ENGINE

Engine - Repair

ENGINE, GENERAL

11 00 039 CHECKING COMPRESSION OF ALL CYLINDERS (S65)

IMPORTANT: High tension - mortal danger!
Disconnect all supply leads from ignition coils (interrupt power supply to ignition coils).

IMPORTANT: Check Schrader valve on special tool 11 0 235 for correct seating (engine damage).
The throttle valves cannot be opened by opening the throttle.
The compression check is carried out exclusively by means of the idle actuators.
A compression check is only possible with the diagnosis tester.
The catalytic converter will incur damage if the fuel injectors are not switched off.

Necessary preliminary tasks:

- Remove **microfilter housing** See **6431062 REMOVING AND INSTALLING/REPLACING LEFT LOWER MICROFILTER HOUSING SECTION** or **6431063 REMOVING AND INSTALLING/REPLACING RIGHT LOWER MICROFILTER HOUSING SECTION** .
- Remove all **spark plugs** See **1213512 REMOVING AND INSTALLING/REPLACING ALL IGNITION COILS (S65)** or **1212011 REPLACING ALL SPARK PLUGS (S65)** .
- Connect diagnosis tester.
-
    1. Service function.
    2. Drive.
    3. Engine electronics
    4. Switch off fuel injection.

       IMPORTANT: Fuel injectors are switched off.

    5. Actuate starter motor for 8 seconds.

Screw special tool 11 0 235 into spark plug hole.

Check that sealing ring is in perfect condition on special tool 11 0 235.

Connection (1) for diagnosis tester or special tool 11 0 224.

NOTE: Picture shows S85.

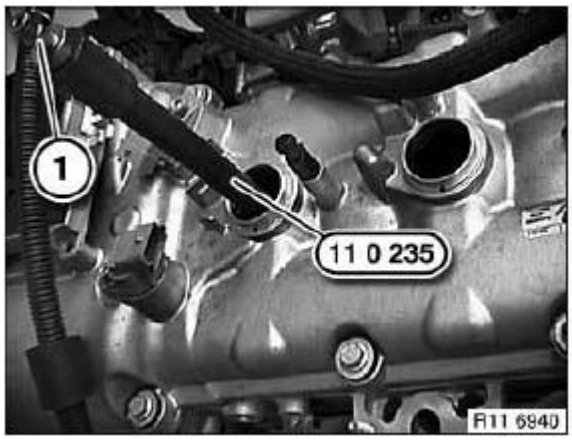


Fig. 1: Inserting Special Tool 11 0 235 Into Spark Plug Hole
Courtesy of BMW OF NORTH AMERICA, INC.

Connect special tool 11 0 224 or 25 bar pressure adapter to diagnosis tester.

COMPRESSION PRESSURE .

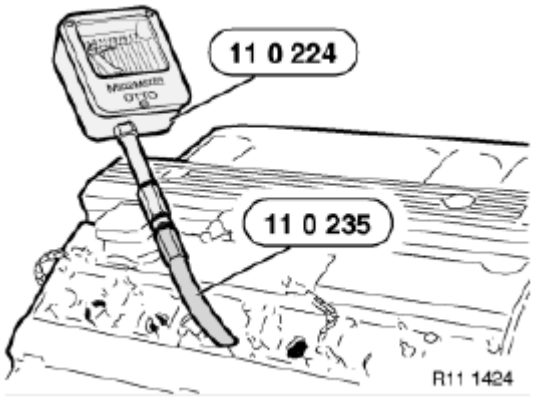


Fig. 2: Connecting Special Tool (11 0 224) Or 25 Bar Pressure Adapter To Diagnosis Tester
Courtesy of BMW OF NORTH AMERICA, INC.

Now clear the fault memory.

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

Danger of poisoning!

Ingesting oil or absorbing through the skin may cause poisoning!

Possible symptoms are:

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

Protective measures/rules of conduct

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

First aid measures

- Do not induce vomiting.

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

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

ENGINE IDENTIFICATION

Punch engine numbers at marked surface with number punch.

Magnesium crankcase with sticker

M47/M47TU/M47T2

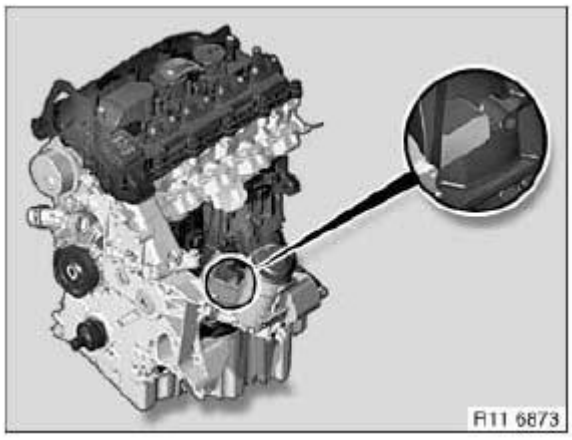


Fig. 3: Identifying Engine (M47/M47TU/M47T2)
Courtesy of BMW OF NORTH AMERICA, INC.

M57/M57TU/M57T2

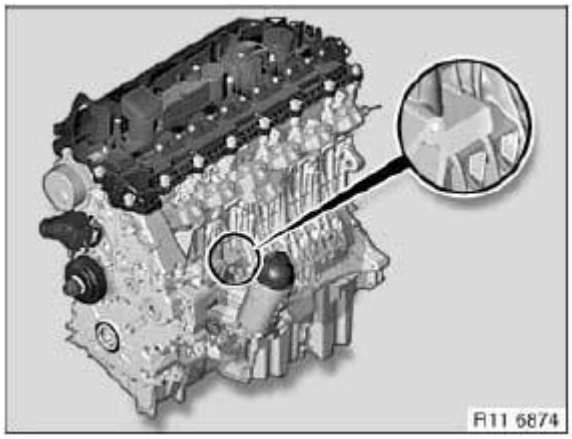


Fig. 4: Identifying Engine (M57/M57TU/M57T2)
Courtesy of BMW OF NORTH AMERICA, INC.

M67/M67TU

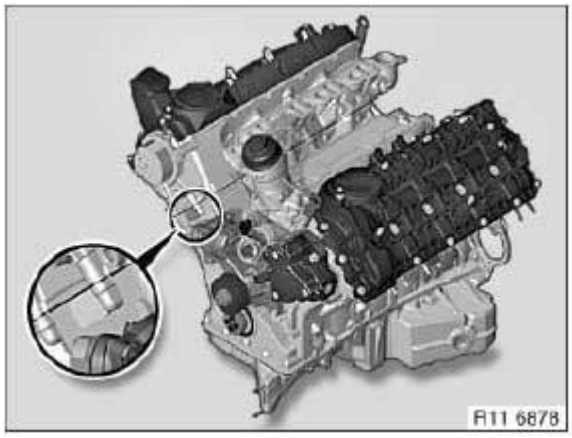


Fig. 5: Identifying Engine (M67/M67TU)
Courtesy of BMW OF NORTH AMERICA, INC.

N47/N47S/N47C/N57 N57S

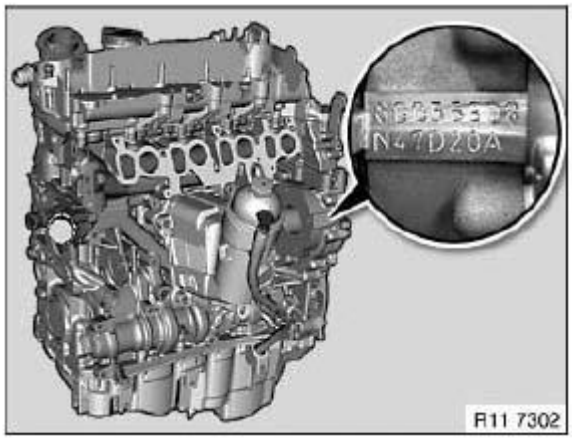


Fig. 6: Identifying Engine (N47/N47S/N47C/N57 N57S)
Courtesy of BMW OF NORTH AMERICA, INC.

M52/M52TU

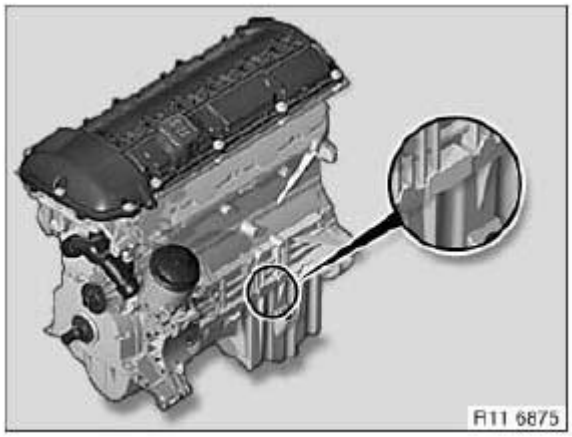


Fig. 7: Identifying Engine (M52/M52TU)
Courtesy of BMW OF NORTH AMERICA, INC.

M54

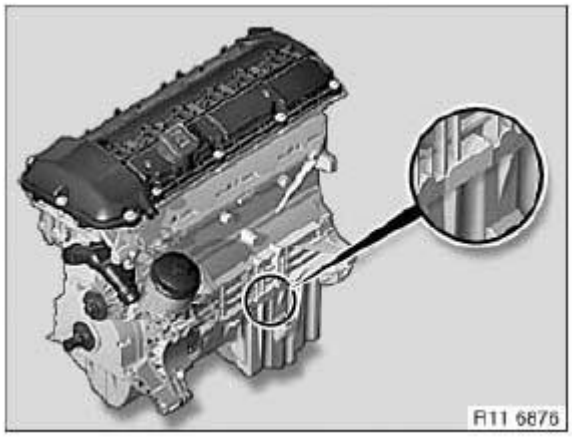


Fig. 8: Identifying Engine (M54)
Courtesy of BMW OF NORTH AMERICA, INC.

M56

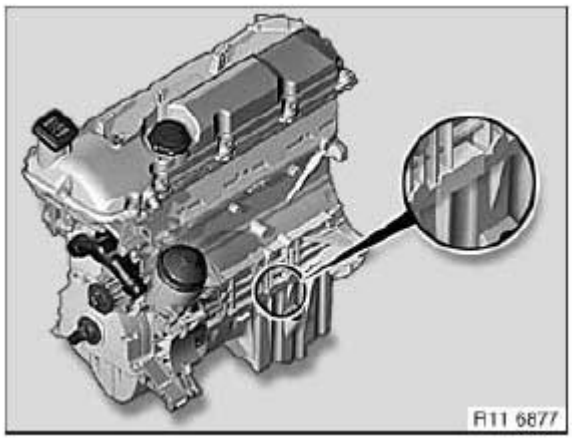


Fig. 9: Identifying Engine (M56)
Courtesy of BMW OF NORTH AMERICA, INC.

N40/N45/N45T/N43

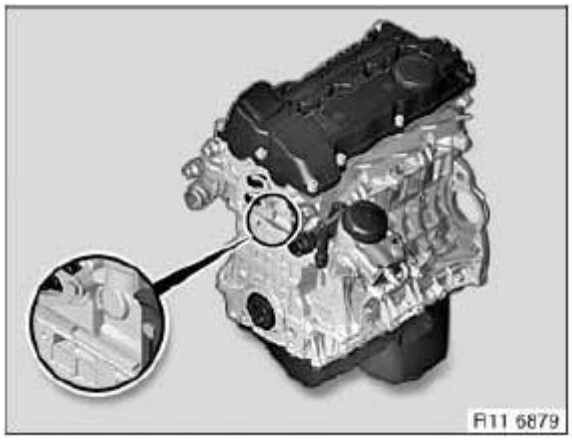


Fig. 10: Identifying Engine (N40/N45/N45T/N43)
Courtesy of BMW OF NORTH AMERICA, INC.

N42/N46/N46T

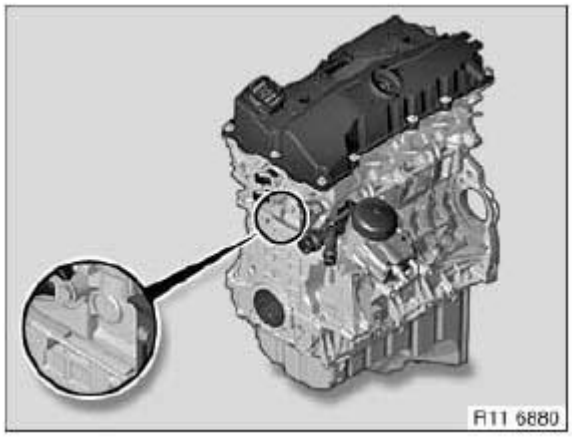


Fig. 11: Identifying Engine (N42/N46/N46T)
Courtesy of BMW OF NORTH AMERICA, INC.

N51/N52/N52K/N52T/N53/N54/N55

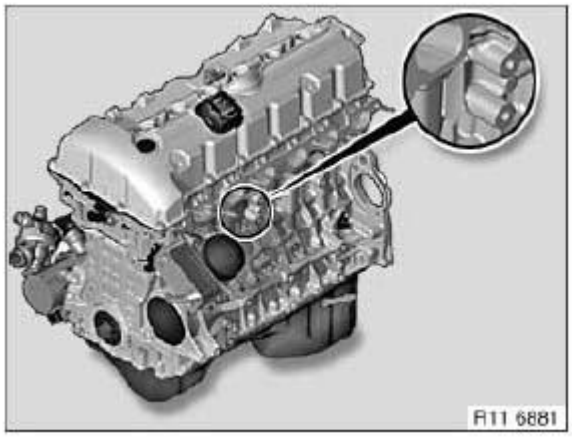


Fig. 12: Identifying Engine (N51/N52/N52K/N52T/N53/N54/N55)
Courtesy of BMW OF NORTH AMERICA, INC.

N62/N62TU

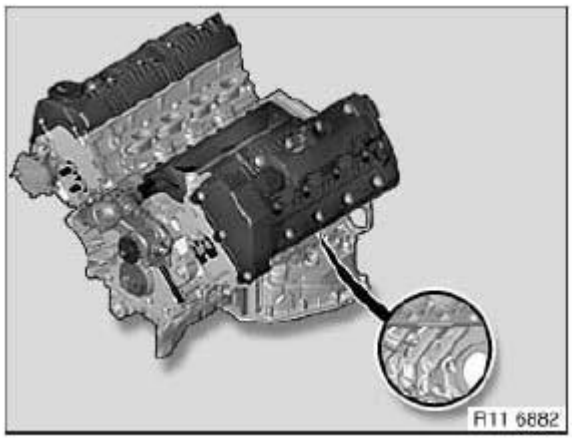


Fig. 13: Identifying Engine (N62/N62TU)
Courtesy of BMW OF NORTH AMERICA, INC.

N73

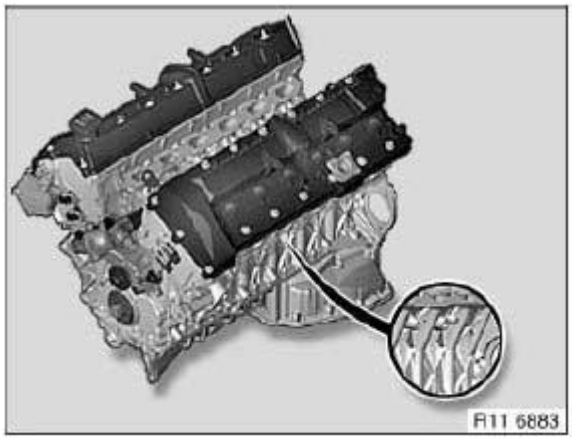


Fig. 14: Identifying Engine (N73)
Courtesy of BMW OF NORTH AMERICA, INC.

S54

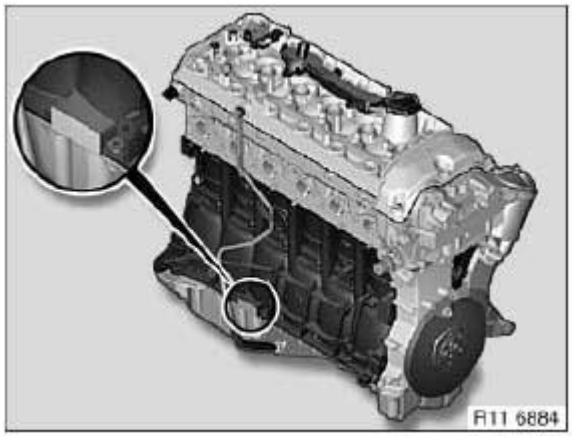


Fig. 15: Identifying Engine (S54)
Courtesy of BMW OF NORTH AMERICA, INC.

S85/S65

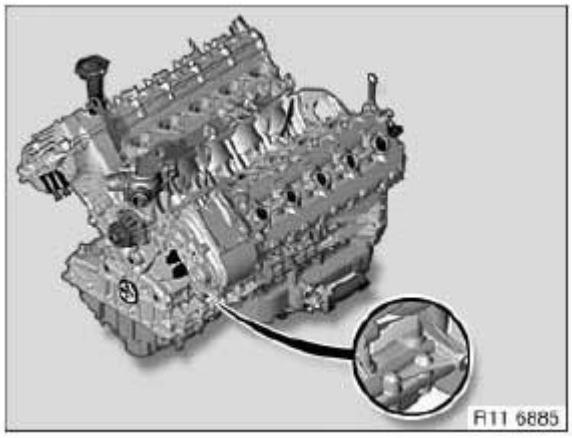


Fig. 16: Identifying Engine (S85/S65)
Courtesy of BMW OF NORTH AMERICA, INC.

W10/W11

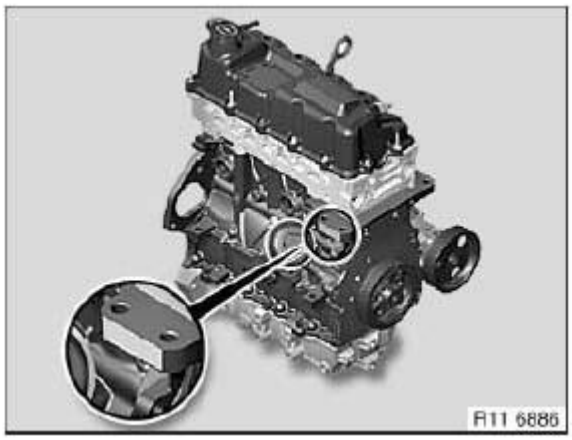


Fig. 17: Identifying Engine (W10/W11)
Courtesy of BMW OF NORTH AMERICA, INC.

N12/N14/N16/N18

Fig. 18: Identifying Engine (N12/N14/N16/N18)
Courtesy of BMW OF NORTH AMERICA, INC.

W17

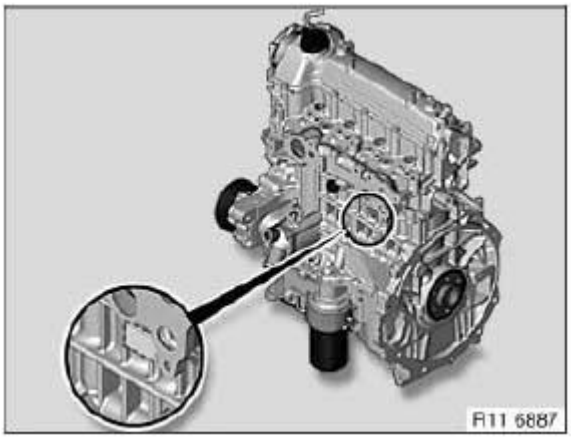


Fig. 19: Identifying Engine (W17)
Courtesy of BMW OF NORTH AMERICA, INC.

Assemble engine.

11 00 091 INSTALLING REPLACEMENT ENGINE (S65)

IMPORTANT: No running-in engine oil required.
10W-60

Necessary preliminary tasks:

- Remove and install **ENGINE** .

- Flush cooling system.

Installation:

If necessary, replace following components.

- Clutch
- Drive belt.
- All outer seals.

  Replace all anti-fatigue bolts on flywheel and vibration damper.

- Change coolant.
- Fill engine with engine oil.

MOUNTING ENGINE ON ASSEMBLY STAND (S65)

Necessary preliminary tasks:

- Remove **engine**.
- Remove rear water pipe.

Secure special tool **11 5 260 PLATE** to crankcase with bolts (2).

Tighten bolts (2) evenly.

NOTE: Bolts (1) are not required on the S65.

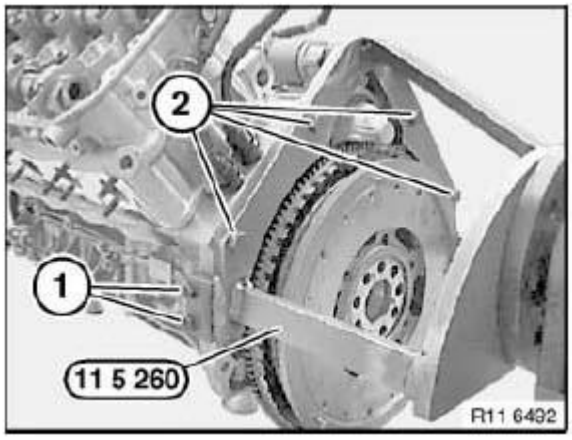


Fig. 20: Securing Special Tool (11 5 260) To Crankcase With Bolts
Courtesy of BMW OF NORTH AMERICA, INC.

Secure engine with special tool **11 5 260 PLATE** to special tool **00 2 300 ASSEMBLY STAND** .

NOTE: Picture shows S85.

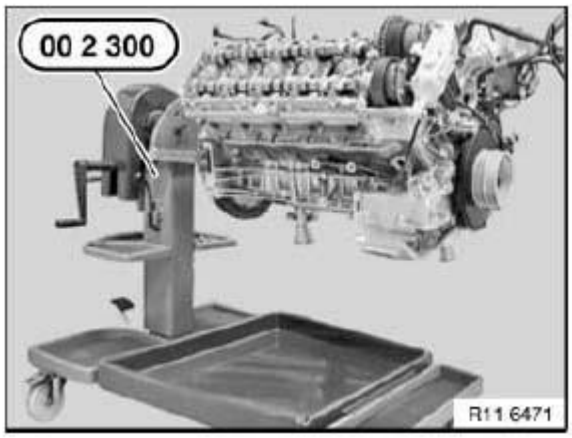


Fig. 21: Securing Engine With Special Tool (11 5 260)
Courtesy of BMW OF NORTH AMERICA, INC.

11 00... OVERVIEW OF CONSUMABLES (ELECTRONIC PARTS CATALOGUE)

1.0 Sealing compound for **injection.**

INJECTION SEALING COMPOUND CHART

	Repair instructions (engine)	Designation, Electronic Parts Catalogue	Part number, Electronic Parts Catalogue	Application examples
1.1	N40, N42, N45, N46, N43, N45N, N46N	Loctite 171000 primer	83 19 7 515 683	For hardening Loctite 128367 sealing compound
1.2	N40, N42, N45, N46, N43, N45N, N46N	Loctite 128357 liquid gasket	83 19 7 536 051	Sealing between crankcase upper and lower halves
1.3	N51, N52, N53, N54, N52N, N55	Loctite 171000 primer	83 19 7 515 683	For hardening Loctite 193140 sealing compound
1.4	N51, N52, N53, N54, N52N, N55	Loctite 193140 liquid gasket	83 19 0 439 030	Sealing between crankcase upper and lower halves
1.5	S65, S85	Loctite 171000 primer	83 19 7 515 683	For hardening Loctite 193140 sealing compound
1.6	S65, S85	Loctite 193140 liquid gasket	83 19 0 439 030	Sealing between crankcase upper and lower halves

2.0 Sealing compound for **application.**

APPLICATION SEALING COMPOUND CHART

	Designation in repair instructions	Designation, Electronic Parts Catalogue	Part number, Electronic Parts Catalogue	Application examples

2.1	M41, M47, M47TU, M47T2, M50, M51, M52, M52TU, M54, M57, M57TU, M57T2, M60, M62 N40, N42, N45, N45N, N46, N46N, N43, N47, N47top, N47C N47D1 N51, N52, N52N, N53, N54, N55, N57, N57S N62, N62TU, N63, N73, N73H, N74 S14, S38, S50, S52, S54, S62, S65, S85 N12, N14, N16, N18	Drei Bond 1209 liquid gasket	07 58 9 062 376	For sealing separation points on crankcase
2.2	N12, N14, N16, N18 W16, N47top, N47D1, N47C1 N57D1,	Loctite 5970 liquid gasket	83 19 0 404 517 83 19 0 404 517	Sealing between crankcase upper and lower sections. Sealing of gear case cover, oil sump, coolant pump, component carrier.
2.3	N12, N14, N16, N18 W16	Loctite 648 liquid gasket	07 58 9 067 732	Sealing between cover sleeve and crankcase

3.0 **Cleaning agent.**

CLEANING AGENT CHART

	Designation in repair instructions	**Designation, Electronic Parts Catalogue**	**Part number, Electronic Parts Catalogue**	**Application examples**
3.1	N45, N46, N45T, N46T, N43, N51, N52, N52Kp, N52TU, N53, N55, N63, N63S, N63Hyprid, N74	Cold cleaner (chlorine free)	83 19 0 026 956	Cleaning assemblies, washing engine

4.0 Lubricant for **application.**

APPLICATION CHART

	Designation in repair instructions	**Designation, Electronic Parts Catalogue**	**Part number, Electronic Parts Catalogue**	**Application examples**
4.1	N20, N42, N46, N46TU, N51, N52, N52KP, N52TU, N55, N62, N62TU, N73	Lubricating grease Longtime PD1	83 19 2 160 340	For greasing the splined shaft on actuator drive/gearing of intermediate shaft.
4.2	M47, M47TU, M47T2, M57, M57TU, M57T2,	High temperature paste	83 19 2 152 323	For greasing the threads on the exhaust turbocharger.
	N12, N14, N16, N18 N40, N42, N45, N45TU			

4.3	N46, N46TU, N43. N51, N52, N52Kp, N52TU, N53, N54, N55. N62, N62TU, N63, N73, N73H, N74. S65, S85.	High temperature paste (NEVER-SEEZ compound)	83 23 0 140 233	For greasing the threads on the oxygen sensors.
4.4	N47, N47O1 N47C1, N47T N47D1 N57 N57D1	Copper paste	81 22 9 400 794	For greasing the double hex head bolt on the exhaust turbocharger.

5.0 Lubricants to loosen locked **screw connections.**

SCREW CONNECTIONS CHART

	Designation in repair instructions	**Designation, Electronic Parts Catalogue**	**Part number, Electronic Parts Catalogue**	**Application examples**
5.1	M47, M47TU, M47TU2, M57, M57TU, M57TU2. N47, N47C, N47D1, N57, N57D1, W16, W17,	Brunox lubricating grease	83 23 0 445 529	For releasing the glow elements

11 00 050 REMOVING AND INSTALLING ENGINE (S65)

Necessary preliminary tasks:

- Engine hood/bonnet in assembly position.
- Drain **ENGINE OIL** .
- Remove **SUCTION FILTER HOUSING** .
- Remove **INTAKE AIR MANIFOLD** .
- Remove **underbody protection** . See **5147490 REMOVING AND INSTALLING/REPLACING FRONT UNDERBODY PROTECTION** or **5147491 REMOVING AND INSTALLING/REPLACING REAR UNDERBODY PROTECTION** at front and rear.
- Remove **TRANSMISSION** (**Important** observe repair instructions).
- Remove **ELECTRIC FAN** .
- Remove **RADIATOR** with coolant hoses.
- Drain coolant.
- Remove **EXPANSION TANK** with coolant hose.
- Draw off **A/C SYSTEM** .
- Remove all **lines** . See **6453670 REPLACING LINE FROM COMPRESSOR TO EVAPORATOR (S85)** , **6453660 REPLACING LINE FROM CONDENSER TO EVAPORATOR (S65)** or **6453642 REPLACING LINE FROM COMPRESSOR TO CONDENSER (S65)** from A/C compressor.
- Remove **SECONDARY-AIR PUMP** .

- Detach **B+ LEAD** in engine compartment.
- Detach **VACUUM HOSE** from brake booster.
- Release **SUSPENSION CROSSBRACE** in engine compartment.
- Release grounding strap on engine support arm.

Release stabilizer (1) on front axle carrier at front.

Allow stabilizer (1) to hang loose.

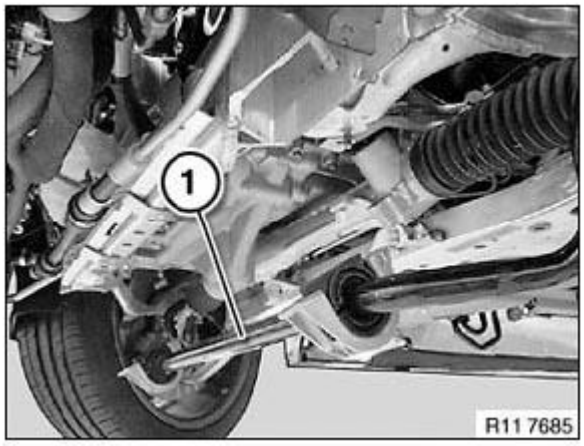


Fig. 22: Identifying Stabilizer
Courtesy of BMW OF NORTH AMERICA, INC.

Remove complete **STEERING SPINDLE** .

Remove heat shield.

Release screws (1).

Detach steering spindle extension (2).

Tightening torque: **32 31 1AZ** .

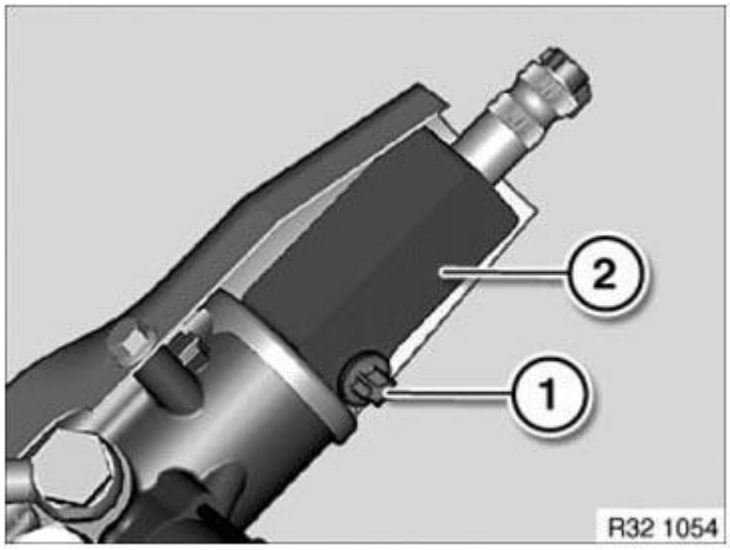


Fig. 23: Identifying Steering Spindle Extension And Screws
Courtesy of BMW OF NORTH AMERICA, INC.

Release nuts (1 and 4).

Detach oil lines (2 and 3).

Recycling:

Have a cloth ready to catch a residual amount of engine oil.

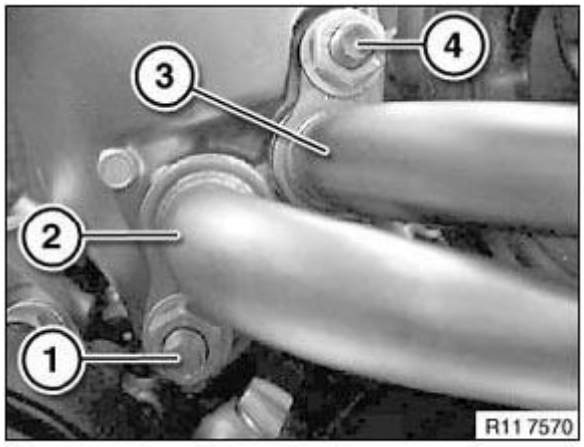


Fig. 24: Identifying Oil Lines And Nuts
Courtesy of BMW OF NORTH AMERICA, INC.

Secure oil lines (1) with a cable tie (2) to front panel.

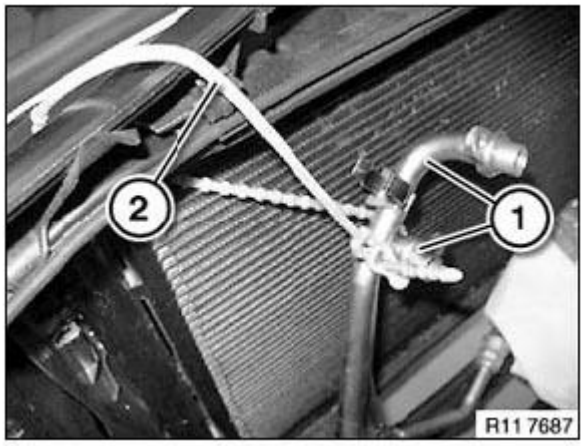


Fig. 25: Securing Oil Lines With Cable Tie
Courtesy of BMW OF NORTH AMERICA, INC.

Unclip heater hose (1) and set down with heating valve on engine.

Disconnect both hoses (2) from secondary-air valves.

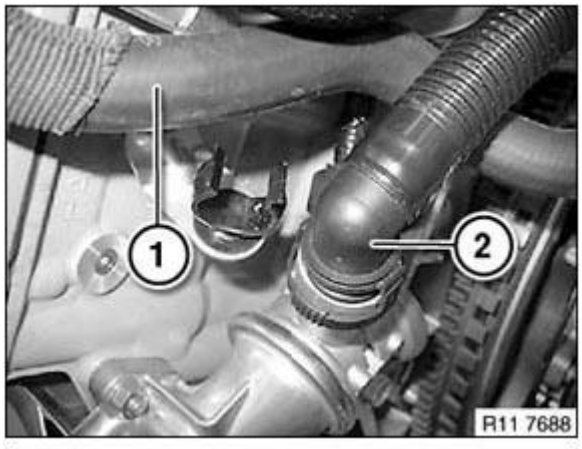


Fig. 26: Identifying Heater And Secondary-Air Valves Hoses
Courtesy of BMW OF NORTH AMERICA, INC.

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

Disconnect fuel line (1) and lock with special tool 13 5 280.

Disconnect flushing line (2).

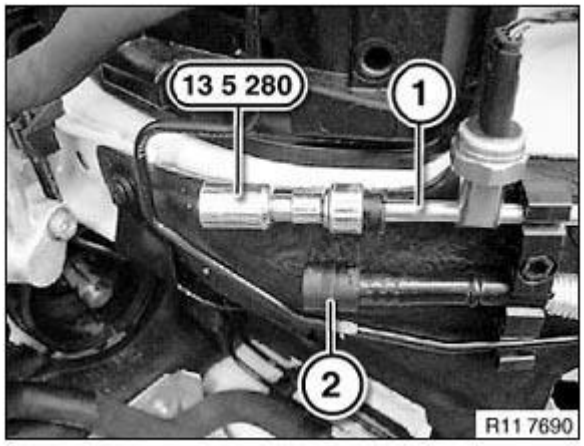


Fig. 27: Locking Fuel Line With Special Tool (13 5 280)
Courtesy of BMW OF NORTH AMERICA, INC.

Unfasten engine wiring harness (1) on engine completely.

Secure engine wiring harness (1) with a cable tie (2) to engine hood/bonnet damper.

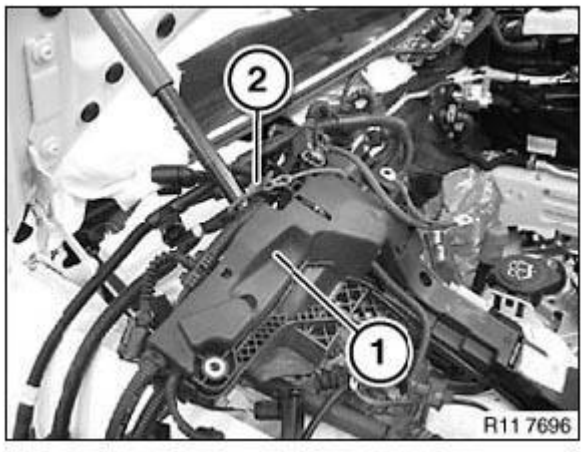


Fig. 28: Securing Engine Wiring Harness With Cable Tie
Courtesy of BMW OF NORTH AMERICA, INC.

Release both clamps (1) with special tool 17 2 050.

Remove coolant hose (2).

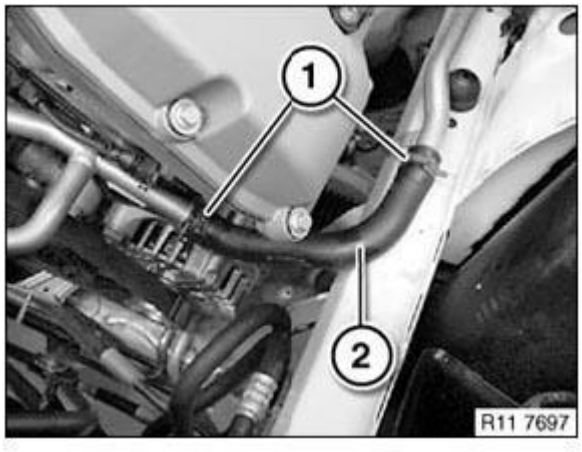


Fig. 29: Identifying Coolant Hose And Clamps
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: Do not release any hydraulic lines on the power steering pump.

Release power steering pump (1) on engine block.

Set down power steering pump (1) on front axle carrier.

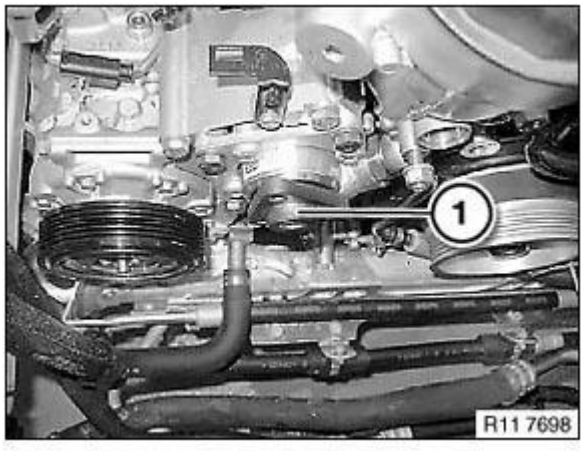


Fig. 30: Identifying Power Steering Pump
Courtesy of BMW OF NORTH AMERICA, INC.

Unscrew left and right **engine mounts** . See **2211001 REPLACING RIGHT ENGINE MOUNT (S65)** or **2211011 REPLACING LEFT ENGINE MOUNT (S65)** .

Secure special tool **11 0 000 LIFTING GEAR** to suspension eyes (1).

Remove engine with 2 persons.

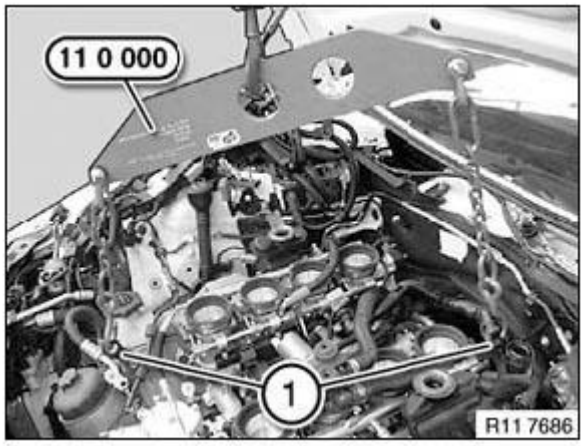


Fig. 31: Securing Special Tool (11 0 000) To Suspension Eyes
Courtesy of BMW OF NORTH AMERICA, INC.

Assemble engine.

Top up **COOLANT** and vent cooling system.

Pour in specified engine oils for BMW Group engines. See **ENGINE - OPERATING FLUIDS** .

Install **REPLACEMENT ENGINE** .

Correct CBS data status.

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:

- 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 INFORMATION FOR WORKING ON VEHICLES WITH AUTOMATIC ENGINE START-STOP FUNCTION (MSA)

WARNING: If the engine hood/bonnet contact is pulled upwards (workshop mode), the information "switch closed" is output. The automatic engine start stop function is active.
An automatic engine start is possible.

Observe safety precautions when working on MSA vehicles

Before carrying out practical work on the engine, always ensure that the MSA functionality is deactivated so as to prevent automatic engine starting while work is being carried out in the engine compartment.

MSA function is deactivated by

- Deactivate MSA by means of button (1) in passenger compartment
- Open seat belt buckle and driver's door

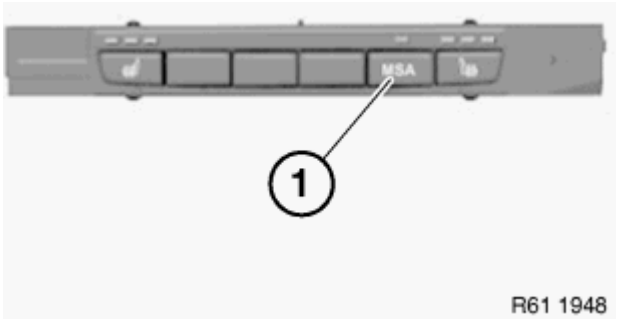


Fig. 32: Identifying MSA Button
Courtesy of BMW OF NORTH AMERICA, INC.

- Open engine bonnet/hood and ensure that engine hood/bonnet contact is not in workshop mode
  - Workshop mode A = 10 mm
  - Basic setting (engine hood/bonnet open) B = 7 mm

To make sure that the engine hood/bonnet contact is at the basic setting, if necessary press the hood/bonnet contact up to the limit position before starting work and slowly release.

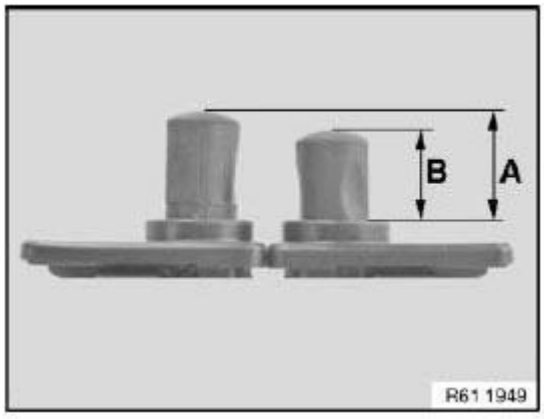


Fig. 33: Identifying Engine Hood/Bonnet Basic Setting
Courtesy of BMW OF NORTH AMERICA, INC.

When working with diagnosis tools

- Observe instructions in diagnosis tool

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 00 670 SECURING ENGINE IN INSTALLATION POSITION (S65)

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/HOOD IN SERVICE POSITION**
- Remove **INTAKE AIR MANIFOLD**

Assemble cross member **00 0 200 DEVICE** with special tools 00 0 202, 00 0 204, 00 0 208.

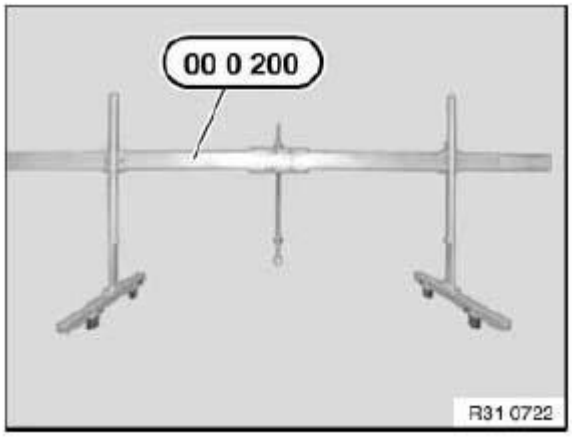


Fig. 34: Identifying Cross Member (00 0 200)
Courtesy of BMW OF NORTH AMERICA, INC.

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: Risk of damage!
Position transverse member 00 0 200 DEVICE with a 2nd person helping by way of rests (1) on bolt connections of side panels.

Secure special tool 11 0 020 to spindle 00 0 202.

Attach suitable chains to special tool 11 0 020 and suspend from both engine suspension eyelets.

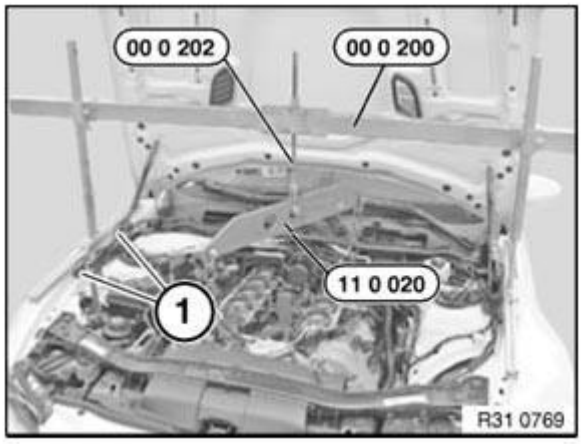


Fig. 35: Securing Special Tool (11 0 020) To Spindle (00 0 202)
Courtesy of BMW OF NORTH AMERICA, INC.

WARNING: Risk of injury!
Tighten down all adjusting screws and nuts on cross member 00 0 200 DEVICE .

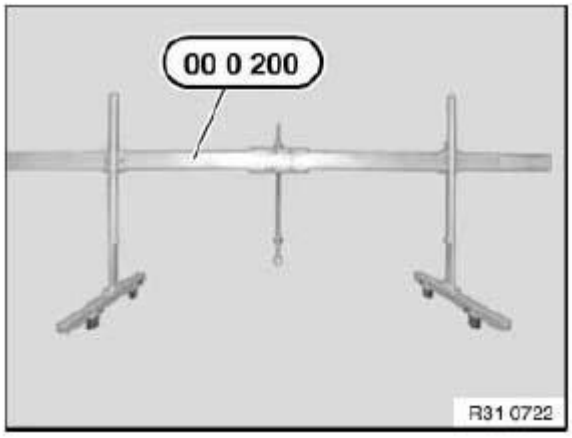


Fig. 36: Identifying Cross Member (00 0 200)
Courtesy of BMW OF NORTH AMERICA, INC.

Unscrew nuts (1).

Raise engine approx. 10 mm with cross member.

Installation:

Replace self-locking nuts.

Tightening torque **22 11 2AZ** .

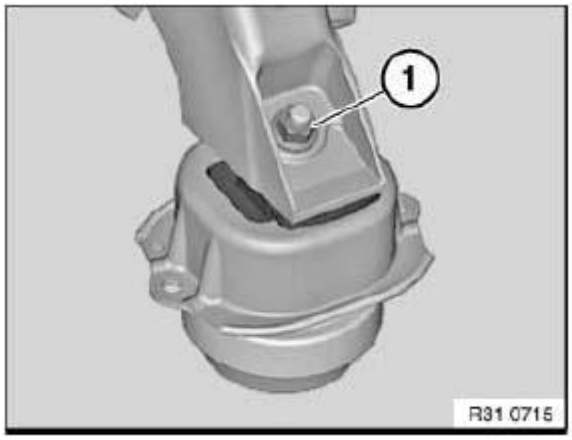


Fig. 37: Identifying Engine Mount Nut
Courtesy of BMW OF NORTH AMERICA, INC.

11 00... SERVICE - ENGINE OIL (S65)

WARNING: Danger of scalding!
Carry out all tasks only when wearing oil-resistant, heat-resistant protective gloves incl. underarm protection, face guard and protective apron.

IMPORTANT: Perform engine oil service only when engine is at normal operating temperature (>70°C engine oil temperature).
An exact engine oil level reading can only be obtained from an engine oil temperature > or = 70°.
Engine oil temperature can be read off in the instrument cluster.
Observe the exact engine oil filling capacity.
Overfilling the engine with engine oil will result in engine damage.
Inspection and drain-off times must be observed.
Determining the oil level via the BC button detects only changes > +/- 0.5 liter.

Recycling

Catch and dispose of drained engine oil in a suitable container.

Observe country-specific waste-disposal regulations.

WARNING: Danger of scalding!

NOTE: The remaining engine oil can flow off into the oil sump only when the oil filter cap is opened.

Release oil filter cover (1).

Tightening torque **11 42 1AZ** .

Installation:

Replace oil filter element and sealing rings.

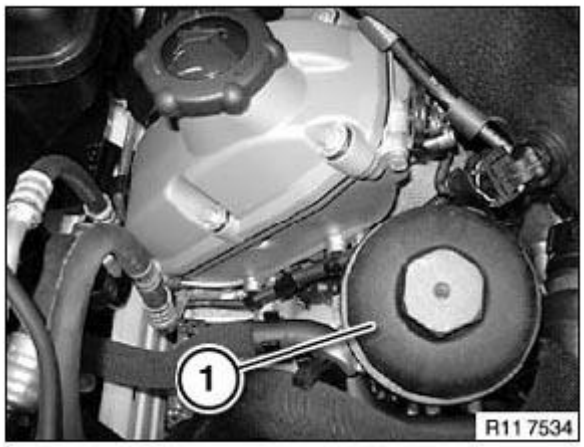


Fig. 38: Identifying Oil Filter Cover
Courtesy of BMW OF NORTH AMERICA, INC.

WARNING: Danger of scalding!
Carry out all tasks only when wearing oil-resistant, heat-resistant protective gloves incl. underarm protection, face guard and protective apron.

Open screw plug (1) with socket and a long extension (2).

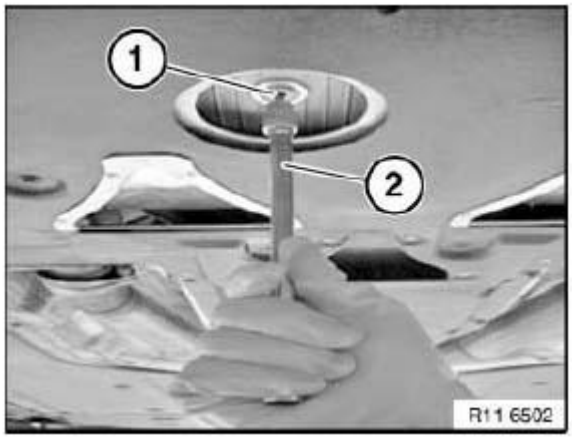


Fig. 39: Opening Screw Plug
Courtesy of BMW OF NORTH AMERICA, INC.

Tilt long extension (1) with socket and screw plug in direction of arrow.

Recycling

Catch and dispose of engine oil with suitable equipment.

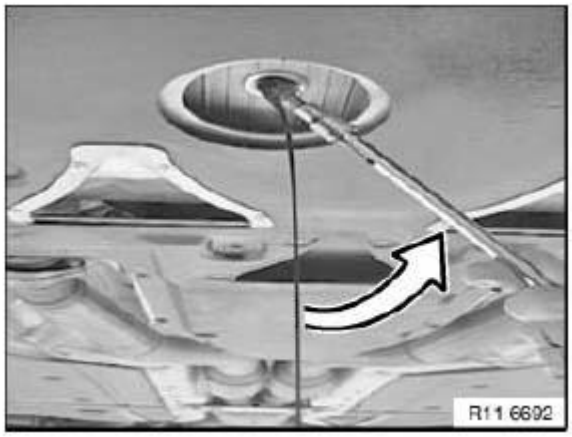


Fig. 40: Draining Engine Oil
Courtesy of BMW OF NORTH AMERICA, INC.

Remove oil drain plug (1).

Drain-off time of 10 minutes must be observed without fail.

Remove oil drain plug (2).

Drain-off time of 2 minutes must be observed without fail.

Tightening torque **11 13 1AZ** .

Installation:

Replace sealing ring.

Assemble engine.

Pour in **engine oil** . See **ENGINE - OPERATING FLUIDS** or **OIL SUPPLY E90, E92, E93/S65/B40** .

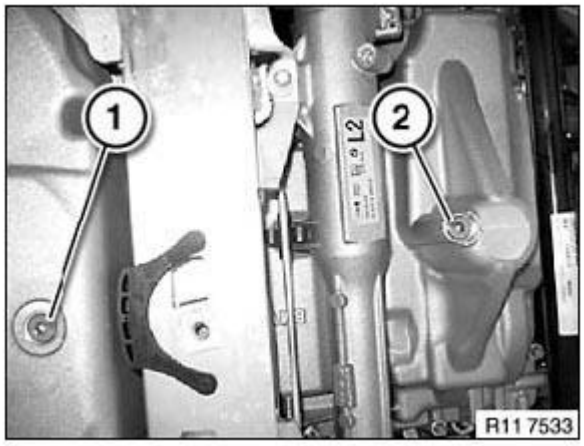


Fig. 41: Identifying Oil Drain Plug
Courtesy of BMW OF NORTH AMERICA, INC.

Checking engine oil level:

- Park vehicle on a horizontal surface
- Start engine and run at idle until an engine oil temperature > or = 70°C is reached
- Pressing the BC button for more 3 seconds results in the oil level been determined again.
- Only changes > +/- 0.5 liter are detected.
- If necessary, perform odometer reset.
- Top up engine oil if necessary
- **Pre-delivery inspection/engine replacement**

Carry out distance travelled reset **only** with the BMW diagnosis system.

Observe vehicle-specific maintenance scopes.

CYLINDER HEAD WITH COVER

11 12 729 CHECKING CYLINDER HEAD FOR WATERTIGHTNESS (S65)

NOTE: Special tool 11 5 230 can be used for both cylinder heads.

Necessary preliminary tasks:

- Remove **cylinder head** See **1112105 REMOVING AND INSTALLING LEFT CYLINDER HEAD (S65)** or **1112106 REMOVING AND INSTALLING RIGHT CYLINDER HEAD (S65)**.
- Disassemble **cylinder head** . See **1134552 REMOVING AND INSTALLING/REPLACING ALL VALVES (S65)**, **1134715 REPLACING ALL VALVE SPRINGS (S65)** or **1134560 REPLACING ALL VALVE STEM SEALS (S65)**.

Secure special tool 11 5 231 with old cylinder head bolts.

Secure special tool 11 5 235 with special tool 11 5 237.

NOTE: Picture shows S85.

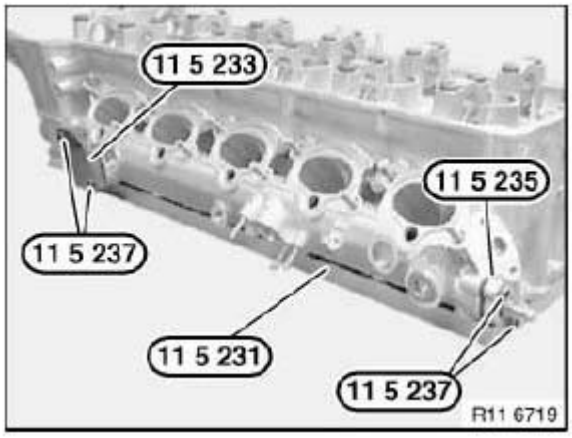


Fig. 42: Identifying Special Tools (11 5 235 And 11 5 237)
Courtesy of BMW OF NORTH AMERICA, INC.

Secure special tool 11 9 961 with special tool 11 5 237 to 10 Nm.

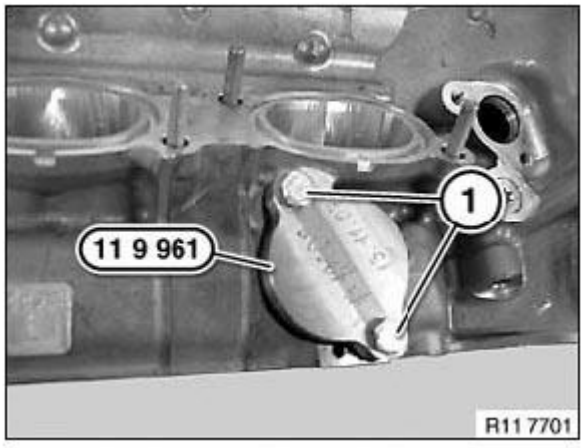


Fig. 43: Identifying Special Tool (11 9 961)
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: Immerse cylinder head in a water bath.

Test pressure: 4.5 bar.

Check cylinder head for escaping air (cracks).

If necessary, add cleaning agent to water bath.

Assemble engine.

11 12 105 REMOVING AND INSTALLING LEFT CYLINDER HEAD (S65)

Necessary preliminary tasks:

- Remove **EXHAUST SYSTEM** .
- Remove left **EXHAUST MANIFOLD (S65)** .
- Remove left **CYLINDER HEAD COVER**
- Remove **LEFT INLET CAMSHAFT** .
- Remove left **EXHAUST CAMSHAFT** .
- Partially unfasten **ENGINE WIRING HARNESS** and lay to one side.
- Remove **THROTTLE VALVES** from cylinders 5 to 8.
- Remove **THERMOSTAT HOUSING** .
- Remove rear water pipe from cylinder head.

Release screws (1).

Remove water fitting (2).

Installation:

Replace seal.

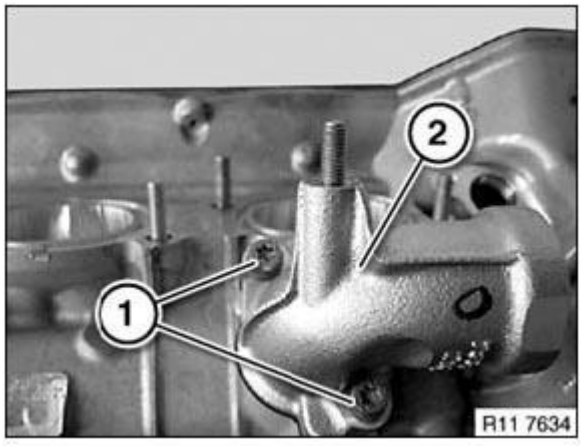


Fig. 44: Identifying Water Fitting And Screws
Courtesy of BMW OF NORTH AMERICA, INC.

Release screws (1).

IMPORTANT: Screws (1) can fall into the chain drive. Risk of damage to the timing chain.

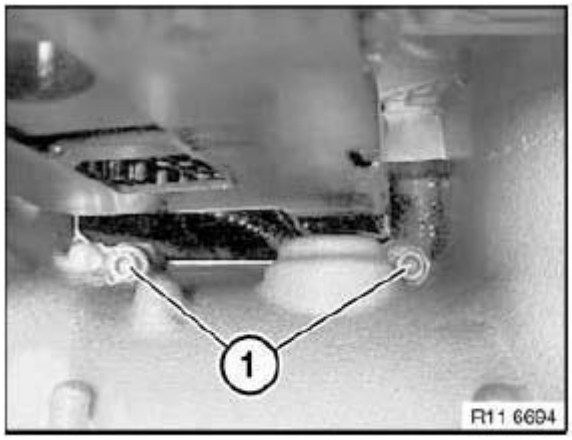


Fig. 45: Identifying Screws
Courtesy of BMW OF NORTH AMERICA, INC.

Remove screw (1) with a magnet from gearcase.

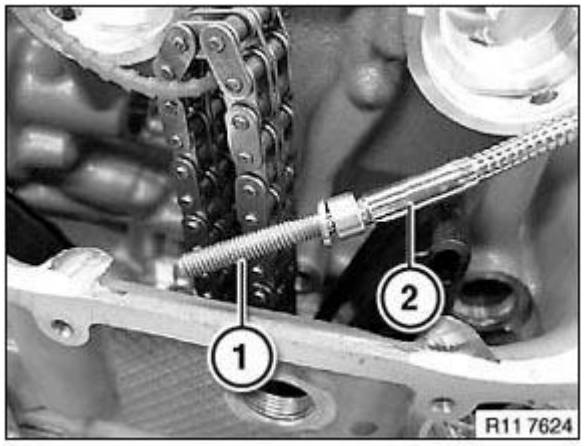


Fig. 46: Identifying Screw On Magnet
Courtesy of BMW OF NORTH AMERICA, INC.

Release cylinder head bolt (1) with special tool 11 2 250.

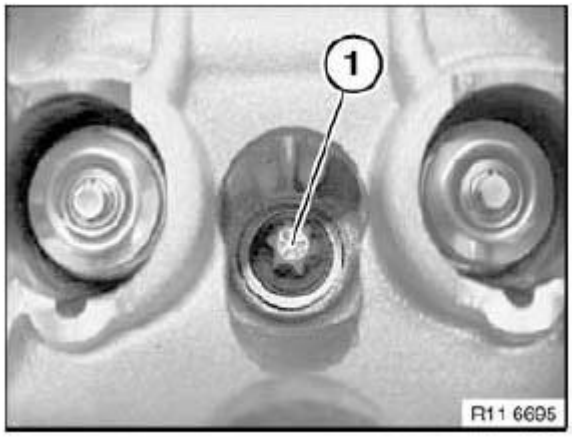


Fig. 47: Identifying Cylinder Head Bolt
Courtesy of BMW OF NORTH AMERICA, INC.

Release cylinder head bolts from outside to inside in sequence (10 to 1).

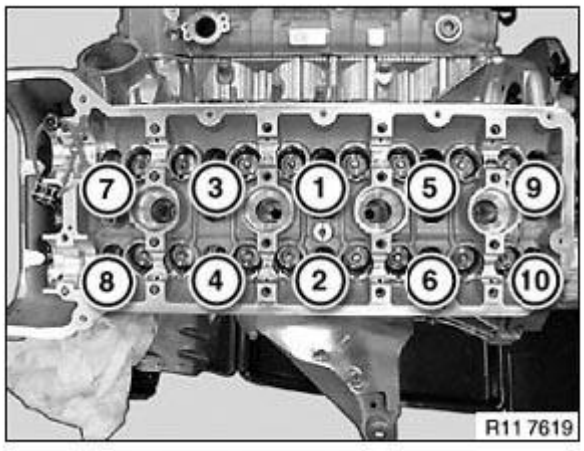


Fig. 48: Identifying Cylinder Head Bolts Removal Sequence
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: Replace CYLINDER HEAD GASKET .
Check CYLINDER HEAD for water leaks.

Installation:

Fit new cylinder head screws.

Tighten down cylinder head bolts from inside to outside in sequence (1 to 10).

Tightening torque: **11 12 1AZ** .

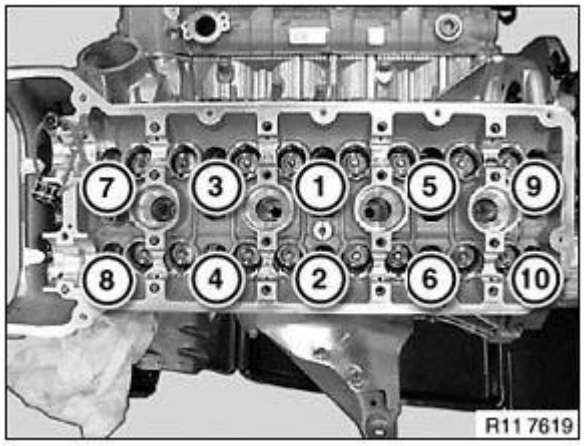


Fig. 49: Identifying Cylinder Head Bolts Tightening Sequence
Courtesy of BMW OF NORTH AMERICA, INC.

Insert bolts (1).

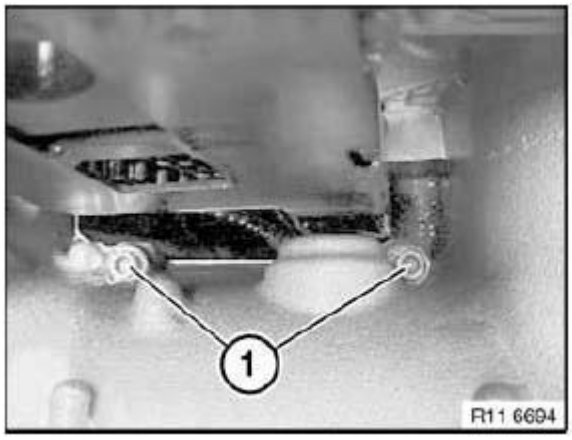


Fig. 50: Identifying Bolts
Courtesy of BMW OF NORTH AMERICA, INC.

Assemble engine.

11 12 106 REMOVING AND INSTALLING RIGHT CYLINDER HEAD (S65)

Necessary preliminary tasks:

- Remove **EXHAUST SYSTEM** .
- Remove right **EXHAUST MANIFOLD** .
- Remove right **CYLINDER HEAD COVER** .
- Remove right **INLET CAMSHAFT** .
- Remove right **EXHAUST CAMSHAFT** .
- Partially unfasten **ENGINE WIRING HARNESS** and lay to one side.

- Remove **THROTTLE VALVES** from cylinders 1 to 4.
- Remove **THERMOSTAT HOUSING** .
- Remove rear water pipe from cylinder head.

Release screws (1).

Remove coolant fitting (2).

Installation:

Replace seal.

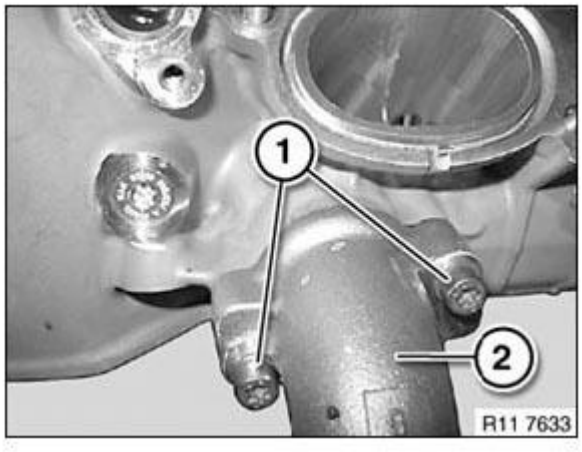


Fig. 51: Identifying Coolant Fitting And Screws
Courtesy of BMW OF NORTH AMERICA, INC.

Release screw (1).

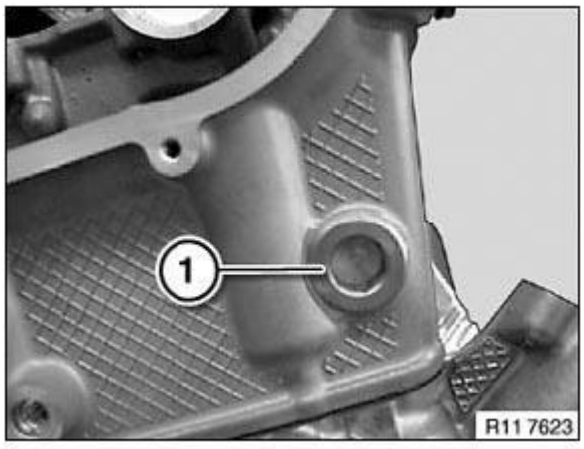


Fig. 52: Identifying Screw
Courtesy of BMW OF NORTH AMERICA, INC.

Remove bearing pin (1) with special tool 11 5 290.

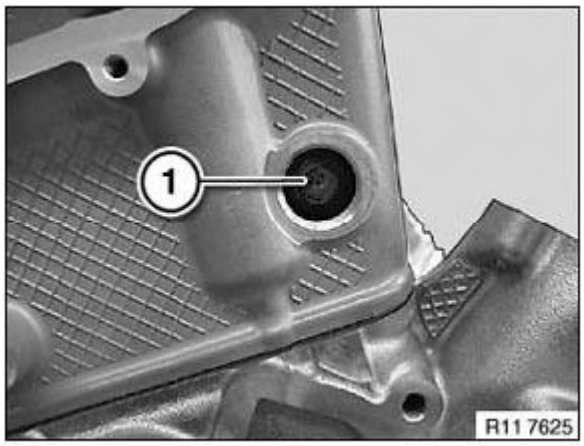


Fig. 53: Identifying Bearing Pin
Courtesy of BMW OF NORTH AMERICA, INC.

Release screws (1).

IMPORTANT: Screws (1) can fall into the chain drive. Risk of damage to the timing chain.

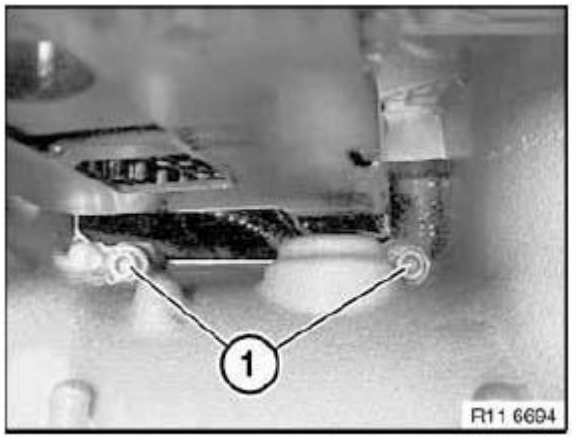


Fig. 54: Identifying Screws
Courtesy of BMW OF NORTH AMERICA, INC.

Remove screw (1) with a magnet (2) from gearcase.

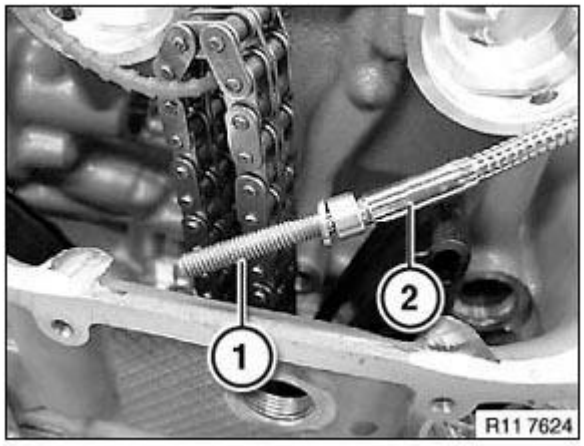


Fig. 55: Identifying Screw On Magnet
Courtesy of BMW OF NORTH AMERICA, INC.

Release cylinder head bolt (1) with special tool 11 2 250.

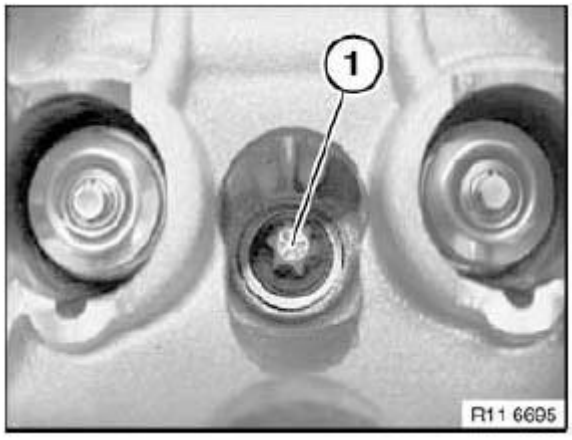


Fig. 56: Identifying Cylinder Head Bolt
Courtesy of BMW OF NORTH AMERICA, INC.

Release cylinder head bolts from outside to inside in sequence (10 to 1).

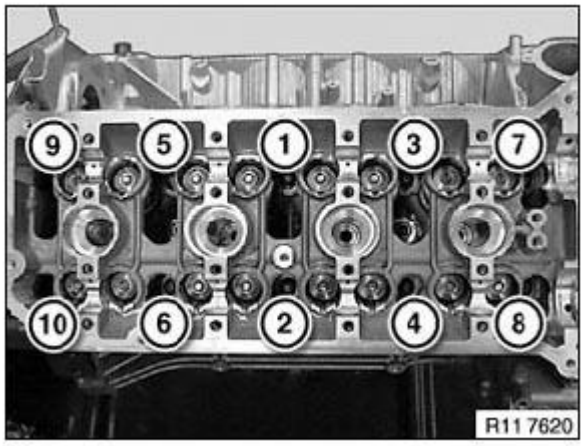


Fig. 57: Identifying Cylinder Head Bolts Removal Sequence
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: Replace CYLINDER HEAD GASKET .
Check CYLINDER HEAD for water leaks.

Installation:

Fit new cylinder head screws.

Tighten down cylinder head bolts from inside to outside in sequence (1 to 10).

Tightening torque: **11 12 1AZ** .

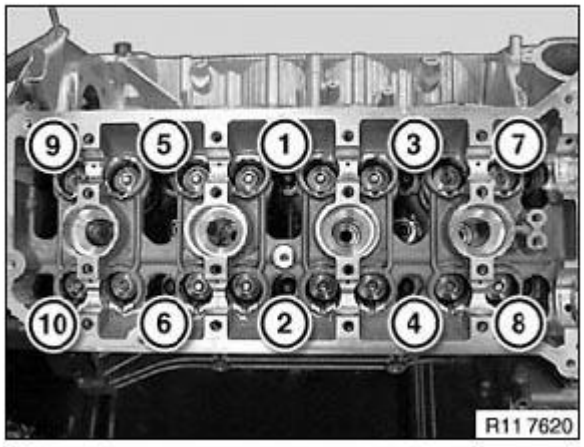


Fig. 58: Identifying Cylinder Head Bolts Tightening Sequence
Courtesy of BMW OF NORTH AMERICA, INC.

Insert bolts (1).

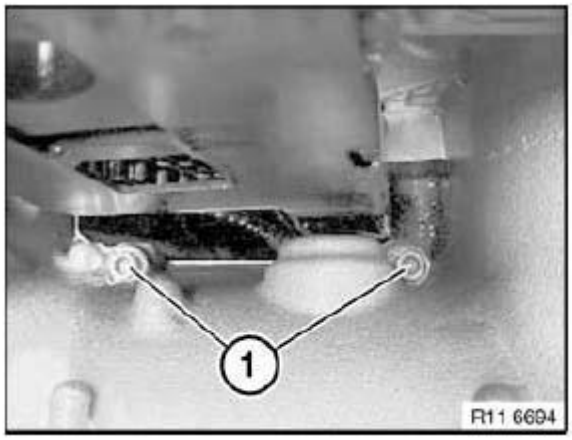


Fig. 59: Identifying Bolts
Courtesy of BMW OF NORTH AMERICA, INC.

Assemble engine.

11 12 005 REMOVING AND INSTALLING/SEALING LEFT CYLINDER HEAD COVER (S65)

IMPORTANT: Magnesium material.

No steel screws/bolts may be used due to the threat of electrochemical corrosion.

A magnesium material requires aluminum screws/bolts exclusively.

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).

Scratching of the cylinder head cover is not permitted **(risk of corrosion).**

Necessary preliminary tasks:

- Remove **INTAKE AIR MANIFOLD** .
- Remove **ROD-TYPE IGNITION COILS** .
- Disconnect plug connection at camshaft sensors.

Release bolts along line (1).

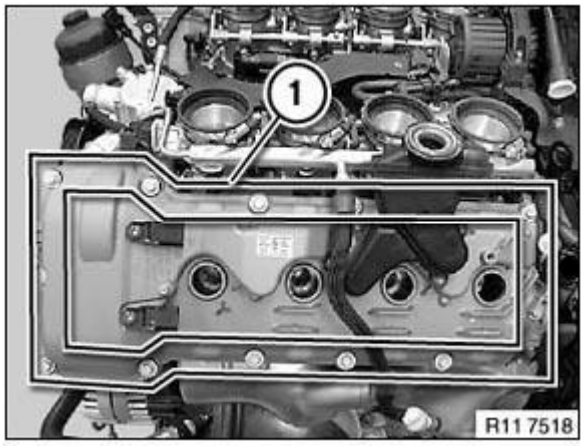


Fig. 60: Identifying Cylinder Head Cover
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Replace seal (1).

Align gasket (1) on cylinder head cover groove.

Press in gasket (1) so that it is free from tension.

Release park plug tube (2).

Installation:

Check rubber on spark plug tube (2) for damage; replace spark plug tube (2) if necessary.

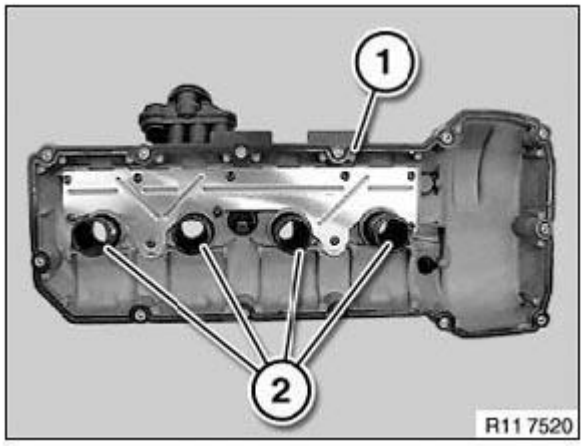


Fig. 61: Identifying Park Plug Tube And Gasket
Courtesy of BMW OF NORTH AMERICA, INC.

Apply a light coating of engine oil to spark plug tube (2) prior to installation.

Installation:

Clean seal residue from sealing surfaces.

Coat contact surfaces of joint (1) with Drei Bond 1209.

NOTE: Picture shows S85.

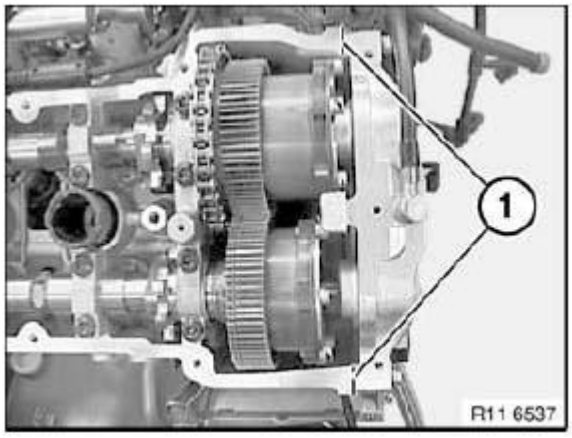


Fig. 62: Identifying Contact Surfaces Of Joint
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Check decoupling element (1) for damage and replace if necessary.

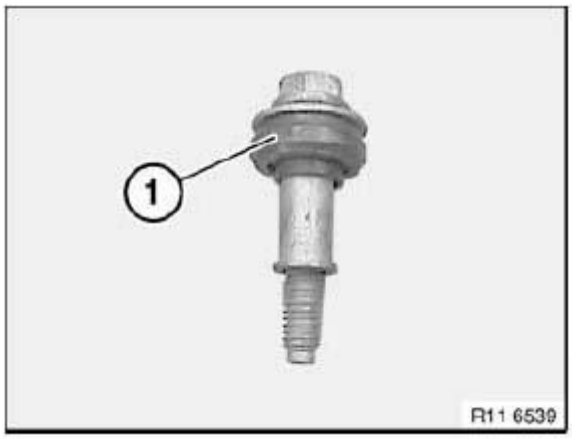


Fig. 63: Identifying Decoupling Element
Courtesy of BMW OF NORTH AMERICA, INC.

Fit cylinder head cover.

Align spark plug tubes.

Tighten down all retaining elements diagonally from inside to outside.

Tightening torque: **11 12 8AZ** .

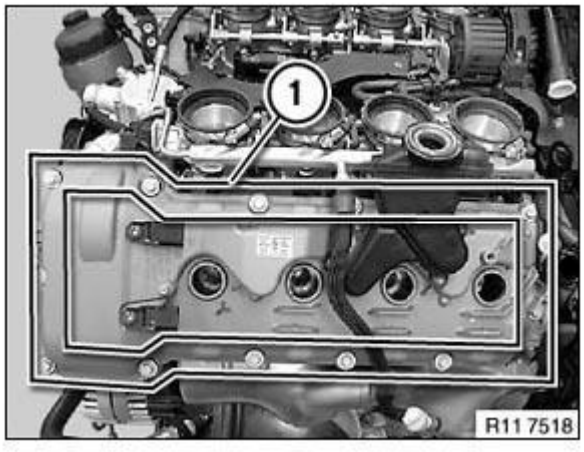


Fig. 64: Identifying Cylinder Head Cover
Courtesy of BMW OF NORTH AMERICA, INC.

Assemble engine.

11 12 006 REMOVING AND INSTALLING/SEALING RIGHT CYLINDER HEAD COVER (S65)

IMPORTANT: Magnesium material.

No steel screws/bolts may be used due to the threat of electrochemical corrosion.

A magnesium material requires aluminum screws/bolts exclusively.

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).

Scratching of the cylinder head cover is not permitted **(risk of corrosion).**

Necessary preliminary tasks:

- Remove **INTAKE AIR MANIFOLD** .
- Remove **ROD-TYPE IGNITION COILS** .
- Disconnect plug connection at camshaft sensors.

Release bolts along line (1).

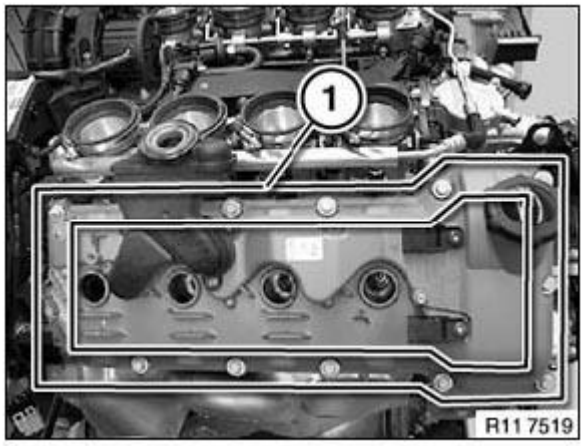


Fig. 65: Identifying Cylinder Head Cover
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Replace seal (1).

Align gasket (1) on cylinder head cover groove.

Press in gasket (1) so that it is free from tension.

Release park plug tube (1).

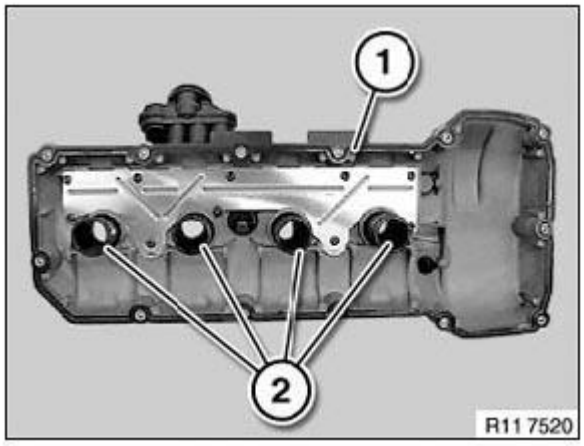


Fig. 66: Identifying Park Plug Tube And Gasket
Courtesy of BMW OF NORTH AMERICA, INC.

Installation

Check rubber on spark plug tube (2) for damage; replace spark plug tube (2) if necessary.

Apply a light coating of engine oil to spark plug tube (2) prior to installation.

Installation:

Clean seal residue from sealing surfaces.

Coat contact surfaces of joint (1) with Drei Bond 1209.

NOTE: Picture shows S85.

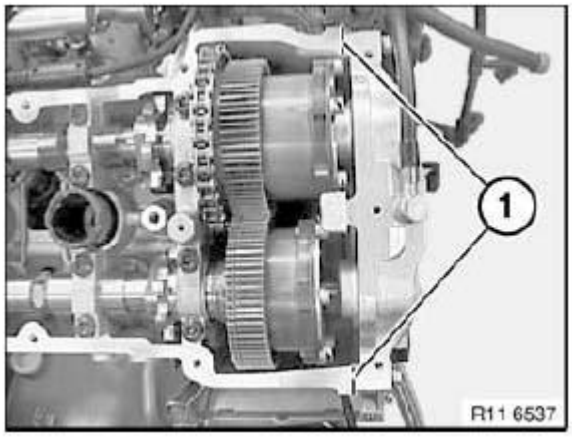


Fig. 67: Identifying Contact Surfaces Of Joint
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Check decoupling element (1) for damage and replace if necessary.

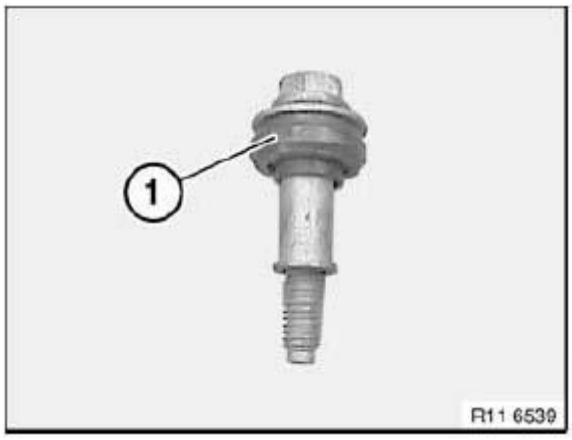


Fig. 68: Identifying Decoupling Element
Courtesy of BMW OF NORTH AMERICA, INC.

Fit cylinder head cover.

Align spark plug tubes.

Tighten down all retaining elements diagonally from inside to outside.

Tightening torque: **11 12 8AZ** .

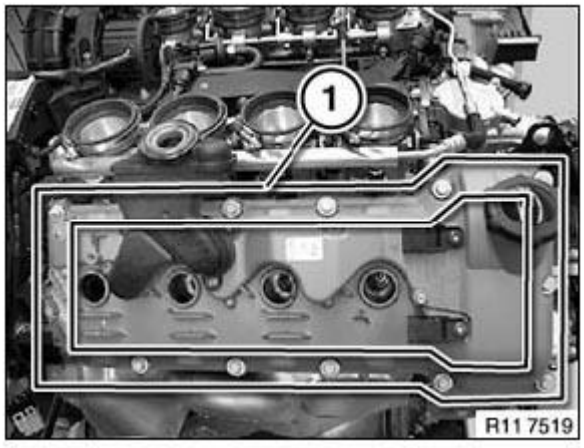


Fig. 69: Identifying Cylinder Head Cover
Courtesy of BMW OF NORTH AMERICA, INC.

Assemble engine.

11 12 112 REPLACING BOTH CYLINDER HEAD GASKETS (S65)

Necessary preliminary tasks:

- Remove left **cylinder head**.
- Remove right **cylinder head**.
- Check cylinder head for leaks.

IMPORTANT: Do not open screw plugs.
The screw plug must always be replaced if it is opened by mistake.

Installation:

Make sure oil bore (1) is clean.

NOTE: Picture shows S85.

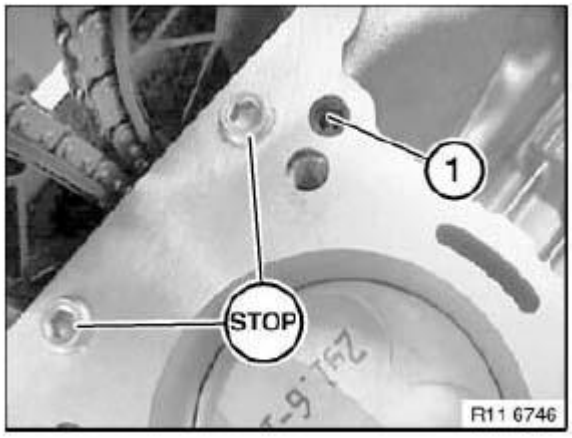


Fig. 70: Identifying Oil Bore
Courtesy of BMW OF NORTH AMERICA, INC.

Check dowel sleeves (1) for damage and correct installation position.

Clean sealing faces with special tool 11 4 470.

Do not use any metal-cutting tools.

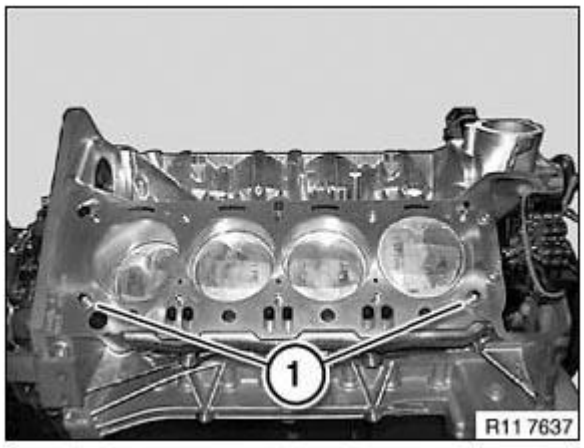


Fig. 71: Identifying Dowel Sleeves
Courtesy of BMW OF NORTH AMERICA, INC.

Check dowel sleeves (1) for damage and correct installation position.

Clean sealing faces with special tool 11 4 470.

Do not use any metal-cutting tools.

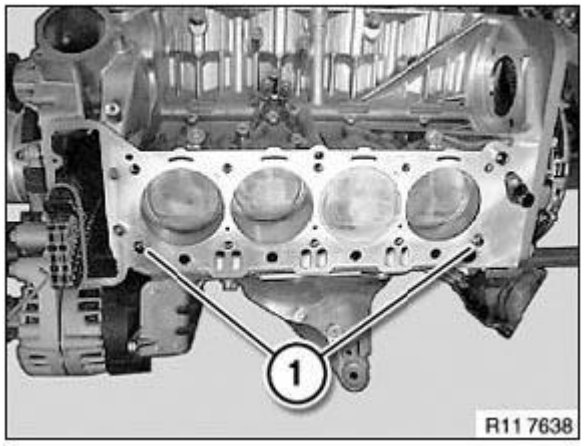


Fig. 72: Identifying Dowel Sleeves
Courtesy of BMW OF NORTH AMERICA, INC.

Remove spacer sleeves (1) in direction of arrow.

NOTE: Picture show cylinder bank 2. Procedure for cylinder bank 1 is identical.

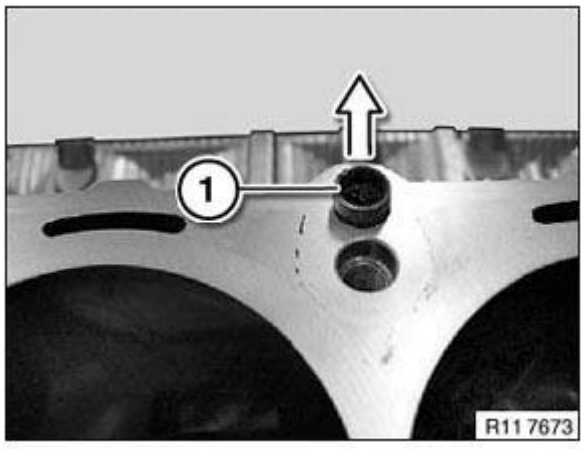


Fig. 73: Removing Spacer Sleeves
Courtesy of BMW OF NORTH AMERICA, INC.

Remove non-return valves (1) in direction of arrow.

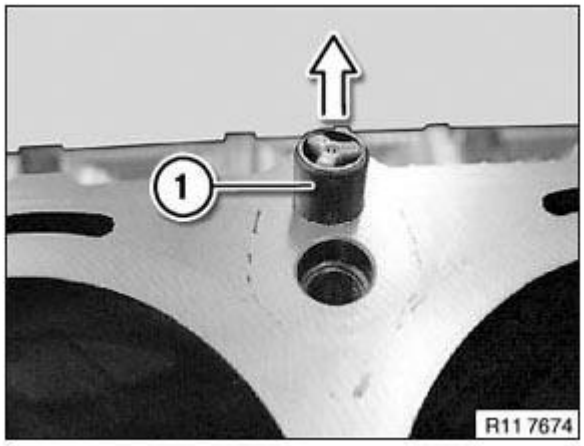


Fig. 74: Removing Non-Return Valves
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Replace spacer sleeves (1) and non-return valves (2).

Note installation direction of non-return valves (2).

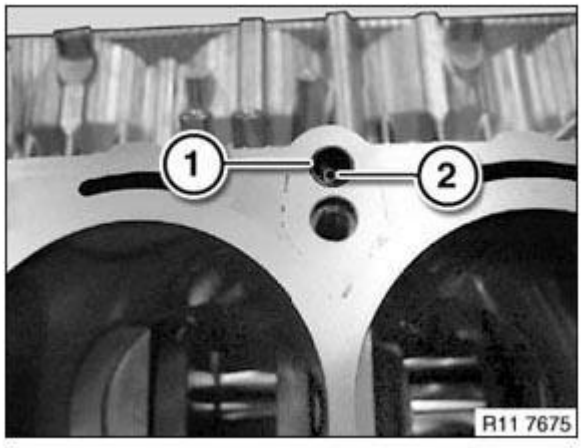


Fig. 75: Identifying Spacer Sleeves And Non-Return Valves
Courtesy of BMW OF NORTH AMERICA, INC.

Replace head gasket (1) for cylinders 1-4.

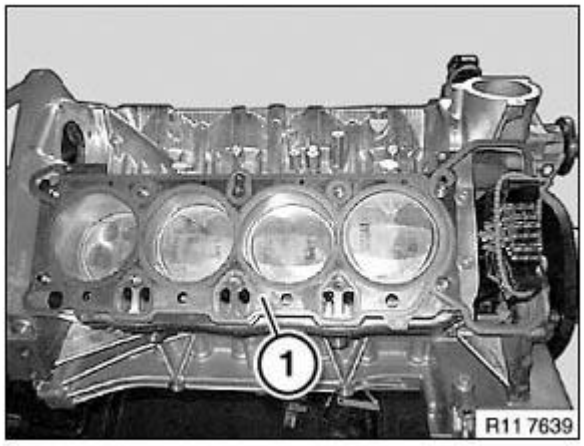


Fig. 76: Identifying Head Gasket
Courtesy of BMW OF NORTH AMERICA, INC.

Replace head gasket (1) for cylinders 5-8.

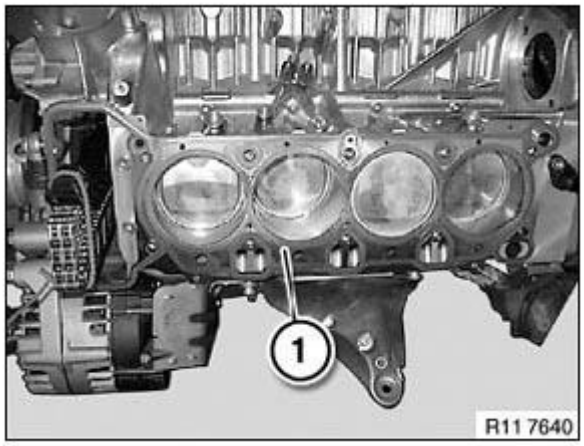


Fig. 77: Identifying Head Gasket
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: There is no oversize gasket for the S65 engine.

Assemble engine.

OIL SUMP

11 13 000 REMOVING AND INSTALLING OR REPLACING OIL SUMP (S65)

Recycling

Catch and dispose of used oil in a suitable container.

Observe country-specific waste-disposal regulations.

Necessary preliminary tasks:

- Drain engine oil.
- Secure **ENGINE IN INSTALLATION POSITION** .
- Lower **FRONT AXLE** .
- Remove **ribbed V-belt**.
- Release 4x transmission bolts.

Release screws (1).

Take off holder (2).

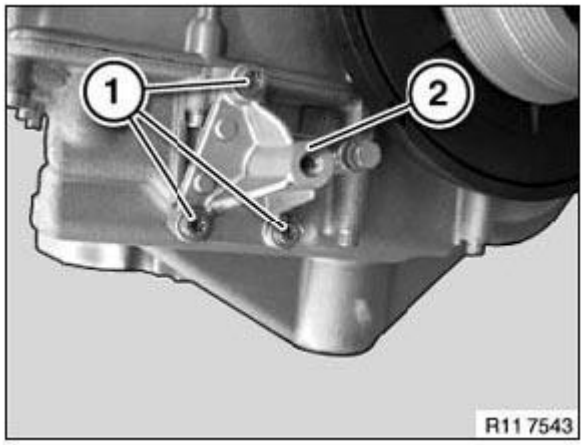
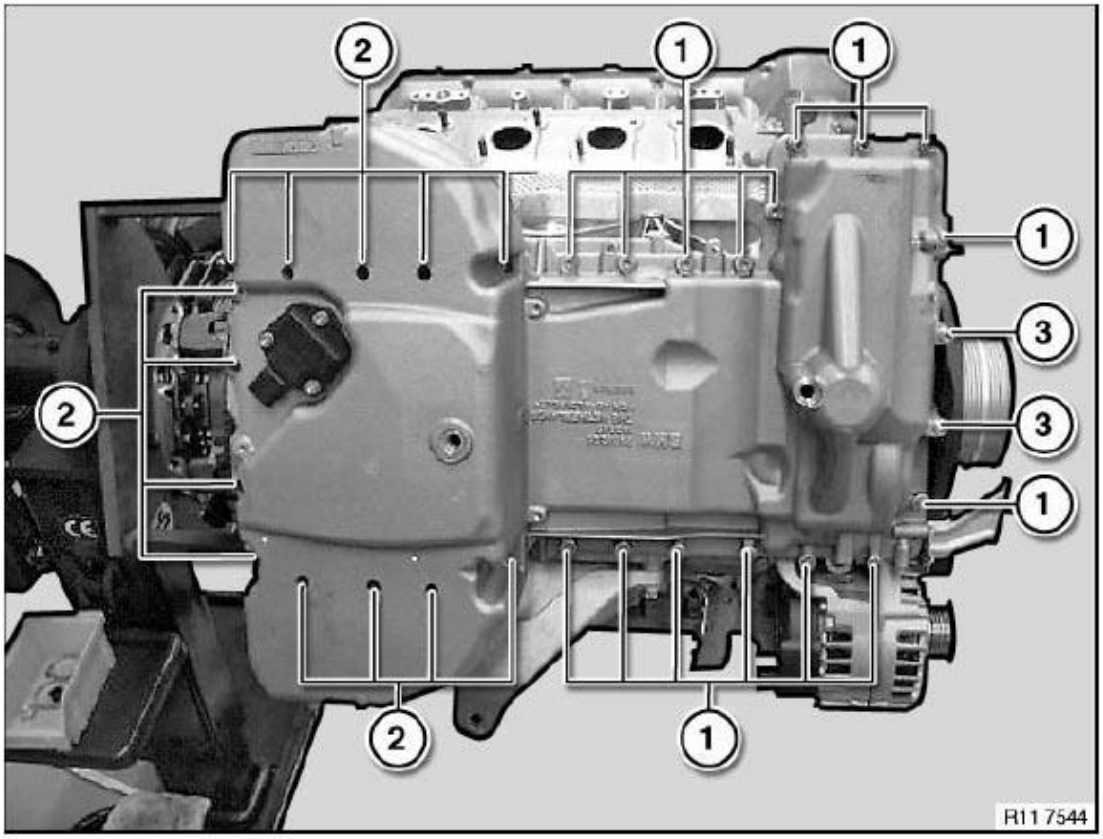


Fig. 78: Identifying Holder And Screws
Courtesy of BMW OF NORTH AMERICA, INC.



Overview of oil sump screw/bolt connections

1 Torx bolt M6x30 (16 x)
2 Torx bolt M6x50 (12 x)
3 Torx bolt M6x75 (2 x)

Fig. 79: Oil Sump Screw/Bolt Locations
Courtesy of BMW OF NORTH AMERICA, INC.

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

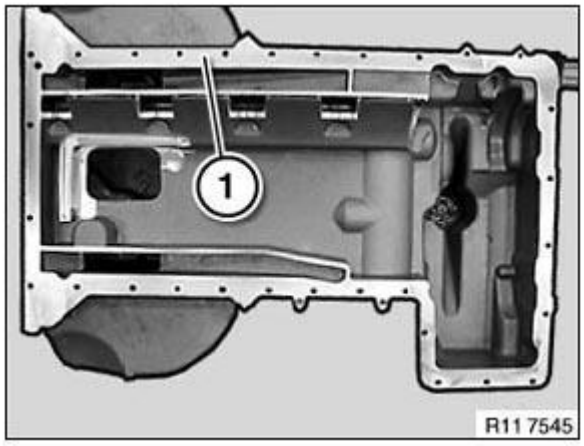


Fig. 80: Identifying Sealing Faces
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Replace oil sump gasket (1).

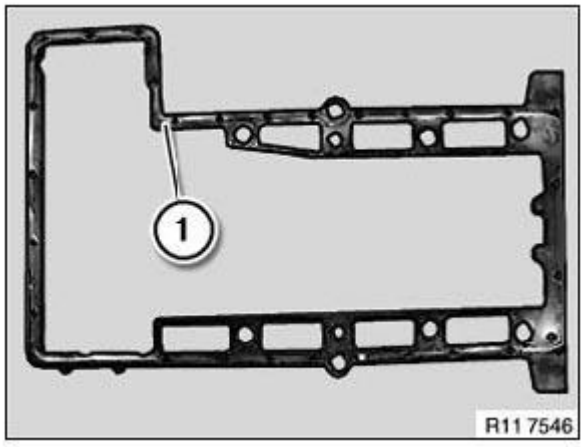


Fig. 81: Identifying Oil Sump Gasket
Courtesy of BMW OF NORTH AMERICA, INC.

Assemble engine.

HOUSING COVER

11 14 151 REPLACING CRANKSHAFT SEAL (S65)

Necessary preliminary tasks:

- Remove **TRANSMISSION** .
- Remove clutch.

- Remove **FLYWHEEL** .

Drill a 3 mm hole into shaft seal.

IMPORTANT: Risk of damage! Remove chips/shavings immediately.

Screw in special tool **23 0 490 PULLER** .

Drive out radial shaft seal with impact weight.

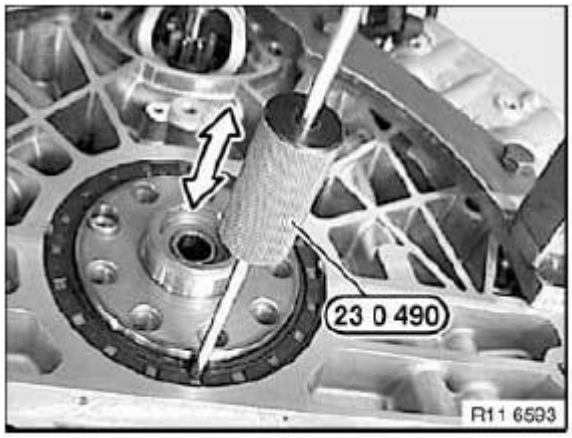


Fig. 82: Removing Radial Shaft Seal With Impact Weight
Courtesy of BMW OF NORTH AMERICA, INC.

IMPORTANT: Risk of damage! Remove chips/shavings immediately.

Remove remnants of sealant from sealant outlet (1) on left and right.

Apply Drei Bond sealant 1209 to sealant outlet (1) on left and right.

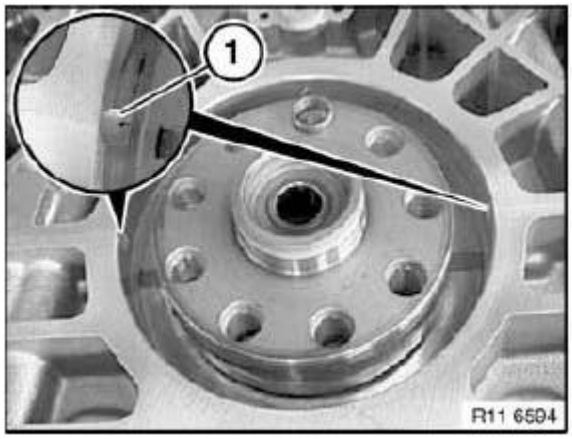


Fig. 83: Identifying Sealant Outlet

Courtesy of BMW OF NORTH AMERICA, INC.

IMPORTANT: Pay attention to fitting sleeve.
Special tool 11 5 311 must rest flat on crankshaft (pay attention to fitting sleeve).

Install special tool 11 5 311 with bolts (1).

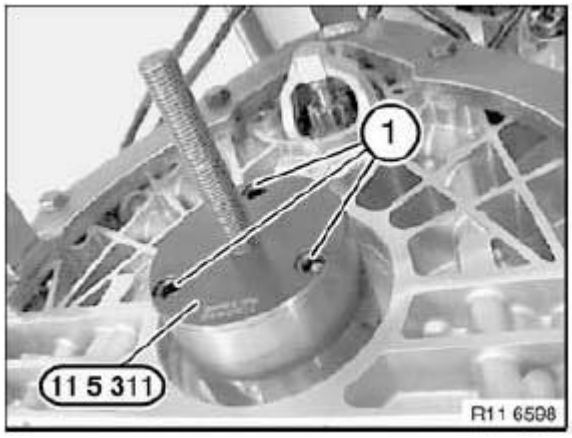


Fig. 84: Installing Special Tool (11 5 311) With Bolts
Courtesy of BMW OF NORTH AMERICA, INC.

Position support ring (1) with radial shaft seal (2) on special tool 11 5 311.

Push radial shaft seal (2) uniformly in direction of arrow over support ring onto special tool 11 5 311.

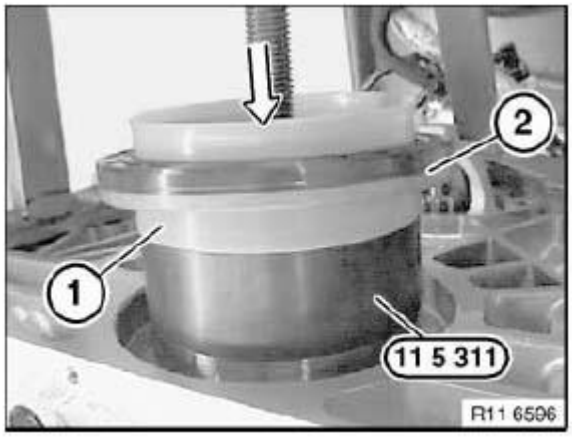


Fig. 85: Pushing Radial Shaft Seal
Courtesy of BMW OF NORTH AMERICA, INC.

Position shaft seal (1) approx. 5 mm before crankcase.

Remove support ring (2).

NOTE: Support ring (2) is no longer needed.

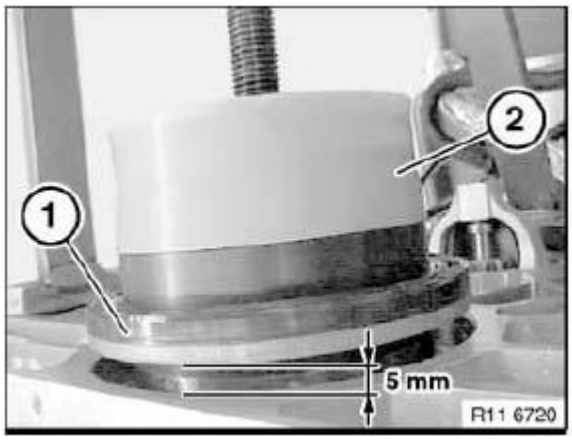


Fig. 86: Identifying Shaft Seal Position
Courtesy of BMW OF NORTH AMERICA, INC.

Press in radial shaft seal (1) with special tools 11 5 312 and 11 5 313.

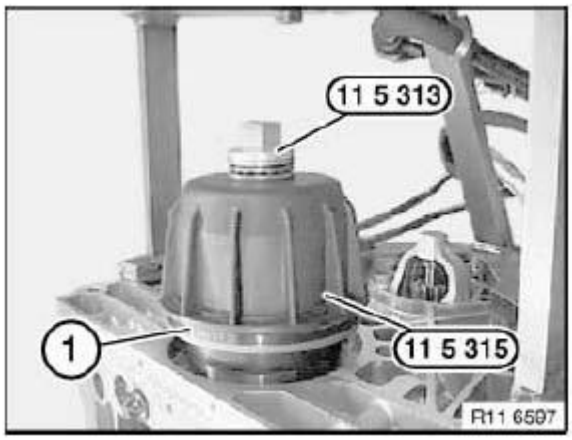


Fig. 87: Pressing Radial Shaft Seal Using Special Tools
Courtesy of BMW OF NORTH AMERICA, INC.

Assemble engine.

Settling time of radial shaft seal approx. 1 hour.

Correct **ENGINE OIL LEVEL** if necessary.

11 14 005 REPLACING FRONT CRANKSHAFT SEAL (S65)

Necessary preliminary tasks:

- Remove **FAN COWL** with electric fan.

- Remove **RADIATOR** .
- Remove **VIBRATION DAMPER** .

Lay special tool 11 2 386 on crankshaft.

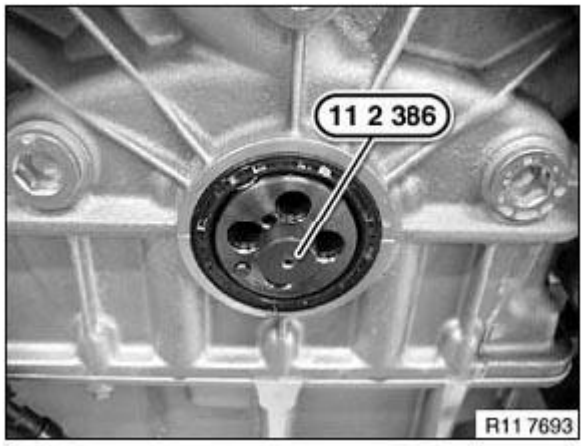


Fig. 88: Identifying Special Tool (11 2 386) On Crankshaft
Courtesy of BMW OF NORTH AMERICA, INC.

Screw special tool **11 6 360 PULLER** to 80 Nm into radial shaft seal.

Release radial seal from housing.

Repeat the operation several times if necessary.

NOTE: Carefully saw open old radial shaft seal with an iron saw from special tool 11 6 360 PULLER .

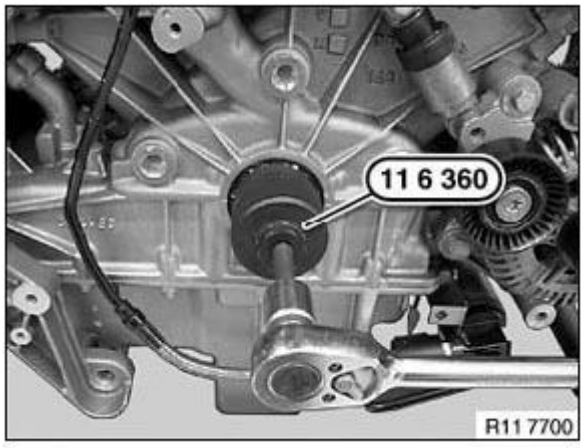


Fig. 89: Inserting Special Tool (11 6 360) Into Radial Shaft Seal
Courtesy of BMW OF NORTH AMERICA, INC.

Remove remnants of sealant from sealant outlet (1) on left and right.

Apply Drei Bond sealant (refer to Electronic Parts Catalogue) to sealant outlet (1) on left and right.

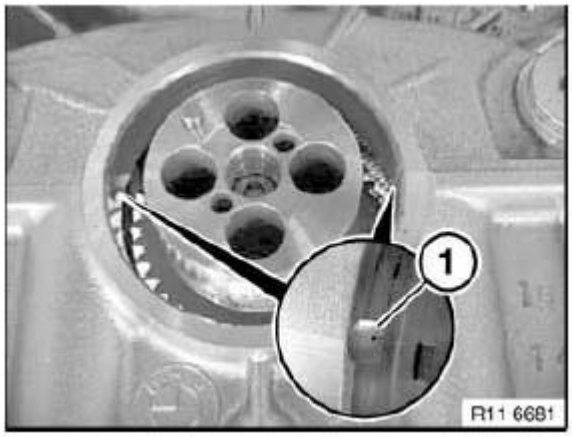


Fig. 90: Identifying Sealant Outlet
Courtesy of BMW OF NORTH AMERICA, INC.

Secure special tool 11 5 331 with bolts (1).

IMPORTANT: Pay attention to dowel pin.

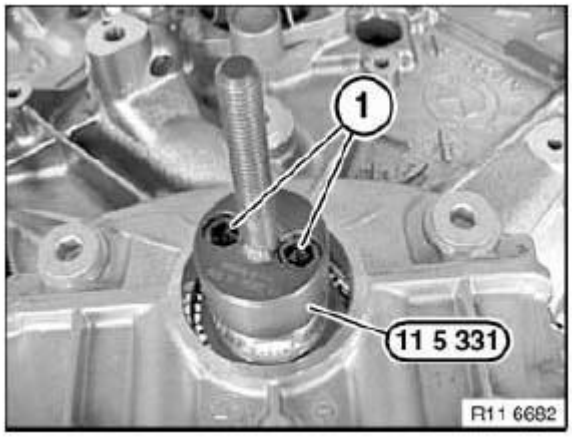


Fig. 91: Securing Special Tool (11 5 331) With Bolts
Courtesy of BMW OF NORTH AMERICA, INC.

Push special tool 11 7 231 onto special tool 11 5 331 in direction of arrow.

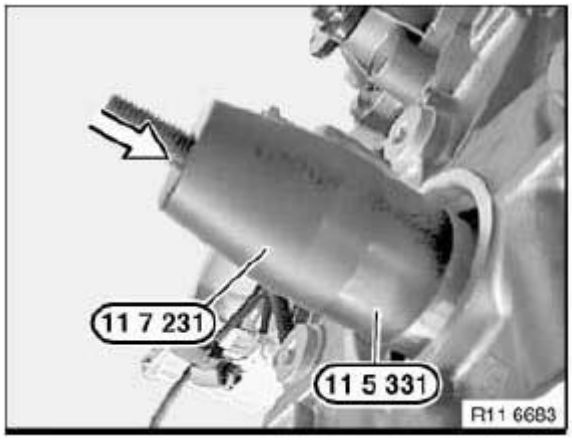


Fig. 92: Pushing Special Tool (11 7 231) Onto Special Tool (11 5 331)
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Remove support ring from shaft seal.

Push radial shaft seal (1) uniformly by way of fitting aid 11 7 231 onto special tool 11 5 331.

Position shaft seal approx. 5 mm before crankcase.

Remove special tool 11 7 231.

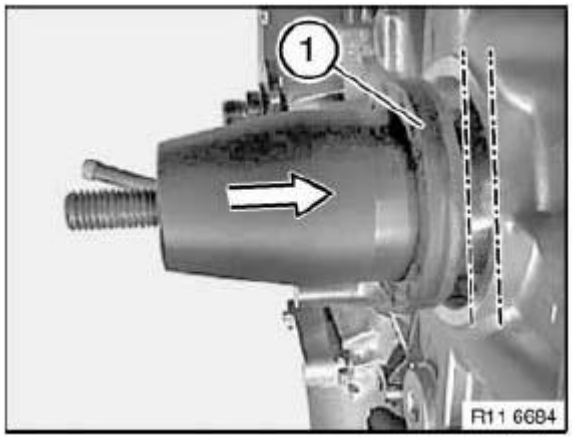


Fig. 93: Pushing Radial Shaft Seal
Courtesy of BMW OF NORTH AMERICA, INC.

Press in radial shaft seal (1) with special tools 11 5 332 and 11 5 333.

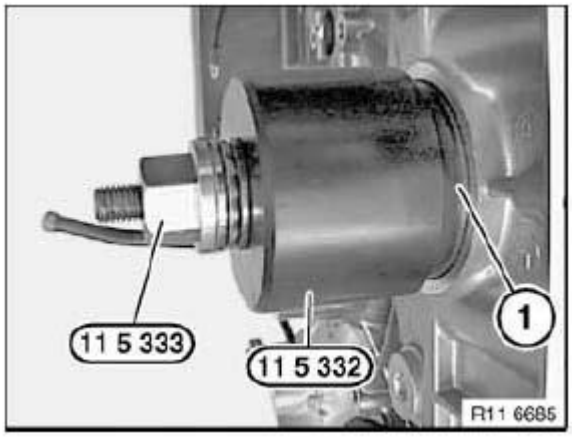


Fig. 94: Pressing Radial Shaft Seal
Courtesy of BMW OF NORTH AMERICA, INC.

Assemble engine.

Setting time of shaft seal approx. 1 hour.

CORRECT engine oil level if necessary.

CRANKSHAFT WITH BEARING

11 21 531 REPLACING ALL CRANKSHAFT MAIN BEARINGS (S65)

IMPORTANT:

1. **Repair crankcase worn St.0 or 1/crankshaft worn St.0.**

   If the bearing channel is opened and closed again after engine operation, all main bearing shells must be replaced with special repair bearing shells.

   Altered settling behavior at the crankcase.

   Repair bearing shells are marked with an (R) on their backs.

2. **Repair crankcase worn St.0 or 1/crankshaft new St.0.**

   Repair bearing shells marked with (R) must be used.

   The crankshaft comes as a set together with the bearing shells. The bearing shells for the bedplate are provided in accordance with the crankshaft classification. For the crankcase bearing shells, the green bearing shells are always provided. The half classification is retained.

3. **Repair crankcase new St.0 or 1/crankshaft worn St.0.**

The bearing shells also designated for initial installation must be used.

The crankcase comes as a set together with the bearing shells. The bearing shells for the crankcase are provided in accordance with the crankcase classification. For the bedplate, the green bearing shells are always provided. The half classification is retained.

4. **Repair crankcase new St.0 or 1/crankshaft new St.0.**

   The bearing shells also designated for initial installation must be used.

   The bearing shells provided with the crankcase must be used.

   The crankcase comes as a set together with the bearing shells. The bearing shells for the crankcase are provided in accordance with the crankcase classification. For the bedplate, the green bearing shells are always provided. The half classification is retained.

Necessary preliminary tasks:

- **ENGINE** removed
- Remove **CRANKSHAFT** .

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).

Determine bearing play with special tool **002590 MEASUREMENT AID** .

Insert crankshaft without engine oil, bolt crankcase upper and lower sections together.

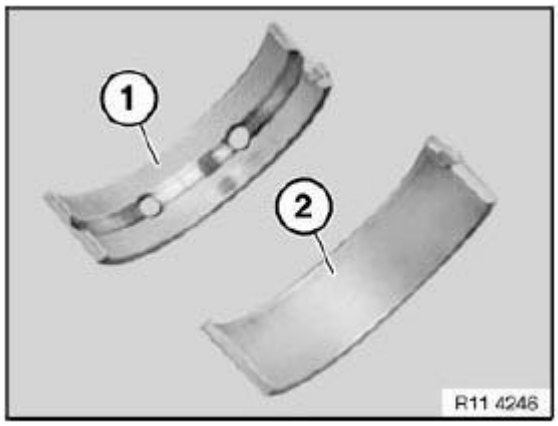


Fig. 95: Identifying Bearing Shells

Courtesy of BMW OF NORTH AMERICA, INC.

Lay plastic thread (Plastigage) on crankshaft.

Fit crankcase upper section on lower section and bolt together.

NOTE: Do not twist crankshaft.

Remove crankshaft.

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

Crankshaft bearing clearance **radial** See **CRANKSHAFT AND BEARINGS S65** or **CRANKSHAFT AND BEARINGS S65** .

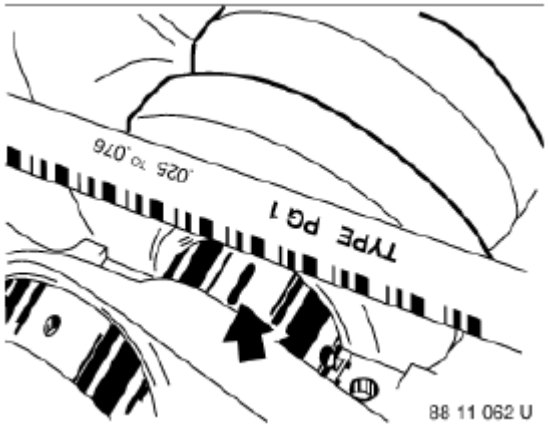


Fig. 96: Reading Bearing Play At Width Of Flattened Plastic Thread
Courtesy of BMW OF NORTH AMERICA, INC.

Crankcase upper half

Installation:

Bearing shell (2) is a guide bearing.

Pay attention to guide lugs on bearing shells (see arrow).

Remove all bearing shells with lubricant groove.

Observe **bearing classification** See **CRANKSHAFT AND BEARINGS S65** or **CRANKSHAFT AND BEARINGS S65** .

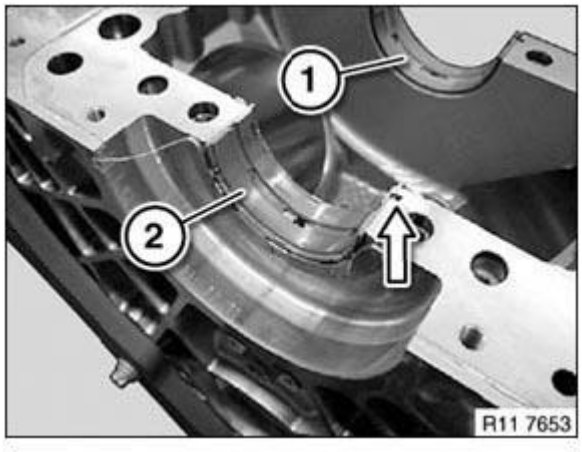


Fig. 97: Identifying Crankcase Upper Half Guide Lugs Position
Courtesy of BMW OF NORTH AMERICA, INC.

Crankcase lower half

Installation:

Bearing shell (2) is a guide bearing.

Pay attention to guide lugs on bearing shells (see arrow).

Remove all bearing shells without lubricant groove.

Observe **bearing classification** See **CRANKSHAFT AND BEARINGS S65** or **CRANKSHAFT AND BEARINGS S65** .

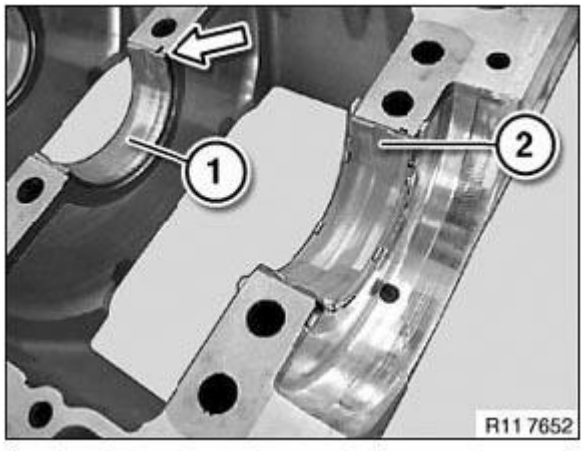


Fig. 98: Identifying Crankcase Lower Half Guide Lugs Position
Courtesy of BMW OF NORTH AMERICA, INC.

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

Insert bearing shells (2) without lubricant groove.

Insert guide bearing (3) without lubricant groove on bearing seat 5.

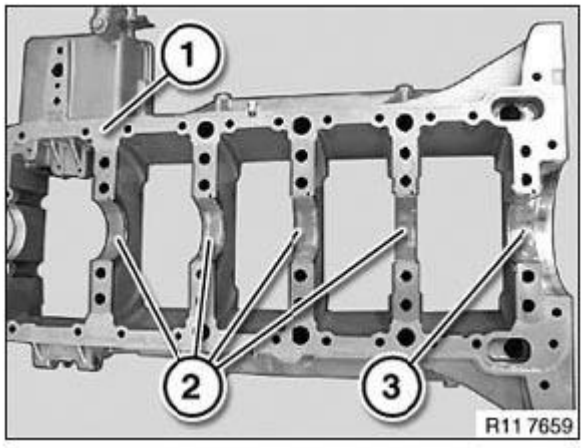


Fig. 99: Identifying Sealing Face, Bearing Shells And Guide Bearing
Courtesy of BMW OF NORTH AMERICA, INC.

Release screws (1).

Remove oil nozzle (2) towards top.

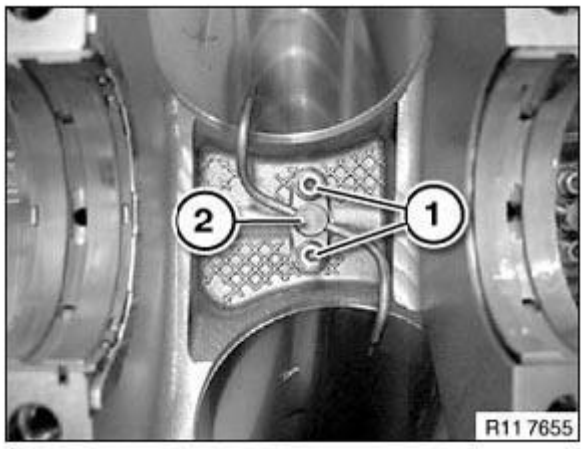


Fig. 100: Identifying Oil Nozzle And Screws
Courtesy of BMW OF NORTH AMERICA, INC.

Bearing classification on bedplate bearing seat.

Observe color allocation on crankshaft (1 to 5).

V = Violet.

G = Green.

Y = Yellow.

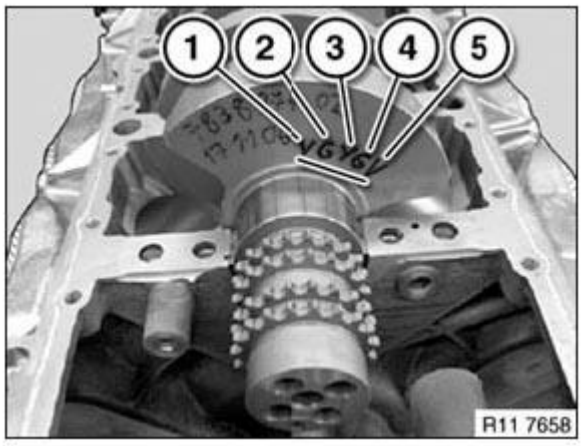


Fig. 101: Identifying Bearing Classification On Bedplate Bearing Seat
Courtesy of BMW OF NORTH AMERICA, INC.

Bearing classification on crankcase bearing seat.

Observe color allocation in crankcase (1 to 5).

V = Violet.

G = Green.

Y = Yellow.

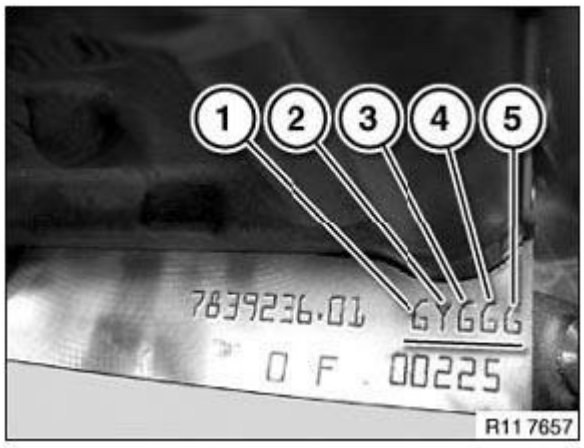


Fig. 102: Identifying Bearing Classification On Crankcase Bearing Seat
Courtesy of BMW OF NORTH AMERICA, INC.

Assemble engine.

11 21 500 REPLACING CRANKSHAFT (S65)

IMPORTANT: Unscrew all M9 fit bolts first before releasing the crankshaft lower section. Altered settling behavior at the crankcase!
If the main bearing channel is opened after engine operation, all main bearing shells must be replaced with special repair bearing shells marked with an (R). There are two different groups of main bearing shells.

Necessary preliminary tasks:

- Remove **ENGINE** .
- Mount engine on assembly stand **Mounting engine on assembly stand (S65)** .
- Remove **FLYWHEEL** .
- Removing **OIL SUMP** .
- Remove **ENGINE OIL PUMP** .
- Remove **OIL RETURN PUMP** .
- Remove **cylinder head** See **LEFT CYLINDER HEAD (S65)** or **RIGHT CYLINDER HEAD (S65)** on left and right.
- Remove all **PISTONS** .
- Remove **VIBRATION DAMPER** .
- Remove both **TIMING CHAINS** .

IMPORTANT: Unscrew all M9 fit bolts (2) first before releasing the crankshaft lower section - risk of damage!

Bearing seat bolts (1) M11.

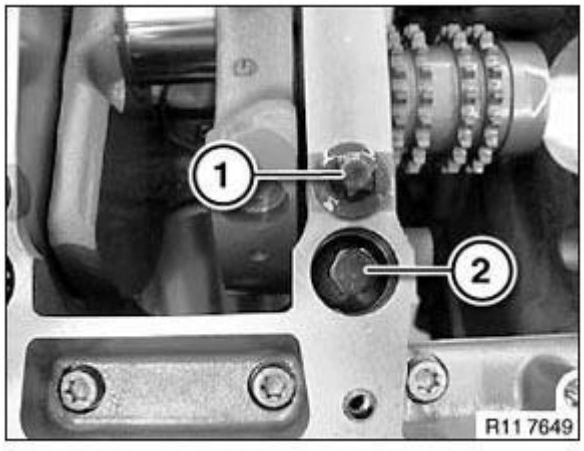


Fig. 103: Identifying Bearing Seat And M9 Fit Bolts
Courtesy of BMW OF NORTH AMERICA, INC.

IMPORTANT: Release all M9 fit bolts and remove.

Release fit bolts (M9) in sequence 1-10 and remove.

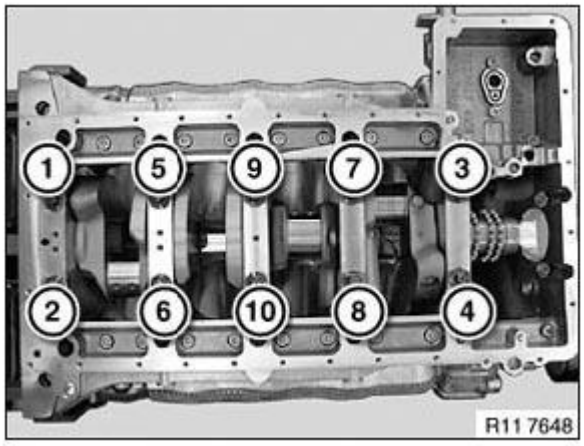


Fig. 104: Identifying M9 Fit Bolts Removal Sequence
Courtesy of BMW OF NORTH AMERICA, INC.

Release bearing seat bolts M11 in sequence 1-10.

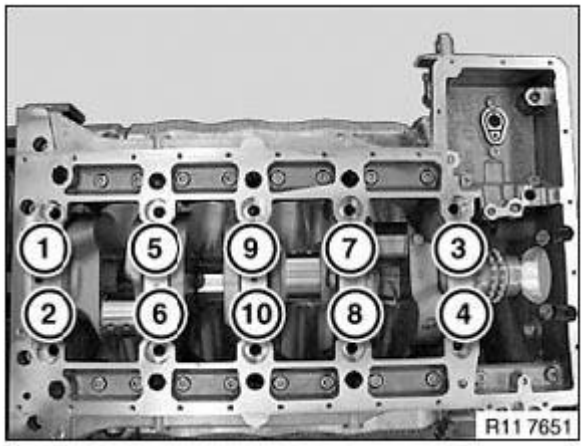


Fig. 105: Identifying M11 Bearing Seat Bolts Removal Sequence
Courtesy of BMW OF NORTH AMERICA, INC.

Release screws (3).

Unfasten screws (2).

Bolts (1) from inside outwards.

Lift out bedplate.

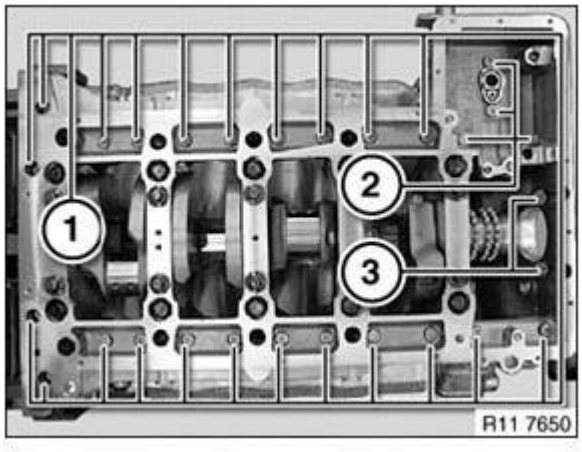


Fig. 106: Identifying Bedplate Screws
Courtesy of BMW OF NORTH AMERICA, INC.

Lever out crankshaft (1) with aid of a second person in direction of arrow.

NOTE: Weight of crankshaft approx. 22 kg.

Picture shows S85.

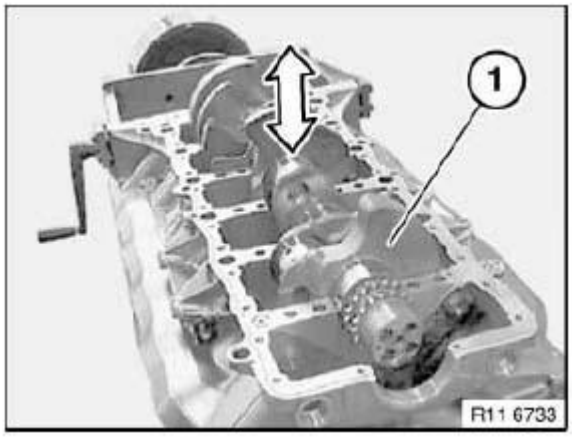


Fig. 107: Levering Out Crankshaft
Courtesy of BMW OF NORTH AMERICA, INC.

IMPORTANT: If the lower crankcase section (bedplate) is opened and closed again, fit special main bearing shells marked with (R) on the bearing backs.

Replace all bearing shells (2).

Replace guide bearing (3).

Installation:

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

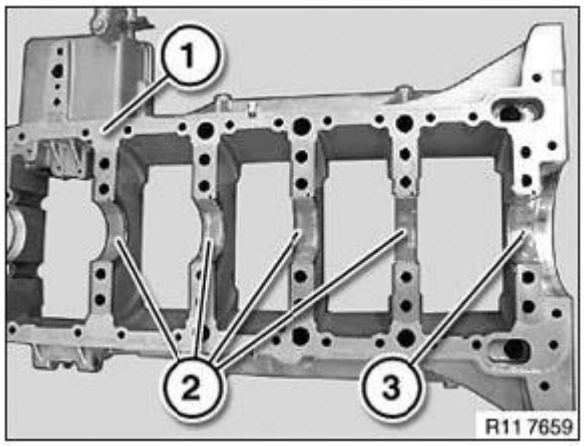


Fig. 108: Identifying Sealing Face, Bearing Shells And Guide Bearing
Courtesy of BMW OF NORTH AMERICA, INC.

Remove sealing compound from joint (1).

Carefully clean threads and contact surfaces in upper and lower sections of crankcase.

Installation:

Replace injector nozzles (2).

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

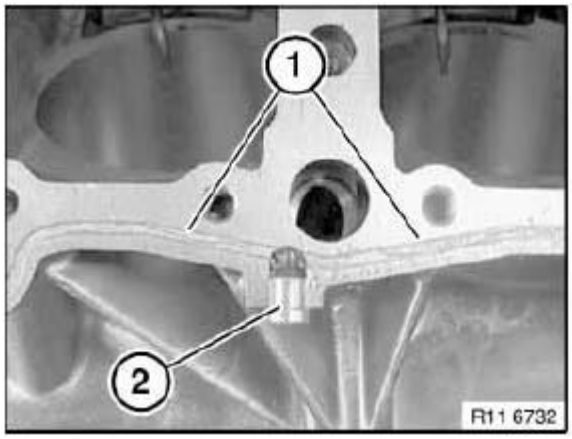


Fig. 109: Identifying Sealing Surface And Injector Nozzles
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Replace main bearing shells.

Apply a light coating of engine oil to bearing shells.

Lay crankshaft (1) with a second person helping in direction of arrow into crankcase.

NOTE: Weight of crankshaft approx. 22 kg.

Picture shows S85.

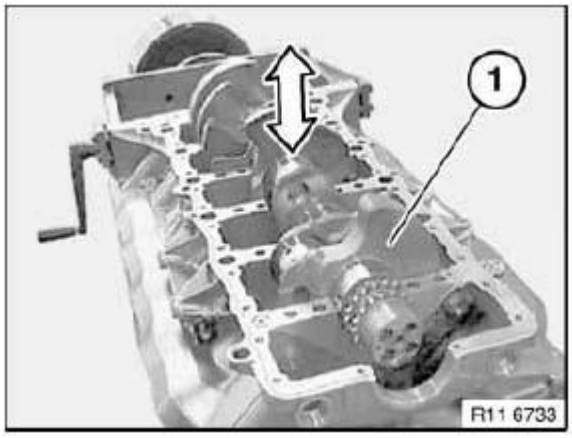


Fig. 110: Laying Crankshaft
Courtesy of BMW OF NORTH AMERICA, INC.

Insert seal (1).

IMPORTANT: Make sure oil bore is clean.

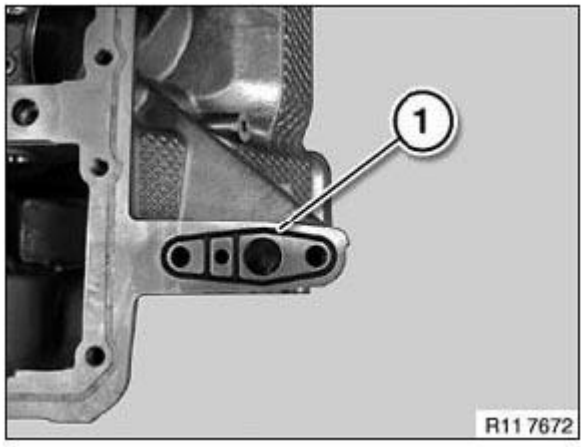


Fig. 111: Identifying Seal
Courtesy of BMW OF NORTH AMERICA, INC.

IMPORTANT: Adhere without fail to the specified sequence of bedplate bolt connections. Risk of damage to crankshaft.

Leaks at bedplate/crankcase.

IMPORTANT: There are no more fitting sleeves in the crankcase.
Do not use new bolts.
If new bolts are used, observe special tightening/torque specifications.

Fit lower crankcase section (bedplate) on crankcase.

Position lower section diagonally on bearing seats (1 and 5) using two fit bolts (1 and 2).

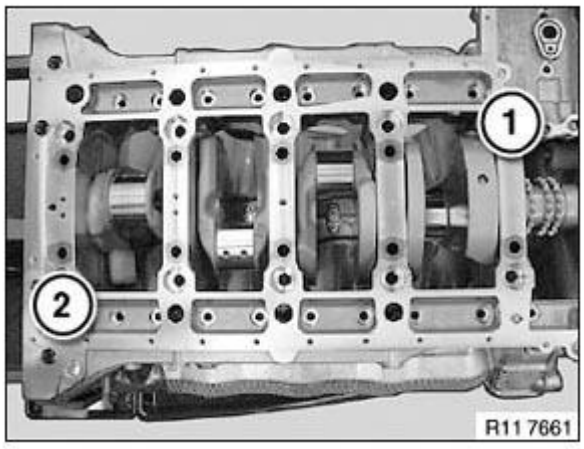


Fig. 112: Identifying Crankshaft Fit Bolts
Courtesy of BMW OF NORTH AMERICA, INC.

Join fit bolts (1 and 2) to **8 Nm.**

Insert fit bolts (1-8).

Join fit bolts (1-8) to **8 Nm.**

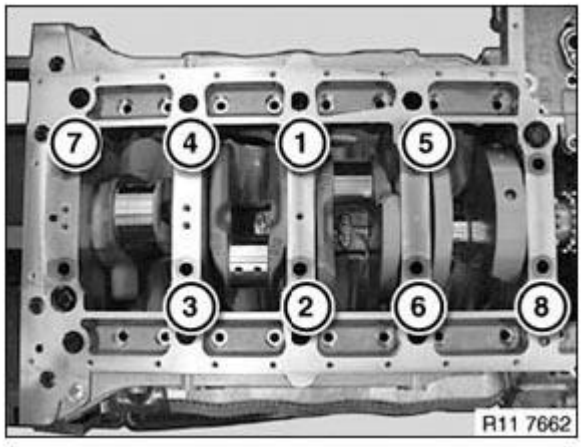


Fig. 113: Identifying Crankshaft Bolt Tightening Sequence

Courtesy of BMW OF NORTH AMERICA, INC.

Insert all M11 bolts (1).

Join bearing seat bolts in sequence (1- -10) to **30 Nm.**

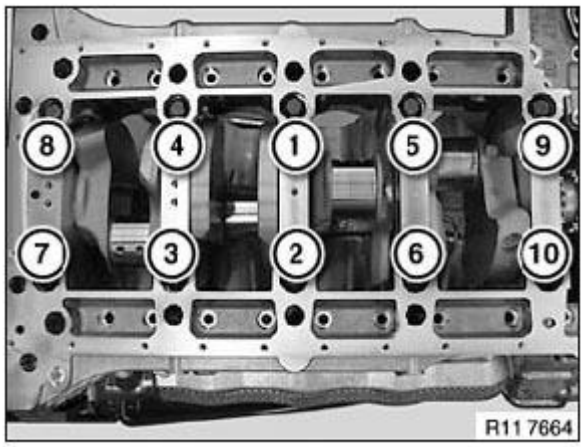


Fig. 114: Identifying M11 Bearing Seat Bolts
Courtesy of BMW OF NORTH AMERICA, INC.

Mark all M11 bearing seat bolts with a colored line (1).

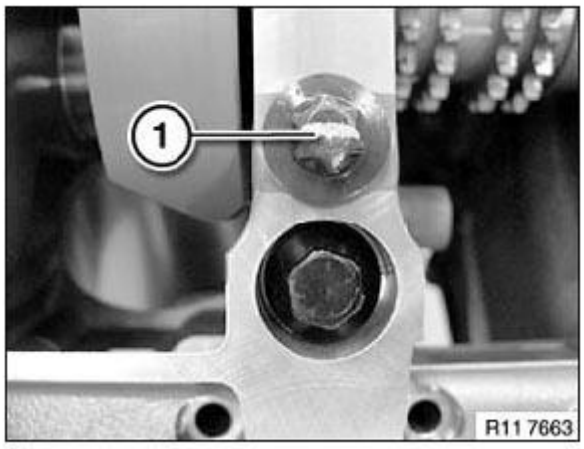


Fig. 115: Identifying M11 Bearing Seat Bolts Mark
Courtesy of BMW OF NORTH AMERICA, INC.

Secure bearing seat bolts M11 with special tools **00 9 120 TORQUE ANGLE MEASURING DIAL** and **00 9 130** .

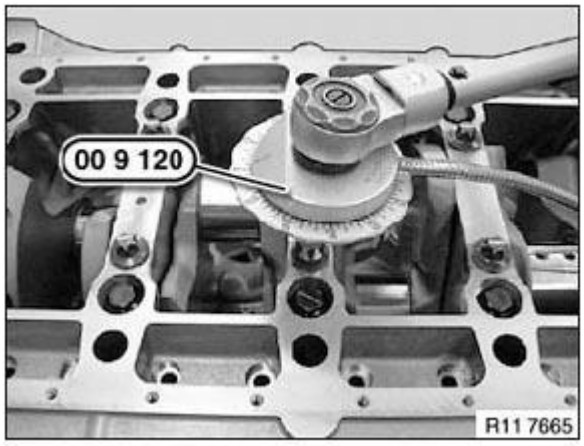


Fig. 116: Securing M11 Bearing Seat Bolts With Special Tools (00 9 120)
Courtesy of BMW OF NORTH AMERICA, INC.

Tighten M11 bolts to **130° angle of rotation.**

IMPORTANT: Observe bolting sequence when using new bolts.

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

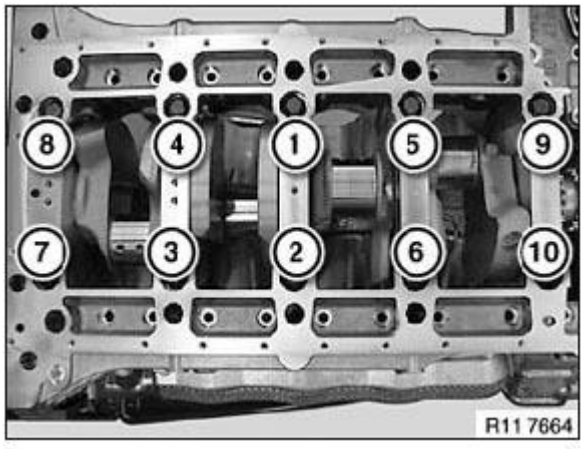


Fig. 117: Identifying M11 Bolts Tightening Sequence
Courtesy of BMW OF NORTH AMERICA, INC.

Join all fitting bolts in sequence 1 to 10 to **15 Nm.**

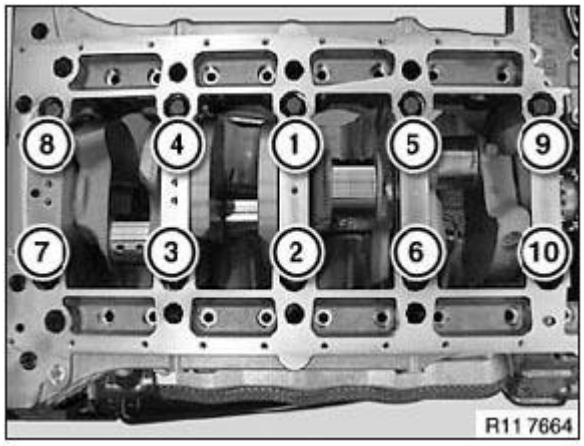


Fig. 118: Identifying Fitting Bolts Tightening Sequence
Courtesy of BMW OF NORTH AMERICA, INC.

Mark all fit bolts with a colored line (1).

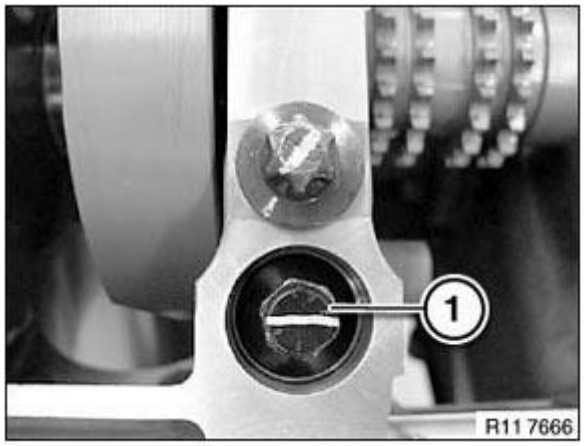


Fig. 119: Identifying Seat Bolt Mark
Courtesy of BMW OF NORTH AMERICA, INC.

Tighten fit bolts with special tools **00 9 120 TORQUE ANGLE MEASURING DIAL** and **00 9 130** .

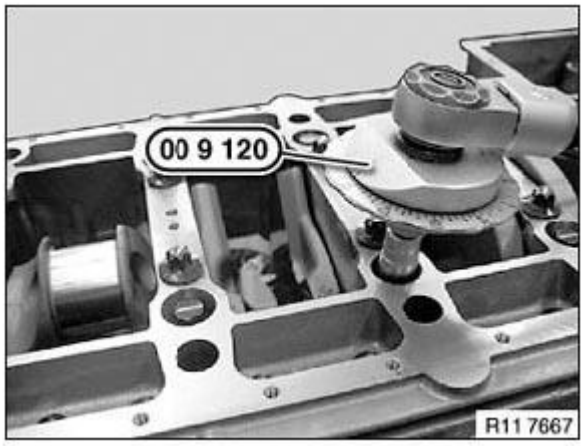


Fig. 120: Tightening Fit Bolts With Special Tools (00 9 120)
Courtesy of BMW OF NORTH AMERICA, INC.

Secure all fit bolts (1-10) to **130° angle of rotation.**

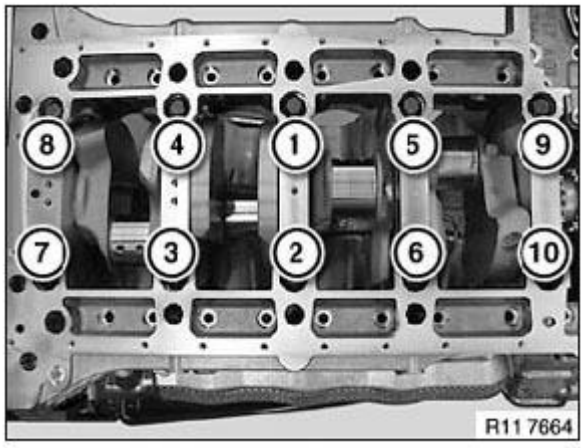


Fig. 121: Identifying Fitting Bolts Tightening Sequence
Courtesy of BMW OF NORTH AMERICA, INC.

Insert bolts (1).

Insert bolts (2).

Insert bolts (3).

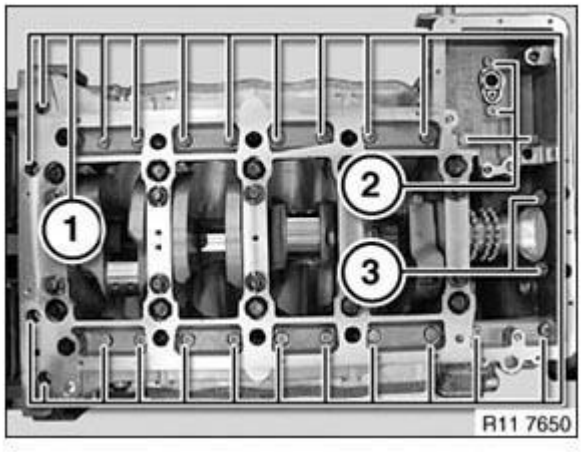


Fig. 122: Identifying Bolts
Courtesy of BMW OF NORTH AMERICA, INC.

Secure bolts (1) M8x65 (22 x) with special tools **00 9 120 TORQUE ANGLE MEASURING DIAL** and **00 9 130** .

Tightening torque, see 11 11 3 AZ in **11 11 ENGINE BLOCK** .

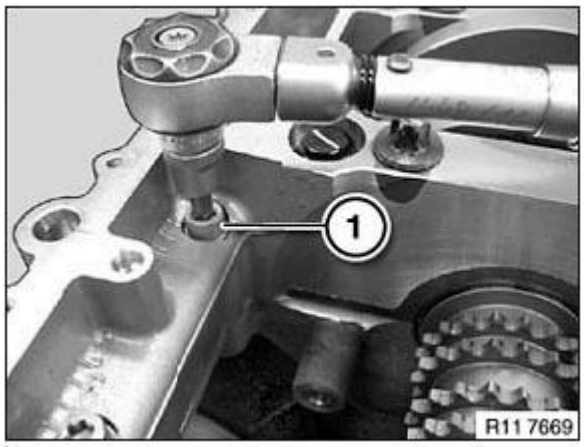


Fig. 123: Securing M8x65 (22 x) Bolts With Special Tools
Courtesy of BMW OF NORTH AMERICA, INC.

Secure bolts (1) M8x40 (4 x) with special tools **00 9 120 TORQUE ANGLE MEASURING DIAL** and **00 9 130** .

Tightening torque, see 11 11 4 AZ in **11 11 ENGINE BLOCK** .

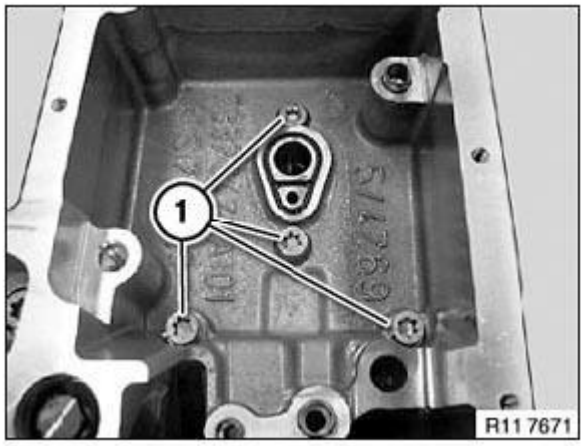


Fig. 124: Securing M8x40 (4 x) Bolts With Special Tools
Courtesy of BMW OF NORTH AMERICA, INC.

Secure bolts (1) M6x30 (2 x).

Tightening torque, see 11 11 5 AZ in **11 11 ENGINE BLOCK** .

Installation:

Insert timing chains.

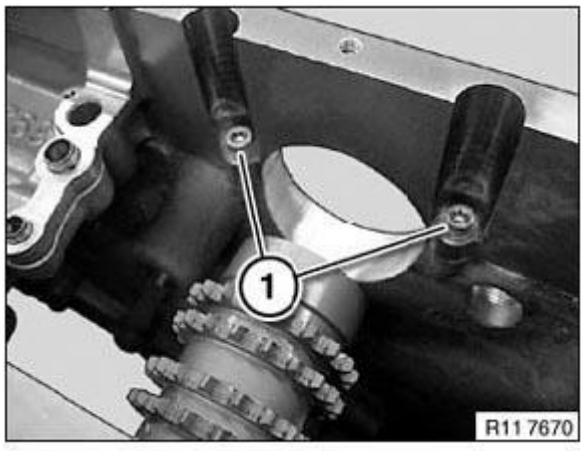


Fig. 125: Identifying M6x30 (2 x) Bolts
Courtesy of BMW OF NORTH AMERICA, INC.

Insert gear (2) for oil pump drive.

Tighten bolt (1).

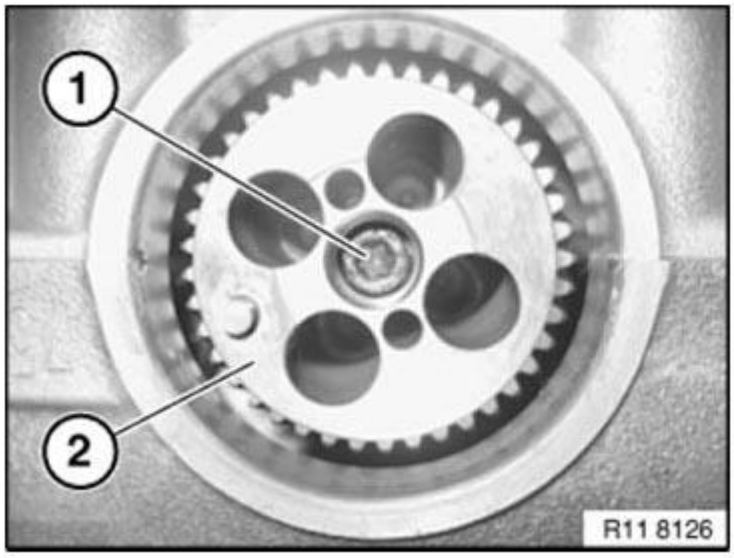


Fig. 126: Identifying Oil Pump Drive Gear And Bolt
Courtesy of BMW OF NORTH AMERICA, INC.

Secure special tool 11 5 331 with bolts (1).

IMPORTANT: Pay attention to dowel pin.

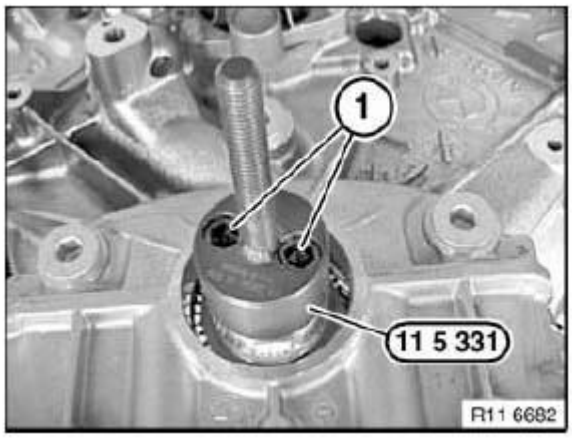


Fig. 127: Securing Special Tool (11 5 331) With Bolts
Courtesy of BMW OF NORTH AMERICA, INC.

Push special tool 11 7 231 onto special tool 11 5 331 in direction of arrow.

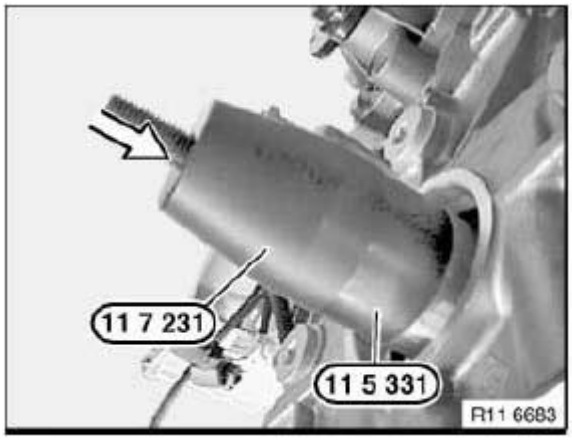


Fig. 128: Pushing Special Tool (11 7 231) Onto Special Tool (11 5 331)
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Remove support ring from shaft seal.

Push radial shaft seal (1) uniformly by way of fitting aid 11 7 231 onto special tool 11 5 331.

Position shaft seal approx. 5 mm before crankcase.

Remove special tool 11 7 231.

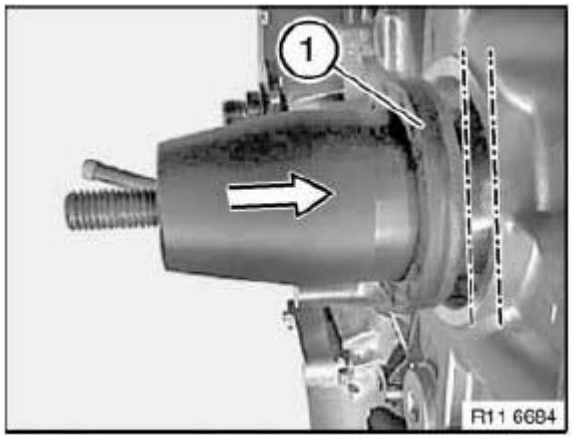


Fig. 129: Pushing Radial Shaft Seal
Courtesy of BMW OF NORTH AMERICA, INC.

Press in radial shaft seal (1) with special tools 11 5 332 and 11 5 333.

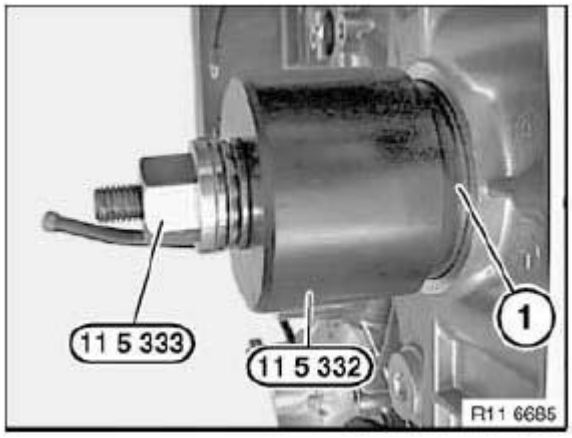


Fig. 130: Pressing Radial Shaft Seal
Courtesy of BMW OF NORTH AMERICA, INC.

IMPORTANT: Pay attention to fitting sleeve.
Special tool 11 5 311 must rest flat on crankshaft (pay attention to fitting sleeve).

Install special tool 11 5 311 with bolts (1).

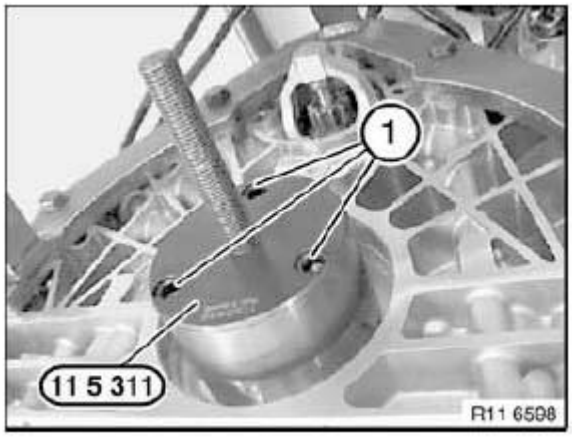


Fig. 131: Installing Special Tool (11 5 311) With Bolts
Courtesy of BMW OF NORTH AMERICA, INC.

Position support ring (1) with radial shaft seal (2) on special tool 11 5 311.

Push radial shaft seal (2) uniformly in direction of arrow over support ring onto special tool 11 5 311.

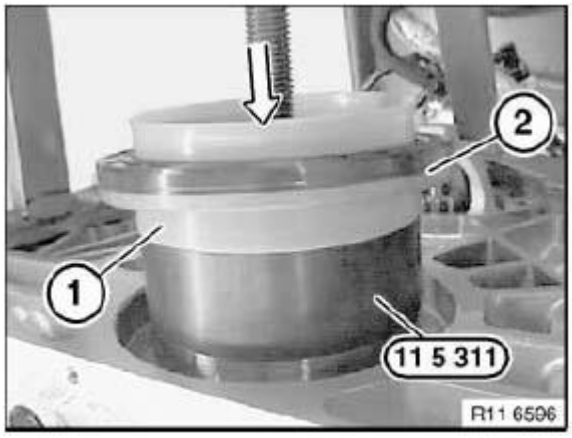


Fig. 132: Pushing Radial Shaft Seal
Courtesy of BMW OF NORTH AMERICA, INC.

Position shaft seal (1) approx. 5 mm before crankcase.

Remove support ring (2).

NOTE: Support ring (2) is no longer needed.

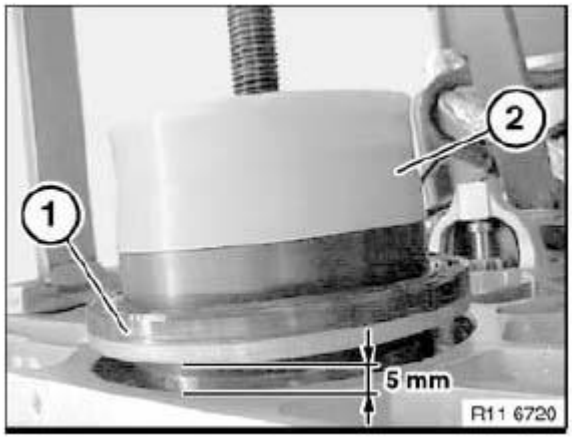


Fig. 133: Identifying Shaft Seal Position
Courtesy of BMW OF NORTH AMERICA, INC.

Press in radial shaft seal (1) with special tools 11 5 312 and 11 5 313.

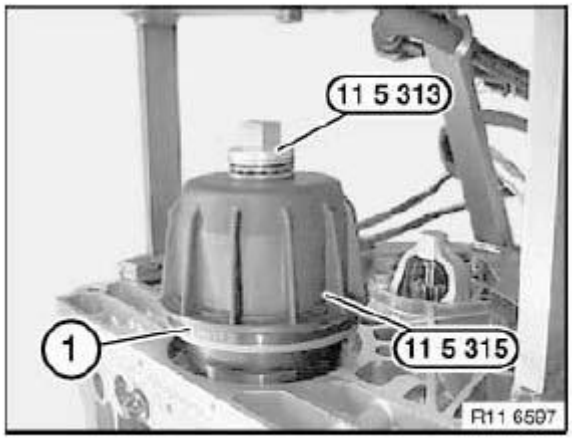


Fig. 134: Pressing Radial Shaft Seal
Courtesy of BMW OF NORTH AMERICA, INC.

Drive both injector nozzles with special tool 11 9 360 on left and right into crankcase.

Installation:

Always replace injector nozzles.

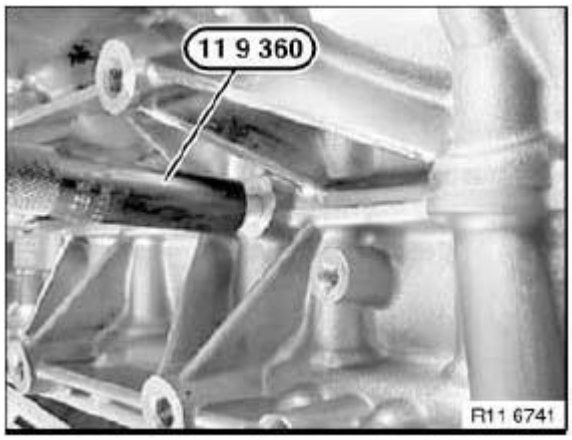


Fig. 135: Driving Injector Nozzles With Special Tool (11 9 360)
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Use **PRIMER 1.5 AND LIQUID SEALING COMPOUND 1.6** .

Prepare liquid sealing compound (2) in special tool 11 4 370.

Screw on nozzle (1) for injecting liquid sealing compound.

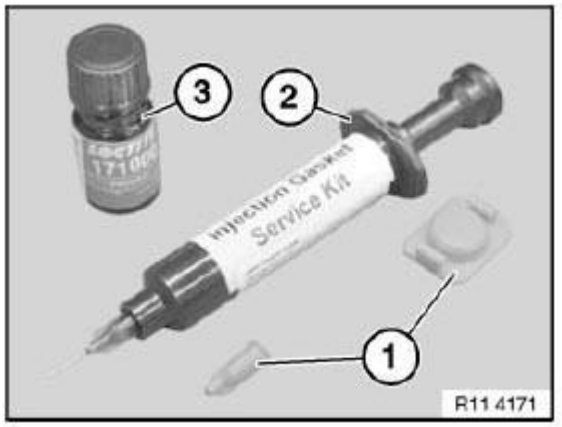


Fig. 136: Identifying Nozzle And Liquid Sealing Compound
Courtesy of BMW OF NORTH AMERICA, INC.

Press sealing compound nozzle in direction of arrow onto nozzle at 90°.

Slowly and evenly insert liquid sealing compound (1) with special tool 11 4 370 in direction of arrow.

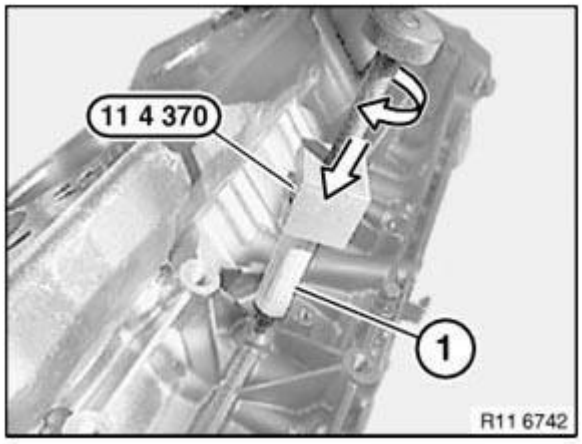


Fig. 137: Inserting Liquid Sealing Compound Using Special Tool (11 4 370)
Courtesy of BMW OF NORTH AMERICA, INC.

Stop (seal off) escaping liquid sealing compound with **PRIMER (2) 1.5** at outlet bore (1).

The procedure is identical as on the rear radial shaft seal.

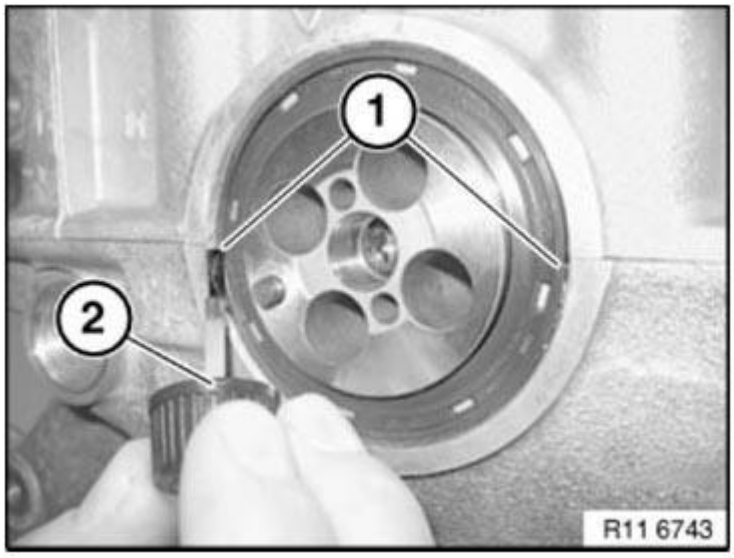


Fig. 138: Applying Liquid Sealing Compound At Outlet Bore
Courtesy of BMW OF NORTH AMERICA, INC.

Assemble engine.

11 21 571 REPLACING GROOVED BALL BEARINGS IN CRANKSHAFT (S65)

Necessary preliminary tasks:

- Remove **CLUTCH** .

Remove grooved ball bearing with special tool 11 2 340 in conjunction with special tool 11 2 016.

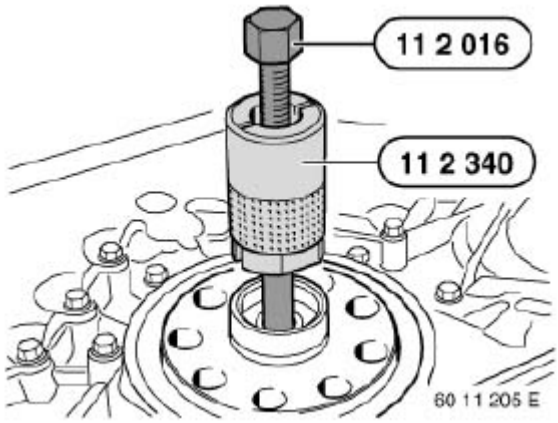


Fig. 139: Removing Grooved Ball Bearing With Special Tool (11 2 340)
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Replace guide bearing.

Drive in guide bearing as far as it will go with special tools 11 2 350 and **005500 MANDREL** .

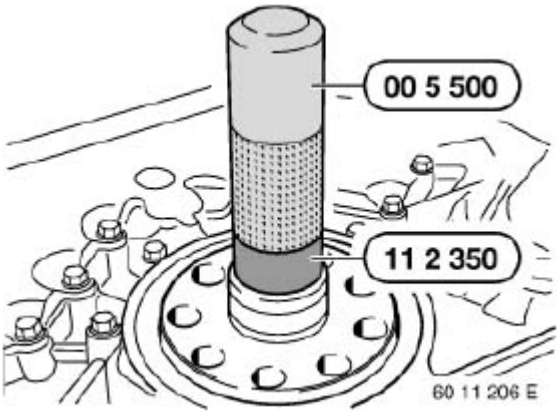


Fig. 140: Driving Guide Bearing
Courtesy of BMW OF NORTH AMERICA, INC.

Assemble engine.

FLYWHEEL

11 22 500 REMOVING AND INSTALLING/REPLACING FLYWHEEL (S65)

Necessary preliminary tasks:

- Remove **TRANSMISSION** .
- Remove **CLUTCH** .

Secure flywheel (1) with special tools 11 9 263 and **11 9 260 HOLDER** .

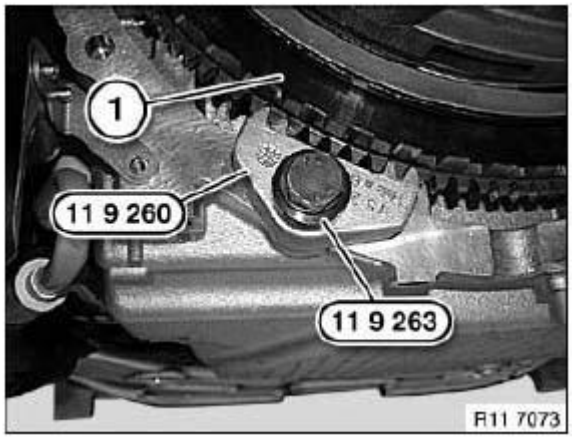


Fig. 141: Securing Flywheel Using Special Tools (11 9 263 And 11 9 260)

Courtesy of BMW OF NORTH AMERICA, INC.

Release flywheel screws with special tool 11 4 180.

Tightening torque: **11 22 1AZ** .

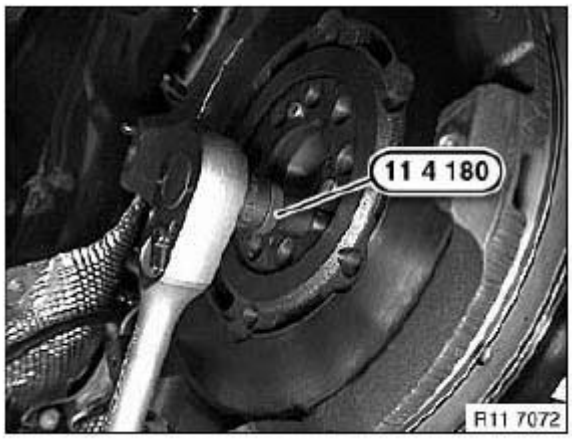


Fig. 142: Removing Flywheel Screws Using Special Tool (11 4 180)
Courtesy of BMW OF NORTH AMERICA, INC.

Assemble engine.

11 22 513 REPLACING ROLLER BEARING FOR DUAL-MASS FLYWHEEL

NOTE: Flywheel removed!

Position special tool 11 2 010 in roller bearing.

Twist out roller bearing with special tool 11 2 343.

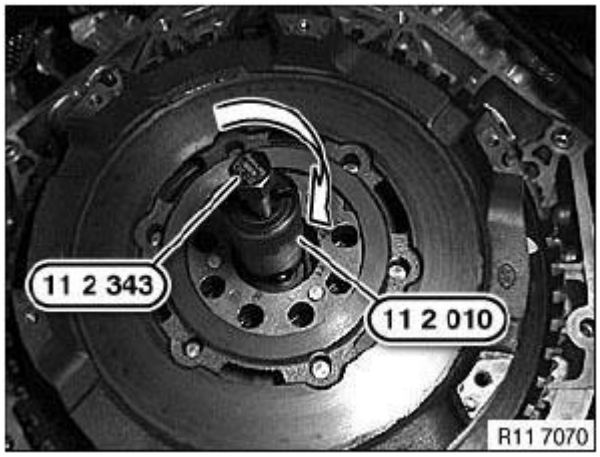


Fig. 143: Removing Roller Bearing Using Special Tool (11 2 343)

Courtesy of BMW OF NORTH AMERICA, INC.

Assemble special tools 11 2 350 and **005500 MANDREL** .

Drive in roller bearing with special tools 11 2 350 and **005500 MANDREL** in direction of arrow as far as it will go.

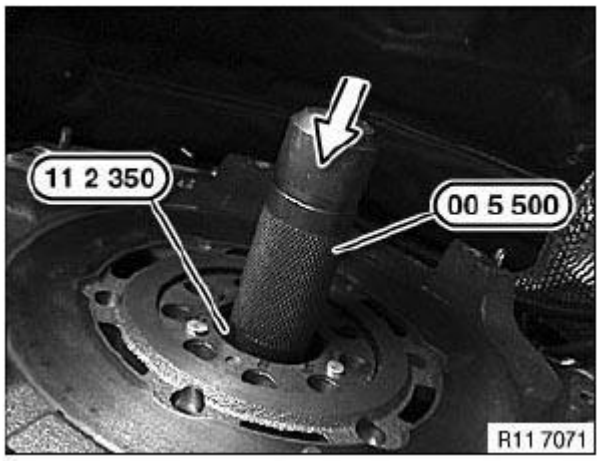


Fig. 144: Driving Roller Bearing Using Special Tools (11 2 350 And 00 5 500)
Courtesy of BMW OF NORTH AMERICA, INC.

Assemble engine.

VIBRATION DAMPER

11 23 010 REMOVING AND INSTALLING/REPLACING VIBRATION DAMPER (S65)

Necessary preliminary tasks:

- Remove **FAN COWL WITH ELECTRIC FAN** .
- Remove A/C compressor **DRIVE BELT** .
- Remove alternator **DRIVE BELT** .

Release screws (1).

Remove cover (2) with belt pulley (3).

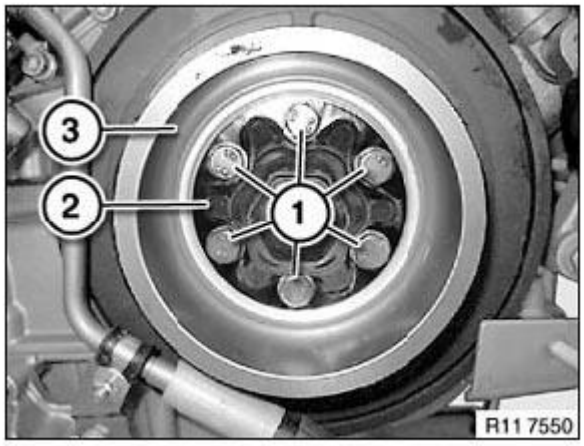


Fig. 145: Identifying Cover, Belt Pulley And Screws
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: Engine or transmission removed.

Secure special tool **119260 HOLDER** to flywheel (1).

Screw in special tool 11 9 263 with bolt (2) on crankcase.

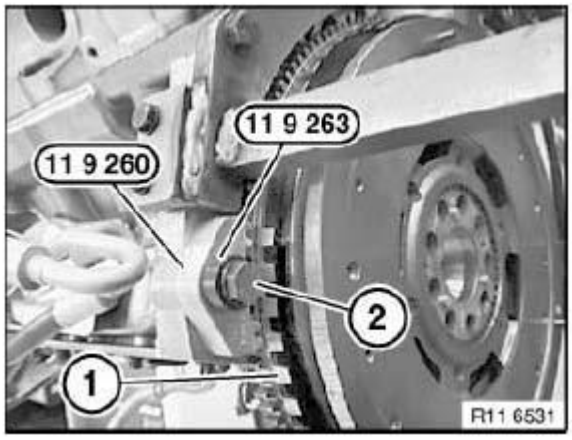


Fig. 146: Securing Special Tool (11 9 260) To Flywheel
Courtesy of BMW OF NORTH AMERICA, INC.

Release screws (2).

Remove vibration damper (1).

Tightening torque: **11 23 1AZ** .

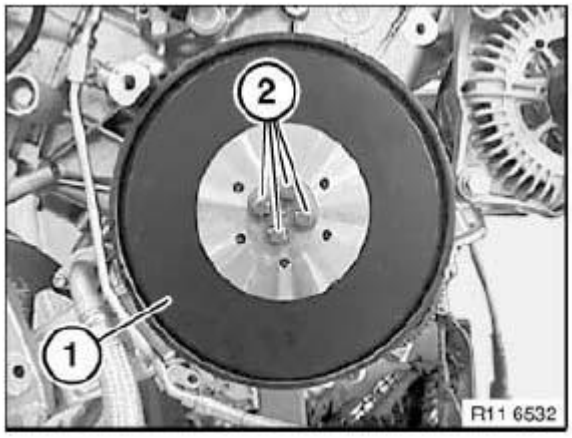


Fig. 147: Identifying Vibration Damper And Screws
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: Engine or transmission installed.

Attach special tool 11 0 280 to vibration damper.

Support special tool 11 0 280 on holder (1).

Release all anti-fatigue bolts (2).

Installation:

Replace stress bolts.

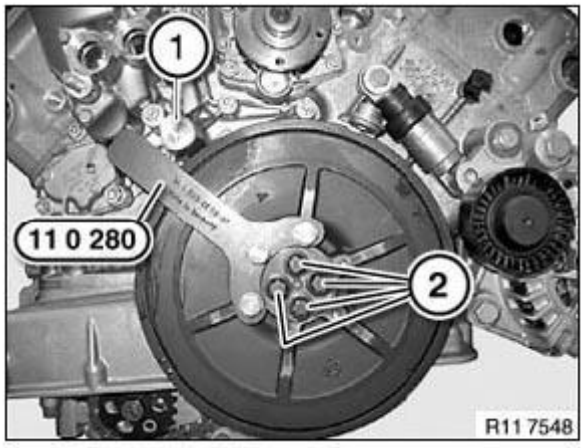


Fig. 148: Supporting Special Tool (11 0 280) On Holder
Courtesy of BMW OF NORTH AMERICA, INC.

Support special tool 11 0 280 on holder (2).

Tighten anti-fatigue bolts (1) with special tool **00 9 120 TORQUE ANGLE MEASURING DIAL** .

Tightening torque: **11 23 1AZ** .

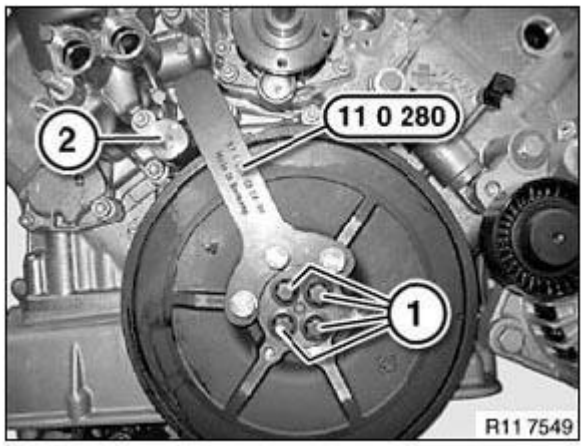


Fig. 149: Supporting Special Tool (11 0 280) On Holder
Courtesy of BMW OF NORTH AMERICA, INC.

Assemble engine.

CONNECTING ROD WITH BEARING

11 24 571 REPLACING ALL CONNECTING ROD BEARINGS (S65)

IMPORTANT: Note grinding stages on crankshaft . See TED-TED-TDMUC1121-S65-01B1S2 CRANKSHAFT AND BEARINGS S65 or TED-TED-TDMUC1121-S65-01B1S1 CRANKSHAFT AND BEARINGS S65 .

Necessary preliminary tasks:

- Remove all **PISTONS** .

Install new conrod bearing shells.

Installation:

Install one blue (1) and one red (2) bearing shell in each conrod.

Install all **PISTONS** .

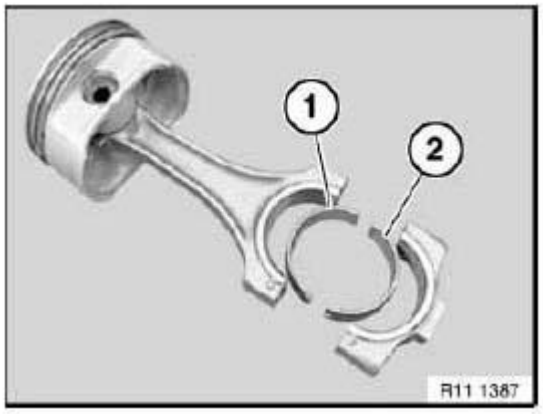


Fig. 150: Identifying Bearing Shell
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: Check connecting rod bearing clearance.

Piston in BDC position.

Place special tool 00 2 590 (Plastigage model PG 1) on oil-free crankshaft.

Place bearing caps in position, making sure that matching numbers are paired.

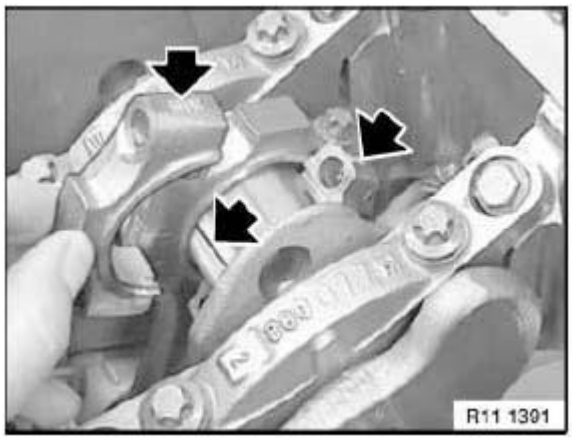


Fig. 151: Identifying Bearing Caps Position
Courtesy of BMW OF NORTH AMERICA, INC.

IMPORTANT: Do not distort connecting rods or crankshaft.

Use the old conrod bearing bolts to check conrod clearance.

Tighten down conrod bolts with special tool **00 9 120 TORQUE ANGLE MEASURING DIAL** .

Tightening torque: **11 24 1AZ** .

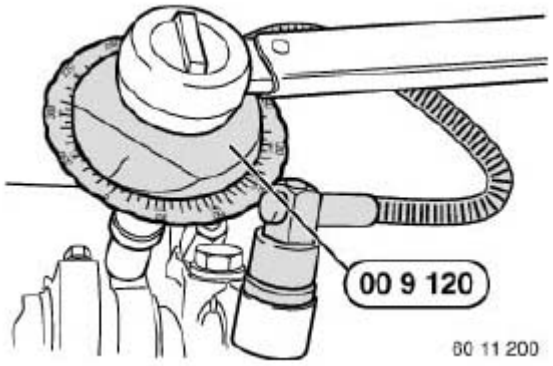


Fig. 152: Tightening Connecting Rod Bolts Using Special Tool (00 9 120)
Courtesy of BMW OF NORTH AMERICA, INC.

Remove conrod bearing cap and read off bearing clearance at width of pinched plastic thread on measuring scale.

Conrod bearing clearance: Refer to **TECHNICAL DATA** .

- Remove plastic thread.
- Lubricate crankshaft and bearing shells.
- Install new conrod bolts and tighten down.

Tightening torque: **11 24 1AZ** .

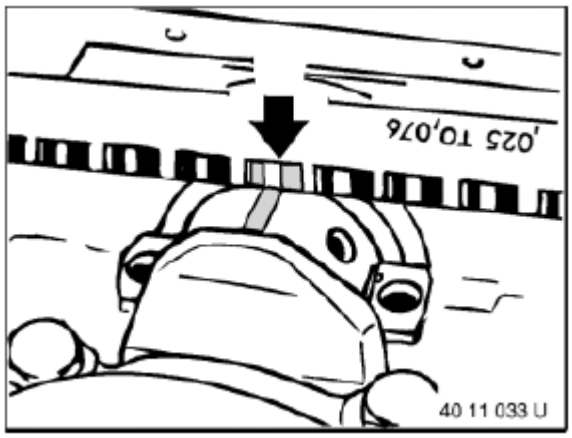


Fig. 153: Locating Bearing Clearance At Width Of Crushed Plastic Thread (Plastigage)
Courtesy of BMW OF NORTH AMERICA, INC.

Assemble engine.

PISTON WITH RINGS AND PIN

11 25 530 REMOVING AND INSTALLING/REPLACING ALL PISTONS (S65)

WARNING: Safety goggles must be worn when working on the gudgeon pin circlip.

IMPORTANT: If pistons, connecting rods and bearing shells are reused, they must be reinstalled in the same places.
Piston and piston pin are matched to each other and can only be replaced as a pair.
Connecting rod and connecting rod bearing cap are cracked.
Identification is effected by means of identical pairing letters on the connecting rod big end.
Mixing up the components will result in engine damage.
Setting of special tool 11 5 343 must not be altered.

Necessary preliminary tasks:

- Remove **ENGINE** .
- Mount engine on **assembly stand (S65)** .
- Remove **INTAKE AIR MANIFOLD** .
- Remove **cylinder head on left and right** . See **1112105 REMOVING AND INSTALLING LEFT CYLINDER HEAD (S65)** or **1112106 REMOVING AND INSTALLING RIGHT CYLINDER HEAD (S65)**.
- Remove **ENGINE OIL SUMP** .
- Remove **OIL PUMP** .
- Remove **OIL SUCTION PUMP** .

IMPORTANT: Do not bend oil nozzle (2) at outlets.

It is not possible to adjust the nozzles.

Oil nozzle (2) must be replaced if it is maladjusted or bent.

NOTE: Graphic shows crankshaft removed.

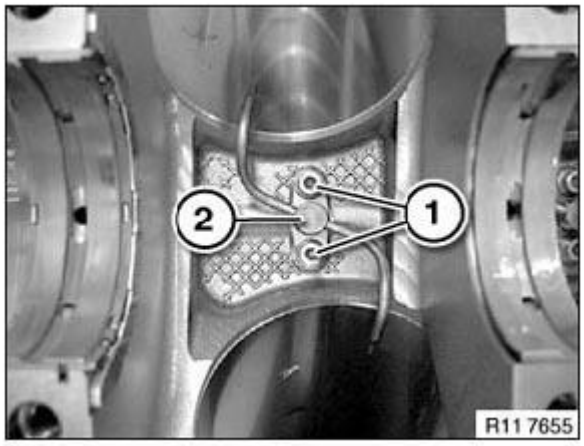


Fig. 154: Identifying Oil Nozzle And Screws
Courtesy of BMW OF NORTH AMERICA, INC.

Release screws (1).

Remove holder for oil pipes.

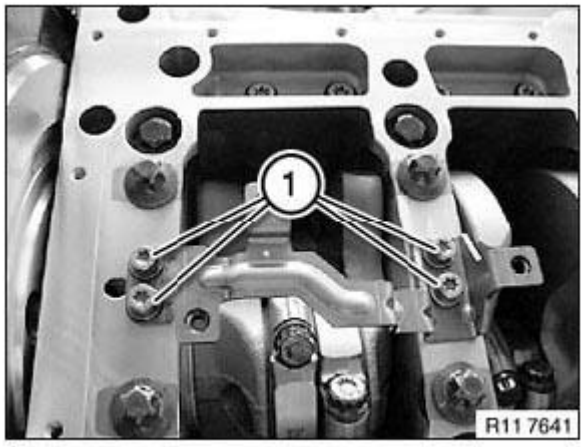


Fig. 155: Identifying Holder Screws
Courtesy of BMW OF NORTH AMERICA, INC.

Release connecting rod bolts (1) with special tool 12 2 100.

Remove connecting rod bearing cap with bearing shell.

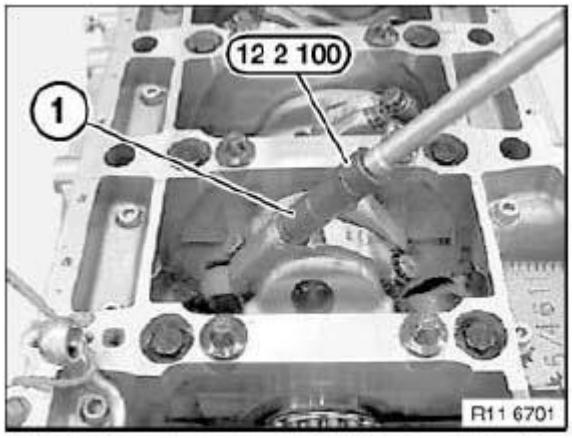


Fig. 156: Removing Connecting Rod Bolts
Courtesy of BMW OF NORTH AMERICA, INC.

Special tool 11 5 250 **without** locating rod must be screwed in on the connecting rod at the bottom.

Special tool 11 5 250 **with** locating rod must be screwed in on the connecting rod at the top.

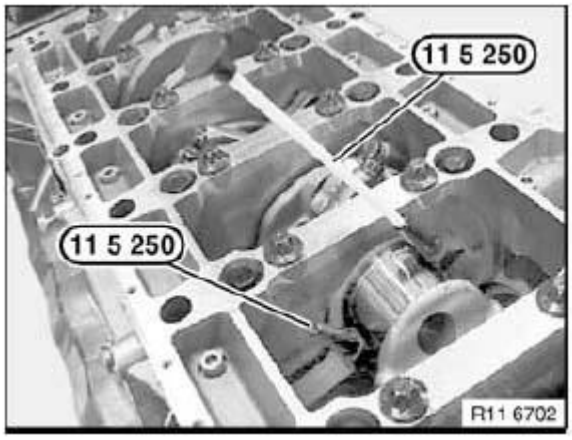


Fig. 157: Identifying Special Tool (11 5 250) On Connecting Rod
Courtesy of BMW OF NORTH AMERICA, INC.

Rotate crankshaft (1) in direction of arrow, **risk of damage** to special tool 11 5 250.

Remove piston with connecting rod and special tool 11 5 250.

Depiction of function on cylinders 1-4.

IMPORTANT: Risk of damage to oil nozzle.

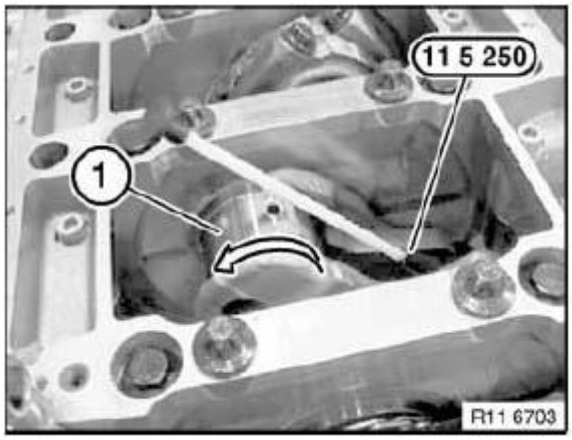


Fig. 158: Rotating Crankshaft
Courtesy of BMW OF NORTH AMERICA, INC.

Clamp special tool 11 5 341 in a vice.

NOTE: Piston and piston pin are optimized to each other.

There are two different inside diameters on the piston pin.

Screw matching special tool 11 5 342 into special tool 11 5 341.

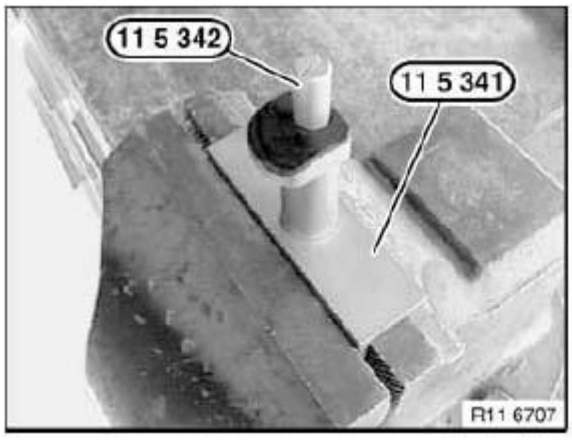


Fig. 159: Identifying Special Tool (11 5 342 And 11 5 341)
Courtesy of BMW OF NORTH AMERICA, INC.

Secure piston (1) with connecting rod to special tool 11 5 341.

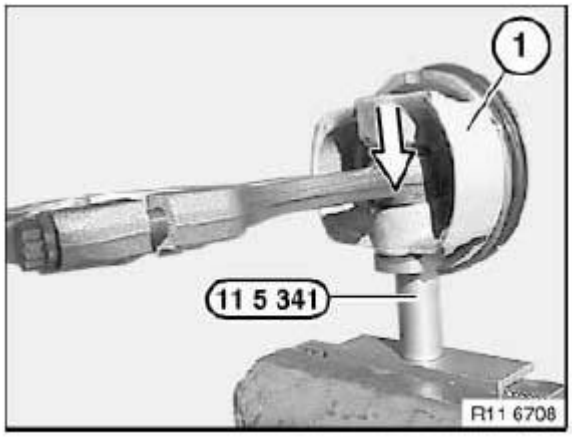


Fig. 160: Securing Piston With Connecting Rod To Special Tool (11 5 341)
Courtesy of BMW OF NORTH AMERICA, INC.

WARNING: Safety goggles must be worn for the next operation.

WARNING: Safety goggles must be worn.

Lever out piston circlip with special tool 11 4 492 in direction of arrow.

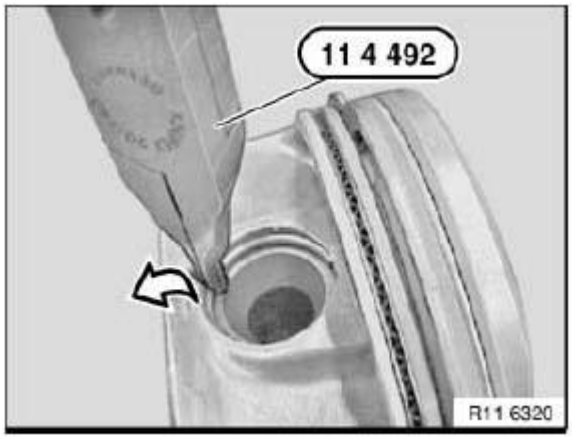
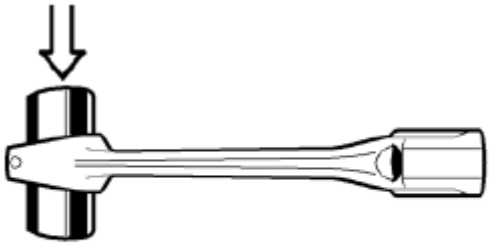


Fig. 161: Removing Piston Circlip With Special Tool (11 4 492)
Courtesy of BMW OF NORTH AMERICA, INC.

If necessary, replace connecting rods.

Installation:

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



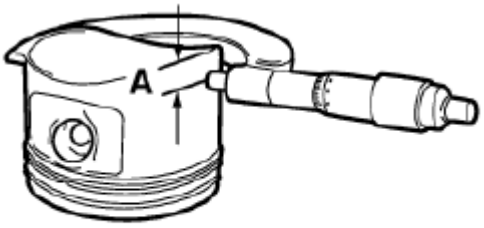
R11 4212

Fig. 162: Installing Gudgeon Pin
Courtesy of BMW OF NORTH AMERICA, INC.

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 gudgeon pin.

Piston diameter at measuring point A.



88 11 051 U

Fig. 163: Measuring Piston Diameter
Courtesy of BMW OF NORTH AMERICA, INC.

Adjust micrometer to cylinder bore of engine block. Set internal calliper 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 See **ENGINE BLOCK, CYLINDER CRANKCASE S65** ; **PISTONS WITH RINGS AND PINS S65** or **PISTONS WITH RINGS AND PINS S65** .

If necessary, replace piston.

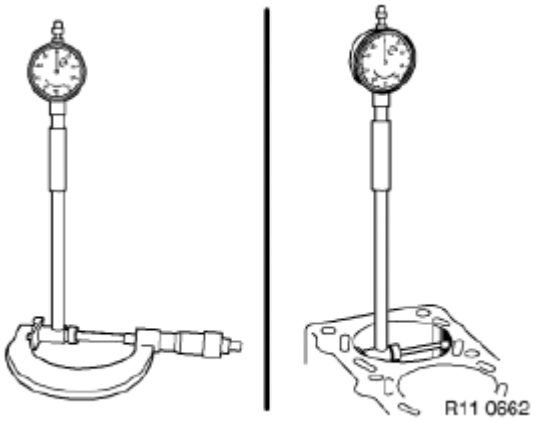


Fig. 164: Measuring Cylinder Bore Diameter
Courtesy of BMW OF NORTH AMERICA, INC.

IMPORTANT: The connecting rods are not symmetrical.

Pay attention to elevation to direction of travel arrow.

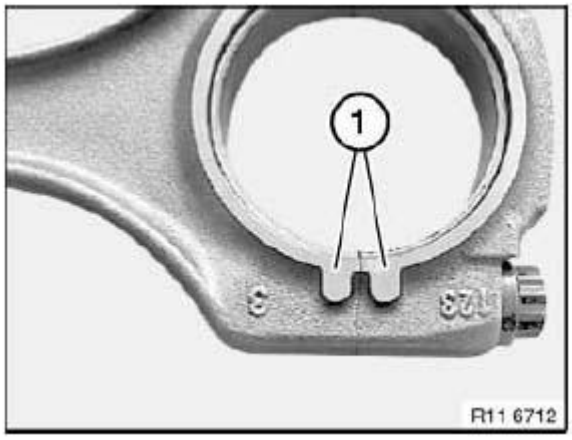


Fig. 165: Identifying Elevation To Direction Of Travel Arrow
Courtesy of BMW OF NORTH AMERICA, INC.

Make sure the connecting rod is in the correct installation position during preliminary installation.

On cylinders 6-10 the elevation (2) must point forwards **with** the arrow.

On cylinders 1-4 the elevation (1) must point rearwards **against** the arrow.

Valve pockets (E) point to inlet side.

Arrow direction is identical to direction of travel.

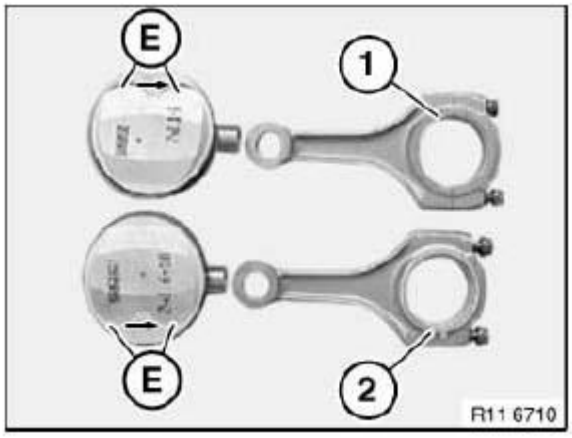


Fig. 166: Identifying Valve Pockets And Cylinders Elevation
Courtesy of BMW OF NORTH AMERICA, INC.

On cylinders 5-8 the elevation must point forwards **with** the arrow.

On cylinders 1-4 the elevation (1) must point rearwards **against** the arrow.

IMPORTANT: No elevations on the connecting rod big end are permitted to point to each other during installation, risk of damage to connecting rod.

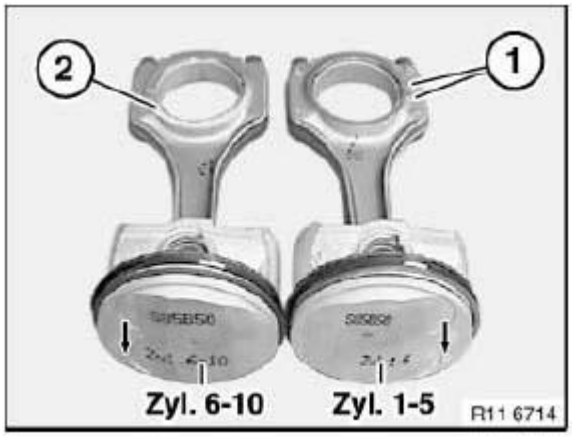


Fig. 167: Identifying Cylinders Elevation
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

When installed, the two lugs on connecting rods (1 and 2) must point outwards.

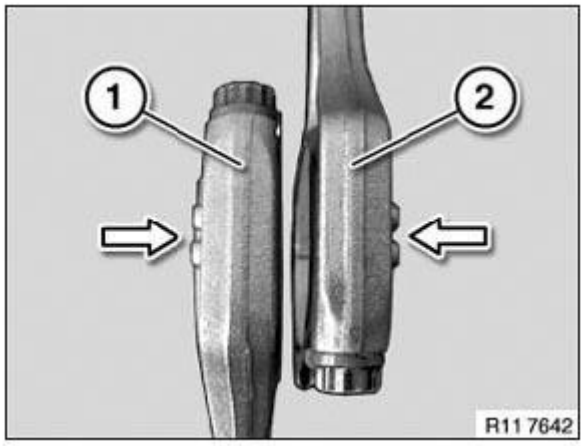


Fig. 168: Locating Lugs On Connecting Rods
Courtesy of BMW OF NORTH AMERICA, INC.

Secure piston (1) with connecting rod to special tool 11 5 341.

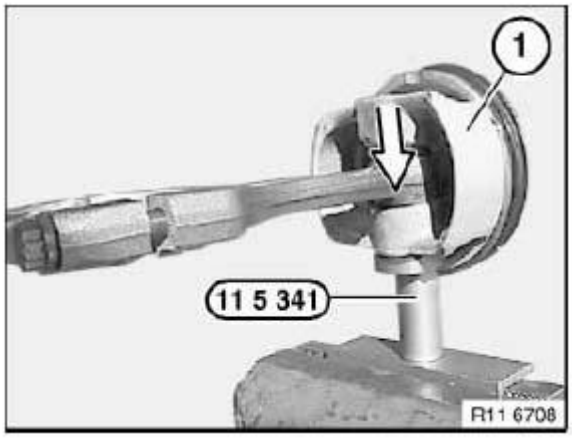


Fig. 169: Securing Piston With Connecting Rod To Special Tool (11 5 341)
Courtesy of BMW OF NORTH AMERICA, INC.

WARNING: Safety goggles must be worn.

IMPORTANT: Setting of special tool 11 5 343 must not be altered.

Installation:

Insert piston circlip (2) so that opening points to window.

Insert piston circlip (2) into groove (1) of special tool 11 5 343.

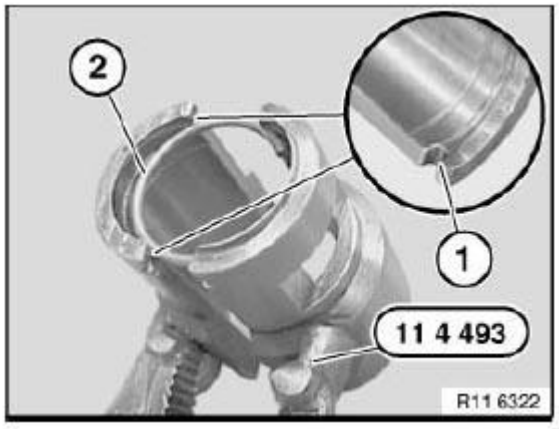


Fig. 170: Identifying Piston Circlip Groove
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: Graphic shows N52.

Position special tool 11 5 343 with window to recess on piston (see arrow).

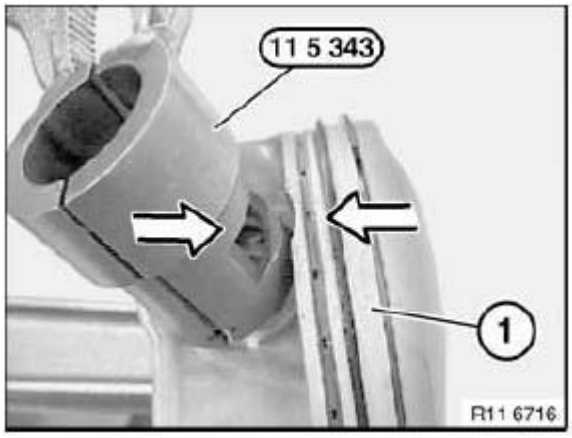


Fig. 171: Positioning Special Tool (11 5 343) With Window To Recess On Piston
Courtesy of BMW OF NORTH AMERICA, INC.

Position special tool 11 5 343 with window to recess on piston (see arrow).

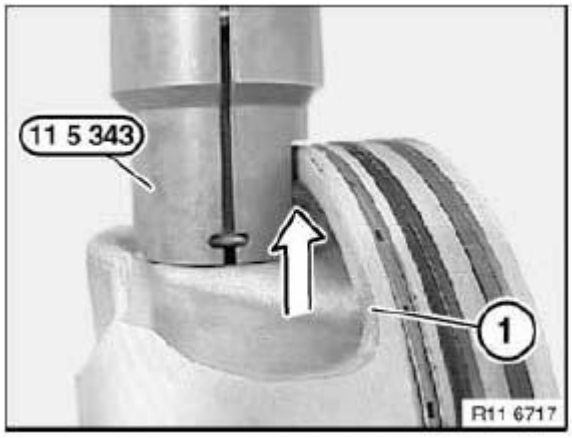


Fig. 172: Positioning Special Tool (11 5 343) With Window To Recess On Piston
Courtesy of BMW OF NORTH AMERICA, INC.

WARNING: Safety goggles must be worn.

Guide lug and aperture on special tool 11 5 343 must point to piston crown.

When special tools 11 5 343 and 11 5 344 are correctly positioned, the piston circlip must be driven in with a plastic hammer in the direction of the arrow.

NOTE: See graphic.

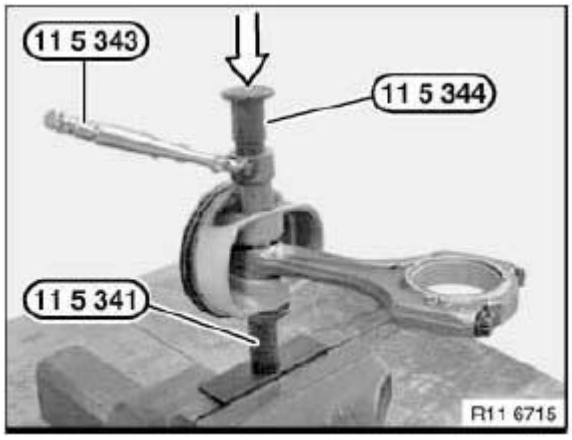


Fig. 173: Installing Piston Circlip
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Piston circlip (1) is correctly installed when the opening points upwards.

See graphic.

It must still be possible for piston pin to moved easily.

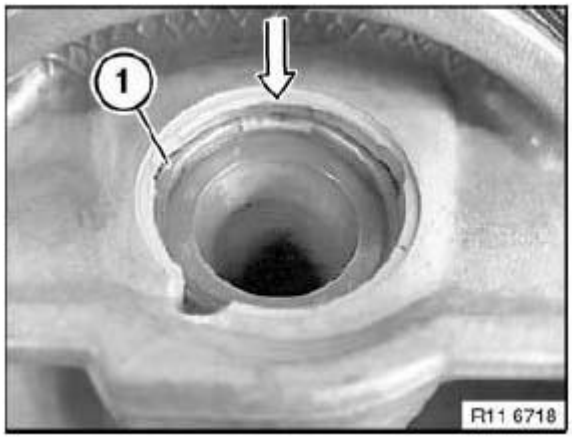


Fig. 174: Installing Piston Circlip
Courtesy of BMW OF NORTH AMERICA, INC.

Install all **PISTON RINGS** .

Install all **BEARING SHELLS** .

Screw special tool 11 5 250 into connecting rod.

Always screw in special tool 11 5 250 with rod to exhaust side.

Preinstall piston with piston rings in special tool 11 9 500.

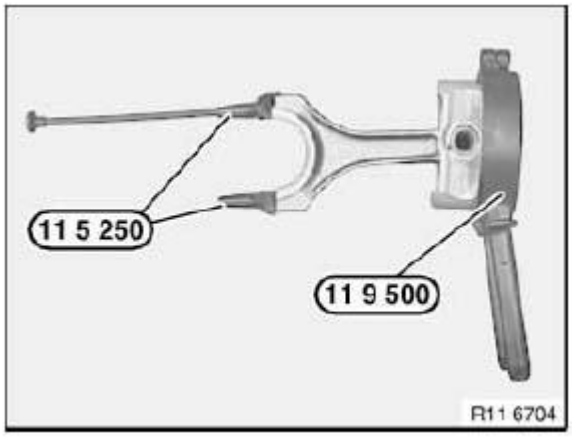


Fig. 175: Inserting Special Tool (11 5 250) Into Connecting Rod
Courtesy of BMW OF NORTH AMERICA, INC.

Insert piston with connecting rod in cylinder.

**IMPORTANT: Risk of damage to oil spray nozzle.
Danger of piston ring failure.**

Insert piston so that arrow (direction of travel pointing forwards) on piston crown points to camshaft drive.

Piston cyl. 1-4 right side, cyl. 5-8 left side.

Press in piston with special tool 11 9 500.

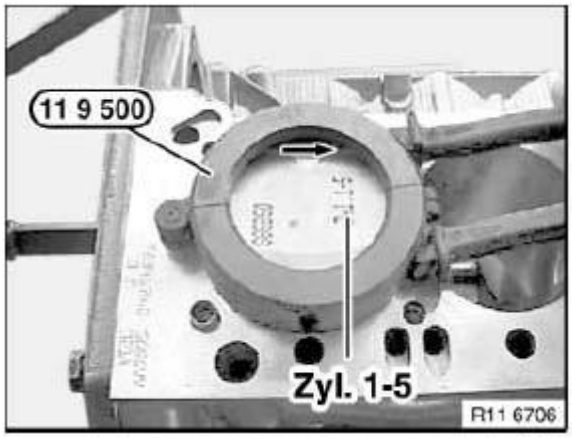


Fig. 176: Inserting Piston With Connecting Rod In Cylinder
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: Picture shows S85.

Arrow on piston crown must point to camshaft drive (direction of travel towards front).

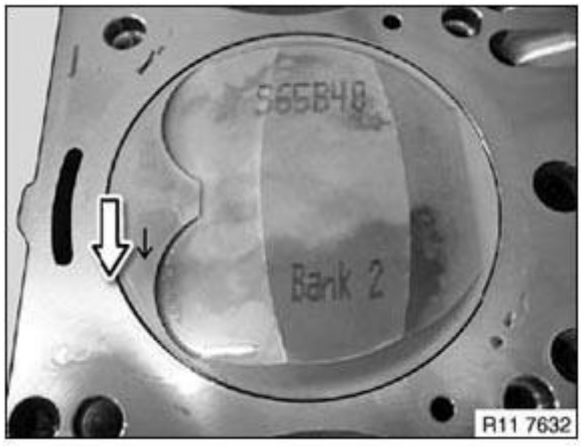


Fig. 177: Identifying Piston Crown Position
Courtesy of BMW OF NORTH AMERICA, INC.

IMPORTANT: Connecting rod and connecting rod bearing cap are identified with pairing

letters (1) and must not be mixed up.
Mixing them up or incorrectly fitting the connecting rod bearing cap on the big end will result in engine damage.

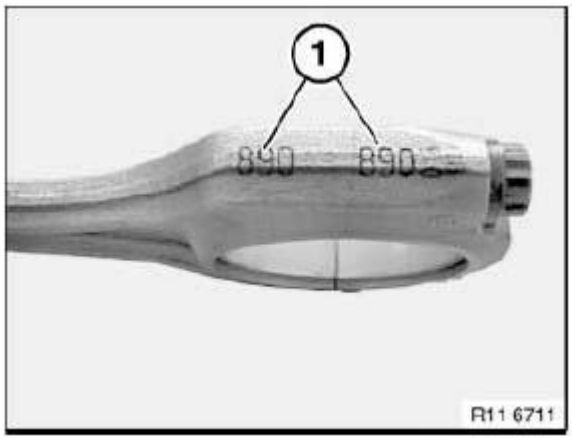


Fig. 178: Identifying Connecting Rod Bearing Cap Pairing Letters
Courtesy of BMW OF NORTH AMERICA, INC.

IMPORTANT: Risk of damage to oil nozzle.

Rotate crankshaft (1) in direction of arrow, **risk of damage** to special tool 11 5 250.

Insert piston with connecting rod and special tool 11 5 250.

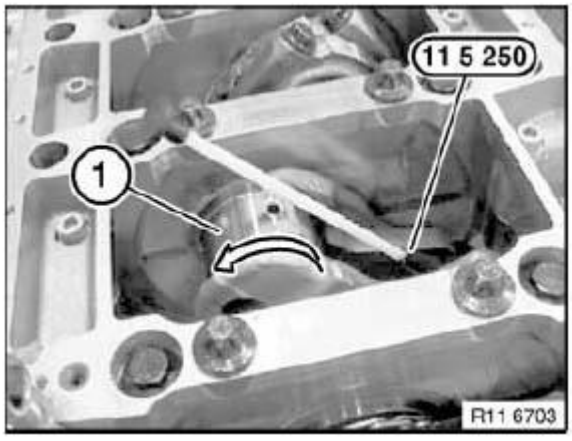


Fig. 179: Rotating Crankshaft
Courtesy of BMW OF NORTH AMERICA, INC.

Moisten connecting rod bearing shell and crankshaft journal slightly with engine oil.

Assemble connecting rod and crankshaft journal.

Remove special tool 11 5 250.

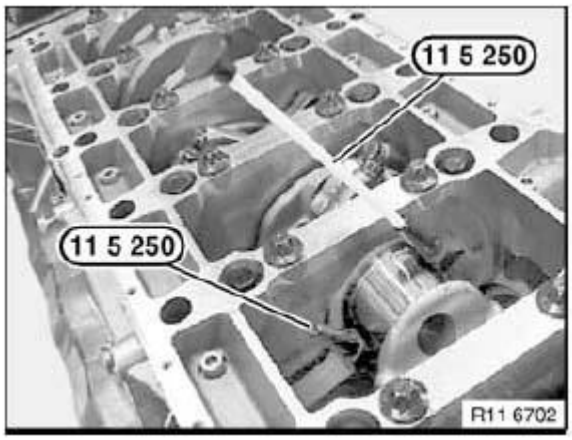


Fig. 180: Identifying Special Tool (11 5 250) On Connecting Rod
Courtesy of BMW OF NORTH AMERICA, INC.

Install connecting rod bearing cap with bearing shell.

Secure connecting rod bolts (1) with special tools 12 2 100 and **00 9 120 TORQUE ANGLE MEASURING DIAL** .

Tightening torque: **11 24 1AZ** .

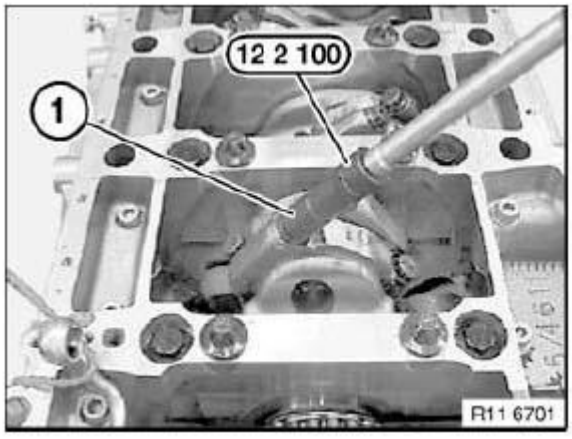


Fig. 181: Securing Connecting Rod Bolts With Special Tools (12 2 100)
Courtesy of BMW OF NORTH AMERICA, INC.

Assemble engine.

11 25 671 REPLACING PISTON RINGS ON ALL PISTONS (S65)

Necessary preliminary tasks:

- Remove all **PISTONS**

Remove piston rings with a piston-ring compressing pliers.

NOTE: It might not be possible to find the identification on used piston rings.

Put aside piston rings in correct sequence and installation position.

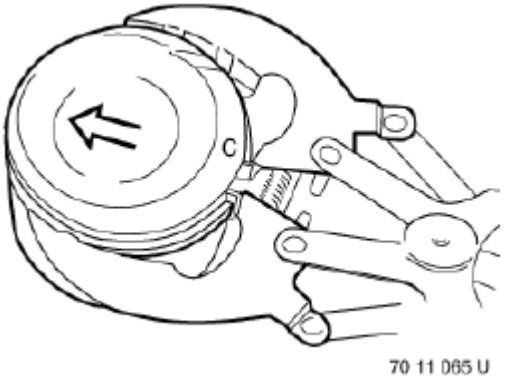


Fig. 182: Removing Piston Rings
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Piston rings marked with "R" must point to piston crown.

Groove (2), plain compression ring.

Groove (3), stepped ring.

Groove (4), bevel-edged oil control ring.

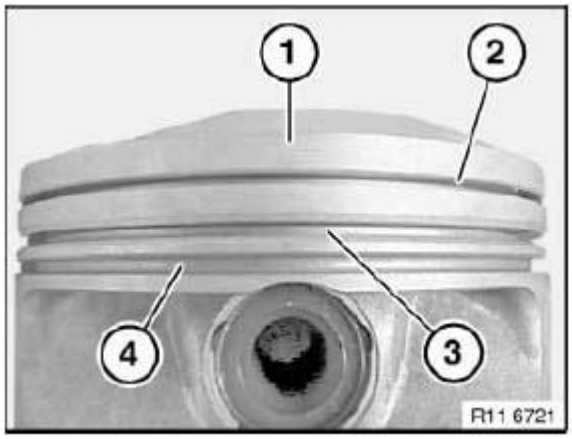


Fig. 183: Identifying Piston Ring Groove

Courtesy of BMW OF NORTH AMERICA, INC.

Piston ring (1), bevel-edged oil control ring.

Piston ring (2), stepped ring.

Piston ring (3), plain compression ring.

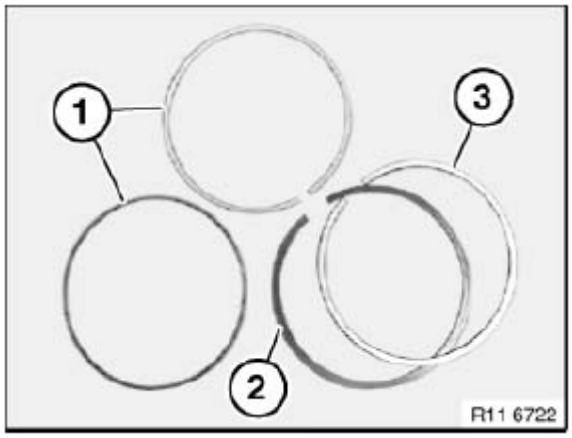


Fig. 184: Identifying Piston Rings
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Piston rings marked with "R" must point to piston crown.

Plain compression ring is marked with (R).

Stepped ring is marked with (R1).

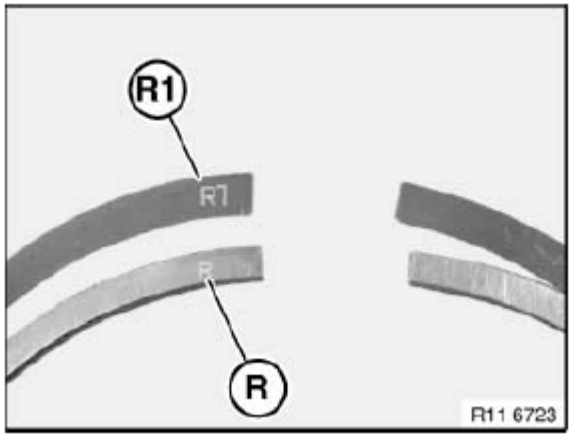


Fig. 185: Identifying Ring Marks
Courtesy of BMW OF NORTH AMERICA, INC.

Measure **AXIAL PLAY** .

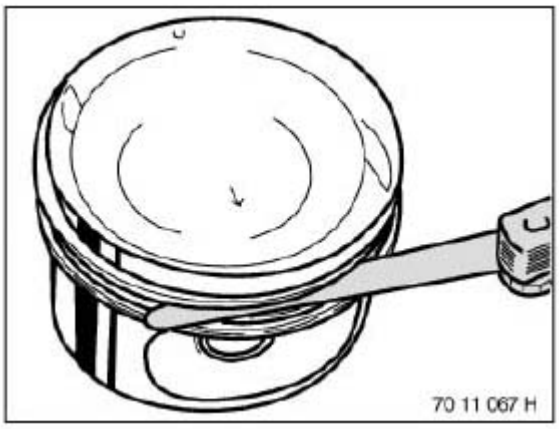


Fig. 186: Measuring Piston Ring Axial Play
Courtesy of BMW OF NORTH AMERICA, INC.

Measure **END CLEARANCE** .

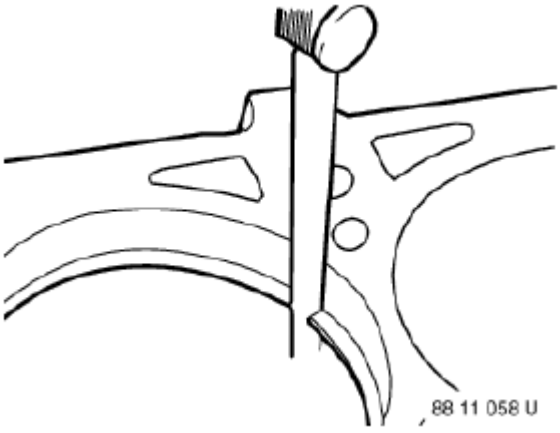


Fig. 187: Measuring Piston Ring End Clearance
Courtesy of BMW OF NORTH AMERICA, INC.

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

NOTE: See picture S85.

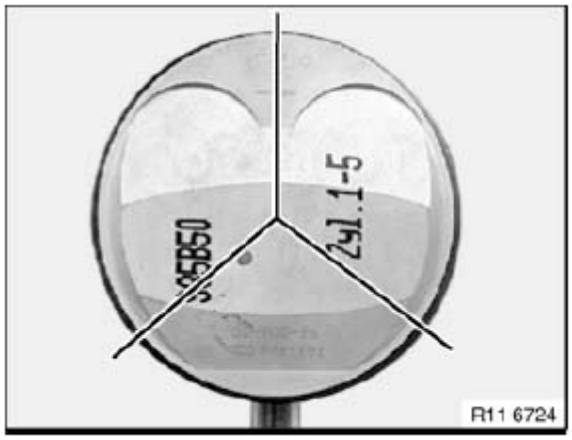


Fig. 188: Identifying Piston Rings Contact Points
Courtesy of BMW OF NORTH AMERICA, INC.

Assemble engine.

V-RIBBED BELT WITH TENSION DEFLECTION ELEMENT

11 28 060 REMOVING AND INSTALLING/REPLACING BELT TENSIONER FOR A/C COMPRESSOR (S65)

IMPORTANT: Mixed installation of the assemblies is not permitted.
Mixed installation will result in failure of the steering assistance.
Mark the direction of rotation of the drive belt if it is to be reused.
Replace the drive belt if it is fouled with coolant or engine oil.

Necessary preliminary tasks:

- Remove **FAN COWL WITH ELECTRIC FAN** .
- Remove **A/C COMPRESSOR DRIVE BELT** .

Release screw (1).

Release screw for power steering high-pressure line.

Release screws (2).

Remove belt tensioner (3) with fixture.

Installation:

Observe the installation direction if the belt tensioner is replaced individually.

The lettering TOP must point upwards.

Different idler pulleys for c.c.w.- and c.w.-rotating power steering pumps.

Tightening torque, see **11 28 1-2AZ** .

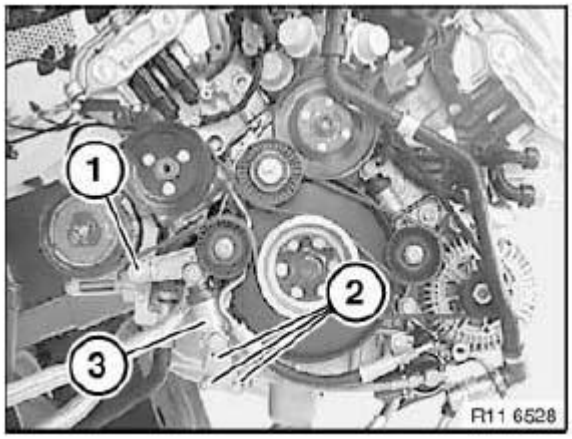


Fig. 189: Identifying Belt Tensioner And Screws
Courtesy of BMW OF NORTH AMERICA, INC.

Assemble engine.

11 28 050 REPLACING A/C COMPRESSOR DRIVE BELT (S65)

IMPORTANT: Mixed installation of the assemblies is not permitted.
Mixed installation will result in failure of the steering assistance.
Mark the direction of rotation of the drive belt if it is to be reused.
Replace the drive belt if it is fouled with coolant or engine oil.
Different idler pulleys for c.c.w.- and c.w.-rotating power steering pumps.
Tightening torque: 11 28 1-2AZ .

Necessary preliminary tasks:

- Remove **FAN COWL WITH ELECTRIC FAN** .

IMPORTANT: Note belt routing of clockwise-rotating power steering pump (see arrow).

Press down tensioning device (1) on damper in direction of arrow and hold.

Take off ribbed V-belt.

Installation:

Observe direction of rotation if reusing the drive belt.

Ensure drive belt is in correct installation position.

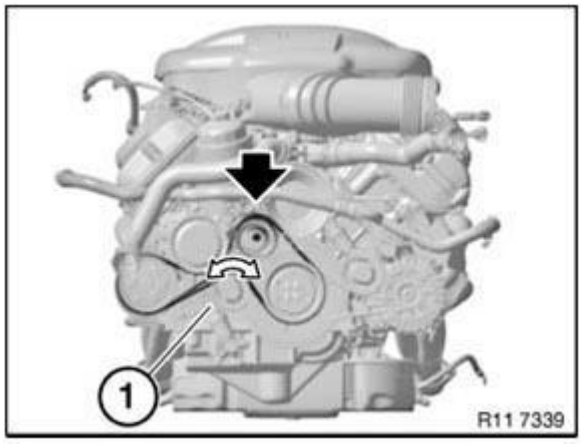


Fig. 190: Pressing Down Tensioning Device
Courtesy of BMW OF NORTH AMERICA, INC.

IMPORTANT: Belt routing of counterclockwise-rotating power steering pump (see arrow). Double-sided ribbed V-belt.

Press down tensioning device (1) on damper in direction of arrow and hold.

Take off ribbed V-belt.

Installation:

Observe direction of rotation if reusing the drive belt.

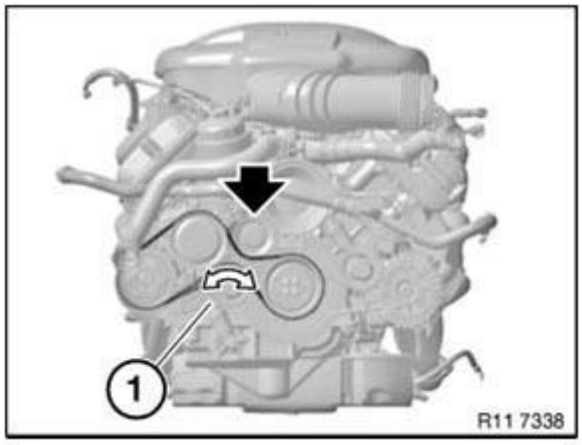


Fig. 191: Pressing Down Tensioning Device
Courtesy of BMW OF NORTH AMERICA, INC.

Ensure drive belt is in correct installation position.

Assemble engine.

11 28 010 REPLACING ALTERNATOR DRIVE BELT (S65)

IMPORTANT: Mark the direction of rotation of the drive belt if it is to be reused. Replace the drive belt if it is fouled with coolant or engine oil.

Necessary preliminary tasks:

- Remove drive belt for A/C system.

Release cover (1) with a screwdriver.

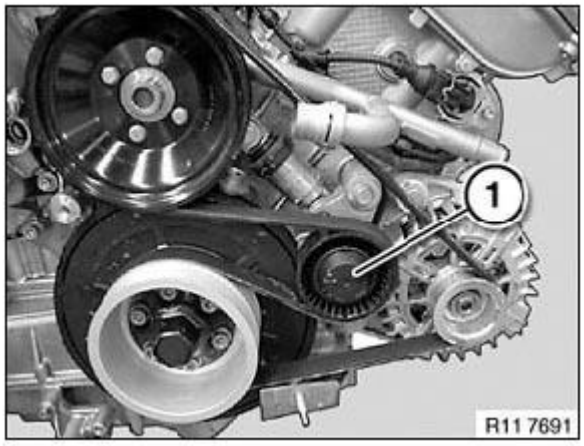


Fig. 192: Identifying Cover
Courtesy of BMW OF NORTH AMERICA, INC.

Press down tensioning device (1) with standard tool in direction of arrow.

Remove drive belt.

Installation:

Observe direction of rotation if reusing the drive belt.

Make sure drive belt is installed in correct position.

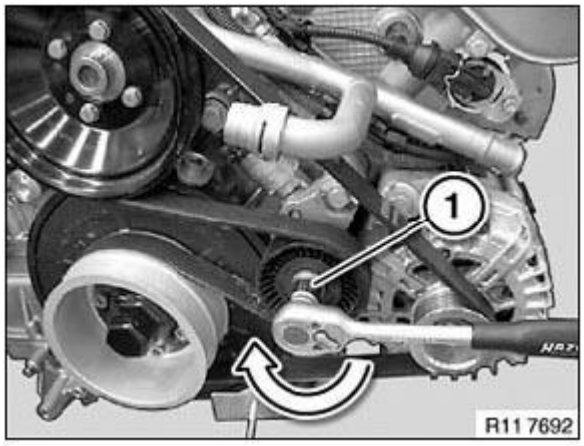


Fig. 193: Pressing Down Tensioning Device In Direction Of Arrow
Courtesy of BMW OF NORTH AMERICA, INC.

Assemble engine.

11 28 020 REPLACING TENSIONING DEVICE FOR ALTERNATOR DRIVE BELT (S65)

IMPORTANT: Mark the direction of rotation of the drive belt if it is to be reused. Replace the drive belt if it is fouled with coolant or engine oil.

Necessary preliminary tasks:

- Remove fan cowl with electric fan.
- Remove A/C compressor drive belt.

Release screws (1).

Remove alternator drive belt.

Remove belt pulley (2) from coolant pump.

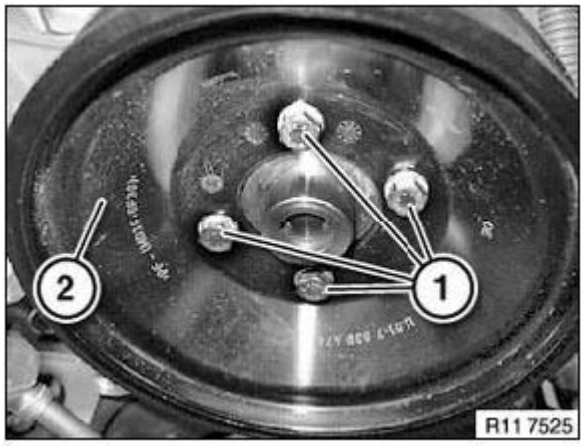


Fig. 194: Identifying Belt Pulley And Screws
Courtesy of BMW OF NORTH AMERICA, INC.

Release screws (1 and 2).

Remove belt tensioner (3) with tensioning pulley.

Installation:

Observe the installation direction if the belt tensioner is replaced individually.

The lettering TOP must point upwards.

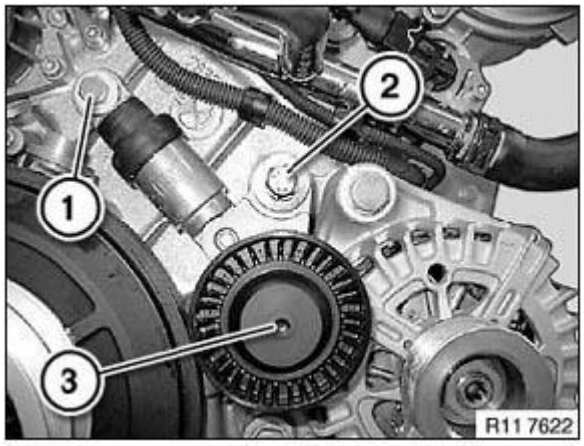


Fig. 195: Identifying Belt Tensioner And Screws
Courtesy of BMW OF NORTH AMERICA, INC.

Assemble engine.

CAMSHAFT

11 31 575 ADJUSTING CAMSHAFT TIMING (S65)

IMPORTANT: Central bolts on VANOS gears have left-hand threads.

IMPORTANT: The procedure for adjusting the timing is different from that for checking the timing.
The letters/numbers on the camshafts (E1 and A1) and (E2 and A2) must point upwards.
Do not release the central bolts of the adjustment units without the special tool 11 9 970 GAUGE (risk of damage!).
If the special tool 11 9 970 GAUGE cannot be positioned on the dihedron of the camshafts, bar the engine at the central bolt until the special tool 11 9 970 GAUGE can be secured on the cylinder head.

Release bolts (1) on cylinder bank 1.

Remove timing case cover (2).

Installation:

Replace seal.

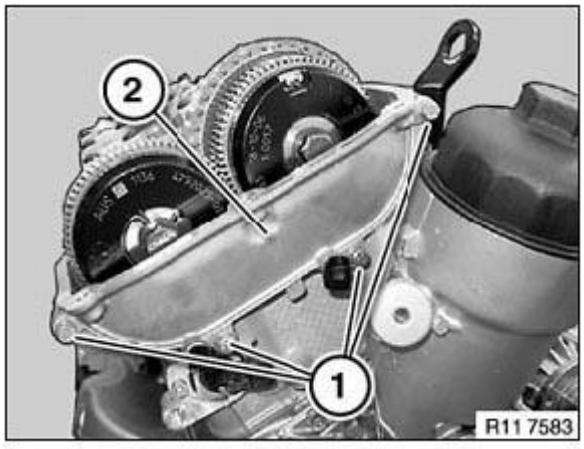


Fig. 196: Identifying Timing Case Cover And Bolts
Courtesy of BMW OF NORTH AMERICA, INC.

Release bolts (1) on cylinder bank 2.

Remove timing case cover (2).

Installation:

Replace seal.

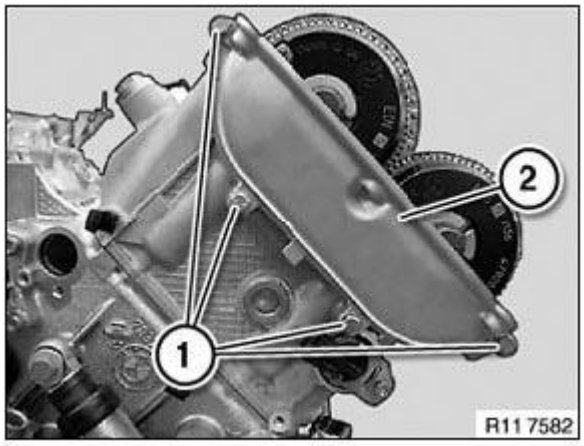


Fig. 197: Identifying Timing Case Cover And Bolts
Courtesy of BMW OF NORTH AMERICA, INC.

IMPORTANT: Both inlet and exhaust camshafts can be adjusted in the 1st cylinder firing TDC position.
Danger of mixing up both special tool bores.

- **10° before TDC**
- **TDC= top dead center.**

Before the crankshaft can be secured, the gauges **119970 GAUGE** must be positioned on the camshafts.

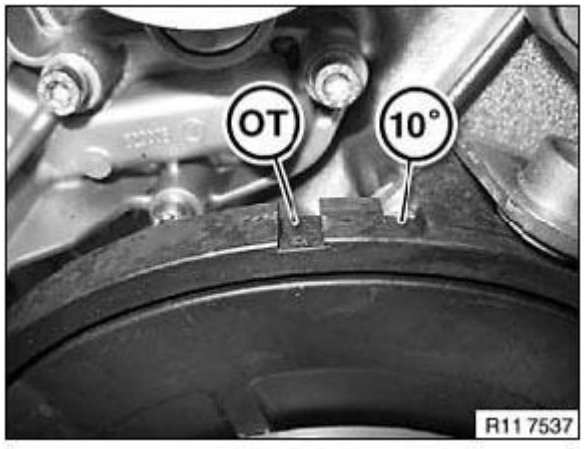


Fig. 198: Identifying Timing Marks
Courtesy of BMW OF NORTH AMERICA, INC.

Rotate crankshaft at central bolt.

IMPORTANT: Always start timing with bank 1 (cylinders 1-4).

Position of inlet camshaft, cylinders 1-4.

Designation (E1) on dihedron points upwards.

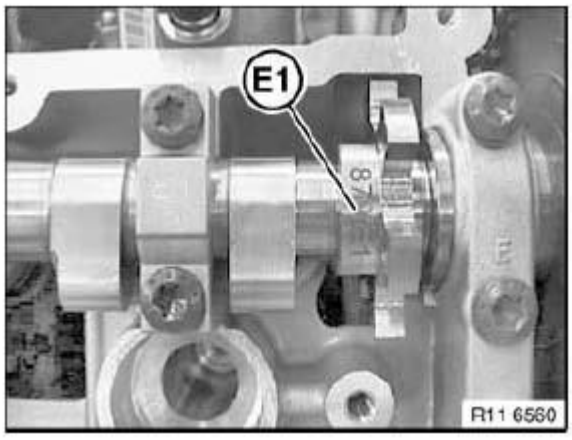


Fig. 199: Identifying Inlet Camshaft Designation
Courtesy of BMW OF NORTH AMERICA, INC.

Position of exhaust camshaft, cylinders 1-4.

Designation (A1) on dihedron (1) points upwards.

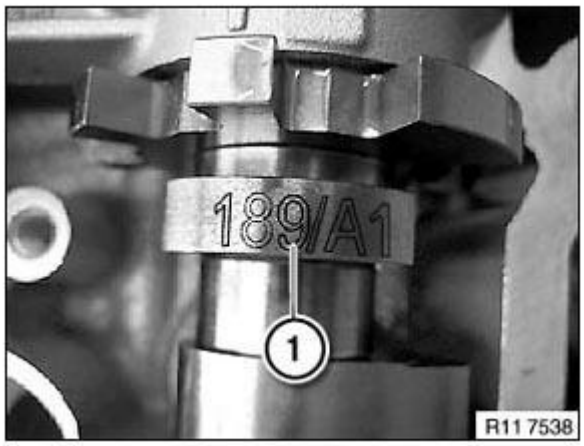


Fig. 200: Identifying Exhaust Camshaft Designation
Courtesy of BMW OF NORTH AMERICA, INC.

Rotate inlet camshaft with open-end wrench (1) with minimal effort at hexagon head in direction of arrow until special tool 11 9 972 can be attached.

Designation (E1) on dihedron points upwards.

Secure special tool 11 9 972 with bolts (2) on cylinder head to **10 Nm.**

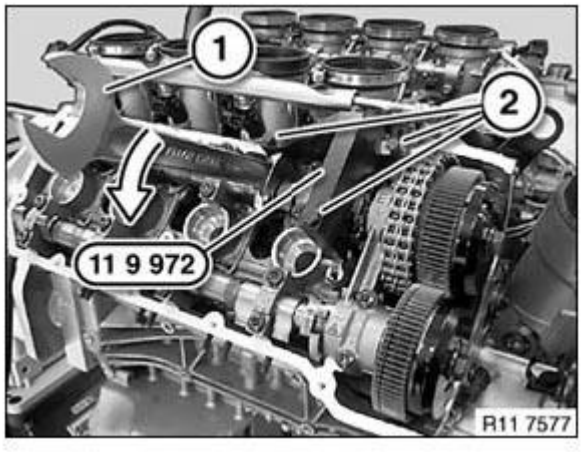


Fig. 201: Rotating Inlet Camshaft Using Open-End Wrench
Courtesy of BMW OF NORTH AMERICA, INC.

Rotate exhaust camshaft with open-end wrench with minimal effort in direction of arrow until special tool 11 9 971 can be attached.

Designation (A1) on dihedron points upwards.

Secure special tool 11 9 971 with bolts (1) on cylinder head to **10 Nm.**

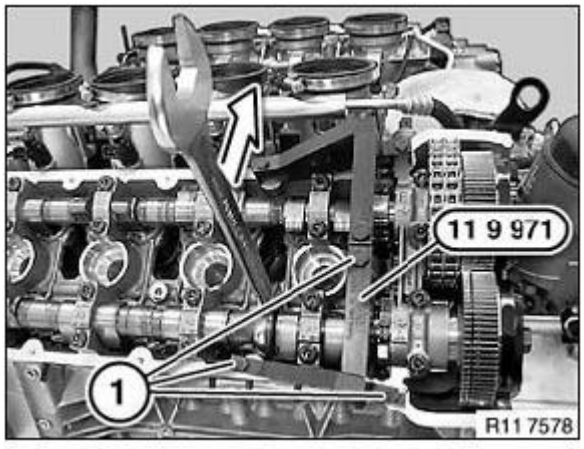


Fig. 202: Securing Special Tool (11 9 971) With Bolts On Cylinder Head
Courtesy of BMW OF NORTH AMERICA, INC.

IMPORTANT: CCW thread!

Release central bolt (1).

Release central bolt (2).

Installation:

Replace central bolts (1 and 2).

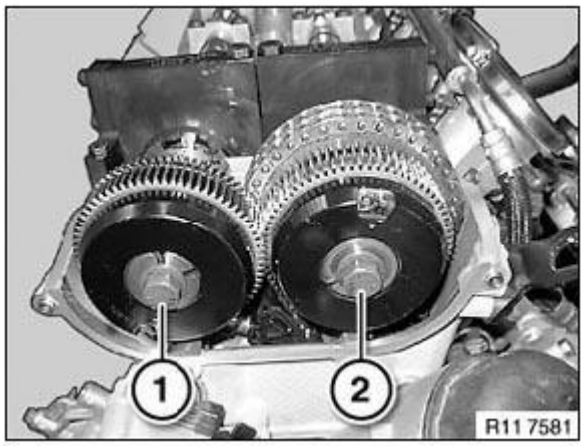


Fig. 203: Identifying Central Bolts
Courtesy of BMW OF NORTH AMERICA, INC.

IMPORTANT: Rotate crankshaft at central bolt back until special tool 11 5 320 can be secured in the 10° position.

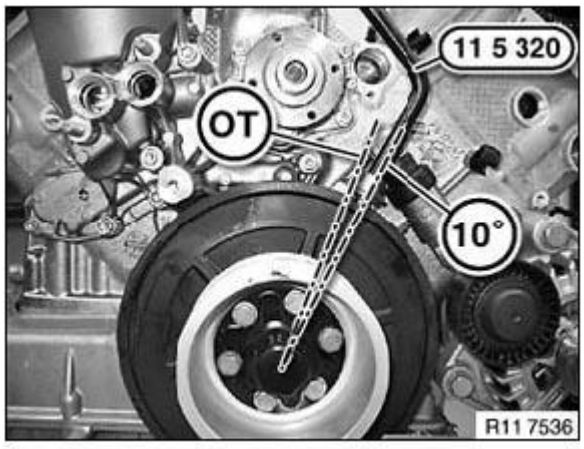


Fig. 204: Identifying Crankshaft Position
Courtesy of BMW OF NORTH AMERICA, INC.

IMPORTANT: Replace central bolts of adjustment units.
Central bolts must be fully screwed once (refer to SCREW FASTENING LIST).

Cylinders 1 to 4:

Always start screwing on the inlet side.

Secure central bolt (1) with special tool **00 9 120 TORQUE ANGLE MEASURING DIAL** .

IMPORTANT: Screw central bolt fully once.

1. **Joining 20 Nm**
2. **Settling torque 80 Nm**
3. **Torsion angle 200°**
4. **Unscrew central bolt.**
5. **Preload central bolt to 10 Nm.**

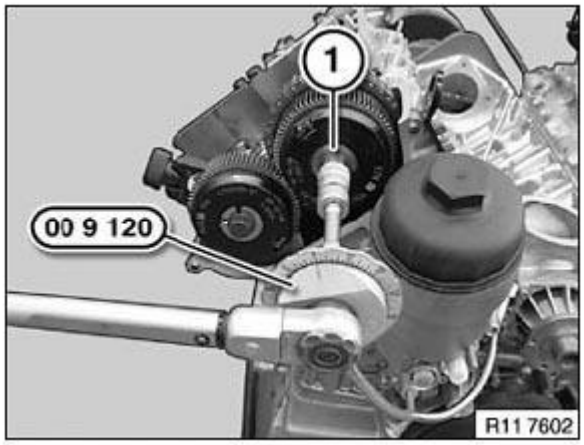


Fig. 205: Securing Central Bolt Using Special Tool (00 9 120)
Courtesy of BMW OF NORTH AMERICA, INC.

Secure central bolt (1) with special tool **00 9 120 TORQUE ANGLE MEASURING DIAL** .

IMPORTANT: Screw central bolt fully once.

1. **Joining 20 Nm**
2. **Settling torque 80 Nm**
3. **Torsion angle 200°**
4. **Unscrew central bolt.**
5. **Preload central bolt to 10 Nm.**

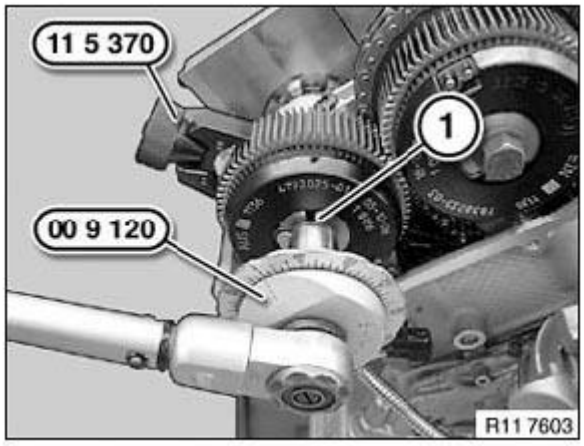


Fig. 206: Securing Central Bolt Using Special Tool (00 9 120)
Courtesy of BMW OF NORTH AMERICA, INC.

Camshafts, cylinders 1-4, **remain secured with special tool 119970 GAUGE** .

Release special tool 11 5 320 and continue barring engine at central bolt **10°** to **firing TDC position of cylinder no. 1.**

Installation:

This minimizes timing chain play.

Secure crankshaft with special tool 11 5 320.

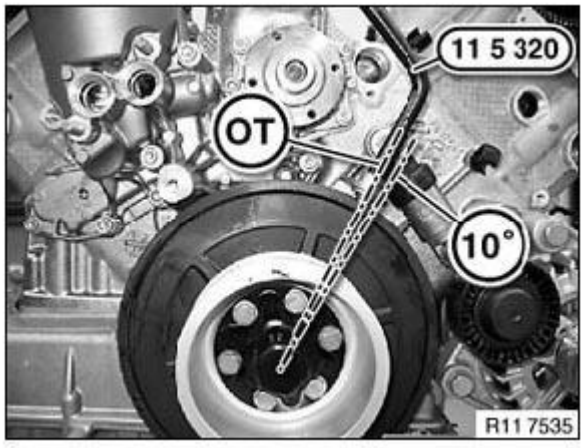


Fig. 207: Identifying Crankshaft Position
Courtesy of BMW OF NORTH AMERICA, INC.

Cylinders 1 to 4:

Always start screwing on the inlet side.

Secure central bolt (1) with special tool **00 9 120 TORQUE ANGLE MEASURING DIAL** .

IMPORTANT: Central bolt final tightening.

1. **Joining 20 Nm**
2. **Settling torque 80 Nm**
3. **Torsion angle 200°**

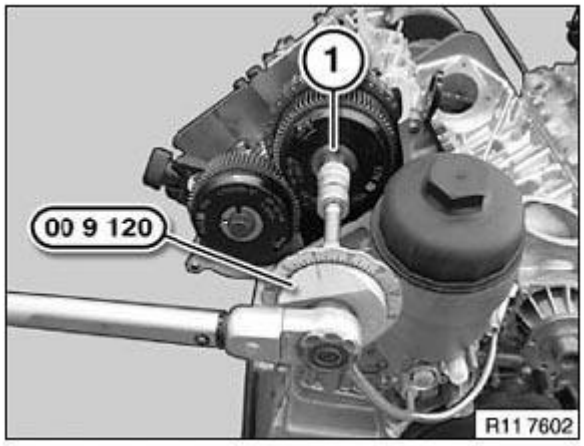


Fig. 208: Securing Central Bolt Using Special Tool (00 9 120)
Courtesy of BMW OF NORTH AMERICA, INC.

Secure central bolt (1) with special tool **00 9 120 TORQUE ANGLE MEASURING DIAL** .

IMPORTANT: Central bolt final tightening.

1. **Joining 20 Nm**
2. **Settling torque 80 Nm**
3. **Torsion angle 200°**

IMPORTANT: Remove all special tools.

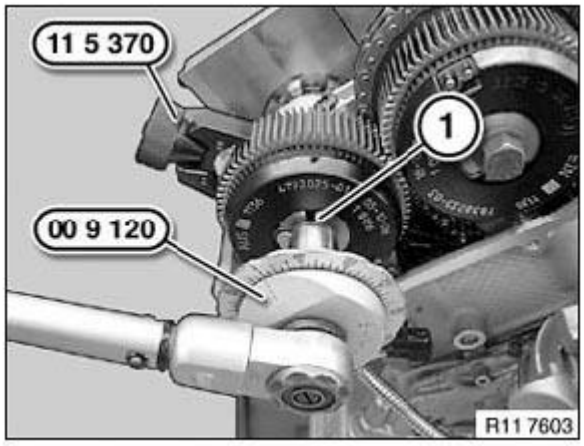


Fig. 209: Securing Central Bolt Using Special Tool (00 9 120)
Courtesy of BMW OF NORTH AMERICA, INC.

Position of inlet camshaft, cylinders 5-8.

Designation (E2) on dihedron points upwards.

Installation:

If necessary, crank at crankshaft central bolt.

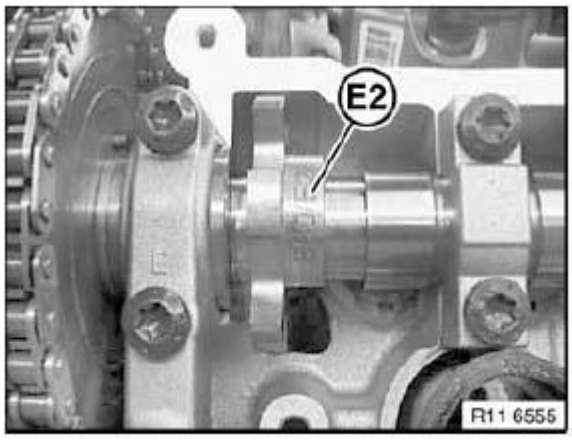


Fig. 210: Identifying Inlet Camshaft Designation
Courtesy of BMW OF NORTH AMERICA, INC.

Position of exhaust camshaft, cylinders 5-8.

Designation (A2) on dihedron points upwards.

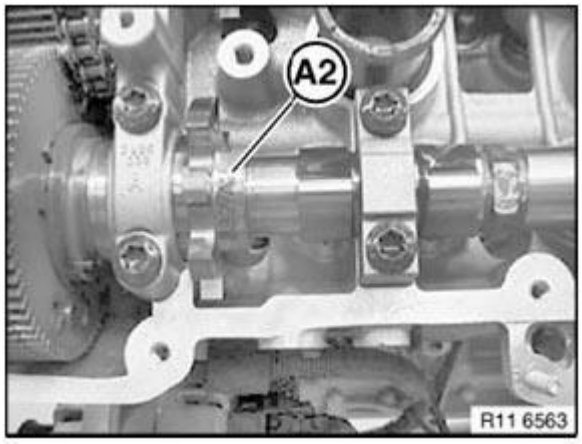


Fig. 211: Identifying Exhaust Camshaft Designation
Courtesy of BMW OF NORTH AMERICA, INC.

Secure inlet camshaft with special tool 11 9 971.

Secure exhaust camshaft with special tool 11 9 972.

Secure special tools 11 9 971 and 11 9 972 with bolts (1) on cylinder head to **10 Nm.**

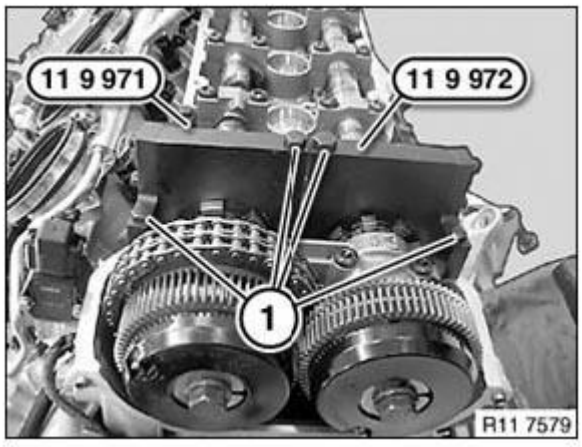


Fig. 212: Securing Camshafts With Special Tools (11 9 971 And 11 9 972)
Courtesy of BMW OF NORTH AMERICA, INC.

IMPORTANT: CCW thread!

Release central bolt (1).

Release central bolt (2).

Installation:

Replace central bolts (1 and 2).

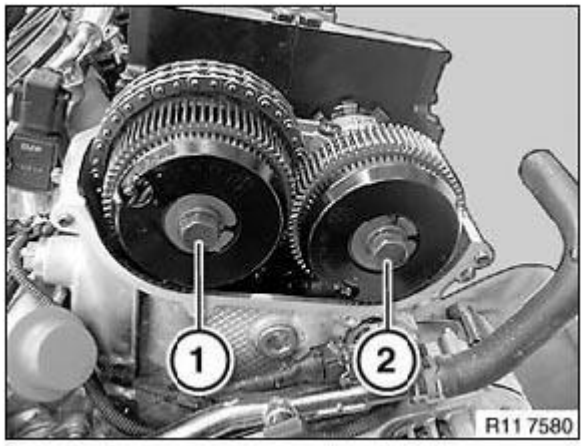


Fig. 213: Identifying Central Bolts
Courtesy of BMW OF NORTH AMERICA, INC.

IMPORTANT: Rotate crankshaft at central bolt back until special tool 11 5 320 can be secured in the 10° position.

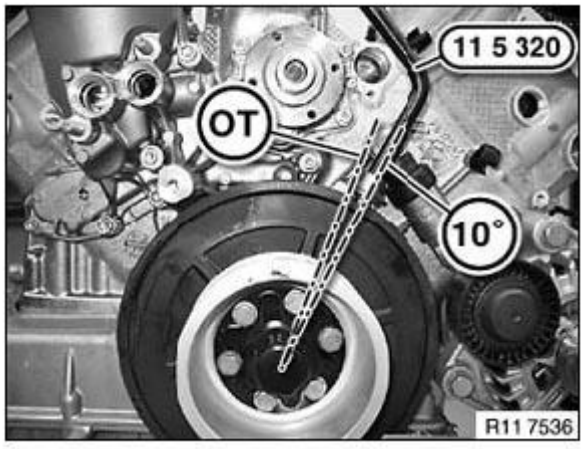


Fig. 214: Identifying Crankshaft Position
Courtesy of BMW OF NORTH AMERICA, INC.

IMPORTANT: Replace central bolts of adjustment units.
Central bolts must be fully screwed once (refer to SCREW FASTENING LIST).

Cylinders 5 to 8:

Always start screwing on the inlet side.

Secure central bolt (1) with special tool **00 9 120 TORQUE ANGLE MEASURING DIAL** .

IMPORTANT: Screw central bolt fully once.

1. **Joining 20 Nm**
2. **Settling torque 80 Nm**
3. **Torsion angle 200°**
4. **Unscrew central bolt.**
5. **Preload central bolt to 10 Nm.**

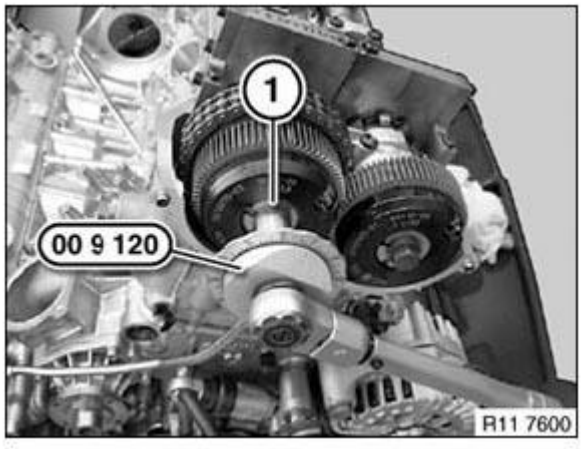


Fig. 215: Securing Central Bolt Using Special Tool (00 9 120)
Courtesy of BMW OF NORTH AMERICA, INC.

Secure central bolt (1) with special tool **00 9 120 TORQUE ANGLE MEASURING DIAL** .

IMPORTANT: Screw central bolt fully once.

1. **Joining 20 Nm**
2. **Settling torque 80 Nm**
3. **Torsion angle 200°**
4. **Unscrew central bolt.**
5. **Preload central bolt to 10 Nm.**

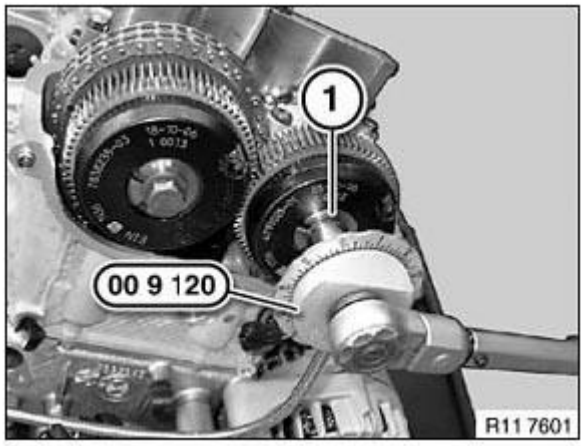


Fig. 216: Securing Central Bolt Using Special Tool (00 9 120)
Courtesy of BMW OF NORTH AMERICA, INC.

Camshafts, cylinders 5-8, **remain secured with special tool 119970 GAUGE** .

Release special tool 11 5 320 and continue barring engine at central bolt **10°** to **firing TDC position of cylinder no. 1.**

Installation:

This minimizes timing chain play.

Secure crankshaft with special tool 11 5 320.

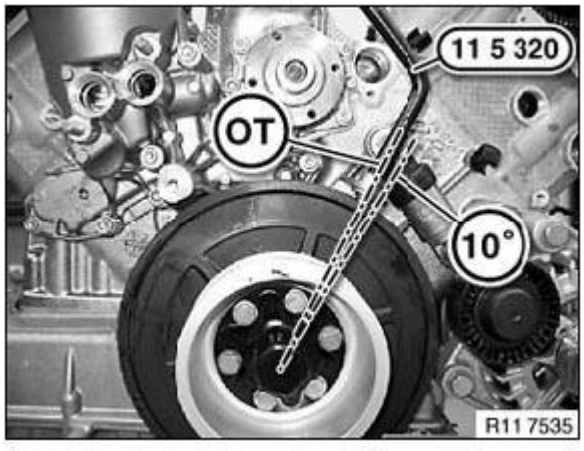


Fig. 217: Identifying Crankshaft Position
Courtesy of BMW OF NORTH AMERICA, INC.

Cylinders 5 to 8:

Always start screwing on the inlet side.

Secure central bolt (1) with special tool **00 9 120 TORQUE ANGLE MEASURING DIAL** .

IMPORTANT: Central bolt final tightening.

1. **Joining 20 Nm**
2. **Settling torque 80 Nm**
3. **Torsion angle 200°**

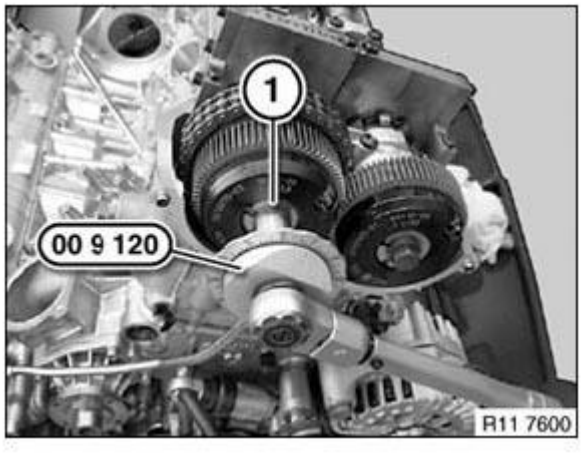


Fig. 218: Securing Central Bolt Using Special Tool (00 9 120)
Courtesy of BMW OF NORTH AMERICA, INC.

Secure central bolt (1) with special tool **00 9 120 TORQUE ANGLE MEASURING DIAL** .

IMPORTANT: Central bolt final tightening.

1. **Joining 20 Nm**
2. **Settling torque 80 Nm**
3. **Torsion angle 200°**

Remove all special tools.

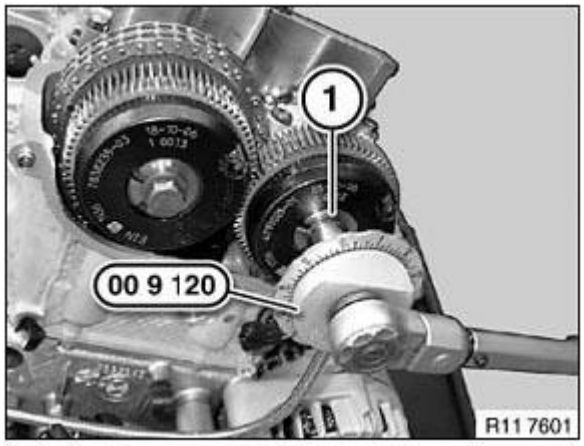


Fig. 219: Securing Central Bolt Using Special Tool (00 9 120)
Courtesy of BMW OF NORTH AMERICA, INC.

Remove all special tools.

Check **TIMING** .

Assemble engine.

11 31 072 CHECKING CAMSHAFT TIMING (S65)

IMPORTANT: Bank (2), cylinders (5 - 8), is checked first.
The timing of bank (1) at cylinders (1-4) can only be checked at overlap TDC.
The lettering (E1 and A1) must point downwards.

Necessary preliminary tasks:

- Remove **FAN COWL** with electronic fan.
- Remove left **CYLINDER HEAD COVER** .
- Remove right **CYLINDER HEAD COVER**
- Remove all **SPARK PLUGS** .

IMPORTANT: Danger of mixing up both special tool bores.

10° **before** TDC (top dead center)

OT Top dead center

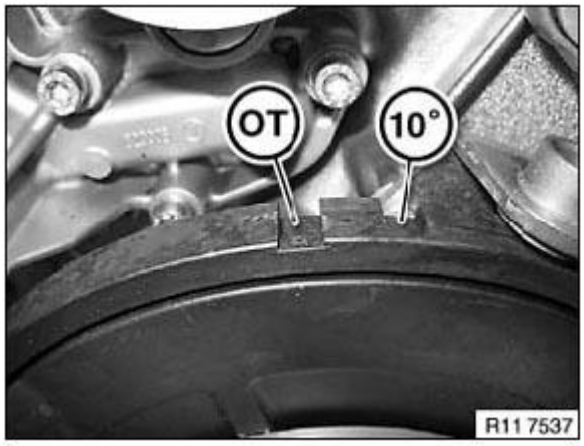


Fig. 220: Identifying Timing Marks
Courtesy of BMW OF NORTH AMERICA, INC.

IMPORTANT: Only bank 2, cylinders (5 - 8), can be checked in cylinder no. 1 firing TDC position.
The 10° position is required only to adjust the timing.

Crank engine at central bolt until the firing TDC position appears on the vibration damper.

Engine installed: Secure vibration damper in position with special tool **110480 MANDREL** .

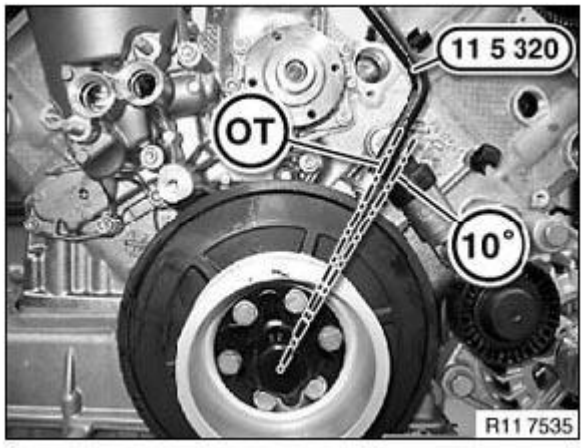


Fig. 221: Identifying Crankshaft Position
Courtesy of BMW OF NORTH AMERICA, INC.

Engine removed: Secure vibration damper in position with special tool 11 5 320.

IMPORTANT: Bank 2 is checked first.

The lettering (A2 and E2) points upwards.

The positions of the cams on the exhaust camshaft point vertically upwards (see picture).

The positions of the cams on the inlet camshaft point at an angle downwards (see picture).

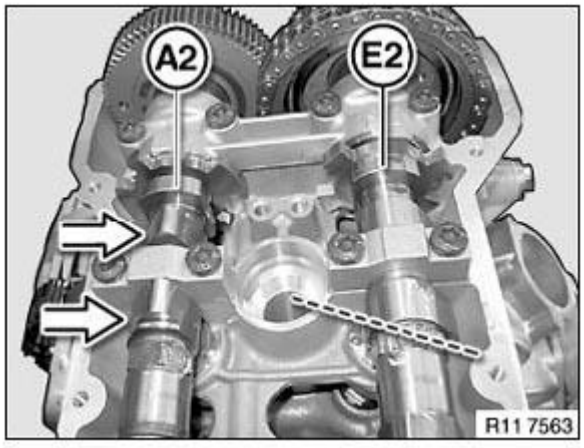


Fig. 222: Identifying Camshaft Lettering
Courtesy of BMW OF NORTH AMERICA, INC.

Position special tool 11 9 972 on twin surface of exhaust camshaft (A2).

Position special tool 11 9 971 on twin surface of inlet camshaft (E2).

The timings are correctly set when special tool **119970 GAUGE** rests without a gap on the cylinder head.

Permissible tolerance: A maximum gap of 1.0 mm is permitted on the non-contacting side of special tool **119970 GAUGE** .

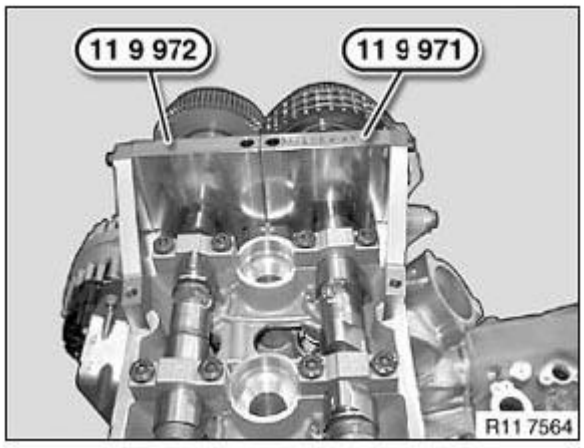


Fig. 223: Positioning Special Tool (11 9 972) On Twin Surface Of Exhaust Camshaft
Courtesy of BMW OF NORTH AMERICA, INC.

IMPORTANT: Remove special tools 119970 GAUGE and 11 5 320.
Crank engine at central bolt 360° in direction of rotation.

The timing of bank 1 at cylinders (1-4) can only be checked at overlap TDC.

Crank engine at central bolt until the firing TDC position appears on the vibration damper.

Engine installed: Secure vibration damper in position with special tool **110480 MANDREL** .

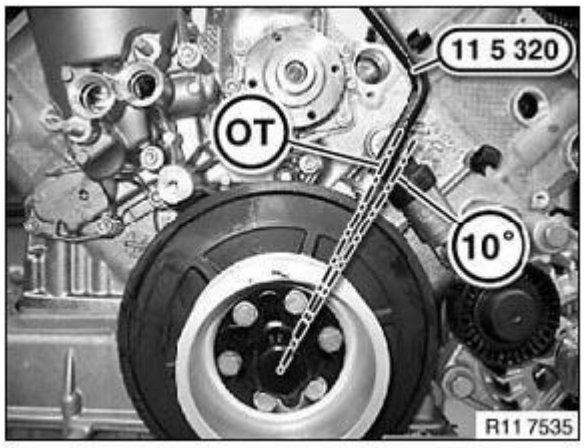


Fig. 224: Identifying Crankshaft Position
Courtesy of BMW OF NORTH AMERICA, INC.

Engine removed: Secure vibration damper in position with special tool 11 5 320.

IMPORTANT: Position of camshaft at overlap TDC
The lettering (E1 and A1) points downwards.

The cams on cylinder no. 1 on the inlet camshaft point at an angle downwards (see picture).

The cams on cylinder no. 1 on the exhaust camshaft point at an angle downwards (see picture).

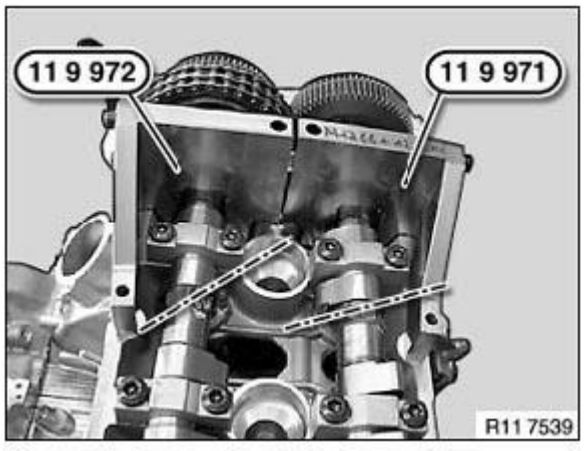


Fig. 225: Positioning Special Tool (11 9 971) On Twin Surface Of Inlet Camshaft
Courtesy of BMW OF NORTH AMERICA, INC.

Position special tool 11 9 971 on twin surface of inlet camshaft (E1).

Position special tool 11 9 972 on twin surface of exhaust camshaft (A1).

The timings are correctly set when special tool **119970 GAUGE** rests without a gap on the cylinder head.

Permissible tolerance: A maximum gap of 1.0 mm is permitted on the non-contacting side of special tool **119970 GAUGE** .

Adjust **VALVE TIMING** .

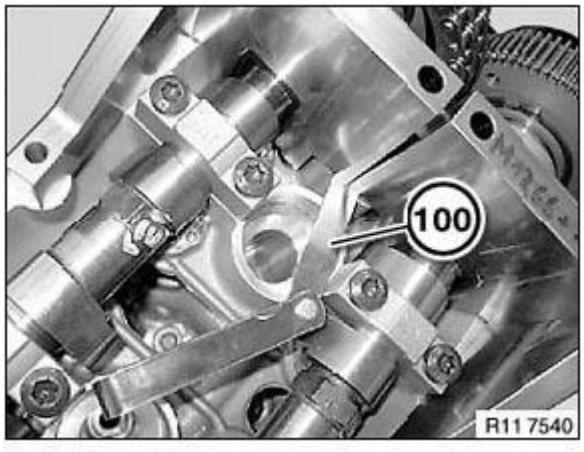


Fig. 226: Adjusting Valve Timing
Courtesy of BMW OF NORTH AMERICA, INC.

Remove all special tools.

Assemble engine in reverse sequence to its disassembly.

11 31 032 REMOVING AND INSTALLING OR REPLACING LEFT INLET CAMSHAFTS (S65)

Necessary preliminary tasks:

- Remove **LEFT CYLINDER HEAD COVER** .
- Remove left **VANOS EXHAUST GEAR**
- Remove left **VANOS INLET GEAR**

Release screws (1).

Tightening torque: **11 12 2AZ** .

E Intake camshaft

A Exhaust camshaft.

IMPORTANT: Risk of mix-up with cylinder bank 1-5.
Arrow (2) must point in direction of travel to chain drive.

Installation:

Lubricate all bearing points with engine oil.

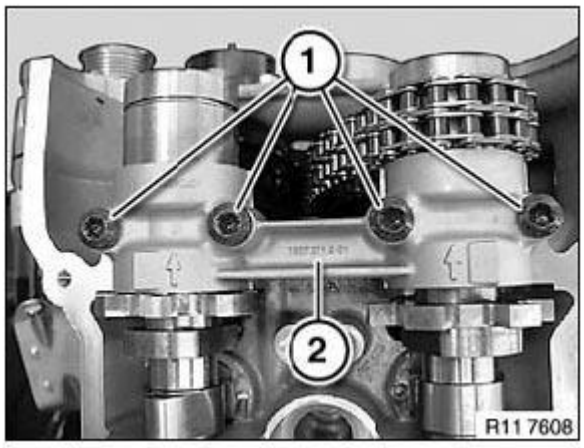


Fig. 227: Identifying Camshaft Screws
Courtesy of BMW OF NORTH AMERICA, INC.

Release screws (1) from outside inwards in 1/2 turns.

Tightening torque: **11 12 2AZ** .

Remove inlet camshaft for cylinders 5 to 8.

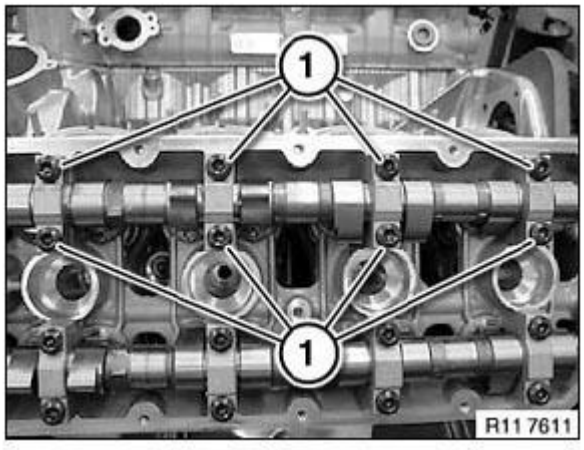


Fig. 228: Identifying Camshaft Screws
Courtesy of BMW OF NORTH AMERICA, INC.

Do not place timing chain in gearcase.

Secure timing chain (1) against falling down with a cable tie (3) to one screw (2).

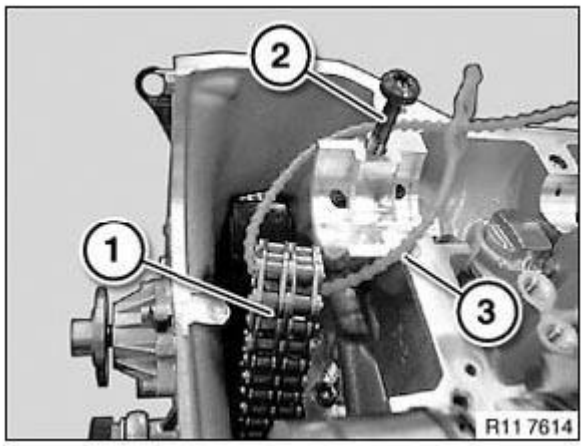


Fig. 229: Securing Timing Chain
Courtesy of BMW OF NORTH AMERICA, INC.

Check plain compression rings for damage and replace if necessary.

The plain compression rings have catches at the joint.

Press plain compression rings apart upwards and downwards and remove towards front.

IMPORTANT: Plain compression rings can break easily.

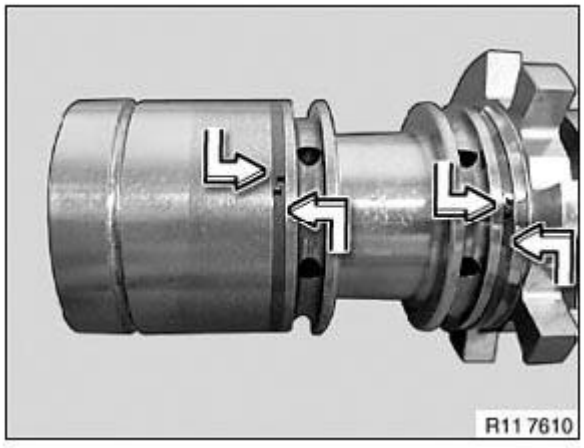


Fig. 230: Removing Plain Compression Rings
Courtesy of BMW OF NORTH AMERICA, INC.

Insert inlet camshaft for cylinders 5 to 8.

Designation (E2) on dihedron points upwards.

Cams on cylinder no. 6 point upwards.

Installation:

Lubricate all bearing points with engine oil.

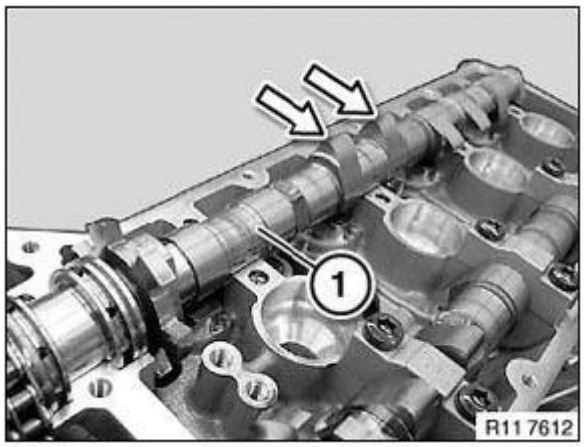


Fig. 231: Positioning Camshaft Lobs
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

All bearing shells are assigned to one cylinder.

E and A from (1 to 8), e.g. E 5= inlet side on cylinder no. 5.

Arrow must point in direction of travel to chain drive.

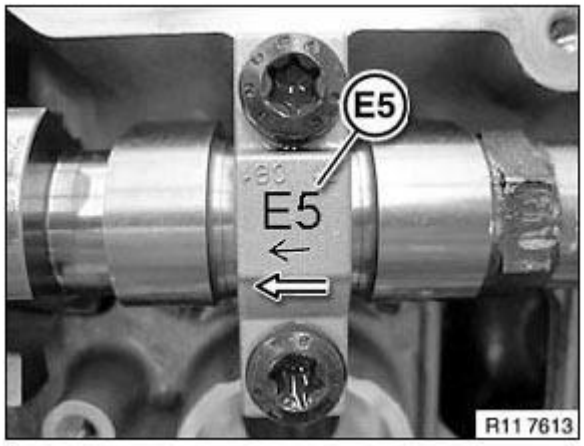


Fig. 232: Positioning Travel Direction To Chain Drive
Courtesy of BMW OF NORTH AMERICA, INC.

Release screws (1) from inside outwards in 1/2 turns.

Tightening torque: **11 12 2AZ** .

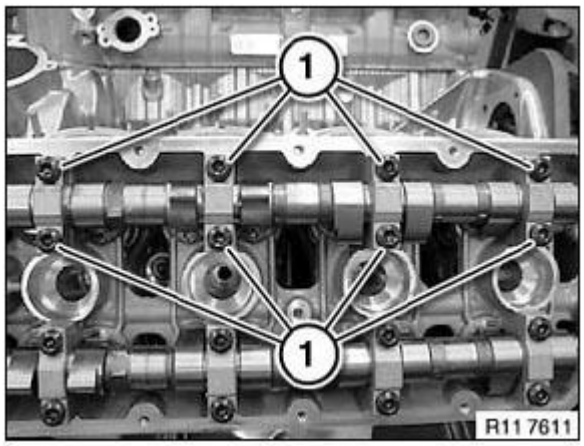


Fig. 233: Identifying Camshaft Screws
Courtesy of BMW OF NORTH AMERICA, INC.

Adjust **VALVE TIMING** .

Assemble engine.

11 31 036 REMOVING AND INSTALLING/REPLACING LEFT EXHAUST CAMSHAFT (S65)

Necessary preliminary tasks:

- Remove **LEFT CYLINDER HEAD COVER** .
- Remove left **VANOS EXHAUST GEAR**

Release screws (1).

Tightening torque: **11 12 2AZ** .

E Intake camshaft

A Exhaust camshaft.

IMPORTANT: Risk of mix-up with cylinder bank 1-4.
Arrow must point in direction of travel to chain drive.

Remove bearing cap (2).

Installation:

Lubricate all bearing points with engine oil.

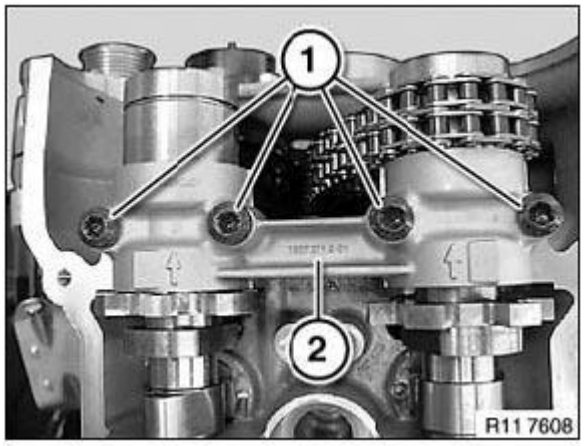


Fig. 234: Identifying Camshaft Screws
Courtesy of BMW OF NORTH AMERICA, INC.

Release screws (1) from outside inwards in 1/2 turns.

Tightening torque: **11 12 2AZ** .

Installation:

Lubricate all bearing points with engine oil.

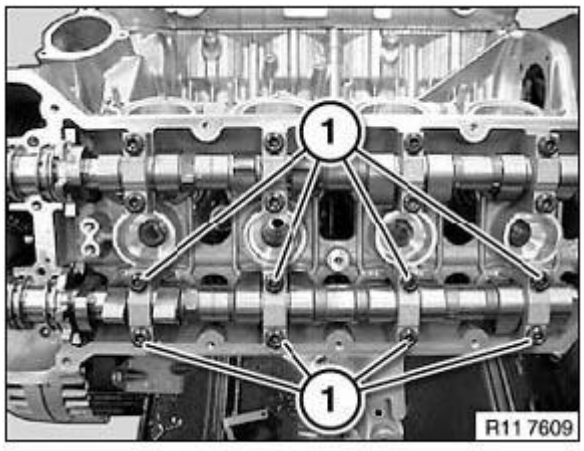


Fig. 235: Identifying Camshaft Screws
Courtesy of BMW OF NORTH AMERICA, INC.

Check plain compression rings for damage and replace if necessary.

The plain compression rings have catches at the joint.

Press plain compression rings apart upwards and downwards and remove towards front.

IMPORTANT: Plain compression rings can break easily.

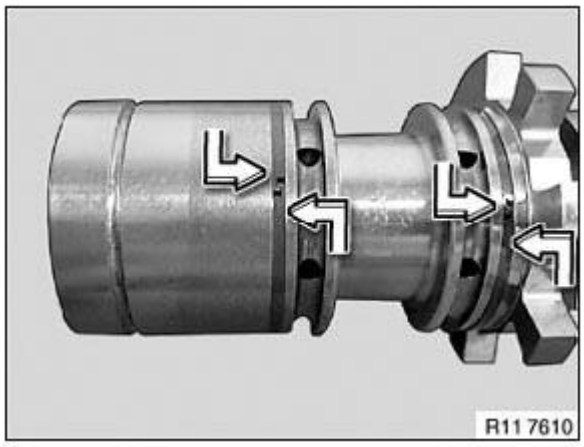


Fig. 236: Removing Plain Compression Rings
Courtesy of BMW OF NORTH AMERICA, INC.

Insert exhaust camshaft for cylinders 5 to 8.

Designation (A 2) on dihedron points upwards.

Cams (1) on cylinder no. 5 point upwards.

Installation:

Lubricate all bearing points with engine oil.

NOTE: Picture shows S85.

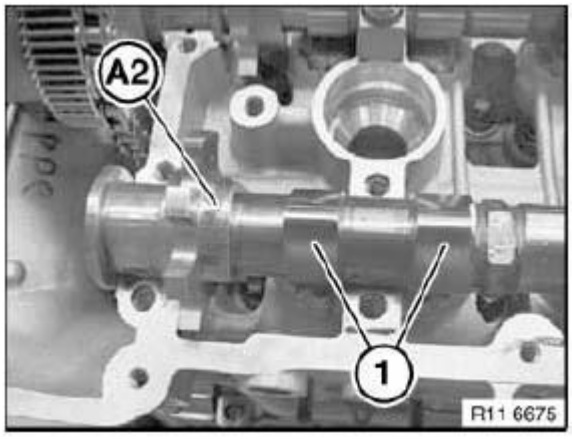


Fig. 237: Identifying Exhaust Camshaft Designation
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

All bearing shells are assigned to one cylinder.

E and A from (1 to 8), e.g. E 5= inlet side on cylinder no. 5.

Arrow must point in direction of travel to chain drive.

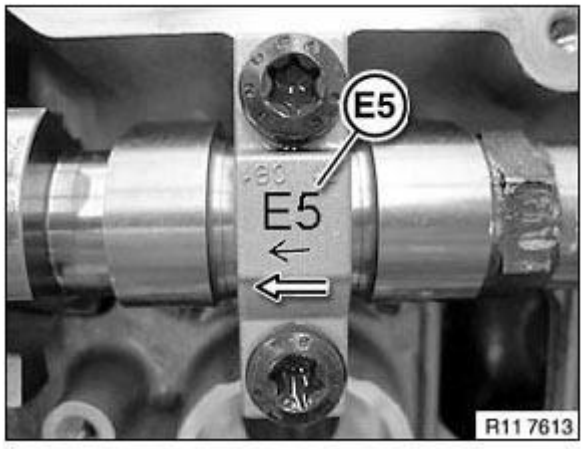


Fig. 238: Positioning Travel Direction To Chain Drive
Courtesy of BMW OF NORTH AMERICA, INC.

Release screws (1) from inside outwards in 1/2 turns.

Tightening torque: **11 12 2AZ** .

Installation:

Lubricate all bearing points with engine oil.

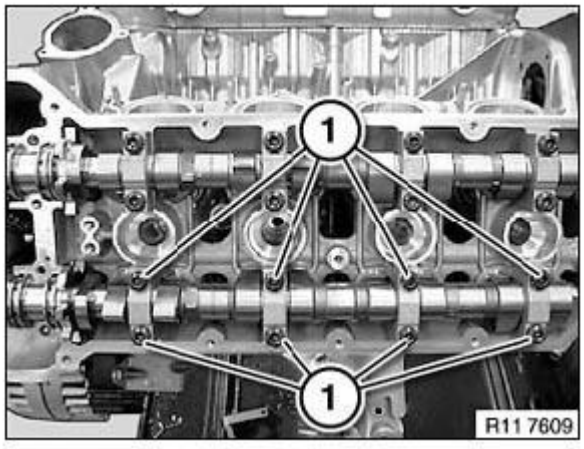


Fig. 239: Identifying Camshaft Screws
Courtesy of BMW OF NORTH AMERICA, INC.

Adjust **VALVE TIMING** .

Assemble engine.

11 31 094 REMOVING AND INSTALLING/REPLACING LEFT HYDRAULIC CHAIN TENSIONER (S65)

Necessary preliminary tasks:

- Remove left **INTAKE FILTER HOUSING**
- Remove **INTAKE AIR MANIFOLD** .

Release chain tensioner (1).

Installation:

Replace sealing ring.

Tightening torque: **11 31 1AZ** .

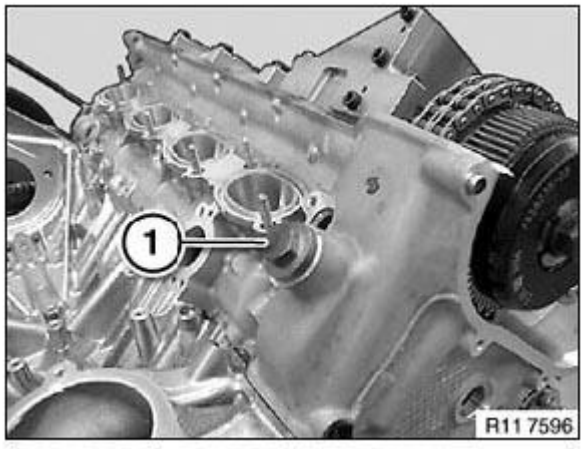


Fig. 240: Identifying Chain Tensioner
Courtesy of BMW OF NORTH AMERICA, INC.

Assemble engine.

11 31 038 REMOVING AND INSTALLING/REPLACING RIGHT EXHAUST CAMSHAFT (S65)

Necessary preliminary tasks:

- Remove right **CYLINDER HEAD COVER** .
- Remove right **VANOS EXHAUST GEAR**

Release screws (1).

Tightening torque: **11 12 2AZ** .

E Intake camshaft

A Exhaust camshaft.

IMPORTANT: Risk of mix-up with cylinder bank 5-8.
Arrow must point in direction of travel to chain drive.

Remove bearing caps.

Installation:

Lubricate all bearing points with engine oil.

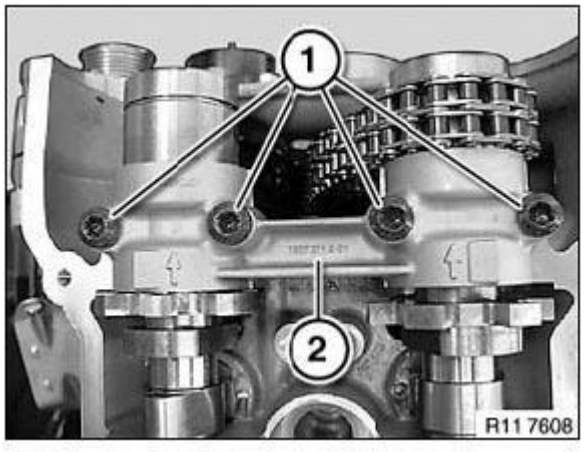


Fig. 241: Identifying Camshaft Screws
Courtesy of BMW OF NORTH AMERICA, INC.

Release screws (1) from outside inwards in 1/2 turns.

Tightening torque: **11 12 2AZ** .

Remove exhaust camshaft for cylinders 1 to 4.

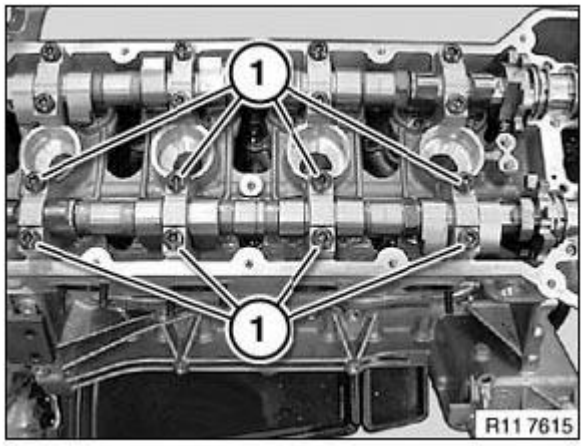


Fig. 242: Identifying Camshaft Screws
Courtesy of BMW OF NORTH AMERICA, INC.

Check plain compression rings for damage and replace if necessary.

The plain compression rings have catches at the joint.

Press plain compression rings apart upwards and downwards and remove towards front.

IMPORTANT: Plain compression rings can break easily.

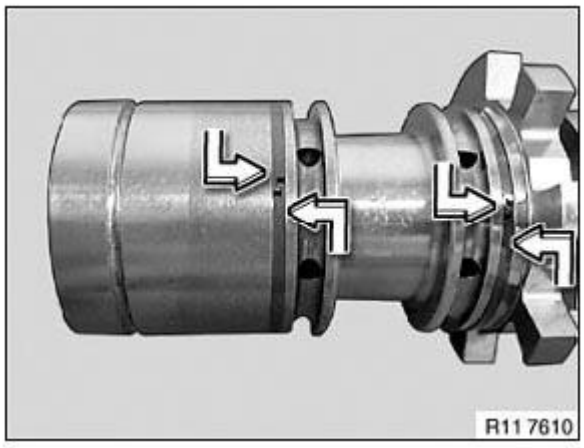


Fig. 243: Removing Plain Compression Rings
Courtesy of BMW OF NORTH AMERICA, INC.

Insert exhaust camshaft for cylinders 1 to 4.

Designation (A1) on dihedron points upwards.

Cams on cylinder no. 4 point upwards.

Installation:

Lubricate all bearing points with engine oil.

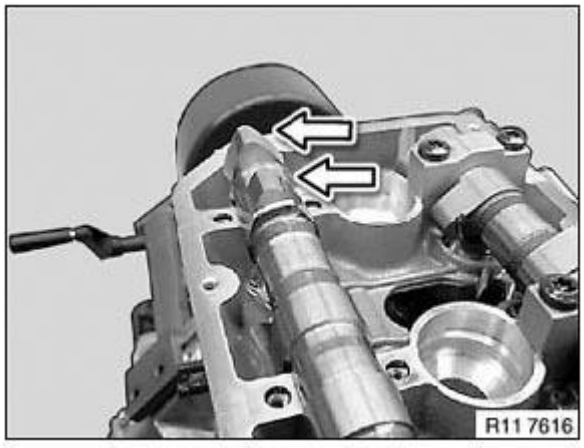


Fig. 244: Positioning Exhaust Camshaft Lobs
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

All bearing shells are assigned to one cylinder.

E and A from (1 to 8), e.g. A 1= exhaust side on 1st cylinder.

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

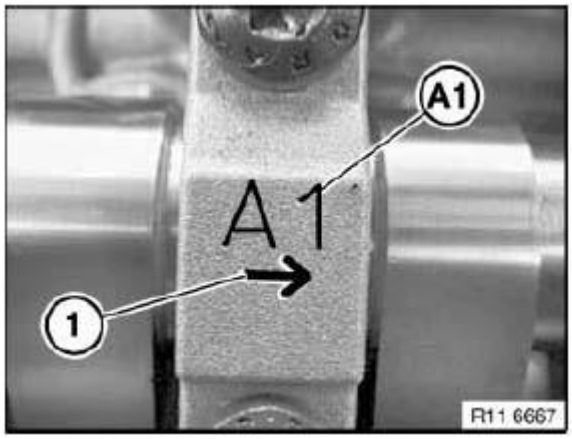


Fig. 245: Positioning Travel Direction To Chain Drive
Courtesy of BMW OF NORTH AMERICA, INC.

Release screws (1) from inside outwards in 1/2 turns.

Tightening torque: **11 12 2AZ** .

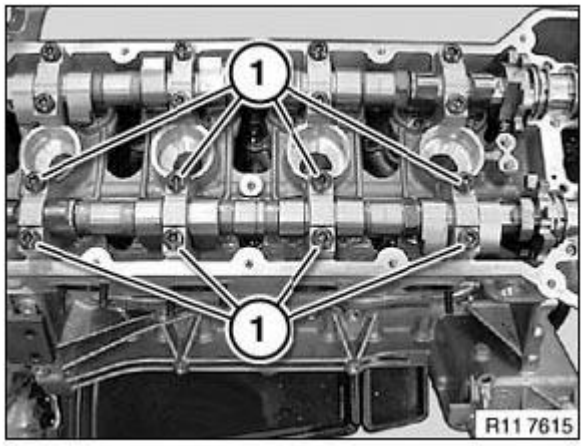


Fig. 246: Identifying Camshaft Screws
Courtesy of BMW OF NORTH AMERICA, INC.

Adjust valve timing.

Assemble engine.

11 31 095 REMOVING AND INSTALLING/REPLACING RIGHT HYDRAULIC CHAIN TENSIONER (S65)

Necessary preliminary tasks:

- Remove **EXPANSION TANK** .
- Unfasten both **A/C LINES** on A/C compressor.

Release chain tensioner (1).

Installation:

Replace sealing ring.

Tightening torque: **11 31 1AZ** .

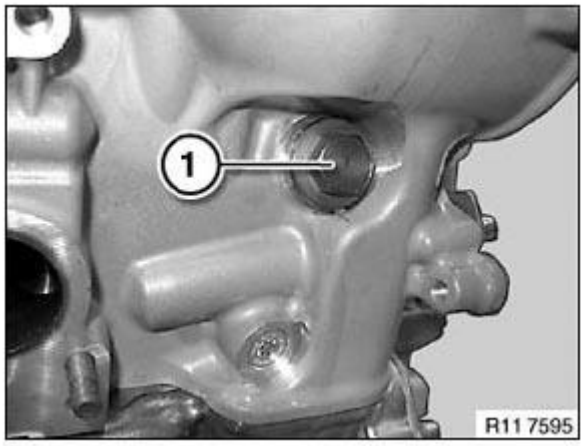


Fig. 247: Identifying Chain Tensioner
Courtesy of BMW OF NORTH AMERICA, INC.

Assemble engine.

11 31 034 REMOVING AND INSTALLING/REPLACING RIGHT INLET CAMSHAFT (S65)

Necessary preliminary tasks:

- Remove right **CYLINDER HEAD COVER** .
- Remove right **VANOS EXHAUST GEAR**
- Remove right **VANOS INLET GEAR**

Release screws (1).

Tightening torque: **11 12 2AZ** .

E Intake camshaft

A Exhaust camshaft.

IMPORTANT: Risk of mix-up with cylinder bank 5-8.
Arrow must point in direction of travel to chain drive.

Installation:

Lubricate all bearing points with engine oil.

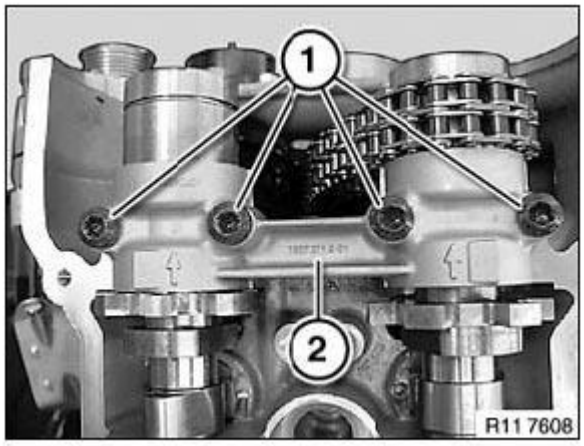


Fig. 248: Identifying Camshaft Screws
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: Illustration shows cylinders 5-8.

Release screws (1) from outside inwards in 1/2 turns.

Tightening torque: **11 12 2AZ** .

Installation:

Lubricate all bearing points with engine oil.

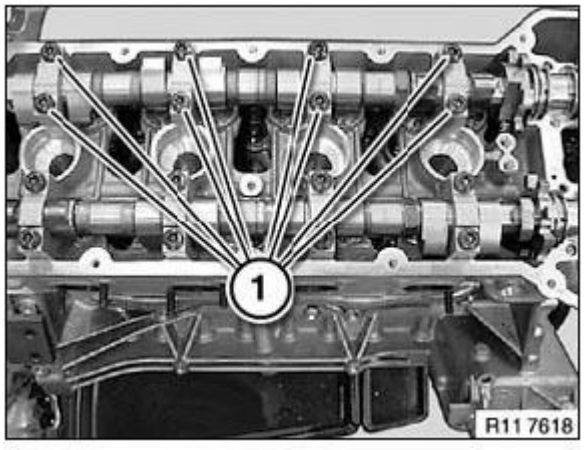


Fig. 249: Identifying Camshaft Screws
Courtesy of BMW OF NORTH AMERICA, INC.

Check plain compression rings for damage and replace if necessary.

The plain compression rings have catches at the joint.

Press plain compression rings apart upwards and downwards and remove towards front.

IMPORTANT: Plain compression rings can break easily.

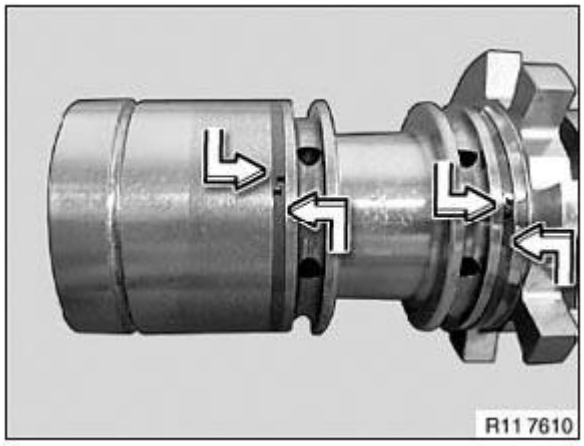


Fig. 250: Removing Plain Compression Rings
Courtesy of BMW OF NORTH AMERICA, INC.

Insert inlet camshaft (1) for cylinders 1 to 4.

Designation (E1) on dihedron points upwards.

Cams on cylinders (1 and 3) point upwards at an angle.

Installation:

Lubricate all bearing points with engine oil.

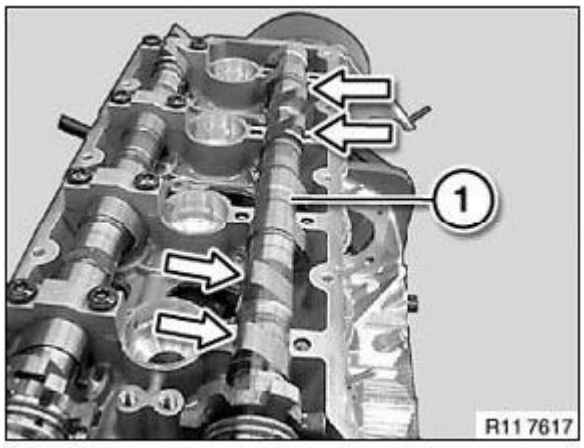


Fig. 251: Positioning Inlet Camshaft Lobes
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

All bearing shells are assigned to one cylinder.

E and A from (1 to 8), e.g. E 1= inlet side on 1st cylinder.

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

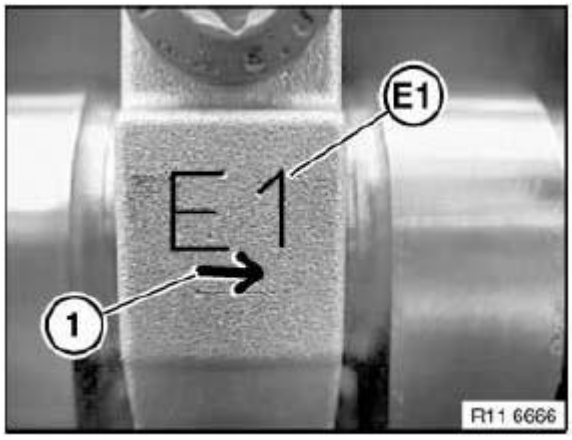


Fig. 252: E 1= Inlet Side On 1st Cylinder
Courtesy of BMW OF NORTH AMERICA, INC.

Release screws (1) from inside outwards in 1/2 turns.

Tightening torque: **11 12 2AZ** .

Installation:

Lubricate all bearing points with engine oil.

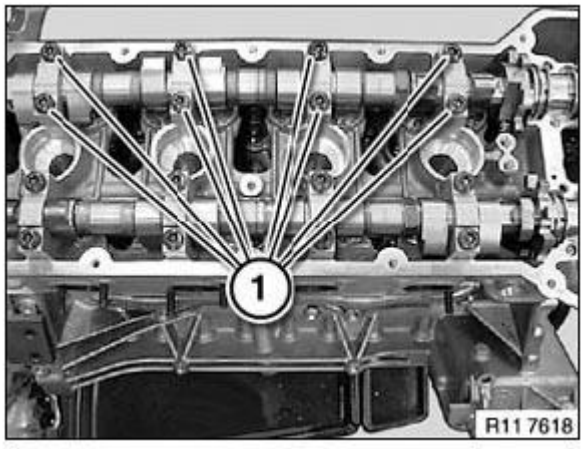


Fig. 253: Identifying Camshaft Screws
Courtesy of BMW OF NORTH AMERICA, INC.

Adjust valve timing.

Assemble engine.

11 31 051 REPLACING BOTH TIMING CHAINS (S65)

Necessary preliminary tasks:

- Remove all **VANOS gears** . See **1136142 REMOVING AND INSTALLING/REPLACING LEFT INLET VANOS GEAR (S65)**; **1136144 REMOVING AND INSTALLING/REPLACING LEFT EXHAUST VANOS GEAR (S65)**; **1136148 REMOVING AND INSTALLING/REPLACING RIGHT INLET VANOS GEAR (S65)** or **1136150 REMOVING AND INSTALLING/REPLACING RIGHT EXHAUST VANOS GEAR (S65)**.
- Remove **RADIAL SHAFT SEAL** at front.
- Remove **OIL PUMP** .
- Remove **OIL RETURN PUMP** .
- Remove **OIL FILTER HOUSING** .

Release screw plug (1) on bank 1.

Tightening torque: **11 12 4AZ** .

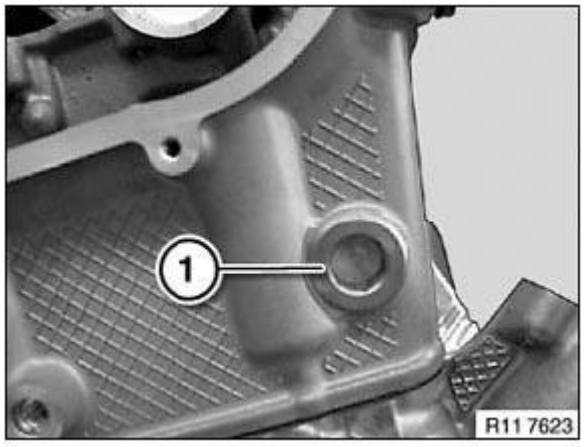


Fig. 254: Identifying Screw Plug
Courtesy of BMW OF NORTH AMERICA, INC.

Release screw plugs (1).

Tightening torque: **11 11 6AZ** .

Release screw (2).

Remove intermediate piece (3) without gearwheel towards front.

IMPORTANT: Gearwheel can fall out.

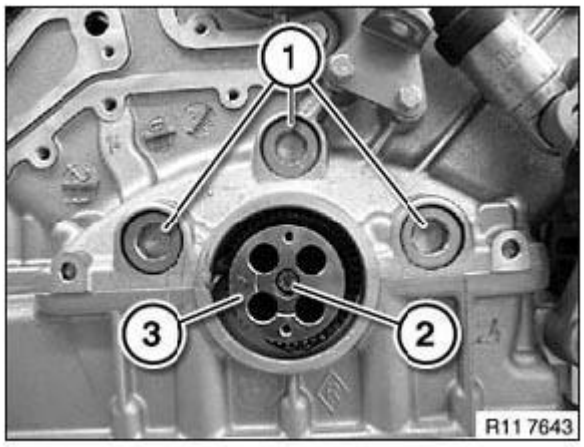


Fig. 255: Identifying Screw Plugs, Screw And Intermediate Piece
Courtesy of BMW OF NORTH AMERICA, INC.

Arrangement of gearwheel and intermediate piece

Gearwheel (1) with dowel pin.

Intermediate piece (2).

Central bolt (3).

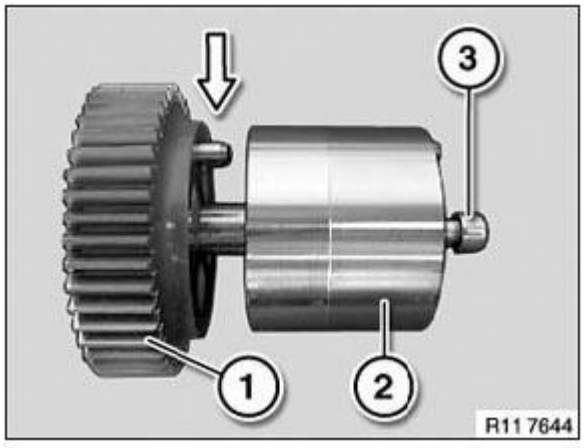


Fig. 256: Identifying Intermediate Piece, Gearwheel And Central Bolt
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: Bearing pin (1) is only inserted.

Bearing pin (2) for two tensioning rails.

Remove bearing pin with special tool 11 5 290.

Tightening torque: **11 31 2AZ** .

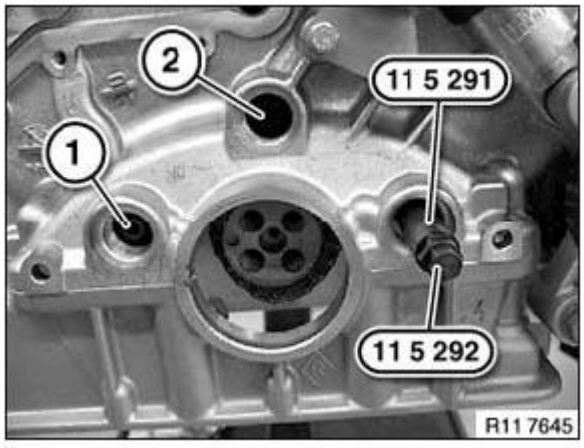


Fig. 257: Removing Bearing Pin
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: Bearing pin (1) is only inserted.

Screw in special tool 11 5 292 at bearing pin (1) and pull out.

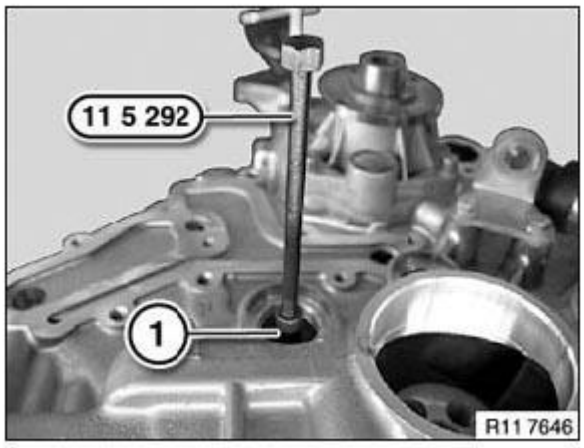


Fig. 258: Removing Bearing Pin
Courtesy of BMW OF NORTH AMERICA, INC.

Remove bearing pin with special tool 11 5 290.

Tightening torque: **11 31 2AZ** .

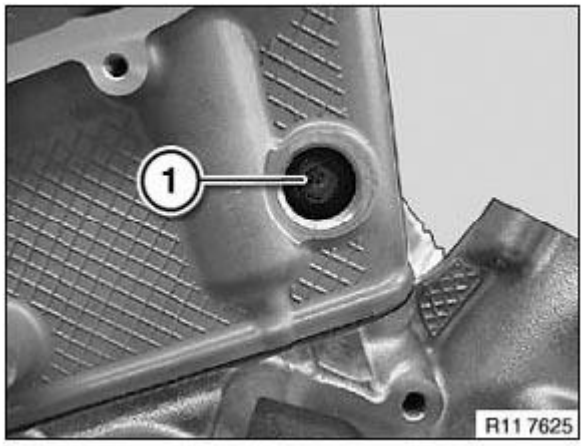


Fig. 259: Identifying Bearing Pin
Courtesy of BMW OF NORTH AMERICA, INC.

Arrangement of both timing chains

1. Timing chain, bank 2.
2. Timing chain, bank 2.
3. Guide rail, bank 1.
4. Timing chain, bank 1.
5. Tensioning rail, bank 1.
6. Bearing pin, inserted type.
7. Bearing pin for two tensioning and guide rails.
8. Bearing pin, screwed type.
9. Guide rail, bank 2.

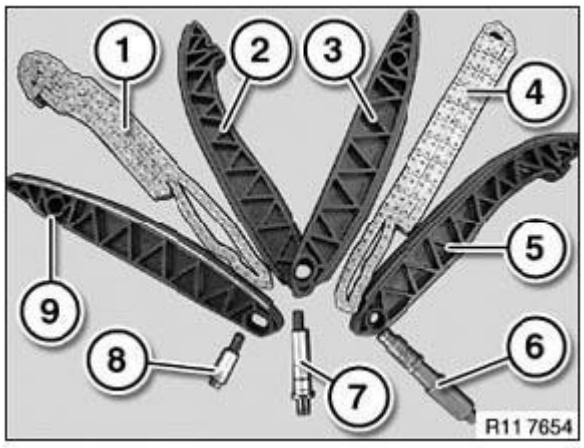


Fig. 260: Identifying Tensioning Rail, Bank 1, Timing Chain, Bank 1 And Guide Rail, Bank 1
Courtesy of BMW OF NORTH AMERICA, INC.

Remove timing chain, bank 2.

Remove timing chain, bank 1.

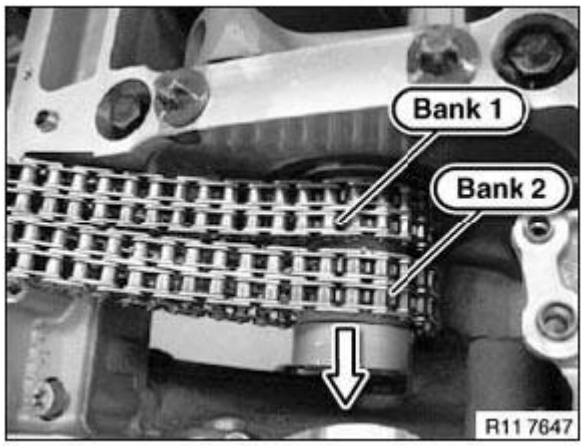


Fig. 261: Removing Timing Chain, Bank 1
Courtesy of BMW OF NORTH AMERICA, INC.

Assemble engine.

ROCKER ARM WITH BEARING MOUNT

11 33 062 REMOVING AND INSTALLING/REPLACING ALL HVCA (HYDRAULIC VALVE CLEARANCE ADJUSTMENT) ELEMENTS (S65)

IMPORTANT: Used HVCA elements may only be reused in the same position. Set HVCA elements down in a clean and orderly manner.

Necessary preliminary tasks:

- Remove **inlet camshaft** . See **1131032 REMOVING AND INSTALLING OR REPLACING LEFT INLET CAMSHAFTS (S65)** or **1131034 REMOVING AND INSTALLING/REPLACING RIGHT INLET CAMSHAFT (S65)**.
- Remove **exhaust camshaft** See **1131036 REMOVING AND INSTALLING/REPLACING LEFT EXHAUST CAMSHAFT (S65)** or **1131038 REMOVING AND INSTALLING/REPLACING RIGHT EXHAUST CAMSHAFT (S65)**.

Remove HVCA element (1) in upward direction.

Installation:

Turning lock (2) on cylinder head.

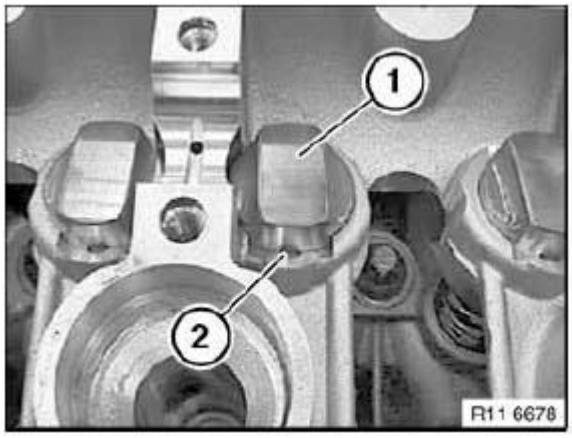


Fig. 262: Identifying HVCA Element And Lock
Courtesy of BMW OF NORTH AMERICA, INC.

Check surface (1) of HVCA element for damage.

Installation:

Turning lock (2) on HVCA element.

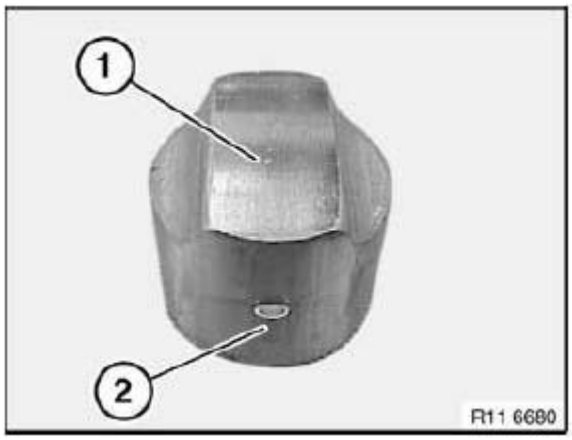


Fig. 263: Identifying HVCA Element Lock
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Check valve keys (1) for correct seating.

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

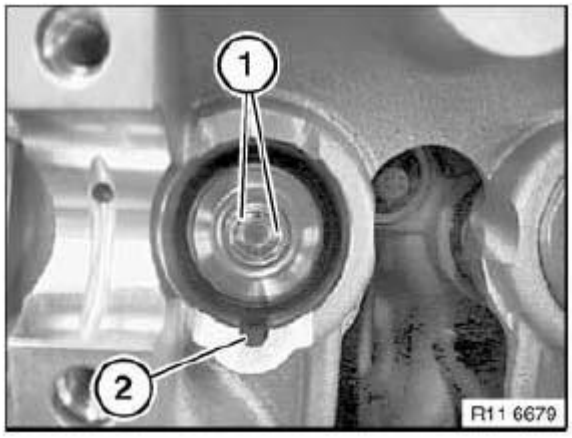


Fig. 264: Identifying Valve Keys
Courtesy of BMW OF NORTH AMERICA, INC.

Assemble engine.

VALVES WITH SPRINGS

11 34 552 REMOVING AND INSTALLING/REPLACING ALL VALVES (S65)

IMPORTANT: Risk of damage to cylinder head.
Use only the approved special tools.
Plastic rings on the special tools must not be damaged.

Necessary preliminary tasks:

- Remove **INTAKE AIR MANIFOLD**.
- Remove **cylinder head cover and cylinder heads** on left and right.
- Remove all **SPARK PLUGS** .
- If necessary, remove and install engine.

NOTE: Place cylinder head (1) on special tool 11 9 001.

Prepare special tool 11 9 006 with special tool 11 9 008.

NOTE: Picture shows S85.

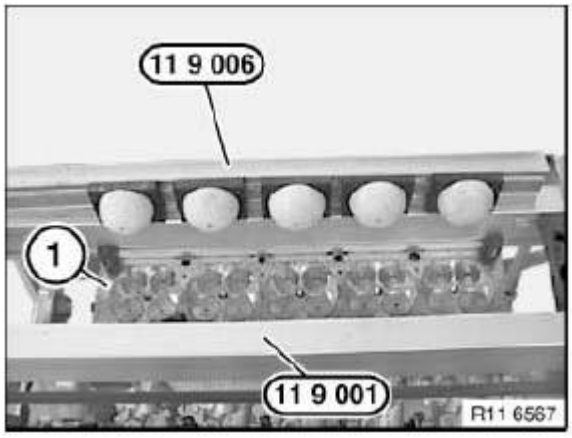


Fig. 265: Identifying Cylinder Head On Special Tool
Courtesy of BMW OF NORTH AMERICA, INC.

Insert aluminum profile rail (1) and align.

Secure eccentric clamping levers (2 and 3).

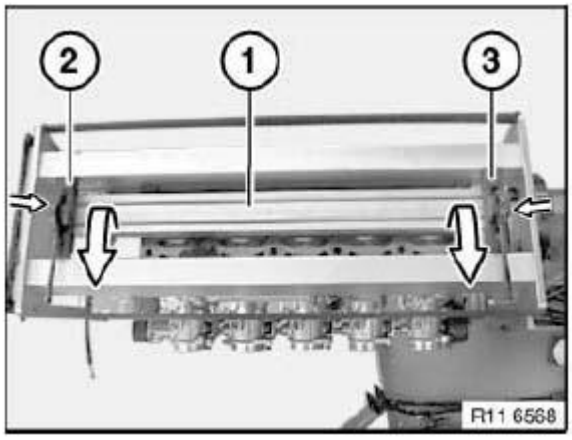


Fig. 266: Securing Eccentric Clamping Levers
Courtesy of BMW OF NORTH AMERICA, INC.

IMPORTANT: Special tools S85 11 5 281 and 11 5 282 must be modified to S65.

Special tool 11 5 281 for **removing** valve keys.

Special tool 11 5 282 for **installing** valve keys.

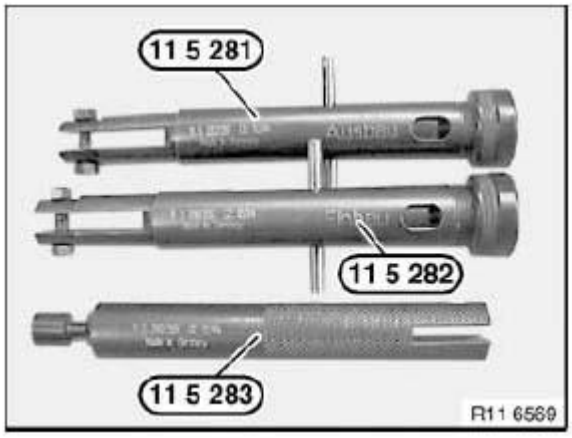


Fig. 267: Identifying Special Tool (11 5 281 And 11 5 282)
Courtesy of BMW OF NORTH AMERICA, INC.

Unscrew valve cage from special tool 11 5 281.

Special tool 11 9 951 (1 to 3) must be replaced.

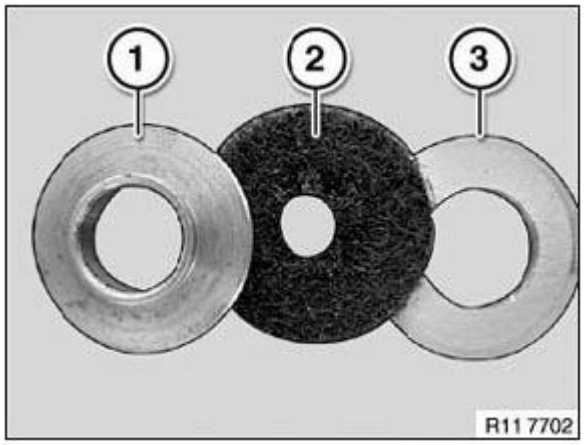


Fig. 268: Identifying Valve Cage
Courtesy of BMW OF NORTH AMERICA, INC.

Remove all washers of special tool 11 5 281 (S85).

Insert special tool 11 9 951 in correct order.

Insert washer (1) with collar facing down in valve cage (2).

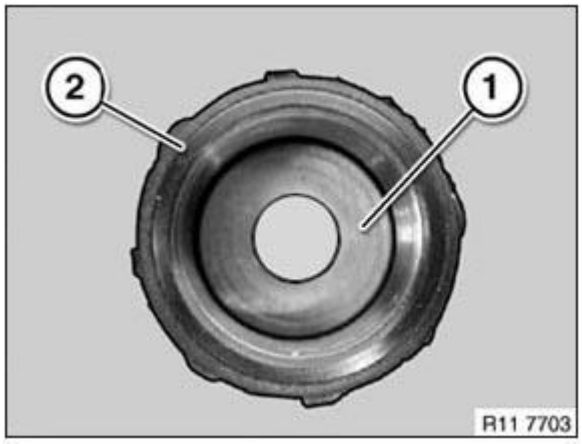


Fig. 269: Identifying Washer And Valve Cage
Courtesy of BMW OF NORTH AMERICA, INC.

Insert felt washer (2) with smooth side facing down in valve cage (1).

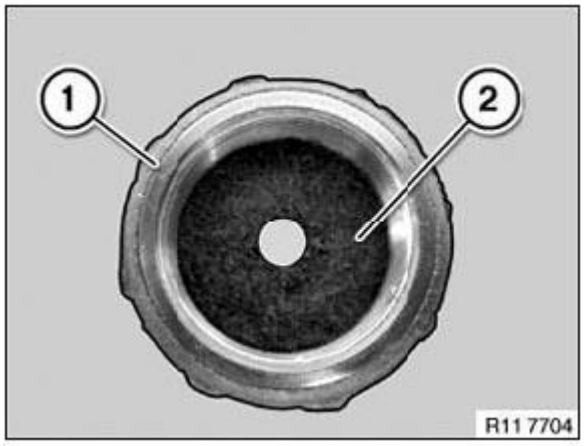


Fig. 270: Identifying Felt Washer And Valve Cage
Courtesy of BMW OF NORTH AMERICA, INC.

Insert washer (3) in valve cage (1).

Screw down special tool 11 5 281 with inserted special tool 11 9 951 again.

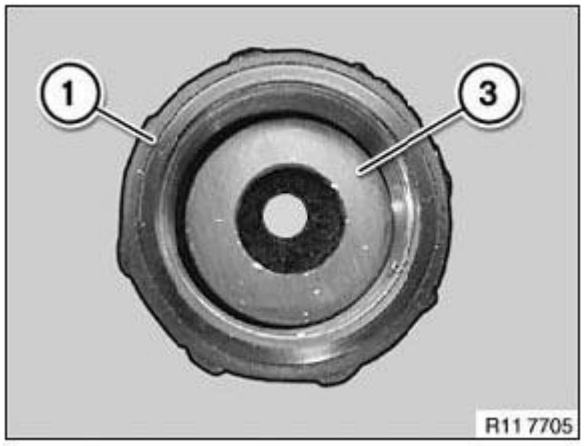


Fig. 271: Identifying Washer And Valve Cage
Courtesy of BMW OF NORTH AMERICA, INC.

Modify special tool 11 5 281 with special tool 11 9 951.

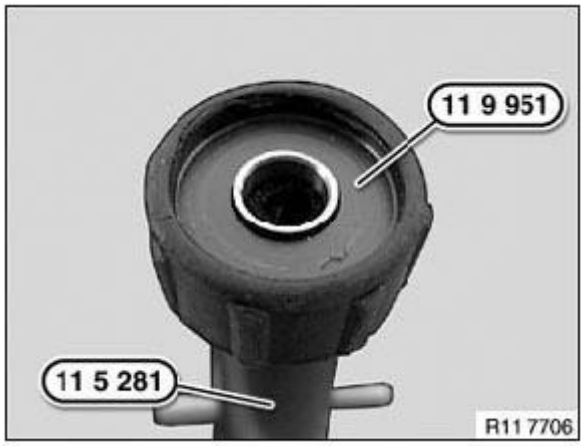


Fig. 272: Identifying Special Tool (11 5 281 And 11 9 951)
Courtesy of BMW OF NORTH AMERICA, INC.

IMPORTANT: In order to avoid damaging the HVCA guide, use only the designated special tools.

Adjust special tool 11 9 009 so that special tool 11 5 281 can press vertically onto the valve spring.

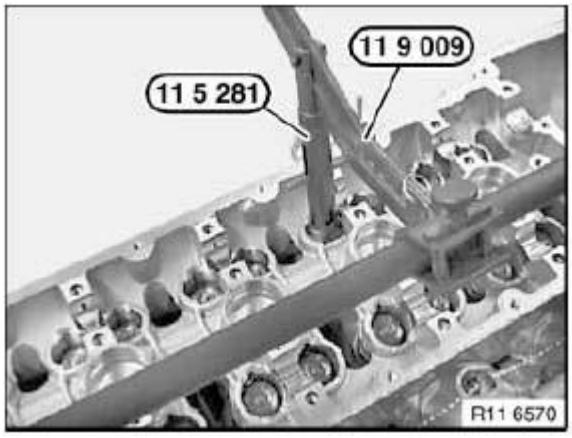


Fig. 273: Pressing Special Tool Onto Valve Spring
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: Special tool 11 5 281 incorporates a lever (1) which is tensioned with a spring.

Press down valve spring with special tool 11 9 009 and keep pressed.

Pretension lever (1) in direction of arrow.

Release lever (1) in tensioned position.

The valve keys still installed are thus forced out and drop into the working chamber of special tool 11 5 281.

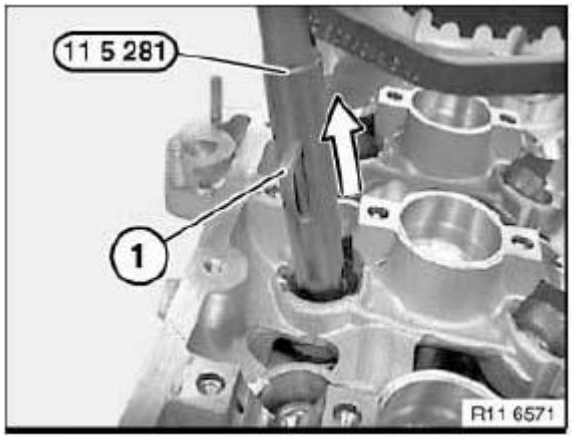


Fig. 274: Releasing Lever
Courtesy of BMW OF NORTH AMERICA, INC.

Repeat the operation several times if necessary until all the valve keys are forced out.

Pull back lever on special tool 11 5 281.

Valve keys (1) can now be ejected from the working chamber (2).

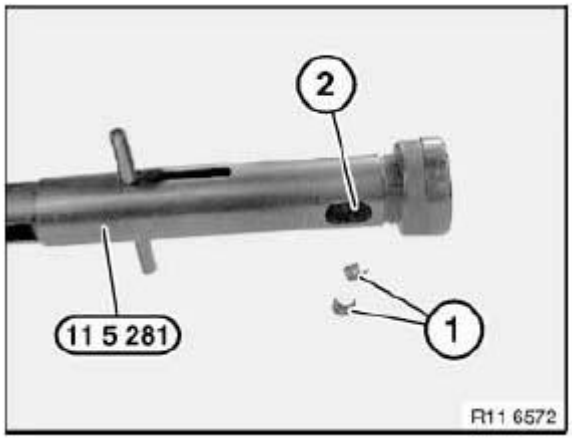


Fig. 275: Identifying Valve Keys And Working Chamber
Courtesy of BMW OF NORTH AMERICA, INC.

Remove special tool 11 9 006.

All the engine valves are now accessible.

Installation:

Set the engine valves down in neat and tidy order if they are to be reused.

Check valve seat for damage.

IMPORTANT: The cylinder head must be replaced if the valve seat is damaged. Remachining the valve seat ring is not permitted.

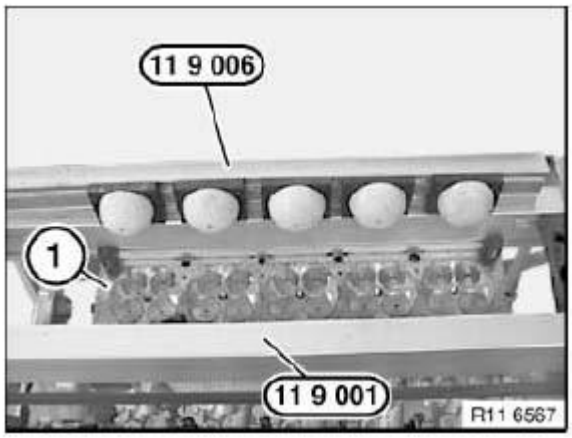


Fig. 276: Identifying Cylinder Head On Special Tool
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: Picture shows S85.

IMPORTANT: Use only special tool 11 9 953 to install the valve keys - risk of damage!

Press valve key (1) in direction of arrow into special tool 11 9 953.

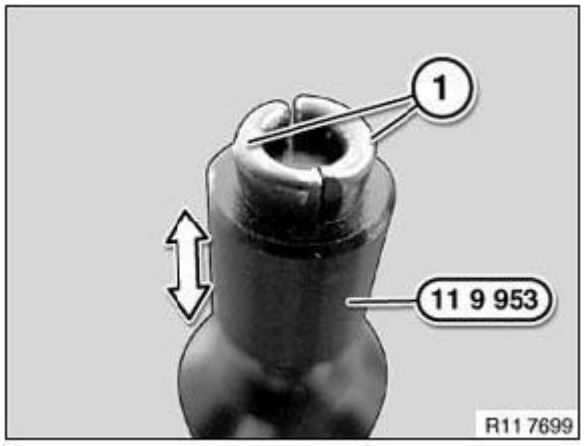


Fig. 277: Pressing Valve Key
Courtesy of BMW OF NORTH AMERICA, INC.

Secure valve keys (1).

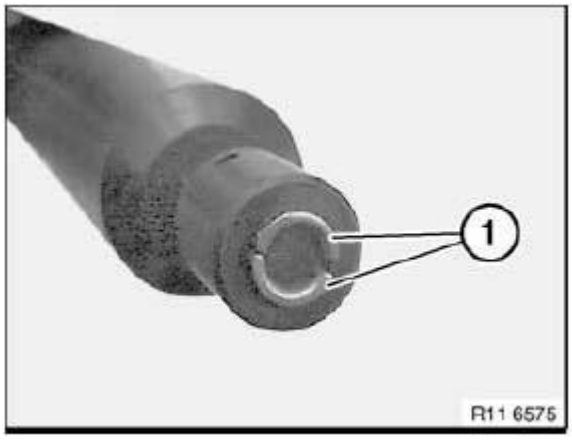


Fig. 278: Identifying Valve Keys
Courtesy of BMW OF NORTH AMERICA, INC.

Unscrew valve cage from special tool 11 5 282.

Special tool 11 9 952 must be replaced.

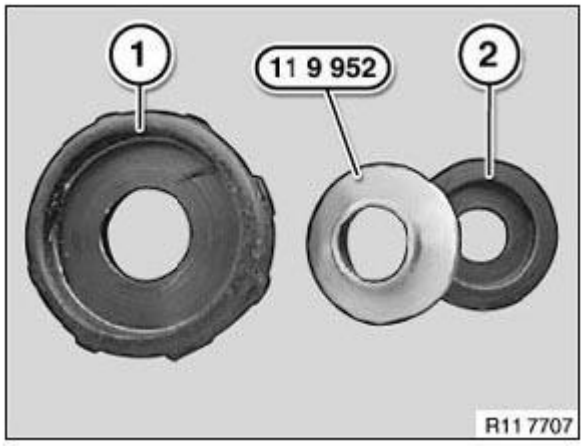


Fig. 279: Identifying Valve Cage
Courtesy of BMW OF NORTH AMERICA, INC.

Remove insert washer of special tool 11 5 282 (S85).

Insert special tool 11 9 952 in correct order.

Insert special tool 11 9 952 with taper facing up in valve cage (1) (see arrow).

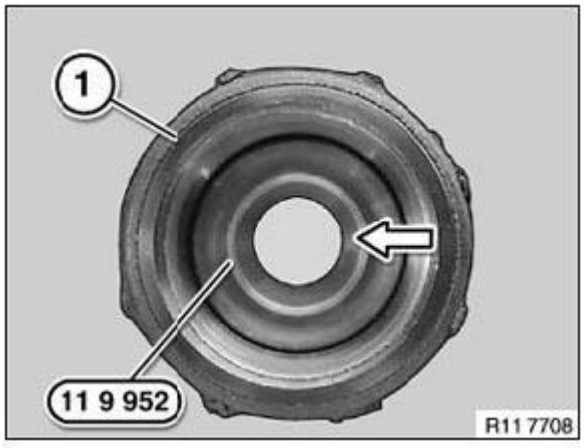


Fig. 280: Inserting Special Tool (11 9 952) Into Valve Cage
Courtesy of BMW OF NORTH AMERICA, INC.

Press valve keys into special tool 11 9 953 with special tool 11 5 283.

NOTE: Picture shows S85.

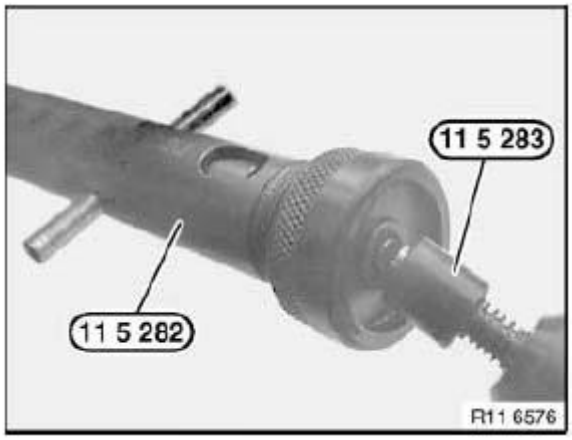


Fig. 281: Identifying Special Tool (11 5 283)
Courtesy of BMW OF NORTH AMERICA, INC.

Press valve keys in direction of arrow into special tool 11 5 282 with special tool 11 9 953.

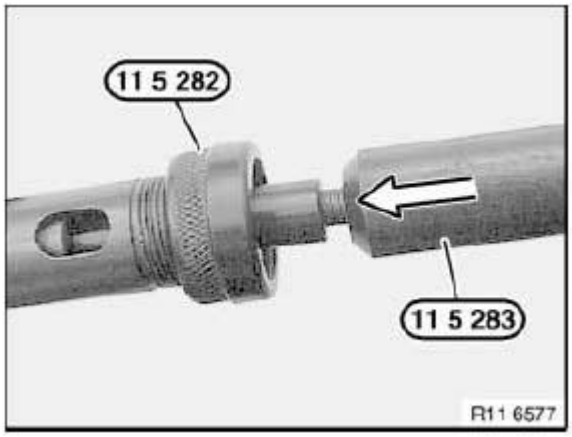


Fig. 282: Pressing Valve Keys
Courtesy of BMW OF NORTH AMERICA, INC.

Make sure valve keys (1) are correctly positioned.

Special tool 11 5 282 is prepared.

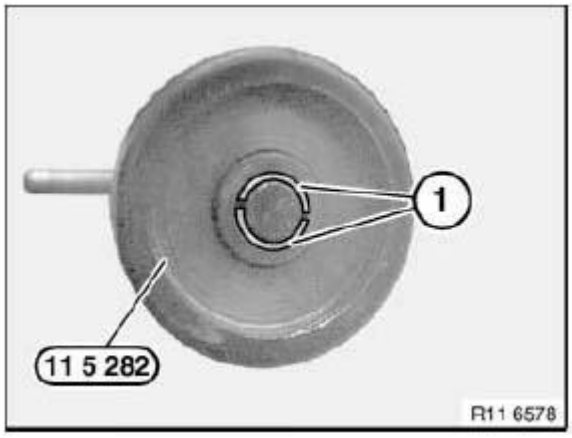


Fig. 283: Identifying Valve Keys Position
Courtesy of BMW OF NORTH AMERICA, INC.

Press down special tool 11 5 282 with special tool 11 9 009 in direction of arrow.

Installation:

Both valve keys are now pressed into their initial positions.

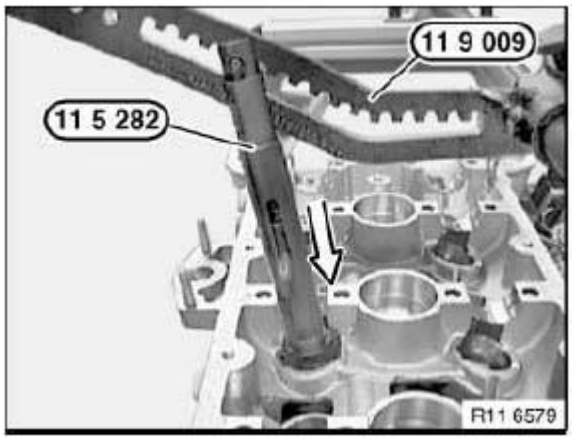


Fig. 284: Pressing Down Special Tool (11 5 282) With Special Tool (11 9 009)
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Check that valve keys are in correct installation position.

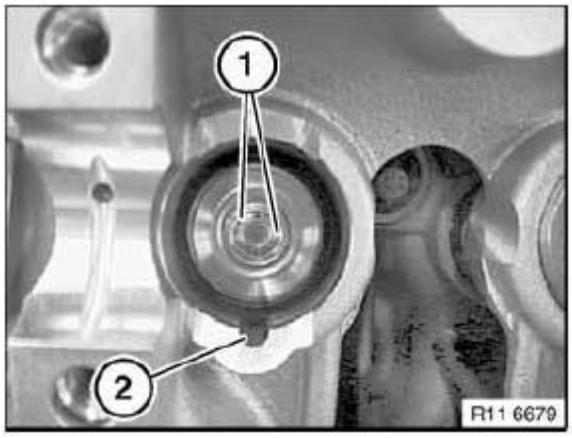


Fig. 285: Identifying Valve Keys
Courtesy of BMW OF NORTH AMERICA, INC.

Assemble engine.

11 34 715 REPLACING ALL VALVE SPRINGS (S65)

IMPORTANT: Risk of damage to cylinder head.
Use only the approved special tools.
Plastic rings on the special tools must not be damaged.
Special tools 11 5 821 and 11 5 282 must be modified to special tool 119950 DEVICE .

Necessary preliminary tasks:

- Remove **cylinder head**.
- Remove all **HVCA** elements.

NOTE: Place cylinder head (1) with cylinder head bolts on special tool 11 9 001.

Prepare special tool 11 9 006 with special tool 11 9 008.

NOTE: Picture shows S85.

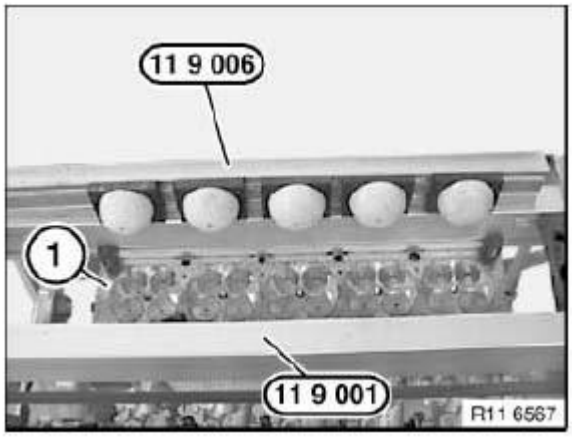


Fig. 286: Identifying Cylinder Head On Special Tool
Courtesy of BMW OF NORTH AMERICA, INC.

Insert aluminum profile rail (1) and align.

Secure eccentric clamping levers (2 and 3) in direction of arrow.

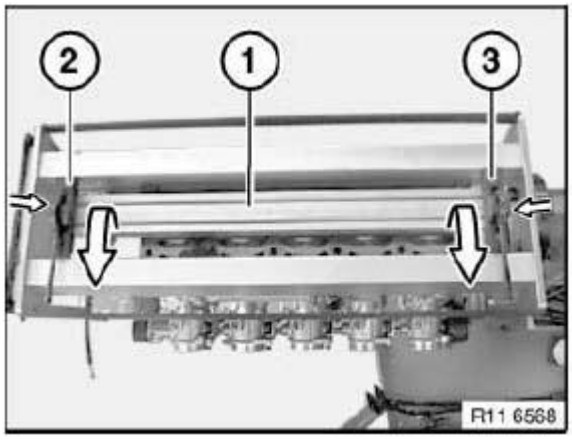


Fig. 287: Securing Eccentric Clamping Levers
Courtesy of BMW OF NORTH AMERICA, INC.

IMPORTANT: Special tools S85 11 5 281 and 11 5 282 must be modified to S65 119950 DEVICE .

Special tool 11 5 281 for **removing** valve keys.

Special tool 11 5 282 for **installing** valve keys.

Special tool 11 9 953 for **securing** valve keys.

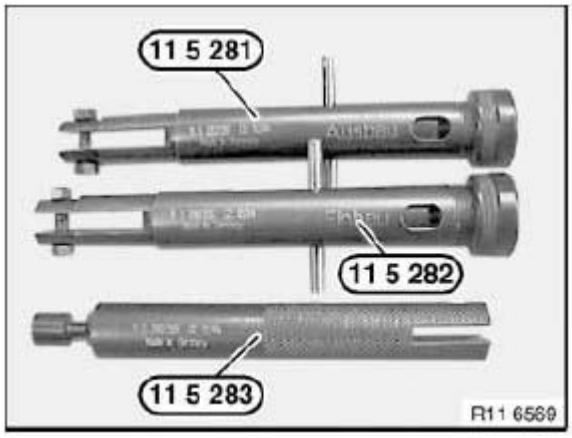


Fig. 288: Identifying Special Tool (11 5 281 And 11 5 282)
Courtesy of BMW OF NORTH AMERICA, INC.

Unscrew valve cage from special tool 11 5 281.

Special tool 11 9 951 (1 to 3) must be replaced.

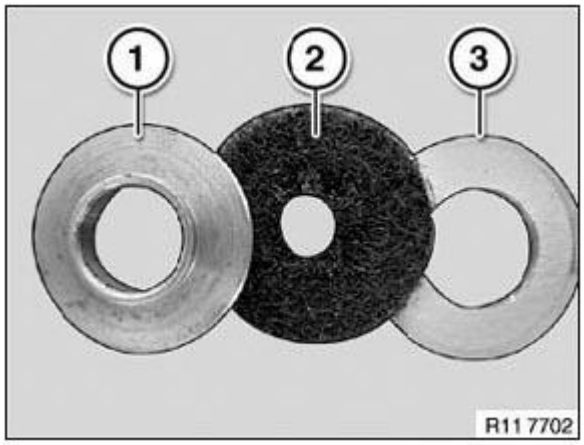


Fig. 289: Identifying Valve Cage
Courtesy of BMW OF NORTH AMERICA, INC.

Remove all washers of special tool 11 5 281 (S85).

Insert special tool 11 9 951 in correct order.

Insert washer (1) with collar facing down in valve cage (2).

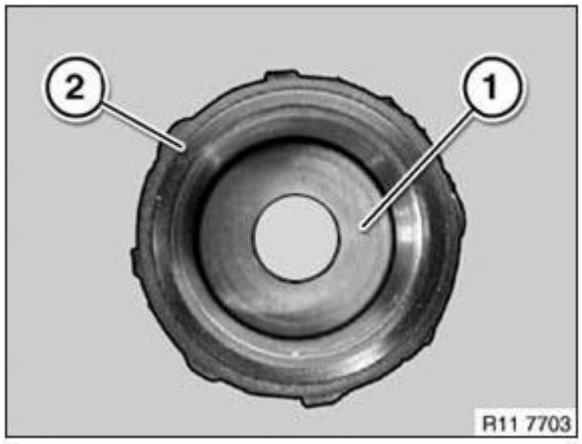


Fig. 290: Identifying Washer And Valve Cage
Courtesy of BMW OF NORTH AMERICA, INC.

Insert felt washer (2) with smooth side facing down in valve cage (1).

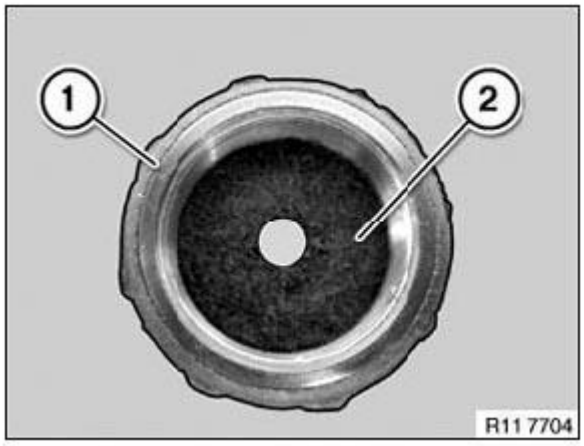


Fig. 291: Identifying Felt Washer And Valve Cage
Courtesy of BMW OF NORTH AMERICA, INC.

Insert washer (3) in valve cage (1).

Screw down special tool 11 5 281 with inserted special tool 11 9 951 again.

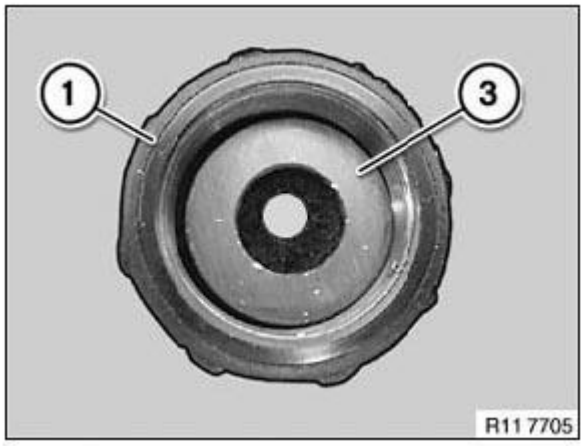


Fig. 292: Identifying Washer And Valve Cage
Courtesy of BMW OF NORTH AMERICA, INC.

Modify special tool 11 5 281 with special tool 11 9 951.

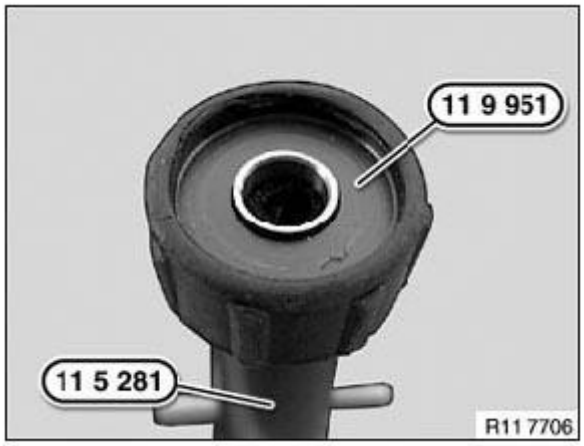


Fig. 293: Identifying Special Tool (11 5 281 And 11 9 951)
Courtesy of BMW OF NORTH AMERICA, INC.

IMPORTANT: Use only approved special tools.
Risk of damage to the HVCA guide.

Adjust special tool 11 9 009 so that special tool 11 5 281 can press vertically onto the valve spring.

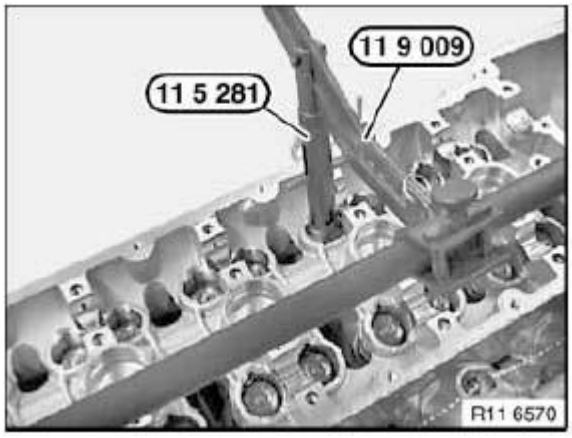


Fig. 294: Pressing Special Tool Onto Valve Spring
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: Lever (1) on special tool 11 5 281 is tensioned with a spring.

Press down valve spring with special tool 11 5 281 and keep pressed.

Pretension lever (1) in direction of arrow.

Release lever (1) in tensioned position.

The valve keys still installed are thus forced out and drop into the working chamber of special tool 11 5 281.

Repeat the operation several times if necessary until all the valve keys are forced out.

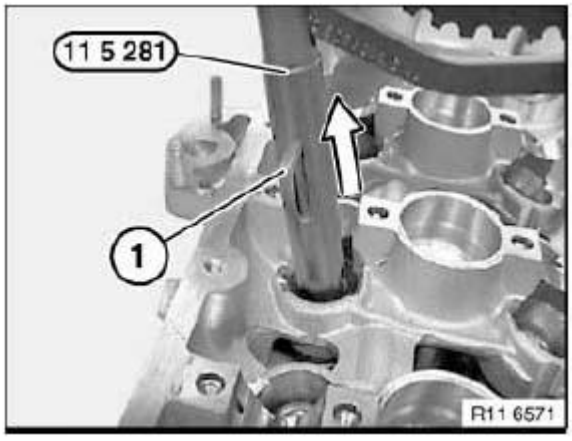


Fig. 295: Releasing Lever
Courtesy of BMW OF NORTH AMERICA, INC.

Pull back lever on special tool 11 5 281.

Valve keys (1) can now be ejected from the working chamber (2).

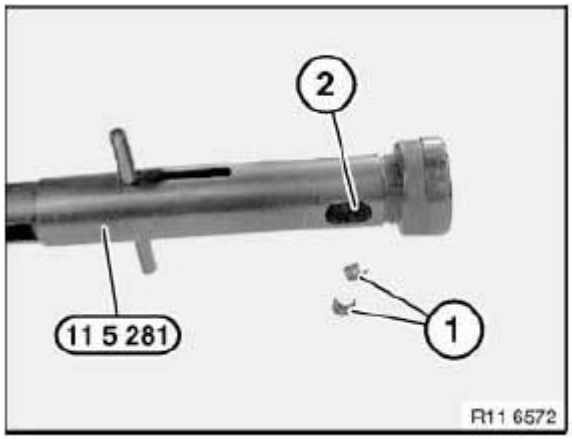


Fig. 296: Identifying Valve Keys And Working Chamber
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: Lower spring plate (1).
Progressive valve spring (2).
Upper spring plate (3).

Installation:

Incorrect installation is not possible.

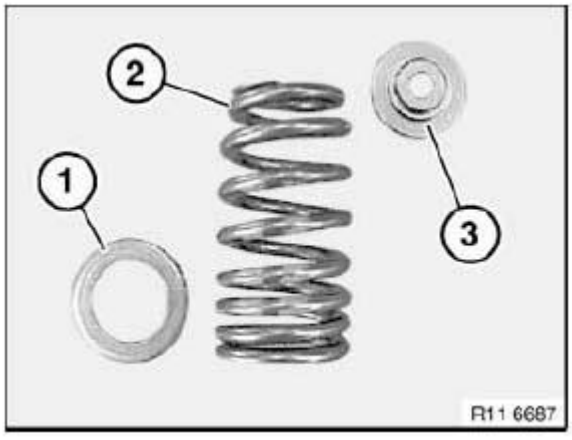


Fig. 297: Identifying Lower Spring Plate, Progressive Valve Spring And Upper Spring Plate
Courtesy of BMW OF NORTH AMERICA, INC.

Insert lower spring plate (1).

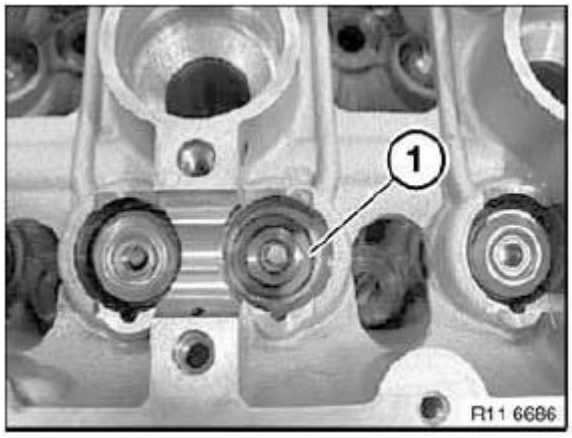


Fig. 298: Identifying Lower Spring Plate
Courtesy of BMW OF NORTH AMERICA, INC.

IMPORTANT: Use only special tool 11 9 953 to install the valve keys - risk of damage!

Press valve key (1) in direction of arrow into special tool 11 9 953.

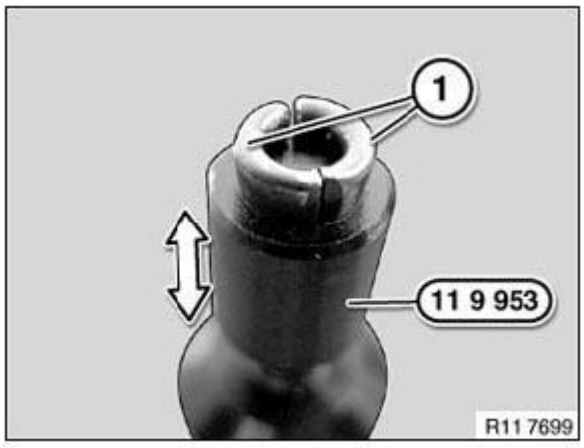


Fig. 299: Pressing Valve Key
Courtesy of BMW OF NORTH AMERICA, INC.

Secure valve keys (1).

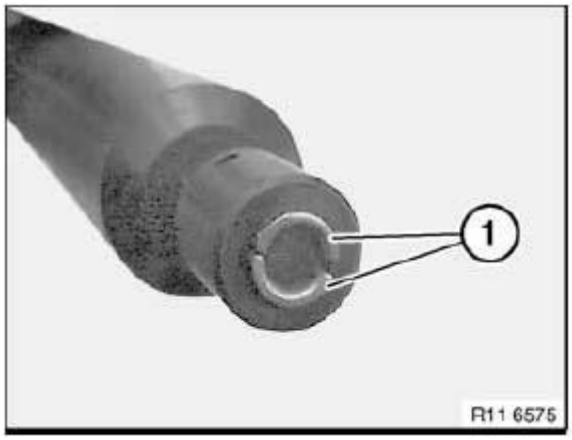


Fig. 300: Identifying Valve Keys
Courtesy of BMW OF NORTH AMERICA, INC.

Press valve keys into special tool 11 5 282 with special tool 11 9 953.

NOTE: Picture shows S85.

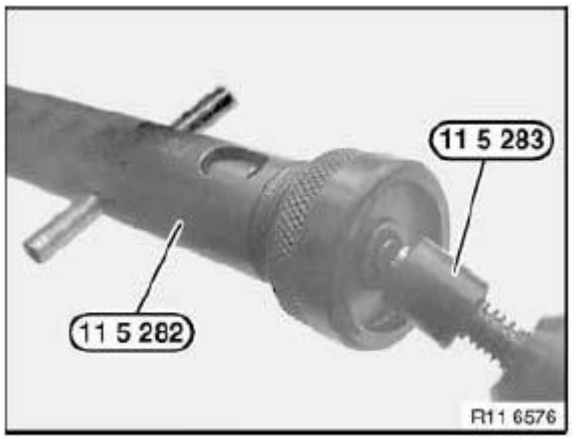


Fig. 301: Identifying Special Tool (11 5 283)
Courtesy of BMW OF NORTH AMERICA, INC.

Press valve keys into special tool 11 5 282 with special tool 11 9 953.

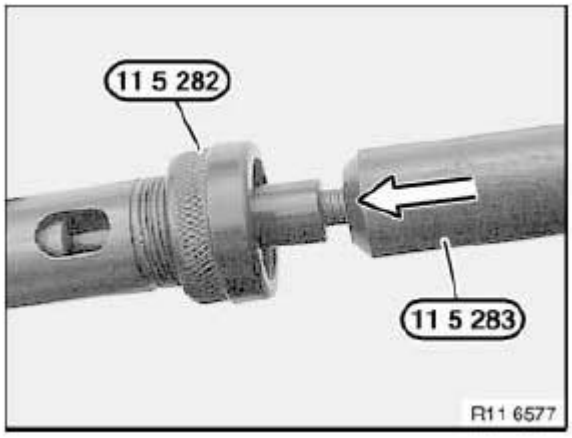


Fig. 302: Pressing Valve Keys
Courtesy of BMW OF NORTH AMERICA, INC.

Special tool 11 5 282 is prepared for installation.

Installation:

Positioning of valve keys (1).

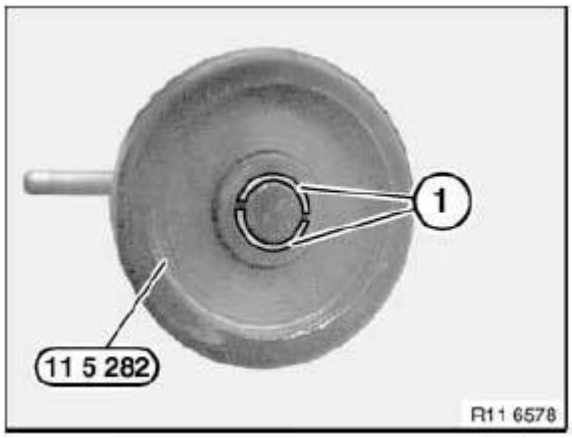


Fig. 303: Identifying Valve Keys Position
Courtesy of BMW OF NORTH AMERICA, INC.

Press down special tool 11 5 282 with special tool 11 9 009 in direction of arrow.

Installation:

Both valve keys are now pressed into their initial positions.

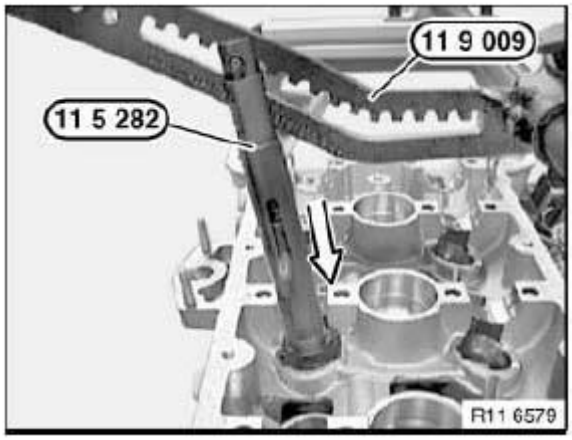


Fig. 304: Pressing Down Special Tool (11 5 282) With Special Tool (11 9 009)
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Check that valve keys (1) are in correct installation position.

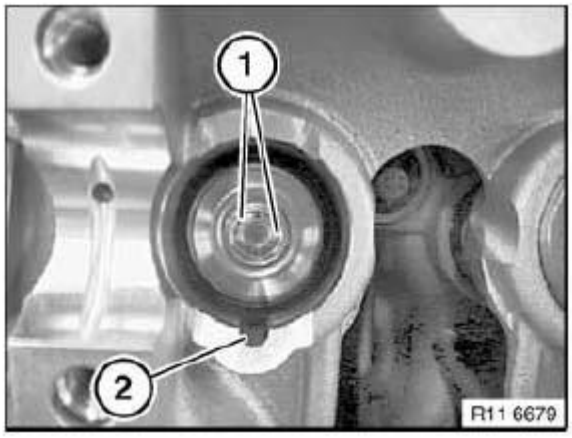


Fig. 305: Identifying Valve Keys
Courtesy of BMW OF NORTH AMERICA, INC.

Assemble engine.

11 34 560 REPLACING ALL VALVE STEM SEALS (S65)

Necessary preliminary tasks:

- Remove **cylinder head** See **1112105 REMOVING AND INSTALLING LEFT CYLINDER HEAD (S65)** or **1112106 REMOVING AND INSTALLING RIGHT CYLINDER HEAD (S65)**.
- Remove all **VALVE SPRINGS** .

Remove valve stem seal with special tool 11 1 480 in direction of arrow.

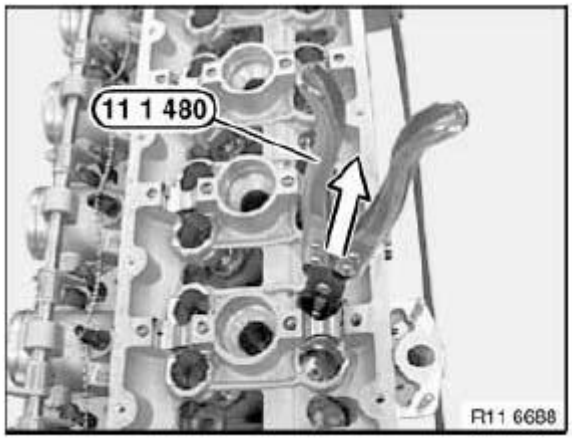


Fig. 306: Removing Valve Stem Seal Using Special Tool (11 1 480)
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Attach the mounting sleeve (1) supplied with the new part to the valve stem.

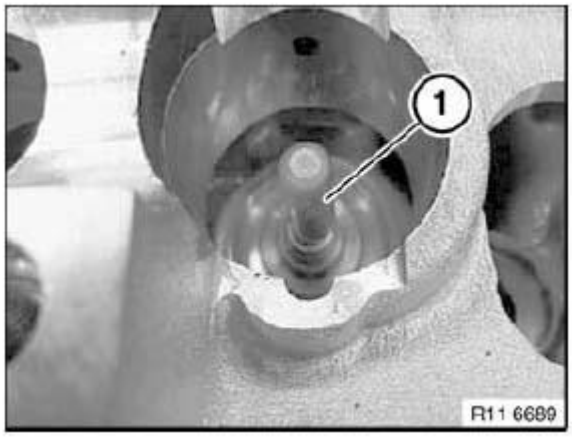


Fig. 307: Identifying Mounting Sleeve
Courtesy of BMW OF NORTH AMERICA, INC.

Attach valve stem seal (2) over mounting sleeve (1).

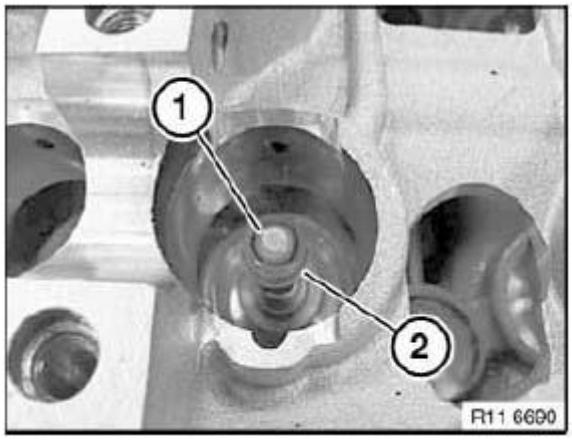


Fig. 308: Identifying Valve Stem Seal And Mounting Sleeve
Courtesy of BMW OF NORTH AMERICA, INC.

Press on valve stem seal with special tool 11 5 270 in direction of arrow as far as it will go.

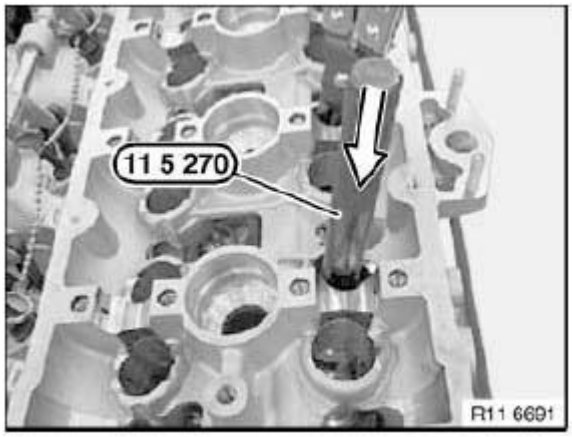


Fig. 309: Pressing Valve Stem Seal Using Special Tool (11 5 270)
Courtesy of BMW OF NORTH AMERICA, INC.

Assemble engine.

VARIABLE CAMSHAFT TIMING

11 36 144 REMOVING AND INSTALLING/REPLACING LEFT EXHAUST VANOS GEAR (S65)

IMPORTANT: Central bolts on VANOS gears have left-hand threads.
Do not release the central bolt of the adjustment units without the special tool 119970 GAUGE .
Grease contact surfaces of central bolts with copper paste.

Necessary preliminary tasks:

- Remove right **CYLINDER HEAD COVER**

Release bolts (1) on cylinder bank 2.

Remove timing case cover (2).

Installation:

Replace seal.

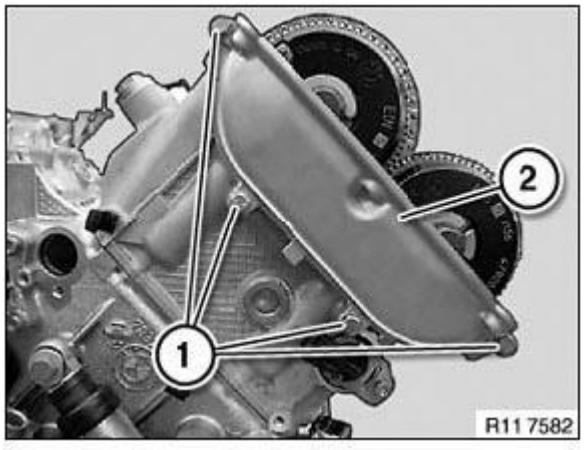


Fig. 310: Identifying Timing Case Cover And Bolts
Courtesy of BMW OF NORTH AMERICA, INC.

IMPORTANT: Both inlet and exhaust camshafts can be adjusted in the 1st cylinder firing TDC position.
Danger of mixing up both special tool bores.
The procedure for CHECKING TIMING is different from that for adjusting.

Fig. 311: Identifying Timing Marks
Courtesy of BMW OF NORTH AMERICA, INC.

Crank engine at central bolt.

Secure crankshaft with special tool 11 5 320 in firing TDC position of cylinder no. 1.

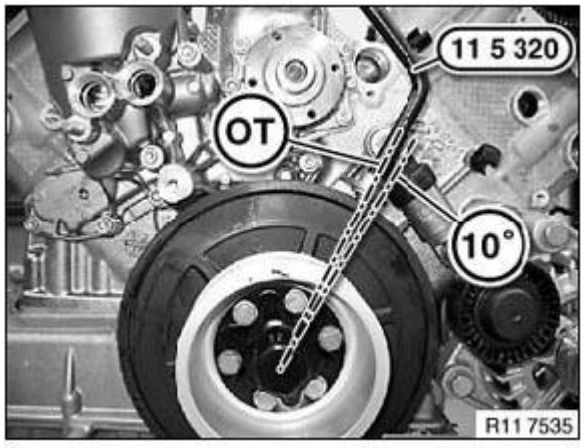


Fig. 312: Identifying Crankshaft Position
Courtesy of BMW OF NORTH AMERICA, INC.

Position of inlet camshafts, cyl. 5-8, in firing TDC position of cylinder no. 1.

Dihedron of inlet camshafts is vertical to cylinder axis, letters/numbers on camshafts point upwards (E2).

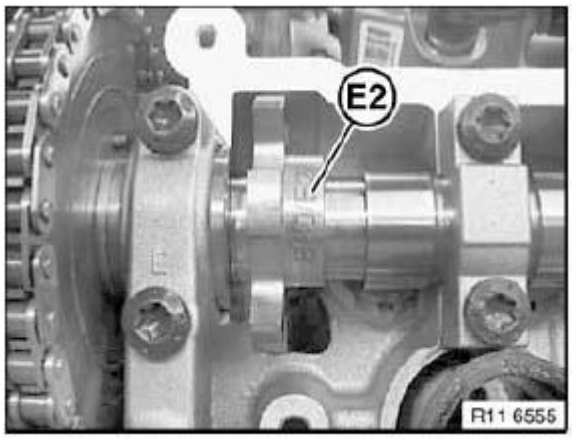


Fig. 313: Identifying Inlet Camshaft Designation
Courtesy of BMW OF NORTH AMERICA, INC.

Position of exhaust camshafts, cyl. 5-8, in firing TDC position of cylinder no. 1.

Dihedron of camshafts is vertical to cylinder axis, letters/numbers on camshafts point upwards (A2).

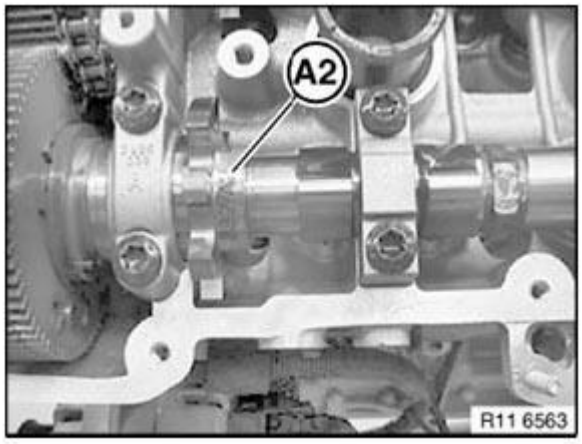


Fig. 314: Identifying Exhaust Camshaft Designation
Courtesy of BMW OF NORTH AMERICA, INC.

Place special tool 11 9 971 on inlet camshaft.

Designation (E2) on dihedron points upwards.

Place special tool 11 9 972 on exhaust camshaft.

Designation (A2) on dihedron points upwards.

Secure special tools 11 9 971 and 11 9 972 with bolts (1) on cylinder head to 10 Nm.

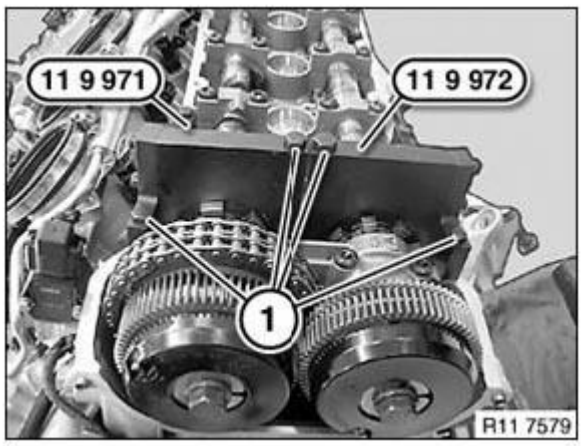


Fig. 315: Securing Camshafts With Special Tools (11 9 971 And 11 9 972)
Courtesy of BMW OF NORTH AMERICA, INC.

Align gearwheels on exhaust adjustment unit with special tool 11 5 370.

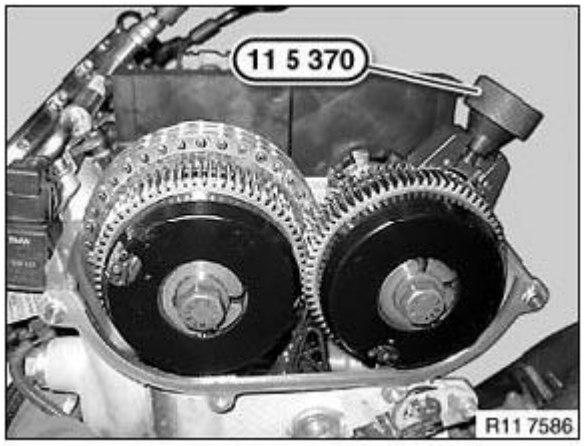


Fig. 316: Aligning Gearwheels On Exhaust Adjustment Unit Using Special Tool (11 5 370)
Courtesy of BMW OF NORTH AMERICA, INC.

IMPORTANT: Removal/installation is not possible without hexagon socket screw (2).
Hexagon socket screw (1) must not be longer than 10 mm.
Gearwheels of exhaust VANOS gear are pretensioned with a spring.

Insert M5x10 hexagon socket screw on VANOS gear.

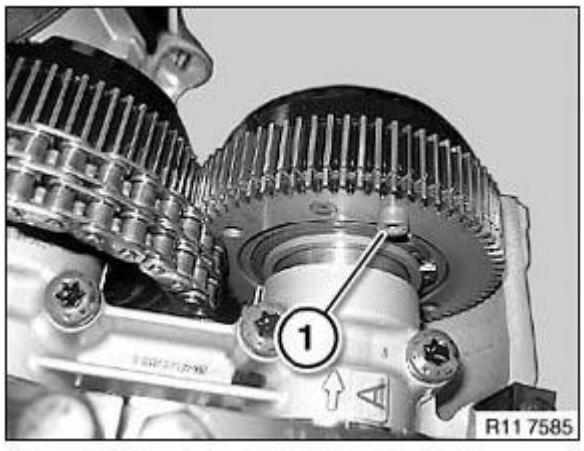


Fig. 317: Identifying Hexagon Socket Screw
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: Picture shows cylinders 1-4.

IMPORTANT: CCW thread!
Release central bolts (1 and 2).

Installation:

Replace central bolts (1 and 2).

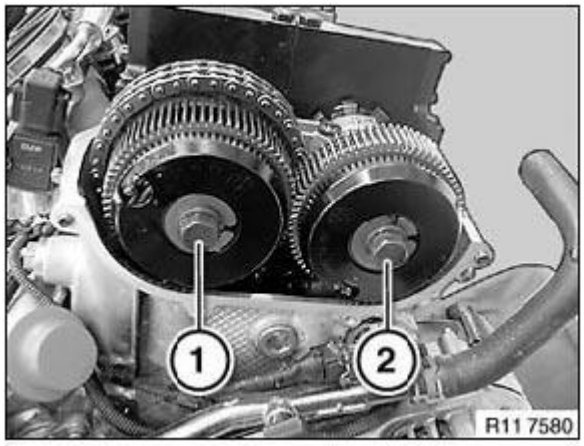


Fig. 318: Identifying Central Bolts
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

If the hexagon socket screw is released or forgotten by mistake, the gear teeth can be readjusted with special tool 11 5 370.

Screw in knurled screw on special tool 11 5 370 until gearwheel (1) lines up with bore (see arrow) on thread.

Failure to tension the exhaust VANOS gear (1) will result in rattling noises at idle.

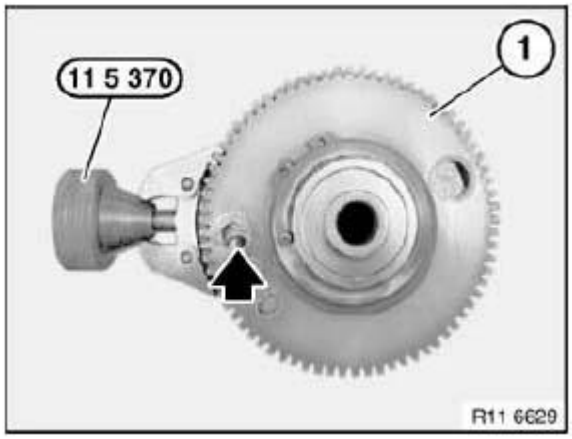


Fig. 319: Identifying Exhaust VANOS Gear
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: Picture shows (S85).

Installation:

Check O-ring (1) on VANOS gear, replace if necessary.

Fig. 320: Identifying VANOS Gear O-Ring
Courtesy of BMW OF NORTH AMERICA, INC.

IMPORTANT: Replace central bolt of adjustment unit.
Central bolt must be fully screwed once (refer to SCREW FASTENING LIST).

IMPORTANT: Rotate crankshaft at central bolt back until special tool 11 5 320 can be secured in the 10° position.

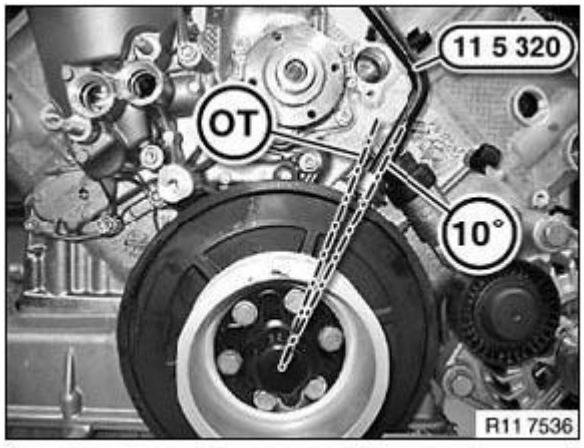


Fig. 321: Identifying Crankshaft Position
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Coat contact face of new central bolt (1) with copper paste.

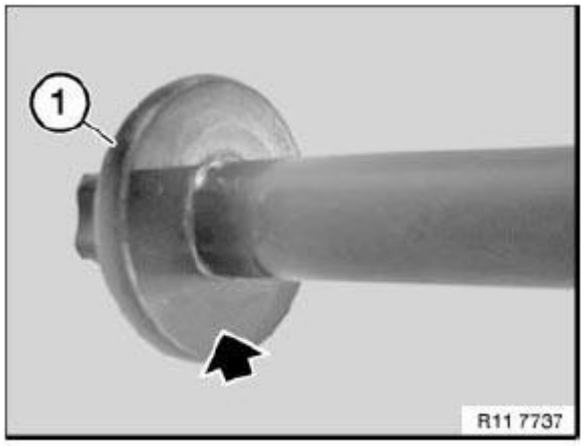


Fig. 322: Identifying Contact Face Of Central Bolt
Courtesy of BMW OF NORTH AMERICA, INC.

Position VANOS adjustment unit on camshaft.

Hexagon socket screw points upwards.

Insert central bolts (1 and 2) and screw with special tool **00 9 120 TORQUE ANGLE MEASURING DIAL** .

1. Joining 10 Nm
2. Joining 20 Nm
3. Settling torque 80 Nm
4. Torsion angle 200°
5. Unscrew central bolt.
6. Joining 10 Nm

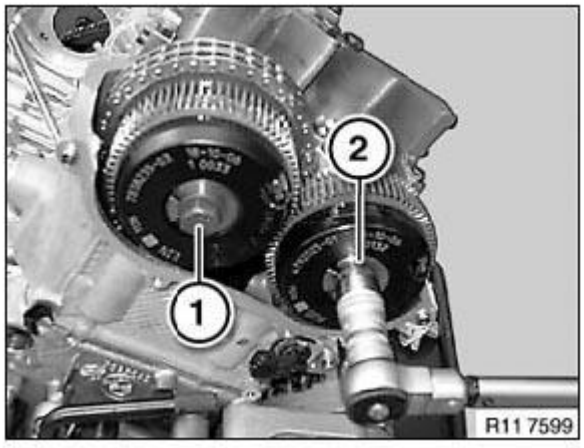


Fig. 323: Inserting Central Bolts
Courtesy of BMW OF NORTH AMERICA, INC.

Remove hexagon socket screw (1) or special tool 11 5 370.

NOTE: Picture shows cylinders 1-4.

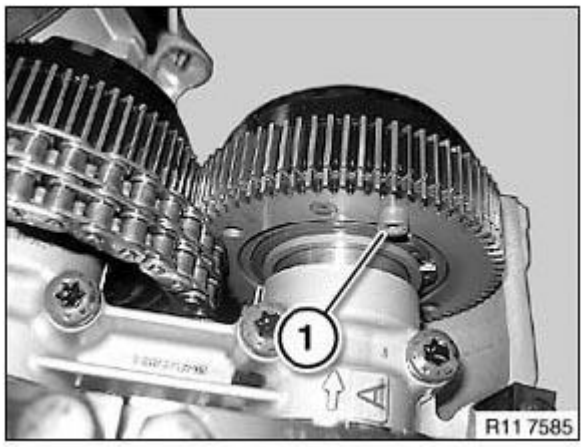


Fig. 324: Identifying Hexagon Socket Screw
Courtesy of BMW OF NORTH AMERICA, INC.

Camshafts, cylinders 5-8, remain secured with special tool **119970 GAUGE** .

Release special tool 11 5 320 and continue barring engine at central bolt 10° to firing TDC position of cylinder no. 1.

Installation:

This minimizes timing chain and gearwheel play.

Secure crankshaft with special tool 11 5 320.

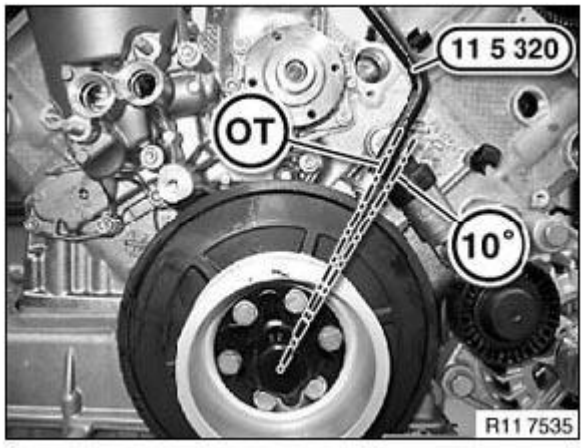


Fig. 325: Identifying Crankshaft Position
Courtesy of BMW OF NORTH AMERICA, INC.

Cylinders 5 to 8:

Always start screwing on the inlet side.

Secure central bolt (1) with special tool **00 9 120 TORQUE ANGLE MEASURING DIAL** .

IMPORTANT: Central bolt final tightening.

1. **Joining 20 Nm**
2. **Settling torque 80 Nm**
3. **Torsion angle 200°**

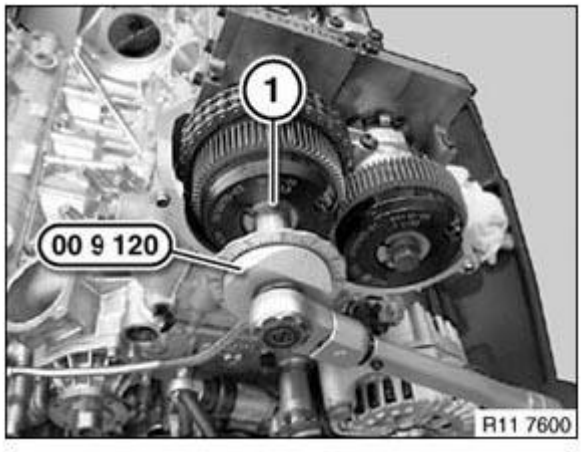


Fig. 326: Securing Central Bolt Using Special Tool (00 9 120)
Courtesy of BMW OF NORTH AMERICA, INC.

Secure central bolt (1) with special tool **00 9 120 TORQUE ANGLE MEASURING DIAL** .

IMPORTANT: Central bolt final tightening.

1. **Joining 20 Nm**
2. **Settling torque 80 Nm**
3. **Torsion angle 200°**

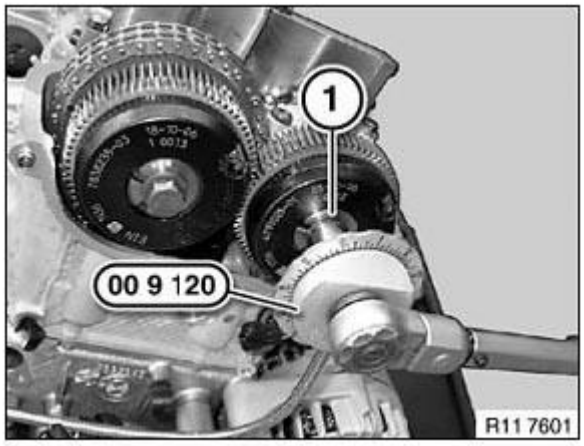


Fig. 327: Securing Central Bolt Using Special Tool (00 9 120)
Courtesy of BMW OF NORTH AMERICA, INC.

Remove all special tools.

Check **TIMING** , cylinders (5 to 8).

Assemble engine.

11 36 142 REMOVING AND INSTALLING/REPLACING LEFT INLET VANOS GEAR (S65)

IMPORTANT: Central bolts on VANOS gears have left-hand threads.
Do not release the central bolt of the adjustment units without the special tool 119970 GAUGE .
Grease contact surfaces of central bolts with copper paste.

Necessary preliminary tasks:

- Remove left **CYLINDER HEAD COVER** .

Release bolts (1) on cylinder bank 2.

Remove timing case cover (2).

Installation:

Replace seal.

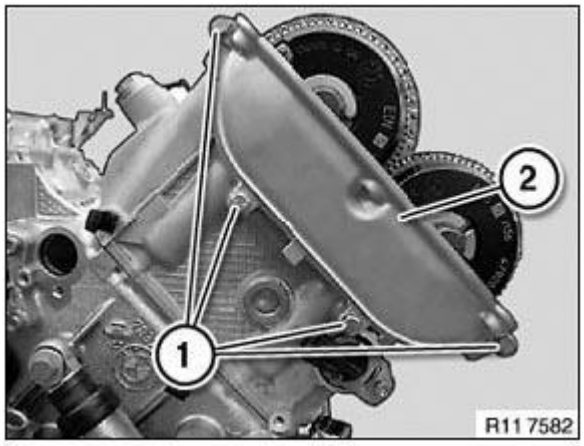


Fig. 328: Identifying Timing Case Cover And Bolts
Courtesy of BMW OF NORTH AMERICA, INC.

IMPORTANT: Both inlet and exhaust camshafts can be adjusted in the 1st cylinder firing TDC position.
Danger of mixing up both special tool bores.
The procedure for CHECKING TIMING is different from that for adjusting.

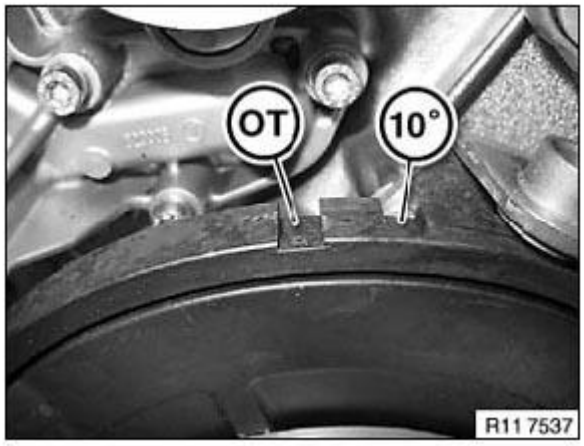


Fig. 329: Identifying Timing Marks
Courtesy of BMW OF NORTH AMERICA, INC.

Crank engine at central bolt.

Secure crankshaft with special tool 11 5 320 in **firing TDC position of cylinder no. 1.**

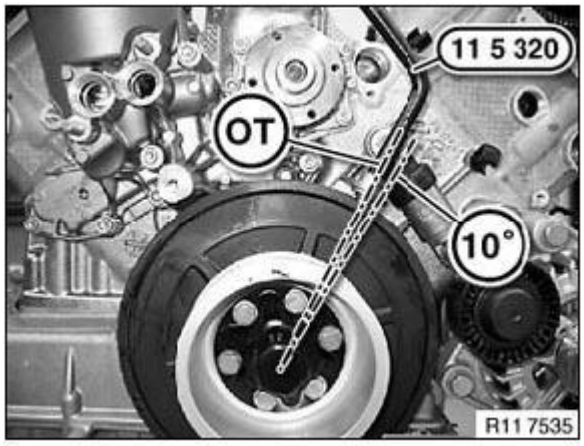


Fig. 330: Identifying Crankshaft Position
Courtesy of BMW OF NORTH AMERICA, INC.

Position of inlet camshafts, cyl. 5-8, in firing TDC position of cylinder no. 1.

Dihedron of inlet camshafts is vertical to cylinder axis, letters/numbers on camshafts point upwards (E2).

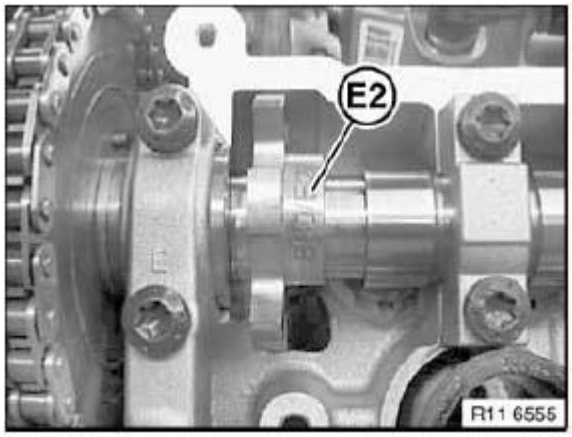


Fig. 331: Identifying Inlet Camshaft Designation
Courtesy of BMW OF NORTH AMERICA, INC.

Position of exhaust camshafts, cyl. 5-8, in firing TDC position of cylinder no. 1.

Dihedron of camshafts is vertical to cylinder axis, letters/numbers on camshafts point upwards (A2).

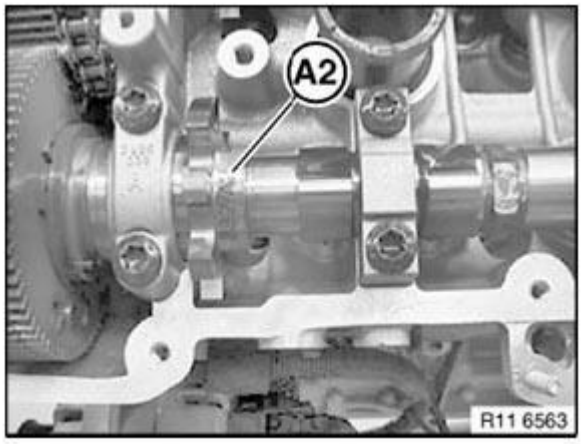


Fig. 332: Identifying Exhaust Camshaft Designation
Courtesy of BMW OF NORTH AMERICA, INC.

Place special tool 11 9 971 on inlet camshaft.

Designation (E2) on dihedron points upwards.

Place special tool 11 9 972 on exhaust camshaft.

Designation (A2) on dihedron points upwards.

Secure special tools 11 9 971 and 11 9 972 with bolts (1) on cylinder head to **10 Nm.**

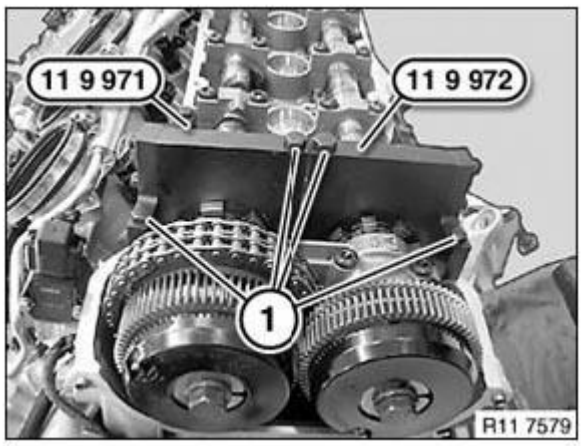


Fig. 333: Securing Camshafts With Special Tools (11 9 971 And 11 9 972)
Courtesy of BMW OF NORTH AMERICA, INC.

Align gearwheels on exhaust adjustment unit with special tool 11 5 370.

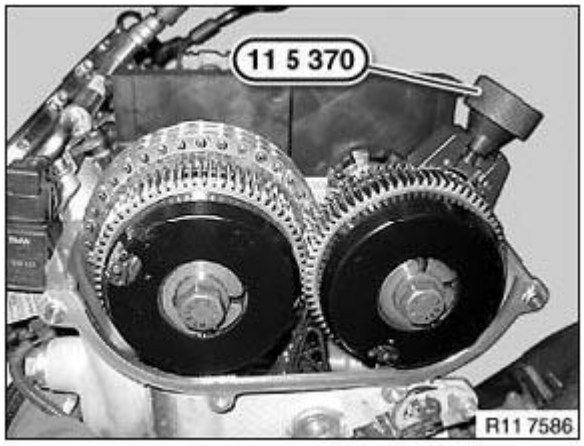


Fig. 334: Aligning Gearwheels On Exhaust Adjustment Unit Using Special Tool (11 5 370)
Courtesy of BMW OF NORTH AMERICA, INC.

IMPORTANT: Removal/installation is not possible without hexagon socket screw (2).
Hexagon socket screw (1) must not be longer than 10 mm.
Gearwheels of exhaust VANOS gear are pretensioned with a spring.

Insert M5x10 hexagon socket screw on VANOS gear.

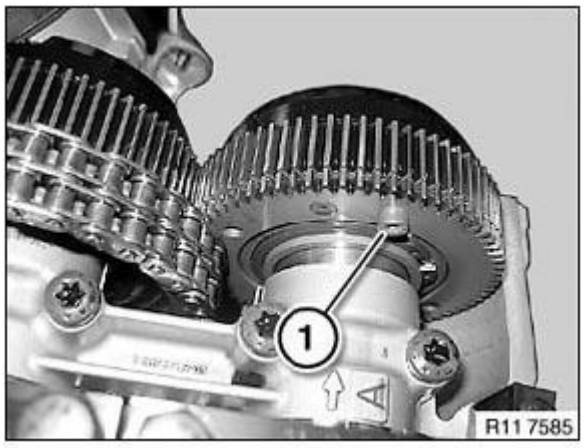


Fig. 335: Identifying Hexagon Socket Screw
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: Picture shows cylinders 1-4.

IMPORTANT: CCW thread!
Release central bolt (2).

Installation:

Replace central bolt (2).

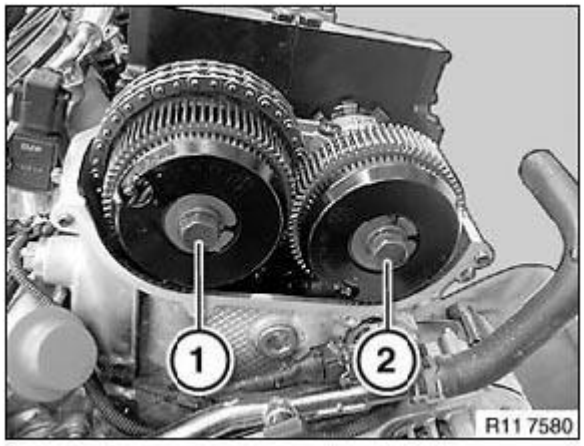


Fig. 336: Identifying Central Bolt
Courtesy of BMW OF NORTH AMERICA, INC.

Remove exhaust adjustment unit (1).

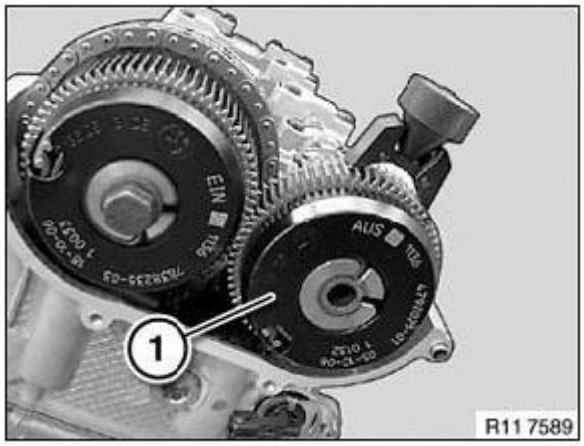


Fig. 337: Identifying Exhaust Adjustment Unit
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

If the hexagon socket screw is released or forgotten by mistake, the gear teeth can be readjusted with special tool 11 5 370.

Screw in knurled screw on special tool 11 5 370 until gearwheel (1) lines up with bore (see arrow) on thread.

Failure to tension the exhaust VANOS gear (1) will result in rattling noises at idle.

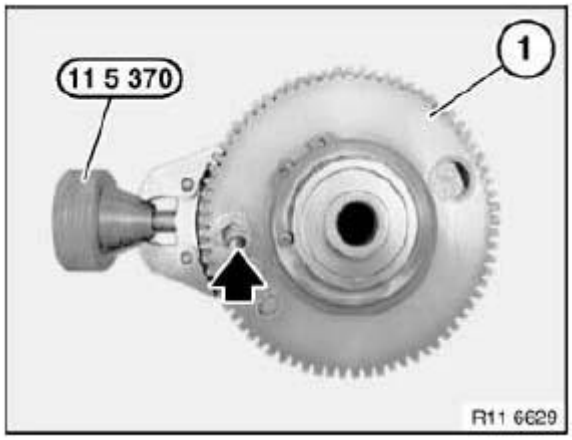


Fig. 338: Identifying Exhaust VANOS Gear
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: Picture shows (S85).

Installation:

Check O-ring (1) on VANOS gear, replace if necessary.

Fig. 339: Identifying VANOS Gear O-Ring
Courtesy of BMW OF NORTH AMERICA, INC.

Release chain tensioner (1).

Installation:

Replace sealing ring.

Tightening torque: **11 31 1AZ** .

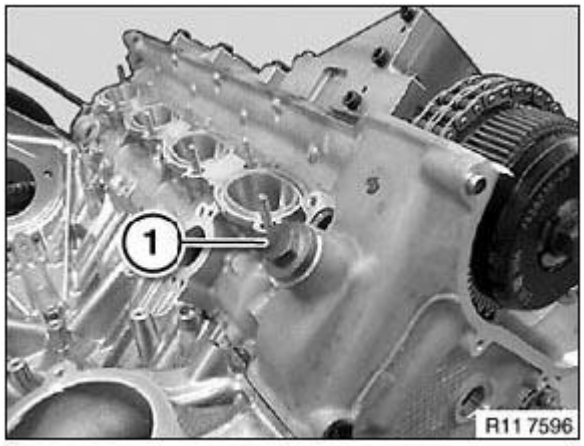


Fig. 340: Identifying Chain Tensioner
Courtesy of BMW OF NORTH AMERICA, INC.

IMPORTANT: CCW thread!

Release central bolt (1).

Installation:

Replace central bolt (1).

Remove inlet adjustment unit (2).

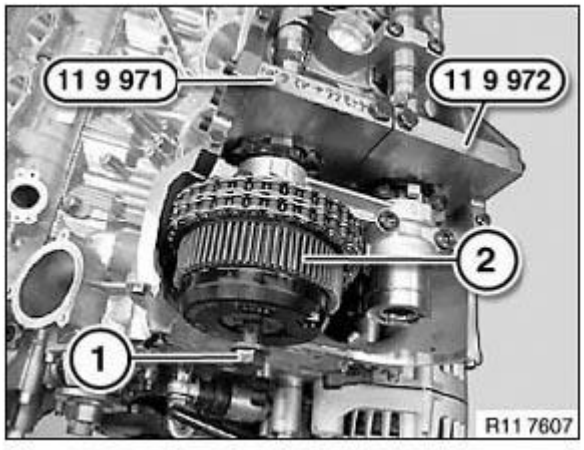


Fig. 341: Identifying Inlet Adjustment Unit And Central Bolt
Courtesy of BMW OF NORTH AMERICA, INC.

Open plug (1).

Installation:

Replace seal.

Tightening torque: **11 12 4AZ** .

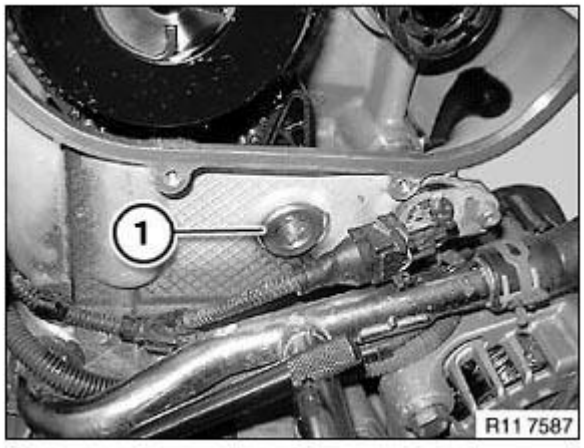


Fig. 342: Identifying Plug
Courtesy of BMW OF NORTH AMERICA, INC.

Secure screw connection against falling out with special tool 11 5 292.

Release screw connection at chain guide with special tool 11 5 291.

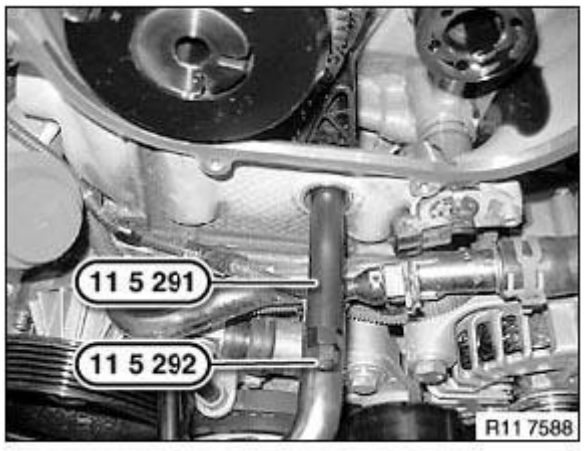


Fig. 343: Identifying Special Tool (11 5 291 And 11 5 292)
Courtesy of BMW OF NORTH AMERICA, INC.

Remove inlet adjustment unit.

Lay timing chain (1) on inlet camshaft.

IMPORTANT: Do not bar engine at central bolt.
Risk of damage! to engine valves and timing chain.

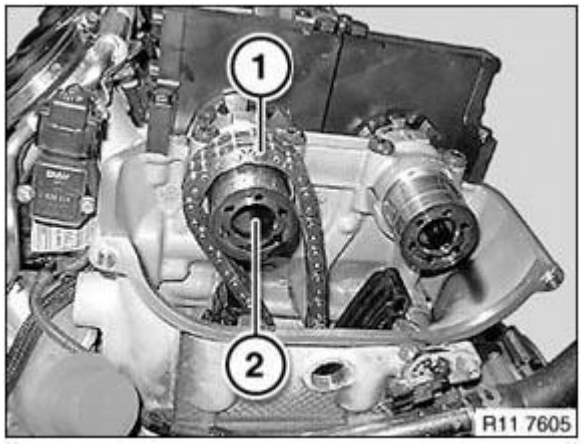


Fig. 344: Identifying Timing Chain
Courtesy of BMW OF NORTH AMERICA, INC.

EIN Inlet adjustment unit

AUS Exhaust adjustment unit

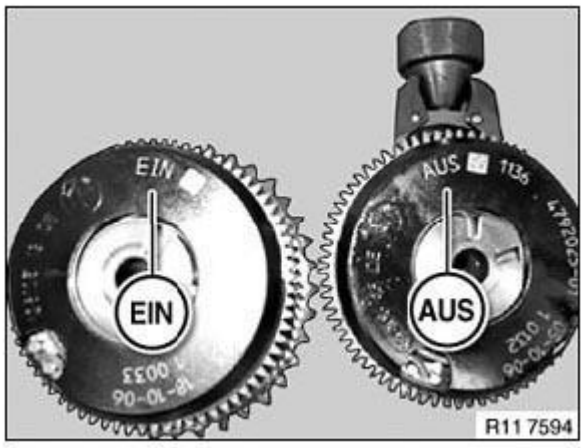


Fig. 345: Identifying Inlet And Exhaust Adjustment Unit
Courtesy of BMW OF NORTH AMERICA, INC.

IMPORTANT: Replace central bolt of adjustment unit. Central bolt must be fully screwed once (refer to SCREW FASTENING LIST).

IMPORTANT: Rotate crankshaft at central bolt back until special tool 11 5 320 can be secured in the 10° position.

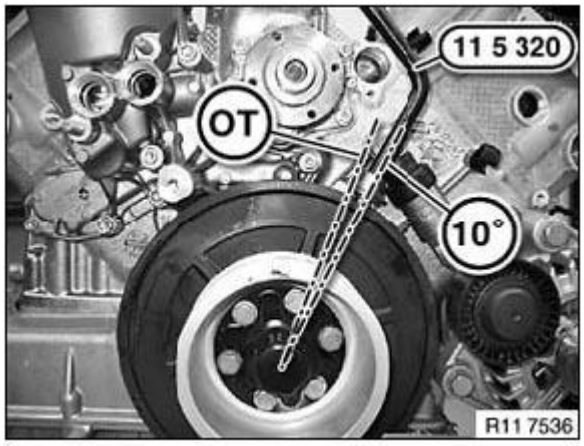


Fig. 346: Identifying Crankshaft Position
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Coat contact face of new central bolt (1) with copper paste.

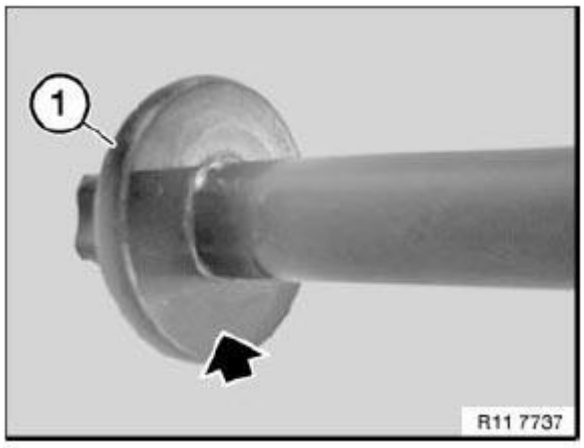


Fig. 347: Identifying Contact Face Of Central Bolt
Courtesy of BMW OF NORTH AMERICA, INC.

Position VANOS adjustment unit on camshaft.

Hexagon socket screw points upwards.

Insert central bolts (1 and 2) without play.

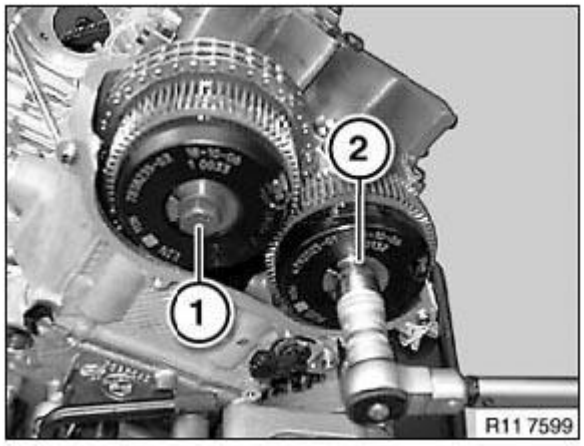


Fig. 348: Inserting Central Bolts
Courtesy of BMW OF NORTH AMERICA, INC.

Remove hexagon socket screw (1) or special tool 11 5 370.

NOTE: Picture shows cylinders 1-4.

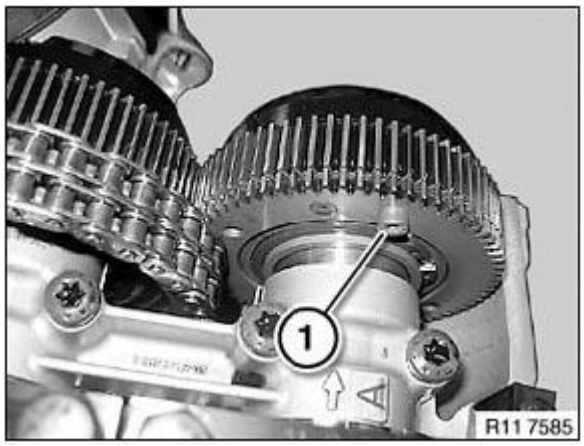


Fig. 349: Identifying Hexagon Socket Screw
Courtesy of BMW OF NORTH AMERICA, INC.

Secure timing chain tensioning rail.

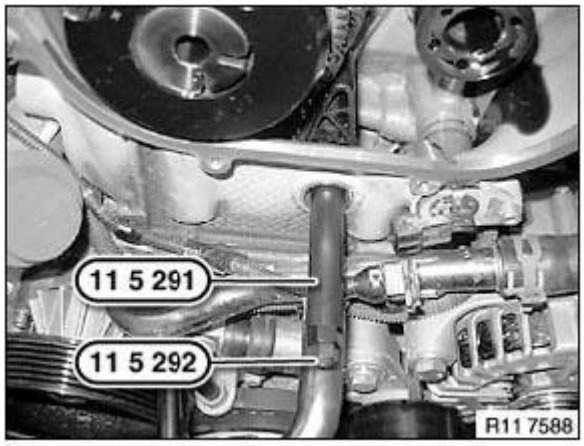


Fig. 350: Identifying Special Tool (11 5 291 And 11 5 292)
Courtesy of BMW OF NORTH AMERICA, INC.

Install chain tensioner (1).

Installation:

Replace sealing ring.

Tightening torque: **11 31 1AZ** .

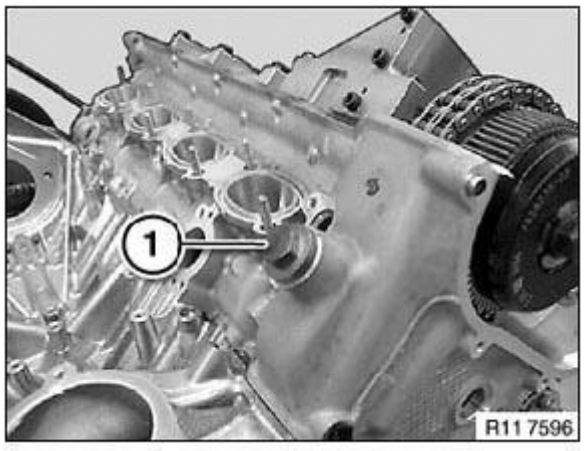


Fig. 351: Identifying Chain Tensioner
Courtesy of BMW OF NORTH AMERICA, INC.

Insert central bolt (1) and screw with special tool **00 9 120 TORQUE ANGLE MEASURING DIAL** .

1. Joining 10 Nm
2. Joining 20 Nm
3. Settling torque 80 Nm
4. Torsion angle 200°

5. **Unscrew central bolt.**
6. Joining 10 Nm

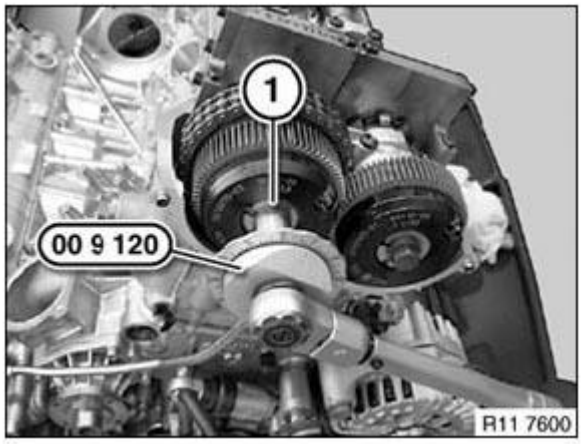


Fig. 352: Securing Central Bolt Using Special Tool (00 9 120)
Courtesy of BMW OF NORTH AMERICA, INC.

Insert central bolt (2) and screw with special tool **00 9 120 TORQUE ANGLE MEASURING DIAL** .

1. Joining 10 Nm
2. Joining 20 Nm
3. Settling torque 80 Nm
4. Torsion angle 200°
5. **Unscrew central bolt.**
6. Joining 10 Nm

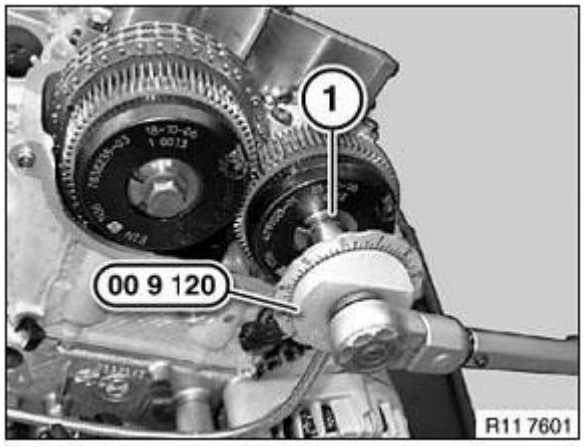


Fig. 353: Securing Central Bolt Using Special Tool (00 9 120)
Courtesy of BMW OF NORTH AMERICA, INC.

Camshafts, cylinders 5-8, remain secured with special tool **119970 GAUGE** .

Release special tool 11 5 320 and continue barring engine at central bolt 10° to **firing TDC position of cylinder no. 1.**

Installation:

This minimizes timing chain and gearwheel play.

Secure crankshaft with special tool 11 5 320.

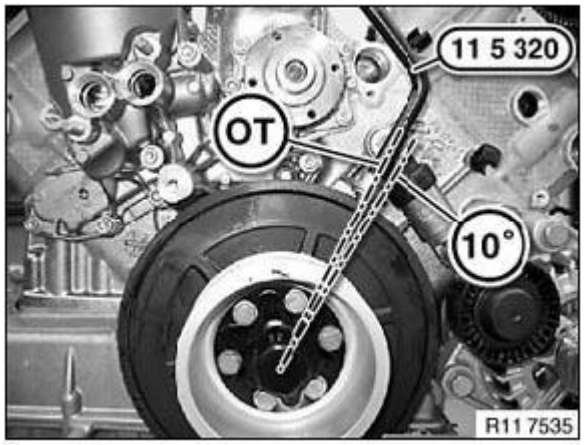


Fig. 354: Identifying Crankshaft Position
Courtesy of BMW OF NORTH AMERICA, INC.

Cylinders 5 to 8:

Always start screwing on the inlet side.

Secure central bolt (1) with special tool **00 9 120 TORQUE ANGLE MEASURING DIAL** .

IMPORTANT: Central bolt final tightening.

1. **Joining 20 Nm**
2. **Settling torque 80 Nm**
3. **Torsion angle 200°**

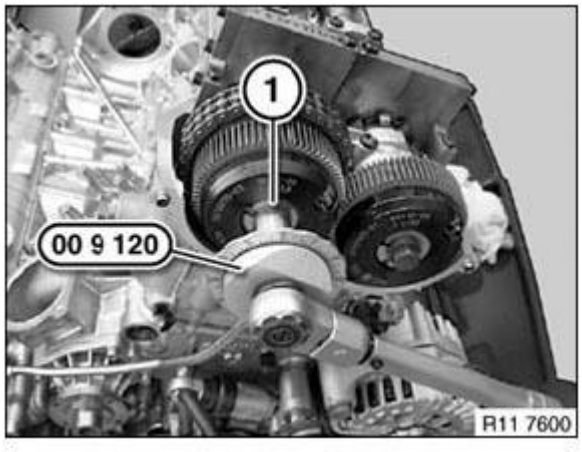


Fig. 355: Securing Central Bolt Using Special Tool (00 9 120)
Courtesy of BMW OF NORTH AMERICA, INC.

Secure central bolt (1) with special tool **00 9 120 TORQUE ANGLE MEASURING DIAL** .

IMPORTANT: Central bolt final tightening.

1. **Joining 20 Nm**
2. **Settling torque 80 Nm**
3. **Torsion angle 200°**

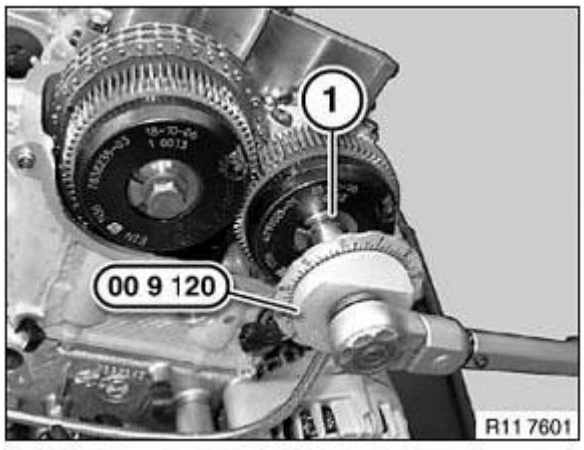


Fig. 356: Securing Central Bolt Using Special Tool (00 9 120)
Courtesy of BMW OF NORTH AMERICA, INC.

Remove all special tools.

Check **TIMING** , cylinders (5 to 8).

Assemble engine.

11 41 050 REMOVING AND INSTALLING/REPLACING OIL SUCTION PUMP (S65)

IMPORTANT: Excessively low or high play between the gearwheel pairs results in failure of the oil supply.

Necessary preliminary tasks:

- Remove **ENGINE OIL SUMP** .
- Remove **OIL PUMP** .

Release screws (1).

Tightening torque. **11 41 3AZ** .

Remove oil pump (2).

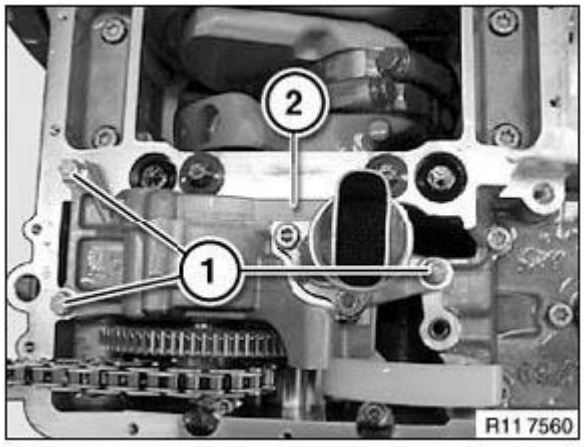


Fig. 357: Identifying Oil Pump And Screws
Courtesy of BMW OF NORTH AMERICA, INC.

Replacing gear wheels

Necessary preliminary tasks:

- Remove **VIBRATION DAMPER** .
- Remove **RADIAL SHAFT SEAL** at front.

Mount special tool 11 6 254 on crankcase.

Secure special tool 11 6 252 with magnetic base to special tool 11 6 254.

NOTE: Special tool 11 6 254 can only be secured to the crankcase with one screw.

Picture shows (S85).

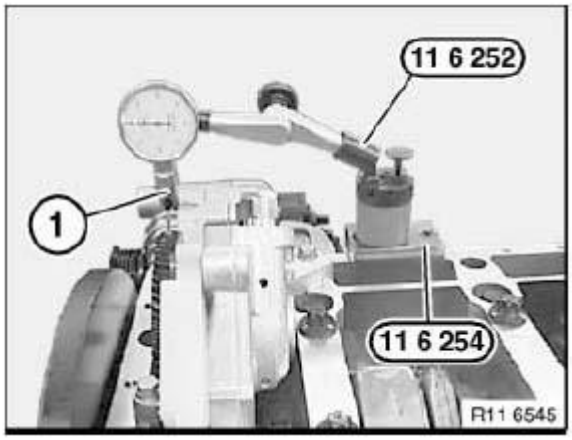


Fig. 358: Securing Special Tool (11 6 252) With Magnetic Base To Special Tool (11 6 254)
Courtesy of BMW OF NORTH AMERICA, INC.

IMPORTANT: The oil pump chain of the oil suction pump must be removed. The chain tensioner must not exert any tension on the oil suction pump.

Align special tool 11 6 251 with its measuring shaft (2) vertically to gearwheel (1).

Turn oil suction pump gearwheel (1) to stop.

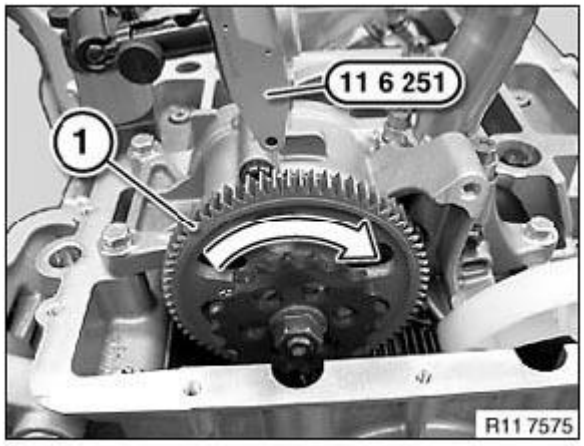


Fig. 359: Turning Oil Suction Pump Gearwheel
Courtesy of BMW OF NORTH AMERICA, INC.

Set special tool 11 6 251 to zero.

Turn oil suction pump gearwheel (1) in direction of arrow to stop.

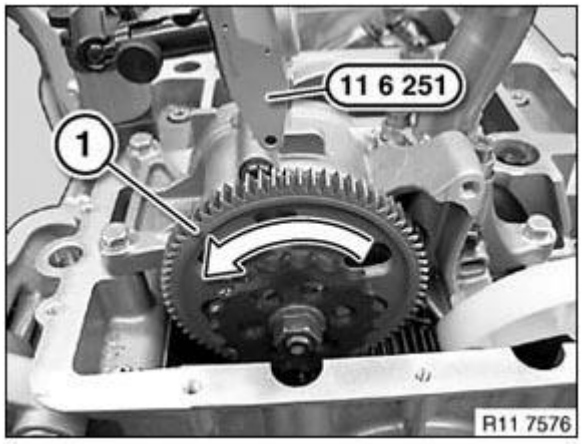


Fig. 360: Turning Oil Suction Pump Gearwheel
Courtesy of BMW OF NORTH AMERICA, INC.

Backlash on oil suction pump **min. 0.06 to max. 0.08 mm.**

If necessary, correct oil suction pump adjustment.

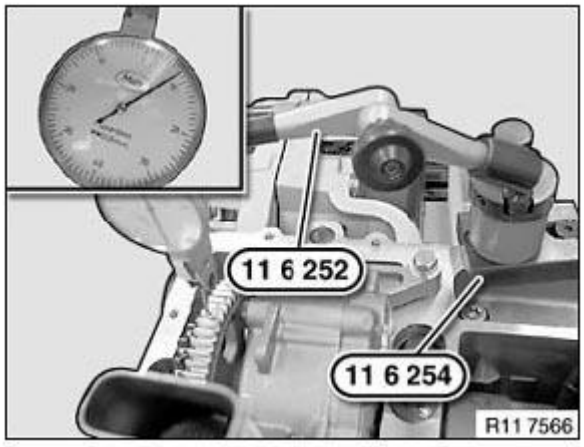


Fig. 361: Measuring Oil Suction Pump Backlash
Courtesy of BMW OF NORTH AMERICA, INC.

Adjust oil suction pump (2) with a rubber mallet on pump housing in direction of arrow.

Tightening torque **11 41 3AZ** .

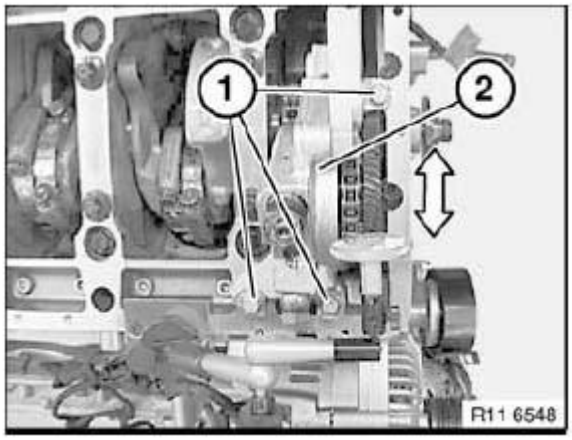


Fig. 362: Adjusting Oil Suction Pump
Courtesy of BMW OF NORTH AMERICA, INC.

Assemble engine.

11 36 150 REMOVING AND INSTALLING/REPLACING RIGHT EXHAUST VANOS GEAR (S65)

IMPORTANT: Central bolts on VANOS gears have left-hand threads.
Do not release the central bolt of the adjustment units without the special tool 119970 GAUGE .
Grease contact surfaces of central bolts with copper paste.

Necessary preliminary tasks:

- Remove right **CYLINDER HEAD COVER**

Release bolts (1) on cylinder bank 2.

Remove timing case cover (2).

Installation:

Replace seal.

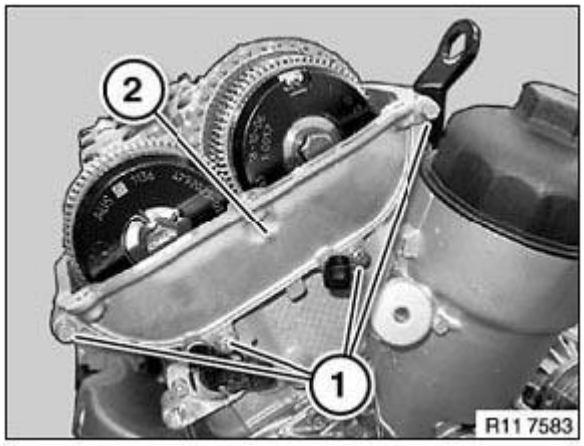


Fig. 363: Identifying Timing Case Cover And Bolts
Courtesy of BMW OF NORTH AMERICA, INC.

IMPORTANT: Both inlet and exhaust camshafts can be adjusted in the 1st cylinder firing TDC position.
Danger of mixing up both special tool bores.
The procedure for CHECKING TIMING is different from that for adjusting.

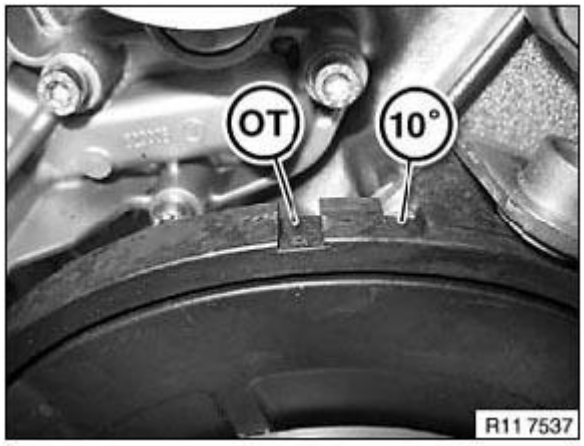


Fig. 364: Identifying Timing Marks
Courtesy of BMW OF NORTH AMERICA, INC.

Crank engine at central bolt.

Secure crankshaft with special tool 11 5 320 in **firing TDC position of cylinder no. 1.**

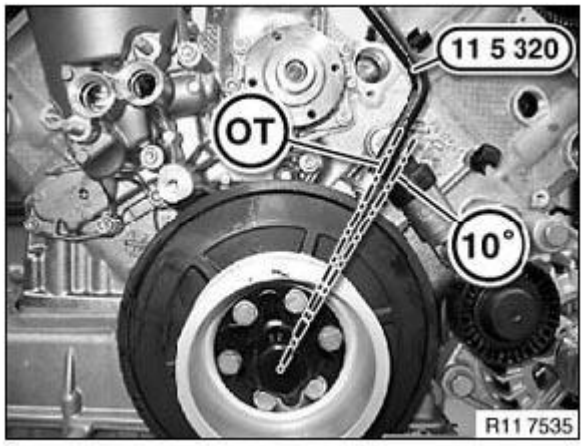


Fig. 365: Identifying Crankshaft Position
Courtesy of BMW OF NORTH AMERICA, INC.

Position of inlet camshafts, cyl. 1-4, in firing TDC position of cylinder no. 1.

Dihedron of inlet camshafts is vertical to cylinder axis, letters/numbers on camshafts point upwards (E1).

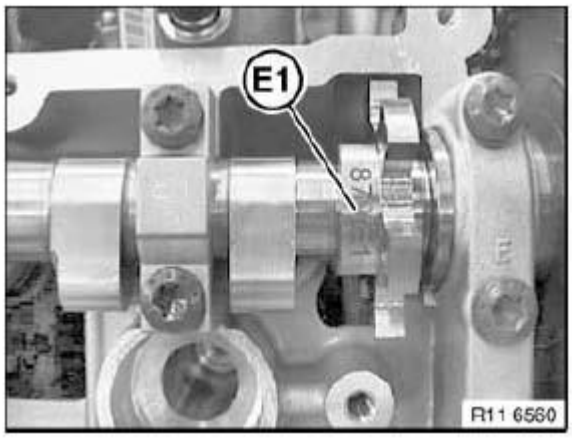


Fig. 366: Identifying Inlet Camshaft Designation
Courtesy of BMW OF NORTH AMERICA, INC.

Position of exhaust camshafts, cyl. 1-4, in firing TDC position of cylinder no. 1.

Dihedron of camshafts is vertical to cylinder axis, letters/numbers (A1) on camshafts (1) point upwards.

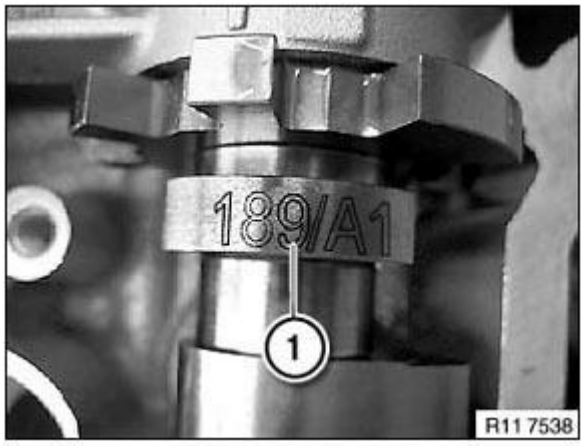


Fig. 367: Identifying Exhaust Camshaft Designation
Courtesy of BMW OF NORTH AMERICA, INC.

Rotate inlet camshaft with open-end wrench (1) with minimal effort at hexagon head in direction of arrow until special tool 11 9 972 can be attached.

Designation (E1) on dihedron points upwards.

Secure special tool 11 9 972 with bolts (2) on cylinder head to **10 Nm.**

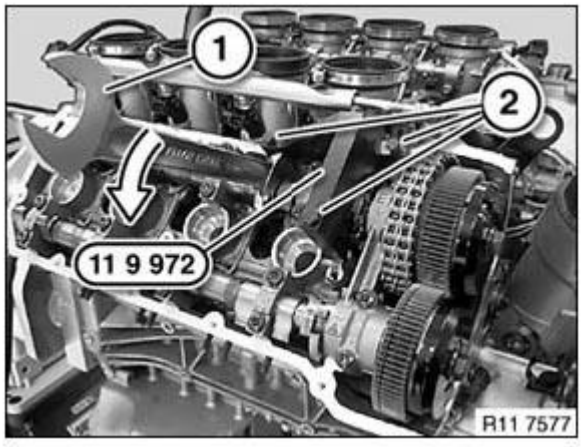


Fig. 368: Rotating Inlet Camshaft
Courtesy of BMW OF NORTH AMERICA, INC.

Rotate exhaust camshaft with open-end wrench (1) with minimal effort at hexagon head in direction of arrow until special tool 11 9 971 can be attached.

Designation (A1) on dihedron points upwards.

Secure special tool 11 9 972 with bolts (2) on cylinder head to **10 Nm.**

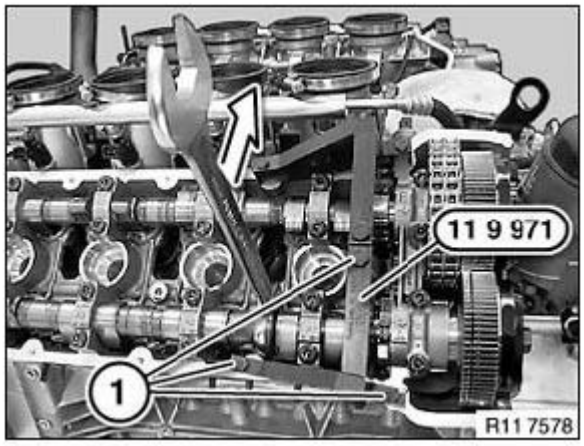


Fig. 369: Rotating Exhaust Camshaft
Courtesy of BMW OF NORTH AMERICA, INC.

Align gearwheels on exhaust adjustment unit with special tool 11 5 370.

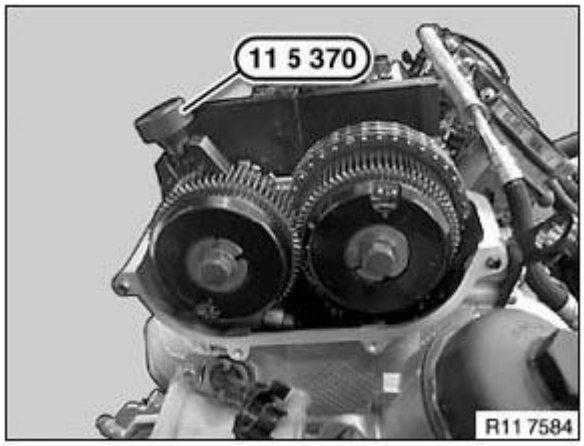


Fig. 370: Aligning Gearwheels On Exhaust Adjustment Unit With Special Tool (11 5 370)
Courtesy of BMW OF NORTH AMERICA, INC.

IMPORTANT: Removal/installation is not possible without hexagon socket screw (2).
Hexagon socket screw (1) must not be longer than 10 mm.
Gearwheels of exhaust VANOS gear are pretensioned with a spring.

Insert M5x10 hexagon socket screw on VANOS gear.

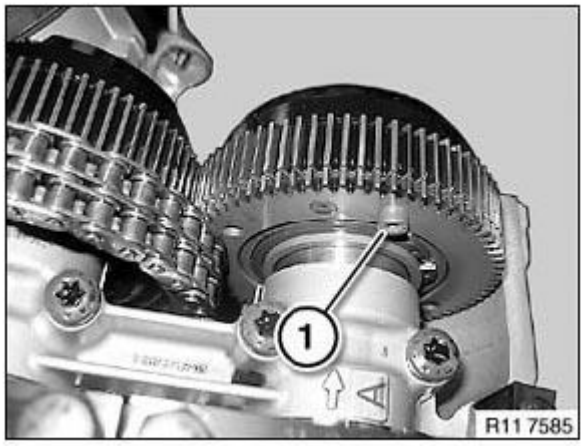


Fig. 371: Identifying Hexagon Socket Screw
Courtesy of BMW OF NORTH AMERICA, INC.

IMPORTANT: CCW thread!

Release central bolts (1 and 2).

Installation:

Replace central bolts (1 and 2).

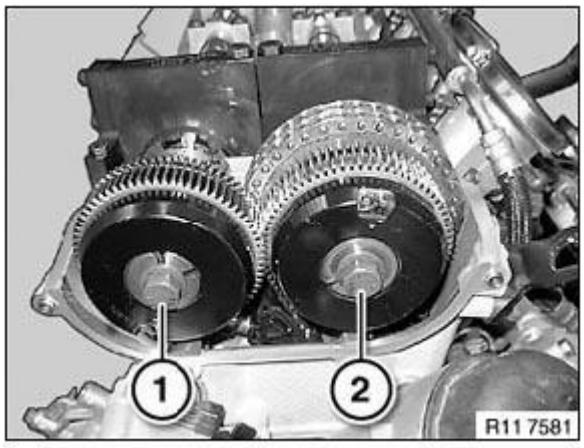


Fig. 372: Identifying Central Bolts
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

If the hexagon socket screw is released or forgotten by mistake, the gear teeth can be readjusted with special tool 11 5 370.

Screw in knurled screw on special tool 11 5 370 until gearwheel (1) lines up with bore (see arrow) on thread.

Failure to tension the exhaust VANOS gear (1) will result in rattling noises at idle.

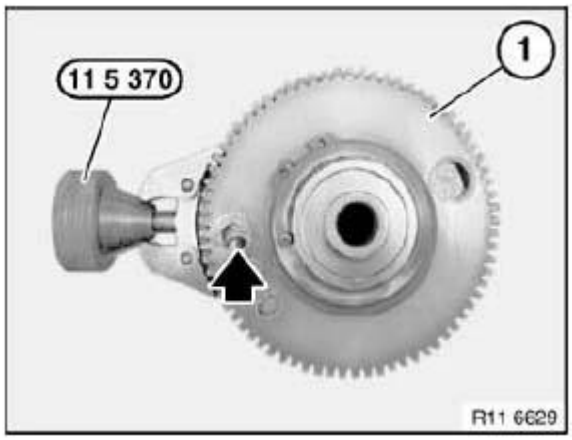


Fig. 373: Identifying Exhaust VANOS Gear
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: Picture shows (S85).

Installation:

Check O-ring (1) on VANOS gear, replace if necessary.

Fig. 374: Identifying VANOS Gear O-Ring
Courtesy of BMW OF NORTH AMERICA, INC.

IMPORTANT: Replace central bolt of adjustment unit.
Central bolt must be fully screwed once (refer to SCREW FASTENING LIST).

IMPORTANT: Rotate crankshaft at central bolt back until special tool 11 5 320 can be secured in the 10° position.

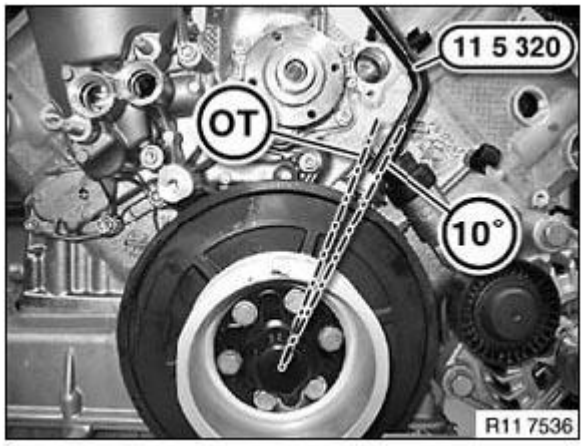


Fig. 375: Identifying Crankshaft Position
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Coat contact face of new central bolt (1) with copper paste.

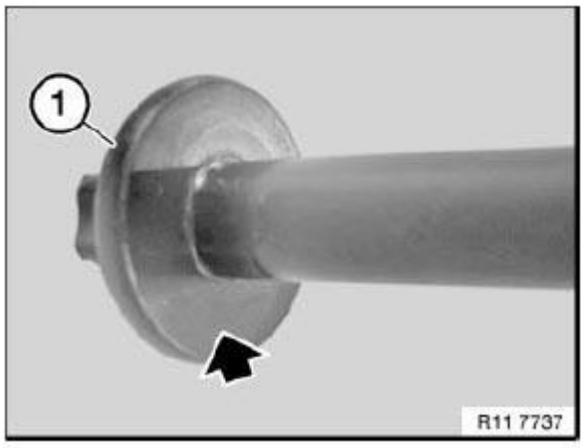


Fig. 376: Identifying Contact Face Of Central Bolt
Courtesy of BMW OF NORTH AMERICA, INC.

Position VANOS adjustment unit on camshaft.

Hexagon socket screw points upwards.

Insert central bolt (1) and screw with special tool **00 9 120 TORQUE ANGLE MEASURING DIAL** .

1. Joining 10 Nm
2. Joining 20 Nm
3. Settling torque 80 Nm
4. Torsion angle 200°

5. **Unscrew central bolt.**
6. Joining 10 Nm

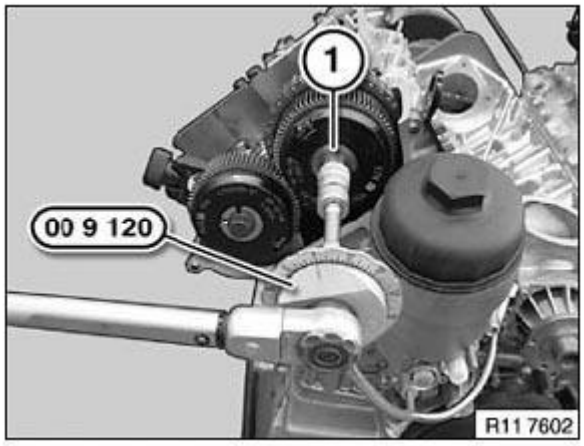


Fig. 377: Securing Central Bolt Using Special Tool (00 9 120)
Courtesy of BMW OF NORTH AMERICA, INC.

Insert central bolt (1) and screw with special tool **00 9 120 TORQUE ANGLE MEASURING DIAL** .

1. Joining 10 Nm
2. Joining 20 Nm
3. Settling torque 80 Nm
4. Torsion angle 200°
5. **Unscrew central bolt.**
6. Joining 10 Nm

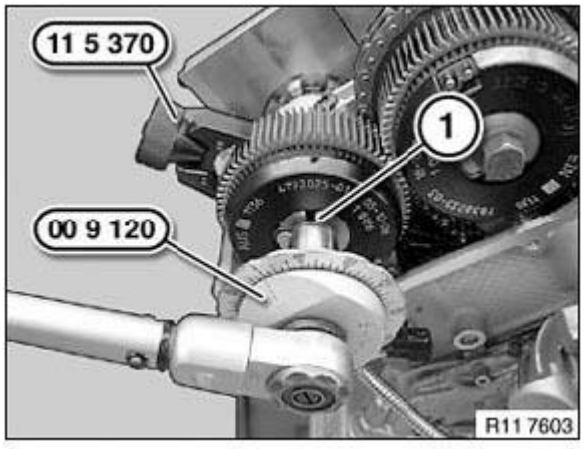


Fig. 378: Securing Central Bolt Using Special Tool (00 9 120)
Courtesy of BMW OF NORTH AMERICA, INC.

Remove hexagon socket screw (1) or special tool 11 5 370.

NOTE: Picture shows cylinders 1-4.

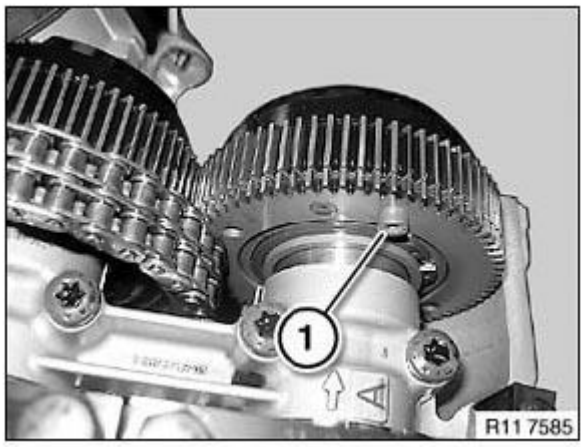


Fig. 379: Identifying Hexagon Socket Screw
Courtesy of BMW OF NORTH AMERICA, INC.

Camshafts, cylinders 5-8, remain secured with special tool **119970 GAUGE** .

Release special tool 11 5 320 and continue barring engine at central bolt 10° to **firing TDC position of cylinder no. 1.**

Installation:

This minimizes timing chain and gearwheel play.

Secure crankshaft with special tool 11 5 320.

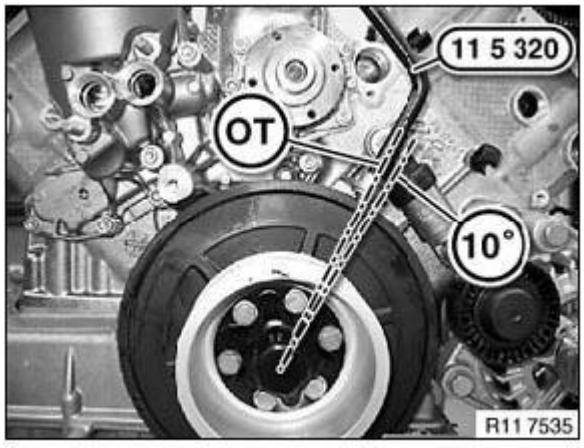


Fig. 380: Identifying Crankshaft Position
Courtesy of BMW OF NORTH AMERICA, INC.

Cylinders 5 to 8:

Always start screwing on the inlet side.

Secure central bolt (1) with special tool **00 9 120 TORQUE ANGLE MEASURING DIAL** .

IMPORTANT: Central bolt final tightening.

1. **Joining 20 Nm**
2. **Settling torque 80 Nm**
3. **Torsion angle 200°**

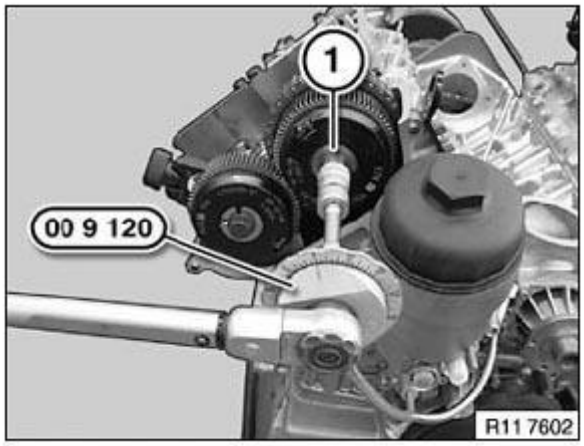


Fig. 381: Securing Central Bolt Using Special Tool (00 9 120)
Courtesy of BMW OF NORTH AMERICA, INC.

Secure central bolt (1) with special tool **00 9 120 TORQUE ANGLE MEASURING DIAL** .

IMPORTANT: Central bolt final tightening.

1. **Joining 20 Nm**
2. **Settling torque 80 Nm**
3. **Torsion angle 200°**

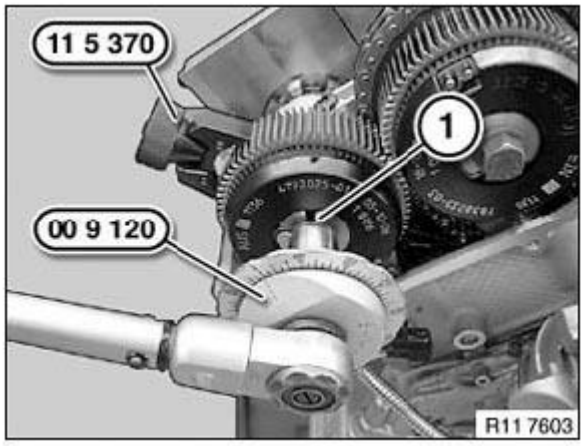


Fig. 382: Securing Central Bolt Using Special Tool (00 9 120)
Courtesy of BMW OF NORTH AMERICA, INC.

Remove all special tools.

Check **TIMING** , bank 1, cylinders (1 to 4).

Assemble engine.

11 36 148 REMOVING AND INSTALLING/REPLACING RIGHT INLET VANOS GEAR (S65)

IMPORTANT: Central bolts on VANOS gears have left-hand threads.
Do not release the central bolt of the adjustment units without the special tool 119970 GAUGE .
Grease contact surfaces of central bolts with copper paste.

Necessary preliminary tasks:

- Remove right **CYLINDER HEAD COVER**

Release bolts (1) on cylinder bank 2.

Remove timing case cover (2).

Installation:

Replace seal.

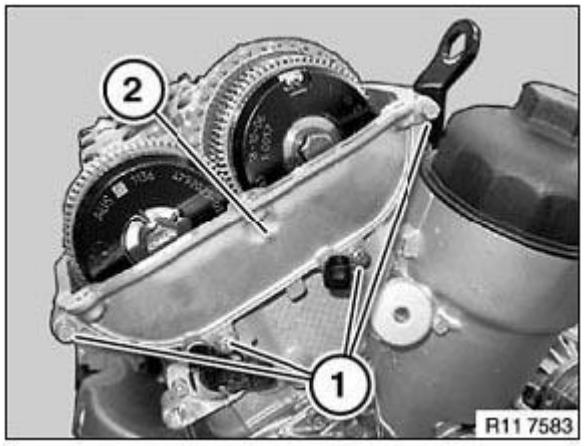


Fig. 383: Identifying Timing Case Cover And Bolts
Courtesy of BMW OF NORTH AMERICA, INC.

IMPORTANT: Both inlet and exhaust camshafts can be adjusted in the 1st cylinder firing TDC position.
Danger of mixing up both special tool bores.
The procedure for CHECKING TIMING is different from that for adjusting.

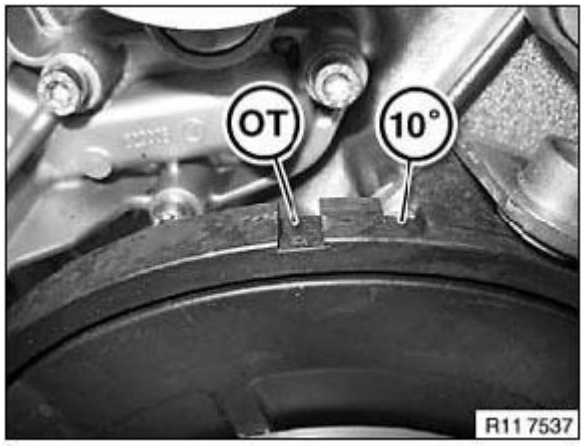


Fig. 384: Identifying Timing Marks
Courtesy of BMW OF NORTH AMERICA, INC.

Crank engine at central bolt.

Secure crankshaft with special tool 11 5 320 in **firing TDC position of cylinder no. 1.**

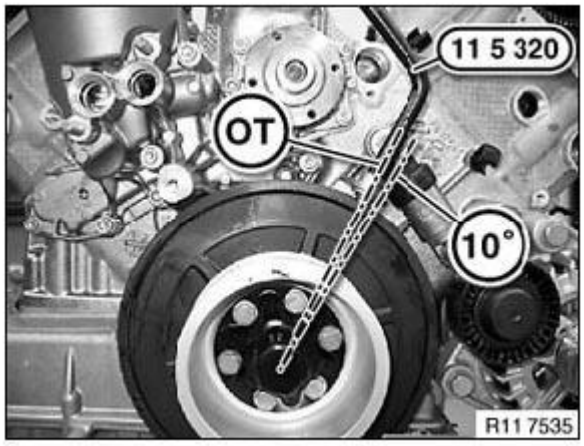


Fig. 385: Identifying Crankshaft Position
Courtesy of BMW OF NORTH AMERICA, INC.

Position of inlet camshafts, cyl. 1-4, in firing TDC position of cylinder no. 1.

Dihedron of inlet camshafts is vertical to cylinder axis, letters/numbers on camshafts point upwards (E1).

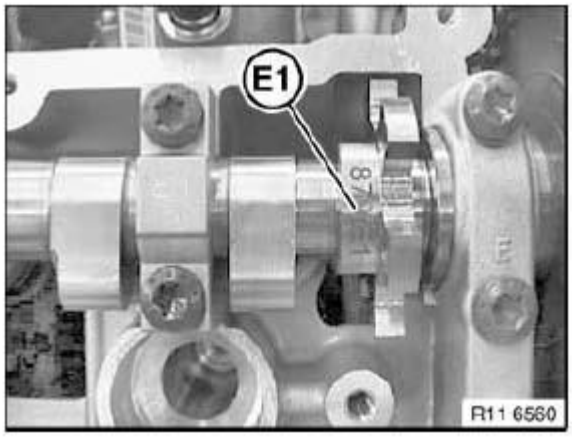


Fig. 386: Identifying Inlet Camshaft Designation
Courtesy of BMW OF NORTH AMERICA, INC.

Position of exhaust camshafts, cyl. 1-4, in firing TDC position of cylinder no. 1.

Dihedron of camshafts is vertical to cylinder axis, letters/numbers (A1) on camshafts (1) point upwards.

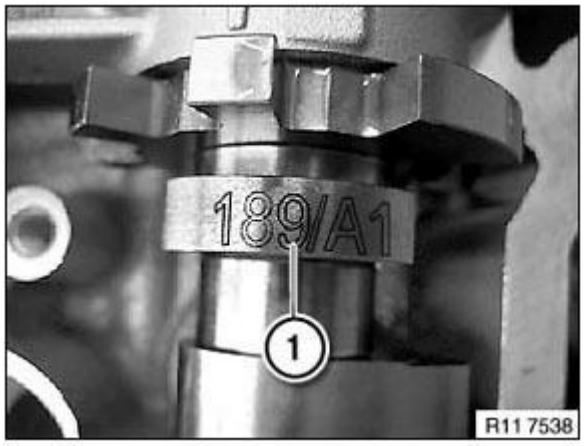


Fig. 387: Identifying Exhaust Camshaft Designation
Courtesy of BMW OF NORTH AMERICA, INC.

Rotate inlet camshaft with open-end wrench (1) with minimal effort at hexagon head in direction of arrow until special tool 11 9 972 can be attached.

Designation (E1) on dihedron points upwards.

Secure special tool 11 9 972 with bolts (2) on cylinder head to **10 Nm.**

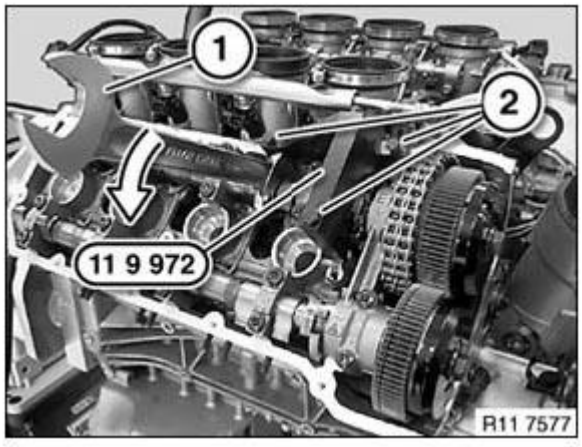


Fig. 388: Rotating Inlet Camshaft
Courtesy of BMW OF NORTH AMERICA, INC.

Rotate exhaust camshaft with open-end wrench (1) with minimal effort at hexagon head in direction of arrow until special tool 11 9 971 can be attached.

Designation (A1) on dihedron points upwards.

Secure special tool 11 9 972 with bolts (2) on cylinder head to **10 Nm.**

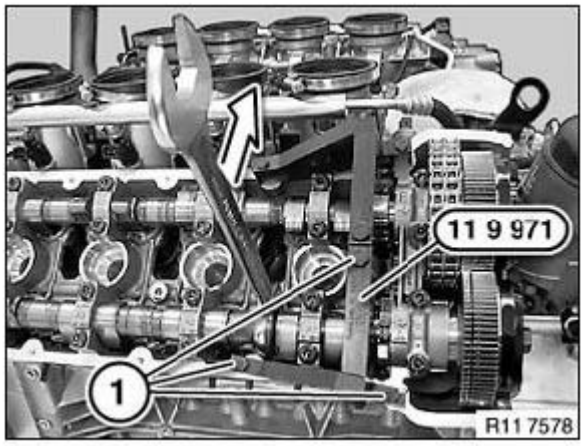


Fig. 389: Rotating Exhaust Camshaft
Courtesy of BMW OF NORTH AMERICA, INC.

Align gearwheels on exhaust adjustment unit with special tool 11 5 370.

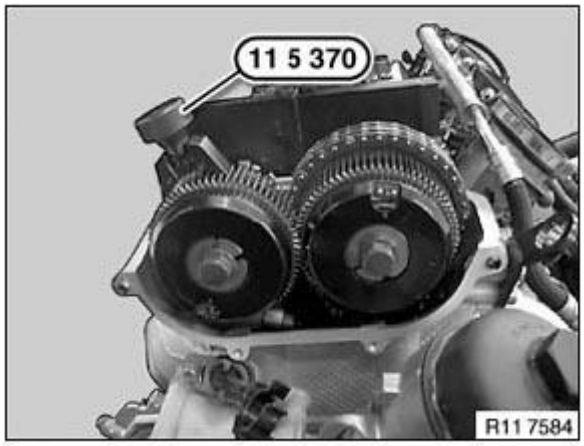


Fig. 390: Aligning Gearwheels On Exhaust Adjustment Unit With Special Tool (11 5 370)
Courtesy of BMW OF NORTH AMERICA, INC.

IMPORTANT: Removal/installation is not possible without hexagon socket screw (2).
Hexagon socket screw (1) must not be longer than 10 mm.
Gearwheels of exhaust VANOS gear are pretensioned with a spring.

Insert M5x10 hexagon socket screw on VANOS gear.

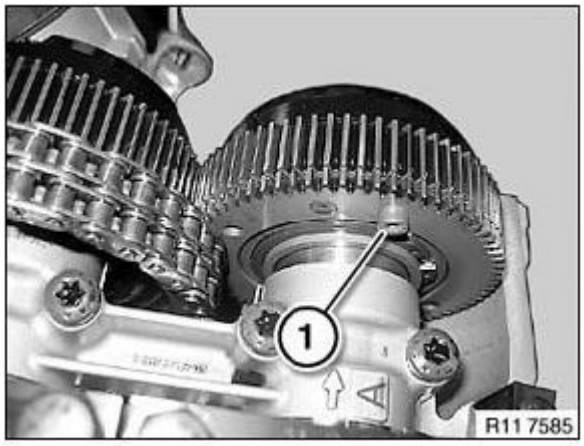


Fig. 391: Identifying Hexagon Socket Screw
Courtesy of BMW OF NORTH AMERICA, INC.

IMPORTANT: CCW thread!

Release central bolt (1).

Installation:

Replace central bolt (1).

Remove exhaust adjustment unit

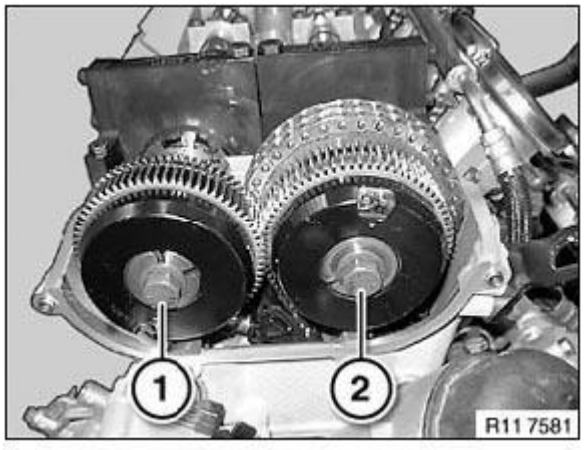


Fig. 392: Identifying Central Bolts
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

If the hexagon socket screw is released or forgotten by mistake, the gear teeth can be readjusted with special tool 11 5 370.

Screw in knurled screw on special tool 11 5 370 until gearwheel (1) lines up with bore (see arrow) on thread.

Failure to tension the exhaust VANOS gear (1) will result in rattling noises at idle.

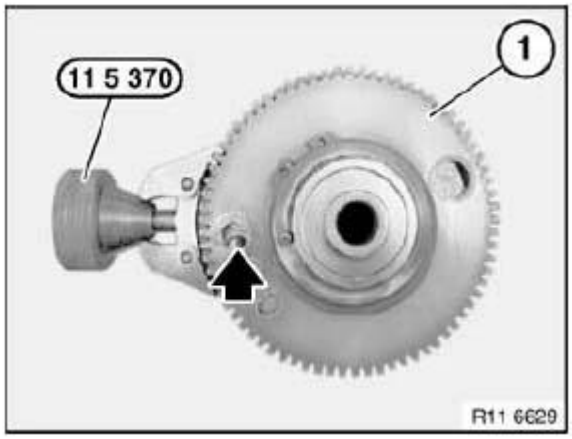


Fig. 393: Identifying Exhaust VANOS Gear
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: Picture shows (S85).

Installation:

Check O-ring (1) on VANOS gear, replace if necessary.

Fig. 394: Identifying VANOS Gear O-Ring
Courtesy of BMW OF NORTH AMERICA, INC.

Release chain tensioner (1).

Installation:

Replace sealing ring.

Tightening torque: **11 31 1AZ**

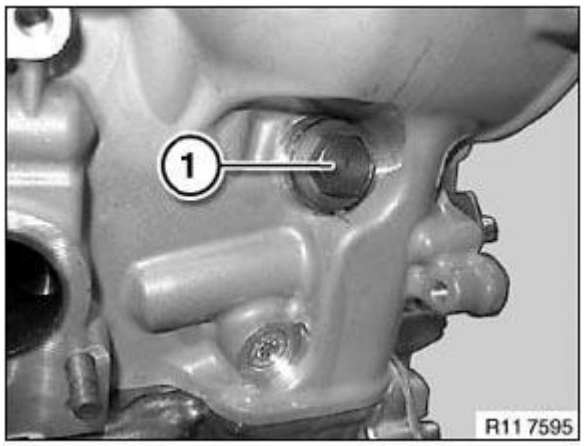


Fig. 395: Identifying Chain Tensioner
Courtesy of BMW OF NORTH AMERICA, INC.

IMPORTANT: CCW thread!

Release central bolt (1).

Installation:

Replace central bolt (1).

Remove inlet adjustment unit (2).

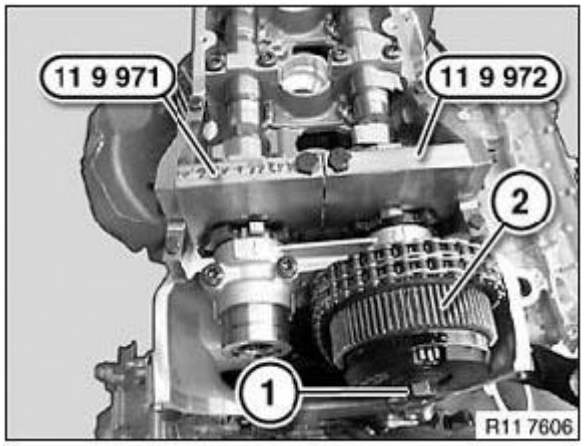


Fig. 396: Identifying Inlet Adjustment Unit And Central Bolt
Courtesy of BMW OF NORTH AMERICA, INC.

Lay timing chain (1) on inlet camshaft (2).

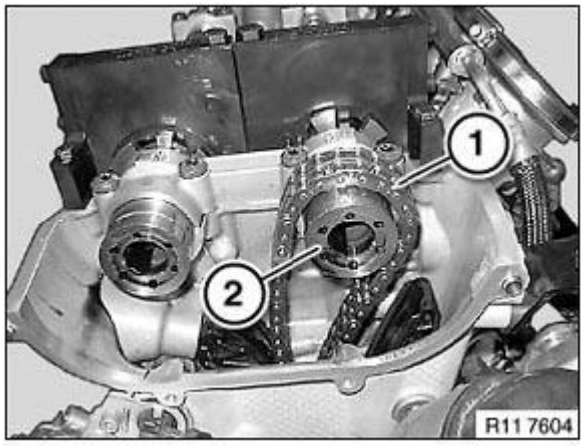


Fig. 397: Identifying Timing Chain And Inlet Camshaft
Courtesy of BMW OF NORTH AMERICA, INC.

EIN Inlet adjustment unit

AUS Exhaust adjustment unit

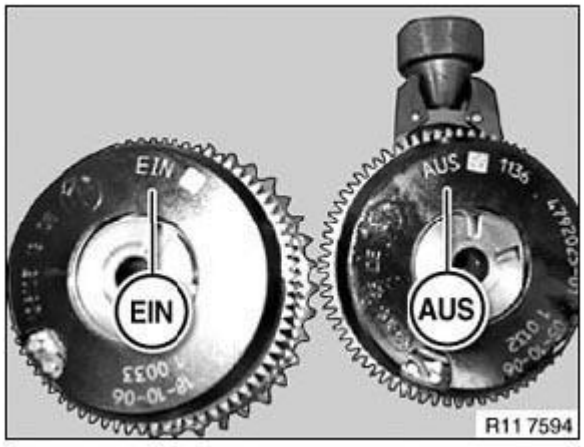


Fig. 398: Identifying Inlet And Exhaust Adjustment Unit
Courtesy of BMW OF NORTH AMERICA, INC.

IMPORTANT: Replace central bolt of adjustment unit.
Central bolt must be fully screwed once (refer to SCREW FASTENING LIST).

IMPORTANT: Rotate crankshaft at central bolt back until special tool 11 5 320 can be secured in the 10° position.

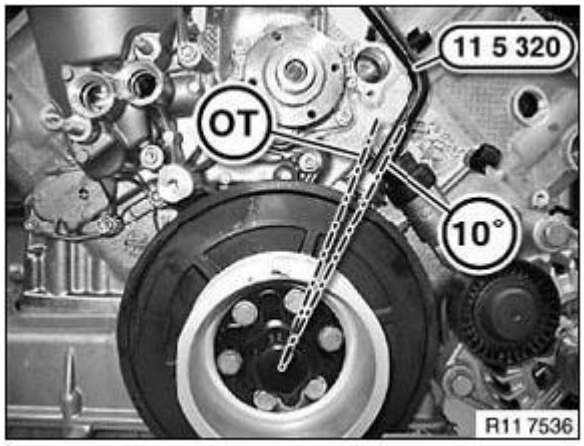


Fig. 399: Identifying Crankshaft Position
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Coat contact face of new central bolt (1) with copper paste.

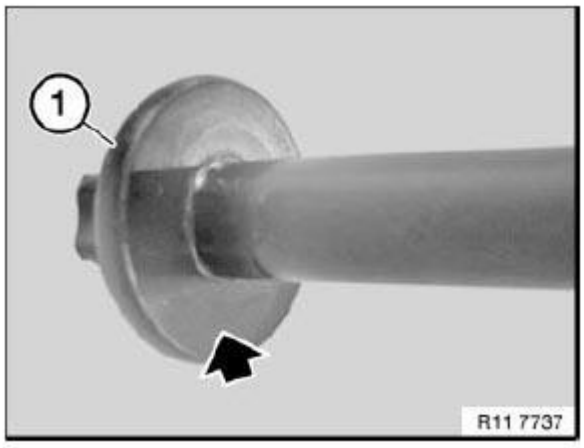


Fig. 400: Identifying Contact Face Of Central Bolt
Courtesy of BMW OF NORTH AMERICA, INC.

Position inlet adjustment unit with timing chain on inlet camshaft.

Screw in central bolt (2) hand-tight.

Position exhaust adjustment unit on exhaust camshaft.

Hexagon socket screw points upwards.

Screw in central bolt (1) hand-tight.

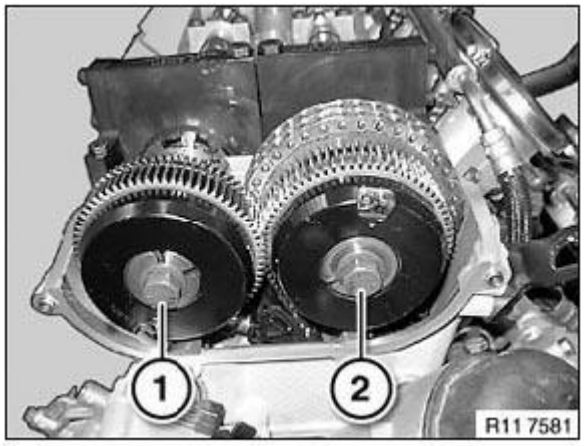


Fig. 401: Identifying Central Bolts
Courtesy of BMW OF NORTH AMERICA, INC.

Install chain tensioner (1).

Tightening torque: **11 31 1AZ**

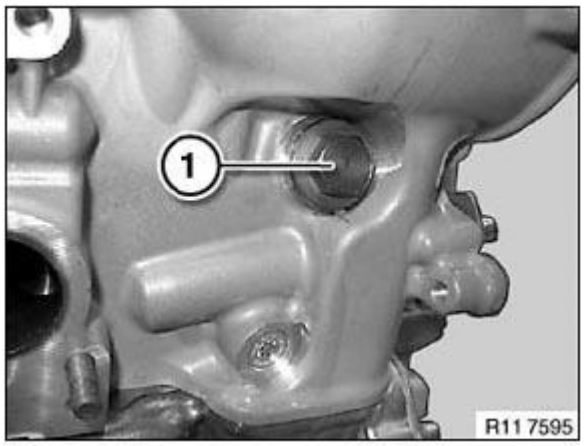


Fig. 402: Identifying Chain Tensioner
Courtesy of BMW OF NORTH AMERICA, INC.

Screw in central bolt (1) with special tool **00 9 120 TORQUE ANGLE MEASURING DIAL** .

1. Joining 10 Nm
2. Joining 20 Nm
3. Settling torque 80 Nm
4. Torsion angle 200°
5. **Unscrew central bolt.**
6. Joining 10 Nm

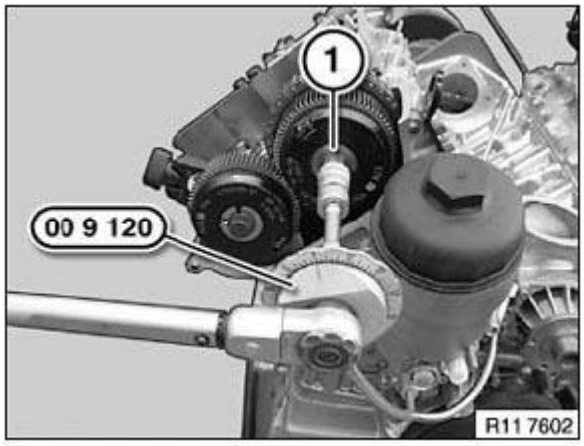


Fig. 403: Securing Central Bolt Using Special Tool (00 9 120)
Courtesy of BMW OF NORTH AMERICA, INC.

Insert central bolt (1) and screw with special tool **00 9 120 TORQUE ANGLE MEASURING DIAL** .

1. Joining 10 Nm
2. Joining 20 Nm
3. Settling torque 80 Nm
4. Torsion angle 200°
5. **Unscrew central bolt.**
6. Joining 10 Nm

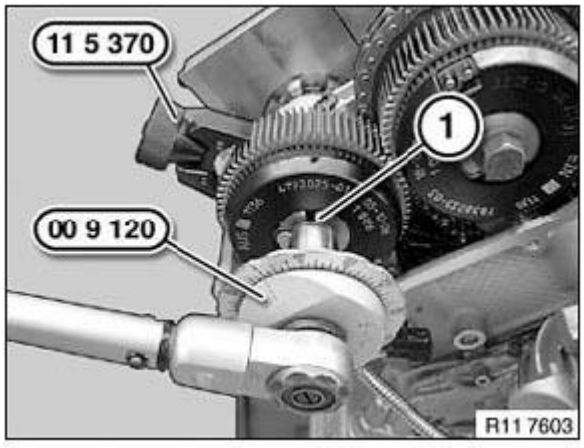


Fig. 404: Securing Central Bolt Using Special Tool (00 9 120)
Courtesy of BMW OF NORTH AMERICA, INC.

Remove hexagon socket screw (1) or special tool 11 5 370.

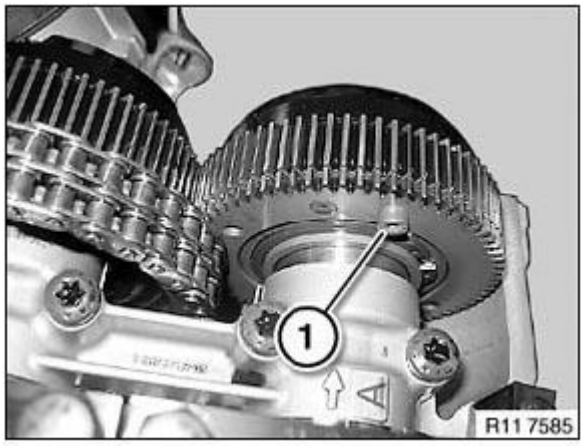


Fig. 405: Identifying Hexagon Socket Screw
Courtesy of BMW OF NORTH AMERICA, INC.

Release special tool 11 5 320 and continue barring engine at central bolt 10° to **firing TDC position of cylinder no. 1.**

Installation:

This minimizes timing chain and gearwheel play.

Secure crankshaft with special tool 11 5 320.

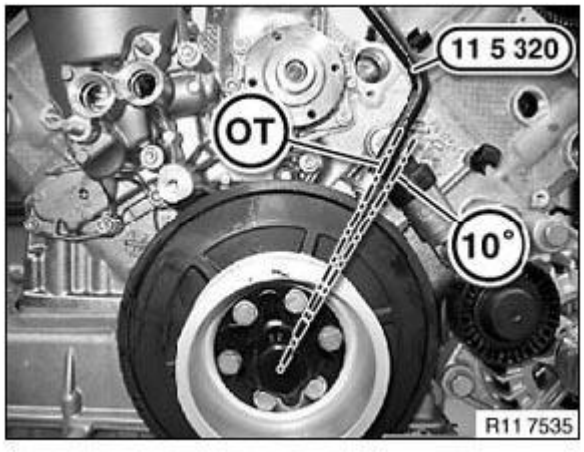


Fig. 406: Identifying Crankshaft Position
Courtesy of BMW OF NORTH AMERICA, INC.

Cylinders 1 to 4:

Always start screwing on the inlet side.

Secure central bolt (1) with special tool **00 9 120 TORQUE ANGLE MEASURING DIAL** .

IMPORTANT: Central bolt final tightening.

1. **Joining 20 Nm**
2. **Settling torque 80 Nm**
3. **Torsion angle 200°**

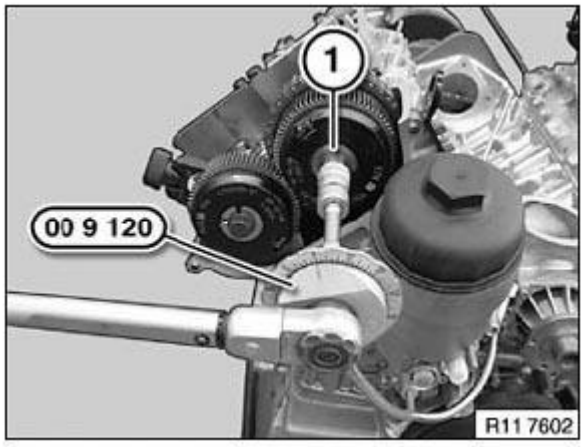


Fig. 407: Securing Central Bolt Using Special Tool (00 9 120)
Courtesy of BMW OF NORTH AMERICA, INC.

Secure central bolt (1) with special tool **00 9 120 TORQUE ANGLE MEASURING DIAL** .

IMPORTANT: Central bolt final tightening.

1. **Joining 20 Nm**
2. **Settling torque 80 Nm**
3. **Torsion angle 200°**

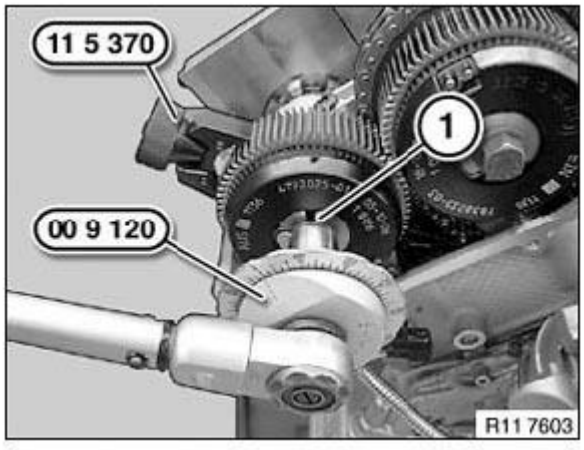


Fig. 408: Securing Central Bolt Using Special Tool (00 9 120)
Courtesy of BMW OF NORTH AMERICA, INC.

Remove all special tools.

Check **TIMING** , bank 1, cylinders (1 to 4).

Assemble engine.

11 36 715 REMOVING AND INSTALLING/REPLACING SOLENOID VALVES ON LEFT VANOS ADJUSTMENT UNIT (S65)

Necessary preliminary tasks:

- Remove **INTAKE AIR MANIFOLD** .

Disconnect plug connections (2).

Release screw (1).

Remove solenoid valve (3), exhaust adjustment.

Installation:

Replace O-rings.

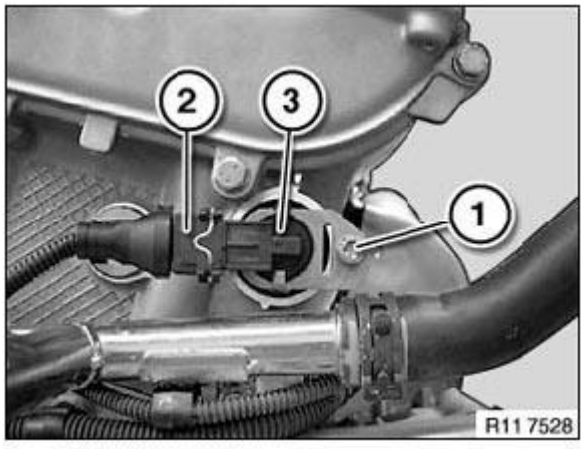


Fig. 409: Identifying Solenoid Valve, Plug Connections And Screw
Courtesy of BMW OF NORTH AMERICA, INC.

Release screw (1).

Unfasten plug connection.

Remove solenoid valve (2), inlet adjustment.

Installation:

Replace O-ring.

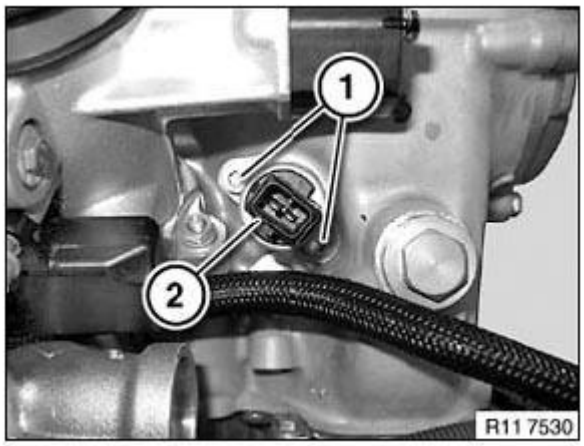


Fig. 410: Identifying Solenoid Valve And Screw
Courtesy of BMW OF NORTH AMERICA, INC.

Assemble engine.

Perform VANOS test.

11 36 720 REMOVING AND INSTALLING/REPLACING SOLENOID VALVES ON RIGHT VANOS ADJUSTMENT UNIT (S65)

Necessary preliminary tasks:

- Remove **INTAKE MANIFOLD** (inlet solenoid valve only).

Disconnect plug connection (2) on solenoid valve for exhaust adjustment.

Release screw (1).

Remove exhaust solenoid valve.

Installation:

Replace O-rings.

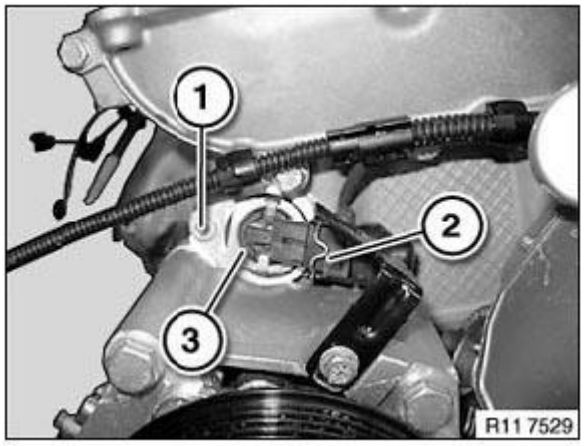


Fig. 411: Identifying Screw And Plug Connection
Courtesy of BMW OF NORTH AMERICA, INC.

Disconnect plug connection on solenoid valve for inlet adjustment.

Release screws (1).

Remove inlet solenoid valve (2).

Installation:

Replace O-ring.

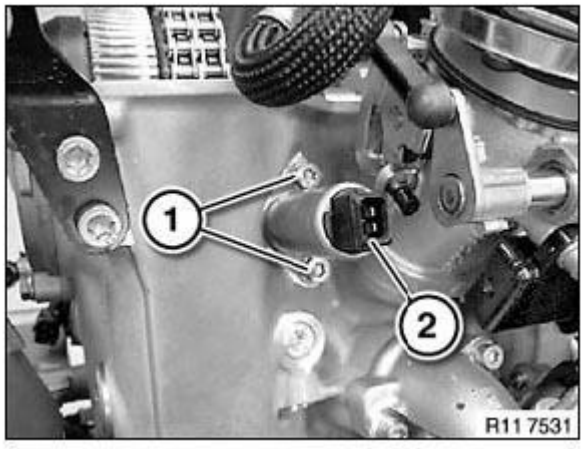


Fig. 412: Identifying Screws And Inlet Solenoid Valve
Courtesy of BMW OF NORTH AMERICA, INC.

Assemble engine.

Perform VANOS test.

OIL PUMP WITH FILTER AND DRIVE

11 41 000 REMOVING AND INSTALLING/REPLACING OIL PUMP (S65)

Necessary preliminary tasks:

- Remove **OIL PAN**

Release screws (1).

Release screws (2).

Installation:

Replace screws.

Clean threads before installation.

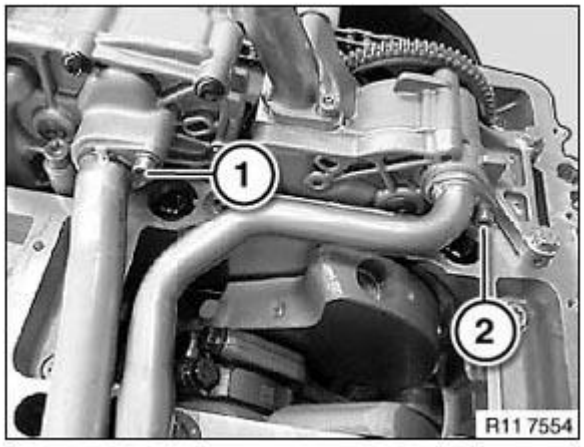


Fig. 413: Identifying Oil Pipe Screws
Courtesy of BMW OF NORTH AMERICA, INC.

Release screw (1).

Release screw (2).

Detach oil pipes from oil pump.

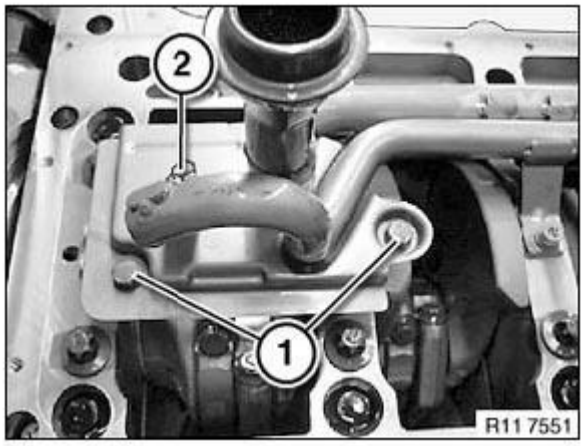


Fig. 414: Identifying Oil Pipe Screws
Courtesy of BMW OF NORTH AMERICA, INC.

Release screw (1).

Detach oil pipes from oil pump.

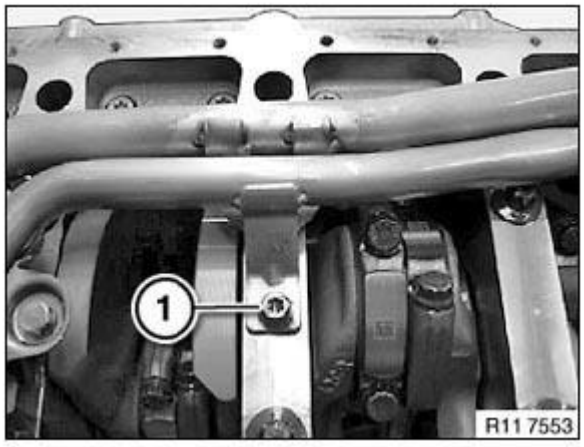


Fig. 415: Identifying Oil Pipe Screw
Courtesy of BMW OF NORTH AMERICA, INC.

Detach oil pipes (1 and 2) from oil pump.

Installation:

Replace sealing rings.

To facilitate fitting, apply a light coating of engine oil to sealing rings.

Clean all sealing surfaces.

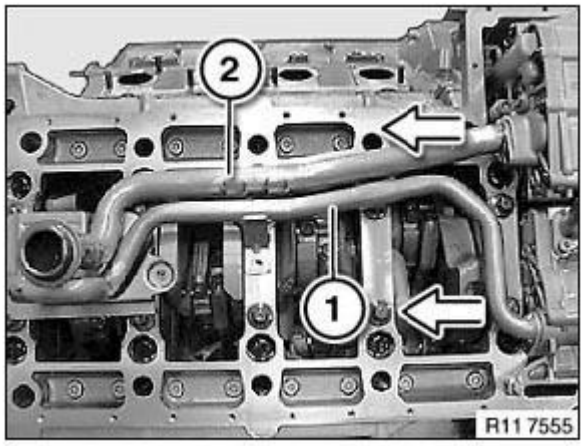


Fig. 416: Detaching Oil Pipes
Courtesy of BMW OF NORTH AMERICA, INC.

Slacken nut (1).

Installation:

If reusing the sprocket wheel, check dihedron for damage and if necessary replace.

Replace microencapsulated nut (1).

Tightening torque:**11 41 1AZ** .

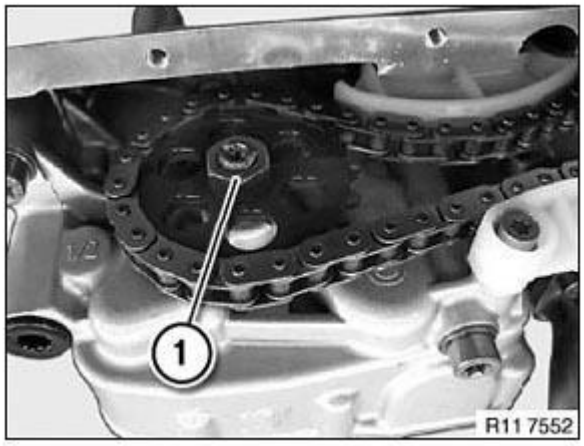


Fig. 417: Identifying Microencapsulated Nut
Courtesy of BMW OF NORTH AMERICA, INC.

Release screw (1).

Release screw (2).

Fold sliding rail (3) downwards.

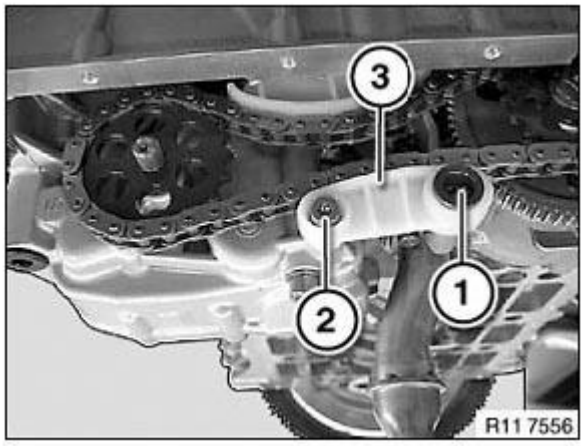


Fig. 418: Identifying Sliding Rail And Screw
Courtesy of BMW OF NORTH AMERICA, INC.

Remove sprocket wheel (1) from shaft.

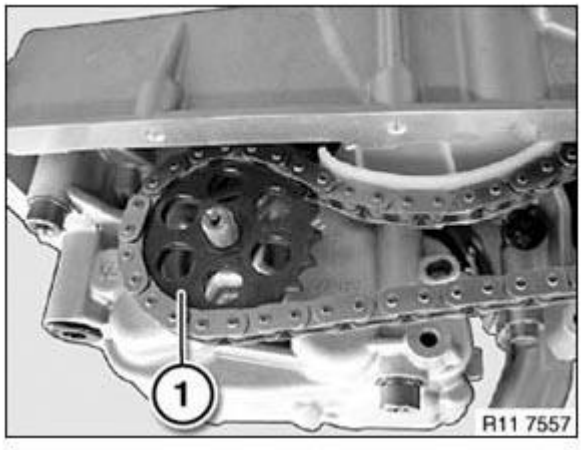


Fig. 419: Identifying Sprocket Wheel
Courtesy of BMW OF NORTH AMERICA, INC.

IMPORTANT: Chain tensioner piston may fall out.

Remove piston (1) in direction of arrow.

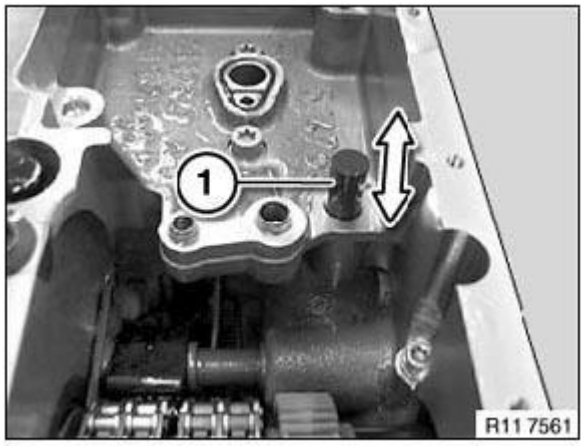


Fig. 420: Removing Piston
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Arrangement, chain tensioner, oil pump.

1. Base valve
2. Spring
3. Piston

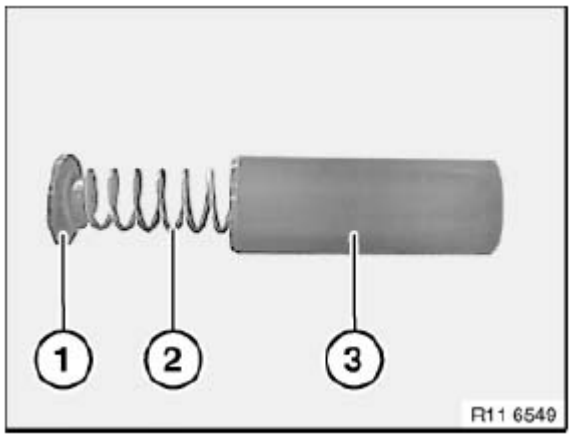


Fig. 421: Identifying Base Valve, Spring And Piston
Courtesy of BMW OF NORTH AMERICA, INC.

Release screws (1) on oil pump (2).

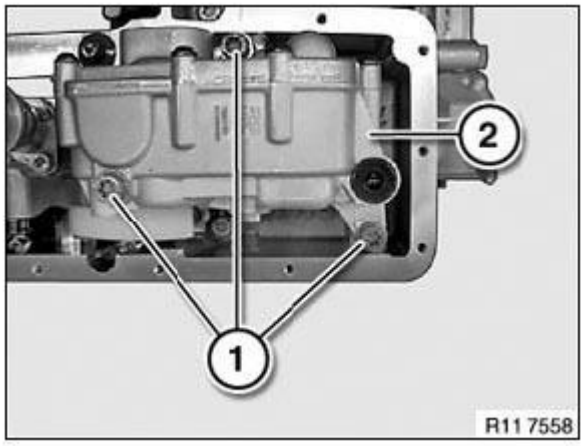


Fig. 422: Identifying Screws And Oil Pump
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Replace sealing ring.

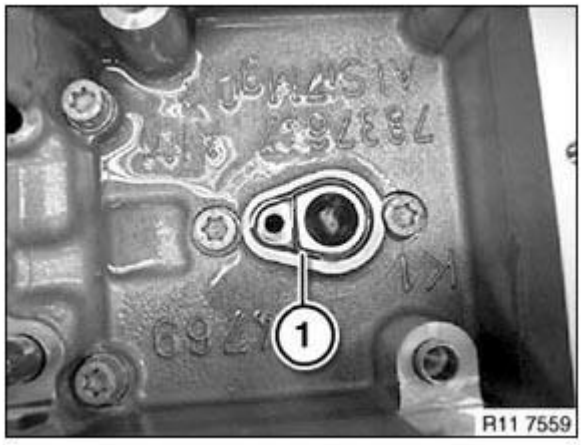


Fig. 423: Identifying Sealing Ring
Courtesy of BMW OF NORTH AMERICA, INC.

Assemble engine.

11 41 050 REMOVING AND INSTALLING/REPLACING OIL SUCTION PUMP (S65)

IMPORTANT: Excessively low or high play between the gearwheel pairs results in failure of the oil supply.

Necessary preliminary tasks:

- Remove **ENGINE OIL SUMP** .

- Remove **OIL PUMP** .

Release screws (1).

Tightening torque, see **11 41 3AZ** .

Remove oil pump (2).

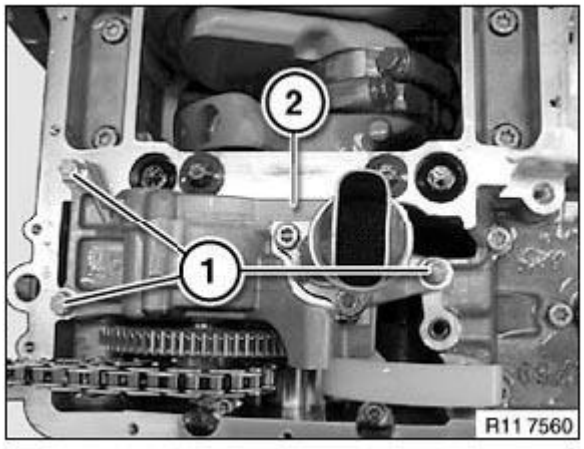


Fig. 424: Identifying Oil Pump And Screws
Courtesy of BMW OF NORTH AMERICA, INC.

REPLACING GEAR WHEELS

Necessary preliminary tasks:

- Remove **VIBRATION DAMPER** .
- Remove **RADIAL SHAFT SEAL** at front.

Mount special tool 11 6 254 on crankcase.

Secure special tool 11 6 252 with magnetic base to special tool 11 6 254.

NOTE: Special tool 11 6 254 can only be secured to the crankcase with one screw.

Picture shows (S85).

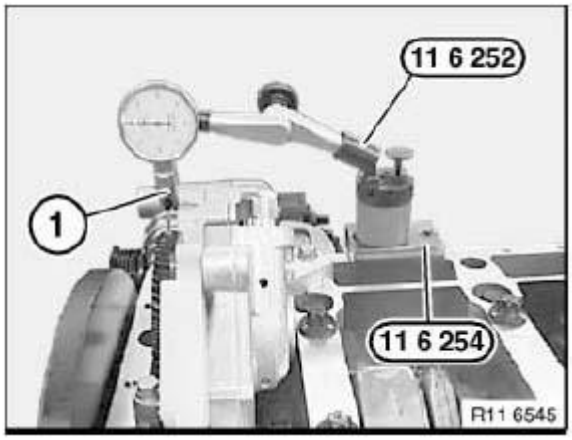


Fig. 425: Securing Special Tool (11 6 252) With Magnetic Base To Special Tool (11 6 254)
Courtesy of BMW OF NORTH AMERICA, INC.

IMPORTANT: The oil pump chain of the oil suction pump must be removed. The chain tensioner must not exert any tension on the oil suction pump.

Align special tool 11 6 251 with its measuring shaft (2) vertically to gearwheel (1).

Turn oil suction pump gearwheel (1) to stop.

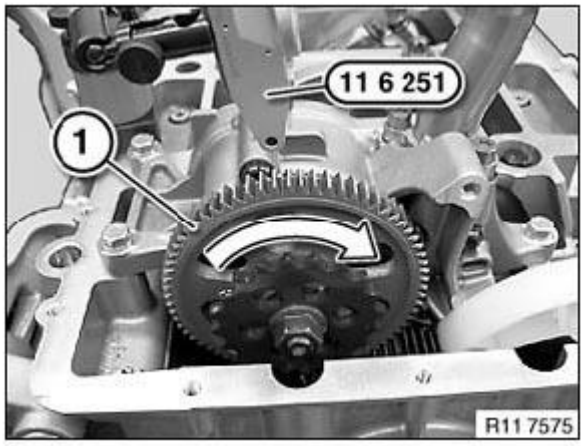


Fig. 426: Turning Oil Suction Pump Gearwheel
Courtesy of BMW OF NORTH AMERICA, INC.

Set special tool 11 6 251 to zero.

Turn oil suction pump gearwheel (1) in direction of arrow to stop.

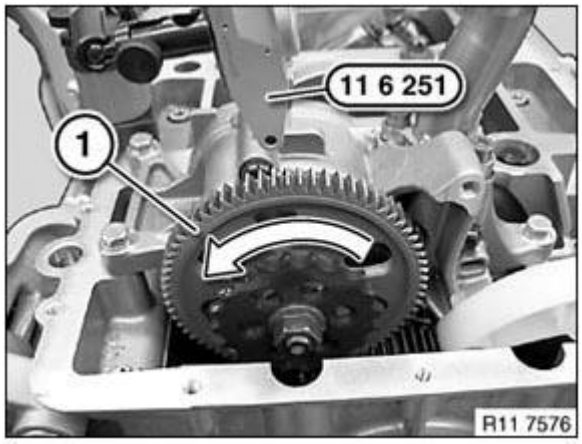


Fig. 427: Turning Oil Suction Pump Gearwheel
Courtesy of BMW OF NORTH AMERICA, INC.

Backlash on oil suction pump **min. 0.06 to max. 0.08 mm.**

If necessary, correct oil suction pump adjustment.

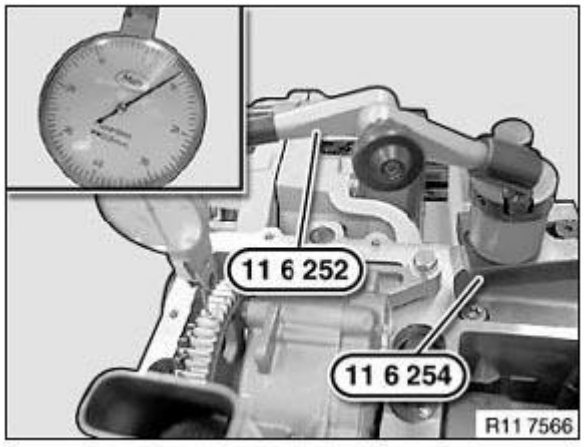


Fig. 428: Measuring Oil Suction Pump Backlash
Courtesy of BMW OF NORTH AMERICA, INC.

Adjust oil suction pump (2) with a rubber mallet on pump housing in direction of arrow.

Tightening torque **11 41 3AZ** .

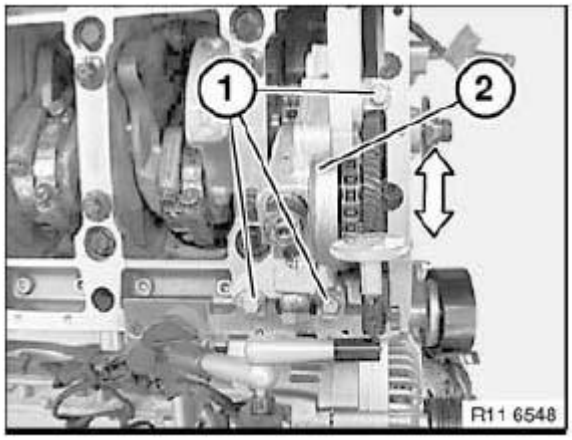


Fig. 429: Adjusting Oil Suction Pump
Courtesy of BMW OF NORTH AMERICA, INC.

Assemble engine.

OIL FILTER AND LINES

11 42 020 REMOVING AND INSTALLING, SEALING/REPLACING MAIN FLOW OIL FILTER (S65)

IMPORTANT: It is essential to adhere to the exact filling capacities specified. Overfilling the engine with engine oil will result in engine damage.

Recycling

Catch and dispose of engine oil with suitable equipment.

Note national regulations.

Necessary preliminary tasks:

- Remove fan cowl with electronic fan.
- Remove front underbody protection.
- Remove A/C system **DRIVE BELT** .
- Remove water pump **BELT PULLEY** .
- Remove coolant hoses.
- Remove **VIBRATION DAMPER** .
- Release **POWER STEERING PUMP** and lay to one side (do not open pressure lines).

Release oil filter cover (1).

Installation:

Replace sealing ring.

Tightening torque: **11 42 1AZ** .

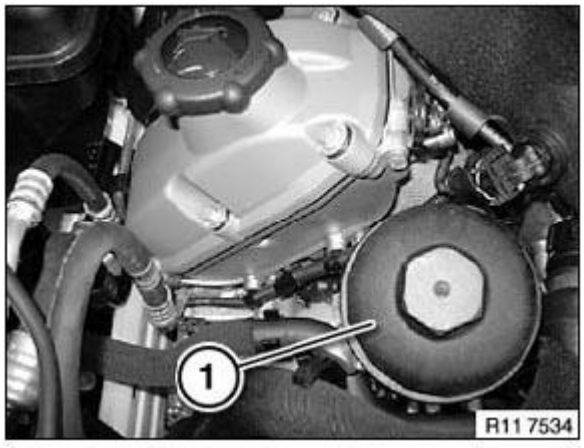


Fig. 430: Identifying Oil Filter Cover
Courtesy of BMW OF NORTH AMERICA, INC.

Release nuts (1 and 4).

Tightening torque: 11 42 3AZ

Detach lines (2 and 3).

Installation:

Replace O-rings.

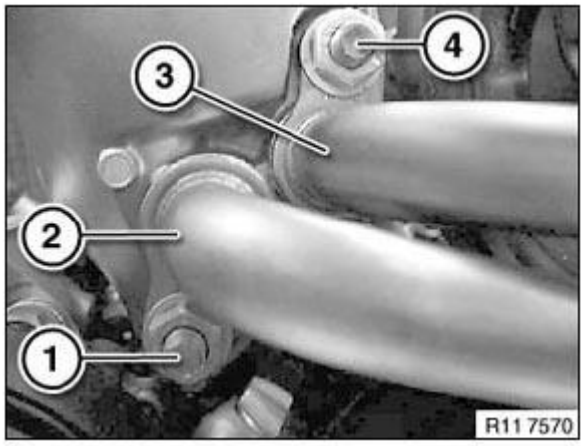


Fig. 431: Identifying Lines And Nuts
Courtesy of BMW OF NORTH AMERICA, INC.

Release screws (1).

Release screws (2).

Release screws (3).

Tightening torque: **11 42 2AZ**

Lift out oil filter housing.

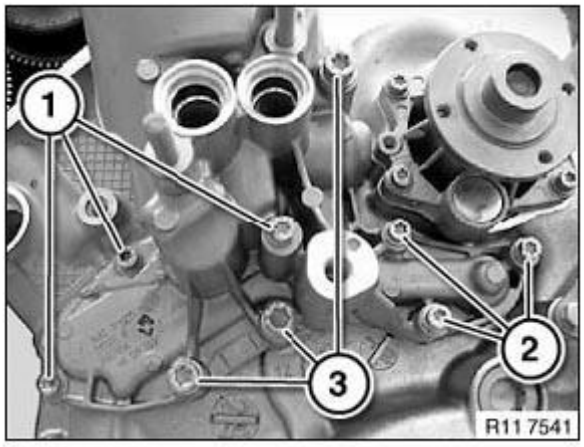


Fig. 432: Identifying Screws
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Replace seal (1).

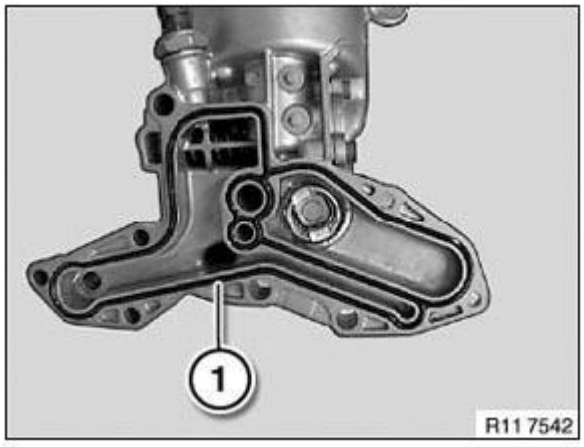


Fig. 433: Identifying Seal
Courtesy of BMW OF NORTH AMERICA, INC.

Assemble engine.

Park vehicle on a horizontal surface.

Allow engine at normal operating temperature to run for 3 minutes with increased revs (min. 1000/max. 1500 RPM).

Read off engine oil level in instrument cluster or on Control Display.

Top up engine oil if necessary.

11 42 080 REMOVING AND INSTALLING/REPLACING OIL PRESSURE HOSE - FEED - (S65)

IMPORTANT: It is essential to adhere to the exact filling capacities specified. Overfilling the engine with engine oil will result in engine damage.

Recycling

Catch and dispose of emerging engine oil with suitable equipment.

Note national regulations.

Necessary preliminary tasks:

- Remove **FAN COWL** with electronic fan.
- Remove front **UNDERBODY PROTECTION** .

Slacken nut (1).

Disconnect oil line (2).

Installation:

Replace O-ring.

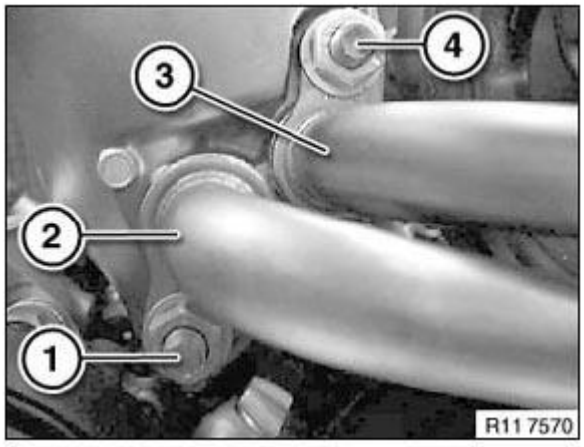


Fig. 434: Identifying Oil Line And Nut
Courtesy of BMW OF NORTH AMERICA, INC.

Slacken nut (1).

Unclip bracket (2).

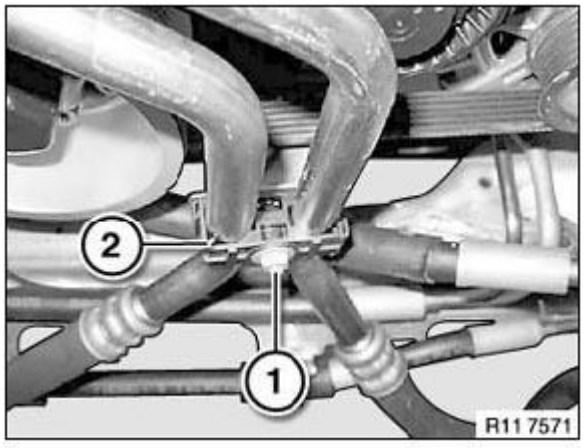


Fig. 435: Identifying Bracket And Nut
Courtesy of BMW OF NORTH AMERICA, INC.

Slacken nut (1).

Disconnect oil line (2).

Installation:

Replace O-ring.

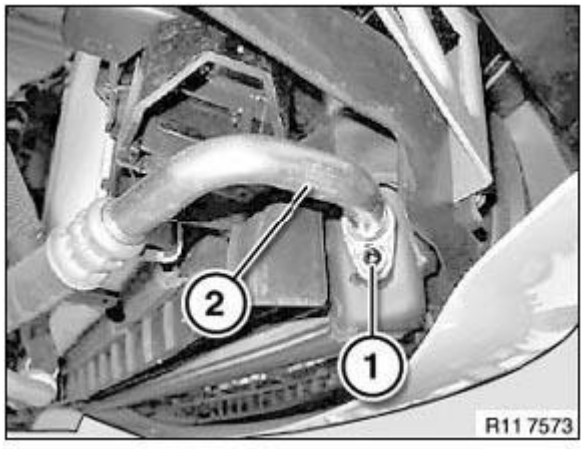


Fig. 436: Identifying Oil Line And Nut
Courtesy of BMW OF NORTH AMERICA, INC.

Assemble engine.

Park vehicle on a horizontal surface.

Allow engine at normal operating temperature to run for 3 minutes with increased revs (min. 1000/max. 1500 RPM).

Read off engine oil level in instrument cluster or on Control Display.

11 42 085 REMOVING AND INSTALLING/REPLACING OIL PRESSURE HOSE - RETURN - (S65)

IMPORTANT: It is essential to adhere to the exact filling capacities specified. Overfilling the engine with engine oil will result in engine damage.

Recycling

Catch and dispose of emerging engine oil with suitable equipment.

Note national regulations.

Necessary preliminary tasks:

- Remove **FAN COWL** with electronic fan.
- Remove front **UNDERBODY PROTECTION** .

Slacken nut (4).

Disconnect oil line (3).

Installation:

Replace O-ring.

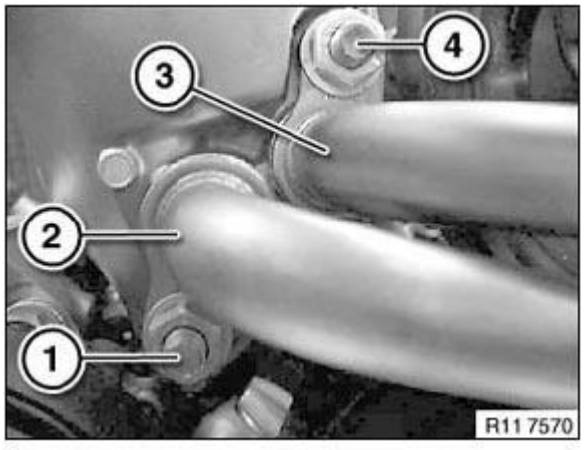


Fig. 437: Identifying Oil Line And Nut
Courtesy of BMW OF NORTH AMERICA, INC.

Slacken nut (1).

Unclip retainer (2).

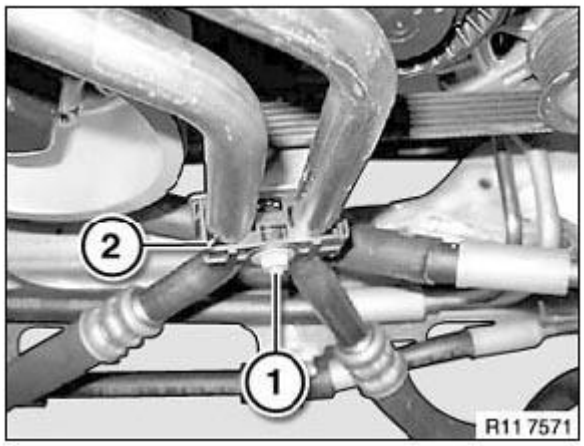


Fig. 438: Identifying Retainer And Nut
Courtesy of BMW OF NORTH AMERICA, INC.

Slacken nut (1).

Disconnect oil line (2).

Installation:

Replace O-ring.

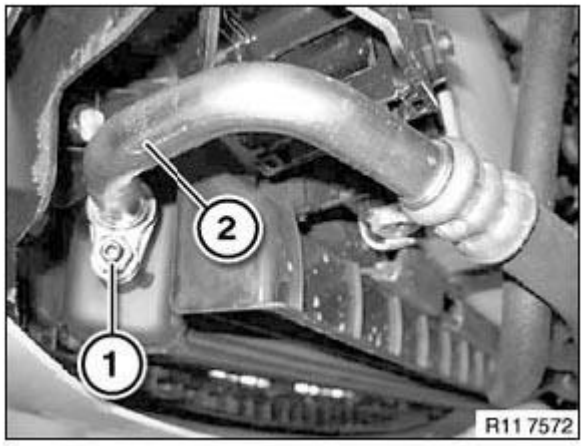


Fig. 439: Identifying Oil Line And Nut
Courtesy of BMW OF NORTH AMERICA, INC.

Assemble engine.

Park vehicle on a horizontal surface.

Allow engine at normal operating temperature to run for 3 minutes with increased revs (min. 1000/max. 1500

RPM).

Read off engine oil level in instrument cluster or on Control Display.

WATER PUMP WITH DRIVE

11 51 000 REMOVING AND INSTALLING/REPLACING WATER PUMP (S65)

Necessary preliminary tasks:

- Remove **FAN COWL WITH ELECTRONIC FAN** .
- Remove **RADIATOR** .
- Remove A/C compressor drive belt.
- Remove upper **IDLER PULLEY** for A/C compressor.

Release screw (1).

Remove alternator **DRIVE BELT** .

Remove belt pulley (2).

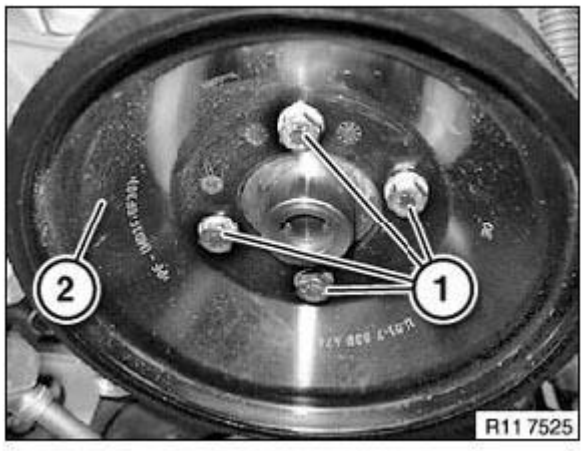


Fig. 440: Identifying Belt Pulley And Screw
Courtesy of BMW OF NORTH AMERICA, INC.

Release screws (1).

To facilitate removal of the coolant pump, it is possible to insert M6 screws on left and right (see arrows).

Installation:

Replace all sealing rings.

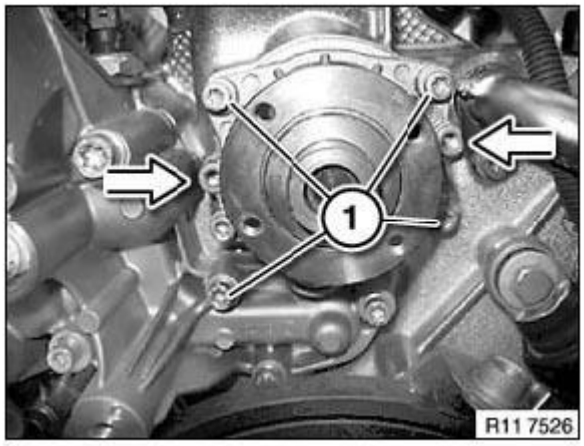


Fig. 441: Inserting M6 Screws
Courtesy of BMW OF NORTH AMERICA, INC.

Assemble engine.

Vent **COOLING SYSTEM** and check for leaks.

THERMOSTAT AND CONNECTIONS

11 53 000 REMOVING AND INSTALLING/REPLACING COOLANT THERMOSTAT (S65)

Necessary preliminary tasks:

- Remove intake air **MANIFOLD** .
- Drain **COOLANT** .

Release unlocking element (1).

Detach vent line (2).

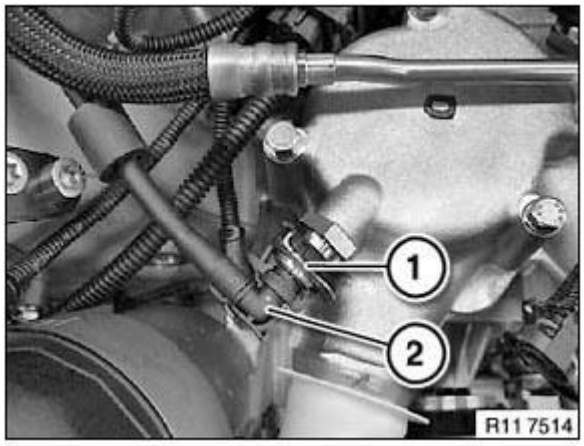


Fig. 442: Identifying Vent Line And Unlocking Element
Courtesy of BMW OF NORTH AMERICA, INC.

Disconnect **FUEL LINE** from fuel rail.

Release screws (2).

Unlock wiring harness of fuel injectors (1).

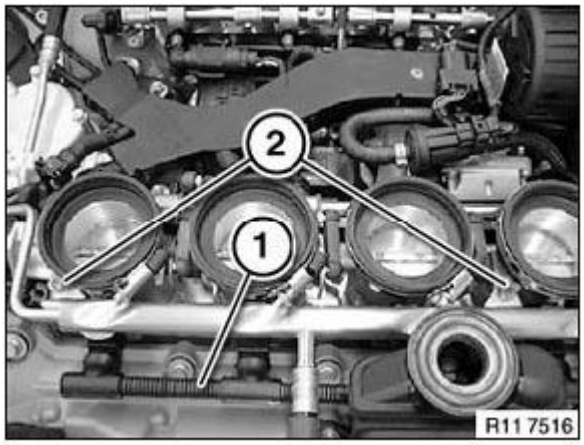


Fig. 443: Identifying Fuel Injectors And Screws
Courtesy of BMW OF NORTH AMERICA, INC.

Clip injection pipe (1) out of holder (2).

Lay injection pipe, cylinders 5 to 8, to one side.

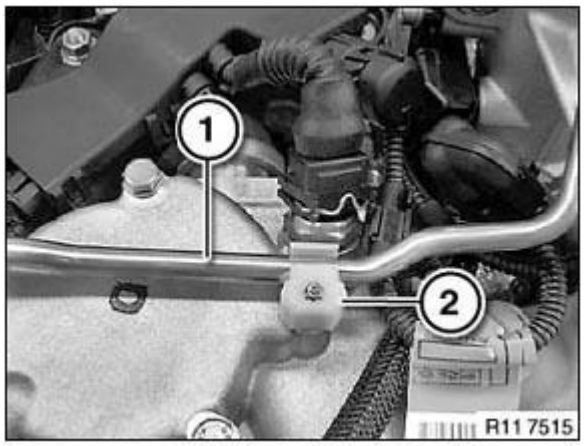


Fig. 444: Identifying Injection Pipe And Holder
Courtesy of BMW OF NORTH AMERICA, INC.

Disconnect plug connection (1) on coolant temperature sensor.

Disconnect plug connection (2) on solenoid valve.

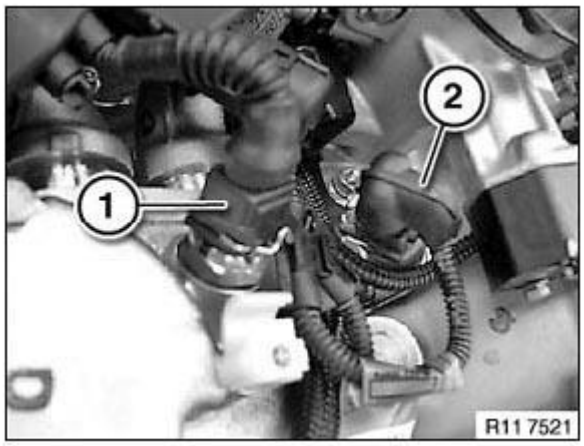


Fig. 445: Identifying Plug Connections
Courtesy of BMW OF NORTH AMERICA, INC.

Unlock coolant hoses and detach.

Release screws (1).

Installation:

Replace sealing rings.

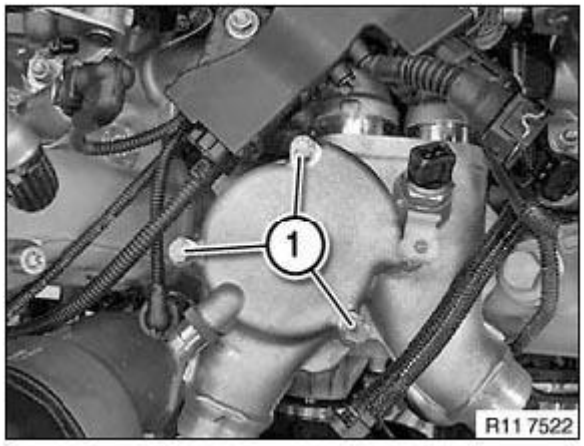


Fig. 446: Identifying Screws
Courtesy of BMW OF NORTH AMERICA, INC.

Remove thermostat housing with thermostat forwards in direction of arrow.

Clean sealing surfaces.

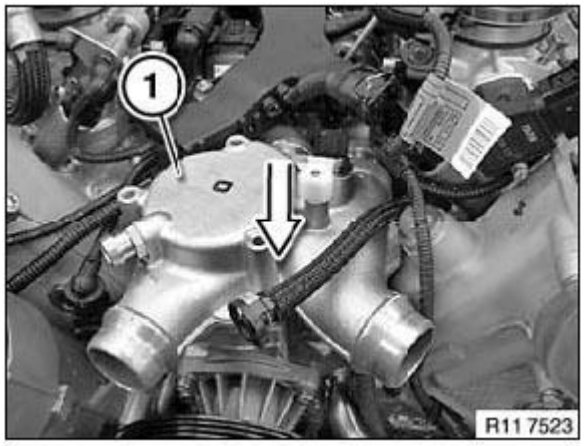


Fig. 447: Removing Thermostat Housing
Courtesy of BMW OF NORTH AMERICA, INC.

Remove thermostat (1).

Check rubber section (2) for damage.

Remove connecting pipes (2).

Installation:

Replace all O-rings on connecting pipes.

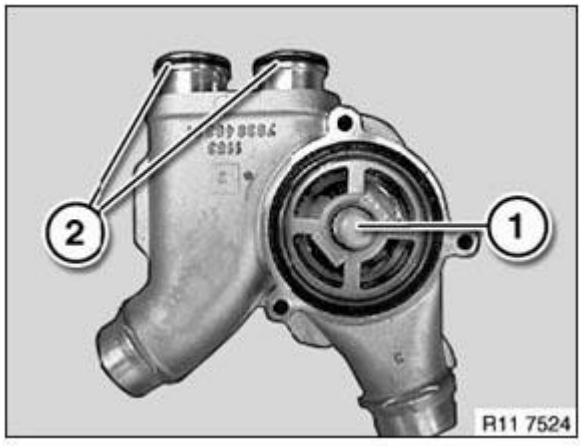


Fig. 448: Identifying Connecting Pipes And Thermostat
Courtesy of BMW OF NORTH AMERICA, INC.

Assemble engine.

Vent **COOLING SYSTEM** and check for leaks.

INTAKE MANIFOLD

11 61 050 REMOVING AND INSTALLING AIR INTAKE MANIFOLD (S65)

IMPORTANT: Do not use antiseize agents to install the air intake manifold.

Necessary preliminary tasks:

- Remove **AIR CLEANER HOUSING** .

Disconnect plug connection (1) on intake air temperature sensor.

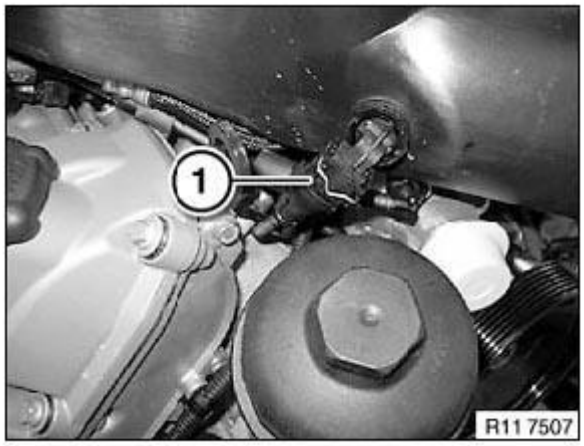


Fig. 449: Identifying Plug Connection
Courtesy of BMW OF NORTH AMERICA, INC.

Unlock hose (2) for idle actuator incoming air at fastener (1) and detach in direction of arrow.

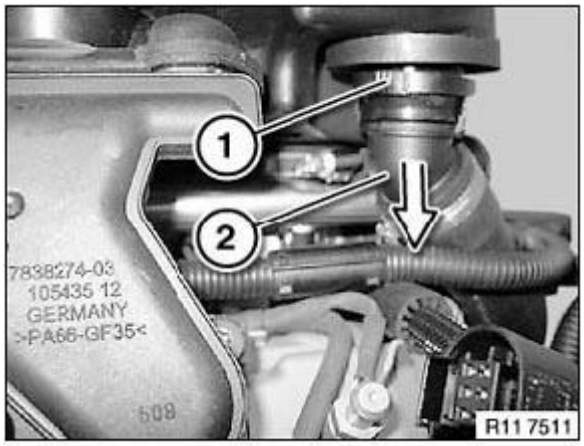


Fig. 450: Unlocking Hose
Courtesy of BMW OF NORTH AMERICA, INC.

Unlock hose (2) for condensate drain line at fastener (1) and detach in direction of arrow.

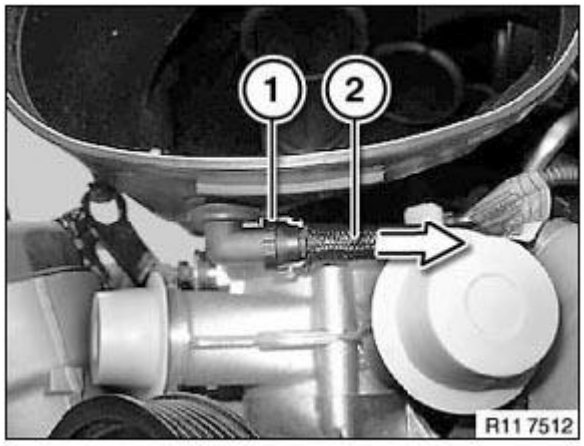


Fig. 451: Unlocking Hose
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Each hose clamp on the decoupling element is exactly positioned.

Loosen hose clamps (1).

Secure hose clamps with special tool 009250 .

Tightening torque: **11 61 1AZ** .

NOTE: Picture shows hose clamps (1 to 3).

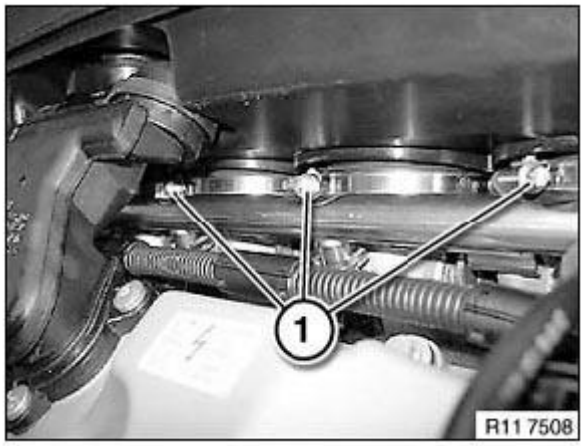


Fig. 452: Identifying Hose Clamps
Courtesy of BMW OF NORTH AMERICA, INC.

Release hose clamp (1) on cylinder 4.

Secure hose clamps with special tool 009250 .

Tightening torque: **11 61 1AZ** .

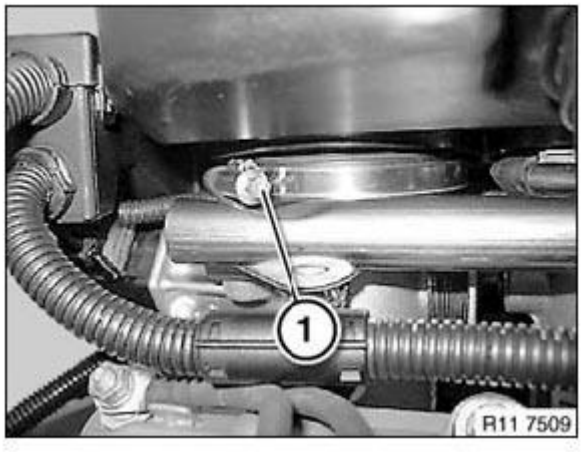


Fig. 453: Identifying Hose Clamp
Courtesy of BMW OF NORTH AMERICA, INC.

Release hose clamp (1) on cylinders 5 to 8.

Secure hose clamps with special tool 009250 .

Tightening torque: **11 61 1AZ** .

Remove intake air manifold towards top.

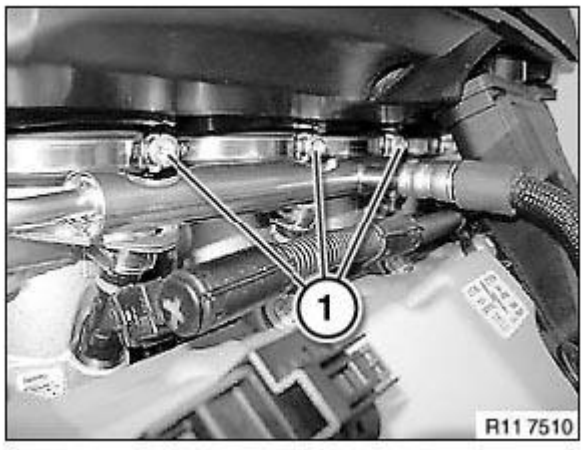


Fig. 454: Identifying Hose Clamp
Courtesy of BMW OF NORTH AMERICA, INC.

IMPORTANT: Do not lay any tools or foreign bodies in intake area. Risk of damage to throttle valves/engine.

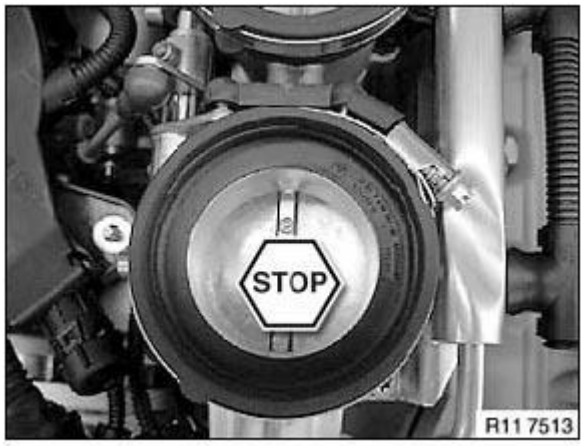


Fig. 455: Precaution For Throttle Valve
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: Assemble engine.

AIR PUMP, LINES AND CONTROL VALVES

11 72 060 REMOVING AND INSTALLING/REPLACING BOTH SECONDARY-AIR VALVES (S65)

Necessary preliminary tasks:

- Carry out system test: secondary air with BMW diagnosis system.
- Disconnect battery at negative lead.
- Remove **LEFT EXHAUST MANIFOLD (S65)** .
- Remove right **EXHAUST MANIFOLD** .
- Remove **SECONDARY-AIR PUMP** .
- Unfasten engine wiring harness partially and lay to one side.

Removing secondary-air valve, bank 1:

Unscrew nuts (1).

Remove secondary-air valve (2).

Installation:

Clean sealing surfaces.

Replace seal.

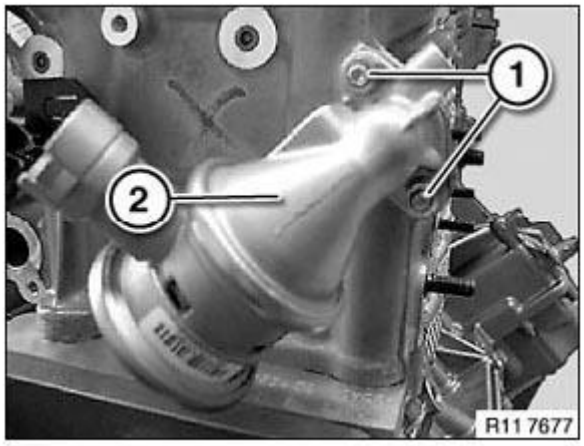


Fig. 456: Identifying Secondary-Air Valve And Nuts
Courtesy of BMW OF NORTH AMERICA, INC.

Removing secondary-air valve, bank 2:

Unscrew nuts (1).

Remove secondary-air valve (2).

Installation:

Clean sealing surfaces.

Replace seal.

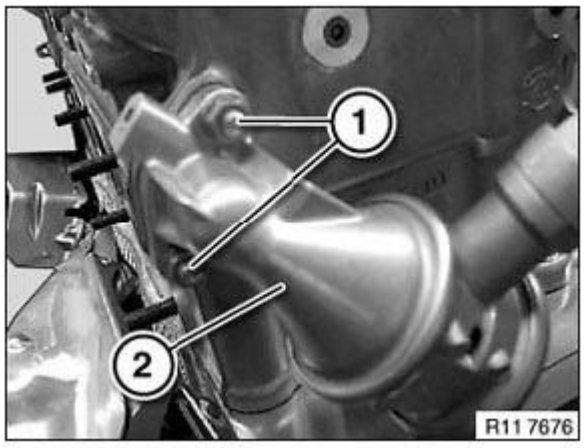


Fig. 457: Identifying Secondary-Air Valve And Nuts
Courtesy of BMW OF NORTH AMERICA, INC.

Assemble engine.

Carry out system test: secondary air.

11 72 000 REMOVING AND INSTALLING/REPLACING SECONDARY-AIR PUMP (S65)

Necessary preliminary tasks:

- Remove **INTAKE AIR MANIFOLD**

Release screws (arrow) on holding frame.

Release nuts on secondary-air pump.

Unlock and detach both air hoses.

Unlock connector and remove.

Lift out secondary-air pump.

Remove holding frame from secondary-air pump.

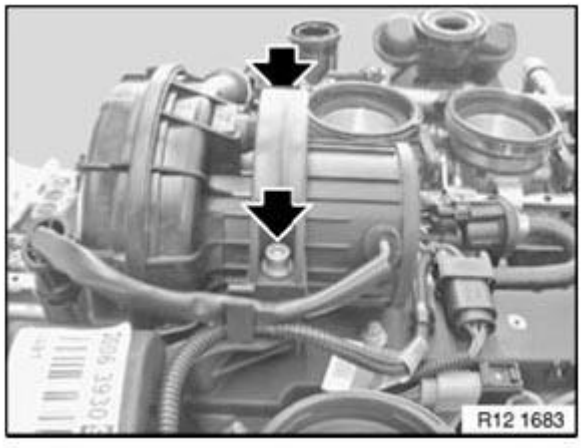


Fig. 458: Locating Holding Frame Screws
Courtesy of BMW OF NORTH AMERICA, INC.

Assemble engine.

Check function of DME.

EMISSION CONTROL, OXYGEN SENSOR

11 78 530 REPLACING LEFT LAMBDA OXYGEN CONTROL SENSOR (S65)

WARNING: Scalding hazard!
Only perform these tasks after exhaust system has cooled down.

Necessary preliminary tasks:

- Read out fault memory in Digital Motor Electronics (DME).
- Remove transmission underbody protection.

Pull plug connection (1) from holder (2).

Disconnect plug connection (1).

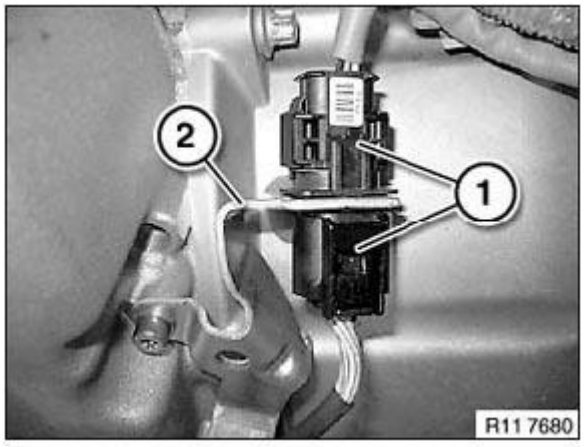


Fig. 459: Identifying Plug Connection And Holder
Courtesy of BMW OF NORTH AMERICA, INC.

Remove oxygen control sensor with special tool 11 7 030.

If the oxygen control sensor is reused, apply a thin and even coat of Never Seez Compound to the thread only.

The part of the oxygen control sensor which projects into the exhaust system branch (sensor ceramic) must **not be cleaned or come into contact with lubricant.**

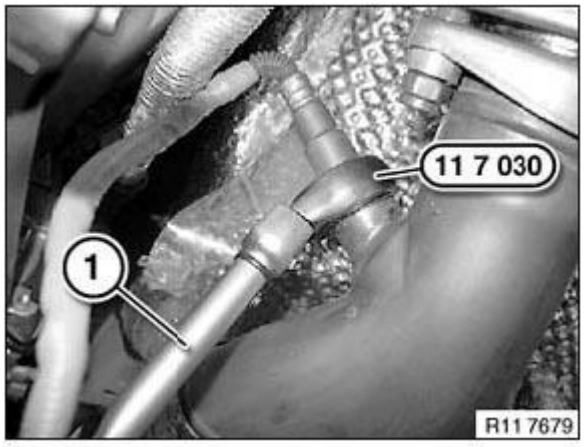


Fig. 460: Removing Oxygen Control Sensor Using Special Tool (11 7 030)
Courtesy of BMW OF NORTH AMERICA, INC.

Secure oxygen control sensor with special tool 11 7 030 and a torque wrench (1).

Tightening torque: 11 78 1AZ .

Check function of DME.

11 78 540 REPLACING LEFT MONITOR SENSOR (S65)

WARNING: Scalding hazard!
Only perform these tasks after exhaust system has cooled down.

Necessary preliminary tasks:

- Read out fault memory in Digital Motor Electronics (DME)
- Remove transmission underbody protection

Disconnect plug connection (1).

Remove monitor sensor with special tool 11 7 030.

Installation:

If the monitor sensor is reused, only apply a thin and uniform coat of Never Seez Compound to thread.

The part of the oxygen monitor sensor which projects into the exhaust system branch (sensor ceramic) must **not be cleaned or come into contact with lubricant.**

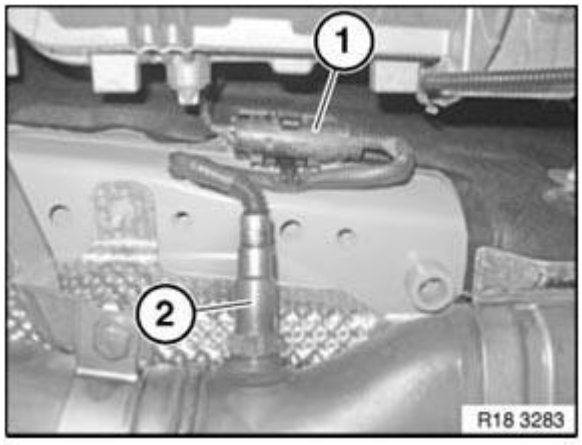


Fig. 461: Identifying Monitor Sensor And Plug Connection
Courtesy of BMW OF NORTH AMERICA, INC.

IMPORTANT: Reinstall plug connection (1) and cable routing without fail in condition on delivery (see illustration).
Risk of damage if this instruction is not observed!

Secure monitor sensor (2) with special tool 11 7 030 and a torque wrench.

Tightening torque: 11 78 1AZ .

Add final details to vehicle.

Check function of DME.

11 78 543 REPLACING RIGHT LAMBDA OXYGEN MONITOR SENSOR (S65)

WARNING: Scalding hazard!
Only perform these tasks after exhaust system has cooled down.

Necessary preliminary tasks:

- Read out fault memory in Digital Motor Electronics (DME).
- Remove transmission underbody protection.

Disconnect plug connection (1).

Remove oxygen monitor sensor with special tool 11 7 030.

Installation:

If the oxygen monitor sensor is reused, apply a thin and even coat of Never Seez Compound (refer to BMW Parts Service) to the thread only.

The part of the oxygen monitor sensor which projects into the exhaust system branch (sensor ceramic) must **not be cleaned or come into contact with lubricant.**

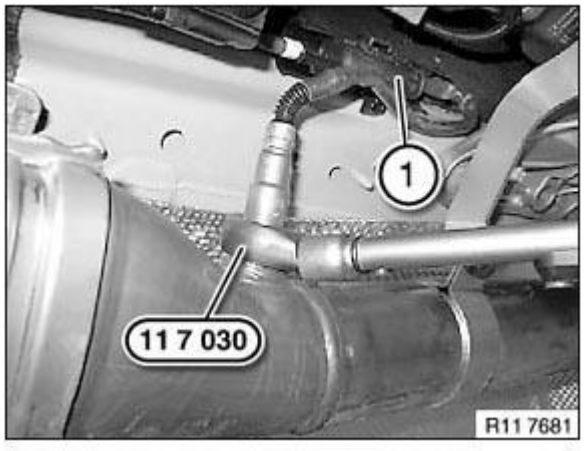


Fig. 462: Removing Oxygen Monitor Sensor Using Special Tool (11 7 030)
Courtesy of BMW OF NORTH AMERICA, INC.

Secure oxygen monitor sensor with special tool 11 7 030 and a torque wrench.

Tightening torque: 11 78 1AZ .

Check function of DME.

