ENGINE

Engine - Repair Instructions - S85

00 ENGINE GENERAL

00 DANGER OF POISONING IF OIL IS INGESTED/ABSORBED THROUGH THE SKIN

Danger of poisoning!

Ingesting oil or absorbing through the skin may cause poisoning!

Possible symptoms are:

- Headaches
- Dizziness
- Stomach aches
- Vomiting
- Diarrhoea
- Cramps/fits
- Unconsciousness

Protective measures/rules of conduct:

- Pour oil only into appropriately marked containers
- Do not pour oil into drinking vessels (drinks bottles, glasses, cups or mugs)
- Observe country-specific safety regulations

First aid measures:

- Do not induce vomiting.

  If the person affected is still conscious, he/she must rinse out their mouth with water, drink plenty of water and consult a doctor immediately.

  If the person affected is unconscious, do not administer anything by mouth, place the person in the recovery position and seek immediate medical attention.

00 RISK OF INJURY IF OIL COMES INTO CONTACT WITH EYES AND SKIN

Danger of injury!

Contact with eyes or skin may result in injury!

Possible symptoms are:

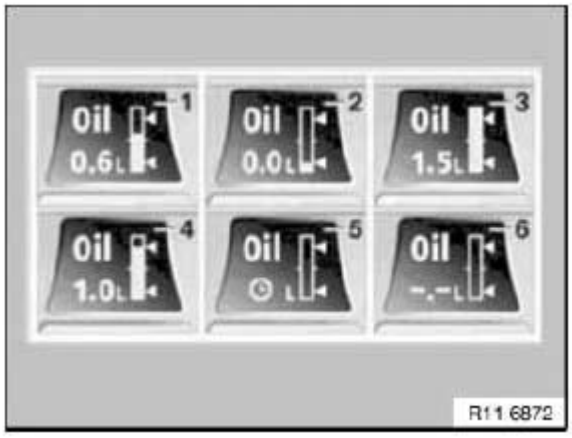

Fig. 1: Explanation Of Instrument Displays
Courtesy of BMW OF NORTH AMERICA, INC.

Run engine at idle speed. Repeatedly press on-board computer button on turn indicator lever until the display for the engine oil level can be read off on the instrument display. Press the on-board computer button for longer than three seconds: displayed value is reset

Run the engine at idle speed until the engine oil level has been remeasured (engine oil temperature = 70 °C). The required engine oil temperature for an engine oil service has therefore been reached. Measuring range from minimum (3) to maximum (2) = 1 liter.

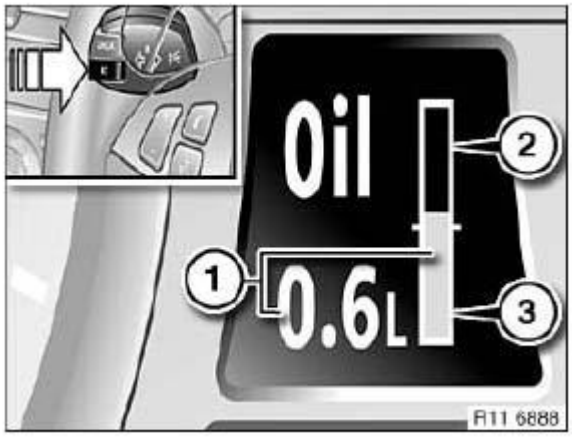

Fig. 2: Measuring Range From Minimum To Maximum
Courtesy of BMW OF NORTH AMERICA, INC.

WARNING: Risk of scalding!

Release screw plug (1) on oil filter cover (2). Tightening torque 11 42 2AZ. See **11 42 OIL FILTER AND PIPES** .

Installation note: Replace sealing ring.

- Remove both intake filter housings. See **13 71 000 REMOVING AND INSTALLING LEFT INTAKE FILTER HOUSING (S85)** or **13 71 020 REMOVING AND INSTALLING RIGHT INTAKE FILTER HOUSING (S85)**
- Remove **intake air manifold**.
- Disconnect hose for crankcase ventilation.
- Disconnect hose for suction jet pump.
- Remove heat shield on front axle carrier.
- Release steering spindle. See **32 31 070 REMOVING AND INSTALLING / REPLACING LOWER SECTION OF STEERING SPINDLE (M5)** or **32 31 070 REMOVING AND INSTALLING/REPLACING LOWER SECTION OF STEERING SPINDLE (M6)** .
- Remove left and right **oxygen sensors**.
- Remove left and right temperature sensors [17, 62].
- Release grounding strap on engine support arm.
- Unscrew left and right engine mounts. See **ENGINE SUSPENSION** .
- Carefully lift out engine with two persons.

IMPORTANT: Risk of damage to steering gear and oil sump.

11 00 670 SECURING ENGINE IN INSTALLATION POSITION (S85)

Special tools required:

- 00 0 200
- 00 0 202
- 00 0 204
- 00 0 208
- 11 0 020

WARNING: Danger of injury!

Observe following instructions relating to special tool:

1. Prior to each use, check the special tools for defects, modifications and operational reliability.
2. Damaged/modified special tools must not be used!
3. No changes or modifications may be made to the special tools!
4. Keep special tools dry, clean and free of grease.

Necessary preliminary tasks:

- Secure engine bonnet/hood in service position

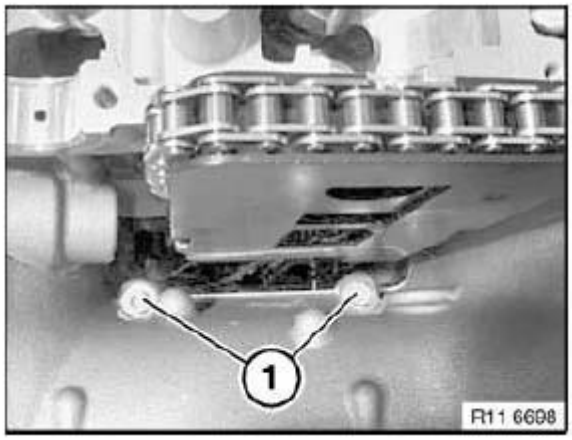

Fig. 64: Identifying Screws
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Modifying check valves, refer to memory entries in DME.

In engines where it is not possible to connect check valves, replace the vacuum-controlled check valves with self-opening check valves.

Vacuum lines will then no longer be required.

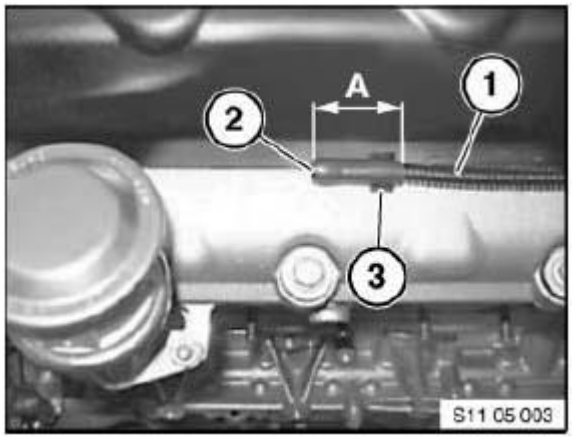

Fig. 65: Identifying Check Valve
Courtesy of BMW OF NORTH AMERICA, INC.

Assemble engine.

11 12 112 REPLACING BOTH CYLINDER HEAD GASKETS (S85)

Necessary preliminary tasks:

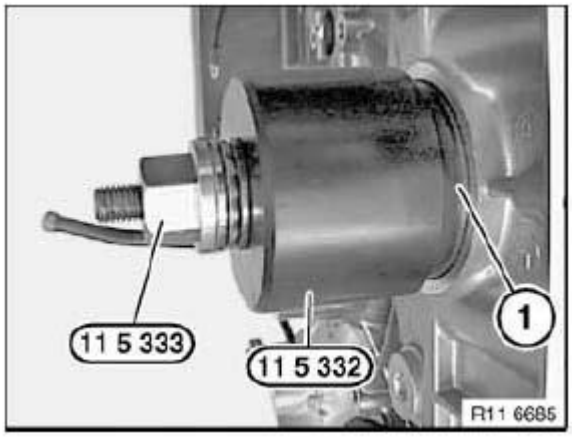

Fig. 89: Identifying Radial Shaft Seal, Special Tools 11 5 332 And 11 5 333
Courtesy of BMW OF NORTH AMERICA, INC.

Assemble engine.

Setting time of radial shaft seal approx. 1 hour.

Correct engine oil level if necessary.

11 14 151 REPLACING CRANKSHAFT RADIAL SEAL (S85)

Special tools required:

- 11 5 311
- 11 5 312
- 11 5 313
- 23 0 490

IMPORTANT: A radial shaft seal is damaged if it is supplied without a support bushing.
The sealing lip of the radial shaft seal is highly sensitive and must not be kinked.
Do not touch the sealing lip with your fingers.
The functional reliability of the radial shaft seal is no longer guaranteed and it must not be fitted.

Necessary preliminary tasks:

- Remove transmission. See **REMOVING AND INSTALLING TRANSMISSION (M5)** or **REMOVING AND INSTALLING TRANSMISSION (M6)** .
- Remove clutch. See **REMOVING AND INSTALLING/REPLACING CLUTCH (M5)** or **REMOVING AND INSTALLING/REPLACING CLUTCH (M6)** .
- Remove **flywheel**.

Tightening torque 11 24 1AZ. See **CONNECTING RODS AND BEARINGS** .

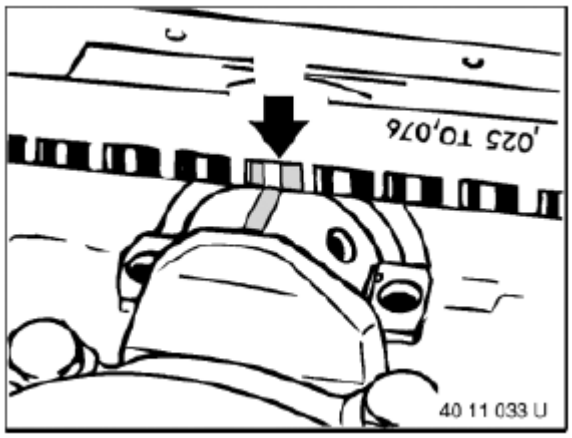

Fig. 143: Identifying Plastic Thread (Plastigage)
Courtesy of BMW OF NORTH AMERICA, INC.

Assemble engine.

25 PISTON WITH RINGS AND PIN

11 25 530 REMOVING AND INSTALLING/REPLACING ALL PISTONS (S85)

Special tools required:

- 00 9 120
- 11 4 492
- 11 5 250
- 11 5 341
- 11 5 342
- 11 5 343
- 11 5 344
- 11 9 500
- 12 2 100

WARNING: Protective goggles must be worn when working on the piston pin circlip.

IMPORTANT: If pistons, conrods and bearing shells are reused, they must be reinstalled in the same places.
Piston and piston pin are matched to each other and can only be replaced as a pair.
Connecting rod and connecting rod bearing cap are cracked.

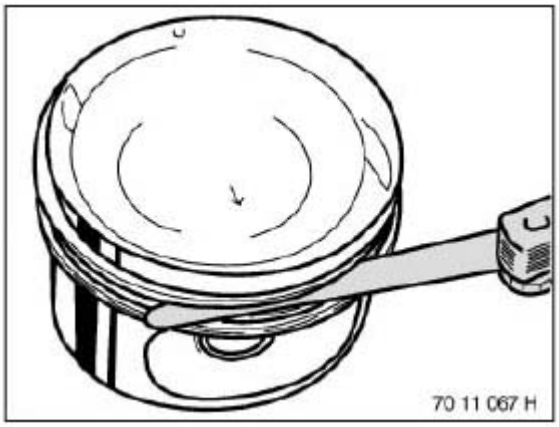

Fig. 173: Measuring Axial Play
Courtesy of BMW OF NORTH AMERICA, INC.

Measure end clearance.

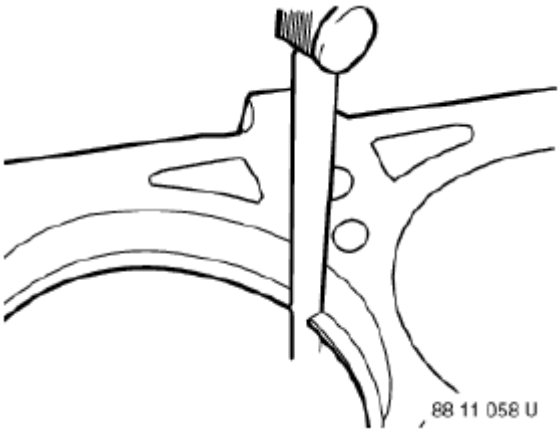

Fig. 174: Measuring Ring End Clearance
Courtesy of BMW OF NORTH AMERICA, INC.

Offset the contact points of the piston rings by approx. 120° to each other but do not position above the piston pin boss.

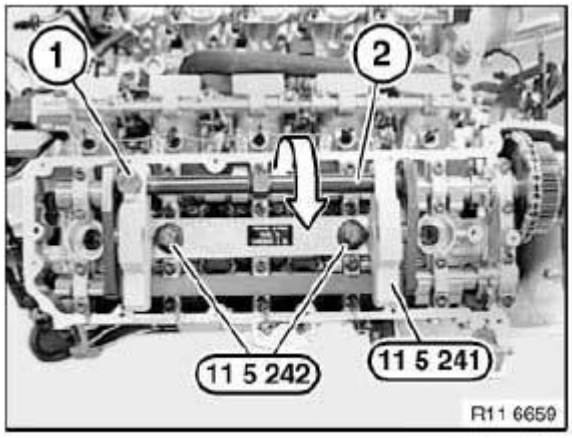

Fig. 211: Relieving Tension On Eccentric Shaft At Hexagon Head (1 Of 2)
Courtesy of BMW OF NORTH AMERICA, INC.

Insert exhaust camshaft, cylinders 1-5.

Designation (A 2) on dihedron points upwards.

Installation:

Lubricate all bearing points with engine oil.

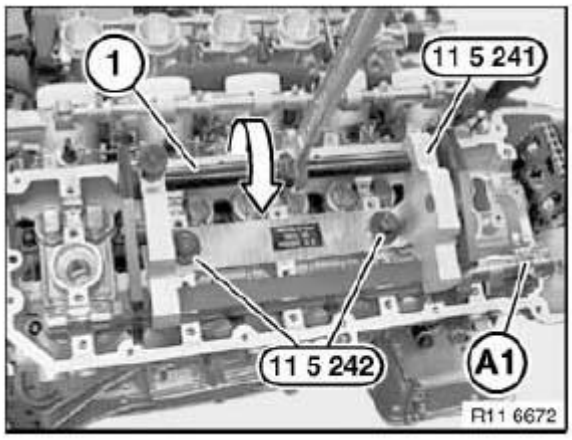

Fig. 212: Relieving Tension On Eccentric Shaft At Hexagon Head (2 Of 2)
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

All bearing shells are assigned to one cylinder.

E and A from (1 to 10), e.g. A 1= exhaust side on 1st cylinder.

Arrow (1) must point in direction of travel to chain drive.

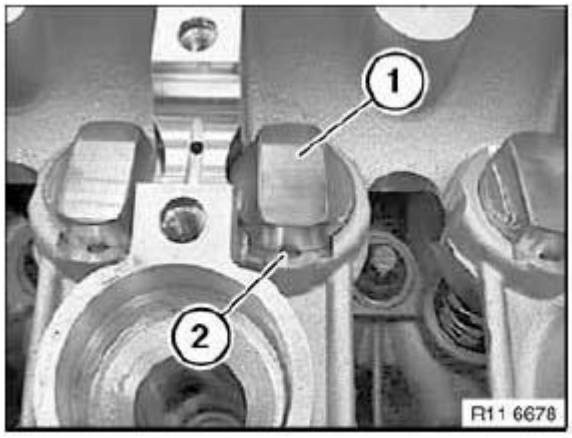

Fig. 253: Identifying HVCA Elements And Lock
Courtesy of BMW OF NORTH AMERICA, INC.

Check surface (1) of HVCA element for damage.

Installation:

Turning lock (2) on HVCA element.

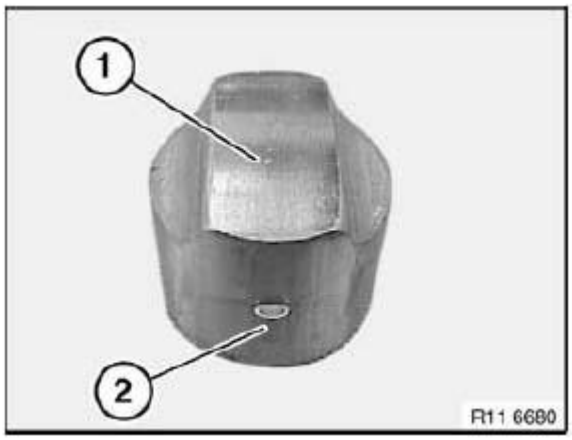

Fig. 254: Identifying Surface Of HVCA Element
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Check valve keys (1) for correct seating.

Check turning lock (2) on cylinder head for damage.

necessary to readjust the timing.

Necessary preliminary tasks:

- Remove **intake air manifold**.
- Remove **right cylinder head cover**.
- Remove fan cowl with electronic fan. See **17 11 035 REMOVING AND INSTALLING/REPLACING FAN COWL WITH ELECTRIC FAN (M5)** or **17 11 035 REMOVING AND INSTALLING/REPLACING FAN COWL WITH ELECTRIC FAN (M6)** .
- Detach **oil line from VANOS adjustment unit**.
- Remove coolant hose from radiator inlet on right.

IMPORTANT: 6 hexagon socket screws with washers must not be released.

If the 6 hexagon socket screws with washers are released by mistake, it will be necessary to readjust the timing.

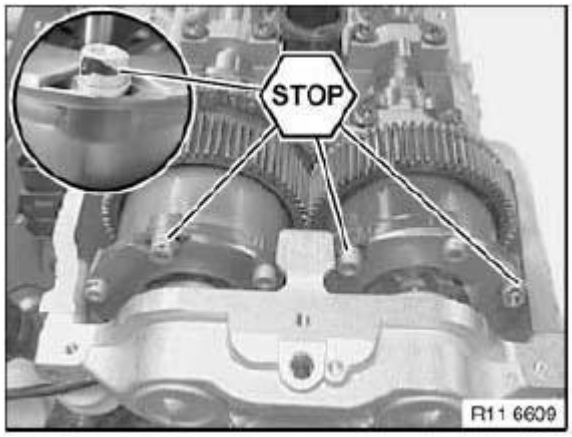

Fig. 289: Identifying Hexagon Socket Screws
Courtesy of BMW OF NORTH AMERICA, INC.

IMPORTANT: Hexagon socket screws (1) may fall into the engine compartment after they have been released (risk of damage).

Release screws (1).

Crank engine at central bolt until 6 hexagon socket screws of the adjustment unit have been released.

Do not crank engine while banjo bolt is released.

Necessary preliminary tasks:

- Remove **engine oil sump**.
- Remove **oil pump**.

Release banjo bolt (1).

Tightening torque 11 36 4AZ. See **36 VARIABLE CAMSHAFT TIMING** .

Release screws (2).

Remove VANOS high-pressure pump (3).

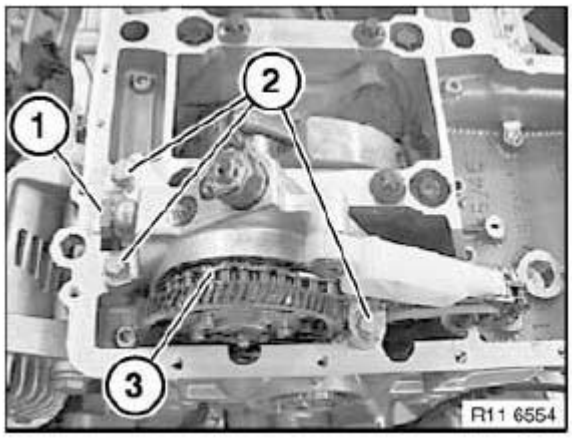

Fig. 306: Identifying VANOS High-Pressure Pump
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: Engine installed.

Secure piston (1) against falling out; remove if necessary.

Check adapter sleeve (2) for damage and secure seating; replace if necessary.

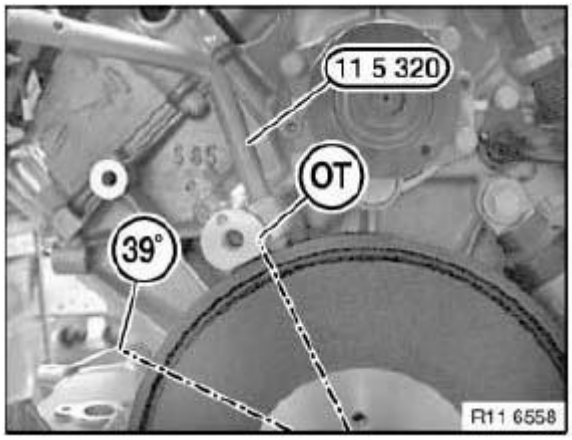

Fig. 322: Identifying Special Tool 11 5 320
Courtesy of BMW OF NORTH AMERICA, INC.

Position of inlet camshaft, cylinders 6-10.

Designation (E2) on dihedron points upwards.

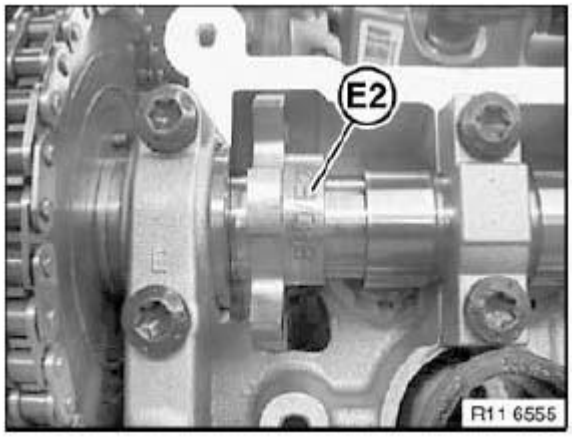

Fig. 323: Identifying Designation On Dihedron Points Upwards
Courtesy of BMW OF NORTH AMERICA, INC.

Rotate exhaust camshaft at hexagon head with an open-end wrench (2) in direction of arrow until special tool A 11 3 302 can be attached.

Designation (A2) on dihedron points upwards.

NOTE: Exhaust VANOS gear (1) adjusted in direction of arrow (advance).

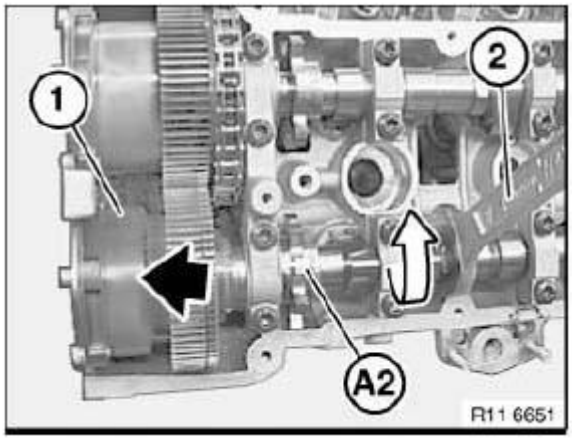

Fig. 350: Rotating Exhaust Camshaft At Hexagon Head
Courtesy of BMW OF NORTH AMERICA, INC.

Disconnect inlet and exhaust camshafts.

NOTE: Rotate exhaust camshaft at hexagon head, attach special tool A 11 5 302.

Attach special tool E 11 5 302 and secure with bolts (1).

IMPORTANT: Screw in bolts (1) without fail, risk of damage to camshafts.

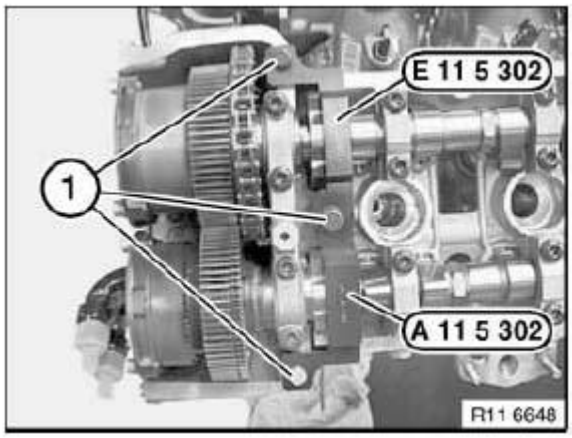

Fig. 351: Identifying Special Tool E 11 5 302 And A 11 5 302
Courtesy of BMW OF NORTH AMERICA, INC.

IMPORTANT: Removal/installation is not possible without hexagon socket screw (1).
Hexagon socket screw (1) with washer must not be longer than 18 mm.
Gearwheels (2 and 3) of exhaust VANOS gear are tensioned with a spring.

Insert M8x18 hexagon socket screw (1) into VANOS gear.

If necessary, remove transportation lock from VANOS gear. Insert special tool 11 5 381 between outer sleeve and gearwheel. Fit special tool 11 5 410. Remove M8x18 hexagon socket screw or special tool 11 5 370.

IMPORTANT: Secure central bolts (1 and 2) with special tools 11 5 381 and 11 5 410 only.

Tighten central bolts (1 and 2). Tightening torque: 11 36 1AZ. See **11 36 VARIABLE CAMSHAFT CONTROL** .

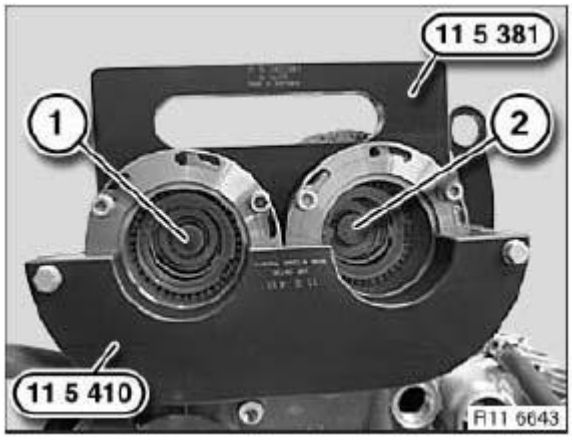

Fig. 386: Identifying Exhaust VANOS Gear And Special Tool 11 5 381 (2 Of 2)
Courtesy of BMW OF NORTH AMERICA, INC.

Remove special tools 11 5 381 and 11 5 410. Release hexagon socket screws with washers (1 and 2) through 90°.

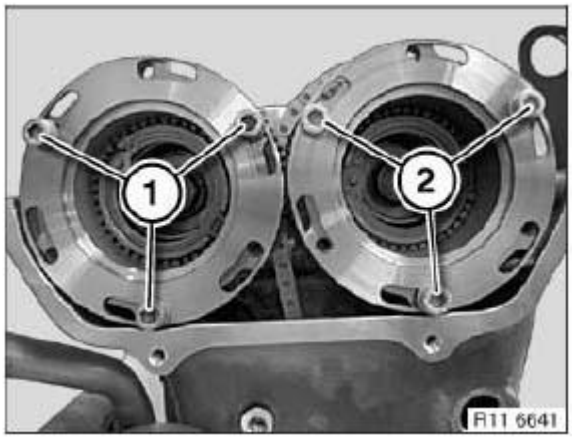

Fig. 387: Identifying Hexagon Socket Screws With Washers
Courtesy of BMW OF NORTH AMERICA, INC.

Installation: Both thrust bearing plates (1) on the VANOS adjustment unit can be rotated. Both thrust bearing plates (1) must be retracted. Clean sealing surface (2). Replace seal.

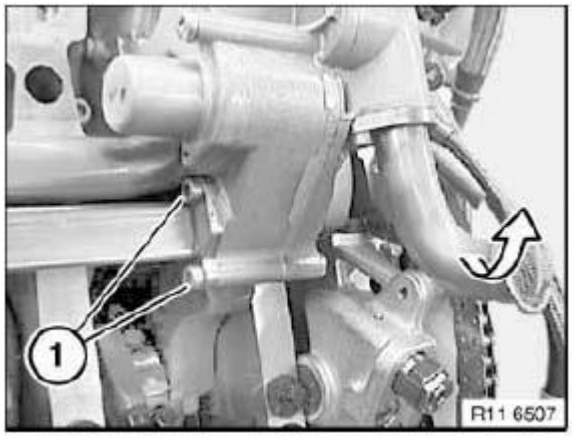

Fig. 427: Identifying Screws (1 Of 2)
Courtesy of BMW OF NORTH AMERICA, INC.

Release screw (1).

Release screw (2).

Detach oil pipes from oil pump.

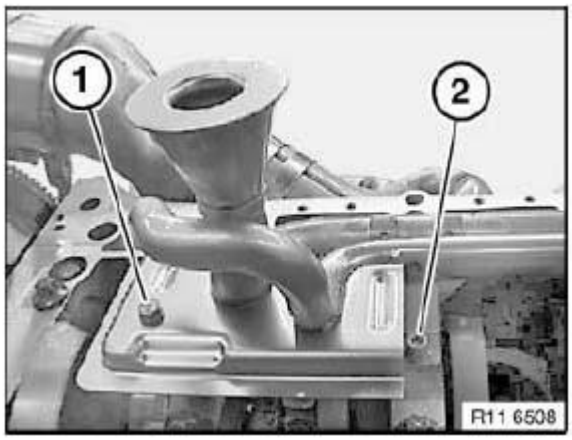

Fig. 428: Identifying Screws (1 Of 2)
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Replace sealing ring (1).

To aid installation, apply a thin coat of engine oil to sealing ring (1).

Clean all sealing surfaces.