torque support on rubber buffer for torque support and tighten bolts - **arrows** -.
- Install front bumper --> **63 - BUMPERS** .
- Adjust headlights --> **01 - MAINTENANCE** .

Torque specifications

Component	Nm
Torque support stop to lock carrier	40

DRIVE PLATE, REMOVING AND INSTALLING

Drive plate, component overview

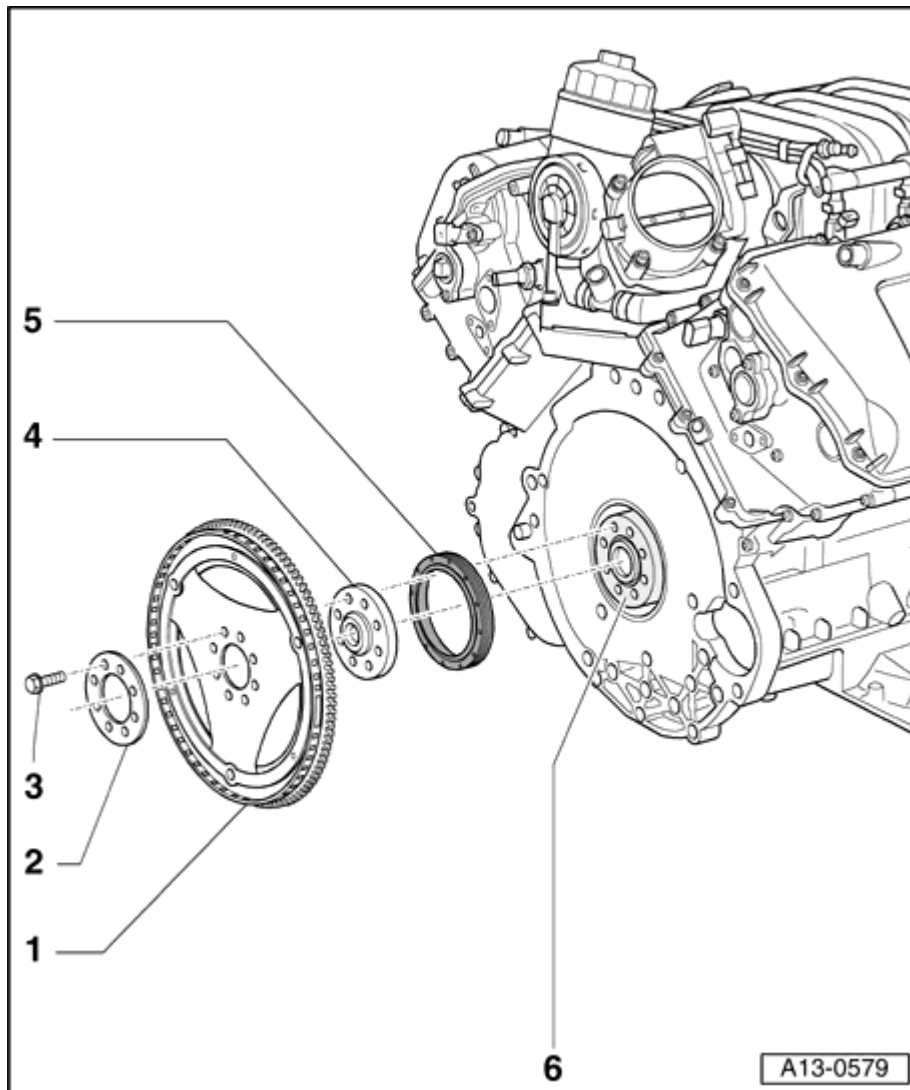


Fig. 101: Drive Plate, Component Overview

Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Drive plate

- Removing and installing --> **Drive plate, removing and installing**

2 - Washer

- Mark for re-installation

3 - 30 Nm plus an additional $\frac{1}{4}$ turn (90°)

- Replace

4 - Shim

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- Mark for re-installation

5 - Seal

- For crankshaft (timing chain side)
- Removing and installing --> **Crankshaft seal (timing chain side), replacing**

6 - Crankshaft

Drive plate, removing and installing

Special tools, testers and auxiliary items required

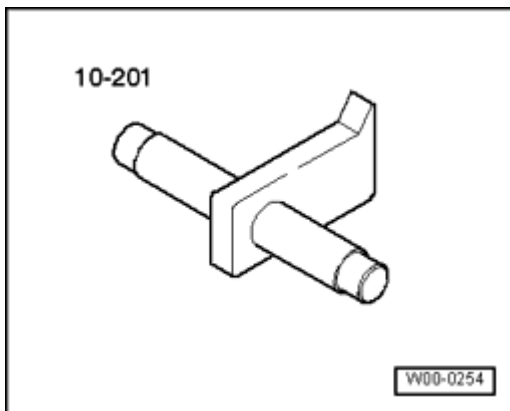


Fig. 102: Counter-Holder Tool 10-201

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Counter-holder tool 10-201

Removing

- Remove engine --> **Engine, removing and installing.**
- Separate engine/transmission unit --> **Engine and transmission, separating.**
- Mark drive plate and washer to engine.
- Remove drive plate --> **Drive plate, removing and installing.**

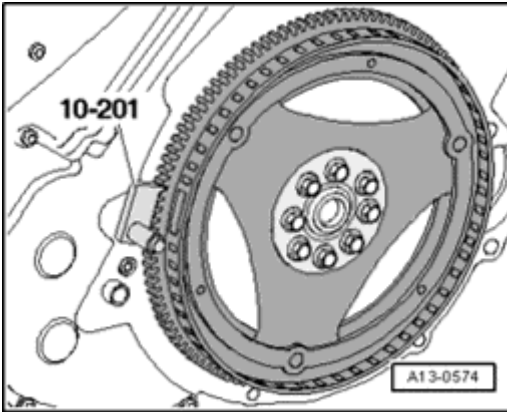


Fig. 103: Inserting Counter Hold Tool 10-201 To Loosen Bolts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Insert counter hold tool 10-201 to loosen bolts.
- Remove drive plate.

Installing

Installation is in reverse order of removal, note the following:

- Install drive plate with washer.
- Use new bolts when securing.
- Re-position counter hold tool 10-201 to tighten bolts.
- Bolt transmission to engine and install engine/transmission unit --> **Engine, installing.**

Torque specifications

Component	Nm
Drive plate to crankshaft	30 + 90° * See note* See note

* 90° corresponds to a 1/4 turn

*Replace bolts.

Crankshaft seal (timing chain side), replacing

Special tools, testers and auxiliary items required

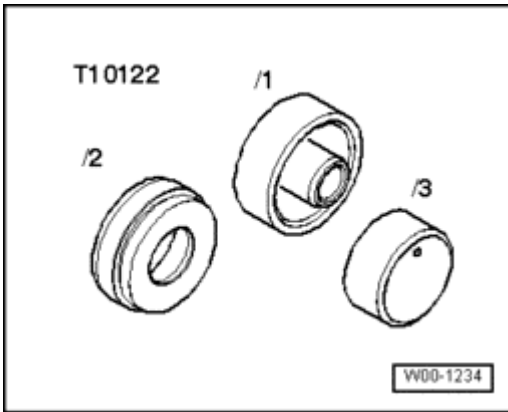


Fig. 104: Pulling Fixture T10122

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Pulling fixture T10122

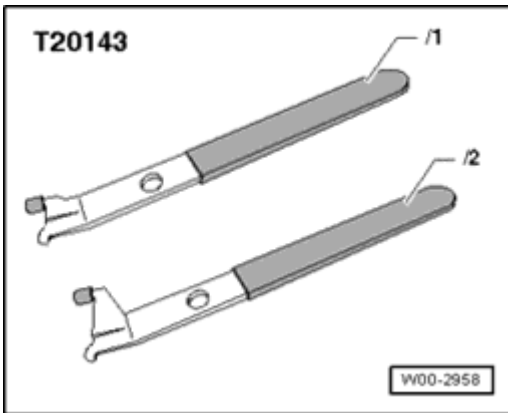


Fig. 105: Identifying Extractor Hook T20143

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Extractor lever T20143/2

Removing

- Remove engine --> **Engine, removing and installing.**
- Separate engine/transmission unit --> **Engine and transmission, separating.**
- Remove drive plate --> **Drive plate, removing and installing.**

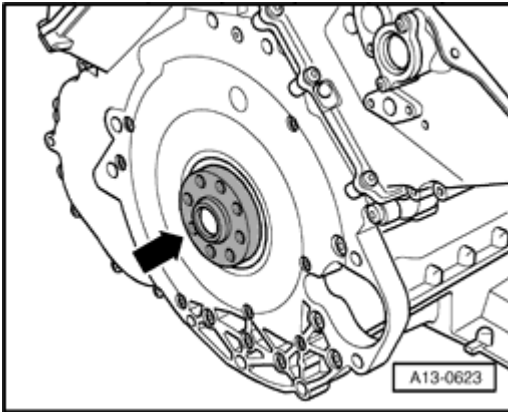


Fig. 106: Removing Shim From Crankshaft
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Pull off shim - **arrow** - from crankshaft.

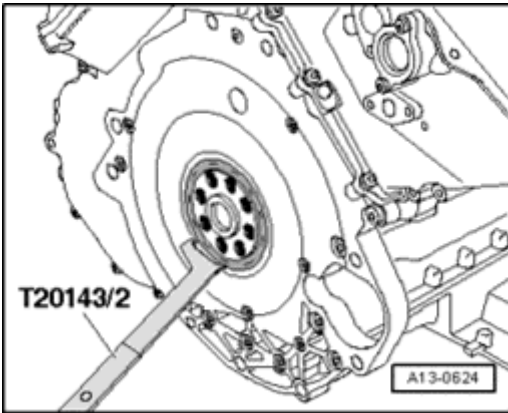


Fig. 107: Prying Out Sealing Ring Using Extractor Lever T20143/2
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Pry out sealing ring using extractor lever T20143/2.

Installing

- Clean running and sealing surface.

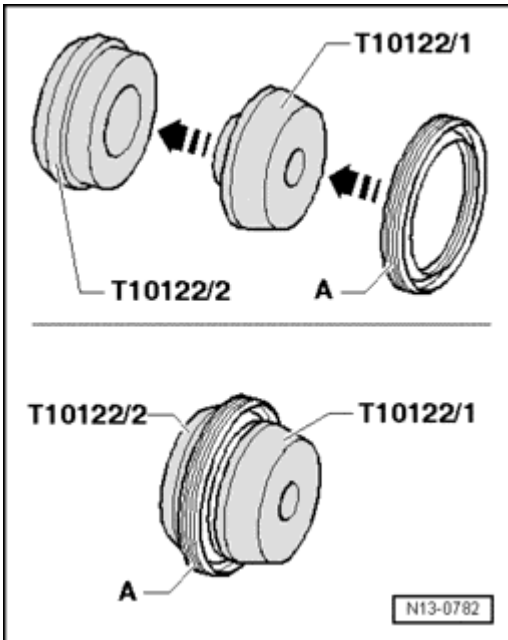


Fig. 108: Inserting Assembly Device T10122/1 Onto Pull Sleeve T10122/2 And Sliding Seal Onto Pull Sleeve

Courtesy of VOLKSWAGEN UNITED STATES, INC.

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

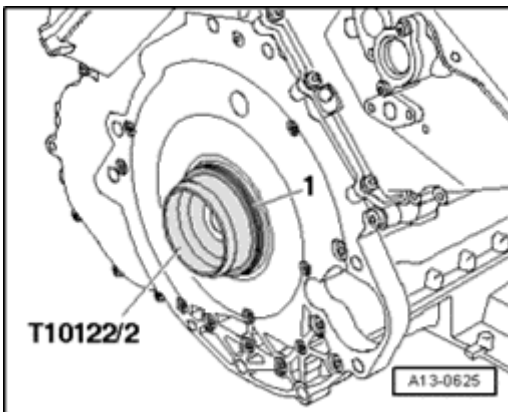


Fig. 109: Pushing New Seal Onto Pull Sleeve T10122/2

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Push new seal - 1 - onto pull sleeve T10122/2.
- Install pull sleeve T10122/2 with onto crankshaft.

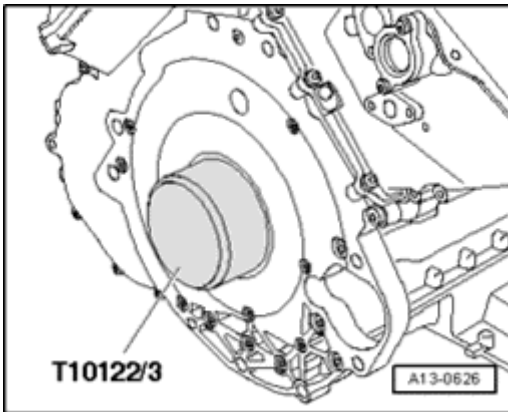


Fig. 110: Pressing In Sealing Ring All Around Evenly And Flush Using Pressure Sleeve T10122/3
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Press in sealing ring all around evenly and flush using pressure sleeve T10122/3.

Further installation is in reverse order of removal, note the following:

- Install drive plate --> **Drive plate, removing and installing.**
- Bolt transmission to engine and install engine/transmission unit --> **Engine, installing--> Engine, installing.**

TIMING CHAIN COVERS

Timing chain covers, component overview

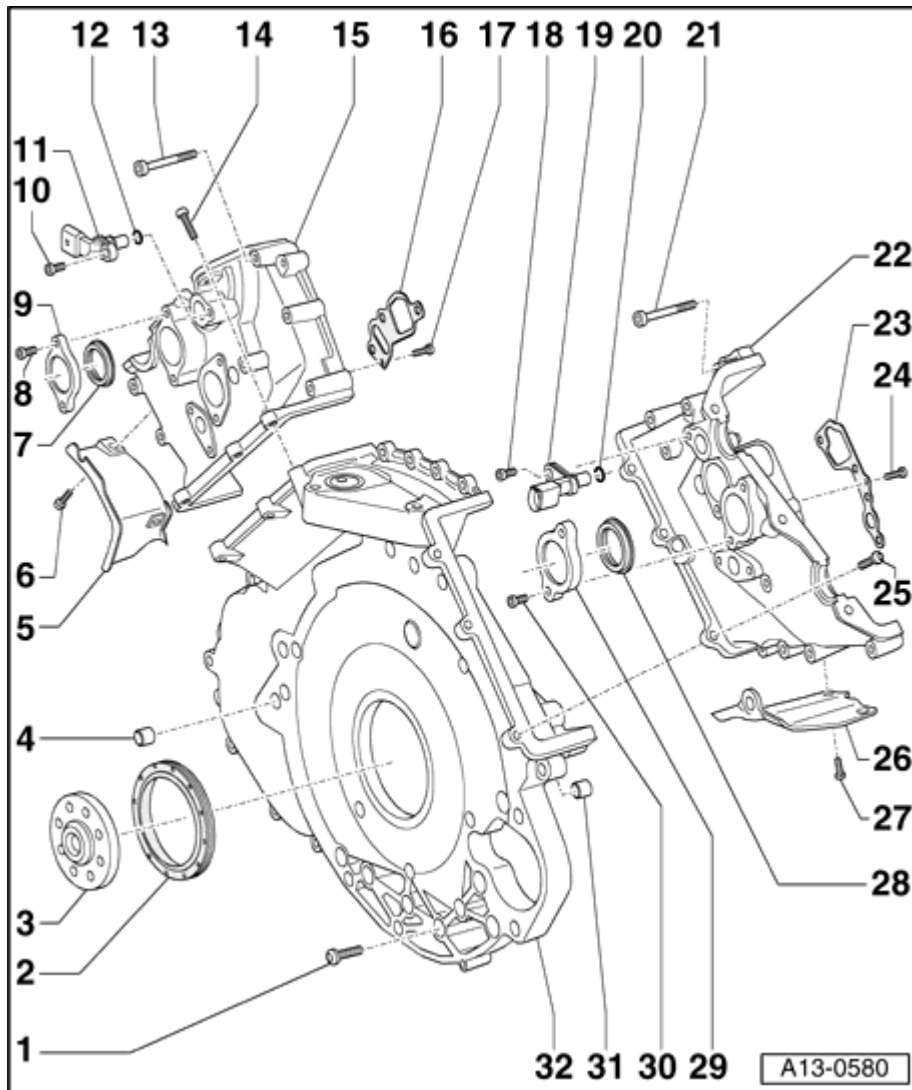


Fig. 111: Timing Chain Covers, Component Overview
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - M6 - 10 Nm; M8 - 22 Nm

- Observe sequence for tightening --> **Fig. 148**

2 - Seal

- For crankshaft (timing chain side)
- Removing and installing --> **Crankshaft seal (timing chain side), replacing**

3 - Shim

4 - Alignment bushing

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- 2 pieces

5 - Heat shield

6 - 10 Nm

7 - Seal

- Replace

8 - 10 Nm

9 - Sealing flange

10 - 10 Nm

11 - Camshaft position (CMP) sensor 2 G163

12 - O-ring

- Replace

13 - 10 Nm

- Observe sequence for tightening --> **Fig. 151**

14 - 10 Nm

- Observe sequence for tightening --> **Fig. 151**

15 - Left cover

- For timing chain

16 - Gasket

- Replace

17 - 4 Nm

- Insert with locking fluid
- Locking fluid

18 - 10 Nm

19 - Camshaft Position (CMP) sensor G40

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20 - O-ring

- Replace

21 - 10 Nm

- Observe sequence for tightening --> **Fig. 153**

22 - Right cover

- For timing chain

23 - Gasket

- Replace

24 - 4 Nm

- Insert with locking fluid
- Locking fluid

25 - 10 Nm

- Observe sequence for tightening --> **Fig. 153**

26 - Heat shield

27 - 10 Nm

28 - Seal

- Replace

29 - Sealing flange

30 - 10 Nm

31 - Alignment bushing

- 2 pieces

32 - Lower cover

- For timing chain

Timing chain covers, removing and installing

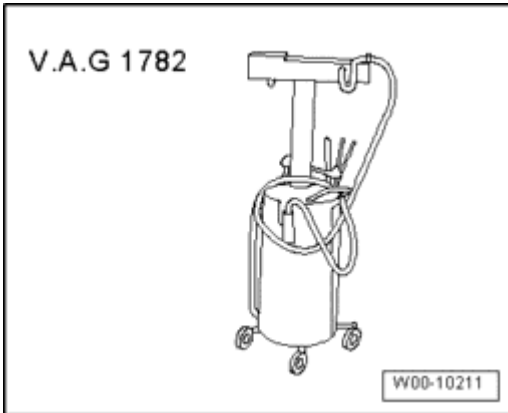
Special tools, testers and auxiliary items required

Fig. 112: Identifying Old Oil Collecting And Extracting Device V.A.G 1782
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Old oil collecting and extracting device V.A.G 1782
- Hand drill with plastic brush attachment
- Protective glasses
- Sealant

Removing

- Drain engine oil --> **01 - MAINTENANCE** .
- Remove engine --> **Engine, removing and installing.**
- Separate engine/transmission unit --> **Engine and transmission, separating.**
- Remove drive plate --> **Drive plate, removing and installing.**

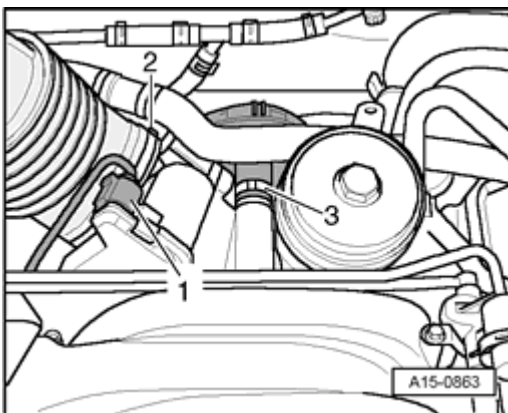


Fig. 113: Disconnecting Electrical Connection At Throttle Valve Control Module J338 & Crankcase Ventilation Hose At Intake Pipe
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical connection - **1** - at throttle valve control module J338.

- Disconnect crankcase ventilation hose - **3** - at intake pipe.

NOTE:

- Ignore - **2** -.

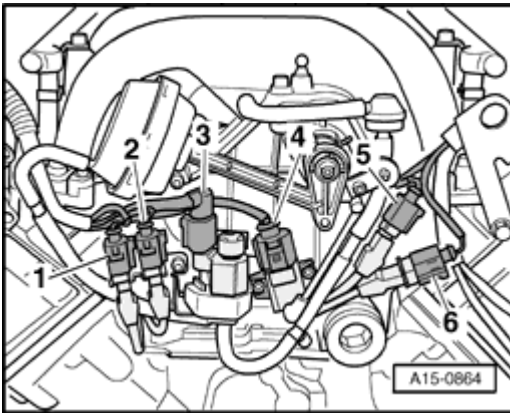


Fig. 114: Remove Electrical Harness Connectors Toward Front From Brackets On Intake Pipe
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove electrical harness connectors - **1** -, - **2** -, - **5** - and - **6** - toward front from brackets on intake pipe.
- Disconnect electrical connectors - **3** - and - **4** -.

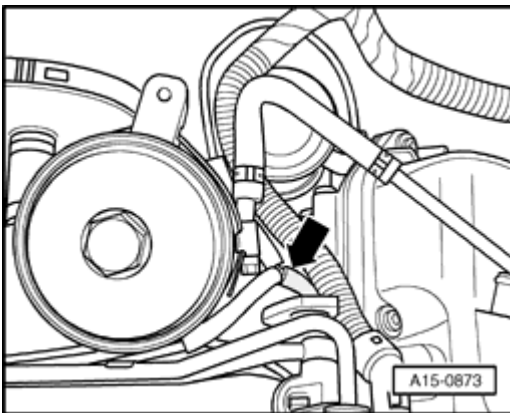


Fig. 115: Disconnecting Vacuum Hose At T-Piece
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect vacuum hose - **arrow** - at T-piece.

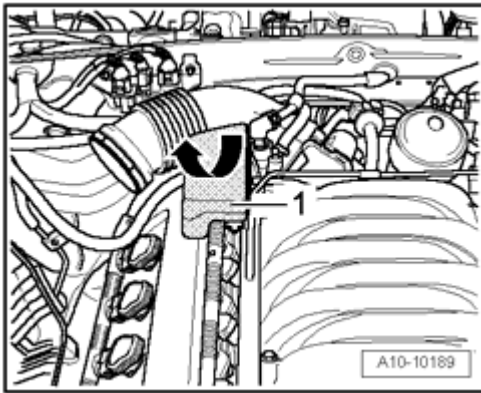


Fig. 116: Removing Resonator

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Pull resonator - 1 - in direction of - **arrow** - upward and unclip it.

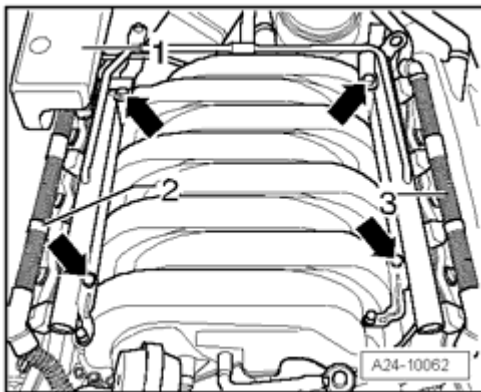


Fig. 117: Pulling Off Connector Strips At Fuel Injectors & Removing Bolts From Fuel Rail

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Pull off connector strips - 2 - and - 3 - at 8 fuel injectors.
- Remove bolts - **arrows** - from fuel rail.
- Pull fuel rail with injectors upward uniformly from intake manifold and set aside in engine compartment on a clean cloth.

NOTE:

- **Carefully protect the removed fuel injectors from contamination.**

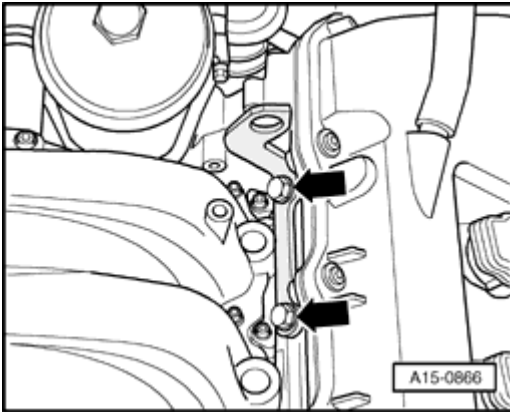


Fig. 118: Removing Left Rear Engine Lifting Eye
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove left rear engine lifting eye - **arrows** -.

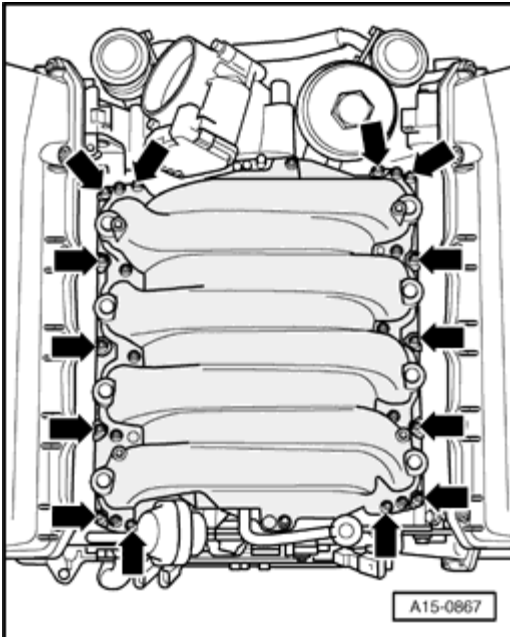


Fig. 119: Removing Intake Manifold Bolts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove intake manifold - **arrows** - and remove it.

NOTE:

- Plug intake ports of the cylinder head with clean rags.

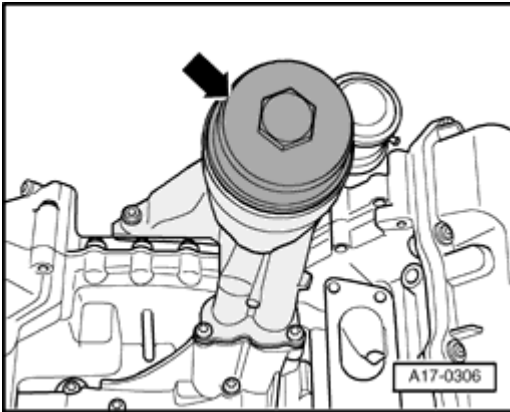


Fig. 120: Removing Cap For Oil Filter Housing

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove cap - **arrow** - for oil filter housing.
- Remove oil filter element.
- Extract engine oil using old oil collecting and extracting device V.A.G 1782 from oil filter housing.

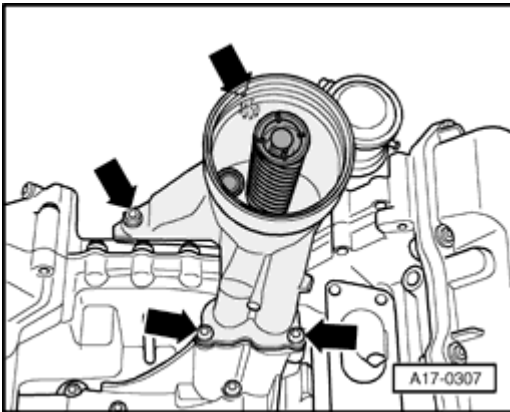


Fig. 121: Removing Bolts & Oil Filter Housing

Courtesy of VOLKSWAGEN UNITED STATES, INC.

NOTE:

- Place a rag around oil filter housing to catch escaping engine oil.

- Remove bolts - **arrows** -.
- Remove oil filter housing.

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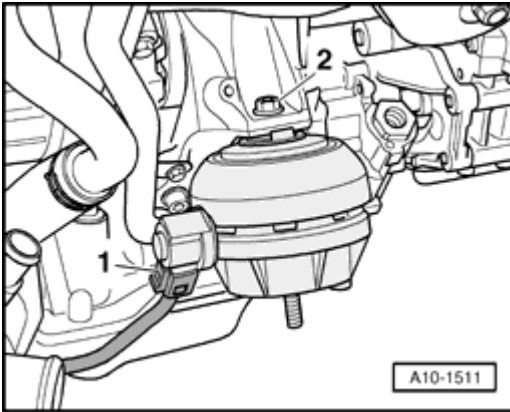


Fig. 122: Disconnecting Electrical Connector, Removing Nut And Engine Mount
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical harness connector - **1** - at left engine mount.
- Remove nut - **2** - and remove engine mount.

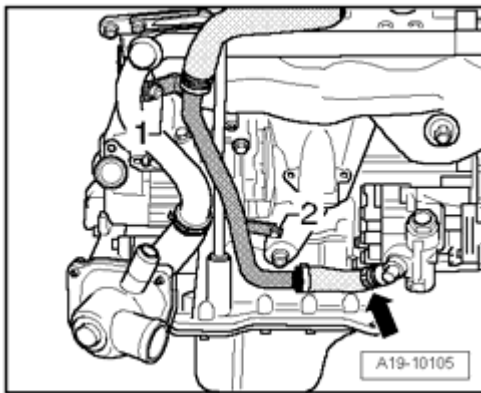


Fig. 123: Removing Bolts & Return Pipe From Power-Steering Pump
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts - **1** - and - **2** -.
- Remove return pipe from power-steering pump - **arrow** -.

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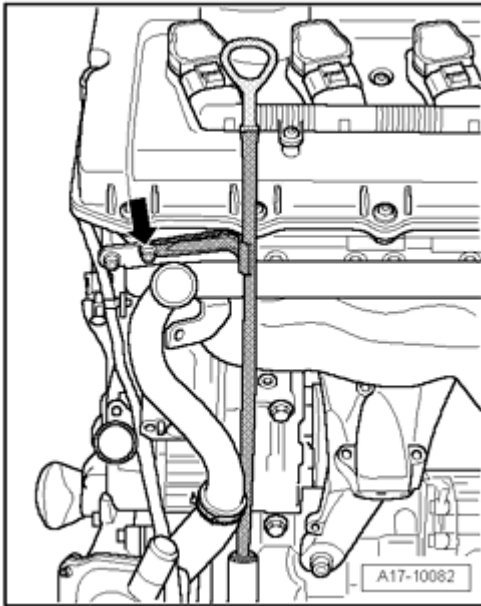


Fig. 124: Removing Guide Pipe For Oil Dipstick At Cylinder Head
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove guide pipe for oil dipstick at cylinder head - **arrow** - , pull up and remove.

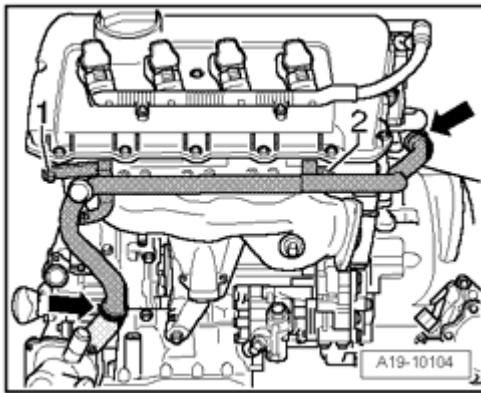


Fig. 125: Removing Bolts & Loosening Hose Clamps And Removing Left Coolant Pipe From Coolant Hoses
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts - **1** - and - **2** -.
- Loosen hose clamps - **arrows** - and remove left coolant pipe from coolant hoses.

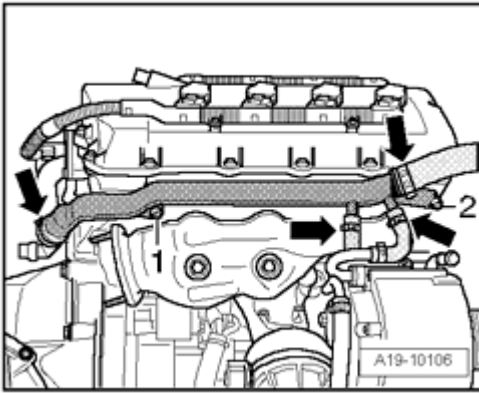


Fig. 126: Removing Bolts & Loosening Hose Clamps And Removing Right Coolant Pipe From Coolant Hoses

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts - 1 - and - 2 -.
- Loosen hose clamps - **arrows** - and remove right coolant pipe from coolant hoses.

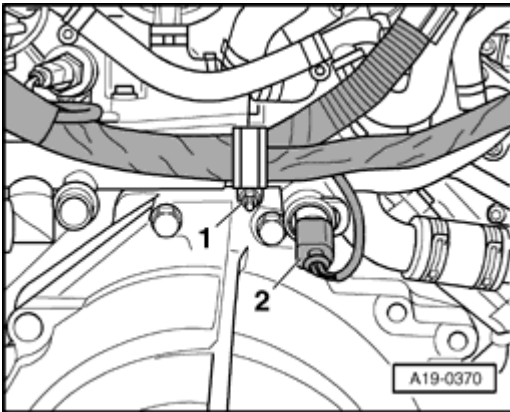


Fig. 127: Disconnecting Electrical Connector On Engine Coolant Temperature (ECT) Sensor G62 & Removing Nut And Electrical Wiring Harness At Rear Coolant Pipe

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical connector - 2 - on Engine Coolant Temperature (ECT) Sensor G62.
- Remove nut - 1 - and remove electrical wiring harness at rear coolant pipe.

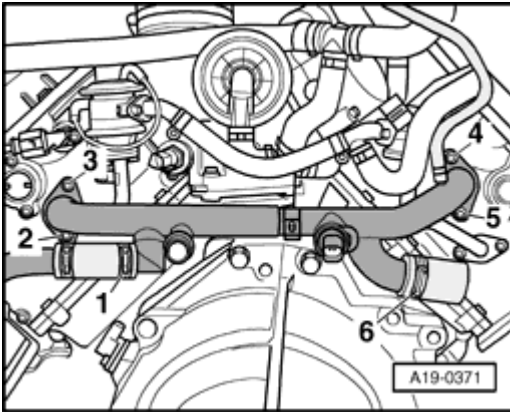


Fig. 128: Removing Bolts & Rear Coolant Pipe
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts - **2 to 5** -.
- Remove rear coolant pipe.

NOTE: • Ignore - **1** - and - **6** -.

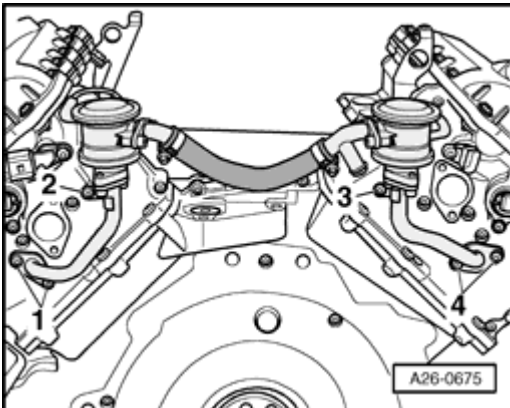


Fig. 129: Removing Secondary Air Injection (AIR) System Combi-Valve Mounting Bolts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove Secondary Air Injection (AIR) system combi-valve mounting bolts - **1 through 4** -.

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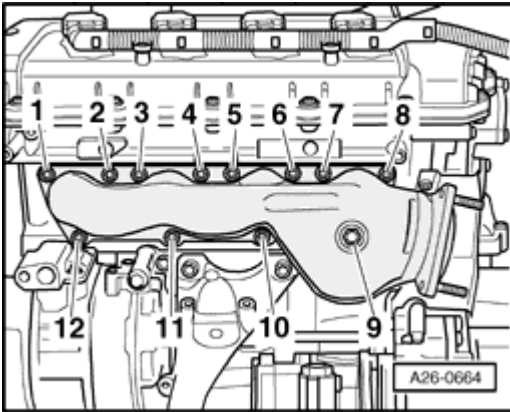


Fig. 130: Removing Nuts And Left Exhaust Manifold
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove nuts - **1 to 12** - and remove left exhaust manifold.

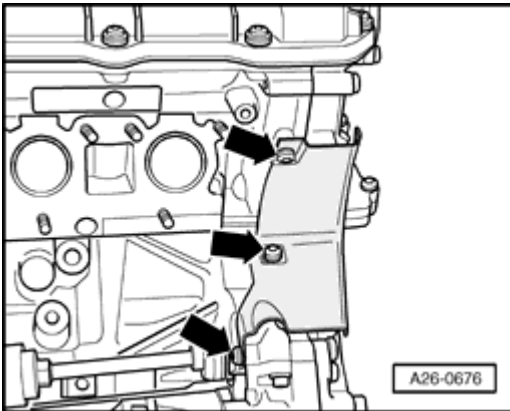


Fig. 131: Removing Left Heat Shield
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove left heat shield - **arrows** -.

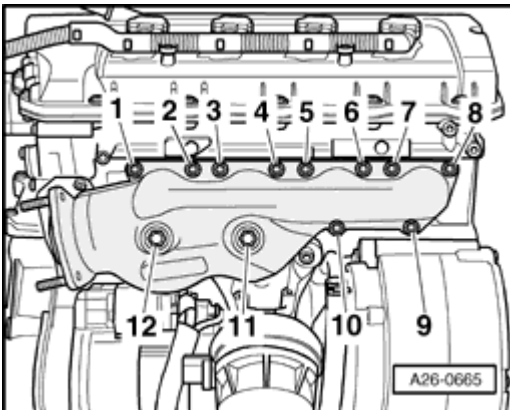


Fig. 132: Removing Nuts And Right Exhaust Manifold
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove nuts - **1 to 12** - and remove right exhaust manifold.

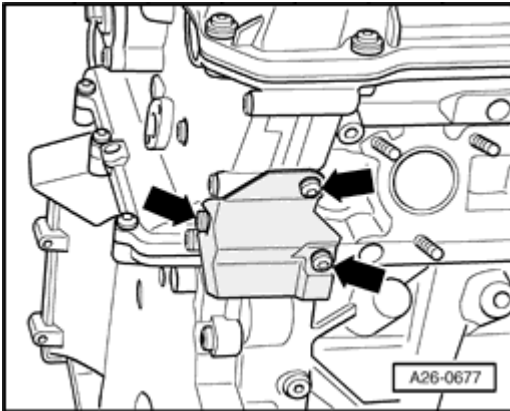


Fig. 133: Removing Right Heat Shield

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove right heat shield - **arrows** -.

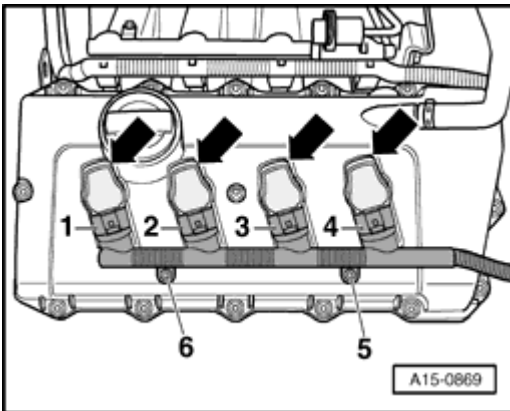


Fig. 134: Removing Bolts On Left Cylinder Head, Disconnecting Electrical Harness Connectors & Removing Ignition Coils

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts - **5** - and - **6** - on left cylinder head.
- Disconnect electrical harness connectors - **1 to 4** -.
- Remove ignition coils - **arrows** -.

NOTE:

- **Extractor T10094 can be used for removal.**

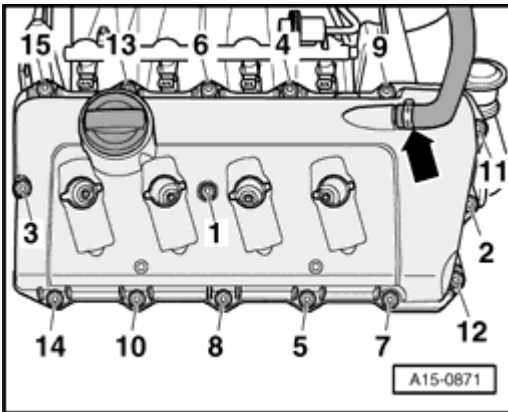


Fig. 135: Disconnecting Hose Of Crankshaft Housing Ventilation & Removing Left Cylinder Head Cover Bolts In Sequence

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect hose of crankshaft housing ventilation - **arrow** -.
- Remove left cylinder head cover bolts in sequence - **15 to 1** -.
- Remove cylinder head cover.

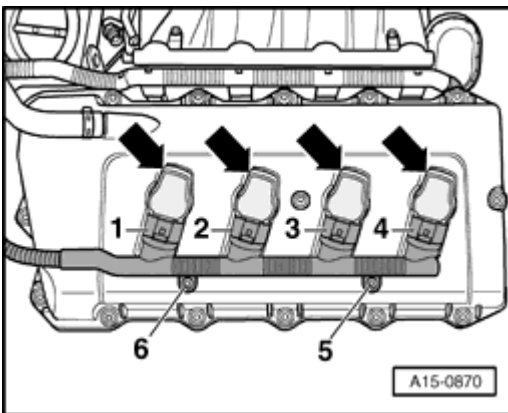


Fig. 136: Removing Bolts On Right Cylinder Head, Disconnecting Electrical Harness Connectors & Removing Ignition Coils

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts - **5** - and - **6** - on right cylinder head.
- Disconnect electrical harness connectors - **1 to 4** -.
- Remove ignition coils - **arrows** -.

NOTE:

- **Extractor T10094 can be used for removal.**

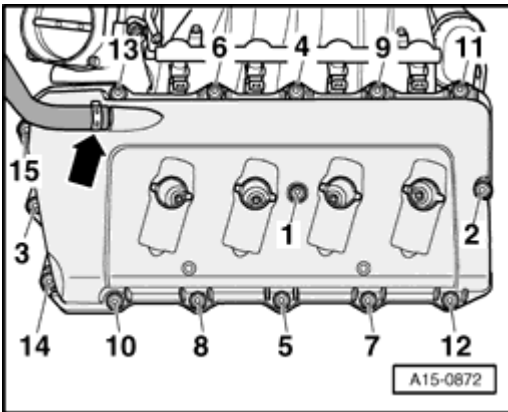


Fig. 137: Disconnecting Hose Of Crankshaft Housing Ventilation & Removing Right Cylinder Head Cover Screws In Sequence

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect hose of crankshaft housing ventilation - **arrow** -.
- Remove right cylinder head cover bolts in sequence - **15 to 1** -.
- Remove cylinder head cover.

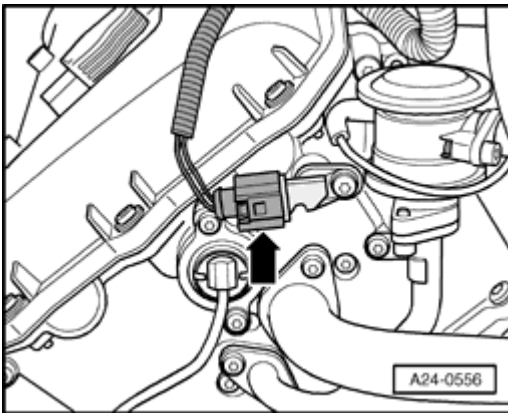


Fig. 138: Disconnecting Electrical Harness Connector For Camshaft Position (CMP) Sensor 2 G163 On Left Cylinder Head

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical harness connector - **arrow** - for Camshaft Position (CMP) Sensor 2 G163 on left cylinder head.

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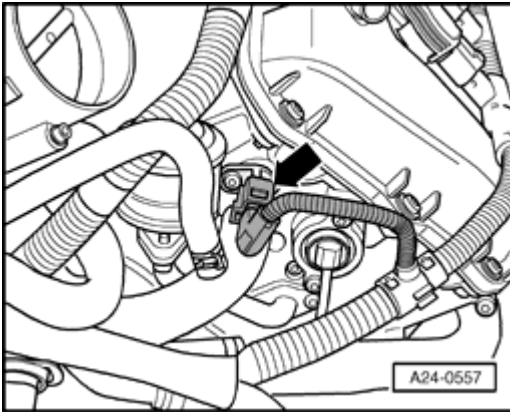


Fig. 139: Disconnecting Electrical Harness Connector For Camshaft Position (CMP) Sensor G40 On Right Cylinder Head

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical harness connector - **arrow** - for Camshaft Position (CMP) Sensor G40 on right cylinder head.

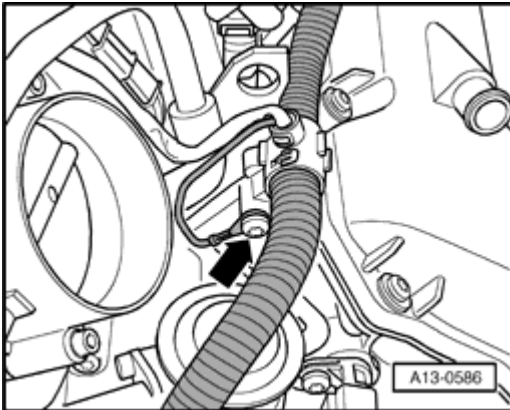


Fig. 140: Removing Ground (GND) Cable On Right Cylinder Head

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove Ground (GND) cable on right cylinder head - **arrow** -.
- Set wiring harness aside.

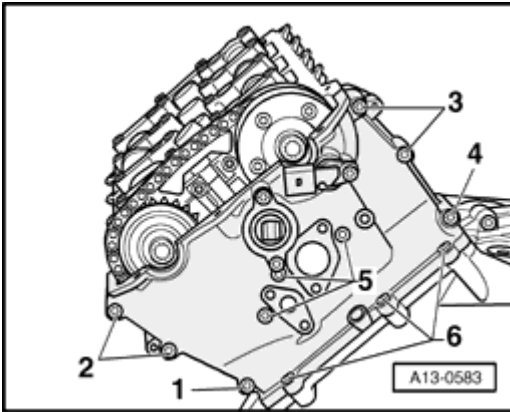


Fig. 141: Removing/Installing Bolts And Left Timing Chain Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts - 1 to 6 - and remove left timing chain cover.

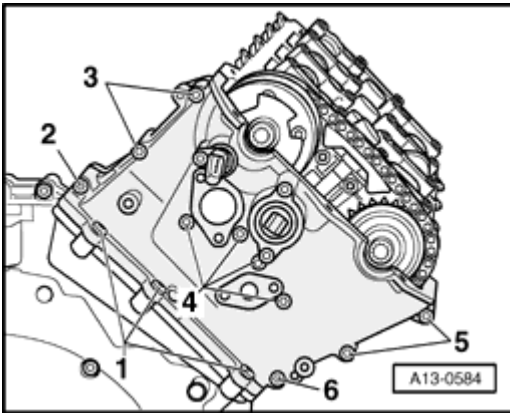


Fig. 142: Removing/Installing Bolts And Right Timing Chain Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts - 1 to 6 - and remove right timing chain cover.

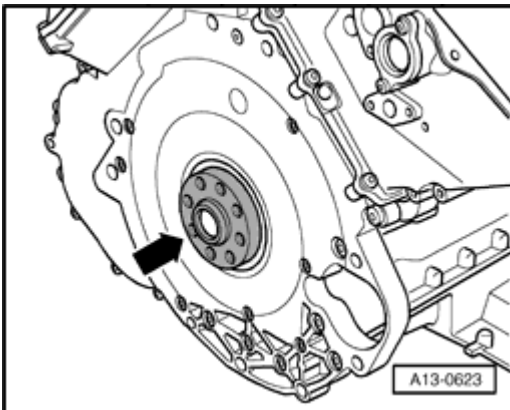


Fig. 143: Removing Shim From Crankshaft
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove shim - **arrow** - from crankshaft.

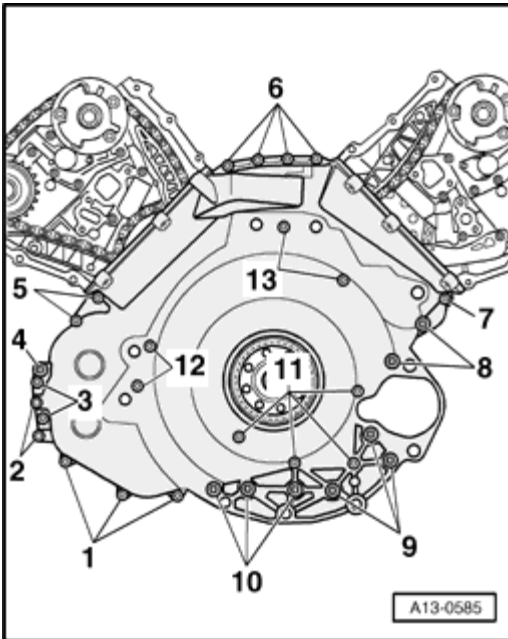


Fig. 144: Removing Bolts And Lower Timing Chain Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts - **1 to 13** - and remove lower timing chain cover.
- Press sealing ring for crankshaft at rear out of cover.

Installing

- NOTE:**
- Replace gaskets, seals and O-rings.

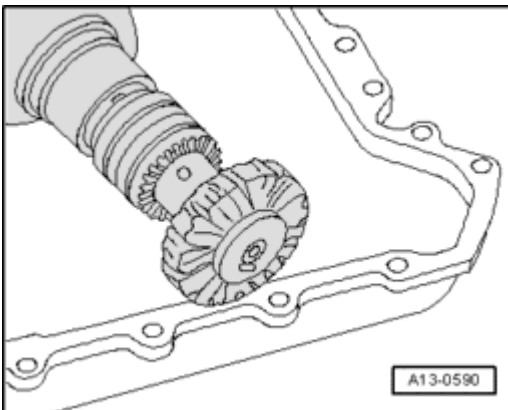


Fig. 145: Using Rotating Plastic Brush To Remove Any Sealant Residue From Sealing Flange, Cylinder Block And Upper Part Of Oil Pan
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Using e.g. a rotating plastic brush, remove sealant residue on covers for timing chain and on cylinder block and head.

CAUTION: Wear safety glasses.

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

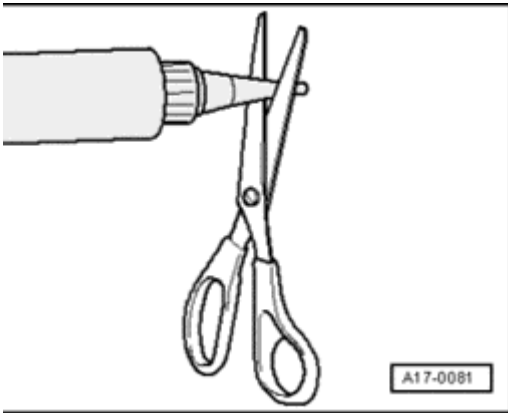


Fig. 146: Cutting Tube Nozzle At Front Marking
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Cut tube nozzle at front marking (dia. approx. 1 mm).

NOTE:

- Covers for timing chain must be installed within 5 minutes after applying sealant.

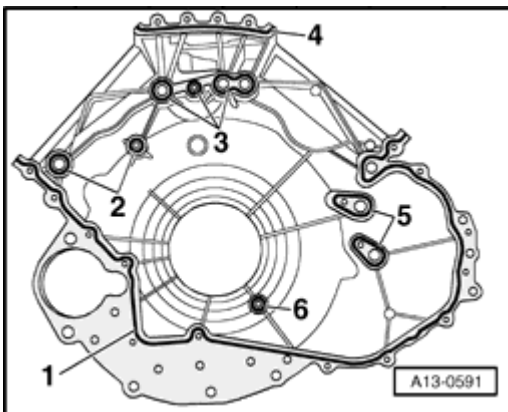


Fig. 147: Applying Sealant Beads On Clean Sealing Surfaces Of Lower Cover For Timing Chain
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Apply sealant beads - 1 to 6 - , as shown in illustration, on clean sealing surfaces of lower cover for timing chain.

- Thickness of sealant bead: 1.5 to 2.0 mm.
- Check whether 2 alignment bushings are present in cylinder block, install if necessary.

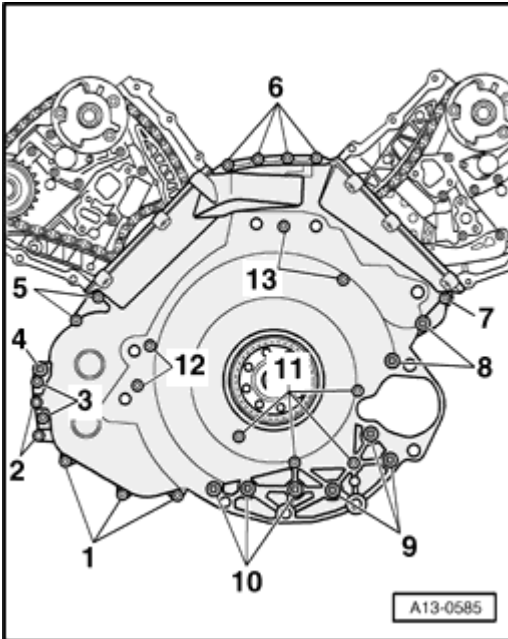


Fig. 148: Removing Bolts And Lower Timing Chain Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Position lower cover for timing chain and tighten bolts as follows.

Tightening sequence	Bolt	Nm
I	11, 12, 13	10
II	1, 3, 4, 5, 6, 7, 8, 9, 10	10
III	4, 8, 9, 10	22
IV	2 for power steering pump	22

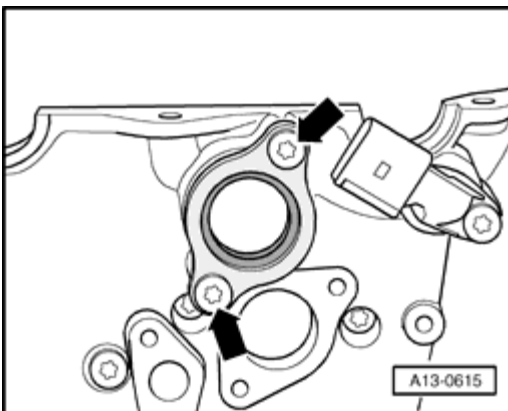


Fig. 149: Removing/Installing Sealing Flanges For Camshaft Adjuster On Left/Right Covers For Timing

Chain

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove sealing flanges for camshaft adjuster on left and right covers for timing chain - **arrows** -.

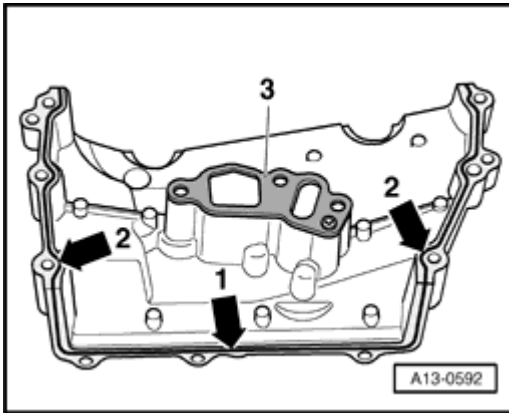


Fig. 150: Applying Sealant Bead On Clean Sealing Surfaces Of Left Cover For Timing Chain
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Apply sealant bead - **arrow** - , as shown in illustration, on clean sealing surfaces of left cover for timing chain.
- Groove on lower sealing surface - **arrow 1** - must be completely filled with sealant. Sealant bead must stand 1.5 to 2.0 mm above sealing surface.
- Sealant bead on front sealing surface - **arrows 2** - must be 1.5 to 2.0 mm thick.
- Install new seal - **3** - on left cover for timing chain.

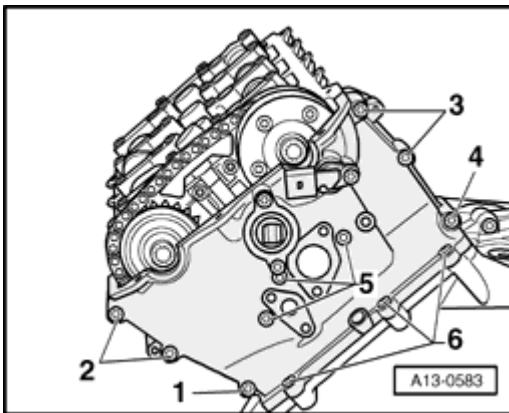


Fig. 151: Removing/Installing Bolts And Left Timing Chain Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Position left cover for timing chain and tighten bolts as follows.

Tightening sequence	Bolt	Nm
---------------------	------	----

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I	1 4	5
II	6	10
III	5	10
IV	1 4	10

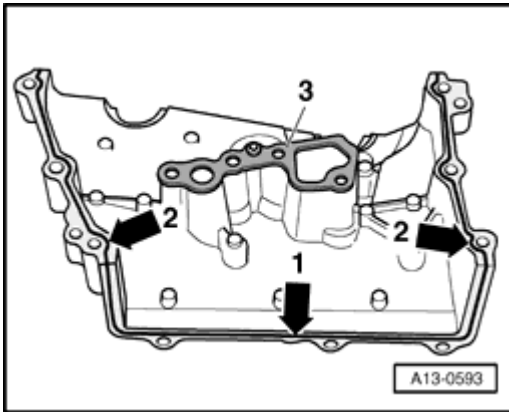


Fig. 152: Applying Sealant Beads On Clean Sealing Surfaces Of Right Cover For Timing Chain
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Apply sealant beads - **arrows** - , as shown in illustration, on clean sealing surfaces of right cover for timing chain.
- Groove on lower sealing surface - **arrow 1** - must be completely filled with sealant. Sealant bead must stand 1.5 to 2.0 mm above sealing surface.
- Sealant bead on front sealing surface - **arrows 2** - must be 1.5 to 2.0 mm thick.
- Install new seal - **3** - on right cover for timing chain.

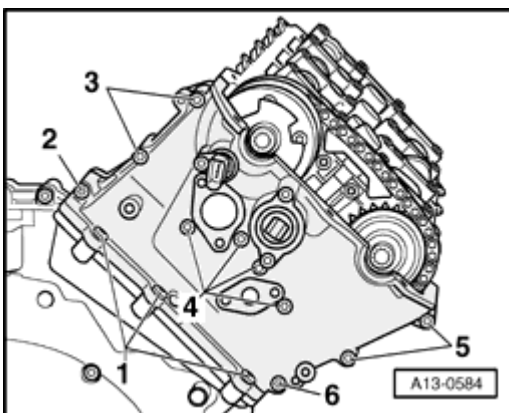


Fig. 153: Removing/Installing Bolts And Right Timing Chain Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Position right cover for timing chain and tighten bolts as follows.

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ENGINE 4.2 Liter V8 4V Engine Mechanical, Engine Code(s): BAT, BNK

Tightening sequence	Bolt	Nm
I	2, 3, 5, 6	5
II	1	10
III	4	10
IV	2, 3, 5, 6	10

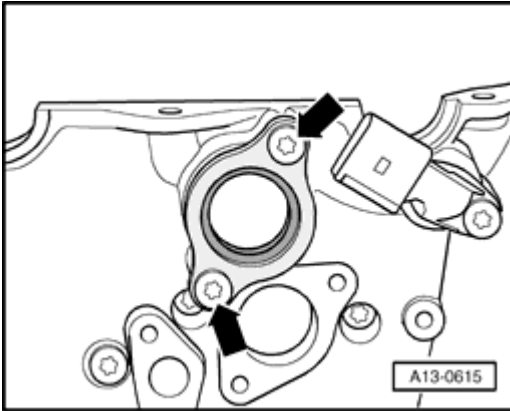


Fig. 154: Removing/Installing Sealing Flanges For Camshaft Adjuster On Left/Right Covers For Timing Chain

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Install sealing flanges for camshaft adjuster with new sealing rings on left and right covers for timing chain - **arrows** -.

Further installation is in reverse order of removal, note the following:

- Install crankshaft seal, timing chain side --> **Crankshaft seal (timing chain side), replacing.**
- Install cylinder head cover: left **Installing** , right **Installing**.
- Install exhaust manifold: left --> **Left exhaust manifold, removing and installing** , right --> **Right exhaust manifold, removing and installing.**
- Install combination valve for Secondary Air Injection (AIR) system: left --> **Left combination valve for Secondary Air Injection (AIR), removing and installing** , right --> **Right combination valve for Secondary Air Injection (AIR), removing and installing.**
- Install rear coolant pipe --> **Rear coolant line, removing and installing.**
- Install left coolant pipe --> **Left coolant pipe, removing and installing.**
- Install oil filter housing --> **Oil filter housing, removing and installing.**
- Install intake manifold --> **Intake manifold, removing and installing.**
- Install drive plate --> **Drive plate, removing and installing.**
- Bolt transmission to engine and install engine/transmission unit --> **Engine, installing.**
- Add engine oil and check oil level --> **01 - MAINTENANCE** .

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Torque specifications

Component			Nm
Lower cover for	Power-steering pump		22
Timing chain to	Engine	M6	10
		M8	22
Seal on cover for timing chain			4 * See note
Left and right cover for timing chain on engine			10
Sealing flange on cover for timing chain			10
Hall sensor on cover for timing chain			10
Ground (GND) wire to cylinder head			10
Heat shield to engine			10

* Insert using locking compound; locking compound .

CAMSHAFT DRIVE

Camshaft drive

NOTE:

- Crankshaft and camshafts must only be rotated when chain drive is installed completely. Otherwise the valves impact on the pistons danger of damage to valves/piston heads.

Camshaft timing chain, component overview

Left camshaft timing chain

NOTE:

- Before removing timing chain, mark direction of travel with paint. Reversing rotation direction of a used chain can destroy it.

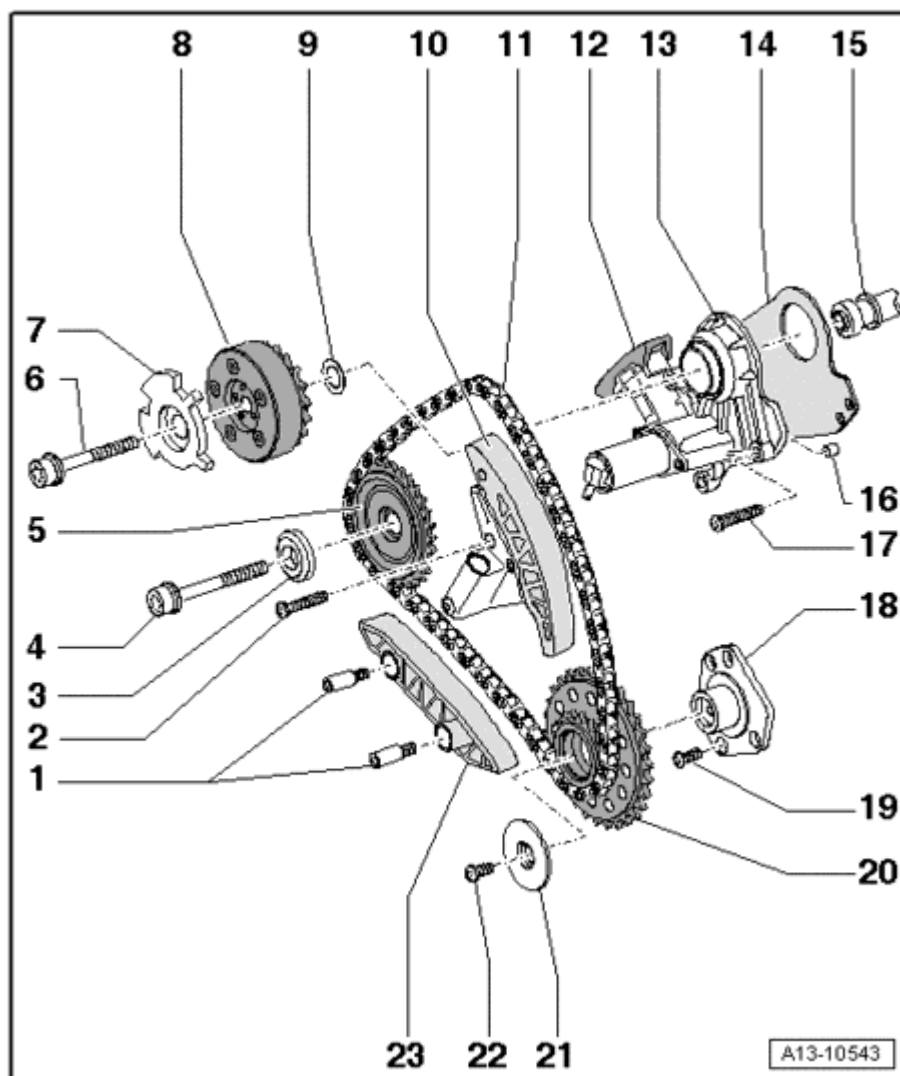


Fig. 155: Camshaft Timing Chain, Component Overview
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Pivot pin - 10 Nm

2 - 5 Nm plus an additional $\frac{1}{4}$ turn (90°)

- Replace

3 - Washer

- Note installation position

4 - Camshaft bolt

- Replace

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- Initial tightening torque: 40 Nm
- Final tightening torque: 100 Nm plus an additional $1/4$ turn (90°)

5 - Chain sprocket

- For exhaust camshaft

6 - Camshaft bolt

- Replace
- Initial tightening torque: 40 Nm
- Final tightening torque: 100 Nm plus an additional $1/4$ turn (90°)

7 - Hall sensor wheel

- When installing timing chain, adjust using setting gauge T40047 **Right exhaust manifold, removing and installing**

8 - Camshaft adjuster

- For intake camshaft

9 - Diamond disc

- Replace

10 - Chain tensioner

- For left timing chain

11 - Left camshaft timing chain

- Removing and installing --> **Camshaft timing chain, removing and installing**

12 - Guide rail

- Can be replaced separately

13 - Control housing

- For camshaft adjuster

14 - Gasket

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- Replace

15 - Camshaft

16 - Alignment bushing

- 2 pieces

17 - 5 Nm plus an additional $\frac{1}{4}$ turn (90°)

- Replace

18 - Bracket

- For drive sprocket

19 - 10 Nm

20 - Drive sprocket

- For left timing chain

21 - Thrust washer

- For drive sprocket

22 - 5 Nm plus an additional $\frac{1}{4}$ turn (90°)

- Replace

23 - Guide rail

Right camshaft timing chain

NOTE:

- Before removing timing chain, mark direction of travel with paint. Reversing rotation direction of a used chain can destroy it.

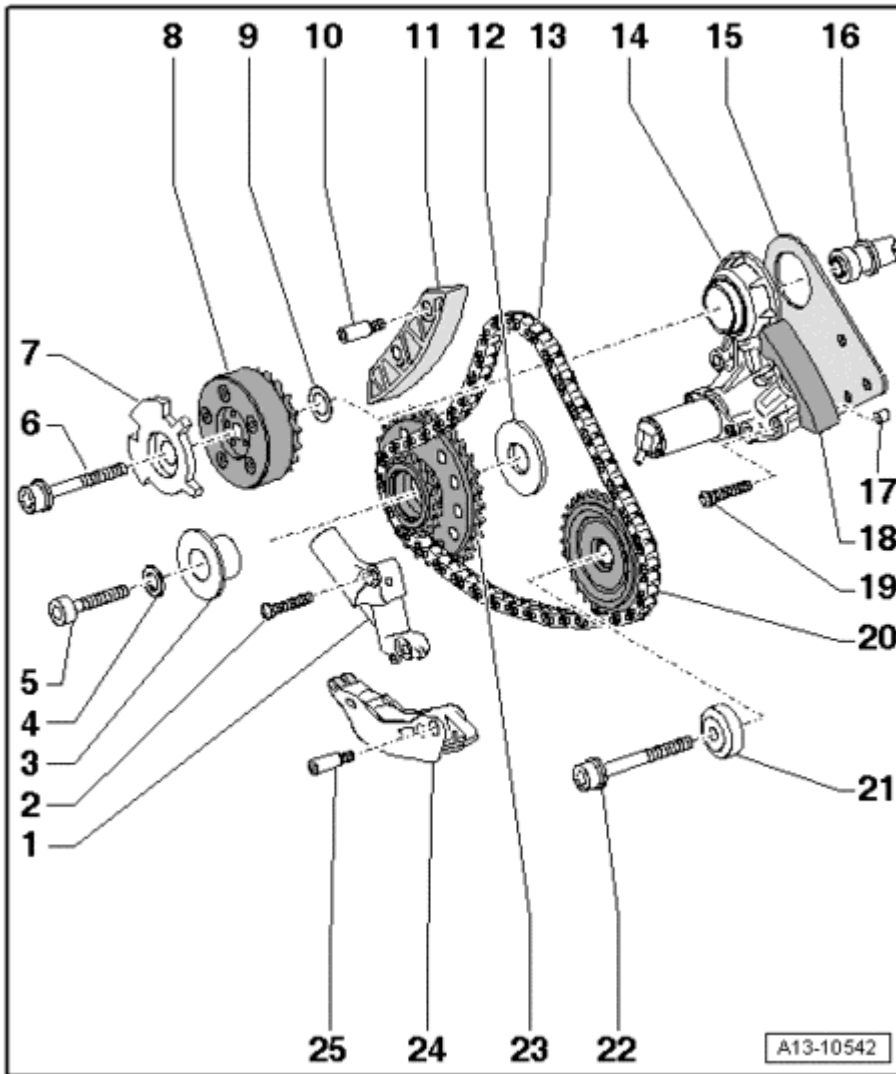


Fig. 156: Camshaft Timing Chain, Component Overview (Right Camshaft Timing Chain)
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Chain tensioner

- For right timing chain

2 - 5 Nm plus an additional $\frac{1}{4}$ turn (90°)

- Replace

3 - Mounting pin

- For drive sprocket

4 - Washer

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5 - 42 Nm

6 - Camshaft bolt

- Replace
- Initial tightening torque: 40 Nm
- Final tightening torque: 100 Nm plus an additional $\frac{1}{4}$ turn (90°)

7 - Hall sensor wheel

- When installing timing chain, adjust using setting gauge T40047 **Right exhaust manifold, removing and installing**

8 - Camshaft adjuster

- For intake camshaft

9 - Diamond disc

- Replace

10 - Pivot pin -10 Nm

11 - Guide rail

12 - Thrust washer

- For drive sprocket

13 - Right camshaft timing chain

- Removing and installing --> **Camshaft timing chain, removing and installing**

14 - Control housing

- For camshaft adjuster

15 - Gasket

- Replace

16 - Camshaft

17 - Alignment bushing

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ENGINE 4.2 Liter V8 4V Engine Mechanical, Engine Code(s): BAT, BNK

18 - Guide rail

- Can be replaced separately

19 - 5 Nm plus an additional $\frac{1}{4}$ turn (90°)

- Replace

20 - Chain sprocket

- For exhaust camshaft

21 - Washer

- Note installation position

22 - Camshaft bolt

- Replace
- Initial tightening torque: 40 Nm
- Final tightening torque: 100 Nm plus an additional $\frac{1}{4}$ turn (90°)

23 - Drive sprocket

- For right timing chain

24 - Guide rail

- For timing chain

25 - Pivot pin -10 Nm

Camshaft timing chain, removing and installing

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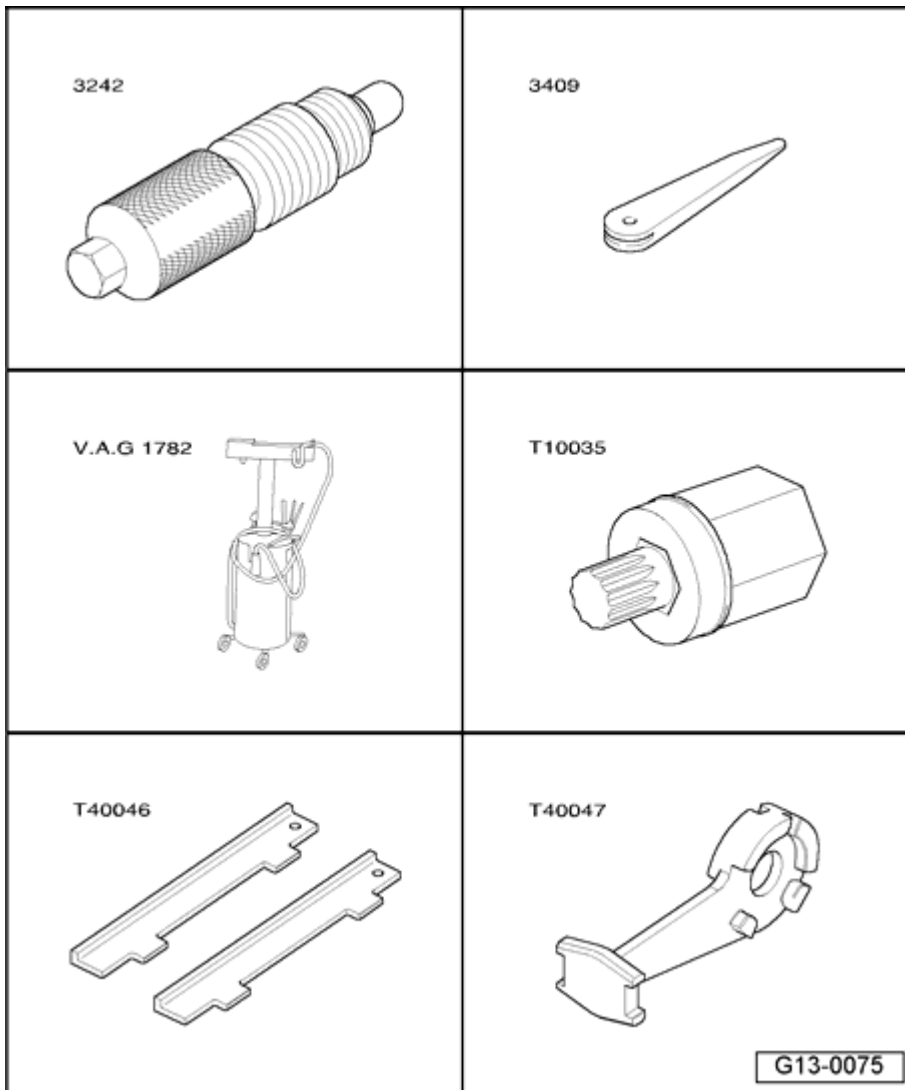


Fig. 157: Identifying Special Tools - Camshaft Timing Chain, Removing And Installing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools, testers and auxiliary items required

- Locking pin 3242
- Crankshaft Holder 3242
- Trim removal wedge 3409 (2x)
- Old oil collecting and extracting device V.A.G 1782
- Multi-point socket T10035
- Camshaft locator T40046 (qty. 2)
- Setting gauge T40047

Special tools, testers and auxiliary items required

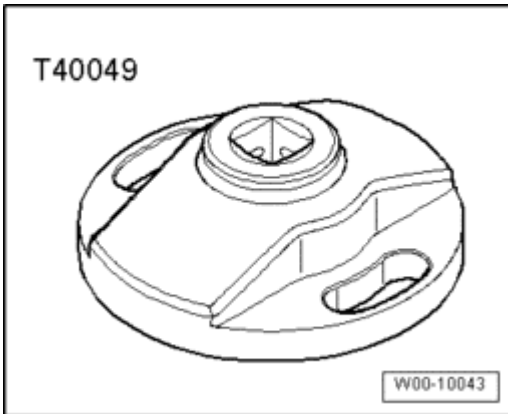


Fig. 158: Wrench T40049

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Wrench T40049
- Drill bit 3.3 mm dia. (2x)

Removing

- Drain engine oil --> **01 - MAINTENANCE** .
- Remove engine --> **Engine, removing and installing.**
- Separate engine/transmission unit --> **Engine and transmission, separating.**
- Remove covers for timing chains --> **Timing chain covers, removing and installing.**

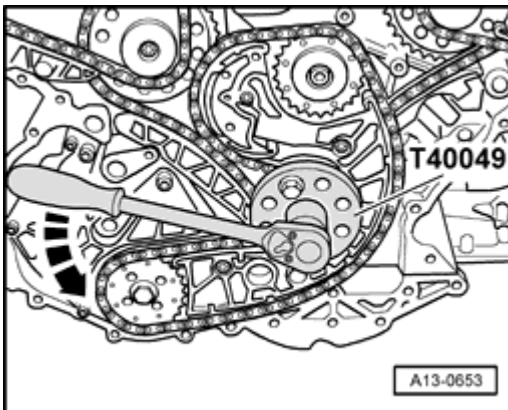


Fig. 159: Rotating Crankshaft To TDC Ignition Timing

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Install Key T40049 at rear on crankshaft using 2 old drive plate bolts.
- Rotate crankshaft in direction of engine rotation - **arrow** - to TDC ignition timing.

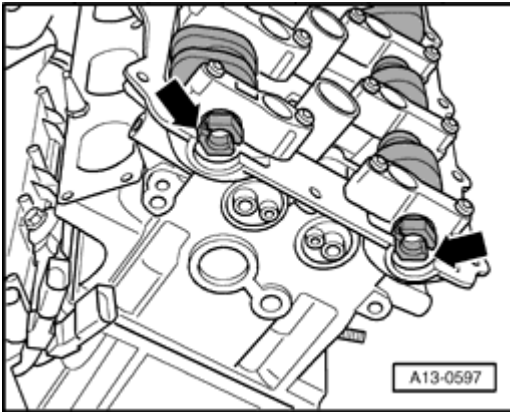


Fig. 160: Identifying Slits At Front In Camshafts Stand Parallel At Same Height With Upper Edge Of Cylinder Head

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Slits - **arrows** - at front in camshafts must stand parallel at same height with upper edge of cylinder head.

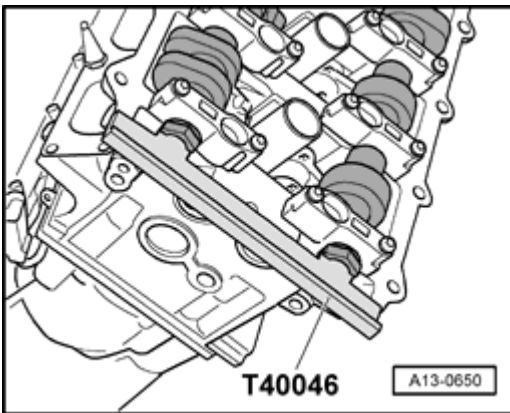


Fig. 161: Removing/Installing Camshaft Locator T40046

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Rotate camshafts at hex head slightly back or forth if necessary so that camshaft locator T40046 can be inserted.
- If camshaft locator T40046 cannot be inserted, rotate crankshaft 1 rotation (360°) further.
- Remove camshaft locator again.
- Unscrew drain plug from upper section of oil pan.

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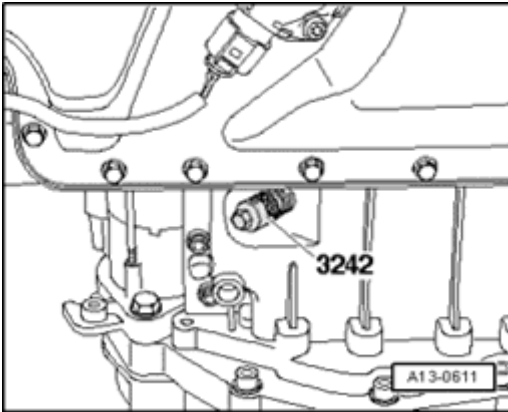


Fig. 162: Removing/Installing Crankshaft Holder 3242 Into Hole
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Screw crankshaft holder 3242 into hole (20 Nm), if necessary rotate crankshaft very slightly back and forth to completely center the holder.

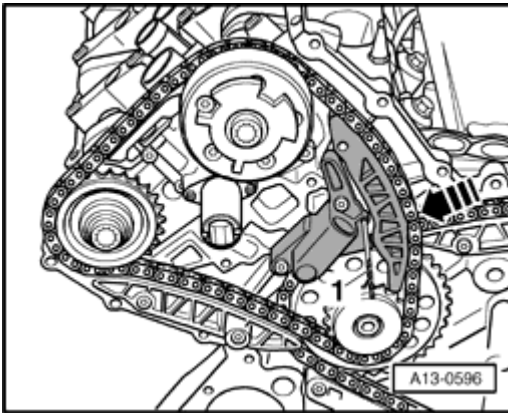


Fig. 163: Pushing Glide Track Of Chain Tensioner For Left Timing Chain
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Push glide track of chain tensioner for left timing chain in direction of - **arrow** - and pull off chain tensioner using a drill bit - **item 1** - 3.3 mm dia..
- Mark running direction of left timing chain with paint.

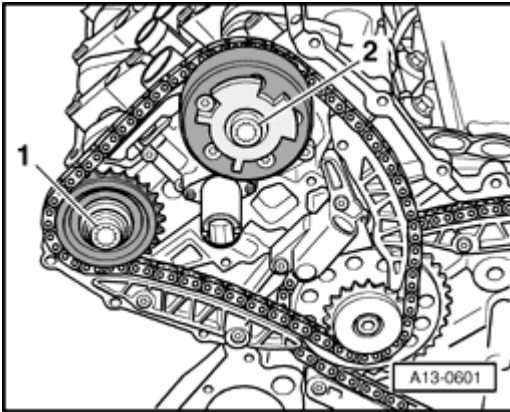


Fig. 164: Removing/Installing Bolts For Camshaft Chain Sprocket Or Camshaft Adjuster Using Multipoint Socket T10035

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts - **1** - and - **2** - for camshaft chain sprocket or camshaft adjuster using multipoint socket T10035.
- Remove camshaft chain sprocket, camshaft adjuster and timing chain.

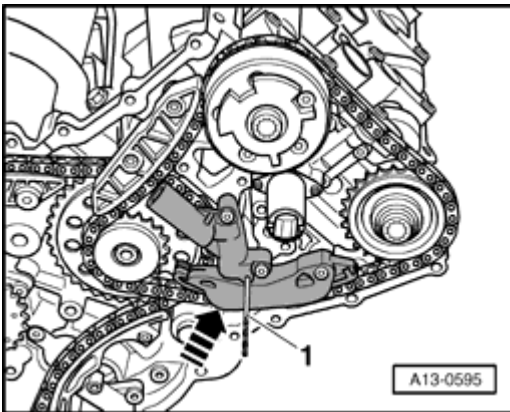


Fig. 165: Pushing Glide Track Of Chain Tensioner For Right Timing Chain

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Push glide track of chain tensioner for right timing chain in direction of - **arrow** - and pull off chain tensioner using a drill bit - **1** - 3.3 mm dia.
- Mark running direction of right timing chain with paint.

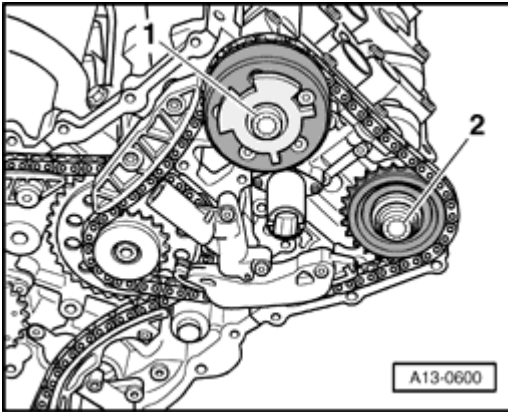


Fig. 166: Removing/Installing Bolts For Camshaft Chain Sprocket Or Camshaft Adjuster Using Multipoint Socket T10035

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts - 1 - and - 2 - for camshaft chain sprocket or camshaft adjuster using multipoint socket T10035.
- Remove camshaft chain sprocket, camshaft adjuster and timing chain.

Installing

- Secure crankshaft in TDC position using crankshaft holder 3242.
- Drive chain for timing mechanism installed --> **Drive chain for timing mechanism, removing and installing.**

NOTE:

- Always replace bolts that are tightened to torque as well as O-rings and gaskets.
- When turning camshaft, crankshaft must not be at TDC for any cylinder. Valves and/or pistons may be damaged.

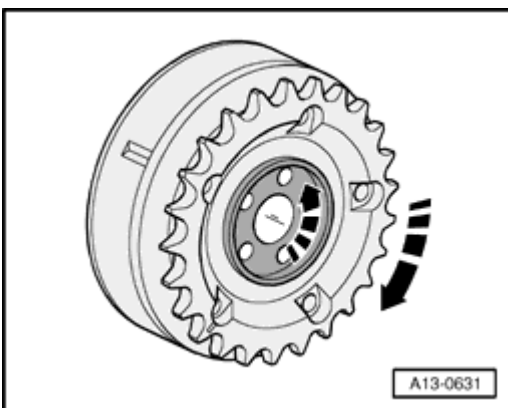


Fig. 167: Rotating Inner Part And Outer Part Of Both Camshaft Adjusters Against Each Other Up To Lock Position

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Rotate inner part and outer part of both camshaft adjusters against each other up to lock position - **arrows** -.
- Inner part and outer part must not be able to be against each other in lock position (slight play can still be felt)

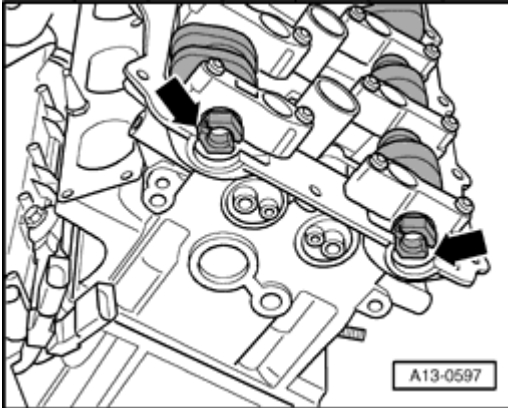


Fig. 168: Identifying Slits At Front In Camshafts Stand Parallel At Same Height With Upper Edge Of Cylinder Head

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Check whether camshafts of both cylinder heads stand in TDC position.
- Slits - **arrows** - at front in camshafts must stand parallel at same height with upper edge of cylinder head.

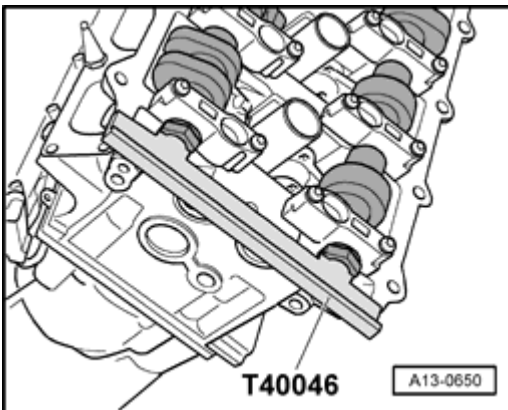


Fig. 169: Removing/Installing Camshaft Locator T40046

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Insert camshaft locator T40046 into camshafts of left cylinder head, to do so rotate camshafts back or forth at hex head if necessary.

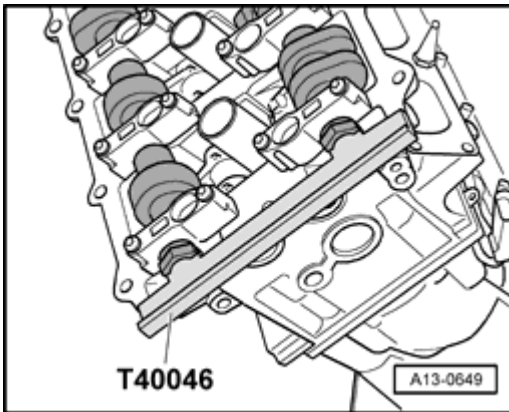


Fig. 170: Removing/Inserting Camshaft Locator T40046 From/Into Camshafts Of Right Cylinder Head
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Insert camshaft locator T40046 into camshafts of right cylinder head, to do so rotate camshafts back or forth at hex head if necessary.
- Replace all four camshaft bolts.

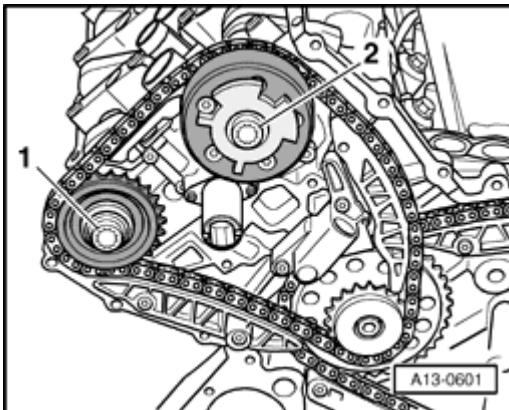


Fig. 171: Removing/Installing Bolts For Camshaft Chain Sprocket Or Camshaft Adjuster Using Multipoint Socket T10035
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Replace the diamond disc between the camshaft and left cylinder head camshaft adjuster.
- Assemble left timing chain with chain sprocket and camshaft adjuster.
- Loosely screw in bolts - 1 - and - 2 -.
- Chain sprocket and camshaft adjuster must be able to still be rotated on camshaft and must not tip.

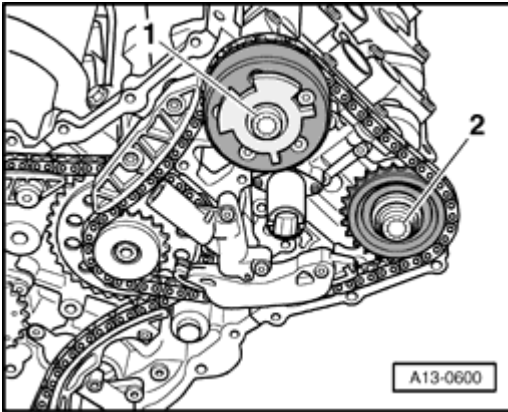


Fig. 172: Removing/Installing Bolts For Camshaft Chain Sprocket Or Camshaft Adjuster Using Multipoint Socket T10035

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Replace diamond disc between camshafts and right cylinder head camshaft adjuster.
- Assemble right timing chain with chain sprocket and camshaft adjuster.
- Loosely screw in bolts - 1 - and - 2 -.
- Chain sprocket and camshaft adjuster must be able to still be rotated on camshaft and must not tip.

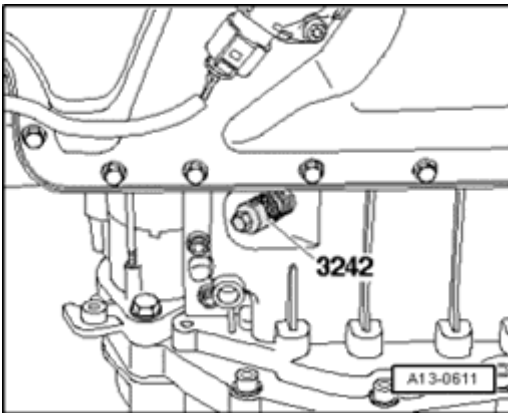


Fig. 173: Removing/Installing Crankshaft Holder 3242 Into Hole

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove crankshaft holder 3242.

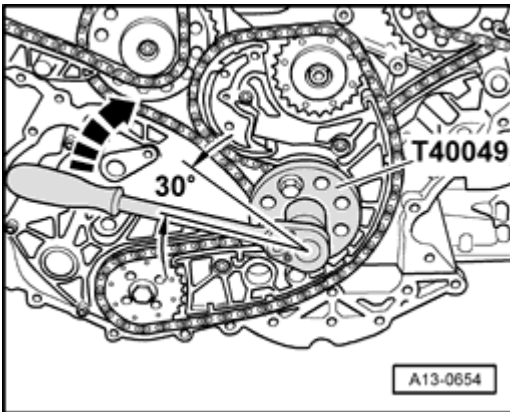


Fig. 174: Using Key T40049 To Rotate Crankshaft In Opposite Direction Of Engine Rotation
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Using Key T40049 , rotate crankshaft approx. 30° in opposite direction of engine rotation - **arrow** -.
- Pull drill out of alignment hole, which slackens the left chain tensioner.

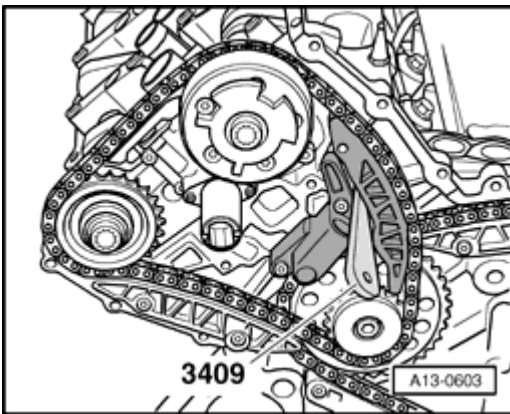


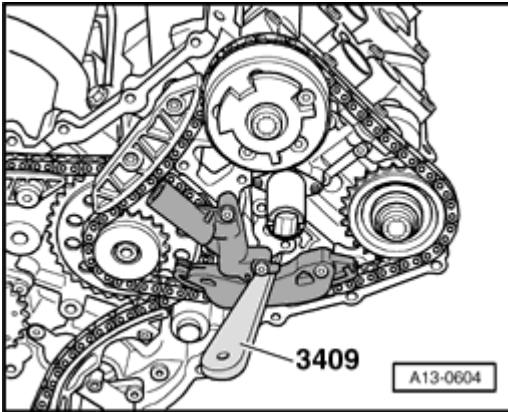
Fig. 175: Inserting Trim Removal Wedge 3409
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Insert Trim Removal Wedge 3409 as depicted in illustration and bring chain tensioner into contact with wedge.

NOTE:

- **Lightly pressing in an extra 0.5 mm is permitted.**

- Pull drill out of alignment hole, which slackens the right chain tensioner.

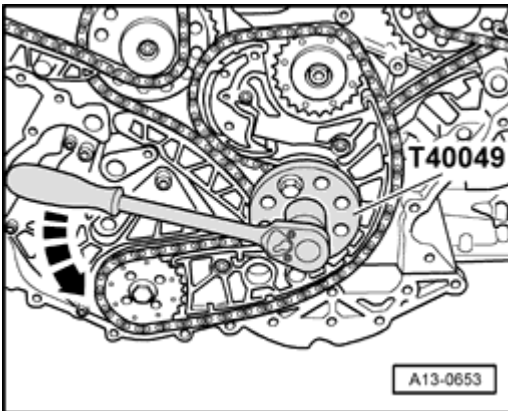
**Fig. 176: Insert Trim Removal Wedge 3409**

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Insert trim removal wedge 3409 as depicted in illustration and bring chain tensioner into contact with trim removal wedge 3409.

NOTE:

- Lightly pressing in an extra 0.5 mm is permitted.

**Fig. 177: Rotating Crankshaft To TDC Ignition Timing**

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Using Key T40049 , rotate crankshaft in direction of engine rotation - **arrow** - to TDC ignition timing.

NOTE:

- If rotated unintentionally beyond TDC, turn back crankshaft again approx. 30° and set to TDC again.

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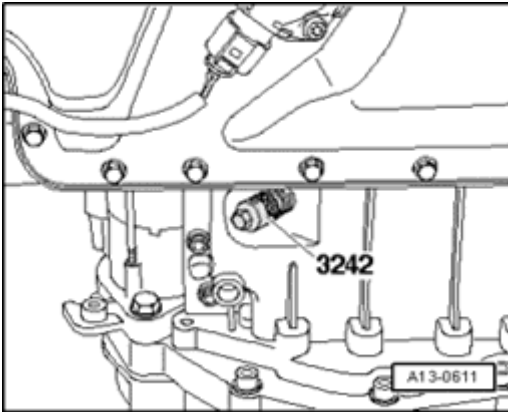


Fig. 178: Removing/Installing Crankshaft Holder 3242 Into Hole
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Screw crankshaft holder 3242 into hole, if necessary rotate crankshaft very slightly back and forth to completely center the holder. Torque specification: 20 Nm.

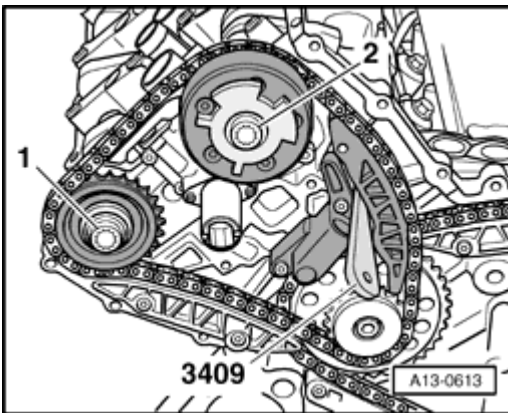


Fig. 179: Tightening Camshaft Bolt On Exhaust Camshaft Of Left Cylinder Head To Initial Tightening Torque
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Tighten camshaft bolt - 1 - on exhaust camshaft of left cylinder head to initial tightening torque. Torque specification: 40 Nm.

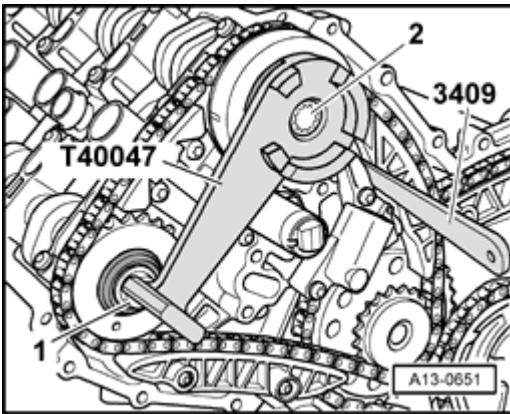


Fig. 180: Securing Hall Sensor Wheel On Camshaft Adjuster Of Intake Camshaft Of Left Cylinder Head Using Setting Gauge T40047

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Secure Hall sensor wheel on camshaft adjuster of intake camshaft of left cylinder head using setting gauge T40047.
- Place setting gauge T40047 on bolt - 1 -.
- Tighten camshaft bolt - 2 - on intake camshaft to initial tightening torque. Torque specification: 40 Nm

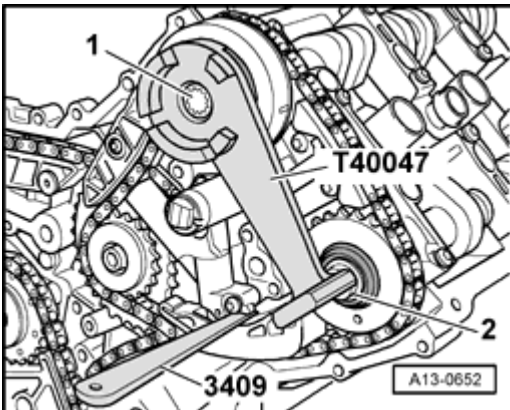


Fig. 181: Securing Hall Sensor Wheel On Camshaft Adjuster Of Intake Camshaft Of Right Cylinder Head Using Setting Gauge T40047

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Secure Hall sensor wheel on camshaft adjuster of intake camshaft of right cylinder head using setting gauge T40047.
- Place setting gauge T40047 on bolt - 2 -.
- Tighten camshaft bolt - 1 - on intake camshaft to initial tightening torque. Torque specification: 40 Nm.
- Remove setting gauge.

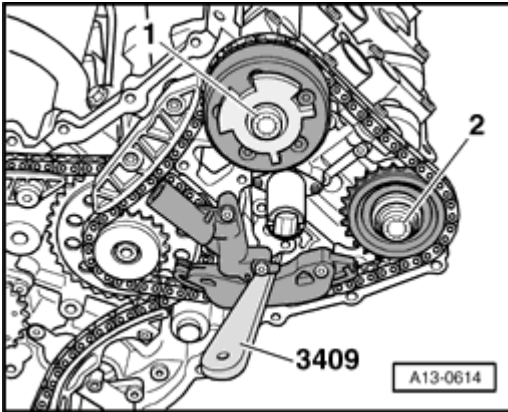


Fig. 182: Tightening Camshaft Bolt On Exhaust Camshaft Of Right Cylinder Head To Initial Tightening Torque

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Tighten camshaft bolt - 2 - on exhaust camshaft of right cylinder head to initial tightening torque. Torque specification: 40 Nm.

NOTE:

- Camshaft locators T40046 must not be used as counter holder for final tightening of camshaft bolts.

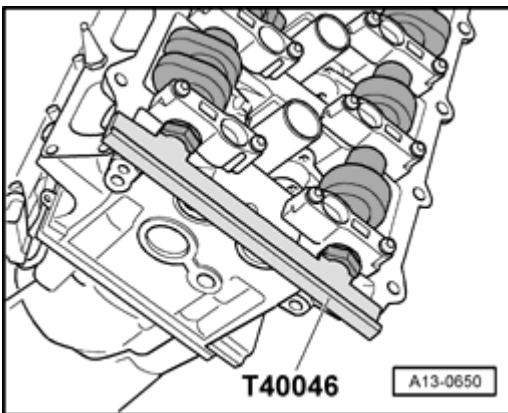


Fig. 183: Removing/Installing Camshaft Locator T40046

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove camshaft locators T40046 on both cylinder heads.

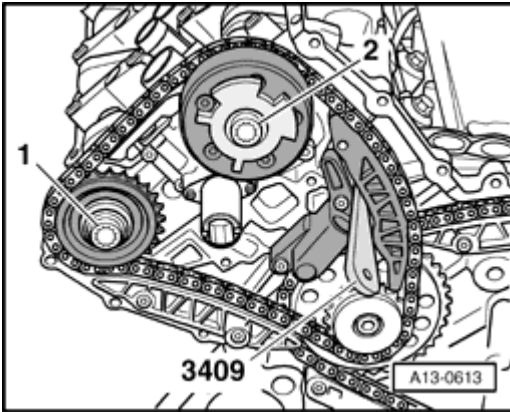


Fig. 184: Tightening Camshaft Bolt On Exhaust Camshaft Of Left Cylinder Head To Initial Tightening Torque

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Tighten camshaft bolt - **1** - on exhaust camshaft of left cylinder head to final tightening torque. Torque specification: 100 Nm + 90° ($\frac{1}{4}$ additional rotation).

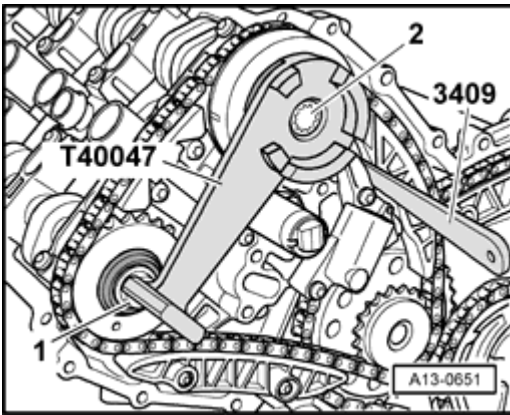


Fig. 185: Securing Hall Sensor Wheel On Camshaft Adjuster Of Intake Camshaft Of Left Cylinder Head Using Setting Gauge T40047

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Secure Hall sensor wheel on camshaft adjuster of intake camshaft of left cylinder head using setting gauge T40047.
- Place setting gauge T40047 on bolt - **1** -.
- Tighten camshaft bolt - **2** - on intake camshaft to final tightening torque. Torque specification: 100 Nm + 90° ($\frac{1}{4}$ additional rotation).

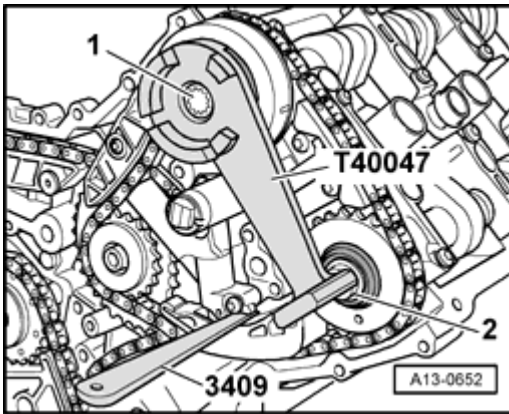


Fig. 186: Securing Hall Sensor Wheel On Camshaft Adjuster Of Intake Camshaft Of Right Cylinder Head Using Setting Gauge T40047

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Secure Hall sensor wheel on camshaft adjuster of intake camshaft of right cylinder head using setting gauge T40047.
- Place setting gauge T40047 on bolt - 2 -.
- Tighten camshaft bolt - 1 - on intake camshaft to final tightening torque. Torque specification: 100 Nm + 90° ($\frac{1}{4}$ additional rotation).
- Remove setting gauge.

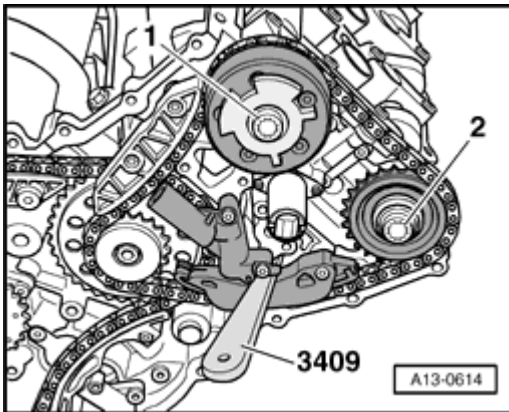


Fig. 187: Tightening Camshaft Bolt On Exhaust Camshaft Of Right Cylinder Head To Initial Tightening Torque

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Tighten camshaft bolt - 2 - on exhaust camshaft of right cylinder head to final tightening torque. Torque specification: 100 Nm + 90° ($\frac{1}{4}$ additional rotation).

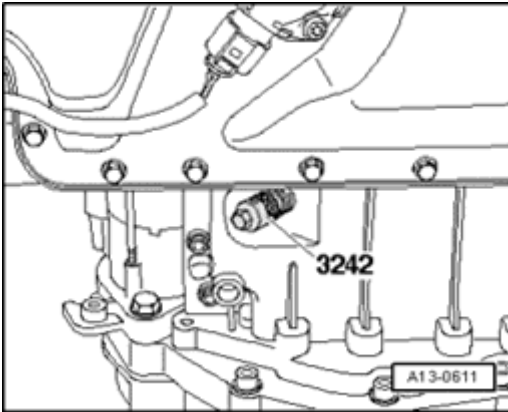


Fig. 188: Removing/Installing Crankshaft Holder 3242 Into Hole
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove crankshaft holder 3242.

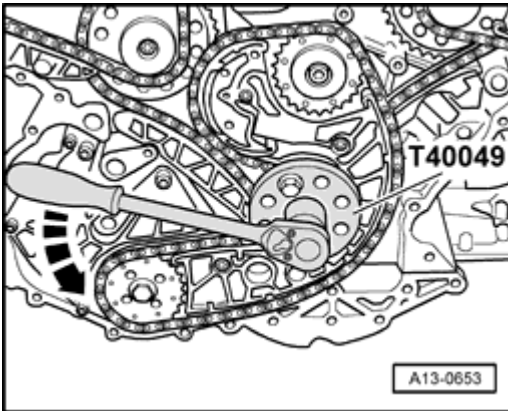


Fig. 189: Rotating Crankshaft To TDC Ignition Timing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Using Key T40049 turn crankshaft two complete rotations in direction of engine rotation - **arrow** - until crankshaft stands at TDC again.

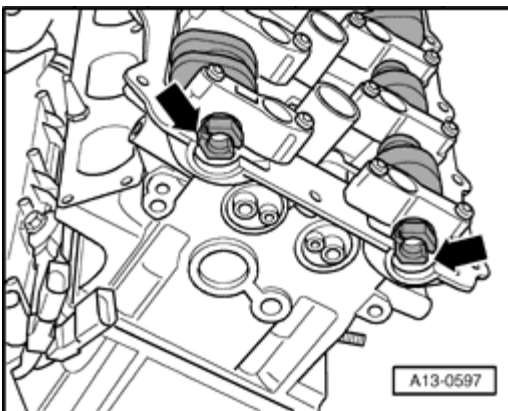


Fig. 190: Identifying Slits At Front In Camshafts Stand Parallel At Same Height With Upper Edge Of

Cylinder Head

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Slits - **arrows** - at front in camshafts must stand parallel at same height with upper edge of cylinder head.

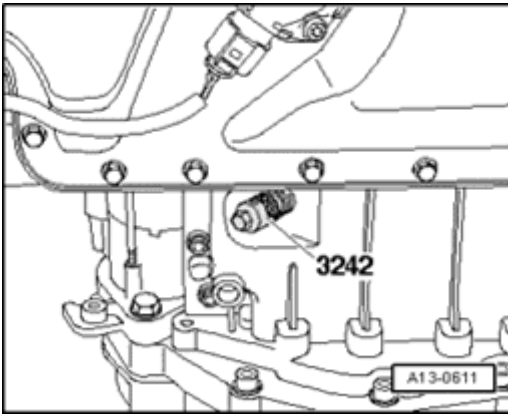


Fig. 191: Removing/Installing Crankshaft Holder 3242 Into Hole

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Screw crankshaft holder 3242 into hole (20 Nm), if necessary rotate crankshaft very slightly back and forth to completely center the holder.

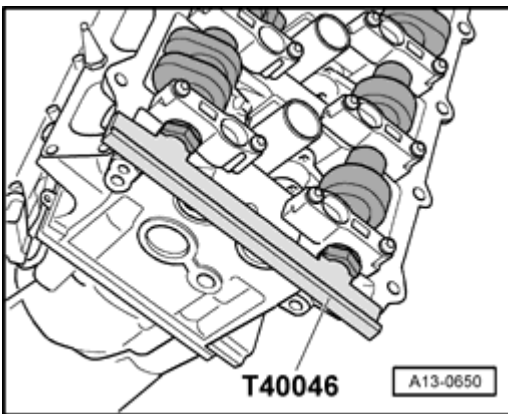


Fig. 192: Removing/Installing Camshaft Locator T40046

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Insert camshaft locator T40046 into camshafts of left cylinder head.

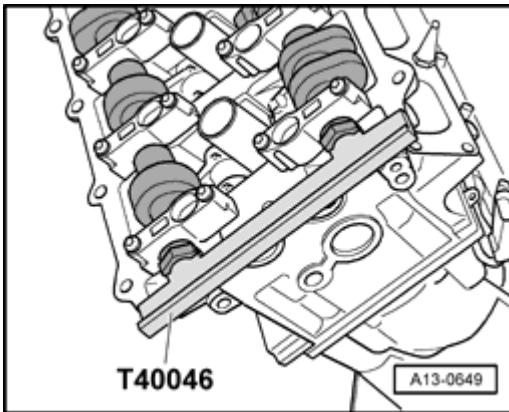


Fig. 193: Removing/Inserting Camshaft Locator T40046 From/Into Camshafts Of Right Cylinder Head
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Insert camshaft locator T40046 into camshafts of right cylinder head.

NOTE:

- If camshaft locators cannot be inserted, repeat adjustment.

- Pull out trim removal wedge 3409.
- Remove camshaft locators T40046 on both cylinder heads.
- Remove crankshaft holder 3242.
- Screw sealing plug of TDC marking with new sealing ring into upper section of oil pan.

Further installation is performed in reverse order of removal, noting the following:

- Install covers for timing chains **Installing**.
- Install drive plate --> **Drive plate, removing and installing**.
- Bolt transmission to engine and install engine-/transmission unit --> **Engine, installing**.

Torque specifications

Component	Nm
Camshaft bolts	100 + 90° * See note* See note
Sealing plug in upper section of oil pan	35

* 90° corresponds to a 1/4 turn

*Replace bolts.

Camshaft timing chains, removing from camshafts

NOTE:

- For the removal of the cylinder head or camshafts, it is sufficient to remove camshaft timing chains only from the camshafts. The chains

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remain on the engine, the transmission is not disconnected.

- Even if work is performed only on one of the cylinder heads, the procedure described must be followed, since then the valve timing at both cylinder heads must be adjusted.

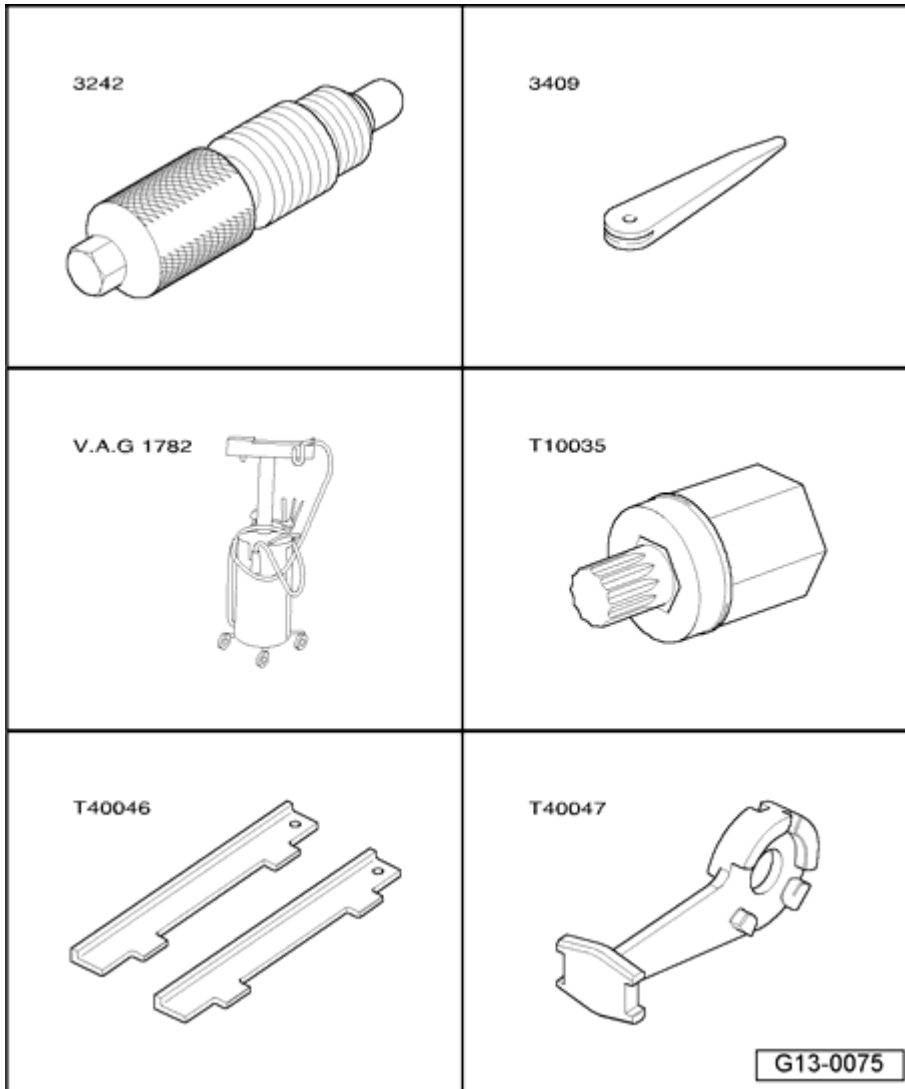


Fig. 194: Identifying Special Tools - Camshaft Timing Chains, Removing From Camshafts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools, testers and auxiliary items required

- Crankshaft Holder 3242
- Trim removal wedge 3409 (2x)
- Old oil collecting and extracting device V.A.G 1782
- Multi-point socket T10035

- Camshaft locator T40046 (qty. 2)
- Setting gauge T40047
- Drill bit 3.3 mm dia. (2x)

Special tools, testers and auxiliary items required

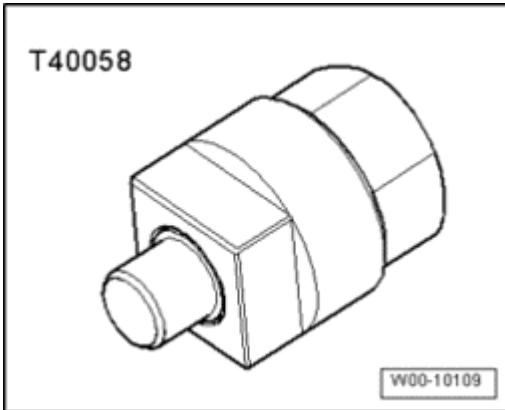


Fig. 195: Socket T40058

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Socket T40058

Work procedure

- Remove engine --> **Engine, removing and installing.**
- Separate engine/transmission unit --> **Engine and transmission, separating.**

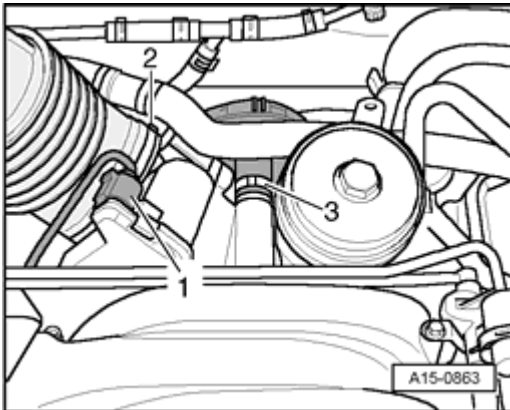


Fig. 196: Disconnecting Electrical Connection At Throttle Valve Control Module J338 & Crankcase Ventilation Hose At Intake Pipe

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical connection - **1** - at throttle valve control module J338.
- Disconnect crankcase ventilation hose - **3** - at intake pipe.

NOTE:

- Ignore - 2 -.

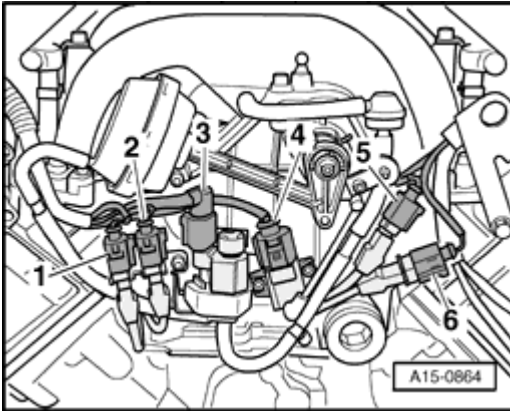


Fig. 197: Remove Electrical Harness Connectors Toward Front From Brackets On Intake Pipe
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove electrical harness connectors - 1 - , - 2 - , - 5 - and - 6 - toward front from brackets on intake pipe.
- Disconnect electrical connectors - 3 - and - 4 -.

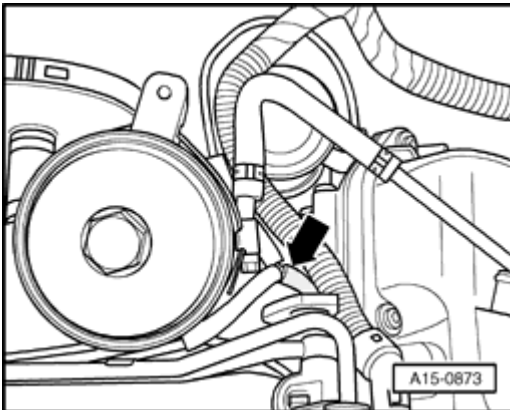


Fig. 198: Disconnecting Vacuum Hose At T-Piece
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect vacuum hose - **arrow** - at T-piece.

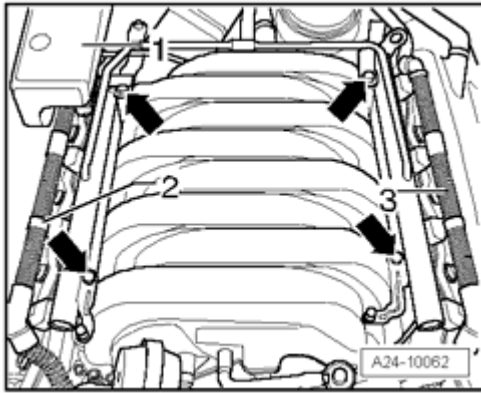


Fig. 199: Pulling Off Connector Strips At Fuel Injectors & Removing Bolts From Fuel Rail
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove connector strips - **2** - and - **3** - at 8 fuel injectors.
- Remove bolts - **arrows** - from fuel rail.
- Pull fuel rail with injectors upward uniformly from intake manifold and set aside in engine compartment on a clean cloth.

NOTE:

- **Carefully protect removed fuel injectors from contamination.**

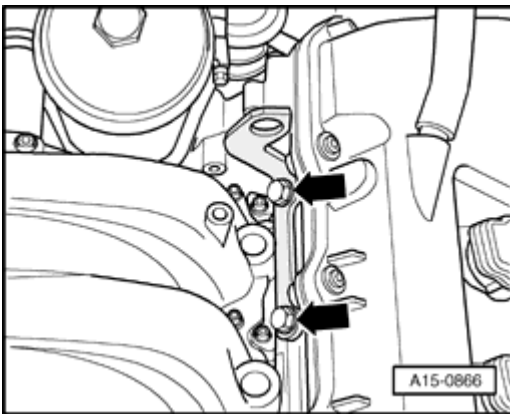


Fig. 200: Removing Left Rear Engine Lifting Eye
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove left rear engine lifting eye - **arrows** -.

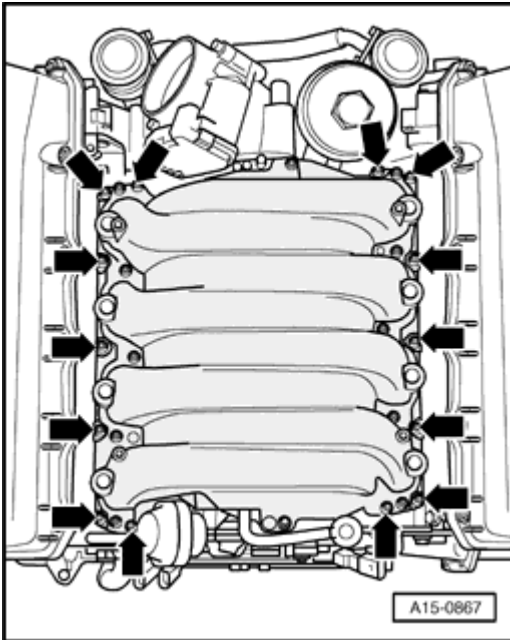


Fig. 201: Removing Intake Manifold Bolts

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove intake manifold bolts - **arrows** - and remove it.

NOTE:

- **Plug intake ports of the cylinder head with clean rags.**

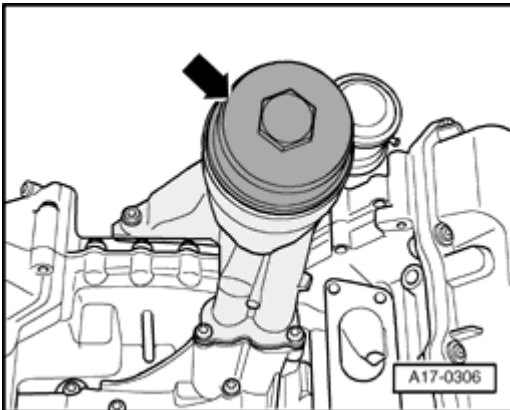


Fig. 202: Removing Cap For Oil Filter Housing

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove cap - **arrow** - for oil filter housing.
- Remove oil filter element.
- Extract engine oil using old oil collecting and extracting device V.A.G 1782 from oil filter housing.

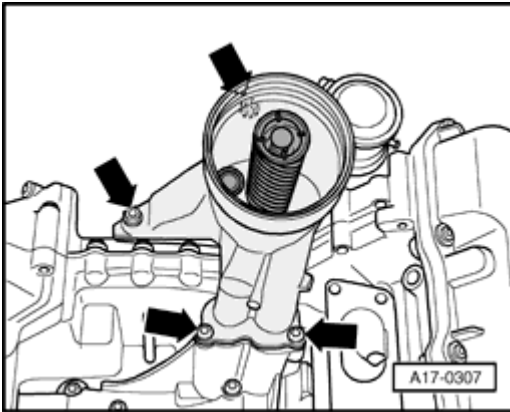


Fig. 203: Removing Bolts & Oil Filter Housing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

NOTE:

- Place a rag around oil filter housing to catch escaping engine oil.

- Remove bolts - **arrows** -.
- Remove oil filter housing.

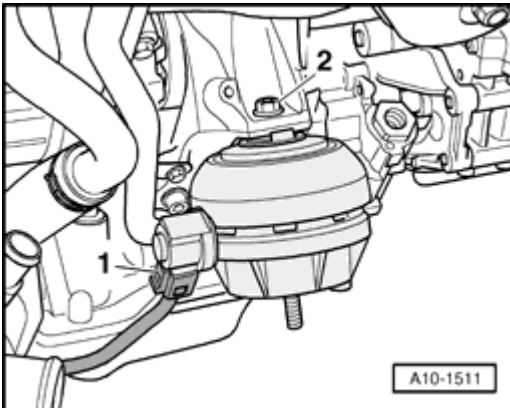


Fig. 204: Disconnecting Electrical Connector, Removing Nut And Engine Mount
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical harness connector - **1** - at left engine mount.
- Remove nut - **2** - and remove engine mount.

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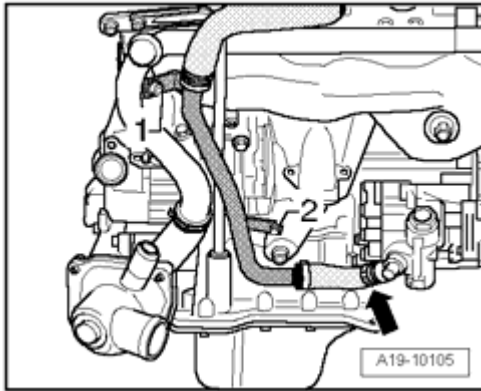


Fig. 205: Removing Bolts & Return Pipe From Power-Steering Pump
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts - **1** - and - **2** -.
- Remove return pipe from power-steering pump - **arrow** -.

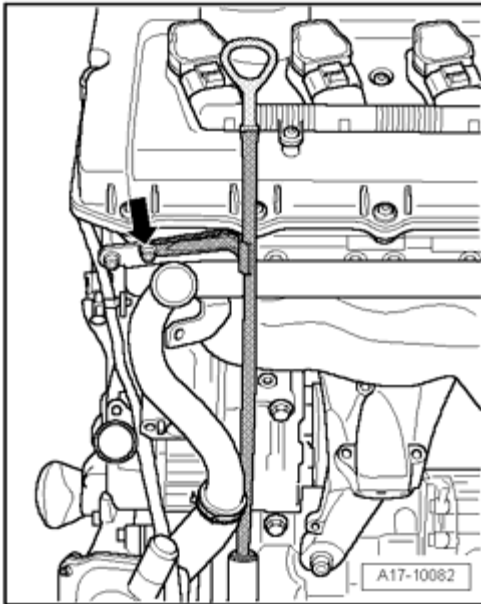


Fig. 206: Removing Guide Pipe For Oil Dipstick At Cylinder Head
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove guide pipe for oil dipstick at cylinder head - **arrow** - , pull up and remove.

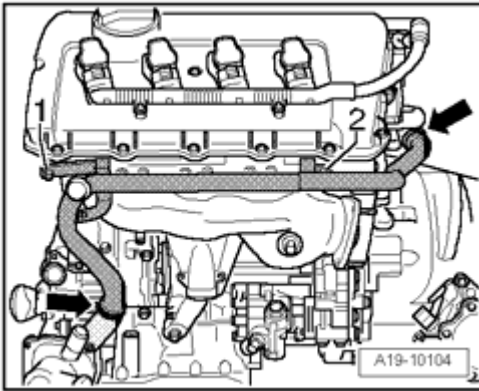


Fig. 207: Removing Bolts & Loosening Hose Clamps And Removing Left Coolant Pipe From Coolant Hoses

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts - **1** - and - **2** -.
- Loosen hose clamps - **arrows** - and remove left coolant pipe from coolant hoses.

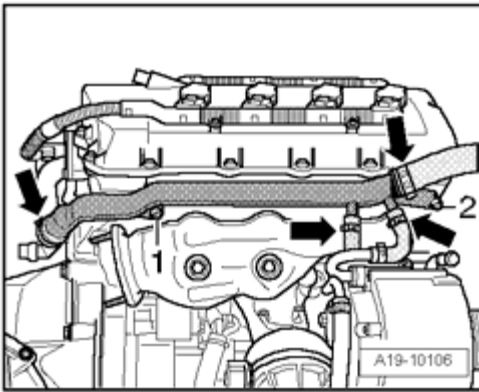


Fig. 208: Removing Bolts & Loosening Hose Clamps And Removing Right Coolant Pipe From Coolant Hoses

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts - **1** - and - **2** -.
- Loosen hose clamps - **arrows** - and remove right coolant pipe from coolant hoses.

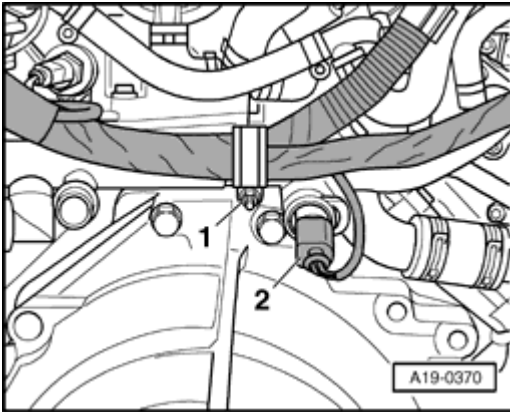


Fig. 209: Disconnecting Electrical Connector On Engine Coolant Temperature (ECT) Sensor G62 & Removing Nut And Electrical Wiring Harness At Rear Coolant Pipe
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical connector - 2 - on Engine Coolant Temperature (ECT) Sensor G62.
- Remove nut - 1 - and remove electrical wiring harness at rear coolant pipe.

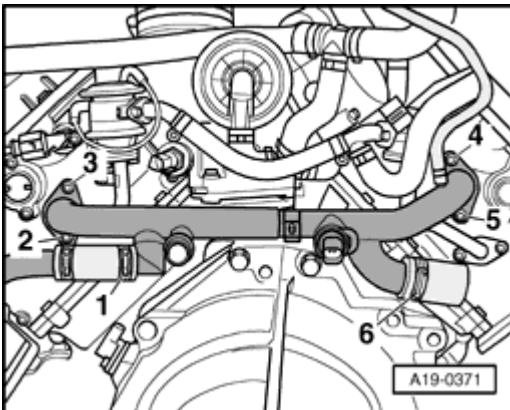


Fig. 210: Removing Bolts & Rear Coolant Pipe
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts - 2 to 5 -.
- Remove rear coolant pipe.

NOTE: • Ignore - 1 - and - 6 -.

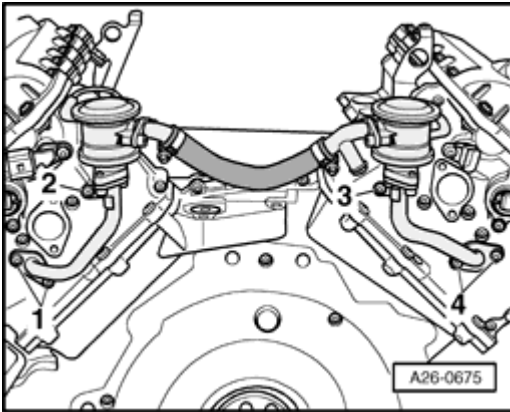


Fig. 211: Removing Secondary Air Injection (AIR) System Combi-Valve Mounting Bolts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove Secondary Air Injection (AIR) system combi-valve mounting bolts - **1 through 4** -.

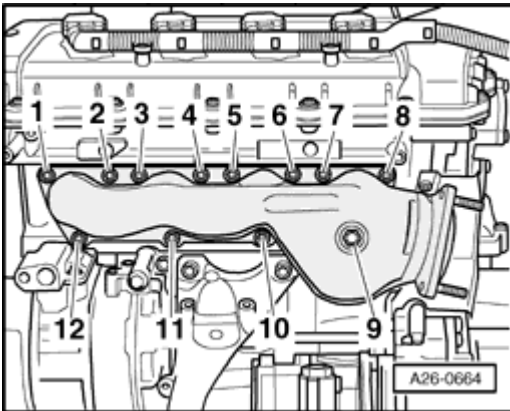


Fig. 212: Removing Nuts And Left Exhaust Manifold
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove nuts - **1 to 12** - and remove left exhaust manifold.

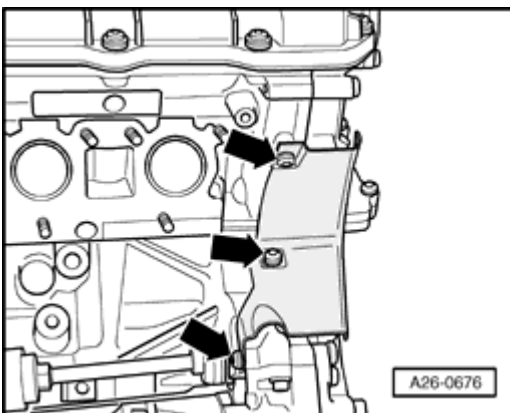


Fig. 213: Removing Left Heat Shield
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove left heat shield - **arrows** -.

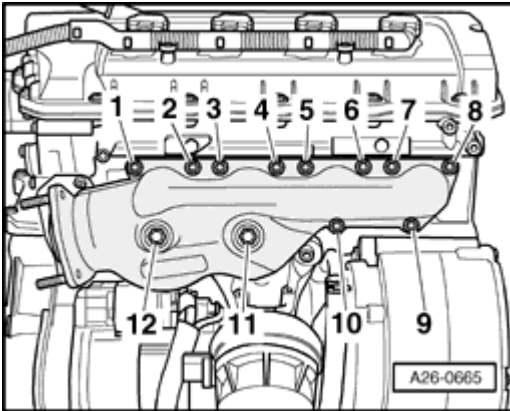


Fig. 214: Removing Nuts And Right Exhaust Manifold
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove nuts - **1 to 12** - and remove right exhaust manifold.

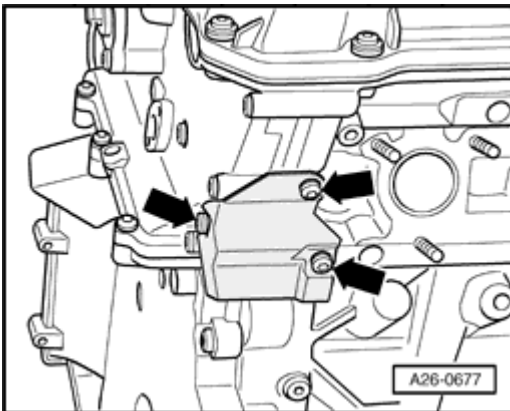


Fig. 215: Removing Right Heat Shield
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove right heat shield - **arrows** -.

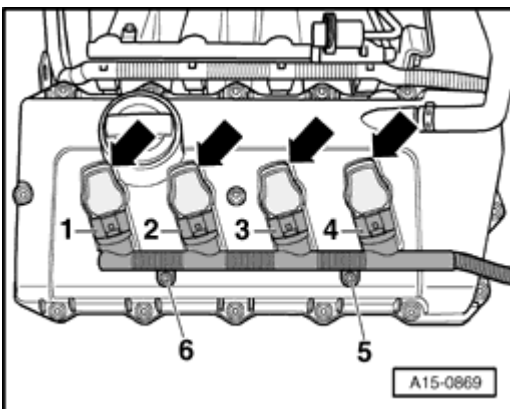


Fig. 216: Removing Bolts On Left Cylinder Head, Disconnecting Electrical Harness Connectors & Removing Ignition Coils

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts - **5** - and - **6** - on left cylinder head.
- Disconnect electrical harness connectors - **1 to 4** -.
- Remove ignition coils - **arrows** -.

NOTE:

- Extractor T10094 can be used for removal.

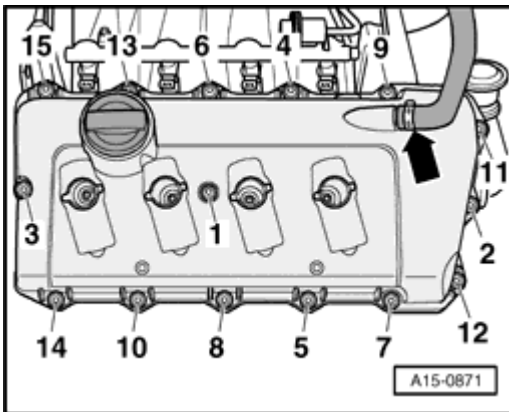


Fig. 217: Disconnecting Hose Of Crankshaft Housing Ventilation & Removing Left Cylinder Head Cover Bolts In Sequence

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect hose of crankshaft housing ventilation - **arrow** -.
- Remove left cylinder head cover bolts in sequence - **15 to 1** -.
- Remove cylinder head cover.

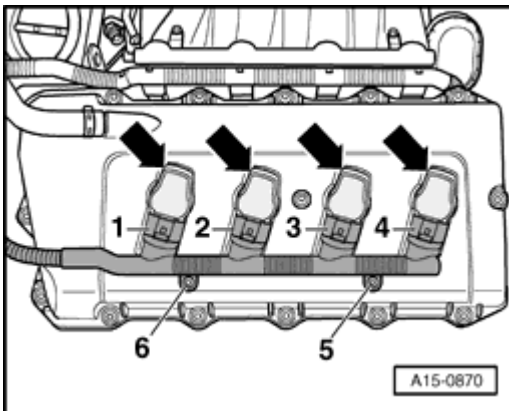


Fig. 218: Removing Bolts On Right Cylinder Head, Disconnecting Electrical Harness Connectors & Removing Ignition Coils

Courtesy of VOLKSWAGEN UNITED STATES, INC.

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- Remove bolts - **5** - and - **6** - on right cylinder head.
- Disconnect electrical harness connectors - **1 to 4** -.
- Remove ignition coils - **arrows** -.

NOTE:

- **Extractor T10094 can be used for removal.**

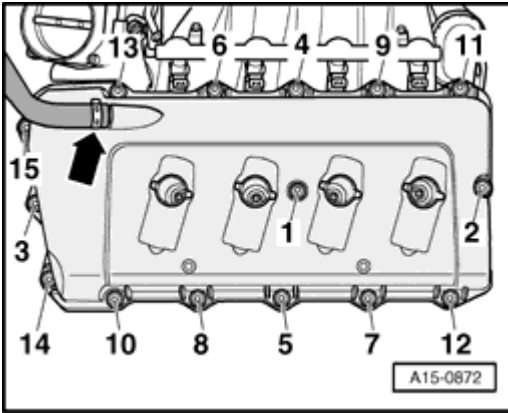


Fig. 219: Disconnecting Hose Of Crankshaft Housing Ventilation & Removing Right Cylinder Head Cover Screws In Sequence

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect hose of crankshaft housing ventilation - **arrow** -.
- Remove right cylinder head cover bolts in sequence - **15 to 1** -.
- Remove cylinder head cover.

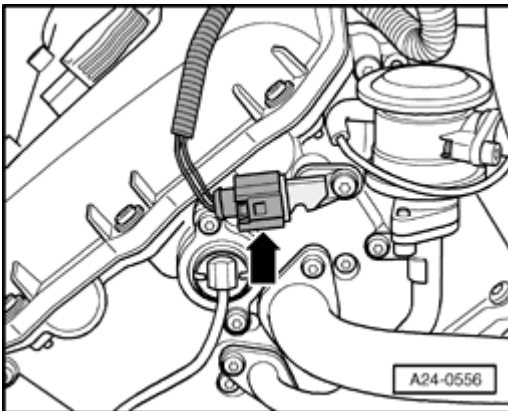


Fig. 220: Disconnecting Electrical Harness Connector For Camshaft Position (CMP) Sensor 2 G163 On Left Cylinder Head

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical harness connector - **arrow** - for Camshaft Position (CMP) Sensor 2 G163 on left cylinder head.

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ENGINE 4.2 Liter V8 4V Engine Mechanical, Engine Code(s): BAT, BNK

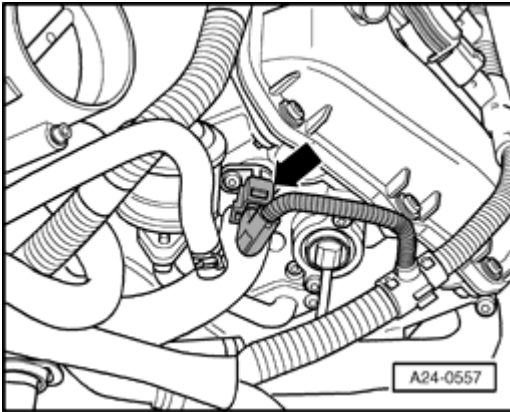


Fig. 221: Disconnecting Electrical Harness Connector For Camshaft Position (CMP) Sensor G40 On Right Cylinder Head

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical harness connector - **arrow** - for Camshaft Position (CMP) Sensor G40 on right cylinder head.

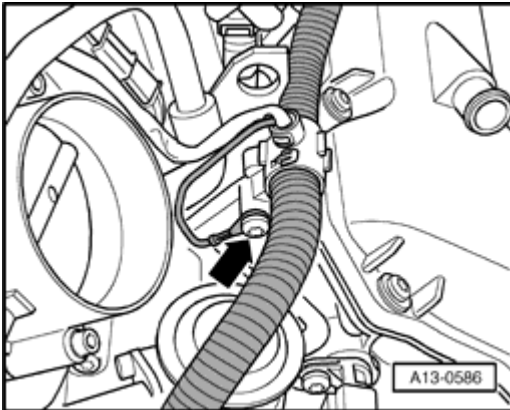


Fig. 222: Removing Ground (GND) Cable On Right Cylinder Head

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove Ground (GND) cable on right cylinder head - **arrow** -.
- Set wiring harness aside.

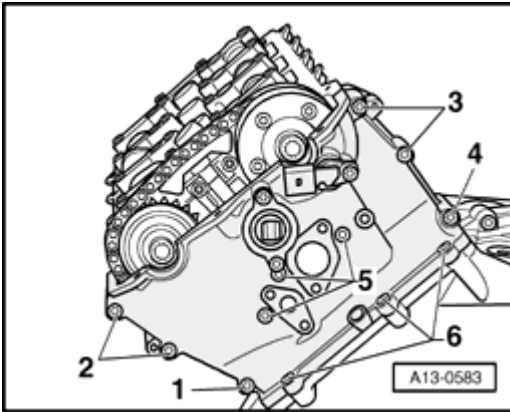


Fig. 223: Removing/Installing Bolts And Left Timing Chain Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts - 1 to 6 - and remove left timing chain cover.

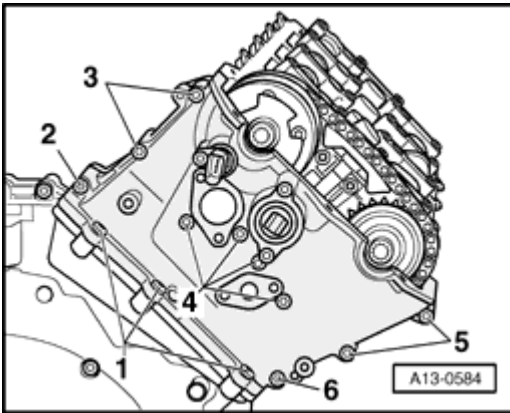


Fig. 224: Removing/Installing Bolts And Right Timing Chain Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts - 1 to 6 - and remove right timing chain cover.

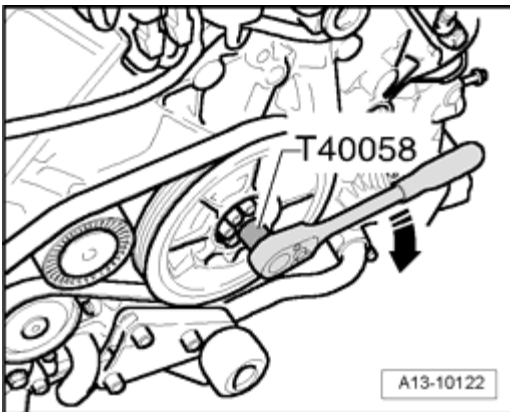


Fig. 225: Counter Holding Crankshaft Using Adapter T40058 To Loosen Torque Converter Bolts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Using Socket T40058 , rotate crankshaft in direction of engine rotation - **arrow** - to TDC ignition timing.

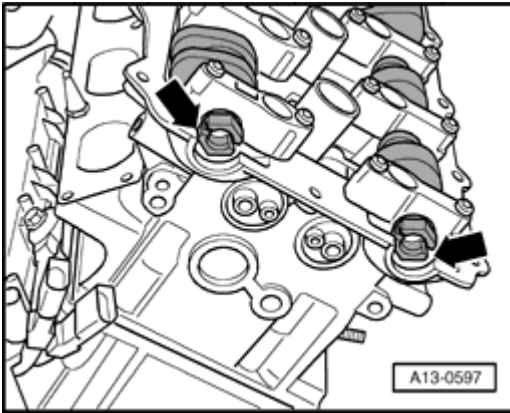


Fig. 226: Identifying Slits At Front In Camshafts Stand Parallel At Same Height With Upper Edge Of Cylinder Head

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Slits - **arrows** - at front in camshafts must stand parallel at same height with upper edge of cylinder head.

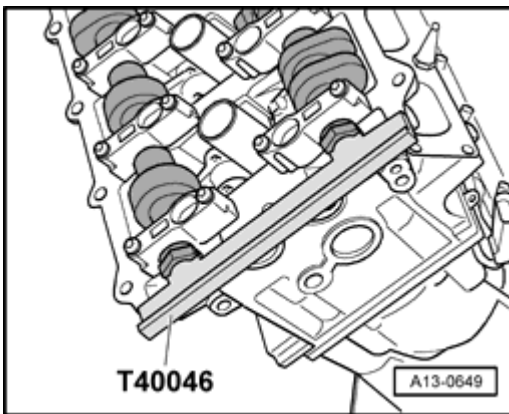


Fig. 227: Removing/Inserting Camshaft Locator T40046 From/Into Camshafts Of Right Cylinder Head

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Rotate camshafts at hex head slightly back or forth if necessary so that camshaft locator T40046 can be inserted.
- If camshaft locator T40046 cannot be inserted, rotate crankshaft 1 rotation (360°) further.
- Remove camshaft locator again.
- Remove drain plug from upper section of oil pan.

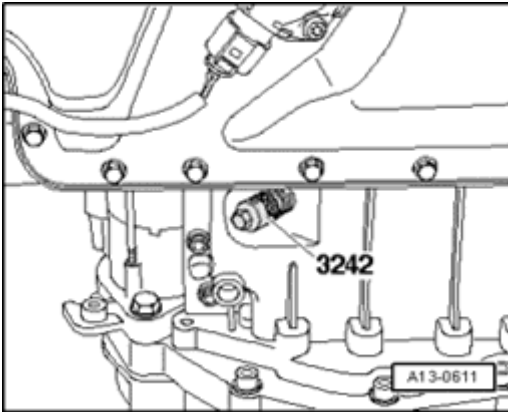


Fig. 228: Removing/Installing Crankshaft Holder 3242 Into Hole
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Install crankshaft holder 3242 into hole, if necessary rotate crankshaft very slightly back and forth to completely center holder. Torque specification: 20 Nm.

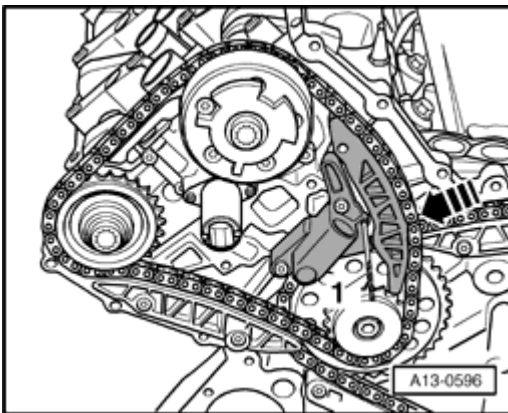


Fig. 229: Pushing Glide Track Of Chain Tensioner For Left Timing Chain
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Push glide track of chain tensioner for left timing chain in direction of - **arrow** - and pull off chain tensioner using a drill bit - **1** - 3.3 mm dia.

NOTE:

- In the following illustration, the timing mechanism is depicted with covers completely removed.

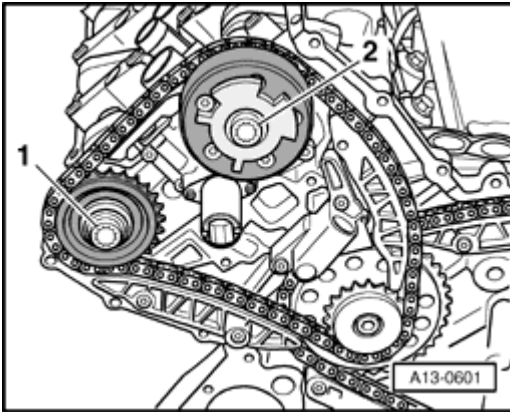


Fig. 230: Removing/Installing Bolts For Camshaft Chain Sprocket Or Camshaft Adjuster Using Multipoint Socket T10035

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts - 1 - and - 2 - for camshaft chain sprocket or camshaft adjuster using multipoint socket T10035.
- Remove camshaft chain sprocket and camshaft adjuster.

NOTE:

- **Camshaft timing chain remains on engine.**
- **Also, if only one of the two cylinder heads is removed, bolts for camshaft gears must be loosened at both cylinder heads.**

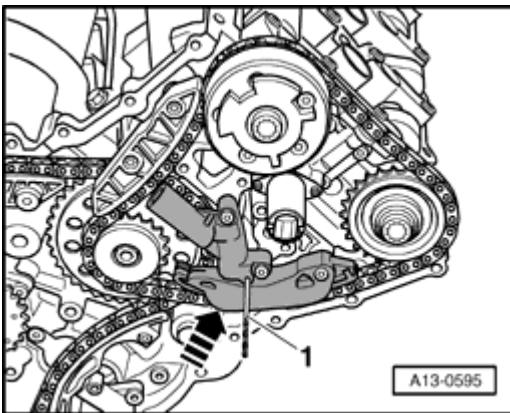


Fig. 231: Pushing Glide Track Of Chain Tensioner For Right Timing Chain

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Push glide track of chain tensioner for right timing chain in direction of - **arrow** - and pull off chain tensioner using a drill bit - 1 - 3.3 mm dia.

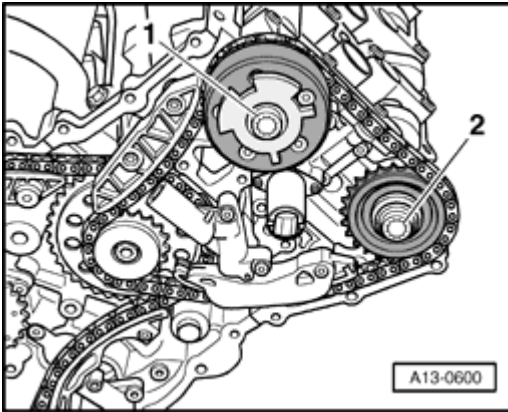


Fig. 232: Removing/Installing Bolts For Camshaft Chain Sprocket Or Camshaft Adjuster Using Multipoint Socket T10035

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts - 1 - and - 2 - for camshaft chain sprocket or camshaft adjuster using multipoint socket T10035.
- Remove camshaft chain sprocket and camshaft adjuster.

NOTE:

- **Camshaft timing chain remains on engine.**
- **Also, if only one of the two cylinder heads is removed, bolts for camshaft gears must be loosened at both cylinder heads.**

Installing

- Secure crankshaft in TDC position using crankshaft holder 3242.

NOTE:

- **During assembly, replace self-locking nuts and bolts.**
- **Always replace bolts that are tightened to torque as well as O-rings and gaskets.**
- **When turning camshaft, crankshaft must not be at TDC for any cylinder. Valves and/or pistons may be damaged.**

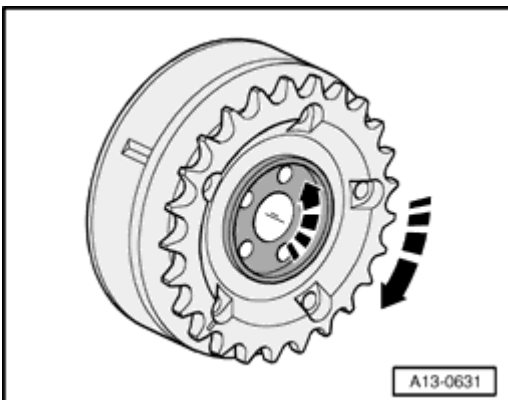
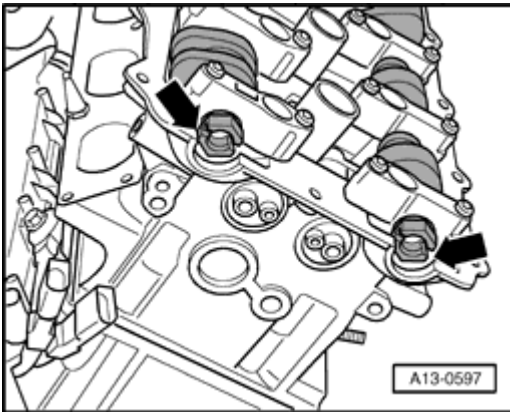


Fig. 233: Rotating Inner Part And Outer Part Of Both Camshaft Adjusters Against Each Other Up To Lock Position

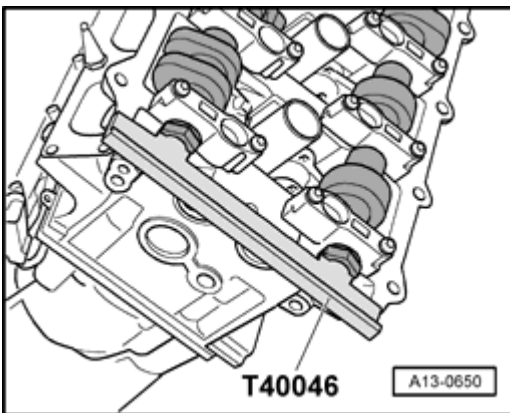
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Rotate inner part and outer part of both camshaft adjusters against each other up to lock position - **arrows** -.
- Inner part and outer part must not be able to be against each other in lock position (slight play can still be felt).

**Fig. 234: Identifying Slits At Front In Camshafts Stand Parallel At Same Height With Upper Edge Of Cylinder Head**

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Check whether camshafts of both cylinder heads stand in TDC position.
- Slits - **arrows** - at front in camshafts must stand parallel at same height with upper edge of cylinder head.

**Fig. 235: Removing/Installing Camshaft Locator T40046**

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Insert camshaft locator T40046 into camshafts of left cylinder head, to do so rotate camshafts back or forth at hex head if necessary.

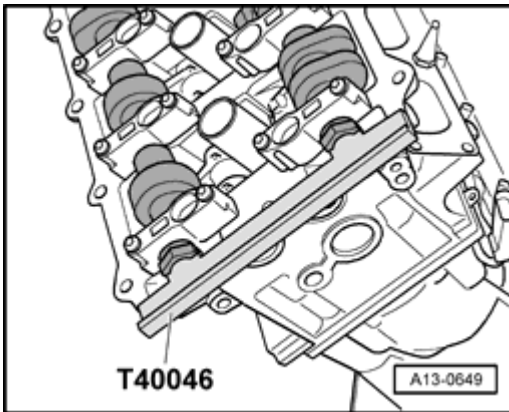


Fig. 236: Removing/Inserting Camshaft Locator T40046 From/Into Camshafts Of Right Cylinder Head
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Insert camshaft locator T40046 into camshafts of right cylinder head, to do so rotate camshafts back or forth at hex head if necessary.
- Replace all four camshaft bolts.

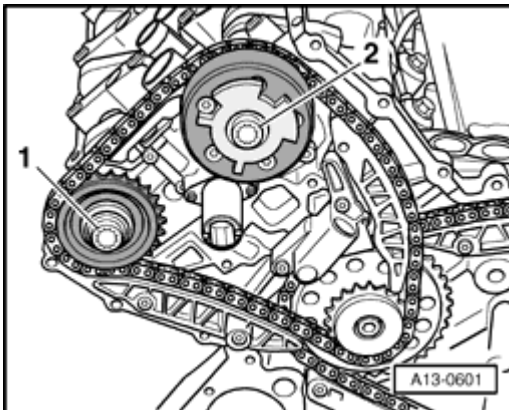


Fig. 237: Removing/Installing Bolts For Camshaft Chain Sprocket Or Camshaft Adjuster Using Multipoint Socket T10035
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Replace diamond disc between camshaft and left cylinder head camshaft adjuster.
- Assemble left timing chain with chain sprocket and camshaft adjuster.
- Loosely install bolts - 1 - and - 2 -.
- Chain sprocket and camshaft adjuster must be able to still be rotated on camshaft and must not tip.

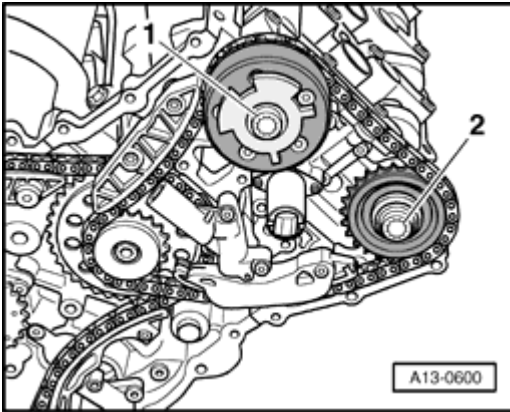


Fig. 238: Removing/Installing Bolts For Camshaft Chain Sprocket Or Camshaft Adjuster Using Multipoint Socket T10035

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Replace diamond disc between camshafts and right cylinder head camshaft adjuster.
- Assemble right timing chain with chain sprocket and camshaft adjuster.
- Loosely install bolts - 1 - and - 2 -.
- Chain sprocket and camshaft adjuster must be able to still be rotated on camshaft and must not tip.

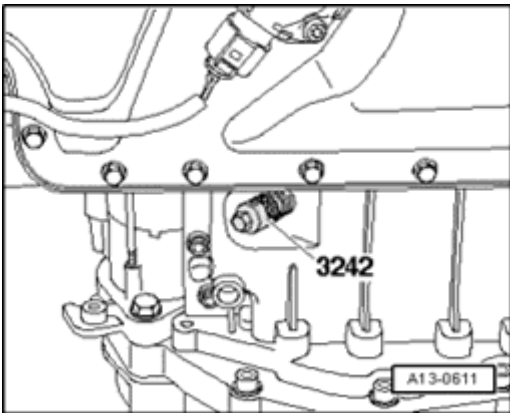


Fig. 239: Removing/Installing Crankshaft Holder 3242 Into Hole

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove crankshaft holder 3242.

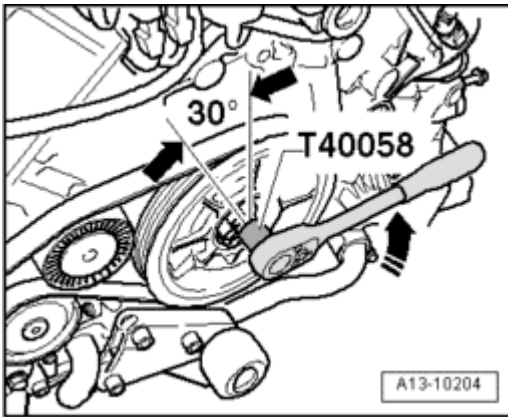


Fig. 240: Using Socket T40058 To Rotate Crankshaft In Opposite Direction Of Engine Rotation
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Using Socket T40058 , rotate crankshaft approx. 30° in opposite direction of engine rotation - **arrow** -.
- Pull drill out of alignment hole, which loosens left chain tensioner.

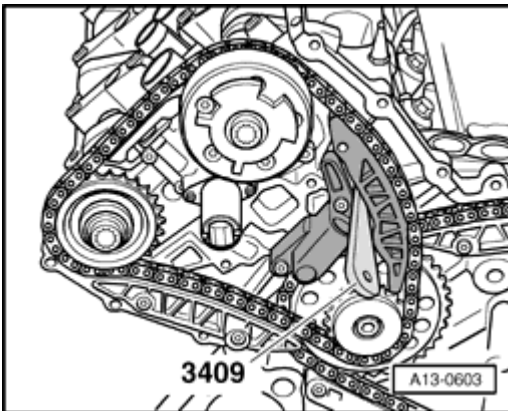


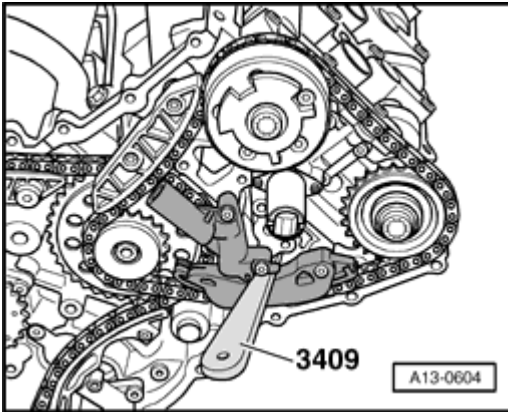
Fig. 241: Inserting Trim Removal Wedge 3409
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Insert trim removal wedge 3409 as depicted in illustration and bring chain tensioner into contact with trim removal wedge 3409.

NOTE:

- **Lightly pressing in an extra 0.5 mm is permitted.**

- Pull drill out of alignment hole, which loosens right chain tensioner.

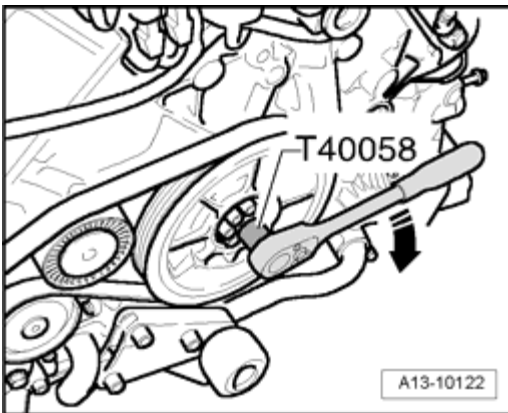
**Fig. 242: Insert Trim Removal Wedge 3409**

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Insert trim removal wedge 3409 as depicted in illustration and bring chain tensioner into contact with trim removal wedge 3409.

NOTE:

- Lightly pressing in an extra 0.5 mm is permitted.

**Fig. 243: Using Socket T40058 To Rotate Crankshaft In Direction Of Engine Rotation To TDC Ignition Timing**

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Using Socket T40058 , rotate crankshaft in direction of engine rotation - **arrow** - to TDC ignition timing.

NOTE:

- If rotated unintentionally beyond TDC, turn back crankshaft again approx. 30° and set to TDC again.

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ENGINE 4.2 Liter V8 4V Engine Mechanical, Engine Code(s): BAT, BNK

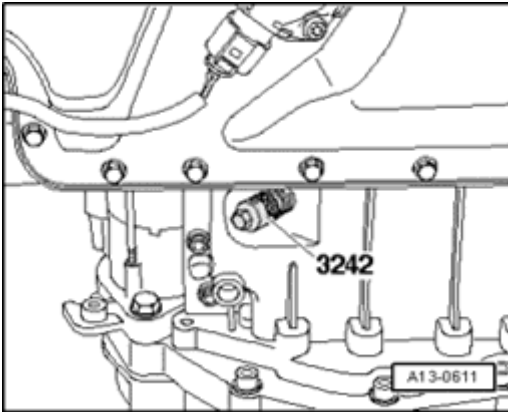


Fig. 244: Removing/Installing Crankshaft Holder 3242 Into Hole
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Install crankshaft holder 3242 into hole, if necessary rotate crankshaft very slightly back and forth to completely center the holder. Torque specification: 20 Nm.

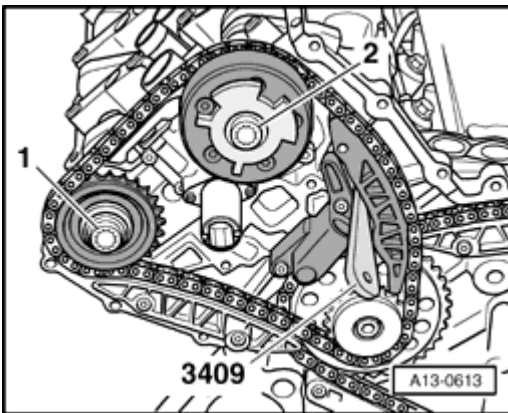


Fig. 245: Tightening Camshaft Bolt On Exhaust Camshaft Of Left Cylinder Head To Initial Tightening Torque
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Tighten camshaft bolt - 1 - on exhaust camshaft of left cylinder head to initial tightening torque. Torque specification: 40 Nm.

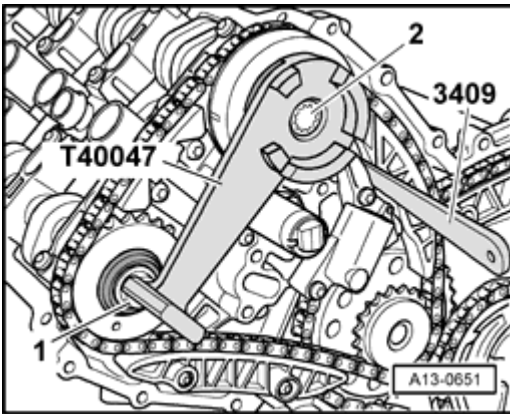


Fig. 246: Securing Hall Sensor Wheel On Camshaft Adjuster Of Intake Camshaft Of Left Cylinder Head Using Setting Gauge T40047

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Secure Hall sensor wheel on camshaft adjuster of intake camshaft of left cylinder head using setting gauge T40047.
- Place setting gauge T40047 on bolt - 1 -.
- Tighten camshaft bolt - 2 - on intake camshaft to initial tightening torque. Torque specification: 40 Nm.

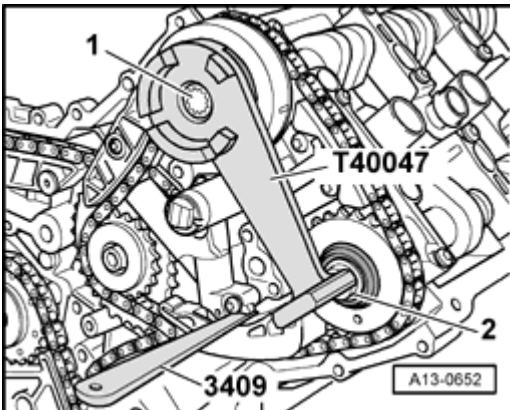


Fig. 247: Securing Hall Sensor Wheel On Camshaft Adjuster Of Intake Camshaft Of Right Cylinder Head Using Setting Gauge T40047

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Secure Hall sensor wheel on camshaft adjuster of intake camshaft of right cylinder head using setting gauge T40047.
- Place setting gauge T40047 on bolt - 2 -.
- Tighten camshaft bolt - 1 - on intake camshaft to initial tightening torque. Torque specification: 40 Nm.
- Remove setting gauge.

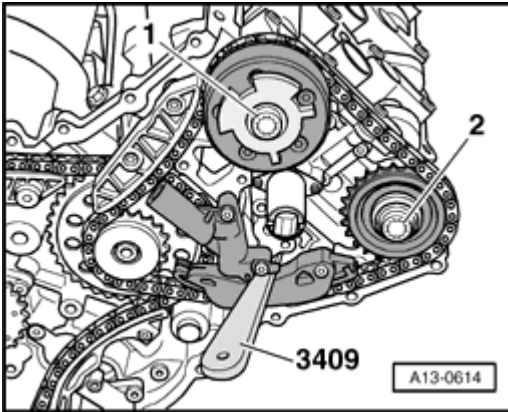


Fig. 248: Tightening Camshaft Bolt On Exhaust Camshaft Of Right Cylinder Head To Initial Tightening Torque

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Tighten camshaft bolt - 2 - on exhaust camshaft of right cylinder head to initial tightening torque. Torque specification: 40 Nm.

NOTE:

- Camshaft locators T40046 must not be used as counter holder for final tightening of camshaft bolts.

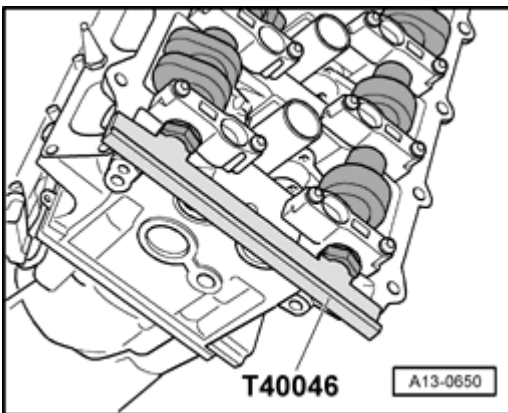


Fig. 249: Removing/Installing Camshaft Locator T40046

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove camshaft locators T40046 on both cylinder heads.

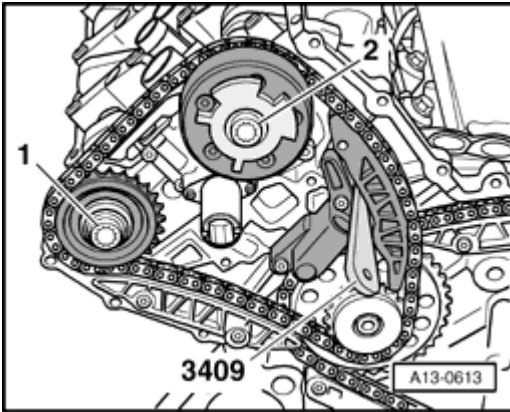


Fig. 250: Tightening Camshaft Bolt On Exhaust Camshaft Of Left Cylinder Head To Initial Tightening Torque

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Tighten camshaft bolt - **1** - on exhaust camshaft of left cylinder head to final tightening torque. Torque specification: 100 Nm plus an additional $\frac{1}{4}$ turn (90°).

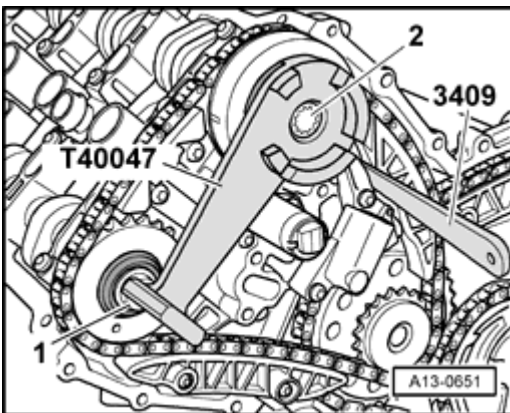


Fig. 251: Securing Hall Sensor Wheel On Camshaft Adjuster Of Intake Camshaft Of Left Cylinder Head Using Setting Gauge T40047

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Secure Hall sensor wheel on camshaft adjuster of intake camshaft of left cylinder head using setting gauge T40047.
- Place setting gauge T40047 on bolt - **1** -.
- Tighten camshaft bolt - **2** - on intake camshaft to final tightening torque. Torque specification: 100 Nm plus an additional $\frac{1}{4}$ turn (90°).

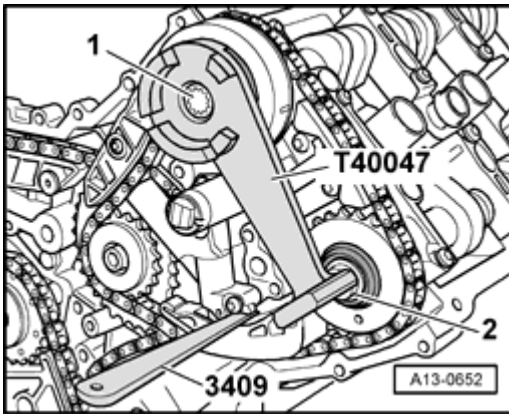


Fig. 252: Securing Hall Sensor Wheel On Camshaft Adjuster Of Intake Camshaft Of Right Cylinder Head Using Setting Gauge T40047

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Secure Hall sensor wheel on camshaft adjuster of intake camshaft of right cylinder head using setting gauge T40047.
- Place setting gauge T40047 on bolt - 2 -.
- Tighten camshaft bolt - 1 - on intake camshaft to final tightening torque. Torque specification: 100 Nm plus an additional $\frac{1}{4}$ turn (90°).
- Remove setting gauge.

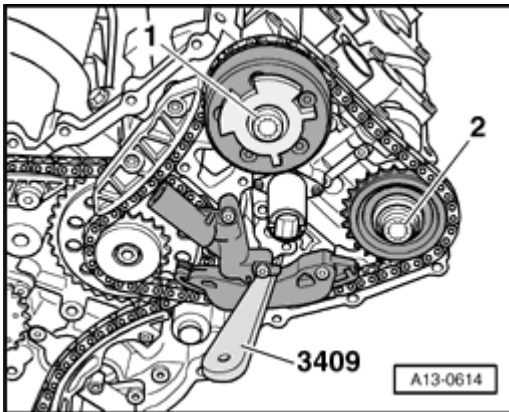


Fig. 253: Tightening Camshaft Bolt On Exhaust Camshaft Of Right Cylinder Head To Initial Tightening Torque

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Tighten camshaft bolt - 2 - on exhaust camshaft of right cylinder head to final tightening torque. Torque specification: 100 Nm plus an additional $\frac{1}{4}$ turn (90°).

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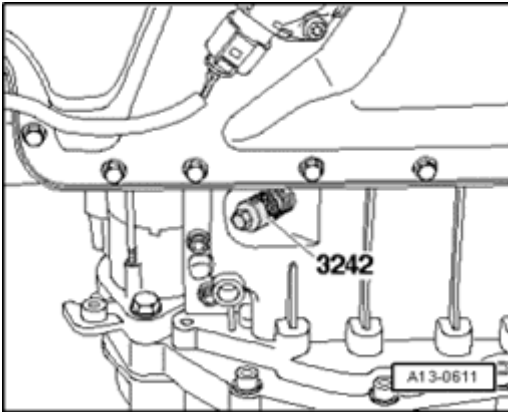


Fig. 254: Removing/Installing Crankshaft Holder 3242 Into Hole
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove crankshaft holder 3242.

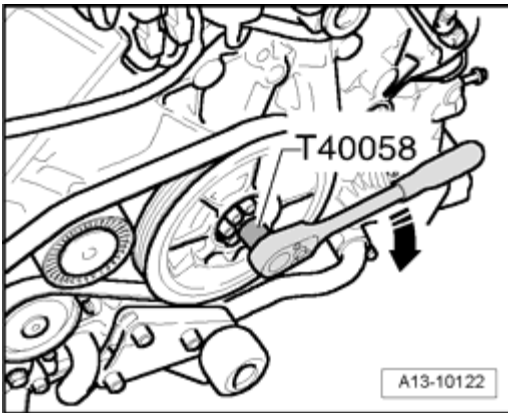


Fig. 255: Using Socket T40058 Turn Crankshaft Two Complete Rotations In Direction Of Engine Rotation Until Crankshaft Stands At TDC
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Using Socket T40058 turn crankshaft two complete rotations in direction of engine rotation - **arrow** - until crankshaft stands at TDC again.

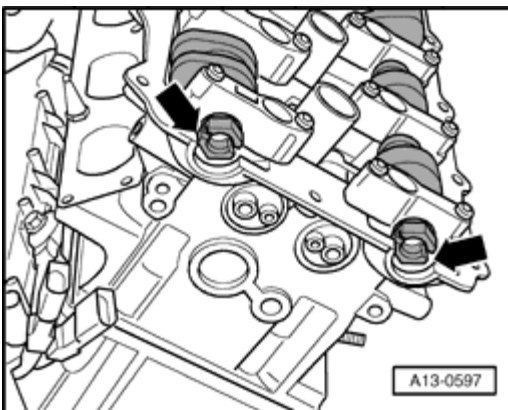
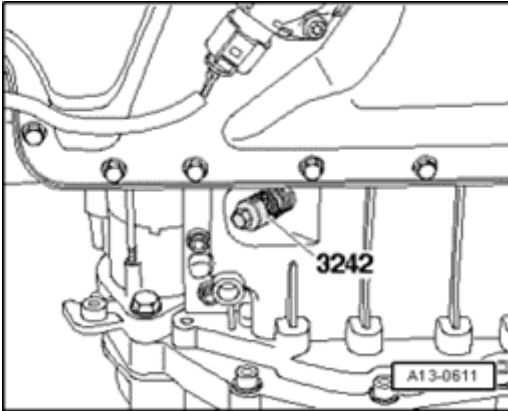


Fig. 256: Identifying Slits At Front In Camshafts Stand Parallel At Same Height With Upper Edge Of Cylinder Head

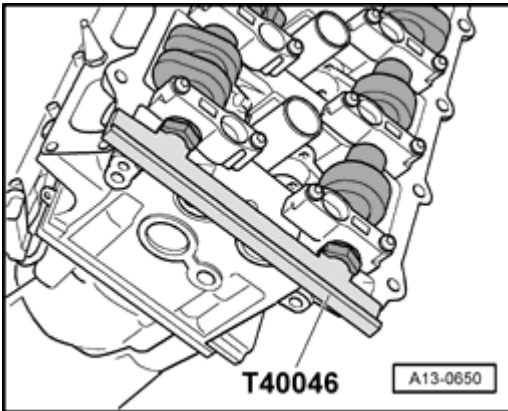
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Slits - **arrows** - at front in camshafts must stand parallel at same height with upper edge of cylinder head.

**Fig. 257: Removing/Installing Crankshaft Holder 3242 Into Hole**

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Install crankshaft holder 3242 into hole (20 Nm), if necessary rotate crankshaft very slightly back and forth to completely center holder.

**Fig. 258: Removing/Installing Camshaft Locator T40046**

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Insert camshaft locator T40046 into camshafts of left cylinder head.

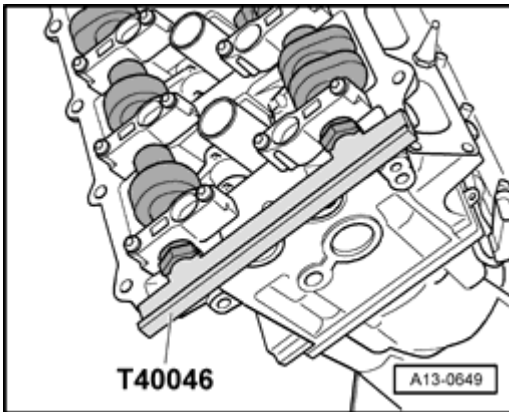


Fig. 259: Removing/Inserting Camshaft Locator T40046 From/Into Camshafts Of Right Cylinder Head
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Insert camshaft locator T40046 into camshafts of right cylinder head.

NOTE:

- If camshaft locators T40046 cannot be inserted, repeat adjustment.

- Pull out trim removal wedge 3409.
- Remove camshaft locators T40046 on both cylinder heads.
- Remove crankshaft holder 3242.
- Install sealing plug of TDC marking with new sealing ring into upper section of oil pan.

Further installation is in reverse order of removal, note the following:

- Install covers for timing chains **Installing**.
- Bolt transmission to engine and install engine/transmission unit --> **Engine, installing**.

Torque specifications

Component	Nm
Camshaft bolts	100 + 90° * See note* See note
Sealing plug in upper section of oil pan	35

* 90° corresponds to a 1/4 turn

*Replace bolts.

Drive chain for timing mechanism, component overview

NOTE:

- Before removing timing chain, mark direction of travel with paint. Reversing rotation direction of a used chain can destroy it.

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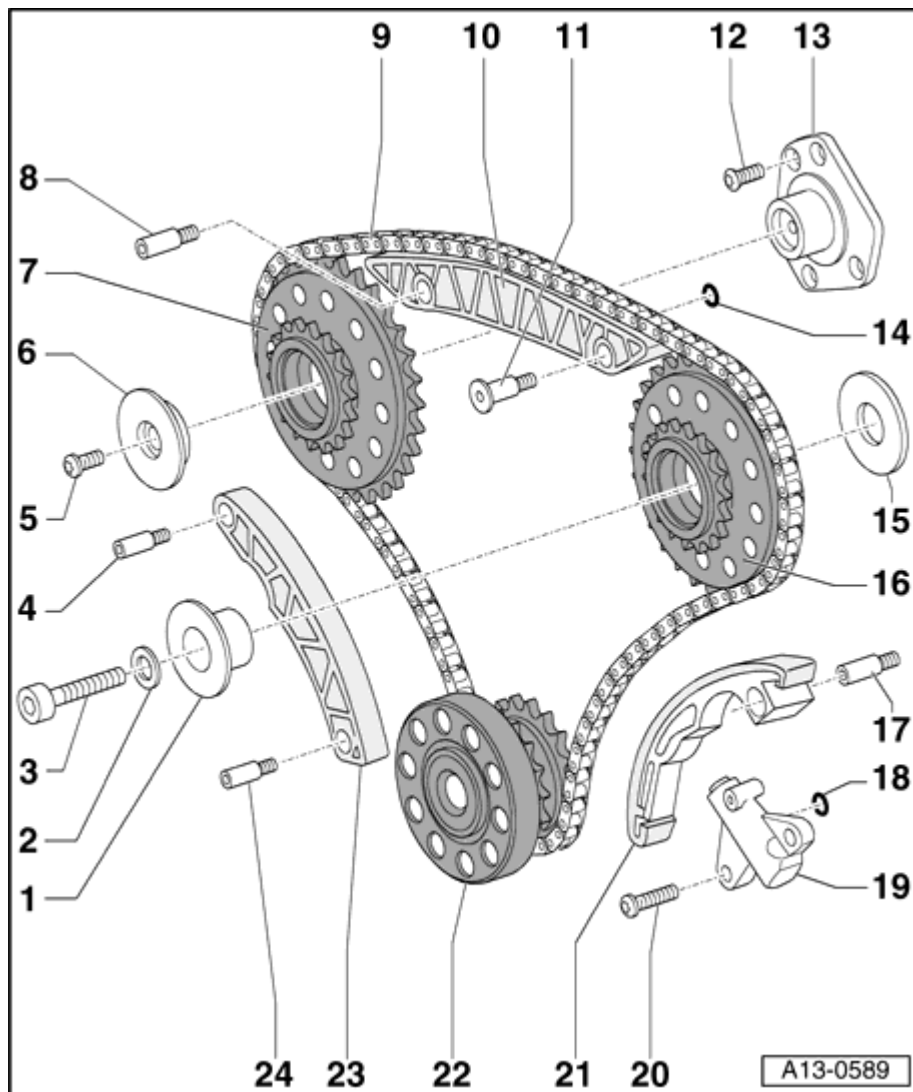


Fig. 260: Drive Chain For Timing Mechanism, Component Overview
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Mounting pin

- For drive sprocket

2 - Washer

3 - 42 Nm

4 - Pivot pin - 10 Nm

5 - 5 Nm plus an additional $\frac{1}{4}$ turn (90°)

- Replace

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6 - Thrust washer

- For drive sprocket

7 - Drive sprocket

- For left timing chain

8 - Pivot pin - 10 Nm

9 - Drive chain

- For timing mechanism

10 - Guide rail

11 - Pivot pin - 10 Nm

12 - 10 Nm

13 - Bracket

- For drive sprocket

14 - O-ring

- Replace

15 - Thrust washer

16 - Drive sprocket

- For right timing chain

17 - Pivot pin - 10 Nm

18 - O-ring

- Replace

19 - Chain tensioner

20 - 10 Nm

21 - Guide rail

22 - Crankshaft

23 - Guide rail

24 - Pivot pin - 10 Nm

Drive chain for timing mechanism, removing and installing

Removing

- Remove camshaft timing chains --> **Camshaft timing chain, removing and installing.**
- Remove chain for power take-off --> **Chain for power take-off, removing and installing.**

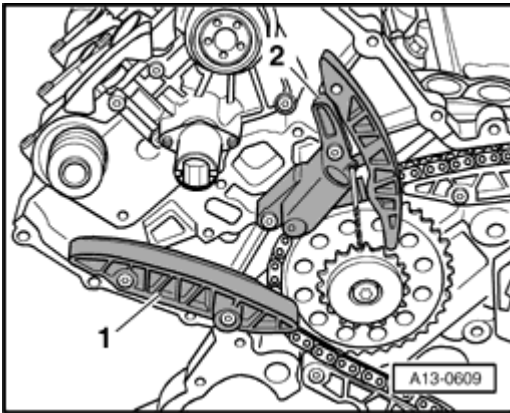


Fig. 261: Removing Glide Track At Left Cylinder Head & Chain Tensioner
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove glide track - 1 - at left cylinder head.
- Remove chain tensioner - 2 -.

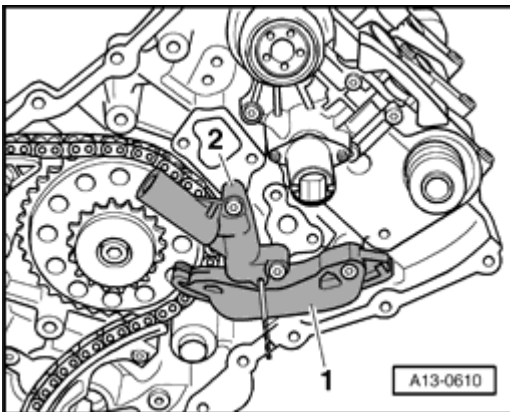


Fig. 262: Removing Glide Track At Right Cylinder Head & Chain Tensioner
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove glide track - 1 - at right cylinder head.

- Remove chain tensioner - **2** -.

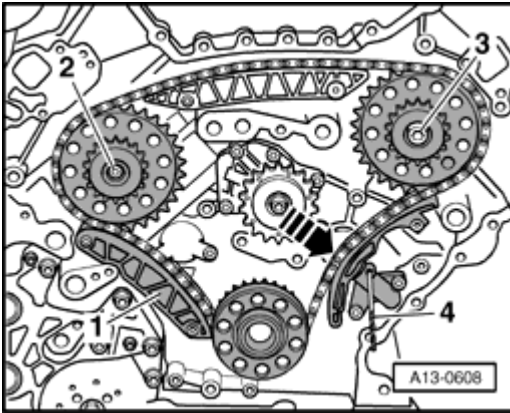


Fig. 263: Pushing Glide Track Of Chain Tensioner For Chain Drive And Pull
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Push glide track of chain tensioner for chain drive in direction of - **arrow** - and pull off chain tensioner using a drill bit - **4** - 3.3 mm dia.
- Mark running direction of timing chain with paint.
- Remove bolts - **2** - and - **3** - and remove chain sprockets with drive chain and glide track - **1** -.

Installing

Installation is in reverse order of removal, note the following:

NOTE:

- **Replace bolts which have been tightened to torque.**

- Install chain for power take-off --> **Chain for power take-off, removing and installing.**
- Install camshaft timing chains **Installing.**

Torque specifications

Component	Nm
Left drive sprocket to mounting bracket	5 + 90° * See note* See note
Right drive sprocket to cylinder block	42
Chain tensioner for left camshaft timing chain to cylinder head	5 + 90° * See note* See note
Chain tensioner for right camshaft timing chain to cylinder head	5 + 90° * See note* See note

* 90° corresponds to a 1/4 turn

*Replace bolts.

POWER TAKE-OFF

Chain for power take-off, component overview

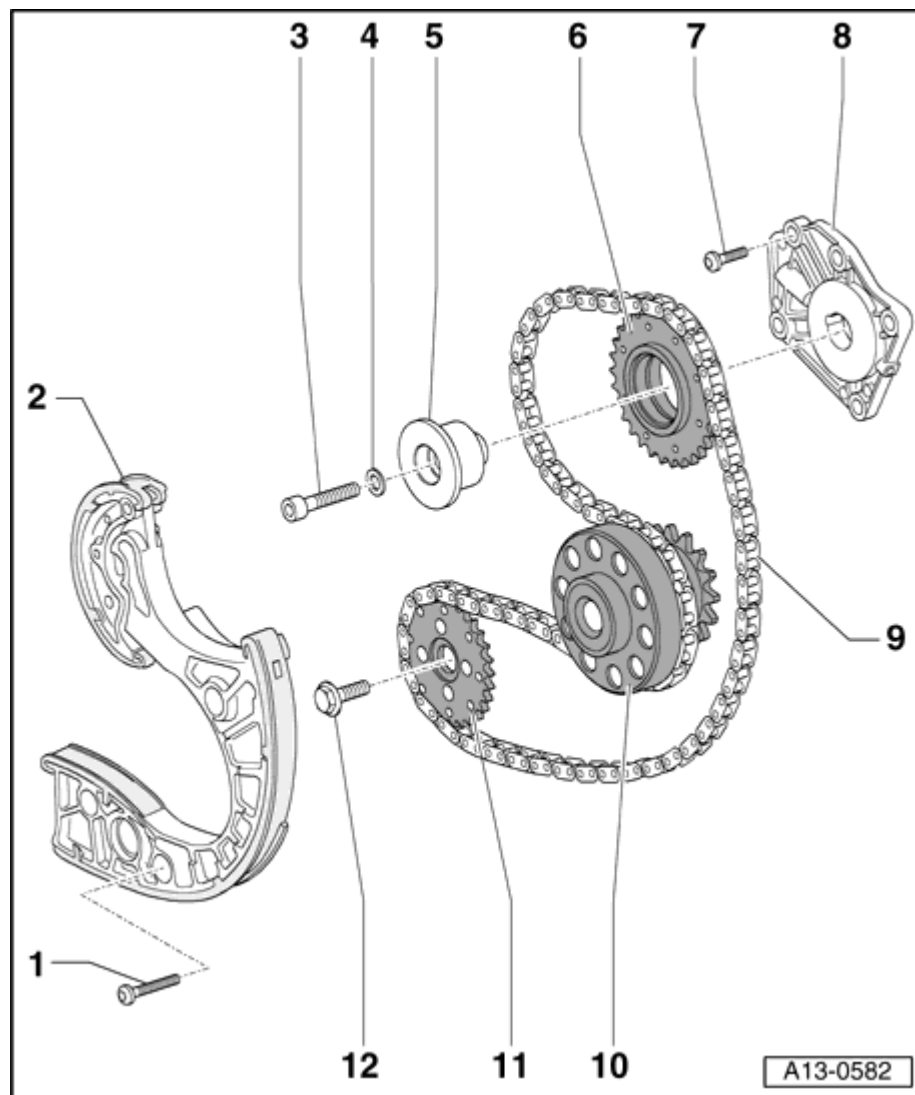


Fig. 264: Chain For Power Take-Off, Component Overview
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - 10 Nm

2 - Chain tensioner

- With glide track

3 - 42 Nm

4 - Washer

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5 - Mounting pin

- For idler sprocket

6 - Idler sprocket

- For chain for power take-off

7 - 10 Nm

8 - Bracket

- For idler sprocket

9 - Chain

- For power take-off
- Removing and installing --> **Chain for power take-off, removing and installing**

10 - Crankshaft

11 - Drive sprocket

- For power take-off

12 - 62 Nm

Chain for power take-off, removing and installing

Removing

- Drain engine oil --> **01 - MAINTENANCE** .
- Remove engine --> **Engine, removing and installing**.
- Separate engine/transmission unit --> **Engine and transmission, separating**.
- Remove camshaft timing chains from camshafts --> **Camshaft timing chains, removing from camshafts**.
- Remove drive plate --> **Drive plate, removing and installing**.
- Remove covers for timing chains --> **Timing chain covers, removing and installing**.

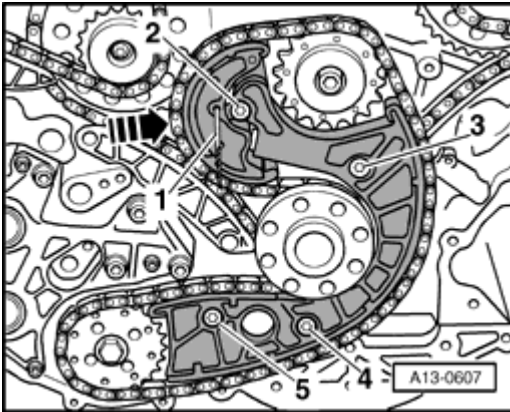


Fig. 265: Pushing Glide Track Of Chain Tensioner And Pulling Off Chain Tensioner
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Push glide track of chain tensioner in direction of - **arrow** - and pull off chain tensioner using a drill bit - **1** - 3.3 mm dia.

NOTE:

- If chain sprocket for power take-off is to be removed, mounting bolt must be loosened before removing chain.

- Mark running direction of chain for power take-off with paint.
- Remove bolts - **2 to 5** - and remove chain tensioner.
- Remove chain for power take-off.

Installing

Installation is performed in the reverse order of removal, noting the following:

NOTE:

- Replace bolts which have been tightened to torque.

- First install chain for power take-off.
- Install chain tensioner (starting at top) on engine.
- Install covers for timing chains **Installing**.
- Install drive plate --> **Drive plate, removing and installing**.
- Bolt transmission to engine and install engine/transmission unit --> **Engine, installing**.

Torque specifications

Component	Nm
Chain tensioner on cylinder block	10

Power take-off, component overview

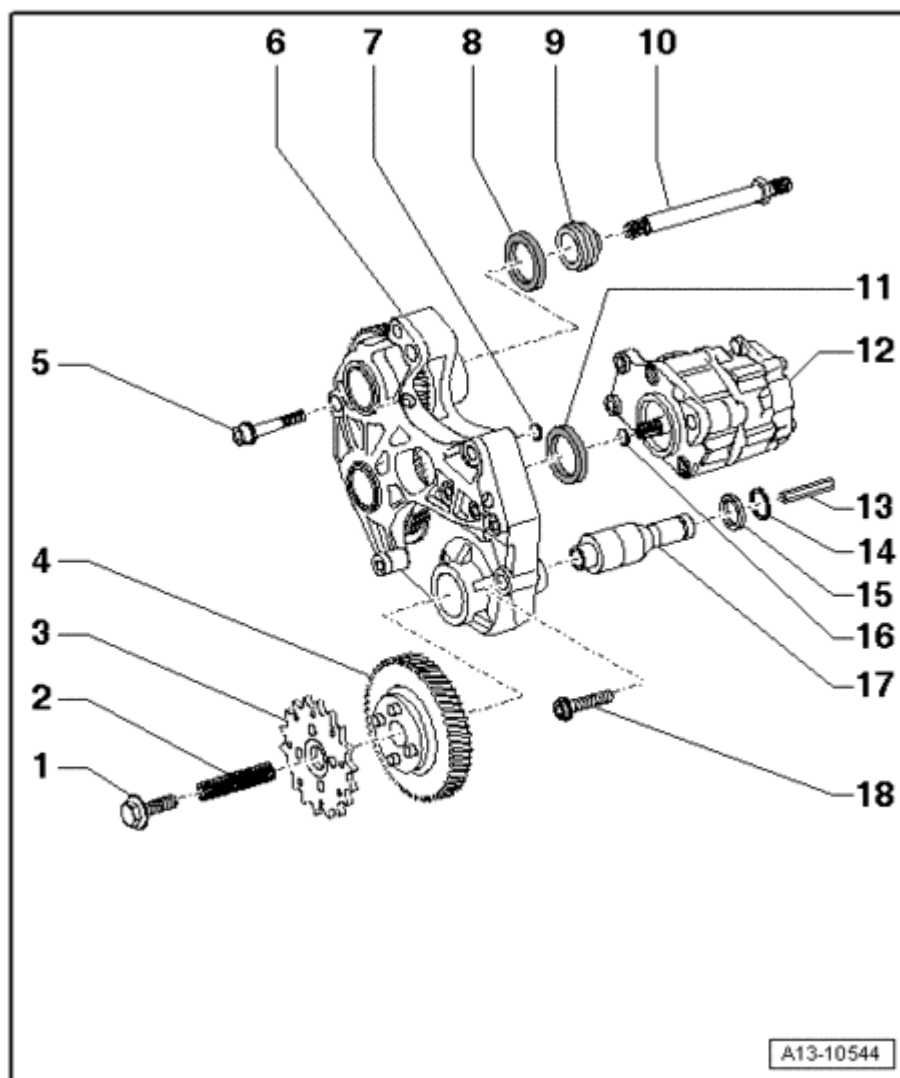


Fig. 266: Power Take-Off, Component Overview
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - 62 Nm

2 - Spring

3 - Drive sprocket

- For power take-off

4 - Drive spur gear

- For power take-off

5 - 22 Nm

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ENGINE 4.2 Liter V8 4V Engine Mechanical, Engine Code(s): BAT, BNK

6 - Spur gear unit

7 - O-ring

- Replace

8 - Seal

- For A/C compressor drive
- Replacing --> **Seals for power take-off, replacing.**

9 - Protective dust cap

- For A/C compressor drive

10 - Input shaft

- For air conditioning compressor
- Tighten to 60 Nm

11 - Seal

- For power steering pump drive
- Replacing --> **Seals for power take-off, replacing.**

12 - Power-steering pump

13 - Input shaft

- For oil pump

14 - Circlip

15 - Thrust washer

16 - O-ring

- Replace

17 - Shaft for drive spur gear

18 - Fitting bolt - 22 Nm

Seals for power take-off, replacing

2006 Audi A6 Quattro

ENGINE 4.2 Liter V8 4V Engine Mechanical, Engine Code(s): BAT, BNK

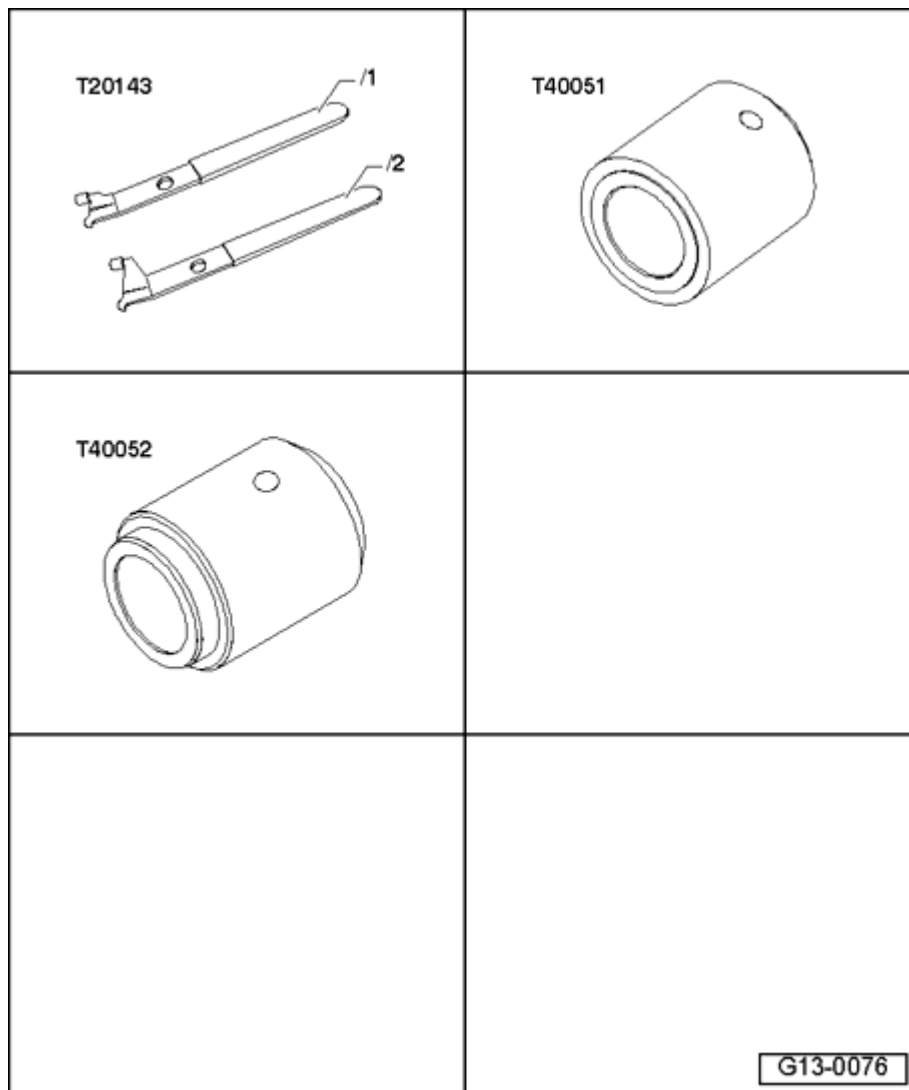


Fig. 267: Identifying Special Tools - Seals For Power Take-Off, Replacing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools, testers and auxiliary items required

- Extractor hook T20143/1
- Pressure piece T40051
- Pressure piece T40052

Work procedure

- Remove air conditioning compressor --> **87 - AIR CONDITIONING** .
- Remove power steering pump --> **48 - STEERING** .

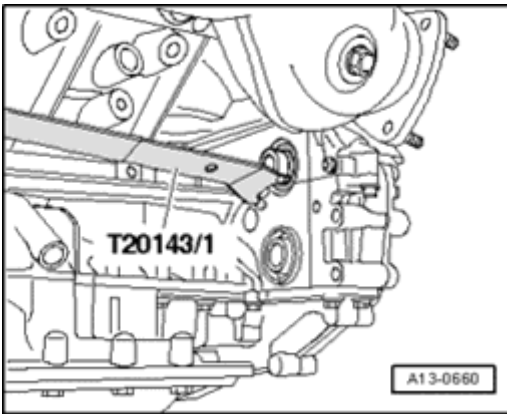


Fig. 268: Prying Out Sealing Ring For A/C Compressor Drive Using Pulling Hook T20143/1
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Pry out sealing ring for A/C compressor drive using extractor lever T20143/1.

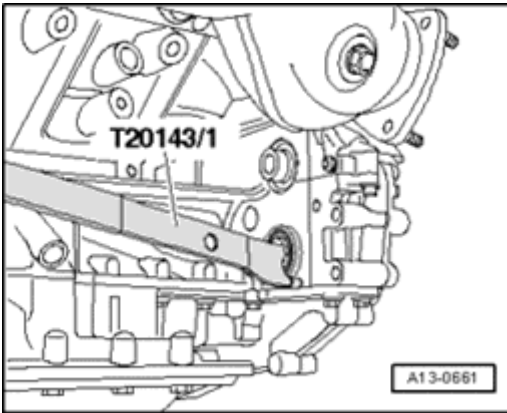


Fig. 269: Prying Out Power-Steering Pump Drive Seal Using Pulling Hook T20143/1
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Pry out power steering pump drive seal using Extractor Lever T20143/1.

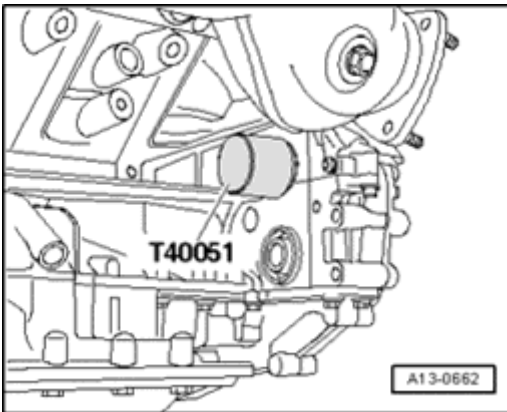


Fig. 270: Driving In Sealing Ring For A/C Compressor Drive Using Thrust Piece T40051
Courtesy of VOLKSWAGEN UNITED STATES, INC.

2006 Audi A6 Quattro

ENGINE 4.2 Liter V8 4V Engine Mechanical, Engine Code(s): BAT, BNK

- Drive in seal for A/C compressor drive using thrust piece T40051.

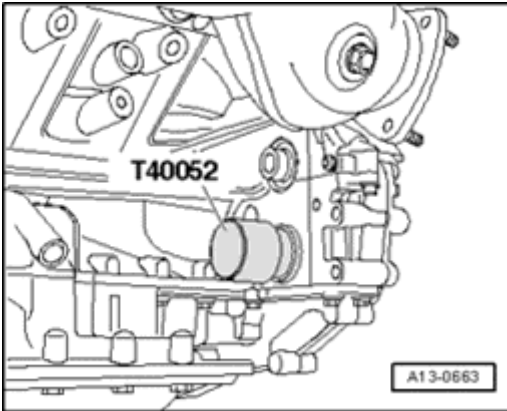


Fig. 271: Driving In Sealing Ring For Power-Steering Pump Drive Using Thrust Piece T40052
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Drive in sealing ring for power-steering pump drive using thrust piece T40052.

Further installation is in reverse order of removal, note the following:

- Install power steering pump --> **48 - STEERING** .
- Install A/C compressor --> **87 - AIR CONDITIONING** .

Spur gear unit, removing and installing

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ENGINE 4.2 Liter V8 4V Engine Mechanical, Engine Code(s): BAT, BNK

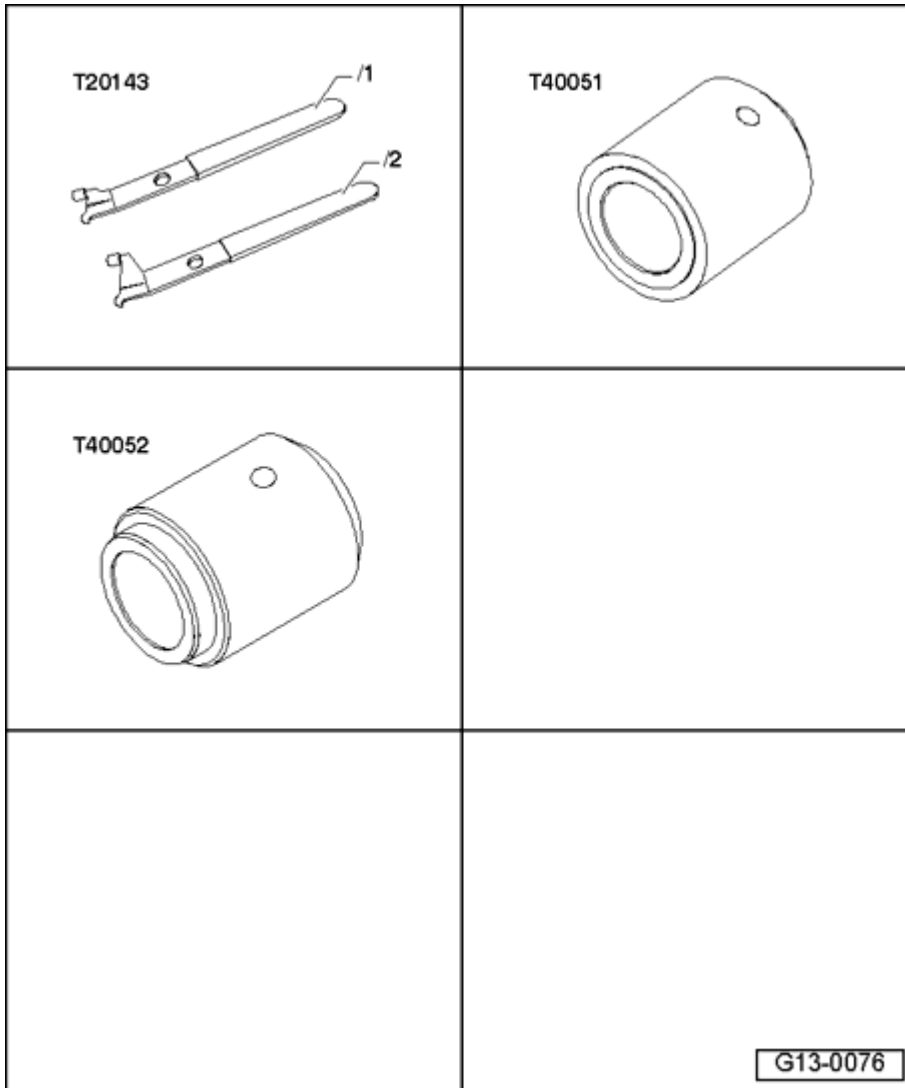


Fig. 272: Identifying Special Tools - Spur Gear Unit, Removing And Installing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools, testers and auxiliary items required

- Extractor hook T20143
- Pressure piece T40051
- Pressure piece T40052
- Sealant

Removing

- Drain engine oil --> **01 - MAINTENANCE** .
- Remove engine --> **Engine, removing and installing.**
- Separate engine/transmission unit --> **Engine and transmission, separating.**

- Remove drive plate --> **Drive plate, removing and installing.**
- Remove covers for timing chains --> **Timing chain covers, removing and installing.**
- Remove power-steering pump from cylinder block.

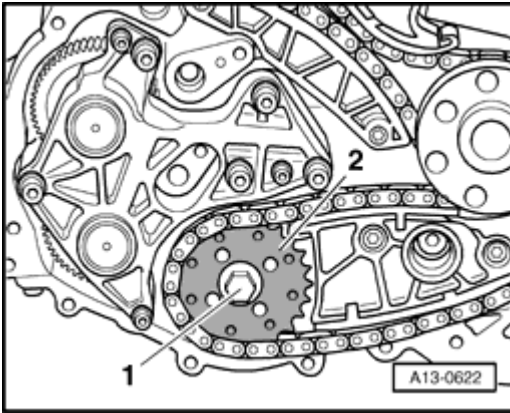


Fig. 273: Loosening/Tightening Bolt On Drive Sprocket
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Loosen bolt - 1 - on drive sprocket - 2 - a few turns.
- Remove chain for power take-off --> **Chain for power take-off, removing and installing.**
- Remove drive sprocket for power take-off.

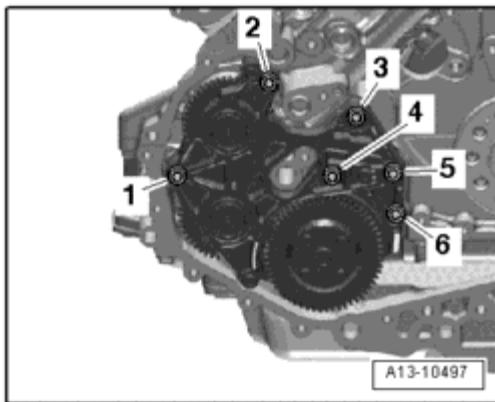


Fig. 274: Positioning Spur Gear Unit And Tightening Bolts In Diagonal Sequence In Stages
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts - 1 to 6 -.
- Remove spur gear unit.

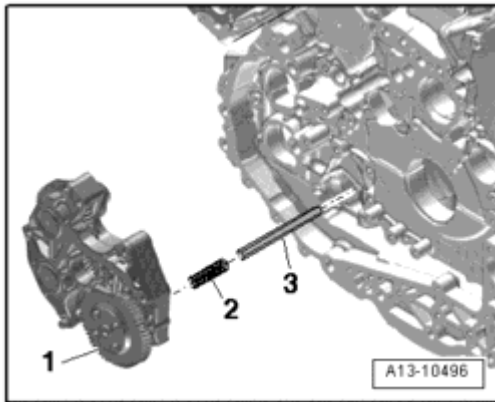


Fig. 275: Positioning Compress Spring For Input Shaft In Spur Gear Unit
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove compression spring - 2 - between spur gear unit - 1 - and oil pump input shaft - 3 -.

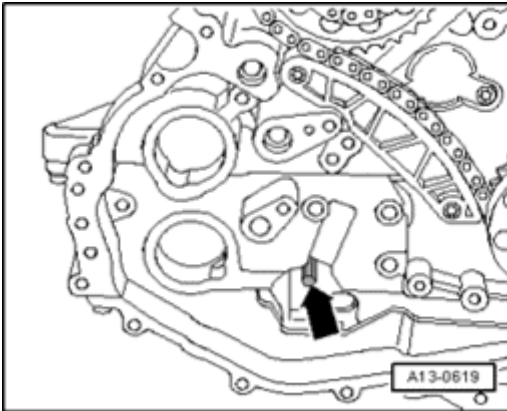


Fig. 276: Removing/Installing Drive Shaft For Oil Pump
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove drive shaft - **arrow** - for oil pump.

Installing

NOTE:

- **Replace seals and O-rings.**

- Remove A/C compressor drive seal - 2 - and power steering pump drive seal - 3 - using pulling hook T20143/1.

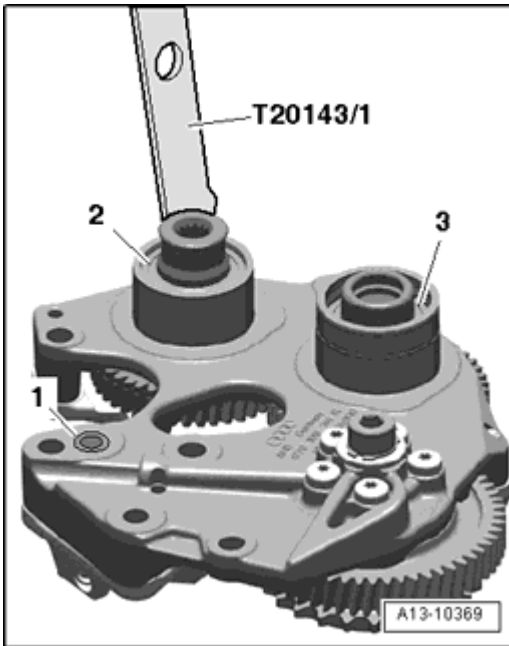


Fig. 277: Removing A/C Compressor Drive Seal And Power Steering Pump Drive Seal Using Pulling Hook T20143/1

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove O-ring - 1 -.
- Remove sealant residue on spur gear unit and cylinder block.
- Clean sealing surfaces so they are completely free of any oil or grease.

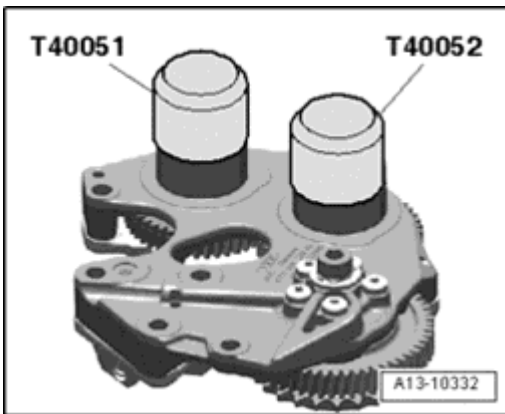


Fig. 278: Driving In Sealing Ring For A/C Compressor Drive Using Thrust Piece T40051 & Sealing Ring For Power-Steering Pump Drive Using Thrust Piece T40052

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Drive in sealing ring for A/C compressor drive using thrust piece T40051.
- Drive in sealing ring for power-steering pump drive using thrust piece T40052.

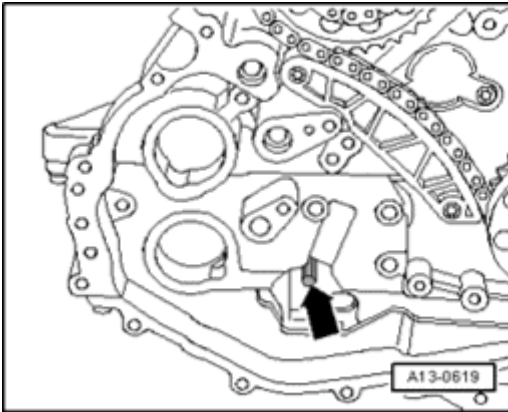


Fig. 279: Removing/Installing Drive Shaft For Oil Pump
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Insert drive shaft - **arrow** - for oil pump into guide on oil pump.

NOTE:

- To guarantee that the drive shaft engages correctly in the oil pump, insert drive shaft into oil pump separately, do not install together with front bearing cap.

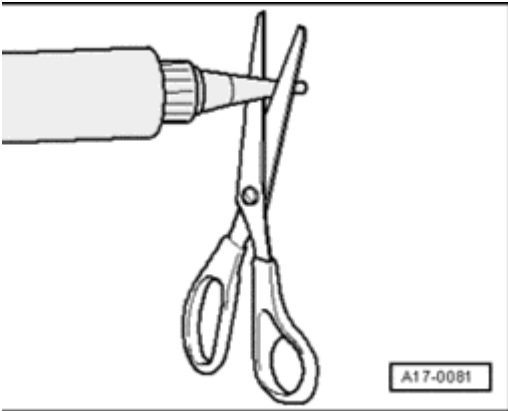


Fig. 280: Cutting Tube Nozzle At Front Marking
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Cut off nozzle on tube of sealant at front mark (dia. of nozzle approx. 1.5 mm).

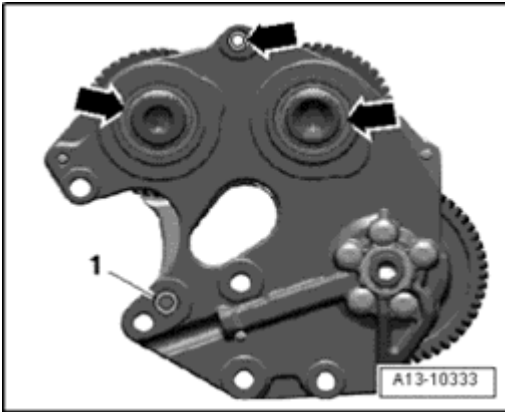


Fig. 281: Applying Sealant Beads To Clean Sealing Surfaces Of Spur Gear Unit
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Apply sealant beads - **arrows** - to clean sealing surfaces of spur gear unit as shown in illustration.
- Thickness of sealant beads: 2.0 mm.
- Position O-ring - **1** - and secure it with some grease.

NOTE:

- **The spur gear unit must be installed within 5 minutes after application of sealant.**

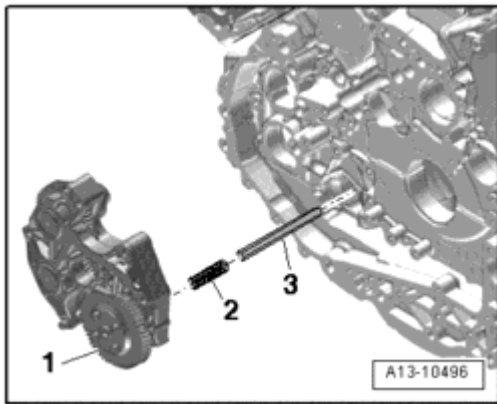


Fig. 282: Positioning Compress Spring For Input Shaft In Spur Gear Unit
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Position compress spring - **2** - for input shaft - **3** - in spur gear unit - **1** -.

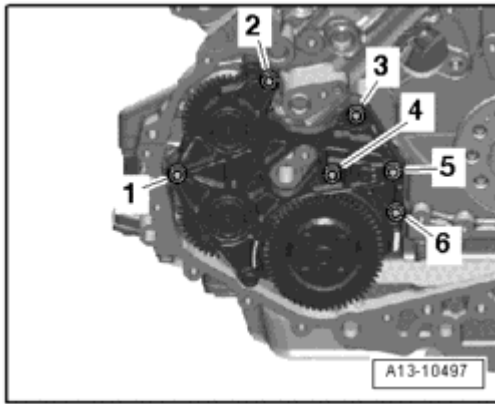


Fig. 283: Positioning Spur Gear Unit And Tightening Bolts In Diagonal Sequence In Stages
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Position spur gear unit and tighten bolts - **1 to 6** - in a diagonal sequence in stages.

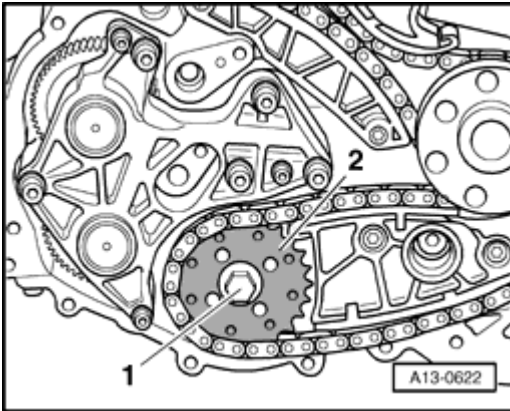


Fig. 284: Loosening/Tightening Bolt On Drive Sprocket
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Hand tighten power take-off drive sprocket - **2** -.
- Install chain for power take-off --> **Chain for power take-off, removing and installing.**
- Tighten power take-off drive sprocket bolt - **1** -.
- Slide power steering pump with new O-ring onto spur gear for power-steering pump drive.

Further installation is in reverse order of removal, note the following:

- Install covers for timing chains **Installing.**
- Install drive plate --> **Drive plate, removing and installing.**
- Bolt transmission to engine and install engine/transmission unit --> **Engine, installing.**
- Add engine oil and check oil level --> **01 - MAINTENANCE** .

Torque specifications

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ENGINE 4.2 Liter V8 4V Engine Mechanical, Engine Code(s): BAT, BNK

Component	Nm
Spur gear unit to cylinder block	22
Drive sprocket for power take-off to shaft	62

CRANKSHAFT, REMOVING AND INSTALLING

Crankshaft, component overview

NOTE:

- To perform assembly work, secure engine with V8 engine holder VAS 6095/1-6 or VAS 6095/1-6A to Engine and Transmission Holder VAS 6095 -- > Engine, securing to assembly stand.

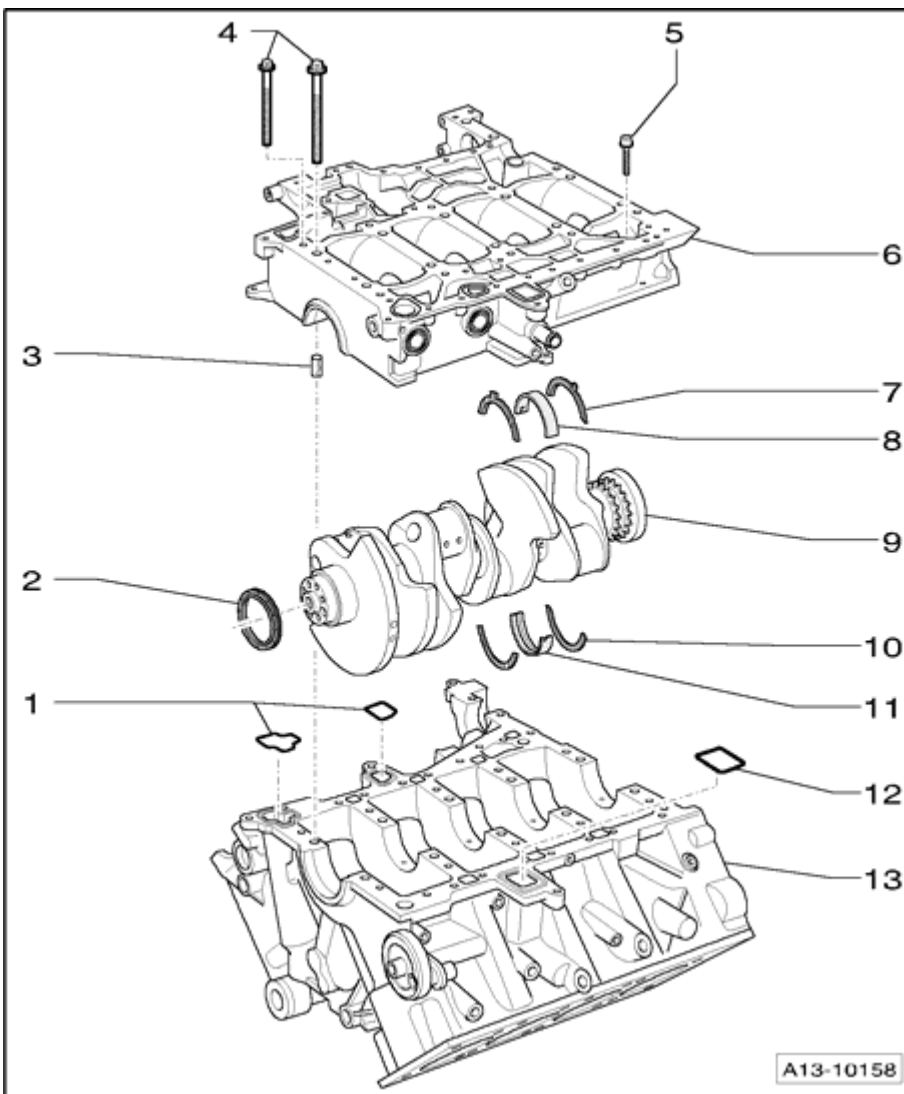


Fig. 285: Crankshaft, Component Overview

Courtesy of VOLKSWAGEN UNITED STATES, INC.

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ENGINE 4.2 Liter V8 4V Engine Mechanical, Engine Code(s): BAT, BNK

1 - Seals

- Replace

2 - Seal for crankshaft (ribbed belt side)

- Replacing --> **Seal for crankshaft (ribbed belt side), replacing.**

3 - Alignment bushing

- 3 pieces
- Insert into guide frame
- Installed location **Sealant applied on cylinder block (for guide frame)**

4 - Screws

- For guide frame
- Replace
- Different bolt sizes
- Tightening order **Installing guide frame**

5 - Bolt

- For sealing surfaces of cylinder block/guide frame
- Different bolt lengths
- Tightening order **Installing guide frame**

6 - Bearing bracket

- Sealant applied on cylinder block (for guide frame) **Sealant applied on cylinder block (for guide frame)**
- Tightening sequence for manifold mounting bolts **Installing guide frame**

7 - Thrust washer

- Only at 4th crankshaft bearing
- Lubricating grooves face outward
- Note locating point in guide frame
- Measuring crankshaft axial clearance --> **Axial clearance, measuring**

8 - Bearing shell

- For guide frame without lubricating groove

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- Insert new bearing shells for guide frame with proper color marking --> **Allocation of main bearing shells for new crankshafts** or --> **Allocation of main bearing shells for used and reworked crankshafts**

9 - Crankshaft

- Measuring axial play --> **Axial clearance, measuring**
- Radial clearance, measuring --> **Radial clearance, measuring**
- Do not turn crankshaft when measuring radial play
- Crankshaft dimensions --> **Crankshaft dimensions**

10 - Thrust washer

- Only at 4th crankshaft bearing
- Lubricating grooves face outward
- Measuring crankshaft axial clearance --> **Axial clearance, measuring**

11 - Bearing shell

- For cylinder block with oil groove
- Do not interchange used bearing shells (mark)
- Insert new bearing shells for cylinder block with proper color marking --> **Allocation of main bearing shells for new crankshafts** or --> **Allocation of main bearing shells for used and reworked crankshafts**

12 - Gasket

- Replace

13 - Cylinder block

- Sealant applied on cylinder block (for guide frame) **Sealant applied on cylinder block (for guide frame)**

Sealant applied on cylinder block (for guide frame)

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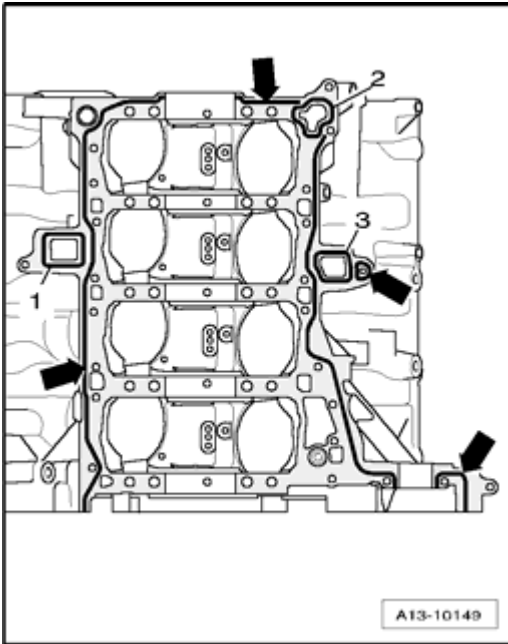


Fig. 286: Sealant Applied On Cylinder Block (For Guide Frame)

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Clean sealing surfaces, they must be free of oil and grease.
- Apply sealant beads - **arrows** - on clean sealing surfaces of guide frame as shown in illustration.
- Thickness of sealant beads: 1.5 to 2.0 mm.
- Install seals - **1 to 3** -.

Installation position of alignment bushings

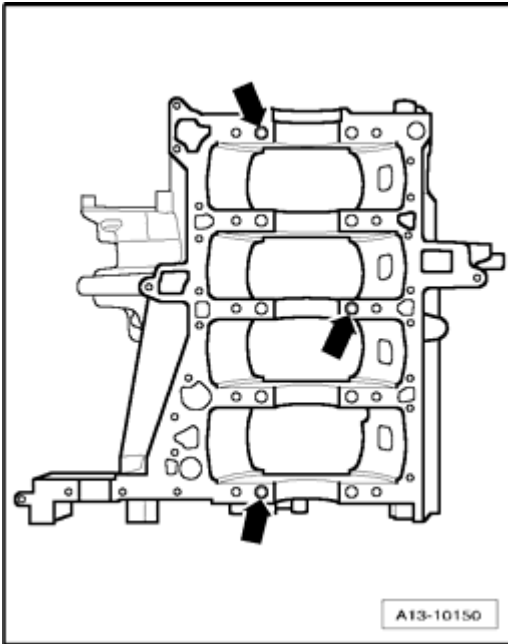


Fig. 287: Installation Position Of Alignment Bushings
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Check whether alignment bushings - **arrows** - are inserted at locations in guide frame as shown in the illustration.

Installing guide frame

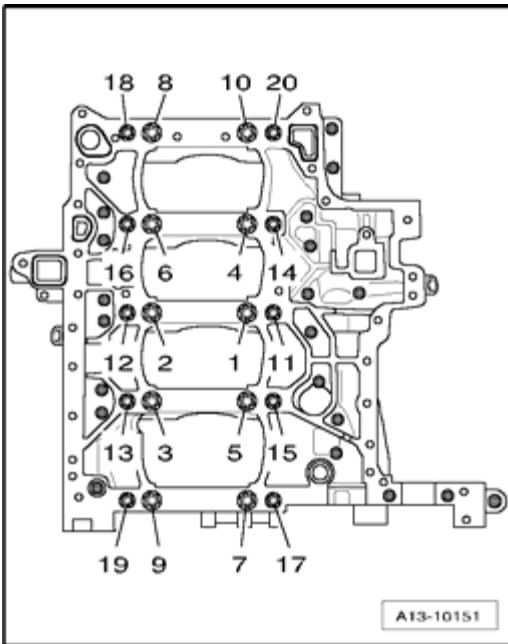


Fig. 288: Installing Guide Frame Bolts Sequence
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Replace bolts - **1 to 20** -.
- Tighten bolts for guide frame as follows:
 - Tighten bolts - **1 to 10** - to 30 Nm with torque wrench.
 - Tighten bolts - **11 to 20** - to 20 Nm with torque wrench.
- Tighten bolts - **1 to 10** - to 50 Nm with torque wrench.
- Tighten bolts - **11 to 20** - to 30 Nm with torque wrench.
- Tighten bolts - **1 to 10** - 90° ($\frac{1}{4}$ additional turn) using a rigid wrench.
- Tighten bolts - **11 to 20** - 90° ($\frac{1}{4}$ additional turn) using a rigid wrench.
- Tighten bolts for sealing surfaces of cylinder block/guide frame - **dark hatching in the illustration** - to 9 Nm in diagonal sequence.

Allocation of main bearing shells for new crankshafts

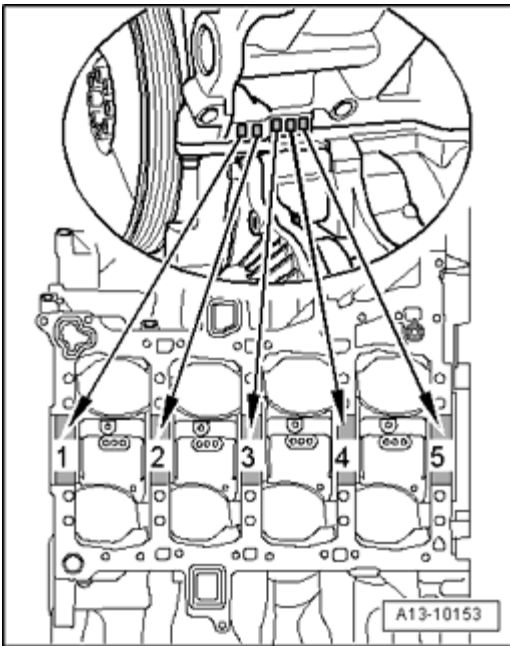


Fig. 289: Allocation Of Crankshaft Bearing Shells For Cylinder Block
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

Allocation of crankshaft bearing shells for cylinder block

- Bearing shells with correct thickness are allocated to cylinder block in the factory. Colored dots on sides of bearing shells serve for identifying bearing shell thickness.
- Allocation of bearing shells to cylinder block is marked by one letter each at left front on cylinder block (can be read from outside) as shown in the illustration.

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Letter on cylinder block	Color of bearing
R=	Red
G=	Yellow
B=	Blue

NOTE:

- In addition, the letters are also stamped on the guide frame.

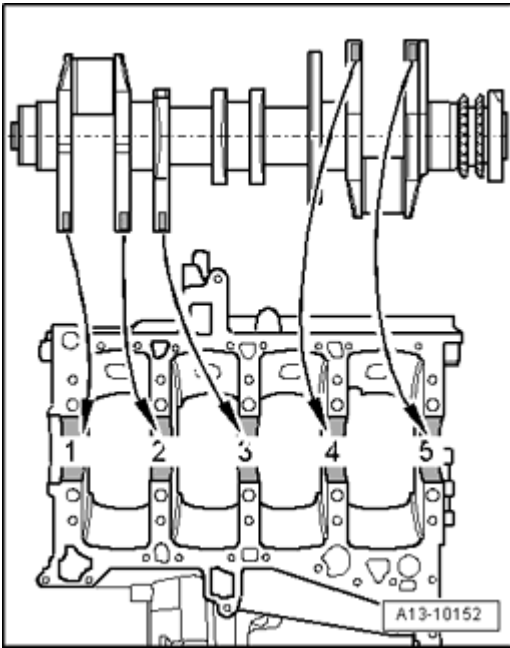


Fig. 290: Allocation Of Crankshaft Bearing Shells For Guide Frame - Crankshaft Manufactured By Alfing

Courtesy of VOLKSWAGEN UNITED STATES, INC.

Allocation of crankshaft bearing shells for guide frame - crankshaft manufactured by Alfing

- Bearing shells with correct thickness are allocated to guide frame in the factory. Colored dots on sides of bearing shells serve for identifying bearing shell thickness.
- Allocation of bearing shells to guide frame is marked by one colored dot each on crankshaft counterweight as shown in the illustration.
- Crankshafts manufactured by Alfing have no manufacturers identification.

Colored dot on crankshaft	Color of bearing
Red	Red
Yellow	Yellow
Blue	Blue

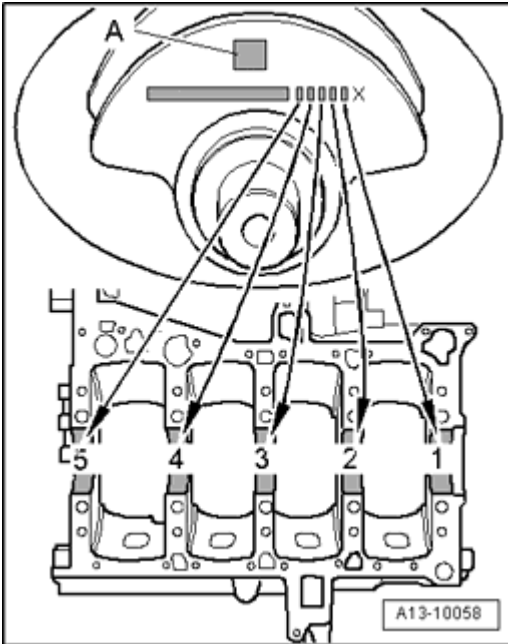


Fig. 291: Allocation Of Crankshaft Bearing Shells For Guide Frame - Crankshaft Manufactured By Weber

Courtesy of VOLKSWAGEN UNITED STATES, INC.

Allocation of crankshaft bearing shells for guide frame - crankshaft manufactured by Weber

- Bearing shells with correct thickness are allocated to guide frame in the factory. Colored dots on sides of bearing shells serve for identifying bearing shell thickness.
- Allocation of bearing shells to guide frame is marked by one colored dot each on front crankshaft counterweight as shown in the illustration. The "X" marks the end of the letter series and stand next to color identification for bearing 1 (belt pulley side).
- Crankshafts manufactured by Weber have a manufacturers identification - A - on front crankshaft counterweight.

NOTE:

- The letter series begins at left with bearing 5 (flywheel side).

Letter on crankshaft	Color of bearing
R=	Red
G=	Yellow
B=	Blue

Allocation of main bearing shells for used and reworked crankshafts

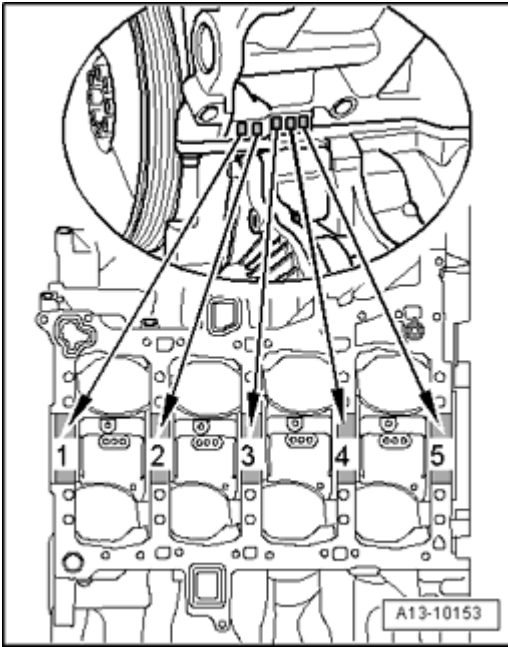


Fig. 292: Allocation Of Crankshaft Bearing Shells For Cylinder Block
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

Allocation of crankshaft bearing shells for cylinder block

- Bearing shells are allocated to cylinder block corresponding to color markings stamped into cylinder block.
- For used and reworked crankshafts, the main crankshaft journals must be measured in order to allocate the matching bearing shells.
- Basic dimension of main crankshaft journals = dia. 65 mm.
- Repair stage of main crankshaft journals = dia. 64.75 mm.
- Thicker over-sized bearing shells are available for reworked crankshafts. These have the same color markings as original-size bearing shells.

Letter on cylinder block		Color of bearing
R=		Red
G=		Yellow
B=		Blue

Allocation of crankshaft bearing shells for guide frame

- For used and reworked crankshafts, the main crankshaft journals must be measured in order to allocate matching bearing shells.
- Any other markings on crankshaft are invalid when reworking crankshafts.
- Allocate bearing shells to determined diameter of main crankshaft journals according to following table.

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Main crankshaft journals dia.	Color identification of bearing shells for guide frame		
	Red	Yellow	Blue
Dimensions in mm			
Basic dimension 65 * See note	64.978 to 64.972	64.972 to 64.965	64.965 to 64.958
Repair stage 64.75 * See note	64.728 to 64.722	64.722 to 64.715	64.715 to 64.708

*Colored markings on bearing shells do not indicate if they are for new or used crankshafts.

Crankshaft dimensions

Reconditioning dimension in mm	Crankshaft journal dia.		Connecting rod journal dia.	
Basic dimension	65.00	0.022 0.042	54.00	0.022 0.042
Repair stage	64.75	0.022 0.042	53.75	0.022 0.042

Axial clearance, measuring

Special tools, testers and auxiliary items required

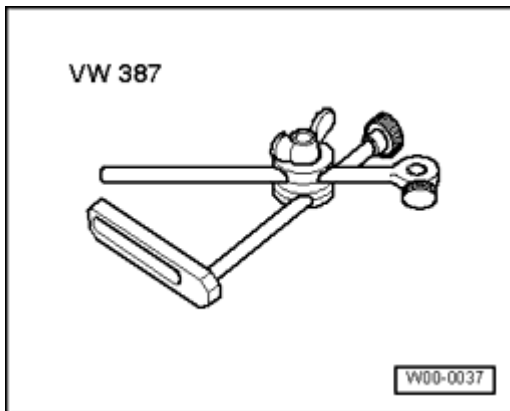


Fig. 293: Dial Gauge Holder VW 387

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Dial gauge holder VW 387

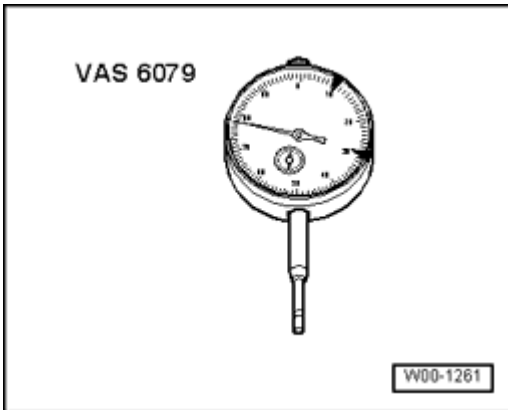


Fig. 294: Identifying Dial Gauge VAS 6079

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Dial gauge VAS 6079

Work procedure

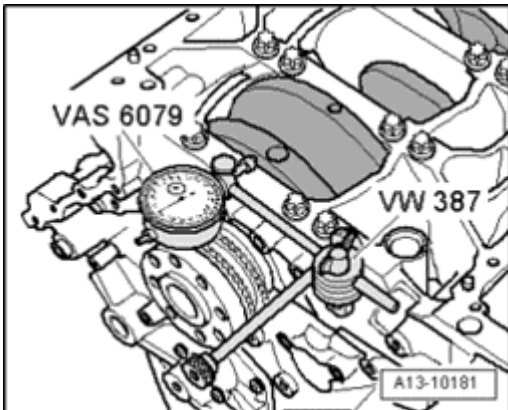


Fig. 295: Attaching Dial Indicator VAS 6079 Together With Dial Gauge Holder VW 387 To Cylinder Block And Setting Indicator Against Crankshaft Counterweight

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Attach dial indicator VAS 6079 together with dial gauge holder VW 387 to cylinder block and set indicator against crankshaft counterweight.
- Press crankshaft against dial indicator by hand, set indicator to "0".
- Press crankshaft off dial indicator and read off value:

- Axial clearance: 0.090 to 0.251 mm.

Radial clearance, measuring

Special tools, testers and auxiliary items required

- Plastigage

Work procedure**NOTE:**

- **Do not interchange used bearings**
- **Bearing shells that are worn down to the nickel layer must be replaced.**
- Remove guide frame and clean journals.
- Place Plastigage over entire width of bearing journal or into bearing shells.
- Plastigage must rest in center of bearing shell.
- Install guide frame and tighten to 30 Nm. Do not turn crankshaft.
- Remove guide frame again.
- Compare width of Plastigage with measuring scale:
 - Radial clearance, new: 0.010 to 0.039 mm.
 - Radial clearance wear limit: 0.08 mm.

PISTON AND CONNECTING ROD, DISASSEMBLING AND ASSEMBLING**Piston and connecting rod, component overview****NOTE:**

- **Oil injector jet for piston cooling Oil spray jet for piston cooling**

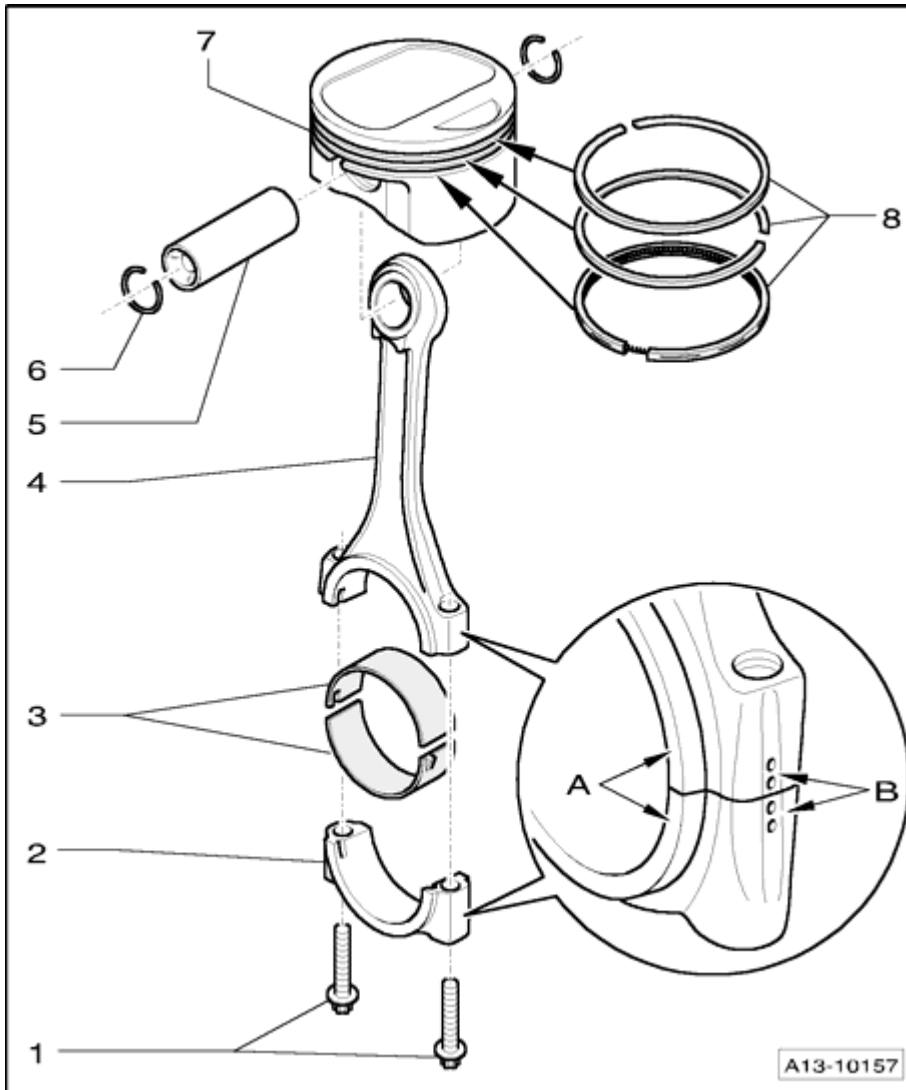


Fig. 296: Piston And Connecting Rod, Component Overview
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Connecting rod bolt - 30 Nm plus an additional $\frac{1}{4}$ turn (90°)

- Replace
- Lubricate threads and contact surface
- Tighten to 30 Nm to measure radial play, do not turn further

2 - Connecting rod bearing cap

- Do not interchange
- Mark allocation to cylinder using a color marker - **B - Mark connecting rod**
- When installing bearing cap, observe: The wide thrust flange - **A** - must point to the same side on connecting rod and connecting rod bearing cap

- Installation position of connecting rod pairs **Connecting rod, installed location**

3 - Bearing shells

- Check that retaining tabs are secured
- Do not interchange used bearing shells (mark, but not on the running surface)
- Radial clearance, measuring --> **Connecting rod radial clearance, measuring**
- Over-sized bearings are available for reworked crankshaft connecting rod journals

4 - Connecting rod

- Only replace as set
- Mark allocation to cylinder with paint - **B** - **Mark connecting rod**
- When installing bearing cap, observe: The wide thrust flange - **A** - must point to the same side on connecting rod and connecting rod bearing cap
- Installation position of connecting rod pairs **Connecting rod, installed location**
- Axial play for each new connecting rod pair: 0.20 to 0.38 mm
- Axial play wear limit: 0.60 mm
- Radial clearance, measuring --> **Connecting rod radial clearance, measuring**

5 - Piston pin

- If tight, heat piston to 60° C
- Removing and installing using a drift VW 222 A

6 - Circlip

7 - Piston

- Installation position of pistons **Piston installation position**
- Piston and cylinder dimensions --> **Piston and cylinder dimensions**
- Checking **Checking piston**
- Install with piston ring compressor
- Measuring cylinder bore **Measuring cylinder bore**

8 - Piston rings

- Offset gaps by 120°
- Use piston ring pliers for removal and installation
- "TOP" marking or inscribed side must point to piston head

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- Measuring side clearance **Measuring piston ring side clearance**

Piston ring end gap, measuring

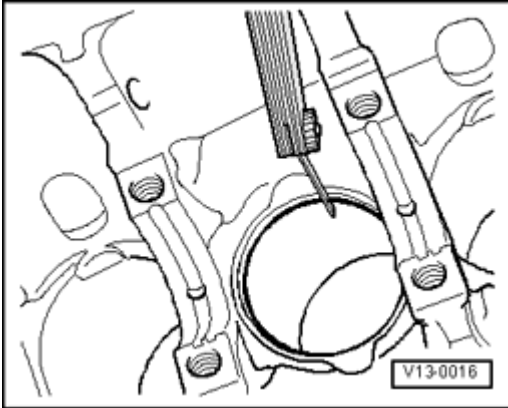


Fig. 297: Piston Ring End Gap, Measuring

Courtesy of VOLKSWAGEN UNITED STATES, INC.

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

Piston ring dimensions in mm	New	Wear limit
1st Compression ring	0.25 to 0.40	0.8
2nd Compression ring	0.20 to 0.40	0.8
Oil scraping ring		0.4

Measuring piston ring side clearance

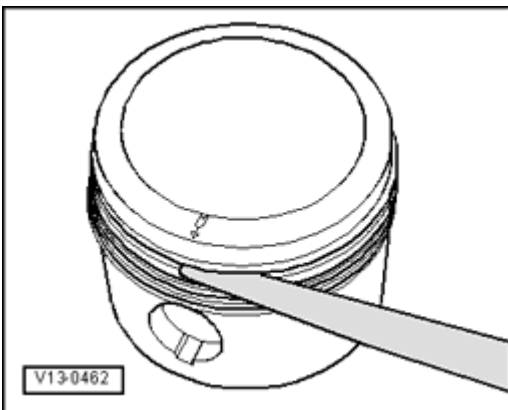


Fig. 298: Measuring Piston Ring Side Clearance

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Clean ring groove of piston before checking.

Piston ring dimensions in mm	New	Wear limit
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1st Compression ring	0.04 0.08	0.20
2nd Compression ring	0.005 0.045	0.20
Oil scraping ring	0.01 0.05	0.15

Checking piston

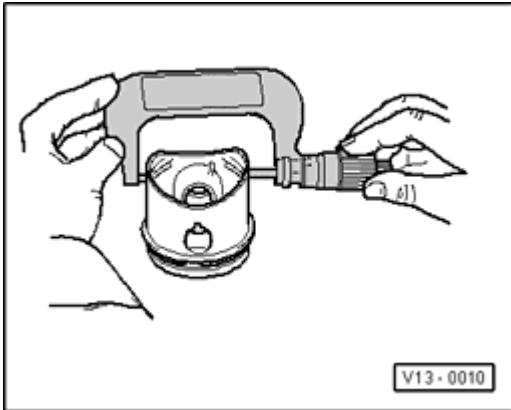


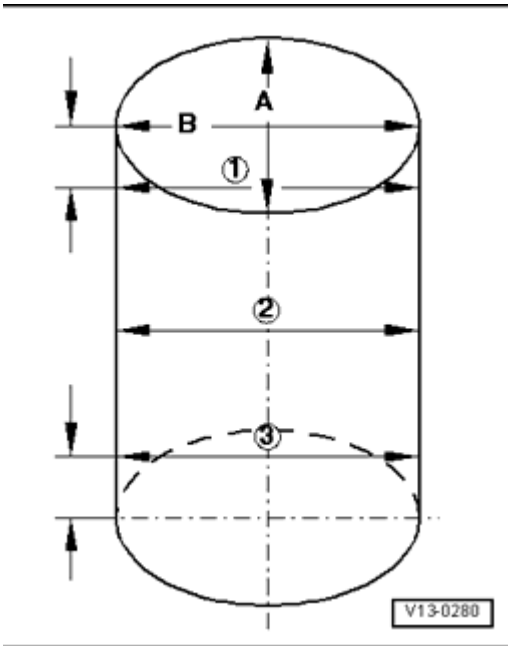
Fig. 299: Checking Piston

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Measure approx. 10 mm from lower edge, at a 90° angle to piston pin axis using an external micrometer 75 to 100 mm.
- Maximum deviation from nominal dimension: 0.04 mm.

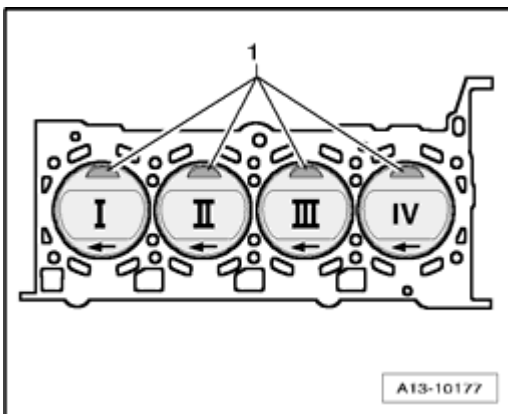
Nominal dimension --> **Piston and cylinder dimensions.**

Measuring cylinder bore

**Fig. 300: Measuring Cylinder Bore**

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Using an internal dial gauge 50 to 100 mm, measure at 3 points in diagonal sequence horizontally - A - and vertically - B -.
- Maximum deviation from nominal dimension: 0.08 mm.

Nominal dimension --> **Piston and cylinder dimensions.****Piston installation position****Fig. 301: Piston Installation Position**

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Mark allocation to cylinder on piston head using chalk or water-proof felt pen.

NOTE:

- Do not use a center punch or scribe, since the piston head coating will be damaged.

Installed location:

- Arrows on piston heads point to belt pulley side.
- Valve recesses - **1** - point toward center of engine.

Mark connecting rod

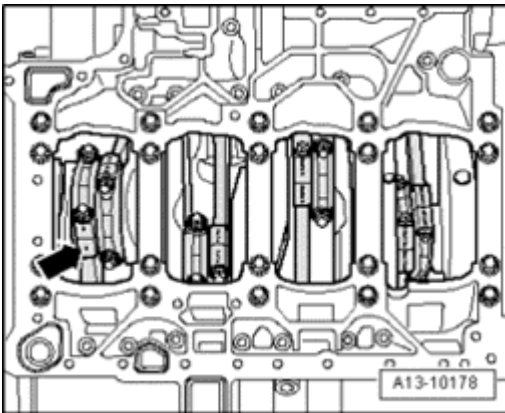


Fig. 302: Mark Connecting Rod

Courtesy of VOLKSWAGEN UNITED STATES, INC.

NOTE:

- Only replace connecting rod as 1 a set.
 - Do not interchange connecting rod bearings.
- Before removing, mark allocation of connecting rod and connecting rod bearing caps to each other and to cylinder with paint - **arrow** -.

Connecting rod, installed location

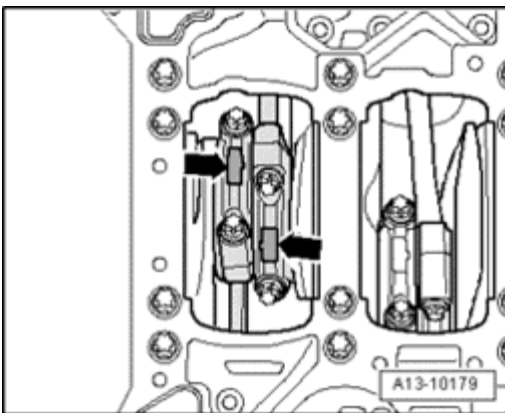


Fig. 303: Connecting Rod, Installed Location

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Molded tabs - **arrows** - at beveled surfaces of connecting rod pairs 1 and 2, 3 and 4, 5 and 6 as well as 7 and 8 must point toward each other.

Oil spray jet for piston cooling

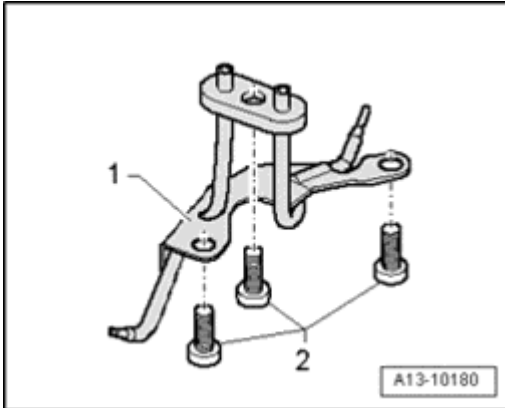


Fig. 304: Oil Spray Jet For Piston Cooling

Courtesy of VOLKSWAGEN UNITED STATES, INC.

1. Oil injector jet (opening pressure 2 to 2.4 bar positive pressure)
2. Bolts - 9 Nm. Insert using locking compound; locking compound

Oil spray jet for piston cooling

Matching pistons are allocated to the different manufacturing stages of the cylinder block.

Cylinder bore dia. mm	Piston dia. mm
84.510 ± 0.005	84.490 ± 0.010 * See note
84.610 ± 0.005	84.590 ± 0.010 * See note
84.710 ± 0.005	84.690 ± 0.010 * See note

*Dimensions with coating (thickness 0.01 mm). The coating wears off.

Connecting rod radial clearance, measuring

Special tools, testers and auxiliary items required

- Plastigage

Test sequence

- Remove connecting rod bearing caps.
- Clean bearing caps and journals

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- Place Plastigage over entire width of bearing journal or into bearing shells.
- Install connecting rod bearing cap and tighten to 30 Nm. Do not turn crankshaft.
- Remove connecting rod bearing caps again.
- Compare width of Plastigage with measuring scale:

Radial clearance

- New: 0.028 to 0.077 mm.
- Wear limit: 0.12 mm.
- Replace bolts for connecting rod bearings.