

2004-2006 ENGINE**Engine Mechanical - Repair Instructions - X3 & X5 (M54)****ENGINE GENERAL****00 00 250 BMW ENGINE OIL SERVICE (M54/56)***Recycling:*

Catch and dispose of used oil in a suitable container.

Observe country-specific waste-disposal regulations.

Undo oil filter cap (36 A/F).

**G03310177**

Fig. 1: Identifying Oil Filter Cap (36 A/F)
Courtesy of BMW OF NORTH AMERICA, INC.

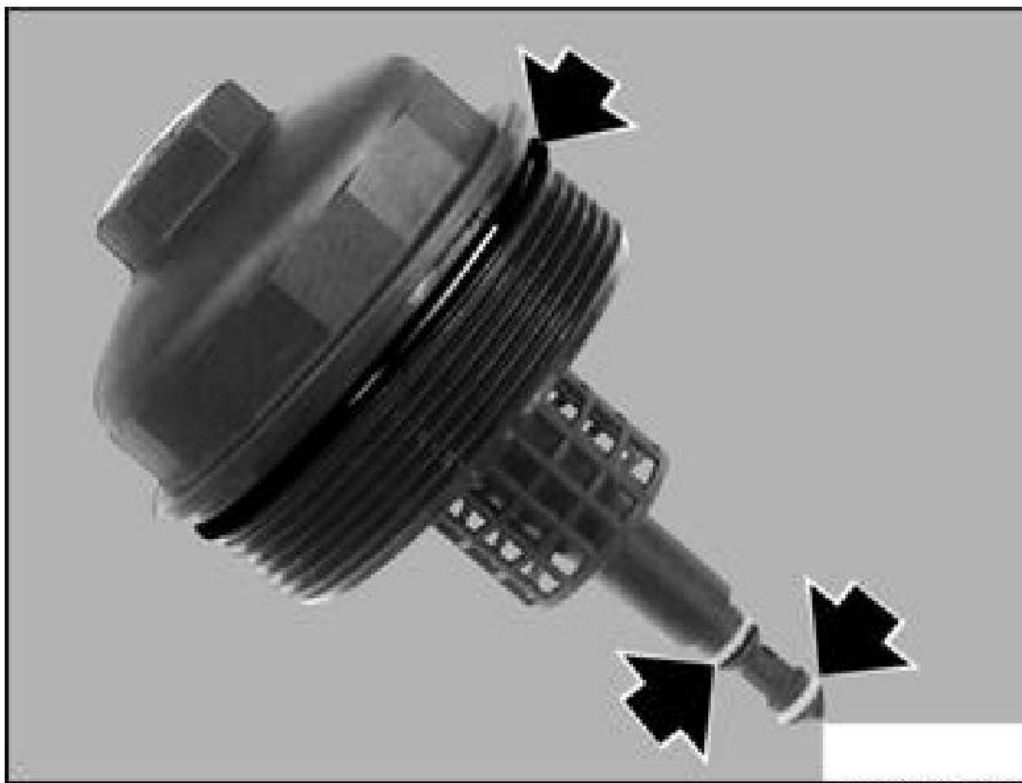
Oil flows from oil-filter housing into oil pan.

Installation:

Tightening torque: 11 42 2AZ. Refer to **ENGINE - TIGHTENING TORQUES** .

Installation:

Replace seals and coat with oil.

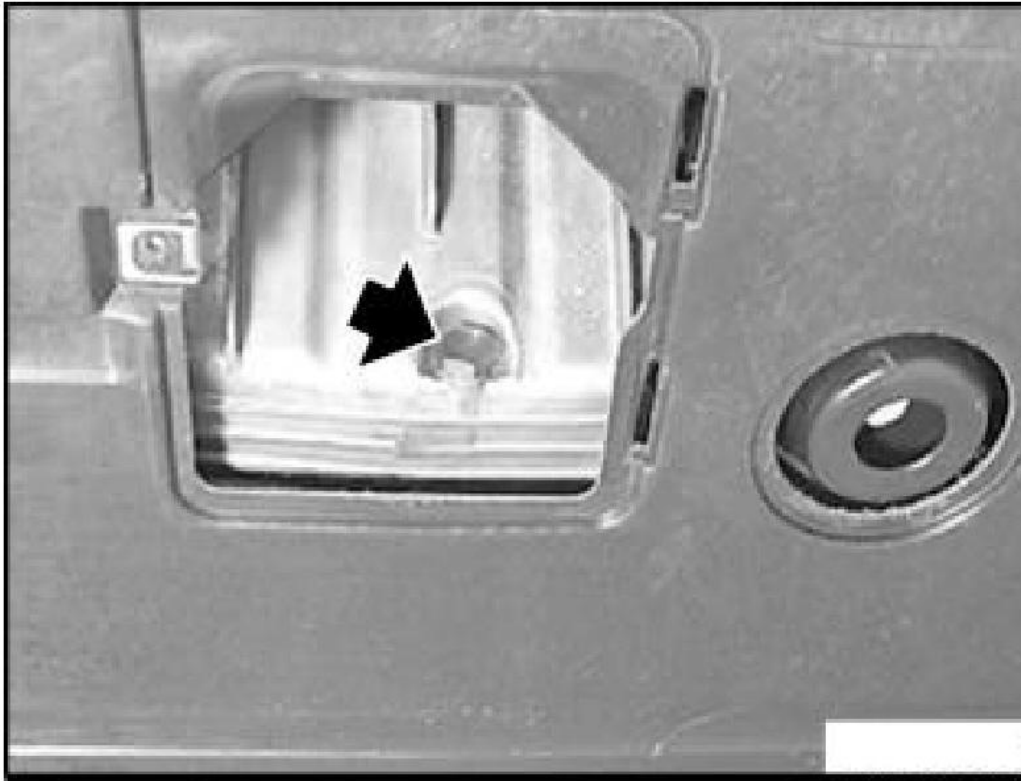


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Fig. 2: Locating Seals

Courtesy of BMW OF NORTH AMERICA, INC.

Once oil has drained from oil filter housing, open oil drain plug or draw off oil.



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Fig. 3: Opening Oil Drain Plug

Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Replace sealing ring.

Tightening torque: 11 13 1AZ. Refer to **ENGINE - TIGHTENING TORQUES** .

00 00 250 BMW ENGINE OIL SERVICE INCL. SUPPLEMENTARY SERVICE (M54 / M56)

NOTE: **Work step 00 00 250 comprises the engine oil and supplementary services. Only the engine oil service will be described in these repair instructions. For the supplementary service work steps, refer to the vehicle -specific inspection sheet.**

Engine oil service:

Release and tighten down main flow oil filter cap with a socket only.



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Fig. 4: View Of Main Flow Oil Filter Cap
Courtesy of BMW OF NORTH AMERICA, INC.

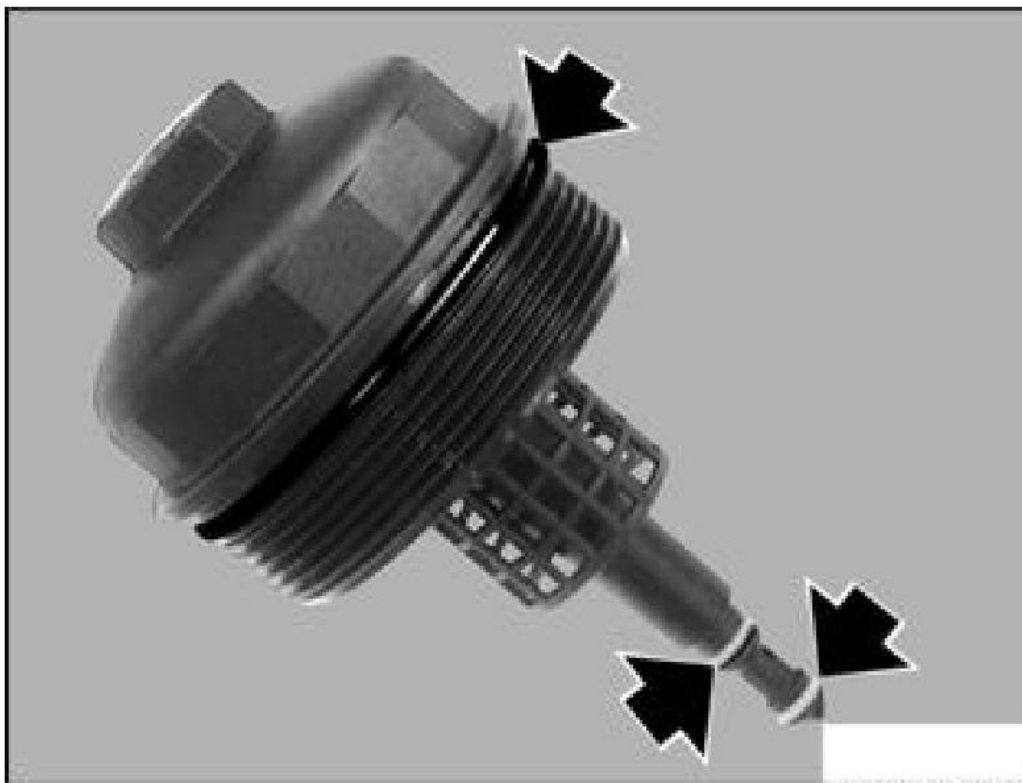
When the main flow oil filter cap is opened, engine oil flows from the oil filter housing back into the oil sump. Release main flow oil filter cap and remove towards top.

Installation:

Tightening torque 11 42 2AZ. Refer to **ENGINE - TIGHTENING TORQUES** .

Installation:

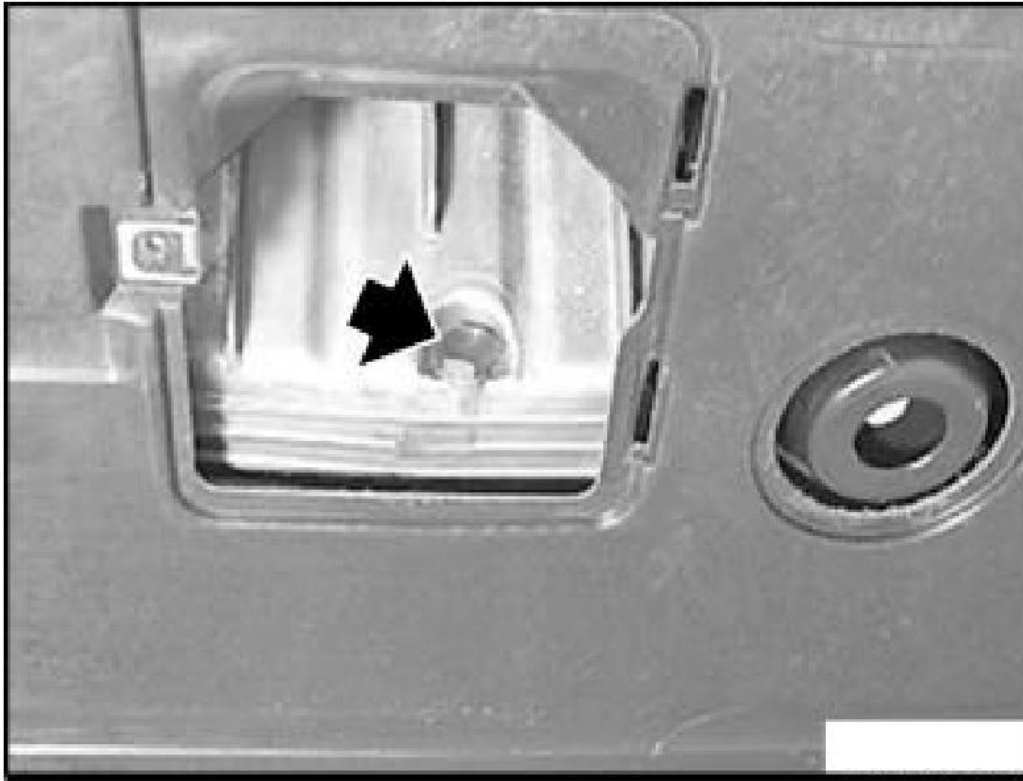
Replace and oil O-ring.



G03310181

Fig. 5: Locating Oil O-Ring
Courtesy of BMW OF NORTH AMERICA, INC.

Drain or draw off engine oil.

**G03310182****Fig. 6: Opening Oil Drain Plug****Courtesy of BMW OF NORTH AMERICA, INC.**

When engine oil is drained, open cap in engine underguard.

Open oil drain plug and drain off engine oil.

Installation:

Replace sealing ring.

Tightening torque 11 13 lA.Z. Refer to **ENGINE - TIGHTENING TORQUES**.

Complete vehicle and set in horizontal position.

Top up engine oil.

Start engine and run at idle until oil indicator lamp goes out.

Switch off engine, wait approx. 5 minutes and then check engine oil level.

Top up engine oil if necessary.

Supplementary service:

Refer to vehicle-specific inspection sheet.

11 00 039 CHECKING COMPRESSION OF ALL CYLINDERS (M60 / M62 / M73 / S62 / M54)

Special tools required:

- 110 224
- 110 226

IMPORTANT: High tension - mortal danger!

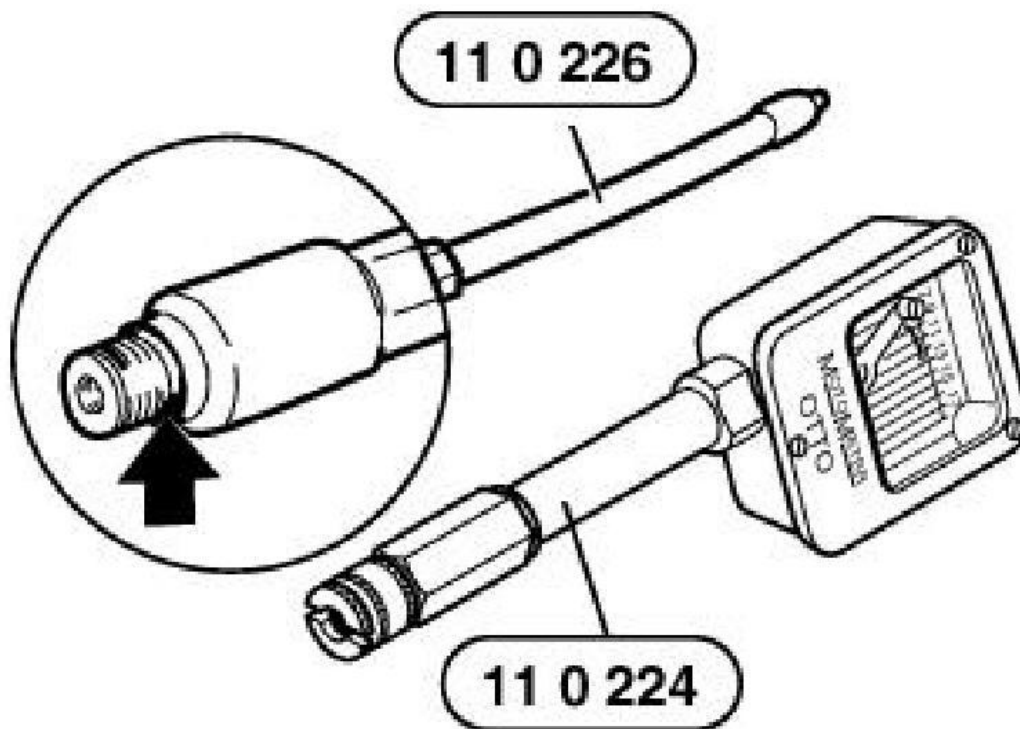
Cut off power supply to ignition coils (disconnect plug connection at DME control unit).

Necessary preliminary tasks:

- Connect charger or a second battery.
- Read out fault memory of DME control unit
- Pull fuel pump relay or fuel pump fuse.
- Start engine and allow residual fuel to drain out (pressure reduction).
- Remove all spark plugs.

IMPORTANT: Check Schrader valve on special tool 11 0 226 for tight fit.

Screw special tool 11 0 226 by hand into spark plug thread and connect special tool 11 0 0224.



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Fig. 7: Identifying Special Tools

Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: Check that sealing ring is in perfect condition (see arrow).

Depress accelerator and actuate starter until compression stops rising.

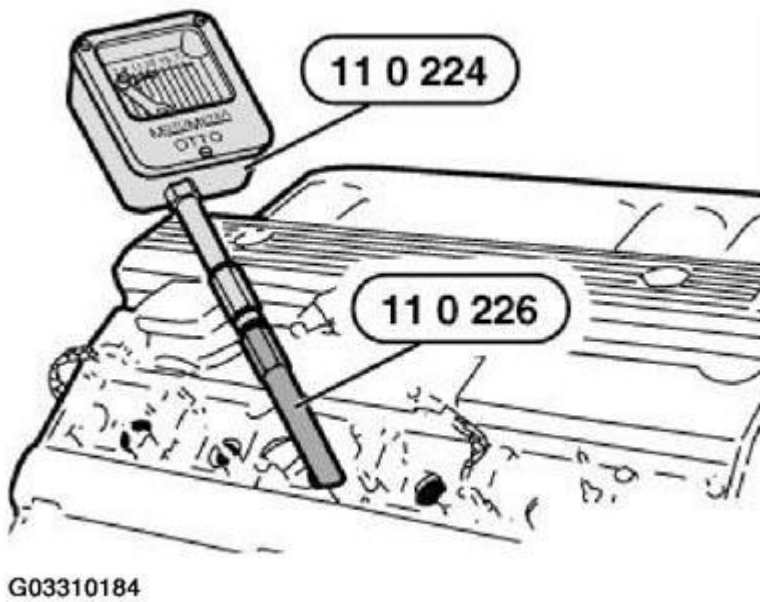


Fig. 8: Checking Compression

Courtesy of BMW OF NORTH AMERICA, INC.

Compression pressure, refer to **ENGINE - TECHNICAL DATA** .

Assemble engine.

Now clear the fault memory.

11 00 045 CHECKING ABSOLUTE COMPRESSION OF ALL CYLINDERS

With BMW Diagnosis Information System (DIS)



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Fig. 9: View Of Diagnosis Information System
Courtesy of BMW OF NORTH AMERICA, INC.

- Connect DIS tester
- BMW measuring technology

- Preset measurements
- Absolute compression
 - The further procedure is described in
 - Help
 - Help on preset measurements
 - Adaptation of "Absolute compression"
- Clear fault memory

11 00 050 REMOVING AND INSTALLING ENGINE (M54)**Special tools required:**

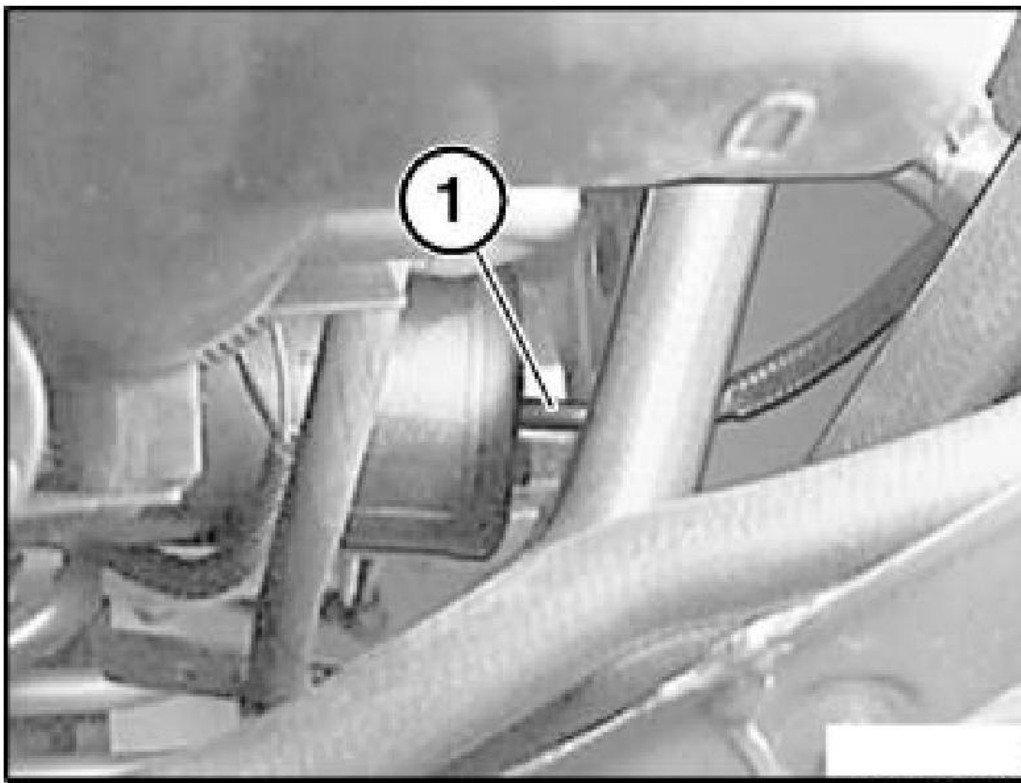
- 11 0 020
- 11 0 250
- 13 5 280

Necessary preliminary tasks:

- Disconnect battery negative lead. Refer to **12 00... INSTRUCTIONS FOR DISCONNECTING AND CONNECTING BATTERY** .
- Lift engine hood into assembly position. Refer to **51 00 ... SERVICE POSITION OF ENGINE HOOD** .
- Remove design cover.
- Remove air cleaner housing. Refer to **13 71 000 REMOVING AND INSTALLING INTAKE FILTER HOUSING (M54)** .
- Remove clean air duct.
- Remove heater bulkhead. Refer to **51 71 080 REMOVING AND INSTALLING/REPLACING HEATER BULKHEAD** .
- Remove left assembly partition wall.
- Release engine wiring harness from electronics box.
- Drain coolant. Refer to **17 00 005 DRAINING OFF AND TOPPING UP COOLANT (M54)** .
- Remove radiator. Refer to **17 11 000 REMOVING AND INSTALLING RADIATOR (M54)** .
- Remove A/C compressor drive belt. Refer to **11 28 050 REPLACING A/C COMPRESSOR DRIVE BELT (M52 / S52 / M52TU / M54 / M56)**.
- Remove alternator drive belt. Refer to **11 28 010 REPLACING ALTERNATOR DRIVE BELT (M52 / S52 / M52TU / M54 / M56)**.
- Disconnect fuel line (feed).
- Remove front/middle underbody protection. Refer to **51 47 ... REMOVING AND INSTALLING/REPLACING LEFT OR RIGHT UNDERBODY PANELING** and **51 47 490 REMOVING AND INSTALLING/REPLACING FRONT UNDERBODY PROTECTION** .
- Remove reinforcement plate.

- Remove exhaust system. Refer to **18 00 020 REMOVING AND INSTALLING COMPLETE EXHAUST SYSTEM (M54)** .
- Remove transmission. Refer to **REMOVAL & INSTALLATION - X3 (GS6-37BZ)** or **REMOVAL & INSTALLATION (A5S 360R/390R)** .
- Remove oxygen sensors (monitor). Refer to **11 78 611 REPLACING OXYGEN MONITOR SENSOR (CYLINDERS 1-3)** and **11 78 612 REPLACING OXYGEN MONITOR SENSOR (CYLINDERS 4-6)**.

Detach vacuum line (1) from vacuum accumulator.

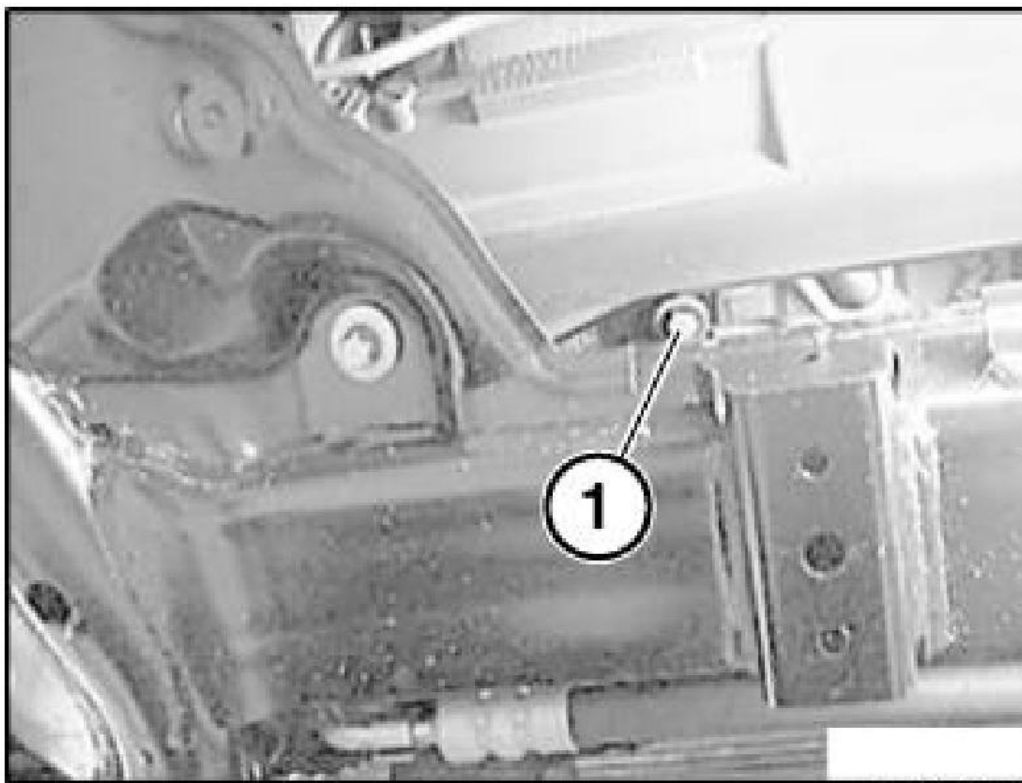


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Fig. 10: Detaching Vacuum Line From Vacuum Accumulator
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: **Automatic transmission only:**

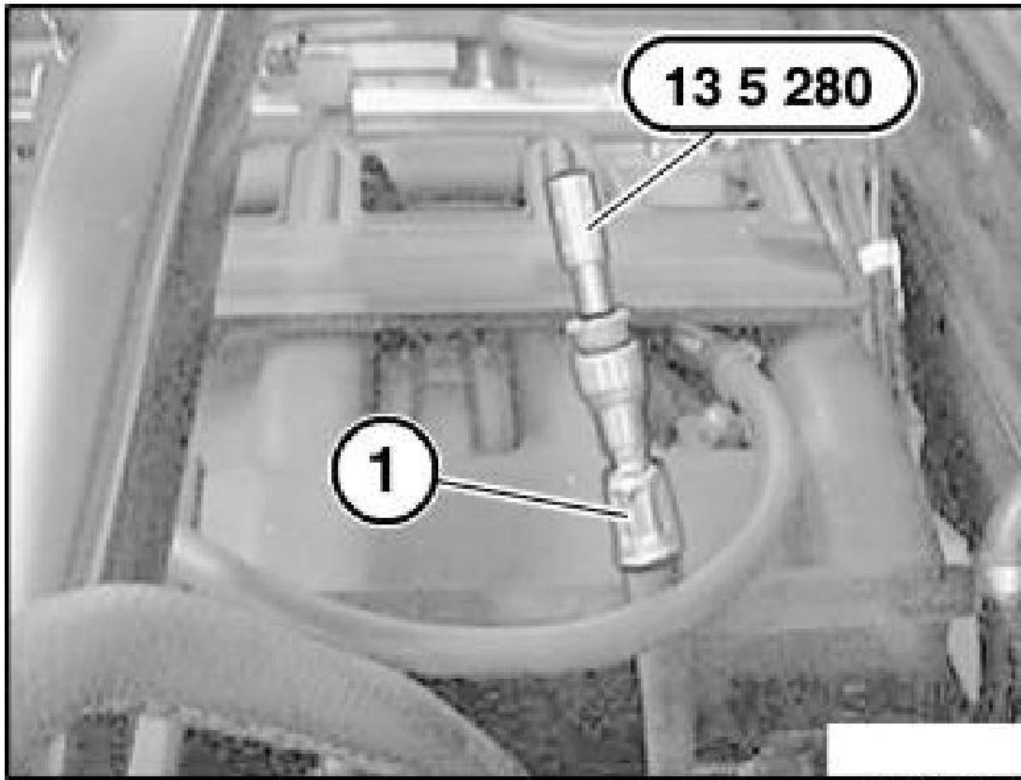
Release transmission fluid line screw (1) on engine oil sump.



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Fig. 11: Releasing Transmission Fluid Line Screw On Engine Oil Sump
Courtesy of BMW OF NORTH AMERICA, INC.

Release fuel line (1).



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Fig. 12: Releasing Fuel Line**Courtesy of BMW OF NORTH AMERICA, INC.**

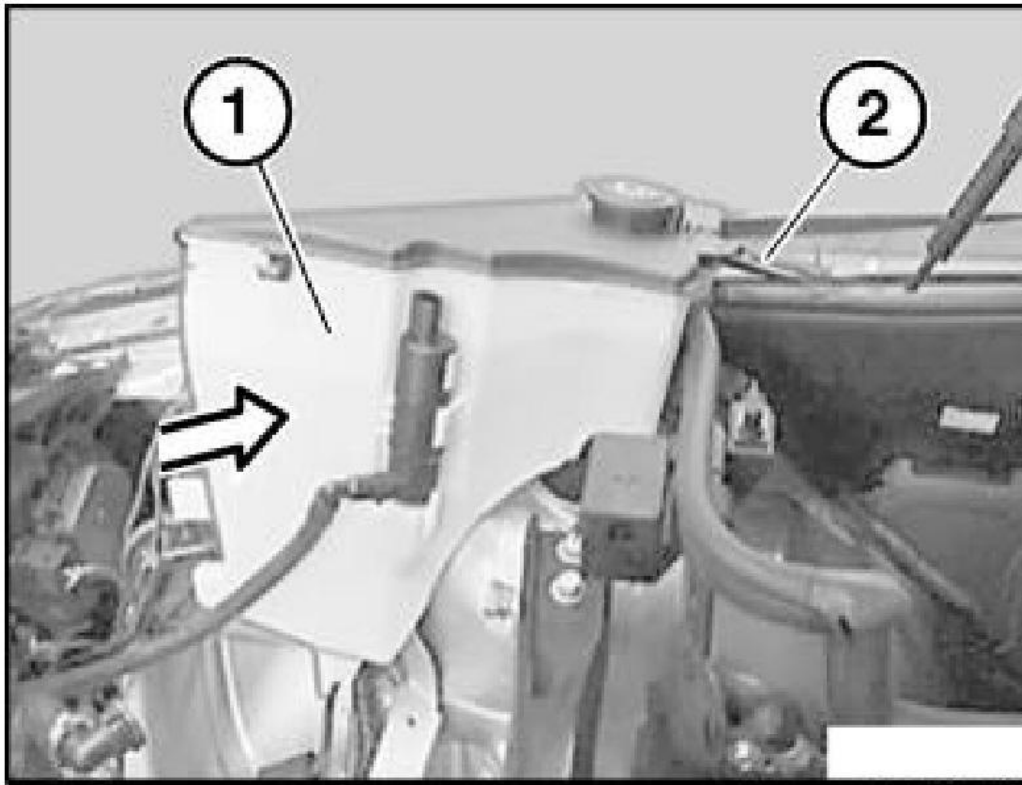
Seal off fuel line with special tool 13 5 280.

Recycling:

Catch and dispose of escaping fuel in a suitable container.

Observe country-specific waste-disposal regulations.

Disconnect all plug connections on windscreen washer fluid reservoir (1).



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Fig. 13: Disconnecting Plug Connections On Windscreen Washer Fluid Reservoir
Courtesy of BMW OF NORTH AMERICA, INC.

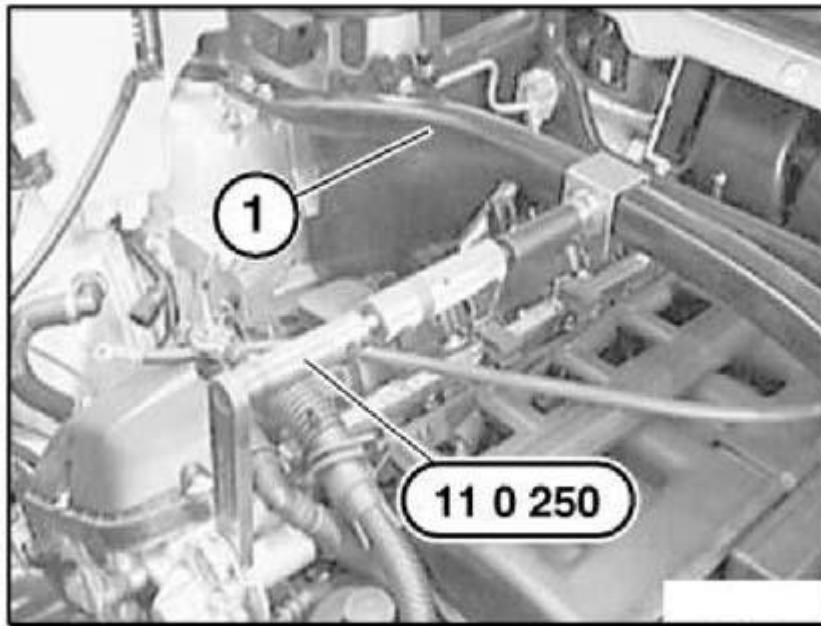
Press windscreen washer fluid reservoir (1) in direction of arrow upwards.

Secure windscreen washer fluid reservoir (1) with a cable tie (2).

Remove special tool 11 0 250.

IMPORTANT: Engine tips forward - *risk of damage* .

Remove tension strut (1).



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Fig. 14: Removing Tension Strut**Courtesy of BMW OF NORTH AMERICA, INC.**

Secure engine wiring harness (2) on engine against falling out. Mount special tool 11 0 020 on engine.

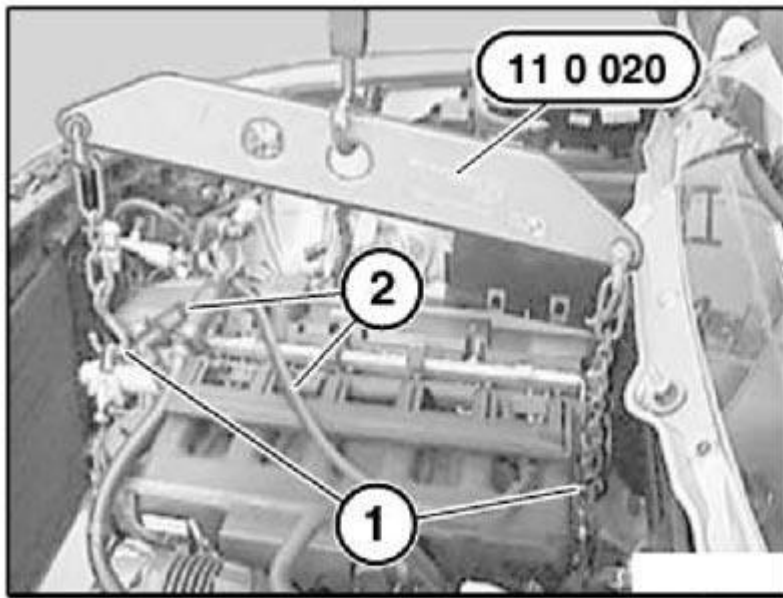
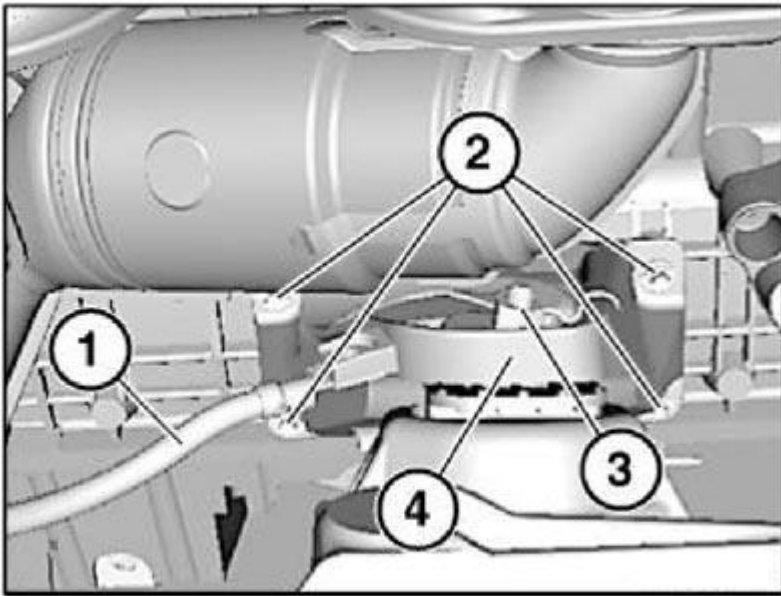


Fig. 15: Raising Engine At Suspension Lugs
Courtesy of BMW OF NORTH AMERICA, INC.

IMPORTANT: Pay attention to chain of special tool 11 0 020. *Risk of damage to manifold.*

Only raise engine at the suspension lugs (1) provided for this purpose.

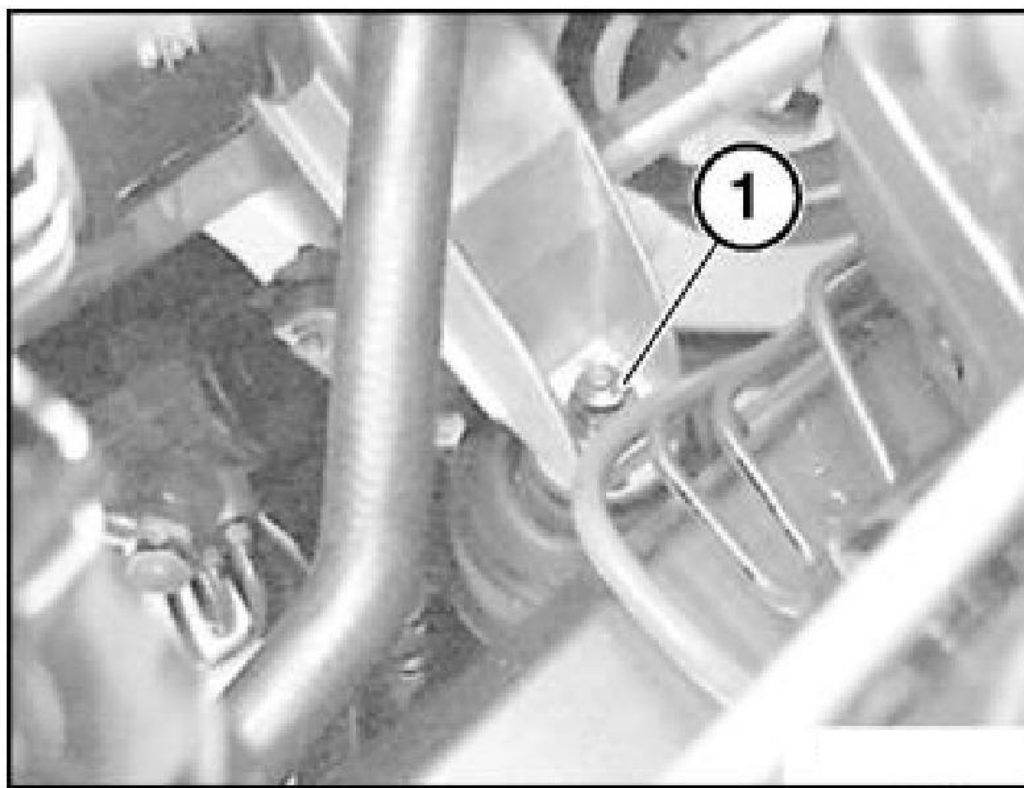
Release grounding strap (1) on right engine support arm. Unscrew nut (3).



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Fig. 16: Releasing Grounding Strap On Right Engine Support Arm
Courtesy of BMW OF NORTH AMERICA, INC.

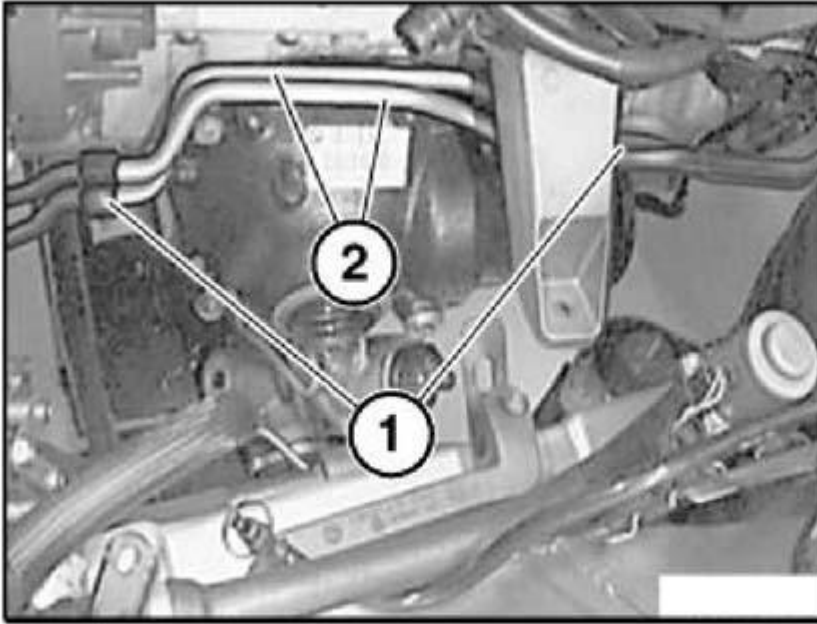
Release nut (1) on left engine support arm.



G03310193

Fig. 17: Releasing Nut On Left Engine Support Arm
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: **Automatic only:**
 Raise engine approx. 10 cm.
 Release screws (1).
 Remove transmission fluid lines (2).



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Fig. 18: Removing Transmission Fluid Lines
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Reinstall the transmission fluid lines in reverse sequence to prevent damaging them during installation.

IMPORTANT: Narrow points:

- **Steering gear.**
- **Condenser.**
- **Bulkhead.**

Remove engine **carefully** .

Assemble engine.

Fill cooling system and check for leaks. Refer to **17 00 005 DRAINING OFF AND TOPPING UP COOLANT (M54)** .

Check engine oil level.

SECURING ENGINE WITH SPECIAL TOOL IN INSTALLATION POSITION (M54)

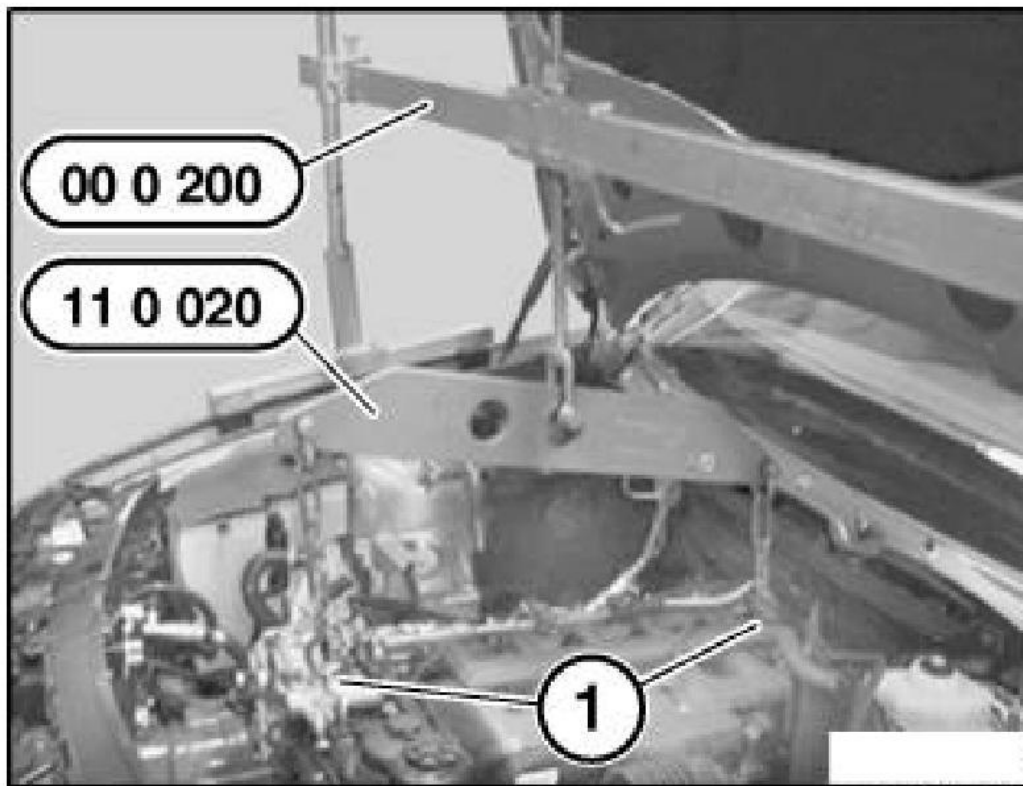
Special tools required:

- 00 0 200
- 00 0 201
- 00 0 202
- 00 0 203
- 00 0 204
- 11 0 208
- 11 0 020

Necessary preliminary tasks:

- Remove lower section of microfilter housing.
- Remove cover for cowl panel. Refer to **51 13 115 REMOVING AND INSTALLING/REPLACING COWL PANEL COVER** .
- Remove air cleaner housing.
- Secure engine hood in service position. Refer to **51 00 ... SERVICE POSITION OF ENGINE HOOD** .

Assemble special tool 00 0 200 with special tools 00 0 201 / 00 0 202 / 00 0 203 / 00 0 204 / 00 0 208 and fit.



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Fig. 19: Assembling Special Tools

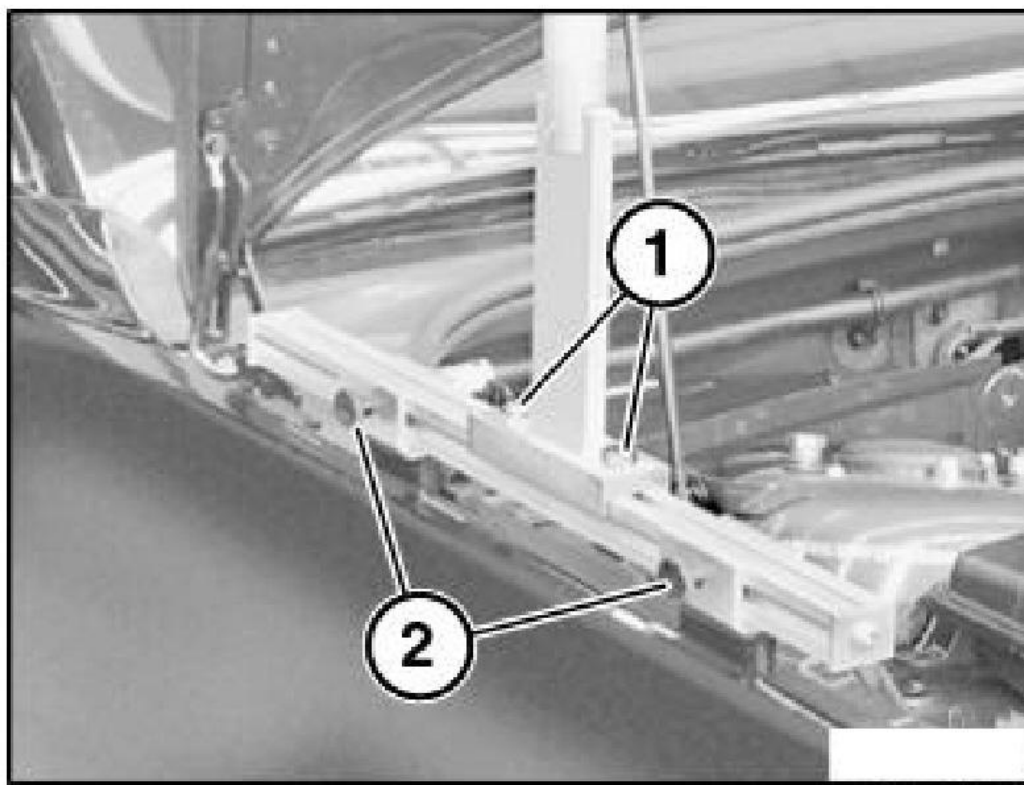
Courtesy of BMW OF NORTH AMERICA, INC.

Secure special tool 11 0 020 to the designated suspension eyes at front and rear only.

IMPORTANT: Risk of damage to fuel line and engine wiring harness.

NOTE: The supports of special tool 00 0 208 must rest on the *bolt connection of both side walls* .
Risk of damage .

Tighten the screws (1 and 2).

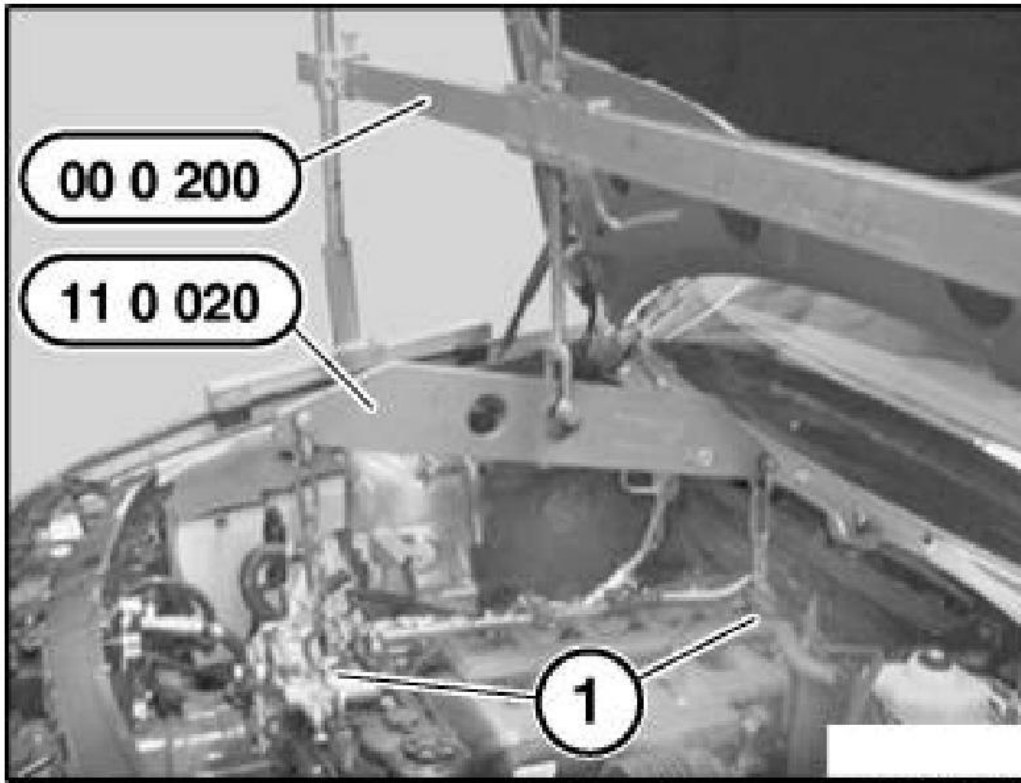


G03310196

Fig. 20: Tightening Screws

Courtesy of BMW OF NORTH AMERICA, INC.

Release engine mounts at top left and right.



G03310197

Fig. 21: Raising Engine

Courtesy of BMW OF NORTH AMERICA, INC.

Raise engine with special tool 00 0 200 approx. 10 mm

max. 30 mm - risk of damage. .

CYLINDER HEAD WITH COVER**11 12 000 REMOVING AND INSTALLING, SEALING CYLINDER HEAD COVER (M52TU / M54 / M56)**

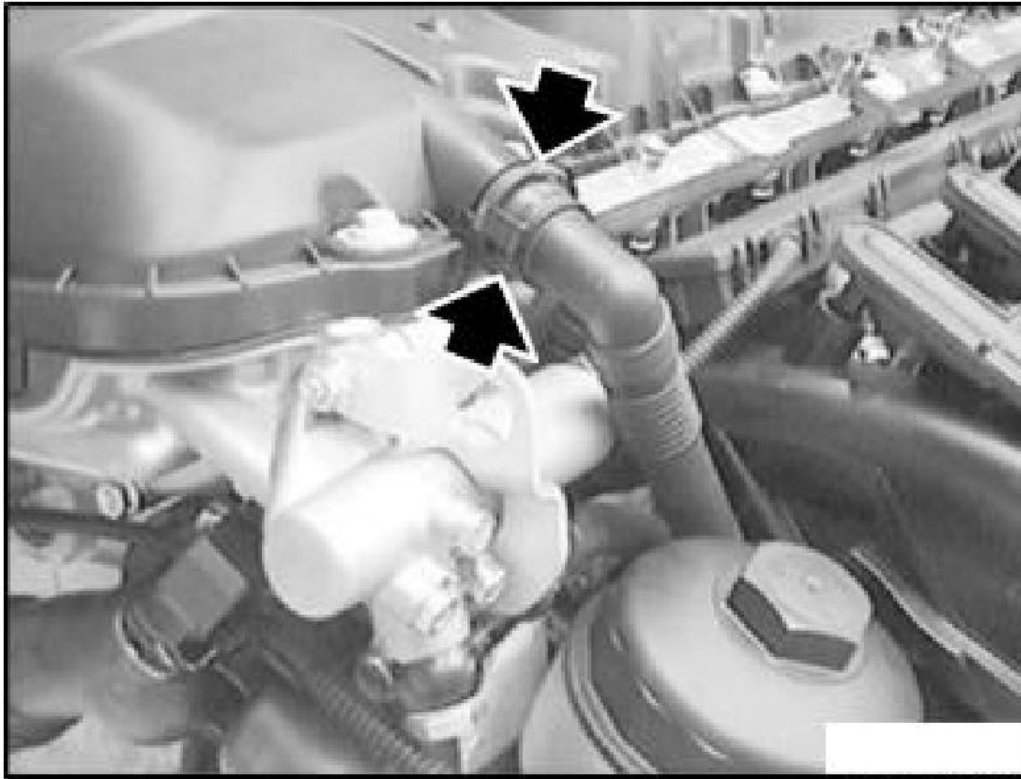
Remove engine cover.

Remove ignition coils. Refer to **12 13 511 REPLACING IGNITION COILS (M54)** .

Remove wiring harness of ignition coils from cylinder head cover and place to one side.

NOTE: Illustration on M54 engine.

Press lock.

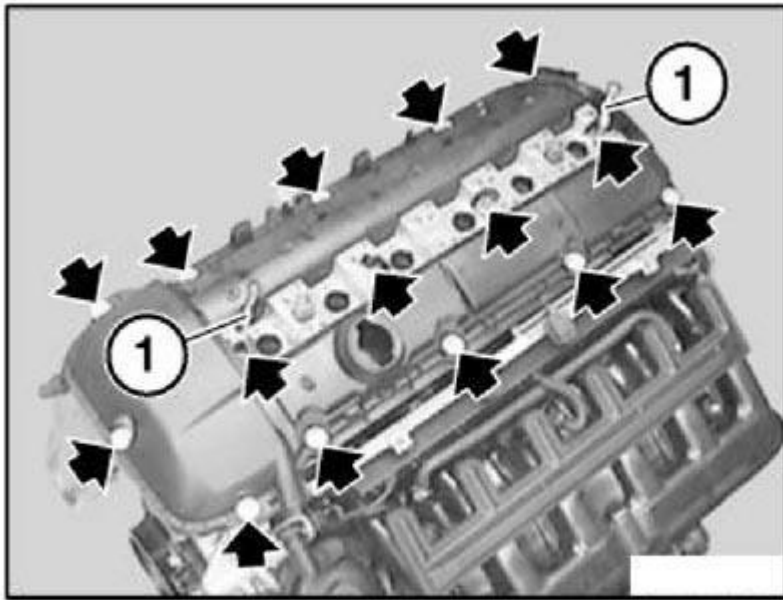


G03310198

Fig. 22: Pulling Off Hose For Engine Breather
Courtesy of BMW OF NORTH AMERICA, INC.

Pull off the hose for the engine breather.

Remove grounding straps (1).



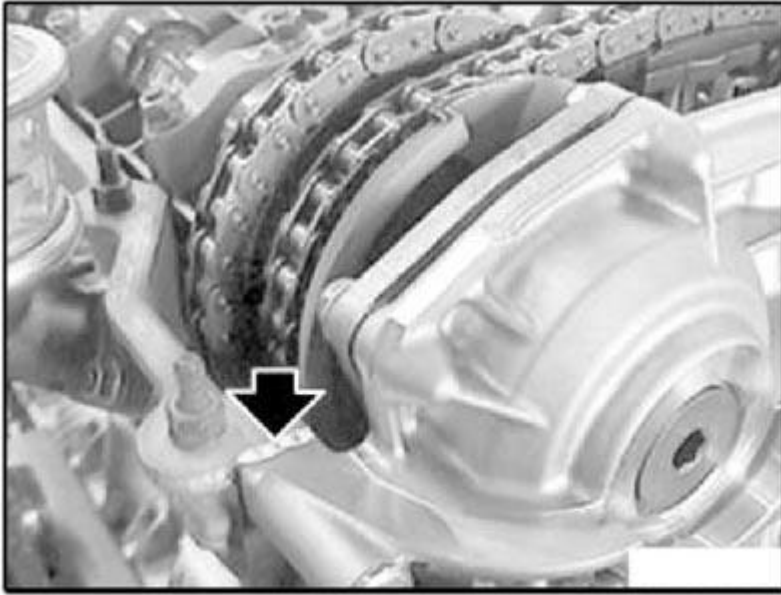
G03310199

Fig. 23: Removing Grounding Straps**Courtesy of BMW OF NORTH AMERICA, INC.**

Remove cylinder head cover.

Installation:

Remove sealing debris from sealing faces of cylinder head and cylinder head cover.



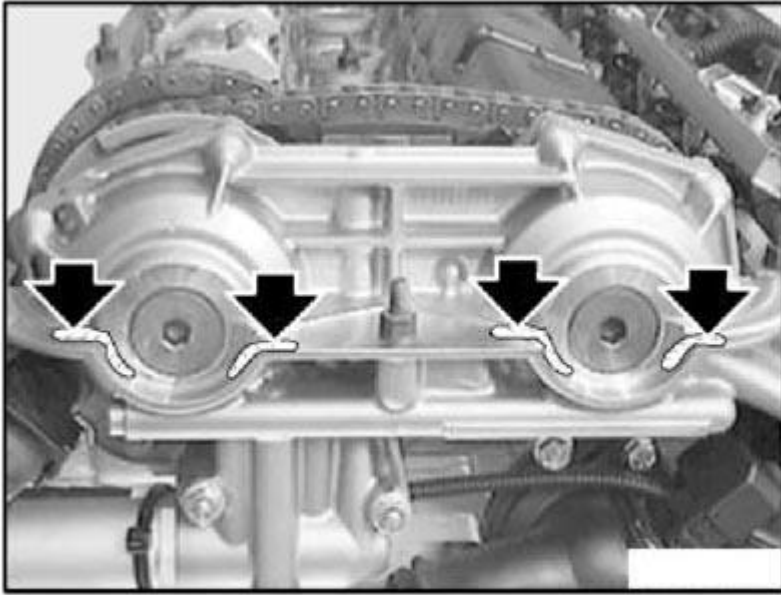
G03310200

Fig. 24: Removing Sealing Debris From Sealing Faces
Courtesy of BMW OF NORTH AMERICA, INC.

Apply a sealing bead of Drei Bond 1209 (refer to BMW Parts Service) on left and right sides at transition between cylinder head and VANOS adjustment unit.

Installation:

Apply a thin and even sealing bead of Drei Bond 1209 (refer to BMW Parts Service) at transition to half-moon sections at VANOS adjustment unit.



G03310201

Fig. 25: Identifying VANOS Adjustment Unit
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: Illustration with engine removed.

Installation:

Apply a thin and even sealing bead of Drei Bond 1209 (refer to BMW Parts Service) at transition to half-moon sections at rear of cylinder head.

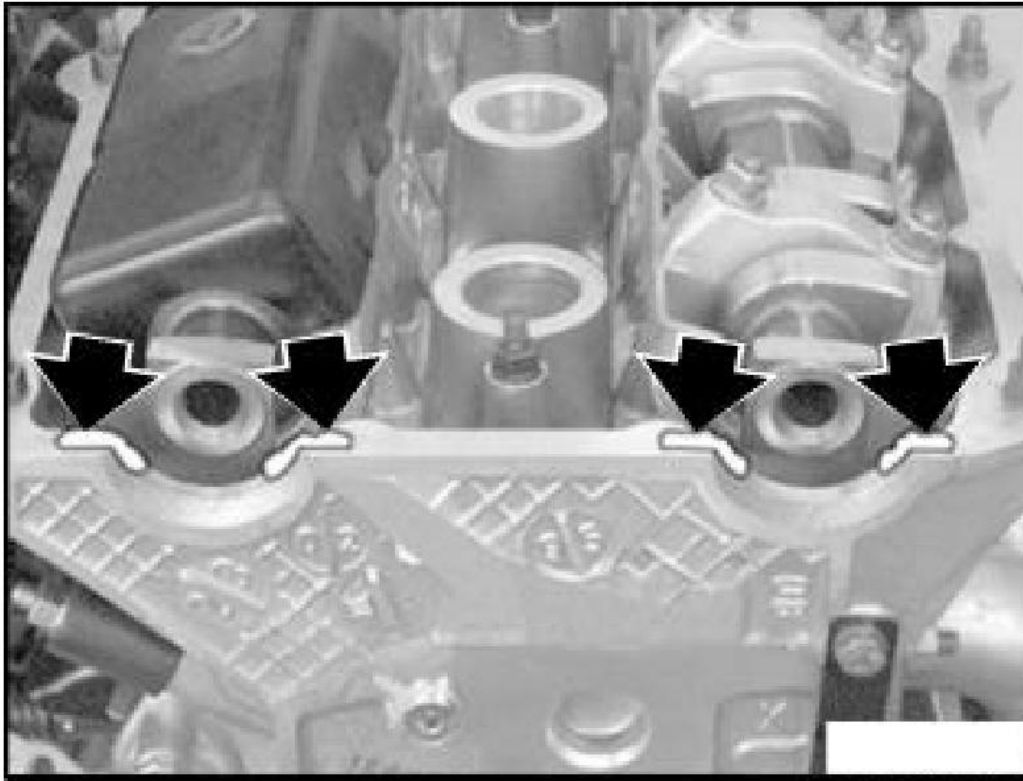
**G03310202**

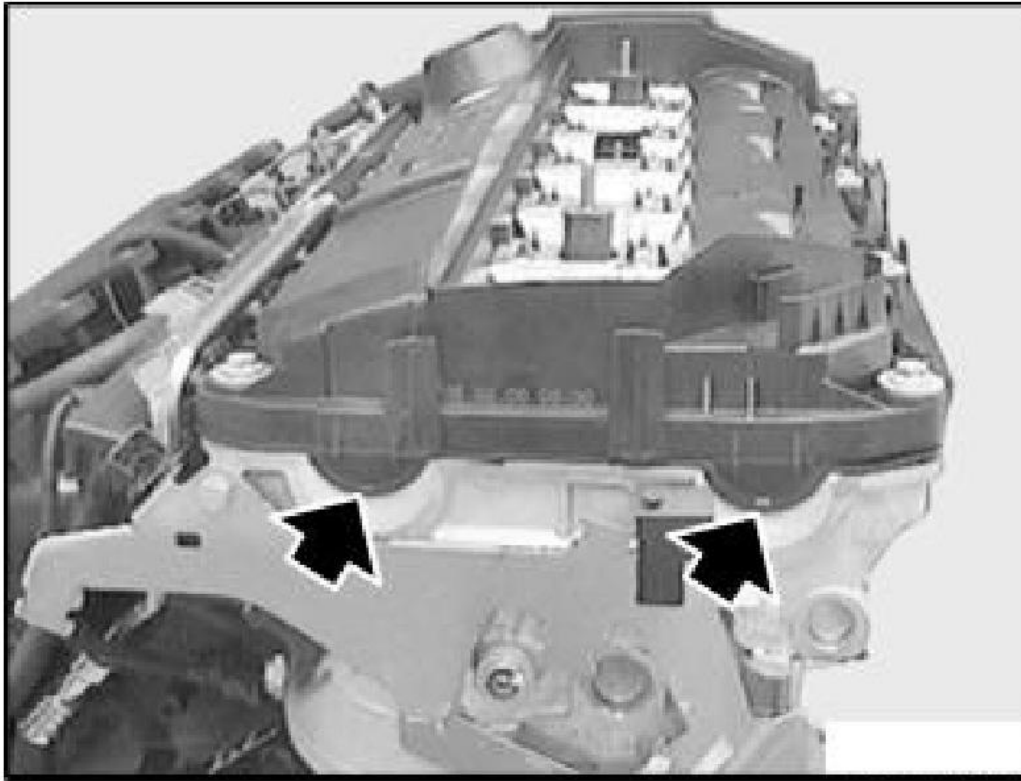
Fig. 26: Applying Drei Bond
Courtesy of BMW OF NORTH AMERICA, INC.

Check seals and replace if necessary.

NOTE: Illustration with engine removed.

Installation:

Make sure gasket is correctly seated on rear and front ends of cylinder head.

**G03310203****Fig. 27: Installing Cover Bolts**

Courtesy of BMW OF NORTH AMERICA, INC.

Install cover bolts and align cylinder head cover.

Hand-tighten all cover bolts without preload. Tighten cap nuts crosswise from inside to outside.

11 12 100 REMOVING AND INSTALLING/REPLACING CYLINDER HEAD (M52TU / M54 / M56)**Special tools required:**

- 00 0 200
- 00 9 120

Remove both exhaust manifolds, refer to **11 62 140 REMOVING AND INSTALLING BOTH EXHAUST MANIFOLDS WITH CATALYTIC CONVERTERS (M52TU / M54 / M56)**.

NOTE: **After removing exhaust manifolds:**

Reinstall engine support arm with engine mount and remove special tool 00 0 200.

Remove intake filter housing with air-mass flow sensor. See **11 61 050 REMOVING AND INSTALLING INTAKE AIR MANIFOLD (M54)**.

Remove cylinder head cover, refer to **11 12 000 REMOVING AND INSTALLING, SEALING CYLINDER HEAD COVER (M52TU / M54 / M56)**.

Remove all spark plugs. See **12 12 011 REPLACING ALL SPARK PLUGS** .

Remove intake air manifold, refer to **11 61 050 REMOVING AND INSTALLING INTAKE AIR MANIFOLD (M54)**.

Remove coolant drain plug in engine block. Drain and dispose of coolant.

Installation:

Replace sealing ring on drain plug.

Tightening torque: 25 N.m.

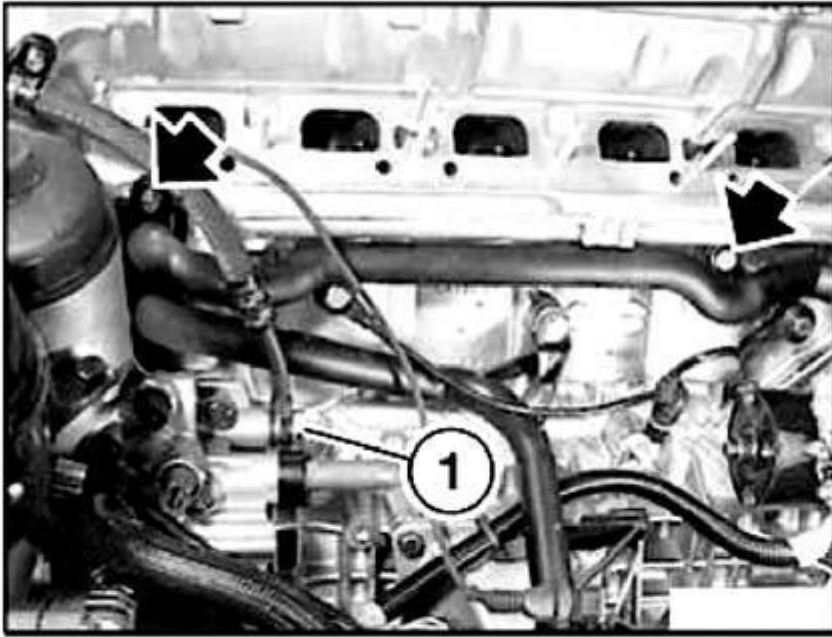
Vent cooling system and check for leaks, refer to **17 00 039 VENTING COOLING SYSTEM AND CHECKING FOR LEAKS (M54/M56)** .

Remove coolant thermostat housing, refer to **11 53 000 REMOVING AND INSTALLING/REPLACING COOLANT THERMOSTAT (M52TU / M54 / M56)**.

Remove coolant pipe.

NOTE: **If the coolant pipe cannot be fed out:**

Release banjo bolt (1) and disconnect oil pressure line for VANOS adjustment unit.



G03163899

Fig. 28: Releasing Banjo Bolt

Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Replace O-ring on coolant pipe.

If necessary, replace sealing rings on banjo bolt (1).

Tightening torque of banjo bolt (1): 32 N.m.

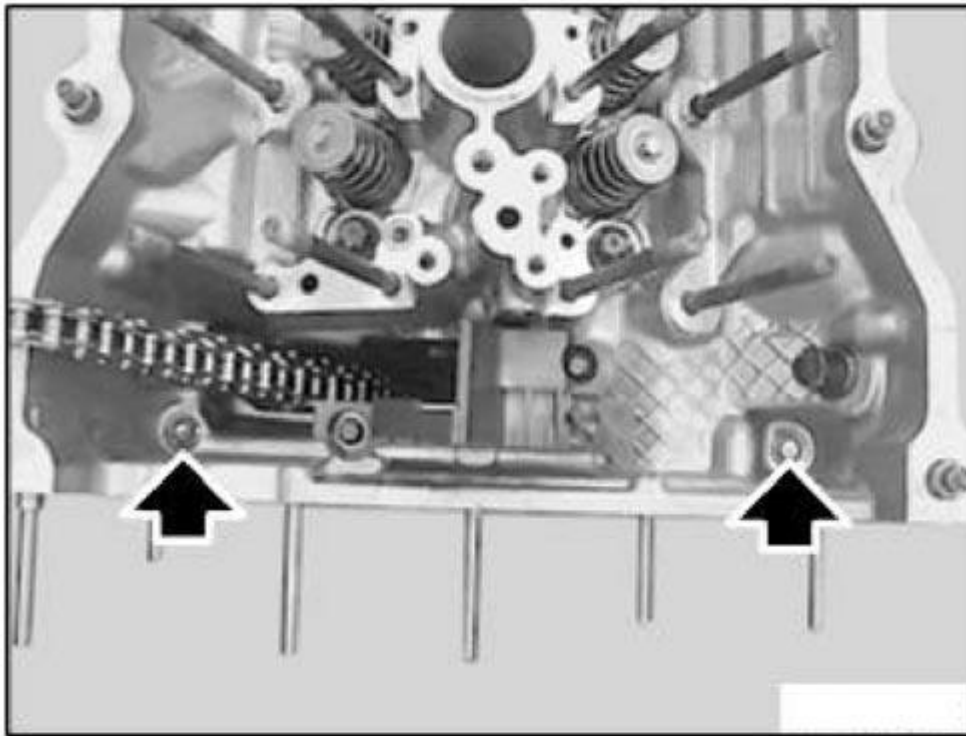
Removal

Removal of cylinder head is described separately from installation.

Remove double VANOS adjustment unit, refer to **11 36 010 REMOVING AND INSTALLING OR REPLACING DOUBLE VANOS ADJUSTMENT UNIT (M52TU / M54 / M56)**.

Remove camshafts with bearing strips, refer to **11 31 001 REPLACING CAMSHAFT (M52TU / M54 / M56)**.

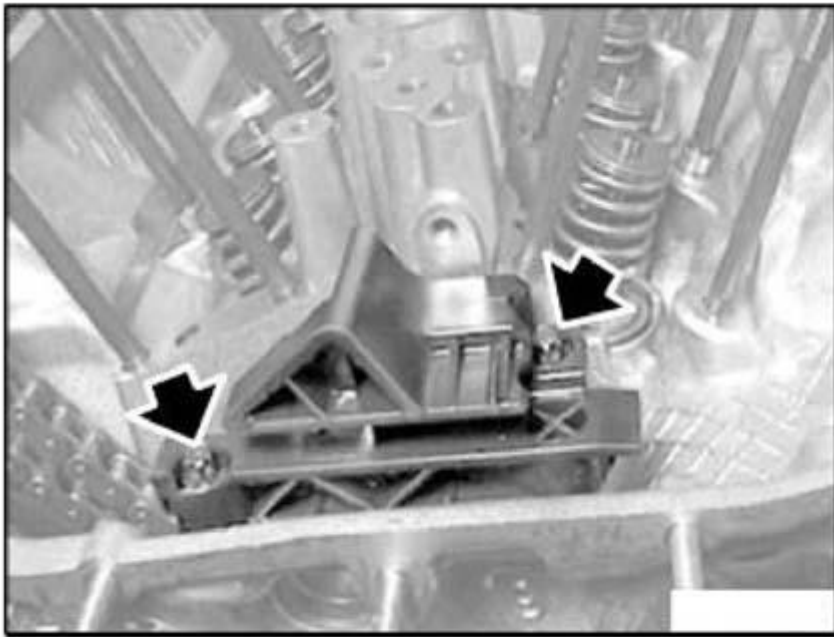
Release screw connection between timing case cover and cylinder head.



G03163900

Fig. 29: Releasing Screw Connection
Courtesy of BMW OF NORTH AMERICA, INC.

Release screws, remove chain guide.

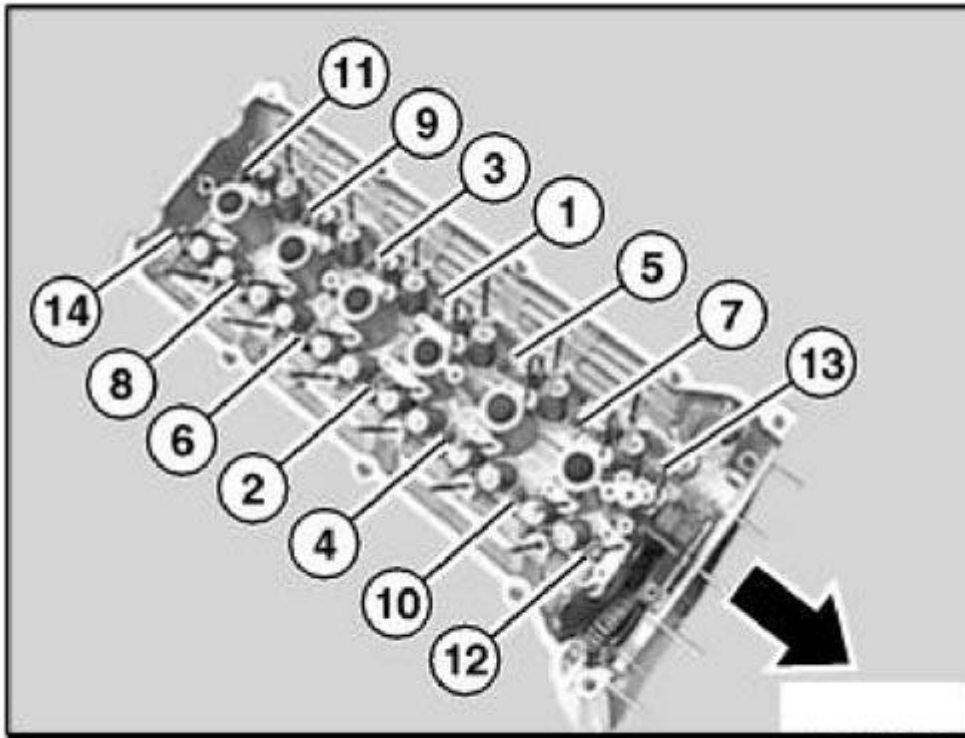


G03163901

Fig. 30: Releasing Screws

Courtesy of BMW OF NORTH AMERICA, INC.

Release cylinder head bolts from outside to inside in sequence 14 to 1.



G03163902

Fig. 31: Releasing Cylinder Head Bolts
Courtesy of BMW OF NORTH AMERICA, INC.

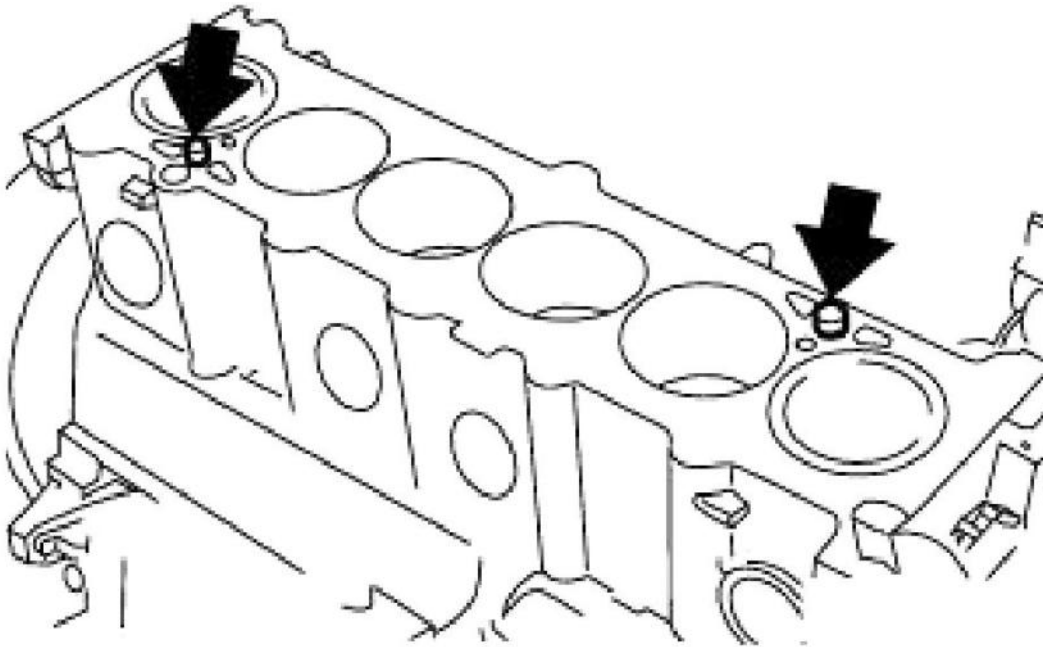
Lift off cylinder head.

Installation

Installation of cylinder head is described separately from removal.

Clean sealing faces of cylinder head and engine block; if necessary, remove traces of gasket with hardwood spatula. Make sure no gasket remnants drop into oil and cooling channels.

Check adapter sleeves for damage and correct installation position.



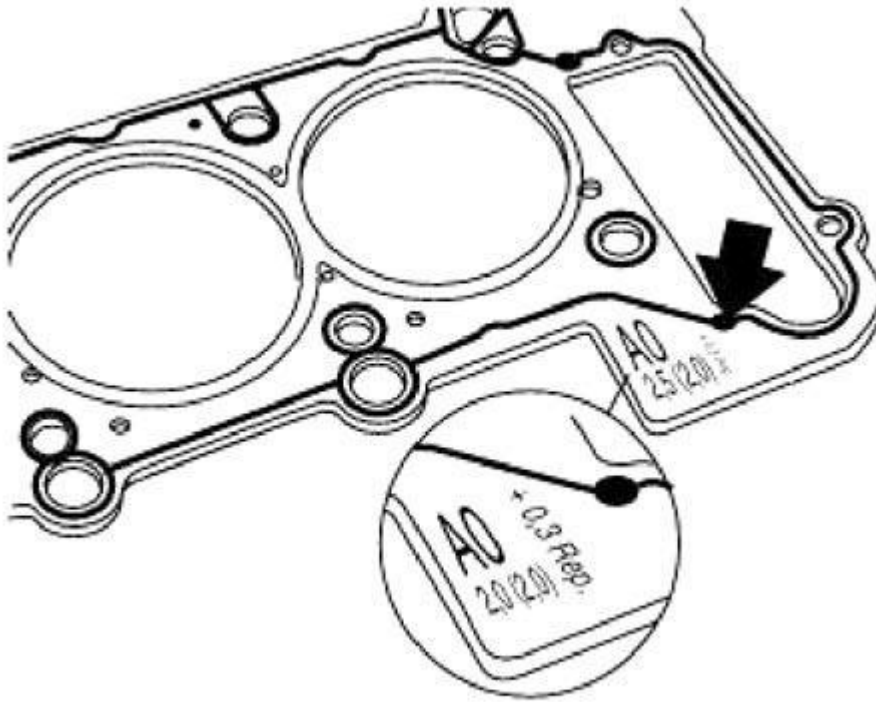
G03163903

Fig. 32: Checking Adapter Sleeves For Damage And Correct Installation Position
Courtesy of BMW OF NORTH AMERICA, INC.

Apply permanently elastic sealing compound Drei Bond 1209 to joints to timing case cover.

Replace cylinder head gasket.

NOTE: A cylinder head seal 0.3 mm thicker than usual can be obtained for machined (milled) cylinder heads.



G03163904

Fig. 33: Identifying Cylinder Head Seal
 Courtesy of BMW OF NORTH AMERICA, INC.

CAUTION: Different cylinder head bolts for M52TU engine: M10x95 for engines with cast iron engine block. M10x110 for engines with aluminum engine block.

Use cylinder head bolts only once.

There must be no oil in the tapped holes of the engine block and the timing case cover.

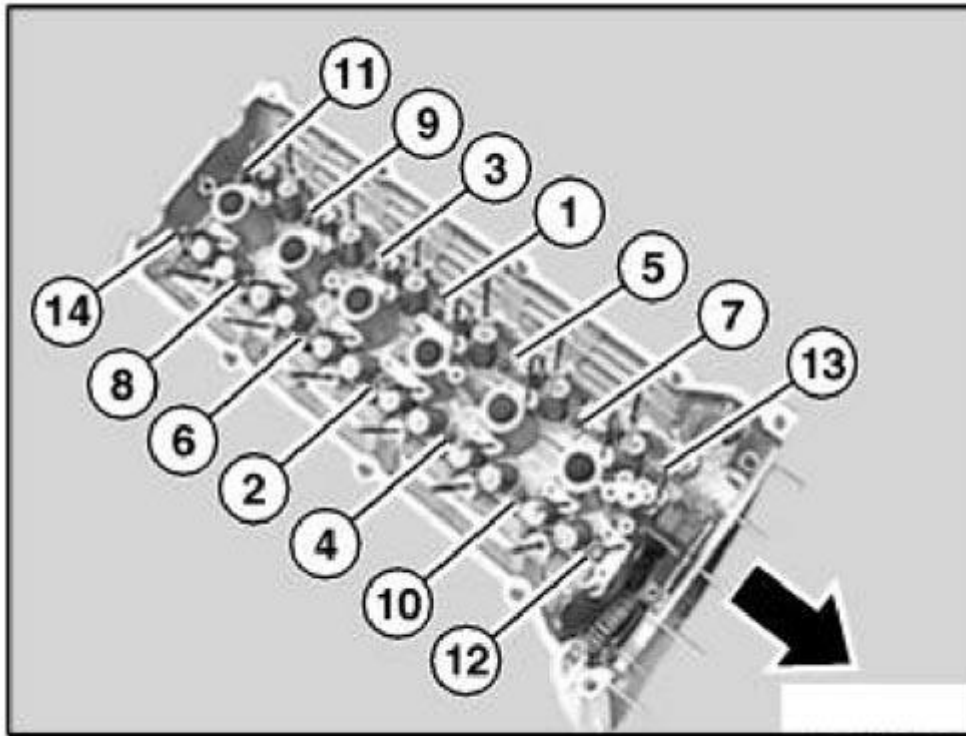
Risk of cracking and distorted tightening values.

Put the cylinder head on.

Apply a light coat of oil to washer contact area and thread of new cylinder head bolts.

Tighten down cylinder head bolts in sequence 1 to 14.

Tightening torque; Jointing torque 30 N.m and an additional 90° and an 90°.

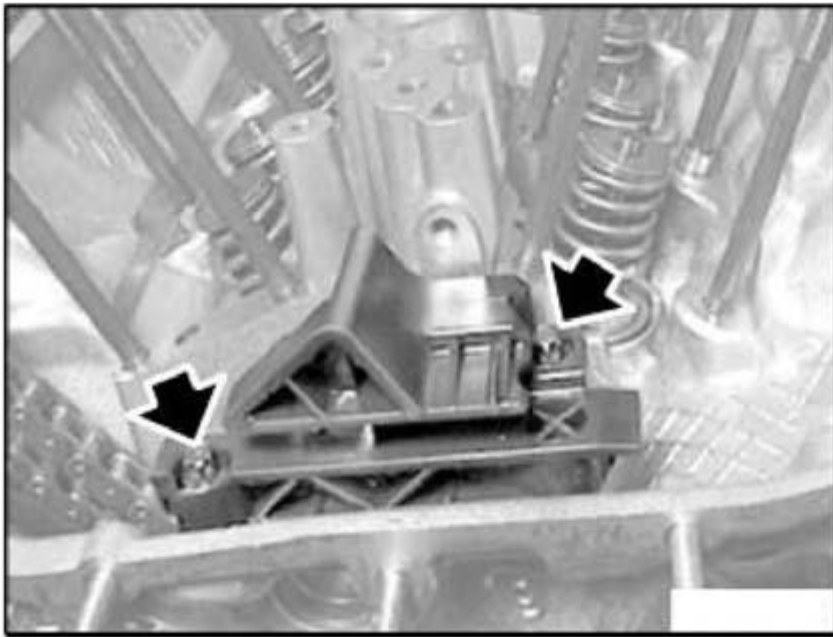


G03163905

Fig. 34: Tightening Cylinder Head Bolts
 Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: Use special tool 00 9 120 for torsion angle tightening.

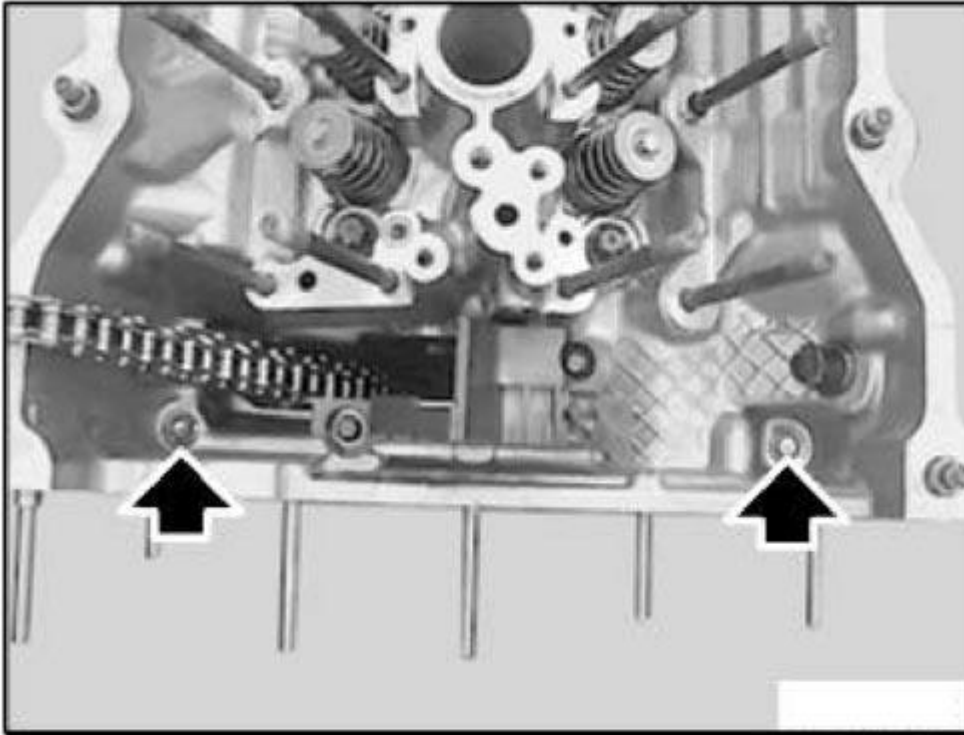
Install chain guide.



G03163906

Fig. 35: Installing Chain Guide
Courtesy of BMW OF NORTH AMERICA, INC.

Insert screws and tighten down screw connection between timing case cover and cylinder head.



G03163907

Fig. 36: Inserting Screws

Courtesy of BMW OF NORTH AMERICA, INC.

Install camshafts, refer to **11 31 001 REPLACING CAMSHAFT (M52TU / M54 / M56)**.

Install double VANOS adjustment unit, refer to **11 36 010 REMOVING AND INSTALLING OR REPLACING DOUBLE VANOS ADJUSTMENT UNIT (M52TU / M54 / M56)**.

Assemble engine.

11 12 101 REPLACING CYLINDER HEAD GASKET (M52 / S52 / M52TU / M54 / M56)

Tasks are identical to **REMOVING AND INSTALLING, SEALING CYLINDER HEAD COVER (M52TU / M54 / M56)**.

11 12 503 DISASSEMBLING AND ASSEMBLING CYLINDER HEAD (M52 / S52 / M52TU / M54 / M56)**Special tools required:**

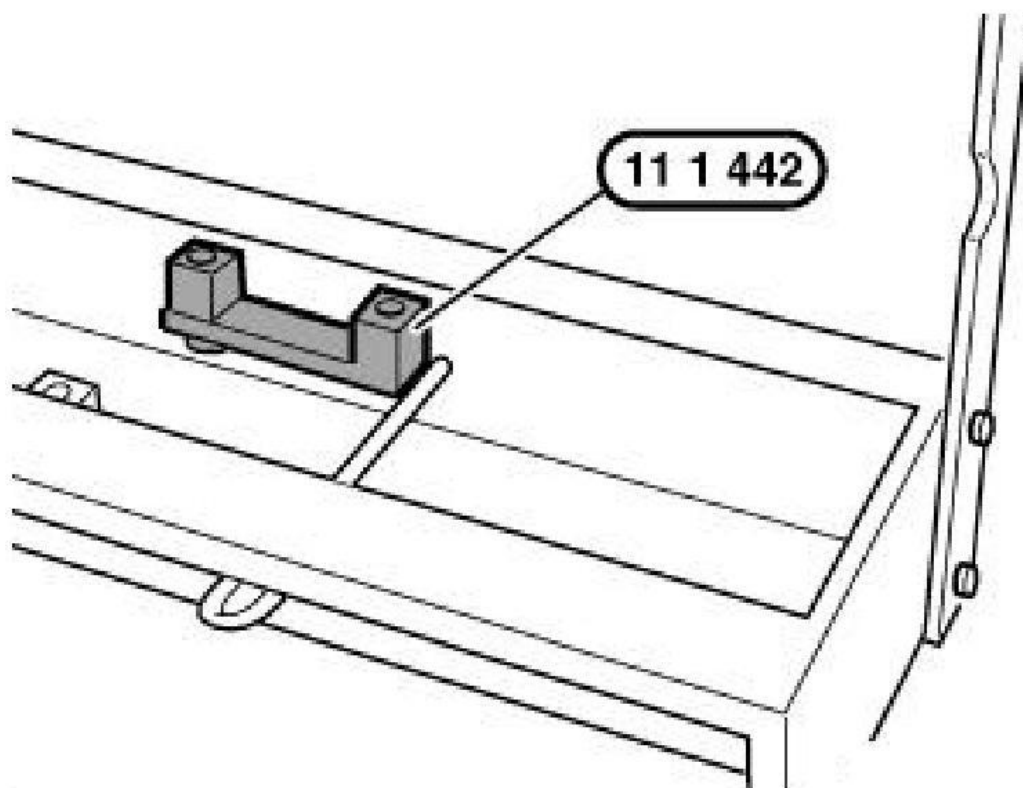
- 00 1 490

- 11 0 192
- 11 0 342
- 11 0 343
- 11 0 345
- 11 1 045
- 11 1 065
- 11 1 067
- 11 1 071
- 11 1 441
- 11 1 442

(cylinder head removed)

If necessary, remove coolant thermostat.

Screw on special tool 11 1 442.

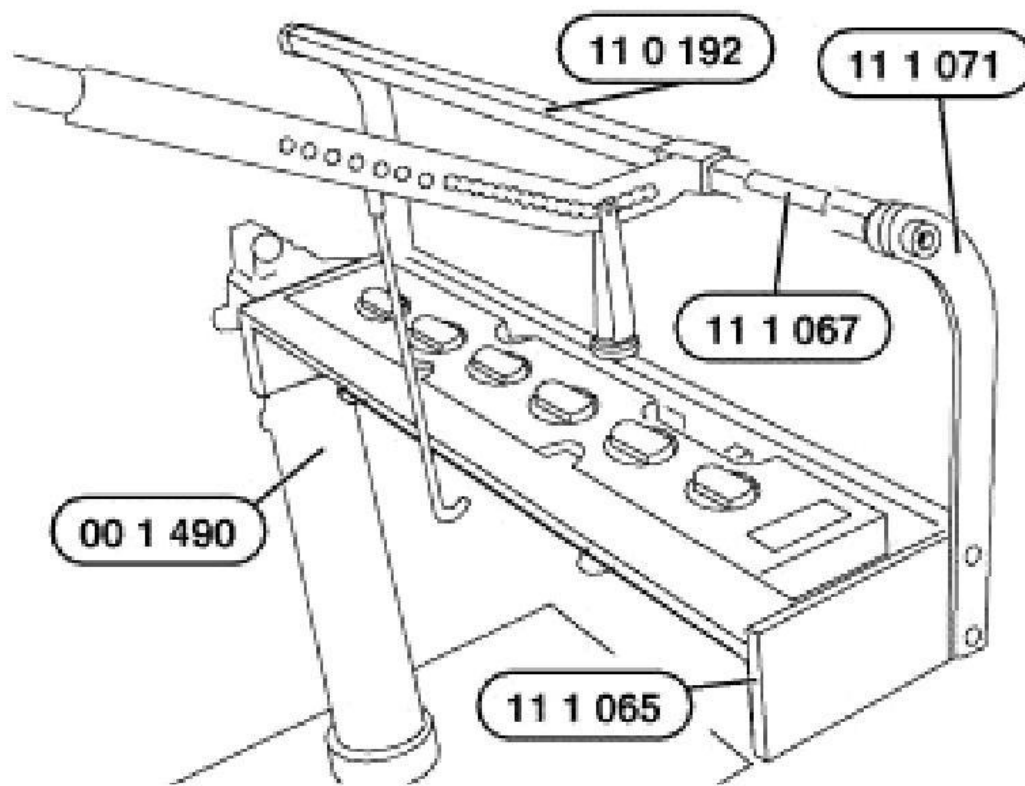


G03310204

Fig. 37: Installing Special Tool

Courtesy of BMW OF NORTH AMERICA, INC.

Screw special tool 11 1 065 onto special tool 00 1 490.

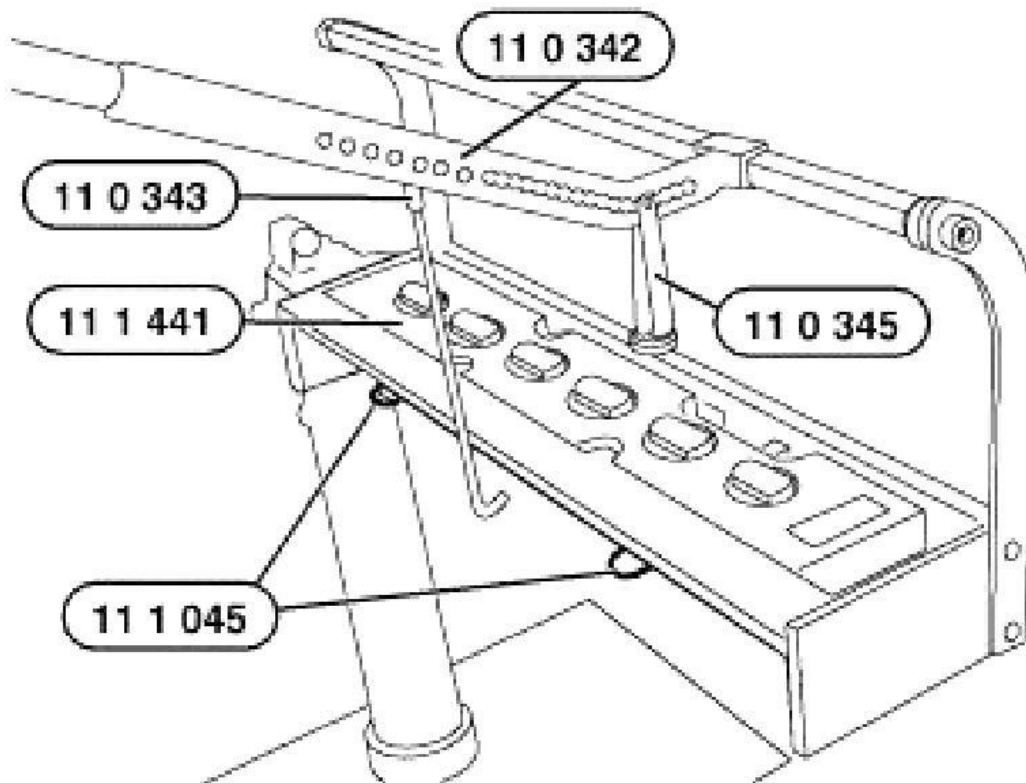


G03310205

Fig. 38: Assembling Special Tools For Disassembling Cylinder Head
Courtesy of BMW OF NORTH AMERICA, INC.

Provide special tools for disassembling cylinder head:

- special tool 11 1 071
- special tool 11 1 067
- special tool 11 0 192
- special tool 11 1 045
- special tool 11 0 342
- special tool 11 0343
- special tool 11 0345
- special tool 11 1 441



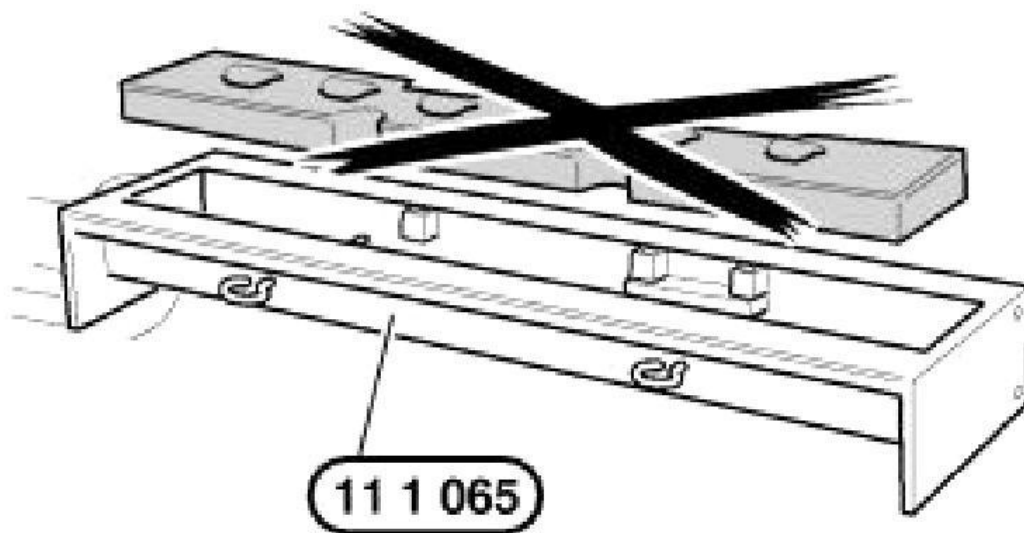
G03310206

Fig. 39: Assembling Special Tools

Courtesy of BMW OF NORTH AMERICA, INC.

Assemble special tools.

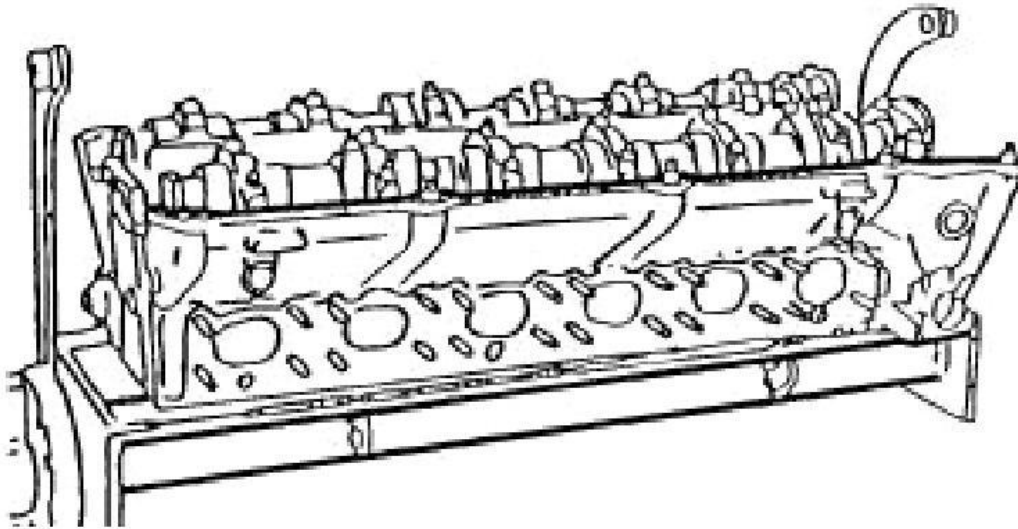
NOTE: Do not install special tool 11 1 441 (locating board) in special tool 11 1 065 at this stage.



G03310207

Fig. 40: Precaution For Installing Special Tool
Courtesy of BMW OF NORTH AMERICA, INC.

Place cylinder head on special tool 11 1 065 and screw on with two screws.

**G03310208****Fig. 41: View Of Cylinder Head****Courtesy of BMW OF NORTH AMERICA, INC.**

Remove all valve springs. Refer to **11 34 715 REPLACING ALL VALVE SPRINGS (M52 / S52 / M52TU / M54 / M56)**.

Remove all valve stem seals. Refer to **11 34 560 REPLACING ALL VALVE STEM SEALS (M52 / S52 / M52TU / M54 / M56)**.

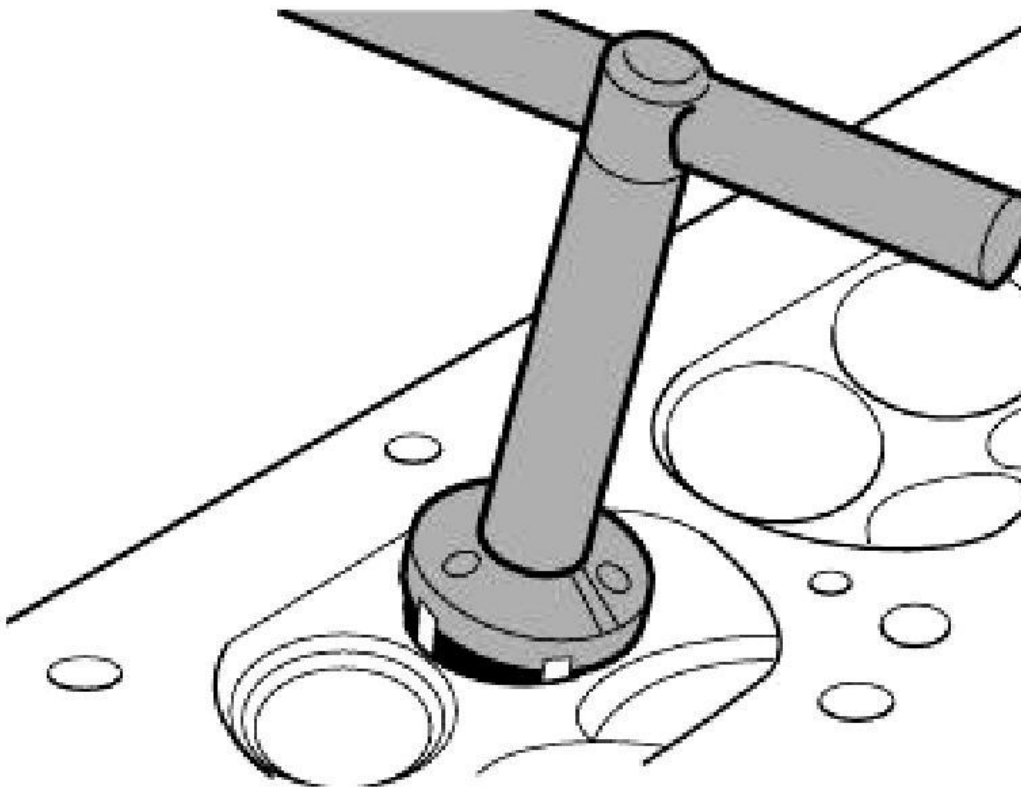
Remove all valves. Refer to **11 34 552 REMOVING AND INSTALLING OR REPLACING ALL VALVES (M52 / S52 / M52TU / M54 / M56)**.

11 12 527 REMACHINING A VALVE SEAT (M52 / S52 / M52TU / M54 / M56)**Special tools required:**

- 00 3 520
- 00 3 580

(cylinder head dismantled)

Machine valve seat surface with special tool 00 3 520 or with special tool 00 3 580 in accordance with manufacturer's instructions.



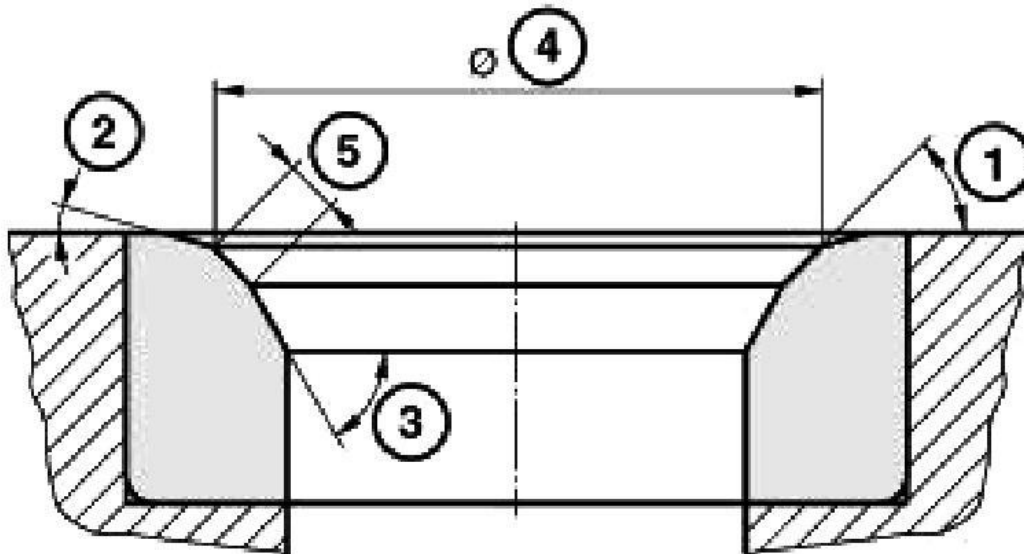
G03310209

Fig. 42: Machining Valve Seat Surface
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: After machining the valve seat surface, remachine the outside and inside diameters with a correction milling tool to the prespecified diameter to produce valve seat width (5).

1. Valve-seat angle
2. Correction angle, outside
3. Correction angle, inside
4. Outside diameter seat face
5. Valve-seat width

Specified values (1 to 5).



G03310210

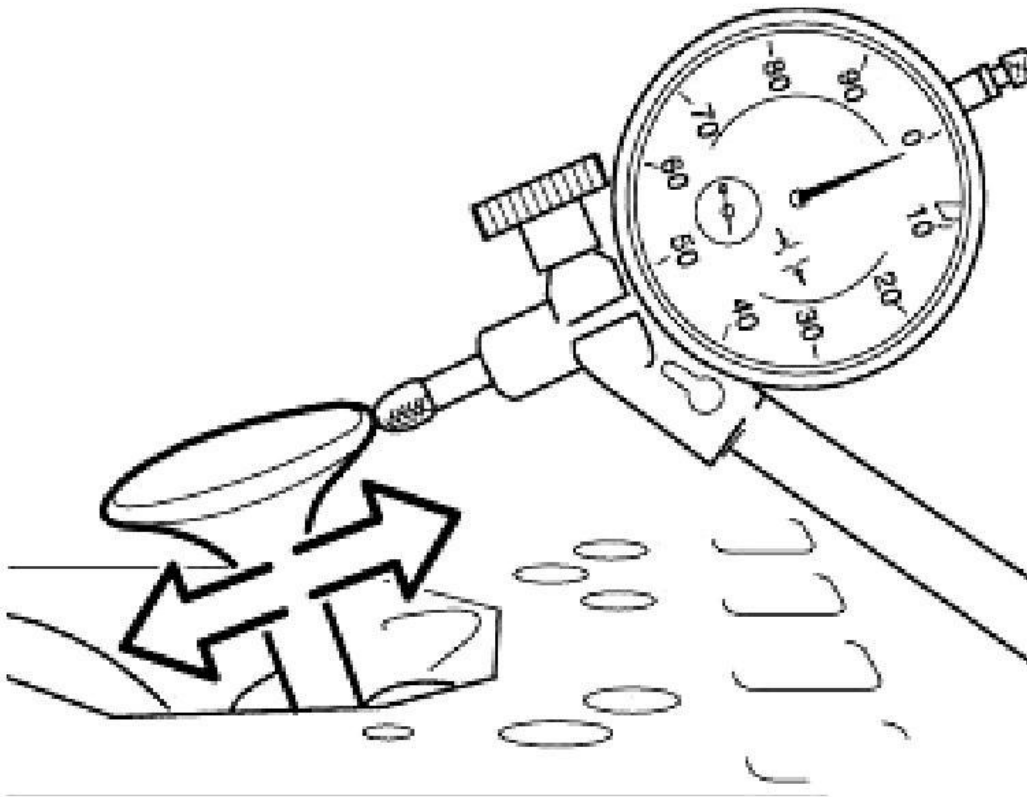
Fig. 43: Identifying Valve Seat Dimensions
Courtesy of BMW OF NORTH AMERICA, INC.

11 12 595 CHECKING A VALVE GUIDE FOR WEAR (M52 / S52 / M52TU / M54 / M56)

(valve removed)

To measure tilt clearance, install a new valve so that end of valve stem is flush with valve guide.

Attach dial gauge and measure tilt clearance.



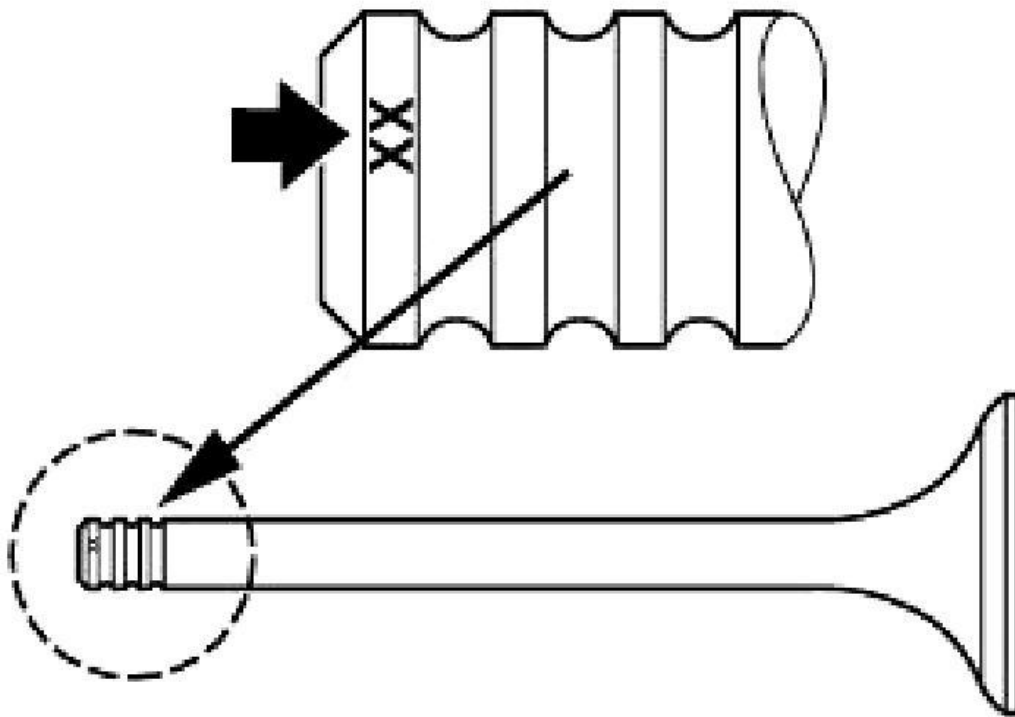
G03310211

Fig. 44: Attaching Dial Gauge

Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: Max. permissible tilt clearance, refer to ENGINE - TECHNICAL DATA .

NOTE: If tilt clearance is excessive, valve guide is reamed out and a repair valve with a larger shaft diameter is installed.



G03310212

Fig. 45: Identifying Ream Valve Guide Dimension
 Courtesy of BMW OF NORTH AMERICA, INC.

If necessary, ream valve guide. Refer to **11 12 600 REAMING A VALVE GUIDE (M52 / S52 / M52TU / M54 / M56)**.

11 12 600 REAMING A VALVE GUIDE (M52 / S52 / M52TU / M54 / M56)

Special tools required:

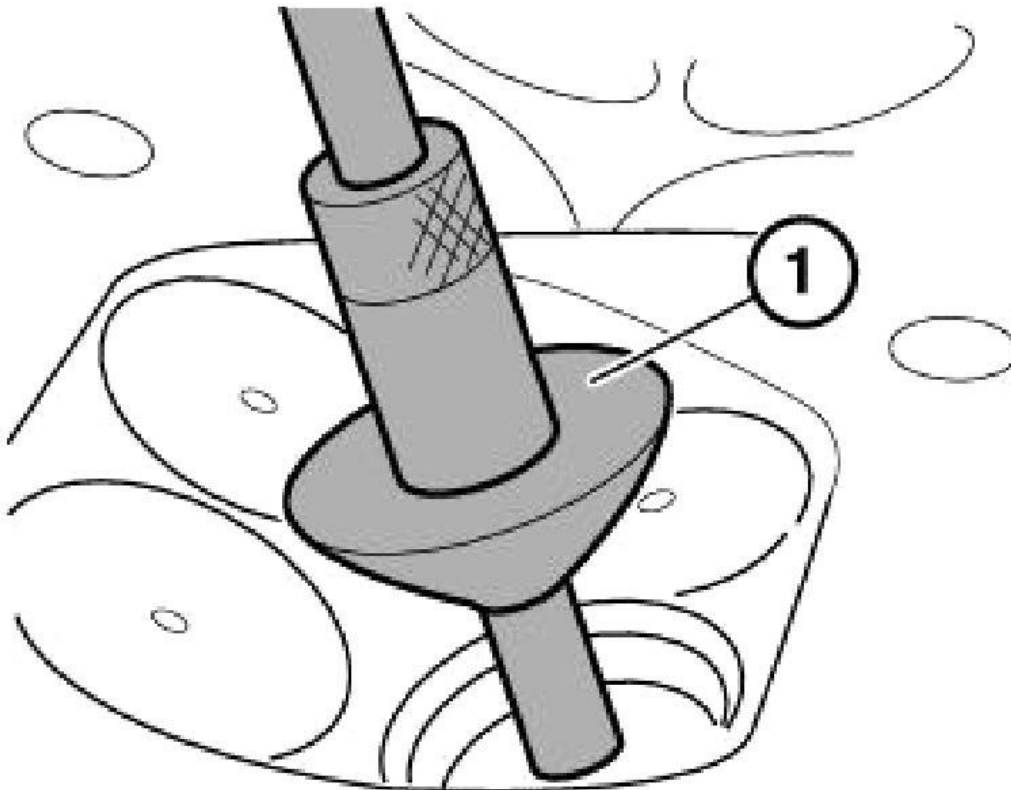
- 00 4 210

(valve removed)

NOTE: In event of excessive clearance between valve stem and valve guide:
 Valve guide is reamed and a repair valve with a larger stem diameter is installed.

Assemble reaming tool and guide taper (1) from special tool kit 00 4 210 depending on stem diameter. Press

guide taper (1) onto valve seat. Starting from combustion chamber side, ream valve guide dry. Rotate reaming tool once in downwards direction.



G03310213

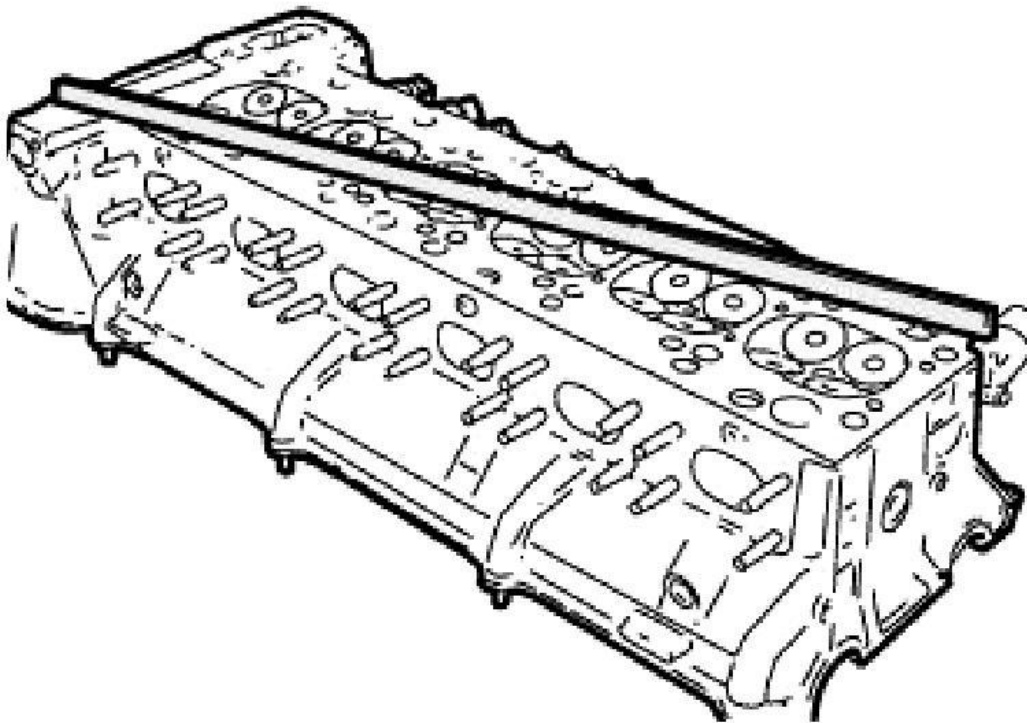
Fig. 46: Pressing Guide Taper Onto Valve Seat
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: Remachine valve seat after reaming. Refer to **11 12 527 REMACHINING A VALVE SEAT (M52 / S52 / M52TU / M54 / M56)**.

11 12 719 RESURFACING CYLINDER HEAD SEALING SURFACE (M52 / M52TU / M54 / M56)

(cylinder head dismantled)

Check flatness of cylinder head sealing surface with a commercially available straightedge.

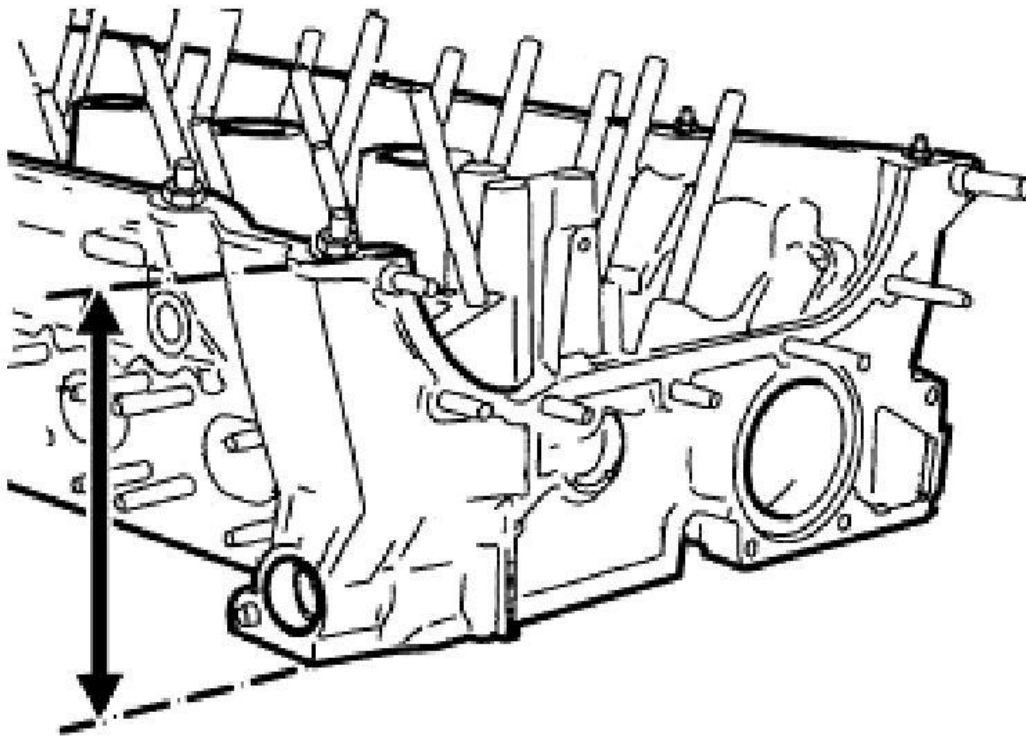


G03310214

Fig. 47: Checking Flatness Of Cylinder Head Sealing Surface
Courtesy of BMW OF NORTH AMERICA, INC.

Deviation from flatness max. 0.05 mm.

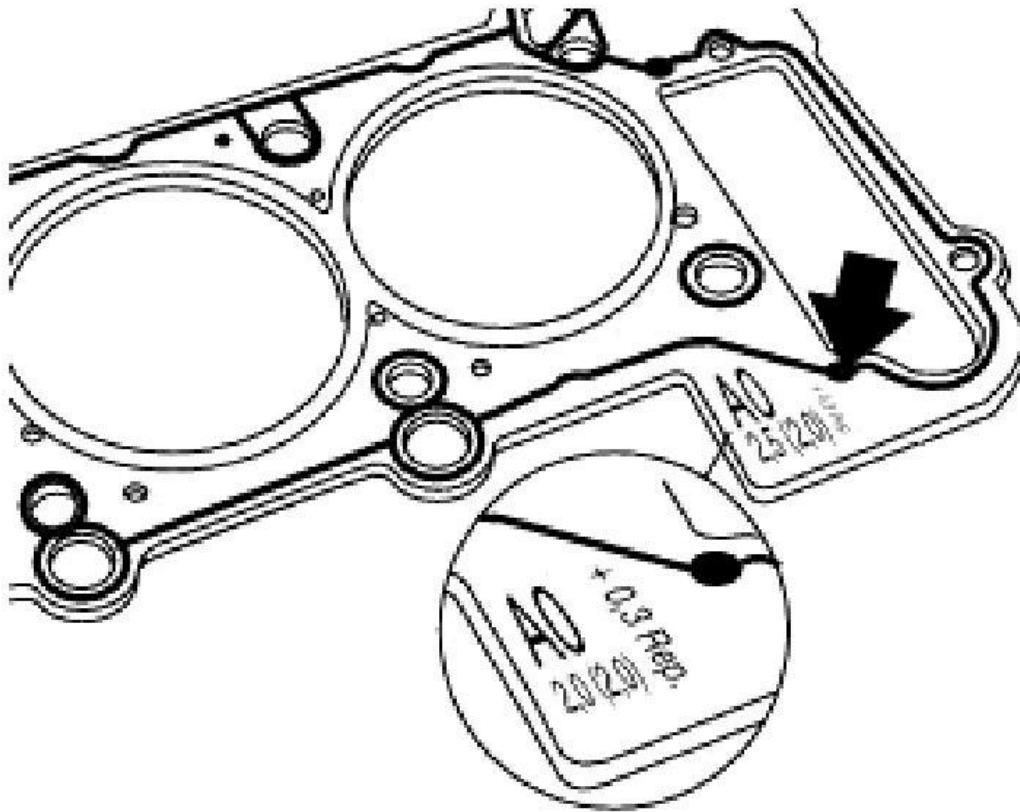
NOTE: **Machining limit. Refer to ENGINE - TECHNICAL DATA .**



G03310215

Fig. 48: Identifying Machining Limit
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: For compression comparison check, a repair cylinder head seal is provided.



G03310216

Fig. 49: Identifying Cylinder Head Seal
Courtesy of BMW OF NORTH AMERICA, INC.

11 12 729 CHECKING CYLINDER HEAD FOR WATERTIGHTNESS (M52TU / M54 / M56)

Special tools required:

- 11 7 390
- 11 7 391
- 11 7 392
- 11 7 393
- 11 7 394
- 11 7 395
- 11 7 396
- 11 7 397

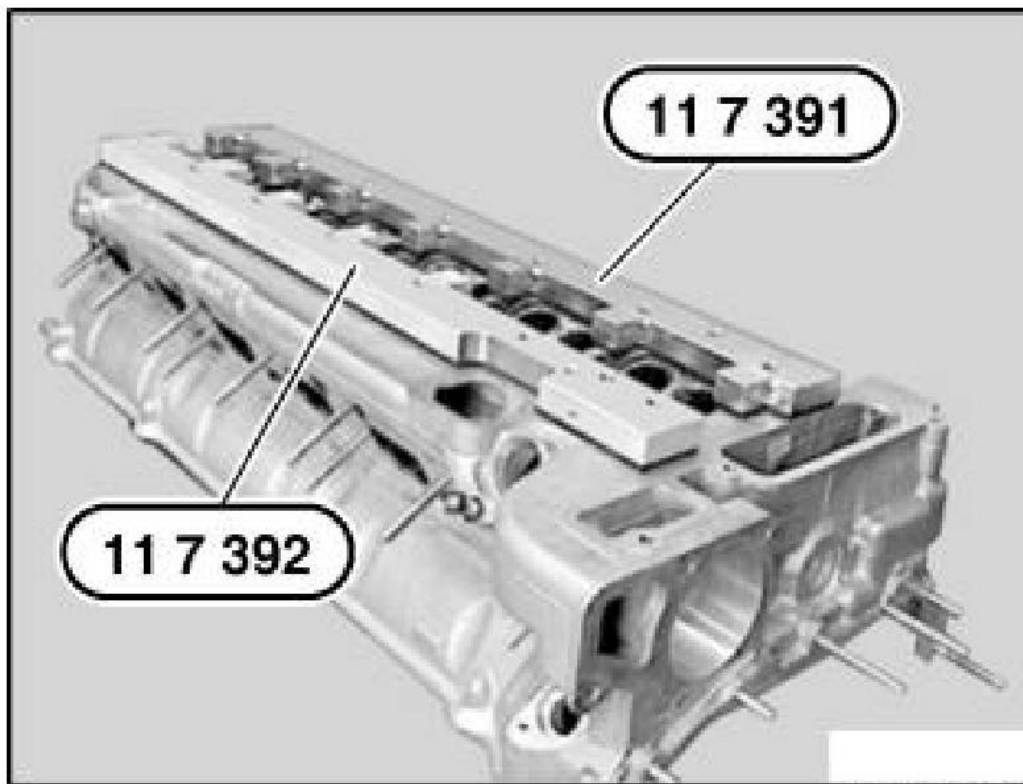
- 11 7 398

(cylinder head dismantled)

Prepare special tool kit 11 7 390.

NOTE: Special tool kit in 390 consists of special tools 11 7 391 / 11 7 392 / 11 7 393 / 11 7 394 / 11 7 395 / 11 7 396 / 11 7 397 / 11 7 398.

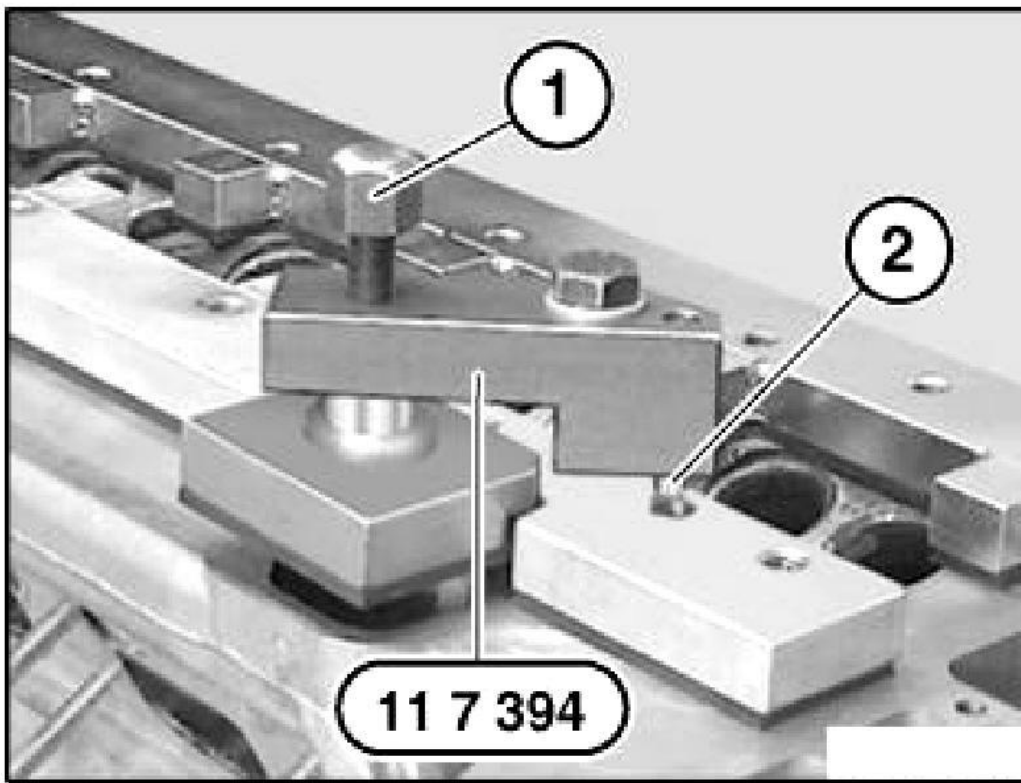
Place special tools 11 7 391 / 11 7 392 on cylinder head sealing surface and screw down with cylinder head bolts.



G03310217

Fig. 50: Placing Special Tools On Cylinder Head Sealing Surface
Courtesy of BMW OF NORTH AMERICA, INC.

Turn back screw (1).



G03310218

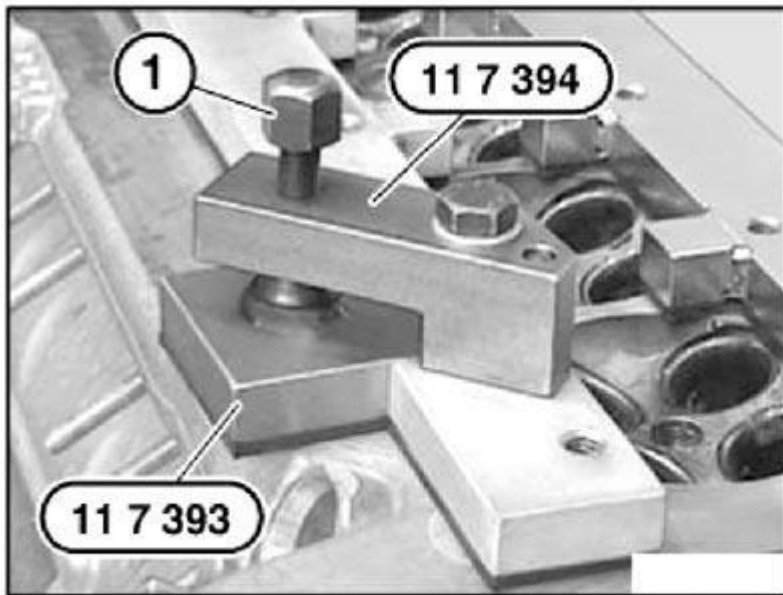
Fig. 51: Fitting Special Tool

Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: special tool 11 7 394 is secured with a pin (2).

Fit special tool 11 7394.

Insert screw (1) by hand until special tool 11 7 393 rests on sealing surface.

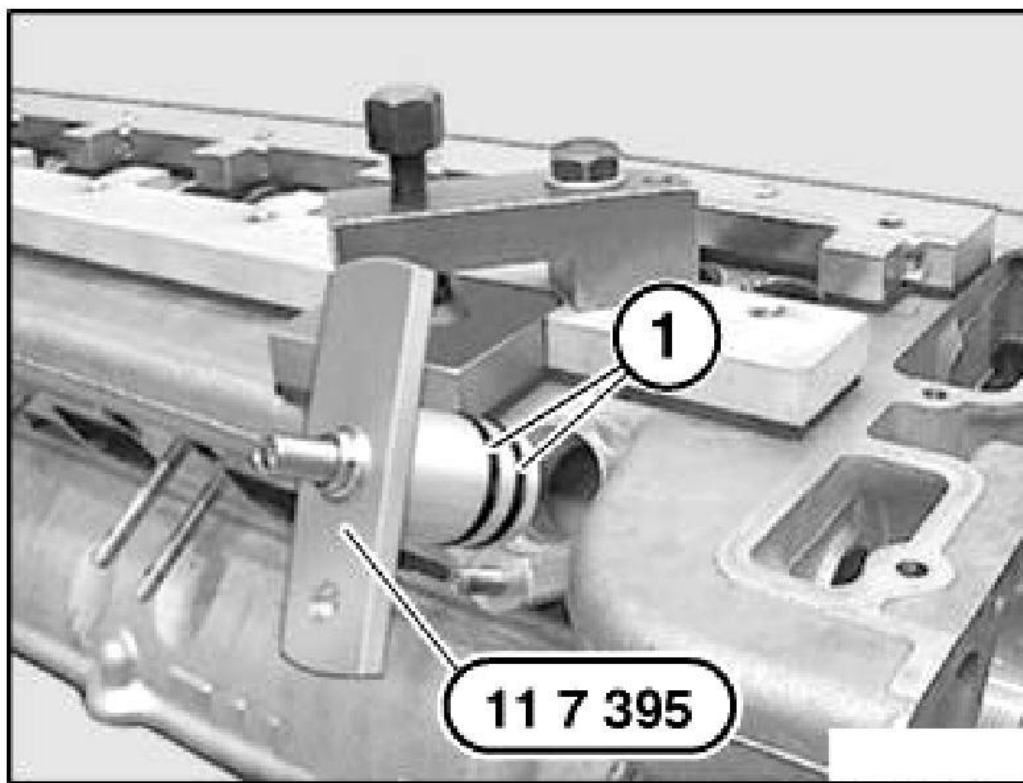


G03310219

Fig. 52: Tightening Down Screw**Courtesy of BMW OF NORTH AMERICA, INC.**

Tighten down screw (1) by approx. a half to one turn.

Check sealing rings (1) and coat with water as anti -friction coating. Insert special tool 11 7 395 and tighten down.

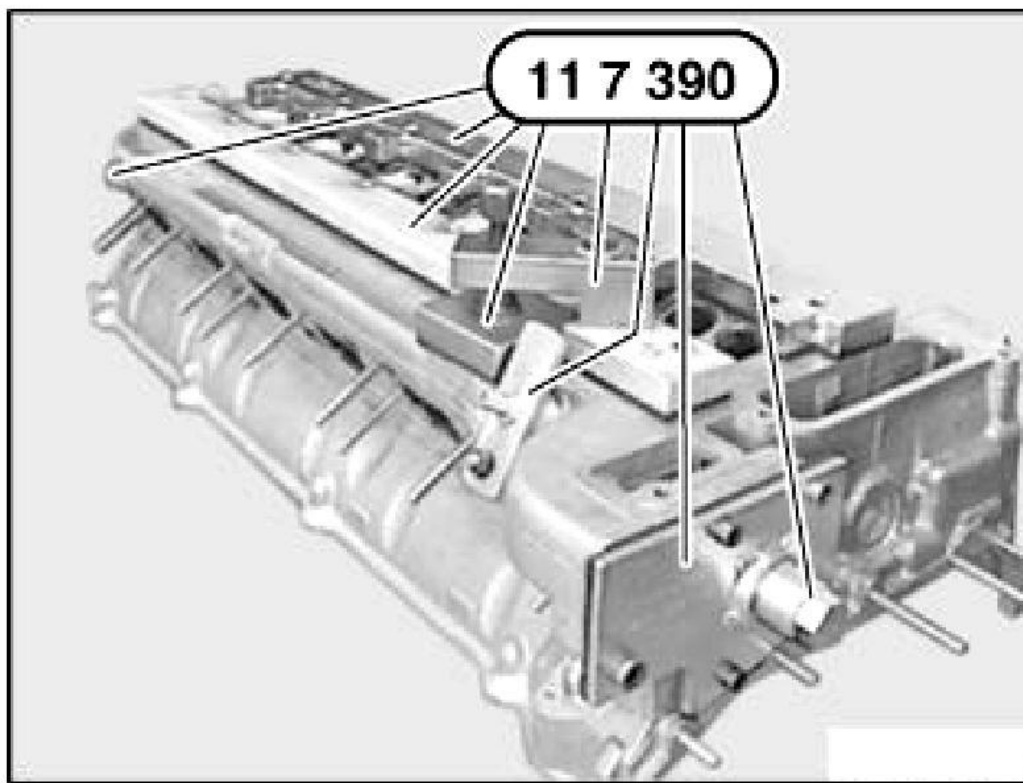


G03310220

Fig. 53: Checking Sealing Rings

Courtesy of BMW OF NORTH AMERICA, INC.

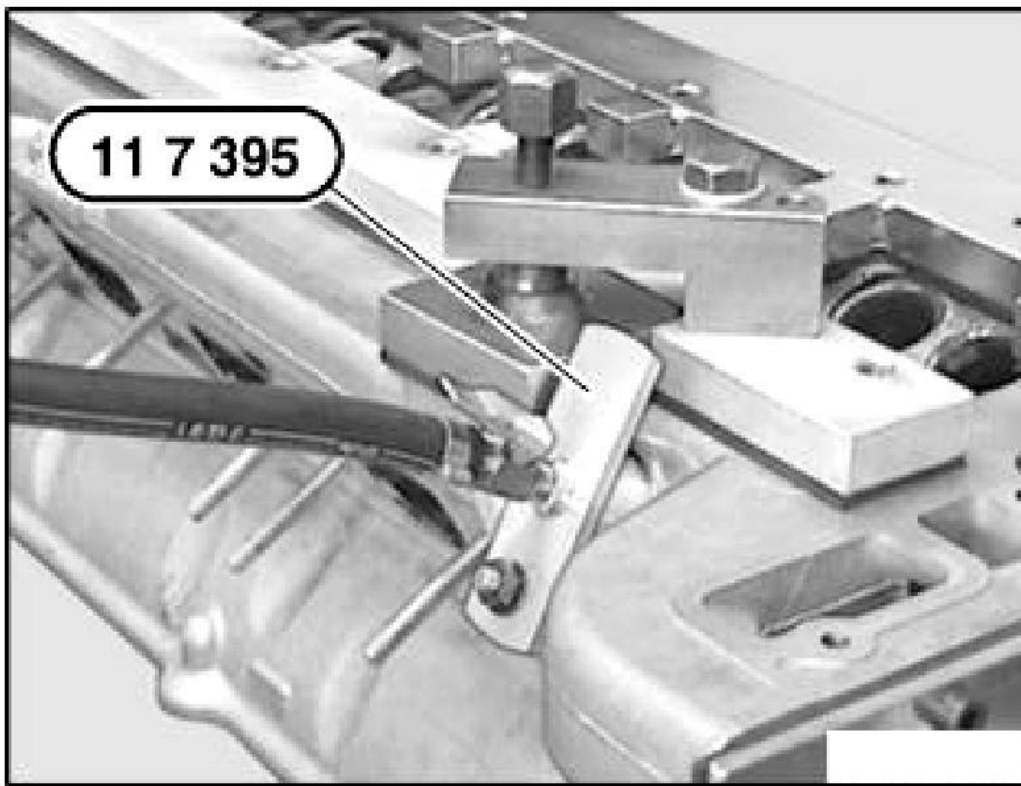
Seal coolant apertures with special tool kit 11 7 390.



G03310221

Fig. 54: Sealing Coolant Apertures
Courtesy of BMW OF NORTH AMERICA, INC.

Connect compressed air to special tool 11 7 395.



G03310222

Fig. 55: Connecting Compressed Air To Special Tool
Courtesy of BMW OF NORTH AMERICA, INC.

Immerse cylinder head in a water bath. Inspection pressure 4.5 bar.

Check cylinder head for escaping air (cracks).

NOTE: If necessary, soften the bath water with a cleaning agent.

OIL SUMP

11 13 000 REMOVING AND INSTALLING, SEALING OR REPLACING OIL SUMP (M52TU / M54 / M56)

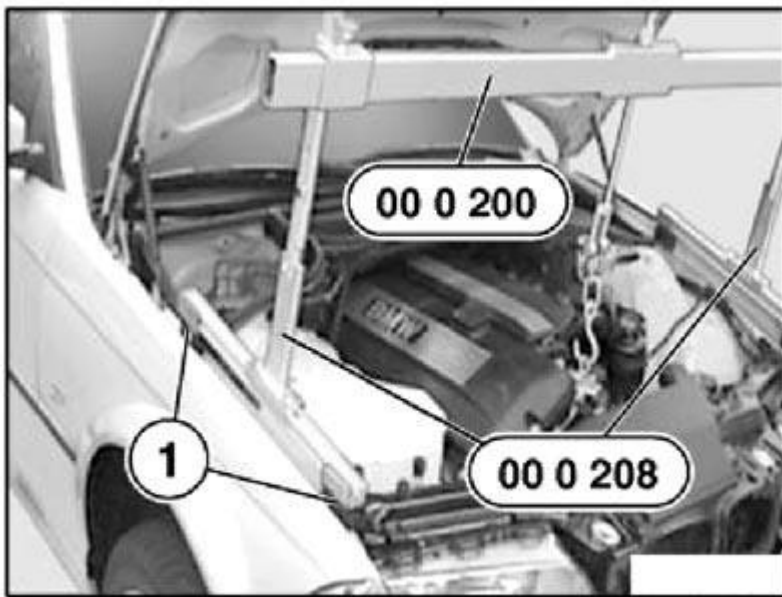
Special tools required:

- 00 0 200

- 00 0 201
- 00 0 202
- 00 0 204
- 00 0 208

NOTE: To remove the oil sump, you must lower the front axle support. There is no need to perform a front axle alignment check.

Assemble special tool 00 0 200 with special tools 00 0 201 / 00 0 202 / 00 0 208 and fit.



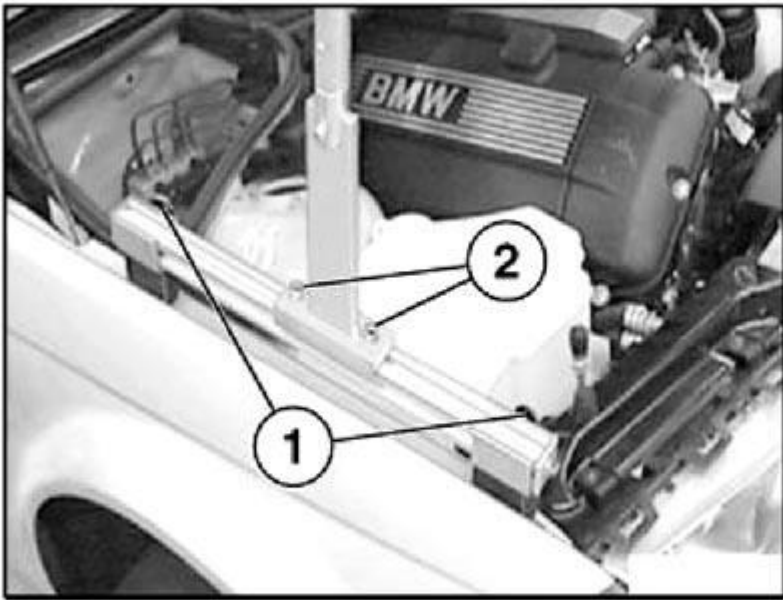
G03310223

Fig. 56: Installing Special Tool On Engine
Courtesy of BMW OF NORTH AMERICA, INC.

Secure special tool 00 0 200 to front suspension eye on engine.

NOTE: The supports (1) of special tool 00 0 208 must rest on the bolt connection of both side walls.

Tighten the screws (1 and 2).



G03310224

Fig. 57: Tightening Screws

Courtesy of BMW OF NORTH AMERICA, INC.

Raise engine with special tool 00 0 200 approx. 5 mm.

**G03310225**

Fig. 58: Raising Engine With Special Tool
Courtesy of BMW OF NORTH AMERICA, INC.

Remove suction filter housing.

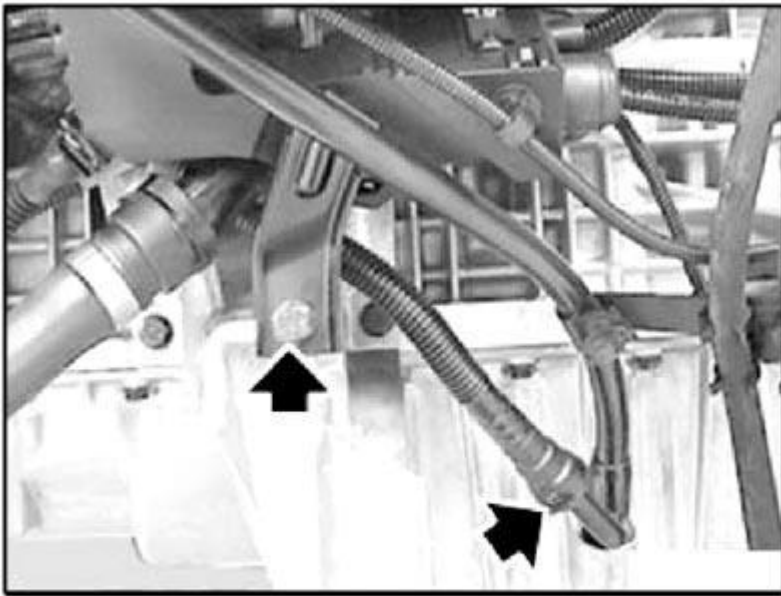
Remove engine splash guard.

Drain engine oil. Refer to **00 00 250 BMW ENGINE OIL SERVICE INCL. SUPPLEMENTARY SERVICE (M54 / M56).**

On vehicles with automatic transmission:

Disconnect oil lines from automatic transmission and from oil pan.

Release guide tube for dipstick.



G03310226

Fig. 59: Removing Oil Dipstick Guide Tube
Courtesy of BMW OF NORTH AMERICA, INC.

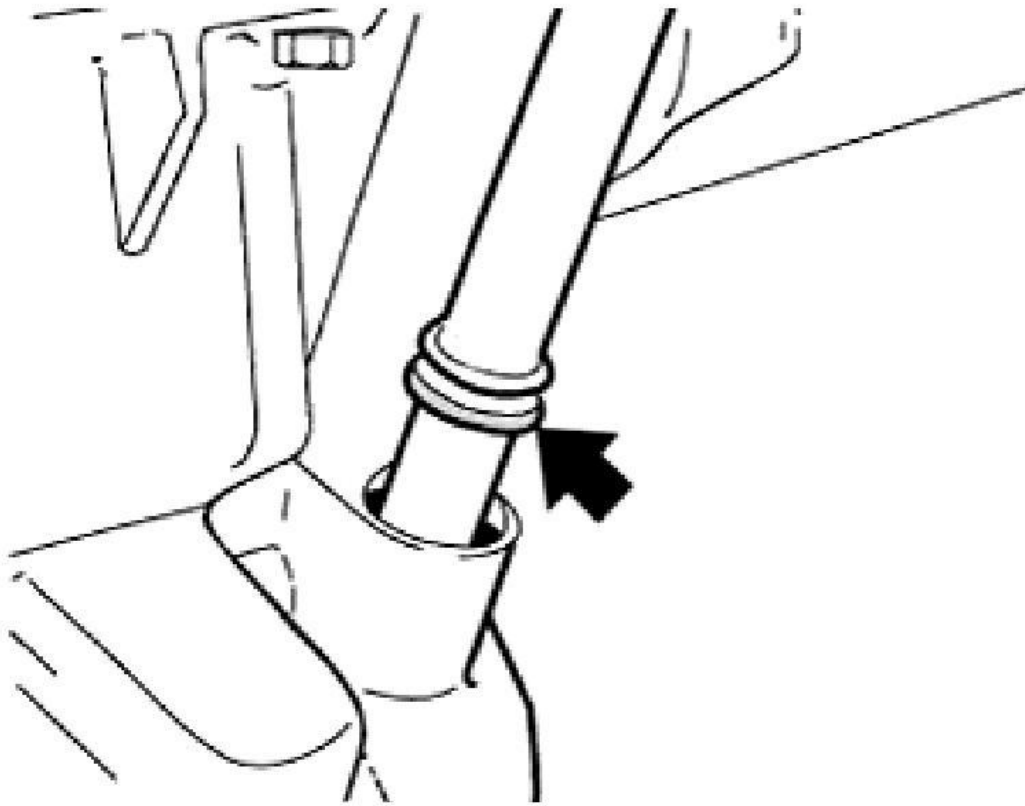
NOTE: **M52TU and M54 only.**

Detach return hose from cyclone oil separator on oil dipstick guide tube.

Remove oil dipstick guide tube upwards.

Installation:

Replace O-ring.

**G03310227****Fig. 60: Identifying O-Ring****Courtesy of BMW OF NORTH AMERICA, INC.**

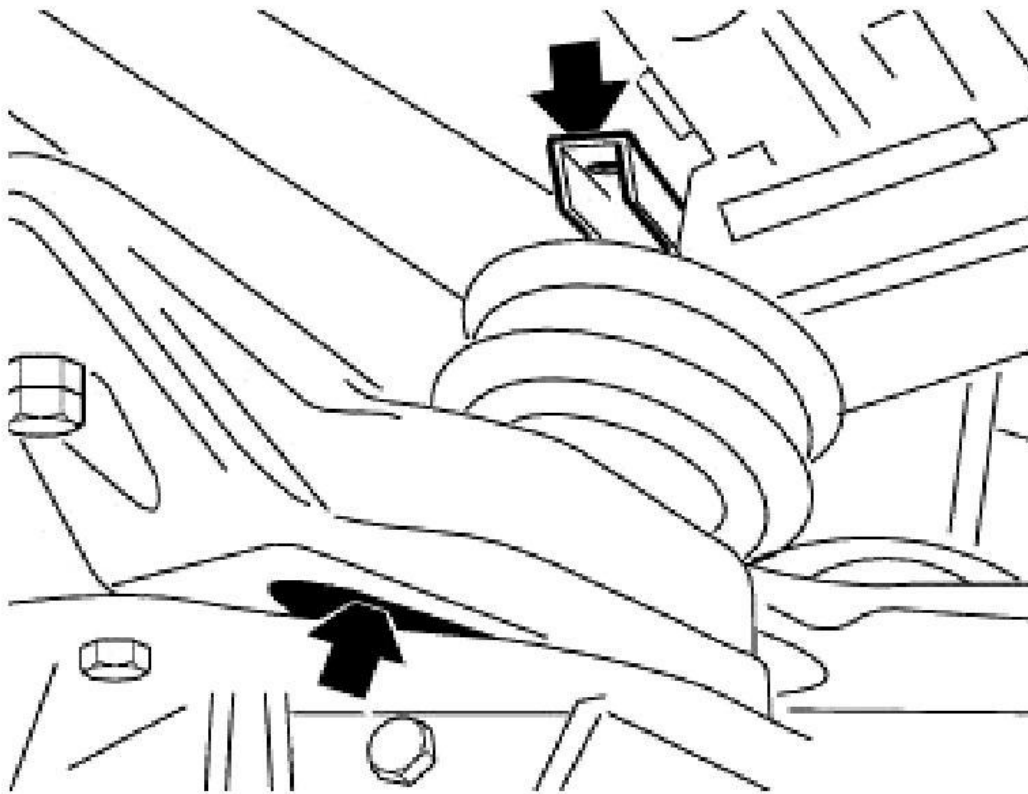
Remove front end reinforcement.

Detach steering spindle from steering gear.

Remove vane pump for power steering unit (lines remain connected).

Disconnect plug connection to oil level sensor.

Loosen top and unfasten bottom of left and right engine mounts.



G03310228

Fig. 61: View Of Engine Mount

Courtesy of BMW OF NORTH AMERICA, INC.

E46 4WD only

Remove left and right swivel bearings.

Remove output shafts.

Remove front propeller shaft.

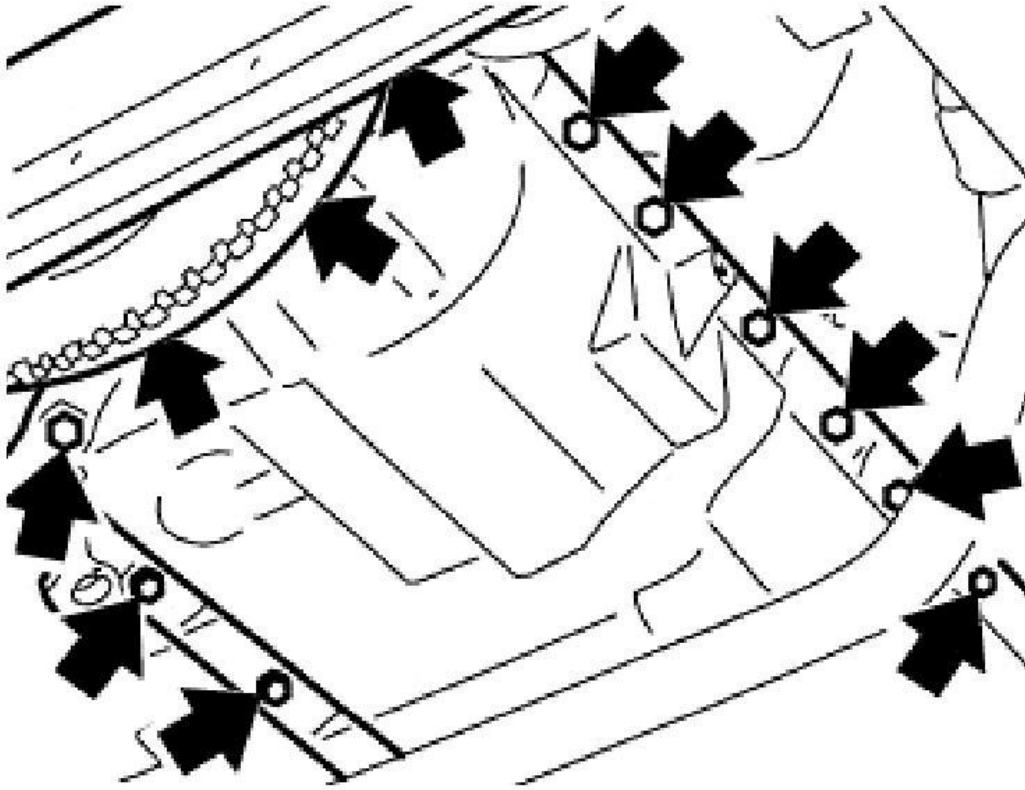
Remove front axle differential.

Detach brackets for left and right control arms from engine carrier. Release retaining brackets for left and right stabilizer bars. Unfasten screw connection on front axle support and lower the front axle support.

These operations are described in the work step Replacing front axle support.

NOTE: There is no need to detach the steering gear from the front axle support.

Unfasten oil sump screws at transmission and engine ends. Lower and remove oil sump.



G03310229

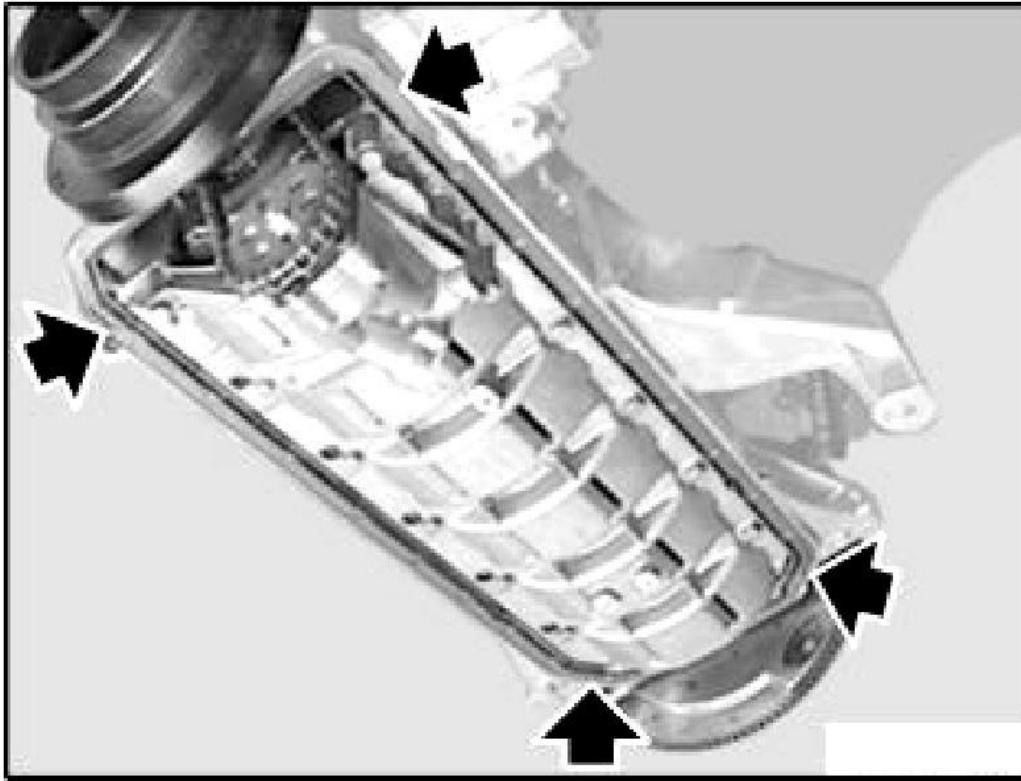
Fig. 62: Locating Oil Sump Screws

Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Sealing faces clean and free of seal debris.

Apply approx. 3 mm wide, 2 mm high coat of Drei Bond 1209 sealing agent (refer to BMW Parts Service) to the area around seams.



G03310230

Fig. 63: Identifying Sealing Faces

Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

1. Replace gasket
2. Install oil sump.
3. Insert all oil sump screws.
4. Insert screws in transmission end without preload at this stage.
5. Tighten down screws in engine end.
6. Tighten down screws in transmission end.

11 13 000 REMOVING AND INSTALLING, SEALING/REPLACING OIL SUMP (M54/56)*Necessary preliminary tasks:*

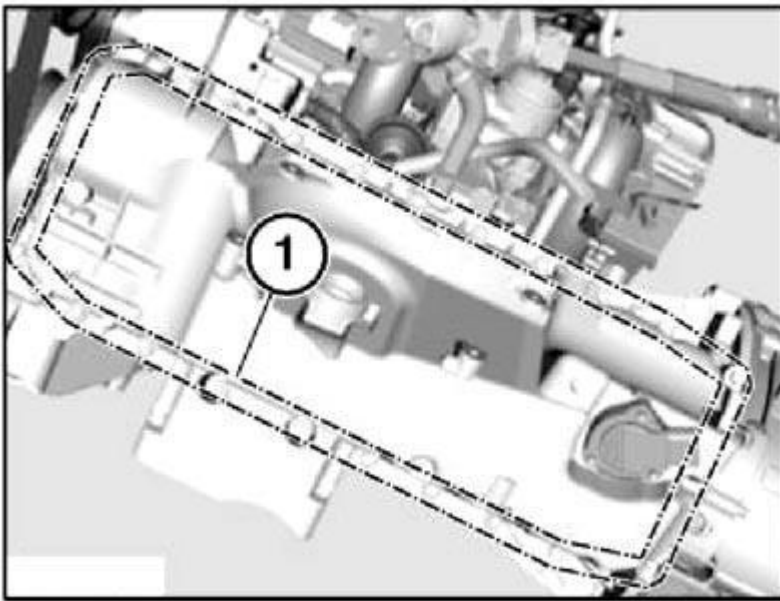
- Drain engine oil. Refer to **00 00 250 BMW ENGINE OIL SERVICE (M54/56)**.

- Remove front left and right output shafts.
- Remove front axle differential. Refer to 31 50 001 Removing and installing/replacing front differential .
- Release vane pump for power steering (lines remain connected). Refer to 32 41 060 Removing and installing/replacing vane pump for power steering (M54) .
- Remove oil dipstick. Refer to **11 43 000 REMOVING AND INSTALLING/REPLACING OIL DIPSTICK (M54/56)**.
- Secure engine in installation position. Refer to **SECURING ENGINE WITH SPECIAL TOOL IN INSTALLATION POSITION (M54)**.
- Detach steering spindle from steering gear. Refer to **LOWER SECTION OF STEERING SPINDLE** .
- Lower front axle. Refer to **FRONT AXLE CARRIER** .

(Front axle alignment is not required).

- Disconnect plug connection on oil level sensor.
- Remove oil lines for automatic transmission.

Release oil sump screws along line (1).



G03310231

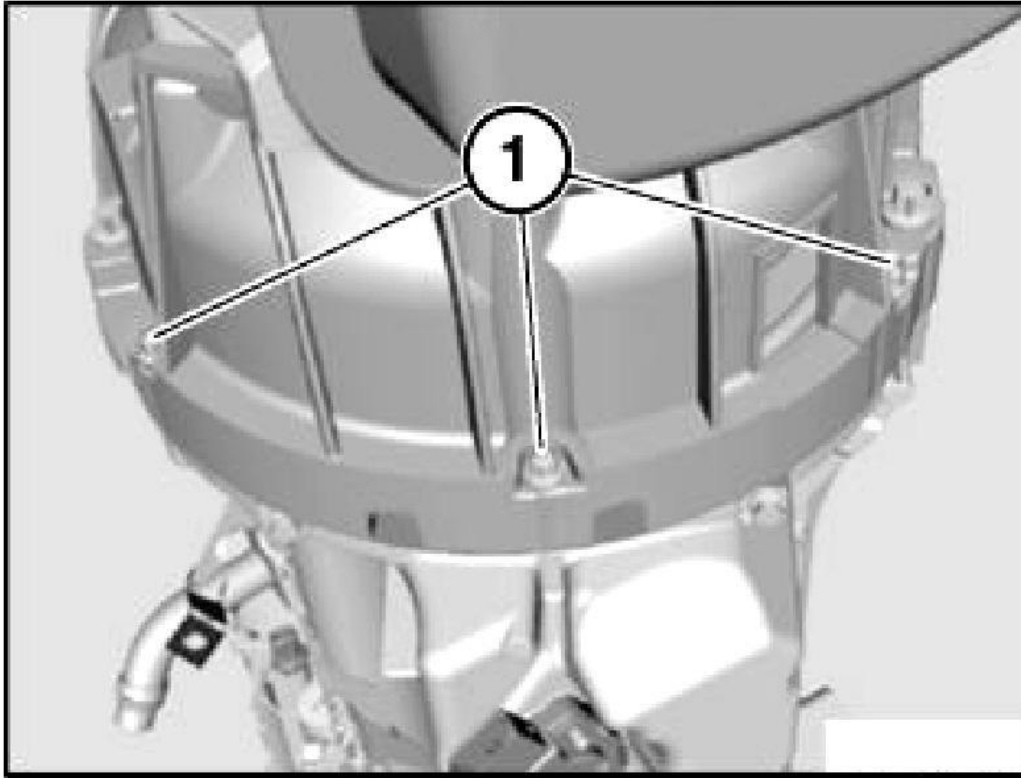
Fig. 64: Releasing Oil Sump Screws
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Tightening torque: 11 13 2AZ. Refer to **ENGINE - TIGHTENING TORQUES** .

Move oil pan backwards.

Release transmission screws (1).



G03310232

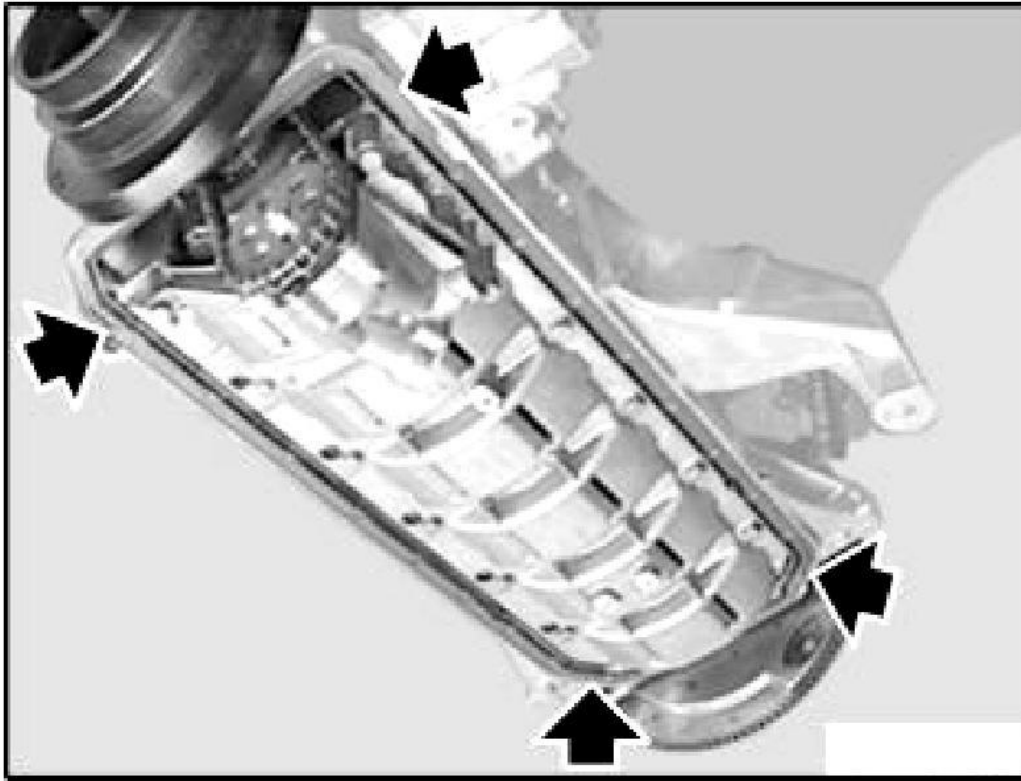
Fig. 65: Releasing Transmission Screws
Courtesy of BMW OF NORTH AMERICA, INC.

Automatic transmission: Tightening torque, refer to **TORQUE SPECIFICATIONS** .

Manual transmission: Tightening torque, refer to **TORQUE SPECIFICATIONS** .

Installation:

Clean sealing surfaces.



G03310233

Fig. 66: Locating Sealing Surfaces

Courtesy of BMW OF NORTH AMERICA, INC.

In area of joint, apply approx. 3 mm of Drei Bond 1209 sealing compound (refer to BMW Parts Service)

Assemble engine.

Check engine for leaks.

HOUSING COVER

11 14 110 REMOVING AND INSTALLING LOWER TIMING CASE COVER (M52 / S52 / M52TU / M54)

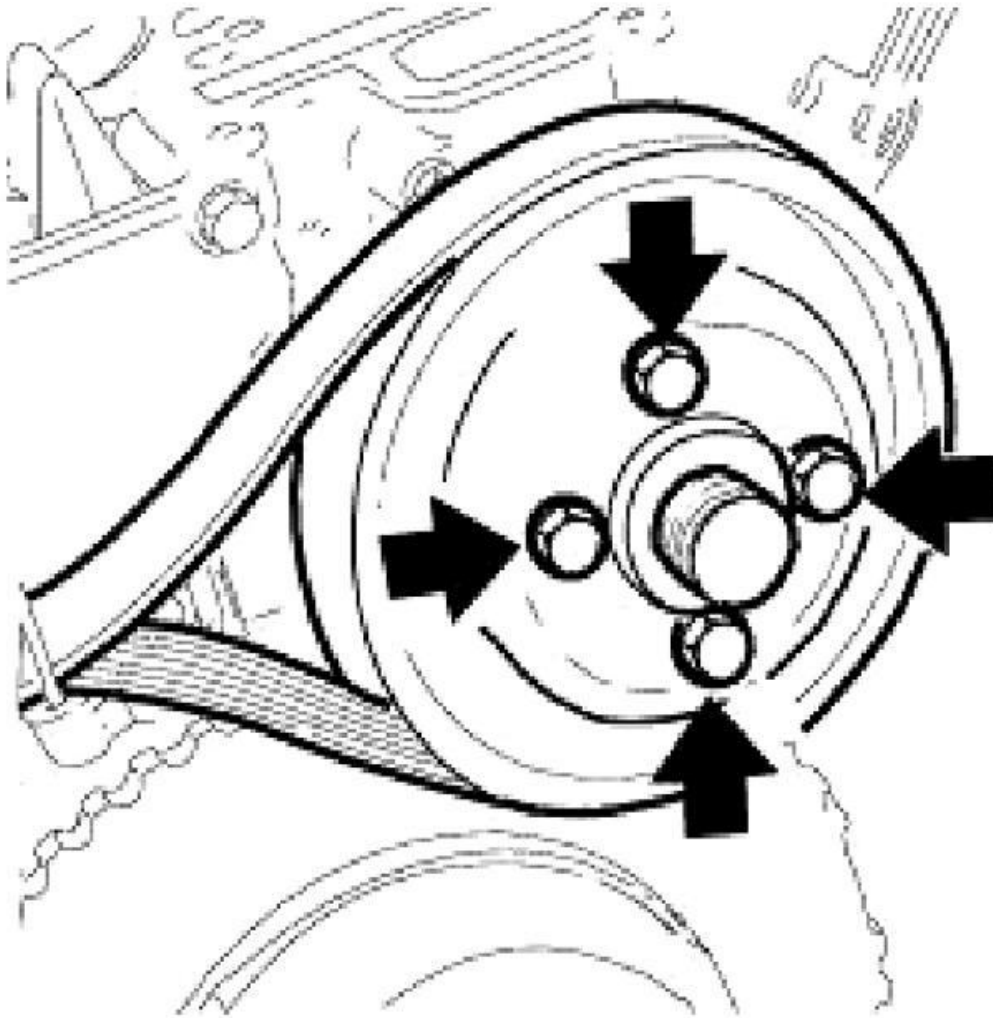
Remove VANOS adjustment unit. Refer to **11 36 010 REMOVING AND INSTALLING OR REPLACING DOUBLE VANOS ADJUSTMENT UNIT (M52TU / M54 / M56)**.

Remove coolant thermostat. Refer to **11 53 000 REMOVING AND INSTALLING/REPLACING**

COOLANT THERMOSTAT (M52TU / M54 / M56).

Remove alternator drive belt and drive belt tensioner.

Brace pulley for water pump with drive belt and unfasten screws.

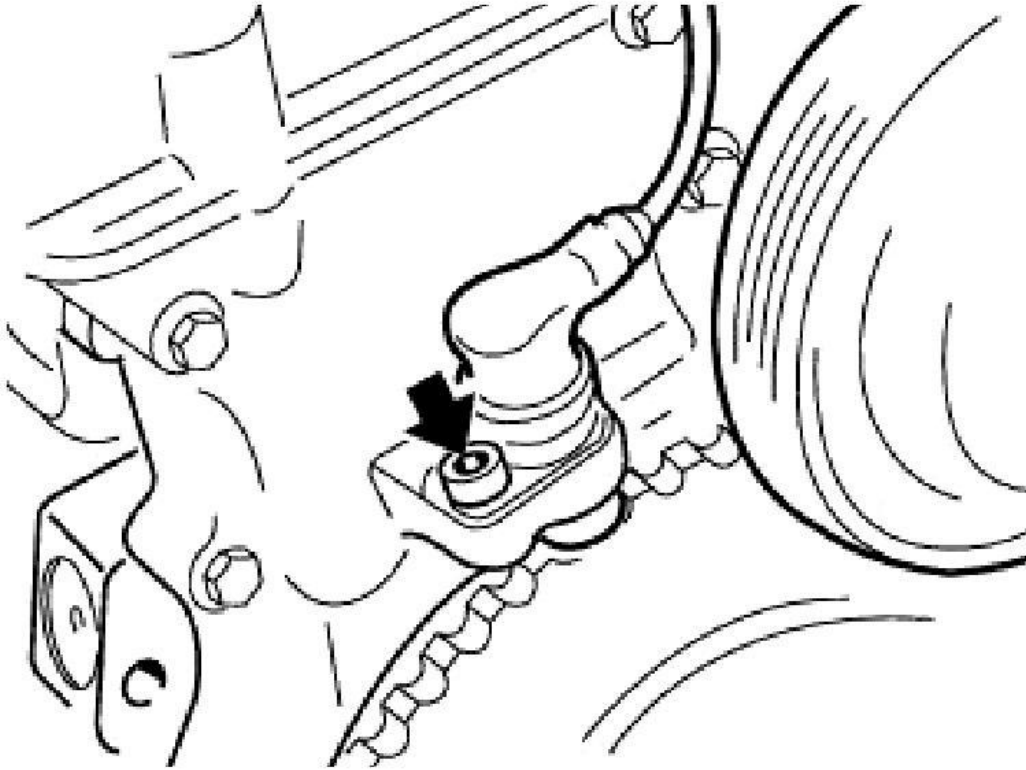


G03310234

Fig. 67: Locating Bolts For Water Pump Pulley
Courtesy of BMW OF NORTH AMERICA, INC.

M52/S52 only

Unfasten engine speed sensor.



G03310235

Fig. 68: Identifying Engine Speed Sensor

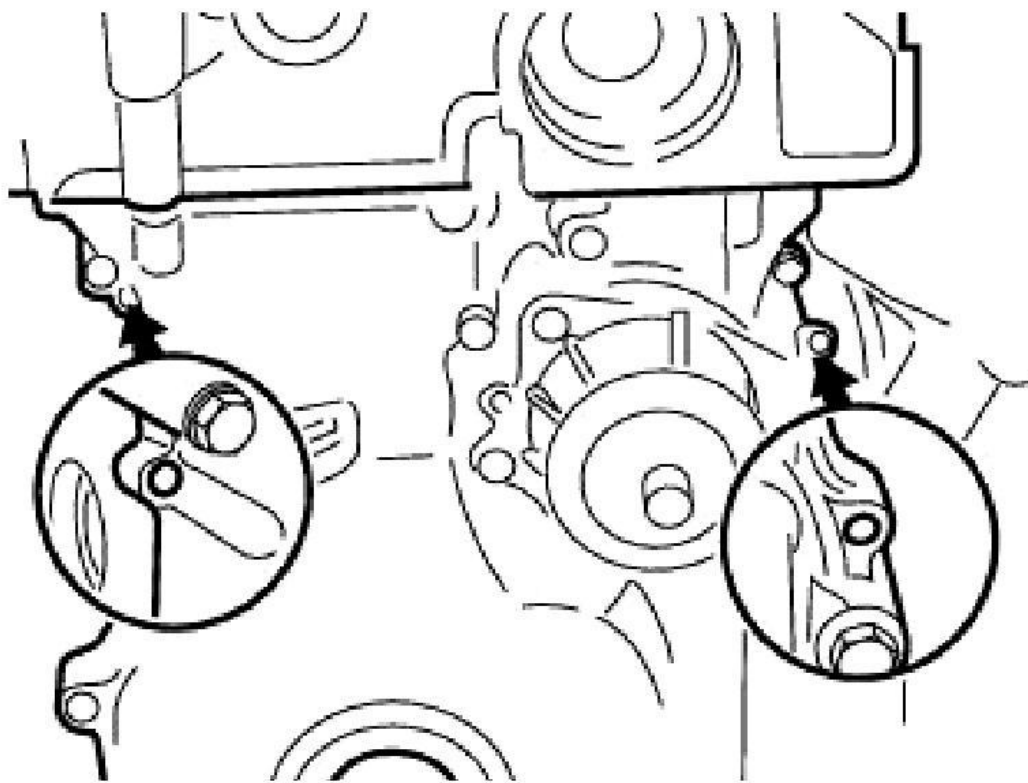
Courtesy of BMW OF NORTH AMERICA, INC.

Remove vibration damper. Refer to **11 23 010 REMOVING AND INSTALLING OR REPLACING VIBRATION DAMPER (M52TU / M54 / M56)**.

Version where vibration damper and hub are two parts: Remove hub for vibration damper.

Remove oil sump. Refer to **11 13 000 REMOVING AND INSTALLING, SEALING OR REPLACING OIL SUMP (M52TU / M54 / M56)**.

Drive out dowel pins from timing case cover towards rear. (Mandrel diameter less than 5 mm)



G03310236

Fig. 69: Driving Out Dowel Pins From Timing Case Cover
Courtesy of BMW OF NORTH AMERICA, INC.

Unscrew timing case cover to cylinder head bolts.

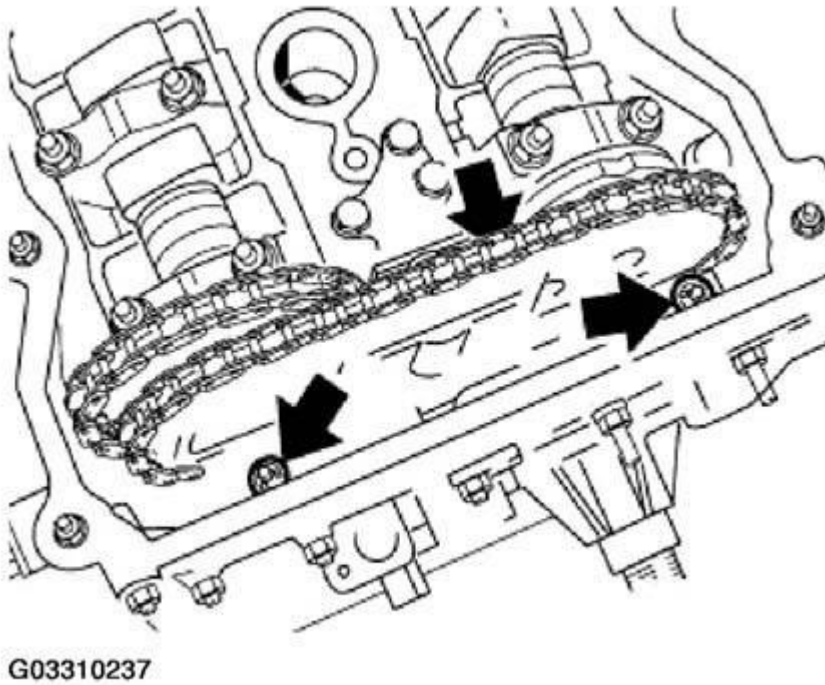
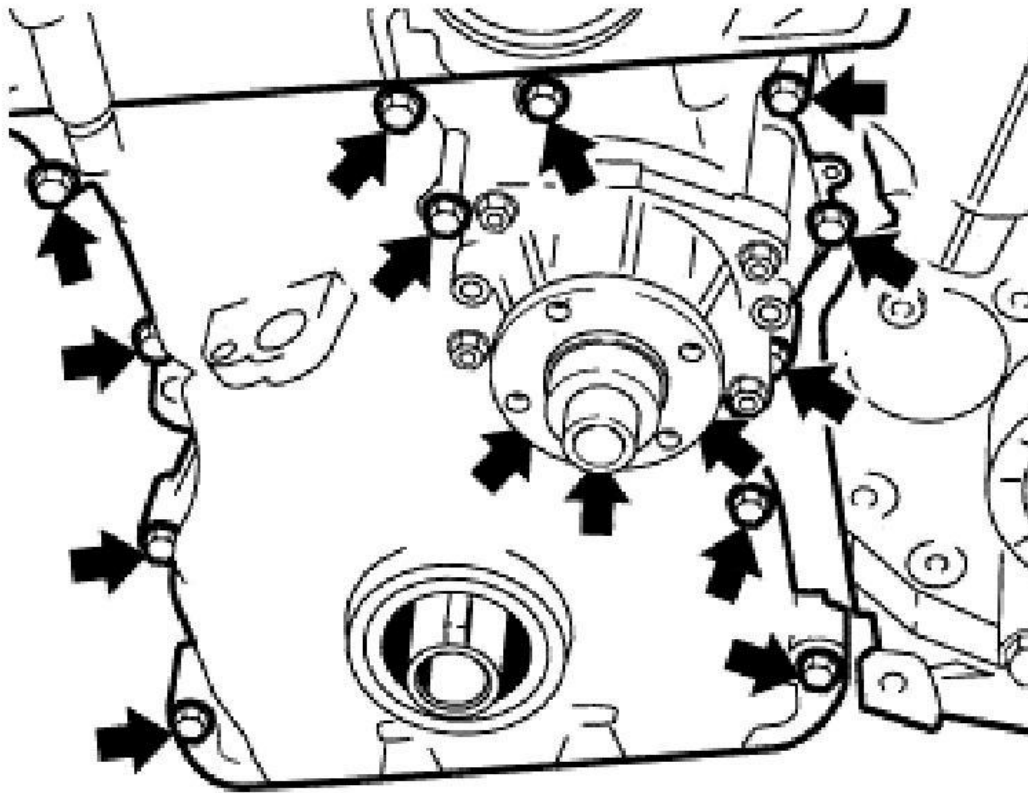


Fig. 70: Unscrewing Timing Case Cover To Cylinder Head Bolts
Courtesy of BMW OF NORTH AMERICA, INC.

Unfasten screws and remove timing case cover.



G03310238

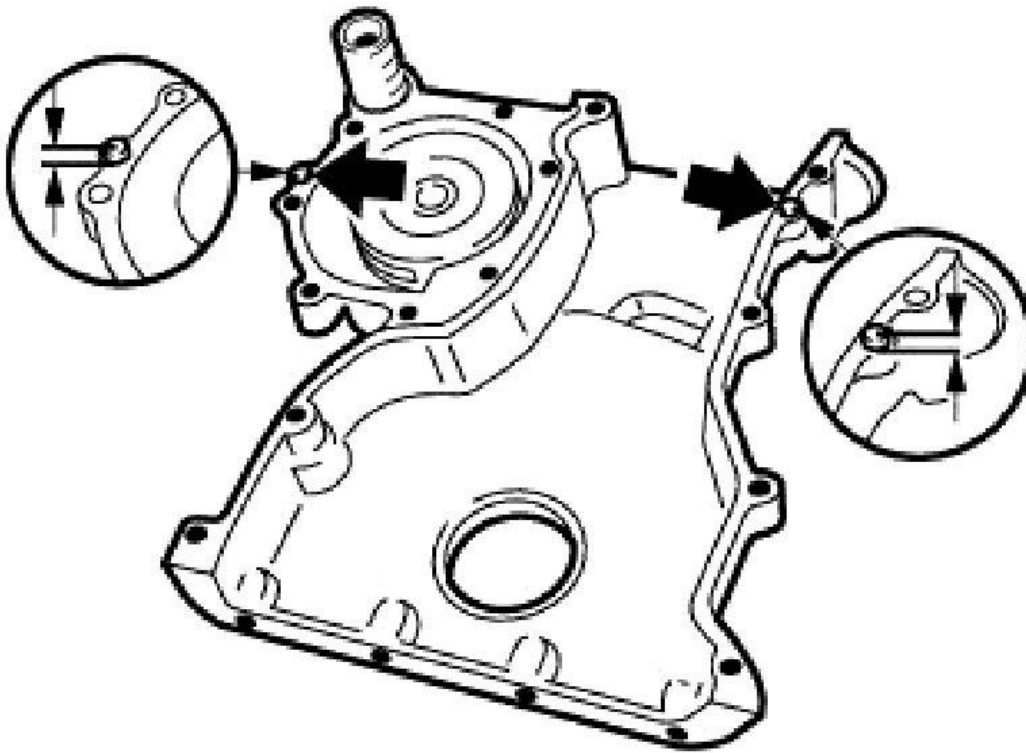
Fig. 71: Removing Timing Case Cover

Courtesy of BMW OF NORTH AMERICA, INC.

IMPORTANT: Check cylinder head gasket for damage; if necessary, remove cylinder head and replace cylinder head gasket.

Installation:

Clean sealing surfaces.



G03310239

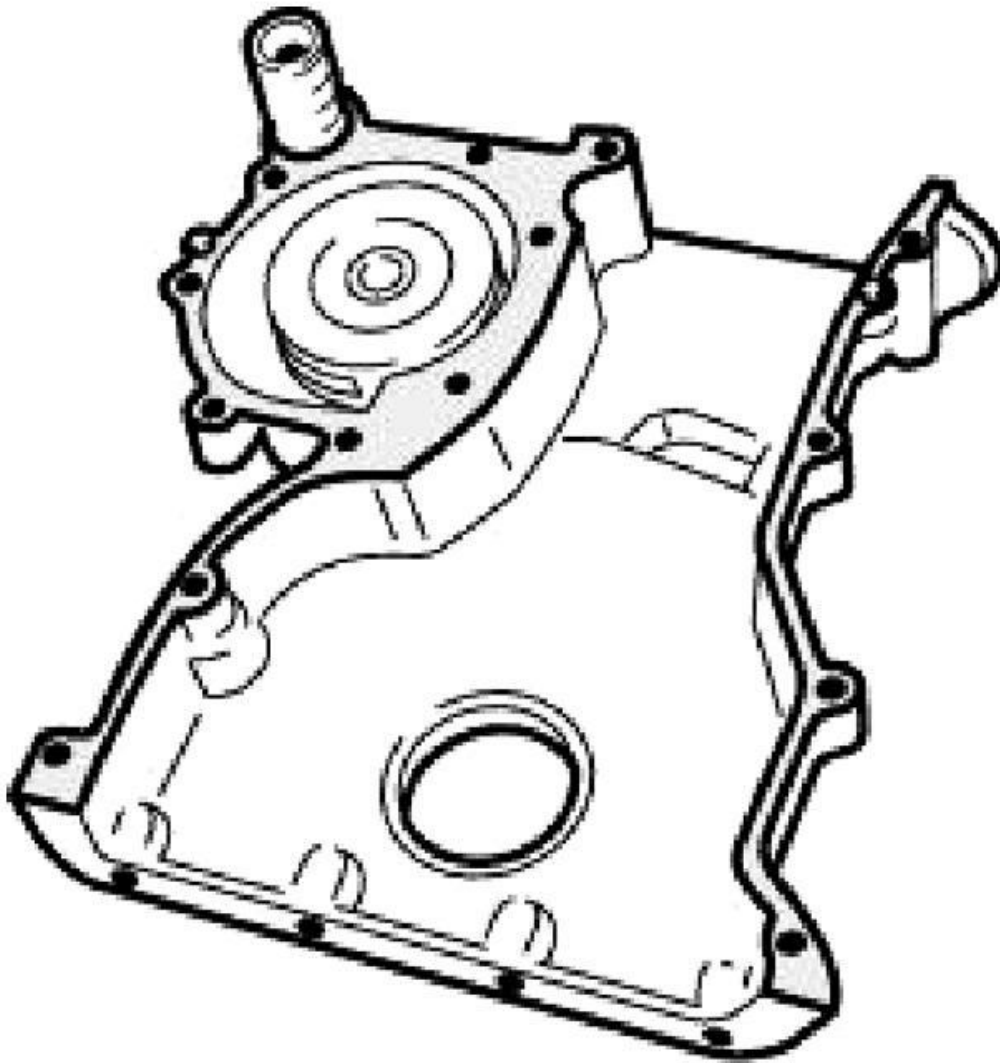
Fig. 72: Identifying Sealing Surfaces

Courtesy of BMW OF NORTH AMERICA, INC.

Drive alignment pins into timing case cover until they protrude approx. 2 to 3 mm.

Installation:

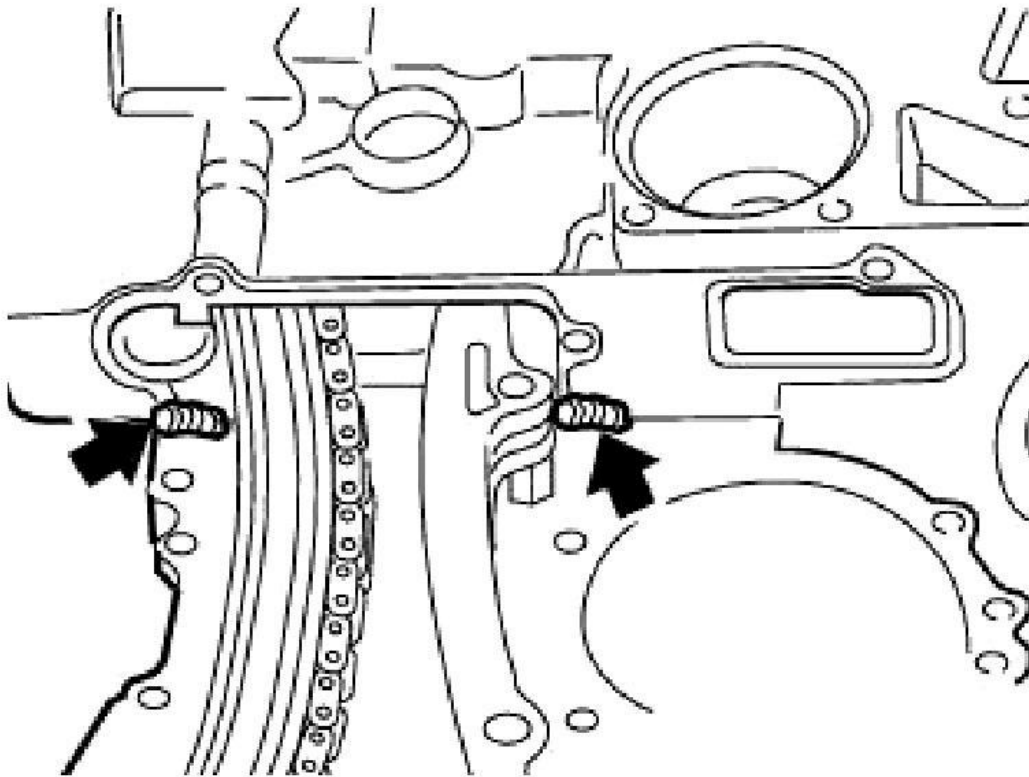
Secure new seals to timing case cover with a little grease.

**G03310240****Fig. 73: Identifying Seals****Courtesy of BMW OF NORTH AMERICA, INC.***Installation:*

Sealing faces clean and free of seal debris.

Apply Drei Bond 1209 sealing compound (refer to BMW Parts Service) at following points:

- A bead at the transitions to the cylinder head gasket on the left and right.
- Thinly and evenly to the entire sealing face of the timing case cover to the cylinder head gasket.

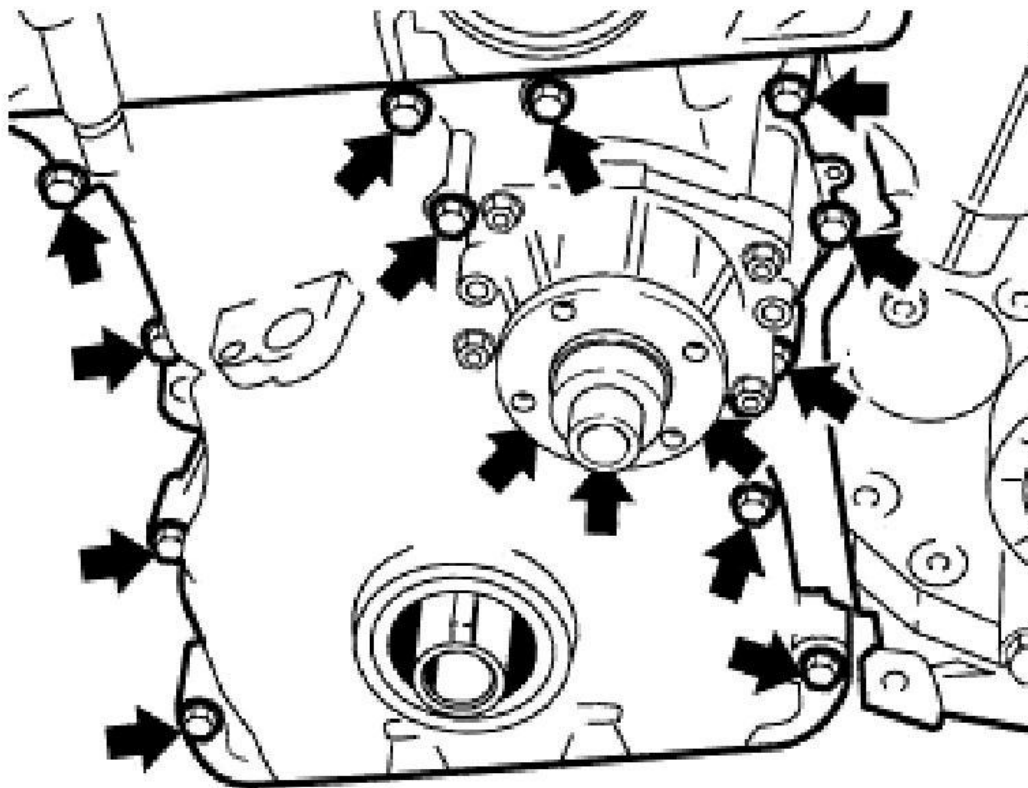


G03310241

Fig. 74: Applying Drei Bond Sealing Compound
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Install timing case cover, insert all screws and initially tighten to approx. 5 N.m.

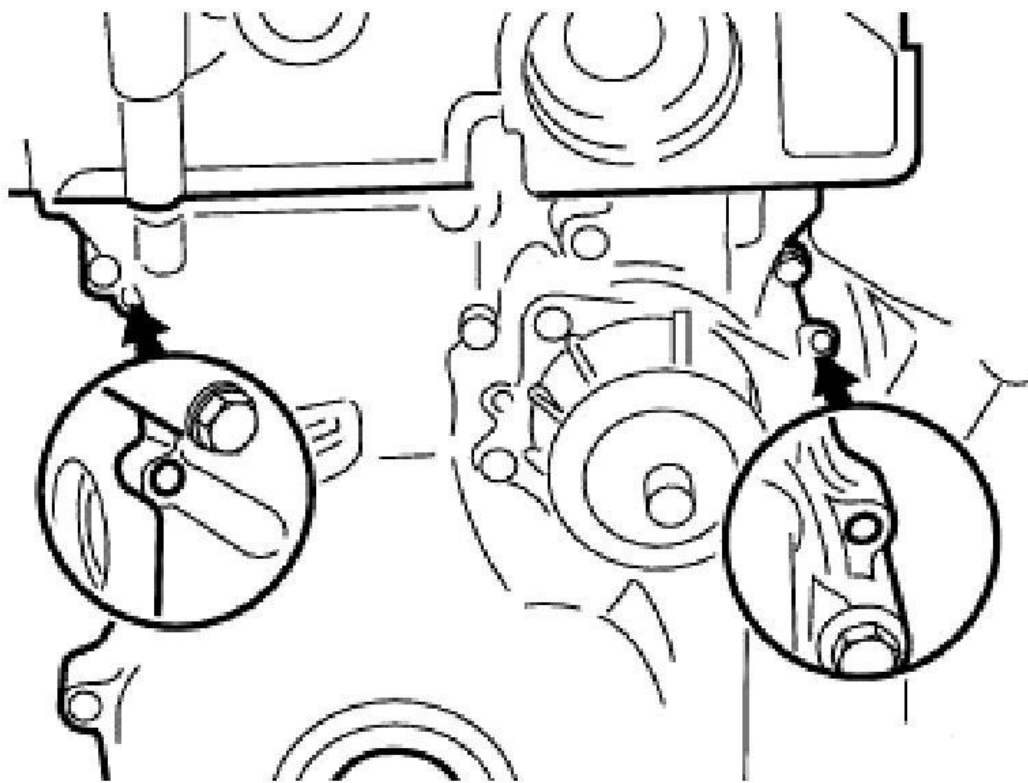


G03310242

Fig. 75: Installing Timing Case Cover
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Drive in dowel pins from front until flush.



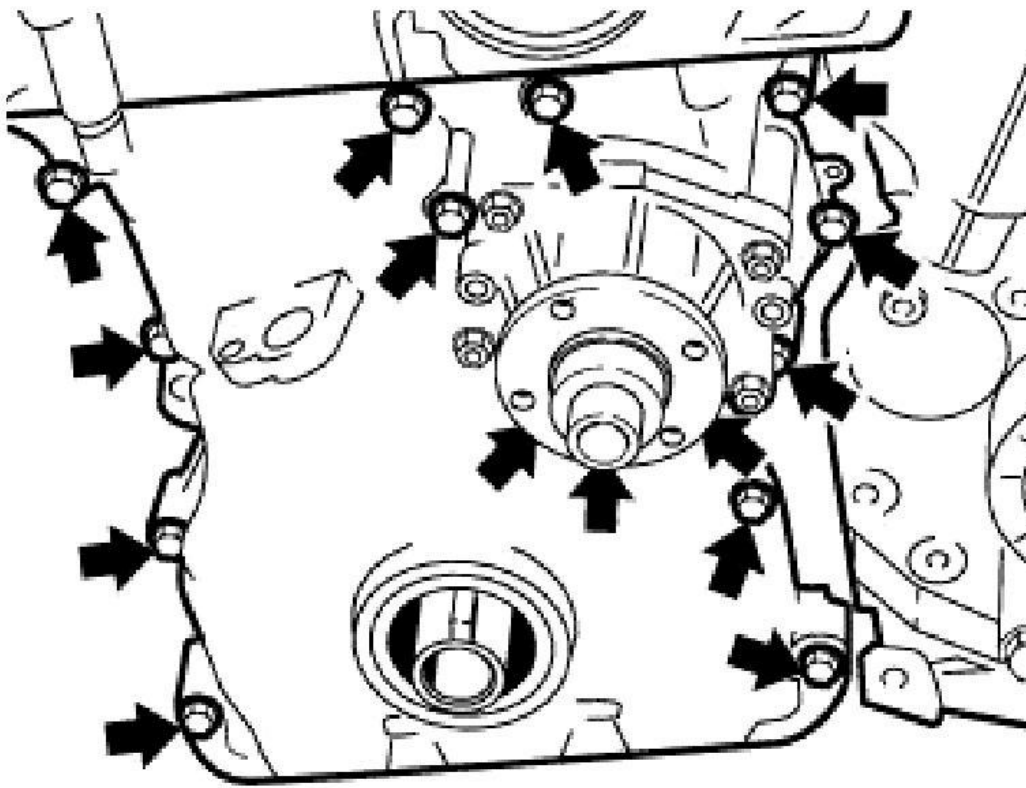
G03310243

Fig. 76: Driving In Dowel Pins

Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Fully tighten all screws in alternate sequence.



G03310244

Fig. 77: Tightening Screws

Courtesy of BMW OF NORTH AMERICA, INC.

Tightening torque, 11 14 1AZ. Refer to **ENGINE - TIGHTENING TORQUES**.**IMPORTANT:** Once all screws have been tightened down, retighten them in a second operation.

Insert screws, tighten screw connection for timing case cover to cylinder head.

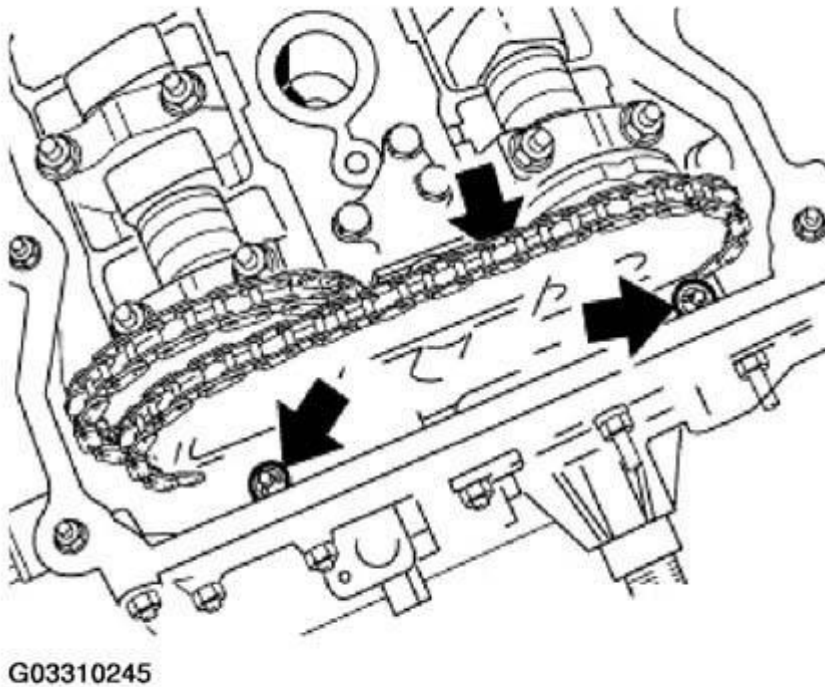


Fig. 78: Tightening Screw Connection For Timing Case Cover
 Courtesy of BMW OF NORTH AMERICA, INC.

Replace radial seal in lower timing case cover. Refer to **11 14 141 REPLACING RADIAL SEAL IN LOWER TIMING CASE COVER.**

Assemble engine.

11 14 141 REPLACING RADIAL SEAL IN LOWER TIMING CASE COVER

Special tools required:

- 11 2 380
- 11 2 383
- 11 2 385
- 11 3 280

NOTE: This repair instruction is valid for the following engines:

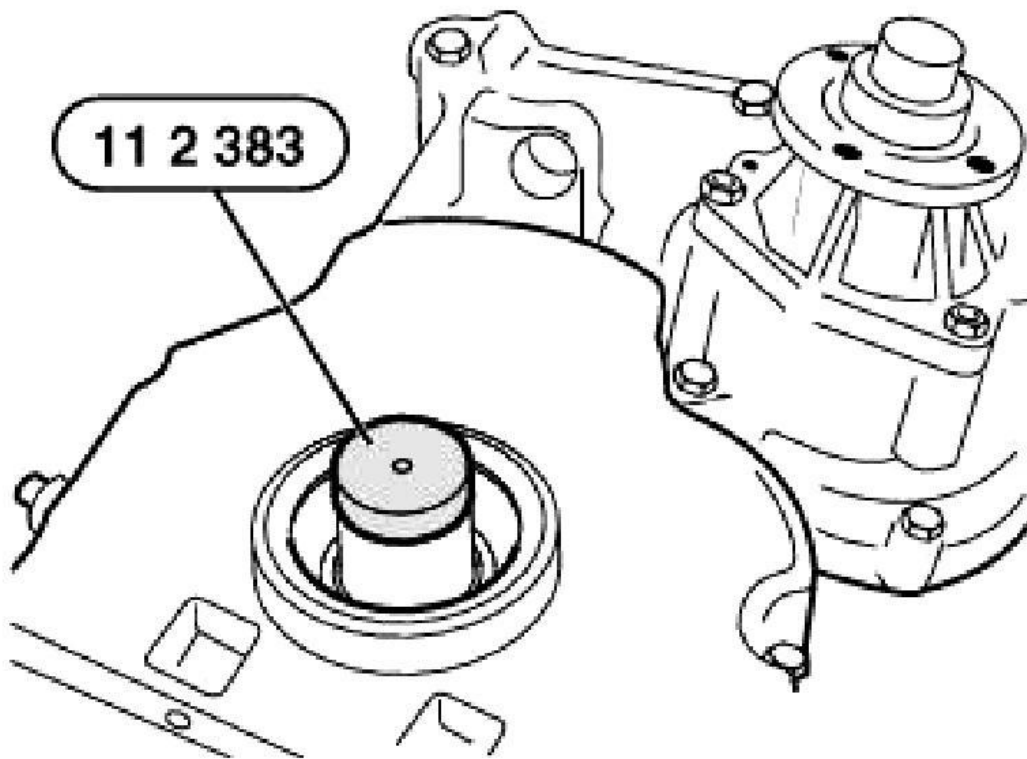
- M50/M52/M52TU/M54/M56
- S52

Remove vibration damper. Refer to **11 23 010 REMOVING AND INSTALLING OR REPLACING**

VIBRATION DAMPER (M52TU / M54 / M56).

NOTE: Version where vibration damper and hub are two parts:
Remove hub for vibration damper.

Fit special tool 11 2 383 to crankshaft.



G03310246

Fig. 79: Fitting Special Tool To Crankshaft
Courtesy of BMW OF NORTH AMERICA, INC.

Fit special tool 11 2 385 to crankshaft.

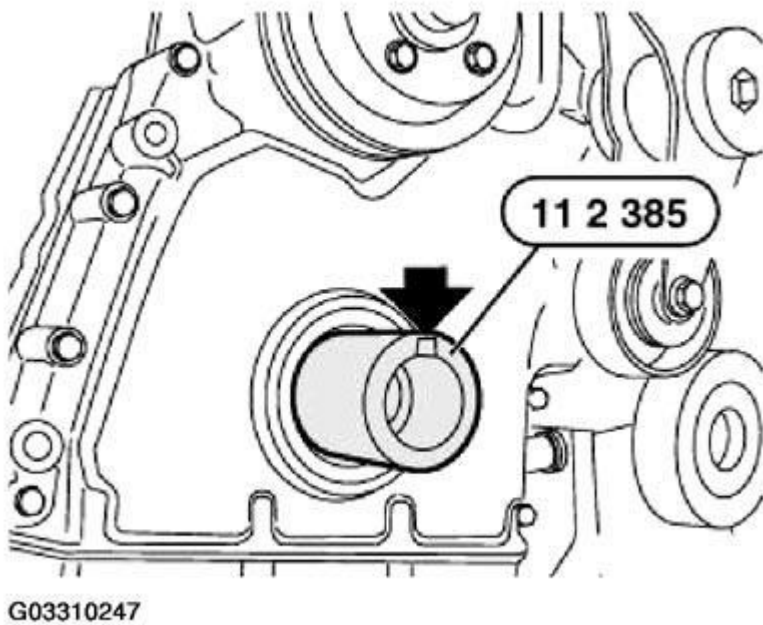


Fig. 80: Aligning Groove Of Special Tool

Courtesy of BMW OF NORTH AMERICA, INC.

Align groove of special tool 11 2 385 to featherkey of crankshaft.

NOTE: Special tool 11 2 385 centers special tool 11 2 380.

Screw in special tool 11 2 380 until it has made firm contact with radial seal.

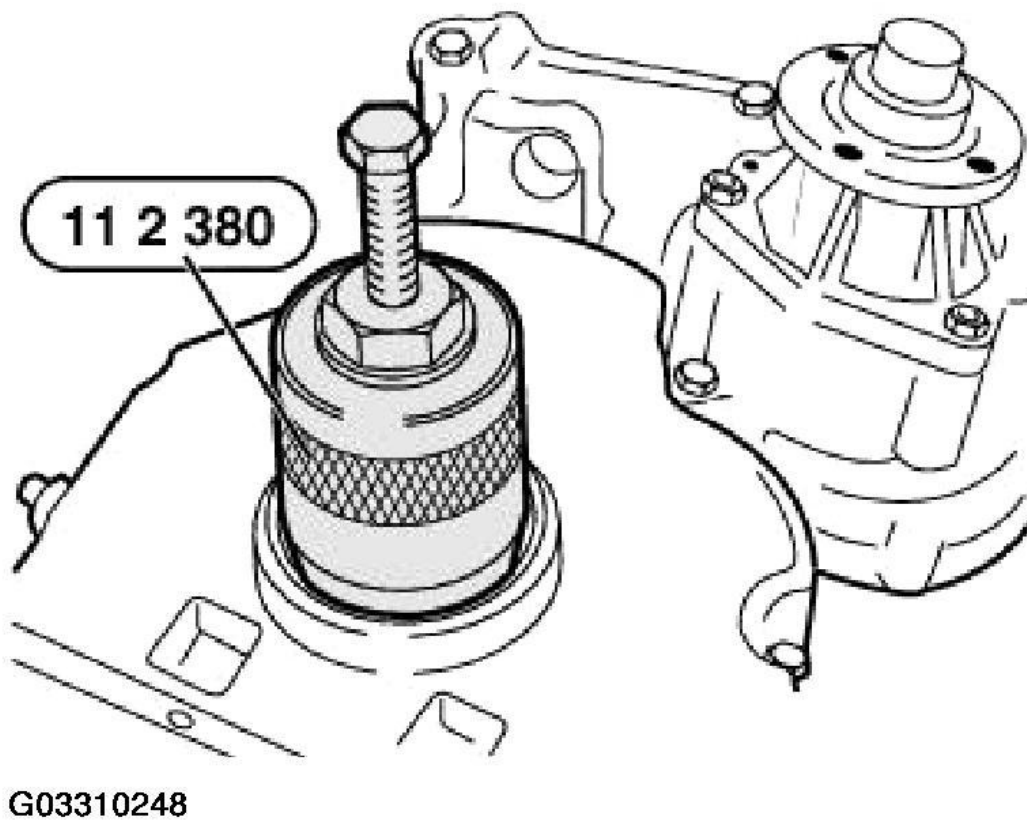


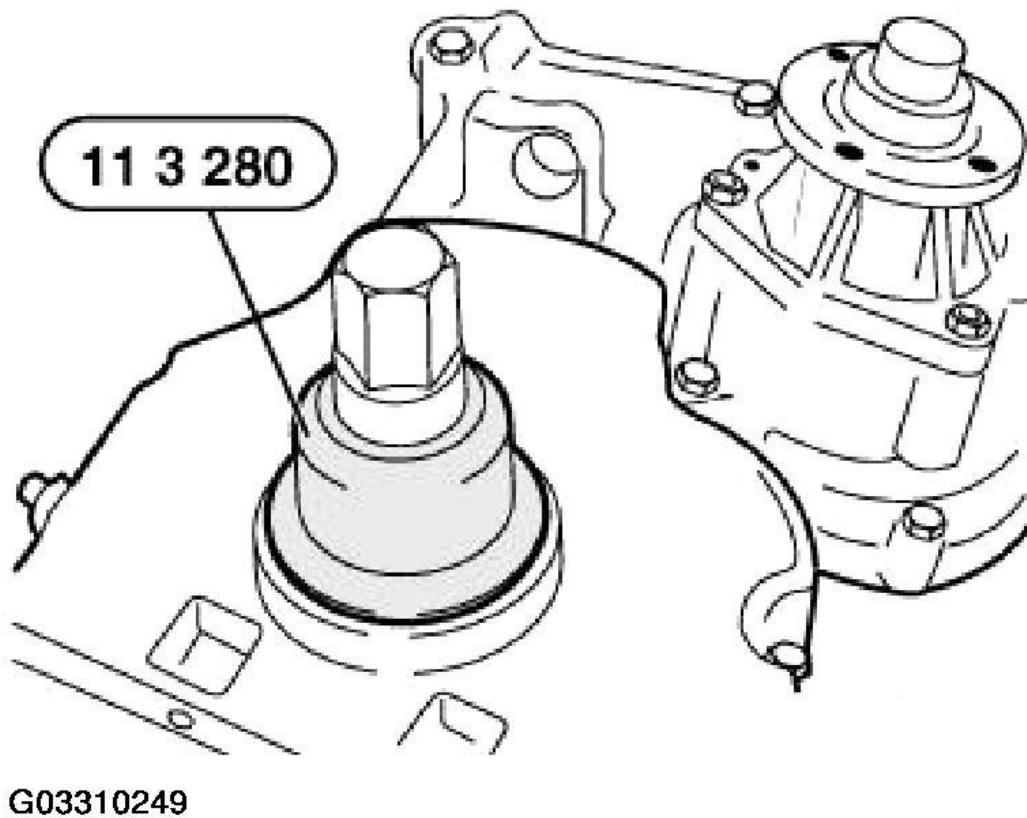
Fig. 81: Removing Radial Seal
Courtesy of BMW OF NORTH AMERICA, INC.

Remove radial seal by tightening screw on special tool.

Installation:

Coat sealing lips of new radial sealing ring with oil.

Using special tool 11 3 280 and centering screw, install new radial seal flush with timing case cover.

**Fig. 82: Installing Radial Seal**

Courtesy of BMW OF NORTH AMERICA, INC.

11 14 151 REPLACING CRANKSHAFT RADIAL SEAL (TRANSMISSION SIDE)**NOTE:** This repair instruction is valid for the following engines:

- M40 / M42 / M43 / M43TU / M44
- M50/M52/M52TU/M54/M56
- S52 / S54

Necessary preliminary tasks:

- Remove gearbox
- Drain off engine oil
- Remove flywheel

Unfasten oil sump screws on transmission end.

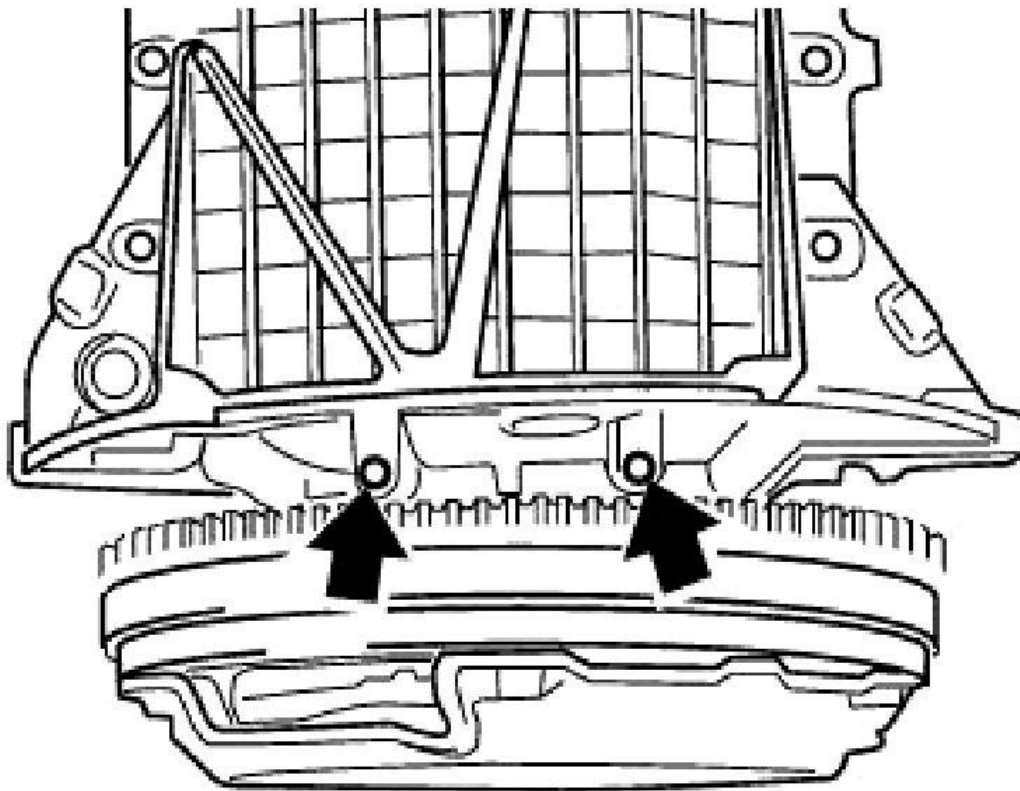
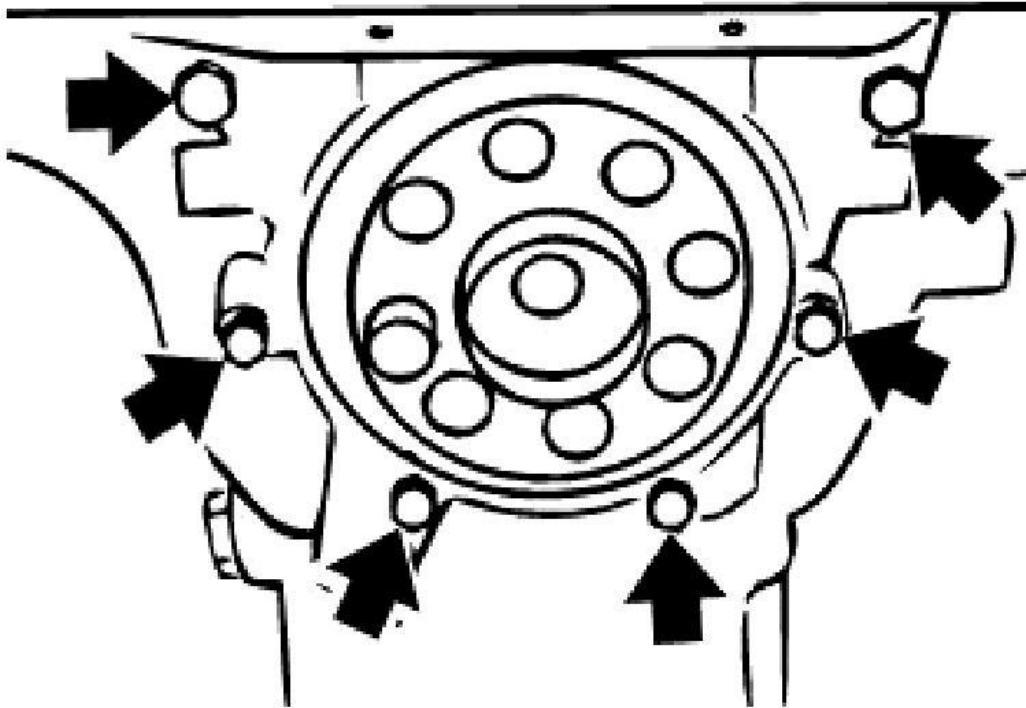
**G03310250**

Fig. 83: Unfastening Oil Sump Screws On Transmission End
Courtesy of BMW OF NORTH AMERICA, INC.

Loosen oil pan.

Release screws in end cover at rear.



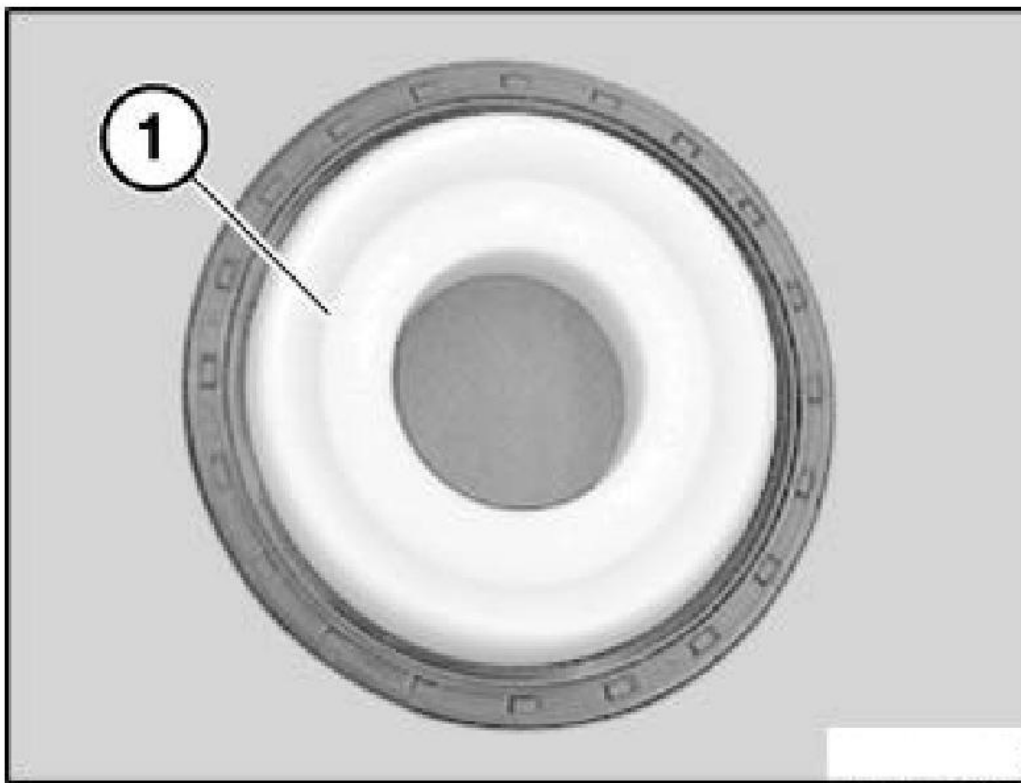
G03310251

Fig. 84: Releasing Screws In End Cover At Rear
Courtesy of BMW OF NORTH AMERICA, INC.

Carefully detach oil sump gasket from end cover, remove end cover.

NOTE: After removing end cover: check oil sump gasket for damage.
If necessary, remove oil sump and replace oil sump gasket.

NOTE: As from 4/98, a new type of radial seal is used in the Series and as a replacement. This radial seal may only be supported with a "support bushing". If the radial seal is supported without the support bushing (1) for more than six months, operational reliability will no longer be assured and the radial seal must not be used any further.



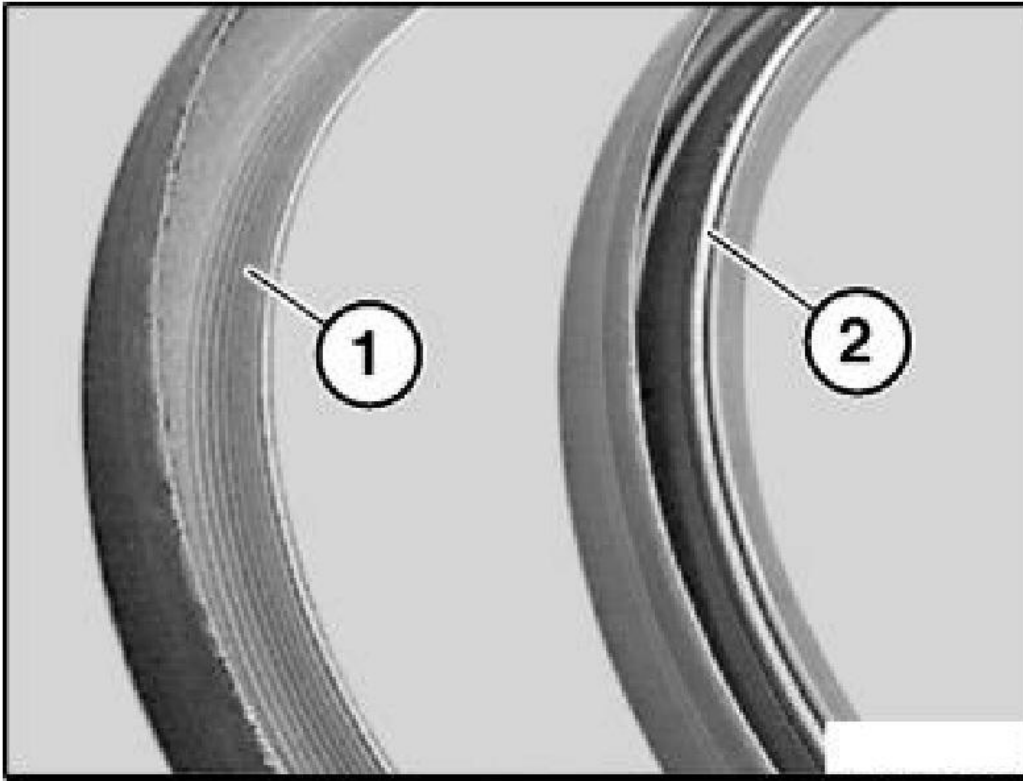
G03310252

Fig. 85: Identifying Radial Seal

Courtesy of BMW OF NORTH AMERICA, INC.

Distinguishing feature:

1. New version "without hose spring"
2. Old version "with hose spring"



G03310253

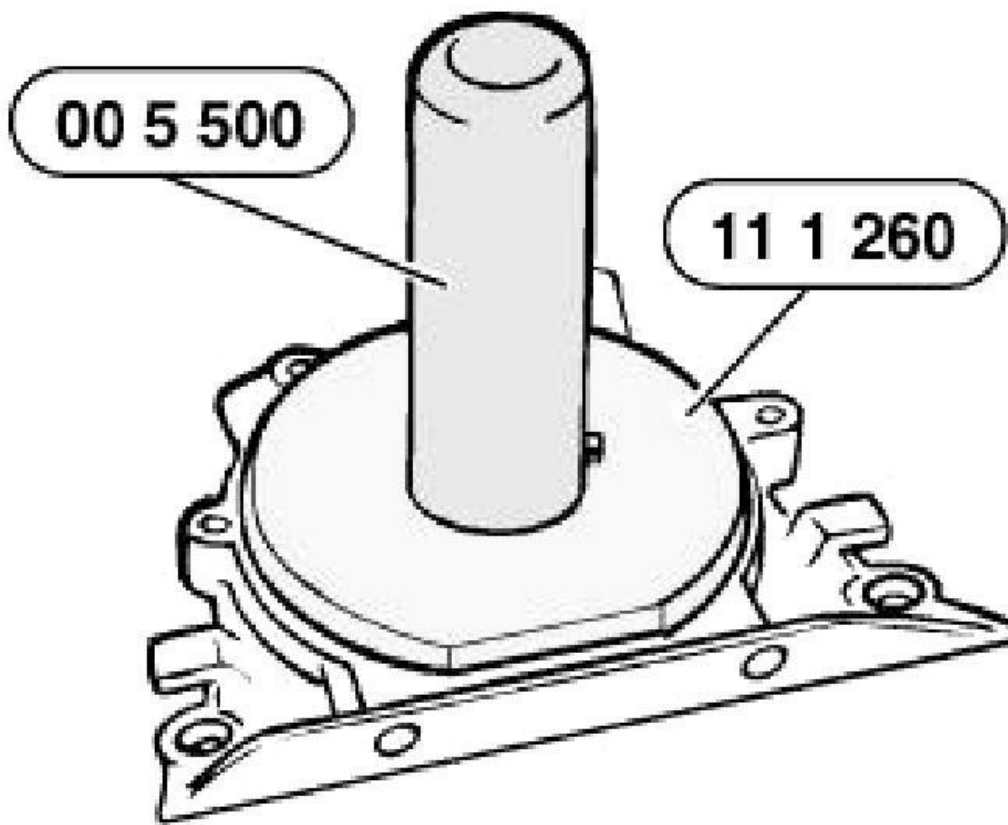
Fig. 86: Identifying Sealing Lip Versions

Courtesy of BMW OF NORTH AMERICA, INC.

IMPORTANT: The sealing lip of the new version (1) is very sensitive and must not be kinked under any circumstances. Do not touch the sealing lip with your fingers.

NOTE: The end cover is offered in the kit with a radial seal.

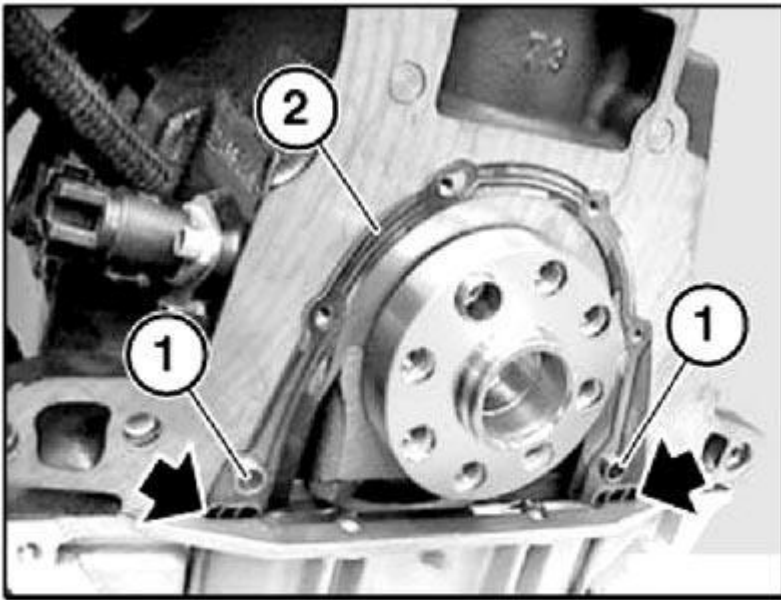
If necessary, lift out the radial sealing ring and drive in new sealing ring using special tool 11 1 260 in conjunction with special tool 00 5 500.



G03310254

Fig. 87: Installing Radial Sealing Ring
Courtesy of BMW OF NORTH AMERICA, INC.

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



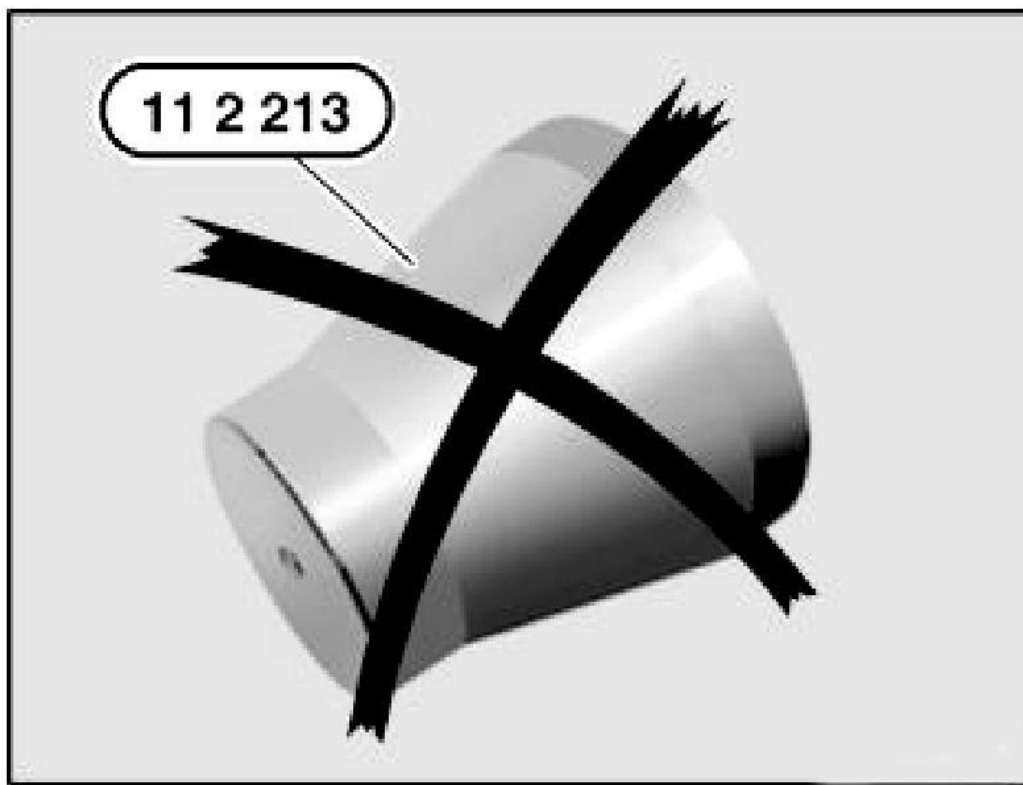
G03310255

Fig. 88: Checking Dowel Sleeves**Courtesy of BMW OF NORTH AMERICA, INC.**

Replace seal (2).

Apply thin, uniform coat of Drei Bond 1209 sealing compound (refer to BMW Parts Service) to edges of joint on oil pan.

IMPORTANT: Do not use special tool 11 2 213 for the new radial seal version.

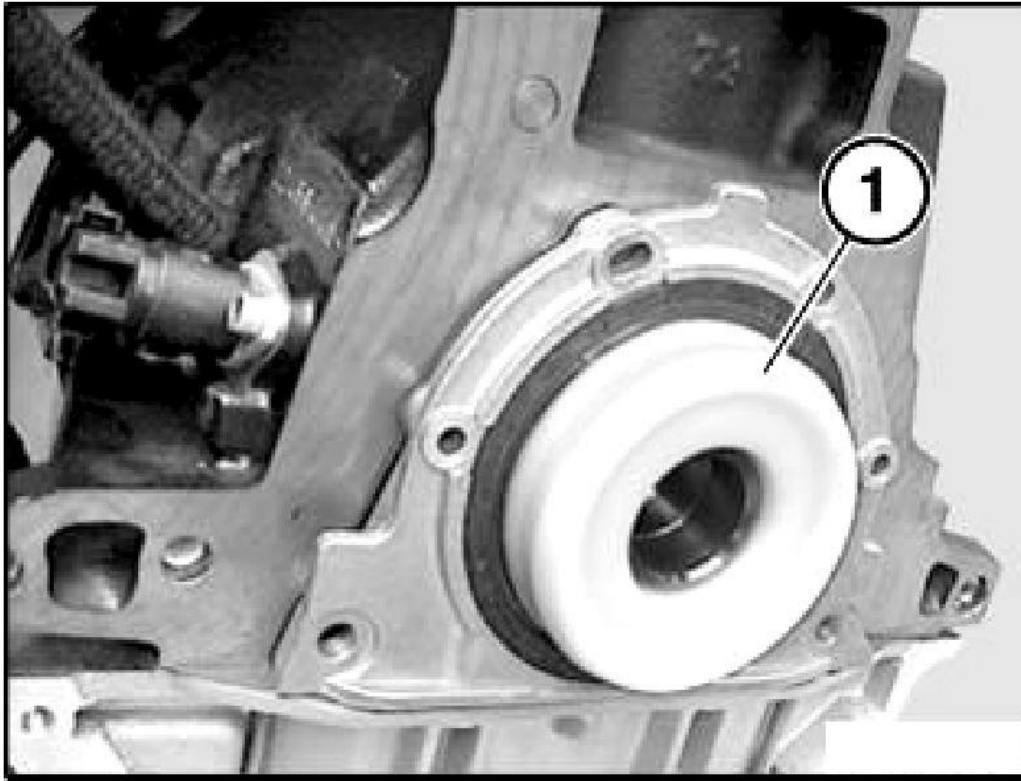


G03310256

Fig. 89: View Of Special Tool

Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: When fitting the end cover with radial seal on the crankshaft, it is only permitted to use the "support bushing (1)" as an installation tool.



G03310257

Fig. 90: Identifying Support Bushing

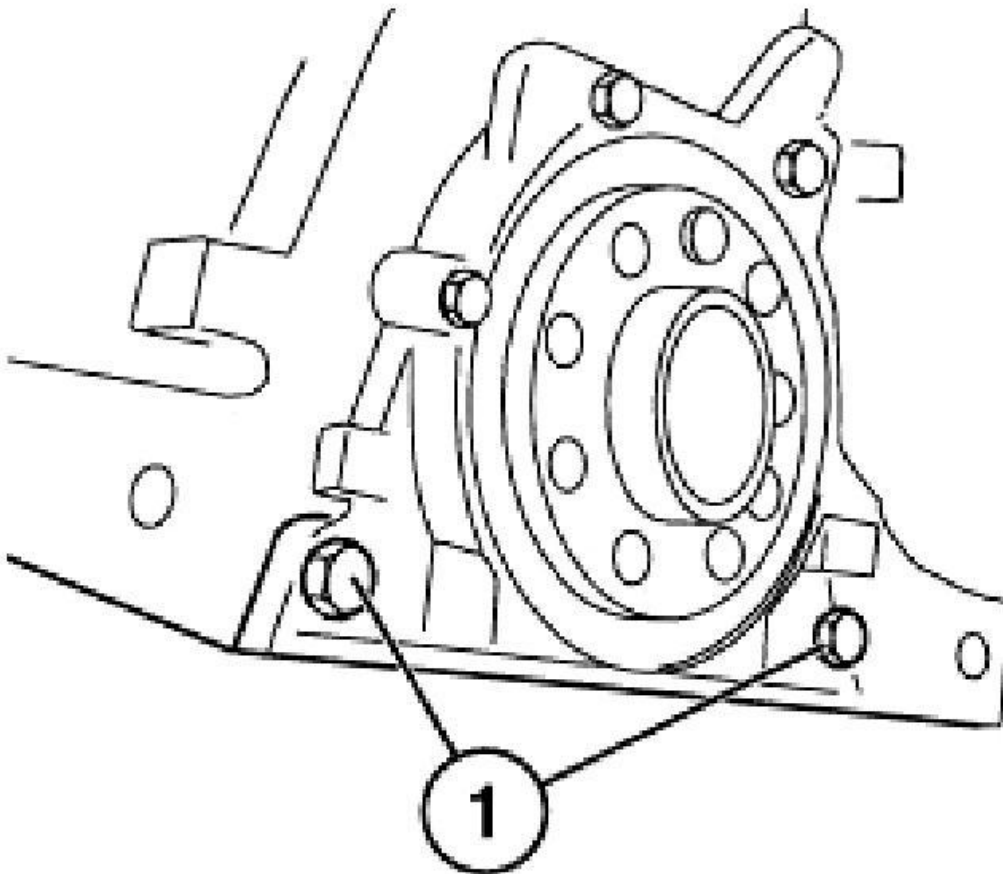
Courtesy of BMW OF NORTH AMERICA, INC.

Lubricate contact face of crankshaft.

IMPORTANT: Push on end cover with support bushing (1) straight and without tilting sideways.

NOTE: Screw threads (1) are coated with sealing compound.

Replace screws (1).



G03310258

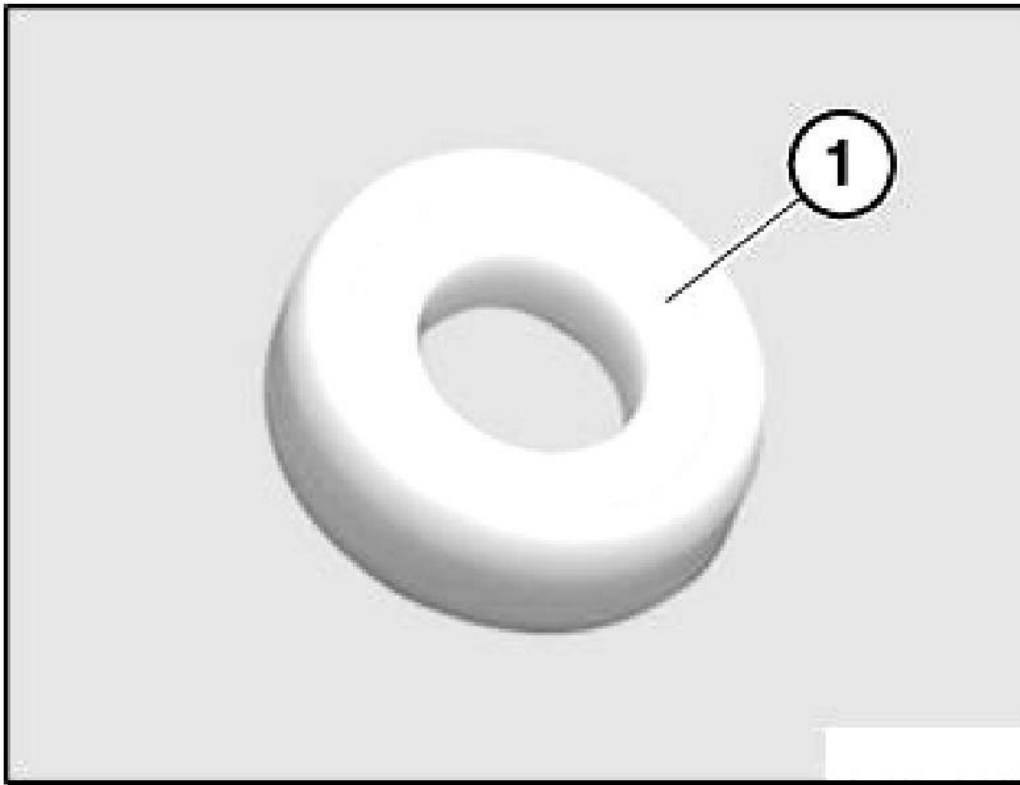
Fig. 91: Locating Screws

Courtesy of BMW OF NORTH AMERICA, INC.

Insert all screws and tighten down end cover.

NOTE: Keep the support bushing (1) of the new radial seal version as a "special tool", then render the special tool 11 2 213 unusable and dispose of it.

The old and new radial seal versions can be installed with the support bushing (1).



G03310259

Fig. 92: View Of Support Bushing

Courtesy of BMW OF NORTH AMERICA, INC.

CRANK SHAFT WITH BEARING

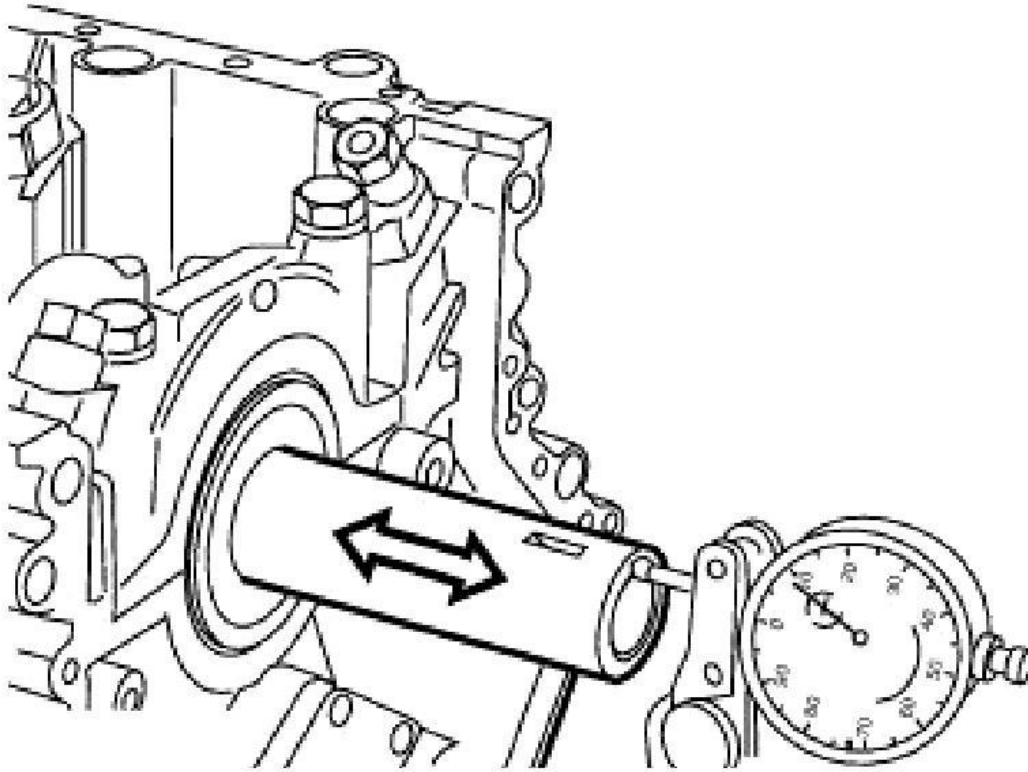
11 21 500 REPLACING CRANKSHAFT (M52 / S52 / M52TU / M54 / M56)

(engine removed)

Necessary preliminary tasks:

- Removing cylinder head
- Removing lower timing case cover
- Removing all pistons, refer to **11 25 530 REMOVING AND INSTALLING OR REPLACING ALL PISTONS (M52 / S52 / M52TU / M54 / M56)**
- Remove end cover at rear; this operation is described in the section Replacing crankshaft radial seal. Refer to **11 14 151 REPLACING CRANKSHAFT RADIAL SEAL (TRANSMISSION SIDE)**.

Checking axial clearance:



G03310260

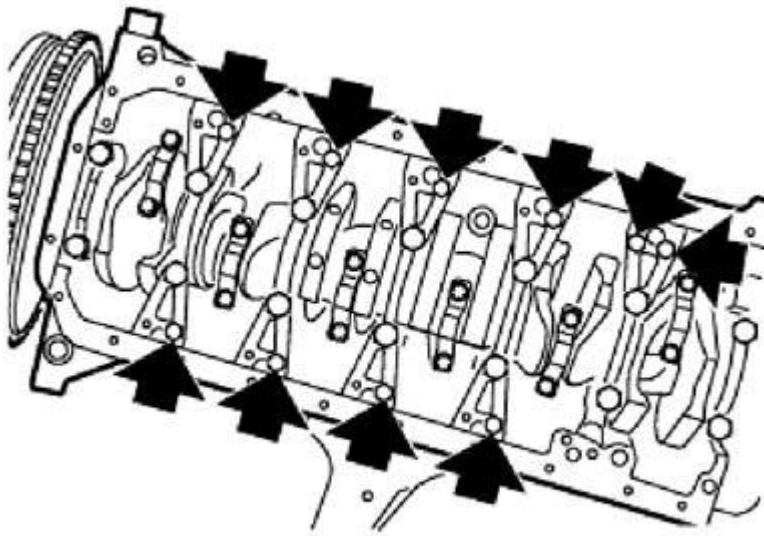
Fig. 93: Checking Axial Clearance

Courtesy of BMW OF NORTH AMERICA, INC.

If permitted end float is exceeded, check crankshaft, guide bearing shells and engine block, replacing if necessary.

End float, refer to **ENGINE - TECHNICAL DATA**

Unfasten screw connection on reinforcement plates.



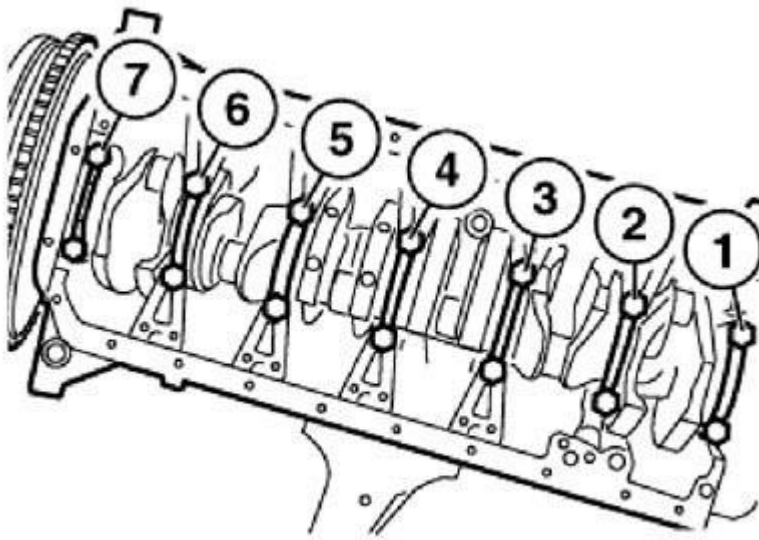
G03310261

Fig. 94: Unfastening Screw Connection On Reinforcement Plates

Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: The reinforcement plates are not fitted on engines with gray cast iron engine blocks or on engines with oil pumps integrated in oil scrapers.

Unfasten screw connection on main bearing.



G03310262

Fig. 95: Removing Main Bearing Caps
Courtesy of BMW OF NORTH AMERICA, INC.

Remove main bearing caps (1 to 7).

Lever out crankshaft.

If necessary, release incremental gear.

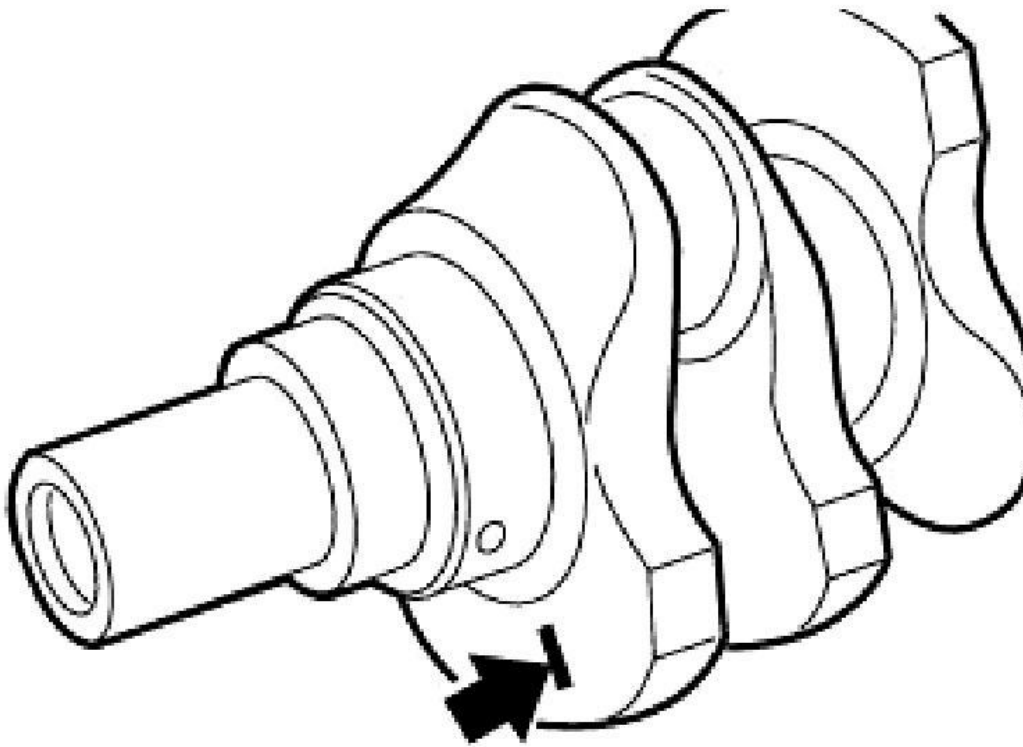
Installation:

Replace screws.

Install screws and tighten down in two passes.

Tightening torque 11 21 1AZ. Refer to **ENGINE - TIGHTENING TORQUES**.

IMPORTANT: Check grinding stage of crankshaft. Refer to **ENGINE - TECHNICAL DATA**.



G03310263

Fig. 96: Checking Grinding Stage Of Crankshaft
Courtesy of BMW OF NORTH AMERICA, INC.

Replace main crankshaft bearing shells. Refer to **11 21 531 REPLACING ALL MAIN CRANKSHAFT BEARING SHELLS (M52 / S52 / M52TU / M54 / M56)**.

Replace conrod bearing shells. Refer to **11 24 571 REPLACING ALL CONNECTING ROD BEARINGS (M52 / S52 / M52TU / M54 / M56)**.

Replace grooved ball bearings in crankshaft. Refer to **11 21 571 REPLACING GROOVED BALL BEARING IN CRANKSHAFT (M52 / S52 / M52TU / M54 / S50 / S54)**.

11 21 531 REPLACING ALL MAIN CRANKSHAFT BEARING SHELLS (M52 / S52 / M52TU / M54 / M56)

Special tools required:

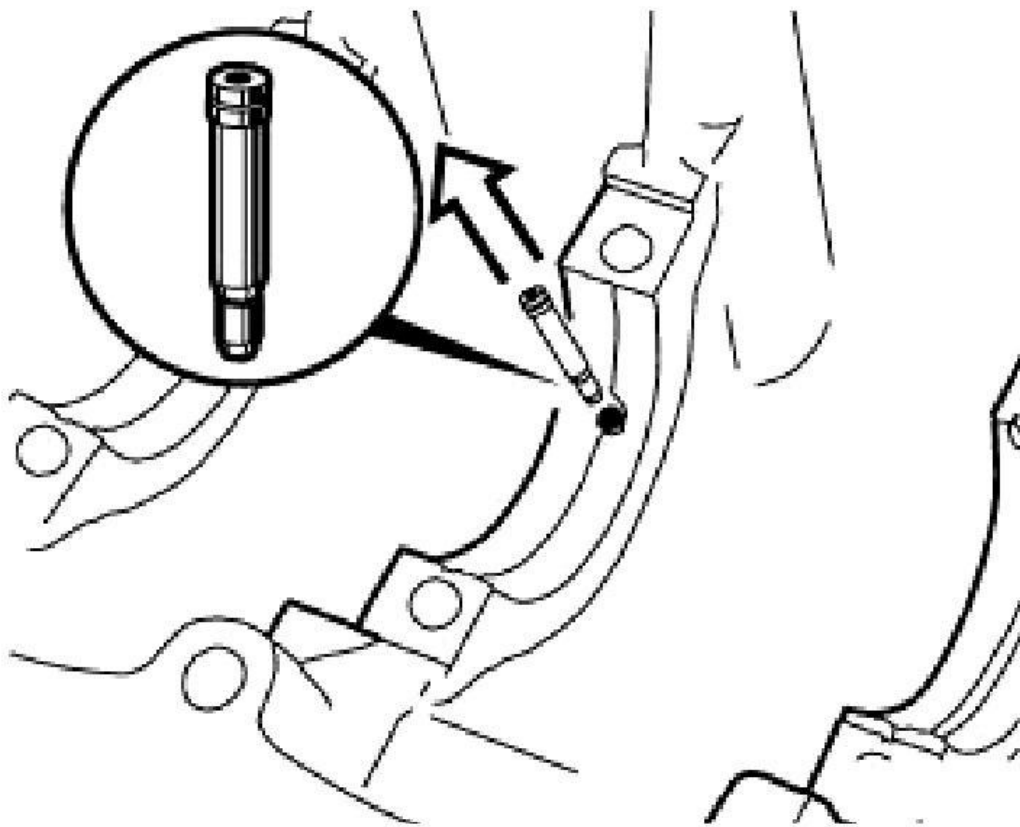
- 00 2 590
- 00 9 120

- 11 2 110

(engine dismantled)

M52 B20/M52TU B20 M54 M22

NOTE: Injection nozzles for cooling the pistons are installed in the bores of bearing seats 2 to 7.

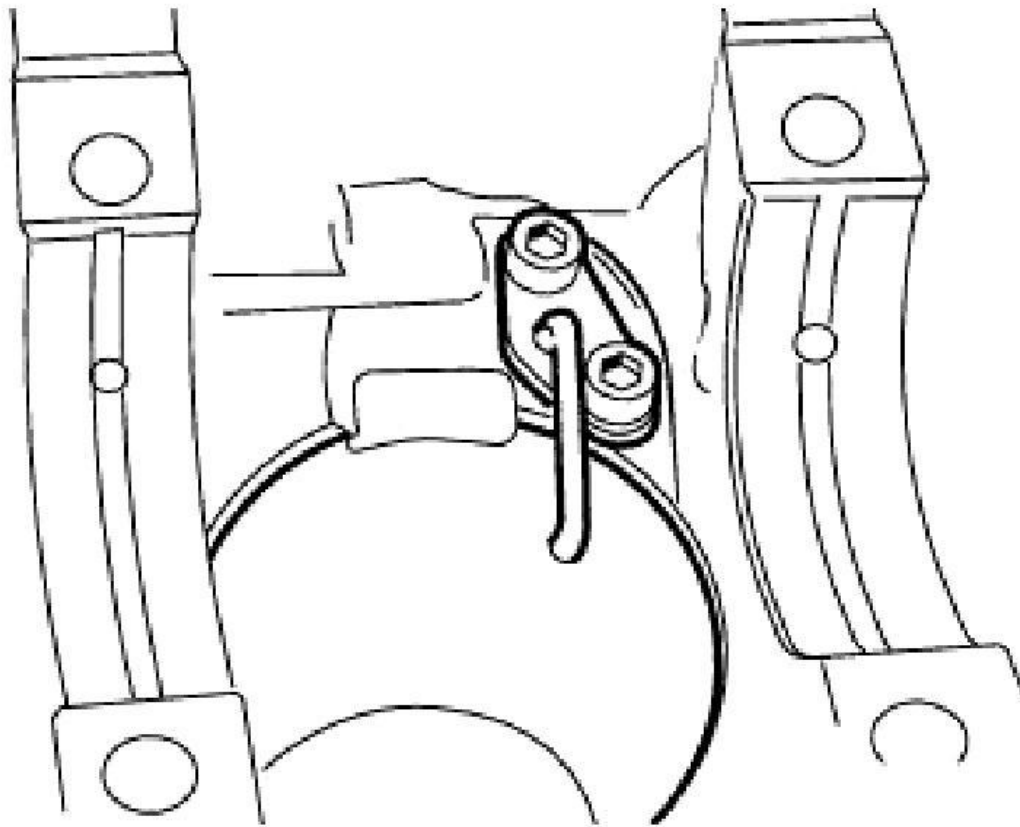


G03310264

Fig. 97: Identifying Injection Nozzles
Courtesy of BMW OF NORTH AMERICA, INC.

M52 B25/B28 S52 M52TU B25/B28 M54 B25/B30 M56

NOTE: Injection nozzles for cooling the pistons are installed on the underside of the cylinder between the bearing seats.



G03310265

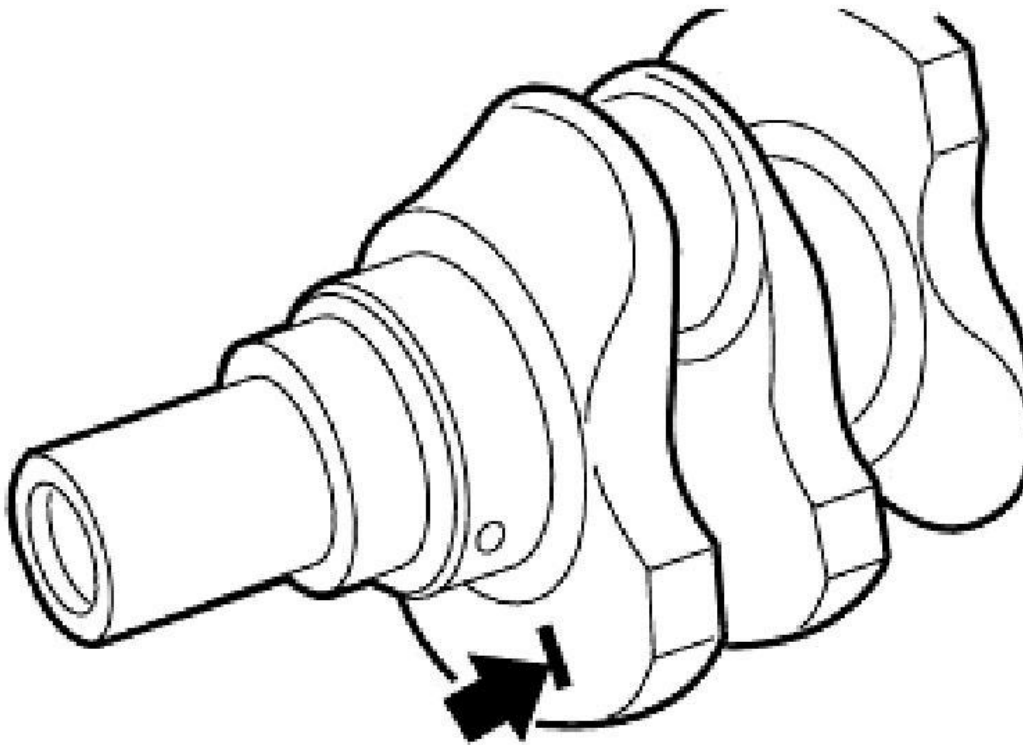
Fig. 98: Identifying Injection Nozzles
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Screw threads are coated with screw securing adhesive (Loctite).

Replace screws.

IMPORTANT: Observe grinding stage of crankshaft. Refer to ENGINE - TECHNICAL DATA .



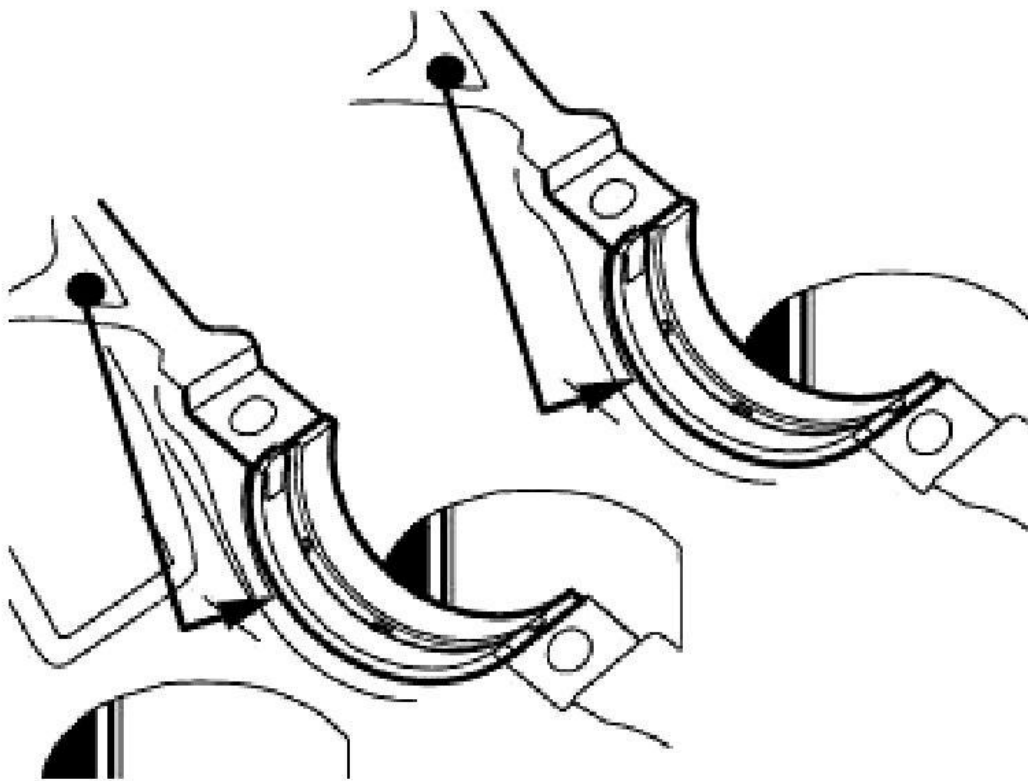
G03310266

Fig. 99: Identifying Grinding Stage Of Crankshaft
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

When replacing the bearing shells (also for replacement crankshaft), classification for bearing shell arrangement in engine block is waived.

Insert bearing shells with yellow color coding in engine block.



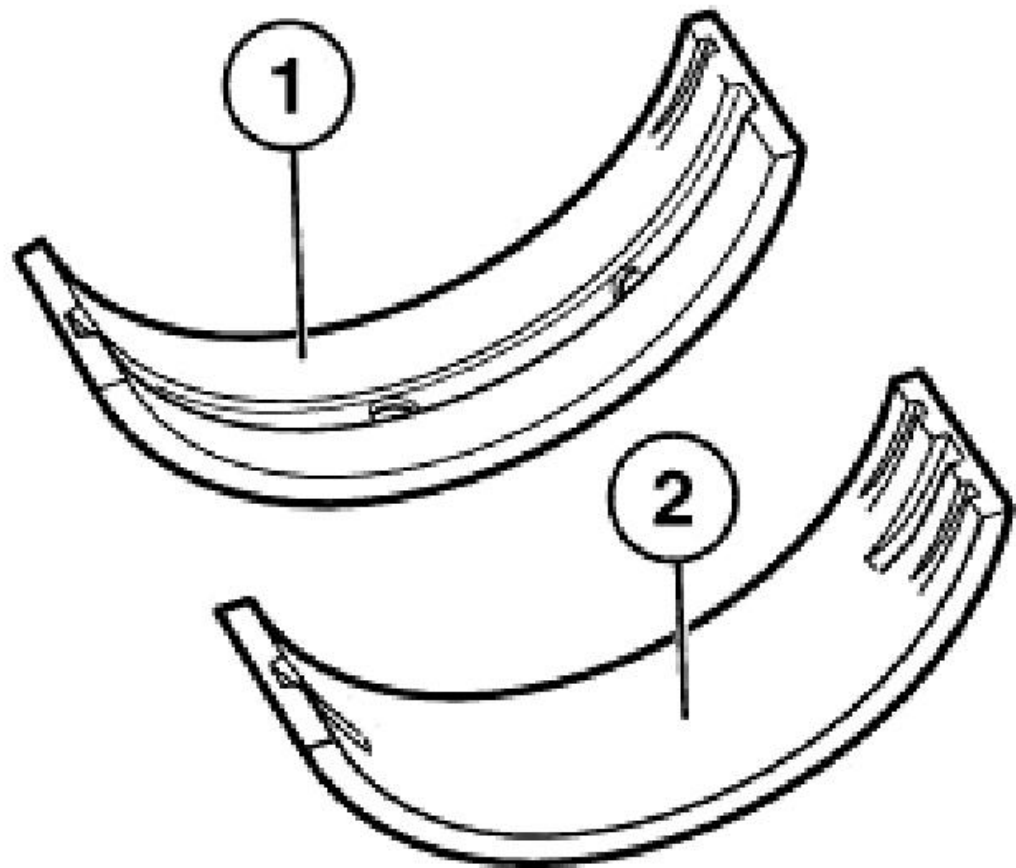
G03310267

Fig. 100: Inserting Bearing Shells

Courtesy of BMW OF NORTH AMERICA, INC.

NOTE:

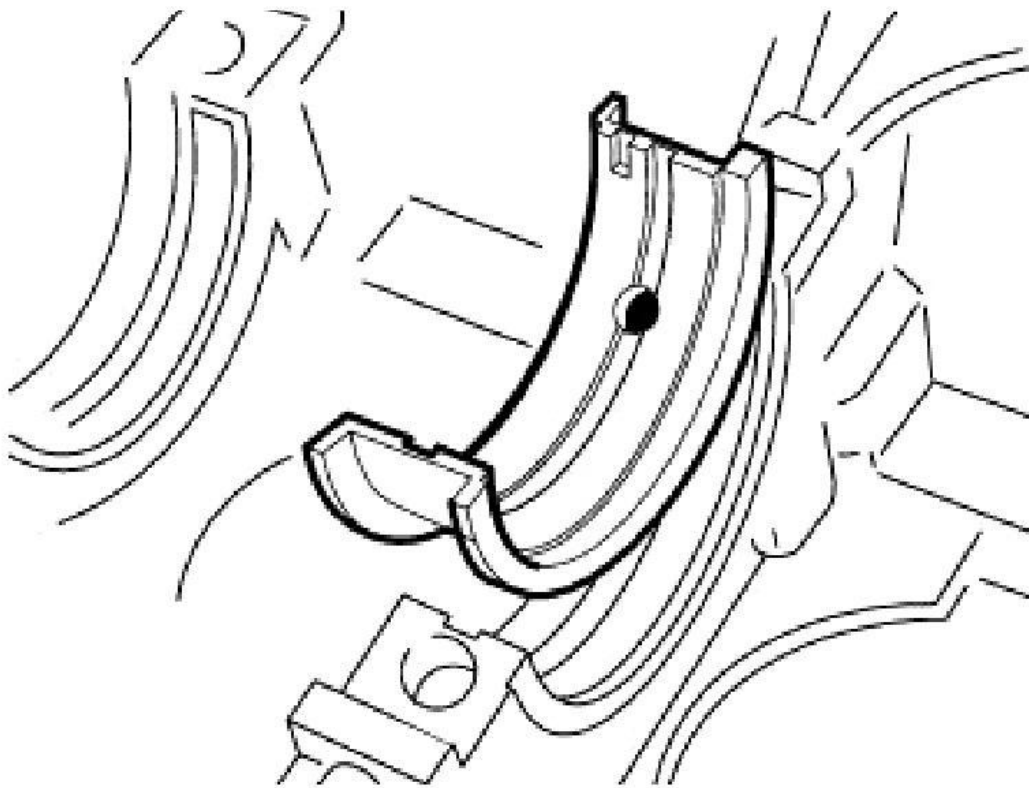
- Install bearing shells with continuous lubricant groove and one retaining lug in engine block.
- Fit bearing shells without continuous lubricant groove and two retaining lugs in bearing cover.



G03310268

Fig. 101: Identifying Bearing Shells
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: The axial guide on the crankshaft is fitted to bearing point 6. Insert pilot bearing shell in the engine block.

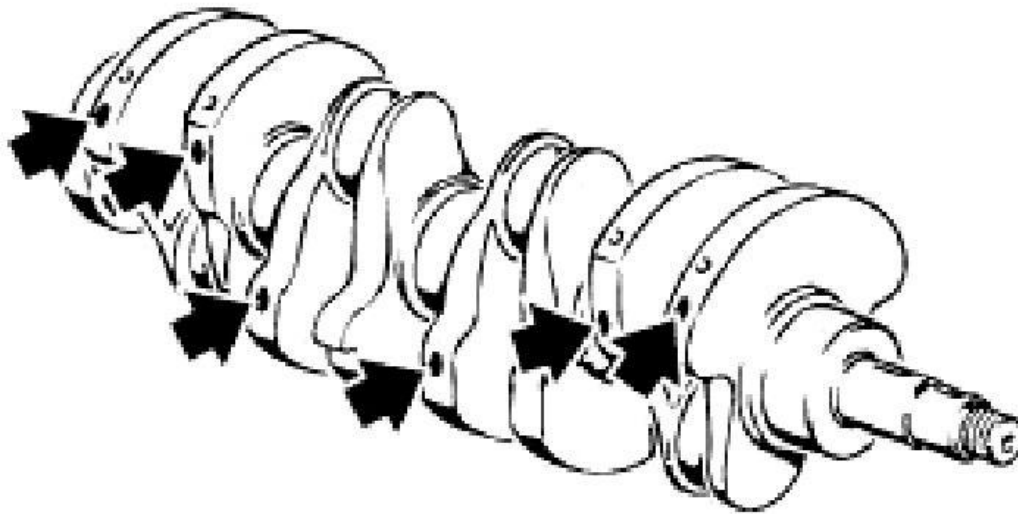


G03310269

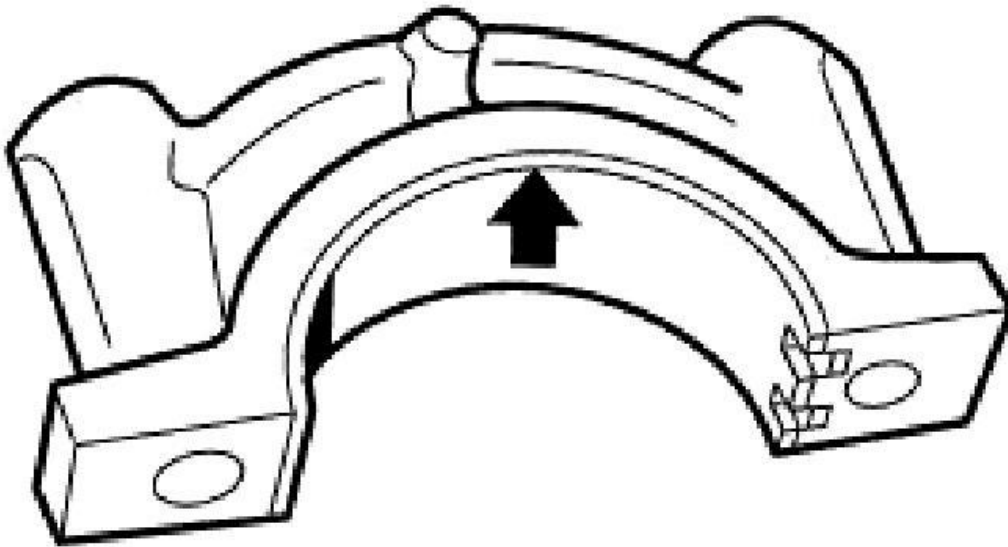
Fig. 102: Inserting Pilot Bearing Shell In Engine Block
Courtesy of BMW OF NORTH AMERICA, INC.

Install crankshaft.

NOTE: The crankshaft is marked with yellow, green or white paint according to the tolerance of the main journal.

**G03310270****Fig. 103: Locating Crankshaft Marks****Courtesy of BMW OF NORTH AMERICA, INC.***Installation:*

The bearing shell classification for the bearing cover is marked on the crankshaft in yellow, green or white paint.



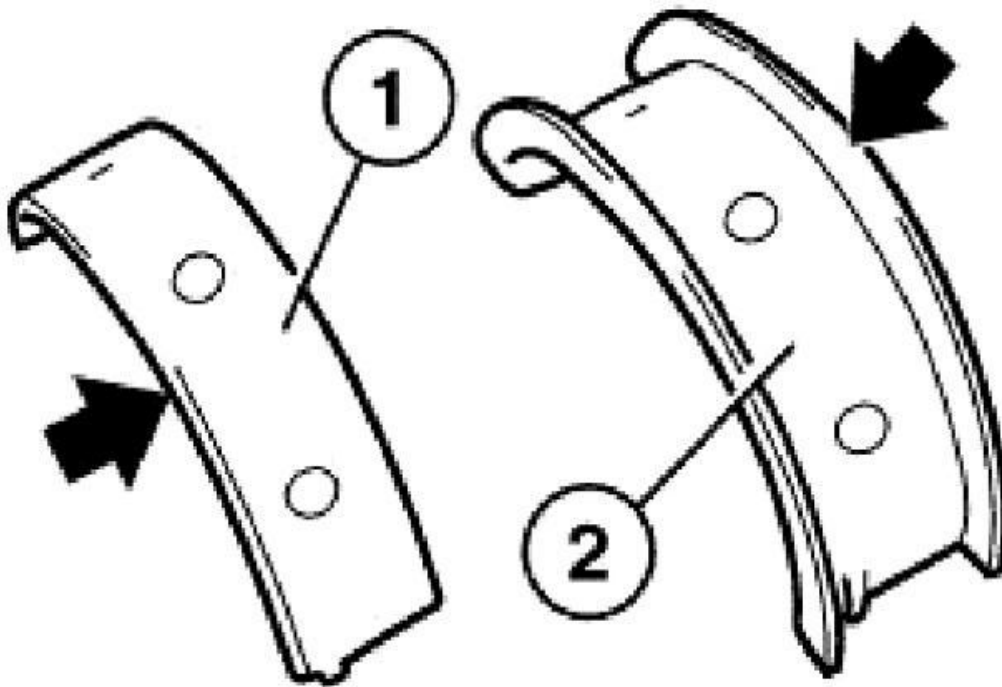
G03310271

Fig. 104: Identifying Bearing Cover Mark
Courtesy of BMW OF NORTH AMERICA, INC.

Insert main bearing shells with same crankshaft color coding in main bearing caps.

The bearing shells are marked with yellow, green or white paint.

1. Bearing shell
2. Guide bearing

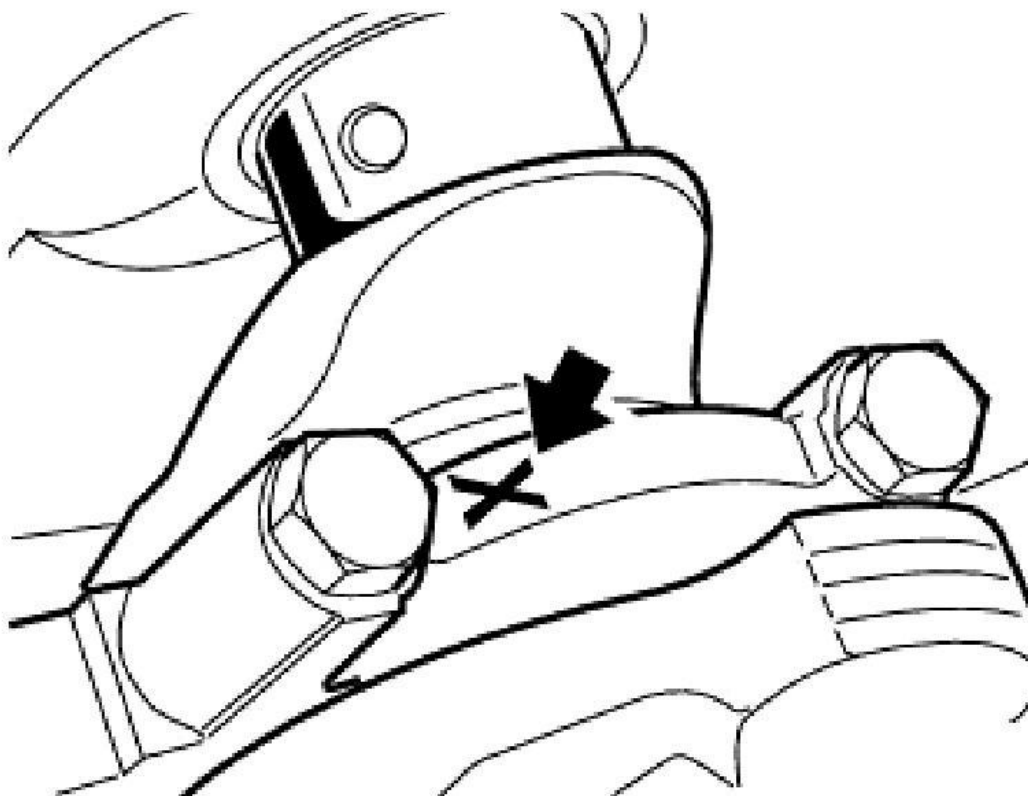


G03310272

Fig. 105: Identifying Bearing Shells Marks
Courtesy of BMW OF NORTH AMERICA, INC.

Observe grinding stage of main bearing journals. Refer to ENGINE - TECHNICAL DATA .

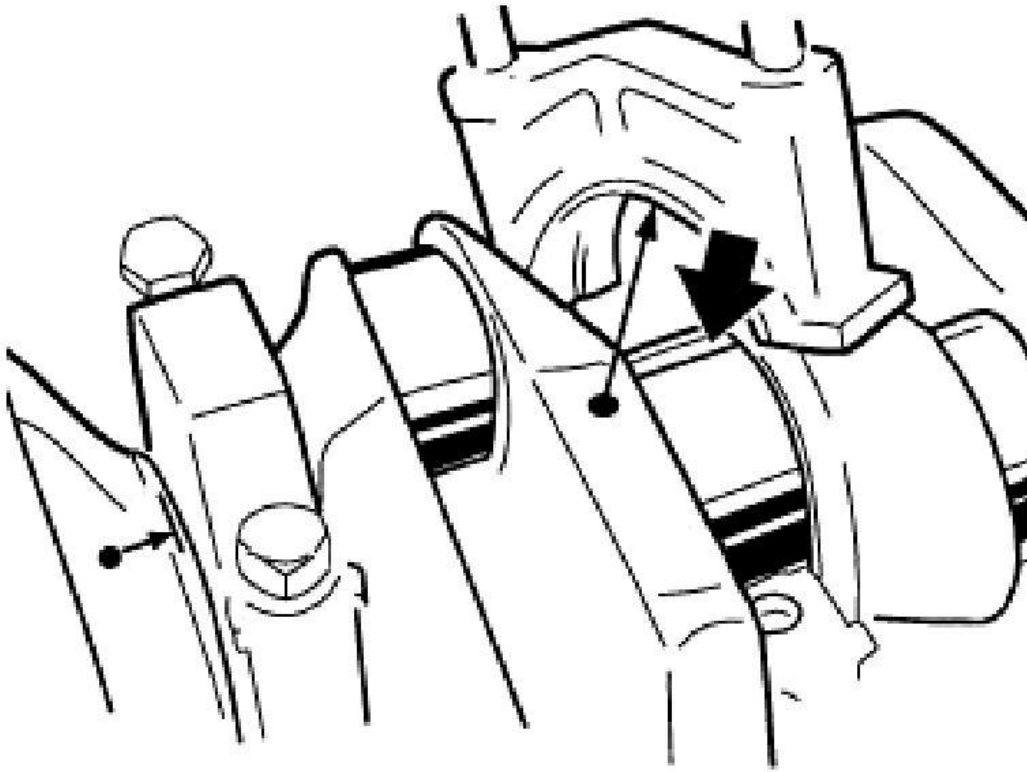
NOTE: **Bearing caps 1 to 5 are marked on exhaust side.**
 Bearing caps 6 and 7 are not designated.
 Bearing cap 6 is a thrust bearing.



G03310273

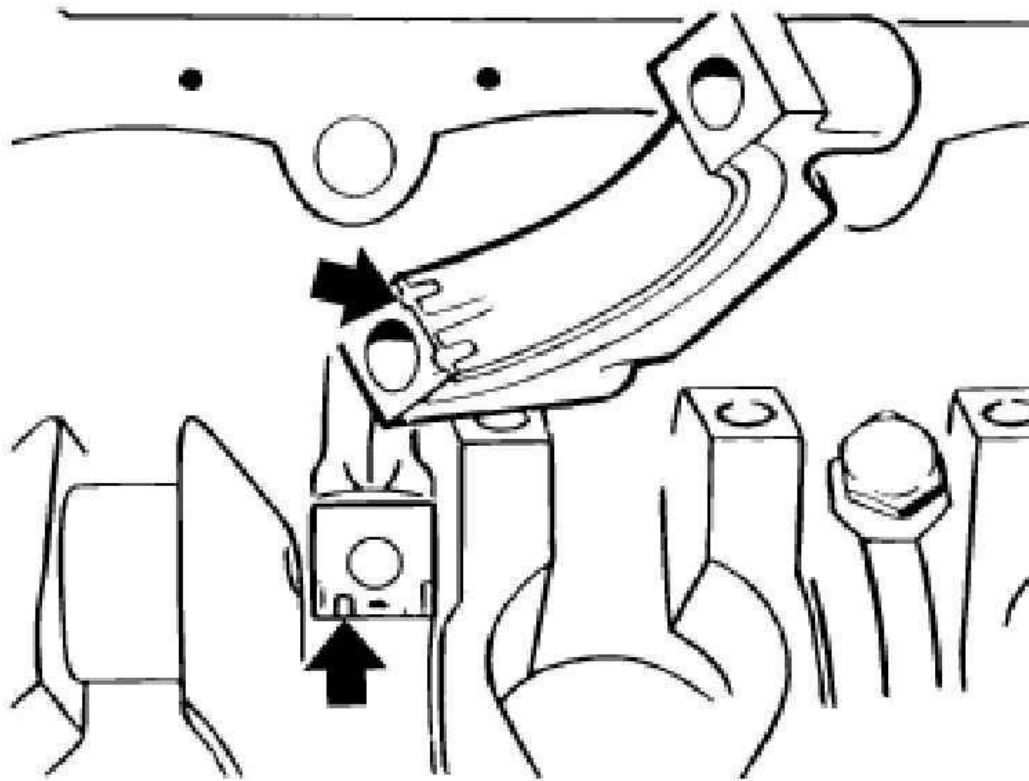
Fig. 106: View Of Bearing Cap Mark
Courtesy of BMW OF NORTH AMERICA, INC.

Check clearance on main crankshaft bearing.

**G03310274****Fig. 107: Checking Clearance****Courtesy of BMW OF NORTH AMERICA, INC.**

Install crankshaft and place special tool 00 2 590 (Plastigage Type PG1) on oil-free crankshaft. Do not twist crankshaft.

Install main bearing cap so that grooves in main bearing shell guide are on one side. Align main bearing cap flush with side of bearing seat.



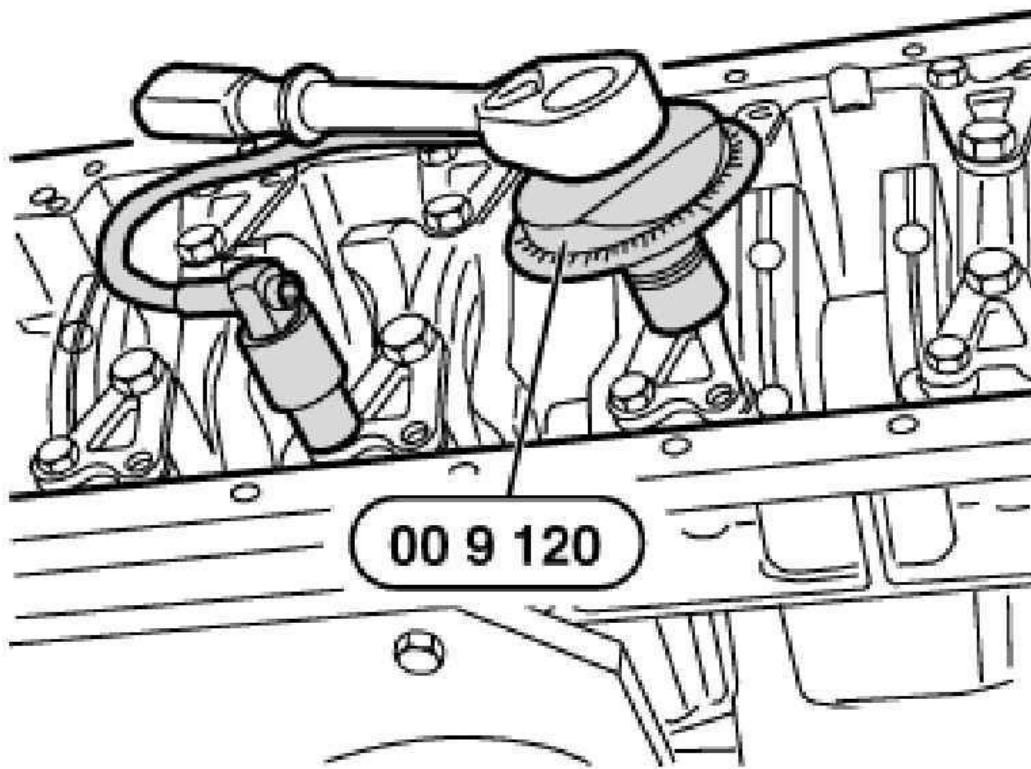
G03260527

Fig. 108: Installing Main Bearing Cap
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

To check main bearing clearance, use the old main bearing screws. There must be no oil in the blind holes (risk of cracking).

1. Tighten down main bearing screws with jointing torque.
2. Tighten down main bearing bolts with special tool 00 9 120 to angle of rotation.



G03260525

Fig. 109: Tightening Down Main Bearing Bolts
Courtesy of BMW OF NORTH AMERICA, INC.

Tightening torque, 11 11 1AZ. Refer to **ENGINE - TIGHTENING TORQUES** .

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



G03260526

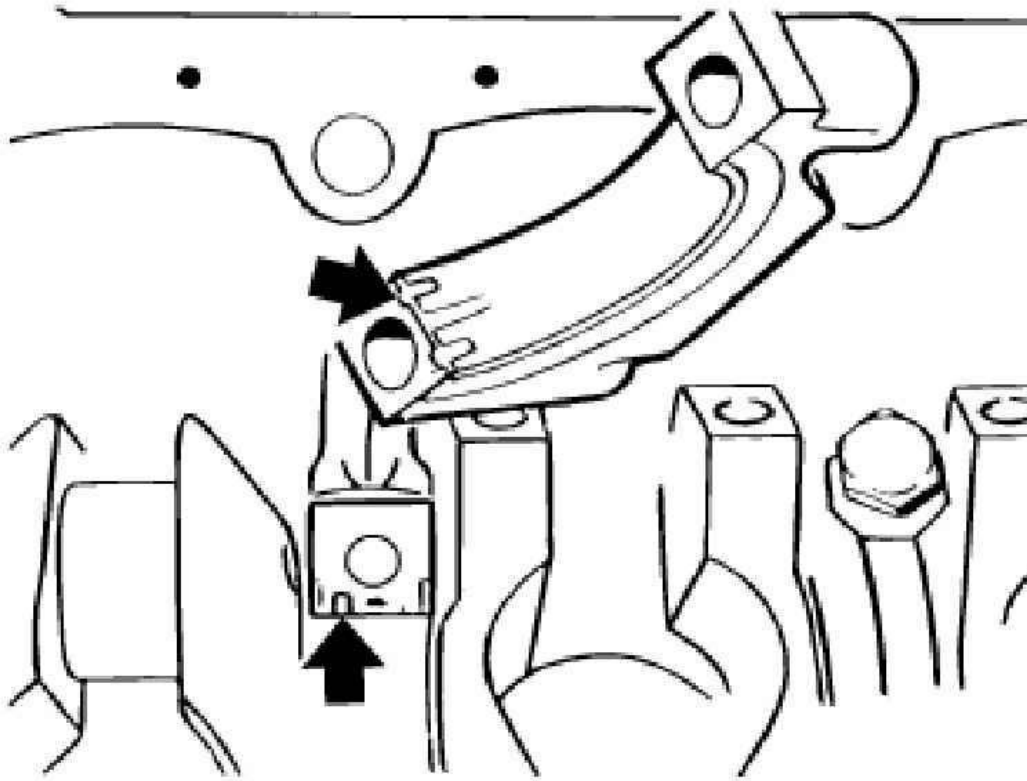
Fig. 110: Reading Off Bearing Clearance
Courtesy of BMW OF NORTH AMERICA, INC.

Radial crankshaft bearing clearance, refer to **ENGINE - TECHNICAL DATA**.

If necessary, to correct bearing clearance, fit new bearing shells with a different color coding.

Remove plastic thread. Coat main bearing shells and crankshaft with engine oil.

Install main bearing cap so that grooves in main bearing shell guide are on one side.



G03260527

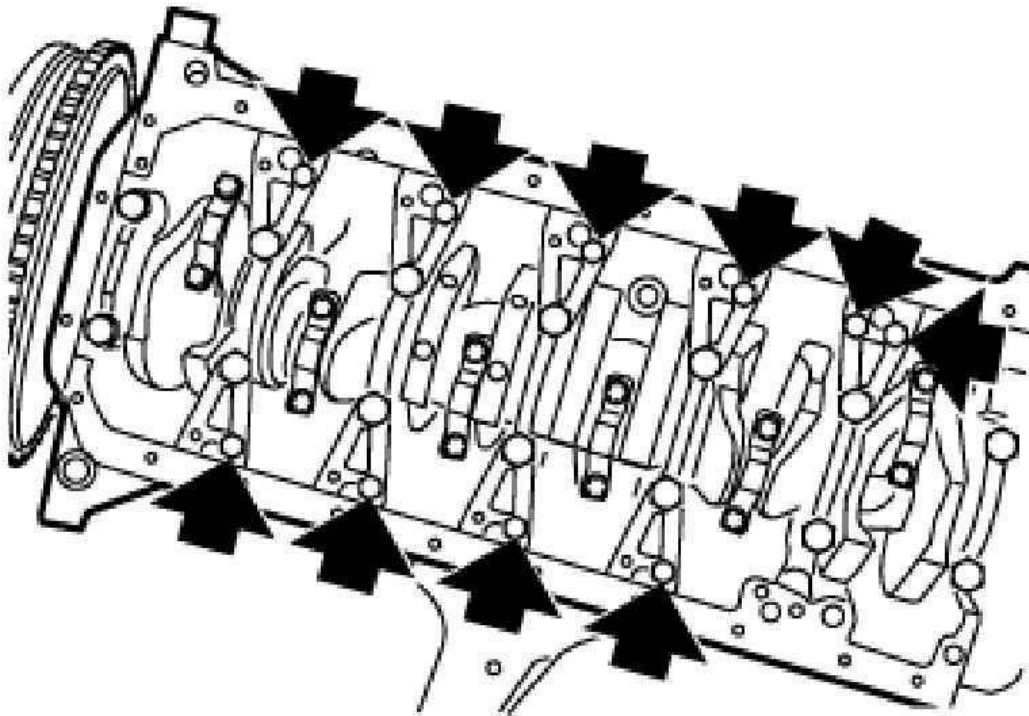
Fig. 111: Installing Main Bearing Cap
Courtesy of BMW OF NORTH AMERICA, INC.

Align main bearing cap flush with side of bearing seat.

Installation:

Always replace bolts of main bearing cap with new bolts. There must be no oil in the blind holes (risk of cracking).

NOTE: The reinforcement plates are not fitted on engines with gray cast iron engine blocks or on engines with oil pumps integrated in oil scrapers.



G03260528

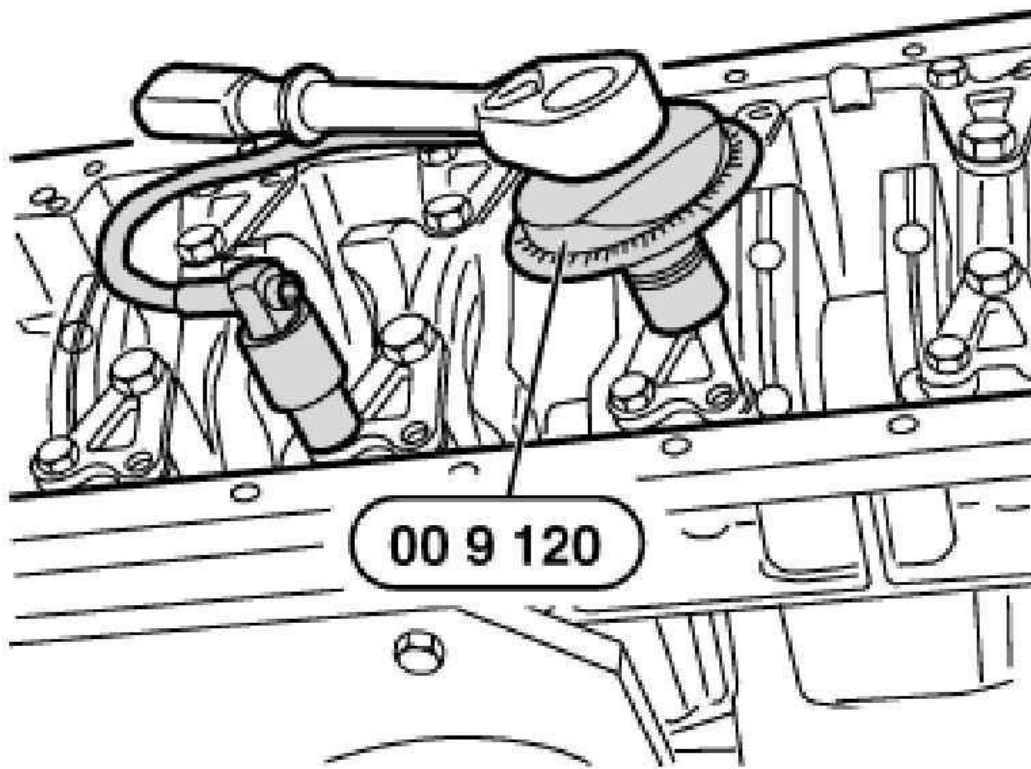
Fig. 112: View Of Reinforcement Plate
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Install reinforcement plates and fit screws with zero backlash. Install main bearing shells and abut firmly. Tighten down screw connection on reinforcement plates.

Tightening specifications for main bearing:

1. Tighten all screws on main bearing cover with jointing torque.
2. Unfasten screws on main bearing cover 6.
3. Strike back and front of crankshaft with plastic hammer to center thrust bearing (do not damage crankshaft).
4. Tighten screws of main bearing cover 6 with jointing torque.
5. Tighten down all screws of main bearing caps with special tool 11 2 110 or with special tool 00 9 120 to torsion angle.

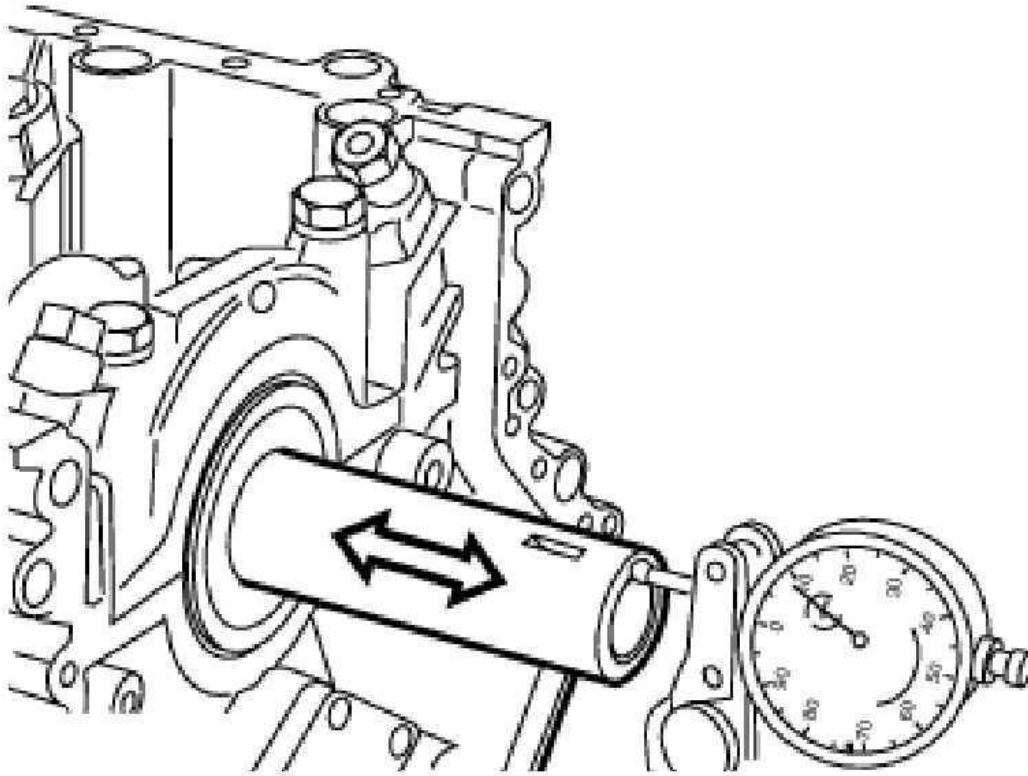


G03260525

Fig. 113: Tightening Down Main Bearing Cover
Courtesy of BMW OF NORTH AMERICA, INC.

Tightening torque, 11 11 1AZ. Refer to **ENGINE - TIGHTENING TORQUES** .

Check axial play. If permitted end float is exceeded, check crankshaft, guide bearing shells and engine block, replacing if necessary.



G03260509

Fig. 114: Checking Axial Clearance

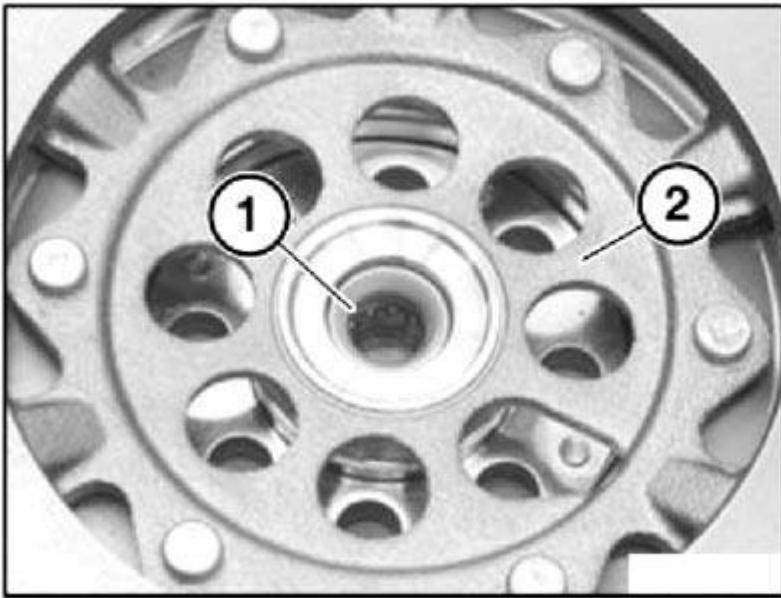
Courtesy of BMW OF NORTH AMERICA, INC.

End float, refer to **ENGINE - TECHNICAL DATA** .**11 21 571 REPLACING GROOVED BALL BEARING IN CRANKSHAFT (M52 / S52 / M52TU / M54 / S50 / S54)****Special tools required:**

- 00 5 500
- 11 2 340
- 11 2 350

(clutch removed)

IMPORTANT: In version with needle bearing (1) in dual-mass flywheel (2), *no* grooved ball bearing may be fitted in the crankshaft.

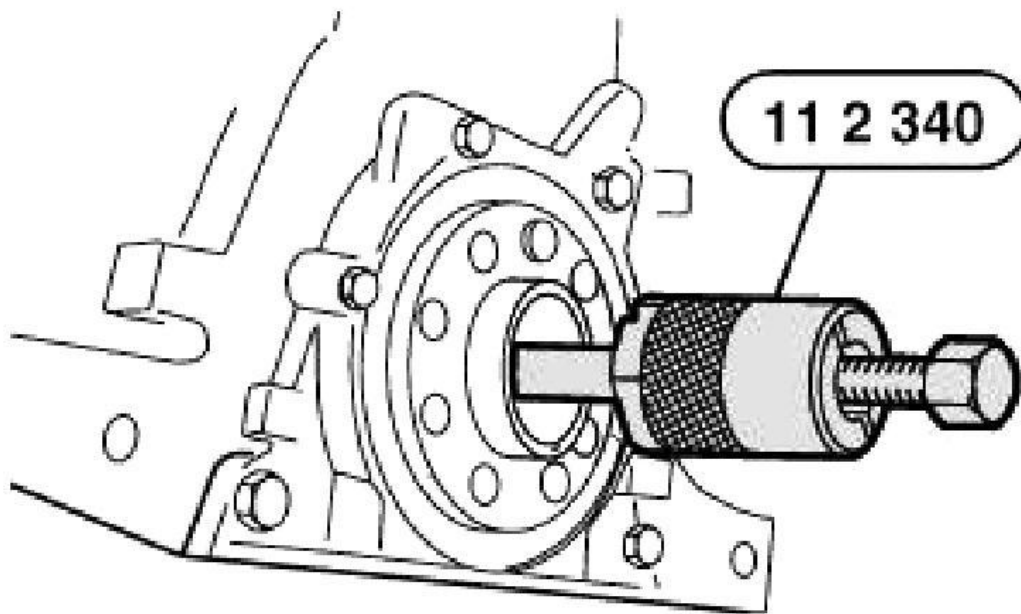


G03310275

Fig. 115: Identifying Needle Bearing In Dual-Mass Flywheel
Courtesy of BMW OF NORTH AMERICA, INC.

Version with grooved ball bearing:

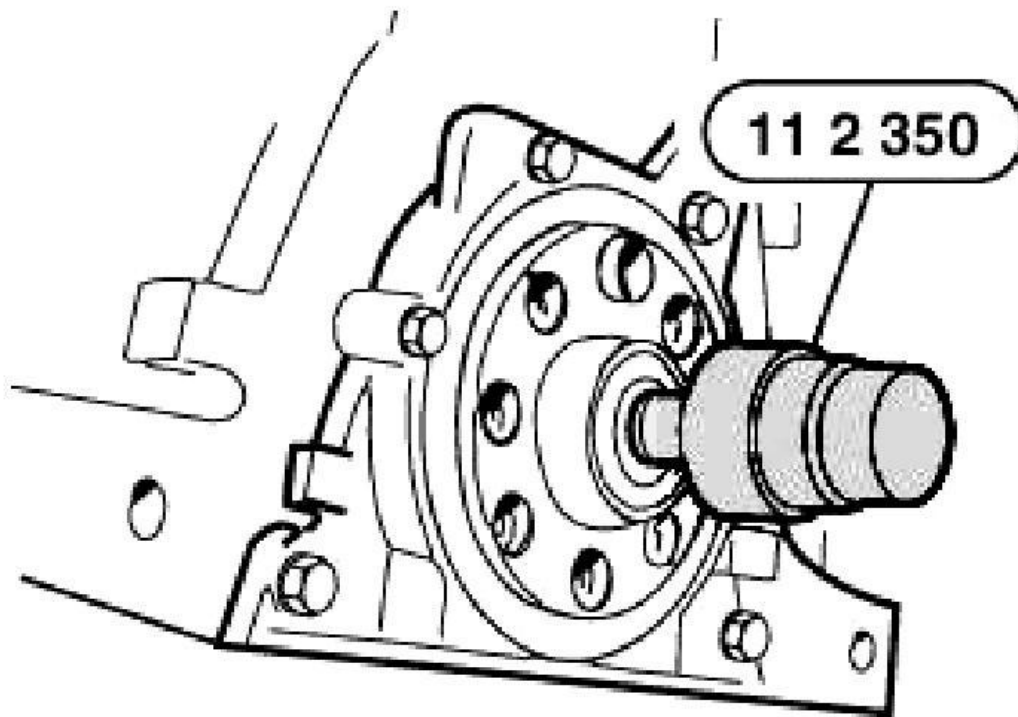
Remove guide bearing with special tool 11 2 340.



G03310276

Fig. 116: Removing Guide Bearing With Special Tool
Courtesy of BMW OF NORTH AMERICA, INC.

Install new thrust bearing and drive firmly home with special tool 11 2 350 in conjunction with special tool 00 5 500.



G03310277

Fig. 117: Installing Thrust Bearing

Courtesy of BMW OF NORTH AMERICA, INC.

FLYWHEEL

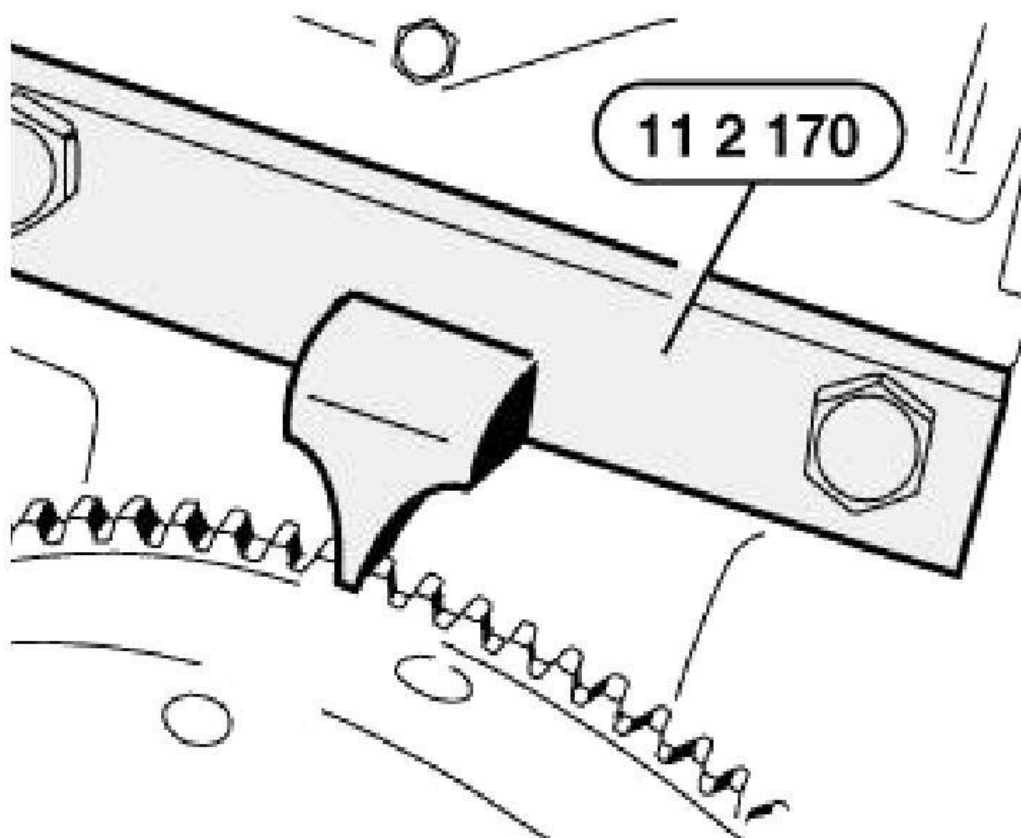
11 22 500 REMOVING AND INSTALLING OR REPLACING FLYWHEEL (M52 / S52 / M52TU / M54 / S54)

Special tools required:

- 11 2 170

(clutch removed)

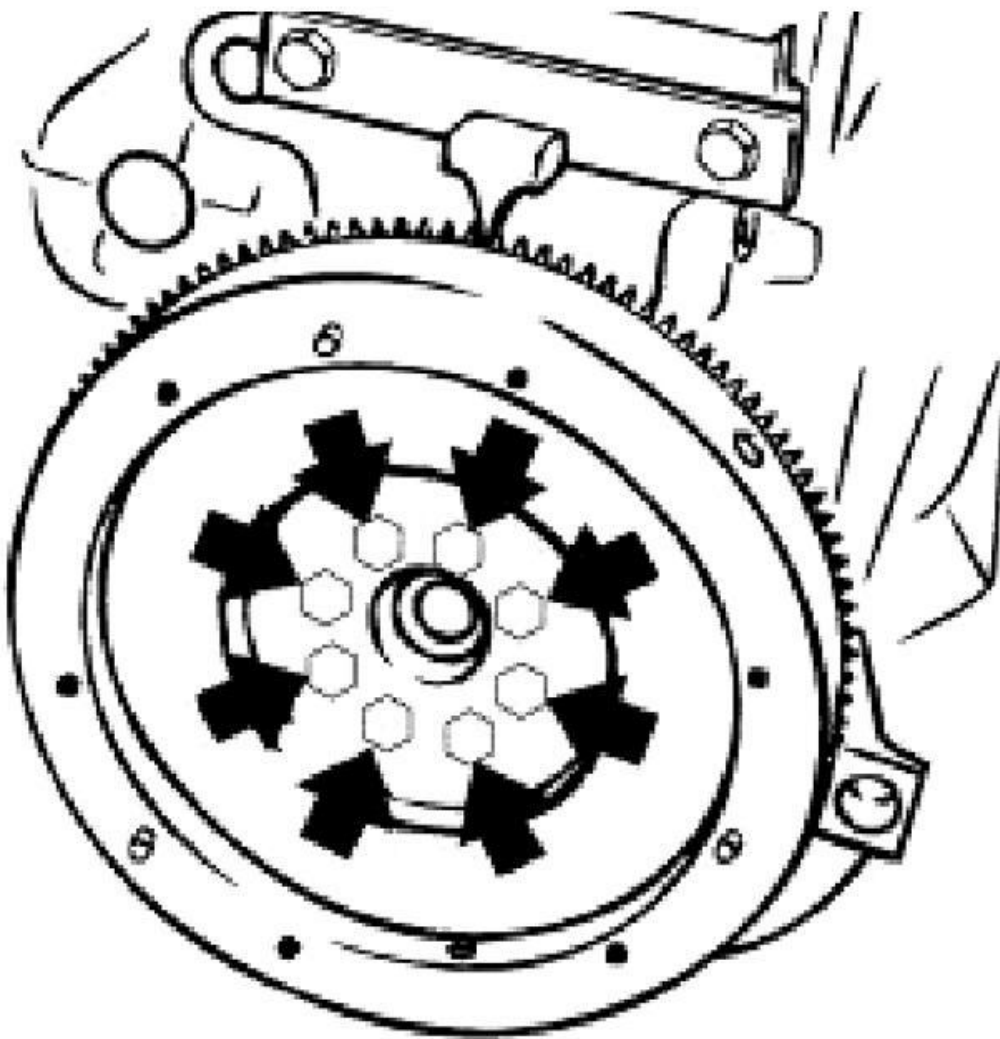
Lock flywheel with special tool 11 2 170.



G03310278

Fig. 118: Locking Flywheel With Special Tool
Courtesy of BMW OF NORTH AMERICA, INC.

Unfasten screws and remove flywheel.



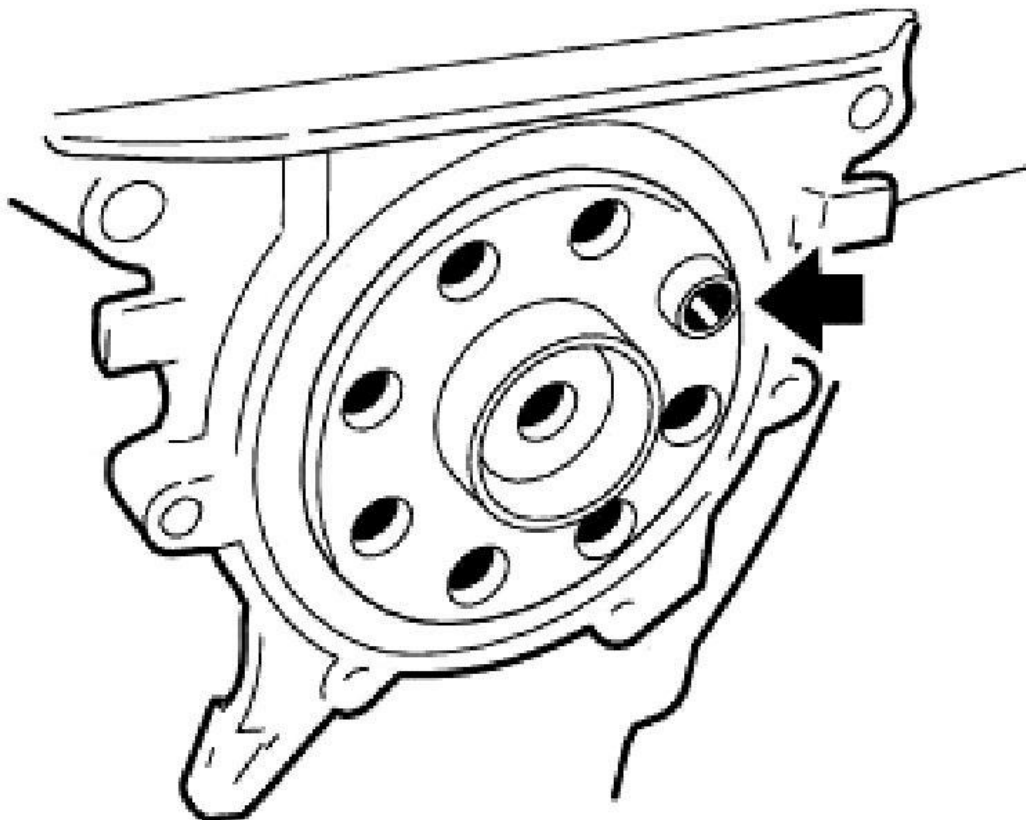
G03310279

Fig. 119: Removing Flywheel

Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Check dowel sleeve for damage and correct installation position.

**G03310280****Fig. 120: Checking Dowel Sleeve****Courtesy of BMW OF NORTH AMERICA, INC.****Installation:**

Position of dowel sleeve (1) in dual-mass flywheel is identified by two notches next to associated bolt hole.

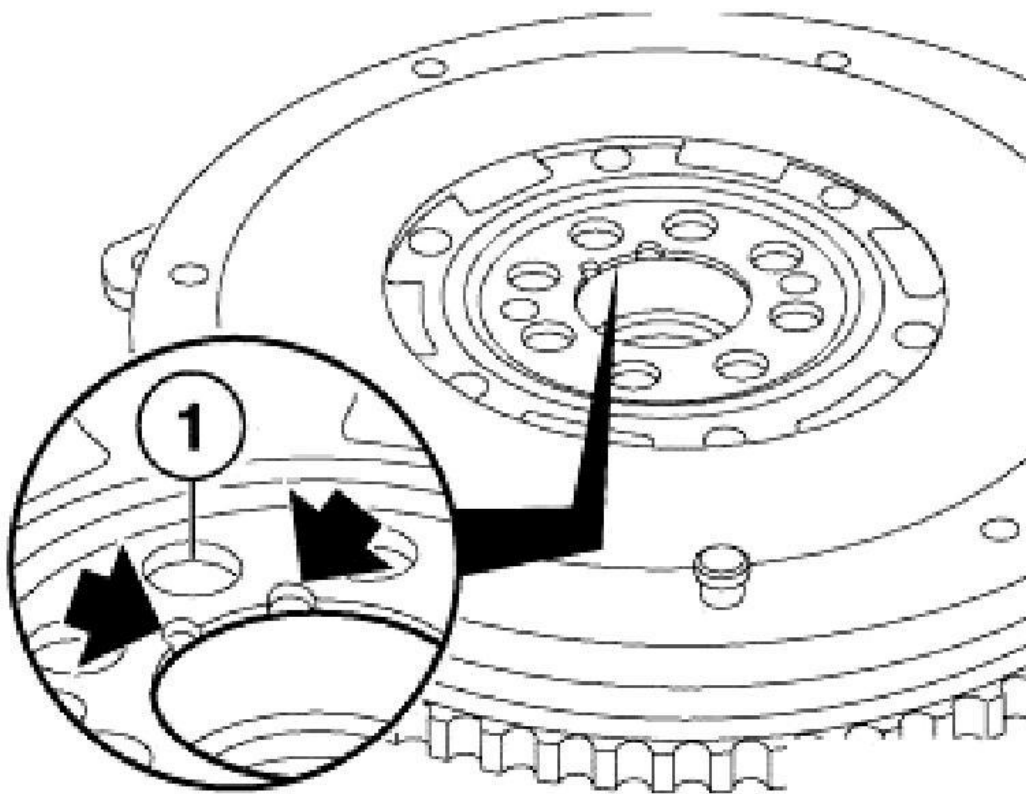
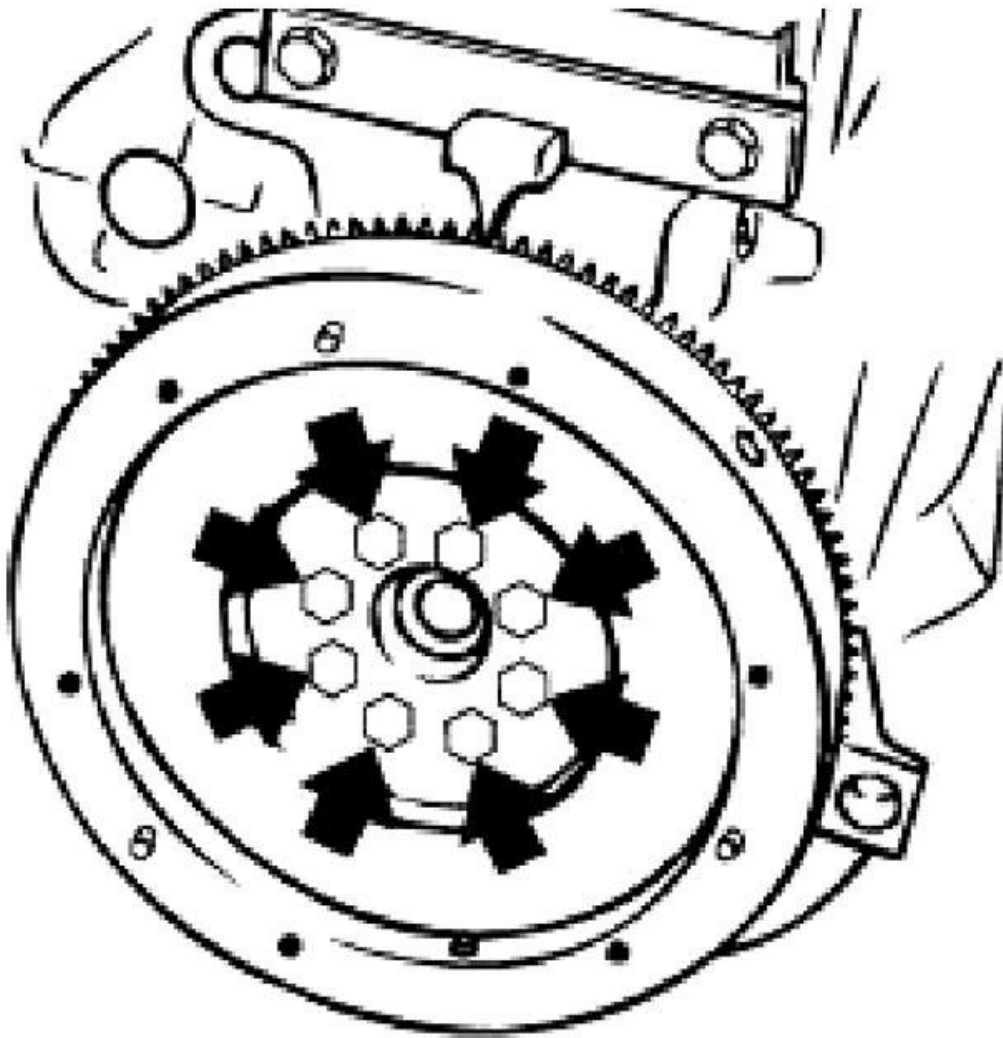
**G03310281**

Fig. 121: Identifying Position Of Dowel Sleeve In Dual-Mass Flywheel
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Clean thread and install new micro-encapsulated screws.



G03310282

Fig. 122: Installing Micro-Encapsulated Screws
Courtesy of BMW OF NORTH AMERICA, INC.

Tightening torque 11 22 1AZ. Refer to **ENGINE - TIGHTENING TORQUES** .

11 22 500 REMOVING AND INSTALLING/REPLACING FLYWHEEL (M54)

Special tools required:

- 11 4 180

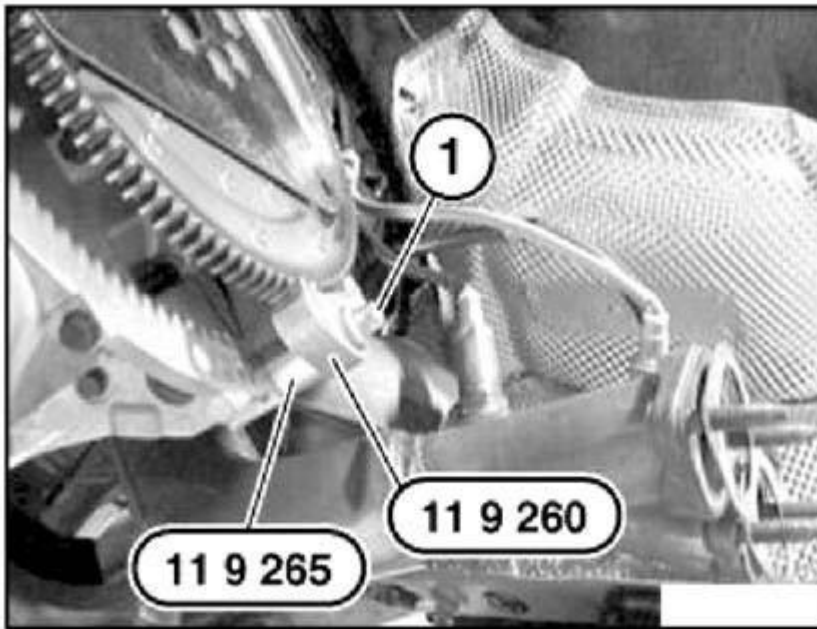
- 11 9 260
- 11 9 265

Necessary preliminary tasks:

- Remove exhaust system. Refer to **18 00 020 REMOVING AND INSTALLING COMPLETE EXHAUST SYSTEM (M54)** .
- Remove transmission. Refer to **REMOVAL & INSTALLATION - X3 (GS6-37BZ)** or **REMOVAL & INSTALLATION (A5S 360R/390R)** .
- Remove clutch (manual transmissions only). Refer to **CLUTCH** .

NOTE: **Automatic transmissions only:**

Secure flywheel with transmission screw (1) and special tools 11 9 260 and 11 9 265. Unfasten flywheel screws.



G03310283

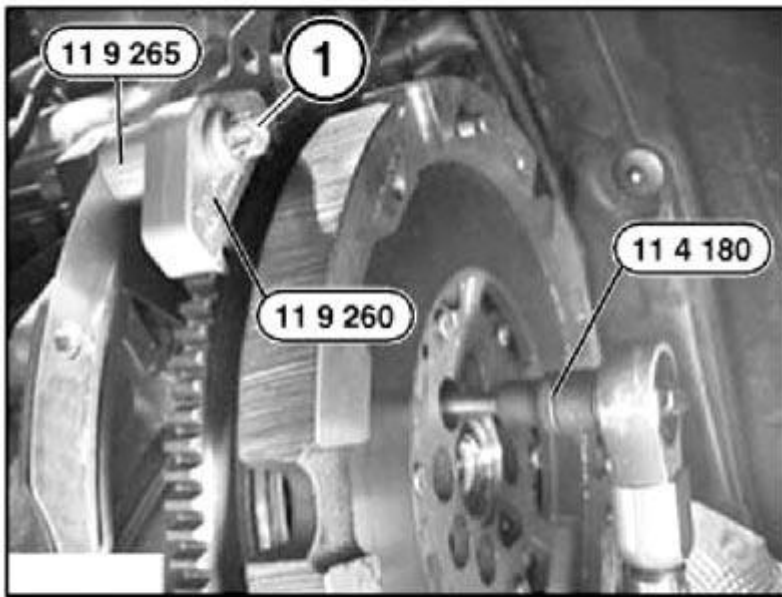
Fig. 123: Unfastening Flywheel Screws

Courtesy of BMW OF NORTH AMERICA, INC.

Tightening torque: 11 22 1AZ. Refer to **ENGINE - TIGHTENING TORQUES** .

NOTE: **Manual transmissions only:**

Secure flywheel with transmission screw (1) and special tools 11 9 260 and 11 9 265. Release flywheel screws with special tool 11 4 180.



G03310284

Fig. 124: Releasing Flywheel Screws

Courtesy of BMW OF NORTH AMERICA, INC.

Tightening torque: 11 22 1AZ. Refer to **ENGINE - TIGHTENING TORQUES** .

Installation:

Check dowel sleeves for damage and firm seating.

Assemble engine.

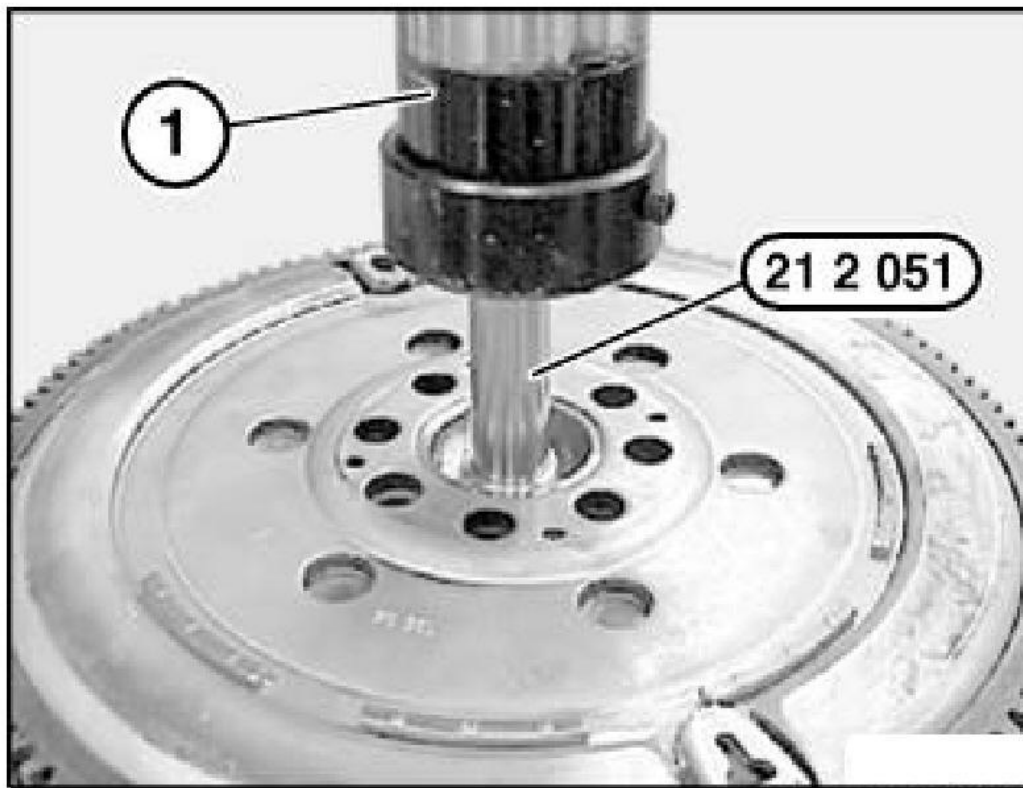
11 22 513 REPLACING ROLLER BEARING FOR DUAL-MASS FLYWHEEL

Special tools required:

- 21 2 051
- 21 2 052

NOTE: Flywheel removed!

Using hydraulic press (1) and special tool 21 2 051, press out dual-mass flywheel downwards on engine side.



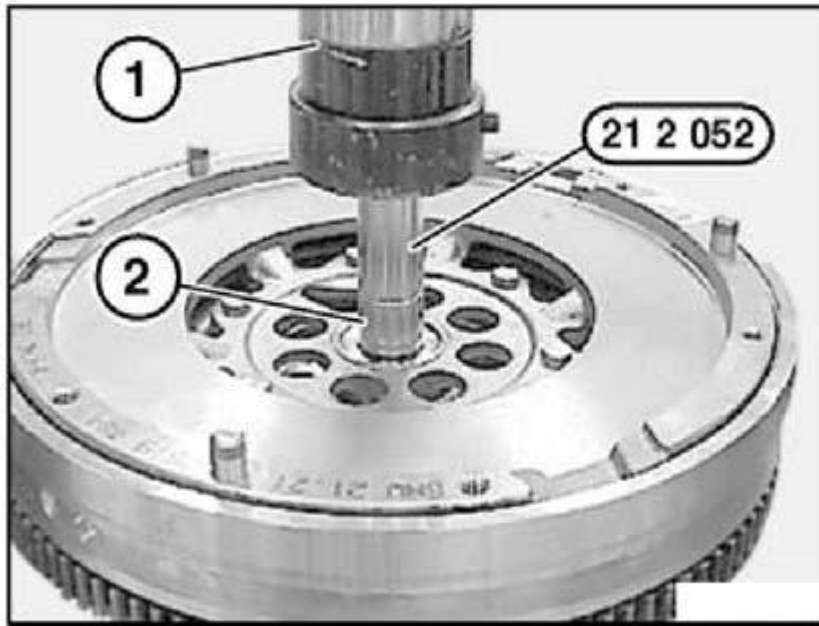
G03310285

Fig. 125: Pressing Out Dual-Mass Flywheel
Courtesy of BMW OF NORTH AMERICA, INC.

IMPORTANT: Risk of damage:

Roller bearing must not be driven out.

Push roller bearing (2) onto special tool 21 2 052.



G03310286

Fig. 126: Pressing Roller Bearing Into Dual-Mass Flywheel
Courtesy of BMW OF NORTH AMERICA, INC.

Using hydraulic press (1), press roller bearing into dual-mass flywheel as far as it will go on clutch side.

IMPORTANT: Risk of damage:

Observe press-in instruction:

- Roller bearing must not be driven in.
- Roller bearing mounting force/travel monitored:

Min. 2000N 1 mm before end of pressing in.

Max. 15000N during entire press-in procedure.

VIBRATION DAMPER

11 23 010 REMOVING AND INSTALLING OR REPLACING VIBRATION DAMPER (M52TU / M54 / M56)

Special tools required:

- 11 8 190
- 11 8 200
- 11 8 210

Necessary preliminary tasks:

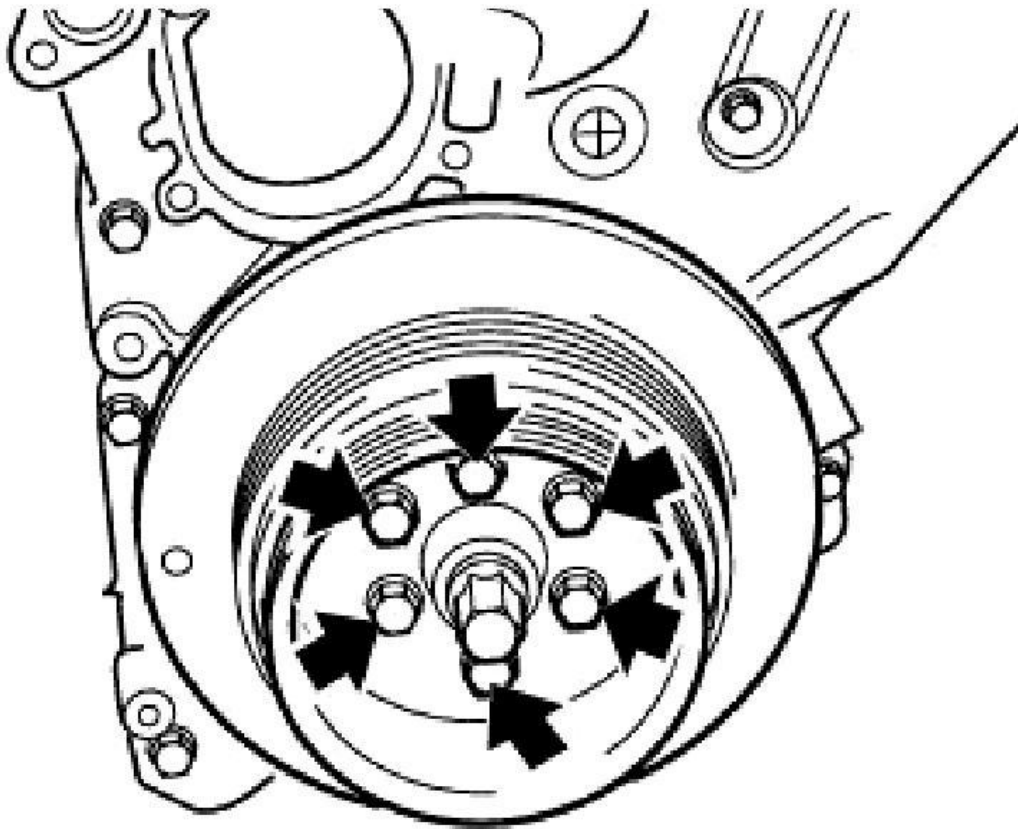
- Unscrew and remove splash guard
- Remove fan impeller with fan clutch and fan cowl
- E83/E85/E60: Remove fan cowl with electric fan
- Remove A/C compressor drive belt, refer to **11 28 050 REPLACING A/C COMPRESSOR DRIVE BELT (M52 / S52 / M52TU / M54 / M56)**
- Remove alternator drive belt, refer to **11 28 010 REPLACING ALTERNATOR DRIVE BELT (M52 / S52 / M52TU / M54 / M56)**

IMPORTANT: Risk of damage.

Protect cooler against damage.

Version 1

Vibration damper and hub for vibration damper are two parts: Unscrew vibration damper bolts and take off vibration damper.



G03310287

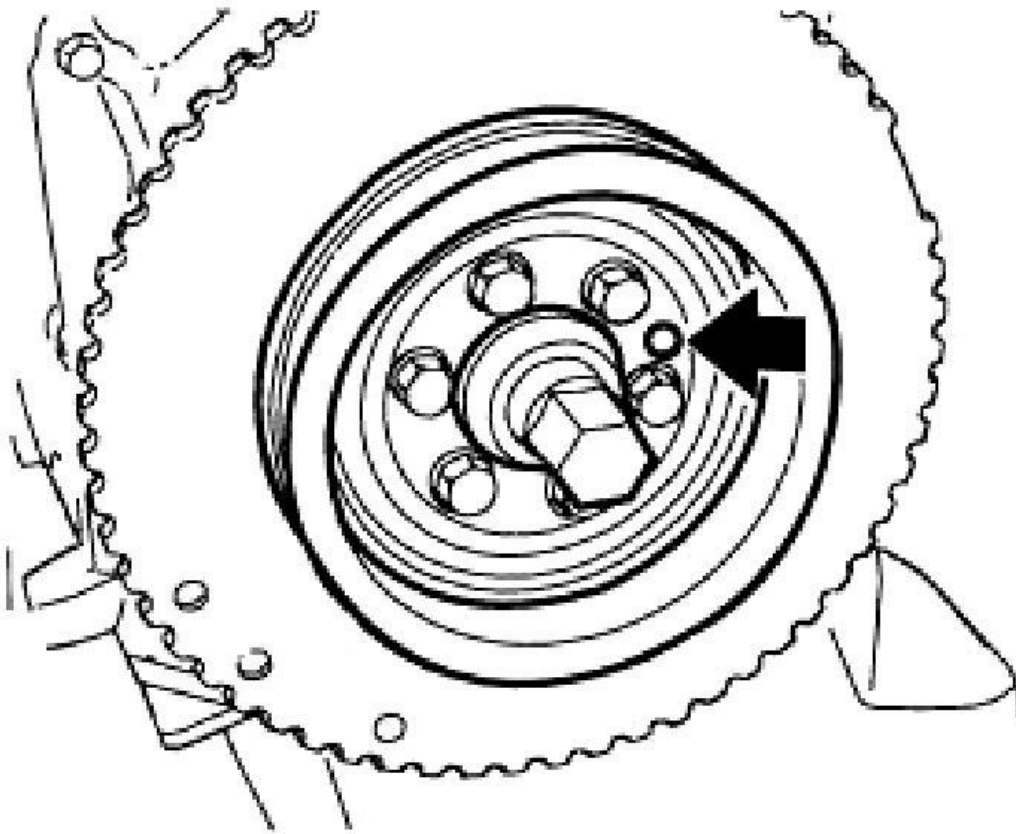
Fig. 127: Unscrewing Vibration Damper Bolts
Courtesy of BMW OF NORTH AMERICA, INC.

Version 1

Vibration damper and hub for vibration damper are two parts:

Installation:

Align locating bore in vibration damper to dowel pin.



G03310288

Fig. 128: Aligning Locating Bore In Vibration Damper To Dowel Pin
Courtesy of BMW OF NORTH AMERICA, INC.

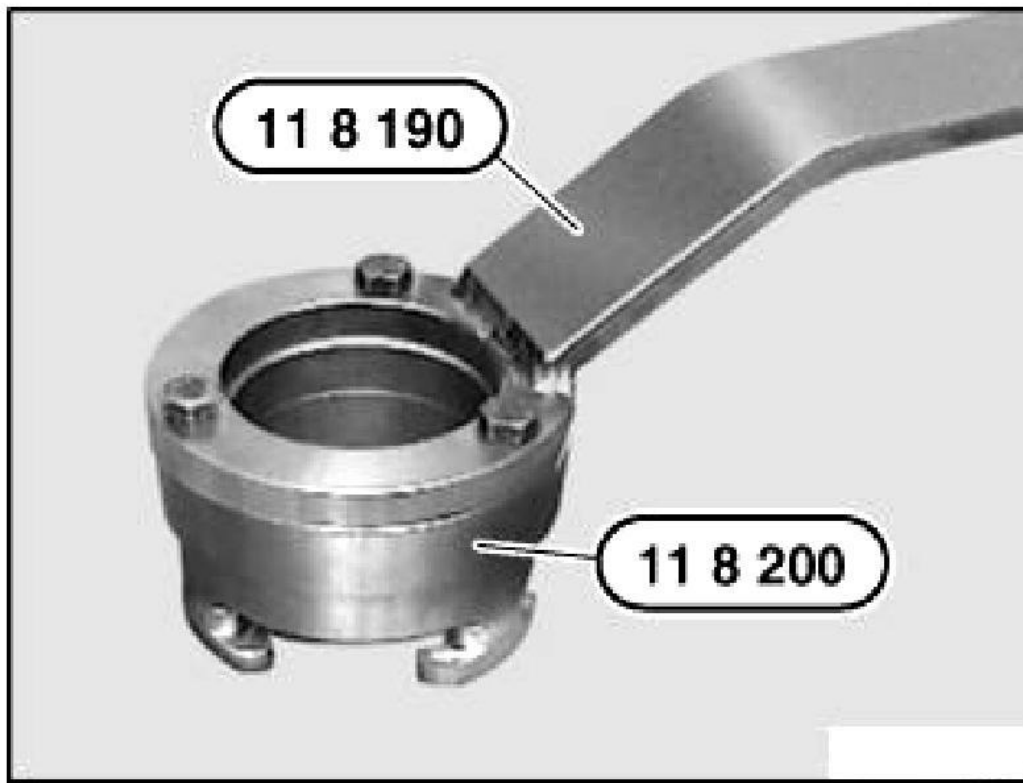
Install and tighten down screws.

Tightening torque 11 23 3AZ. Refer to **ENGINE - TIGHTENING TORQUES** .

Version 2

Vibration damper and hub for vibration damper are one part:

Screw special tool 11 8 190 to special tool 11 8 200.



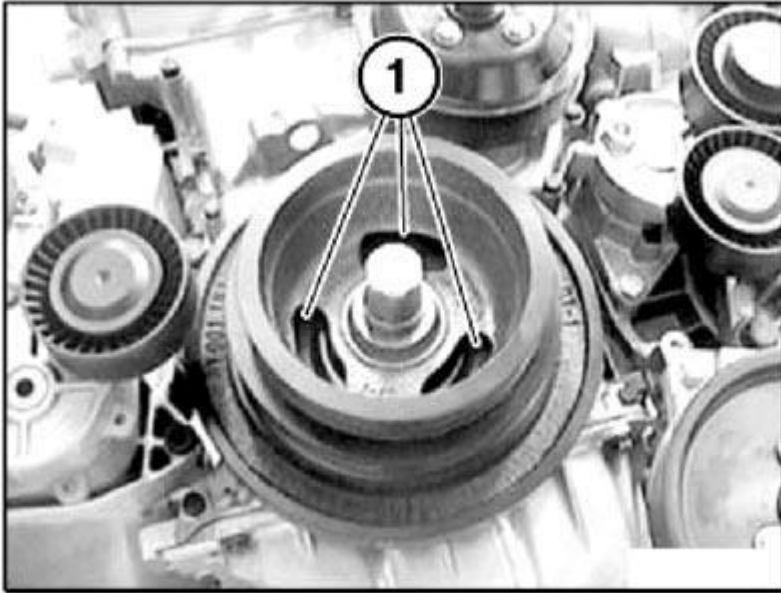
G03310289

Fig. 129: Identifying Special Tool

Courtesy of BMW OF NORTH AMERICA, INC.

Version 2

NOTE: Special tool 11 8 200 must snap into place in openings (1).



G03310290

Fig. 130: Installing Special Tool

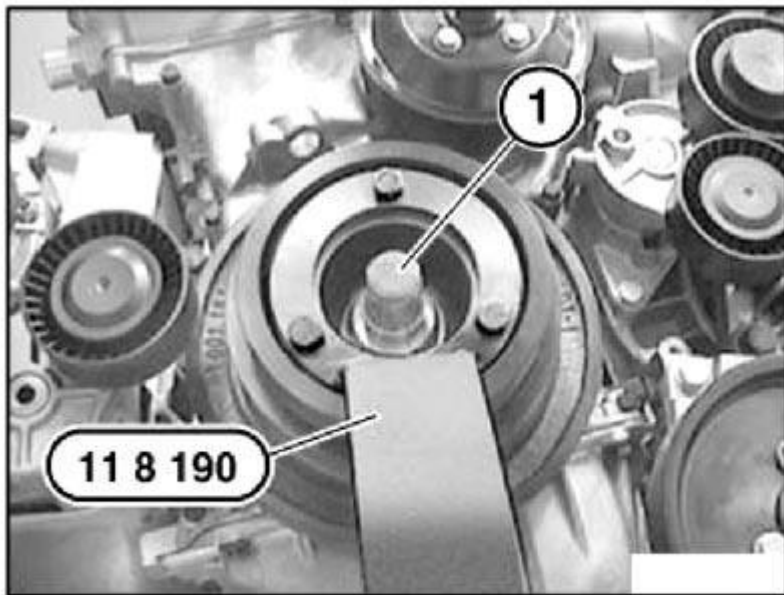
Courtesy of BMW OF NORTH AMERICA, INC.

Version 2

When releasing and tightening down central bolt, grip special tool 11 8 190 with assistance of a second person.

Version 2

Insert special tool 11 8 200 in openings on vibration damper and turn counterclockwise so that counter-supports snap into place on vibration damper.



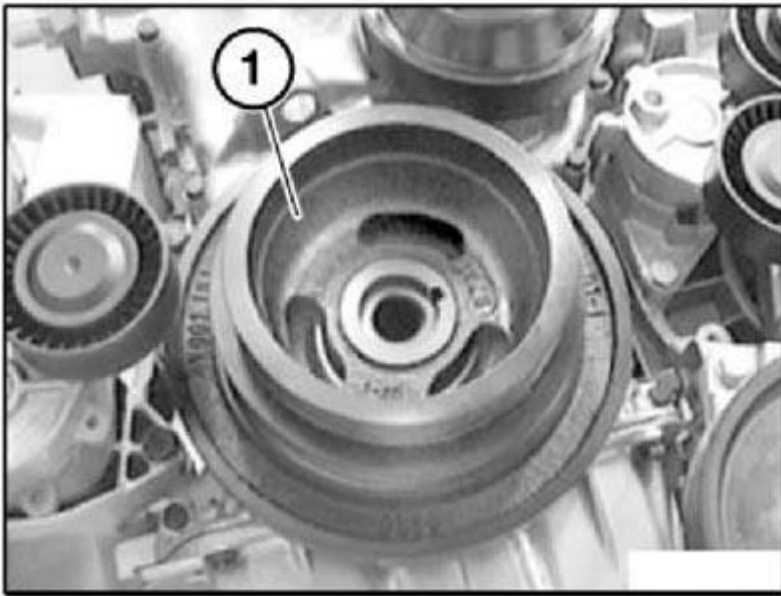
G03310291

Fig. 131: Releasing Central Screw**Courtesy of BMW OF NORTH AMERICA, INC.**

Release central screw (1).

Version 2

Feed out special tools 11 8 190/ 11 8 200.



G03310292

Fig. 132: Detaching Vibration Damper
Courtesy of BMW OF NORTH AMERICA, INC.

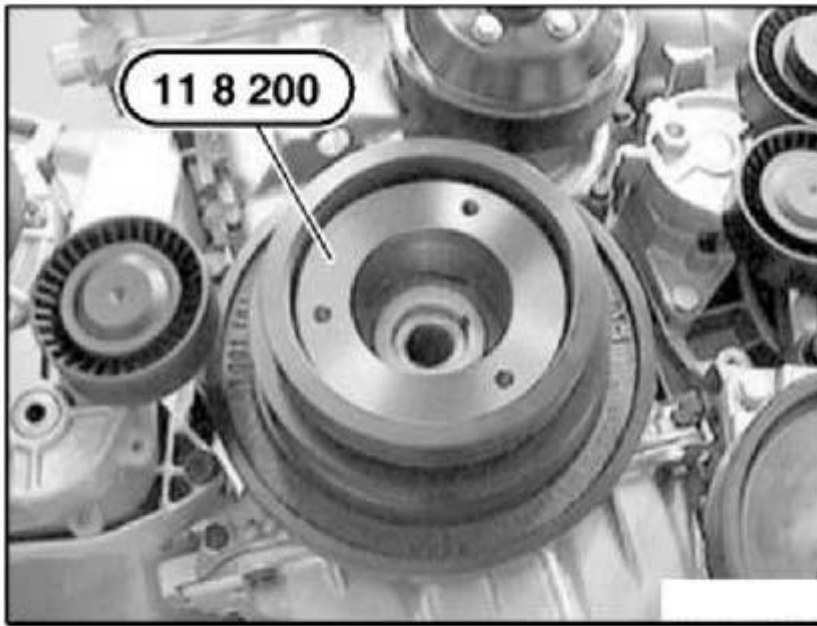
Remove central screw and washer.

Carefully detach vibration damper (1) by hand.

Version 2

NOTE: **If vibration damper cannot be detached by hand:**

Insert special tool 11 8 200 in openings on vibration damper and turn clockwise so that counter-supports snap into place on vibration damper.

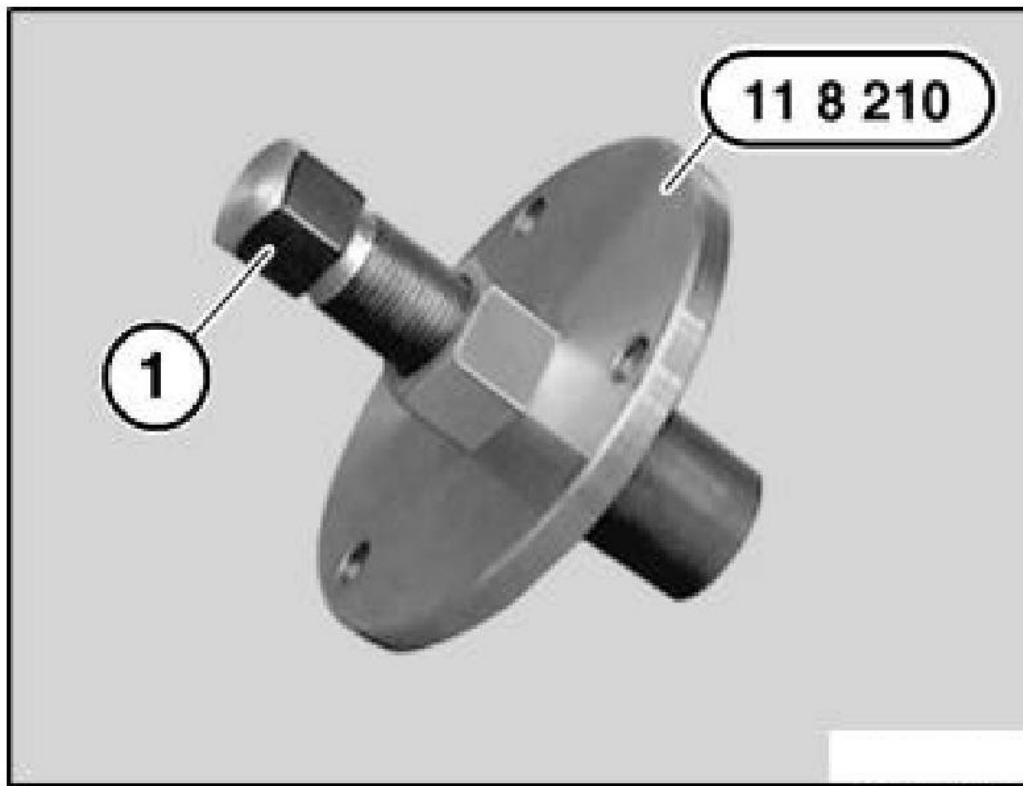


G03310293

Fig. 133: Inserting Special Tool In Openings On Vibration Damper
Courtesy of BMW OF NORTH AMERICA, INC.

Version 2

Screw out spindle (1) on special tool 11 8 210 as far as possible.



G03310294

Fig. 134: Screwing Out Spindle On Special Tool
Courtesy of BMW OF NORTH AMERICA, INC.

Version 2

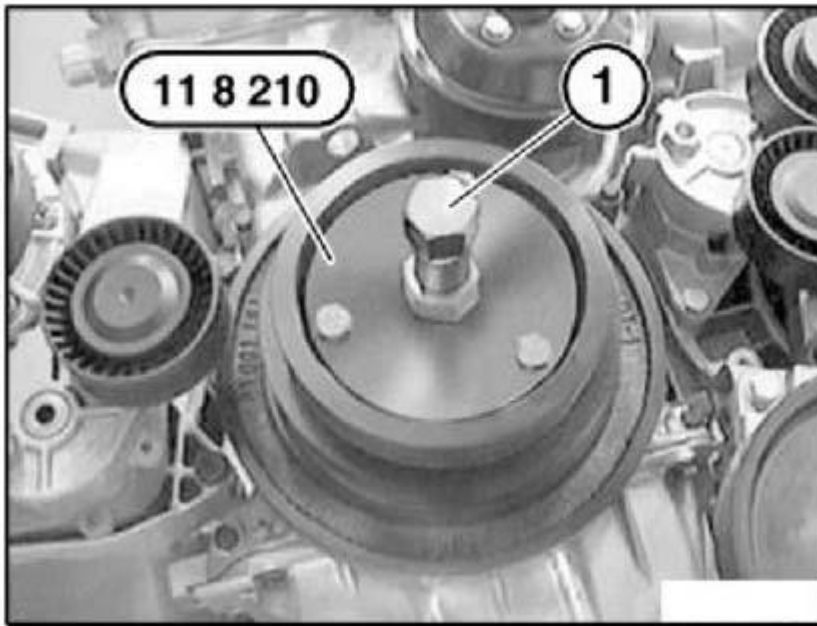
IMPORTANT: Risk of damage.

Protect cooler against damage.

Carefully install special tool 11 8 210.

Screw special tool 11 8 210 to special tool 11 8 200.

Detach vibration damper by turning spindle (1) on special tool 11 8 210.



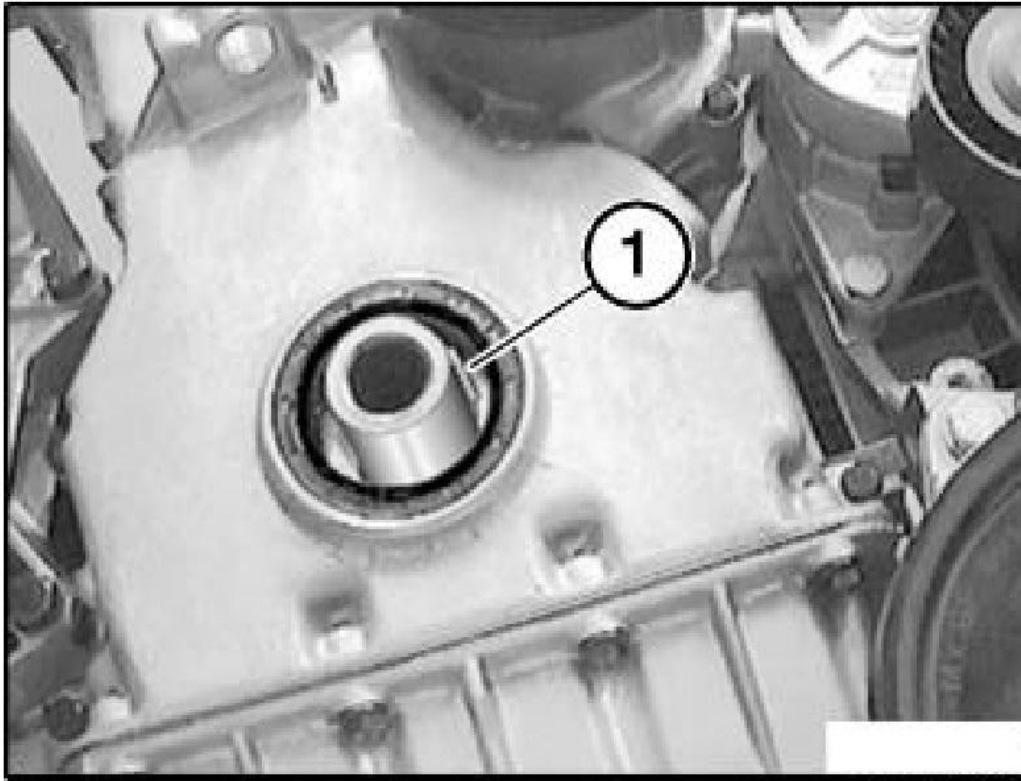
G03310295

Fig. 135: Detaching Vibration Damper
Courtesy of BMW OF NORTH AMERICA, INC.

Version 2

Installation:

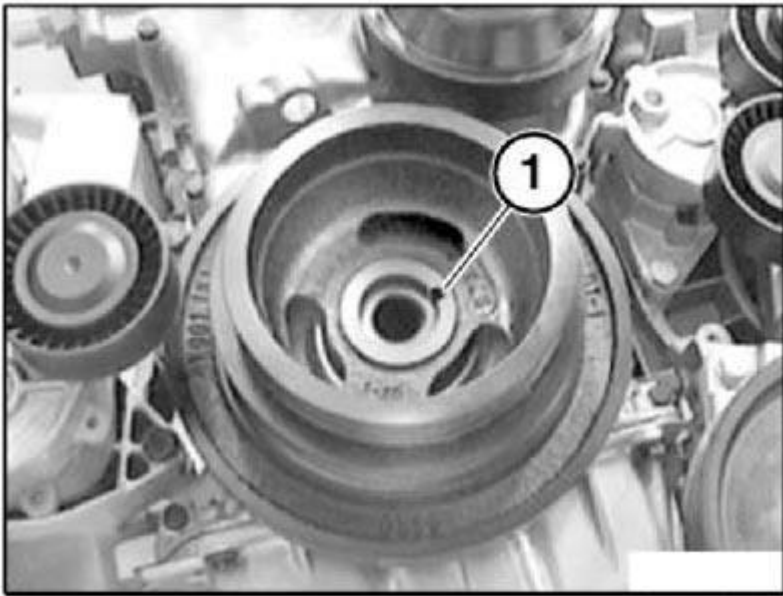
Check featherkey (1) for damage and correct installation position.

**G03310296****Fig. 136: Identifying Featherkey****Courtesy of BMW OF NORTH AMERICA, INC.**

Replace radial seal in lower timing case cover. Refer to **11 14 141 REPLACING RADIAL SEAL IN LOWER TIMING CASE COVER.**

Version 2***Installation:***

Align groove (1) in vibration damper to featherkey.



G03310297

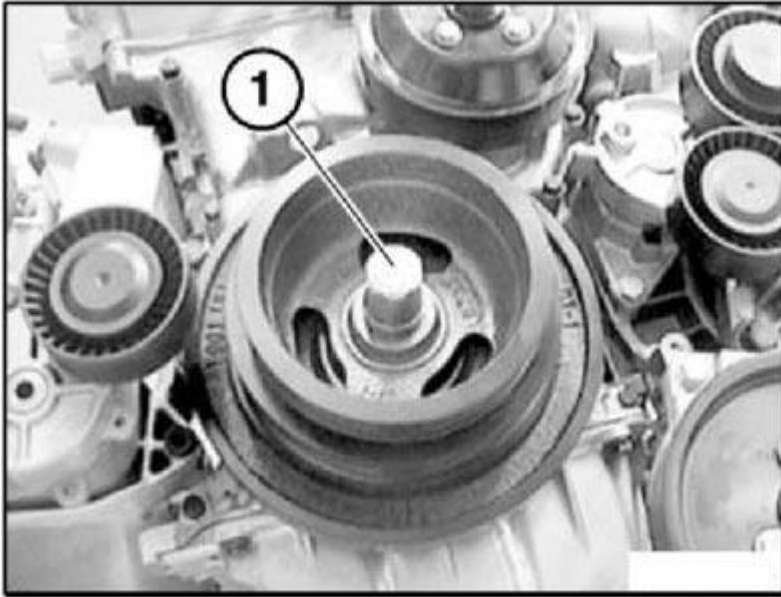
Fig. 137: Aligning Groove In Vibration Damper To Featherkey
Courtesy of BMW OF NORTH AMERICA, INC.

Fit vibration damper.

Version 2

Installation:

Replace central screw (1).



G03310298

Fig. 138: Replacing Central Screw

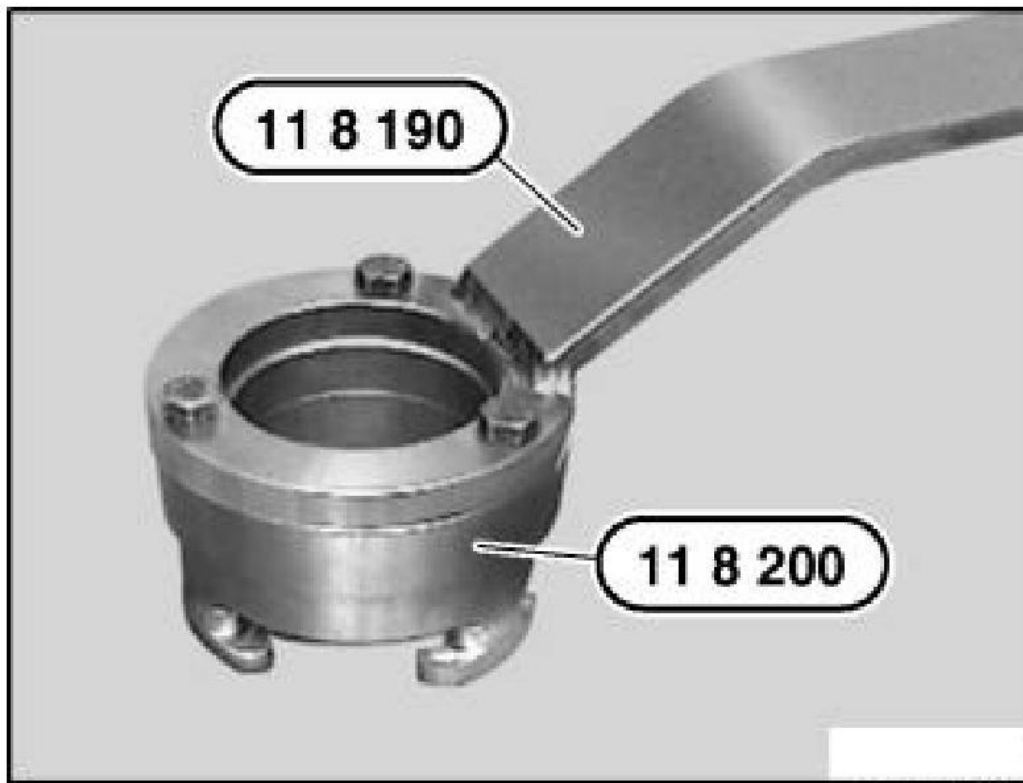
Courtesy of BMW OF NORTH AMERICA, INC.

Install central screw and washer.

Version 2

Installation:

Screw special tool 11 8 190 to special tool 11 8 200.



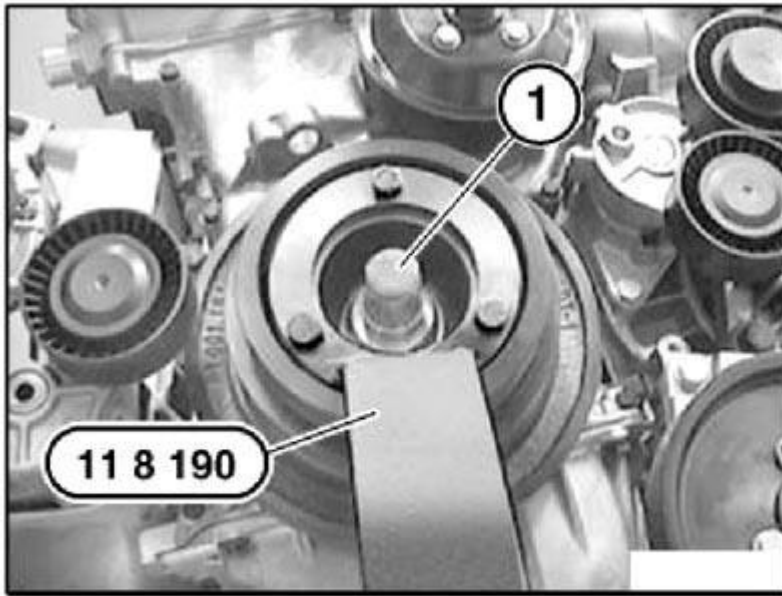
G03310299

Fig. 139: Identifying Special Tool

Courtesy of BMW OF NORTH AMERICA, INC.

Version 2

Insert special tool 11 8 200 in openings on vibration damper and turn clockwise so that counter-supports snap into place on vibration damper.



G03310300

Fig. 140: Tightening Down Central Screw

Courtesy of BMW OF NORTH AMERICA, INC.

Tighten down central screw (1).

Tightening torque, 11 23 2AZ. Refer to **ENGINE - TIGHTENING TORQUES**.

CONNECTING ROD WITH BEARINGS

11 24 571 REPLACING ALL CONNECTING ROD BEARINGS (M52 / S52 / M52TU / M54 / M56)

Special tools required:

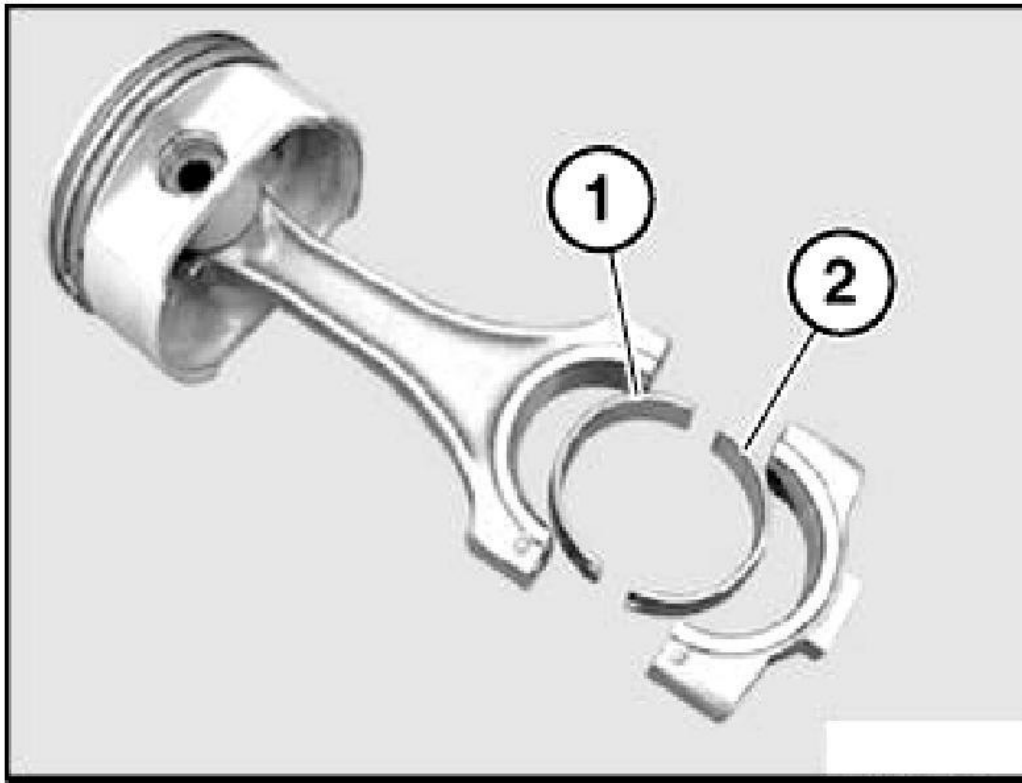
- 00 2 590
- 00 9 120
- 11 2 110

(piston removed)

IMPORTANT: Note grinding stages on crankshaft. Refer to **ENGINE - TECHNICAL DATA**.

Install new conrod bearing shells.

Insert one blue (1) and one red (2) bearing shell (irrespective of the color coding on the conrod shaft).

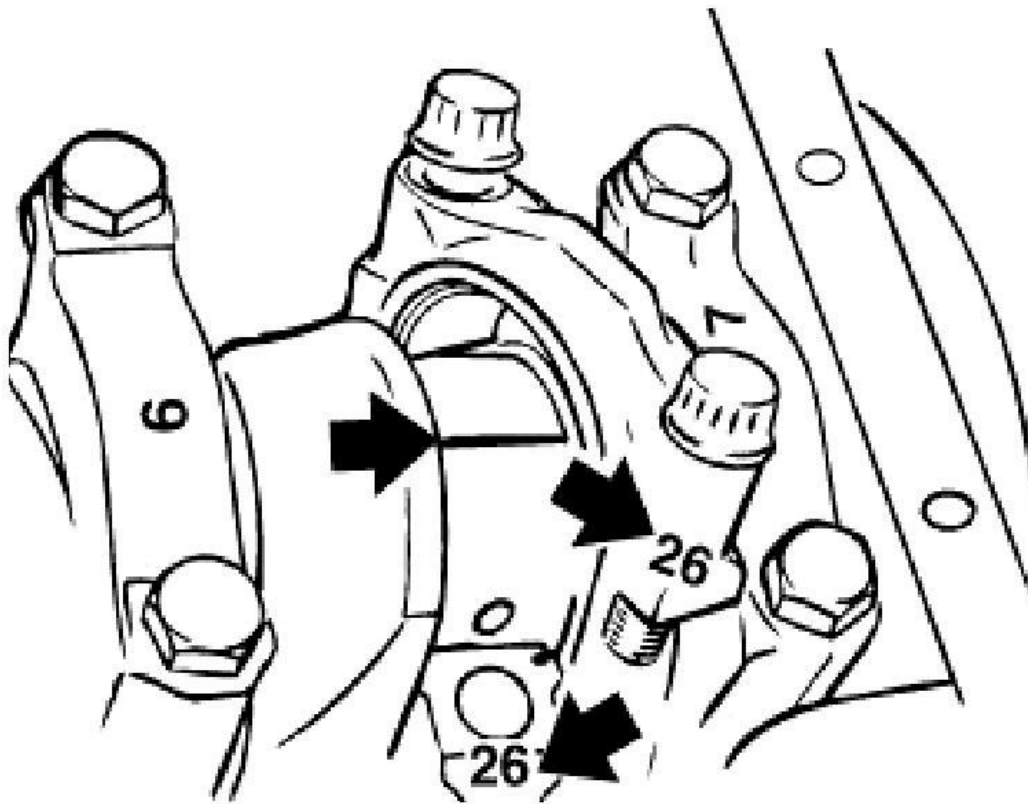
**G03310301****Fig. 141: Inserting Bearing Shells****Courtesy of BMW OF NORTH AMERICA, INC.**

Install piston. Refer to **11 25 530 REMOVING AND INSTALLING OR REPLACING ALL PISTONS (M52 / S52 / M52TU / M54 / M56).**

Check conrod bearing clearance.

Piston in BDC position.

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



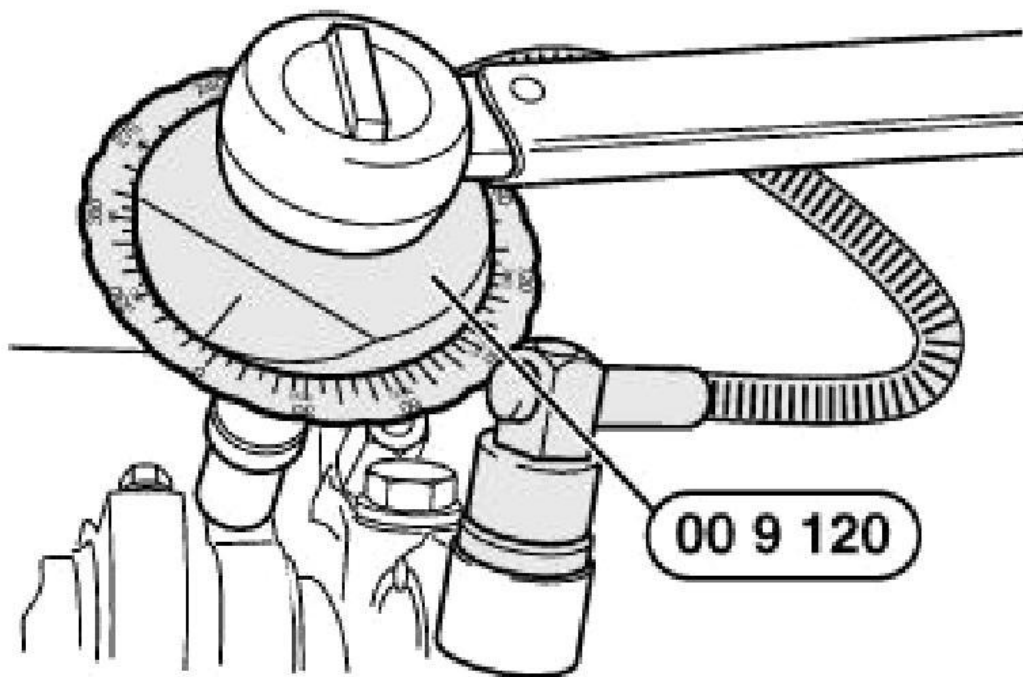
G03310302

Fig. 142: Fitting Special Tool To Oil -Free Crankshaft
Courtesy of BMW OF NORTH AMERICA, INC.

Fit bearing caps so that pair numbers match up.

IMPORTANT: Do not distort conrods or crankshaft.

Use the old conrod bolts to check conrod clearance.



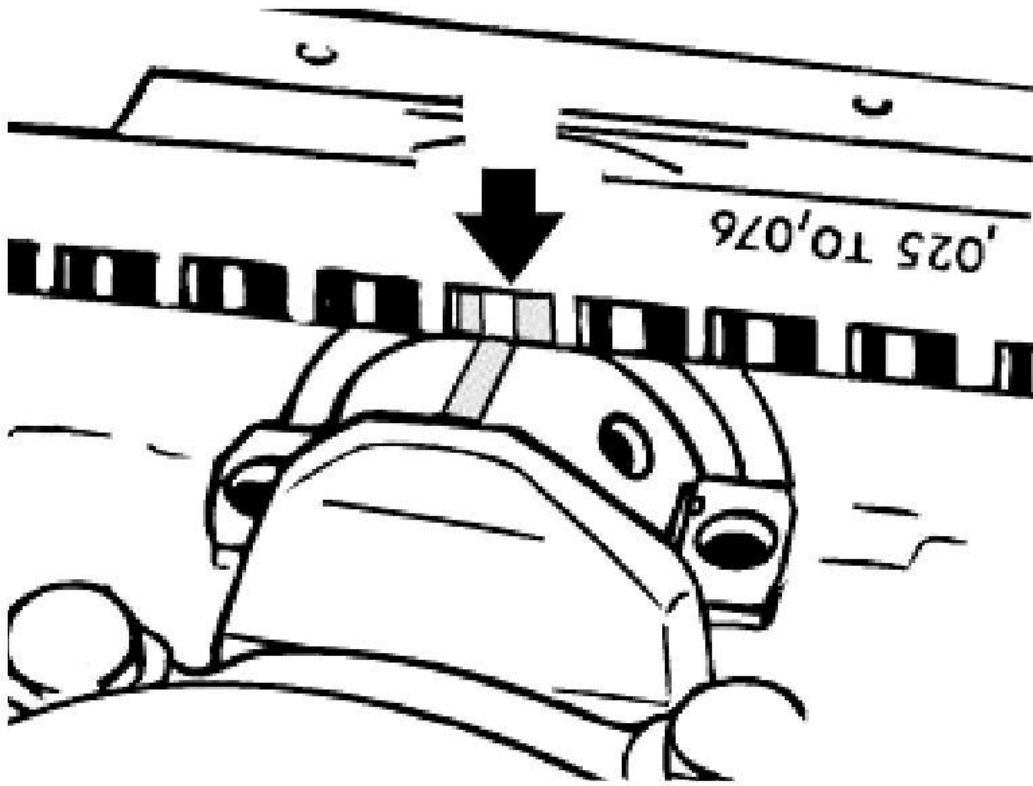
G03310303

Fig. 143: Tightening Down Conrod Bolts With Special Tool
Courtesy of BMW OF NORTH AMERICA, INC.

Tighten down conrod bolts with special tool 00 9 120 or with special tool 11 2 110.

Tightening torque 11 24 1AZ. Refer to **ENGINE - TIGHTENING TORQUES** .

Remove bearing cap and read off bearing play at width of flattened plastic thread with assistance of measurement scale.



G03310304

Fig. 144: Measuring Bearing Play

Courtesy of BMW OF NORTH AMERICA, INC.

Conrod bearing clearance, refer to ENGINE - TECHNICAL DATA .

- Remove plastic thread.
- Coat crankshaft and bearing shells with oil.
- Install new conrod bolts and tighten down.

Tightening torque 11 24 1AZ. Refer to ENGINE - TIGHTENING TORQUES .

PISTON WITH RINGS AND PIN

11 25 530 REMOVING AND INSTALLING OR REPLACING ALL PISTONS (M52 / S52 / M52TU / M54 / M56)

Special tools required:

- 00 9 120
- 11 2 110
- 11 2 260
- 11 2 470
- 11 3 480
- 11 8 141

(engine removed) Remove cylinder head.

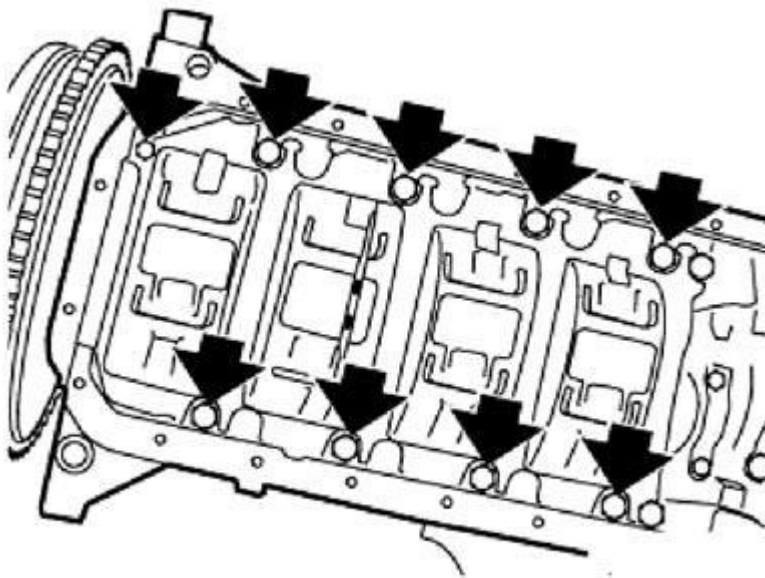
Removal:

Removal of pistons is described separately from installation. Assembly sequence for removal and installation is different.

IMPORTANT: Re-install piston, connecting rod and bearing shells back in the same position and in the same installation location. Connecting rods and bearing covers are designated with the same pair number: do not mix them.

Remove oil pump. Refer to **11 41 000 REMOVING AND INSTALLING/REPLACING OIL PUMP (M52TU / M54 / M56)**.

If oil pump and oil scraper are two parts: Remove oil scraper.

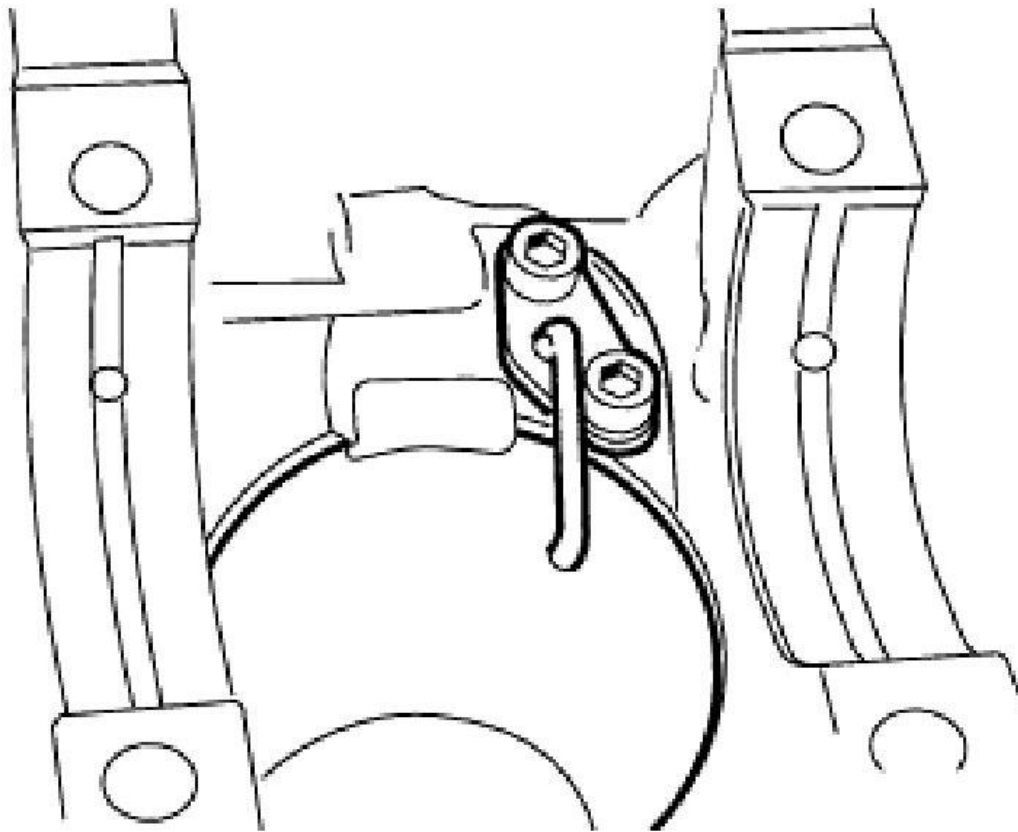


G03310305

Fig. 145: Removing Oil Scraper

Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: Figure shows crankshaft removed.



G03310306

Fig. 146: View Of Spray Nozzle For Piston Cooling
Courtesy of BMW OF NORTH AMERICA, INC.

On engines with spray nozzles for piston cooling on cylinder underside:

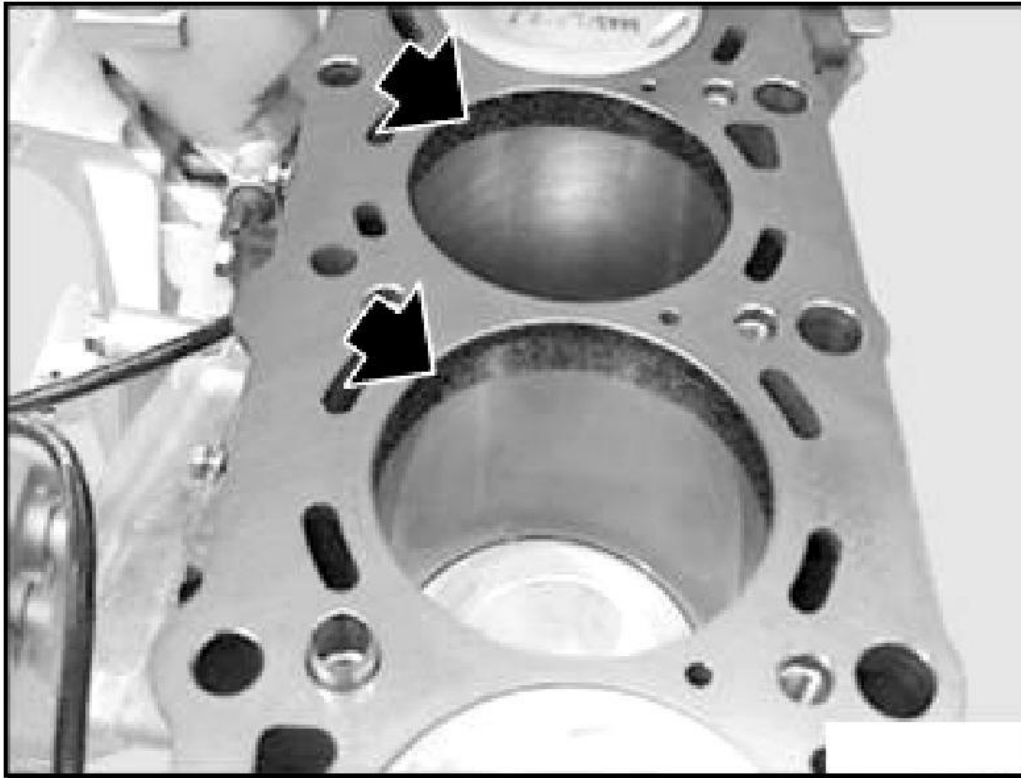
IMPORTANT: When removing and installing pistons, make sure the piston cooling spray nozzles are not damaged.

Installation:

Screw threads are coated with screw securing adhesive (Loctite). Replace screws.

In event of heavy oil carbon residue:

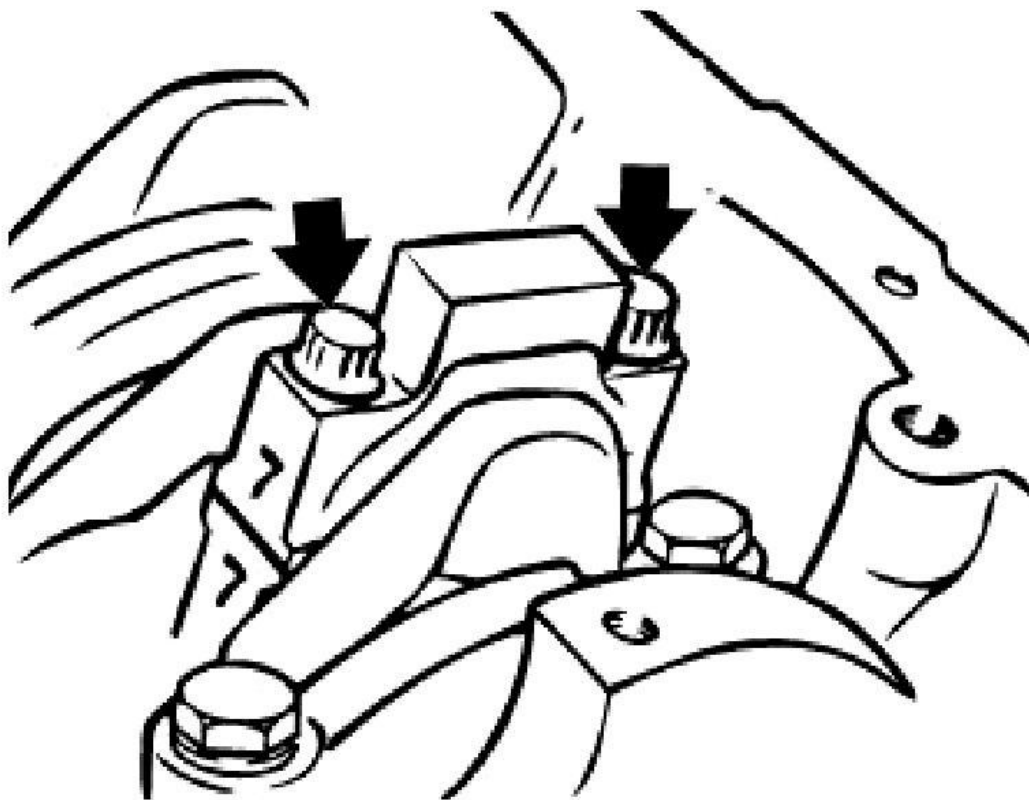
Carefully remove oil carbon residue from cylinder wall.



G03310307

Fig. 147: Removing Oil Carbon Residue From Cylinder Wall
Courtesy of BMW OF NORTH AMERICA, INC.

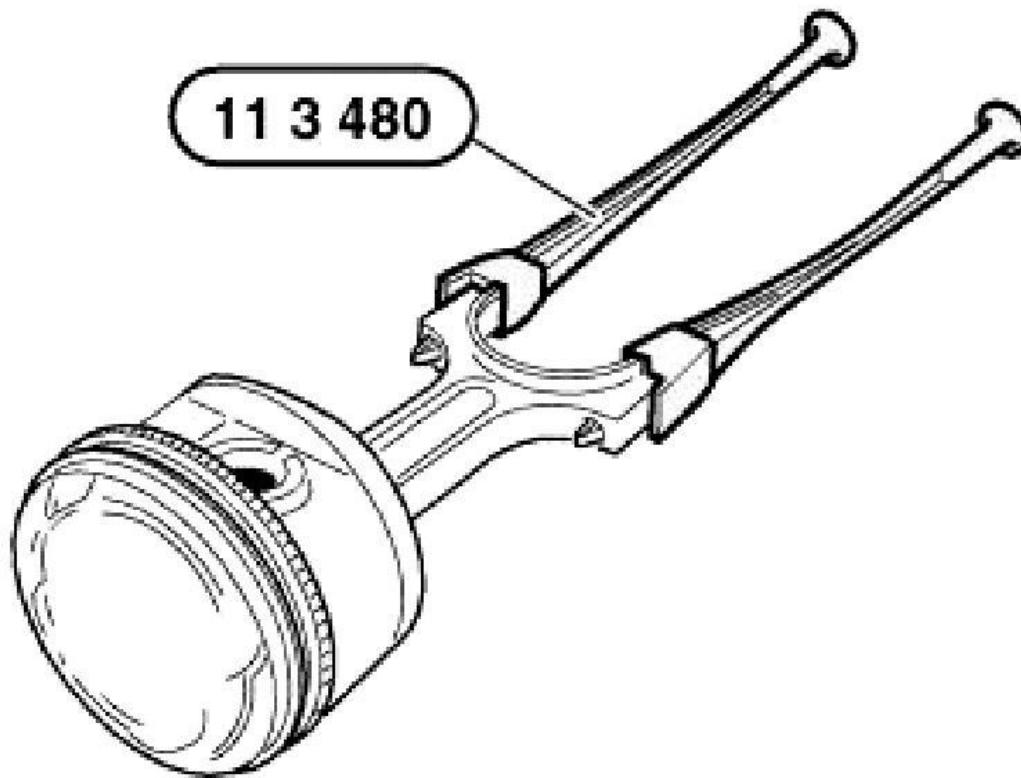
Unscrew conrod bearing cover.



G03310308

Fig. 148: Unscrewing Conrod Bearing Cover
Courtesy of BMW OF NORTH AMERICA, INC.

Insert special tool 11 3 480 in conrod.

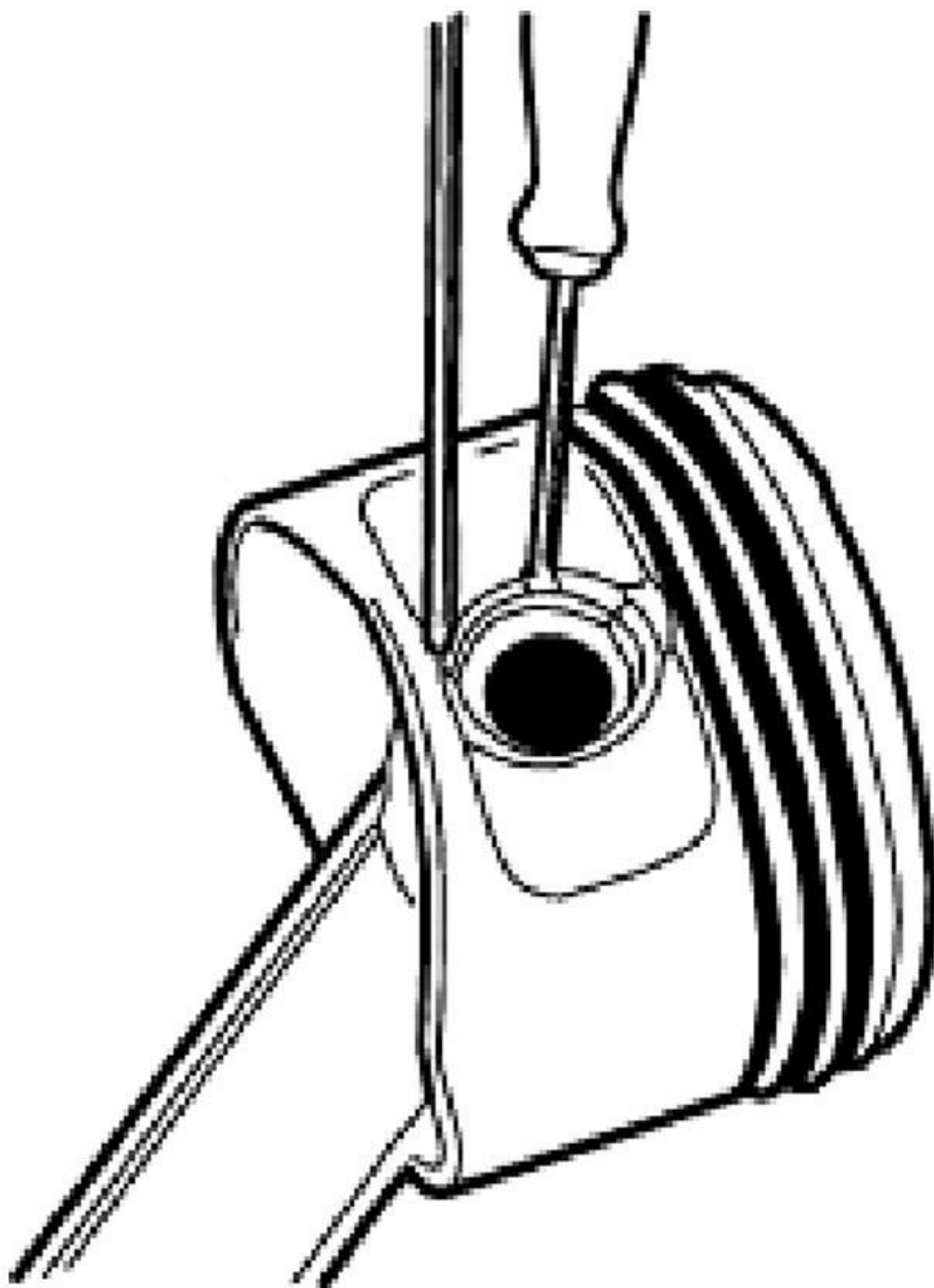


G03310309

Fig. 149: Removing Conrod With Piston From Cylinder Head Side
Courtesy of BMW OF NORTH AMERICA, INC.

Remove conrod with piston from cylinder head side.

Lift out retaining ring and press out piston pin.



G03310310

Fig. 150: Lifting Out Retaining Ring And Pressing Out Piston Pin

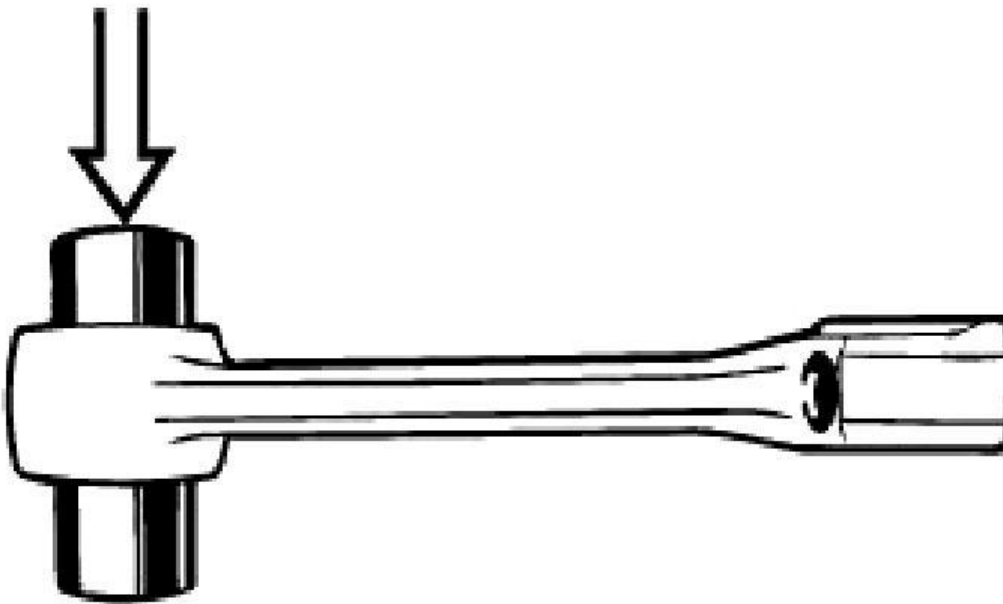
Courtesy of BMW OF NORTH AMERICA, INC.

IMPORTANT: Piston and piston pin are paired and must not be fitted individually.

Installation:

Installation of pistons is described separately from removal. The assembly sequence differs between removal and installation.

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



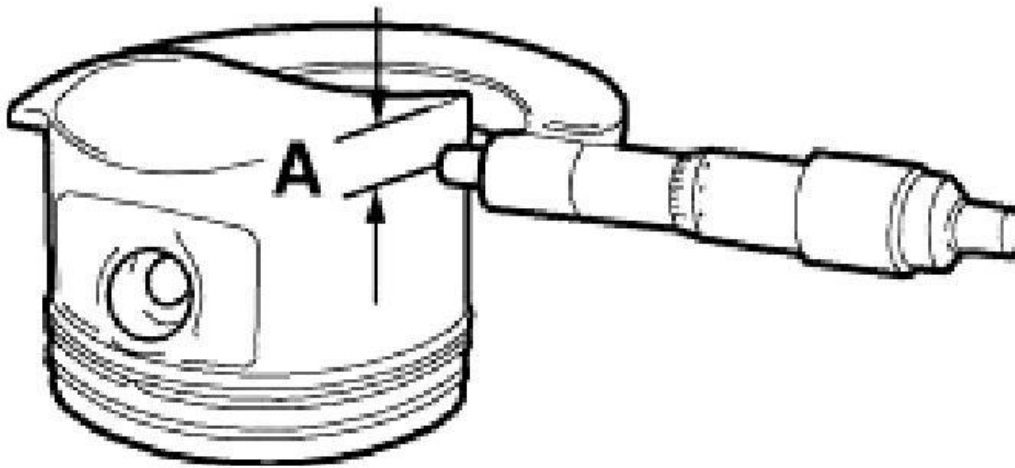
G03310311

Fig. 151: Installing Piston Pin

Courtesy of BMW OF NORTH AMERICA, INC.

Measure piston installation clearance:

Measure piston diameter with micrometer at distance A from the underside of the piston and at offset angle of 90° to piston pin axis.

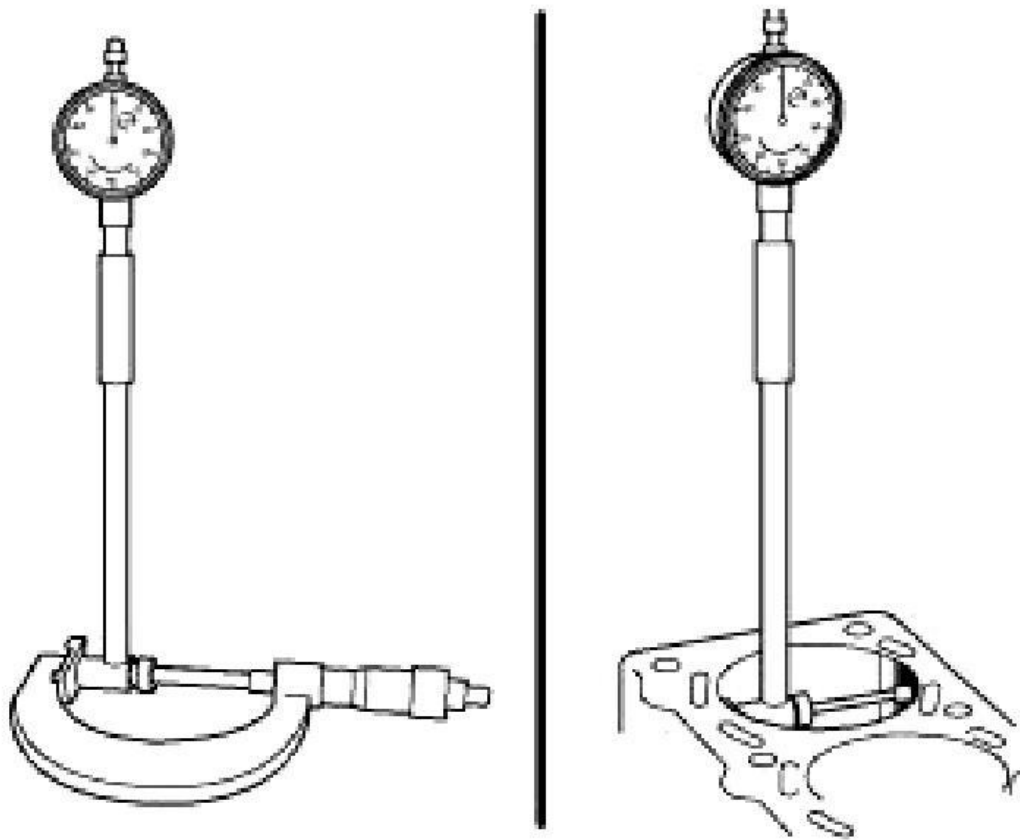


G03310312

Fig. 152: Measuring Piston Diameter With Micrometer
Courtesy of BMW OF NORTH AMERICA, INC.

Measurement A, refer to **ENGINE - TECHNICAL DATA** .

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



G03310313

Fig. 153: Adjusting Micrometer To Cylinder Bore Of Engine Block
Courtesy of BMW OF NORTH AMERICA, INC.

Diameter of cylinder bore, refer to **ENGINE - TECHNICAL DATA** .

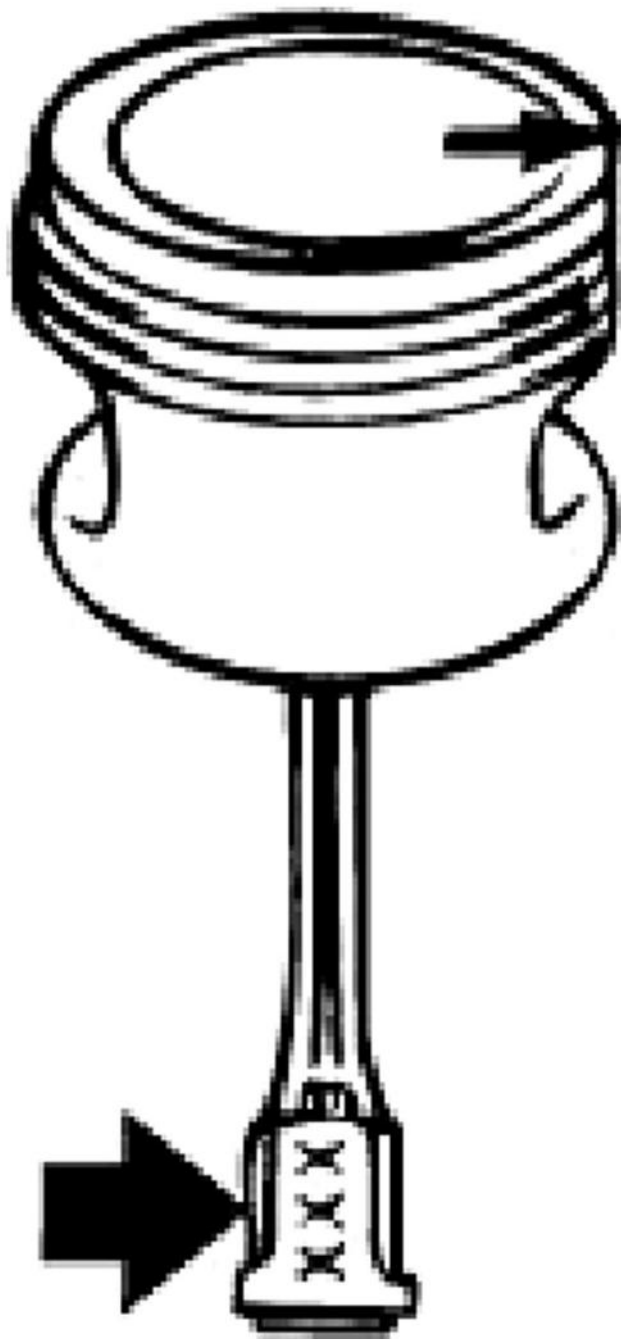
Piston installation clearance, refer to **ENGINE - TECHNICAL DATA** .

Total permissible wear tolerance, refer to **ENGINE - TECHNICAL DATA** .

Replace conrod bearing shells. Refer to **11 24 571 REPLACING ALL CONNECTING ROD BEARINGS (M52 / S52 / M52TU / M54 / M56)**.

IMPORTANT: Piston and piston pin are paired and must not be fitted individually.

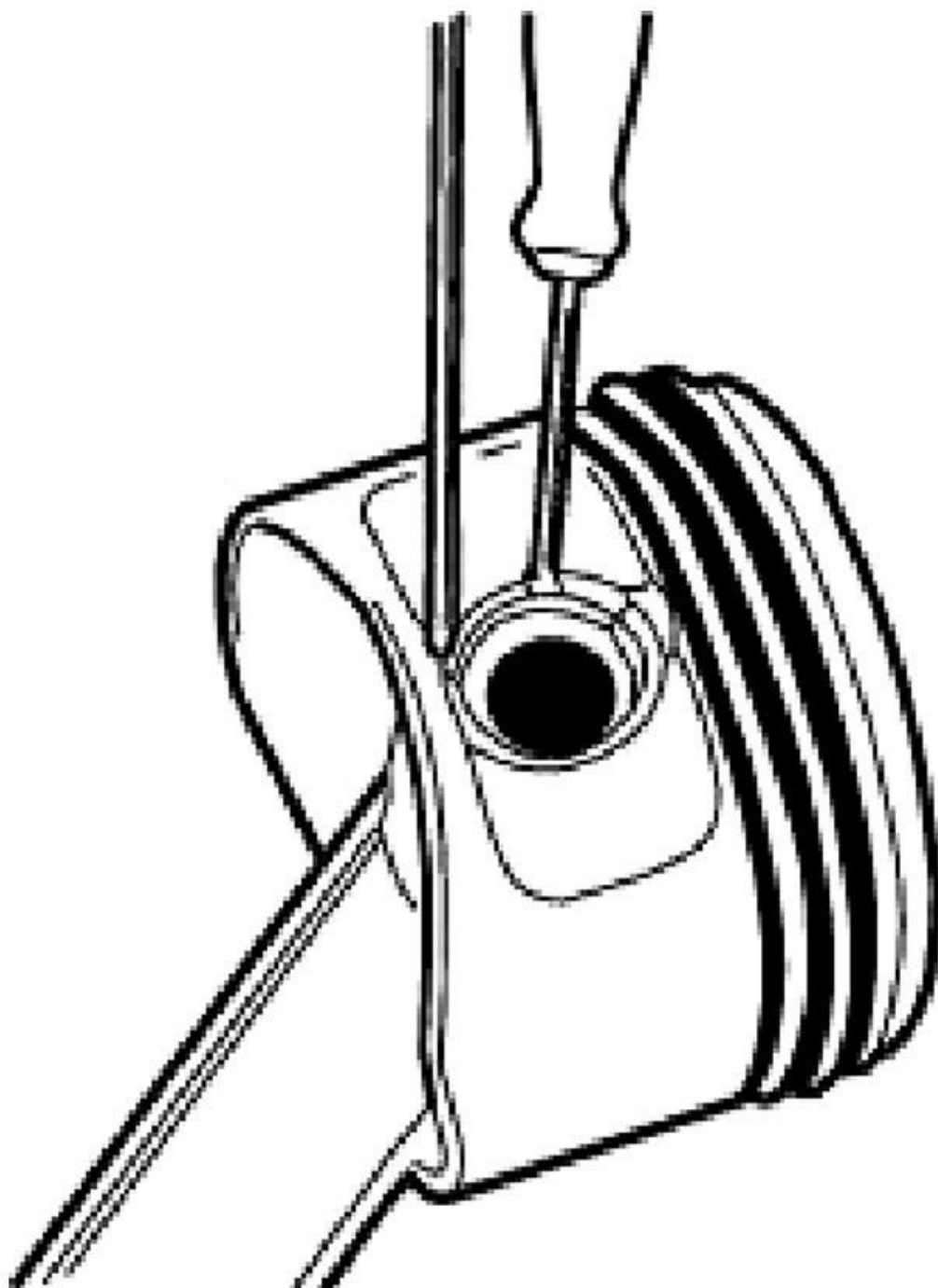
Fit conrod with piston pin to piston in such a way that both of the visible pair numbers on the installation direction arrow on the piston point to the right.



G03310314

Fig. 154: Fitting Conrod With Piston Pin To Piston
Courtesy of BMW OF NORTH AMERICA, INC.

Install snap ring so that opening is opposite recess.

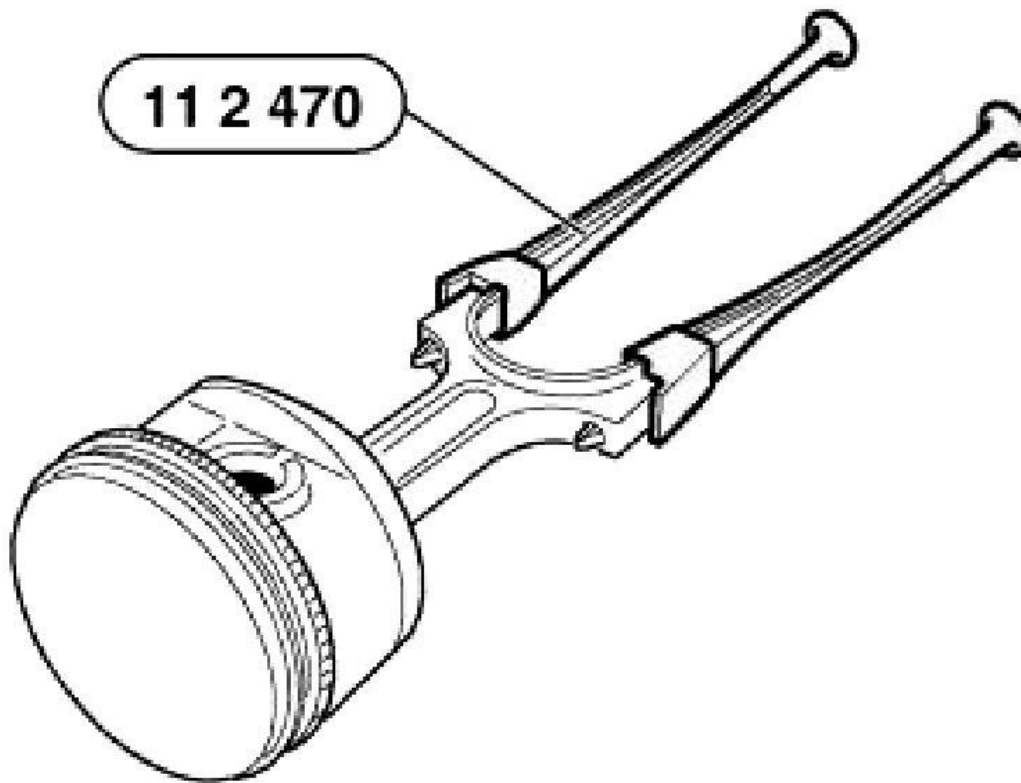


G03310315

Fig. 155: Installing Snap Ring

Courtesy of BMW OF NORTH AMERICA, INC.

Insert special tool 11 2 470 in conrod.



G03310316

Fig. 156: Inserting Special Tool In Conrod

Courtesy of BMW OF NORTH AMERICA, INC.

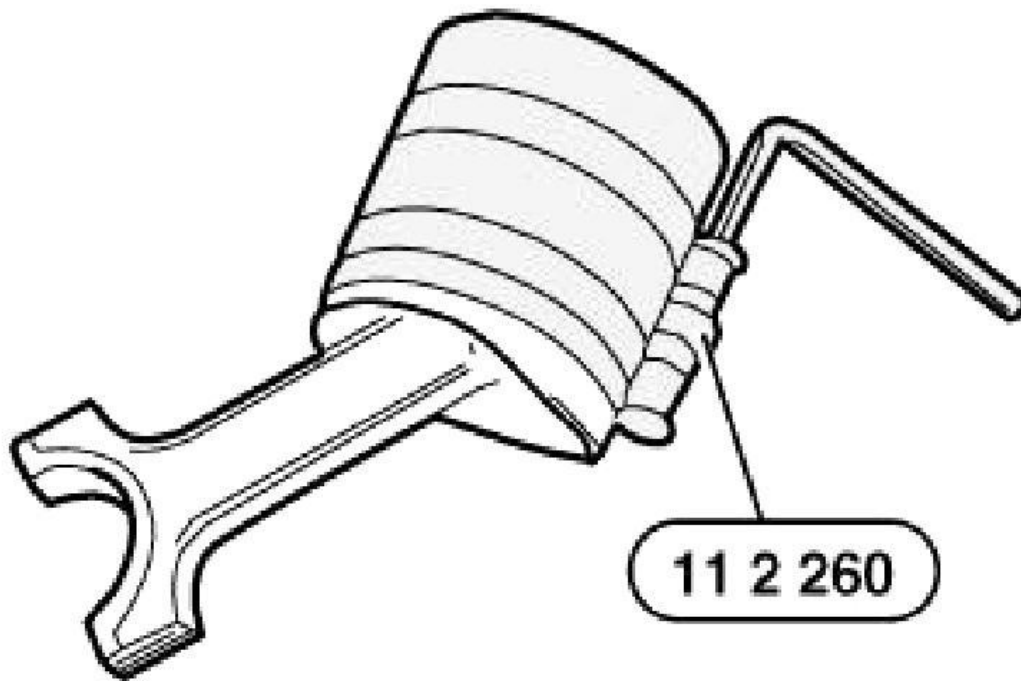
Lightly coat pistons and piston rings with oil.

Align contact points on piston rings (offset at approx. 120°, but do not arrange over piston pin lug).

NOTE: **Piston diameter 84 mm:**
 Use special tool 11 8 141.

Piston diameter 80 mm:

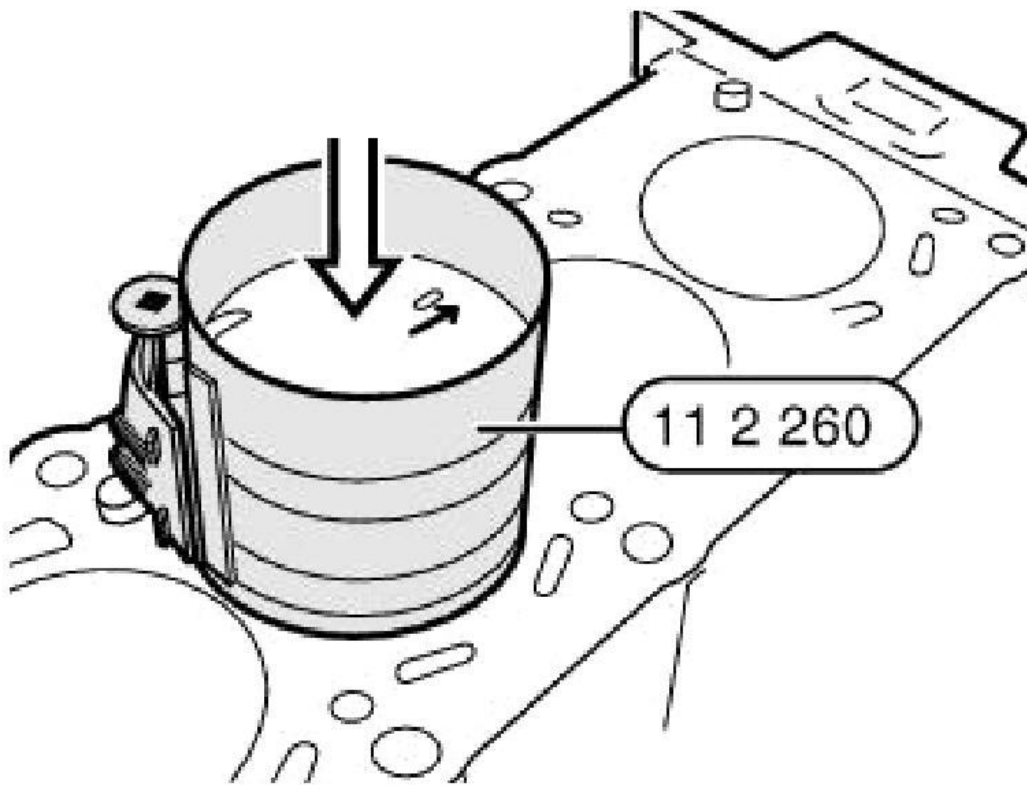
Press together piston rings with special tool 11 2 260.



G03310317

Fig. 157: Pressing Together Piston Rings With Special Tool
Courtesy of BMW OF NORTH AMERICA, INC.

Install piston so that arrow points to camshaft drive.



G03310318

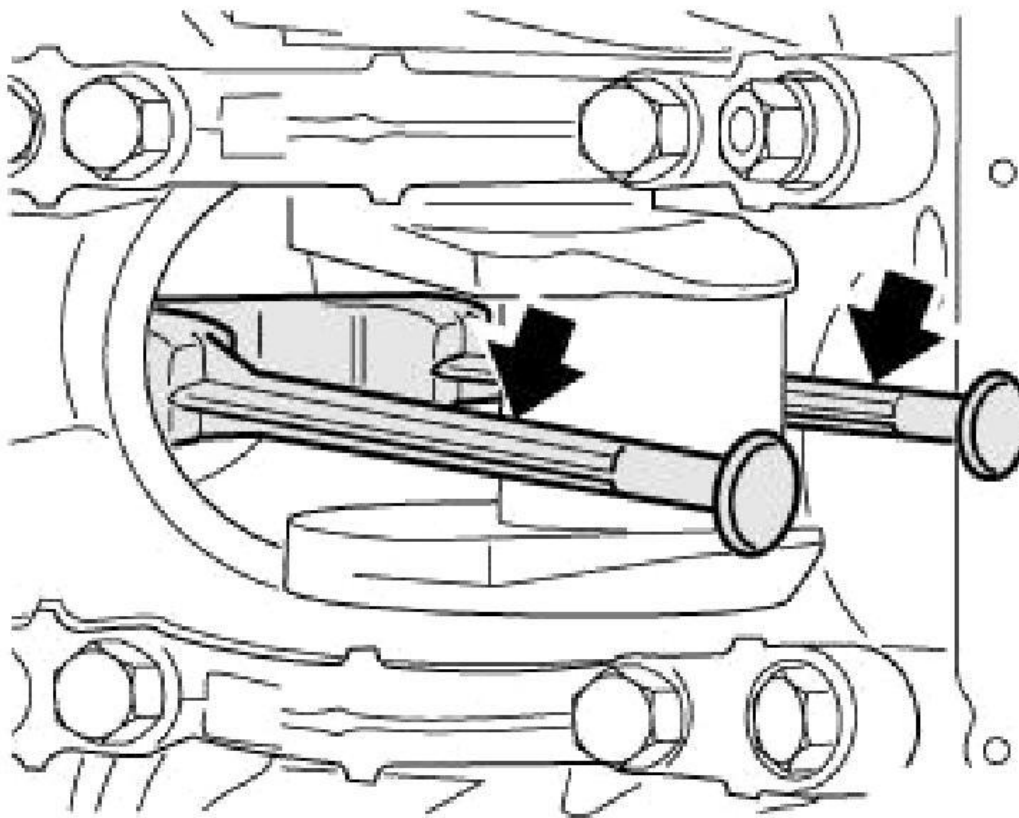
Fig. 158: Installing Piston Using Special Tool
Courtesy of BMW OF NORTH AMERICA, INC.

Entire circumference of tightening strap must rest firmly on engine block.

IMPORTANT: Danger of piston ring failure.

Press in piston only with finger force (do not knock in!).

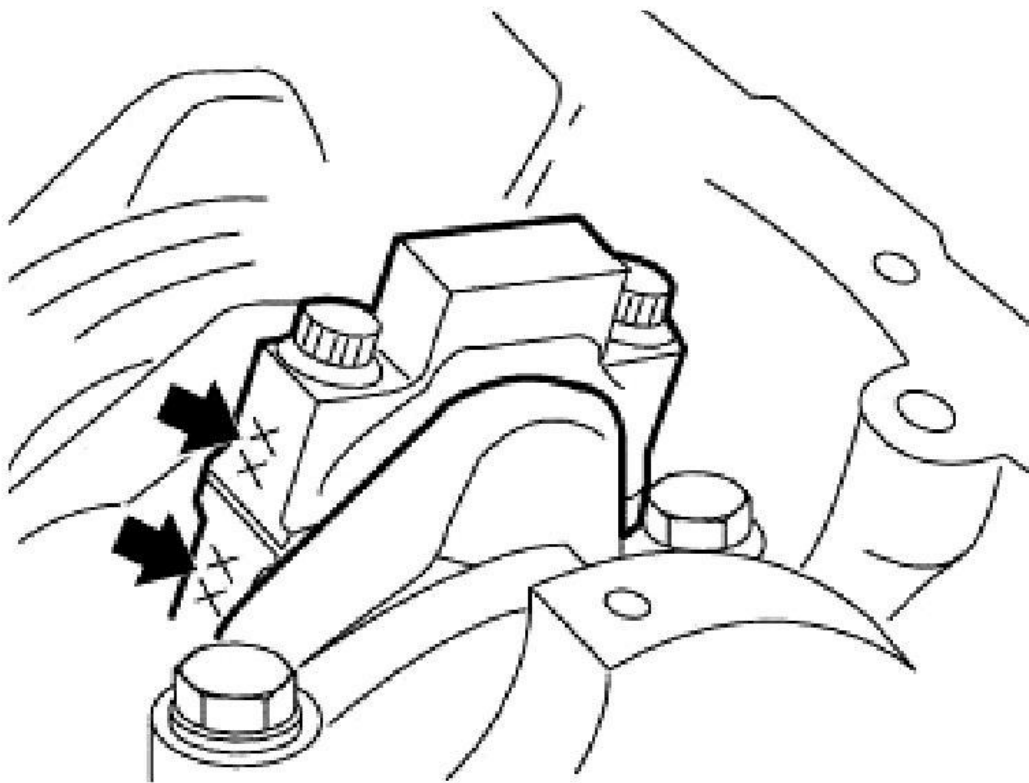
Attach crankpin to connecting rod.



G03310319

Fig. 159: Attaching Crankpin To Connecting Rod
Courtesy of BMW OF NORTH AMERICA, INC.

Apply light coat of oil to connecting -rod bearing shells. Fit bearing caps so that pair numbers match up. Install new conrod bolts.

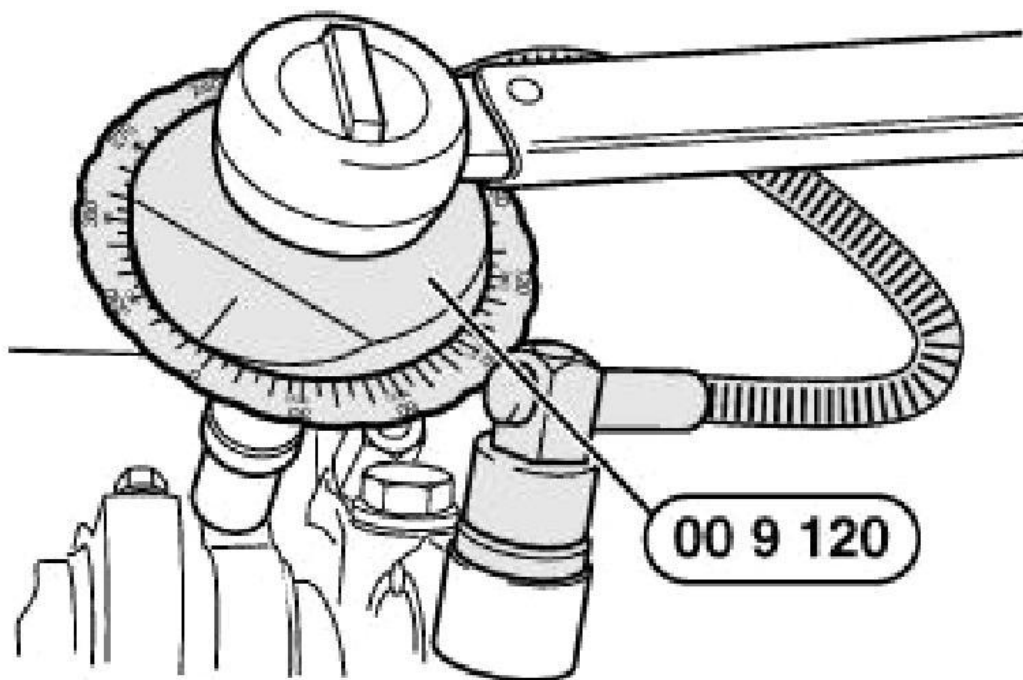


G03310320

Fig. 160: Fitting Bearing Caps

Courtesy of BMW OF NORTH AMERICA, INC.

Tighten down conrod bolts with special tool 00 9 120 or special tool 11 2 110.



G03310321

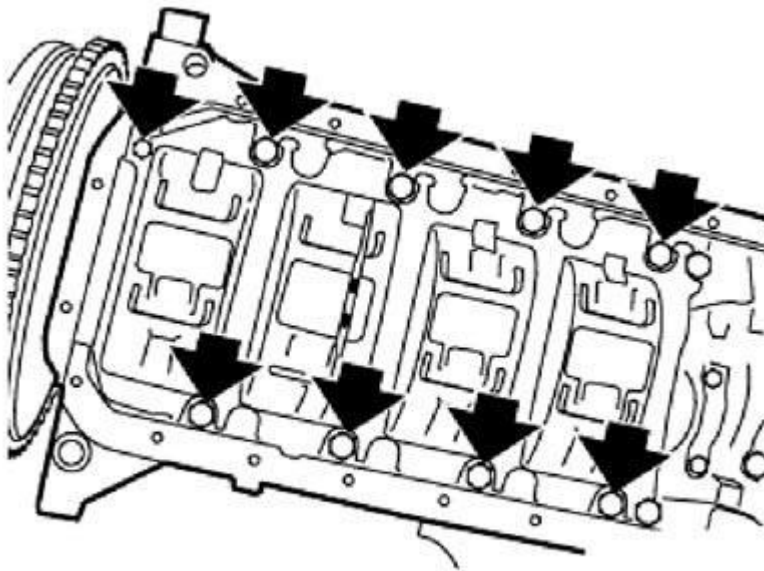
Fig. 161: Tightening Down Conrod Bolts With Special Tool
Courtesy of BMW OF NORTH AMERICA, INC.

Tightening torque 11 24 1AZ. Refer to **ENGINE - TIGHTENING TORQUES** .

Install oil pump. Refer to **11 41 000 REMOVING AND INSTALLING/REPLACING OIL PUMP (M52TU / M54 / M56)**.

If oil pump and oil scraper are two parts:

Fit oil scraper.



G03310322

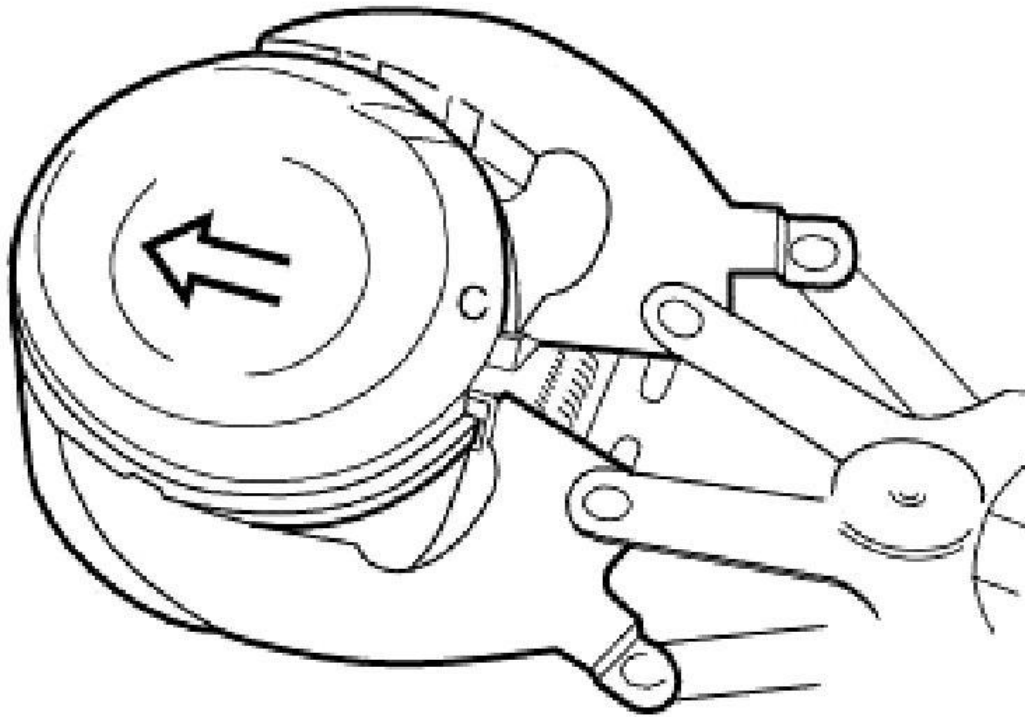
Fig. 162: Fitting Oil Scraper**Courtesy of BMW OF NORTH AMERICA, INC.**

Assemble engine.

11 25 671 REPLACING PISTON RINGS ON ALL PISTONS (M52 / S52 / M52TU / M54 / M56)

(piston removed)

Remove piston rings with a piston-ring compressing pliers.



G03310323

Fig. 163: Removing Piston Rings With Piston-Ring Compressing Pliers

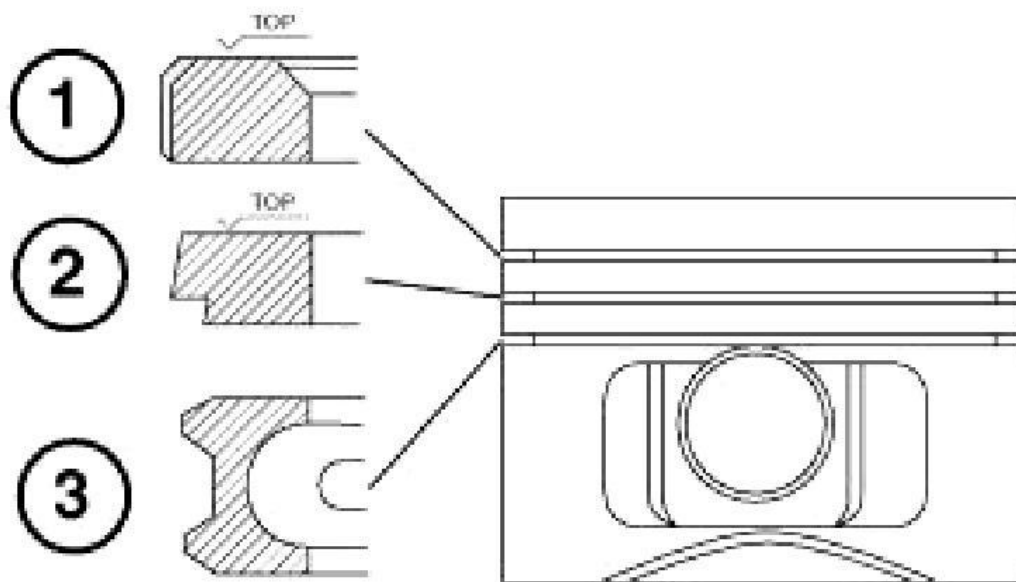
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: It might not be possible to find the identification on used piston rings.
Put aside piston rings in correct sequence and installation position.
Only install new pistons in conjunction with new piston rings.

Installation:

Install piston rings with "TOP" to piston top.

1. Plain compression ring
2. Stepped compression ring "Top"
3. Slotted oil ring with hose spring clip

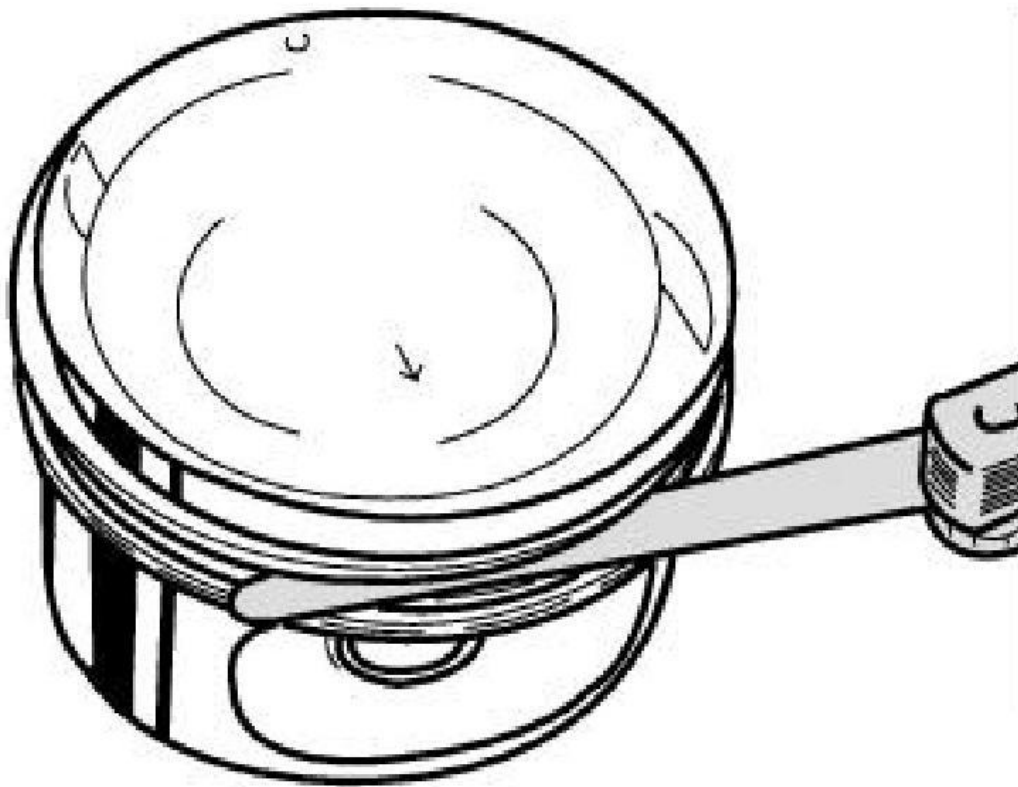


G03310324

Fig. 164: Identifying Piston Rings

Courtesy of BMW OF NORTH AMERICA, INC.

Measure axial play, refer to ENGINE - TECHNICAL DATA .

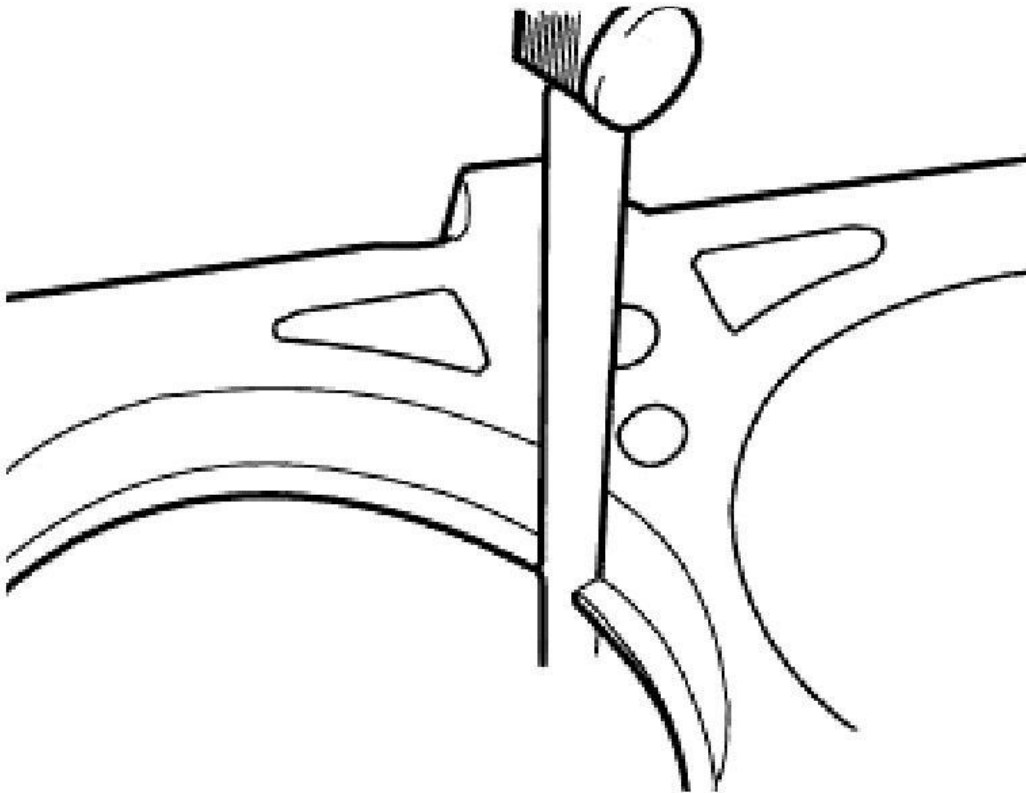


G03310325

Fig. 165: Measuring Axial Play

Courtesy of BMW OF NORTH AMERICA, INC.

Measure end clearance, refer to **ENGINE - TECHNICAL DATA** .



G03310326

Fig. 166: Measuring End Clearance

Courtesy of BMW OF NORTH AMERICA, INC.

V-RIBBED BELT

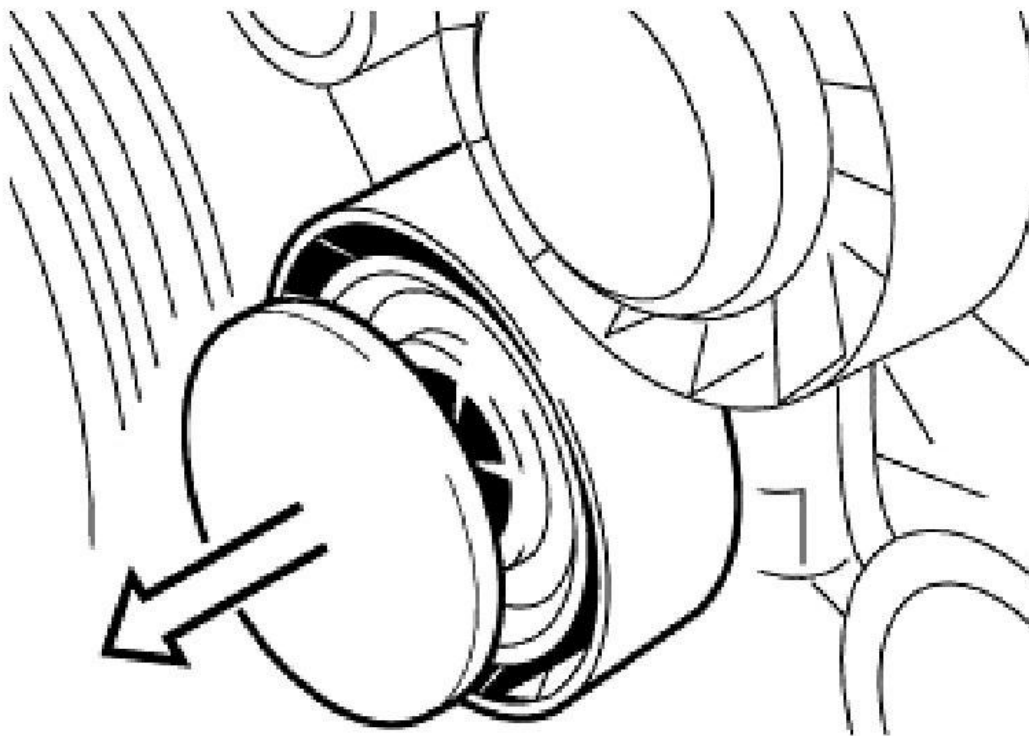
11 28 010 REPLACING ALTERNATOR DRIVE BELT (M52 / S52 / M52TU / M54 / M56)

NOTE: If the drive belt is to be subsequently reused:
Mark direction of travel and reinstall drive belt in same direction of travel.

Necessary preliminary tasks:

- Remove fan clutch with fan impeller
- Remove A/C compressor drive belt, refer to **11 28 050 REPLACING A/C COMPRESSOR DRIVE BELT (M52 / S52 / M52TU / M54 / M56)**

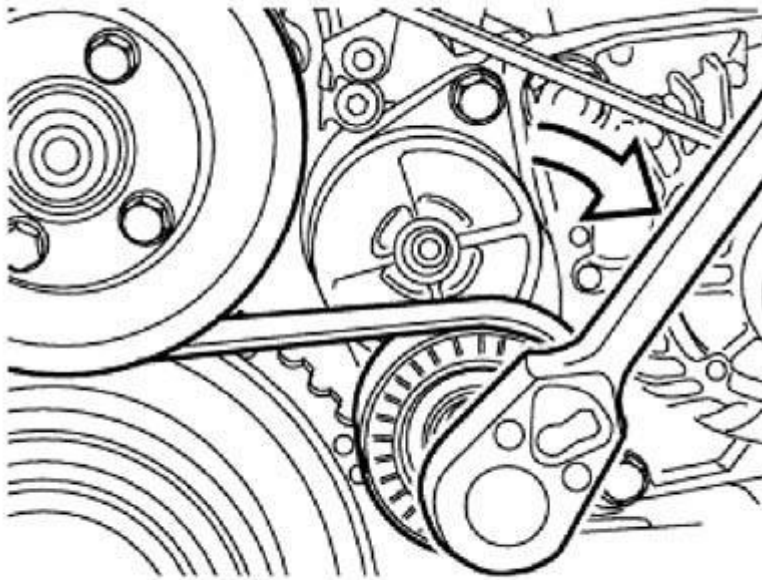
Remove cap from tensioning roller.



G03310327

Fig. 167: Removing Cap From Tensioning Roller
Courtesy of BMW OF NORTH AMERICA, INC.

Relieve tension on belt drive.



G03310328

Fig. 168: Removing Drive Belt

Courtesy of BMW OF NORTH AMERICA, INC.

Remove drive belt.

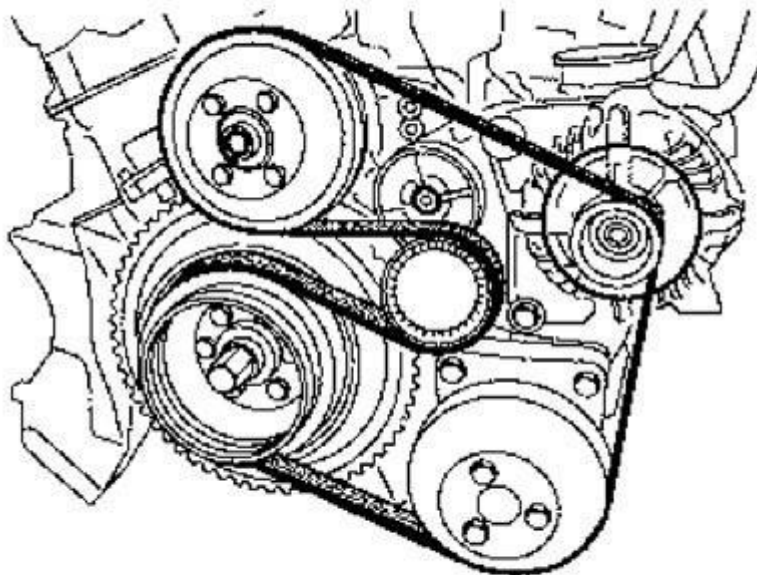
IMPORTANT: Drive belt must be replaced if fouled with hydraulic fluid.

Installation:

Check drive belt for coolant and oil residues, replace if necessary.

Installation:

Check that belt is correctly positioned on belt pulleys.

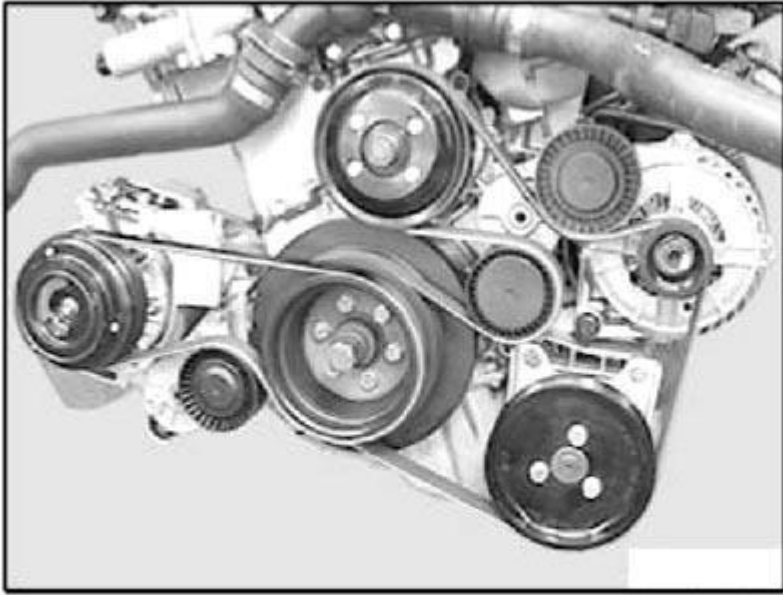


G03310329

Fig. 169: View Of Belt Position

Courtesy of BMW OF NORTH AMERICA, INC.

Version with auxiliary tensioning roller.



G03310330

Fig. 170: View Of Belt Position With Auxiliary Tensioning Roller
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

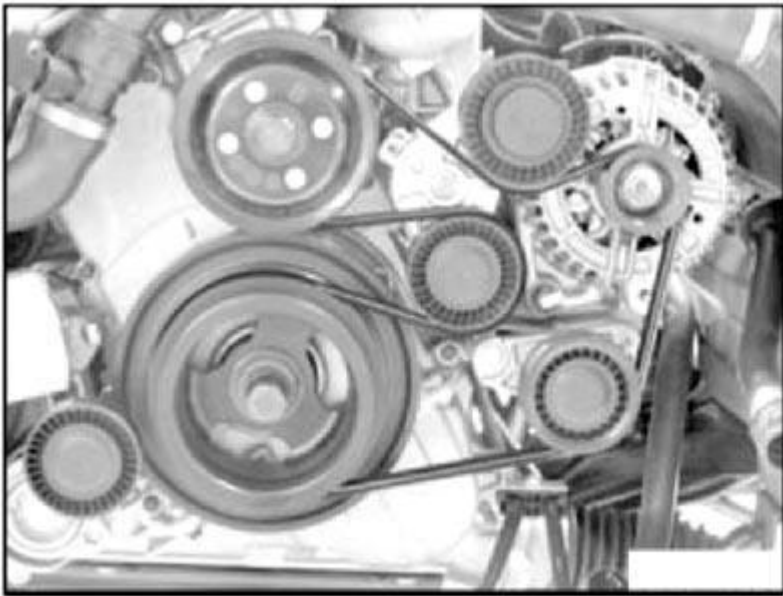
Locking device of auxiliary tensioning roller must snap into groove on alternator.



G03310331

Fig. 171: Identifying Locking Device Of Auxiliary Tensioning Roller
Courtesy of BMW OF NORTH AMERICA, INC.

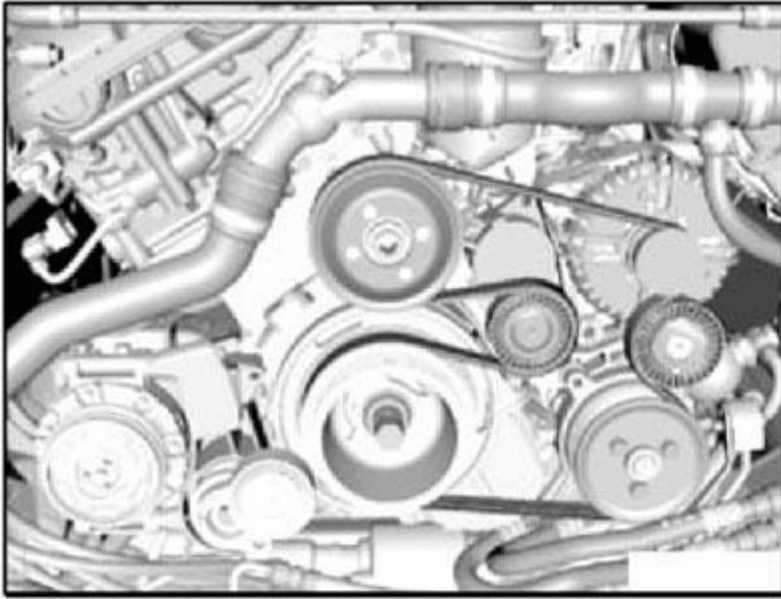
Version on E85.



G03310332

Fig. 172: Identifying Locking Device Of Auxiliary Tensioning Roller (E85)
Courtesy of BMW OF NORTH AMERICA, INC.

Version on E60/E65.



G03310333

Fig. 173: Identifying Locking Device Of Auxiliary Tensioning Roller (E60/E65)
Courtesy of BMW OF NORTH AMERICA, INC.

11 28 050 REPLACING A/C COMPRESSOR DRIVE BELT (M52 / S52 / M52TU / M54 / M56)

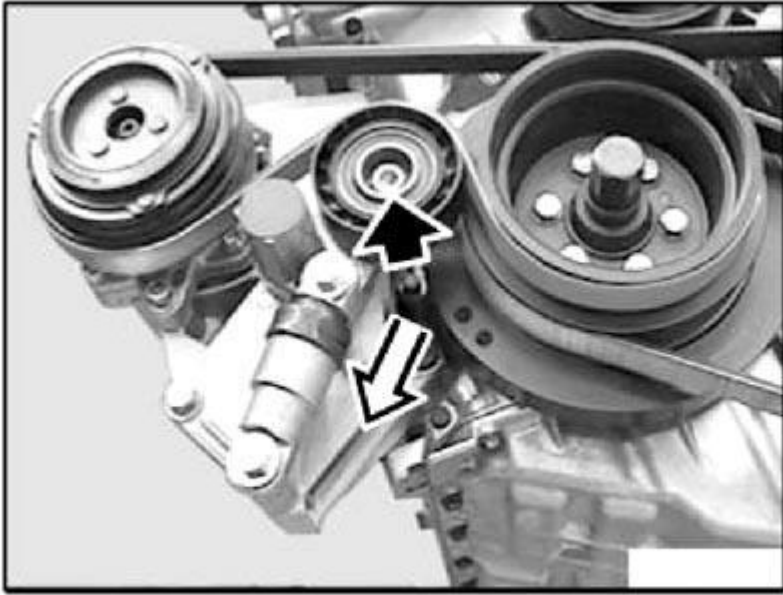
NOTE: **If the drive belt is to be subsequently reused:
Mark direction of travel and reinstall drive belt in same direction of travel.**

Necessary preliminary tasks:

- If necessary, remove splash guard.

Model with hydraulic drive belt and tension jack:

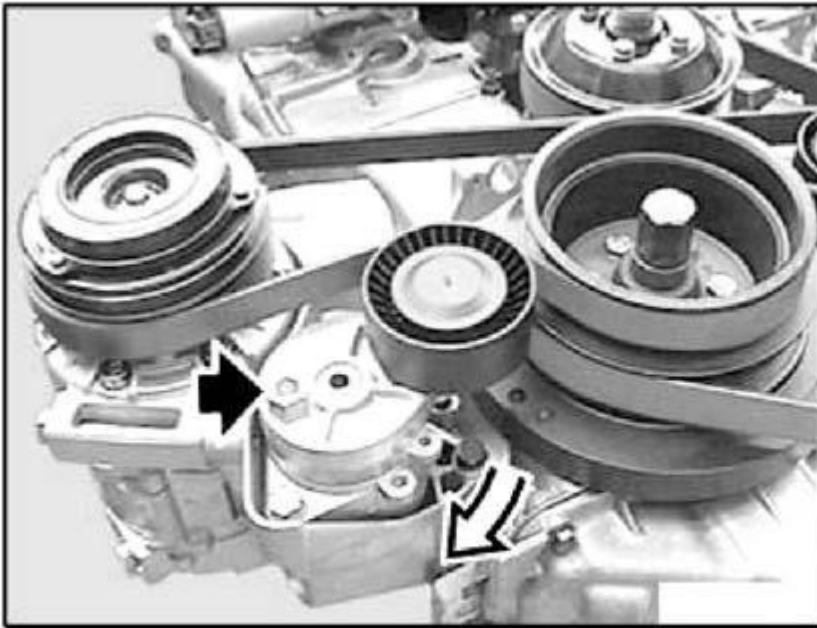
Remove the dust cap. Push back belt tensioner at bolt connection of guide pulley and remove drive belt.



G03310334

Fig. 174: Removing Drive Belt**Courtesy of BMW OF NORTH AMERICA, INC.****Model with mechanical drive belt and tension jack:**

Press back drive belt tensioner at hexagon head or Torx socket and remove drive belt.



G03310335

Fig. 175: Removing Drive Belt

Courtesy of BMW OF NORTH AMERICA, INC.

IMPORTANT: Drive belt must be replaced if fouled with hydraulic fluid.*Installation:*

Check drive belt for coolant and oil residues, replace if necessary.

Install drive belt, make sure it is correctly positioned on belt pulleys.

CAMSHAFT**11 31 001 REPLACING CAMSHAFT (M52TU / M54 / M56)****Special tools required:**

- 00 9 250
- 11 2 300
- 11 3 240
- 11 3 244
- 11 3 250

- 11 3 260
- 11 3 292
- 11 4 220
- 11 6 150
- 11 6 180

(if necessary inlet or exhaust side)

The inlet or exhaust camshaft can be replaced in the vehicle.

IMPORTANT: Incorrect assembly/removal without special tools exposes the camshaft to the risk of preliminary damage or breakage. The valves may also be bent by contact with the piston crown. Comply without fail with the job instructions, recommended special tools and work sequence.

Removal

Removal of camshafts is described separately from installation. The assembly sequence for removal and installation is different.

Remove VANOS adjustment unit. Refer to **11 36 010 REMOVING AND INSTALLING OR REPLACING DOUBLE VANOS ADJUSTMENT UNIT (M52TU / M54 / M56)**.

IMPORTANT: Cylinder for chain tensioning piston is under spring pressure.

Unfasten cylinder for chain tensioning piston.

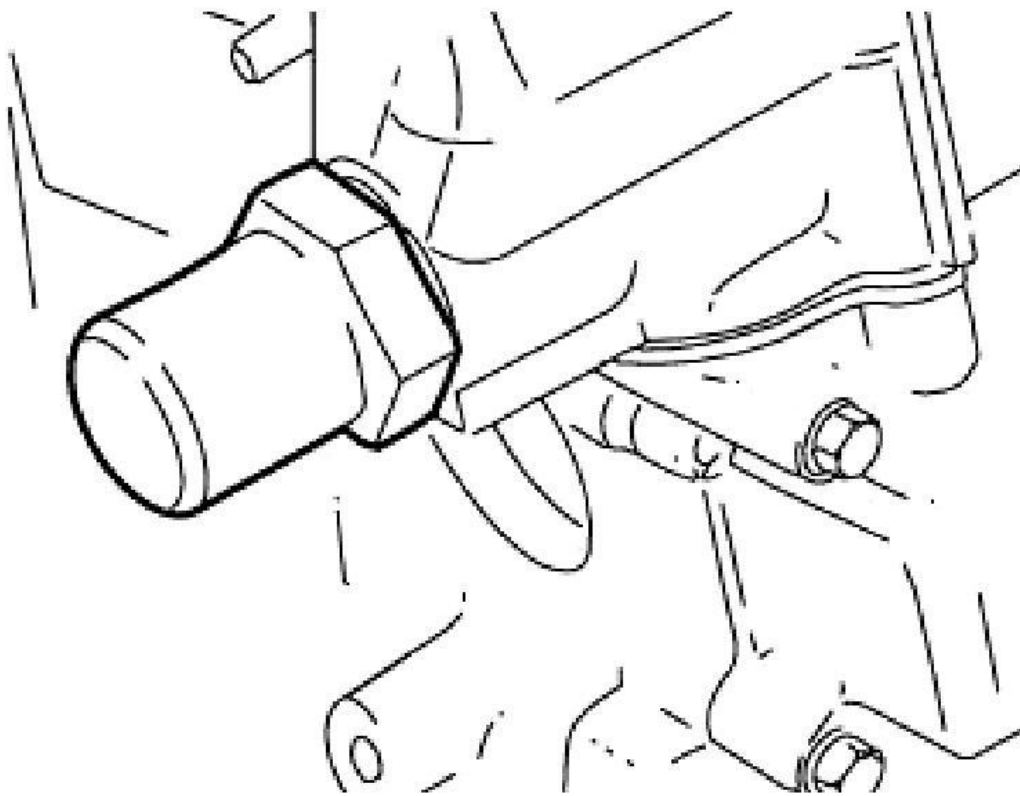
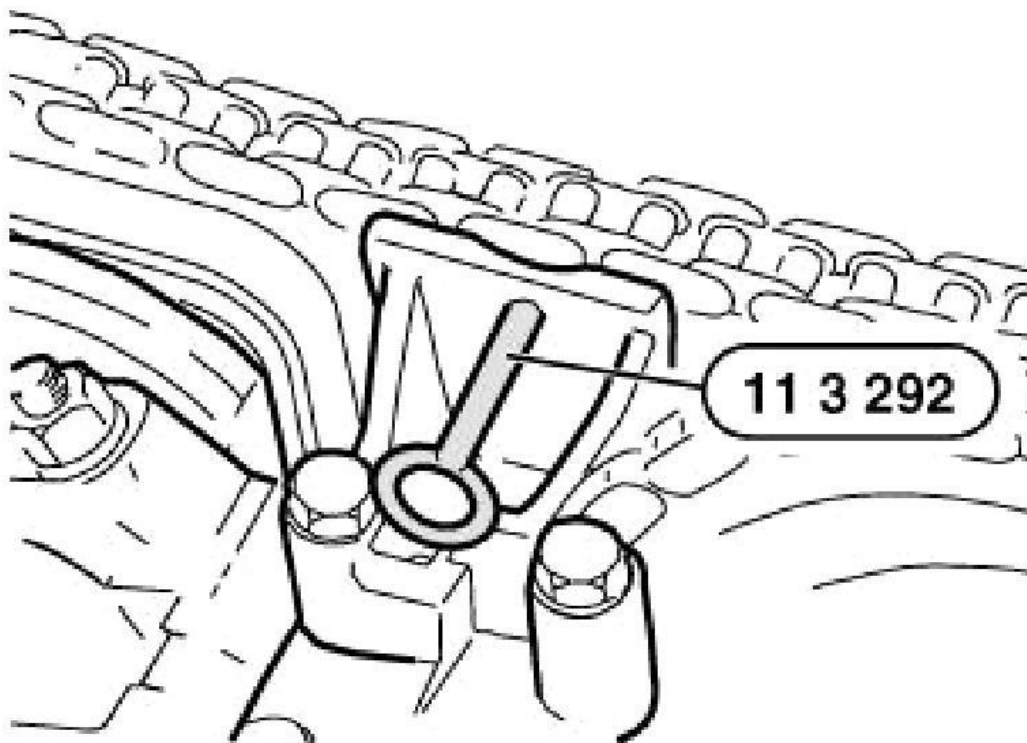
**G03310336**

Fig. 176: Unfastening Cylinder For Chain Tensioning Piston
Courtesy of BMW OF NORTH AMERICA, INC.

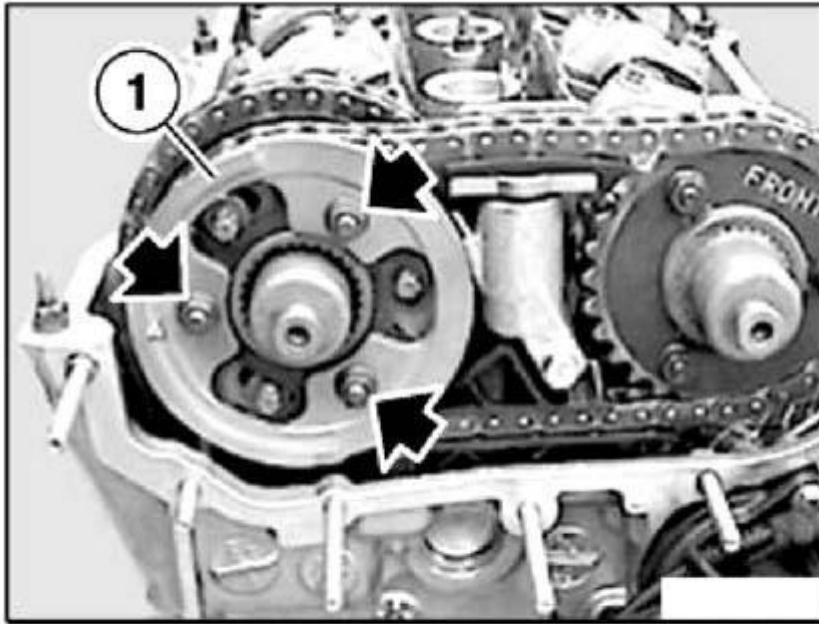
Press down secondary chain tensioner at top and lock with special tool 11 3 292.



G03310337

Fig. 177: Locking Secondary Chain Tensioner
Courtesy of BMW OF NORTH AMERICA, INC.

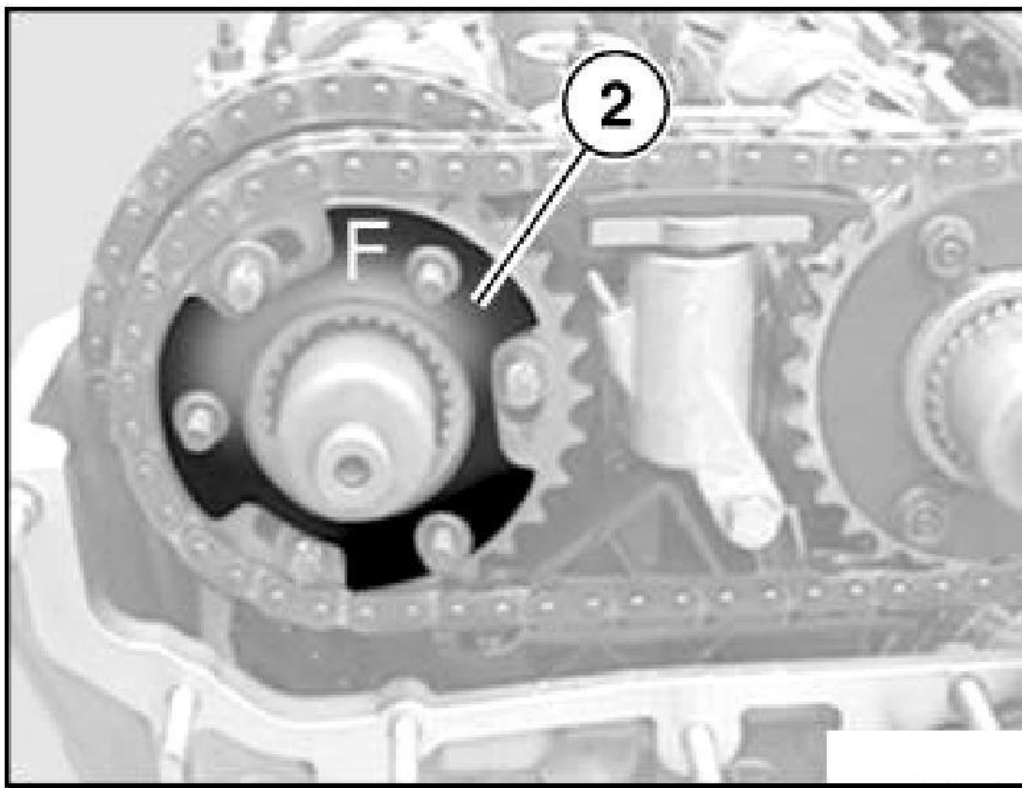
Release nuts, remove sensor gear (1).



G03310338

Fig. 178: Removing Sensor Gear**Courtesy of BMW OF NORTH AMERICA, INC.**

Remove plate spring (2).

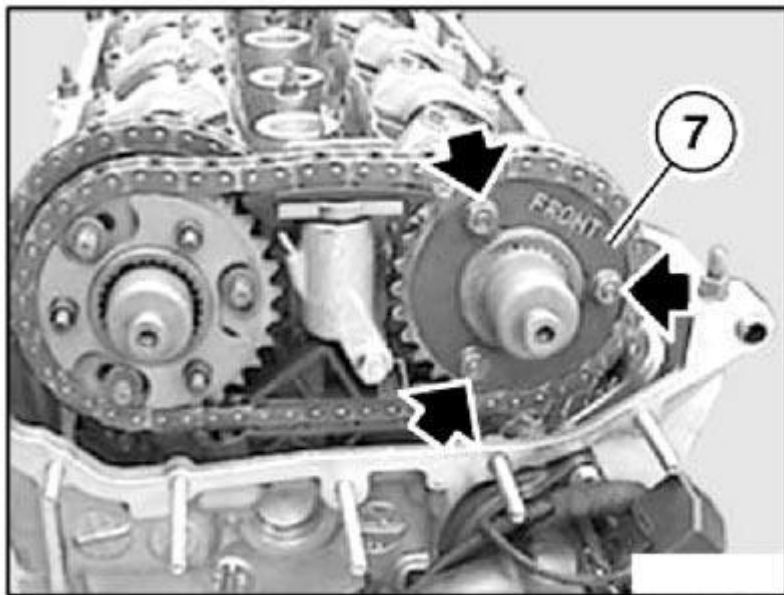


G03310339

Fig. 179: Removing Plate Spring

Courtesy of BMW OF NORTH AMERICA, INC.

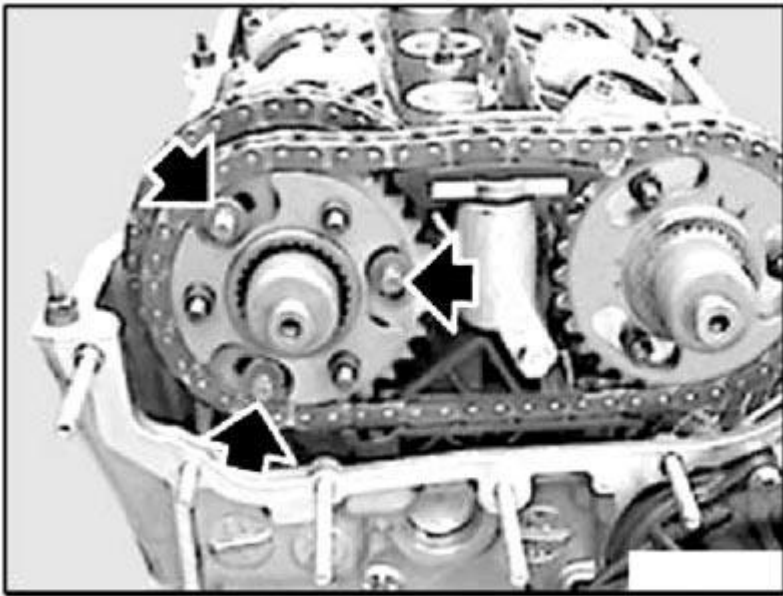
Release nuts on inlet side and remove corrugated washer (7).



G03310340

Fig. 180: Removing Corrugated Washer
Courtesy of BMW OF NORTH AMERICA, INC.

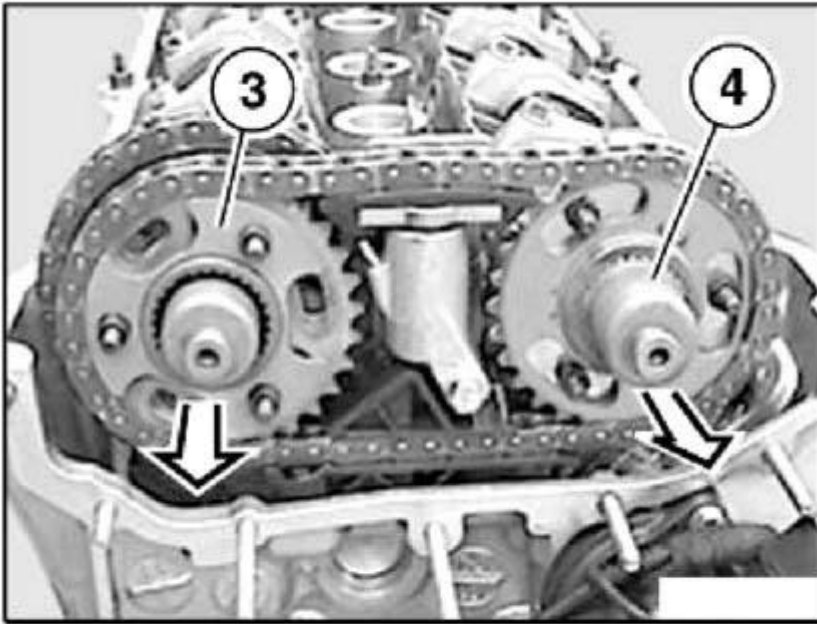
Unfasten screws.



G03310341

Fig. 181: Unfastening Screws**Courtesy of BMW OF NORTH AMERICA, INC.**

Lift off exhaust and inlet chain wheels together with chain, friction washer (3) and toothed shaft (4).

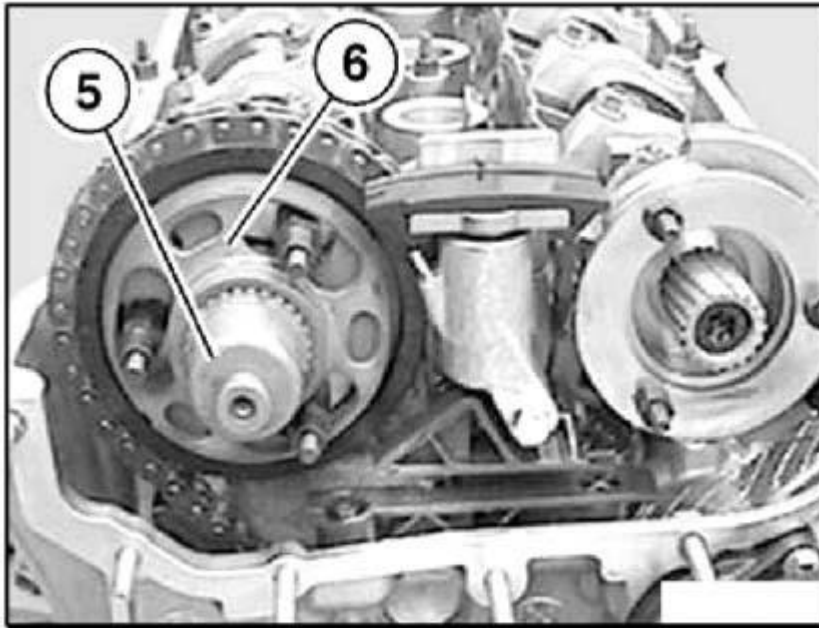


G03310342

Fig. 182: Lifting Off Exhaust And Inlet Chain Wheels
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: **Toothed shaft (4) is an identical part for exhaust and inlet sides. Store used toothed shafts in order and reinstall on the same side only.**

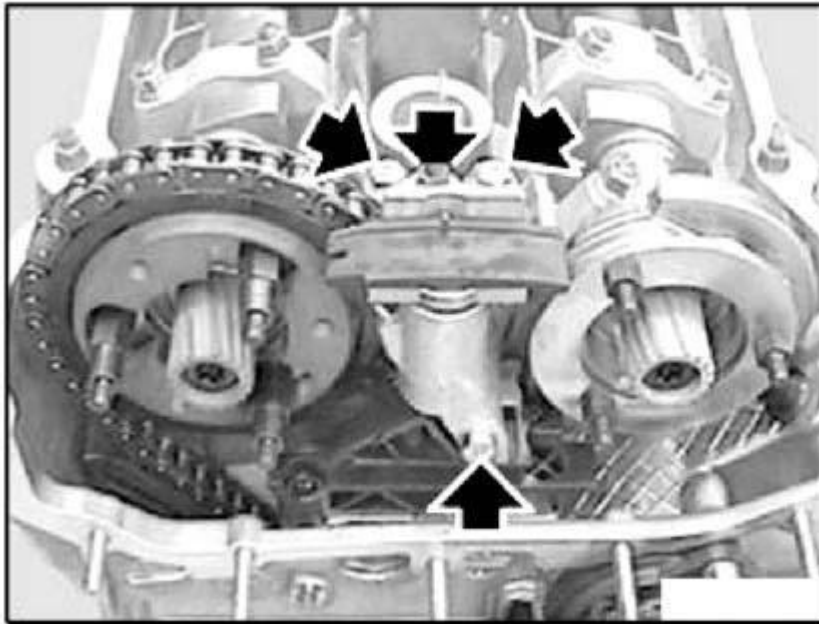
Remove toothed shaft (5) with toothed sleeve (6).



G03310343

Fig. 183: Removing Toothed Shaft With Toothed Sleeve
Courtesy of BMW OF NORTH AMERICA, INC.

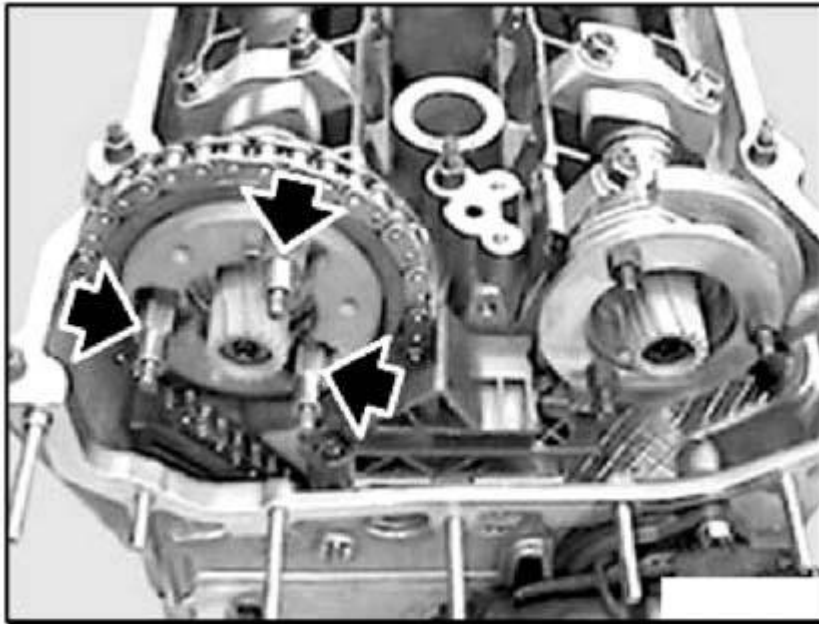
Unfasten screws. Remove secondary chain tensioner.



G03310344

Fig. 184: Removing Secondary Chain Tensioner
Courtesy of BMW OF NORTH AMERICA, INC.

Release screw-in pin.

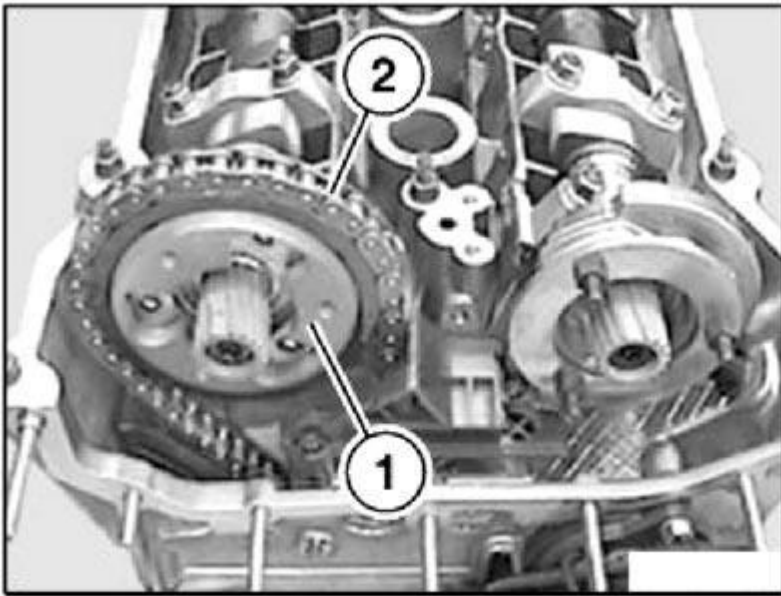


G03310345

Fig. 185: Releasing Screw-In Pin

Courtesy of BMW OF NORTH AMERICA, INC.

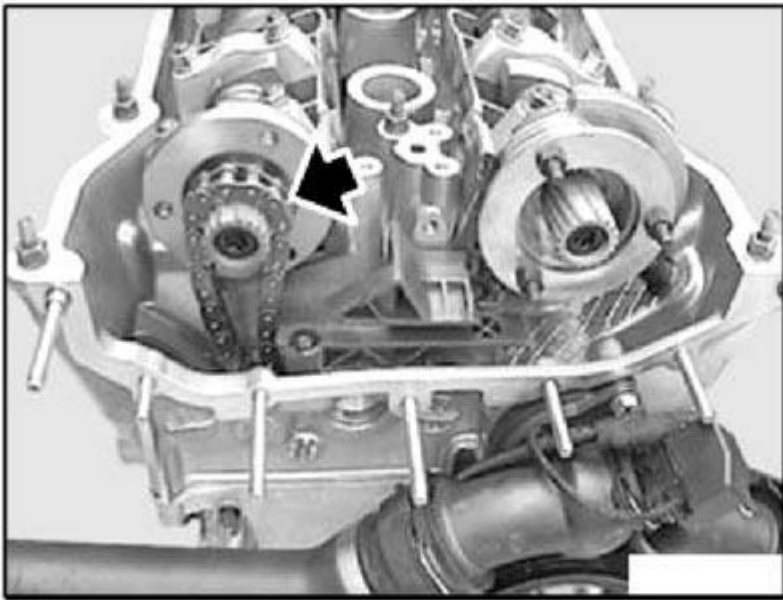
Feed chain wheel (1) towards front out of timing chain (2).



G03310346

Fig. 186: Feeding Chain Wheel Out Of Timing Chain
Courtesy of BMW OF NORTH AMERICA, INC.

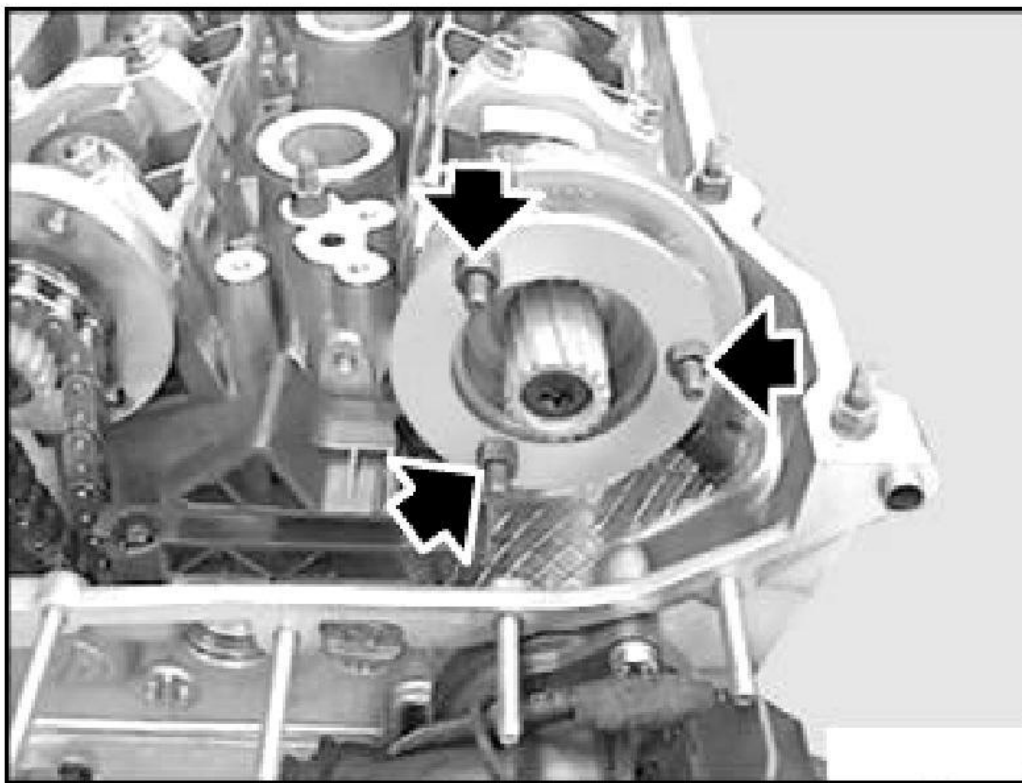
NOTE: Timing chain remains positioned over exhaust camshaft.



G03310347

Fig. 187: Identifying Timing Chain Position**Courtesy of BMW OF NORTH AMERICA, INC.**

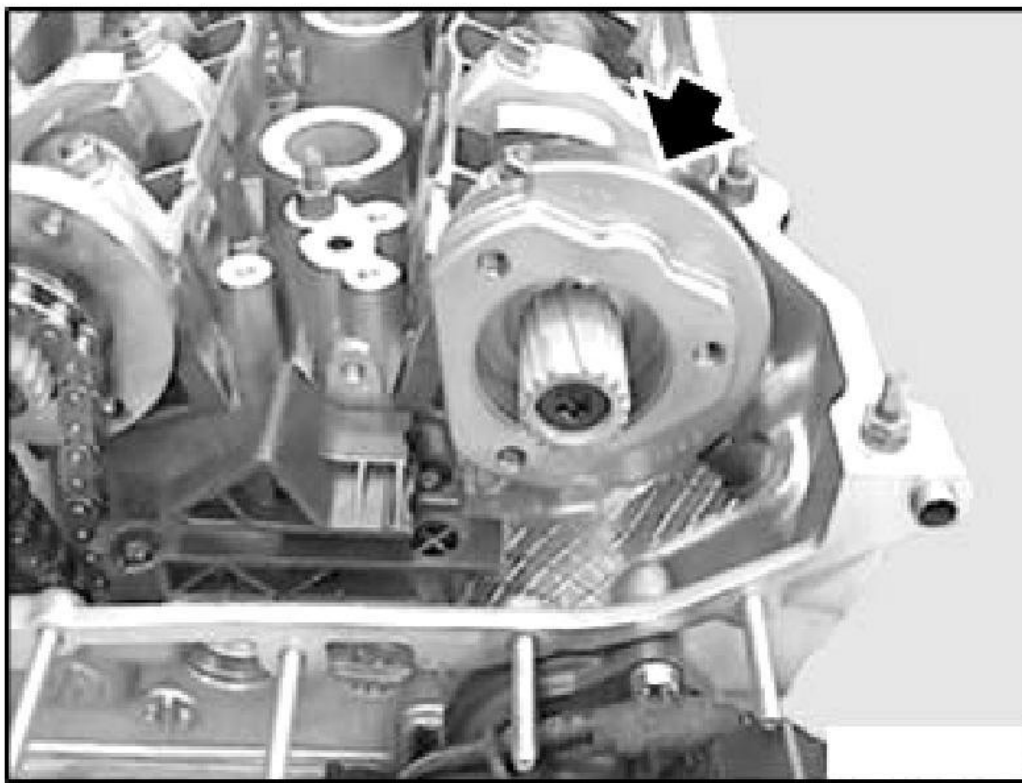
If necessary, release screw-in pin on inlet side. Remove thrust washer.



G03310348

Fig. 188: Removing Thrust Washer
Courtesy of BMW OF NORTH AMERICA, INC.

Remove sensor gear.

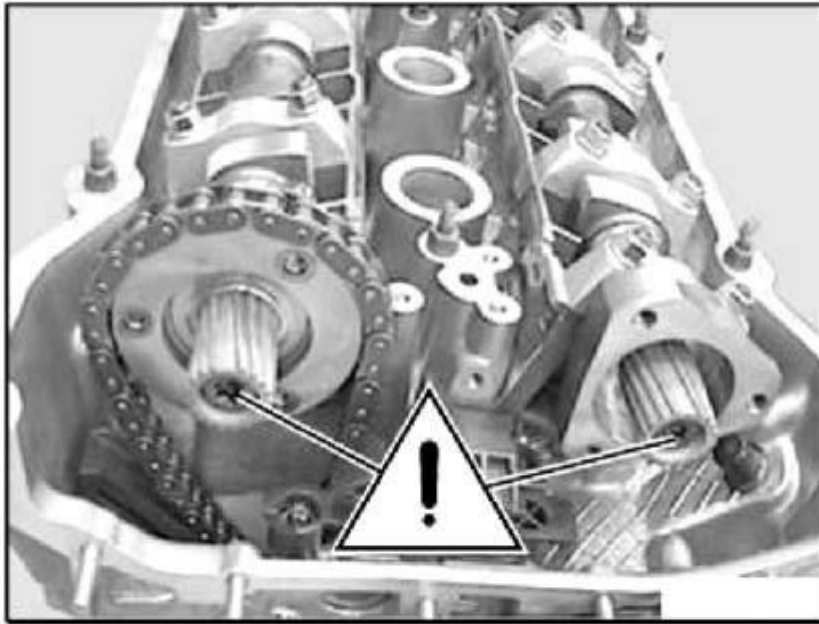


G03310349

Fig. 189: Removing Sensor Gear

Courtesy of BMW OF NORTH AMERICA, INC.

IMPORTANT: Do "NOT" release these screws.

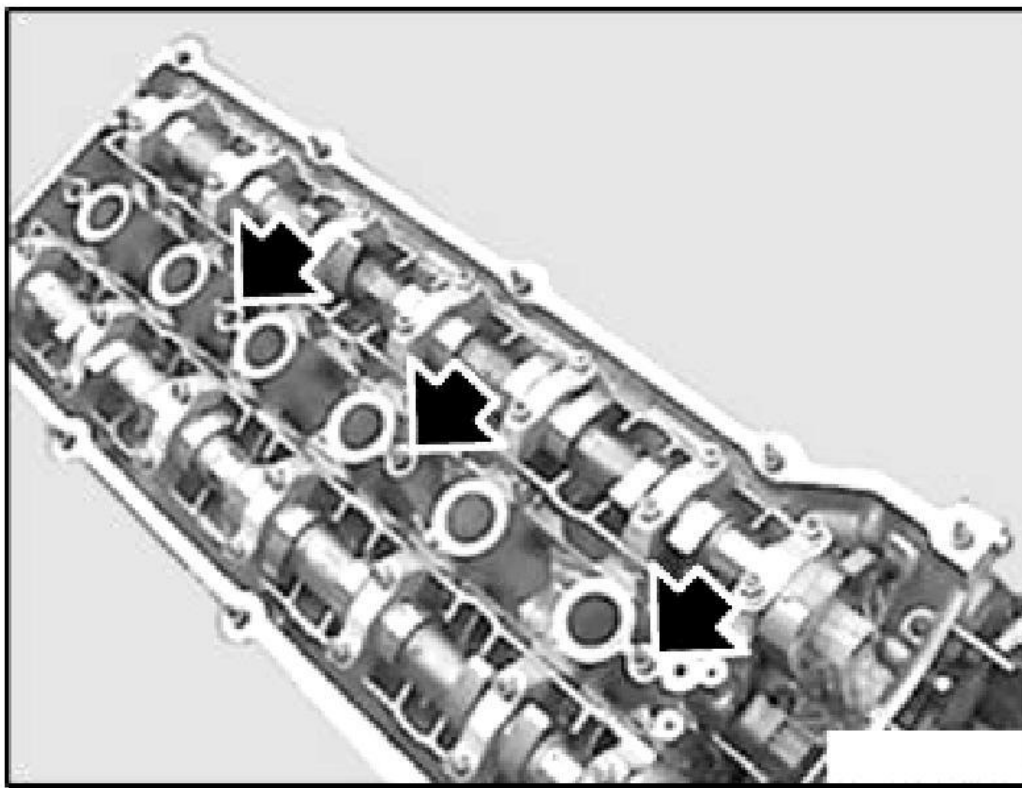


G03310350

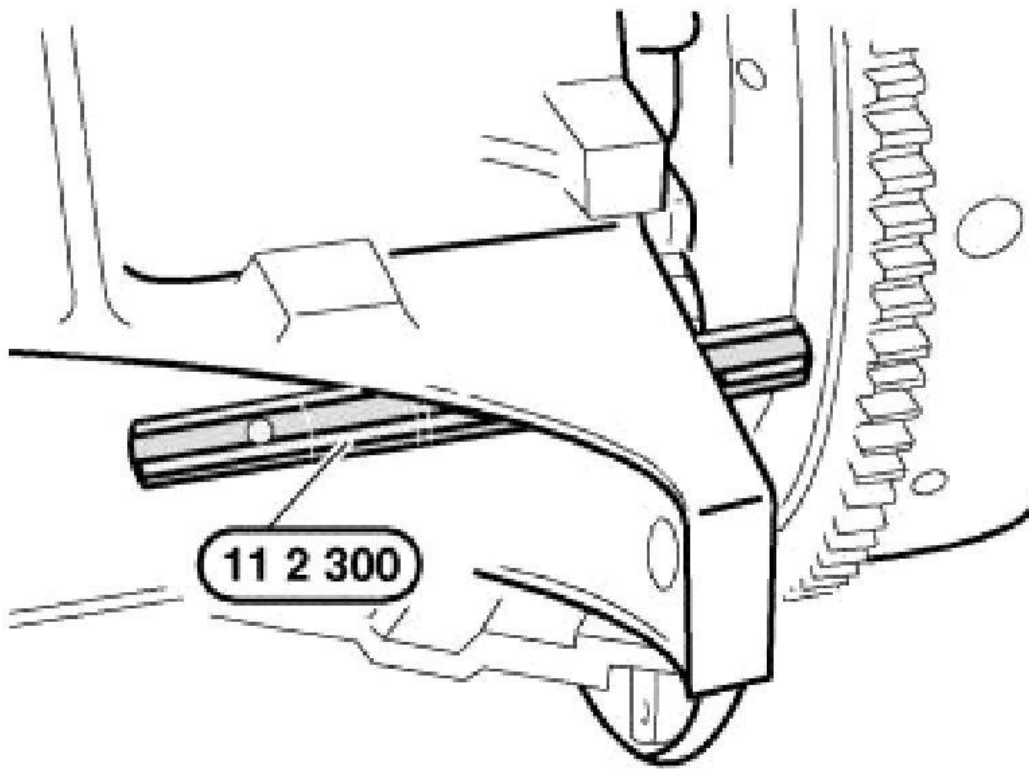
Fig. 190: Locating Screws

Courtesy of BMW OF NORTH AMERICA, INC.

Unscrew studs.

**G03310351****Fig. 191: Unscrewing Studs****Courtesy of BMW OF NORTH AMERICA, INC.**

Pull special tool 11 2 300 back until flywheel is no longer secured in position.



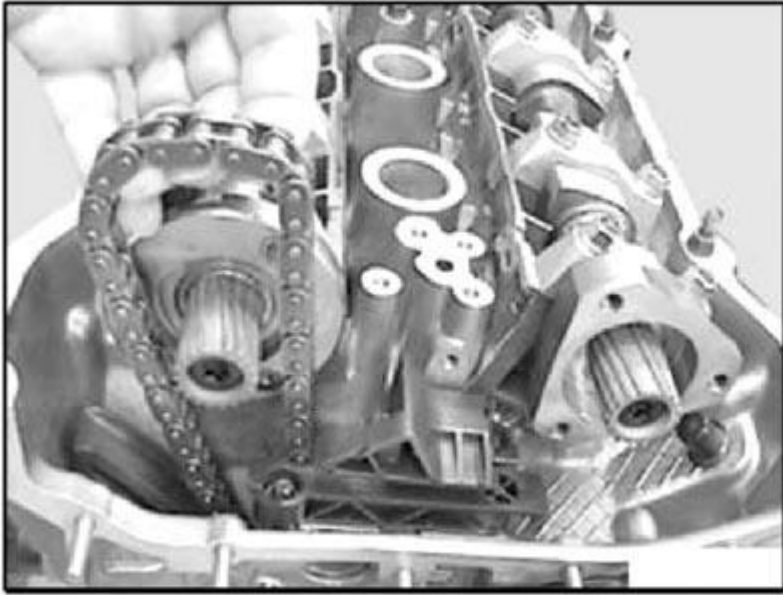
G03310352

Fig. 192: Pulling Special Tool Back
Courtesy of BMW OF NORTH AMERICA, INC.

IMPORTANT: To prevent damaging valves when fitting the camshafts, no pistons should be in TDC position.

Lift timing chain and hold under tension.

Rotate engine against direction of engine rotation approx. 30° using the central bolt.



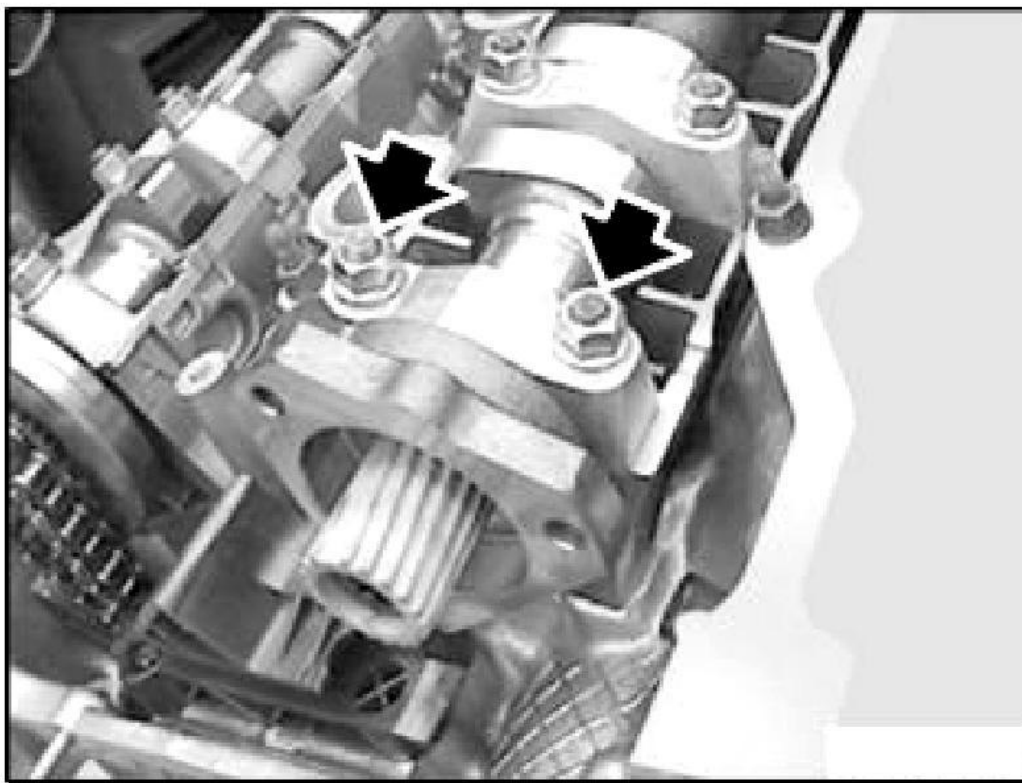
G03310353

Fig. 193: Lifting Timing Chain

Courtesy of BMW OF NORTH AMERICA, INC.

IMPORTANT: Bearing cap 1 of inlet camshaft is centered with adapter sleeves.

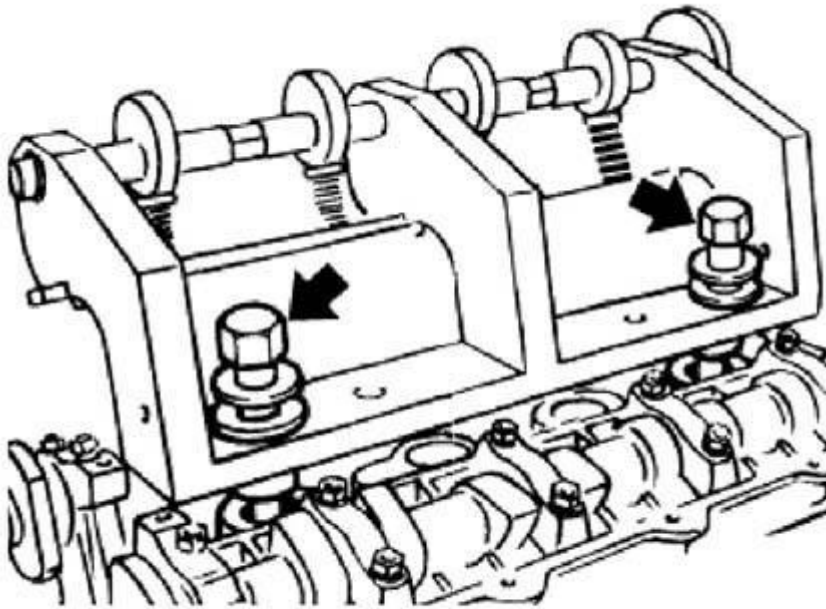
To prevent inlet camshaft from tilting in bearing strip, release nuts and remove bearing cap 1.



G03310354

Fig. 194: Removing Bearing Cap
Courtesy of BMW OF NORTH AMERICA, INC.

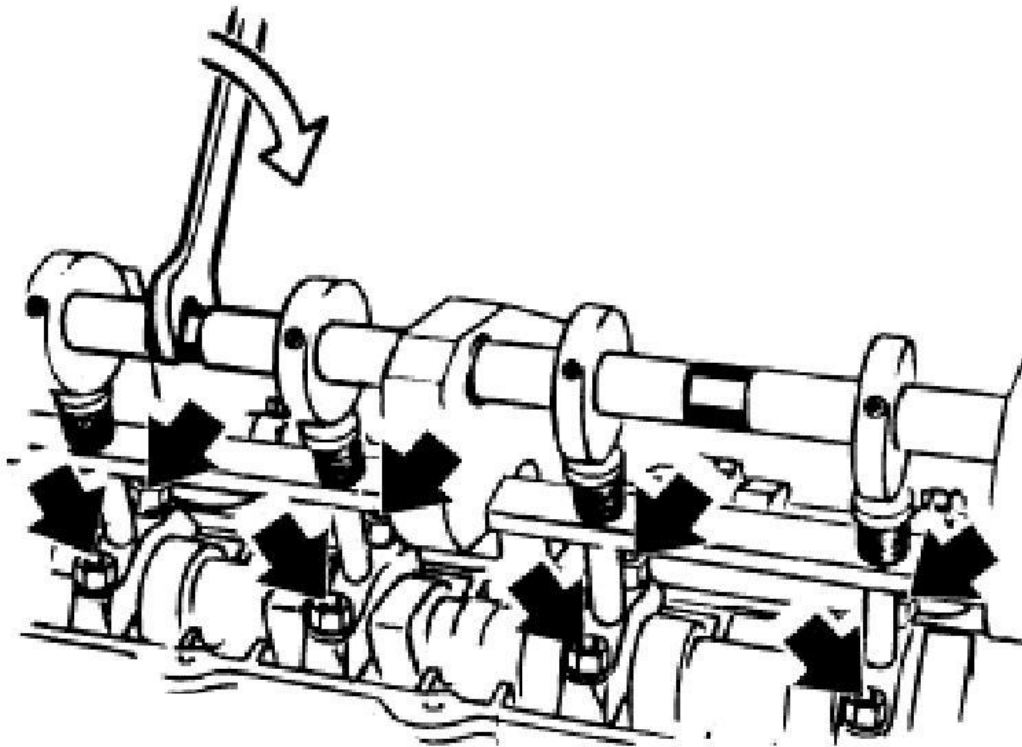
Fit special tool 11 3 260 to cylinder head and screw into spark plug threads in cylinders 1 and 4.



G03310355

Fig. 195: Fitting Special Tool To Cylinder Head
Courtesy of BMW OF NORTH AMERICA, INC.

Turn the eccentric shaft to tension the bearing caps. Unfasten nuts on bearing cover.

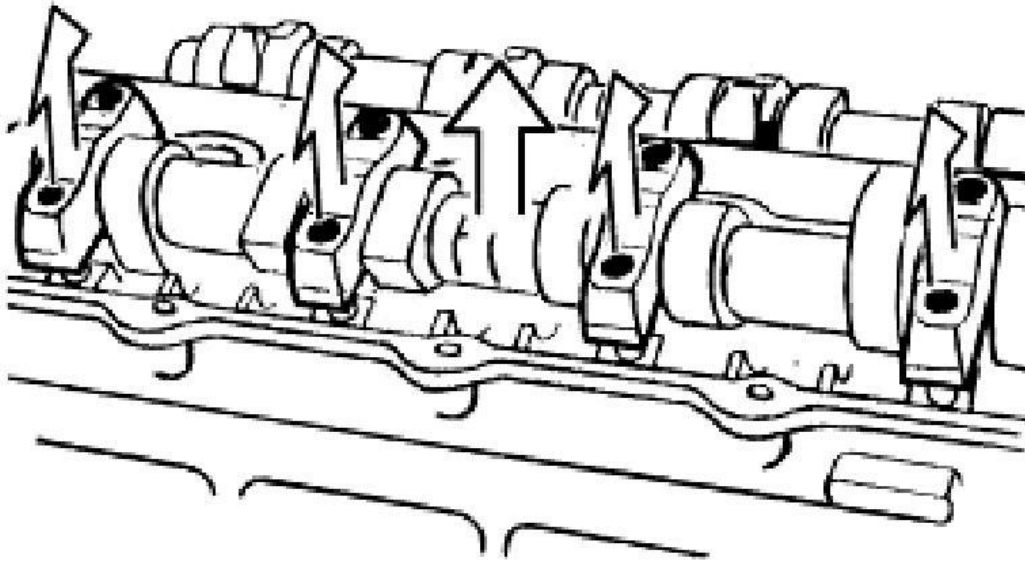


G03310356

Fig. 196: Unfastening Nuts On Bearing Cover
Courtesy of BMW OF NORTH AMERICA, INC.

Relieve tension on eccentric shaft and remove special tool 11 3 260.

Remove bearing covers and place to one side in orderly fashion. Remove camshaft.



G03310357

Fig. 197: Removing Bearing Covers

Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: If the cylinder head is then to be removed, remove complete bearing strip with bucket tappets.

Locate bucket tappets in bearing strip with special tool 11 3 250. Lift out complete bearing strip with bucket tappet.

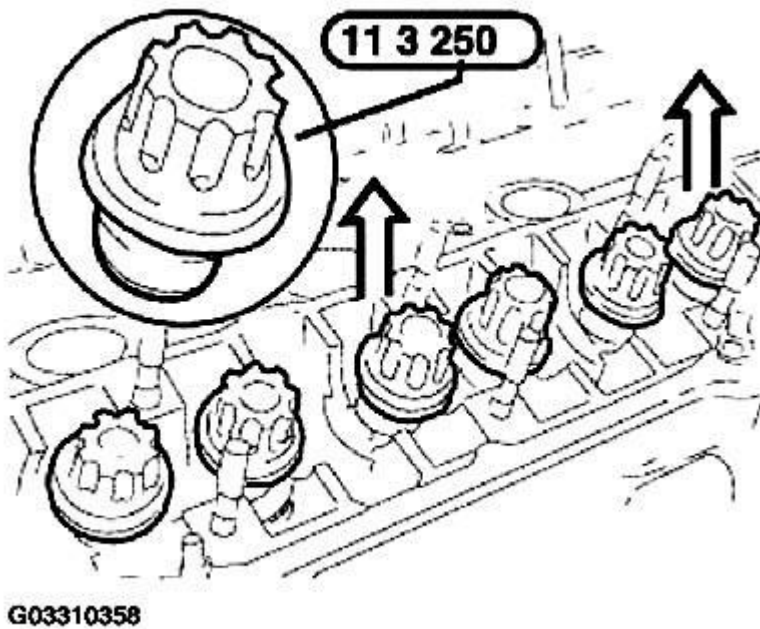
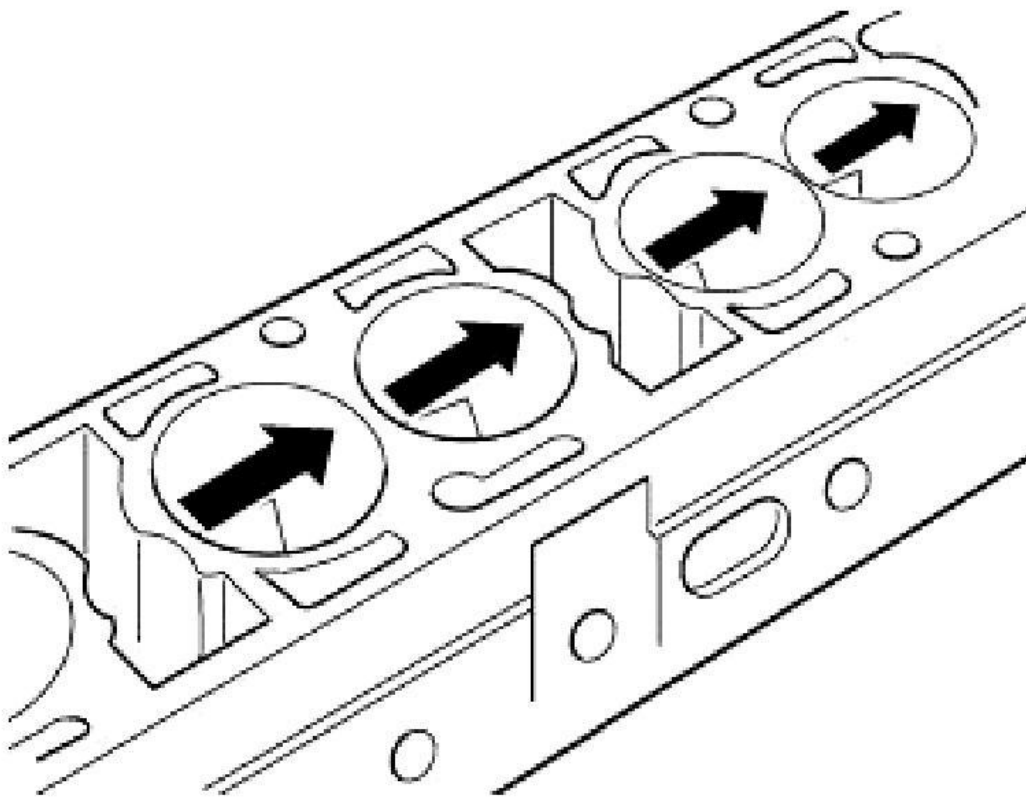


Fig. 198: Locating Bucket Tappets In Bearing Strip With Special Tool
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: Only re-use used bucket tappets in the same tappet bore.

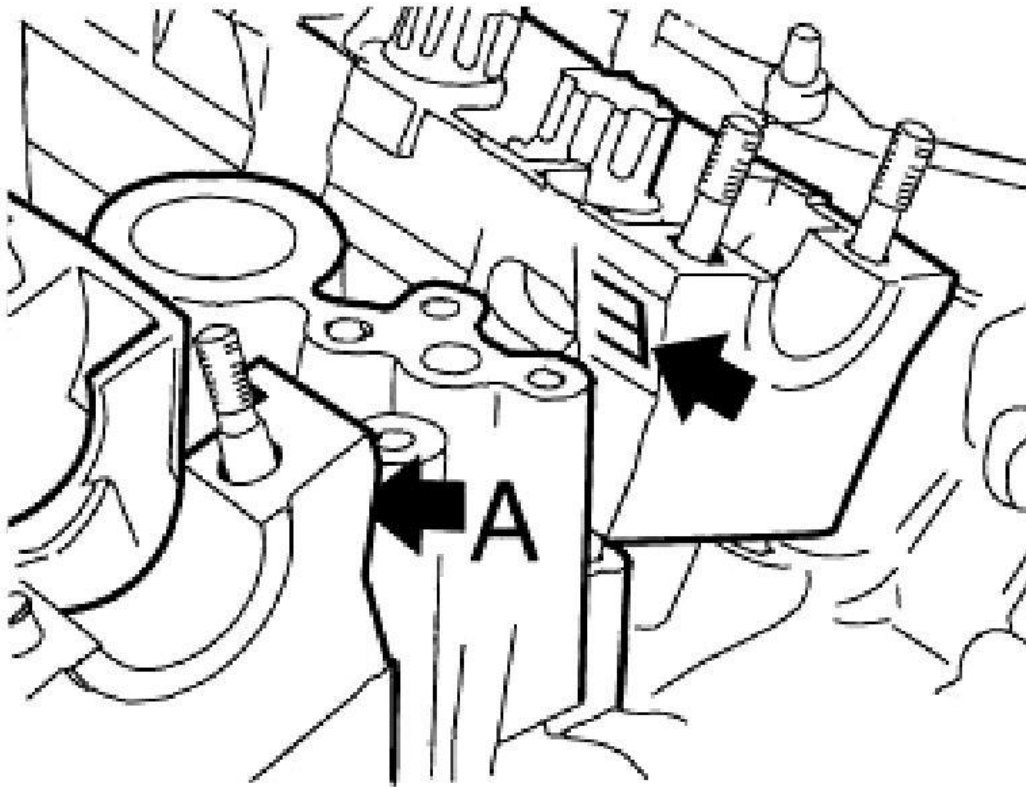
Check bearing points on bucket tappets for signs of wear (scoring).



G03310359

Fig. 199: Checking Bearing Points On Bucket Tappets
Courtesy of BMW OF NORTH AMERICA, INC.

Bearing strips are marked "A" for exhaust side and "E" for inlet side.

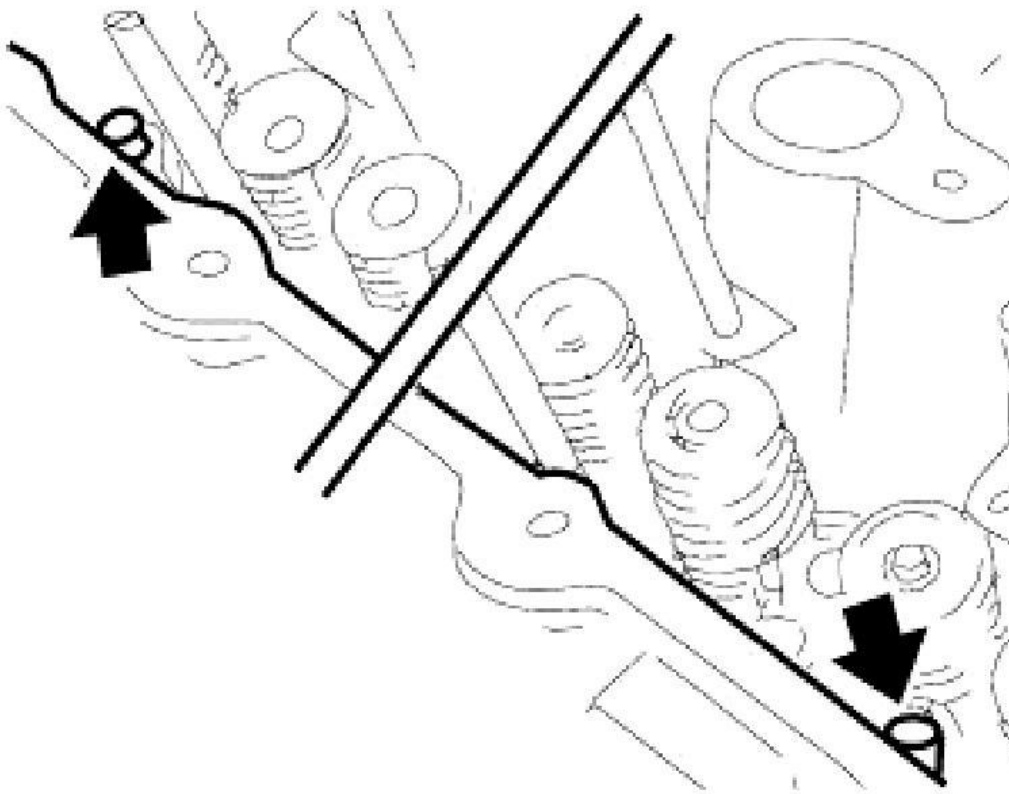


G03310360

Fig. 200: Identifying Bearing Strips Marks
Courtesy of BMW OF NORTH AMERICA, INC.

Note centering dowels on retaining pins at bearing points 2 and 7.

Install bearing strips.



G03310361

Fig. 201: Installing Bearing Strips

Courtesy of BMW OF NORTH AMERICA, INC.

Installation

Installation of camshafts is described separately from removal. The assembly sequence for removal and installation is different.

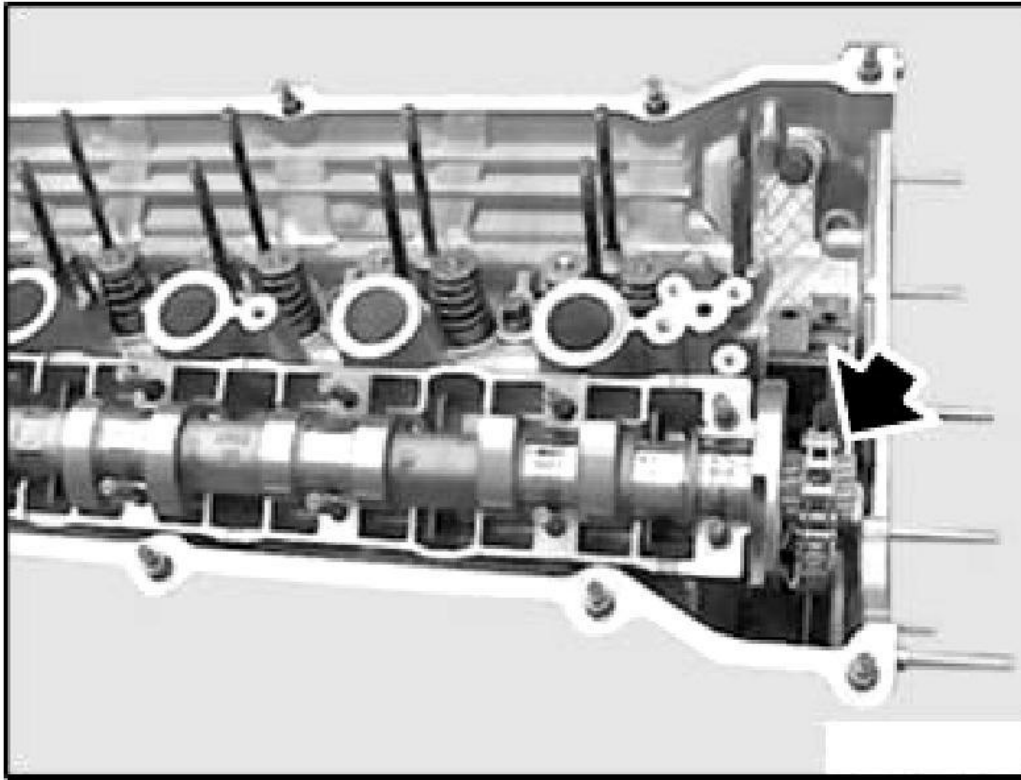
NOTE: Camshafts, bearings and bearing caps, friction washers, all splines on toothed shafts and spline hubs must be oiled before installation.

IMPORTANT: The bucket tappets expand when not subjected to load by the camshaft and therefore require some time before they can be pushed back down. During a rapid assembly sequence, the "closed" valves may still be open and be in contact with the piston.

Comply with following waiting periods after installing camshaft and before cranking engine back to TDC position.

- Room temperature (20°C) 4 mins
- 10°C ... 20°C 11 mins
- 0°C ... 10°C 30 mins

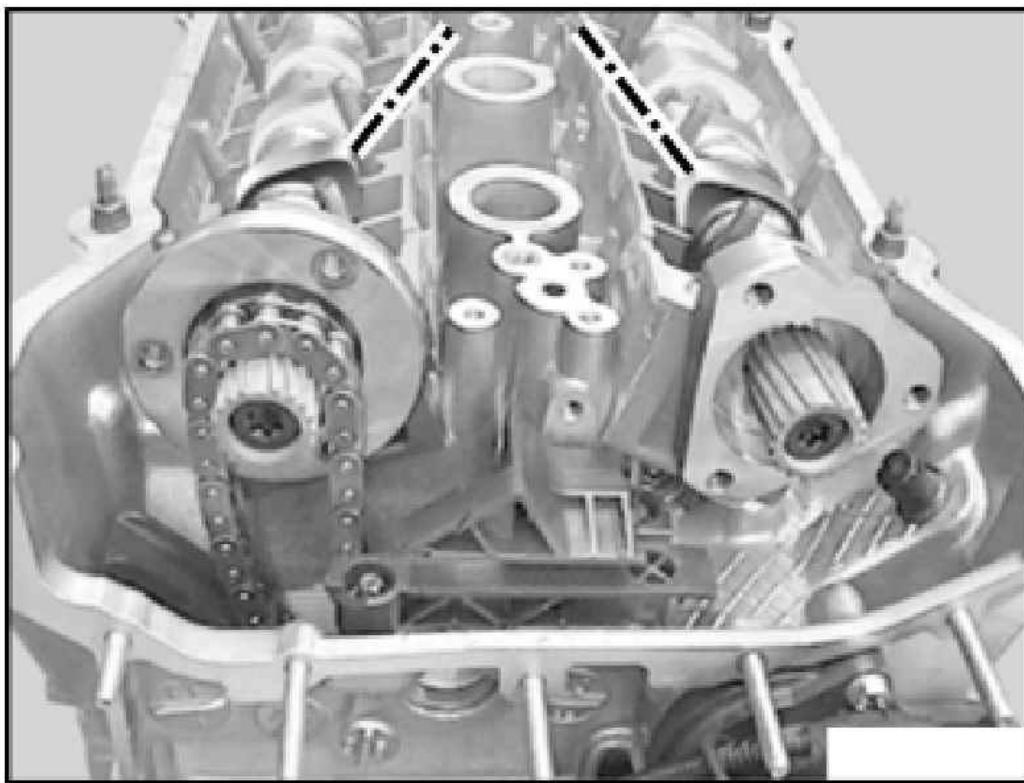
Pull up timing chain and feed in exhaust camshaft. Position timing chain on exhaust camshaft.



G03310362

Fig. 202: Feeding In Exhaust Camshaft
Courtesy of BMW OF NORTH AMERICA, INC.

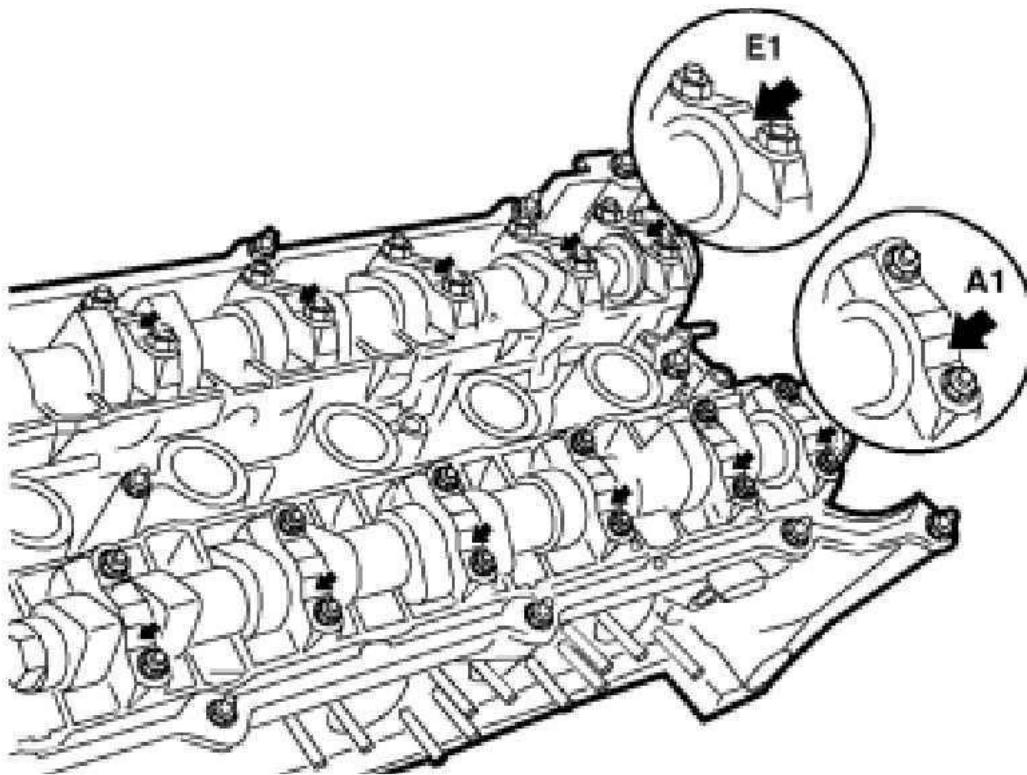
Install camshafts so that cam tips on inlet and exhaust valves on 1st cylinder face one another.



G03260617

Fig. 203: Installing Camshafts
Courtesy of BMW OF NORTH AMERICA, INC.

Fit bearing cover.



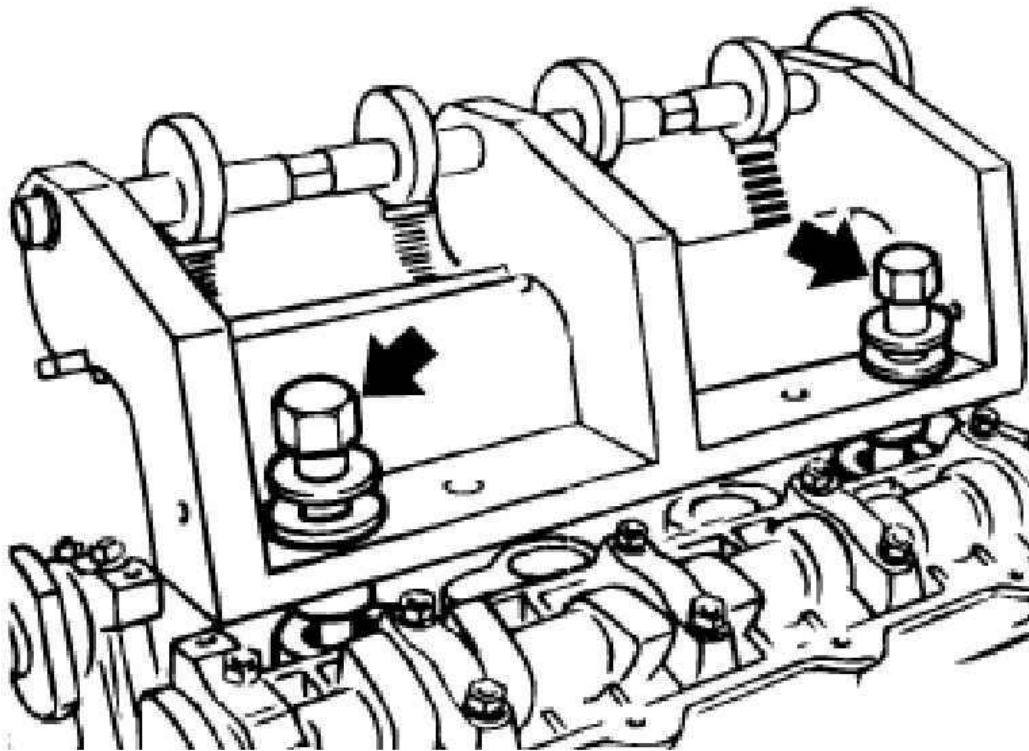
G03260618

Fig. 204: Fitting Bearing Cover

Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: Bearing caps are marked from exhaust side: A1 ... A7 for exhaust side, E1 ... E7 for inlet side.

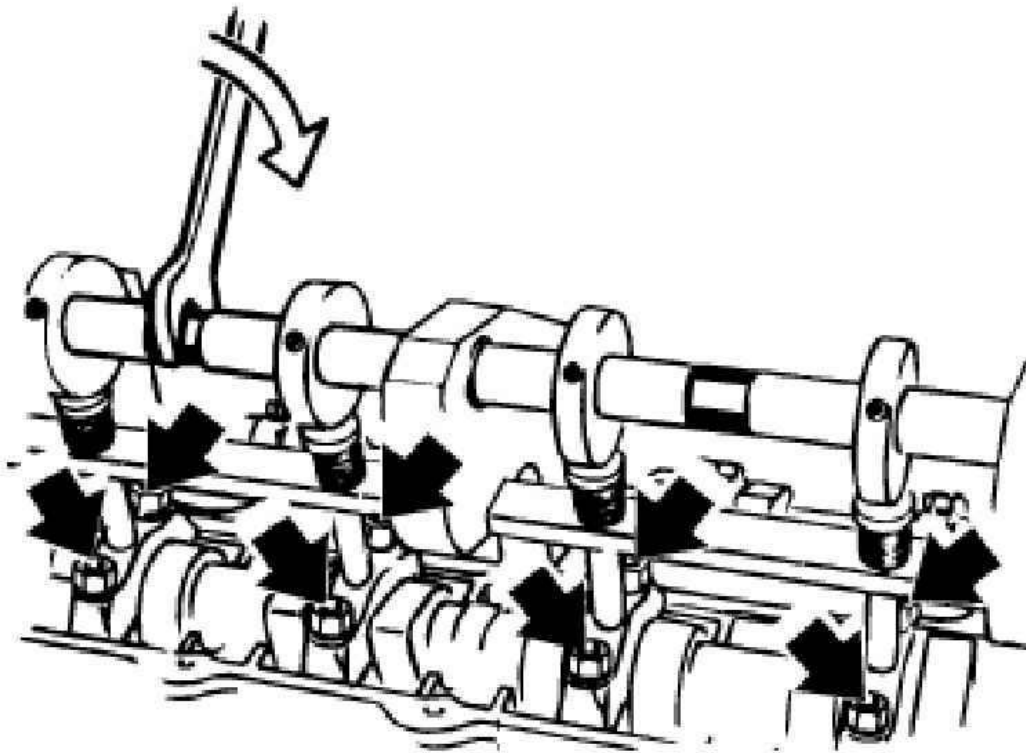
Fit special tool 11 3 260 to cylinder head and screw into spark plug threads in cylinders 1 and 4.



G03260619

Fig. 205: Fitting Special Tool To Cylinder Head
Courtesy of BMW OF NORTH AMERICA, INC.

Turn the eccentric shaft to tension the bearing caps. Tighten down bearing cover.



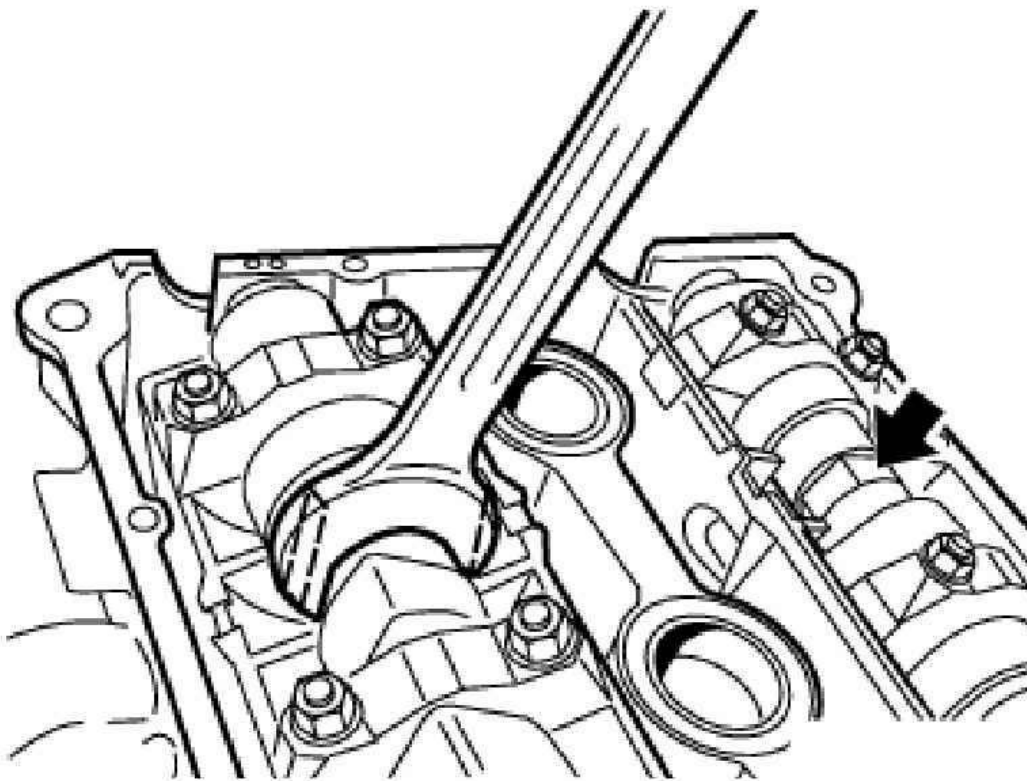
G03260620

Fig. 206: Turning Eccentric Shaft To Tension Bearing Caps
Courtesy of BMW OF NORTH AMERICA, INC.

Tightening torque, 11 31 1AZ. Refer to ENGINE - TIGHTENING TORQUES .

IMPORTANT: Do not damage the cylinder head. If necessary, machine open-end wrench accordingly.

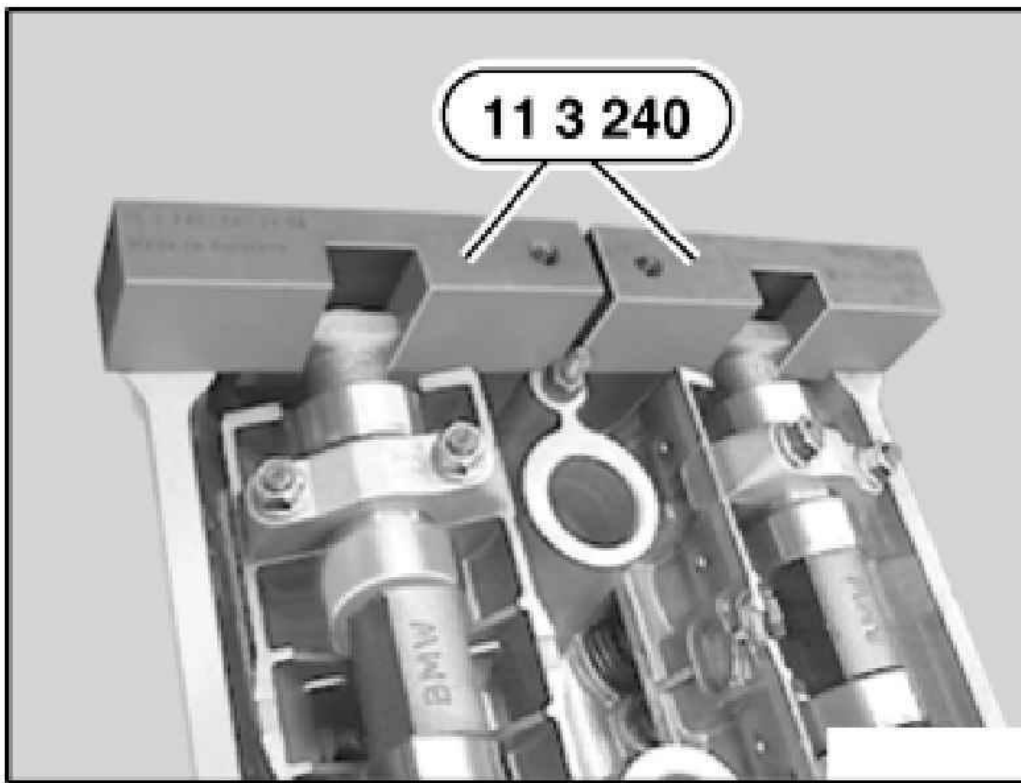
Align camshafts with open-end wrench.



G03260621

Fig. 207: Aligning Camshafts With Open-End Wrench
Courtesy of BMW OF NORTH AMERICA, INC.

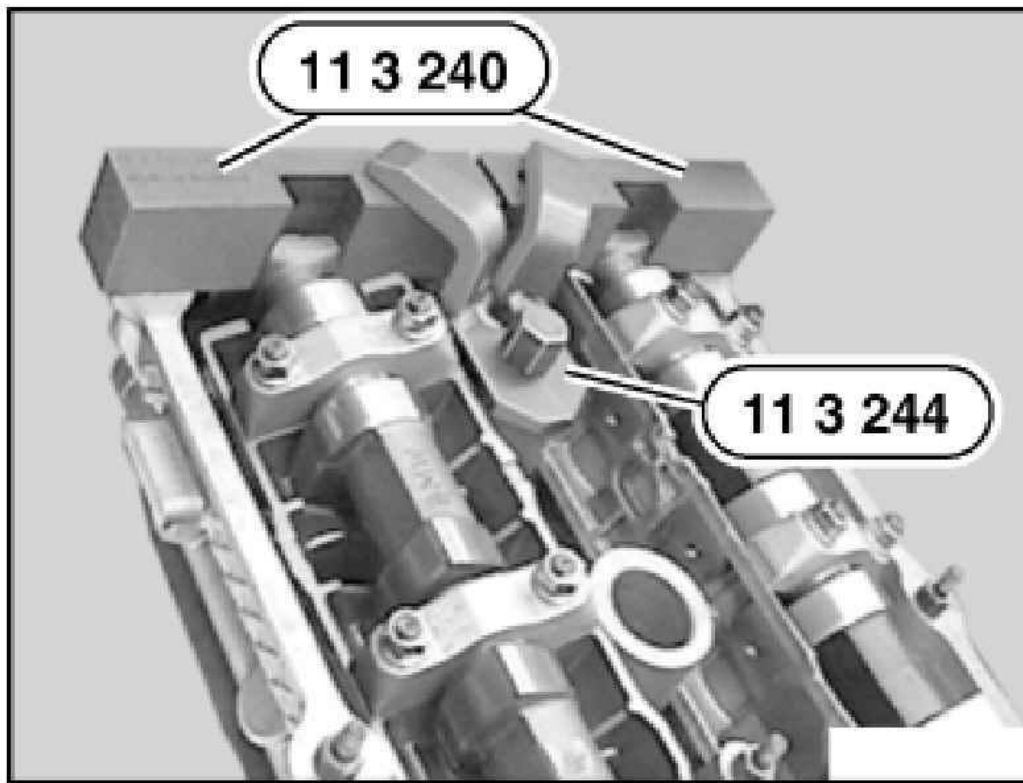
Fit special tool 11 3 240 to camshafts on cylinder 6. Align camshafts so that special tool 11 3 240 rests without gaps on cylinder head.



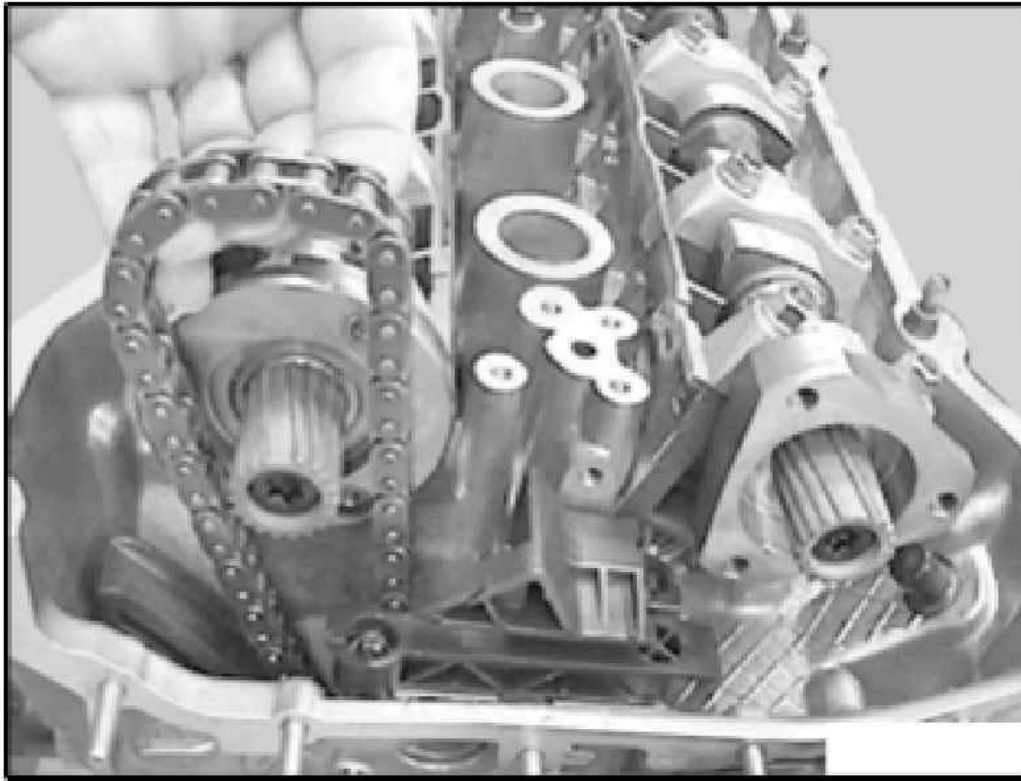
G03260622

Fig. 208: Fitting Special Tool To Camshafts On Cylinder
Courtesy of BMW OF NORTH AMERICA, INC.

Attach special tool 11 3 244 to special tool 11 3 240 and locate by way of spark plug thread.

**G03260623****Fig. 209: Attaching Special Tool****Courtesy of BMW OF NORTH AMERICA, INC.**

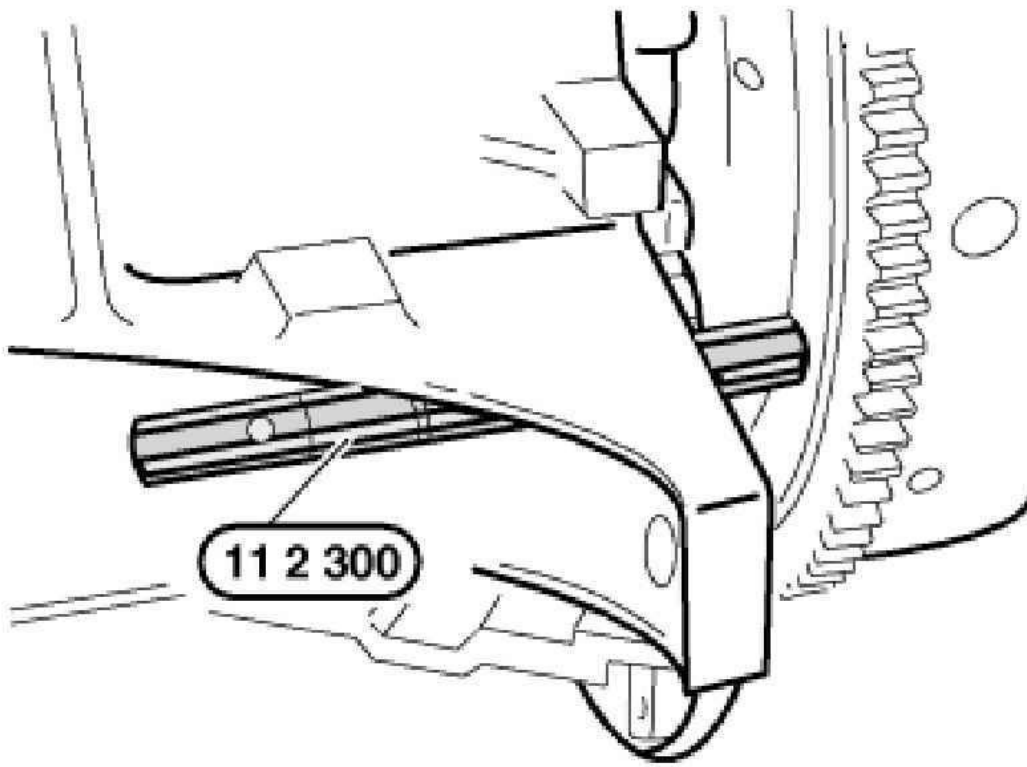
Lift timing chain and hold under tension. Turn engine from 30° before TDC position in direction of rotation as far as TDC position.



G03260624

Fig. 210: Lifting Timing Chain And Holding Under Tension
Courtesy of BMW OF NORTH AMERICA, INC.

Secure crankshaft in firing TDC position with special tool 11 2 300.



G03260625

Fig. 211: Securing Crankshaft In Firing TDC Position With Special Tool
Courtesy of BMW OF NORTH AMERICA, INC.

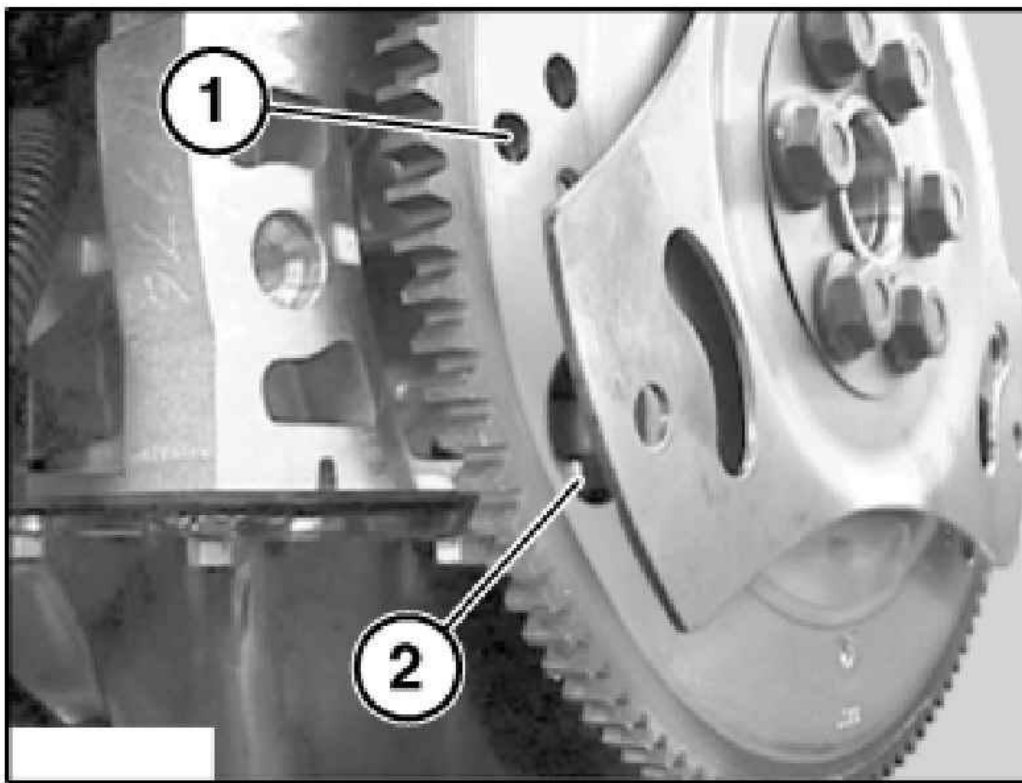
IMPORTANT: Remove special tool 11 2 300 before starting engine.

Automatic transmissions only:

Illustration does not show automatic transmission.

IMPORTANT: On engines with automatic transmissions, there is shortly before the special tool bore (1) a large bore (2) which can be confused with the special tool bore.

If special tool 11 2 300 is secured in the correct bore (1), the engine can no longer be cranked at the central bolt.



G03260626

Fig. 212: Locating Special Tool Bore
Courtesy of BMW OF NORTH AMERICA, INC.

Position sensor gear on inlet camshaft.

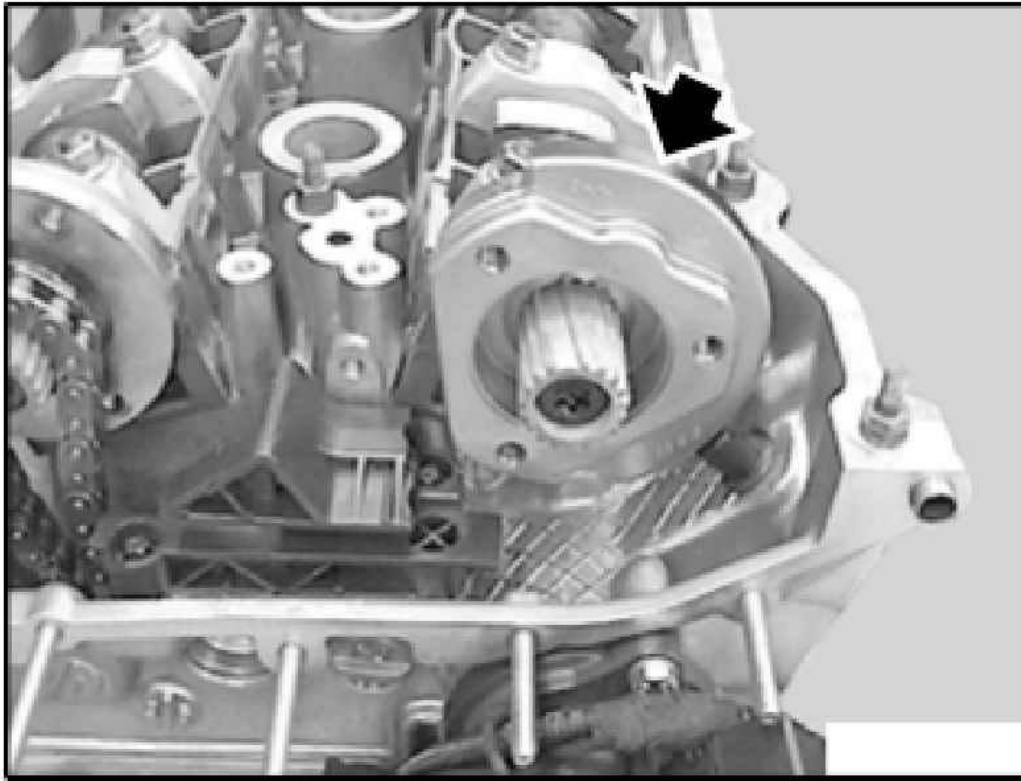
**G03260627**

Fig. 213: Positioning Sensor Gear On Inlet Camshaft
Courtesy of BMW OF NORTH AMERICA, INC.

Fit thrust washer and tighten down with dowels.

Tightening torque 11 31 11AZ. Refer to **ENGINE - TIGHTENING TORQUES** .

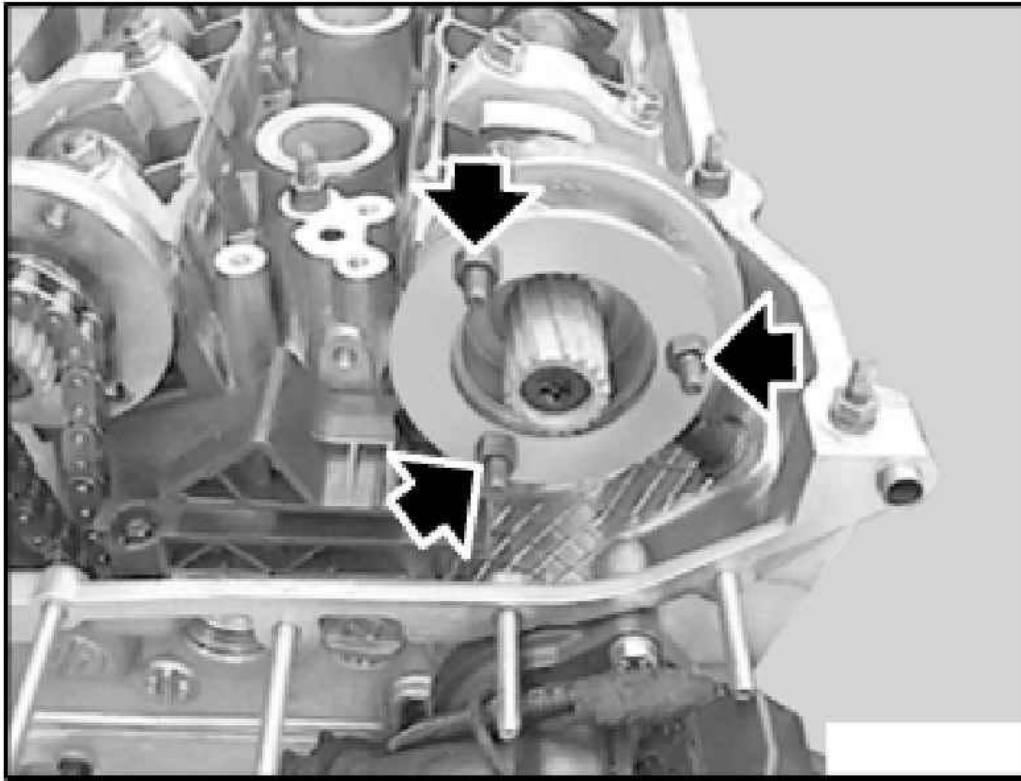
**G03260628**

Fig. 214: Fitting Thrust Washer And Tightening Down With Dowels
Courtesy of BMW OF NORTH AMERICA, INC.

Feed chain wheel onto timing chain so that arrow on chain wheel faces separating face of upper side of cylinder head.

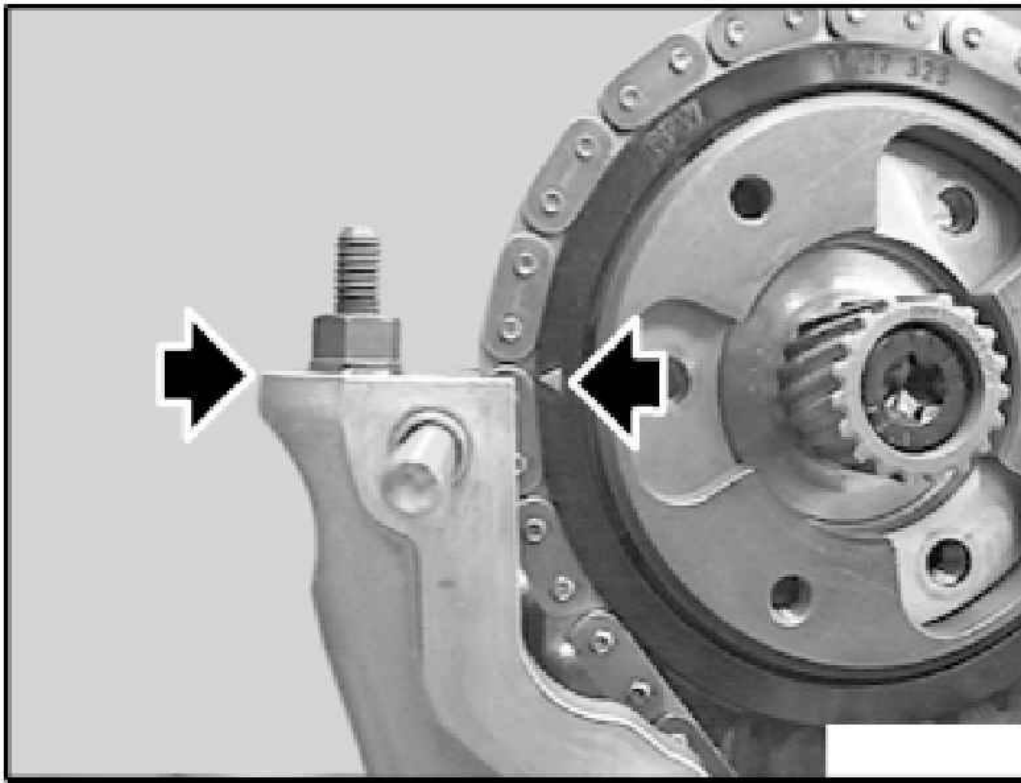
**G03260629**

Fig. 215: Feeding Chain Wheel Onto Timing Chain
Courtesy of BMW OF NORTH AMERICA, INC.

Insert special tool 11 4 220 in cylinder head and bring adjustment screw into contact with tensioning rail, but do not pretension timing chain yet.

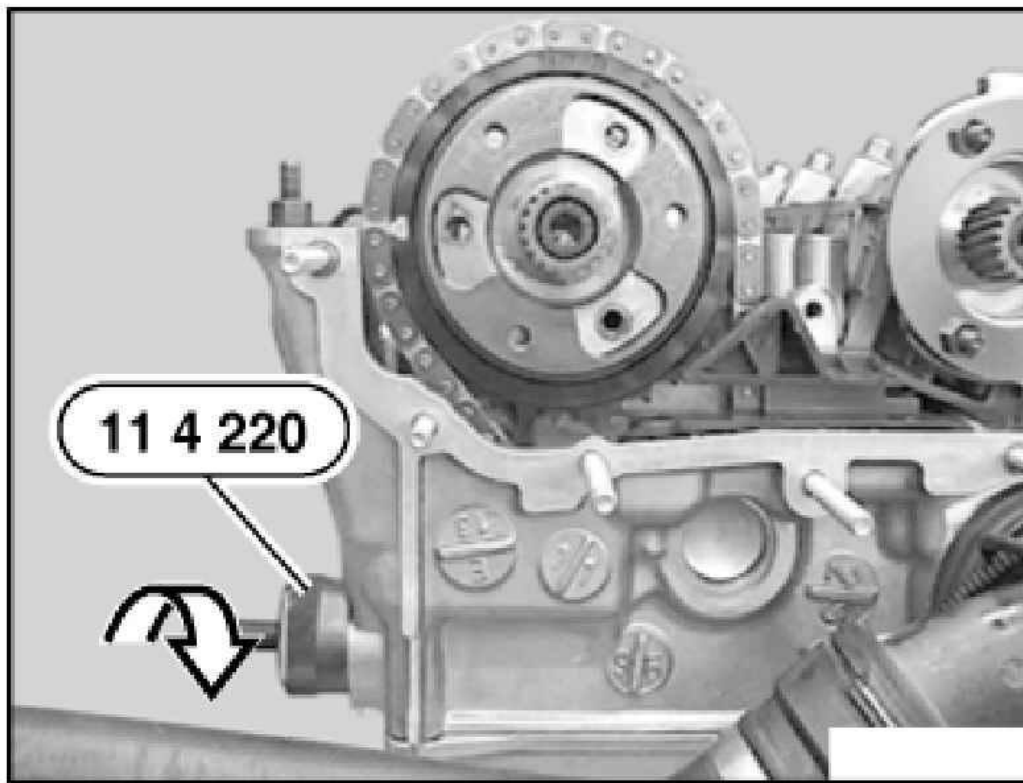
**G03260630**

Fig. 216: Inserting Special Tool In Cylinder Head
Courtesy of BMW OF NORTH AMERICA, INC.

Check arrow on chain wheel to separating face of upper side of cylinder head, reposition chain wheel if necessary.

Insert and tighten down screw-in pin.

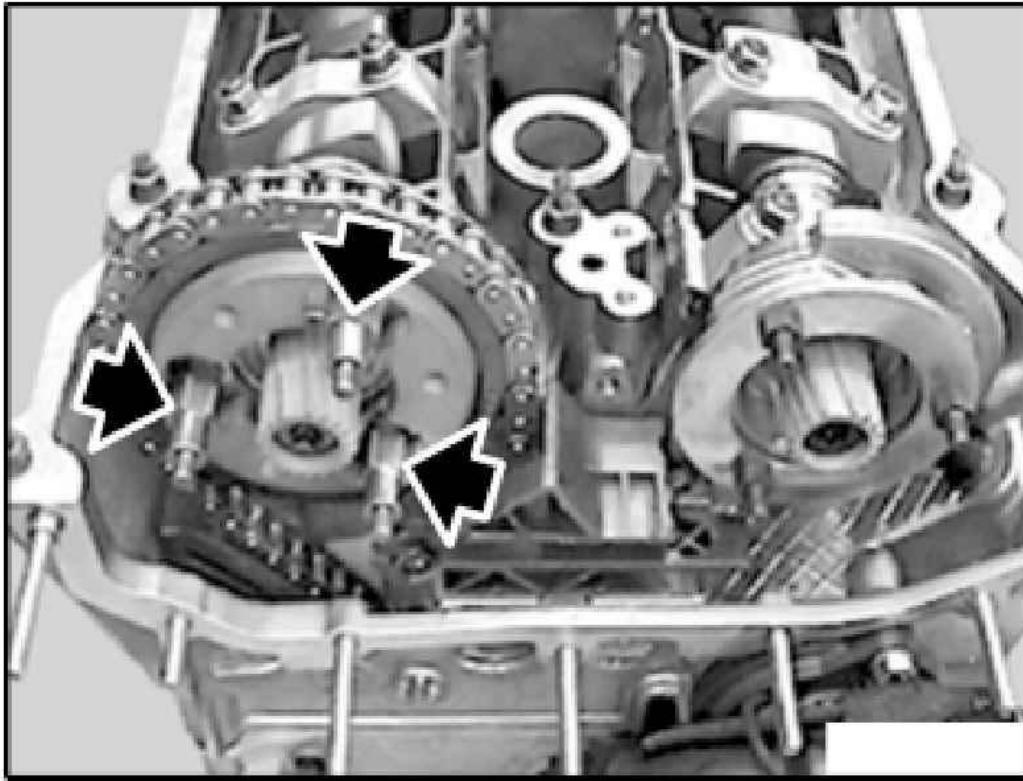
**G03260631**

Fig. 217: Inserting And Tightening Down Screw-In Pin
Courtesy of BMW OF NORTH AMERICA, INC.

Tightening torque 11 31 11AZ. Refer to **ENGINE - TIGHTENING TORQUES** .

Install secondary chain tensioner.

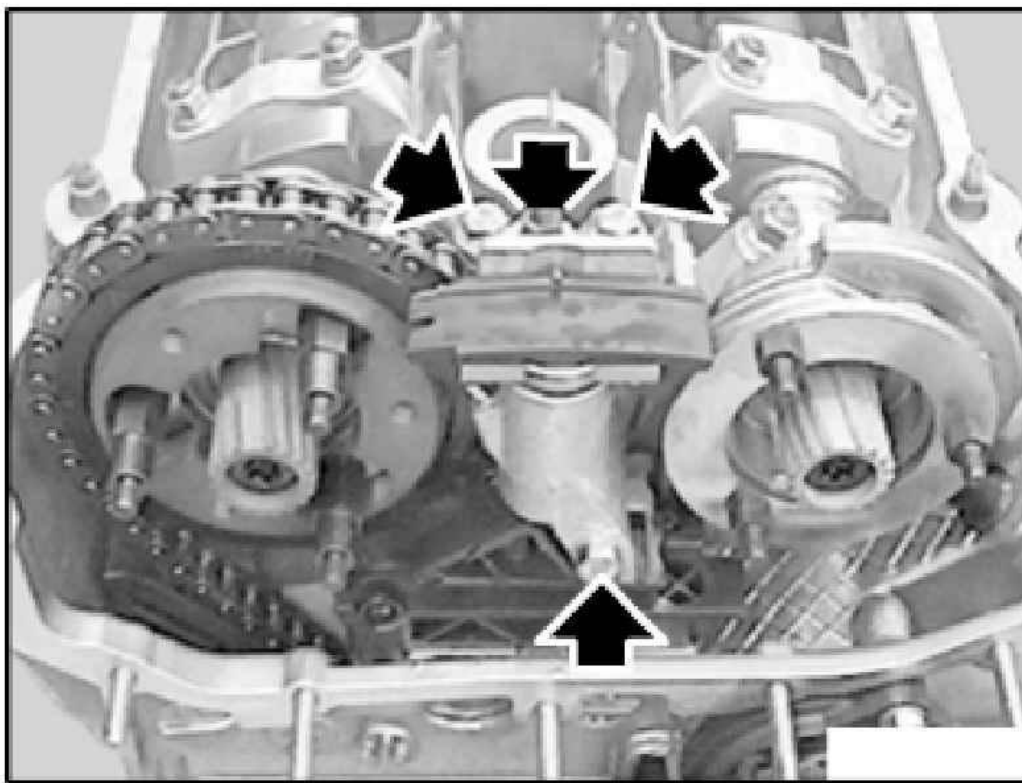
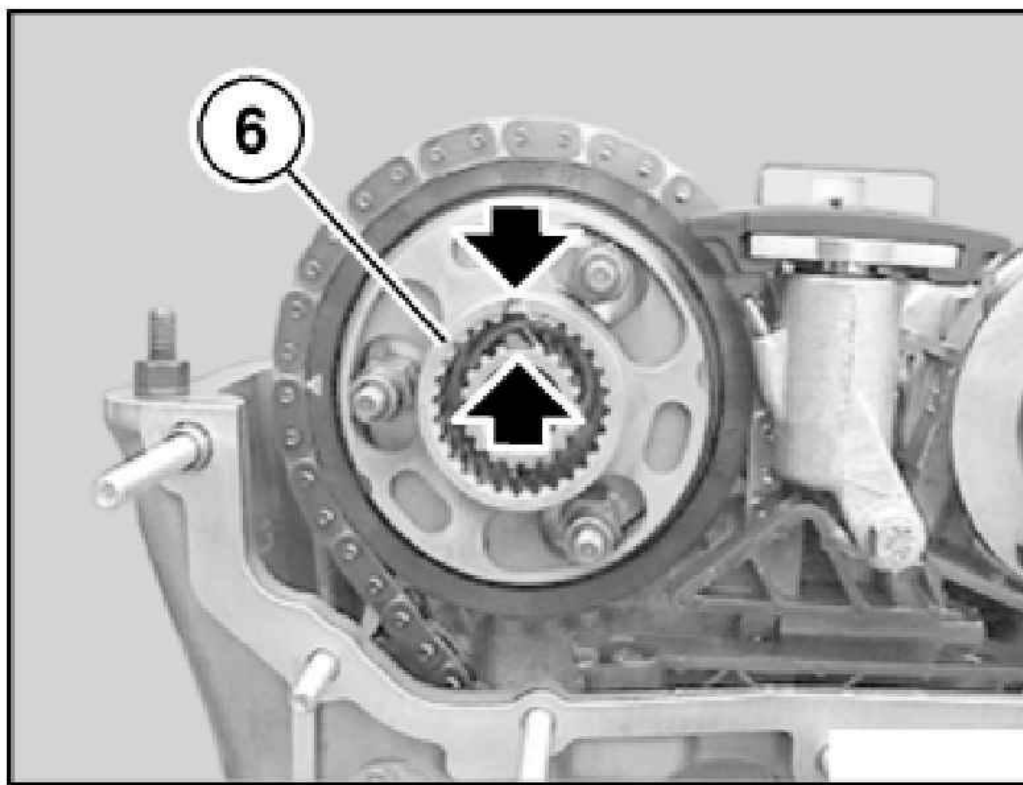
**G03260632**

Fig. 218: Installing Secondary Chain Tensioner
Courtesy of BMW OF NORTH AMERICA, INC.

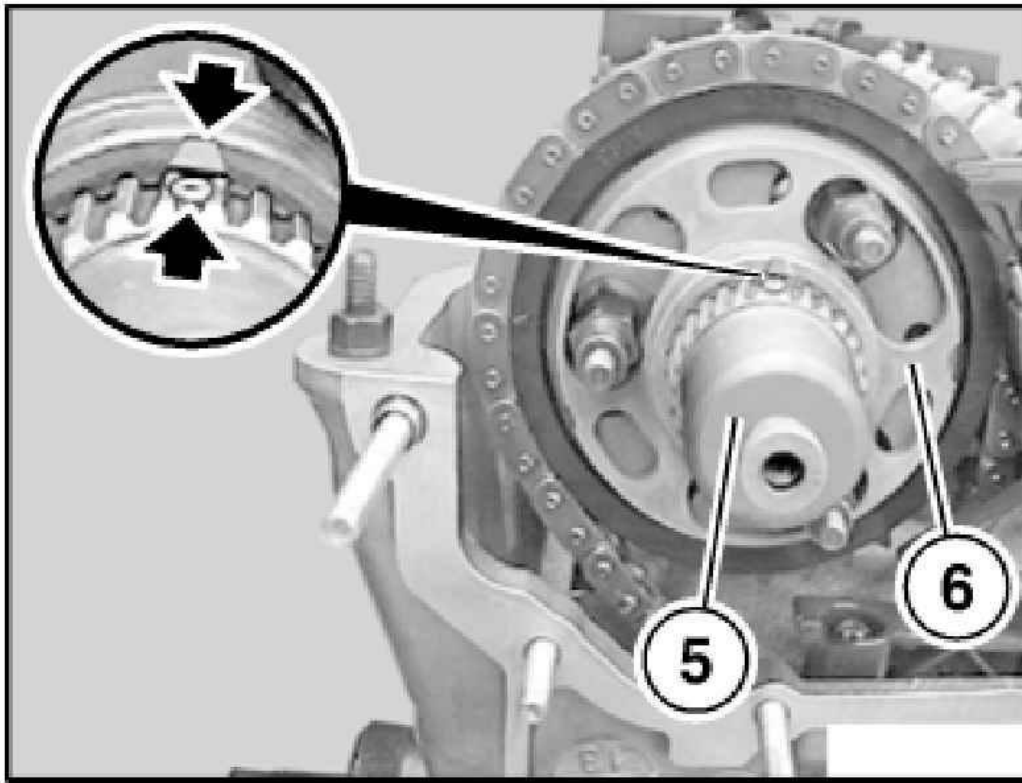
Fit toothed sleeve (6) and align to toothed shaft in camshaft so that tooth gaps are opposed.



G03260633

Fig. 219: Fitting Toothed Sleeve
Courtesy of BMW OF NORTH AMERICA, INC.

Secure toothed shaft (5).

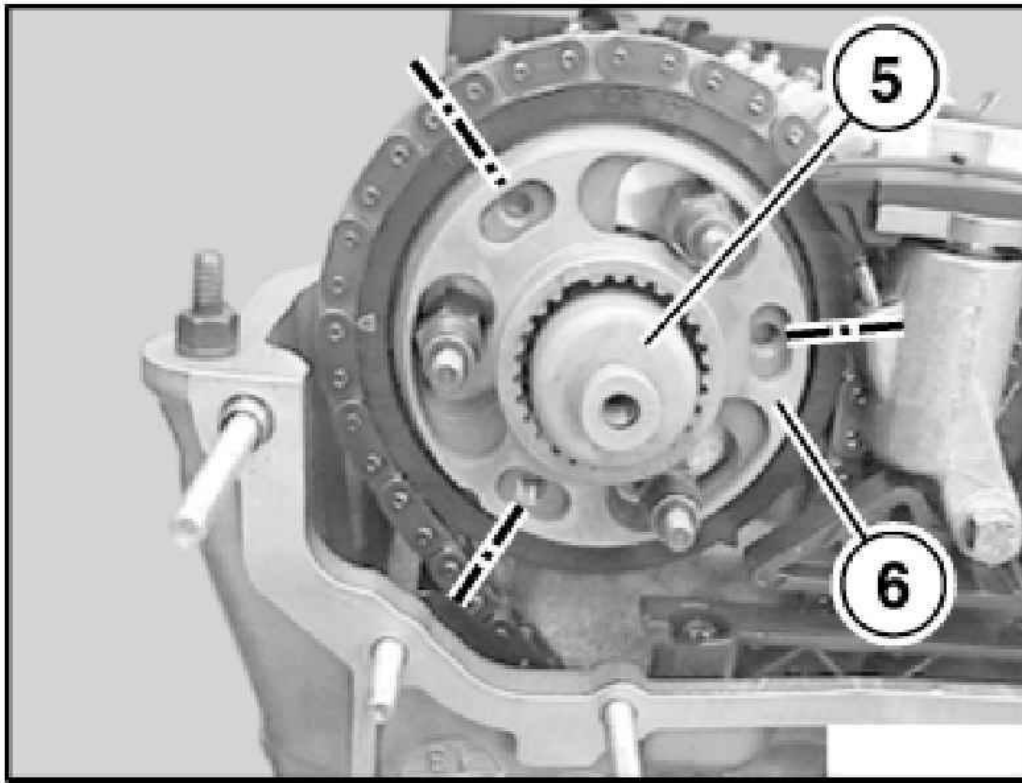


G03260634

Fig. 220: Securing Toothed Shaft**Courtesy of BMW OF NORTH AMERICA, INC.**

Insert pin of toothed shaft (5) into tooth gaps of splines on camshaft and toothed sleeve (6).

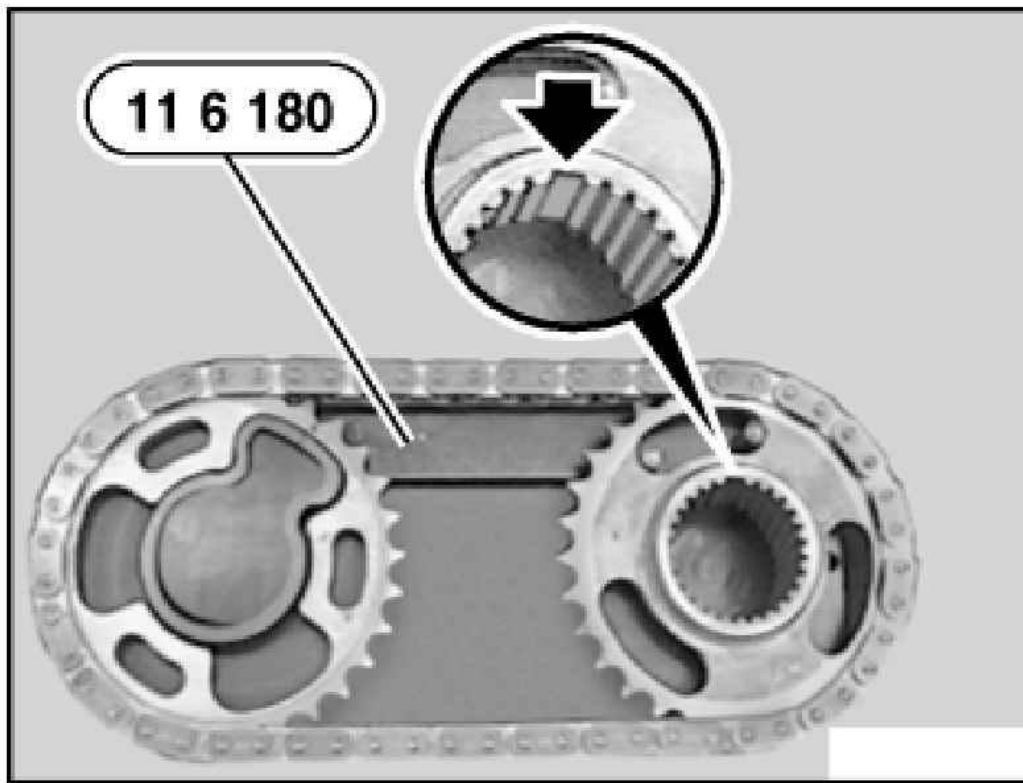
Push in toothed shaft (5) until the longitudinal holes in the toothed sleeve (6) are positioned centrally with respect to the thread.



G03260635

Fig. 221: Pushing In Toothed Shaft**Courtesy of BMW OF NORTH AMERICA, INC.**

Place chain wheels in special tool 11 6 180, position tooth gap on inlet chain wheel as shown in illustration and feed on chain.

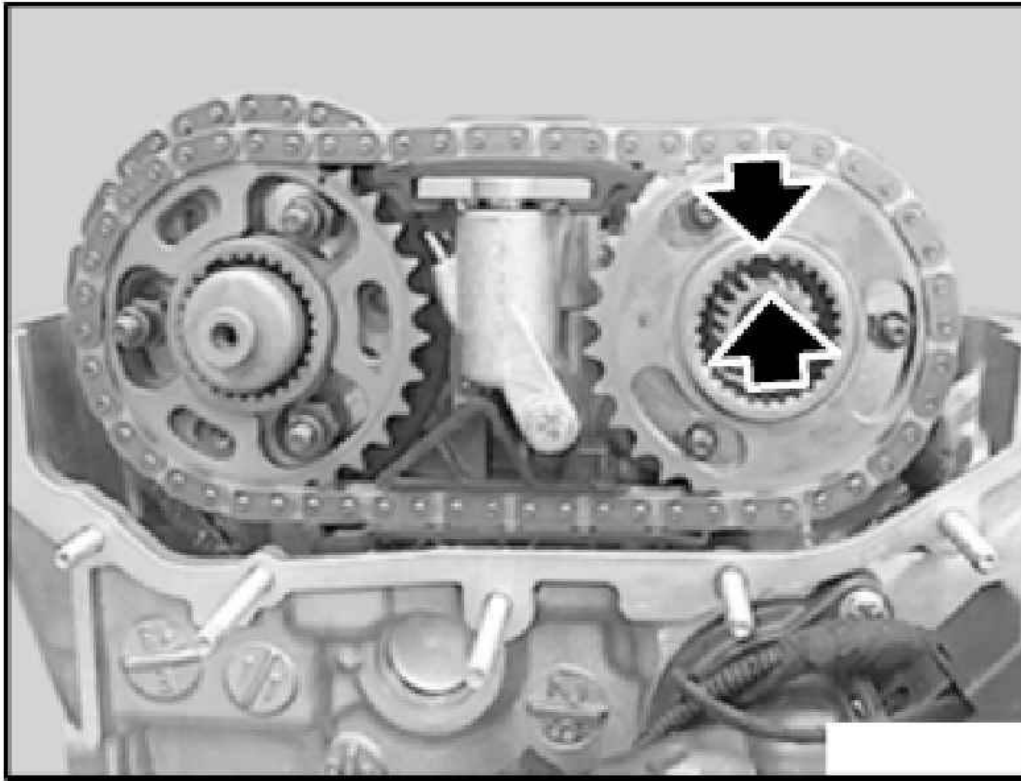


G03260636

Fig. 222: Placing Chain Wheels In Special Tool
Courtesy of BMW OF NORTH AMERICA, INC.

IMPORTANT: Do not alter position of chain wheels with respect to chain when removing from special tool 11 6 180.

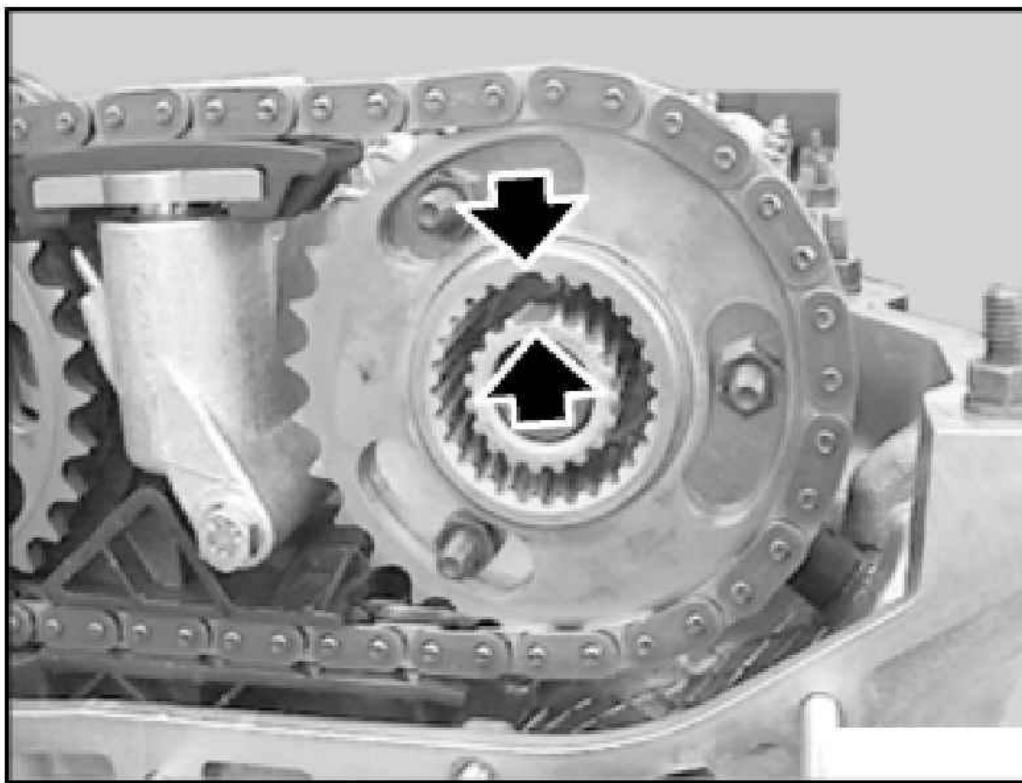
Remove chain with sprocket wheels positioned from special tool 11 6 180 and so that tooth spaces oppose each other on inlet side.



G03260637

Fig. 223: Removing Chain With Sprocket Wheels
Courtesy of BMW OF NORTH AMERICA, INC.

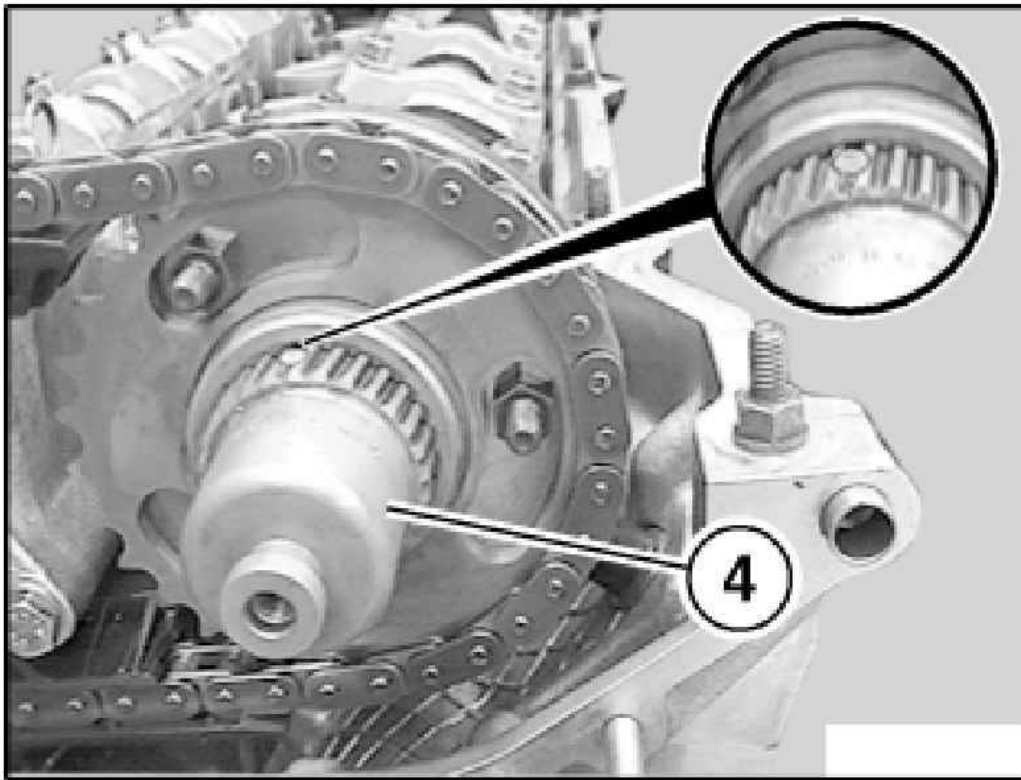
Align chain with sprocket wheels so that tooth spaces are positioned exactly over each other on inlet side.



G03260638

Fig. 224: Aligning Chain With Sprocket Wheels
Courtesy of BMW OF NORTH AMERICA, INC.

Secure toothed shaft (4).

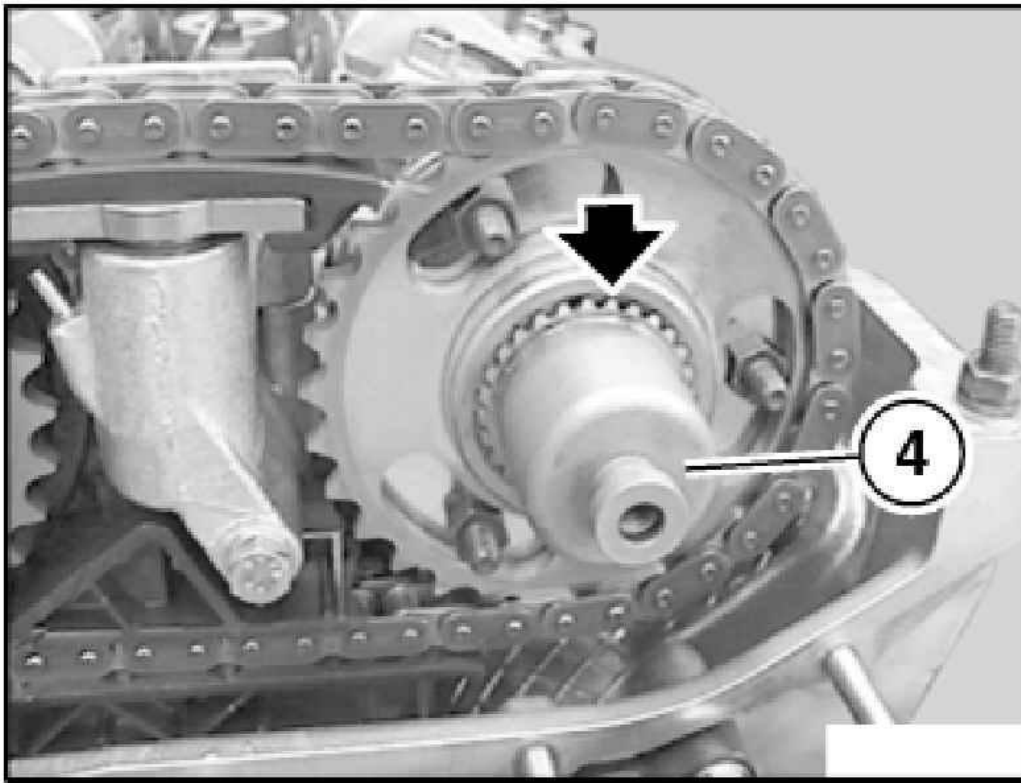


G03260639

Fig. 225: Securing Toothed Shaft**Courtesy of BMW OF NORTH AMERICA, INC.**

Insert pin of toothed shaft (4) into tooth gaps of splines on camshaft and chain wheel.

Push in toothed shaft (4) until approx. 1 mm of splines can still be seen.



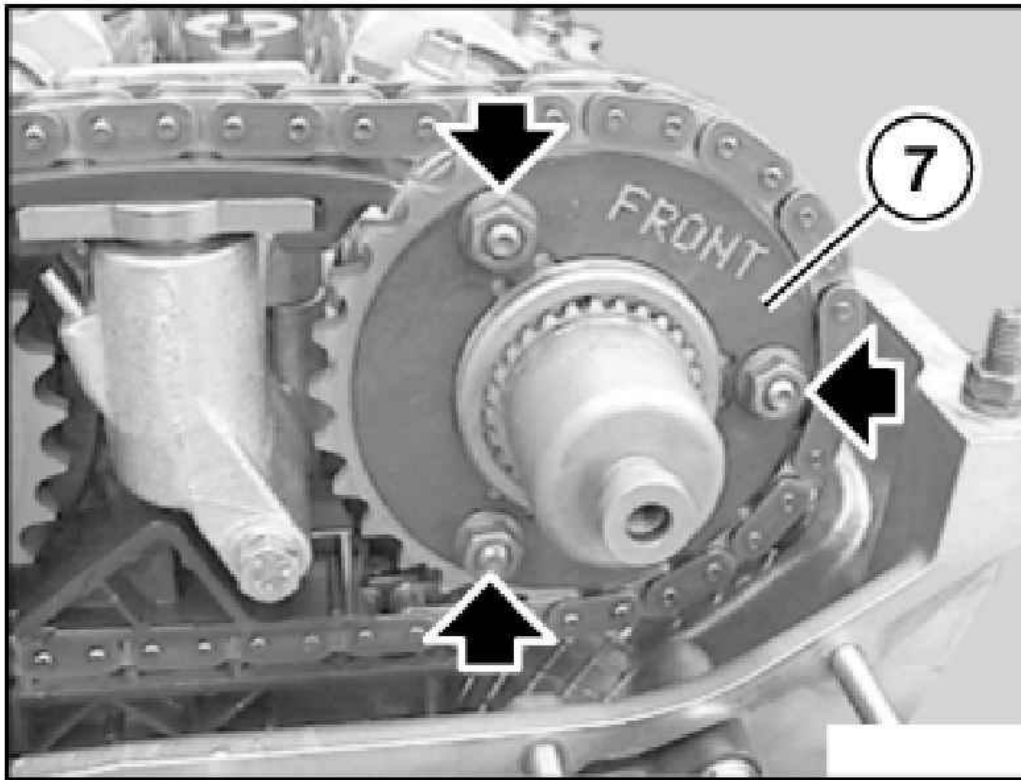
G03260640

Fig. 226: Pushing In Toothed Shaft

Courtesy of BMW OF NORTH AMERICA, INC.

Note installation direction of corrugated washer (7), "FRONT" lettering must be visible.

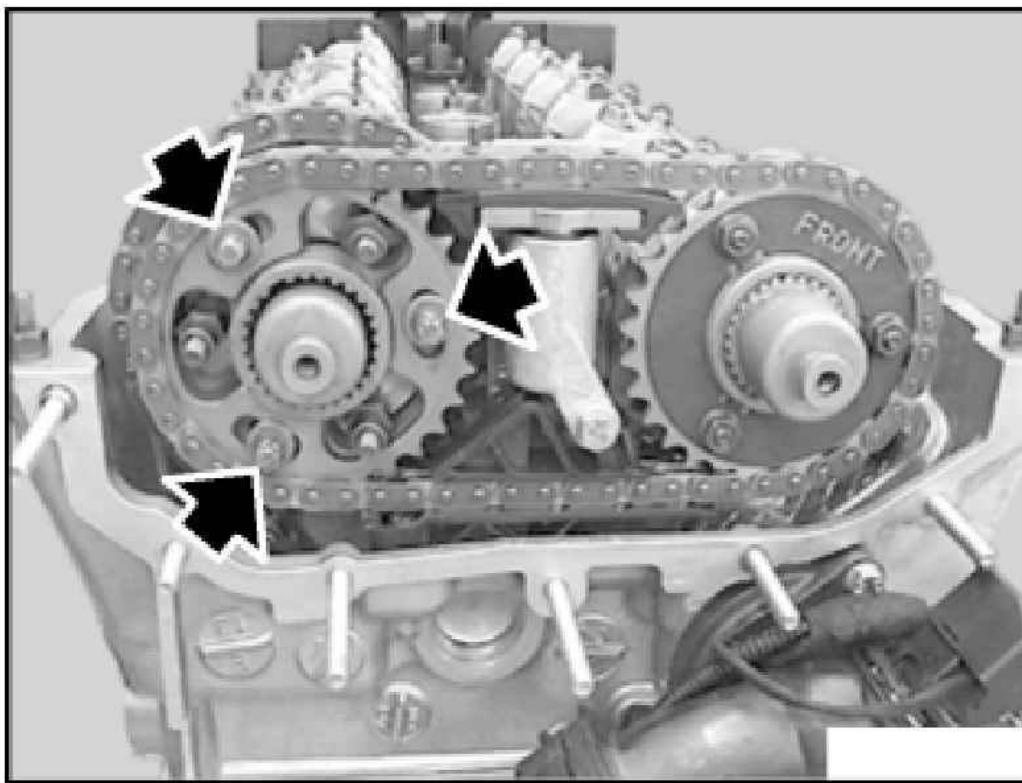
Install corrugated washer, tighten nuts by hand but do not tighten down fully yet.



G03260641

Fig. 227: Installing Corrugated Washer
Courtesy of BMW OF NORTH AMERICA, INC.

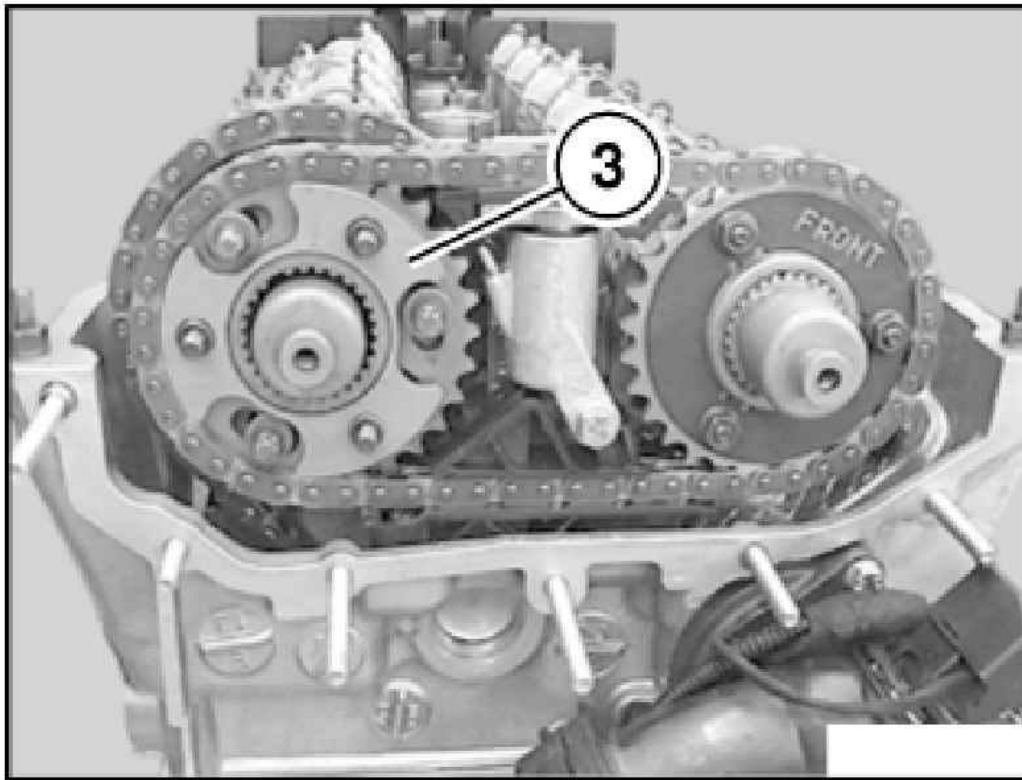
Insert screws on exhaust side, initially tighten to approx. 5 Nm and then slacken off again half a turn.



G03260642

Fig. 228: Inserting Screws On Exhaust Side
Courtesy of BMW OF NORTH AMERICA, INC.

Fit thrust washer (3).



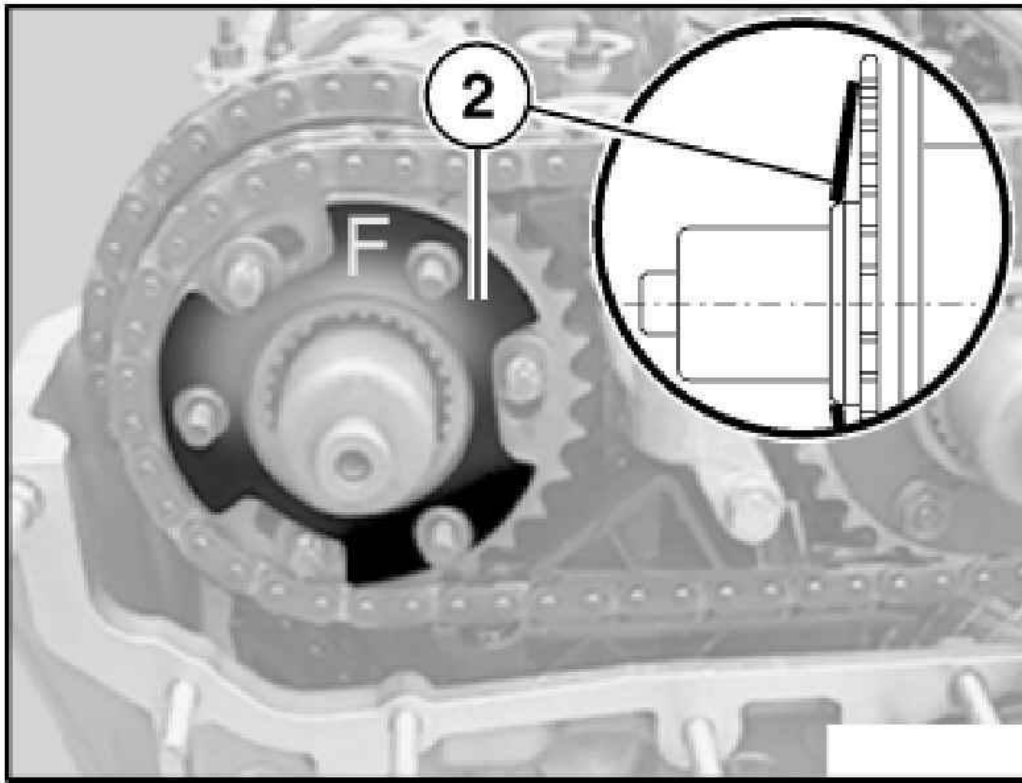
G03260643

Fig. 229: Fitting Thrust Washer

Courtesy of BMW OF NORTH AMERICA, INC.

Note installation direction of cup spring (2), "F" lettering must be visible.

NOTE: If "F" lettering is no longer visible on an engine that has been run:



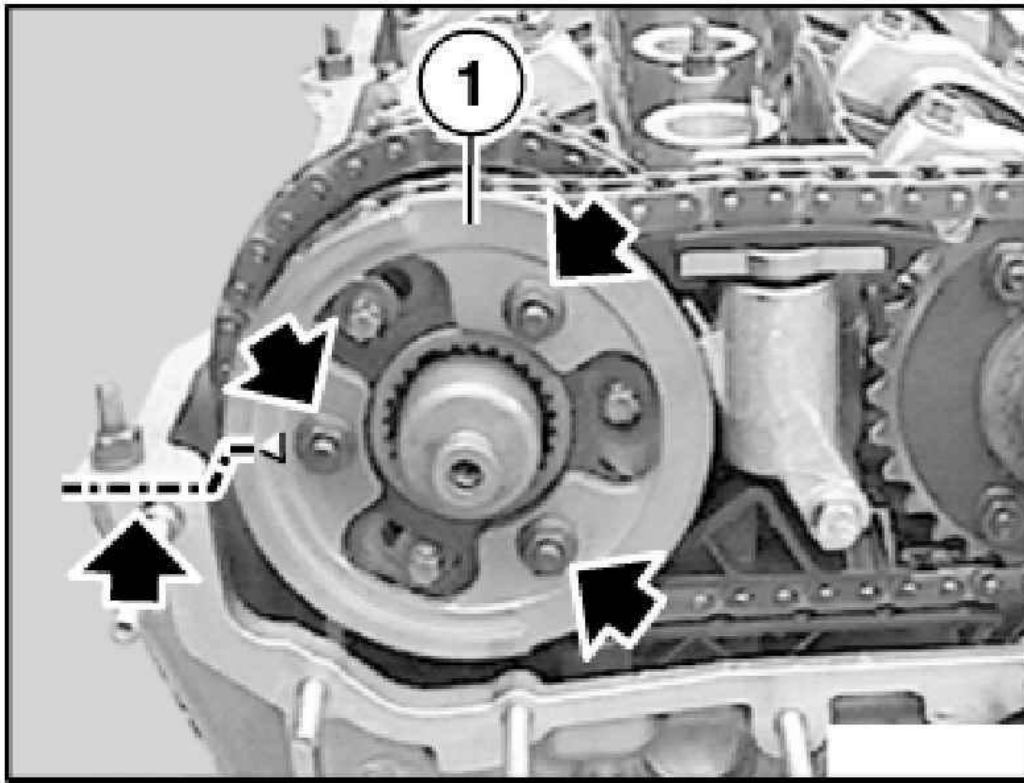
G03260644

Fig. 230: Installing Cup Spring**Courtesy of BMW OF NORTH AMERICA, INC.**

Install cup spring (2) so that small locating diameter of spring (2) points to sensor gear.

Fit cup spring (2) in position.

Position sensor gear (1) so that arrow on sensor gear faces separating face of upper side of cylinder head.



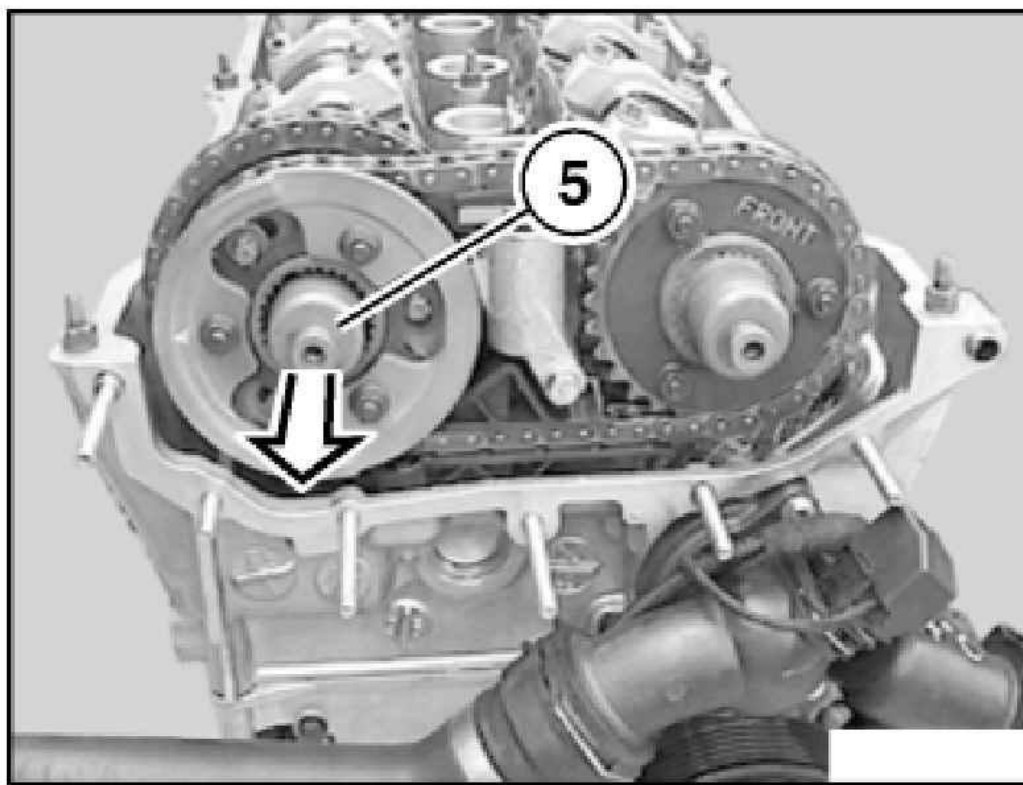
G03260645

Fig. 231: Positioning Sensor Gear

Courtesy of BMW OF NORTH AMERICA, INC.

Install nuts and tighten by hand but do not tighten down fully yet.

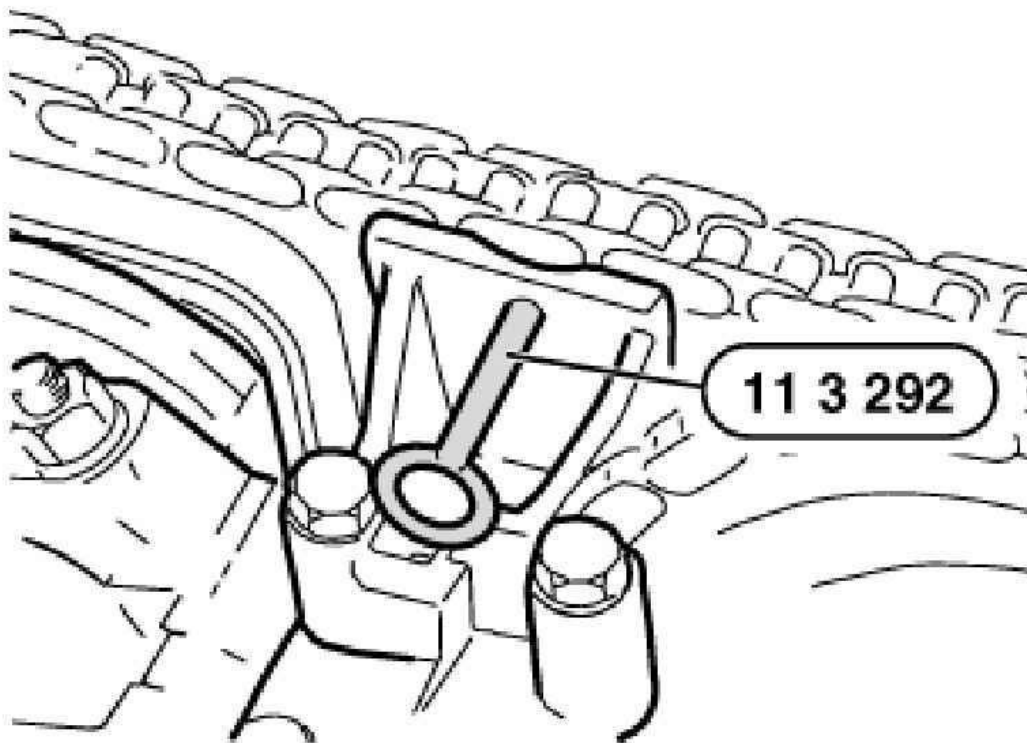
Withdraw toothed shaft (5) up to stop.



G03260646

Fig. 232: Withdrawing Toothed Shaft
Courtesy of BMW OF NORTH AMERICA, INC.

Press down secondary chain tensioner at top and remove special tool 11 3 292.



G03260647

Fig. 233: Pressing Down Secondary Chain Tensioner
Courtesy of BMW OF NORTH AMERICA, INC.

Preload tensioning rail with special tool 11 4 220 by rotating adjusting screw with special tool 00 9 250 or standard torque wrench to 0.7 Nm.

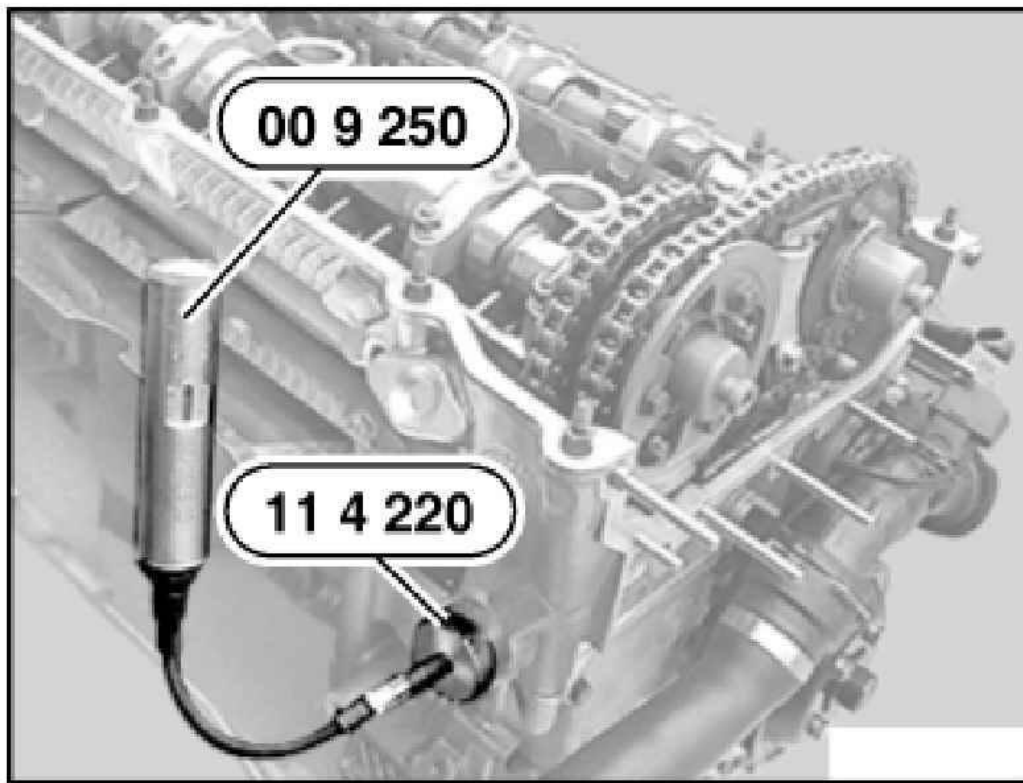
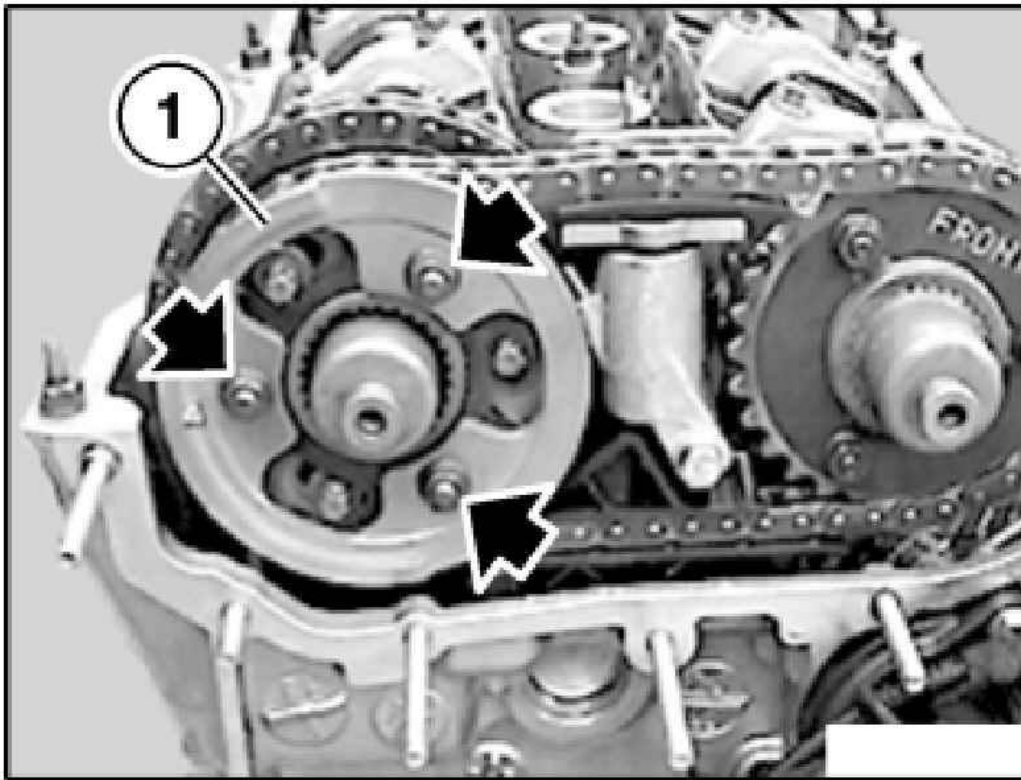
**G03260648**

Fig. 234: Preloading Tensioning Rail With Special Tool
Courtesy of BMW OF NORTH AMERICA, INC.

Preload cup spring slightly by pressing on sensor gear (1) and tighten nuts by hand.



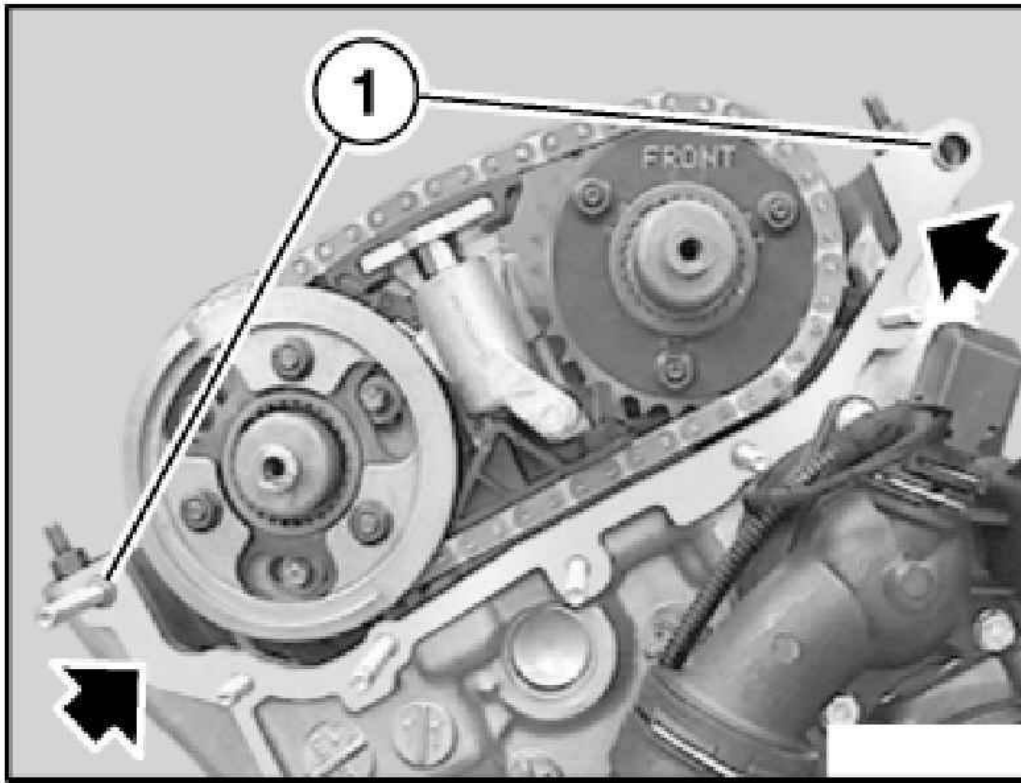
G03260649

Fig. 235: Preloading Cup Spring

Courtesy of BMW OF NORTH AMERICA, INC.

IMPORTANT: Do not tighten down nuts fully.

Remove gasket.



G03260650

Fig. 236: Checking Dowel Sleeves For Damage
Courtesy of BMW OF NORTH AMERICA, INC.

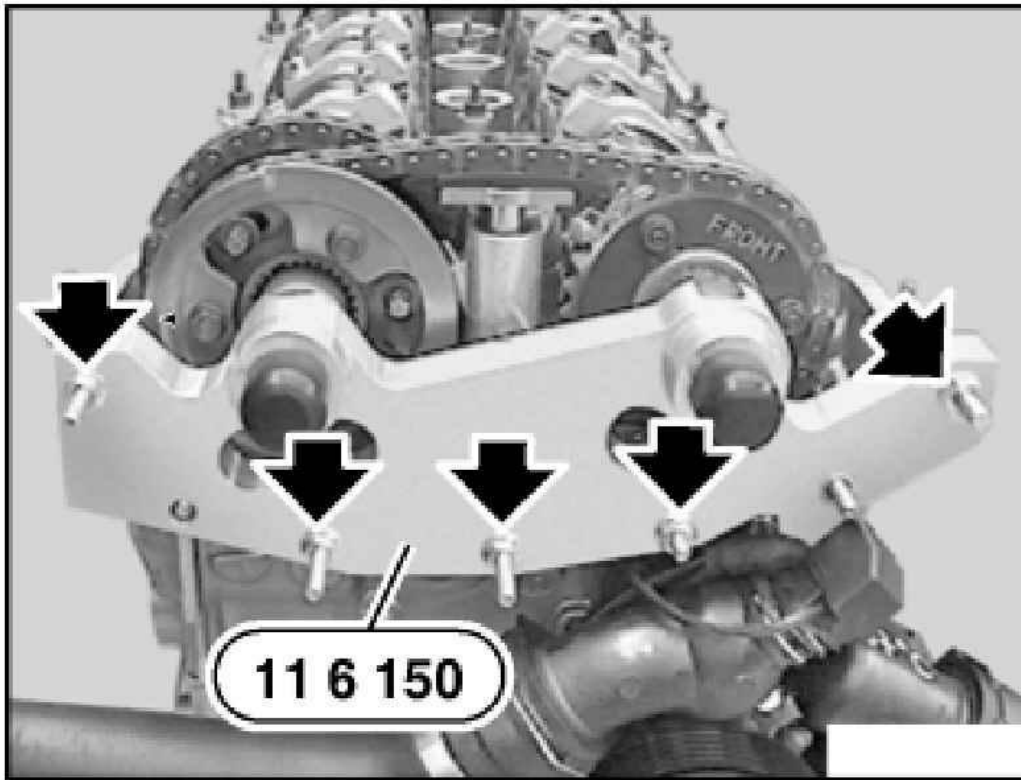
Check dowel sleeves (1) for damage and correct installation position.

Keep sealing face clean and free of oil.

IMPORTANT: Fit special tool 11 6 150 "without gasket" only.

If gasket remains underneath special tool 11 6 150, camshaft timing will be "incorrectly" set.

Attach special tool 11 6 150 "without gasket", tighten nuts by hand and then tighten down uniformly until special tool 11 6 150 is in full contact with cylinder head.

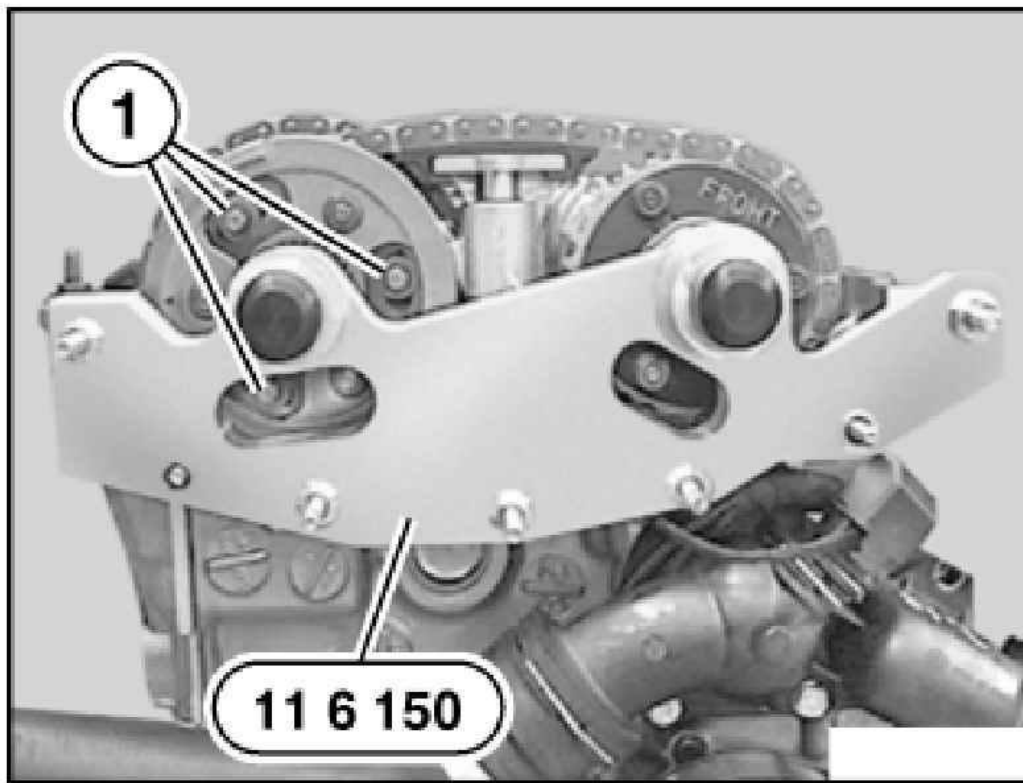


G03260651

Fig. 237: Fitting Special Tool

Courtesy of BMW OF NORTH AMERICA, INC.

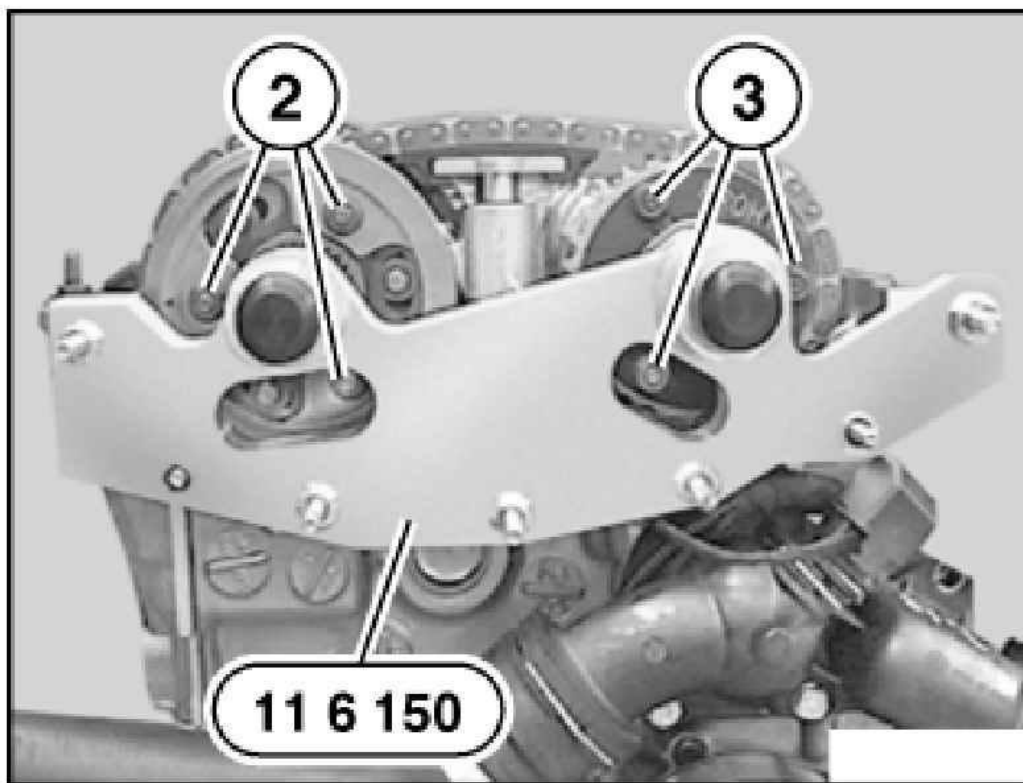
Insert screws (1) on exhaust side and initially tighten to approx. 5 Nm.



G03260652

Fig. 238: Inserting Screws On Exhaust Side
Courtesy of BMW OF NORTH AMERICA, INC.

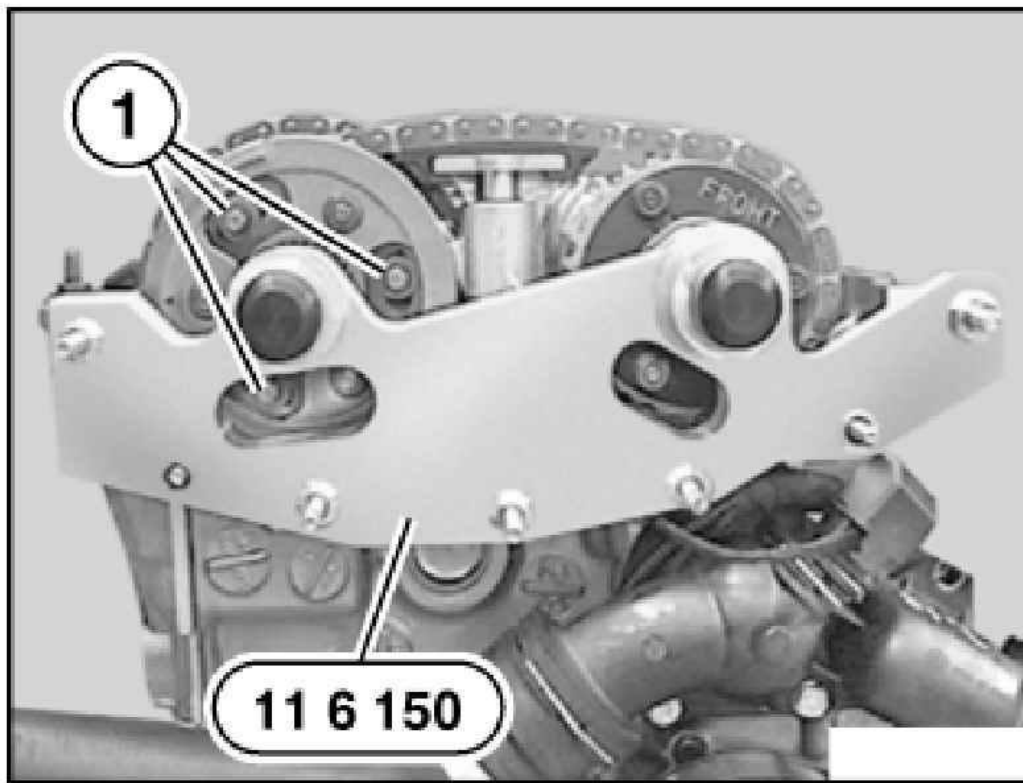
Initially tighten nuts (2) on exhaust side and nuts (3) on inlet side to approx. 5 Nm.



G03260653

Fig. 239: Tightening Nuts On Exhaust Side
Courtesy of BMW OF NORTH AMERICA, INC.

Tighten down screws (1) on exhaust side.

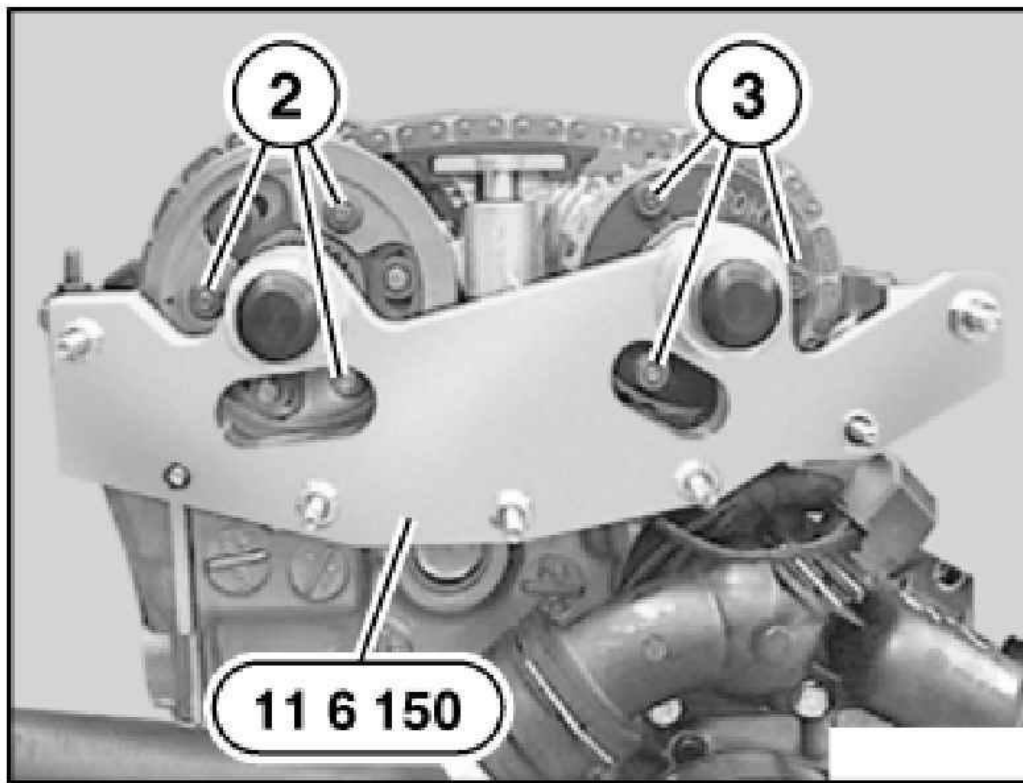


G03260654

Fig. 240: Tightening Down Screws On Exhaust Side
Courtesy of BMW OF NORTH AMERICA, INC.

Tightening torque 11 31 3AZ. Refer to **ENGINE - TIGHTENING TORQUES** .

Tighten down nuts (2) on exhaust side and nuts (3) on inlet side.

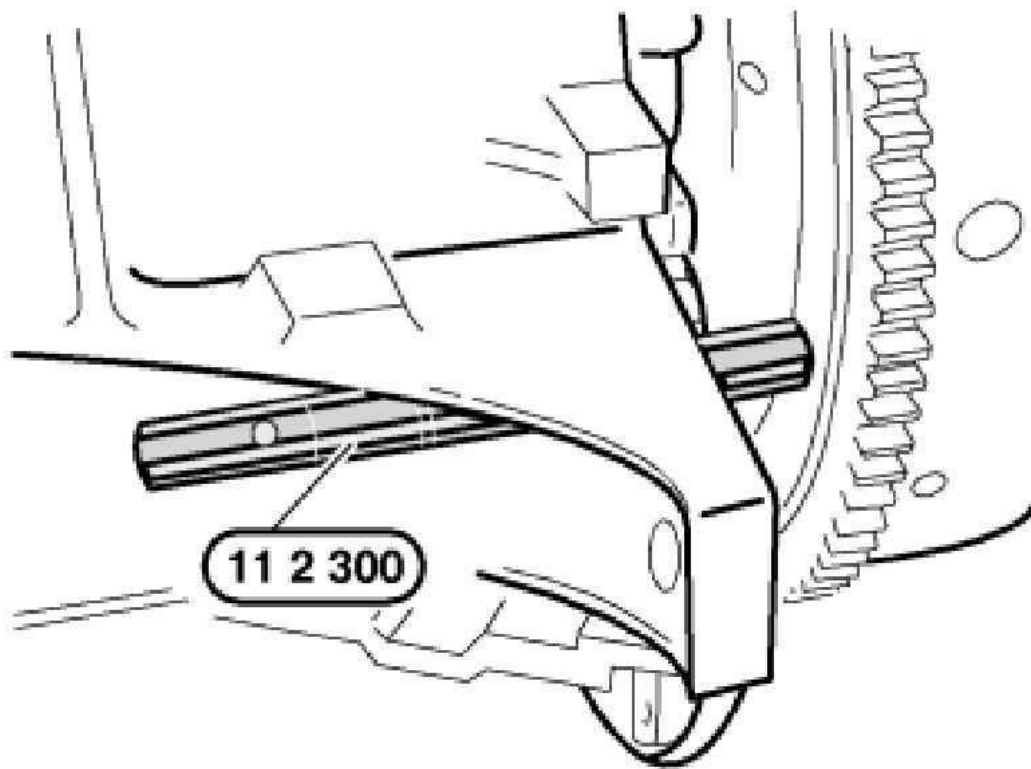


G03260655

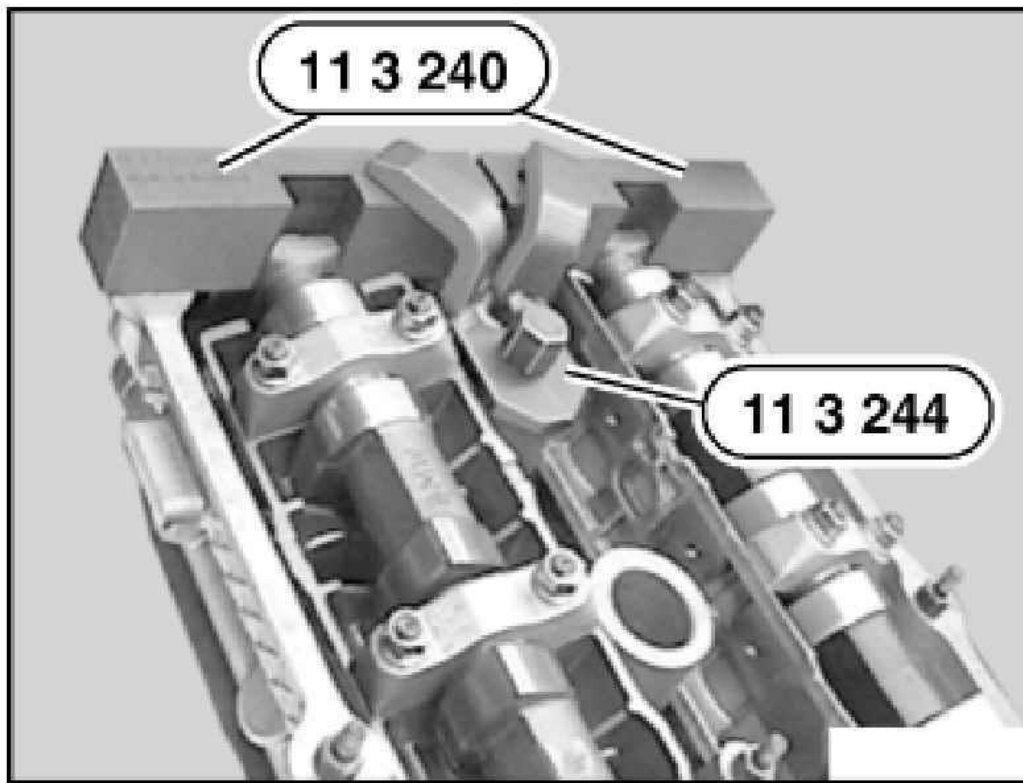
Fig. 241: Tightening Down Nuts On Exhaust & Inlet Side
Courtesy of BMW OF NORTH AMERICA, INC.

Tightening torque 11 31 11AZ. Refer to **ENGINE - TIGHTENING TORQUES**.

Pull special tool 11 2 300 back until flywheel is no longer secured in position.

**G03260656****Fig. 242: Releasing Flywheel****Courtesy of BMW OF NORTH AMERICA, INC.**

Remove special tool 11 3 244 and special tool 11 3 240.

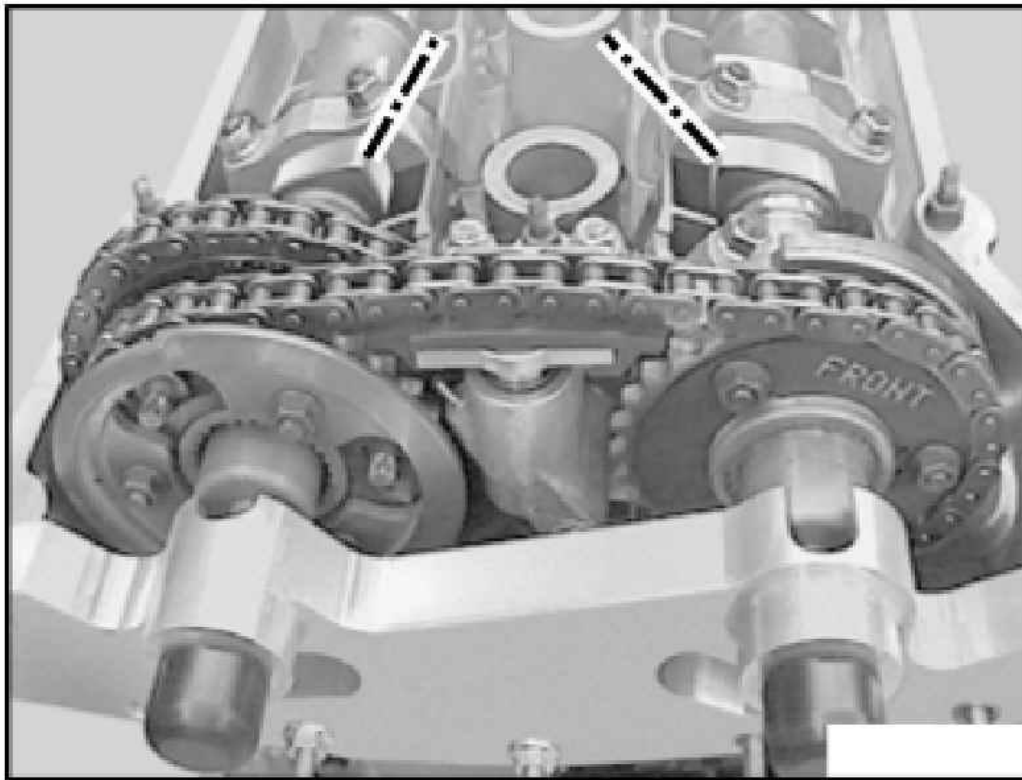


G03260657

Fig. 243: Removing Special Tools

Courtesy of BMW OF NORTH AMERICA, INC.

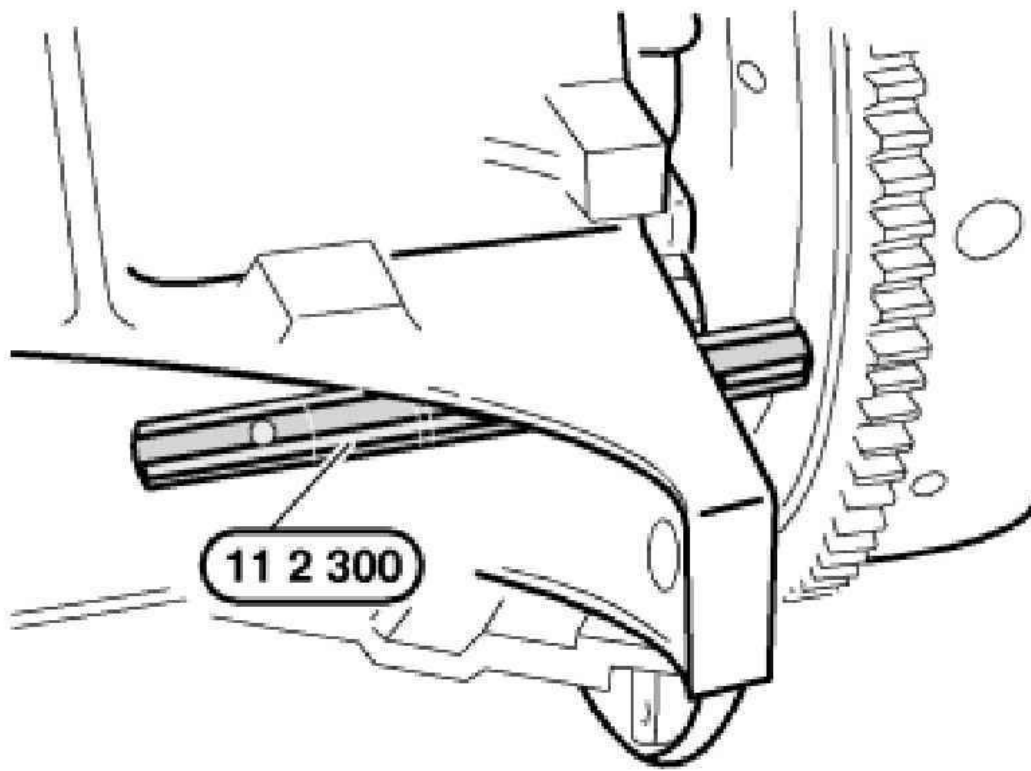
Crank engine twice in direction of rotation until cam tips on inlet and exhaust camshafts on 1st cylinder face one another.



G03260658

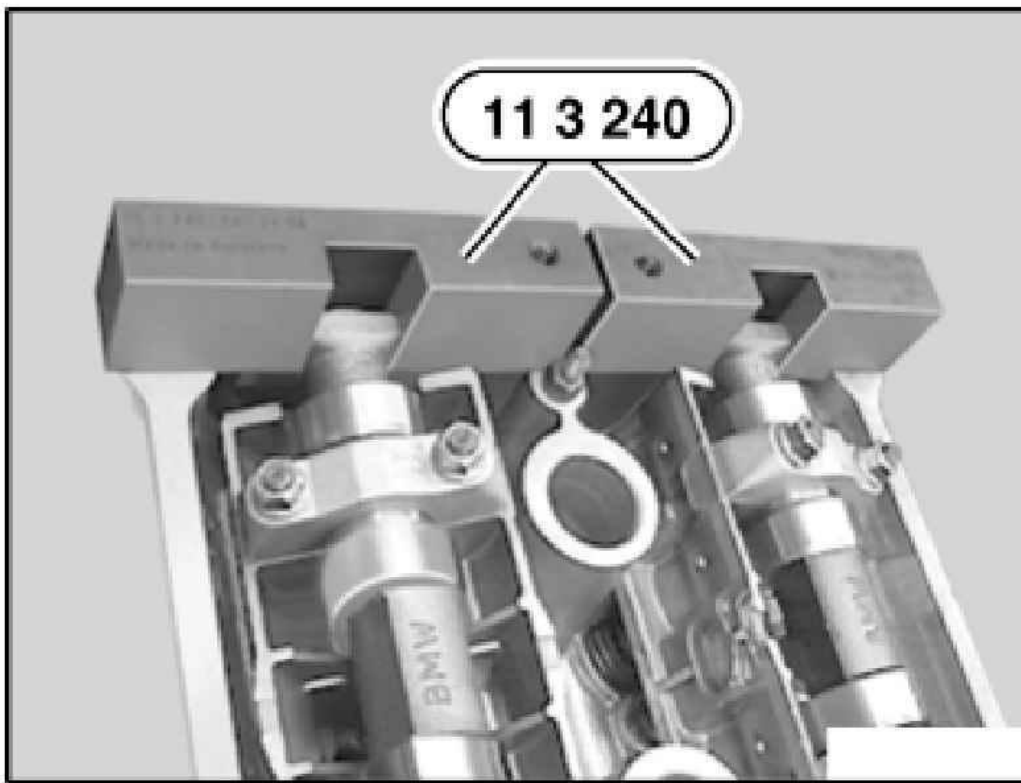
Fig. 244: Aligning Cam Tips On Inlet And Exhaust Camshafts
Courtesy of BMW OF NORTH AMERICA, INC.

Secure crankshaft in firing TDC position with special tool 11 2 300.

**G03260659****Fig. 245: Securing Crankshaft****Courtesy of BMW OF NORTH AMERICA, INC.****IMPORTANT: Do not turn the engine back.**

Remove special tool 11 2 300 before switching on the engine.

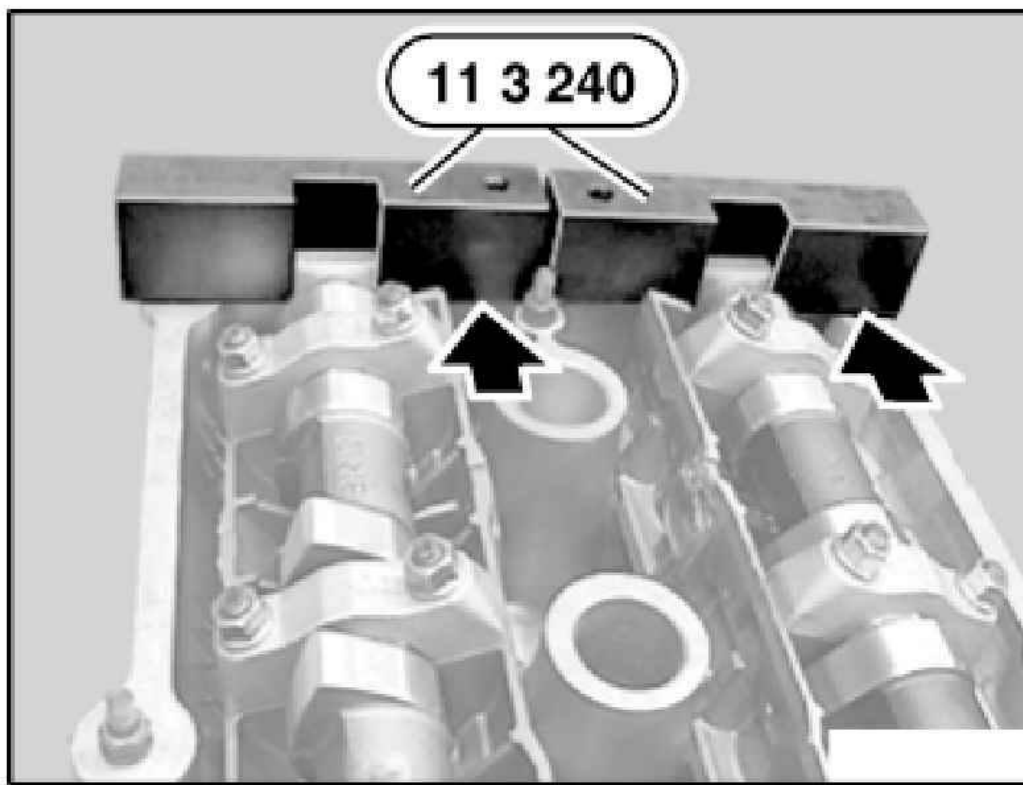
Fit special tool 11 3 240 to camshafts.



G03260660

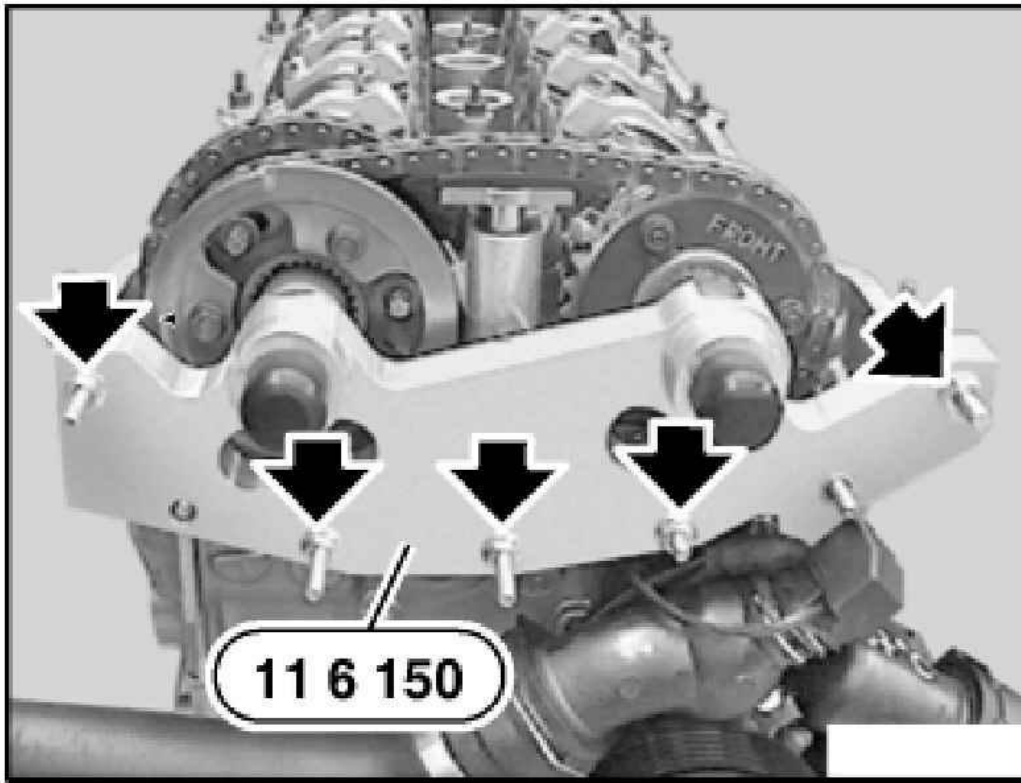
Fig. 246: Fitting Special Tool To Camshafts
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: The timing is correctly set if the special tool 11 3 240 rests without a gap on the cylinder head or protrudes up to 1 mm to the inlet side.

**G03260661****Fig. 247: Checking Timing****Courtesy of BMW OF NORTH AMERICA, INC.**

The timing must be reset if the special tool 11 3 240 protrudes to the exhaust side.

Remove special tool 11 6 150.



G03260662

Fig. 248: Removing Special Tool

Courtesy of BMW OF NORTH AMERICA, INC.

Install VANOS adjustment unit. Refer to **11 36 010 REMOVING AND INSTALLING OR REPLACING DOUBLE VANOS ADJUSTMENT UNIT (M52TU / M54 / M56)**.

Assemble engine.

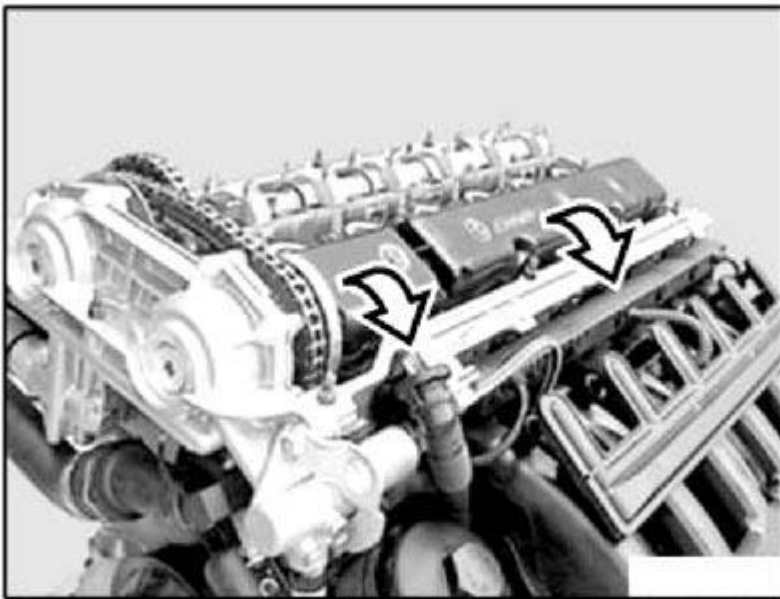
11 31 005 CHECKING CAMSHAFT TIMING (M52TU / M54 / M56)**Special tools required:**

- 00 9 250
- 11 2 300
- 11 3 240
- 11 3 450
- 11 4 220

Necessary preliminary tasks:

- Remove fan impeller with fan clutch
- **E60:** Remove fan cowl with electric fan
- Remove cylinder head cover, refer to **11 12 000 REMOVING AND INSTALLING, SEALING CYLINDER HEAD COVER (M52TU / M54 / M56)**
- Remove all spark plugs, refer to **12 12 011 REPLACING ALL SPARK PLUGS**

Detach cover for inlet camshaft.



G03310363

Fig. 249: Detaching Cover For Inlet Camshaft
Courtesy of BMW OF NORTH AMERICA, INC.

IMPORTANT: Cylinder for chain tensioning piston is under spring pressure.

Remove cylinder for chain tensioning piston.

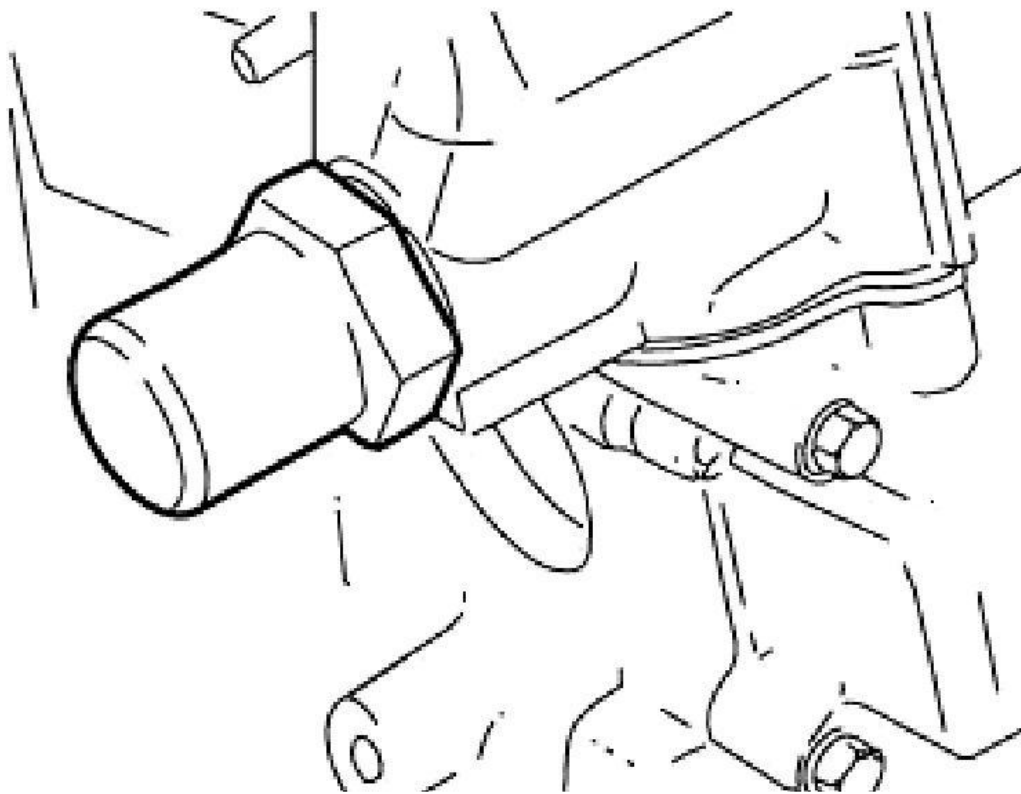
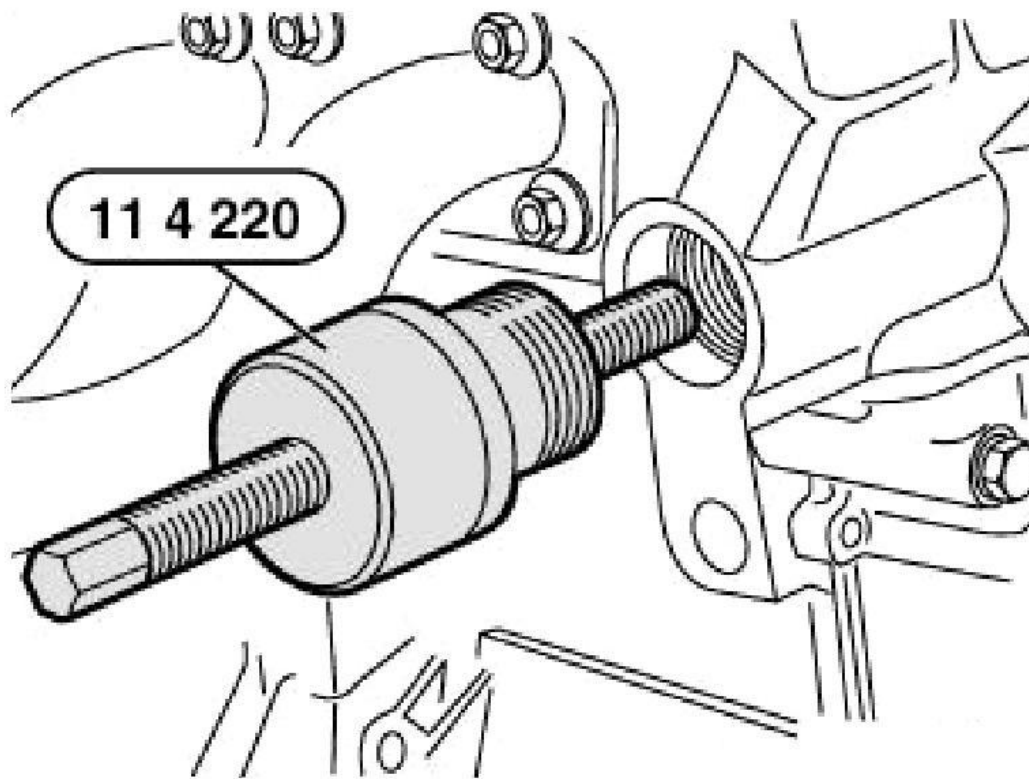
**G03310364**

Fig. 250: Removing Cylinder For Chain Tensioning Piston
Courtesy of BMW OF NORTH AMERICA, INC.

Install special tool 11 4 220.

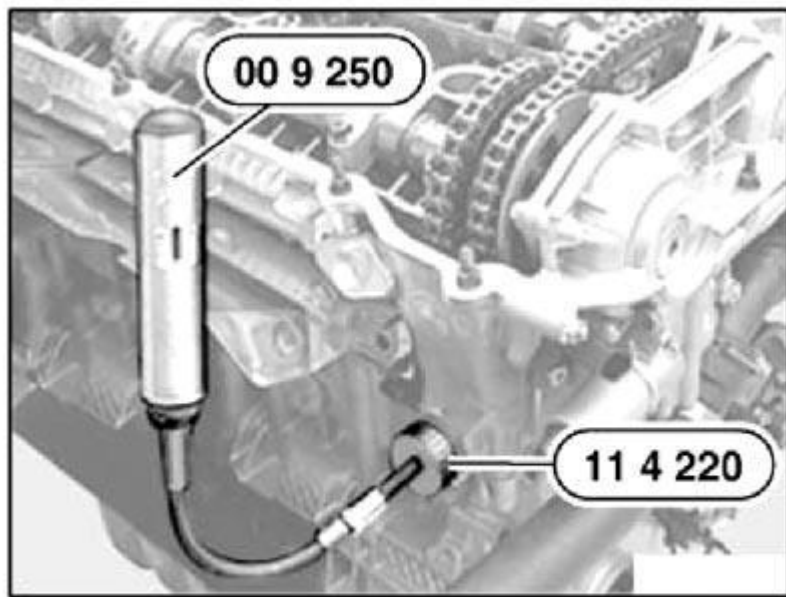
Fit adjusting screw to bow cover.



G03310365

Fig. 251: Fitting Adjusting Screw To Bow Cover
Courtesy of BMW OF NORTH AMERICA, INC.

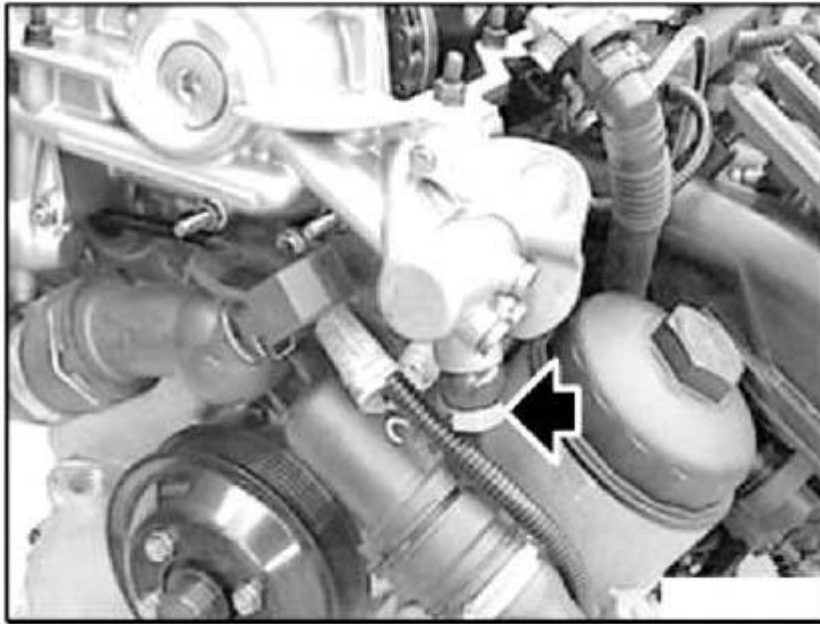
Preload tensioning rail with special tool 11 4 220 by rotating adjusting screw with special tool 00 9 250 or standard torque wrench to 0.7 N.m.



G03310366

Fig. 252: Preloading Tensioning Rail
Courtesy of BMW OF NORTH AMERICA, INC.

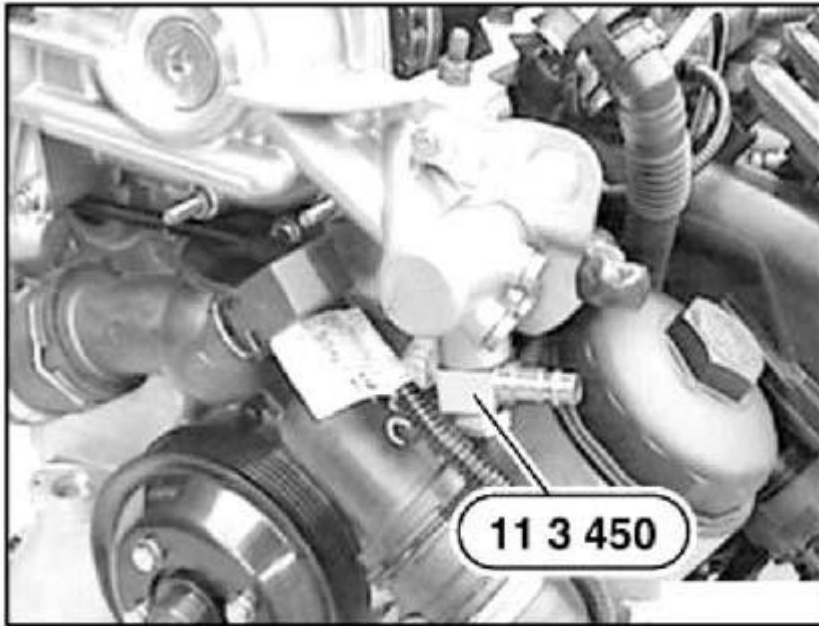
Unscrew oil pressure pipe.



G03310367

Fig. 253: Unscrewing Oil Pressure Pipe
Courtesy of BMW OF NORTH AMERICA, INC.

Mount special tool 11 3 450 with banjo bolt of oil pressure line.

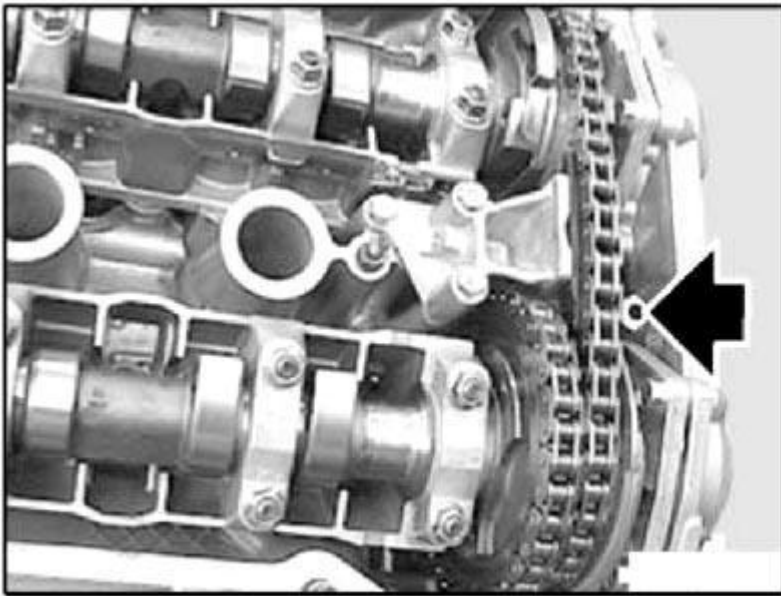


G03310368

Fig. 254: Mounting Special Tool

Courtesy of BMW OF NORTH AMERICA, INC.

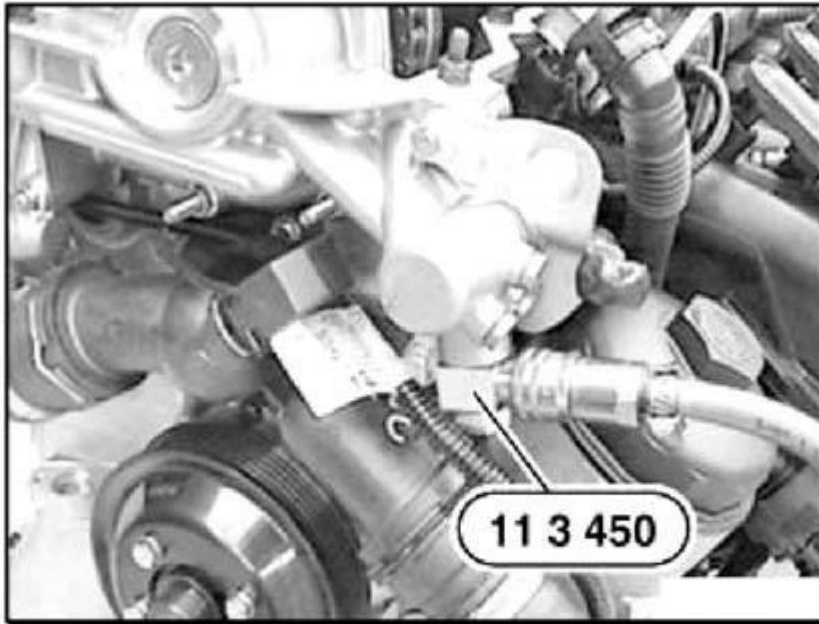
IMPORTANT: Cover double VANOS adjustment unit; when the compressed air supply is connected, several drops of oil are sprayed out of the bore.



G03310369

Fig. 255: View Of Double VANOS Adjustment Unit
Courtesy of BMW OF NORTH AMERICA, INC.

Connect compressed air (2 to 8 bar).

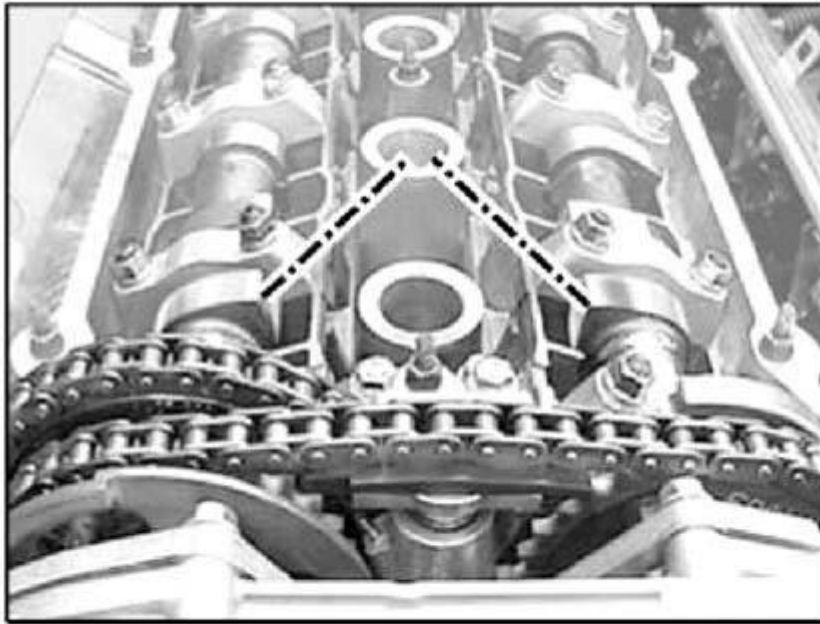


G03310370

Fig. 256: Connecting Compressed Air
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: When the engine is switched off, it is possible that the camshafts are not in their initial positions. With the compressed air supply connected, rotate the engine to return the camshafts to their initial positions.

With compressed air supply connected, crank engine at least two revolutions in direction of rotation until cam tips on inlet and exhaust camshafts on 1st cylinder face each other.



G03310371

Fig. 257: Identifying Camshafts Position
Courtesy of BMW OF NORTH AMERICA, INC.

Pull dust guard out of the special tool bore.

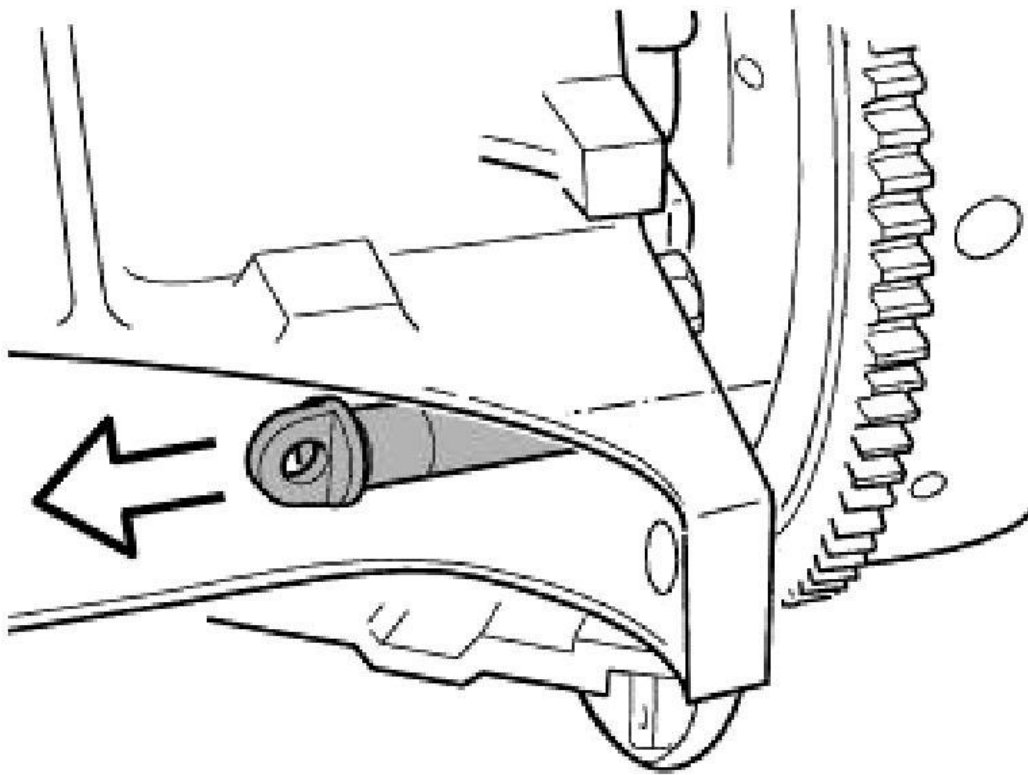
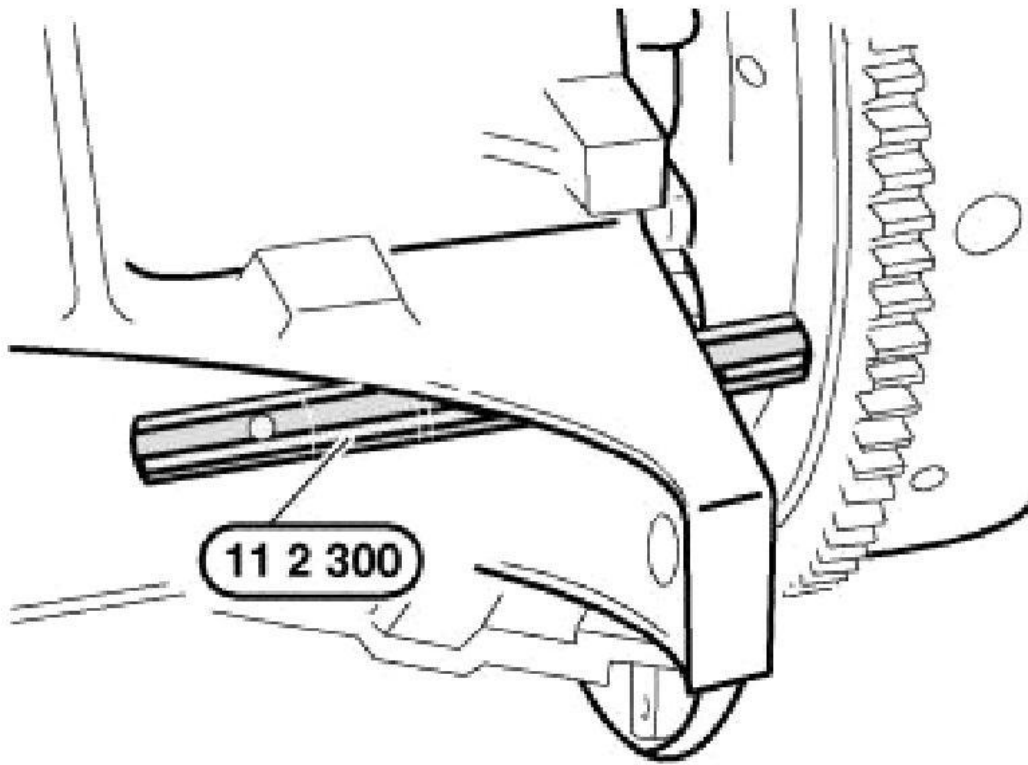
**G03310372**

Fig. 258: Pulling Dust Guard Out Of Special Tool Bore
Courtesy of BMW OF NORTH AMERICA, INC.

Secure crankshaft with special tool 11 2 300 in TDC firing position of 1st cylinder.



G03310373

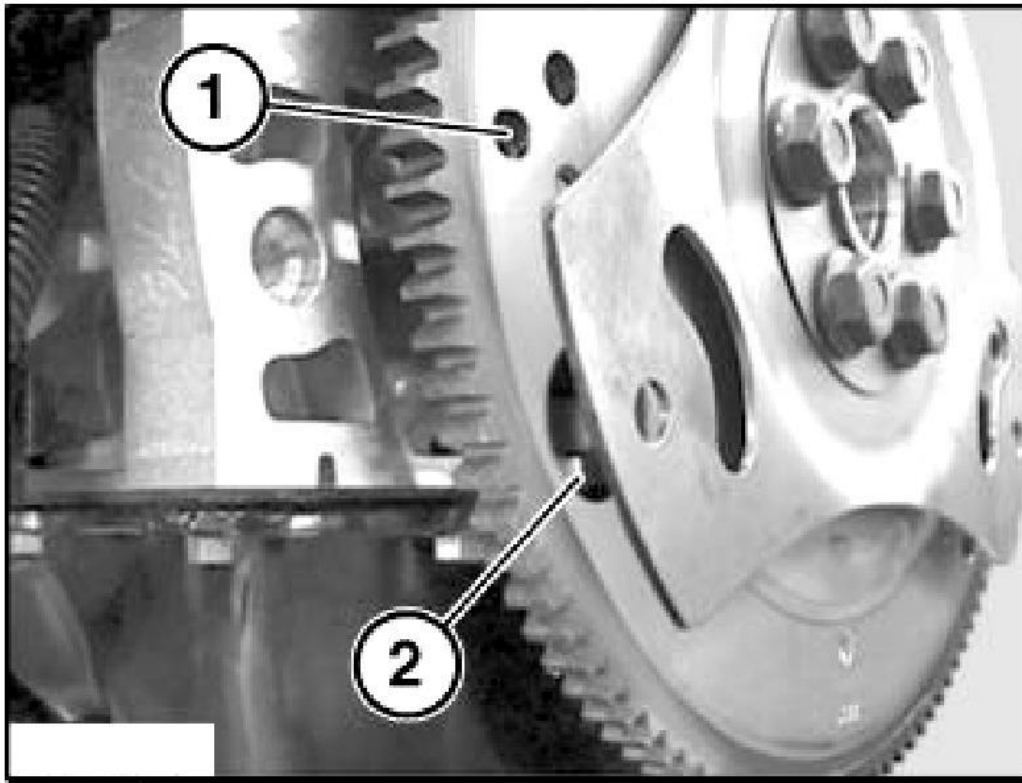
Fig. 259: Securing Crankshaft

Courtesy of BMW OF NORTH AMERICA, INC.

IMPORTANT: Do not turn the engine back.

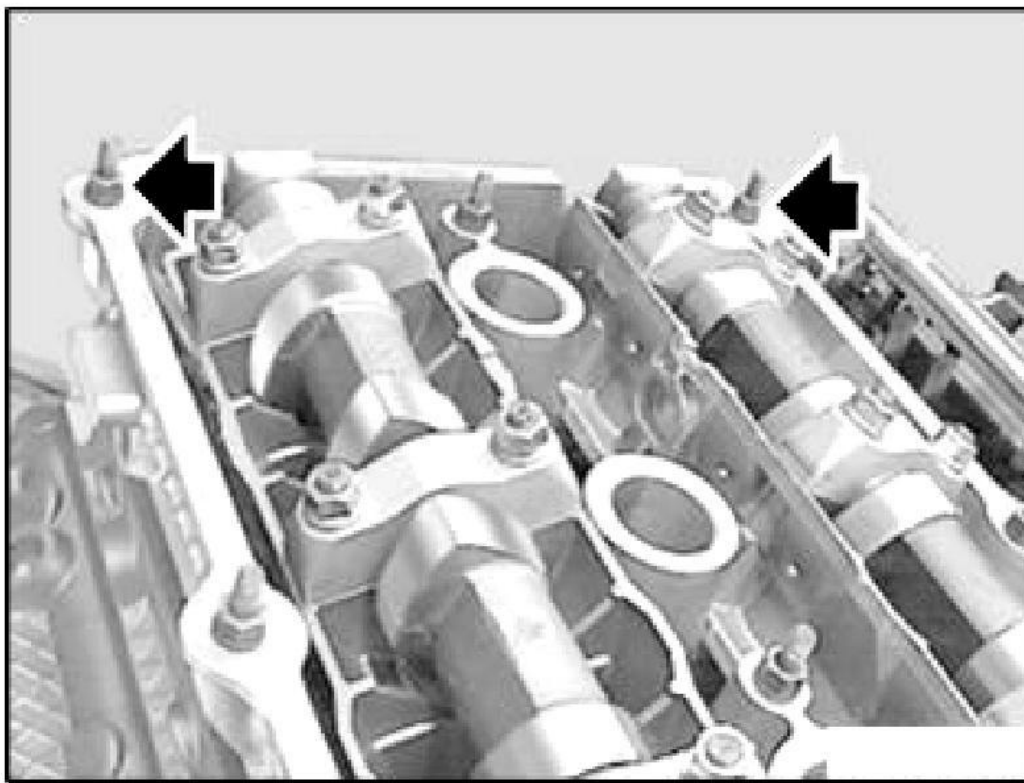
Remove special tool 11 2 300 before starting engine.

Automatic transmissions only: Illustration does not show automatic transmission.**IMPORTANT:** On engines with automatic transmissions, there is shortly before the special tool bore (1) a large bore (2) which can be confused with the special tool bore (1)

**G03310374****Fig. 260: Identifying Correct Bore****Courtesy of BMW OF NORTH AMERICA, INC.**

If special tool 11 2 300 is secured in the correct bore (1), the engine can no longer be cranked at the central bolt.

Unscrew studs.

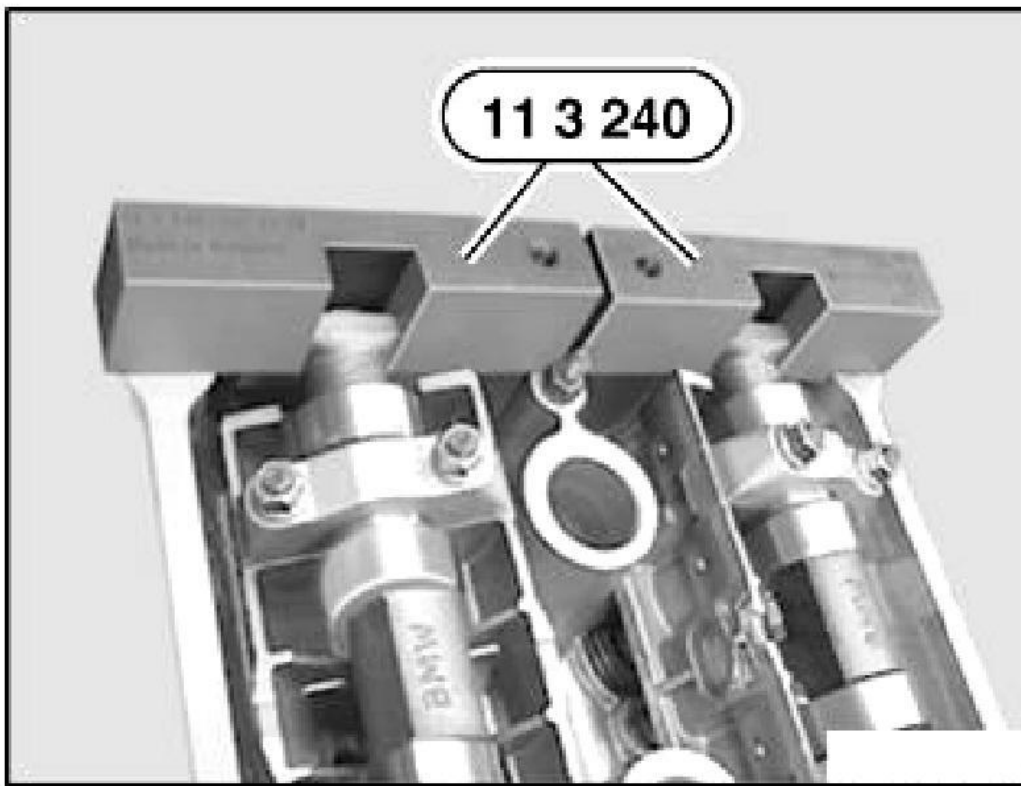


G03310375

Fig. 261: Unscrewing Studs

Courtesy of BMW OF NORTH AMERICA, INC.

Place special tool 11 3 240 on camshafts.

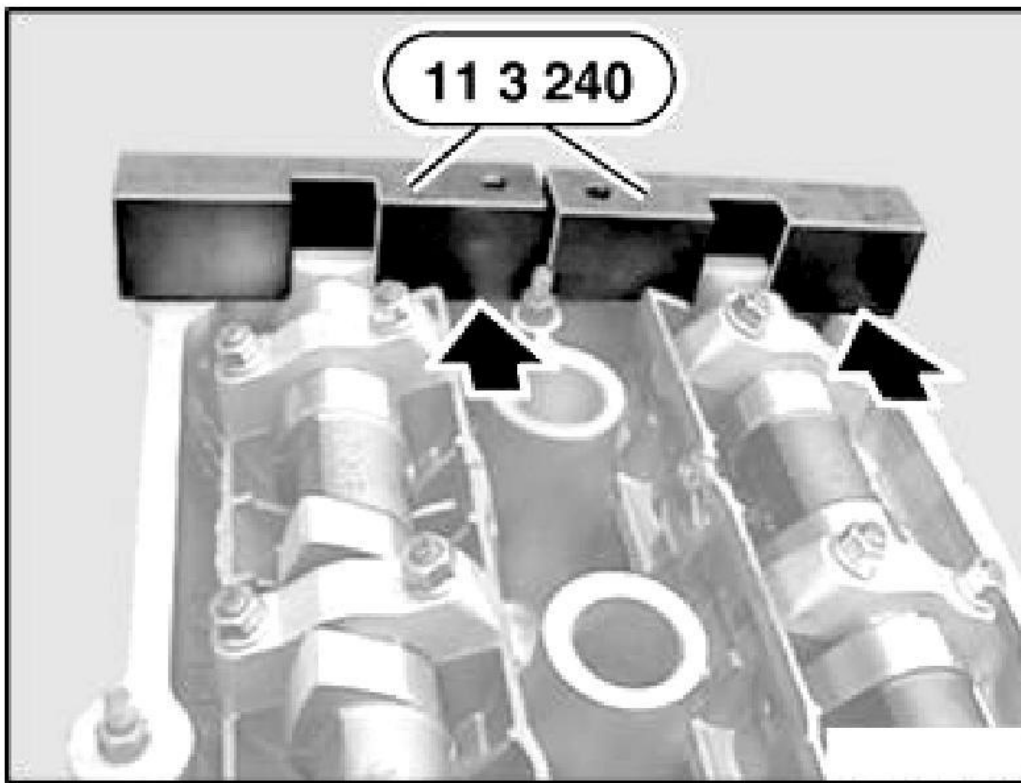


G03310376

Fig. 262: Placing Special Tool On Camshafts

Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: The timing is correctly set if the special tool 11 3 240 rests without a gap on the cylinder head or protrudes up to 1 mm to the inlet side. The timing must be reset if the special tool 11 3 240 protrudes to the exhaust side.



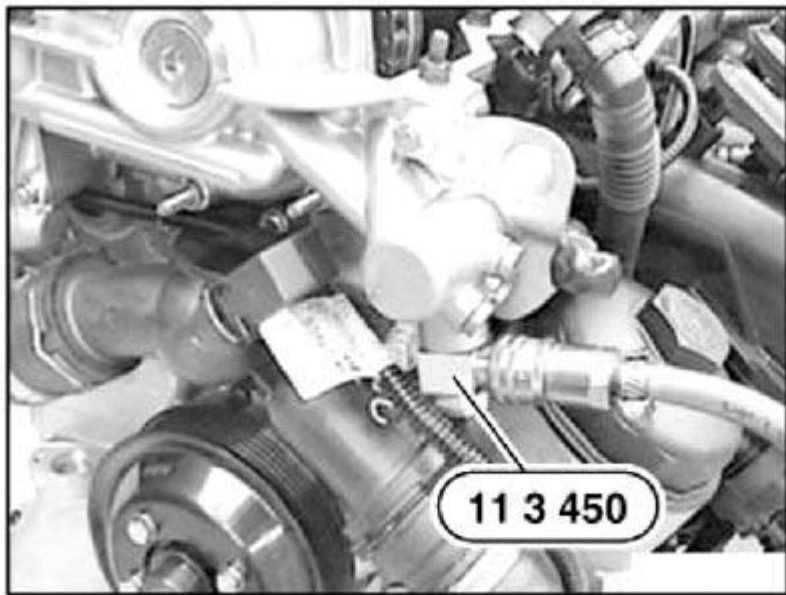
G03310377

Fig. 263: Checking Timing

Courtesy of BMW OF NORTH AMERICA, INC.

If necessary, adjust camshaft timing. Refer to **11 31 505 ADJUSTING CAMSHAFT TIMING (M52TU / M54 / M56)**.

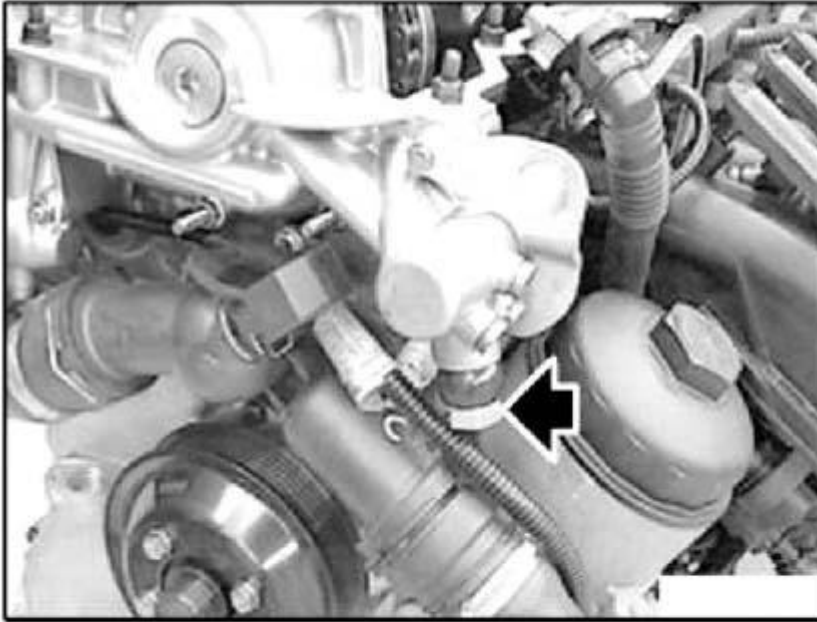
Detach compressed air connection. Remove special tool 11 3 450.



G03310378

Fig. 264: Detaching Compressed Air Connection
Courtesy of BMW OF NORTH AMERICA, INC.

Fit oil pressure line with new seals.

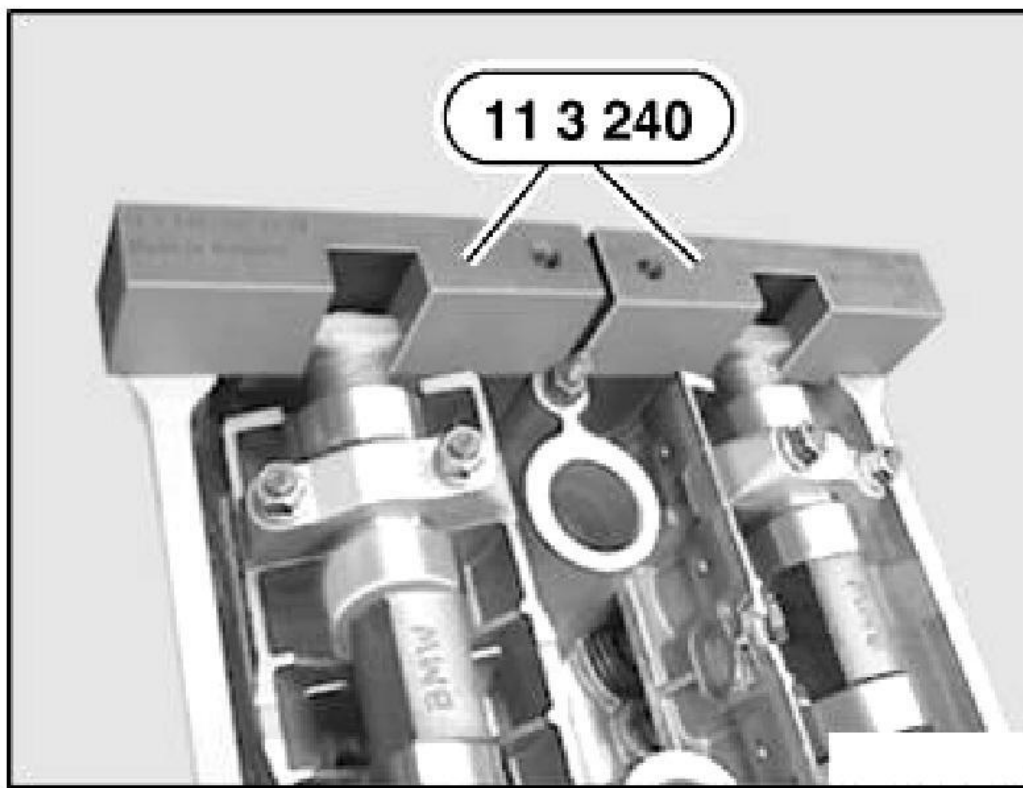


G03310379

Fig. 265: Fitting Oil Pressure Line With New Seals
Courtesy of BMW OF NORTH AMERICA, INC.

Tightening torque 11 36 2AZ. Refer to **ENGINE - TIGHTENING TORQUES** .

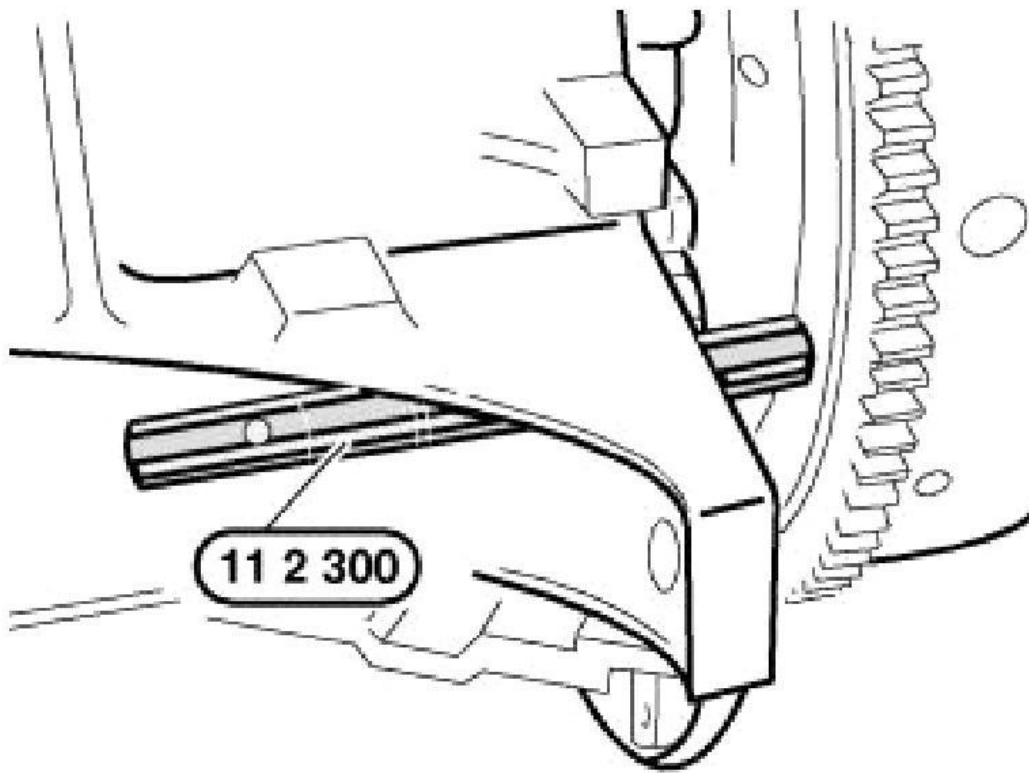
Remove special tool 11 3 240.



G03310380

Fig. 266: Removing Special Tool
Courtesy of BMW OF NORTH AMERICA, INC.

Remove special tool 11 2 300.

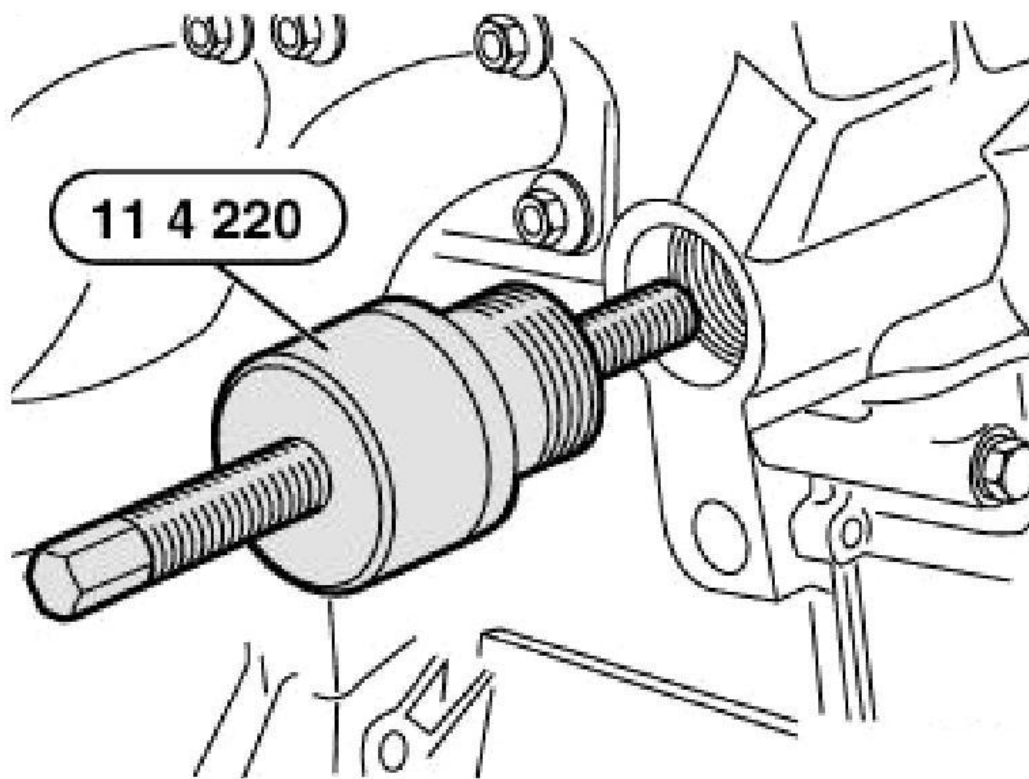


G03310381

Fig. 267: Installing Dust Guard From Inspection Bore
Courtesy of BMW OF NORTH AMERICA, INC.

Install dust guard from inspection bore.

Unfasten and remove special tool 11 4 220.

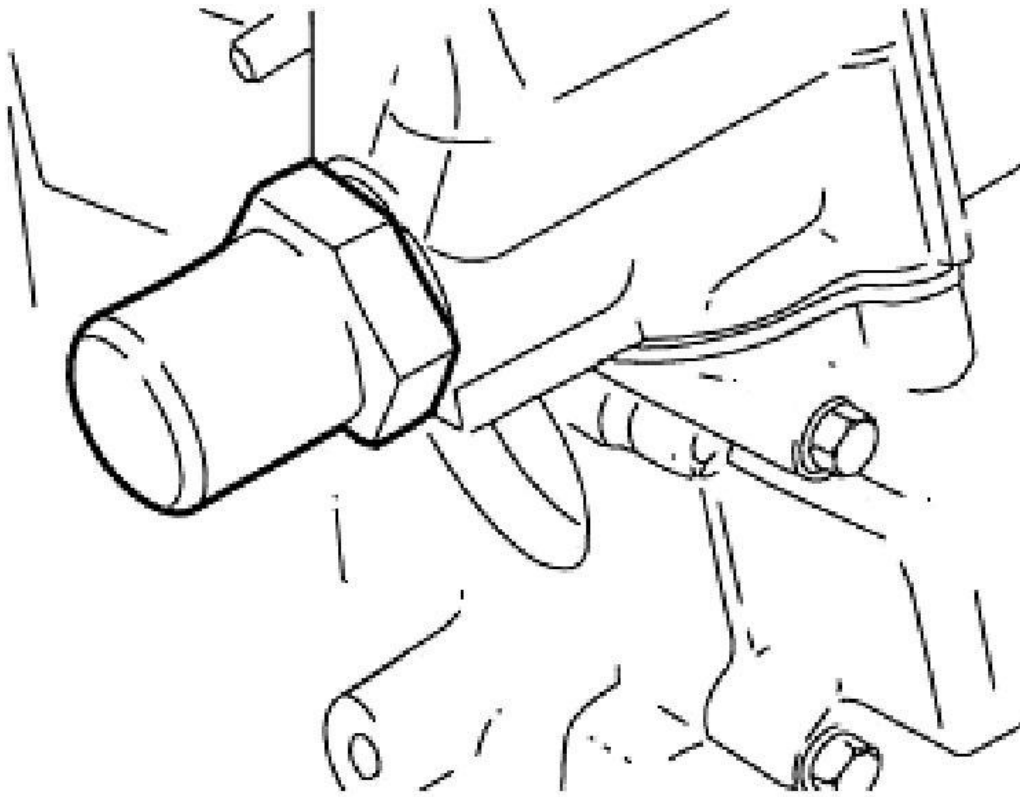


G03310382

Fig. 268: Removing Special Tool

Courtesy of BMW OF NORTH AMERICA, INC.

Install cylinder for chain tensioning piston. Refer to **11 31 090 REMOVING AND INSTALLING/REPLACING CHAIN TENSIONING PISTON (M52 / M52TU / M54 / M56)**.



G03310383

Fig. 269: Installing Cylinder For Chain Tensioning Piston
Courtesy of BMW OF NORTH AMERICA, INC.

Assemble engine.

11 31 090 REMOVING AND INSTALLING/REPLACING CHAIN TENSIONING PISTON (M52 / M52TU / M54 / M56)

IMPORTANT: Spring pressure!

Unfasten cylinder for chain tensioning piston.

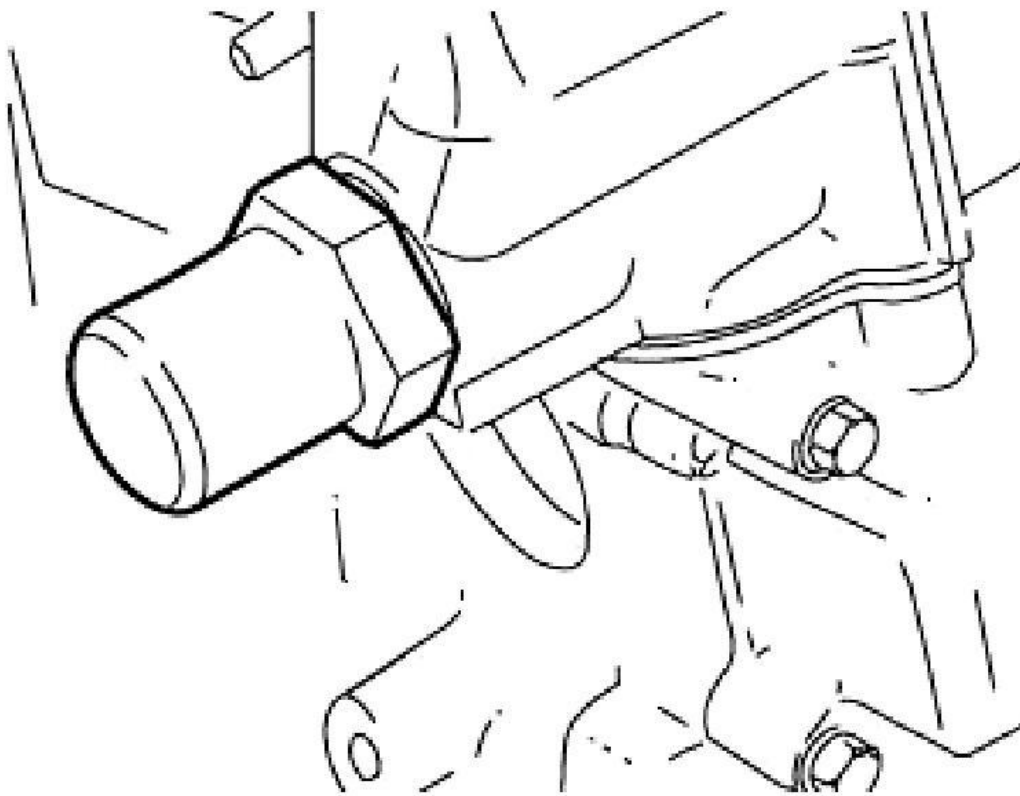
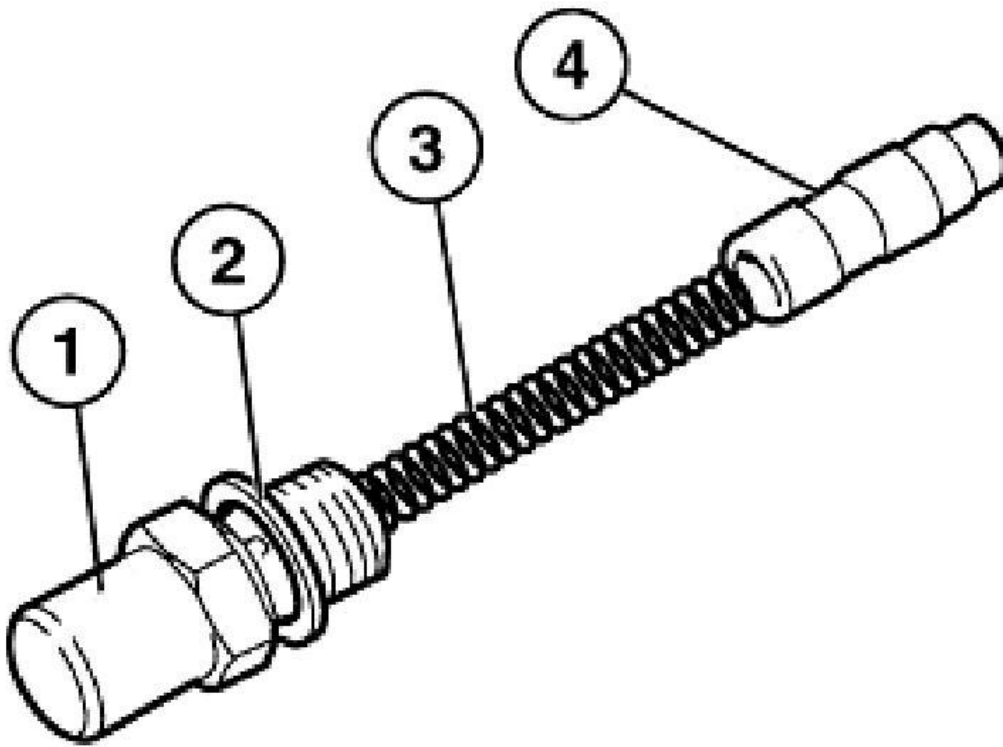
**G03310384**

Fig. 270: Unfastening Cylinder For Chain Tensioning Piston
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Replace sealing ring.

Tightening torque 11 31 8AZ. Refer to **ENGINE - TIGHTENING TORQUES** .



- 1) Cylinder for chain tensioning piston
- 2) Sealing ring
- 3) Spring
- 4) Piston

G03310385

Fig. 271: Arrangement Of Components

Courtesy of BMW OF NORTH AMERICA, INC.

11 31 505 ADJUSTING CAMSHAFT TIMING (M52TU / M54 / M56)

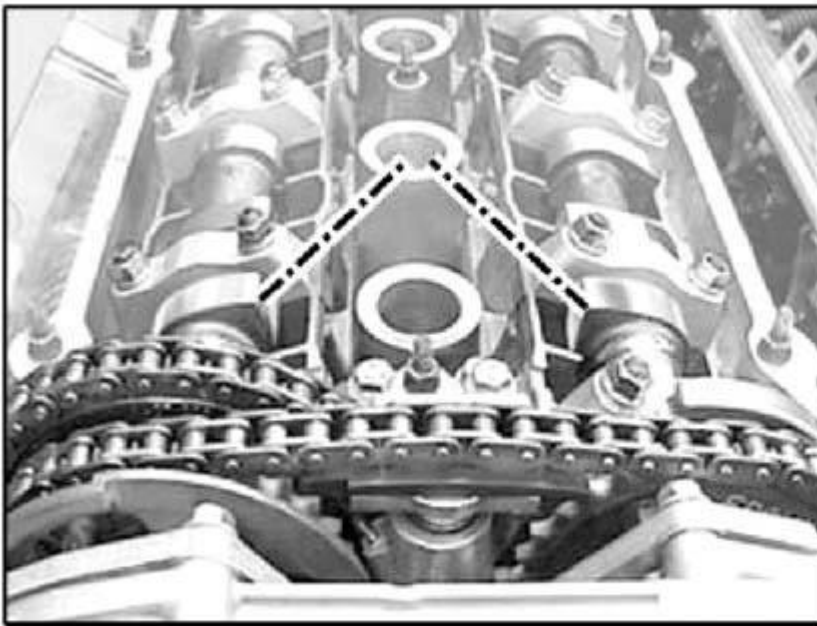
Special tools required:

- 00 9 250

- 11 2 300
- 11 3 240
- 11 3 244
- 11 3 292
- 11 4 220
- 11 5 180
- 11 6 150

Before carrying out adjustment work: check camshaft timing. Refer to **11 31 005 CHECKING CAMSHAFT TIMING (M52TU / M54 / M56)**.

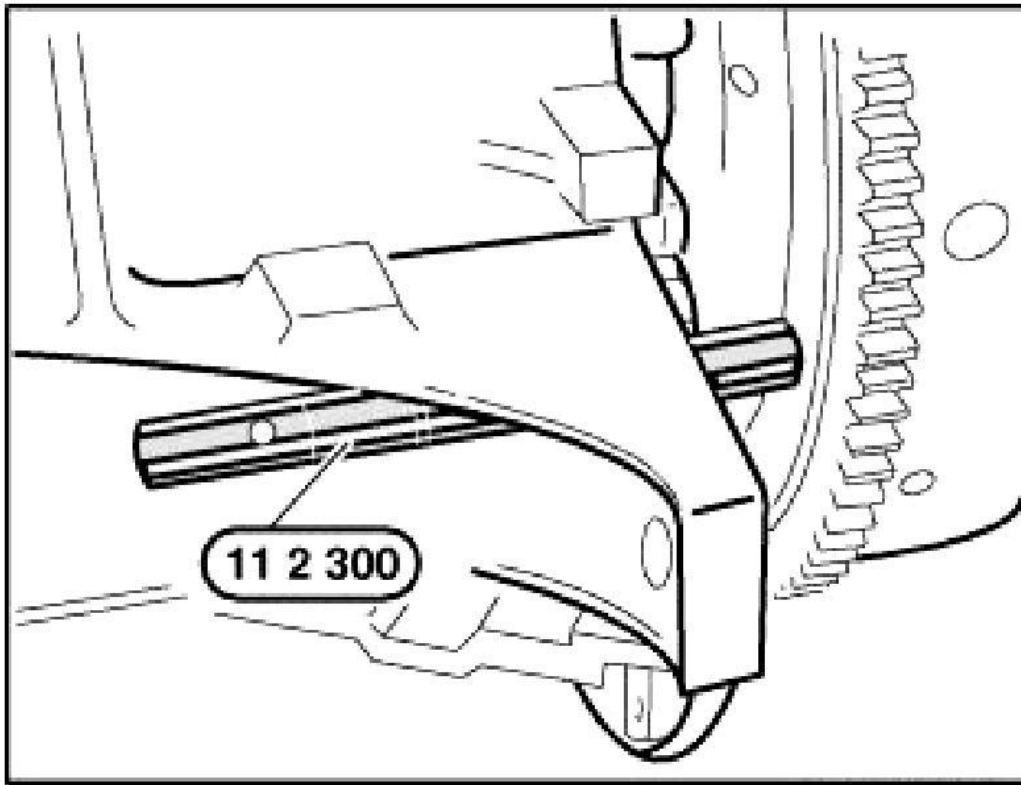
Crank engine in direction of rotation until cam tips on inlet and exhaust camshafts on 1st cylinder face one another.



G03310386

Fig. 272: Adjusting Position Of Cam Tips
Courtesy of BMW OF NORTH AMERICA, INC.

Secure crankshaft with special tool 11 2 300 in TDC position of 1st cylinder.



G03310387

Fig. 273: Securing Crankshaft

Courtesy of BMW OF NORTH AMERICA, INC.

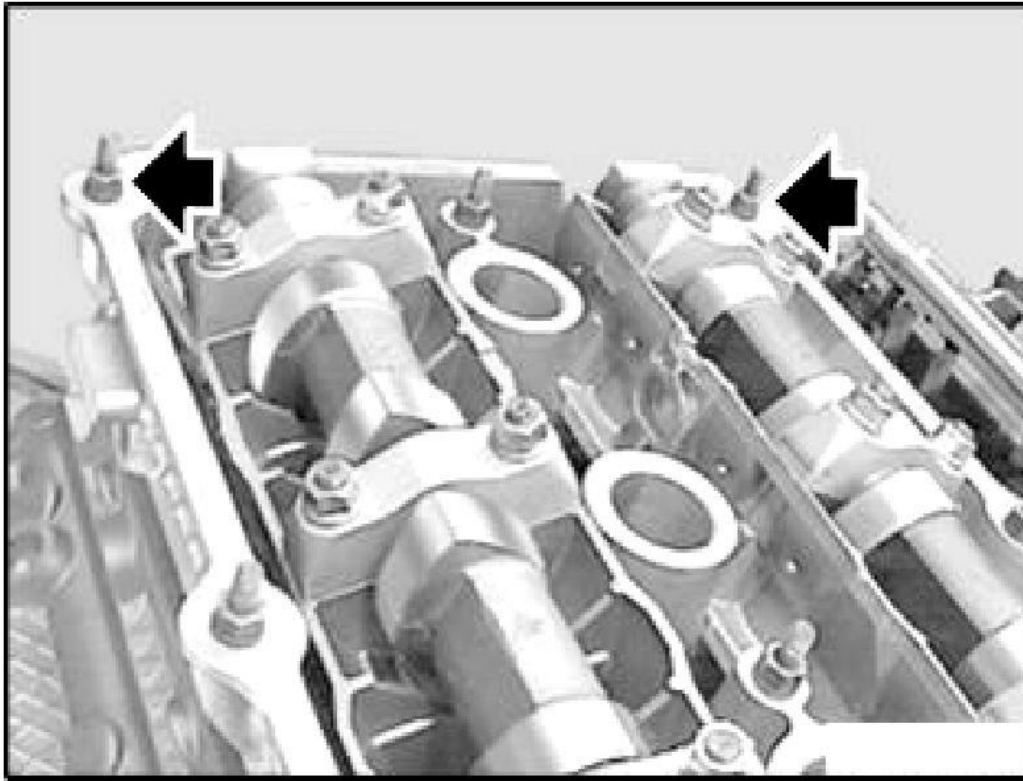
X3 only:

Secure crankshaft with special tool 11 5 180 in TDC position of 1st cylinder.

IMPORTANT: Do not turn the engine back.

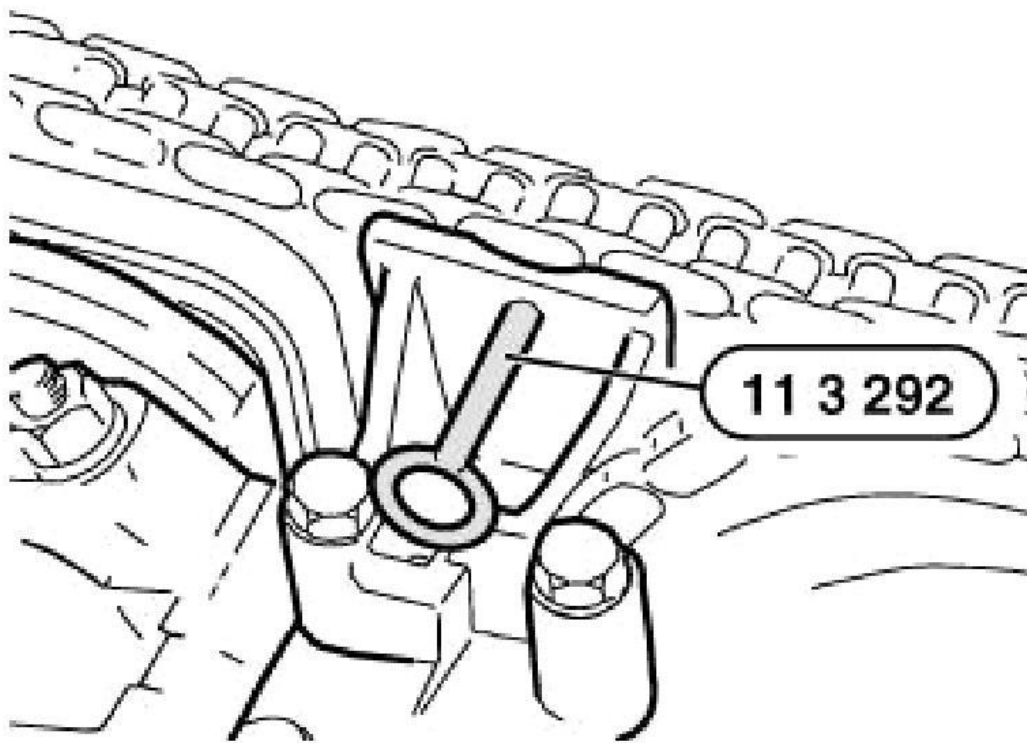
Remove special tools 11 2 300 / 11 5 180 before starting engine.

Unscrew studs.

**G03310388****Fig. 274: Unscrewing Studs****Courtesy of BMW OF NORTH AMERICA, INC.**

Remove double VANOS adjustment unit. Refer to **11 36 010 REMOVING AND INSTALLING OR REPLACING DOUBLE VANOS ADJUSTMENT UNIT (M52TU / M54 / M56).**

Press down top of chain tensioner and lock off with special tool 11 3 292.

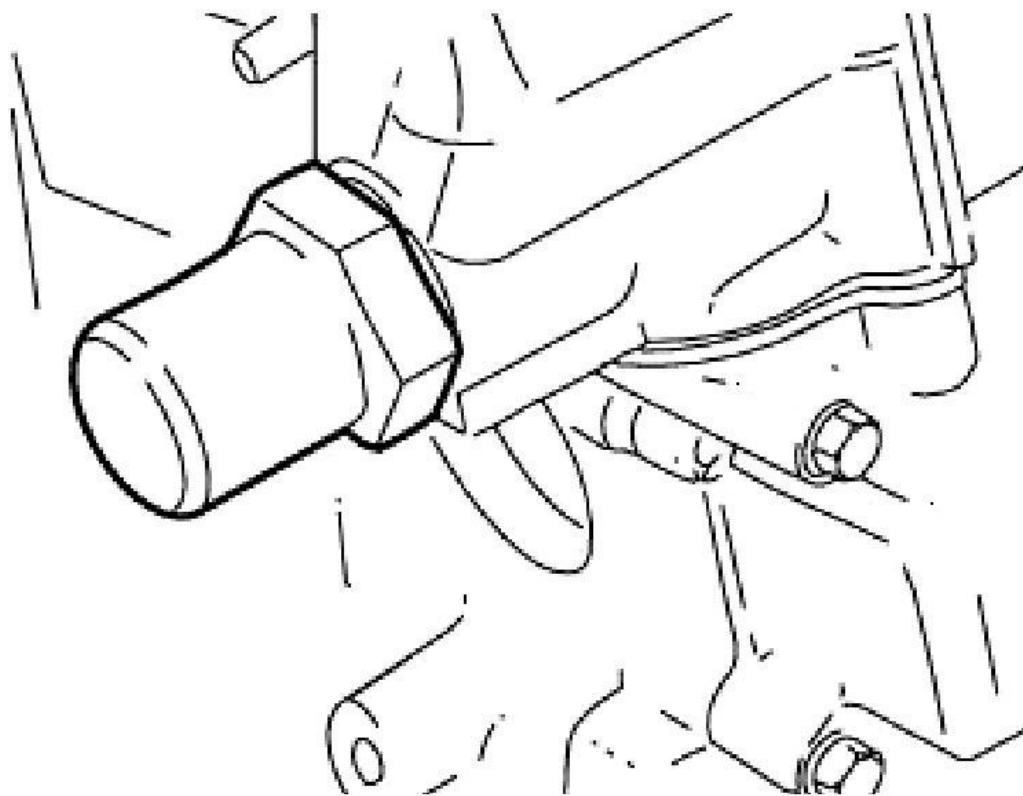


G03310389

Fig. 275: Locking Off Chain Tensioner
Courtesy of BMW OF NORTH AMERICA, INC.

IMPORTANT: Cylinder for chain tensioning piston is under spring pressure.

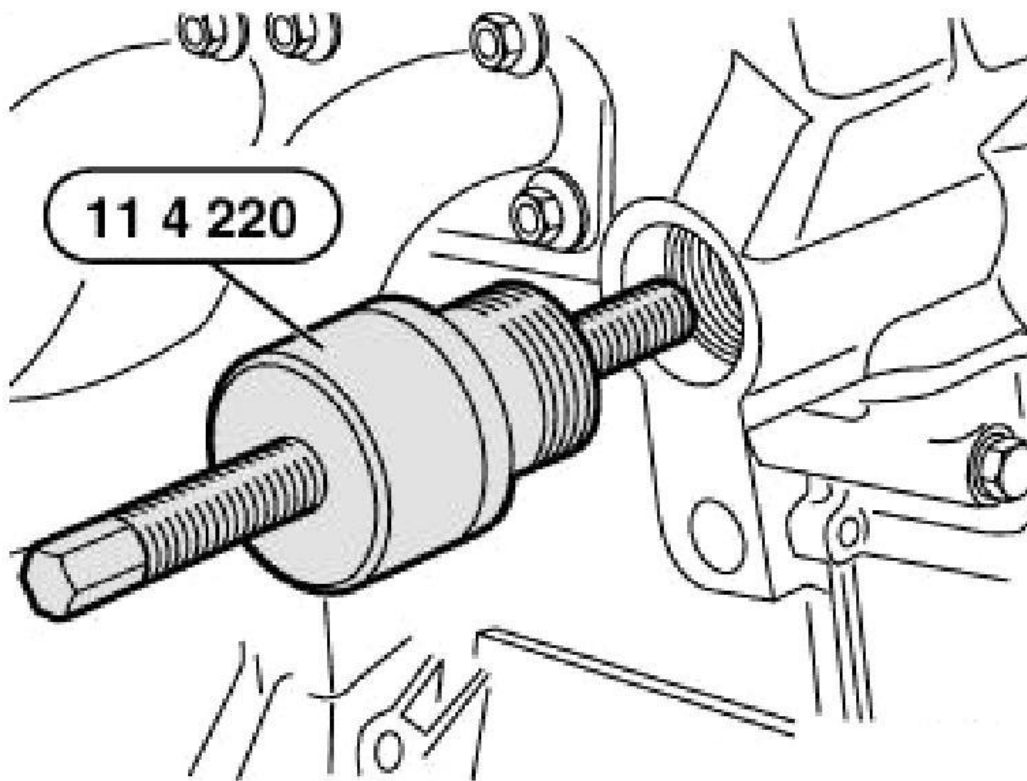
Remove cylinder for chain tensioning piston.



G03310390

Fig. 276: Removing Cylinder Chain Tensioning Piston
Courtesy of BMW OF NORTH AMERICA, INC.

Install special tool 11 4 220.

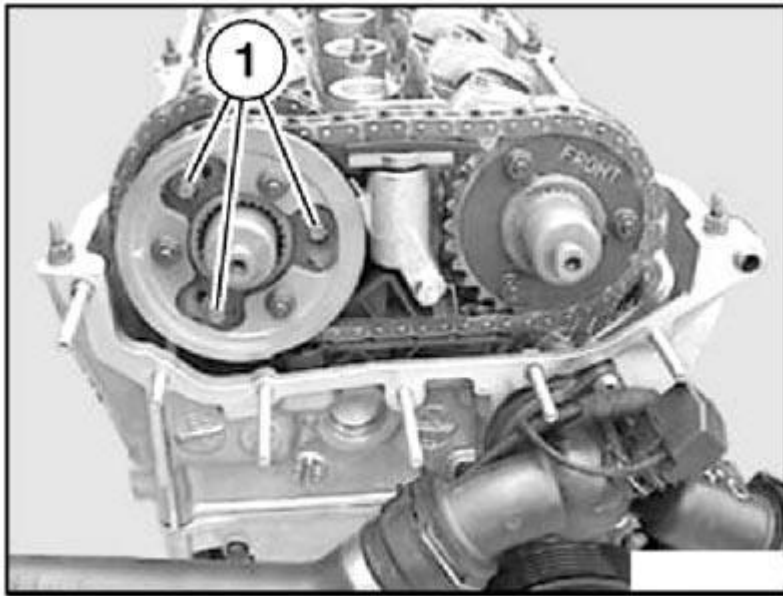


G03310391

Fig. 277: Fitting Adjusting Screw To Bow Cover
Courtesy of BMW OF NORTH AMERICA, INC.

Fit adjusting screw to bow cover.

Release screws (1) by half a turn.

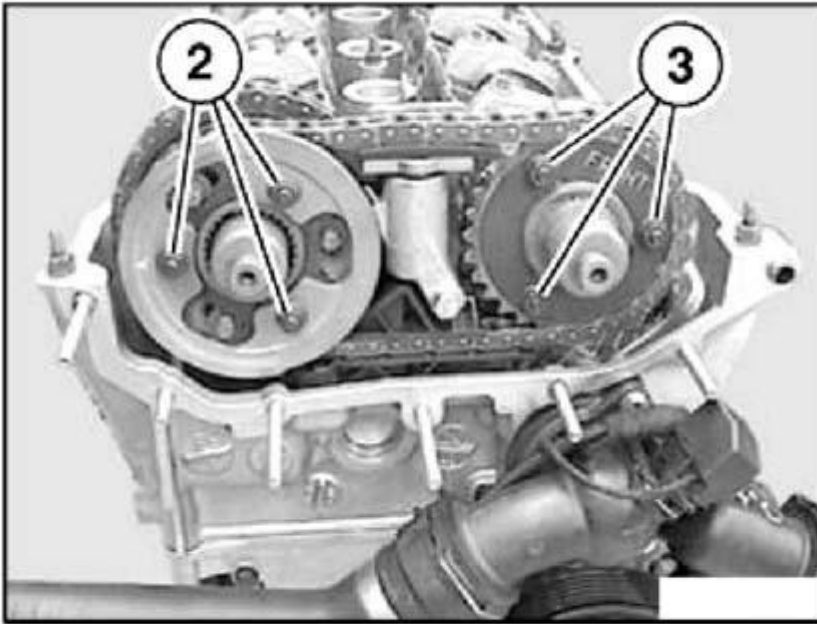


G03310392

Fig. 278: Releasing Screws

Courtesy of BMW OF NORTH AMERICA, INC.

Release nuts (2) by two turns.



G03310393

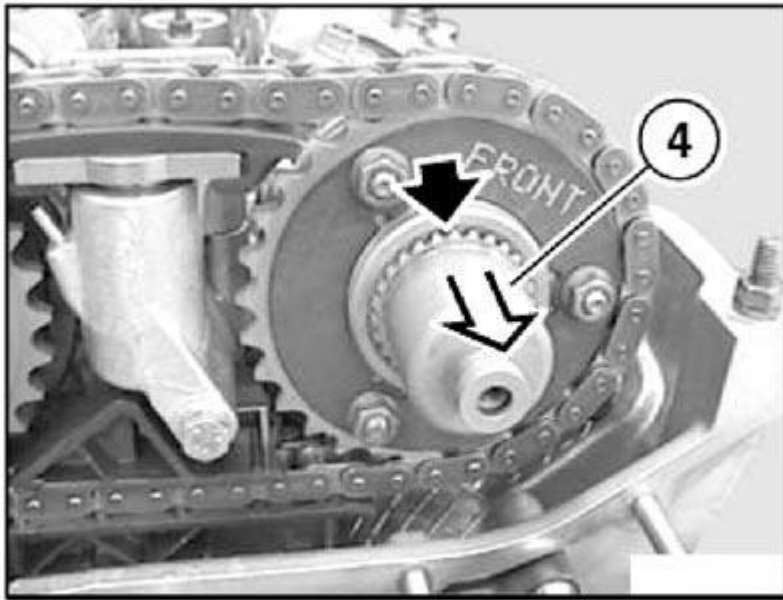
Fig. 279: Releasing Nuts

Courtesy of BMW OF NORTH AMERICA, INC.

Release nuts (3) by one turn.

IMPORTANT: Toothed shaft (4) slips very easily from splines.

Pull out toothed shaft (4) until approx. 1 mm of splines can be seen.

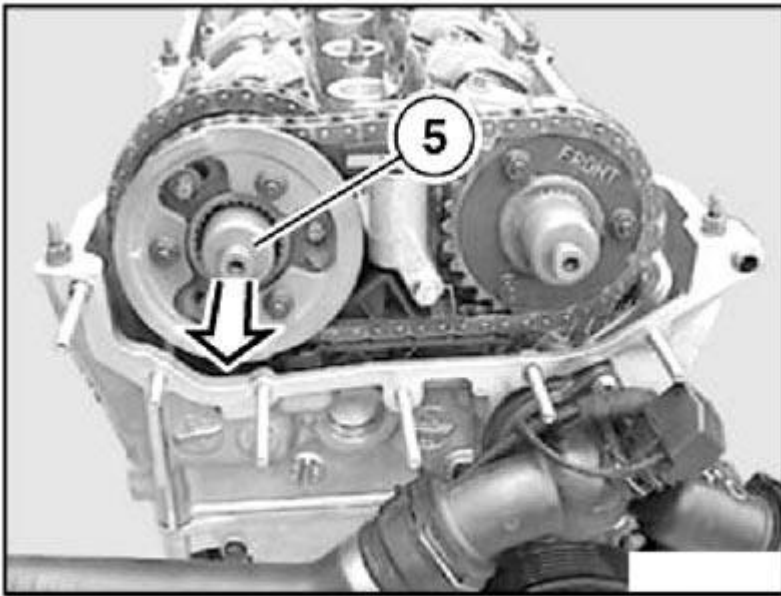


G03310394

Fig. 280: Pulling Out Toothed Shaft

Courtesy of BMW OF NORTH AMERICA, INC.

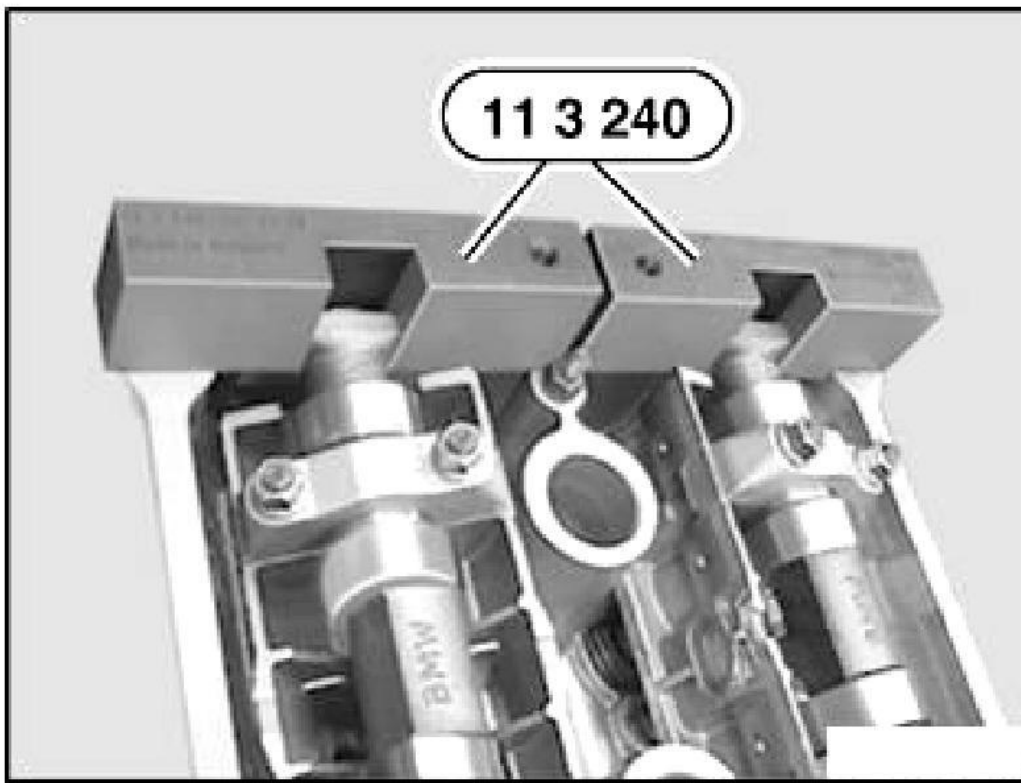
Withdraw toothed shaft (5) up to stop.



G03310395

Fig. 281: Removing Toothed Shaft Up To Stop
Courtesy of BMW OF NORTH AMERICA, INC.

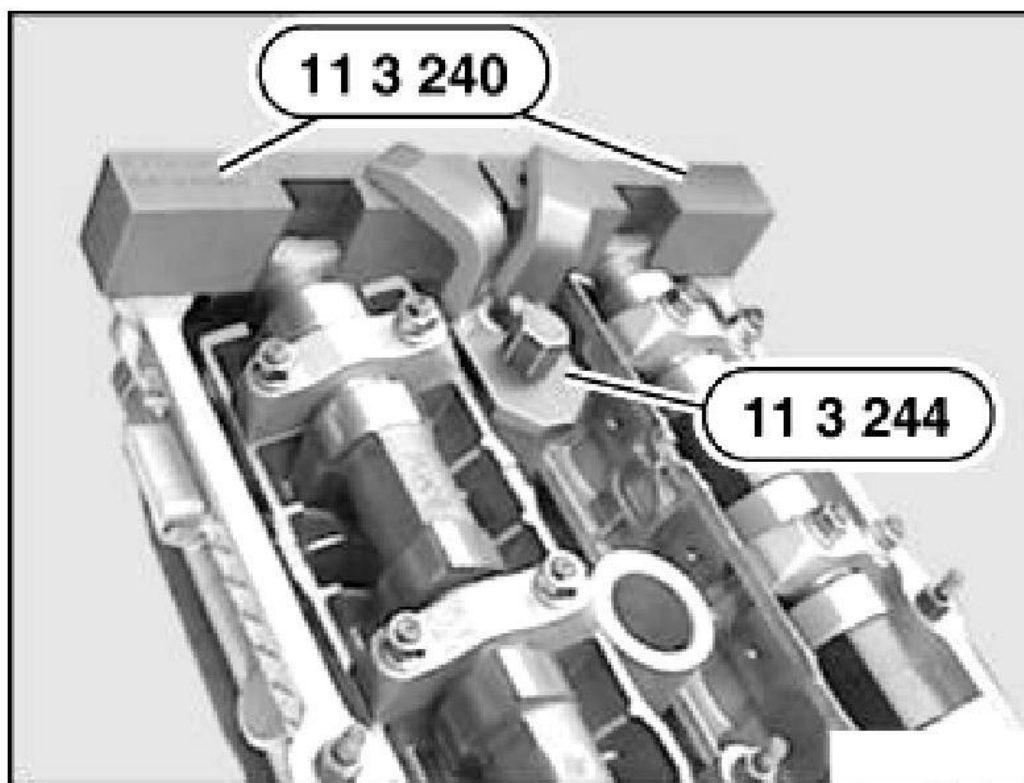
Fit special tool 11 3 240 to camshafts on cylinder 6. Align camshafts so that special tool 11 3 240 rests without gaps on cylinder head.



G03310396

Fig. 282: Fitting Special Tool To Camshafts
Courtesy of BMW OF NORTH AMERICA, INC.

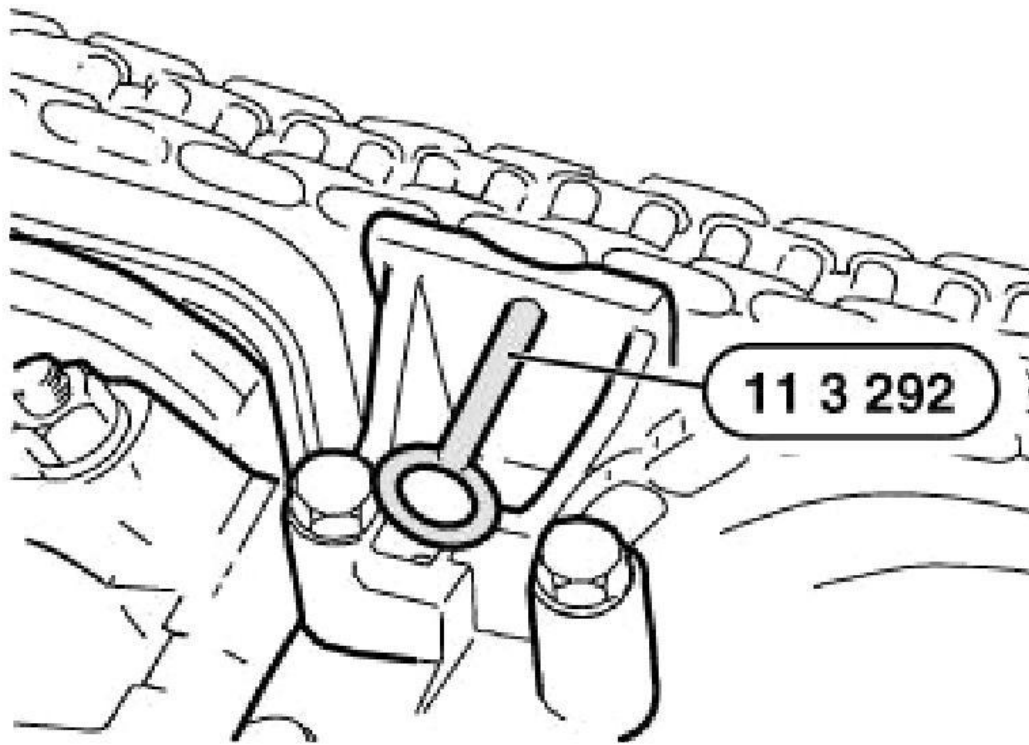
Attach special tool 11 3 244 to special tool 11 3 240 and locate by way of spark plug thread.



G03310397

Fig. 283: Attaching Special Tools
Courtesy of BMW OF NORTH AMERICA, INC.

Press down chain tensioner at top and remove special tool 11 3 292.

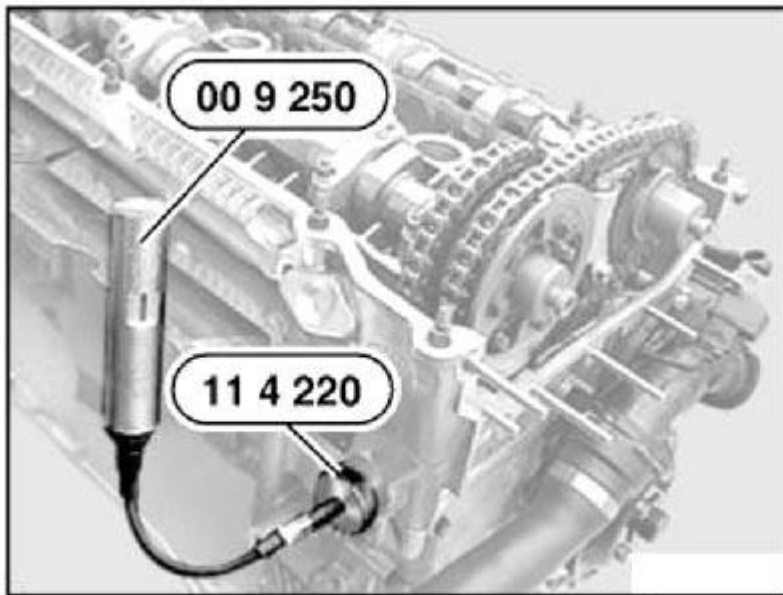


G03310398

Fig. 284: Removing Special Tool

Courtesy of BMW OF NORTH AMERICA, INC.

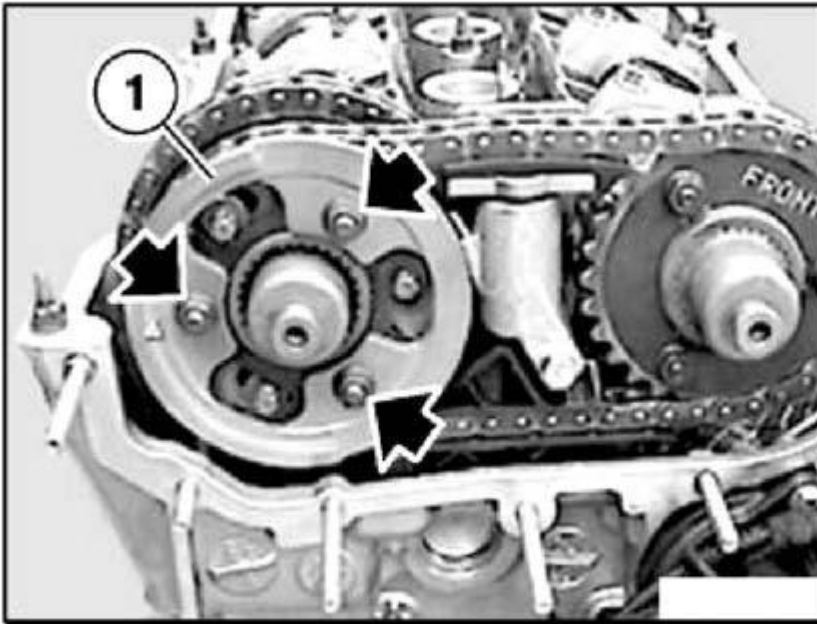
Preload tensioning rail with special tool 11 4 220 by rotating adjusting screw with special tool 00 9 250 or standard torque wrench to 0.7 N.m.



G03310399

Fig. 285: Rotating Adjusting Screw With Special Tool
Courtesy of BMW OF NORTH AMERICA, INC.

Preload cup spring slightly by pressing on sensor gear (1) and tighten nuts by hand.



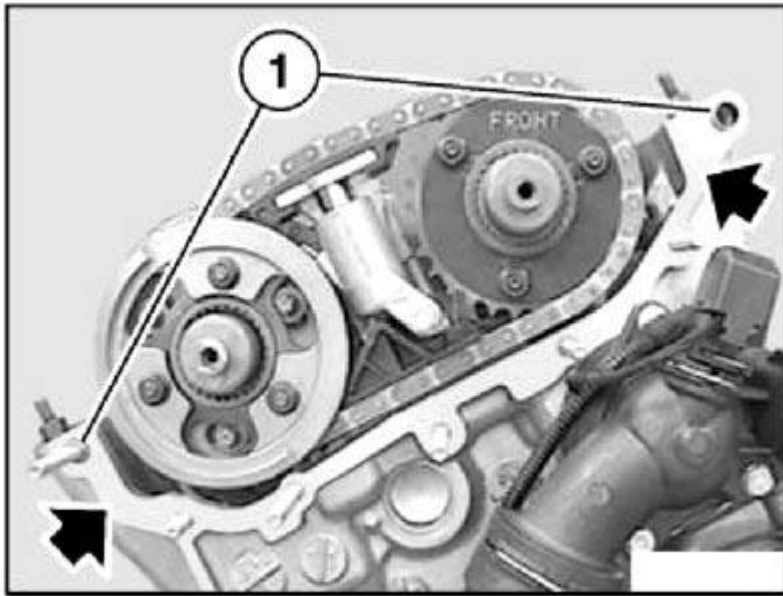
G03310400

Fig. 286: Preloading Spring

Courtesy of BMW OF NORTH AMERICA, INC.

IMPORTANT: Do not tighten down nuts fully.

Remove gasket.



G03310401

Fig. 287: Checking Dowel Sleeves

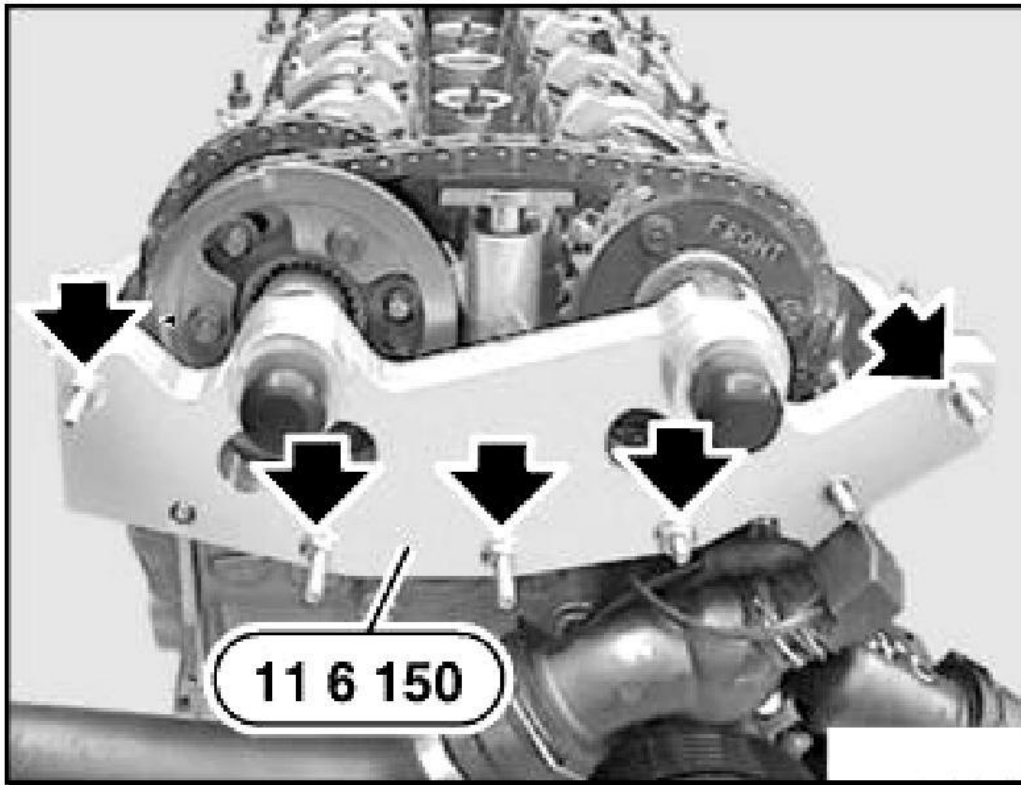
Courtesy of BMW OF NORTH AMERICA, INC.

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

Keep sealing face clean and free of oil.

IMPORTANT: Fit special tool 11 6 150 "without gasket" only. If gasket remains underneath special tool 11 6 150, camshaft timing will be "incorrectly" set.

Attach special tool 11 6 150 "without gasket", tighten nuts by hand and then tighten down uniformly until special tool 11 6 150 is in full contact with cylinder head.



G03310402

Fig. 288: Attaching Special Tool
Courtesy of BMW OF NORTH AMERICA, INC.

Insert screws (1) on exhaust side and initially tighten to approx. 5 N.m.

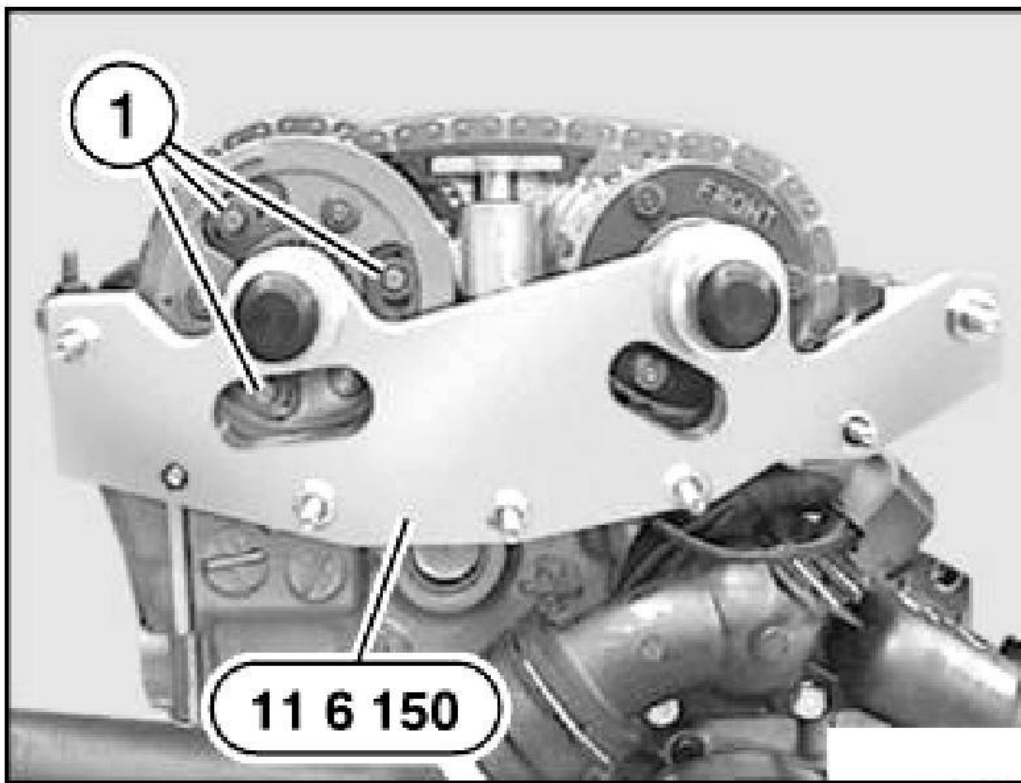
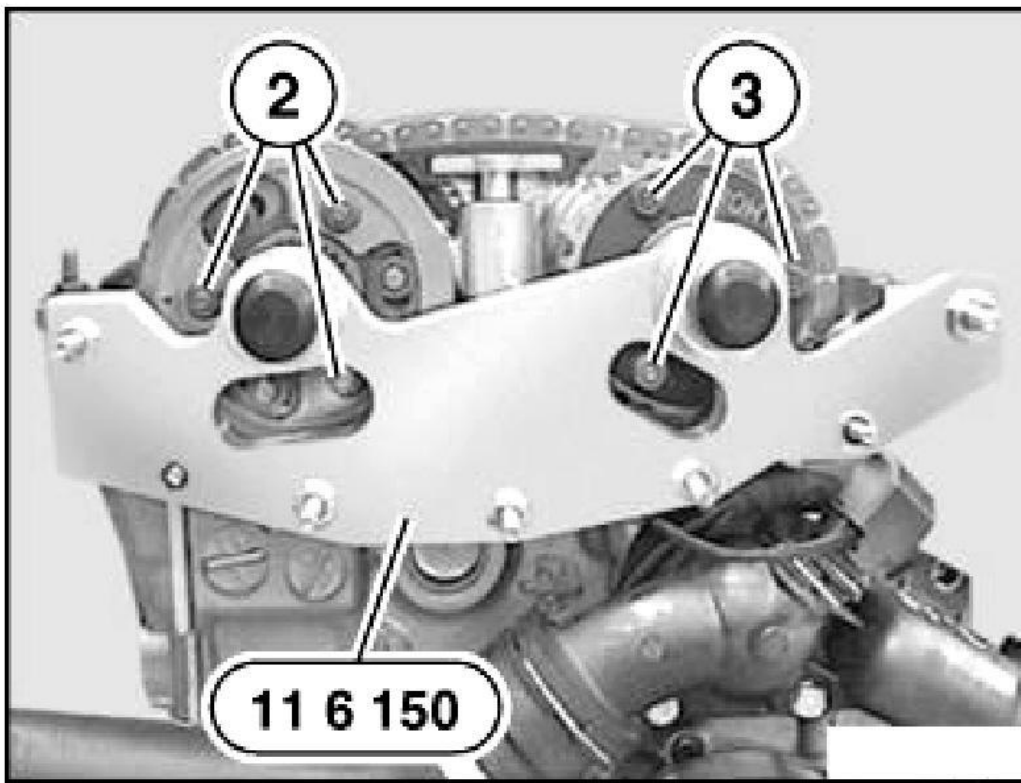
**G03310403**

Fig. 289: Inserting Screws On Exhaust Side
Courtesy of BMW OF NORTH AMERICA, INC.

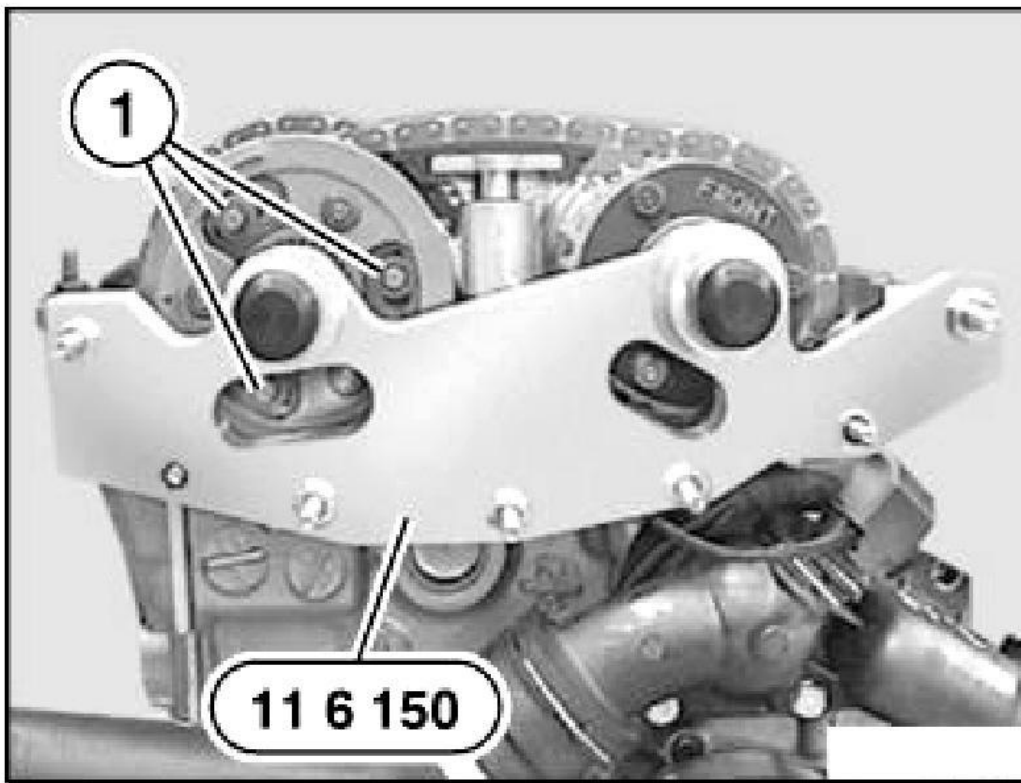
Initially tighten nuts (2) on exhaust side and nuts (3) on inlet side to approx. 5 N.m.



G03310404

Fig. 290: Tightening Nuts On Exhaust And Inlet Side
Courtesy of BMW OF NORTH AMERICA, INC.

Tighten down screws (1) on exhaust side.

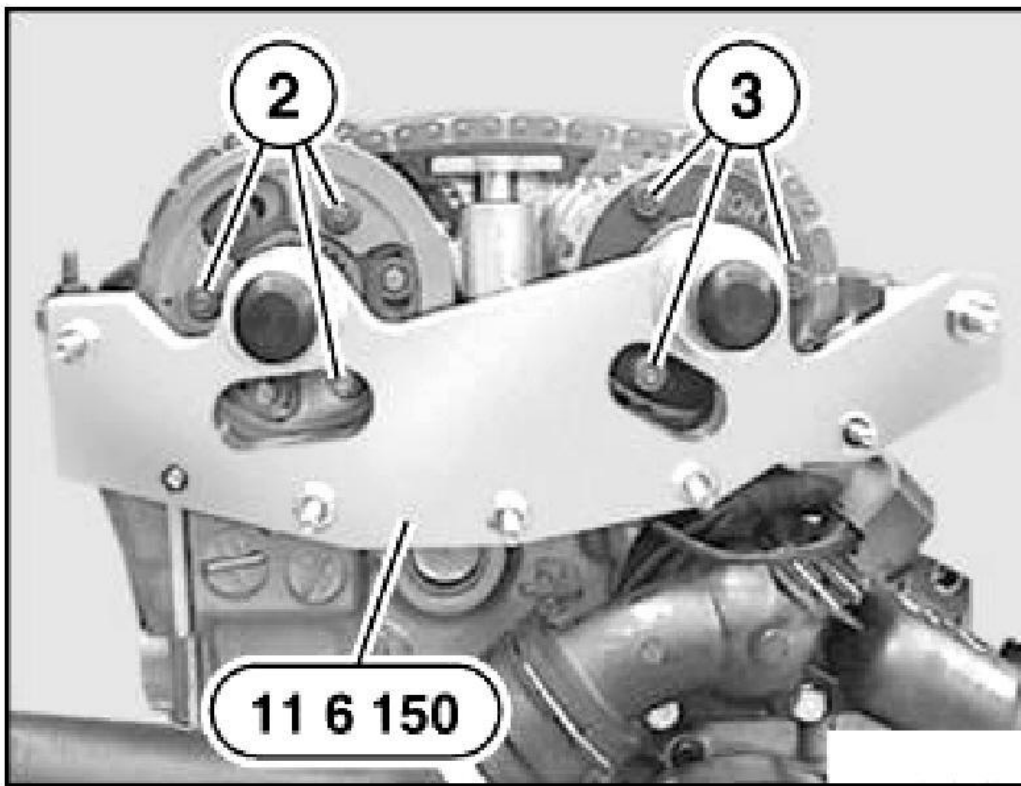


G03310405

Fig. 291: Tightening Down Screws On Exhaust Side
Courtesy of BMW OF NORTH AMERICA, INC.

Tightening torque 11 31 3AZ. Refer to **ENGINE - TIGHTENING TORQUES** .

Tighten down nuts (2) on exhaust side and nuts (3) on inlet side.



G03310406

Fig. 292: Tightening Down Nuts On Exhaust And Inlet Side
Courtesy of BMW OF NORTH AMERICA, INC.

Tightening torque 11 31 11AZ. Refer to **ENGINE - TIGHTENING TORQUES**.

Pull special tool 11 2 300/11 5 180 back until flywheel is no longer secured.

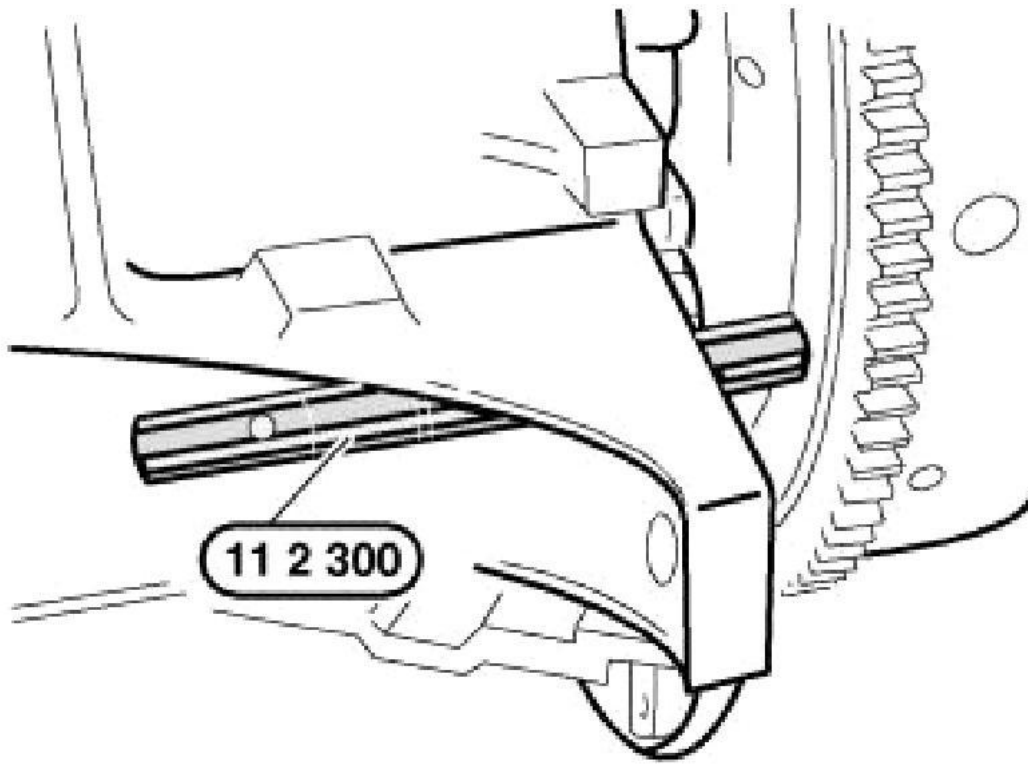
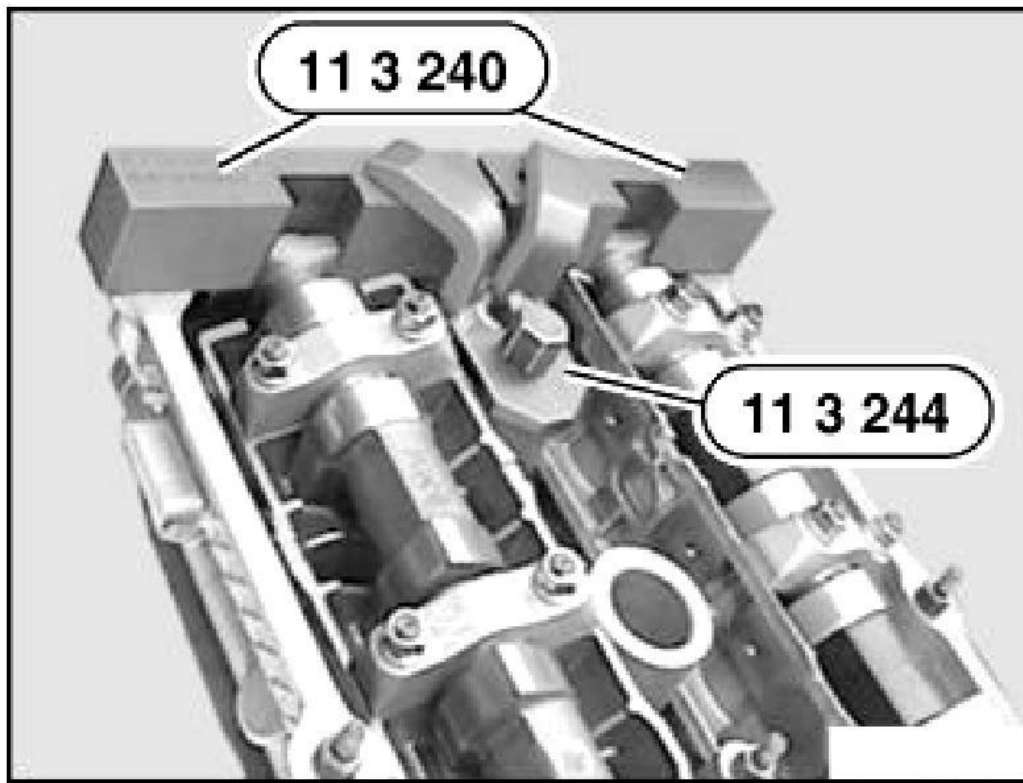
**G03310407**

Fig. 293: Pulling Special Tool Back
Courtesy of BMW OF NORTH AMERICA, INC.

Remove special tool 11 3 244 and special tool 11 3 240.

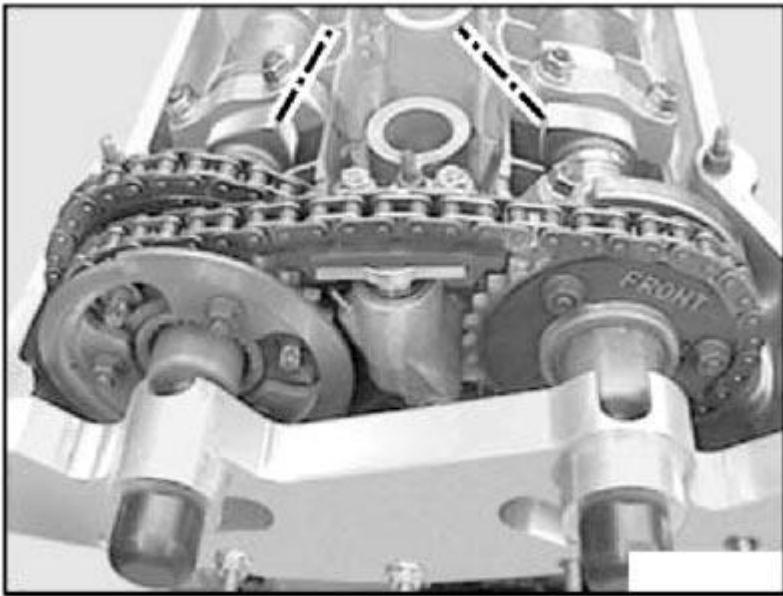


G03310408

Fig. 294: Removing Special Tools

Courtesy of BMW OF NORTH AMERICA, INC.

Crank engine twice in direction of rotation until cam tips on inlet and exhaust camshafts on 1st cylinder face one another.

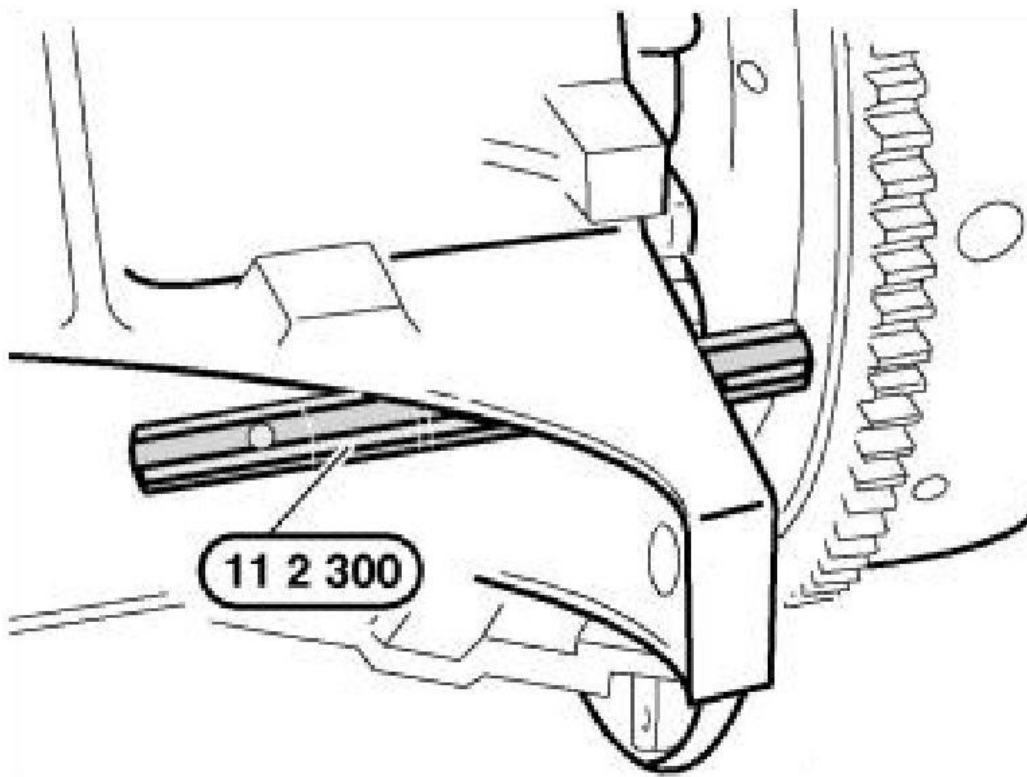


G03310409

Fig. 295: Identifying Camshafts Position

Courtesy of BMW OF NORTH AMERICA, INC.

Secure crankshaft in firing TDC position with special tool 11 2 300.



G03310410

Fig. 296: Securing Crankshaft

Courtesy of BMW OF NORTH AMERICA, INC.

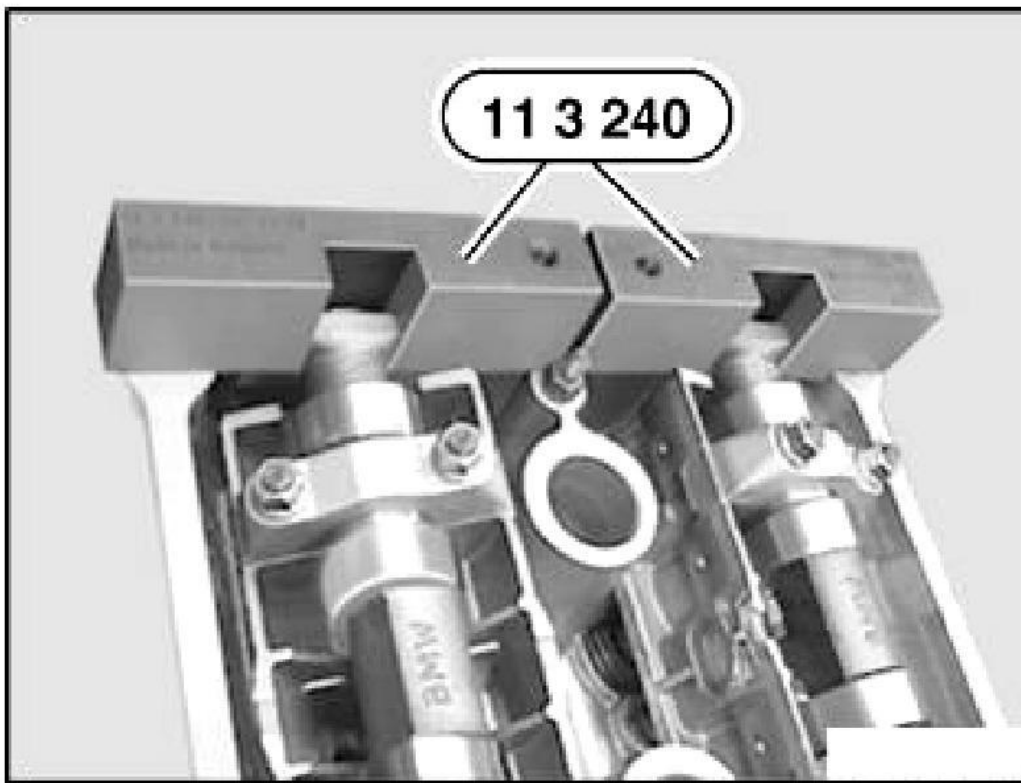
X3 only:

Secure crankshaft with special tool 11 5 180 in TDC position of 1st cylinder.

IMPORTANT: Do not turn the engine back.

Remove special tools 11 2 300 / 11 5 180 before starting engine.

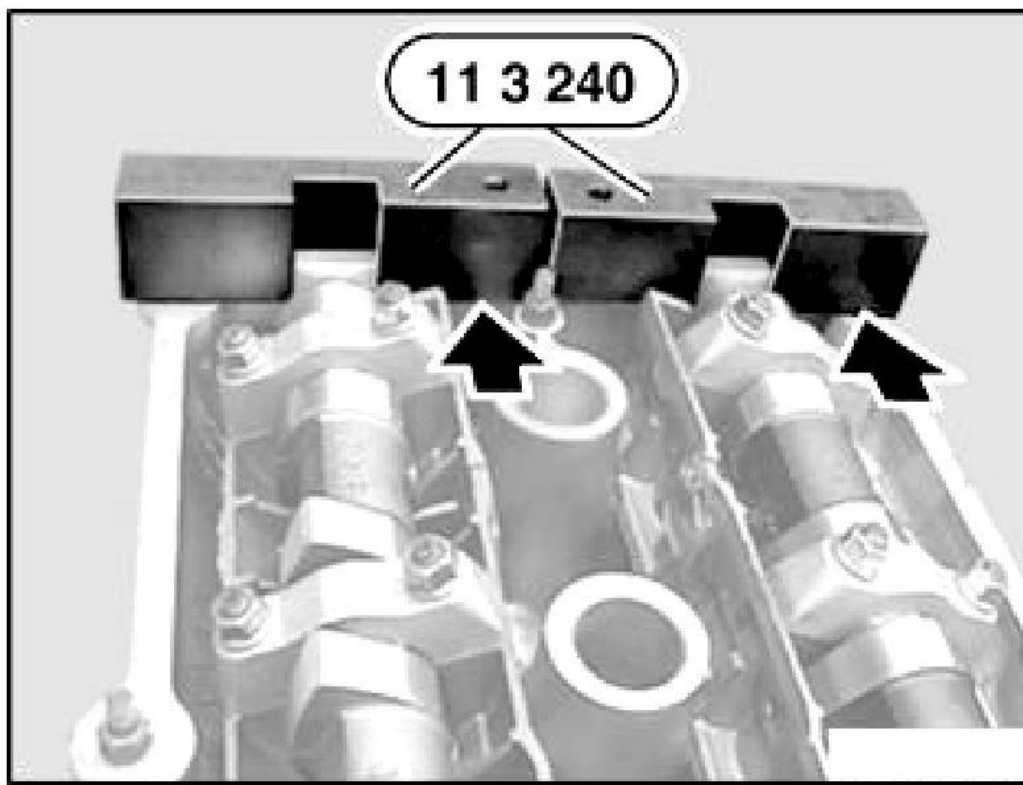
Fit special tool 11 3 240 to camshafts.



G03310411

Fig. 297: Fitting Special Tool To Camshafts
Courtesy of BMW OF NORTH AMERICA, INC.

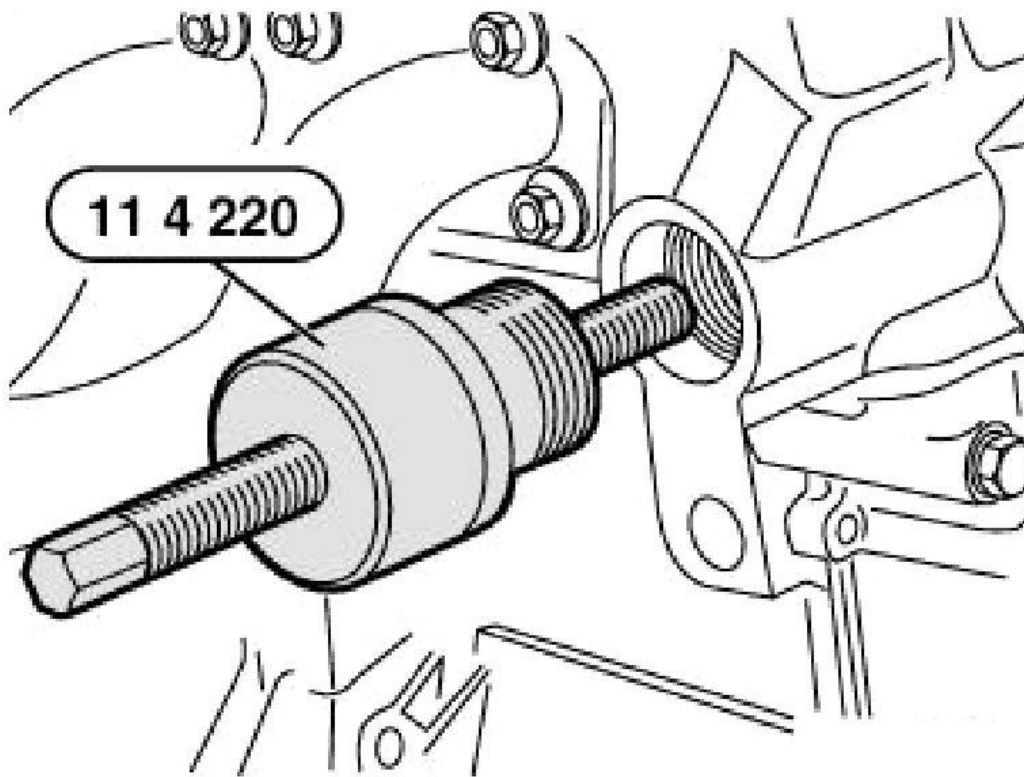
NOTE: The timing is correctly set if the special tool 11 3 240 rests without a gap on the cylinder head or protrudes up to 1 mm to the inlet side.
The timing must be reset if the special tool 11 3 240 protrudes to the exhaust side.



G03310412

Fig. 298: View Of Correct Timing
Courtesy of BMW OF NORTH AMERICA, INC.

Unfasten and remove special tool 11 4 220.

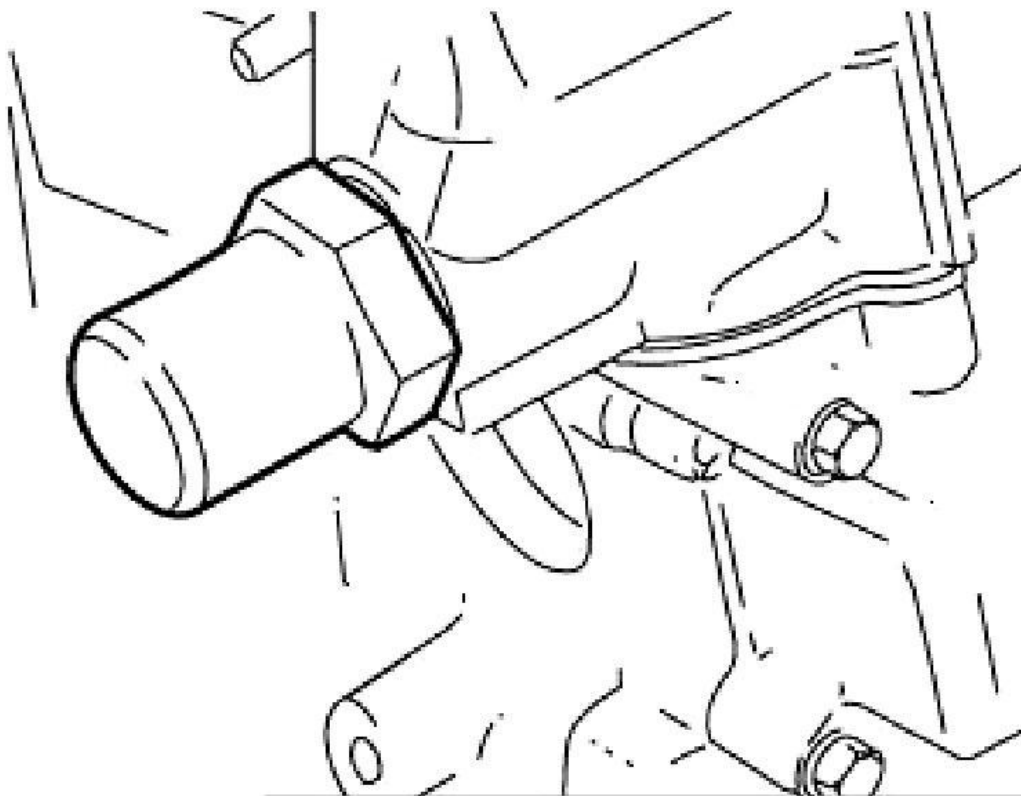


G03310413

Fig. 299: Removing Special Tool

Courtesy of BMW OF NORTH AMERICA, INC.

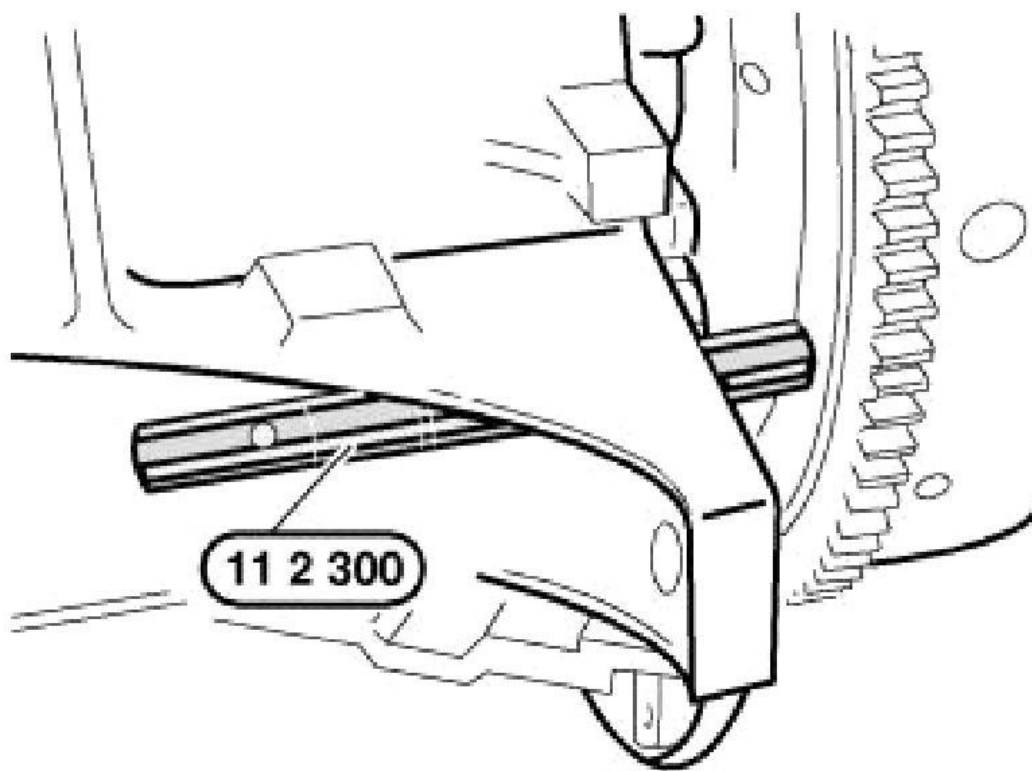
Install cylinder for chain tensioning piston. Refer to **11 31 090 Removing and installing/replacing chain tensioning piston (M52 / M52TU / M54 / M56).**



G03310414

Fig. 300: Installing Cylinder For Chain Tensioning Piston
Courtesy of BMW OF NORTH AMERICA, INC.

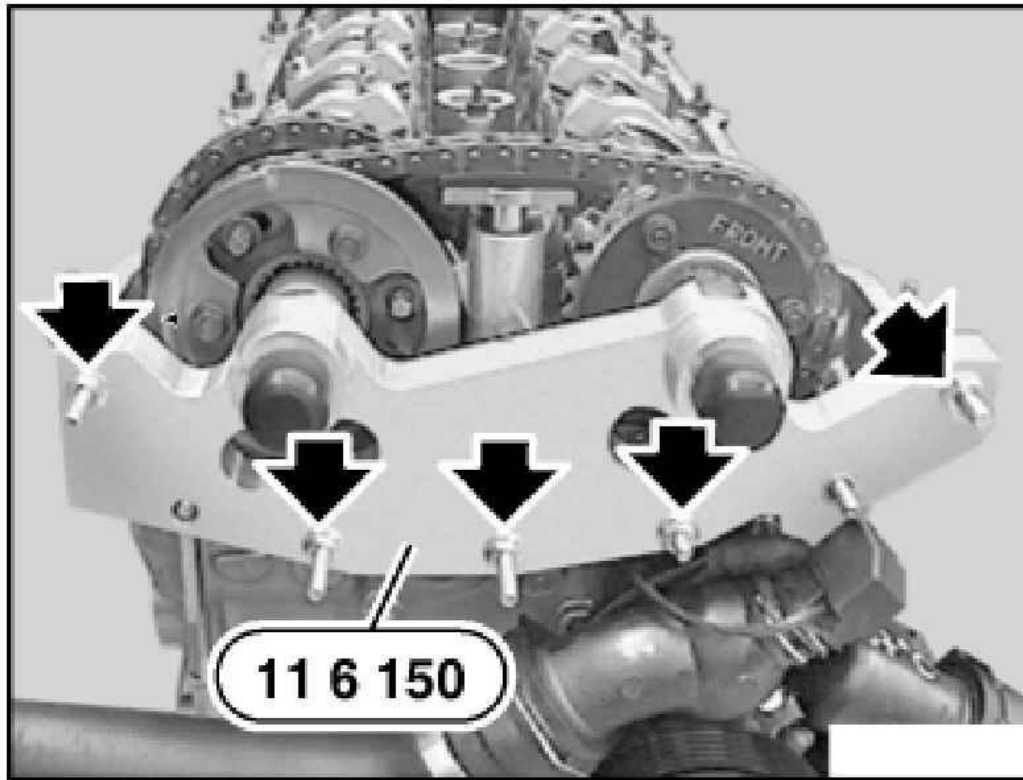
Remove special tool 11 2 300 / 11 5 180.



G03310415

Fig. 301: Removing Special Tool
Courtesy of BMW OF NORTH AMERICA, INC.

Remove special tool 11 6 150.



G03260662

Fig. 302: Removing Special Tool

Courtesy of BMW OF NORTH AMERICA, INC.

Install VANOS adjustment unit. Refer to **11 36 010 REMOVING AND INSTALLING OR REPLACING DOUBLE VANOS ADJUSTMENT UNIT (M52TU / M54 / M56)**.

Assemble engine.

VALVES WITH SPRINGS

11 34 552 REMOVING AND INSTALLING OR REPLACING ALL VALVES (M52 / S52 / M52TU / M54 / M56)

(cylinder head removed)

Preliminary tasks are described in Disassembling and assembling cylinder head. Refer to **11 12 503 DISASSEMBLING AND ASSEMBLING CYLINDER HEAD (M52 / S52 / M52TU / M54 / M56)**.

Replace valve stem seals. Refer to **11 34 560 REPLACING ALL VALVE STEM SEALS (M52 / S52 / M52TU / M54 / M56)**.

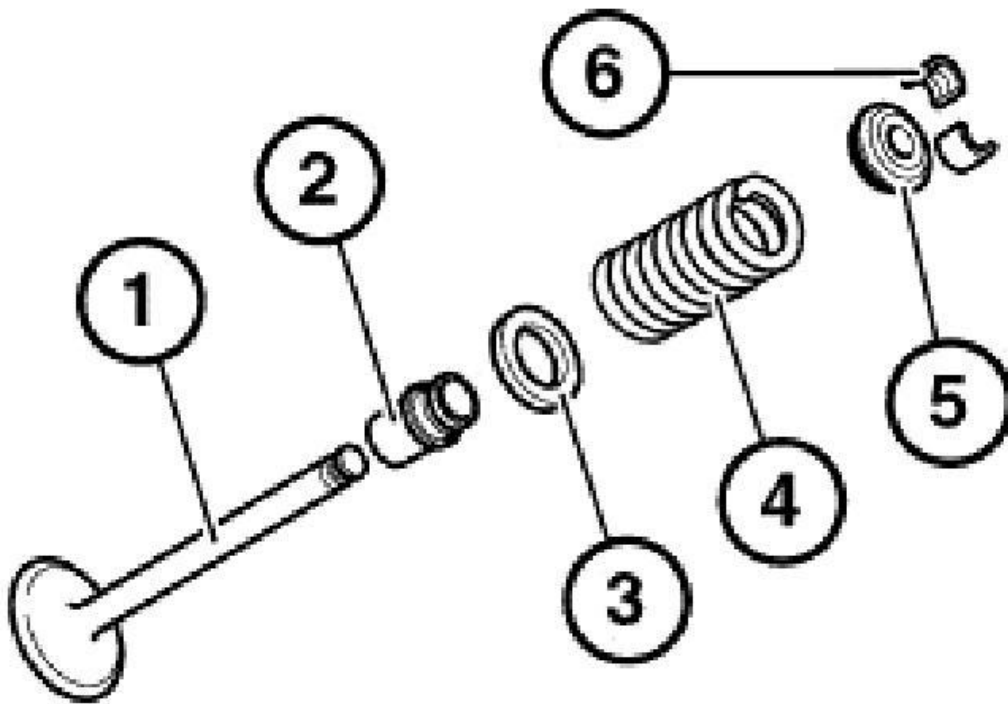
Remove valves from cylinder head.

If necessary, check valve guide for wear. Refer to **11 12 595 CHECKING A VALVE GUIDE FOR WEAR (M52 / S52 / M52TU / M54 / M56)**.

If necessary, ream valve guide. Refer to **11 12 600 REAMING A VALVE GUIDE (M52 / S52 / M52TU / M54 / M56)**.

If necessary, remachine valve seat. Refer to **11 12 527 REMACHINING A VALVE SEAT (M52 / S52 / M52TU / M54 / M56)**.

Arrangement:



- 1) Valve
- 2) Valve-stem seal
- 3) Lower plate spring
- 4) Valve spring
- 5) Top plate spring
- 6) Valve tapers

G03310416

Fig. 303: Exploded View Of Valve Components

Courtesy of BMW OF NORTH AMERICA, INC.

11 34 560 REPLACING ALL VALVE STEM SEALS (M52 / S52 / M52TU / M54 / M56)

Special tools required:

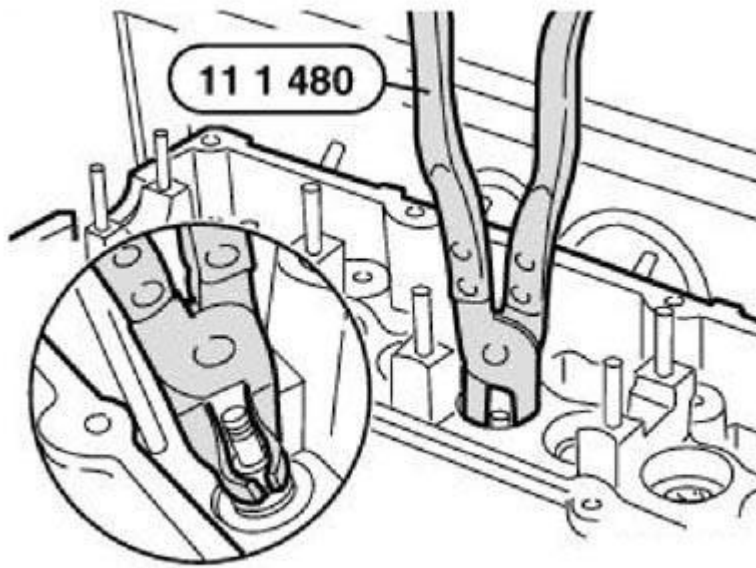
- 11 1 200
- 11 1 480
- 11 1 960

(cylinder head removed)

Preliminary tasks are described in Disassembling and assembling cylinder head. Refer to **11 12 503 DISASSEMBLING AND ASSEMBLING CYLINDER HEAD (M52 / S52 / M52TU / M54 / M56)**.

Remove all valve springs. Refer to **11 34 715 REPLACING ALL VALVE SPRINGS (M52 / S52 / M52TU / M54 / M56)**.

Remove valve stem seal with special tool 11 1 480.

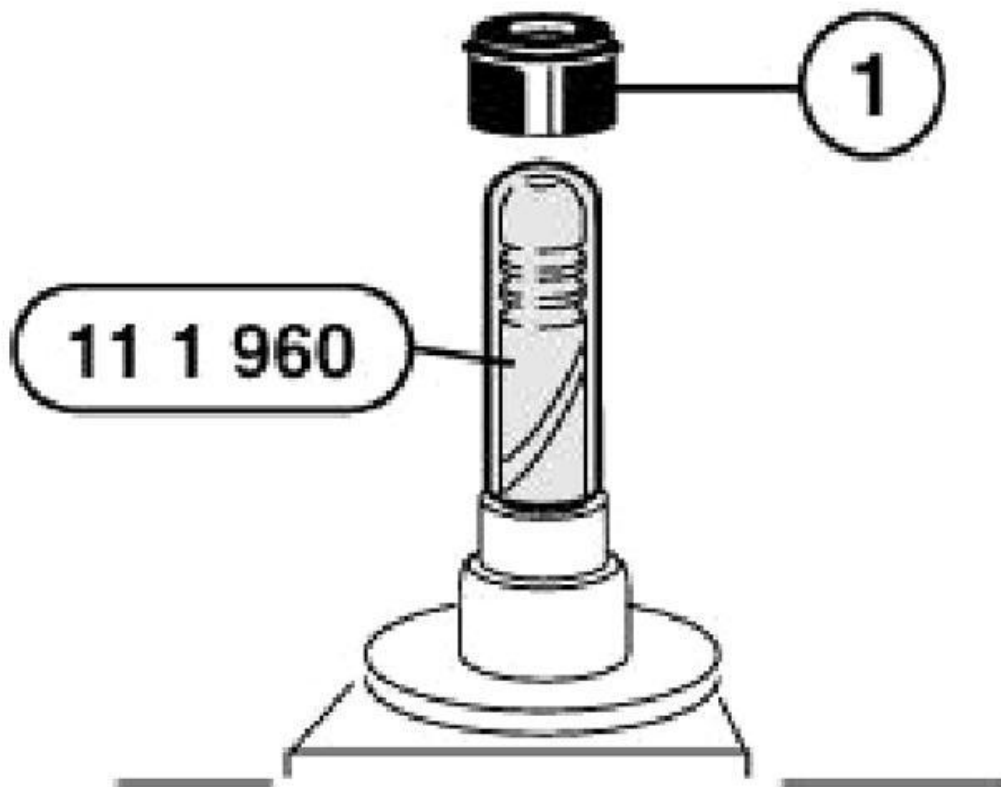


G03310417

Fig. 304: Removing Valve Stem Seal

Courtesy of BMW OF NORTH AMERICA, INC.

Lubricate valve stem with oil and insert valve. Fit special tool 11 1 960.



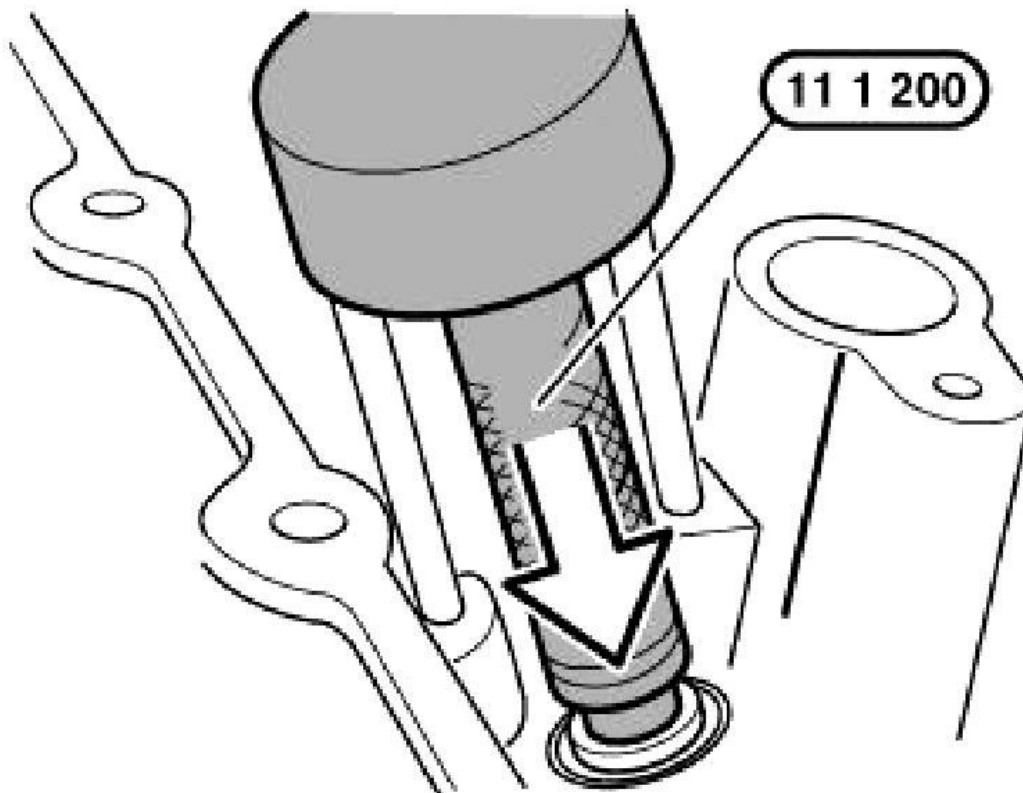
G03310418

Fig. 305: Installing Valve Stem Seal

Courtesy of BMW OF NORTH AMERICA, INC.

Coat new valve stem seal (1) with oil and install.

Press valve stem seal firmly home by hand with special tool 11 1 200.



G03310419

Fig. 306: Pressing Valve Stem Seal With Special Tool
Courtesy of BMW OF NORTH AMERICA, INC.

11 34 715 REPLACING ALL VALVE SPRINGS (M52 / S52 / M52TU / M54 / M56)

Special tools required:

- 11 0 342
- 11 0 345
- 11 1 045
- 11 1 065
- 11 1 441
- 11 3 030
- 11 3 250

(cylinder head removed)

Preliminary tasks are described in Disassembling and assembling cylinder head. Refer to **11 12 503**
DISASSEMBLING AND ASSEMBLING CYLINDER HEAD (M52 / S52 / M52TU / M54 / M56).

Brace bucket tappets with special tool 11 3 250.

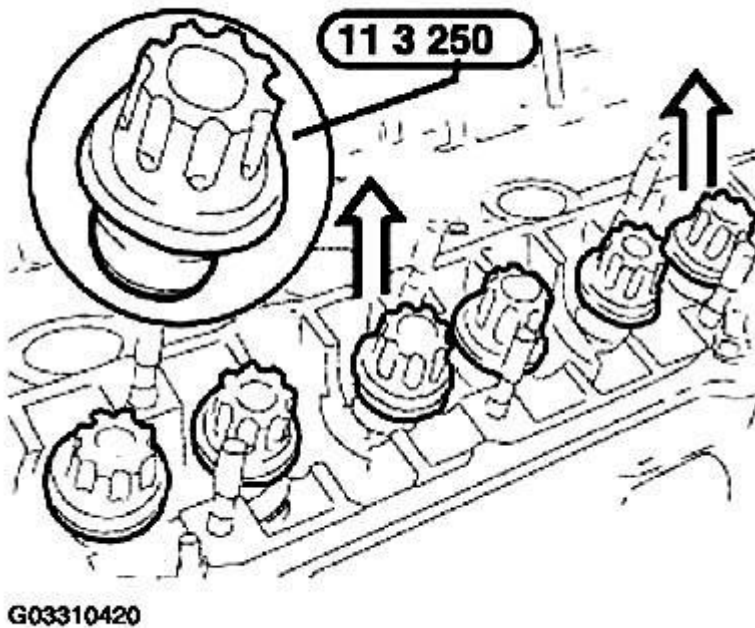


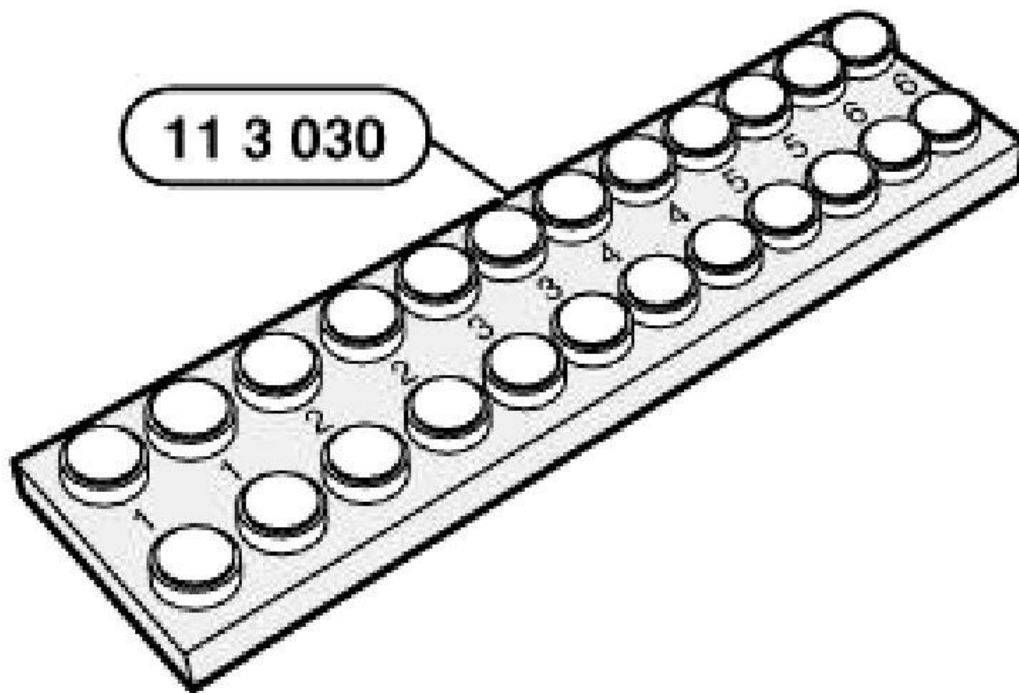
Fig. 307: Lifting Out Bearing Strip With Bucket Tappet
Courtesy of BMW OF NORTH AMERICA, INC.

Lift out bearing strip with bucket tappet.

Installation:

Only re-use used bucket tappets in the same tappet bore.

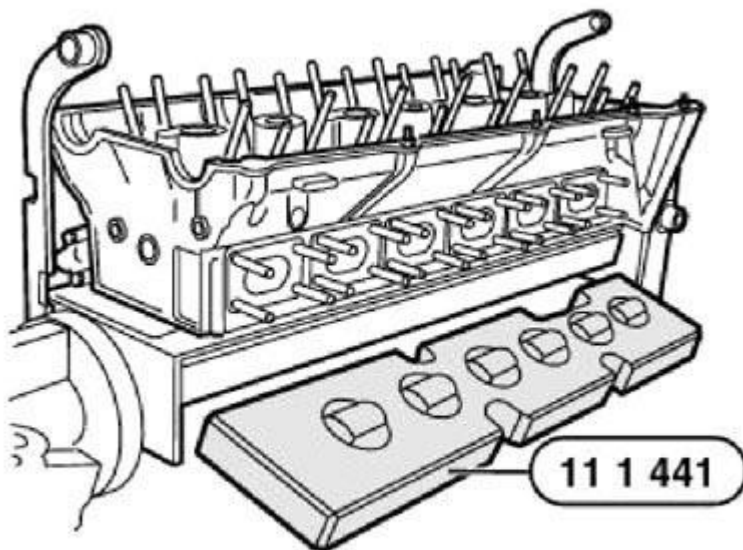
Arrange bucket tappets by cylinder and place on special tool 11 3 030 in correct order.



G03310421

Fig. 308: Arranging Bucket Tappets
Courtesy of BMW OF NORTH AMERICA, INC.

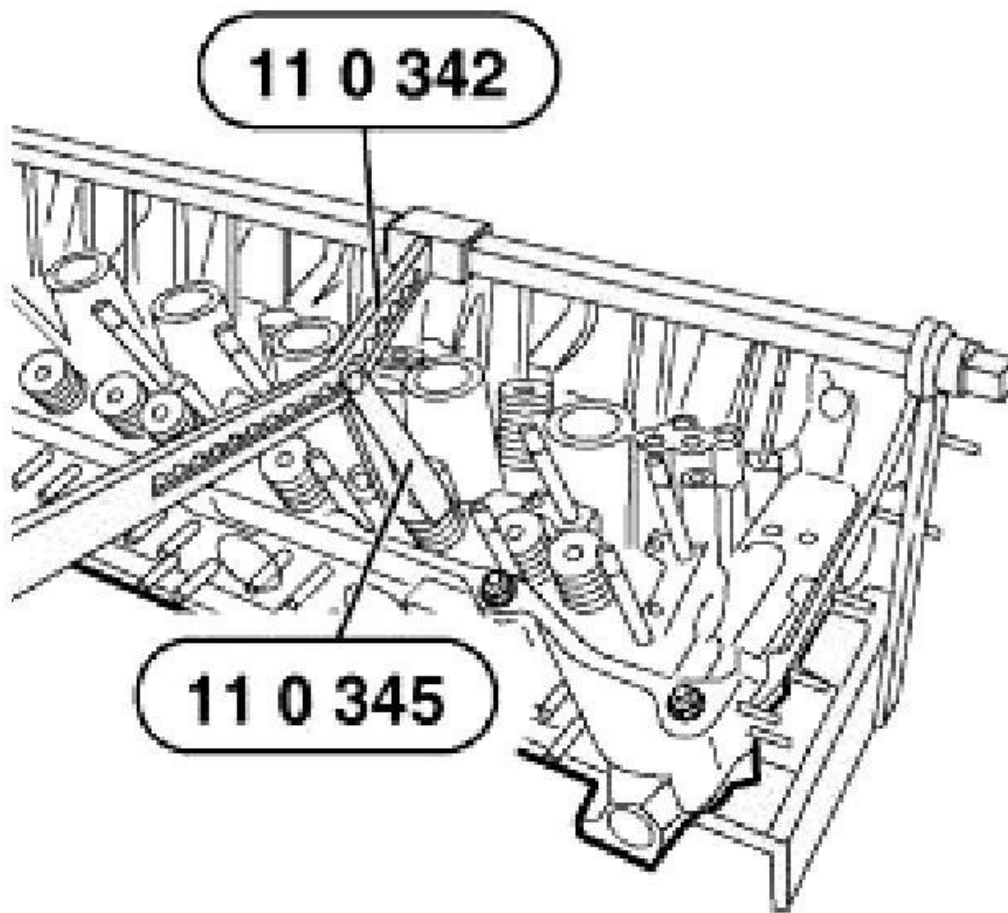
Insert special tool 11 1 441 from below in special tool 11 1 065 and secure with special tool 11 1 045.



G03310422

Fig. 309: Inserting Special Tool**Courtesy of BMW OF NORTH AMERICA, INC.**

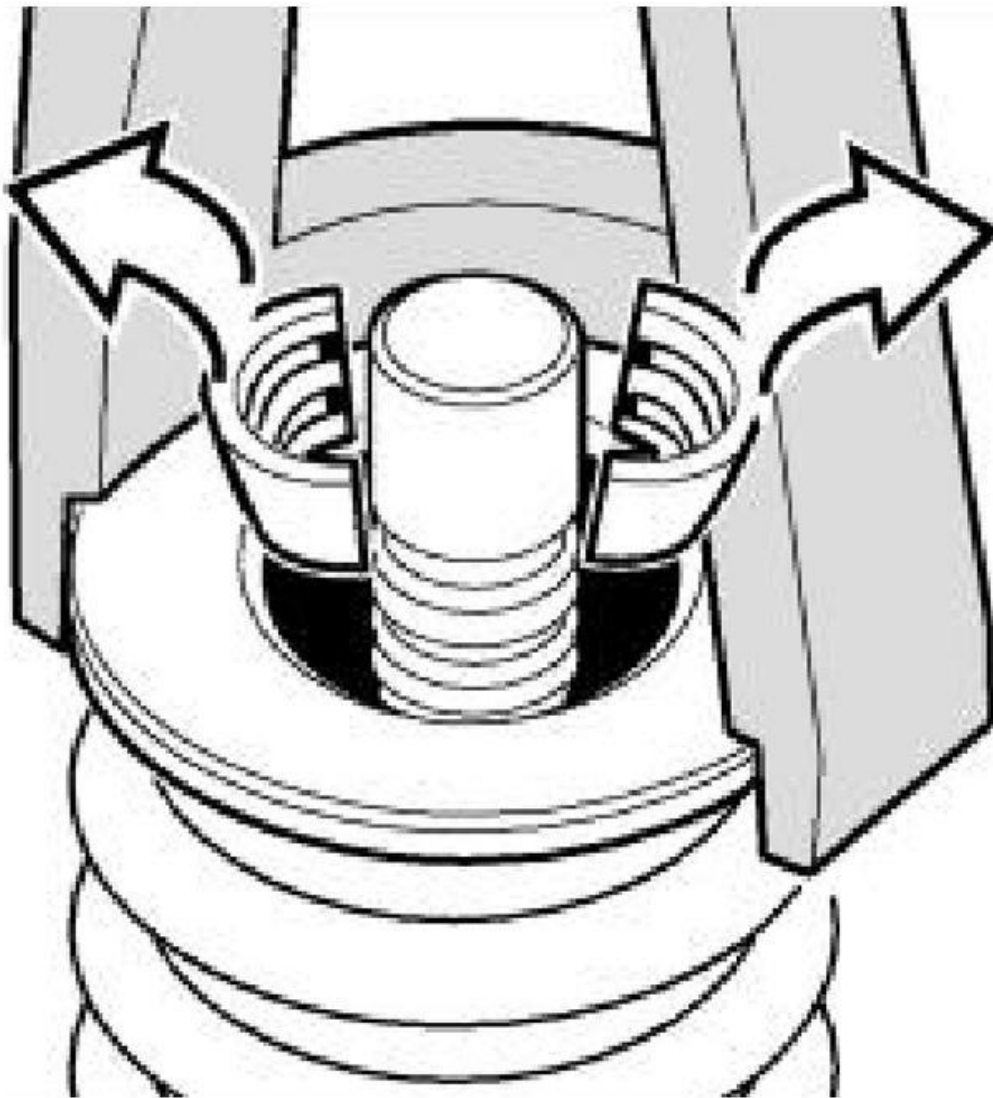
Align special tool 11 0 345 in direction of valve shaft and select appropriate groove in special tool 11 0 342.



G03310423

Fig. 310: Aligning Special Tool In Direction Of Valve Shaft
Courtesy of BMW OF NORTH AMERICA, INC.

Press down valve spring on spring cap, top, and remove valve keys.

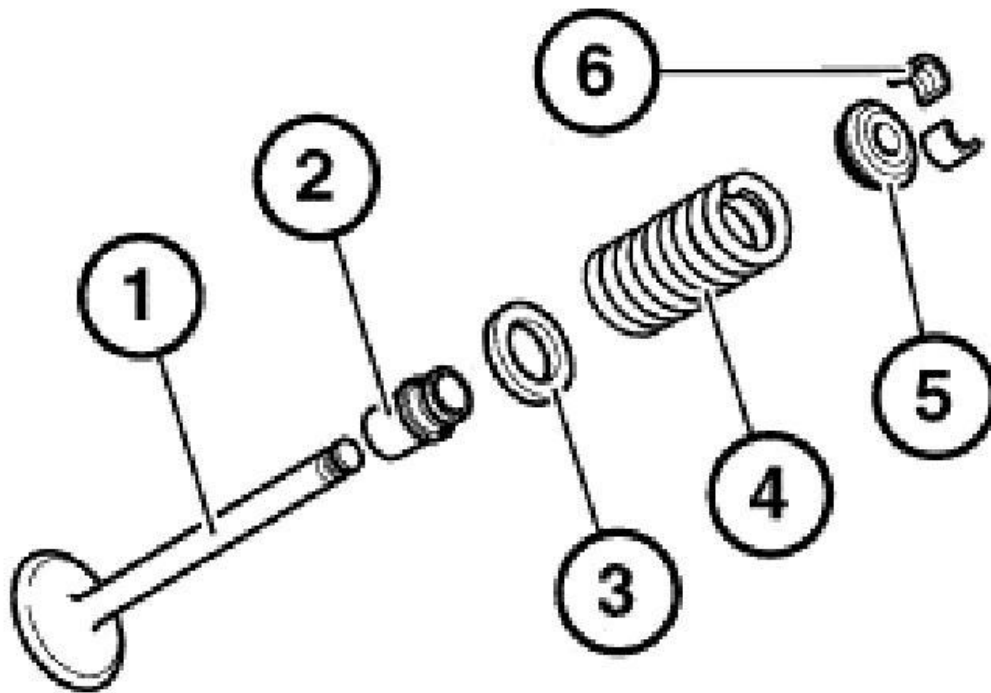


G03310424

Fig. 311: Removing Valve Spring And Plate Spring
Courtesy of BMW OF NORTH AMERICA, INC.

Remove valve spring and plate spring.

Arrangement:



- 1) Valve
- 2) Valve-stem seal
- 3) Lower plate spring
- 4) Valve spring
- 5) Top plate spring
- 6) Valve tapers

G03310425

Fig. 312: Exploded View Of Valve Components

Courtesy of BMW OF NORTH AMERICA, INC.

VARIABLE CAMSHAFT TIMING

11 36 010 REMOVING AND INSTALLING OR REPLACING DOUBLE VANOS ADJUSTMENT UNIT (M52TU / M54 / M56)

Special tools required:

- 00 9 250
- 11 2 300
- 11 3 240
- 11 3 450
- 11 4 220
- 11 6 170

Necessary preliminary tasks:

- Remove intake filter housing with air -mass flow sensor
- Remove fan impeller with fan clutch and fan cowl
- **E60:** Remove fan cowl with electric fan
- Remove cylinder head cover, refer to **11 12 000 REMOVING AND INSTALLING, SEALING CYLINDER HEAD COVER (M52TU / M54 / M56)**
- Remove spark plugs, refer to **12 12 011 REPLACING ALL SPARK PLUGS**

E85 only:

- Remove radiator cover
- Drain coolant from radiator, refer to **17 00 005 DRAINING OFF AND TOPPING UP COOLANT (M54)**

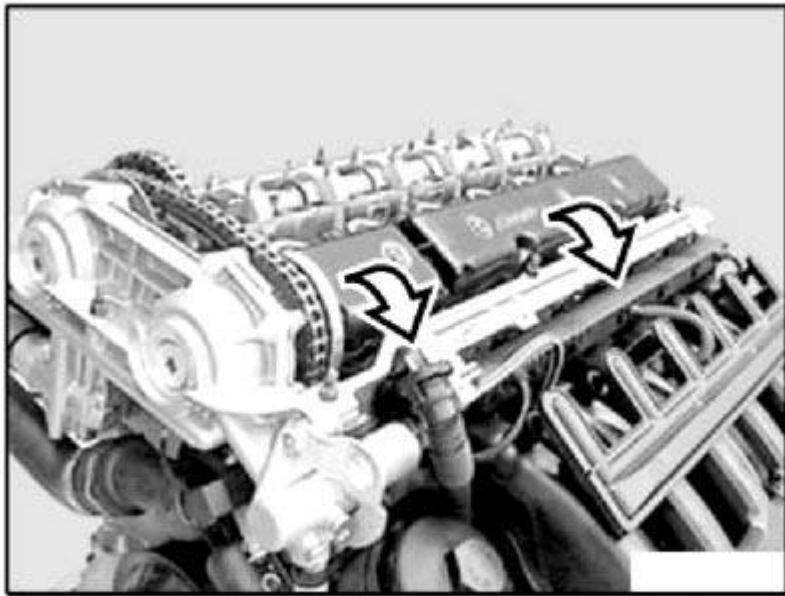
NOTE: Protect drive belt against emerging coolant.

- Remove right coolant hose
- Remove solenoid valve for exhaust side, refer to **11 36 575 REPLACING SOLENOID VALVE FOR EXHAUST SIDE ON VANOS ADJUSTMENT UNIT**

Removal:

Removal of double VANOS adjustment unit is described separately from installation. Assembly sequence for removal and installation is different.

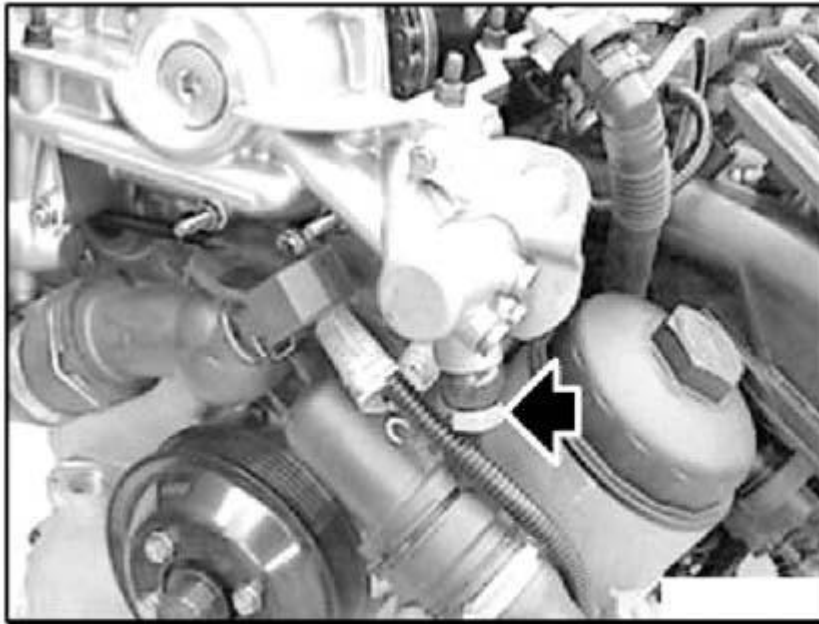
Detach plastic cover for inlet camshaft.



G03310426

Fig. 313: Detaching Plastic Cover For Inlet Camshaft
Courtesy of BMW OF NORTH AMERICA, INC.

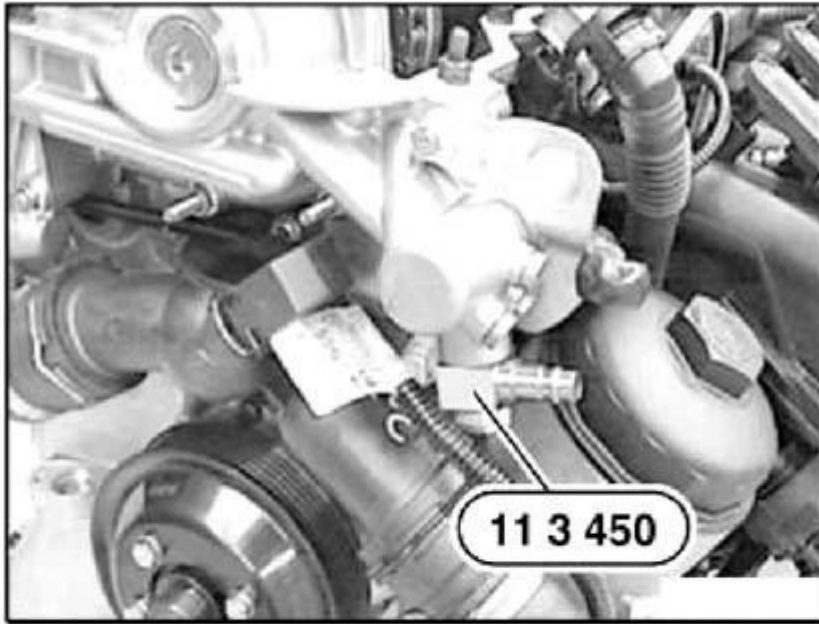
Unscrew oil pressure pipe.



G03310427

Fig. 314: Unscrewing Oil Pressure Pipe
Courtesy of BMW OF NORTH AMERICA, INC.

Mount special tool 11 3 450 with banjo bolt of oil pressure line.

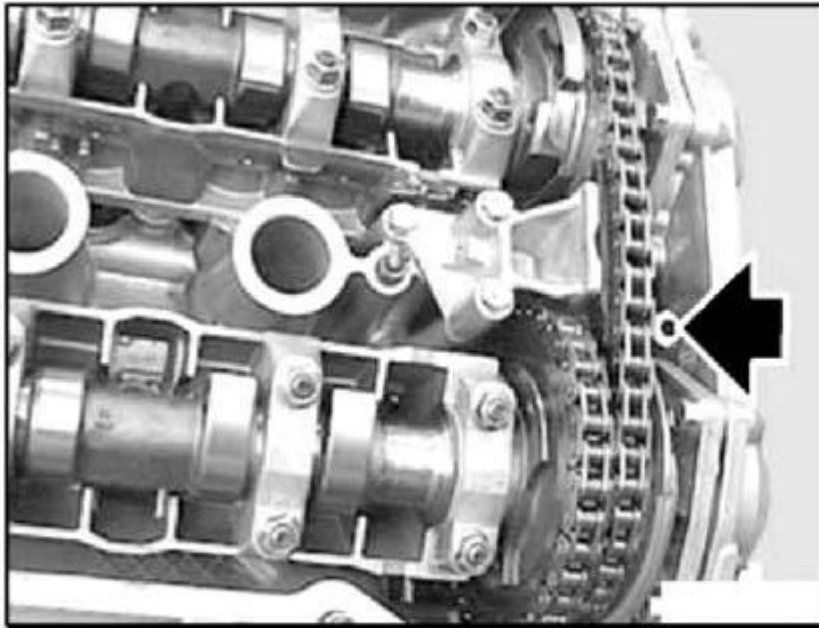


G03310428

Fig. 315: Mounting Special Tool 11 With Banjo Bolt Of Oil Pressure Line
Courtesy of BMW OF NORTH AMERICA, INC.

IMPORTANT: Cover double VANOS adjustment unit.

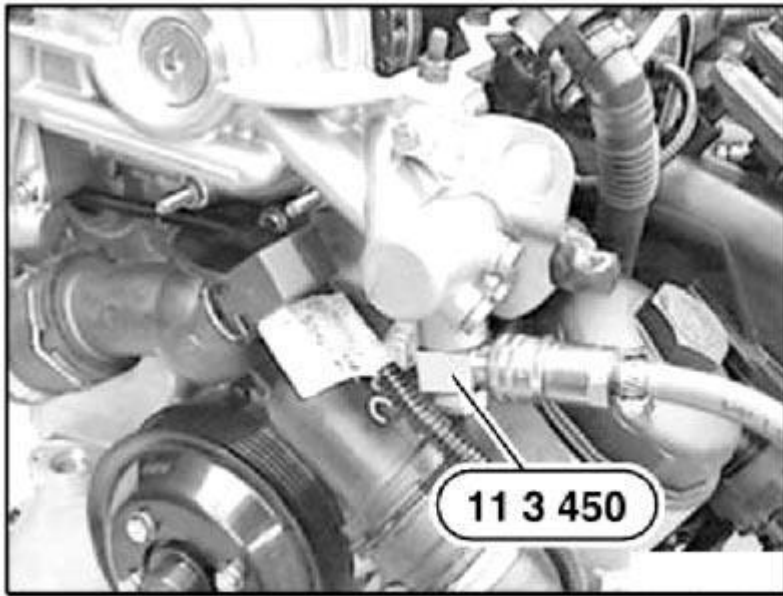
When the compressed air supply is connected, several drops of oil are sprayed out of the bore.



G03310429

Fig. 316: Covering Double VANOS Adjustment Unit
Courtesy of BMW OF NORTH AMERICA, INC.

Connect compressed air (2 to 8 bar).



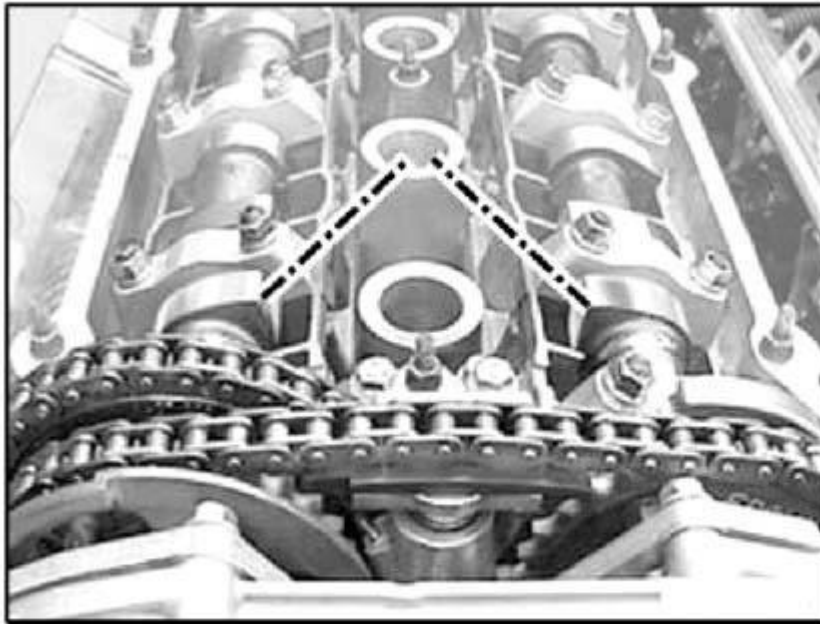
G03310430

Fig. 317: Connecting Compressed Air

Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: When the engine is switched off, it is possible that the camshafts are not in their initial positions. With the compressed air supply connected, rotate the engine to return the camshafts to their initial positions.

With compressed air supply connected, crank engine at least two revolutions in direction of rotation until cam tips on inlet and exhaust camshafts on 1st cylinder face each other.



G03310431

Fig. 318: Identifying Camshafts Positions
Courtesy of BMW OF NORTH AMERICA, INC.

Pull dust guard out of the special tool bore.

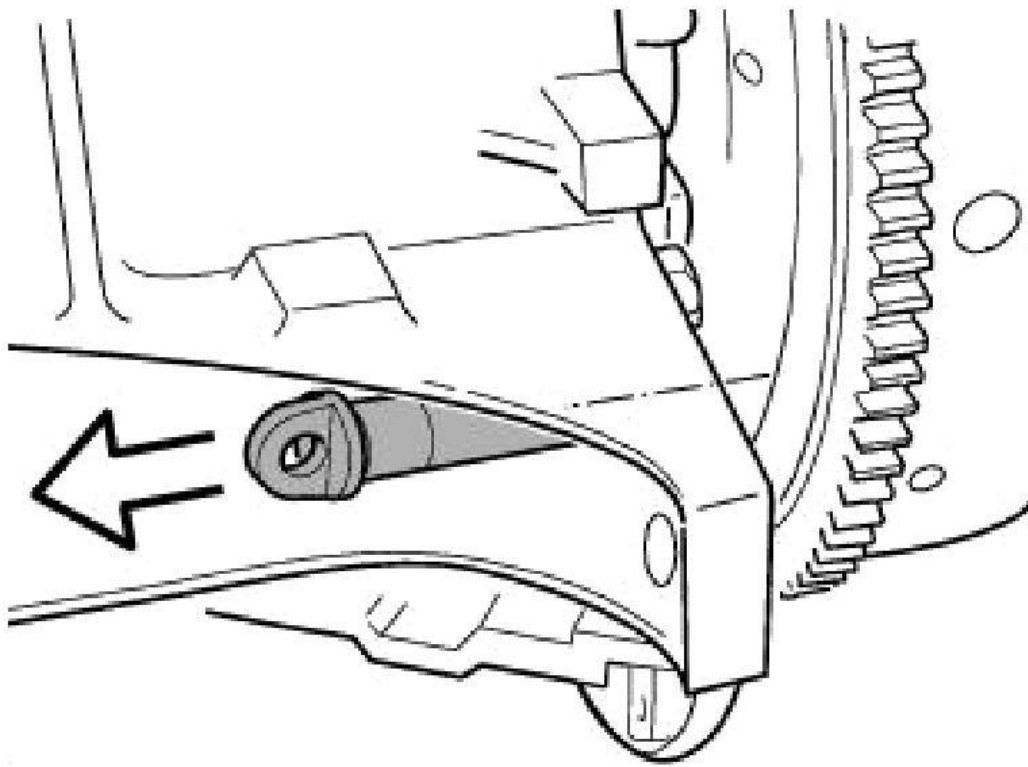
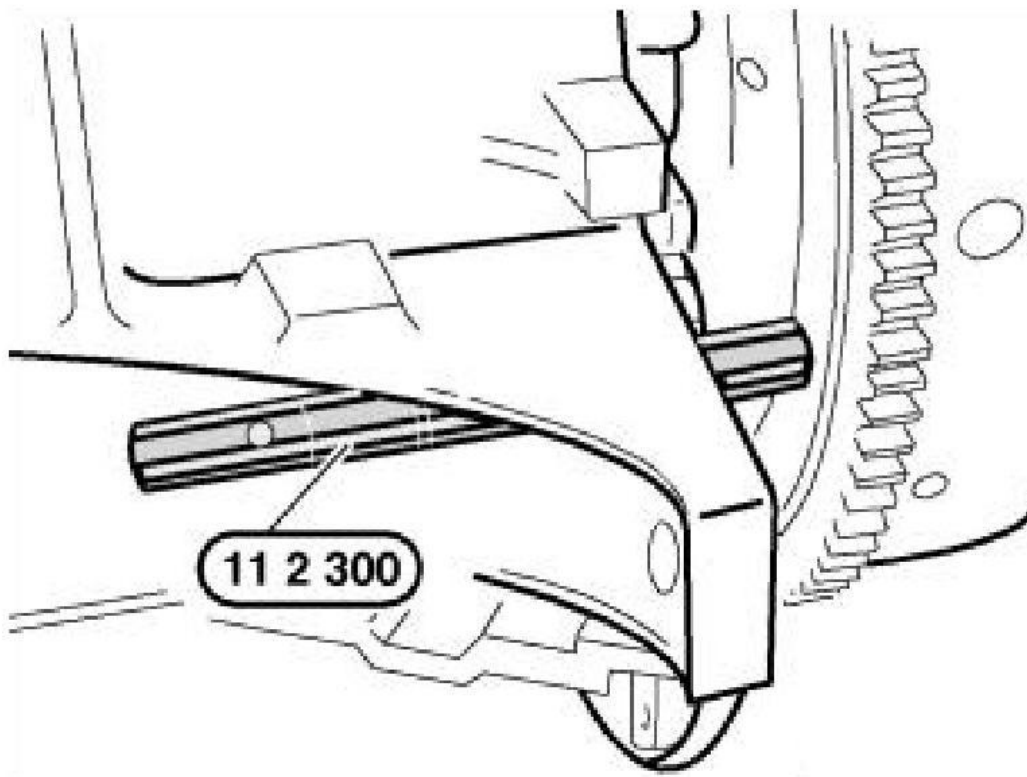
**G03310432**

Fig. 319: Pulling Dust Guard Out Of Special Tool Bore
Courtesy of BMW OF NORTH AMERICA, INC.

Secure crankshaft in firing TDC position with special tool 11 2 300.



G03310433

Fig. 320: Securing Crankshaft

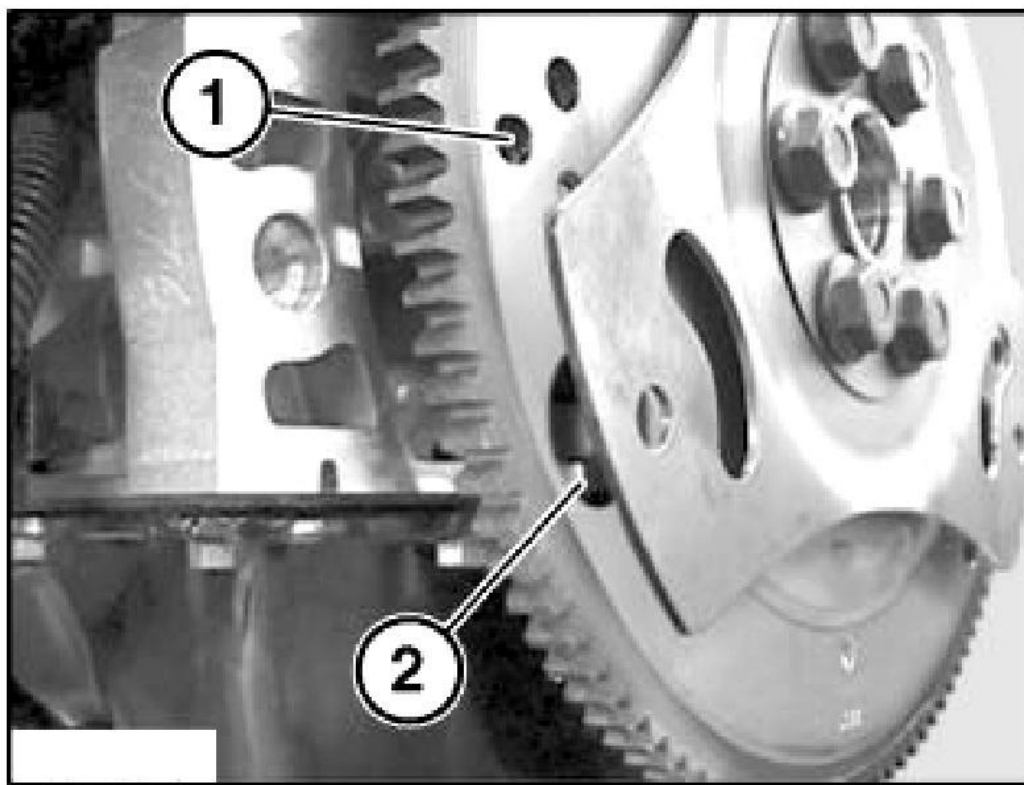
Courtesy of BMW OF NORTH AMERICA, INC.

IMPORTANT: Remove special tool 11 2 300 before switching on the engine.**Automatic transmissions only:**

Illustration does not show automatic transmission.

IMPORTANT: On engines with automatic transmissions, there is shortly before the special tool bore (1) a large bore (2) which can be confused with the special tool bore.

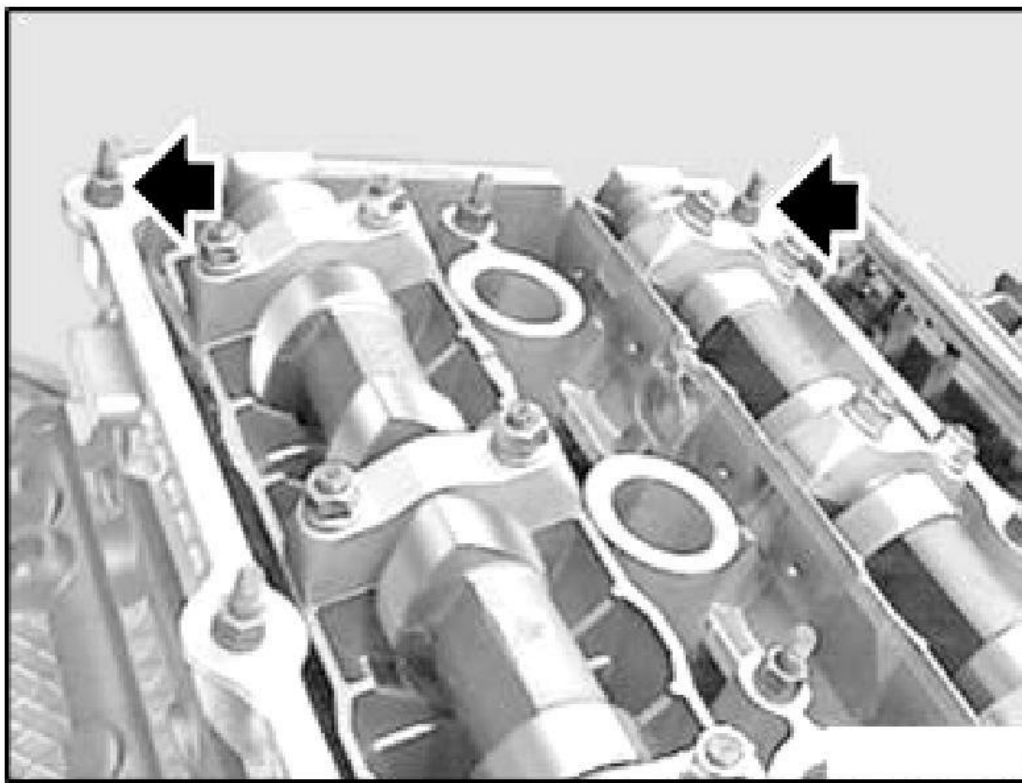
If special tool 11 2 300 is secured in the correct bore (1), the engine can no longer be cranked at the central bolt.



G03310434

Fig. 321: Identifying Correct Bore
Courtesy of BMW OF NORTH AMERICA, INC.

Unscrew studs.

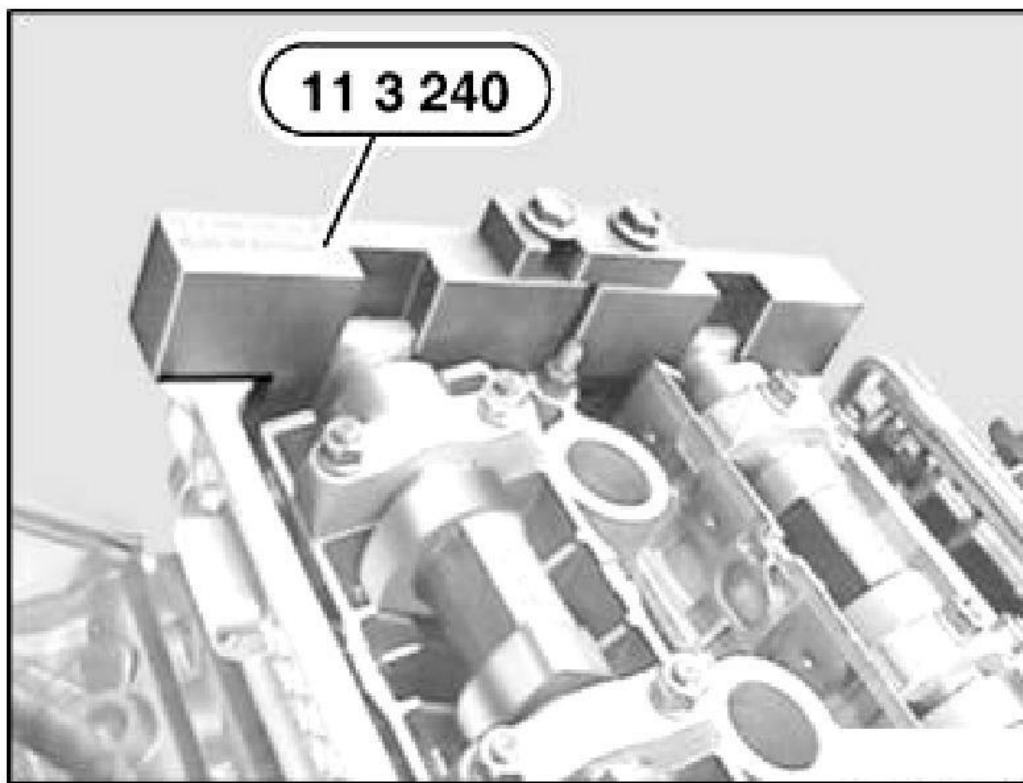


G03310435

Fig. 322: Unscrewing Studs

Courtesy of BMW OF NORTH AMERICA, INC.

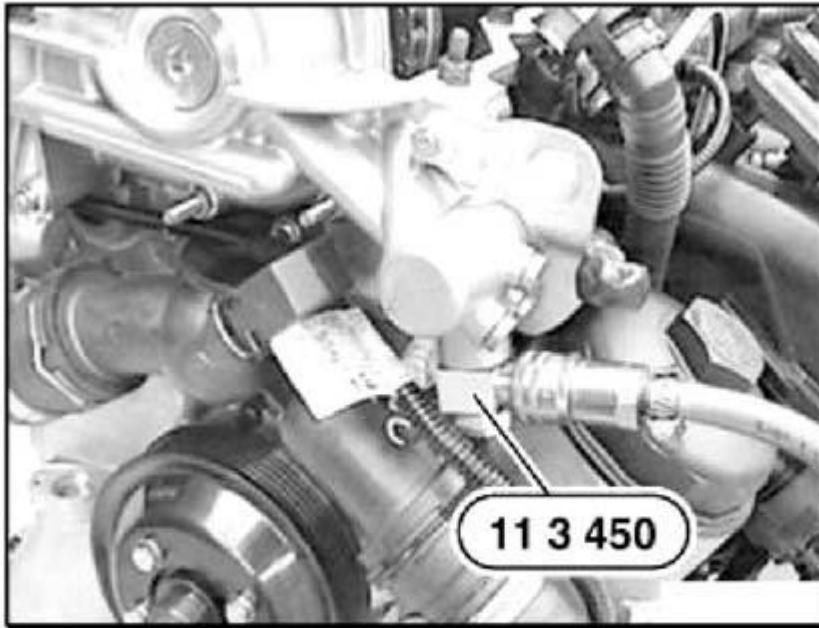
Secure camshafts with special tool 11 3 240.



G03310436

Fig. 323: Securing Camshafts With Special Tool
Courtesy of BMW OF NORTH AMERICA, INC.

Detach compressed air connection.



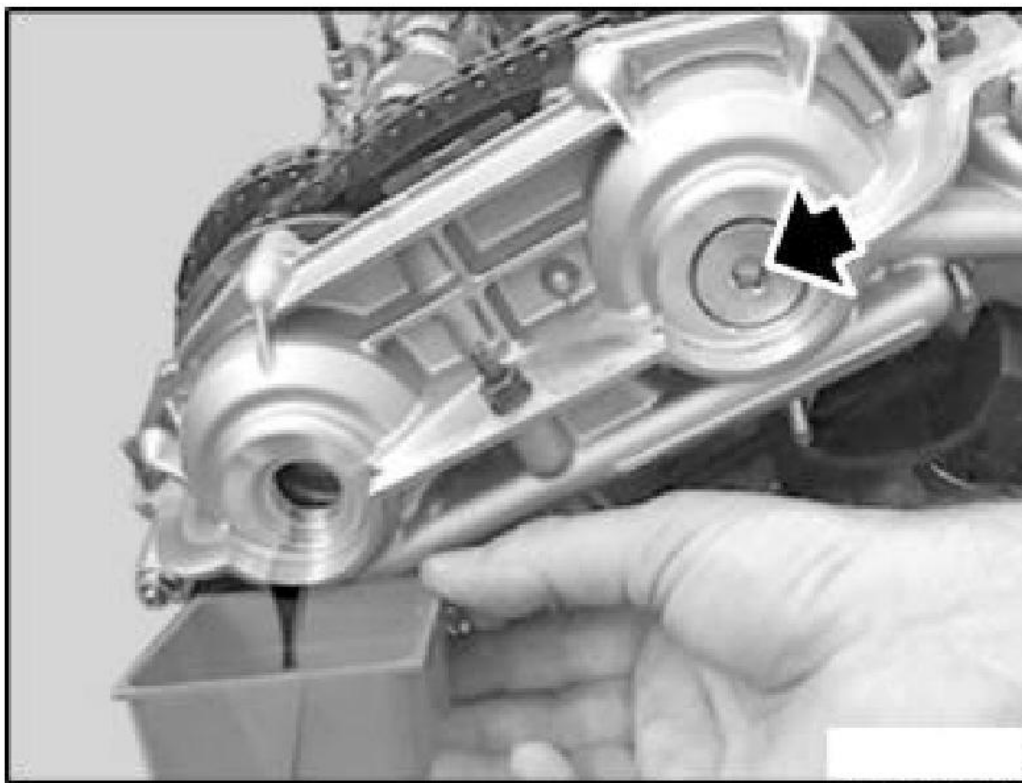
G03310437

Fig. 324: Detaching Compressed Air Connection
Courtesy of BMW OF NORTH AMERICA, INC.

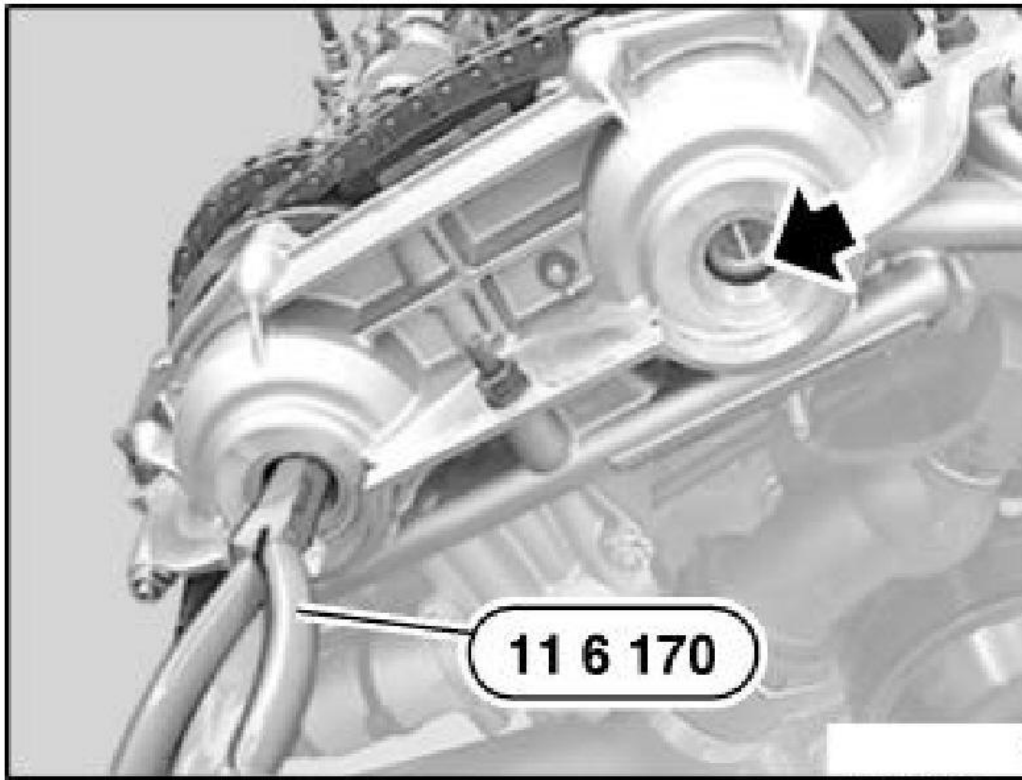
NOTE: special tool 11 3 450 still remains fitted.

IMPORTANT: Oil escapes after screw plugs have been removed. Have cleaning cloths and container ready. Make sure no oil runs onto belt drive. Remove any remnants of oil immediately with cleaning cloth.

Remove screw plugs, catch escaping oil on inlet and exhaust sides.

**G03310438****Fig. 325: Removing Screw Plugs****Courtesy of BMW OF NORTH AMERICA, INC.**

Remove sealing caps with special tool 11 6 170 or with commercially available short flat nose pliers.



G03310439

Fig. 326: Removing Sealing Caps

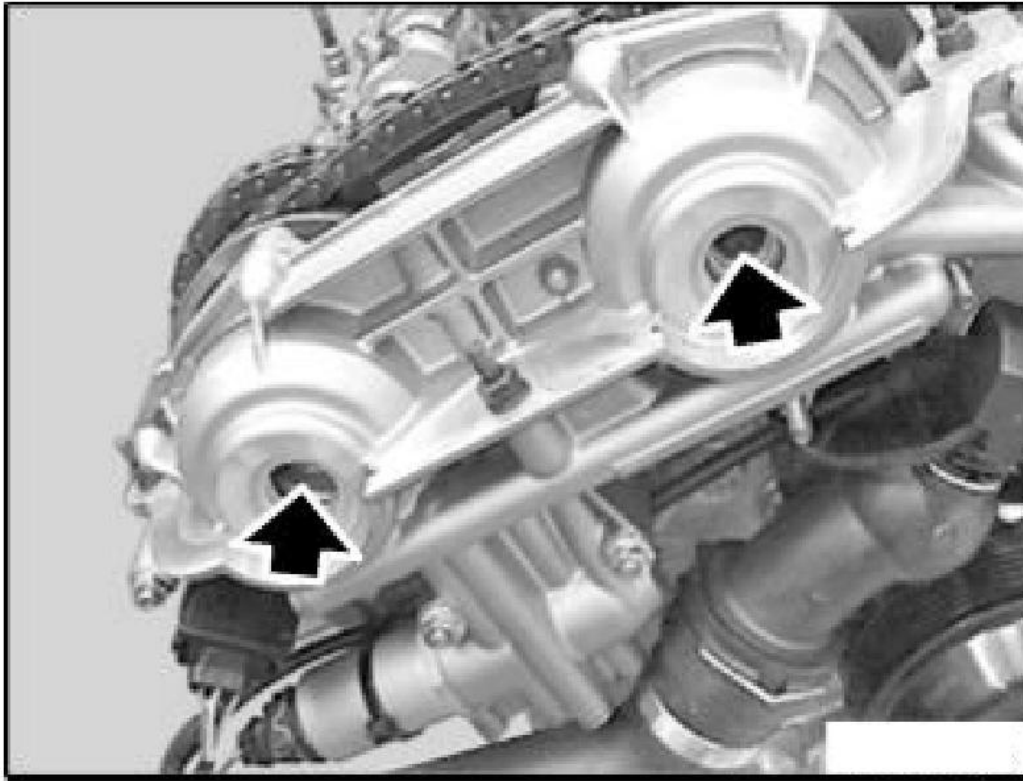
Courtesy of BMW OF NORTH AMERICA, INC.

E85:

Use commercially available offset flat nose pliers.

IMPORTANT: Left-hand threads.

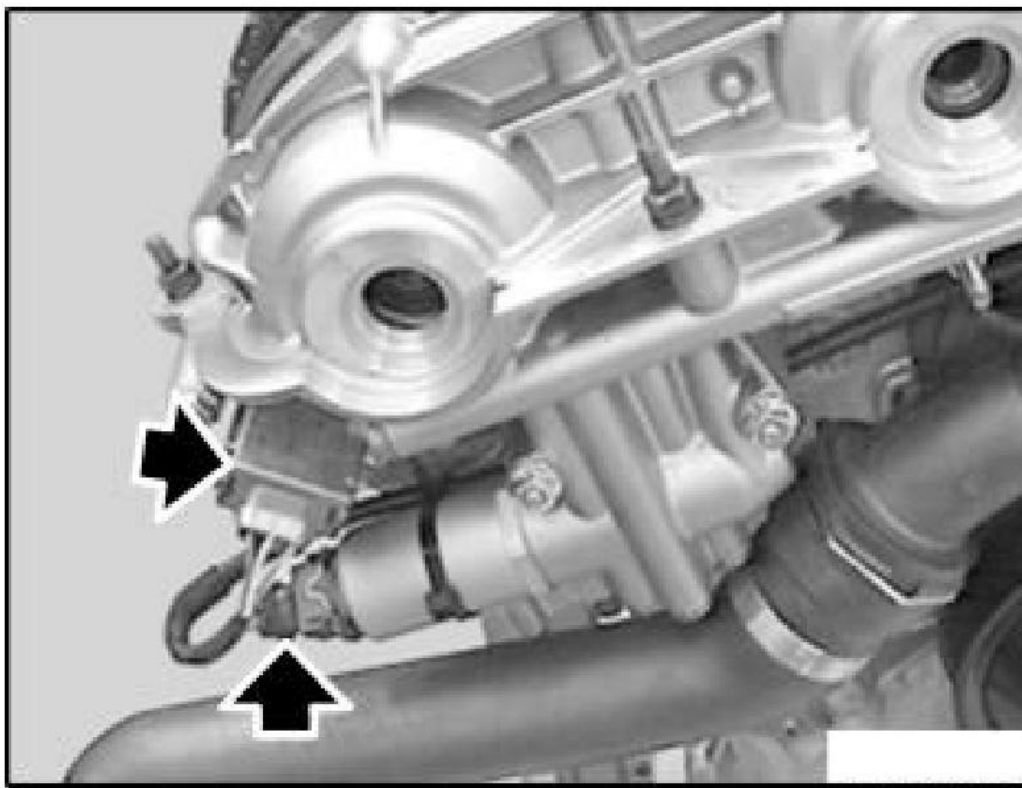
Release fitting screws on inlet and exhaust sides.



G03310440

Fig. 327: Releasing Fitting Screws On Inlet And Exhaust Sides
Courtesy of BMW OF NORTH AMERICA, INC.

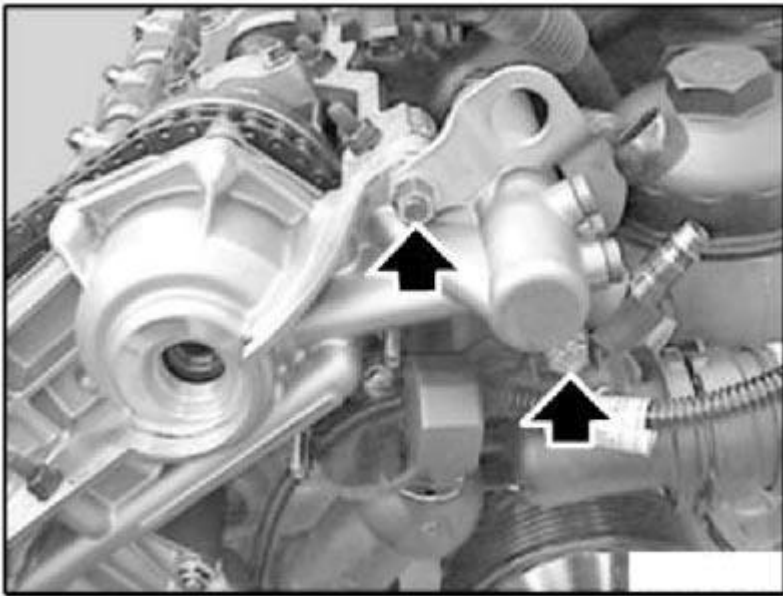
Detach plug connections from camshaft sensor and solenoid valves on exhaust and inlet sides.



G03310441

Fig. 328: Detaching Plug Connections
Courtesy of BMW OF NORTH AMERICA, INC.

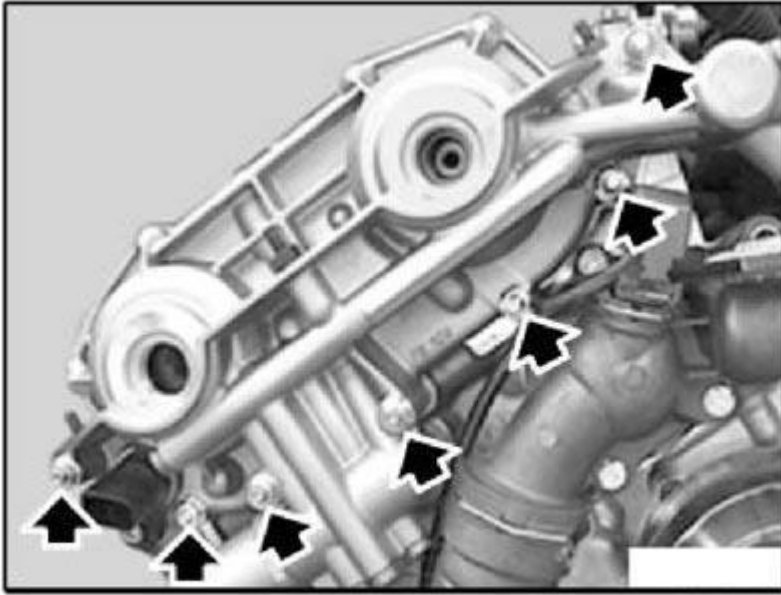
Unscrew suspension eye.



G03310442

Fig. 329: Unscrewing Suspension Eye
Courtesy of BMW OF NORTH AMERICA, INC.

Release nuts and remove double VANOS adjustment unit.



G03310443

Fig. 330: Removing Double VANOS Adjustment Unit
Courtesy of BMW OF NORTH AMERICA, INC.

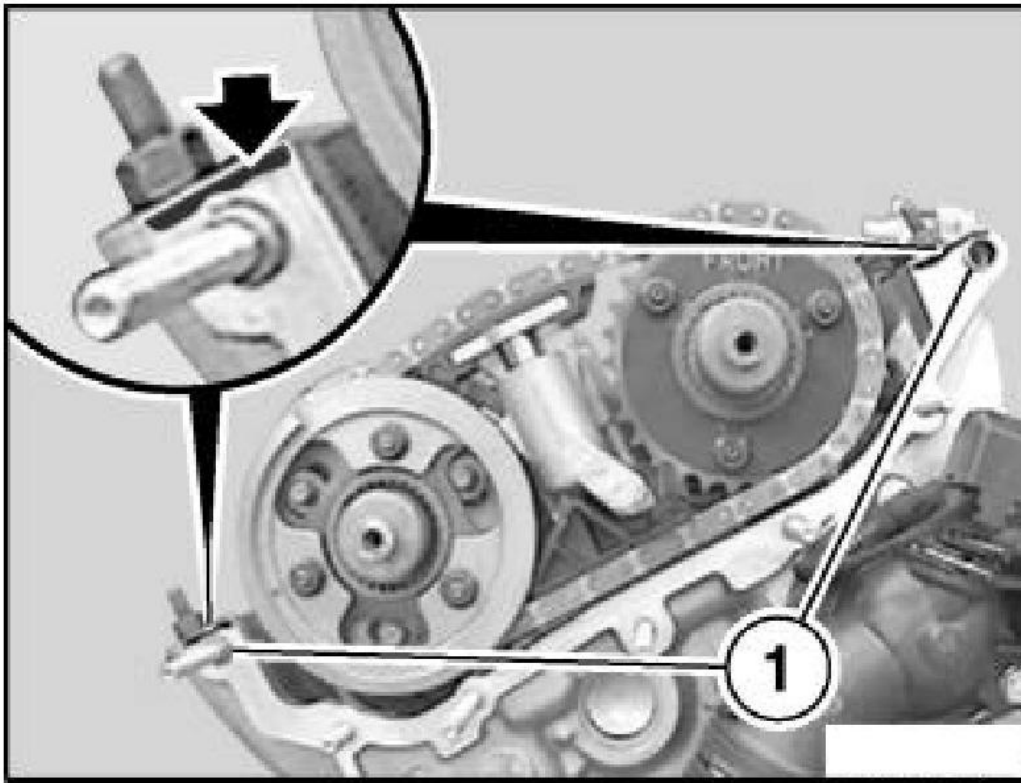
IMPORTANT: With double VANOS adjustment unit removed: Do not crank engine.

The toothed shaft on the inlet side may move and slip out of the spline teeth, the inlet camshaft is thus no longer non-positively connected and the valves could rest on the piston.

Installation:

Installation of double VANOS adjustment unit is described separately from removal. Assembly sequence for removal and installation is different.

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



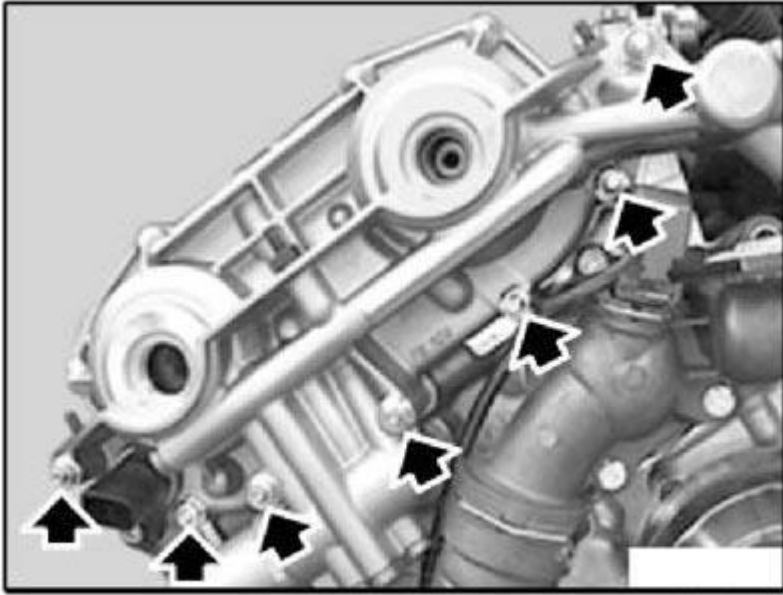
G03310444

Fig. 331: Checking Dowel Sleeves**Courtesy of BMW OF NORTH AMERICA, INC.**

Keep sealing faces clean and free of oil. Apply a thin and even coat of sealing compound Drei Bond 1209 (refer to BMW Parts Service) to contact surface edges of separating face between cylinder head and double VANOS adjustment unit.

Replace seal.

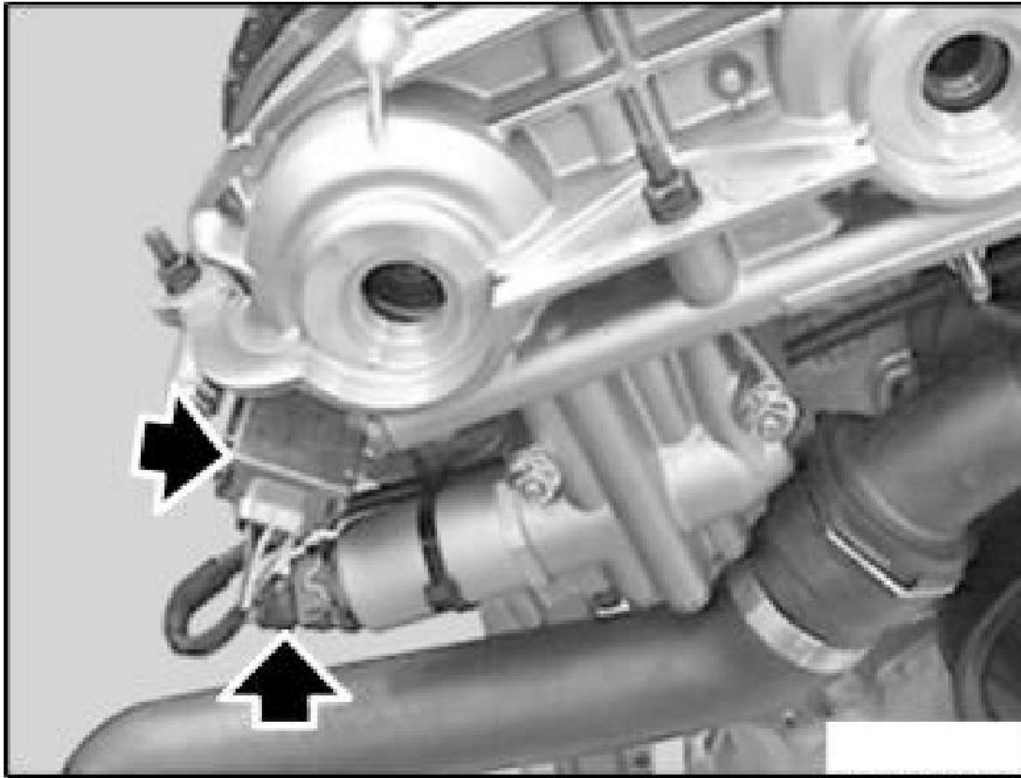
Install and secure double VANOS adjustment unit.



G03310445

Fig. 332: Installing Double VANOS Adjustment Unit
Courtesy of BMW OF NORTH AMERICA, INC.

Attach plug connections of camshaft sensor and solenoid valves on exhaust and inlet sides.

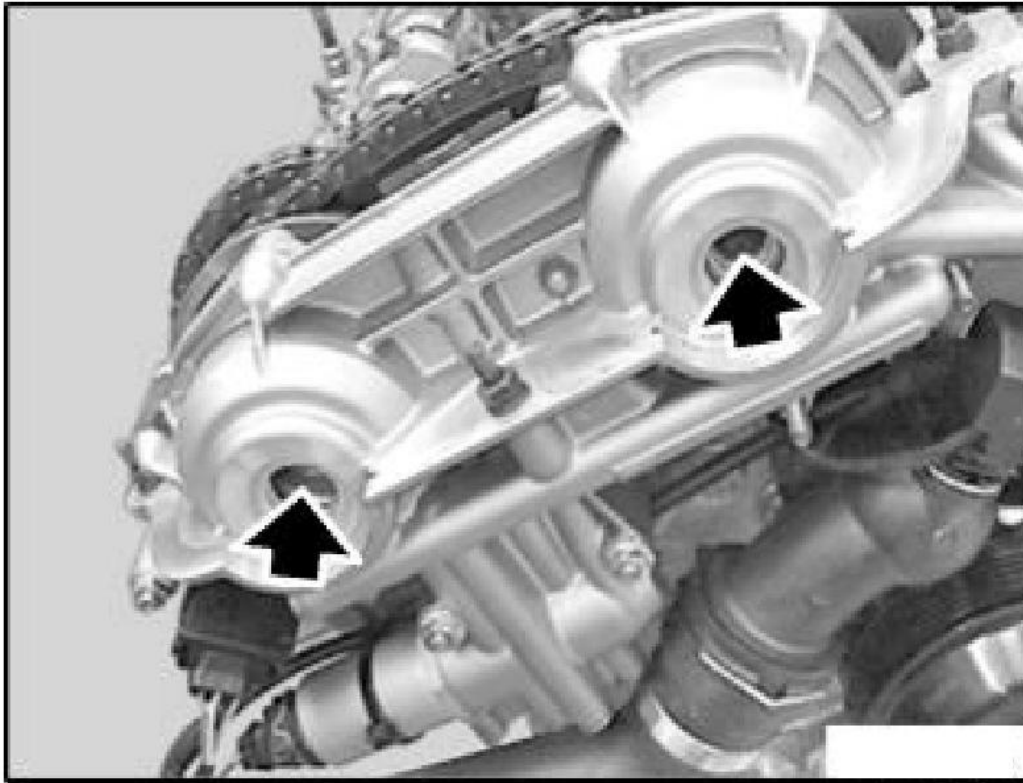


G03310446

Fig. 333: Attaching Plug Connections
Courtesy of BMW OF NORTH AMERICA, INC.

IMPORTANT: Left-hand threads.

Insert fitting screws for hydraulic piston on toothed shaft on inlet and exhaust sides and tighten down.

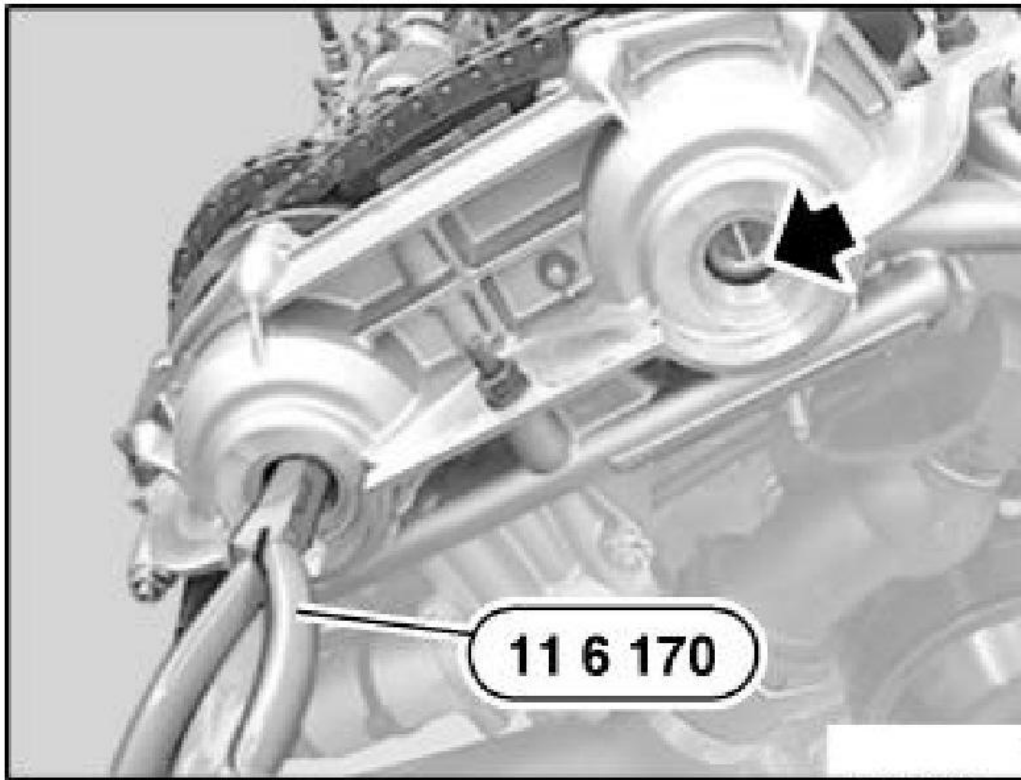
**G03310447****Fig. 334: Inserting Fitting Screws****Courtesy of BMW OF NORTH AMERICA, INC.**

Tightening torque 11 36 4AZ. Refer to **ENGINE - TIGHTENING TORQUES** .

Replace sealing caps and install with special tool 11 6 170 or with commercially available short flat nose pliers.

E85:

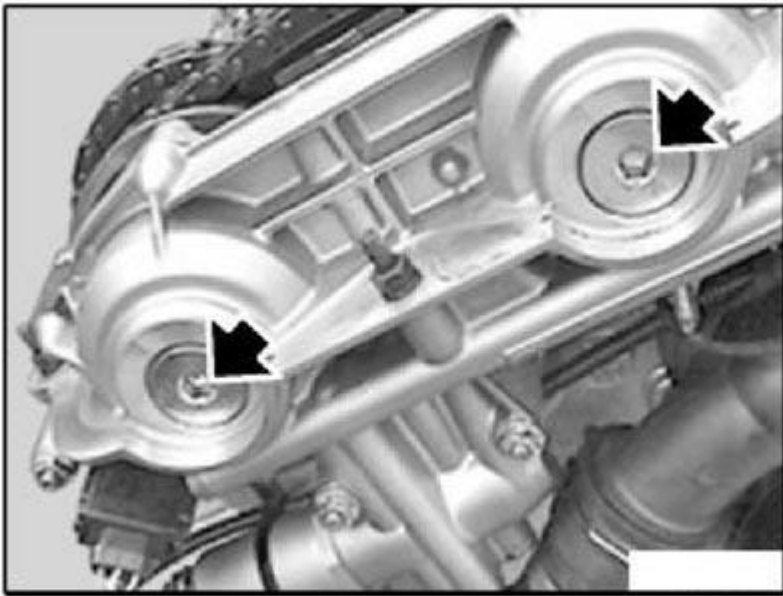
Use commercially available offset flat nose pliers.



G03310448

Fig. 335: Installing Sealing Caps With Special Tool
Courtesy of BMW OF NORTH AMERICA, INC.

Insert screw plugs with new sealing rings and tighten down.

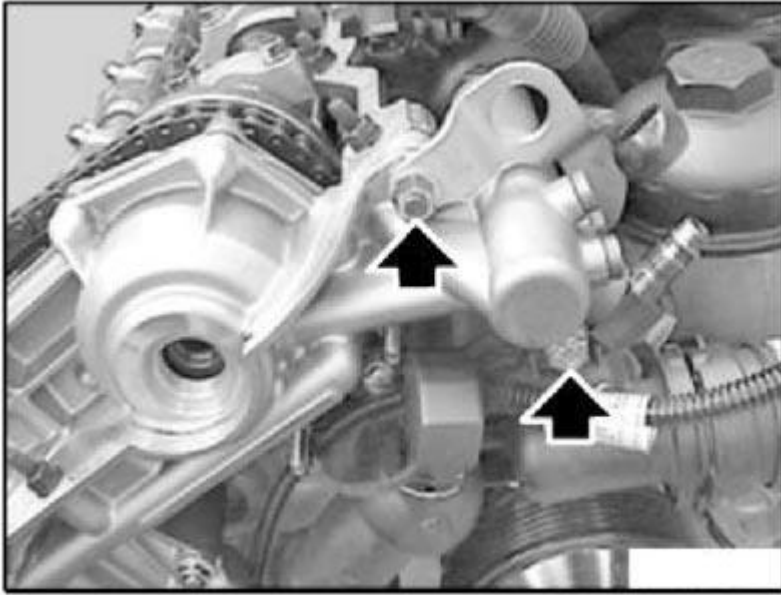


G03310449

Fig. 336: Inserting Screw Plugs With Sealing Rings
Courtesy of BMW OF NORTH AMERICA, INC.

Tightening torque 11 36 3AZ. Refer to **ENGINE - TIGHTENING TORQUES** .

Fit suspension lug.



G03310450

Fig. 337: Fitting Suspension Lug

Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: If the double VANOS adjustment unit has been replaced, you must check and, if necessary, adjust the camshaft timing.
If work has been carried out which has "no" effect on the timing and it is assured that the timing adjustment is correct, the timing check described in the following does not have to be conducted.

IMPORTANT: Cylinder for chain tensioning piston is under spring pressure.

Remove cylinder for chain tensioning piston.

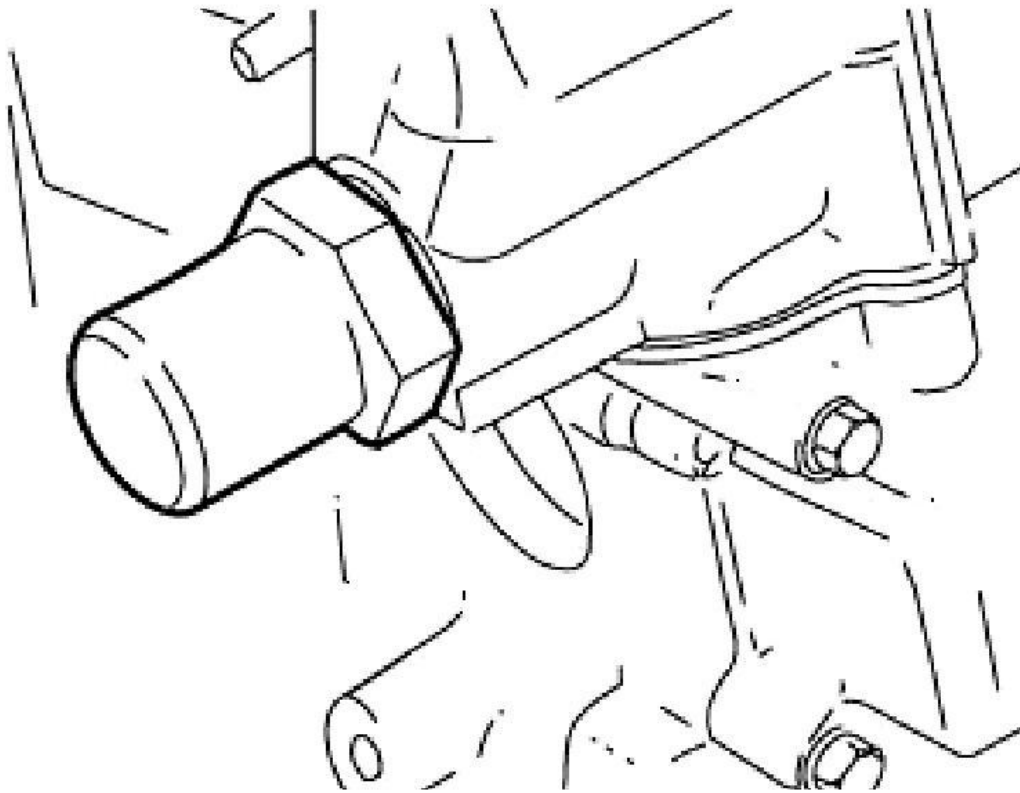
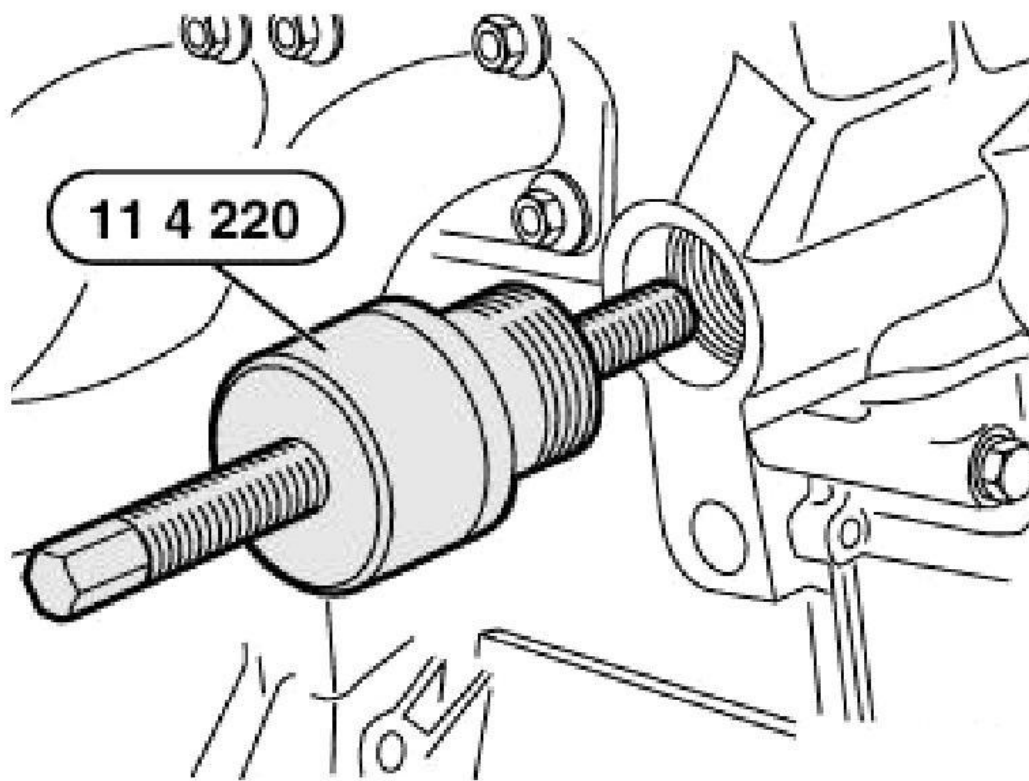
**G03310451**

Fig. 338: Removing Cylinder For Chain Tensioning Piston
Courtesy of BMW OF NORTH AMERICA, INC.

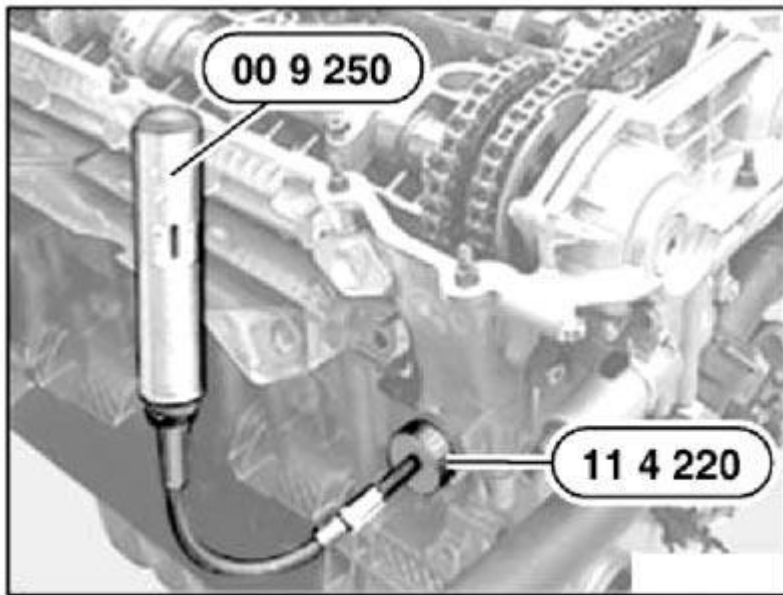
Insert special tool 11 4 220 in cylinder head and bring adjustment screw into contact with tensioning rail.



G03310452

Fig. 339: Inserting Special Tool In Cylinder Head
Courtesy of BMW OF NORTH AMERICA, INC.

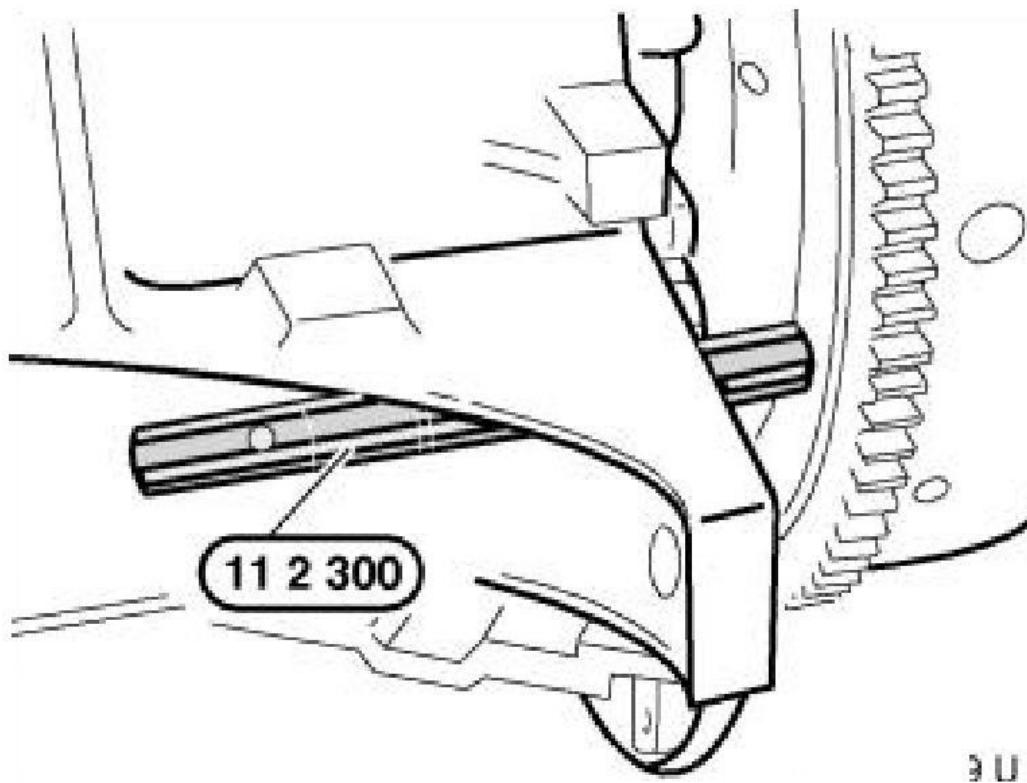
Preload tensioning rail with special tool 11 4 220 by rotating adjusting screw with special tool 00 9 250 or standard torque wrench to 0.7 N.m.



G03310453

Fig. 340: Rotating Adjusting Screw**Courtesy of BMW OF NORTH AMERICA, INC.**

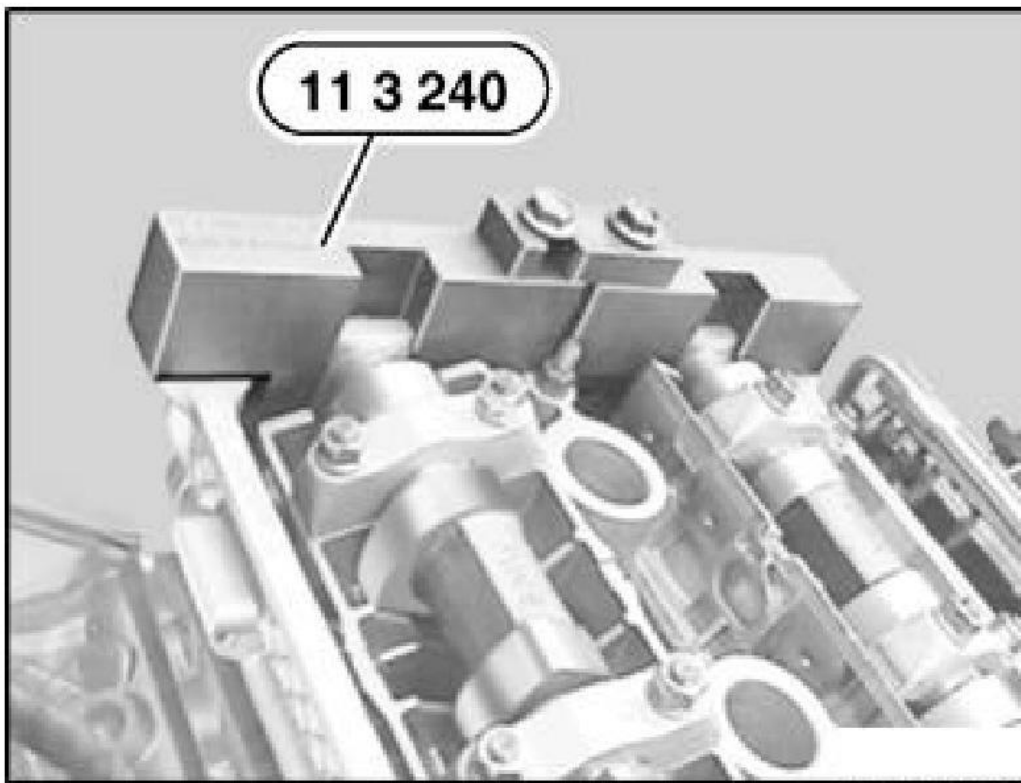
Pull special tool 11 2 300 back until flywheel is no longer secured in position.



G03310454

Fig. 341: Pulling Special Tool Back
Courtesy of BMW OF NORTH AMERICA, INC.

Remove special tool 11 3 240.

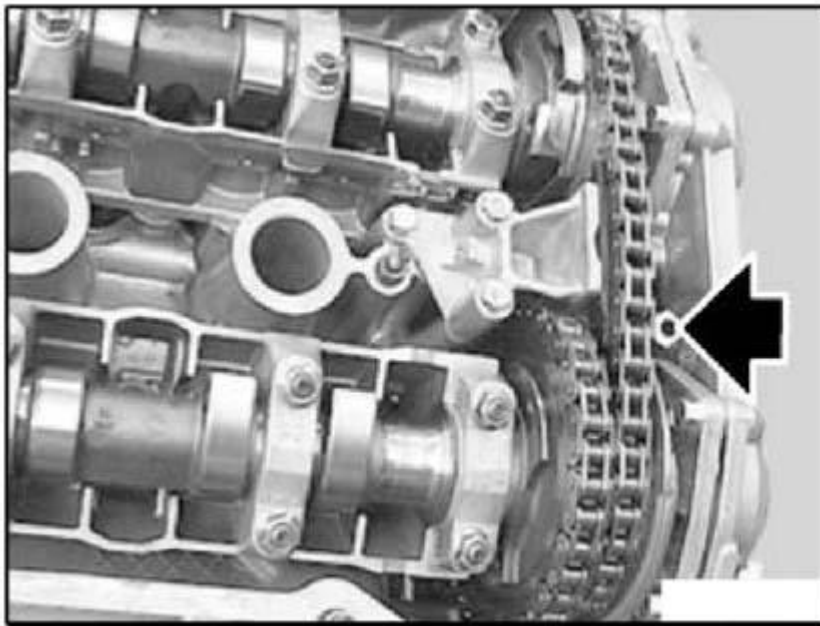


G03310455

Fig. 342: Removing Special Tool

Courtesy of BMW OF NORTH AMERICA, INC.

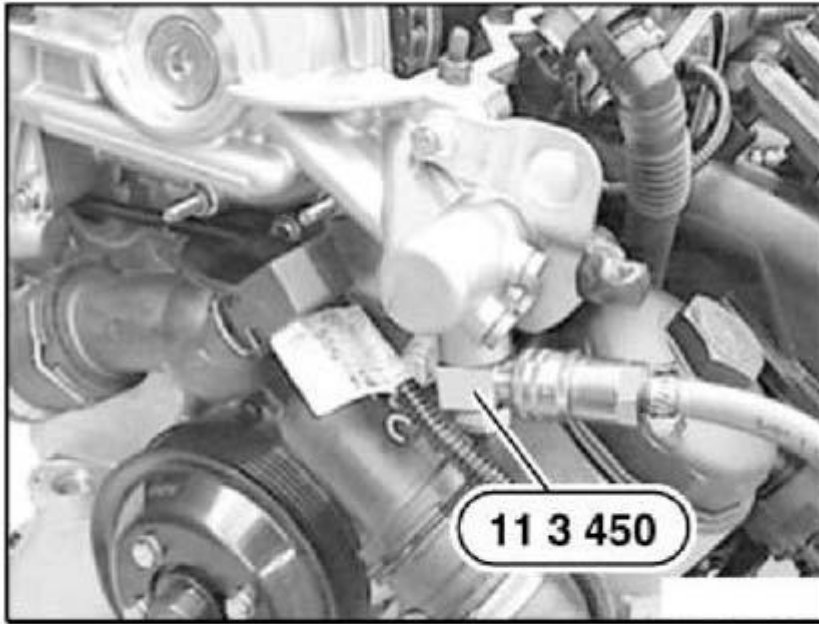
IMPORTANT: Cover double VANOS adjustment unit; when the compressed air supply is connected, several drops of oil are sprayed out of the bore.



G03310456

Fig. 343: Covering Double VANOS Adjustment Unit
Courtesy of BMW OF NORTH AMERICA, INC.

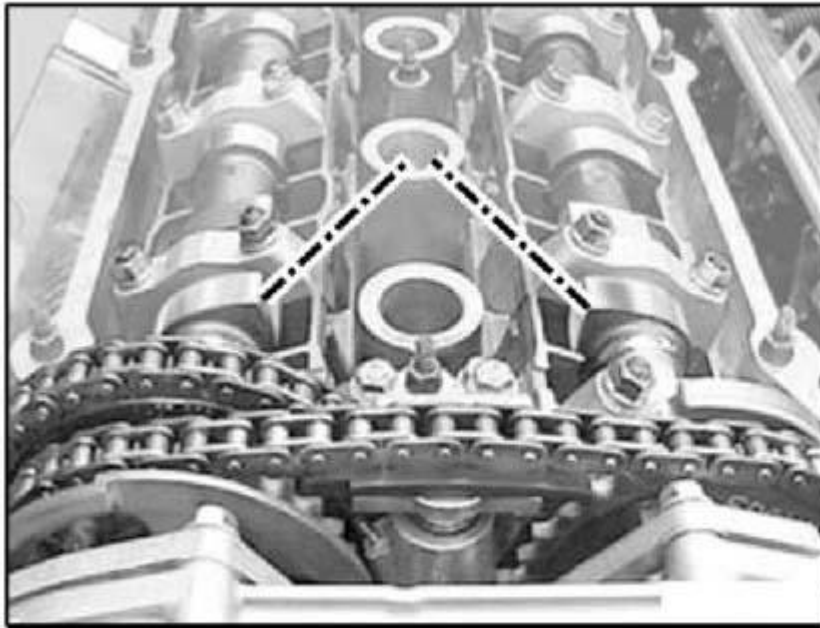
Connect compressed air (2 to 8 bar).



G03310457

Fig. 344: Connecting Compressed Air
Courtesy of BMW OF NORTH AMERICA, INC.

With compressed air supply connected, crank engine twice in direction of rotation until cam tips on inlet and exhaust camshafts on 1st cylinder face each other.

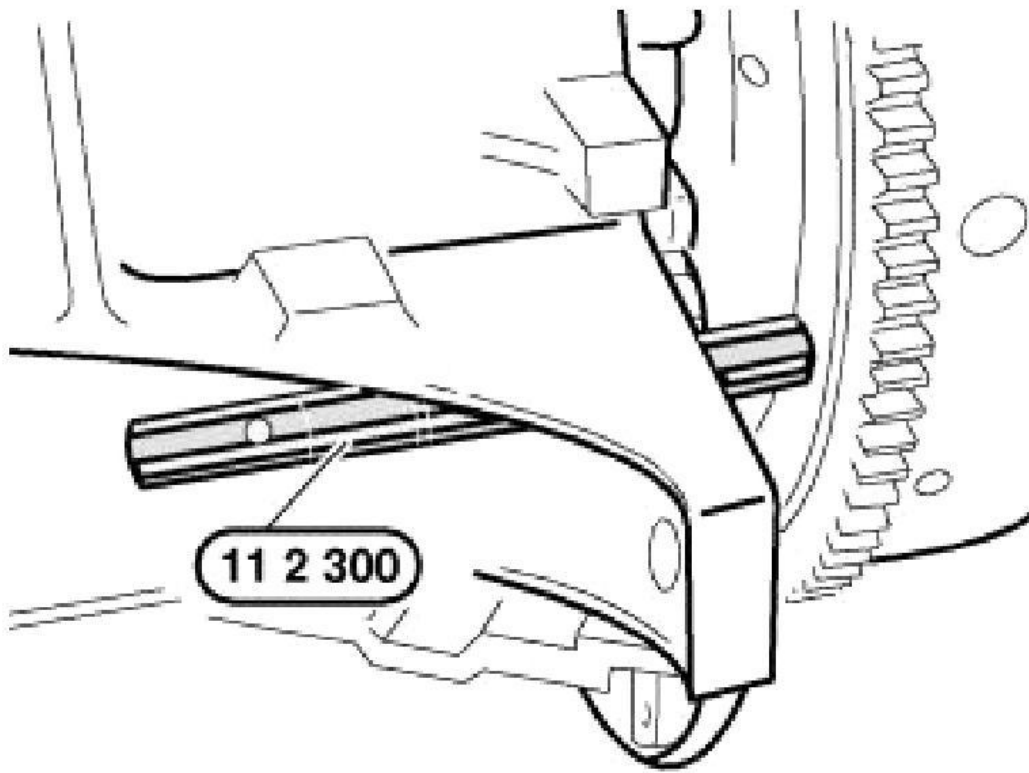


G03310458

Fig. 345: Identifying Camshafts Position

Courtesy of BMW OF NORTH AMERICA, INC.

Secure crankshaft with special tool 11 2 300 in TDC position of 1st cylinder.



G03310459

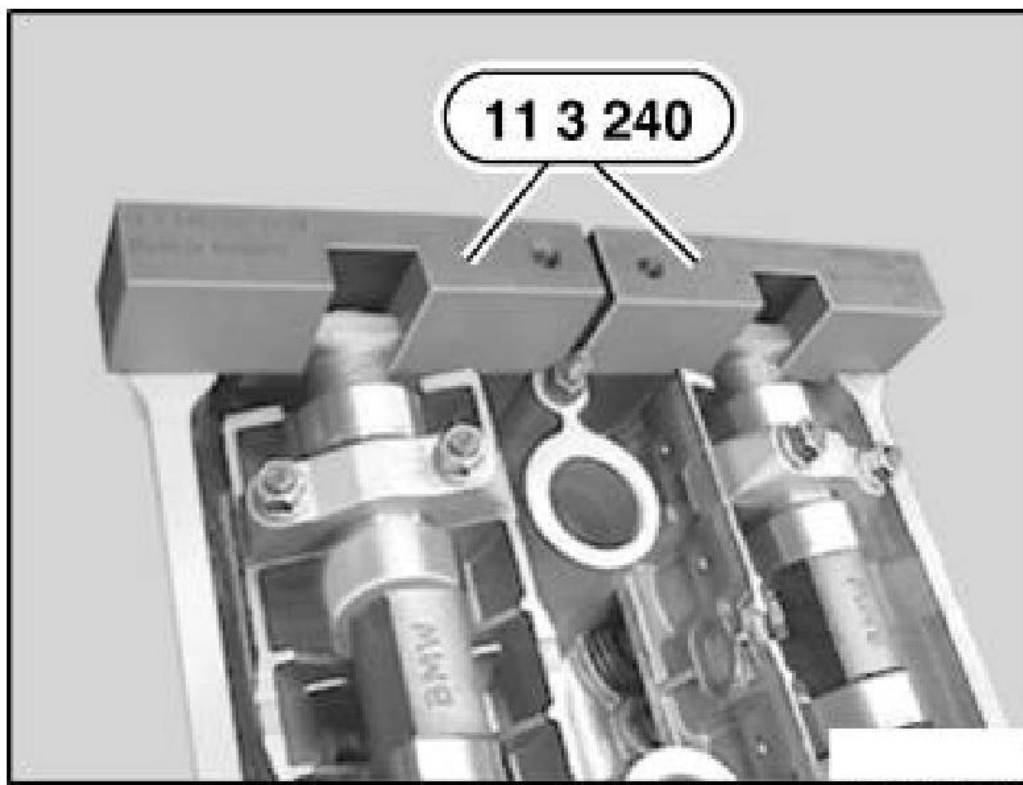
Fig. 346: Securing Crankshaft
Courtesy of BMW OF NORTH AMERICA, INC.

IMPORTANT: Do not turn the engine back.

Remove special tool 11 2 300 before switching on the engine.

Check camshaft setting:

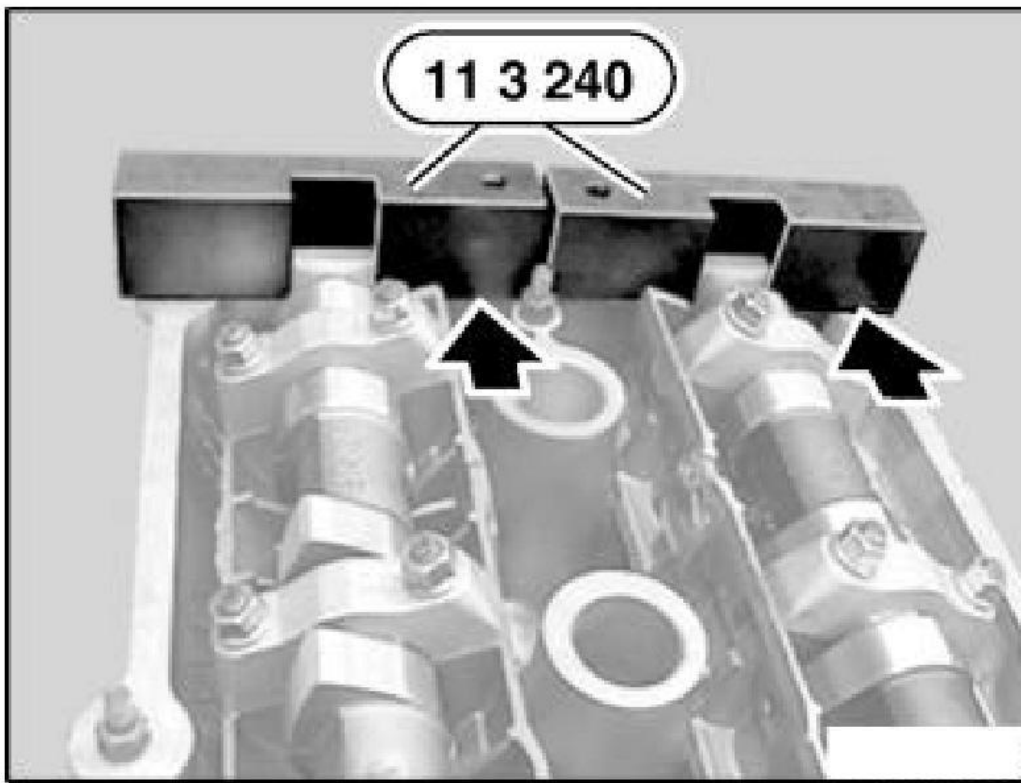
Fit special tool 11 3 240 to camshafts.



G03310460

Fig. 347: Fitting Special Tool To Camshafts
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: The timing is correctly set if the special tool 11 3 240 rests without a gap on the cylinder head or protrudes up to 1 mm to the inlet side. The timing must be reset if the special tool 11 3 240 protrudes to the exhaust side.

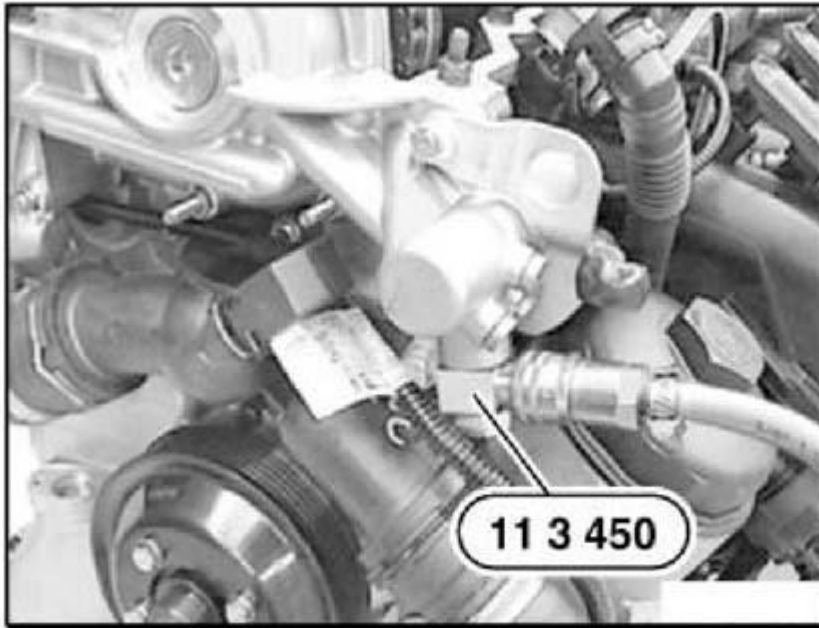


G03310461

Fig. 348: View Of Correct Camshaft Timing
Courtesy of BMW OF NORTH AMERICA, INC.

If necessary, adjust camshaft timing. Refer to **11 31 505 ADJUSTING CAMSHAFT TIMING (M52TU / M54 / M56)**.

Detach compressed air connection.

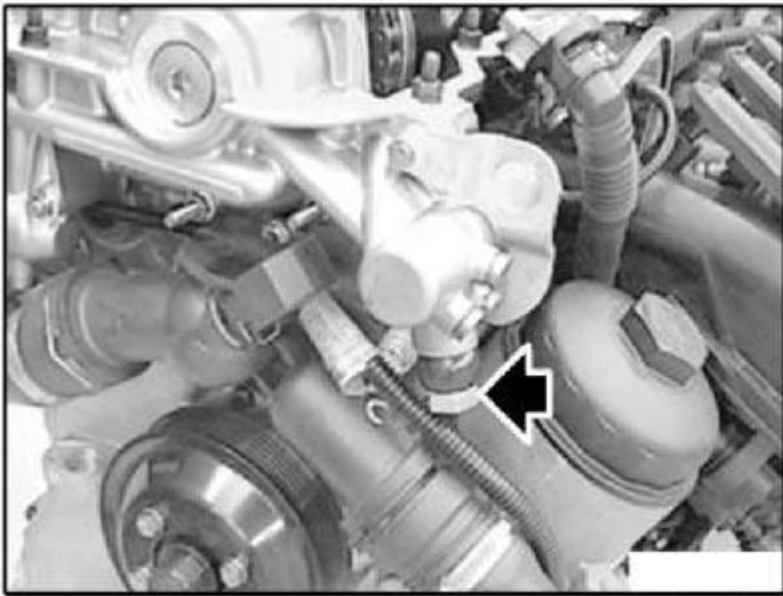


G03310462

Fig. 349: Detaching Compressed Air Connection
Courtesy of BMW OF NORTH AMERICA, INC.

Remove special tool 11 3 450.

Fit oil pressure line with new seals.

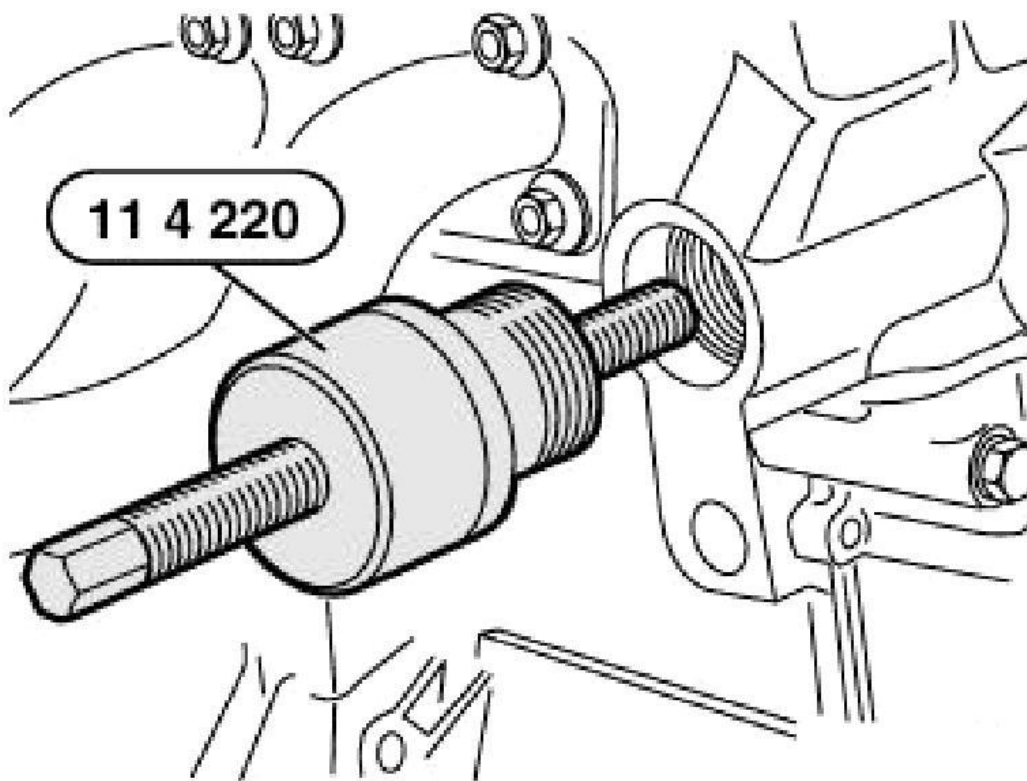


G03310463

Fig. 350: Fitting Oil Pressure Line With Seals
Courtesy of BMW OF NORTH AMERICA, INC.

Tightening torque 11 36 2AZ. Refer to **ENGINE - TIGHTENING TORQUES** .

Unfasten and remove special tool 11 4 220.

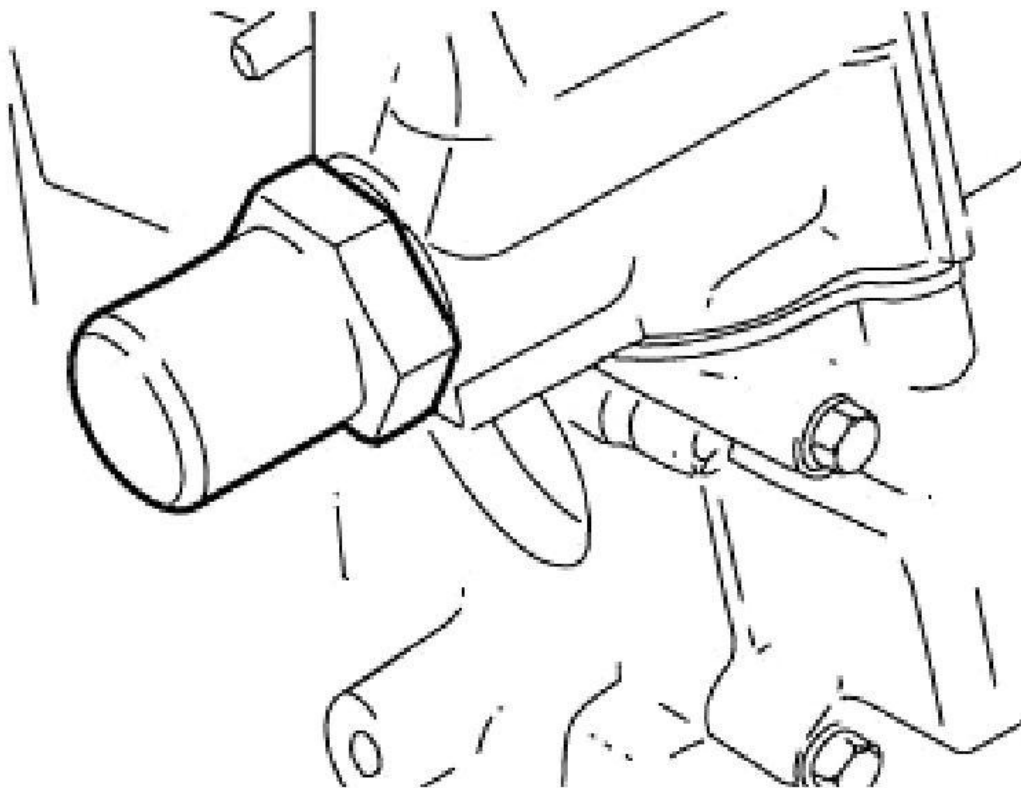


G03310464

Fig. 351: Removing Special Tool

Courtesy of BMW OF NORTH AMERICA, INC.

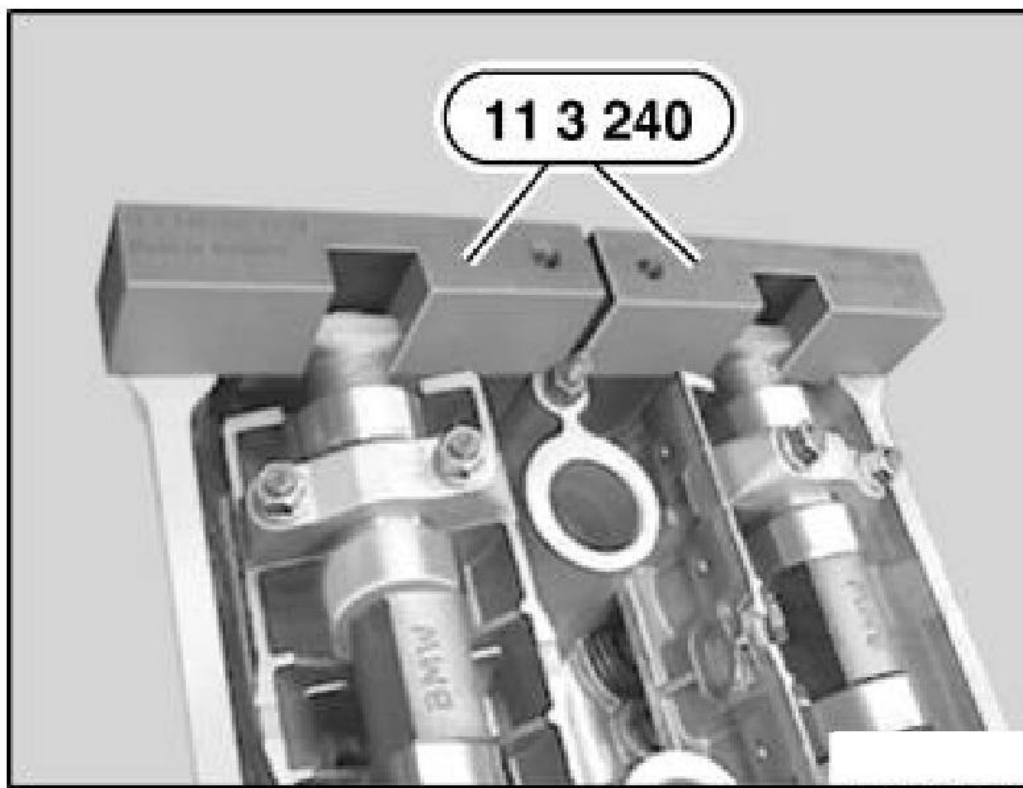
Install cylinder for chain tensioning piston. Refer to **11 31 090 REMOVING AND INSTALLING/REPLACING CHAIN TENSIONING PISTON (M52 / M52TU / M54 / M56)**.



G03310465

Fig. 352: Installing Cylinder Chain Tensioning Piston
Courtesy of BMW OF NORTH AMERICA, INC.

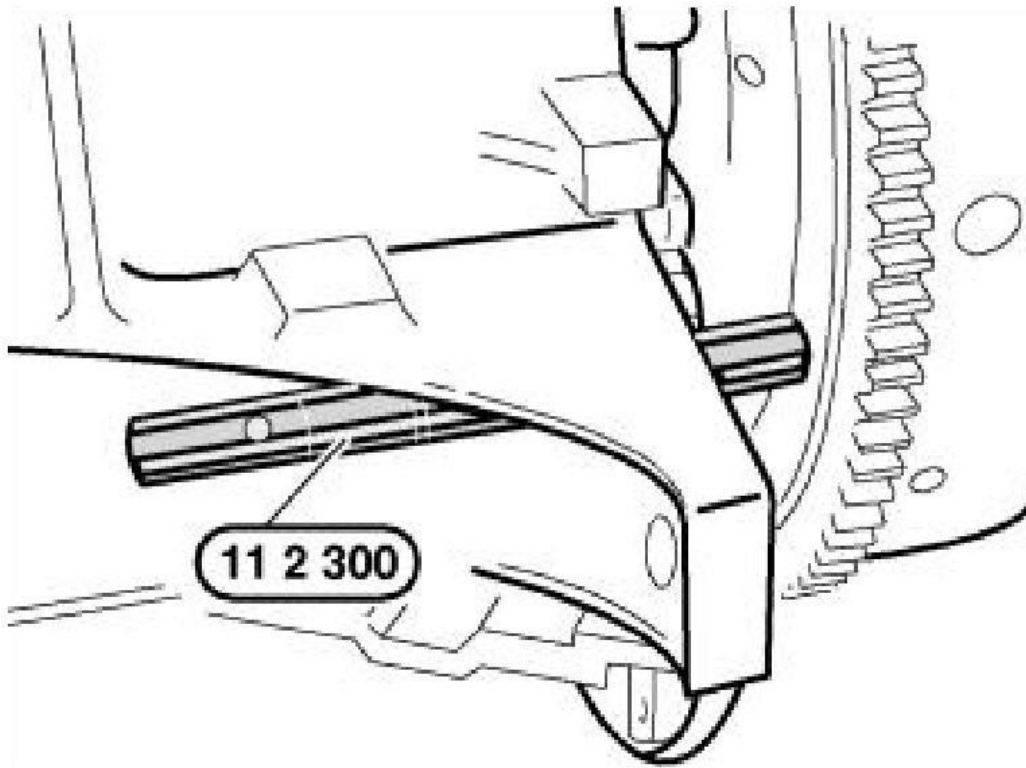
Remove special tool 11 3 240.



G03310466

Fig. 353: Removing Special Tool
Courtesy of BMW OF NORTH AMERICA, INC.

Remove special tool 11 2 300.



G03310467

Fig. 354: Removing Special Tool 11 2 300
 Courtesy of BMW OF NORTH AMERICA, INC.

Assemble engine.

11 36 570 REPLACING SOLENOID VALVE FOR INLET SIDE ON VANOS ADJUSTMENT UNIT

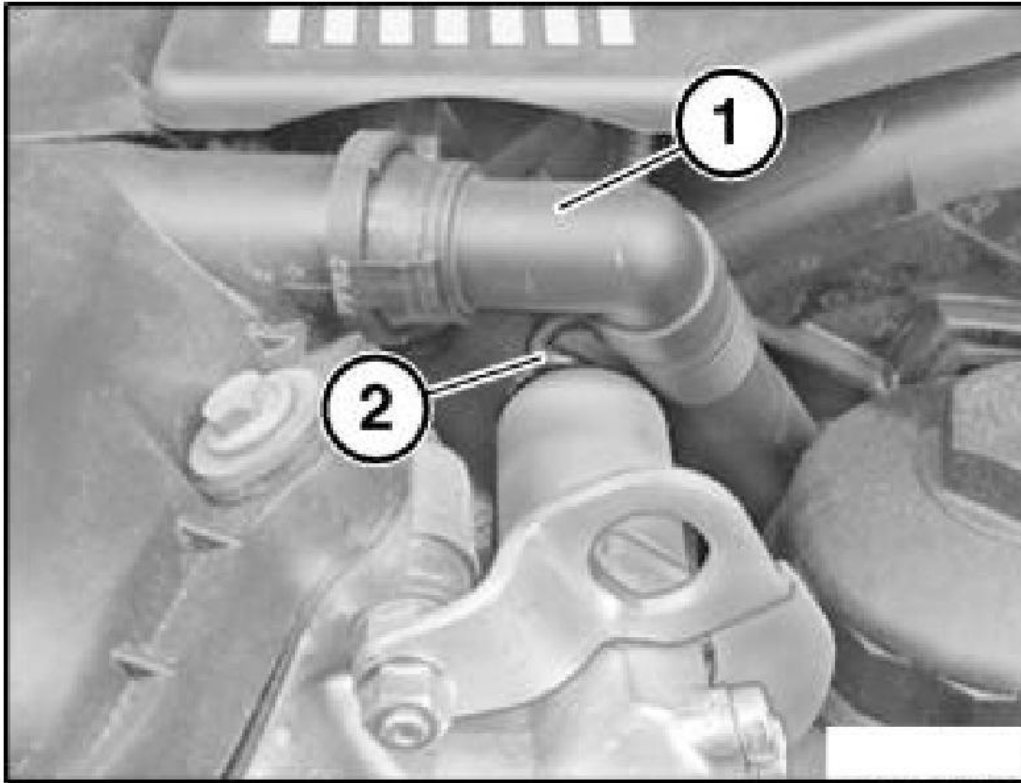
Special tools required:

- 32 2 110

Necessary preliminary tasks:

- Read out fault memory of DME control unit
- Check stored fault messages
- Switch off ignition

Unlock hose (1) and detach.



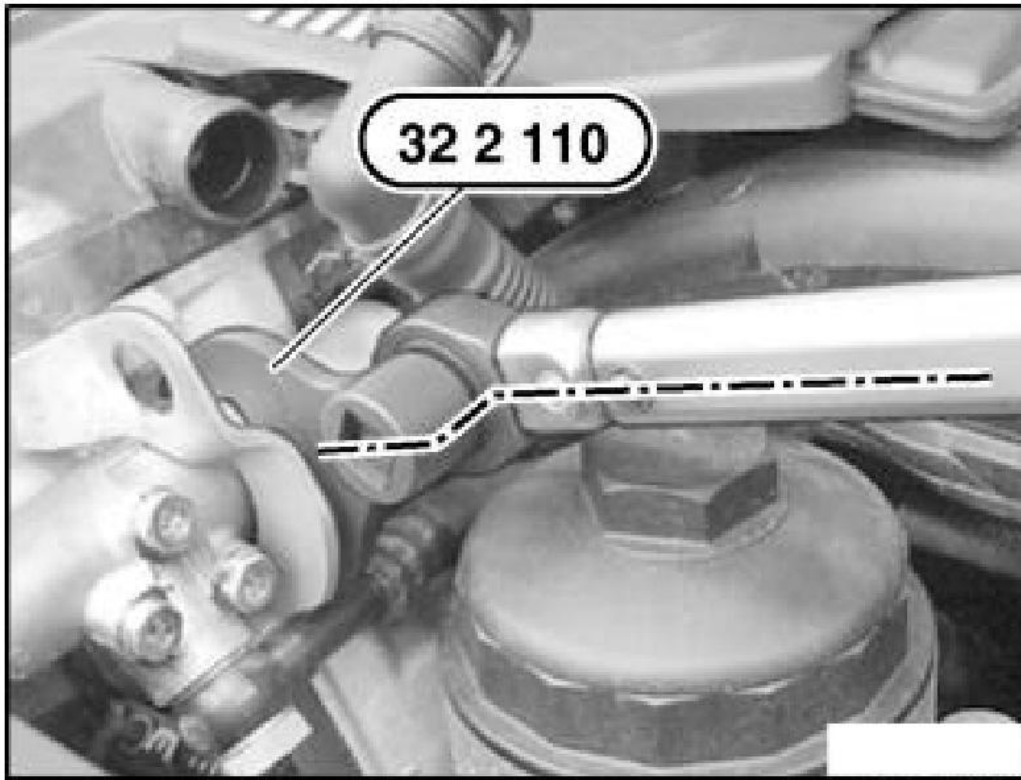
G03310468

Fig. 355: Unlocking Hose

Courtesy of BMW OF NORTH AMERICA, INC.

Unlock plug (2) and remove.

NOTE: Once it has been removed, oil drips from the solenoid valve. Have a cleaning cloth ready. Make sure no oil drips onto the belt drive. Remove any remnants of oil immediately with cleaning cloth. Do not damage oil line when releasing solenoid valve. Release solenoid valve with special tool 32 2 110.



G03310469

Fig. 356: Releasing Solenoid Valve With Special Tool
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Tightening torque 11 36 1AZ. Refer to **ENGINE - TIGHTENING TORQUES** .

Now clear the fault memory.

11 36 575 REPLACING SOLENOID VALVE FOR EXHAUST SIDE ON VANOS ADJUSTMENT UNIT

Special tools required:

- 11 6 420

Necessary preliminary tasks:

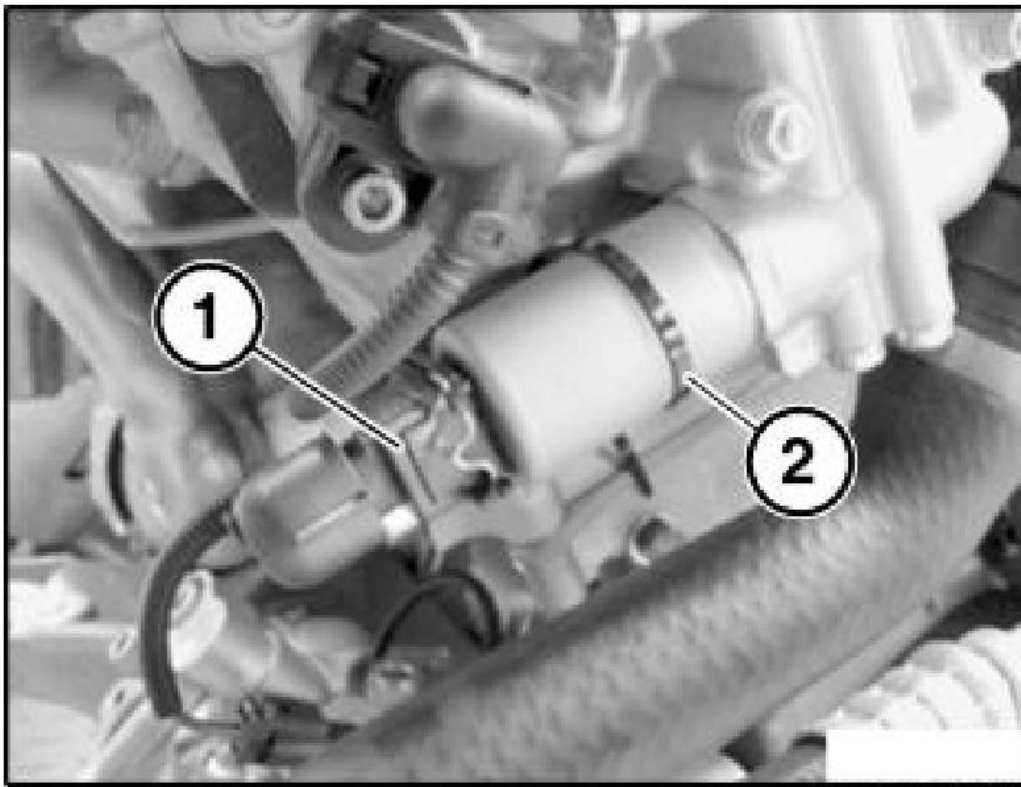
- Read out fault memory of DME control unit

- Check stored fault messages
- Switch off ignition

E85 only:

- Remove fluid tank for windshield washer system

Unlock plug (1) and remove.



G03310470

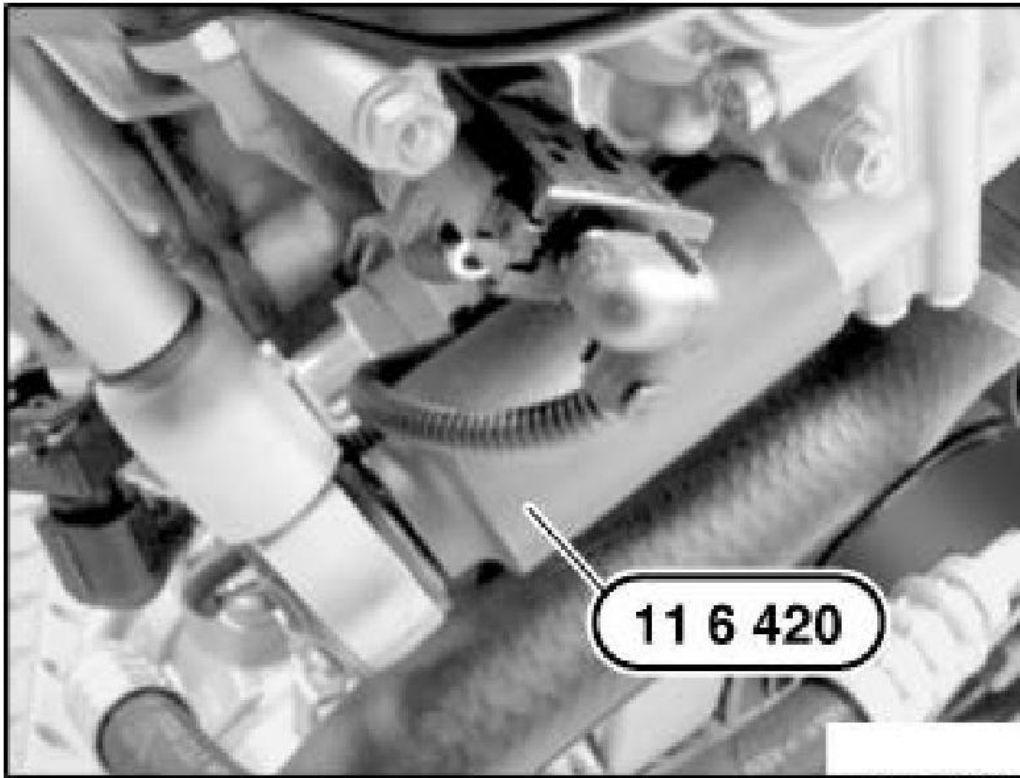
Fig. 357: Removing Plug

Courtesy of BMW OF NORTH AMERICA, INC.

Cut through cable tie (2).

NOTE: Once it has been removed, oil drips from the solenoid valve.
Have a cleaning cloth ready.
Make sure no oil drips onto the belt drive. Remove any remnants of oil

immediately with cleaning cloth.
Release solenoid valve with special tool n 6 420.



G03310471

Fig. 358: Releasing Solenoid Valve With Special Tool
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Tightening torque 11 36 1AZ. Refer to **ENGINE - TIGHTENING TORQUES**.

Now clear the fault memory.

OIL SUPPLY

11 40 000 CHECKING ENGINE OIL PRESSURE

Special tools required:

- 11 4 050
- 13 3 061
- 13 3 063
- 13 6 051
- 13 6 054

NOTE: For engine oil pressure to be checked, oil pressure switch must be removed and special tools must be installed and connected.

To avoid an excess discharge of oil when removing oil pressure switch:

Unscrew oil filter cap; the engine oil flows out of the oil filter housing into the oil sump.

Installation:

Replace sealing ring.

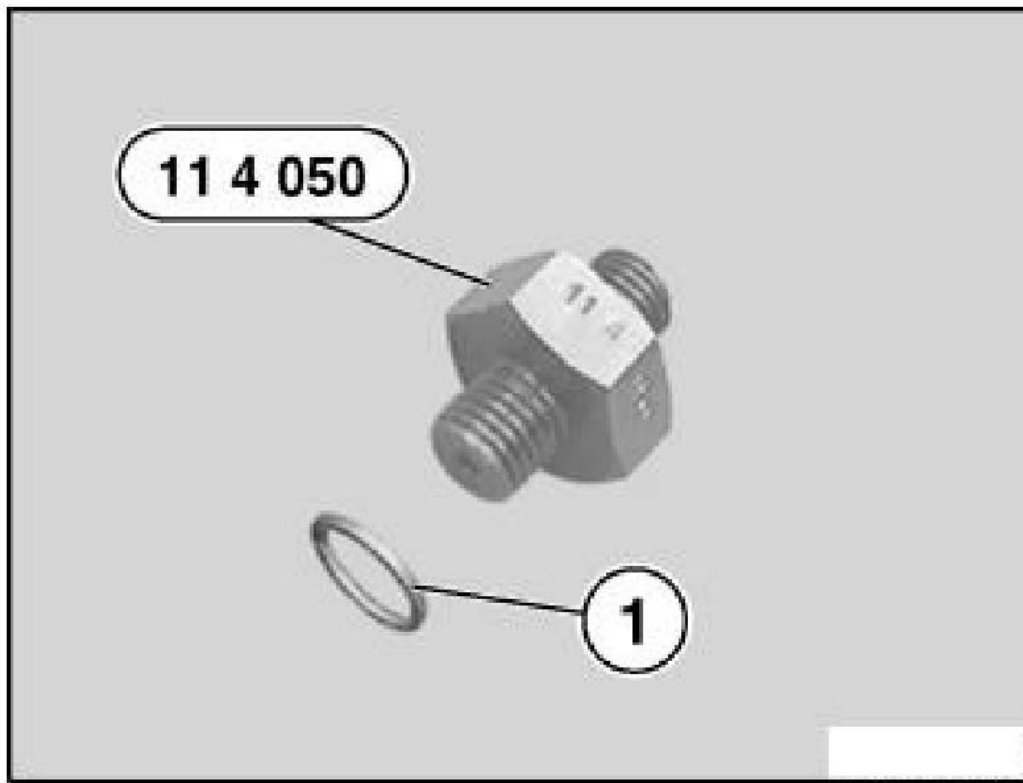
Tightening torque 11 42 2AZ. Refer to **ENGINE - TIGHTENING TORQUES** .

Remove oil pressure switch.

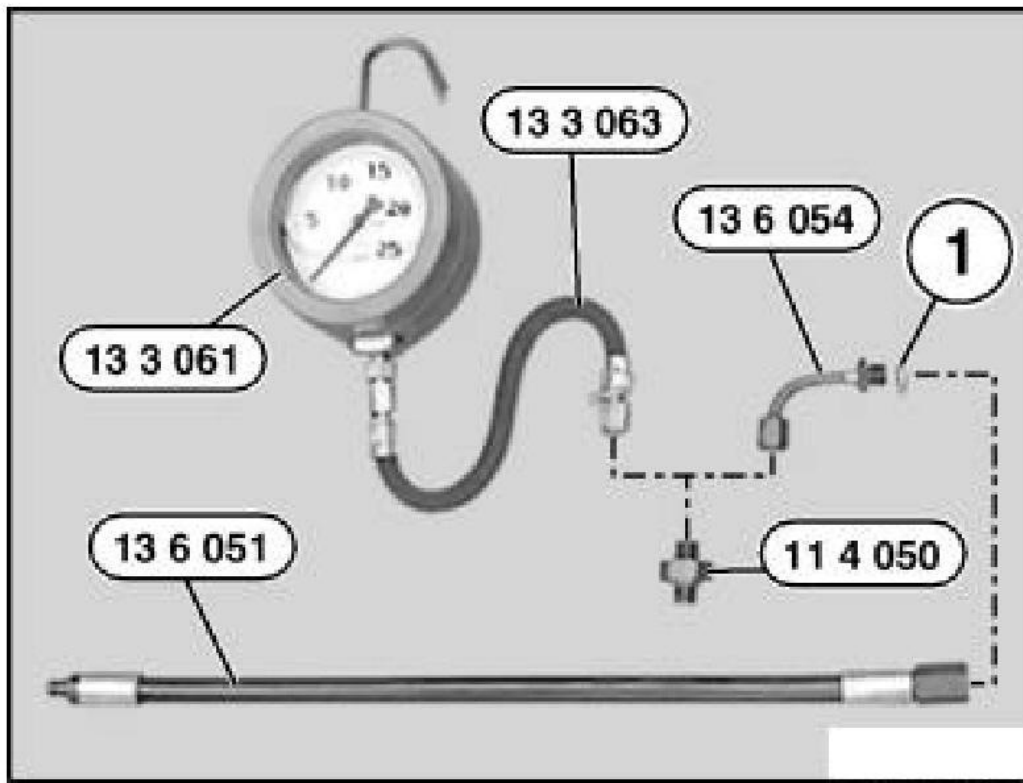
Installation:

Tightening torque 12 61 1AZ, refer to **ENGINE ELECTRICAL SYSTEM - TIGHTENING TORQUES** .

Install special tool 11 4 050 with sealing ring (1) in place of oil pressure switch.

**G03310472****Fig. 359: View Of Special Tool****Courtesy of BMW OF NORTH AMERICA, INC.****Checking engine oil pressure with DIS Tester**

Attach special tool 13 6 054 with sealing ring (1) and special tool 13 6 051 and connect to DIS Tester.



G03310473

Fig. 360: Checking Engine Oil Pressure
 Courtesy of BMW OF NORTH AMERICA, INC.

Checking engine oil pressure with pressure gauge

Install special tool 13 3 063 and special tool 13 3 061 (pressure gauge).

Start engine and check engine oil pressure.

Specified value. Refer to **ENGINE - TECHNICAL DATA** .

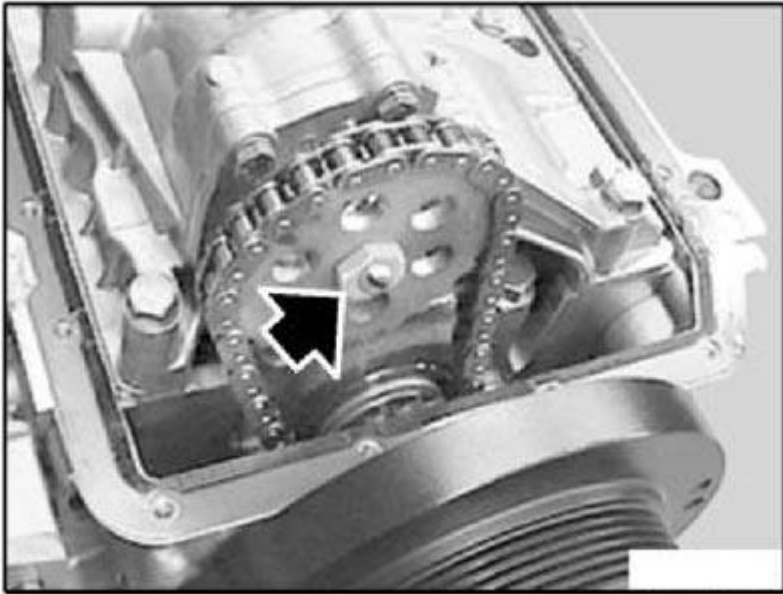
OIL PUMP WITH FILTER

11 41 000 REMOVING AND INSTALLING/REPLACING OIL PUMP (M52TU / M54 / M56)

Remove oil sump. Refer to **11 13 000 Removing and installing, sealing/replacing oil sump (M54/56)**.

CAUTION: Left-hand threads.

Unfasten nut.



G03310474

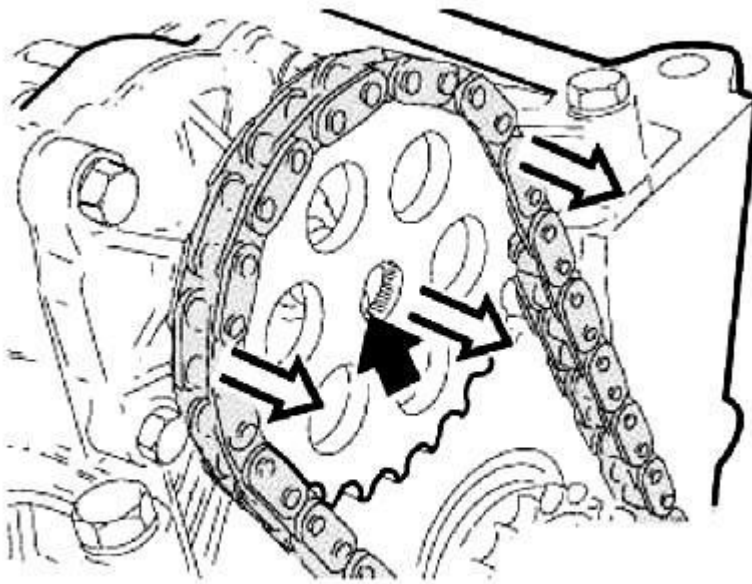
Fig. 361: Unfastening Nut

Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Tightening torque 11 41 4AZ. Refer to **ENGINE - TIGHTENING TORQUES** .

Remove sprocket with chain.



G03310475

Fig. 362: Removing Sprocket

Courtesy of BMW OF NORTH AMERICA, INC.

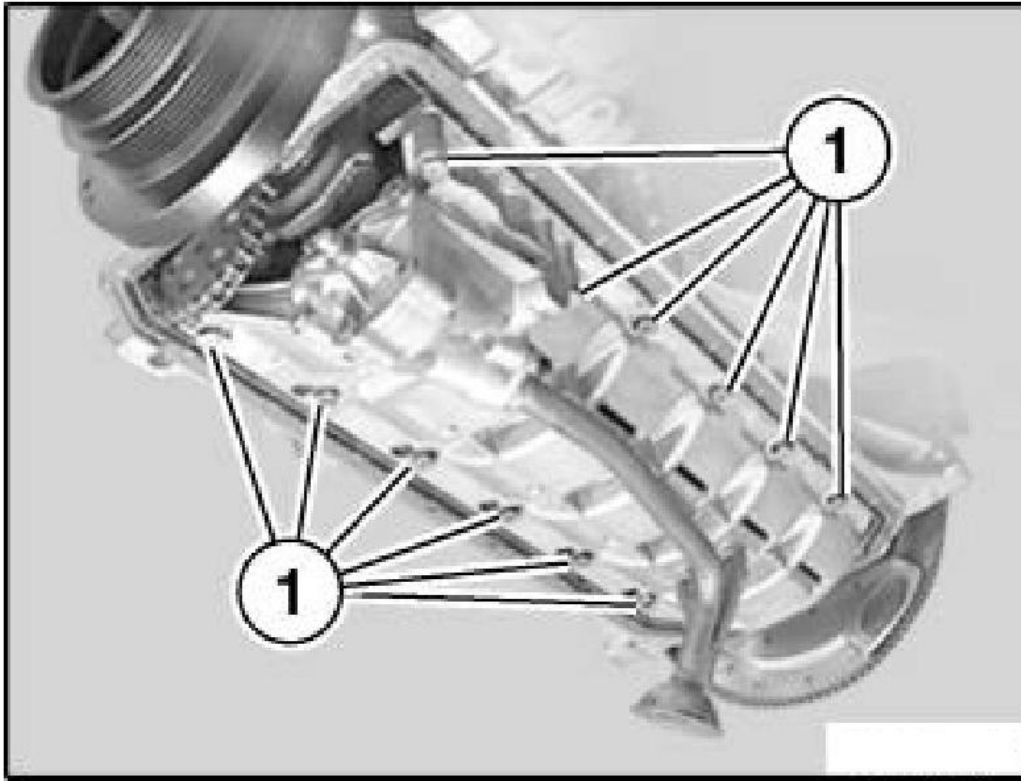
Installation:

Align splines of chain wheel and oil pump shaft to each other.

Version 1

Oil pump integrated in oil scraper:

Release screws (1), remove oil pump with oil scraper.



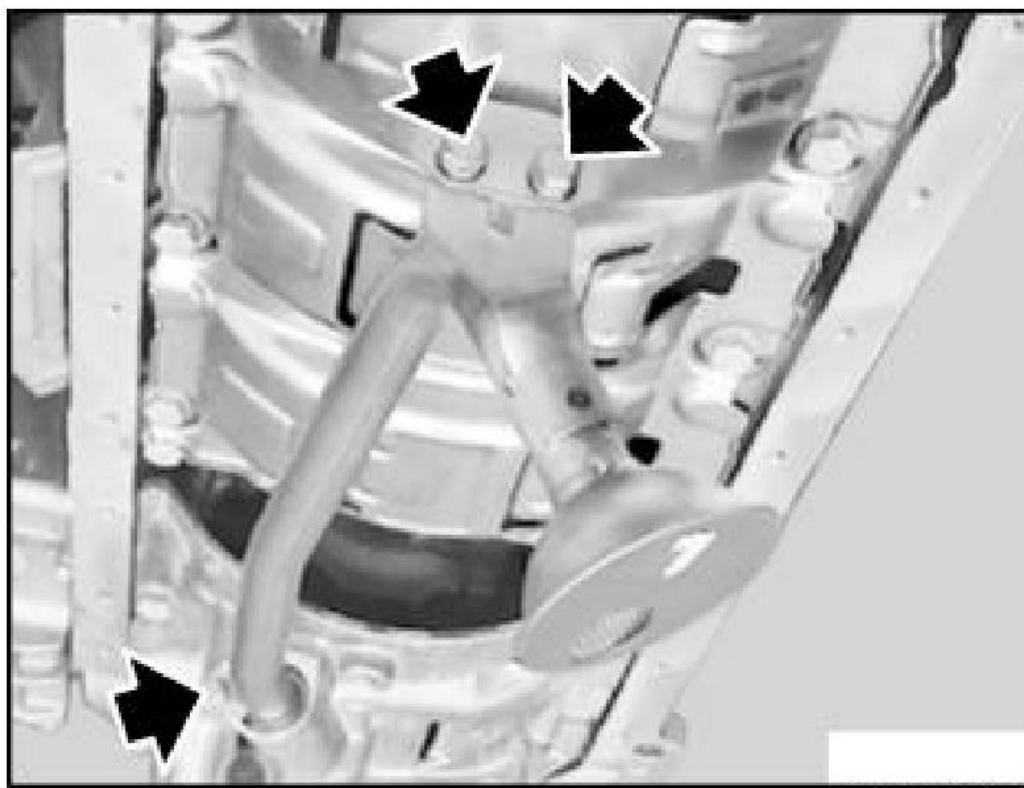
G03310476

Fig. 363: Removing Oil Pump
Courtesy of BMW OF NORTH AMERICA, INC.

Version 2

Oil pump and oil scraper - two parts:

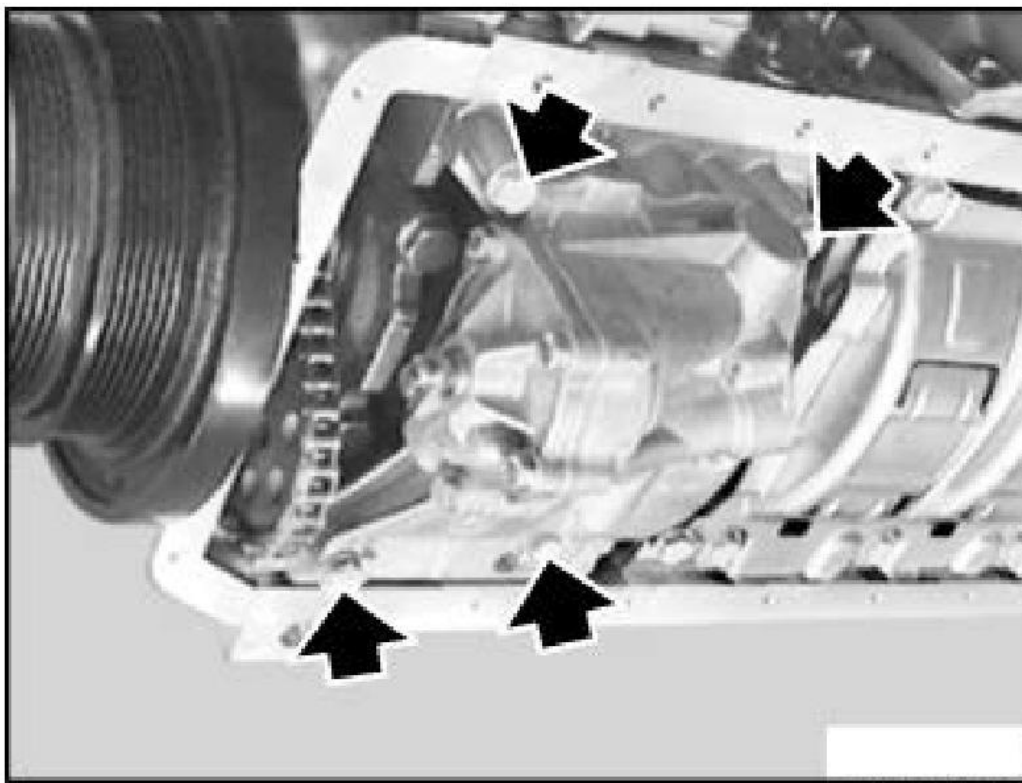
Release screws and remove oil pump intake pipe.



G03310477

Fig. 364: Removing Oil Pump Intake Pipe
Courtesy of BMW OF NORTH AMERICA, INC.

Release screws and remove oil pump.

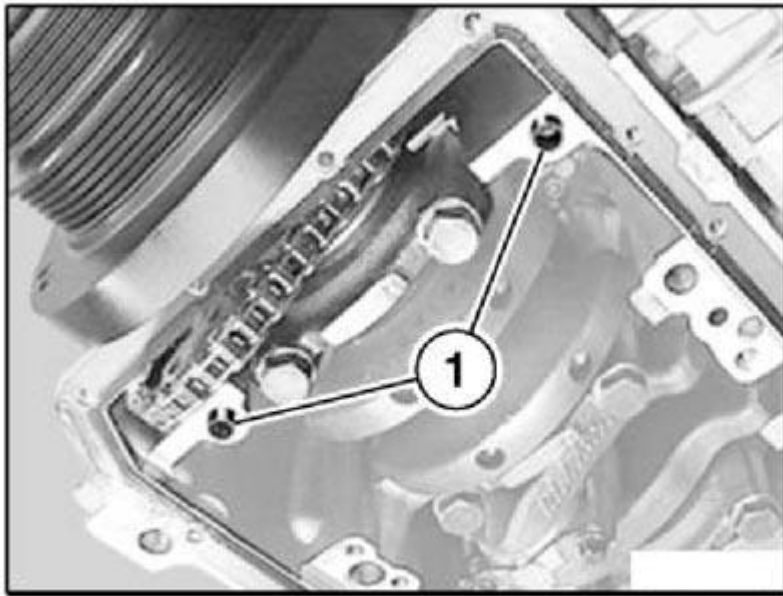


G03310478

Fig. 365: Removing Oil Pump
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

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



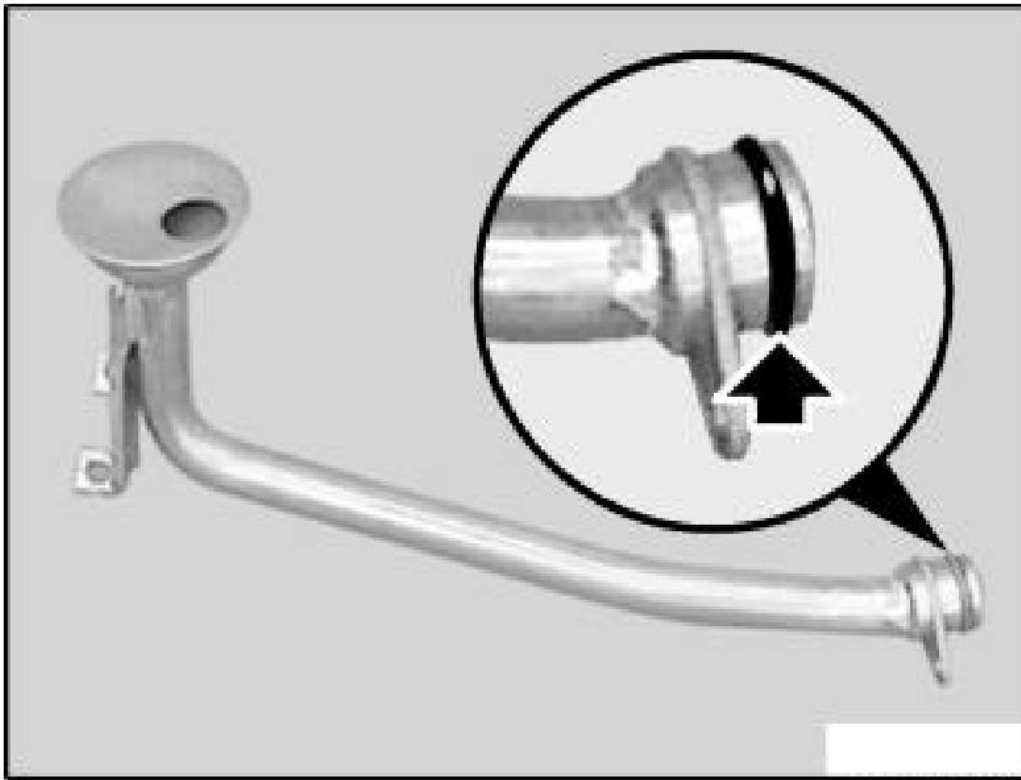
G03310479

Fig. 366: Checking Dowel Sleeves

Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Replace O -ring on intake pipe.



G03310480

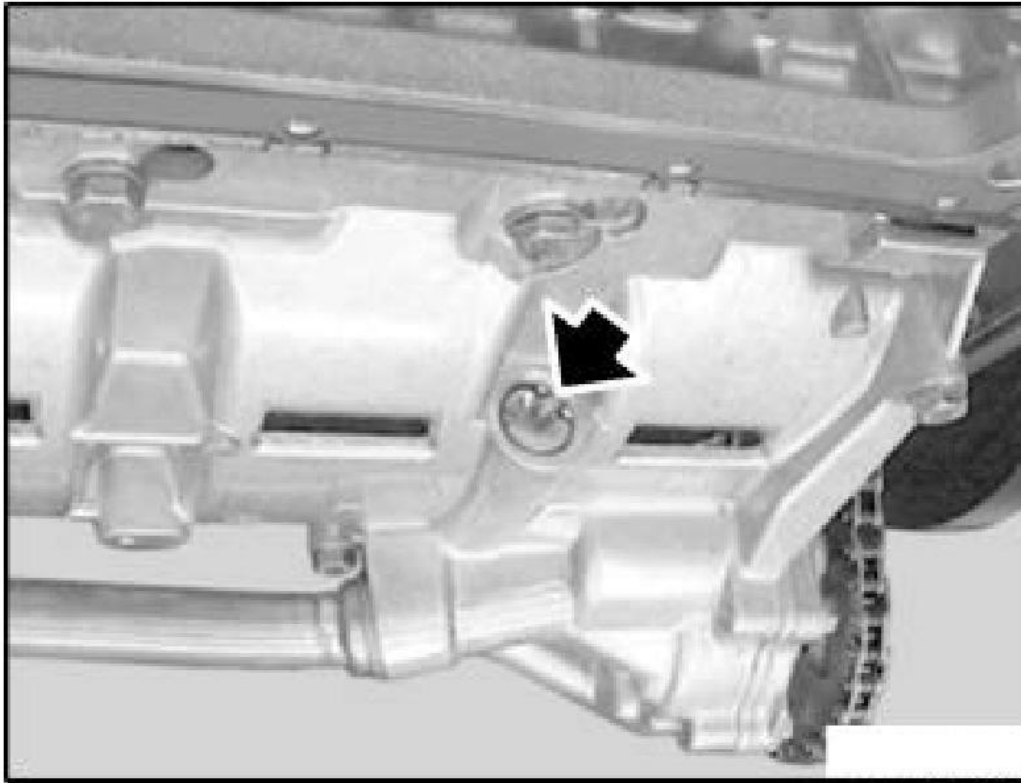
Fig. 367: Identifying O -Ring On Intake Pipe
Courtesy of BMW OF NORTH AMERICA, INC.

If necessary, remove control piston.

Press sleeve downwards with suitable drift.

CAUTION: The sleeve for the control plunger is under spring pressure.

Remove circlip.



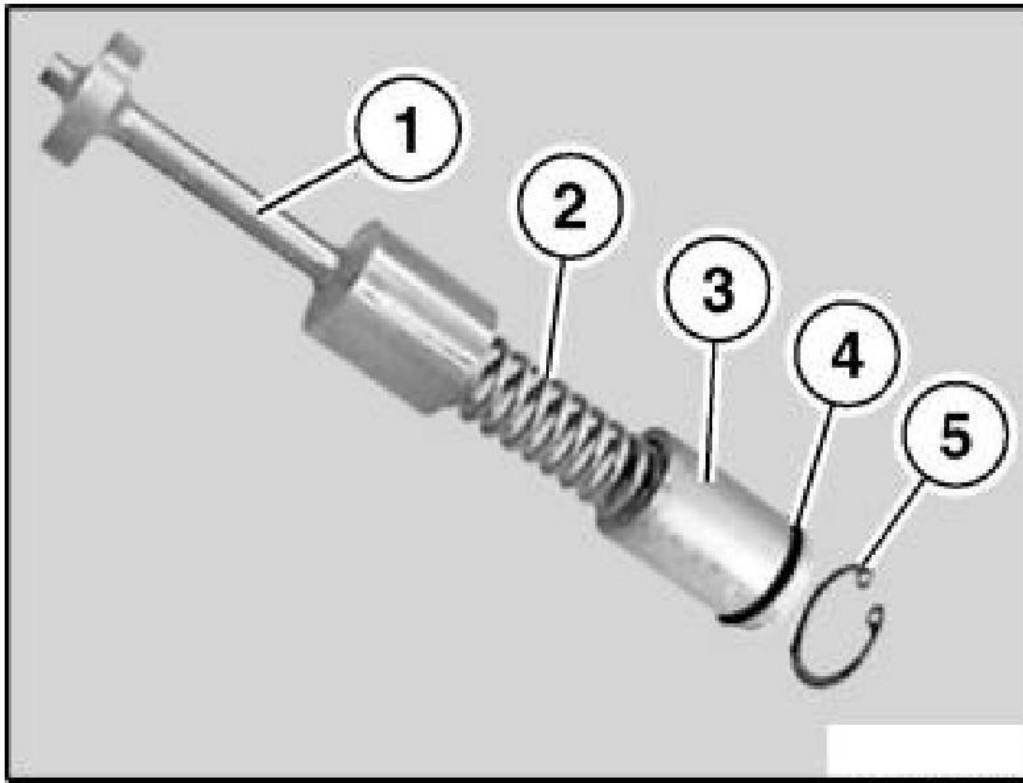
G03310481

Fig. 368: Removing Circlip

Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

1. Control plunger
2. Spring
3. Sleeve
4. O-ring (replace)
5. Circlip



G03310482

Fig. 369: Identifying Control Plunger Components
Courtesy of BMW OF NORTH AMERICA, INC.

OIL FILTER AND LINES

11 42 020 REMOVING AND INSTALLING COMPLETE FULL-FLOW OIL FILTER (M52 / S52 / M52TU / M54 / M56)

Remove intake air housing with air-mass flow sensor.

Unfasten oil filter cover to allow oil to flow out of main flow oil filter housing and back into oil pan.

This operation is described in the section BMW engine oil service. Refer to **00 00 250 BMW ENGINE OIL SERVICE INCL. SUPPLEMENTARY SERVICE (M54 / M56)**.

Remove alternator. Refer to **12 31 020 REMOVING AND INSTALLING OR REPLACING ALTERNATOR (M54)**.

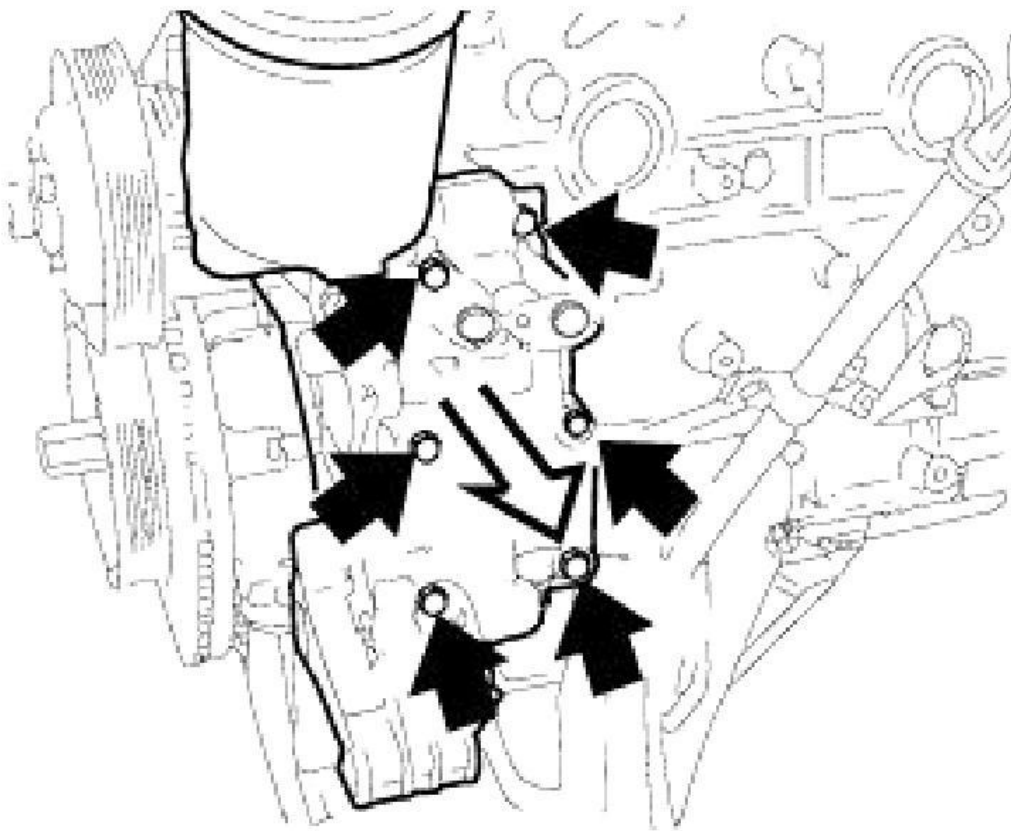
If necessary, empty supply tank for power steering.

If necessary, remove supply tank (lines remain connected).

If necessary, remove vane pump for power steering (lines remain connected).

If necessary, remove alternator drive belt tensioner.

Remove connector for oil pressure switch.



G03310483

Fig. 370: Removing Oil Filter

Courtesy of BMW OF NORTH AMERICA, INC.

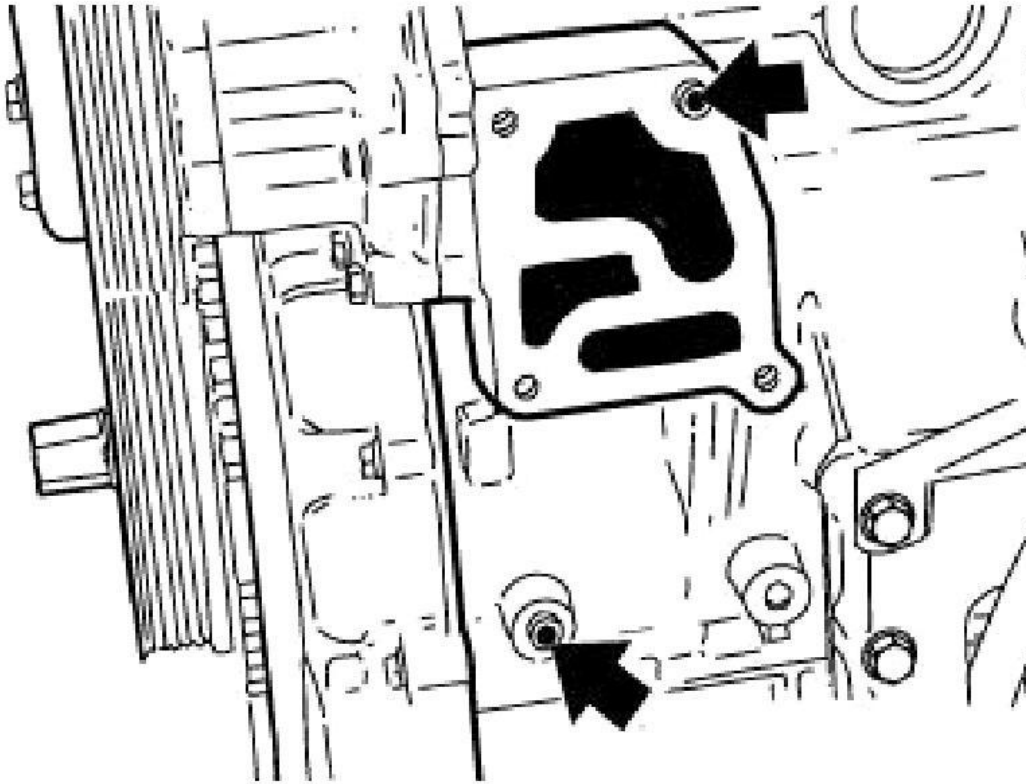
If necessary, disconnect plug for oil temperature switch.

Disconnect oil pressure line for VANOS adjustment unit from oil filter housing.

Unfasten screws and remove complete full-flow oil filter.

Installation:

Check dowel sleeves for damage and correct installation position.



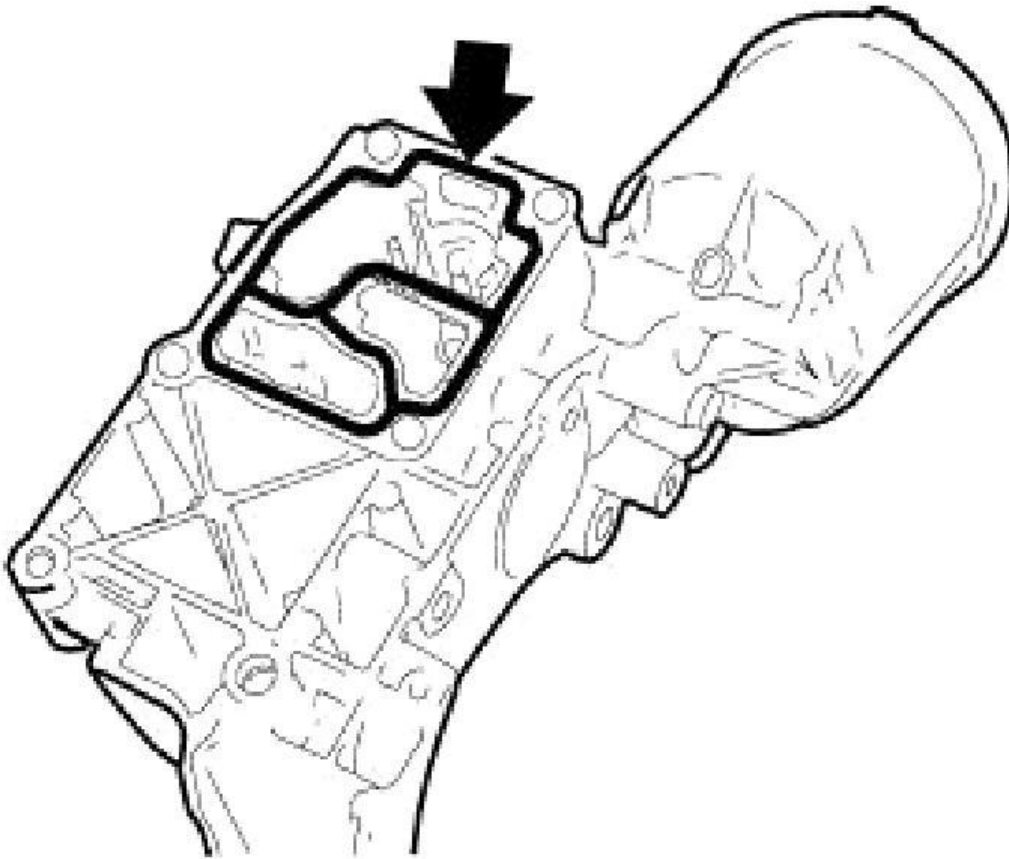
G03310484

Fig. 371: Checking Dowel Sleeves

Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Replace seal.



G03310485

Fig. 372: Replacing Seal

Courtesy of BMW OF NORTH AMERICA, INC.

Top up engine oil.

OIL FILLING, DIPSTICK

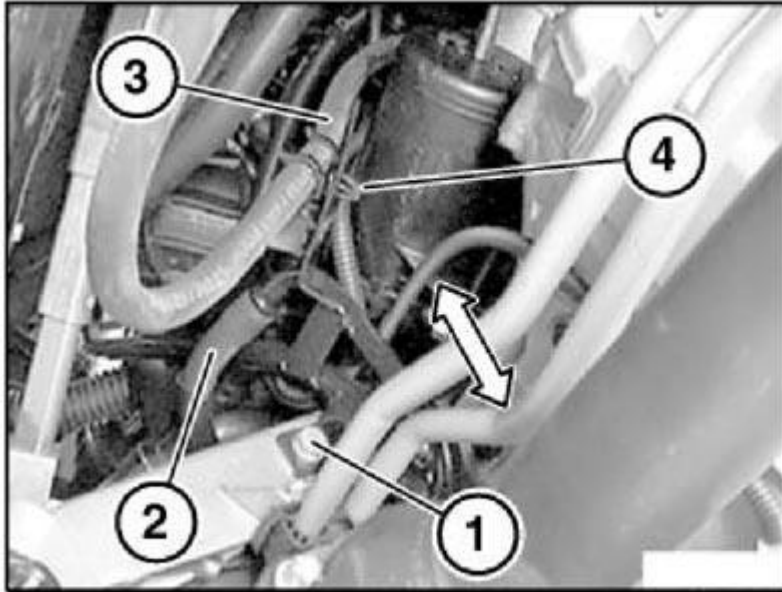
11 43 000 REMOVING AND INSTALLING/REPLACING OIL DIPSTICK (M54/56)

Necessary preliminary tasks:

- Remove air cleaner housing. Refer to **13 71 000 REMOVING AND INSTALLING INTAKE FILTER HOUSING (M54)** .
- Remove intake hose.
- Remove left firewall panel.

- Drain engine oil. Refer to **00 00 250 BMW ENGINE OIL SERVICE (M54/56)**.

Unscrew bolt (1).



G03310486

Fig. 373: Removing Oil Dipstick Guide Tube
Courtesy of BMW OF NORTH AMERICA, INC.

Detach hose (2) from oil dipstick guide tube.

Unclip fuel line (3).

Unclip retaining clip (4).

Remove oil dipstick guide tube in direction of arrow.

Installation:

Replace O-ring.

Assemble engine.

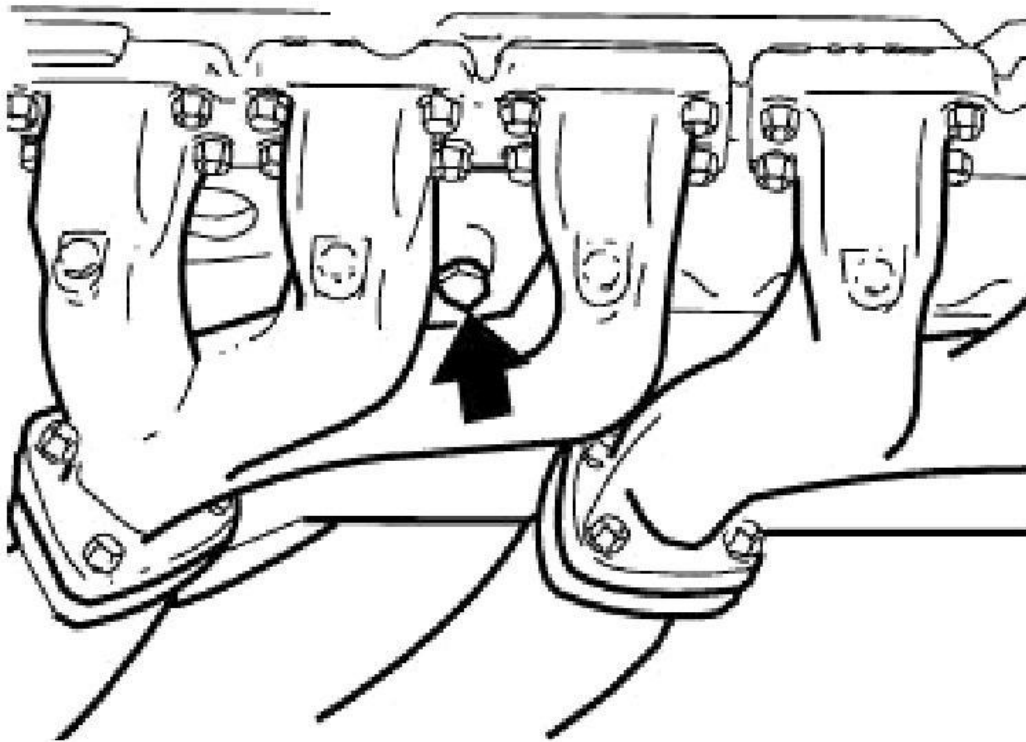
Check engine for leaks.

WATER PUMP WITH DRIVE

11 51 000 REMOVING AND INSTALLING COMPLETE WATER PUMP (M52 / S52 / M52TU / M54 / M56)

Remove alternator drive belt. Refer to **11 28 010 REPLACING ALTERNATOR DRIVE BELT (M52 / S52 / M52TU / M54 / M56)**.

NOTE: *M52 / S52*
Water drain plug is located on exhaust side between cylinders 4 and 5 in engine block (illustration).
M52TU / M54 / M56
Water drain plug is located on exhaust side on cylinder 2 in engine block.



G03310487

Fig. 374: Locating Water Drain Plug
Courtesy of BMW OF NORTH AMERICA, INC.

Drain and dispose of coolant.

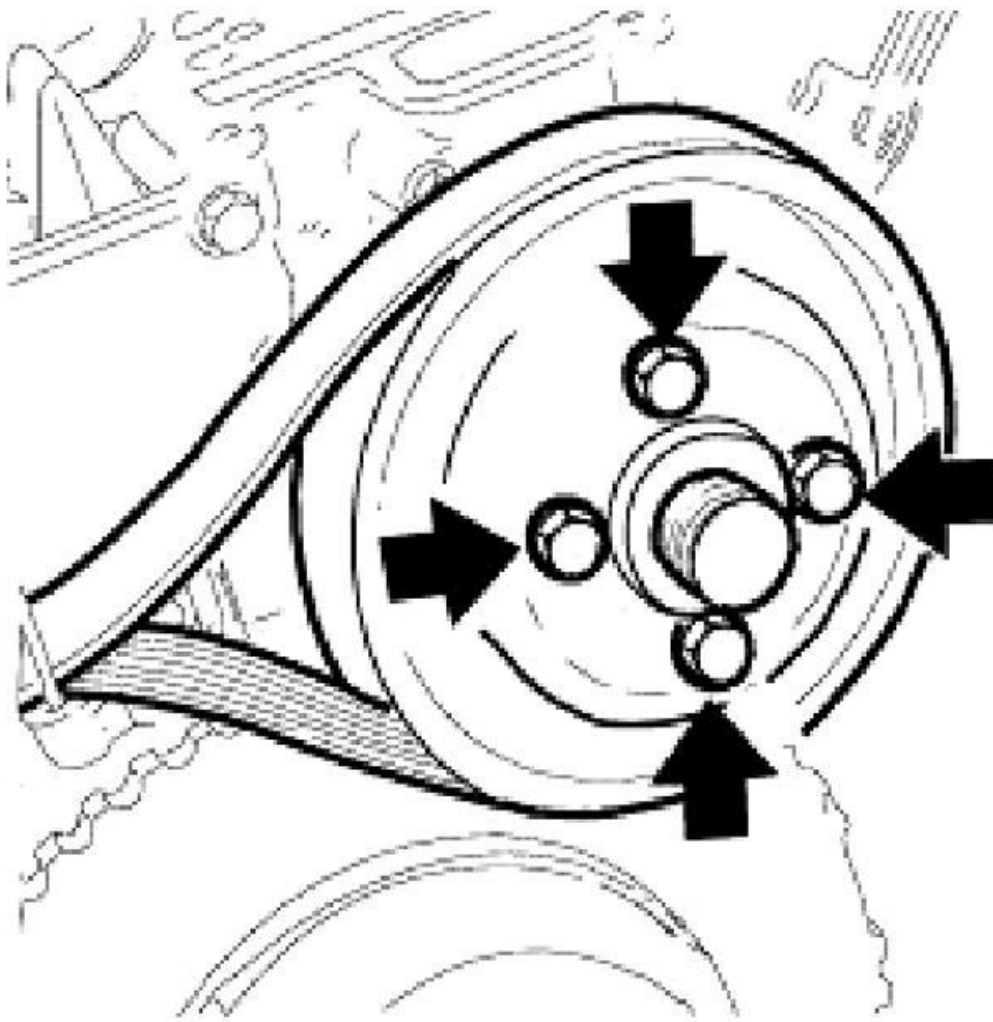
Installation:

Replace seal.

Tightening torque 11 11 5AZ. Refer to **ENGINE - TIGHTENING TORQUES** .

Vent cooling system and check for leaks.

Release belt pulley.

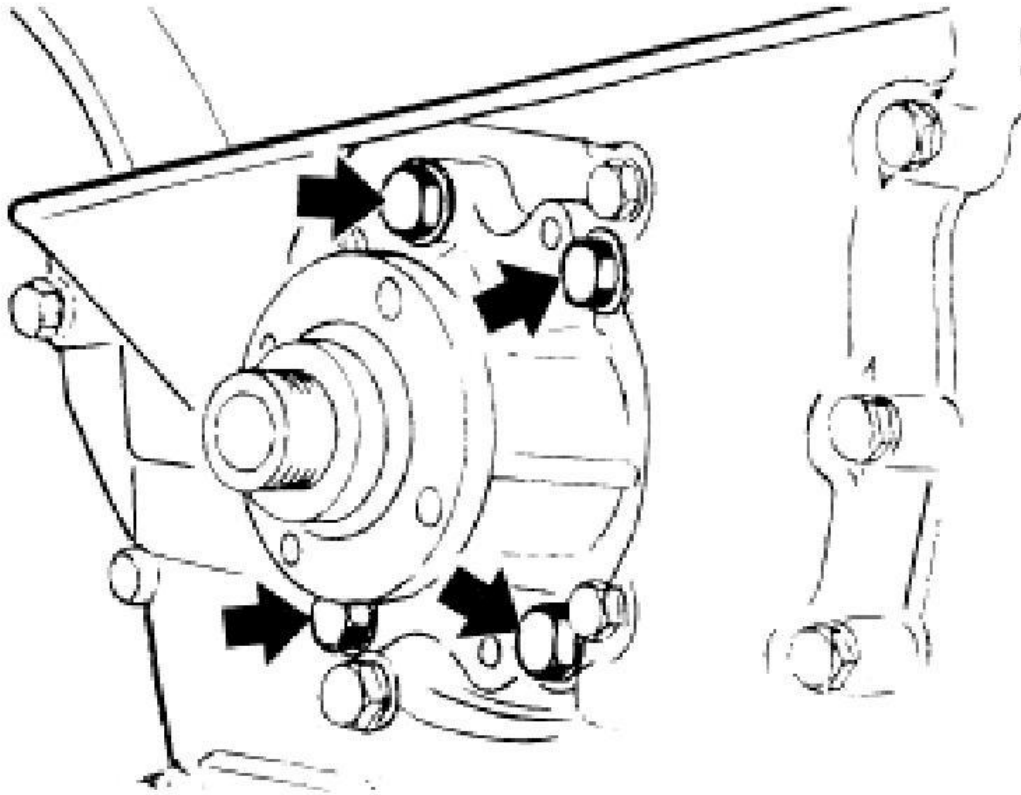


G03310488

Fig. 375: Releasing Belt Pulley

Courtesy of BMW OF NORTH AMERICA, INC.

Release water pump.

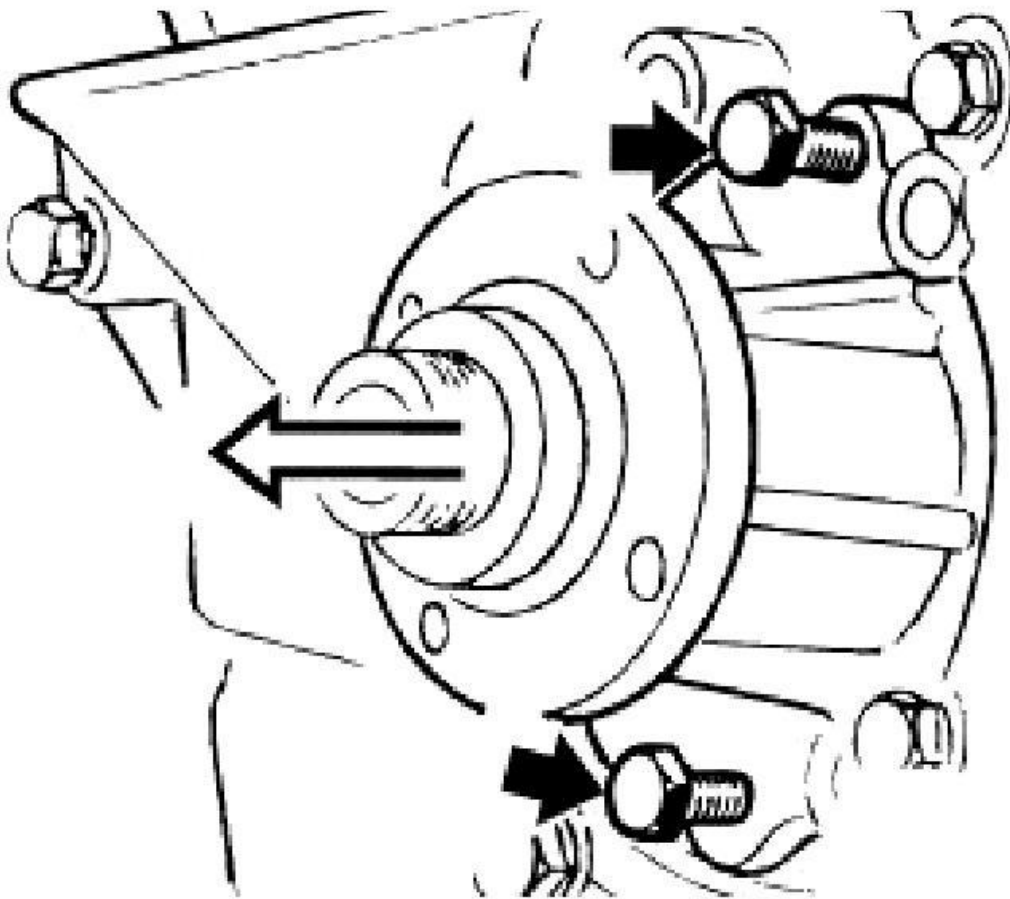


G03310489

Fig. 376: Releasing Water Pump

Courtesy of BMW OF NORTH AMERICA, INC.

Tighten two screws (M 6) into thread of water pump and water pump out of timing case.

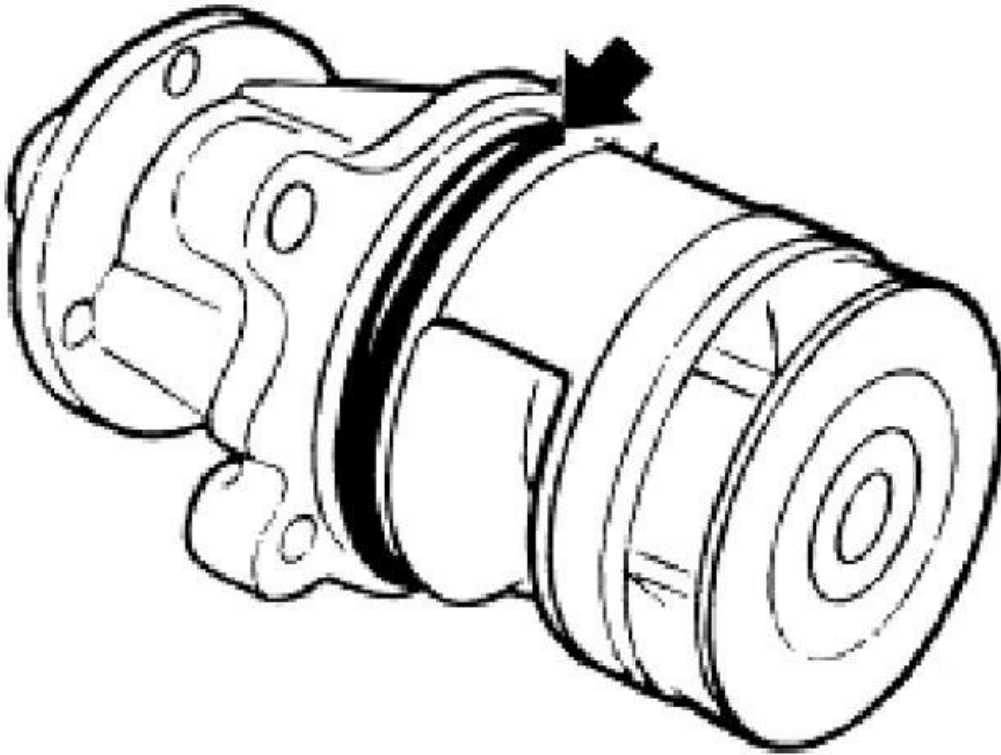


G03310490

Fig. 377: Tightening Two Screws Into Thread Of Water Pump
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Replace O -ring and coat with coolant as anti-friction agent.



G03310491

Fig. 378: Locating O -Ring

Courtesy of BMW OF NORTH AMERICA, INC.

THERMOSTAT AND CONNECTIONS

11 53 000 REMOVING AND INSTALLING/REPLACING COOLANT THERMOSTAT (M52TU / M54 / M56)

Remove fan clutch with fan impeller and fan cowl.

Drain and dispose of coolant.

NOTE: The water drain plug is located on the exhaust side on cylinder 2 in the engine block.

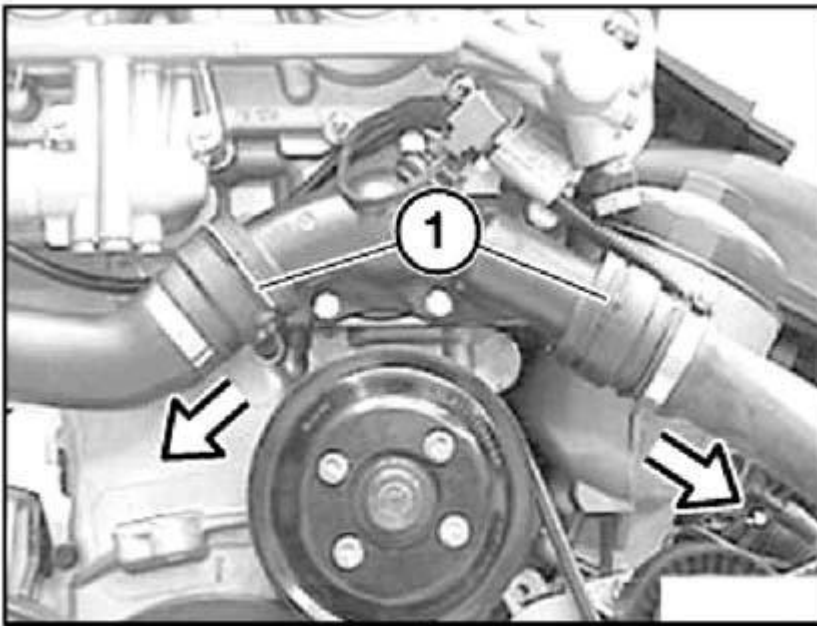
Installation:

Replacing sealing ring on water drain plug.

Tightening torque 11 11 5AZ. Refer to **ENGINE - TIGHTENING TORQUES** .

Vent cooling system and check for leaks.

Pull locks and disconnect water hoses.



G03310492

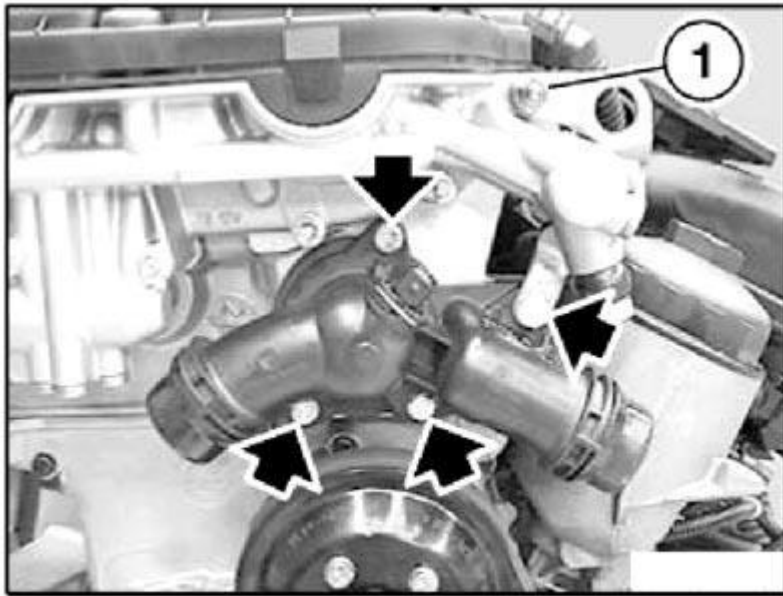
Fig. 379: Disconnecting Water Hoses
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Refer to **17 00 ... INSTRUCTIONS FOR WORKING ON COOLING SYSTEM** .

Loosen nut (1).

Release screws on thermostat housing, remove thermostat housing.

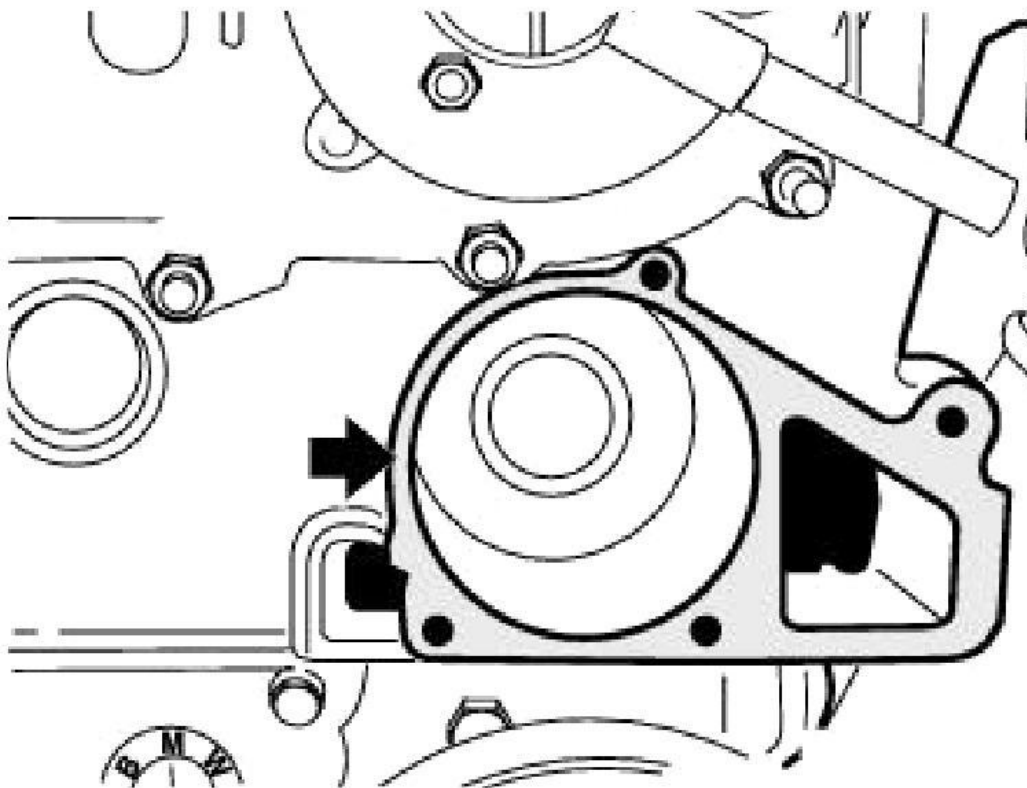


G03310493

Fig. 380: Removing Thermostat Housing
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Keep sealing faces clean and free of oil.



G03310494

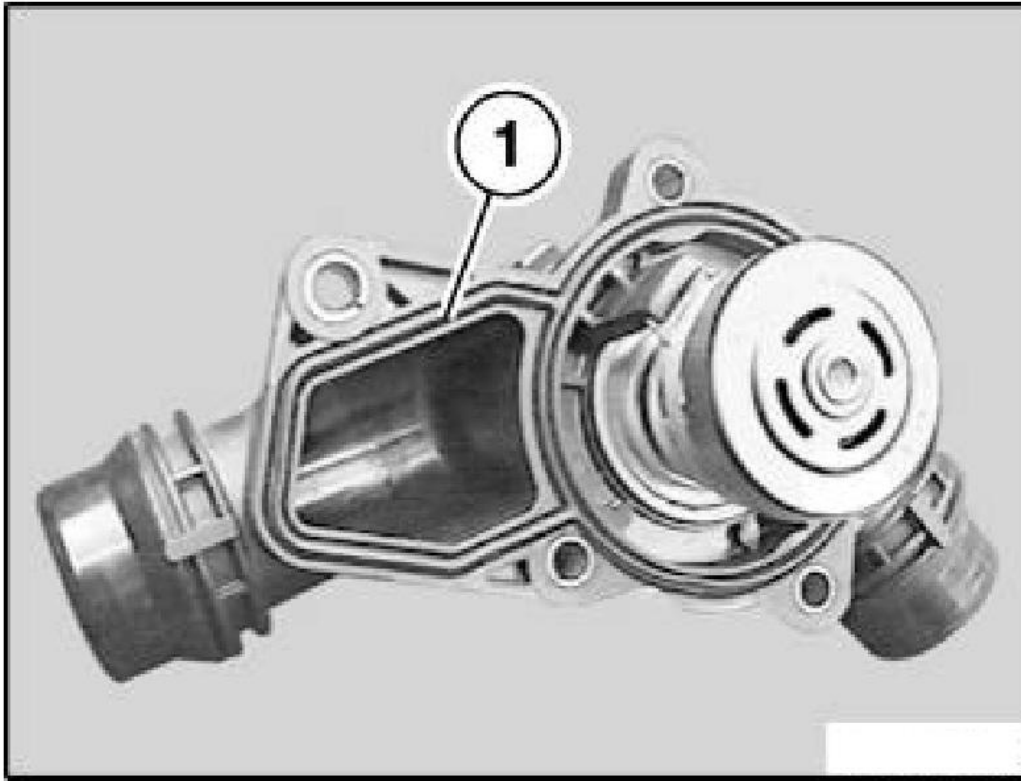
Fig. 381: Identifying Sealing Faces

Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: Coolant thermostat is integrated in coolant thermostat housing and can only be replaced as a single unit.

Installation:

Replace seal (1).



G03310495

Fig. 382: Replacing Seal

Courtesy of BMW OF NORTH AMERICA, INC.

INTAKE MANIFOLD

11 61 050 REMOVING AND INSTALLING INTAKE AIR MANIFOLD (M54)

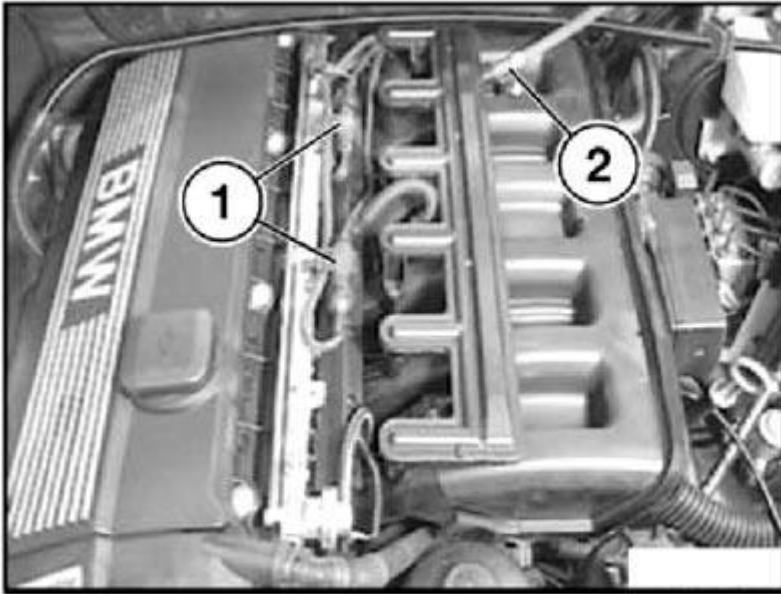
Instructions for disconnecting and connecting battery. Refer to **12 00... INSTRUCTIONS FOR DISCONNECTING AND CONNECTING BATTERY**.

Disconnect negative battery lead.

Remove engine cover.

CAUTION: Do not mix up oxygen monitor sensors for cylinders 1 to 3 and 4 to 6 at plug connection to wiring harness. Mark plug connections.

Unclip plug connections (1) from holders.



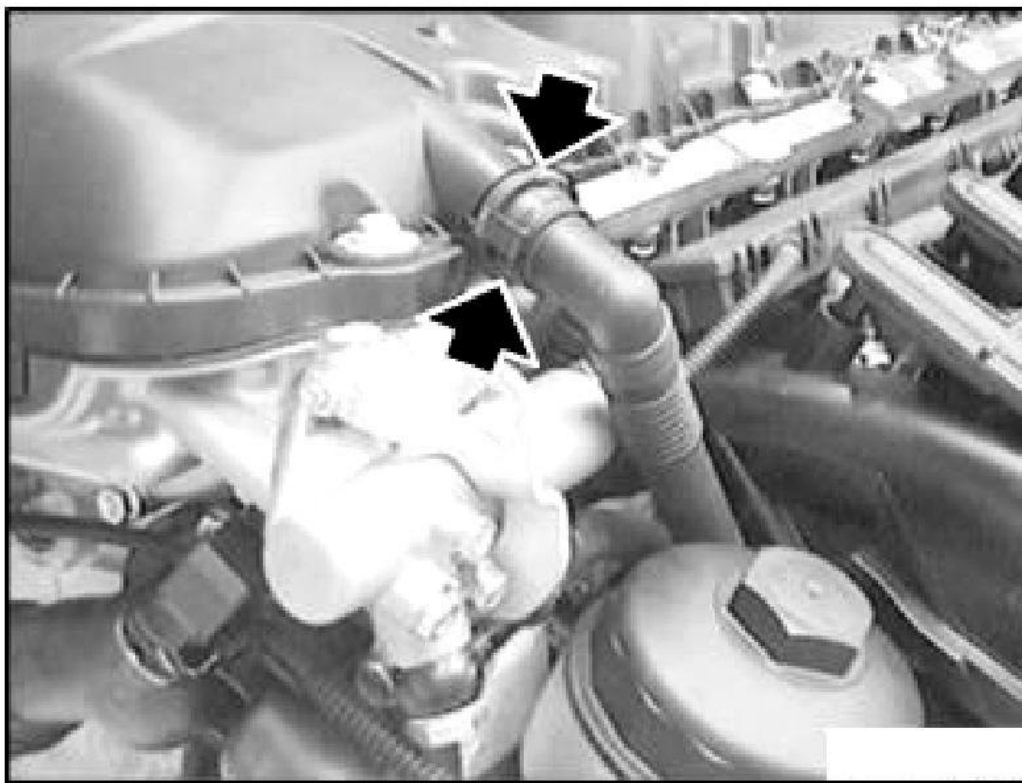
G03310496

Fig. 383: Unclipping Plug Connections From Holders
Courtesy of BMW OF NORTH AMERICA, INC.

Detach battery positive lead from intake air manifold.

Detach retainer (2) from battery positive lead.

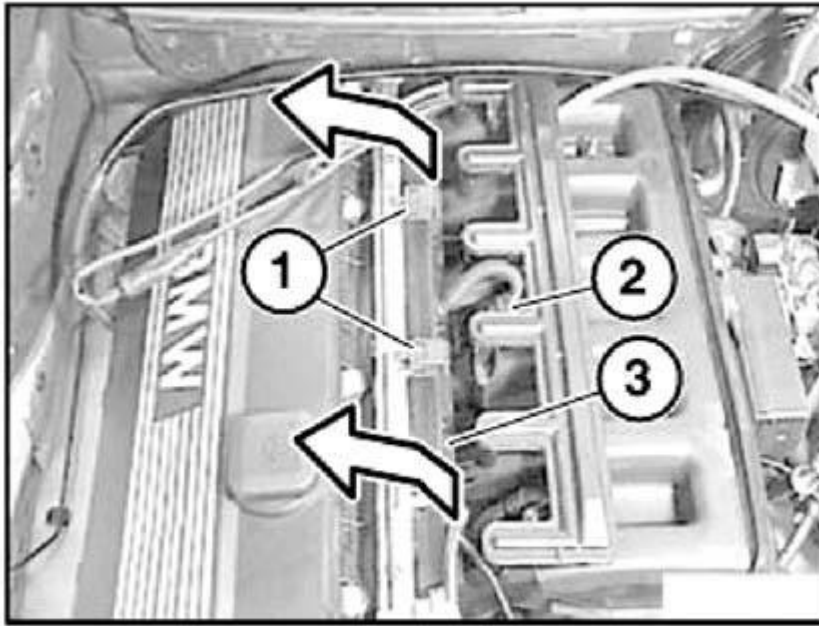
Press lock and detach vent hose from cylinder head cover.



G03310499

Fig. 384: Detaching Vent Hose From Cylinder Head Cover
Courtesy of BMW OF NORTH AMERICA, INC.

Pull off retainer (1).



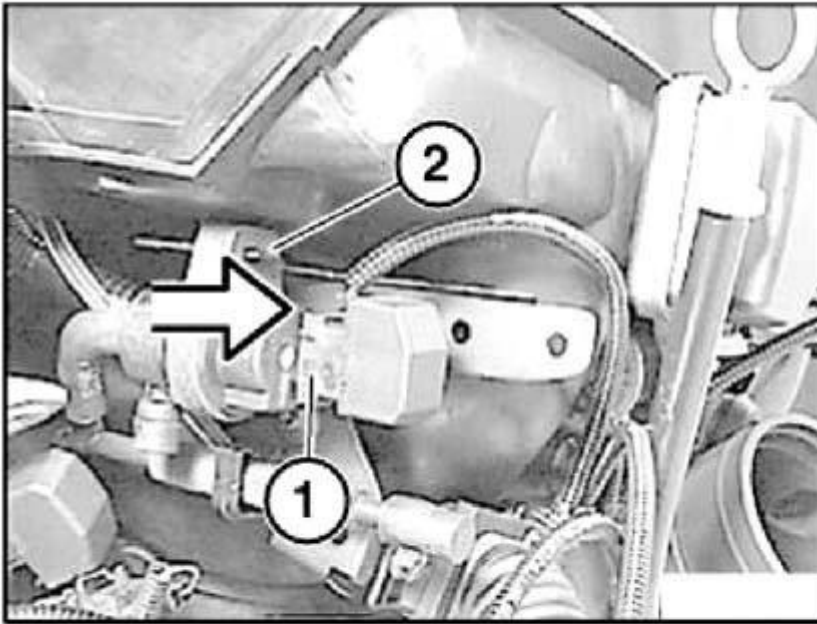
G03310500

Fig. 385: Disconnecting Plug Connection For Intake Air Temperature Sensor
Courtesy of BMW OF NORTH AMERICA, INC.

Disconnect plug connection (2) for intake air temperature sensor.

Detach terminal strip (3) from fuel injectors and place to one side.

Disconnect plug connection (1) on tank venting valve.



G03310501

Fig. 386: Disconnecting Plug Connection On Tank Venting Valve
Courtesy of BMW OF NORTH AMERICA, INC.

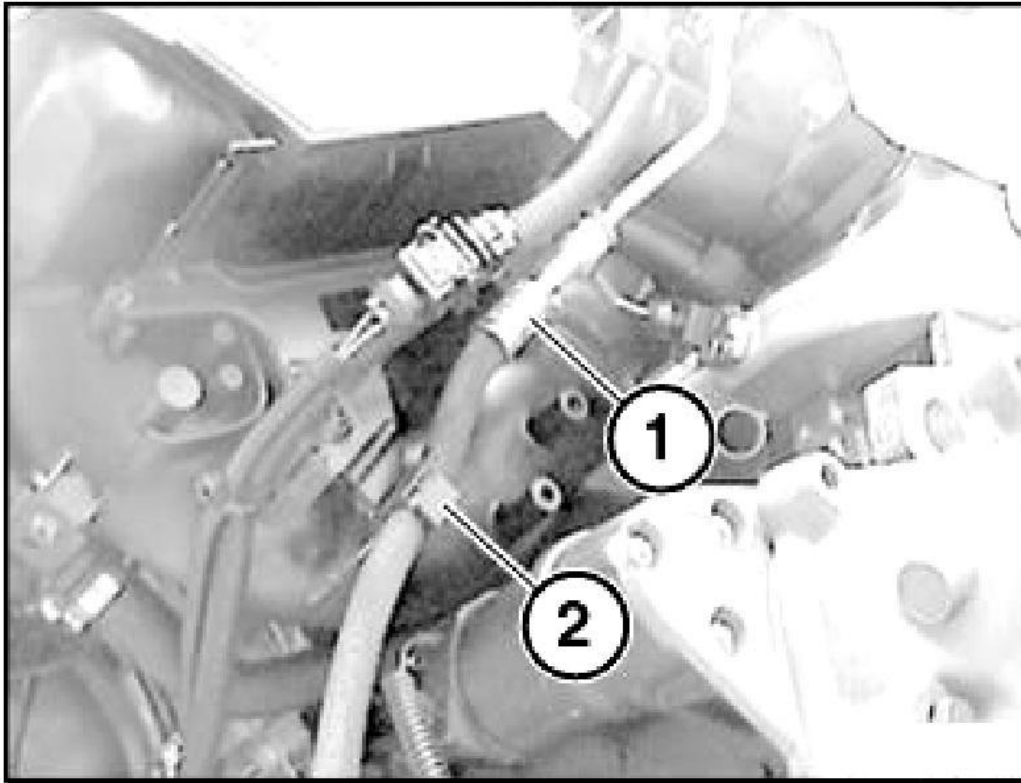
Remove tank venting valve from retainer (2) on manifold.

NOTE: For a better overview, this work step is shown on an engine that has been removed.

CAUTION: Catch and dispose of fuel as it escapes.

Instructions for removing and installing fuel hoses. Refer to **13 53 540 REPLACING, SEALING FUEL HOSES** .

Unclip fuel line (1) from holder (2).



G03310502

Fig. 387: Unclipping Fuel Line From Holder
Courtesy of BMW OF NORTH AMERICA, INC.

Unlock fuel line (1).

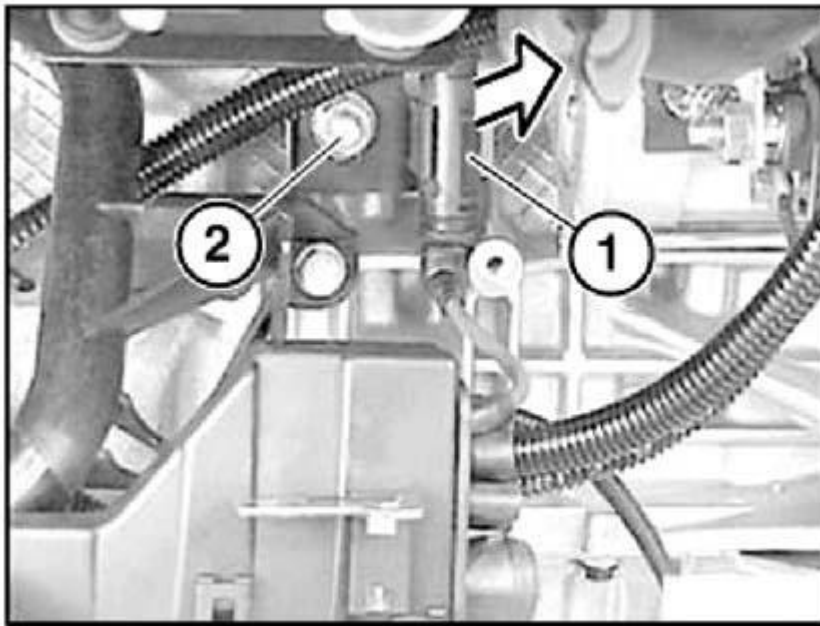
Loosen guide tube for dipstick.

Press lock and detach return line from guide tube for oil dipstick.

Remove throttle assembly. Refer to **13 54 030 REMOVING AND INSTALLING/SEALING THROTTLE ASSEMBLY (M54)** .

Disconnect plug connections and lay cable duct to one side.

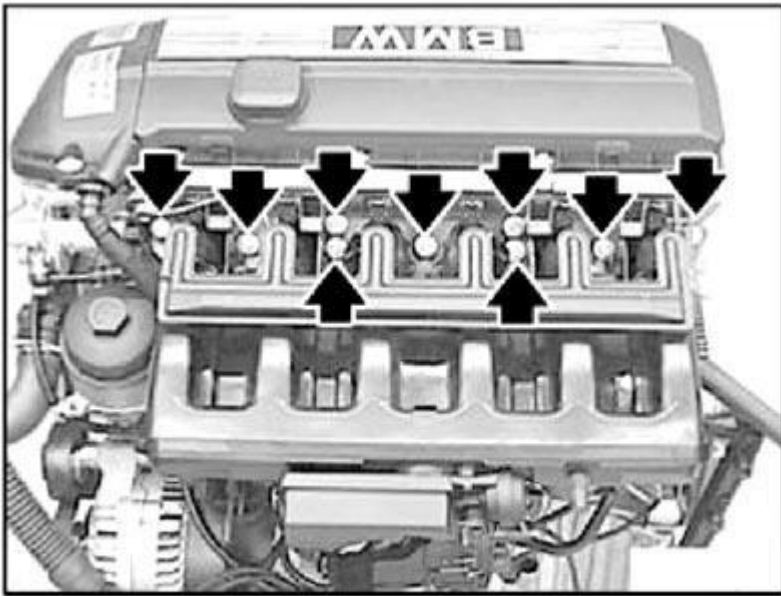
Unclip plug connection (1) for knock sensors from holder. Release nut (2) on manifold support.



G03310503

Fig. 388: Unclipping Plug Connection For Knock Sensors
Courtesy of BMW OF NORTH AMERICA, INC.

Release nuts on manifold.



G03310504

Fig. 389: Removing Intake Air Manifold

Courtesy of BMW OF NORTH AMERICA, INC.

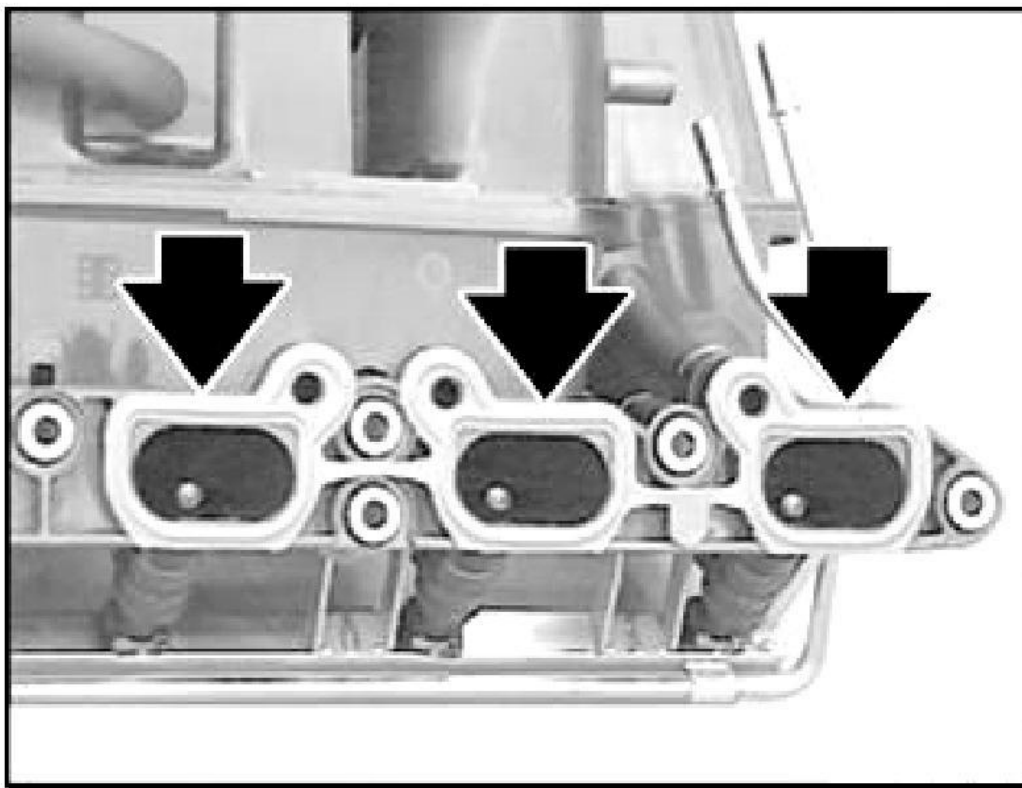
NOTE: Engines with air injection:

Detach vacuum line on reverse side of intake air manifold.

Remove intake air manifold.

Installation:

Check gaskets on all cylinders and replace if necessary.



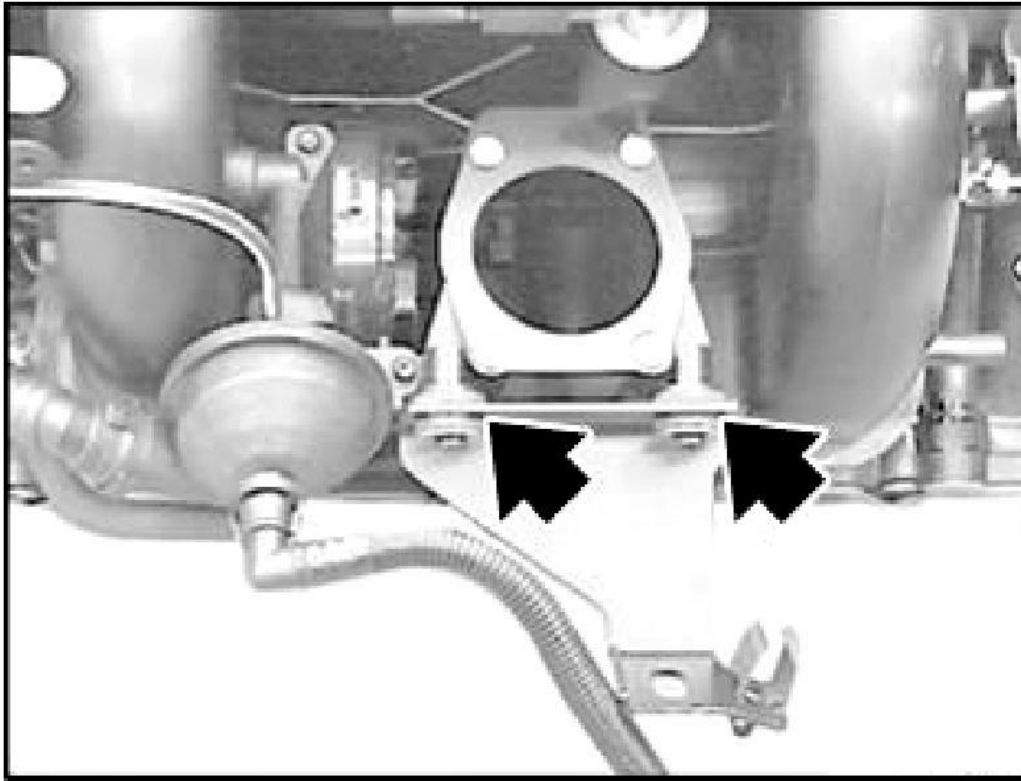
G03310505

Fig. 390: Checking Gaskets

Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Check rubber dampers and if necessary replace together with manifold support.



G03310506

Fig. 391: Checking Rubber Dampers
Courtesy of BMW OF NORTH AMERICA, INC.

EXHAUST MANIFOLD

11 62 140 REMOVING AND INSTALLING/REPLACING BOTH EXHAUST MANIFOLDS WITH CATALYTIC CONVERTER (M54 X3)

Necessary preliminary tasks:

- Remove microfilter compartment. Refer to **51 71 080 REMOVING AND INSTALLING/REPLACING HEATER BULKHEAD** .
- Secure engine in installation position. Refer to **SECURING ENGINE WITH SPECIAL TOOL IN INSTALLATION POSITION (M54)**.
- Remove exhaust system. Refer to **18 00 020 REMOVING AND INSTALLING COMPLETE EXHAUST SYSTEM (M54)** .
- Remove oxygen sensors. Refer to **11 78 511 REPLACING OXYGEN CONTROL SENSOR (CYLINDERS 1-3)**, **11 78 512 REPLACING OXYGEN CONTROL SENSOR (CYLINDERS 4-6)**,

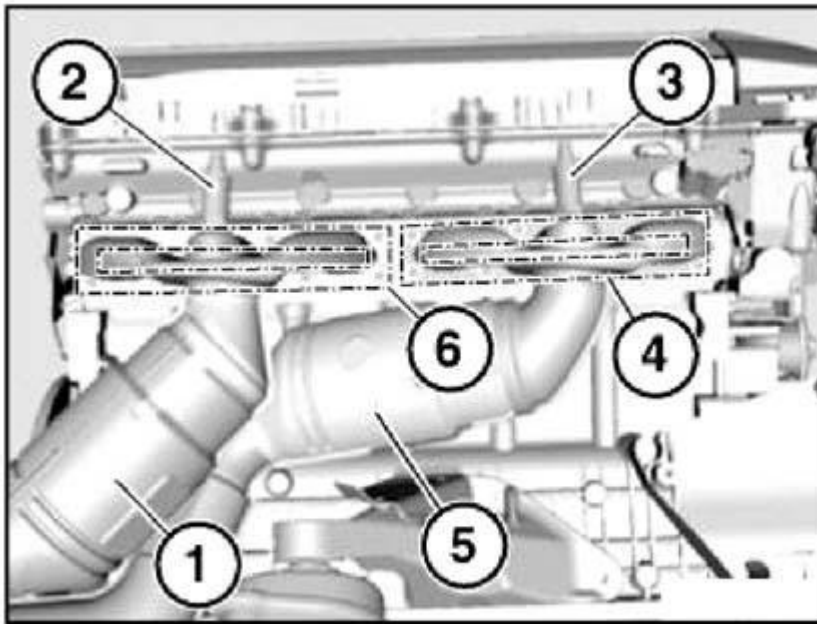
11 78 611 REPLACING OXYGEN MONITOR SENSOR (CYLINDERS 1-3) and 11 78 612 REPLACING OXYGEN MONITOR SENSOR (CYLINDERS 4-6).

- Lower front axle. Refer to **FRONT AXLE CARRIER** .

NOTE: It is not necessary to perform a wheel alignment on the front axle when the front axle is lowered.

Cylinders 1 -3:

Release nut along line (4).



G03310507

Fig. 392: Removing Exhaust Manifolds
Courtesy of BMW OF NORTH AMERICA, INC.

Feed out exhaust manifold (5) downwards.

Tightening torque: 11 6 21AZ. Refer to **ENGINE - TIGHTENING TORQUES** .

Cylinders 4 -6:

Remove oxygen sensor (2).

Release nut along line (6).

Feed out exhaust manifold (1) downwards.

Tightening torque: 11 62 1AZ. Refer to **ENGINE - TIGHTENING TORQUES** .

Check exhaust system for leaks.

Check function of DME.

18 40 050 REMOVING AND INSTALLING/REPLACING FRONT EXHAUST MANIFOLD (M54)

Necessary preliminary tasks:

- Secure engine in installation position, refer to **SECURING ENGINE WITH SPECIAL TOOL IN INSTALLATION POSITION (M54)**.
- Remove reinforcement plate
- Remove complete exhaust system, refer to **18 00 020 REMOVING AND INSTALLING COMPLETE EXHAUST SYSTEM (M54)** .
- Detach grounding cable from body.
- Remove right engine support arm with engine mount, refer to **22 11 100 REPLACING RIGHT ENGINE SUPPORT ARM**
- Remove air pump

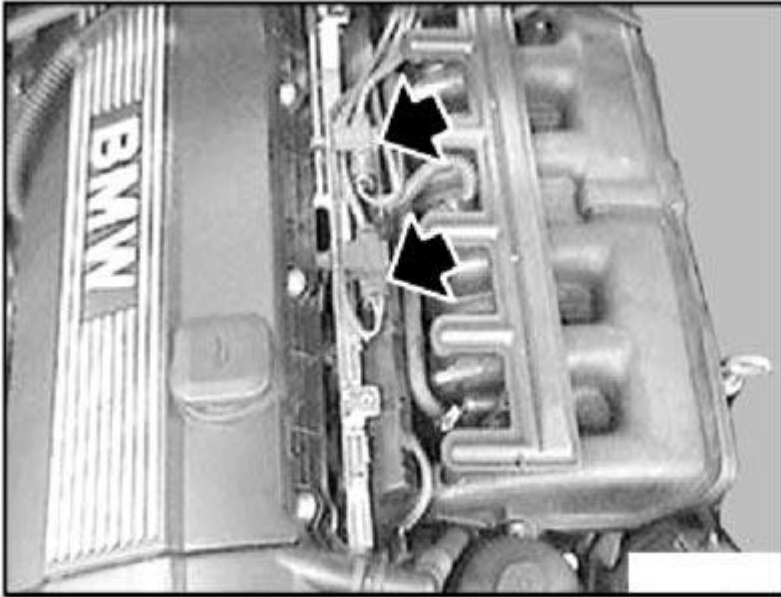
NOTE: **The oxygen sensors are in danger of being damaged when the exhaust manifolds are removed and installed.**

Remove front control sensor. Refer to **11 78 511 REPLACING OXYGEN CONTROL SENSOR (CYLINDERS 1-3)**.

Remove cover from fuel injectors.

NOTE: **Do not mix up monitor sensors for cylinders 1 to 3 and 4 to 6 at plug connection to wiring harness.**

Mark plug connections.



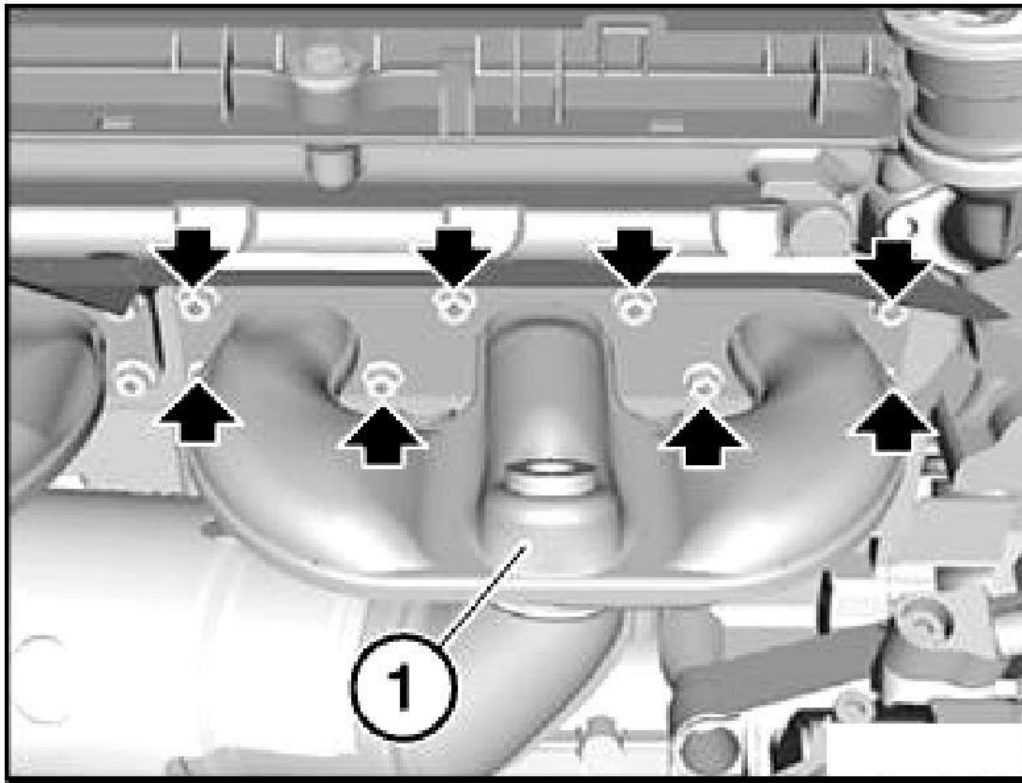
G03310508

Fig. 393: Locating Monitor Sensors**Courtesy of BMW OF NORTH AMERICA, INC.**

Unclip cable from holder. Disconnect plug connection. Unclip cable on rear side of engine from cable guide.

Remove monitor sensor from cylinders 1 to 3. Refer to **11 78 611 REPLACING OXYGEN MONITOR SENSOR (CYLINDERS 1-3)**.

Unscrew nuts.



G03310509

Fig. 394: Removing Exhaust Manifold
Courtesy of BMW OF NORTH AMERICA, INC.

Remove exhaust manifold (1).

Installation:

Clean sealing faces, replace gaskets.

Replace nuts.

Tightening torque 11 62 1AZ. Refer to **ENGINE - TIGHTENING TORQUES**.

18 40 060 REMOVING AND INSTALLING/REPLACING REAR EXHAUST MANIFOLD (M54)

Necessary preliminary tasks:

- Remove reinforcement plate

- Remove complete exhaust system, refer to **18 00 020 REMOVING AND INSTALLING COMPLETE EXHAUST SYSTEM (M54)**
- Remove air pump

NOTE: The oxygen sensors are in danger of being damaged when the exhaust manifolds are removed and installed.

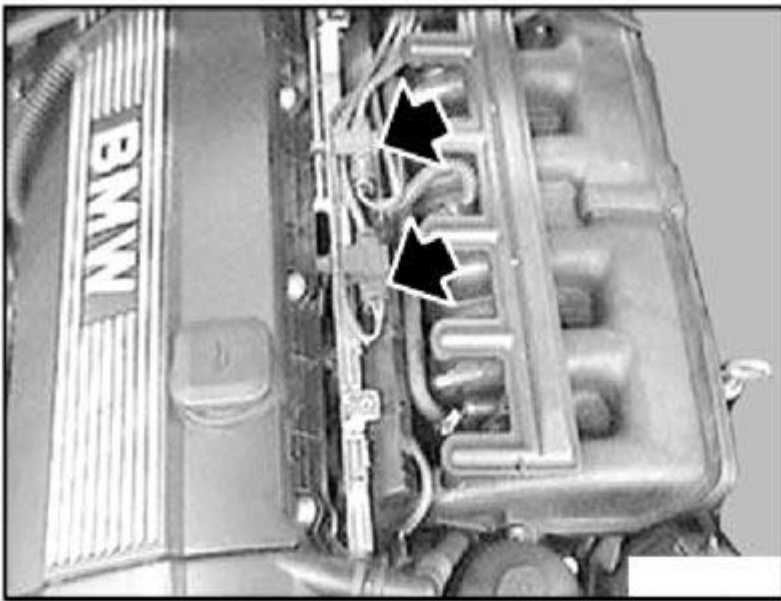
Remove rear control sensor. Refer to **11 78 512 REPLACING OXYGEN CONTROL SENSOR (CYLINDERS 4-6)**.

Remove cover from fuel injectors.

NOTE: Do not mix up monitor sensors for cylinders 1 to 3 and 4 to 6 at plug connection to wiring harness.

Mark plug connections.

Unclip cable from holder. Disconnect plug connection. Unclip cable on rear side of engine from cable guide.



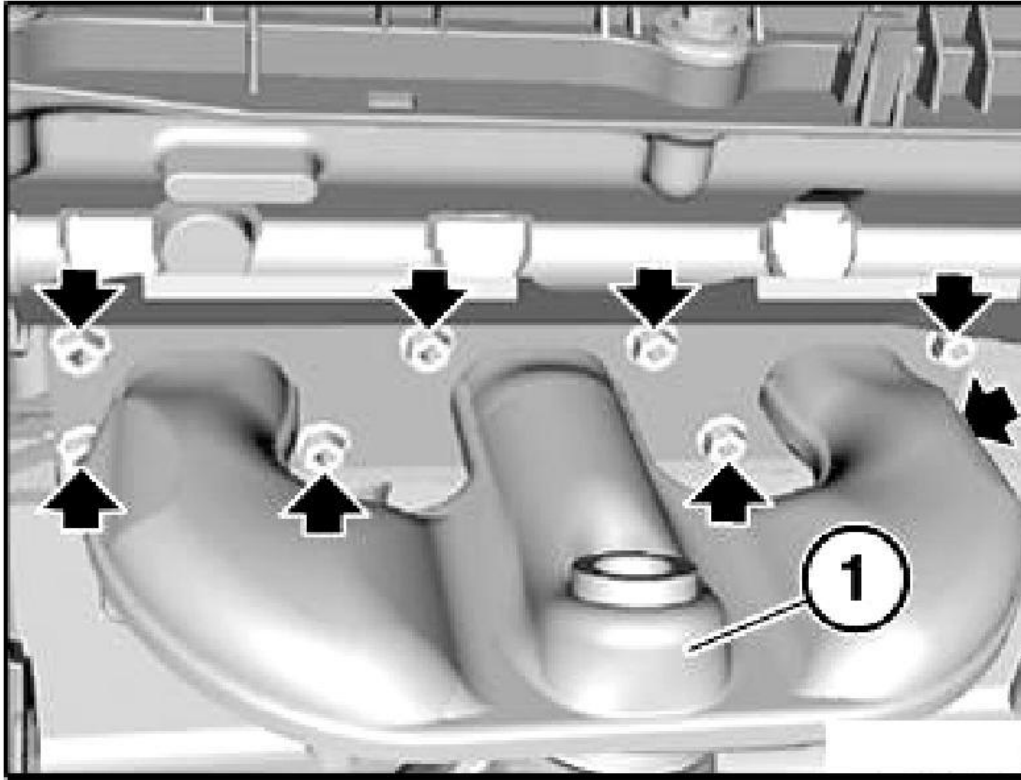
G03310510

Fig. 395: Locating Monitor Sensors

Courtesy of BMW OF NORTH AMERICA, INC.

Remove monitor sensor from cylinders 4 to 6. Refer to **11 78 612 REPLACING OXYGEN MONITOR SENSOR (CYLINDERS 4-6)**.

Unscrew nuts.



G03310511

Fig. 396: Removing Exhaust Manifold
Courtesy of BMW OF NORTH AMERICA, INC.

Remove exhaust manifold (1).

Installation:

Clean sealing faces, replace gaskets.

Replace nuts.

Tightening torque 11 62 1AZ. Refer to **ENGINE - TIGHTENING TORQUES** .

EMISSION CONTROL, OXYGEN SENSORS

11 78 510 REPLACING OXYGEN CONTROL SENSOR (M52TU / M54 / M56)

Special tools required:

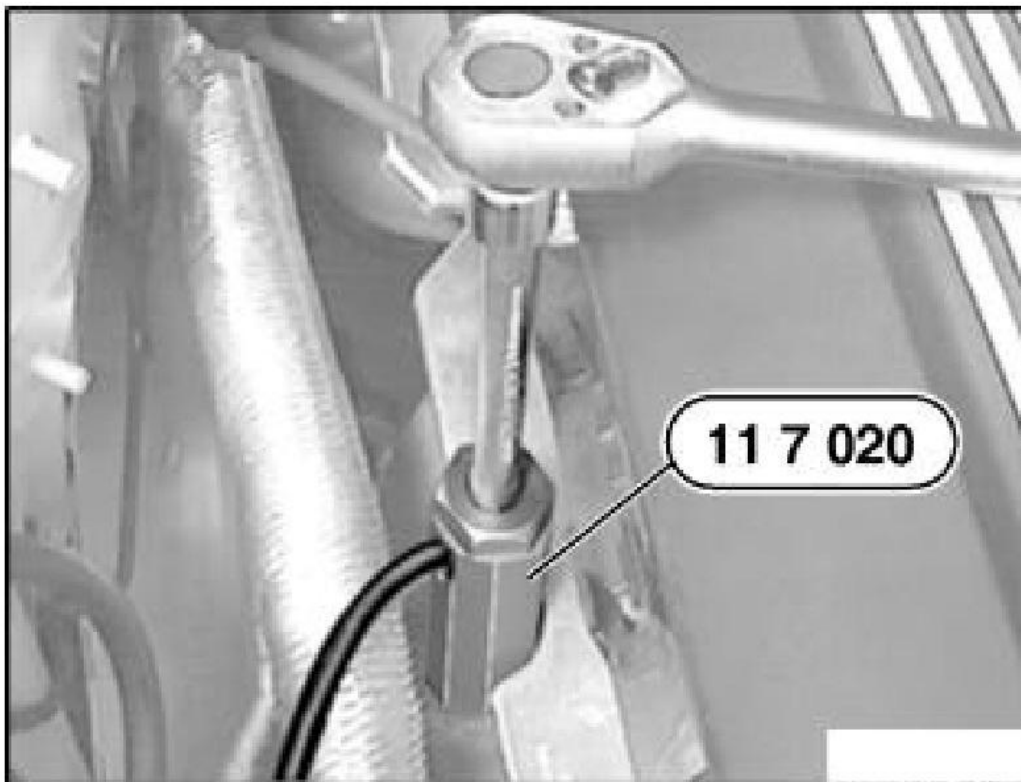
- 11 7 020

(for work step number 13 00 002), read out fault memory, clear if necessary.

NOTE: **The plug connection must be disconnected before the oxygen control sensor is removed.**
If the plug connection separation point is below the cover for the fuel injectors:
If necessary, remove lower section of microfilter housing. Remove cover from fuel injectors.

Unclip oxygen control sensor cable from retainer.

Disconnect plug connection for oxygen control sensor. Release oxygen control sensor with special tool 11 7 020.



G03310512

Fig. 397: Removing Oxygen Control Sensor

Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

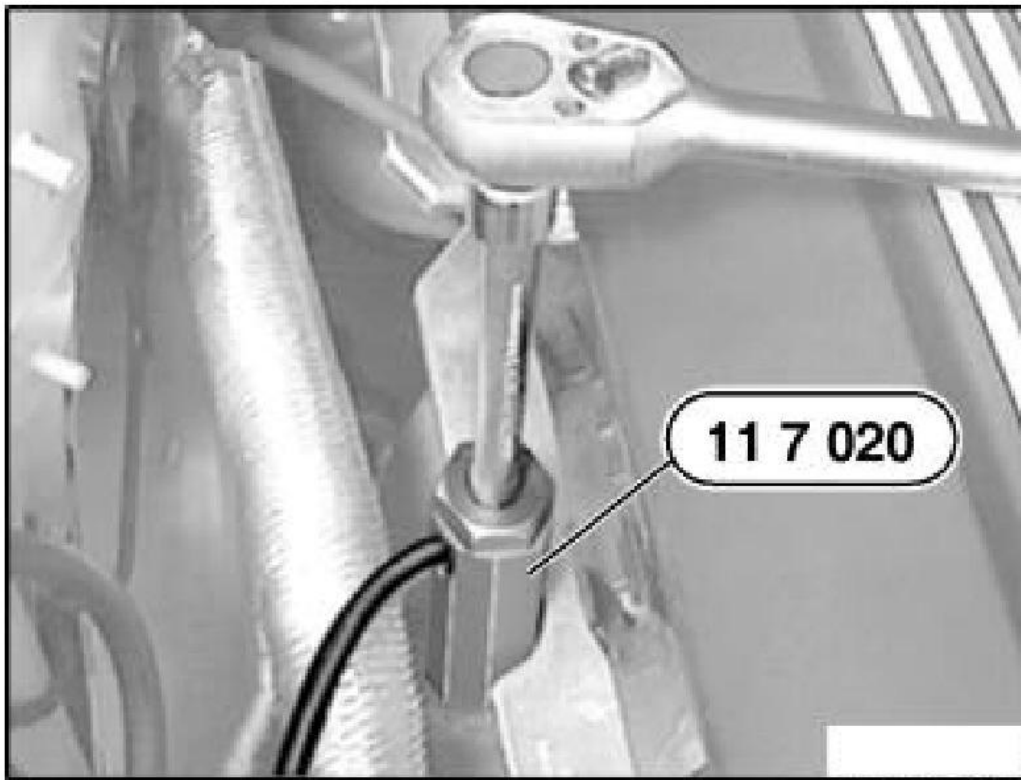
The threads of new oxygen sensors are already coated with Never Seez Compound.

If an oxygen sensor is used again, apply a thin and even coat of Never Seez Compound (refer to BMW Parts Service) to the thread only.

Part of oxygen control sensor which projects into exhaust system branch must not be cleaned or come into contact with lubricant.

Installation:

Secure oxygen control sensor with special tool 11 7 020.



G03310513

Fig. 398: Installing Oxygen Control Sensor
Courtesy of BMW OF NORTH AMERICA, INC.

Tightening torque 11 78 1AZ. Refer to **ENGINE - TIGHTENING TORQUES**.

Pay attention to cable routing of oxygen control sensor.

11 78 511 REPLACING OXYGEN CONTROL SENSOR (CYLINDERS 1-3)

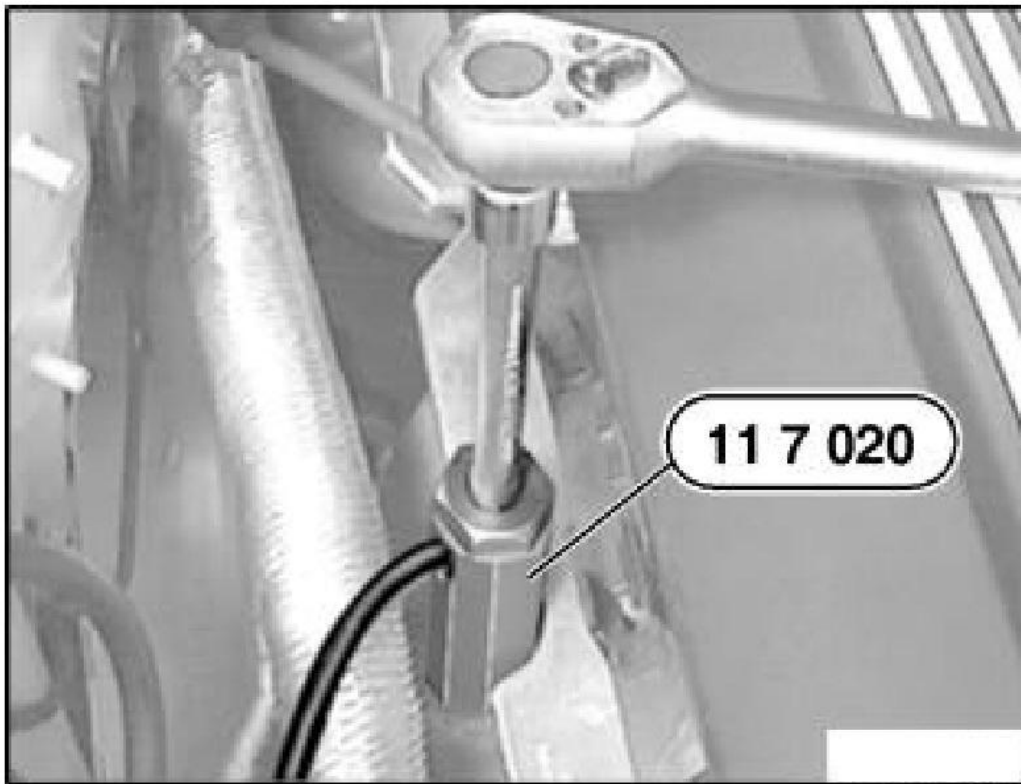
Special tools required:

- 11 7 020

Necessary preliminary tasks:

- Read out DME fault memory.

Disconnect plug connection for control sensor.



G03310514

Fig. 399: Removing Control Sensor
Courtesy of BMW OF NORTH AMERICA, INC.

Release control sensor with special tool 11 7 020.

Tightening torque: 11 78 1AZ. Refer to **ENGINE - TIGHTENING TORQUES** .

Installation:

Threads of new control sensors are already coated with Never Seez compound.

If the control sensor is reused, coat only the thread with a thin layer of Never Seez compound (refer to BMW Parts Service).

The control sensor section projecting into the exhaust system branch must not be cleaned or come into contact with lubricant.

Check function of DME.

11 78 512 REPLACING OXYGEN CONTROL SENSOR (CYLINDERS 4-6)

Special tools required:

- 11 7 020

Necessary preliminary tasks:

- Read out DME fault memory.

Disconnect plug connection for control sensor. Release control sensor with special tool 11 7 020.

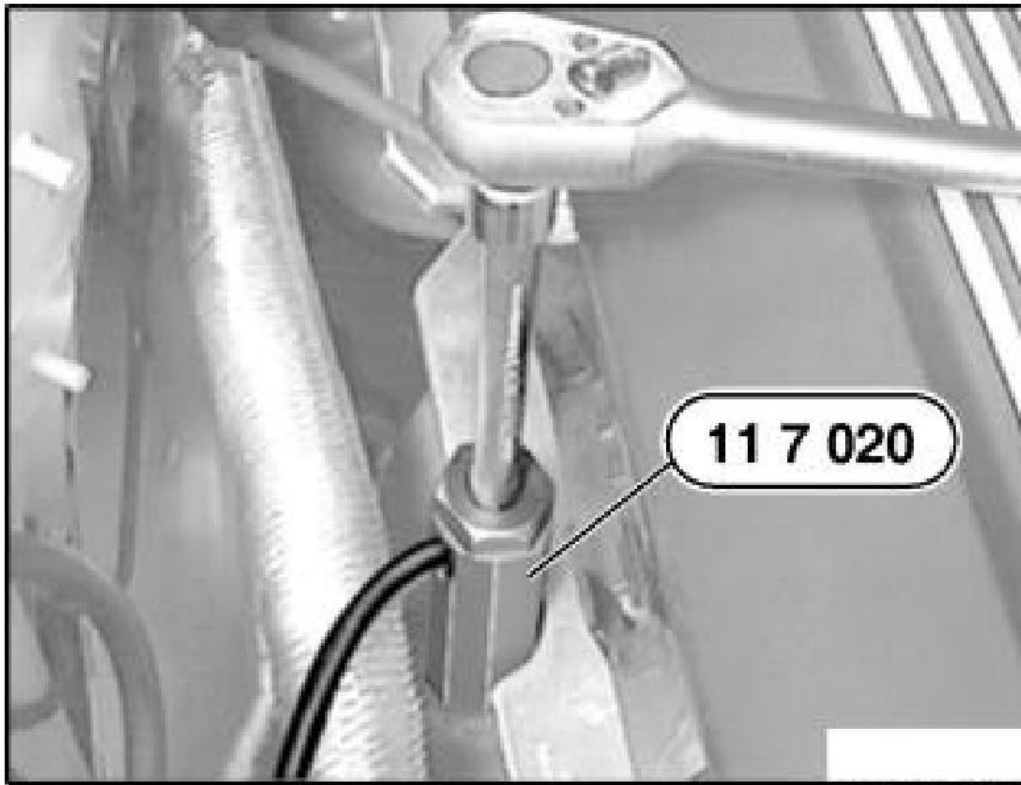
**G03310515**

Fig. 400: Releasing Control Sensor With Special Tool
Courtesy of BMW OF NORTH AMERICA, INC.

Tightening torque: 11 78 1AZ. Refer to **ENGINE - TIGHTENING TORQUES** .

Installation:

Threads of new control sensors are already coated with Never Seez compound.

If the control sensor is reused, coat only the thread with a thin layer of Never Seez compound (refer to Parts Service).

The control sensor section projecting into the exhaust system branch must not be cleaned or come into contact with lubricant.

Check function of DME.

11 78 611 REPLACING OXYGEN MONITOR SENSOR (CYLINDERS 1-3)

Special tools required:

- 11 7 030
- 11 9 150

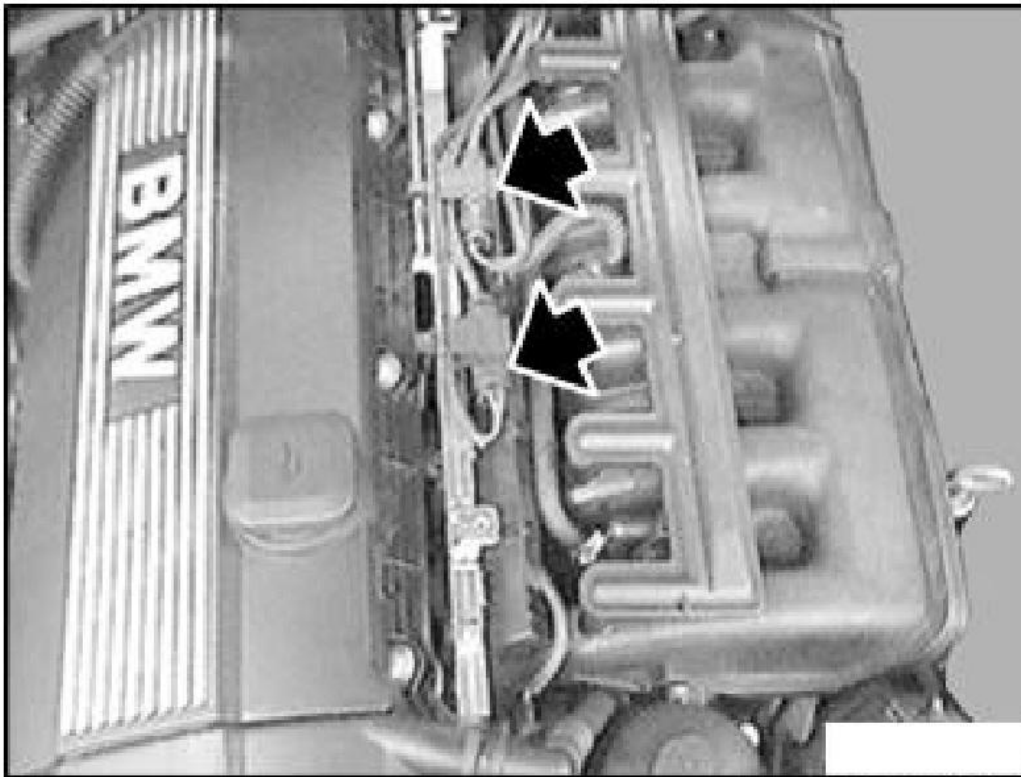
Necessary preliminary tasks:

- Read out DME fault memory.
- Remove protection under transmission.
- Remove cover from injector valves.

WARNING: Scalding hazard!

Only perform this task on an engine that has cooled down.

Unclip cable and plug.



G03310516

Fig. 401: Disconnecting Plug Connection

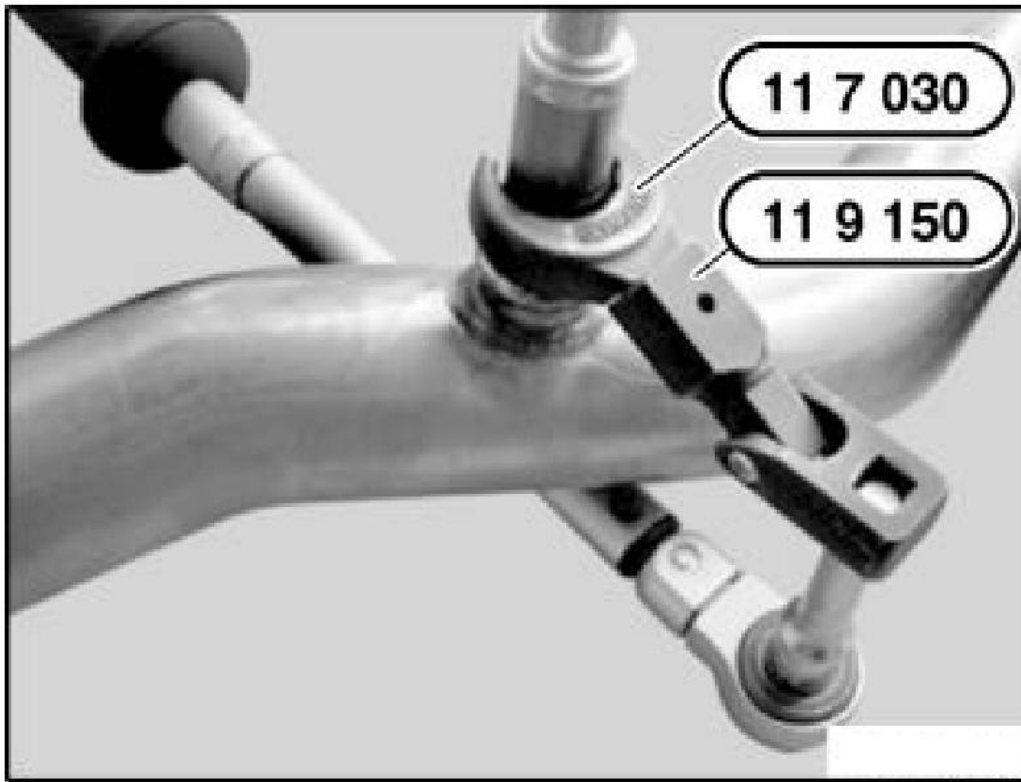
Courtesy of BMW OF NORTH AMERICA, INC.

Disconnect plug connection.

IMPORTANT: Mark sensor plug connections (*risk of mix-up*) .

NOTE: For purposes of clarity, this work step is shown on the removed exhaust manifold.

Release monitor sensor with special tool 11 7 030 in conjunction with special tool 11 9 150.



G03310517

Fig. 402: Releasing Monitor Sensor

Courtesy of BMW OF NORTH AMERICA, INC.

Tightening torque 11 78 1AZ. Refer to **ENGINE - TIGHTENING TORQUES** .

Installation:

When special tool 11 9 150 is used in conjunction with special tool 11 7 030, 53 N.m on the dial on the torque wrench corresponds to an actual tightening torque of 50 N.m.

Installation:

Threads of new monitor sensors are already coated with Never Seez compound.

If a monitor sensor is reused, apply a thin and even coating of Never Seez compound (refer to BMW Parts Service) to the thread only.

The monitor sensor section projecting into the exhaust system branch must not be cleaned or come into contact with lubricant.

Cover monitor sensor when applying underseal. Check function of DME.

11 78 612 REPLACING OXYGEN MONITOR SENSOR (CYLINDERS 4-6)**Special tools required:**

- 11 7 030
- 11 9 150

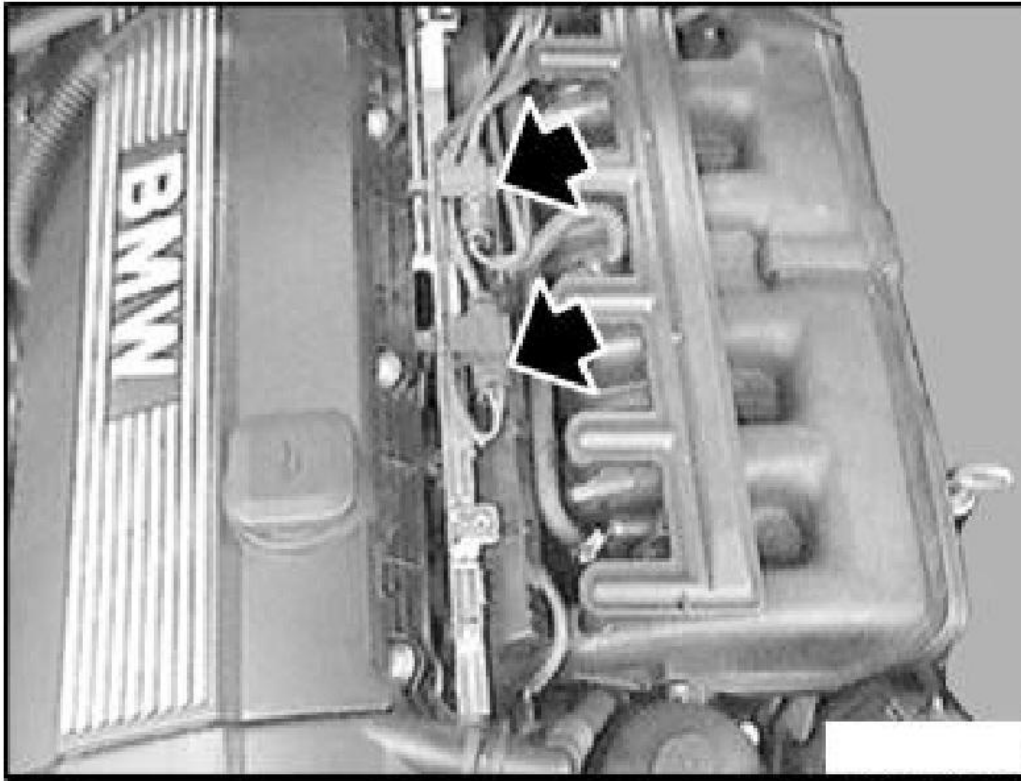
Necessary preliminary tasks:

- Read out DME fault memory.
- Remove protection under transmission.
- Remove cover from injector valves.

WARNING: Scalding hazard!

Only perform this task on an engine that has cooled down.

Unclip cable and plug.



G03310518

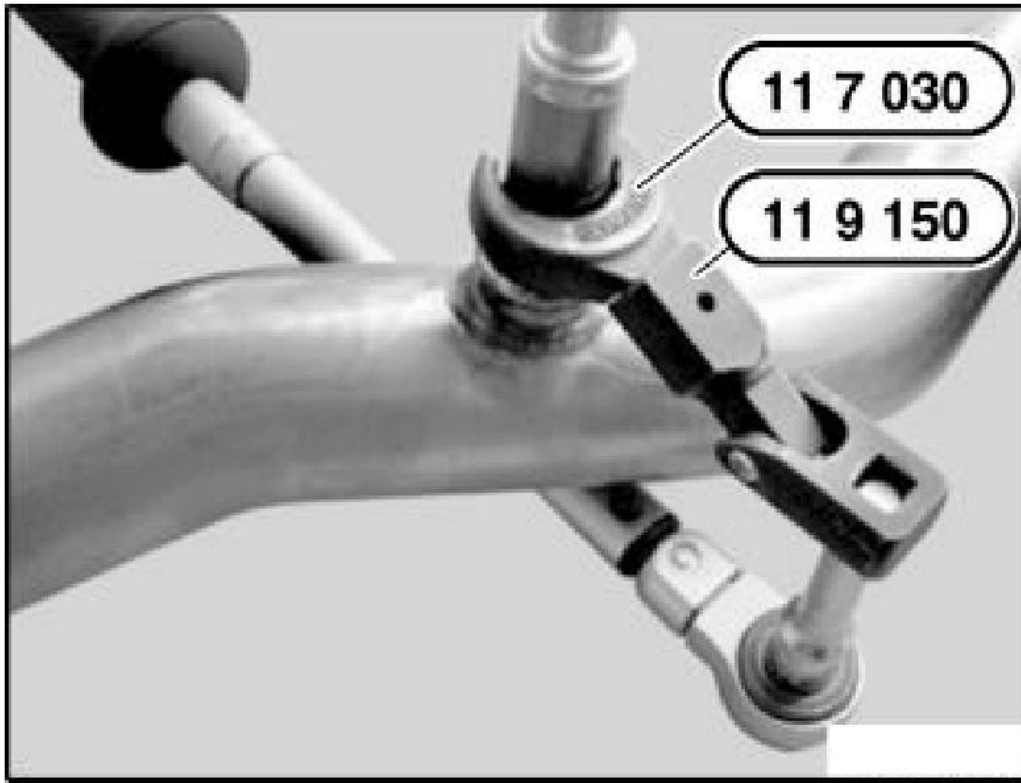
Fig. 403: Disconnecting Plug Connection
Courtesy of BMW OF NORTH AMERICA, INC.

Disconnect plug connection.

IMPORTANT: Mark sensor plug connections (*risk of mix-up*) .

NOTE: For purposes of clarity, this work step is shown on the removed exhaust manifold.

Release monitor sensor with special tool 11 7 030 in conjunction with special tool 11 9 150.



G03310519

Fig. 404: Releasing Monitor Sensor
Courtesy of BMW OF NORTH AMERICA, INC.

Tightening torque: 11 78 1AZ. Refer to **ENGINE - TIGHTENING TORQUES** .

Installation:

When special tool 11 9 150 is used in conjunction with special tool 11 7 030, 53 N.m on the torque wrench dial corresponds to an actual Tightening torque of 50 N.m.

Installation:

Threads of new monitor sensors are already coated with Never Seez compound.

If a monitor sensor is reused, apply a thin and even coating of Never Seez compound (refer to Parts Service) to the thread only.

The monitor sensor section projecting into the exhaust system branch must not be cleaned or come into contact

with lubricant.

Cover monitor sensor when applying underseal.

Pay attention to cable routing of monitor sensor.

Check DME fault memory.

11 78 613 REPLACING BOTH OXYGEN MONITOR SENSORS (M52TU / M54 / M56)

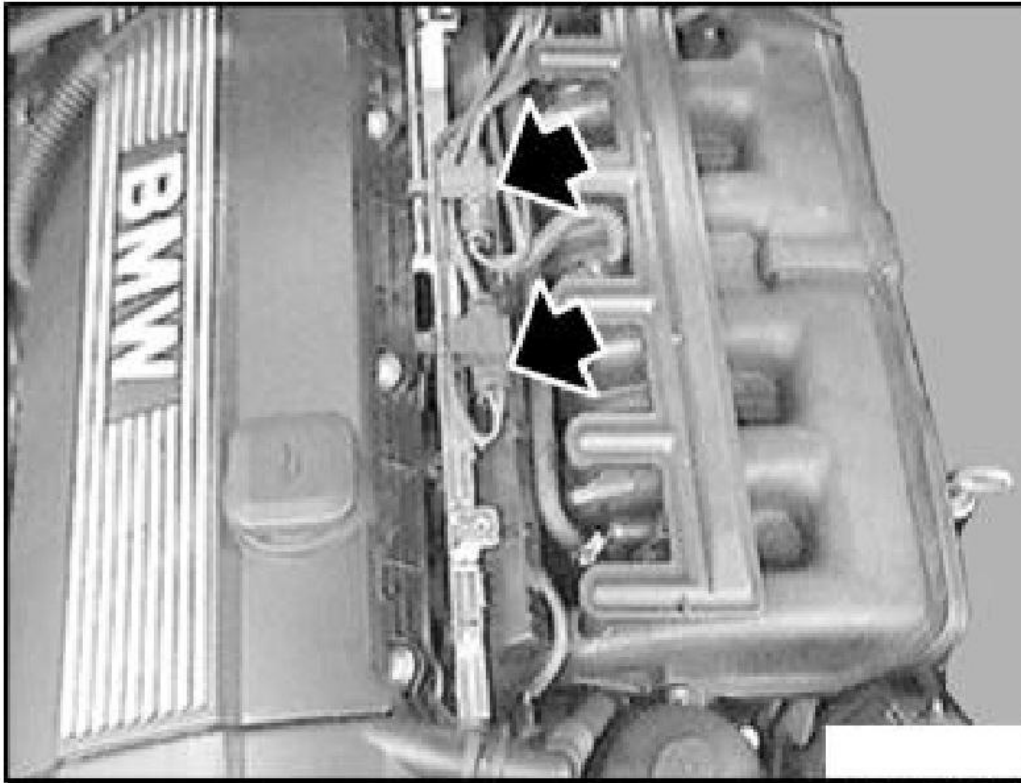
Special tools required:

- 11 7 020
- 11 7 030

(for work step number 13 00 002), read out fault memory, clear if necessary.

Illustrations show M54.

Remove cover from fuel injectors.



G03310521

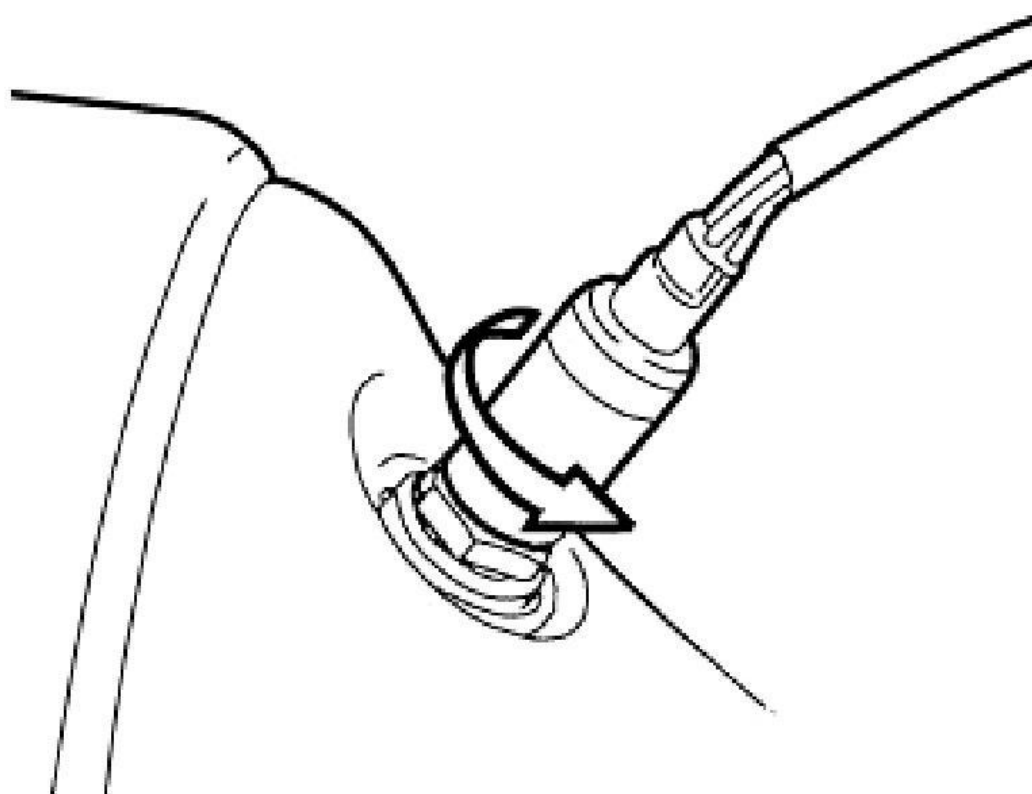
Fig. 405: Disconnecting Plug Connections

Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: Do not mix up oxygen monitor sensors for cylinders 1 to 3 and 4 to 6 at plug connection to wiring harness.
Mark plug connections.

Unclip the cable from the retainer. Disconnect plug. Unclip cable on rear side of engine from cable guide.

NOTE: On vehicles with automatic transmission:
In event of unfavorable tolerances, accessibility to the oxygen monitor sensor from cylinders 4 to 6 is only possible after the exhaust system has been removed.



G03310522

Fig. 406: Releasing Oxygen Monitor Sensor
Courtesy of BMW OF NORTH AMERICA, INC.

Release oxygen monitor sensor from cylinders 1 to 3 with special tool 11 7 030.

Release oxygen monitor sensor from cylinders 4 to 6 with special tool 11 7 020.

Installation:

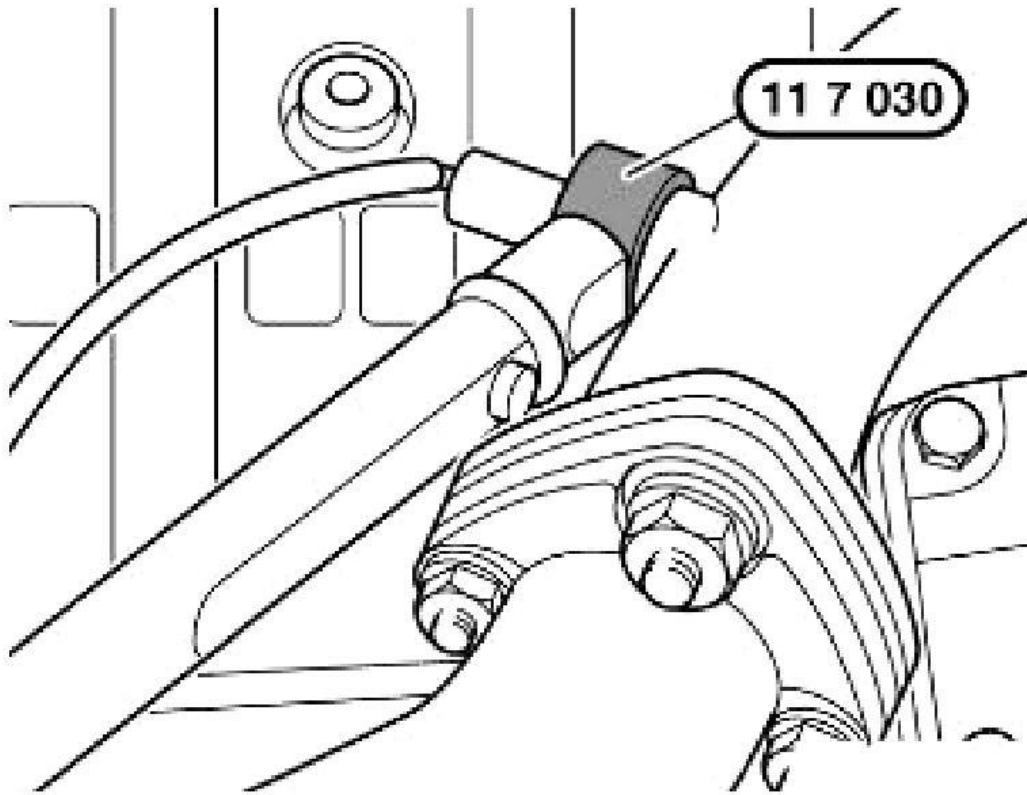
The threads of new oxygen monitor sensors are already coated with Never Seez compound.

If an oxygen monitor sensor is reused, only apply a thin and uniform coat of Never Seez compound (refer to BMW Parts Service) to thread.

Part of oxygen control sensor which projects into exhaust system branch must not be cleaned or come into contact with lubricant.

Installation:

Secure oxygen monitor sensor for cylinders 1 to 3 with special tool 11 7 030.



G03310523

Fig. 407: Installing Oxygen Monitor Sensor
Courtesy of BMW OF NORTH AMERICA, INC.

Secure oxygen monitor sensor for cylinders 4 to 6 with special tool 11 7 020.

Tightening torque 11 78 1AZ. Refer to **ENGINE - TIGHTENING TORQUES** .

Cover oxygen monitor sensors when applying underseal.

Pay attention to cable routing of oxygen monitor sensors.

POSITIVE CRANKCASE VENTILATION/OIL SEPARATOR

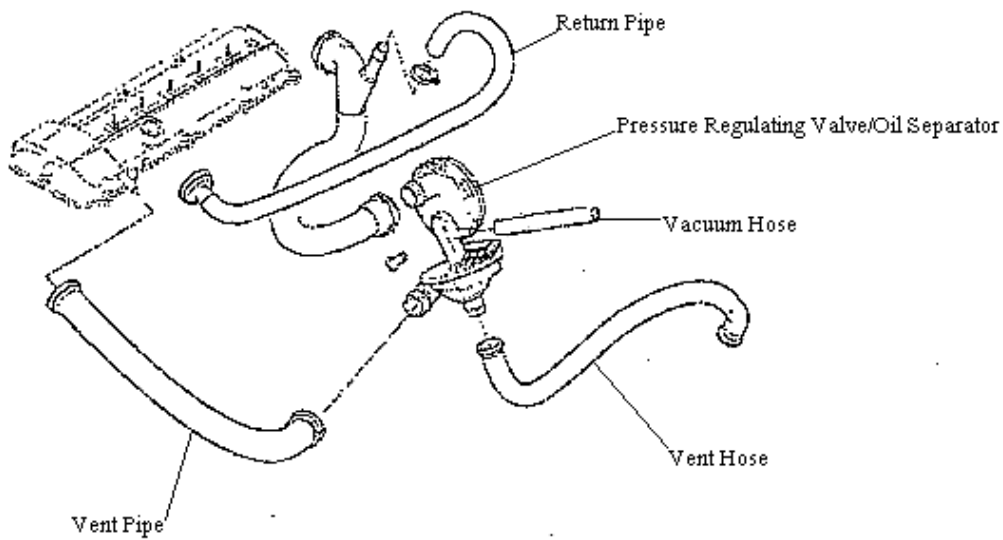


Fig. 408: Identifying Positive Crankcase Ventilation/Oil Separator Components
Courtesy of BMW OF NORTH AMERICA, INC.