ENGINE

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

15 CYLINDER HEAD, VALVETRAIN

DESCRIPTION AND OPERATION

CYLINDER HEAD COVER OVERVIEW

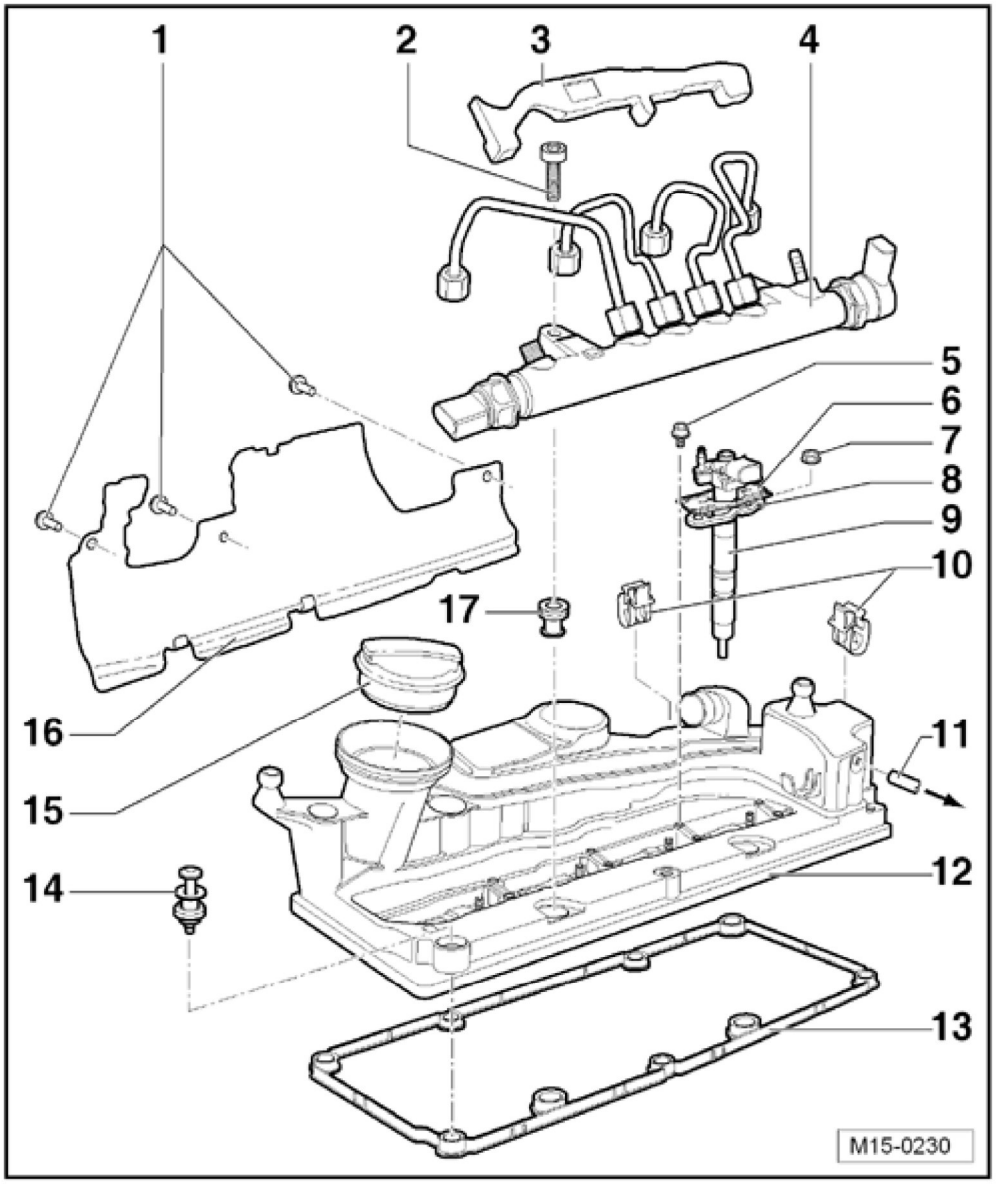

Fig. 1: Identifying Cylinder Head Cover Overview
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

1. **Bolt**

- 5 Nm

2. **Bolt**
   - 22 Nm
3. **Protective Strip**
   - For the fuel rail and high pressure lines.
4. **Fuel Rail**
   - With high pressure lines.
   - Do not change the angles of the high pressure lines.
   - Overview, refer to **FUEL RAIL AND INJECTORS OVERVIEW** .
5. **Bolt**
   - 5 Nm
6. **Sealing Cap**
7. **Nut**
   - 10 Nm
8. **Tensioning Plate**
   - Always replace.
   - Note the installed position, refer to **Fig. 2**.
9. **Fuel Injector**

   Overview, refer to **FUEL RAIL AND INJECTORS OVERVIEW** .

10. **Bracket**
    - For the wiring harness.
11. **Vacuum Hose**
    - Make sure it is seated correctly and is routed without kinks.
    - To the wastegate bypass regulator valve -N75-
12. **Cylinder Head Cover**
    - Removing and installing, refer to **CYLINDER HEAD COVER**.
13. **Gasket**
    - Replace if damaged or leaking.
14. **Bolt**
    - 10 Nm
    - Follow the loosening and tightening sequence, refer to **CYLINDER HEAD COVER**.
15. **Cap**
    - Replace the seal if damaged.
16. **Heat Shield**
17. **Bushing**
    - For the fuel rail mounting.

- Replace if damaged.

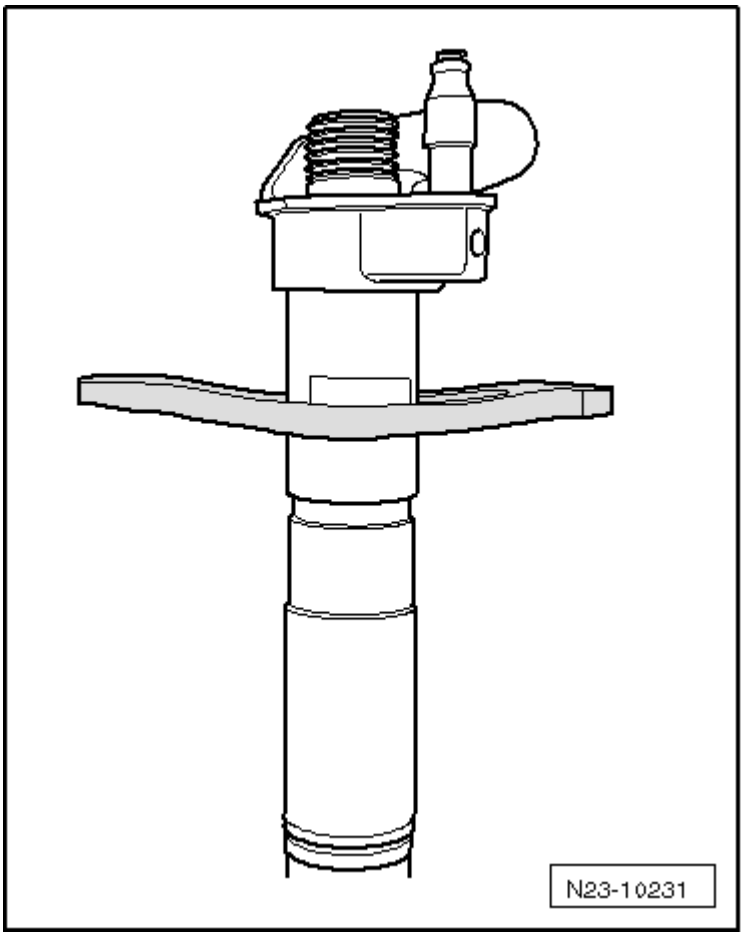

Fig. 2: Identifying Tensioning Plate Installed Position
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

CYLINDER HEAD OVERVIEW

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

When replacing the cylinder head or cylinder head gasket, the coolant must be completely replaced.

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.

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.

Always replace self-locking nuts, seals, gaskets and clamps.

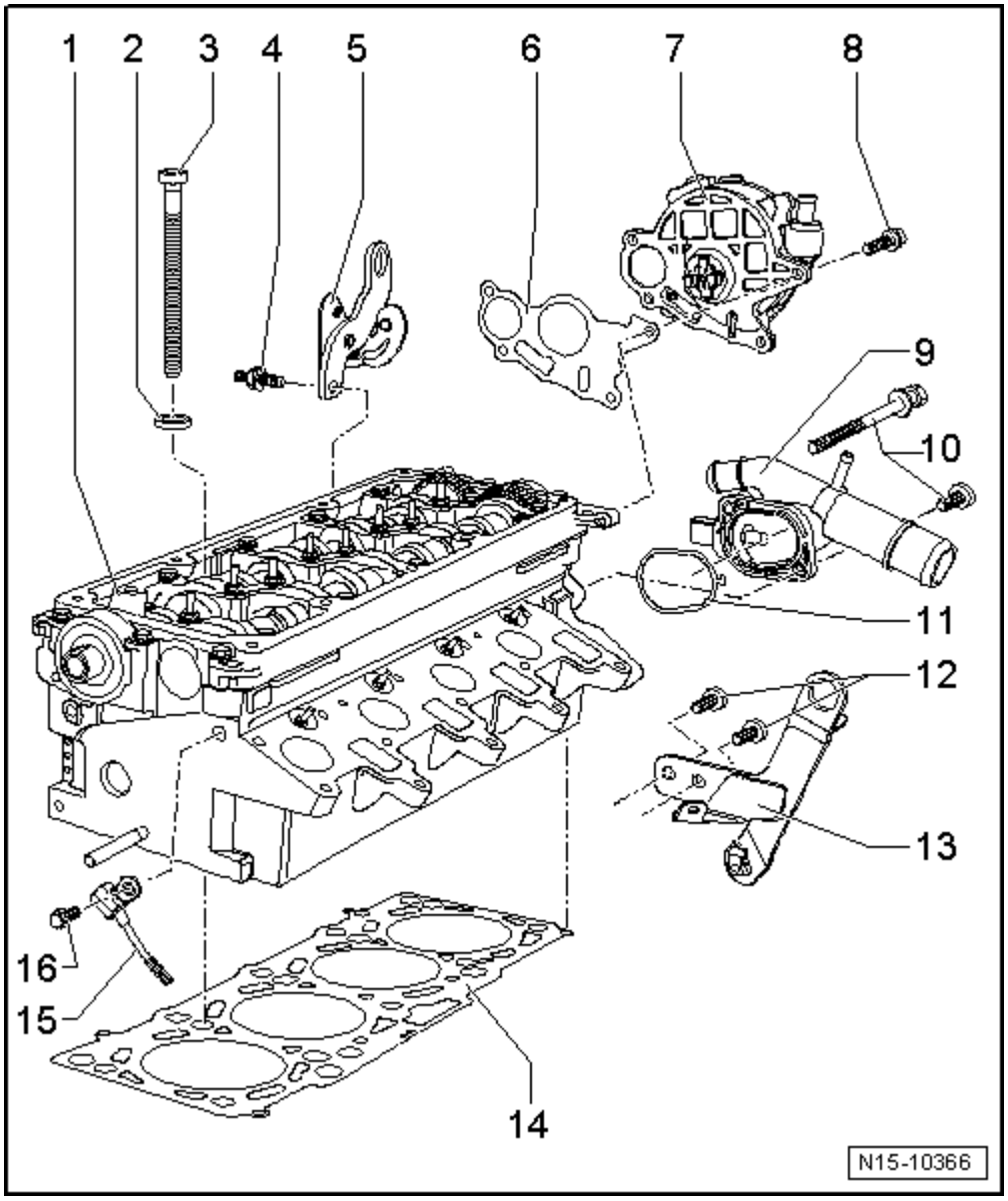

Fig. 3: Identifying Cylinder Head Overview
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

1. **Cylinder Head**
   - See the note above.
   - Checking for distortion, refer to **Fig. 4**.
   - Removing and installing, refer to **CYLINDER HEAD**.
   - All of the coolant must be replaced after installation.
   - Checking the compression, refer to **COMPRESSION, CHECKING**.
2. **Washer**

- For the cylinder head bolt.

3. **Cylinder Head Bolt**
   - Observe the sequence for loosening and tightening, refer to **CYLINDER HEAD**.
   - Before installing, insert the washers -item 2- into the cylinder head.
4. **Stud Bolt**
   - 25 Nm
5. **Lifting Eye**
6. **Gasket**
   - Always replace.
7. **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 and installing, refer to **VACUUM PUMP**.
8. **Bolt**
   - 10 Nm
9. **Coolant Connection**
   - Coolant hose connection diagram. Refer to **COOLANT HOSE CONNECTION DIAGRAM** .
10. **Bolt**
    - 10 Nm
11. **Seal**
    - Always replace.
12. **Bolt**
    - 25 Nm
13. **Lifting Eye**
14. **Cylinder Head Gasket**
    - Always replace.
    - Observe the identification, refer to **Fig. 5**.
    - All of the coolant must be replaced after removing and installing.
15. **Camshaft Position Sensor -G40-**
    - For the camshaft position.
16. **Bolt**
    - 10 Nm

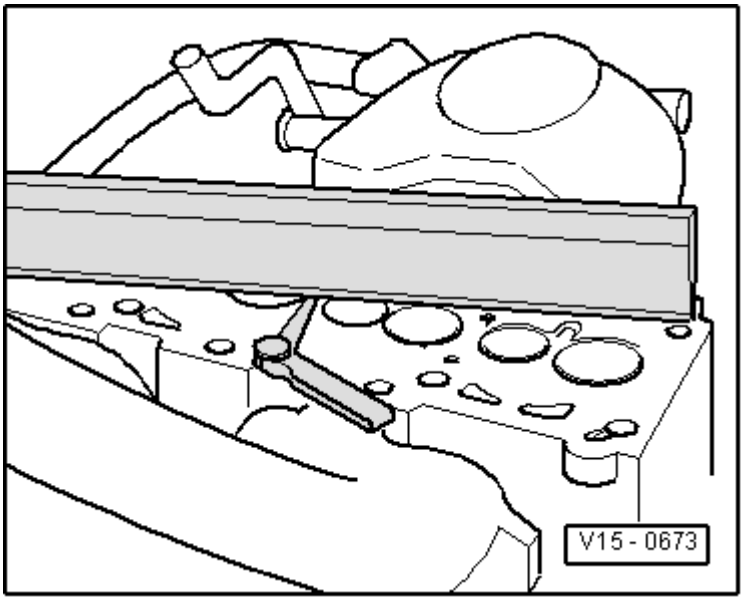

Fig. 4: Identifying Check Of Cylinder Head For Distortion
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

Special tools and workshop equipment required

- Straight Edge 500 mm VAS 6075
- Feeler Gauge

Procedure

-- Check the cylinder head for distortion using straight edge 500 mm VAS 6075 and feeler gauge in several places.

- Max. permissible distortion: 0.10 mm

NOTE: Remanufacturing diesel cylinder heads is not permitted.

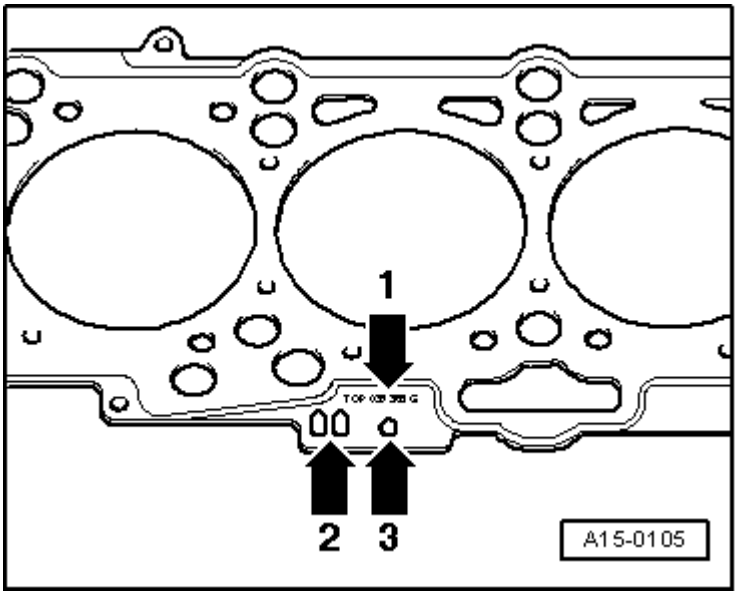

Fig. 5: Identifying Cylinder Head Gasket Identification
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

- Part number = -arrow 1-
- Control code = -arrow 2- (ignore this!)
- Holes = -arrow 3-
- Installed position: the mark faces up.

NOTE: Depending on piston projection, varying cylinder head gasket thicknesses can be installed. When replacing the gasket, install a new gasket with the same identification -arrow 3-.

Determine the piston position at Top Dead Center (TDC) when installing new pistons or a partial engine. Refer to PISTON PROJECTION IN TDC, CHECKING .

VALVETRAIN OVERVIEW

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

When replacing the cylinder head or cylinder head gasket, the coolant must be completely replaced.

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.

After installing the camshafts, the engine may not be started for approximately 30 minutes. The hydraulic equalization elements 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.

Always replace gaskets and seals.

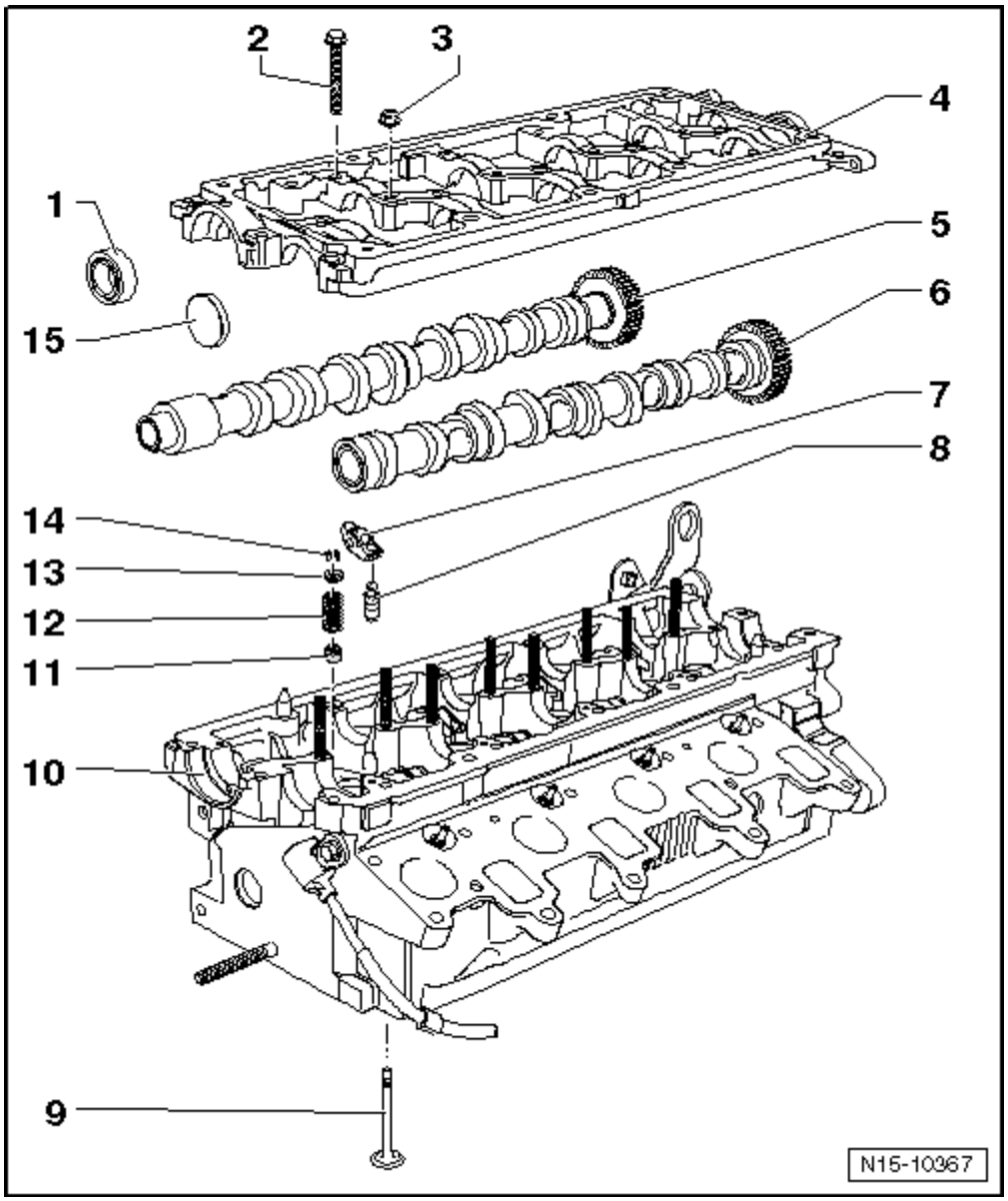

Fig. 6: Identifying Valvetrain Component Overview
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

1. **Seal**
   - Do not additionally oil or grease the sealing lip of the seal.
   - Before installing, remove any remaining oil from the 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 sequence for loosening and tightening **CAMSHAFTS**.
   - Seal using silicone adhesive Sealant D 176 501 A1.
5. **Exhaust Camshaft**
   - Removing and installing, refer to **CAMSHAFTS**.
6. **Intake Camshaft**
   - Removing and installing, refer to **CAMSHAFTS**.
7. **Roller Rocker Lever**
   - Mark the installed position.
   - Do not interchange.
   - Check the roller for ease of movement.
   - Lubricate the running surfaces before installing.
8. **Hydraulic Lash Adjusters**
   - Mark the installed position.
   - Do not interchange.
   - Lubricate the running surfaces before installing.
9. **Valve**
   - Mark the installed position.
   - Do not grind, only hand lapping is permitted.
   - Valve dimensions, refer to **Fig. 7**.
   - Checking valve guides, refer to **VALVE GUIDE, CHECKING**.
10. **Cylinder Head**
    - See the note above.
    - Checking for distortion, refer to **Fig. 4**.
    - Removing and installing, refer to **CYLINDER HEAD**.
    - All of the coolant must be replaced after installation.
11. **Valve Stem Seal**

    Replacing, refer to **VALVE STEM SEALS, CYLINDER HEAD INSTALLED**.

12. **Valve Spring**
13. **Valve Spring Plate**

14. **Valve Retainers**
15. **Cap**
    - Always replace.
    - Drive in using a suitable drift until it is flush.

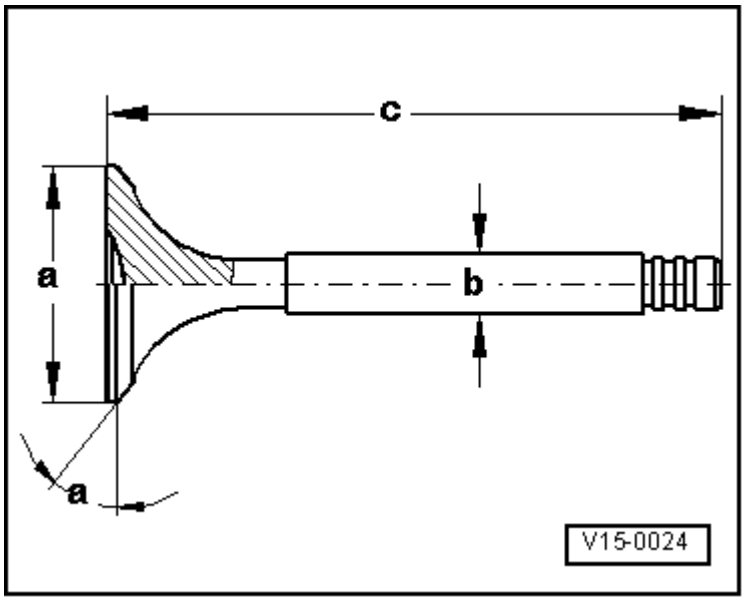

Fig. 7: Identifying Valve Dimensions
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

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

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

SPECIFICATIONS

FASTENER TIGHTENING SPECIFICATIONS

Component	Fastener Size	Nm
Camshaft Position Sensor to Cylinder Head Bolt	-	10
Coolant Connection to Cylinder Head Bolt	-	10
Fuel Rail to Cylinder Head Cover Bolt	-	22
Heat Shield to Cylinder Head Cover Bolt	-	5
Injection Unit Cover to Cylinder Head Cover Bolt	-	5

Injection Unit Tensioning Bracket to Cylinder Head Cover Nut	-	10
Lifting Eye to Cylinder Head Stud/Bolt	-	25
Vacuum Pump to Cylinder Head Bolt	-	10

Cylinder Head Cover Bolt Tightening Sequence and Specification

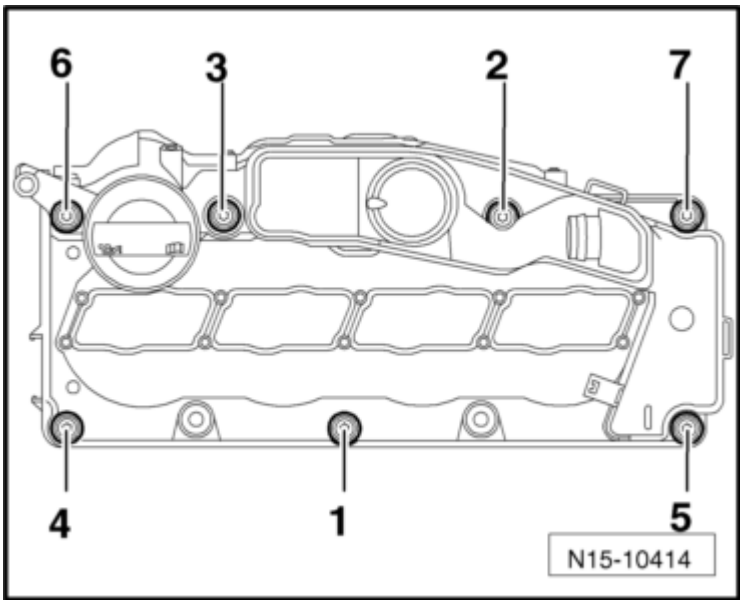

Fig. 8: Identifying Head Cover Bolts -1 Through 7- Tightening Sequence
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

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

Cylinder Head Bolt Tightening Sequence and Specification

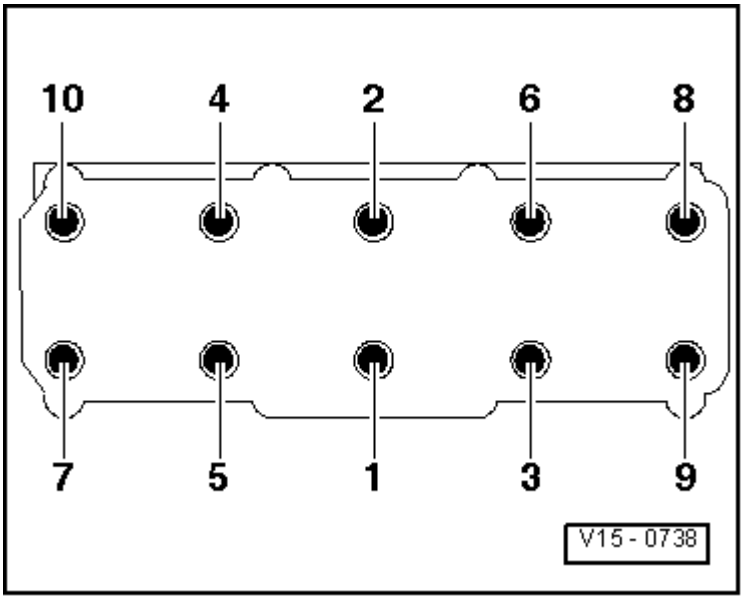

Fig. 9: Identifying Cylinder Head Bolt Tightening Sequence
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Tighten cylinder head bolts in the sequence indicated, in four stages as follows:

1. **Tighten using a Torque Wrench**

   Stage 1 = 35 Nm

   Stage 2 = 60 Nm

2. **Tighten further using a Ratchet**

   Stage 3 = an additional 90° (1/4) turn

   Stage 4 = an additional 90° (1/4) turn

Bearing Frame Bolt Tightening Sequence and Specification

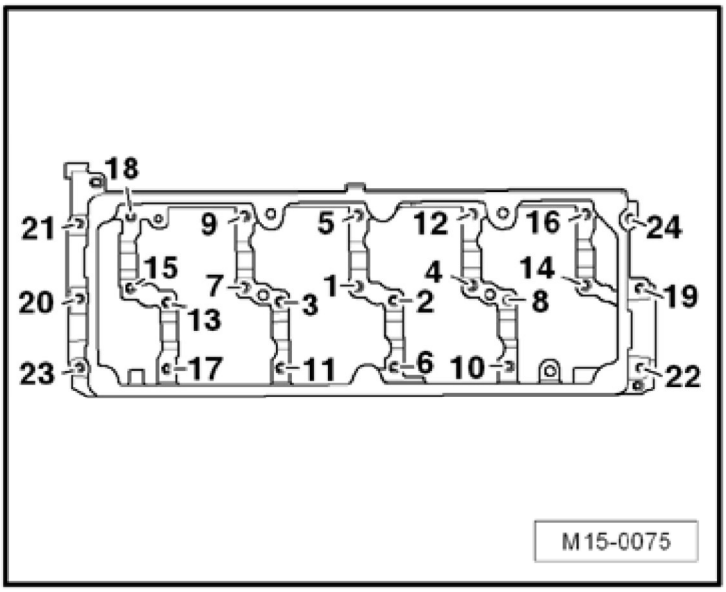

Fig. 10: Identifying Bearing Frame Bolt Tightening Sequence
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Tighten the bearing frame bolts and nuts in sequence -1 through 24- to 10 Nm.

DIAGNOSIS AND TESTING

COMPRESSION, CHECKING

NOTE: The compression can also be checked using a vehicle diagnostic tester such as the vehicle diagnosis, testing and information system VAS 5051 B.

Special tools and workshop equipment required

- Adapter V.A.G 1381/12
- Compression Tester V.A.G 1763

Test Conditions

- Engine oil temperature must be at least 30 °C (86 °F).
- The battery voltage must be at least 12.7 volts.
- All electrical consumers such as, for example, lights and rear window defogger, must be turned off.

Test Sequence

-- Remove the glow plug from the corresponding cylinder. Refer to **GLOW PLUGS** .

-- Install the adapter V.A.G 1381/12 in place of the glow plug.

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

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

-- Operate the starter until the tester show there is no further increase in pressure.

Compression Pressure

- New: 25.0 to 31.0 bar
- Wear limit: 19.0 bar
- Permissible difference between all cylinders: maximum 5.0 bar

-- Install the glow plug to the corresponding cylinder. Refer to **GLOW PLUGS** .

NOTE: By disconnecting the connectors, Diagnostic Trouble Codes (DTCs) are stored to memory. After the test, check the fault memory and erase, if necessary.

-- Read the Engine Control Module (ECM) DTC memory and erase all DTC entries. Refer to "Guided Functions" in the vehicle diagnostic tester.

VALVE GUIDE, CHECKING

Special tools and workshop equipment required

- Dial Gauge Holder VW 387
- Dial Gauge VAS 6079

Test Sequence

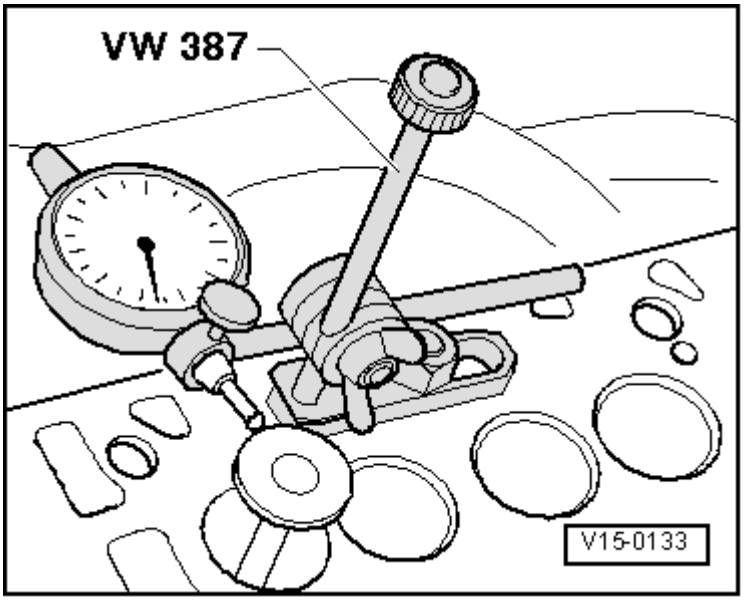

Fig. 11: Identifying Dial Gauge Holder VW 387 And Dial Gauge VAS 6079 To Determine Valve Rock (Wear Limit)
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Insert a new valve into the guide. The end of the valve stem must be flush with the guide. Use only the intake valve in the intake guide and the exhaust valve in the exhaust guide.

-- Determine tilt clearance.

- Wear limit: 1.30 mm.

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

REMOVAL AND INSTALLATION

ENGINE COVER

Removing

-- Pull the corners of the engine cover -arrows- up off of the ball studs.

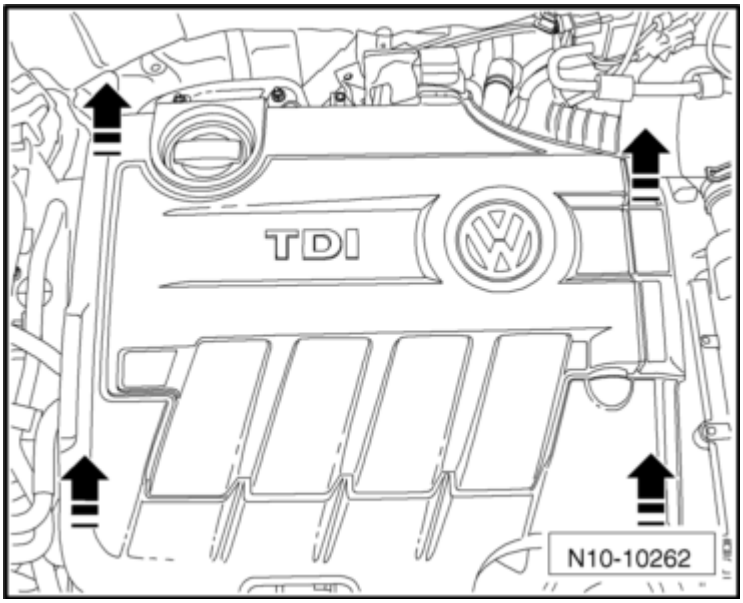

Fig. 12: Identifying Direction To Pull Engine Cover
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

Installing

CAUTION: Check the position of the 4 mounting elements (ball sockets) before installing the engine cover. Bring them back into the correct position if necessary. Otherwise the engine cover will be damaged.

-- Press the ball sockets on the engine cover into the correct installed position, if necessary.

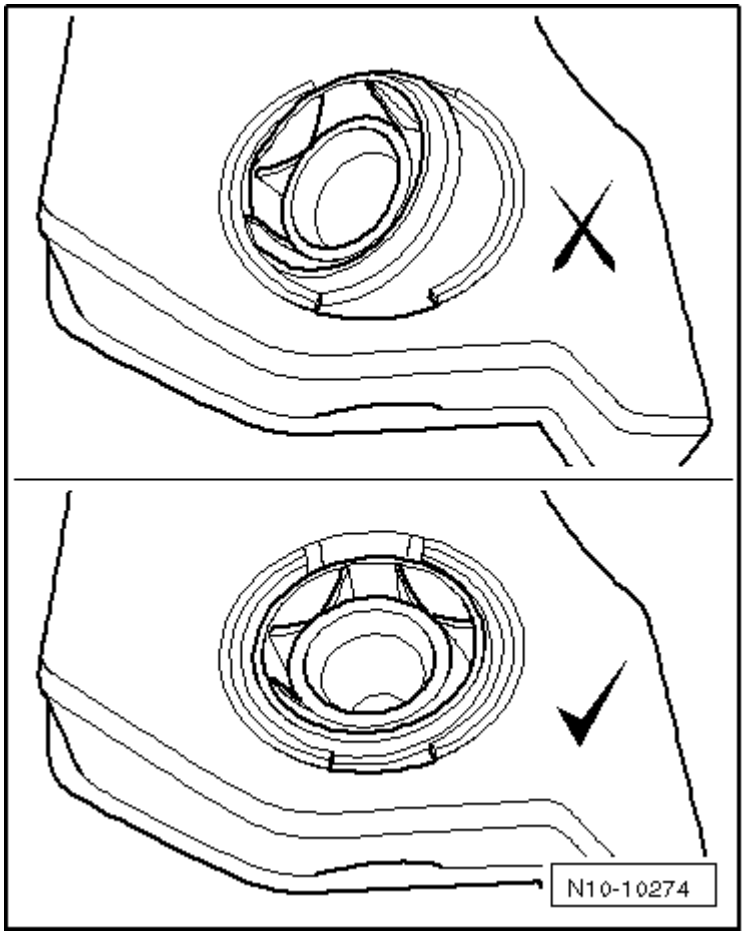

Fig. 13: Identifying Ball Sockets Correct Installed Position
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Position the engine cover on the ball studs and press down the corners onto the ball studs.

CAMSHAFT POSITION SENSOR -G40-

Removing

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

-- Remove the fuel filter and the auxiliary fuel pump -V393-. Refer to **Auxiliary Fuel Pump -V393- (IN-LINE ELECTRIC FUEL PUMP)** .

-- Disconnect the connector from the engine coolant temperature sensor on radiator outlet -G83-.

-- Open the clips -arrows- and remove the toothed belt guard.

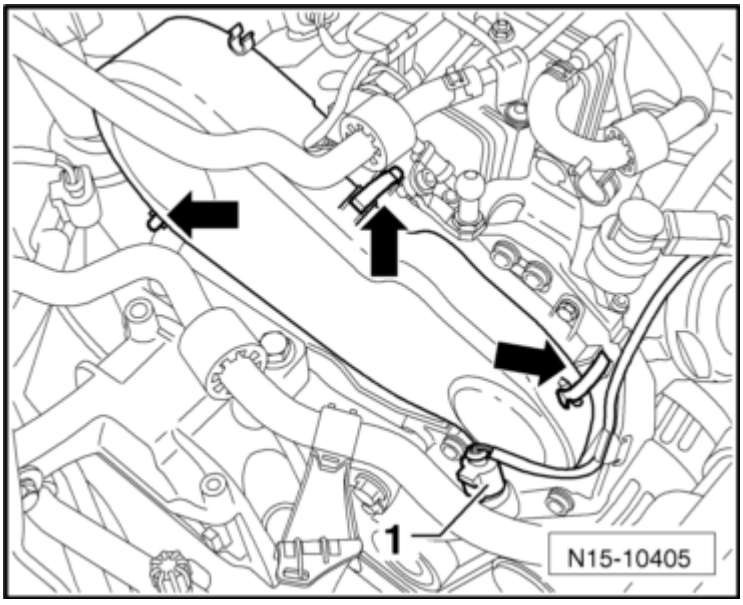

Fig. 14: Identifying Connector -1- And Clips -Arrows-
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Remove the front right wheel housing liner.

-- Remove the ribbed belt. Refer to **RIBBED BELT** .

-- 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 toothed gear must be in the >>12 o'clock<< position.

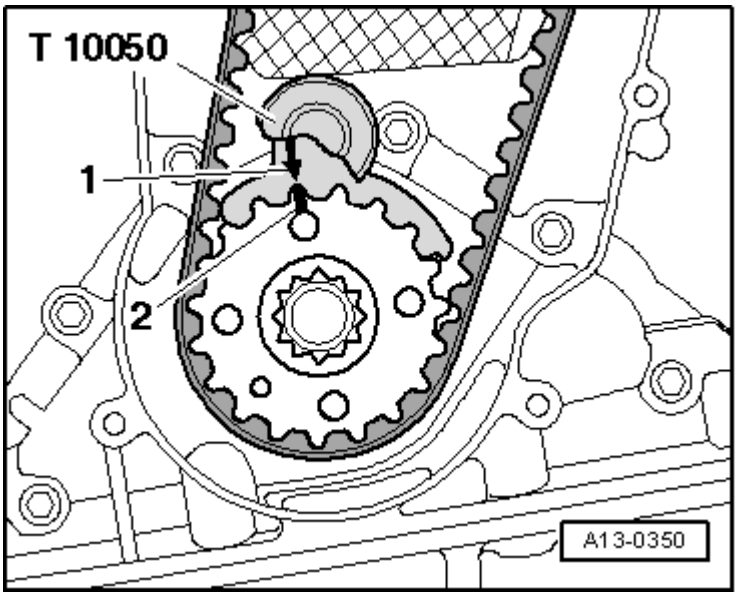

Fig. 15: Identifying Crankshaft Toothed Belt Pulley And Crankshaft Stop T10050

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 camshaft gear bolts -1-.

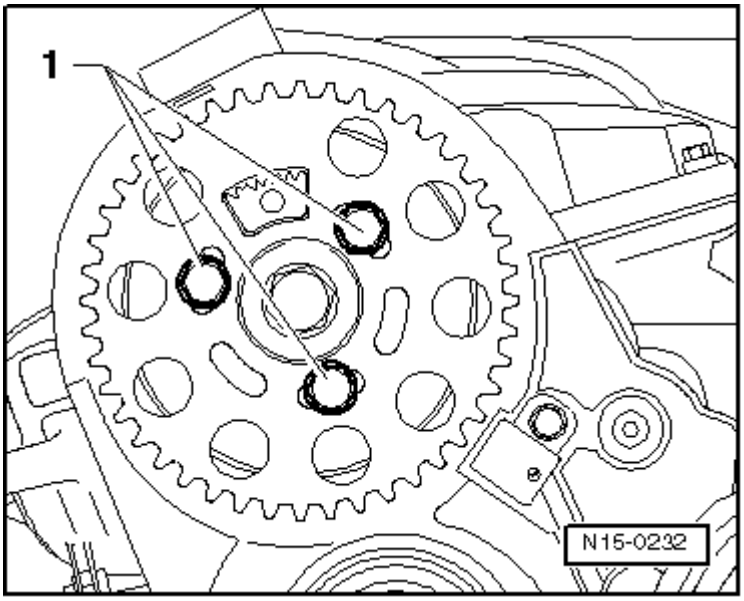

Fig. 16: Identifying Camshaft Pulley Securing Bolts
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

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

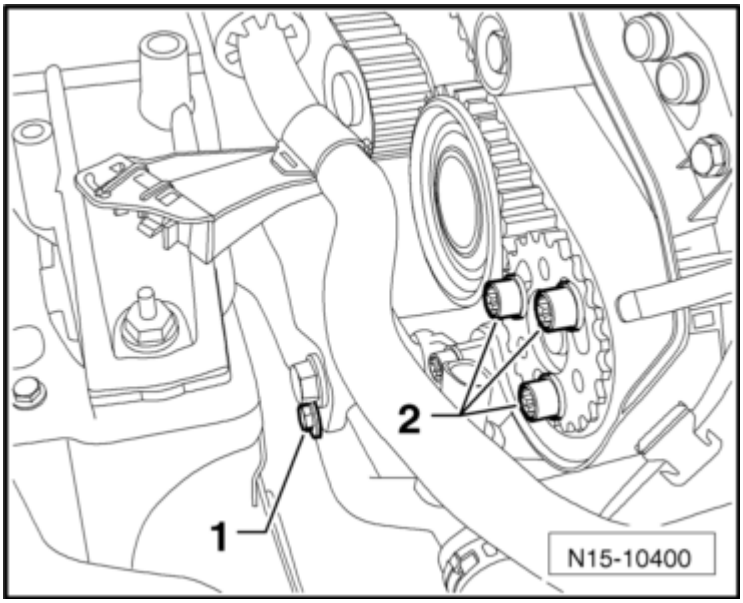

Fig. 17: Identifying Coolant Pipe Bolt -1- And High Pressure Fuel Pump Toothed Belt Gear -2-

Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Loosen the nut -1- for the tensioner and rotate the tensioner eccentric pulley counterclockwise -arrow- using the special wrench, long reach T10264 until it is possible to lock the tensioner using the locking tool T10265.

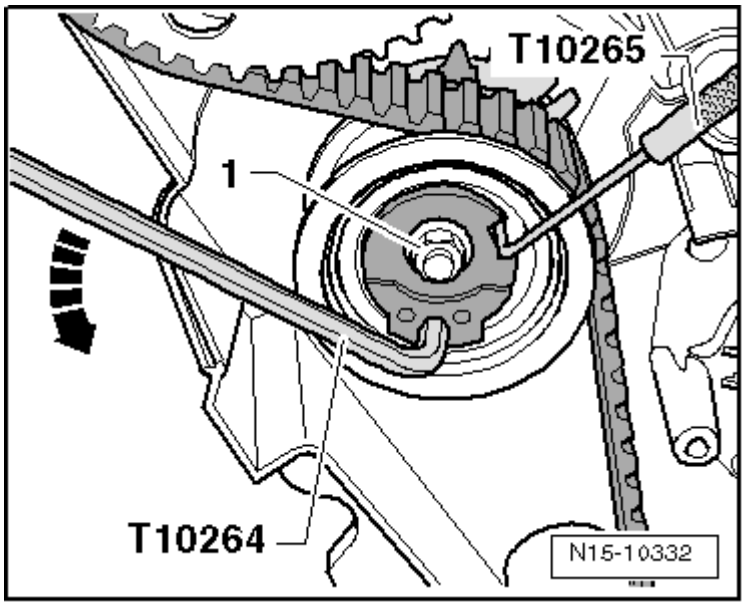

Fig. 18: Identifying Long Reach T10264 And Locking Tool T10265
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

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

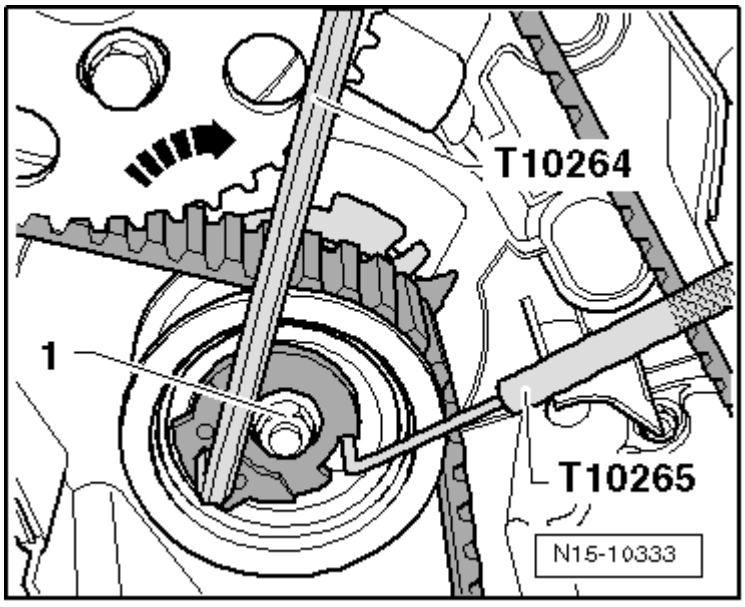

Fig. 19: Identifying Long Reach T10264 And Locking Tool T10265
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

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

-- Disconnect the Camshaft Position (CMP) sensor connector -arrow-.

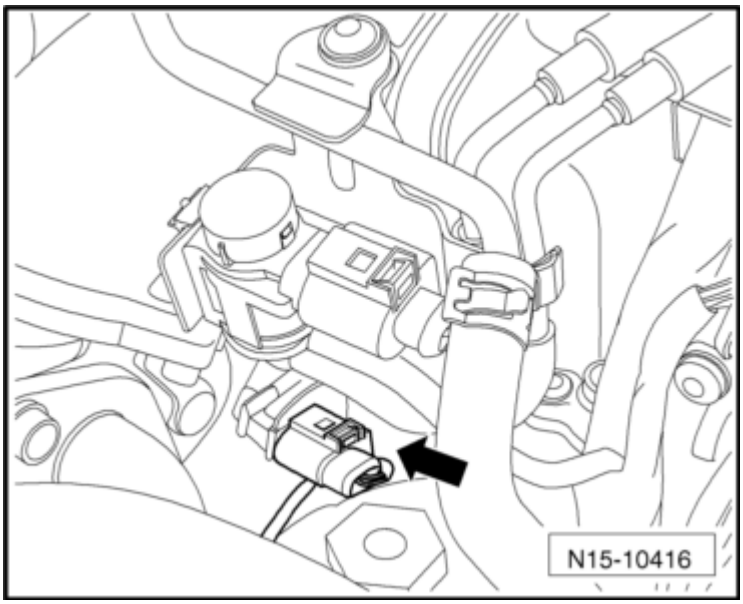

Fig. 20: Identifying Camshaft Position Sensor -G40- Connector -Arrow-
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Remove the connector from the mount.

-- Remove the CMP sensor -arrow-.

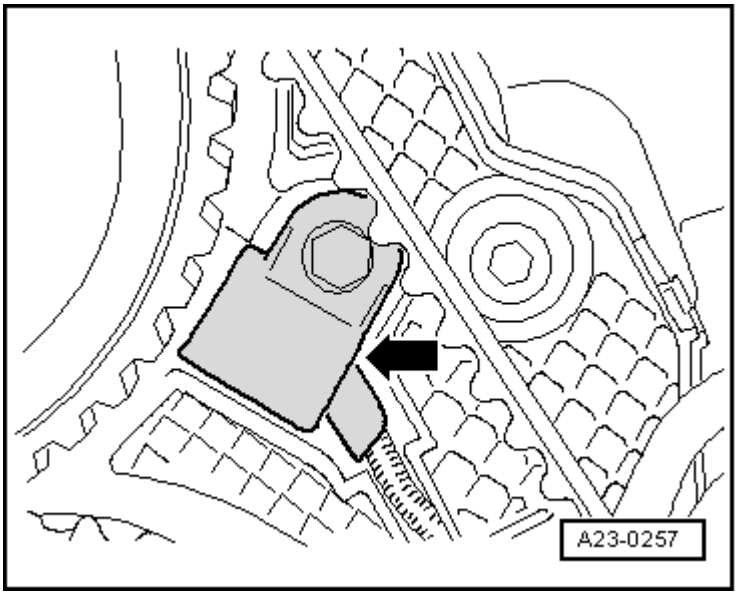

Fig. 21: Identifying CMP Sensor -Arrow-
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

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

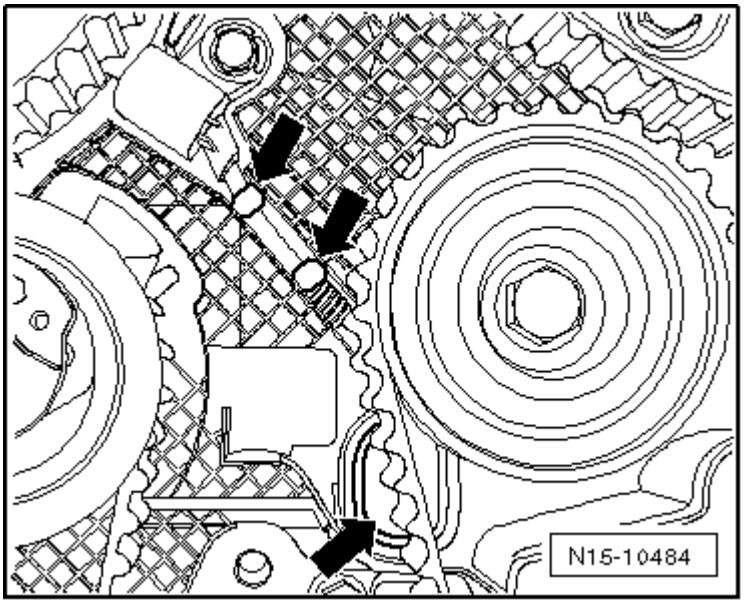

Fig. 22: Identifying Repair Opening -Arrows-
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

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

Installing

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

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

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

CYLINDER HEAD COVER

Special tools and workshop equipment required

- Torque Wrench (5-50 Nm) V.A.G 1331
- Hose Clip Pliers VAS 6362
- Socket T40055
- Ratchet, Reversible V.A.G 1331/1
- Engine Bung Set VAS 6122

CAUTION:

- **Follow the safety precautions when working on the diesel direct injection system. Refer to SAFETY PRECAUTIONS .**
- **Observe rules for cleanliness. Refer to CLEAN WORKING CONDITIONS .**

Always follow these instructions before and during work.

NOTE: Cylinder head cover overview. Refer to CYLINDER HEAD COVER OVERVIEW.

Removing

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

- **Route all lines and wires in their original locations.**
- **For example, fuel, hydraulic, Evaporative Emission (EVAP), coolant, refrigerant, brake fluid and vacuum lines.**
- **Ensure sufficient clearance to all moving or hot components.**

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

-- Remove the protective strip.

-- Disconnect the connectors from the fuel injectors -A-, the exhaust pressure sensor 1 -G450- -B- and the fuel pressure sensor -G247- -C-.

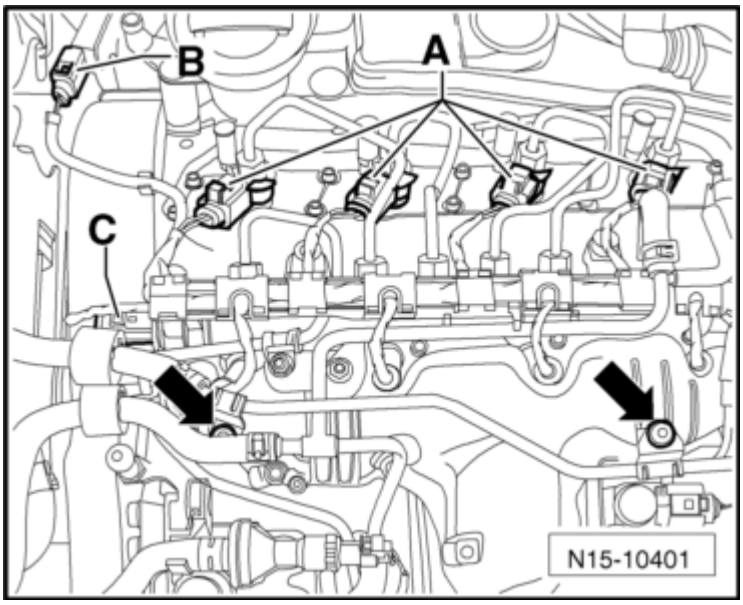

Fig. 23: Identifying Fuel Injectors -A-, Exhaust Pressure Sensor 1 -G450- -B- And Fuel Pressure Sensor -G247- -C-
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

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

-- Unclip the wiring harness for the glow plugs from the wiring guide.

CAUTION: Always follow the procedure "glow plug connectors, disconnecting and installing".

-- Disconnect the glow plug connectors. Refer to **GLOW PLUG CONNECTOR, DISCONNECTING AND CONNECTING** .

-- Remove the fuel return line bolt from the intake manifold.

-- Reposition the hose clamp -arrow- using hose clip pliers VAS 6362 and remove the line from the fuel rail.

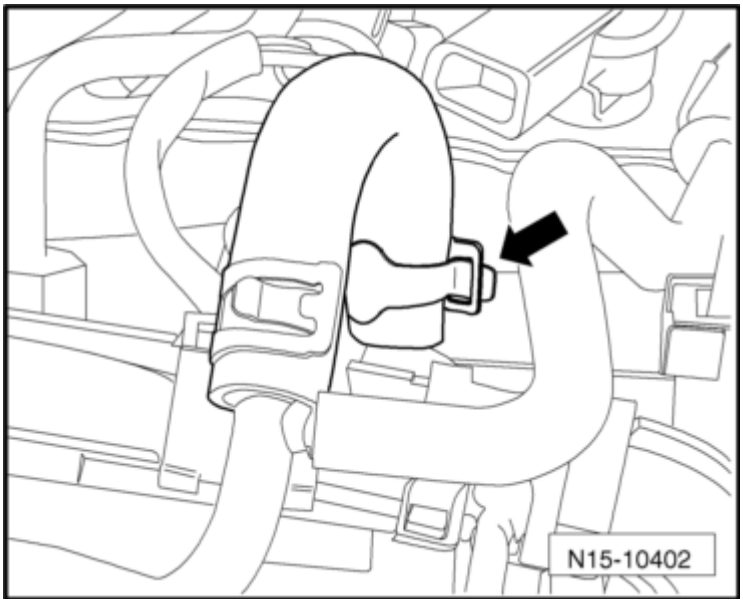

Fig. 24: Identifying Hose Clamp -Arrow-
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Before removing, clean the return line connection on the fuel injectors (for example using a commercially available detergent).

-- Cover the return line connections with a cloth.

-- Remove the fuel return line connections on the fuel injectors. Pull them upward to release them -arrow-.

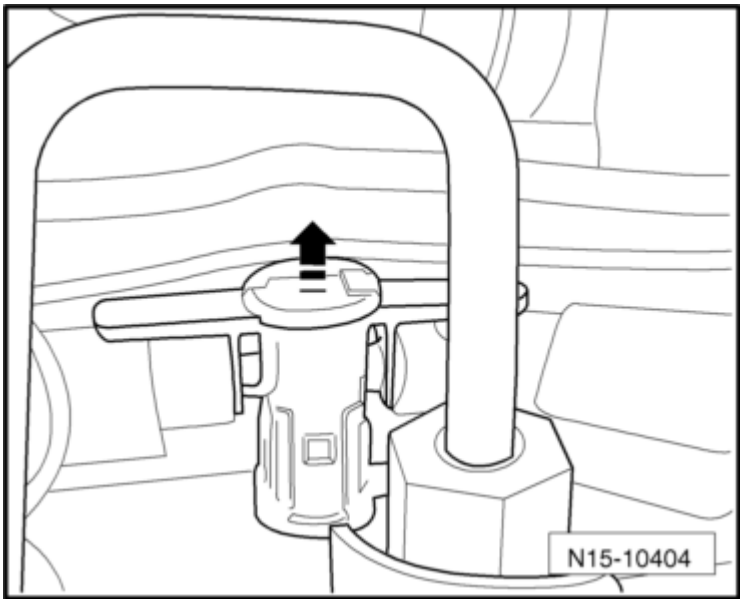

Fig. 25: Identifying Fuel Return Line Connections On Fuel Injectors
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

NOTE: Follow the rules of cleanliness.

Do not let any dirt to get into the disconnected return lines or into the connections for the fuel injection units.

-- Reposition the hose clamp using hose clip pliers VAS 6362 and remove the fuel return line.

-- Reposition the hose clamp -4- using hose clip pliers VAS 6362 and remove the fuel return line at the high pressure fuel pump.

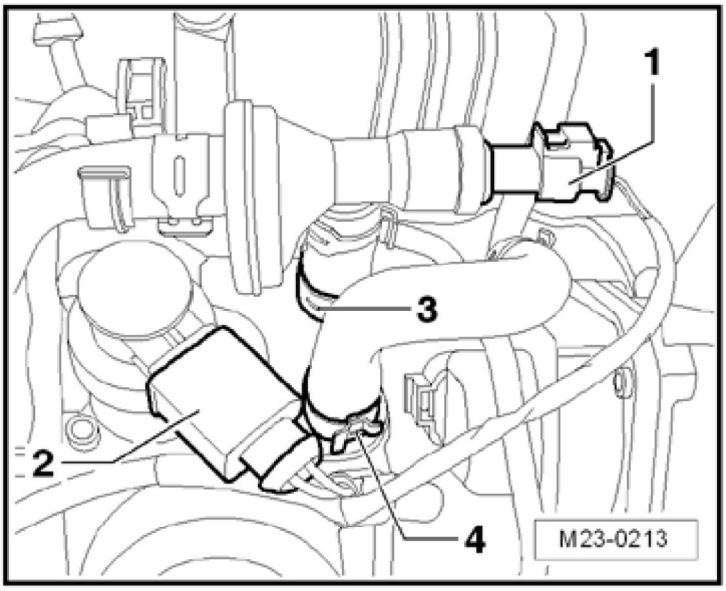

Fig. 26: Identifying Hose Clamp -4-
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Seal the lines so that the fuel system is not contaminated by dirt, etc.

-- Remove the fuel return line and lay the lines in front of the intake manifold.

-- Disconnect the connector from the charge pressure actuator position sensor -G581- -arrow- at the turbocharger vacuum diaphragm and guide the line out of the retainers.

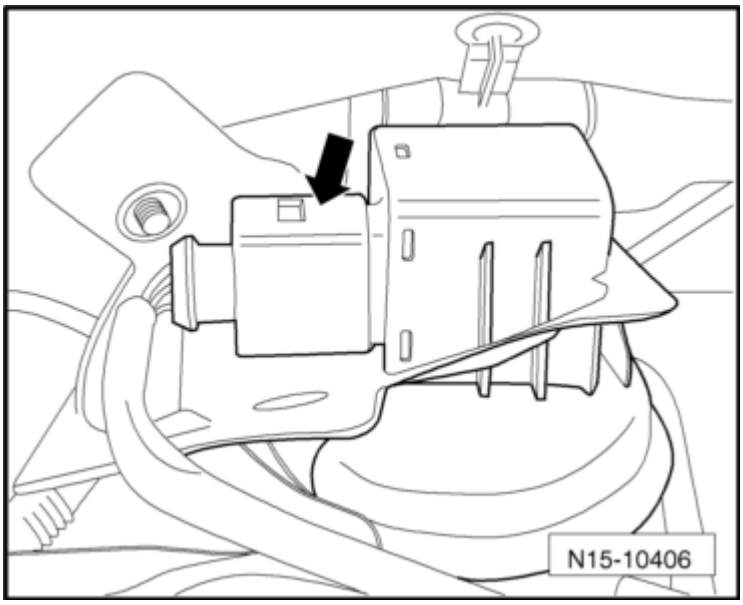

Fig. 27: Identifying Connector To Charge Pressure Actuator Position Sensor -Arrow-
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

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

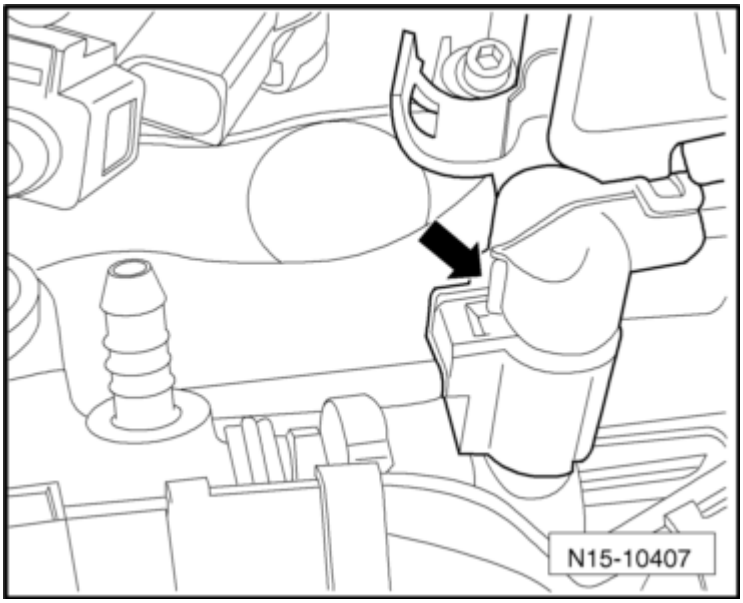

Fig. 28: Identifying Connector To Fuel Pressure Regulator Valve -Arrow-
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Remove the line guide on the fuel rail and lay it aside.

-- Remove the vacuum hose from the cylinder head cover.

-- Remove the remaining vacuum hoses from the bracket on the cylinder head cover.

-- Disconnect the connector -1- from the engine coolant temperature sensor on radiator outlet -G83-, open the clips -arrows- and remove the upper toothed belt guard.

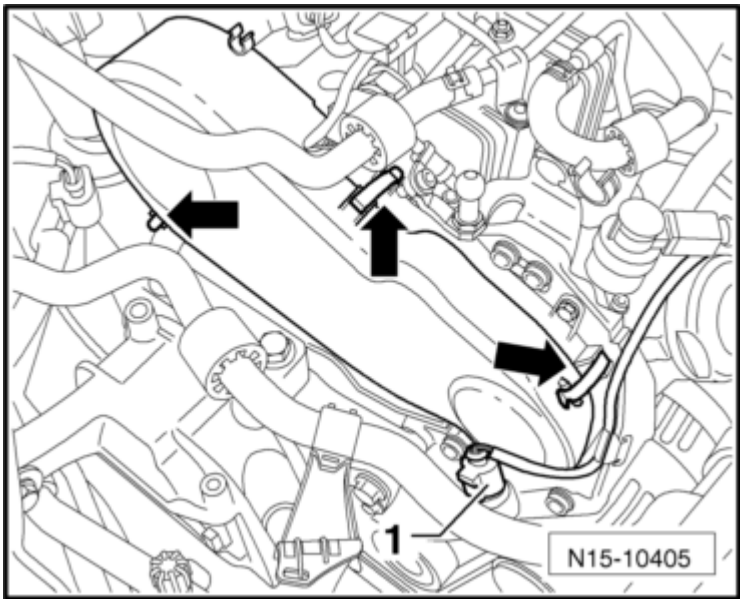

Fig. 29: Identifying Connector -1- And Clips -Arrows-
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Remove the crankcase ventilation hose between the intake tube and the cylinder head cover.

NOTE: The crankcase ventilation hose is destroyed when it is removed.

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

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

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

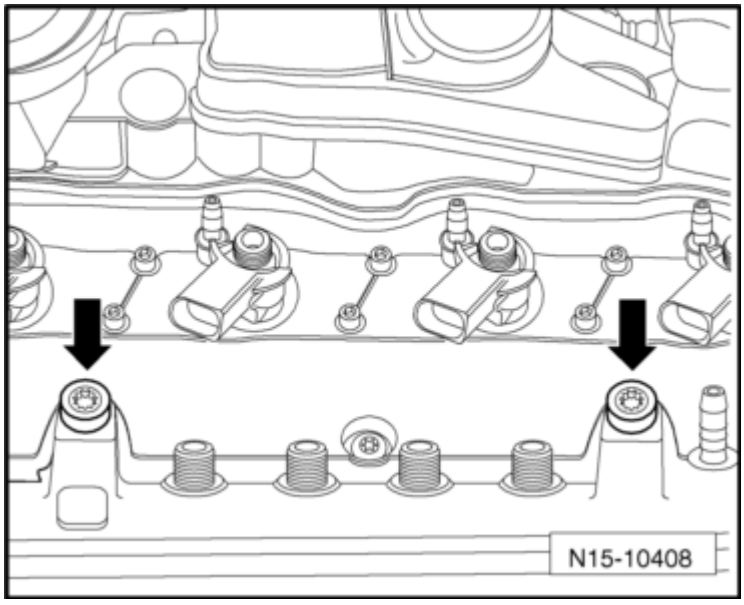

Fig. 30: Identifying Bolts -Arrows- And Fuel Rail
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

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

-- Remove the cylinder head cover bolts in sequence -7 through 1-.

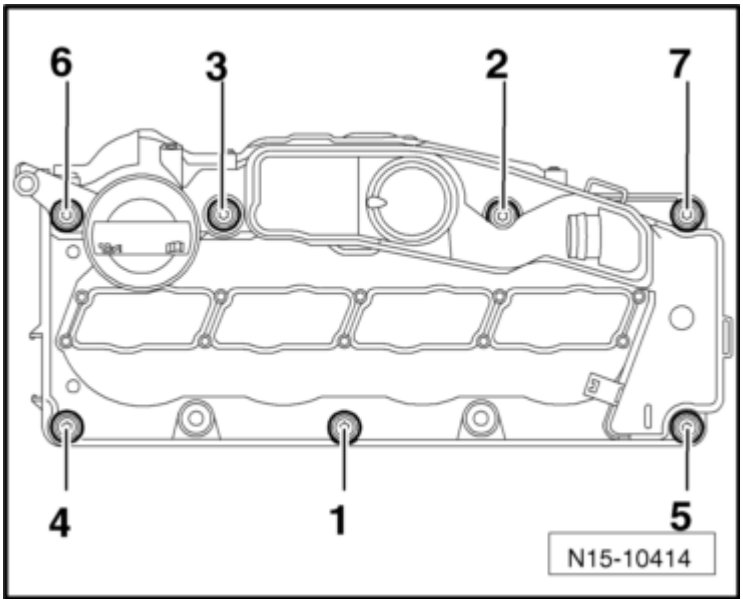

Fig. 31: Identifying Head Cover Bolts -1 Through 7- Tightening Sequence
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Remove the cylinder head cover.

Installing

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

- Replace the cylinder head cover gasket if it leaks or is damaged.
- When installing the high pressure line or fuel lines, make sure no dirt or contaminants enter the fuel system.
- Only remove the sealing plugs right before installing the fuel lines.
- Do not change the angles of the high pressure lines
- Make sure line connections are securely fastened.
- Do not swap the supply and return lines.

-- First, tighten the cylinder head cover bolts by hand in sequence -1 through 7-.

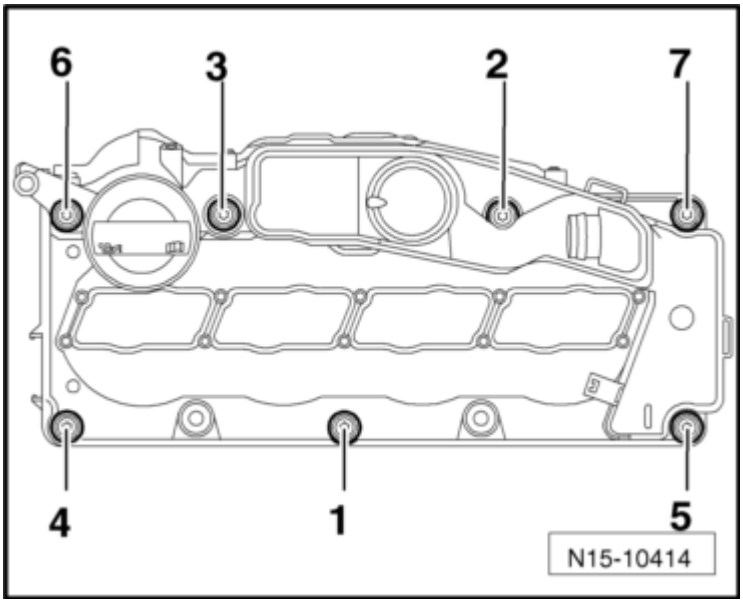

Fig. 32: Identifying Head Cover Bolts -1 Through 7- Tightening Sequence
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Tighten the cylinder head cover bolts in sequence -1 through 7- to specification.

- Tightening specification, see -item 14- in the **CYLINDER HEAD COVER OVERVIEW**.

-- Install the upper toothed belt guard.

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

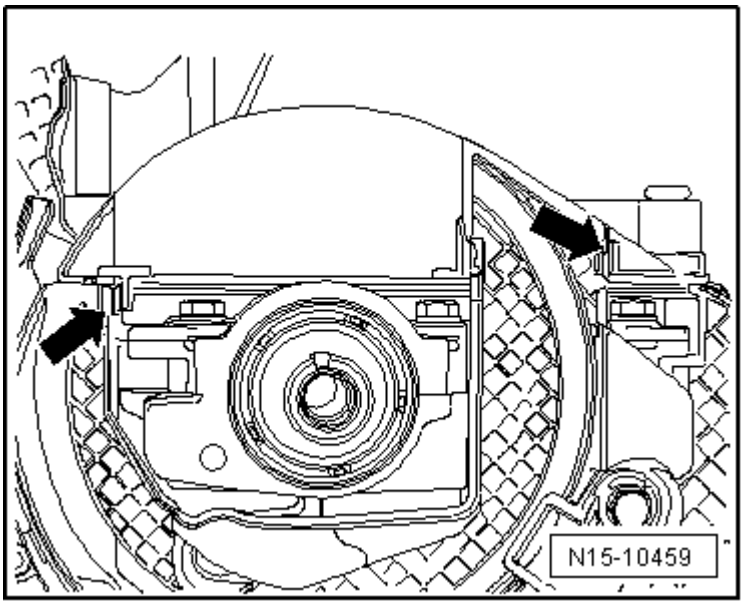

Fig. 33: Identifying Upper Toothed Belt Guard
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

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

-- Press the upper 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.

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

-- Tighten the high pressure line union nuts by hand.

-- Make sure the high pressure line is free of tension.

-- Use the torque wrench (5-50 Nm) V.A.G 1331 with the ratchet, reversible V.A.G 1331/1 and the socket T40055 to tighten the high pressure line.

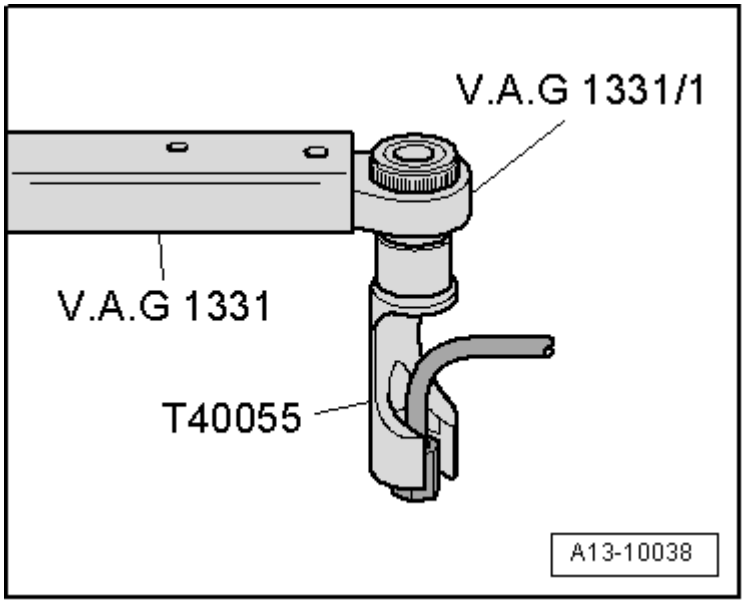

Fig. 34: Identifying Torque Wrench V.A.G 1331T, Reversible V.A.G 1331/1 And Socket T40055
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

Tightening Specifications

- Cylinder head cover overview, refer to **CYLINDER HEAD COVER OVERVIEW**.
- Fuel system overview, refer to **FUEL RAIL AND INJECTORS OVERVIEW** .

-- Fill the fuel system, refer to **FUEL SYSTEM, FILLING AND BLEEDING** .

TOOTHED BELT

Special tools and workshop equipment required

- Diesel Injection Pump Locking Pin 3359
- Crankshaft Stop T10050

- Counterhold Tool Touareg V10 T10172
- Special Wrench, Long Reach T10264
- Locking Tool T10265
- Torque Wrench V.A.G 1331 (5-50 Nm)
- Torque Wrench V.A.G 1332 (40-200 Nm)

NOTE: Toothed belt overview. Refer to TOOTHED BELT OVERVIEW .

Requirements

- Ignition is turned off.
- Engine must be cold.

NOTE: Adjustments to the toothed belt may generally only be performed when the engine is cold, because the indicator position of the tensioning element changes depending on engine temperature.

The engine mount bracket must be removed to remove/install the belt tensioner. Refer to ENGINE MOUNT AND BRACKET .

Removing

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

-- Remove the fuel filter. Refer to **FUEL FILTER** .

-- Remove the auxiliary fuel pump -V393-. Refer to **Auxiliary Fuel Pump -V393- (IN-LINE ELECTRIC FUEL PUMP)** .

-- Disconnect the connector -1- from the engine coolant temperature sensor on radiator outlet -G83-, open the clips -arrows- and remove the upper toothed belt guard.

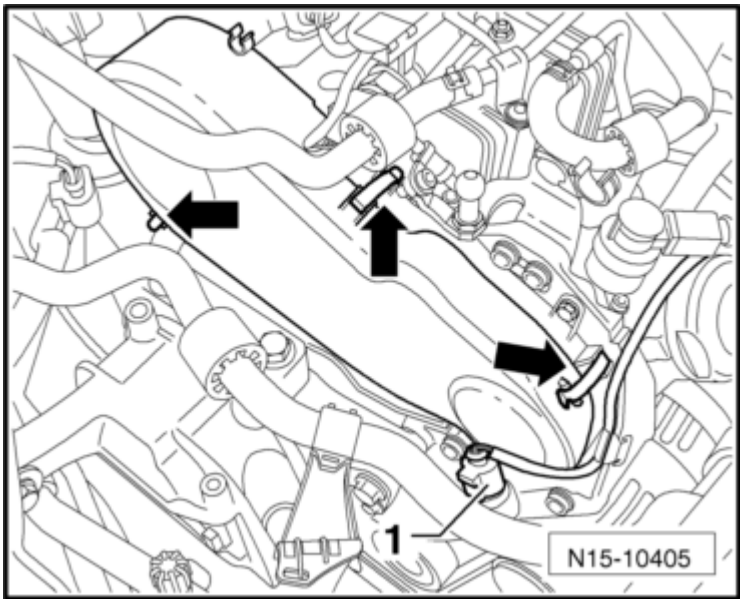

Fig. 35: Identifying Connector -1- And Clips -Arrows-
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

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

-- Remove the ribbed belt. Refer to **RIBBED BELT** .

-- Remove the vibration damper.

-- Remove the lower and center toothed belt guard bolts -arrows-.

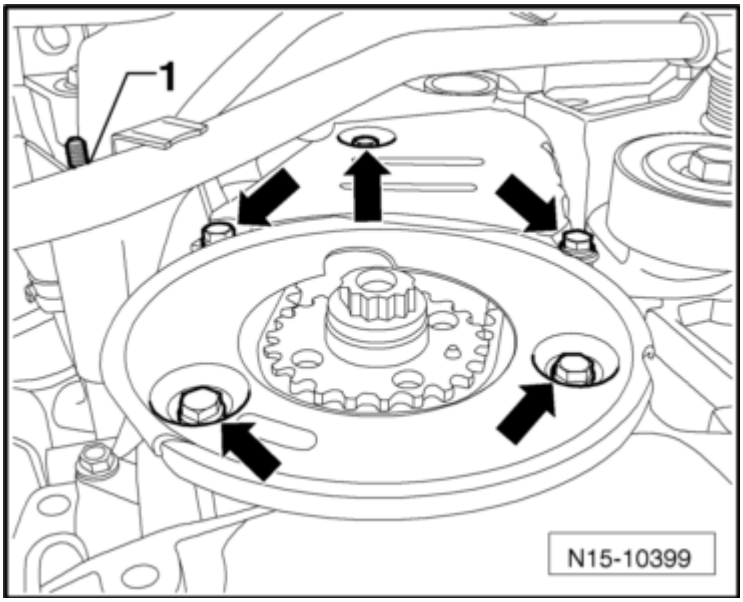

Fig. 36: Identifying Lower And Center Toothed Belt Guard Bolts -Arrows-
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Remove the coolant pipe nut -1-.

-- 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 toothed gear must be in the >>12 o'clock<< position.

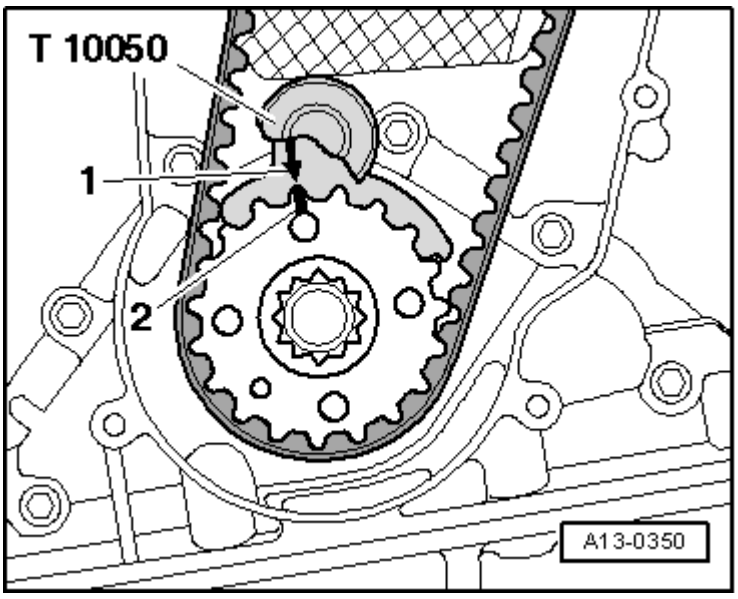

Fig. 37: Identifying Crankshaft Toothed Belt Pulley And Crankshaft Stop T10050
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

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 gear.

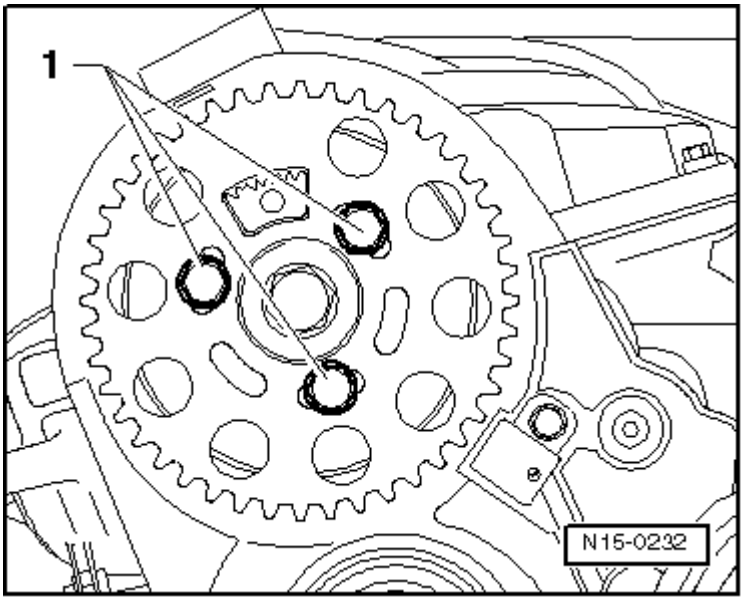

Fig. 38: Identifying Camshaft Pulley Securing Bolts
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

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

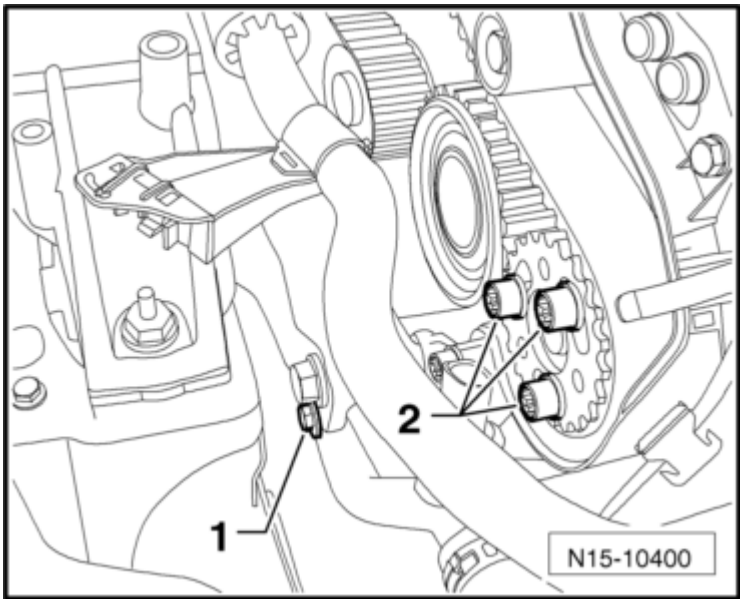

Fig. 39: Identifying Coolant Pipe Bolt -1- And High Pressure Fuel Pump Toothed Belt Gear -2-
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Loosen the nut -1- on the tensioner and turn the tensioner eccentric pulley counterclockwise in the -direction of the arrow- using the special wrench, long reach T10264 until it is possible to lock the tensioner using the locking tool T10265.

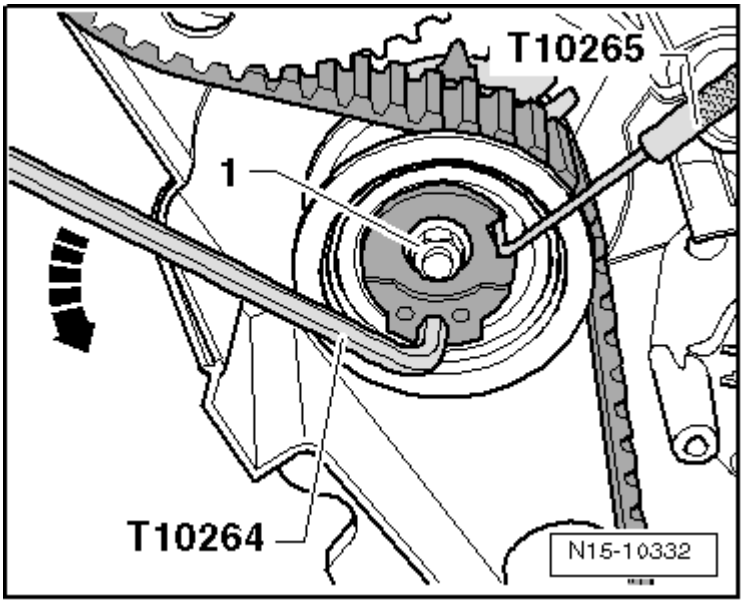

Fig. 40: Identifying Long Reach T10264 And Locking Tool T10265
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

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

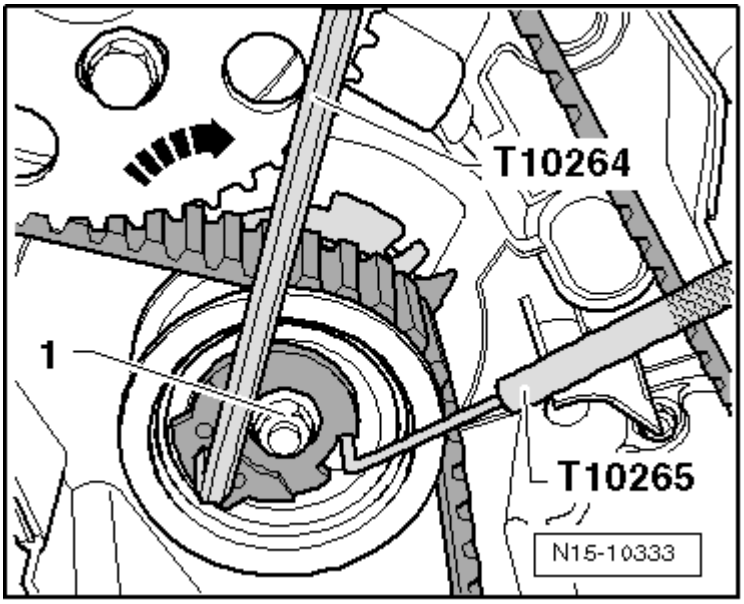

Fig. 41: Identifying Long Reach T10264 And Locking Tool T10265
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- First, remove the toothed belt from the idler roller and then from the remaining gears.

Installing and Tensioning

Requirements

- Ignition is turned off.
- Engine must be cold.
- 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: Adjustments to the toothed belt may generally only be performed when the engine is cold, because the indicator position of the tensioning element changes depending on engine temperature.

The engine mount bracket must be removed to remove/install the tensioner. Refer to ENGINE MOUNT AND BRACKET .

Procedure

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

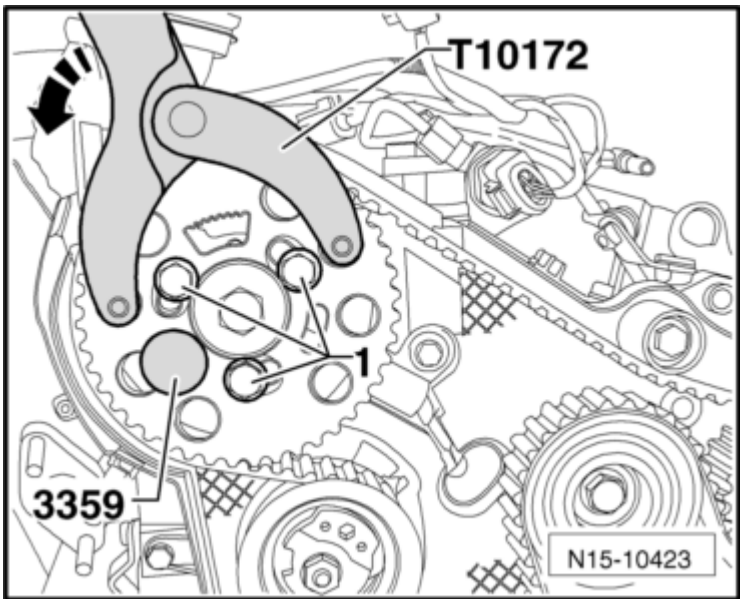

Fig. 42: Identifying T10172 Pushed In -Direction Of Arrow- And Bolts -1-
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- 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.

-- Loosen the bolts -1- that were tightened by hand.

-- If necessary, rotate the high pressure fuel pump hub with a screwdriver at the bolt heads -1- until it can be secured.

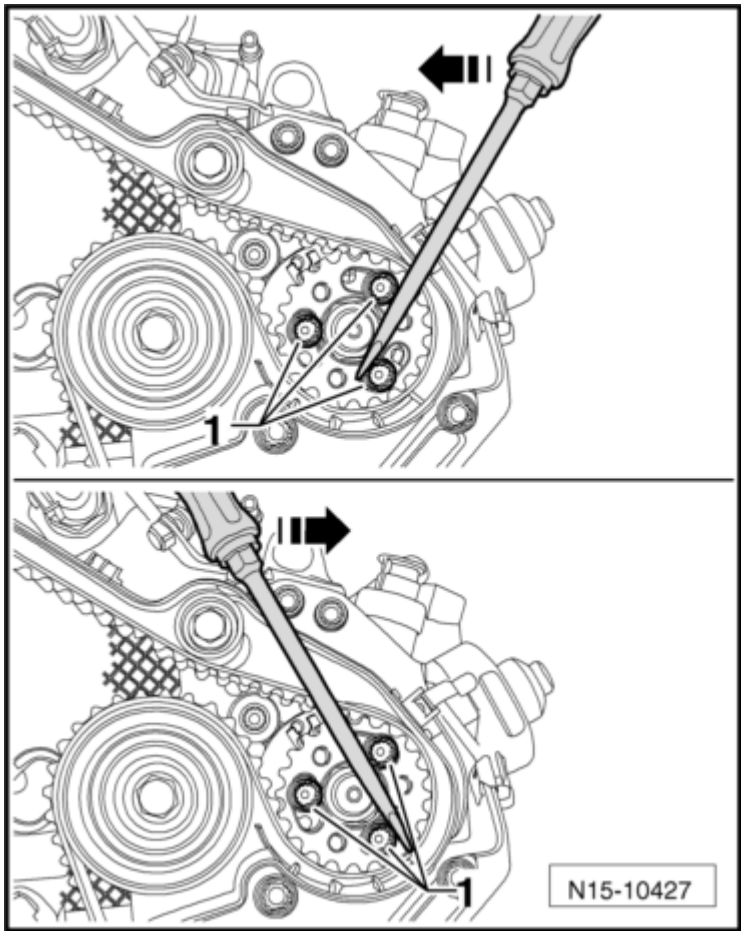

Fig. 43: Identifying Screwdriver Secured At Bolt Heads -1-
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Secure the high pressure fuel pump hub using the diesel injection pump locking Pin 3359. To do that, slide the pin into the hole outside the toothed belt sprocket.

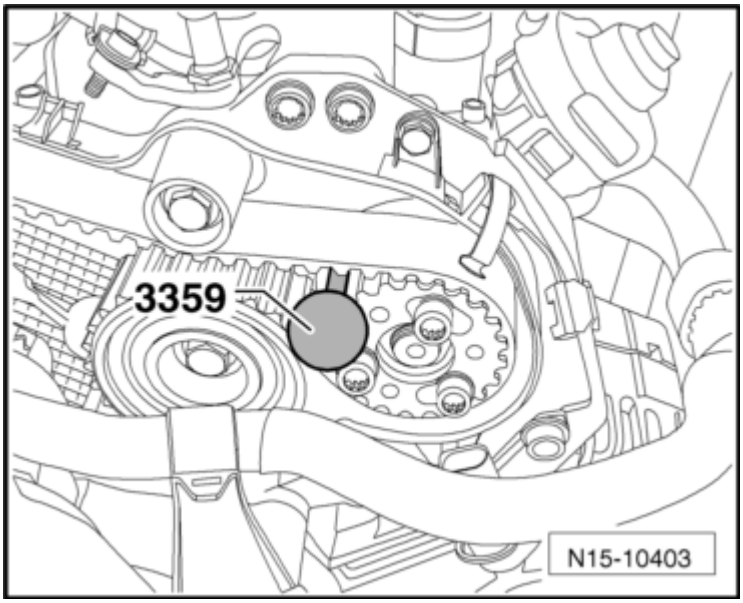

Fig. 44: Identifying Diesel Injection Pump Locking Pin 3359
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Rotate the camshaft gear and high pressure fuel pump gear clockwise in their slots as far as the stop.

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

-- Lay the toothed belt on the tensioner last.

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

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

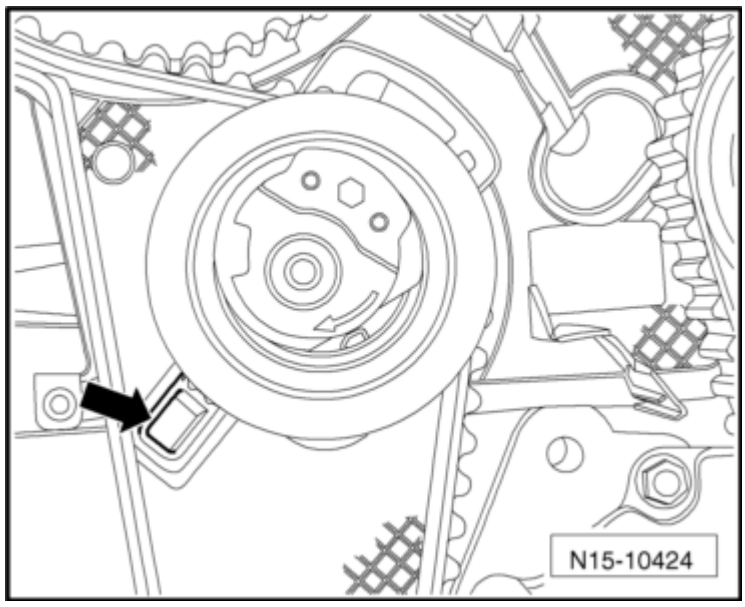

Fig. 45: Identifying Tensioner Positioned In Rear Toothed Belt Guard -Arrow-
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Carefully rotate the tensioner eccentric pulley clockwise using the special wrench, long reach T10264 until the indicator is centered in the base plate gap -2-.

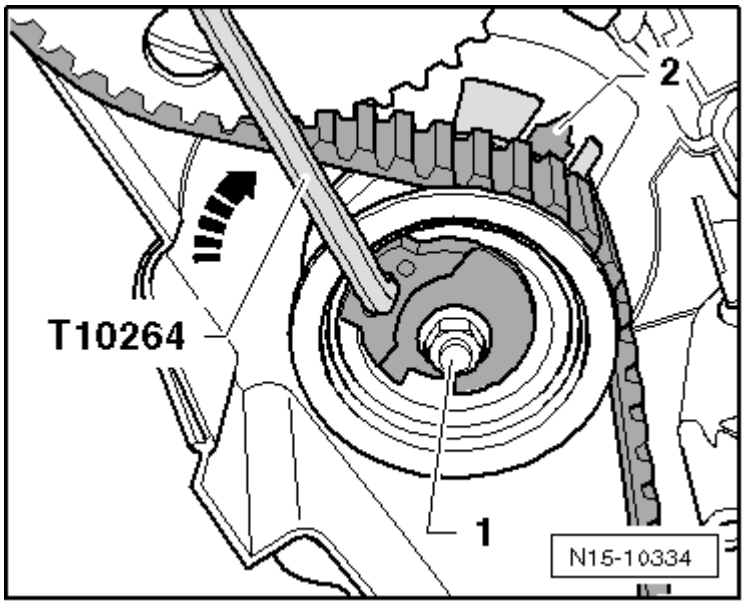

Fig. 46: Identifying Long Reach T10264 And Nut -1-
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

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

-- Hold the tensioner in this position and tighten the nut on it.

- Tightening specification, see -item 6- in the **TOOTHED BELT OVERVIEW** .

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

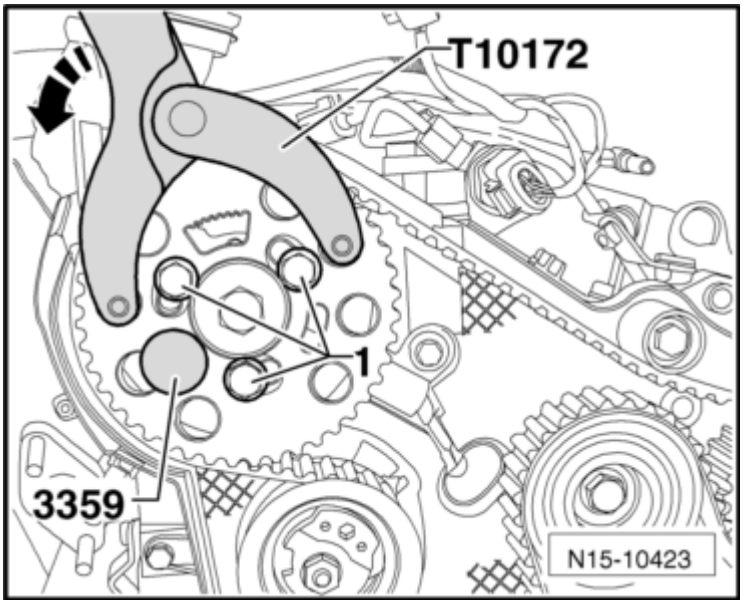

Fig. 47: Identifying T10172 Pushed In -Direction Of Arrow- And Bolts -1-
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- In this position, tighten the bolts -1- for the camshaft gear and high pressure fuel pump toothed belt gear.

- Tightening specification: 20 Nm.

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

-- Rotate the crankshaft at least two rotations in engine rotation direction and position it just before cylinder 1 TDC.

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

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

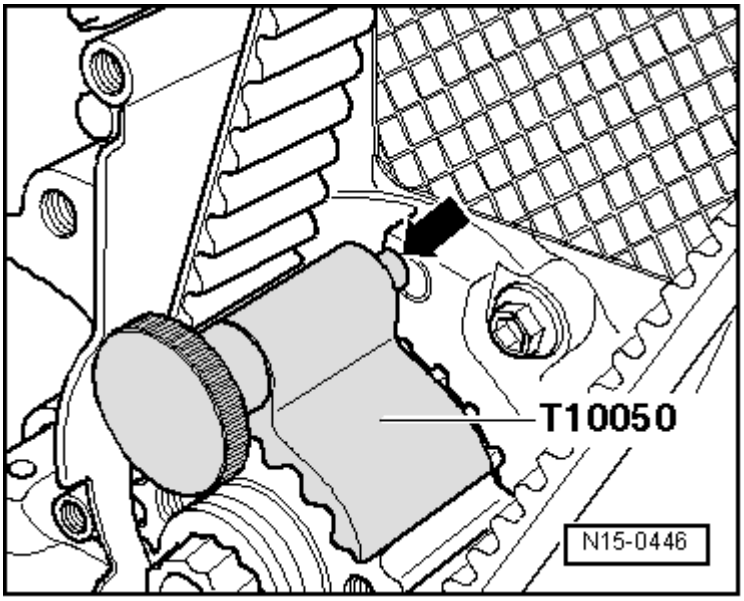

Fig. 48: Identifying Crankshaft Stop T10050
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

NOTE: In the following check, only the camshaft and crankshaft are secured. It is difficult to find the securing point on the high pressure fuel pump hub. A small deviation -arrow- does not affect engine operation.

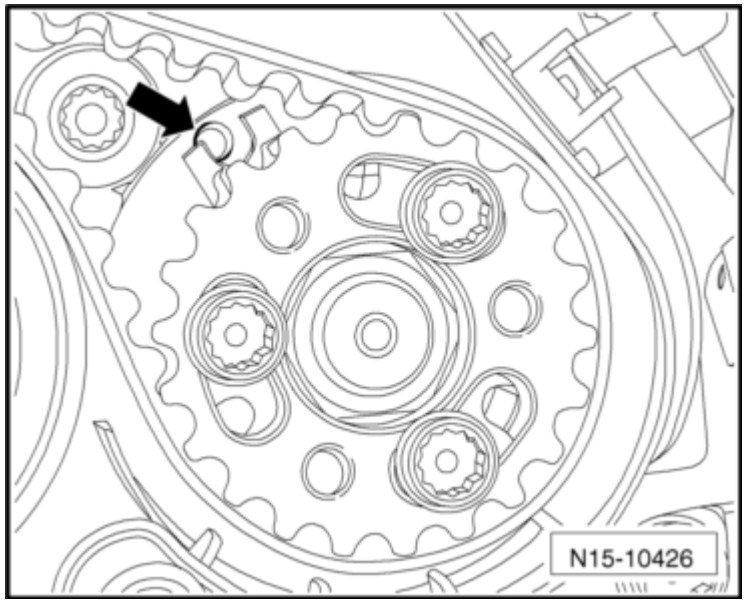

Fig. 49: Identifying Small Deviation -Arrow- On High Pressure Fuel Pump Hub
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Check if:

- the camshaft hub can be secured using the diesel injection pump locking Pin 3359 and

- the tensioner indicator is centered with or a maximum of 5 mm to the right of the base plate gap.

If the camshaft hub cannot be secured:

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

-- Rotate the crankshaft opposite 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.

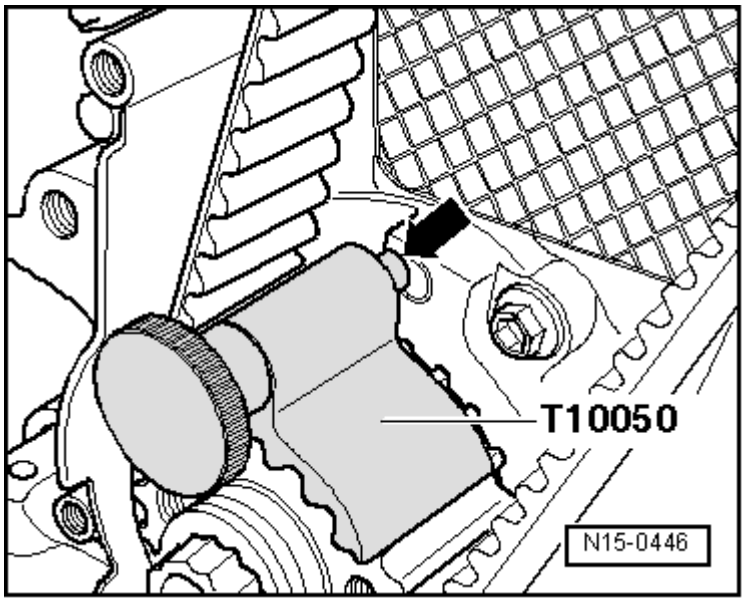

Fig. 50: Identifying Crankshaft Stop T10050
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Tighten the bolts on the camshaft toothed belt gear.

- Tightening specification: 20 Nm.

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

-- Rotate the crankshaft slightly opposite engine rotation direction.

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

-- Tighten the bolts on the camshaft toothed belt gear.

- Tightening specification: 20 Nm.

Continued

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

-- Rotate the crankshaft at least two rotations in engine rotation direction and position it just before cylinder 1 TDC.

-- Check again.

If the camshaft hub can now be secured:

-- Tighten the bolts as follows:

- Tighten the camshaft toothed belt gear bolt an additional 45° (1/8) turn. Counterhold it using the counterhold tool Touareg V10 T10172 and the adapter T10172/4.
- Tighten the high pressure fuel pump toothed belt gear bolt an additional 90° (1/4) turn. Counterhold it using the counterhold tool Touareg V10 T10172 and the adapter T10172/8.

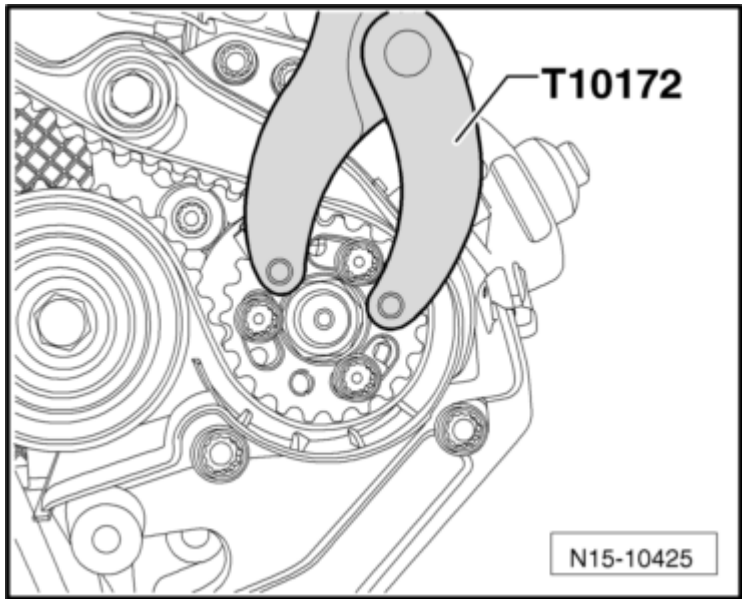

Fig. 51: Identifying Counterhold Tool Touareg V10 T10172
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Install the lower and center toothed belt guard bolts -arrows-.

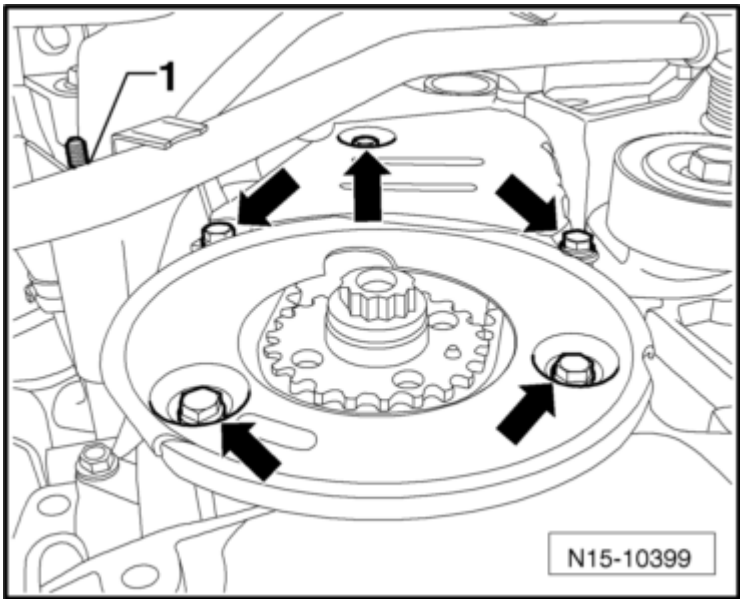

Fig. 52: Identifying Lower And Center Toothed Belt Guard Bolts -Arrows-
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

- Tightening specifications, see -item 27- in the **TOOTHED BELT OVERVIEW** .

-- Install the vibration damper.

- Tightening specification, see -item 28- in the **TOOTHED BELT OVERVIEW** .

-- Install the ribbed belt. Refer to **RIBBED BELT** .

-- Install the upper toothed belt guard.

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

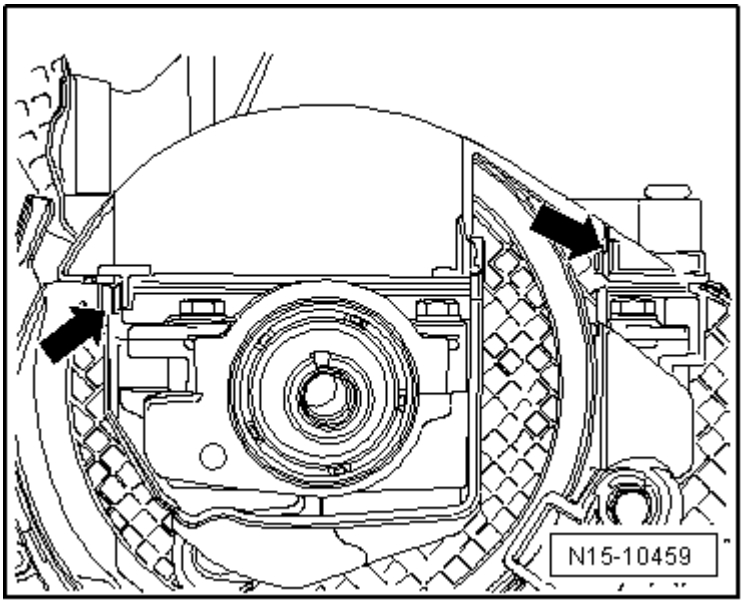

Fig. 53: Identifying Upper Toothed Belt Guard
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

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

-- Press the upper 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.

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

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

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

The rest of the installation is basically a reverse of the removal procedure. When doing this note the following:

- Route the fuel hoses free of kinks.
- Ensure the fuel hoses are seated securely.
- Do not interchange the supply and return lines (the return line is blue or has a blue mark, the supply line is white or has a white mark).
- Clip the fuel hoses into the retainers.

-- Install the auxiliary fuel pump. Refer to **Auxiliary Fuel Pump -V393- (IN-LINE ELECTRIC FUEL PUMP)** .

-- Install the fuel filter. Refer to **FUEL FILTER** .

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

CYLINDER HEAD

Special tools and workshop equipment required

- Guide Pins & Handle - 1112 mm 3070
- Diesel Injection Pump Locking Pin 3359
- Crankshaft Stop T10050
- Camshaft Gear Counter-Holder 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
- Engine Bung Set VAS 6122

CAUTION:

- **Follow the safety precautions when working on the diesel direct injection system. Refer to SAFETY PRECAUTIONS .**
- **Observe the rules for cleanliness. Refer to CLEAN WORKING CONDITIONS .**

Always follow these instructions before and during work.

NOTE:

Toothed belt overview. Refer to TOOTHED BELT OVERVIEW .

Cylinder head cover overview. Refer to CYLINDER HEAD COVER OVERVIEW.

Cylinder head overview. Refer to CYLINDER HEAD OVERVIEW.

Turbocharger and exhaust manifold with attachments overview. Refer to TURBOCHARGER AND EXHAUST MANIFOLD WITH ATTACHMENTS OVERVIEW .

Charge air cooler components overview. Refer to CHARGE AIR COOLER COMPONENT OVERVIEW .

Intake manifold and attachments overview. Refer to INTAKE MANIFOLD AND ATTACHMENTS OVERVIEW .

Particulate filter with NOx reduction catalyst overview. Refer to one of the following:

Engine code CBEA, refer to PARTICULATE FILTER WITH NOX REDUCTION CATALYTIC CONVERTER OVERVIEW .

Engine code CJAA, refer to PARTICULATE FILTER WITH NOX REDUCTION CATALYTIC CONVERTER OVERVIEW .

Exhaust Gas Recirculation (EGR) system overview. Refer to EXHAUST GAS RECIRCULATION SYSTEM COMPONENT OVERVIEW .

Hose connections are secured with either spring type or clamp type clamps.

Always replace clamp-type clamps with spring type clamps.

Hose clip pliers VAS 6362 or hose clip pliers VAS 6340 are recommended for installing spring type clamps.

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.

Removing

NOTE: To perform the procedure, the battery ground cable must be disconnected. See if a coded radio is installed. If so, obtain the anti-theft code beforehand.

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

- **Route all lines and wires in their original locations.**
- **For example, fuel, hydraulic, Evaporative Emission (EVAP), coolant, refrigerant, brake fluid and vacuum lines.**
- **Ensure sufficient clearance to all moving or hot components.**

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

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

CAUTION: Electronic components could be destroyed when the battery is disconnected:

- **Follow the required steps when disconnecting the battery.**

-- Turn off the ignition and disconnect the ground cable -arrow- from the battery. Refer to **Removal and Installation** .

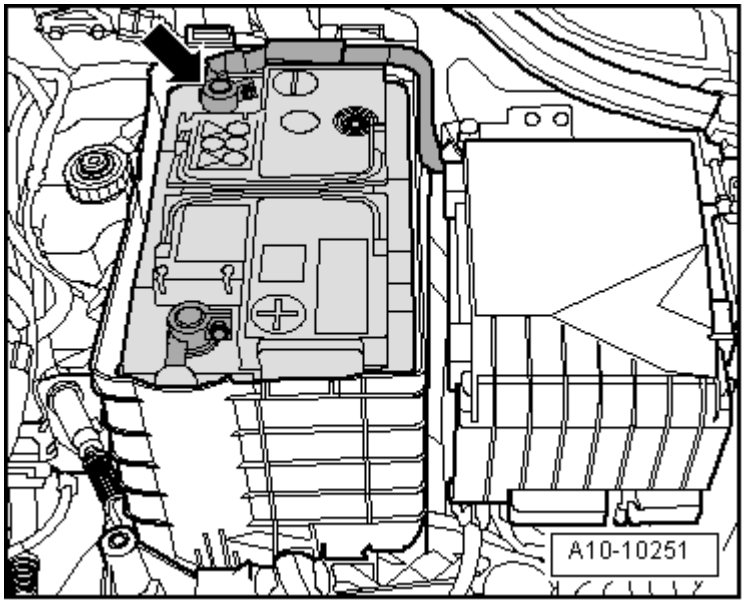

Fig. 54: Identifying Battery And Ground Cable
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Remove the battery, the battery tray bolts -arrows- and tray.

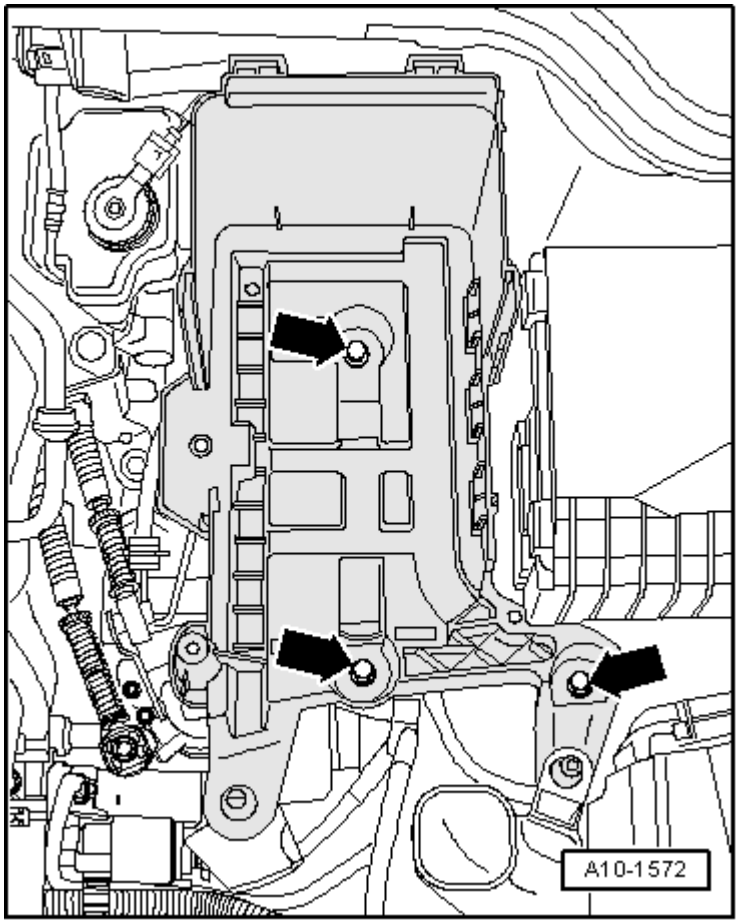

Fig. 55: Identifying Battery Holder Bolts
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

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

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

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

-- Disconnect the connector from the exhaust gas recirculation vacuum regulator solenoid valve -N18- -1- and the throttle valve control module -J338- -3-.

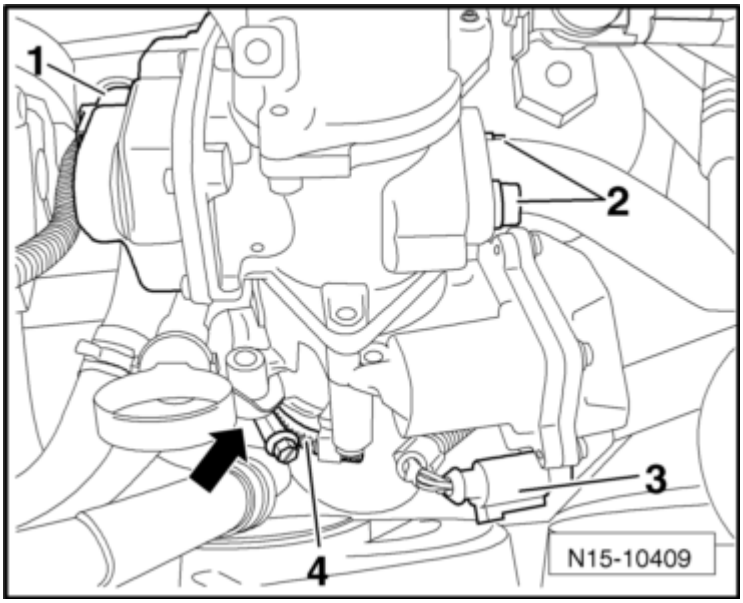

Fig. 56: Identifying Exhaust Gas Recirculation Vacuum Regulator Solenoid Valve -1-, Throttle Valve Control Module -J338- -3- And Clamp -4-
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Loosen the clamp -4- and remove the charge air hose.

-- Remove the oil dipstick tube bracket -arrow-.

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

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

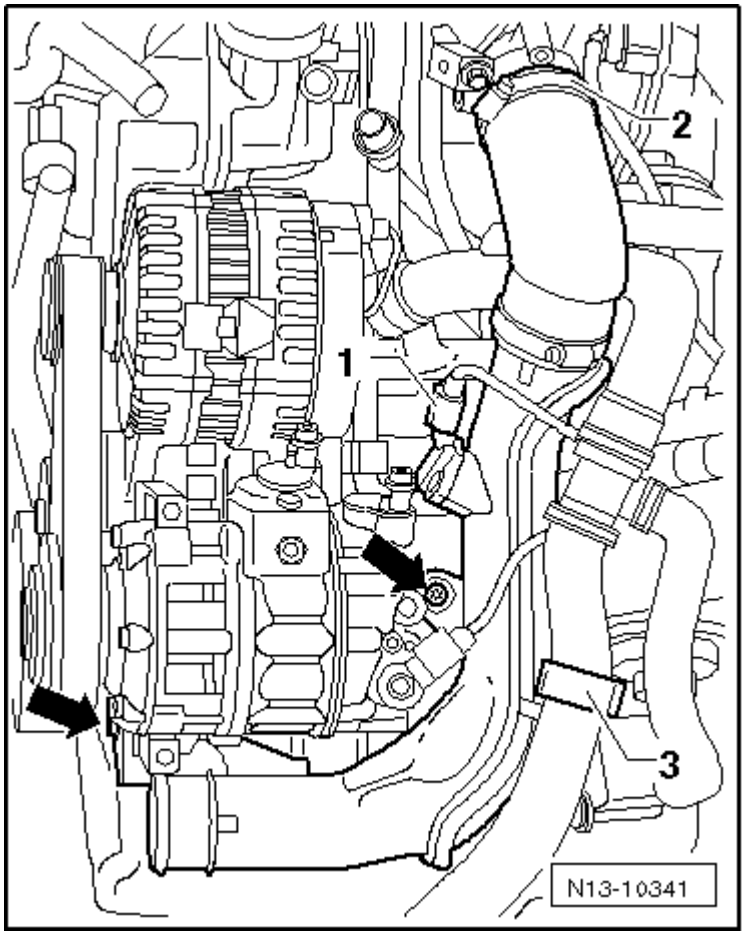

Fig. 57: Identifying Connector -1-, Clamp -2 And Coolant Hose -3-
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

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

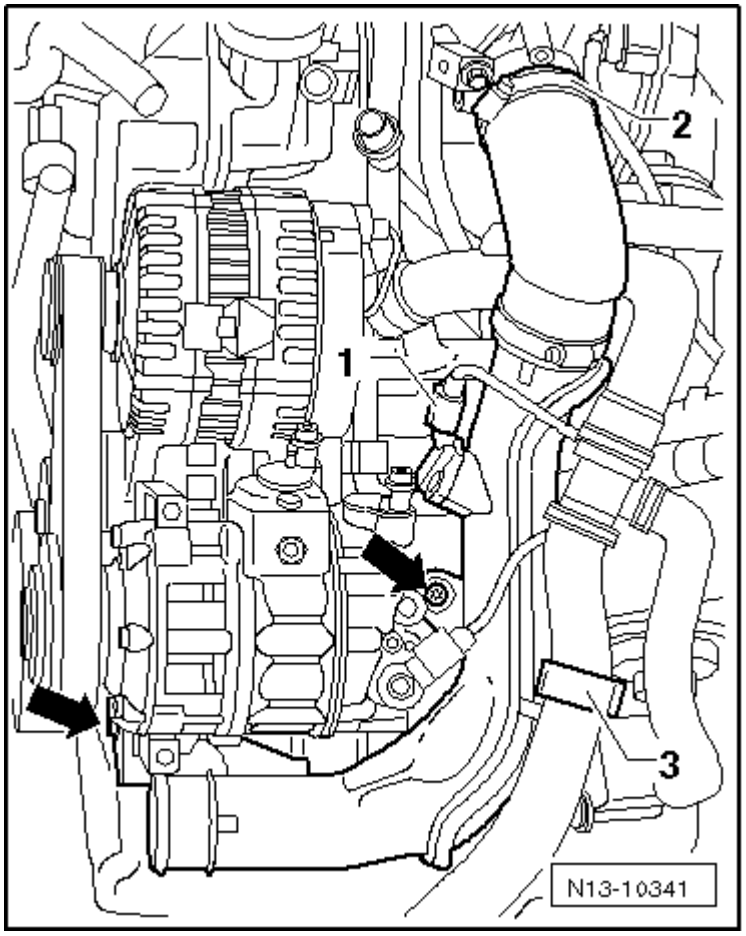

Fig. 58: Identifying Connector -1-, Clamp -2 And Coolant Hose -3-
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Remove the oil supply line. Refer to **OIL SUPPLY LINE TO TURBOCHARGER** .

-- Unclip the Engine Control Module (ECM) wiring harness from the wiring guide -arrow-.

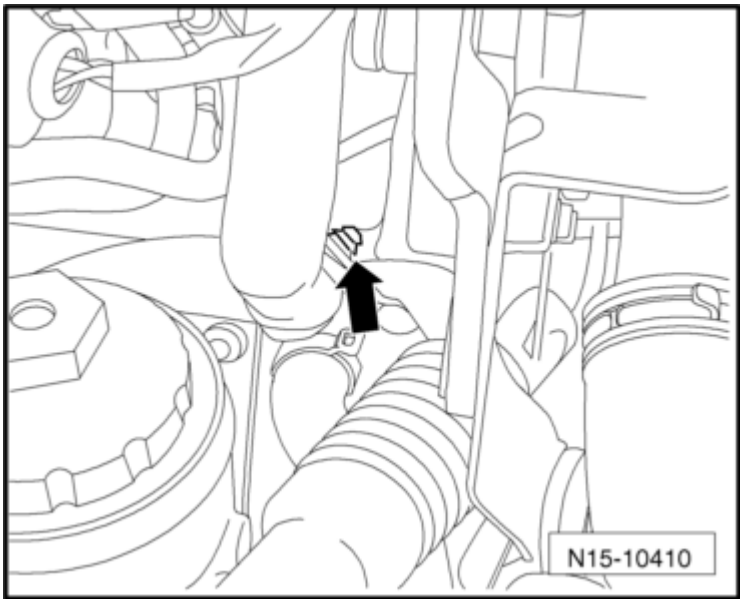

Fig. 59: Identifying Engine Control Module (ECM) Wiring Guide -Arrow-
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

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

-- Disconnect the connector from the charge pressure actuator position sensor -G581- -2- at the turbocharger vacuum diaphragm.

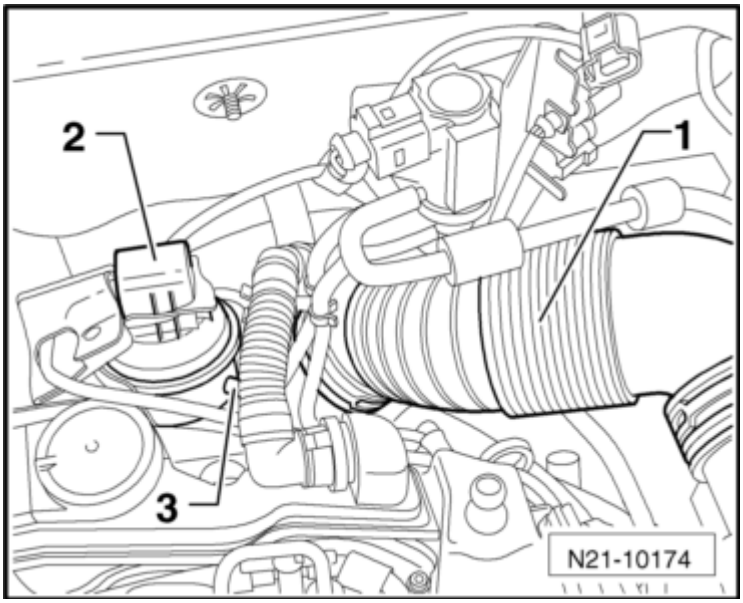

Fig. 60: Identifying Connector To Charge Pressure Actuator Position Sensor -G581- -2- And Vacuum Hose -3-
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Disconnect the vacuum hose -3- from the vacuum diaphragm on the turbocharger.

-- Disconnect the >>black<< connector for the exhaust gas temperature sensor 1 -G235- -2- at the plenum chamber bulkhead.

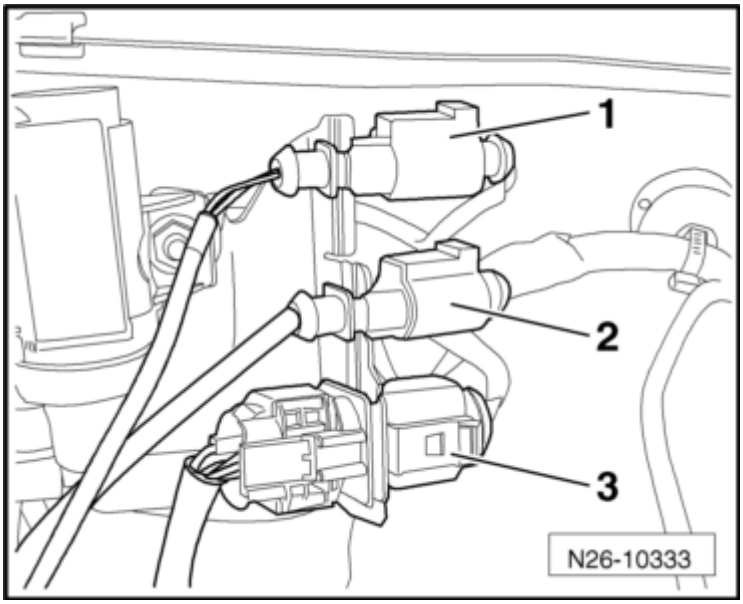

Fig. 61: Identifying >>Black<< Connector To Exhaust Gas Temperature Sensor 1 -G235- -2-
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Guide the wire out of the mount on the plenum chamber bulkhead and on the turbocharger.

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

-- Remove the right drive axle heat shield bolts -arrows- and shield.

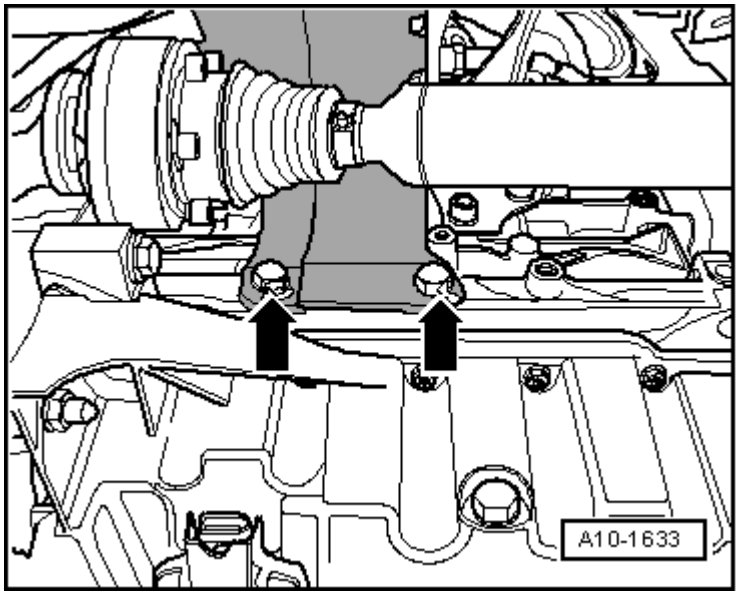

Fig. 62: Identifying Protective Cap For Drive Axle On Engine
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

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

-- Mark the installed position of the exhaust gas temperature sensor 1 and remove it.

-- Remove the heat shield and disconnect the connector from the exhaust pressure sensor 2 -G451-. Refer to one of the following:

- Engine code CBEA, refer to **PARTICULATE FILTER WITH NOX REDUCTION CATALYTIC CONVERTER OVERVIEW** .
- Engine code CJAA, refer to **PARTICULATE FILTER WITH NOX REDUCTION CATALYTIC CONVERTER OVERVIEW** .

-- Remove the control wire between the EGR housing and the exhaust pressure sensor 2. Refer to one of the following:

- Engine code CBEA, refer to **PARTICULATE FILTER WITH NOX REDUCTION CATALYTIC CONVERTER OVERVIEW** .
- Engine code CJAA, refer to **PARTICULATE FILTER WITH NOX REDUCTION CATALYTIC CONVERTER OVERVIEW** .

-- Remove the bolts and bracket with the exhaust pressure sensor 2 and lay them aside (the control wire to the particulate filter remains connected).

-- Remove the lower bracket for the particulate filter.

NOTE: Remove the nuts above the bracket using wrench SW13 T10384.

-- Remove the EGR filter.

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

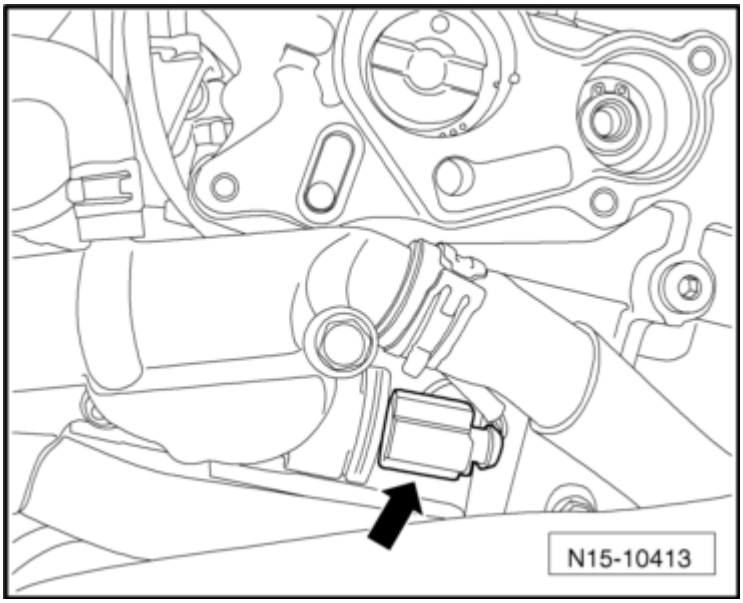

Fig. 63: Identifying Connector -Arrow- To Engine Coolant Temperature Sensor
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Remove the particulate filter from the upper bracket and remove the bracket from the cylinder head.

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

-- Remove the banjo bolt from the turbocharger support.

-- Remove the stud bolt from the turbocharger support.

-- Rotate the lower section of the support 90° and remove the support downward from the upper section.

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

-- Remove the bolt -arrow- from the rear toothed belt guard.

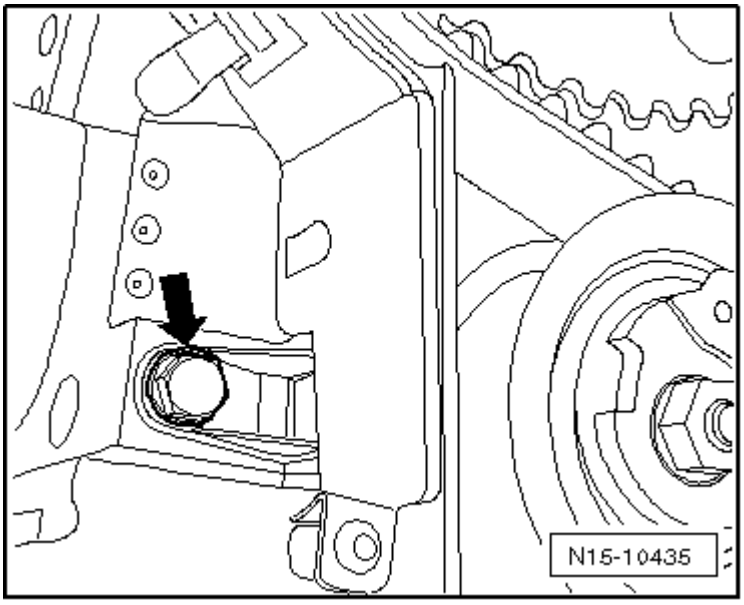

Fig. 64: Identifying Nut To Toothed Belt Tension
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Remove the nut from the toothed belt tension.

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

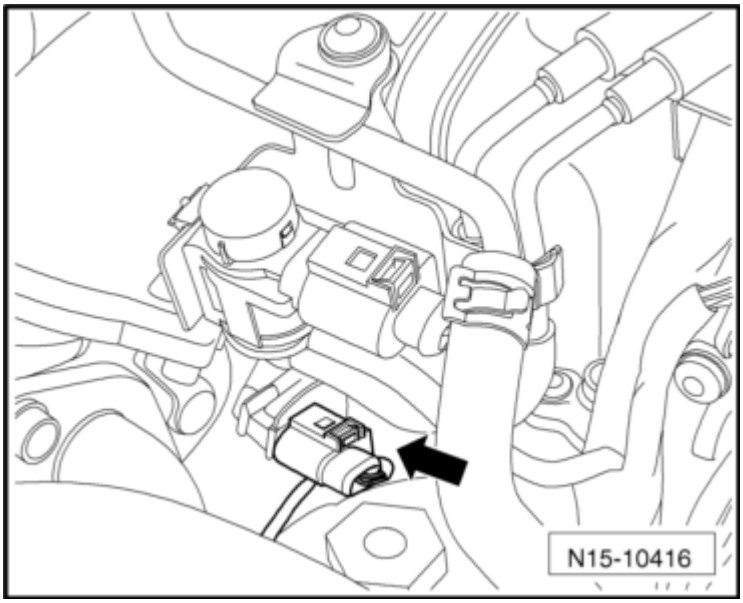

Fig. 65: Identifying Camshaft Position Sensor -G40- Connector -Arrow-
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

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

-- Remove the cylinder head bolts in sequence -1 through 10-.

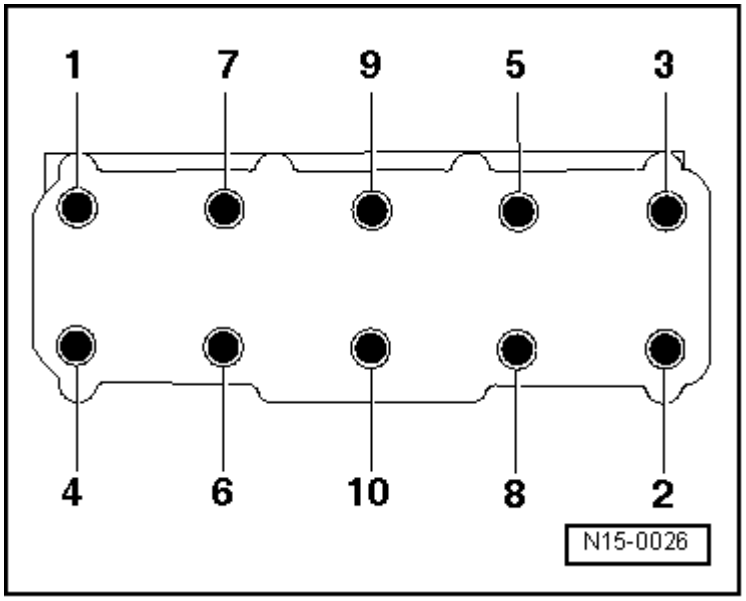

Fig. 66: Identifying Cylinder Head Bolts Loosening Sequence
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

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 support when lifting the cylinder head off.

Make sure all necessary electrical wires are disconnected!

-- Raise the cylinder head at the transmission side first and guide it back 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

CAUTION: The sealing surfaces could be damaged:

- **Carefully remove any sealant residue from the cylinder head and cylinder block.**
- **Make sure that no long scrapes or scratches result.**

Risk of damaging the cylinder block:

- **There must be no oil or coolant in the blind holes for the cylinder**

head bolts in the cylinder block.

Risk of the cylinder head gasket leaking:

- **Carefully remove all grinding and sanding residue.**
- **Only unpack a new cylinder head gasket immediately prior to installation.**
- **To prevent the cylinder head gasket silicone layer and recessed area from being damaged, always handle the gasket extremely carefully.**

Risk of damaging open valves:

- **If a replacement cylinder head is installed, only remove the accompanying plastic base immediately before installing to protect the open valves.**

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

- **To ensure valves do not strike pistons when starting, carefully rotate engine at least 2 full revolutions.**
- **Before installing, check if the oil return pipe coupling element is bent and therefore stretched. If that is the case, tiny cracks can form that can lead to leaks. Replace the oil return pipe before installing the cylinder head if necessary.**

NOTE: **Always replace cylinder head bolts.**

Replace the gaskets, seals, self-locking nuts and clamps.

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

Thoroughly remove all sanding and grinding residue.

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

-- 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 pins3070 into the outer bores on the intake side to center.

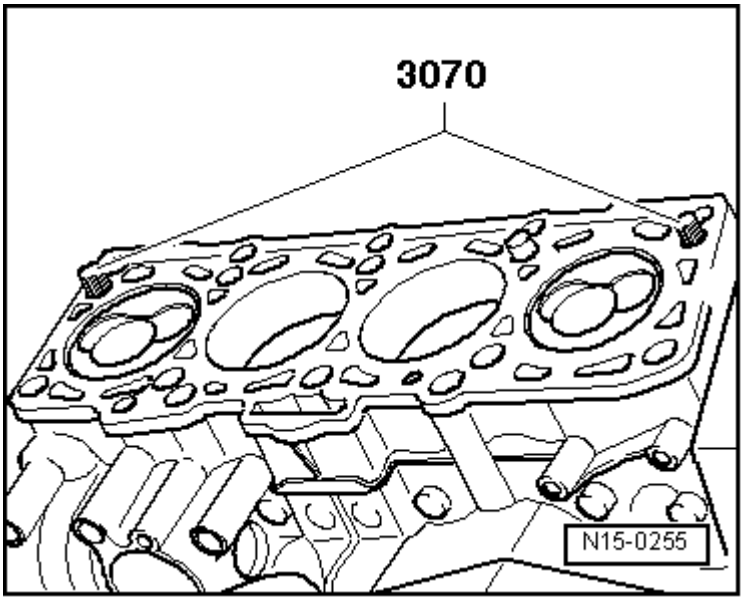

Fig. 67: Identifying Installed Guide Pins
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

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

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

-- Remove the guide pins 3070 through the bolt holes using the guide pin handle. Insert the cylinder head bolts.

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

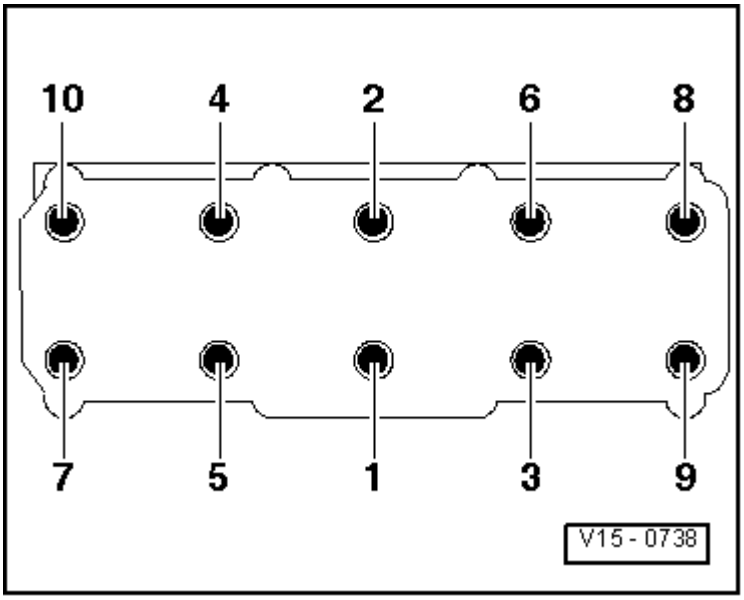

Fig. 68: Identifying Cylinder Head Bolt Tightening Sequence
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

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

   Stage I - 35 Nm

   Stage II - 60 Nm

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

   Stage III - an additional 90° (1/4) turn

   Step IV - an additional 90° (1/4) turn

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

- Tightening specifications, see -item 14- in the **TOOTHED BELT OVERVIEW** .

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

-- Secure the camshaft and the high pressure fuel pump using the diesel injection pump locking Pin 3359.

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

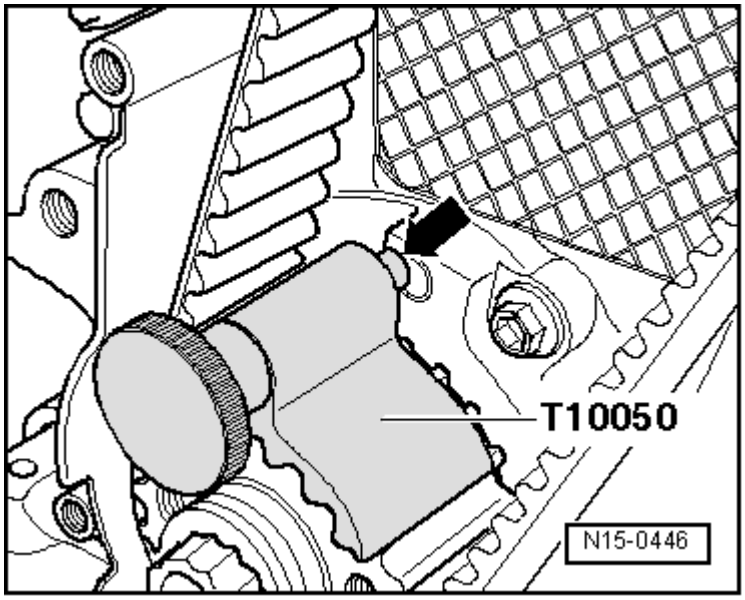

Fig. 69: Identifying Crankshaft Stop T10050
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

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

The additional numbered steps must be followed to ensure the particulate filter with the NOx reduction catalytic converter is installed correctly:

NOTE: After installing the particulate filter with NOx reduction catalytic converter, make sure it is free of tension.

Always replace self-locking nuts, seals, gaskets and clamps.

CAUTION: The coupling elements between the particulate filter and NOx reduction catalytic converter can be damaged. When removing and installing:

- **Do not bend the coupling element more than 10°.**
- **Do not stretch the coupling element.**
- **Do not damage the wire mesh on the coupling element.**

-- Position the lower bracket with the nuts on the cylinder block and on the particulate filter. (Do not tighten the nuts.)

-- Position the new clamp with a new gasket between the particulate filter and turbocharger (do not tighten the clamp):

- Make sure the clamp is in the correct installed position. Refer to one of the following:
- Engine Code CBEA, refer to **MUFFLER OVERVIEW** .
- Engine Code CJAA, refer to **MUFFLER OVERVIEW** .

-- Install the EGR filter -item 9- in the **EXHAUST GAS RECIRCULATION SYSTEM COMPONENT OVERVIEW** .

-- Position a new clamp between the particulate filter and EGR filter (do not tighten the clamp):

- Make sure the clamp is in the correct installed position. Refer to one of the following:
- Engine code CBEA, refer to **PARTICULATE FILTER WITH NOX REDUCTION CATALYTIC CONVERTER OVERVIEW** .
- Engine code CJAA, refer to **PARTICULATE FILTER WITH NOX REDUCTION CATALYTIC CONVERTER OVERVIEW** .

-- Position the particulate filter on the upper bracket with the bolt. (Do not tighten the bolt.)

-- Tighten the mounting elements in the following sequence:

-- Clamp between the particulate filter and turbocharger.

-- Lower bracket to the cylinder block:

-- Lower bracket to the particulate filter:

-- Upper bracket to the particulate filter:

-- Upper bracket to the cylinder head:

-- Clamp between the particulate filter and EGR filter:

- Tightening specifications, refer to one of the following:

- Engine code CBEA, refer to **PARTICULATE FILTER WITH NOX REDUCTION CATALYTIC CONVERTER OVERVIEW** .
- Engine code CJAA, refer to **PARTICULATE FILTER WITH NOX REDUCTION CATALYTIC CONVERTER OVERVIEW** .

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

- Replace the self-locking nuts and seals.
- Position the charge air pipe connecting hose before securing the turbocharger.
- Note the exhaust gas temperature sensor 1 installed position.
- Replace the banjo bolt with the turbocharger support gaskets and oil return pipe O-rings.
- Do not stretch the oil return pipe coupling element when installing the turbocharger support.
- Make sure lines connections are securely fastened.

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

-- Install the right drive axle heat shield and bolts -arrows-. Refer to **Specifications** .

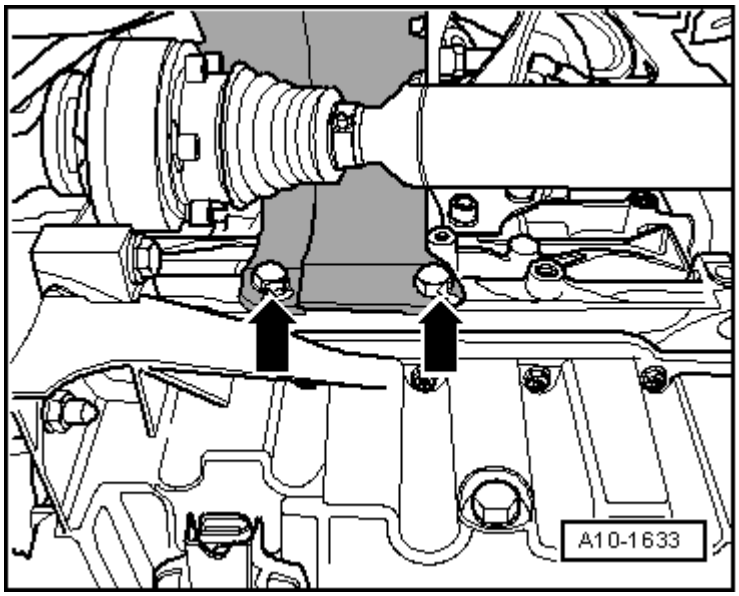

Fig. 70: Identifying Protective Cap For Drive Axle On Engine
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

Tightening Specifications

- **TOOTHED BELT OVERVIEW**
- **CYLINDER HEAD COVER OVERVIEW**
- **CYLINDER HEAD OVERVIEW**
- **TURBOCHARGER AND EXHAUST MANIFOLD WITH ATTACHMENTS OVERVIEW** .
- **CHARGE AIR COOLER COMPONENT OVERVIEW**
- **INTAKE MANIFOLD AND ATTACHMENTS OVERVIEW**
- Engine code CBEA, refer to **PARTICULATE FILTER WITH NOX REDUCTION CATALYTIC CONVERTER OVERVIEW** .
- Engine code CJAA, refer to **PARTICULATE FILTER WITH NOX REDUCTION CATALYTIC CONVERTER OVERVIEW** .
- **EXHAUST GAS RECIRCULATION SYSTEM COMPONENT OVERVIEW**

NOTE: Electrical connections and routings. Refer to DESCRIPTION AND OPERATION and refer to Wiring .

-- Observe the notes after reconnecting the battery. Refer to **Removal and Installation** .

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

-- Fill the fuel system. Refer to **FUEL SYSTEM, FILLING AND BLEEDING** .

VACUUM PUMP

Special tools and workshop equipment required

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

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 engine cover. Refer to **ENGINE COVER**.

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

-- Remove the vacuum hose -1- from the vacuum pump -4-.

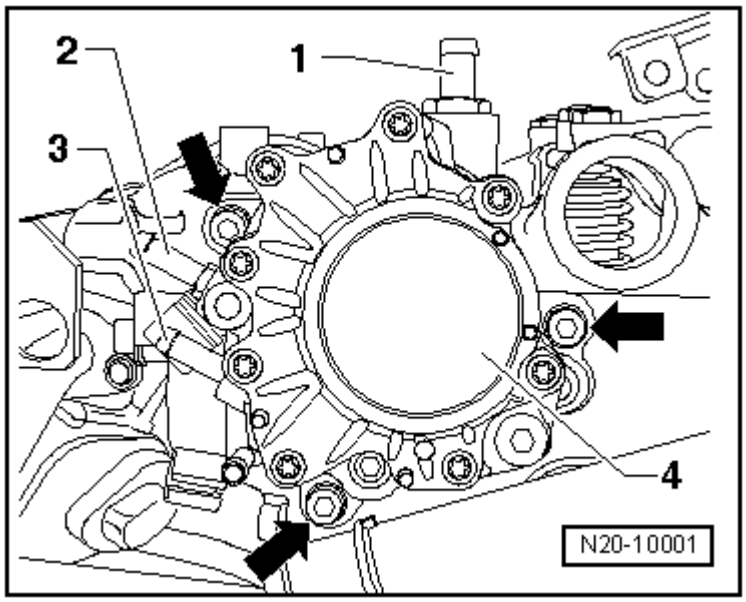

Fig. 71: Identifying Vacuum Hose -1- And Vacuum Pump -4-
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Remove the charge air pipe bolts and then press the pipe down slightly to reach the rear threaded connection on the vacuum pump.

-- Remove the vacuum pump bolts -arrows-.

-- Remove the vacuum pump -4- from the cylinder head.

Installing

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

- Make sure the vacuum pump coupling is seated correctly in the camshaft.
- Always replace the vacuum pump gasket.
- Make sure lines connections are securely fastened.

-- Install the vacuum pump -4- and tighten the bolts -arrows-.

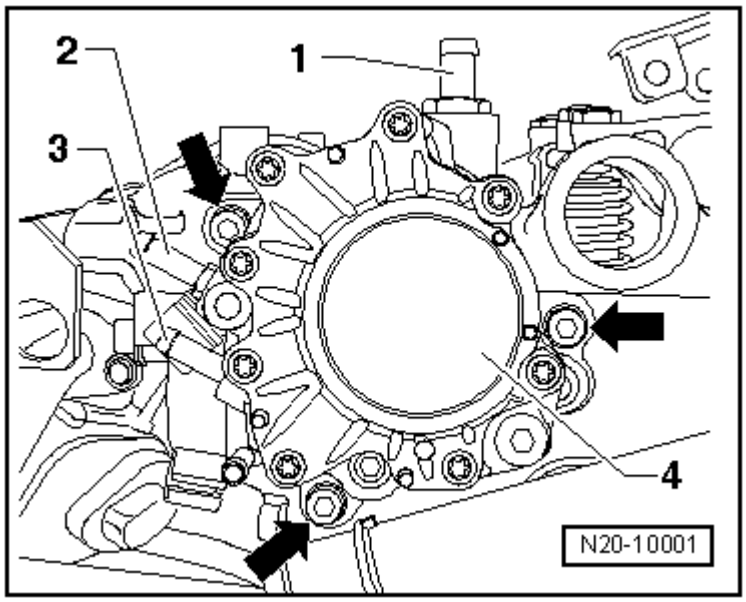

Fig. 72: Identifying Vacuum Hose -1- And Vacuum Pump -4-
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

- Tightening specification, see -item 8- in the **CYLINDER HEAD OVERVIEW**.

-- Tighten the charge air pipe bolts.

- Tightening specification, see -item 11- in the **CHARGE AIR COOLER COMPONENT OVERVIEW** .

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

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

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

CAMSHAFTS

Special tools and workshop equipment required

- Diesel Injection Pump Locking Pin 3359
- Camshaft Gear Counter-Holder T10051
- Puller T10052
- Camshaft Fitting Tool T40094
- Camshaft Clamping Tool T40095
- Camshaft Tensioning Tool T40096
- Torque Wrench (5-50 Nm) V.A.G 1331
- Torque Wrench (40-200 Nm) V.A.G 1332
- Hand Drill with Plastic Brush Attachment

- Protective Eyewear
- Silicone Adhesive Sealant D 176 501 A1

Removing

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

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

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

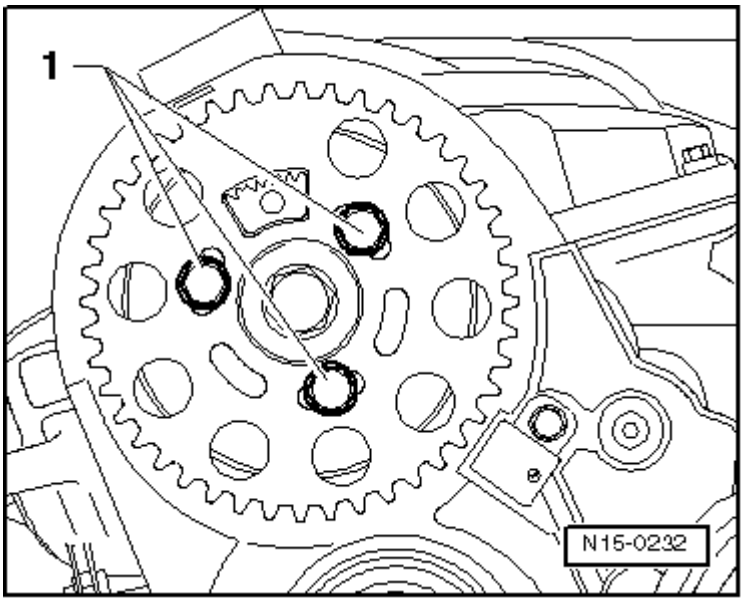

Fig. 73: Identifying Camshaft Pulley Securing Bolts
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Remove the camshaft gear from the hub.

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

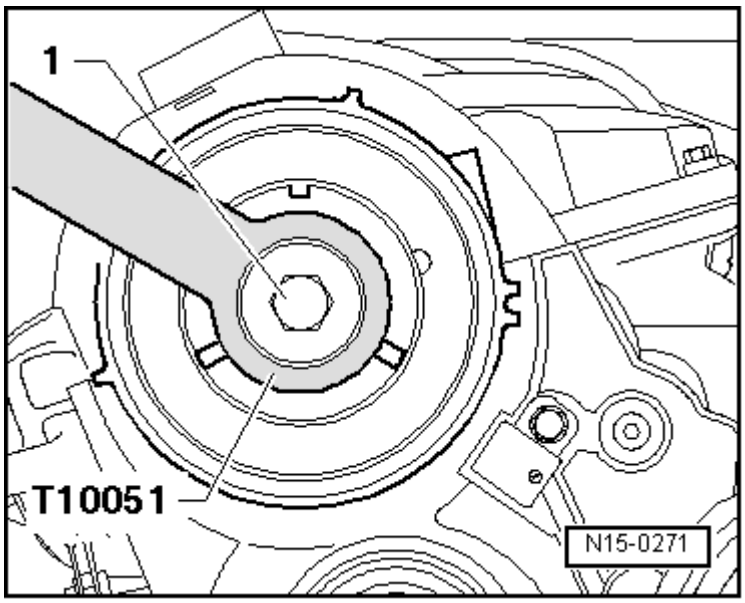

Fig. 74: Identifying Counterhold T10051
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Loosen the bolt for the hub by approximately 2 turns.

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

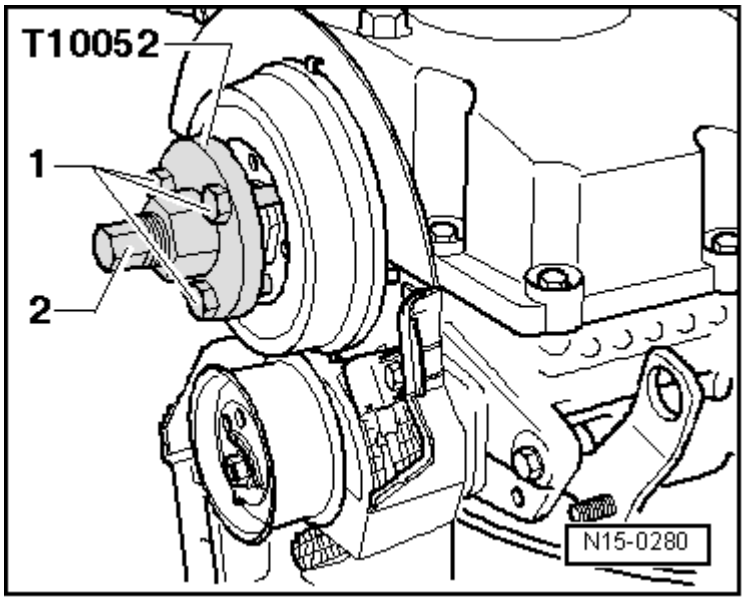

Fig. 75: Identifying Puller T10052
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Tighten the bolts -1-.

-- Tension the hub by tightening the puller T10052 -2- evenly until it can be removed from the camshaft taper.

NOTE: Hold the puller T10052 with 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 and nuts in sequence -24 through 1-.

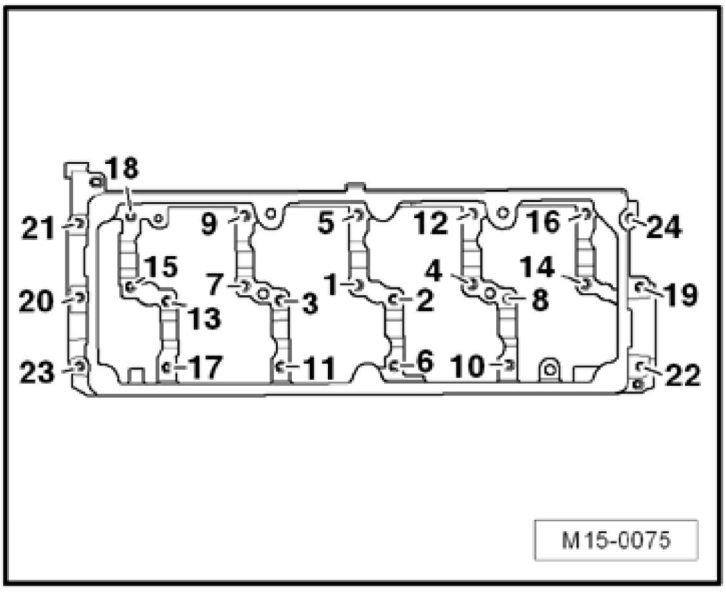

Fig. 76: Identifying Bearing Frame Bolts Removal Sequence -24 Through 1-
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Remove the bearing frame.

-- Carefully remove the camshafts.

Installing

NOTE: Note the expiration date of the silicone adhesive Sealant D 176 501 A1.

Seal the separating surfaces between the bearing frame and cylinder head using silicone adhesive Sealant D 176 501 A1.

CAUTION:
- **Only install the camshafts with the camshaft fitting tool T40094 as described below. Otherwise the axial bearing in the bearing frame will be destroyed and the cylinder head will have to be replaced.**
- **Make sure that no sealant residue enters the cylinder head and bearings.**

WARNING: Wear safety glasses.

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

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

-- Oil the journal surfaces of 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.

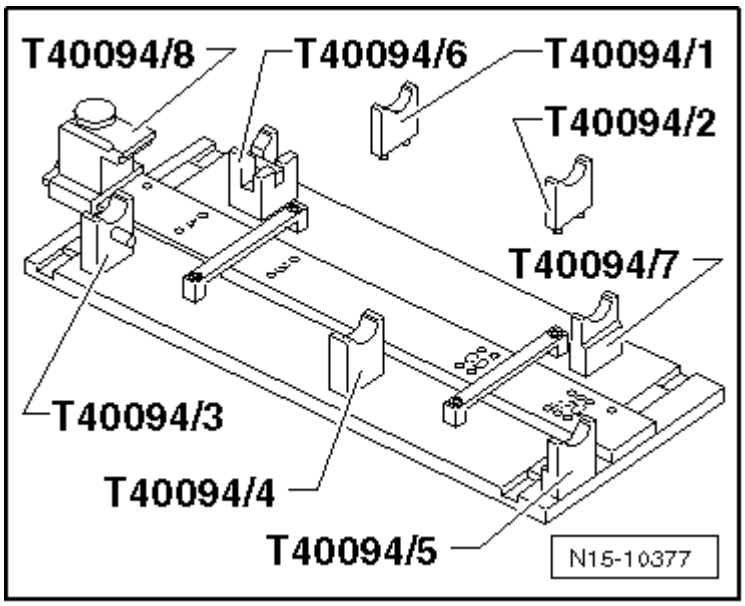

Fig. 77: Identifying Mounts T40094/1 To T40094/8
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

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

-- Install the mounts T40094/9 and T40094/10 in the empty outer locations.

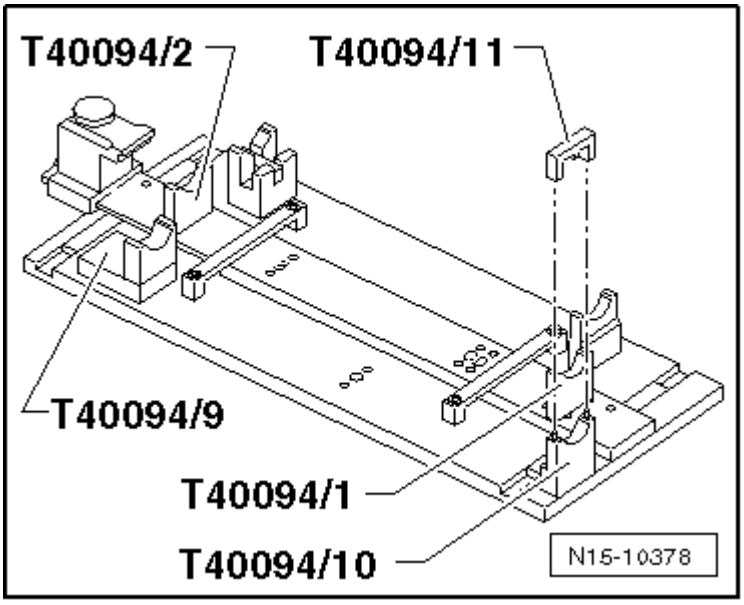

Fig. 78: Identifying Mounts T40094/1, T40094/2, T40094/9, T40094/10 and T40094/11
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

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

-- First install the intake camshaft as illustrated. Make sure the indentation -arrow- for the cylinder head bolt faces >>outward<<.

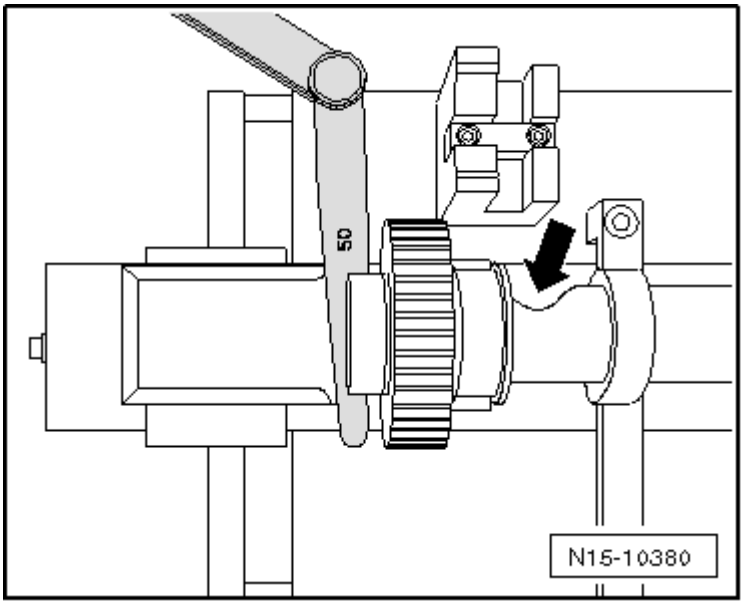

Fig. 79: Identifying 0.50 mm Feeler Gauge
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Position the 0.50 mm feeler gauge and slide the mount T40094/8 into the groove on the intake camshaft.

-- Install the exhaust camshaft.

-- Secure the exhaust camshaft above the groove -arrow- with the cover T40094/11.

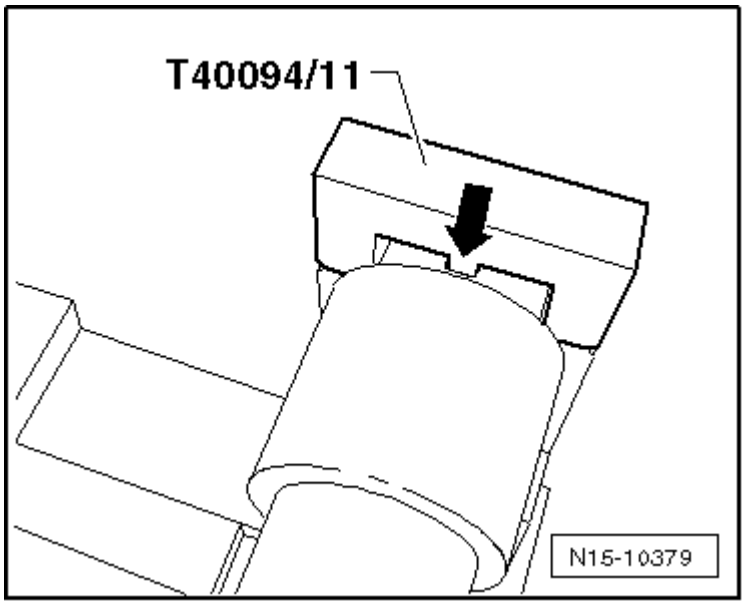

Fig. 80: Identifying Cover T40094/11
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

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

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

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

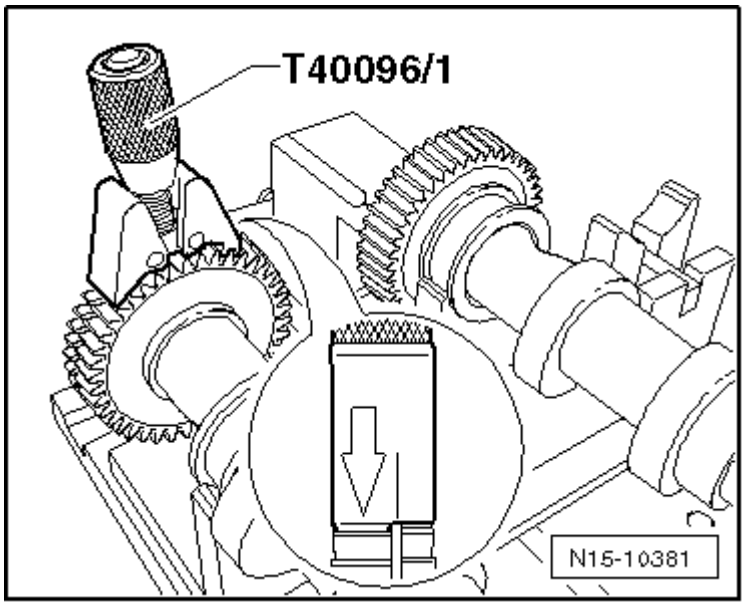

Fig. 81: Identifying Tensioning Tool T40096/1
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

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

-- Position the bearing frame on the camshafts.

- All the camshaft bearings must align on the camshafts.

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

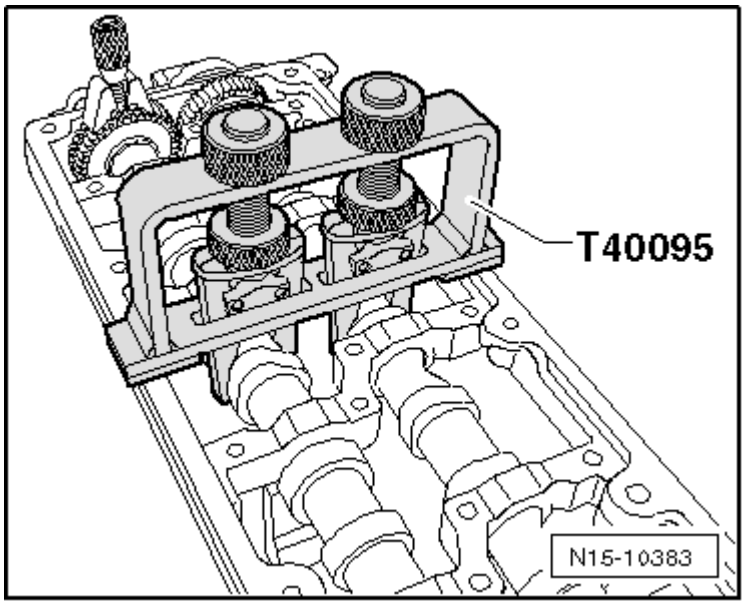

Fig. 82: Identifying Camshaft Clamping Tool T40095
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- 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 3 mm).

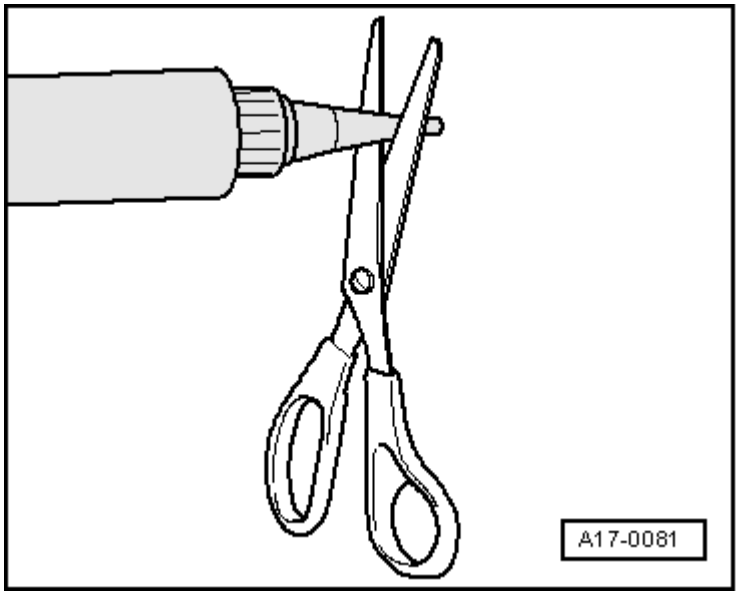

Fig. 83: Identifying Scissors To Cut Tube Nozzle At Front Marking (Nozzle Diameter Approx. 3 Mm)
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Apply the silicone adhesive Sealant D 176 501 A1 to the clean sealing surface of the cylinder head as illustrated. The sealant bead must be:

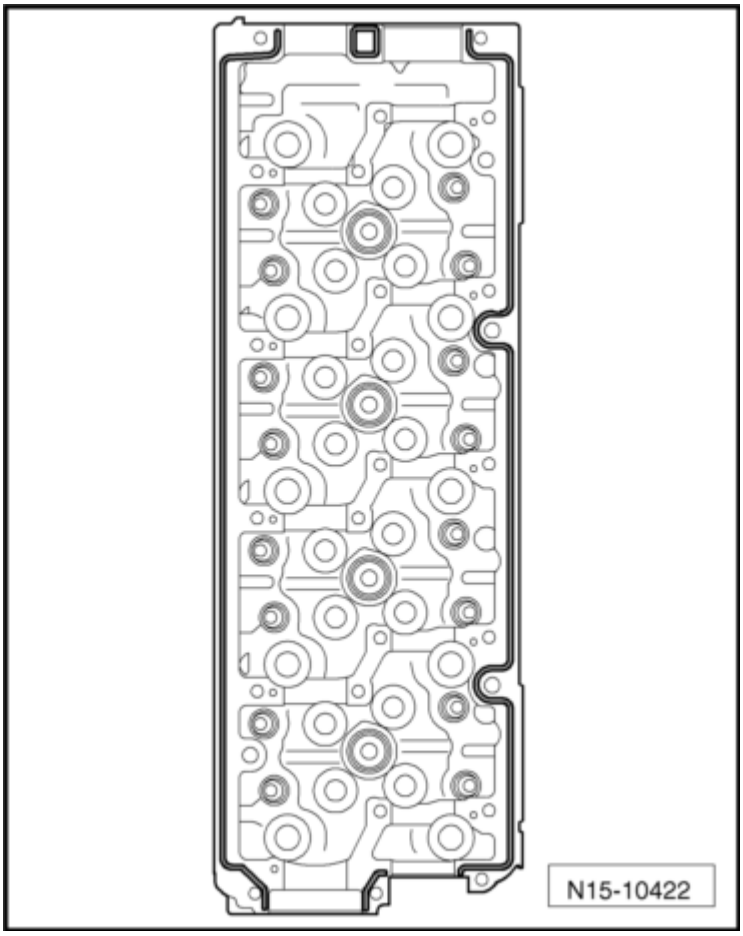

Fig. 84: Identifying Silicone Adhesive Sealant Pattern
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

- 2 to 3 mm thick
- Apply on the inner side in the area with the threaded holes

NOTE: The sealant beads must not be thicker than 2 to 3 mm or the excess sealant can enter the camshaft bearing.

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

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

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

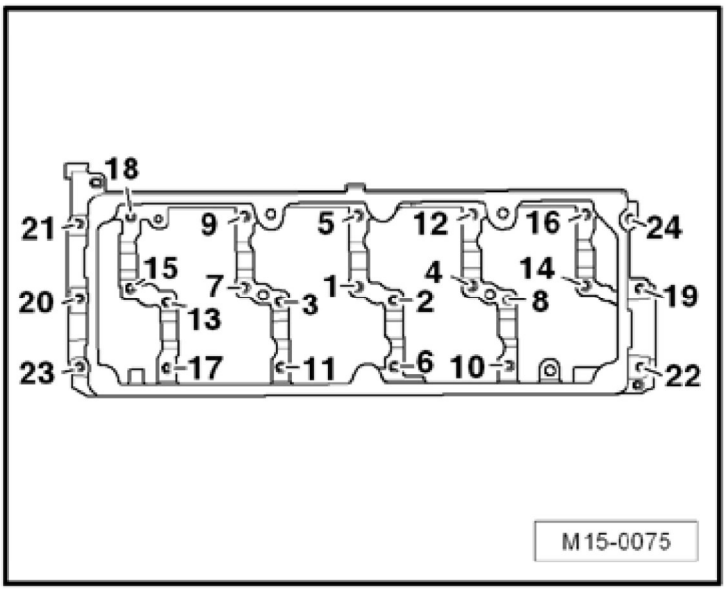

Fig. 85: Identifying Bearing Frame Bolts And Nuts Tightening Sequence
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

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

-- Tighten the bearing frame bolts and nuts in sequence -1 through 24-.

- Tightening specifications, see -items 2 and 3- in the **VALVETRAIN OVERVIEW**.

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

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

-- Drive a new cap onto the cylinder head with a suitable drift until it is flush.

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

NOTE: After installing the camshafts, the engine may not be started for approximately 30 minutes. The hydraulic lash adjusters must seat themselves (otherwise the valves will crash into the pistons).

After working on the valvetrain, carefully rotate the engine by hand at least 2 full revolutions to ensure that valves do not strike the pistons when starting.

-- Place the hub on the camshaft.

-- Counterhold the hub with the camshaft gear counter holder T10051 and tighten the hub bolt -1-.

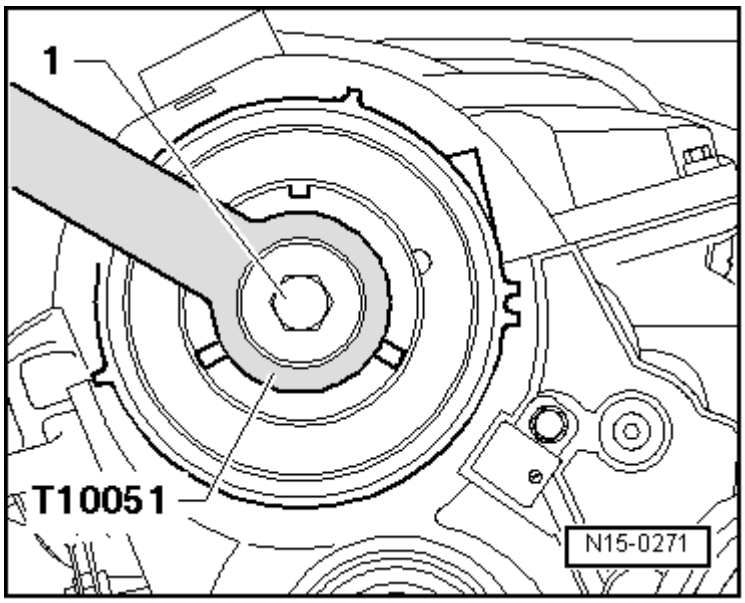

Fig. 86: Identifying Counterhold T10051
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

- Tightening specification, see -item 11- in the **TOOTHED BELT OVERVIEW** .

-- Push the camshaft gear onto the hub.

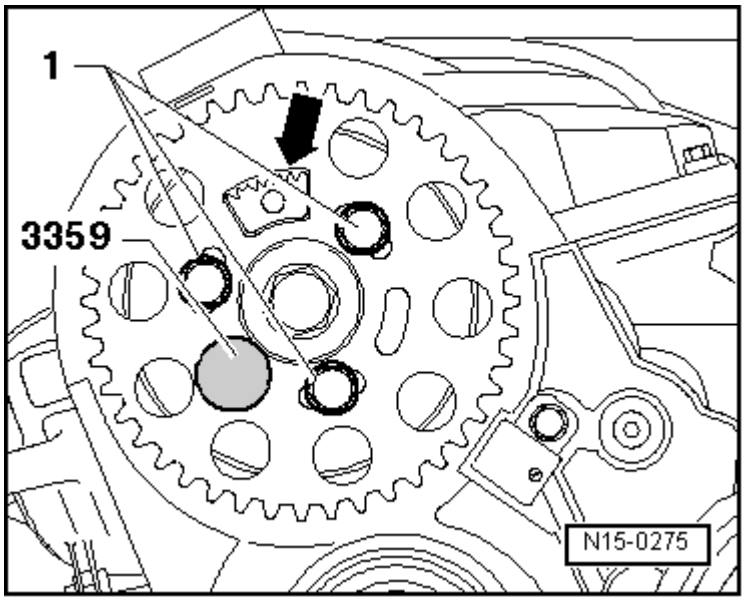

Fig. 87: Identifying Camshaft Pulley Bolts
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

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

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

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

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

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

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

CAMSHAFT SEAL

Special tools and workshop equipment required

- Oil Seal Driver 10-203
- Seal Extractor 3240
- Torque Wrench (5-50 Nm) V.A.G 1331
- Torque Wrench (40-200 Nm) V.A.G 1332
- M12 x 65 Bolt

Removing

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

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

-- Insert the thrust piece 3240/1 into the camshaft.

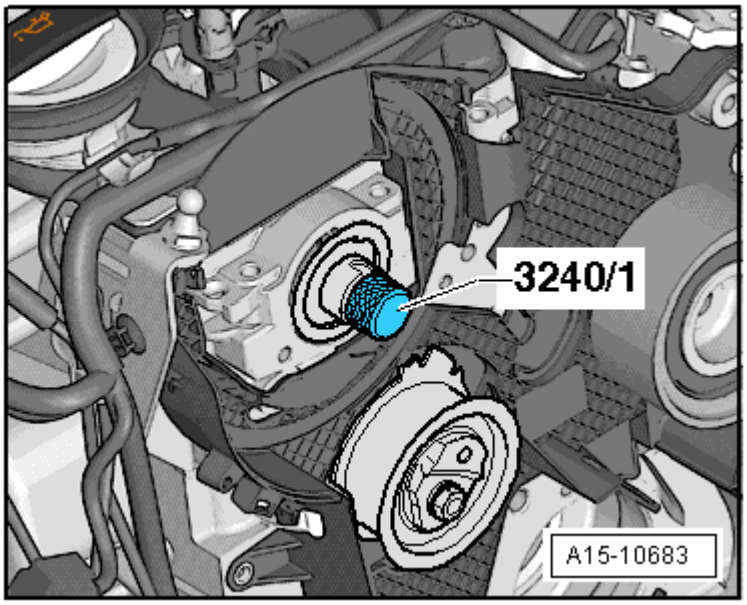

Fig. 88: Identifying Thrust Piece 3240/1 Inserted In Camshaft
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Remove the inner portion of seal puller 3240 two rotations (approximately 3 mm) from the outer portion and secure with the knurled thumb screw.

-- Grease the threaded head of the seal Extractor 3240, position and forcefully screw as far as possible into the seal.

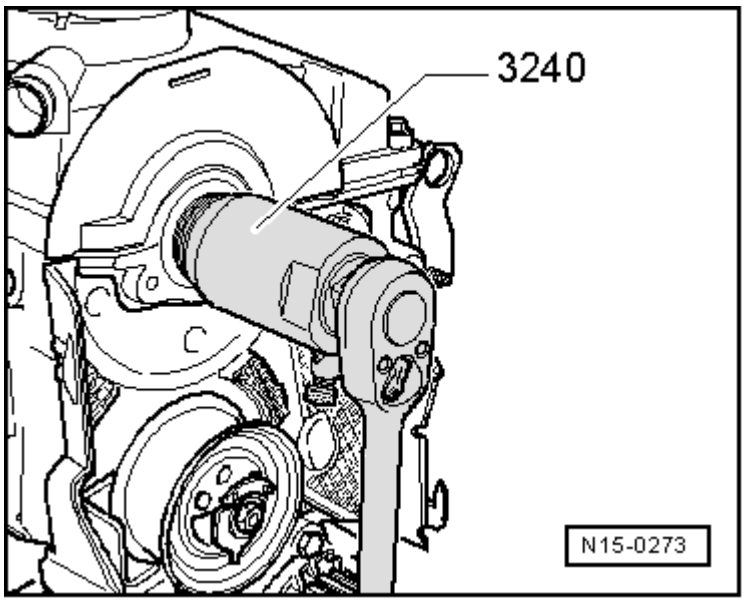

Fig. 89: Identifying Special Tool - 3240
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Loosen the knurled thumb screw and turn the inner part against the camshaft until the seal is removed.

Installing

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

-- Before installing, remove any remaining oil from the camshaft journal with a clean cloth.

-- Mount the guide sleeve 3240 on the camshaft as illustrated.

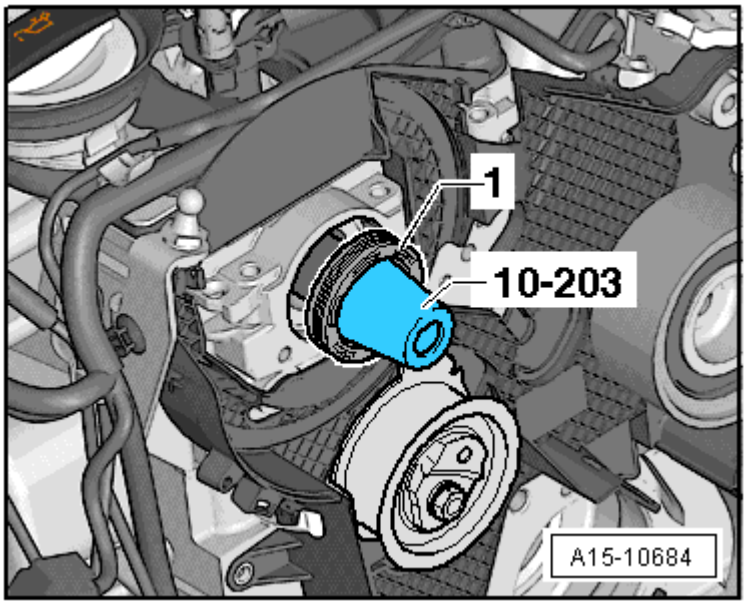

Fig. 90: Identifying Seal -1- Pressed In To Stop Using Seal Driver 10-203
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

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

-- Press the seal in as far as the stop using the seal driver 10-203 thrust piece and a M12 x 65 bolt.

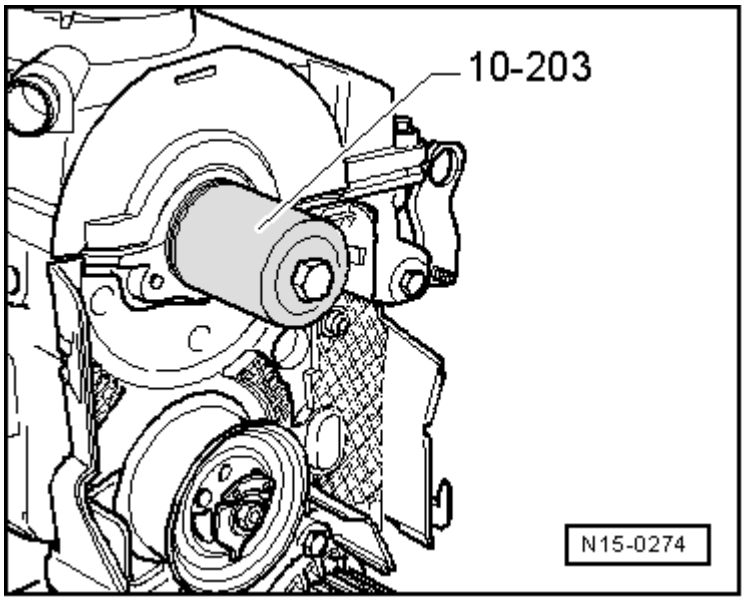

Fig. 91: Identifying Seal Pressed In To Stop Using Seal Driver 10-203
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

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

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

VALVE STEM SEALS, CYLINDER HEAD INSTALLED

Special tools and workshop equipment required

- Valve Seal Removal Tool 3364
- Valve Stem Seal Driver 3365
- Torque Wrench (5-50 Nm) V.A.G 1331
- Valve Cotters Asm/Disasm Device VAS 5161

Removing

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

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

-- Position the guide plate VAS 5161/23 on the cylinder head.

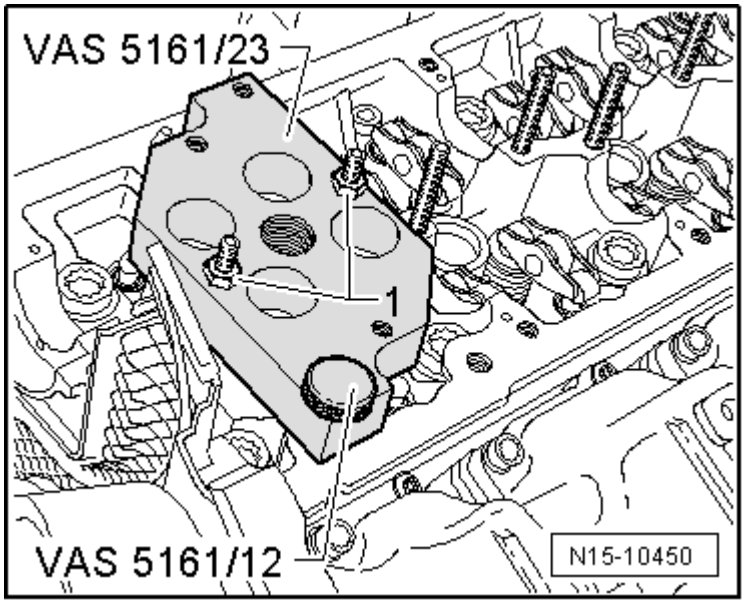

Fig. 92: Identifying Guide Plate VAS 5161/23 Secured Using Knurled Screw VAS 5161/12
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Secure the guide plate VAS 5161/23 to the intake manifold side using a knurled screw VAS 5161/12 and on the studs using collarless M6 nuts -1- tightened by hand.

-- Install the compression stud VAS 5161/10 in the guide plate VAS 5161/23.

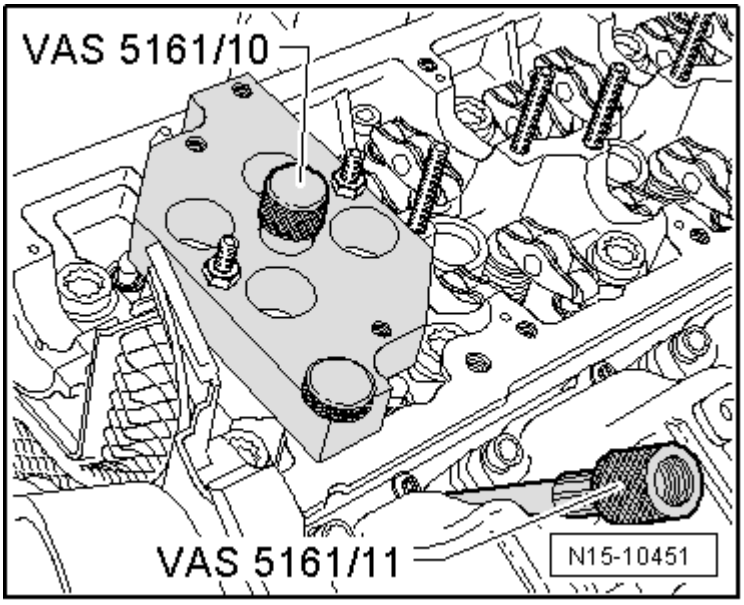

Fig. 93: Identifying Compression Stud VAS 5161/10 Installed In Guide Plate VAS 5161/23
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

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

-- Insert the punch VAS 5161/3 into the guide plate VAS 5161/23 and loosen the valve retainers using a plastic mallet.

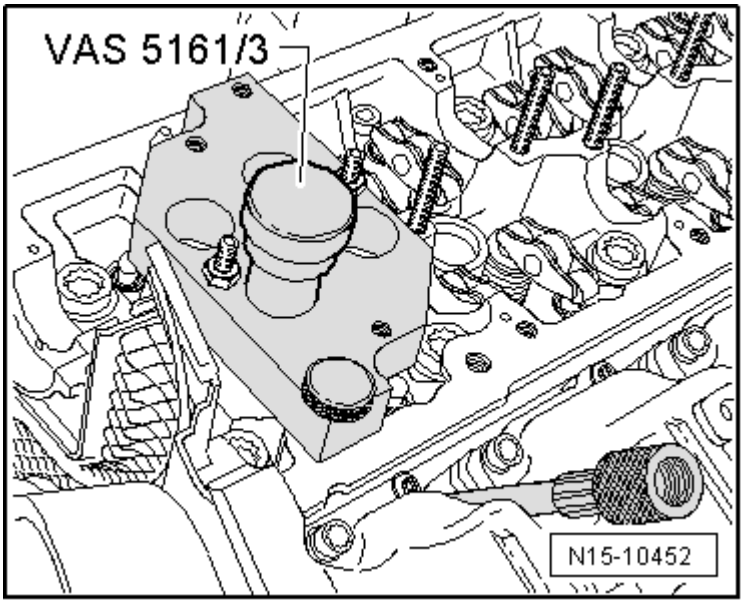

Fig. 94: Identifying Punch VAS 5161/3 Installed In Guide Plate VAS 5161/23
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Install the guide forks M6/M8 with threaded studs VAS 5161/5 in the guide plate VAS 5161/23 with the retainer VAS 5161/6.

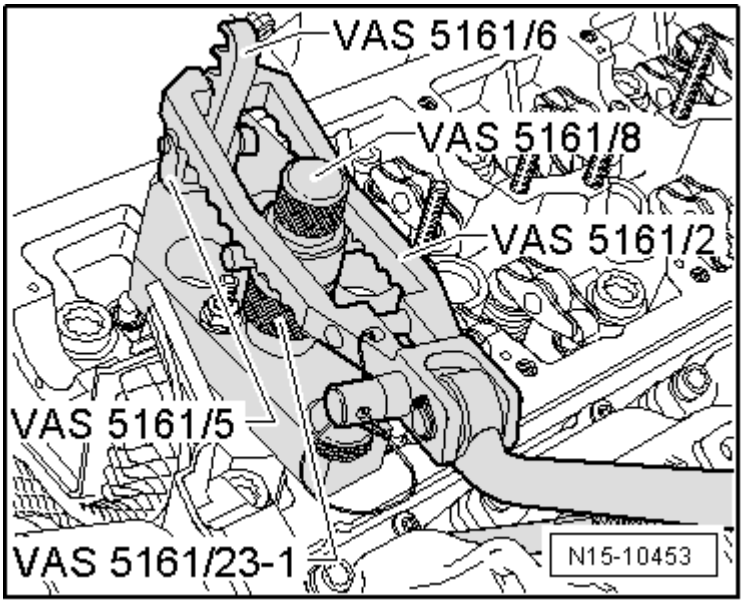

Fig. 95: Identifying Assembly Cartridges VAS 5161/2, Valve Insertion Device VAS 5161/8 And Guide Plate VAS 5161/23
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- 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 a constant pressure.

- Minimum pressure: 6 bar

-- Engage the pressure fork with lever for assembly cartridge VAS 5161/2 at the retainer VAS 5161/6 and press down the assembly cartridge VAS 5161/8.

-- At the same time, turn the knurled thumb screw on the assembly cartridge VAS 5161/8 clockwise 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 VAS 5161/8.

-- Release the pressure fork with lever for assembly cartridge VAS 5161/2.

-- Remove the assembly cartridge VAS 5161/8 with the knurled spacer ring VAS 5161/23-1, the valve plate and the valve spring.

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

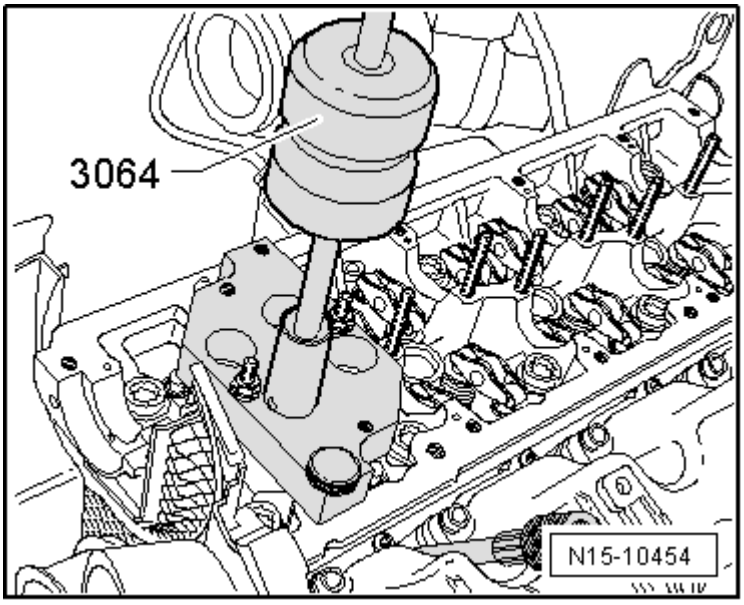

Fig. 96: Identifying Tool 3064 And Punch VAS 5161/3
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

Installing

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

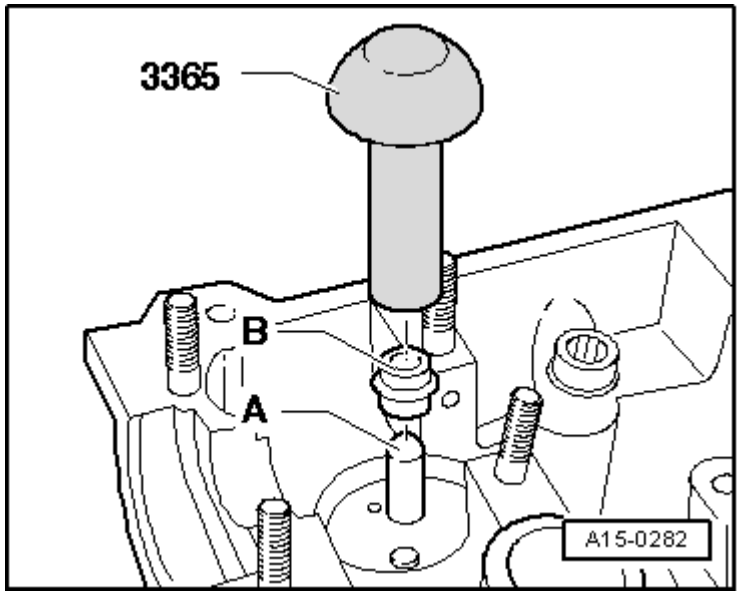

Fig. 97: Identifying Plastic Sleeve, New Valve Stem Oil Seals & Valve Stem Seal Driver 3365
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

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

-- Lightly coat the valve stem seal lips -B- with oil.

-- Slide the valve stem steal -B- onto the plastic sleeve -A-.

-- 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 -A-.

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

-- If the valve retainers were removed from the assembly cartridge VAS 5161/8, they must then be inserted into the valve insertion device VAS 5161/18.

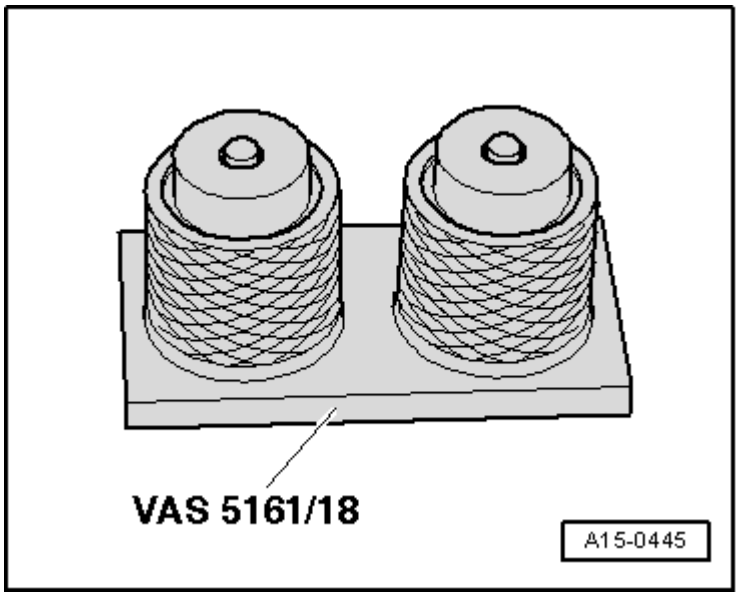

Fig. 98: Identifying Installation Cartridge VAS 5161/8
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

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

-- Press the assembly cartridge VAS 5161/18 onto the valve insertion device VAS 5161/8 from above and take up the valve retainers.

-- Insert the valve insertion device VAS 5161/8 into the guide plate VAS 5161/23.

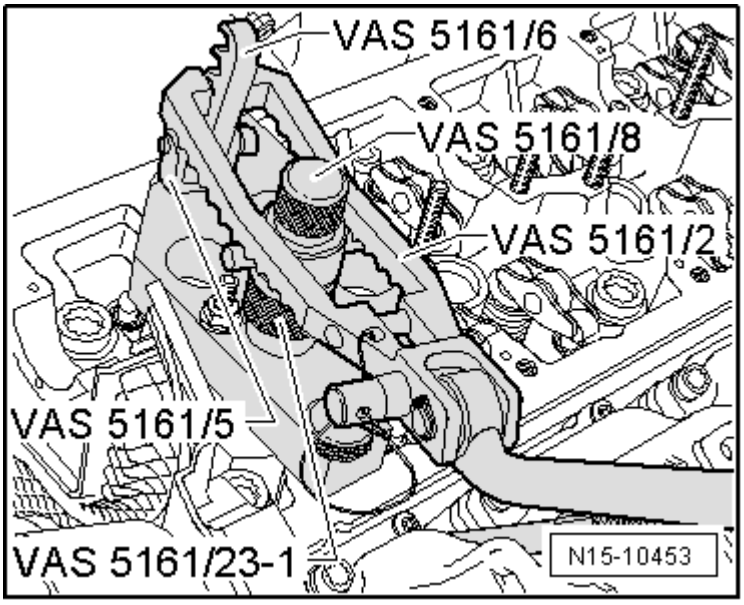

Fig. 99: Identifying Assembly Cartridges VAS 5161/2, Valve Insertion Device VAS 5161/8 And Guide Plate VAS 5161/23
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Press the pressure fork with lever for assembly cartridge VAS 5161/2 down and pull the knurled thumb screw upward while turning it left and right to insert the valve retainers.

-- Release the pressure fork with lever for assembly cartridge VAS 5161/2 with the knurled thumb screw still pulled.

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

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

NOTE: After installing the camshafts, the engine may not be started for approximately 30 minutes. The hydraulic lash adjusters must seat themselves (otherwise the valves will crash into the pistons).

After working on the valvetrain, carefully rotate the engine by hand at least 2 full revolutions to ensure that the valves do not strike the pistons when starting.

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

SPECIAL TOOLS

Special tools and workshop equipment required

- Straight Edge 500 mm VAS 6075
- Socket T40055
- Ratchet, Reversible V.A.G 1331/1

- Engine Bung Set VAS 6122
- Guide Pins & Handle - 1112 mm 3070
- Camshaft Gear Counter-Holder T10051
- Puller T10052
- Socket Insert XZN 10 T10385
- Drip Tray for VAS 6100 VAS 6208
- Camshaft Fitting Tool T40094
- Camshaft Clamping Tool T40095
- Camshaft Tensioning Tool T40096
- Oil Seal Driver 10-203
- Seal Extractor 3240
- Valve Seal Removal Tool 3364
- Valve Stem Seal Driver 3365
- Valve Cotters Asm/Disasm Device VAS 5161
- Adapter V.A.G 1381/12

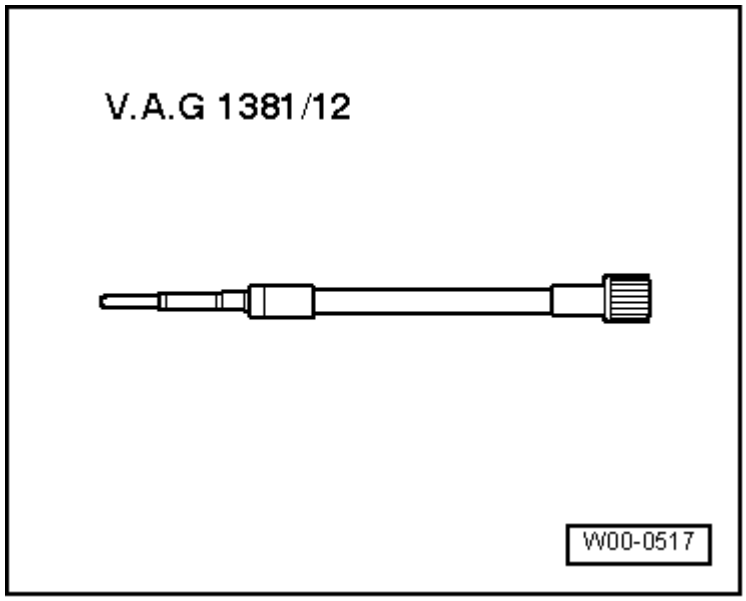

Fig. 100: Identifying Adapter V.A.G 1381/12
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

- Compression Tester V.A.G 1763

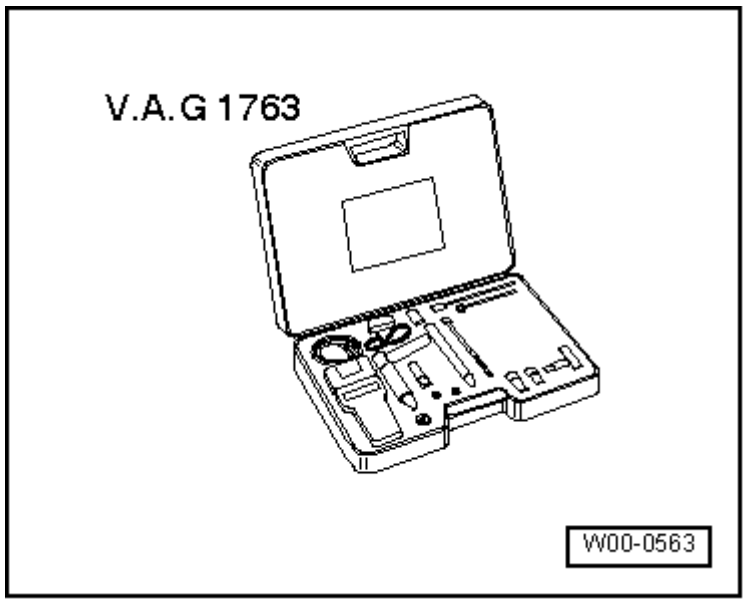

Fig. 101: Identifying Compression Tester V.A.G 1763
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

- Dial Gauge Holder VW 387

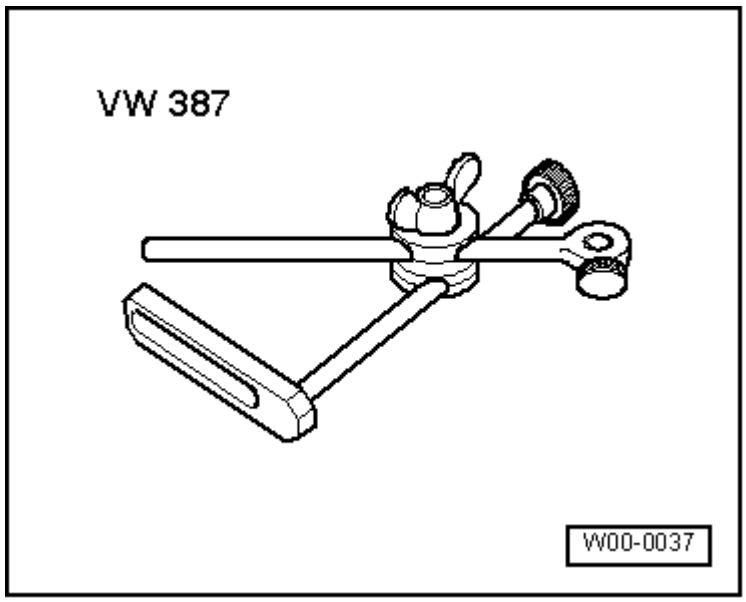

Fig. 102: Identifying Dial Gauge Holder VW 387
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

- Dial Gauge (0-10 mm) VAS 6079

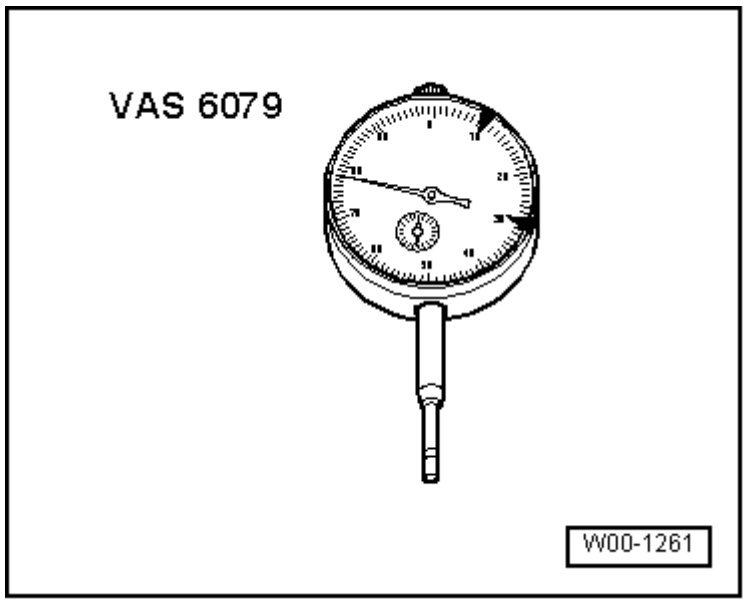

Fig. 103: Identifying Dial Gauge VAS 6079
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

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

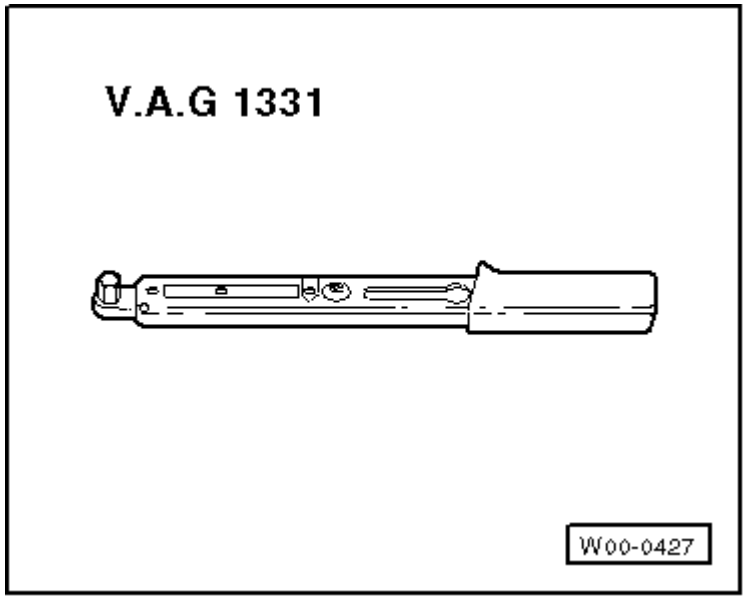

Fig. 104: Identifying Torque Wrench (5 To 50 Nm) V.A.G 1331
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

- Hose Clip Pliers VAS 6362

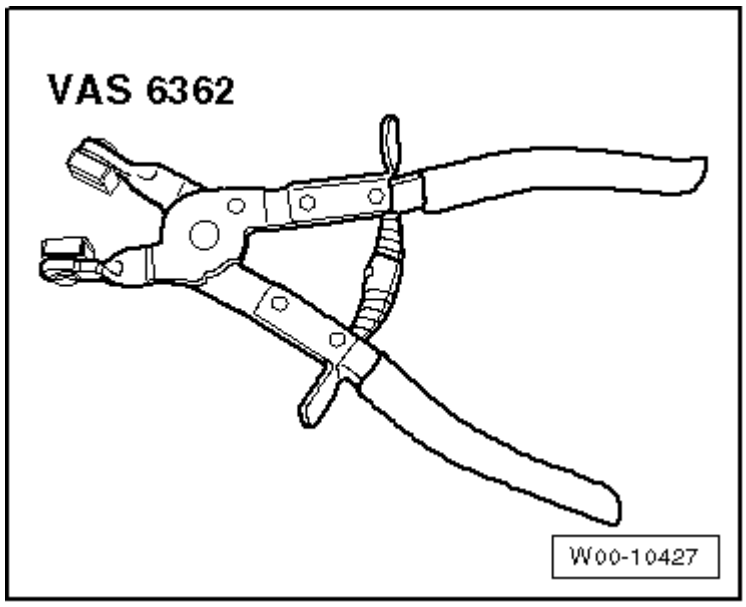

Fig. 105: Identifying Clamp Pliers VAS 6362
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

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

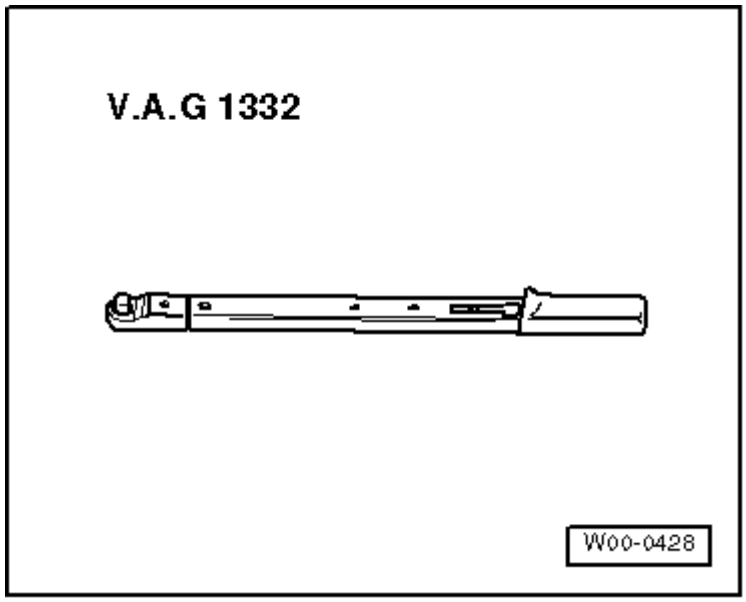

Fig. 106: Identifying Torque Wrench 40-200 Nm VAG 1332
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

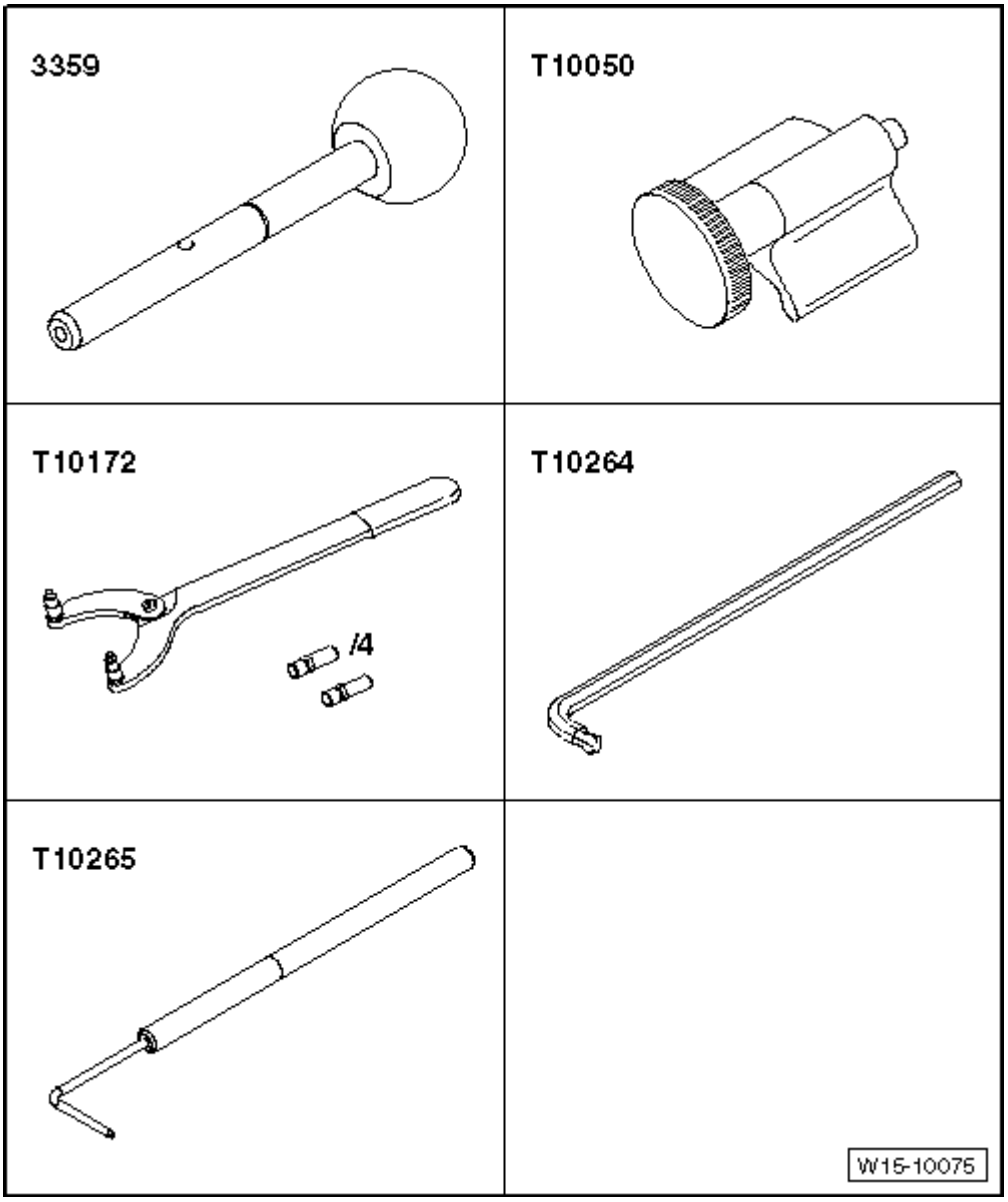

Fig. 107: Identifying Diesel Injection Pump Remove/Install Components
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

Special tools and workshop equipment required

- Diesel Injection Pump Locking Pin 3359
- Crankshaft Stop T10050
- Counterhold Tool Touareg V10 T10172
- Special Wrench, Long Reach T10264
- Locking Tool T10265

ENGINE

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

13 CRANKSHAFT, CYLINDER BLOCK

GENERAL INFORMATION

CYLINDER BLOCK

CAUTION: If metal shavings or a large quantity of small metal particles are found when repairing an engine, this could indicate that the crankshaft or connecting rod bearings are damaged. To prevent further damage, perform the following steps after the repair:

- **Thoroughly clean the oil passages**
- **Replace the oil spray jets**
- **Replace the oil cooler**
- **Replace the oil filter element**

NEW CONNECTING ROD, SEPARATING

New connecting rods may not be separated at the location where they should be. If it is difficult to remove the connecting rod bearing cap by hand, do the following:

-- Mark which cylinder the connecting rod belongs too.

-- Clamp the connecting rod in a vice, which has protective jaw covers to prevent damage.

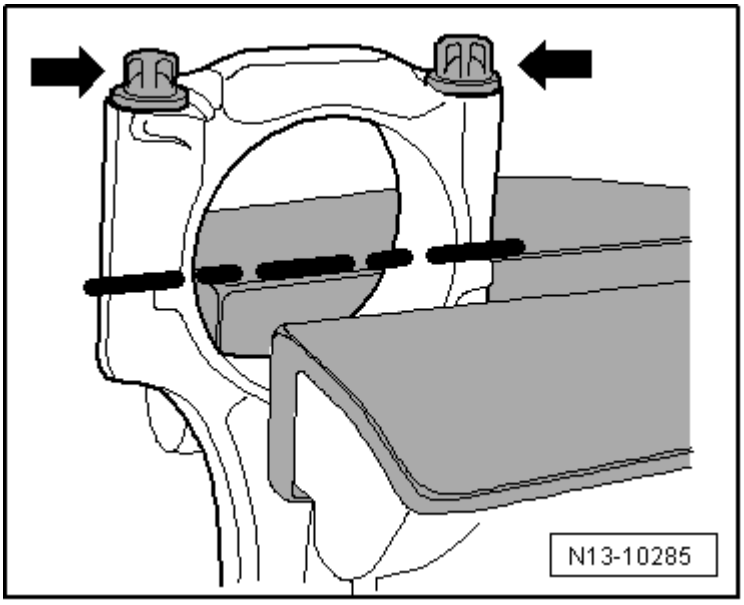

Fig. 1: Identifying Connecting Rod Clamped In Vise Equipped With Aluminum Protective Pads
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

NOTE: Clamp the connecting rod below the dotted line.

-- Loosen the bolts -arrows- approximately 5 turns.

-- Carefully tap the connecting rod bearing cap using a plastic hammer -arrow- until it comes loose.

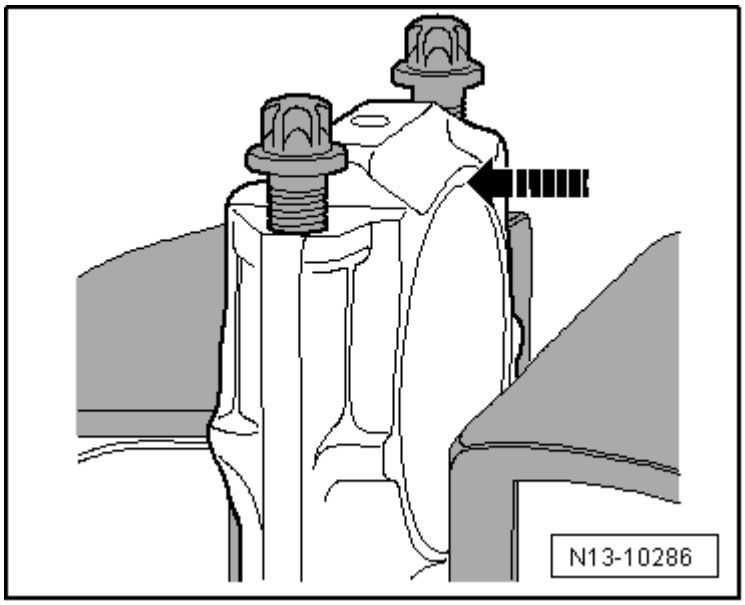

Fig. 2: Identifying Connecting Rod Bearing Cap
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

BEARING SHELLS, INSTALLED LOCATION

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

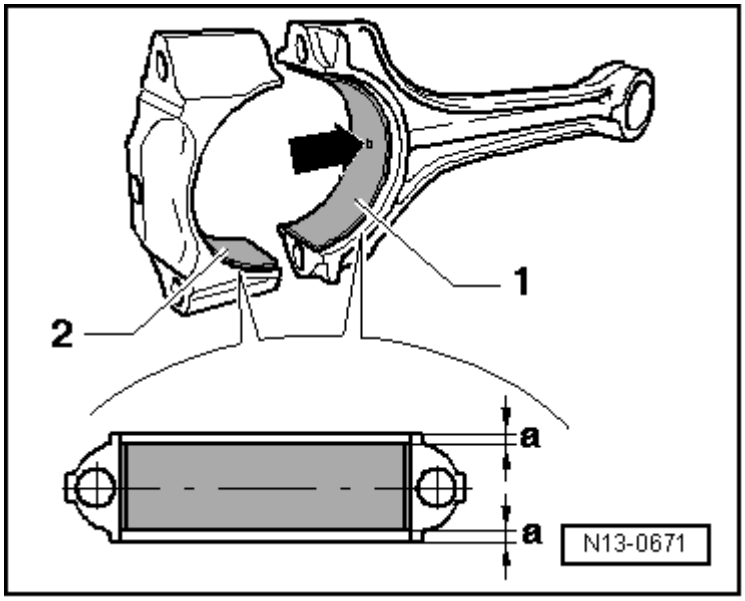

Fig. 3: Identifying Bearing Shells - Installed Positions
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

Bearing shell -2- without a oil bore for connecting rod cap.

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

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

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 (0-10 mm) VAS 6079

Test Sequence

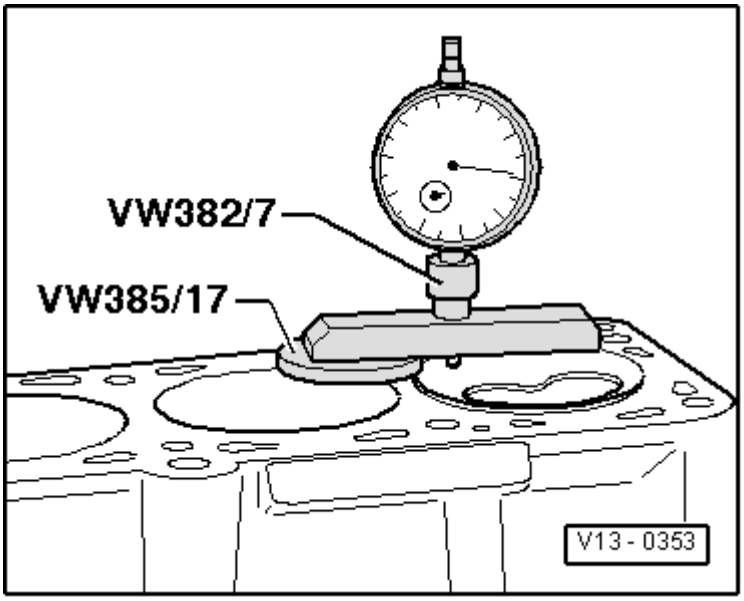

Fig. 4: Identifying Measurement Of Piston Projection
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

When installing new pistons or working on a partial engine, check the piston projection in Top Dead Center (TDC) on all pistons. Depending on the piston projection, install the corresponding cylinder head gasket according to the following table.

NOTE: To measure the piston position at TDC, rotate the engine clockwise.

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

Piston Projection Dimensions in mm	Identification, Notches/Holes
0.91...1.00	1
1.01...1.10	2
1.11...1.20	3

CYLINDER HEAD GASKET IDENTIFICATION

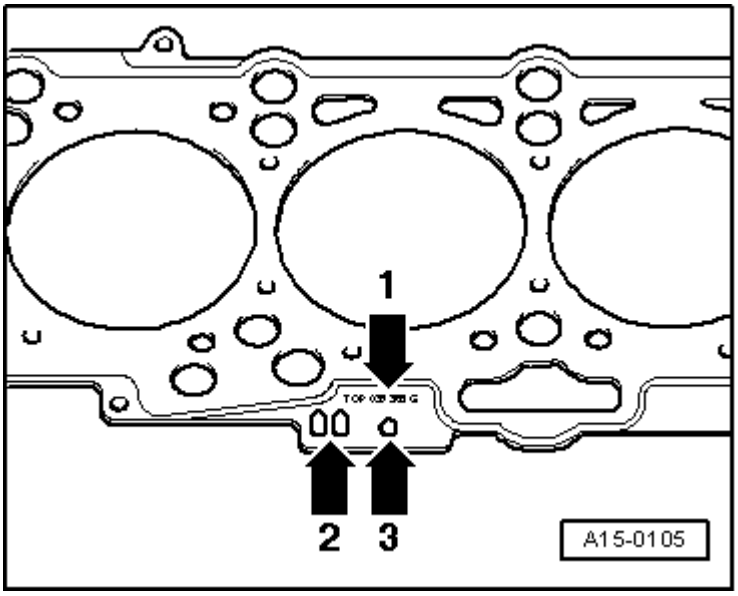

Fig. 5: Identifying Cylinder Head Gasket Identification
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

- Part number = -arrow 1-
- Control code = -arrow 2- (ignore this!)
- Holes = -arrow 3-
- Installed position: the mark faces up.

NOTE: Depending on piston projection, varying cylinder head gasket thicknesses can be installed. When replacing the gasket, install a new gasket with the same identification -arrow 3-.

DESCRIPTION AND OPERATION

RIBBED BELT OVERVIEW

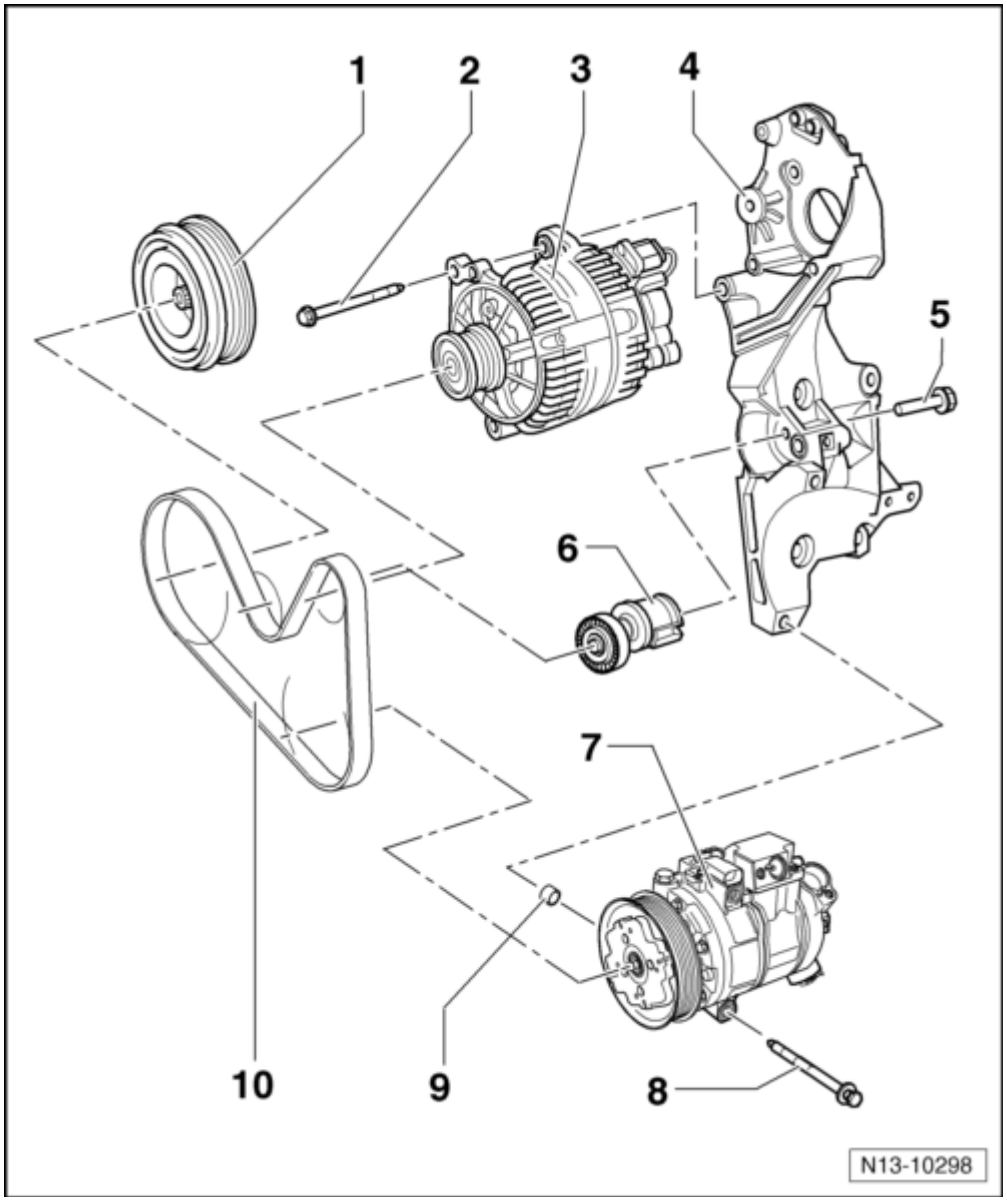

Fig. 6: Identifying Ribbed Belt Overview
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

1. **Vibration Damper**
   - Only possible to install in one position - The bores are offset.
2. **Bolt**
   - 25 Nm
3. **Generator**
   - Removing and installing, refer to **Removal and Installation** .
4. **Accessory Bracket**
   - Removing and installing, refer to **ACCESSORY BRACKET**.
5. **Bolt**

- 20 Nm + an additional 180° (1/2) turn.
- Always replace.
- Do not lubricate or grease the threads or collar.
- The additional turn can occur in several stages.

6. **Belt Tensioner**
   - To release tension on the belt, rotate using an open end wrench. Refer to **RIBBED BELT**.
7. **Air Conditioning (A/C) Compressor**
   - Removing and installing, refer to **Removal and Installation** .
8. **Bolt**
   - 45 Nm
9. **Alignment Sleeve**
10. **Ribbed Belt**
    - Mark the direction of rotation before removing.
    - Check for wear.
    - Do not kink.
    - Removing and installing, refer to **RIBBED BELT**.

TOOTHED BELT OVERVIEW

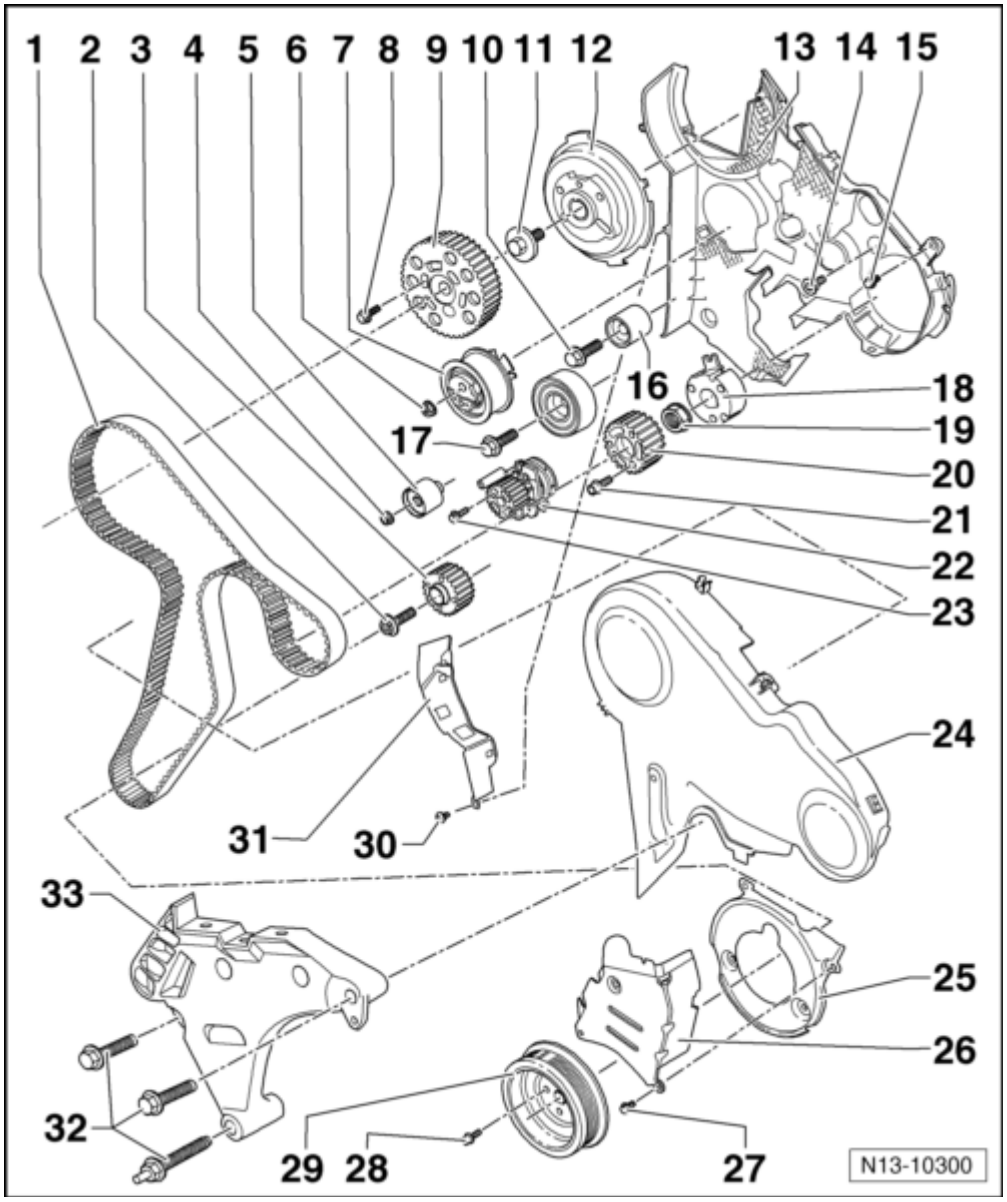

Fig. 7: Identifying Toothed Belt Overview
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

1. **Toothed Belt**
   - Mark the direction of rotation 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. **Bolt**
   - 20 Nm
5. **Idler Roller**
6. **Nut**
   - 20 Nm + an additional 45° (1/8) turn.
   - Always replace.
7. **Belt Tensioner**
   - Remove the engine mount bracket to remove and install. Refer to **ENGINE MOUNT AND BRACKET** .
8. **Bolt**
   - 20 Nm + an additional 90° (1/4) turn.
   - Always replace.
9. **Camshaft Toothed Belt Gear**
10. **Bolt**
    - 25 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
    - 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 **HIGH PRESSURE FUEL PUMP** .

19. **Nut**
    - 95 Nm
20. **High Pressure Fuel 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**
    - Installing, refer to **Fig. 8**.
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**
    - Only possible to install in one position - the bores are offset.
30. **Bolt**
    - 5 Nm
31. **Protective Plate**
32. **Bolt**
    - 40 Nm + an additional 180° (1/4) turn.
    - Always replace.
    - Observe the tightening sequence, refer to **Fig. 9**.
33. **Engine Mount Bracket**
    - Removing and installing, refer to **ENGINE MOUNT AND BRACKET** .

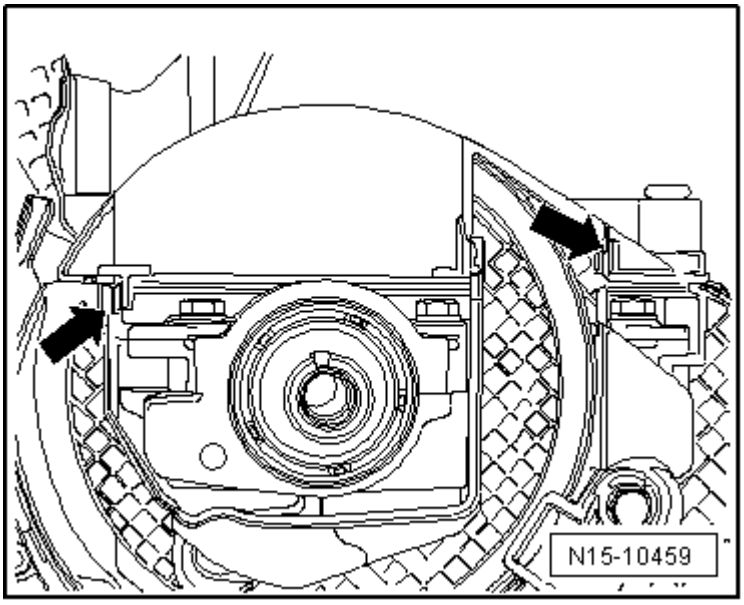

Fig. 8: Identifying Upper Toothed Belt Guard
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Make sure the upper toothed belt guard section is clipped to the cylinder head cover correctly.

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

-- Press the upper 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.

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

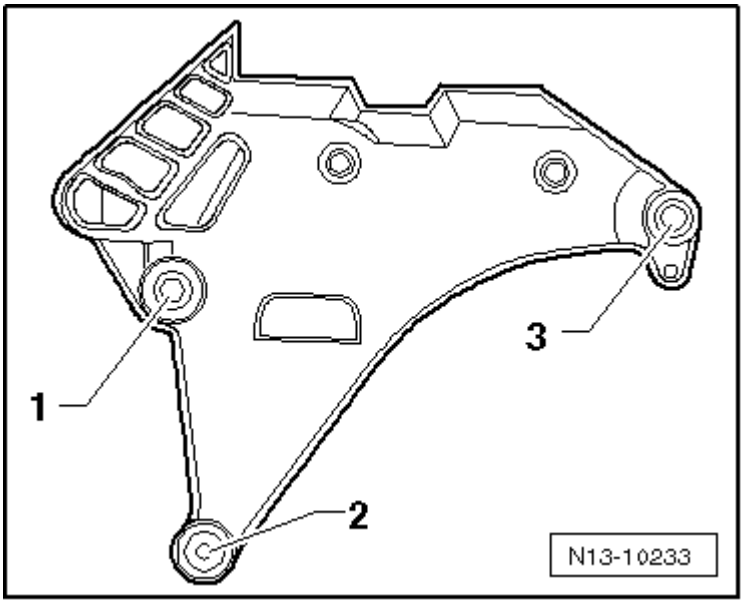

Fig. 9: Identifying Engine Mount Bracket to Cylinder Block Bolt Tightening Sequence
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

CYLINDER BLOCK OVERVIEW

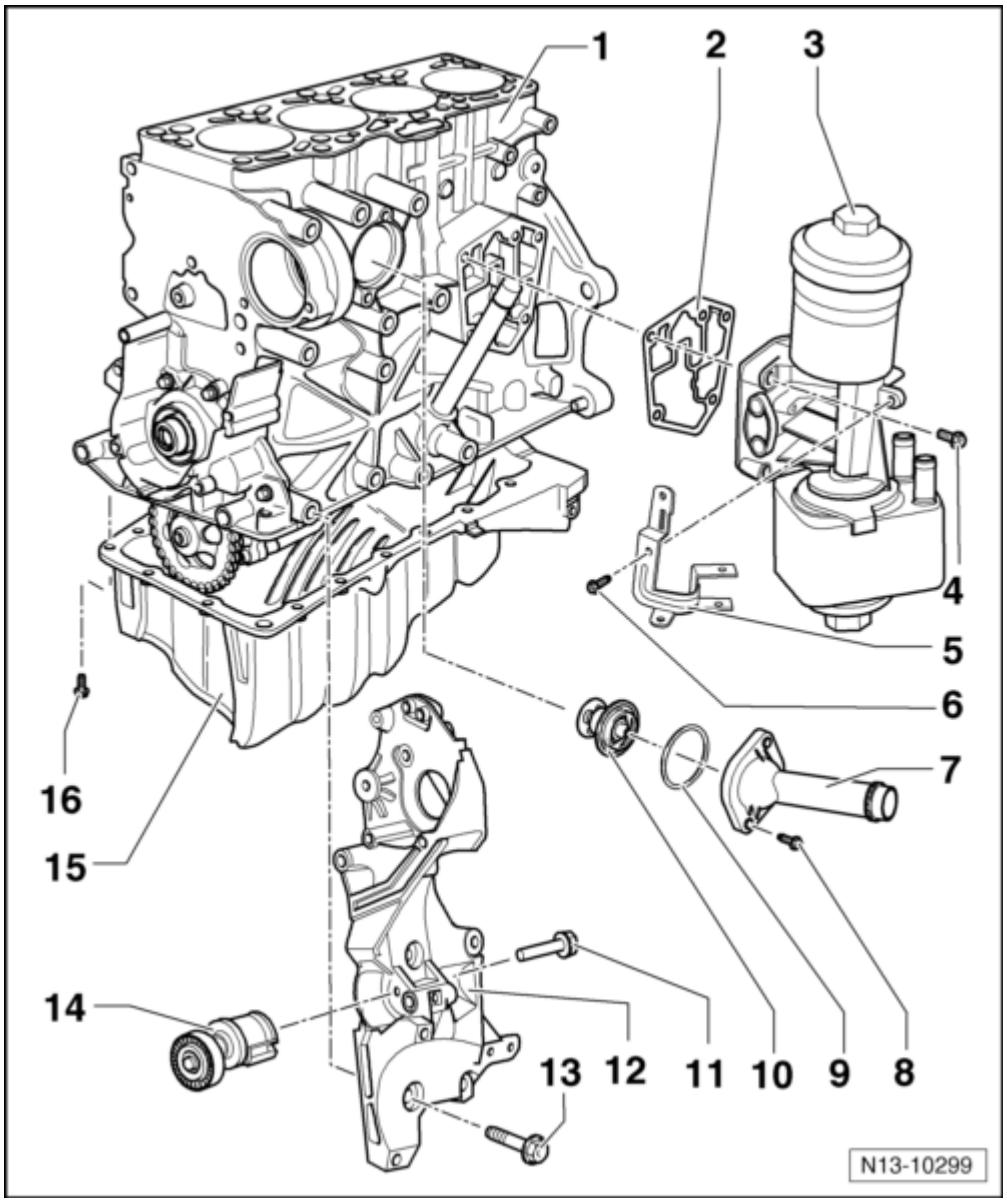

Fig. 10: Identifying Cylinder Block Overview
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

1. **Cylinder Block**
   - Sealing flanges and flywheel overview. Refer to **SEALING FLANGE AND FLYWHEEL OVERVIEW**.
   - Piston and connecting rod overview. Refer to **PISTONS AND CONNECTING ROD OVERVIEW**.
   - Crankshaft overview. Refer to **CRANKSHAFT OVERVIEW**.
   - Engine code CBEA with a balance shaft assembly:

Balance shaft module removing and installing. Refer to **BALANCE SHAFT MODULE** .

2. **Gasket**
   - 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, and then tighten all 4 bolts in a diagonal sequence.
5. **Bracket**
   - For the wiring harness.
6. **Bolt**
   - 10 Nm
7. **Connecting Piece**
   - For the thermostat.
8. **Bolt**
   - 15 Nm
9. **O-ring**
   - Always replace
10. **Coolant Thermostat**
    - Use the correct installed position, refer to **COOLANT THERMOSTAT** .
    - Checking: warm the thermostat in water.
    - Opening: Begins approximately 85 °C (185 °F).
    - Ends: Approximately 105 °C (221 °F).
    - Opening lift: Minimum: 7 mm.
    - Removing and installing, refer to **COOLANT THERMOSTAT** .
    - 4/2 way valve with thermostat, removing and installing. Refer to **4/2 WAY VALVE WITH THERMOSTAT** .
11. **Bolt**
    - 20 Nm + an additional 180° (1/2) turn.
    - Always replace.
    - Do not lubricate or grease the threads or collar.
    - The additional turn can occur in several stages.
12. **Accessory Bracket**
    - Removing and installing, refer to **ACCESSORY BRACKET**.
13. **Bolt**
    - 40 Nm + an additional 90° (1/4) turn.

- Always replace.

14. **Ribbed Belt Tensioner**
    - To release tension on the ribbed belt, rotate using a open end wrench. Refer to **RIBBED BELT**.
    - Removing and installing, refer to **RIBBED BELT TENSIONER**.
15. **Oil Pan**
    - Clean the sealing surface before installing.
    - Install using silicone sealant D 176 404 A2
16. **Bolt**
    - 15 Nm
    - Tighten in a diagonal sequence and in steps.

SEALING FLANGE AND FLYWHEEL OVERVIEW

Servicing the Clutch:

- Vehicles with a manual transmission, refer to **CLUTCH** .
- Vehicles with a Direct Shift Gearbox (DSG®), refer to **CLUTCH** .

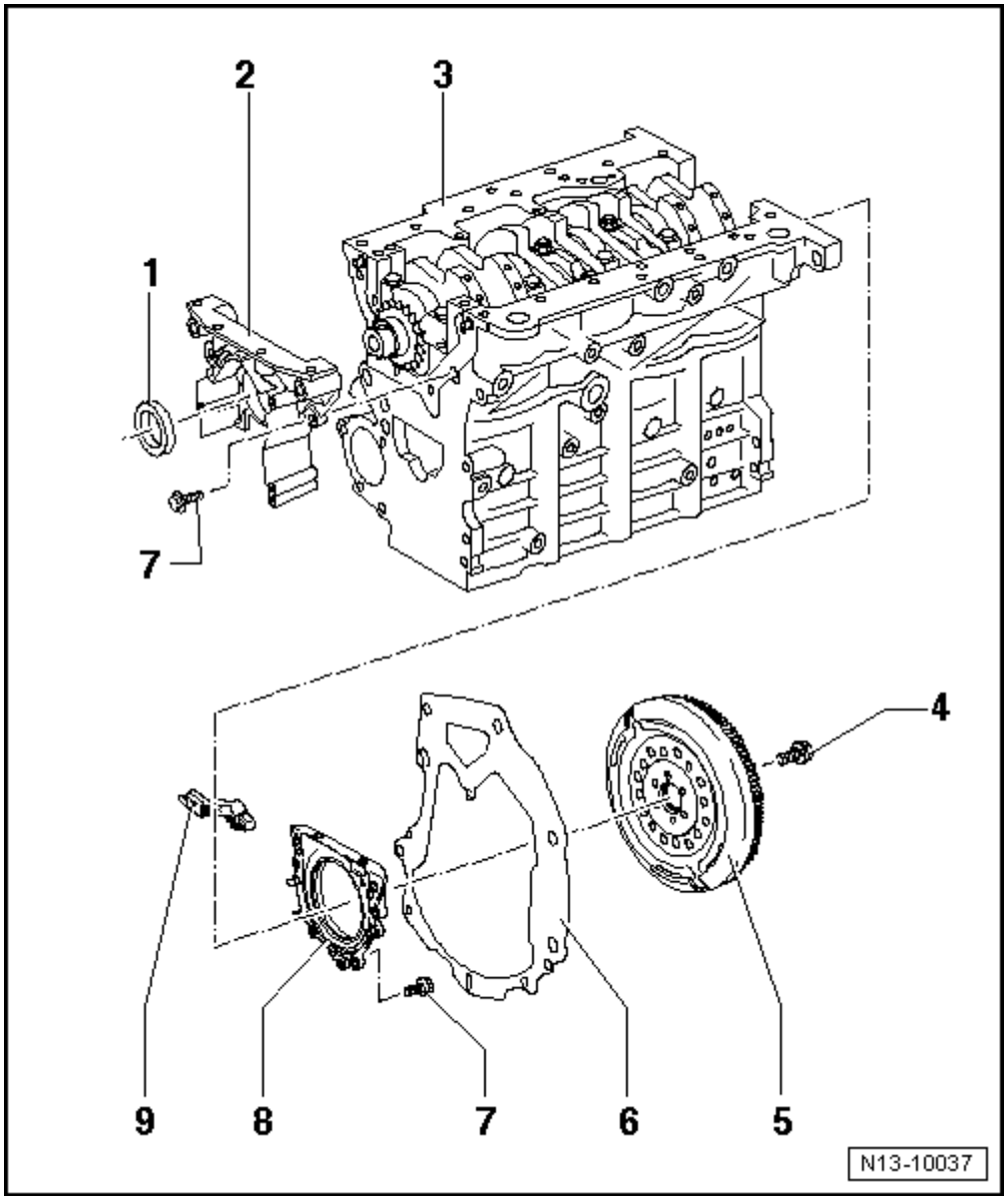

Fig. 11: Identifying Sealing Flanges And Flywheel Assembly Overview
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

1. **Seal**
   - Do not additionally oil or grease the sealing lip of the seal.
   - Before installing, remove any remaining oil from the crankshaft journal with a clean cloth.
   - Crankshaft seal, replacing. Refer to **CRANKSHAFT SEAL, BELT PULLEY SIDE**.
2. **Sealing Flange**
   - Must be located on the alignment sleeves.
   - Removing and installing, refer to **SEALING FLANGE, BELT PULLEY SIDE**.
   - Install using silicone sealant D 176 404 A2. Refer to **SEALING FLANGE, BELT PULLEY SIDE**.

3. **Cylinder Block**
   - Piston and connecting rod overview. Refer to **PISTONS AND CONNECTING ROD OVERVIEW**.
   - Crankshaft overview. Refer to **CRANKSHAFT OVERVIEW**.
   - Engine code CBEA with a balance shaft assembly:
   - Balance shaft module removing and installing. Refer to **BALANCE SHAFT MODULE** .
4. **Bolt**
   - 60 Nm + an additional 90° (1/4) turn.
   - Always replace.
5. **Flywheel**
   - Secure the flywheel using the flywheel retainer 3067 to loosen and tighten the bolts.
6. **Intermediate Plate**
   - Must be located on the alignment sleeves.
   - Do not damage or bend when doing assembly work.
7. **Bolt**
   - 15 Nm
8. **Sealing Flange with Seal**
   - With the engine speed sensor, sensor wheel.
   - Only replaced as a complete unit.
   - Do not additionally oil or grease the sealing lip of the seal.
   - Before installing, remove any remaining oil from the crankshaft journal with a clean cloth.
   - Use the support sleeve provided to install.
   - Removing and installing, refer to **CRANKSHAFT SEALING FLANGE, FLYWHEEL SIDE**.
9. **Engine Speed Sensor -G28-**
   - 5 Nm
   - Removing and installing, refer to **Engine Speed Sensor -G28-**.

PISTONS AND CONNECTING ROD OVERVIEW

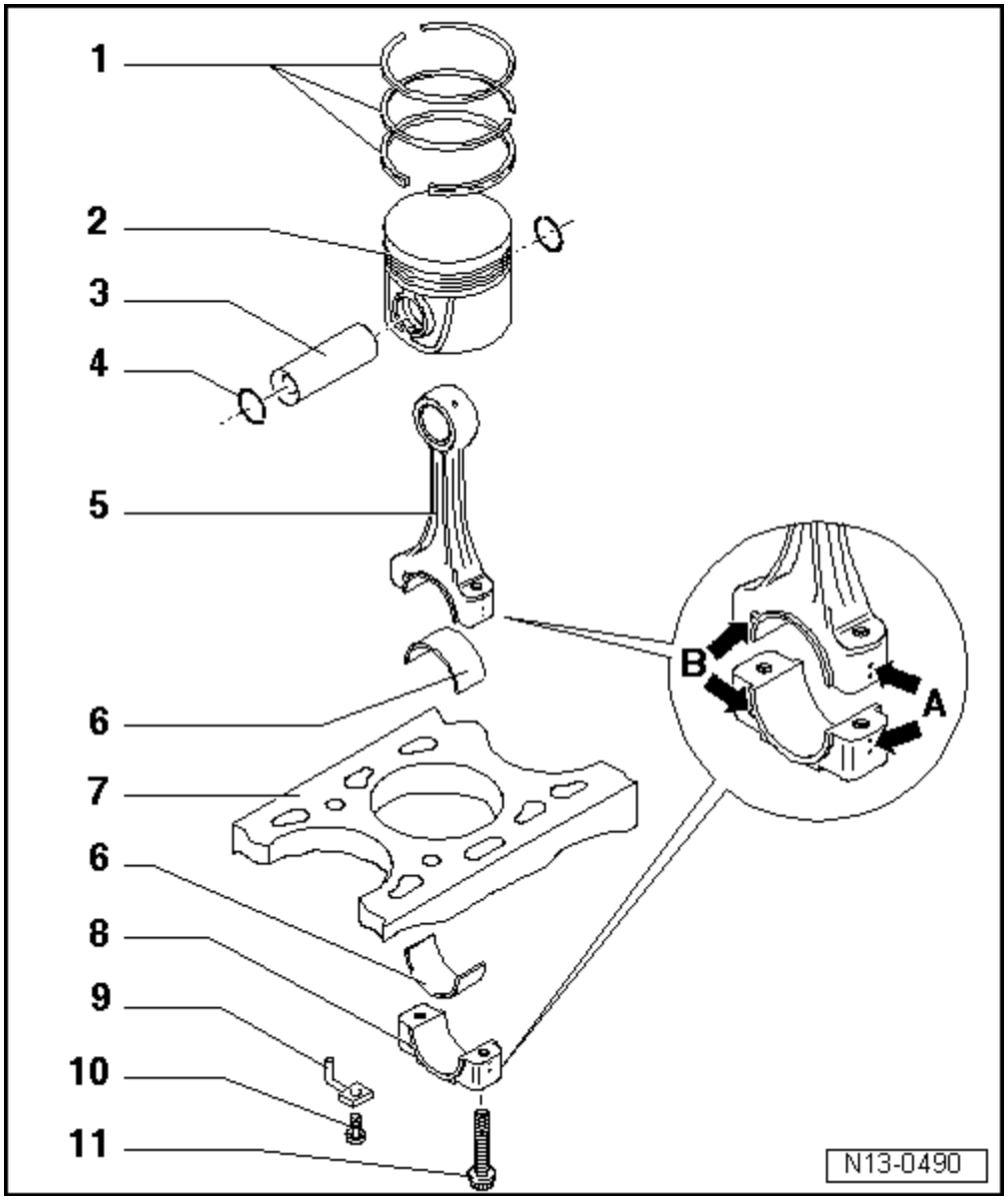

Fig. 12: Identifying Pistons And Connecting Rod Assembly Overview
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

1. **Piston Rings**
   - Offset gaps by 120°
   - Use piston ring pliers for removal and installation.
   - "TOP" faces toward piston crown.
   - Checking ring gap, refer to **Fig. 13**.
   - Checking piston ring groove clearance, refer to **Fig. 14**.
2. **Piston**
   - With the combustion chamber.
   - Mark the installed position and cylinder allocation.

- Installed position and allocation, piston/cylinder. Refer to **Fig. 16**.
- Arrow on the piston face points toward the belt pulley side.
- Install with a piston ring compressor.
- Replace if the piston skirt is cracked.
- Checking 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. **Circlip**
5. **Connecting Rod**
   - Mark the allocation to the cylinder using a colored mark -A-.
   - Installed position: the marks -B- face the belt pulley side.
   - With a cracked bearing cap.
   - Separating new connecting rods, refer to **NEW CONNECTING ROD, SEPARATING**.
6. **Bearing Shell**
   - Note the installed position, refer to **BEARING SHELLS, INSTALLED LOCATION**.
   - Pay attention to the version: upper bearing shell (facing the piston) is made from wear resistant material; how to recognize it: a black line on the running surface near the separating point.
   - Do not interchange used bearing shells.
   - Insert bearing shells in the center.
   - Ensure the bearing shell is seated tightly.
   - Axial play:

     Wear limit 0.37 mm

   - Measure the radial play using Plastigage®:

     Wear limit: 0.08 mm

   - Do not rotate the crankshaft when measuring radial play.
7. **Cylinder Block**
   - Checking, cylinder bore. Refer to **Fig. 15**.
   - Piston and cylinder dimensions. Refer to **PISTON AND CYLINDER DIMENSIONS**.
8. **Connecting Rod Bearing Cap**
   - Note the installed position.
   - Due to the separation procedure (cracking) of the connecting rod, the connecting rod bearing cap only fits in one position and only to the corresponding connecting rod.
9. **Oil Spray Jet**
   - For piston cooling.

10. **Bolt with Pressure Relief Valve**
    - 27 Nm
    - Install without sealant.
11. **Bolt**
    - 30 Nm + an additional 90° (1/4) turn.
    - Always replace.
    - Lubricate the threads and contact surface.
    - Use a old bolt to measure radial play.

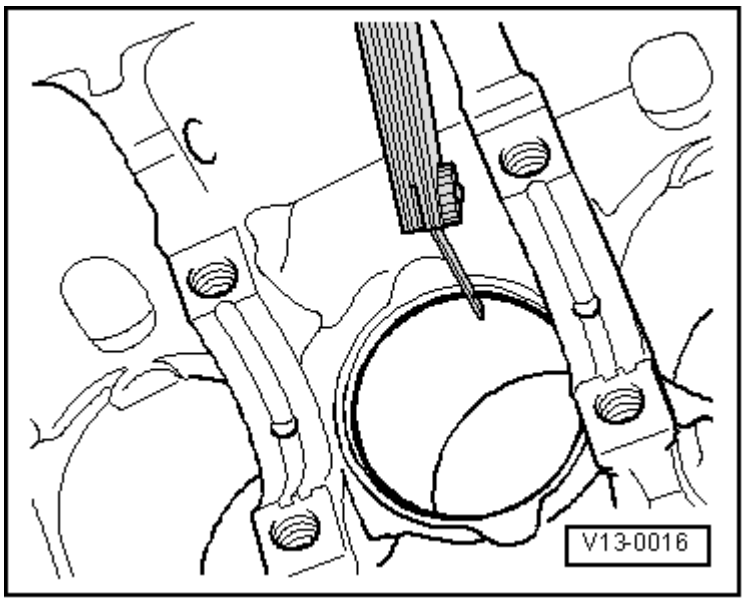

Fig. 13: Identifying Piston Ring Gap
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

Special tools and workshop equipment required

- Feeler Gauge

Procedure

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

Piston Ring	Gap	
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

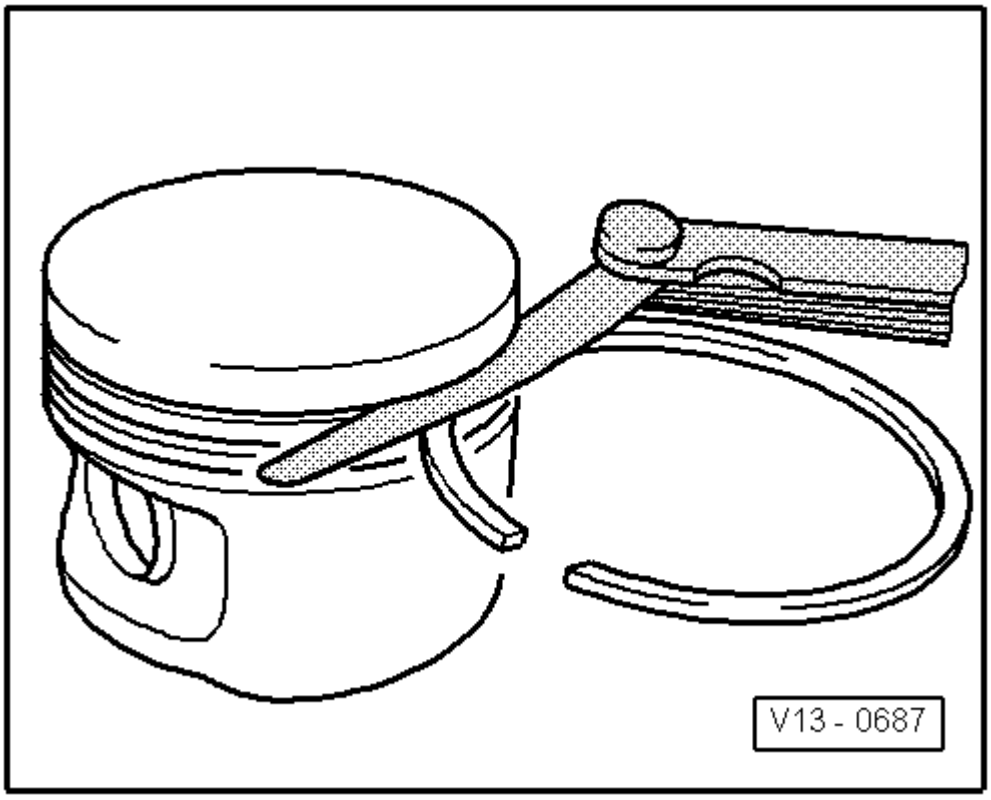

Fig. 14: Identifying Piston Ring Gap
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

Special tools and workshop equipment required

- Feeler Gauge

Procedure

-- Before measuring, clean the ring groove.

Piston Ring	Ring to Groove Clearance	
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

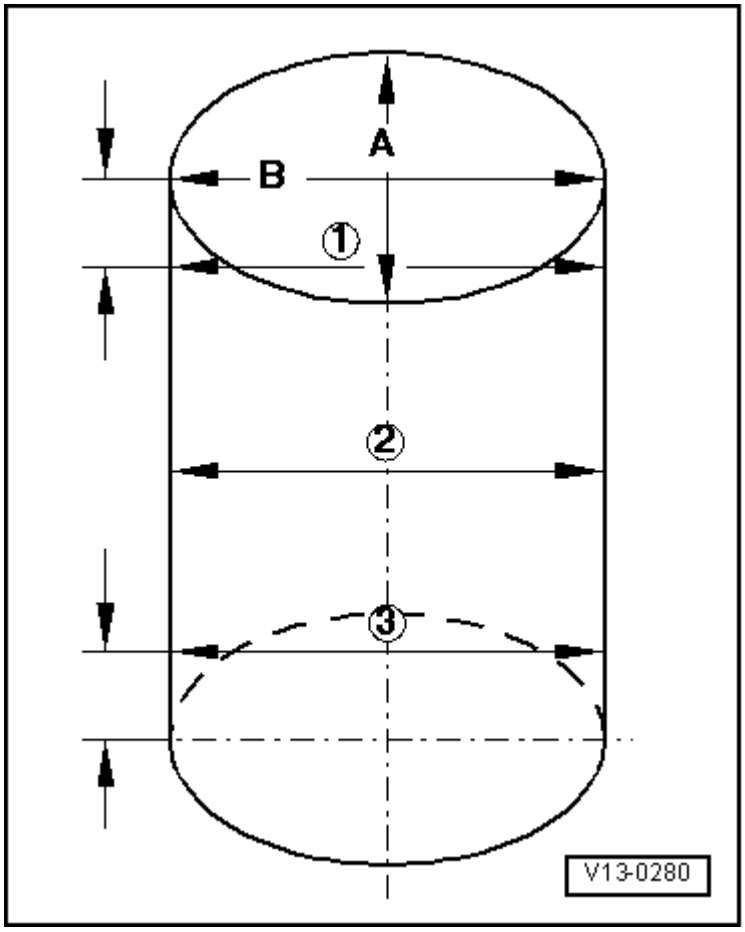

Fig. 15: Identifying Check Of Cylinder Bores
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

Special tools and workshop equipment required

- Inside Caliper 50-100 mm

Procedure

-- Measure the bore at 3 locations in both directions -A- across the engine and -B- in line with the crankshaft.

- Deviations to the nominal size: maximum 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.

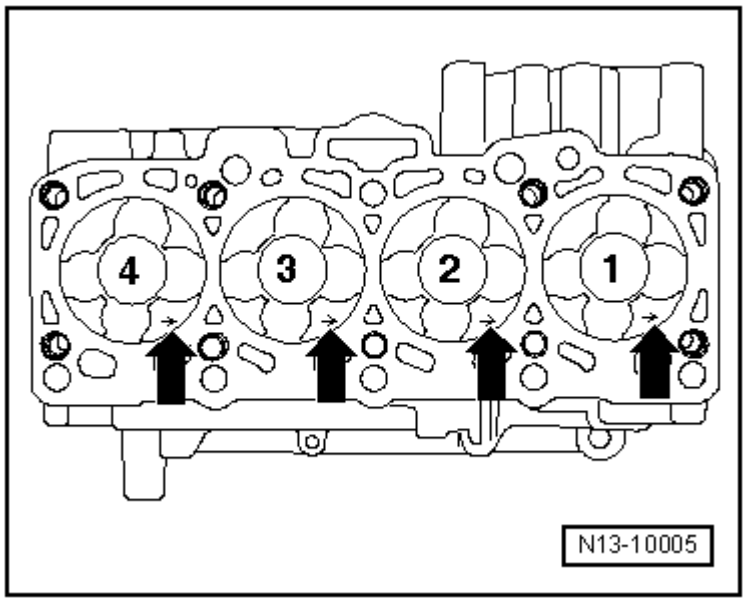

Fig. 16: Identifying Installed Position of the Piston and Piston/Cylinder Allocation
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

The arrow on the piston crown -arrows- faces toward the belt pulley side.

CRANKSHAFT OVERVIEW

CAUTION:

- **If the crankshaft was removed, a new intermediate sprocket with a coating must be installed and the hub including the bolt and axial bearing discs must be replaced. Otherwise the backlash will be incorrect.**
- **Installation procedure, refer to NEW BALANCE SHAFT, INSTALLING .**

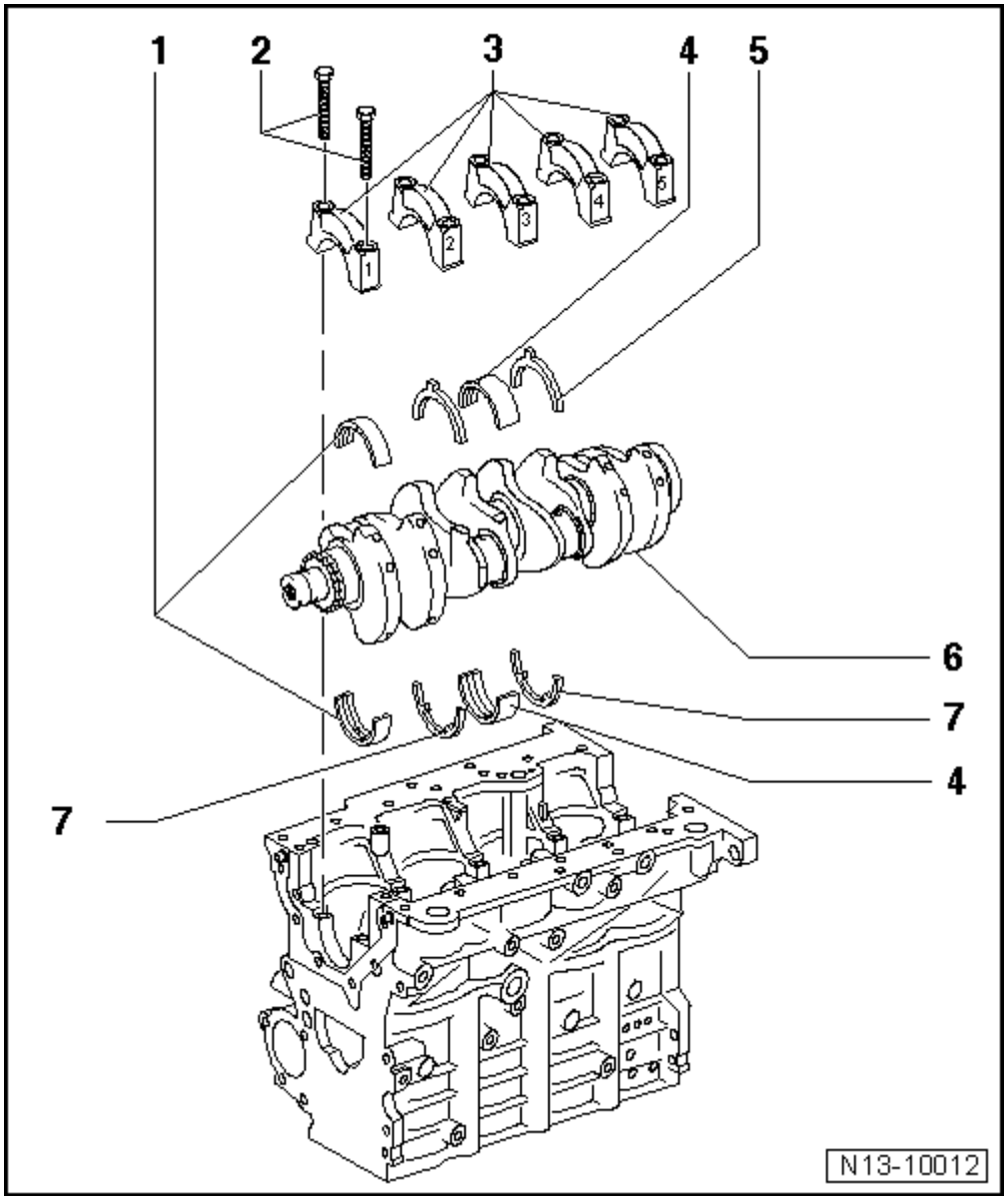

Fig. 17: Identifying Crankshaft, Assembly Overview
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

1. **Bearing Shells 1, 2, 4 and 5**
   - For the bearing caps without oil grooves.
   - For the cylinder block with oil grooves
   - Do not interchange used bearing shells (mark them).
2. **Bolt**
   - 65 Nm + an additional 90° (1/4) turn.
   - Always replace.
   - Tighten to 65 Nm to measure the radial play, do not tighten further.
3. **Bearing Cap**

- Bearing cap 1: belt pulley side
- Bearing cap 3 with notches for thrust washers
- Retaining tabs on bearing shells and cylinder block/bearing caps must align above one another.

4. **Bearing Shell 3**
   - For the bearing cap without a oil groove.
   - For the cylinder block with a oil groove.
5. **Thrust Washer**
   - For bearing cap 3.
   - Observe the locating point.
6. **Crankshaft**
   - Refer to the caution at the top.
   - Axial play:

     New: 0.07 to 0.17 mm

     Wear limit: 0.37 mm

   - Check the radial clearance using Plastigage®:

     New: 0.03 to 00.08 mm

     Wear limit: 0.17 mm

   - Do not rotate the crankshaft when measuring the radial play.
   - Crankshaft dimensions, refer to **CRANKSHAFT DIMENSIONS**.
7. **Thrust Washer**
   - For cylinder block, bearing 3.

SPECIFICATIONS

PISTON AND CYLINDER DIMENSIONS

Honing Dimension	Piston and Cylinder Dimensions	
Dimensions in mm	Piston diameter (1)	Cylinder bore diameter
Basic dimension	80.960	81.010
(1) Take the measurement approximately 12 mm in from the lower edge of the piston and offset 90° to the piston axis.		

CRANKSHAFT DIMENSIONS

Dimension	Crankshaft Bearing Pin Diameter	Connecting Rod Bearing Pin Diameter

Dimensions in mm				
Basic dimension	54.000	-0.022 -0.042	50.900	-0.022 -0.042

FASTENER TIGHTENING SPECIFICATIONS

Component	Fastener Size	Nm
Accessory Bracket to Belt Tensioner Bolt (1), (2)	-	20 + 180°
Air Conditioning Compressor to Accessory Bracket Bolt	-	45
Camshaft Toothed Belt Gear to Camshaft Bolt (1)	-	20 + 90°
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), (7)	-	30 + 90°
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), (2)	-	120 + 90°
Engine Mount Bracket to Cylinder Block Bolt	-	40 + 180°
Engine Speed Sensor to Cylinder Block Bolt	-	5
Flywheel to Crankshaft Bolt (1)	-	60 + 90°
Generator to Accessory Bracket Bolt	-	25
High Pressure Fuel Pump Toothed Belt Gear to Camshaft Bolt (1)	-	20 + 90°
Hub to Camshaft Bolt	-	100
Hub to High Pressure Fuel Pump Nut	-	95
Oil Filter Bracket to Cylinder Block Bolt (1), (5)	-	15 + 90°
Oil Pan to Cylinder Block Bolt (6)	-	15
Oil Spray Jet to Cylinder Block Bolt	-	27
Protective Plate to Rear Toothed Belt Guard Bolt	-	5
Rear Toothed Belt Guard to Cylinder Block/Head Bolt (3)		
	-	10 (1)
	-	20
Sealing Flange to Cylinder Block Bolt	-	15
Toothed Belt Idler Roller to Cylinder Block Bolt (4)		
	-	25
	-	50 + 90° 1
Toothed Belt Idler Roller to Cylinder Block Nut	-	20

Toothed Belt Tensioner to Cylinder Head Stud Nut (1)	-	20 + 45°
Vibration Damper Pulley to Crankshaft Bolt (1)	-	10 + 90°
Wiring Harness Bracket to Oil Filter Bracket Bolt	-	10

(1) Always replace

(2) Do not lubricate or grease the threads or collar

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

(4) For bolt clarification, refer to -items 10 and 17- in the **TOOTHED BELT OVERVIEW**

(5) First, fasten the upper left and lower right bolts, and then tighten all four bolts in a diagonal sequence

(6) Tighten in a diagonal sequence and in steps

(7) Lubricate the threads and contact surface

Accessory Bracket Bolt Tightening Sequence and Specification

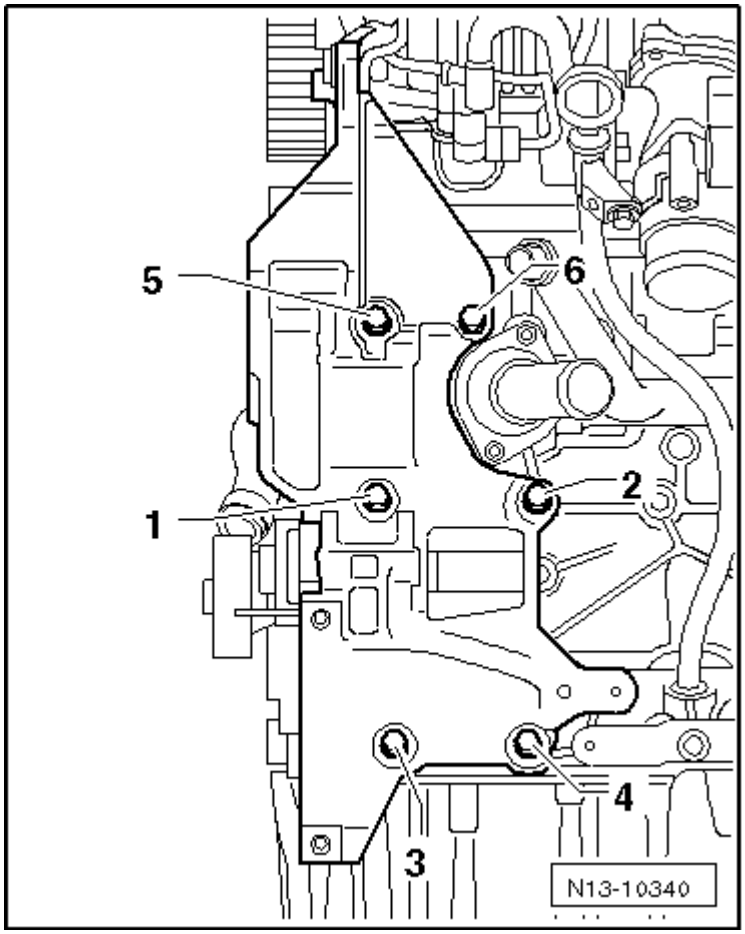

Fig. 18: Identifying Bolt Tightening Sequence
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Tighten the new bolts in sequence -1 through 6- to 40 Nm + an additional 90° (1/4) turn.

REMOVAL AND INSTALLATION

RIBBED BELT

Special tools and workshop equipment required

- Locking Pin T10060 A

Removing

-- Remove the noise insulation. Refer to **Body, Front** .

-- Mark the rotation direction of the ribbed belt.

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

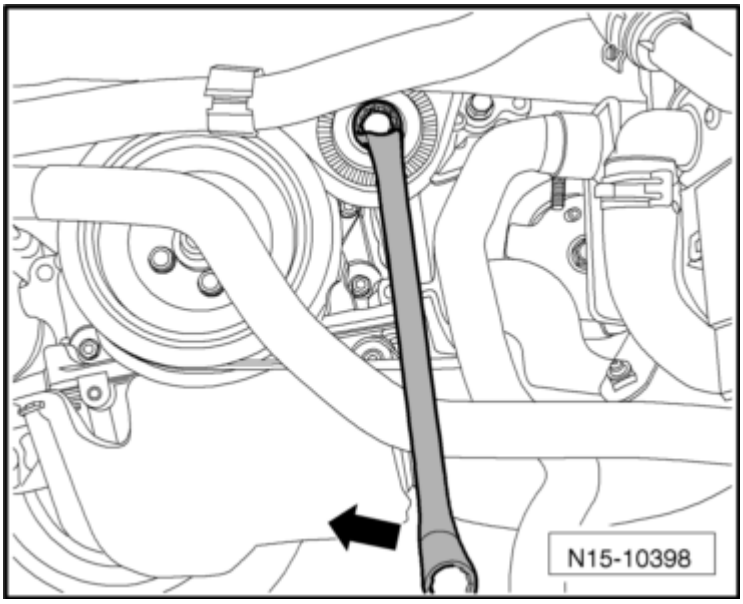

Fig. 19: Identifying Direction To Rotate Belt Tensioner To Release Tension On Ribbed Belt
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

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

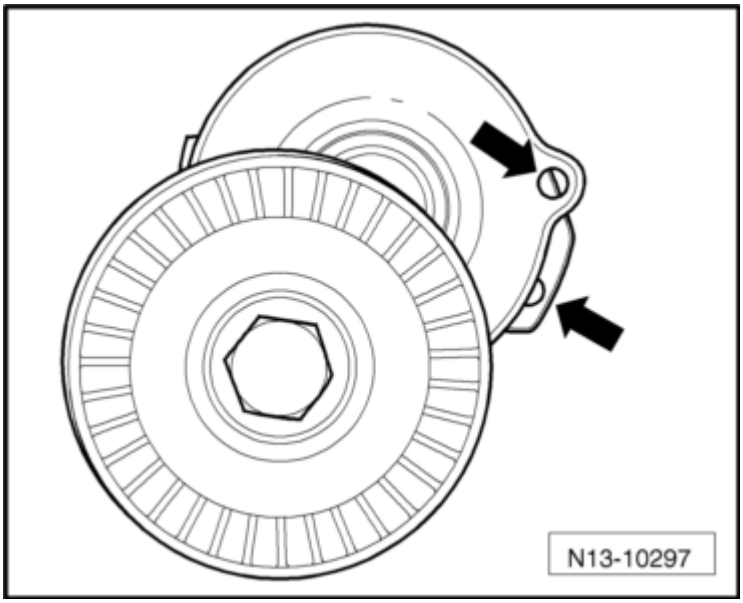

Fig. 20: Identifying Alignment Of Holes To Secure Tensioner Using Locking Pin
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Remove the ribbed belt.

Installing

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

- Ensure that the generator and Air Conditioning (A/C) compressor are secured before installing the ribbed belt.
- Note the previously marked belt rotation direction and be sure that it is seated correctly on the pulleys.

-- Install the ribbed belt on the pulleys.

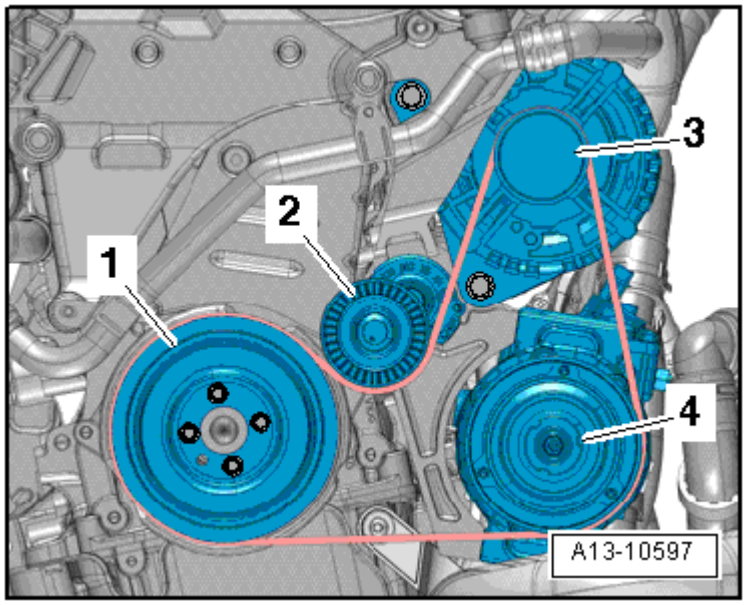

Fig. 21: Identifying Vibration Damper, Belt Tensioner, Generator And A/C Compressor
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

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

When finished, always perform the following work:

-- Start the engine and check the belt.

RIBBED BELT TENSIONER

Removing

-- Remove the ribbed belt. Refer to **RIBBED BELT**.

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

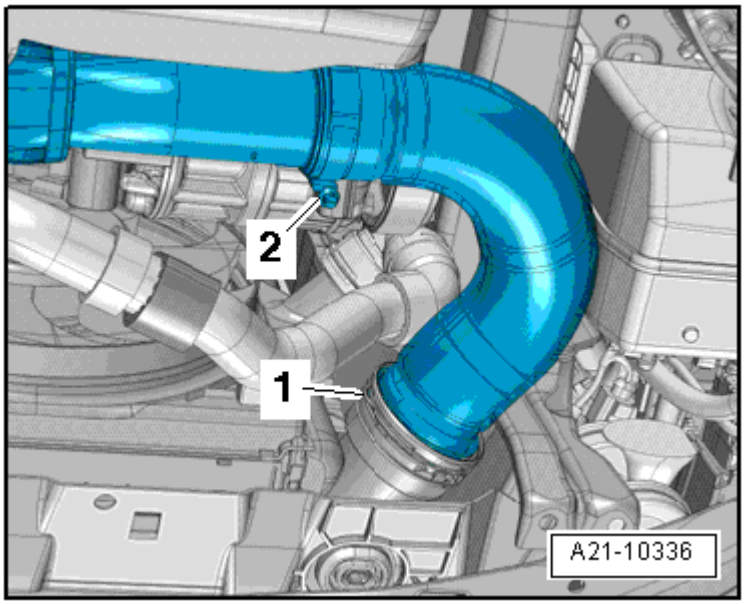

Fig. 22: Identifying Clamp -2- And Circlip -1-
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

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

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

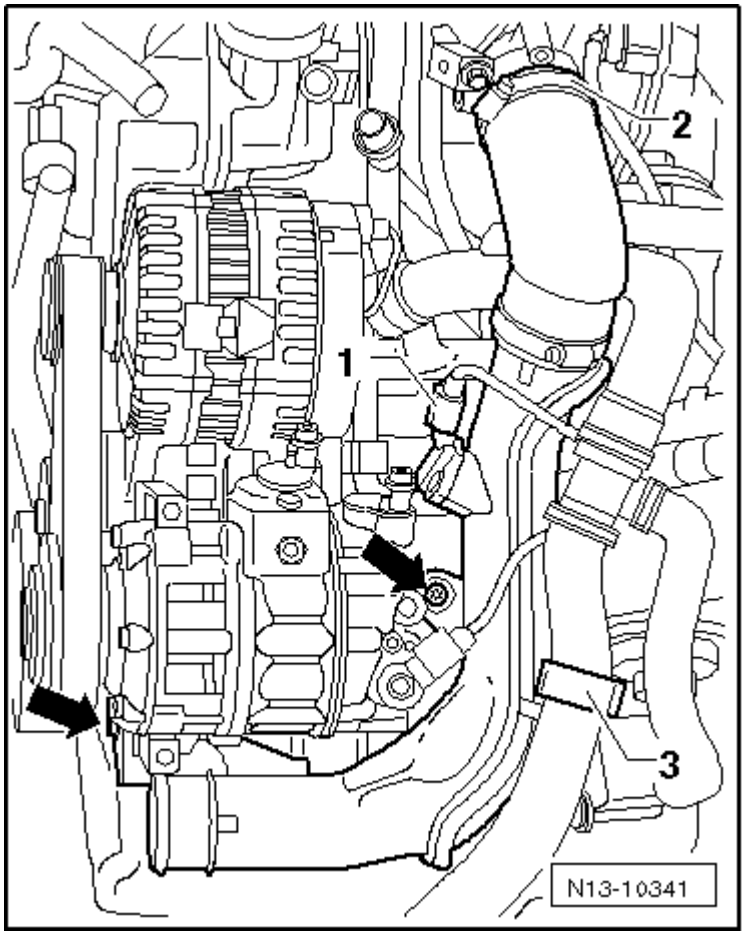

Fig. 23: Identifying Clamp To Open To Free Up Charge Air Pipe -3-
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

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

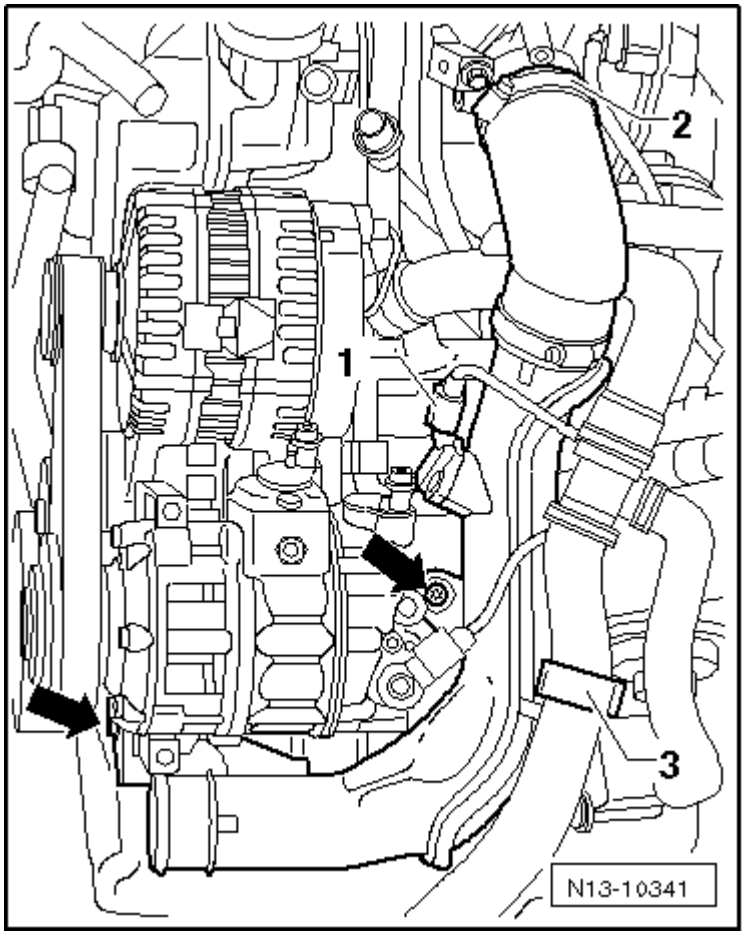

Fig. 24: Identifying Bolt To Remove
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

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

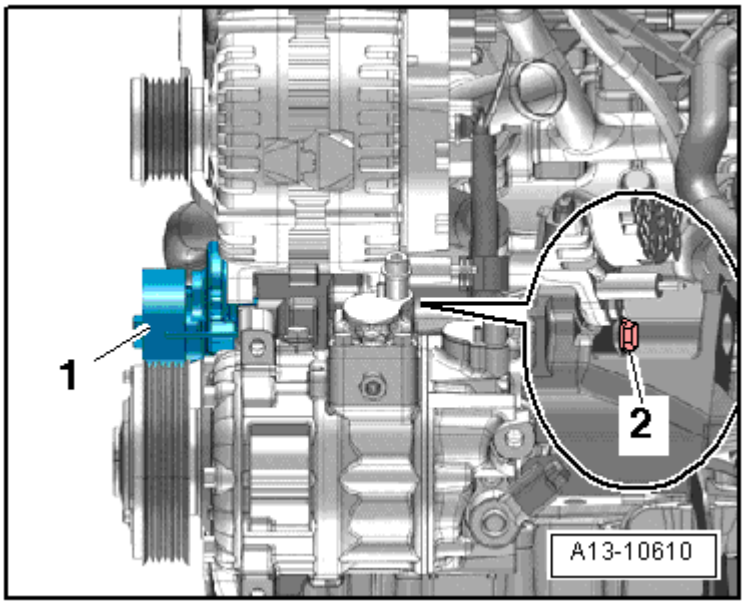

Fig. 25: Identifying Bolt And Belt Tensioner
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

Installing

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

- Replace the bolt for the belt tensioner.
- Tightening specifications, refer to **RIBBED BELT OVERVIEW**.
- Install the ribbed belt. Refer to **RIBBED BELT**.

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 fuel pressure pump. Refer to **HIGH PRESSURE FUEL PUMP** .

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

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

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

-- Remove the idler roller bolts -1 and 2- and remove the bolt -arrow- for the toothed belt guard.

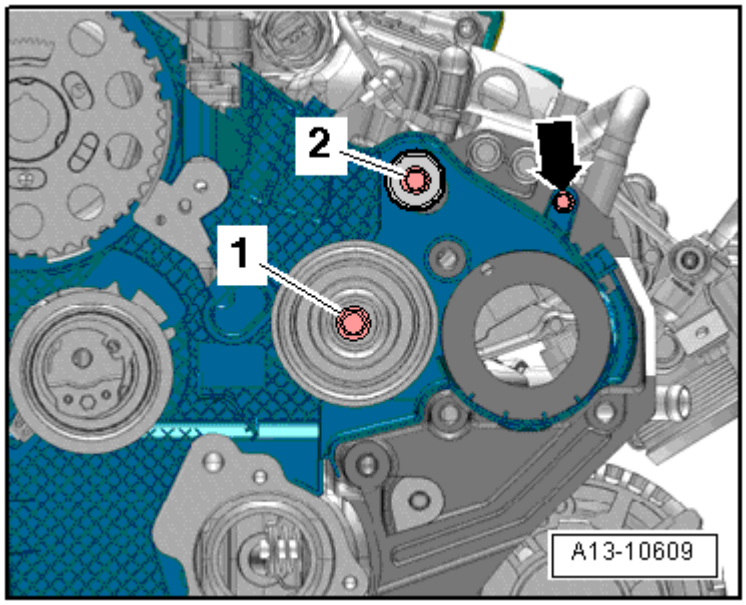

Fig. 26: Identifying Idler Roller Bolts -1 And 2-
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

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

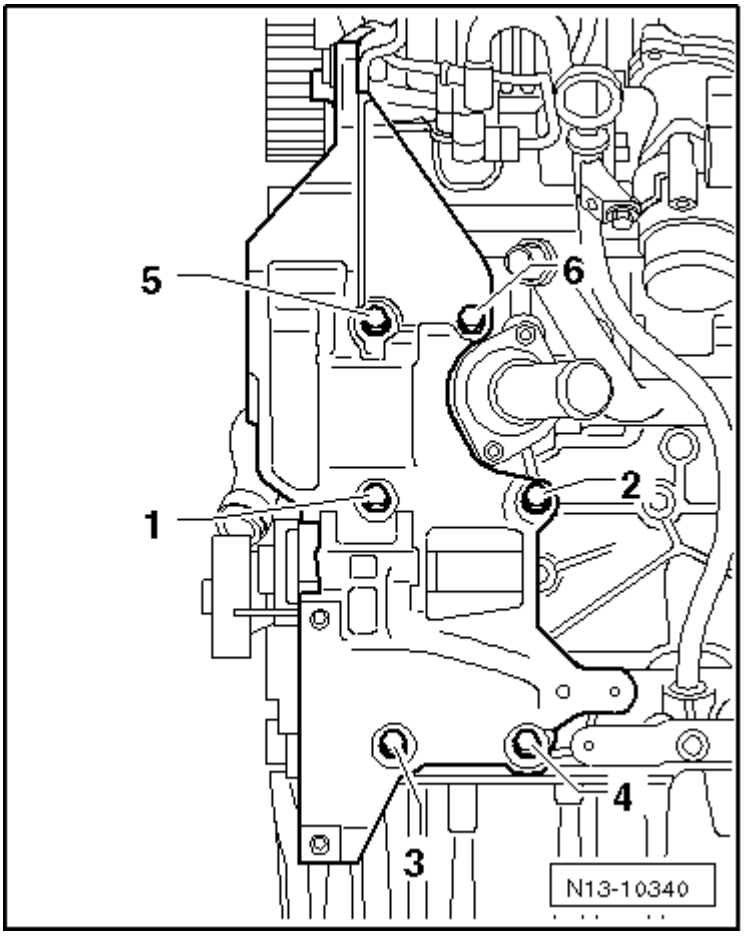

Fig. 27: Identifying Bolt Tightening Sequence
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

Installing

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

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

-- Tighten the bolts in sequence -1 through 6-. Tightening specification, see -item 5- in the **RIBBED BELT OVERVIEW**.

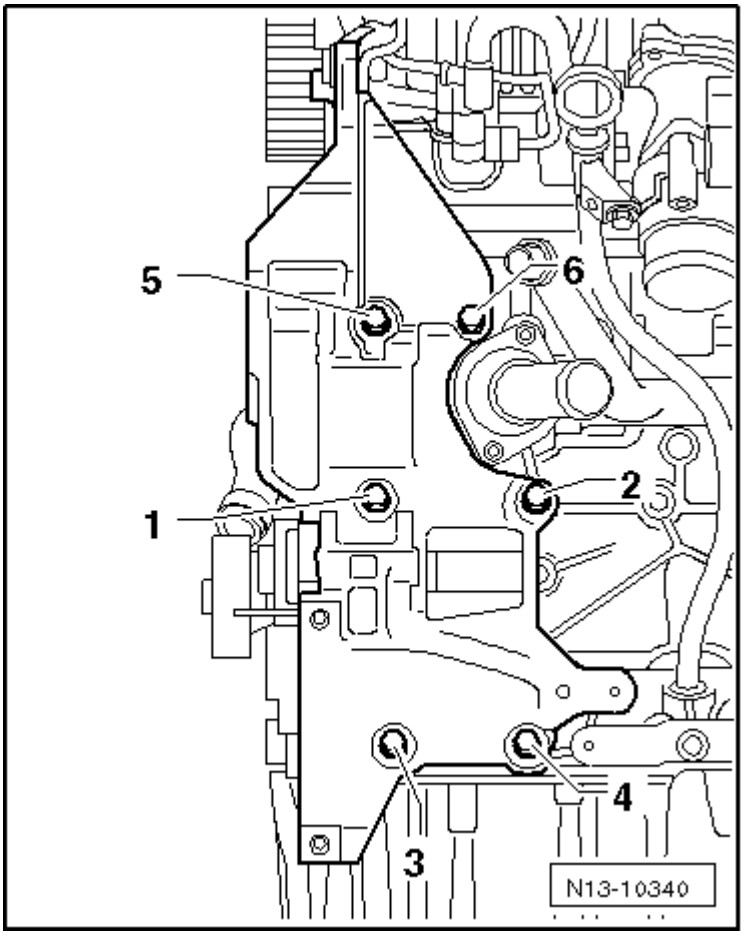

Fig. 28: Identifying Bolt Tightening Sequence
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

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

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

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

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 AF24 V.A.G 1332/11
- Caliper Gauge
- Three M6 x 35 Bolts
- Two M7 x 35 Bolts

Removing

-- Remove the transmission:

- Vehicles with a manual transmission, refer to **[For transmission(s) 02Q] Removing** and refer to **[For transmission(s) 02Q] Removing** and refer to **[For transmission(s) 02Q] Removal and Installation** .
- Vehicles with a Direct Shift Gearbox (DSG®), refer to **[For transmission(s) 02E] Removing** and refer to **[For transmission(s) 02E] Removal and Installation** .

-- Remove the flywheel -item 5- in the **SEALING FLANGE AND FLYWHEEL OVERVIEW**.

-- Remove the intermediate plate -item 6- in the **SEALING FLANGE AND FLYWHEEL OVERVIEW**.

-- Rotate the crankshaft to Top Dead Center (TDC) for cylinder 1, as illustrated.

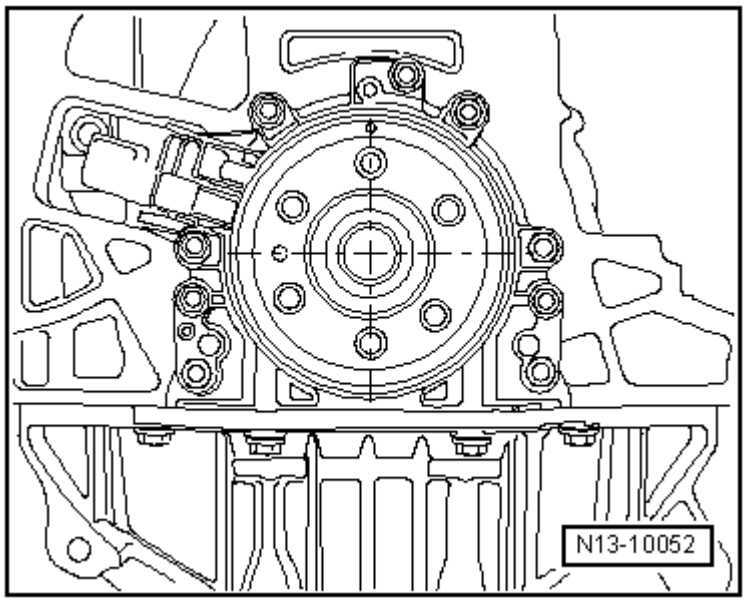

Fig. 29: Identifying Crankshaft Rotated To Top Dead Center (TDC) For Cylinder 1
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Remove the oil pan, refer to one of the following:

Engine code CBEA, refer to **OIL PUMP, PAN AND BALANCE SHAFT MODULE OVERVIEW** .

Engine code CJAA, refer to **OIL PUMP AND OIL PAN OVERVIEW** .

NOTE: To improve clarity, the steps/graphics are shown with the engine removed.

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

-- Remove the engine speed sensor -G28-. Refer to **Engine Speed Sensor -G28-**.

-- 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 -arrows- on the sealing flange.

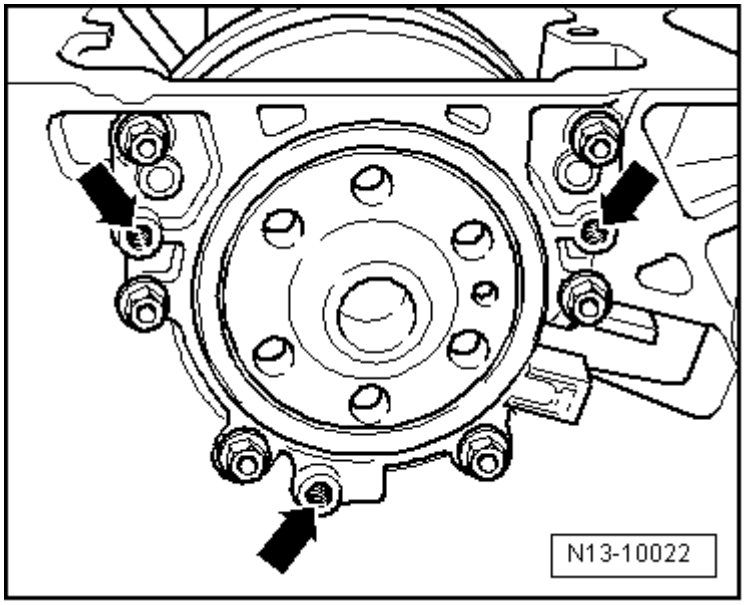

Fig. 30: Identifying Sealing Flange Threaded Holes
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Tighten the bolts in an alternating sequence (maximum one 1/2 turn (180°) per bolt at a time) in the sealing flange and press the sealing flange and sensor wheel off the crankshaft.

Installing

NOTE: The sealing flange with a 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 replacement part 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.

Assembly Tool T10134

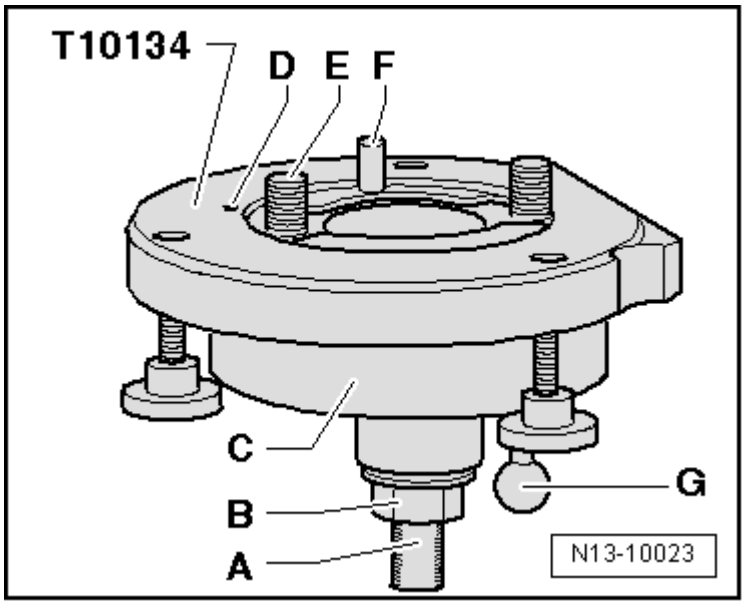

Fig. 31: Identifying Assembly Tool T10134
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

A - Tension surface

B - Nut

C - Assembly bell

D - Locating pin

E - Socket head bolt

F - Guide pin for diesel engines (black handle)

G - Guide pin for gas engines (red handle)

Installing the Seal with Sensor Wheel to the Assembly Tool T10134

-- Screw on the nut -B- until shortly before the tension surface of the threaded spindle -A-.

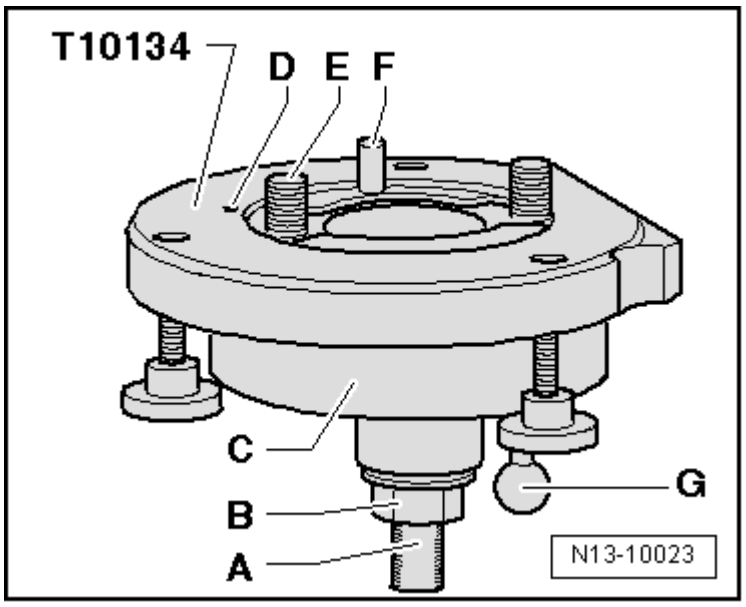

Fig. 32: Identifying Assembly Tool T10134
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

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

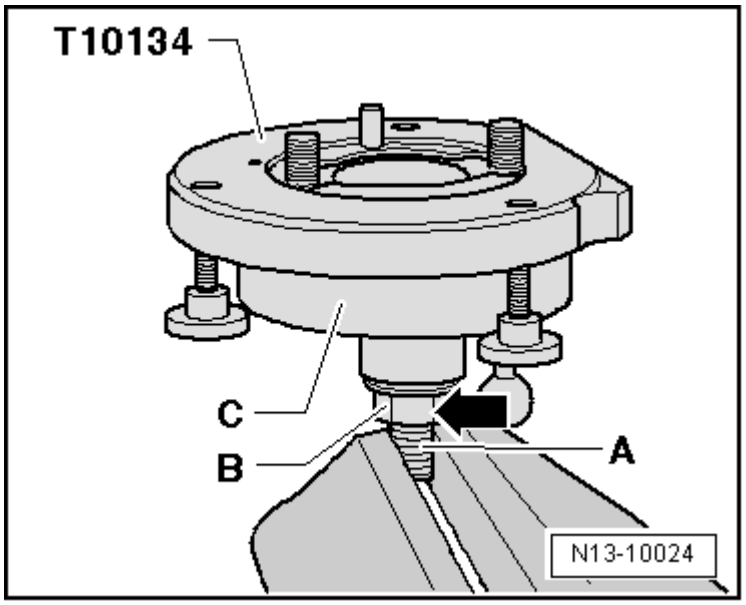

Fig. 33: Identifying Tensioning Assembly Tool T10134 In Vise To Tension Surface Of Threaded Spindle
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- 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 -C-.

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

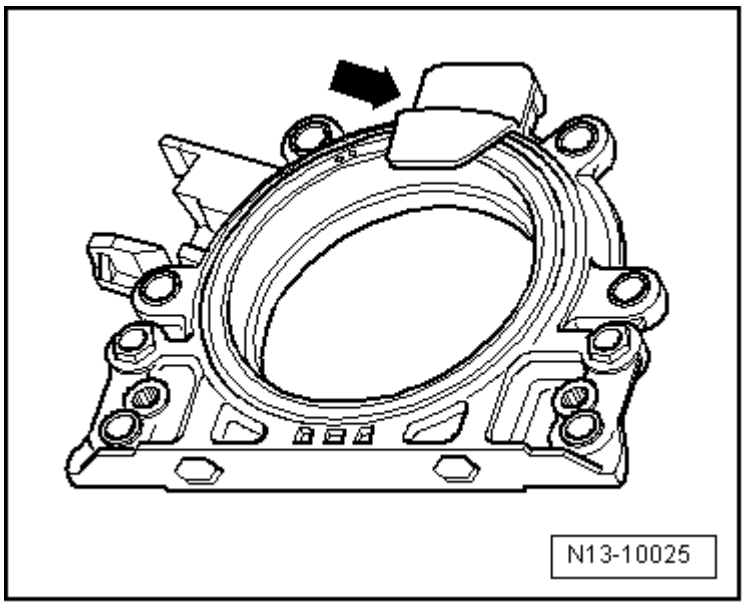

Fig. 34: Identifying Securing Clip From New Sealing Flange
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

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.

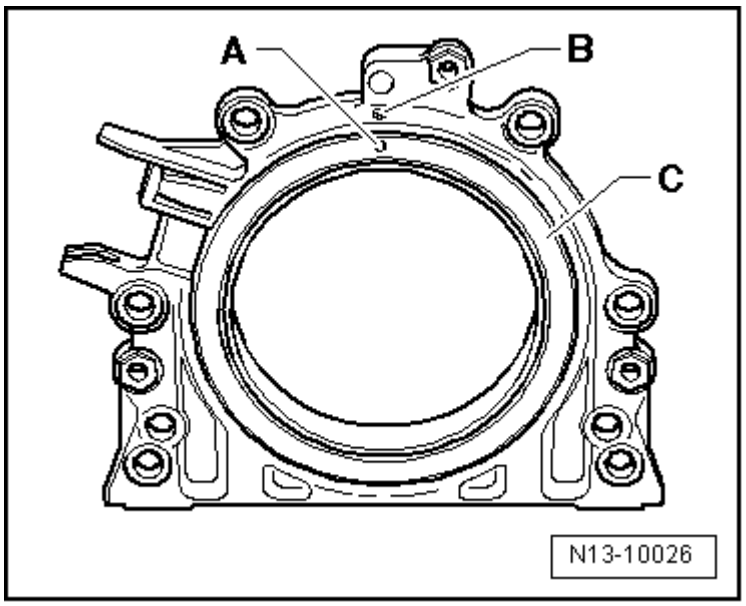

Fig. 35: Locating Pin On Sensor Wheel Aligns With Marking On Sealing Flange
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

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

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

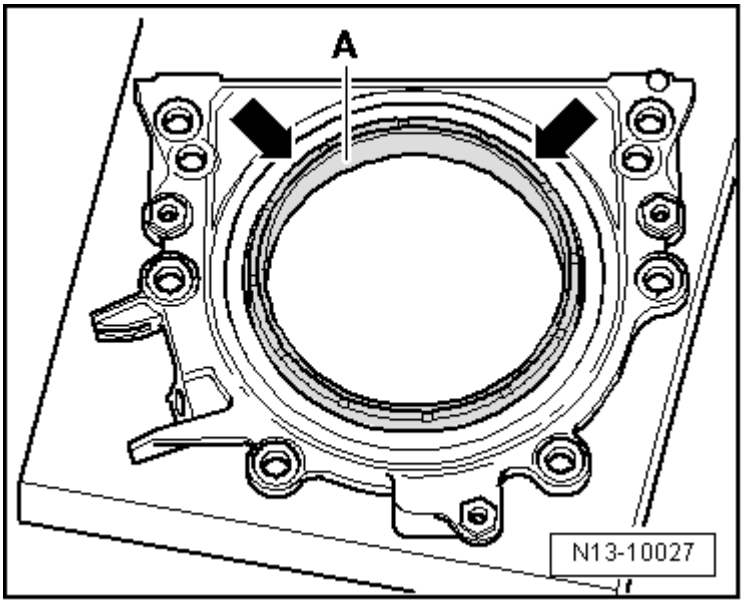

Fig. 36: Identifying Sealing Lip Support Ring Pressed Until It Rests On Level Surface
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

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

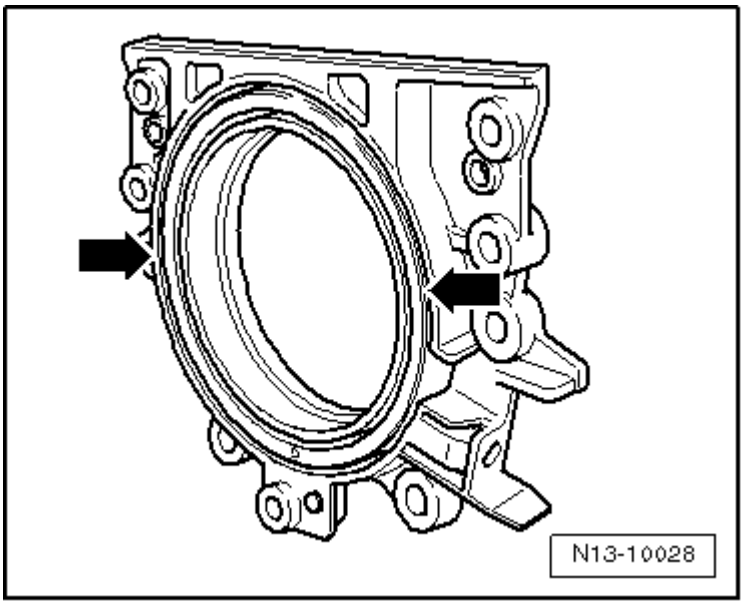

Fig. 37: Identifying Upper Edge Of Sensor Wheel And Front Edge Of Sealing Flange Align
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- 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.

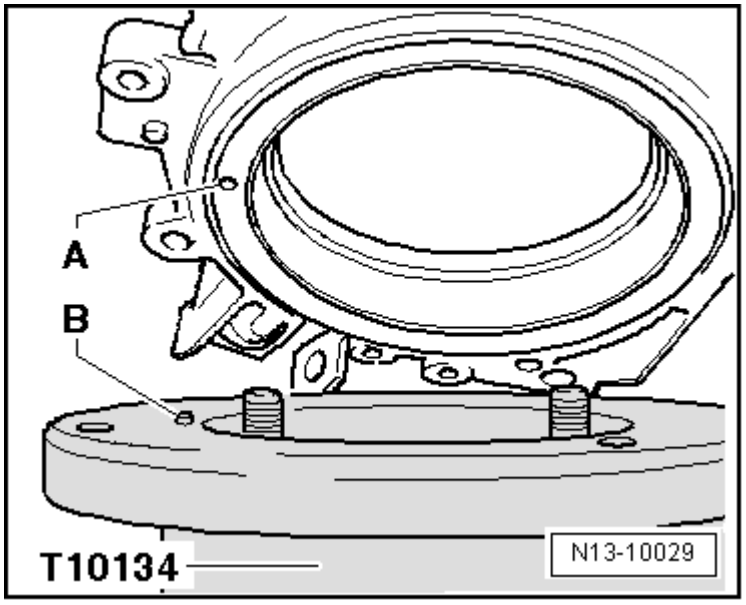

Fig. 38: Identifying Front Side Of Sealing Flange Placed Onto Assembly Tool T10134 To Position Locating Pin In Bore Of Sensor Wheel
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

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

-- Push the sealing flange and the sealing lip support ring -B- onto the surface of the assembly tool T10134 while tightening the 3 knurled thumb screws -A- so that the securing pin cannot slip out of the hole in the sensor wheel.

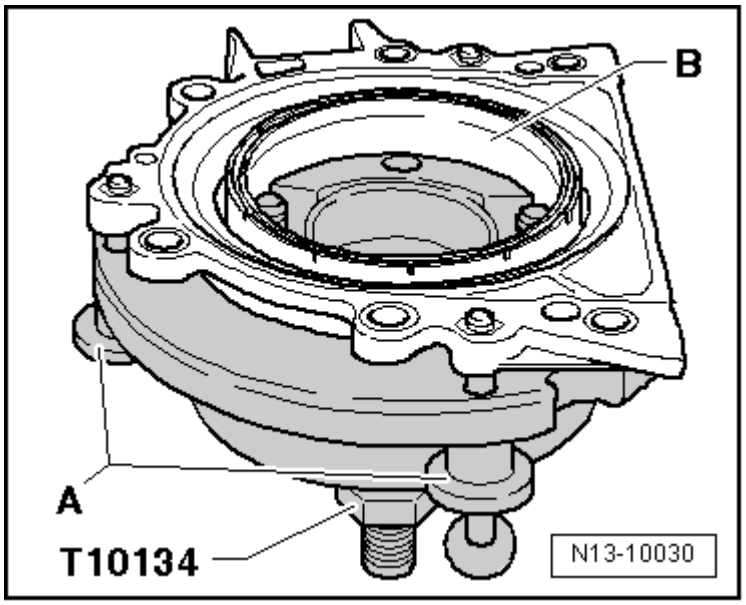

Fig. 39: Identifying Sealing Flange And Sealing Lip Support Ring Pressed Onto Surface Of Assembly Tool T10134 So Locating Pin Can No Longer Slip Out Of Bore Of Sensor Wheel
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

NOTE: Make sure the sensor wheel remains fixed inside the assembly tool when installing the sealing flange.

Installing the Assembly Tool T10134 with Sealing Flange to the Crankshaft Flange

Requirements

- Crankshaft flange must be free of oil and grease.
- The engine is at TDC cylinder 1.

Procedure

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

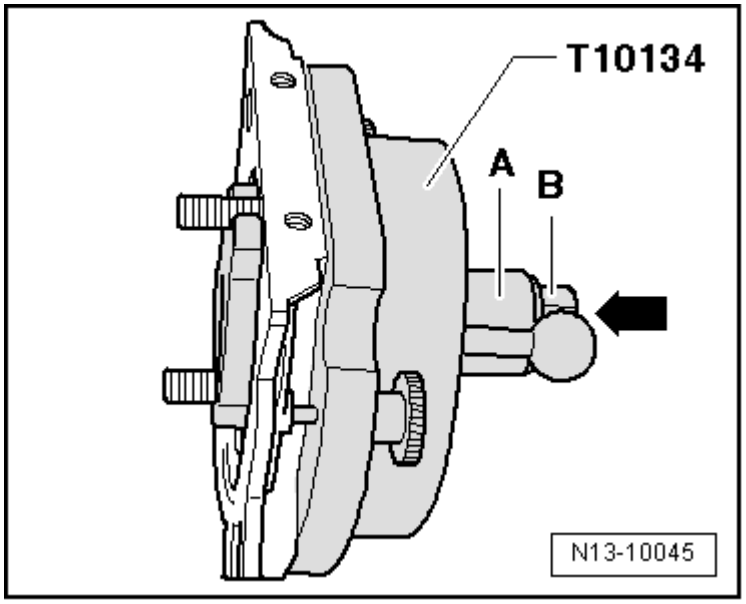

Fig. 40: Identifying Threaded Spindle Pressed Of Assembly Tool T10134 Until Nut Rests On Assembly Bell
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

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

-- Align the flat side of the assembly bell to the sealing surface on the oil pan side of the cylinder block.

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

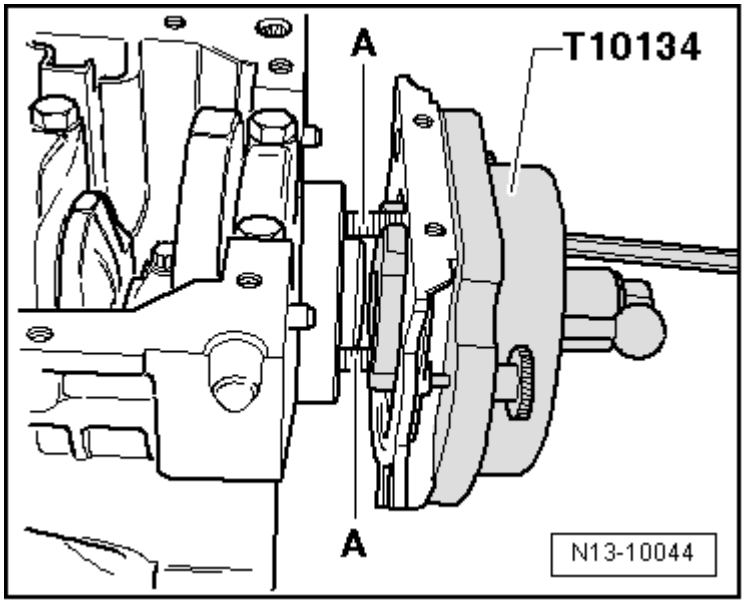

Fig. 41: Identifying Assembly Tool T10134 Secured Onto Crankshaft Flange Using Socket Head Hex Bolts
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

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

-- Install two M7 x 35 mm bolts -A- to guide the sealing flange into the cylinder block.

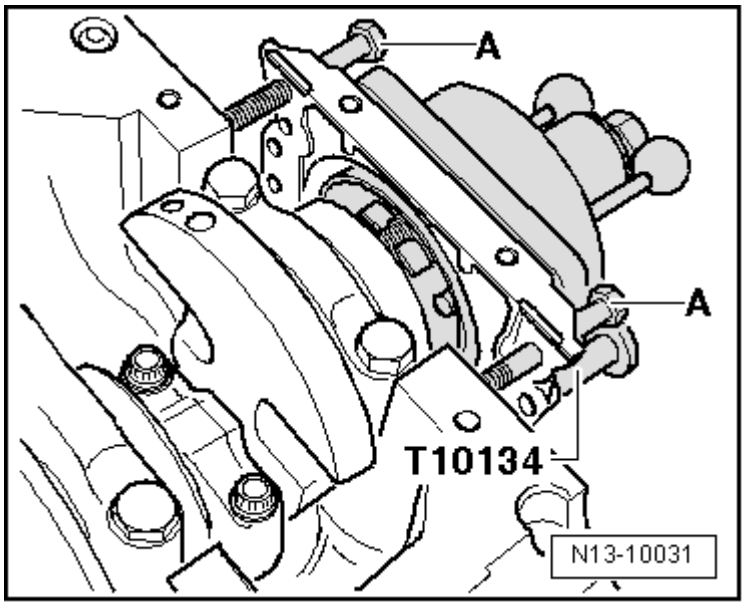

Fig. 42: Identifying Bolts Screwed Into Cylinder Block To Guide Sealing Flange
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

Attach the Assembly Tool T10134 to the Crankshaft Flange

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

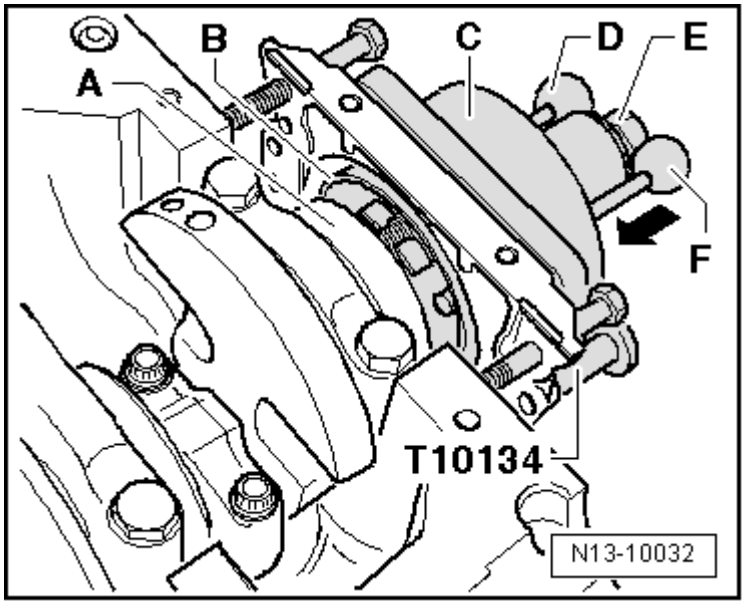

Fig. 43: Identifying Assembly Bell Pushed Until Sealing Lip Support Ring Rests On Crankshaft Flange
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- 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.

-- Tighten both bolts on the assembly tool by hand.

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

Installing the Sensor Wheel on the Crankshaft Flange using the Assembly Tool T10134

-- Tighten the nut on the assembly tool T10134 using torque wrench (5-50 Nm) V.A.G 1331 and the tool insert AF24 V.A.G 1332/11.

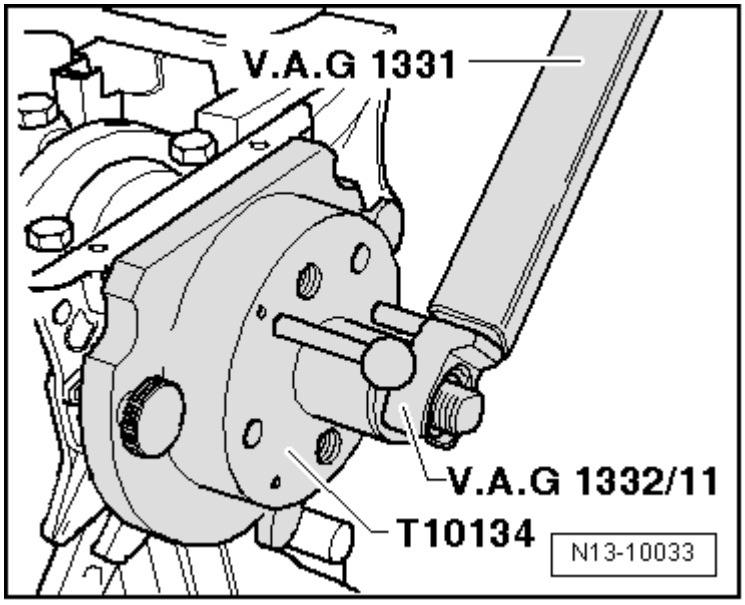

Fig. 44: Identifying Sensor Wheel Pressed With Assembly Tool T10134 Onto Crankshaft Flange
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

- Tightening specification: 35 Nm.

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 THE INSTALLED POSITION

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

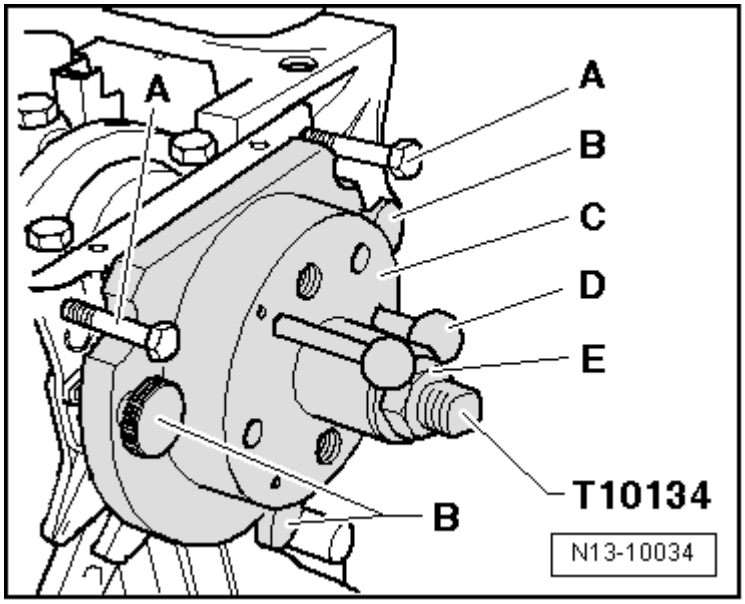

Fig. 45: Identifying Installed Position Of Sensor Wheel On Crankshaft
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Remove the two bolts -A- out of the cylinder block.

-- Remove the three knurled thumb screws -B- out of the sealing flange.

-- Remove the assembly tool T10134.

-- Remove the sealing lip support ring.

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

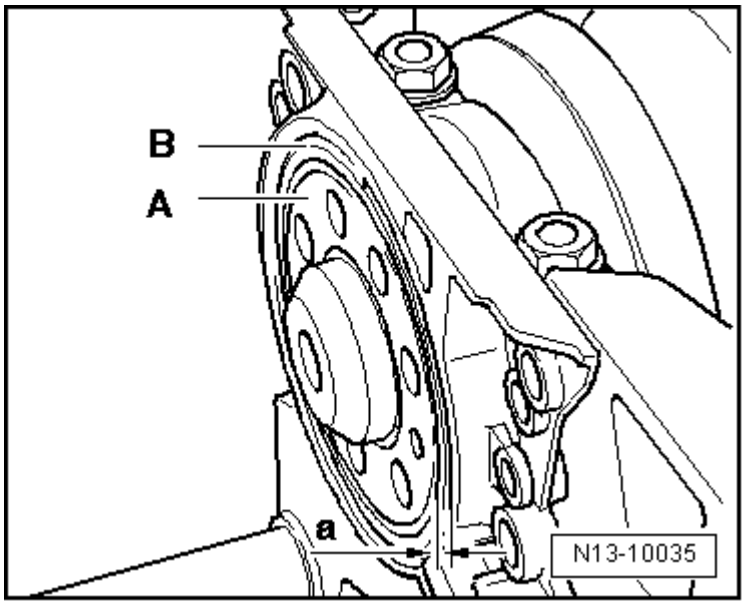

Fig. 46: Identifying Installed Position Of Sensor Wheel On Crankshaft Is Exact
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Set a caliper gauge onto the crankshaft flange.

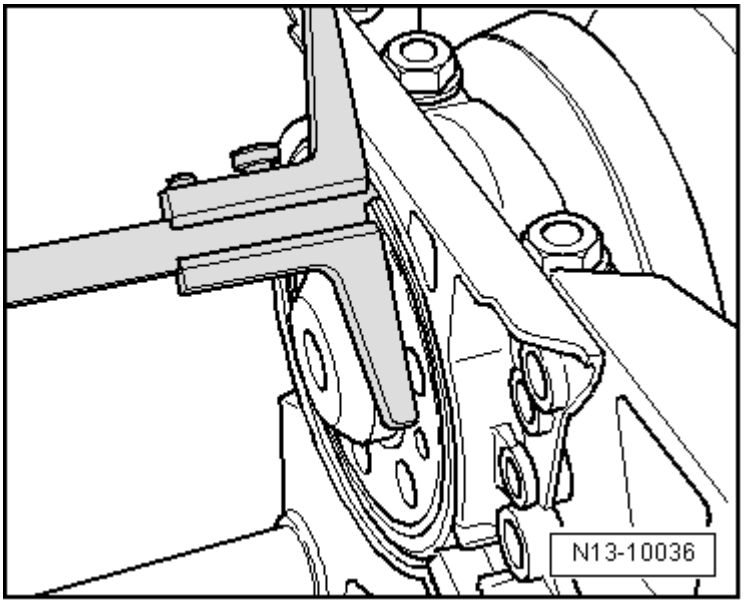

Fig. 47: Identifying Caliper Gauge Set Onto Crankshaft Flange
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Measure the gap -a- between the crankshaft flange and 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 obtained:

-- Tighten the new sealing flange bolts alternating in a diagonal sequence:

- Tightening specifications, see -item 7- in the **SEALING FLANGE AND FLYWHEEL OVERVIEW**.

-- Install the engine speed sensor. Refer to **Engine Speed Sensor -G28-**.

-- Install the oil pan, refer to one of the following:

Engine code CBEA, refer to **OIL PUMP, PAN AND BALANCE SHAFT MODULE OVERVIEW** .

Engine code CJAA, refer to **OIL PUMP AND OIL PAN OVERVIEW** .

-- Install the intermediate plate -item 6- in the **SEALING FLANGE AND FLYWHEEL OVERVIEW**.

-- Install the flywheel with new bolts:

- Tightening specifications, refer to -item 4- in the **SEALING FLANGE AND FLYWHEEL OVERVIEW**.

SENSOR WHEEL, PRESSING ON AGAIN

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

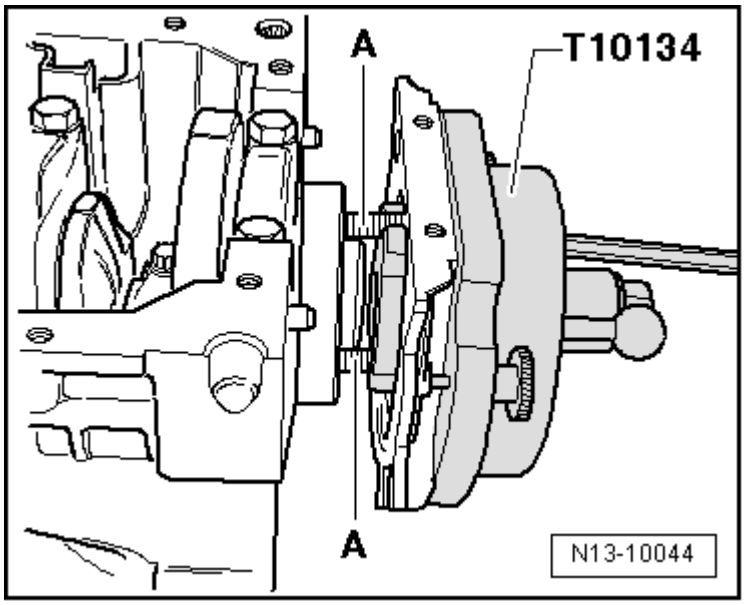

Fig. 48: Identifying Assembly Tool T10134 Secured Onto Crankshaft Flange Using Socket Head Hex Bolts
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Tighten both the socket head bolts -A- by hand.

-- 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-.

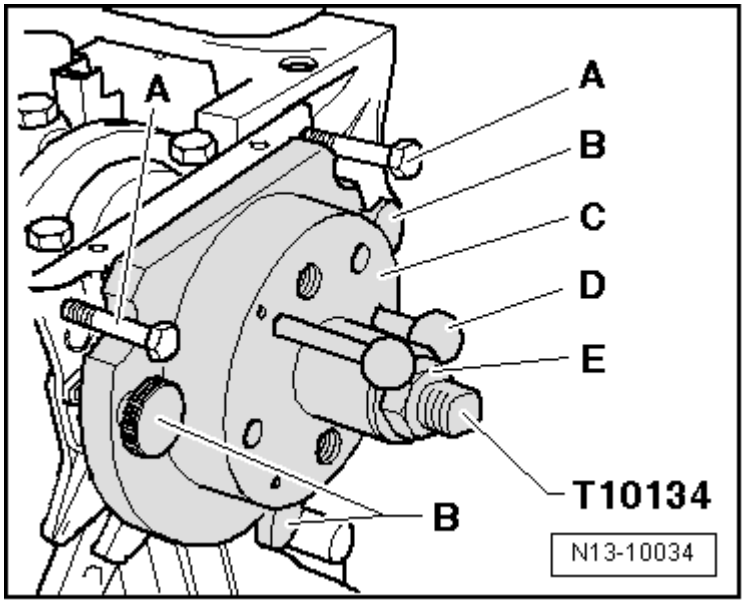

Fig. 49: Identifying Installed Position Of Sensor Wheel On Crankshaft
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Tighten the nut on the assembly tool T10134 using a torque wrench (5-50 Nm) V.A.G 1331 and the tool insert AF24 V.A.G 1332/11:

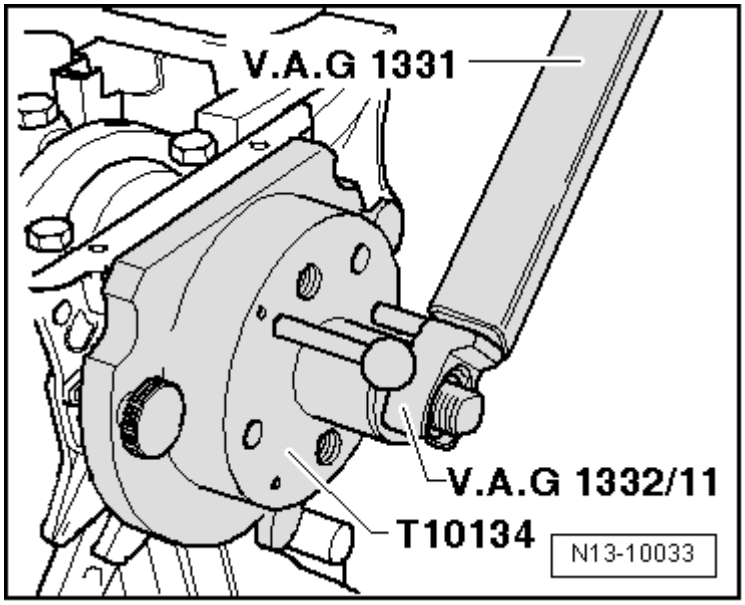

Fig. 50: Identifying Sensor Wheel Pressed With Assembly Tool T10134 Onto Crankshaft Flange
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

- Tightening specification: 40 Nm.

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

If dimension -a- is too small:

-- Tighten the nut on the assembly tool T10134:

- Tightening specification: 45 Nm.

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

CRANKSHAFT SEAL, BELT PULLEY SIDE

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

Removing

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

-- Remove the crankshaft toothed belt gear. Secure the gear using counter support 3415

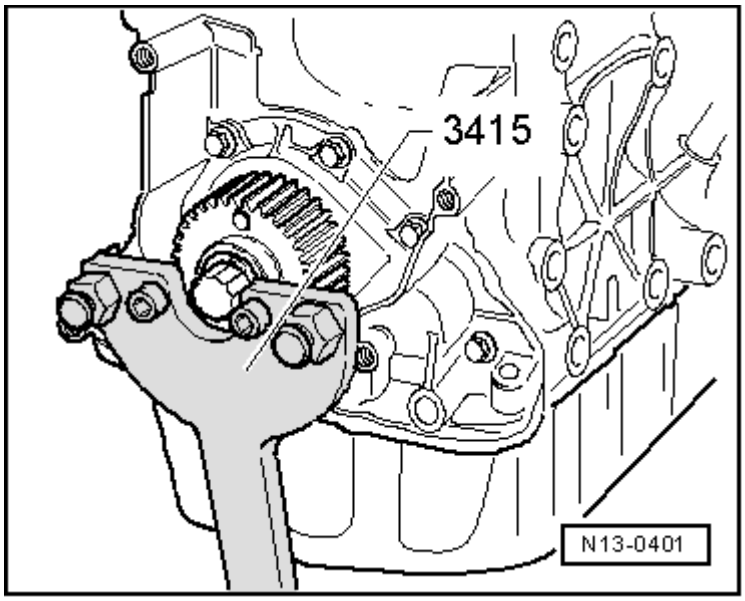

Fig. 51: Identifying Counter-Hold 3415 On Crankshaft Toothed Belt Sprocket
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- To guide the seal remover 3203, install the center bolt manually into the crankshaft all the way.

-- Rotate the inner section of the seal remover two turns (approximately 3 mm) out of the outer section and secure 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.

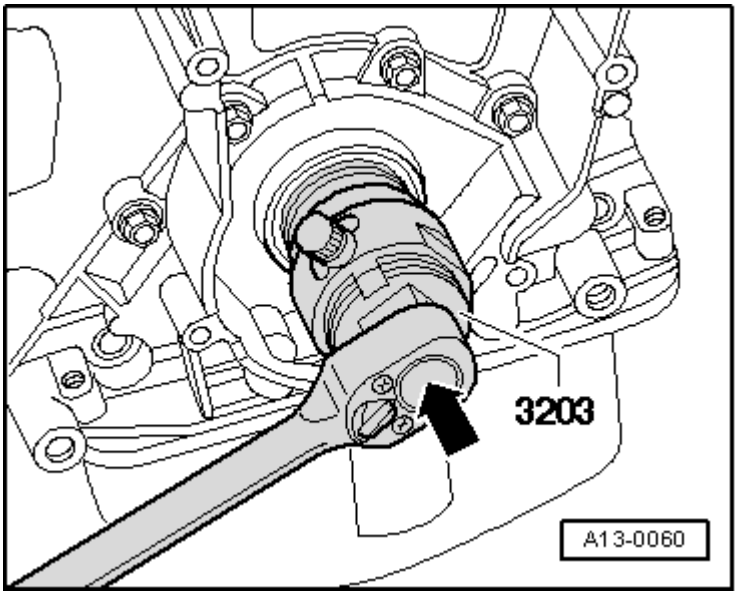

Fig. 52: Identifying Firm Pressure Exerted To Oil Seal Extractor 3203 Into Oil Seal
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- 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 sealing ring 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 the crankshaft.

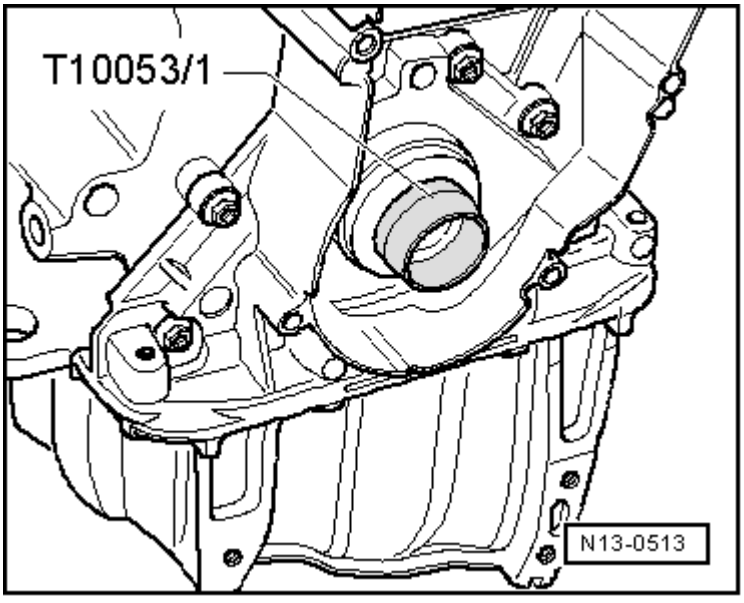

Fig. 53: Identifying Guide Sleeve From Assembly Tool T10053 & Crankshaft Journal

Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

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

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

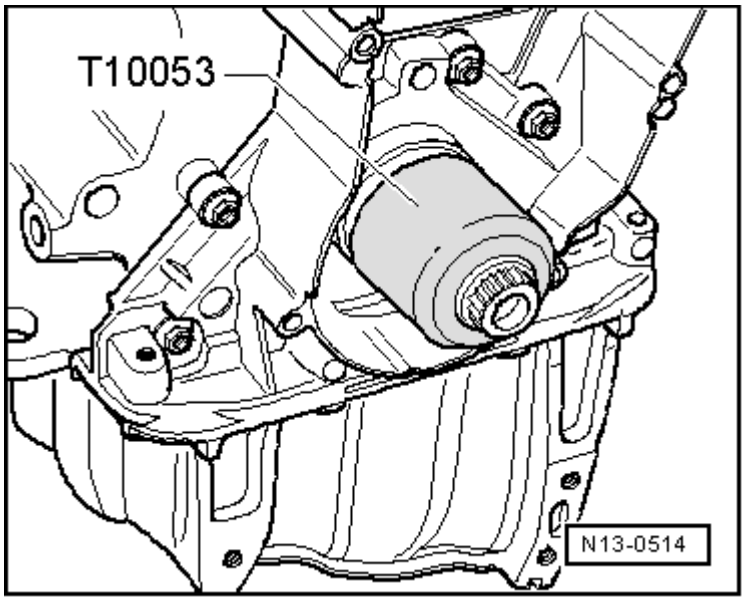

Fig. 54: Identifying Press Sleeve T10053
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Install the crankshaft toothed belt gear:

- Tightening specifications, see -item 2- in the **TOOTHED BELT OVERVIEW**.

-- Install and tension 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
- Protective Eyewear
- Flat Scraper
- Silicone Sealant D 176 404 A

Removing

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

-- Remove the crankshaft toothed belt gear. Secure the gear using the counter support 3415

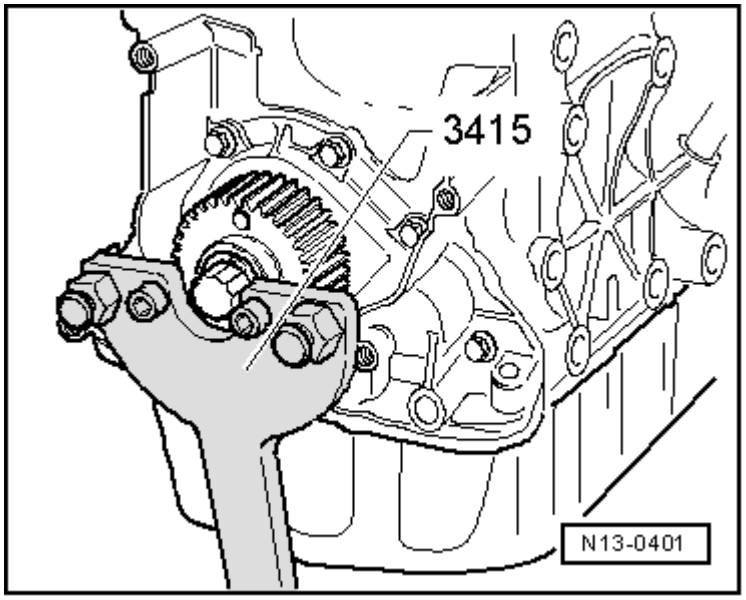

Fig. 55: Identifying Counter-Hold 3415 On Crankshaft Toothed Belt Sprocket
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

-- Remove the oil pan, refer to one of the following:

Engine code CBEA, refer to **OIL PUMP, PAN AND BALANCE SHAFT MODULE OVERVIEW** .

Engine code CJAA, refer to **OIL PUMP AND OIL PAN OVERVIEW** .

-- Remove the sealing flange bolts.

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

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

WARNING: Wear safety glasses.

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

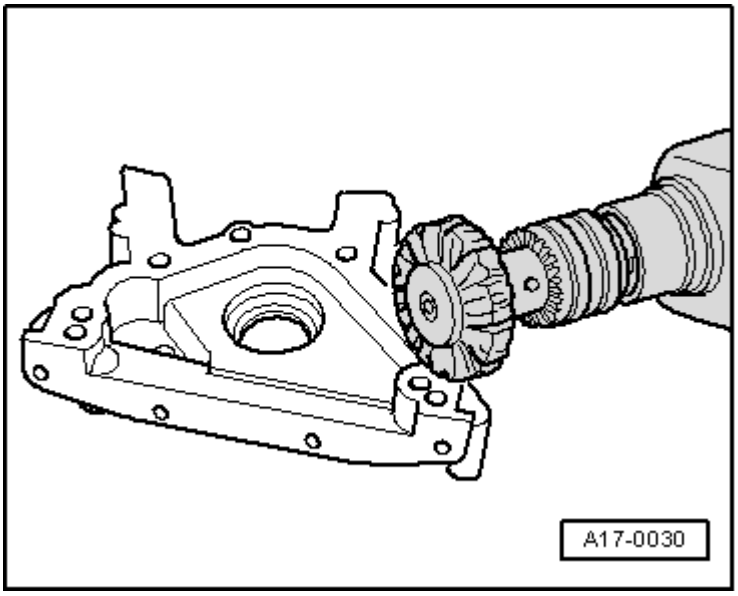

Fig. 56: Identifying Rotating Plastic Brush
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

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

Installing

NOTE: Note the expiration date of the silicone sealant D 176 404 A.

The sealing flange must be installed within 5 minutes after applying the silicone sealant D 176 404 A.

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

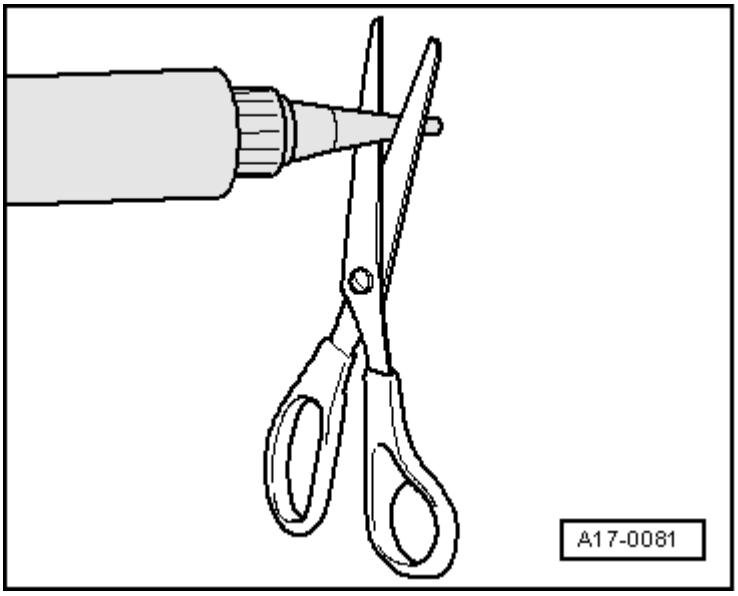

Fig. 57: Identifying Cut Tube Nozzle At Front Marking (Nozzle Diameter Approx. 3 Mm)
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

NOTE: The sealant bead must not be thicker than 2 to 3 mm.

The extra sealant will get into the oil pan and can clog up the intake line for the oil pump.

Do not let the sealant 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.

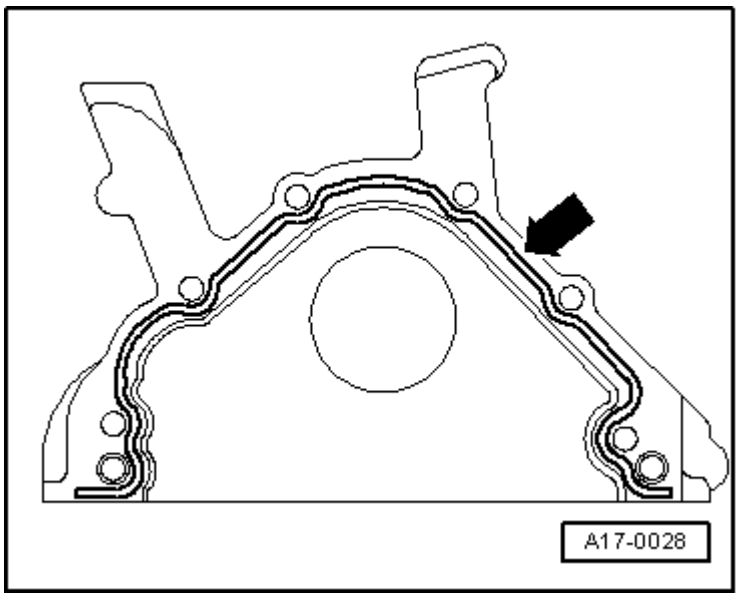

Fig. 58: Identifying Silicone Sealant Bead Applied To Clean Sealing Surface Of Sealing Flange
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

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

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

-- Tighten the sealing flange bolts in a diagonal sequence:

- Tightening specifications, see -item 7- in the **SEALING FLANGE AND FLYWHEEL OVERVIEW**.

-- Install the crankshaft toothed belt gear:

- Tightening specification, see -item 2- in the **TOOTHED BELT OVERVIEW**.

-- Install the oil pan, refer to one of the following:

Engine code CBEA, refer to **OIL PUMP, PAN AND BALANCE SHAFT MODULE OVERVIEW** .

Engine code CJAA, refer to **OIL PUMP AND OIL PAN OVERVIEW** .

NOTE: After installing, allow the sealant to dry for approximately 30 minutes. Only after then may the engine oil be added.

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

Engine Speed Sensor -G28-

Special tools and workshop equipment required

- Hose Clamps Up to 25 mm Dia. 3094
- Torque Wrench (5-50 Nm) V.A.G 1331
- Drip Tray for VAS 6100 VAS 6208
- Hose Clip Pliers VAS 6362

Conditions

- The engine must be cold.

Removing

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

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

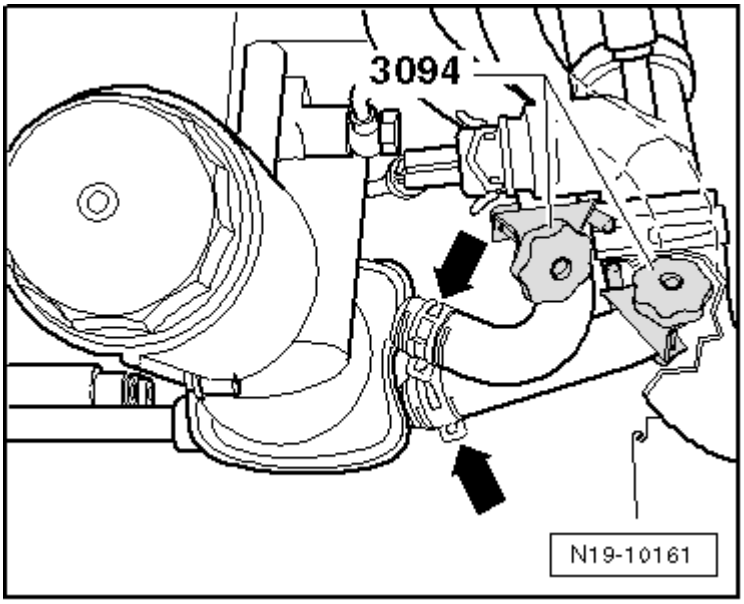

Fig. 59: Identifying Hose Clamps 3094
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

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

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

-- Remove the coolant hoses from the oil cooler.

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

-- Remove the bolt -arrow- and the engine speed sensor.

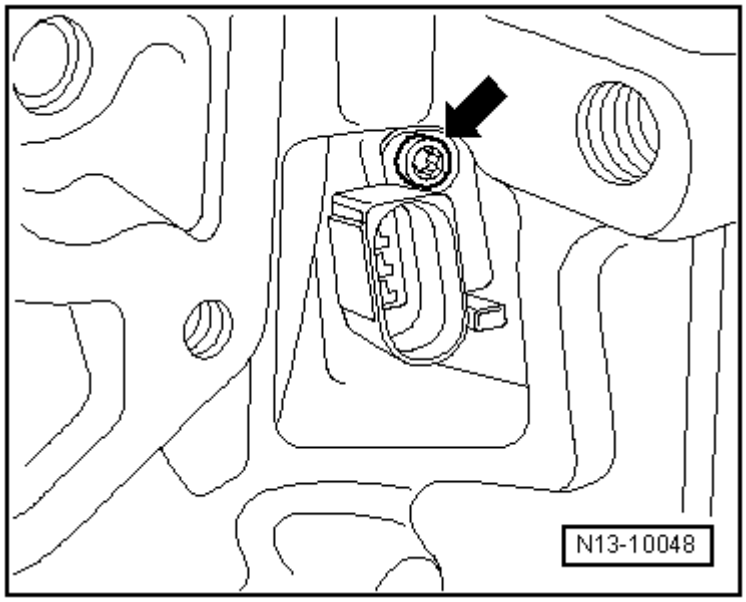

Fig. 60: Identifying Bolt To Engine Speed Sensor
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

Installing

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

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

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

CRANKSHAFT NEEDLE BEARINGS

Only on vehicles with a Direct Shift Gearbox (DSG®)

Special tools and workshop equipment required

- Puller T10055
- With Adapter T10055/3
- Centering Mandrel 3176 or
- Drift VW 207 C
- Puller, for example, Kukko Support 21/2

NOTE: In vehicles with a DSG®, the needle bearing must be installed in the rear of the crankshaft.

Removing

-- Remove using a commercially available puller, for example, kukko support21/2 -arrow-, adapter T10055/3 and the puller T10055.

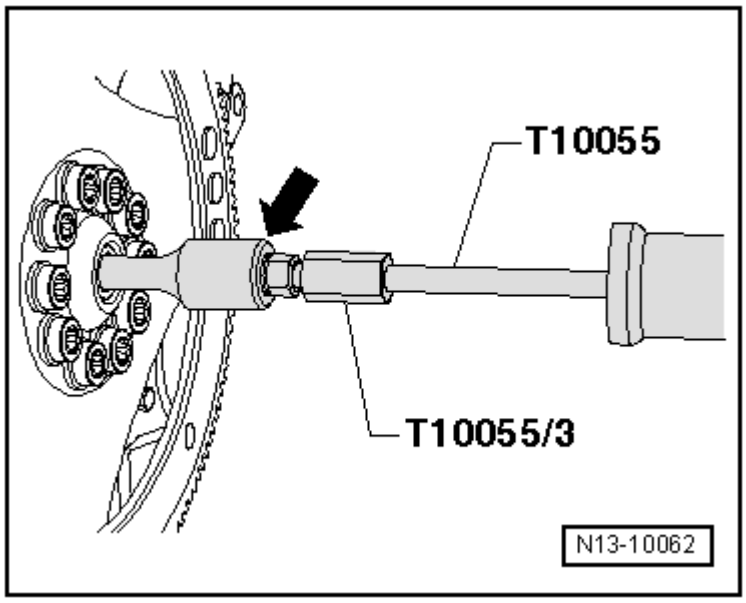

Fig. 61: Identifying Standard Extractor E.G. Kukko 21/2, Adapter T10055/3 And Puller T10055
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

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.

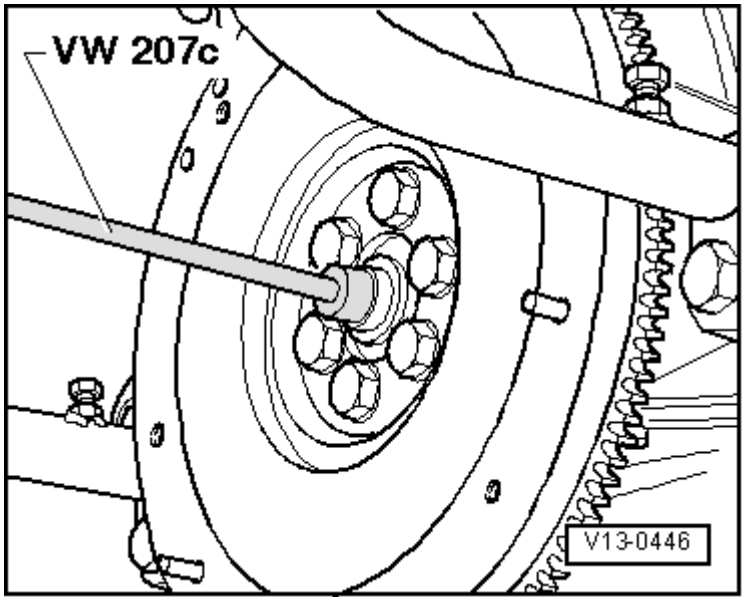

Fig. 62: Identifying Needle Bearing Driven In Using Drift VW 207 C
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

Installed depth dimension -a- = 2 mm

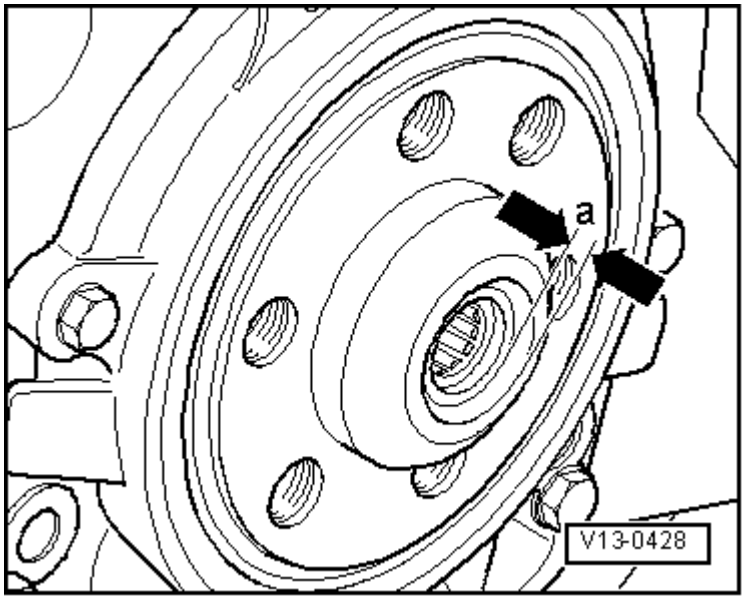

Fig. 63: Identifying Installation Depth Dimension
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

SPECIAL TOOLS

Special tools and workshop equipment required

- Dial Gauge (0-10 mm) VAS 6079
- Engine Support Bridge 10 - 222 A

- Adapter T10055/3
- Drift VW 207 C
- Kukko Support 21/2
- Assembly Tool T10134
- Tool Insert AF24 V.A.G 1332/11
- Hose Clamps Up to 25 mm Dia. 3094
- Drip Tray for VAS 6100 VAS 6208
- Hose Clip Pliers VAS 6362
- Measuring BarVW 382/7

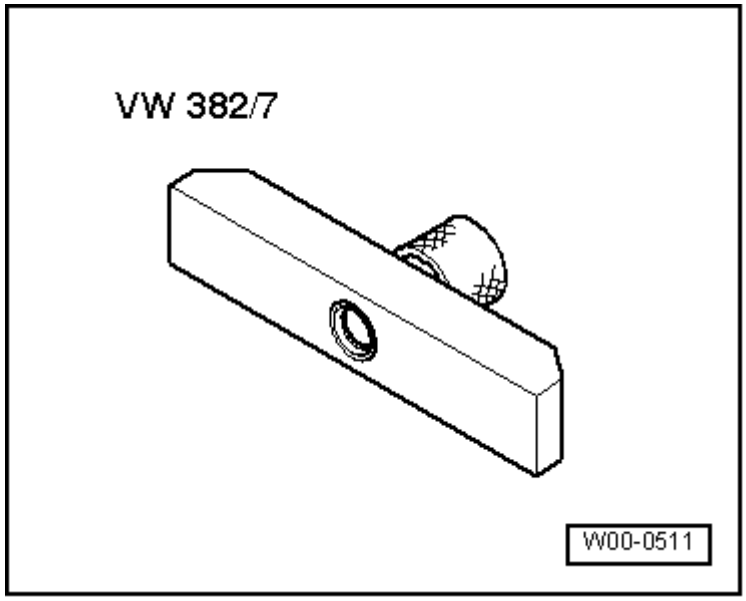

Fig. 64: Identifying Measuring Bar VW 382/7
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

- Magnetic Plate 50 mm Dia. VW 385/17

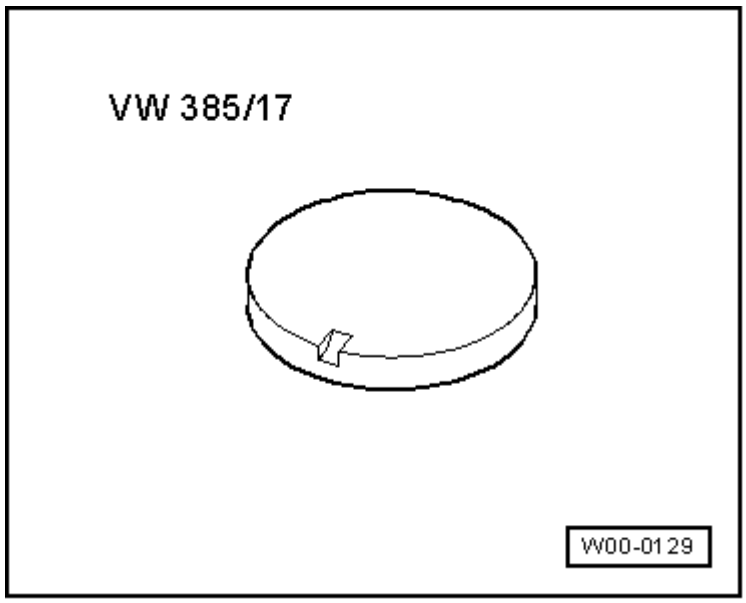

Fig. 65: Identifying Final Measurement Plate VW385/17
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

- Locking Pin T10060 A

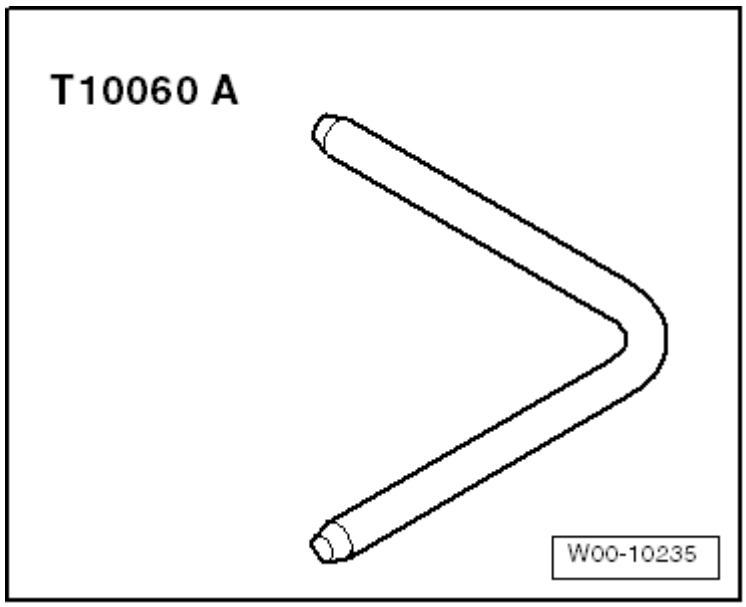

Fig. 66: Identifying Locking Pin T10060 A
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

- Puller T10055

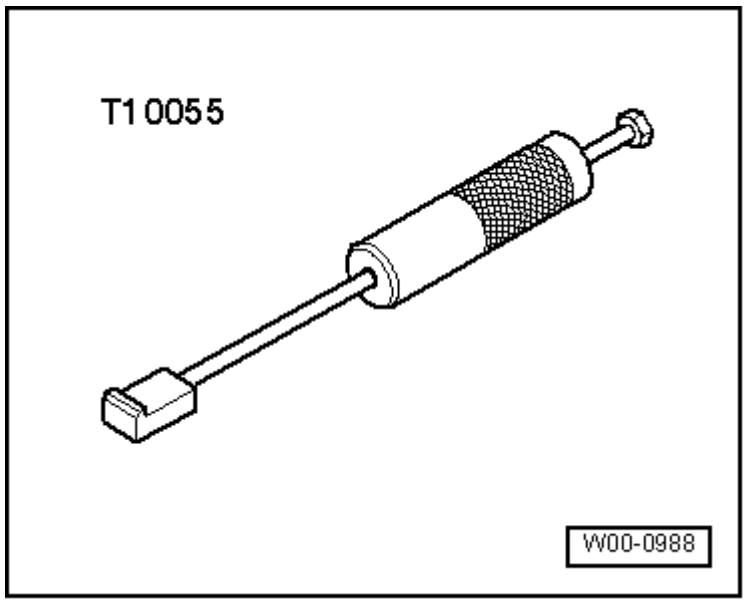

Fig. 67: Identifying Puller T10055
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

- Centering Mandrel 3176

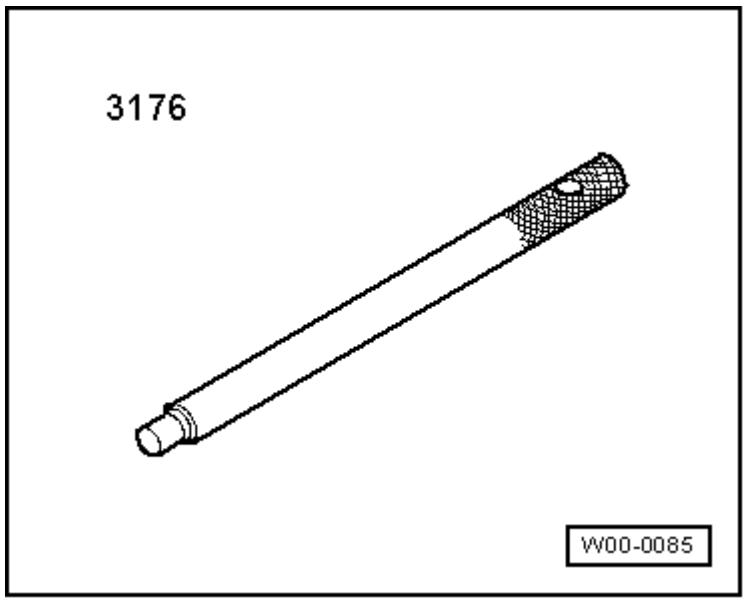

Fig. 68: Identifying 3176 Centering Mandrel
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

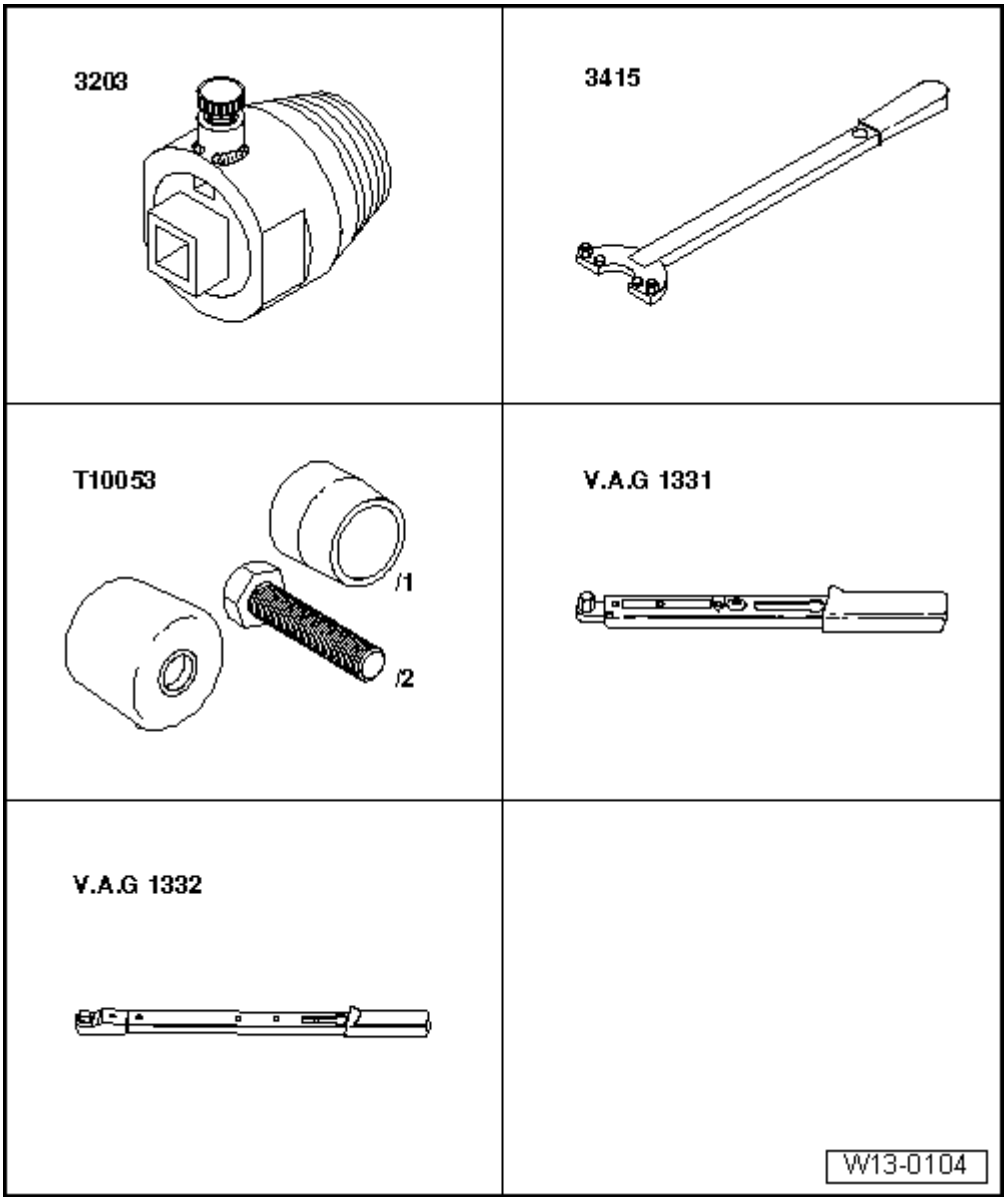

Fig. 69: Identifying Special Tools -- Crankshaft Seal, Ribbed Belt Side, Replacing
Courtesy of VOLKSWAGEN GROUP OF AMERICA, INC.

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

