ENGINE

Engine - Repair Instructions - 128i

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
- Diarrhea
- 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:

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- Impaired sight
- Irritation of the eyes
- Reddening of the skin
- Rough and cracked skin

Protective measures/rules of conduct:

- Wear protective goggles
- Wear oil-resistant protective gloves
- Observe country-specific safety regulations

First aid measures:

- **Eye contact:** Rinse eyes immediately with plenty of water for at least 15 minutes; if available, use an eye-rinsing bottle. If irritation of the eyes persists, consult a doctor.
- **Skin contact:** Wash off with soap and water immediately. If irritation persists, consult a doctor.

NOTE: Do not use solvents/thinners.

00 SAFETY INSTRUCTIONS FOR HANDLING OIL

WARNING: Danger of poisoning if oil is ingested/absorbed through the skin! Risk of injury if oil comes into contact with eyes and skin!

Recycling:

Observe country-specific waste-disposal regulations.

Measures if oil is unintentionally released:

- **Personal precautionary measures:** Danger of slipping! Keep non-involved persons away from the work area. Wear personal protective clothing/equipment.
- **Environmental protection measures:** Prevent oil from draining into drain channels, sewerage systems, pits, cellars, water and the ground.
- **Limiting spread:** Use oil blocks to prevent the surface spread of oil.
- **Cleaning procedure:** Bind and dispose of escaped oil with nonflammable absorbents.

NOTE: Do not flush oil away with water or aqueous cleaning agents.

11 00 REMOVING AND INSTALLING/REPLACING ACOUSTIC COVER (N51)

Necessary preliminary tasks:

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- **Remove microfilter housing** . See **64 31 092 REMOVING AND INSTALLING/REPLACING MICROFILTER HOUSING (LOWER SECTION)** .

Unfasten screws.

Tightening torque. See 11 12 6AZ in **CYLINDER HEAD WITH COVER** .

Remove acoustic cover (1).

NOTE: For purposes of improved clarity, illustration and descriptions shows wiring harness and tension strut removed.

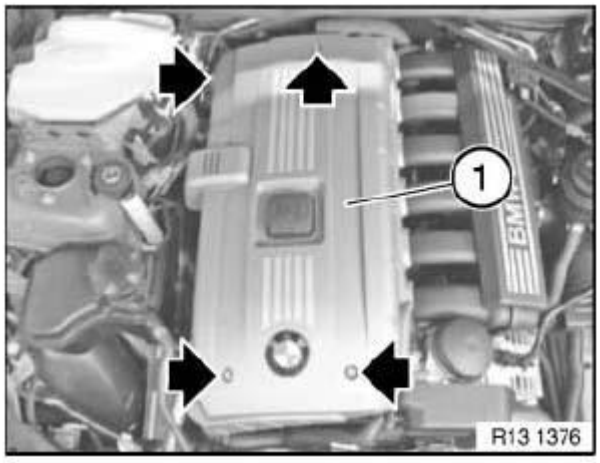


Fig. 1: Locating Acoustic Cover
Courtesy of BMW OF NORTH AMERICA, INC.

11 00 050 REMOVING AND INSTALLING ENGINE (N51)

Special tools required:

- **11 0 020** . See **ENGINE - SPECIAL TOOLS (N51)** .

IMPORTANT: Aluminum-magnesium materials. No steel screws/bolts may be used due to the threat of electrochemical corrosion. A magnesium crankcase requires aluminum screws/bolts exclusively. Aluminum screws/bolts must be replaced each time they are released . Aluminum screws/bolts are permitted with and without color coding (blue). For reliable identification: Aluminum screws/bolts are not magnetic . Jointing torque and angle of rotation must be observed without fail (risk of damage) .

Necessary preliminary tasks:

- Lift engine hood into **assembly position** . See **51 00... SERVICE POSITION OF ENGINE HOOD/BONNET** .

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- Remove exhaust system. See **18 00 020 REMOVING AND INSTALLING/REPLACING COMPLETE EXHAUST SYSTEM (N52/N52K/N51)** .
- Remove transmission. See **23 00 017 REMOVING AND INSTALLING TRANSMISSION (GS6-17BZ) N51/N52/N52K/N53** or **24 00 032 REMOVING AND INSTALLING AUTOMATIC TRANSMISSION (GA6L45R)** .
- Drain engine oil.
- Disconnect negative battery lead.
- Remove air cleaner housing. See **13 71 000 REMOVING AND INSTALLING/REPLACING INTAKE FILTER HOUSING (N51)** .
- Remove fan cowl with electric fan. See **17 11 035 REMOVING AND INSTALLING/REPLACING FAN COWL WITH ELECTRIC FAN (N51)** .
- Remove radiator. See **17 11 000 REMOVING AND INSTALLING RADIATOR (N51, S65)** .
- Remove **water pump** . See **11 51 000 REMOVING AND INSTALLING/REPLACING WATER PUMP (N51)**.
- Remove thermostat. See **11 51 000 REMOVING AND INSTALLING/REPLACING WATER PUMP (N51)**.
- Detach all coolant hoses from engine.
- Remove left and right **fresh air duct** . See **51 13 115 REMOVING AND INSTALLING/REPLACING COWL PANEL COVER** .
- Remove intake air manifold. See **11 61 050 REMOVING AND INSTALLING INTAKE AIR MANIFOLD (N51)**.
- Detach vacuum line from brake booster.
- Unfasten ignition wiring harness and lay to one side. See **12 51 100 REPLACING WIRING HARNESS SECTION FOR IGNITION COIL (N52K, N51)** .
- Unfasten engine wiring harness and lay to one side. See **12 51 001 REPLACING WIRING HARNESS SECTION FOR ENGINE (N52K, N51)** .
- Remove fuel injector rail and place to one side. See **13 53 240 REPLACING COMPLETE INJECTION PIPE (N52/N52K)** .

Release air-conditioning compressor (1) and set down on front axle carrier. See **Fig. 2**.

IMPORTANT: A/C lines are pressurized. Do not disconnect A/C lines.

Do **not** disconnect coolant pipe from crankcase.

NOTE: Illustrations show E60.

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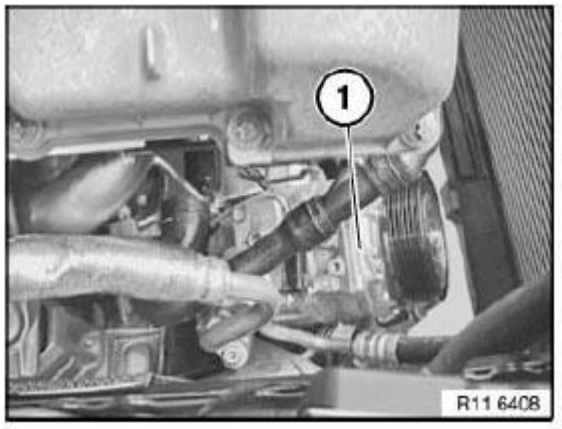


Fig. 2: Identifying Air Conditioning Compressor
Courtesy of BMW OF NORTH AMERICA, INC.

Release power steering pump (1) and set down on front axle carrier. See **Fig. 3**.

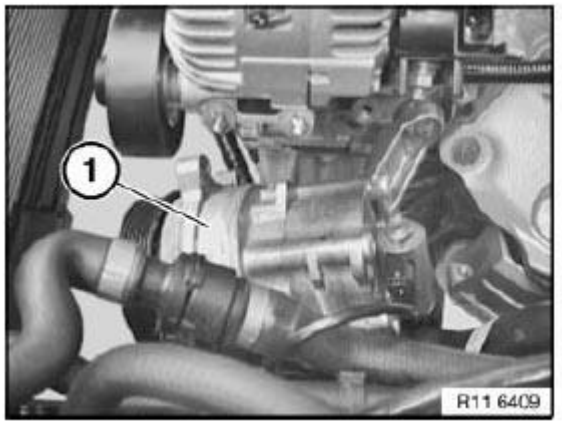


Fig. 3: Identifying Power Steering Pump
Courtesy of BMW OF NORTH AMERICA, INC.

11 00 670 SECURING ENGINE IN INSTALLATION POSITION

Special tools required:

For the following special tools, refer to **MAINTENANCE AND GENERAL INFORMATION - SPECIAL TOOLS -- 128I** .

- **00 0 200**
- **00 0 202**
- **00 0 204**
- **00 0 208**
- **11 0 000** . See **ENGINE - SPECIAL TOOLS (N51)** .

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WARNING: Risk 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** . See **51 00... SERVICE POSITION OF ENGINE HOOD/BONNET** .
- Remove **intake filter housing** . See **13 71 000 REMOVING AND INSTALLING/REPLACING INTAKE FILTER HOUSING (N51)** .

Assemble transverse member 00 6 000 with special tools:

- 00 6 051 (profile strips)
- 00 6 070 (supports)
- 00 6 052 (supports)
- 00 6 031 (connections)

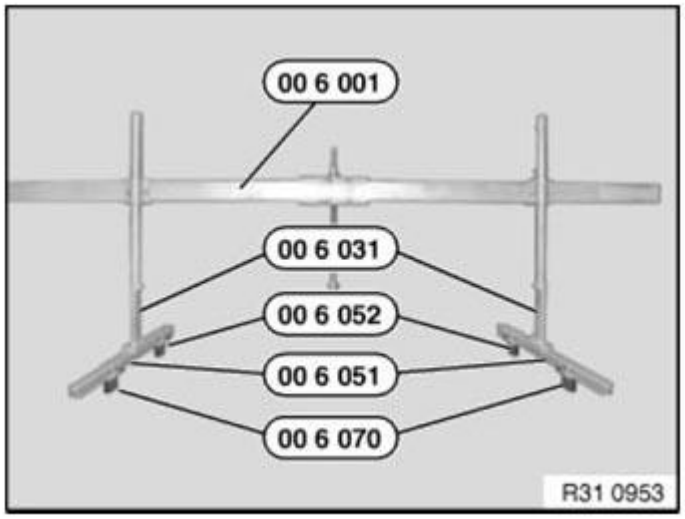


Fig. 4: Identifying Profile Strips (00 6 051), Supports (00 6 070), And Connections (00 6 031)
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: Use towing hook (72 15 8 108 670).

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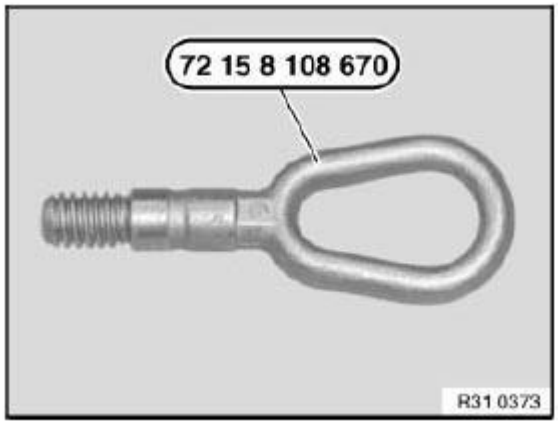


Fig. 5: Identifying Towing Hook (72 15 8 108 670)
Courtesy of BMW OF NORTH AMERICA, INC.

IMPORTANT: Avoid a change of engine position in the transverse or longitudinal direction. Always make sure there is sufficient clearance between the engine (or its attachment parts) and the body.

IMPORTANT: For N51, N52, N52K: Aluminum magnesium materials. No steel screws/bolts may be used due to the threat of electrochemical corrosion. A magnesium crankcase requires aluminum screws/bolts exclusively. Aluminum screws/bolts must be replaced each time they are released. Aluminum screws/bolts are permitted with and without color coding (blue). For reliable identification: Aluminum screws/bolts are not magnetic. Jointing torque and angle of rotation must be observed without fail (risk of damage).

Release front screws (1) on acoustic cover (2). Tightening torque for N51: **11 12 6AZ**

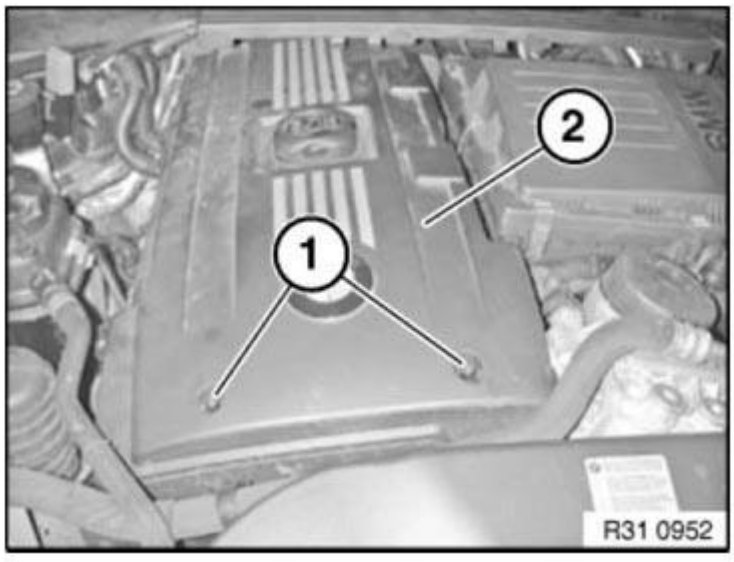


Fig. 6: Identifying Acoustic Cover With Mounting Screws

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Courtesy of BMW OF NORTH AMERICA, INC.

Raise acoustic cover (1) slightly. Screw in towing hook (2) and tighten down to approx. 30 Nm.

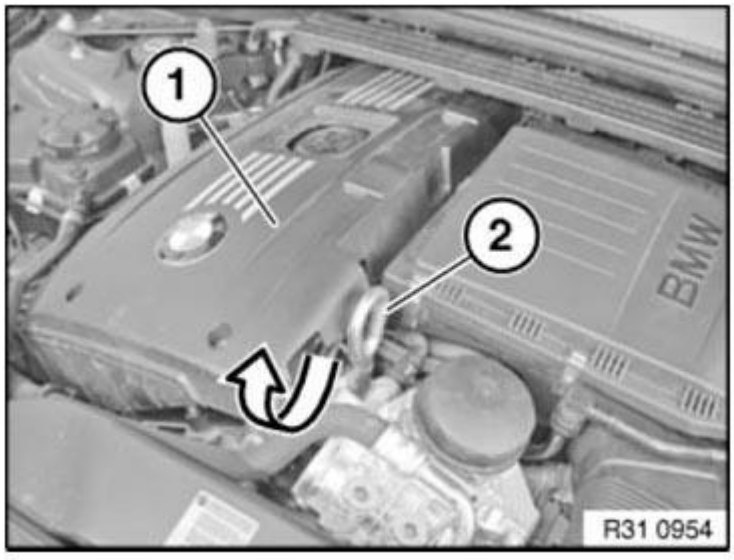


Fig. 7: Lifting Acoustic Cover
Courtesy of BMW OF NORTH AMERICA, INC.

Unscrew bolt (1), then loosen screw (2). Fold up headlight bracket (3). Screw (1): Tightening torque **63 12 12AZ** . Screw (2): Tightening torque: **63 12 3AZ.**

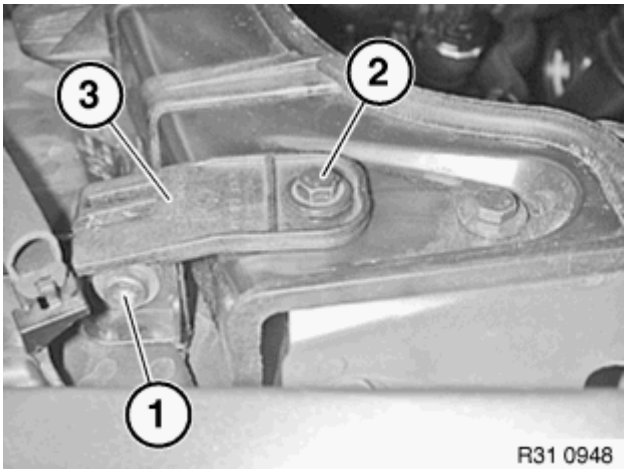


Fig. 8: Removing Headlight Bracket
Courtesy of BMW OF NORTH AMERICA, INC.

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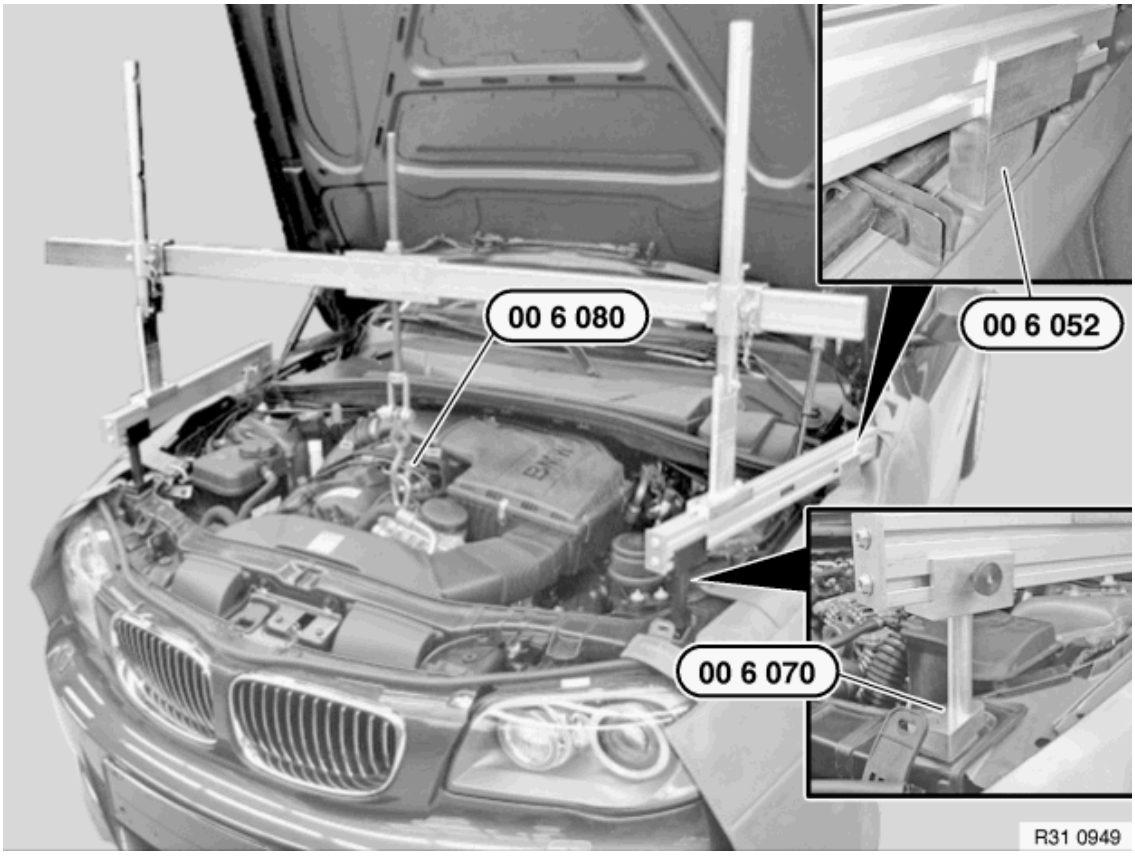


Fig. 9: Fixing Special Tool In Engine Compartment
Courtesy of BMW OF NORTH AMERICA, INC.

IMPORTANT: Risk of damage! Fit transverse member 00 6 000 with a 2nd person helping. Place supports in front in the area of front panel attachment and in the rear on the fasteners of the side panels. Bolt connections of transverse member 00 6 001 must point to windscreen.

Adapt bevel of special tool 00 6 052 to inclination of side panels. Special tool 00 6 070 consists of a left and right support. Secure chain with coat hook 00 6 080 to spindle 00 6 002 and align centrally over towing hook. Attach special tool to towing hook.

WARNING: Risk of injury! Tighten down all adjusting screws and nuts on transverse member 00 6 000.

Unscrew nuts (1). Raise engine approx. 10 mm with transverse member.

Installation: Replace self-locking nuts. Tightening torque 22 11 2AZ. Check vacuum lines of engine mounts for correct position and connection.

WARNING: Risk of injury! Tighten down all adjusting screws and nuts on transverse member 00 6 000.

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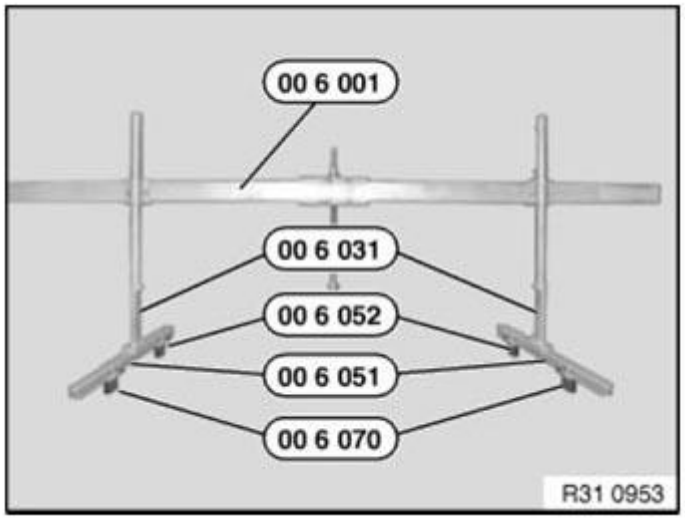


Fig. 10: Identifying Profile Strips (00 6 051), Supports (00 6 070), And Connections (00 6 031)
Courtesy of BMW OF NORTH AMERICA, INC.

Unscrew nuts (1).

Raise engine approx. 10 mm with cross member.

Installation:

Replace self-locking nuts.

Tightening torque. See 22 11 2AZ in **22 11 ENGINE SUSPENSION** .

Check vacuum lines of engine mounts for correct position and connection.

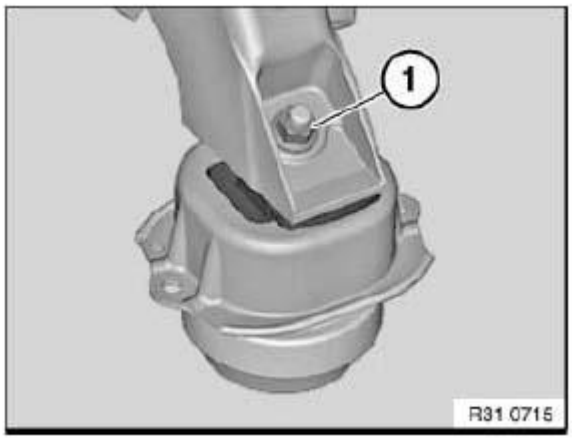


Fig. 11: Identifying Crossmember Nut
Courtesy of BMW OF NORTH AMERICA, INC.

11 00 SERVICE - ENGINE OIL (N51)

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WARNING: Risk of scalding! Carry out work on the vehicle only when wearing oil- and heat-resistant protective gloves incl. forearm protection, face guard and protective apron.

IMPORTANT: Carry out the engine oil service only when the engine is at operating temperature. Observe the exact engine oil filling capacity. Overfilling the engine with engine oil will result in engine damage. Checking and drip-off times (at least 10 minutes) must be observed.

IMPORTANT: Risk of damage! Protect belt drive against dirt. Cover with suitable materials.

Recycling: Catch and dispose of drained engine oil in a suitable collecting vessel. Observe country-specific waste disposal regulations.

Release oil filter cover with special tool **11 9 240** . Tightening torque **11 42 1AZ** .

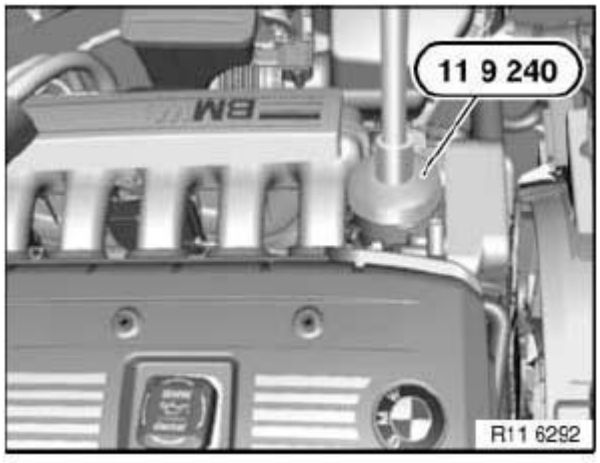


Fig. 12: Identifying Special Tool (11 9 240)
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: Engine oil flows out of the oil filter housing and back into the oil sump.

NOTE: Presentation: without underbody protection or reinforcement plate (AWD = four-wheel drive).

Unclip sensor opening on underbody protection or reinforcement plate. Remove screw plug (1) from oil sump and drain engine oil. Tightening torque **11 13 1AZ** .

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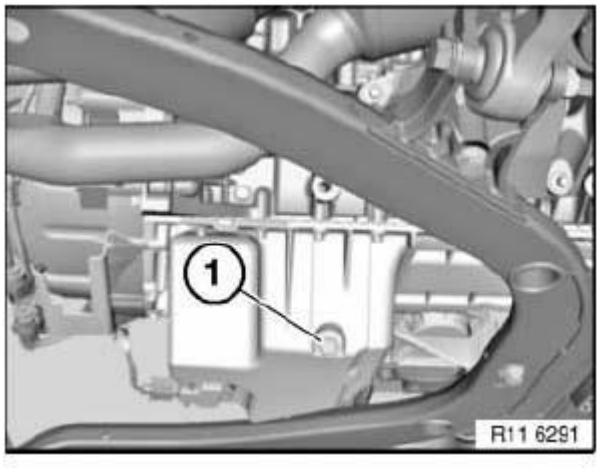


Fig. 13: Identifying Engine Oil Drain Plug
Courtesy of BMW OF NORTH AMERICA, INC.

Installation note: Replace sealing ring.

Remove and insert oil filter element (1) in direction of arrow.

Installation note: Replace oil filter element (1) and sealing ring (2). Replace gasket (3) and renew if necessary.

NOTE: Moisten sealing ring (2, 3) with engine oil.

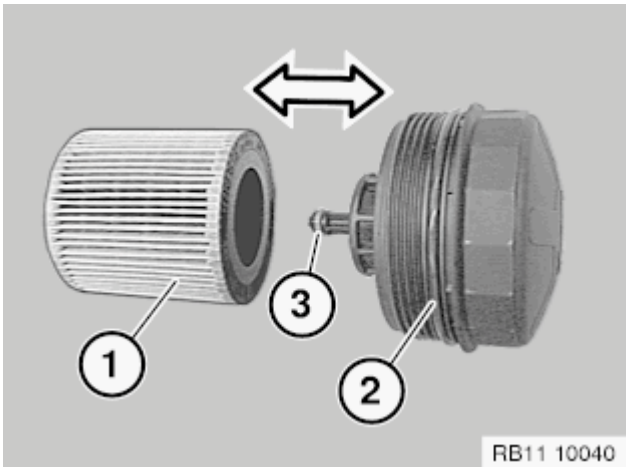


Fig. 14: Identifying Oil Filter Element And Sealing Ring
Courtesy of BMW OF NORTH AMERICA, INC.

Secure oil filter cover with special tool 11 9 240. Tightening torque **11 42 1AZ** .

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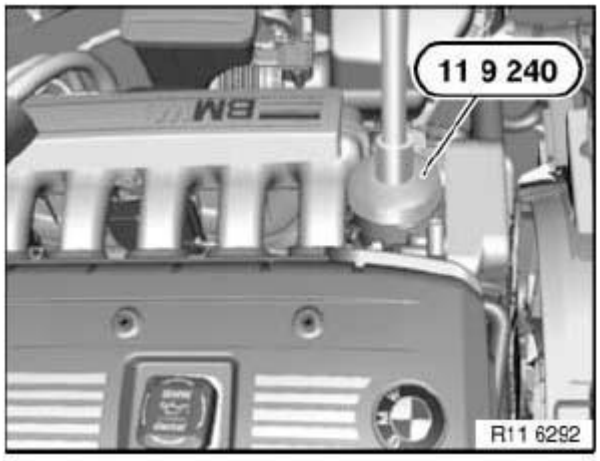


Fig. 15: Identifying Special Tool (11 9 240)
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: Pour in engine oil.

Start engine and run at idle until oil pressure indicator light goes out. Switch off engine Check oil filter cover and screw plug on oil sump for leaks. Assemble engine.

Checking engine oil level:

- Park vehicle on a horizontal surface
- Allow engine to run at operating temperature for three minutes with increased engine speed (approx. 1100 RPM)
- Read off engine oil level in instrument panel or on Control Display
- Top up engine oil if necessary

ENGINE IDENTIFICATION

Drive in engine numbers at marked surface with impact tool.

M47 / M47TU / M47T2

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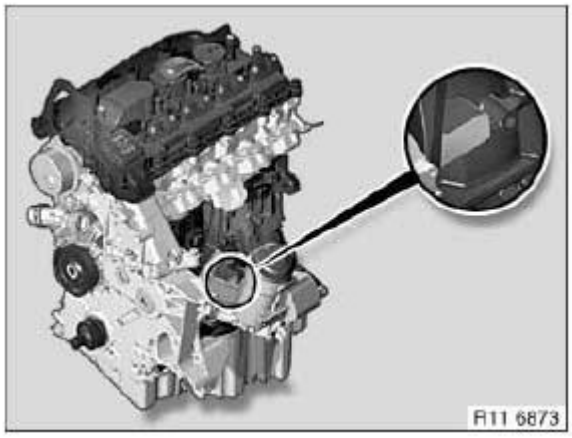


Fig. 16: Identifying Engine Number (M47/M47TU/M47T2)
Courtesy of BMW OF NORTH AMERICA, INC.

M57 / M57TU / M57T2

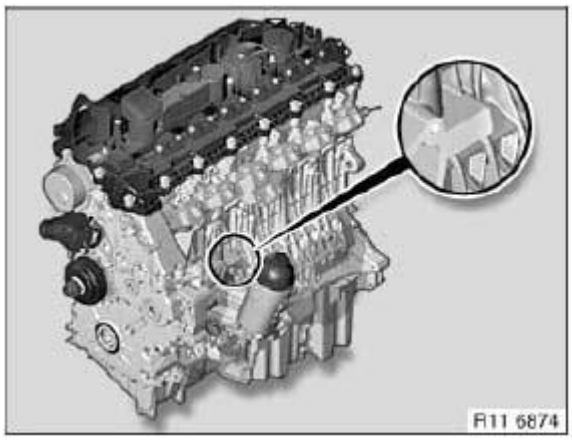


Fig. 17: Identifying Engine Number (M57 / M57TU / M57T2)
Courtesy of BMW OF NORTH AMERICA, INC.

M67 / M67TU

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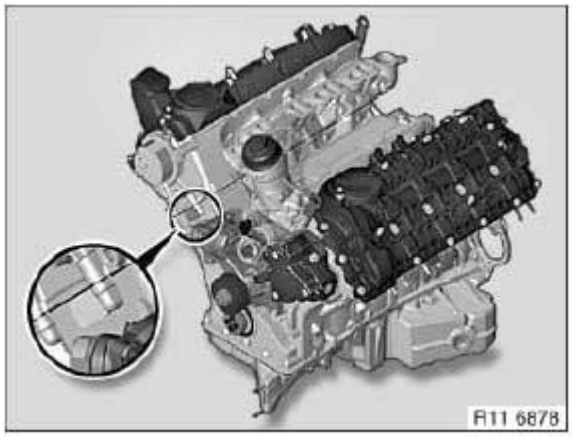


Fig. 18: Identifying Engine Number (M67/M67TU)
Courtesy of BMW OF NORTH AMERICA, INC.

N47 / N47S

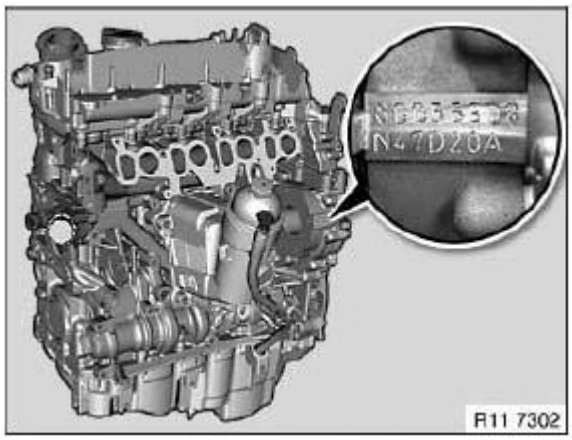


Fig. 19: Identifying Engine Number (N47 / N47S)
Courtesy of BMW OF NORTH AMERICA, INC.

M52 / M52TU

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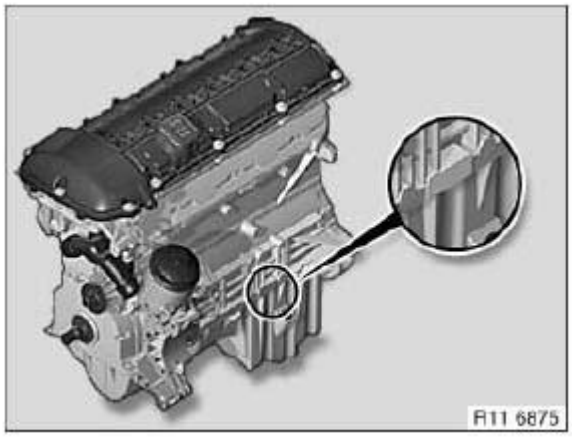


Fig. 20: Identifying Engine Number (M52 / M52TU)
Courtesy of BMW OF NORTH AMERICA, INC.

M54

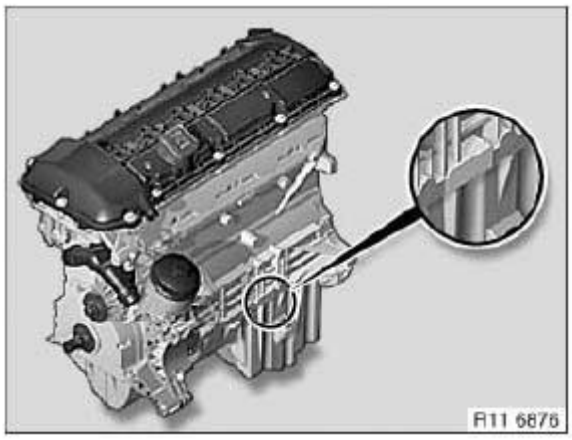
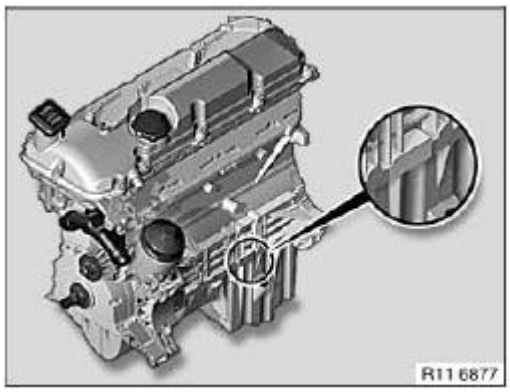


Fig. 21: Identifying Engine Number (M54)
Courtesy of BMW OF NORTH AMERICA, INC.

M56



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Fig. 22: Identifying Engine Number (M56)
Courtesy of BMW OF NORTH AMERICA, INC.

N40 / N45 / N45T / N43

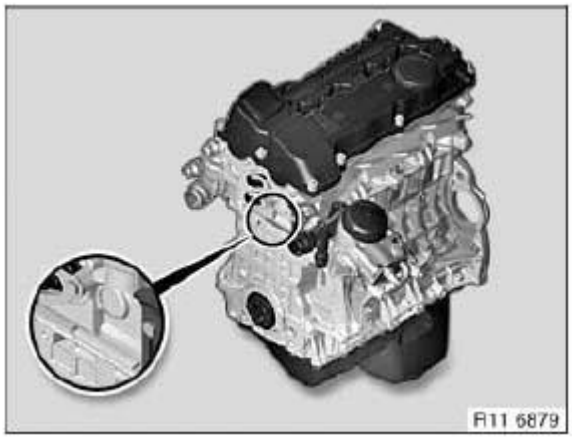


Fig. 23: Identifying Engine Number (N40 / N45 / N45T / N43)
Courtesy of BMW OF NORTH AMERICA, INC.

N42 / N46 / N46T

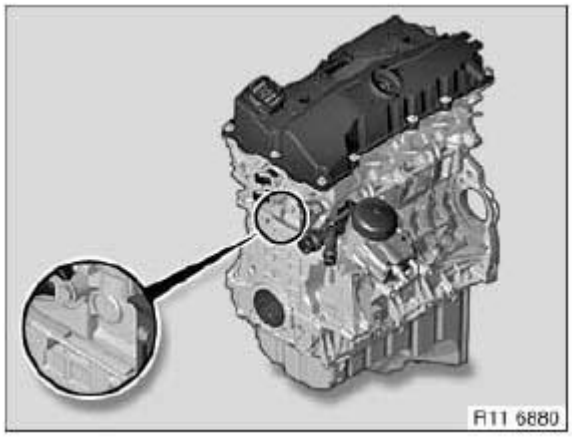


Fig. 24: Identifying Engine Number (N42 / N46 / N46T)
Courtesy of BMW OF NORTH AMERICA, INC.

N51 / N52 / N52K / N53 / N54

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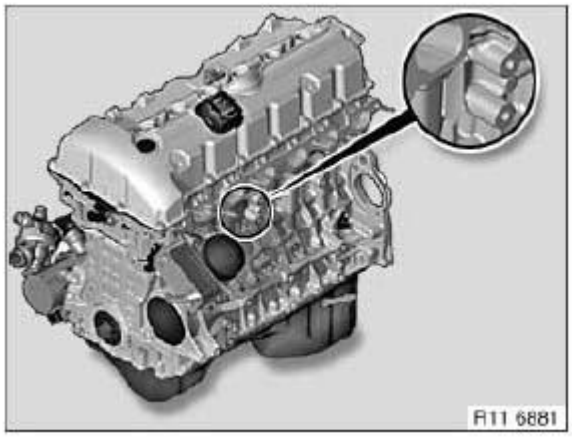


Fig. 25: Identifying Engine Number (N51 / N52 / N52K / N53 / N54)
Courtesy of BMW OF NORTH AMERICA, INC.

N62

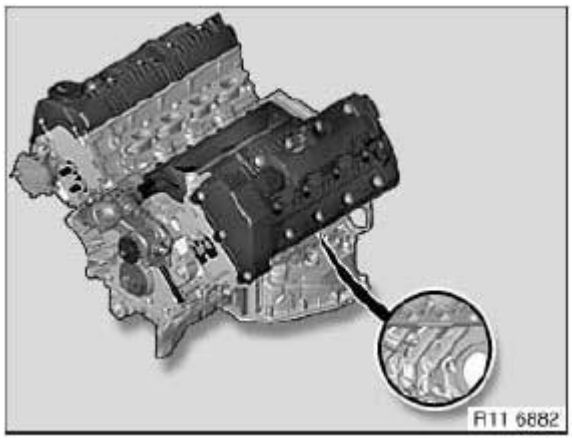


Fig. 26: Identifying Engine Number (N62)
Courtesy of BMW OF NORTH AMERICA, INC.

N73

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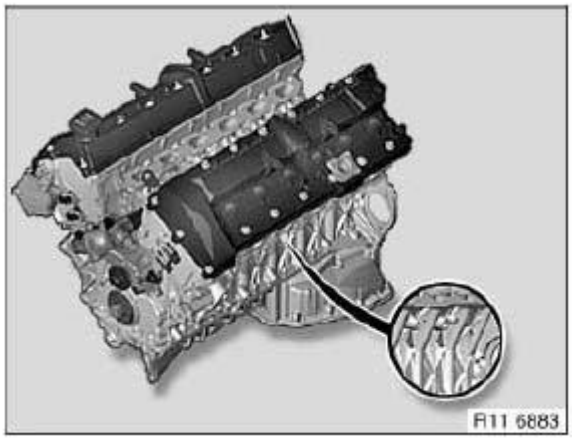


Fig. 27: Identifying Engine Number (N73)
Courtesy of BMW OF NORTH AMERICA, INC.

S54

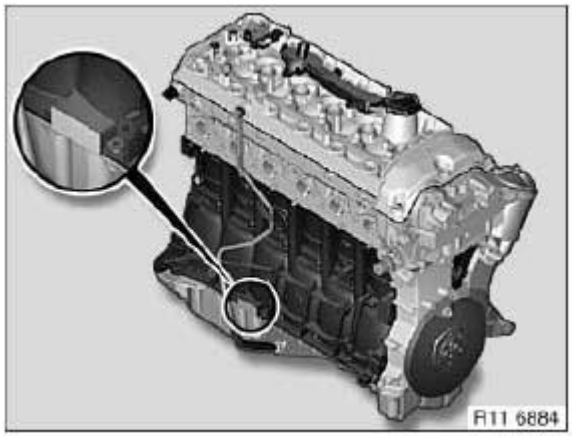


Fig. 28: Identifying Engine Number (S54)
Courtesy of BMW OF NORTH AMERICA, INC.

S85 / S65

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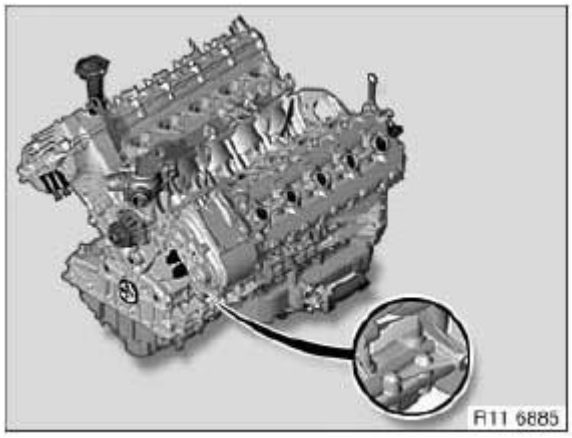


Fig. 29: Identifying Engine Number (S85 / S65)
Courtesy of BMW OF NORTH AMERICA, INC.

W10 / W11

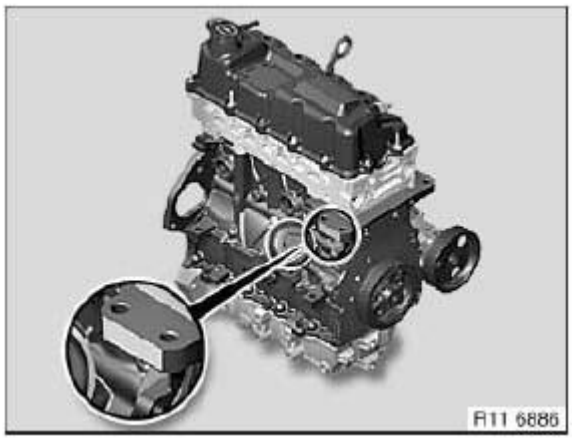


Fig. 30: Identifying Engine Number (W10 / W11)
Courtesy of BMW OF NORTH AMERICA, INC.

W17

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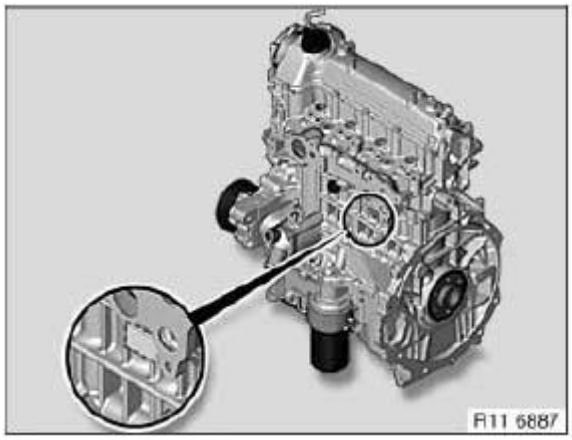


Fig. 31: Identifying Engine Number (W17)
Courtesy of BMW OF NORTH AMERICA, INC.

Assemble engine.

MOUNTING ENGINE ON ASSEMBLY STAND (N51)

Special tools required:

For the following special tools, refer to **MAINTENANCE AND GENERAL INFORMATION - SPECIAL TOOLS -- 128I** .

- **00 1 450**

For the following special tools, refer to **ENGINE - SPECIAL TOOLS (N51)** .

- **11 3 370**
- **11 4 440**
- **11 9 261**
- **11 9 265**

IMPORTANT: Aluminum screws/bolts must be replaced each time they are released .
The end faces of aluminum screws/bolts are painted blue for the purposes of reliable identification.
Jointing torque and angle of rotation must be observed without fail (risk of damage) .

Necessary preliminary tasks:

- Remove engine.

Bolt engine or engine block with steel bolts (1) and aluminum bolts (2) to special tool 11 4 440. See **Fig. 32**.

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To release central bolt, bolt on special tools 11 9 261 and 11 9 265 as well. See **Fig. 32**

Mount engine with special tool 11 3 370 to special tool 00 1 450.

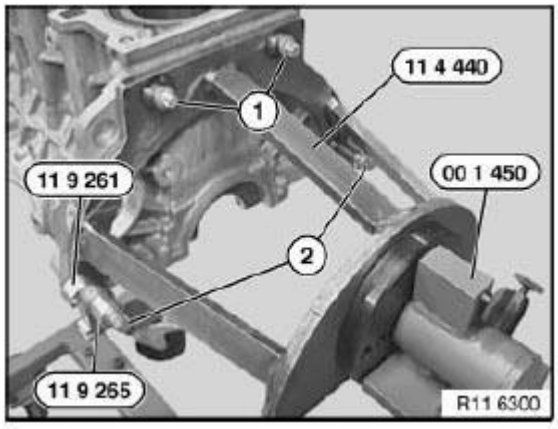


Fig. 32: Identifying Engine Block Steel Bolts And Special Tools
Courtesy of BMW OF NORTH AMERICA, INC.

CYLINDER HEAD WITH COVER

11 12 000 REMOVING AND INSTALLING/SEALING CYLINDER HEAD COVER (N51)

IMPORTANT: Aluminum-magnesium materials. No steel screws/bolts may be used due to the threat of electrochemical corrosion. A magnesium crankcase requires aluminum screws/bolts exclusively. Aluminum screws/bolts must be replaced each time they are released . Aluminum screws/bolts are permitted with and without color coding (blue). For reliable identification: Aluminum screws/bolts are not magnetic . Jointing torque and angle of rotation must be observed without fail (risk of damage) .

Necessary preliminary tasks:

- Remove acoustic cover.
- Remove rod-type ignition coils.
- Unclip wiring harness for fuel injectors.
- Remove **tension strut** . See **51 71 371 REMOVING AND INSTALLING/REPLACING TENSION STRUT ON LEFT OR RIGHT SPRING STRUT DOME** .
- Remove **clean air duct** . See **51 13 115 REMOVING AND INSTALLING/REPLACING COWL PANEL COVER** .

Unlock and detach engine vent hose (1).

If necessary, pull off metal bracket (2) in direction of arrow.

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Release screws (3).

Tightening torque. See 11 37 3AZ in **11 37 VARIABLE VALVE GEAR** .

Remove servodrive (4) in direction of arrow.

If necessary, release nuts (5).

If necessary, remove secondary air valve (6).

Installation:

Replace aluminum screws .

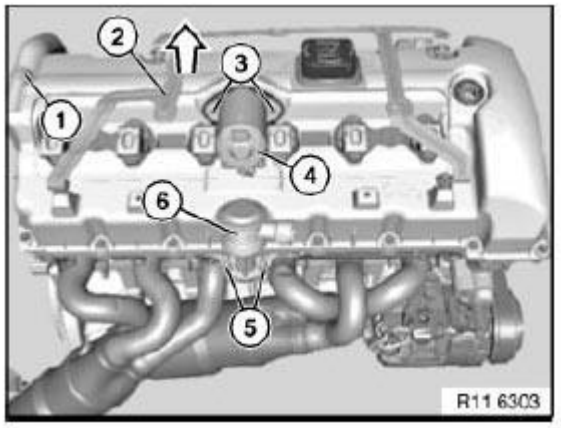


Fig. 33: Pulling Off Metal Bracket
Courtesy of BMW OF NORTH AMERICA, INC.

Release screws in area (1).

Installation:

Replace aluminum screws.

Tightening torque. See 11 12 4AZ in **CYLINDER HEAD WITH COVER** .

Release screws (2).

Tightening torque. See 11 12 4AZ in **CYLINDER HEAD WITH COVER** .

Installation:

Replace aluminum screws .

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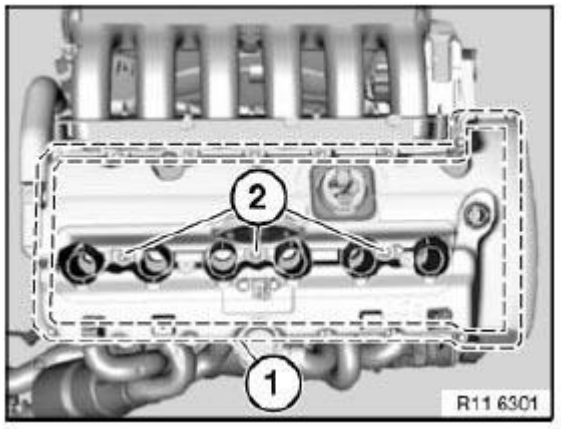


Fig. 34: Identifying Screws
Courtesy of BMW OF NORTH AMERICA, INC.

Installation note: Slotted sleeves (2) for guiding ignition coils in cylinder head cover (1) must be replaced. Remove slotted sleeves (2).

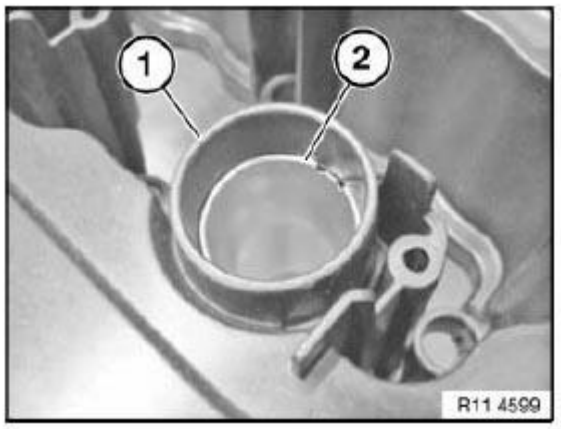


Fig. 35: Identifying Slotted Sleeves And Cylinder Head Cover
Courtesy of BMW OF NORTH AMERICA, INC.

Replace seal (1).

Replace seal (2).

Installation:

Clean all sealing surfaces.

Do not clean sealing faces (1 and 2) with a metal-cutting tool.

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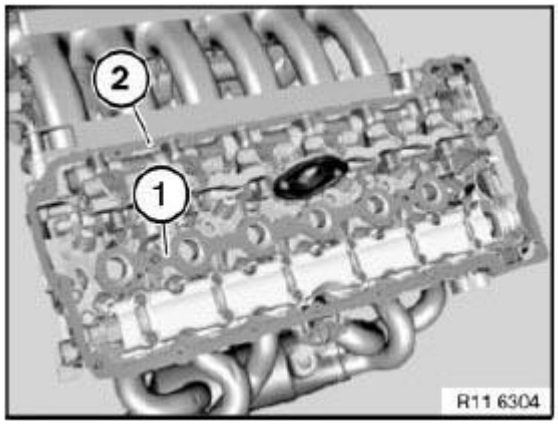


Fig. 36: Identifying Seal And Sealing Faces
Courtesy of BMW OF NORTH AMERICA, INC.

Assemble engine.

11 12 100 REMOVING AND INSTALLING/SEALING CYLINDER HEAD (N51)

Special tools required:

For the following special tools, refer to **ENGINE - SPECIAL TOOLS (N51)** .

- **11 0 320**
- **11 4 420**
- **11 4 430**
- **11 4 471**
- **11 4 47**
- **11 5 190**
- **11 8 580**

IMPORTANT: Aluminum-magnesium materials. No steel screws/bolts may be used due to the threat of electrochemical corrosion. A magnesium crankcase requires aluminum screws/bolts exclusively. Aluminum screws/bolts must be replaced each time they are released . Aluminum screws/bolts are permitted with and without color coding (blue). For reliable identification: Aluminum screws/bolts are not magnetic . Jointing torque and angle of rotation must be observed without fail (risk of damage) .

Necessary preliminary tasks:

- Remove exhaust system. See **18 00 020 REMOVING AND INSTALLING/REPLACING COMPLETE EXHAUST SYSTEM (N52/N52K/N51)** .
- Drain **coolant** . See **17 11 000 REMOVING AND INSTALLING RADIATOR (N51, S65)** .

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- Drain **engine oil**.
- Remove both **exhaust manifolds** . See **18 40 050 REMOVING AND INSTALLING/REPLACING FRONT EXHAUST MANIFOLD (N53/N52/N52K/N51)** or **18 40 060 REMOVING AND INSTALLING/REPLACING REAR EXHAUST MANIFOLD (N53/N52/N52K/N51)** .
- Remove intake air **manifold** . See **11 61 050 REMOVING AND INSTALLING INTAKE AIR MANIFOLD (N51)**.
- Detach coolant hoses from cylinder head.
- Remove **cylinder head cover** . See **11 12 000 REMOVING AND INSTALLING OR SEALING CYLINDER HEAD COVER (N51)**.
- Remove **inlet and exhaust adjustment unit** . See **11 36 046 REMOVING AND INSTALLING/REPLACING INLET AND EXHAUST ADJUSTMENT UNITS (N51)**.

IMPORTANT: Fit new cylinder head screws. Do not wash off bolt coating. There must not be any coolant, water or oil present in the pocket holes (risk of corrosion and cracking) .

Release screws (1).

Unclip timing chain module (2) at junction (3) and remove towards top.

Do not allow timing chain to drop down.

Installation:

Only during assembly is the timing chain lifted out with a hook.

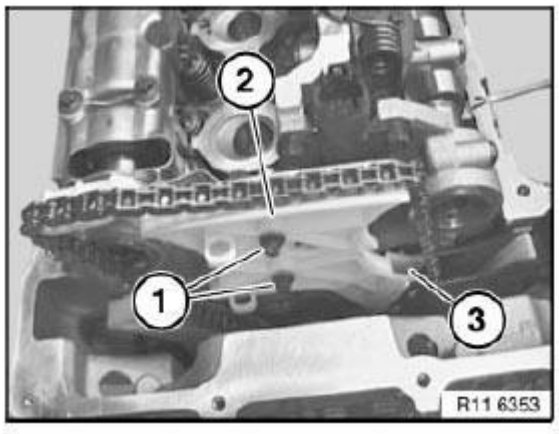


Fig. 37: Identifying Timing Chain Module And Screws
Courtesy of BMW OF NORTH AMERICA, INC.

Release screws (2).

Remove eccentric shaft sensor (1) towards front.

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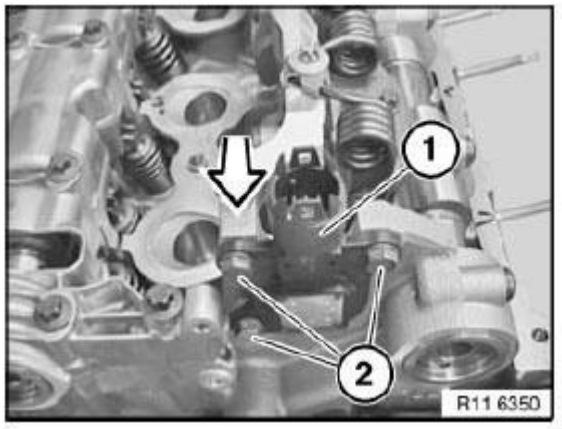


Fig. 38: Removing Eccentric Shaft Sensor
Courtesy of BMW OF NORTH AMERICA, INC.

Release screw (1).

Remove magnet wheel (2) towards front.

IMPORTANT: Magnet wheel (2) is extremely magnetic.

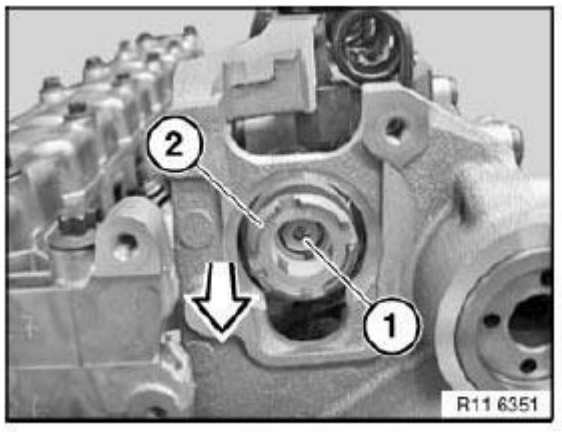


Fig. 39: Removing Magnet Wheel
Courtesy of BMW OF NORTH AMERICA, INC.

IMPORTANT: After removing, pack magnet wheel (1) away immediately in a plastic bag (2) for safety reasons.
Magnet wheel must be protected against metal chips.

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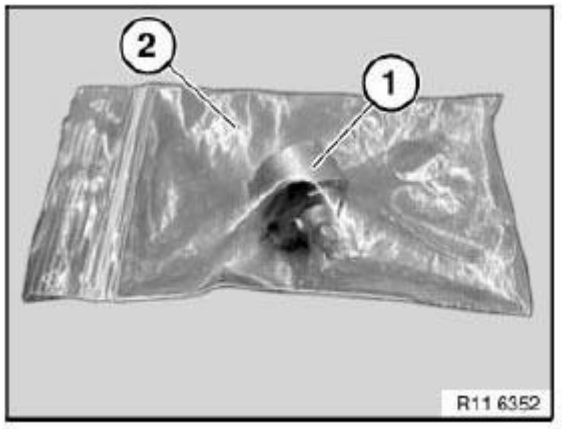


Fig. 40: Identifying Pack Magnet Wheel
Courtesy of BMW OF NORTH AMERICA, INC.

Pretension eccentric shaft (1) upwards in direction of arrow.

Remove min stop screw between 1st and 2nd cylinders.

Tightening torque. See 11 37 6AZ in **11 37 VARIABLE VALVE GEAR** .

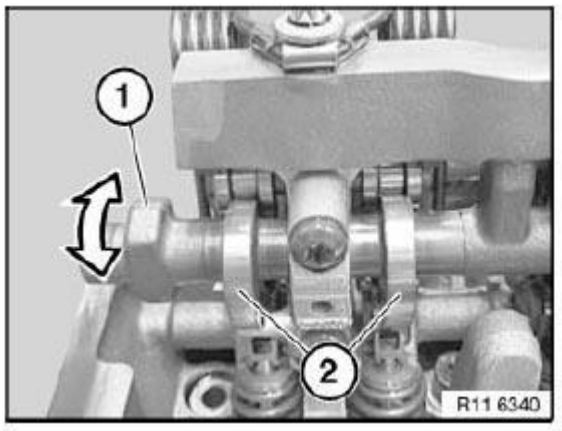


Fig. 41: Identifying Eccentric Shaft
Courtesy of BMW OF NORTH AMERICA, INC.

Release screws (1).

Tightening torque. See 11 12 3AZ in **CYLINDER HEAD WITH COVER** .

Screw (2) can only be released when the chain module is pressed forward slightly.

IMPORTANT: Secure screw (2) with a gripper against falling out and remove.

Installation:

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Replace aluminum screws .

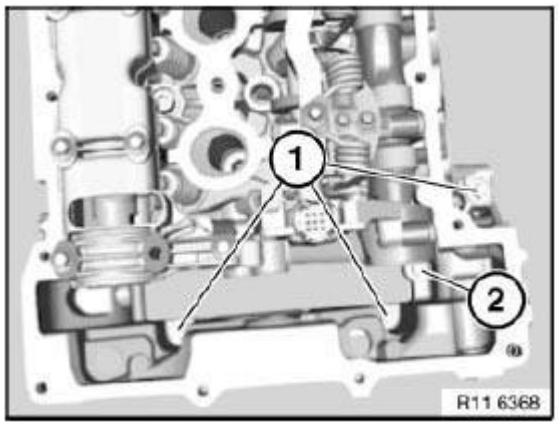


Fig. 42: Identifying Screws
Courtesy of BMW OF NORTH AMERICA, INC.

IMPORTANT: Different screw heads

M10 screw (1) is released with special tool 11 8 580. See **Fig. 43**.

M9 screw (2) is released with special tool 11 4 420. See **Fig. 43**

NOTE: Illustration shows camshaft removed.

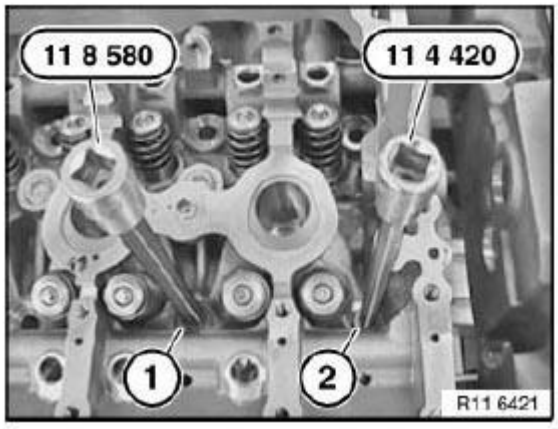


Fig. 43: Identifying Special Tools
Courtesy of BMW OF NORTH AMERICA, INC.

Release screws (1 and 3) with special tool 11 4 420.

Tightening torque, see 11 12 2AZ in **CYLINDER HEAD WITH COVER** .

Release screws (2) with special tool 11 8 580 from outside inwards.

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Tightening torque. See in 11 12 1AZ **CYLINDER HEAD WITH COVER** .

IMPORTANT: All screws must be replaced.
Jointing torque and angle of rotation must be observed without fail (risk of damage) .

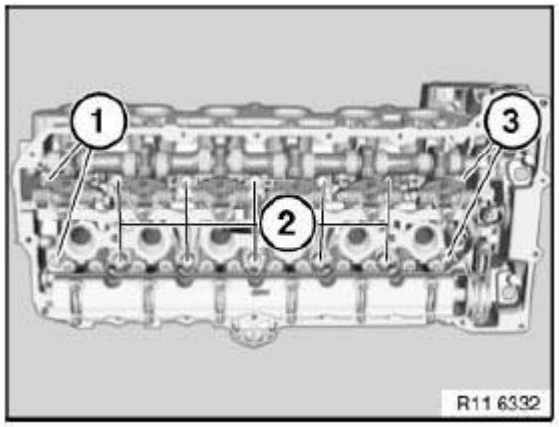


Fig. 44: Identifying Screws
Courtesy of BMW OF NORTH AMERICA, INC.

Secure special tool 11 0 320 with old cylinder head cover bolts (1).

Tightening torque, see 11 12 4AZ in **CYLINDER HEAD WITH COVER** .

IMPORTANT: Weight of cylinder head with add-on parts is approx. 40 kg.

Remove and install cylinder head with two persons.

Do not set cylinder head down on sealing face, **risk of damage** to engine valves.

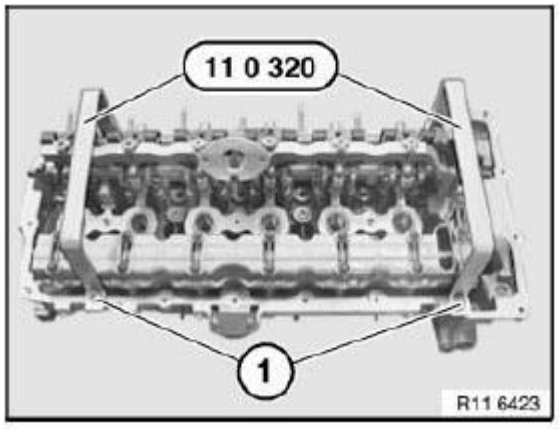


Fig. 45: Identifying Cylinder Head With Persons
Courtesy of BMW OF NORTH AMERICA, INC.

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Insert special tool 11 4 430 into bores. See **Fig. 46**.

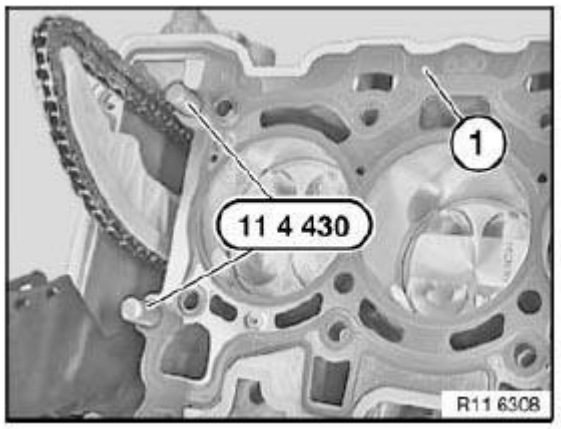


Fig. 46: Identifying Special Tool (11 4 430)
Courtesy of BMW OF NORTH AMERICA, INC.

Use special tool 11 4 471 to remove coarse gasket remnants from sealing faces of cylinder head and crankcase. See **Fig. 47**.

IMPORTANT: Do not use any metal-cutting tools.

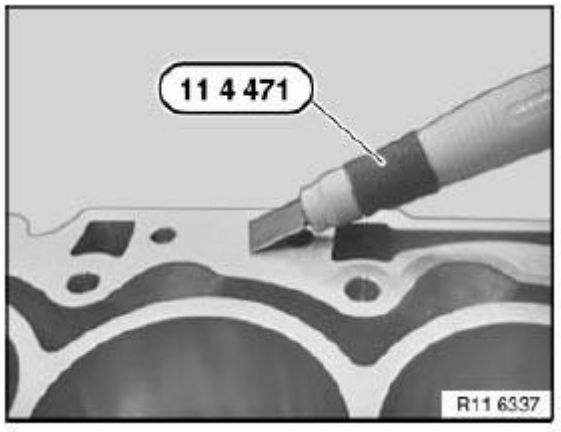


Fig. 47: Identifying Special Tool (11 4 471)
Courtesy of BMW OF NORTH AMERICA, INC.

Remove fine gasket remnants with special tool 11 4 472. See **Fig. 48**.

IMPORTANT: Do not use any metal-cutting tools.

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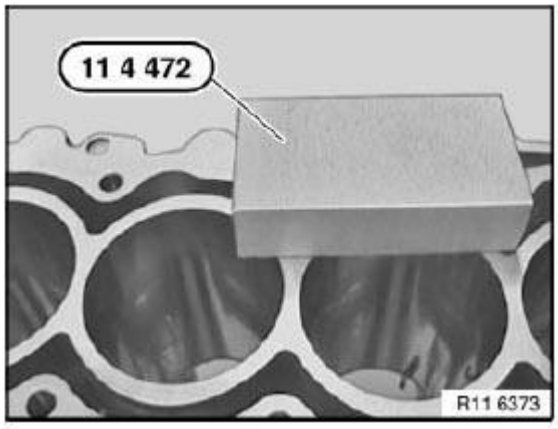


Fig. 48: Identifying Special Tool (11 4 472)
Courtesy of BMW OF NORTH AMERICA, INC.

There must not be any coolant, water or oil present in the pocket holes **(risk of corrosion and cracking)** .

Clean all threaded holes.

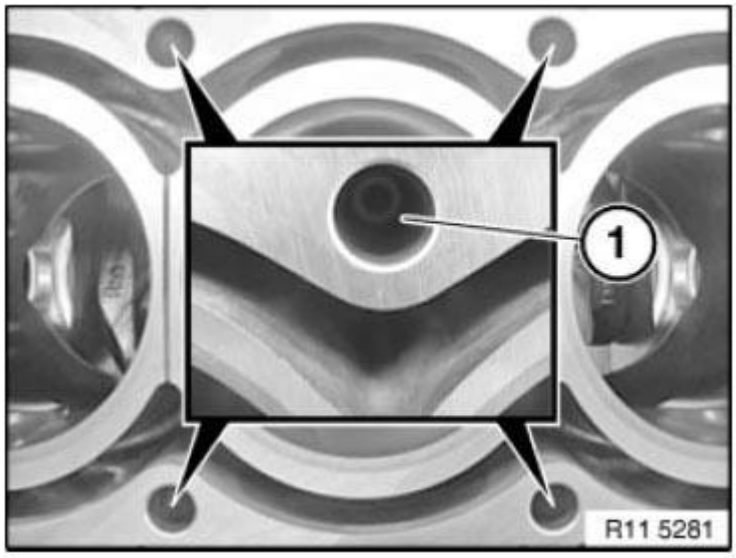


Fig. 49: Identifying Threaded Hole
Courtesy of BMW OF NORTH AMERICA, INC.

Replace **cylinder head gasket** . See **11 12 101 REPLACING CYLINDER HEAD GASKET (N51)**.

IMPORTANT: Observe tightening sequence.

Fit new cylinder head screws.

Insert screws (1 to 10) with special tool 11 5 190.

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Tightening torque. See 11 12 1AZ in **CYLINDER HEAD WITH COVER** .

Insert screws (11 to 14) with special tool 11 4 420.

Tightening torque. See 11 12 2AZ in **CYLINDER HEAD WITH COVER** .

NOTE: Illustration shows camshafts removed.

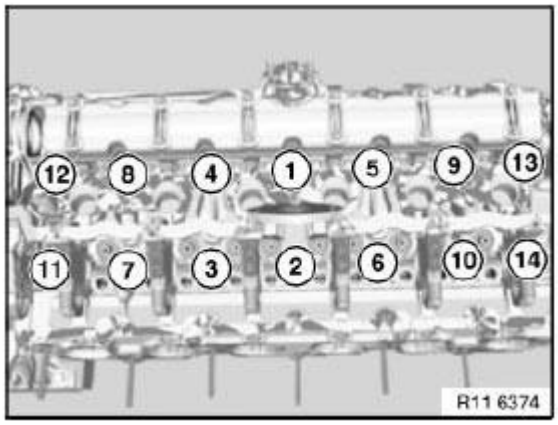


Fig. 50: Identifying Cylinder Head Screws
Courtesy of BMW OF NORTH AMERICA, INC.

Observe tightening sequence .

Installation:

- Jointing torque: Screws 1 to 14 / 1x 30 Nm

1. Angle of rotation: Screws 1 to 14 / 1x 90°
2. Angle of rotation: Screws 1 to 10 / 1x 90°
3. Angle of rotation: Screws 1 to 14 / 1x 45°

Replace screws (1).

Tightening torque. See 11 12 3AZ in **CYLINDER HEAD WITH COVER** .

IMPORTANT: Secure screw (2) with a gripper against falling out.

Installation:

Replace aluminum screws .

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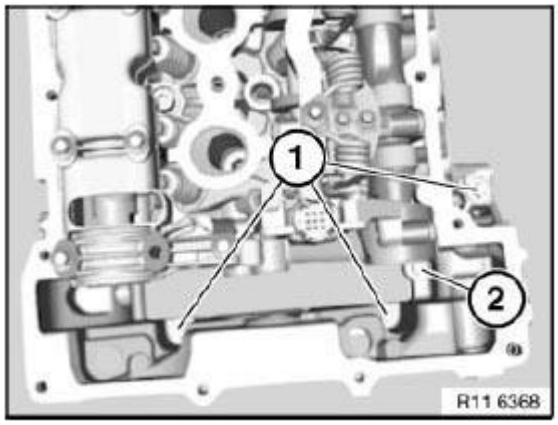


Fig. 51: Identifying Screw With Gripper
Courtesy of BMW OF NORTH AMERICA, INC.

Assemble engine.

11 12 101 REPLACING CYLINDER HEAD GASKET (N51)

Special tools required:

For the following special tools, refer to **ENGINE - SPECIAL TOOLS (N51)** .

- **11 4 430**
- **11 4 470**

IMPORTANT: Aluminum-magnesium materials. No steel screws/bolts may be used due to the threat of electrochemical corrosion. A magnesium crankcase requires aluminum screws/bolts exclusively. Aluminum screws/bolts must be replaced each time they are released . Aluminum screws/bolts are permitted with and without color coding (blue). For reliable identification: Aluminum screws/bolts are not magnetic . Jointing torque and angle of rotation must be observed without fail (risk of damage) .

Necessary preliminary tasks:

- Remove **cylinder head** . See **11 12 100 REMOVING AND INSTALLING/SEALING CYLINDER HEAD (N51)**.

Insert special tool 11 4 430 into bores. See **Fig. 52**.

Remove head gasket.

IMPORTANT: Check identification (1) on cylinder head gasket (N51).

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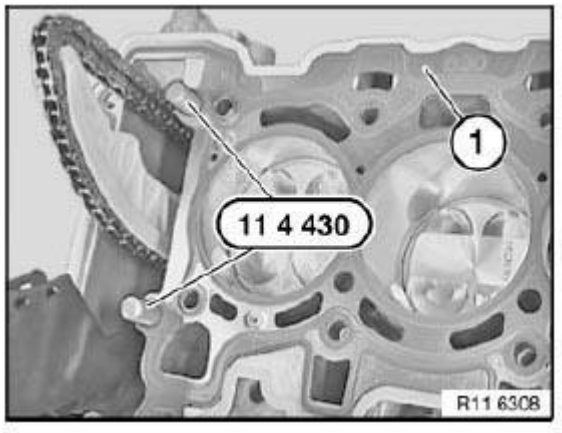


Fig. 52: Identifying Special Tool (11 4 430)
Courtesy of BMW OF NORTH AMERICA, INC.

Remove remnants of oil and dirt from pocket holes (1).

IMPORTANT: Work on sealing face on engine block and on cylinder head with special tool 11 4 470 only.
Do not use any metal-cutting tools.

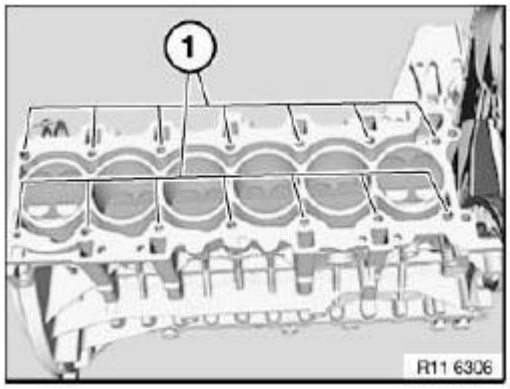


Fig. 53: Identifying Engine Block Surface
Courtesy of BMW OF NORTH AMERICA, INC.

Identification (1) of head gasket.

IMPORTANT: Rubber coating (2) on cylinder head gasket must not under any circumstances be damaged (electrochemical corrosion).

Gasket (3) is a beaded metal gasket

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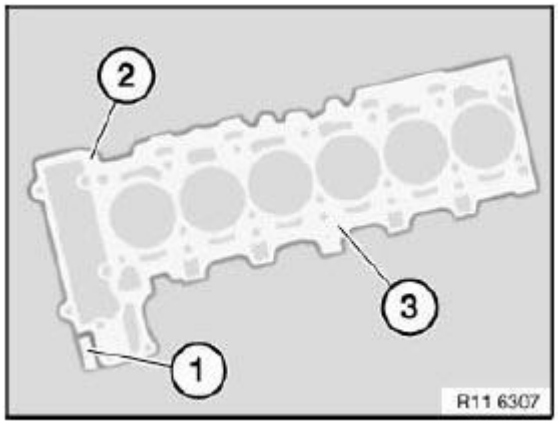


Fig. 54: Identifying Head Gasket
Courtesy of BMW OF NORTH AMERICA, INC.

Check adapter sleeves (1) for damage and firm seating.

Place head gasket (2) in direction of arrow on engine block.

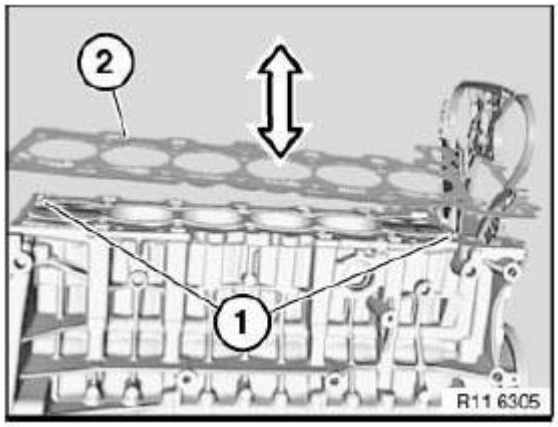


Fig. 55: Identifying Head Gasket Position
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: Check cylinder head for deviation from flatness . See 11 12 719 RESURFACING CYLINDER HEAD SEALING FACE (N51). Check cylinder head for water leaks . See 11 12 729 CHECKING CYLINDER HEAD FOR LEAKS (N51).

Assemble engine.

11 12 719 RESURFACING CYLINDER HEAD SEALING FACE (N51)

Necessary preliminary tasks:

- Remove **cylinder head**.

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- Remove exhaust camshaft. See **11 31 028 REMOVING AND INSTALLING/REPLACING EXHAUST CAMSHAFT (N51)**.
- Remove **intermediate lever** on inlet side.

Check evenness of cylinder head sealing faces with a standard straight-edge (1).

NOTE: Max. deviation from level (longitudinal) 0.10 mm

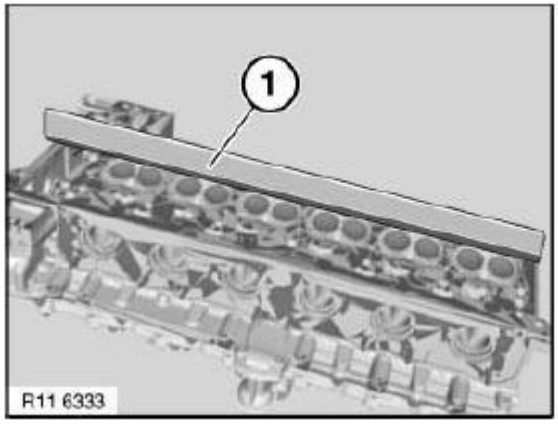


Fig. 56: Checking Evenness Of Cylinder Head Sealing Faces With Standard Straight-Edge
Courtesy of BMW OF NORTH AMERICA, INC.

Check evenness of cylinder head sealing faces with a standard straight-edge (1).

NOTE: Max. deviation from level (transversal) 0.05 mm

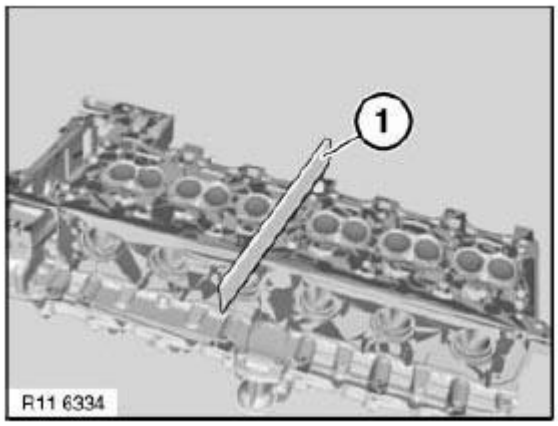


Fig. 57: Checking Evenness Of Cylinder Head Sealing Faces With Standard Straight-Edge
Courtesy of BMW OF NORTH AMERICA, INC.

Check cylinder head for water leaks.

Assemble engine.

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11 12 729 CHECKING CYLINDER HEAD FOR LEAKS (N51)

Special tools required:

For the following special tools, refer to **ENGINE - SPECIAL TOOLS (N51)** .

- **11 4 341**
- **11 4 342**
- **11 4 344**
- **11 4 345**

IMPORTANT: Pressure-test cylinder head to max. 3 bar.
Heat cylinder head to 60°.
Check for bubble formation in a water bath.

Necessary preliminary tasks:

- Remove **cylinder head** . See **11 12 100 REMOVING AND INSTALLING/SEALING CYLINDER HEAD (N51)**.
- Remove **all engine valves** . See **11 34 552 REMOVING AND INSTALLING OR REPLACING ALL VALVES (N51)**.

NOTE: Observe mounting of special tool 11 4 341 on cylinder. See Fig. 58. Secure special tool 11 4 341 with bolts 11 4 345 to 25 Nm.

Installation:

1 cyl is marked.

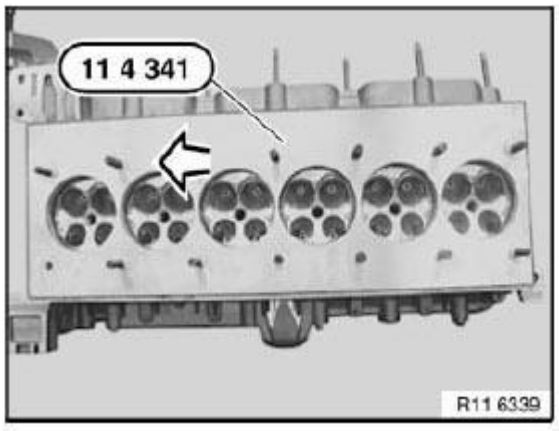


Fig. 58: Identifying Special Tool (11 4 341)
Courtesy of BMW OF NORTH AMERICA, INC.

Fit special tool 11 4 342 with bolts (1), insert knurled screw in direction of arrow. See **Fig. 59**.

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Sealing flange must rest flat.

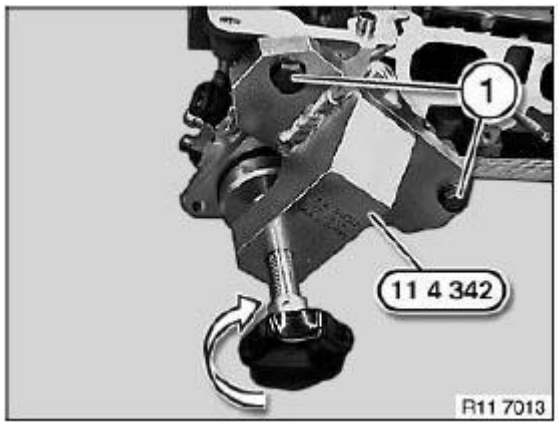


Fig. 59: Inserting Knurled Screw
Courtesy of BMW OF NORTH AMERICA, INC.

Secure special tool 11 4 344 with bolts (1). See **Fig. 60**.

NOTE: Compressed air at valve max. 3 bar.
Heat cylinder head to 60°.
Check for bubble formation in a water bath.

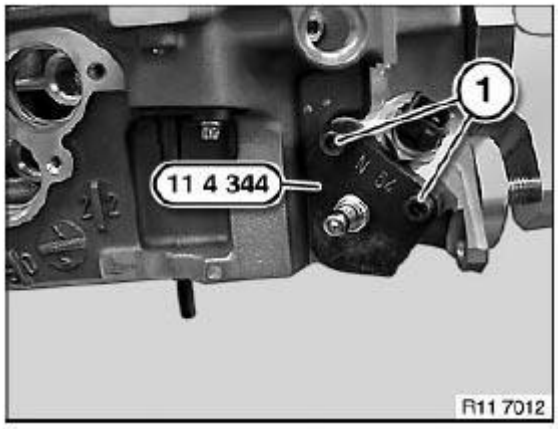


Fig. 60: Identifying Special Tool With Bolts
Courtesy of BMW OF NORTH AMERICA, INC.

Assemble engine.

OIL SUMP

11 13 000 REMOVING AND INSTALLING, SEALING OR REPLACING OIL SUMP (N51)

IMPORTANT: Aluminum-magnesium materials. No steel screws/bolts may be used due to the

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threat of electrochemical corrosion. A magnesium crankcase requires aluminum screws/bolts exclusively. Aluminum screws/bolts must be replaced each time they are released . Aluminum screws/bolts are permitted with and without color coding (blue). For reliable identification: Aluminum screws/bolts are not magnetic . Jointing torque and angle of rotation must be observed without fail (risk of damage) .

Necessary preliminary tasks:

- Remove engine splash guard.
- Secure engine in **installation position** . See **11 00 670 SECURING ENGINE IN INSTALLATION POSITION (N52)**.
- Lower **front axle** . See **31 11 506 LOWERING/RAISING FRONT AXLE CARRIER (SPECIAL TOOL SWZ00-2040)** or **31 11 506 LOWERING/RAISING FRONT AXLE CARRIER (UNIVERSAL LIFTER)** .
- **In all-wheel-drive vehicles:**
  - Remove drive shafts.
  - Remove front axle differential.

NOTE: The lines must be detached from the engine oil sump in the case of the optional extra automatic transmission; if necessary, detach vane pump and place to one side.

Release bolts (3) on transmission.

Detach return hose (2).

Release bolts along line (1).

Tightening torque. See 11 13 1AZ in **OIL SUMP** .

Installation:

Replace aluminum screws .

If necessary, release bolts (4), remove oil level sensor.

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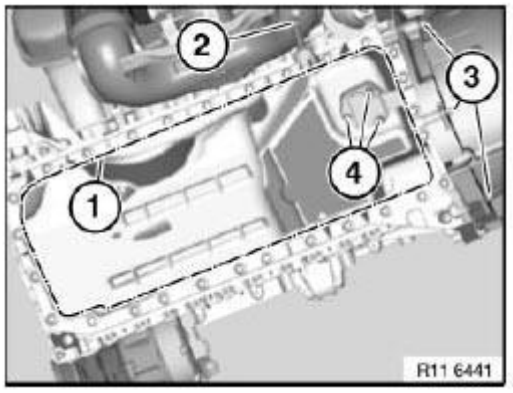


Fig. 61: Identifying Bolts On Transmission
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Replace all seals.

Assemble engine.

HOUSING COVER

11 14 005 REPLACING FRONT CRANKSHAFT SEAL (N51)

Special tools required:

For the following special tools, refer to **ENGINE - SPECIAL TOOLS (N51)** .

- **11 0 371**
- **11 0 372**
- **11 9 221**
- **11 9 222**
- **11 9 224**
- **11 9 231**
- **11 9 232**
- **11 9 233**
- **11 9 234**

Necessary preliminary tasks:

- Remove **vibration damper** . See **11 22 500 REMOVING AND INSTALLING OR REPLACING FLYWHEEL (N51)**.

IMPORTANT: Do not release central bolt.

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If the central bolt is released, the sprocket wheels of the timing chain and the oil pump will no longer be non-positively connected to the crankshaft. The camshafts to the crankshaft can warp **(risk of damage)** .

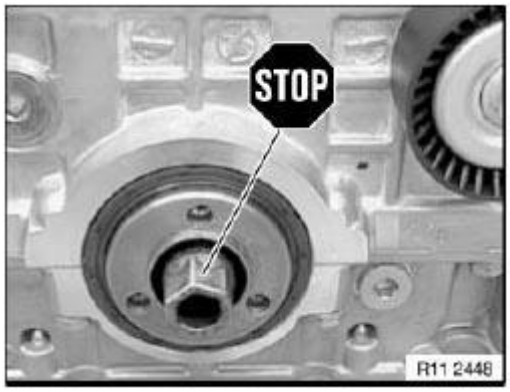


Fig. 62: Identifying Central Bolt
Courtesy of BMW OF NORTH AMERICA, INC.

Turn back special tool 11 9 222. See **Fig. 63**.

Push special tool 11 9 221 onto crankshaft. See **Fig. 63**.

IMPORTANT: When screws are tightened down (special tool 11 9 224), crankshaft seal is pressed inwards approx. 1 mm and thus slackened for subsequent removal. See Fig. 63.

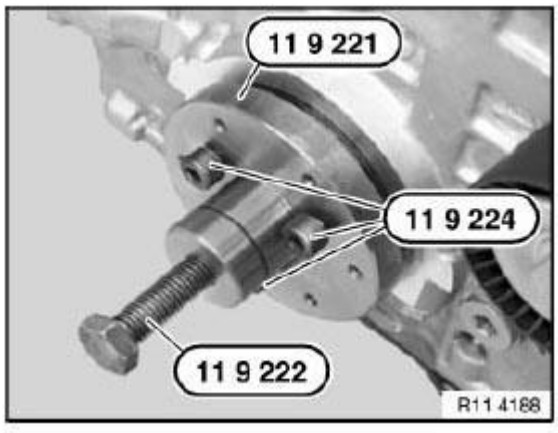


Fig. 63: Identifying Special Tools
Courtesy of BMW OF NORTH AMERICA, INC.

Insert screws (special tool 11 9 224) and tighten down to approx. 20 Nm.

Screw special tool 11 0 371 to 80 N.m into crankshaft seal.

Screw in spindle 11 0 372. See **Fig. 64**.

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Release crankshaft seal from housing.

Repeat the operation several times if necessary.

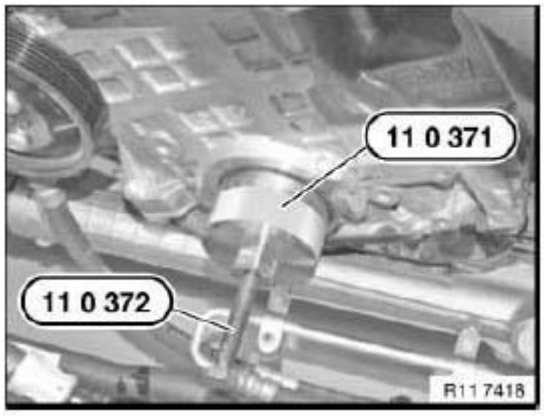


Fig. 64: Identifying Special Tool (11 3 372)
Courtesy of BMW OF NORTH AMERICA, INC.

Carefully saw open crankshaft seal (1) at cutting line (2).

Remove crankshaft seal (1) from special tool 1 0 371.

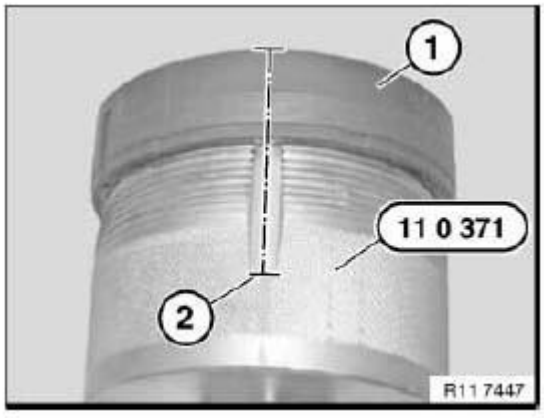


Fig. 65: Identifying Crankshaft Seal
Courtesy of BMW OF NORTH AMERICA, INC.

IMPORTANT: The following text describes installation and sealing between the engine block and crankshaft seal.
The engine block will not be leakproof at the outside of the crankshaft seal if you fail to comply with the individual work steps and the work sequence.

Installation:

Clean sealing surface (1) and degrease thoroughly in area of housing partition.

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Apply a light coat of oil to running surface (2) of crankshaft seal.

Illustration N42.

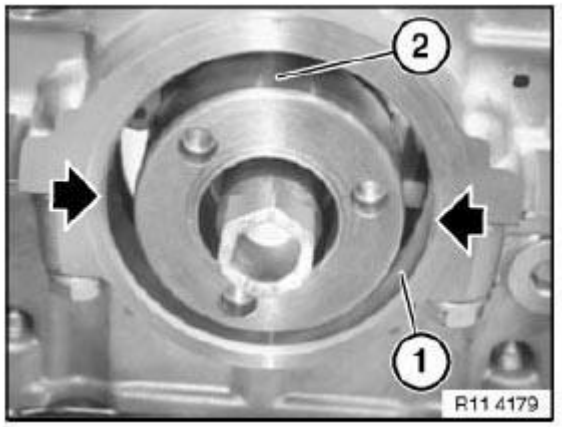


Fig. 66: Identifying Sealing Surface And Running Surface Of Crankshaft Seal
Courtesy of BMW OF NORTH AMERICA, INC.

Screw special tool 11 9 232 with screws (special tool 11 9 234) to crankshaft. See **Fig. 67**.

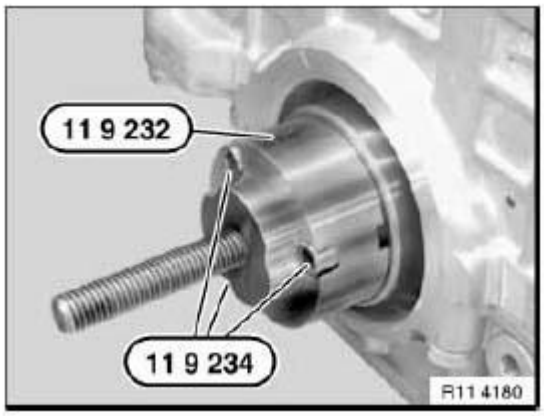


Fig. 67: Identifying Special Tools (11 9 234 And 11 9 232)
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: Support sleeve (1) is supplied with crankshaft seal (2).
When crankshaft seal (2) is installed, only support sleeve (1) may be used as a slip sleeve.
Crankshaft seal (2) has a groove on both left and right sides.

IMPORTANT: After installation, the grooves must be filled with sealing compound.

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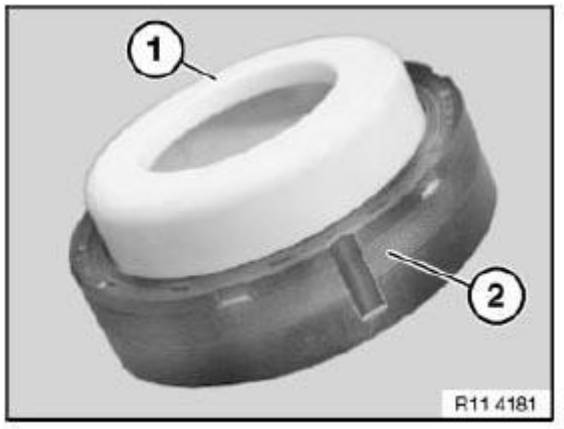


Fig. 68: Identifying Crankshaft Seal And Support Sleeve
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: The required parts are available from the BMW Parts Service (Electronic Parts Catalogue ETK).

Remove screw caps (1) from injector (2).

Screw on metering needle.

Insert piston for pressing out.

Injector (2) contains the sealing compound Loctite, manufacturer's number 128357.

Bottle (3) contains the primer Loctite, manufacturer's number 171000.

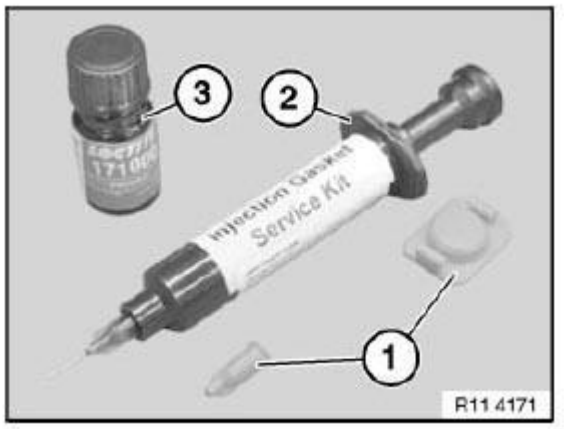


Fig. 69: Identifying Injector, Sealing Compound And Bottle
Courtesy of BMW OF NORTH AMERICA, INC.

Push support sleeve (1) with radial shaft seal (2) onto special tool 11 9 232. See **Fig. 70**.

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IMPORTANT: Support sleeve (1) remains on special tool 11 9 232, until crankshaft seal is drawn in.

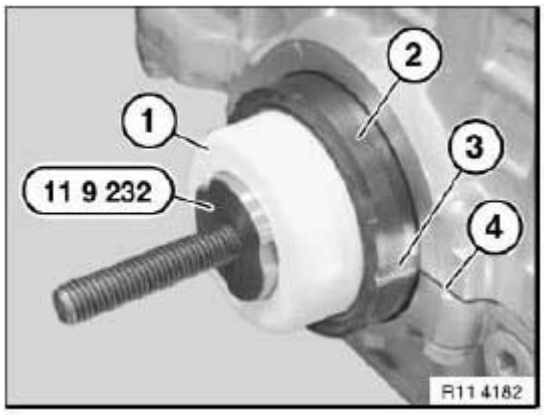


Fig. 70: Pushing Support Sleeve With Radial Shaft Seal Onto Special Tool
Courtesy of BMW OF NORTH AMERICA, INC.

Align groove (3) centrally to housing partition (4).

Coat both grooves (3) on crankshaft seal (2) with Loctite primer, manufacturer's number 171000, and expose to air for approx. one minute.

Draw in crankshaft seal with special tool 11 9 231 in conjunction with special tool 11 9 233 until flush. See **Fig. 71**.

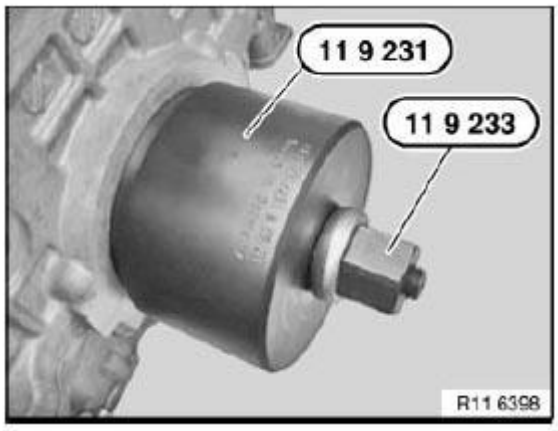


Fig. 71: Identifying Special Tools (11 9 231 And 11 9 233)
Courtesy of BMW OF NORTH AMERICA, INC.

Before filling with sealing compound:

Insert brush with Loctite primer, manufacturer's number 171000, as far as possible into grooves (1) on crankshaft seal and coat housing partition on engine block.

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Illustration N42.

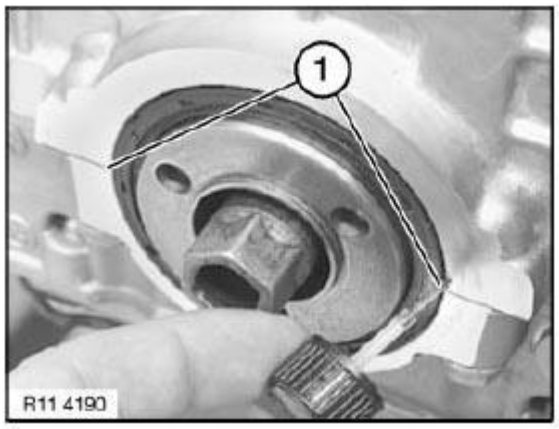


Fig. 72: Identifying Grooves On Crankshaft Seal
Courtesy of BMW OF NORTH AMERICA, INC.

Using injector (2), fill both grooves (3) flush with Loctite sealing compound, manufacturer's number 128357.

Illustration N42.

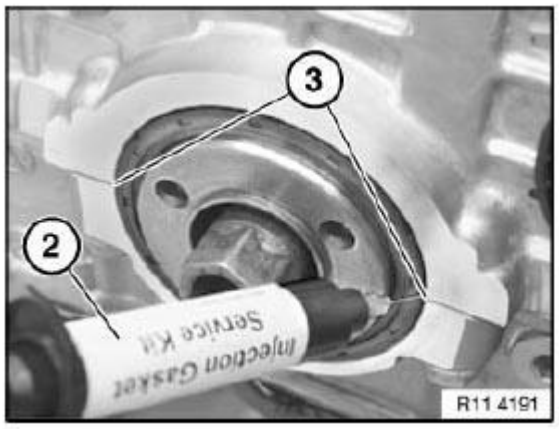


Fig. 73: Identifying Injector And Grooves
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: Loctite primer, manufacturer's number 171000, binds the Loctite sealing compound, manufacturer's number 128357, and prevents leakage.

Coat surface of sealing compound in both grooves (1) with Loctite primer, manufacturer's number 171000.

Illustration N42.

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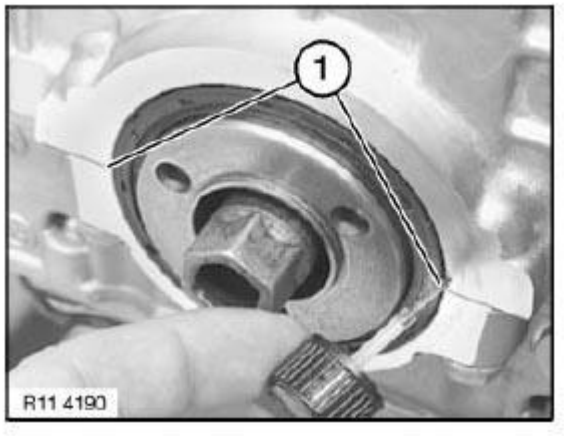


Fig. 74: Identifying Grooves
Courtesy of BMW OF NORTH AMERICA, INC.

Assemble engine.

11 14 010 REPLACING VACUUM PUMP SEALING COVER (N51)

Special tools required:

For the following special tools, refer to **ENGINE - SPECIAL TOOLS (N51)** .

- **11 4 361**
- **11 4 362**
- **11 4 363**
- **11 4 364**
- **11 9 200**

Necessary preliminary tasks:

- Remove **fan cowl** . See **17 11 035 REMOVING AND INSTALLING/REPLACING FAN COWL WITH ELECTRIC FAN (N51)** .
- Remove alternator **drive belt** . See **11 28 010 REPLACING ALTERNATOR DRIVE BELT (N51)**.
- Remove **tensioner** for drive belt. See **11 28 020 REPLACING TENSIONING DEVICE FOR ALTERNATOR DRIVE BELT (N51)**.

NOTE: Procedure is identical to that for radial shaft seal.
Expose removal openings on sealing cover.

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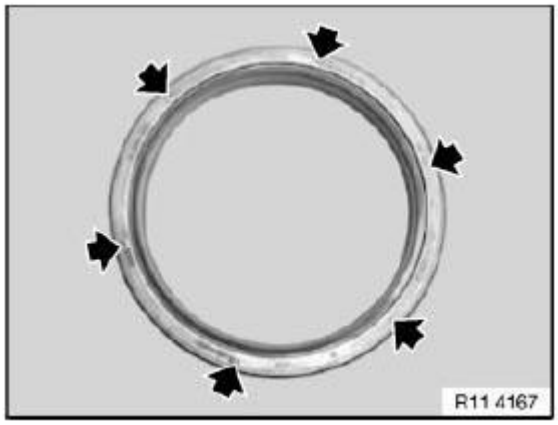


Fig. 75: Locating Radial Shaft Seal
Courtesy of BMW OF NORTH AMERICA, INC.

Convert special tool 11 9 200. See **Fig. 76**.

Screw special tool 11 9 200 onto end cover.

NOTE: Insert screws until flush only with special tool 11 9 200.

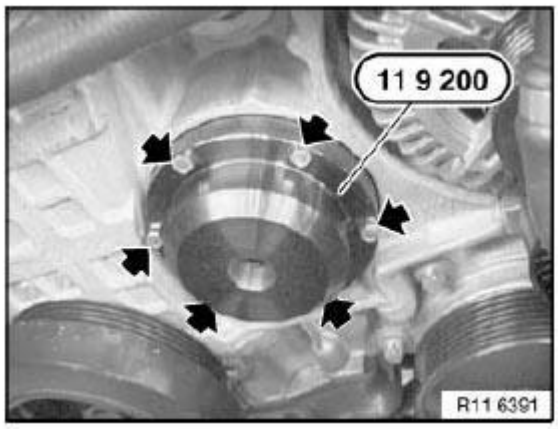


Fig. 76: Identifying Special Tools (11 9 200)
Courtesy of BMW OF NORTH AMERICA, INC.

Screw in special tool 11 4 362. See **Fig. 77**.

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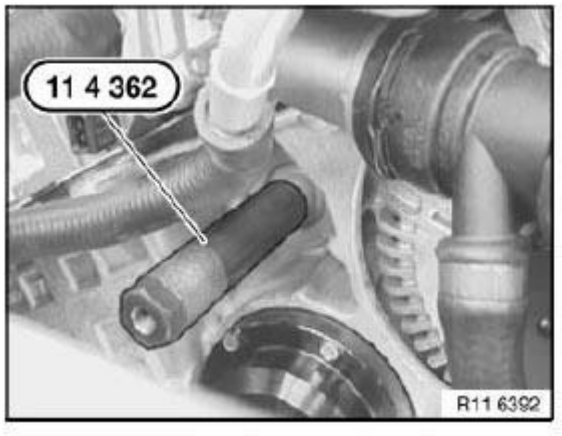


Fig. 77: Identifying Special Tool (11 4 362)
Courtesy of BMW OF NORTH AMERICA, INC.

Attach special tool 11 4 361 to Bedplate screw connection (see arrow). See **Fig. 78**.

Secure with knurled screw (1).

Screw special tool 11 4 364 into special tool 11 9 200 and screw out in direction of arrow. See **Fig. 78**.

NOTE: For purposes of clarity, illustrations show alternator and servo pump.

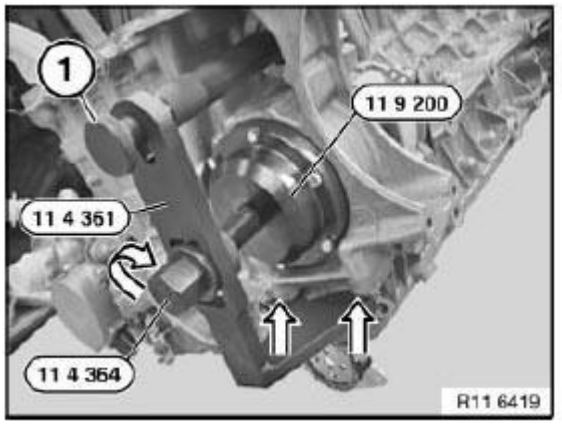


Fig. 78: Identifying Special Tools
Courtesy of BMW OF NORTH AMERICA, INC.

Prepare new sealing cover (1) with special tool 11 9 200 **without** screws. See **Fig. 79**.

Screw in sealing cover with special tool 11 4 363 until it is flush.

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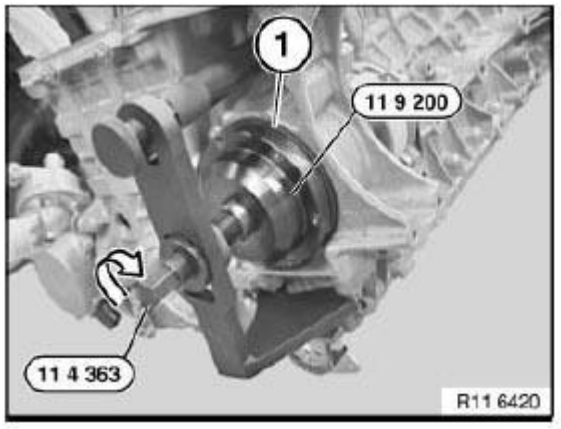


Fig. 79: Identifying Special Tools (11 9 200 And 11 4 363)
Courtesy of BMW OF NORTH AMERICA, INC.

Assemble engine.

11 14 151 REPLACING CRANKSHAFT SEAL (N51) TO 12/31/08

Special tools required:

For the following special tools, refer to **ENGINE - SPECIAL TOOLS (N51)** .

- **11 9 181**
- **11 9 182**
- **11 9 183**
- **11 9 184**
- **11 9 200**

Necessary preliminary tasks:

- Remove **transmission** . See **23 00 017 REMOVING AND INSTALLING TRANSMISSION (GS6-17BZ) N51/N52/N52K/N53** or **24 00 032 REMOVING AND INSTALLING AUTOMATIC TRANSMISSION (GA6L45R)** .
- Remove **flywheel** . See **11 21 500 REPLACING CRANKSHAFT (N51)**.

NOTE: Radial seal has six removal openings for removal with special tool 11 9 200. See Fig. 82.

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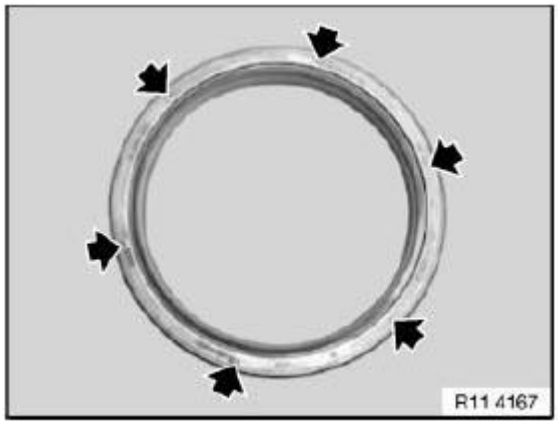


Fig. 80: Locating Radial Seal Portions
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: If necessary, remove rubber coating (1) on top side of radial seal and expose a removal opening (2). See Fig. 81.

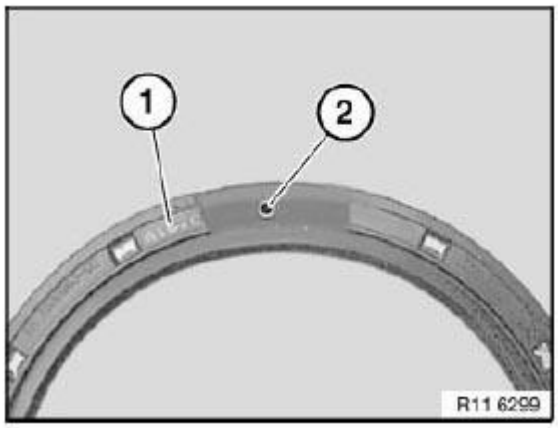


Fig. 81: Identifying Rubber Coating On Top Side Of Radial Seal
Courtesy of BMW OF NORTH AMERICA, INC.

Fit special tool. See **Fig. 82**. Insert metal screws into removal opening of radial seal and initially tighten without play (do **not** overtighten metal screws).

Screw in spindle (1) slowly and carefully and detach radial seal.

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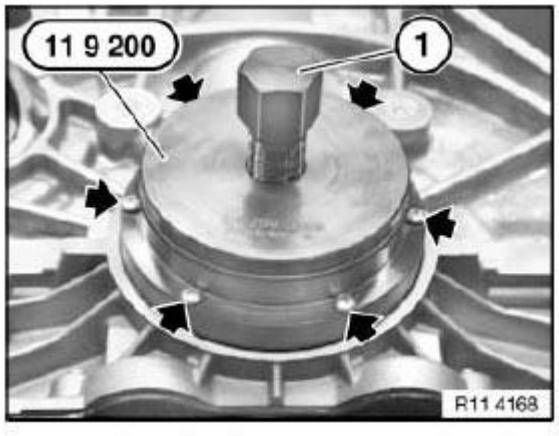


Fig. 82: Identifying Special Tool (11 9 200)
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Clean sealing surface (1) and degrease thoroughly in area of housing partition.

Apply a light coat of oil to running surface (2) of radial shaft seal.

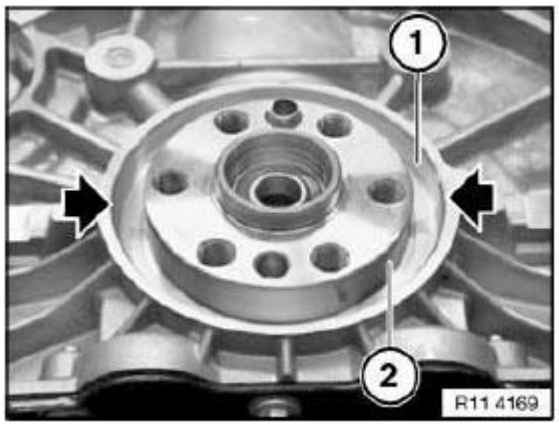


Fig. 83: Identifying Running Surface Of Radial Shaft Seal
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: Support sleeve (4) is supplied with radial shaft seal (1). When radial shaft seal (1) is installed, only support sleeve (4) may be used as a slip sleeve. Radial shaft seal (1) has a groove (2) on both left and right sides.

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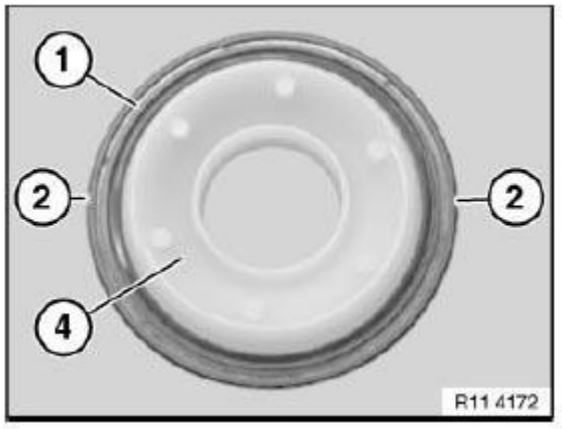


Fig. 84: Identifying Radial Shaft Seal Parts
Courtesy of BMW OF NORTH AMERICA, INC.

IMPORTANT: After installation, grooves (2) must be filled with sealing compound.

IMPORTANT: The seal between the engine block and radial seal is described below. The engine block will not be leakproof at the outside of the radial seal if you fail to comply with the individual work steps and the work sequence.

NOTE: The required parts are available from the BMW Parts Service (EPC).

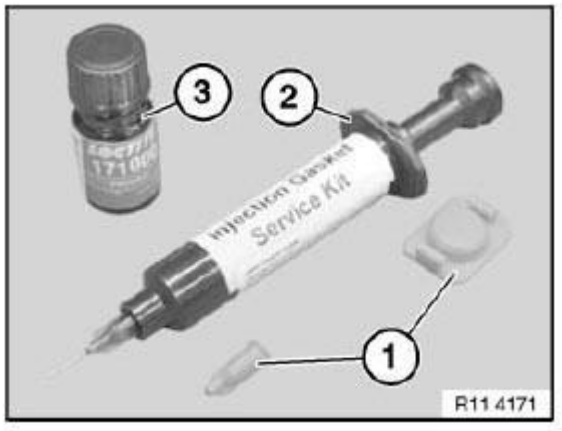
Remove screw caps (1) from injector (2).

Screw on metering needle.

Insert piston for pressing out.

Injector (2) contains the sealing compound Loctite, manufacturer's number 128357.

Bottle (3) contains the primer Loctite, manufacturer's number 171000.



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Fig. 85: Identifying Injector, Sealing Compound And Bottle
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Fit support sleeve (4) with radial shaft seal (1) on crankshaft.

Align groove (2) centrally to housing partition (3).

Coat both grooves (2) on radial shaft seal (1) with Loctite primer, manufacturer's number 171000, and expose to air for approx. one minute.

Push radial shaft seal (1) by hand as far as possible onto running surface.

Carefully remove support sleeve (4).

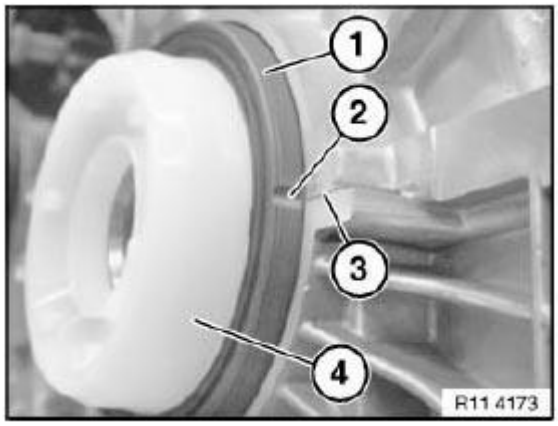


Fig. 86: Fitting Support Sleeve With Radial Shaft Seal On Crankshaft
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: Spacer ring (1) is supplied with radial shaft seal.

Screw special tool 11 9 182 with screws (special tool 11 9 184) to crankshaft. See **Fig. 87**.

Fit spacer ring on preassembled radial shaft seal.

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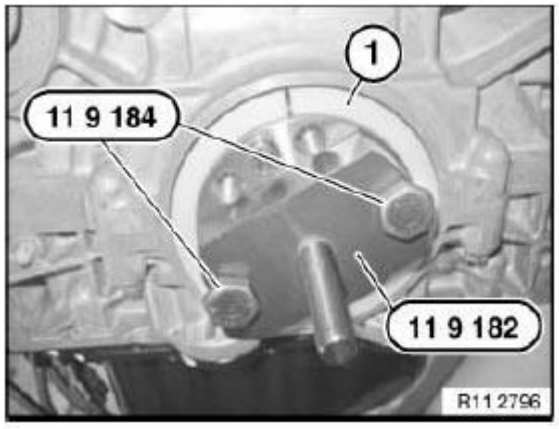


Fig. 87: Identifying Special Tools (11 9 182 And 11 9 184)
Courtesy of BMW OF NORTH AMERICA, INC.

Draw in radial shaft seal and spacer ring with special tool 11 9 181in conjunction with special tool 11 9 183. See **Fig. 88**.

Then remove spacer ring again.

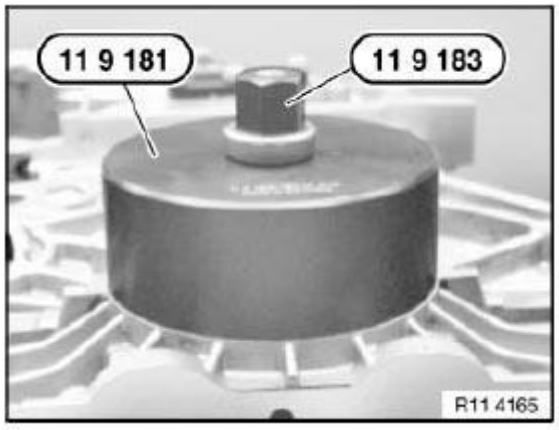


Fig. 88: Identifying Special Tools (11 9 181 And 11 9 183)
Courtesy of BMW OF NORTH AMERICA, INC.

Before filling with sealing compound:

Insert brush with Loctite primer, manufacturer's number 171000, as far as possible into grooves (1) on radial shaft seal and coat housing partition on engine block.

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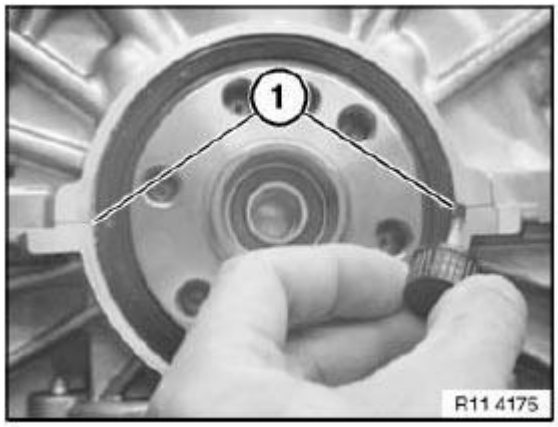


Fig. 89: Identifying Grooves On Radial Shaft Seal
Courtesy of BMW OF NORTH AMERICA, INC.

Fill both grooves (1) flush with Loctite sealing compound, manufacturer's number 128357.

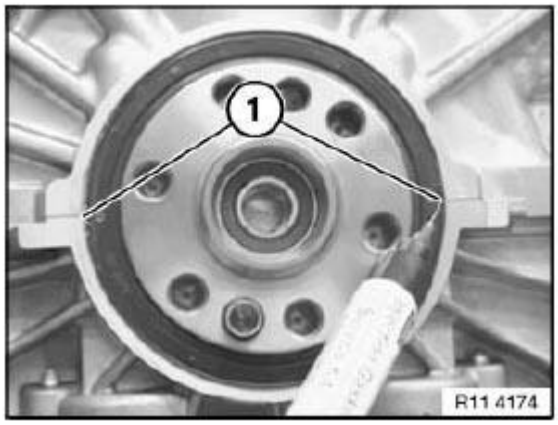


Fig. 90: Filling Both Grooves Flush With Loctite Sealing Compound
Courtesy of BMW OF NORTH AMERICA, INC.

Coat surface of sealing compound in both grooves (1) with Loctite primer, manufacturer's number 171000.

NOTE: Loctite primer, manufacturer's number 171000, binds the Loctite sealing compound, manufacturer's number 128357, and prevents leakage.

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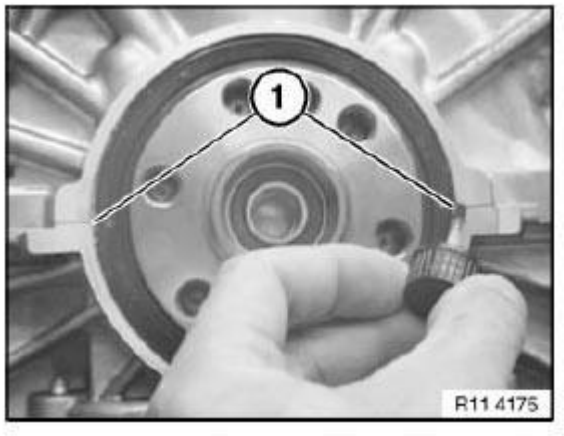


Fig. 91: Coating Surface Of Sealing Compound In Both Grooves With Loctite Primer
Courtesy of BMW OF NORTH AMERICA, INC.

Assemble engine.

11 14 151 REPLACING CRANKSHAFT SEAL (N51) ON TRANSMISSION SIDE FROM 1/1/09

Necessary preliminary tasks:

- Remove **FLYWHEEL**

IMPORTANT: Magnet wheel (1) is magnetic.

Keep magnet wheel (1) in a plastic bag away from metallic debris.

Remove magnet wheel (1) from crankshaft.

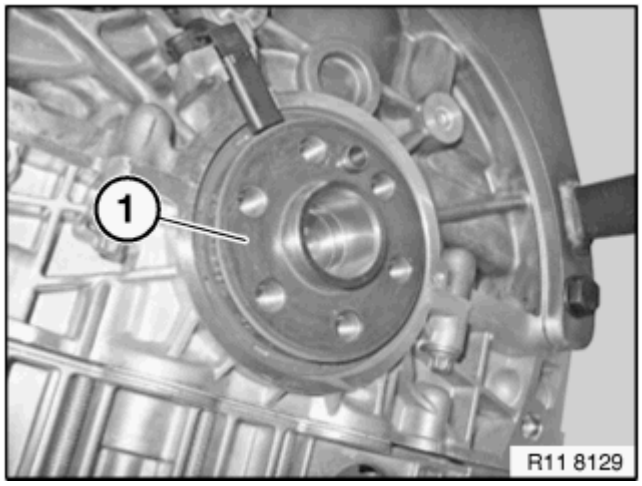


Fig. 92: Identifying Magnet Wheel
Courtesy of BMW OF NORTH AMERICA, INC.

Release screw on pulse sensor (1).

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Slide **PULSE SENSOR** (2) upwards.

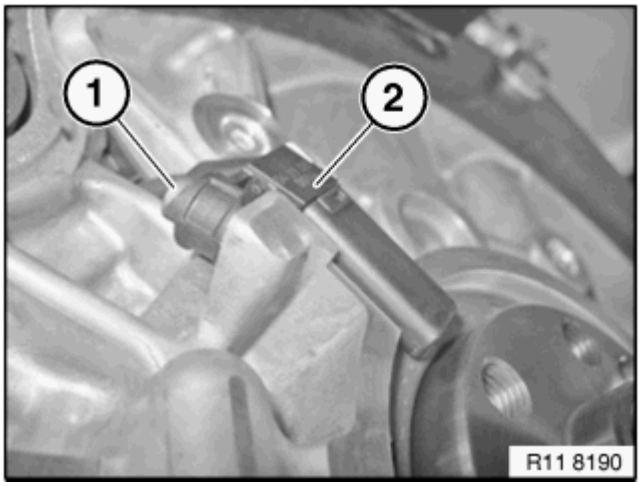


Fig. 93: Identifying Pulse Sensor And Screw
Courtesy of BMW OF NORTH AMERICA, INC.

IMPORTANT: Drill size maximum 2.5 millimeters.

Remove shavings immediately.

Drill a hole with a drill (1) in the radial shaft seal (see arrow).

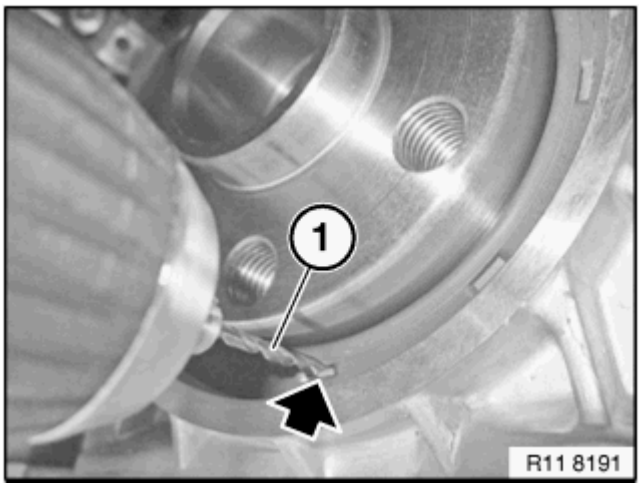


Fig. 94: Drilling Hole In Radial Shaft Seal Using Drill
Courtesy of BMW OF NORTH AMERICA, INC.

Immediately carefully remove shavings on the radial shaft seal (1).

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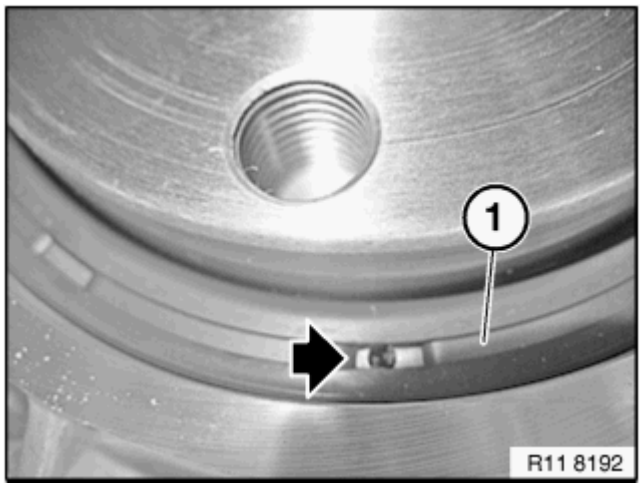


Fig. 95: Identifying Radial Shaft Seal
Courtesy of BMW OF NORTH AMERICA, INC.

Screw in special tool **23 0 490** in direction of arrow.

Drive out radial shaft seal with impact weight in direction of arrow.

IMPORTANT: Immediately carefully remove residual shavings.

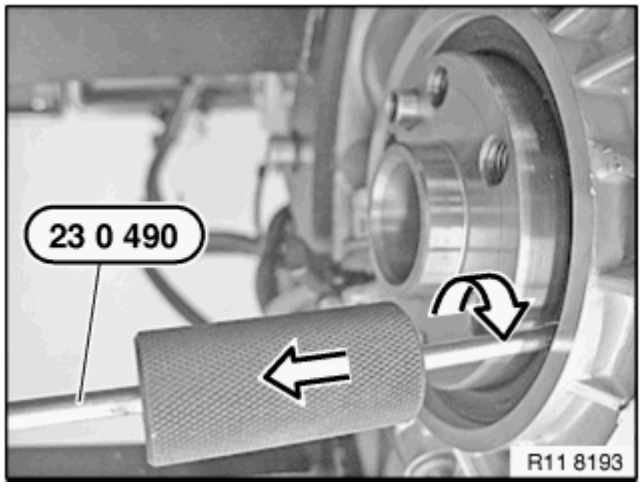


Fig. 96: Screwing In Special Tool 23 0 490 In Clockwise Direction
Courtesy of BMW OF NORTH AMERICA, INC.

Prepare radial shaft seal (1) on special tool 11 8 220.

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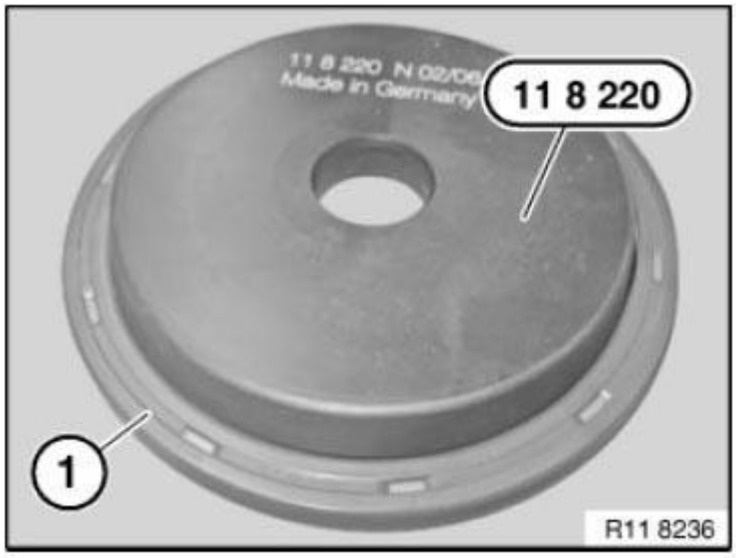


Fig. 97: Identifying Radial Shaft Seal On Special Tool 11 8 220
Courtesy of BMW OF NORTH AMERICA, INC.

Position the radial shaft seal (1) with special tool 11 8 220 on the crankshaft.

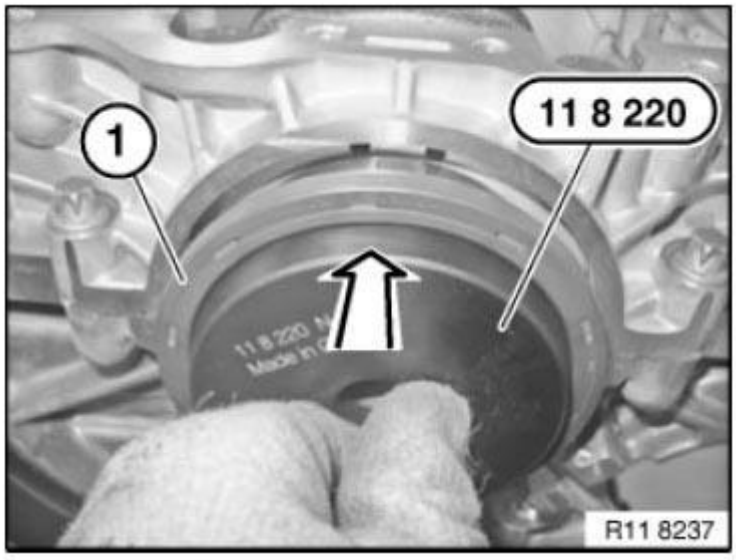


Fig. 98: Positioning Radial Shaft Seal Using Special Tool 11 8 220 On Crankshaft
Courtesy of BMW OF NORTH AMERICA, INC.

Brush radial shaft seal (1) over the special tool 11 8 220.

Move radial shaft seal (1) parallel up against the crankcase.

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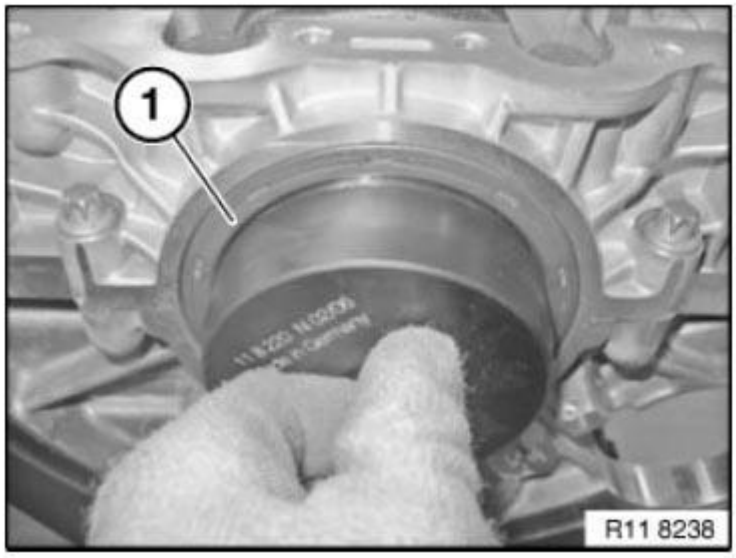


Fig. 99: Moving Radial Shaft Seal Parallel Up Against Crankcase
Courtesy of BMW OF NORTH AMERICA, INC.

Fasten special tool 11 9 182 (synchronizing key) with special tool 11 9 184 (screw) on the crankshaft.

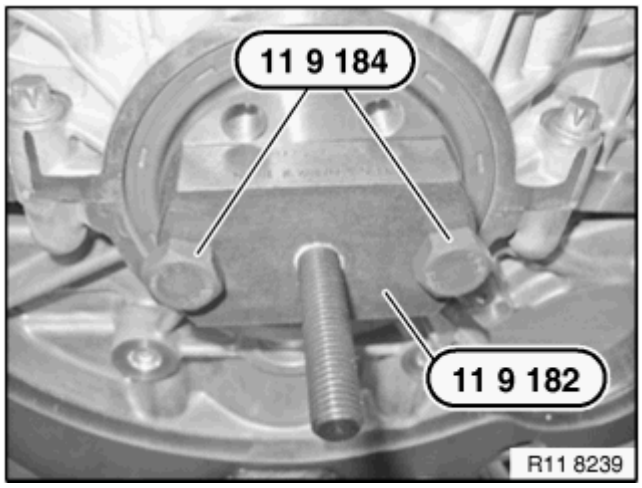


Fig. 100: Fastening Special Tool 11 9 182 With Special Tool 11 9 184 On Crankshaft
Courtesy of BMW OF NORTH AMERICA, INC.

Installation note:

Prepare special tool 11 9 181 (bush) for installation.

Connect special tool 11 9 185 (ring) onto special tool 11 9 181 (bush).

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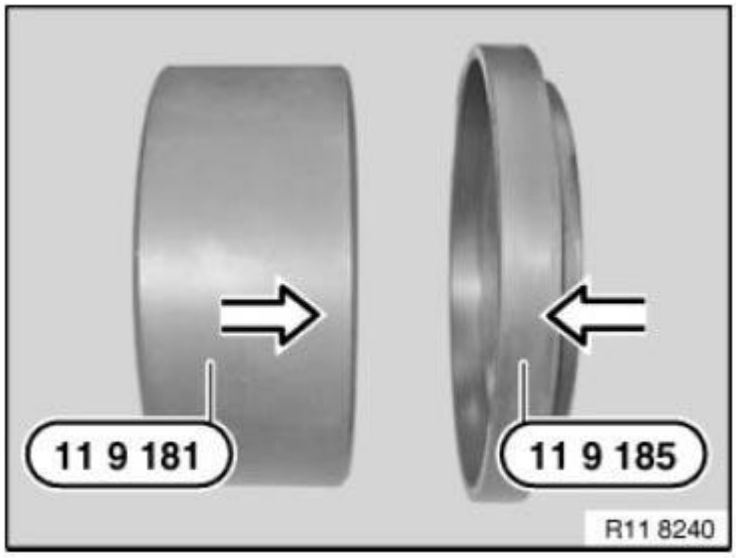


Fig. 101: Connecting Special Tool 11 9 185 Onto Special Tool 11 8 181
Courtesy of BMW OF NORTH AMERICA, INC.

Pull on radial shaft seal with special tools 11 9 181 (bush) and 11 9 185 (ring) in combination with special tool 11 9 183 (nut).

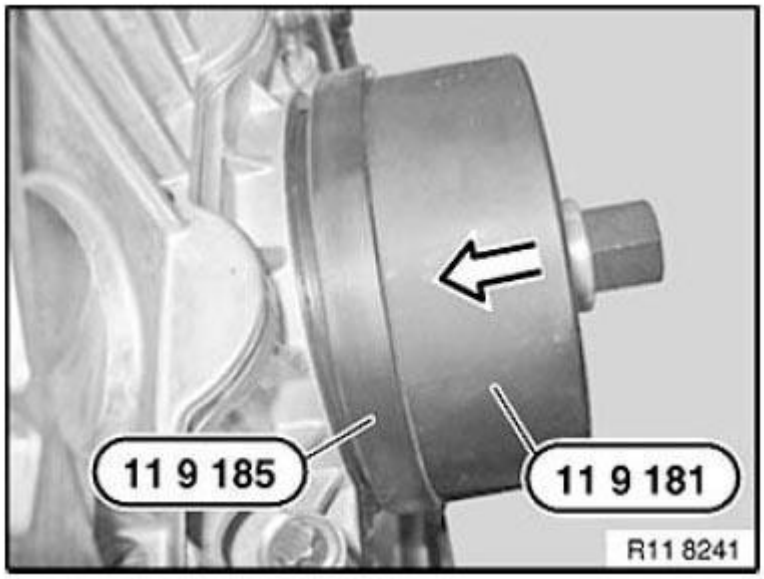


Fig. 102: Installing Rear Crankshaft Seal Using Tool 119 180/181
Courtesy of BMW OF NORTH AMERICA, INC.

Screw on radial shaft seal with special tool 11 9 183 (nut) to limit position.

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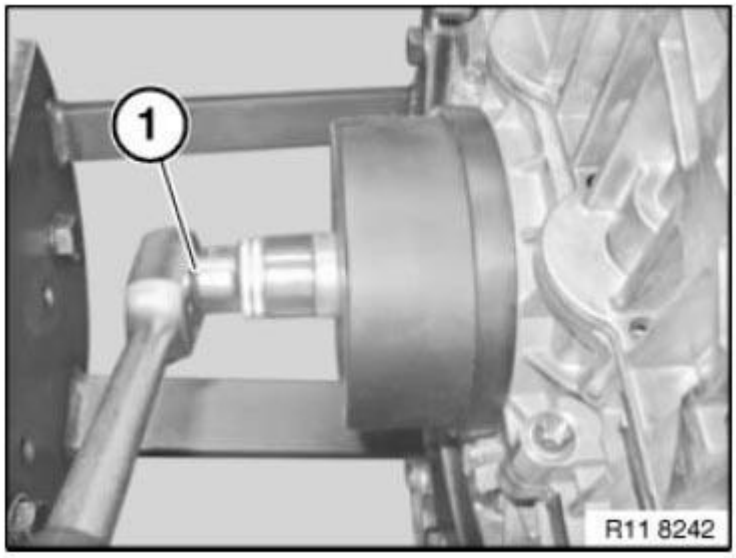


Fig. 103: Screwing On Radial Shaft Seal Using Special Tool 11 9 183
Courtesy of BMW OF NORTH AMERICA, INC.

Remove all special tools.

Assemble engine.

CRANKSHAFT WITH BEARING

11 21 500 REPLACING CRANKSHAFT (N51)

Special tools required:

For the following special tools, refer to **MAINTENANCE AND GENERAL INFORMATION - SPECIAL TOOLS -- 128I** .

- **00 2 510**
- **00 9 120** .

For the following special tools, refer to **ENGINE - SPECIAL TOOLS (N51)** .

- **11 4 370**
- **11 4 440**
- **11 9 360**

IMPORTANT: Aluminum-magnesium materials. No steel screws/bolts may be used due to the threat of electrochemical corrosion. A magnesium crankcase requires aluminum screws/bolts exclusively. Aluminum screws/bolts must be replaced each time they are released . Aluminum screws/bolts are permitted with and without color coding (blue). For reliable identification: Aluminum screws/bolts

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are not magnetic . Jointing torque and angle of rotation must be observed without fail (risk of damage) .

Necessary preliminary tasks:

- Remove **engine** . See **11 00 050 REMOVING AND INSTALLING ENGINE (N51)**.
- Mount engine on **assembly stand** . See **MOUNTING ENGINE ON ASSEMBLY STAND (N51)**.
- Remove **vibration damper** . See **11 23 010 REMOVING AND INSTALLING OR REPLACING VIBRATION DAMPER (M51)**
- Removing **oil sump** . See **11 13 000 REMOVING AND INSTALLING, SEALING OR REPLACING OIL SUMP (N51)**.
- Remove **oil pump** . See **11 41 000 REMOVING AND INSTALLING OIL PUMP (N51)**.
- Remove oil pump/vacuum pump **chain module** . See **11 41 010 REMOVING AND INSTALLING/REPLACING CHAIN MODULE FOR OIL PUMP/VACUUM PUMP (N51)**.
- Remove **timing chain module** . See **11 31 051 REPLACING TIMING CHAIN (N51)**.

Release screws (1).

Tightening torque: **11 13 5AZ** .

Installation:

Replace aluminum screws.

Remove oil deflector (2).

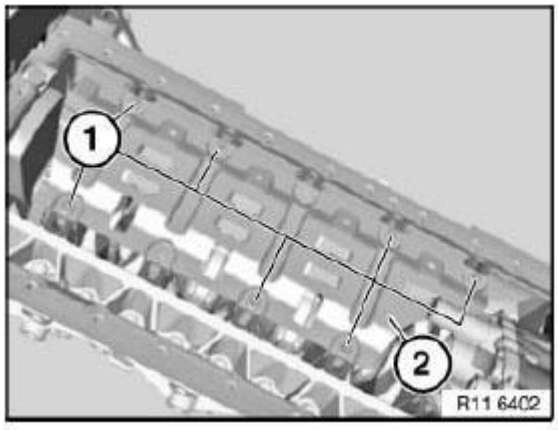


Fig. 104: Identifying Oil Deflector With Screws
Courtesy of BMW OF NORTH AMERICA, INC.

Release screws (1).

Tightening torque: **11 11 2AZ** .

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Unfasten screws (2).

Tightening torque: **11 11 3AZ** .

Installation:

Replace aluminum screws.

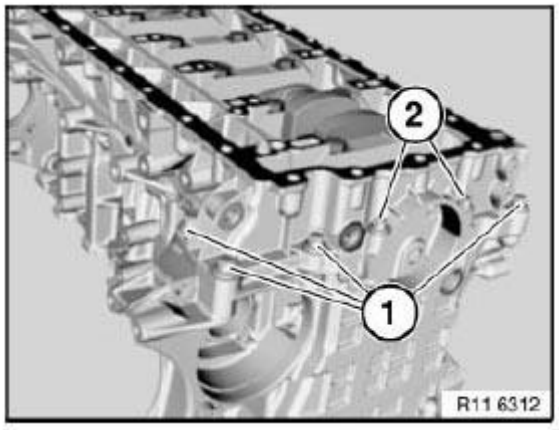


Fig. 105: Identifying Aluminum Screws
Courtesy of BMW OF NORTH AMERICA, INC.

Release screws (1).

Tightening torque: **11 11 2AZ** .

Unfasten screws (2).

Tightening torque: **11 11 4AZ** .

Installation:

Replace aluminum screws.

Release steel screws (1 to 14) from outside inwards.

Tightening torque: **11 11 1AZ** .

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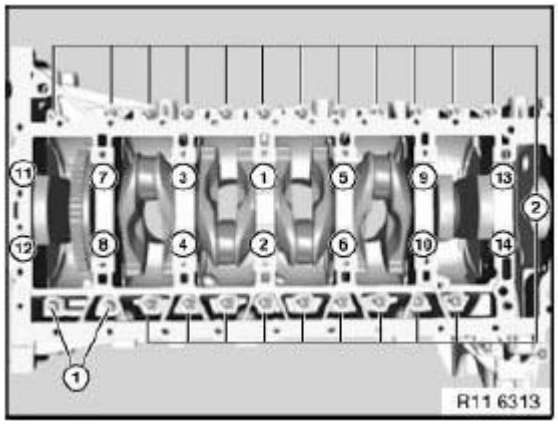


Fig. 106: Steel Screws Removing Order
Courtesy of BMW OF NORTH AMERICA, INC.

Release screws (1).

Tightening torque **11 11 3AZ** .

Installation:

Replace aluminum screws.

Remove crankcase lower section in upward direction.

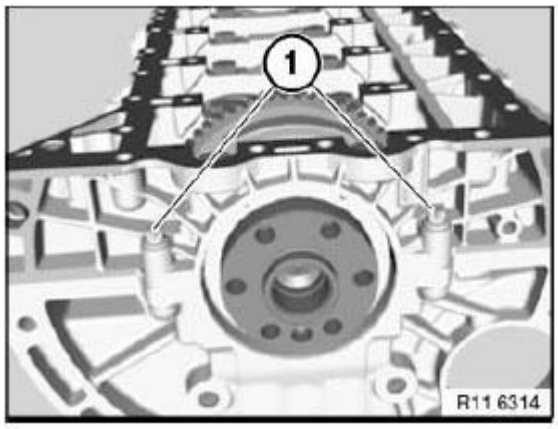


Fig. 107: Identifying Screws
Courtesy of BMW OF NORTH AMERICA, INC.

Remove crankshaft (1) in direction of arrow.

IMPORTANT: Remove crankshaft with aid of a second person.
Weight of crankshaft approx. 25 kg.

Remove **main bearing shells** , replace if necessary.

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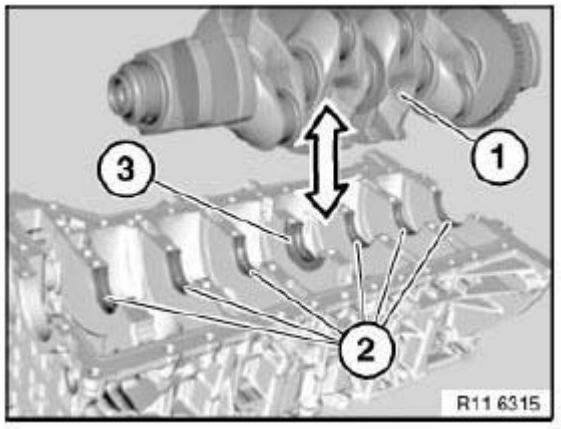


Fig. 108: Removing Crankshaft
Courtesy of BMW OF NORTH AMERICA, INC.

Check adapter sleeves (1) for damage and secure seating; replace if necessary.

Insert all **crankshaft main bearing shells** .

Installation:

Lubricate all bearing points with engine oil.

NOTE: Illustrations show N46.

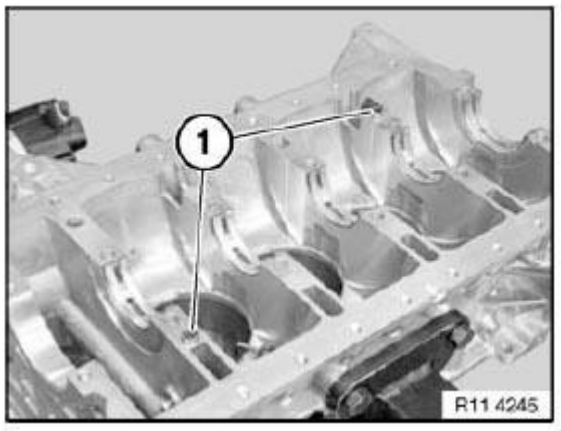


Fig. 109: Identifying Adapter Sleeves
Courtesy of BMW OF NORTH AMERICA, INC.

Insert crankshaft (1).

IMPORTANT: Remove crankshaft with aid of a second person.
Weight of crankshaft approx. 25 kg.

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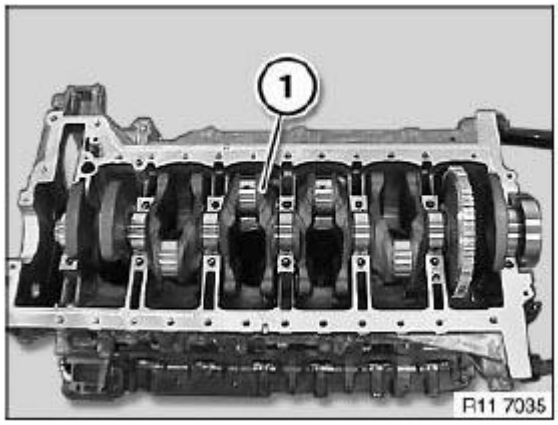


Fig. 110: Identifying Crankshaft
Courtesy of BMW OF NORTH AMERICA, INC.

Tighten steel screws (1 to 14) from inside outwards.

Tightening torque: **11 11 1AZ** .

Tighten screws (2) from inside outwards.

Tightening torque: **11 11 4AZ** .

Tighten screws (1).

Tightening torque: **11 11 2AZ** .

Installation:

Replace aluminum screws.

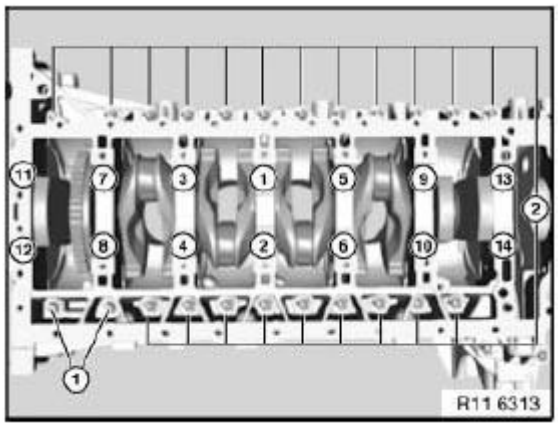


Fig. 111: Steel Screws Tightening Sequence
Courtesy of BMW OF NORTH AMERICA, INC.

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Tighten aluminum screws exclusively with special tool 00 9 120.

IMPORTANT: In the case of aluminum screws, jointing torque and angle of rotation must be observed without fail.

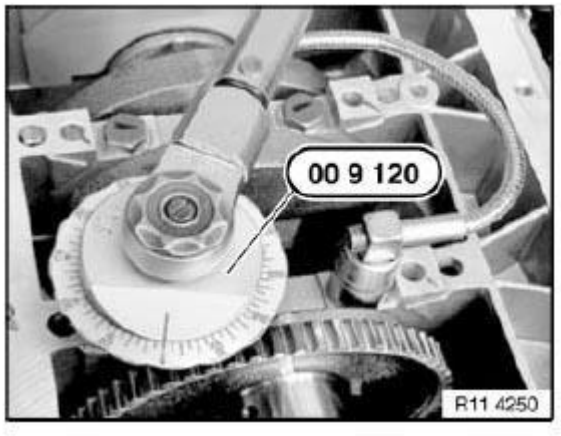


Fig. 112: Tightening Main Bearing Bolts Using Special Tool (00 9 120)
Courtesy of BMW OF NORTH AMERICA, INC.

Set up stand with magnetic base on special tool 11 4 440.

Set up special tool 00 2 510 on stand.

Position special tool 00 2 510 on crankshaft.

Move crankshaft in direction of arrow.

Determine bearing play.

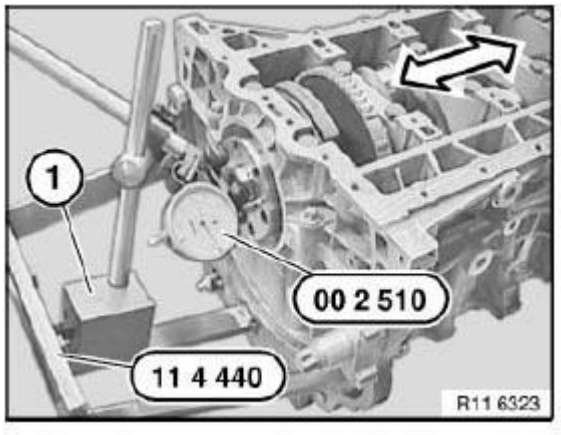


Fig. 113: Moving Crankshaft
Courtesy of BMW OF NORTH AMERICA, INC.

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Drive in both nozzles (1) with special tool 11 9 360 on left and right into crankcase.

Installation:

Always replace nozzles (1).

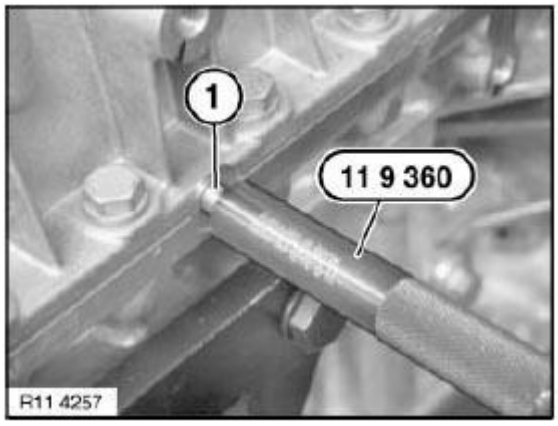


Fig. 114: Driving Nozzles Into Crankcase Using Special Tool 11 9 360
Courtesy of BMW OF NORTH AMERICA, INC.

Replace radial shaft seal at **FRONT**.

Replace radial shaft seal at **REAR (FROM 1/1/09)** or **REAR (TO 12/31/08)**.

Installation:

Use PRIMER 1.3 AND LIQUID GASKET 1.4.

Prepare liquid gasket (1) in special tool **11 4 370 DEVICE** .

Screw on nozzle for injecting liquid gasket.

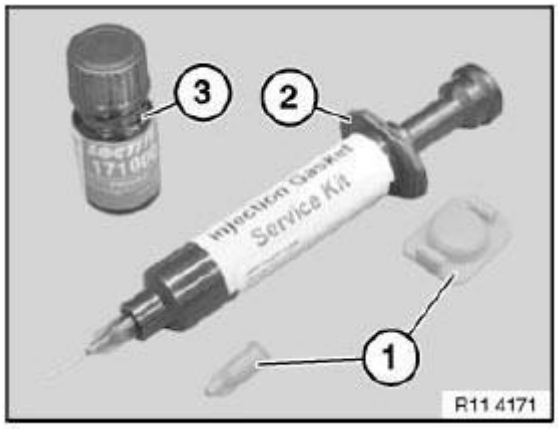


Fig. 115: Identifying Sealing Compound And Bottle Of Injector

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Courtesy of BMW OF NORTH AMERICA, INC.

Slowly insert liquid gasket (1) with special tool 11 4 370 in direction of arrow.

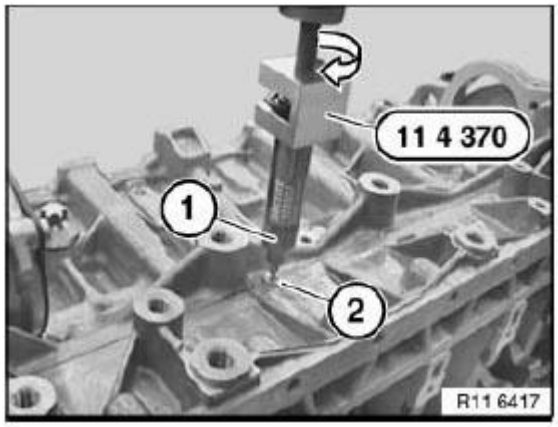


Fig. 116: Inserting Liquid Gasket Using Special Tool (11 4 370)
Courtesy of BMW OF NORTH AMERICA, INC.

Stop (seal off) escaping liquid gasket with primer 1.3.

(Picture shows N40).

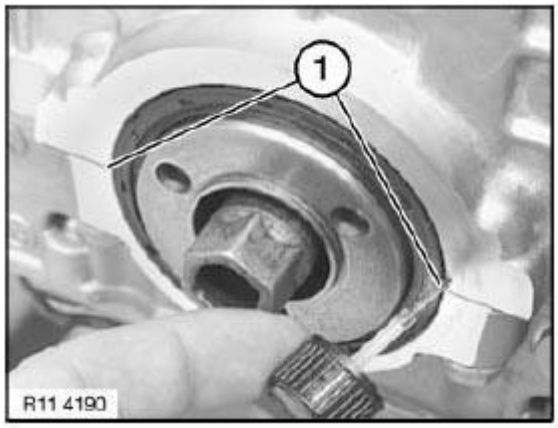


Fig. 117: Inserting Brush Into Groove
Courtesy of BMW OF NORTH AMERICA, INC.

Assemble engine.

11 21 531 REPLACING ALL CRANKSHAFT MAIN BEARINGS (N51)

Special tools required:

For the following special tools, refer to **MAINTENANCE AND GENERAL INFORMATION - SPECIAL TOOLS -- 128I** .

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- **00 2 590**

  For the following special tools, refer to **ENGINE - SPECIAL TOOLS (N51)** .

- **11 4 251**
- **11 4 252**
- **11 4 470**

IMPORTANT: Aluminum-magnesium materials. No steel screws/bolts may be used due to the threat of electrochemical corrosion. A magnesium crankcase requires aluminum screws/bolts exclusively. Aluminum screws/bolts must be replaced each time they are released . Aluminum screws/bolts are permitted with and without color coding (blue). For reliable identification: Aluminum screws/bolts are not magnetic . Jointing torque and angle of rotation must be observed without fail (risk of damage) .

Necessary preliminary tasks:

- Remove **crankshaft** . See **11 21 500 REPLACING CRANKSHAFT (N51)**.

Check setting of oil spray nozzles, adjusting if necessary:

Attach special tool 11 4 251 to screw connection on main bearing.

Special tool 11 4 252 must be pre-installed at the seventh main bearing block.

Tightening torque. See 11 11 5AZ in **11 11 ENGINE BLOCK** .

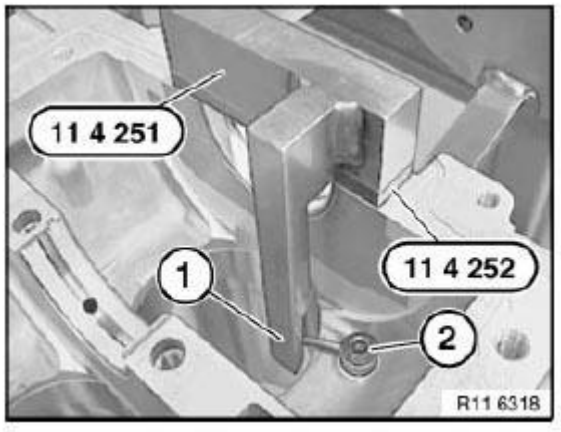


Fig. 118: Attaching Special Tool To Screw Connection On Main Bearing
Courtesy of BMW OF NORTH AMERICA, INC.

Remove crankshaft (1).

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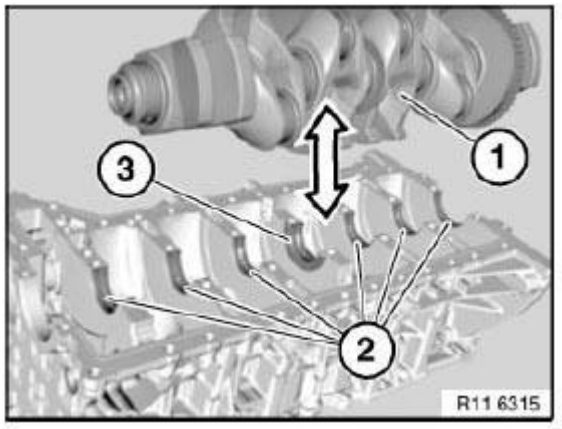


Fig. 119: Removing Crankshaft
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: Pilot bearing shell (1) at the fourth bearing block is a thrust bearing.

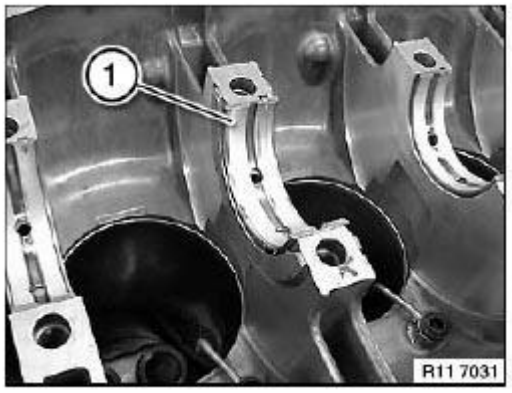


Fig. 120: Identifying Pilot Bearing Shell
Courtesy of BMW OF NORTH AMERICA, INC.

Remove bearing shells (1).

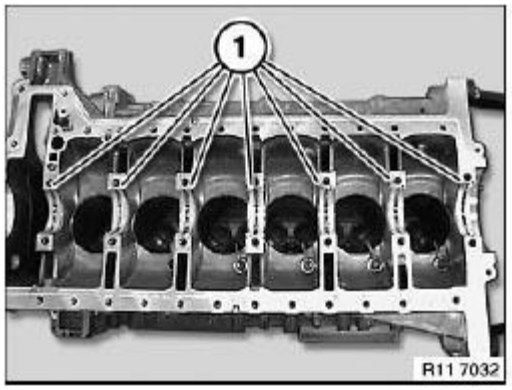


Fig. 121: Identifying Bearing Shells

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Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Bearing shell (1) with lubricant groove must be fitted in crankcase upper section.

Bearing shell (2) without lubricant groove must be fitted in crankcase lower section (bedplate).

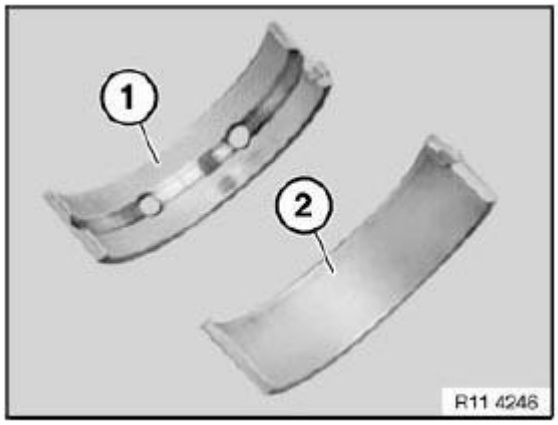


Fig. 122: Identifying Bearing Shells
Courtesy of BMW OF NORTH AMERICA, INC.

Bearing classification (1) on crankcase lower section (values from 1 to 3).

Bearing classification (2) of **connecting rod bearings** (b/r). See **11 24 571 REPLACING ALL CONNECTING ROD BEARINGS (N51)**.

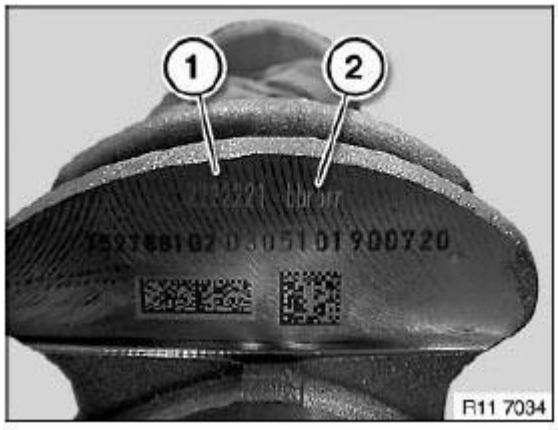


Fig. 123: Identifying Bearing Classifications
Courtesy of BMW OF NORTH AMERICA, INC.

Bearing classification (1) in crankcase upper section as per table (values of A/B/C).

Installation:

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When all the letters and numbers have been determined, the bearing shell color must be allocated, see table.

IMPORTANT: Engine damage will result if a small bearing play is determined. The color combination Yellow and Red must not be fitted. Possible color combinations, see BEARING CLASSIFICATION.

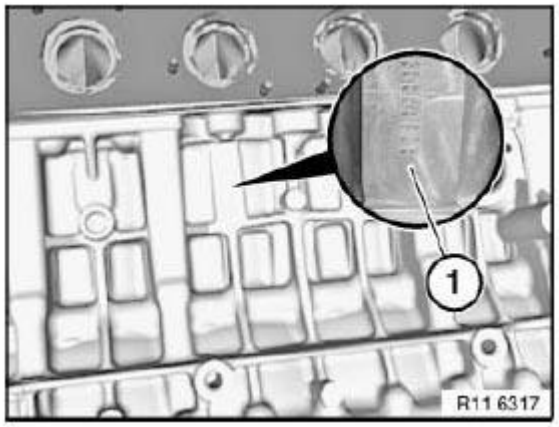


Fig. 124: Identifying Bearing Classification Of Crankcase Upper Section
Courtesy of BMW OF NORTH AMERICA, INC.

BEARING CLASSIFICATION

(A1) Bedplate / Yellow	**(B1)** Bedplate / Yellow	**(C1)** Bedplate / Green
(A1) Crankcase / Yellow	**(B1)** Crankcase / Green	**(C1)** Crankcase / Green
(A2) Bedplate / Green	**(B2)** Bedplate / Green	**(C2)** Bedplate / Green
(A2) Crankcase / Yellow	**(B2)** Crankcase / Green	**(C2)** Crankcase / Red
(A3) Bedplate / Green	**(B3)** Bedplate / Red	**(C3)** Bedplate / Red
(A3) Crankcase / Green	**(B3)** Crankcase / Green	**(C3)** Crankcase / Red

Clean sealing faces (1).

IMPORTANT: Do not clean sealing faces with a metal-cutting tool.

Clean sealing faces (1) with special tool 11 4 470.

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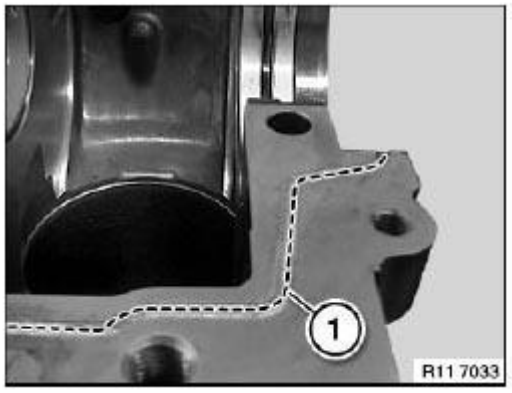


Fig. 125: Identifying Sealing Faces
Courtesy of BMW OF NORTH AMERICA, INC.

Insert all bearing shells (2 and 3).

NOTE: Bearing shell at the fourth bearing block is a thrust bearing.

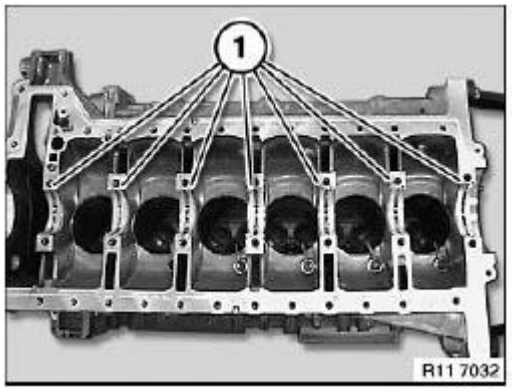


Fig. 126: Identifying Bearing Shells
Courtesy of BMW OF NORTH AMERICA, INC.

Determine bearing play with special tool 00 2 590.

Installation:

All measuring points must be free from oil and grease.

Use used screws to determine bearing play.

Set up **crankcase lower section** with bearing shells. See **11 21 500 REPLACING CRANKSHAFT (N51)**.

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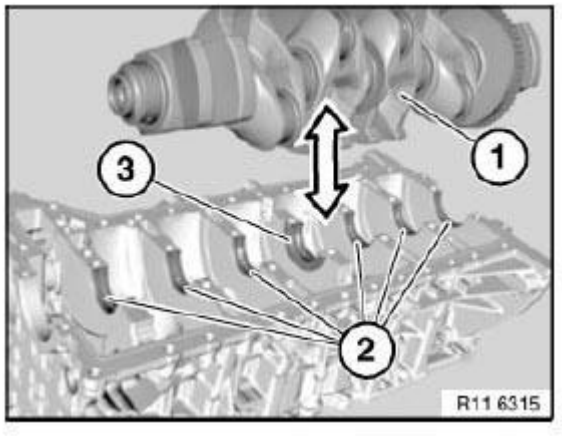


Fig. 127: Removing Crankshaft
Courtesy of BMW OF NORTH AMERICA, INC.

Remove lower crankcase.

Read off bearing play at width of flattened plastic thread and measurement scale.

Crankshaft bearing clearance radial.

Installation:

Remove plastic thread.

Apply a light coat of oil to bearing shells and crankshaft.

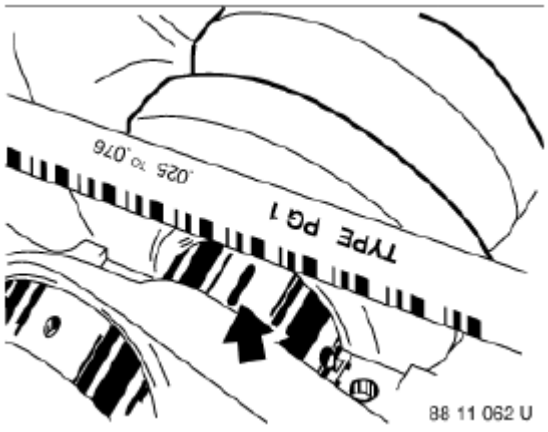


Fig. 128: Locating Measurement Scale
Courtesy of BMW OF NORTH AMERICA, INC.

Install **crankcase lower section** . See **11 21 500 REPLACING CRANKSHAFT (N51)**.

Assemble engine.

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11 22 500 REMOVING AND INSTALLING OR REPLACING FLYWHEEL (N51)

Special tools required:

For the following special tools, refer to **ENGINE - SPECIAL TOOLS (N51)** .

- **11 4 180**
- **11 9 260**
- **11 9 265**

IMPORTANT: Aluminum-magnesium materials. No steel screws/bolts may be used due to the threat of electrochemical corrosion. A magnesium crankcase requires aluminum screws/bolts exclusively. Aluminum screws/bolts must be replaced each time they are released . Aluminum screws/bolts are permitted with and without color coding (blue). For reliable identification: Aluminum screws/bolts are not magnetic . Jointing torque and angle of rotation must be observed without fail (risk of damage) .

Necessary preliminary tasks:

- Remove **transmission** . See **23 00 017 REMOVING AND INSTALLING TRANSMISSION (GS6-17BZ) N51/N52/N52K/N53** or **24 00 032 REMOVING AND INSTALLING AUTOMATIC TRANSMISSION (GA6L45R)** .
- Remove **clutch** . See **11 22 500 REMOVING AND INSTALLING OR REPLACING FLYWHEEL (N51)**.

Block flywheel (1) with special tool 11 9 260, use an old transmission screw for this purpose. See **Fig. 129**.

Installation:

Replace aluminum screws .

Unfasten flywheel screws.

Tightening torque. See 11 22 1AZ in **11 22 FLYWHEEL** .

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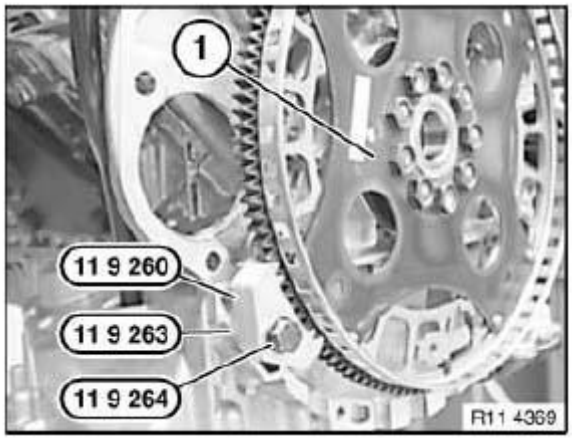


Fig. 129: Identifying Flywheel With Special Tools
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Flywheel (1) is secured with an alignment pin.

Fit new flywheel screws.

Clean crankshaft thread for flywheel screws.

Secure flywheel with an old transmission screw (1) and special tools 11 9 260 and 11 9 265. See **Fig. 130**.

Installation:

Replace aluminum screws .

Release flywheel screws with special tool 11 4 180. See **Fig. 130**.

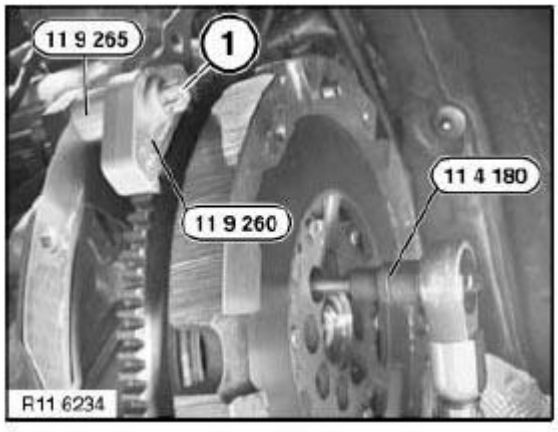


Fig. 130: Identifying Transmission Screw And Special Tools
Courtesy of BMW OF NORTH AMERICA, INC.

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Installation:

Flywheel is secured with a dowel pin.

Fit new flywheel screws.

Tightening torque. See 11 22 2AZ in **11 22 FLYWHEEL** .

Assemble engine.

FLYWHEEL

11 22 500 REMOVING AND INSTALLING OR REPLACING FLYWHEEL (N51)

Special tools required:

For the following special tools, refer to **ENGINE - SPECIAL TOOLS (N51)** .

- **11 4 180**
- **11 9 260**
- **11 9 265**

IMPORTANT: Aluminum-magnesium materials. No steel screws/bolts may be used due to the threat of electrochemical corrosion. A magnesium crankcase requires aluminum screws/bolts exclusively. Aluminum screws/bolts must be replaced each time they are released . Aluminum screws/bolts are permitted with and without color coding (blue). For reliable identification: Aluminum screws/bolts are not magnetic . Jointing torque and angle of rotation must be observed without fail (risk of damage) .

Necessary preliminary tasks:

- Remove **transmission** . See **23 00 017 REMOVING AND INSTALLING TRANSMISSION (GS6-17BZ) N51/N52/N52K/N53** or **24 00 032 REMOVING AND INSTALLING AUTOMATIC TRANSMISSION (GA6L45R)** .
- Remove **clutch** . See **11 22 500 REMOVING AND INSTALLING OR REPLACING FLYWHEEL (N51)**.

Block flywheel (1) with special tool 11 9 260, use an old transmission screw for this purpose. See **Fig. 131**.

Installation:

Replace aluminum screws .

Unfasten flywheel screws.

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Tightening torque. See 11 22 1AZ in **11 22 FLYWHEEL** .

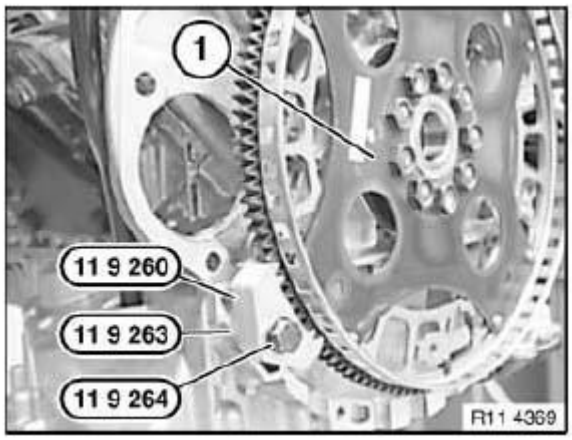


Fig. 131: Identifying Flywheel With Special Tools
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Flywheel (1) is secured with an alignment pin.

Fit new flywheel screws.

Clean crankshaft thread for flywheel screws.

Secure flywheel with an old transmission screw (1) and special tools 11 9 260 and 11 9 265. See **Fig. 132**.

Installation:

Replace aluminum screws .

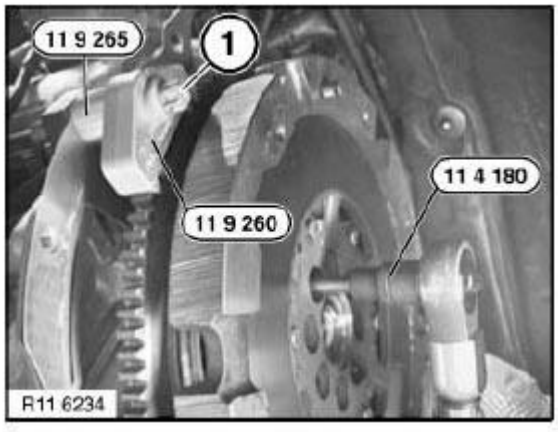


Fig. 132: Identifying Special Tools
Courtesy of BMW OF NORTH AMERICA, INC.

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Release flywheel screws with special tool 11 4 180.

Installation:

Flywheel is secured with a dowel pin.

Fit new flywheel screws.

Tightening torque. See 11 22 2AZ in **11 22 FLYWHEEL** .

Assemble engine.

VIBRATION DAMPER

11 23 010 REMOVING AND INSTALLING OR REPLACING VIBRATION DAMPER (M51)

Necessary preliminary tasks:

- Detach front underbody protection.
- Remove **drive belt** . See **11 28 010 REPLACING ALTERNATOR DRIVE BELT (N51)**.

Release screws (1).

Tightening torque. See 11 23 1AZ in **VIBRATION DAMPER** .

Remove vibration damper (2).

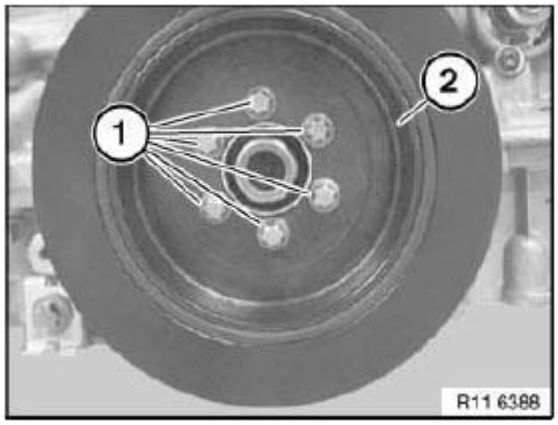


Fig. 133: Identifying Vibration Damper Screws
Courtesy of BMW OF NORTH AMERICA, INC.

Assemble engine.

CONNECTING ROD WITH BEARING

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11 24 571 REPLACING ALL CONNECTING ROD BEARINGS (N51)

Special tools required:

For the following special tools, refer to **MAINTENANCE AND GENERAL INFORMATION - SPECIAL TOOLS -- 128I** .

- **00 2 590**
- **00 9 120**

IMPORTANT: All crank pins are connected with the crankshaft.
Modified procedure; the bearing shell colors are the same at the top and bottom.
Blue / Red bearing shell colors are no longer used in combination.

Necessary preliminary tasks:

- Removing **oil pan** . See **11 13 000 REMOVING AND INSTALLING, SEALING OR REPLACING OIL SUMP (N51)**.

IMPORTANT: All crankshaft crank pins are classified.

Possible classifications per connecting rod at top and bottom:

r: Red

b: Blue

Only **one** color may be fitted per big end and connecting rod.

In direction of arrow from (1 to 2) crank pin (1 to 6).

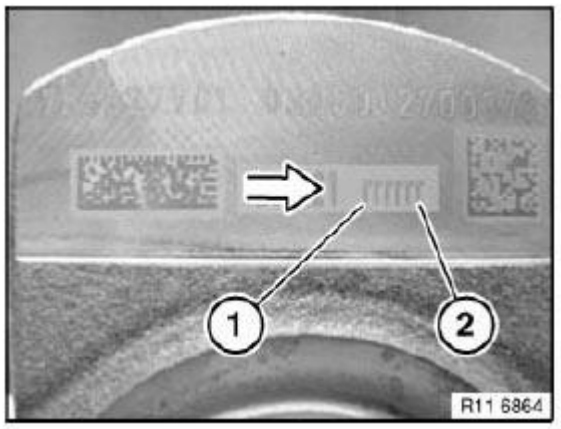


Fig. 134: Locating Crankshaft Crank Pins
Courtesy of BMW OF NORTH AMERICA, INC.

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Example:

Possible classification:

Cylinder Classification Red / Red.

1:

Cylinder Classification Blue / Blue.

2:

Cylinder Classification Blue / Blue.

3:

Cylinder Classification Red / Red.

4:

Cylinder Classification Red / Red.

5:

Cylinder Classification Blue / Blue.

6:

Release conrod bolts (1).

Remove connecting rod bearing cap (2).

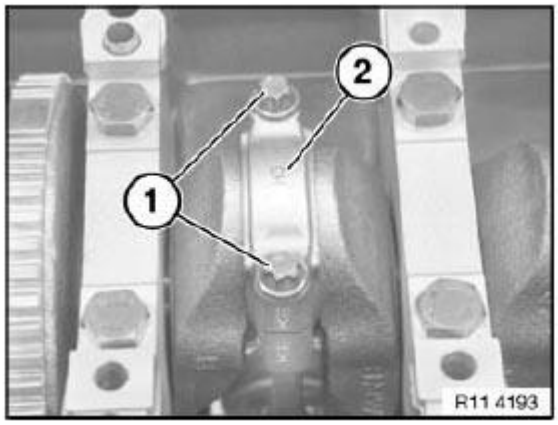


Fig. 135: Identifying Conrod Bolts And Connecting Rod Bearing Cap
Courtesy of BMW OF NORTH AMERICA, INC.

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IMPORTANT: Risk of damage to cylinder wall and to crankshaft.

Gently release connecting rod from crankshaft.

Remove bearing shells (1 and 2).

Install new conrod bearing shells.

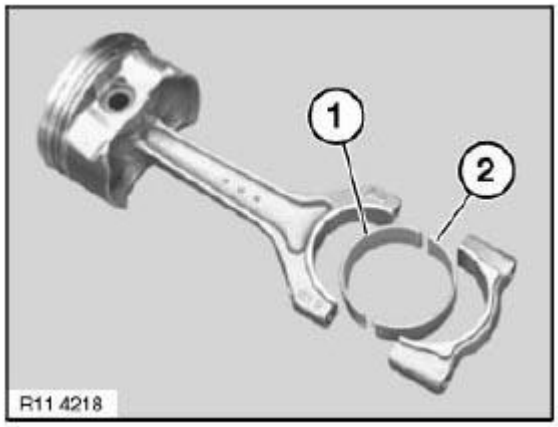


Fig. 136: Removing Bearing Shells
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Pay attention to guide lugs during installation.

IMPORTANT: All crankshaft crank pins are classified.

In each case insert only one color of bearing shell (1 and 2) for each conrod.

Check conrod bearing clearance.

Piston in BDC position.

Determine bearing clearance, ensure that bearing points are free from oil and grease.

Fit special tool 00 2 590 (Plastigage Type PG 1) to oil-free crankshaft.

Fit bearing cap so that pairing letters match up.

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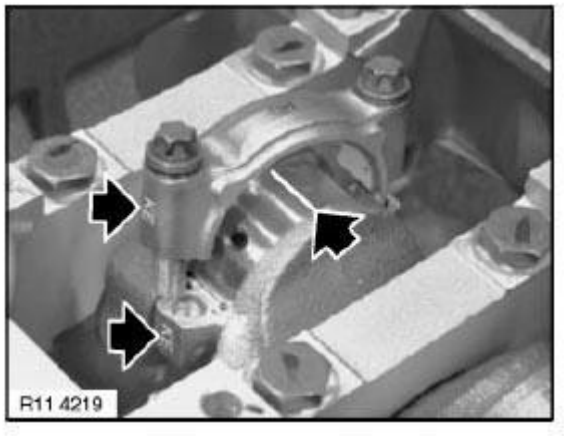


Fig. 137: Locating Bearing Points
Courtesy of BMW OF NORTH AMERICA, INC.

IMPORTANT: Do not distort conrods or crankshaft.

Use the old conrod bolts to check conrod clearance.

Tighten down conrod bolts with special tool 00 9 120. See **Fig. 138**.

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

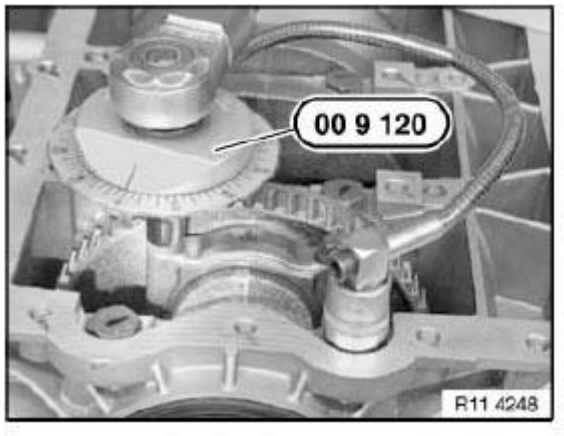


Fig. 138: Identifying Special Tool (00 9 120)
Courtesy of BMW OF NORTH AMERICA, INC.

Remove bearing cap. Read off bearing clearance at width of crushed plastic thread (Plastigage) with aid of measuring scale.

Conrod bearing clearance .

- Remove Plastigage
- Coat crankshaft and bearing shells with oil.

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- Install new conrod bolts and tighten down with special tool 00 9 120.

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

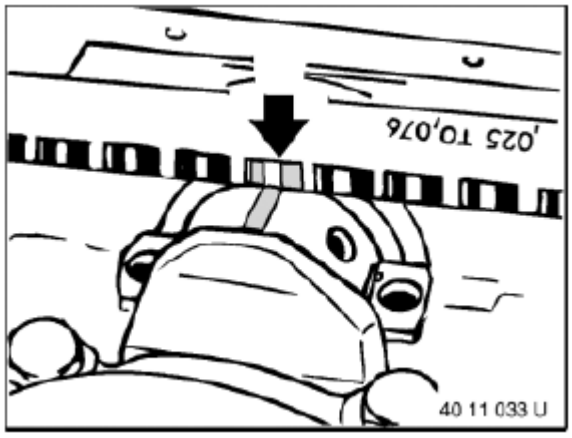


Fig. 139: Inspecting Bearing Clearance Using Plastigage
Courtesy of BMW OF NORTH AMERICA, INC.

Assemble engine.

PISTON WITH RINGS AND PIN

11 25 530 REMOVING AND INSTALLING/REPLACING ALL PISTONS (N51)

Special tools required:

For the following special tools, refer to **MAINTENANCE AND GENERAL INFORMATION - SPECIAL TOOLS -- 128I** .

- **00 9 120**

For the following special tools, refer to **ENGINE - SPECIAL TOOLS (N51)** .

- **11 4 491**
- **11 4 492**
- **11 4 493**
- **11 4 494**
- **11 6 261**
- **11 8 330**

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

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IMPORTANT: If pistons, conrods and bearing shells are reused, they must be reinstalled in the same places.
Individual conrod replacement is not permitted; they are classified according to weight categories.
Conrods and conrod bearing caps are denoted with the same pairing letters; mixing them up will result in engine damage.
Piston and piston pins are paired and must not be fitted individually.

Necessary preliminary tasks:

- Remove **engine** . See **11 00 050 REMOVING AND INSTALLING ENGINE (N51)**.
- Mount engine on **assembly stand** . See **MOUNTING ENGINE ON ASSEMBLY STAND (N51)**.
- Remove intake air manifold. See **11 61 050 REMOVING AND INSTALLING INTAKE AIR MANIFOLD (N51)**.
- Remove **cylinder head** . See **11 12 100 REMOVING AND INSTALLING/SEALING CYLINDER HEAD (N51)**.
- Remove **engine oil sump** . See **11 13 000 REMOVING AND INSTALLING, SEALING OR REPLACING OIL SUMP (N51)**.
- Remove **oil pump** . See **11 41 000 REMOVING AND INSTALLING OIL PUMP (N51)**.

NOTE: In event of heavy oil carbon residue:

Carefully remove oil carbon residue from cylinder wall.

NOTE: Illustrations show N46.

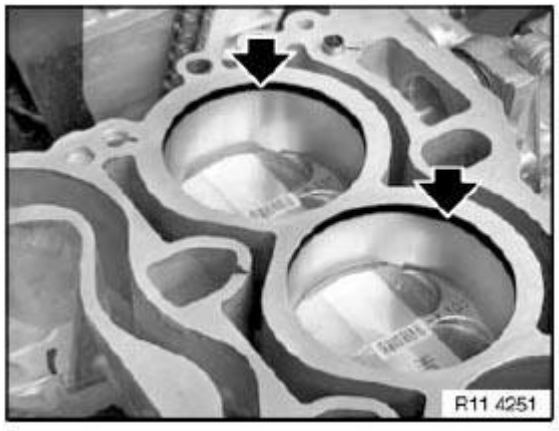


Fig. 140: Locating Carbon Deposit Area In Cylinder Wall
Courtesy of BMW OF NORTH AMERICA, INC.

Do **not** release screw (1).

Oil spray nozzle (2) must not be maladjusted or bent **(risk of damage)** .

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Readjust if necessary.

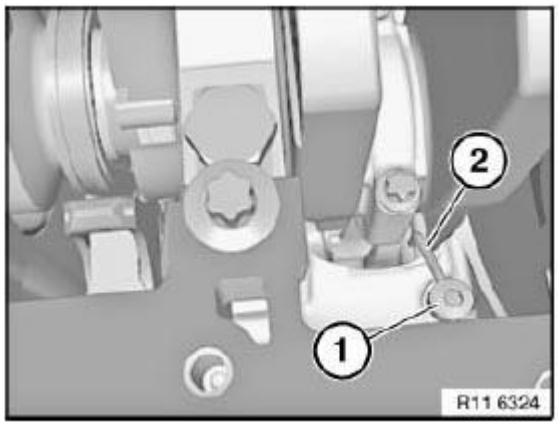


Fig. 141: Identifying Screw
Courtesy of BMW OF NORTH AMERICA, INC.

Release conrod bolts (1).

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

Remove conrod bearing cap (2) in direction of arrow.

IMPORTANT: Conrods and conrod bearing caps are denoted with the same pairing letters; mixing them up will result in engine damage.

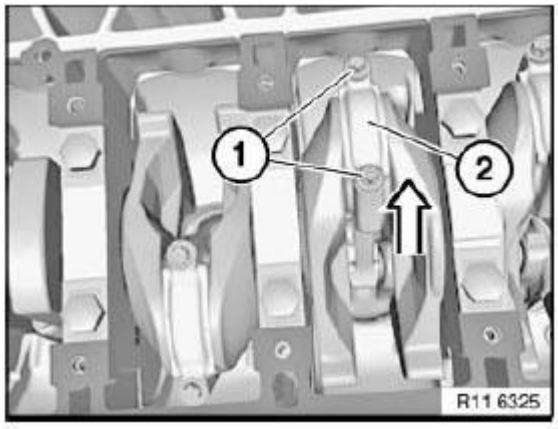


Fig. 142: Removing Conrod Bearing Cap
Courtesy of BMW OF NORTH AMERICA, INC.

Attach special tool 11 8 330 in conrod big end. See **Fig. 143**.

Press out conrod and piston to cylinder head side.

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IMPORTANT: Risk of damage to oil spray nozzle.

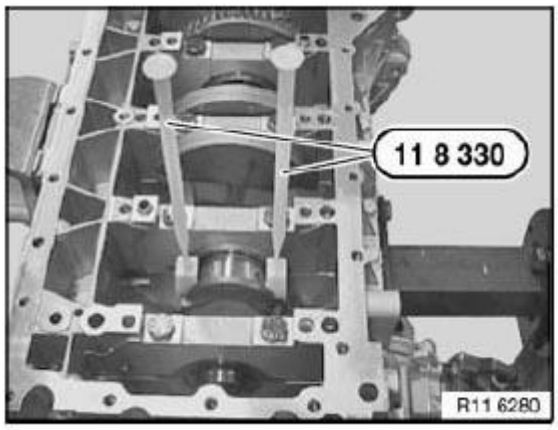


Fig. 143: Identifying Special Tool (11 8 330)
Courtesy of BMW OF NORTH AMERICA, INC.

Preliminary work:

Clamp special tool 11 4 491in a vice. See **Fig. 144**.

Secure piston (1) with conrod to special tool 11 4 491.

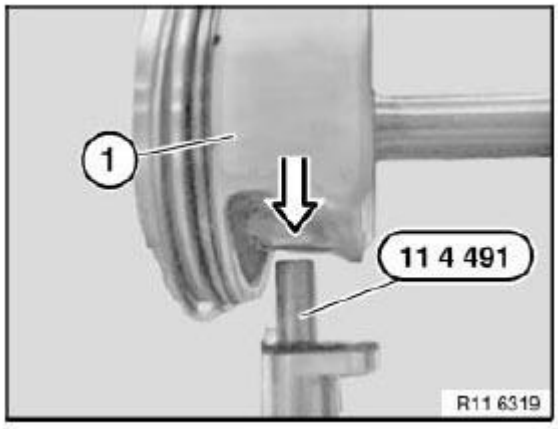


Fig. 144: Securing Piston With Conrod To Special Tool
Courtesy of BMW OF NORTH AMERICA, INC.

WARNING: Protective goggles must be worn for the next work step.

WARNING: Protective goggles must be worn.

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Lever out piston circlip with special tool 11 4 492 in direction of arrow. See **Fig. 145**.

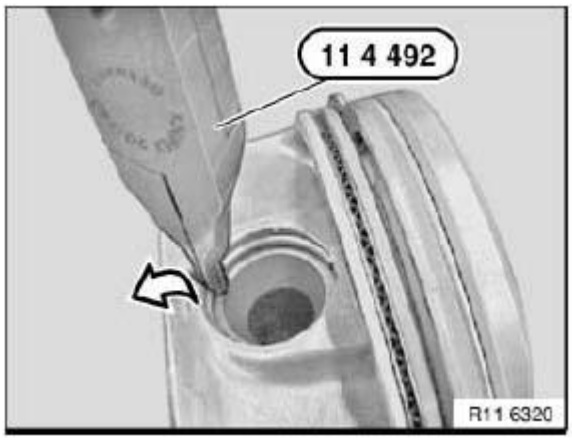


Fig. 145: Removing Piston Circlip With Special Tool
Courtesy of BMW OF NORTH AMERICA, INC.

If necessary, replace connecting rods.

IMPORTANT: Connecting rods are divided into weight categories and are only available as a set.
Old and new connecting rods must not be installed in mixed combinations.

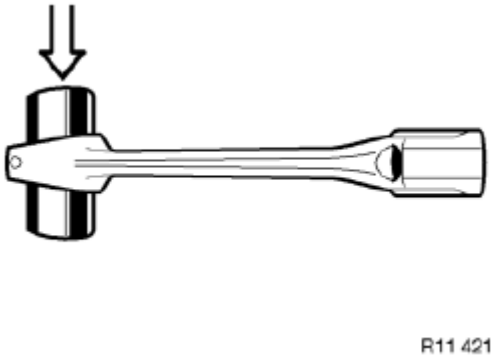


Fig. 146: Identifying Connecting Rod
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

The piston pin must be able to be pressed through the liner by hand with little force and must not display any significant play.

Measure piston installation clearance:

Measure piston diameter with micrometer at measuring point A from bottom edge of piston and offset at 90° to the axis of the piston pin.

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Piston diameter at measuring point A.

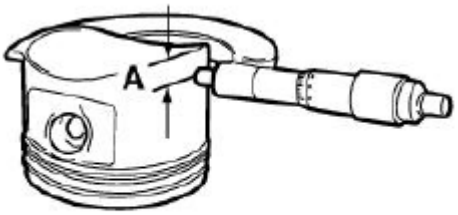


Fig. 147: Measuring Piston Diameter With Micrometer
Courtesy of BMW OF NORTH AMERICA, INC.

Adjust micrometer to cylinder bore of engine block. Set internal caliper on micrometer to zero. Measure bottom, center and top of cylinder bore in direction of travel and direction of engine rotation.

Diameter of cylinder bore.

Piston installation clearance.

Total permissible wear tolerance .

If necessary, replace piston.

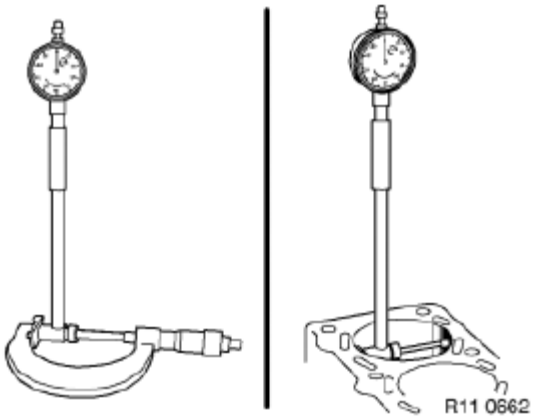


Fig. 148: Measuring Diameter Of Cylinder Bore
Courtesy of BMW OF NORTH AMERICA, INC.

WARNING: Protective goggles must be worn.

Insert piston circlip (2) into groove (1) of special tool 11 4 493. See **Fig. 149**.

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Bring piston circlip into assembly position.

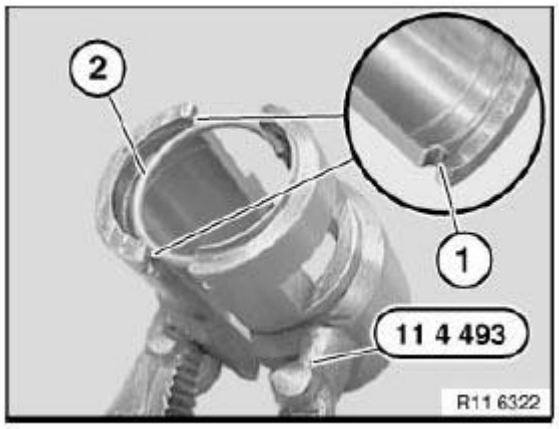


Fig. 149: Inserting Piston Circlip Into Groove Of Special Tool
Courtesy of BMW OF NORTH AMERICA, INC.

WARNING: Protective goggles must be worn.

Guide lug and cutout on special tool 11 4 493 must point to the piston crown; only then can special tool 11 4 494 be correctly fitted. See **Fig. 150**.

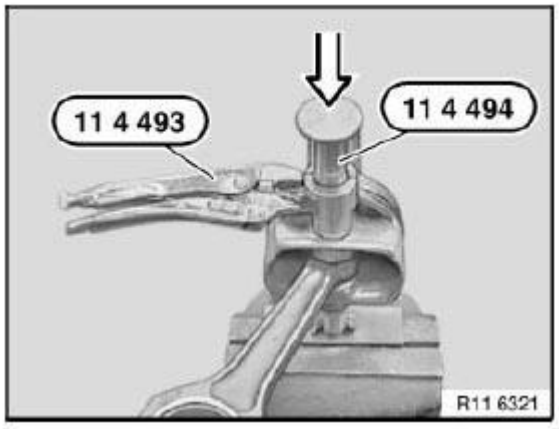


Fig. 150: Identifying Special Tools (11 4 493 And 11 4 494)
Courtesy of BMW OF NORTH AMERICA, INC.

When special tools 11 4 493 and 11 4 494 are correctly positioned, the piston pin circlip must be driven in with a plastic hammer in the direction of the arrow.

NOTE: See Fig. 151 illustration.

NOTE: B 30 .

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Install all **piston rings** .

Install all **bearing shells** .

Coat piston and piston rings with oil.

Pre-install piston (2) in special tool 11 6 261. See **Fig. 151**.

Attach special tool 11 8 330 in conrod (2).

Installation:

Check protective lugs (1) on special tool 11 8 330 for correct position and damage.

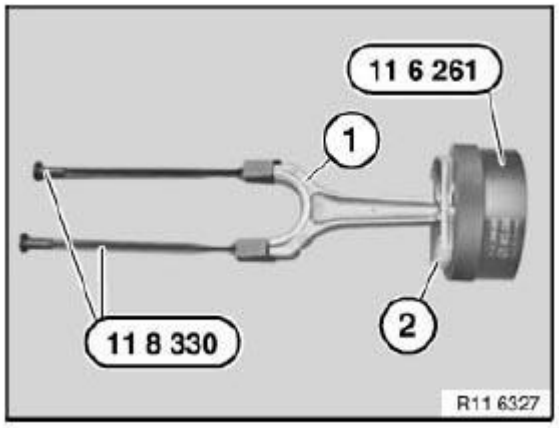


Fig. 151: Attaching Special Tool In Conrod
Courtesy of BMW OF NORTH AMERICA, INC.

Insert piston with conrod in cylinder.

IMPORTANT: Risk of damage to oil spray nozzle.
Danger of piston ring failure.
Press in piston with finger pressure only, do not drive in (see arrows).

Insert piston (1) so that arrow (2) on piston crown points to camshaft drive.

Press in piston (1) with special tool 11 6 261. See **Fig. 152**.

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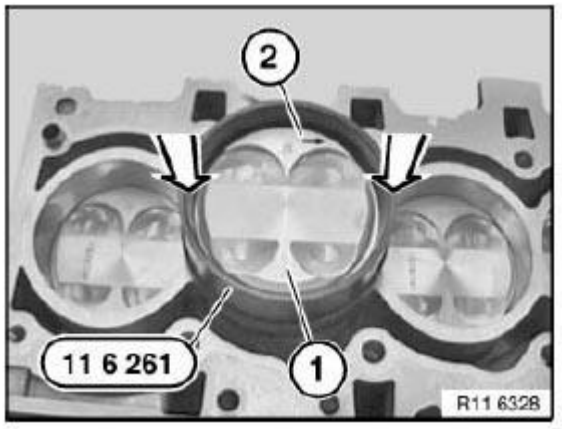


Fig. 152: Inserting Piston On Piston Crown Points
Courtesy of BMW OF NORTH AMERICA, INC.

IMPORTANT: Conrod and conrod bearing cap are identified with pairing letters (1) and must not be mixed up.
Mixing them up or incorrectly fitting the conrod bearing cap on the big end will result in engine damage .

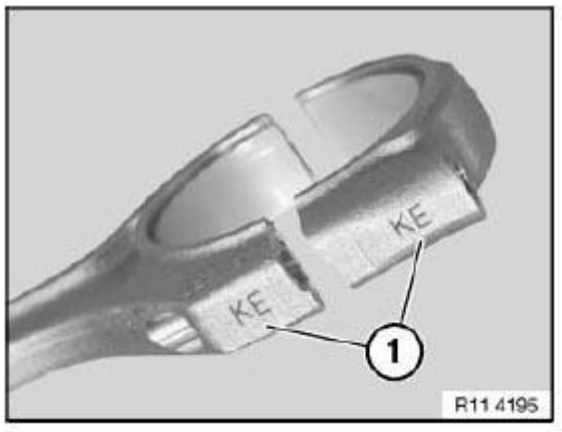


Fig. 153: Identification Of Conrod Bearing Cap
Courtesy of BMW OF NORTH AMERICA, INC.

Apply a light coat of oil to crank pin.

Assemble conrod and crank pin.

Detach special tool 11 8 330. See **Fig. 154**.

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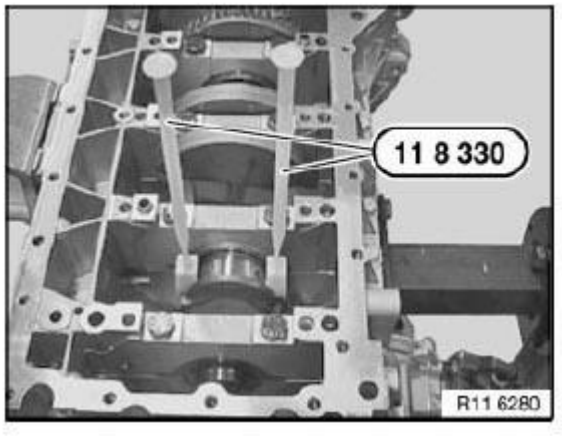


Fig. 154: Identifying Special Tool (11 8 330)
Courtesy of BMW OF NORTH AMERICA, INC.

Fit bearing caps (2) so that pairing letters match up.

Install new conrod bolts (1).

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

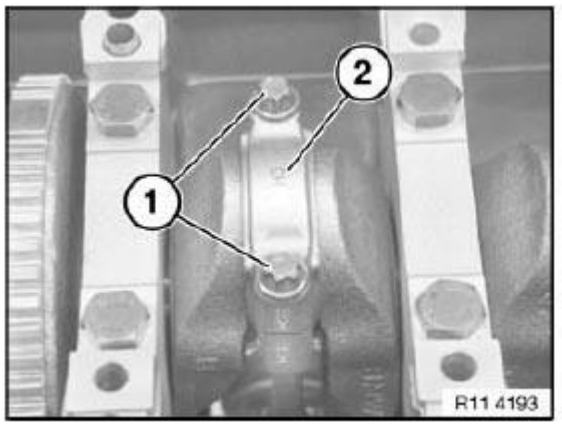


Fig. 155: Identifying Bearing Caps And Conrod Bolts
Courtesy of BMW OF NORTH AMERICA, INC.

Adjust torsion angle of conrod with special tool. See **Fig. 156**.

Tightening torque. See 11 23 1AZ in **11 24 CONNECTING RODS AND BEARINGS** .

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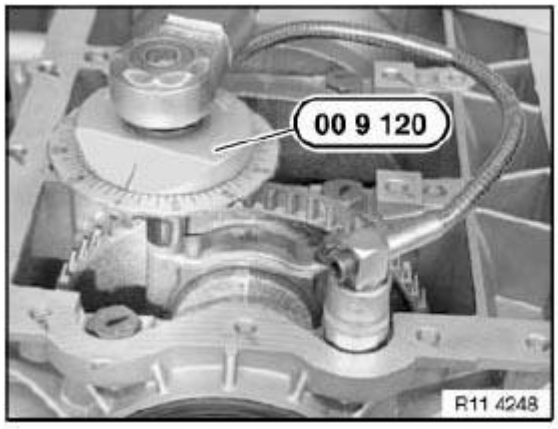


Fig. 156: Identifying Special Tool (00 9 120)
Courtesy of BMW OF NORTH AMERICA, INC.

Assemble engine.

11 25 671 REPLACING PISTON RINGS ON ALL PISTONS (N51)

Necessary preliminary tasks:

- Remove all **pistons** . See **11 25 530 REMOVING AND INSTALLING/REPLACING ALL PISTONS (N51)**.

Measuring axial clearance of piston rings in piston ring groove.

Technical Data .

NOTE: It is not possible to measure the axial clearance of the oil scraper rings.

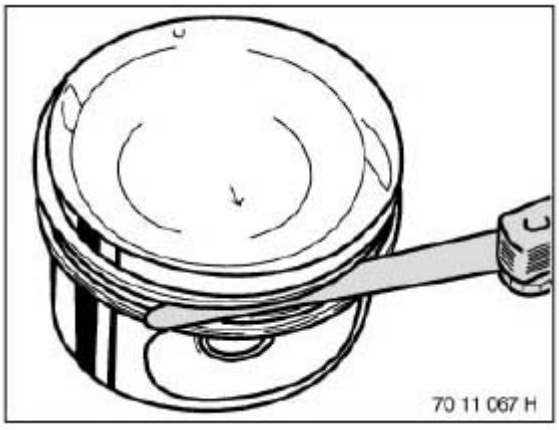


Fig. 157: Measuring Axial Clearance Of Piston Rings In Piston Ring Groove
Courtesy of BMW OF NORTH AMERICA, INC.

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Remove compression ring and stepped ring upwards with piston ring pliers.

Oil scraper ring comprises two steel band rings and a support spring.

**NOTE: Oil scraper ring cannot be removed with piston ring pliers.
Put aside piston rings in correct sequence and installation position.
It might not be possible to find the identification on used piston rings.**

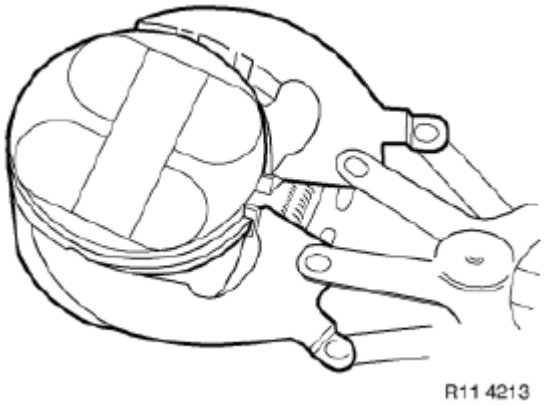


Fig. 158: Removing Compression Ring And Stepped Ring
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

New pistons may only be installed together with new piston rings.

Determine **gap** with a feeler gauge.

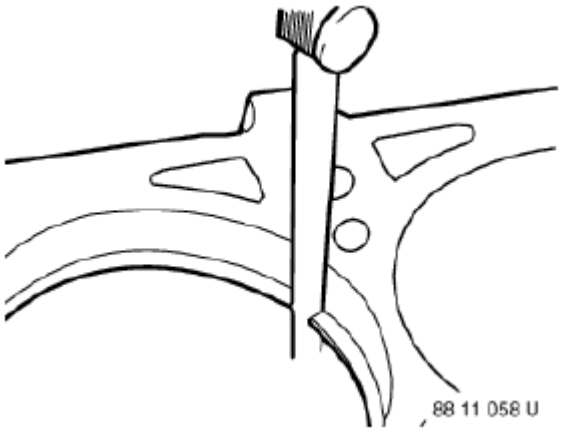


Fig. 159: Measuring Piston Rings
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: Schematic representation of piston rings.

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Installation:

Piston rings with "TOP" identification must point to piston crown.

1. Plain compression ring
2. Stepped compression ring "Top"
3. Two-part oil scraper ring

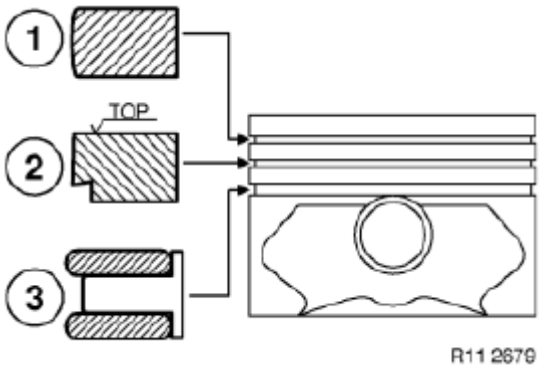


Fig. 160: Installation Positions Of Piston Rings
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: Oil control ring comprises two steel band rings (1) and a support spring (2).

Installation:

Insert support spring (2) into piston ring groove and then fit steel band rings (1) so that contact points are offset by approx. 120°.

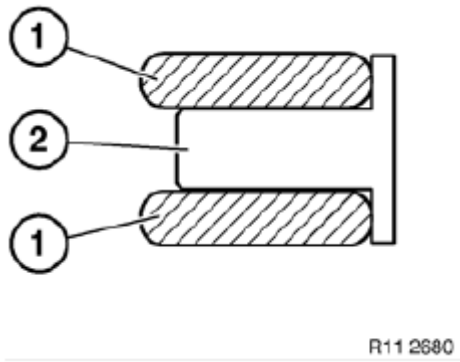


Fig. 161: Inserting Support Spring Into Piston Ring Groove
Courtesy of BMW OF NORTH AMERICA, INC.

Offset the contact points (1) of the piston rings by approx. 120° to each other but do not position above the piston pin boss.

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NOTE: **See Fig. 162.**

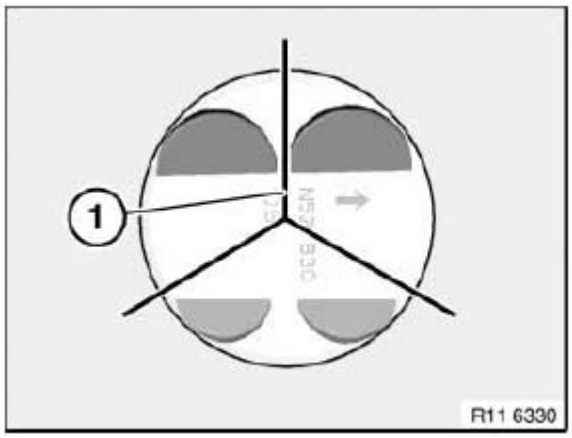


Fig. 162: Identifying Piston Rings Angle
Courtesy of BMW OF NORTH AMERICA, INC.

V-RIBBED BELT W/TENSIONER

11 28 010 REPLACING ALTERNATOR DRIVE BELT (N51)

Special tools required:

For the following special tools, refer to **ENGINE - SPECIAL TOOLS (N51)** .

- **11 3 340**

IMPORTANT: Aluminum-magnesium materials. No steel screws/bolts may be used due to the threat of electrochemical corrosion. A magnesium crankcase requires aluminum screws/bolts exclusively. Aluminum screws/bolts must be replaced each time they are released . Aluminum screws/bolts are permitted with and without color coding (blue). For reliable identification: Aluminum screws/bolts are not magnetic . Jointing torque and angle of rotation must be observed without fail (risk of damage) .

Necessary preliminary tasks:

- Remove fan cowl.
- Mark the direction of rotation of the drive belt if it is to be reused.

Layout of drive belt.

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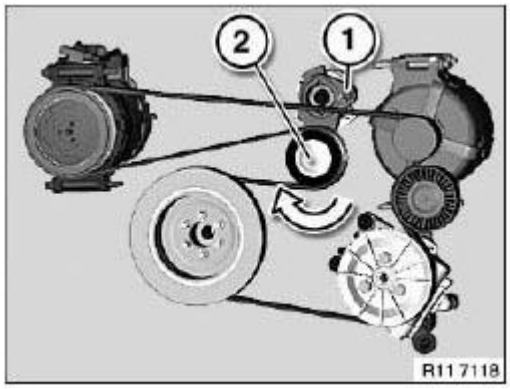


Fig. 163: Drive Belt Layout
Courtesy of BMW OF NORTH AMERICA, INC.

Turn belt tensioner (4) in direction of arrow until bore (2) is flush on housing.

Hold belt tensioner (4) under tension.

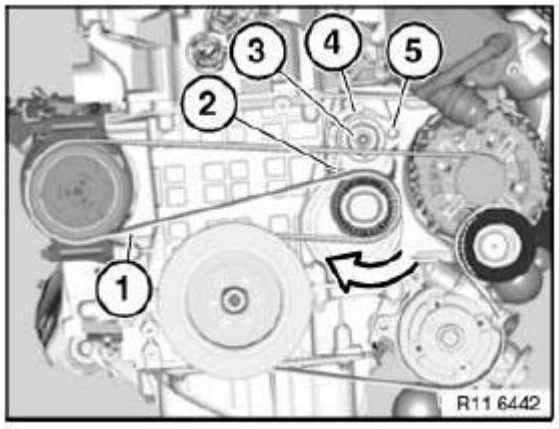


Fig. 164: Identifying Belt Tensioner
Courtesy of BMW OF NORTH AMERICA, INC.

Secure belt tensioner with special tool 11 3 340. See **Fig. 165**.

NOTE: Illustration N42.

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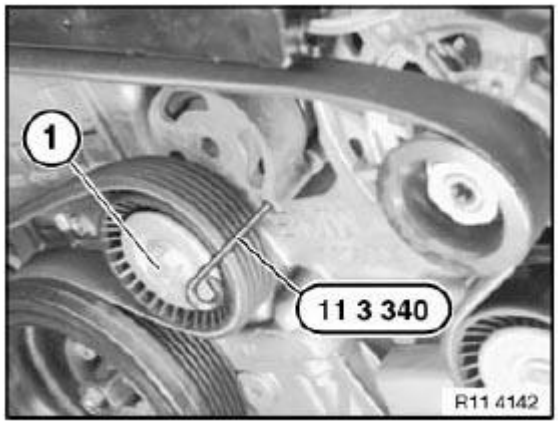


Fig. 165: Securing Belt Tensioner With Special Tool
Courtesy of BMW OF NORTH AMERICA, INC.

Remove drive belt (1) towards top.

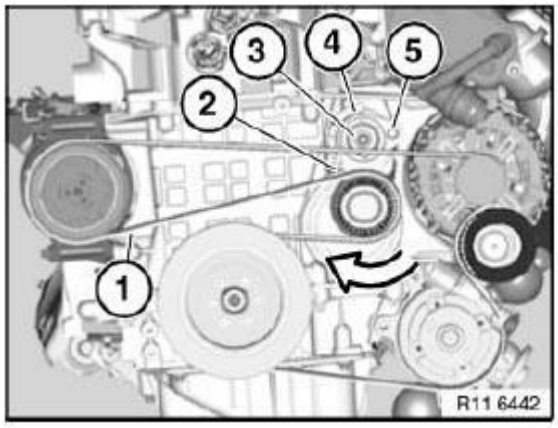


Fig. 166: Removing Drive Belt Towards Top
Courtesy of BMW OF NORTH AMERICA, INC.

Assemble engine.

Installation:

Check that drive belt for is in correct installation position - **risk of damage** .

11 28 020 REPLACING TENSIONING DEVICE FOR ALTERNATOR DRIVE BELT (N51)

Special tools required:

For the following special tools, refer to **ENGINE - SPECIAL TOOLS (N51)** .

- **11 3 340**

IMPORTANT: Aluminum-magnesium materials. No steel screws/bolts may be used due to the threat of electrochemical corrosion. A magnesium crankcase requires aluminum screws/bolts exclusively. Aluminum screws/bolts must be replaced each time they are released . Aluminum screws/bolts are permitted with and without color coding (blue). For reliable identification: Aluminum screws/bolts are not magnetic . Jointing torque and angle of rotation must be observed without fail (risk of damage) .

Necessary preliminary tasks:

- Remove **drive belt** . See **11 28 010 REPLACING ALTERNATOR DRIVE BELT (N51)**.

Remove special tool 11 3 340.

Unscrew bolt (3).

Tightening torque. See 11 28 1AZ in **11 28 V-RIBBED BELT WITH TENSION AND DEFLECTION ELEMENT** .

Installation:

Replace aluminum screws .

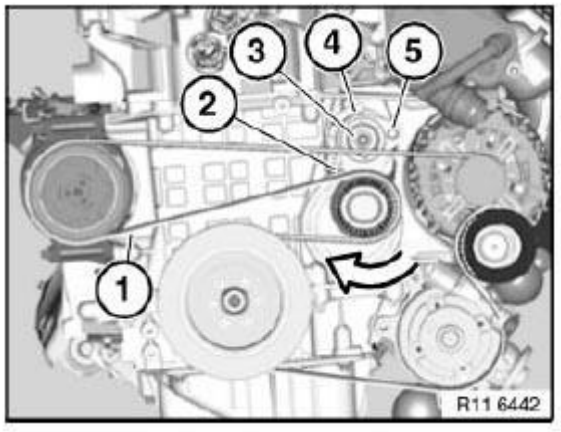


Fig. 167: Removing Special Tool
Courtesy of BMW OF NORTH AMERICA, INC.

Assemble engine.

CAMSHAFT

11 31 005 CHECKING CAMSHAFT TIMING

Special tools required:

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For the following special tools, refer to **ENGINE - SPECIAL TOOLS (N51)** .

- **11 0 300**
- **11 4 281**
- **11 4 282**
- **11 4 283**

Necessary preliminary tasks:

- Remove **cylinder head cover** . See **11 12 000 REMOVING AND INSTALLING OR SEALING CYLINDER HEAD COVER (N51)**.
- Remove front splash guard.

Remove fastener (1) in direction of arrow.

Installation:

Install fastener (1) with bore facing outwards.

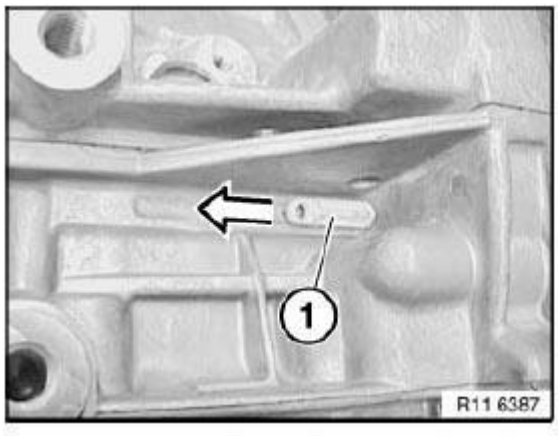


Fig. 168: Removing Fastener
Courtesy of BMW OF NORTH AMERICA, INC.

Rotate crankshaft at central bolt into TDC position.

Slide in special tool 11 0 300 in direction of arrow and block crankshaft. See **Fig. 169**.

IMPORTANT: On engines with automatic transmissions, there is shortly before the special tool bore for the TDC position a large bore which can be confused with the special tool bore.

If the flywheel is secured in the correct bore with special tool 11 0 300, the engine can no longer be moved at the central bolt. See **Fig. 169**.

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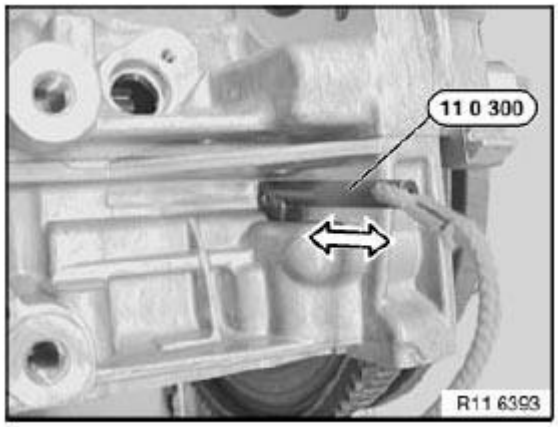


Fig. 169: Sliding In Special Tool
Courtesy of BMW OF NORTH AMERICA, INC.

The timings are correct when the part number (2) can be read from above on the camshafts (1).

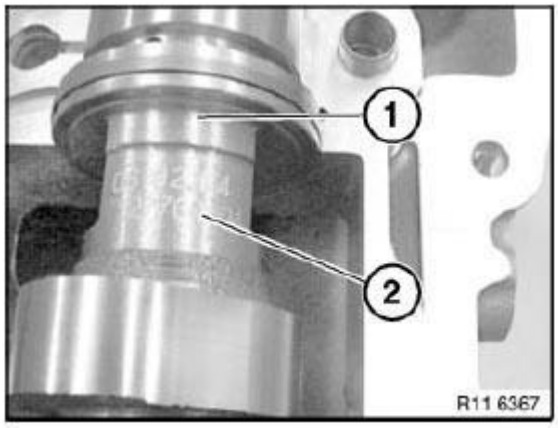


Fig. 170: Identifying Camshafts
Courtesy of BMW OF NORTH AMERICA, INC.

With 1st cylinder in firing TDC position, cams of inlet camshaft (1) at 1st cylinder point upwards at an angle.

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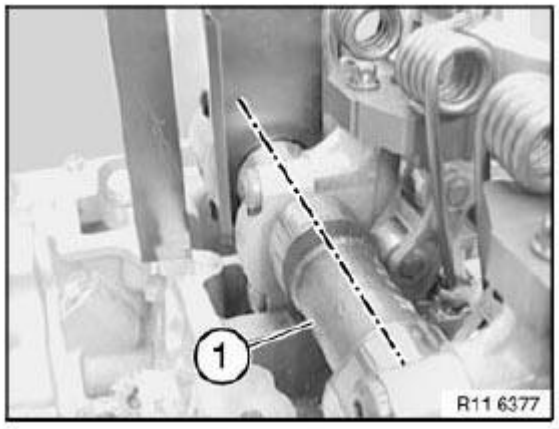


Fig. 171: Identifying Cams Of Inlet Camshaft
Courtesy of BMW OF NORTH AMERICA, INC.

With 1st cylinder in firing TDC position, cams of exhaust camshaft (3) at 6th cylinder point downwards at an angle.

Roller cam follower (1) is not actuated.

NOTE: If the timing is checked while the engine is installed, the position of the camshaft can only be checked with a mirror.

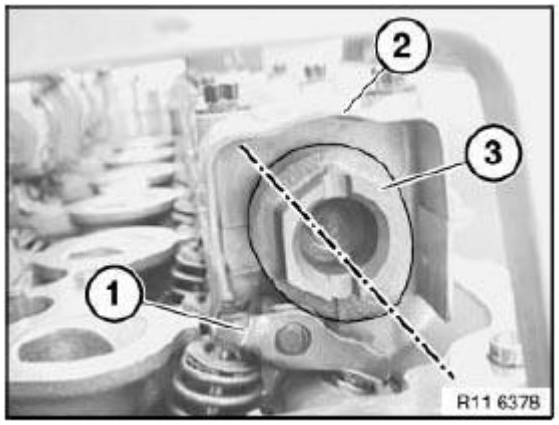


Fig. 172: Identifying Camshaft Position
Courtesy of BMW OF NORTH AMERICA, INC.

Secure special tool 11 4 283 on cylinder head with screws (1). See **Fig. 173**.

NOTE: Fit special tool 11 4 282 underneath on inlet side. See Fig. 173.

Mount special tool 11 4 281 on inlet and exhaust camshafts. See **Fig. 173**.

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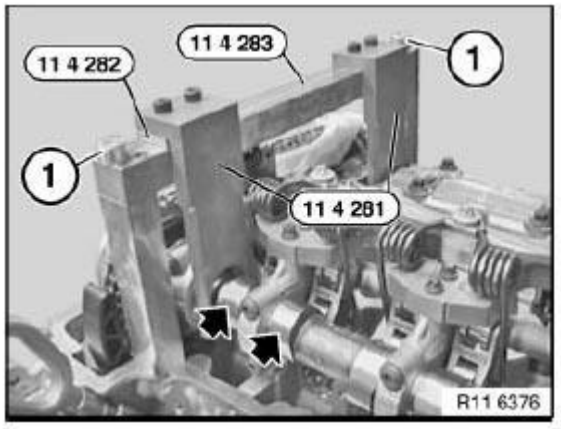


Fig. 173: Identifying Special Tools
Courtesy of BMW OF NORTH AMERICA, INC.

If necessary, adjust **valve timing** . See **11 31 505 ADJUSTING CAMSHAFT TIMING (N51)**.

Assemble engine.

11 31 025 REMOVING AND INSTALLING/REPLACING INLET CAMSHAFT (N51)

Special tools required:

For the following special tools, refer to **ENGINE - SPECIAL TOOLS (N51)** .

- **11 4 281**
- **11 4 481**

IMPORTANT: Aluminum-magnesium materials. No steel screws/bolts may be used due to the threat of electrochemical corrosion. A magnesium crankcase requires aluminum screws/bolts exclusively. Aluminum screws/bolts must be replaced each time they are released . Aluminum screws/bolts are permitted with and without color coding (blue). For reliable identification: Aluminum screws/bolts are not magnetic . Jointing torque and angle of rotation must be observed without fail (risk of damage) .

Necessary preliminary tasks:

- Remove **cylinder head cover** . See **11 12 000 REMOVING AND INSTALLING OR SEALING CYLINDER HEAD COVER (N51)**.
- Remove **adjusting unit** for inlet camshaft. See **11 36 046 REMOVING AND INSTALLING/REPLACING INLET AND EXHAUST ADJUSTMENT UNITS (N51)**.
- Remove **intermediate lever** . See **11 37 010 REMOVING AND INSTALLING/REPLACING INTERMEDIATE LEVER (N51)**.
- Adjust **valve timing** . See **11 31 505 ADJUSTING CAMSHAFT TIMING (N51)**.

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Bearing cap (1) is a thrust bearing.

Release screws of bearing caps (1 and 2).

Set all bearing caps down in Placement boards (special tool 11 4 481) in a tidy and orderly fashion.

All bearing caps are identified from 1 to 6.

Tightening torque. See 11 31 1AZ in **11 31 CAMSHAFT** .

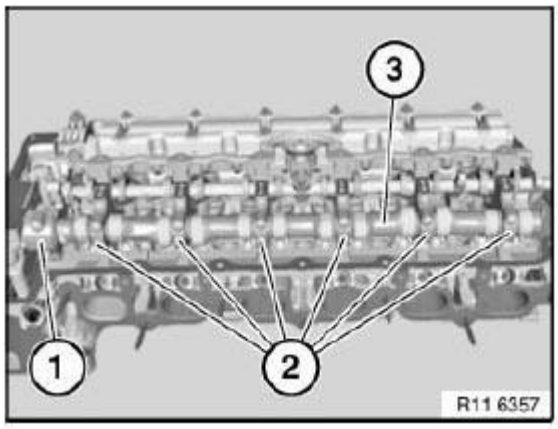


Fig. 174: Identifying Screws Of Bearing Caps
Courtesy of BMW OF NORTH AMERICA, INC.

Lift out camshaft (2).

Installation:

Clean all bearing points and lubricate with oil.

Check plain compression rings (1) for damage and replace if necessary.

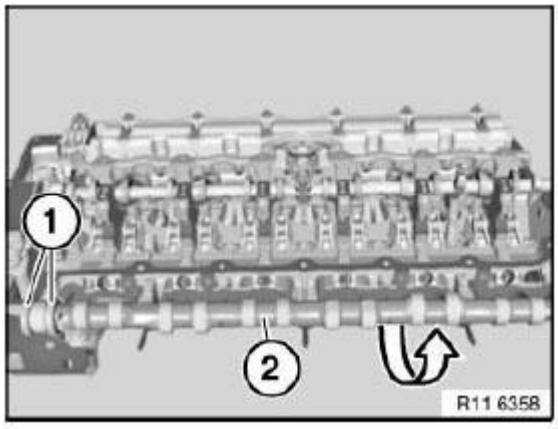


Fig. 175: Checking Plain Compression Rings

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Courtesy of BMW OF NORTH AMERICA, INC.

If necessary, replace plain compression rings (1).

The plain compression rings have catches at the joint.

Press plain compression rings (1) apart upwards and downwards and removed towards front.

IMPORTANT: Plain compression rings (1) can easily break.

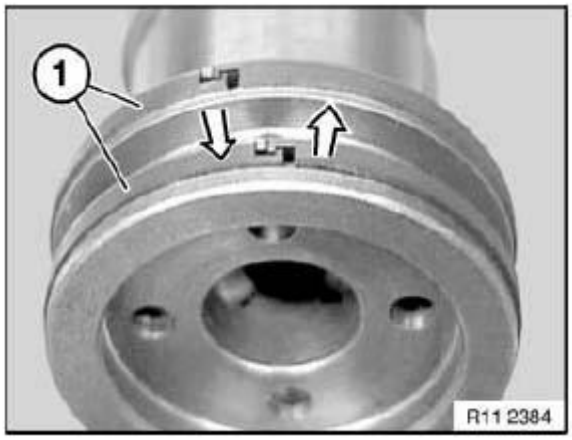


Fig. 176: Identifying Plain Compression Rings
Courtesy of BMW OF NORTH AMERICA, INC.

IMPORTANT: Both camshafts have different identifications.
Mixing up the two camshafts will result in engine damage .

A Exhaust camshaft.

E Inlet camshaft

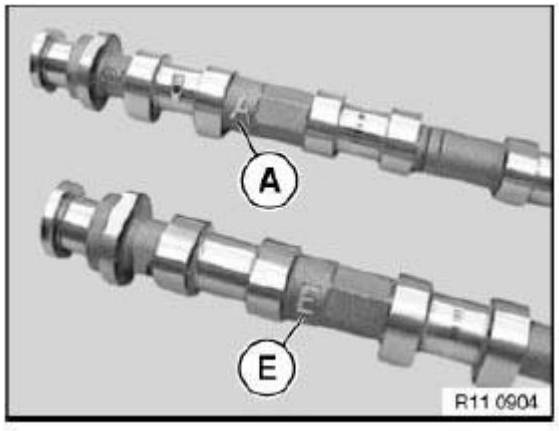


Fig. 177: Identifying Exhaust Camshaft And Inlet Camshaft

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Courtesy of BMW OF NORTH AMERICA, INC.

Insert camshaft (1) so that part number on twin surface points upwards.

Position inlet camshaft (1) so that cams point upwards at an angle.

Attach special tool 11 4 281 to twin surface. See **Fig. 178**.

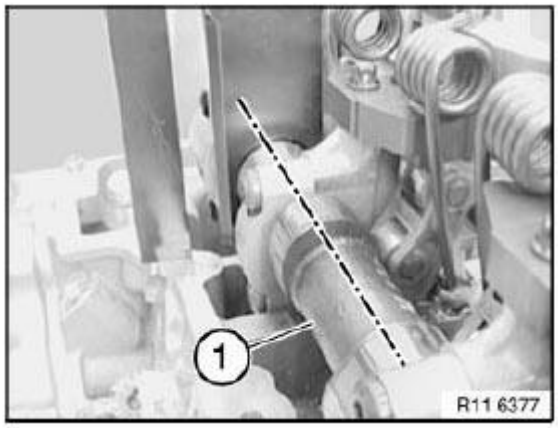


Fig. 178: Identifying Camshaft
Courtesy of BMW OF NORTH AMERICA, INC.

Assemble engine.

11 31 028 REMOVING AND INSTALLING/REPLACING EXHAUST CAMSHAFT (N51)

Special tools required:

For the following special tools, refer to **MAINTENANCE AND GENERAL INFORMATION - SPECIAL TOOLS -- 128I** .

- **00 9 120**

For the following special tools, refer to **ENGINE - SPECIAL TOOLS (N51)** .

- **11 4 350**
- **11 4 461**
- **11 4 462**
- **11 4 463**
- **11 9 000**

IMPORTANT: It is absolutely essential to follow an exact procedure for removing and installing the exhaust camshaft.
Risk of damage!

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The upper and lower bearing banks must be pretensioned with a total of six special tools 11 4 461.

Necessary preliminary tasks:

- Remove cylinder head cover. See **11 12 000 REMOVING AND INSTALLING OR SEALING CYLINDER HEAD COVER (N51)**.
- Remove exhaust adjusting unit for exhaust camshaft.
- Adjust valve timing.

Release bearing cap screw connections from outside inwards.

Lift out lower and upper bearing banks (1) with camshaft.

Remove upper bearing bank (1).

Remove exhaust camshaft from lower bearing bank.

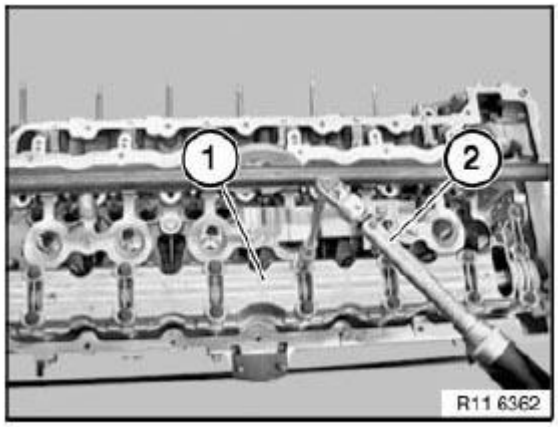


Fig. 179: Identifying Lower And Upper Bearing Banks With Camshaft
Courtesy of BMW OF NORTH AMERICA, INC.

IMPORTANT: Both camshafts have different identifications.
Mixing up the two camshafts will result in engine damage .

A Exhaust camshaft.

E Inlet camshaft.

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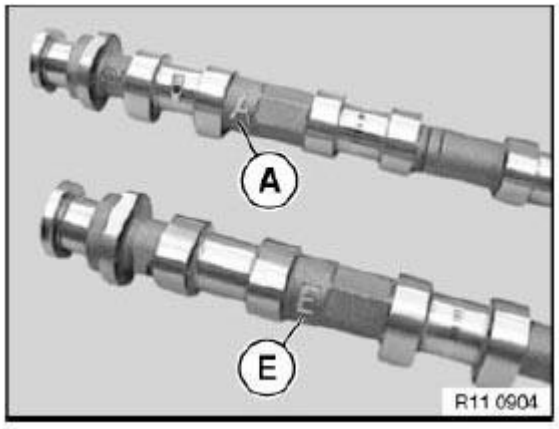


Fig. 180: Identifying Exhaust Camshaft And Inlet Camshaft
Courtesy of BMW OF NORTH AMERICA, INC.

Check plain compression rings (1) for damage and replace if necessary.

Plain compression rings (1) are engaged at joint.

Press plain compression rings (1) apart upwards and downwards and removed towards front.

IMPORTANT: Plain compression rings (1) can easily break.

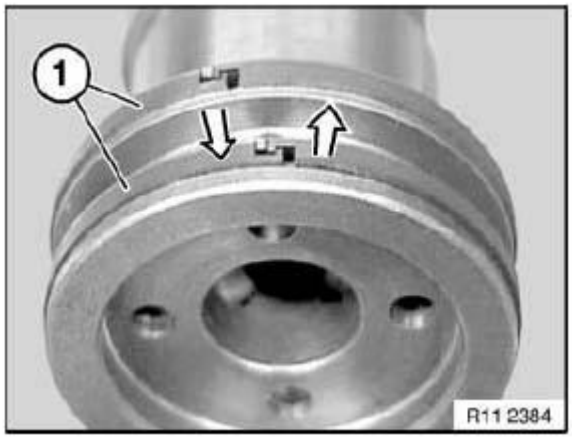


Fig. 181: Identifying Compression Rings
Courtesy of BMW OF NORTH AMERICA, INC.

IMPORTANT: Removal on engine:
Set engine to firing TDC at 1st cylinder.
Removed cylinder head:
When using special tool 11 9 000, it will be necessary to remove the aluminum profile insert.

Installing camshaft bearing bank:

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Pre-install special tool 11 4 462 on cylinder 2.

Insert special tool 11 4 463 in screw connection of cylinder head cover.

IMPORTANT: Special tool 11 4 463 is a special screw.

Press down roller rocker arms (3) on 2nd cylinder with spindle nut (2) of special tool 11 4 462.

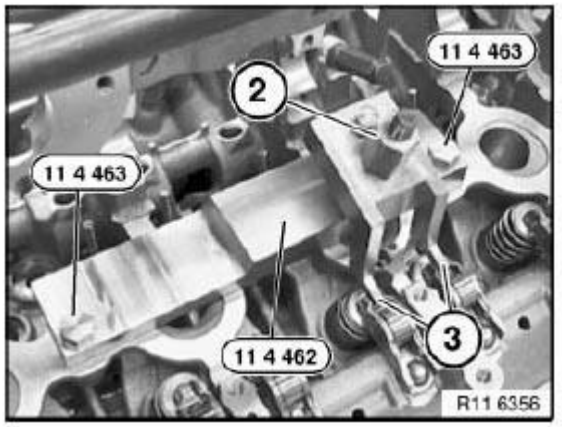


Fig. 182: Identifying Special Tools
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Before installing exhaust camshaft, make sure roller rocker arm is correctly seated HVCA element and valve.

Refer to **11 33 050 REMOVING AND INSTALLING/REPLACING ALL ROCKER ARMS (N51)**.

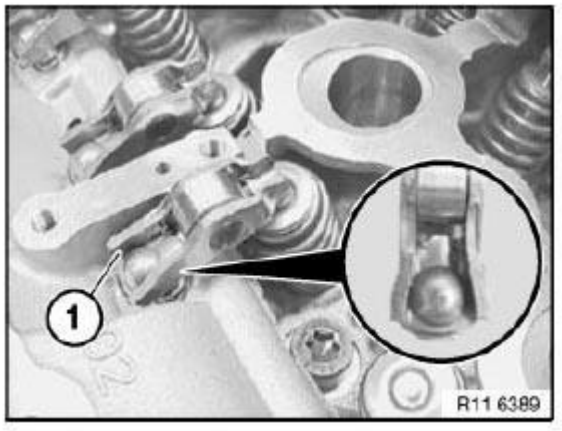


Fig. 183: Identifying Roller Rocker Arm
Courtesy of BMW OF NORTH AMERICA, INC.

Position lower bearing bank (1) with exhaust camshaft (2) on roller rocker arms.

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Align exhaust camshaft (2).

Cylinders 2 and 4 are at overlap.

Cams (3) on 1st cylinder point upwards at an angle.

Part number (4) points upwards.

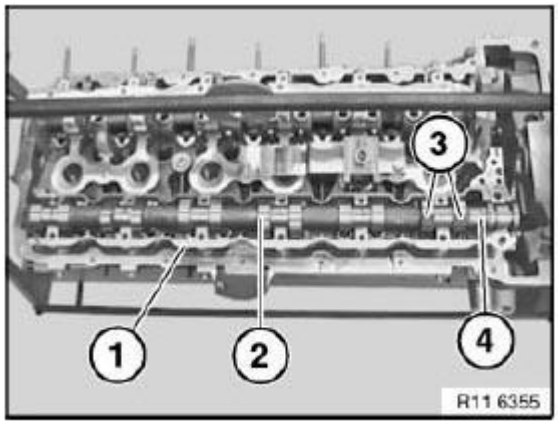


Fig. 184: Identifying Lower Bearing Bank With Exhaust Camshaft
Courtesy of BMW OF NORTH AMERICA, INC.

Join exhaust camshaft to lower and upper bearing banks (1) with torque wrench (2) from inside outwards to **8 Nm** .

Release all screws of bearing bank (1) from outside inwards by 90°.

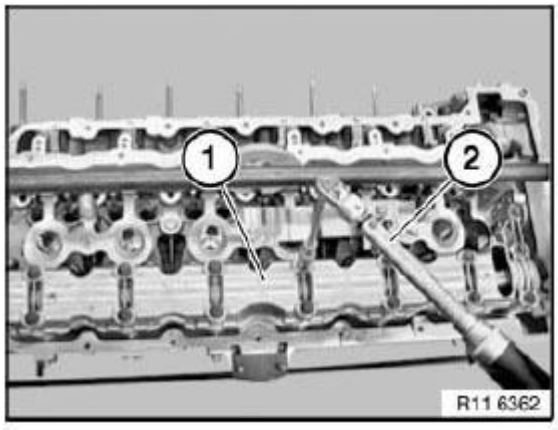


Fig. 185: Identifying Lower And Upper Bearing Banks
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Lower and upper bearing banks must be aligned to each other at ground surfaces (1 and 2).

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Bring thrust piece and legs of special tool 11 4 461 into contact at milled surfaces.

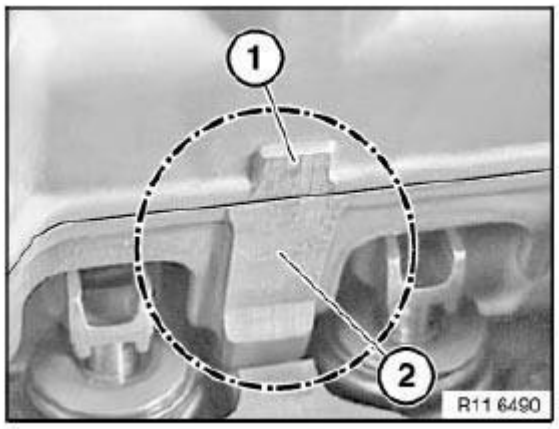


Fig. 186: Identifying Upper Bearing Banks Surface
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: Schematic depiction of special tool 11 4 461 at lower bearing bank (1) and upper bearing bank (2).
Pretension all special tools 11 4 461 with special tool 11 4 350 only. See Fig. 188.

IMPORTANT: Tighten screw (3) on thrust piece to 2 Nm (risk of damage).

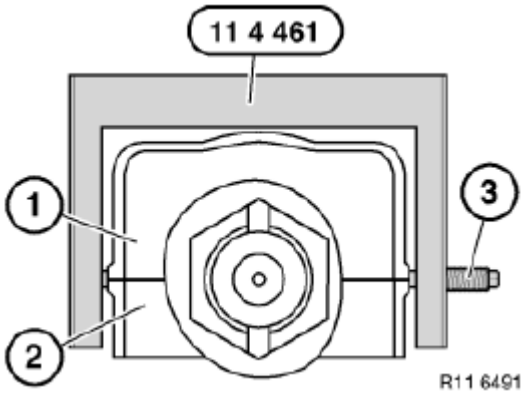


Fig. 187: Identifying Special Tools
Courtesy of BMW OF NORTH AMERICA, INC.

Position special tool 11 4 461 over screw connection of bearing banks.

Make sure that legs come into exact contact on ground surfaces, lower bearing bank (1) and upper bearing bank (2).

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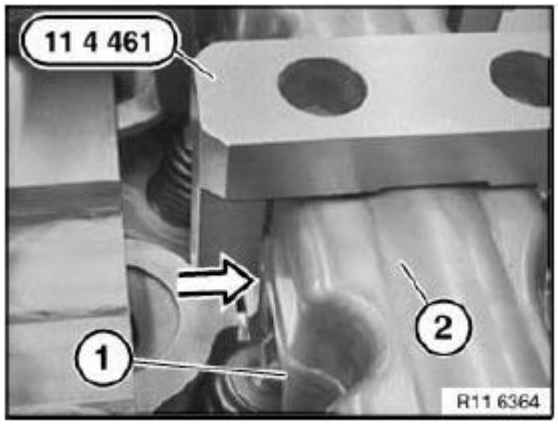


Fig. 188: Identifying Special Tool (11 4 461)
Courtesy of BMW OF NORTH AMERICA, INC.

Initially tighten screw of special tool 11 4 461 to ground surfaces of lower bearing bank (1) and upper bearing bank (2).

IMPORTANT: Tighten screws on thrust piece to 2 Nm (risk of damage).

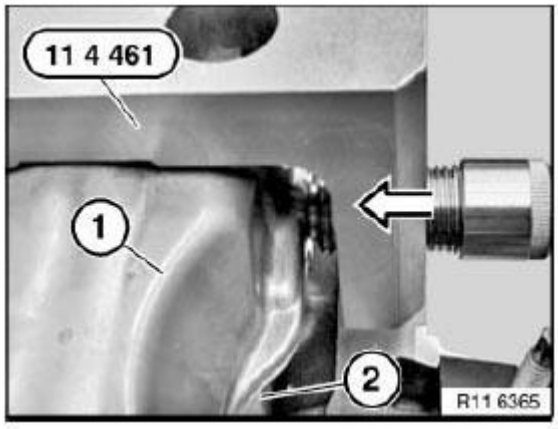


Fig. 189: Tightening Screws On Thrust Piece
Courtesy of BMW OF NORTH AMERICA, INC.

IMPORTANT: Set special tool 11 4 350 to 2 Nm .
Pretension all special tools 11 4 461 with special tool 11 4 350 only.

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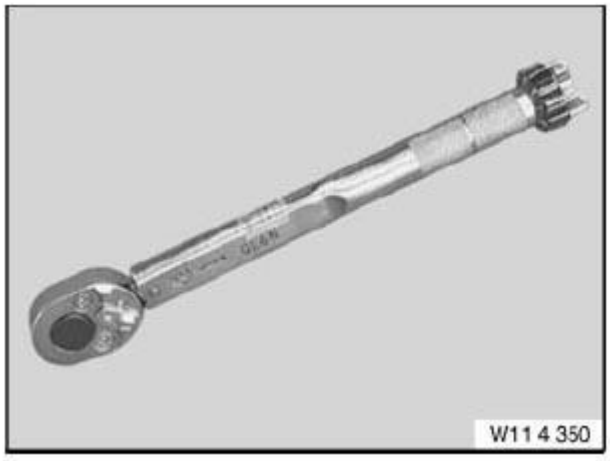


Fig. 190: Identifying Special Tool
Courtesy of BMW OF NORTH AMERICA, INC.

Mount special tools 11 4 461 with screw (1) to inside of cylinder head.

On cylinder 2 mount special tool 11 4 461 with screw (1) facing outwards.

Position special tools 11 4 461 so that screw connections (2) of bearing bank are easily accessible.

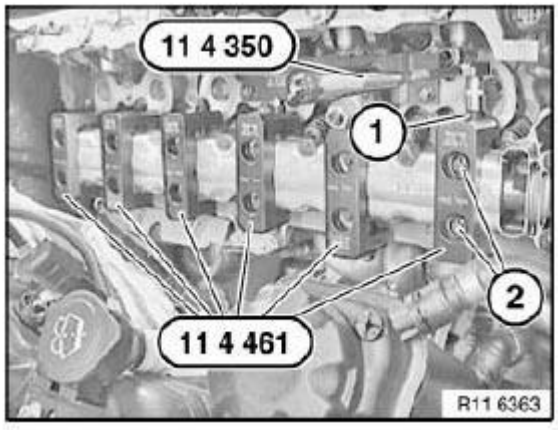


Fig. 191: Identifying Special Tools
Courtesy of BMW OF NORTH AMERICA, INC.

Tighten lower and upper bearing banks with special tool 00 9 120.

Tightening torque. See 11 31 1AZ in

IMPORTANT: Remove special tool 11 4 461 only when camshaft screw connection is completed .

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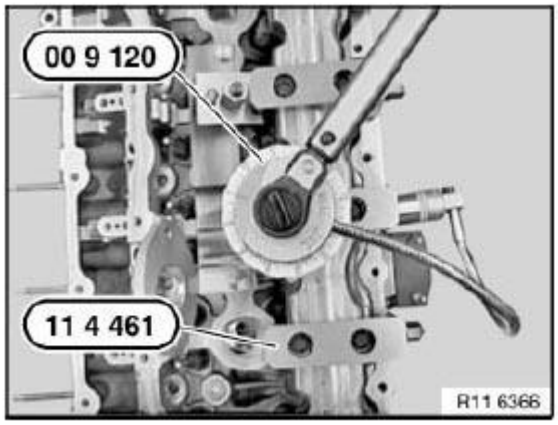


Fig. 192: Tightening Lower And Upper Bearing Banks With Special Tool
Courtesy of BMW OF NORTH AMERICA, INC.

Assemble engine.

11 31 051 REPLACING TIMING CHAIN (N51)

Special tools required:

For the following special tools, refer to **ENGINE - SPECIAL TOOLS (N51)** .

- **11 0 300**
- **11 4 280**
- **11 4 360**
- **11 4 362**
- **11 5 200**
- **11 9 280**

Necessary preliminary tasks:

- Remove **cylinder head cover** . See **11 12 000 REMOVING AND INSTALLING OR SEALING CYLINDER HEAD COVER (N51)**.
- Remove all spark plugs.
- Remove **chain tensioner** . See **11 31 090 INSTALLING AND REMOVING/REPLACING CHAIN TENSIONER PISTON (N51)**.
- Remove **radial shaft seal** at front. See **11 14 005 REPLACING FRONT CRANKSHAFT SEAL (N51)**.
- Remove **belt tensioner** . See **11 28 020 REPLACING TENSIONING DEVICE FOR ALTERNATOR DRIVE BELT (N51)**.
- Remove **vibration damper** . See **11 23 010 REMOVING AND INSTALLING OR REPLACING VIBRATION DAMPER (M51)**.

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Remove fastener (1) in direction of arrow.

Installation:

Install fastener (1) with bore facing outwards.

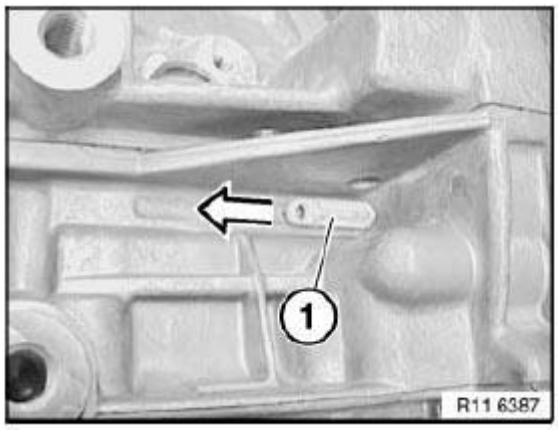


Fig. 193: Removing Fastener
Courtesy of BMW OF NORTH AMERICA, INC.

Secure crankshaft during entire repair operation with special tool 11 0 300. See **Fig. 194**.

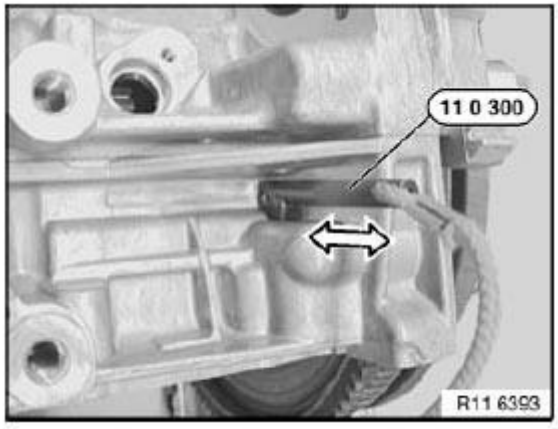


Fig. 194: Securing Crankshaft
Courtesy of BMW OF NORTH AMERICA, INC.

Do not remove special tool 11 4 280. See **Fig. 196**.

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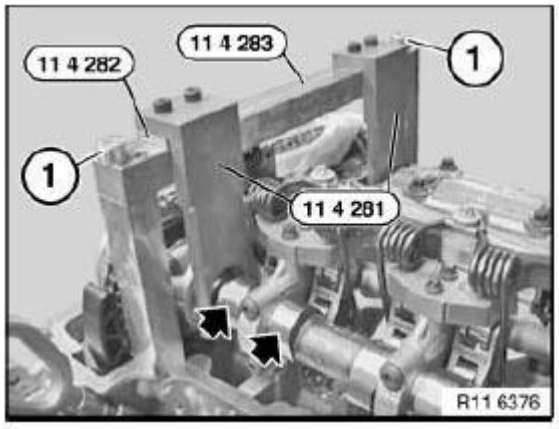


Fig. 195: Identifying Special Tools
Courtesy of BMW OF NORTH AMERICA, INC.

IMPORTANT: Do not remove special tool 11 0 300 to release central bolt (1). Employ a second person for gripping when releasing central bolt (1).

Mount special tool 11 9 280 on hub for vibration damper. See **Fig. 196**.

Release central bolt (1).

Tightening torque. See 11 21 1AZ in **11 21 CRANKSHAFT AND BEARINGS** .

Remove central bolt with hub towards front.

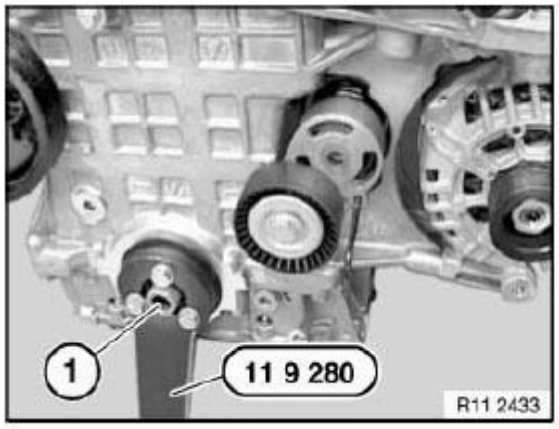


Fig. 196: Identifying Special Tool (11 9 280) And Vibration Damper
Courtesy of BMW OF NORTH AMERICA, INC.

Open plug (1).

Tightening torque. See 11 31 6AZ in **11 31 CAMSHAFT** .

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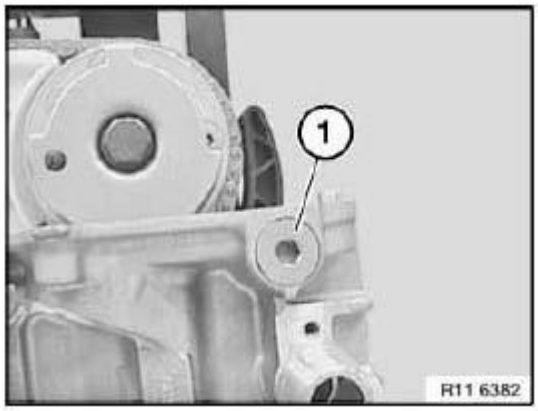


Fig. 197: Identifying Plug
Courtesy of BMW OF NORTH AMERICA, INC.

Open plug (1).

Tightening torque. See 11 31 6AZ in **11 31 CAMSHAFT** .

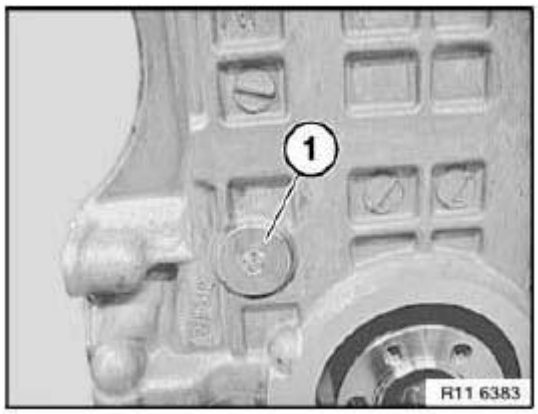


Fig. 198: Identifying Plug
Courtesy of BMW OF NORTH AMERICA, INC.

Release screw (1) on chain drive at top.

Tightening torque. See 11 31 2AZ in **11 31 CAMSHAFT** .

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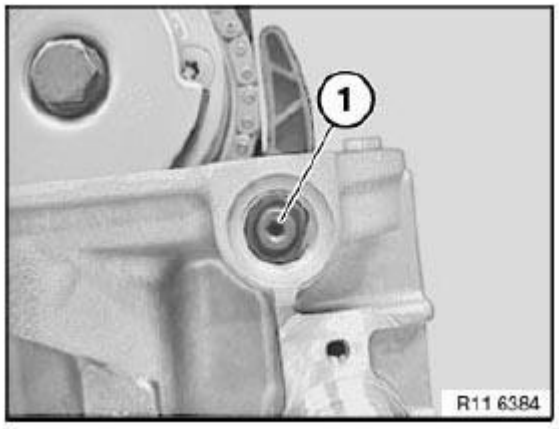


Fig. 199: Identifying Screw On Chain Drive
Courtesy of BMW OF NORTH AMERICA, INC.

Release screw (1) on chain drive at bottom.

Tightening torque. See 11 31 3AZ in **11 31 CAMSHAFT** .

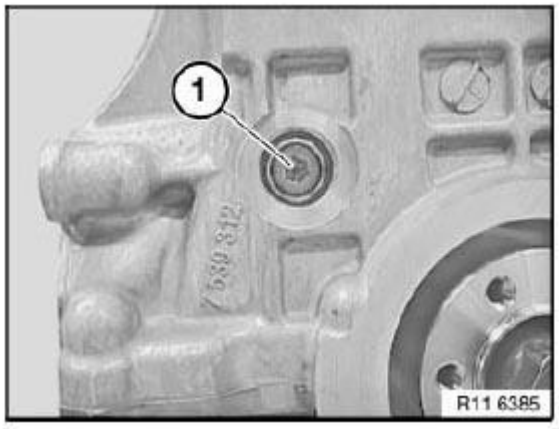


Fig. 200: Identifying Screw On Chain Drive At Bottom
Courtesy of BMW OF NORTH AMERICA, INC.

Remove both **adjusting units** . See **11 36 046 REMOVING AND INSTALLING/REPLACING INLET AND EXHAUST ADJUSTMENT UNITS (N51)**.

Release screws (1).

Tightening torque. See 11 31 2AZ in **11 31 CAMSHAFT** .

Remove timing chain module with timing chain and sprocket wheel upwards in direction of arrow.

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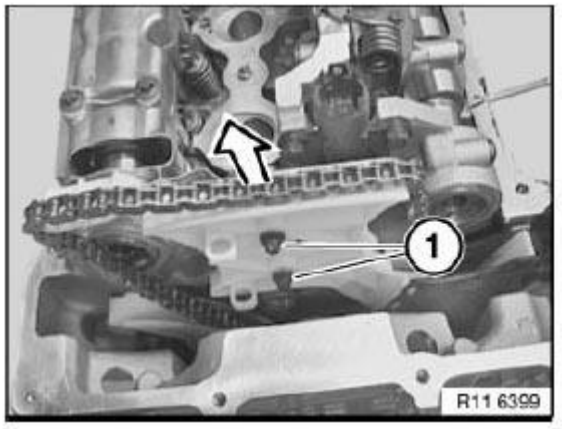


Fig. 201: Identifying Screws
Courtesy of BMW OF NORTH AMERICA, INC.

IMPORTANT: Note installation direction of sprocket wheel (2).
Collar (see arrow) on sprocket wheel (2) points to crankshaft .
Incorrect assembly will result in engine damage .

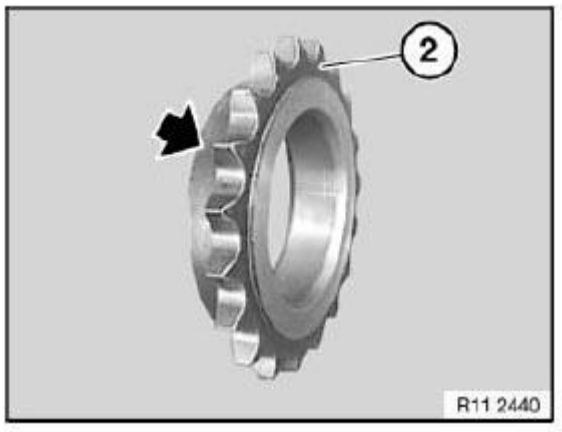


Fig. 202: Locating Sprocket Wheel
Courtesy of BMW OF NORTH AMERICA, INC.

Pull timing chain (1) upwards until sprocket wheel (2) engages chain guide (3).

Install timing chain (1) and sprocket wheel (2) in this position.

Installation:

Always keep timing chain tensioned; it is possible for timing chain (1) to jam on chain module (3).

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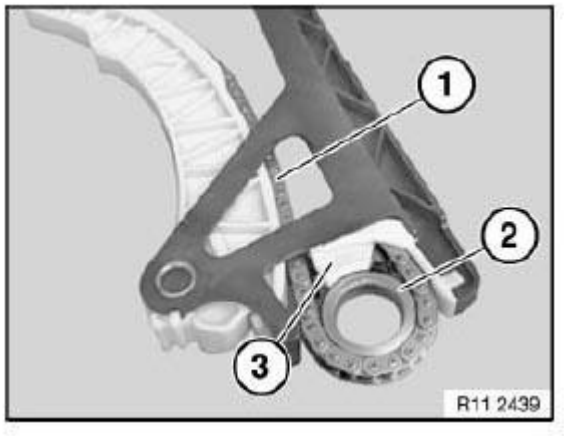


Fig. 203: Identifying Timing Chain And Sprocket Wheel
Courtesy of BMW OF NORTH AMERICA, INC.

Install hub with central bolt.

Tighten down special tool 11 5 200 with screws (1). See **Fig. 204**.

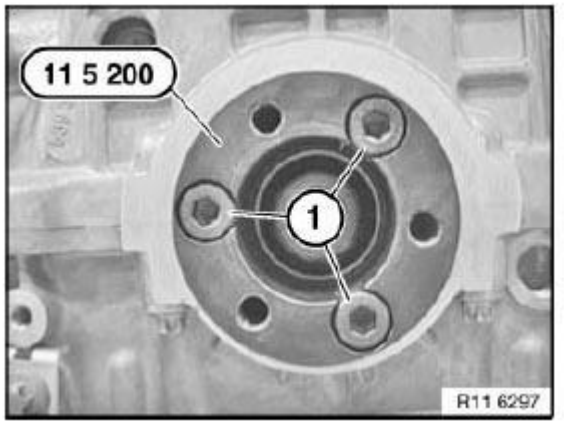


Fig. 204: Identifying Special Tool (11 5 200)
Courtesy of BMW OF NORTH AMERICA, INC.

Remove **belt tensioner** . See **11 28 020 REPLACING TENSIONING DEVICE FOR ALTERNATOR DRIVE BELT (N51)**.

Screw in special tool 11 4 360. See **Fig. 205**.

Mount special tool 11 9 280 on 11 5 200. See **Fig. 205**.

Support special tool 11 9 280 on special tool 11 4 362. See **Fig. 205**.

Special tool 11 0 300 secures crankshaft. See **Fig. 205**.

Tighten central bolt (1) to jointing torque.

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Tightening torque. See 11 21 1AZ in **11 21 CRANKSHAFT AND BEARINGS** or **11 21 CRANKSHAFT AND BEARINGS** .

Mark central bolt and hub with paint.

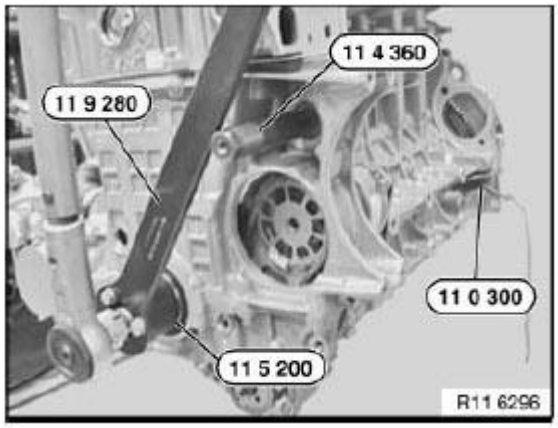


Fig. 205: Identifying Special Tools
Courtesy of BMW OF NORTH AMERICA, INC.

Apply stroke of paint (1) for torsion angle tightening to tool.

See illustrations.

IMPORTANT: Do not remove tool from central bolt during torsion angle tightening - risk of damage .

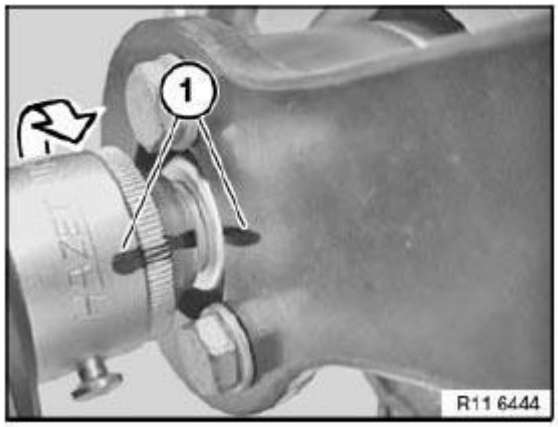


Fig. 206: Identifying Paint For Torsion Angle
Courtesy of BMW OF NORTH AMERICA, INC.

Tighten central bolt with two persons.

Tightening torque. See 11 21 1AZ in **11 21 CRANKSHAFT AND BEARINGS** or **11 21 CRANKSHAFT AND BEARINGS** .

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Install both **adjusting units** . See **11 36 046 REMOVING AND INSTALLING/REPLACING INLET AND EXHAUST ADJUSTMENT UNITS (N51)**.

Install **chain tensioner** . See **11 31 090 INSTALLING AND REMOVING/REPLACING CHAIN TENSIONER PISTON (N51)**.

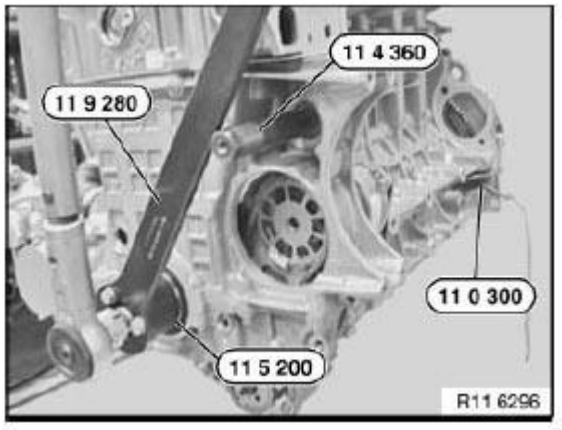


Fig. 207: Identifying Special Tools
Courtesy of BMW OF NORTH AMERICA, INC.

Crank engine twice.

Check **timing** . See **11 31 505 ADJUSTING CAMSHAFT TIMING (N51)**.

Assemble engine.

11 31 090 INSTALLING AND REMOVING/REPLACING CHAIN TENSIONER PISTON (N51)

Release chain tensioner (1).

Tightening torque. See 11 31 5AZ in **11 31 CAMSHAFT N51 B30** .

IMPORTANT: Have a cleaning cloth ready. A small quantity of engine oil will emerge after the screw connection has been released.
Make sure no oil runs onto the belt drive.

Installation:

No sealing ring is fitted during series-production assembly.

A sealing ring must be fitted by service personnel when the chain tensioner is fitted.

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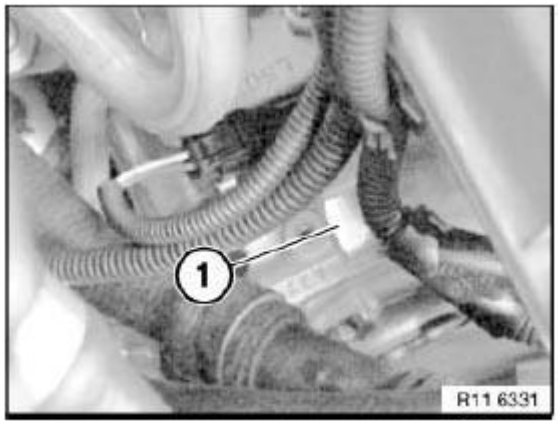


Fig. 208: Identifying Chain Tensioner
Courtesy of BMW OF NORTH AMERICA, INC.

If the chain tensioner is reused, its oil chamber must be drained. Place chain tensioner on a level working surface and slowly compress.

Repeat procedure twice.



Fig. 209: Identifying Chain Tensioner Piston
Courtesy of BMW OF NORTH AMERICA, INC.

Assemble engine.

11 31 505 ADJUSTING CAMSHAFT TIMING (N51)

Special tools required:

For the following special tools, refer to **MAINTENANCE AND GENERAL INFORMATION - SPECIAL TOOLS -- 128I** .

- **00 9 120**
- **00 9 250**

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For the following special tools, refer to **ENGINE - SPECIAL TOOLS (N51)** .

- **11 0 300**
- **11 4 280**
- **11 4 281**
- **11 4 282**
- **11 4 283**
- **11 4 290**
- **11 9 340**

Necessary preliminary tasks:

- Remove cylinder head cover. See **11 12 000 REMOVING AND INSTALLING OR SEALING CYLINDER HEAD COVER (N51)**.

Remove fastener (1) in direction of arrow.

Installation:

Install fastener (1) with bore facing outwards.

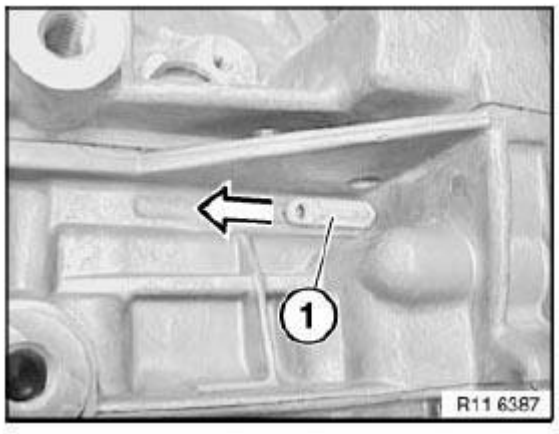


Fig. 210: Removing Fastener
Courtesy of BMW OF NORTH AMERICA, INC.

Rotate crankshaft at central bolt into TDC position.

Slide in special tool 11 0 300 in direction of arrow and block crankshaft. See **Fig. 211**.

IMPORTANT: On engines with automatic transmissions, there is shortly before the special tool bore for the TDC position a large bore which can be confused with the special tool bore.

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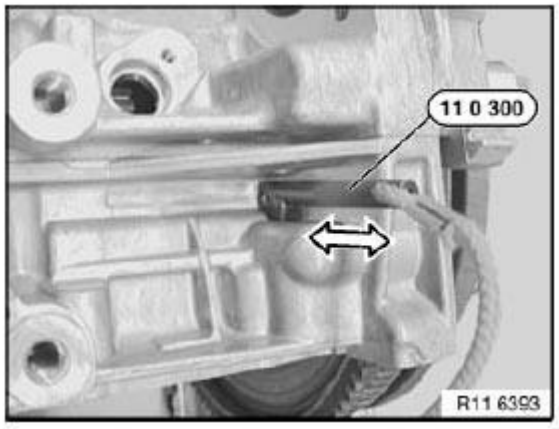


Fig. 211: Sliding Special Tool
Courtesy of BMW OF NORTH AMERICA, INC.

If the flywheel is secured in the correct bore with special tool 11 0 300, the engine can no longer be moved at the central bolt.

With 1st cylinder in firing TDC position, cams of inlet camshaft (1) point upwards at an angle.

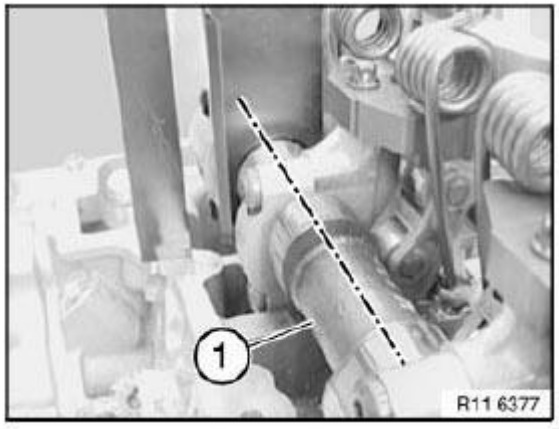


Fig. 212: Identifying Inlet Camshaft Point
Courtesy of BMW OF NORTH AMERICA, INC.

Part numbers (2) on twin surface of inlet and exhaust camshafts (1) point upwards.

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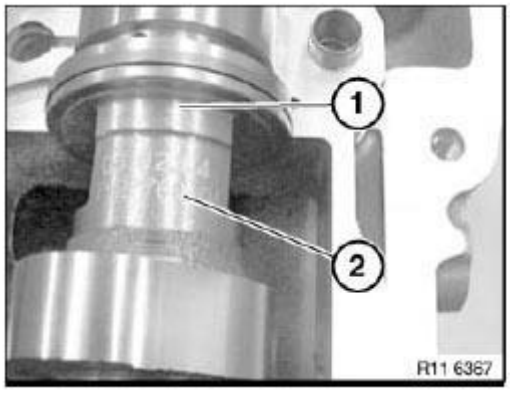


Fig. 213: Identifying Camshaft Points
Courtesy of BMW OF NORTH AMERICA, INC.

With 1st cylinder in firing TDC position, cams of exhaust camshaft (3) at 6th cylinder point downwards at an angle.

NOTE: If the timing is checked while the engine is installed, the position of the camshaft can only be checked with a mirror.

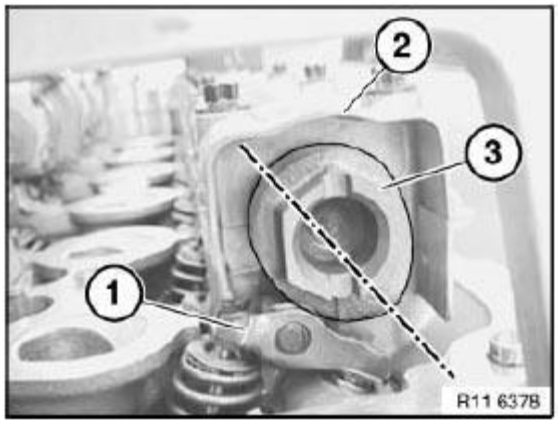


Fig. 214: Identifying Exhaust Camshaft Position
Courtesy of BMW OF NORTH AMERICA, INC.

IMPORTANT: Risk of damage!
To open central bolt, mount special tools 11 4 283, 11 4 281 and 11 4 282 on camshaft. See Fig. 215.

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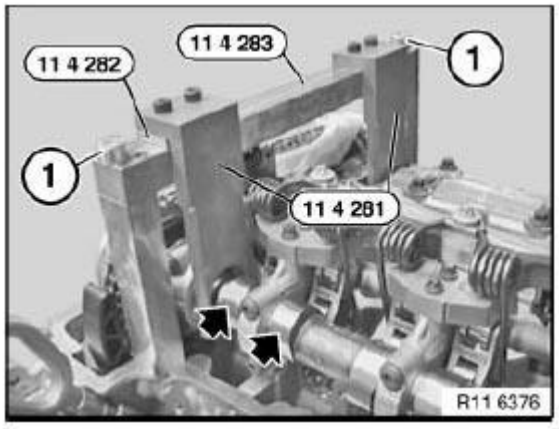


Fig. 215: Identifying Special Tools
Courtesy of BMW OF NORTH AMERICA, INC.

Release central bolts (1).

Release central bolts (1) with special tool 11 4 280 only.

Release chain tensioner (2) (have a cleaning cloth ready).

NOTE: Illustrations in CAD do not show special tools.

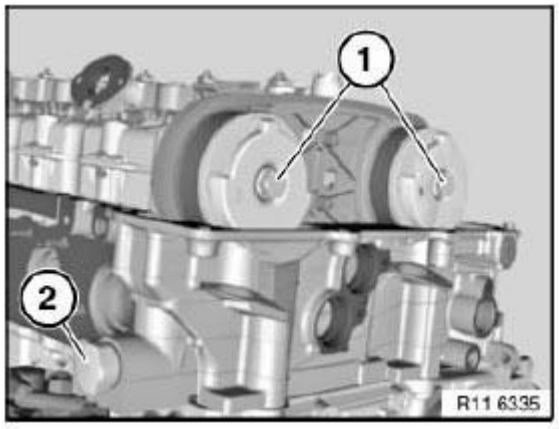


Fig. 216: Identifying Central Bolt And Chain Tensioner
Courtesy of BMW OF NORTH AMERICA, INC.

Turn sensor gears (2) in direction of arrow until locating pins (1) on special tool 11 4 290 match up. See **Fig. 217**.

Slide on special tool 11 4 290 in direction of arrow.

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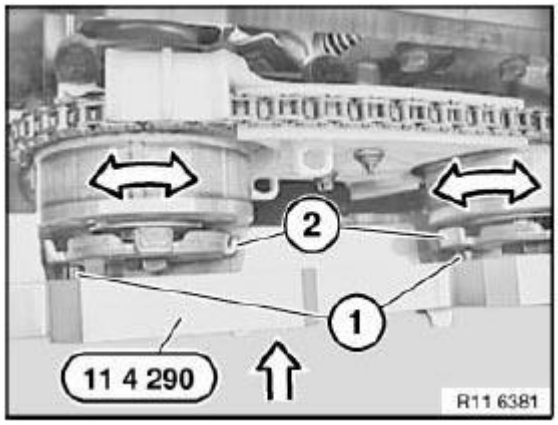


Fig. 217: Identifying Sensor Gears And Pins
Courtesy of BMW OF NORTH AMERICA, INC.

Secure special tool 11 4 290 with bolts (1). See **Fig. 218**.

Screw special tool 11 9 340 into cylinder head. See **Fig. 218**.

Pretension timing chain with special tool 00 9 250 to **0.6 Nm** .

Secure both central bolts of adjustment units to camshafts with special tool 00 9 120. See **Fig. 218**.

Tightening torque. See 11 36 1AZ in **11 36 VARIABLE CAMSHAFT CONTROL** .

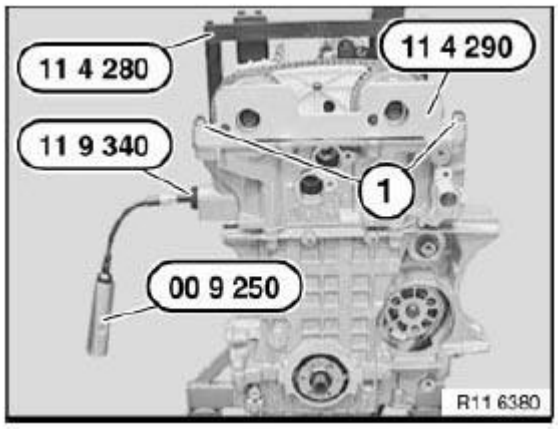


Fig. 218: Identifying Special Tools
Courtesy of BMW OF NORTH AMERICA, INC.

Assemble engine.

ROCKER ARM WITH BEARING MOUNT

11 33 050 REMOVING AND INSTALLING/REPLACING ALL ROCKER ARMS (N51)

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Special tools required:

For the following special tools, refer to **ENGINE - SPECIAL TOOLS (N51)** .

- **11 4 480**

Necessary preliminary tasks:

- Remove **cylinder head cover** . See **11 12 000 REMOVING AND INSTALLING OR SEALING CYLINDER HEAD COVER (N51)**.
- Remove **intermediate lever** . See **11 37 010 REMOVING AND INSTALLING/REPLACING INTERMEDIATE LEVER (N51)**.
- Remove **exhaust camshaft** . See **11 31 028 REMOVING AND INSTALLING/REPLACING EXHAUST CAMSHAFT (N51)**.

**IMPORTANT: Rocker arms (1) are divided into bearing categories.
The tolerance classes are designated as illustrated with numbers from 1 to 5.
Already used rocker arms (1) may only be reused in the same position.**

Detach roller cam followers (1) from HVCA element and remove.

Set all roller cam followers down in special tool 11 4 480 in a tidy and orderly fashion. See **11 4 480 PLACEMENT BOARDS (2 X)** .

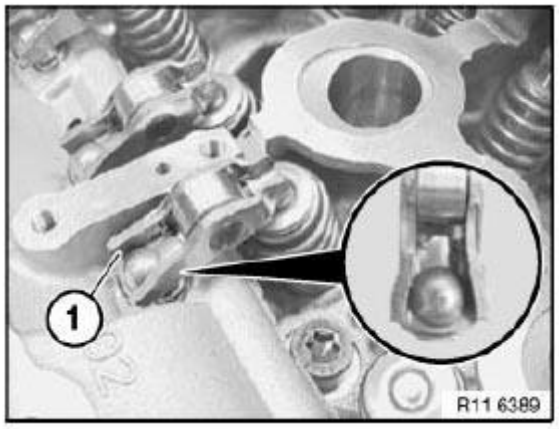


Fig. 219: Identifying Rocker Arm
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Before installing exhaust camshaft and intermediate lever, make sure roller cam followers are correctly seated.

Remove HVCA element in direction of arrow.

Installation:

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If the HVCA elements are to be reused, set them down in special tool 11 4 480 in a tidy and orderly fashion with the roller cam followers.

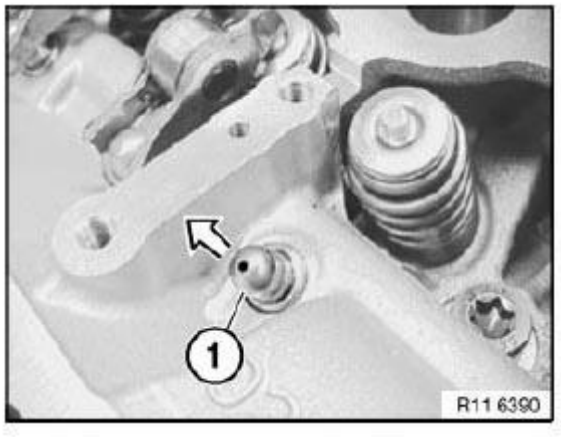


Fig. 220: Removing HVCA Element
Courtesy of BMW OF NORTH AMERICA, INC.

Assemble engine.

Check function of DME; if necessary, readjust uniform mixture distribution.

VALVES WITH SPRINGS

11 34 552 REMOVING AND INSTALLING OR REPLACING ALL VALVES (N51)

Special tools required:

For the following special tools, refer to **ENGINE - SPECIAL TOOLS (N51)** .

- **11 4 480**

Necessary preliminary tasks:

- Remove **cylinder head** . See **11 12 000 REMOVING AND INSTALLING OR SEALING CYLINDER HEAD COVER (N51)**.
- Remove **intermediate lever** . See **11 37 010 REMOVING AND INSTALLING/REPLACING INTERMEDIATE LEVER (N51)**.
- Remove **eccentric shaft** . See **11 37 005 REMOVING AND INSTALLING/REPLACING ECCENTRIC SHAFT (N51)**.
- Remove **inlet camshaft** . See **11 31 025 REMOVING AND INSTALLING/REPLACING INLET CAMSHAFT (N51)**.
- Remove **exhaust camshaft** . See **11 31 028 REMOVING AND INSTALLING/REPLACING EXHAUST CAMSHAFT (N51)**.
- Remove **roller cam follower** . See **11 33 050 REMOVING AND INSTALLING/REPLACING ALL**

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ROCKER ARMS (N51).

- Remove **valve springs** . See **11 34 715 REPLACING ALL VALVE SPRINGS (N51)**.
- Remove **valve stem seals** . See **11 34 560 REPLACING ALL VALVE STEM SEALS (N51)**.

Arrangement:

1. Valve
2. Valve stem seal with spring plate, bottom
3. Valve spring
4. Top plate spring
5. Valve tapers

If the valves are to be reused, set then down in special tool 11 4 480 in a tidy and orderly fashion. See **11 4 480 PLACEMENT BOARDS (2 X)** .

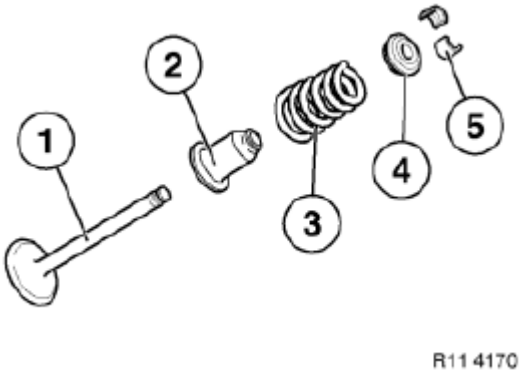


Fig. 221: Exploded View Of Valve Components
Courtesy of BMW OF NORTH AMERICA, INC.

Assemble engine.

Check function of DME; if necessary, readjust uniform mixture distribution.

11 34 560 REPLACING ALL VALVE STEM SEALS (N51)

Special tools required:

For the following special tools, refer to **ENGINE - SPECIAL TOOLS (N51)** .

- **11 1 480**
- **11 6 380**

Necessary preliminary tasks:

- Remove **cylinder head** . See **11 12 000 REMOVING AND INSTALLING OR SEALING**

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CYLINDER HEAD COVER (N51).

- Remove **intermediate lever** . See **11 37 010 REMOVING AND INSTALLING/REPLACING INTERMEDIATE LEVER (N51)**.
- Remove **eccentric shaft** . See **11 37 005 REMOVING AND INSTALLING/REPLACING ECCENTRIC SHAFT (N51)**.
- Remove **inlet camshaft** . See **11 31 025 REMOVING AND INSTALLING/REPLACING INLET CAMSHAFT (N51)**.
- Remove **exhaust camshaft** . See **11 31 028 REMOVING AND INSTALLING/REPLACING EXHAUST CAMSHAFT (N51)**.
- Remove **roller cam follower** . See **11 33 050 REMOVING AND INSTALLING/REPLACING ALL ROCKER ARMS (N51)**.

Firmly press special tool 11 1 480 onto old valve stem seals. See **Fig. 222**.

Detach valve stem seal from valve stem by turning and simultaneously pulling special tool 11 1 480.

Installation:

Insert all **valves** . See **11 34 552 REMOVING AND INSTALLING OR REPLACING ALL VALVES (N51)**.

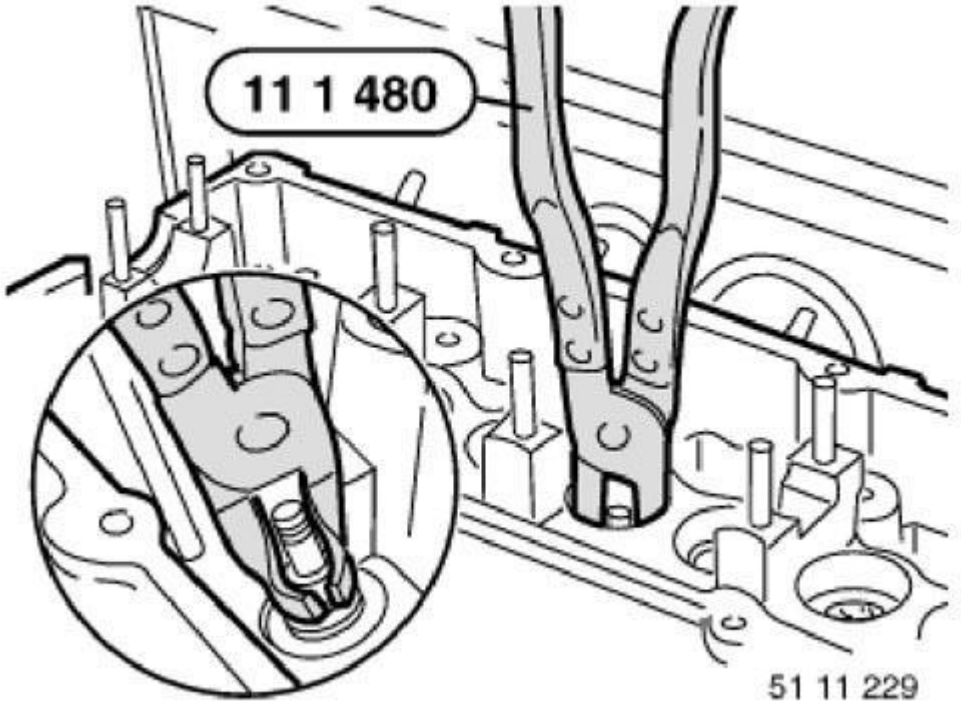


Fig. 222: Identifying Special Tool (11 1 480)
Courtesy of BMW OF NORTH AMERICA, INC.

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NOTE: For use on the N51 engine, special tool 11 6 380 must be remachined according to the sketch with a 10mm dia. drill bit to a depth of B = approx. 23 mm. See Fig. 223. This modification has already been taken into account for reordering.

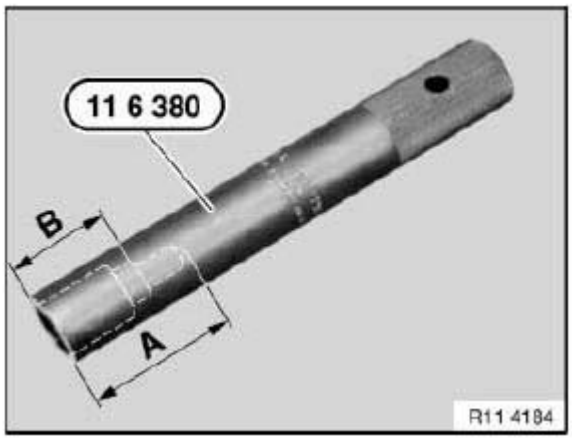


Fig. 223: Identifying Special Tool Dimension
Courtesy of BMW OF NORTH AMERICA, INC.

IMPORTANT: Different diameters at valve stem.

Valve dia. 5 mm: valve stem seal is red or brown.

Valve dia. 6 mm: valve stem seal is green or light green.

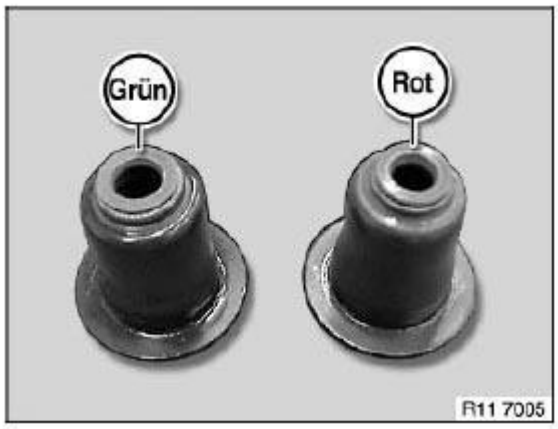


Fig. 224: Inspecting Valve Stem
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Fit the mounting sleeves (plastic sleeves) supplied in the spare part on the valve stem end

Lubricate mounting sleeve.

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Press on valve stem seal by hand with special tool 11 6 380 as far as it will go. See **Fig. 225**.

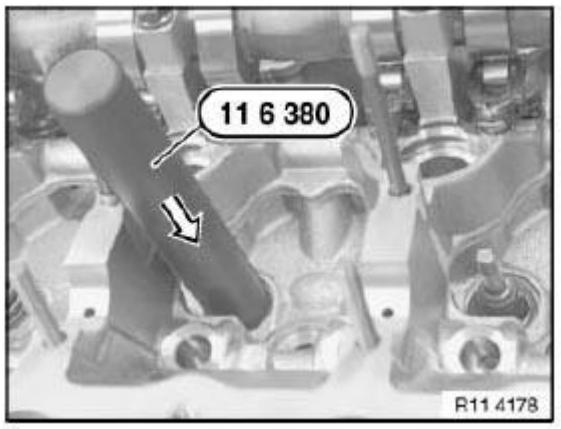


Fig. 225: Identifying Special Tool (11 6 380)
Courtesy of BMW OF NORTH AMERICA, INC.

Assemble engine.

11 34 715 REPLACING ALL VALVE SPRINGS (N51)

Special tools required:

For the following special tools, refer to **ENGINE - SPECIAL TOOLS (N51)** .

- **11 0 346**
- **11 4 480**
- **11 9 000**
- **11 9 017**

Necessary preliminary tasks:

- Remove **cylinder head cover** . See **11 12 000 REMOVING AND INSTALLING OR SEALING CYLINDER HEAD COVER (N51)**.
- Remove **cylinder head** . See **11 12 100 REMOVING AND INSTALLING/SEALING CYLINDER HEAD (N51)**.
- Remove **exhaust camshaft** . See **11 31 028 REMOVING AND INSTALLING/REPLACING EXHAUST CAMSHAFT (N51)**.
- Remove **intermediate lever** . See **11 37 010 REMOVING AND INSTALLING/REPLACING INTERMEDIATE LEVER (N51)**.
- Remove **inlet camshaft** . See **11 31 025 REMOVING AND INSTALLING/REPLACING INLET CAMSHAFT (N51)**.
- Remove **roller cam follower** . See **11 33 050 REMOVING AND INSTALLING/REPLACING ALL ROCKER ARMS (N51)**.

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Place cylinder head on special tool 11 9 000. See **Fig. 226**.

Press down inlet valves with special tool 11 9 017. See **Fig. 226**.

Exhaust valves with special tool 11 0 346.

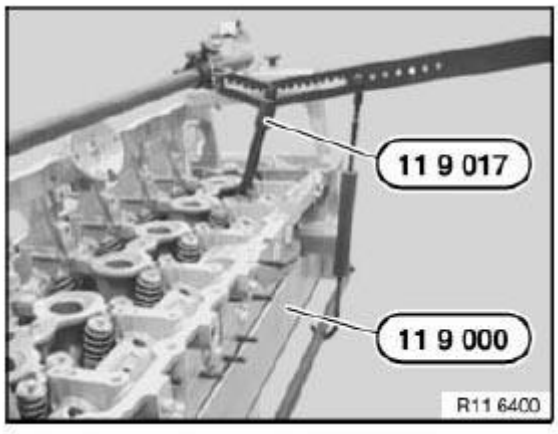


Fig. 226: Identifying Special Tools
Courtesy of BMW OF NORTH AMERICA, INC.

Remove valve tapers with a magnet.

Remove valve spring and spring retainer.

Set down on special tool 11 4 480 in a tidy and orderly fashion. See **11 4 480 PLACEMENT BOARDS (2 X)** .

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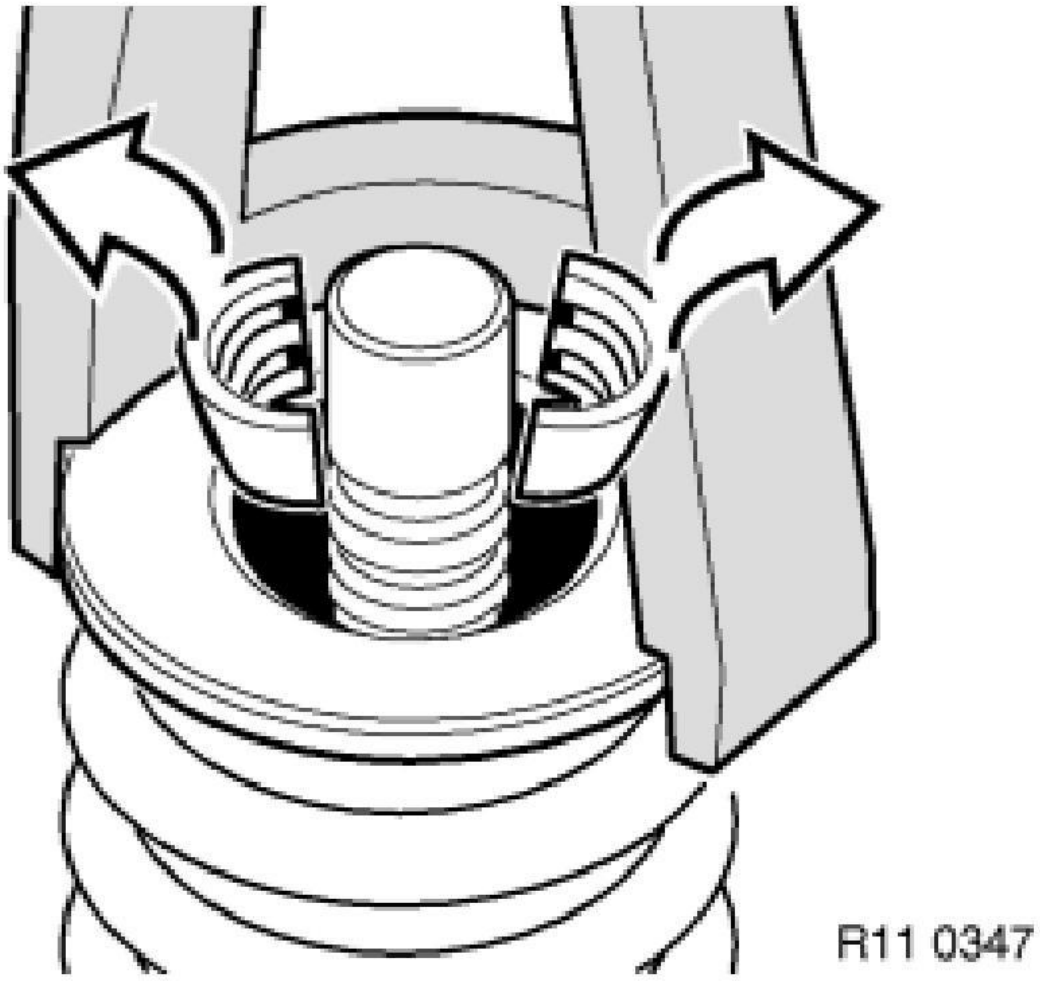


Fig. 227: Removing Valve Spring And Spring Retainer
Courtesy of BMW OF NORTH AMERICA, INC.

IMPORTANT: Incorrect installation possible.
Incorrect installation will result in valve spring breakage.
Risk of mixing up inlet and exhaust springs.

Color marking (1) is normally on lower end of valve spring.

Only the diameter pointing to the spring retainer at the bottom is required for correct installation of the valve spring.

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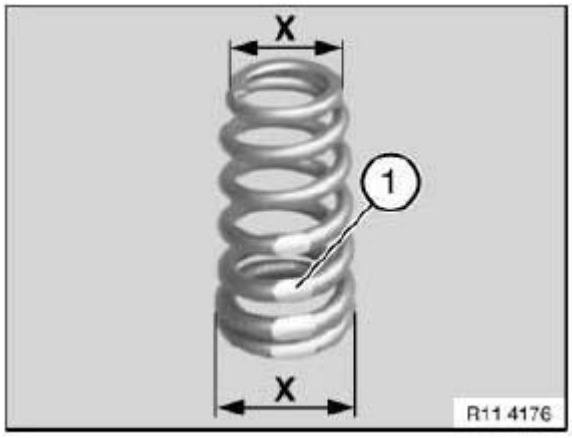


Fig. 228: Dimensions Of Valve Spring
Courtesy of BMW OF NORTH AMERICA, INC.

Arrangement:

1. Valve
2. Valve stem seal with spring plate, bottom
3. Valve spring
4. Top plate spring
5. Valve tapers

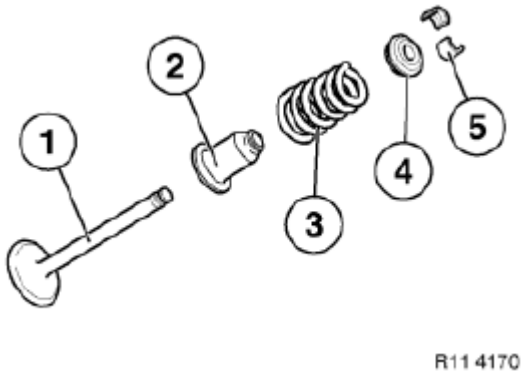


Fig. 229: Exploded View Of Valve Assembly
Courtesy of BMW OF NORTH AMERICA, INC.

Assemble engine.

Check function of DME; if necessary, readjust uniform mixture distribution.

VARIABLE CAMSHAFT TIMING

11 36 046 REMOVING AND INSTALLING/REPLACING INLET AND EXHAUST ADJUSTMENT UNITS (N51)

Special tools required:

For the following special tools, refer to **ENGINE - SPECIAL TOOLS (N51)** .

- **11 4 280**
- **11 4 281**
- **11 4 28**
- **11 4 283**

Necessary preliminary tasks:

- Remove **cylinder head cover** . See **11 12 000 REMOVING AND INSTALLING OR SEALING CYLINDER HEAD COVER (N51)**.
- Check **timing** . See **11 31 005 CHECKING CAMSHAFT TIMING**.

IMPORTANT: To release central bolts on adjustment units and camshafts. Fit special tool 11 4 280. See Fig. 230.

Fit special tool 11 4 283 with screws (1).

Fit special tool 11 4 281 on special tool 11 4 283. See **Fig. 230**.

IMPORTANT: Special tool 11 4 282 must be fitted underneath on inlet camshaft.

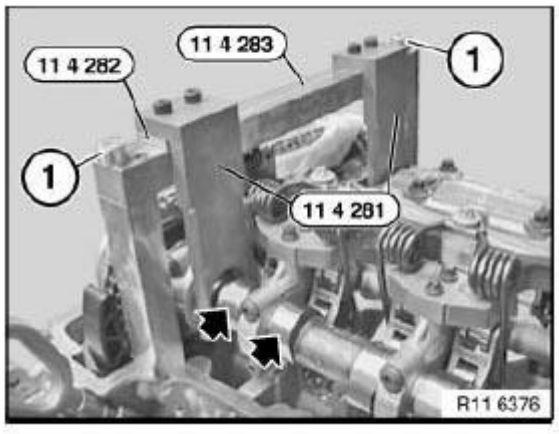


Fig. 230: Identifying Central Bolts On Adjustment Units And Camshafts
Courtesy of BMW OF NORTH AMERICA, INC.

Release chain tensioner (2).

Tightening torque. See 11 31 5AZ in **11 31 CAMSHAFT** .

Release central bolt on inlet/exhaust adjustment units (1).

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Tightening torque. See 11 36 1AZ in **11 36 VARIABLE CAMSHAFT CONTROL** .

NOTE: Illustrations in CAD and do not show special tools.

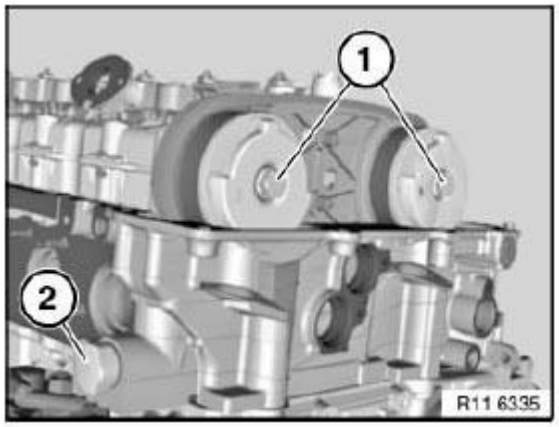


Fig. 231: Identifying Chain Tensioner And Central Bolt
Courtesy of BMW OF NORTH AMERICA, INC.

Detach exhaust adjustment unit (1) from exhaust camshaft.

Detach inlet adjustment unit (2) from inlet camshaft.

Installation:

To facilitate removal and installation of adjustment units, turn sensor gears at cutout downwards.

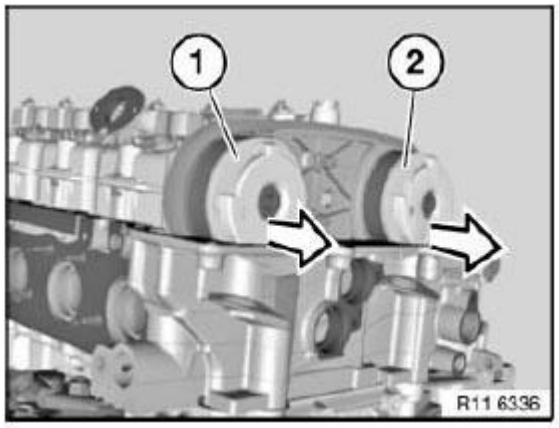


Fig. 232: Identifying Inlet/Exhaust Adjustment Unit
Courtesy of BMW OF NORTH AMERICA, INC.

IMPORTANT:

- **Danger of mixing up adjustment units .**
- **Mixing up the adjustment units will result in engine damage.**

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The inlet and exhaust adjustment units are different.

VANOS is marked with AUS and EX for the exhaust camshaft.

VANOS is marked with EIN and IN for the inlet camshaft.

Sensor gears can be fitted alternatively.

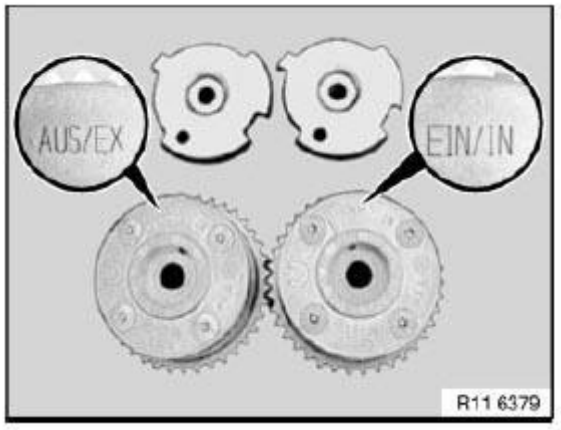


Fig. 233: Identifying AUS And EX Marks For Exhaust Camshaft
Courtesy of BMW OF NORTH AMERICA, INC.

Fit both adjustment units on camshafts.

The installation position of the adjustment units can be freely selected.

Insert screws (1).

Tightening torque. See 11 36 1AZ in **11 36 VARIABLE CAMSHAFT CONTROL** .

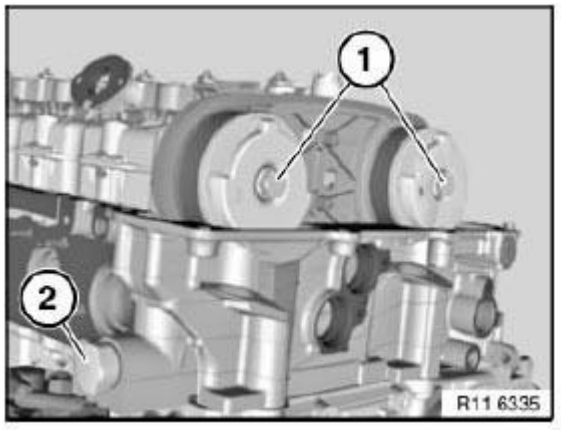


Fig. 234: Identifying Screws
Courtesy of BMW OF NORTH AMERICA, INC.

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IMPORTANT: To secure central bolts on adjustment units and camshafts. Fit special tool 11 4 280.

NOTE: Illustrations in CAD and do not show special tools.

IMPORTANT: Incorrect installation possible.

Press clamping rail (1) by hand against timing chain and make sure timing chain is guided in clamping rail (1).

NOTE: Schematic representation on removed chain drive.

Adjust **valve timing** . See **11 31 505 ADJUSTING CAMSHAFT TIMING (N51)**.

Fit **chain tensioner** . See **11 31 090 INSTALLING AND REMOVING/REPLACING CHAIN TENSIONER PISTON (N51)**.

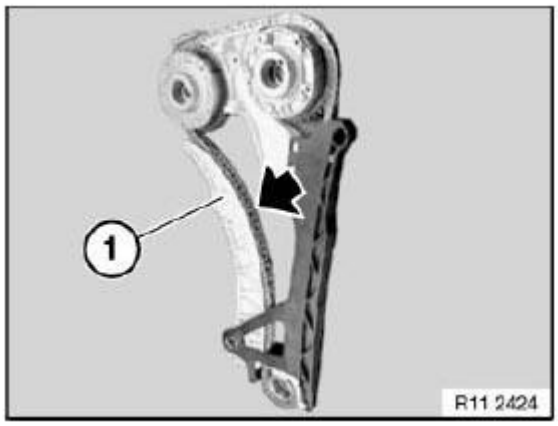


Fig. 235: Securing Timing Chain Guided In Clamping Rail
Courtesy of BMW OF NORTH AMERICA, INC.

Assemble engine.

VARIABLE VALVE GEAR

11 37 005 REMOVING AND INSTALLING/REPLACING ECCENTRIC SHAFT (N51)

Special tools required:

For the following special tools, refer to **ENGINE - SPECIAL TOOLS (N51)** .

- **11 4 481**

Necessary preliminary tasks:

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- Remove **cylinder head cover** . See **11 12 000 REMOVING AND INSTALLING OR SEALING CYLINDER HEAD COVER (N51)**.
- Remove **intermediate lever** . See **11 37 010 REMOVING AND INSTALLING/REPLACING INTERMEDIATE LEVER (N51)**.

If necessary, move eccentric shaft (1) on twin surface to minimum lift (2).

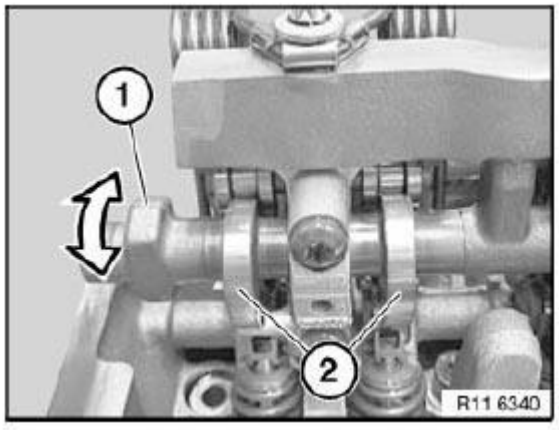


Fig. 236: Removing Eccentric Shaft
Courtesy of BMW OF NORTH AMERICA, INC.

Release screws on bearing cap number (1).

Release screws on all bearing caps (2).

All bearing caps are identified with numbers; set caps down in special tool 11 4 481 in a tidy and orderly fashion.

Remove intermediate shaft with a light tilting and rotating motion.

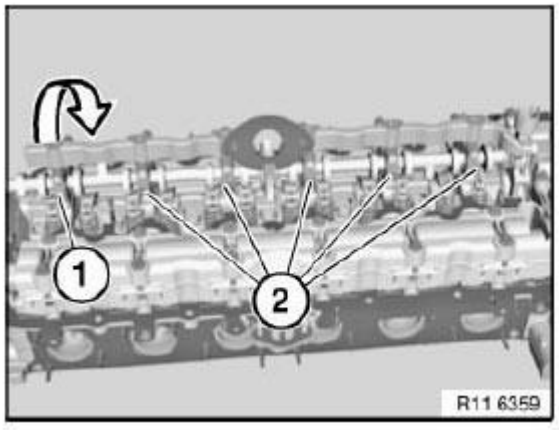


Fig. 237: Identifying Bearing Cap Number And Bearing Caps
Courtesy of BMW OF NORTH AMERICA, INC.

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Release screw and remove magnet wheel (1).

IMPORTANT: Screw is not magnetic and is secured against falling out.

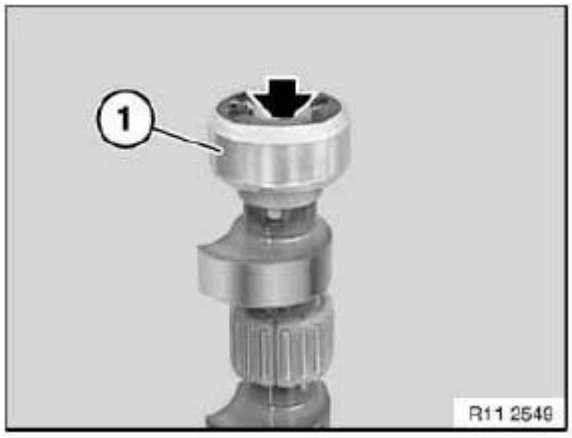


Fig. 238: Identifying Magnet Wheel
Courtesy of BMW OF NORTH AMERICA, INC.

IMPORTANT: Magnet wheel (1) is extremely magnetic.
After removing, protect magnet wheel (1) against metal chips by placing it in a plastic bag (2) with a seal.

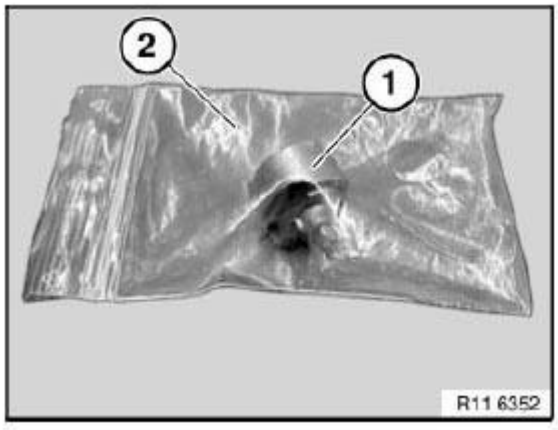


Fig. 239: Identifying Magnet Wheel And Plastic Bag
Courtesy of BMW OF NORTH AMERICA, INC.

Carefully press needle bearing (1) apart at split position only to such an extent that it can be removed from eccentric shaft.

IMPORTANT: Needle bearing (1) can break very easily.

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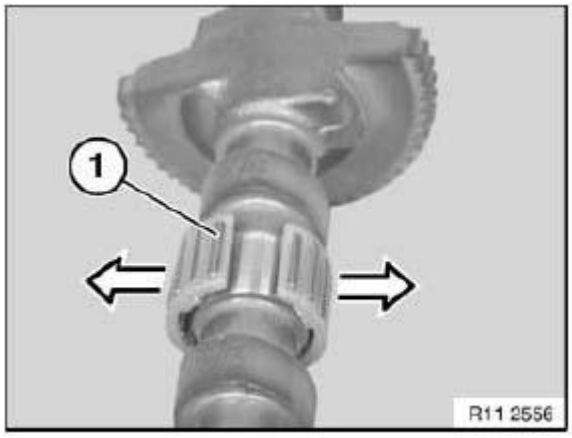


Fig. 240: Pressing Needle Bearing
Courtesy of BMW OF NORTH AMERICA, INC.

Install bearing shells (1) in such a way that ends of bearing shells (1) face each other as shown in illustration.

NOTE: Always replace bearing shells and needle bearings together.

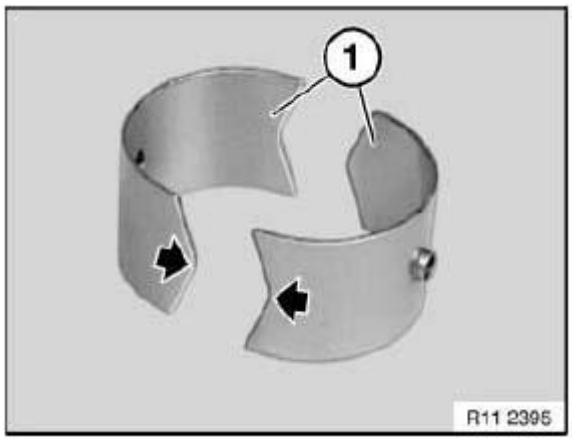


Fig. 241: Identifying Bearing Shells
Courtesy of BMW OF NORTH AMERICA, INC.

Install bearing shell (1) with tip facing down (see arrow) in cylinder head.

Install bearing shell (2) with tip facing up in bearing cap.

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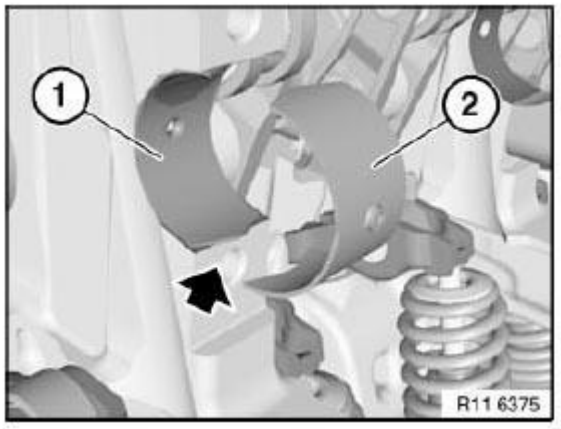


Fig. 242: Identifying Bearing Shells
Courtesy of BMW OF NORTH AMERICA, INC.

Install eccentric shaft and set to minimum lift.

Bearing cap number 6 (1) is provided with a stop.

All bearing caps (2) are identified with numbers from 1 to 5.

Tightening torque. See 11 37 7AZ in **11 37 VARIABLE VALVE GEAR** .

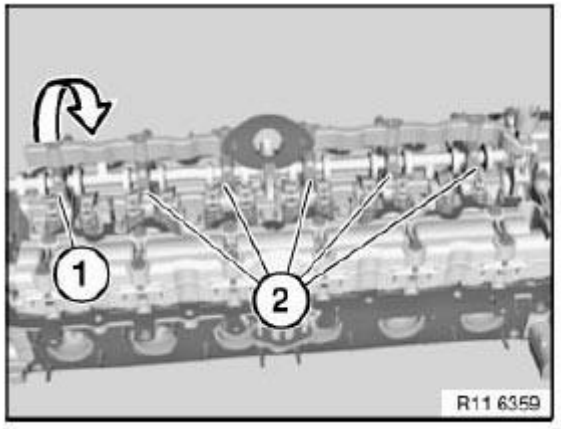


Fig. 243: Identifying Bearing Cap Numbers
Courtesy of BMW OF NORTH AMERICA, INC.

Assemble engine.

11 37 010 REMOVING AND INSTALLING/REPLACING INTERMEDIATE LEVERS (N51)

Special tools required:

For the following special tools, refer to **ENGINE - SPECIAL TOOLS (N51)** .

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- **11 4 270**
- **11 4 450**
- **11 4 481**
- **11 7 110**

IMPORTANT: Aluminum-magnesium materials. No steel screws/bolts may be used due to the threat of electrochemical corrosion. A magnesium crankcase requires aluminum screws/bolts exclusively. Aluminum screws/bolts must be replaced each time they are released . Aluminum screws/bolts are permitted with and without color coding (blue). For reliable identification: Aluminum screws/bolts are not magnetic . Jointing torque and angle of rotation must be observed without fail (risk of damage) .

NOTE: There are 2 different versions of the gate

IMPORTANT: Establish size of gates.

Version 1

Size 55.2 mm

Version 2

Size 58 mm

Version 1 Size (1) 55.2 mm

Necessary preliminary tasks:

- Remove **CYLINDER HEAD COVER (N51)**.

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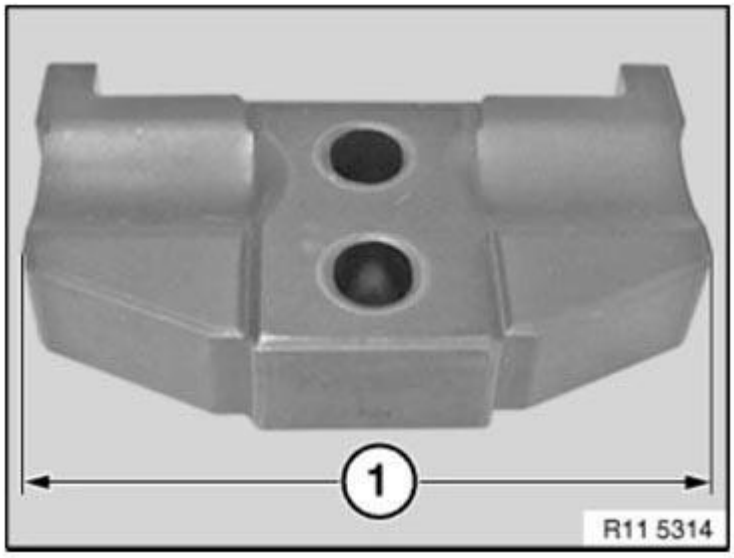


Fig. 244: Identifying Guide Block Dimension
Courtesy of BMW OF NORTH AMERICA, INC.

If necessary, set eccentric shaft (1) on twin surface to minimum lift (2).

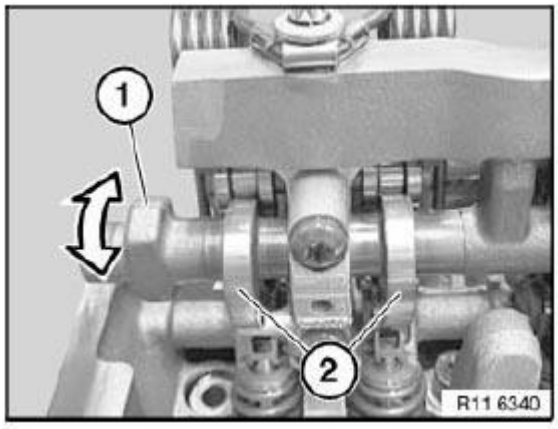


Fig. 245: Setting Eccentric Shaft On Twin Surface To Minimum Lift
Courtesy of BMW OF NORTH AMERICA, INC.

Secure special tool 11 4 270 with gripping pliers (3) to guide block (2).

IMPORTANT: Special tool 11 4 270 is only secured to guide block. Adjusting the gripping pliers (3) is not permitted (risk of damage) on special tool 11 4 270.

NOTE: The oil nozzle must be removed beforehand from cylinder no. 3.

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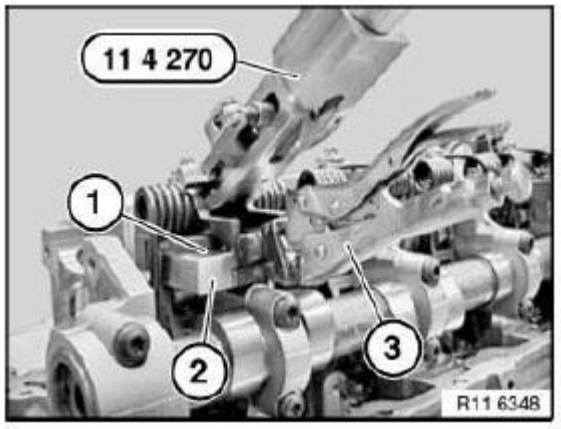


Fig. 246: Identifying Special Tools
Courtesy of BMW OF NORTH AMERICA, INC.

WARNING: Risk of injury in event of incorrect use.

IMPORTANT: Incorrect handling - risk of damage!

Secure both bearing pins (2) in return spring with knurled screw (1) on special tool 11 4 270.

Press special tool 11 4 270 in direction of arrow as far as it will go.

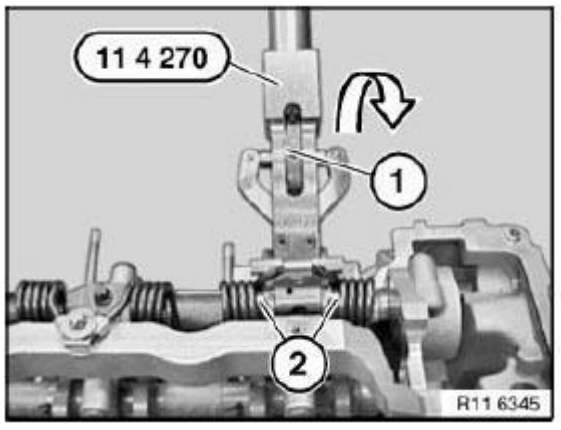


Fig. 247: Securing Both Bearing Pins In Return Spring With Knurled Screw On Special Tool
Courtesy of BMW OF NORTH AMERICA, INC.

Release steel screw (2).

To avoid jamming with screw (2) and return spring, it is necessary when releasing screw (2) to relieve the pretension on special tool 11 4 270 uniformly.

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IMPORTANT: Risk of damage to cylinder head thread.

Tightening torque. See **11 37 2AZ** .

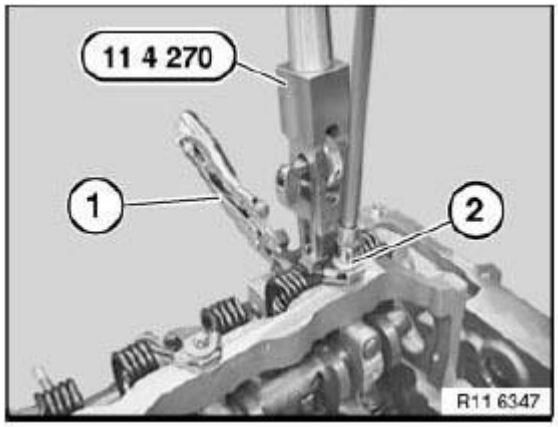


Fig. 248: Identifying Steel Screw
Courtesy of BMW OF NORTH AMERICA, INC.

Relieve tension on return spring (1) with special tool 11 4 270.

NOTE: Metal lug (2) cannot be disassembled and must not be removed.

Installation:

Replace metal lug if tab washer is defective.

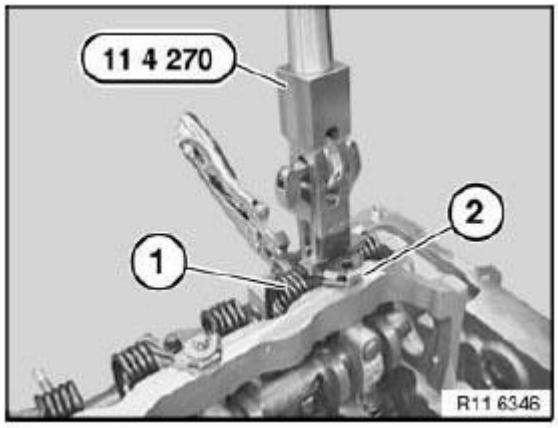


Fig. 249: Identifying Return Spring And Metal Lugs
Courtesy of BMW OF NORTH AMERICA, INC.

Press return spring apart at position (1) and remove towards top.

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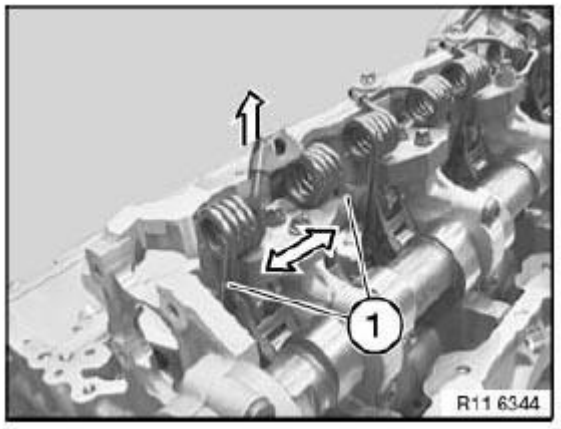


Fig. 250: Removing Return Spring
Courtesy of BMW OF NORTH AMERICA, INC.

IMPORTANT: Uniform distribution must not be changed.
All components must be set down in a clean and orderly fashion.

All components must be reinstalled in the same positions in an engine which has already been in use.

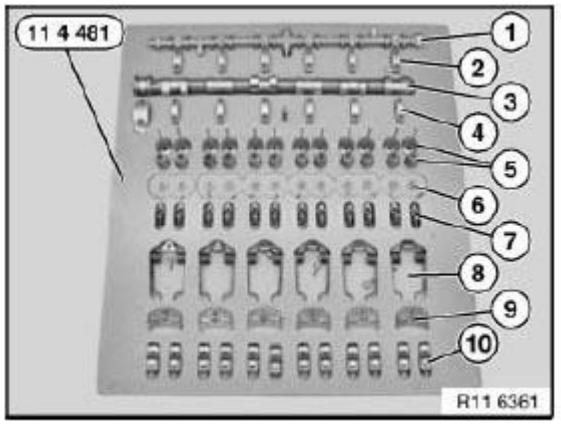


Fig. 251: Identifying Special Tool
Courtesy of BMW OF NORTH AMERICA, INC.

1. Eccentric shaft with bearing
2. Bearing caps of eccentric shaft set out in order.
3. Inlet camshaft
4. Bearing caps of inlet camshaft set out in order.
5. Intake valves with valve springs
6. Valve plates and valve cotters
7. Roller cam followers with HVC element set out in order.
8. Return springs.
9. Guide blocks set out in order.

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10. Intermediate levers set out in order.

Release screws (1).

Tightening torque. See 11 37 1AZ in **11 37 VARIABLE VALVE GEAR** .

Set down guide blocks (2) in special tool 11 4 481 in neat order.

Installation:

Mixing up the guide blocks may cause the engine to demonstrate idle fluctuations.

This will result in maladjustment of uniform distribution.

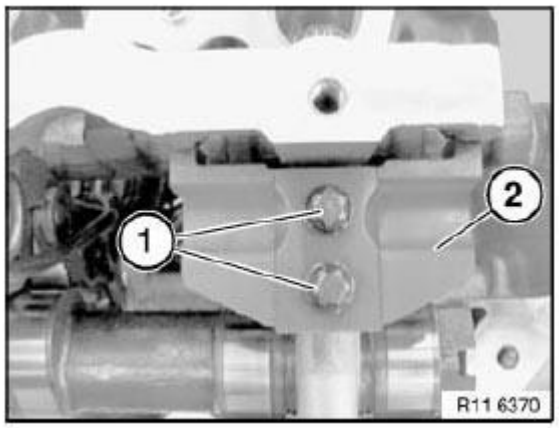


Fig. 252: Identifying Screws And Guide Blocks
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Contact surfaces (1) must be clean and oil-free.

Clean if necessary.

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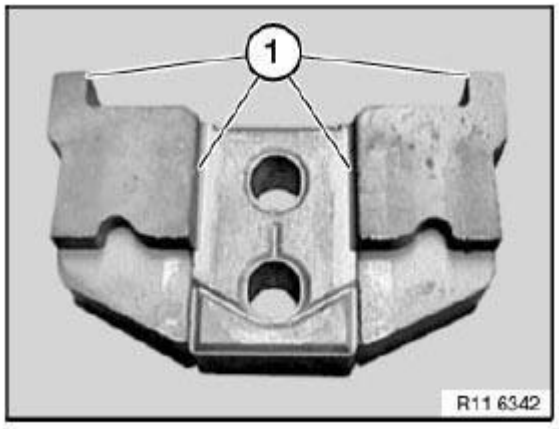


Fig. 253: Identifying Contact Surface
Courtesy of BMW OF NORTH AMERICA, INC.

Lift out intermediate levers (2).

Intermediate levers (2) set out in special tool 11 4 481 in order.

Installation:

Mixing up the intermediate levers may cause the engine to demonstrate RPM fluctuations.

Installation:

Contact surfaces (1) must be clean and oil-free.

Clean if necessary.

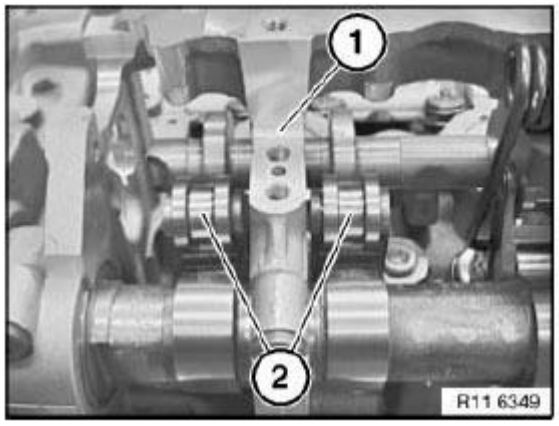


Fig. 254: Identifying Contact Surface And Intermediate Levers
Courtesy of BMW OF NORTH AMERICA, INC.

All intermediate levers (1) are classified.

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Reinstall intermediate levers which have already been used in the same positions.

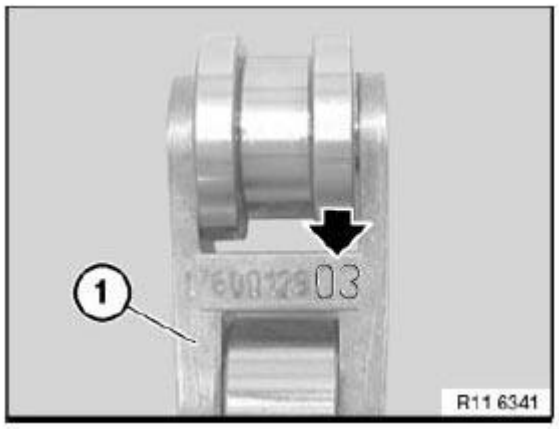


Fig. 255: Locating Marking On Intermediate Levers
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Before reinstalling the intermediate levers, make sure the roller cam followers are correctly positioned **(risk of damage).**

Install intermediate levers (2).

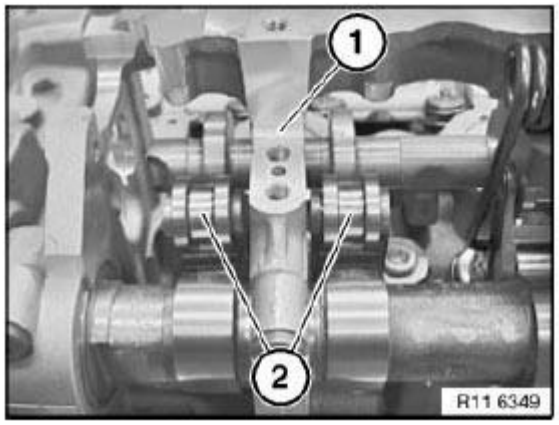


Fig. 256: Identifying Contact Surfaces And Intermediate Levers
Courtesy of BMW OF NORTH AMERICA, INC.

Fit guide block (2) cleanly into opening.

Tighten screws (1) hand-tight.

Check both intermediate levers again to ensure correct installation position.

Release bolts (1) again by a 1/4 turn.

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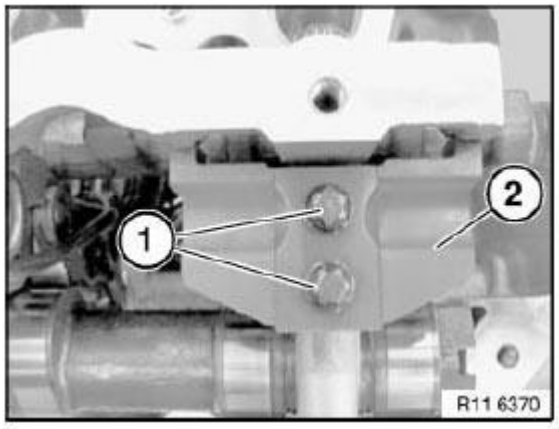


Fig. 257: Identifying Guide Block With Bolts
Courtesy of BMW OF NORTH AMERICA, INC.

Secure special tool **11 4 450 DEVICE** to bolt connection (1) of eccentric shaft.

Turn eccentric lever (3) on special tool **11 4 450 DEVICE** in direction of arrow.

Guide block is now tensioned.

Secure screws (2).

Tightening torque: **11 37 1AZ** .

Installation:

At cylinder no. 3, the guide block can be preinstalled with one bolt (2) only.

Fit oil pump only after retaining spring has been fitted.

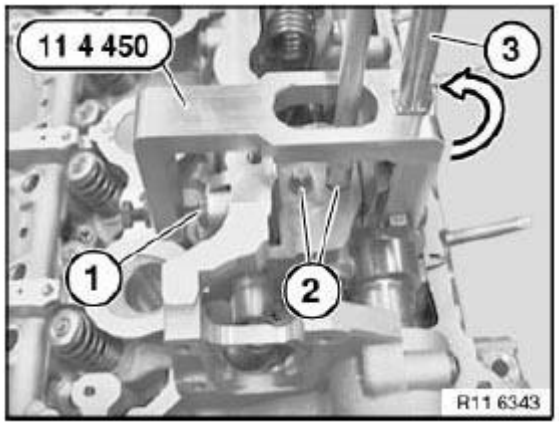


Fig. 258: Turning Eccentric Lever
Courtesy of BMW OF NORTH AMERICA, INC.

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Fit return spring on guide block.

Installation:

Insert return spring (2) in intermediate lever (1) (see arrow).

Check roller cam follow (3) again to ensure correct installation position.

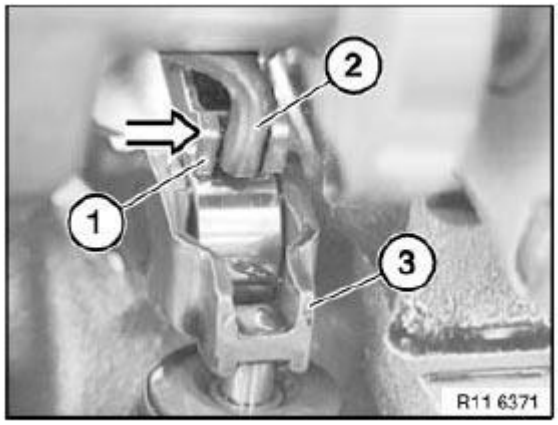


Fig. 259: Inserting Torsion Spring In Intermediate Lever
Courtesy of BMW OF NORTH AMERICA, INC.

Secure special tool **11 4 270 DEVICE** with gripping pliers (3) to guide block (1).

IMPORTANT: Special tool 11 4 270 DEVICE is only secured to guide block. Adjusting the gripping pliers (3) is not permitted (risk of damage) on special tool 11 4 270 DEVICE .

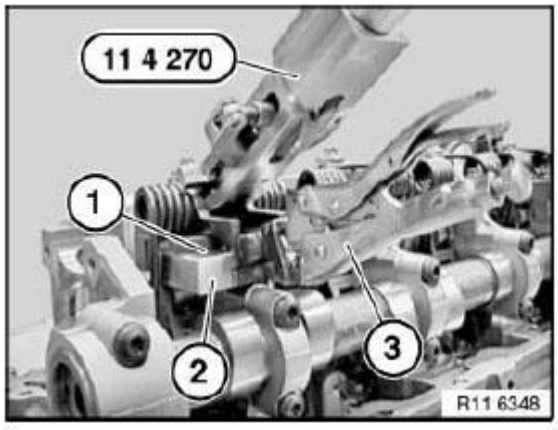


Fig. 260: Identifying Gripping Pliers, Guide Block And Special Tool (11 4 270)
Courtesy of BMW OF NORTH AMERICA, INC.

WARNING: Risk of injury in event of incorrect use.

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IMPORTANT: Incorrect handling risk of damage.

Secure both bearing pins (2) in return spring with knurled screw (1) on special tool **11 4 270 DEVICE** .

IMPORTANT: Check return spring again on intermediate lever to ensure correct installation position.

Press special tool **11 4 270 DEVICE** in direction of arrow as far as it will go.

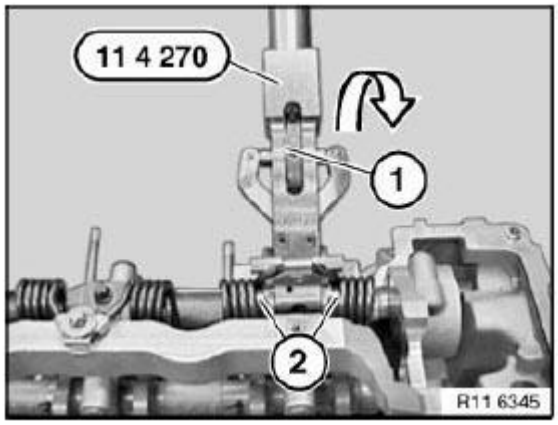


Fig. 261: Pressing Special Tool (11 4 270)
Courtesy of BMW OF NORTH AMERICA, INC.

Insert steel screw (2).

To avoid jamming with screw (2) and return spring, it is necessary when inserting screw (2) to increase the pretension on special tool **11 4 270 DEVICE** uniformly.

IMPORTANT: Risk of damage to cylinder head thread.

Tightening torque: **11 37 2AZ** .

Remove special tool **11 4 270 DEVICE** .

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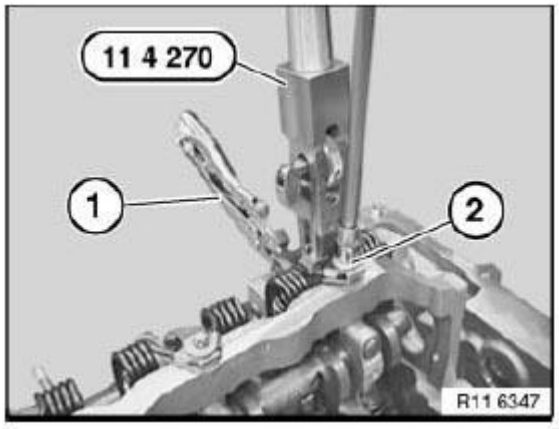


Fig. 262: Inserting Steel Screw
Courtesy of BMW OF NORTH AMERICA, INC.

At cylinder no. 3, adjust oil nozzle (2) so that oil spray (3) points precisely towards spline teeth.

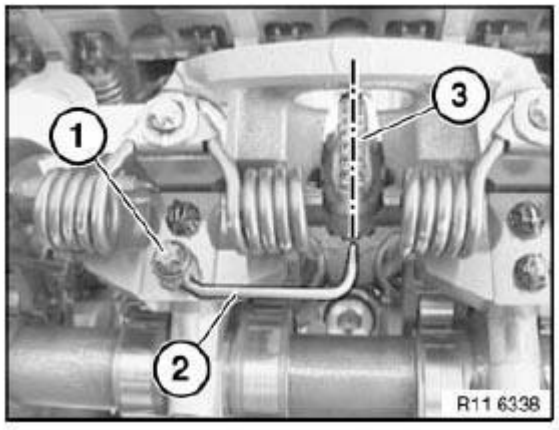


Fig. 263: Identifying Oil Spray Nozzle With Spray
Courtesy of BMW OF NORTH AMERICA, INC.

Assemble engine.

Version 2

Size (1) 58 mm

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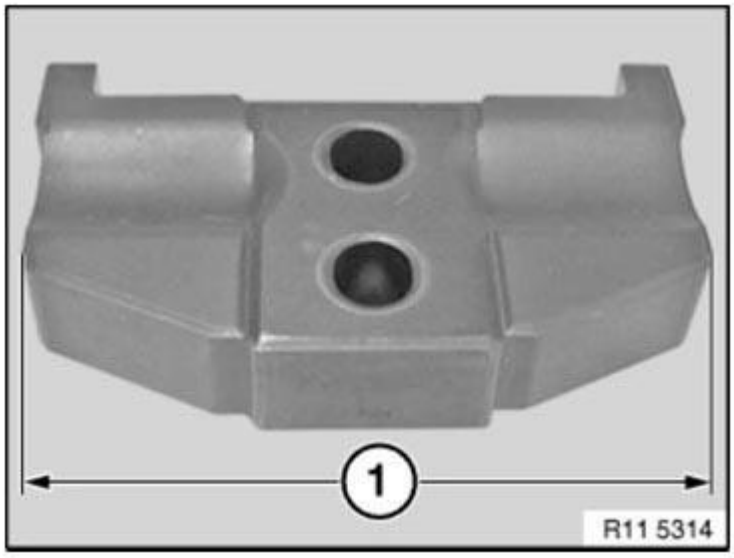


Fig. 264: Identifying Guide Block Dimension
Courtesy of BMW OF NORTH AMERICA, INC.

- Remove **CYLINDER HEAD COVER (N51)**

If necessary, move eccentric shaft (1) on twin surface to minimum lift (2).

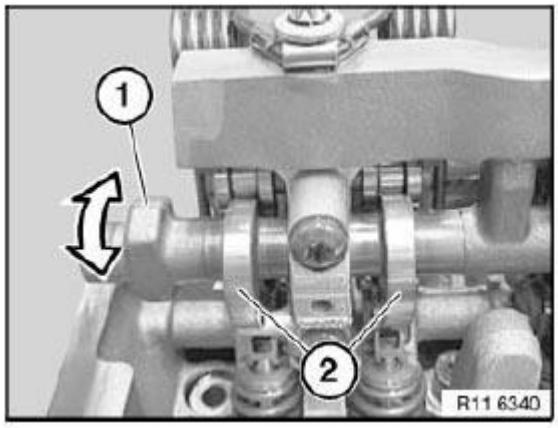


Fig. 265: Moving Eccentric Shaft
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: Oil spray nozzle must be removed from 3rd cylinder (make a note of installation position of oil spray nozzle).

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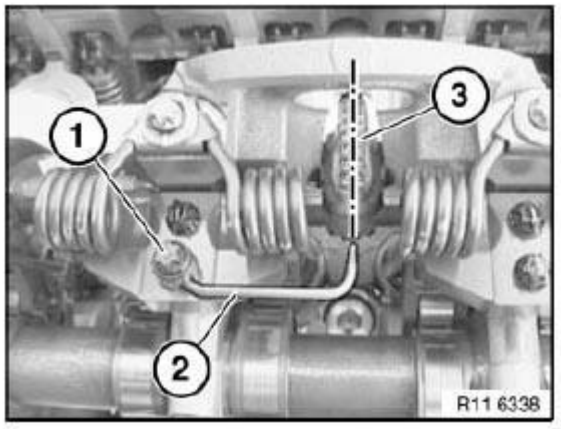


Fig. 266: Identifying Oil Spray Nozzle With Spray
Courtesy of BMW OF NORTH AMERICA, INC.

Position special tool **11 7 110** on return spring (1) (see arrows).

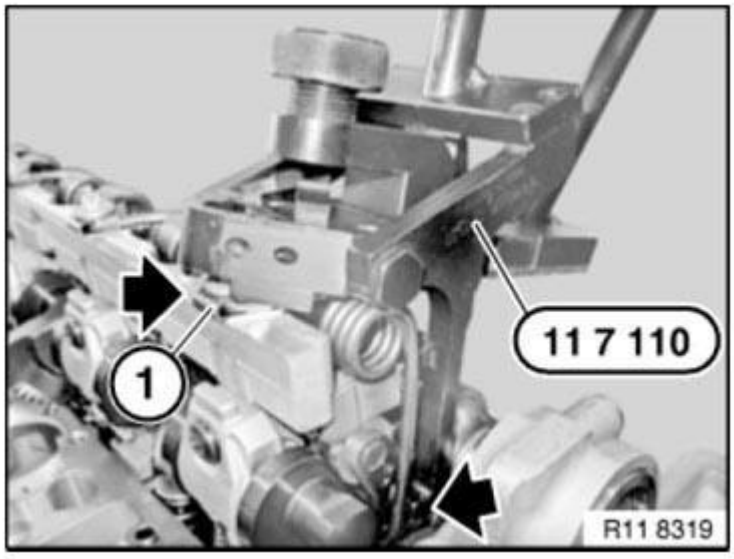


Fig. 267: Positioning Special Tool (11 7 110) On Return Spring
Courtesy of BMW OF NORTH AMERICA, INC.

WARNING: Risk of injury in event of incorrect use.

IMPORTANT: Improper handling. Risk of damage!

Place special tool **11 7 110** flat on cylinder head.

Turn knurled screw (1) in direction of arrow until both clamping levers secure return spring in guide block.

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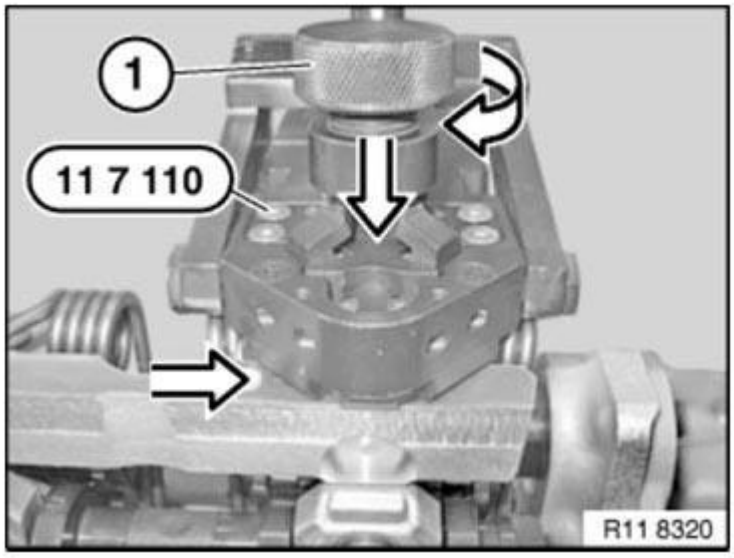


Fig. 268: Turning Knurled Screw
Courtesy of BMW OF NORTH AMERICA, INC.

Return spring is correctly preloaded when both clamping levers are parallel to guide block.

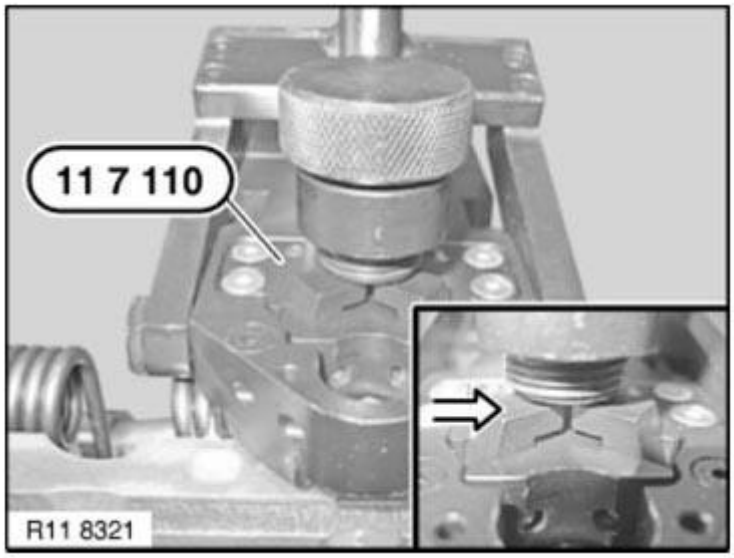


Fig. 269: Identifying Special Tool (11 7 110)
Courtesy of BMW OF NORTH AMERICA, INC.

IMPORTANT: Risk of damage!

Left and right return springs (1) must be positioned in lateral guide of special tool **11 7 110** .

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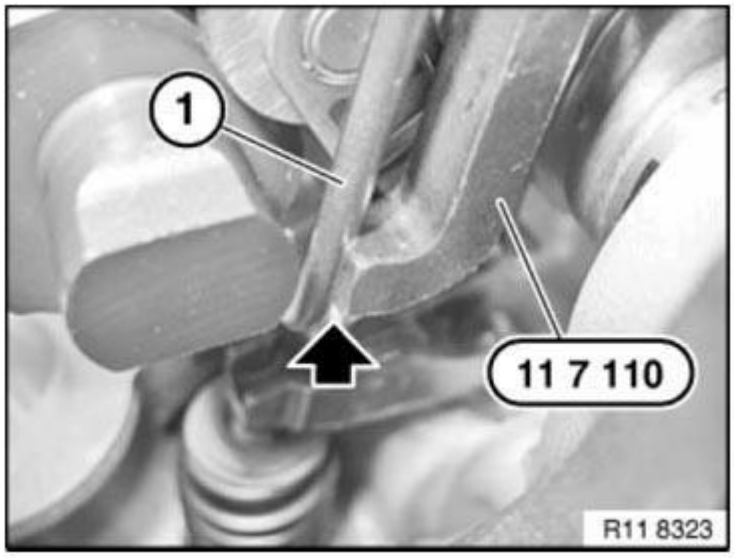


Fig. 270: Positioning Return Spring
Courtesy of BMW OF NORTH AMERICA, INC.

Preload return spring with lever (1) on special tool **11 7 110** in direction of arrow.

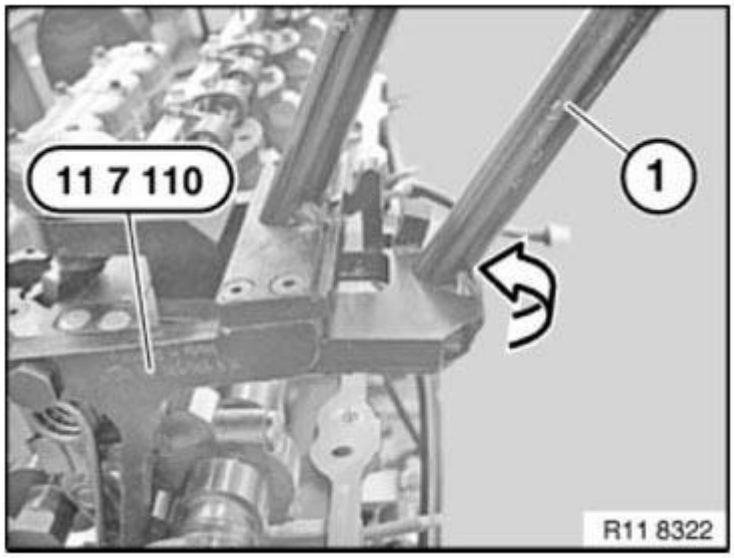


Fig. 271: Preloading Return Spring On Special Tool (11 7 110)
Courtesy of BMW OF NORTH AMERICA, INC.

Lock special tool **11 7 110** with catch on lever (1).

IMPORTANT: Screw fixing on return spring can only be released with special tool 11 7 110 secured.

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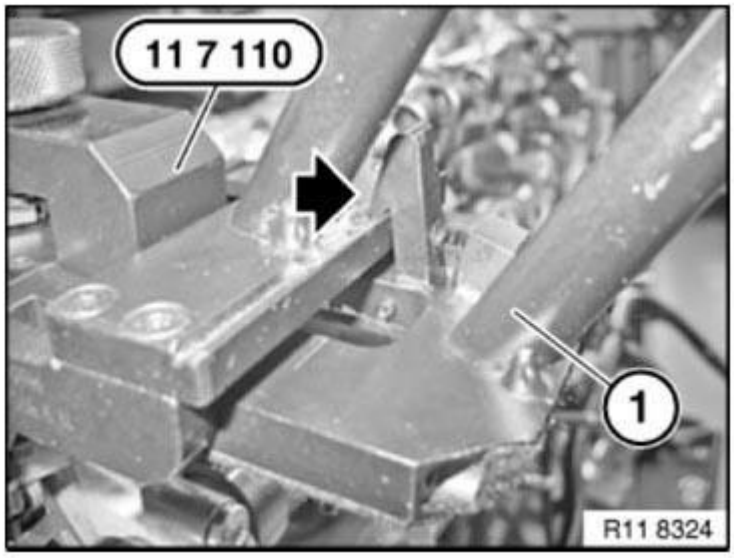


Fig. 272: Locking Special Tool (11 7 110) On Lever
Courtesy of BMW OF NORTH AMERICA, INC.

Release screw (1).

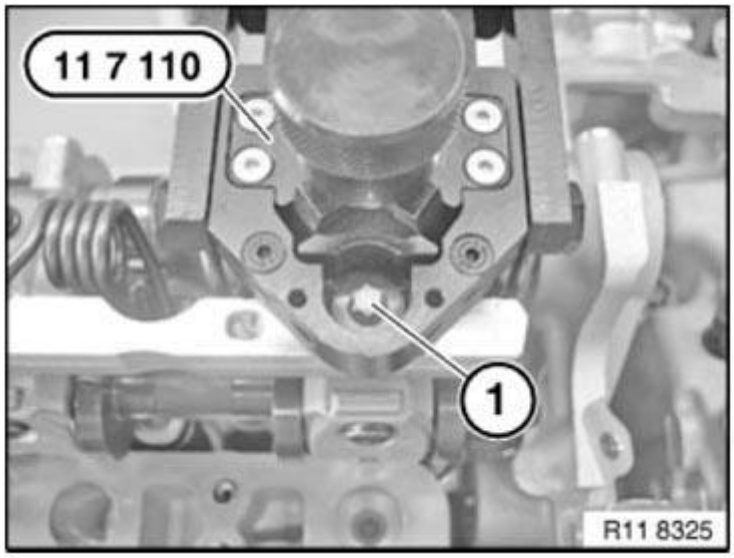


Fig. 273: Releasing Screw
Courtesy of BMW OF NORTH AMERICA, INC.

WARNING: Risk of injury in event of incorrect use.
Lever (1) is under pre-tension.

IMPORTANT: Improper handling.
Risk of damage!

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Secure lever (1)

Press back latching hook (2).

Return spring tension can now be released.

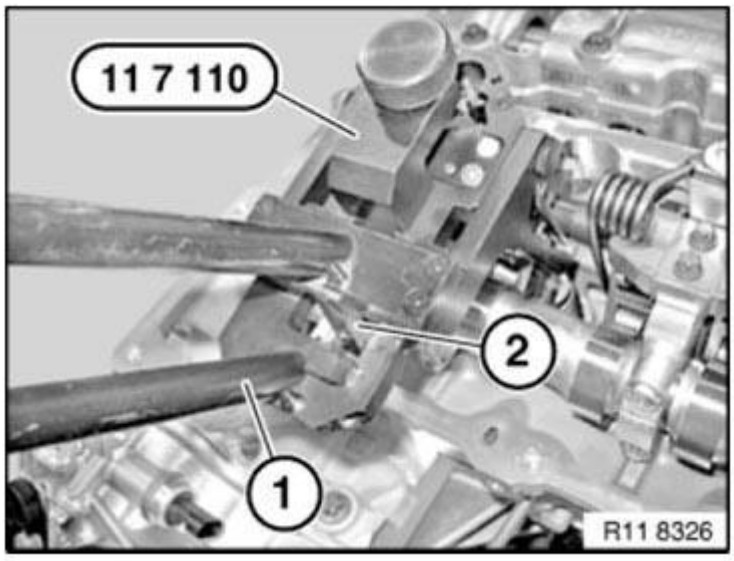


Fig. 274: Pressing Latching Hook
Courtesy of BMW OF NORTH AMERICA, INC.

Release knurled screw (1) on special tool **11 7 110** in direction of arrow.

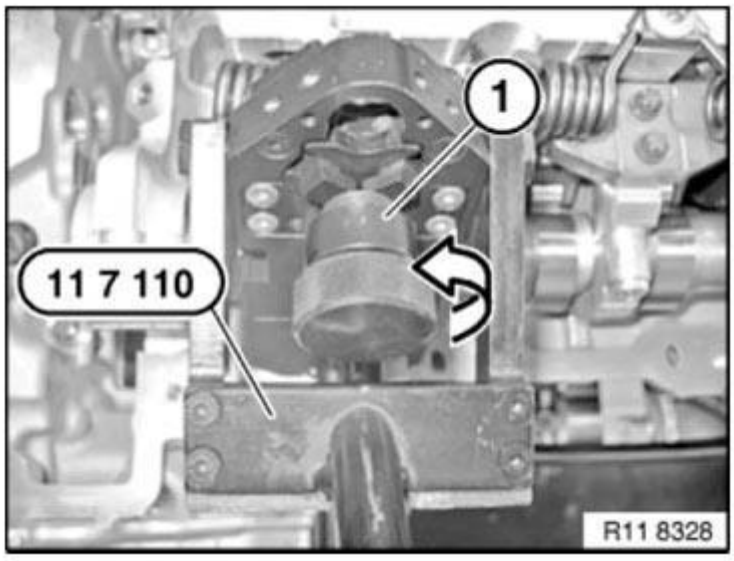


Fig. 275: Releasing Knurled Screw On Special Tool (11 7 110)
Courtesy of BMW OF NORTH AMERICA, INC.

Release special tool **11 7 110** in direction of arrow from return spring (1).

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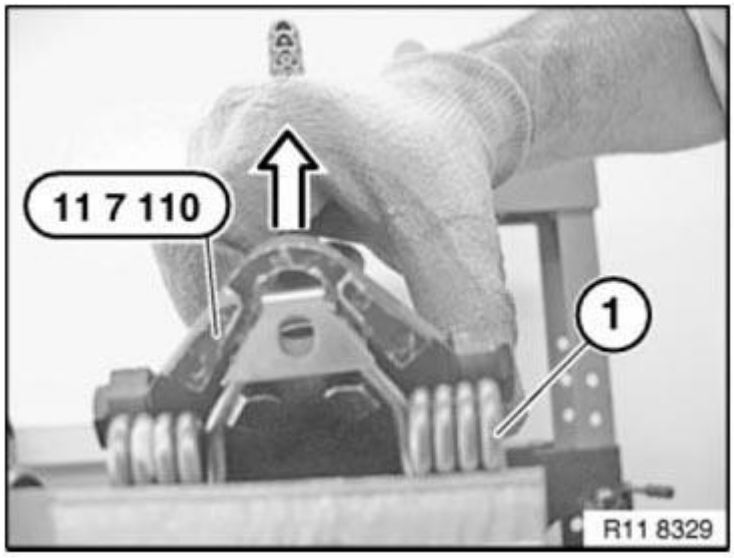


Fig. 276: Releasing Special Tool (11 7 110)
Courtesy of BMW OF NORTH AMERICA, INC.

Press torsion spring apart at positions (1).

Remove torsion spring towards top.

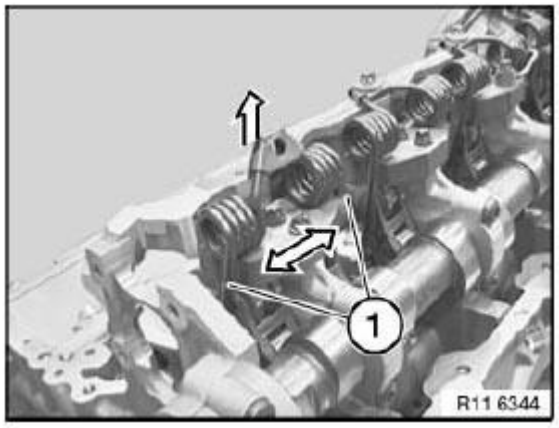


Fig. 277: Removing Torsion Spring
Courtesy of BMW OF NORTH AMERICA, INC.

IMPORTANT: Uniform distribution must not be changed.
Place all components in clean and orderly condition in special tool 11 4 481.

All components must be reinstalled in the same positions in an engine which has already been in use.

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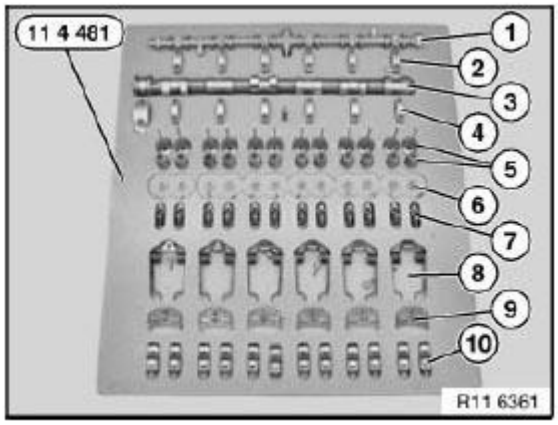


Fig. 278: Identifying Intermediate Lever Components On Special Tool
Courtesy of BMW OF NORTH AMERICA, INC.

1. Eccentric shaft with bearing
2. Bearing caps of eccentric shaft (set out in order)
3. Intake camshaft
4. Bearing caps of inlet camshaft (set out in order)
5. Intake valves with valve springs
6. Valve plates and valve cotters
7. Cam followers with HVCA elements (set out in order)
8. Torsion springs
9. Guide blocks (set out in order)
10. Intermediate levers (set out in order)

Release screws (1) on guide block (2).

Tightening torque **11 37 1AZ** .

Place all guide blocks (2) in neat order in special tool 11 4 481.

Installation:

Mixing up the guide blocks (2) will cause the engine to suffer idle-speed fluctuations.

This will result in maladjustment of **uniform distribution** .

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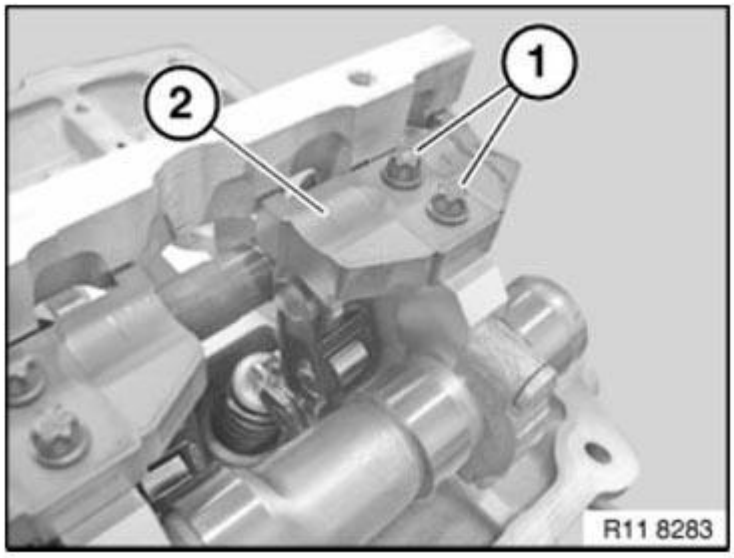


Fig. 279: Identifying Screws On Guide Block
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

All contact surfaces (1) of guide block must be clean and free from oil and grease. If necessary, clean contact surfaces (1).

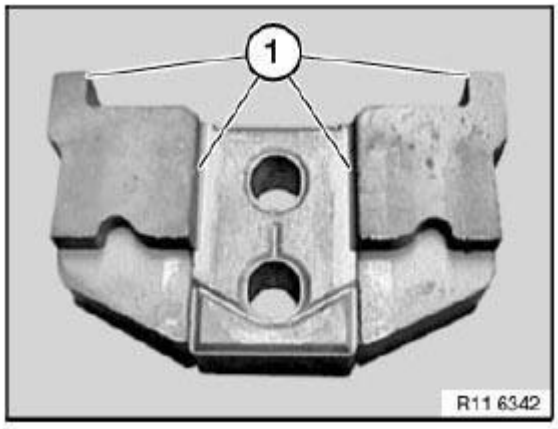


Fig. 280: Identifying Contact Surface Of Guide Block
Courtesy of BMW OF NORTH AMERICA, INC.

Lift out intermediate levers (2).

Place all intermediate levers (2) in neat order in special tool 11 4 481.

Installation:

Mixing up the intermediate levers (2) will cause the engine to suffer idle-speed fluctuations.

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Installation:

All contact surfaces (1) must be clean and free from oil and grease. If necessary, clean contact surfaces (1).

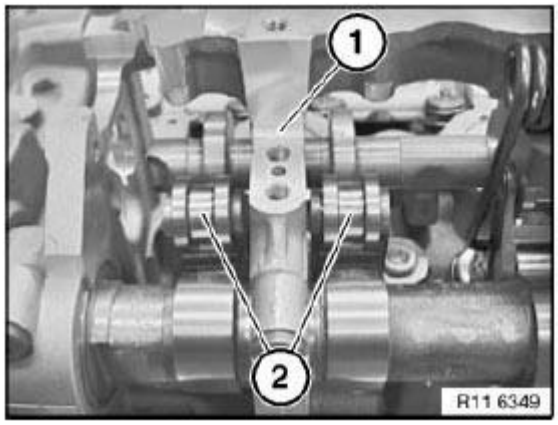


Fig. 281: Identifying Contact Surface Of Guide Block
Courtesy of BMW OF NORTH AMERICA, INC.

All intermediate levers (1) are classified.

All intermediate levers (1) must be reinstalled in the same positions in an engine which has already been in use.

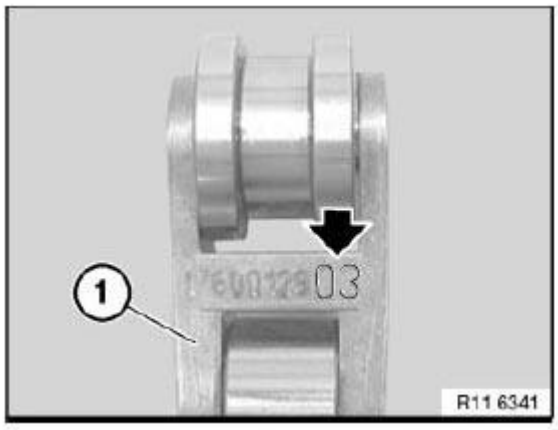


Fig. 282: Locating Marking On Intermediate Levers
Courtesy of BMW OF NORTH AMERICA, INC.

IMPORTANT: Before installing intermediate levers (2), make sure cam followers are correctly positioned.
Risk of damage!

Install intermediate levers (2).

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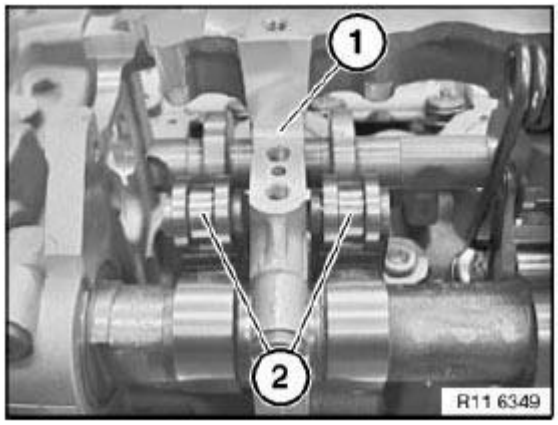


Fig. 283: Identifying Contact Surface Of Guide Block And Intermediate Levers
Courtesy of BMW OF NORTH AMERICA, INC.

Fit guide block (2) cleanly into opening.

Tighten screws (1) hand-tight.

Check that intermediate levers are in correct installation position.

Release screws (1) by a 1/4 turn.

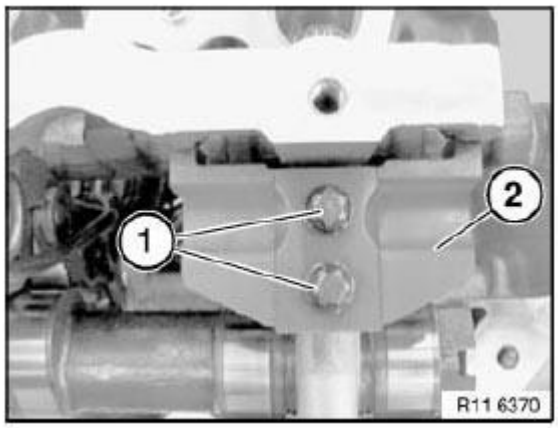


Fig. 284: Identifying Guide Block And Screws
Courtesy of BMW OF NORTH AMERICA, INC.

Secure special tool **11 4 450** to screw fixing (1) of eccentric shaft.

Move eccentric lever (3) on special tool **11 4 450** in direction of arrow.

Guide block is now pretensioned.

Insert screws (2) of guide blocks.

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Tightening torque **11 37 1AZ** .

Installation:

At cylinder no. 3, the guide block can be pre-installed with one screw (internal) only.

Oil spray nozzle is fitted only after torsion spring has been installed.

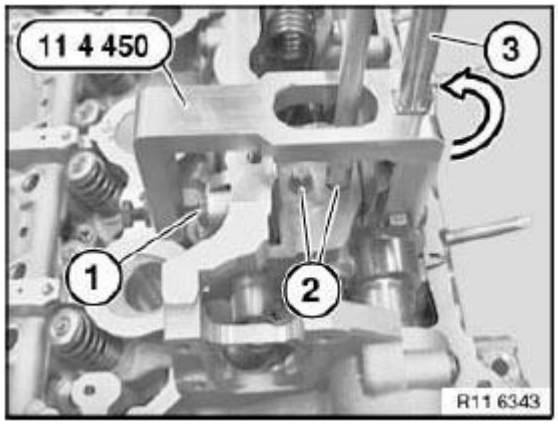


Fig. 285: Moving Eccentric Lever On Special Tool (11 4 450)
Courtesy of BMW OF NORTH AMERICA, INC.

Install torsion spring (2) on guide block.

Installation:

Insert torsion spring (2) in intermediate lever (1) (see arrow).

Check that cam follower (3) is in correct installation position.

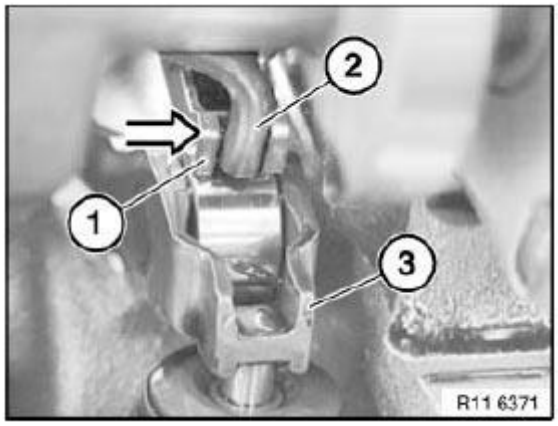


Fig. 286: Inserting Torsion Spring On Intermediate Lever
Courtesy of BMW OF NORTH AMERICA, INC.

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Position special tool **11 7 110** on return spring.

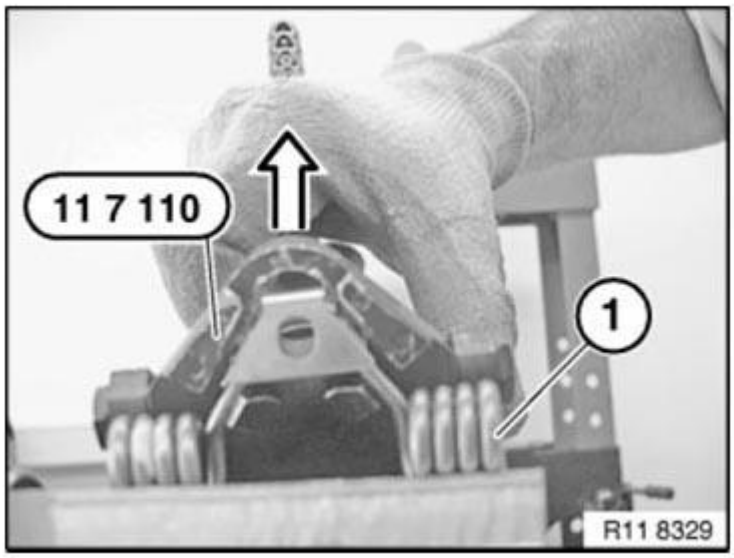


Fig. 287: Positioning Special Tool (11 7 110) On Return Spring
Courtesy of BMW OF NORTH AMERICA, INC.

Clamp return spring with knurled screw (1) in direction of arrow.

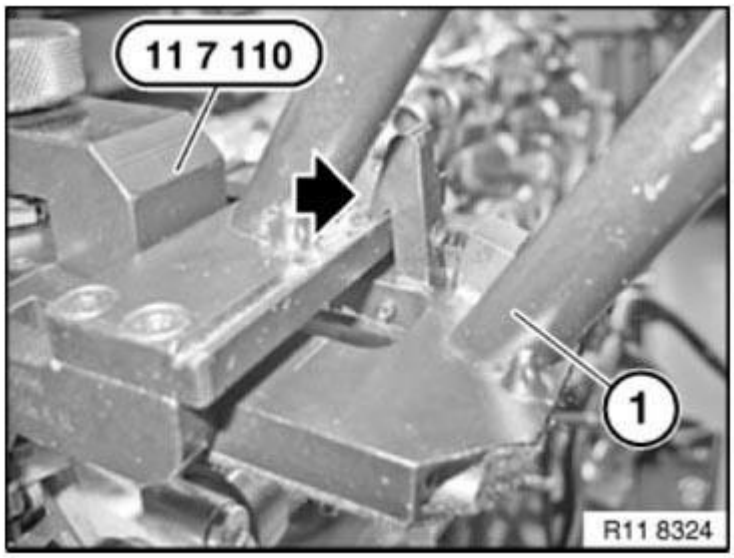


Fig. 288: Compressing Return Spring With Knurled Screw
Courtesy of BMW OF NORTH AMERICA, INC.

Return spring (1) is positioned correctly when catches (see arrows) are surrounding return spring (1).

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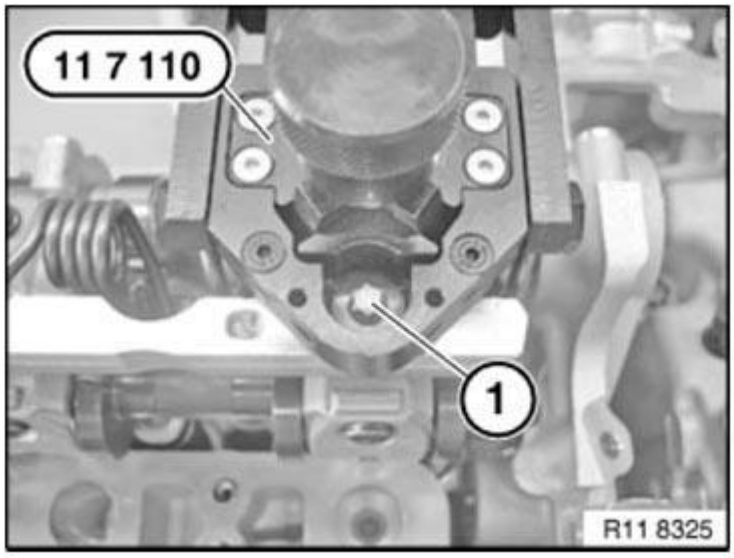


Fig. 289: Positioning Return Spring
Courtesy of BMW OF NORTH AMERICA, INC.

WARNING: Risk of injury in event of incorrect use.

IMPORTANT: Improper handling.
Risk of damage!
Check return spring on intermediate lever to ensure correct installation position.

Press special tool **11 7 110** to stop in direction of arrow.

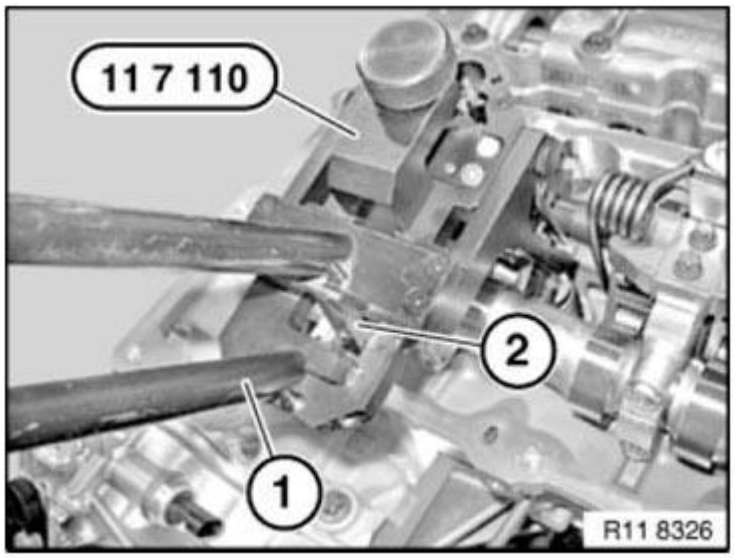


Fig. 290: Pressing Special Tool (11 7 110)

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Courtesy of BMW OF NORTH AMERICA, INC.

**IMPORTANT: Pay attention to thread on cylinder head.
Risk of damage!**

Tighten bolt (1).

Tightening torque **11 37 2AZ** .

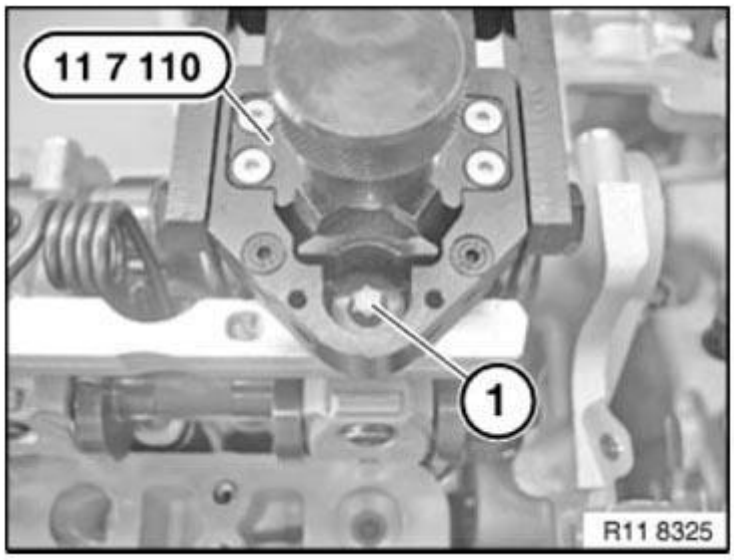
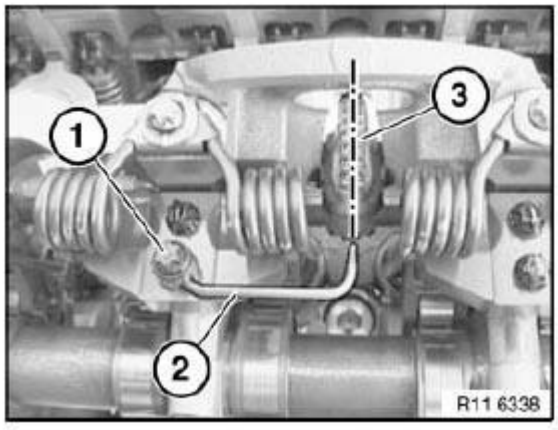


Fig. 291: Tightening Bolt
Courtesy of BMW OF NORTH AMERICA, INC.

At cylinder no. 3, adjust oil spray nozzle (2) so that oil spray points precisely towards spline teeth (3).

Insert screw (1) with oil spray nozzle (2) (external).

Tightening torque **11 37 4AZ** .



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Fig. 292: Identifying Oil Spray Nozzle With Spray
Courtesy of BMW OF NORTH AMERICA, INC.

Assemble engine.

11 37 020 REMOVING AND INSTALLING/REPLACING POSITIONING MOTOR FOR ECCENTRIC SHAFT (N51)

IMPORTANT: Aluminum-magnesium materials. No steel screws/bolts may be used due to the threat of electrochemical corrosion. A magnesium crankcase requires aluminum screws/bolts exclusively. Aluminum screws/bolts must be replaced each time they are released . Aluminum screws/bolts are permitted with and without color coding (blue). For reliable identification: Aluminum screws/bolts are not magnetic . Jointing torque and angle of rotation must be observed without fail (risk of damage) .

Necessary preliminary tasks:

- Remove acoustic cover.
- Unfasten ignition wiring harness and lay to one side.
- Remove the two rod-type ignition coils next to electric motor.

IMPORTANT: The screw connection must not be released before the servodrive is in the service position.
Risk of damage to intermediate shaft.

Turn ratchet (1) with Allen key (2) clockwise in direction of arrow and relieve tension on intermediate shaft.

NOTE: Do not turn shaft (2) too far.

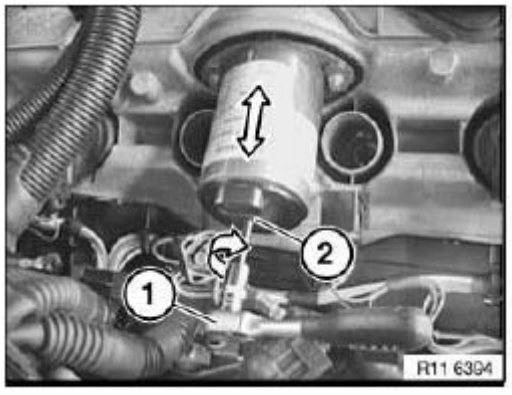


Fig. 293: Turning Ratchet With Allen Key
Courtesy of BMW OF NORTH AMERICA, INC.

Release screws (3).

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Tightening torque. See 11 12 5AZ in **CYLINDER HEAD WITH COVER** .

NOTE: Screw (4) is under servodrive.

Release screw (4).

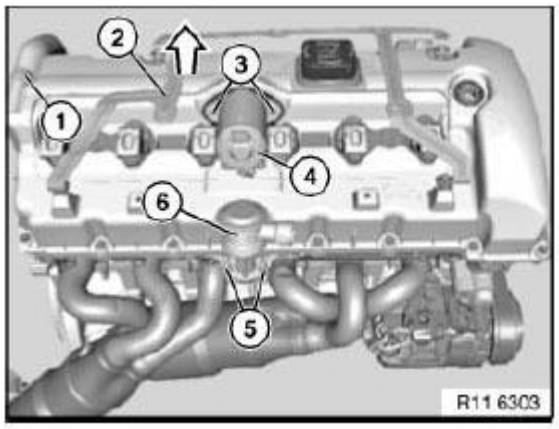


Fig. 294: Removing Screws
Courtesy of BMW OF NORTH AMERICA, INC.

Turn servodrive with screw (2) counterclockwise in direction of arrow.

Servodrive can now be withdrawn in direction of arrow.

Installation:

All removed subassemblies are reinstalled in reverse sequence.

Screw in shaft (2) in counterclockwise direction until servodrive rests on flange of cylinder head cover.

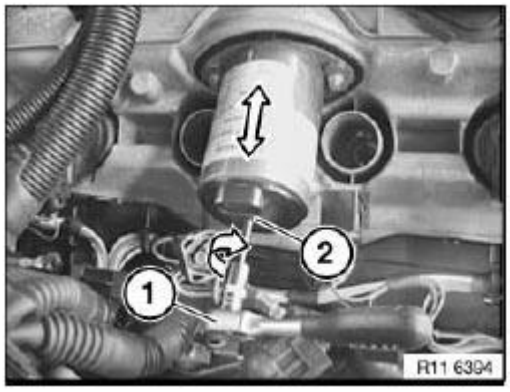


Fig. 295: Turning Servodrive With Screw
Courtesy of BMW OF NORTH AMERICA, INC.

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Assemble engine.

Check function of DME.

11 37 030 REMOVING AND INSTALLING/REPLACING ECCENTRIC SHAFT SENSOR (N51)

Necessary preliminary tasks:

- Remove **CYLINDER HEAD COVER (N51)**.

IMPORTANT: All bolts are secured against falling out, release bolts (2) on cylinder head only but do not unscrew fully.

Bolts (2) can fall out.

Risk of damage to timing chain drive.

Unfasten screws (2).

Lift out sensor (1).

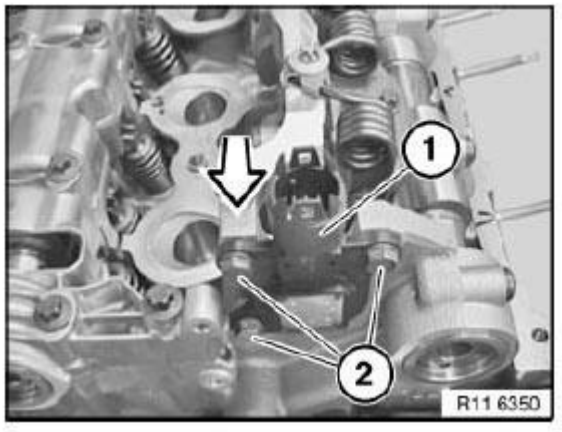


Fig. 296: Identifying Screws And Bolts
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: Illustrations show timing chain removed.

Assemble engine.

Check function of DME.

OIL SUPPLY

11 40 000 CHECKING ENGINE OIL PRESSURE (N51)

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Special tools required:

For the following special tools, refer to **ENGINE - SPECIAL TOOLS (N51)** .

- **11 4 050**

For the following special tools, refer to **FUEL SUPPLY SYSTEM - SPECIAL TOOLS (N51, N52K)** .

- **13 3 061**
- **13 3 063**
- **13 6 051**
- **13 6 054**

Necessary preliminary tasks:

- Remove acoustic cover.

Disconnect plug connection on oil pressure switch (1)

Remove oil pressure switch (2).

Tightening torque. See 12 61 1AZ in **OIL PRESSURE/OIL TEMPERATURE GAUGE** .

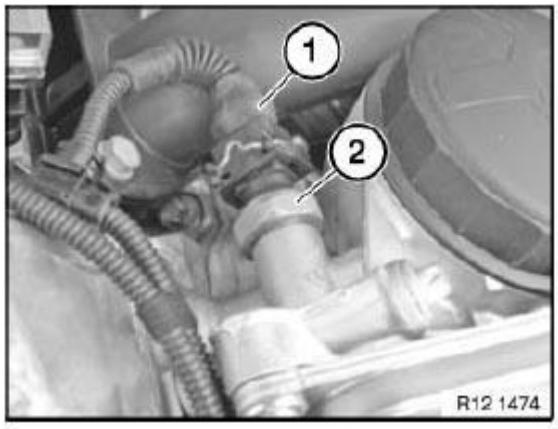


Fig. 297: Identifying Plug Connection On Oil Pressure Switch
Courtesy of BMW OF NORTH AMERICA, INC.

Screw in special tool 11 4 050 with sealing ring. See **Fig. 298**.

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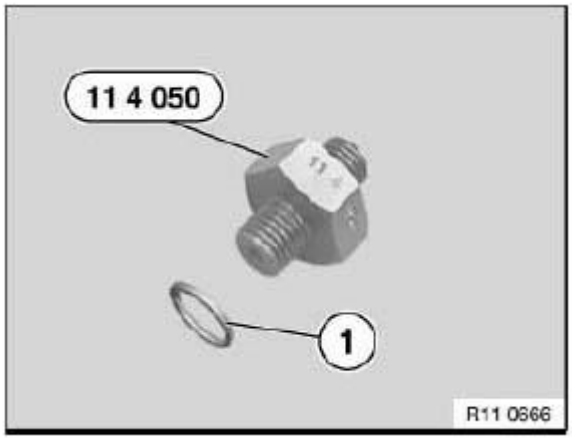


Fig. 298: Identifying Special Tool (11 4 050)
Courtesy of BMW OF NORTH AMERICA, INC.

Check engine oil pressure with diagnosis tester .

Connect special tools 13 6 054 and 13 6 051. See **Fig. 299**.

Check engine oil pressure with pressure gauge .

Connect special tools 13 3 063 and 13 3 061. See **Fig. 299**.

Start engine and check engine oil pressure.

Specified values .

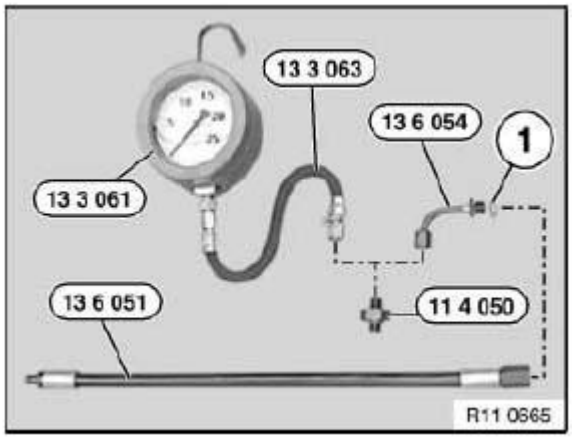


Fig. 299: Identifying Special Tools
Courtesy of BMW OF NORTH AMERICA, INC.

Assemble engine.

OIL PUMP WITH FILTER AND DRIVE

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11 41 000 REMOVING AND INSTALLING OIL PUMP (N51)

Necessary preliminary tasks:

- Remove **oil pan** . See **11 13 000 REMOVING AND INSTALLING, SEALING OR REPLACING OIL SUMP (N51)**.

Release screws (1).

Tightening torque. See 11 41 1AZ in **11 41 OIL PUMP WITH STRAINER AND DRIVE** .

Installation:

Replace aluminum screws .

Remove intake pipe (2) in direction of arrow.

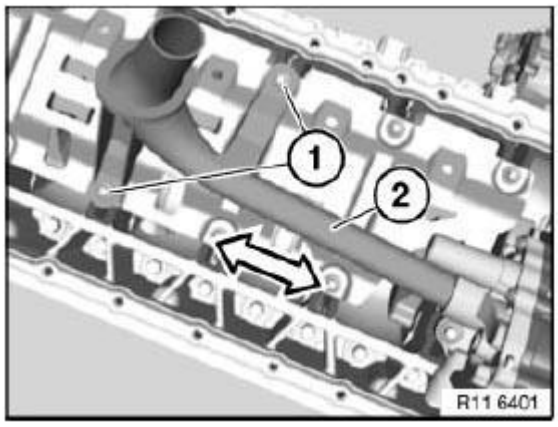


Fig. 300: Removing Intake Pipe
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: To release bolt (1), insert a 6 mm drill bit between sprocket wheel and oil pump housing.

Release screw (1).

Tightening torque. See 11 41 4AZ in **11 41 OIL PUMP WITH STRAINER AND DRIVE** .

Unfasten screws (2).

Tightening torque. See 11 41 3AZ in **11 41 OIL PUMP WITH STRAINER AND DRIVE** .

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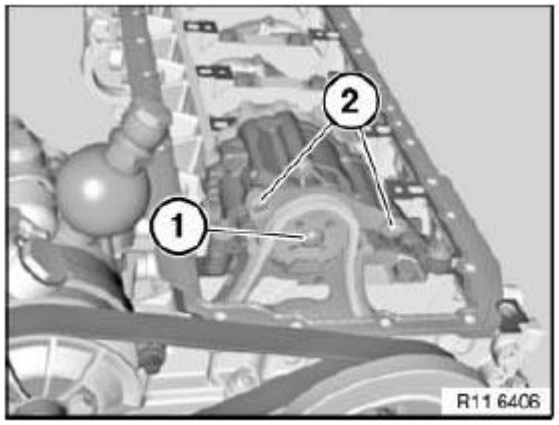


Fig. 301: Identifying Bolt And Screws
Courtesy of BMW OF NORTH AMERICA, INC.

Release screws (1).

Tightening torque. See 11 41 2AZ in **11 41 OIL PUMP WITH STRAINER AND DRIVE** .

Installation:

Replace aluminum screws .

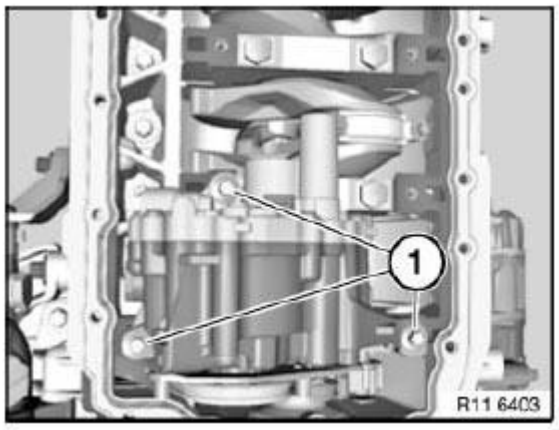


Fig. 302: Identifying Screws
Courtesy of BMW OF NORTH AMERICA, INC.

Detach sprocket wheel (1) in direction of arrow.

NOTE: Timing chain (3) of triangular drive is pressed upwards by chain tensioner.

Do **not** remove sprocket wheel.

Remove oil pump (2) in direction of arrow.

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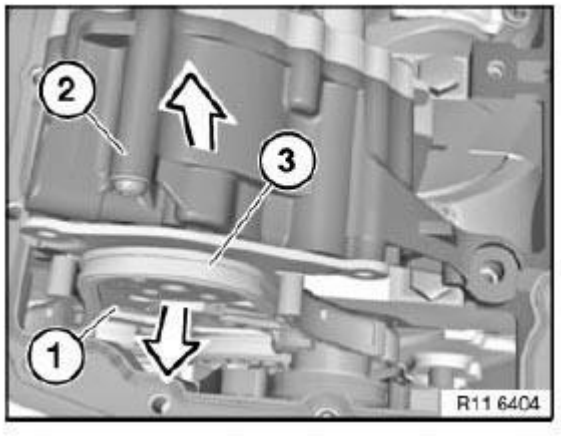


Fig. 303: Removing Oil Pump
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Check spacer bushings (1) for secure seating and damage; replace if necessary.

Align twin surface (3) on oil pump (2) to sprocket wheel.

Install oil pump (2).

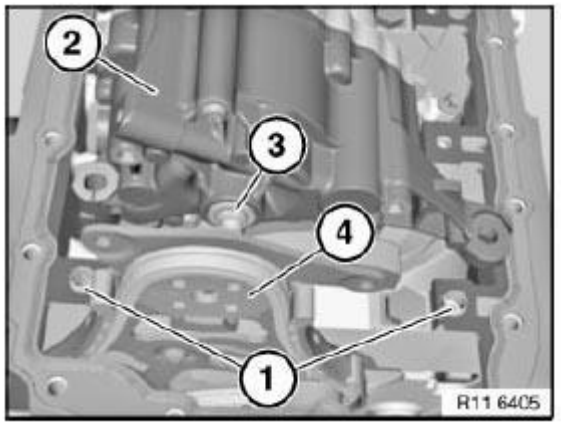


Fig. 304: Identifying Spacer Bushings And Oil Pump
Courtesy of BMW OF NORTH AMERICA, INC.

Assemble engine.

11 41 010 REMOVING AND INSTALLING/REPLACING CHAIN MODULE FOR OIL PUMP/VACUUM PUMP (N51)

Special tools required:

For the following special tools, refer to **ENGINE - SPECIAL TOOLS (N51)** .

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- **11 0 290**
- **11 0 300**
- **11 4 120**
- **11 4 280**
- **11 4 360**
- **11 4 362**
- **11 4 440**
- **11 5 200**
- **11 9 280**

IMPORTANT: Aluminum-magnesium materials. No steel screws/bolts may be used due to the threat of electrochemical corrosion. A magnesium crankcase requires aluminum screws/bolts exclusively. Aluminum screws/bolts must be replaced each time they are released . Aluminum screws/bolts are permitted with and without color coding (blue). For reliable identification: Aluminum screws/bolts are not magnetic . Jointing torque and angle of rotation must be observed without fail (risk of damage) .

Necessary preliminary tasks:

- Remove **cylinder head cover** . See **11 12 000 REMOVING AND INSTALLING OR SEALING CYLINDER HEAD COVER (N51)**.
- Remove **engine oil sump** . See **11 13 000 REMOVING AND INSTALLING, SEALING OR REPLACING OIL SUMP (N51)**.
- Remove **drive belt** . See **11 28 010 REPLACING ALTERNATOR DRIVE BELT (N51)**.
- Remove **tensioner** for drive belt. See **11 28 020 REPLACING TENSIONING DEVICE FOR ALTERNATOR DRIVE BELT (N51)**.
- Remove **vibration damper** at front. See **11 23 010 REMOVING AND INSTALLING OR REPLACING VIBRATION DAMPER (M51)**.
- Remove **sealing cover** for vacuum pump. See **11 14 010 REPLACING VACUUM PUMP SEALING COVER (N51)**.

Turn sprocket wheel (3) at central bolt (crankshaft) into position.

Secure special tool 11 0 290 to sprocket wheel (3) and special tool 11 4 362. See **Fig. 305**.

Release screw (2).

Tightening torque. See 11 66 2AZ in **11 66 VACUUM PUMP** .

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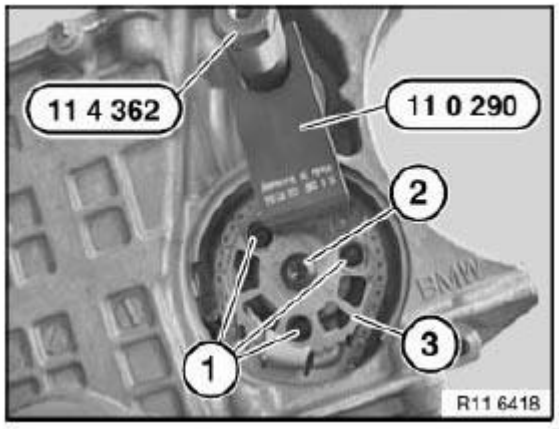


Fig. 305: Identifying Special Tools
Courtesy of BMW OF NORTH AMERICA, INC.

Press timing chain with chain tensioner (1) in direction of arrow.

Disconnect timing chain with special tool 11 4 120.

Feed out sprocket wheel (3) at hexagon head of vacuum pump (4).

Installation:

A lock pin is pre-installed if the triangular drive is replaced.

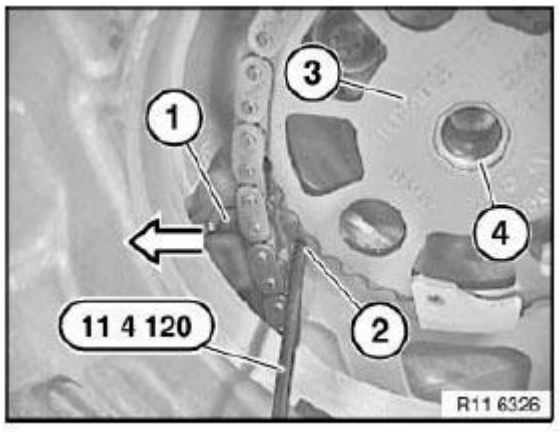


Fig. 306: Pressing Timing Chain With Chain Tensioner
Courtesy of BMW OF NORTH AMERICA, INC.

Release bolt (1) on sprocket wheel.

Tightening torque. See 11 41 4AZ in **11 41 OIL PUMP WITH STRAINER AND DRIVE** .

Release screws (2).

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Tightening torque. See 11 41 3AZ in **11 41 OIL PUMP WITH STRAINER AND DRIVE** .

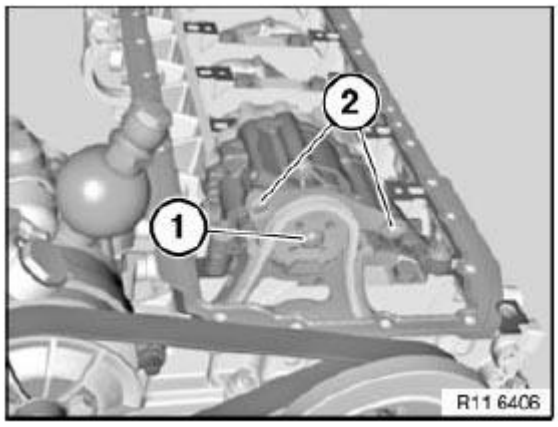


Fig. 307: Identifying Bolt On Sprocket Wheel
Courtesy of BMW OF NORTH AMERICA, INC.

Secure **crankshaft and camshaft** .

Do **not** remove special tools 11 0 300 and 11 4 280.

Fit special tool 11 9 280.

Release central bolt (1).

NOTE: A second person is required.

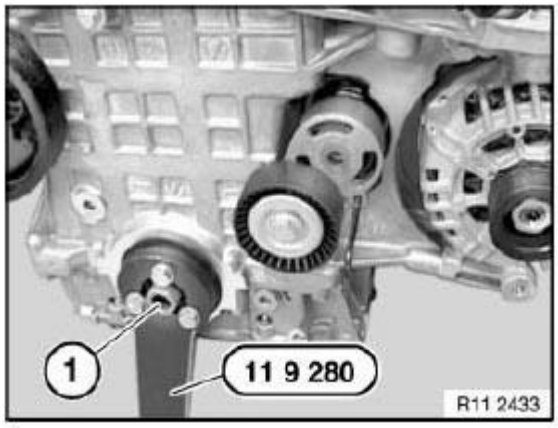


Fig. 308: Identifying Central Bolt
Courtesy of BMW OF NORTH AMERICA, INC.

Remove hub (2) towards front.

Installation:

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Replace **radial seal** at front.

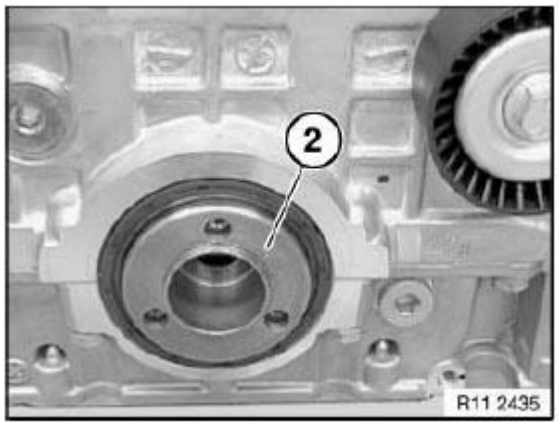


Fig. 309: Identifying Hub
Courtesy of BMW OF NORTH AMERICA, INC.

Open screw plug on bedplate.

Installation:

Replace seal.

Release bolt on triangular drive.

Tightening torque. See 11 41 3AZ in **11 41 OIL PUMP WITH STRAINER AND DRIVE** .

Installation:

Replace aluminum screws .

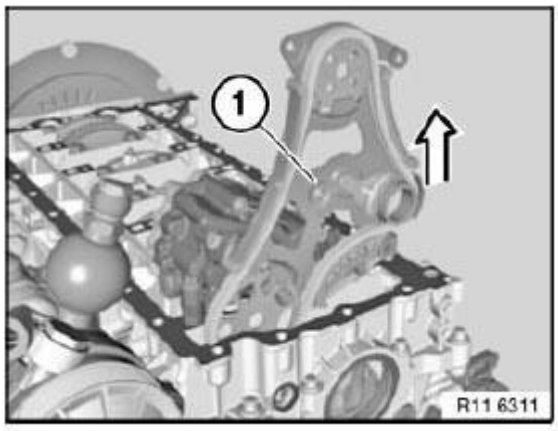


Fig. 310: Removing Screw Plug
Courtesy of BMW OF NORTH AMERICA, INC.

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Remove triangular drive (1) in direction of arrow.

**IMPORTANT: Note installation direction of sprocket wheel (2).
Collar on sprocket wheel (2) points to timing chain drive .
Incorrect assembly will result in engine damage .**

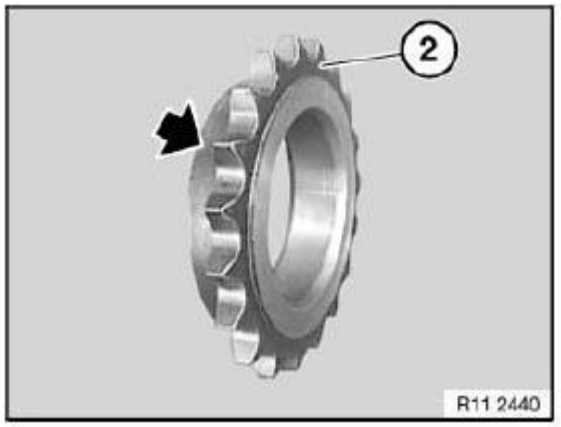


Fig. 311: Locating Sprocket Wheel Points
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: Procedure if engine is mounted on special tool 11 4 440.

Release screw (1).

Tightening torque. See 11 66 2AZ in **11 66 VACUUM PUMP** .

Release screw (2).

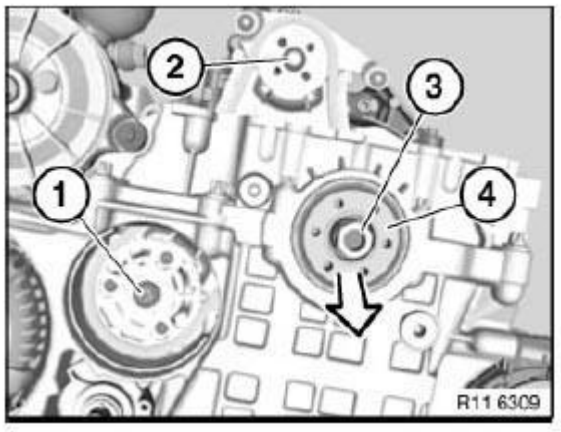


Fig. 312: Removing Hub Towards Front
Courtesy of BMW OF NORTH AMERICA, INC.

Tightening torque. See 11 41 3AZ in **11 41 OIL PUMP WITH STRAINER AND DRIVE** .

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Unscrew bolt (3).

Tightening torque. See 11 21 1AZ in **11 21 CRANKSHAFT AND BEARINGS** .

Installation:

Mark screw (3) with a colored spot.

Remove hub (4) towards front.

Tighten down special tool 11 5 200 with screws (1) to hub. See **Fig. 313**.

Do **not** remove special tools 11 0 300 and 11 4 280.

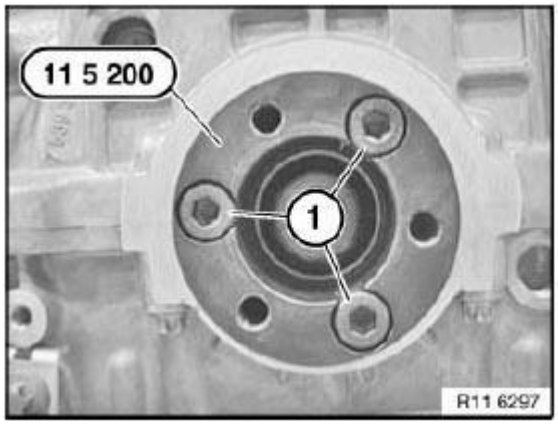


Fig. 313: Identifying Special Tool (11 5 200)
Courtesy of BMW OF NORTH AMERICA, INC.

Remove **belt tensioner** .

Screw in special tool 11 4 360. See **Fig. 314**.

Mount special tool 11 9 280 on 11 5 200. See **Fig. 314**.

Support special tool 11 9 280 on special tool 11 4 360.

Special tool 11 0 300 secures crankshaft. See **Fig. 314**.

Tighten central bolt (1) to jointing torque.

Tightening torque. See 11 21 1AZ in **11 21 CRANKSHAFT AND BEARINGS** or **11 21 CRANKSHAFT AND BEARINGS** .

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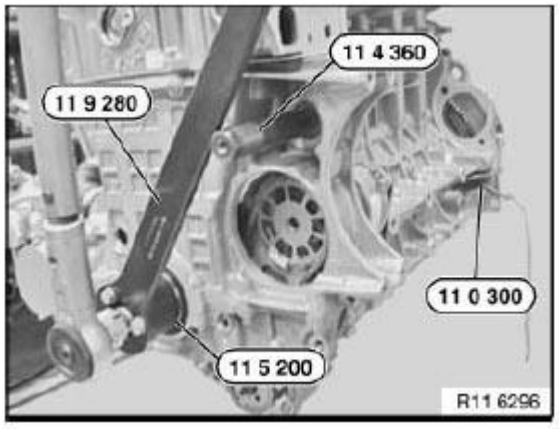


Fig. 314: Identifying Special Tools
Courtesy of BMW OF NORTH AMERICA, INC.

Mark central bolt and hub with paint.

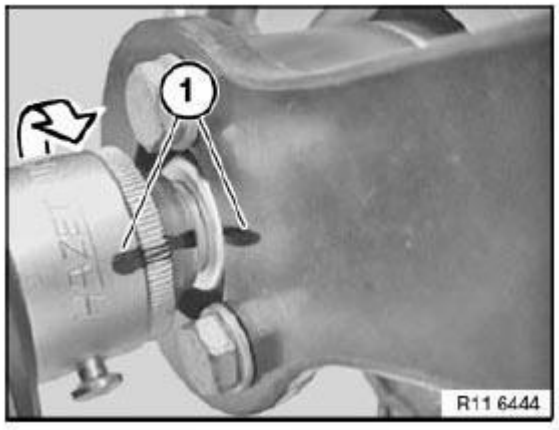


Fig. 315: Identifying Painted Line
Courtesy of BMW OF NORTH AMERICA, INC.

OIL FILTER AND LINES

11 42 020 REMOVING AND INSTALLING/REPLACING FULLFLOW OIL FILTER (N51)

WARNING: Danger of scalding! Only perform these tasks on an engine that has cooled down.

Necessary preliminary tasks:

- Remove intake air **manifold** . See **11 61 050 REMOVING AND INSTALLING INTAKE AIR MANIFOLD (N51)**.
- Release oil filter cap and allow engine oil to drip off.

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- Protect drive belt against dirt.

Release screws (1).

Release screw (2).

NOTE: Have cleaning cloth ready to catch residual oil.

Tightening torque. See 11 42 2AZ in **11 42 OIL FILTER AND PIPES** .

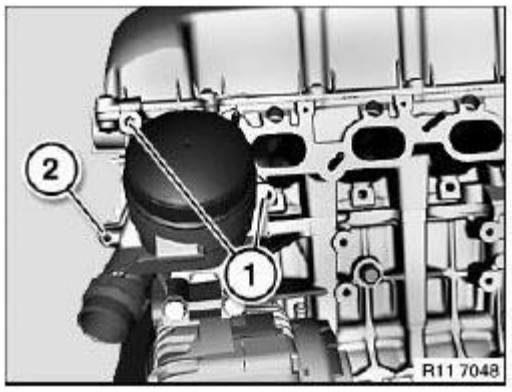


Fig. 316: Identifying Screws
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Replace all seals.

If necessary, replace filter element.

Assemble engine.

WATER PUMP WITH DRIVE

11 51 000 REMOVING AND INSTALLING/REPLACING WATER PUMP (N51)

WARNING: Danger of scalding!
Only perform these tasks on an engine that has cooled down.

Recycling:

Catch and dispose of drained coolant.

Observe country-specific waste-disposal regulations.

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IMPORTANT: Aluminum-magnesium materials. No steel screws/bolts may be used due to the threat of electrochemical corrosion. A magnesium crankcase requires aluminum screws/bolts exclusively. Aluminum screws/bolts must be replaced each time they are released . Aluminum screws/bolts are permitted with and without color coding (blue). For reliable identification: Aluminum screws/bolts are not magnetic . Jointing torque and angle of rotation must be observed without fail (risk of damage) .

Necessary preliminary tasks:

- Remove **coolant thermostat** . See **11 53 000 REMOVING AND INSTALLING/REPLACING COOLANT THERMOSTAT (N51)**.

  Disconnect water hose (1).

  Disconnect plug connection (4).

  Release screws (5).

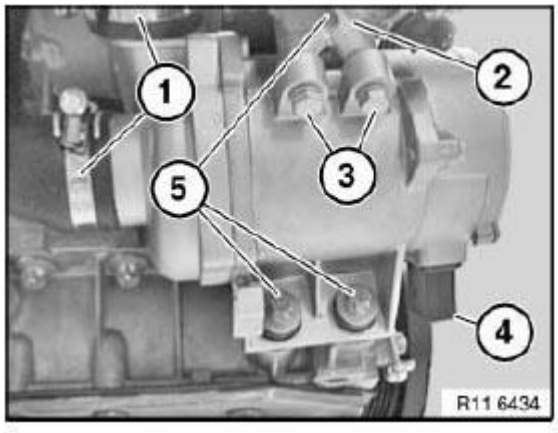


Fig. 317: Identifying Water Hose And Plug Connection
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Replace aluminum screws .

Tightening torque. See 11 51 1AZ in **11 51 WATER PUMP AND DRIVE** .

Installation:

If the water pump is to be reused, it must be mechanically rotated once (breakaway torque at impellers).

One water pump rotation will be sufficient.

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Assemble engine.

Venting instructions must be observed without fail.

THERMOSTAT AND CONNECTIONS

11 53 000 REMOVING AND INSTALLING/REPLACING COOLANT THERMOSTAT (N51)

WARNING: Danger of scalding! Only perform these tasks on an engine that has cooled down.

Recycling:

Catch and dispose of drained coolant.

Observe country-specific waste-disposal regulations.

Necessary preliminary tasks:

- Remove front splash guard.
- Drain **coolant** from radiator. See **17 11 000 REMOVING AND INSTALLING RADIATOR (N51, S65)** .

Release hose clamp (1) and detach coolant hose.

Release hose clamp (2) and detach coolant hose.

Unlock and detach coolant hose (3).

Unlock and detach coolant hose (4).

Disconnect plug connection (5).

Release screws (6).

Tightening torque. See 11 53 1AZ in **THERMOSTAT AND CONNECTIONS** .

Remove coolant thermostat (7).

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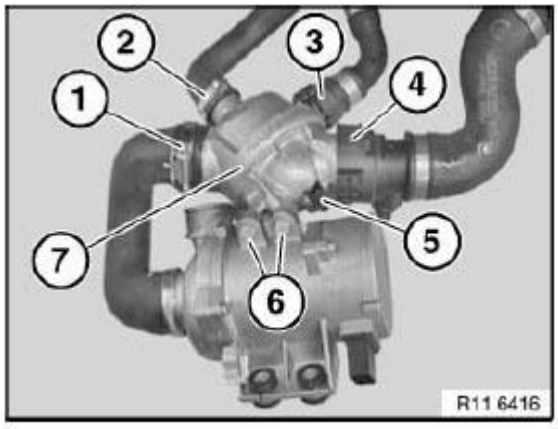


Fig. 318: Identifying Plug Connection And Coolant Hose
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: Illustration shows coolant thermostat removed.

Assemble engine.

Venting instructions must be observed without fail.

INTAKE MANIFOLD

11 61 050 REMOVING AND INSTALLING INTAKE AIR MANIFOLD (N51)

Necessary preliminary tasks:

- Remove tension strut. See **51 71 371 REMOVING AND INSTALLING/REPLACING TENSION STRUT ON LEFT OR RIGHT SPRING STRUT DOME (E82)** or **51 71 371 REMOVING AND INSTALLING/REPLACING TENSION STRUT ON LEFT OR RIGHT SPRING STRUT DOME (E88)**
- Remove suction filter housing. See **13 71 000 REMOVING AND INSTALLING/REPLACING INTAKE FILTER HOUSING (N51)**
- Remove **engine cover**.

Open holder (2).

Disconnect plug connection (1) under manifold.

Release both crankcase breathers (3).

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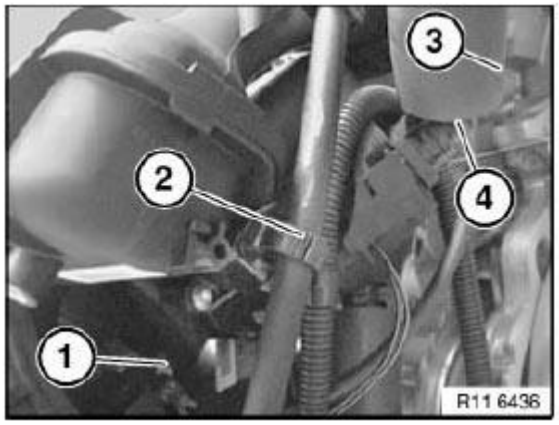


Fig. 319: Identifying Plug Connection And Crankcase Breathers
Courtesy of BMW OF NORTH AMERICA, INC.

Disconnect plug connection (1).

Disconnect plug connection (3).

Release bolts (4).

Detach engine wiring harness (2) from manifold and lay to one side.

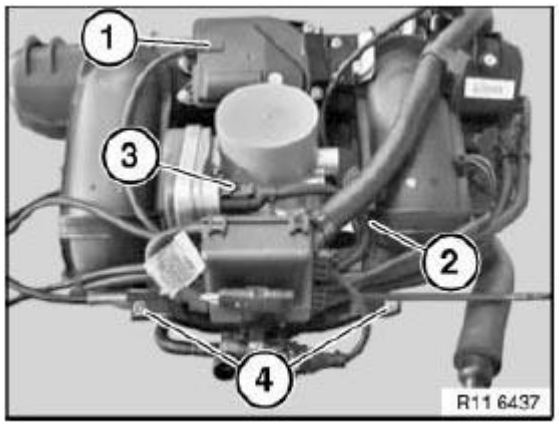


Fig. 320: Identifying Plug Connection And Bolts
Courtesy of BMW OF NORTH AMERICA, INC.

Disconnect plug connection (1) on oil pressure switch.

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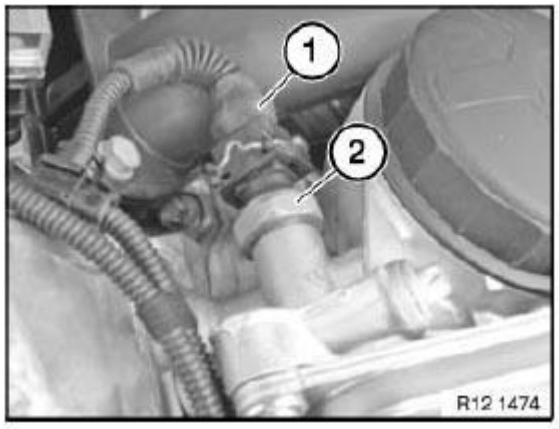


Fig. 321: Identifying Plug Connection On Oil Pressure Switch
Courtesy of BMW OF NORTH AMERICA, INC.

Release fuel rail (2) and lay to one side.

NOTE: Do not detach fuel line.

Release screw (1).

Unscrew nuts (3).

Tightening torque. See 11 61 1AZ in **INTAKE MANIFOLD** .

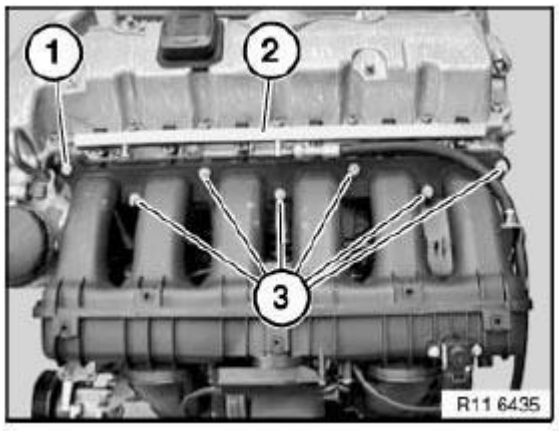


Fig. 322: Identifying Screw And Nuts
Courtesy of BMW OF NORTH AMERICA, INC.

Raise intake manifold approx. 10 cm.

Disconnect plug connection (1) at bottom.

Release tank vent line behind throttle valve assembly.

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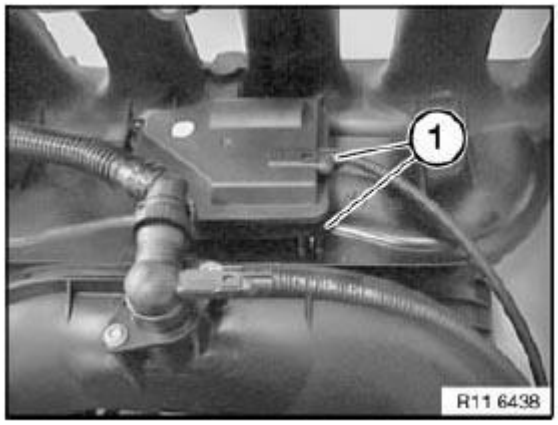


Fig. 323: Identifying Plug Connection
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Replace all seals.

Assemble engine.

EXHAUST MANIFOLD

18 40 050 REMOVING AND INSTALLING/REPLACING FRONT EXHAUST MANIFOLD (N53/N52/N52K/N51)

Necessary preliminary tasks:

- Remove **rear exhaust manifold** . See **EXHAUST SYSTEM - REPAIR INSTRUCTIONS (N51)** .

NOTE: The oxygen sensors are in danger of being damaged when the exhaust manifolds are removed and installed.

Remove control sensor from cylinders 1 to 3.

Remove monitor sensor from cylinders 1 to 3.

Tightening torque. See 11 78 1AZ in **11 78 EMISSIONS CONTROL, CONTROL SENSOR / MONITOR SENSOR** .

Unscrew nuts.

Remove exhaust manifold (1).

Installation:

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Clean sealing faces and replace seals.

Replace nuts.

Tightening torque. See 18 40 1AZ in **18 40 EXHAUST MANIFOLD** .

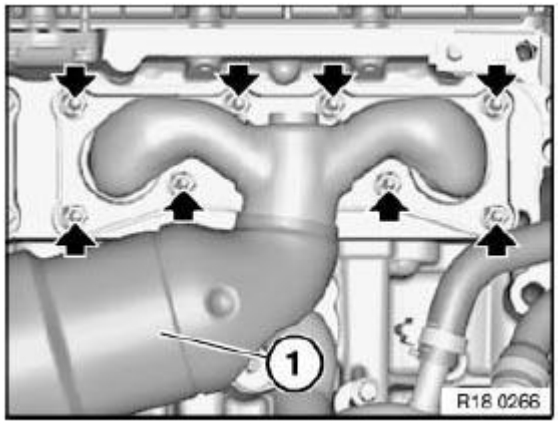


Fig. 324: Locating Nuts For Exhaust Manifold
Courtesy of BMW OF NORTH AMERICA, INC.

18 40 060 REMOVING AND INSTALLING/REPLACING REAR EXHAUST MANIFOLD (N53/N52/N52K/N51)

Necessary preliminary tasks:

- Remove **underbody protection** . See **51 47 490 REMOVING AND INSTALLING/REPLACING FRONT UNDERBODY PROTECTION** or **51 47 491 REMOVING AND INSTALLING/REPLACING REAR UNDERBODY PROTECTION** .
- Remove **complete exhaust system** . See **18 00 020 REMOVING AND INSTALLING/REPLACING COMPLETE EXHAUST SYSTEM (N52/N52K/N51)** .
- Remove **lower section of microfilter housing** .
- Remove **engine cover**.

NOTE: The oxygen sensors are in danger of being damaged when the exhaust manifolds are removed and installed.

Remove control sensor from cylinders 4 to 6.

Remove monitor sensor from cylinders 4 to 6.

Installation:

Tightening torque. See 11 78 1AZ in **EMISSION CONTROL, OXYGEN SENSOR** .

Unscrew nuts.

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Remove exhaust manifold (1).

Installation:

Clean sealing faces and replace seals.

Replace nuts.

Tightening torque. See 18 40 1AZ in **18 40 EXHAUST MANIFOLD** .

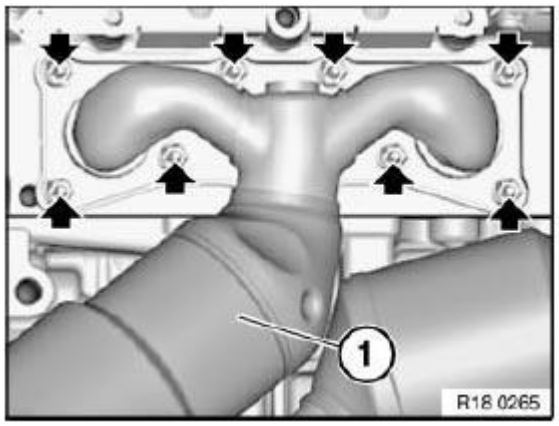


Fig. 325: Locating Nuts For Exhaust Manifold
Courtesy of BMW OF NORTH AMERICA, INC.

VACUUM PUMP

- Remove **DRIVE BELT**.
- Remove **BELT TENSIONER** for drive belt.
- Remove **SEALING CAP** for vacuum pump.
- Remove intake **PLENUM**.

Rotate crankshaft at central bolt.

Rotate camshaft sprocket (3) until drilled holes and screws (1) match up.

Screw in special tool 11 4 362 (adapter).

Secure special tool **11 0 290** in sprocket (3) and on special tool 11 4 362 (adapter).

Release screw (2).

Tightening torque: **11 66 2AZ** .

Release screws (1) and secure against falling out.

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Tightening torque: **11 66 1AZ** .

Remove vacuum pump towards rear.

Installation note:

Replace gasket.

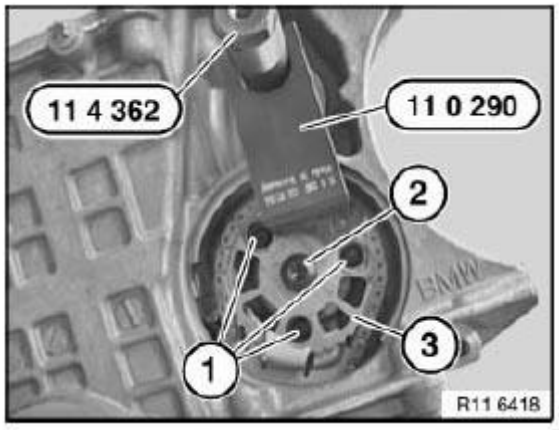


Fig. 326: Identifying Special Tool (11 0 290) And (11 4 362)
Courtesy of BMW OF NORTH AMERICA, INC.

Press chain tensioner with chain (1) in direction of arrow.

Insert special tool **11 4 120** .

Remove special tool **11 0 290** .

Remove camshaft sprocket (2) in direction of arrow.

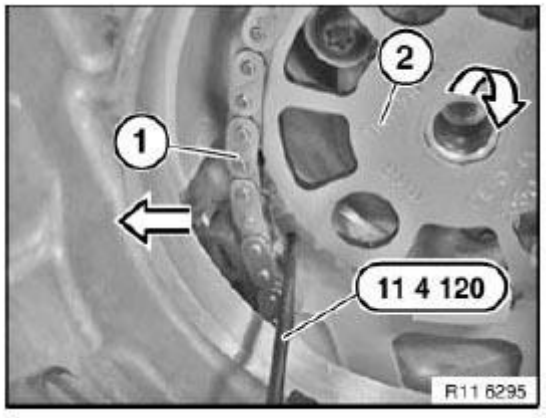


Fig. 327: Removing Camshaft Sprocket
Courtesy of BMW OF NORTH AMERICA, INC.

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Assemble engine.

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