ENGINE

2.0 Liter - Crankshaft, Cylinder Block - Engine Code(s): CJAA

13 CRANKSHAFT, CYLINDER BLOCK

GENERAL INFORMATION

NEW CONNECTING ROD, SEPARATING

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

-- Mark which cylinder the connecting rod belongs to.

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

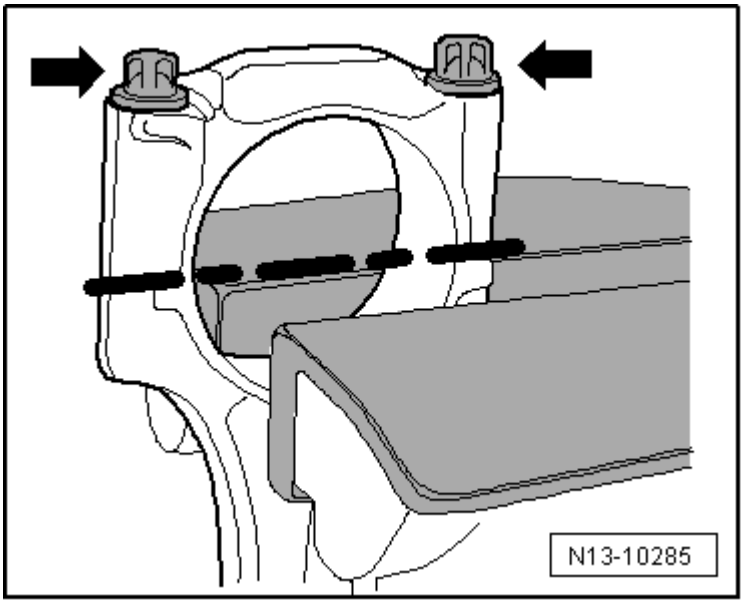

Fig. 1: Identifying Connecting Rod Clamped In Vise Equipped With Aluminum Protective Pads
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

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

Clamp the connecting rod below the dotted line.

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

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

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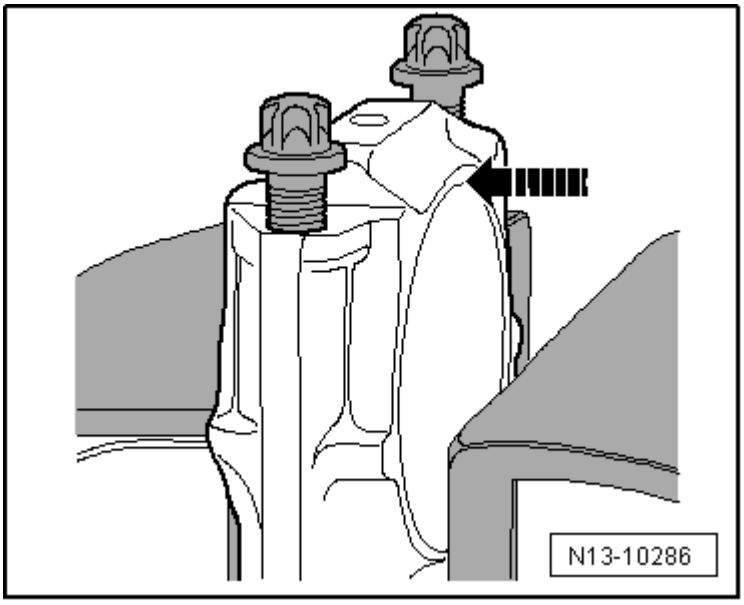

Fig. 2: Identifying Connecting Rod Bearing Cap
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

BEARING SHELL, INSTALLED POSITION

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

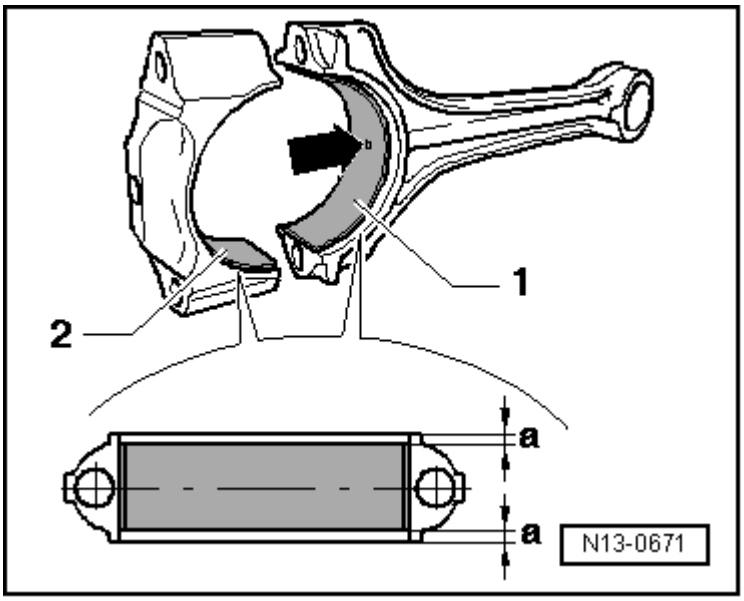

Fig. 3: Identifying Bearing Shells - Installed Positions
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Bearing shell -2- without a oil bore for connecting rod cap.

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

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Dimension -a- must be equal on the left and right sides.

DESCRIPTION AND OPERATION

RIBBED BELT WITH TENSIONER, OVERVIEW

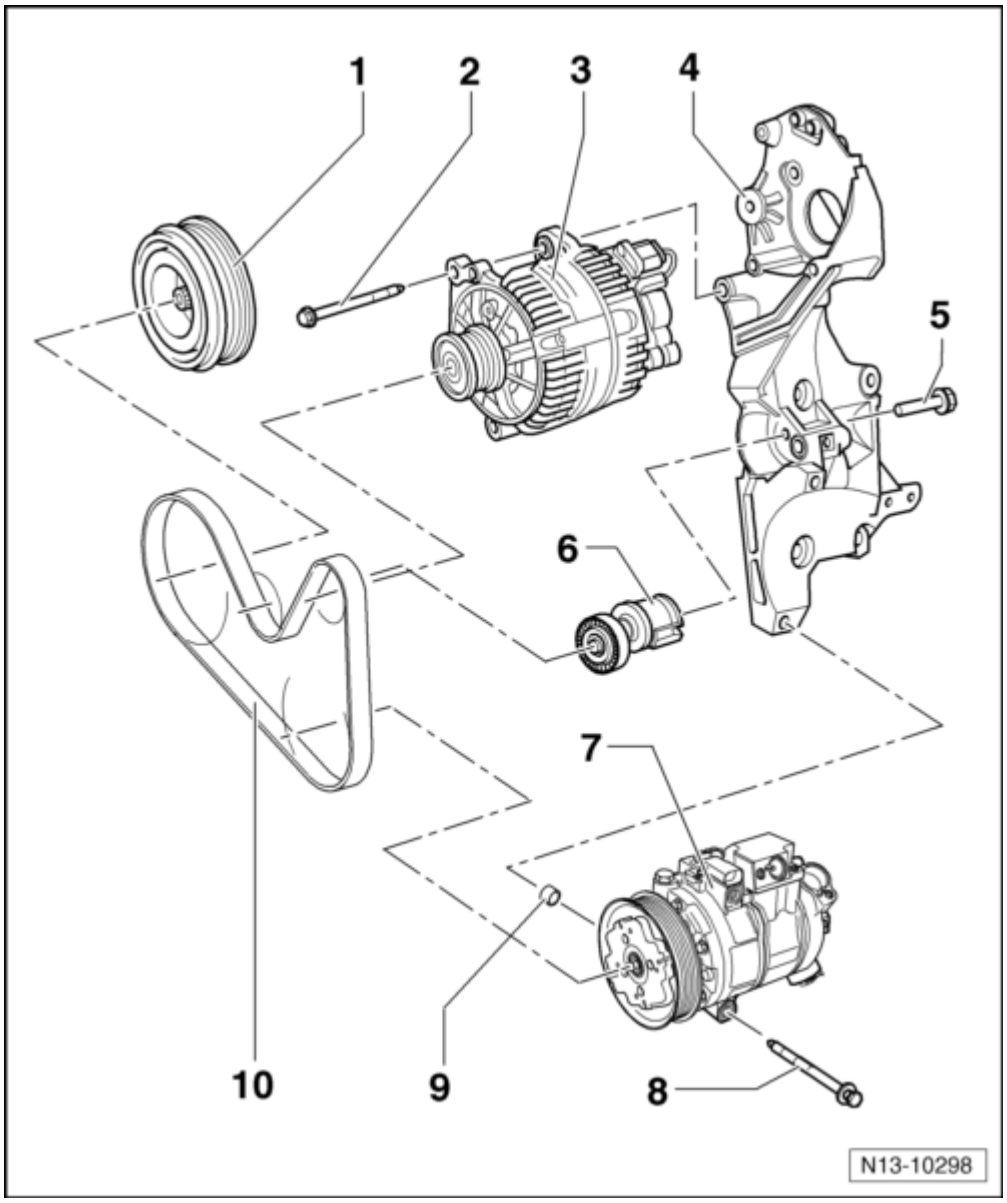

Fig. 4: Identifying Ribbed Belt Overview
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

1. **Vibration Damper**
   - Assembly is only possible in one position because of the offset holes.
2. **Bolt**
   - 25 Nm

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3. **Generator**
4. **Accessory Bracket**
    - For the Air Conditioning (A/C) compressor, generator and belt tensioner.
    - Removing and installing, refer to **ACCESSORY BRACKET**.
5. **Bolt**
    - 20 Nm + an additional 180° (1/2) turn.
    - Always replace.
6. **Ribbed Belt Tensioner**
7. **A/C Compressor**
8. **Bolt**
    - 45 Nm
9. **Alignment Sleeves**
10. **Ribbed Belt**
    - Mark the rotation direction before removing.
    - Check for wear.
    - Do not kink.
    - Removing and installing, refer to **RIBBED BELT (WITH TENSIONER)**.

RIBBED BELT WITH TENSIONING ROLLER, OVERVIEW

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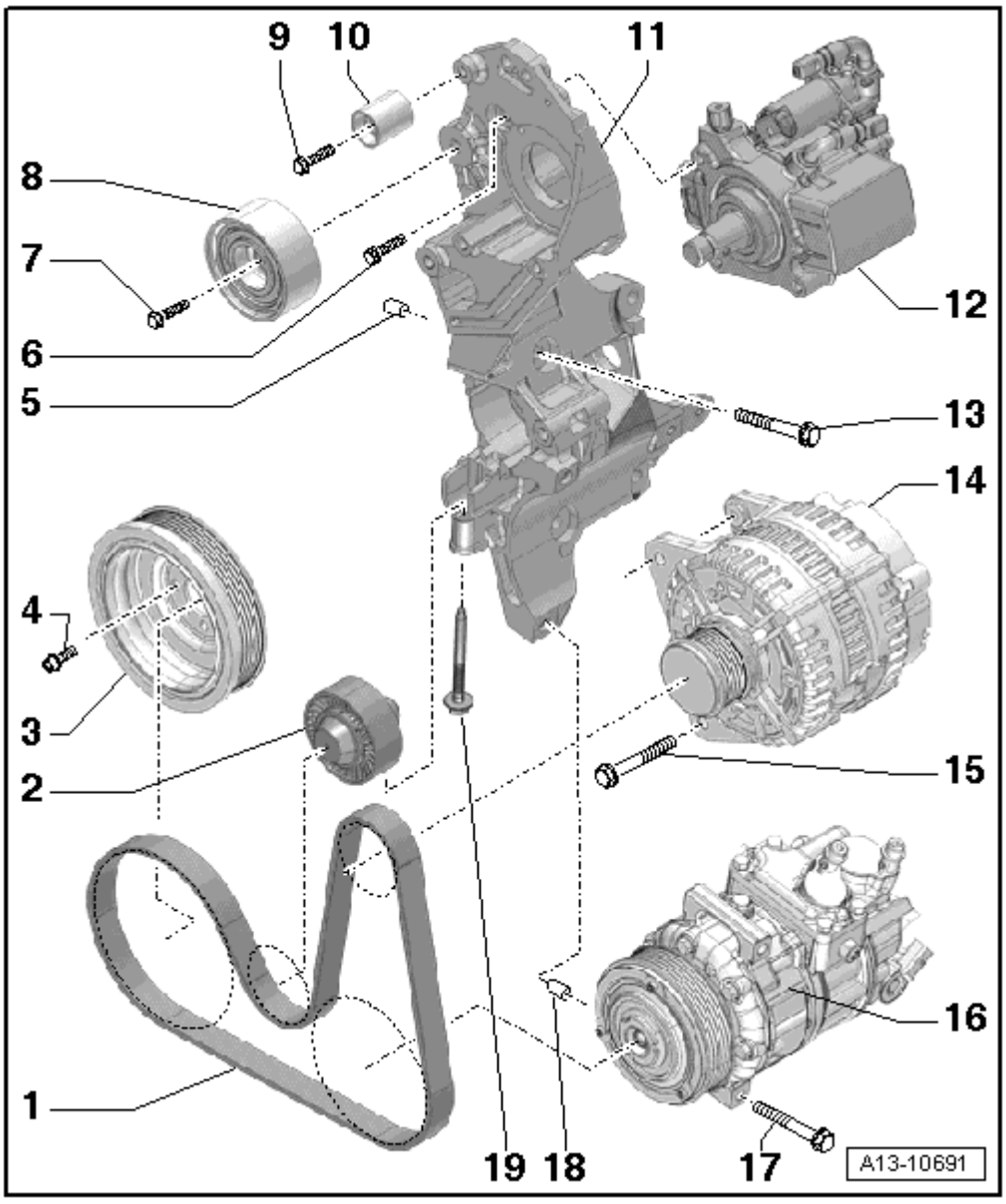

Fig. 5: Identifying Ribbed Belt With Tensioning Roller, Overview
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

1. **Ribbed Belt**
   - Check for wear.
   - Before removing, mark the rotation direction using chalk or a felt-tip marker.
   - Removing and installing, refer to **RIBBED BELT (WITH TENSIONING ROLLER)**.
   - Do not kink
   - When installing, make sure it is seated correctly on the pulleys.
2. **Ribbed Belt Tensioning Roller**
   - Removing and installing, refer to **RIBBED BELT (WITH TENSIONING ROLLER)**.
   - Apply some adhesive lubricating paste to the guide surfaces.

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3. **Vibration Damper**
   - With a pulley for the ribbed belt.
   - Assembly is only possible in one position because of the offset holes.
   - Installed position: The hole inside the vibration damper must be positioned over the protrusion on the crankshaft toothed belt gear.
4. **Bolt**
   - 10 Nm + an additional 90° (1/4) turn.
   - Always replace.
   - Use original bolts.
5. **Alignment Bushing**
   - Make sure the accessory bracket fits correctly.
6. **Bolt**
   - 20 Nm + an additional 90° (1/4) turn.
7. **Bolt**
   - 50 Nm + an additional 90° (1/4) turn.
8. **Idler Pulley**
   - For the toothed belt.
9. **Bolt**
   - 15 Nm
10. **Idler Roller**
    - For the toothed belt.
11. **Accessory Bracket**
    - Removing and installing, refer to **ACCESSORY BRACKET**.
12. **High Pressure Pump**
    - Removing and installing, refer to **HIGH PRESSURE PUMP** .
13. **Bolt**
    - Tightening specification and sequence, refer to **Fig. 34**.
14. **Generator**
    - Removing and installing, refer to **Removal and Installation** .
15. **Bolt**
    - 25 Nm
16. **Air Conditioning (A/C) Compressor**
    - Removing and installing, refer to **Removal and Installation** .
17. **Bolt**
    - 45 Nm
18. **Alignment Bushing**
    - Make sure the accessory bracket fits correctly.
19. **Bolt**

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- Tightening specification and sequence, refer to **Fig. 6**.

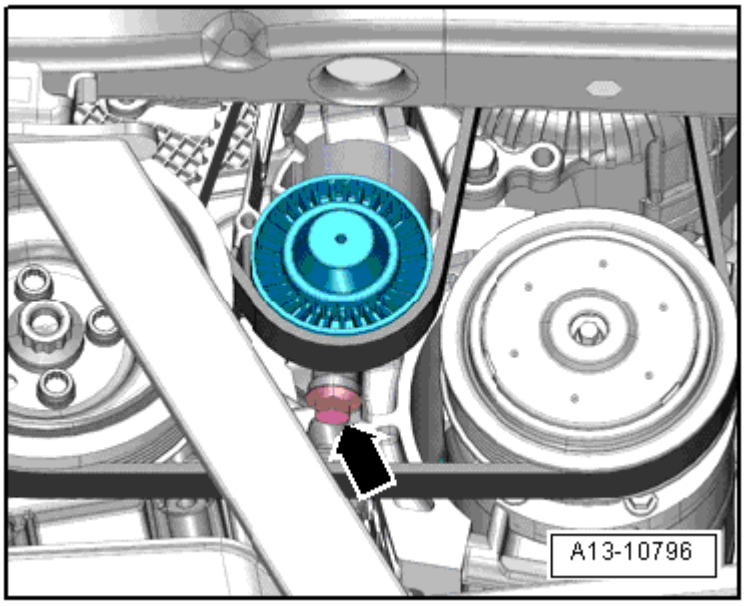

Fig. 6: Identifying Ribbed Belt Tensioning Roller Bolt Tightening Sequence and Specifications
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

NOTE: Replace the tensioning roller bolt.

Apply some adhesive lubricating paste to the guide surfaces on the tensioning roller using a paint brush.

-- Tighten the bolt in 5 steps:

Step	Bolt	Tightening Specification
1.	-arrow-	Install the bolt all the way in by hand. • The ribbed belt will become tensioned.
2.	-arrow-	Turn the bolt is all the way in. • The ribbed belt will

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		be tensioned further.
3.	-arrow-	Loosen a 90° (1/4) turn
4.	-arrow-	Tighten the bolt to 30 Nm
5.	-arrow-	Tighten the bolt an additional 90° (1/4) turn.

TOOTHED BELT DRIVE OVERVIEW

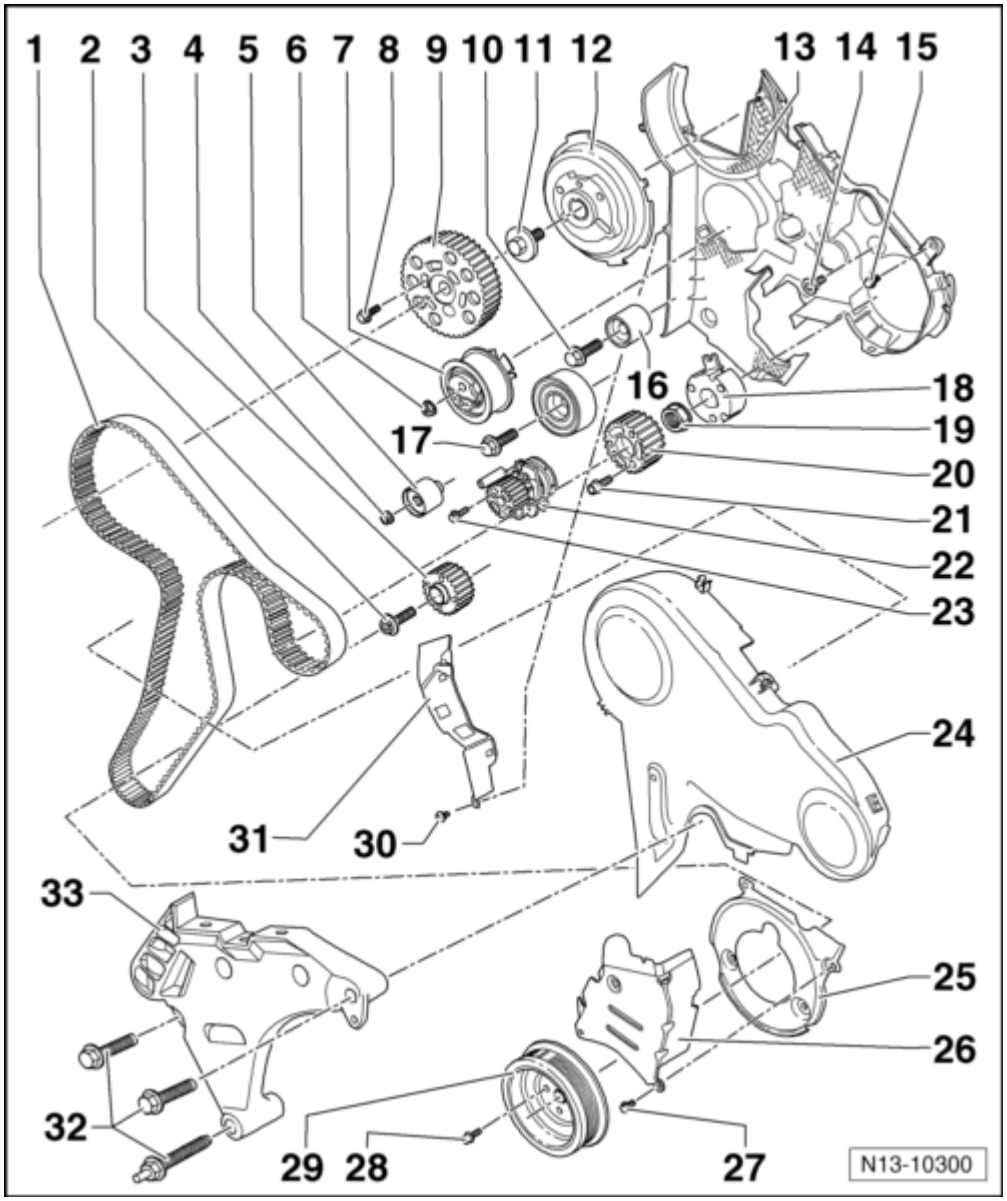

Fig. 7: Identifying Toothed Belt Overview

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Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

1. **Toothed Belt**
   - Mark the rotation direction before removing.
   - Check for wear.
   - Do not kink.
   - Removing, installing and tensioning. Refer to **TOOTHED BELT** .
2. **Bolt**
   - 120 Nm + an additional 90° (1/4) turn.
   - Always replace.
   - Use the counter support 3415 to loosen and tighten.
   - Do not lubricate or grease the threads or collar.
   - The additional turn can occur in several stages.
3. **Crankshaft Toothed Belt Gear**
4. **Nut**
   - 20 Nm
5. **Idler Roller**
6. **Nut**
   - 20 Nm + an additional 45° (1/8) turn.
7. **Belt Tensioner**
   - To remove and install, the engine mount bracket must be removed. Refer to **ENGINE MOUNT AND BRACKET**.
8. **Bolt**
   - 20 Nm + an additional 45° (1/8) turn.
9. **Camshaft Sprocket**
10. **Bolt**
    - 20 Nm
11. **Bolt**
    - 100 Nm
12. **Hub**
    - Use the camshaft gear counter-holder T10051 to loosen and tighten.
    - To remove, use the puller T10052.
    - Removing and installing, refer to **CAMSHAFTS** .
13. **Rear Toothed Belt Guard**
14. **Bolt**
    - 20 Nm
15. **Bolt**
    - 10 Nm

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- Always replace.

16. **Idler Roller**
17. **Bolt**
    - 50 Nm + an additional 90° (14) turn.
    - Always replace.
18. **Hub**
    - Use the camshaft gear counter-holder T10051 to loosen and tighten.
    - Use the pullerT40064 to remove.
    - Removing and installing, refer to **HIGH PRESSURE PUMP** .
19. **Nut**
    - 95 Nm
20. **High Pressure Pump Toothed Belt Gear**
21. **Bolt**
    - 20 Nm + an additional 90° (1/4) turn.
    - Always replace.
22. **Coolant Pump**
    - Removing and installing, refer to **COOLANT PUMP** .
23. **Bolt**
    - 15 Nm
24. **Upper Toothed Belt Guard**
25. **Lower Toothed Belt Guard**
26. **Center Toothed Belt Guard**
27. **Bolt**
    - 10 Nm
    - Always replace.
28. **Bolt**
    - 10 Nm + an additional 90° (1/4) turn.
    - Always replace.
29. **Vibration Damper**
    - Assembly is only possible in one position because of the offset holes.
30. **Bolt**
    - 5 Nm
31. **Protective Plate**
32. **Bolt**
    - 40 Nm + an additional 180° (1/2) turn.
    - Always replace.
    - Follow the tightening sequence, refer to **ENGINE MOUNT AND BRACKET**.
33. **Engine Mount Bracket**

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- Removing and installing, refer to **ENGINE MOUNT AND BRACKET**.

CRANKCASE OVERVIEW

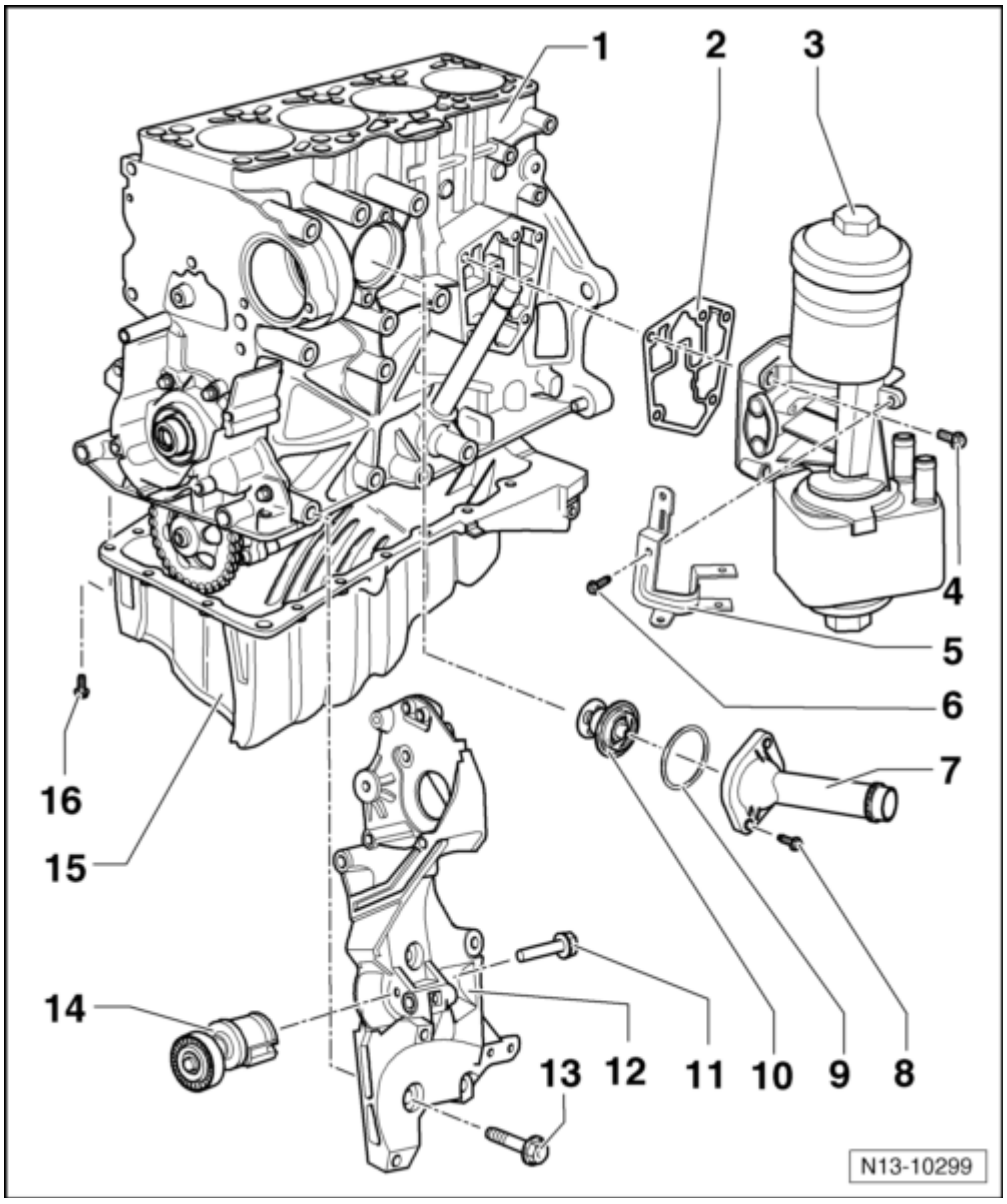

Fig. 8: Identifying Cylinder Block Overview
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

1. **Cylinder Block**
   - Sealing flanges and flywheel overview. Refer to **SEALING FLANGE AND FLYWHEEL OVERVIEW**.
   - Crankshaft overview. Refer to **CRANKSHAFT OVERVIEW**.
   - Piston and connecting rod. Refer to **PISTONS AND CONNECTING ROD OVERVIEW**.
2. **Gasket**

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- Always replace.

3. **Oil Filter Bracket**
   - Overview, refer to **OIL FILTER BRACKET AND OIL COOLER OVERVIEW** .
4. **Bolt**
   - 15 Nm + an additional 90° (1/4) turn.
   - Always replace.
   - First, tighten the upper left and lower right bolts, then tighten all 4 bolts in a diagonal sequence.
5. **Bracket**
6. **Bolt**
   - 10 Nm
7. **Connecting Piece**
   - For the thermostat.
8. **Bolt**
   - 15 Nm
9. **O-ring**
   - Always replace.
10. **Coolant Thermostat**
    - Pay attention to the installed position. Refer to **COOLANT THERMOSTAT** .
    - Checking: Heat the thermostat in water.
    - Opening begins approximately 85 °C (185 °F).
    - Ends approximately 105 °C (221 °F)
    - Opening lift: minimum of 7 mm.
11. **Bolt**
    - 20 Nm + an additional 180° (1/2) turn.
12. **Accessory Bracket**
    - Removing and installing, refer to **ACCESSORY BRACKET**.
13. **Bolt**
    - 40 Nm + an additional 45° (1/8) turn.
    - Always replace.
14. **Ribbed Belt Tensioner**
15. **Oil Pan**
    - Clean the sealing surface before installing.
    - Install using silicone sealantD 176 404 A2.
16. **Bolt**
    - 15 Nm

SEALING FLANGE AND FLYWHEEL OVERVIEW

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Servicing the Clutch:

- If the vehicle has a manual transmission. Refer to **[For transmission(s) 02Q] Clutch** .
- If the vehicle has a Direct Shift Gearbox (DSG). Refer to **[For transmission(s) 02E] Clutch** .

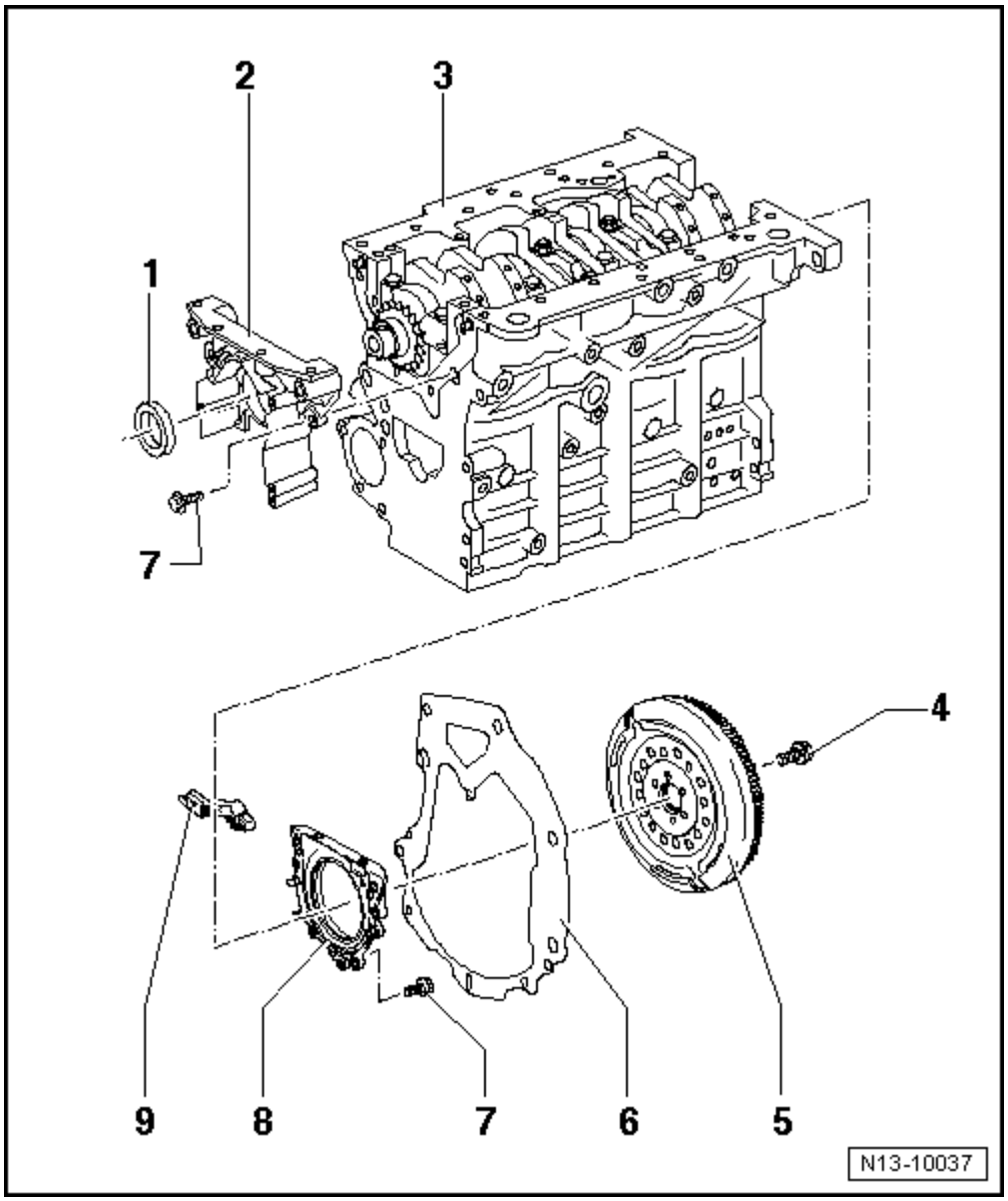

Fig. 9: Identifying Sealing Flanges And Flywheel Assembly Overview
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

1. **Seal**
   - Do not lubricate or grease the sealing lip on the seal.
   - Before installing, remove any remaining oil from the crankshaft journal with a clean cloth.
   - Replacing, refer to **CRANKSHAFT SEAL, BELT PULLEY SIDE**.
2. **Sealing Flange**

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- Must be located on the alignment sleeves.
- Removing and installing, refer to **SEALING FLANGE, BELT PULLEY SIDE**.
- Install using silicone sealantD 176 404 A2. Refer to **SEALING FLANGE, BELT PULLEY SIDE**.

3. **Cylinder Block**
   - Crankshaft overview. Refer to **CRANKSHAFT OVERVIEW**.
   - Piston and connecting rod overview. Refer to **PISTONS AND CONNECTING ROD OVERVIEW**.
4. **Bolt**
   - 60 Nm + an additional 90° (1/4) turn.
   - Always replace.
5. **Flywheel**
   - To loosen the bolts, secure using flywheel retainer3067.
6. **Intermediate Plate**
   - Must be located on the alignment bushings.
   - Be careful not to damage or bend the plate when installing.
7. **Bolt**
   - 15 Nm
8. **Sealing Flange with Seal**
   - Removing and installing, refer to **CRANKSHAFT SEALING FLANGE, FLYWHEEL SIDE**.
   - With the sensor wheel for the engine speed sensor.
   - Always replace as a complete unit.
   - Do not lubricate or grease the sealing lip on the seal.
   - Wipe off any oil on the crankshaft journal with a clean cloth before installing.
   - Use the support sleeve provided to install.
9. **Engine Speed Sensor -G28-**
   - Bolt, 5 Nm
   - Removing and installing, refer to **Engine Speed Sensor -G28-**.

PISTONS AND CONNECTING ROD OVERVIEW

NOTE: If large quantities of metal particles or other deposits such as those caused by a partial seizure of the crankshaft or connecting rod damage are found in the engine oil, clean the oil passages thoroughly and replace the oil cooler to prevent further damage.

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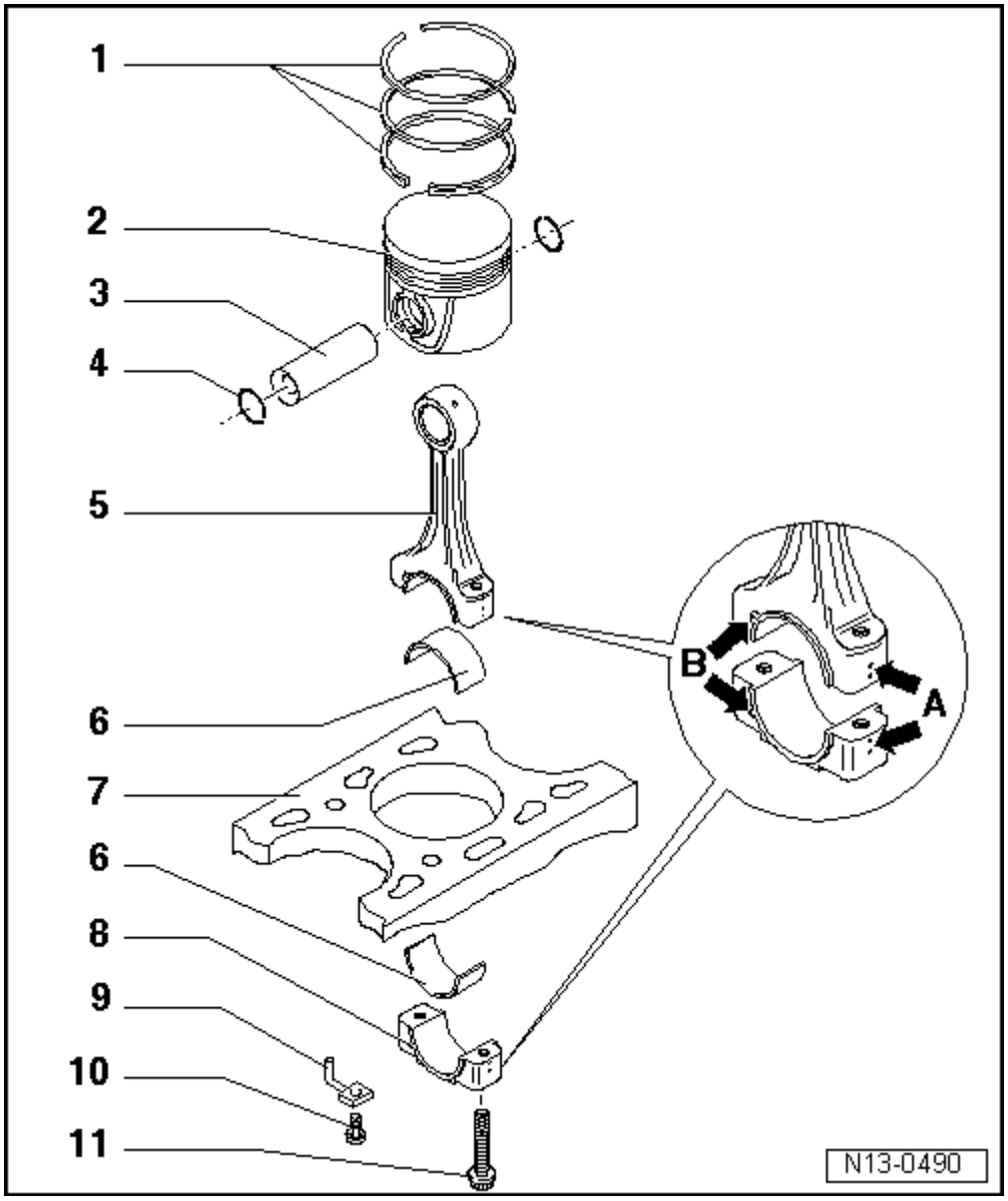

Fig. 10: Identifying Exploded View Of Piston And Connecting Rod
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

1. **Piston Rings**
   - Offset the gaps by 120°
   - Use piston ring pliers to remove and install.
   - "TOP" faces toward the piston crown.
   - Checking the ring gap. Refer to **Fig. 11**.
   - Checking the piston ring groove clearance. Refer to **Fig. 12**.
2. **Piston**
   - With the combustion chamber
   - Mark the installed position and cylinder allocation.

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- Installed position and cylinder allocation, refer to **Fig. 14**.
- The arrow on the piston face points toward the belt pulley side.
- Install using a piston ring compressor.
- Replace if the piston skirt is cracked.
- Check the piston projection in Top Dead Center (TDC). Refer to **PISTON PROJECTION IN TDC, CHECKING**.

3. **Piston Pin**
   - If difficult to move, heat the piston to 60 °C (140 °F).
   - Remove and install using the pilot drift VW 222.
4. **Lock Ring**
5. **Connecting Rod**
   - Mark the allocation to the cylinder using a colored mark -A-.
   - Installed position: The mark -B- points to the belt pulley side.
   - With a cracked bearing cap.
   - Separate a new connecting rod. Refer to **NEW CONNECTING ROD, SEPARATING**.
6. **Bearing Shell**
   - Note the installed position, refer to **BEARING SHELL, INSTALLED POSITION**.
   - Note the version: The upper bearing shell (to piston) is made of wear resistant material, identification: Black line on contact surface in the area of the separating point.
   - Do not interchange used bearing shells.
   - Insert bearing shells in the center.
   - Make sure it is secure.
   - Axial play wear limit: 0.37 mm.
   - Measure radial clearance using Plastigage: Wear limit: 0.08 mm.
   - Do not rotate the crankshaft when checking the radial clearance.
7. **Cylinder Block**
   - Checking the cylinder bore. Refer to **Fig. 13**.
   - For the correct piston and cylinder dimensions, refer to **PISTON AND CYLINDER DIMENSIONS**.
8. **Connecting Rod Bearing Cap**
   - Pay attention to the installed position.
   - Due to the separation procedure (cracking) of the connecting rod, the cap only fits in one position and only to the corresponding connecting rod.
9. **Oil Spray Jet**
   - For the piston cooling.
10. **Bolt**
    - 25 Nm
    - Install without sealant.

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11. **Bolt**
    - 30 Nm + an additional 90° (1/4) turn.
    - Always replace.
    - Lubricate the threads and contact surface.
    - Use an old bolt to measure the radial play.

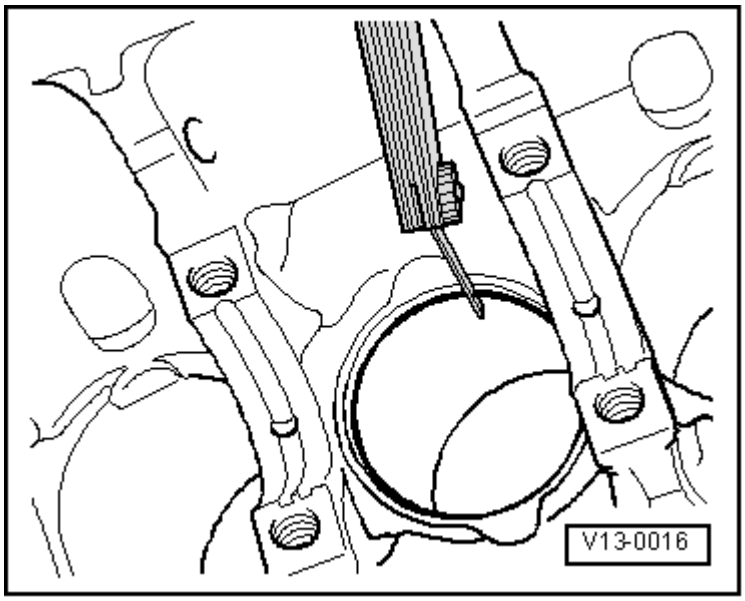

Fig. 11: Identifying Check Of Piston Ring Gap
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

Special tools and workshop equipment required

- Feeler Gauge

-- Push the piston ring squarely from above down to approximately 15 mm from the bottom end of the cylinder.

Piston Ring Dimensions in mm	New	Wear Limit
1. Compression ring	0.20 ••• 0.40	1.0
2. Compression ring	0.20 ••• 0.40	1.0
Oil scraping ring	0.25 ••• 0.50	1.0

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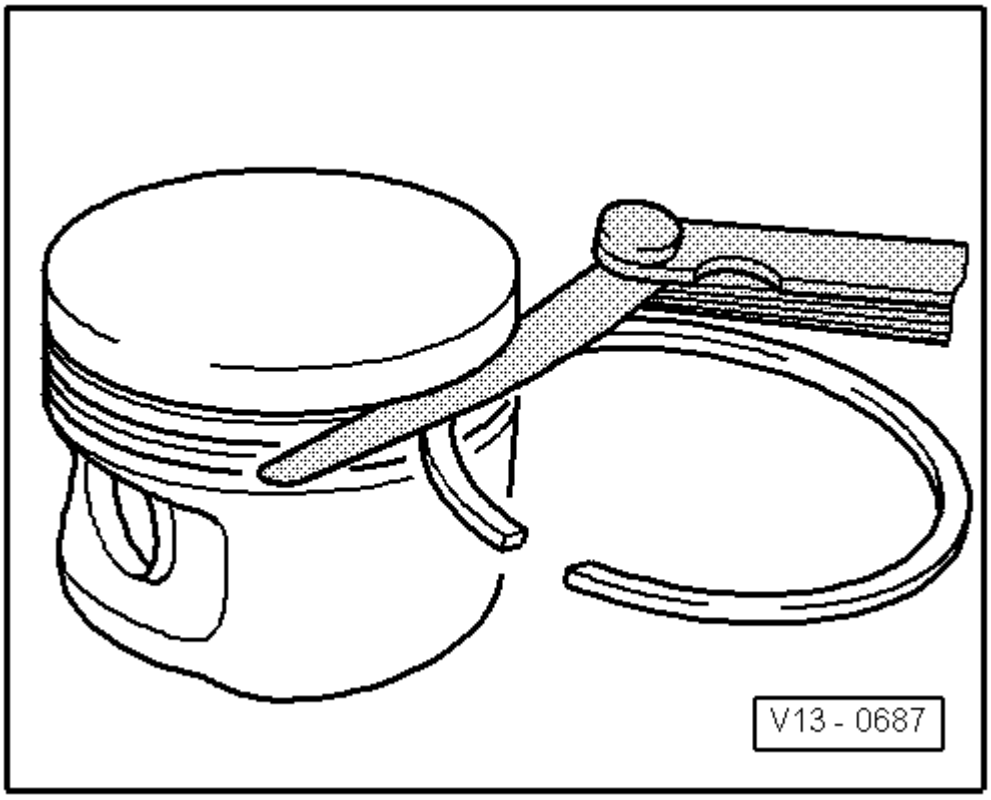

Fig. 12: Identifying Check Of Piston Ring Gap
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

Special tools and workshop equipment required

- Feeler Gauge

-- Clean the groove in the ring before checking.

Piston Ring Dimensions in mm	New	Wear Limit
1. Compression ring	0.06 ••• 0.09	0.25
2. Compression ring	0.05 ••• 0.08	0.25
Oil scraping ring	0.03 ••• 0.06	0.15

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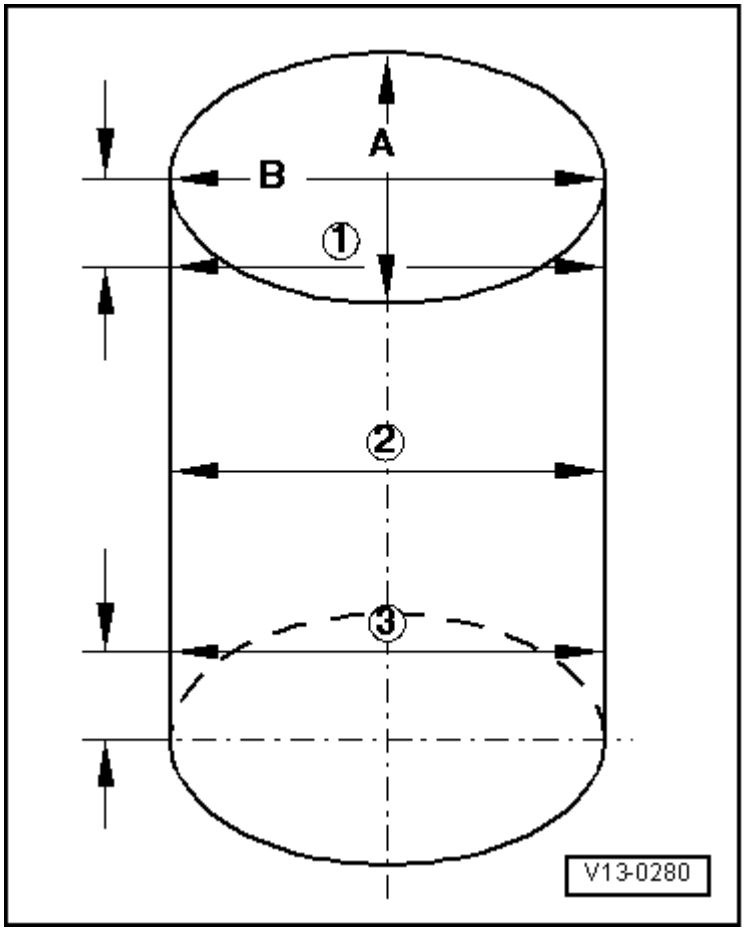

Fig. 13: Identifying Check Of Cylinder Bores
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

Special tools and workshop equipment required

- Internal Dial Gauge (50-100 mm)

-- Measure the bore at 3 locations in both directions -A- across the engine and -B- in line with the crankshaft. Deviation from nominal size: Max. 0.10 mm.

NOTE: The cylinder bore must not be measured when the cylinder block is mounted on the engine and transmission holder VAS 6095 because the measurements may be incorrect.

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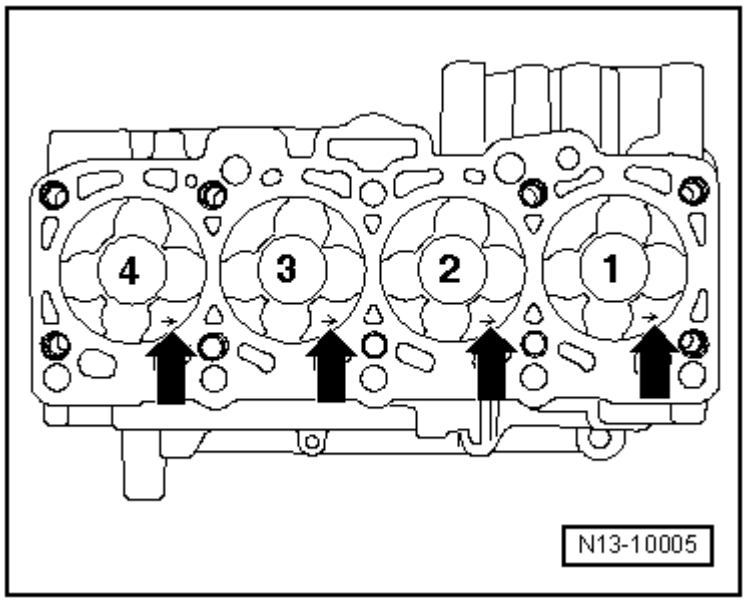

Fig. 14: Installed Position Of Piston And Piston/Cylinder Allocation
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

The arrow on the piston crown -arrows- points to cylinder 1.

CRANKSHAFT OVERVIEW

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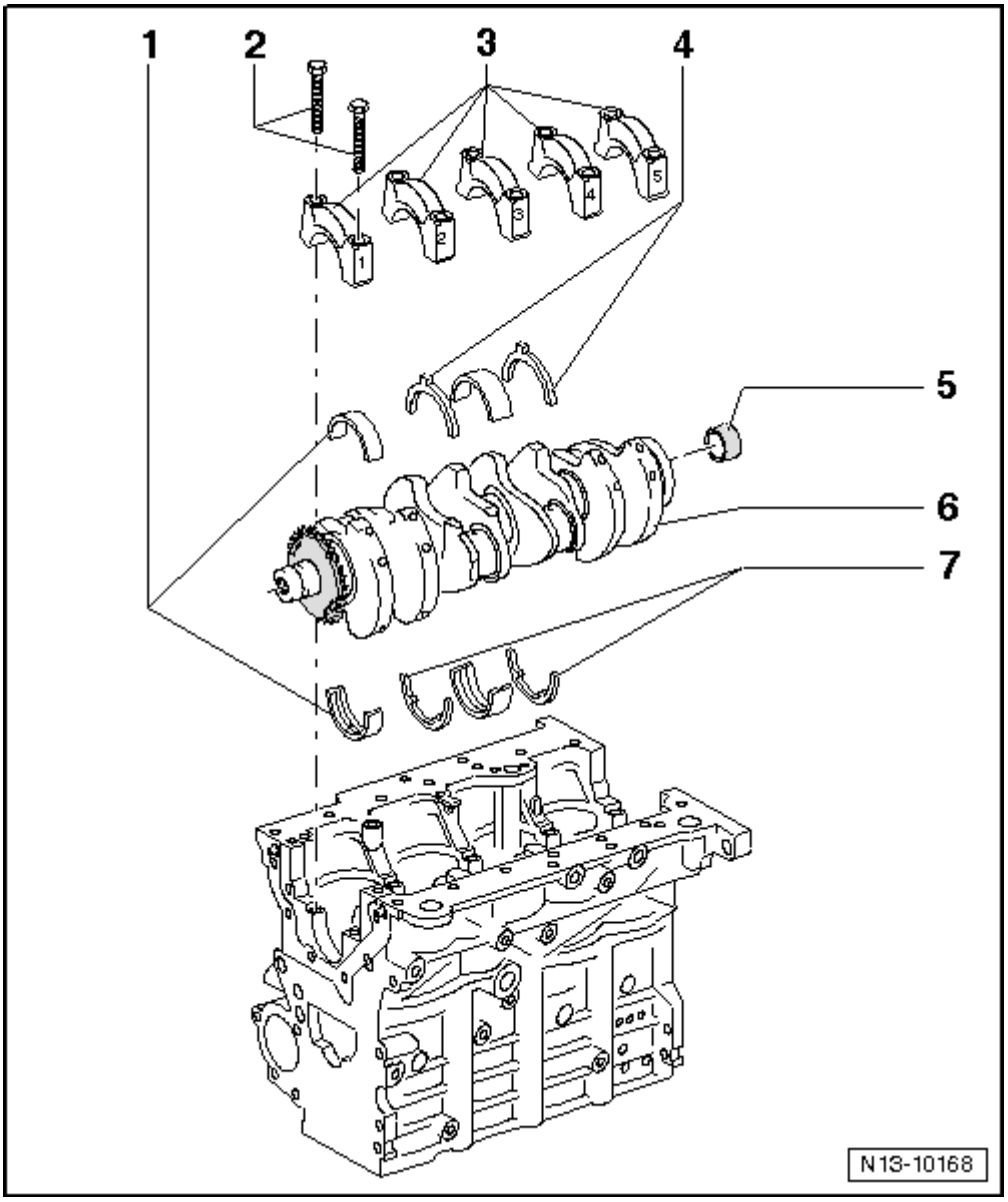

Fig. 15: Identifying Crankshaft Overview
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

1. **Bearing Shell**
   - For bearings 1, 2, 4 and 5.
   - Do not interchange used bearing shells.
2. **Bolt**
   - 65 Nm + an additional 90° (1/4) turn.
   - Always replace.
   - Tighten to 65 Nm to measure radial play but do not tighten the additional torque angle.
3. **Bearing Cap**
   - Bearing cap 1: Belt pulley side.

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- Bearing cap 3 with notches for the thrust washers.
- Retaining tabs on the bearing shells and cylinder block/bearing caps must align above one another.

4. **Thrust Washer**
   - For bearing cap 3.
   - Observe the locating point.
5. **Needle Bearing**
   - Only on vehicles with the Direct Shift Gearbox (DSG).
   - Removing and installing, refer to **CRANKSHAFT NEEDLE BEARINGS**.
6. **Crankshaft**
   - Axial play new: 0.07 to 0.17 mm wear limit: 0.37 mm.
   - Measure radial clearance using Plastigage.
   - New: 0.03 to 0.08 mm, wear limit: 0.17 mm.
   - Do not rotate the crankshaft when measuring radial play.
   - Crankshaft dimensions, refer to **CRANKSHAFT DIMENSIONS**.
7. **Thrust Washer**
   - For cylinder block, bearing 3.

SPECIFICATIONS

PISTON AND CYLINDER DIMENSIONS

	Piston Diameter	Cylinder Bore Diameter
Basic dimension mm	80.96	81.01

CRANKSHAFT DIMENSIONS

(Dimensions are in mm)

	Crankshaft Bearing Pin Diameter		Connecting Rod Bearing Pin Diameter	
Basic dimension	54.00	-0.022 -0.042	50.90	-0.022 -0.042

FASTENER TIGHTENING SPECIFICATIONS

Component	Fastener Size	Nm
Air Conditioning Compressor to Accessory Bracket Bolt	-	45
Bracket to Oil Filter Bracket Bolt	-	10
Camshaft Sprocket to Camshaft Bolt	-	20 + 45°
Center Toothed Belt Guard to Lower Toothed Belt Guard Bolt (1)	-	10
Connecting Piece to Cylinder Block Bolt	-	15
Connecting Rod Cap to Connecting Rod Bolt (1), (4)	-	30 + 90°

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Coolant Pump to Cylinder Block Bolt	-	15
Crankshaft Bearing Cap to Cylinder Block Bolt (1)	-	65 + 90°
Crankshaft Toothed Belt Gear to Crankshaft Bolt (1)	-	120 + 90°
Engine Speed Sensor to Cylinder Block Bolt	-	5
Flywheel to Crankshaft Bolt (1)	-	60 + 90°
Generator to Accessory Bracket Bolt	-	25
High Pressure Pump to Accessory Bracket Bolt	-	20 + 90°
High Pressure Pump Toothed Belt Gear to Hub Bolt (1)	-	20 + 90°
Hub to Camshaft Bolt	-	100
Hub to High Pressure Pump Nut	-	95
Idler Pulley to Accessory Bracket Bolt	-	50 + 90°
Idler Roller to Accessory Bracket Bolt	-	15
Oil Filter Bracket to Cylinder Block Bolt (1), (3)	-	15 + 90°
Oil Pan to Cylinder Block Bolt	-	15
Oil Spray Jet to Cylinder Block Bolt	-	25
Protective Plate to Rear Toothed Belt Guard Bolt	-	5
Rear Toothed Belt Guard to Cylinder Block Bolt (2)		
	-	10 1
	-	20
Ribbed Belt Tensioner to Accessory Bracket Bolt (1)	-	20 + 180°
Sealing Flange to Cylinder Block Bolt	-	15
Toothed Belt Idler Roller to Cylinder Block Bolt/Nut	-	20
Toothed Belt Idler Pulley to Cylinder Block Bolt (1)	-	50 + 90°
Toothed Belt Tensioner to Cylinder Block Nut	-	20 + 45°
Vibration Damper to Crankshaft Bolt (1)	-	10 + 90°

(1) Always replace

(2) For bolt clarification, refer to -items 14 and 15- in **TOOTHED BELT DRIVE OVERVIEW**

(3) First, tighten the upper left and lower right bolts, and then tighten all 4 bolts in a diagonal sequence.

(4) Lubricate the threads and contact surface.

-
- .
-
-

Ribbed Belt Tensioning Roller to Accessory Bracket Bolt Tightening Sequence and Specification

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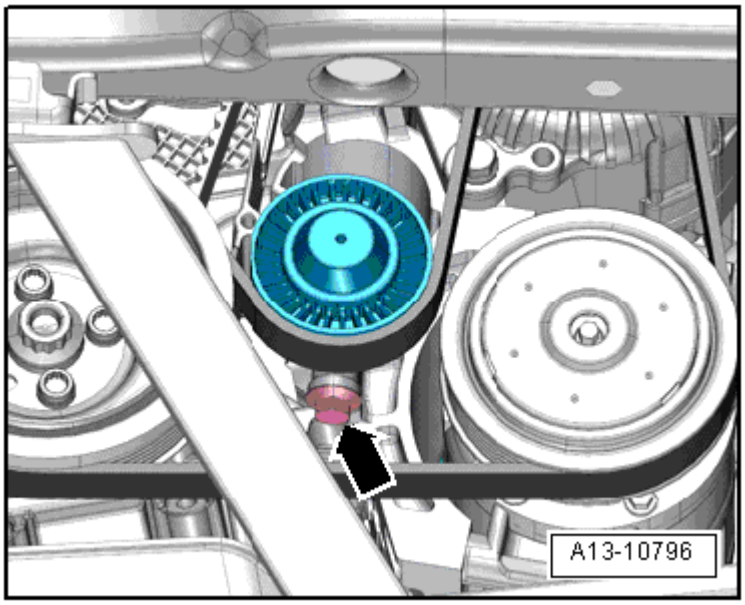

Fig. 16: Identifying Ribbed Belt Tensioning Roller Bolt Tightening Sequence and Specifications
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

NOTE: Replace the tensioning roller bolt.

Apply some adhesive lubricating paste to the guide surfaces on the tensioning roller using a paint brush.

-- Tighten the bolt in 5 steps:

Step	Bolt	Tightening Specification
1.	-arrow-	Install the bolt all the way in by hand. • The ribbed belt will become tensioned.
2.	-arrow-	Turn the bolt is all the way in. • The ribbed belt will be tensioned

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		further.
3.	-arrow-	Loosen a 90° (1/4) turn
4.	-arrow-	Tighten the bolt to 30 Nm
5.	-arrow-	Tighten the bolt an additional 90° (1/4) turn.

Accessory Bracket Bolt Tightening Sequence and Specification

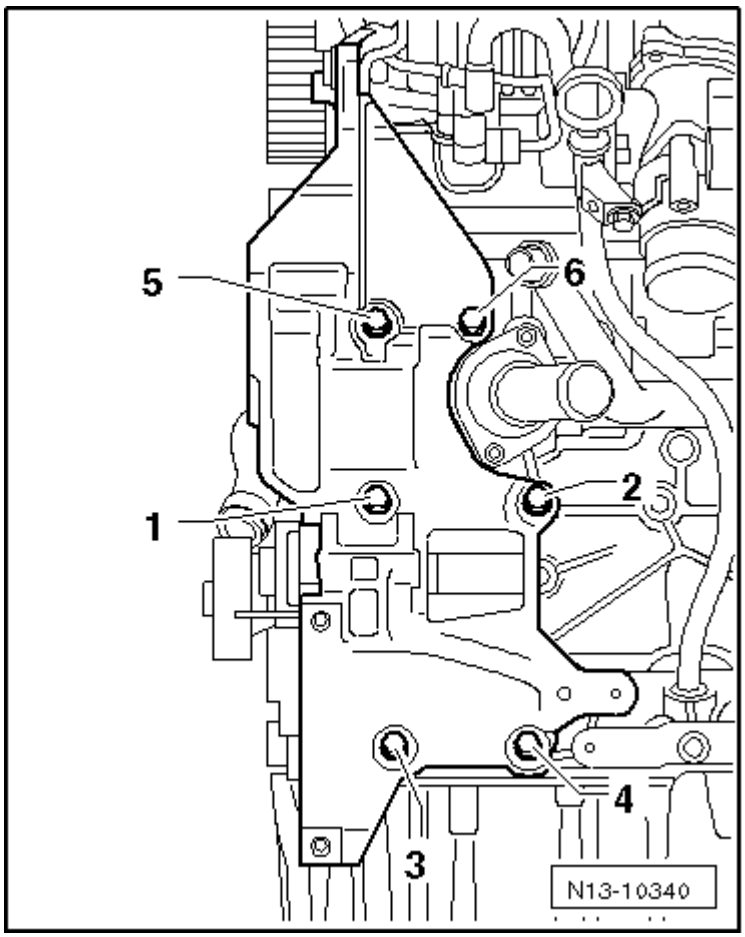

Fig. 17: Identifying Bolt Tightening Sequence
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Install the bolts for the accessory bracket as follows:

- Bolts -1 and 2- M10 x 52.
- Bolts -5 and 6- M10 x 60.
- Bolts -3 and 4- M10 x 30.

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-- Tighten the bolts in 2 steps in sequence -1 through 6- :

-- Install the bolts all the way by hand.

-- Tighten the bolts to 40 Nm.

-- Tighten the bolts -3 and 4- an additional 45° (1/8) turn.

-- Tighten the bolts -1, 2, 5 and 6- an additional 90° (1/4) turn.

Engine Mount Bracket Bolt Tightening Sequence and Specification

-- Tighten the new bolts -1 through 3- in sequence to 40 Nm + an additional 180° (1/2) turn.

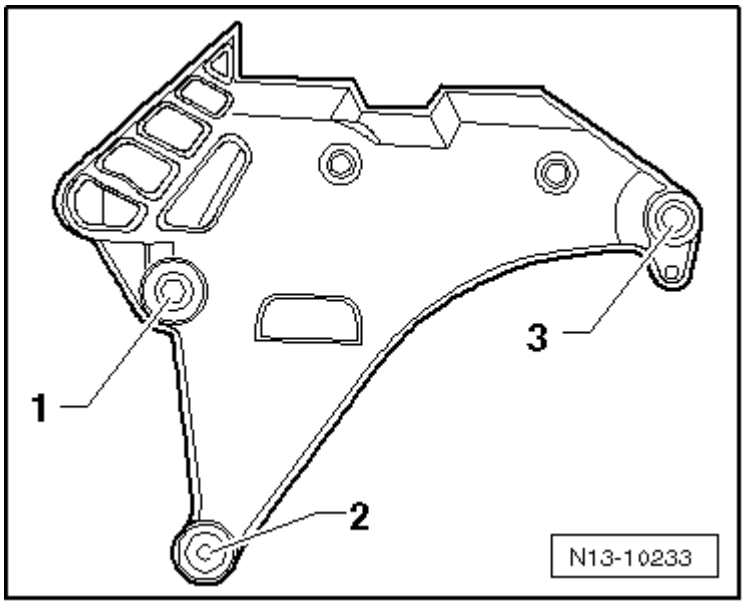

Fig. 18: Identifying Engine Mount Bracket to Cylinder Block Bolt Tightening Sequence
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

DIAGNOSIS AND TESTING

PISTON PROJECTION IN TDC, CHECKING

Special tools and workshop equipment required

- Measuring Bar VW 382/7
- Magnetic Plate 50 mm Dia. VW 385/17
- Dial Gauge

Procedure:

When installing new pistons or working with a partial engine, check the piston projection in Top Dead Center

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(TDC) on all pistons. Depending on the piston projection, install the corresponding cylinder head gasket according to the following table.

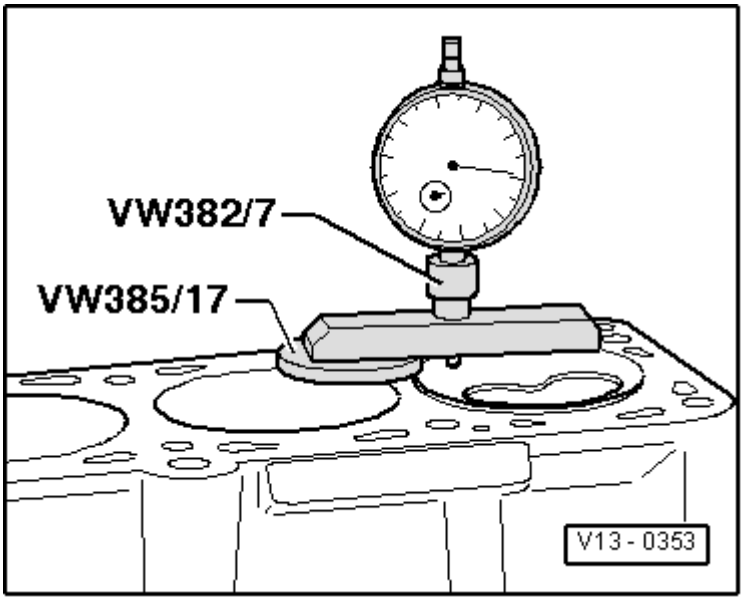

Fig. 19: Identifying Measurement Of Piston Projection
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

NOTE: Rotate the engine clockwise in order to measure the piston position at TDC.

If varying values occur when measuring the projection, use the gasket for the largest value.

Piston Projection	Identification Notches/Holes
0.91 to 1.00 mm	1
1.01 to 1.10 mm	2
1.11 to 1.20 mm	3

CYLINDER HEAD GASKET IDENTIFICATION

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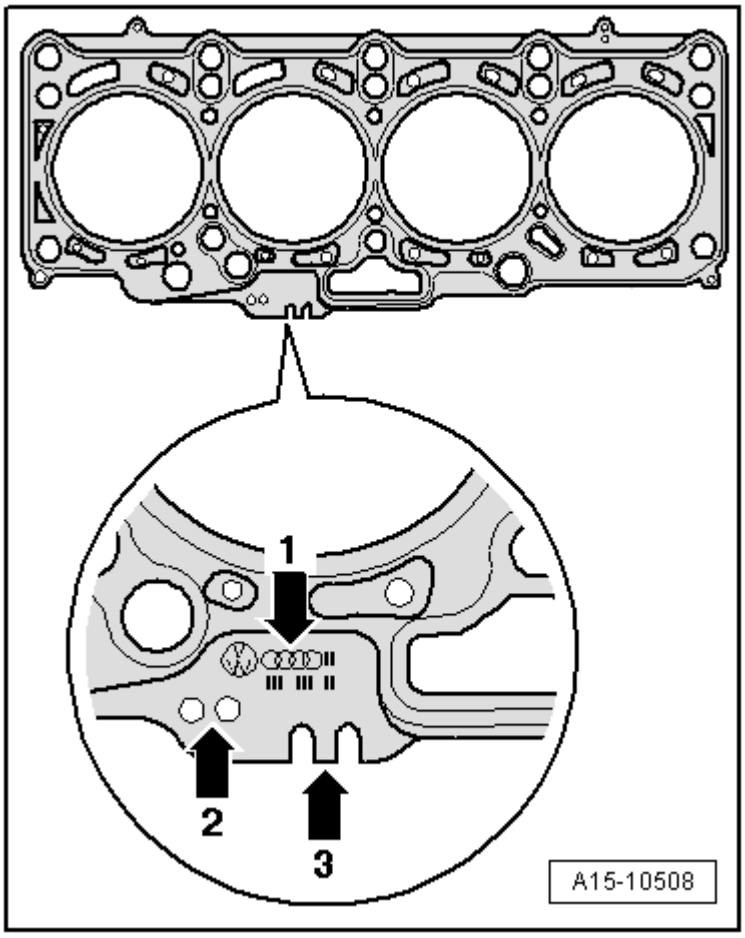

Fig. 20: Identifying Cylinder Head Gasket Identification
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

- Part number = arrow 1
- Holes = arrow 2
- Control code = arrow 3 (ignore this!)

NOTE: **Depending on the piston projection, varying cylinder head gasket thicknesses can be installed. Be sure to use a gasket having the identical identification when replacing.**

Determine the piston projection in TDC when installing new pistons or engine parts. Refer to PISTON PROJECTION IN TDC, CHECKING.

REMOVAL AND INSTALLATION

RIBBED BELT (WITH TENSIONER)

Special tools and workshop equipment required

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- Locking Pin T10060 A

Removing

-- Remove the noise insulation. Refer to **Description and Operation** .

-- Mark the rotation direction on the ribbed belt.

-- Rotate the belt tensioner in the -direction of the arrow- to release the tension on the ribbed belt.

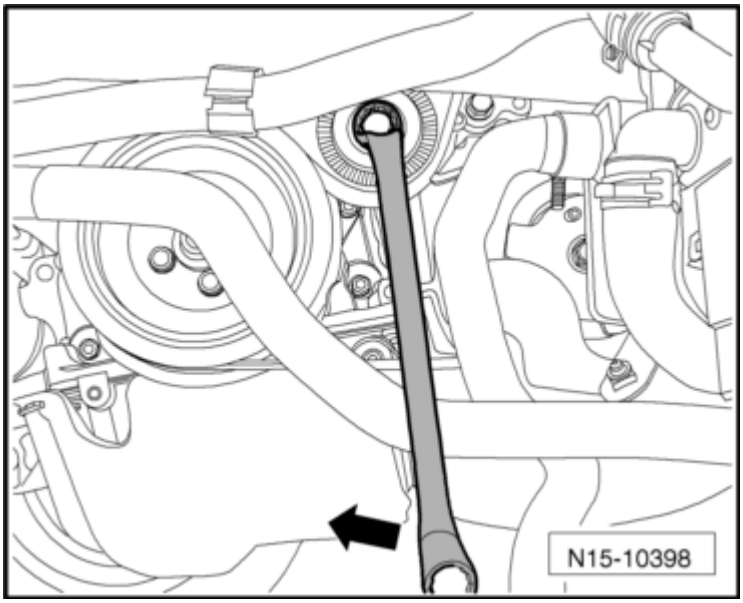

Fig. 21: Identifying Direction To Rotate Belt Tensioner To Release Tension On Ribbed Belt
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Align the holes -arrows- and secure the tensioner using the locking pin T10060 A.

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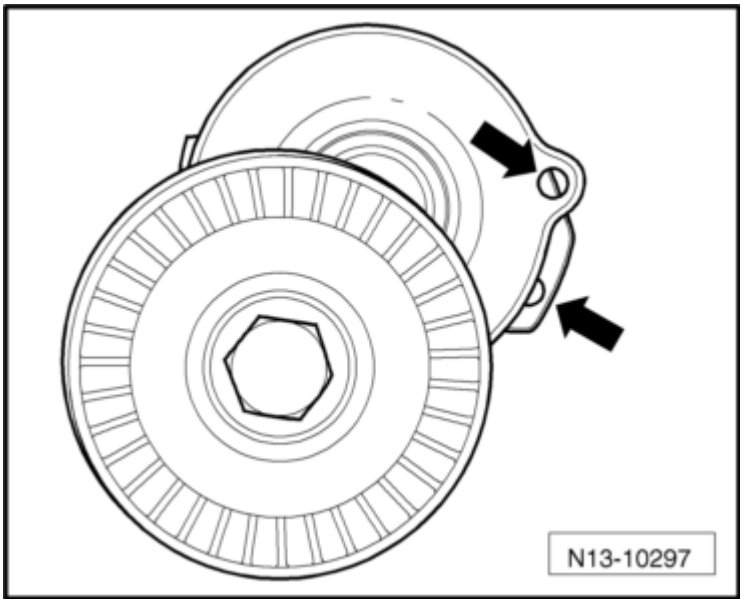

Fig. 22: Identifying Alignment Of Holes To Secure Tensioner Using Locking Pin
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Remove the ribbed belt.

Installing

-- Install in reverse order of removal.

NOTE: Before installing the ribbed belt, make sure that all components (generator, Air Conditioning (A/C compressor) are secured tightly.

Note the previously marked rotation direction of the used belt, if reinstalling it and be sure that it is seated correctly on the pulleys.

-- Install the ribbed belt onto the pulleys.

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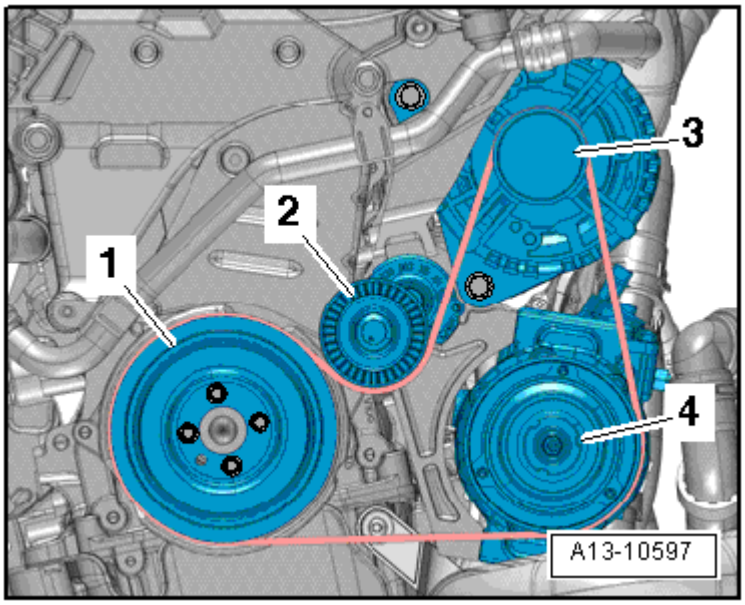

Fig. 23: Identifying Vibration Damper, Belt Tensioner, Generator And A/C Compressor
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

1. **Vibration Damper**
2. **Belt Tensioner**
3. **Generator**
4. **A/C Compressor**

After the work is completed:

-- Start the engine and check the belt.

RIBBED BELT TENSIONER

Removing

-- Remove the ribbed belt. Refer to **RIBBED BELT (WITH TENSIONER)**.

-- Loosen the clamp -2-, lift the circlip -1- and remove the cold side charge air hose.

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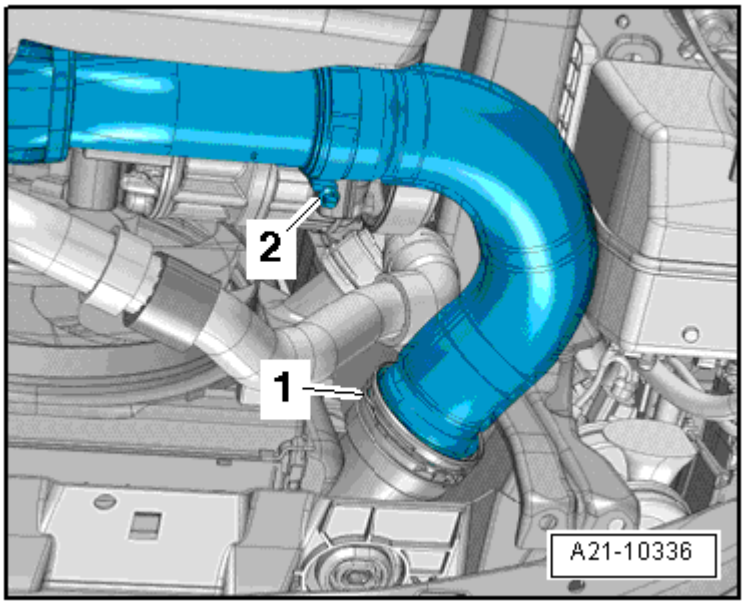

Fig. 24: Identifying Cold Side Charge Air Cooler Hose Circlip
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Remove the fan shroud and fans. Refer to **FAN SHROUD AND FANS** .

-- Remove the bolts -arrows- for the charge air pipe and then disconnect the connector -1- for the charge air pressure sensor -G31-.

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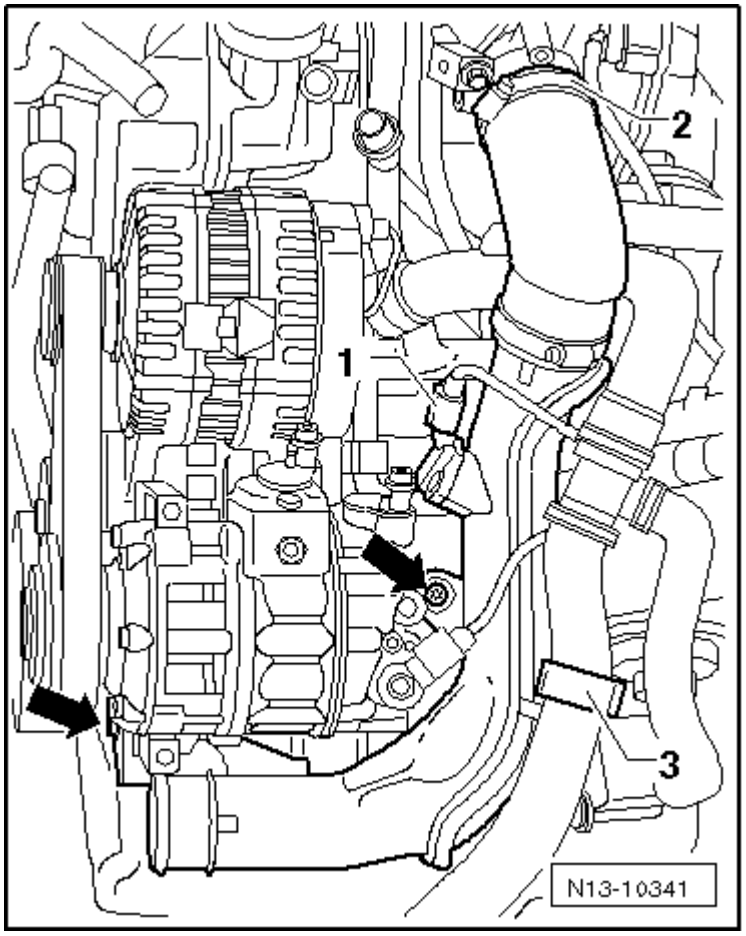

Fig. 25: Identifying Connector -1-, Clamp -2 And Coolant Hose -3-
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Open the clamp -2-, free up the coolant hose -3- and remove the charge air pipe.

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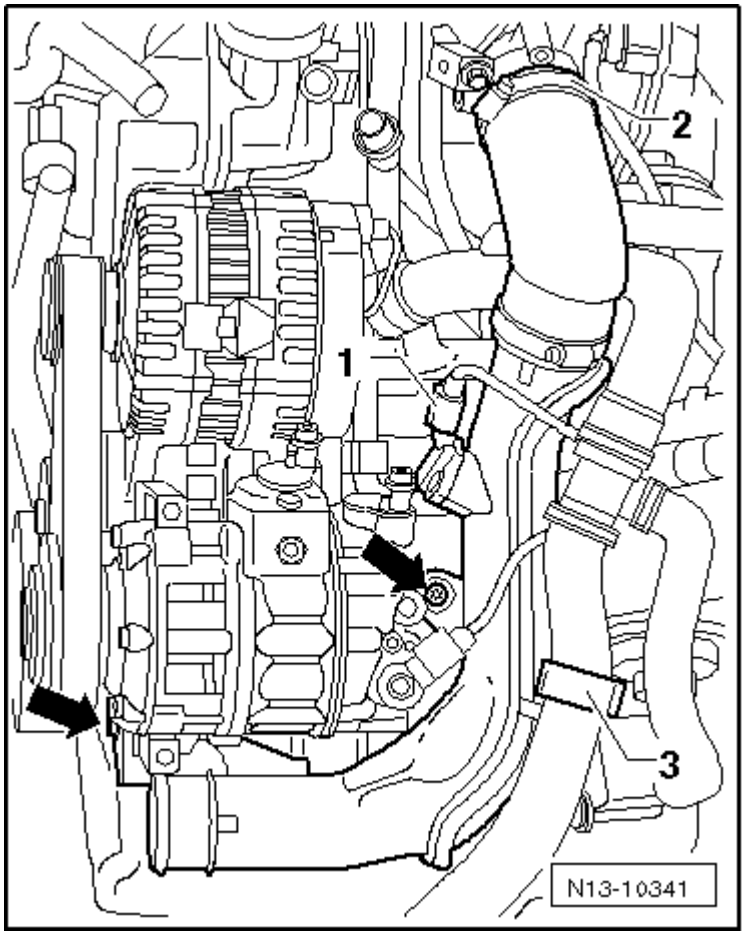

Fig. 26: Identifying Connector -1-, Clamp -2 And Coolant Hose -3-
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Remove the bolt -2- and remove the ribbed belt tensioner -1-.

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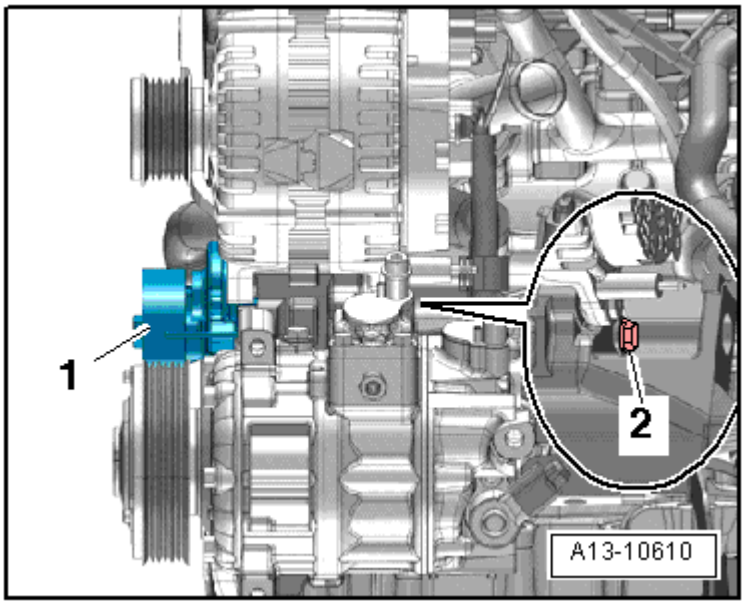

Fig. 27: Identifying Bolt And Belt Tensioner
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

Installing

Install in reverse order of removal. When doing this note the following:

- Replace the bolt for the ribbed belt tensioner.
- For the correct tightening specifications, refer to **RIBBED BELT WITH TENSIONER, OVERVIEW**.
- Install the ribbed belt. Refer to **RIBBED BELT (WITH TENSIONER)**.

RIBBED BELT (WITH TENSIONING ROLLER)

Removing

-- Remove the noise insulation. Refer to **Description and Operation** .

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

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

-- Remove the bolt -arrow- to release the tension on the ribbed belt and remove the tensioning roller.

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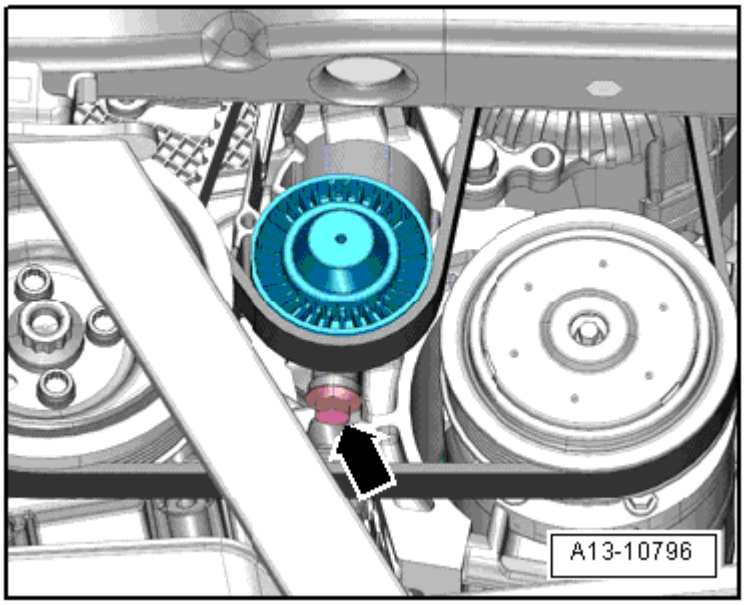

Fig. 28: Identifying Ribbed Belt Tensioning Roller Bolt Tightening Sequence and Specifications
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Remove the ribbed belt.

Installing

Install in reverse order, paying attention to the following:

NOTE: Replace the tensioning roller bolt.

Before installing the ribbed belt, make sure that all components (generator and Air Conditioning (A/C) compressor) are secured tightly.

-- Install the ribbed belt on the pulleys.

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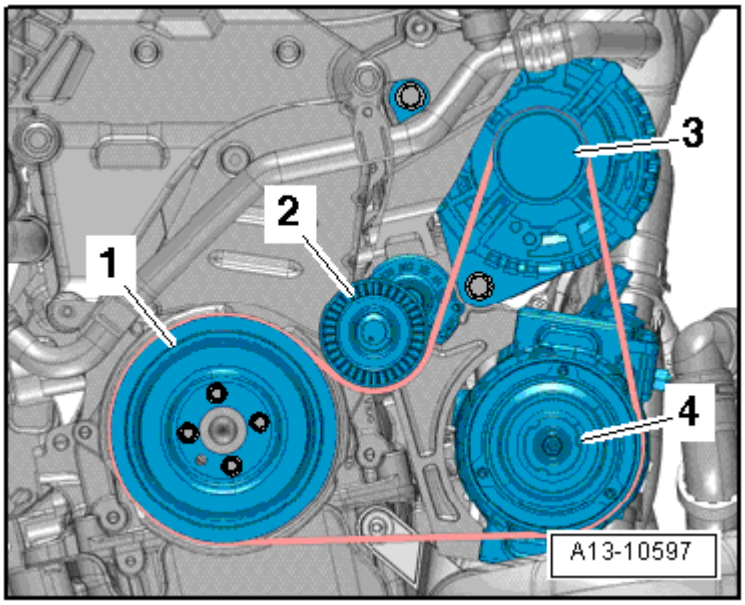

Fig. 29: Identifying Vibration Damper, Belt Tensioner, Generator And A/C Compressor
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

1. **Vibration damper**
2. **Tensioning roller**
3. **Generator**
4. **A/C compressor**

-- Apply some adhesive lubricating paste to the guide surfaces on the tensioning roller using a paint brush.

-- Install the tensioning roller with the bolt into the guide on the accessory bracket.

-- Tighten the tensioning roller bolt -arrow-, refer to **Fig. 6**.

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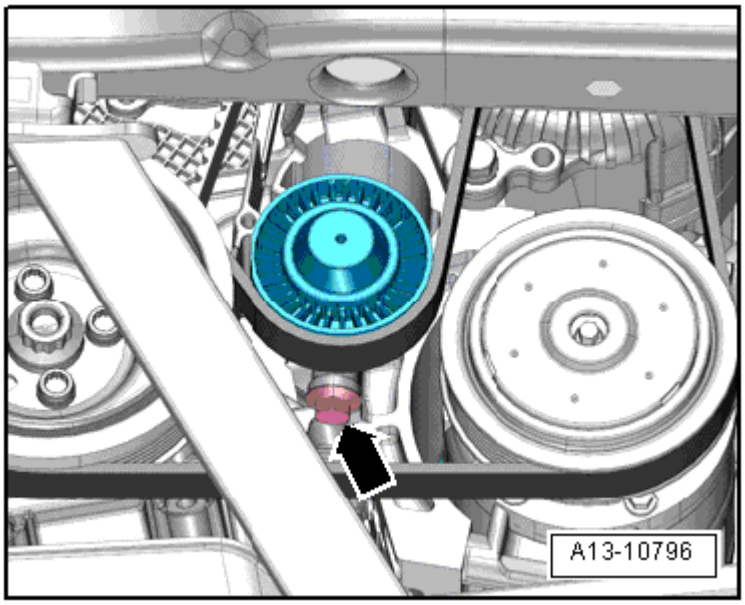

Fig. 30: Identifying Ribbed Belt Tensioning Roller Bolt Tightening Sequence and Specifications
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Make sure the end of the tensioning roller bolt protrudes over the running surface of the tensioning roller by dimension -a-.

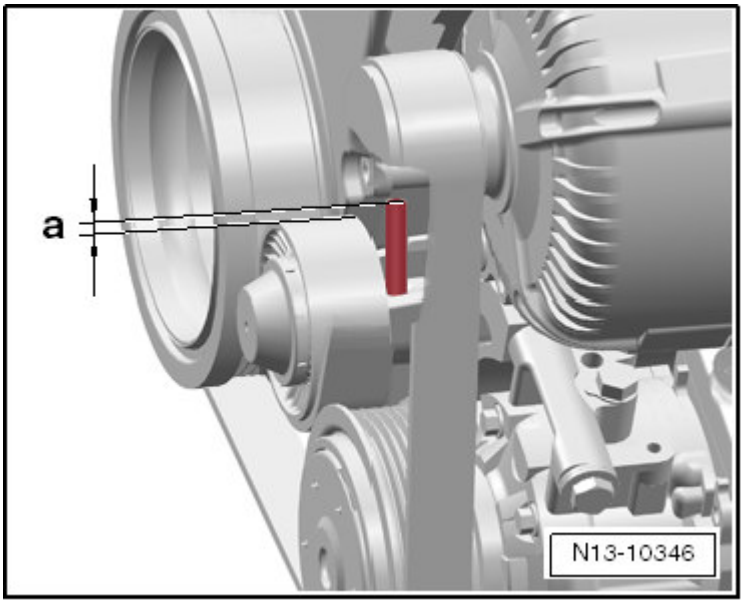

Fig. 31: Identifying Dimension -a-: End Of Tensioning Roller Bolt Over Running Surface Of Tensioning Roller
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

- Dimension -a- = approximately 2.5 mm.
- This assures that the bolt was tightened all the way in.

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-- Start the engine and check the belt routing.

-- Install the noise insulation. Refer to **Description and Operation** .

ACCESSORY BRACKET

Special tools and workshop equipment required

- Engine Support Bridge 10-222 A

Removing

-- Remove the engine mount bracket. Refer to **ENGINE MOUNT AND BRACKET**.

-- Remove the high pressure pump. Refer to **HIGH PRESSURE PUMP** .

-- Remove the generator. Refer to **Removal and Installation** .

WARNING: The Air Conditioning (A/C) refrigerant circuit must not be opened.

-- Remove the A/C compressor from the accessory bracket and secure it to the lock carrier.

-- Remove the idler pulley bolt -1- and pulley and the idler roller bolt -2- and roller. Remove the rear toothed belt guard bolt -arrow-.

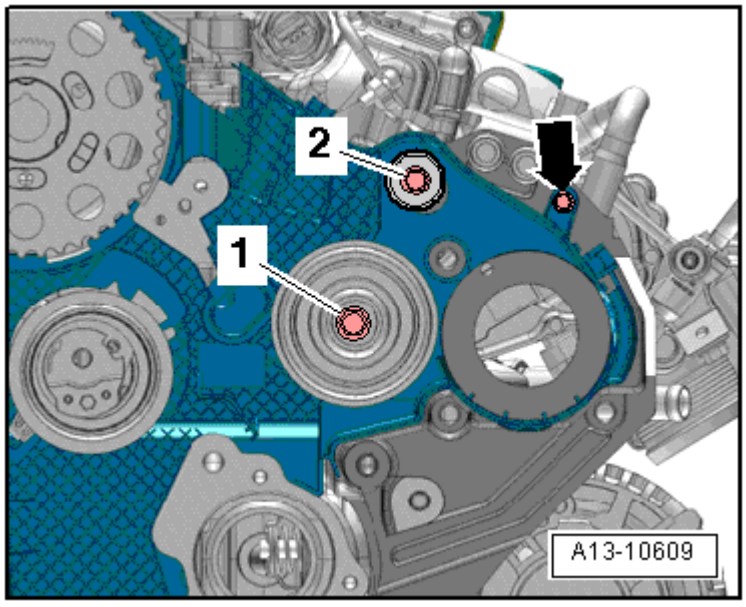

Fig. 32: Identifying Idler Roller Bolts -1 And 2-
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

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-- Remove the bolts -6 through 1- and remove the accessory bracket.

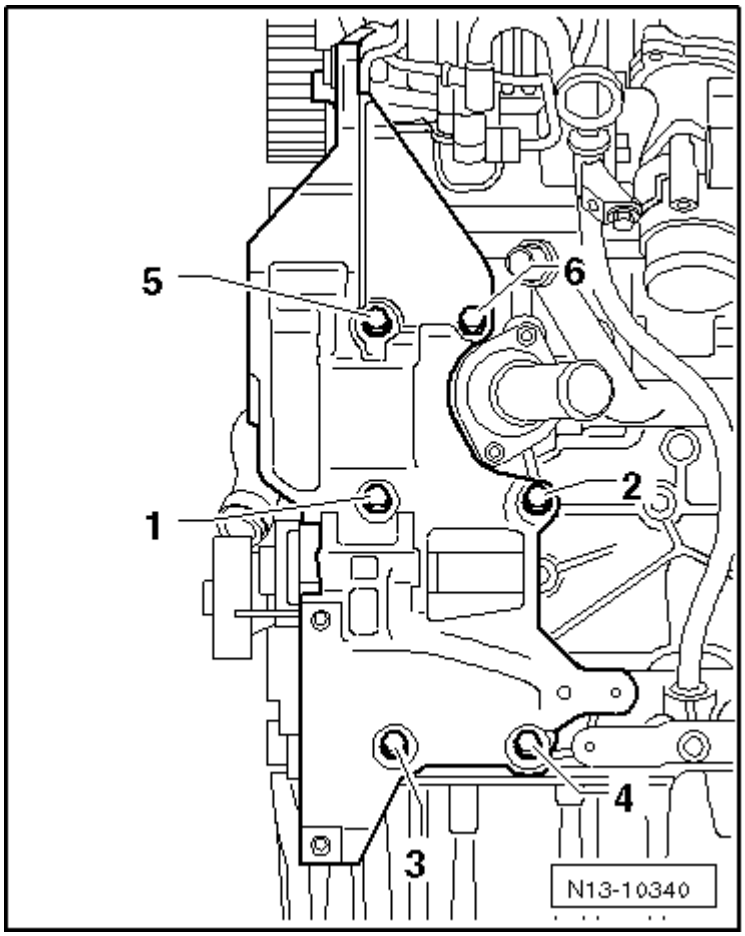

Fig. 33: Identifying Bolt Tightening Sequence
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

Installing

Install in reverse order of removal. When doing this note the following:

- Make sure there are alignment bushings inside the accessory bracket and replace any that are missing.
- Replace bolts, which have been tightened to a torque angle.

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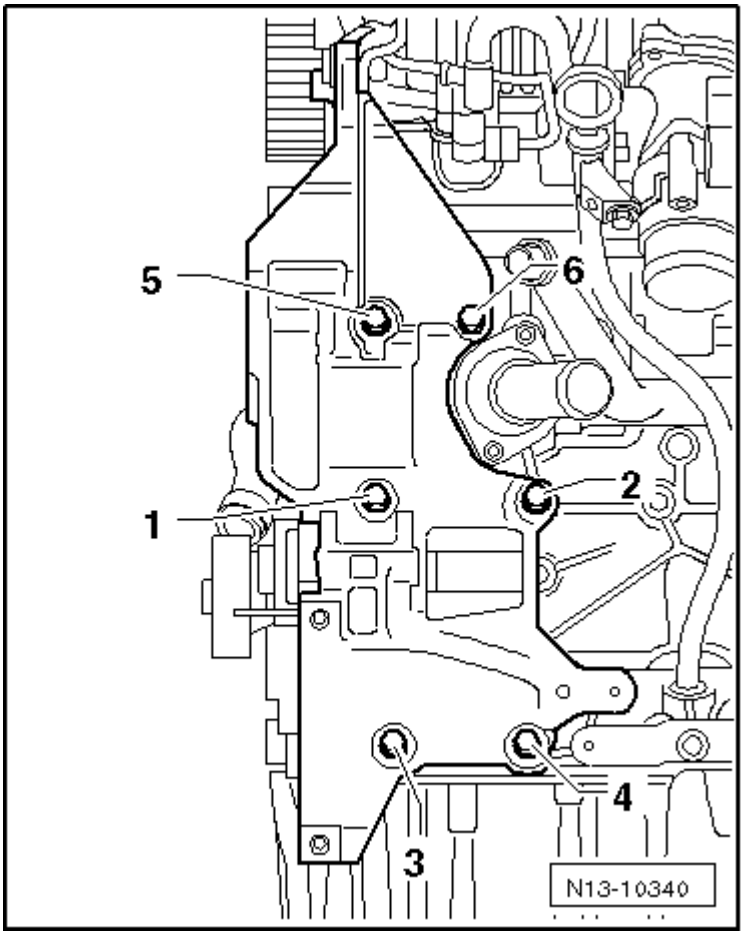

Fig. 34: Identifying Bolt Tightening Sequence
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Install the bolt for the accessory bracket as follows:

- Bolts -1 and 2- M10 x 52.
- Bolts -5 and 6- M10 x 60.
- Bolts -3 and 4- M10 x 30.

-- Tighten the accessory bracket bolts in 2 steps in sequence -1 through 6- :

-- Install the bolts all the way by hand.

-- Tighten the bolts to 40 Nm.

-- Tighten the bolts -3 and 4- an additional 45° (1/8) turn.

-- Tighten the bolts -1, 2, 5 and 6- an additional 90° turn.

-- Install the generator. Refer to **Removal and Installation** .

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-- Install the high pressure pump. Refer to **HIGH PRESSURE PUMP** .

-- Install the engine mount bracket. Refer to **ENGINE MOUNT AND BRACKET**.

ENGINE MOUNT AND BRACKET

Special tools and workshop equipment required

- Engine Support Bridge 10-222 A
- Engine Support Adapter 10-222 A/3
- Bracket for Engine 10-222 A/1
- Torque Wrench (5-50 Nm) V.A.G 1331

Removing

-- Remove the engine cover. Refer to **ENGINE COVER** .

-- Remove the intake hose between the mass airflow sensor -G70- and the turbocharger.

-- Remove the fuel filter and the auxiliary fuel pump -V393- or fuel pump 2 -V277- and the fuel filter. Refer to **Auxiliary Fuel Pump -V393- OR Fuel Pump 2 -V277-** .

-- Install the engine support bridge 10-222 A with the adapters as illustrated and support the engine in its installed position.

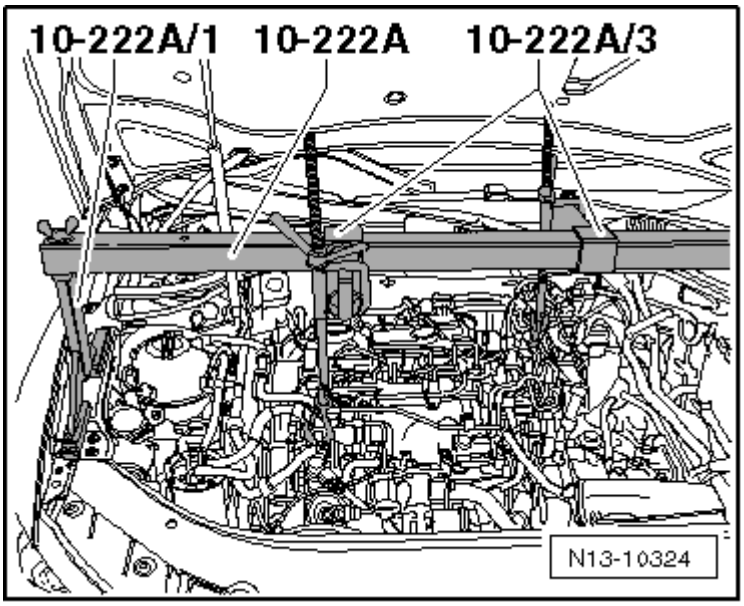

Fig. 35: Identifying Engine Support Bridge 10-222 A
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

NOTE: The subframe may only be removed if the engine is supported using the engine support bridge 10-222 A.

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The engine mount bracket may first be loosened only when the subframe is removed.

-- Remove the bolts -B and C-.

-- Remove the bolts -A- and remove the engine mount.

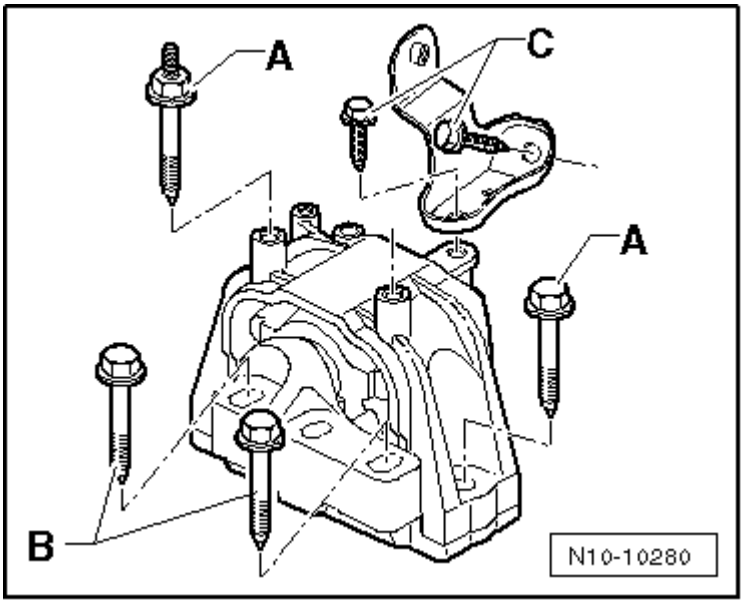

Fig. 36: Identifying Engine Mount
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Remove the bolt -arrow- for the coolant line.

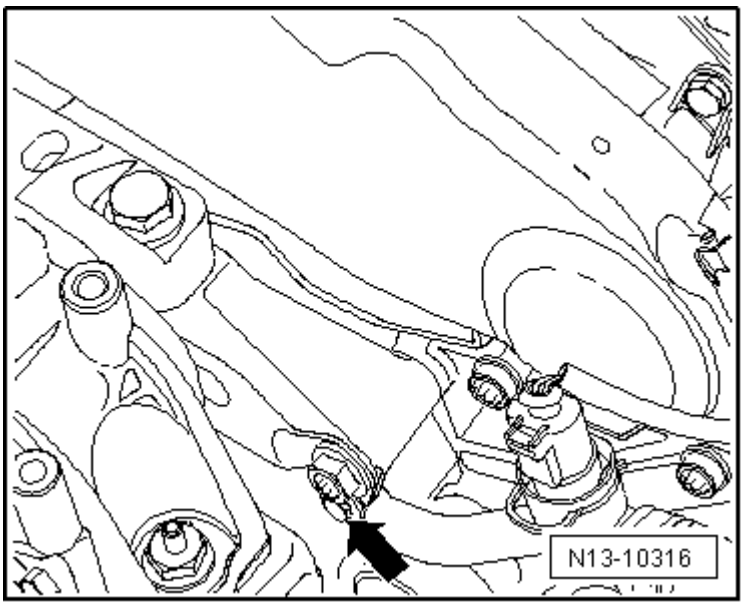

Fig. 37: Identifying Coolant Line Bolt -Arrow-

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Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Remove the right front wheel housing liner. Refer to **Removal and Installation** .

-- Remove the lower bolt -arrow- on the coolant line.

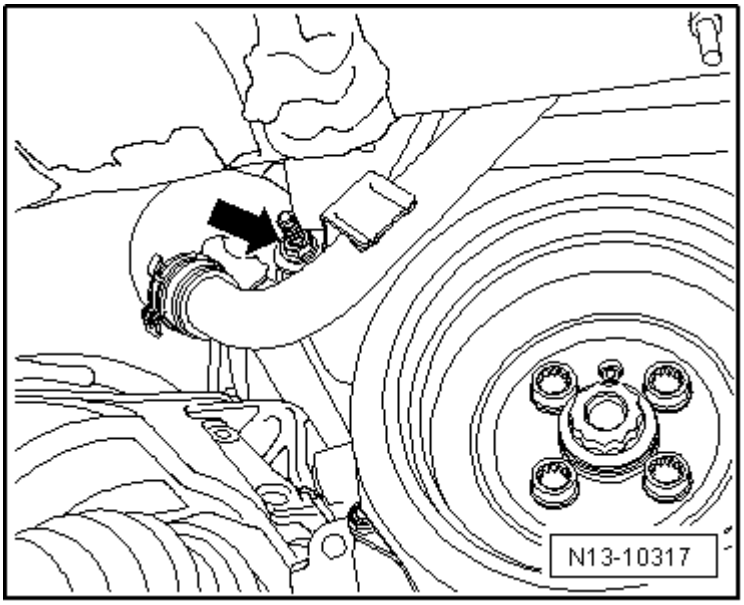

Fig. 38: Identifying Lower Coolant Line Bolt -Arrow-
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

WARNING: Make sure that no components/hoses are damaged, overstretched or torn when lifting or lowering the engine using the engine support bridge 10-222 A.

NOTE: The bolt -1- can be reached through an opening in the wheel housing. If necessary, raise and lower the engine with the spindle on the engine support bridge 10-222 A to remove or install the bolts -2 and 3-.

-- Remove the engine mount bracket bolts in sequence -3 through 1-.

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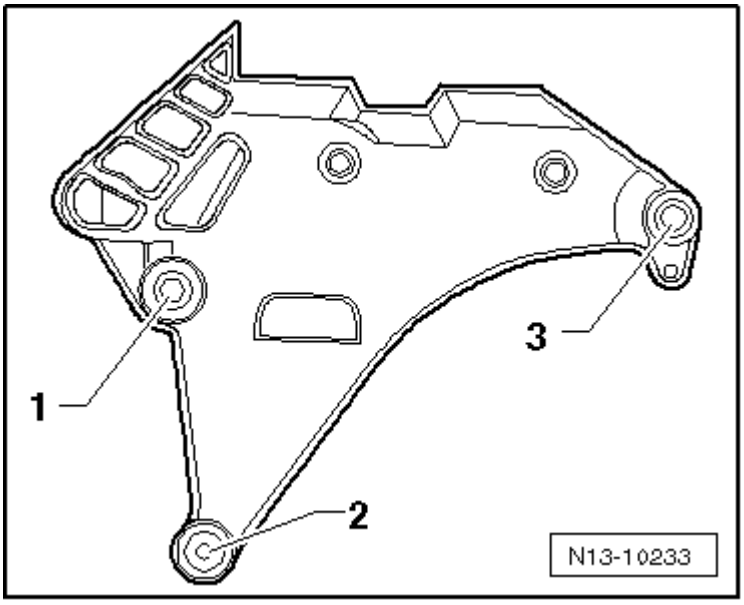

Fig. 39: Identifying Engine Mount Bracket to Cylinder Block Bolt Tightening Sequence
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Remove the engine mount bracket upward.

Installing

Install in reverse order of removal. When doing this note the following:

CAUTION: Always use the correct tightening sequence and specifications for the engine mount bracket bolts. Otherwise tension could develop in the engine mount bracket and break it.

-- Install the engine mount bracket from above.

NOTE: The bolt -1- can be reached through an opening in the wheel housing. If necessary, raise and lower the engine with the spindle on the engine support bridge 10-222 A to remove or install the bolts -2 and 3-.

-- First, tighten the bolts in sequence -1 through 3- in sequence.

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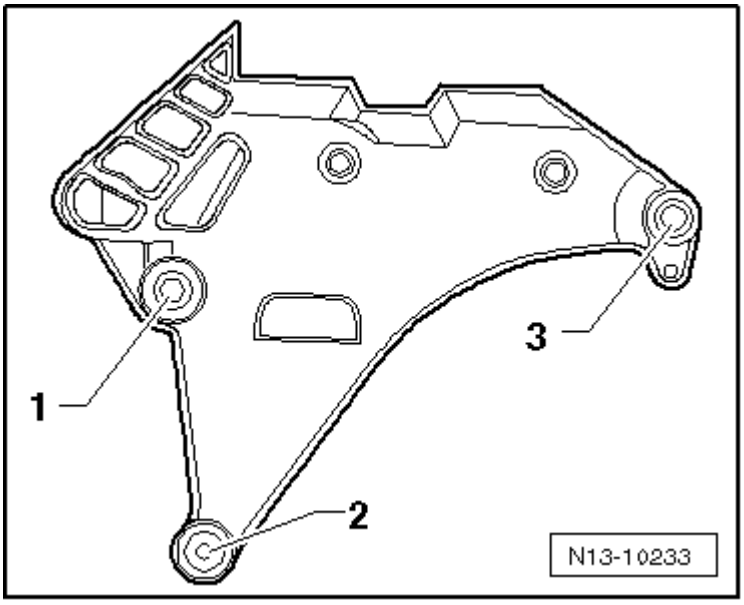

Fig. 40: Identifying Engine Mount Bracket to Cylinder Block Bolt Tightening Sequence
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Then, tighten the bolts in sequence to specification, see -item 32- in the **TOOTHED BELT DRIVE OVERVIEW**.

-- Install the engine mount and tighten the bolts -A and C- first. Tightening specifications, refer to **FASTENER TIGHTENING SPECIFICATIONS** .

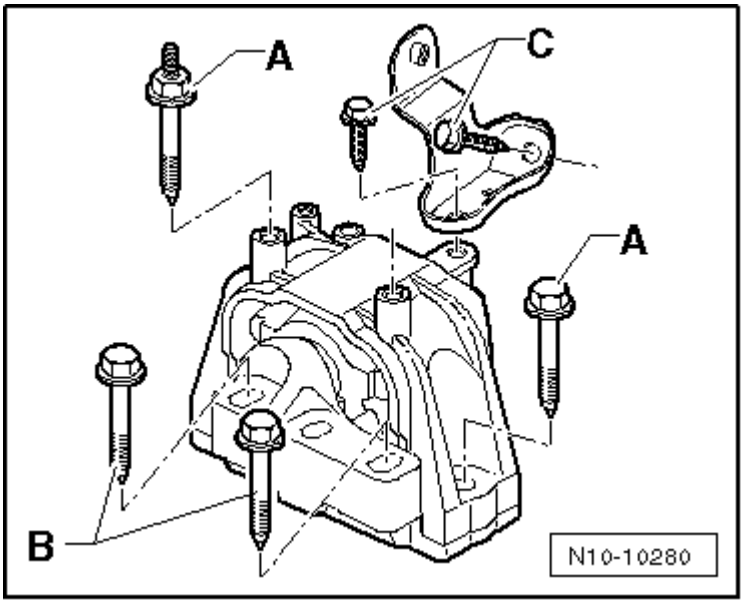

Fig. 41: Identifying Engine Mount
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Use the spindle to bring the engine mount bracket into contact with the engine mount.

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-- Install the bolts -B- and tighten them to specification. Refer to **FASTENER TIGHTENING SPECIFICATIONS** .

Assemble in reverse order of removal. When doing this note the following:

- Make sure the fuel hoses are secure.
- Do not interchange the supply and return lines (the return line is blue or has a blue mark, the supply line is black).

CRANKSHAFT SEALING FLANGE, FLYWHEEL SIDE

Special tools and workshop equipment required

- Assembly Tool T10134
- Torque Wrench (5-50 Nm) V.A.G 1331
- Tool Insert AF 24 V.A.G 1332/11

Special tools and workshop equipment required

- Caliper Gauge
- Three M6 x 35 Bolts
- Two M7 x 35 Bolts

SEALING FLANGE WITH SENSOR WHEEL, REMOVING

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

Manual Transmission: **[For transmission(s) 02Q] Removal and Installation** .

Direct Shift Gearbox: **[For transmission(s) 02E] Removal and Installation** .

-- Remove the flywheel.

-- Remove the intermediate plate.

-- Rotate the crankshaft to Top Dead Center (TDC) for on cylinder 1.

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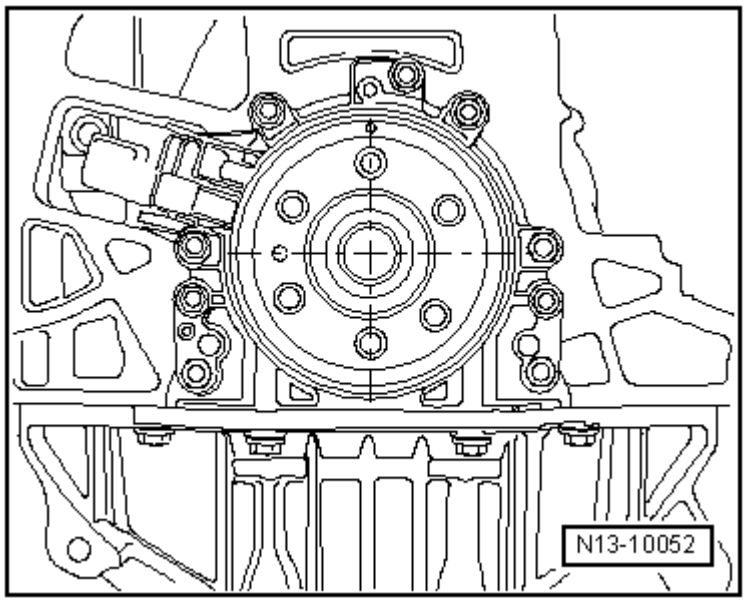

Fig. 42: Identifying Crankshaft Rotated To Top Dead Center (TDC) For Cylinder 1
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Remove the oil pan. Refer to **OIL PAN** .

NOTE: The engine is shown in the illustrations removed.

The steps are the same with the engine installed and removed.

-- Remove the engine speed sensor -G28- -arrow-.

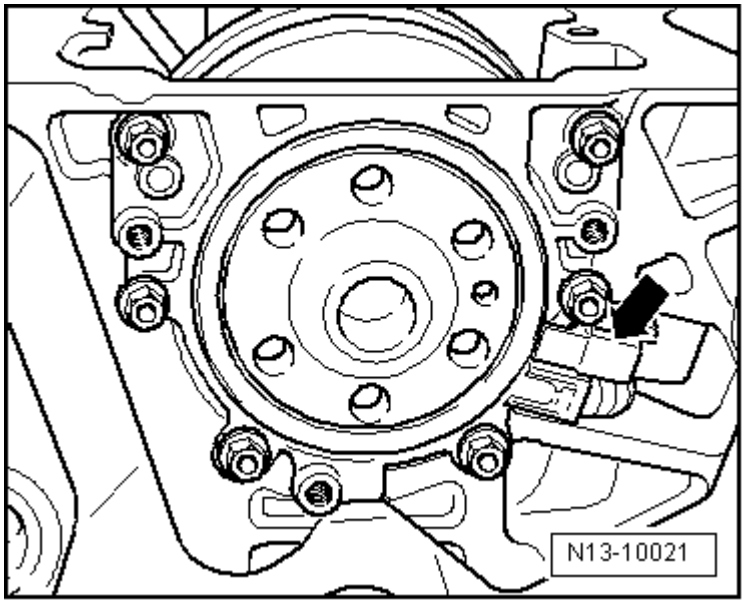

Fig. 43: Identifying Engine Speed (RPM) Sensor G28
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

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-- Remove the sealing flange bolts.

NOTE: The sealing flange and sensor wheel are pressed off the crankshaft using three M6 x 35 mm bolts.

-- Install the three M6 x 35 mm bolts in the threaded holes on the sealing flange -arrows-.

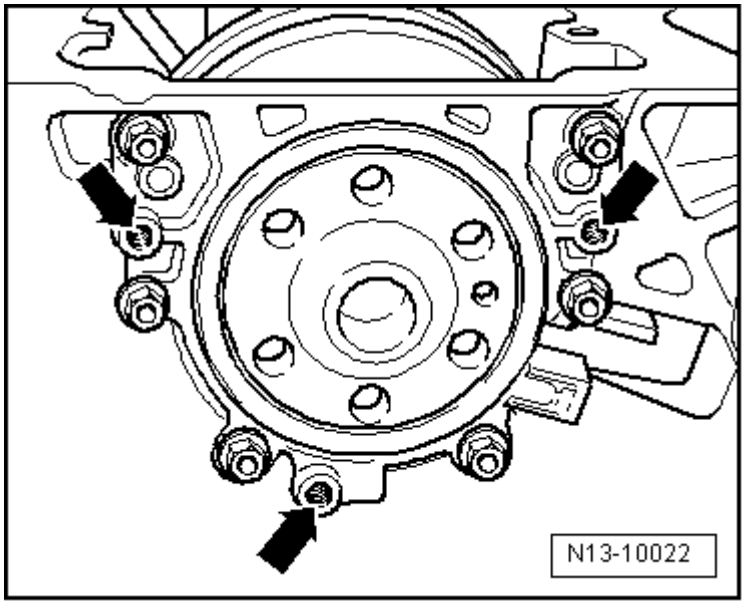

Fig. 44: Identifying Sealing Flange Threaded Holes
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Install the bolts into the sealing flange alternating (Max. 180° pre bolt) and press it and the sensor wheel off the crankshaft.

SEALING FLANGE WITH SENSOR WHEEL, PRESSING IN

NOTE: Sealing flange and Polytetrafluoroethylene (PTFE) seal is equipped with a sealing lip support ring. This support ring serves the same function as an assembly sleeve and must not be removed before installation.

The sealing flange and sensor wheel must not be separated or rotated after being removed from the its packaging.

The sensor wheel retains the installed position via being located on the locating pin of the assembly tool T10134.

The sealing flange and seal are one unit and may only be replaced together with the sensor wheel.

The assembly tool T10134 retains the installed position to the crankshaft via a guide pin, which is guided into the bore of the crankshaft.

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Assembly tool T10134

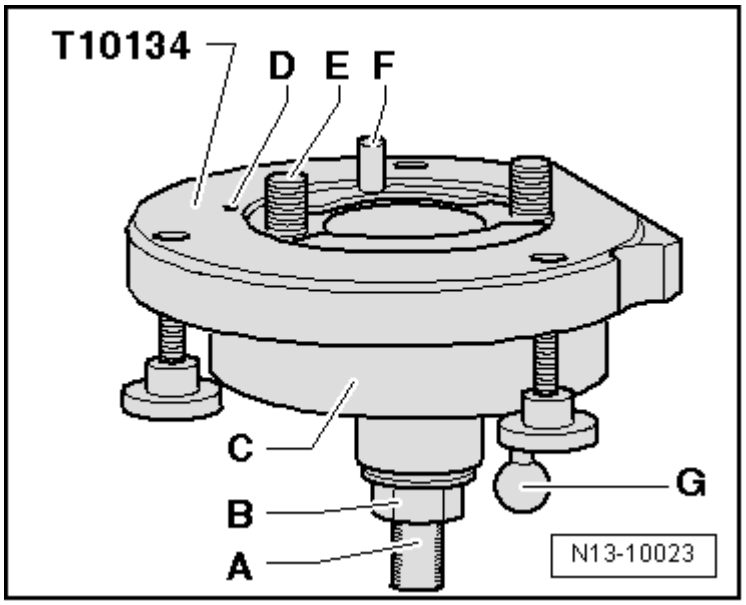

Fig. 45: Identifying Assembly Tool T10134
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

A - Tension surface

B - Nut

C - Assembly bell

D - Locating pin

E - Hex socket head bolt

F - Guide pin for diesel engines (black handle)

G - Guide pin for gas engines (red handle)

SEAL WITH SENSOR WHEEL, INSTALLING TO Assembly Tool T10134

-- Install the nut -B- until shortly before the flat surface -A- of the threaded spindle.

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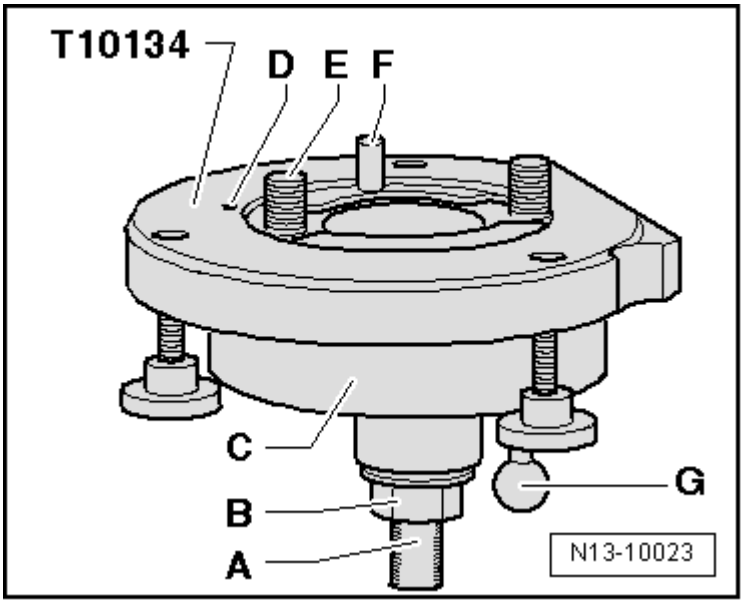

Fig. 46: Identifying Assembly Tool T10134
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Secure the assembly tool T10134 in a vise on the flat surface -A- of the threaded spindle.

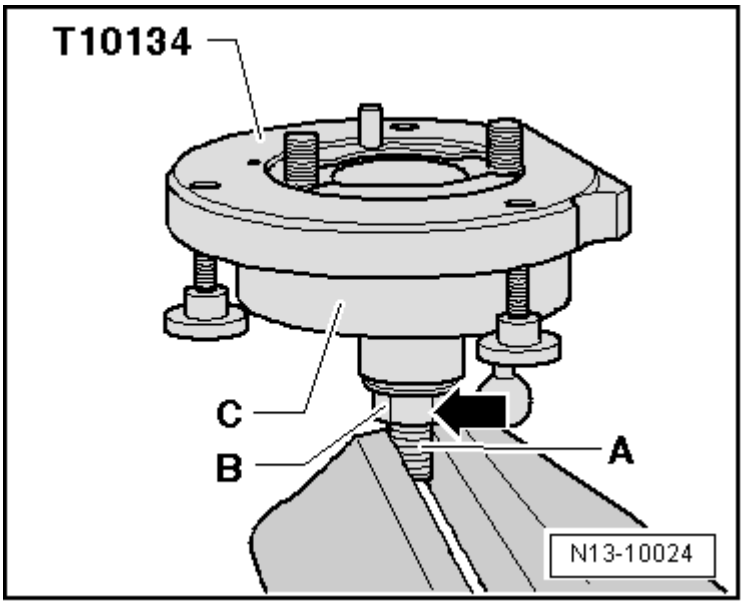

Fig. 47: Identifying Assembly Tool T10134 Tensioned In Vise On Tension Surface Of Threaded Spindle
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Push the assembly bell -C- downward so that it rests on the nut -B- -arrow-.

-- Install the nut on the threaded spindle until the inner section of the assembly tool is level with the assembly bell.

-- Remove the clip -arrow- from the new sealing flange.

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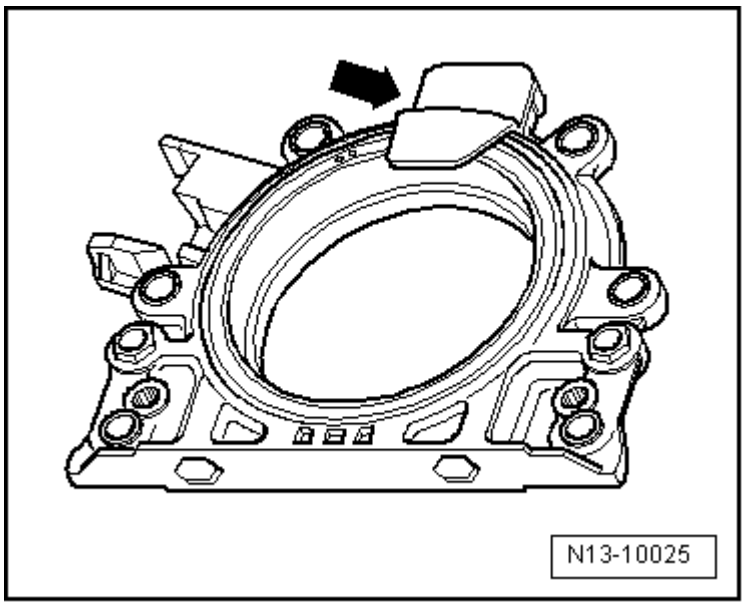

Fig. 48: Identifying Securing Clip From New Sealing Flange
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

NOTE: The sensor wheel must not be removed from or rotated in the sealing flange.

-- The locating pin -A- on the sensor wheel -C- must align with the mark -B- on the sealing flange.

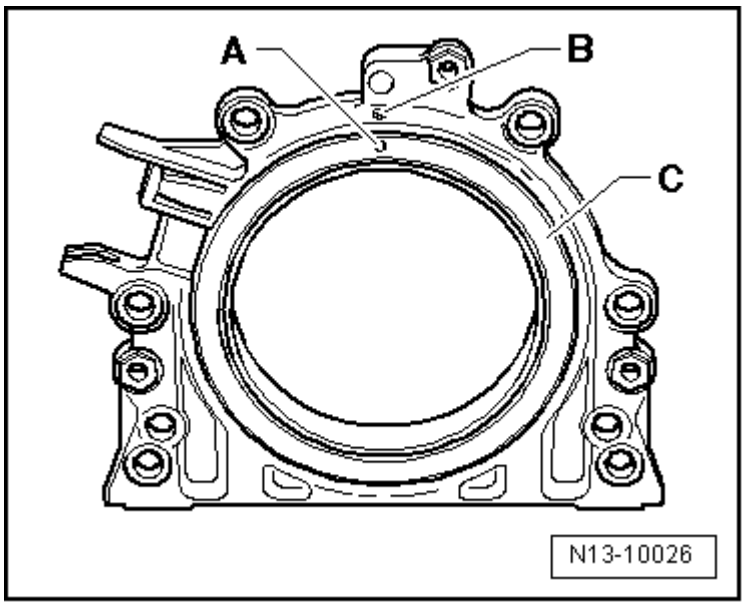

Fig. 49: Identifying Locating Pin On Sensor Wheel Aligns With Marking On Sealing Flange
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Place the front side of the sealing flange onto a clean level surface.

-- Press the sealing lip support ring -A- in the -direction of arrows- until it rests on the level surface.

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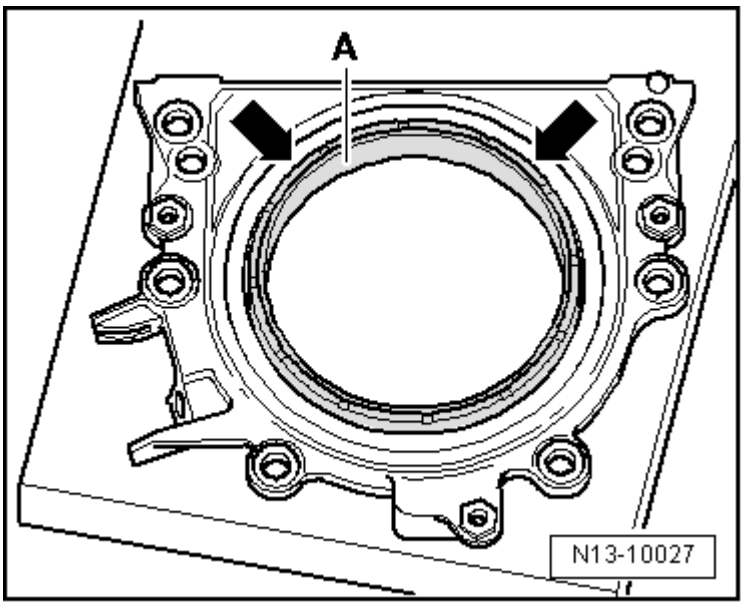

Fig. 50: Identifying Sealing Lip Support Ring Pressed Until It Rests On Level Surface
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- The upper edge of the sensor wheel and the front edge of the sealing flange must align -arrows-.

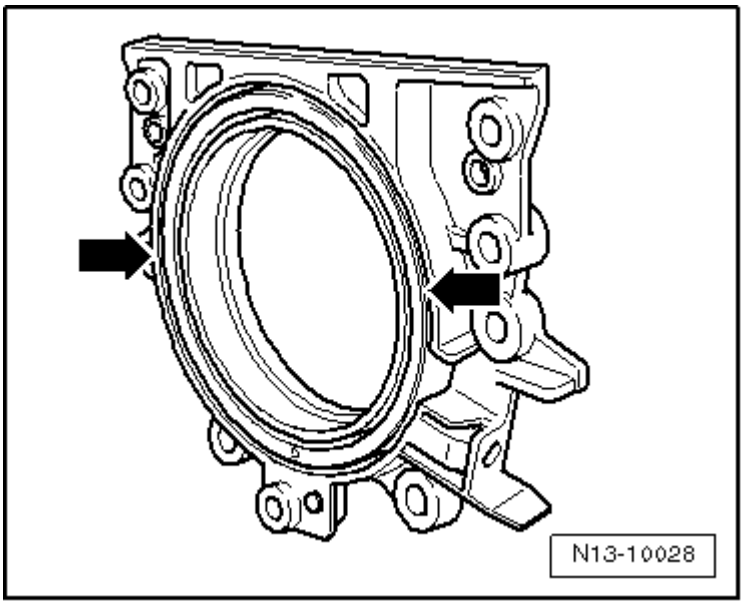

Fig. 51: Identifying Upper Edge Of Sensor Wheel And Front Edge Of Sealing Flange Align
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Place the front side of the sealing flange on the assembly tool T10134 so the locating pin -B- is positioned in the bore -A- on the sensor wheel.

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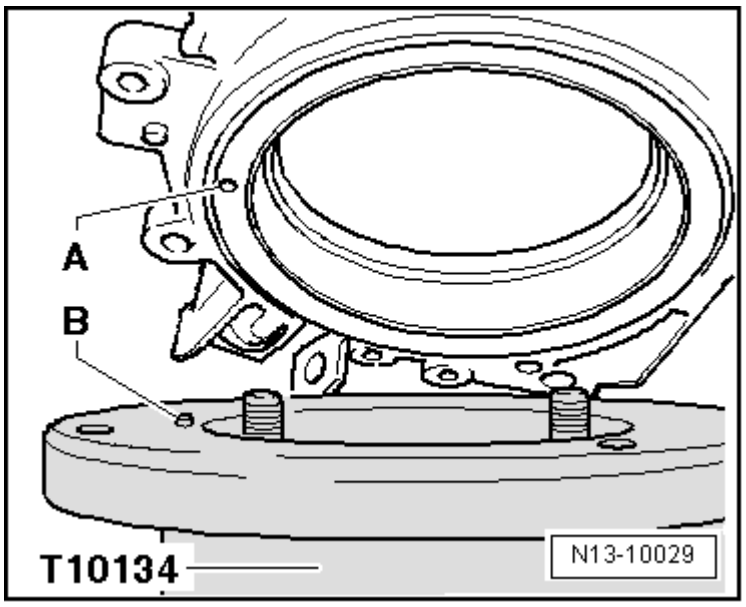

Fig. 52: Identifying Front Side Of Sealing Flange Placed Onto Assembly Tool T10134 To Position Locating Pin In Bore Of Sensor Wheel
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

NOTE: Make sure that all the sealing flange is positioned flat on the assembly tool.

-- While tightening the knurled bolts -A-, press the sealing flange and sealing lip support ring -B- onto the surface of the assembly tool T10134 so that the locating pin can no longer slip out of the bore of the sensor wheel.

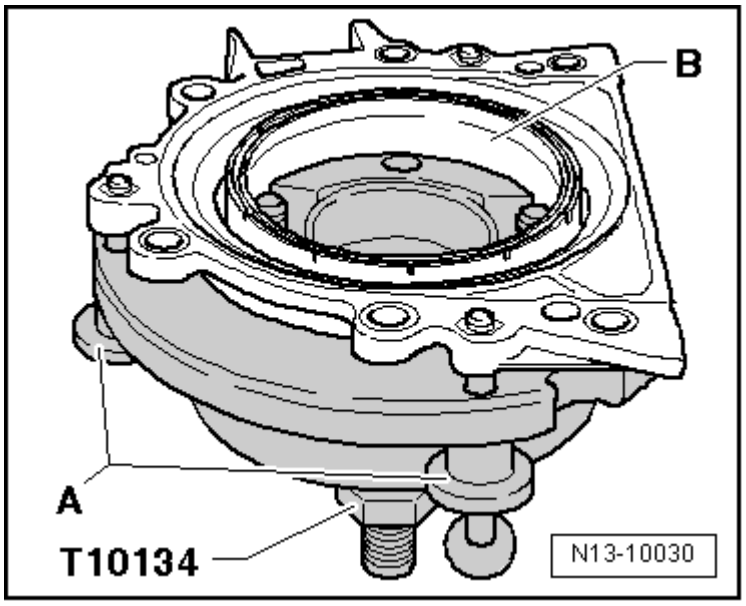

Fig. 53: Identifying Sealing Flange And Sealing Lip Support Ring Pressed On Assembly Tool T10134
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

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NOTE: Make sure that, when installing the sealing flange, the sensor wheel remains located in the assembly tool.

Assembly Tool T10134 WITH SEALING FLANGE, INSTALLING TO CRANKSHAFT FLANGE

- Crankshaft flange must be free of oil and grease.
- The engine is at Top Dead Center (TDC) for cylinder 1.

-- Install the nut -B- to the end of the threaded spindle.

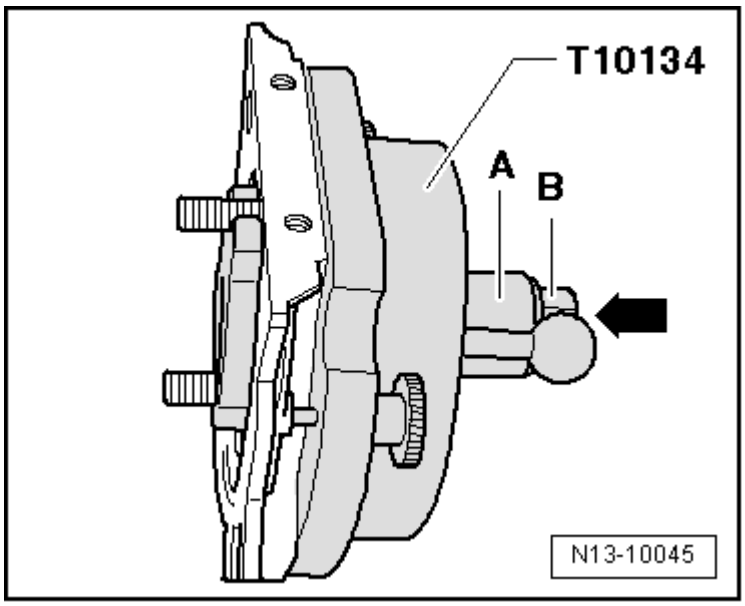

Fig. 54: Identifying Threaded Spindle Pressed Of Assembly Tool T10134 Until Nut Rests On Assembly Bell
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Push the threaded spindle on the assembly tool T10134 in the -direction of the arrow- until the nut -B- rests on the assembly bell -A-.

-- Position the flattened side of the assembly bell toward the oil pan sealing surface side of the crankcase.

-- Secure the assembly tool T10134 onto the crankshaft flange using the socket head bolts -A-.

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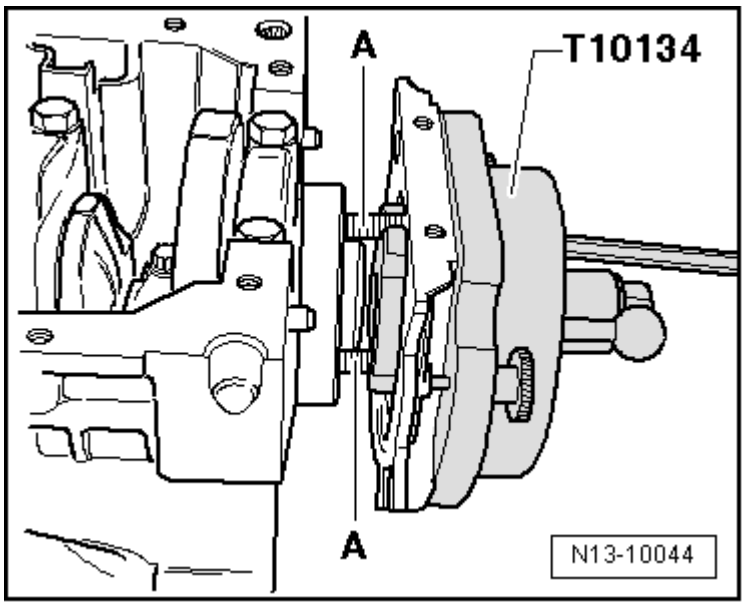

Fig. 55: Identifying Assembly Tool T10134 Secured Onto Crankshaft Flange Using Socket Head Hex Bolts
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

NOTE: Screw the socket head bolts -A- approximately 5 threads into the crankshaft flange.

-- Install the two M7 x 35 mm bolts (or bolts of a comparable length) -A- to guide the sealing flange into the cylinder block.

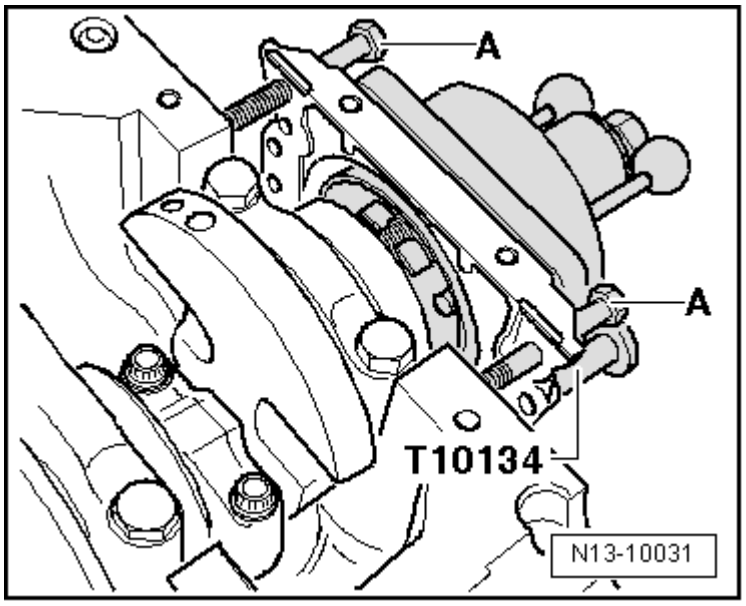

Fig. 56: Identifying Bolts Screwed Into Cylinder Block To Guide Sealing Flange
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

SECURING THE Assembly Tool T10134 TO CRANKSHAFT FLANGE

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-- Push the assembly bell -C- in the -direction of arrow- until the sealing lip support ring -B- rests on the crankshaft flange -A-.

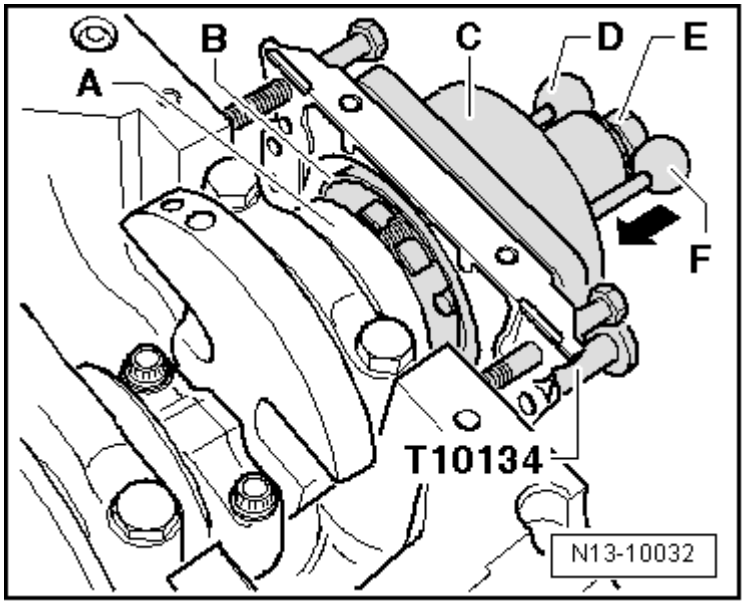

Fig. 57: Identifying Assembly Bell Pushed Until Sealing Lip Support Ring Rests On Crankshaft Flange
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Push the guide pin for diesel engines (black handle) -D- into the crankshaft bore. Thereby the sensor wheel is retained in the final installed position.

NOTE: Do not insert the guide pin for gas engines (red handle) -F- into the crankshaft threaded bore.

-- Hand tighten both socket head bolts of the assembly tool.

-- Install the nut -E- onto the threaded spindle by hand, until it rests on the assembly bell -C-.

INSTALLING THE SENSOR WHEEL TO THE CRANKSHAFT FLANGE, USING Assembly Tool T10134

-- Tighten the nut on the assembly tool T10134 to 35 Nm using the torque wrench (5-50 Nm) V.A.G 1331 and the tool insert AF 24 V.A.G 1332/11.

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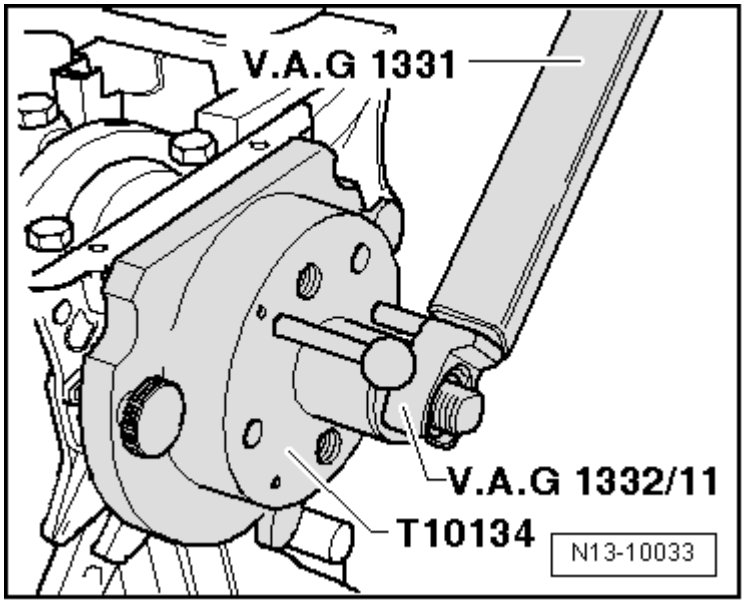

Fig. 58: Identifying Sensor Wheel Pressed With Assembly Tool T10134 Onto Crankshaft Flange
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

NOTE: After tightening the nut to 35 Nm, a minimal air gap must still be present between the cylinder block and sealing flange.

SENSOR WHEEL TO CRANKSHAFT, CHECKING INSTALLED POSITION

-- Screw the nut -E- to the end of the threaded spindle.

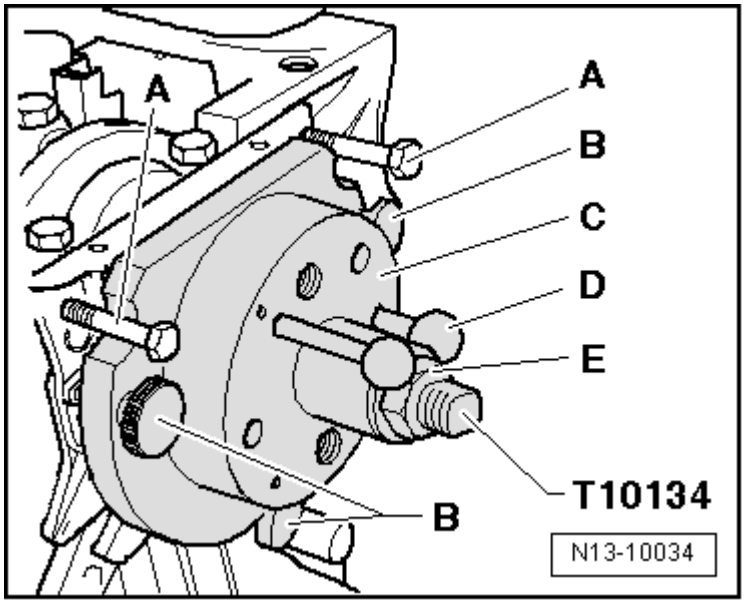

Fig. 59: Identifying Installed Position Of Sensor Wheel On Crankshaft
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Remove the two bolts -A- from the cylinder block.

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-- Remove the 3 knurled bolts -B- from the sealing flange.

-- Remove the hex socket bolts -A- and remove the assembly tool T10134.

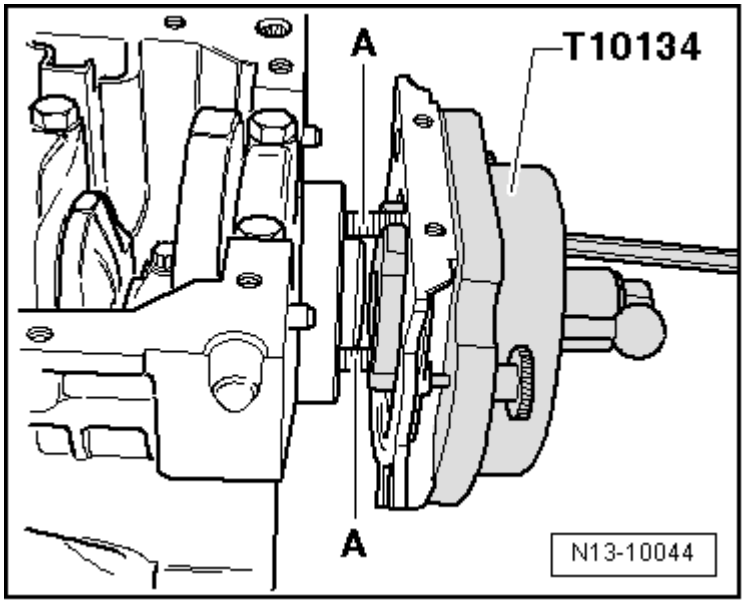

Fig. 60: Identifying Assembly Tool T10134 Secured Onto Crankshaft Flange Using Socket Head Hex Bolts
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Remove the sealing lip support ring.

-- The installed position of the sensor wheel on the crankshaft is exact, if a gap of 0.5 mm -a- is present between the crankshaft flange -A- and sensor wheel -B-.

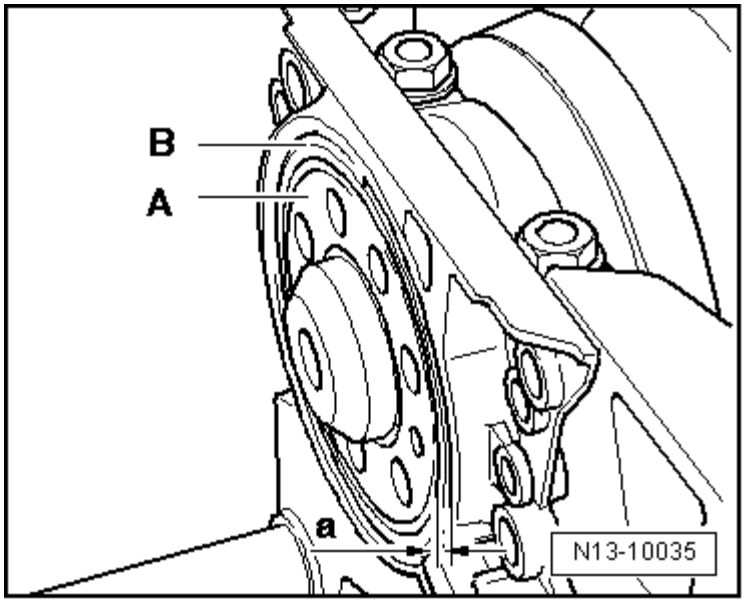

Fig. 61: Identifying Installed Position Of Sensor Wheel On Crankshaft Is Exact

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Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Set a caliper gauge onto the crankshaft flange.

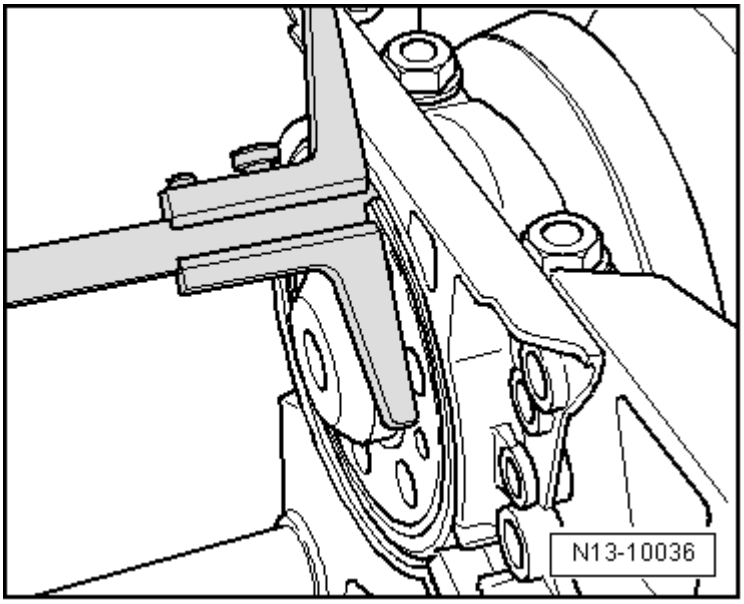

Fig. 62: Identifying Caliper Gauge Set Onto Crankshaft Flange
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Measure the distance -a- between the crankshaft flange and the sensor wheel.

If dimension -a- is too small:

-- Press the sensor wheel on again. Refer to **SENSOR WHEEL, PRESSING ON AGAIN**.

If dimension -a- is attained:

-- Tighten the bolts for the sealing flange in an alternating diagonal sequence to 15 Nm.

-- Install the engine speed sensor -G28- -arrow- and tighten the bolt to 5 Nm.

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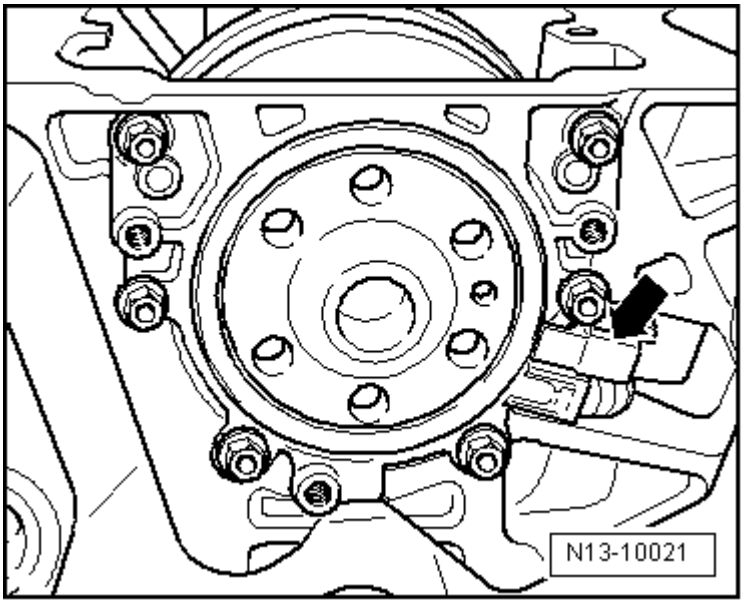

Fig. 63: Identifying Engine Speed (RPM) Sensor G28
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Install the oil pan. Refer to **OIL PAN** .

-- Install the intermediate plate.

-- Install the flywheel with new bolts. Tighten the bolts to 60 Nm + an additional 90° (1/4) turn.

SENSOR WHEEL, PRESSING ON AGAIN

-- Secure the assembly tool T10134 onto the crankshaft flange using the socket head bolts -A-.

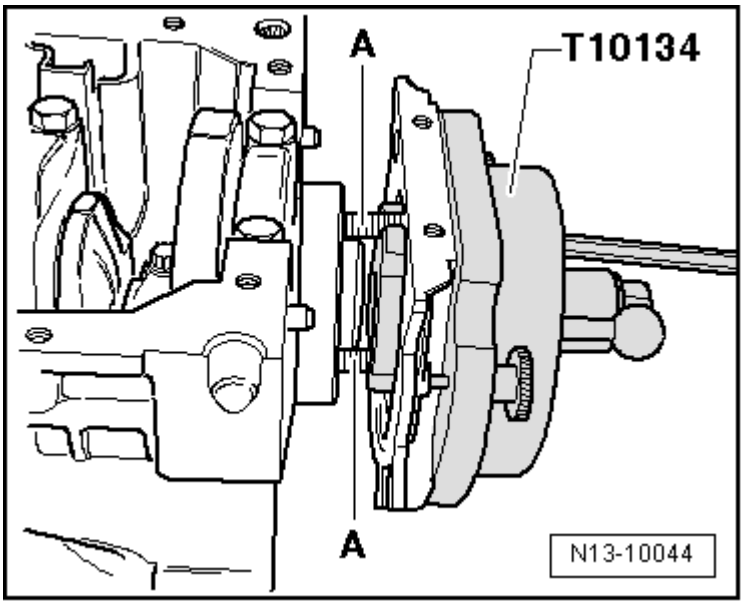

Fig. 64: Identifying Assembly Tool T10134 Secured Onto Crankshaft Flange Using Socket Head Hex

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Bolts
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Hand tighten both of the socket head bolts.

-- Push the assembly tool T10134 onto the sealing flange by hand.

-- Install the nut -E- onto the threaded spindle by hand, until it rests on the assembly bell -C-.

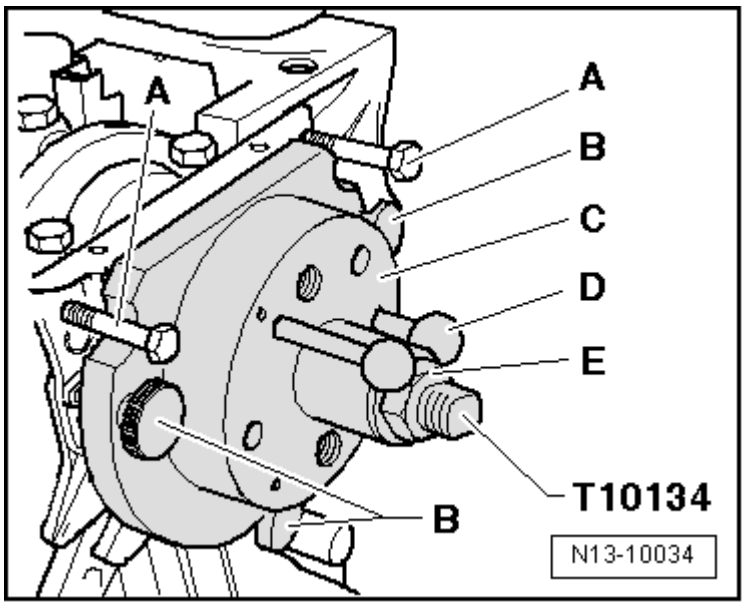

Fig. 65: Identifying Installed Position Of Sensor Wheel On Crankshaft
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Tighten the nut on the assembly tool T10134 to 40 Nm using the torque wrench (5-50 Nm) V.A.G 1331 and the tool insert AF 24 V.A.G 1332/11.

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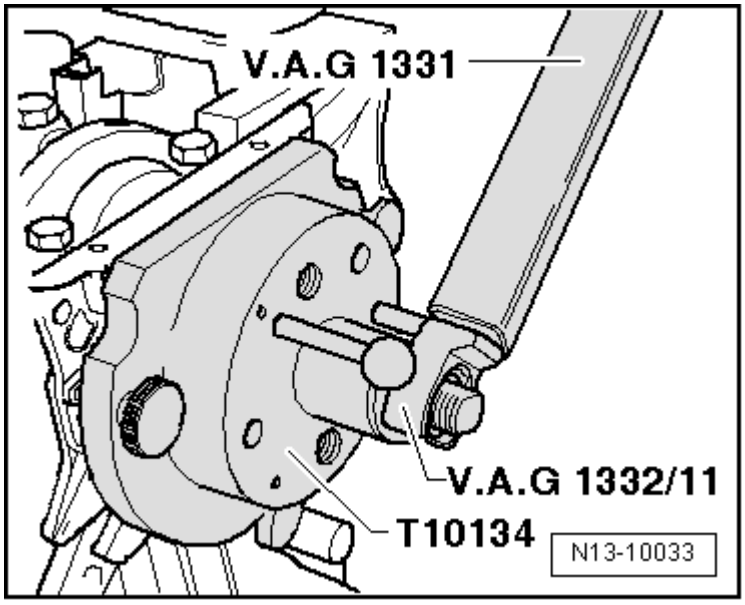

Fig. 66: Identifying Sensor Wheel Pressed With Assembly Tool T10134 Onto Crankshaft Flange
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Check the installed position of the sensor wheel on the crankshaft again. Refer to **SENSOR WHEEL TO CRANKSHAFT, CHECKING INSTALLED POSITION**.

If dimension -a- is too small:

-- Tighten the nut on the assembly tool T10134 to 45 Nm.

-- Check the installed position of the sensor wheel on the crankshaft again. Refer to **SENSOR WHEEL TO CRANKSHAFT, CHECKING INSTALLED POSITION**.

CRANKSHAFT SEAL, BELT PULLEY SIDE

Special tools and workshop equipment required

- Seal Remover3203
- Counter Support3415
- Assembly Tool T10053
- Torque Wrench (5-50 Nm) V.A.G 1331
- Torque Wrench (40-200 Nm) V.A.G 1332

Removing

-- Remove the toothed belt. Refer to **TOOTHED BELT** .

-- Remove the crankshaft toothed belt gear. Secure the toothed belt gear using the counter support3415.

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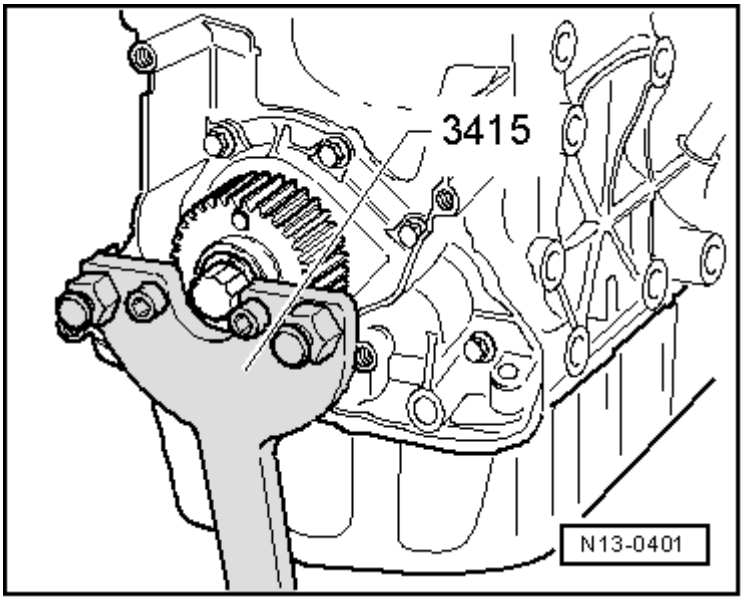

Fig. 67: Identifying Counter-Hold 3415 On Crankshaft Toothed Belt Sprocket
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- To guide the seal remover3203, install the center bolt by hand into the crankshaft all the way.

-- Turn the inner portion of the seal remover 2 revolutions (approximately 3 mm) out from the outer portion and lock it with the knurled thumb screw.

-- Lubricate the threaded head of the seal remover.

-- Install the seal puller as far as possible into the seal.

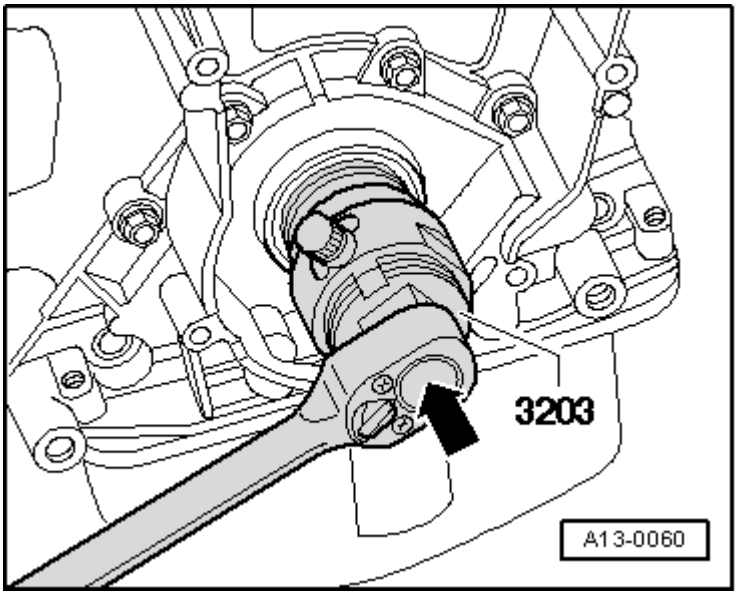

Fig. 68: Identifying Firm Pressure Exerted To Oil Seal Extractor 3203 Into Oil Seal
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

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-- Loosen the knurled thumb screw and turn the inner part against crankshaft until the seal is pulled out.

Installing

NOTE: The sealing lip of the seal may not be additionally oiled or greased.

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

-- Place the guide sleeve T10053/1 on crankshaft journal.

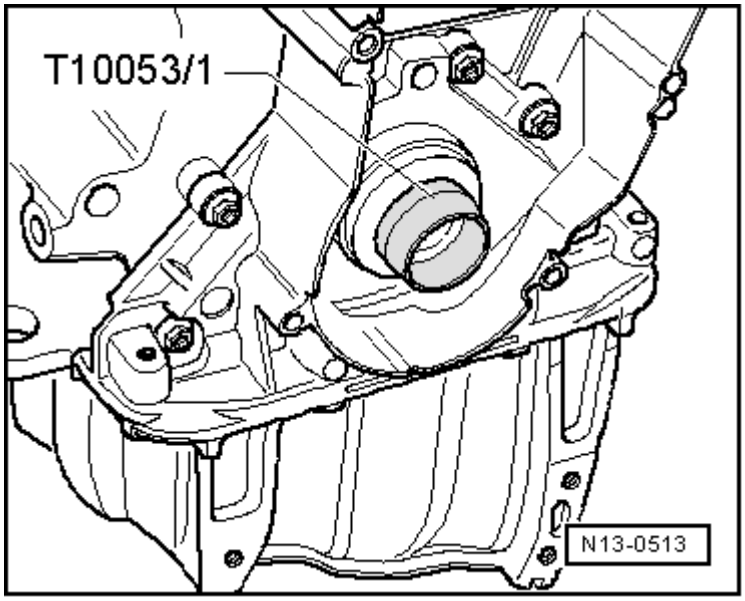

Fig. 69: Identifying Guide Sleeve From Assembly Tool T10053 & Crankshaft Journal
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Push the seal over the guide sleeve onto the end of the crankshaft.

-- Press the seal until seated using the assembly tool T10053 and the center bolt.

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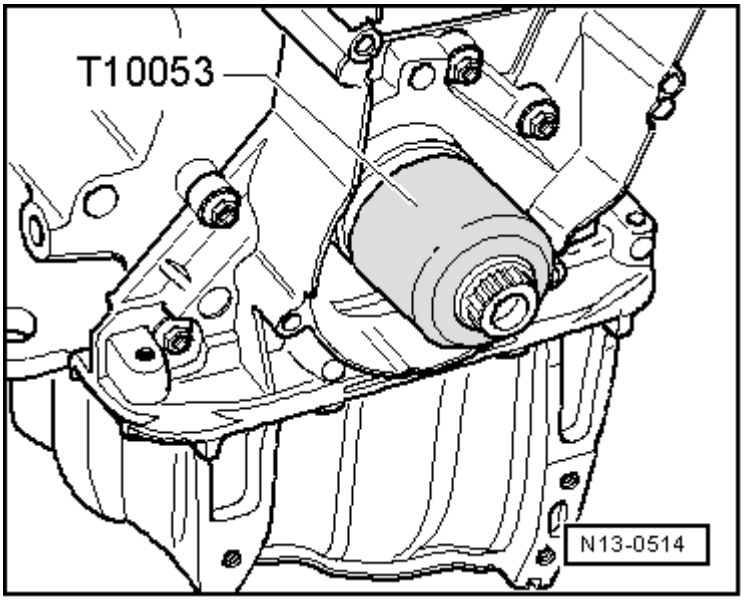

Fig. 70: Identifying Press Sleeve T10053
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Install the crankshaft toothed belt gear.

-- Install a new crankshaft toothed belt gear center bolt, see -item 2- in the **TOOTHED BELT DRIVE OVERVIEW**.

-- Install the toothed belt. Refer to **TOOTHED BELT** .

SEALING FLANGE, BELT PULLEY SIDE

Special tools and workshop equipment required

- Counter Support 3415
- Assembly Tool T10053
- Torque Wrench (5-50 Nm) V.A.G 1331
- Torque Wrench (40-200 Nm) V.A.G 1332
- Hand Drill with Plastic Brush Attachment
- Silicone Sealant D 176 404 A
- Flat Scraper

Removing

-- Remove the toothed belt. Refer to **TOOTHED BELT** .

-- Remove the crankshaft toothed belt gear. Secure the toothed belt gear using the counter support3415.

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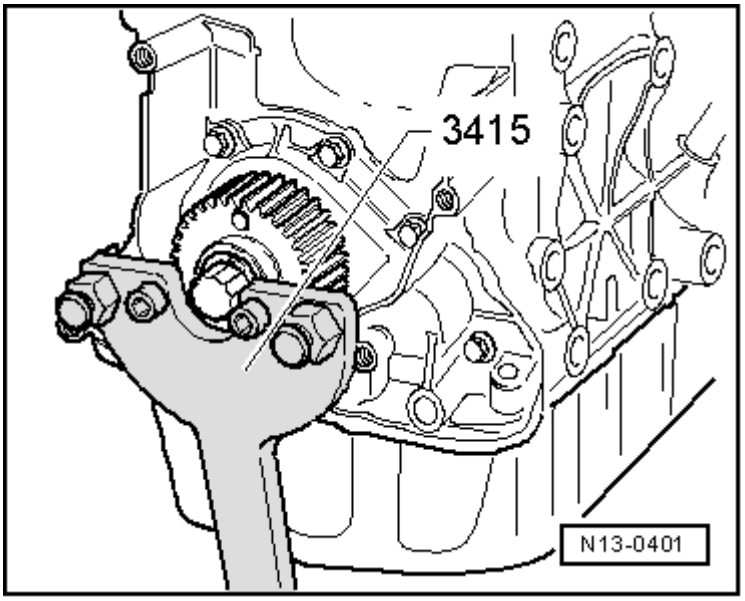

Fig. 71: Identifying Counter-Hold 3415 On Crankshaft Toothed Belt Sprocket
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Drain the engine oil.

-- Remove the oil pan. Refer to **OIL PAN** .

-- Remove the front sealing flange.

-- Remove the sealing flange. If necessary, loosen it by tapping lightly with a rubber mallet.

-- Remove any sealant residue from the cylinder block with a flat scraper.

-- Remove any sealant residue from the sealing flange using a rotating plastic brush (wear safety glasses).

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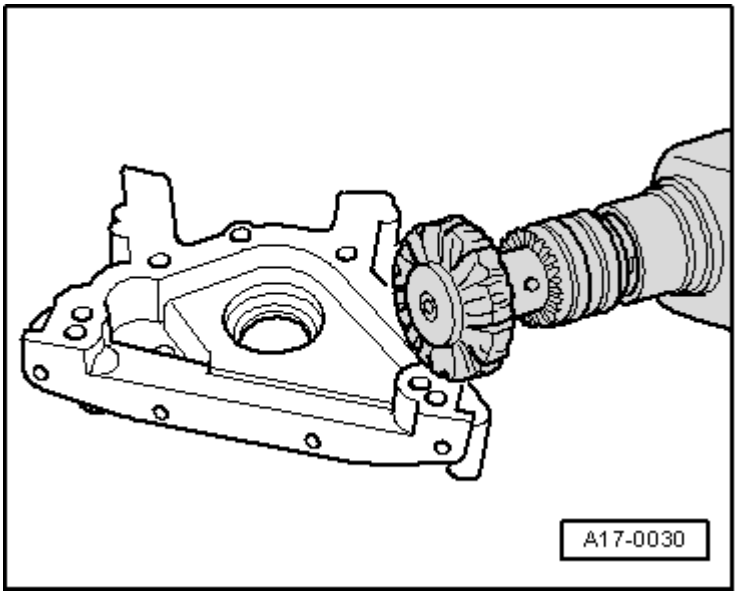

Fig. 72: Identifying Rotating Plastic Brush
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

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

Installing

NOTE: Note the expiration date of the silicone sealant.

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

-- Cut the sealant tube nozzle at the front mark (nozzle diameter: approximately 3 mm).

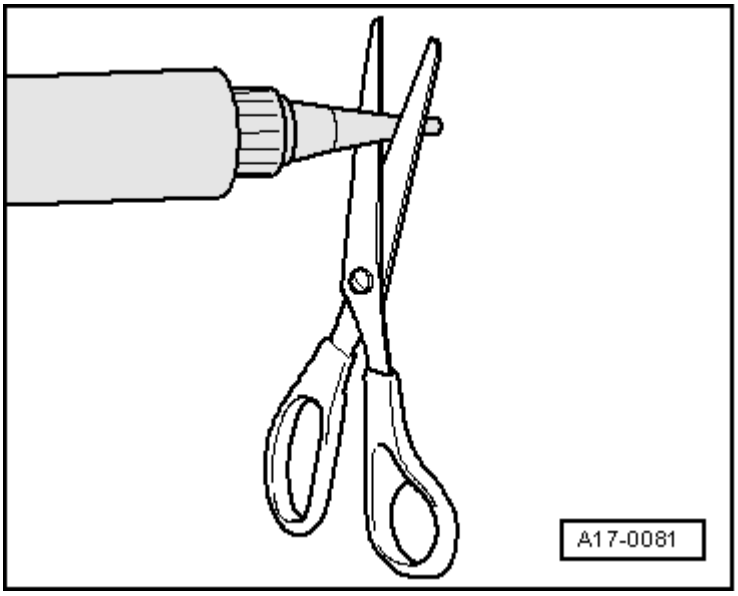

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Fig. 73: Identifying Scissors To Cut Tube Nozzle At Front Marking (Nozzle Diameter Approx. 3 Mm)
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

NOTE: The sealant bead must not be thicker than 2 to 3 mm. Excess sealant could get into the oil pan and plug the screen in the suction pipe or it could drip onto the sealing surface of the crankshaft seal.

Before applying the bead of sealant, cover the sealing surface on the seal with a clean cloth

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

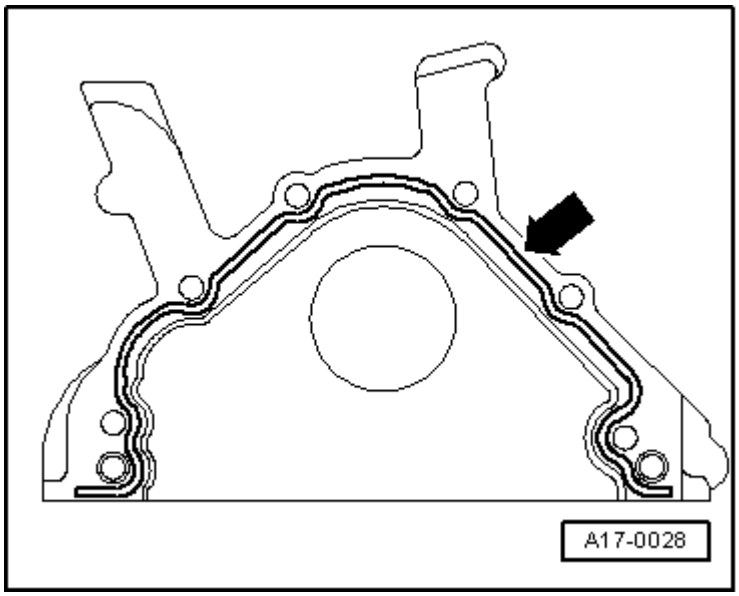

Fig. 74: Identifying Silicone Sealant Bead Applied To Clean Sealing Surface Of Sealing Flange
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Install the sealing flange immediately and tighten all the bolts lightly.

NOTE: To position the sealing flange with the seal installed, use the guide sleeve T10053/1.

-- Tighten the bolts for the sealing flange in a diagonal sequence to 15 Nm.

-- Install the crankshaft toothed belt gear.

-- Install a new crankshaft toothed belt gear center bolt, see -item 2- in the **TOOTHED BELT DRIVE OVERVIEW**.

-- Install the oil pan. Refer to **OIL PAN** .

NOTE: After installing, allow the sealant to dry for approximately 30 minutes. Only after

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then may the engine oil be added.

Install the toothed belt and adjust the valve timing. Refer to **TOOTHED BELT** .

Engine Speed Sensor -G28-

Special tools and workshop equipment required

- Hose Clamps up to 25 mm Dia. 3094
- Hose Clip Pliers VAS 6362
- Drip Tray for VAS 6100 VAS 6208
- 4 mm Socket T10370

Removing

-- Remove the noise insulation. Refer to **Removal and Installation**

-- Clamp off the coolant hoses to the oil cooler using hose clamps up to 25 mm dia.3094.

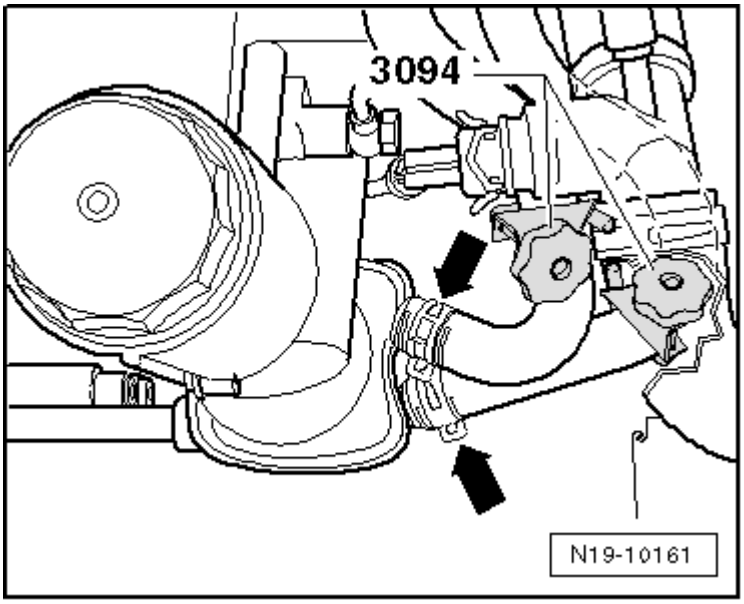

Fig. 75: Identifying Hose Clamps 3094
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Loosen the hose clamps -arrows- using hose clip pliers VAS 6362.

NOTE: Collect any leaking fluid using drip tray for VAS 6100 VAS 6208.

-- Disconnect the coolant hoses from the oil cooler.

-- Remove the oil filter bracket. Refer to **OIL FILTER BRACKET AND OIL COOLER OVERVIEW** .

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-- Loosen the bolt -arrow- using the 4 mm socket T10370 and remove the engine speed sensor.

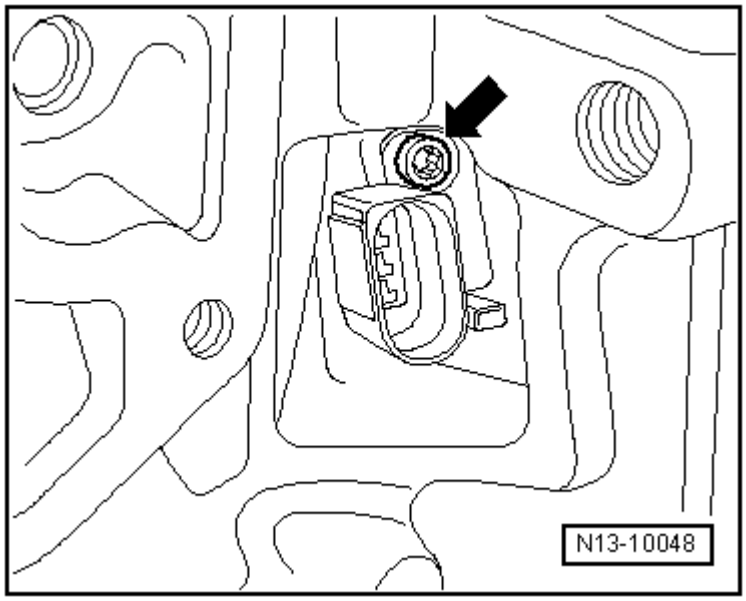

Fig. 76: Identifying Bolt To Engine Speed Sensor
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

Installing

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

- Engine speed sensor bolt tightening specification, see -item 9- in the **SEALING FLANGE AND FLYWHEEL OVERVIEW**.
- Oil filter bracket tightening specification, refer to **OIL FILTER BRACKET AND OIL COOLER OVERVIEW** .

-- Check the coolant level; fill if necessary. Refer to **DRAINING AND FILLING** .

CRANKSHAFT NEEDLE BEARINGS

For Vehicles with a Direct Shift Gearbox (DSG)

Special tools and workshop equipment required

- Puller T10055
- Adapter T10055/3
- Centering Mandrel 3176
- or Drift VW 207 C
- Puller, for example, Kukko Extractor 14.5-18.5 mm 21/2

NOTE: On vehicles with DSG, the needle bearing must be installed in the rear of the

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crankshaft.

Removing

-- Remove using a commercially available puller, for example, Kukko extractor 14.5-18.5 mm 21/2 -arrow-, adapter T10055/3 and puller T10055.

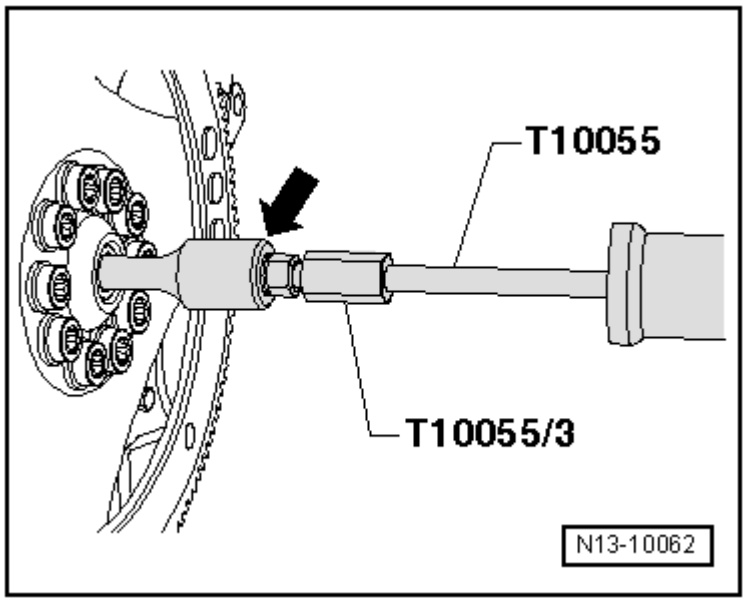

Fig. 77: Identifying Standard Extractor E.G. Kukko 21/2, Adapter T10055/3 And Puller T10055
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

Installing

NOTE: The side of the needle bearing with writing on it must be readable when installed.

-- Drive in using the drift VW 207 C or centering mandrel 3176.

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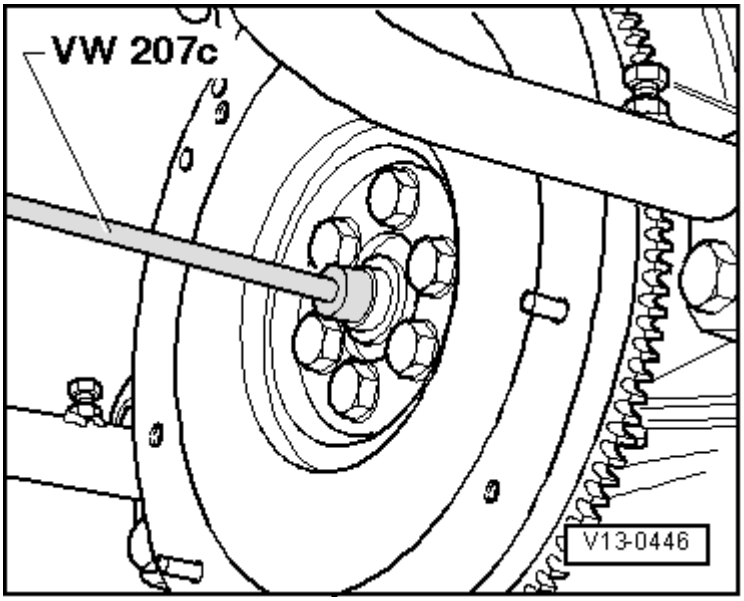

Fig. 78: Identifying Drift -VW 207 C- To Drive In Needle Bearing
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

Installation depth dimension -a- = 2 mm

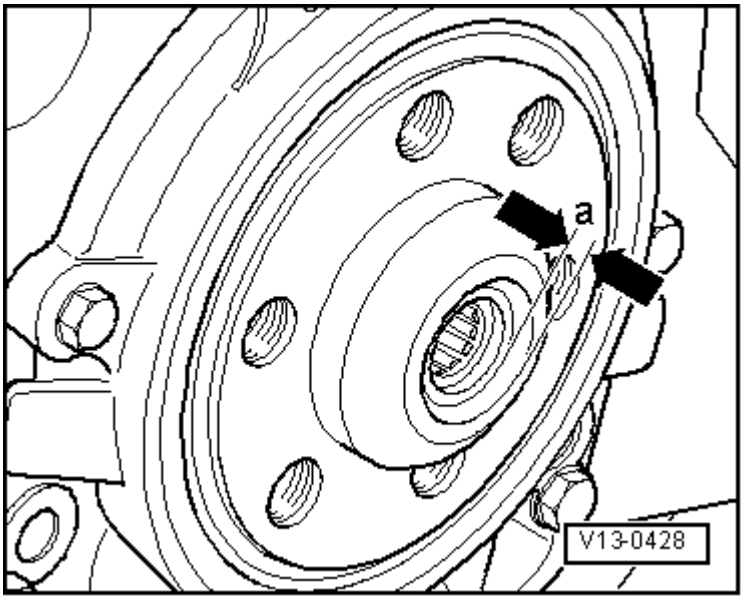

Fig. 79: Identifying Installation Depth Dimension
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

SPECIAL TOOLS

Special tools and workshop equipment required

- Hose Clamps up to 25 mm Dia.3094
- Adapter T10055/3

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- Assembly Tool T10134
- Tool Insert AF 24 V.A.G 1332/11
- Assembly Tool T10053
- Hose Clip Pliers VAS 6362
- Drip Tray for VAS 6100 VAS 6208
- 4 mm Socket T10370
- Measuring Bar VW 382/7

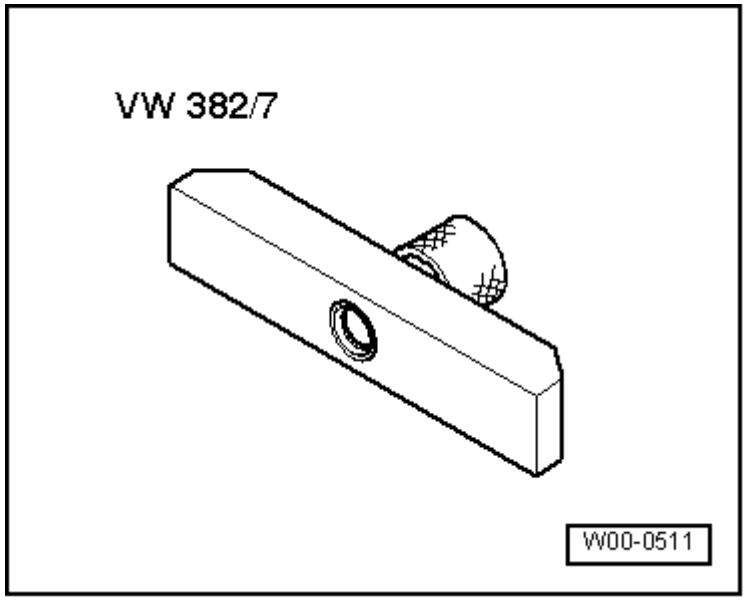

Fig. 80: Identifying Measuring Bar VW 382/7
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

- Magnetic Plate 50 mm Dia. VW 385/17

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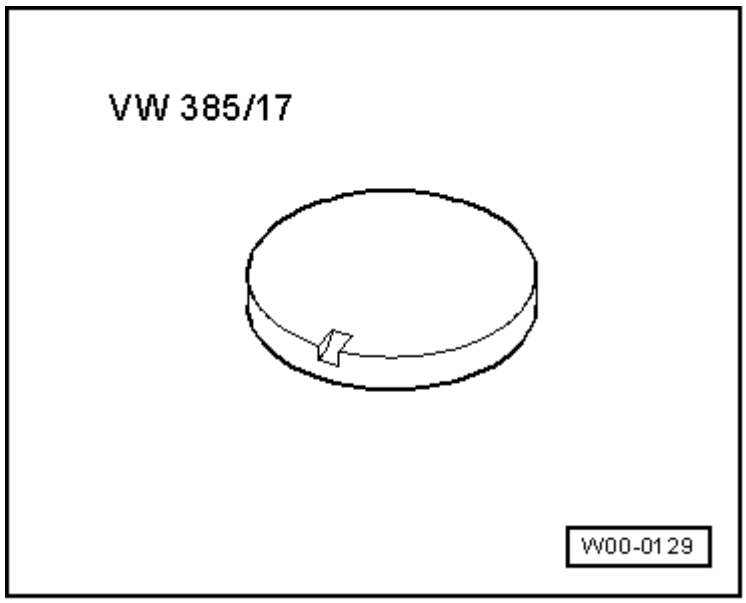

Fig. 81: Identifying Final Measurement Plate VW 385/17
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

- Locking Pin T10060 A

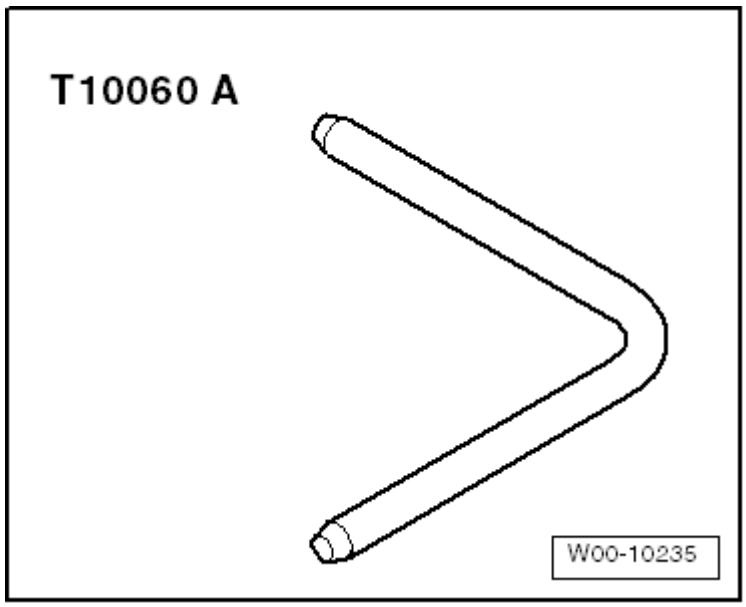

Fig. 82: Identifying Locking Pin T10060 A
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

- Engine Support Bridge 10-222 A

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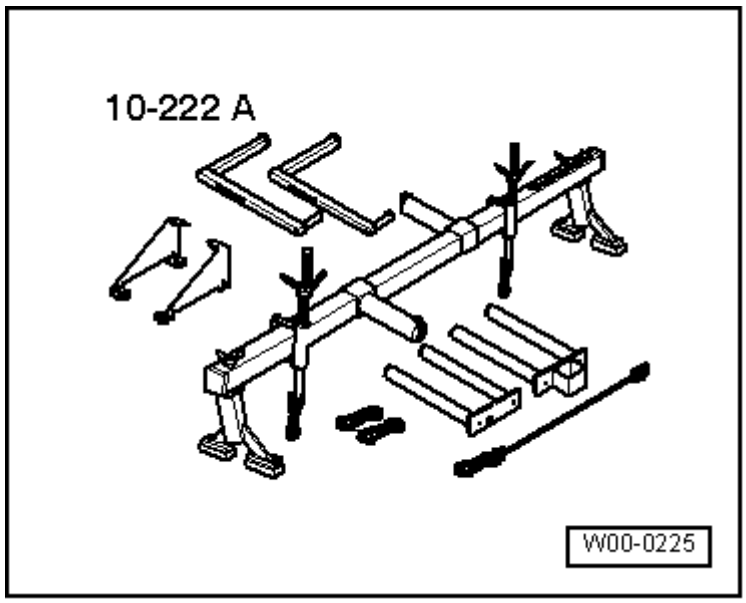

Fig. 83: Identifying 10-222A Engine Support Bridge With 10-222A/8 Bracket For Engine
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

- Engine Support Adapter 10-222 A/3

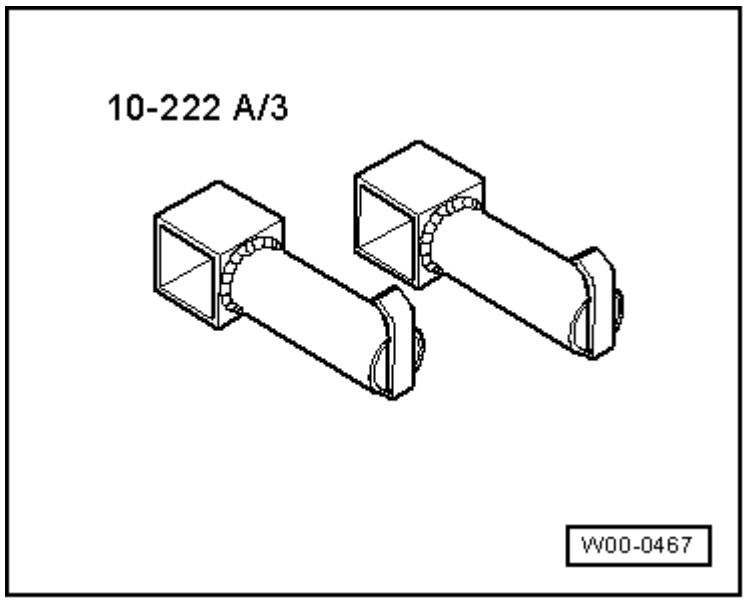

Fig. 84: Identifying Engine Support Adapter 10-222 A/3
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

- Bracket for Engine 10-222 A/1

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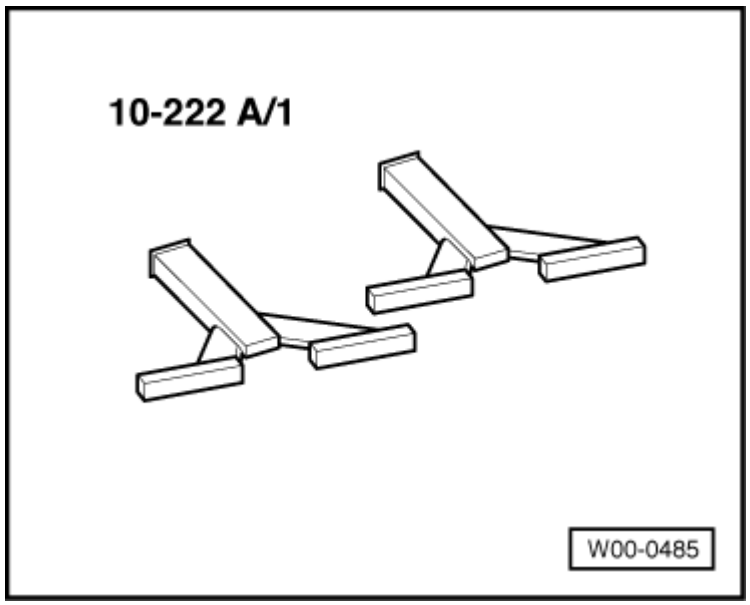

Fig. 85: Identifying Bracket for Engine 10-222 A/1 (Eos Only)
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

- Puller T10055

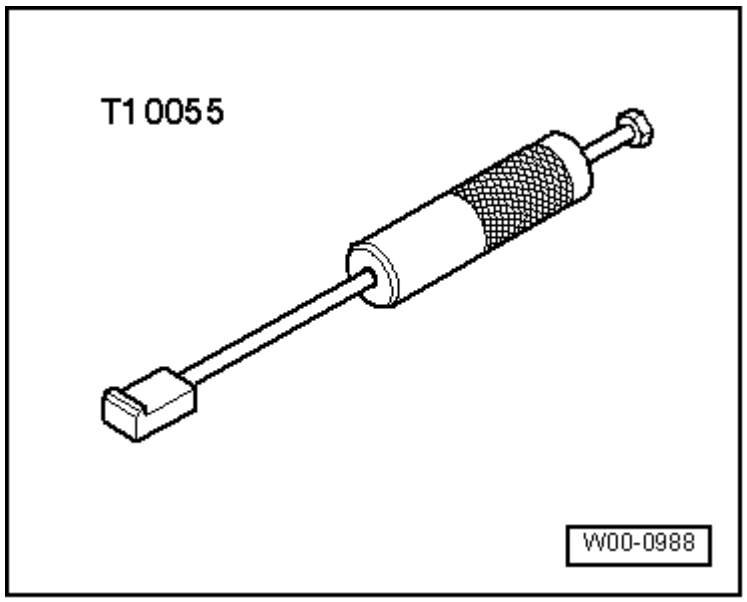

Fig. 86: Identifying Puller T10055
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

- Centering Mandrel 3176

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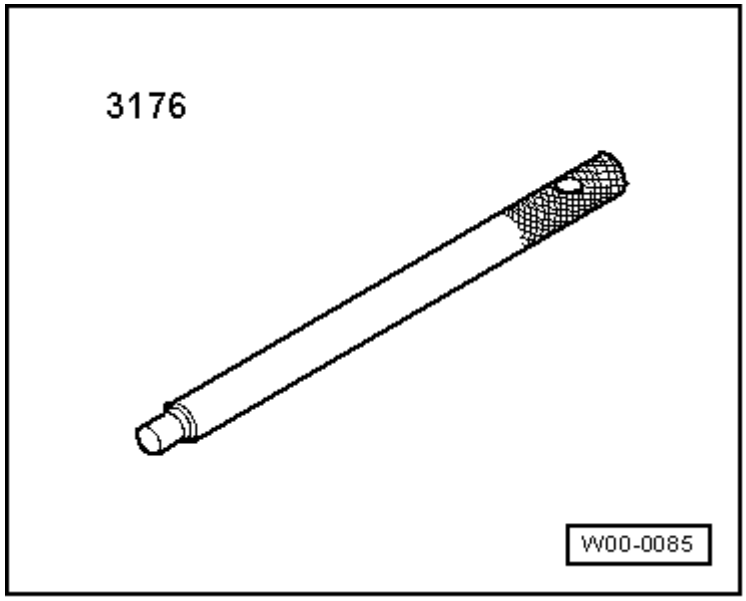

Fig. 87: Identifying Centering Mandrel 3176
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

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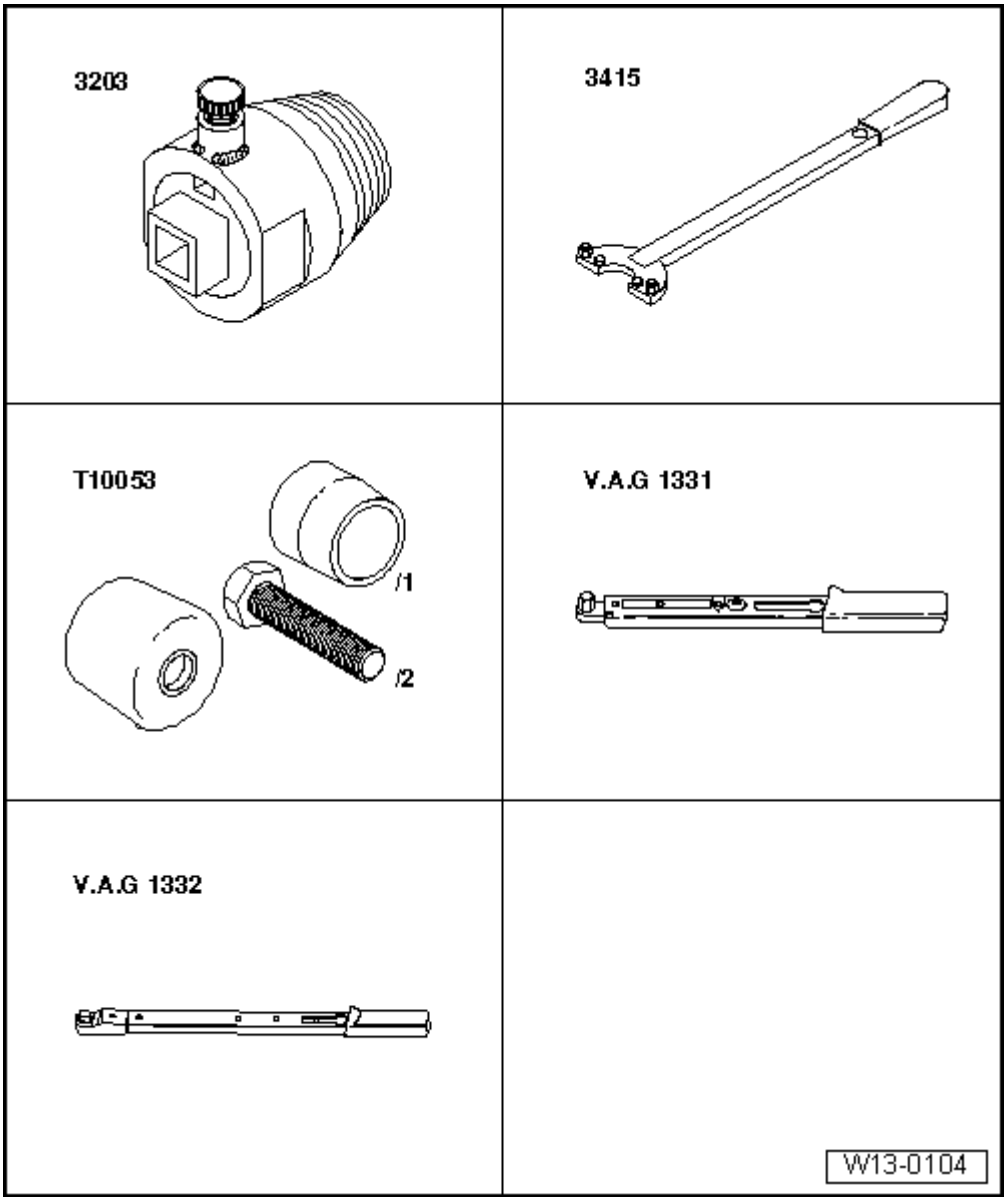

Fig. 88: Identifying Special Tools -- Crankshaft Seal, Ribbed Belt Side, Replacing
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

Special tools and workshop equipment required

- Seal Remover 3203
- Counter Support 3415
- Assembly Tool T10053
- Torque Wrench (5-50 Nm) V.A.G 1331
- Torque Wrench (40-200 Nm) V.A.G 1332

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ENGINE

2.0 Liter - Cylinder Head, Valvetrain - Engine Code(s): CJAA

15 CYLINDER HEAD, VALVETRAIN

DESCRIPTION AND OPERATION

CYLINDER HEAD COVER OVERVIEW

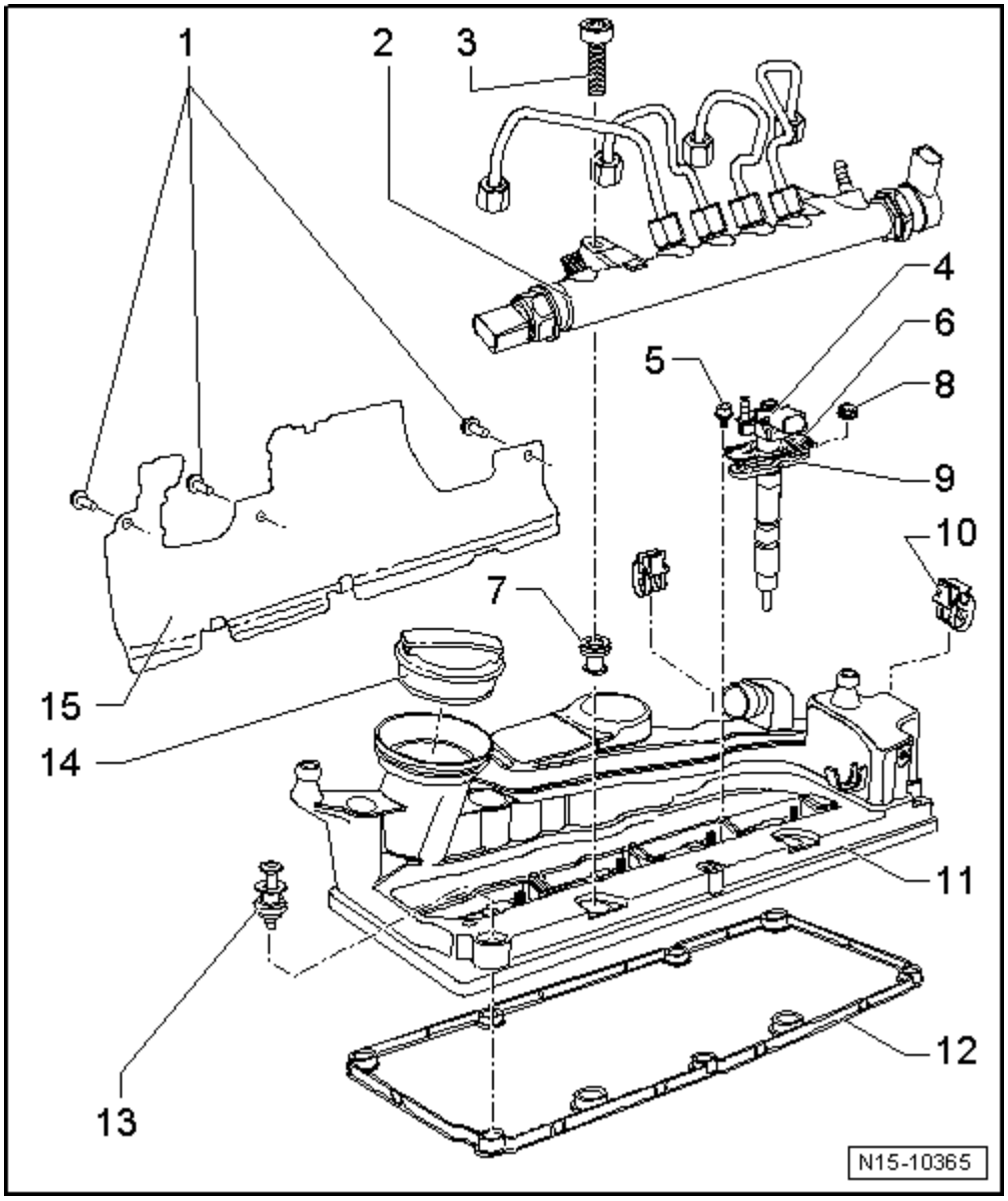

Fig. 1: Identifying Cylinder Head Cover Overview
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

1. **Bolt**

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- 5 Nm

2. **Fuel Rail (High Pressure Reservoir)**
   - With the fuel injection lines.
   - Do not change the shape of the fuel injection lines.
3. **Bolt**
   - 22 Nm
4. **Fuel Injector (Piezo Injection Unit)**
   - Removing and installing, refer to **FUEL INJECTOR** .
5. **Bolt**
   - 5 Nm
6. **Sealing Cap**
7. **Bushing**
   - For the fuel rail mounting.
   - Replace if damaged.
8. **Nut**
   - 10 Nm
9. **Tensioning Plate**
   - Note the installed position, refer to **Fig. 2**.
10. **Wire Guide**
11. **Cylinder Head Cover**
    - Removing and installing, refer to **CYLINDER HEAD COVER**.
12. **Gasket**
    - Replace if damaged or leaking.
13. **Bolt**
    - 10 Nm
    - Follow the tightening sequence, refer to **CYLINDER HEAD COVER**.
14. **Cap**
15. **Heat Shield**

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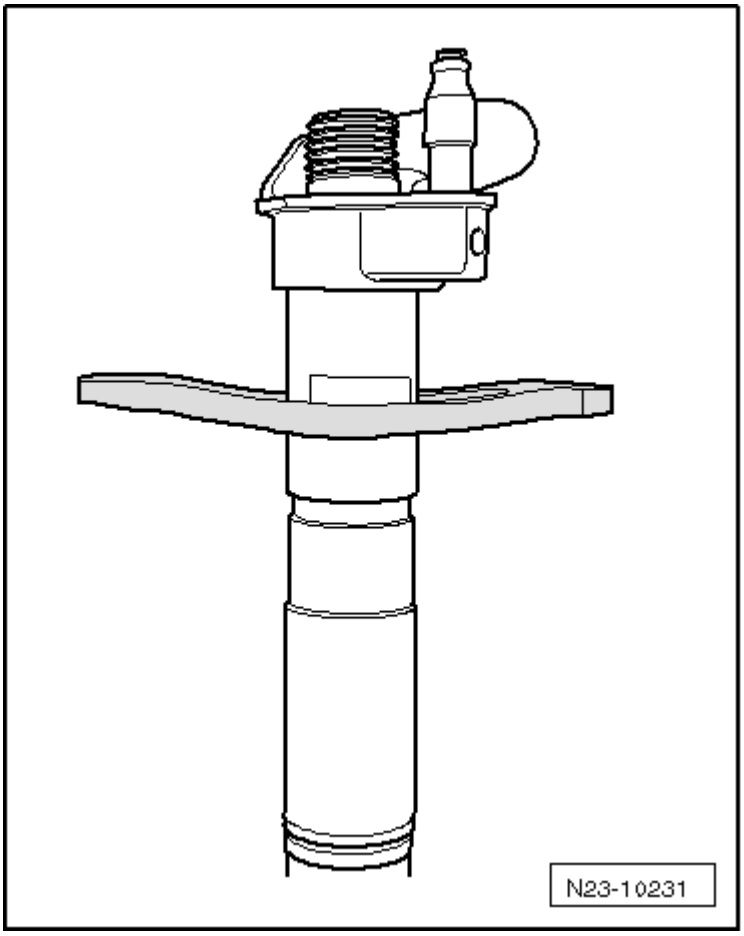

Fig. 2: Identifying Tensioning Plate Installed Position
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

CYLINDER HEAD OVERVIEW

NOTE: Only remove the plastic protectors installed to protect the open valves immediately before fitting the cylinder head.

If the cylinder head is going to be replaced, then it is also necessary to replace all the coolant.

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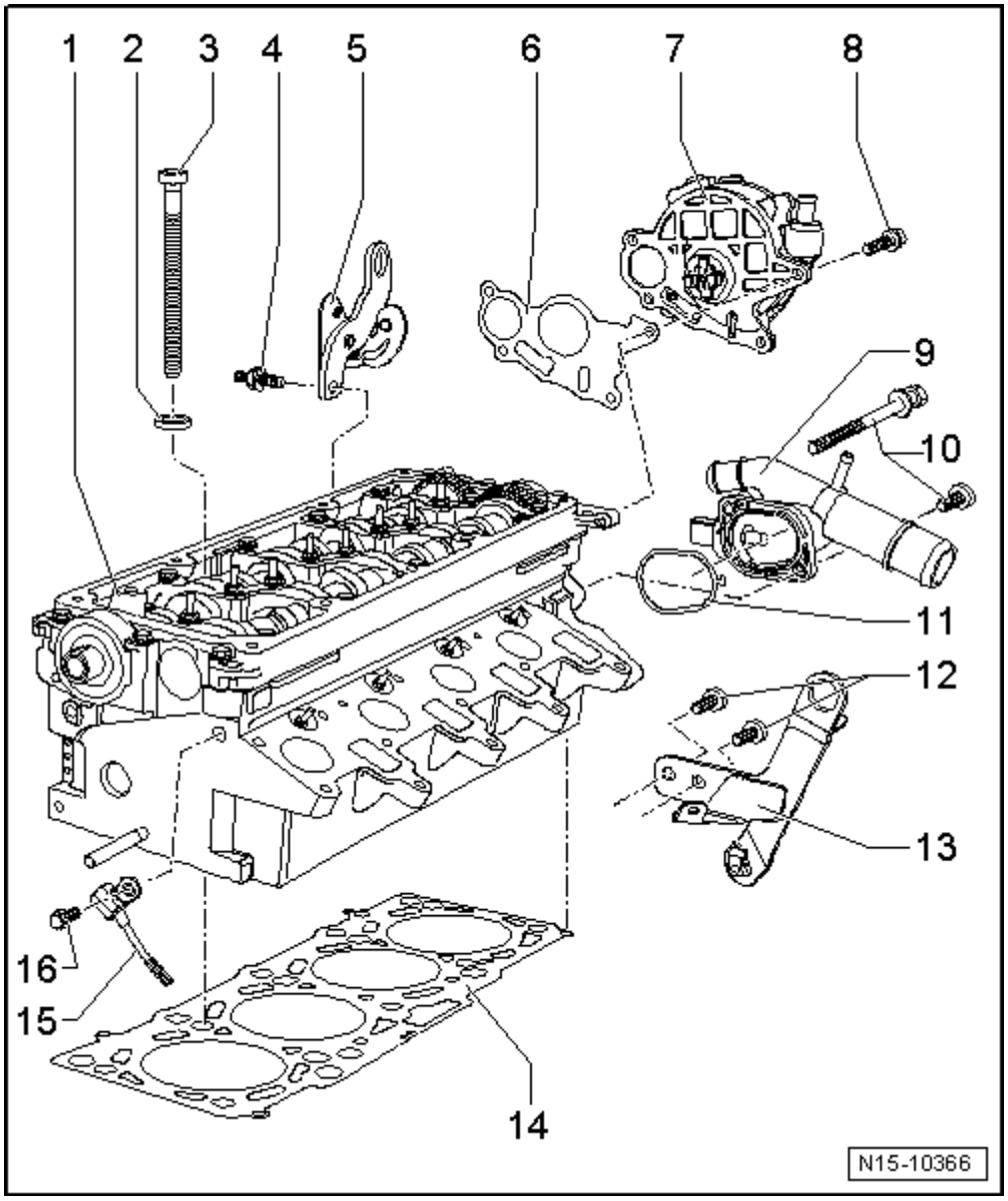

Fig. 3: Identifying Cylinder Head Overview
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

1. **Cylinder Head**
   - Removing and installing, refer to **CYLINDER HEAD**.
   - After replacing replace entire amount of coolant
2. **Washer**
   - For the cylinder head bolt
3. **Bolt**
   - Follow the sequence for loosening and tightening, refer to **CYLINDER HEAD**.
   - Place the washers -item 2- into the cylinder head before installing.
4. **Bolt**

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- 25 Nm

5. **Lifting Eye**
6. **Gasket**
   - Always replace.
7. **Vacuum Pump**
   - Removing and installing, refer to **VACUUM PUMP**.
8. **Bolt**
   - 10 Nm
9. **Coolant Connection**
10. **Bolt**
    - 10 Nm
11. **Gasket**
    - Always replace.
12. **Bolt**
    - 25 Nm
13. **Lifting Eye**
14. **Cylinder Head Gasket**
    - Always replace.
    - Observe the identification. Refer to **CYLINDER HEAD GASKET IDENTIFICATION** .
    - After replacing, replace the entire amount of coolant.
15. **Camshaft Position Sensor -G40-**
16. **Bolt**
    - 10 Nm

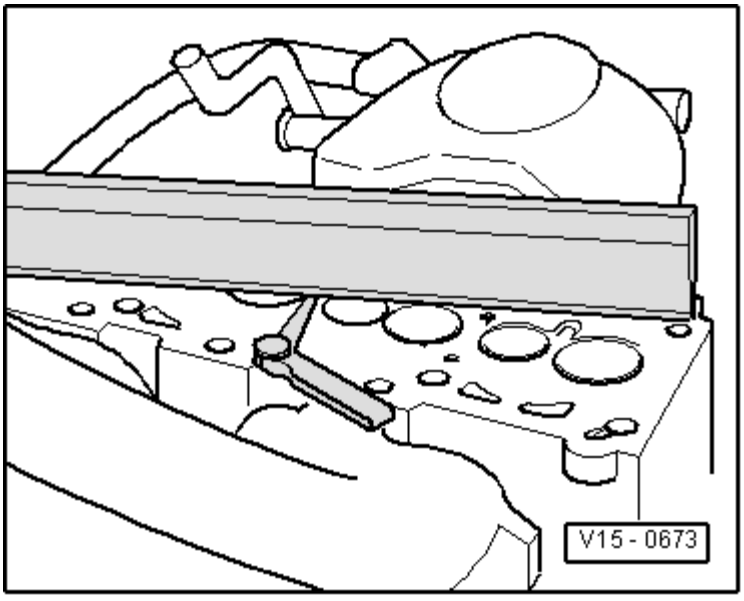

Fig. 4: Identifying Check Of Cylinder Head For Distortion

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Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

Special tools and workshop equipment required

- Straight Edge 500 mm VAS 6075
- Feeler Gauge

Max. permissible distortion: 0.1 mm

NOTE: Remanufactured diesel cylinder heads is not permitted.

TOOTHED BELT OVERVIEW

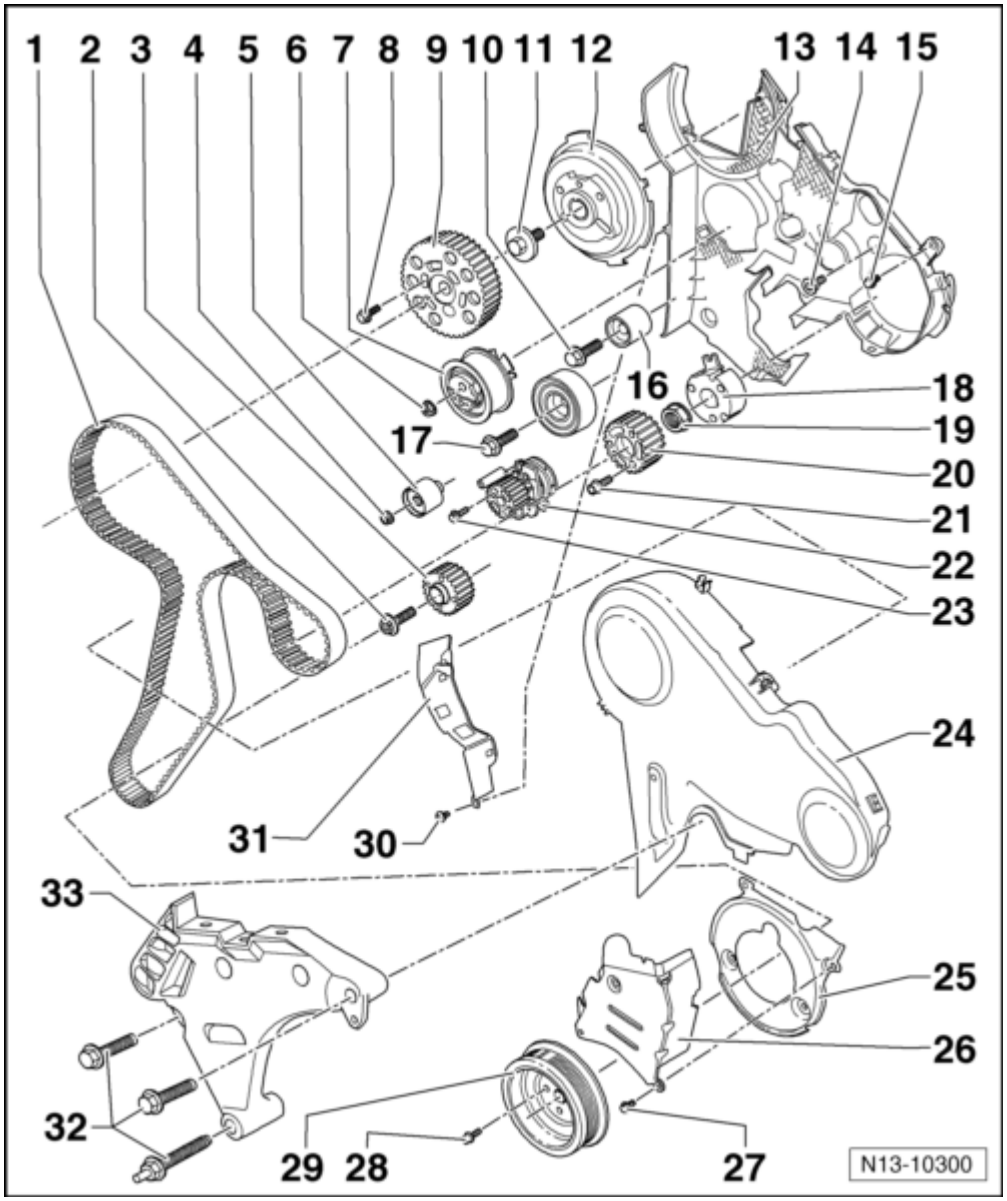

Fig. 5: Identifying Toothed Belt Overview

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Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

1. **Toothed Belt**
   - Mark the rotation direction before removing.
   - Check for wear.
   - Do not kink.
   - Removing, installing and tensioning. Refer to **TOOTHED BELT**
2. **Bolt**
   - 120 Nm + an additional 90° (1/4) turn.
   - Always replace.
   - Use the counter support -3415- to loosen and tighten.
   - Do not lubricate or grease the threads or collar.
   - The additional torque angle can occur in several stages.
3. **Crankshaft Toothed Belt Gear**
4. **Nut**
   - 20 Nm
5. **Idler Roller**
6. **Nut**
   - 20 Nm + an additional 45° (1/8) turn.
7. **Belt Tensioner**
   - Remove the engine mount bracket in order to remove and install. Refer to **ENGINE MOUNT AND BRACKET**
8. **Bolt**
   - 20 Nm + an additional 45° (1/8) turn.
9. **Camshaft Gear**
10. **Bolt**
    - 20 Nm
11. **Bolt**
    - 100 Nm
12. **Hub**
    - Use the camshaft gear counter-holder -T10051- to loosen and tighten.
    - To remove, use the puller -T10052-.
    - Removing and installing, refer to **CAMSHAFTS**
13. **Rear Toothed Belt Guard**
14. **Bolt**
    - 20 Nm
15. **Bolt**
    - 10 Nm

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- Always replace.

16. **Idler Roller**
17. **Bolt**
    - 50 Nm + an additional 90° (1/4) turn.
    - Always replace.
18. **Hub**
    - Use the camshaft gear counter-holder -T10051- to loosen and tighten.
    - Use the puller -T40064- to remove.
    - Removing and installing, refer to **REMOVAL AND INSTALLATION**
19. **Nut**
    - 95 Nm
20. **High Pressure Pump Toothed Belt Gear**
21. **Bolt**
    - 20 Nm + an additional 90° (1/4) turn.
    - Always replace.
22. **Coolant Pump**
    - Removing and installing, refer to **REMOVAL AND INSTALLATION**
23. **Bolt**
    - 15 Nm
24. **Upper Toothed Belt Guard**
25. **Lower Toothed Belt Guard**
26. **Center Toothed Belt Guard**
27. **Bolt**
    - 10 Nm
    - Always replace.
28. **Bolt**
    - 10 Nm + an additional 90° (1/4) turn.
    - Always replace.
29. **Vibration Damper**
    - Installation is only possible in one position because of the offset holes.
30. **Bolt**
    - 5 Nm
31. **Protective Plate**
32. **Bolt**
    - 40 Nm + an additional 180° (1/2) turn.
    - Always replace.
    - Follow the tightening sequence, refer to **ENGINE MOUNT AND BRACKET**
33. **Engine Mount Bracket**

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- Removing and installing, refer to **ENGINE MOUNT AND BRACKET**

VALVETRAIN OVERVIEW

NOTE: Cylinder heads with cracks between the valve seats can continue to be used without reducing service life, as long as the cracks have a Max. width of 0.5 mm.

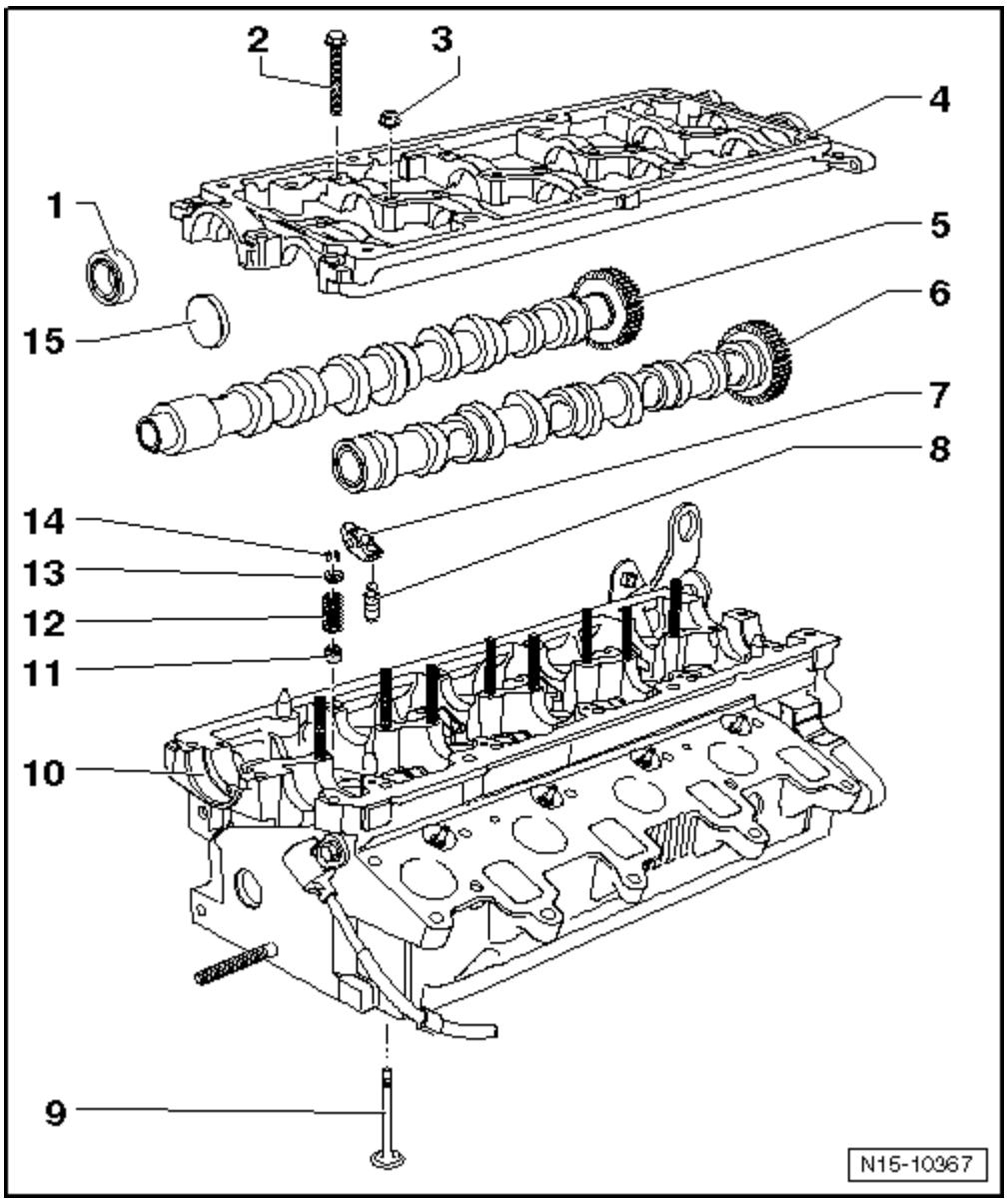

Fig. 6: Identifying Valvetrain Component Overview
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

1. **Seal**
   - Do not lubricate or grease the sealing lip on the seal.

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- Before installing, remove any remaining oil from camshaft journal with a clean cloth.
- To install, tape over the groove on the camshaft taper.
- Removing and installing, refer to **CAMSHAFT SEAL**.

2. **Bolt**
   - 10 Nm
3. **Nut**
   - 10 Nm
4. **Bearing Frame**
   - Follow the loosening/tightening sequence. Refer to **CAMSHAFTS**.
   - Seal using silicone sealantD 176 501 A1.
5. **Exhaust Camshaft**
6. **Intake Camshaft**
7. **Roller Rocker Lever**
   - Mark the installed position.
   - Do not interchange.
   - Check the roller for ease of movement.
   - Lubricate the contact surface.
8. **Hydraulic Lash Adjuster**
   - Mark the installed position.
   - Lubricate the running surfaces before installing.
9. **Valve**
   - Do not rework, only lapping is permitted.
   - Mark the installed position for installation later.
   - For the correct valve dimensions, refer to **VALVE DIMENSIONS**.
   - Checking the valve guides. Refer to **VALVE GUIDE, CHECKING**.
10. **Cylinder Head**
    - See the note in **CYLINDER HEAD OVERVIEW**.
    - Removing and installing, refer to **CYLINDER HEAD**.
11. **Valve Stem Seal**
12. **Valve Spring**
13. **Spring Plate**
14. **Valve Retainer**
15. **Sealing Cap**
    - Always replace.

VALVE SEAT, REFACING

NOTE: The valve seats may not refaced due to a close tolerances.

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SPECIFICATIONS

VALVE DIMENSIONS

NOTE: Valves must not be reworked. Only lapping is permitted.

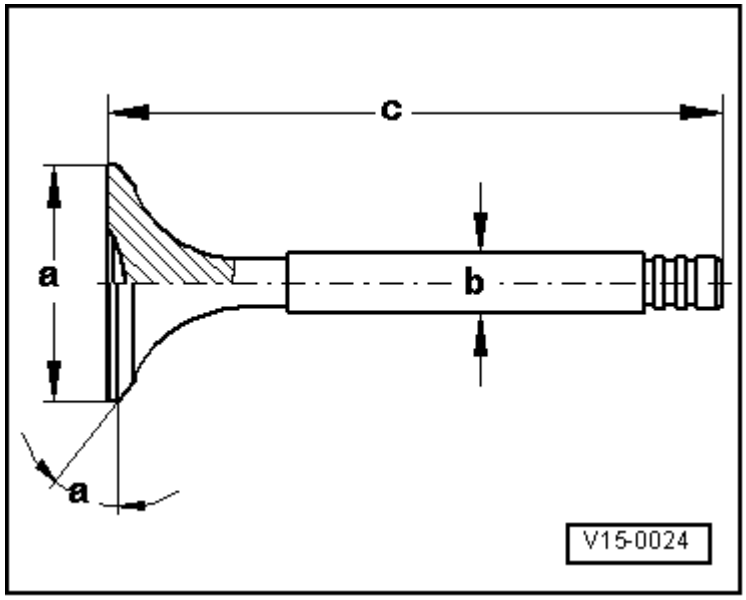

Fig. 7: Identifying Valve Dimensions
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

Dimension		Intake Valve	Exhaust Valve
Diameter a	mm	26.60	26.00
Diameter b	mm	5.940	5.940
c	mm	99.30	99.10
a	Angle°	45	45

FASTENER TIGHTENING SPECIFICATIONS

Component	Fastener Size	Nm
Camshaft Position Sensor to Cylinder Head Bolt	-	10
Camshaft Sprocket to Camshaft Bolt	-	20 + 45°
Coolant Connection to Cylinder Head Bolt	-	10
Fuel Rail to Cylinder Head Cover Bolt	-	22
Heat Shield to Cylinder Head Cover Bolt	-	5
High Pressure Pump Toothed Belt Gear to Hub Bolt (1)	-	20 + 90°
Hub to Camshaft Bolt	-	100
Lifting Eye to Cylinder Head Bolt/Stud Bolt	-	25
Sealing Cap to Cylinder Head Cover Bolt	-	5
Tensioning Plate to Cylinder Head Cover Nut	-	10

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Toothed Belt Tensioner to Cylinder Block Nut	-	20 + 45°
Vacuum Pump to Cylinder Head Bolt	-	10
Vibration Damper to Crankshaft Bolt (1)	-	10 + 90°
(1) Always replace		

- For bolt clarification, refer to -items 14 and 15- in the **TOOTHED BELT OVERVIEW**

Cylinder Head Cover Bolt Tightening Sequence and Specification

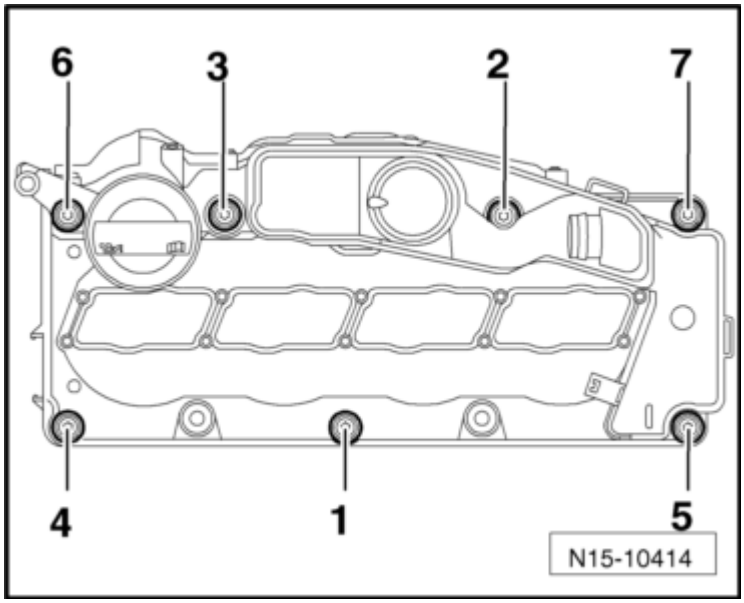

Fig. 8: Identifying Head Cover Bolts -1 Through 7- Tightening Sequence
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Tighten the bolts in sequence -1 through 7- hand tight.

-- Tighten the bolts in sequence -1 through 7- to 10 Nm.

Cylinder Head Bolt Tightening Sequence and Specification

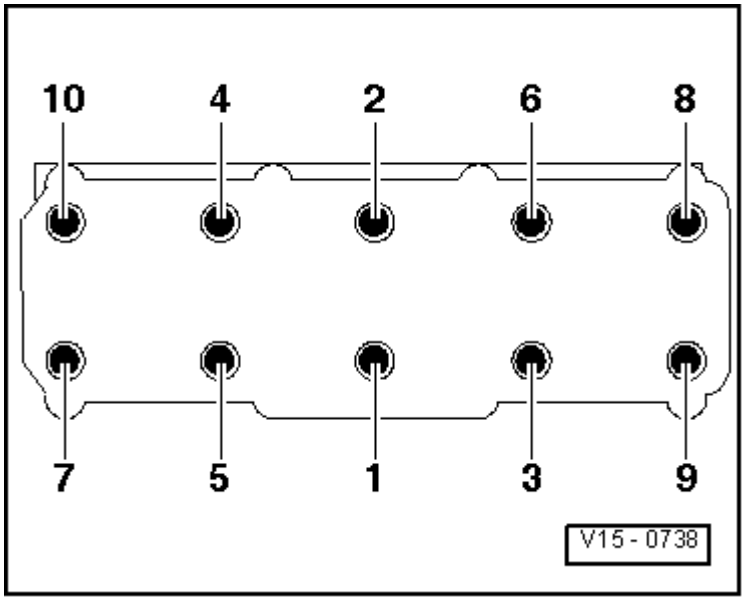

Fig. 9: Identifying Cylinder Head Bolt Tightening Sequence
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

1. **Tighten the bolts using a torque wrench:**

   First pass = 30 Nm

   Second pass = 50 Nm

2. **Tighten the bolts further using a ratchet:**

   Third pass = 90° (1/4) additional turn

   Final pass = 90° (1/4) additional turn

Bearing Frame Bolt Tightening Sequence and Specification

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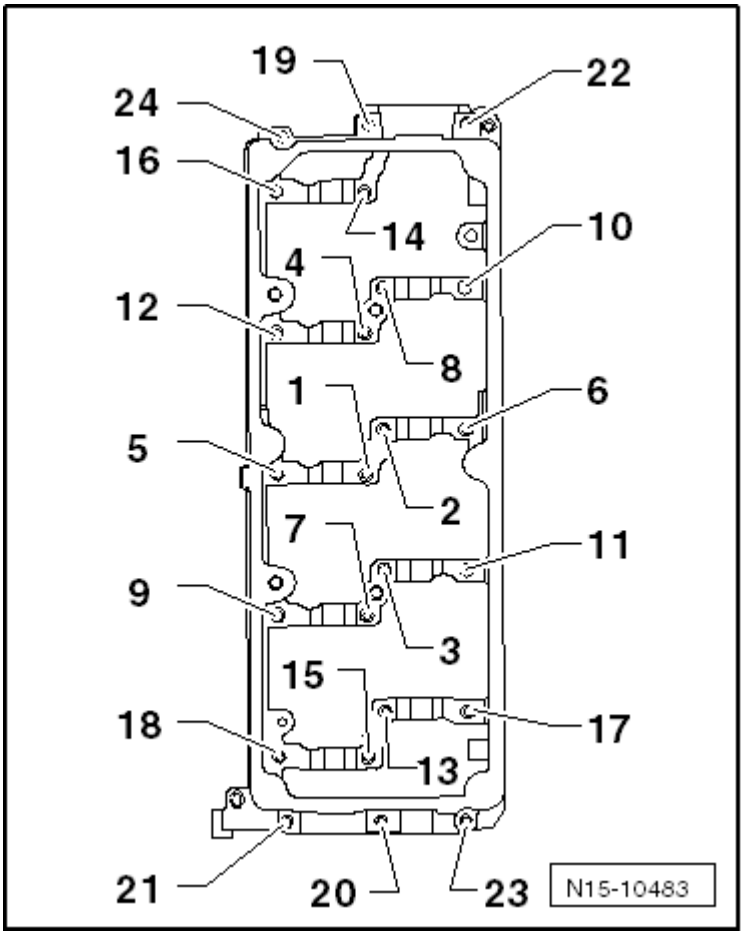

Fig. 10: Identifying Bearing Frame Bolts/Nuts Tightening Sequence
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Tighten the bolts by hand in sequence -1 through 24-.

- The bearing frame must be in contact with the entire contact surface of the cylinder head.

-- Tighten bearing frame bolts in sequence -1 through 24- until they are seated. Tightening specification: 10 Nm

DIAGNOSIS AND TESTING

COMPRESSION TEST

Special tools and workshop equipment required

- Hinged Socket 3220
- Compression Tester V.A.G 1763
- Adapter V.A.G 1763/8
- Torque Wrench (5-50 Nm) V.A.G 1331

Test Conditions:

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- Engine oil temperature is a minimum 30 °C (86 °F).

Test Sequence:

-- Remove the glow plug for each cylinder using the hinged socket 3220. Refer to **GLOW PLUGS** .

-- Install the adapter V.A.G 1763/8 in place of the glow plug.

-- Check the compression pressure using the compression tester V.A.G 1763.

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

-- Start the engine until the tester shows no further pressure increase.

Compression Pressure:

New: 25 to 31 bar excess pressure

Wear limit: 19 bar pressure

Permissible difference between all cylinders: 5 bar

-- Install the glow plugs using the hinged socket 3220. Refer to **GLOW PLUGS** .

-- Check the Engine Control Module (ECM) Diagnostic Trouble Code (DTC) memory. Refer to the vehicle diagnostic tester.

NOTE: By disconnecting the fuel injector connectors, faults will be stored in the ECM. Query the fault memory and erase, if necessary. Refer to the vehicle diagnostic tester.

VALVE GUIDE, CHECKING

Special tools and workshop equipment required

- Dial Gauge Holder VW 387
- Dial Gauge

-- Insert a new valve into the guide. The end of the valve stem must be flush with the guide. Due to the slight difference in stem dimensions, ensure that only an intake valve is used in the intake guide and an exhaust valve in the exhaust guide.

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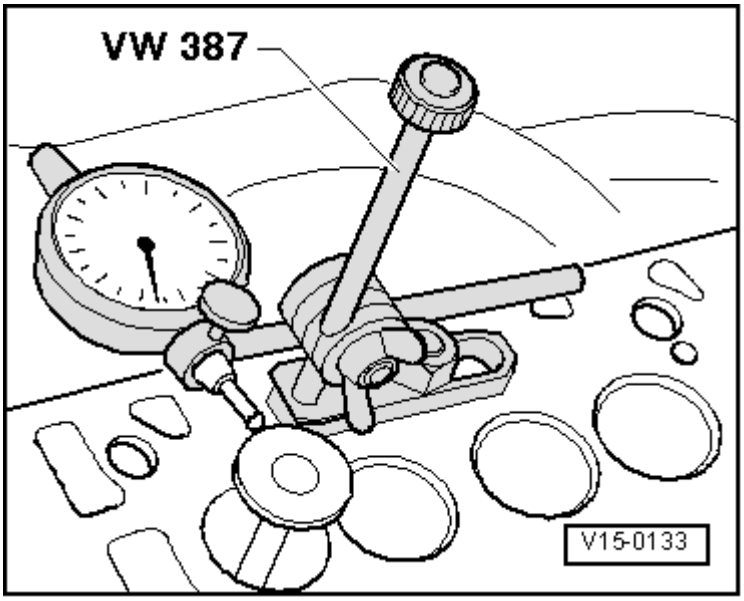

Fig. 11: Identifying Dial Gauge Holder VW 387 To Determine Valve Rock (Wear limit)
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Determine the tilt clearance. Wear limit: maximum 1.3 mm

-- If the tilt clearance exceeds the wear limit, the cylinder head must be replaced.

REMOVAL AND INSTALLATION

Camshaft Position Sensor -G40-

Special tools and workshop equipment required

- Crankshaft Stop T10050
- Special Wrench, Long Reach T10264
- Locking Tool T10265

-- Remove the engine cover. Refer to **ENGINE COVER** .

-- Remove the fuel filter and the auxiliary fuel pump -V393- or fuel pump 2 -V277-. Refer to **Auxiliary Fuel Pump -V393- OR Fuel Pump 2 -V277-** .

-- Disconnect the connector from the engine coolant temperature sensor on radiator -G83-, open the clips - arrows- and remove the toothed belt guard.

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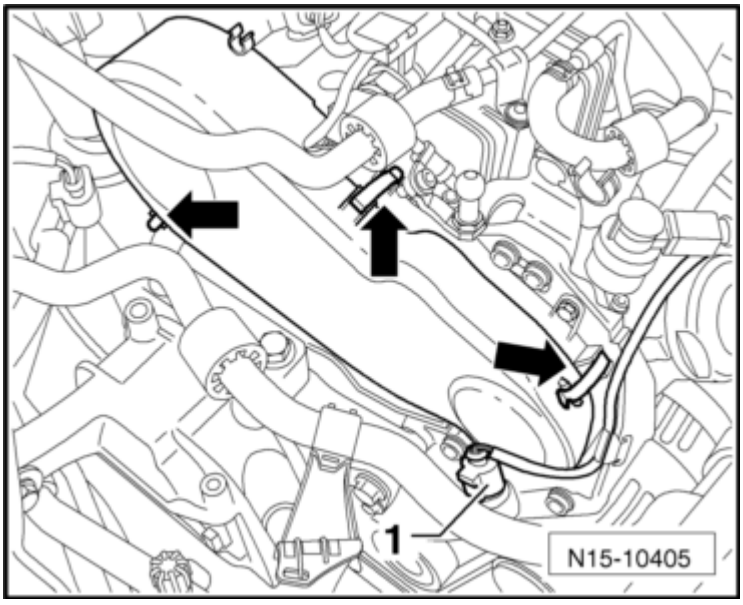

Fig. 12: Identifying Toothed Belt Guard And Clips
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Remove right front wheel housing liner. Refer to **Removal and Installation** .

-- Remove the ribbed belt. Refer to one of the following:

RIBBED BELT (WITH TENSIONER) .

RIBBED BELT (WITH TENSIONING ROLLER) .

-- Remove the vibration damper.

-- Rotate the engine to Top Dead Center (TDC) and secure the crankshaft toothed belt gear using the crankshaft stop T10050. Push the crankshaft stop from the front side of the toothed belt gear into the teeth. The camshaft toothed gear must be in the >>12 o'clock<< position.

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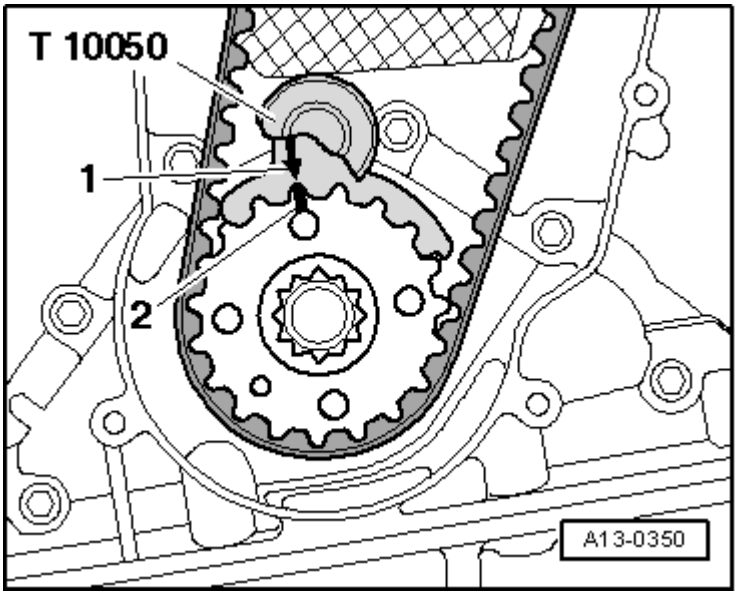

Fig. 13: Identifying Crankshaft Toothed Belt Pulley And Crankshaft Stop T10050
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

NOTE: The marks on the crankshaft toothed belt gear -2- and the crankshaft stop T10050 -1- must align. The pin on the crankshaft stop T10050 must engage in the hole on the sealing flange.

-- Loosen the bolts -1- on the camshaft sprocket.

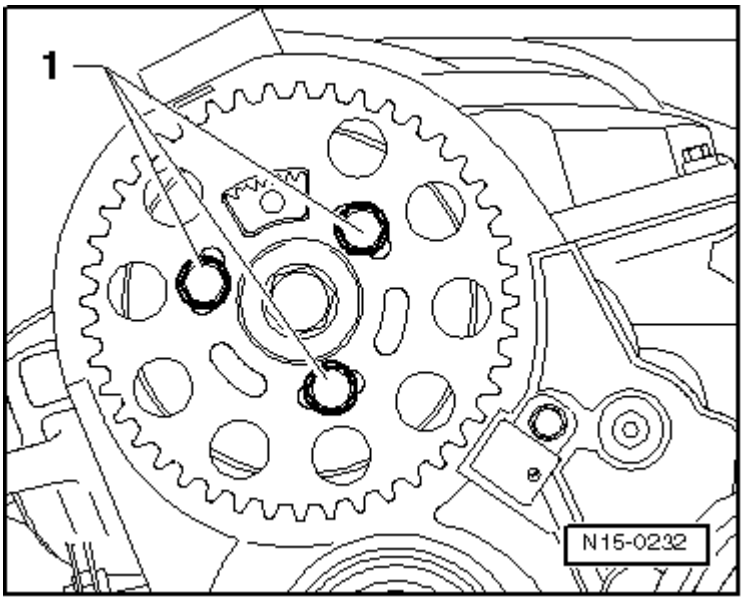

Fig. 14: Identifying Camshaft Pulley Securing Bolts
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Loosen the coolant pipe bolt -1- and then the bolts for the high pressure pump toothed belt gear -2-.

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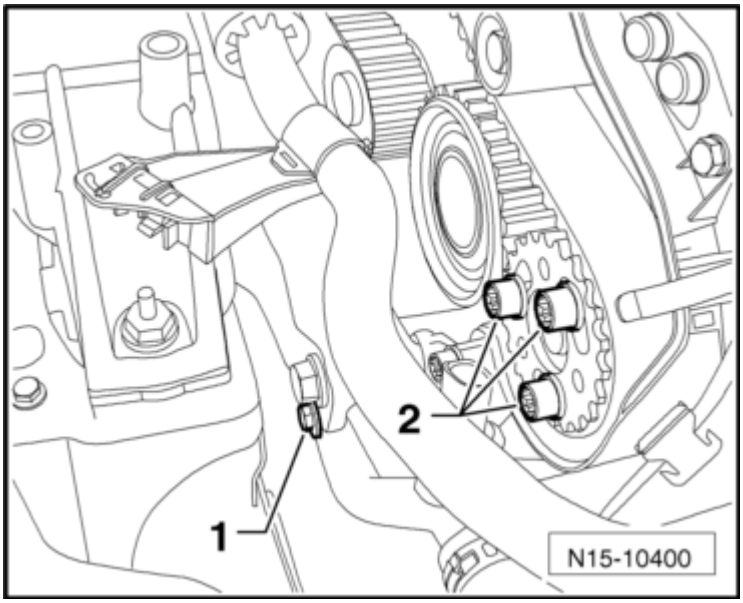

Fig. 15: Identifying Coolant Pipe Bolt -1- And High Pressure Fuel Pump Toothed Belt Gear -2-
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Loosen the nut -1- for belt tensioner.

-- Turn the tensioner eccentric pulley using the special wrench, long reach T10264 counterclockwise -arrow-, until the locking tool T10265 can lock the tensioner.

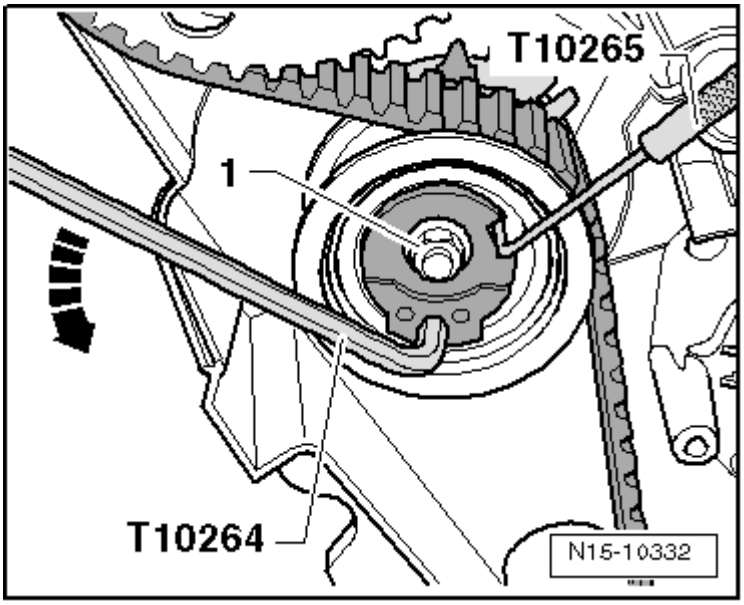

Fig. 16: Identifying Long Reach T10264 And Locking Tool T10265
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Now, turn the tensioner eccentric pulley clockwise -arrow- all the way and tighten the nut -1- by hand.

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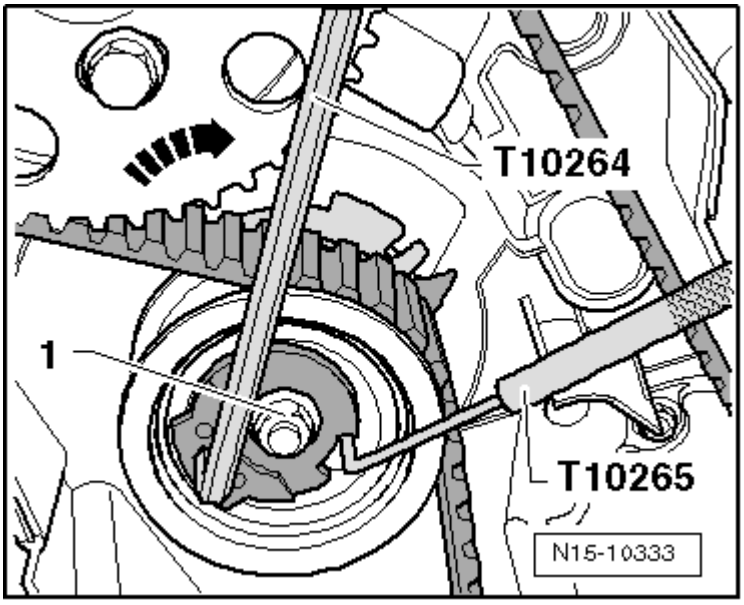

Fig. 17: Identifying Long Reach T10264 And Locking Tool T10265
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Remove the toothed belt from the idler roller and the high pressure pump.

-- Disconnect the camshaft position sensor connector -arrow-.

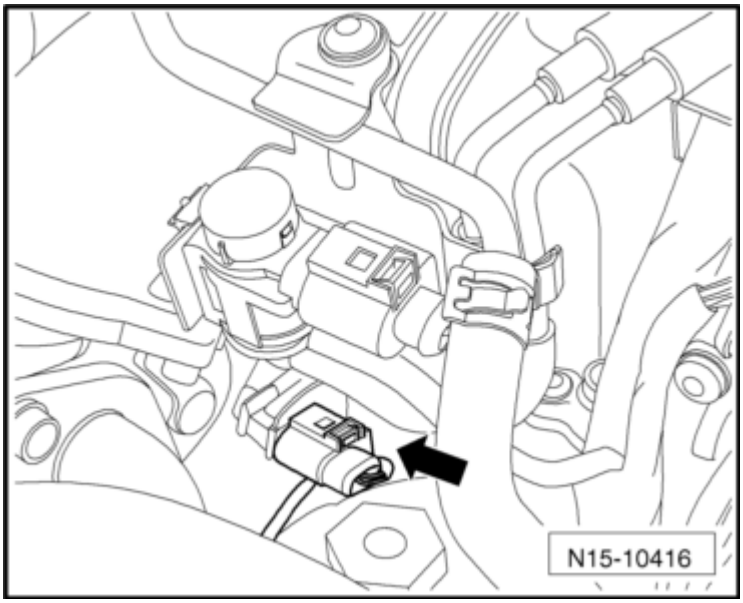

Fig. 18: Identifying Camshaft Position Sensor -G40- Connector -Arrow-
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Remove the connector from the mount.

-- Remove the camshaft position sensor -arrow-.

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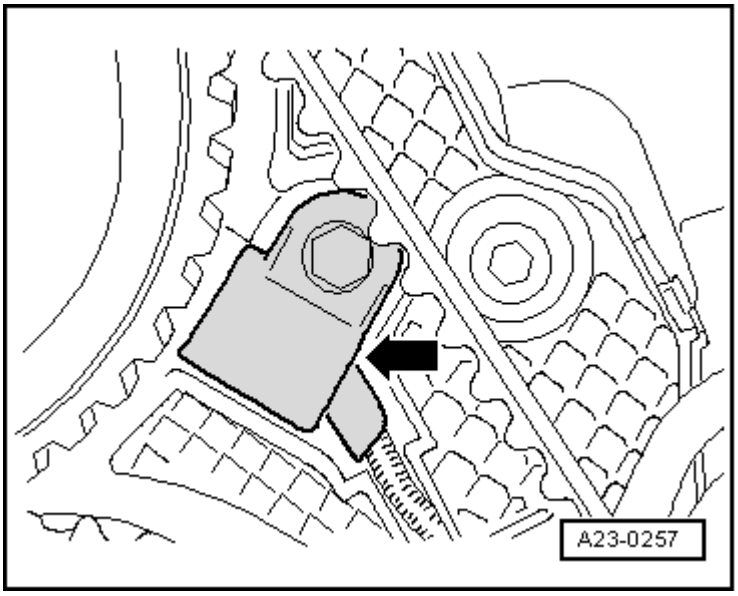

Fig. 19: Identifying Camshaft Position Sensor
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Remove the ribs with a screwdriver and remove the cover for the repair opening -arrows-.

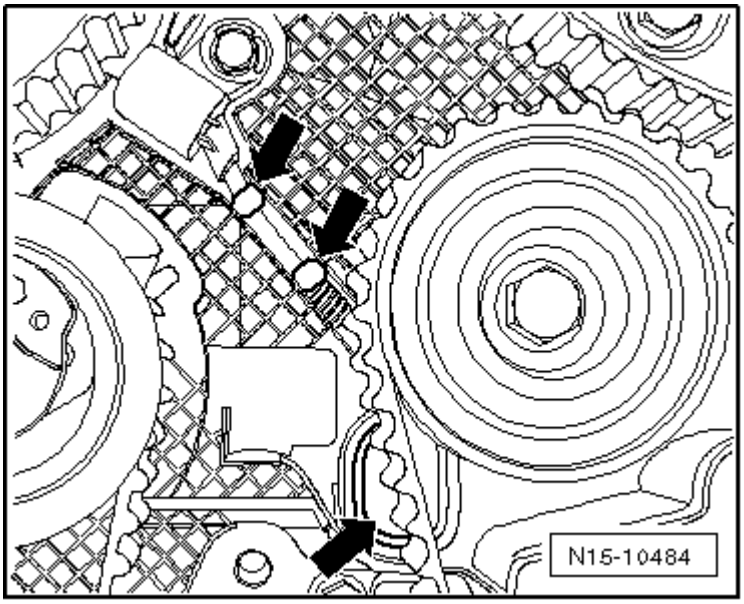

Fig. 20: Identifying Repair Opening -Arrows-
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Remove the camshaft position sensor from the cylinder head and guide the connector through the opening in the toothed belt guard.

Installing

Install in reverse order of removal. When doing this note the following:

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- Seal off the opening in the toothed belt guard with a rubber plug.

-- Adjust the valve timing.

CYLINDER HEAD COVER

Special tools and workshop equipment required

- Torque Wrench (5-50 Nm) V.A.G 1331
- Pliers 3314

Removing

-- Remove the engine cover. Refer to **ENGINE COVER** .

-- Remove the noise insulation from the injectors.

-- Disconnect the connectors from the following components: fuel injectors -A-, exhaust pressure sensor 1 -G450- -B- and fuel rail pressure sensor -C-.

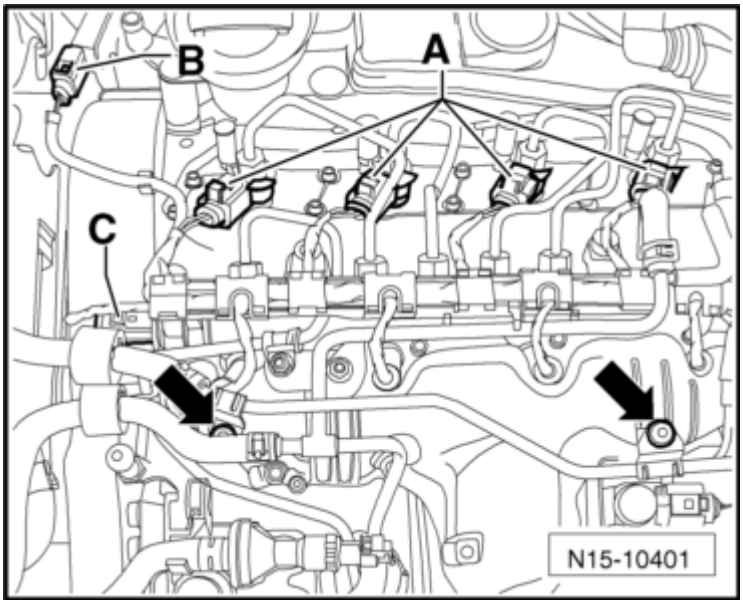

Fig. 21: Identifying Fuel Injectors -A-, Exhaust Pressure Sensor 1 -G450- -B- And Fuel Pressure Sensor -G247- -C-
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Remove the coolant line bolts -arrows- on the intake manifold and lay the line in front of the intake manifold.

CAUTION: Be careful not to damage the wire connection when removing the connectors. Otherwise the whole wiring harness will have to be replaced. Do not squeeze the pliers 3314 too hard when removing the connectors otherwise the protective sleeve will get damaged.

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-- Install the pliers 3314 with the groove -arrow A- on the collar of the protective sleeve -arrow B- and pull the connector off the glow plugs.

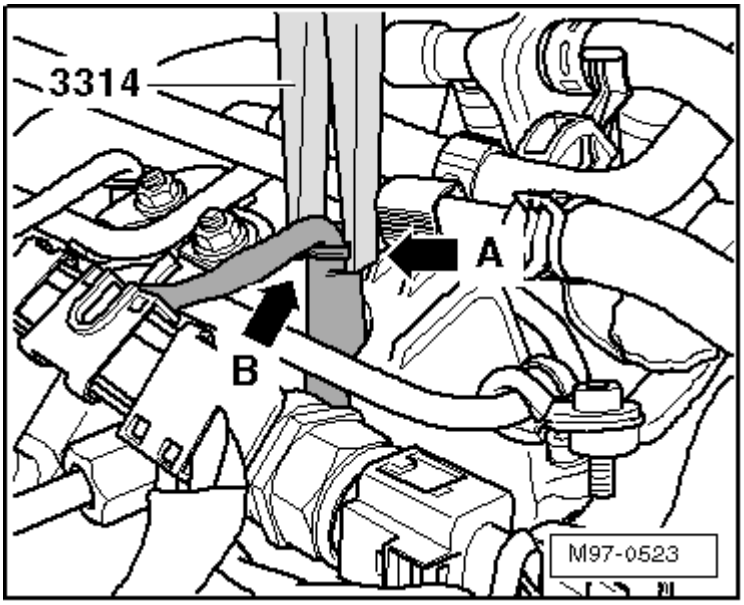

Fig. 22: Identifying Pliers 3314 Positioned With Groove
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Carefully remove the connector in the -direction of the arrow- from the glow plug.

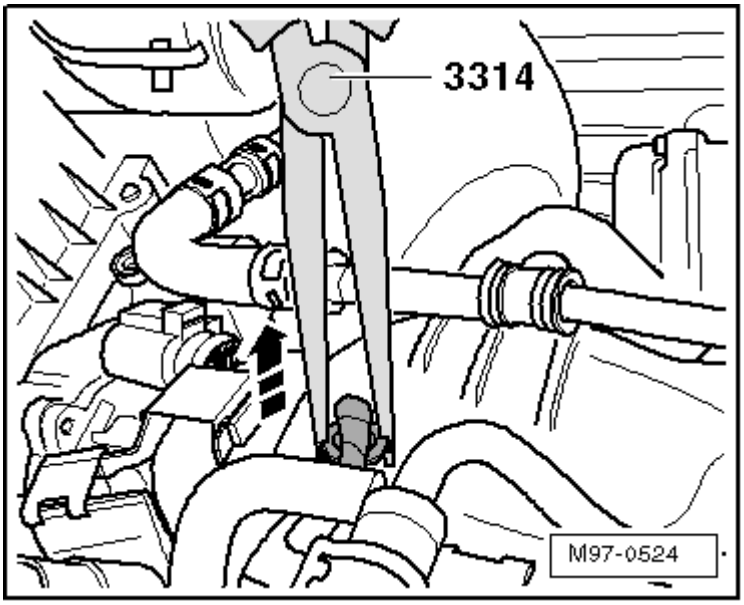

Fig. 23: Identifying Connector Carefully Pulled Off Glow Plug
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Remove the nut on the intake manifold for the fuel return line, open the clamp -arrow- and disconnect the line from the rail.

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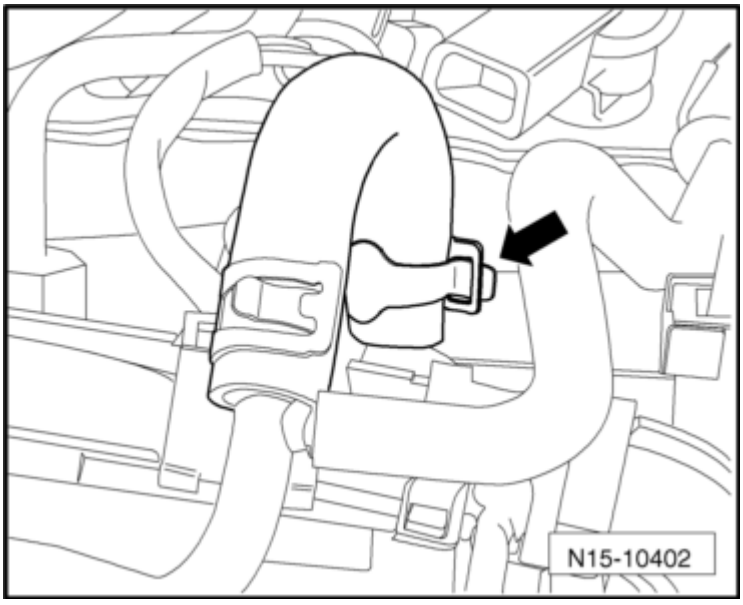

Fig. 24: Identifying Hose Clamp -Arrow-
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Remove the fuel return line connections on the fuel injectors. Press the connection downward and pull the center piece upward.

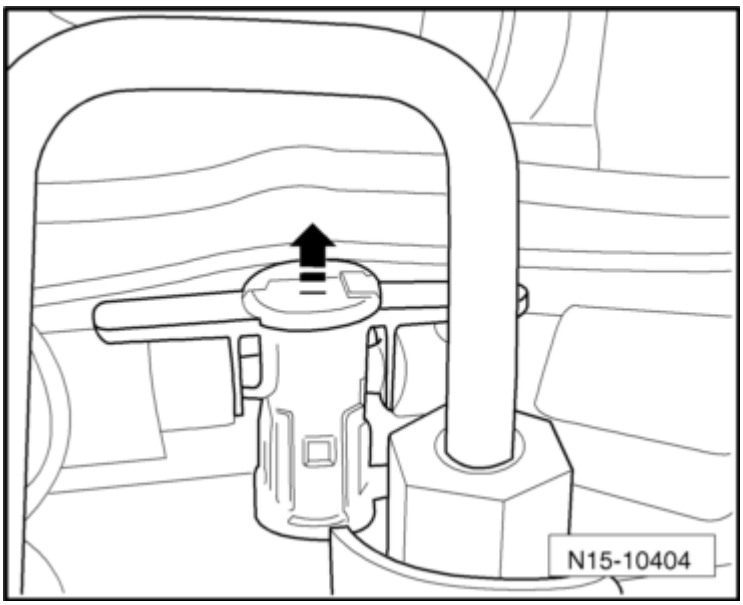

Fig. 25: Identifying Fuel Return Line Connections On Fuel Injectors
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

NOTE: Pay attention to cleanliness. Do not let any dirt to get into the disconnected return lines or into the connections for the fuel injection units.

-- Remove the complete return line and lay it in front of the intake manifold.

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-- Disconnect the connector from the charge pressure actuator position sensor -G581- -arrow- on the turbocharger and guide the wire out of the mounts.

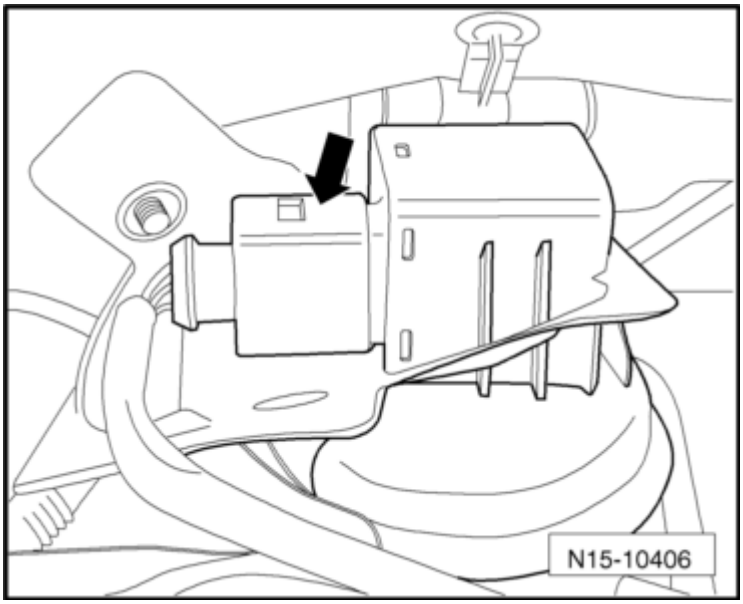

Fig. 26: Identifying Connector To Charge Pressure Actuator Position Sensor -Arrow-
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Disconnect the connector on the fuel pressure regulator valve -N276- -arrow-.

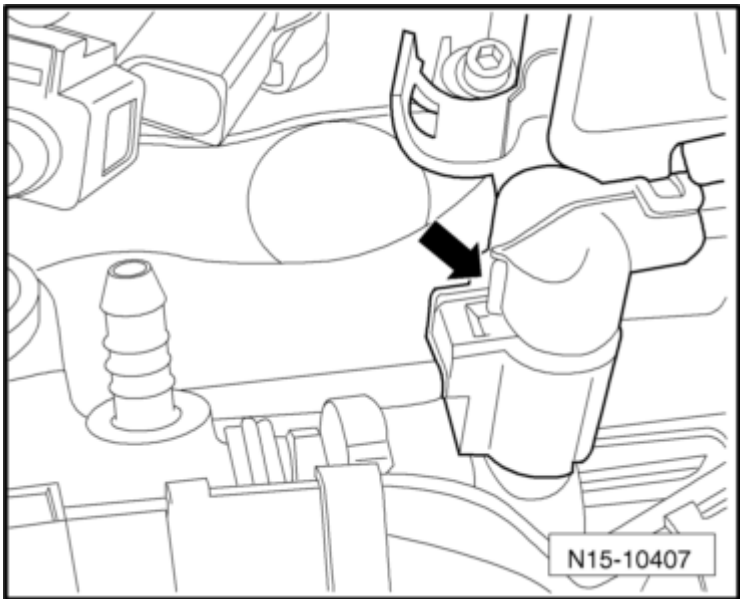

Fig. 27: Identifying Connector To Fuel Pressure Regulator Valve -Arrow-
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Remove the wire guide from the rail and move it to the side.

-- Remove the vacuum line from the cylinder head cover. Remove the remaining vacuum lines from the bracket

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on the cylinder head cover.

-- Remove the upper toothed belt guard.

-- Remove the breather line between the cylinder head cover and the intake hose. To do this press the quick-release fastener together.

-- Remove the high pressure line between the high pressure pump and the rail.

-- Remove the high pressure lines between the rail and the fuel injectors.

-- Remove the bolts -arrows- and remove the fuel rail.

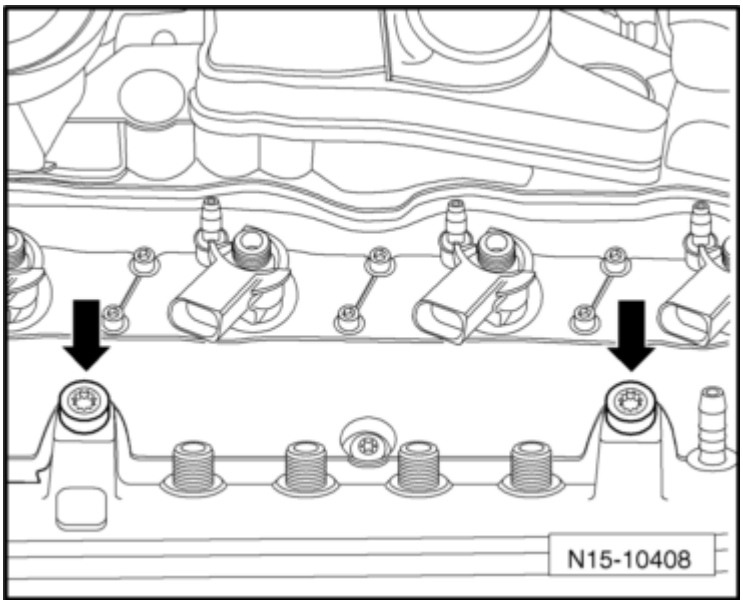

Fig. 28: Identifying Bolts -Arrows- And Fuel Rail
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Remove the fuel injectors. Refer to **FUEL INJECTOR** .

-- Remove the cylinder head cover bolts and remove the cover.

Installing

Install in reverse order of removal. When doing this note the following:

NOTE: Replace the bolt bushings if damaged.

-- Hand tighten the cylinder head cover bolt in sequence -1 through 7-.

-- Tighten the bolts to 10 Nm in sequence -1 through 7-.

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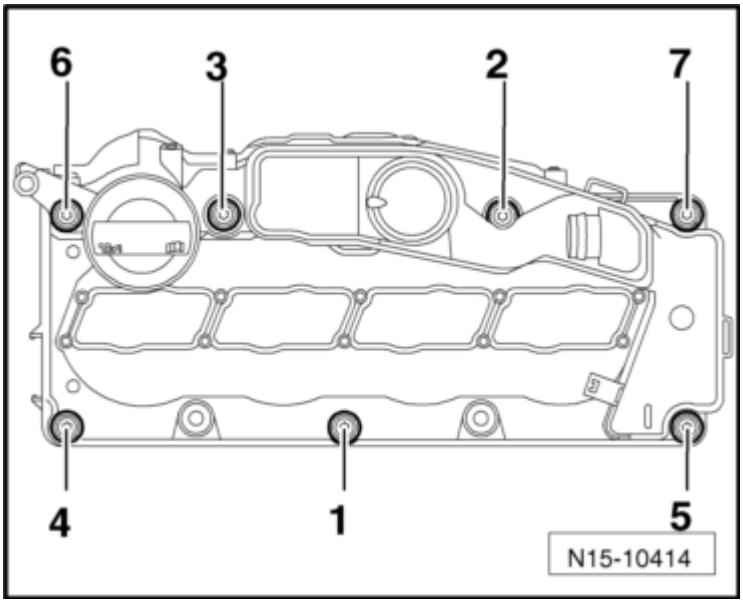

Fig. 29: Identifying Head Cover Bolts -1 Through 7- Tightening Sequence
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Make sure the cylinder head cover is correctly attached to the toothed belt guard.

NOTE: The camshaft sprocket is not shown in the illustration.

-- Press the toothed belt guard in the area with the clips -arrows- against the cylinder head cover until the clips engage with each other. Use a screwdriver to press the guard if necessary.

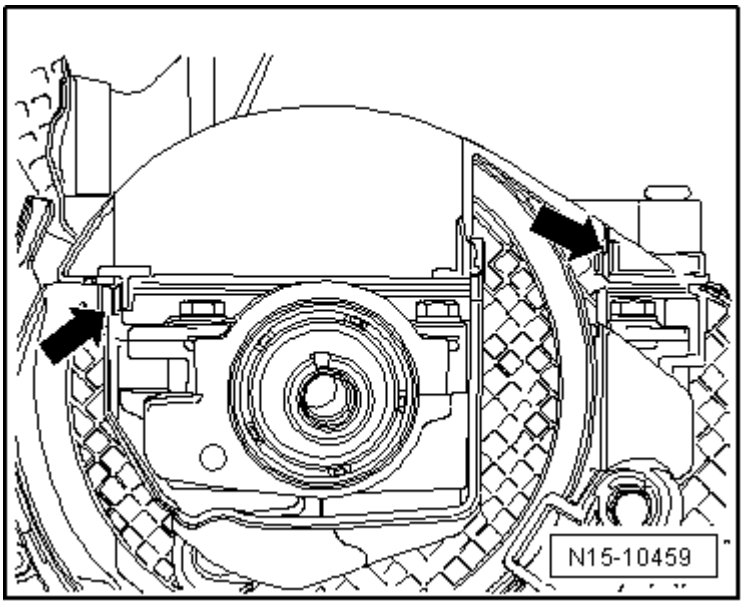

Fig. 30: Identifying Toothed Belt Guard Clips
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Check the clearance between the hub and the toothed belt guard.

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-- Install the high pressure lines. Refer to **HIGH PRESSURE LINES, INSTALLING** .

TOOTHED BELT

Special tools and workshop equipment required

- Diesel Injection Pump Locking Pin 3359
- Crankshaft Stop T10050
- Counterhold Tool V10 T10172 V10 T10172
- Special Wrench, Long Reach T10264
- Locking Tool T10265
- Torque Wrench (5-50 Nm) V.A.G 1331
- Torque Wrench (40-200 Nm) V.A.G 1332

Removing

NOTE: The toothed belt may be adjusted only when the engine is cold because the position of the pointer on the tensioner will change due to the temperature of the engine.

-- Remove the engine cover. Refer to **ENGINE COVER** .

-- Remove the fuel filter and the auxiliary fuel pump -V393- or fuel pump 2 -V277-. Refer to **Auxiliary Fuel Pump -V393- OR Fuel Pump 2 -V277-** .

-- Disconnect the connector from the engine coolant temperature sensor on radiator -G83-, open the clips -arrows- and remove the toothed belt guard.

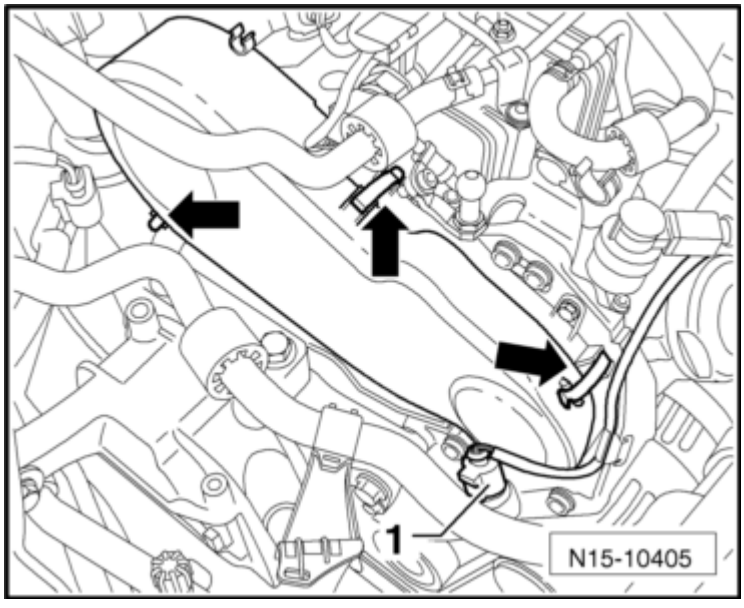

Fig. 31: Identifying Toothed Belt Guard And Clips

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Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Remove the right front wheel housing liner. Refer to **Removal and Installation** .

-- Remove the ribbed belt. Refer to one of the following:

RIBBED BELT (WITH TENSIONER) .

RIBBED BELT (WITH TENSIONING ROLLER) .

-- Remove the vibration damper.

-- Remove the lower and center toothed belt guard bolts -arrows- remove the nut on the coolant pipe -1-.

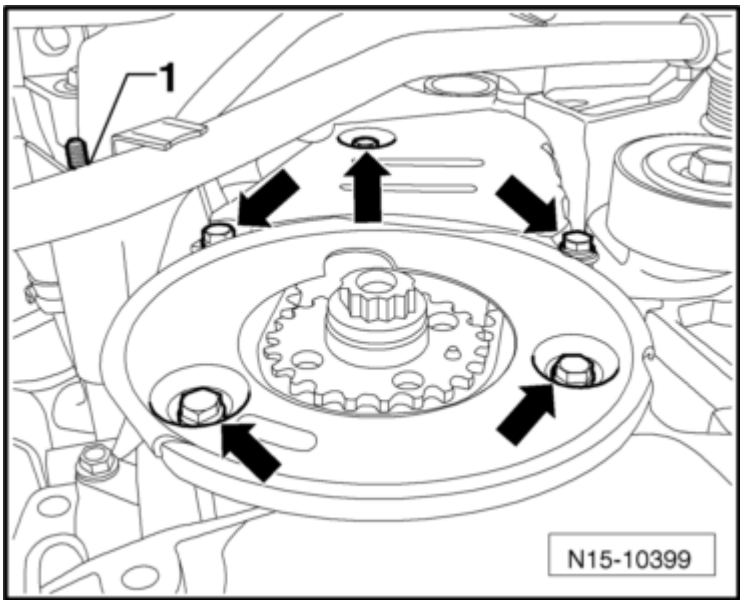

Fig. 32: Identifying Lower And Center Toothed Belt Guard Bolts -Arrows-
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Rotate the engine to Top Dead Center (TDC) and secure the crankshaft toothed belt gear using the crankshaft stop T10050. Push the crankshaft stop from the front side of the toothed belt gear into the teeth. The camshaft toothed gear must be in the >>12 o'clock<< position.

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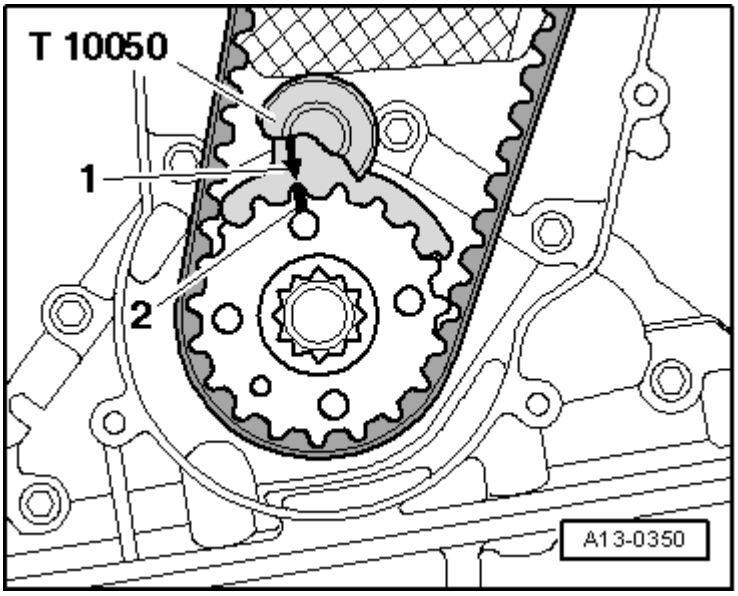

Fig. 33: Identifying Crankshaft Toothed Belt Pulley And Crankshaft Stop T10050
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

NOTE: The marks on the crankshaft toothed belt gear -2- and the crankshaft stop T10050 -1- must align. The pin on the crankshaft stop T10050 must engage in the hole on the sealing flange.

-- Mark the rotational direction of the toothed belt.

-- Loosen the bolts -1- for the camshaft sprocket.

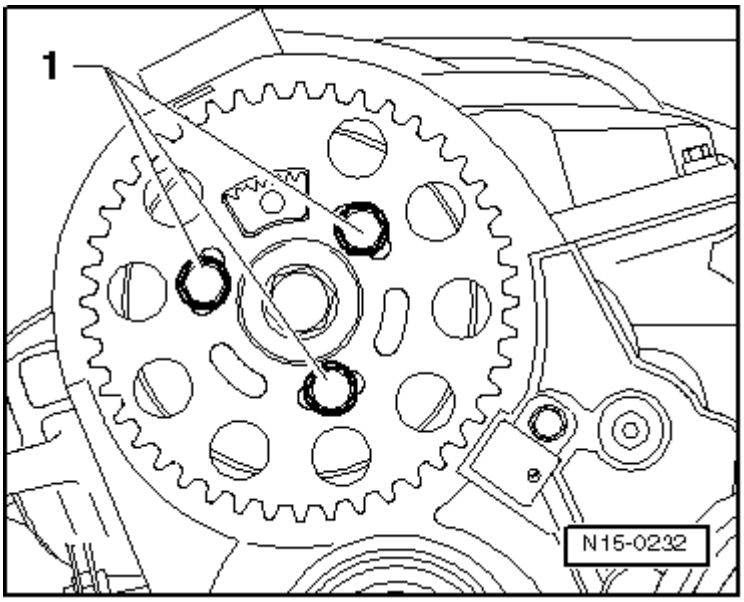

Fig. 34: Identifying Camshaft Pulley Securing Bolts
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

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-- Loosen the coolant pipe bolt -1- and then the bolts for the high pressure pump toothed belt gear -2-.

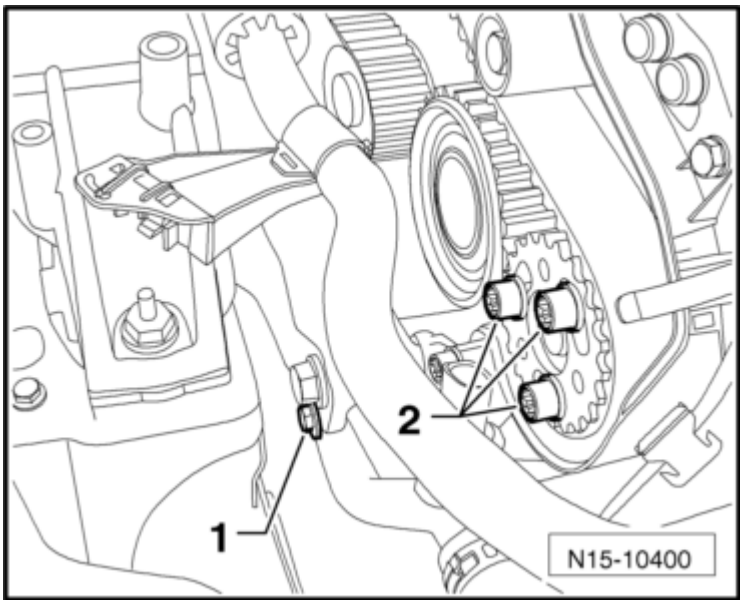

Fig. 35: Identifying Coolant Pipe Bolt -1- And High Pressure Fuel Pump Toothed Belt Gear -2-
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Loosen the nut -1- on the belt tensioner.

-- Turn the tensioner eccentric pulley using the special wrench, long reach T10264 counterclockwise -arrow-, until the locking tool T10265 can lock the tensioner.

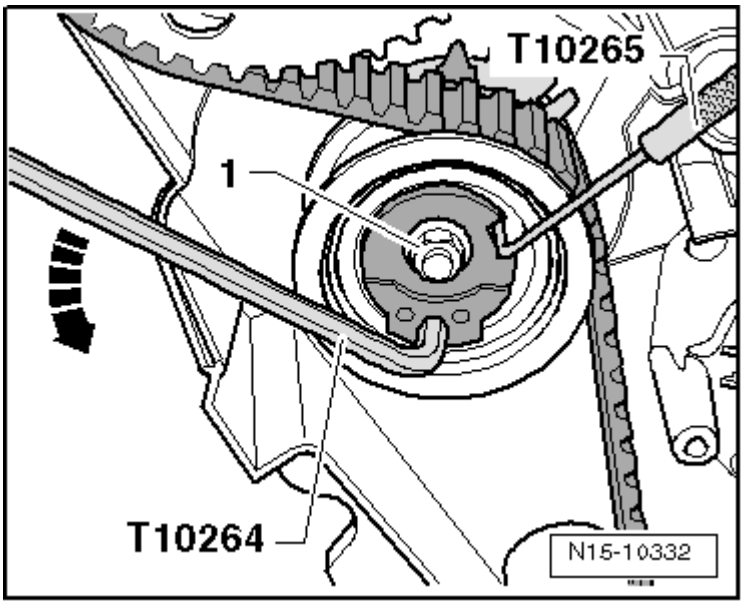

Fig. 36: Identifying Long Reach T10264 And Locking Tool T10265
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Now, turn the tensioner eccentric pulley clockwise -arrow- all the way and tighten the nut -1- by hand.

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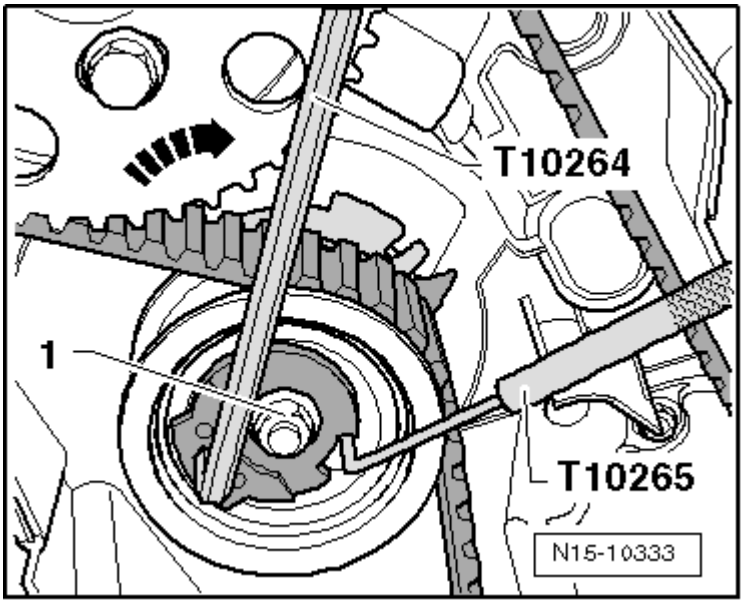

Fig. 37: Identifying Long Reach T10264 And Locking Tool T10265
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- First, remove the toothed belt from the idler pulley and then from the remaining sprockets/gears.

Installing

NOTE: The toothed belt may be adjusted only when the engine is cold because the position of the pointer on the tensioner will change due to the temperature of the engine.

The engine mount bracket must be removed in order to replace the tensioner. Refer to ENGINE MOUNT AND BRACKET .

Replace the bolts for the camshaft and high pressure pump gears.

- The locking tool T10265 must be inserted in the tensioner and the roller must be secured on the right stop.
- Secure the crankshaft using the crankshaft stop T10050.

NOTE: Rotate the camshaft hub using the counterhold tool V10 T10172 and adapters T10172/4 until it can be secured in place. Use at least one bolt -1- tightened by hand to do that.

-- Secure the camshaft hub using the diesel injection pump locking pin 3359. To do this, push the pin through the empty outer slot and into the cylinder head bore.

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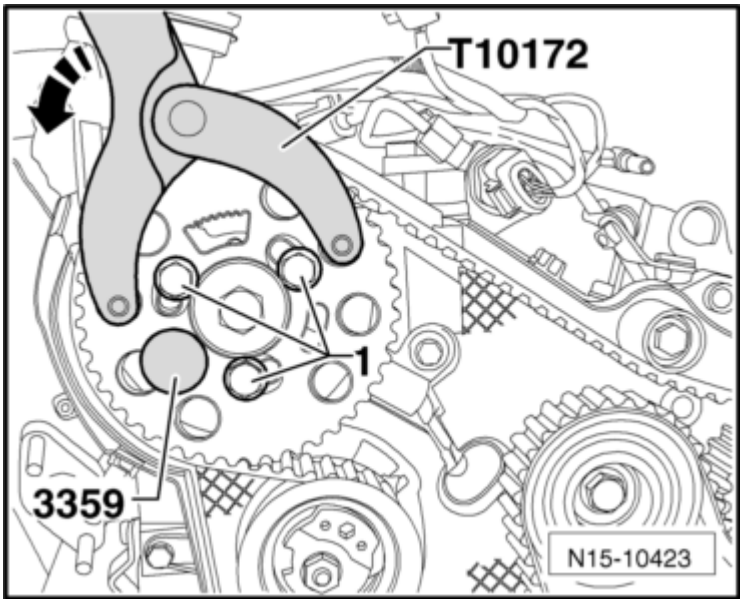

Fig. 38: Identifying T10172 Pushed In -Direction Of Arrow- And Bolts -1-
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Loosen the bolts, which were tightened hand tight.

NOTE: If necessary, rotate the high pressure pump hub with a screwdriver at the bolt heads until it can be secured.

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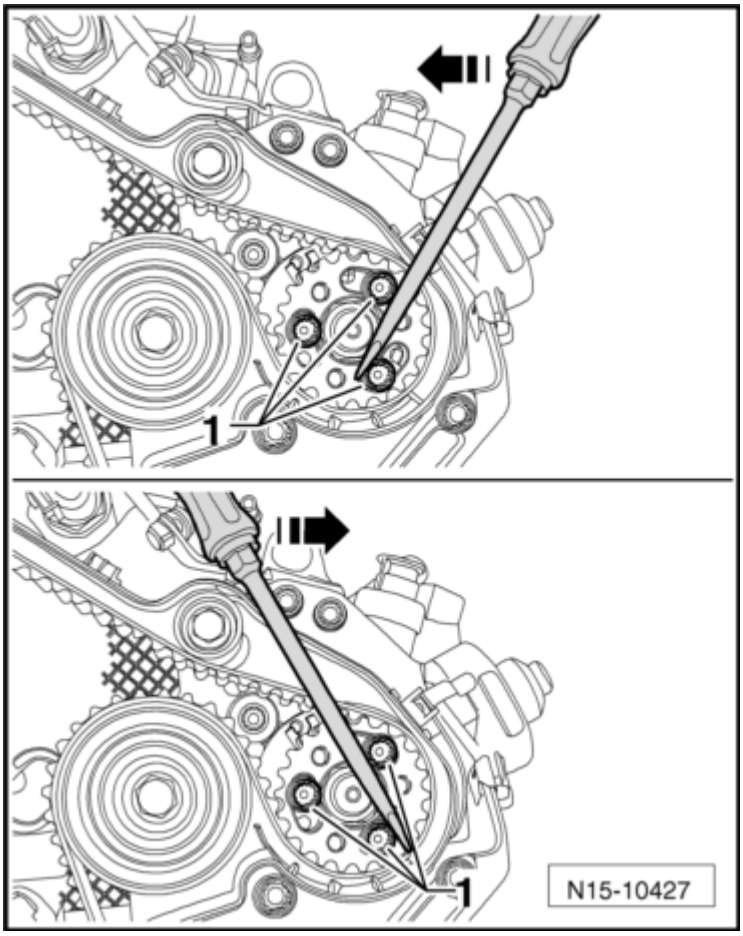

Fig. 39: Identifying Screwdriver Secured At Bolt Heads -1-
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Secure the high pressure pump hub with the diesel injection pump locking pin 3359. To do that, slide the pin into the hole outside the toothed belt gear.

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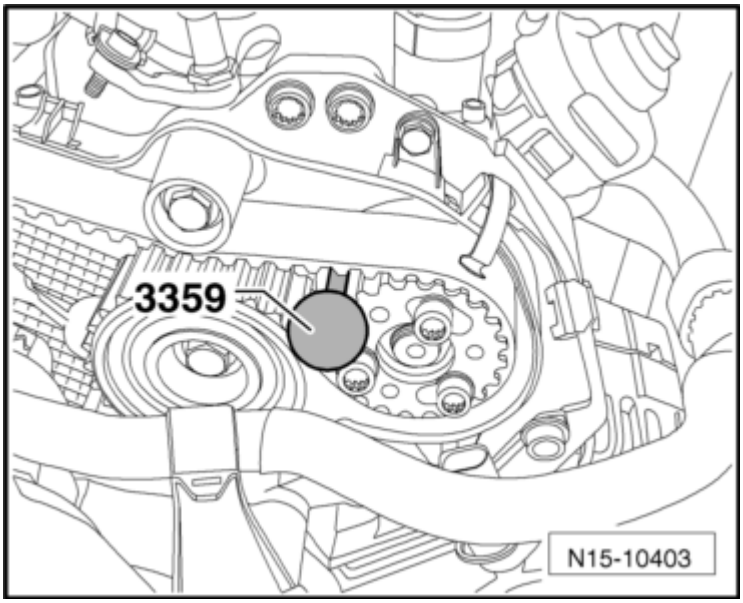

Fig. 40: Identifying Diesel Injection Pump Locking Pin 3359
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Rotate the camshaft sprocket and high pressure toothed belt gear clockwise in their slots as far as the stop.

-- Install the toothed belt on the crankshaft gear, the camshaft sprocket, coolant pump toothed belt gear and the high pressure toothed belt gear.

-- Lay the toothed belt on the tensioner last.

-- Loosen the tensioner nut and remove the locking tool T10265.

NOTE: Make sure the tensioner is properly positioned in the rear toothed belt guard -arrow-.

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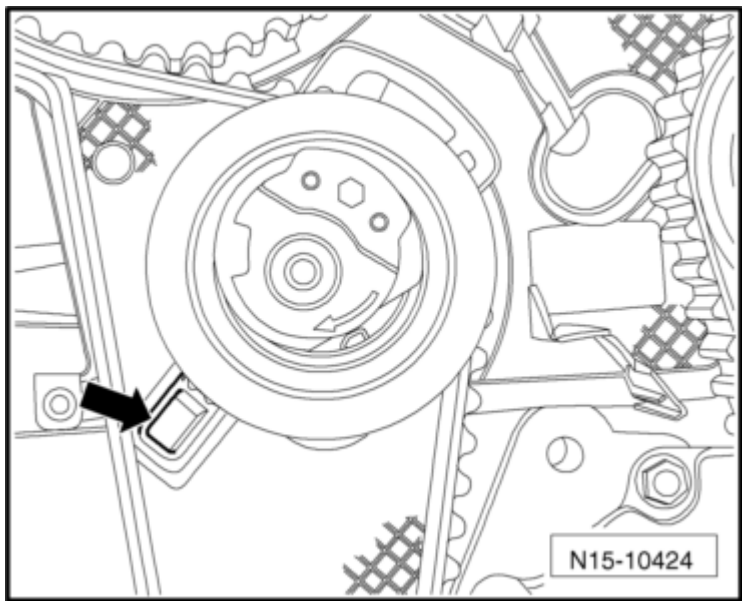

Fig. 41: Identifying Tensioner Positioned In Rear Toothed Belt Guard -Arrow-
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Carefully turn the tensioner eccentric pulley clockwise using the special wrench, long reach T10264. The pointer -2- must be somewhat above the center of the gap in the base plate. This will be corrected when pre-tensioning.

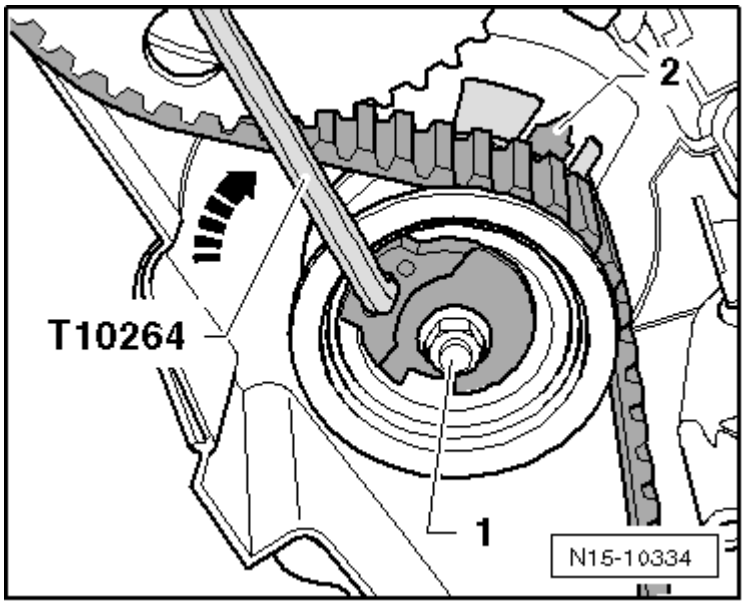

Fig. 42: Identifying Long Reach T10264 And Nut -1-
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

Make sure the nut -1- does not rotate with it.

-- Hold the tensioner in this position and tighten the nut as follows: Continue turning at 20 Nm and 45° (1/8) additional turn.

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-- Position the counterhold tool V10 T10172 as illustrated. Push the counterhold tool V10 T10172 in the -direction of the arrow- and hold the camshaft sprocket pre-tensioned.

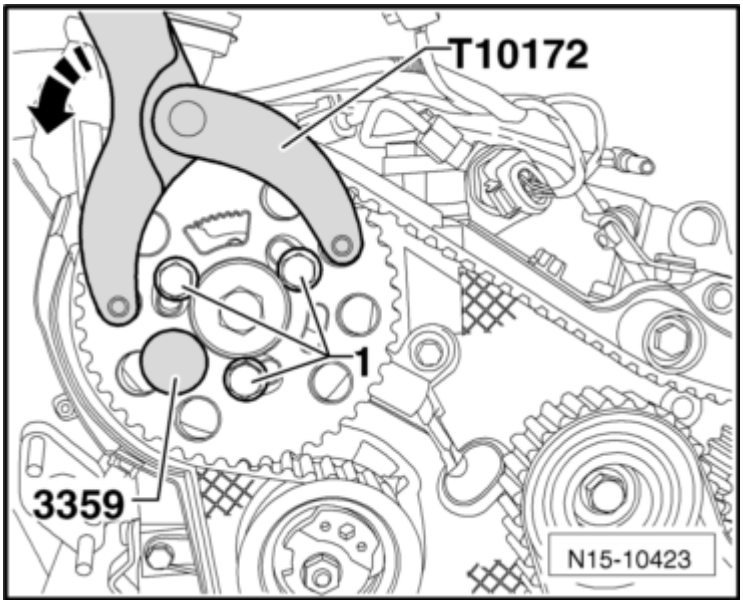

Fig. 43: Identifying T10172 Pushed In -Direction Of Arrow- And Bolts -1-
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- First, tighten the bolts -1- for the camshaft sprocket and for the high pressure pump belt gear hand-tight. Then tighten them again to 20 Nm.

-- Remove the diesel injection pump locking pin 3359 and the crankshaft stop T10050.

-- Rotate the crankshaft 2 turns further in engine rotation direction and just up to TDC for cylinder 1.

-- Position the crankshaft stop T10050 on the crankshaft toothed belt gear again.

-- Now, rotate the crankshaft in engine rotation direction until the crankshaft stop tab -arrow- engages the sealing flange.

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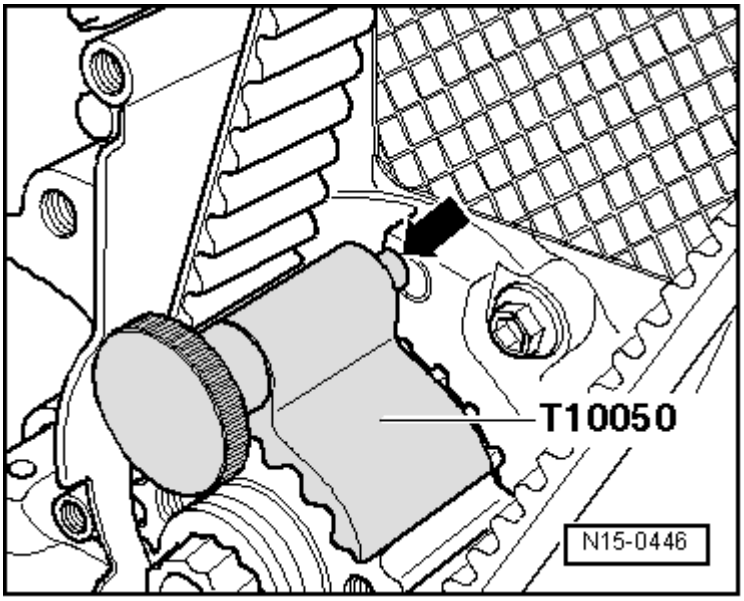

Fig. 44: Identifying Crankshaft Stop T10050
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

NOTE: In the following check, only the camshaft and crankshaft are secured. The peg position for the high pressure pump hub is very difficult to find again. A small deviation -arrow- does not affect engine operation.

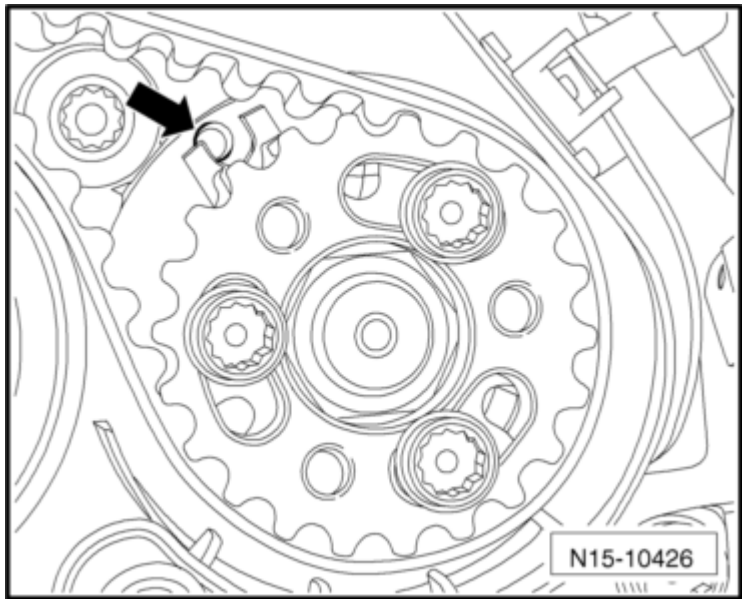

Fig. 45: Identifying Small Deviation -Arrow- On High Pressure Fuel Pump Hub
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Check if:

- The camshaft hub can be secured using the diesel injection pump locking pin 3359.

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- The pointer on the tensioner points to the center or a maximum of 5 mm to the right of the gap in the base plate.

If the camshaft hub cannot be secured:

-- Pull the crankshaft stop T10050 toward the back until the tab exits the hole.

-- Rotate the crankshaft opposite the engine rotation direction until it is slightly past TDC.

-- Now, rotate the crankshaft slowly in engine rotation direction until the camshaft hub can be secured.

-- After securing, loosen the bolts on the camshaft toothed belt gear.

If the crankshaft stop T10050 tab is to the left of the hole:

-- Rotate the crankshaft in engine rotation direction until the crankshaft stop tab engages the sealing flange.

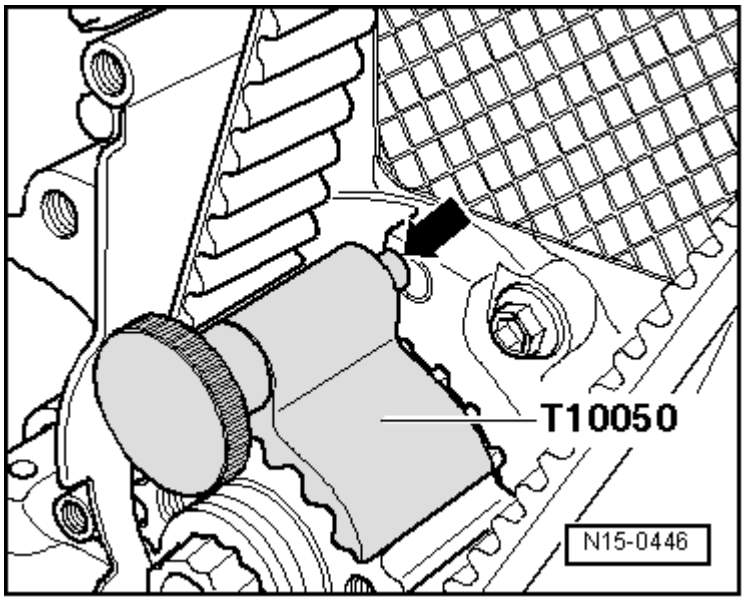

Fig. 46: Identifying Crankshaft Stop T10050
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Tighten the bolts for the camshaft toothed belt gear hand tight. Then tighten them to 20 Nm.

If the crankshaft stop T10050 tab is to the right of the hole:

-- Rotate the crankshaft slightly opposite of engine rotation direction.

-- Now, turn the crankshaft in engine rotation direction until the crankshaft stop tab engages the sealing flange.

-- Tighten the bolts for the camshaft toothed belt gear hand tight. Then tighten them to 20 Nm.

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Continuation:

-- Remove the diesel injection pump locking pin 3359 and the crankshaft stop T10050.

-- Rotate the crankshaft 2 turns further in engine rotation direction and just up to TDC for cylinder 1.

-- Check again.

-- Now it must be possible to install the camshaft hub. If so, tighten the bolts as follows:

- Camshaft sprocket: Tighten the bolts an additional 45° (1/8) turn. Counter hold using the counterhold tool V10 T10172 and adapters T10172/4.
- High pressure pump toothed belt gear: Tighten the bolts an additional 90° (1/4) turn. Counter hold using the counterhold tool V10 T10172 and adapters T10172/8.

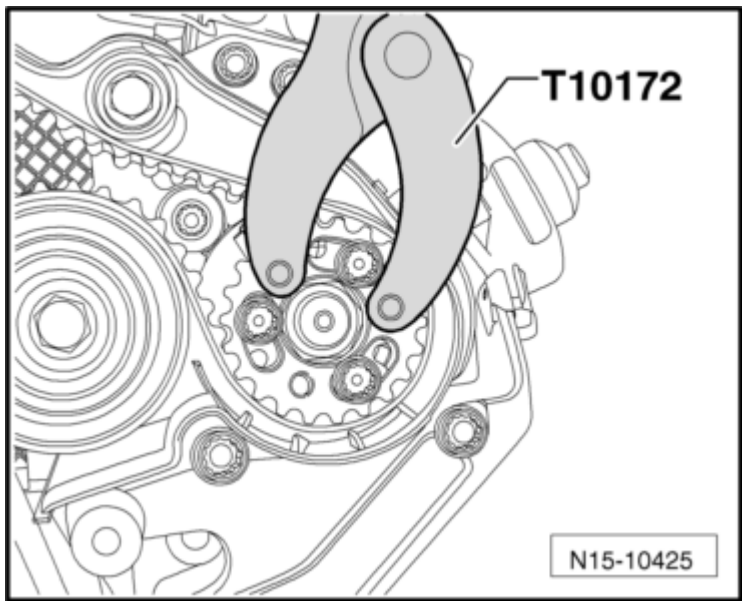

Fig. 47: Identifying Counterhold Tool V10 T10172 V10 T10172
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Install the lower and center toothed belt guard.

-- Install the vibration damper: Tightening specification: 10 Nm + an additional 90° (1/4) turn.

-- Install the ribbed belt. Refer to one of the following:

RIBBED BELT (WITH TENSIONER) .

RIBBED BELT (WITH TENSIONING ROLLER) .

-- Install the upper toothed belt guard.

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Further installation is in reverse order of removal. When doing this note the following:

- Make sure the fuel hoses are secure.
- Do not interchange the supply and return lines (the return line is blue or has a blue mark, the supply line is white).

-- Install the wheel housing liner.

-- Install the noise insulation. Refer to **Description and Operation** .

CYLINDER HEAD

Special tools and workshop equipment required

- Guide Pins & Handle 1112 mm3070
- Diesel Injection Pump Locking Pin 3359
- Crankshaft Stop T10050
- Camshaft Gear Counter-Hold T10051
- Puller T10052
- Socket Insert XZN 10 T10385
- Torque Wrench (5-50 Nm) V.A.G 1331
- Torque Wrench (40-200 Nm) V.A.G 1332
- Drip Tray for VAS 6100 VAS 6208

NOTE: Be sure to get the radio anti-theft code because it will be necessary to disconnect the battery ground cable later in the procedure.

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

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

- **Route all wires and lines so that the original path is followed.**
- **Ensure sufficient clearance to all moving or hot components.**

Removing

-- Disconnect the battery Ground (GND) strap with the ignition turned off. Refer to **Removal and Installation**

-- Remove the engine cover. Refer to **ENGINE COVER** .

-- Remove the air filter housing. Refer to **AIR FILTER HOUSING OVERVIEW** .

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-- Remove the battery and the battery tray. Refer to **Removal and Installation** .

-- Remove the fan shroud and fans. Refer to **FAN SHROUD AND FANS** .

-- Remove the cold side charge air hose from the charge air cooler.

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

-- Remove the toothed belt from the camshaft. Refer to **TOOTHED BELT**.

-- Disconnect the connectors from the EGR vacuum regulator solenoid valve -N18- -1- and the throttle valve control module -J338- -3-.

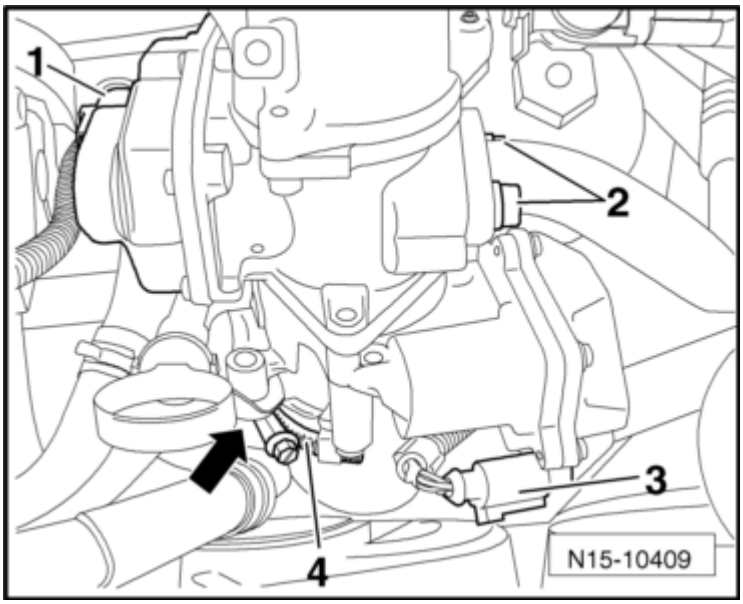

Fig. 48: Identifying Connectors
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Remove the bolts from the oil dipstick connection -arrow- and from the EGR connecting pipe -2-.

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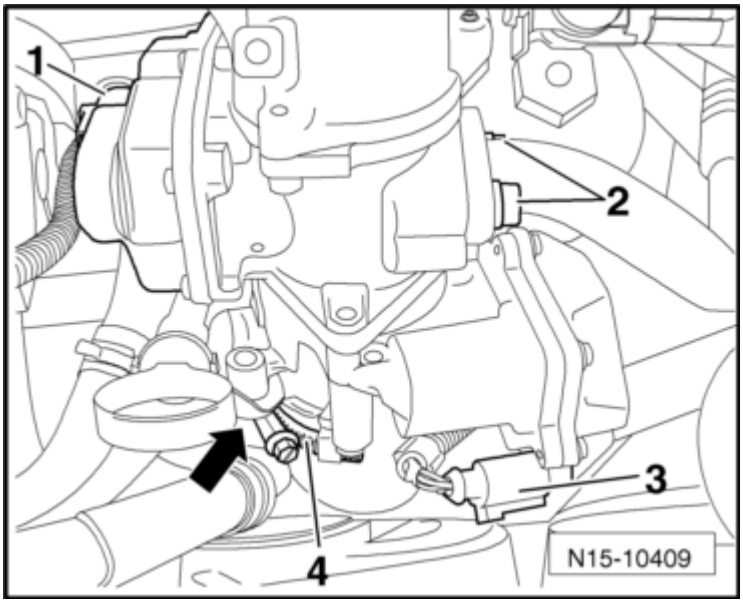

Fig. 49: Identifying Connectors
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Remove the bolts -arrows- from the charge air pipe and then disconnect the connector -1- from the charge air pressure sensor -G31-.

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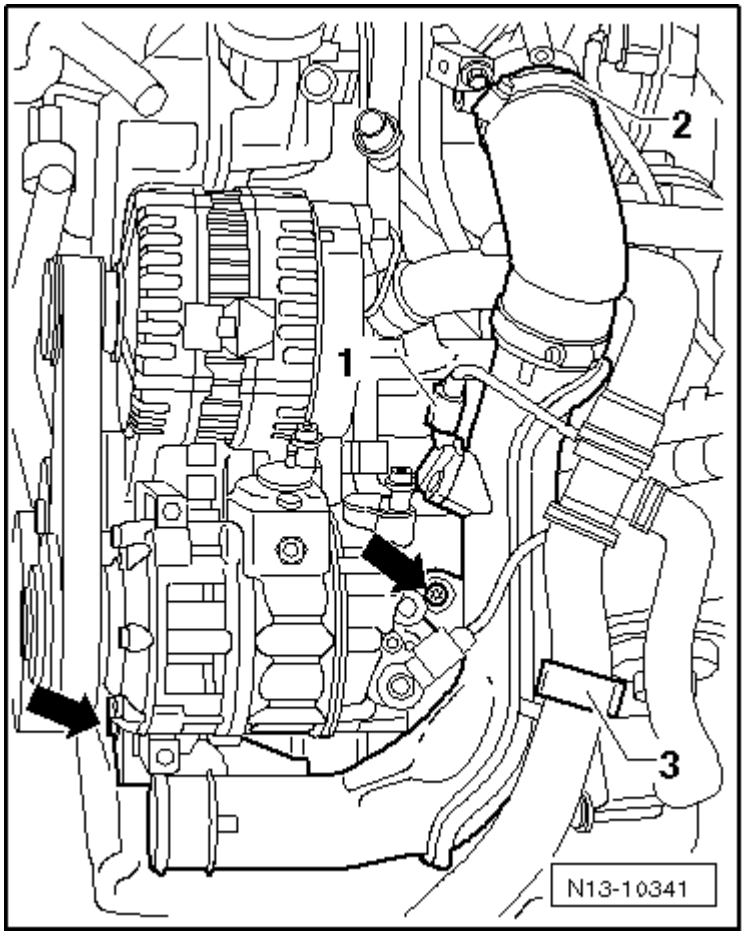

Fig. 50: Identifying Connector -1-, Clamp -2 And Coolant Hose -3-
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Open the clamp -2-, free up the coolant hose -3- and remove the charge air pipe.

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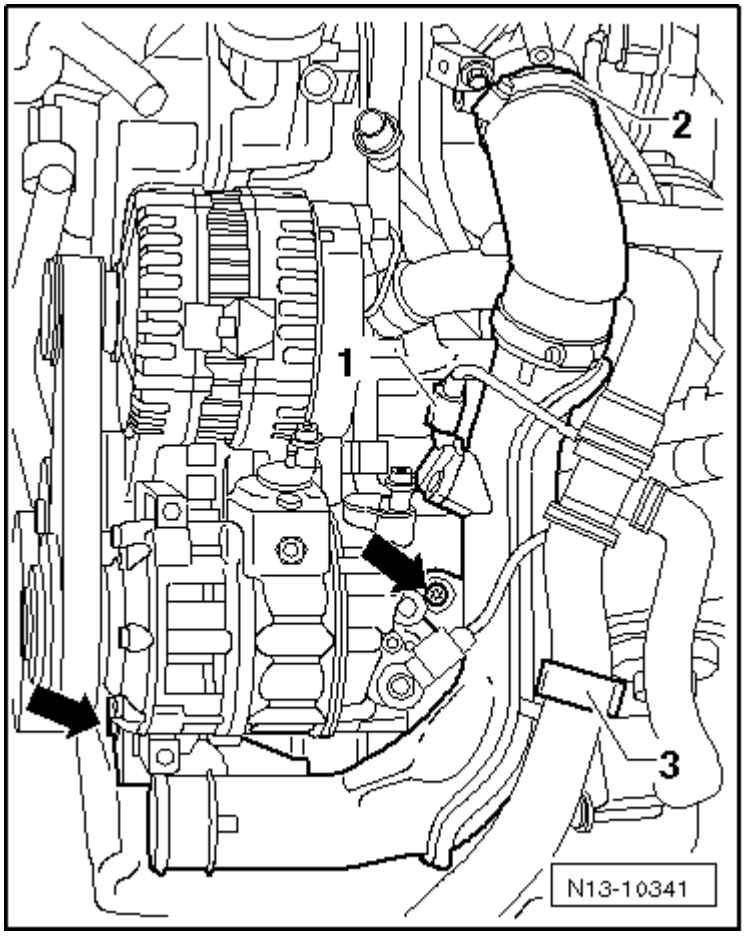

Fig. 51: Identifying Connector -1-, Clamp -2 And Coolant Hose -3-
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Disconnect the vacuum line from the vacuum pump.

-- Remove the engine wiring from the bracket -arrow-.

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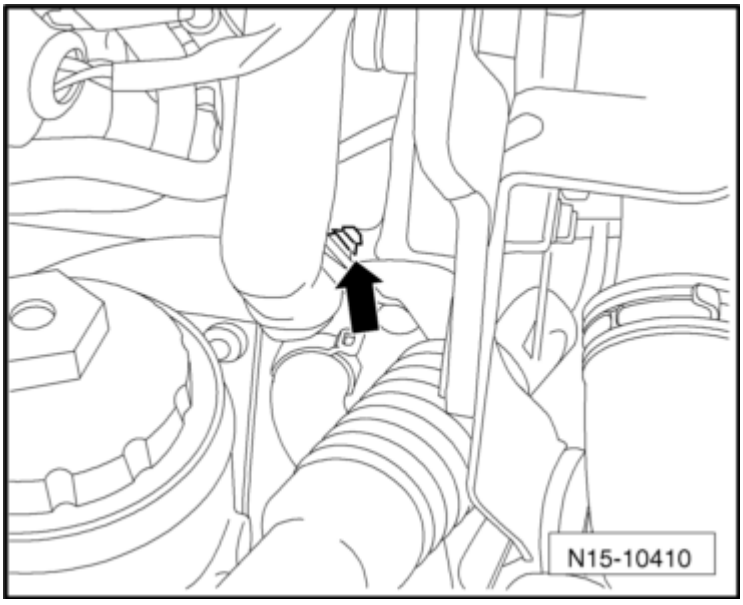

Fig. 52: Identifying Vacuum Line
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Disconnect the vacuum line -arrow-.

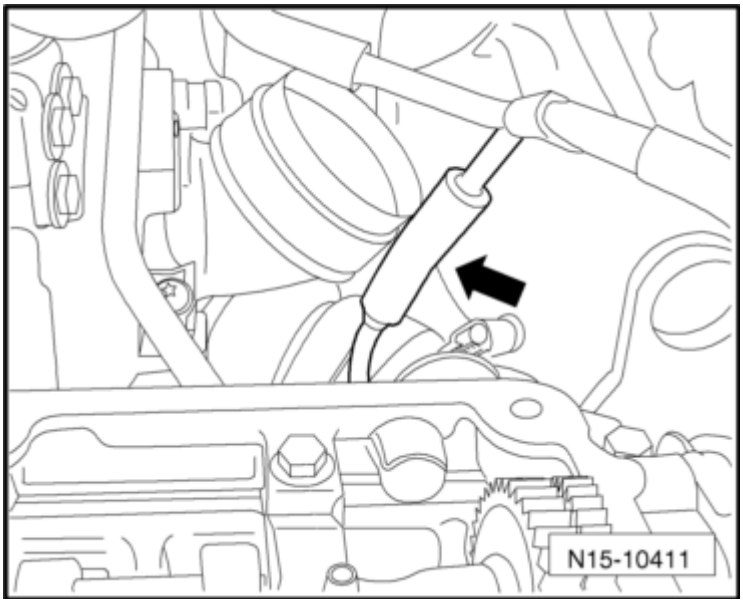

Fig. 53: Identifying Vacuum Line
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Remove the vacuum line connection -arrow-.

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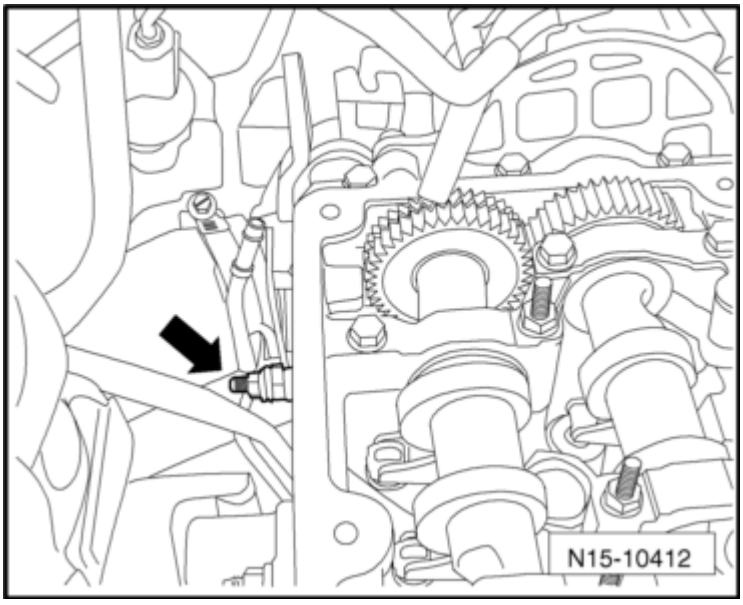

Fig. 54: Identifying Vacuum Line Connection
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Remove the bolts from the charge air pipe and remove the connecting hose from the turbocharger.

-- Remove the vacuum pump from the cylinder head. Refer to **VACUUM PUMP**.

-- Disconnect the connector -arrow- from the engine coolant temperature sensor -G62- and guide the wire out.

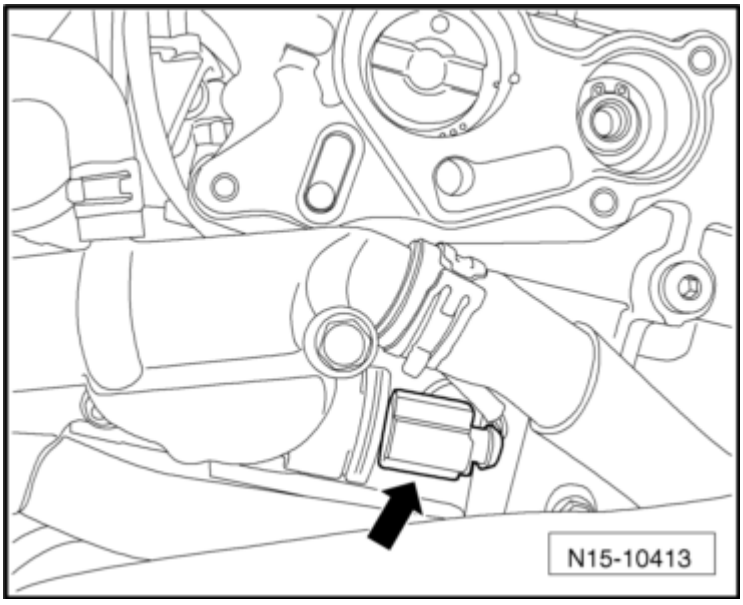

Fig. 55: Identifying Connector -Arrow- To Engine Coolant Temperature Sensor
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

CAUTION: Make sure the connecting pipe flex coupling element does not bend or stretch. Cracks could develop.

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-- Remove the Exhaust Gas Recirculation (EGR) connecting pipe.

NOTE: Use the socket insert XZN 10 T10385 to remove the bolt at the bottom of the EGR cooler.

-- Remove the noise insulation. Refer to **Description and Operation** .

-- Drain the coolant. Refer to **DRAINING AND FILLING** .

-- Remove the nuts -arrows- for the particulate filter mount -A- from the crankcase.

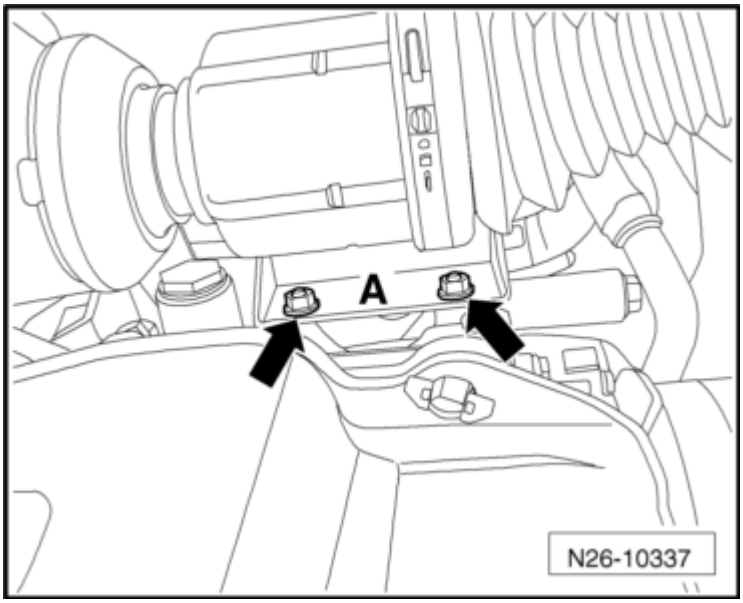

Fig. 56: Identifying Particulate Filter Mount Nuts
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Loosen the clamp between the turbocharger and the particulate filter.

-- Remove the bolt from the bracket on the cylinder head -arrow- and move the particulate filter to the side.

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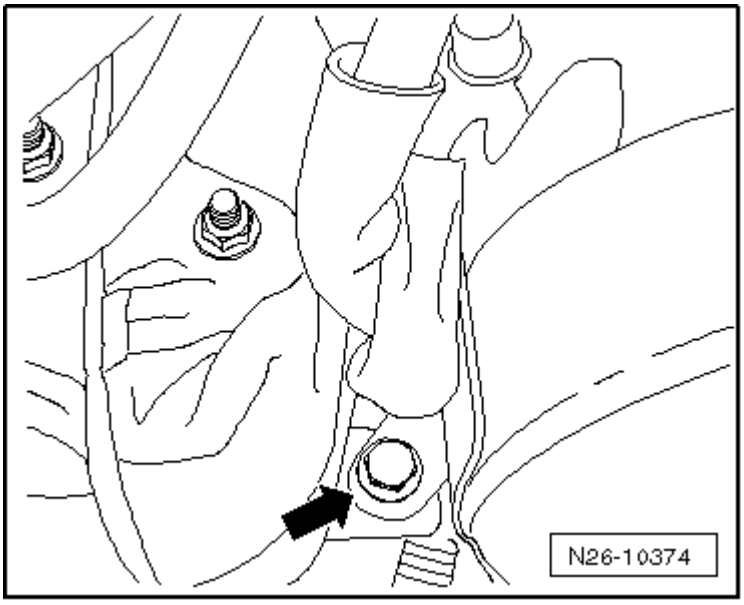

Fig. 57: Identifying Cylinder Head Bracket Bolt
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Remove the connecting pipe -A- for the EGR cooler.

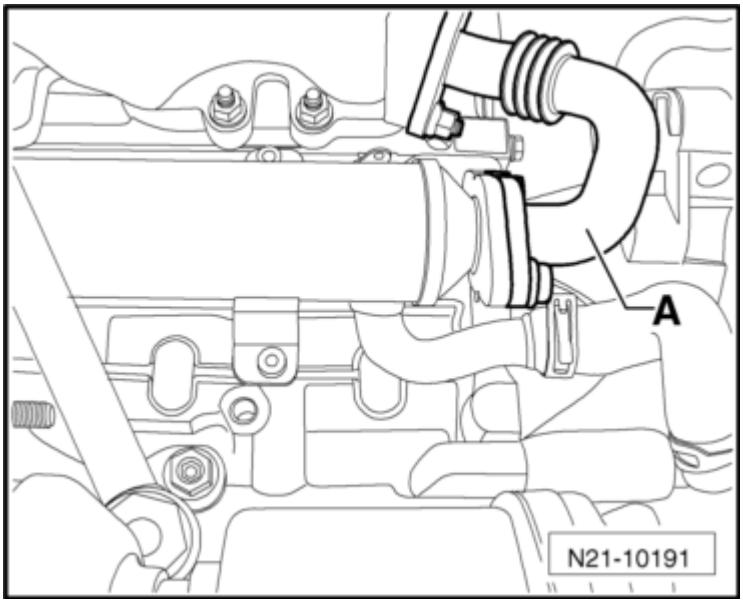

Fig. 58: Identifying Connecting Pipe -A- For EGR Cooler
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

CAUTION: The exhaust gas temperature sensor 1 -G235- covers the upper threaded connector on the turbocharger support and must not be bent. It may be removed.

-- Remove exhaust gas temperature sensor 1 -G235- -1-.

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-- Remove the bolt -arrow- from the support on the turbocharger.

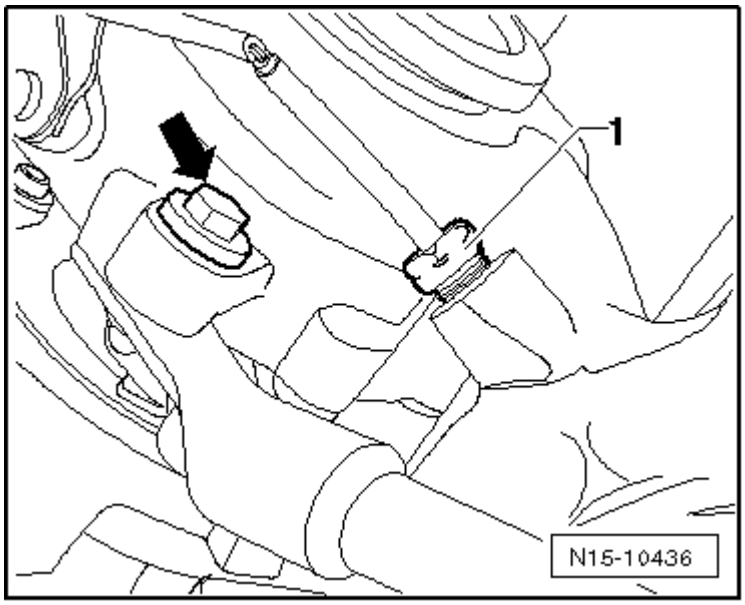

Fig. 59: Identifying Exhaust Gas Temperature Sensor And Bolt
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Remove the coolant hoses at the cylinder head coolant connections.

-- Remove the oil supply line bolt -arrow- and then remove the oil supply line.

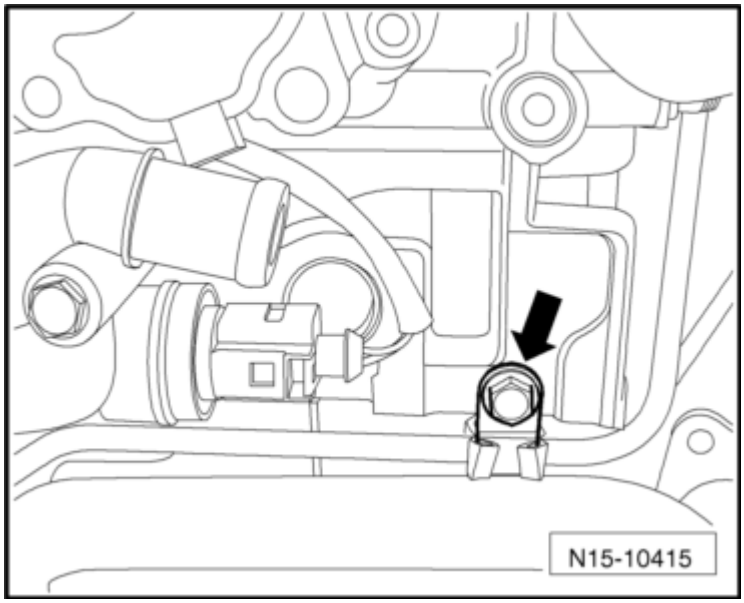

Fig. 60: Identifying Oil Supply Line Clamp Bolt
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Remove the camshaft toothed belt gear and remove the camshaft hub using the puller T10052.

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-- Remove the protective plate bolt -arrow- from the toothed belt guard.

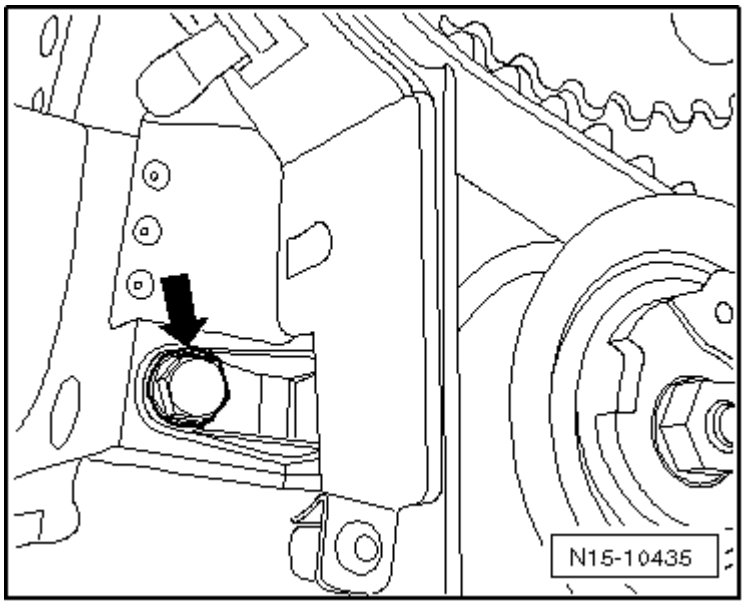

Fig. 61: Identifying Nut To Toothed Belt Tension
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Remove the nut on the toothed belt tensioner.

-- Disconnect the camshaft position sensor -G40- connector -arrow-.

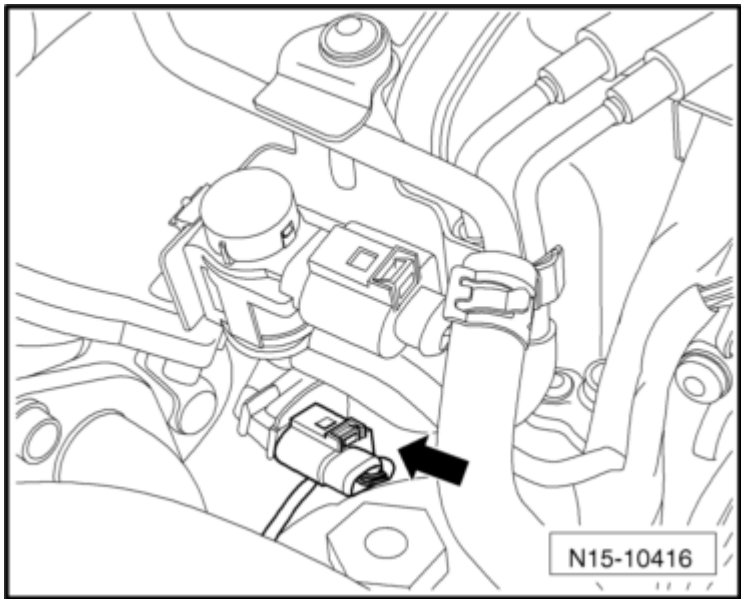

Fig. 62: Identifying Camshaft Position Sensor -G40- Connector -Arrow-
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Follow the sequence -10 through 1- when loosening the cylinder head bolts.

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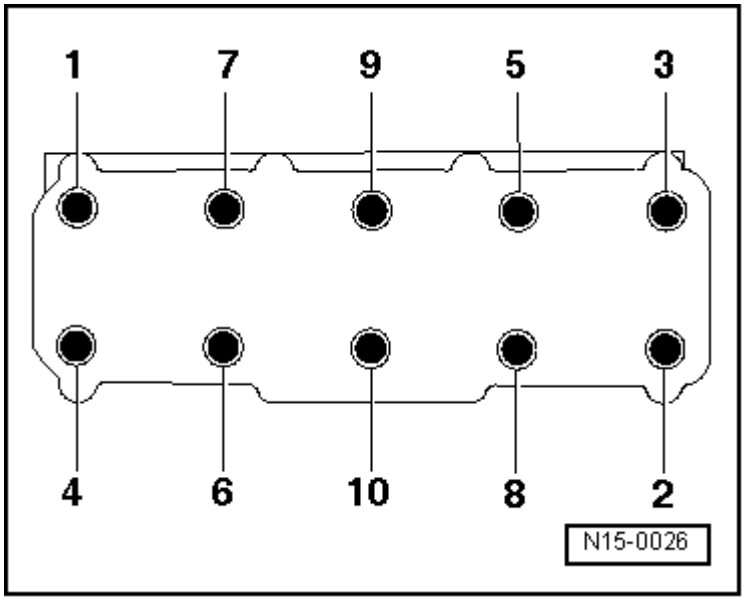

Fig. 63: Identifying Cylinder Head Bolts Loosening Sequence
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

NOTE: A second technician is needed when removing the cylinder head.

The toothed belt tensioner is pulled off the stud bolt when lifting the cylinder head off.

The turbocharger oil return line is pulled out of the supported when lifting the cylinder head off.

-- Lift the cylinder head first on the transmission side and guide it out of the toothed belt guard. Be careful not to let the toothed belt tensioner fall.

-- Lay the cylinder head down so that the oil return line is not bent. Place a wooden block under the exhaust manifold if necessary.

Installing

NOTE: Always replace the cylinder head bolts.

Carefully remove any sealant residue from the cylinder head and cylinder block. Make sure that no long scrapes or scratches result. When using sandpaper, the grit must not be below 100.

Thoroughly remove all sanding and grinding residue.

Only unpack the new cylinder head gasket immediately prior to installation.

Handle the gasket carefully. Damages to the silicone layer and in areas of the

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recesses may result in leaks.

-- Before installing the cylinder head, remove the crankshaft stop T10050 and rotate the crankshaft back opposite the engine rotation direction until all of the pistons are nearly even under Top Dead Center (TDC).

-- Place the cylinder head gasket with the identification upward.

-- Slide the guide pins from the guide pins & handle 1112 mm 3070 into the outer bores on the intake side to center.

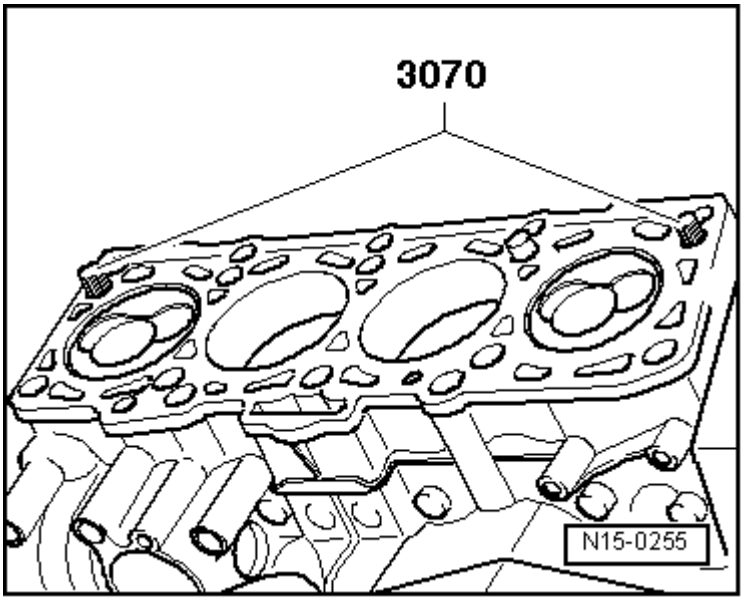

Fig. 64: Identifying Installed Guide Pins
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

NOTE: The tensioner must be placed on the stud bolt when positioning the cylinder head.

-- Install the cylinder head, insert the eight cylinder head bolts and tighten them by hand.

-- Remove the guide pins using the guide pin handle from the guide pins & handle 1112 mm 3070, and then install the remaining cylinder head bolts.

-- Tighten the cylinder head bolt in sequence -1 through 10-, in four stages as follows:

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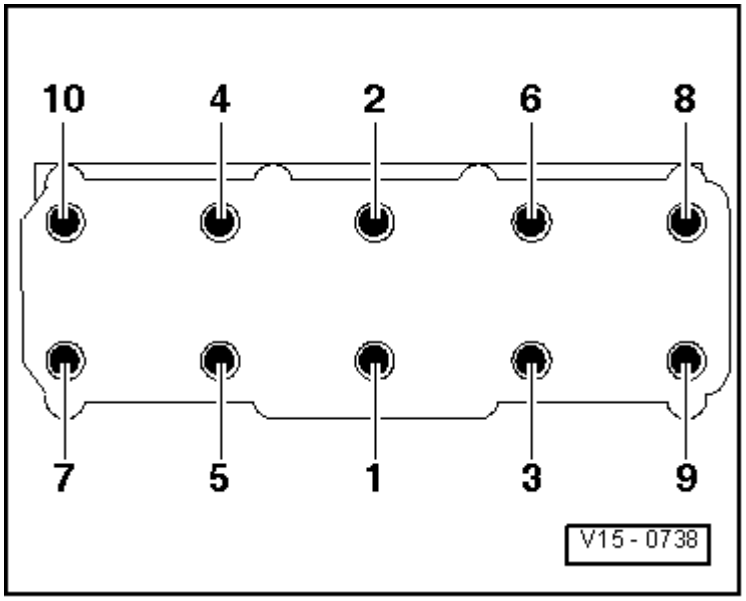

Fig. 65: Identifying Cylinder Head Bolt Tightening Sequence
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

1. **Tighten the Bolts using a Torque Wrench:**

   Step I = 30 Nm

   Step II = 50 Nm

2. **Tighten the Bolts using a Ratchet:**

   Step III = an additional 90° (1/4) turn.

   Step IV = and additional 90° (1/4) turn.

-- Secure the toothed belt guard on the back of the cylinder head.

-- Install the hub and the camshaft sprocket.

-- Use the diesel injection pump locking pin 3359 to secure the camshaft and high pressure pump.

-- Turn the crankshaft in engine rotation direction and secure the crankshaft using the crankshaft stop T10050.

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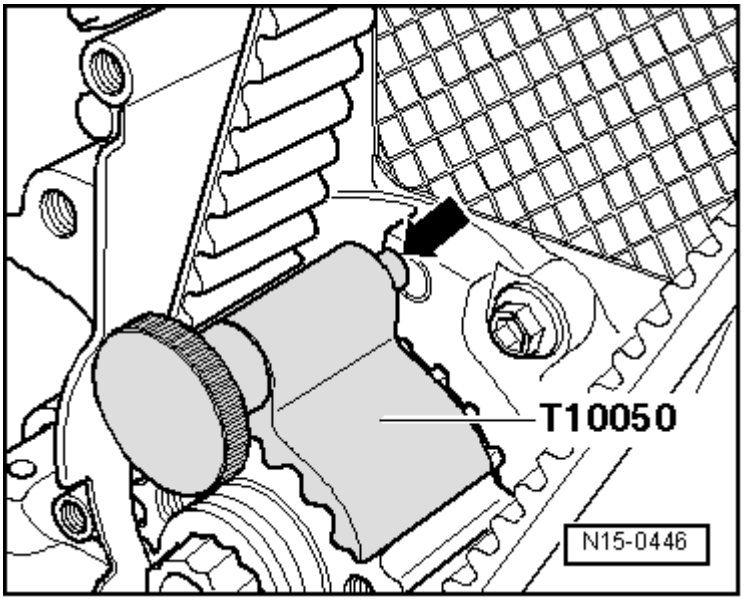

Fig. 66: Identifying Crankshaft Stop T10050
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Install the toothed belt. Refer to **TOOTHED BELT**.

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

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

-- Install the ribbed belt. Refer to one of the following:

RIBBED BELT (WITH TENSIONER) .

RIBBED BELT (WITH TENSIONING ROLLER) .

-- Fill the coolant. Refer to **DRAINING AND FILLING** .

-- Perform a road test and check the Diagnostic Trouble code (DTC) memory. Refer to vehicle diagnostic tester.

VACUUM PUMP

CAUTION: Do not disassemble the vacuum pump under any circumstances because it can cause the vacuum part to malfunction. The result would be brake booster failure.

Removing

-- Remove the air filter housing. Refer to **AIR FILTER HOUSING OVERVIEW** .

-- Remove the vacuum line -1- from the vacuum pump -2-.

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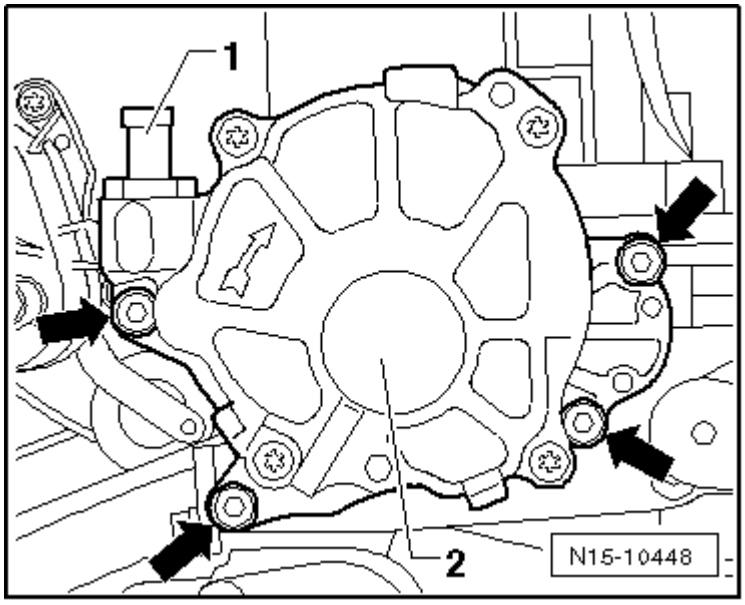

Fig. 67: Identifying Vacuum Pump Bolts
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Remove the bolts for the charge air pipe.

-- Push the charge air pipe slightly downward so that it is possible to reach the threaded connector on the back of the vacuum pump.

-- Remove the bolts -arrows-.

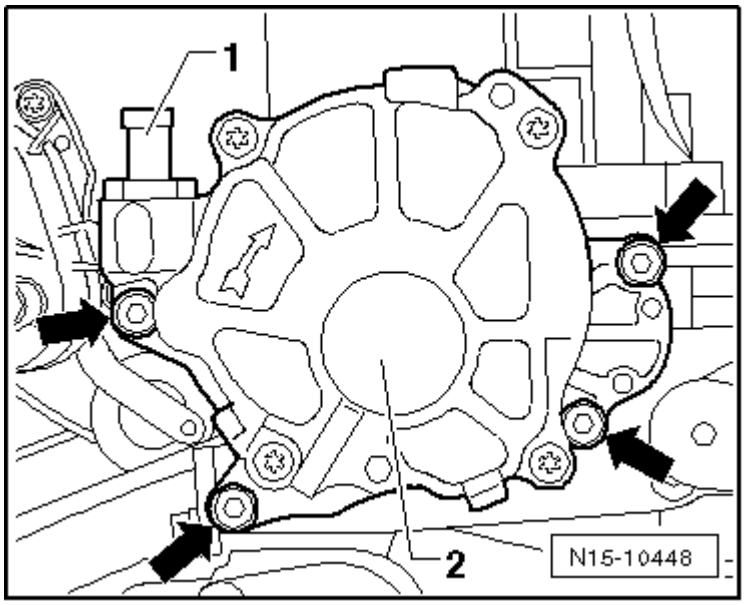

Fig. 68: Identifying Vacuum Pump Bolts
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Remove the vacuum pump -2- from the cylinder head.

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Installing

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

NOTE: Make sure the vacuum pump coupling is seated correctly in the camshaft.

Replace the seal.

-- Install the vacuum pump and tighten the bolts to 10 Nm.

-- Connect the brake booster vacuum hose -1- to the vacuum pump.

CAMSHAFTS

Special tools and workshop equipment required

- Diesel Injection Pump Locking Pin 3359
- Camshaft Gear Counter-Hold T10051
- Puller T10052
- Camshaft Fitting Tool T40094
- Camshaft Fitting Tool T40095
- Camshaft Tensioning Tool T40096
- Torque Wrench (5-50 Nm) V.A.G 1331
- Torque Wrench (40-200 Nm) V.A.G 1332
- Silicone Adhesive Sealant D 176 501 A1

Removing

-- Remove the engine cover. Refer to **ENGINE COVER** .

-- Remove the fuel filter and the auxiliary fuel pump -V393- or fuel pump 2 -V277-. Refer to **Auxiliary Fuel Pump -V393- OR Fuel Pump 2 -V277-** .

-- Remove the toothed belt from the camshaft and high pressure pump. Refer to **TOOTHED BELT**.

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

-- Remove the bolts -1- from the camshaft sprocket.

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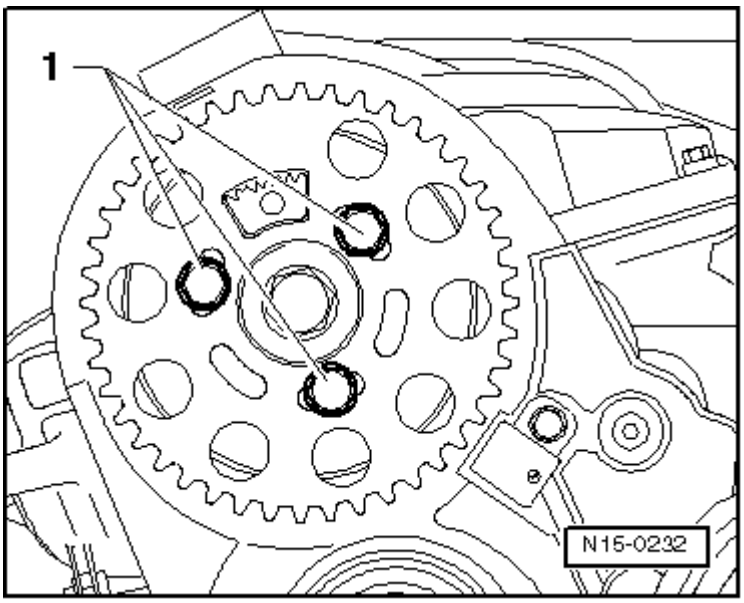

Fig. 69: Identifying Camshaft Pulley Securing Bolts
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Remove the camshaft sprocket from the hub.

-- Counter-hold the hub using the camshaft gear counter-holder T10051 and loosen the hub bolt -1-.

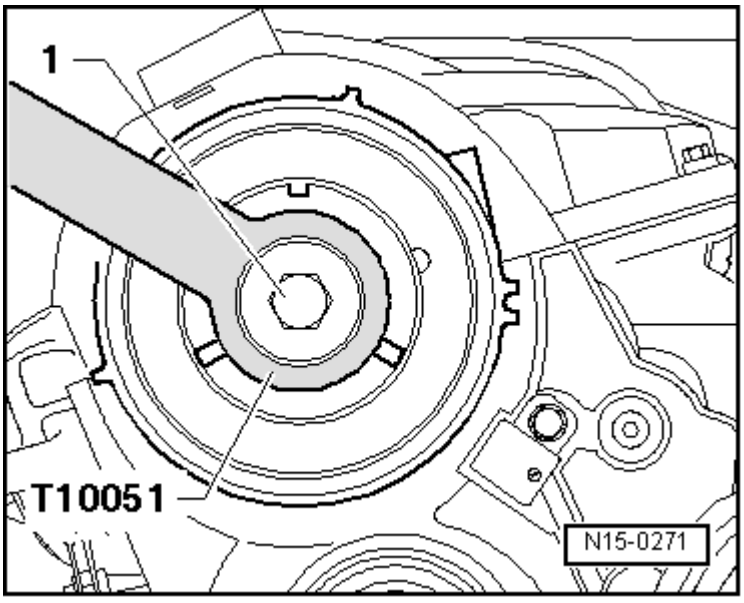

Fig. 70: Identifying Counterhold T10051
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Unscrew the bolt for the hub approximately 2 turns.

-- Install the puller T10052 and align it to the bores in the hub.

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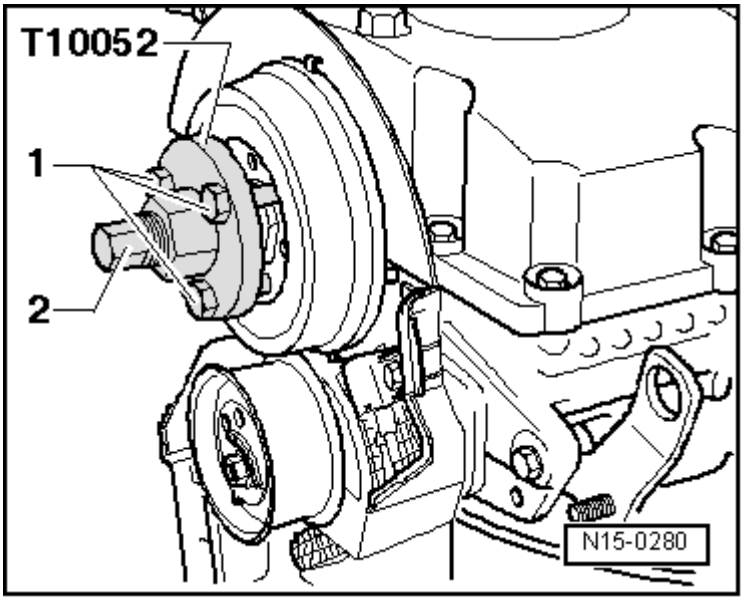

Fig. 71: Identifying Puller T10052
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Tighten the bolts -1-.

-- Tighten the puller -2- evenly to tension the hub until the hub loosens from the camshaft cone.

NOTE: Hold onto the puller using a 30 mm wrench.

-- Remove the hub from the cone of the camshaft.

-- Remove the vacuum pump. Refer to **VACUUM PUMP**.

-- Remove the bearing frame bolts/nuts in sequence -24 through 1-.

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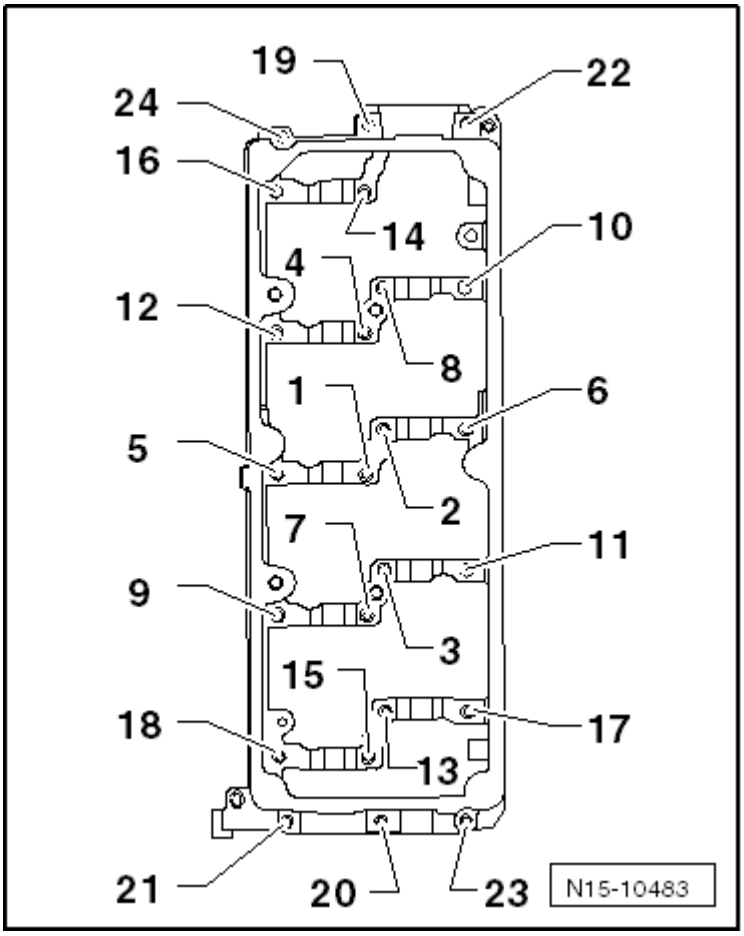

Fig. 72: Identifying Bearing Frame Bolts/Nuts Tightening Sequence
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Remove the bearing frame.

-- Carefully remove the camshafts.

Installing

NOTE: Seal the separating surfaces between the bearing frame and cylinder head with silicone adhesive sealantD 176 501 A1.

CAUTION: The camshafts may only be installed using the camshaft fitting tool T40094 as described. Otherwise the axial bearings inside the bearing frame will get permanently damaged and it will be necessary to replace the cylinder head.

-- Remove any sealant still on the cylinder head and on the bearing frame with a rotating plastic brush.

CAUTION: Make sure that no sealant residue enters the cylinder head and bearings.

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

-- Lubricate the journal surfaces of the camshafts.

Assemble the camshaft fitting tool T40094 as follows:

-- Remove the mounts T40094/3, T40094/4 and T40094/5 from the base plate. Loosen the threaded connections from below.

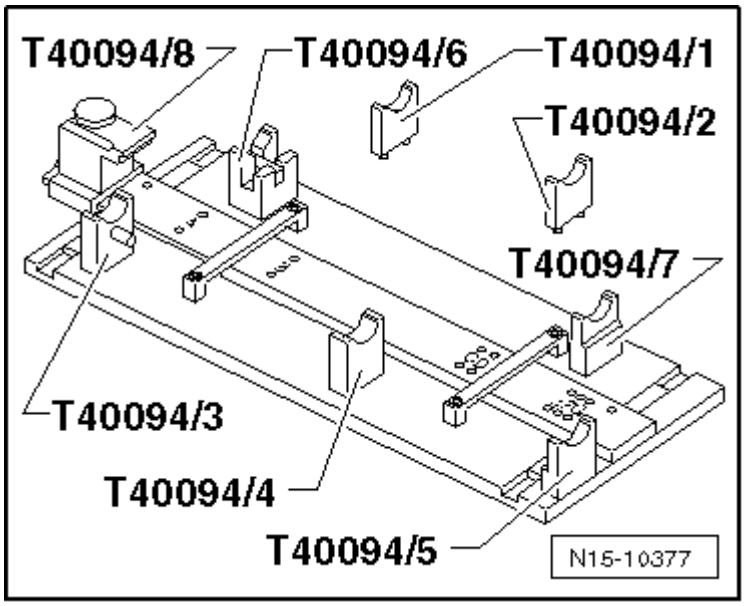

Fig. 73: Identifying Mounts T40094/1 To T40094/8
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

NOTE: If the camshaft fitting tool T40094 mounts are not marked, mark the removed mounts, for example, with numbers, to assure it can be reassembled later.

-- Install the mounts T40094/09 and T40094/10 in the empty outer locations.

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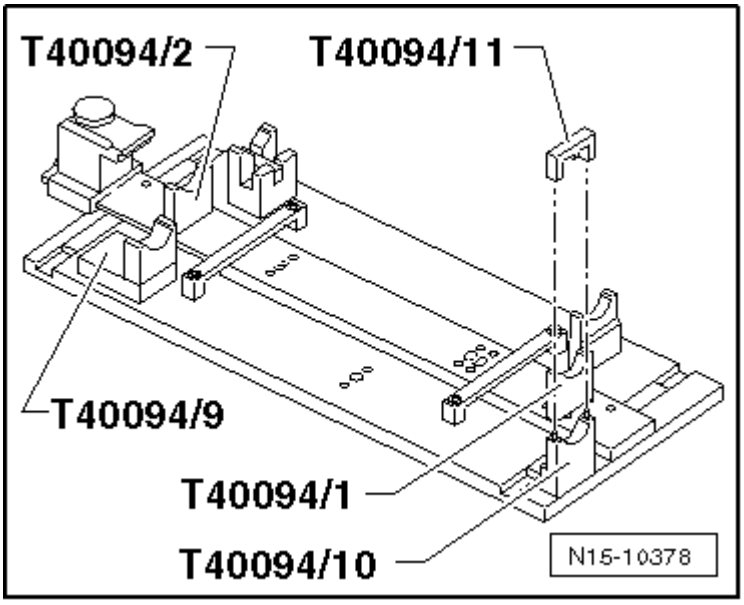

Fig. 74: Identifying Mounts T40094/1, T40094/2, T40094/9, T40094/10 and T40094/11
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Position the mount T40094/2 on "A" and mount T40094/1 on "F".

-- First, install the intake camshaft as illustrated. Make sure the recess -arrow- for the cylinder head bolt faces outward.

-- Install a 0.55 mm feeler gauge and push the mount T40094/8 into the groove in the intake camshaft.

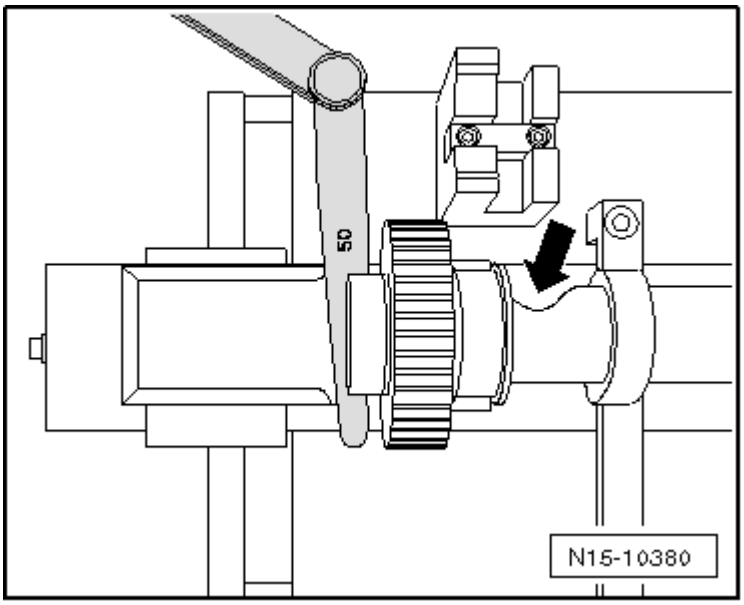

Fig. 75: Identifying 0.50 mm Feeler Gauge
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-- Install the exhaust camshaft and lock it by the groove -arrow- with the cover T40994/11.

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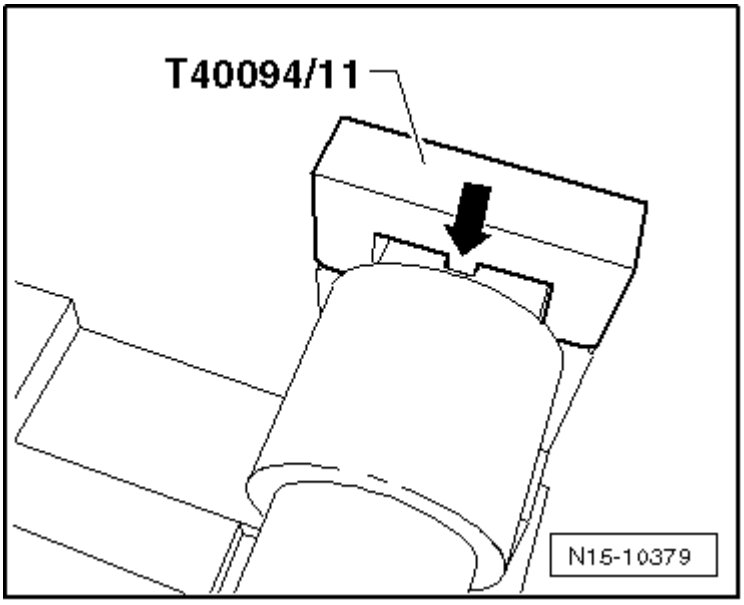

Fig. 76: Identifying Cover T40094/11
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Install the tensioning tool T40096/1 to the toothed gears on the exhaust camshaft.

CAUTION: Make sure the clamping jaw marked with an arrow is on the wider sprocket.

-- Tighten the tensioning tool T40096/1 with the thumb wheel until the tooth faces align. Use a 13 mm open end wrench, if necessary.

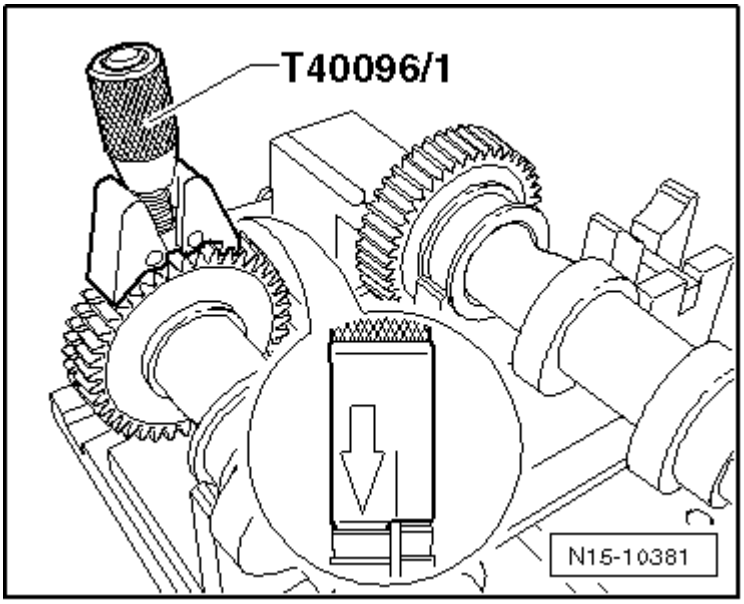

Fig. 77: Identifying Tensioning Tool T40096/1
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

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-- Slide the exhaust camshaft toward the intake camshaft until the splines mesh.

-- Position the bearing frame on the camshafts.

- All the camshaft bearings must align on the camshafts.

-- Position the clamping tool T40095 as illustrated and secure the camshafts in the bearing frame.

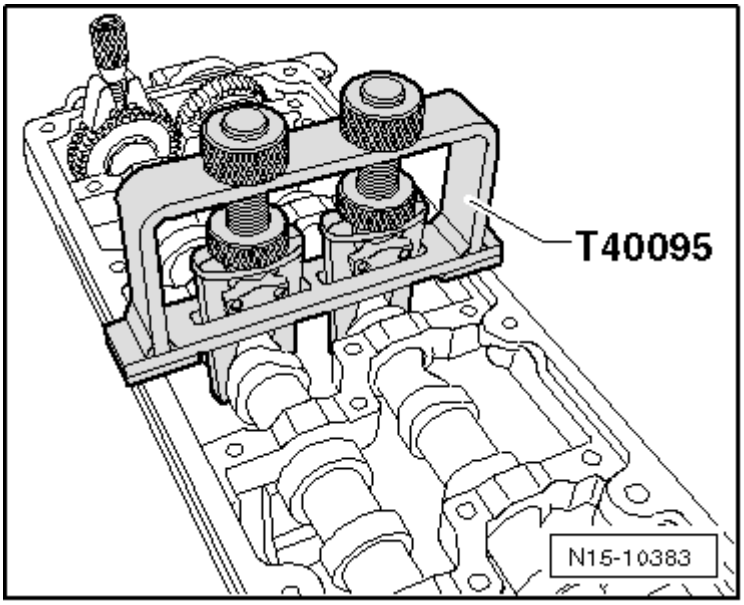

Fig. 78: Identifying Camshaft Clamping Tool T40095
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Remove the cover T40094/11.

-- Remove the mount T40094/8 from the groove in the intake camshaft.

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

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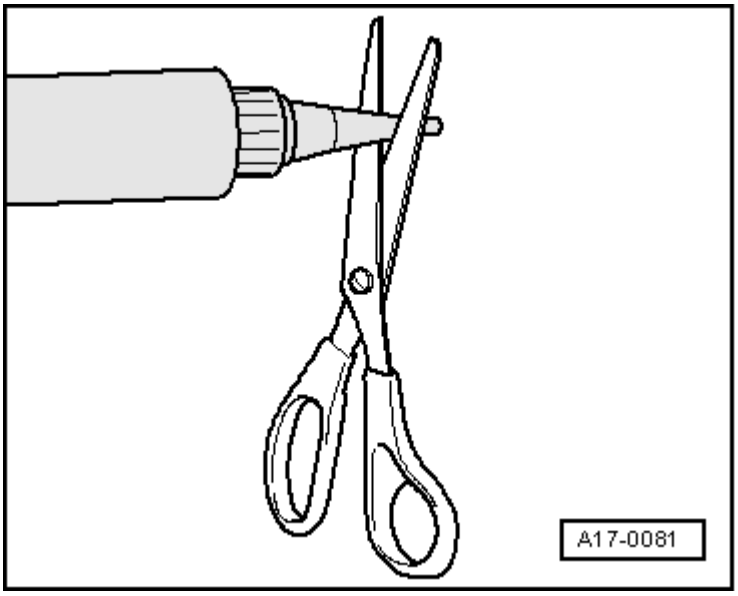

Fig. 79: Identifying Scissors To Cut Tube Nozzle At Front Marking (Nozzle Diameter Approx. 2 Mm)
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Apply a bead of sealant (approximately 2 to 3 mm thick) to the sealing surfaces of the cylinder head.

CAUTION: Excess sealant could get on the camshaft bearings or seal off the oil supply holes.

- **Do not apply the sealant beads thicker than indicated.**
- **Make sure that excess sealant does not seal off the oil supply holes - arrow- for the bearing frame.**

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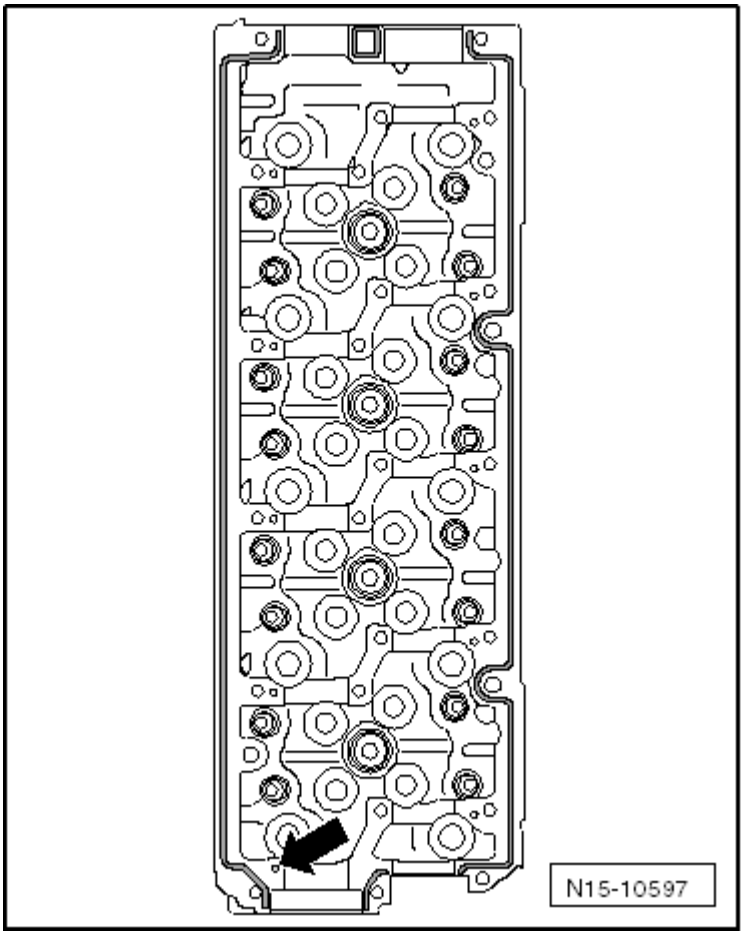

Fig. 80: Identifying Bearing Frame Sealant Position
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Remove the camshafts with the bearing frame and the clamping tool T40095 from the camshaft fitting tool T40094.

-- Carefully install the camshafts and bearing frame onto the cylinder head.

-- First, tighten the bearing frame bolts/nuts by hand in sequence -1 through 24-.

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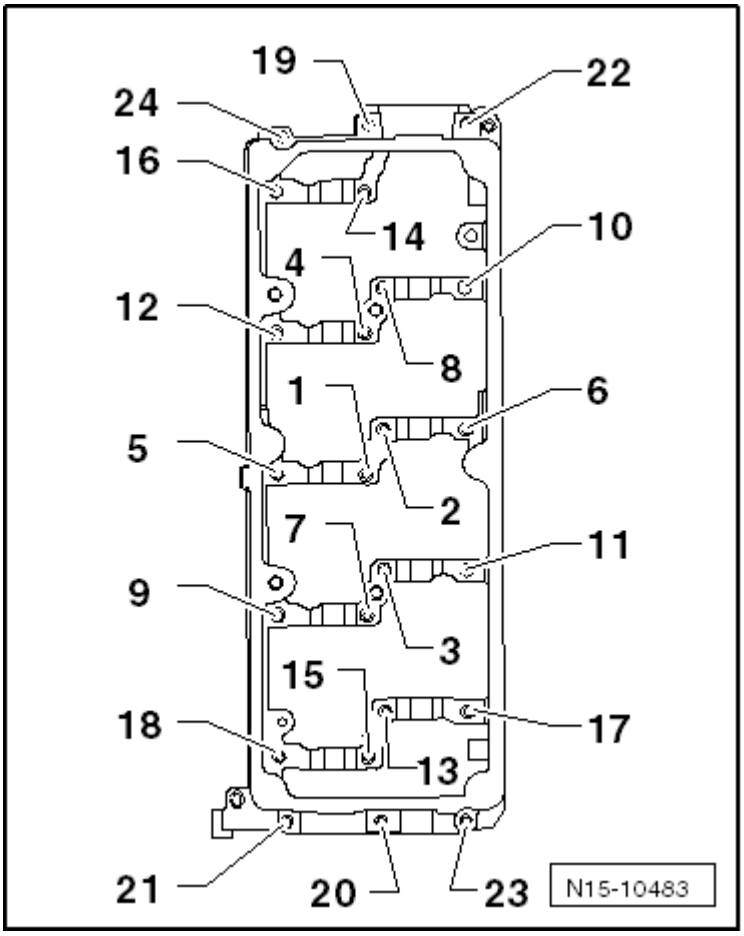

Fig. 81: Identifying Bearing Frame Bolts/Nuts Tightening Sequence
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

- The bearing frame must be touching the entire contact surface of the cylinder head.

-- Tighten the bearing frame bolts/nuts in sequence -1 through 24- until they are seated. Tightening specification: 10 Nm

-- Remove the clamping tool T40095 and tensioning tool T40096/1.

-- Replace the camshaft seal. Refer to **CAMSHAFT SEAL**.

-- Drive a new sealing cap into the cylinder head with a suitable drift until it is flush, refer to -item 15- in the **VALVETRAIN OVERVIEW**.

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

CAUTION: Risk of damaging valves and piston heads after working on valvetrain.

- **The motor must not be started for about 30 minutes after installing camshafts because the hydraulic lash adjusters must seat**

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themselves.

- **To ensure the valves do not strike the pistons when starting, carefully rotate the crankshaft at least 2 turns.**

-- Place the hub onto the camshaft.

-- Tighten the bolt -1- for the hub to 100 Nm. To do this, use the camshaft gear counter-hold T10051.

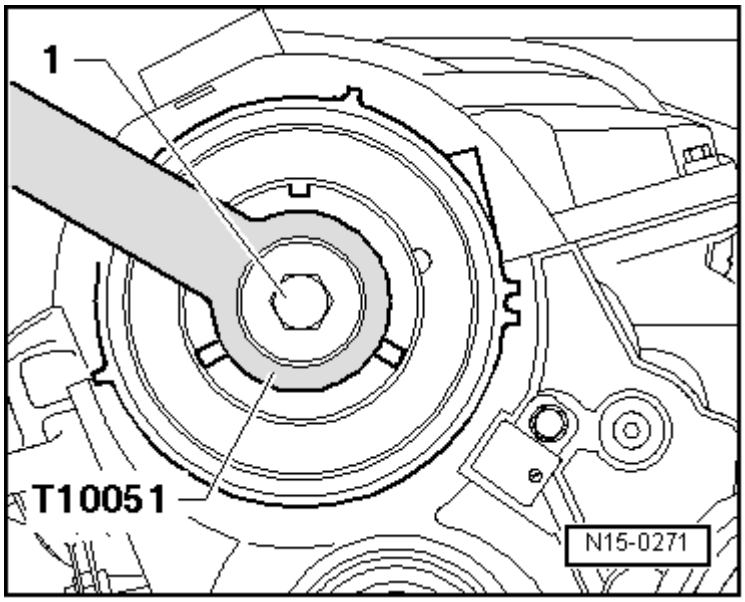

Fig. 82: Identifying Camshaft Gear Counter-Hold T10051
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Push the camshaft sprocket onto the hub.

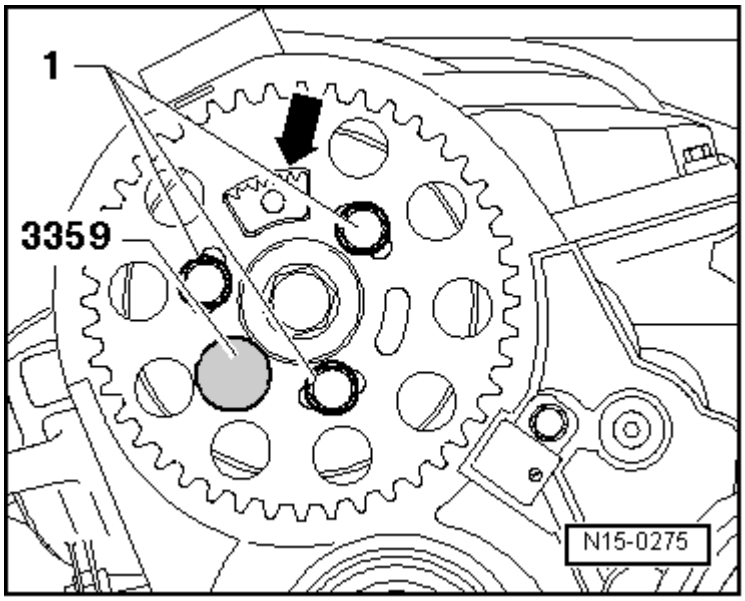

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Fig. 83: Identifying Locking Pin 3359, Camshaft Sprocket Bolts And Toothed Segment
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

NOTE: The toothed segment -arrow- of the camshaft sprocket must face upward.

-- Install the bolts -1- into the camshaft sprocket by hand to eliminate play.

-- Lock the hub using the diesel injection pump locking pin 3359.

-- Install the toothed belt and adjust valve timing. Refer to **TOOTHED BELT**.

-- Install the vacuum pump. Refer to **VACUUM PUMP**.

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

-- Install the fuel filter and the auxiliary fuel pump -V393- or fuel pump 2 -V277-. Refer to **Auxiliary Fuel Pump -V393- OR Fuel Pump 2 -V277-** .

CAMSHAFT SEAL

Special tools and workshop equipment required

- Oil Seal Driver 10-203
- Seal Extractor T10443
- Torque Wrench (5-50 Nm) V.A.G 1331
- Torque Wrench (40-200 Nm) V.A.G 1332
- M12 x 1.5 x 75 Bolt

Removing

-- Remove the toothed belt from the camshaft and high pressure pump. Refer to **TOOTHED BELT**.

-- Remove the camshaft sprocket and hub. Refer to **CAMSHAFTS**.

CAUTION: The thrust pad will fall off the pressure bolt if it is turned backward too far. In this case, it is necessary to press the thrust pad back onto the pressure bolt.

-- Turn back the pressure bolt on the seal puller until a slight resistance is felt.

NOTE: The clamping sleeves on the seal puller have set screws. Only one of the set screws -arrow- tightens the clamp. The other one can not be adjusted.

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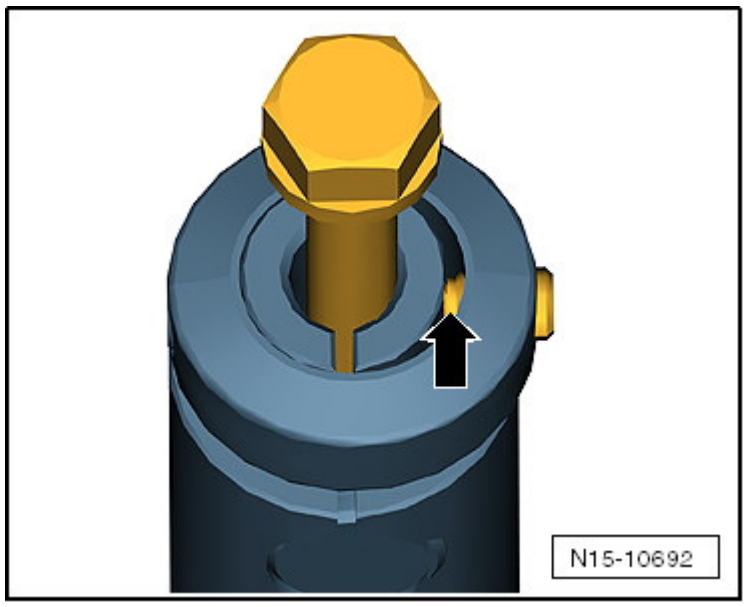

Fig. 84: Identifying Seal Puller And Pressure Screw
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Install the seal puller as illustrated and turn the set screw -A-.

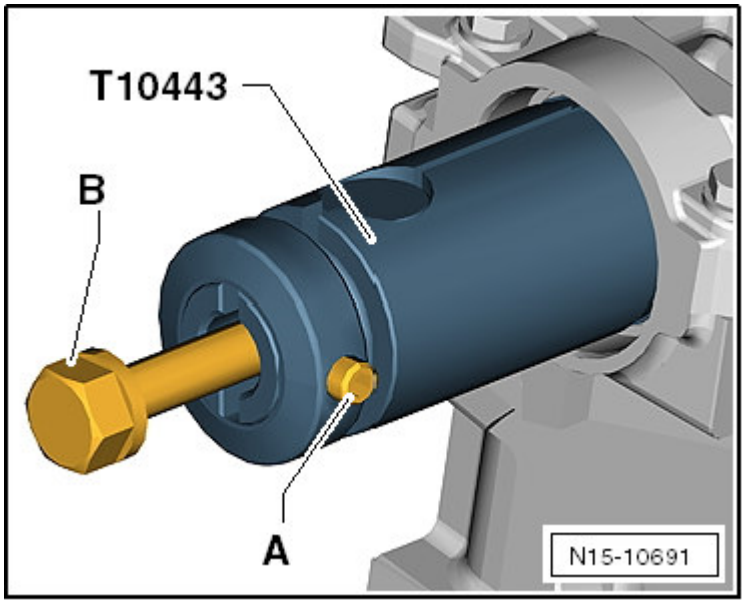

Fig. 85: Identifying Seal Puller And Set Screw -A-
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Turn the pressure screw -B- until the seal is pulled out.

Installing

NOTE: The sealing lip of the seal may not be additionally lubricated or greased.

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-- Clean off any oil on the camshaft with a clean cloth.

-- Install the guide sleeve from the seal driver 10-203 on the camshaft as illustrated. The writing on the seal faces the outside.

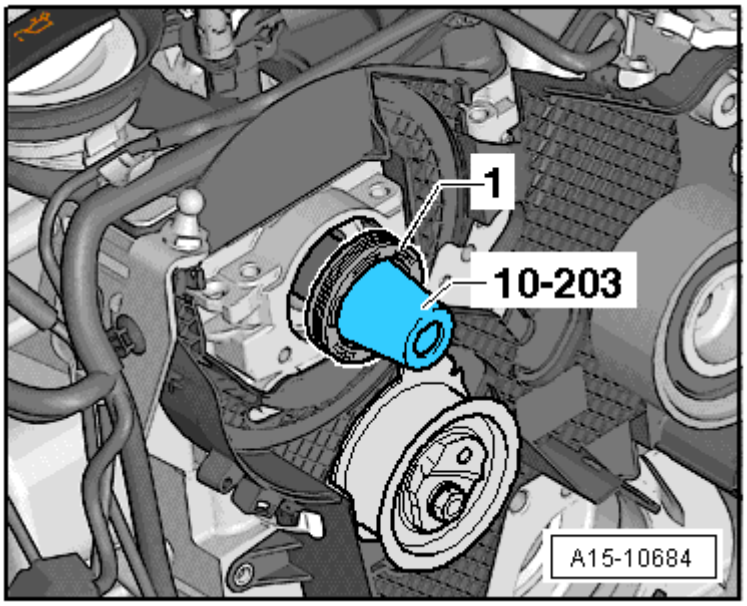

Fig. 86: Identifying Seal -1- Pressed In To Stop Using Seal Driver 10-203
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Carefully slide the seal -1- over the guide sleeve and onto the camshaft.

-- Press the seal in until seated using the thrust piece from the seal driver 10-203 and a M12 x 1.5 x 65 bolt.

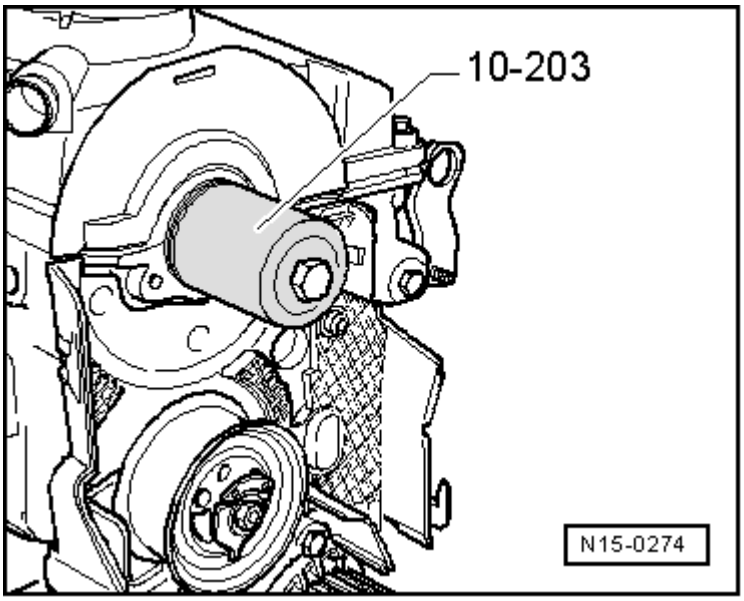

Fig. 87: Identifying Oil Seal Driver 10-203 Thrust Piece And Bolt

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-- Install the camshaft sprocket and hub. Refer to **CAMSHAFTS**.

-- Install the toothed belt and adjust valve timing. Refer to **TOOTHED BELT**.

VALVE STEM SEALS

Special tools and workshop equipment required

- Hinged Socket 3220
- Valve Seal Removal Tool 3364
- Valve Stem Seal Driver 3365
- Valve Cotters Asm/Disasm Device VAS 5161
- Guide Plate for 3.0L TDI Engine VAS 5161/23

Removing

-- Remove the glow plugs using the hinged socket 3220. Refer to **GLOW PLUGS** .

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

-- Install the guide plate for 3.0L TDI engines VAS 5161/23 to the cylinder head.

-- Secure the guide plate to the intake manifold side using the knurled thumb screw M6 VAS 5161/12 and to the stud bolts hand tight with M6 nuts -1-.

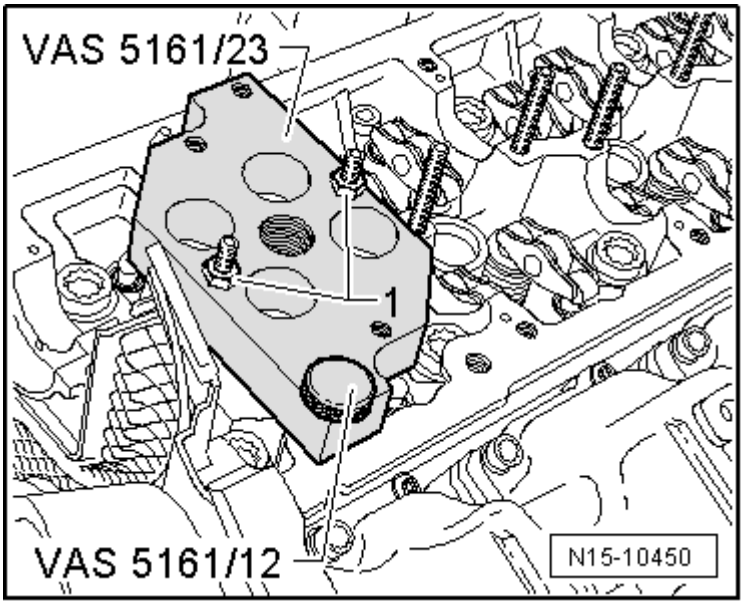

Fig. 88: Identifying Guide Plate VAS 5161/23 Secured Using Knurled Screw VAS 5161/12
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

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-- Install the compression stud VAS 5161/10 in the guide plate.

-- Install the adapter for compressed air connection VAS 5161/11 in the glow plug threads and tighten by hand.

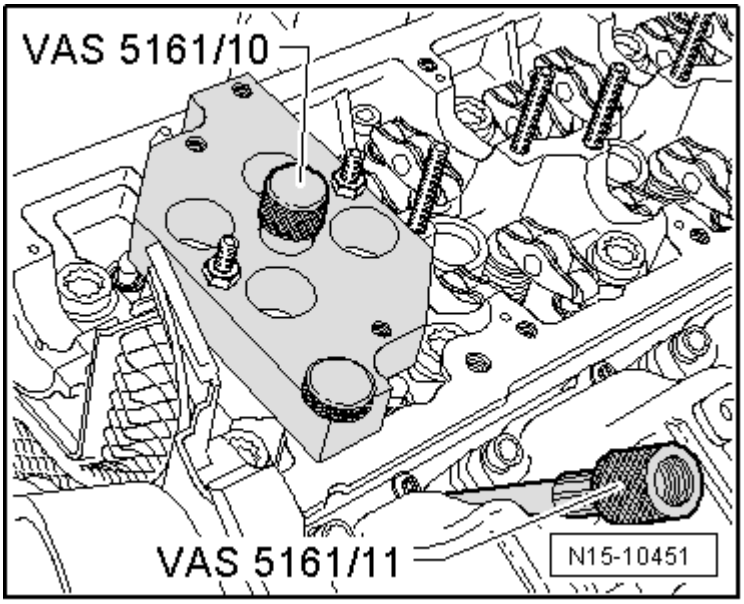

Fig. 89: Identifying Compression Stud VAS 5161/10 Installed In Guide Plate VAS 5161/23
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Insert punch VAS 5161/3 into the guide plate and loosen the stuck valve retainers using a plastic hammer.

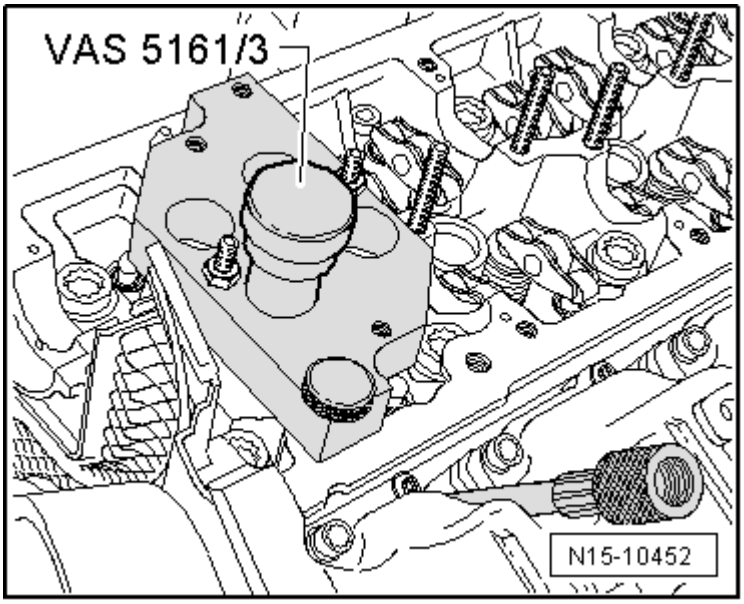

Fig. 90: Identifying Punch VAS 5161/3 Installed In Guide Plate VAS 5161/23
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Install the guide forks M6/M8 with threaded studs VAS 5161/5 in the guide plate with the retainer VAS 5161/6.

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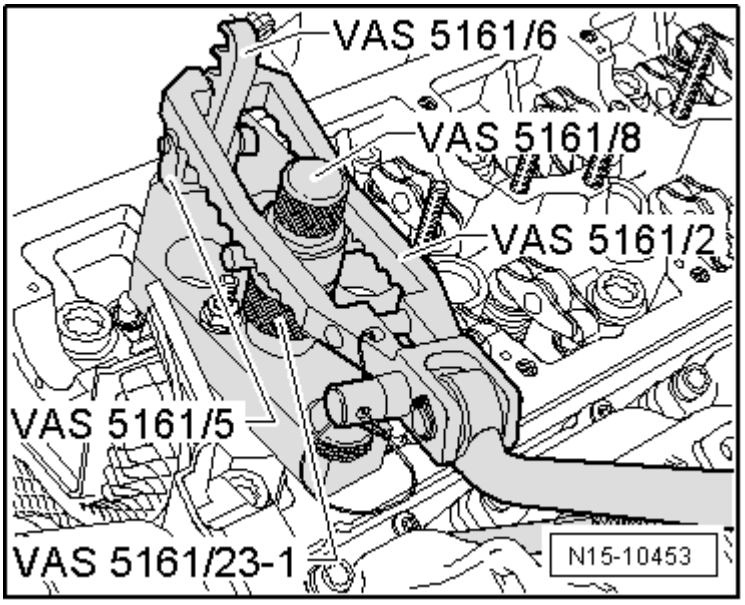

Fig. 91: Identifying Assembly Cartridges VAS 5161/2, Valve Insertion Device VAS 5161/8 And Guide Plate VAS 5161/23
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Push the knurled spacer ring VAS 5161/23-1 onto the assembly cartridge VAS 5161/8.

-- Connect the adapter for compressed air connection VAS 5161/11 to compressed air with a commercially available connector and apply constant pressure.

- Minimum pressure: 6 bar positive pressure.

-- Engage the pressure fork with lever for assembly cartridge VAS 5161/2 at the engaging device and press down the assembly cartridge.

-- At the same time, turn the knurled thumb screw on the assembly cartridge to the right, until the points engage in the valve retainers.

-- Lightly move the knurled thumb screw back and forth, this causes the valve retainers to be pressed apart and captured in the assembly cartridge.

-- Release the pressure fork with lever for assembly cartridge.

-- Remove the assembly cartridge with the knurled spacer ring, the spring plate and the valve spring.

-- Pull off valve stem seal using the valve seal removal tool 3364.

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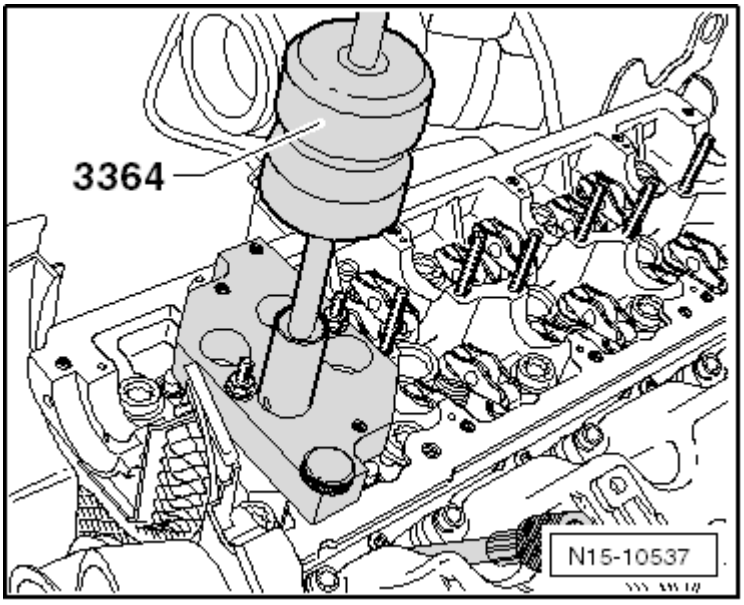

Fig. 92: Identifying Seal Removal Tool 3364
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

NOTE: A plastic sleeve -A- is supplied with the new valve shaft seal.

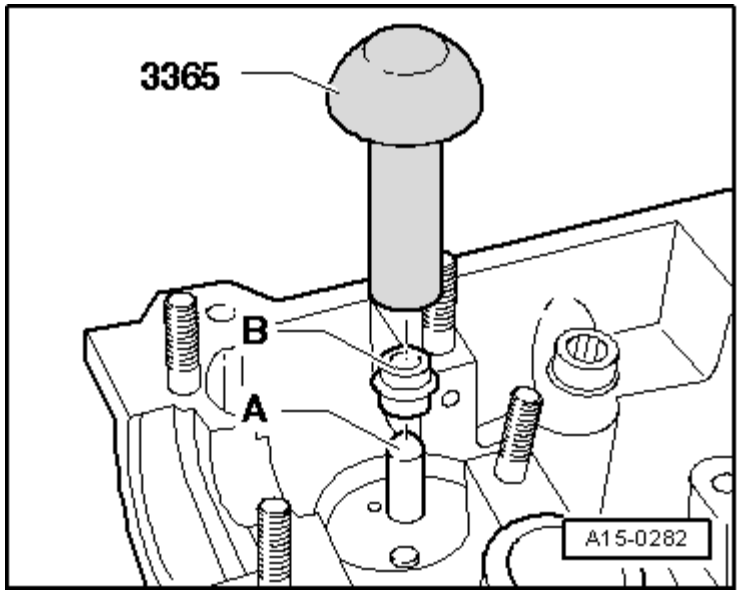

Fig. 93: Identifying Plastic Sleeve, New Valve Stem Oil Seals & Valve Stem Seal Driver 3365
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

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

-- Lightly lubricate the sealing lips of the valve stem seal with oil.

-- Push the valve stem seal onto the plastic sleeve.

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-- Carefully press the valve stem seal onto the valve guide using the valve stem seal driver 3365.

-- Tap lightly on the driver with a plastic mallet until the valve stem seal is at the stop.

-- Remove the plastic sleeve again.

-- Insert the valve spring and spring plate in the cylinder head.

-- If the valve retainers were removed from the assembly cartridge, they must then be inserted into the valve insertion device VAS 5161/18.

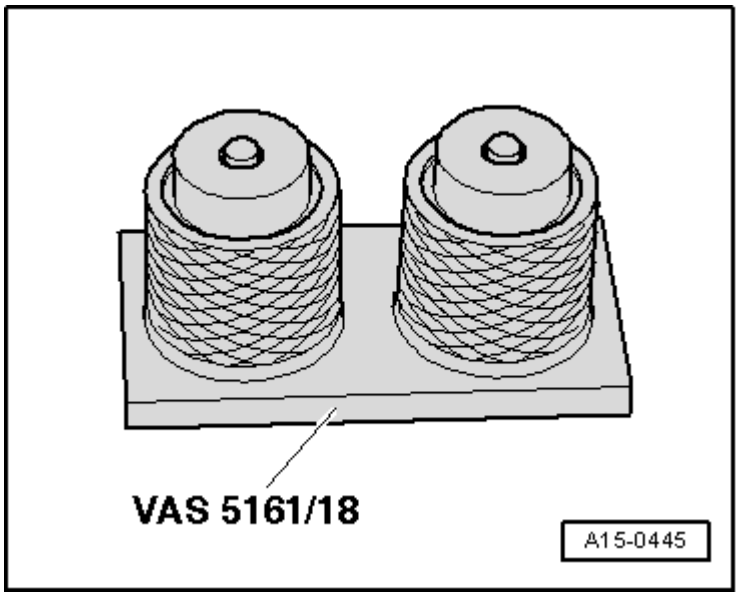

Fig. 94: Identifying Installation Cartridge VAS 5161/8
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

NOTE: The large diameter of the valve retainers point upward.

-- Press the assembly cartridge onto the valve insertion tool from above and remove the valve retainers.

-- Insert the assembly cartridge VAS 5161/8 in the guide plate.

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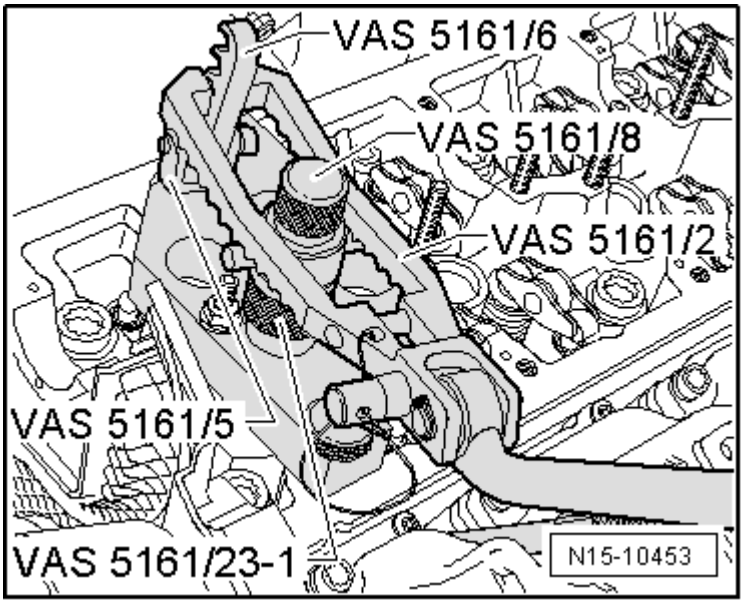

Fig. 95: Identifying Assembly Cartridges VAS 5161/2, Valve Insertion Device VAS 5161/8 And Guide Plate VAS 5161/23
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Press the pressure fork down and pull the knurled thumb screw upward while turning it left and right to insert the valve retainers.

-- Release the pressure fork with the knurled thumb screw still pulled.

Further installation is in the reverse order of removal. Note the following:

-- Install the glow plugs. Refer to **GLOW PLUGS** .

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

NOTE: After installing the camshafts, do not crank the engine for at least 30 minutes. The hydraulic lash adjusters must seat themselves (otherwise the valves will crash into the pistons).

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

SPECIAL TOOLS

Special tools and workshop equipment required

- Dial Gauge Holder VW 387
- Adapter V.A.G 1763/8
- Guide Plate for 3.0L TDI Engine VAS 5161/23

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- Oil Seal Driver 10-203
- Seal Extractor T10443
- Seal Extractor 3240
- Counterhold Tool V10 T10172
- Special Wrench, Long Reach T10264
- Locking Tool T10265
- Drip Tray for VAS 6100 VAS 6208
- Camshaft Fitting Tool T40094
- Camshaft Fitting Tool T40095
- Camshaft Tensioning Tool T40096
- Hinged Socket 3220

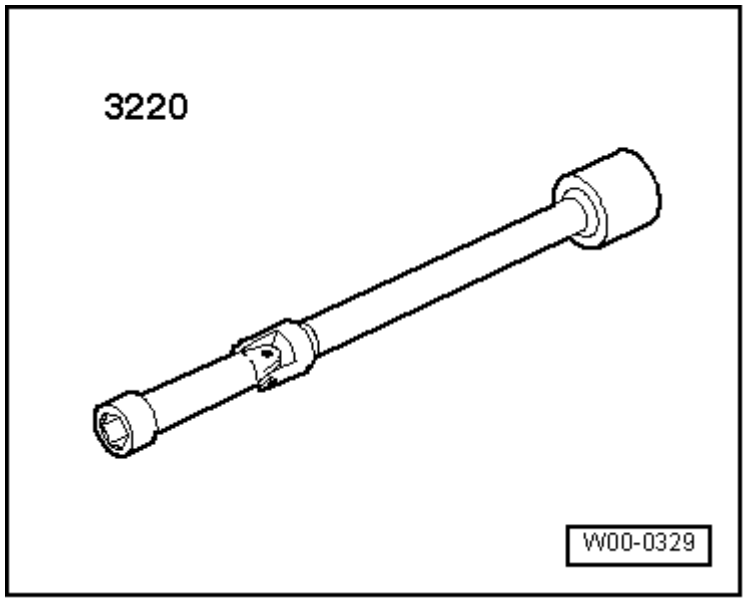

Fig. 96: Identifying Hinged Socket 3220
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

- Compression Tester V.A.G 1763

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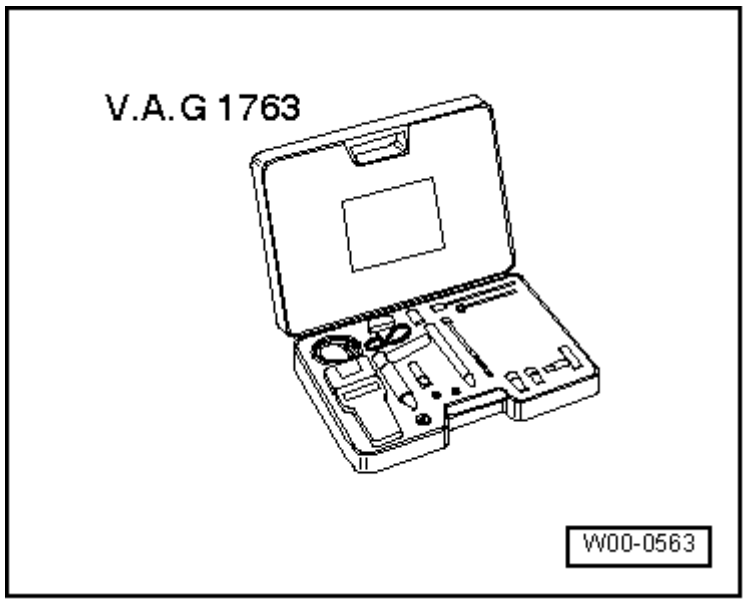

Fig. 97: Identifying Compression Tester V.A.G 1763
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

- Pliers 3314

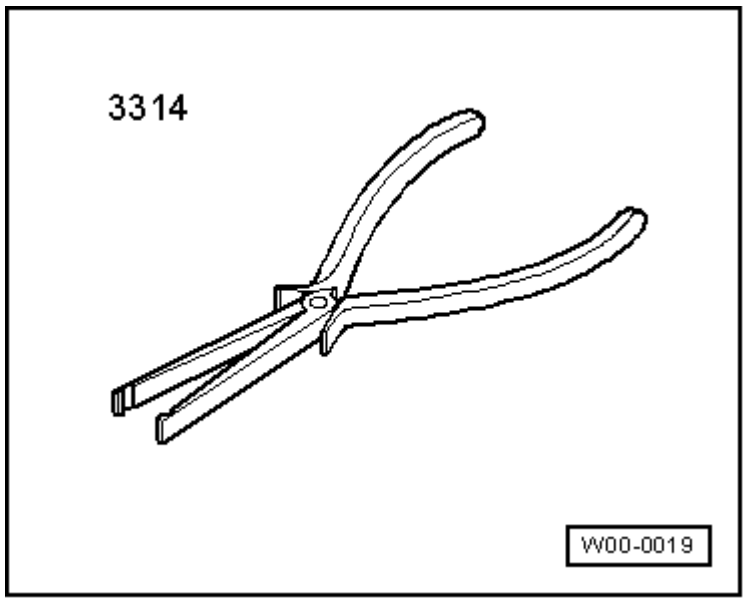

Fig. 98: Identifying Pliers 3314
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

- Torque Wrench (5-50 Nm) V.A.G 1331

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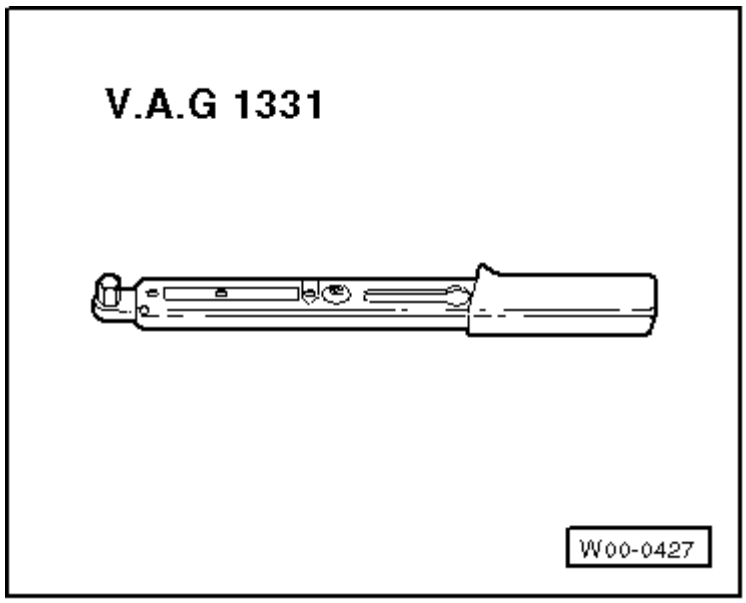

Fig. 99: Identifying Torque Wrench (5-50 Nm) V.A.G 1331
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

- Torque Wrench (40-200 Nm) V.A.G 1332

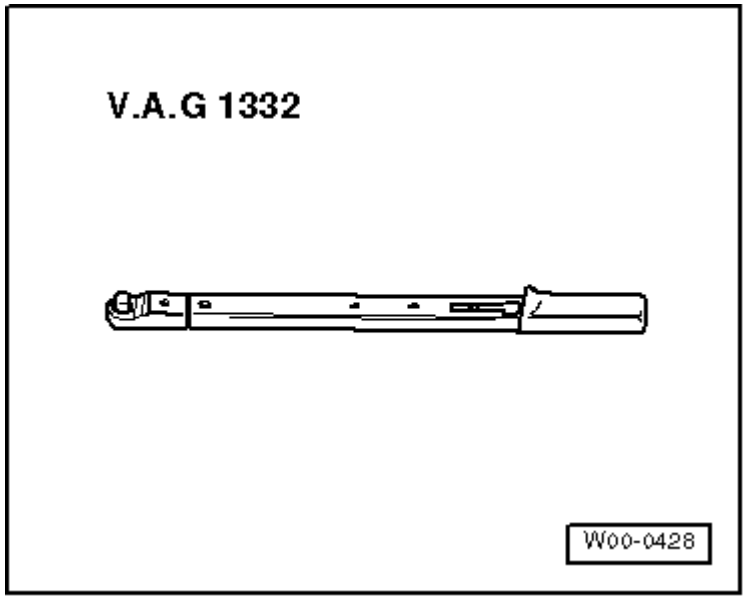

Fig. 100: Torque Wrench (40-200 Nm) V.A.G 1332
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

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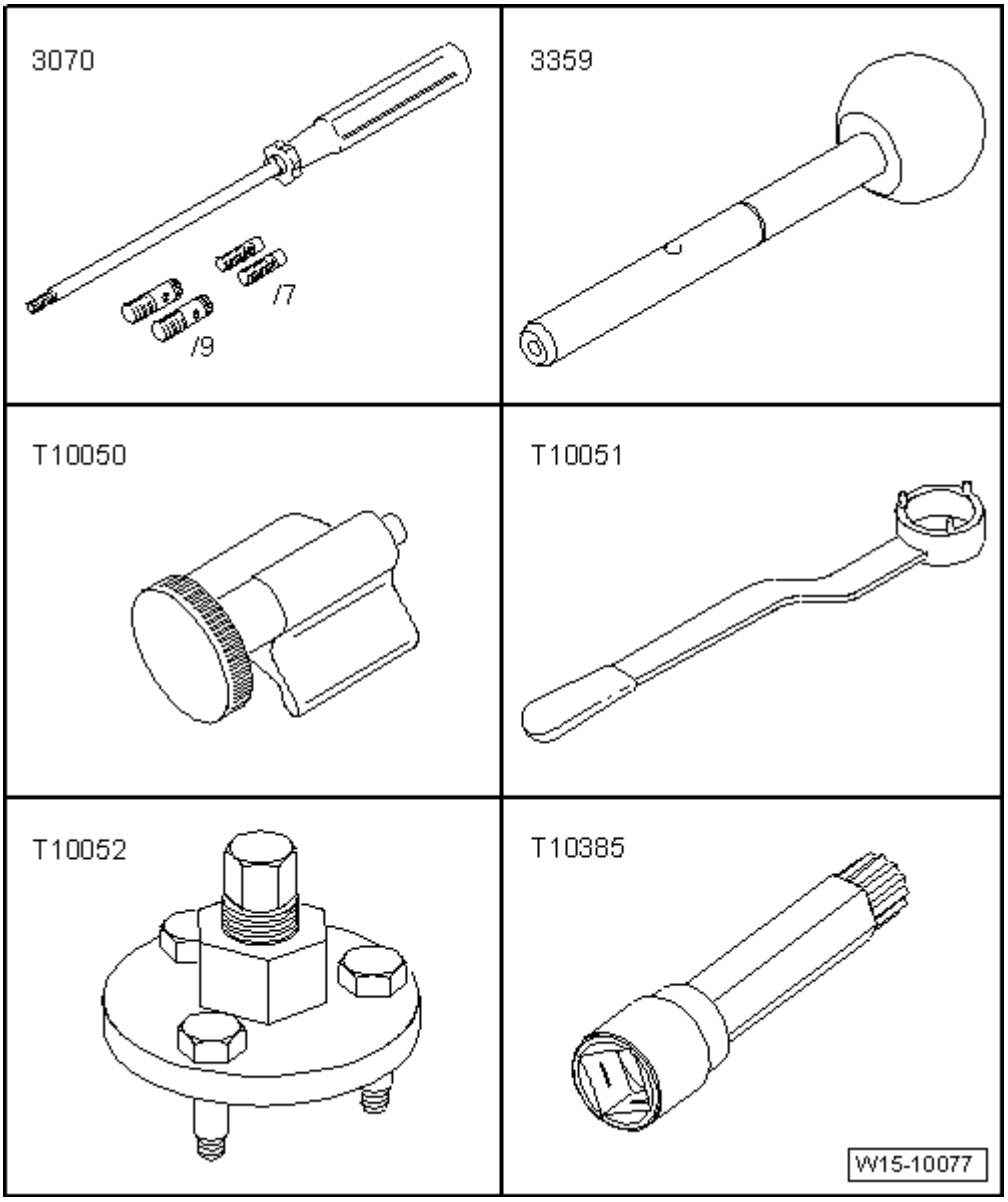

Fig. 101: Identifying 3070, 3359, T10050, T10051, T10052 And T10385
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

Special tools and workshop equipment required

- Guide Pins & Handle 1112 mm 3070
- Diesel Injection Pump Locking Pin 3359
- Crankshaft Stop T10050
- Camshaft Gear Counter-Hold T10051
- Puller T10052
- Socket Insert XZN 10 T10385

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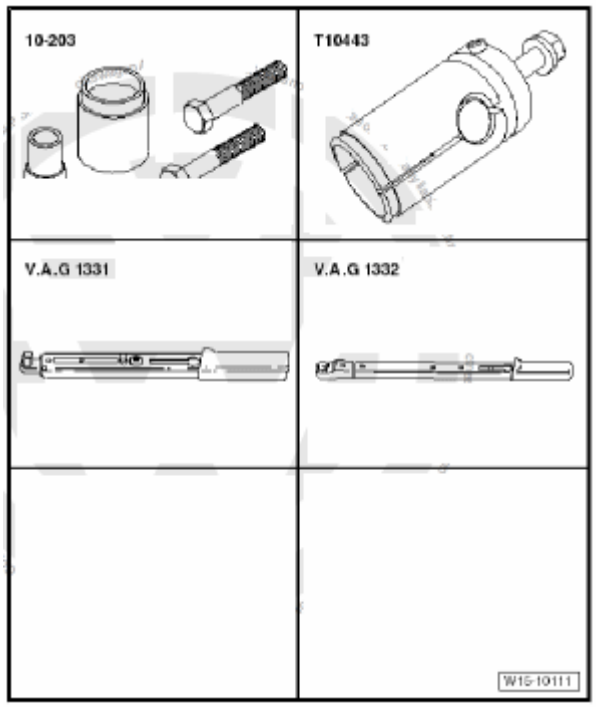

Fig. 102: Identifying 10-203, T10443, V.A.G. 1331 And V.A.G. 1332
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

Special tools and workshop equipment required

- Oil Seal Installer -10-203
- Puller -T10443
- Torque Wrench (5-50 Nm) - V.A.G 1331
- Torque Wrench (40-200 Nm) -V.A.G 1332

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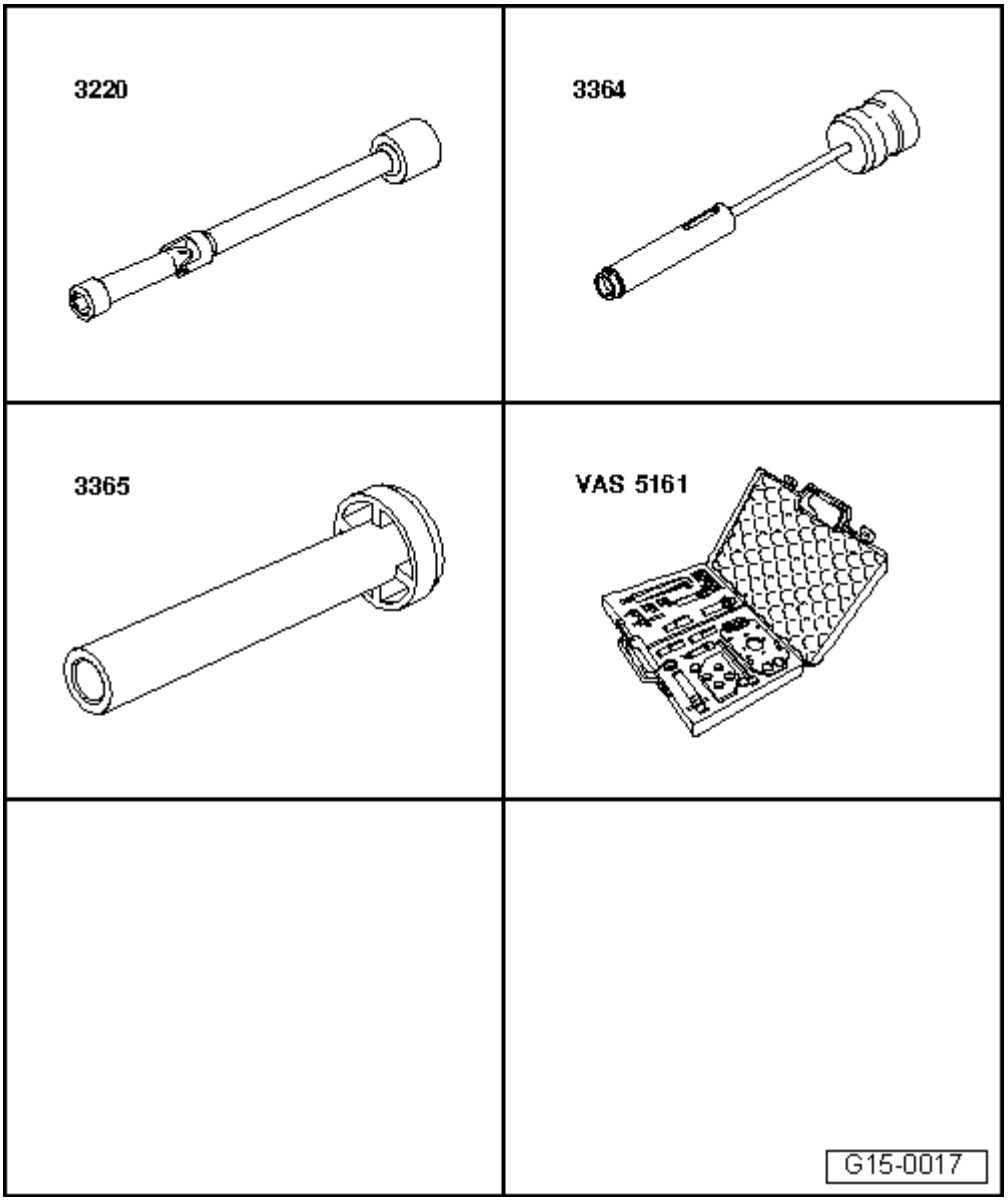

Fig. 103: Identifying 3220, 3364, 3365 And VAS 5161
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

Special tools and workshop equipment required

- Hinged Socket 3220
- Valve Seal Removal Tool 3364
- Valve Stem Seal Driver 3365
- Valve Cotters Asm/Disasm Device VAS 5161
- Guide Plate for 3.0 Ltr. TDI Engine -VAS 5161/23

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