13 - ENGINE - CRANKSHAFT, CYLINDER BLOCK

CYLINDER BLOCK, BELT PULLEY SIDE

Ribbed belt drive, assembly overview

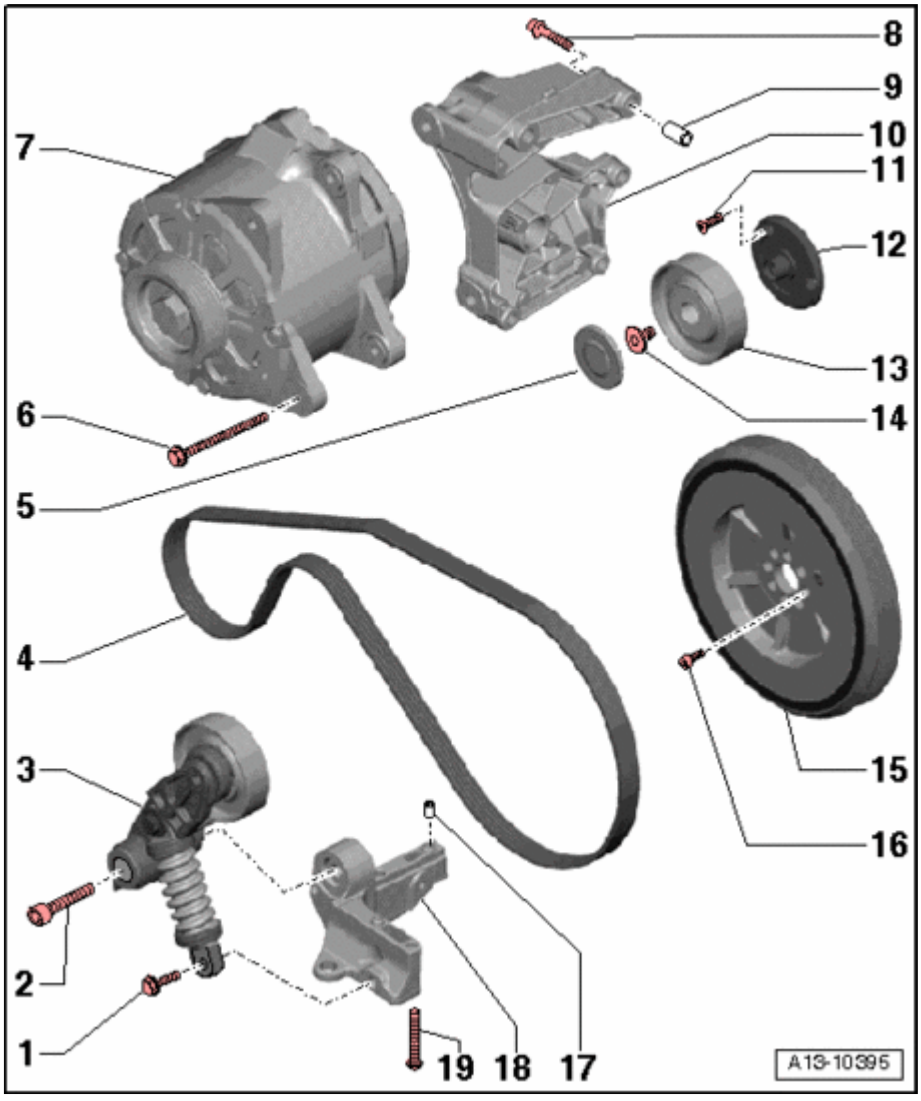

Fig. 157: Ribbed Belt Drive, Assembly Overview
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Bolt

- 22 Nm

2 - Bolt

- 55 Nm

3 - Tensioning device for ribbed belt

- Removing and installing --> **Ribbed belt tensioner, removing and installing**

4 - Ribbed belt

- Check for wear
- Do not kink

CAUTION: Risk of destroying due to reversed running direction on a used ribbed belt.

- **Before removing ribbed belt, marking running direction with chalk or felt-tip pen for reinstallation later.**

- Removing and installing --> **Ribbed belt, removing and installing**
- When installing, make sure it is seated correctly on pulleys

5 - Cover cap

6 - Bolt

- 22 Nm

7 - Generator

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

8 - Bolt

- M8: 22 Nm
- M10: 46 Nm

9 - Alignment bushing

- For generator bracket
- 2 pieces

10 - Generator bracket

11 - Bolt

- 9 Nm

12 - Bracket

- For idler pulley

13 - Idler roller for ribbed belt

14 - Bolt

- 22 Nm

15 - Vibration damper

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

16 - Bolt

- Replace
- Tightening order **Vibration damper tightening sequence**

17 - Alignment bushing

- 2 pieces

18 - Bracket

- For ribbed belt tensioner

19 - Bolt

- Different lengths
- 9 Nm

Vibration damper tightening sequence

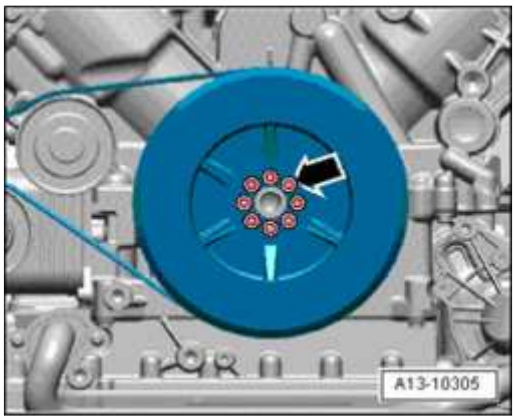

Fig. 158: Loosening Mounting Bolts On Vibration Damper
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Tighten bolts - **arrow** - in diagonal sequence in 3 stages as follows:
- Tighten bolts to 15 Nm.
- Tighten bolts to 22 Nm.
- Tighten an additional 90° ($^{1}/_{4}$ turn).

Ribbed belt, removing and installing

Removing

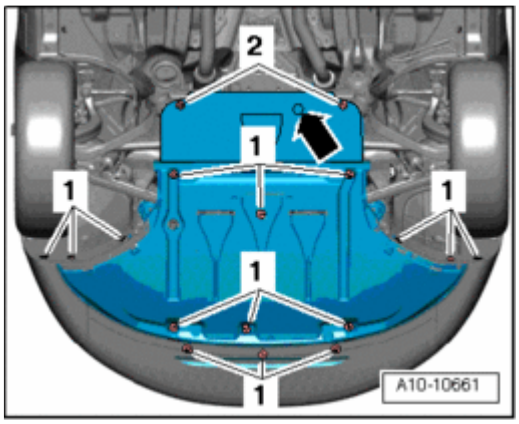

Fig. 159: Identifying Noise Insulation And Mountings
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove sound insulation by loosening securing pieces - **1, 2 and arrow** -.

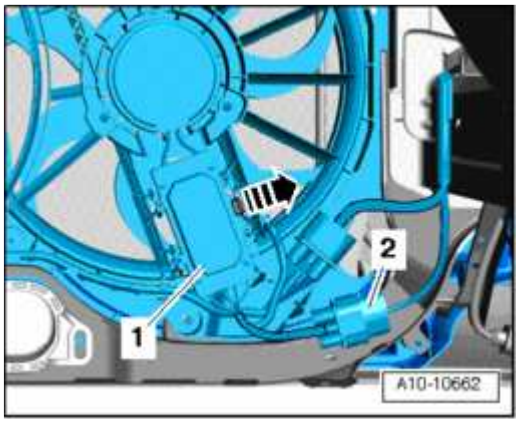

Fig. 160: Identifying Clip, Coolant Fan Control (FC) Control Module J293, And Electrical Harness Connector
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove electrical harness connector - **2** - from bracket and disconnect it.
- Release retaining clip - **arrow** - and lay aside Coolant Fan Control (FC) Control Module J293 - **1** -.

CAUTION: Risk of destroying due to reversed running direction on a used ribbed belt.

- **Before removing ribbed belt, marking running direction with chalk or felt-tip pen for reinstallation later.**

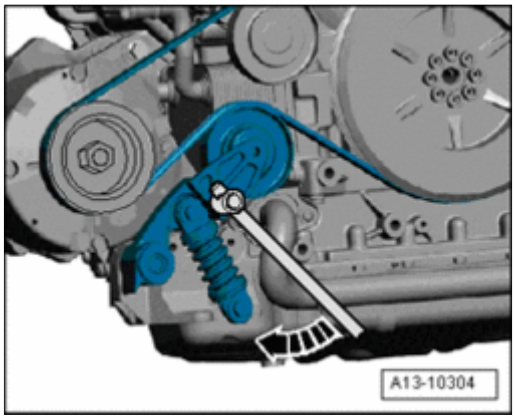

Fig. 161: Releasing Ribbed Belt Tension
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- 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, note the following:

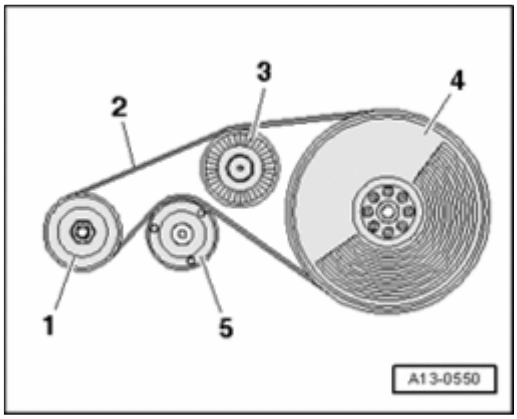

Fig. 162: Placing Ribbed Belt Over Belt Pulley In Specified Sequence
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Route ribbed belt - **2** - over belt pulley in specified sequence.

1 - Generator

3 - Idler roller

4 - Vibration damper

5 - Tensioning roller

NOTE:

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

  - Start engine and check running belt.

Ribbed belt tensioner, removing and installing

Removing

- Remove ribbed belt --> **Ribbed belt, removing and installing**

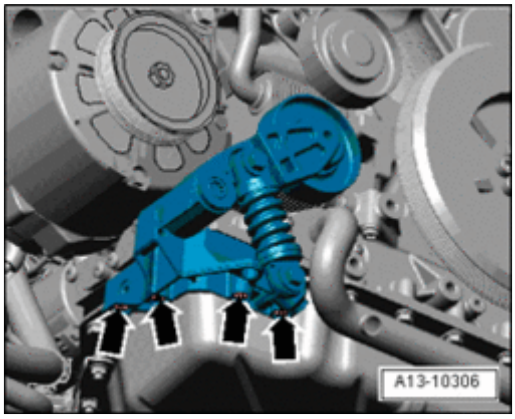

Fig. 163: Removing Bolts & Ribbed Belt Tensioner At Upper Part Of Oil Pan
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts - **arrows** -.
- Remove ribbed belt tensioner from upper part of oil pan.

Installing

- Tightening torque --> **Ribbed belt drive, assembly overview**.

Installation is in reverse order of removal.

Vibration damper, removing and installing

Removing

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

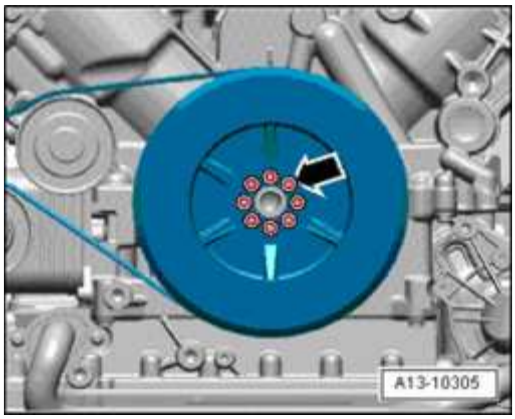

Fig. 164: Loosening Mounting Bolts On Vibration Damper
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Loosen 8 vibration damper bolts - **arrow** - several turns while counter holding at generator ribbed belt pulley center nut with an open-end wrench.
- Remove ribbed belt --> **Ribbed belt, removing and installing**
- Remove bolts - **arrows** - and remove vibration damper.

Installing

- Tightening torque **Vibration damper tightening sequence**

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

NOTE:

- **Replace bolts which have been tightened to torque.**
- **Secure all hose connections using hose clamps appropriate for the model type .**
- **Installation of vibration damper is only possible in one position - note alignment bushing.**

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

Crankshaft seal, ribbed belt side, replacing

Special tools, testers and auxiliary items required

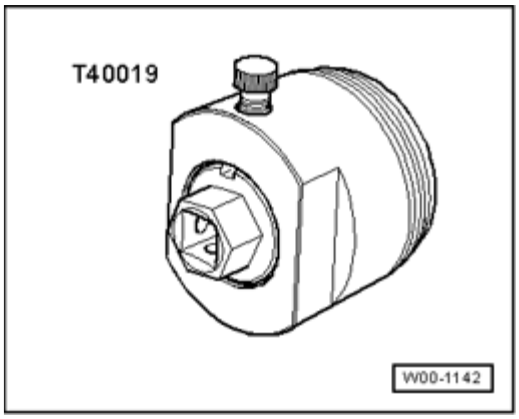

Fig. 165: Seal Remover T40019
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Seal remover T40019

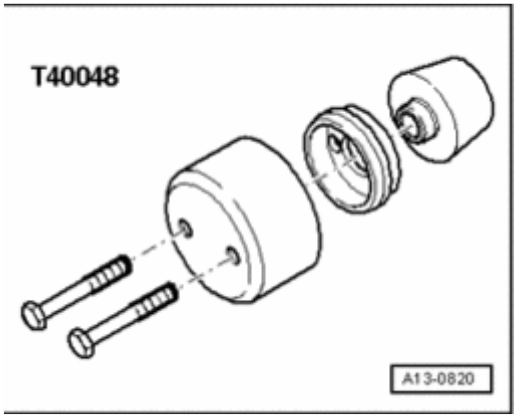

Fig. 166: Assembly Tool T40048
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Assembly tool T40048

Work procedure

- Bring lock carrier into service position --> **50 - BODY - FRONT** .
- Remove vibration damper --> **Vibration damper, removing and installing**.

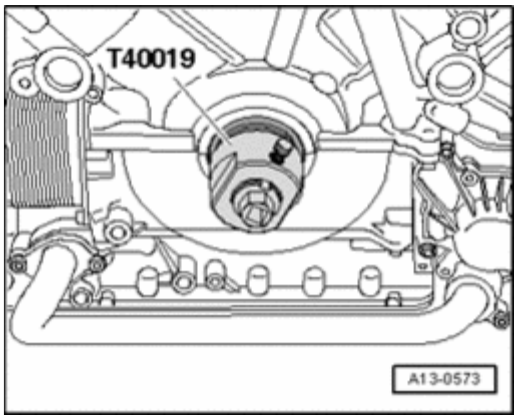

Fig. 167: Installing Oil Seal Extractor T40019
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Position inner part of Oil Seal Extractor T40019 flush with outer part and secure inner part with knurled thumb screw.
- Lubricate threaded head of seal remover, place against seal, and with strong force install into seal as far as possible.
- Loosen knurled screw and turn inner portion against crankshaft until oil seal is pulled out.
- Clamp seal extractor at mounting points in a vise.
- Remove seal using pliers.
- Clean operating and sealing surfaces.

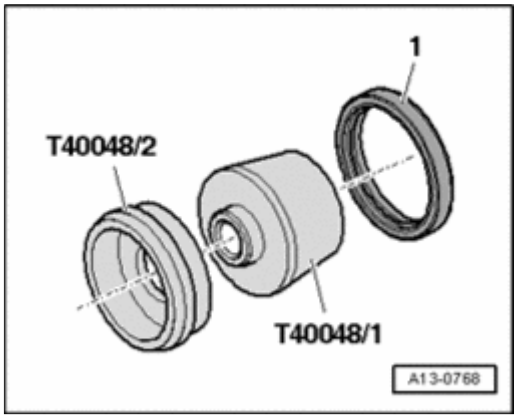

Fig. 168: Inserting Assembly Device T40048/1 Onto Pull Sleeve T40048/2 And Slide Seal Onto Pull Sleeve
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Position assembly device T40048/1 on pull sleeve T40048/2 and slide seal - **1** - onto pull sleeve.
- Remove assembly device.

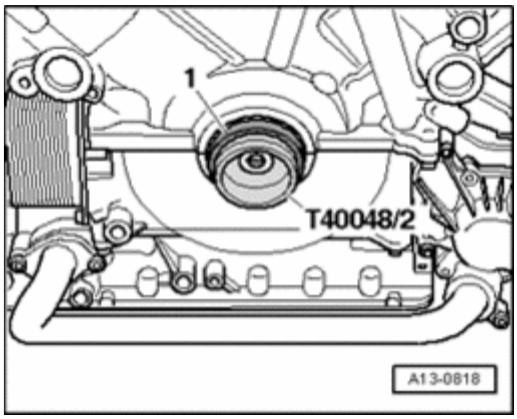

Fig. 169: Placing Pull Sleeve T40048/2 On Crankshaft And Sliding Seal Into Sealing Surface On Engine
Courtesy of VOLKSWAGEN UNITED STATES, INC.

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

NOTE:

- **Pull sleeve remains on crankshaft for pressing in.**

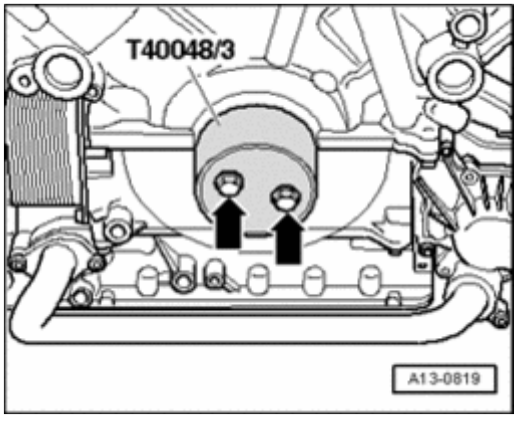

Fig. 170: Positioning Pressure Sleeve T40048/3 With Bolts On Crankshaft
Courtesy of VOLKSWAGEN UNITED STATES, INC.

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

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

NOTE:

- **Secure all hose connections using hose clamps appropriate for the model type .**

- Install vibration damper --> **Vibration damper, removing and installing**.
- Install ribbed belt --> **Ribbed belt, removing and installing**.

- Install lock carrier with attachments --> **50 - BODY - FRONT** .

CYLINDER BLOCK, TRANSMISSION SIDE

Cylinder block, transmission side

NOTE:

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

Drive plate, assembly overview

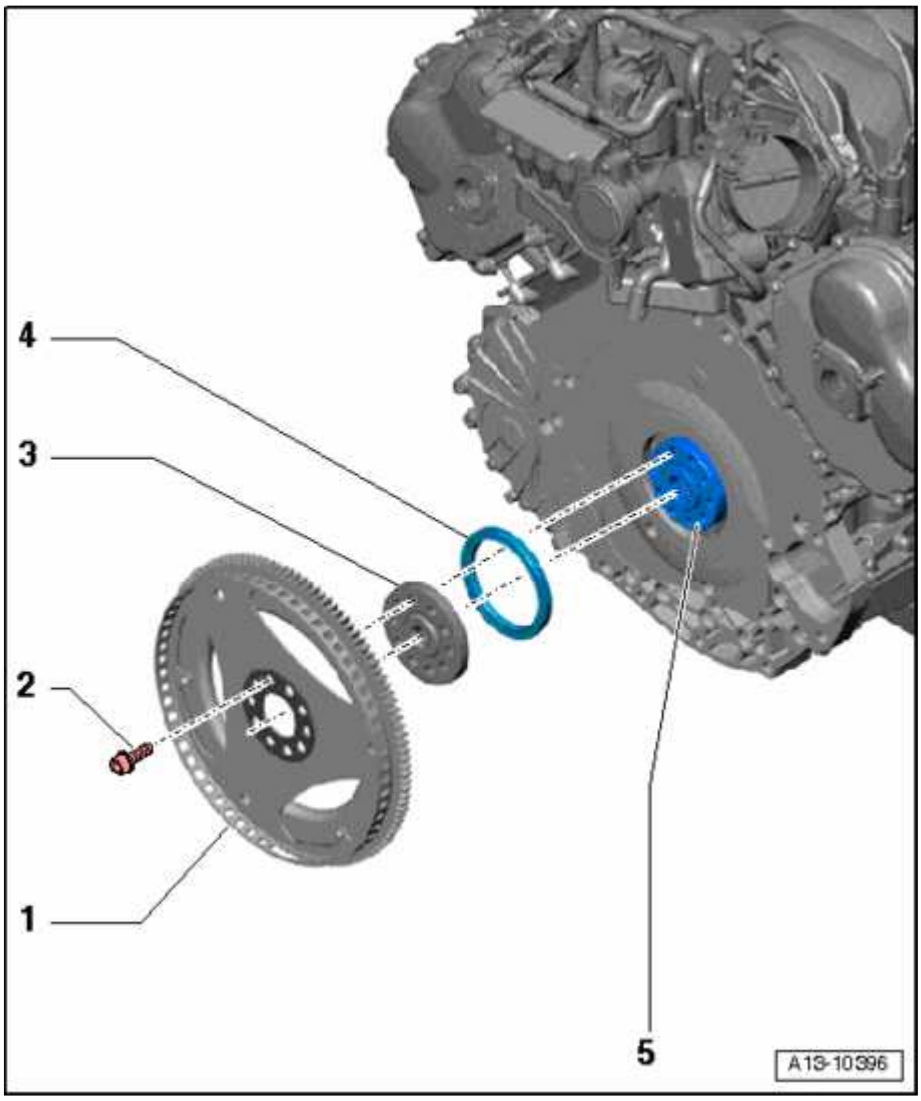

Fig. 171: Drive Plate, Assembly Overview
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Drive plate

- Removing and installing --> **Drive plate, removing and installing**
- Mark for re-installation

2 - Bolt

- Replace
- 60 Nm plus an additional 90° ($^{1}/_{4}$ turn).

3 - Shim

- Mark for re-installation

4 - Transmission-side crankshaft sealing ring

- Replacing --> **Transmission-side crankshaft sealing ring, replacing**.

5 - Crankshaft

Drive plate, removing and installing

Special tools, testers and auxiliary items required

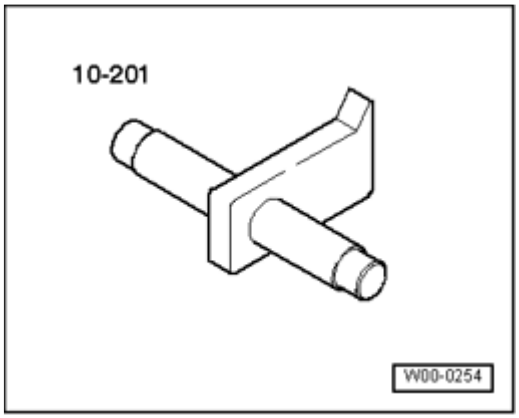

Fig. 172: Counter-Holder Tool 10-201
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Counter-holder tool 10 - 201

Removing

- Engine or transmission removed.

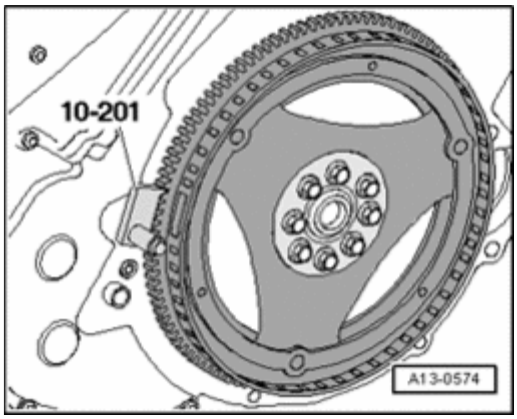

Fig. 173: Inserting Counter Hold Tool 10-201 To Loosen Bolts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Insert counter-hold tool 10 - 201 to loosen bolts.
- Identify position of drive plate to crankshaft with a felt-tip pen for reinstallation.
- Remove drive plate.
- Remove shim from behind it.

Installing

- Tightening torque --> **Drive plate, assembly overview**.

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

NOTE:

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

- Install drive plate with shim.
- Turn over counter-hold tool 10 - 201 to tighten bolts.

Transmission-side crankshaft sealing ring, replacing

Special tools, testers and auxiliary items required

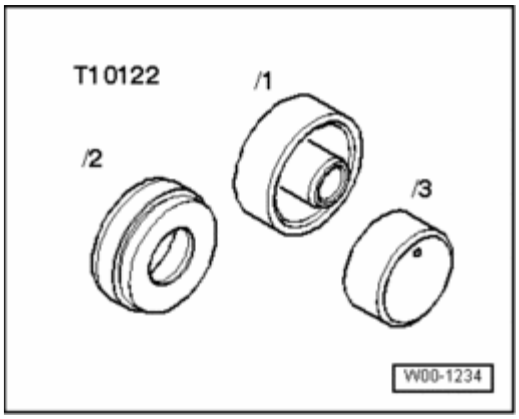

Fig. 174: Pulling Fixture T10122
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Pulling fixture T10122

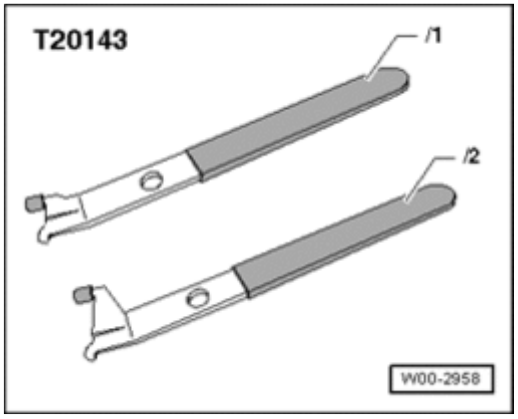

Fig. 175: Extractor Hook T20143
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Extractor hook T20143

Work procedure

- Engine or transmission removed.
  - Remove drive plate --> **Drive plate, removing and installing**.

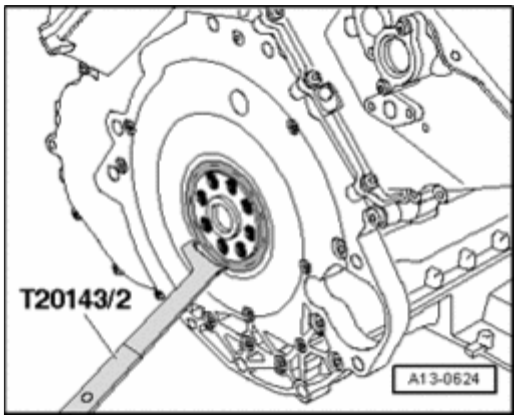

Fig. 176: Prying Out Sealing Ring Using Extractor Lever T20143/2
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Pry out sealing ring using pulling hook T20143/2.
- Clean operating and sealing surfaces.

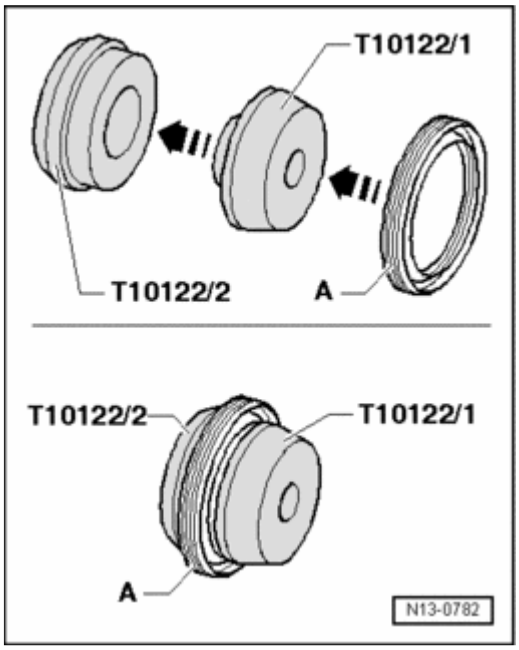

Fig. 177: Inserting Assembly Device T10122/1 Onto Pull Sleeve T10122/2 And Shaft Seal Onto Pull Sleeve
Courtesy of VOLKSWAGEN UNITED STATES, INC.

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

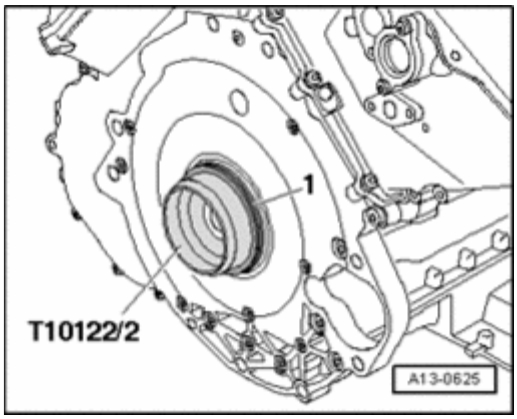

Fig. 178: Installing Pull Sleeve T10122/2 With Sealing Ring Onto Crankshaft
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Install pull sleeve T10122/2 with seal - **1** - on crankshaft.

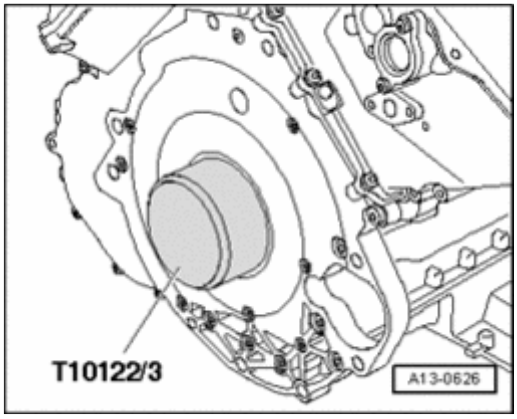

Fig. 179: Pressing In Sealing Ring All Around Evenly And Flush Using Pressure Sleeve T10122/3
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Press seal evenly and flush all around with thrust piece T10122/3.

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

- Install drive plate --> **Drive plate, removing and installing**.

CRANKSHAFT

Crankshaft

NOTE:

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

Crankshaft, assembly overview

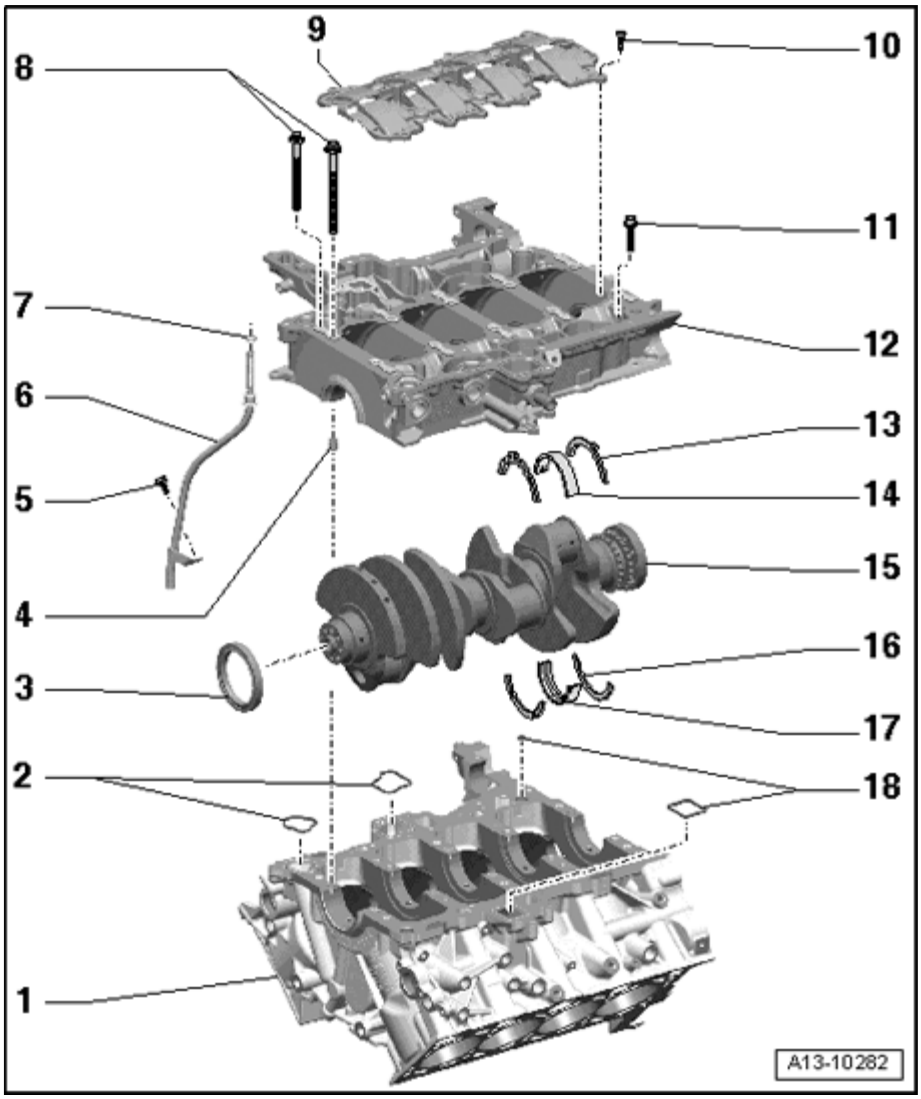

Fig. 180: Crankshaft, Assembly Overview
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Cylinder block

- Paired to - **12** -
- Sealant applied on cylinder block (for guide frame) **Sealant applied on cylinder block (for guide frame)**

2 - Seals

- Replace

3 - Crankshaft seal, ribbed belt side

- Replacing --> **Crankshaft seal, ribbed belt side, replacing**.

4 - Alignment bushing

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

5 - Bolt

- 9 Nm

6 - Guide tube for oil dipstick

7 - O-ring

- Replace

8 - Bolts

- For guide frame
- Replace
- Various bolt sizes
- Tightening order **Guide frame tightening sequence**

9 - Baffle plate

10 - Bolt

- Tightening order **Baffle plate tightening sequence**

11 - Bolt

- For guide frame to cylinder block sealing surfaces
- Different bolt lengths
- Tightening order **Guide frame tightening sequence**

12 - Bearing bracket

- Paired to - **1** -
- Sealant applied on cylinder block (for guide frame) **Sealant applied on cylinder block (for guide frame)**
- Bolt tightening sequence **Guide frame tightening sequence**

13 - Thrust washer

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

14 - Bearing shell

- For guide frame without lubricating groove
- Mark used bearing shells
- Insert new bearing shells for guide frame with proper color marking: New crankshafts --> **Allocation of main bearing shells for new crankshafts** , used and reworked crankshafts --> **Allocation of main bearing shells for used and reworked crankshafts**

15 - 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**

16 - Thrust washer

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

17 - Bearing shell

- For cylinder block with oil groove
- Mark used bearing shells
- Insert new bearing shells for cylinder block with proper color marking: New crankshafts --> **Allocation of main bearing shells for new crankshafts** , used and reworked crankshafts --> **Allocation of main bearing shells for used and reworked crankshafts**

18 - Seals

- Replace

Baffle plate tightening sequence

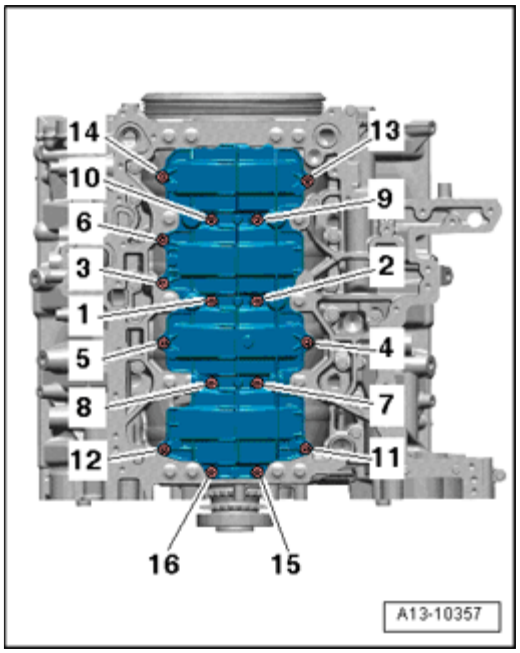

Fig. 181: Baffle Plate Tightening Sequence
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Tighten bolts - **1 to 16** - in sequence.
- 9 Nm

Sealant applied on cylinder block (for guide frame)

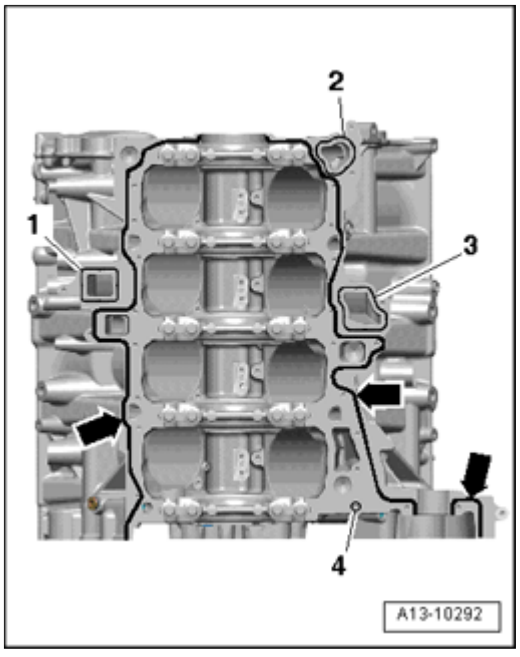

Fig. 182: Sealant Applied On Cylinder Block (For Guide Frame)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Clean sealing surfaces so they are completely free of any oil or grease.
- Apply sealant beads - **arrows** - to clean sealing surfaces as shown in illustration.

- Thickness of sealant beads: 2.0 mm.

- Install seals - **1 to 4** -.

Installation position of alignment bushings

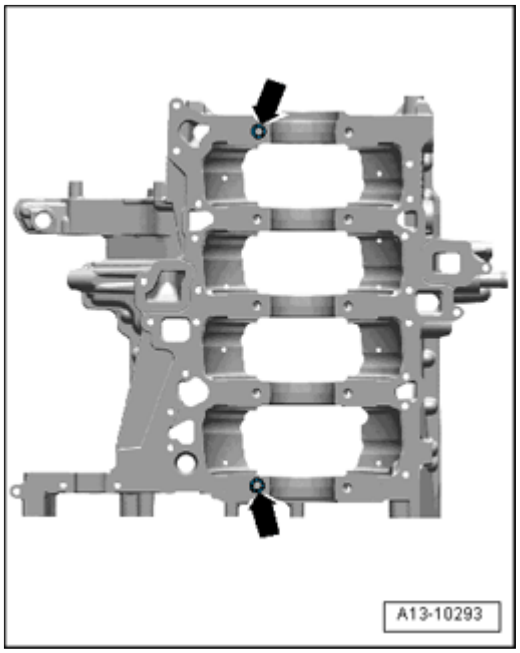

Fig. 183: Installation Position Of Alignment Bushings
Courtesy of VOLKSWAGEN UNITED STATES, INC.

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

Guide frame tightening sequence

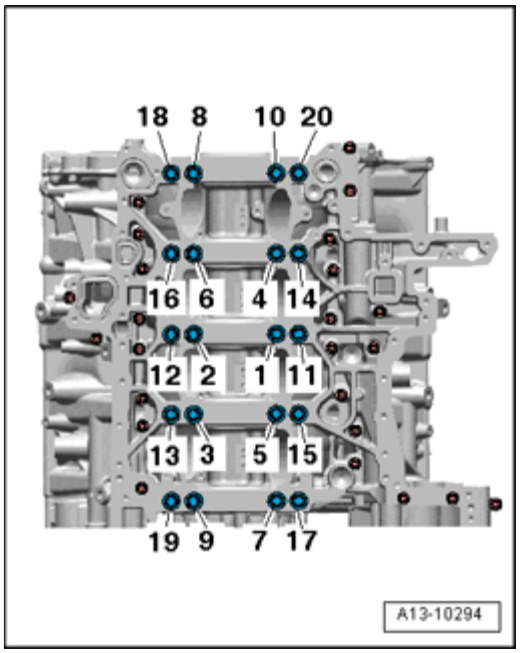

Fig. 184: Guide Frame Tightening Sequence
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Replace bolts - **1 to 20** -.
- Tighten bolts in 7 stages as follows:
- Tighten bolts - **1 to 10** - to 30 Nm.
- Tighten bolts - **11 to 20** - to 20 Nm.
- Tighten bolts - **1 to 10** - to 50 Nm.
- Tighten bolts - **11 to 20** - to 30 Nm.
- Tighten bolts - **1 to 10** - an additional 90° ($^{1}/_{4}$ turn).
- Tighten bolts - **11 to 20** - an additional 90° ($^{1}/_{4}$ turn).
- Tighten guide frame to cylinder block sealing surface bolts, - **highlighted in illustration but not numbered** - , in a diagonal sequence to 9 Nm.

Allocation of main bearing shells for new crankshafts

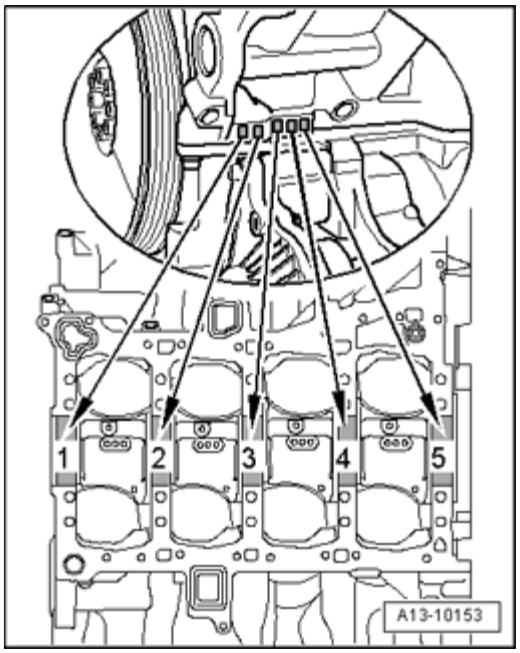

Fig. 185: Allocation Of Crankshaft Bearing Shells For Cylinder Block
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Allocation of crankshaft bearing shells for cylinder block

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

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

NOTE:

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

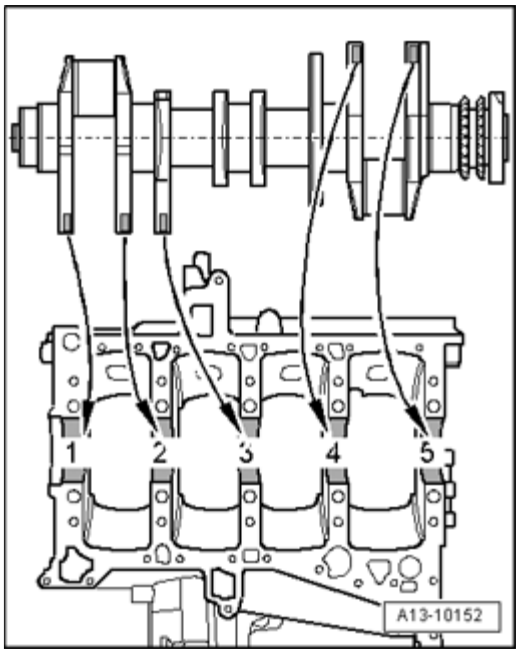

Fig. 186: Allocation Of Crankshaft Bearing Shells For Guide Frame - Version I
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Allocation of crankshaft bearing shells for guide frame - Version I

- Bearing shells with correct thickness are allocated to guide frame in the factory. Colored dots on sides of bearing shells serve for identifying bearing shell thickness.
- Allocation of bearing shells to guide frame is marked by one colored dot each on crankshaft counterweight as shown in the illustration.

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

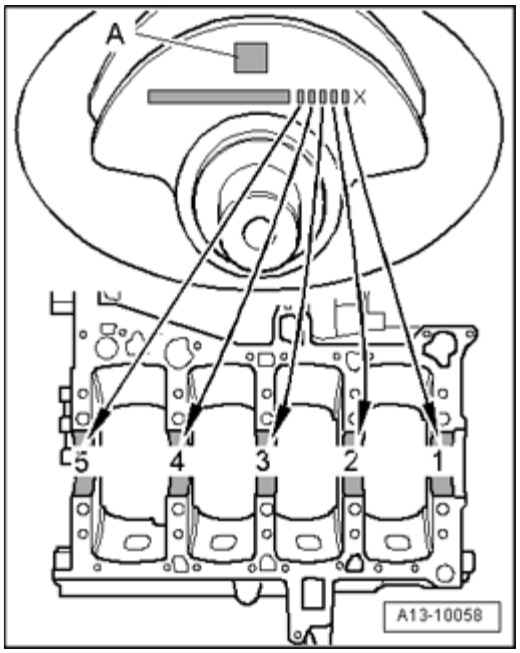

Fig. 187: Allocation Of Crankshaft Bearing Shells For Guide Frame - Version II
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Allocation of crankshaft bearing shells for guide frame - Version II

- Bearing shells with correct thickness are allocated to guide frame in the factory. Colored dots on sides of bearing shells serve for identifying bearing shell thickness.
- The allocation of bearing shells to guide frame is identified by a letter on the front crankshaft counterweight, as shown in the illustration. The "X" marks the end of the letter sequence and is near bearing 1 color identification on belt pulley side.

NOTE:

- **Ignore - A -.**

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

Allocation of main bearing shells for used and reworked crankshafts

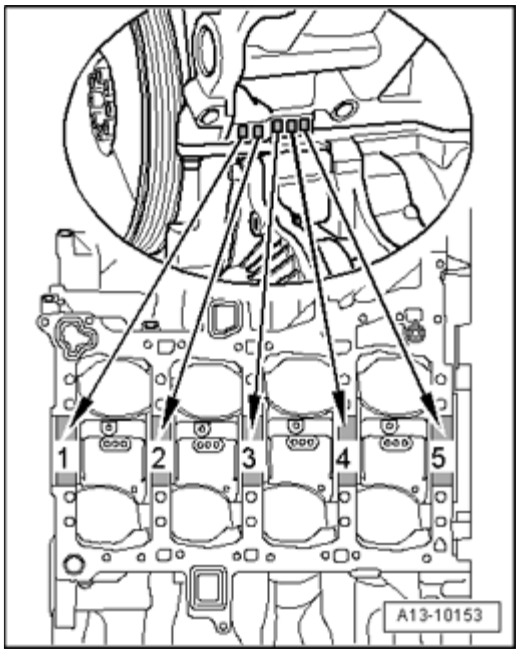

Fig. 188: Allocation Of Crankshaft Bearing Shells For Cylinder Block
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Allocation of crankshaft bearing shells for cylinder block

- Bearing shells are allocated to cylinder block corresponding to color markings stamped into cylinder block.
- For used and reworked crankshafts, the main crankshaft journals must be measured in order to allocate the matching bearing shells.
- Crankshaft dimensions --> **Crankshaft dimensions**.
- Thicker over-sized bearing shells are available for reworked crankshafts. These have the same color markings as the original-size bearing shells.

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

Allocation of crankshaft bearing shells for guide frame

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

Main crankshaft journals diameter	Color identification of bearing shells for guide frame		
Dimensions in mm	Red	Yellow	Blue
Basic dimension 65.000 1)	64.978 to 64.972	64.972 to 64.965	64.965 to 64.958
Repair stage 64.750 1)	64.728 to 64.722	64.722 to 64.715	64.715 to 64.708

- 1) The same color marking is valid for the thicker over-sized bearing for reworked crankshafts as for new crankshafts despite greater bearing thickness.

Crankshaft dimensions

Reconditioning dimension in mm	Main crankshaft journals diameter		Connecting rod pins diameter	
Basic dimension	65.000	0.022 0.042	54.000	0.022 0.042
Repair stage	64.750	0.022 0.042	53.750	0.022 0.042

Axial clearance, measuring

Special tools, testers and auxiliary items required

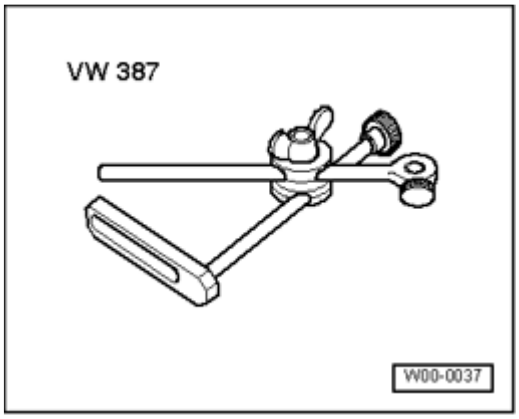

Fig. 189: Dial Gauge Holder VW 387
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Dial gauge holder VW 387

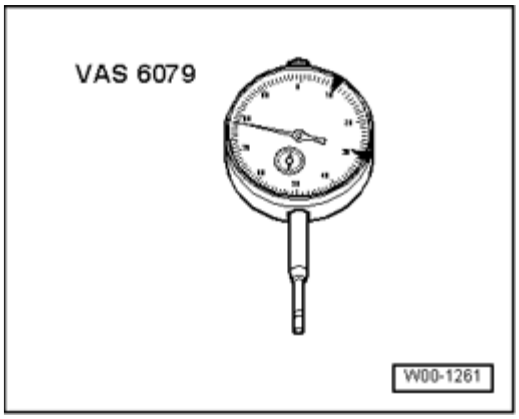

Fig. 190: Dial Gauge VAS 6079
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Dial gauge VAS 6079

Work procedure

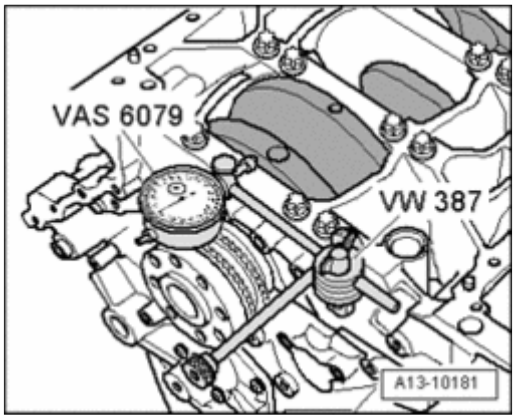

Fig. 191: Securing Dial Gauge VAS 6079 With Dial Gauge Holder VW 387 To Cylinder Block
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Secure Dial Gauge VAS 6079 with Dial Gauge Holder VW 387 to cylinder block as shown in illustration.
- Position dial gauge against crankshaft counterweight.
- Press crankshaft by hand against gauge and set gauge to "0".
- Press crankshaft off gauge and read value.

- Axial clearance: 0.090 to 0.251 mm.

Radial clearance, measuring

Special tools, testers and auxiliary items required

- Plastigage

Work procedure

NOTE:

- **Identify used bearing for reinstallation.**
- **If the bearing shells are worn down to the nickel layer, they 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: 0.017 to 0.044 mm.
- Wear limit: 0.08 mm.

PISTON AND CONNECTING ROD

Piston and connecting rod, assembly overview

NOTE:

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

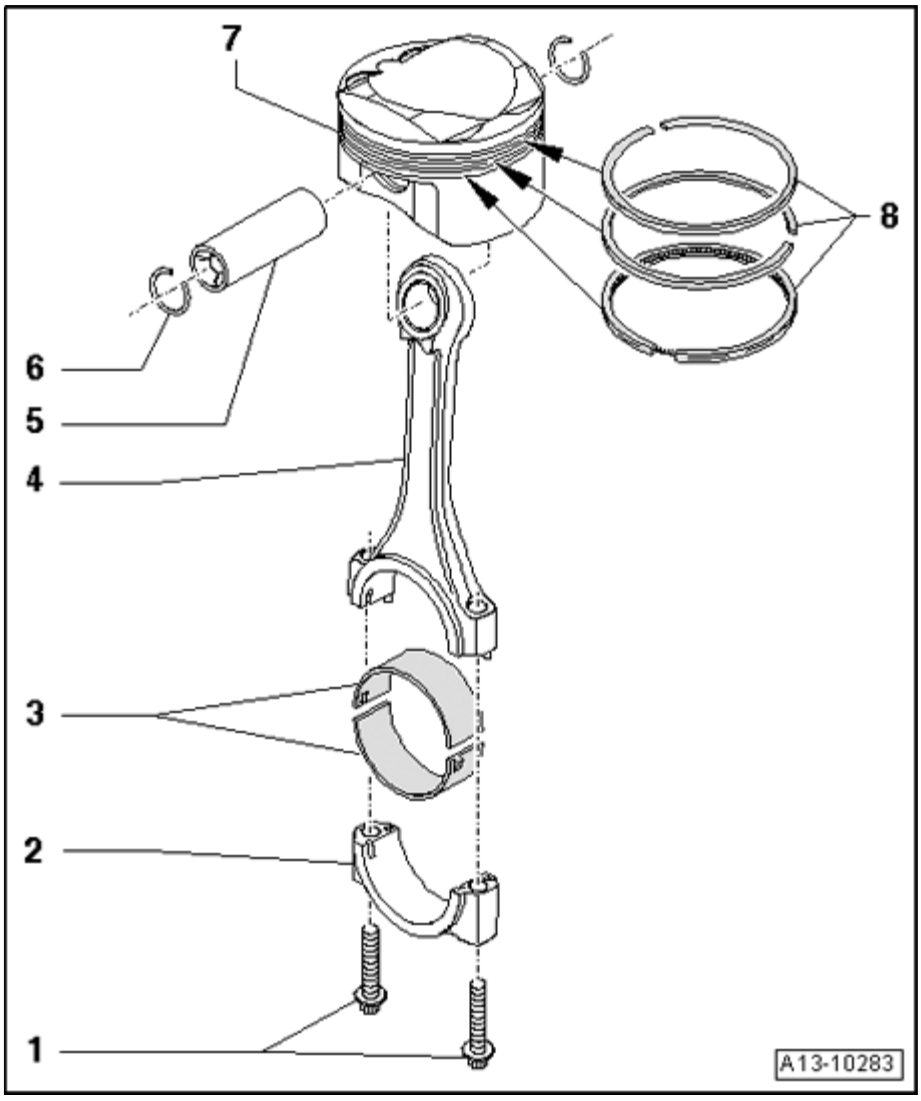

Fig. 192: Piston And Connecting Rod, Assembly Overview
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Bolt

- Replace
- Lubricate threads and contact surface
- 60 Nm plus an additional 90° ($^{1}/_{4}$ turn).
- Tighten to 60 Nm to measure radial play, do not turn further

2 - Connecting rod bearing cap

- Mark for re-installation
- Mark affiliation to cylinder with paint **Mark connecting rod**
- Installation position of connecting rod pairs **Connecting rod, installed location**

3 - Bearing shells

- Check that retaining tabs are secured
- Mark used bearing shells for reinstallation but not on running surface
- Radial clearance, measuring --> **Radial clearance of connecting rod, measuring**
- Over-sized bearings are available for reworked crankshaft connecting rod journals

4 - Connecting rod

- Only replace as set
- Mark affiliation to cylinder with paint **Mark connecting rod**
- Installation position of connecting rod pairs **Connecting rod, installed location**
- Axial play for each new connecting rod pair: 0.20 to 0.27 mm
- Axial play wear limit: 0.30 mm
- Radial clearance, measuring --> **Radial clearance of connecting rod, measuring**

5 - Piston pin

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

6 - Circlip

7 - Piston

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

8 - Piston rings

- Offset gaps by 120°
- Use piston ring pliers for removal and installation
- "TOP" marking or inscribed side must point to piston head
- Gap, measuring **Piston ring end gap, measuring**
- Measuring side clearance **Measuring piston ring side clearance**

Piston ring end gap, measuring

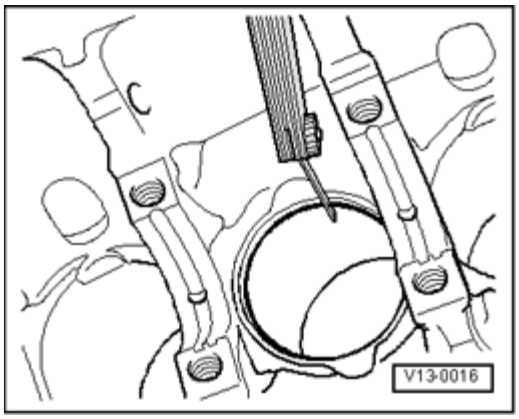

Fig. 193: Piston Ring End Gap, Measuring
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Slide piston ring down from above at a right angle to cylinder wall until it is approx. 15 mm from bottom edge of cylinder.
- When sliding in, use a piston without piston rings.

Piston ring dimensions in mm	New	Wear limit
1. Compression ring	0.20 to 0.35	0.80
2. Compression ring	0.20 to 0.40	0.80
Oil scraping ring	0.20 to 0.40	0.80

Measuring piston ring side clearance

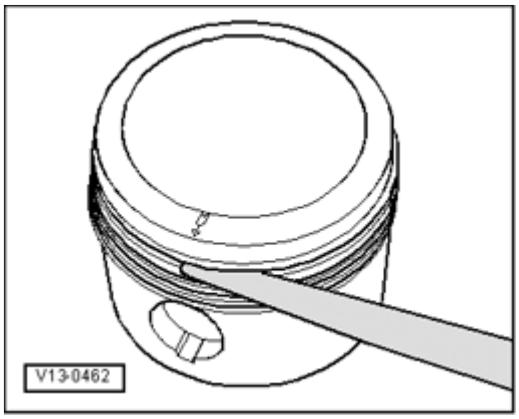

Fig. 194: Measuring Piston Ring Side Clearance
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Clean ring groove of piston before checking.

Piston ring dimensions in mm	New	Wear limit
1. Compression ring	0.035 to 0.085	0.200
2. Compression ring	0.005 to 0.045	0.150

Oil scraping ring	0.010 to 0.050	0.200

Checking piston

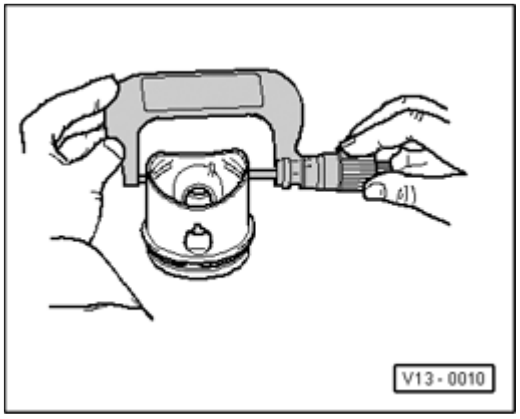

Fig. 195: Checking Piston
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Measure approx. 15 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: 0.03 mm.

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

Measuring cylinder bore

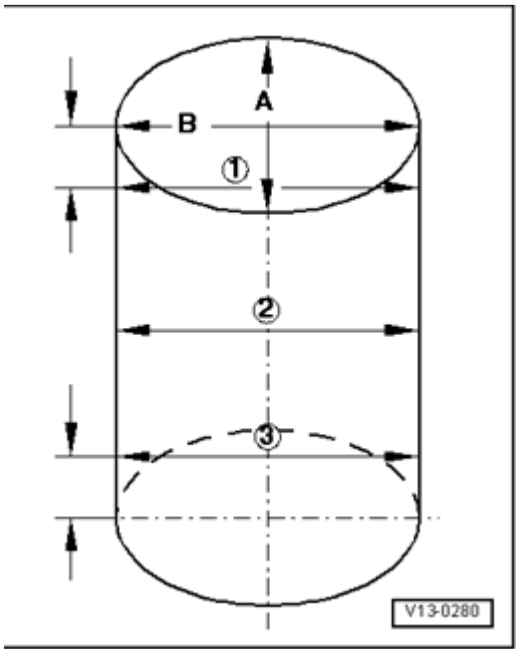

Fig. 196: Measuring Cylinder Bore

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Using an internal dial gauge 50 to 100 mm, measure at 3 points in diagonal sequence horizontally - **A** - and vertically - **B** -.

- Maximum deviation from nominal dimension: 0.08 mm.

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

Piston installation position

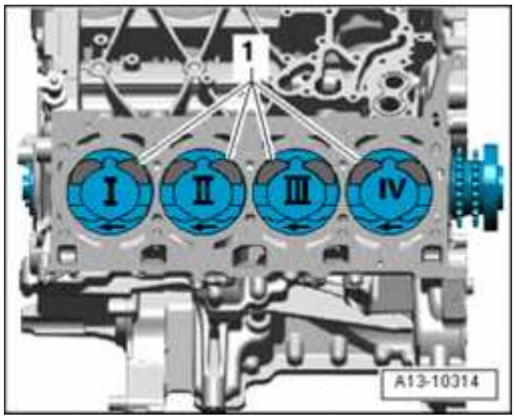

Fig. 197: Piston Installation Position
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Mark allocation to cylinder with pen on piston crown for reinstallation.

NOTE:

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

Installed location:

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

Mark connecting rod

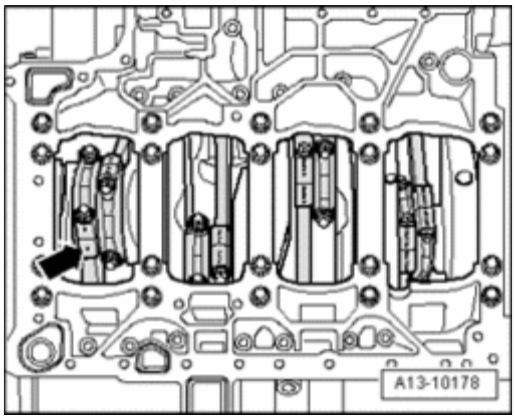

Fig. 198: Mark Connecting Rod
Courtesy of VOLKSWAGEN UNITED STATES, INC.

NOTE:

- **Only replace connecting rod as a set.**

- Mark connecting rod and connecting rod bearing cap to each other and to cylinder - **arrow** - with pen for reinstallation.

Connecting rod, installed location

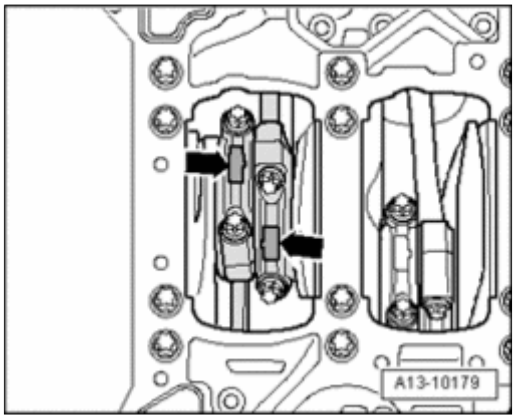

Fig. 199: Connecting Rod, Installed Location
Courtesy of VOLKSWAGEN UNITED STATES, INC.

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

Oil spray jet for piston cooling

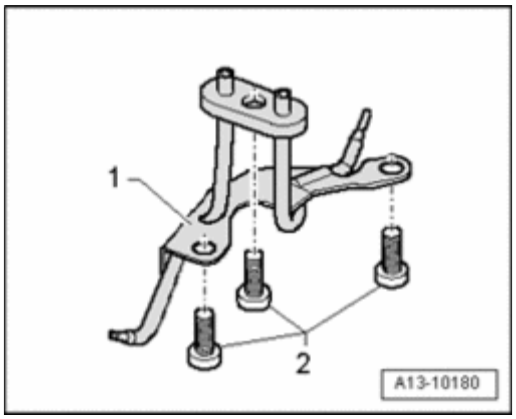

Fig. 200: Oil Spray Jet For Piston Cooling
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1. Oil spray jet
2. Bolts, 9 Nm. Insert with locking compound

NOTE:

- **Do not bend piston spray nozzles.**
- **Bend piston spray nozzles must be replaced.**

Piston and cylinder dimensions

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

Cylinder bore diameter mm	Piston diameter mm
84.510 ± 0.005	84.490 1)
84.610 ± 0.005	84.590 1)

- 1) Measurement with graphite coating (thickness = 0.01 mm). The graphite coating wears off.

Radial clearance of connecting rod, measuring

Special tools, testers and auxiliary items required

- Plastigage

Work procedure

- Remove connecting rod bearing caps.
- Clean bearing caps and journals.
- Place Plastigage over entire width of bearing journal or into bearing shells.
- Install connecting rod bearing cap and tighten to 60 Nm. Do not turn crankshaft.

- Remove connecting rod bearing caps again.

- Compare width of Plastigage with measuring scale.

Radial clearance:

- New: 0.020 to 0.069 mm.
- Wear limit: 0.120 mm.

- Replace connecting rod bolts.