

13 - ENGINE - CRANKSHAFT, CYLINDER BLOCK

BELT PULLEY SIDE, SERVICING

Belt Pulley Side, Servicing

--> **Ribbed Belt Drive, Component Overview**

--> **Coolant Pump Ribbed Belt Pulley, Removing and Installing**

--> **Power Steering Pump Ribbed Belt Pulley, Removing and Installing**

--> **Ribbed Belt, Removing and Installing**

--> **Vibration Damper, Removing and Installing**

--> **Ribbed Belt Side Sealing Flange with Crankshaft Seal, Replacing**

Ribbed Belt Drive, Component Overview

Ribbed Belt Drive, Component Overview

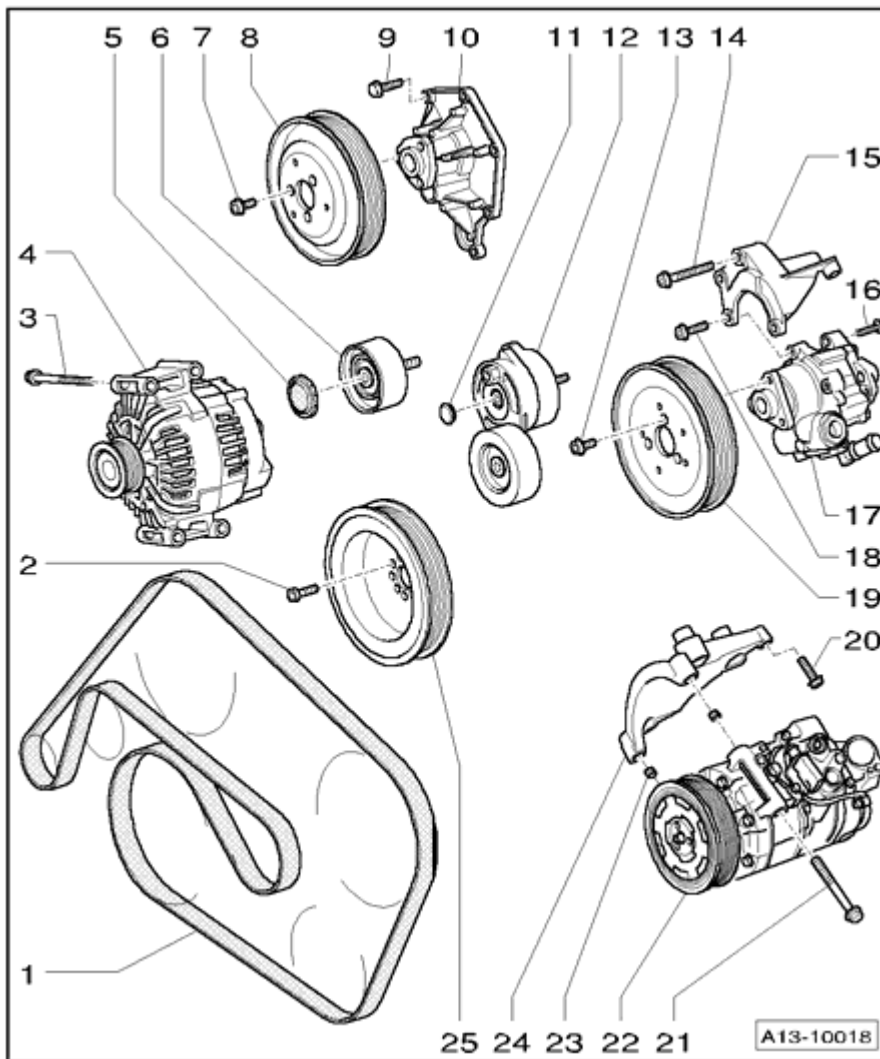


Fig. 204: Ribbed Belt Drive, Component Overview
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Ribbed belt

- Check for wear
- Before removing, mark direction of rotation using chalk or felt-tip marker. Reversing the direction of rotation of a run-in belt can destroy the belt
- Removing and installing --> **Ribbed Belt, Removing and Installing**
- When installing, make sure it is seated correctly on the pulleys

2 - 20 Nm plus an additional 90 ($1 \frac{1}{4}$ turn)

- Replace

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ENGINE 3.2 V6 4V Engine Mechanical, Engine Code(s): BKH

3 - 22 Nm

4 - Generator

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

5 - Cap for idler pulley

6 - Idler roller for ribbed belt

- Tighten to 40 Nm

7 - 20 Nm

8 - Ribbed belt pulley for coolant pump

- Removing and installing --> **Coolant Pump Ribbed Belt Pulley, Removing and Installing**

9 - 9 Nm

10 - Coolant pump

- Removing and installing --> **Coolant Pump, Removing and Installing**

11 - Cap for tensioning element

12 - Tensioning element for ribbed belt

- Tighten to 40 Nm.

13 - 20 Nm

14 - 20 Nm

15 - Bracket for power steering pump

16 - 20 Nm

17 - Power-steering pump

- Removing and installing --> **48 - STEERING**

18 - 20 Nm

19 - Belt pulley for power steering pump

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20 - 20 Nm

21 - 25 Nm

22 - Air conditioner compressor

- Do not unfasten/separate refrigerant lines
- Removing and installing --> **87 - AIR CONDITIONING**

23 - Alignment bushing

- 2 pieces

24 - Bracket for air conditioning compressor

25 - Vibration damper

- With belt pulley for ribbed belt
- Various versions. Sequence
- Removing and installing --> **Vibration Damper, Removing and Installing**

Coolant Pump Ribbed Belt Pulley, Removing and Installing

Coolant Pump Ribbed Belt Pulley, Removing and Installing

Special tools, testers and auxiliary items required

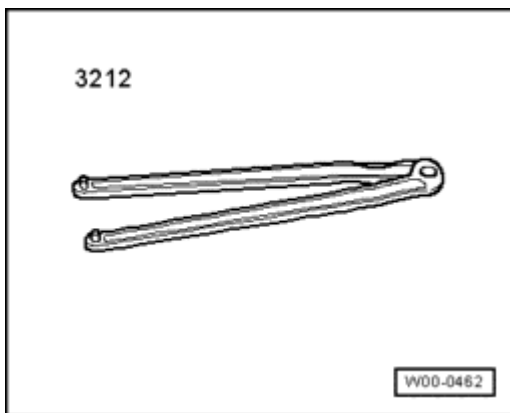


Fig. 205: Spanner Wrench 3212

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Spanner Wrench 3212

Removing

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ENGINE 3.2 V6 4V Engine Mechanical, Engine Code(s): BKH

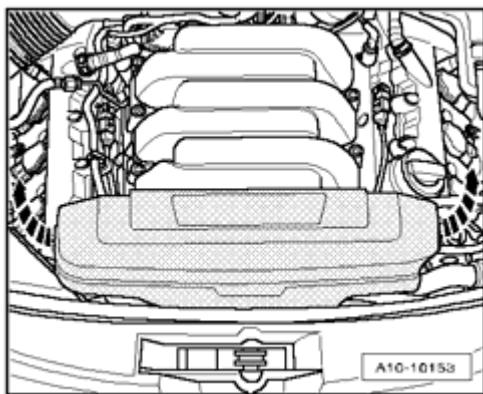


Fig. 206: Identifying Front Engine Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove front engine cover - **arrows** -.

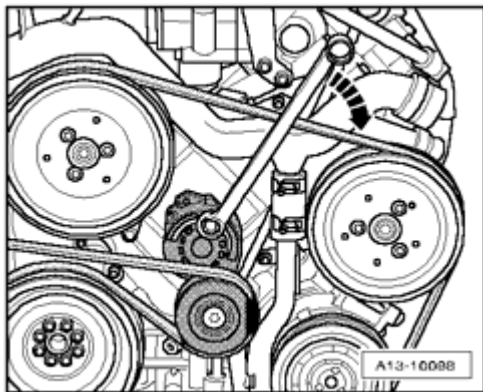


Fig. 207: Pivoting Tensioning Device To Relieve Tension On Ribbed Belt
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Pivot tensioning device in direction of - **arrow** - to relieve tension on ribbed belt.
- Remove ribbed belt from coolant pump belt pulley.
- Release tensioner unit

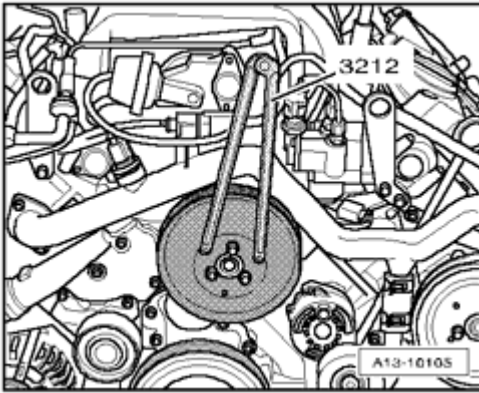


Fig. 208: Loosening Bolts Use Spanner Wrench 3212 To Counter-Hold
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove ribbed belt pulley from coolant pump.
- When loosening bolts use spanner wrench 3212 to counter-hold.

Installing

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

NOTE:

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

- Start engine and check belt running.

Tightening specifications

Component	Nm
Ribbed belt pulley to coolant pump	20

Power Steering Pump Ribbed Belt Pulley, Removing and Installing

Power Steering Pump Ribbed Belt Pulley, Removing and Installing

Special tools, testers and auxiliary items required

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ENGINE 3.2 V6 4V Engine Mechanical, Engine Code(s): BKH

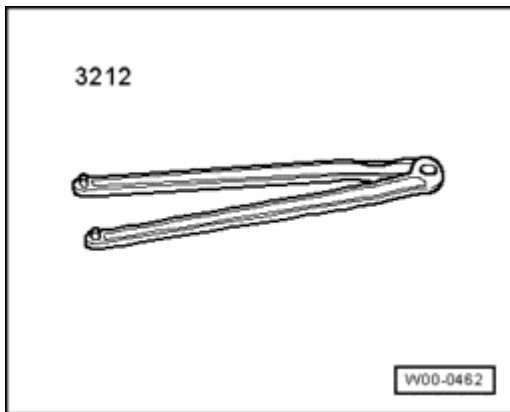


Fig. 209: Spanner Wrench 3212

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Spanner Wrench 3212

Removing

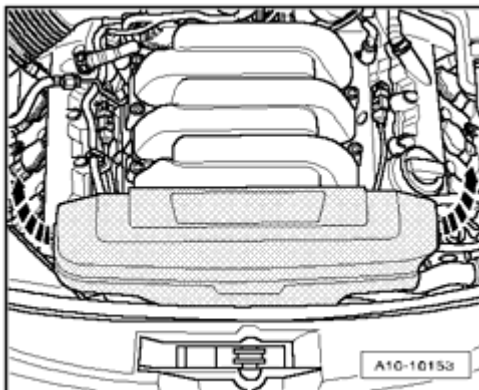


Fig. 210: Identifying Front Engine Cover

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove front engine cover - **arrows** -.

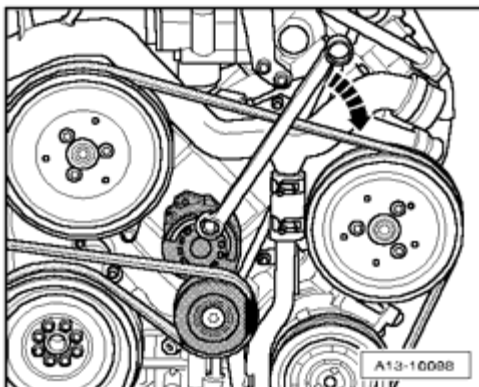
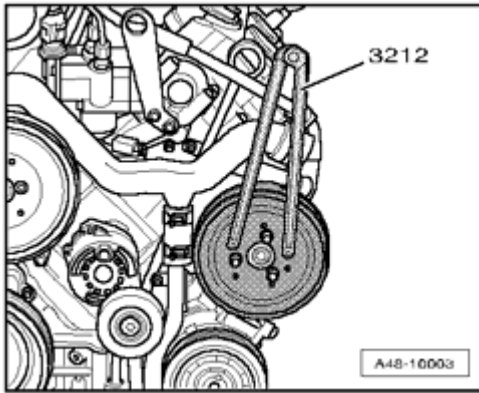


Fig. 211: Pivoting Tensioning Device To Relieve Tension On Ribbed Belt

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Pivot tensioning device in direction of - **arrow** - to relieve tension on ribbed belt.
- Remove ribbed belt from power steering pump belt pulley.
- Release tensioner unit

**Fig. 212: Loosening Bolts Use Spanner Wrench 3212 To Counter-Hold**

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove ribbed belt pulley from power steering pump.
- When loosening bolts use spanner wrench 3212 to counter-hold.

Installing

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

- Installation position: Designation "Front" points in direction of travel.

NOTE:

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

- Start engine and check belt running.

Tightening specifications

Component	Nm
Ribbed belt pulley to power steering pump	20

Ribbed Belt, Removing and Installing**Ribbed Belt, Removing and Installing**

Removing

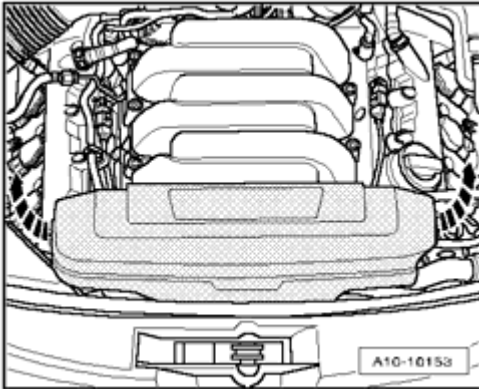


Fig. 213: Identifying Front Engine Cover

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove front engine cover - **arrows** -.

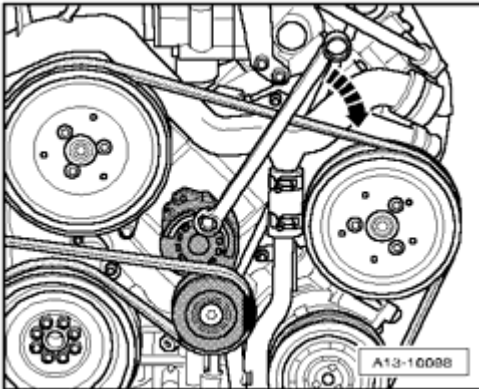


Fig. 214: Pivoting Tensioning Device To Relieve Tension On Ribbed Belt

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 turning direction can cause damage to the belt under operating conditions.

- Pivot tensioning device in direction of - **arrow** - to relieve tension on ribbed belt.
- Remove ribbed belt and release tensioning device.

Installing

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

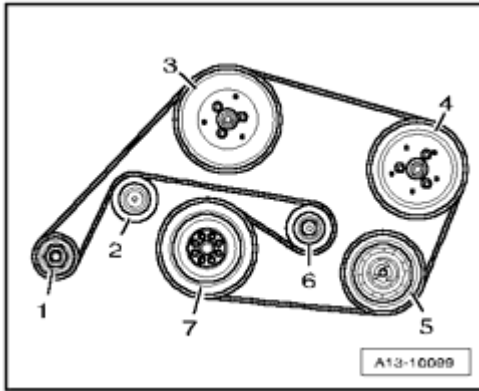


Fig. 215: Placing Ribbed Belt Over Belt Pulley

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Place ribbed belt over belt pulley as shown in the illustration.
- Generator
- Idler roller
- Coolant pump
- Power-steering pump
- Air conditioner compressor
- Tensioning device for ribbed belt
- Crankshaft

NOTE:

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

- Start engine and check belt running.

Vibration Damper, Removing and Installing

Vibration Damper, Removing and Installing

NOTE:

- Different vibration dampers are allocated to the various engine versions .

Removing

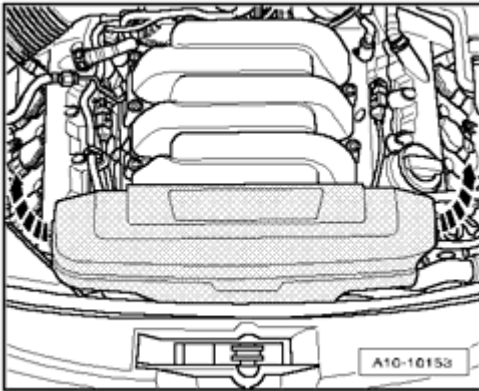


Fig. 216: Identifying Front Engine Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove front engine cover - **arrows** -.

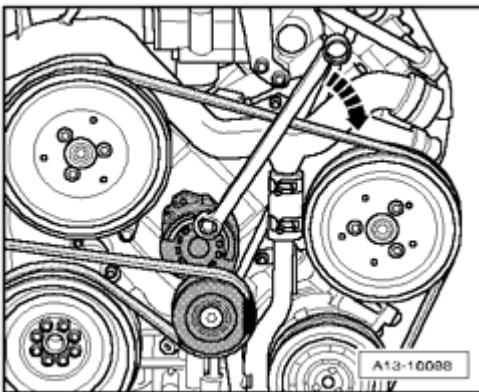


Fig. 217: Pivoting Tensioning Device To Relieve Tension On Ribbed Belt
Courtesy of VOLKSWAGEN UNITED STATES, INC.

NOTE:

- Before removing ribbed belt, mark the turning direction on it with chalk or a felt tip pen. A reversed turning direction can cause damage to the belt under operating conditions.
- Pivot tensioning device in direction of - **arrow** - to relieve tension on ribbed belt.
- Remove ribbed belt and release tensioning device.

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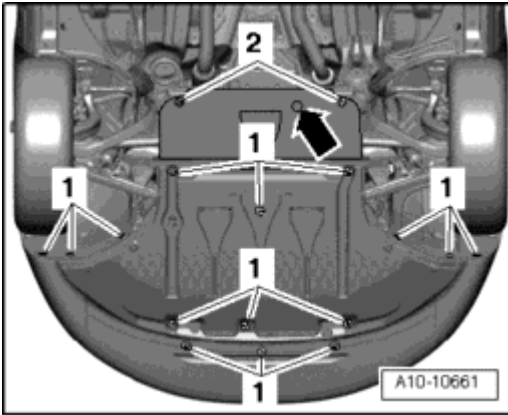


Fig. 218: Identifying Noise Insulation And Mountings
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove noise insulation and the mountings - **1, 2** - - **arrow** - where present.

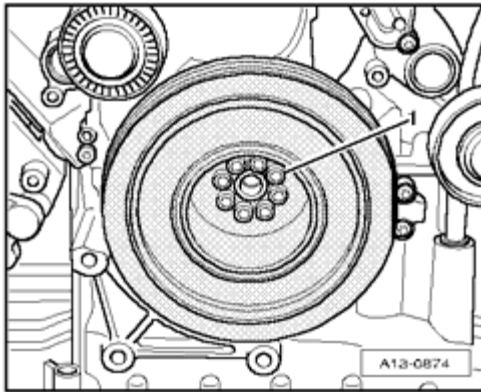


Fig. 219: Removing Vibration Damper
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Mark vibration damper for re-installation.
- Remove bolts - **1** -.
- Remove vibration damper.

Installing

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

- Install ribbed belt --> **Ribbed Belt, Removing and Installing** .

Tightening specifications

Component	Nm
Vibration damper to crankshaft	20 + 90° 1)2)

1) Replace bolts. 2) 90° corresponds to a quarter turn.

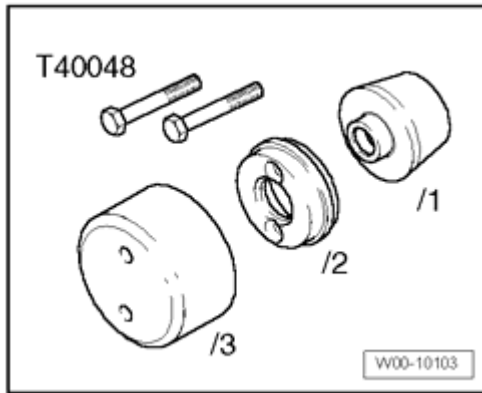
Ribbed Belt Side Sealing Flange with Crankshaft Seal, Replacing**Ribbed Belt Side Sealing Flange with Crankshaft Seal, Replacing****Special tools, testers and auxiliary items required**

Fig. 220: Assembly Tool T40048

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Assembly tool T40048
- Hand drill with plastic brush attachment
- Protective glasses
- Sealant

Procedure

- Remove ribbed belt from the coolant pump --> **Coolant Pump Ribbed Belt Pulley, Removing and Installing.**
- Remove vibration damper --> **Vibration Damper, Removing and Installing .**

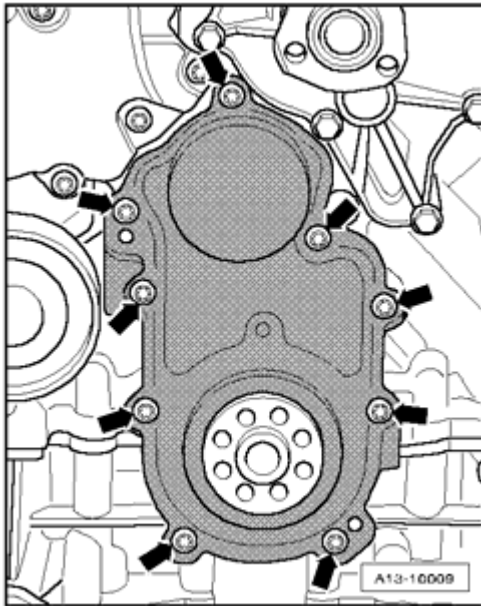


Fig. 221: Removing Bolts & Front Sealing Flange
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts - **arrows** -.
- Remove sealing flange on the belt pulley side.

NOTE: • **Replace the ribbed belt side sealing flange.**

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

CAUTION: Wear safety glasses.

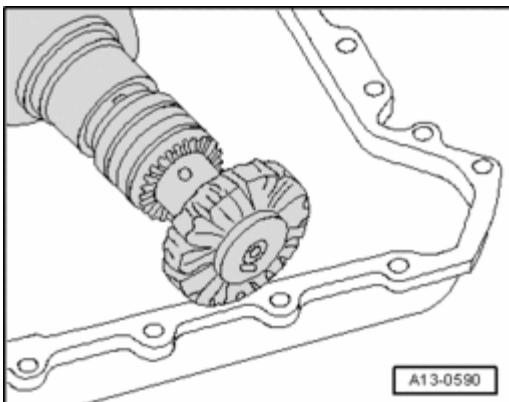


Fig. 222: Using Rotating Plastic Brush To Remove Any Sealant Residue From Sealing Flange, Cylinder

Block And Upper Part Of Oil Pan

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove any sealant residue remaining on the cylinder block and the upper part of the oil pan; use a rotating plastic brush, for example.
- Clean sealing surfaces so they are completely free of any oil or grease.

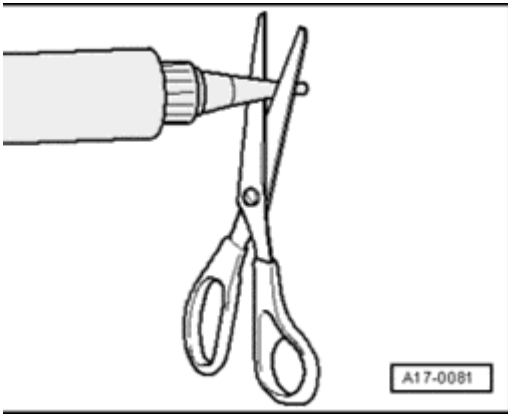


Fig. 223: Cutting Tube Nozzle At Front Marking

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Cut tube nozzle at front marking (diameter of nozzle approximately 1.5 mm).

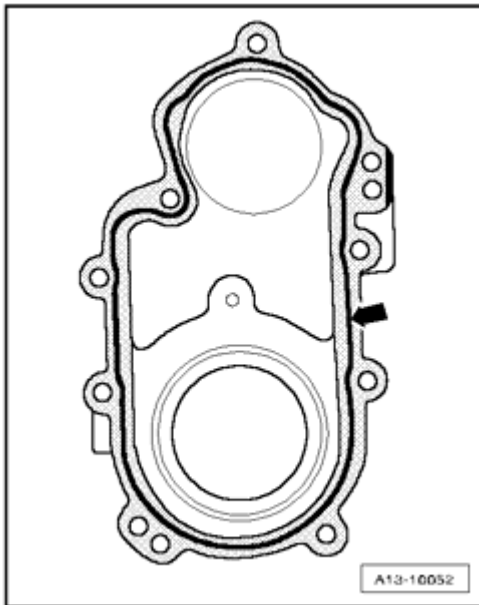


Fig. 224: Applying Bead Of Sealant To Clean Sealing Surface Of Sealing Flange

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Apply bead of sealant as illustrated to the clean sealing surface of the sealing flange.

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- The groove - **arrow** - of sealing surface must be completely filled with sealant.
- The sealant bead must be 1.5 to 2.0 mm above the sealing surface.

NOTE:

- Sealant bead must not be thicker than specified, otherwise sealant could get into oil pan and clog the oil pump strainer.
- The sealing flange on the belt pulley side must be installed within 5 minutes after applying the sealant.

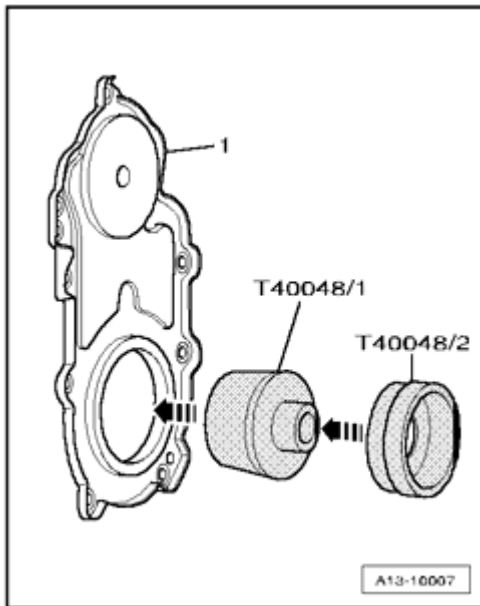


Fig. 225: Inserting Assembly Device T40048/1 Onto Pull Sleeve T40048/2 And Sliding Sealing Flange Onto Pull Sleeve

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Insert assembly device T40048/1 onto pull sleeve T40048/2 and slide sealing flange - **1** - onto pull sleeve.
- Remove assembly device.

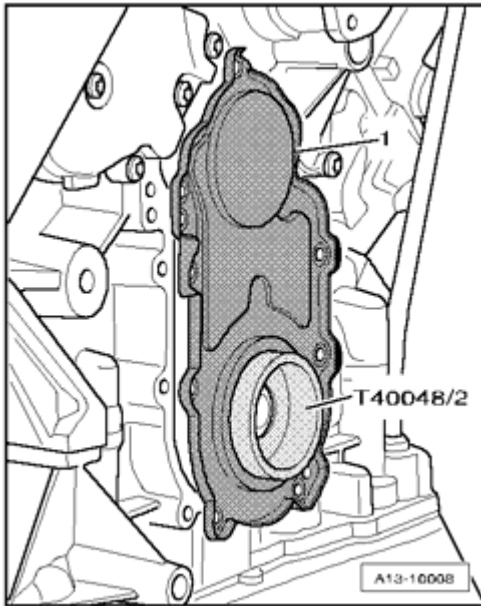


Fig. 226: Placing Sealing Flange With Inserted Pull Sleeve T40048/2 Onto Crankshaft
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Place sealing flange with inserted pull sleeve T40048/2 onto crankshaft.
- Without tipping, push the sealing flange onto engine sealing surface and fasten.

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

- Install vibration damper --> **Vibration Damper, Removing and Installing** .
- Install coolant pump ribbed belt --> **Coolant Pump Ribbed Belt Pulley, Removing and Installing**.
- Install ribbed belt --> **Ribbed Belt, Removing and Installing** .

Tightening specifications

Component	Nm
Sealing flange belt pulley side on the cylinder block	9 1)
1) Tighten diagonally in stages.	

TIMING CHAIN SIDE, SERVICING

Timing Chain Side, Servicing

--> **Flywheel, Multitronic, Component Overview**

--> **Damper Unit, Removing and Installing**

--> **Flywheel, Multitronic Transmission, Removing and Installing**

--> Drive Plate, Automatic Transmission 09L, Component Overview

--> Drive Plate, Automatic Transmission 09L, Removing and Installing

--> Crank Shaft Seal, Timing Chain Side, Replacing

Flywheel, Multitronic, Component Overview

Flywheel, Multitronic, Component Overview

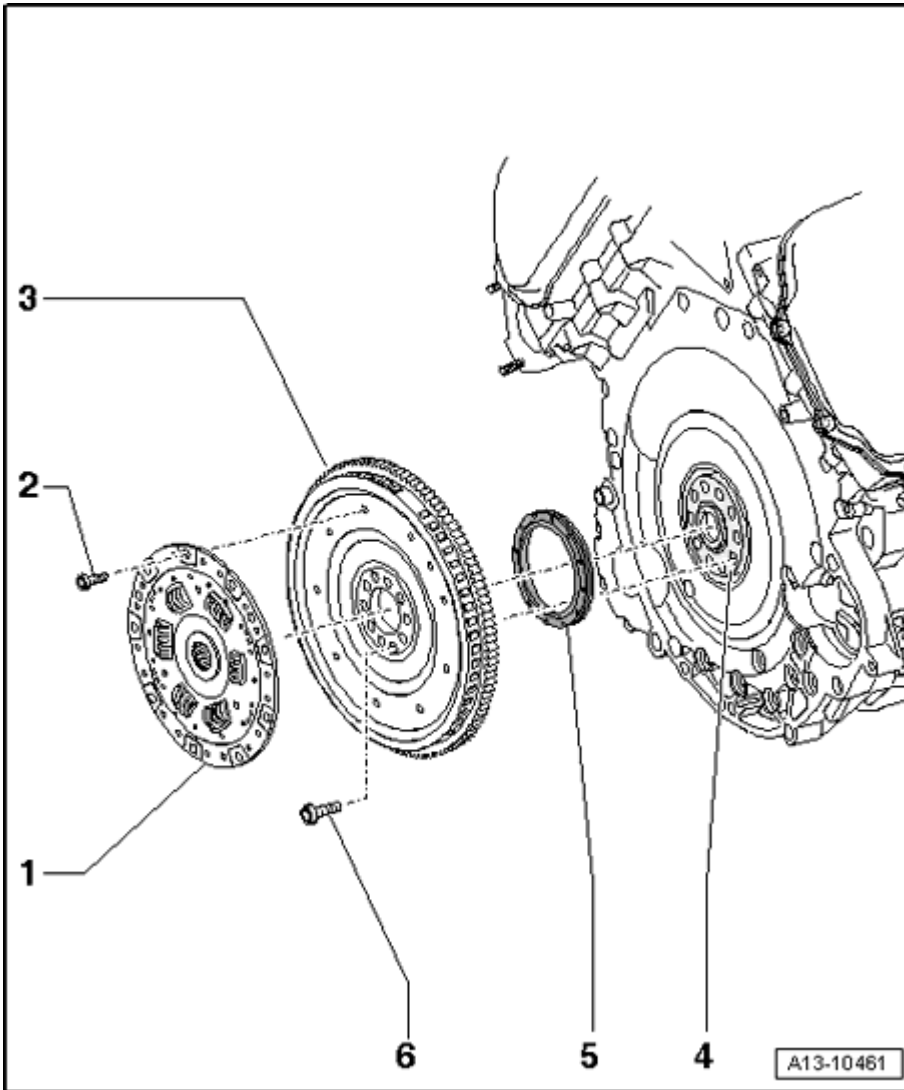


Fig. 227: Flywheel, Multitronic, Component Overview
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Damper unit

- Removing and installing --> Damper Unit, Removing and Installing

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2 - 22 Nm

3 - Flywheel

- Removing and installing --> **Flywheel, Multitronic Transmission, Removing and Installing**

4 - Crankshaft

5 - Shaft seal for crankshaft -timing chain side-

- Replacing --> **Crank Shaft Seal, Timing Chain Side, Replacing** .

6 - 60 Nm plus an additional 90 ($\frac{1}{4}$ turn)

- Replace

Damper Unit, Removing and Installing

Damper Unit, Removing and Installing

Special tools, testers and auxiliary items required

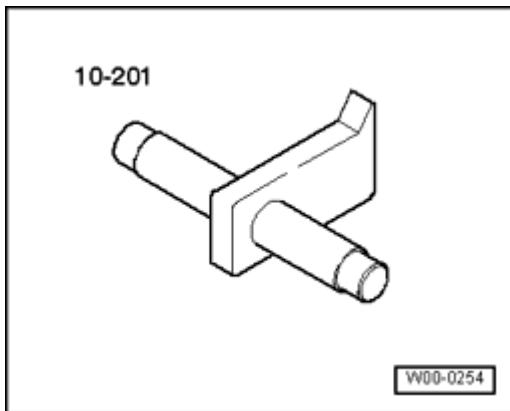


Fig. 228: Counter-Holder Tool 10 - 201

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Counter-holder tool 10 - 201

Removing

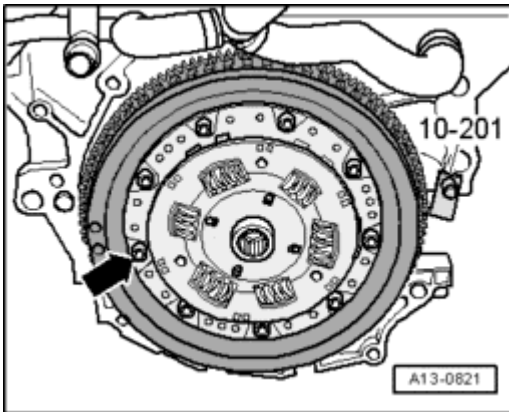


Fig. 229: Inserting Counterhold Tool 10 - 201 To Loosen Bolts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove multitronic transmission --> **37 CONTROLS, HOUSING** .
- Insert counterhold tool 10 - 201 to loosen bolts - **arrow** - .

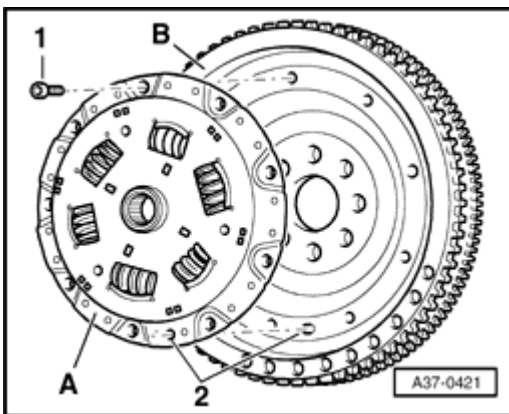


Fig. 230: Removing Bolts And Disconnecting Damper Unit From Flywheel
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts - **1** - and disconnect damper unit - **A** - from the flywheel - **B** - .

Installing

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

NOTE:

- **The damper unit part number is assigned to the transmission code .**

- Align damper unit - **A** - on the flywheel - **B** - .
- Both tabs - **2** - must match up with each other.
- Install bolts - **1** - hand-tight and then tighten diagonally.

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- Install multitronic transmission --> **37 CONTROLS, HOUSING** .

Tightening specifications

Component	Nm
Damper unit on flywheel	22

Flywheel, Multitronic Transmission, Removing and Installing

Flywheel, Multitronic Transmission, Removing and Installing

Special tools, testers and auxiliary items required

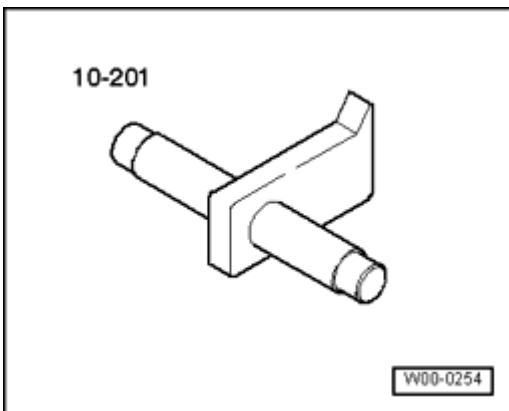


Fig. 231: Counter-Holder Tool 10 - 201

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Counter-holder tool 10 - 201

Removing

- Remove multitronic transmission --> **37 CONTROLS, HOUSING** .
- Remove damper unit --> **Damper Unit, Removing and Installing**.
- Mark crankshaft flywheel

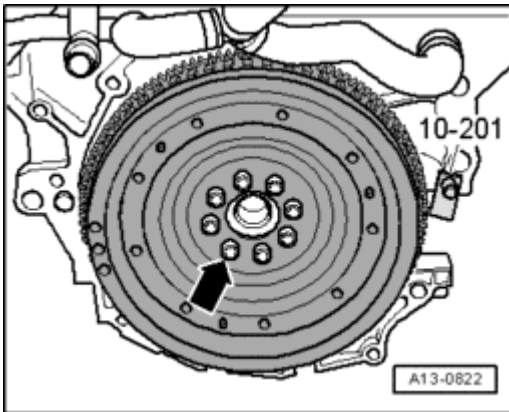


Fig. 232: Removing Bolts And Flywheel Using Counterhold Tool 10 - 201
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Insert counterhold tool 10 - 201 to loosen bolts - **arrow** -.
- Remove bolts and the flywheel.

Installing

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

NOTE:

- **Replace the flywheel bolts.**

- Turn over counterhold tool 10 - 201 to tighten bolts.
- Install damper unit --> **Damper Unit, Removing and Installing.**
- Install multitronic transmission --> **37 CONTROLS, HOUSING .**

Tightening specifications

Component	Nm
Flywheel to crankshaft	60 + 90° 1)2)
1) Replace bolts. 2) 90° corresponds to a quarter turn.	

Drive Plate, Automatic Transmission 09L, Component Overview

Drive Plate, Automatic Transmission 09L, Component Overview

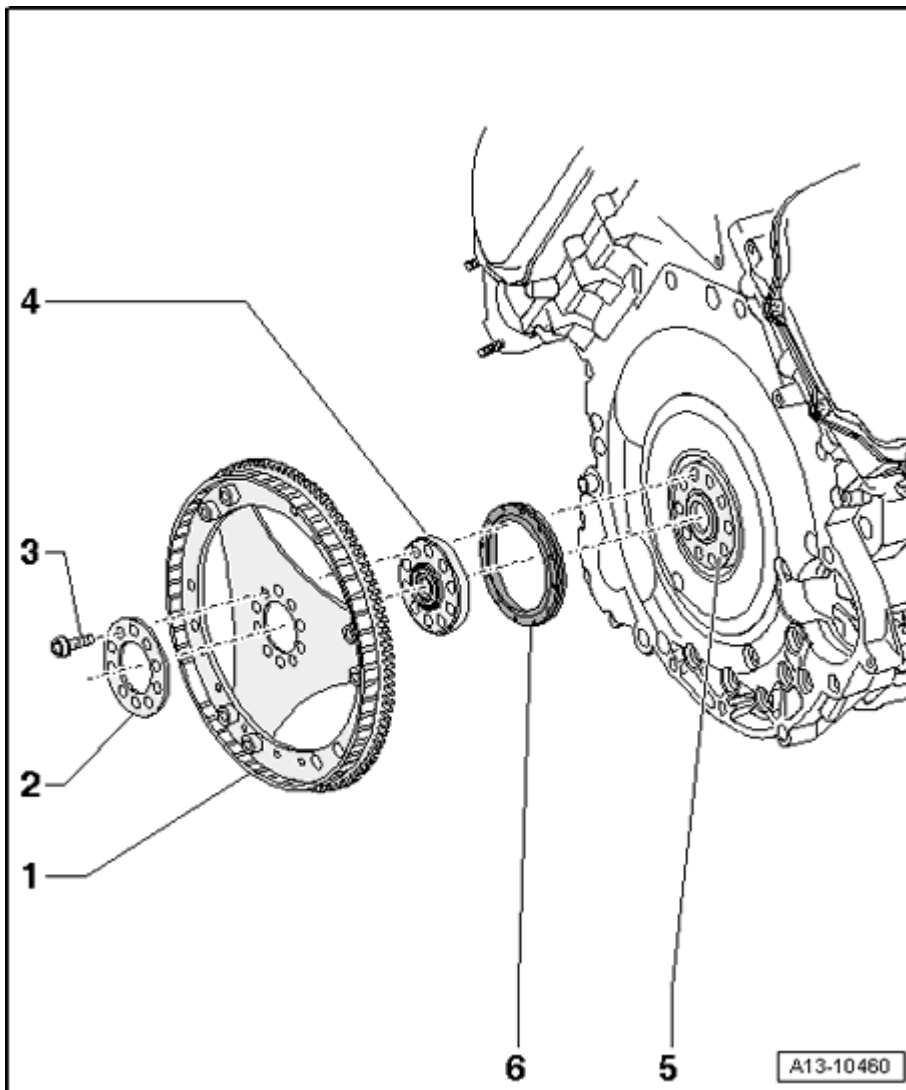


Fig. 233: Drive Plate, Automatic Transmission 09L, Component Overview
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Drive plate

- Removing and installing --> **Drive Plate, Automatic Transmission 09L, Removing and Installing**

2 - Backing plate

3 - 60 Nm plus an additional 90 ($\frac{1}{4}$ turn)

- Replace

4 - Centering washer

- Installed location --> **Centering washer for drive plate on automatic transmission 09L**

5 - Crankshaft

6 - Shaft seal for crankshaft -timing chain side-

- Replacing --> **Crank Shaft Seal, Timing Chain Side, Replacing** .

Drive Plate, Automatic Transmission 09L, Removing and Installing

Drive Plate, Automatic Transmission 09L, Removing and Installing

Special tools, testers and auxiliary items required

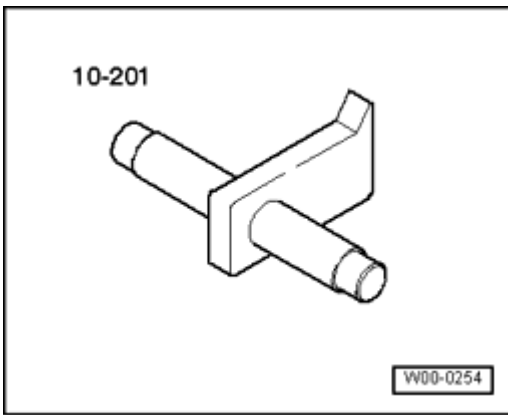


Fig. 234: Counter-Holder Tool 10 - 201

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Counter-holder tool 10-201

Removing

- Remove automatic transmission --> **37 CONTROLS, HOUSING** .

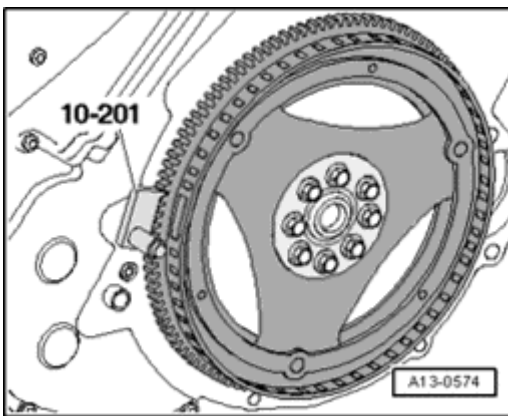


Fig. 235: Inserting Counter Hold Tool 10-201 To Loosen Bolts

Courtesy of VOLKSWAGEN UNITED STATES, INC.

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ENGINE 3.2 V6 4V Engine Mechanical, Engine Code(s): BKH

- Insert counter hold tool 10-201 to loosen the bolts.
- Mark drive plate to engine.
- Remove drive plate.
- Remove centering washer from behind it.

Installing

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

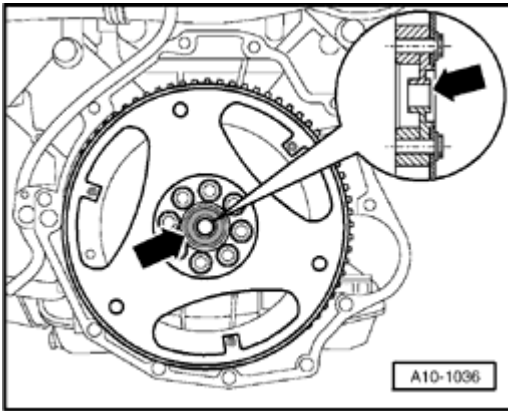


Fig. 236: Installing Drive Plate With Centering Washer And Backing Plate
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Install drive plate with centering washer - **arrow** - and backing plate.
- Use new bolts when securing.
- Turn over counterhold tool 10-201 to tighten bolts.
- Install automatic transmission --> **37 CONTROLS, HOUSING** .

Tightening specifications

Component	Nm
Drive plate to crankshaft	60 + 90° 1)2)
1) Replace bolts. 2) 90° corresponds to a quarter turn.	

Crank Shaft Seal, Timing Chain Side, Replacing

Crank Shaft Seal, Timing Chain Side, Replacing

Special tools, testers and auxiliary items required

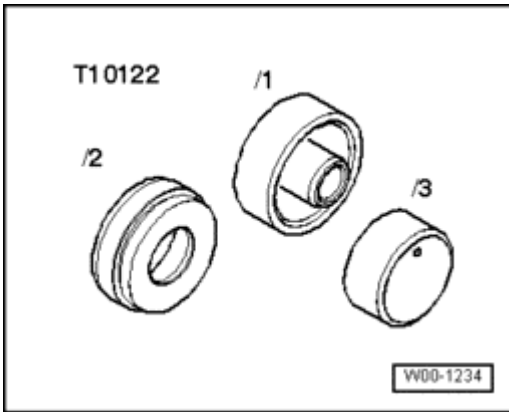


Fig. 237: Pulling Fixture T10122

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Pulling fixture T10122

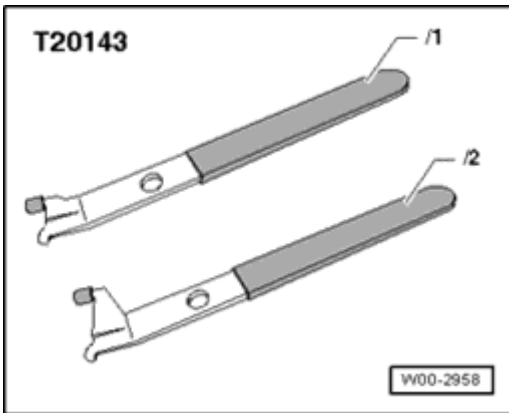


Fig. 238: Extractor Lever T20143/2

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Extractor lever T20143/2

Procedure

- Remove transmission --> **37 CONTROLS, HOUSING** .
- Vehicles with multitronic transmission: Remove damper unit --> **Damper Unit, Removing and Installing** and flywheel --> **Flywheel, Multitronic Transmission, Removing and Installing**.
- Vehicles with automatic transmission 09L: Remove drive plate --> **Drive Plate, Automatic Transmission 09L, Removing and Installing**.

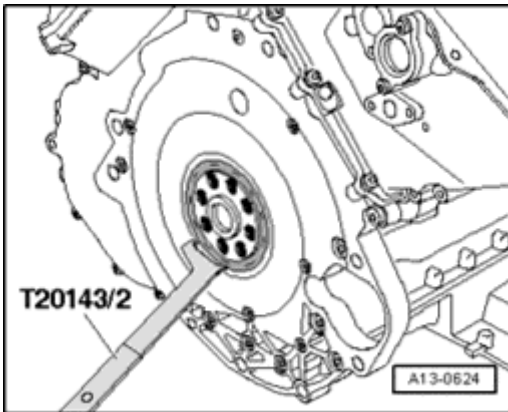


Fig. 239: Prying Out Shaft Seal Using Extractor Lever T20143/2
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Pry out shaft seal using extractor lever T20143/2.
- Clean operating and sealing surfaces.

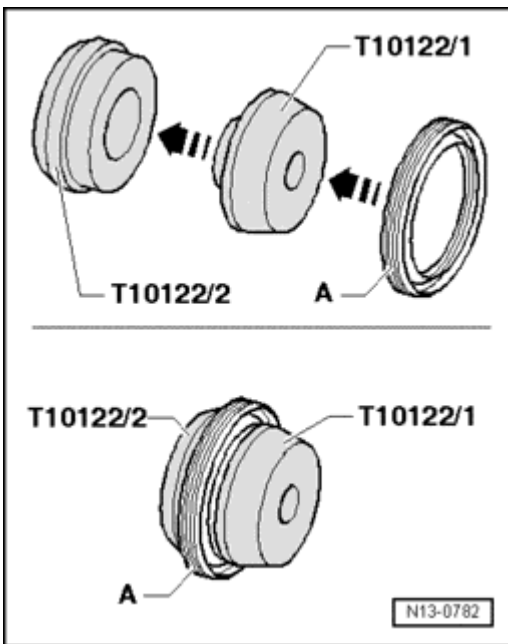


Fig. 240: Inserting Assembly Device T10122/1 Onto Pull Sleeve T10122/2 And Shaft Seal Onto Pull Sleeve
Courtesy of VOLKSWAGEN UNITED STATES, INC.

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

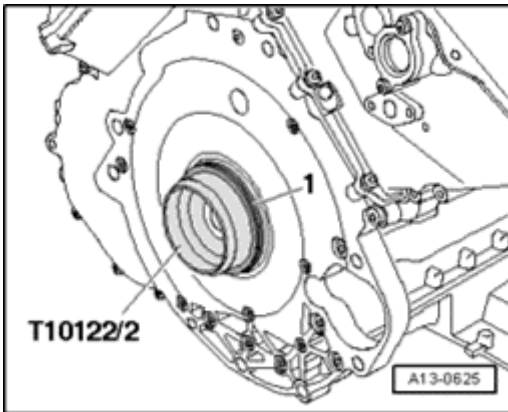


Fig. 241: Installing Pull Sleeve T10122/2 With Sealing Ring Onto Crankshaft
Courtesy of VOLKSWAGEN UNITED STATES, INC.

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

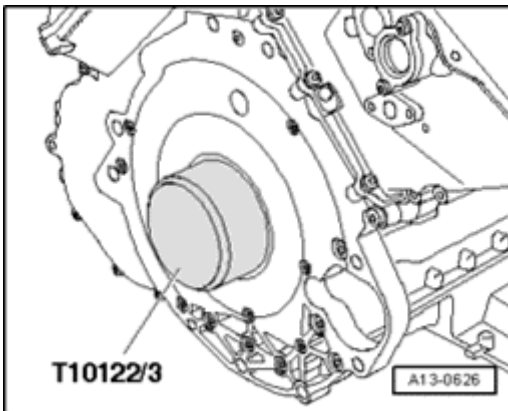


Fig. 242: Pressing In Sealing Ring All Around Evenly And Flush Using Pressure Sleeve T10122/3
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Press shaft seal in, evenly and flush, using pressure sleeve T10122/3.

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

- Vehicles with multitronic transmission: Install flywheel --> **Flywheel, Multitronic Transmission, Removing and Installing** and damper unit --> **Damper Unit, Removing and Installing**.
- Vehicles with automatic transmission 09L: Install drive plate --> **Drive Plate, Automatic Transmission 09L, Removing and Installing**.
- Install transmission --> **37 CONTROLS, HOUSING** .

TIMING CHAIN COVERS

Timing Chain Covers

--> **Timing Chain Covers, Component Overview**

--> **Timing Chain Covers, Removing and Installing**

--> **Lower Timing Chain Cover, Removing and Installing**

Timing Chain Covers, Component Overview

Timing Chain Covers, Component Overview

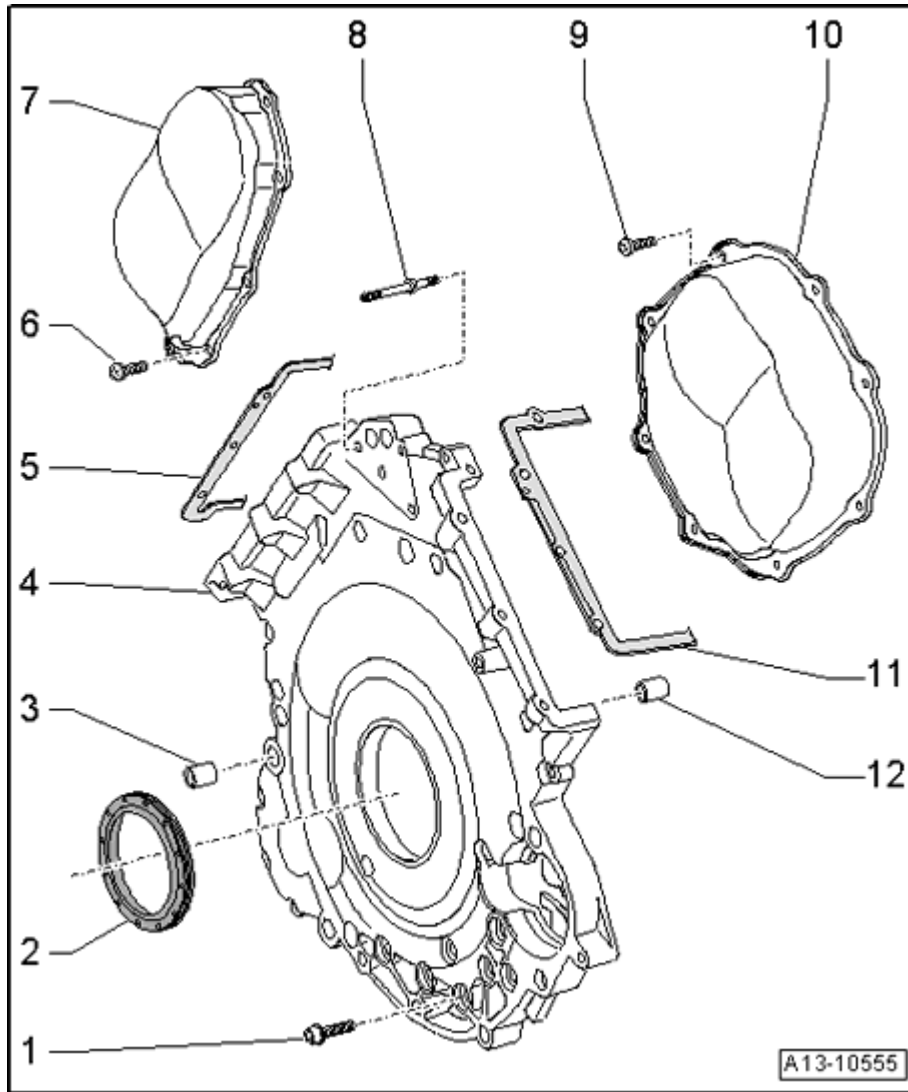


Fig. 243: Timing Chain Covers, Component Overview
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - M6 - 9 Nm; M8 - 20 Nm

- Observe sequence for tightening: Vehicles through 04.2005 --> *Set lower timing chain cover in place, guiding the cover at an angle from below onto the sealing surface of the cylinder block and cylinder head.* under **Lower Timing Chain Cover, Removing and Installing** , vehicles from 05.2005 --> *Set*

2006 Audi A6 Quattro

ENGINE 3.2 V6 4V Engine Mechanical, Engine Code(s): BKH

the cylinder block and cylinder head. under **Lower Timing Chain Cover, Removing and Installing**

2 - Shaft seal for crankshaft timing chain side

- Replacing --> **Crank Shaft Seal, Timing Chain Side, Replacing** .

3 - Alignment bushing

- 2 pieces

4 - Lower timing chain cover

- Removing and installing --> **Lower Timing Chain Cover, Removing and Installing**

5 - Left cylinder head gasket

6 - 5 Nm plus an additional 90 ($1/4$ turn)

- Replace
- Observe sequence for tightening --> *Position right timing chain cover and tighten bolts in sequence 1 to 8.* under **Timing Chain Covers, Removing and Installing**

7 - Left timing chain cover

- Removing and installing --> **Timing Chain Covers, Removing and Installing**

8 - 16 Nm

- For vehicles from 05.2005

9 - 5 Nm plus an additional 90 ($1/4$ turn)

- Replace
- Observe sequence for tightening --> *Position right timing chain cover and tighten bolts in sequence 1 to 8.* under **Timing Chain Covers, Removing and Installing**

10 - Right timing chain cover

- Removing and installing --> **Timing Chain Covers, Removing and Installing**

11 - Right cylinder head gasket

12 - Alignment bushing

- 2 pieces

Timing Chain Covers, Removing and Installing

Timing Chain Covers, Removing and Installing

Special tools, testers and auxiliary items required

- Hand drill with plastic brush attachment
- Protective glasses
- Sealant

Removing

NOTE:

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

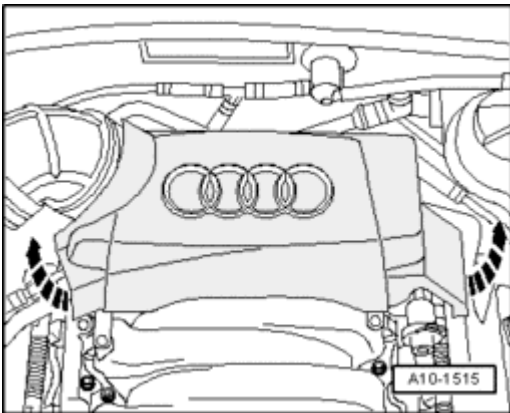
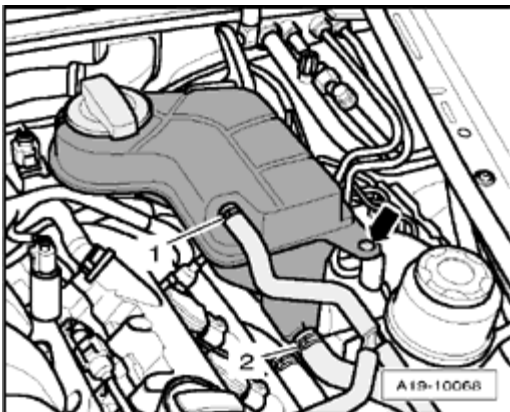


Fig. 244: Removing Rear Engine Cover

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove rear engine cover - **arrows** -.

Left timing chain cover:



Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove coolant expansion tank - **arrow** -.
- Disconnect electrical connection from Engine Coolant Level (ECL) Warning Switch F66 at bottom of coolant reservoir and set aside coolant reservoir with coolant hoses - **1** - and - **2** - connected.

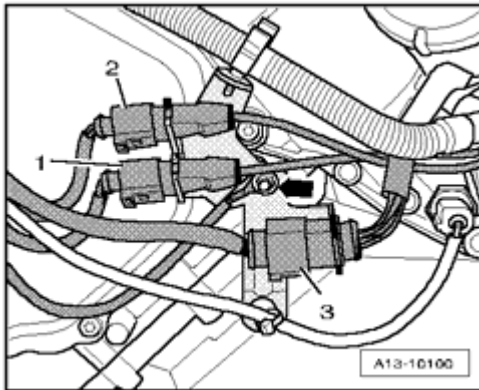


Fig. 246: Disconnecting Electrical Harness Connectors

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical harness connectors - **1 to 3** -.
- Remove nut - **arrow** -.
- Remove retainer for connection - **3** -.
- Remove double-bolt lying beneath.
- Remove retainer for connections - **1** - and - **2** -.

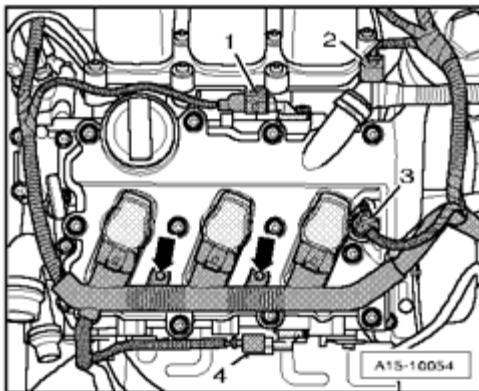


Fig. 247: Remove Bolts & Disconnecting Electrical Harness Connectors At Ignition Coils

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts - **arrows** - and separate electrical connections at the ignition coils.

NOTE:

- Ignore items - 1 to 4 -.

- Free up electrical wiring.

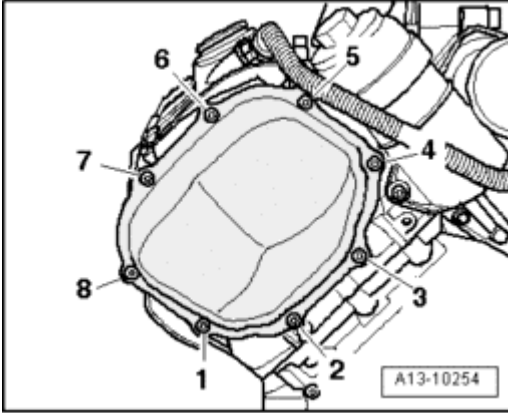


Fig. 248: Removing/Tighten Bolts In Sequence For Left Timing Chain Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts - 1 to 8 - and remove left timing chain cover.

Right timing chain cover:

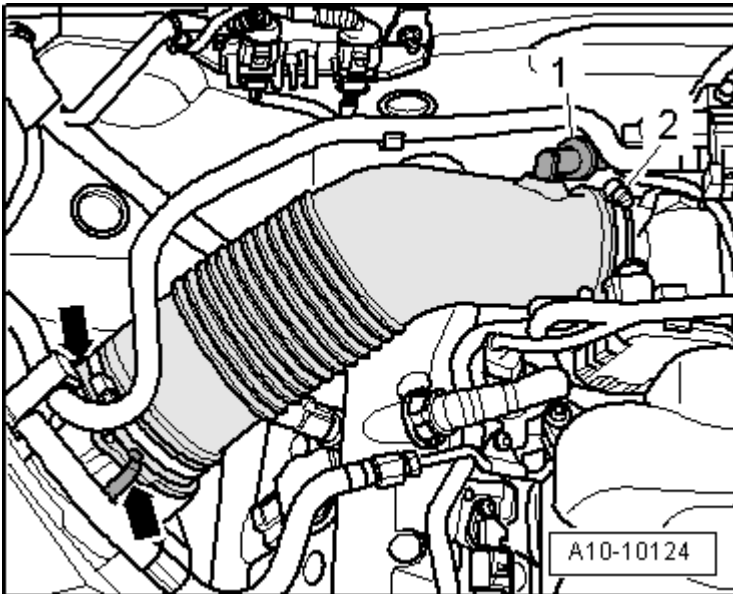


Fig. 249: Disconnecting Check Valve From Connection At Air Duct Hose & Removing Air Duct Hose
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect check valve - 1 - from connection at air duct hose.
- Remove air duct hose, thereby loosening hose clamp - 2 - and opening the clips - **arrows** -.

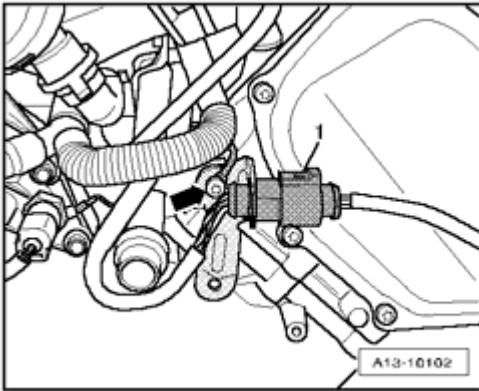


Fig. 250: Disconnecting Electrical Connector & Removing Bolt & Retainer For Connection
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical connector - **1** -.
- Remove bolt - **arrow** - and remove retainer for connection.

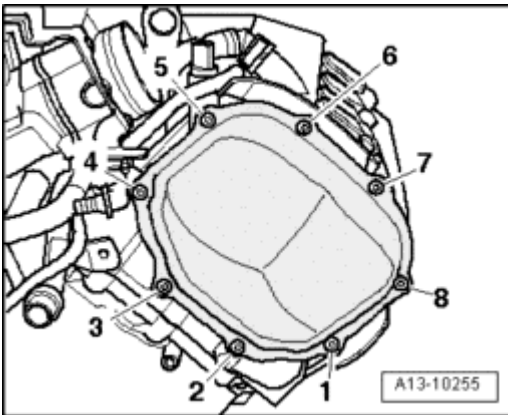


Fig. 251: Removing/Tighten Bolts In Sequence For Right Timing Chain Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts - **1 to 8** - and remove right timing chain cover.

Installing

- NOTE:**
- During installation, all cable ties must be re-installed at the same location.

CAUTION: Wear safety glasses.

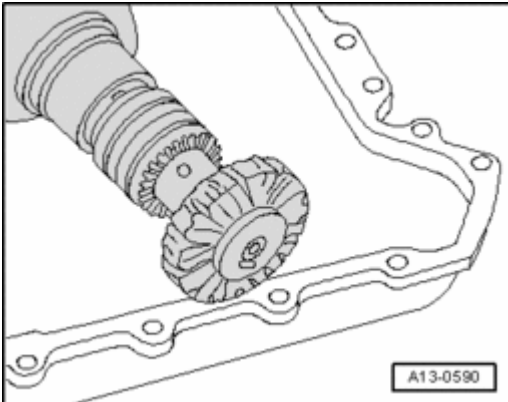


Fig. 252: Using Rotating Plastic Brush To Remove Any Sealant Residue From Sealing Flange, Cylinder Block And Upper Part Of Oil Pan

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: Make sure that no sealant residue enters the engine.

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

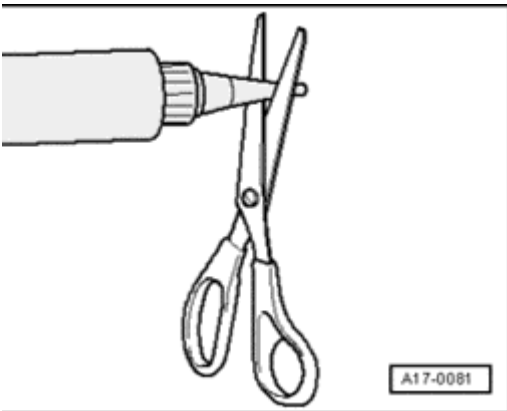


Fig. 253: Cutting Tube Nozzle At Front Marking

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Cut tube nozzle at front marking (diameter of nozzle approximately 1 mm).

NOTE:

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

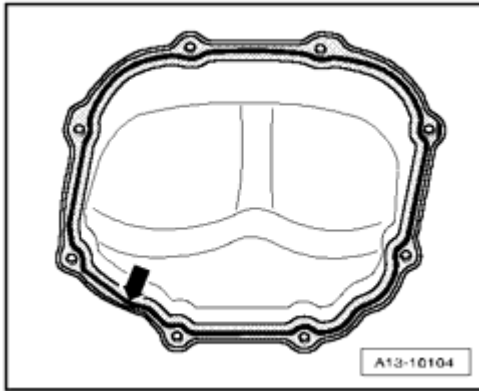


Fig. 254: Applying Sealant Bead On Clean Sealing Surfaces Of Left/Right Cover For Timing Chain
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Apply sealant bead - **arrow** - , as shown in illustration, on clean sealing surfaces of left cover for timing chain.
- The groove of sealing surface must be completely filled with sealant.
- Sealant bead must stand 1.5 to 2.0 mm above sealing surface.

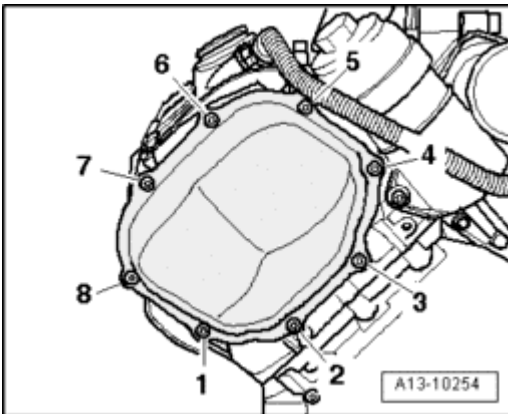


Fig. 255: Removing/Tighten Bolts In Sequence For Left Timing Chain Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Position left timing chain cover and tighten bolts in sequence - **1 to 8** - .

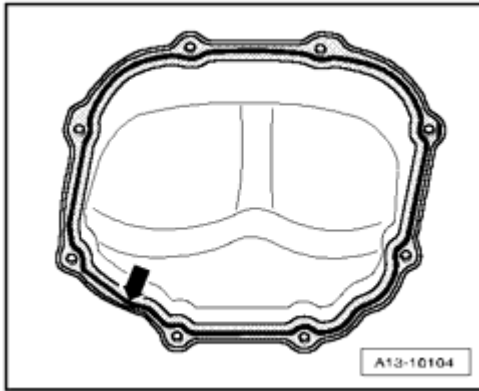


Fig. 256: Applying Sealant Bead On Clean Sealing Surfaces Of Left/Right Cover For Timing Chain
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Apply sealant bead - **arrow** - , as shown in illustration, on clean sealing surfaces of right cover for timing chain.
- The groove of sealing surface must be completely filled with sealant.
- Sealant bead must stand 1.5 to 2.0 mm above sealing surface.

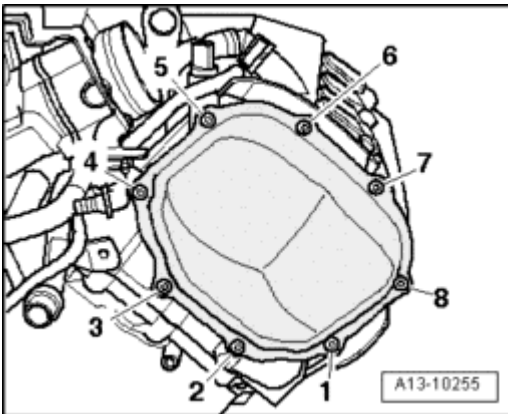


Fig. 257: Removing/Tighten Bolts In Sequence For Right Timing Chain Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Position right timing chain cover and tighten bolts in sequence - **1 to 8** -.

Further installation is in reverse order.

Tightening Specifications

Component	Nm
Left and right cover for timing chain on engine	5 + 90° 1)2)
Retainer for connections to cylinder head	9
Hose clamps 9 mm wide	3

1) Replace bolts. 2) 90° corresponds to a quarter turn.

Lower Timing Chain Cover, Removing and Installing

Lower Timing Chain Cover, Removing and Installing

Special tools, testers and auxiliary items required

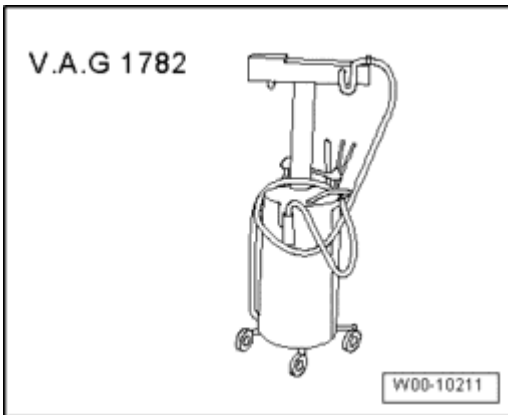


Fig. 258: Identifying Old Oil Collecting And Extracting Device V.A.G 1782
Courtesy of VOLKSWAGEN UNITED STATES, INC.

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

Removing

NOTE:

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

- Remove transmission --> **37 CONTROLS, HOUSING** .

CAUTION: To continue performing the repair procedure, ensure lock carrier is installed and torque support is tightened.

- Vehicles with multitronic transmission: Remove damper unit --> **Damper Unit, Removing and Installing** and flywheel --> **Flywheel, Multitronic Transmission, Removing and Installing**.
- Vehicles with automatic transmission 09L: Remove drive plate --> **Drive Plate, Automatic Transmission 09L, Removing and Installing**.

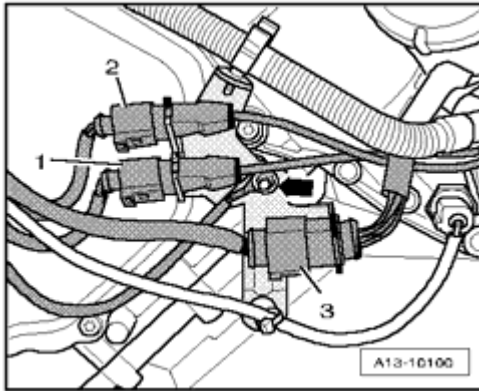


Fig. 259: Disconnecting Electrical Harness Connectors
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical harness connectors - **1 to 3** -.
- Remove nut - **arrow** -.
- Remove retainer for connection - **3** -.
- Remove double-bolt lying beneath.
- Remove retainer for connections - **1** - and - **2** -.

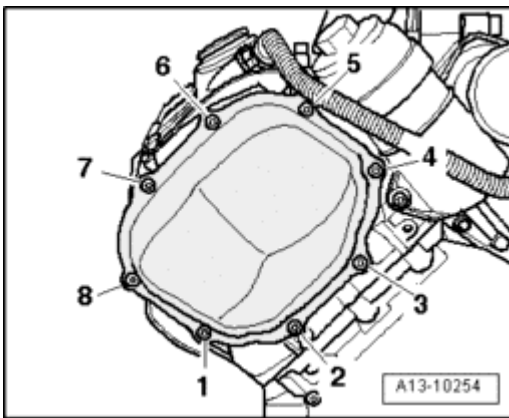


Fig. 260: Removing/Tighten Bolts In Sequence For Left Timing Chain Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts - **1 to 8** - and remove left timing chain cover.

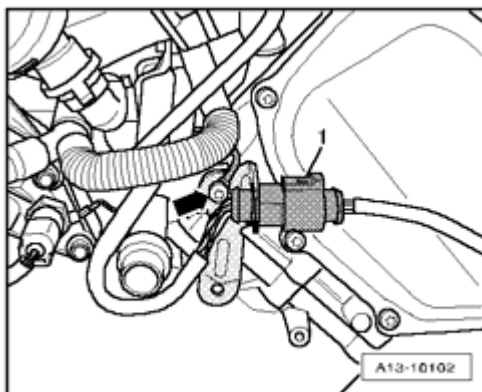


Fig. 261: Disconnecting Electrical Connector & Removing Bolt & Retainer For Connection
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical connector - 1 -.
- Remove bolt - **arrow** - and remove retainer for connection.

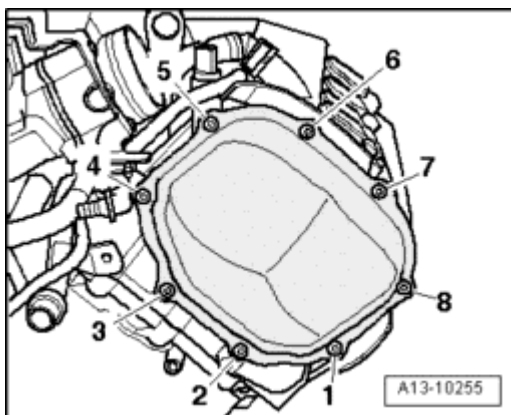


Fig. 262: Removing/Tighten Bolts In Sequence For Right Timing Chain Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts - 1 to 8 - and remove right timing chain cover.

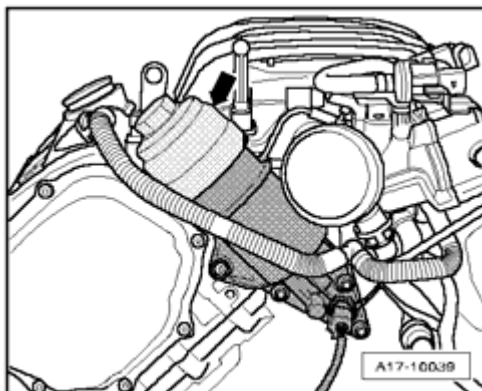


Fig. 263: Removing Cap For Oil Filter Housing

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.

NOTE:

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

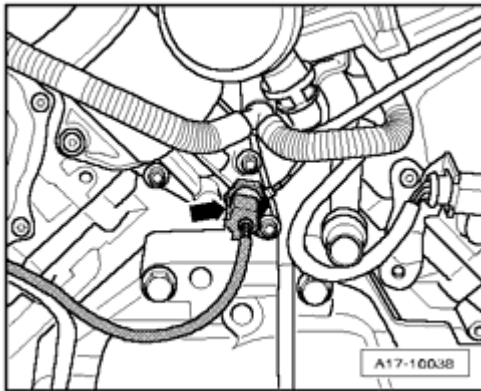


Fig. 264: Disconnecting Electrical Harness Connector From Oil Pressure Switch F1

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical harness connector from Oil Pressure Switch F1 - **arrow** -.
- Remove oil pressure switch.

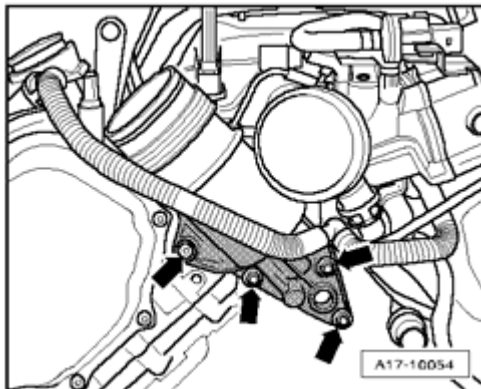


Fig. 265: Removing Oil Filter Housing Bolts

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts - **arrows** -.
- Remove oil filter housing.
- Place old oil collecting and extracting device V.A.G 1782 under engine.

- Drain engine oil.

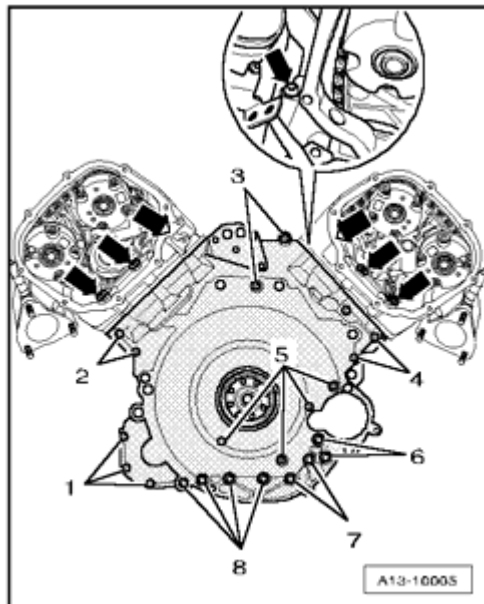
Vehicles through 04.2005:

Fig. 266: Removing/Installing Bolts And Lower Timing Chain Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts - **arrows** -.
- Remove bolts - **1 to 9** - and remove lower timing chain cover.

Vehicles from 05.2005:

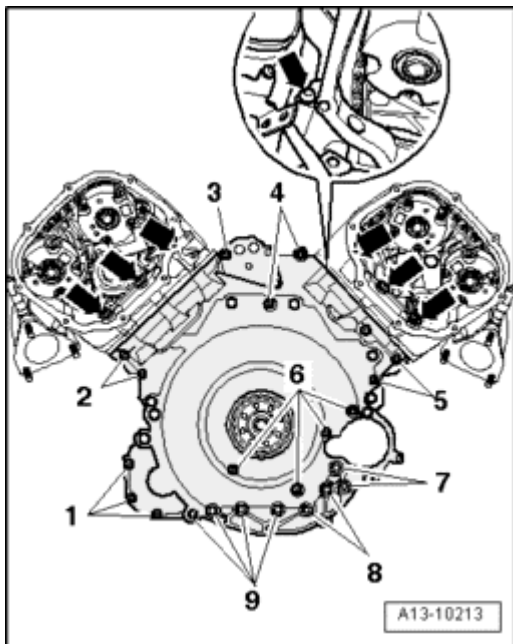


Fig. 267: Removing Bolts And Lower Timing Chain Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts - **1 to 9** - and remove lower timing chain cover.

All:

- Press rear crankshaft seal out of lower timing chain cover.

Installing

NOTE:

- **Replace gaskets, seals and O-rings.**
- **During installation, all cable ties must be re-installed at the same location.**

- Pull alignment bushing out of top right of cylinder block.

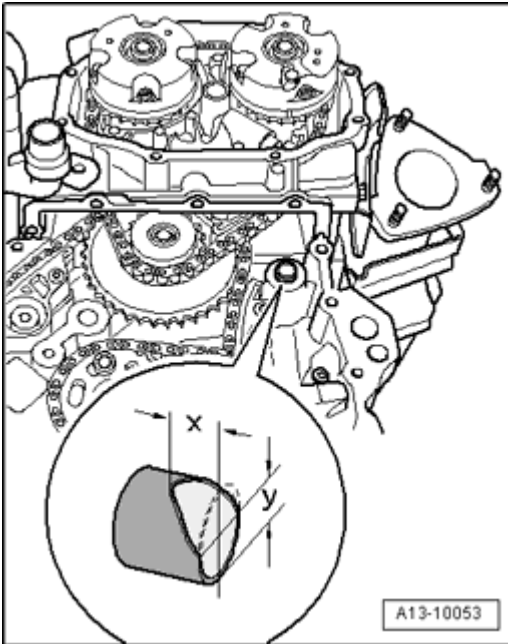


Fig. 268: Chamfering Alignment Bushing With A File
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Chamfer alignment bushing with a file, as shown in the illustration.
- Dimension - x - = 6.5 mm.
- Dimension - y - = 8 mm.
- Install alignment bushing into the cylinder block so that the chamfered side faces upward.

NOTE:

- The chamfer simplifies installation of the lower timing chain cover with cylinder head installed.

CAUTION: Wear safety glasses.

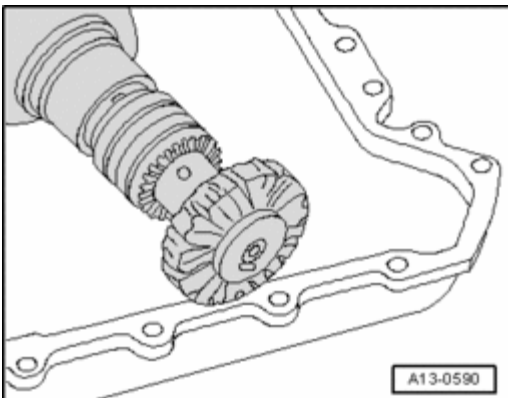


Fig. 269: Using Rotating Plastic Brush To Remove Any Sealant Residue From Sealing Flange, Cylinder Block And Upper Part Of Oil Pan

Courtesy of VOLKSWAGEN UNITED STATES, INC.

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

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

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

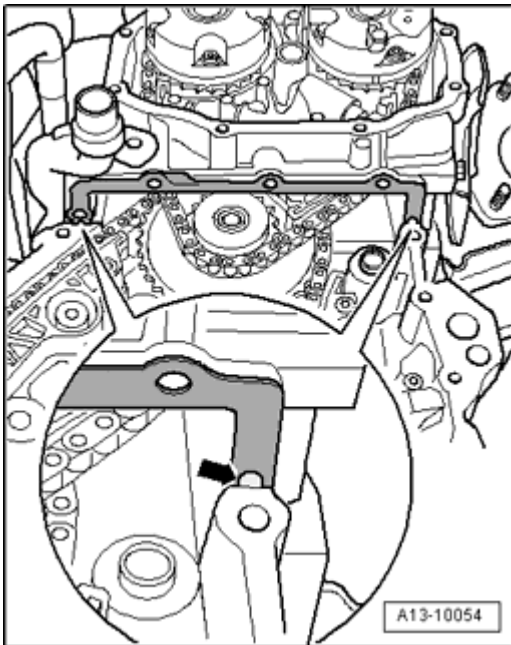


Fig. 270: Cleaning Old Sealant From Holes In Cylinder Head Gaskets

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Clean old sealant from the holes - **arrow** - in the cylinder head gaskets.

NOTE:

- With the cylinder head installed only half of the holes in the cylinder head gasket are visible.

CAUTION: Cylinder head gasket must not be kinked. A kinked cylinder head gasket must be replaced.

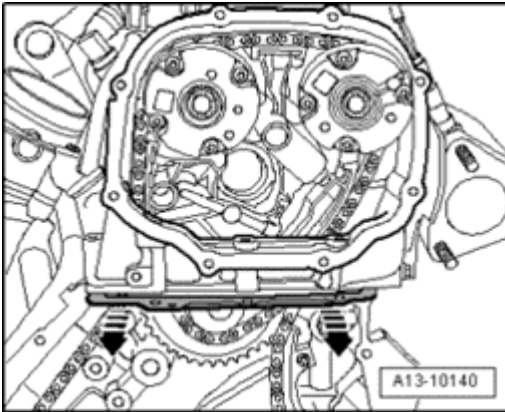


Fig. 271: Bending Ends Of Cylinder Head Gaskets Very Slightly Downward Until Upper Sealing Surface Of Gasket And Cylinder Head Can Be Cleaned

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Bend the ends of the cylinder head gaskets very slightly downward - **arrows** - until the upper sealing surface of the gasket and cylinder head can be cleaned.
- Clean both cylinder head gaskets, top and bottom, so they are completely free of any oil or grease.

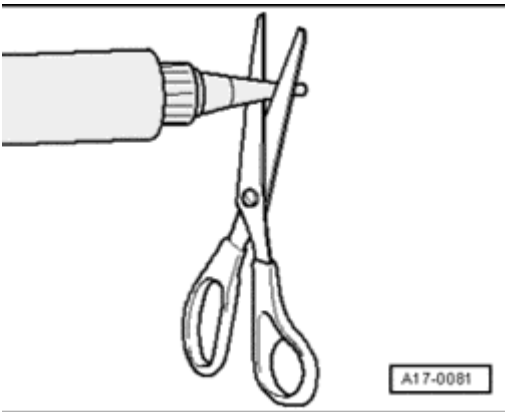


Fig. 272: Cutting Tube Nozzle At Front Marking

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Cut tube nozzle at front marking (diameter of nozzle approximately 2 mm).

NOTE:

- The sealant must be applied to several places on the engine, as described in the following.
- The curing time for the sealant after application is only approximately 5 minutes.

CAUTION: Cylinder head gasket must not be kinked. A kinked cylinder head gasket must be replaced.

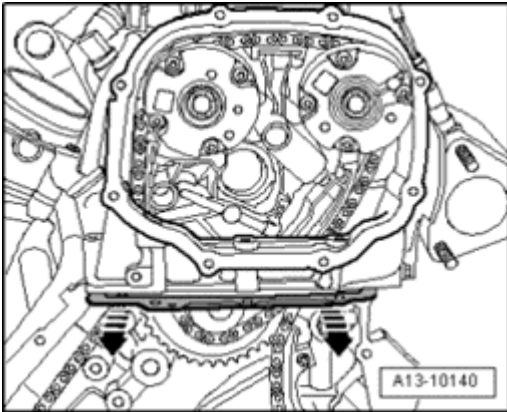


Fig. 273: Bending Ends Of Cylinder Head Gaskets Very Slightly Downward Until Upper Sealing Surface Of Gasket And Cylinder Head Can Be Cleaned

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Coat sealing surfaces of the cylinder head gaskets, top and bottom, with a thin layer of sealant, slightly bending the cylinder head gaskets downward again to do this.
- To coat the surface between the cylinder head and gasket, use a flat object, e.g. a feeler gauge.

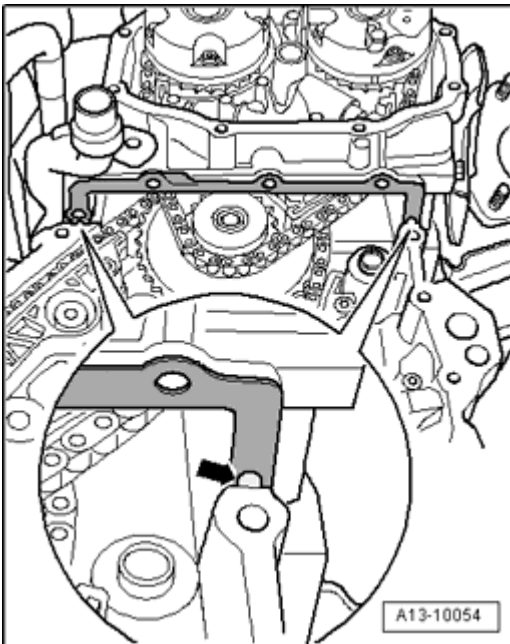


Fig. 274: Cleaning Old Sealant From Holes In Cylinder Head Gaskets

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Fill the cleaned holes - **arrow** - in the cylinder head seal with sealant.

Vehicles through 04.2005:

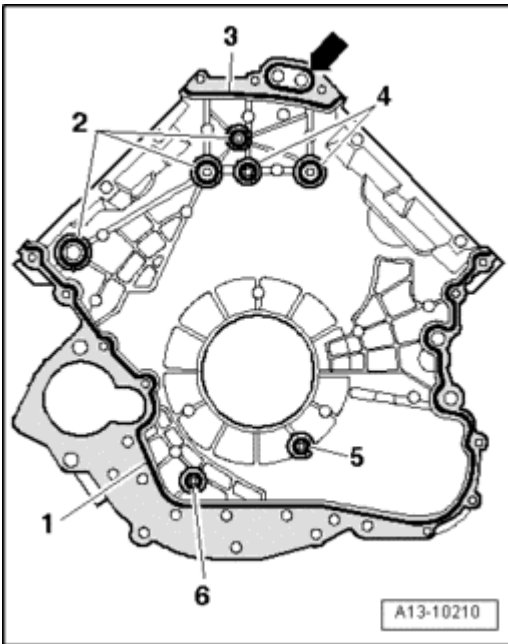


Fig. 275: Applying Sealant Beads On Clean Sealing Surfaces Of Lower Timing Chain Cover
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Apply sealant beads - **1 to 6** - on clean sealing surfaces of lower timing chain cover, as shown in illustration.
- The groove of sealing surface must be completely filled with sealant.
- Sealant beads must be 1.5 to 2.0 mm above the sealing surface.
- The sealant bead - **3** - must be pulled through as shown in the illustration even though the groove is intermittent.
- Lay O-ring - **arrow** - in lower timing chain cover groove.
- Secure O-ring with some sealant.

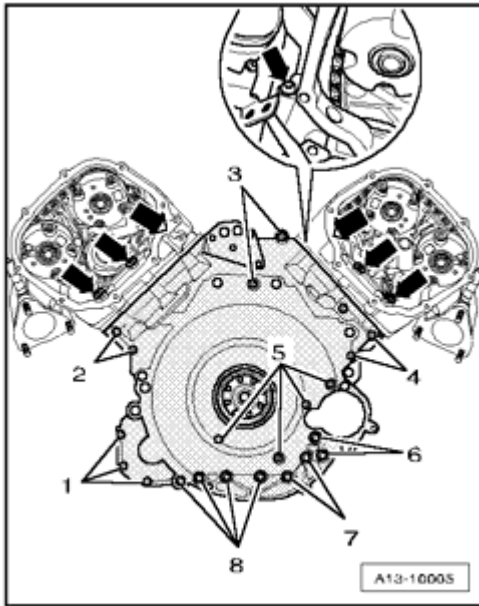


Fig. 276: Removing/Installing Bolts And Lower Timing Chain Cover
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Set lower timing chain cover in place, guiding the cover at an angle from below onto the sealing surface of the cylinder block and cylinder head.
- When installing, make sure that the cylinder head gaskets do not become damaged. A damaged gasket must be replaced.
- Tighten bolts as follows:

Insert bolts arrows with locking compound and tighten to 5 Nm. Tighten bolts 1 to 8 in a diagonal sequence to 9 Nm using a torque wrench. Tighten bolts arrows to 9 Nm. Tighten bolts 6 , 7 and 8 to 20 Nm.

- Then immediately install the oil filter housing --> **Oil Filter Housing, Removing and Installing** .

Vehicles from 05.2005:

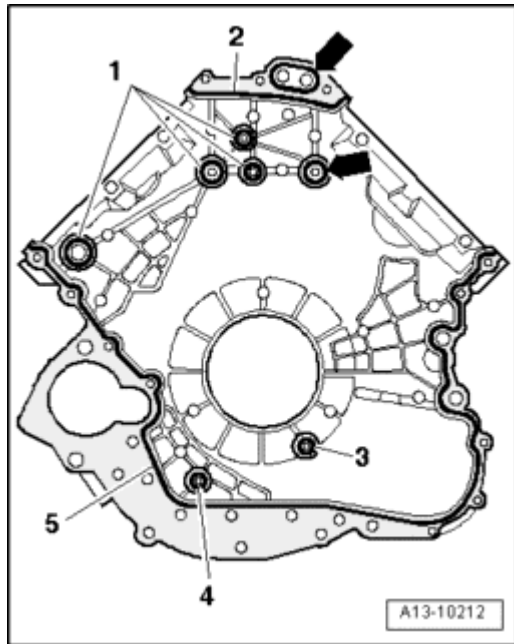


Fig. 277: Applying sealant beads on clean sealing surfaces of lower timing chain cover
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Apply sealant beads - **1 to 5** - on clean sealing surfaces of lower timing chain cover, as shown in illustration.
 - The groove of sealing surface must be completely filled with sealant.
 - Sealant beads must be 1.5 to 2.0 mm above the sealing surface.
 - The sealant bead - **2** - must be pulled through as shown in the illustration even though the groove is intermittent.
- Insert seals - **arrows** - in lower timing chain cover grooves.

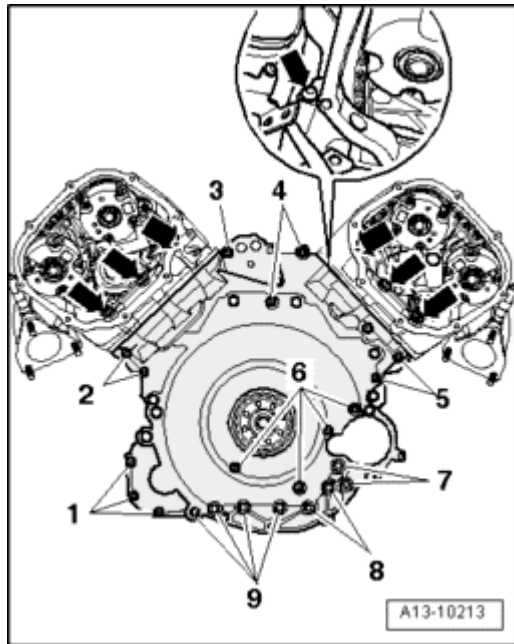


Fig. 278: Setting Lower Timing Chain Cover In Place, Guiding Cover At An Angle From Below Onto Sealing Surface Of Cylinder Block And Cylinder Head
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Set lower timing chain cover in place, guiding the cover at an angle from below onto the sealing surface of the cylinder block and cylinder head.
- When installing, make sure that the cylinder head gaskets do not become damaged. A damaged gasket must be replaced.
- Tighten bolts as follows:

Insert bolts arrows with locking compound and tighten to 5 Nm. Tighten bolts 1 to 9 in a diagonal sequence to 9 Nm using a torque wrench. Tighten bolts arrows to 9 Nm. Tighten bolts 7 , 8 and 9 to 20 Nm. Tighten stud bolt 3 to 16 Nm.

All:

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

- Install left and right timing chain covers --> **Timing Chain Covers, Removing and Installing** .
- Install oil filter housing --> **Oil Filter Housing, Removing and Installing** .
- Install crankshaft seal, timing chain side --> **Crank Shaft Seal, Timing Chain Side, Replacing** .
- Vehicles with multitronic transmission: Install flywheel --> **Flywheel, Multitronic Transmission, Removing and Installing** and damper unit --> **Damper Unit, Removing and Installing**.
- Vehicles with automatic transmission 09L: Install drive plate --> **Drive Plate, Automatic Transmission 09L, Removing and Installing**.
- Install transmission --> **37 CONTROLS, HOUSING** .

2006 Audi A6 Quattro

ENGINE 3.2 V6 4V Engine Mechanical, Engine Code(s): BKH

Tightening Specifications

Component		Nm
Lower timing chain cover to engine	M6	9 1)
M7	16	5 + 90° 2)3)
M8	20	
Left and right cover for timing chain on engine		
Retainer for connections to cylinder head		9

1) Install threaded fasteners between cylinder head and lower timing chain cover with locking compound; Locking compound . 2) Replace bolts. 3) 90° corresponds to a quarter turn.

CAMSHAFT DRIVE

Camshaft Drive

- > Camshaft Timing Chain, Component Overview
- > Timing Chains, Removing from Camshafts and Chain Tensioner, Removing and Installing
- > Timing Mechanism Drive Chain, Component Overview
- > Timing Mechanism Drive Chain, Removing and Installing
- > Power Take-Off Drive Chain, through 03.06, Component Overview
- > Power Take-Off Drive Chain, from 04.06, Removing and Installing
- > Power Take-Off Drive Chain, from 04.06, Component Overview
- > Power Take-Off Drive Chain, from 04.06, Removing and Installing
- > Balancing Shaft, Component Overview
- > Balancing Shaft, Removing and Installing

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

Camshaft Timing Chain, Component Overview

NOTE:

•

Reversing the rotation direction of a used chain can destroy it.

Left camshaft timing chain

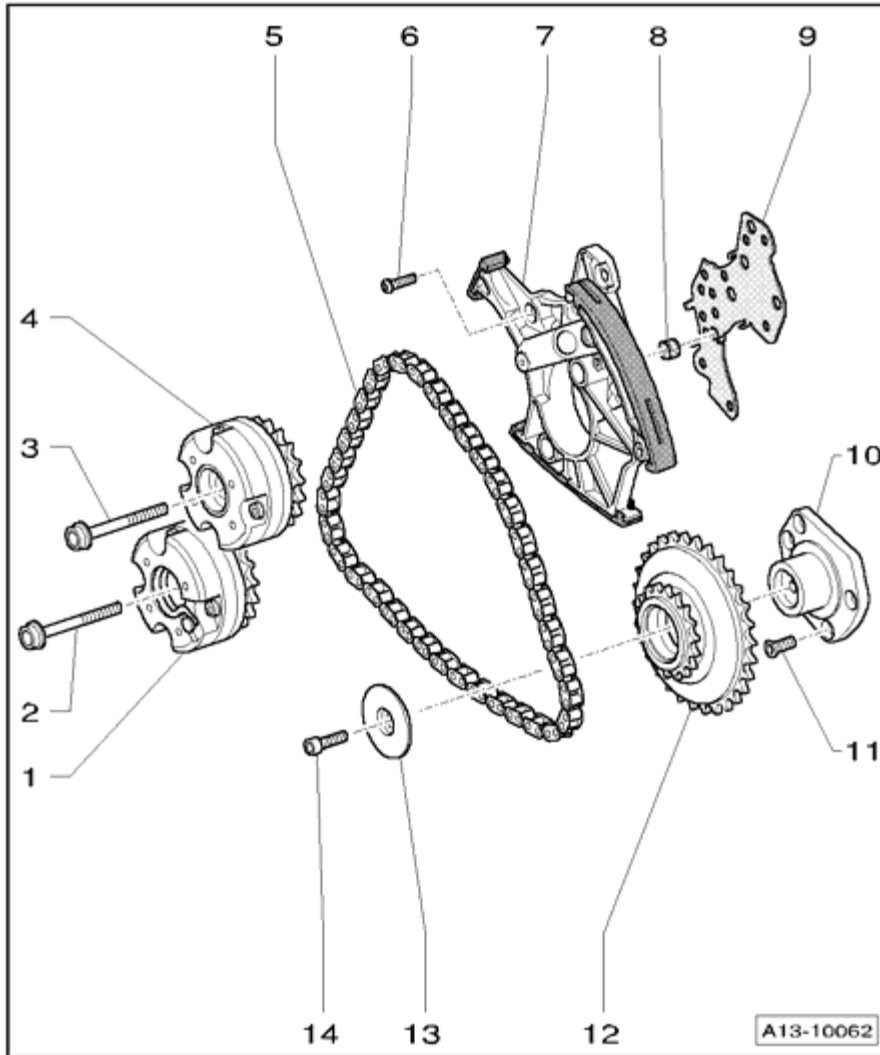


Fig. 279: Camshaft Timing Chain, Component Overview (Left Camshaft Timing Chain)

Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Camshaft adjuster for exhaust camshaft

- Identification "Exhaust"
- Removing and installing --> **Timing Chains, Removing from Camshafts and Chain Tensioner, Removing and Installing**

2 - Camshaft bolt

- Replace

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- Initial tightening specifications: 40 Nm
- Final tightening specifications: 80 Nm plus an additional 90 ($1/4$ turn)

3 - Camshaft bolt

- Replace
- Initial tightening specifications: 40 Nm
- Final tightening specifications: 80 Nm plus an additional 90 ($1/4$ turn)

4 - Camshaft adjuster for intake camshaft

- Identification "Intake"
- Removing and installing --> **Timing Chains, Removing from Camshafts and Chain Tensioner, Removing and Installing**

5 - Left camshaft timing chain

- Removing and installing --> **Timing Chains, Removing from Camshafts and Chain Tensioner, Removing and Installing**

6 - 9 Nm

7 - Chain tensioner for left camshaft timing chain

- Removing and installing --> **Timing Chains, Removing from Camshafts and Chain Tensioner, Removing and Installing**

8 - Oil strainer

- Set into chain tensioner
- Observe locating tabs on circumference

9 - Gasket

- Replace
- Clipped onto chain tensioner

10 - Mounting bracket for drive sprocket

11 - 8 Nm plus an additional 45 ($1/8$ turn)

- Replace
- To be oiled for installation

12 - Drive sprocket for left camshaft timing chain

13 - Thrust washer for drive sprocket

14 - 6 Nm plus an additional 60 ($\frac{1}{6}$ turn)

- Replace

Right camshaft timing chain

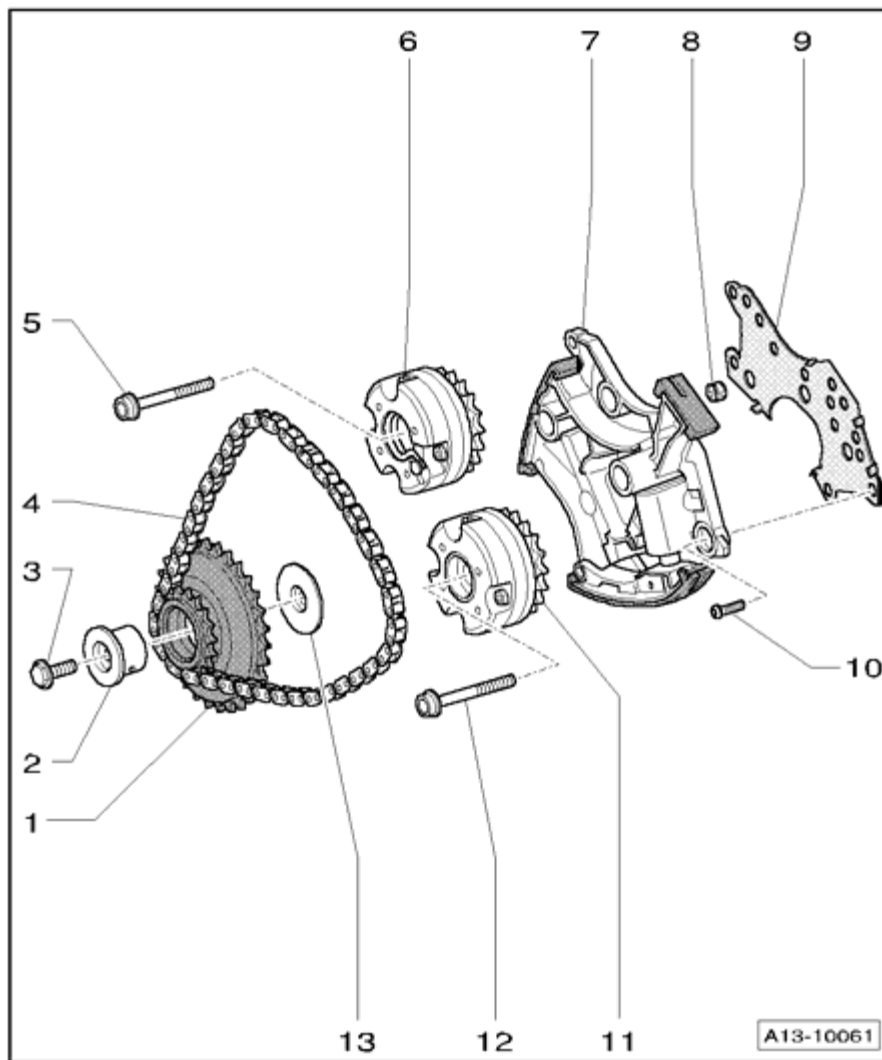


Fig. 280: Camshaft Timing Chain, Component Overview (Right Camshaft Timing Chain)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Drive sprocket for right camshaft timing chain

2 - Pivot pin for drive sprocket

3 - 30 Nm plus an additional 90 ($1/4$ turn)

4 - Right camshaft timing chain

- Removing and installing --> **Timing Chains, Removing from Camshafts and Chain Tensioner, Removing and Installing**

5 - Camshaft bolt

- Replace
- Initial tightening specifications: 40 Nm
- Final tightening specifications: 80 Nm plus an additional 90 ($1/4$ turn)

6 - Camshaft adjuster for intake camshaft

- Identification "Intake"
- Removing and installing --> **Timing Chains, Removing from Camshafts and Chain Tensioner, Removing and Installing**

7 - Chain tensioner for right camshaft timing chain

- Removing and installing --> **Timing Chains, Removing from Camshafts and Chain Tensioner, Removing and Installing**

8 - Oil strainer

- Set into chain tensioner
- Installation position: Locating tabs on circumference

9 - Gasket

- Replace
- Clipped onto chain tensioner

10 - 9 Nm

11 - Camshaft adjuster for exhaust camshaft

- Identification "Exhaust"
- Removing and installing --> **Timing Chains, Removing from Camshafts and Chain Tensioner, Removing and Installing**

12 - Camshaft bolt

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- Replace
- Initial tightening specifications: 40 Nm
- Final tightening specifications: 80 Nm plus an additional 90 ($\frac{1}{4}$ turn)

13 - Thrust washer for drive sprocket

Timing Chains, Removing from Camshafts and Chain Tensioner, Removing and Installing

Timing Chains, Removing from Camshafts and Chain Tensioner, Removing and Installing

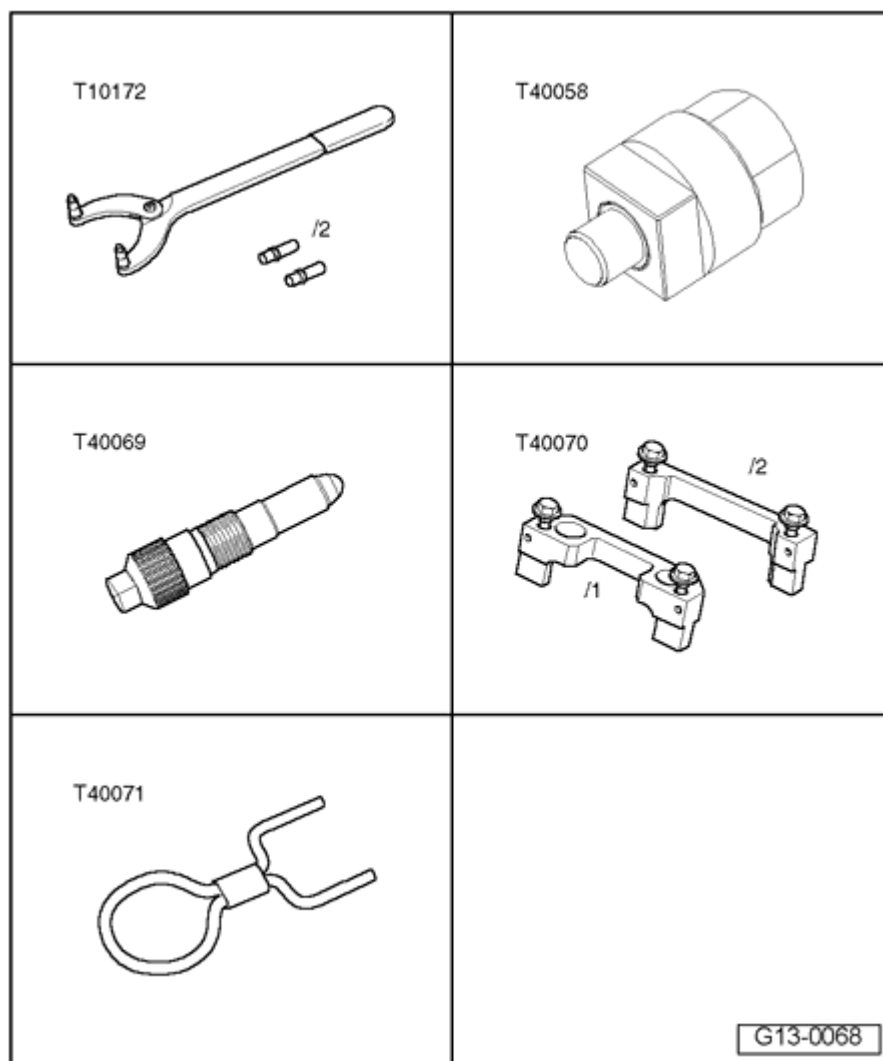


Fig. 281: Identifying Special Tools - Timing Chains, Removing From Camshafts And Chain Tensioner, Removing And Installing

Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools, testers and auxiliary items required

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- Counter-holder T10172 with pin T10172/2
- Adapter T40058
- Locking pin T40069
- Camshaft locator T40070 (qty. 2)
- Securing pin T40071 (qty. 2)

Special tools, testers and auxiliary items required

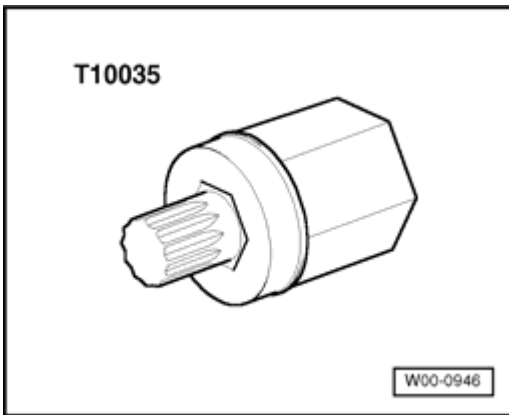


Fig. 282: Multi-Point Socket T10035

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Multi-point socket T10035

Removing

NOTE:

- According to the following description, the timing chains for camshafts remain on engine. If the timing chains for camshafts are to be completely removed, the lower timing chain cover must also be removed --> Lower Timing Chain Cover, Removing and Installing .

- Remove cylinder head cover.
- Remove left and right timing chain covers --> Timing Chain Covers, Removing and Installing .

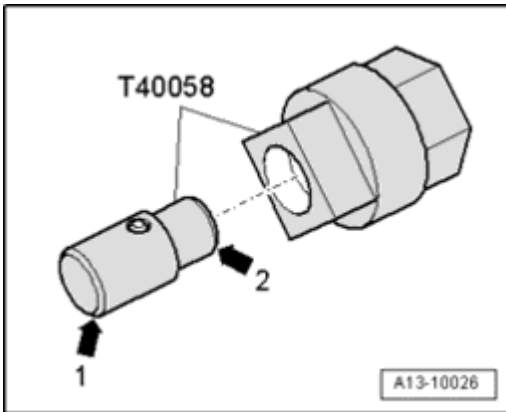


Fig. 283: Inserting Guide Pin Of Adapter T40058 So That Large Diameter Points To Engine
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Insert guide pin of adapter T40058 so that large diameter - **arrow 1** - points to engine. Small diameter - **arrow 2** - points to adapter.

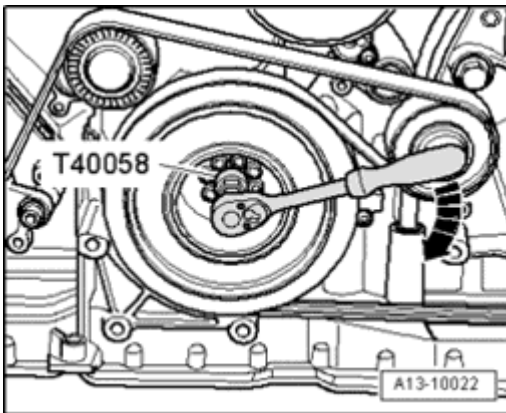


Fig. 284: Loosening Torque Converter Bolts Using Adapter T40058
Courtesy of VOLKSWAGEN UNITED STATES, INC.

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

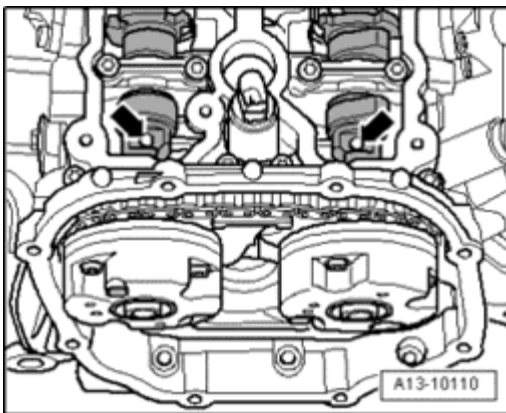


Fig. 285: Identifying Threaded Holes In Camshafts Must Face Upward

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- The threaded holes - **arrows** - in the camshafts must face upward.

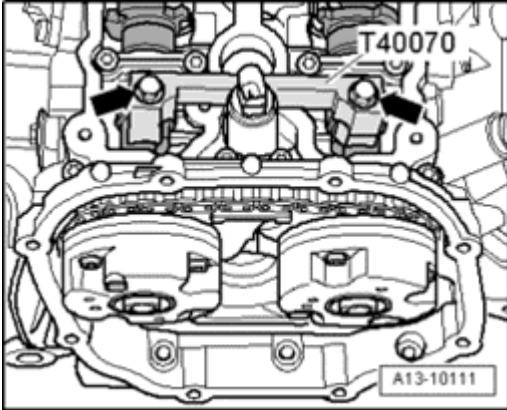


Fig. 286: Mounting Camshaft Locating Tool T40070 To Both Cylinder Heads And Tightening Bolts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Mount camshaft locating tool T40070 on both cylinder heads and tighten bolts - **arrows** - to 20 Nm.
- The camshaft locating tool T40070 is correctly positioned when the holes for the cylinder head bolts remain free.

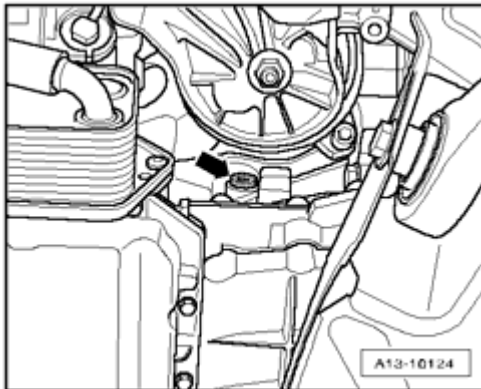


Fig. 287: Removing/Installing Sealing Plug From Cylinder Block
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove sealing plug - **arrow** - from cylinder block.

CAUTION: Do not turn crankshaft while touching TDC hole with finger - Risk of injury.

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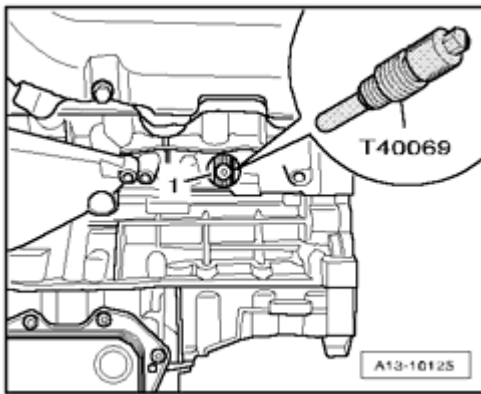


Fig. 288: Installing Crankshaft Holder T40069 Into Hole
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Install crankshaft holder T40069 into hole - 1 - to 10 Nm, if necessary rotate crankshaft very slightly back and forth to completely center the holder.

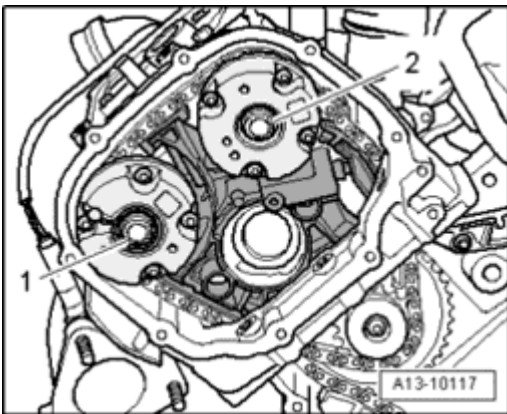


Fig. 289: Removing/Installing Camshaft Adjuster Screws On Left Cylinder Head
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Mark running direction of left camshaft timing chain with paint.
- Remove bolts - 1 - and - 2 - for camshaft adjuster using multipoint socket T10035.
- Remove both camshaft adjusters.

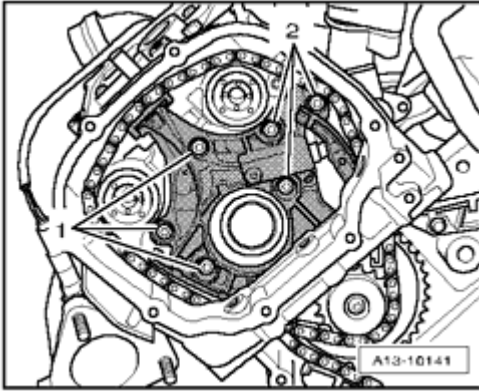


Fig. 290: Removing Bolts And Chain Tensioner
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts - 1 - and - 2 - and remove chain tensioner.

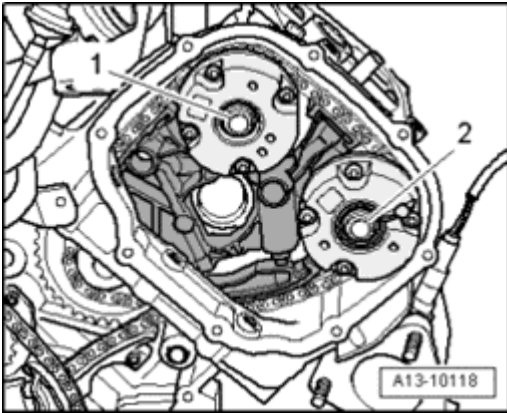


Fig. 291: Removing Bolts For Camshaft Adjuster Using Multipoint Socket T10035
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Mark running direction of right camshaft timing chain with paint.
- Remove bolts - 1 - and - 2 - for camshaft adjuster using multipoint socket T10035.
- Remove both camshaft adjusters.

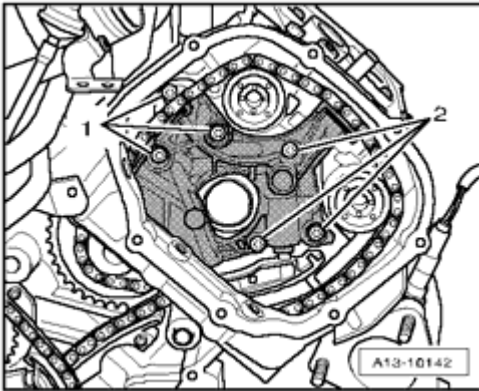


Fig. 292: Removing Bolts And Chain Tensioner
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts - 1 - and - 2 - and remove chain tensioner.

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.
- Drive chain for timing mechanism installed --> Timing Mechanism Drive Chain, Removing and Installing .

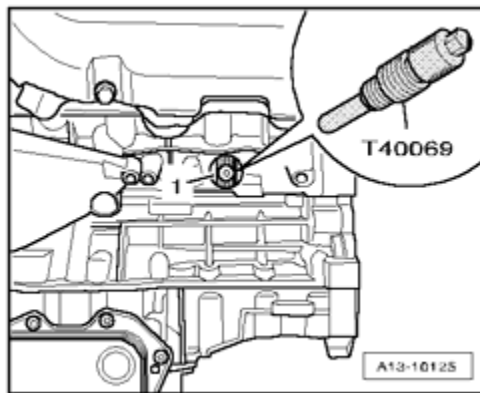


Fig. 293: Installing Crankshaft Holder T40069 Into Hole
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Secure crankshaft in TDC position using crankshaft holder T40069.

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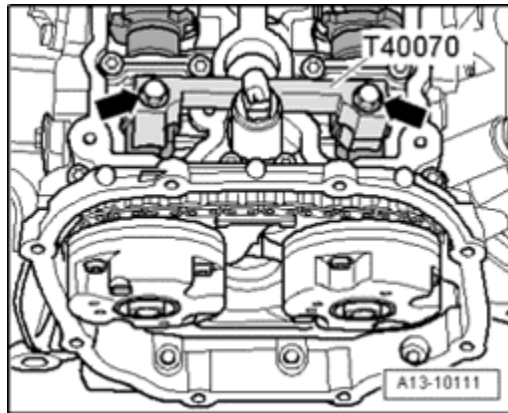


Fig. 294: Mounting Camshaft Locating Tool T40070 To Both Cylinder Heads And Tightening Bolts

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Camshaft locating tool T40070 mounted on both cylinder heads and tightened to 20 Nm.

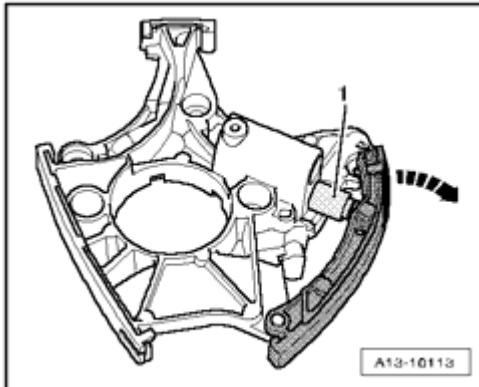


Fig. 295: Fully Relieving Tension Of Guide Rail For Left/Right Camshaft Timing Chain Tensioner

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Fully relieve tension of guide rail for left and right camshaft timing chain tensioner - **arrow** -.
- The piston of the tensioning element - **1** - must be driven out completely, thereby releasing the retainer - for this the chain tensioner must be removed.

NOTE:

- If the tensioning element is to be removed from the chain tensioner, observe the installed position: Hole in housing floor faces toward chain tensioner, piston faces toward tensioning rail.

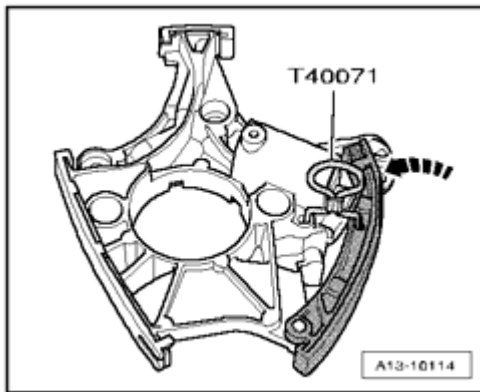


Fig. 296: Pressing Guide Rail Of Left/Right Camshaft Timing Chain Inward Up To Stop And Secure Chain Tensioner With Securing Pin T40071

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Press guide rail of the left and right camshaft timing chain inward - **arrow** - up to stop and secure chain tensioner with the securing pin T40071.

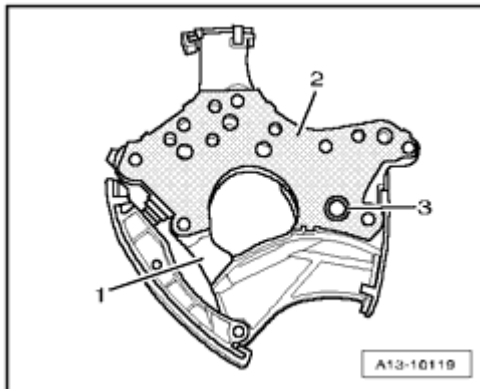


Fig. 297: Cleaning Oil Strainer In Both Chain Tensioners & Placing New Gasket Onto Rear Of Chain Tensioner

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Clean oil strainer - **3** - in both chain tensioners if necessary.
- Place a new gasket - **2** - onto the rear of the chain tensioner - **1** -.

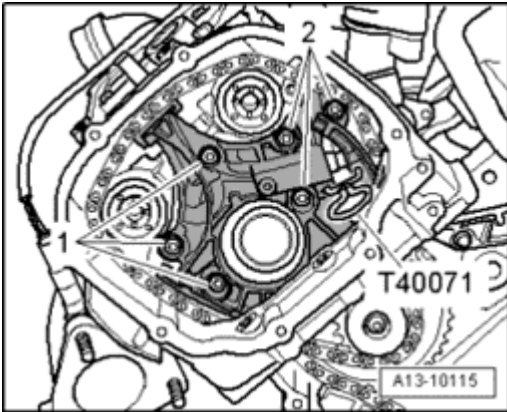


Fig. 298: Tightening Bolts & Replacing Camshaft Bolts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Set chain tensioner in place on the left cylinder head and install the camshaft timing chain, as shown in the illustration.
- Tighten bolts - 1 - and - 2 -.

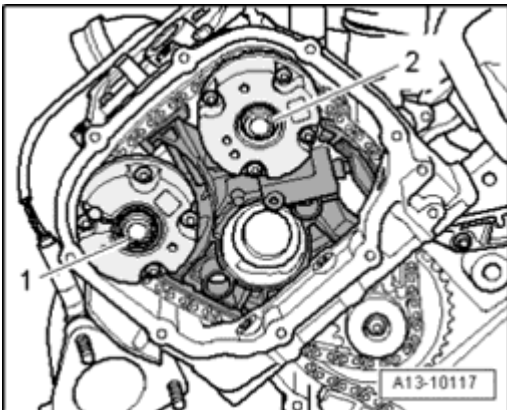


Fig. 299: Removing/Installing Camshaft Adjuster Screws On Left Cylinder Head
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Replace camshaft bolts.
- Place camshaft timing chain onto drive sprocket and onto camshaft adjusters and loosely thread in the bolts - 1 - and - 2 -.
- Both camshaft adjusters must be able to still be rotated on camshaft and must not tip.
- Remove Locking Pin T40071.

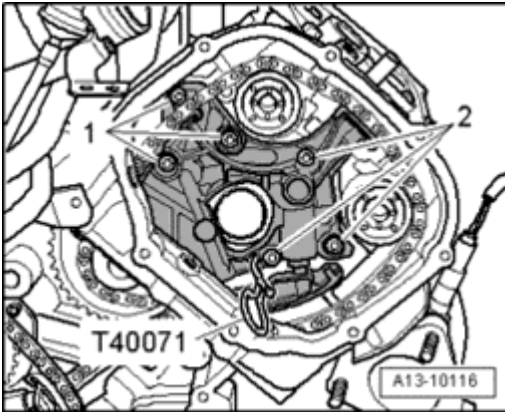


Fig. 300: Tightening Bolts & Replacing Camshaft Bolts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Set chain tensioner in place on the right cylinder head and install the camshaft timing chain, as shown in the illustration.
- Tighten bolts - 1 - and - 2 -.
- Replace camshaft bolts.

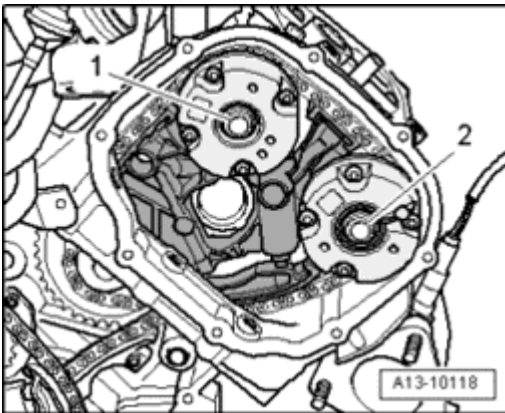


Fig. 301: Removing Bolts For Camshaft Adjuster Using Multipoint Socket T10035
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Place camshaft timing chain onto drive sprocket and onto camshaft adjusters and loosely thread in the bolts - 1 - and - 2 -.
- Both camshaft adjusters must be able to still be rotated on camshaft and must not tip.
- Remove Locking Pin T40071.

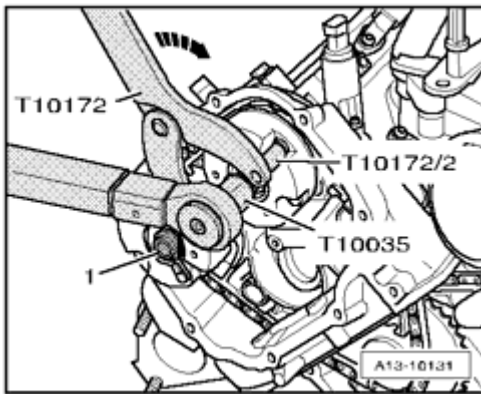


Fig. 302: Setting Counter-Holder T10172 With Pin T10172/2 In Place On Camshaft Adjuster Of Left Intake Camshaft

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Set counter-holder T10172 with pin T10172/2 in place on the camshaft adjuster of the left intake camshaft.
- Hold camshaft timing chain pretensioned by pressing on counter-holder in direction of - **arrow** -.
- Simultaneously, pre-torque the camshaft bolt using the multipoint socket T10035 and torque wrench.
- Tightening Specifications 40 Nm.
- Continue holding the pretension on the intake camshaft and pre-torque the bolt - **1** - on the exhaust camshaft.
- Tightening Specifications 40 Nm.

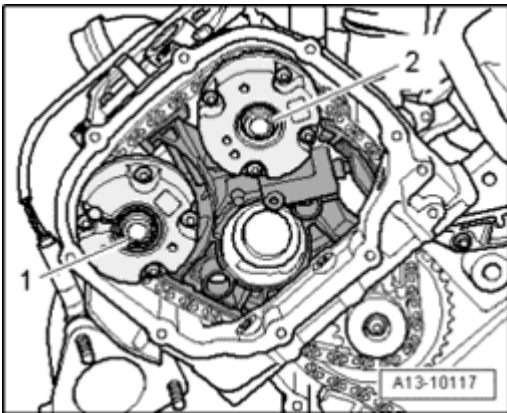


Fig. 303: Removing/Installing Camshaft Adjuster Screws On Left Cylinder Head

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Tighten camshaft bolts - **1** - and - **2** - on left cylinder head to final torque specification.
- Tightening Specifications 80 Nm plus an additional 90 ($\frac{1}{4}$ turn).

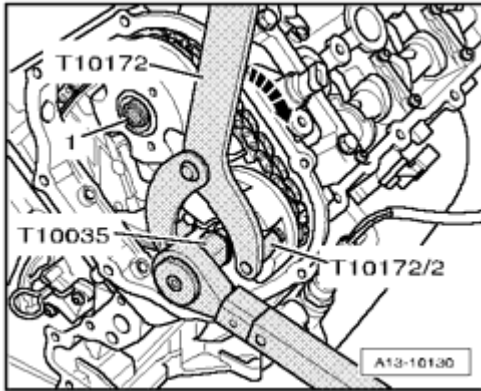


Fig. 304: Setting Counter-Holder T10172 With Pin T10172/2 In Place On Camshaft Adjuster Of Right Exhaust Camshaft

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Set counter-holder T10172 with pin T10172/2 in place on the camshaft adjuster of the right exhaust camshaft.
- Hold camshaft timing chain pretensioned by pressing on counter-holder in direction of - **arrow** -.
- Simultaneously, pre-torque camshaft bolt using the multipoint socket T10035 and torque wrench.
- Tightening Specifications 40 Nm.
- Continue holding the pretension on the exhaust camshaft and pre-torque the bolt - **1** - on the intake camshaft.
- Tightening Specifications 40 Nm.

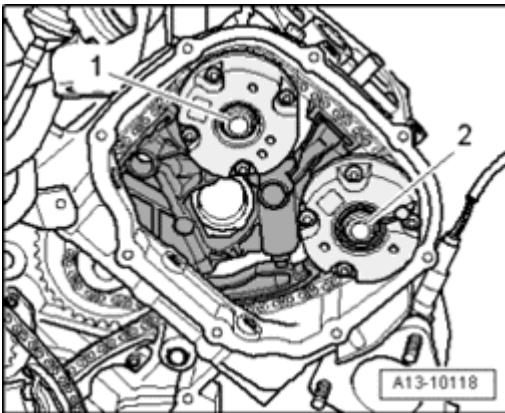


Fig. 305: Removing Bolts For Camshaft Adjuster Using Multipoint Socket T10035

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Tighten camshaft bolts - **1** - and - **2** - on right cylinder head to final torque specification.
- Tightening Specifications 80 Nm plus an additional 90 ($\frac{1}{4}$ turn).

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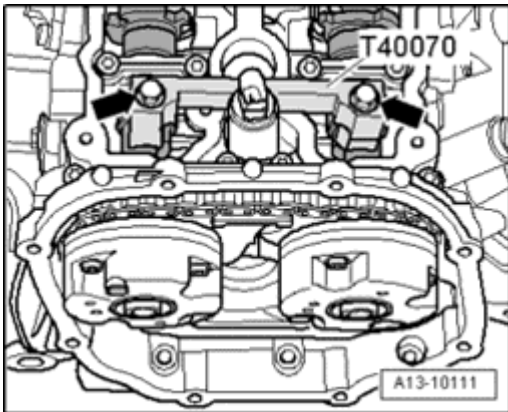


Fig. 306: Mounting Camshaft Locating Tool T40070 To Both Cylinder Heads And Tightening Bolts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove camshaft locators T40070 on both cylinder heads.

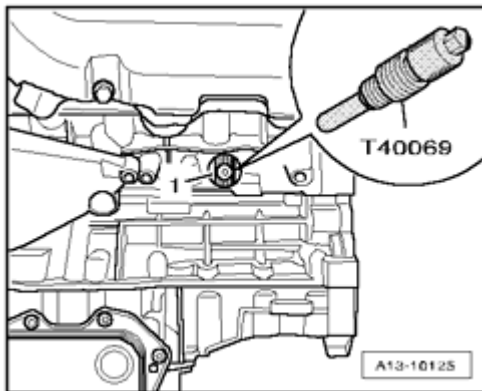


Fig. 307: Installing Crankshaft Holder T40069 Into Hole
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove crankshaft holder T40069.

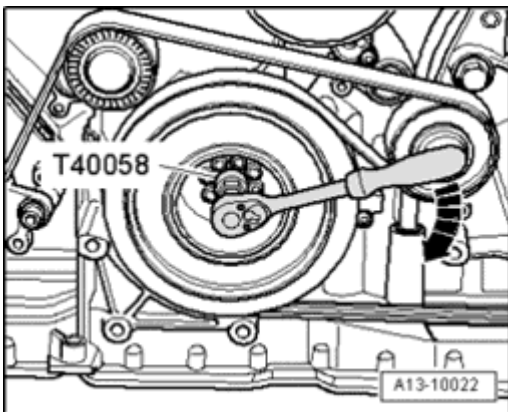


Fig. 308: Loosening Torque Converter Bolts Using Adapter T40058
Courtesy of VOLKSWAGEN UNITED STATES, INC.

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

NOTE:

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

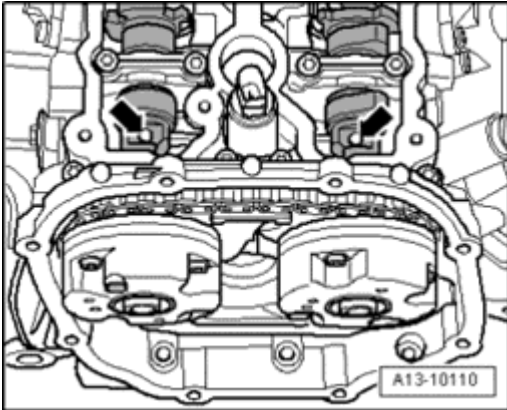


Fig. 309: Identifying Threaded Holes In Camshafts Must Face Upward
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- The threaded holes - **arrows** - in the camshafts must face upward.

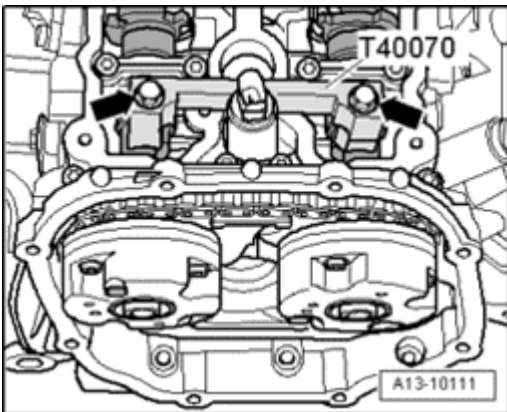


Fig. 310: Mounting Camshaft Locating Tool T40070 To Both Cylinder Heads And Tightening Bolts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Mount camshaft locating tools T40070 to both cylinder heads and tighten the bolts - **arrows** - to 20 Nm.
- The camshaft locating tool T40070 is correctly positioned when the holes for the cylinder head bolts remain free.

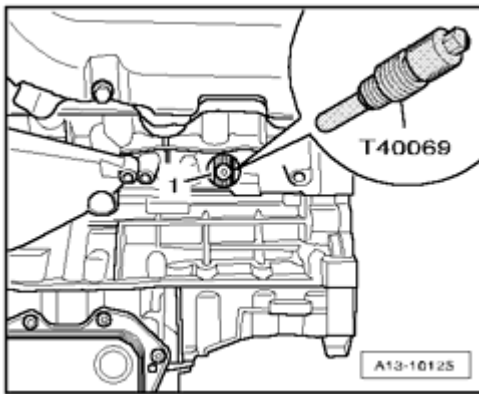


Fig. 311: Installing Crankshaft Holder T40069 Into Hole
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Install crankshaft holder T40069 directly into the hole.
- The crankshaft holder T40069 must engage in the locating hole of the crankshaft - **1** - , otherwise repeat the adjustment.
- Remove camshaft locating tools on both cylinder heads.
- Remove crankshaft holder.

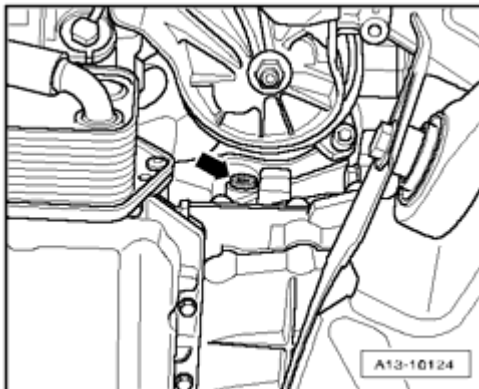


Fig. 312: Removing/Installing Sealing Plug From Cylinder Block
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Install sealing plug of TDC marking with new seal into cylinder block.

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

- Install left and right timing chain covers --> **Timing Chain Covers, Removing and Installing** .
- Install cylinder head cover.

Tightening Specifications

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Component	Nm
Chain tensioner to cylinder head	9
Camshaft bolts	80 + 90° 1)2)
Sealing plug in cylinder block	14 3)
1) Replace bolts. 2) 90° corresponds to a quarter turn. 3) Install with new gasket.	

Timing Mechanism Drive Chain, Component Overview

Timing Mechanism Drive Chain, Component Overview

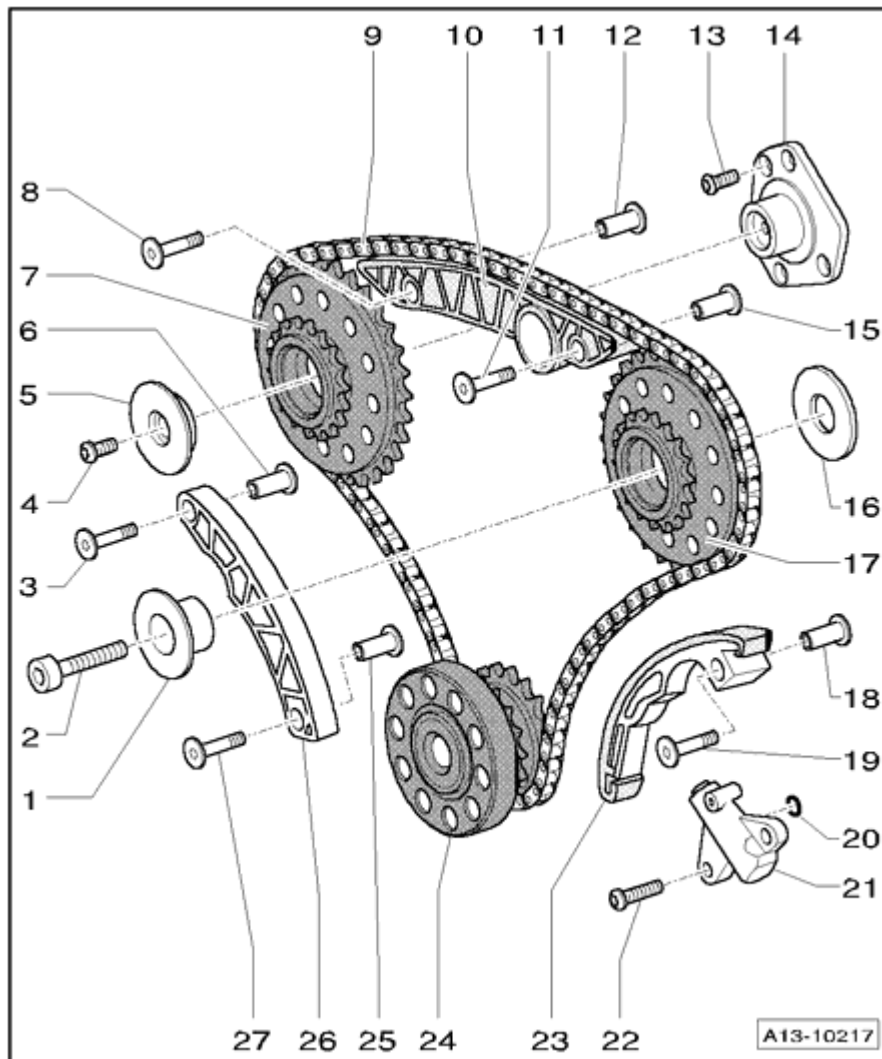


Fig. 313: Drive Chain For Timing Mechanism, Component Overview
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Pivot pin for drive sprocket

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2 - 30 Nm plus an additional 90 ($1/4$ turn)

- Replace

3 - Bolt

- Replace
- Version and tightening specifications, depending on the version --> **Different glide track mountings**

4 - 6 Nm plus an additional 60 ($1/6$ turn)

- Replace

5 - Thrust washer for drive sprocket

6 - Bushing

- Depending on the version --> **Different glide track mountings**

7 - Drive sprocket for left camshaft timing chain

8 - Bolt

- Replace
- Version and tightening specifications, depending on the version --> **Different glide track mountings**

9 - Timing Mechanism Drive Chain

- Before removing, mark the direction of rotation with paint

10 - Guide rail

11 - Bolt

- Replace
- Version and tightening specifications, depending on the version --> **Different glide track mountings**

12 - Bushing

- Depending on the version --> **Different glide track mountings**

13 - 8 Nm plus an additional 45 ($1/8$ turn)

- Replace

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- To be oiled for installation

14 - Mounting bracket for drive sprocket

15 - Bushing

- Depending on the version --> **Different glide track mountings**

16 - Thrust washer

17 - Drive sprocket for right camshaft timing chain

18 - Bushing

- Depending on the version --> **Different glide track mountings**

19 - Bolt

- Replace
- Version and tightening specifications, depending on the version --> **Different glide track mountings**

20 - O-ring

- Replace

21 - Chain tensioner

22 - 6 Nm plus an additional 45 ($\frac{1}{8}$ turn)

- Replace

23 - Glide track for chain tensioner

24 - Crankshaft

25 - Bushing

- Depending on the version --> **Different glide track mountings**

26 - Guide rail

- Note installation position

27 - Bolt

- Replace
- Version and tightening specifications, depending on the version --> **Different glide track mountings**

Different glide track mountings

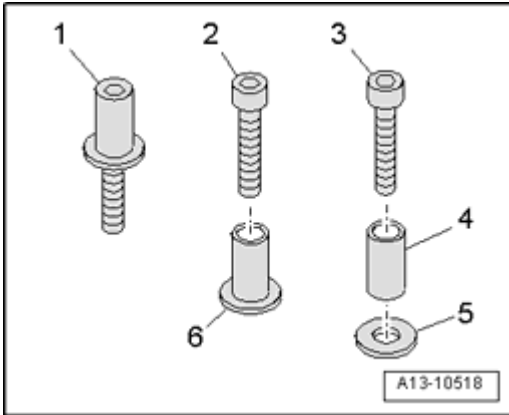


Fig. 314: Different Glide Track Mountings

Courtesy of VOLKSWAGEN UNITED STATES, INC.

Depending on the version, the timing chain glide tracks are mounted differently:

1 -	Bolt with shaft Replace 10 Nm plus an additional 30° (1/12 turn)
2 -	Convex headed bolt 6 and collar Replace 10 Nm plus an additional 90° (1/4 turn)
3 -	Convex headed bolt 4 and washer 5 Replace 10 Nm plus an additional 90° (1/4 turn)

Timing Mechanism Drive Chain, Removing and Installing

Timing Mechanism Drive Chain, Removing and Installing

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ENGINE 3.2 V6 4V Engine Mechanical, Engine Code(s): BKH

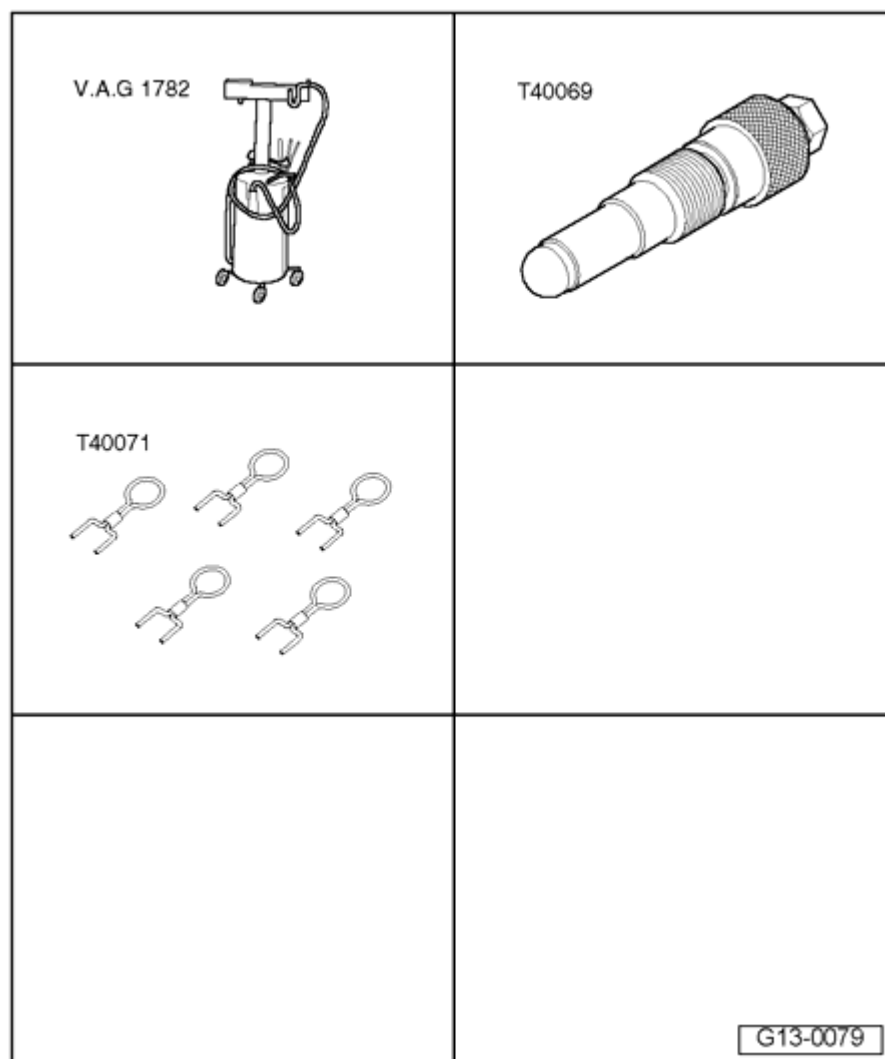


Fig. 315: Identifying Special Tools - Timing Mechanism Drive Chain, Removing And Installing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools, testers and auxiliary items required

- Old oil collecting and extracting device V.A.G 1782
- Locking pin T40069
- Securing pin T40071

Removing

- Remove transmission --> **37 CONTROLS, HOUSING** .

CAUTION: To continue performing the repair procedure, ensure lock carrier is installed and torque support is tightened.

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- Vehicles with multitronic transmission: Remove damper unit --> **Damper Unit, Removing and Installing** and flywheel --> **Flywheel, Multitronic Transmission, Removing and Installing**.
- Vehicles with automatic transmission 09L: Remove drive plate --> **Drive Plate, Automatic Transmission 09L, Removing and Installing**.
- Place old oil collecting and extracting device V.A.G 1782 under engine.
- Drain engine oil.
- Remove left and right timing chain covers --> **Timing Chain Covers, Removing and Installing** .
- Remove lower timing chain cover --> **Lower Timing Chain Cover, Removing and Installing** .
- Remove camshaft timing chains from camshafts --> **Timing Chains, Removing from Camshafts and Chain Tensioner, Removing and Installing** .
- Remove power take-off drive chain: Vehicles up to 04.2006 --> **Power Take-Off Drive Chain, from 04.06, Removing and Installing** , vehicle from 04.2006 --> **Power Take-Off Drive Chain, from 04.06, Removing and Installing**.

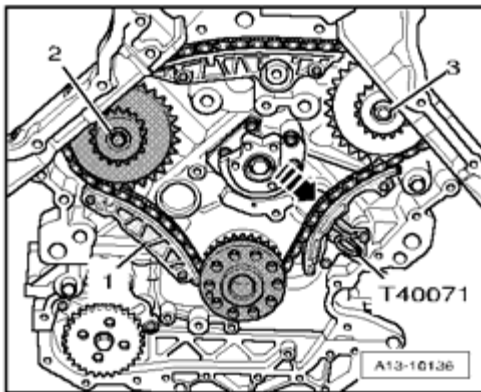


Fig. 316: Pushing Drive Chain Tensioner Guide Rail And Securing Chain Tensioner Using Securing Pin T40071

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Push drive chain tensioner guide rail in direction of - **arrow** - and secure chain tensioner using securing pin T40071.
- 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, noting the following:

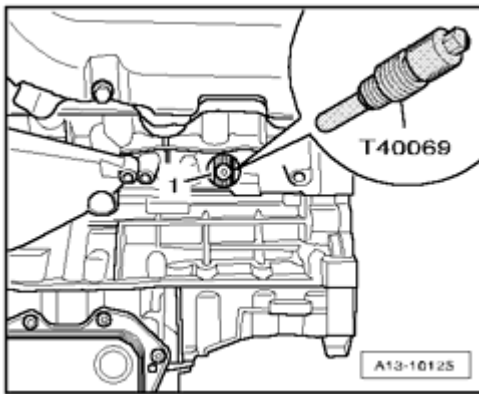


Fig. 317: Installing Crankshaft Holder T40069 Into Hole
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Secure crankshaft - 1 - in TDC position using crankshaft holder T40069.

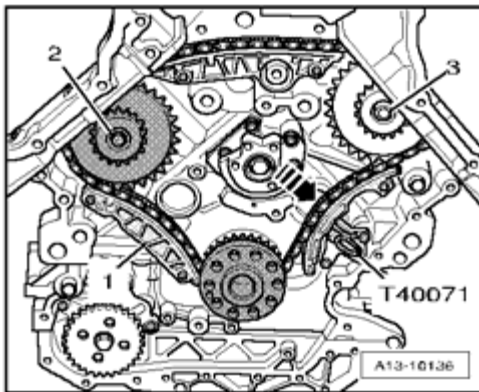


Fig. 318: Pushing Drive Chain Tensioner Guide Rail And Securing Chain Tensioner Using Securing Pin T40071

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- First, install the left camshaft timing chain sprocket - 2 -.
- Install guide rail - 1 - with installed drive chain.
- Now install the right camshaft timing chain sprocket - 3 -.
- Press drive chain tensioner guide rail in direction of - **arrow** - and pull securing pin T40071 out of the chain tensioner.
- Install power take-off drive chain: Vehicles up to 04.2006 --> **Power Take-Off Drive Chain, from 04.06, Removing and Installing** , vehicle from 04.2006 --> **Power Take-Off Drive Chain, from 04.06, Removing and Installing**.
- Install camshaft timing chains --> **Timing Chains, Removing from Camshafts and Chain Tensioner, Removing and Installing** .
- Install lower timing chain cover --> **Lower Timing Chain Cover, Removing and Installing** .

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- Vehicles with multitronic transmission: Install flywheel --> **Flywheel, Multitronic Transmission, Removing and Installing** and damper unit --> **Damper Unit, Removing and Installing**.
- Vehicles with automatic transmission 09L: Install drive plate --> **Drive Plate, Automatic Transmission 09L, Removing and Installing**.
- Install transmission --> **37 CONTROLS, HOUSING** .
- Add engine oil and check oil level --> **Oil Level, Checking** .

Tightening Specifications

Component	Nm
Left drive sprocket to mounting bracket	6 + 60° 1) 2)
Right drive sprocket to cylinder block	30 + 90° 1) 3)
Sealing plug in cylinder block	14 4)
1) Replace bolts. 2) 60° corresponds to a 1/6 turn. 3) 90° corresponds to a quarter turn. 4) Install with new gasket.	

Power Take-Off Drive Chain, through 03.06, Component Overview

Power Take-Off Drive Chain, through 03.06, Component Overview

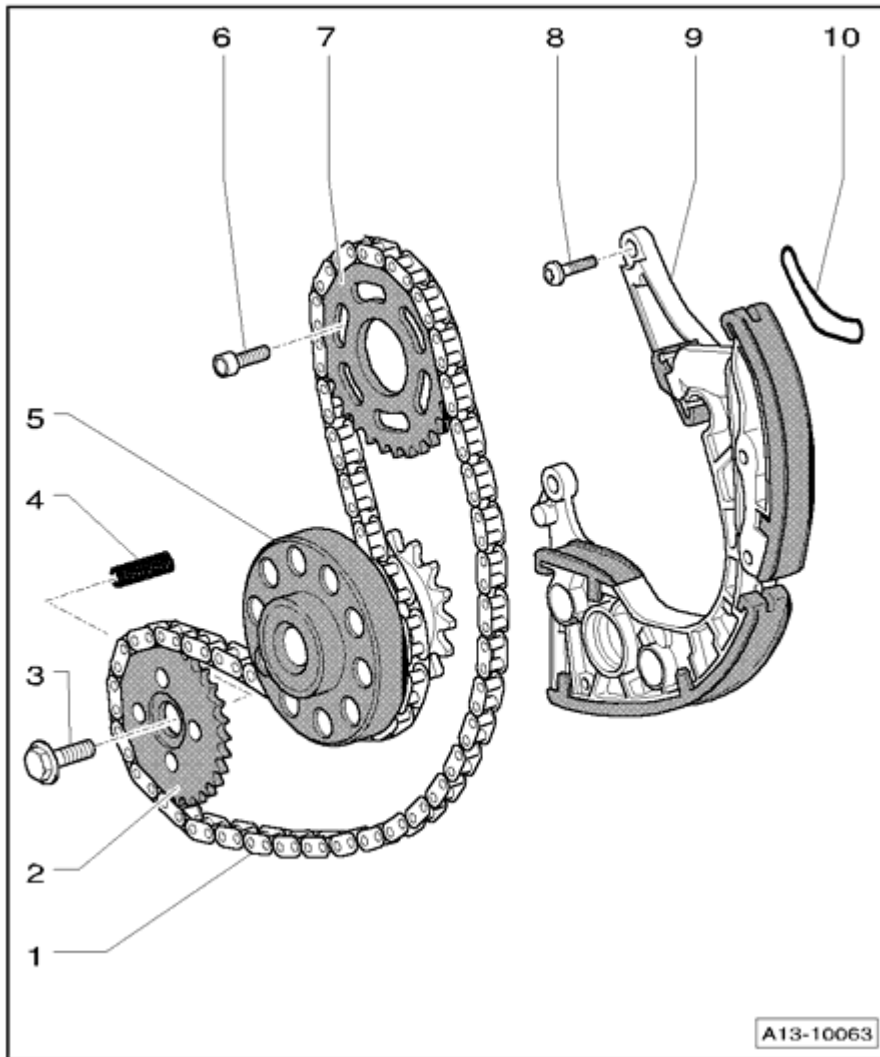


Fig. 319: Power Take-Off Drive Chain, Through 03.06, Component Overview
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Power take-off drive chain

- Before removing, mark the direction of rotation with paint
- Removing and installing --> Power Take-Off Drive Chain, from 04.06, Removing and Installing

2 - Drive sprocket for oil pump

- Installation position: Labeled side faces engine

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

- Replace

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4 - Spring

5 - Crankshaft

6 - 15 Nm plus an additional 90 ($1/4$ turn)

- Replace

7 - Chain sprocket for balance shaft

- Installation position: Labeled side faces transmission

8 - 6 Nm plus an additional 45 ($1/8$ turn)

- Replace

9 - Chain tensioner

- With glide track

10 - Gasket

- Depending on version
- Replace

Power Take-Off Drive Chain, from 04.06, Removing and Installing

Power Take-Off Drive Chain, from 04.06, Removing and Installing

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ENGINE 3.2 V6 4V Engine Mechanical, Engine Code(s): BKH

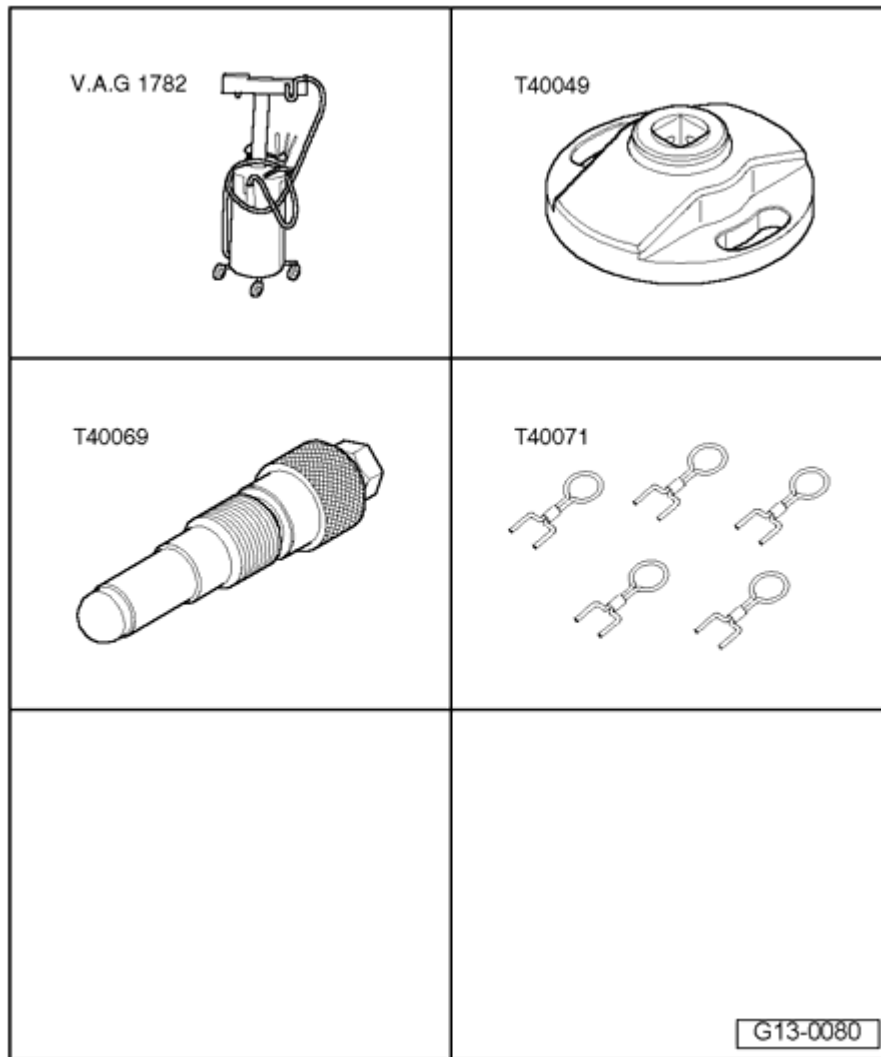


Fig. 320: Identifying Special Tools - Power Take-Off Drive Chain, From 04.06, Removing And Installing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools, testers and auxiliary items required

- Old oil collecting and extracting device V.A.G 1782
- Adapter T40049
- Locking pin T40069
- Securing pin T40071
- Drill 8 mm diameter

Removing

- Remove transmission --> **37 CONTROLS, HOUSING** .

CAUTION: To continue performing the repair procedure, ensure lock carrier is installed and torque support is tightened.

- Vehicles with multitronic transmission: Remove damper unit --> **Damper Unit, Removing and Installing** and flywheel --> **Flywheel, Multitronic Transmission, Removing and Installing**.
- Vehicles with automatic transmission 09L: Remove drive plate --> **Drive Plate, Automatic Transmission 09L, Removing and Installing**.
- Place old oil collecting and extracting device V.A.G 1782 under engine.
- Drain engine oil.
- Remove lower timing chain cover --> **Lower Timing Chain Cover, Removing and Installing**.

CAUTION: Place a washer under the bolt heads, to prevent the chain from being pinched by the bolts.

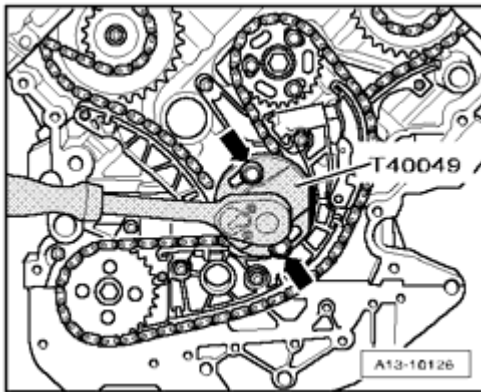


Fig. 321: Installing Key T40049 At Rear On Crankshaft Using 2 Old Bolts For Dual-Mass Flywheel
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Install key T40049 at rear on crankshaft using 2 old bolts for dual-mass flywheel.

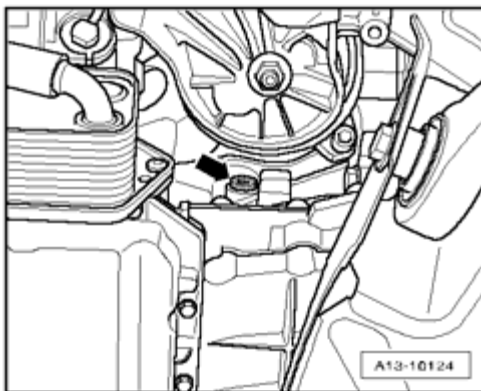


Fig. 322: Removing/Installing Sealing Plug From Cylinder Block

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove sealing plug - **arrow** - from cylinder block.

CAUTION: Do not turn crankshaft while touching TDC hole with finger - Risk of injury.

- Rotate crankshaft in direction of engine rotation to TDC of ignition timing.

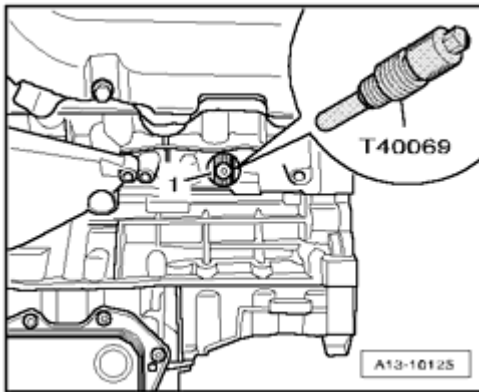


Fig. 323: Installing Crankshaft Holder T40069 Into Hole

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Install crankshaft holder T40069 into hole to 20 Nm, if necessary rotate crankshaft very slightly back and forth to completely center the holder.
- Mark running direction of power take-off chain with paint.

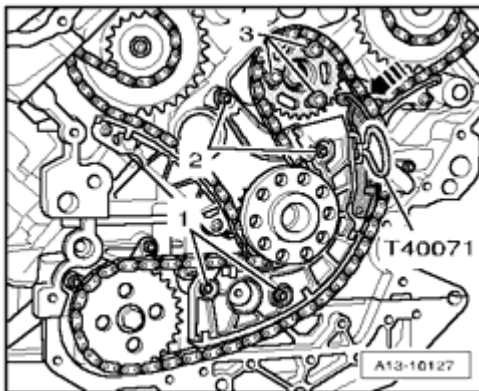


Fig. 324: Pressing Chain Tensioner Guide Rail And Securing Chain Tensioner With Securing Pin T40071

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Press chain tensioner guide rail in direction of - **arrow** - and secure chain tensioner with securing pin T40071.
- Remove bolts - **1 through 3** - and remove chain tensioner, balance shaft sprocket and chain.

Installing

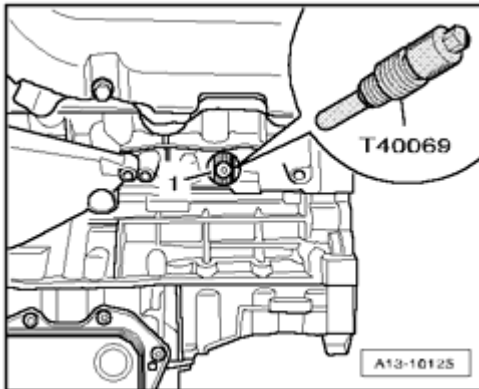


Fig. 325: Installing Crankshaft Holder T40069 Into Hole
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Secure crankshaft - 1 - in TDC position using crankshaft holder T40069.

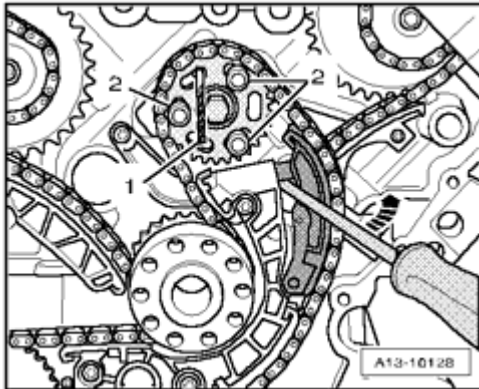


Fig. 326: Mounting Chain Tensioner With Chain And Balance Shaft Sprocket
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Mount chain tensioner with chain and balance shaft sprocket.
- To protect against cuts, wrap point and cutting edges of 8 mm dia. drill bit with insulating tape.
- Secure the balance shaft with drill 8 mm dia. - **item 1** - in TDC position.
- The slots in the balance shaft sprocket must be at the middle position in relation to the threaded holes of the balance shaft. If necessary, adjust chain by one tooth.
- Tighten chain tensioner bolts.
- Loosely screw in bolts - **2** - for sprocket.
- Chain sprocket must still be able to be rotated on balance shaft and must not tip.

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- Pull out securing pin T40071 to release the chain tensioner.
- Press against chain tensioner guide rail - **arrow** - with screwdriver and simultaneously fasten the bolts - **2** - for sprocket.
- Pull drill - **1** - out of the balance shaft.

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

- Install lower timing chain cover --> **Timing Chain Covers, Removing and Installing** .
- Install left and right timing chain covers --> **Timing Chain Covers, Removing and Installing** .
- Install crankshaft seal, timing chain side --> **Crank Shaft Seal, Timing Chain Side, Replacing** .
- Vehicles with multitronic transmission: Install flywheel --> **Flywheel, Multitronic Transmission, Removing and Installing** and damper unit --> **Damper Unit, Removing and Installing**.
- Vehicles with automatic transmission 09L: Install drive plate --> **Drive Plate, Automatic Transmission 09L, Removing and Installing**.
- Install transmission --> **37 CONTROLS, HOUSING** .
- Add engine oil and check oil level --> **Oil Level, Checking** .

Tightening Specifications

Component	Nm
Chain tensioner on cylinder block	6 + 45° 1)2)
Balance shaft sprocket to balance weight	15 + 90° 1)3)
Sealing plug in cylinder block	14 4)
1) Replace bolts. 2) 45° corresponds to one eighth turn. 3) 90° corresponds to a quarter turn. 4) Install with new gasket.	

Power Take-Off Drive Chain, from 04.06, Component Overview

Power Take-Off Drive Chain, from 04.06, Component Overview

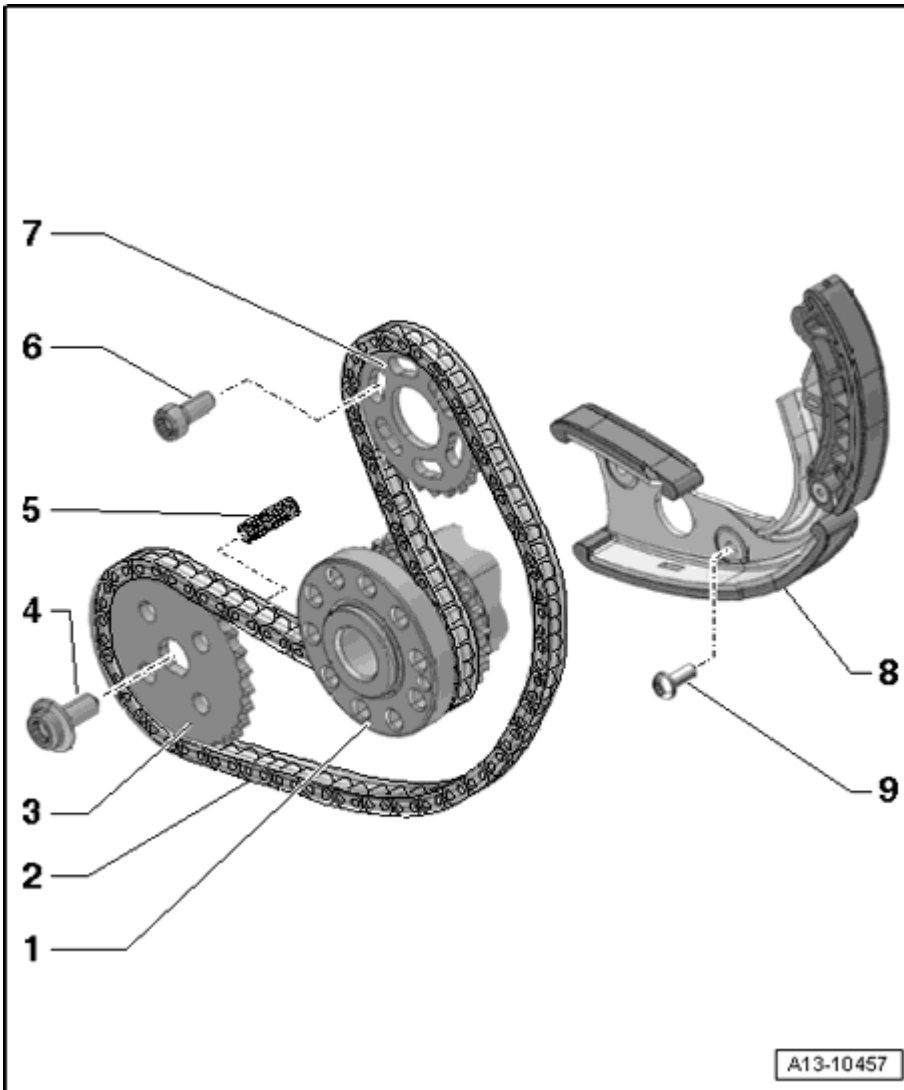


Fig. 327: Power Take-Off Drive Chain, From 04.06, Component Overview
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Crankshaft

2 - Power take-off drive chain

- Before removing, mark the direction of rotation with paint
- Removing and installing --> **Power Take-Off Drive Chain, from 04.06, Removing and Installing**

3 - Drive sprocket for oil pump

- Installation position: Labeled side faces engine

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

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- Replace

5 - Spring

6 - 15 Nm plus an additional 90 ($1 \frac{1}{4}$ turn)

- Replace

7 - Balance shaft chain sprocket

- Installation position: Labeled side faces transmission

8 - Chain tensioner

- With glide track

9 - 10 Nm plus an additional 45 ($1 \frac{1}{8}$ turn)

- Replace

Power Take-Off Drive Chain, from 04.06, Removing and Installing

Power Take-Off Drive Chain, from 04.06, Removing and Installing

Special tools, testers and auxiliary items required

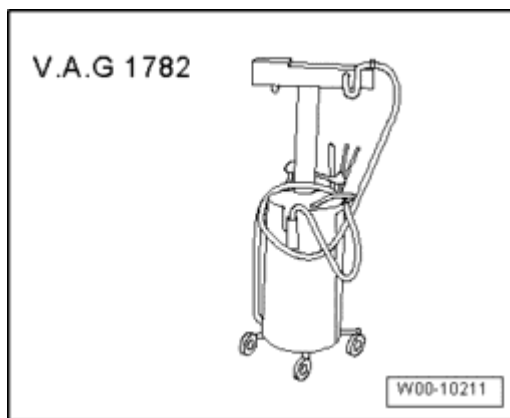
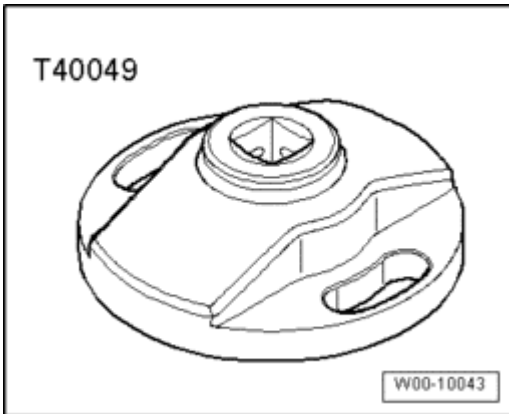


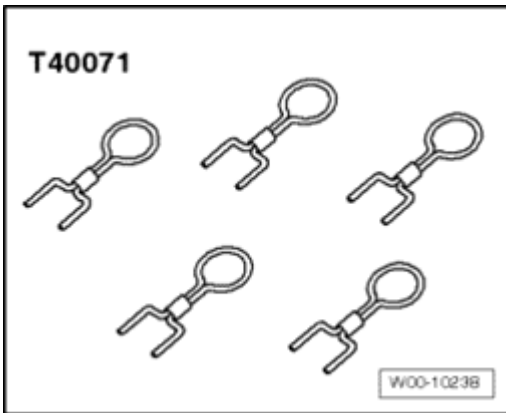
Fig. 328: Identifying Old Oil Collecting And Extracting Device V.A.G 1782
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Old oil collecting and extracting device V.A.G 1782

**Fig. 329: Wrench T40049**

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Wrench T40049

**Fig. 330: Securing Pin T40071**

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Securing pin T40071
- Drill bit 8 mm dia.

Removing

CAUTION: To continue performing the repair procedure, ensure lock carrier is installed and torque support is tightened.

- Remove transmission --> **37 CONTROLS, HOUSING** .
- Vehicles with multitronic transmission: Remove damper unit --> **Damper Unit, Removing and Installing** and flywheel --> **Flywheel, Multitronic Transmission, Removing and Installing**.
- Vehicles with automatic transmission 09L: Remove drive plate --> **Drive Plate, Automatic Transmission 09L, Removing and Installing**.
- Place Used Oil Collecting and Extracting Device V A G 1782 under engine and drain engine oil

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- Remove lower timing chain cover --> **Lower Timing Chain Cover, Removing and Installing** .

CAUTION: If necessary, place a washer under the bolt heads, to prevent the chain from being pinched by the bolts.

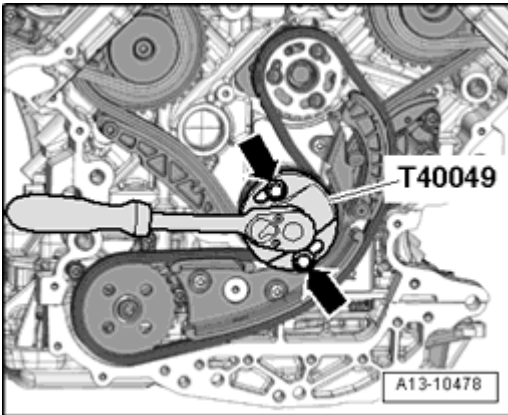


Fig. 331: Installing Key T40049 At Rear On Crankshaft Using Old Bolts For Dual-Mass Flywheel
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Install key T40049 at rear on crankshaft using 2 old bolts for dual-mass flywheel.

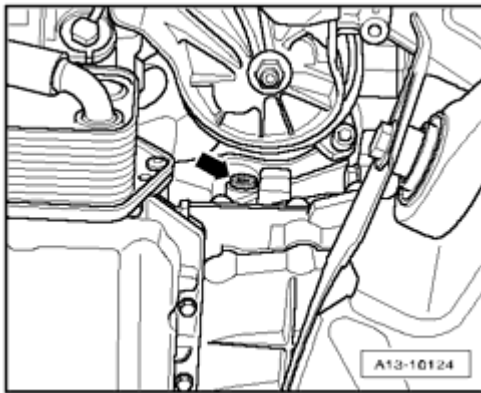


Fig. 332: Removing/Installing Sealing Plug From Cylinder Block
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove locking bolt - **arrow** - for the "TDC" marking from the upper part of the oil pan.
- Rotate crankshaft in direction of engine rotation to "TDC".

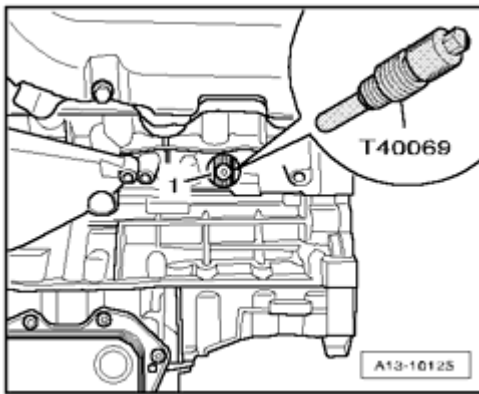


Fig. 333: Installing Crankshaft Holder T40069 Into Hole
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Install crankshaft holder T40069 into hole to 20 Nm, if necessary rotate crankshaft very slightly back and forth to completely center the holder.

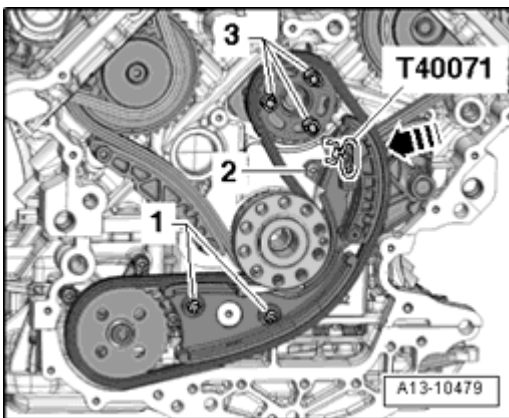


Fig. 334: Pressing Chain Tensioner Guide Rail And Securing Chain Tensioner Using Locking Pin T40071
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Mark running direction of power take-off chain with paint.
- Press chain tensioner guide rail in direction of - **arrow** - and secure chain tensioner using a locking pin T40071.
- Remove bolts - **3** - and balance shaft chain sprocket.
- Remove bolts - **1** - and - **2** - and chain tensioner with the chain.

Installing

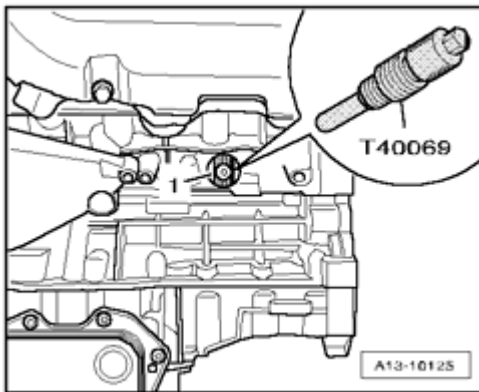


Fig. 335: Installing Crankshaft Holder T40069 Into Hole
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Secure crankshaft - 1 - in "TDC" position using crankshaft holder T40069.

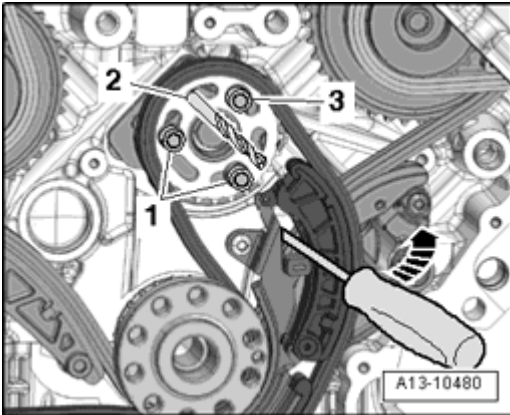


Fig. 336: Securing Balance Shaft Using An 8 Mm Dia. Drill Bit At "TDC"
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Mount chain tensioner with chain and balance shaft sprocket.
- To protect against cuts, wrap point and cutting edges of 8 mm dia. drill bit with insulating tape.
- Secure balance shaft using an 8 mm dia. drill bit - 2 - at "TDC".
- The slots in the balance shaft sprocket must be at the middle position in relation to the threaded holes of the balance shaft. If necessary, adjust chain by one tooth.
- Tighten chain tensioner bolts.
- Loosely install chain sprocket bolts - 1 - and - 3 -.
- It must still be possible to rotate the chain sprocket on the balance shaft and it must not tip.
- Pull out securing pin T40071 to release the chain tensioner.
- Press against the chain tensioner guide rail - **arrow** - using a screwdriver while tightening the chain

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sprocket bolts - **1** - and - **3** -.

- Pull drill bit - **2** - out of the balance shaft.

The rest of installation is in reverse order of removal, noting the following:

- Install timing chain lower cover --> **Lower Timing Chain Cover, Removing and Installing** .
- Install left and right timing chain covers --> **Timing Chain Covers, Removing and Installing** .
- Install transmission-side crankshaft shaft seal --> **Crank Shaft Seal, Timing Chain Side, Replacing** .
- Vehicles multitronic transmission: Install flywheel --> **Flywheel, Multitronic Transmission, Removing and Installing** and damper unit --> **Damper Unit, Removing and Installing**.
- Vehicles with automatic transmission 09L: Install drive plate --> **Drive Plate, Automatic Transmission 09L, Removing and Installing**.
- Install transmission --> **37 CONTROLS, HOUSING** .
- Add engine oil and check oil level --> **Oil Level, Checking** .

Tightening Specifications

Component	Nm
Chain tensioner on cylinder block	10 + 45° 1)2)
Balance shaft sprocket to balance weight	15 + 90° 1)3)
Sealing plug in cylinder block	14 4)
1) Replace bolts. 2) 45° corresponds to one eighth turn. 3) 90° corresponds to a quarter turn. 4) Install with new gasket.	

Balancing Shaft, Component Overview

Balancing Shaft, Component Overview

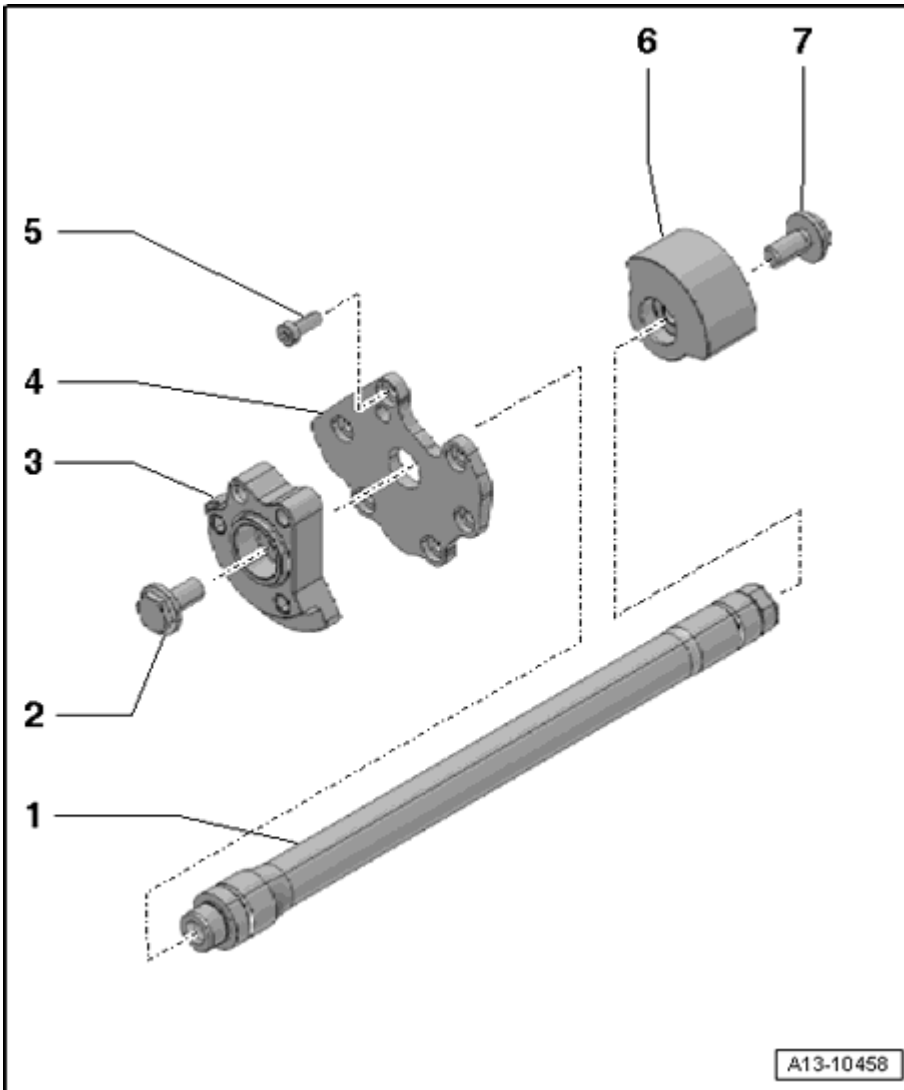


Fig. 337: Balancing Shaft, Component Overview
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Differential shaft

- Removing and installing --> **Balancing Shaft, Removing and Installing**

2 - 60 Nm

- To loosen and fasten, use drill 8 mm dia. as counter-holder

3 - Balance weight (timing chain side)

- Can only be positioned one way on balance shaft

4 - Bearing end bracket

5 - 13 Nm

6 - Balance weight (belt pulley side)

- Can only be positioned one way on balance shaft

7 - 60 Nm

- To loosen and fasten, use drill 8 mm dia. as counter-holder

Balancing Shaft, Removing and Installing

Balancing Shaft, Removing and Installing

Special tools, testers and auxiliary items required

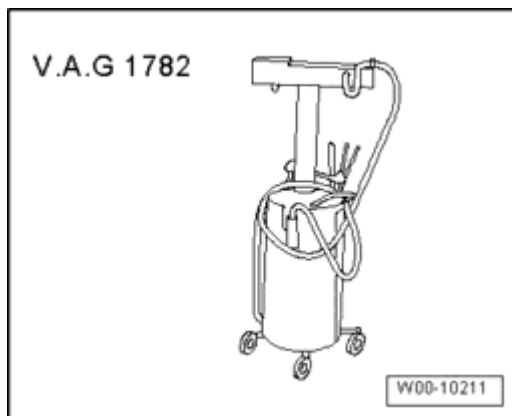


Fig. 338: Identifying Old Oil Collecting And Extracting Device V.A.G 1782
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Old oil collecting and extracting device V.A.G 1782

Removing

- Remove transmission --> **37 CONTROLS, HOUSING** .

CAUTION: To continue performing the repair procedure, ensure lock carrier is installed and torque support is tightened.

- Vehicles with multitronic transmission: Remove damper unit --> **Damper Unit, Removing and Installing** and flywheel --> **Flywheel, Multitronic Transmission, Removing and Installing**.
- Vehicles with automatic transmission 09L: Remove drive plate --> **Drive Plate, Automatic Transmission 09L, Removing and Installing**.
- Place old oil collecting and extracting device V.A.G 1782 under engine.
- Drain engine oil

- Remove sealing flange, belt pulley side --> **Ribbed Belt Side Sealing Flange with Crankshaft Seal, Replacing.**
- Remove lower timing chain cover --> **Lower Timing Chain Cover, Removing and Installing .**
- Remove power take-off drive chain: Vehicles up to 04.2006 --> **Power Take-Off Drive Chain, from 04.06, Removing and Installing** , vehicle from 04.2006 --> **Power Take-Off Drive Chain, from 04.06, Removing and Installing.**

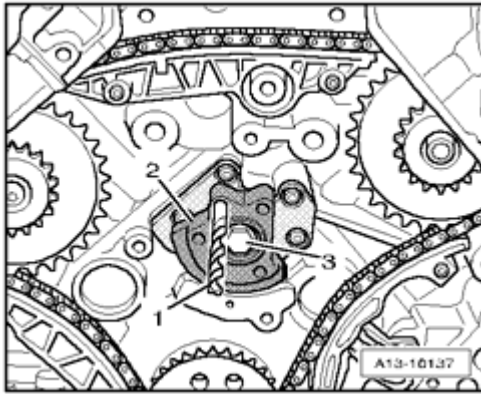


Fig. 339: Securing Balance Weight At Rear Of Engine With Drill Bit
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- To protect against cuts, wrap point and cutting edges of 8 mm dia. drill bit with insulating tape.
- Secure balance weight - **2** - at rear of engine with drill bit 8 mm dia. - **1** -.
- Remove bolt - **3** - and remove balance weight from balance shaft.

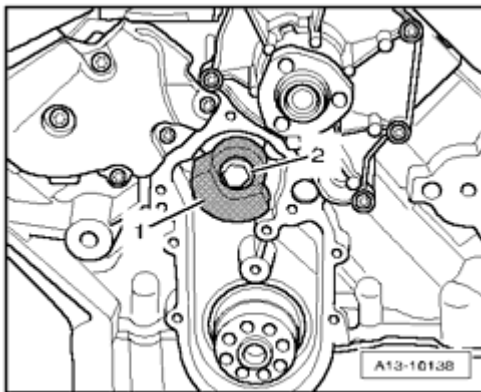


Fig. 340: Removing Bolt, Counter-Holding Balance Weight With Drift And Removing Balance Weight From Balance Shaft At Front Of Engine
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolt - **2** - , thereby counter-hold balance weight with drift and remove balance weight - **1** - from balance shaft at front of engine.

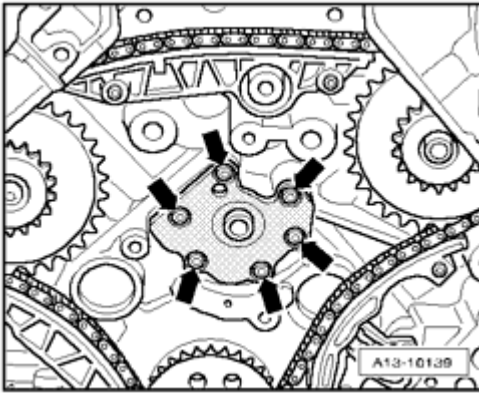


Fig. 341: Removing Bolts And Bearing End Bracket From Balance Shaft At Rear Of Engine
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts - **arrows** - and remove bearing end bracket from balance shaft at rear of engine.
- Pull balance shaft rearward and out from cylinder block.

Installing

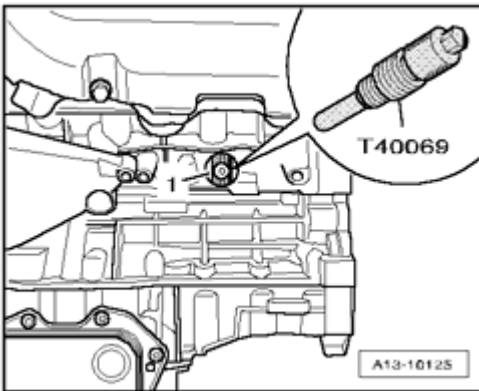


Fig. 342: Installing Crankshaft Holder T40069 Into Hole
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Secure crankshaft - **1** - in TDC position using crankshaft holder T40069.

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

NOTE:

- **The balance weights can only be positioned one way on balance shaft.**

- Install power take-off drive chain: Vehicles up to 04.2006 --> **Power Take-Off Drive Chain, from 04.06, Removing and Installing** , vehicle from 04.2006 --> **Power Take-Off Drive Chain, from 04.06, Removing and Installing**.
- Install lower timing chain cover --> **Lower Timing Chain Cover, Removing and Installing** .
- Install sealing flange belt nulle side --> **Ribbed Belt Side Sealing Flange with Crankshaft Seal.**

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Replacing.

- Vehicles with multitronic transmission: Install flywheel --> **Flywheel, Multitronic Transmission, Removing and Installing** and damper unit --> **Damper Unit, Removing and Installing**.
- Vehicles with automatic transmission 09L: Install drive plate --> **Drive Plate, Automatic Transmission 09L, Removing and Installing**.
- Install transmission --> **37 CONTROLS, HOUSING** .
- Add engine oil and check oil level --> **Oil Level, Checking** .

Tightening Specifications

Component	Nm
Bearing end bracket to cylinder block	9
Balance weight to balance shaft	60
Sealing plug in cylinder block	14 1)
1) Install with new gasket.	

CRANKSHAFT, REMOVING AND INSTALLING

Crankshaft, Removing and Installing

--> **Crankshaft, Component Overview**

--> **Crankshaft Dimensions**

--> **Axial Clearance, Measuring**

--> **Radial Clearance, Measuring**

Crankshaft, Component Overview

Crankshaft, Component Overview

NOTE:

- Secure engine to Engine and Transmission Holder VAS 6095 when working on engine. Vehicles with multitronic transmission --> **Engine, Securing to Engine and Transmission Holder** , vehicles with automatic transmission 09L --> **Engine, Securing to Engine and Transmission Holder**.

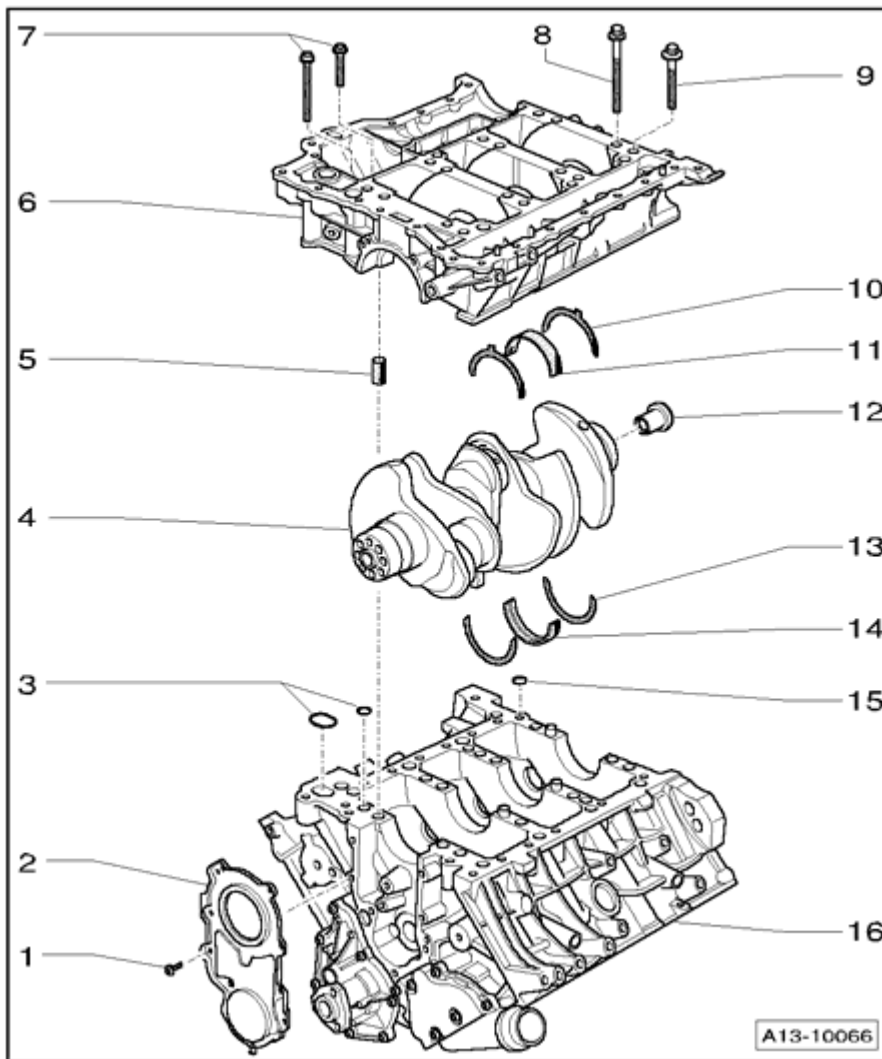


Fig. 343: Crankshaft, Component Overview

Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - 9 Nm

- Fasten in diagonal sequence in steps

2 - Sealing flange (belt pulley side)

- Removing and installing --> **Ribbed Belt Side Sealing Flange with Crankshaft Seal, Replacing**

3 - Seals

- Different versions
- Replace

4 - 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**

5 - Alignment bushing

- 4 pieces
- Insert into guide frame --> **Sealant application for guide frame, position of alignment bushings**

6 - Bearing bracket

- Sealant application --> **Sealant application for guide frame, position of alignment bushings**
- Tightening sequence for manifold mounting bolts --> **Installing guide frame**

7 - Bolt

- For sealing surfaces of cylinder block/guide frame
- Varying bolt lengths and bolt heads
- Tightening order --> **Installing guide frame**

8 - Long bolt, large shoulder

- For inner row of guide frame
- Tightening order --> **Installing guide frame**

9 - Short bolt, small shoulder

- For outer row of guide frame
- Tightening order --> **Installing guide frame**

10 - Thrust washer

- Only on 3rd crankshaft bearing
- Lubricating grooves face outward
- Note locating point in guide frame
- Measuring crankshaft axial clearance --> **Axial Clearance, Measuring**

11 - Bearing shell

- For guide frame without lubricating groove

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- Do not interchange used bearing shells (mark)
- Note installation position
- Insert new bearing shells for guide frame with proper color marking --> **Allocation of crankshaft bearing shells for guide frame**

12 - Centering washer

- For vehicles with automatic transmission 09L --> **Centering washer for drive plate on automatic transmission 09L**

13 - Thrust washer

- Only on 3rd crankshaft bearing
- Lubricating grooves face outward
- Note locating point in guide frame
- Measuring crankshaft axial clearance --> **Axial Clearance, Measuring**

14 - Bearing shell

- For cylinder block with oil groove
- Do not interchange used bearing shells (mark)
- Note installation position
- Insert new bearing shells for cylinder block with proper color marking --> **Allocation of crankshaft bearing shells for cylinder block**

15 - O-ring or sealing ring

- Depending on version
- Replace

16 - Cylinder block

Centering washer for drive plate on automatic transmission 09L

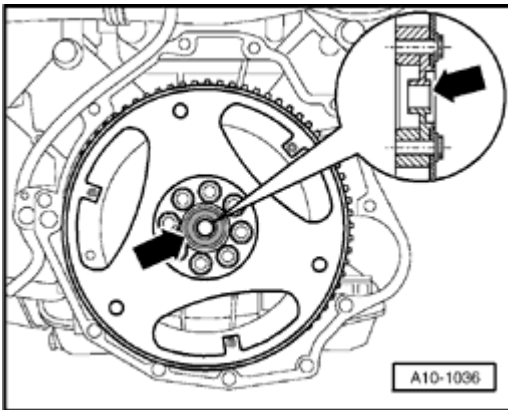


Fig. 344: Installing Drive Plate With Centering Washer And Backing Plate
Courtesy of VOLKSWAGEN UNITED STATES, INC.

NOTE:

- On vehicles with automatic transmission 09L, the drive plate is bolted to the crankshaft with a centering washer - arrow -.

Sealant application for guide frame, position of alignment bushings

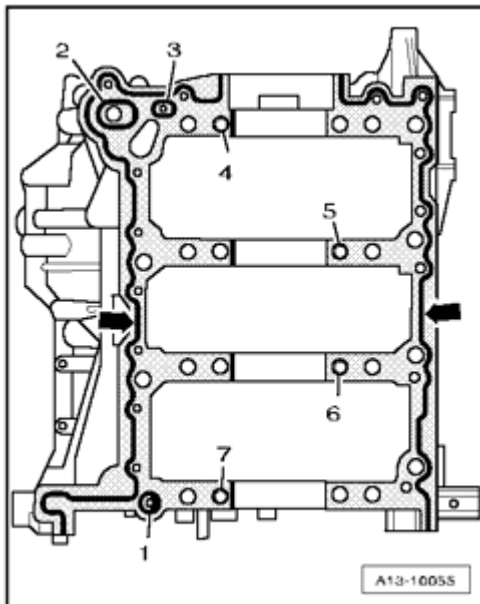


Fig. 345: Sealant Application For Guide Frame, Position Of Alignment Bushings
Courtesy of VOLKSWAGEN UNITED STATES, INC.

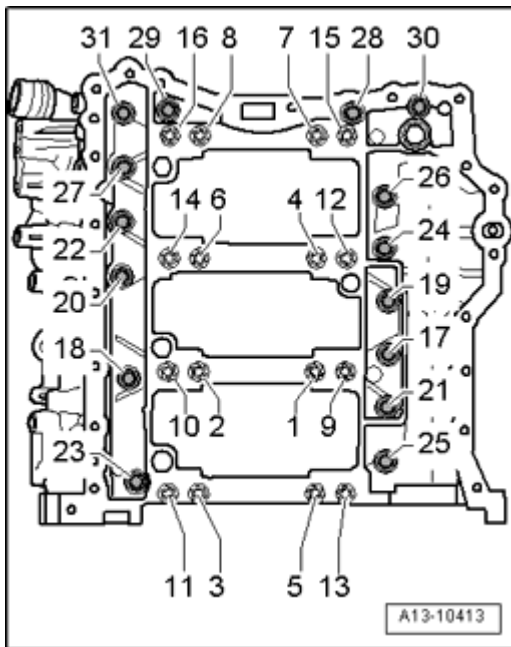
- Clean sealing surfaces, they must be free of oil and grease on top and bottom.
- Apply sealant beads - **arrows** - on clean sealing surfaces of guide frame as shown in illustration.
- The groove of sealing surface must be completely filled with sealant.
- Sealant beads must be 1.5 to 2.0 mm above the sealing surface.

- Install seals - **1 to 3** -.

NOTE:

- Depending on the version, the seals - **2** - and - **3** - are connected by a rib.

- Check whether alignment bushings - **4 through 7** - are inserted at locations in guide frame as shown in the illustration.

Installing guide frame**Fig. 346: Guide Frame Bolts Tightening Sequence**

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Replace guide frame bolts - **1 through 16** -.
- Insert long bolts in the inner row of the guide frame.
- Tighten bolts - **1 through 31** - in 3 stages as follows:
- Tighten bolts to 50 Nm in sequence - **1 to 16** -.
- Tighten bolts an additional 90° in the sequence - **1 to 16** -.
- Tighten bolts for guide frame sealing surfaces on the cylinder block to 23 Nm in sequence - **17 to 31** -.

Allocation of crankshaft bearing shells for cylinder block

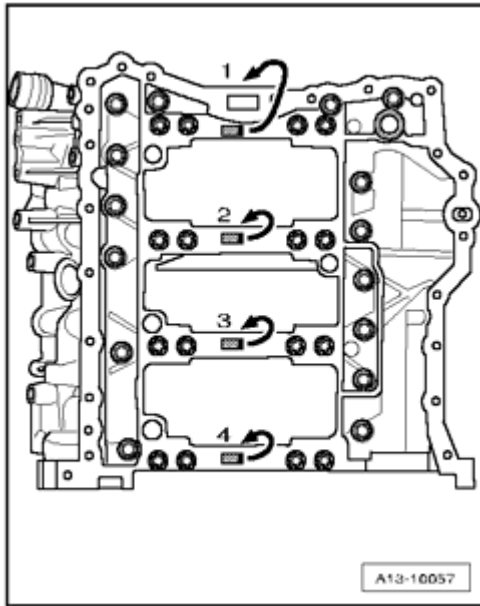


Fig. 347: Allocation Of Crankshaft Bearing Shells For Cylinder Block
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Bearing shells with the correct thickness are allocated to the 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 a letter on the respective bearing on guide frame

Through engine no. AUK 028 000 or BKH 033 000:

On engines through no. AUK 028 000 or BKH 033 000 another allocation of letters on guide frame to bearing shell color applies to bearing 1 (front).

Bearing no.	Letter on guide frame	Color of bearing
1	G=	Red
	B=	Yellow
	S=	Blue
2 4	G=	Yellow
	B=	Blue
	S=	Black

From engine no. AUK 028 001 or BKH 033 001:

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

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S=

Black

Allocation of crankshaft bearing shells for guide frame

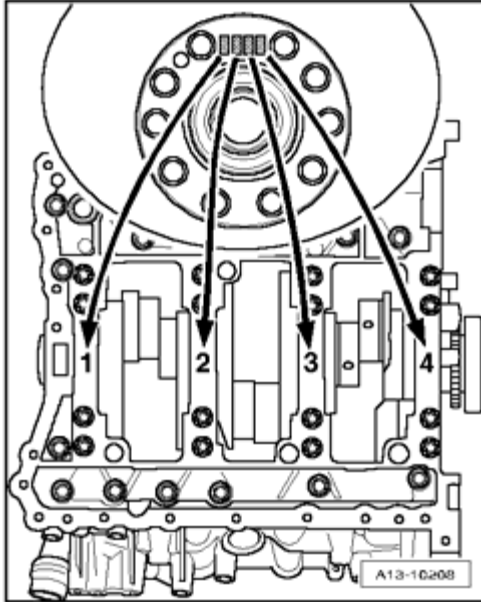


Fig. 348: Allocation Of Crankshaft Bearing Shells For Guide Frame
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Bearing shells with the correct thickness are allocated to the 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 on flywheel flange of crankshaft by a row of letters. The first letter of the row of letters represents bearing "1" , the second letter is for bearing "2" , etc.

Through engine no. AUK 028 000 or BKH 033 000:

On engines through no. AUK 028 000 or BKH 033 000 another allocation of letters on crankshaft to bearing shell color applies to bearing 1 (front).

Bearing no.	Letter on crankshaft	Color of bearing
1	G=	red
	B=	yellow
	S=	Blue
2 4	G=	yellow
	B=	Blue
	S=	black

From engine no. AUK 028 001 or BKH 033 001:

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Letter on crankshaft		Color of bearing
R=		red
G=		yellow
B=		Blue
S=		black

Crankshaft Dimensions

Crankshaft Dimensions

Reconditioning dimension in mm	Crankshaft bearing journal diameter		Connecting rod journal diameter	
Basic dimension	65.00	0.022 0.042	56.00	0.022 0.042

Axial Clearance, Measuring

Axial Clearance, Measuring

Special tools, testers and auxiliary items required

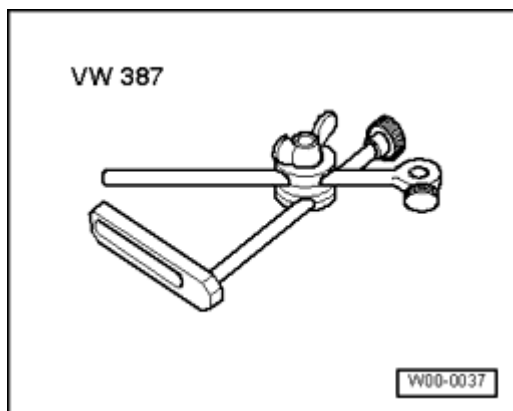


Fig. 349: Dial Gauge Holder VW 387

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Dial gauge holder VW 387

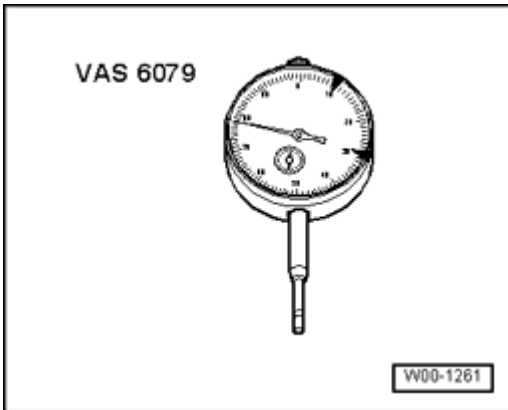


Fig. 350: Dial Gauge VAS 6079

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Dial gauge VAS 6079

Procedure

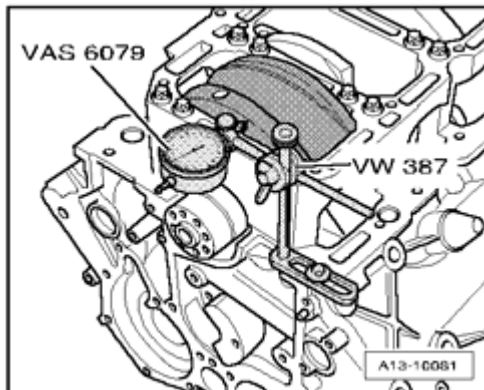


Fig. 351: Attaching Dial Indicator VAS 6079 Together With Dial Gauge Holder VW 387 To Cylinder Block And Setting Indicator Against Crankshaft Counterweight
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- 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: 0.15 to 0.25 mm.

Radial Clearance, Measuring

Radial Clearance, Measuring

Special tools, testers and auxiliary items required

- Plastigage

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: 0.015 to 0.055 mm.
 - Radial clearance wear limit: 0.08 mm.

PISTON AND CONNECTING ROD, DISASSEMBLING AND ASSEMBLING**Piston and Connecting Rod, Disassembling and Assembling**

--> **Piston and Connecting Rod, Component Overview**

--> **Piston and Cylinder Dimensions**

--> **Connecting Rod, Checking Radial Clearance**

Piston and Connecting Rod, Component Overview**Piston and Connecting Rod, Component Overview****NOTE:**

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

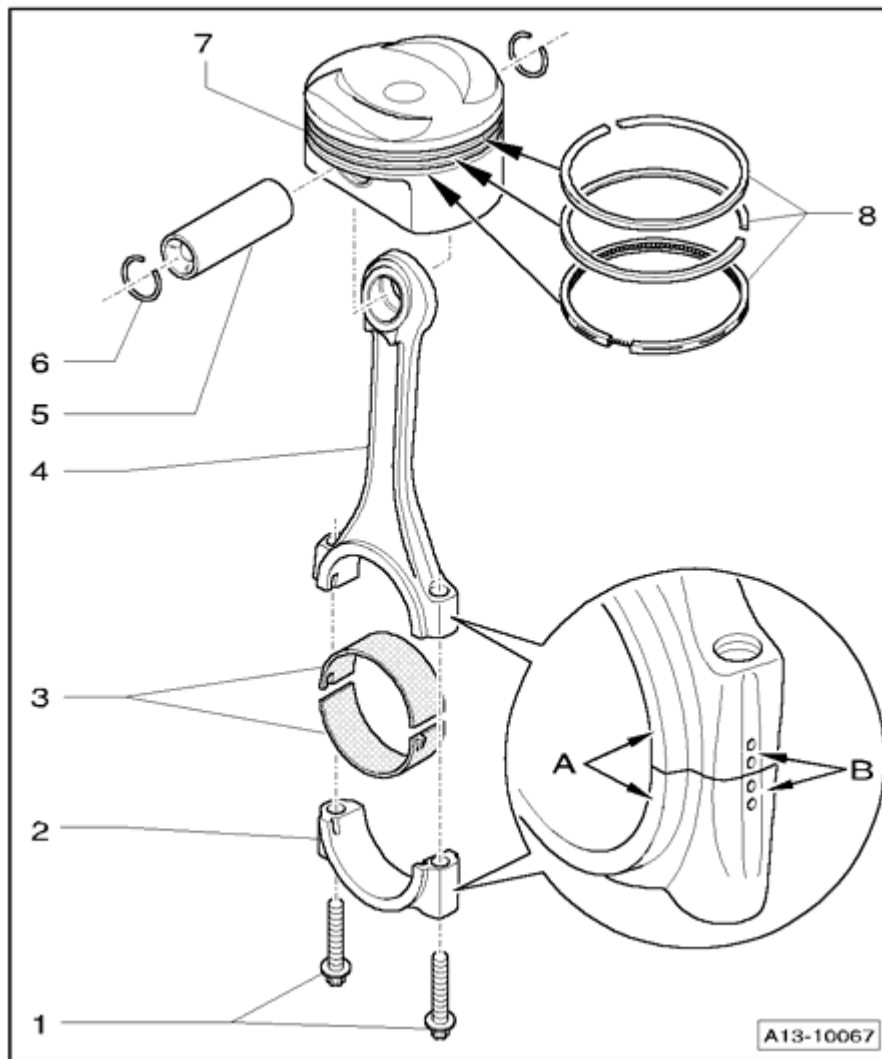


Fig. 352: Piston And Connecting Rod, Component Overview
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

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

- 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 shell

The version depends on the construction:

- Lower bearing shell (for bearing cap), identified by a dark-colored bearing. Upper bearing shell (for connecting rod) made of wear-resistant material, identified by a light-colored bearing

or

- The same bearing, no allocation
- Check that retaining tabs are secured
- Do not interchange used bearing shells (mark)
- Radial clearance, measuring --> **Connecting Rod, Checking Radial Clearance**

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**

5 - Piston pin

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

6 - Circlip

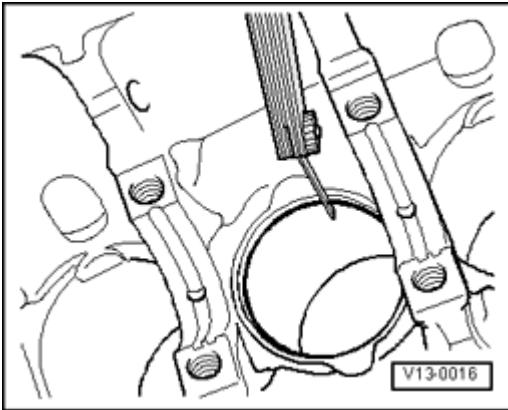
- Replace

7 - Piston

- Installed position and allocation, piston/cylinder --> **Installed position of piston and piston/cylinder allocation**
- Arrow on piston face points toward belt pulley side
- Checking --> **Checking piston**
- Install with piston ring compressor
- Piston and cylinder dimensions --> **Piston and Cylinder Dimensions**
- Cylinder bore, checking --> **Checking cylinder bores**

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
- Checking ring gap --> **Checking piston ring gap**
- Check piston ring groove clearance --> **Checking ring to groove clearance**

Checking piston ring gap**Fig. 353: Checking Piston Ring Gap**

Courtesy of VOLKSWAGEN UNITED STATES, INC.

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

Piston ring dimensions in mm	New	Wear limit
1. Compression ring	0.20 to 0.35	0.8
2. Compression ring	0.50 to 0.70	1.0
Oil scraping ring	0.20 to 0.40	0.8

Checking ring to groove clearance

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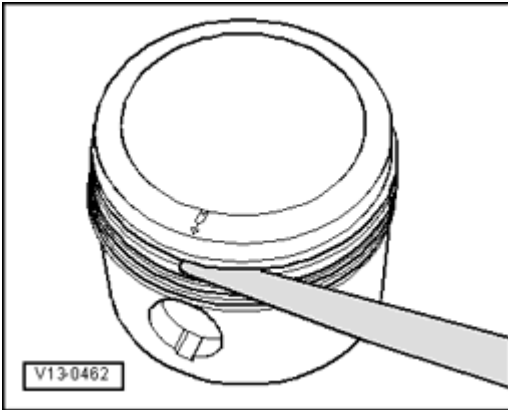


Fig. 354: Checking Ring To Groove Clearance
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Clean ring groove of piston before checking.

Piston ring dimensions in mm	New	Wear limit
Compression rings	0.02 to 0.08	0.20
Oil scraping ring	0.02 to 0.08	0.15

Checking piston

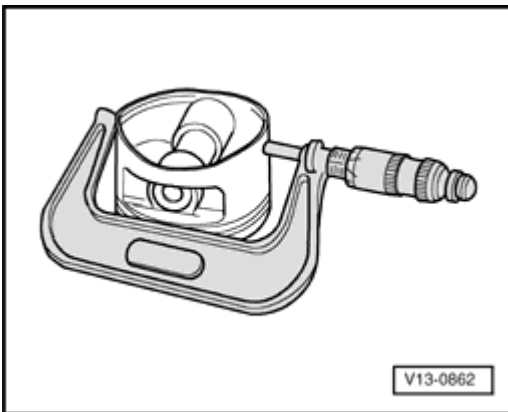


Fig. 355: Checking Piston
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Measure approximately 10 mm from the 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.**

Checking cylinder bores

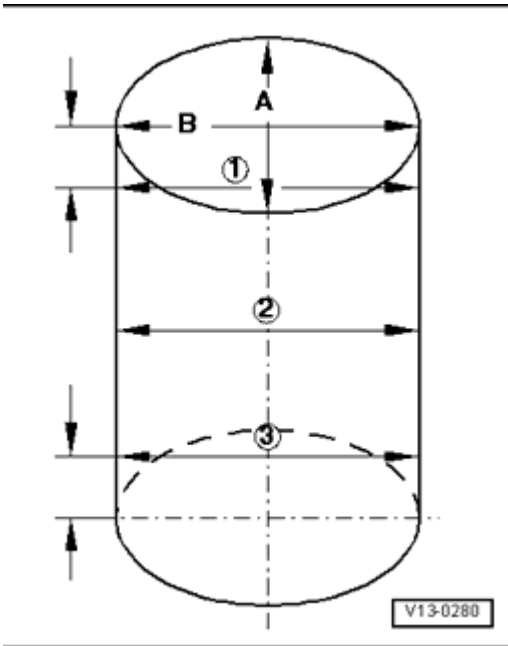


Fig. 356: Checking Cylinder Bores

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.**

Installed position of piston and piston/cylinder allocation

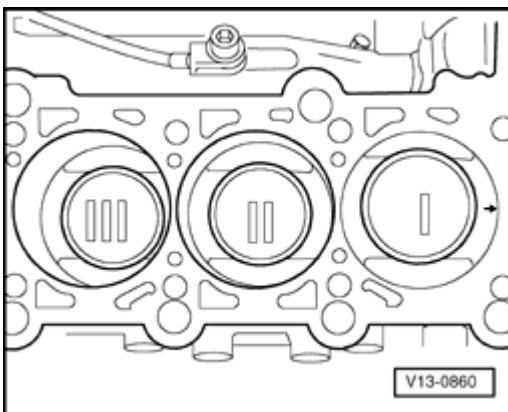


Fig. 357: Installed Position Of Piston And Piston/Cylinder Allocation

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Mark installed position and allocation to cylinder on piston head using chalk or waterproof felt pen.

NOTE:

- Do not use a center punch or scribe, since the piston head coating will be damaged.
- Installation position: Arrow on piston face points toward belt pulley side.

Mark connecting rod

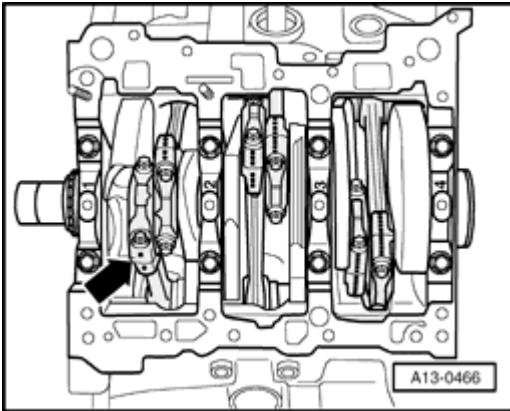


Fig. 358: Mark Connecting Rod

Courtesy of VOLKSWAGEN UNITED STATES, INC.

NOTE:

- Only replace connecting rod as 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

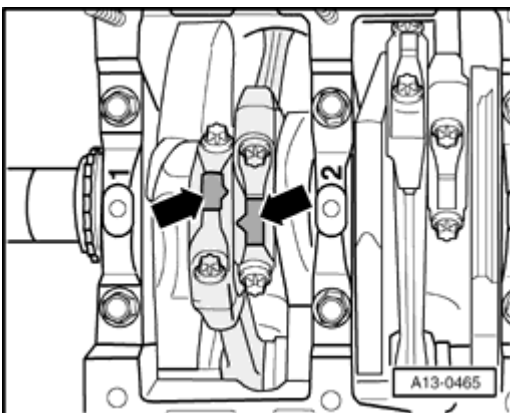
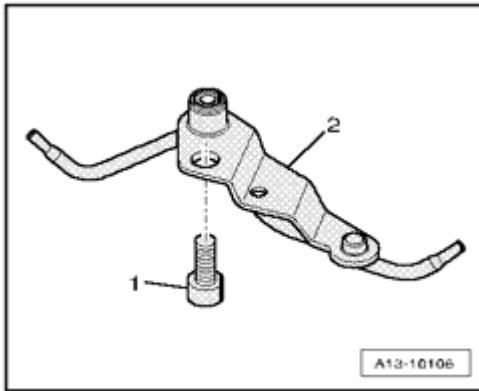


Fig. 359: Connecting Rod, Installed Location

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- The molded tabs - **arrows** - at the beveled surfaces of the connecting rod pairs 1 and 2, 3 and 4, and 5 and 6 must point toward each other.

Oil spray jet for piston cooling**Fig. 360: Oil Spray Jet For Piston Cooling**

Courtesy of VOLKSWAGEN UNITED STATES, INC.

1. Install bolt - 9 Nm - using a locking compound
2. Oil spray jet with spray nozzle valve

Piston and Cylinder Dimensions**Piston and Cylinder Dimensions**

Reconditioning dimension in mm	Piston diameter	Cylinder bore diameter
Basic dimension	84.49 1)	84.51
1) Measurement with coating (thickness = 0.02 mm). The coating wears off.		

Connecting Rod, Checking Radial Clearance**Connecting Rod, Checking Radial Clearance****Special tools, testers and auxiliary items required**

- Plastigage

Procedure

- Remove connecting rod bearing cap. Clean bearing cap and journal.
- 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:

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- Radial clearance, new: 0.010 to 0.052 mm.
- Radial clearance wear limit: 0.12 mm.
- Replace bolts for connecting rod bearings.