

119 Lubrication System

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119-2 Lubrication System

Warnings and Cautions

GENERAL

This repair group covers lubrication system troubleshooting and crankshaft seal replacement. Oil pan removal and oil pump replacement for M54 engine are also covered.

See also:

- **020 Maintenance** for oil and oil filter change
- **100 Engine-General** for engine identification and application

Warnings and Cautions

WARNING—

- *Due to risk of personal injury, be sure the engine is cold before beginning work on engine components.*

CAUTION—

- *Prior to disconnecting the battery, read the battery disconnection cautions in **001 Warnings and Cautions**.*
- *To avoid electrochemical corrosion to engine components made of aluminum-magnesium alloy, do not use steel fasteners. Use aluminum fasteners only. For reliable identification, test fasteners for aluminum composition with magnet.*
- *Replace aluminum bolts each time they are loosened.*
- *Follow torque instructions, including angle of rotation specifications, when installing aluminum fasteners.*
- *Cover alternator with shop towel to protect from oil drips.*

ENGINE LUBRICATION**Engine lubricant**

Engine oil specification	
M54 engine: BMW high performance synthetic • SAE 5W - 30 or 15W - 40	API rating SJ / CF or higher
N52, N54, V8 (N62) engine: BMW long-life rating (LL-01) synthetic oils for US market: • Castrol Syntec European Formula SAE 0W - 30 • Mobil 1 SAE 0W - 40 • Pennzoil Platinum European Formula Ultra SAE 5W - 30 • Valvoline SynPower SAE 5W - 30	API rating SM or higher

Engine oil capacity	
Engine	Approximate capacity (incl. oil filter)
M54	7.5 liters (8.0 US qt)
N52, N54	6.5 liters (6.9 US qt)
V8 (N62)	8 liters (8.45 US qt)

Engine lubrication (M54 engine)

Oil pressure is generated by a gear-type pump bolted to the bottom of the engine block. The oil pump is chain driven off the front of the crankshaft.

The oil pressure warning system consists of an oil pressure switch mounted in the oil circuit and an instrument panel warning light. Other safety features include:

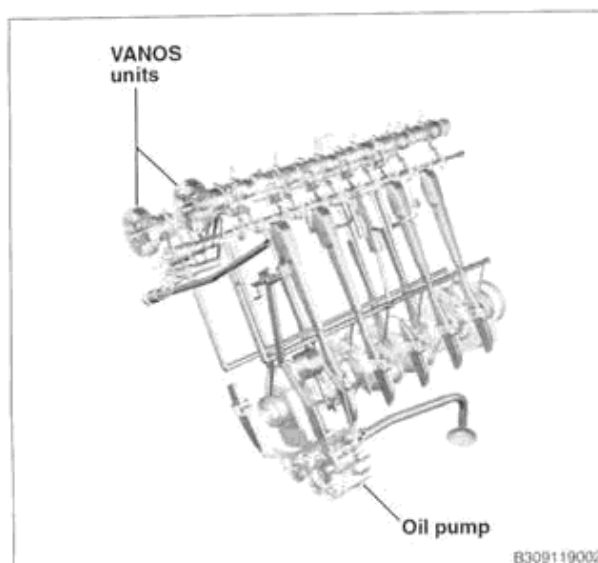
- Filter bypass to provide lubrication should the oil filter become clogged.
- Oil pump pressure relief valve to prevent excessive system pressure.

Engine lubrication (N52, N54 engine)

- ◀ To meet the oiling requirements of N52 and N54 engines, a chain-driven volumetric-flow controlled oil pump is utilized. The VANOS system requires a large volume of oil, particularly at low engine speeds.

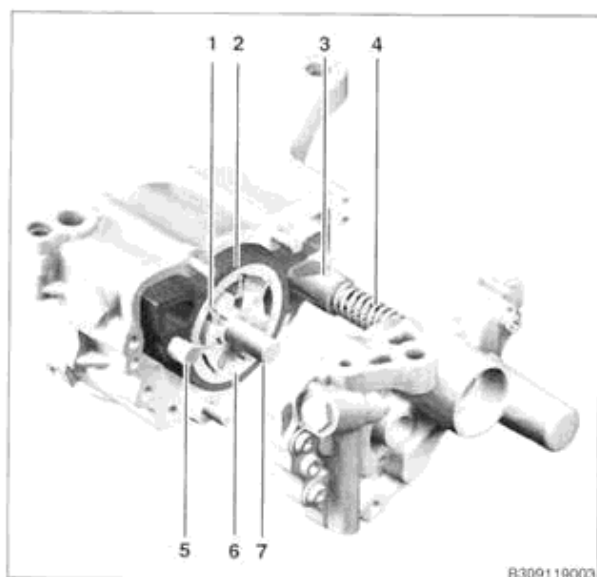
The volumetric-flow controlled pump design allows:

- Increased power output
- Reduced weight
- Optimized fuel consumption
- Reduced exhaust emissions

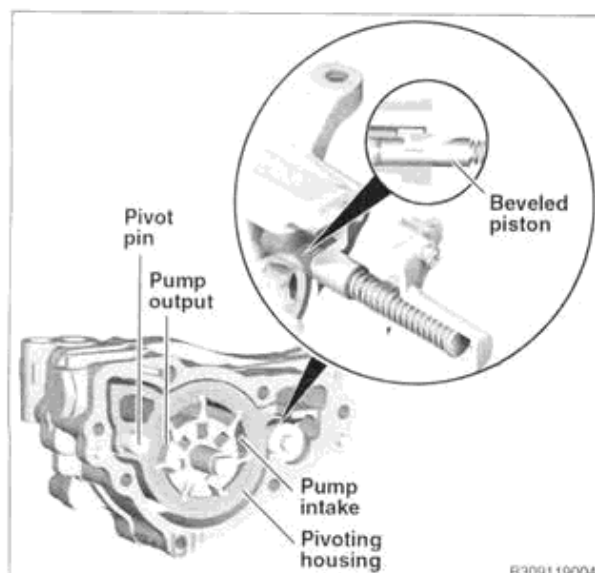


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Engine oil pump (N52, N54 engine)



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Engine oil pump (N52, N54 engine)

1. Sliding vane valve
2. Pivoting rotor housing
3. Beveled control piston
4. Compression spring
5. Pivot pin
6. Rotor
7. Pump shaft

The volumetric-flow controlled oil pump delivers only as much oil as is necessary. No surplus quantities of oil are delivered in low load operating ranges. This reduces the fuel consumption of the engine and slows down the oil wear rate.

The pump is designed with sliding vane valves. The pump shaft and rotor are positioned off-center in the pivoting rotor housing and the vanes are displaced radially during rotation. The vanes form chambers of differing volume depending on the position of the rotor housing.

When the pump rotates, oil pressure acts on the control piston against the force of the compression spring. The beveled piston varies the position of the pivoting housing.

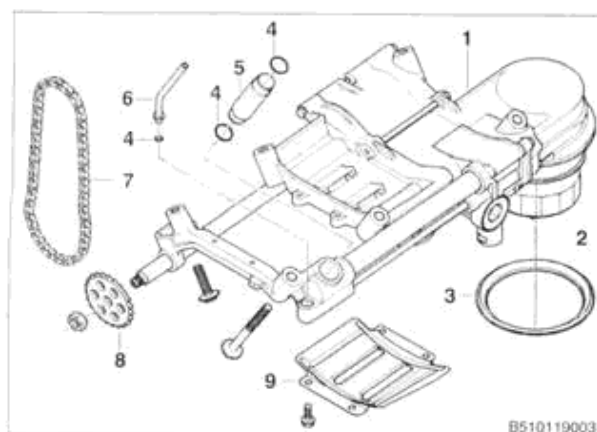
When the housing is centered on the rotor, changes in intake and output chamber volumes are small: Delivered oil volume is low. When the rotor housing is off-center in relation to the rotor, changes in input and output chamber volumes are greater: Delivered oil volume is high.

When the oil volume required by the engine increases, for example during VANOS operation, oil pressure in the lubricating system drops, reducing pressure on the beveled piston. In response, the compression spring presses the beveled piston against the pivoting housing control dog, forcing the housing further off-center and increasing oil volume. The opposite occurs as engine oil pressure increases and the need for delivered oil volume drops.

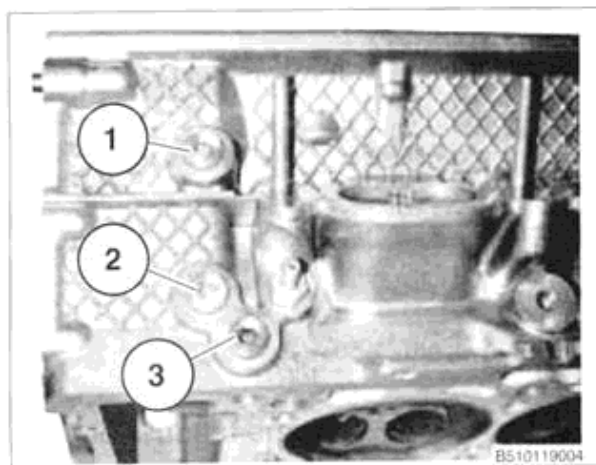
Engine lubrication (V8 engine)

Oil pressure is generated by a two-stage gear-type pump with two parallel switched gear clusters. It is bolted to the bottom of the engine block at an angle. The oil pump is chain driven off the front of the crankshaft.

1. Oil pump
2. Oil filter
3. Profile gasket
4. O-ring
5. Oil pump inlet
6. Oil pipe
7. Oil pump drive chain
8. Oil pump drive gear
9. Oil deflector



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Engine oil is supplied by the oil pump to lubrication points in the engine block and is pumped into the cylinder heads. Three oil check valves are installed in each cylinder head. This prevents engine oil from draining out of the cylinder head and VANOS units. The check valves are serviceable from the outside casting of the cylinder head.

1. Intake VANOS check valve
2. Exhaust VANOS check valve
3. Cylinder head oil supply check valve



OIL PRESSURE WARNING SYSTEM

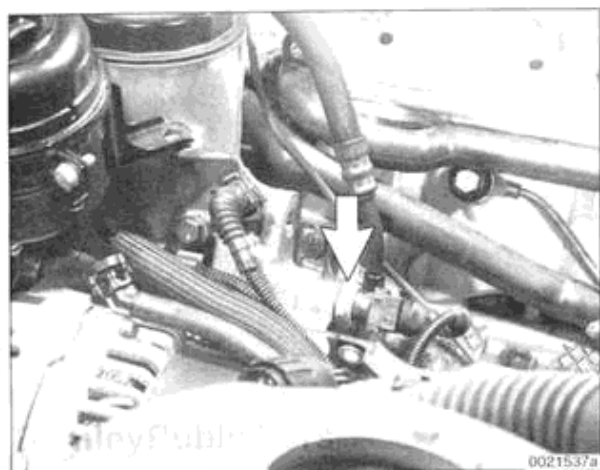
CAUTION—

- If the red oil pressure warning light comes on or flashes on while driving, assume that the oil pressure is low. Stop the engine immediately and make arrangements to test oil pressure.

Oil pressure, checking

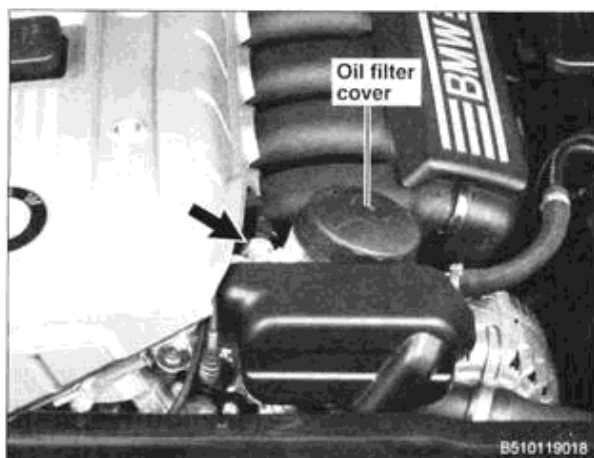
Test oil pressure by removing oil pressure switch and installing oil pressure gauge in its place.

- 6-cylinder engine: Loosen oil filter cover to allow engine oil to drain back down into oil pan. Tighten cover.
- M54 engine: Access to oil pressure warning switch (arrow) is restricted (intake manifold removed for purposes of photo).

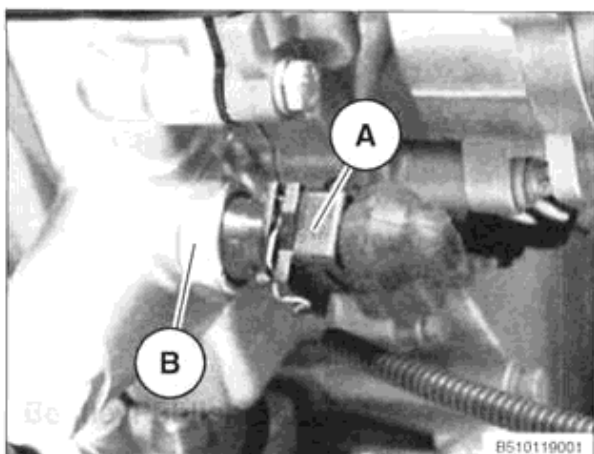


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Oil pressure, checking



- N52, N54 engine: Detach harness connector (**arrow**) from oil pressure switch. If necessary, remove ignition coil cover. See **020 Maintenance**.



- V8 engine: Working at front of right cylinder head, detach electrical connector (**A**) from oil pressure switch (**B**).

- Remove switch. Be prepared to catch leaking oil with a shop towel.

CAUTION—

- Thoroughly clean around the oil pressure switch before removing it.

- Install pressure gauge in place of oil pressure switch. If necessary, use BMW special adapter 11 4 050 in place of oil pressure switch.
- With gauge installed, start engine and allow to reach operating temperature. Check oil pressure. See **Table a**.

NOTE—

- For the most accurate test results, make sure the engine oil and filter are new and the oil of the correct grade.

Table a. Engine oil pressure

At idle, engine at operating temperature	
• M54 engine	0.5 bar (7 psi)
• N52, N54 engine	1.5 bar (22 psi)
• V8 engine	1.0 bar (14.5 psi)
Maximum regulated pressure, engine at operating temperature	
• M54 engine	4 ± 0.5 bar (58 ± 7 psi)
• N52, N54 engine	4.0 - 6.0 bar (58 - 87 psi)
• V8 engine	4.0 - 6.0 bar (58 - 87 psi)

- Remove pressure gauge and reinstall pressure switch with new sealing washer.

Tightening torque

Oil pressure switch to oil filter housing M54 engine (M12 x 1.5)	27 Nm (20 ft-lb)
Oil pressure switch to oil filter housing N52, N54 engine (M12 x 1.5)	20 Nm (15 ft-lb) additional 16°
Oil pressure switch to cylinder head V8 engine (M12 x 1.5)	27 Nm (20 ft-lb)

If testing shows low oil pressure, one or more of the following conditions may be indicated:

- Worn or faulty oil pump or faulty pump pressure relief valve
- Worn or damaged engine bearings
- Severe engine wear

Any of these conditions indicate the need for major repairs.

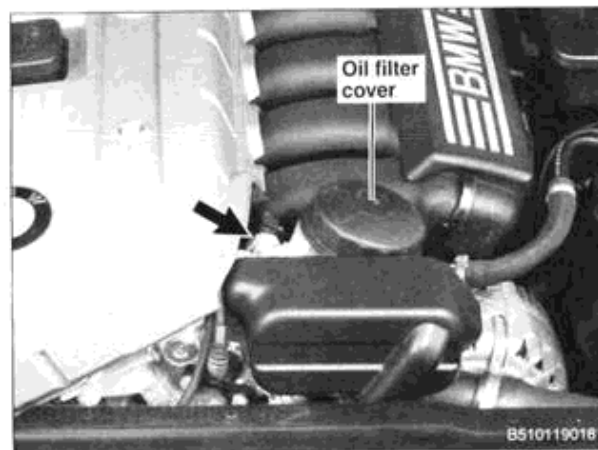
Oil pressure warning switch, replacing

- M54 engine: Access to oil pressure warning switch (**arrow**) is restricted (intake manifold removed for purposes of photo).



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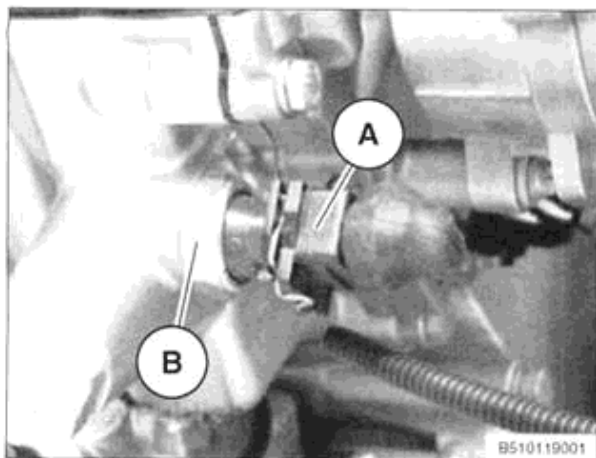
- N52, N54 engine: If necessary, remove ignition coil cover. See **020 Maintenance**.



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119-8 Lubrication System

Oil level and temperature sensor [M54, V8 engine (to 2006)]



- V8 engine: Oil pressure switch (B) is located at right front cylinder head.
- 6-cylinder engine: Loosen oil filter cap to allow engine oil to drain back down into oil pan.
- Disconnect harness connector from oil pressure switch and remove switch. Be prepared to catch leaking oil with a shop towel.

CAUTION—

- Thoroughly clean around the oil pressure switch before removing it.

- Installation is reverse of removal. Tighten oil filter housing cap and top off oil, if necessary.

Tightening torque

Oil pressure switch to oil filter housing M54 engine (M12 x 1.5)	27 Nm (20 ft-lb)
Oil pressure switch to oil filter housing N52, N54 engine (M12 x 1.5)	20 Nm (15 ft-lb) additional 16°
Oil pressure switch to cylinder head V8 engine (M12 x 1.5)	27 Nm (20 ft-lb)

OIL MONITORING

Oil level and temperature sensor [M54, V8 engine (to 2006)]

Engine oil level and temperature is measured by the oil level and temperature sensor and indicated in the instrument cluster or central information display.

Oil condition information is processed by the engine control module (ECM), then routed via PT-CAN and K-CAN buses to the instrument cluster and central information display. The ECM software determines the optimal time for oil change interval.

Checking oil level is covered in **020 Maintenance**.

Oil condition sensor (OZS) [N52, N54, V8 engine (from 2006)]

- Engine oil level is measured by the oil condition sensor (OZS) and indicated in the instrument cluster or central information display. Engine oil temperature and condition are also monitored by the OZS. N52, N54 engines are not equipped with a dipstick.

Oil condition information is processed by the engine control module (ECM), then routed via PT-CAN and K-CAN buses to the instrument cluster and central information display. The ECM uses condition based service (CBS) software to determine optimal oil change interval.

Checking oil level is covered in **020 Maintenance**.



OZS operation, (N52, N54, V8 engine)

1. Housing
2. Outer metal tube
3. Inner metal tube
4. Engine oil (maximum)
5. Engine oil (average)
6. Engine oil (minimum)
7. Oil pan
8. Oil temperature sensor
9. Sensor electronics
10. Sensor connector

OZS consists of two cylindrical capacitors arranged one above the other. Oil condition is determined by the lower, smaller capacitor. Two metal tubes (1, 2), arranged one inside the other, serve as capacitor electrodes. The dielectric is the engine oil between the electrodes. The electrical property of engine oil changes with age and break-down of oil additives, changing the OZS capacitance. This change is processed in the sensor electronics (9) and converted to a digital signal. The digital sensor signal is transferred to the ECM, which uses it to calculate the next oil change service due.

Engine oil level is determined by the capacitor of the OZS. As oil level drops, sensor capacitance changes accordingly. This change is processed in the sensor electronics (9) and converted to a digital signal. The digital sensor signal is transferred to the ECM and displayed to the driver.

A platinum temperature sensor (8) is installed at the base of the oil condition sensor.

Engine oil level, temperature and condition are monitored continuously as long as voltage is applied at terminal 15 (ignition ON). OZS is powered via terminal 87.

OZS fault evaluation

OZS electronic circuitry features a self-diagnosis function. In case of a fault in the sensor, an error message is sent to the ECM. The fault can be viewed using a BMW scan tool.

Oil level and temperature sensor, replacing (M54 engine)

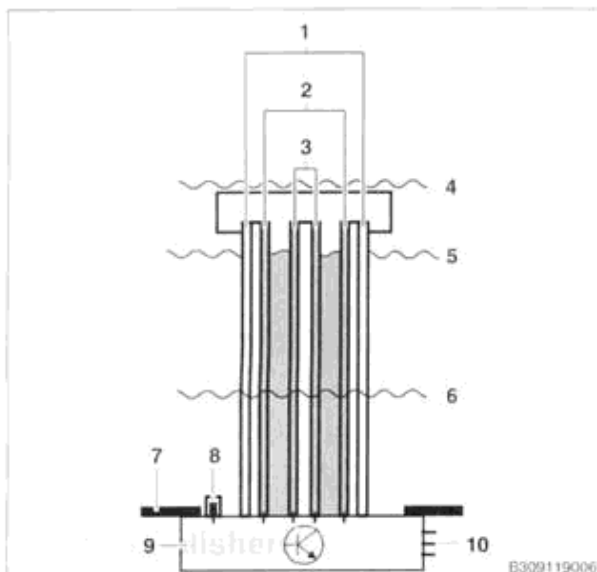
Oil level warning switch is located at bottom of engine oil pan.

- Raise vehicle and support safely.

WARNING —

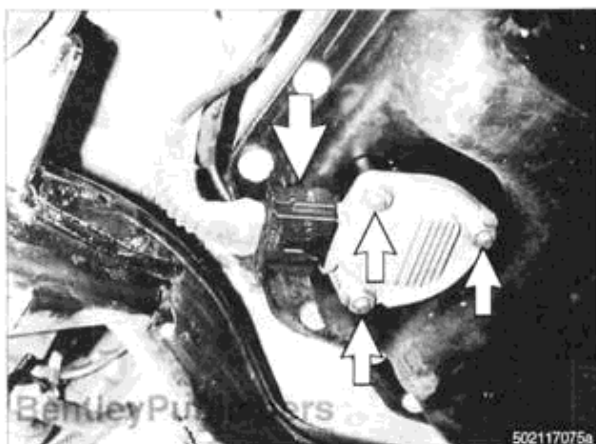
- Make sure the vehicle is stable and well supported at all times. Use a professional automotive lift or jack stands designed for the purpose. A floor jack is not adequate support.

- Remove splash shield underneath engine. See **020 Maintenance**.
- Drain engine oil. See **020 Maintenance**.



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OZS, replacing (N52, N54, V8 engine)



- Disconnect electrical connector and remove mounting nuts (**arrows**). Lower level sensor. be prepared to catch dripping oil.
- When reinstalling, replace sealing O-ring.
- Be sure to refill engine and check for leaks after work is completed.

OZS, replacing (N52, N54, V8 engine)

N52 engine shown. Other engines are similar.

- Raise vehicle and support safely.

WARNING—

- Make sure the vehicle is stable and well supported at all times. Use a professional automotive lift or jack stands designed for the purpose. A floor jack is not adequate support.

- Remove splash shield underneath engine. See **020 Maintenance**.
- Drain engine oil. See **020 Maintenance**.

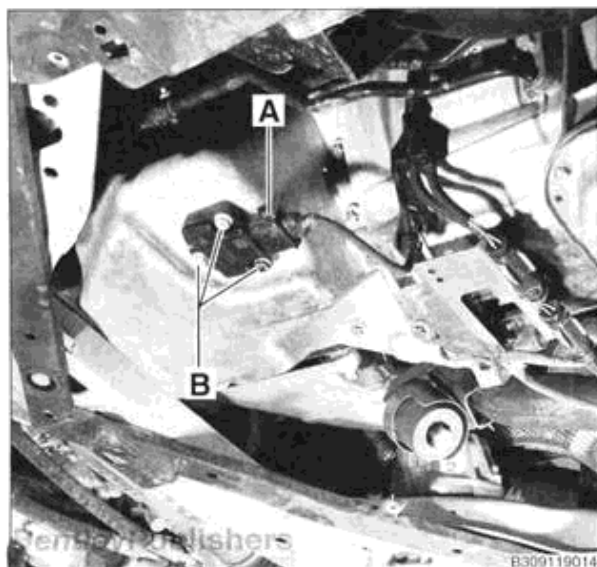
- With engine fully cooled off, disconnect OZS electrical connector (**A**) and remove mounting nuts (**B**). Lower level sensor. Be prepared to catch dripping oil.

- When reinstalling, replace sealing O-ring.

Tightening torque

OZS to oil pan	
• Stage 1	2 Nm (18 lb-in)
• Stage 2	8.5 Nm (75 lb-in)

- Refill engine with oil and check for leaks after work is completed.



CRANKSHAFT SEALS (M54 ENGINE)

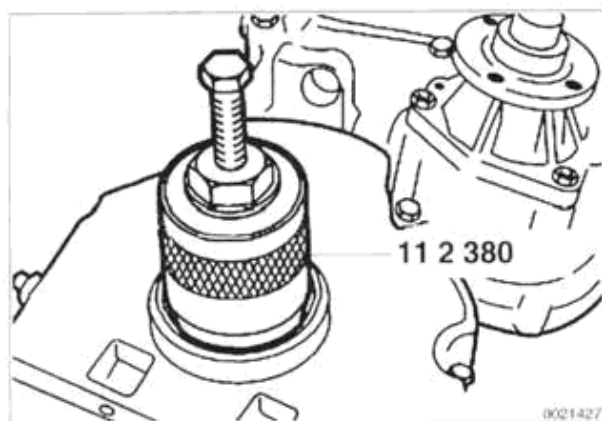
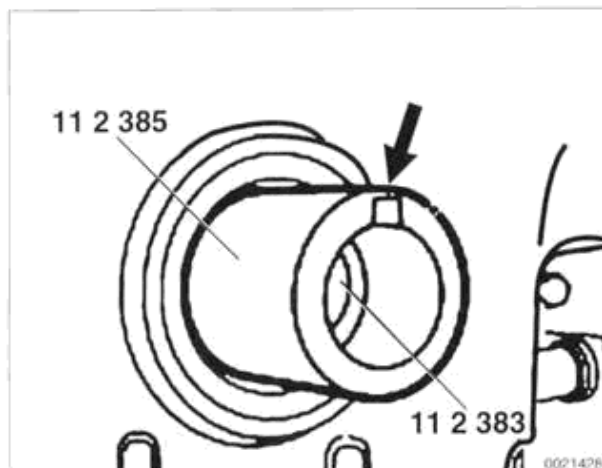
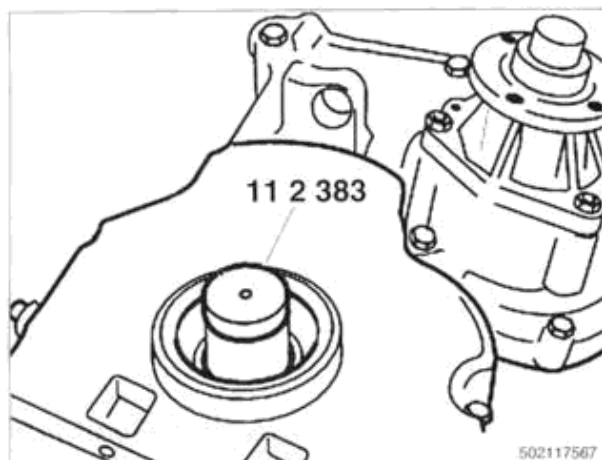
Crankshaft front oil seal, replacing (M54 engine)

- With engine fully cooled off, remove electric cooling fan, engine accessory belts and crankshaft vibration damper and pulley. Be sure to mark belts with direction of rotation. See **117 Camshaft Timing Chain**.

- Install cap (BMW special tool 11 2 383) on end of crankshaft.

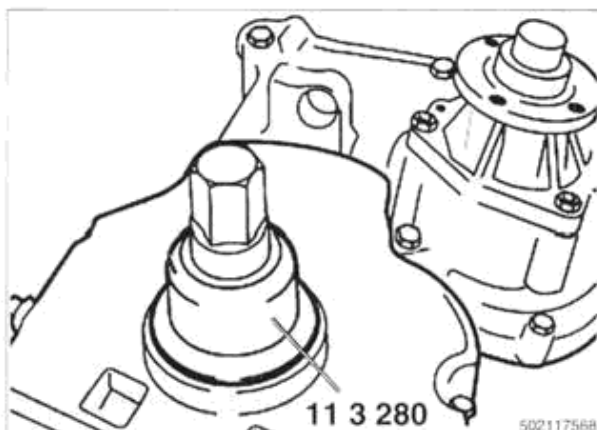
- Install seal guide (BMW special tool 11 2 385) over end of crankshaft. Be sure to align groove with keyway on crankshaft (arrow).

- Install oil seal puller (BMW special tool 11 2 380) and screw in body of puller until it contacts seal. Tighten bolt in center of tool to draw seal out of cover.



119-12 Lubrication System

Crankshaft rear main seal, replacing (M54 engine)



- ◀ Coat new seal with oil and position in timing chain cover. Use BMW special tool 11 3 280 and crankshaft center bolt to draw seal in flush with timing case cover.

- Reinstall crankshaft vibration damper and pulley.

Tightening torque

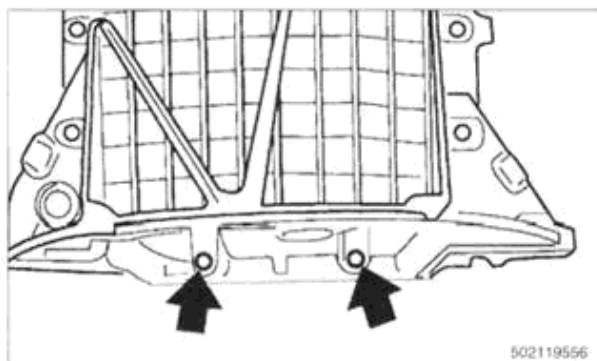
Vibration damper hub to crankshaft (use new bolt)	410 Nm (302 ft-lb)
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- Remainder of installation is reverse of removal, noting the following:
 - Install engine accessory belts. See **020 Maintenance**.
 - Install cooling fan. See **170 Radiator and Cooling System**.

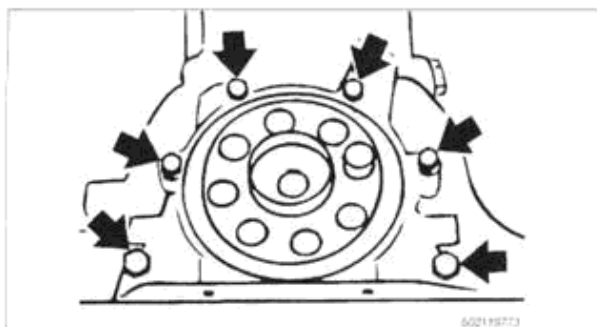
Crankshaft rear main seal, replacing (M54 engine)

Crankshaft rear main seal (flywheel seal) replacement requires removal of the transmission and flywheel.

- Remove transmission. See **230 Manual Transmission**, **231 Sequential Manual Gearbox (SMG)** or **240 Automatic Transmission**.
- Manual transmission vehicles: Remove clutch pressure plate and disc. See **210 Clutch**.
- Remove flywheel. See **210 Clutch** or **240 Automatic Transmission**.
- Drain engine oil.



- ◀ Remove seal carrier bolts from oil pan (**arrows**). Loosen all oil pan bolts.



- ◀ Remove remaining seal carrier bolts (**arrows**) and carefully remove seal carrier without damaging oil pan gasket.

CAUTION—

- After removing seal carrier, check oil pan gasket for damage. If gasket is damaged during removal, remove oil pan and replace gasket. See **Oil pan, removing and installing (M54 engine)** in this repair group.

NOTE—

- BMW offers the rear main seal carrier and seal in a kit. A plastic installation sleeve, required for sliding the seal over the crankshaft, is included with the kit.

- Install new seal carrier to crankcase. Remember to:
 - Check locating sleeves and bores in lower seal housing for damage.
 - Replace gasket between rear main seal carrier and crankcase.
 - Apply thin coat of 3 Bond® 1209 or equivalent sealant to oil pan gasket sealing surfaces.
 - Lubricate crankshaft seal contact surface.

CAUTION—

- Do not kink or damage the sealing lip. Do not touch with fingers.

- ◀ Use plastic support bushing (A) that comes with seal kit as an installation guide when fitting seal over end of crankshaft. Use care to push seal carrier and installation sleeve on straight, without tilting sideways. Remove installation sleeve.

- Install seal carrier bolts and torque to specifications.

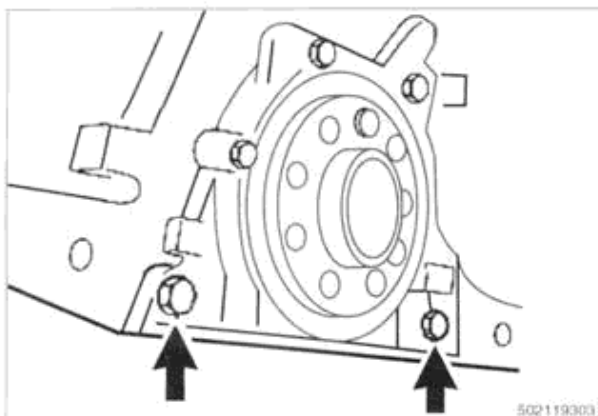
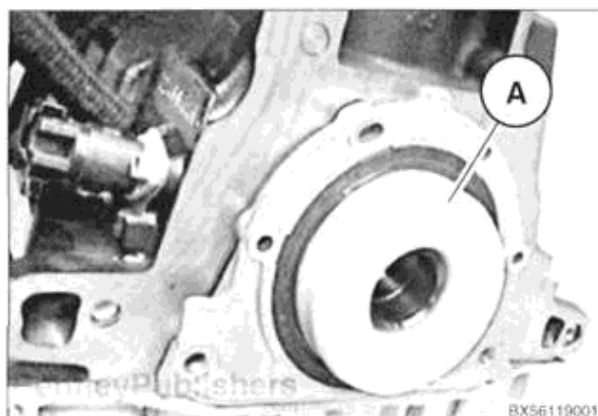
- ◀ Use new bolts (arrows) at base of seal carrier. Coat threads with sealing compound before installing.

- Install and tighten oil pan bolts.

- Remainder of assembly is reverse of disassembly.
 - Install flywheel, clutch or torque converter and transmission.
 - Fill engine with oil.
 - Run engine and check for leaks.

Tightening torques

Oil drain plug to oil pan (M12)	25 Nm (18 ft-lb)
Oil pan to engine block or seal carrier	
• M6 (8.8 grade)	10 Nm (89 in-lb)
• M6 (10.9 grade)	12 Nm (9 ft-lb)
• M8 (8.8 grade)	22 Nm (16 ft-lb)
Rear main seal carrier to crankcase	
• M6	10 Nm (89 in-lb)
• M8	22 Nm (16 ft-lb)



119-14 Lubrication System

Crankshaft front seal, removing and installing (N52, N54 engine)

CRANKSHAFT SEALS (N52, N54 ENGINE)

Crankshaft front seal, removing and installing (N52, N54 engine)

WARNING—

- To avoid personal injury, be sure the engine is cold before beginning the procedure.

CAUTION—

- When the crankshaft seal is replaced, its grooves and crankcase seams are filled with special Loctite® sealant to avoid oil leaks. Be sure to read the entire procedure before starting work.

- Raise vehicle and support safely.

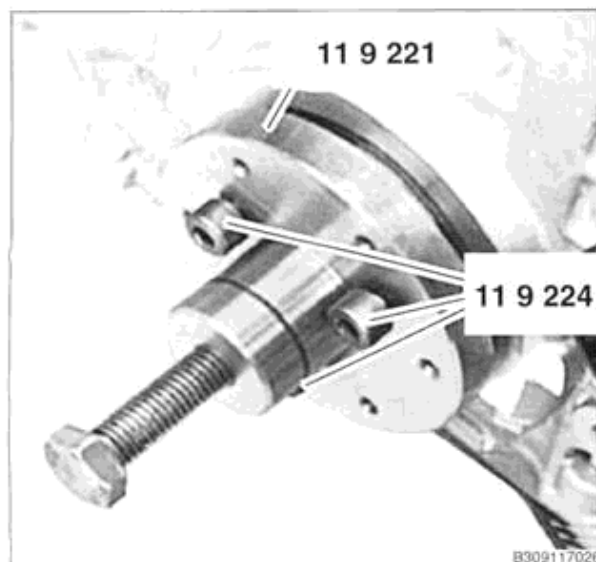
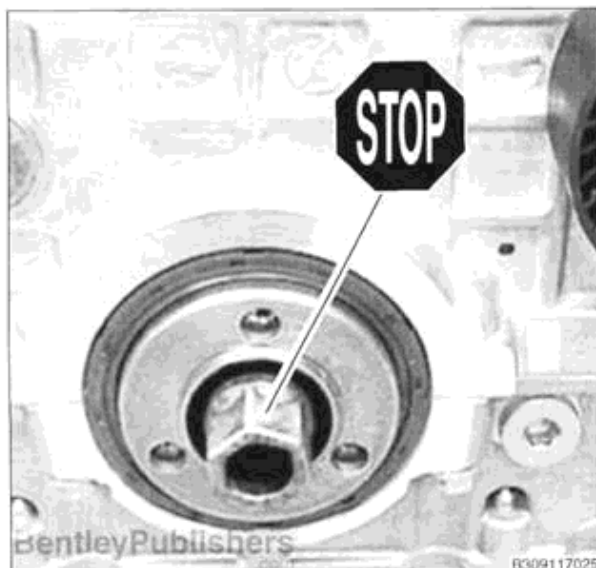
WARNING—

- Make sure the vehicle is stable and well supported at all times. Use a professional automotive lift or jack stands designed for the purpose. A floor jack is not adequate support.

- Remove splash shield underneath engine. See **020 Maintenance**.
- Remove engine accessory belt. See **020 Maintenance**.
- Remove vibration damper (front pulley). See **117 Camshaft Timing Chain**.

CAUTION—

- Do not remove vibration damper hub bolt. If this bolt is removed, the timing chain drive sprocket becomes free to rotate, resulting in valve damage.



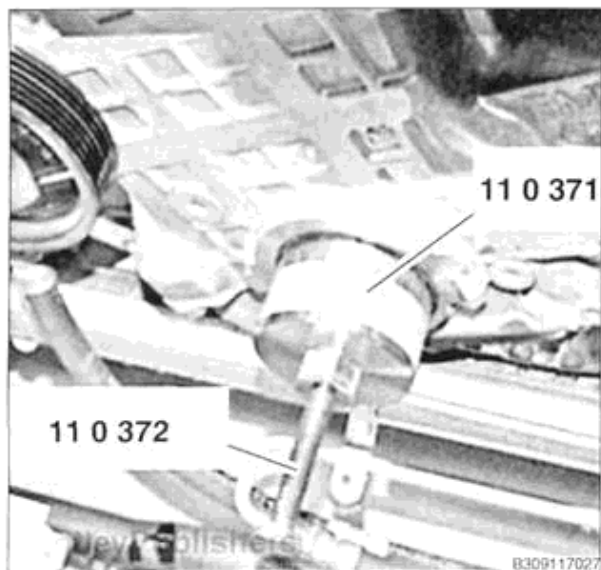
- Place BMW special tool 11 9 221 against vibration damper hub and tighten down using bolts (special tool 11 9 224). This pushes crankshaft seal inward approx. 1 mm, thus loosening it for subsequent removal.

Tightening torque

Special tool 11 9 221 to vibration damper hub	20 Nm (15 ft-lb)
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- Remove special tools.

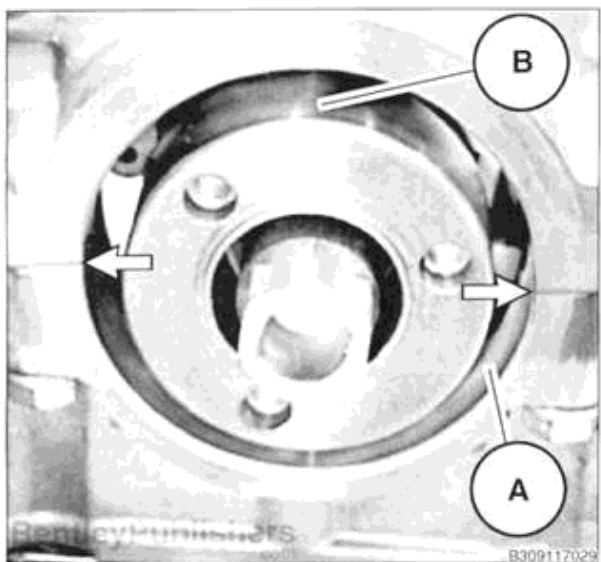
Crankshaft front seal, removing and installing (N52, N54 engine)



- ◀ Screw BMW special tool 11 0 371 into crankshaft seal with approx. 80 Nm (59 ft-lb) of torque. Then rotate special tool 11 0 371 clockwise to pull out seal. Repeat process if necessary.



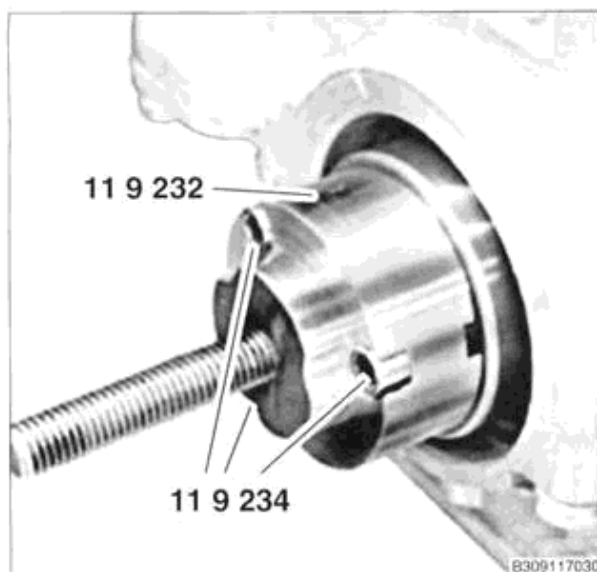
- ◀ Carefully saw seal at **dashed line** and peel off tool.



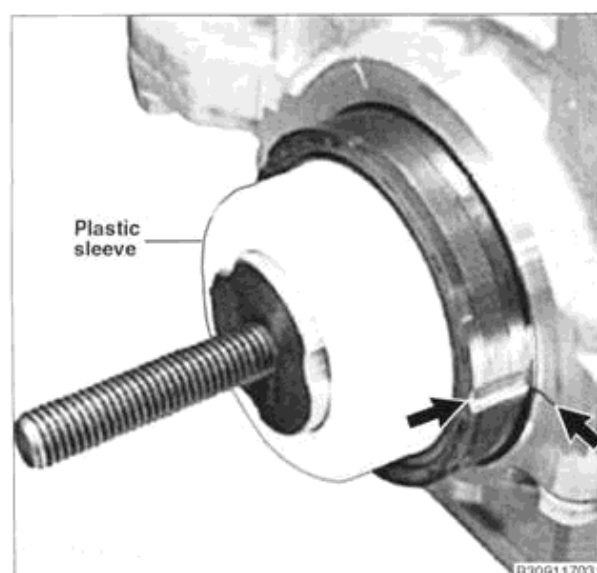
- ◀ Working at crankcase opening:
- Clean crankshaft seal seating surface (A).
 - Degrease thoroughly area around crankcase seam (**arrows**).
 - Lightly oil sealing surface (B) on vibration damper hub.

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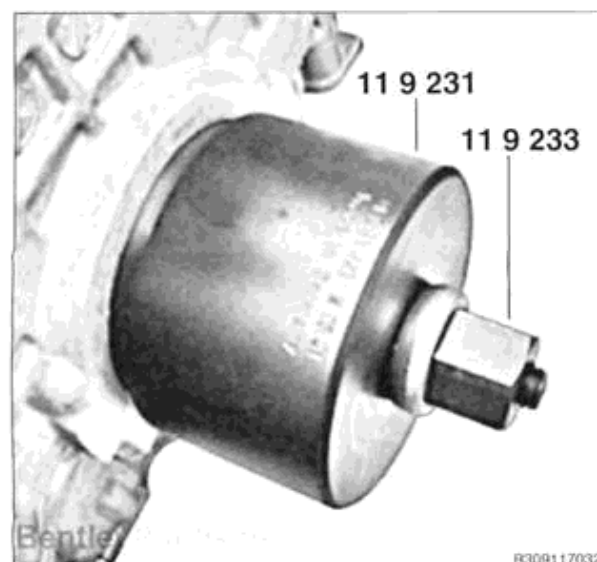
Crankshaft front seal, removing and installing (N52, N54 engine)



- Attach BMW special tool 11 9 232 to vibration damper hub using bolts (special tool 11 9 234).

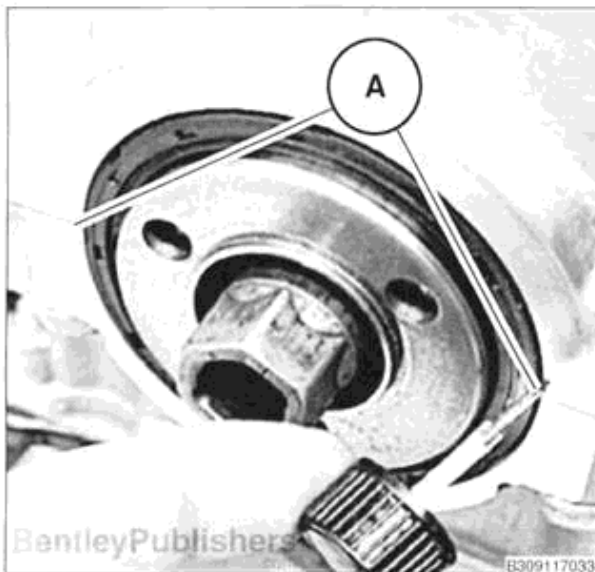


- Place crankshaft seal and installation sleeve over tool and against crankcase opening.
- Plastic sleeve is supplied with seal and is used as installation guide.
 - Make sure seal grooves center on crankcase seam (**arrows**).
 - Coat both grooves on seal with Loctite® 171000 (primer). Allow to dry for approx. 1 minute.



- Use BMW special tools 11 9 231 and 11 9 233 to press in seal.

Crankshaft rear main seal, removing and installing (N52, N54 engine)



- ◀ Use brush to coat seal grooves and crankcase seams (A) with Loctite® 171000 (primer).



- ◀ Use injector kit to fill seal grooves and crankcase seams (A) with Loctite® 128357 (sealant).

- Coat sealed areas with Loctite® 171000 (primer) to bind sealant.
- Reinstall crankshaft vibration damper.

Tightening torque

Vibration damper to vibration damper hub (M8 x 16 mm Torx)	35 Nm (26 ft-lb)
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- Remainder of assembly is reverse of disassembly.

Crankshaft rear main seal, removing and installing (N52, N54 engine)

Crankshaft rear main seal (flywheel seal) replacement requires removal of the transmission and flywheel.

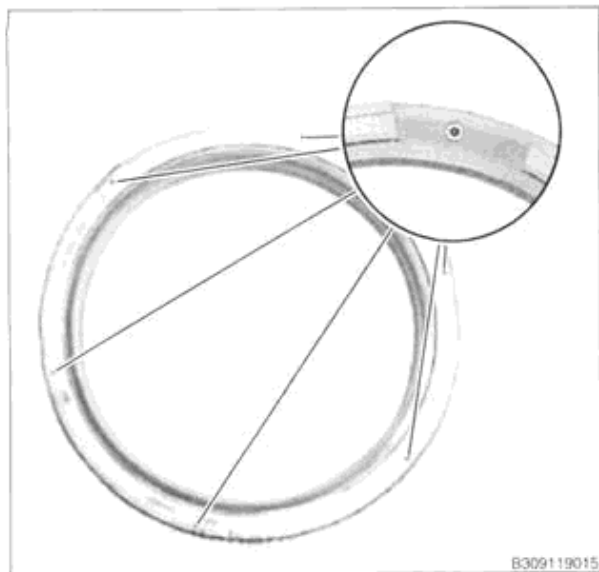
CAUTION—

- When the crankshaft seal is replaced, its grooves and crankcase seams are filled with special Loctite® sealant to avoid oil leaks. Be sure to read the entire procedure before starting work.

- Remove transmission. See 230 Manual Transmission, 231 Sequential Manual Gearbox (SMG) or 240 Automatic Transmission.
- Manual transmission vehicles: Remove clutch pressure plate and disc. See 210 Clutch.

119-18 Lubrication System

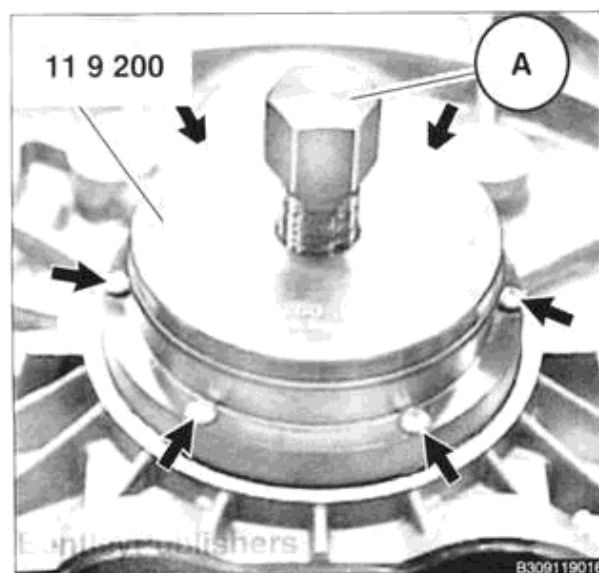
Crankshaft rear main seal, removing and installing (N52, N54 engine)



— Remove flywheel. See **210 Clutch** or **240 Automatic Transmission**.

— Drain engine oil.

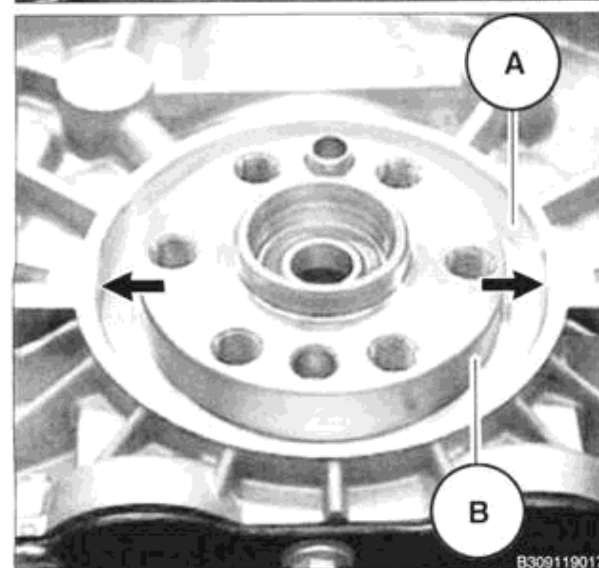
➤ Crankshaft rear main seal has six removal openings (**inset**). If necessary, scrape off rubber coating to expose openings.



➤ Fit BMW seal puller, special tool 11 9 200, to seal.

- Insert sheet metal screws (**arrows**) into seal removal openings. Tighten snugly but do not overtighten.

- Screw in seal remover spindle (**A**) slowly to pull out seal.



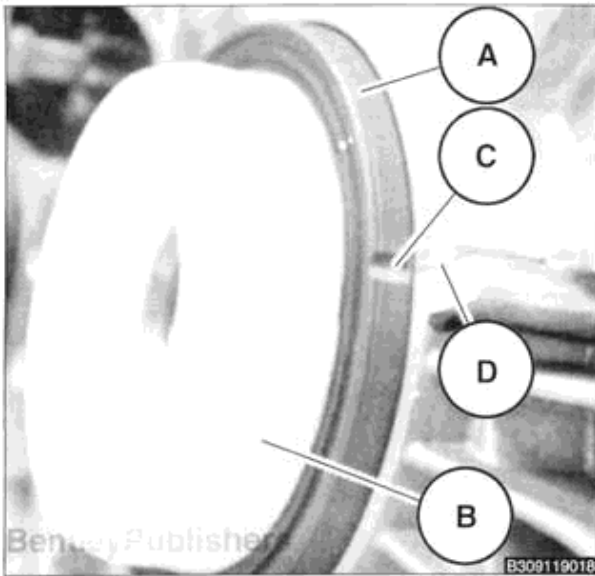
➤ Before installing new seal:

- Clean seal seating surface (**A**).

- Degrease crankcase seams (**arrows**) thoroughly.

- Apply light coat of engine oil to seal lip running surface (**B**) on crankshaft flange.

Crankshaft rear main seal, removing and installing (N52, N54 engine)

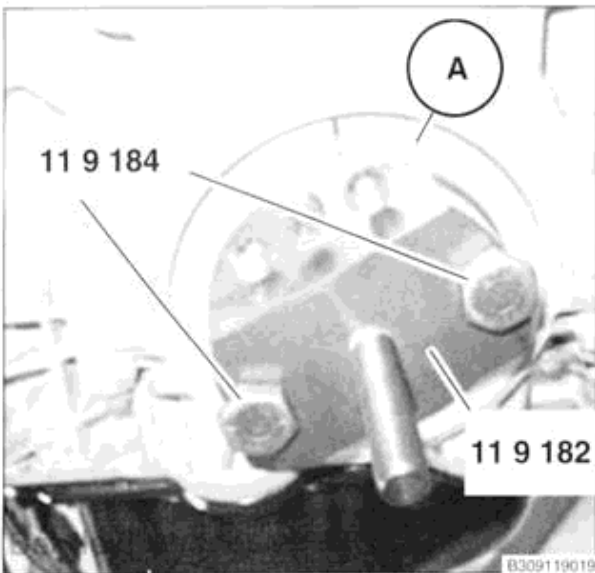


- Place crankshaft seal (A) and installation sleeve (B) against crankcase opening.

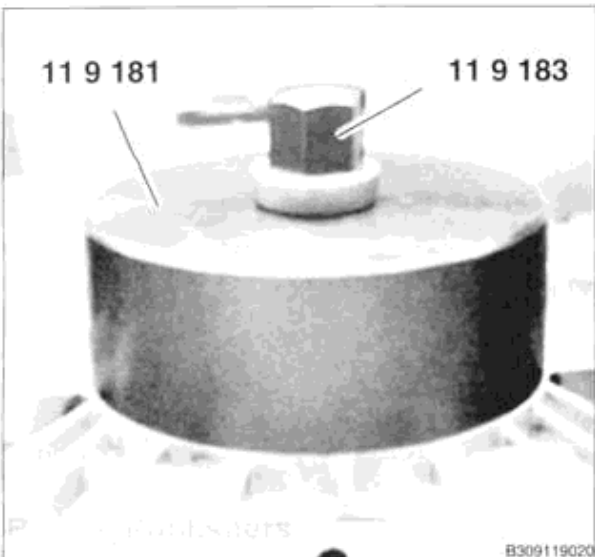
CAUTION—

- Do not kink or damage the sealing lip. Do not touch with fingers.

- Plastic installation sleeve is supplied with seal and is used as installation guide.
- Make sure seal grooves (C) center on crankcase seams (D).
- Coat both grooves on seal with Loctite® 171000 (primer). Allow to dry for approx. 1 minute.
- Press in seal as far as possible by hand, then remove installation sleeve.



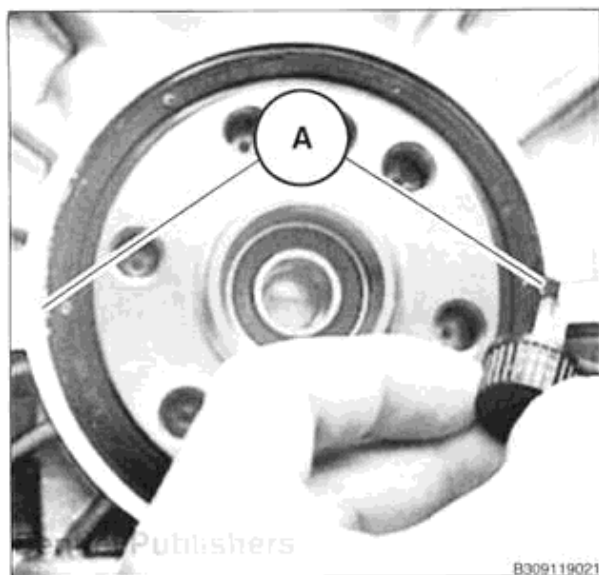
- Fit BMW special tools 11 9 182 and 11 9 184 to crankshaft flange.
- Fit spacer ring (A) over seal. Spacer ring is supplied with seal.



- Use BMW special tools 11 9 181 and 11 9 183 to press in seal.
- Remove special tools and spacer ring.

119-20 Lubrication System

Crankshaft rear main seal, removing and installing (N52, N54 engine)



- ◀ Use brush to coat seal grooves and crankcase seams (A) with Loctite® 171000 (primer).



- ◀ Use injector kit to fill seal grooves and crankshaft seams (A) with Loctite® 128357 (sealant).
- Coat sealed areas with Loctite® 171000 (primer) to bind sealant.
 - Remainder of assembly is reverse of disassembly.
 - Install flywheel, clutch or torque converter and transmission.
 - Fill engine with oil.
 - Run engine and check for leaks.

CRANKSHAFT SEALS (V8 ENGINE)

Crankshaft front seal, removing and installing (V8 engine)

WARNING—

- To avoid personal injury, be sure the engine is cold before beginning the procedure.

CAUTION—

- Be sure to read the entire procedure before starting work.

- Raise vehicle and support safely.

WARNING—

- Make sure the vehicle is stable and well supported at all times. Use a professional automotive lift or jack stands designed for the purpose. A floor jack is not adequate support.

- Remove splash shield underneath engine. See **020 Maintenance**.
- Remove engine accessory belt. See **020 Maintenance**.
- Remove vibration damper (front pulley). See **117 Camshaft Timing Chain**.



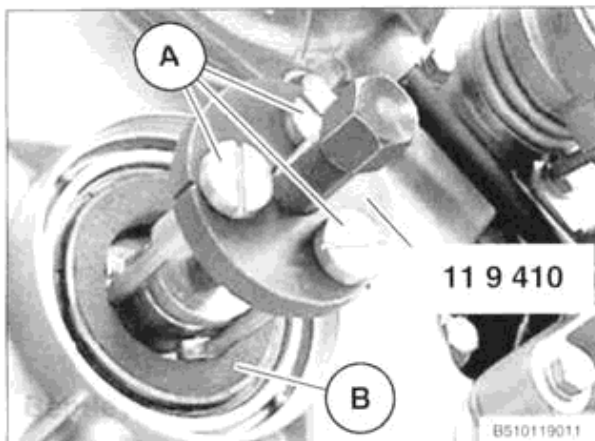
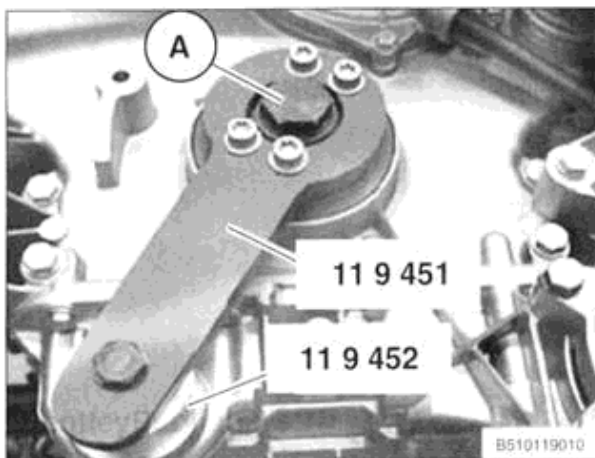
Working at front of engine:

- Install BMW special tool 11 9 451 to vibration damper hub and BMW special tool 11 9 452 to oil sump.
- Remove vibration damper hub bolt (A) and discard.
- Remove vibration damper hub.



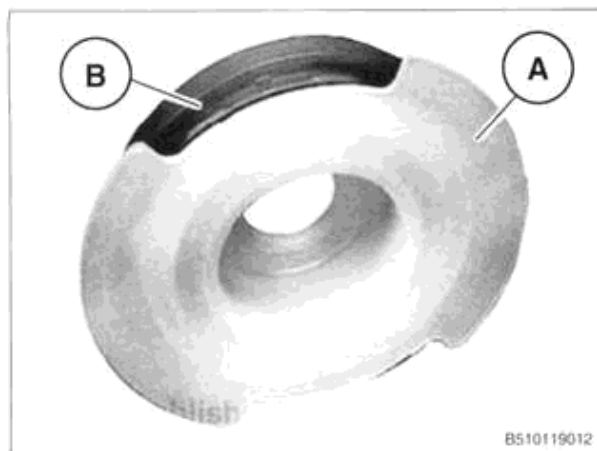
Install BMW special tool 11 9 410 onto crankshaft. Rotate puller levers (A) to grab behind crankshaft seal (B).

- Tighten center bolt of BMW special tool 11 9 410 and remove crankshaft seal (B).



119-22 Lubrication System

Crankshaft front seal, removing and installing (V8 engine)

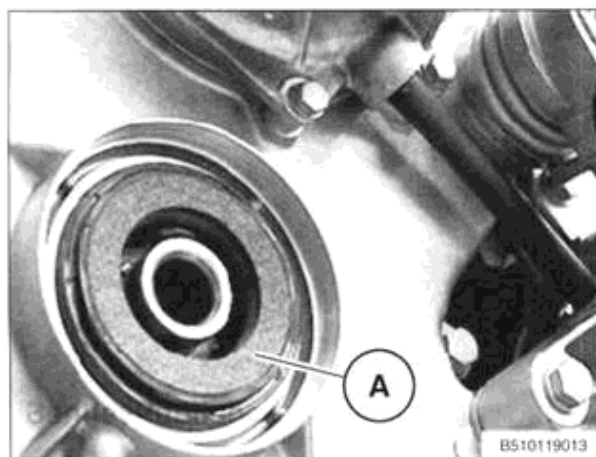


- A support sleeve (A) is included with a new crankshaft seal. The support sleeve remains in crankshaft seal until installation. Do not remove prior to installation.

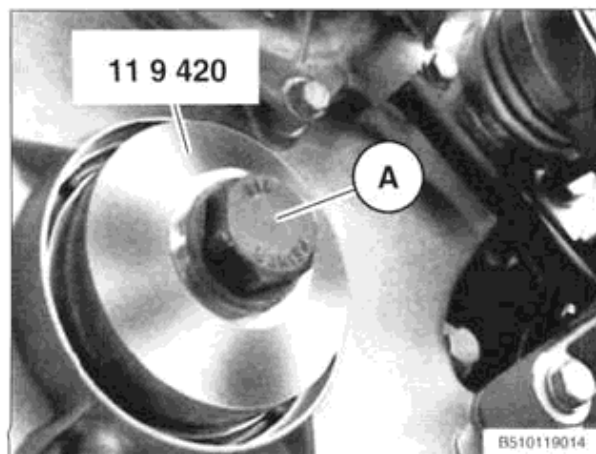
CAUTION—

- Do not touch the sealing lip with your fingers it is highly sensitive and is easily kinked.

- Remove support sleeve from crankshaft seal.



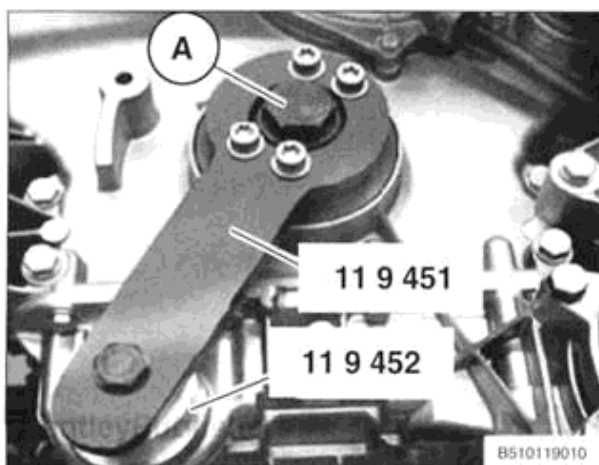
- Place crankshaft seal (A) into timing cover by hand.



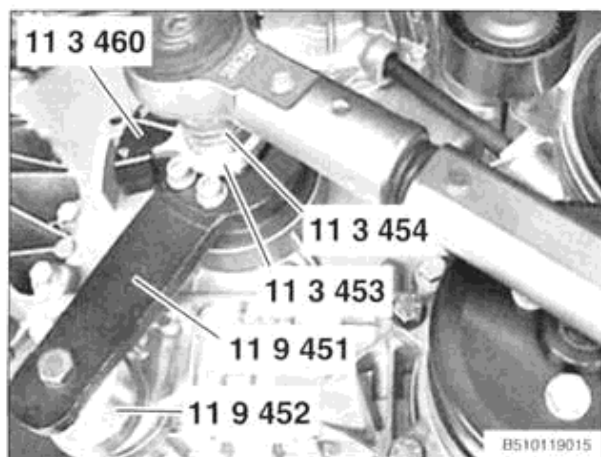
- Using BMW special tool 11 9 420, turn hex (A) to press crankshaft seal into timing cover until it is flush.

- Install vibration damper hub by hand on crankshaft.

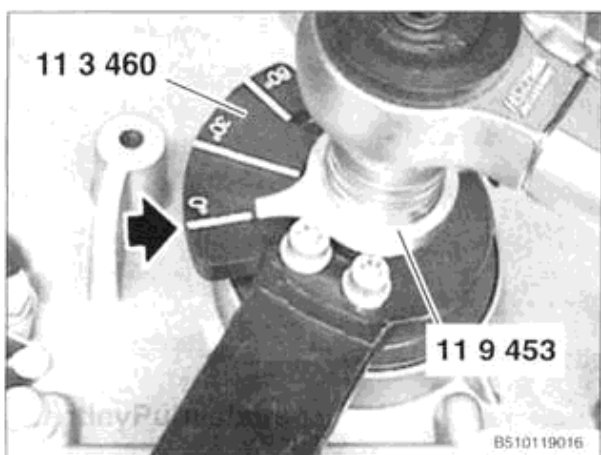
Crankshaft front seal, removing and installing (V8 engine)



- Install BMW special tool 11 9 451 to vibration damper hub and BMW special tool 11 9 452 to oil sump.



- Install BMW special tool 11 3 460 to end of crankshaft.



- Place pointer on BMW special tool 11 3 454 to 0° (arrow).

- Tighten damper bolt to specified torque and angle.

Tightening torque

Vibration damper hub to crankshaft
(replace bolt) (M18 x 1.5)

- Stage 1
- Stage 2
- Stage 3
- Stage 4

100 Nm (73.7 ft-lb)
Additional 60°
Additional 60°
Additional 60°

- Remainder of assembly is reverse of disassembly.

- Install vibration damper.
- Fill engine with oil.
- Run engine and check for leaks.

119-24 Lubrication System

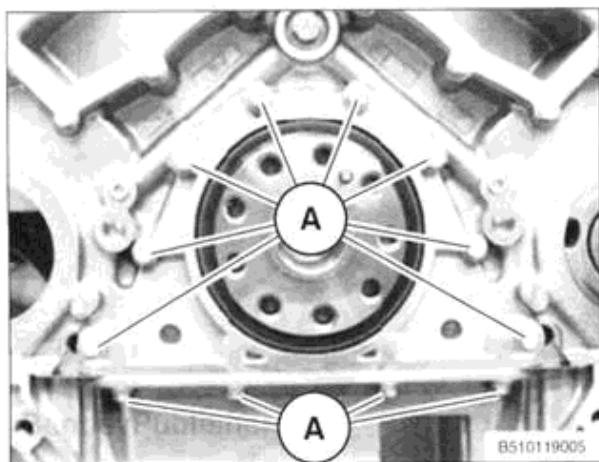
Crankshaft rear main seal, removing and installing (V8 engine)

Crankshaft rear main seal, removing and installing (V8 engine)

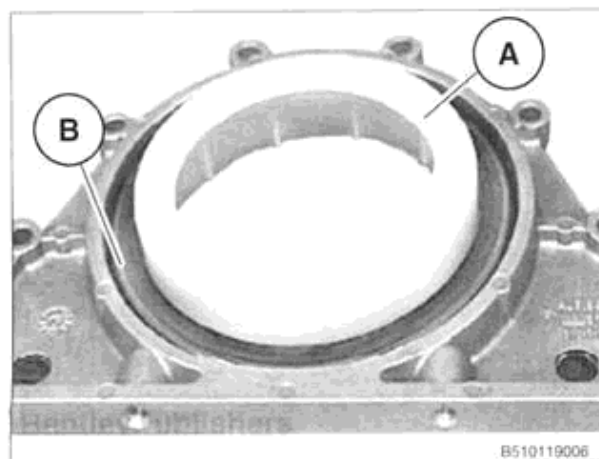
Crankshaft rear main seal (flywheel seal) replacement requires removal of the transmission and flywheel. Crankshaft rear main seal is integral part of rear cover.

- Remove transmission. See **230 Manual Transmission**, **231 Sequential Manual Gearbox (SMG)** or **240 Automatic Transmission**.
- Manual transmission vehicles: Remove clutch pressure plate and disc. See **210 Clutch**.
- Remove flywheel. See **210 Clutch** or **240 Automatic Transmission**.
- Drain engine oil.

➤ Working at rear of engine block, remove fasteners (A).



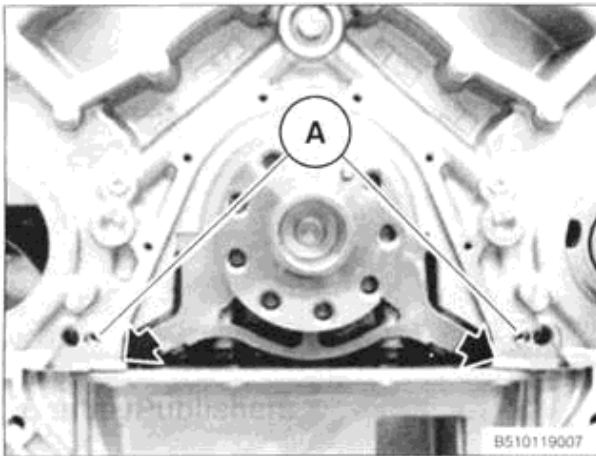
➤ A support sleeve (A) is included with new crankshaft rear main seal. The sleeve remains in crankshaft rear main seal during installation.



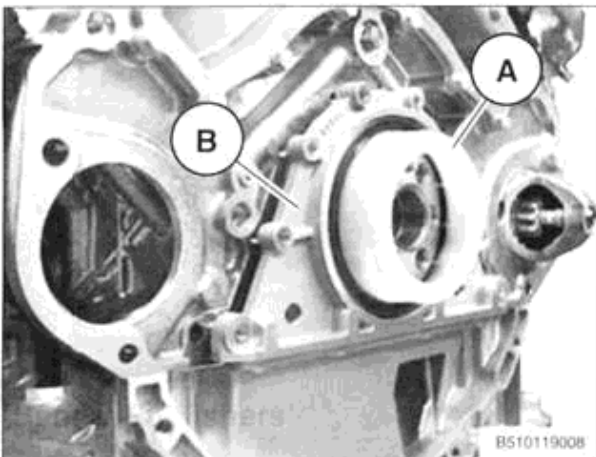
CAUTION—

- Do not touch the sealing lip with your fingers. It is highly sensitive and is easily kinked.

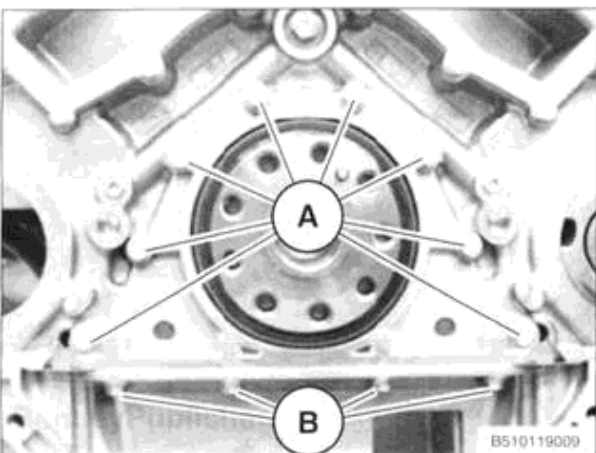
Crankshaft rear main seal, removing and installing (V8 engine)



- ◀ Inspect cover alignment dowels (A) for correct installation. Keep sealing area free from oil (arrows).



- ◀ Lightly oil crankshaft. Place cover (B) and support sleeve (A) over crankshaft and carefully push on.



- ◀ When installing:
 - Install fasteners (A) finger tight
 - Install fasteners (B) finger tight
 - Tighten fasteners (A).
 - Tighten fasteners (B).
- Remainder of assembly is reverse of disassembly.
 - Install flywheel, clutch or torque converter and transmission.
 - Fill engine with oil.
 - Run engine and check for leaks.

119-26 Lubrication System

Oil pan, removing and installing (M54 engine)

OIL PAN AND OIL PUMP (M54 ENGINE)

Oil pan, removing and installing (M54 engine)

- Disconnect negative (-) battery cable.

CAUTION—

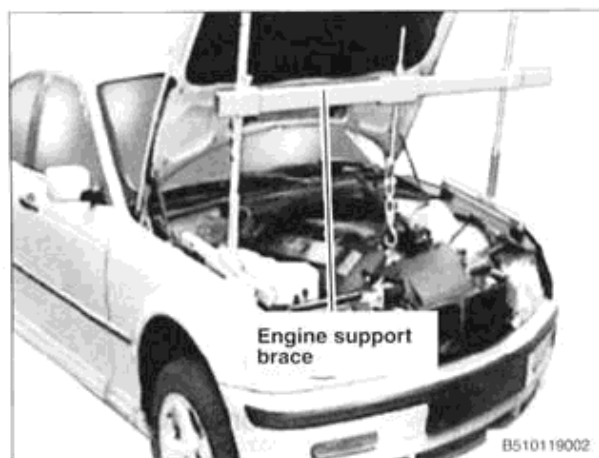
- Prior to disconnecting the battery, read the battery disconnection cautions in **001 Warnings and Cautions**.

- Remove air filter housing. See **130 Fuel Injection**.
- Raise engine hood into assembly position. See **410 Fenders, Engine Hood**.
- Raise car and support safely.

WARNING—

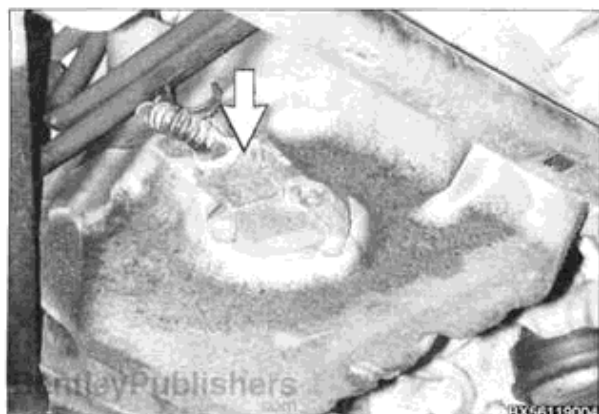
- Make sure the car is stable and well supported at all times. Use a professional automotive lift or jack stands designed for the purpose. A floor jack is not adequate support.

- Drain engine oil. See **020 Maintenance**.
- Remove dipstick guide pipe.
- Remove splash shield and front end reinforcement from under engine.
- Install engine support brace across engine bay. Raise engine slightly to release load on engine mounts.
- Working underneath engine, remove right and left engine mount upper nuts (**arrow**).
- Lower front subframe. See **310 Front Suspension**.

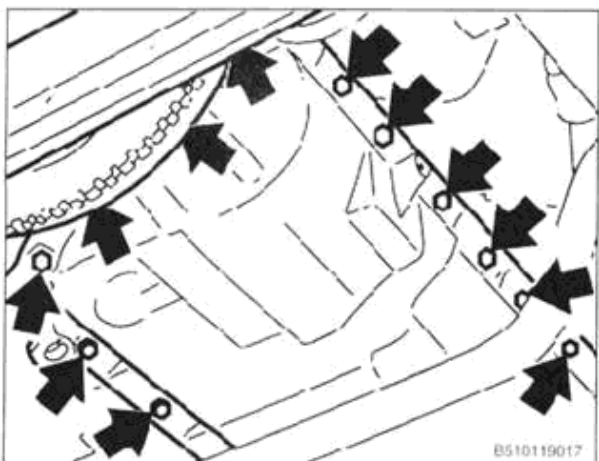


Lubrication System 119-27

Oil pan, removing and installing (M54 engine)



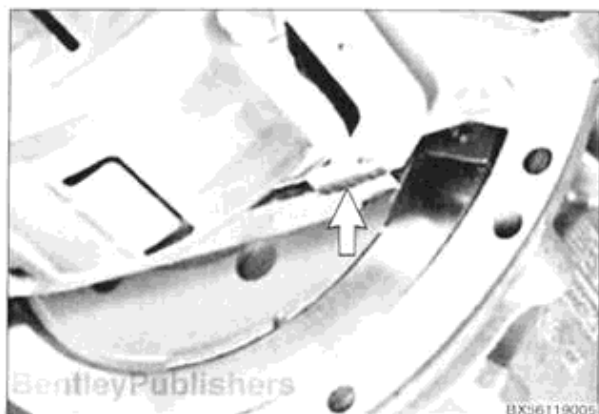
- Detach electrical harness connector (**arrow**) at oil level sensor.
- Automatic transmission: Disconnect transmission oil cooler lines from transmission and oil pan.



- Remove oil pan screws. Slide oil pan backward to remove.

CAUTION—

- If the oil pan does not separate easily from the engine cylinder block, tap lightly with a rubber mallet to break it free. Do not use prying tools.



- Clean sealing surface of engine block, then apply beads of 3-Bond® 1209 or equivalent approx. 3 mm high and 2 mm wide (**arrow**) to timing cover and rear main seal carrier seams.
- When reinstalling oil pan:
 - Thoroughly clean old gasket material from oil pan sealing surface and use a new gasket.
 - Insert oil pan bolts.
 - Tighten front oil pan bolts first.
 - Tighten transmission bellhousing bolts last.
- Remainder of installation is reverse of removal. Fill engine with oil, run engine and check for leaks.

CAUTION—

- Follow correct installation procedure for front end reinforcement in 310 Front Suspension.

NOTE—

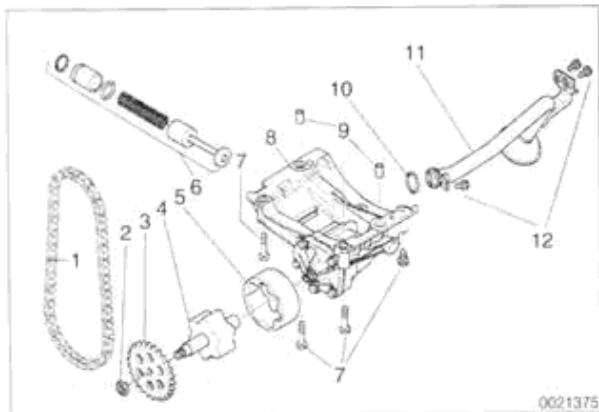
- It is not necessary to realign the front end after this procedure.

119-28 Lubrication System

Oil pump, removing and installing (M54 engine)

Oil pump, removing and installing (M54 engine)

The M54 engine oil pump is located on the underside of the engine block, inside the oil pan. It is driven by the crankshaft via chain and sprocket assembly. To remove the oil pump, lower the front suspension and remove the oil pan. Read the procedure through before starting work.



6-cylinder engine oil pump assembly:

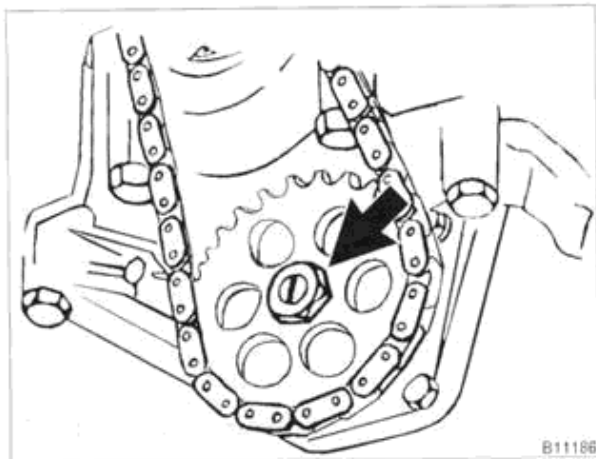
1. Drive chain
2. M10 x 1 nut (left hand threads)
 - tighten to 25 Nm (18 ft-lb)
3. Oil pump sprocket
4. Inner pump rotor
5. Outer pump rotor
6. Pressure relief valve
7. M8 bolt
 - tighten to 23 Nm (17 ft-lb)
8. Oil pump housing
9. Locating dowels
10. Pick-up tube sealing O-ring
11. Pick-up tube
12. Pickup tube mounting bolts (M6)
 - Tighten to 10 Nm (7 ft-lb)

— Remove oil pan. See **Oil pan, removing and installing (M54 engine)** in this repair group.

Remove oil pump sprocket mounting nut (arrow).

CAUTION—

• Oil pump sprocket nut has left hand threads. Turn clockwise to loosen.



- Lift sprocket off pump together with drive chain.
- Unbolt oil pump from engine block.
 - Remove oil pump pick-up tube bolts and remove pick-up tube before removing pump.
 - Remove mounting bolts from oil pump. Withdraw pump.
 - Be sure to record location of spacers between pump and engine block, if applicable.
- Spin oil pump shaft and check that gears turn smoothly. Replace pump if gears spin with difficulty.
- Inspect oil pressure relief valve. See **Oil pressure relief valve (M54 engine)** in this repair group.

- Installation is reverse of removal, noting the following:
 - Inspect pump locating dowels for damage and correct positioning.
 - Replace oil pick-up and return tube sealing O-rings.
 - Align sprocket splines to oil pump shaft splines before tightening sprocket nut.

CAUTION—

- Oil pump sprocket nut has left hand threads. Turn counterclockwise to tighten.

Tightening torques

Oil pump sprocket to oil pump shaft (M10 x 1) (left hand thread)	25 Nm (18 ft-lb)
Oil pump to crankcase (M8)	23 Nm (17 ft-lb)

- Fill engine with oil, run engine and check for leaks.

Oil pressure relief valve (M54 engine)

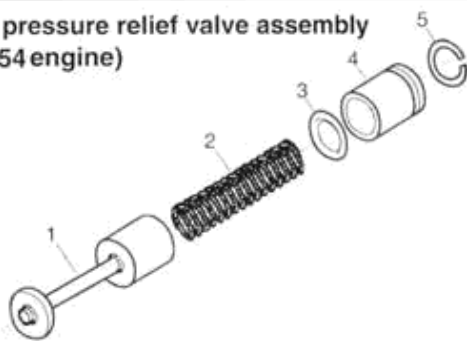
- Remove oil pump. See **Oil pump, removing and installing (M54 engine)**. The oil pump pressure relief valve is held in the side of the oil pump with a circlip.

- ◀ Inspect oil pump relief valve components and bore for scoring or other damage.

1. Control plunger
2. Spring
3. Sealing O-ring
4. Sleeve
5. Circlip

- Install using a new circlip.

**Oil pressure relief valve assembly
(M54 engine)**



0021074



The first part of the paper discusses the importance of understanding the cultural context of the research. It highlights the need for researchers to be sensitive to the values and beliefs of the communities they are studying. This is particularly important in the field of education, where cultural differences can significantly impact learning outcomes. The paper then moves on to discuss the challenges of conducting research in culturally diverse settings. It notes that researchers often face difficulties in finding appropriate research methods and in interpreting the data they collect. To address these challenges, the paper suggests that researchers should adopt a more flexible and open-minded approach to their research. This involves being willing to learn from the community and to adapt their research methods as needed. The paper also emphasizes the importance of building trust and rapport with the community. This is essential for ensuring that the research is conducted in a respectful and ethical manner. Finally, the paper concludes by noting that while there are many challenges to conducting research in culturally diverse settings, it is also an opportunity to gain valuable insights into the lives of people from different cultures. By taking the time to understand and appreciate these differences, researchers can make a significant contribution to the field of education and to the well-being of the communities they study.