

1999-2005 ENGINE**Engine - Repair (M52/S52/M52TU/M54/M56)****ENGINE GENERAL****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.

Engine oil service:

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

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.



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Fig. 1: Identifying Oil Filter Cap

Courtesy of BMW OF NORTH AMERICA, INC.

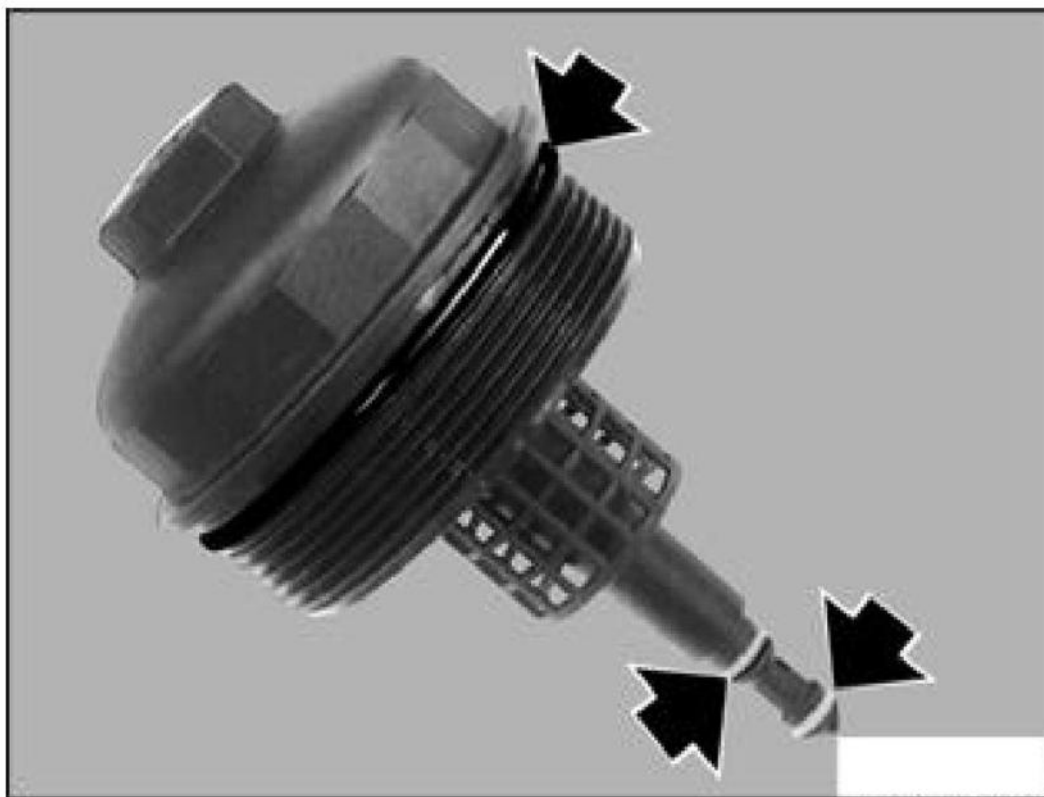
Installation:

Tightening torque:

- Full flow oil filter (cover): M8 22 N.m, M10 33 N.m, M12 33 N.m.
- Screwed-on cover: 25 N.m.

Installation:

Replace and oil O-ring.



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Fig. 2: Replacing And Oiling O-Ring

Courtesy of BMW OF NORTH AMERICA, INC.

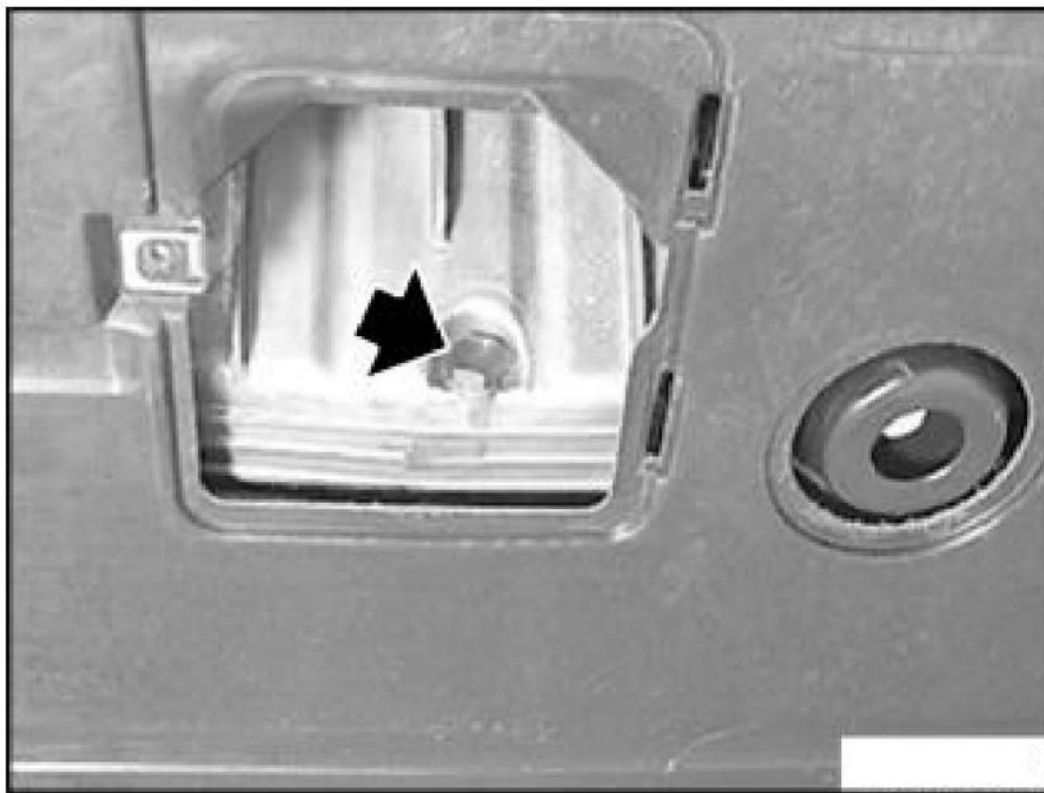
Drain or draw off engine oil.

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

Open oil drain plug and drain off engine oil.

Installation:

Replace sealing ring.



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Fig. 3: Replacing Sealing Ring

Courtesy of BMW OF NORTH AMERICA, INC.

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.

11 00 039 CHECKING COMPRESSION OF ALL CYLINDERS (M60 / M62 / M73 / S62 / M54)**Special tools required:**

NOTE: For special tools, refer to ENGINE - SPECIAL TOOLS .

- 11 0 224
- 11 0 226

IMPORTANT: High tension - mortal danger!

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

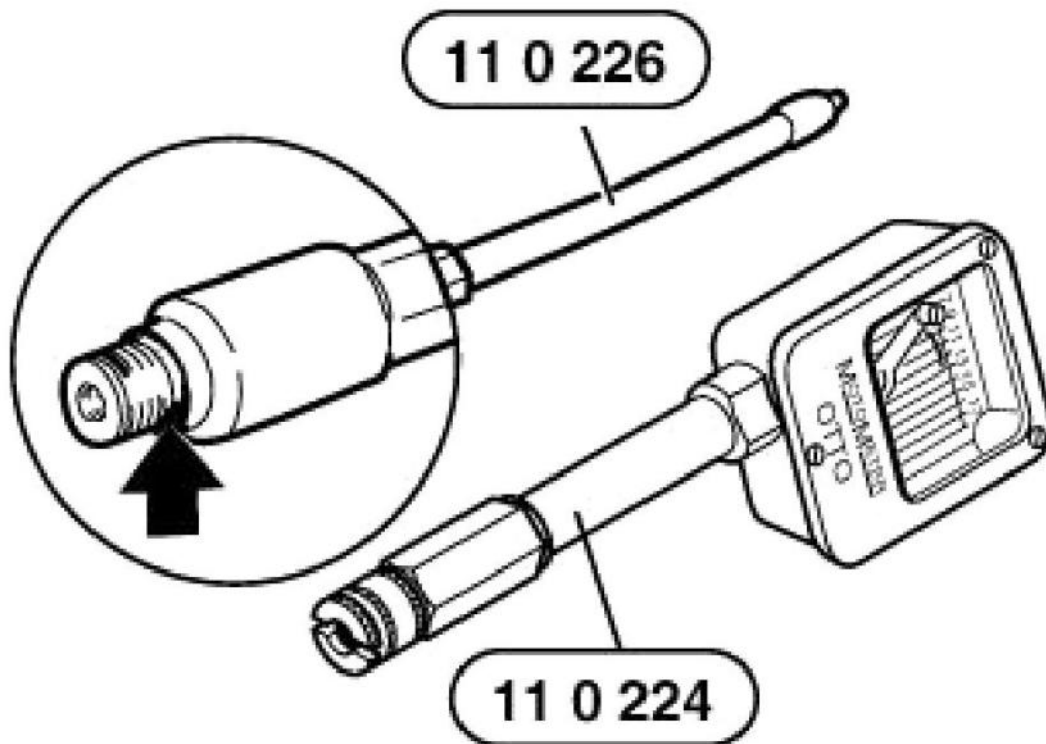
Necessary preliminary tasks:

- 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 reduction).
- Remove all spark plugs. See 12 12 011 REPLACING 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 0 224.

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



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Fig. 4: Identifying Special Tool (1 of 2)

Courtesy of BMW OF NORTH AMERICA, INC.

Depress accelerator and actuate starter until compression stops rising.

Compression pressure.

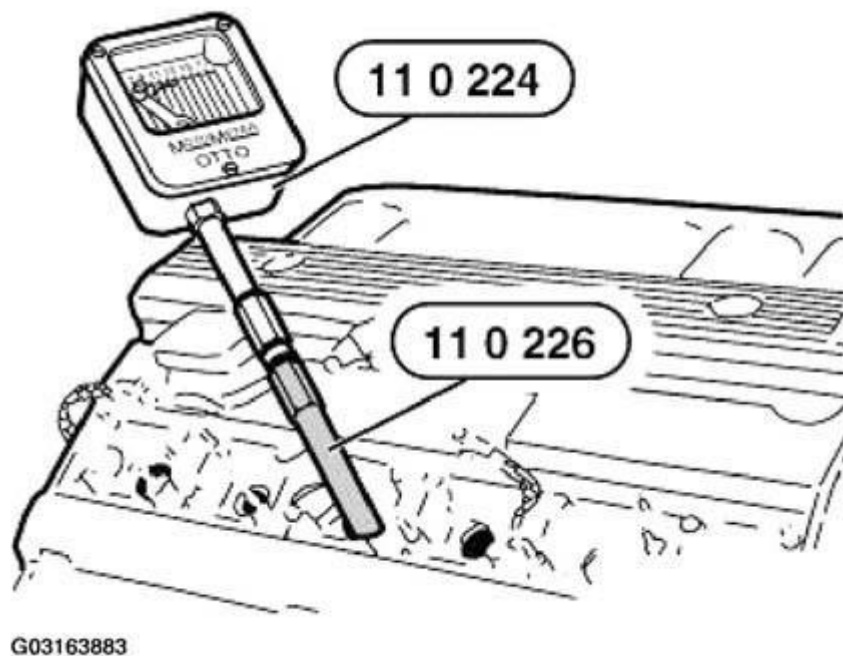


Fig. 5: Identifying Special Tool (2 of 2)

Courtesy of BMW OF NORTH AMERICA, INC.

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. 6: Identifying BMW Diagnosis Information System (DIS)
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 (M52TU / M54 / M56)**Special tools required:**

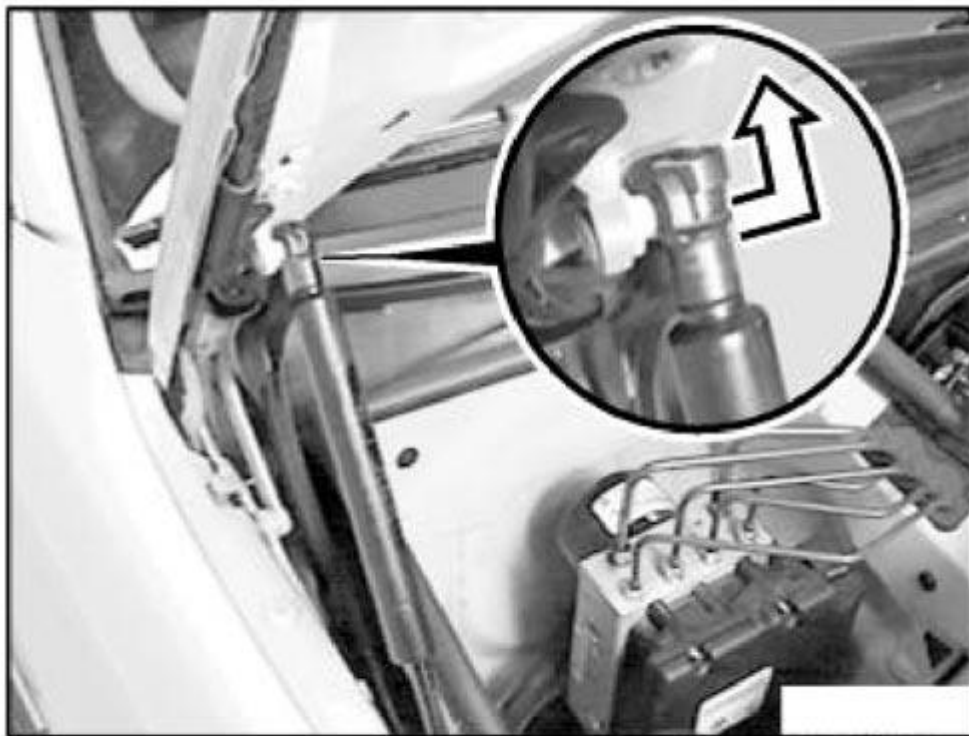
NOTE: For special tools, refer to **ENGINE - SPECIAL TOOLS** .

- 11 0 000
- 51 2 160

Instructions for disconnecting and connecting battery, refer to **12 00... INSTRUCTIONS FOR DISCONNECTING AND CONNECTING BATTERY** .

Disconnect negative battery lead.

Move engine hood to assembly position:



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Fig. 7: Moving Engine Hood To Assembly Position
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: The following work must be carried out with a second person assisting. Work instruction applies to left and right sides.

Gently raise retaining clip and simultaneously push upwards.

Hold engine hood, unhook damper on hood.

Slide special tool 51 2 160 over damper.

Open engine hood completely and reconnect damper with special tool 51 2 160 to hood.



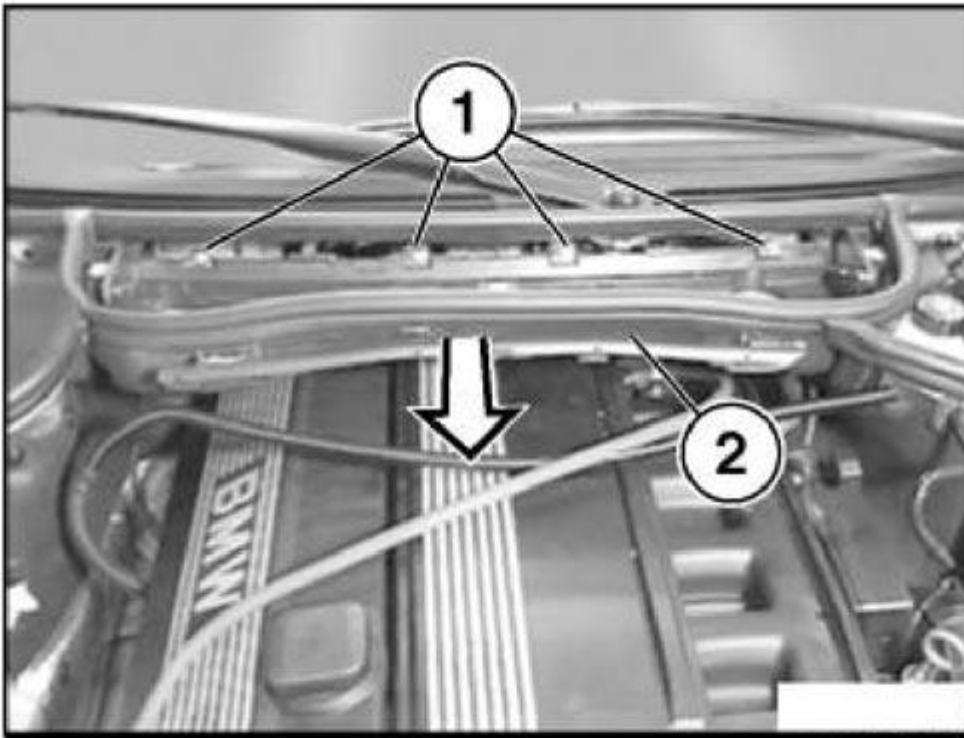
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Fig. 8: Identifying Special Tool 51 2 160
Courtesy of BMW OF NORTH AMERICA, INC.

Remove microfilter. See **64 31 010 REPLACING MICROFILTER FOR INTERIOR VENTILATION**

Open cable duct on lower section of microfilter housing (2) and feed out cable(s).

Release screws (1) and remove lower section of microfilter housing (2).



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Fig. 9: Releasing Screws And Microfilter Housing
Courtesy of BMW OF NORTH AMERICA, INC.

Remove engine underguard. See **51 11 000 REMOVING AND INSTALLING COMPLETE FRONT BUMPER (FROM 10/01)**

Remove transmission. See **REMOVAL & INSTALLATION**

Remove A/C compressor drive belt. See **11 28 050 Replacing A/C compressor drive belt (M52 / S52 / M52TU / M54 / M56)**

Remove A/C compressor from bearing block and tie back to one side. See **64 52 520 REMOVING AND INSTALLING / REPLACING COMPLETE A/C COMPRESSOR**

NOTE: Lines remain connected.

Drain and dispose of coolant.

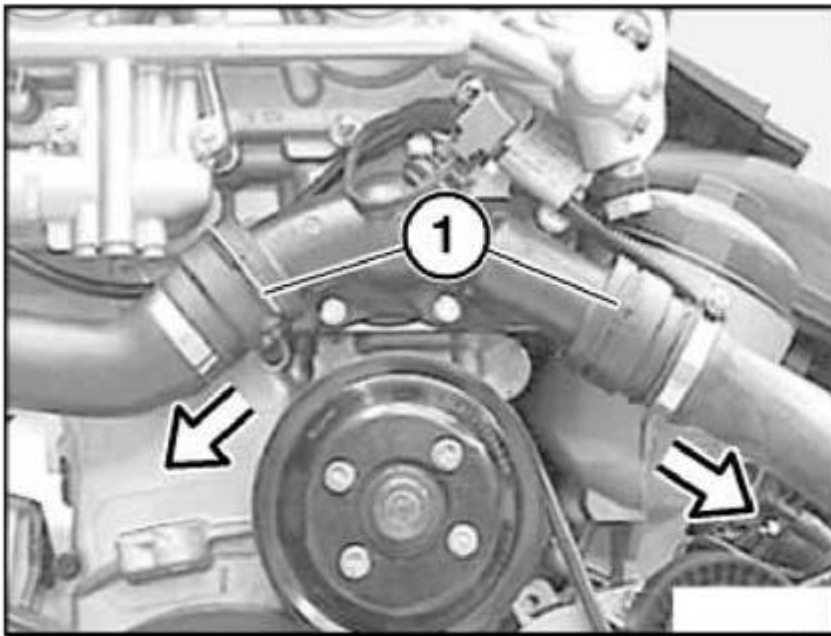
NOTE: The water drain plug is located on the exhaust side on cylinder 2 in the engine block.

Installation:

Replacing sealing ring on water drain plug.

Tightening torque: 25 N.m.

Pull locks (1) and disconnect water hoses.



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Fig. 10: Pulling Locks And Disconnect Water Hoses
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Refer to **17 00... INSTRUCTIONS FOR WORKING ON COOLING** .

Remove radiator. See **17 11 000 REMOVING AND INSTALLING RADIATOR (M52TU, M54, M56)**

Remove cover from fuel injectors. See **Fig. 393**

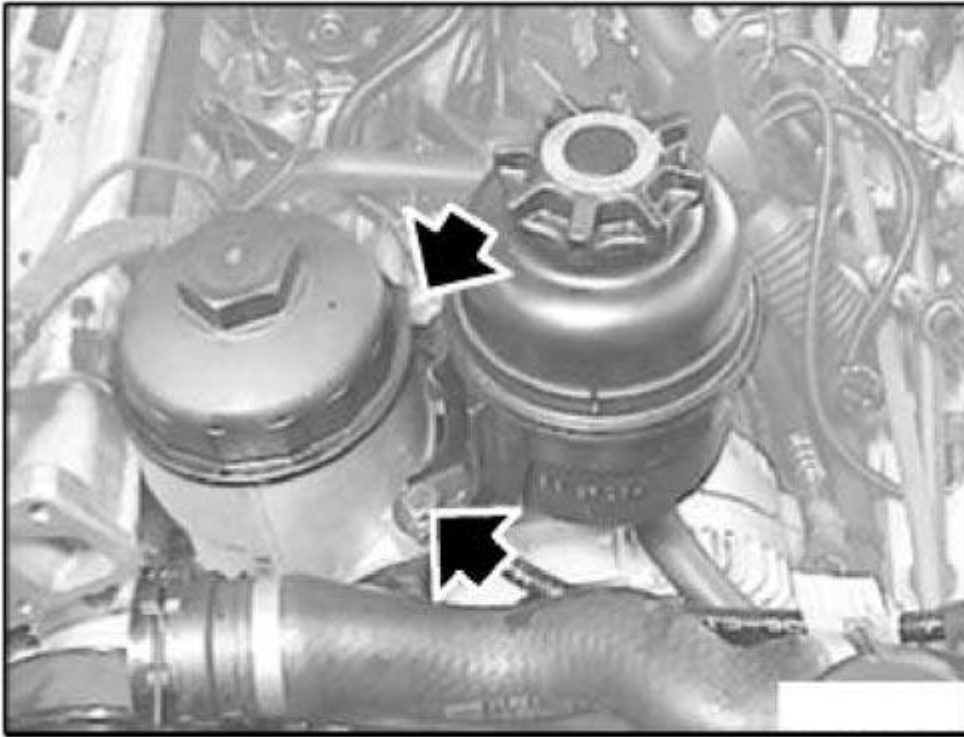
Remove both oxygen monitor sensors, refer to **11 78 613 REPLACING BOTH OXYGEN MONITOR SENSORS (M52TU / M54 / M56)**.

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

Disconnect water hoses from water pipe and from heating valve.

Unfasten engine section of wiring harness and place to one side with cable duct.

Unfasten reservoir for power steering unit and tie up to one side.



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Fig. 11: Identifying Reservoir

Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: Lines remain connected.

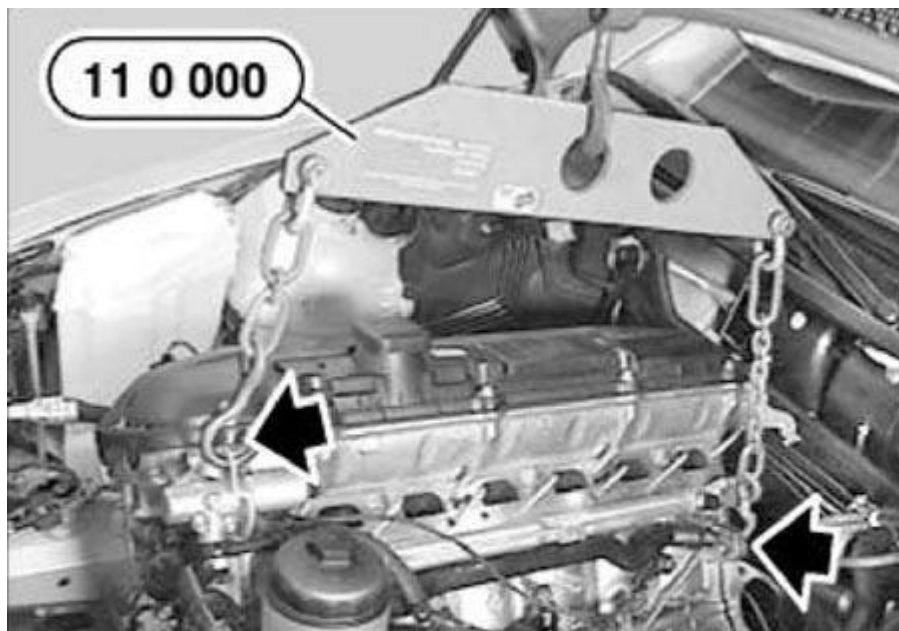
Remove fan clutch with fan impeller from water pump, refer to **11 52 020 REMOVING AND INSTALLING/REPLACING FAN CLUTCH (S52 / S54 / M52 / M52TU / M54 / M56)**.

Remove alternator drive belt. See **11 28 010 Replacing alternator drive belt (M52 / S52 / M52TU / M54 / M56)**

Remove vane pump for power steering and tie back to one side. See **POWER STEERING VANE PUMP (M52/M54)**

NOTE: Lines remain connected.

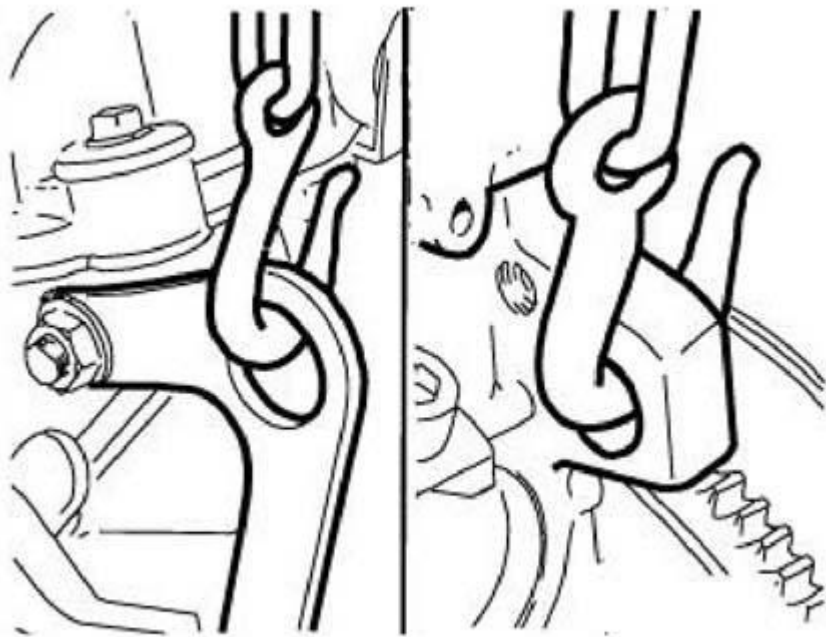
Suspend engine from special tool 11 0 000.



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Fig. 12: Identifying Special Tool 11 0 000
Courtesy of BMW OF NORTH AMERICA, INC.

Front and rear suspension arrangement.

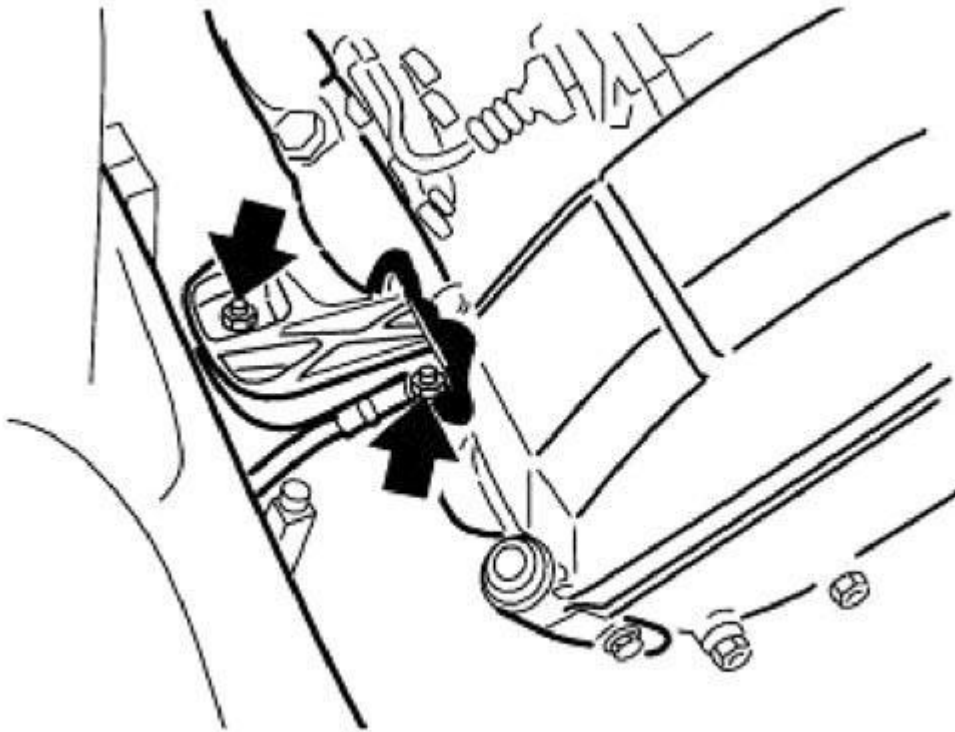


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Fig. 13: Identifying Front And Rear Suspension Arrangement
Courtesy of BMW OF NORTH AMERICA, INC.

Unfasten right ground wire.

Unscrew left and right engine mounts.



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Fig. 14: Unscrewing Left And Right Engine Mounts
Courtesy of BMW OF NORTH AMERICA, INC.

Carefully lift out engine.

CYLINDER HEAD WITH COVER

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

Remove engine cover. See **Fig. 393**

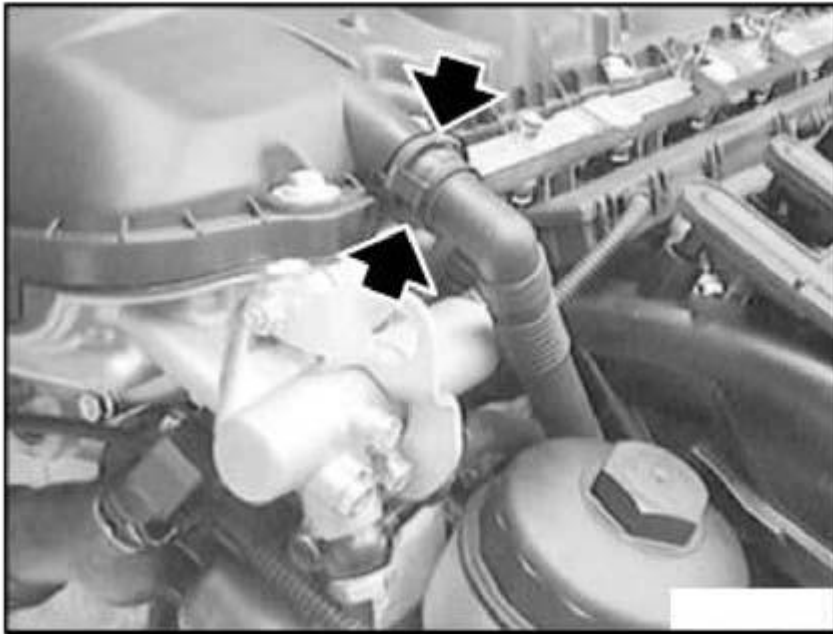
Remove ignition coils, refer to **12 13 511 REPLACING IGNITION COIL (M52, M52TU, S52, S50US, M54)** .

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

NOTE: Illustration on M54 engine.

Press lock.

Pull off the hose for the engine breather.

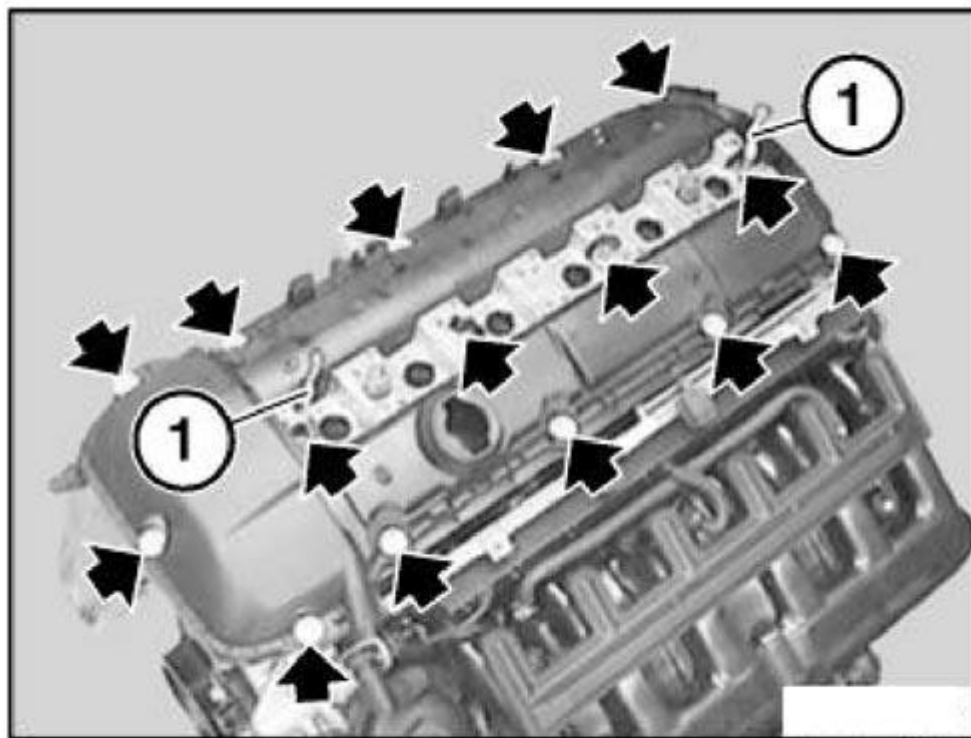


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Fig. 15: Pulling Off Hose For Engine Breather
Courtesy of BMW OF NORTH AMERICA, INC.

Remove grounding straps (1).

Remove cylinder head cover.



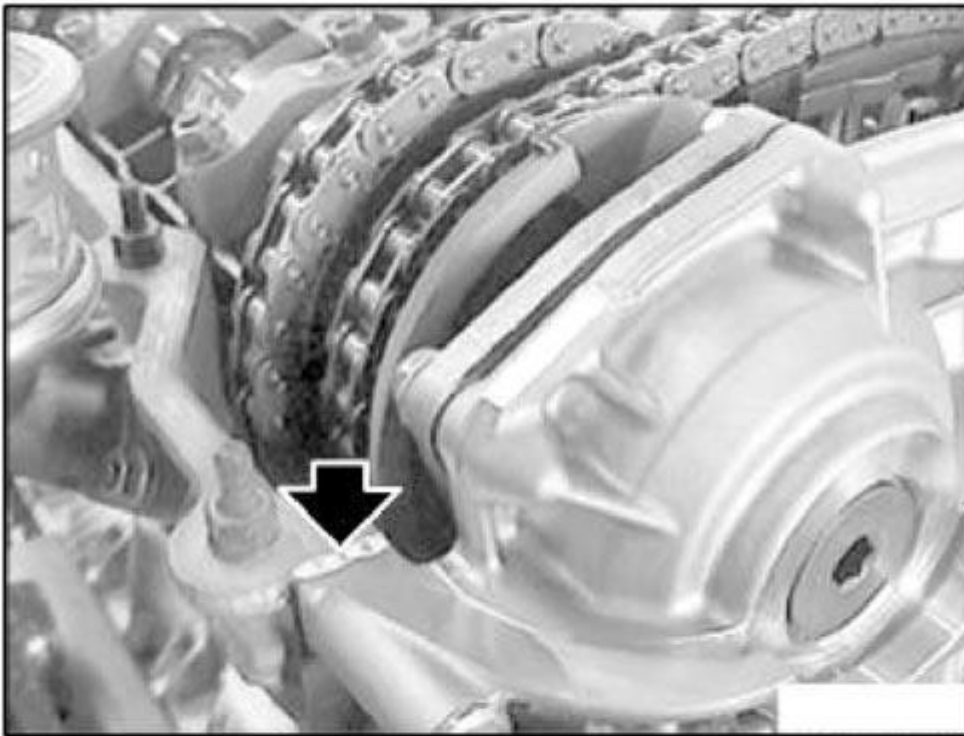
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Fig. 16: Removing Grounding Straps And Cylinder Head Cover
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

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

Apply a sealing bead of Drei Bond 1209 on left and right sides at transition between cylinder head and VANOS adjustment unit.

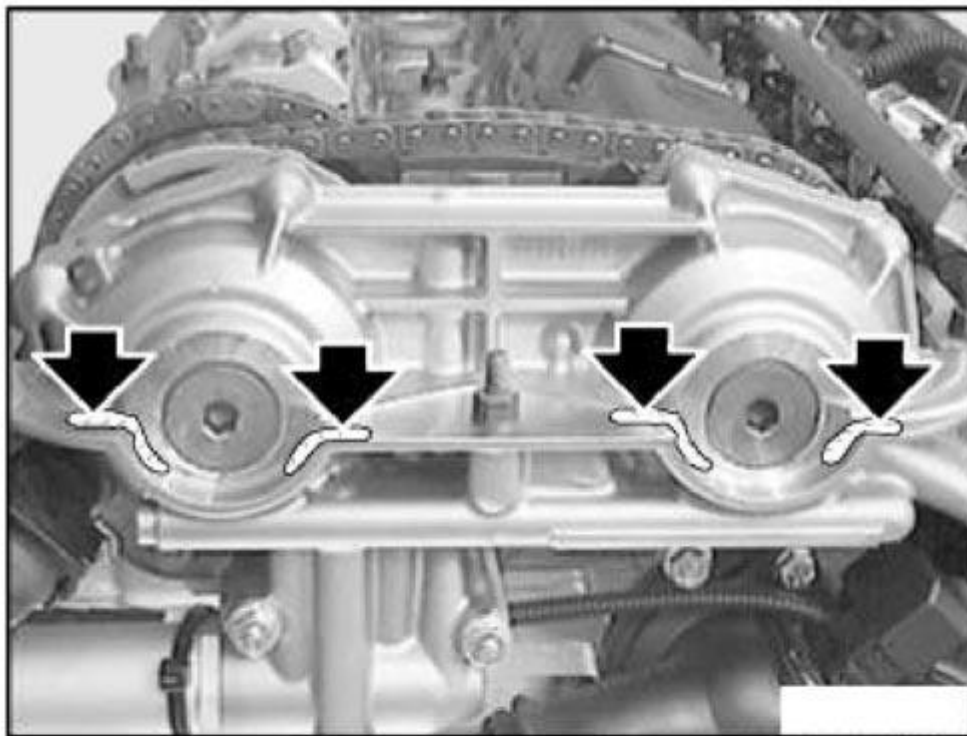


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Fig. 17: Applying Sealing Bead
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Apply a thin and even sealing bead of Drei Bond 1209 at transition to half-moon sections at VANOS adjustment unit.



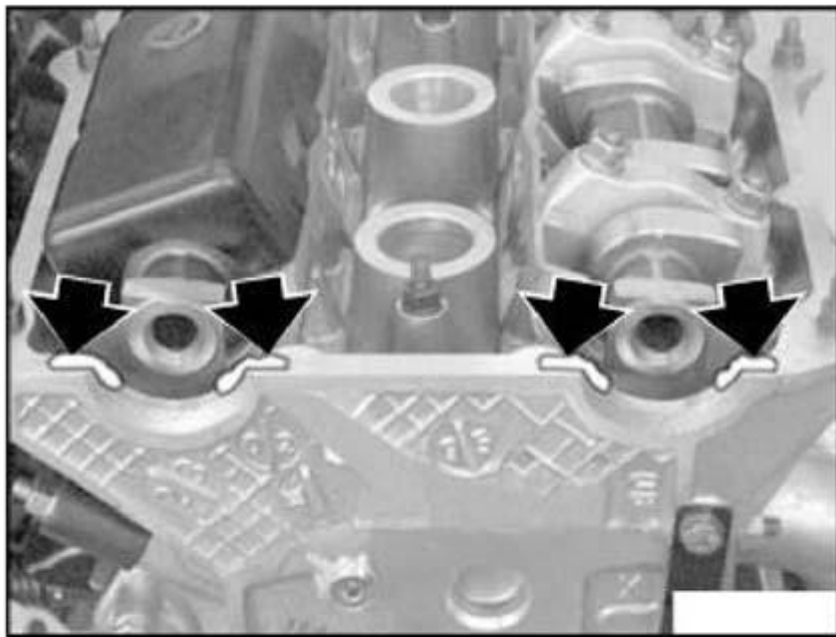
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Fig. 18: Applying Thin And Even Sealing Bead Of Drei Bond
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: Illustration with engine removed.

Installation:

Apply a thin and even sealing bead of Drei Bond 1209 at transition to half-moon sections at rear of cylinder head.



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Fig. 19: Applying Thin And Even Sealing Bead Of Drei Bond
Courtesy of BMW OF NORTH AMERICA, INC.

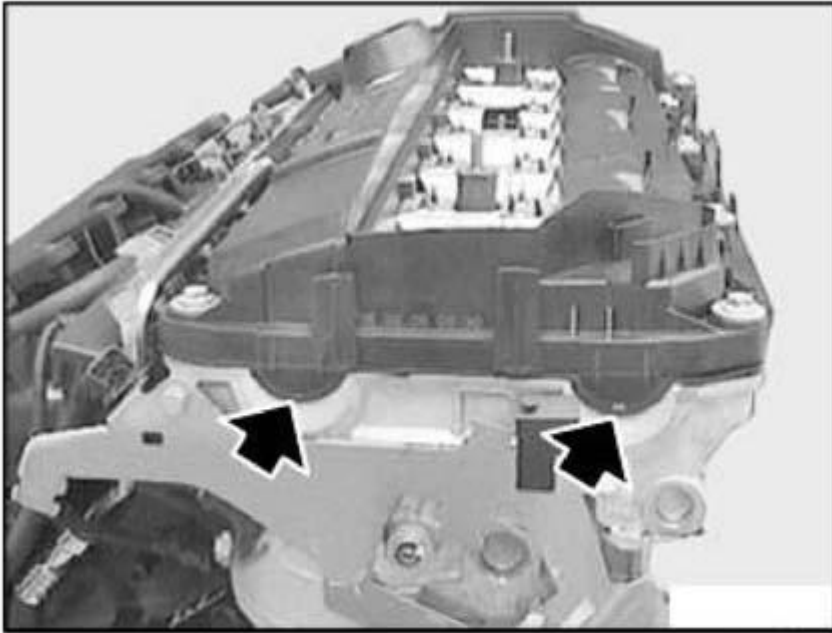
Check seals and replace if necessary.

NOTE: Illustration with engine removed.

Installation:

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

Install cover bolts and align cylinder head cover.



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Fig. 20: Installing Cover Bolts And Align Cylinder Head Cover
Courtesy of BMW OF NORTH AMERICA, INC.

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:

NOTE: For special tools, refer to **ENGINE - SPECIAL TOOLS** .

- 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.

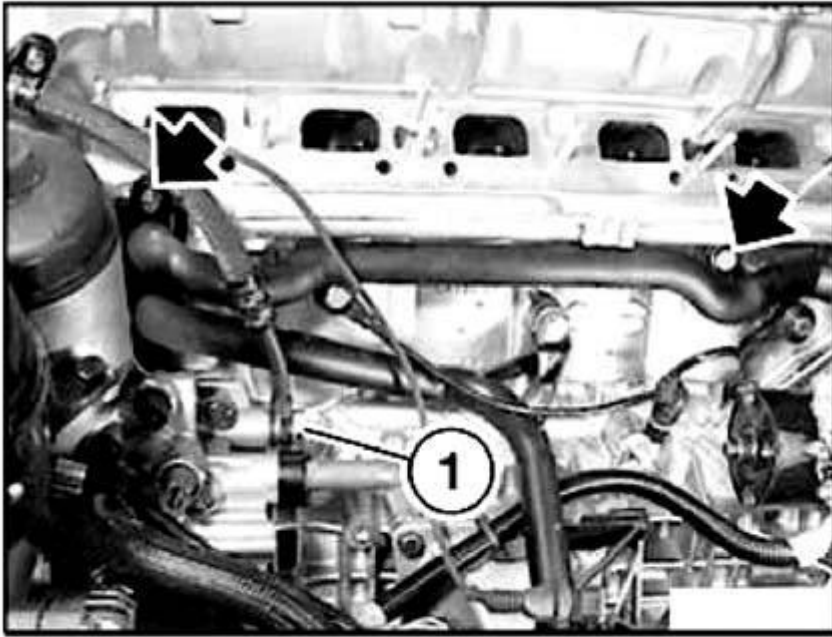
Vent cooling system and check for leaks, refer to **17 00 039 VENTING COOLING SYSTEM AND CHECKING FOR LEAKS (M54 / M56)** .

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.



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Fig. 21: 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.

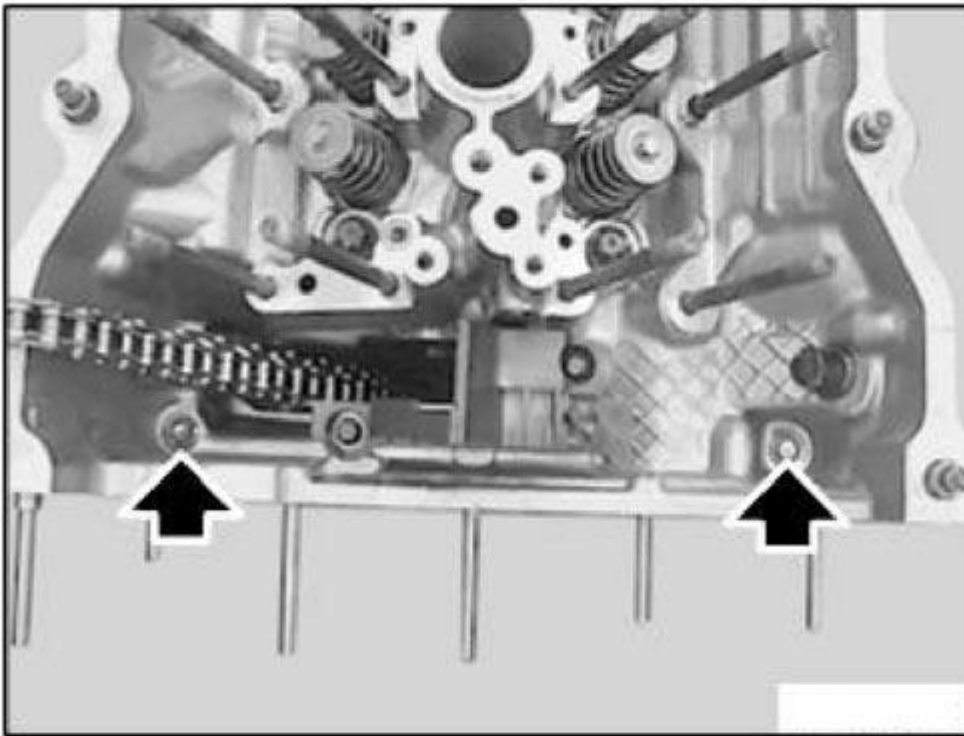
Removal

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).**

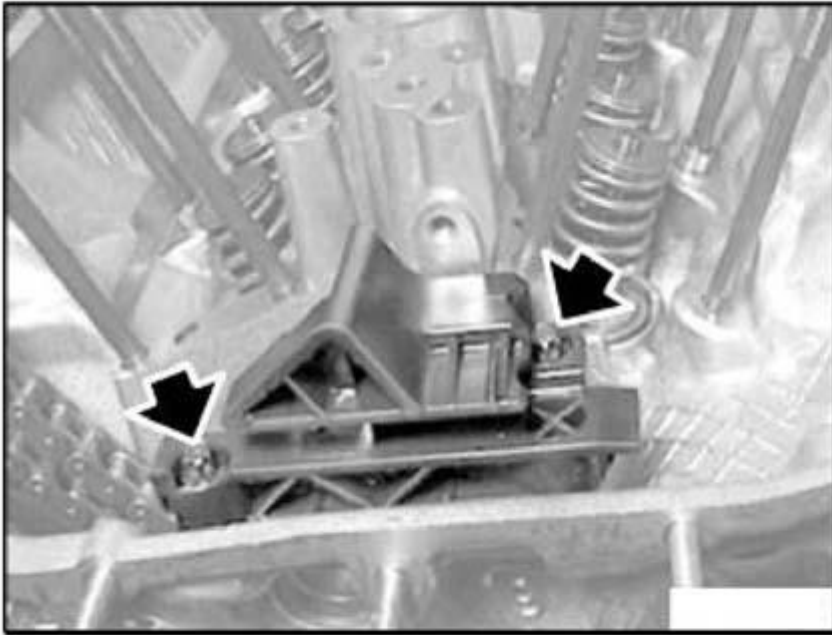
Release screw connection between timing case cover and cylinder head.



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Fig. 22: Releasing Screw Connection
Courtesy of BMW OF NORTH AMERICA, INC.

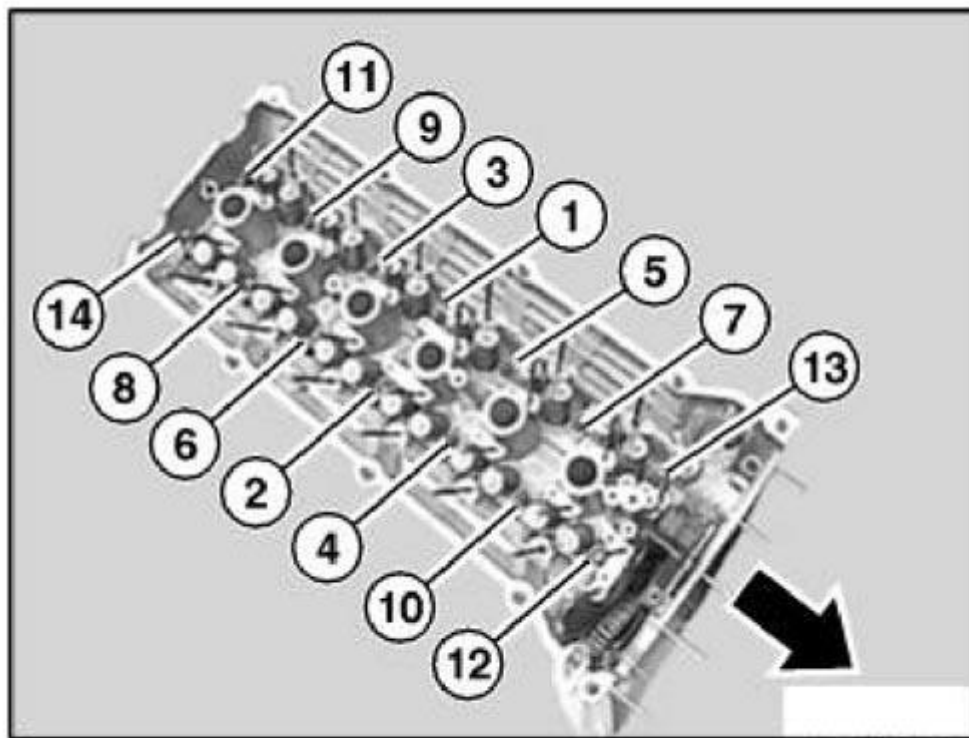
Release screws, remove chain guide.



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Fig. 23: Releasing Screws**Courtesy of BMW OF NORTH AMERICA, INC.**

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



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Fig. 24: Releasing Cylinder Head Bolts
Courtesy of BMW OF NORTH AMERICA, INC.

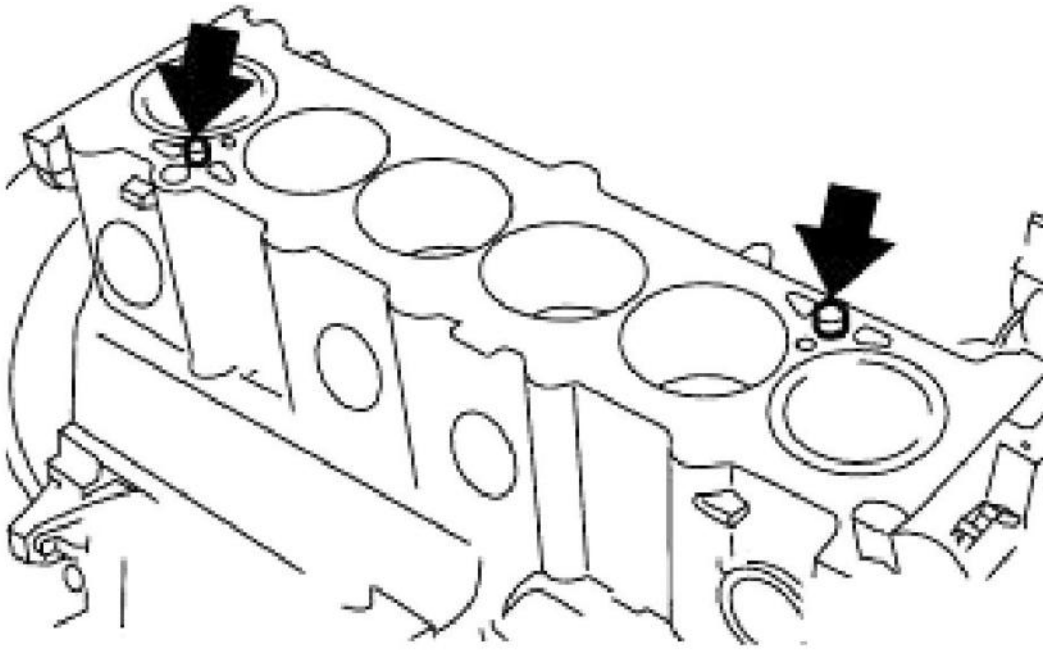
Lift off cylinder head.

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.



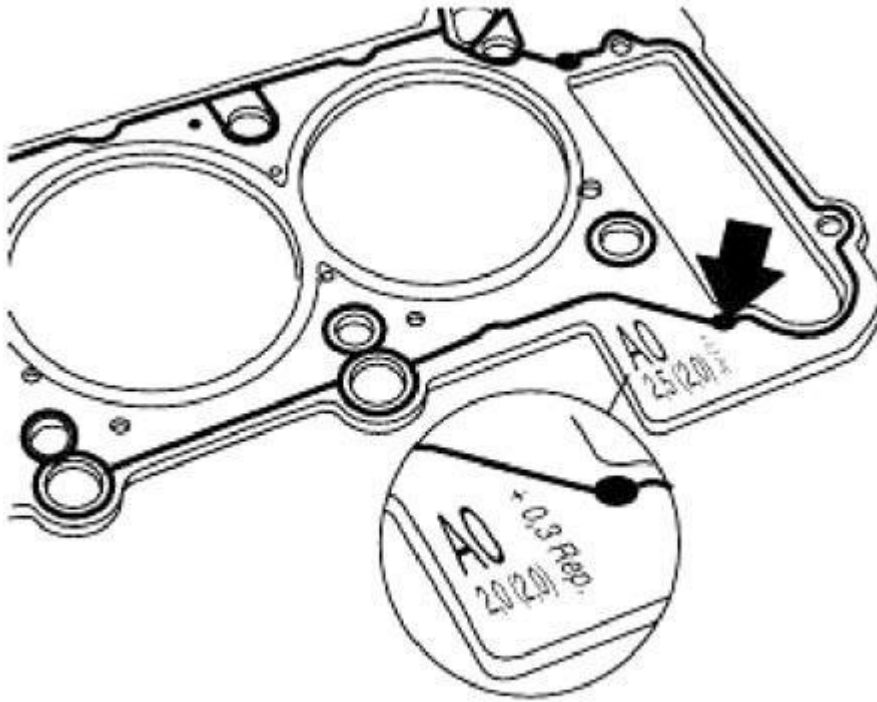
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Fig. 25: Checking Adapter Sleeves For Damage And Correct Installation Position
Courtesy of BMW OF NORTH AMERICA, INC.

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.



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Fig. 26: 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.

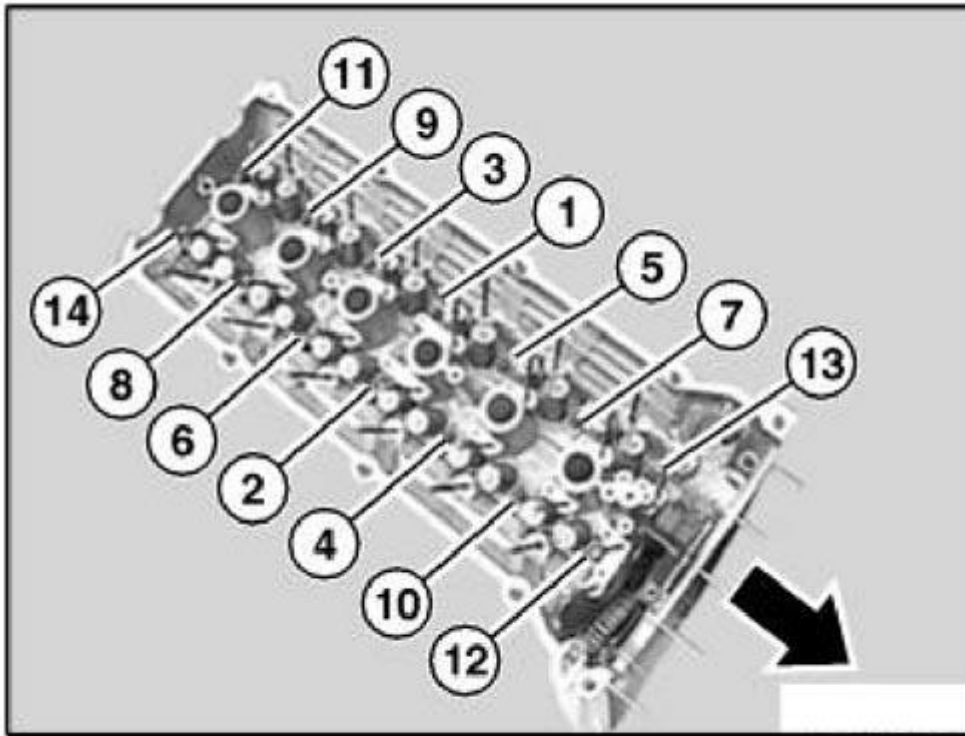
Risk of cracking and distorted tightening values.

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°.

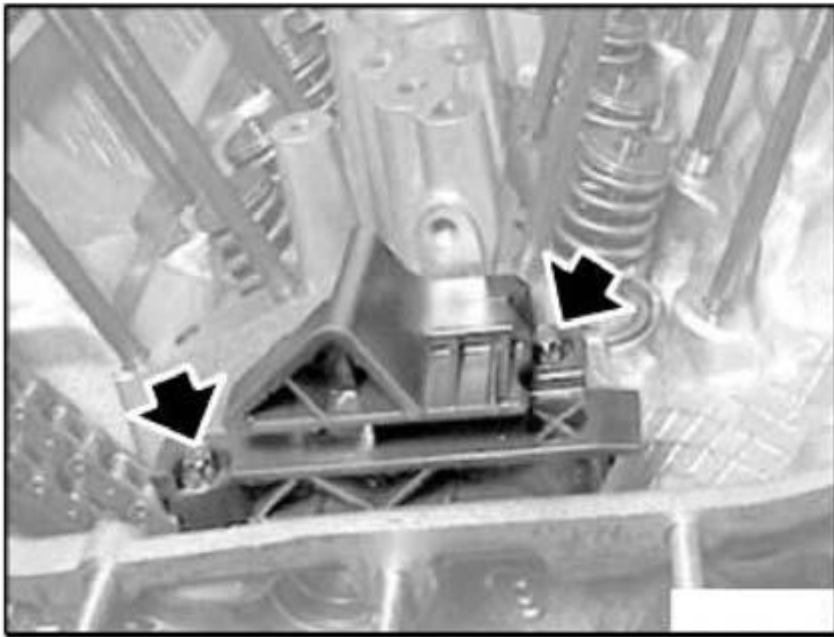


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Fig. 27: Tightening Cylinder Head Bolts
 Courtesy of BMW OF NORTH AMERICA, INC.

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

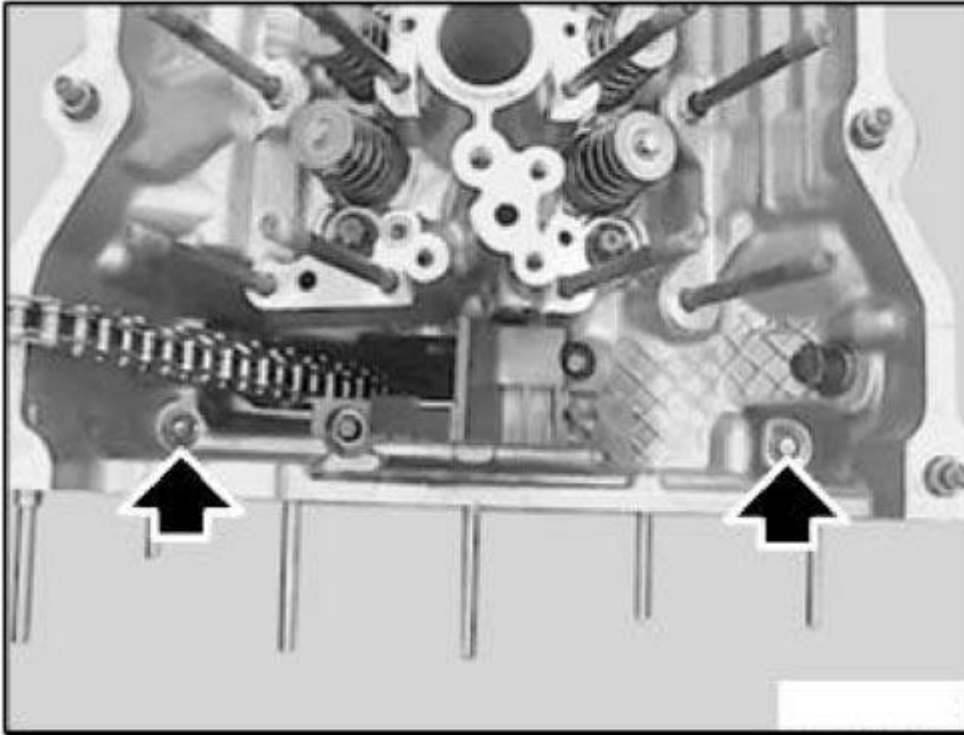
Install chain guide.



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Fig. 28: Installing Chain Guide
Courtesy of BMW OF NORTH AMERICA, INC.

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



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Fig. 29: 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.

B11 12 101 REPLACING CYLINDER HEAD GASKET (M52 / S52 / M52TU / M54 / M56)

Tasks are identical to Removing and installing cylinder head, refer to **11 12 100 REMOVING AND INSTALLING/REPLACING CYLINDER HEAD (M52TU / M54 / M56)**.

11 12 503 DISASSEMBLING AND ASSEMBLING CYLINDER HEAD (M52 / S52 / M52TU / M54 / M56)

Special tools required:

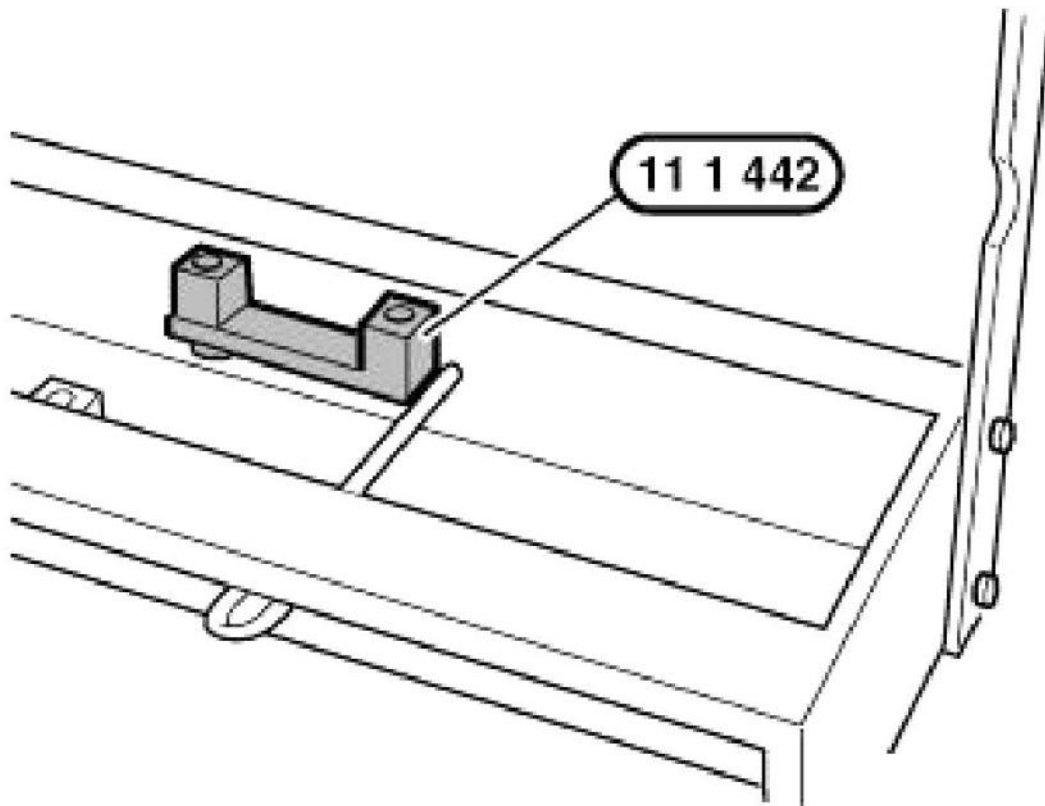
NOTE: For special tools, refer to **ENGINE - SPECIAL TOOLS** .

- 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. See **11 53 000 Removing and installing/replacing coolant thermostat (M52TU / M54 / M56)**

Screw on special tool 11 1 442.



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Fig. 30: Identifying Special Tool 11 1 442
Courtesy of BMW OF NORTH AMERICA, INC.

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

Provide special tools for disassembling cylinder head:

- special tool 11 1 071.
- special tool 11 1 067.
- special tool 11 0 192.

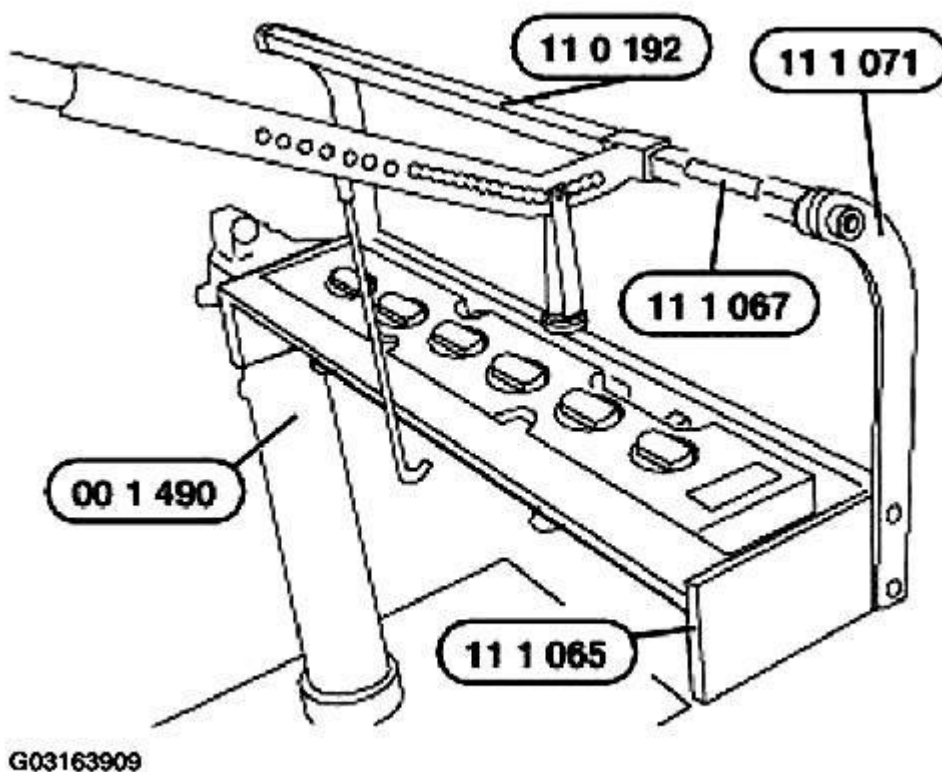


Fig. 31: Identifying Special Tools 11 1 071, 11 1 067 And 11 0 192
Courtesy of BMW OF NORTH AMERICA, INC.

- special tool 11 1 045.
- special tool 11 0 342.
- special tool 11 0 343.
- special tool 11 0 345.
- special tool 11 1 441.

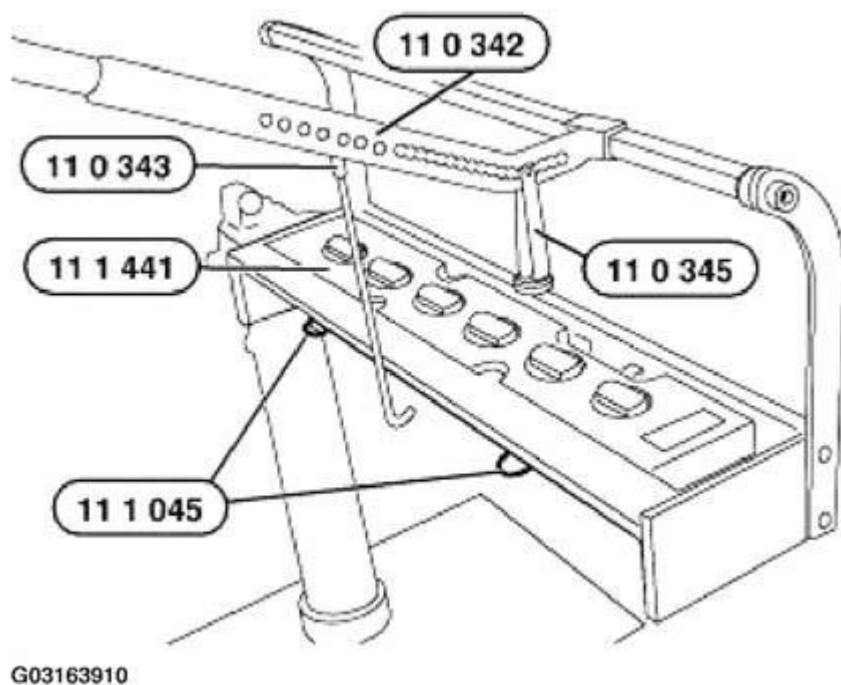
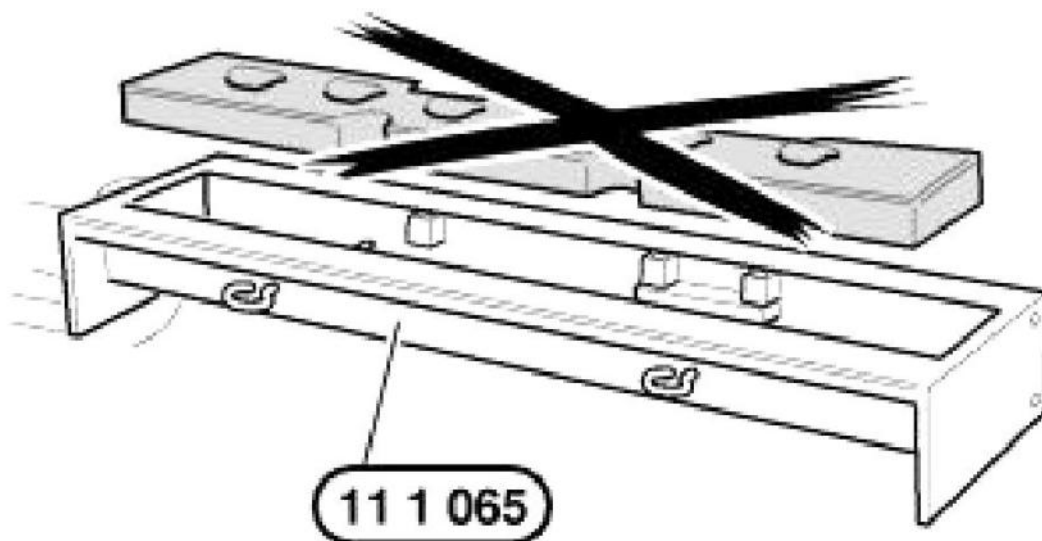


Fig. 32: Identifying Special Tools 11 1 045, 11 0 342, 11 0 343, 11 0 345 And 11 1 441
 Courtesy of BMW OF NORTH AMERICA, INC.

Assemble special tools.

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

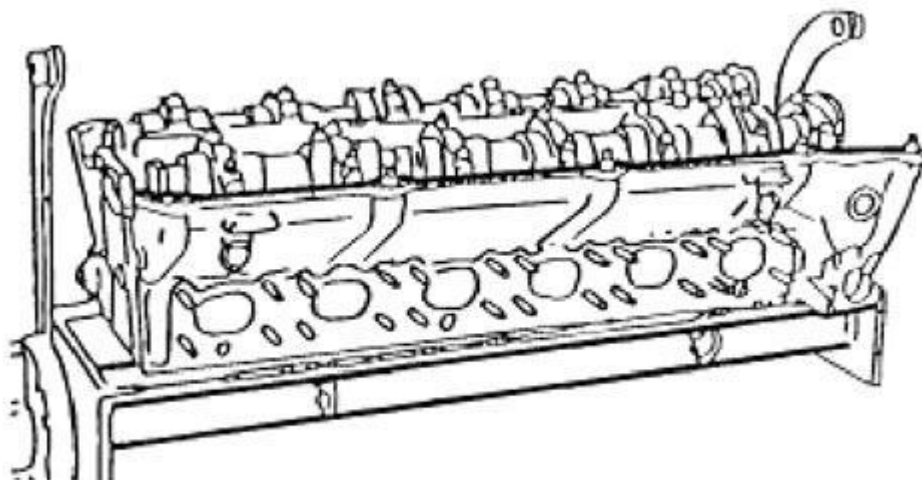


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Fig. 33: Identifying Special Tool 11 1 065

Courtesy of BMW OF NORTH AMERICA, INC.

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



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Fig. 34: Placing Cylinder Head On Special Tool

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)

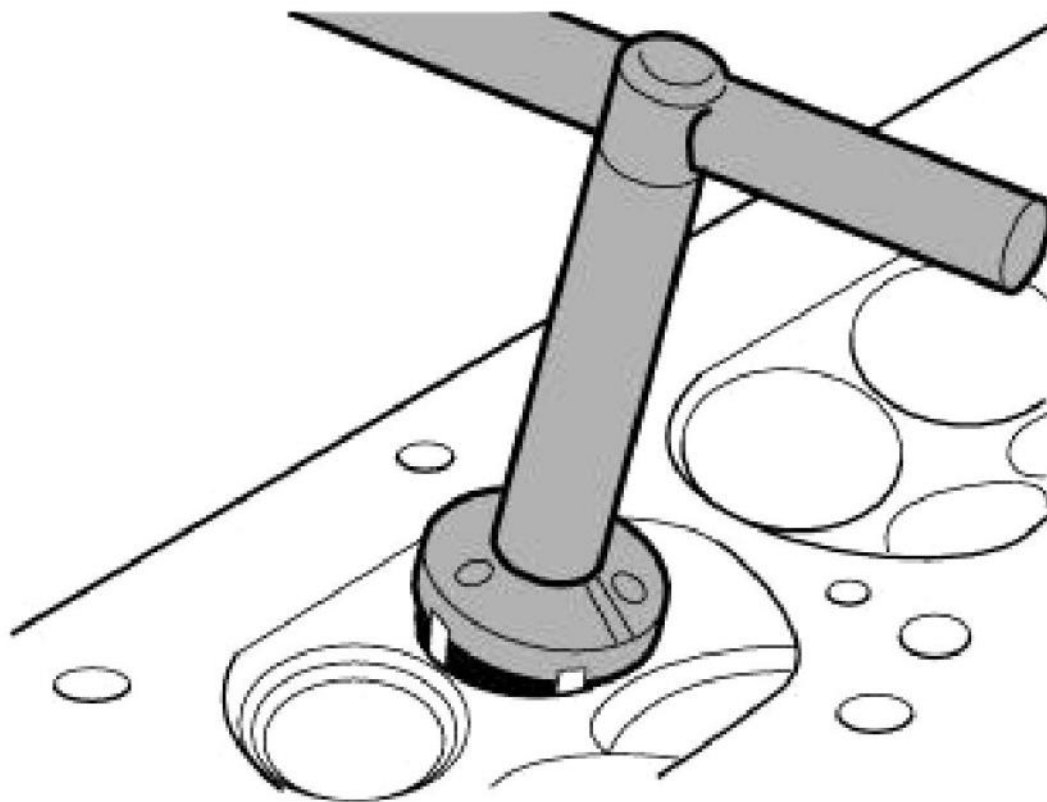
Special tools required:

NOTE: For special tools, refer to **ENGINE - SPECIAL TOOLS** .

- 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.



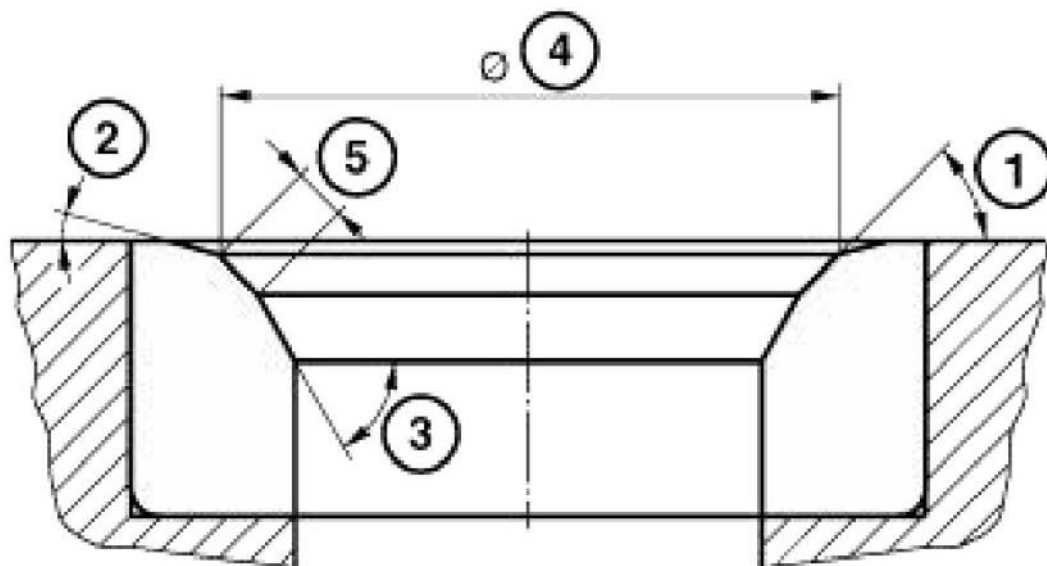
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Fig. 35: Identifying Special Tool

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 pre-specified diameter to produce valve seat width (5).

1. Valve-seat angle
2. Correction angle, outside



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Fig. 36: Identifying Valve-Seat Angle

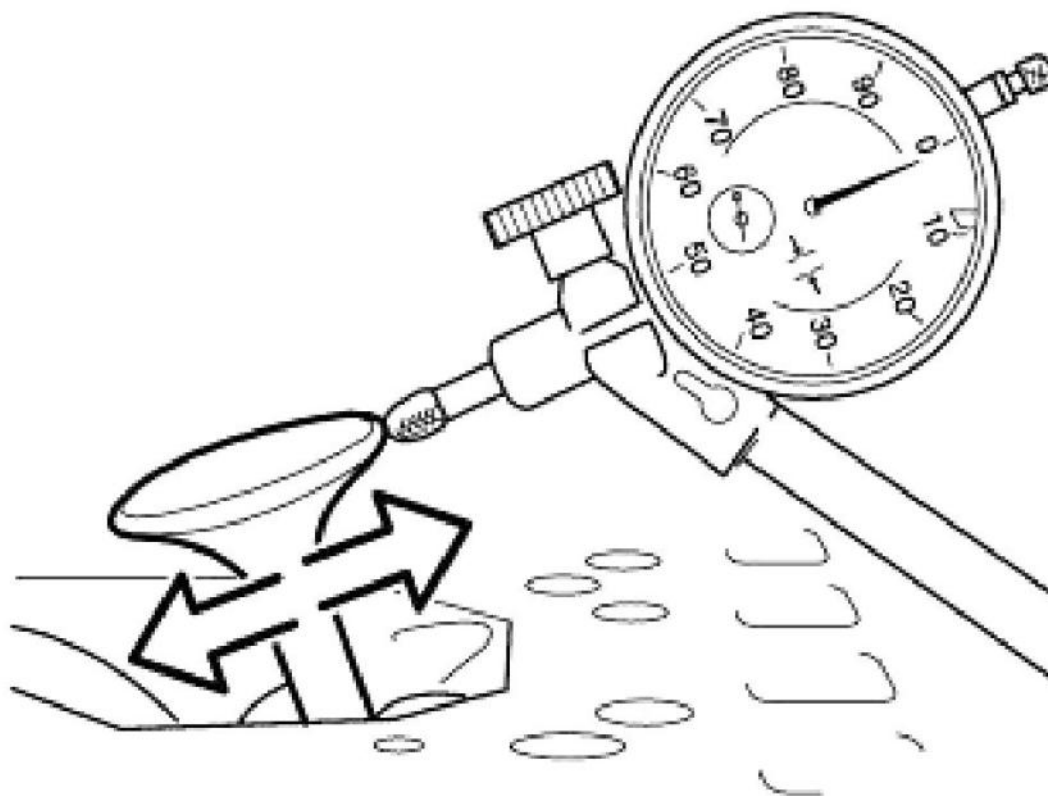
Courtesy of BMW OF NORTH AMERICA, INC.

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.

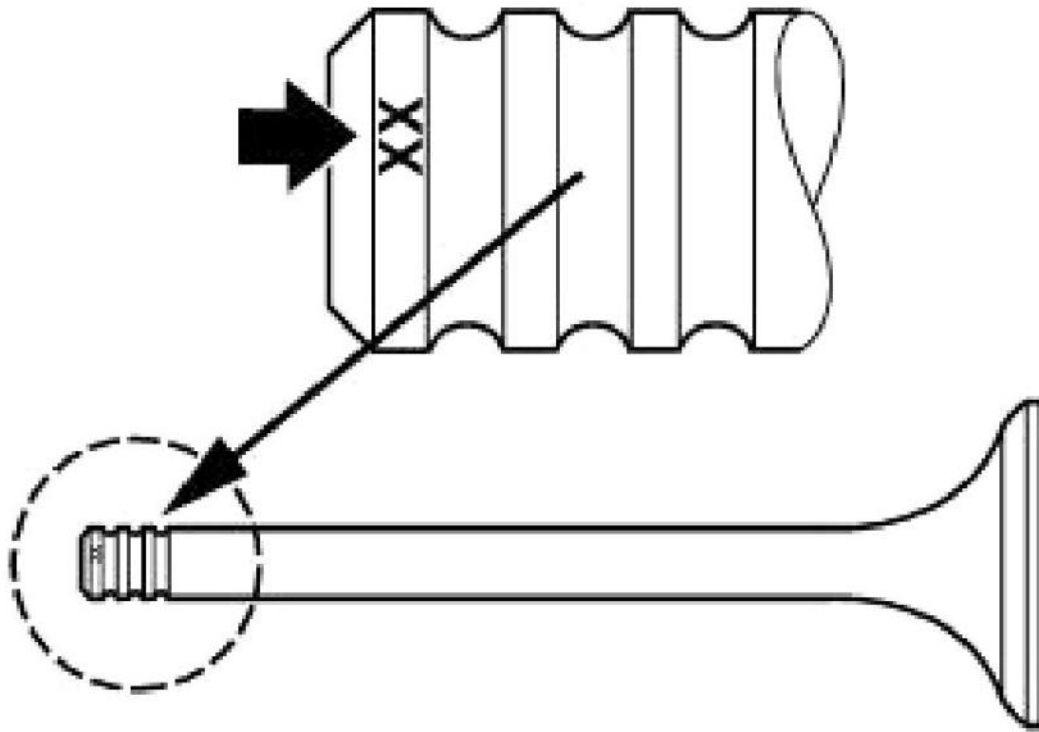


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Fig. 37: Attaching Dial Gauge And Measure Tilt Clearance
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: Max. permissible tilt clearance is 0.5 mm.

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



G03163916

Fig. 38: Identifying Tilt Clearance

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:**

NOTE: For special tools, refer to ENGINE - SPECIAL TOOLS .

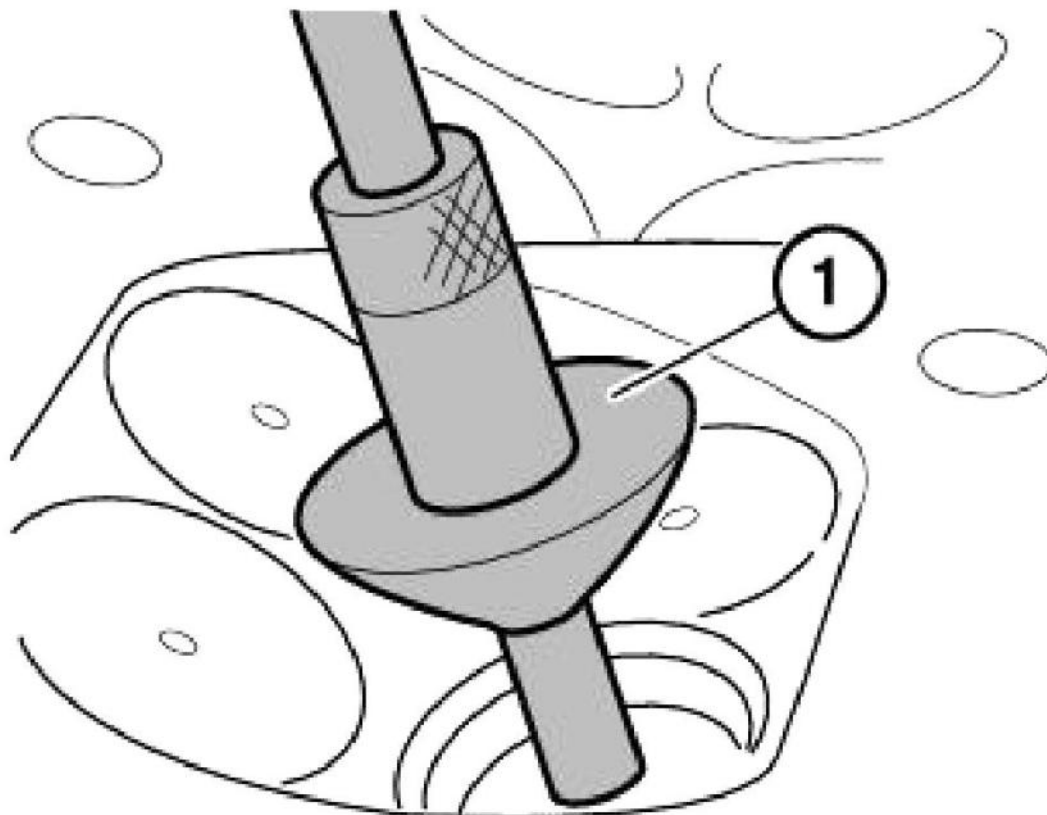
- 00 4 210

(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.



G03163917

Fig. 39: Identifying Reaming Tool And Guide Taper
Courtesy of BMW OF NORTH AMERICA, INC.

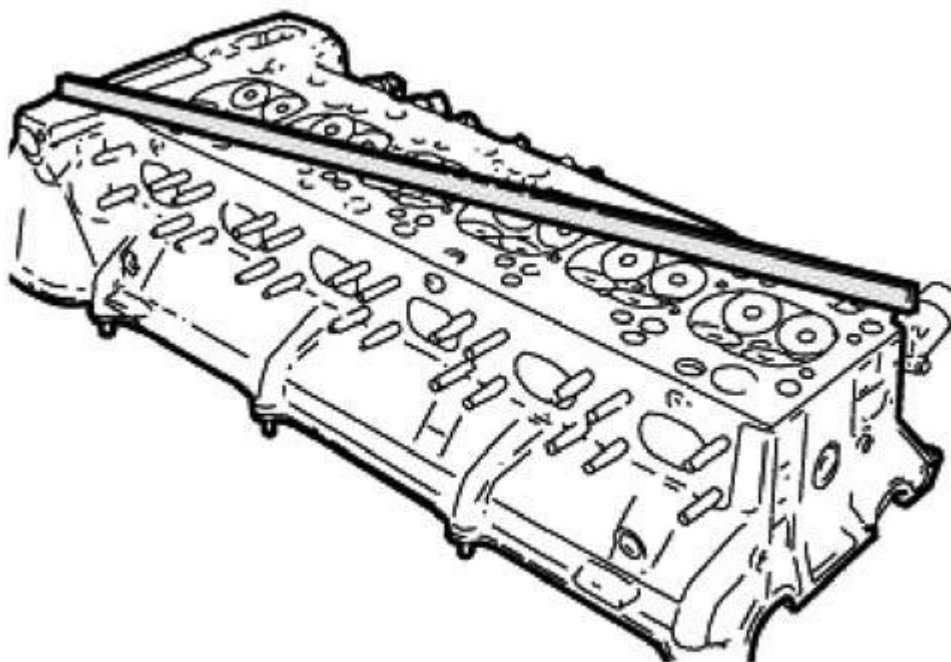
NOTE: Remachine valve seat after reaming.

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.

Deviation from flatness max. 0.05 mm.



G03163918

Fig. 40: Checking Flatness Of Cylinder Head
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: **Machining limit; 139.7 mm.**

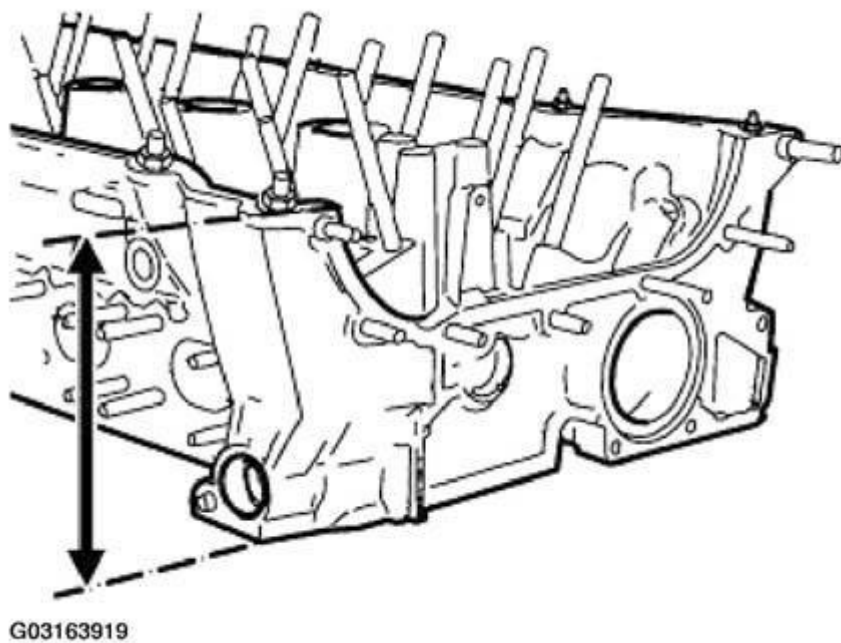
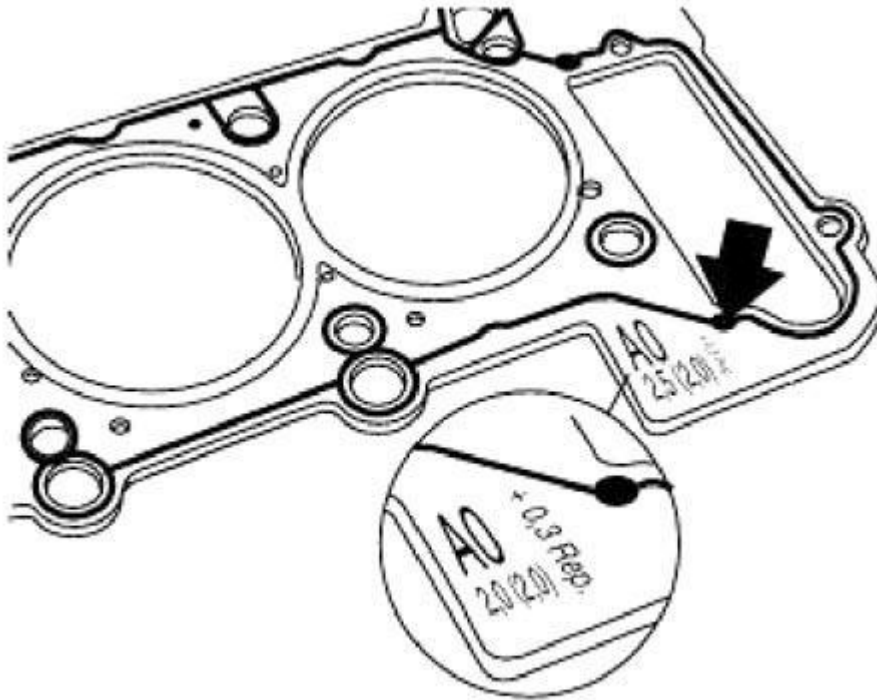


Fig. 41: Identifying Cylinder Head Height
Courtesy of BMW OF NORTH AMERICA, INC.

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



G03163920

Fig. 42: 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:

NOTE: For special tools, refer to ENGINE - SPECIAL TOOLS .

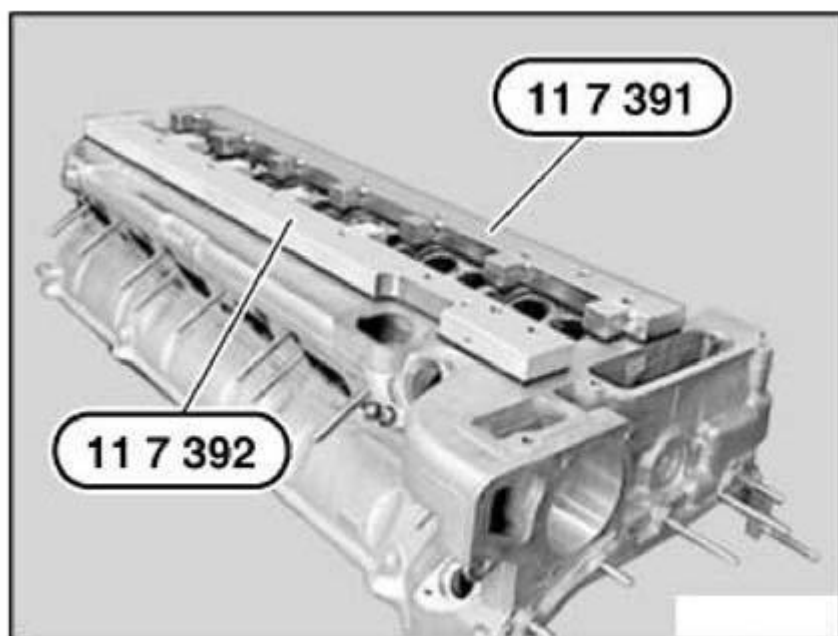
- 11 7 390
- 11 7 391
- 11 7 392
- 11 7 393
- 11 7 394
- 11 7 395
- 11 7 396
- 11 7 397
- 11 7 398

(Cylinder head dismantled)

Prepare special tool kit 11 7 390.

NOTE: Special tool kit 117390 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.

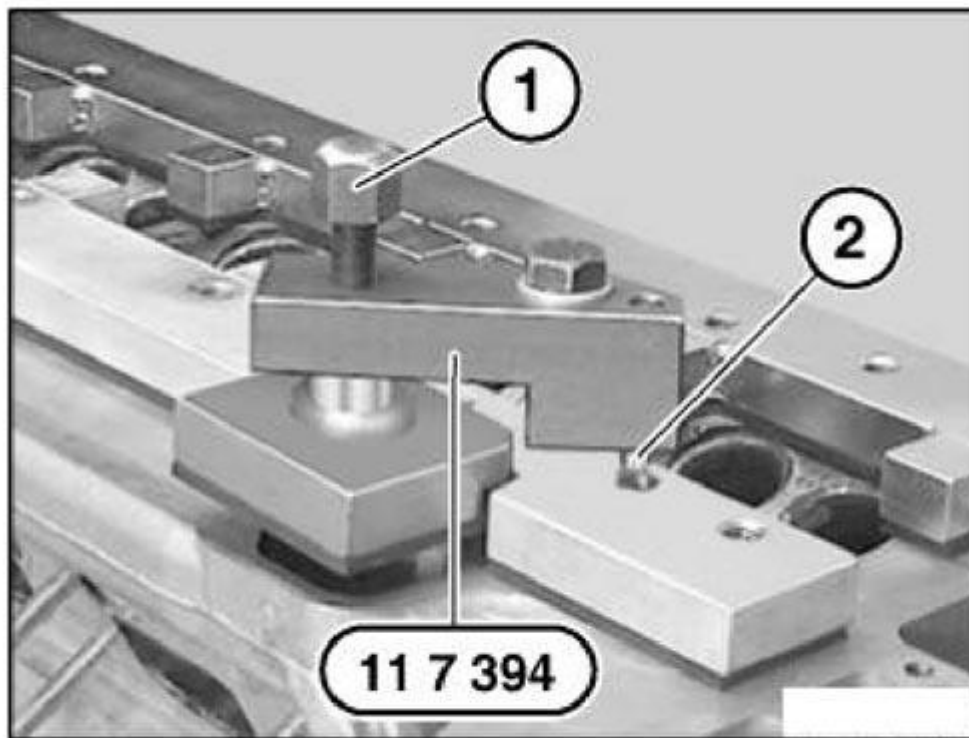
Place special tools 11 7 391 / 11 7 392 on cylinder head sealing surface and screw down with cylinder head bolts.



G03163921

Fig. 43: Identifying Special Tools 11 7 391 And 11 7 392
Courtesy of BMW OF NORTH AMERICA, INC.

Turn back screw (1).



G03163922

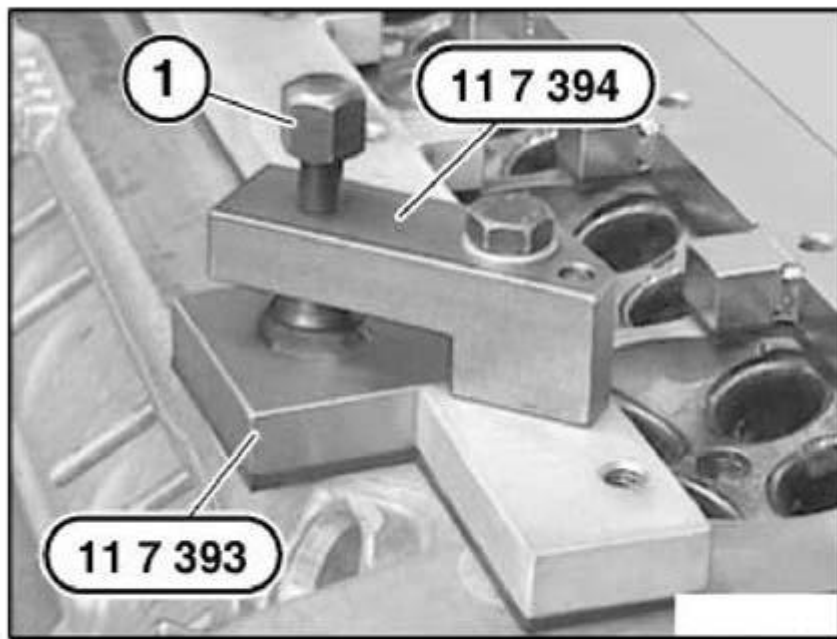
Fig. 44: Turning Back Screw

Courtesy of BMW OF NORTH AMERICA, INC.

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

Fit special tool 11 7 394.

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

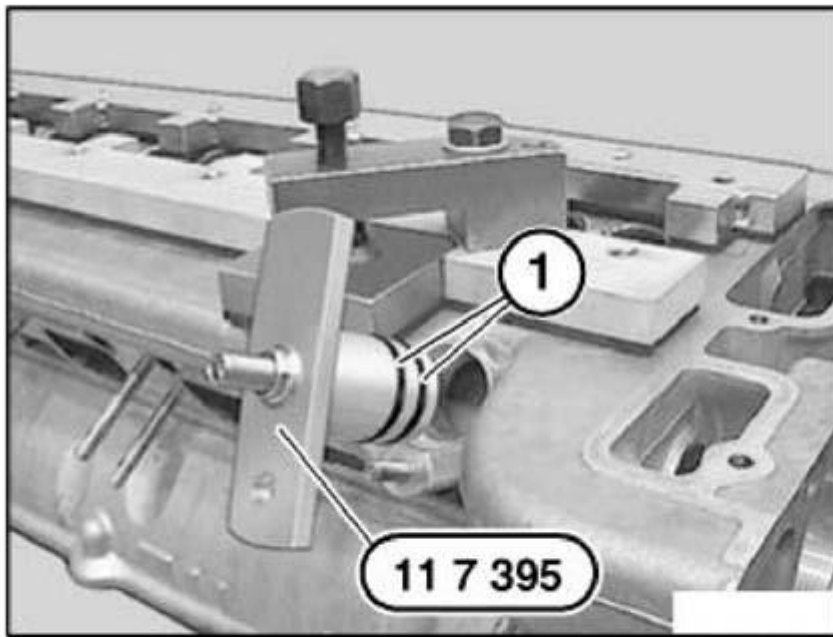


G03163923

Fig. 45: Inserting Screw By Hand Until Special Tool 11 7 393 Rests On Sealing Surface
Courtesy of BMW OF NORTH AMERICA, INC.

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

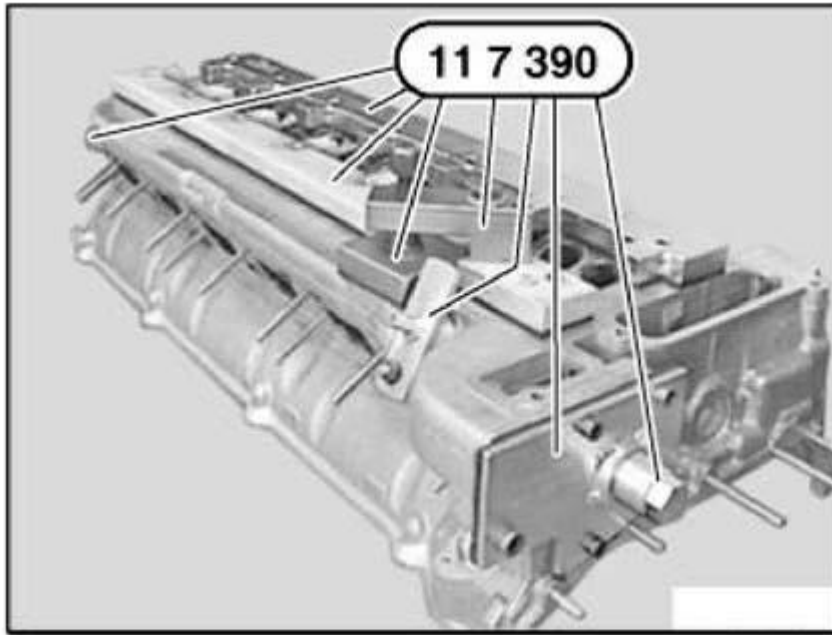
Check sealing rings (1) and coat with water as anti-friction coating. Insert special tool 11 7 395 and tighten down.



G03163924

Fig. 46: Checking Sealing Rings And Coat With Water
Courtesy of BMW OF NORTH AMERICA, INC.

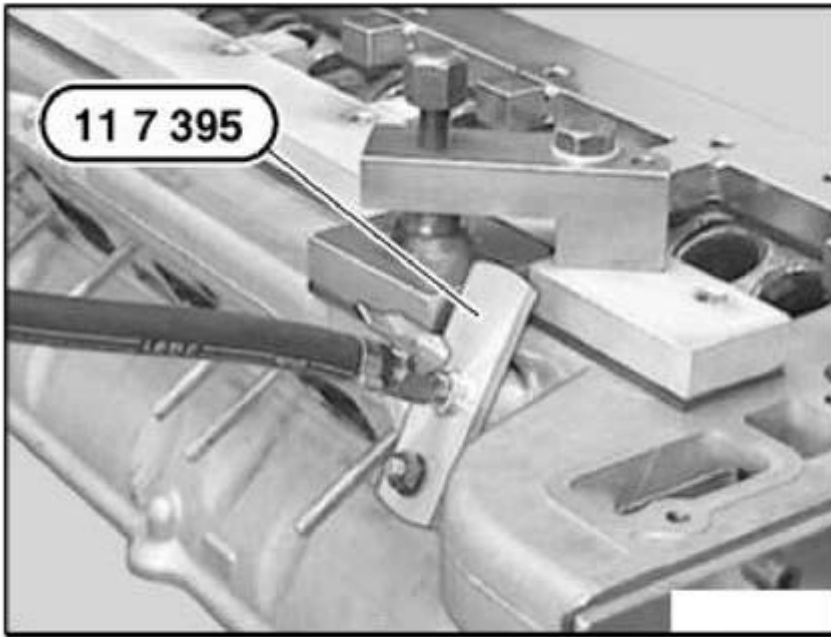
Seal coolant apertures with special tool kit 11 7 390.



G03163925

Fig. 47: Identifying Special Tool Kit 11 7 390
Courtesy of BMW OF NORTH AMERICA, INC.

Connect compressed air to special tool 11 7 395.



G03163926

Fig. 48: Connecting Compressed Air To Special Tool 11 7 395
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:

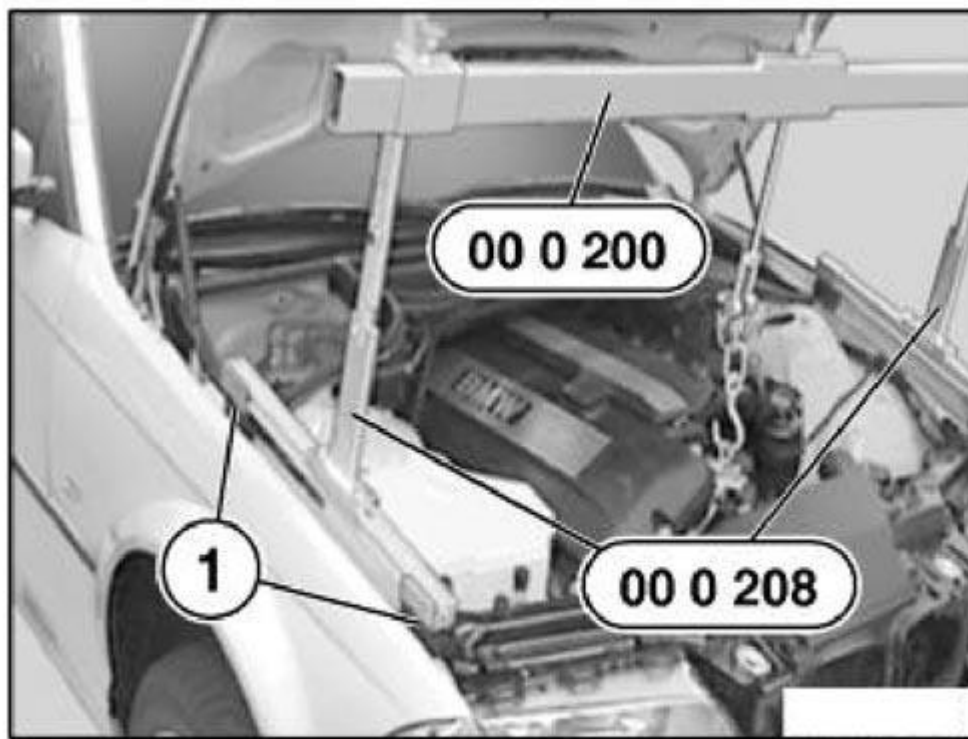
NOTE: For special tools, refer to **ENGINE - SPECIAL TOOLS** .

- 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 0 204 / 00 0 208 and fit.



G03163927

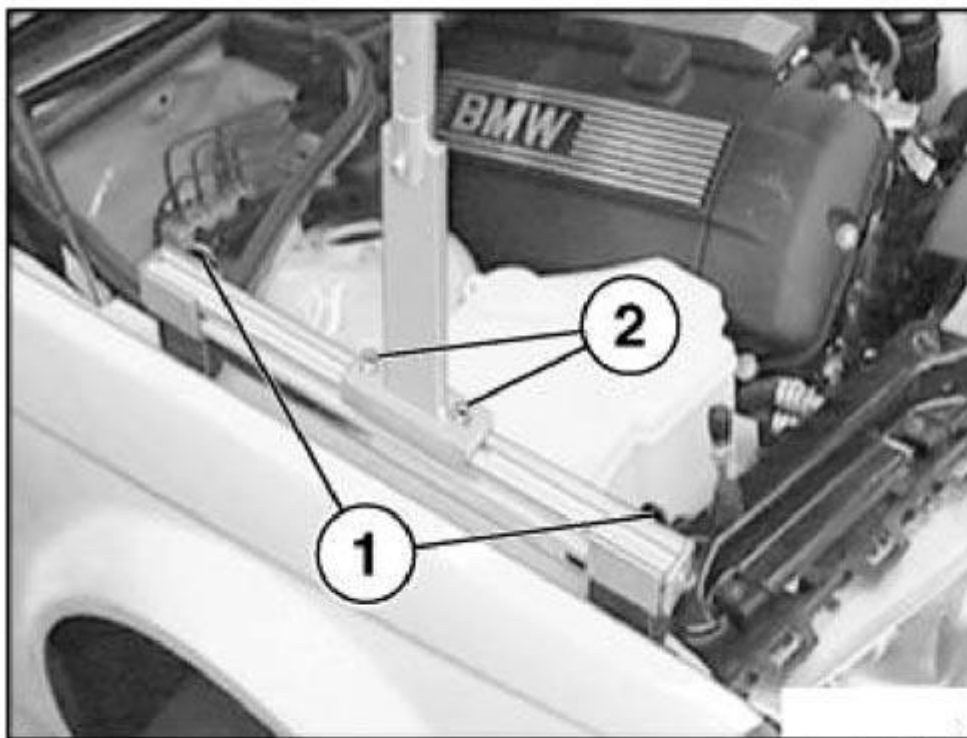
Fig. 49: Identifying Special Tools 00 0 200 And 00 0 208

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).



G03163928

Fig. 50: Tightening Screws

Courtesy of BMW OF NORTH AMERICA, INC.

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



G03163929

Fig. 51: Raising Engine With Special Tool 00 0 200
Courtesy of BMW OF NORTH AMERICA, INC.

Remove suction filter housing, refer to **13 71 000 REMOVE AND INSTALLING INTAKE FILTER HOUSING (M52TU, M54)** .

Remove engine splash guard. See **51 11 000 REMOVING AND INSTALLING COMPLETE FRONT BUMPER (FROM 10/01)**

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

On vehicles with automatic transmission:

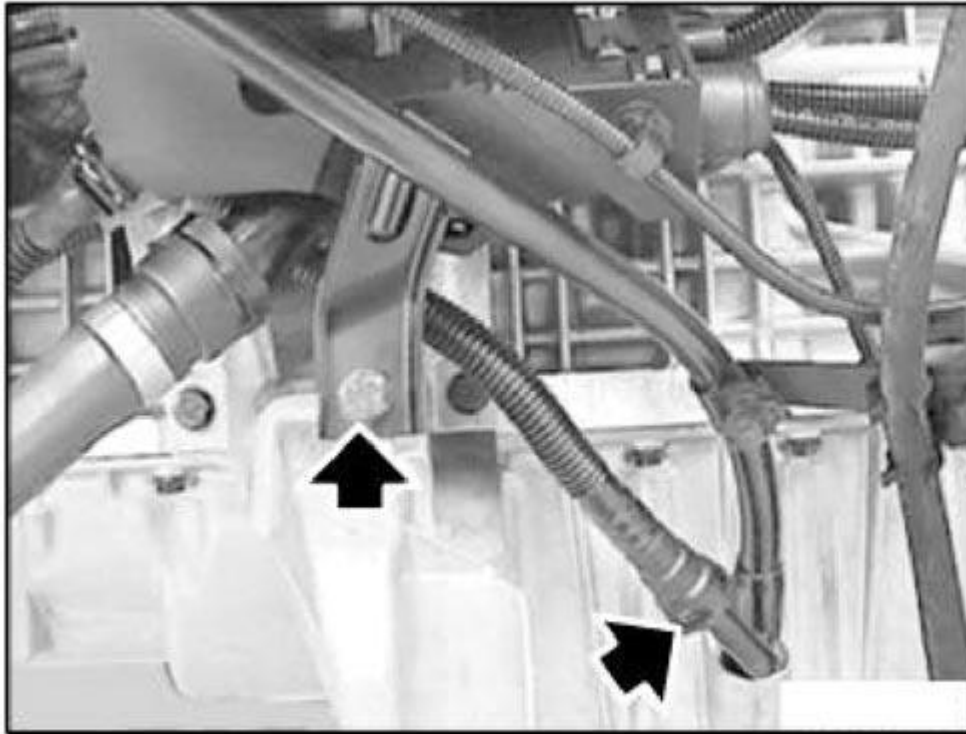
Disconnect oil lines from automatic transmission and from oil pan.

Release guide tube for dipstick.

NOTE: **M52 TU and M54 only.**

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

Remove oil dipstick guide tube upwards.

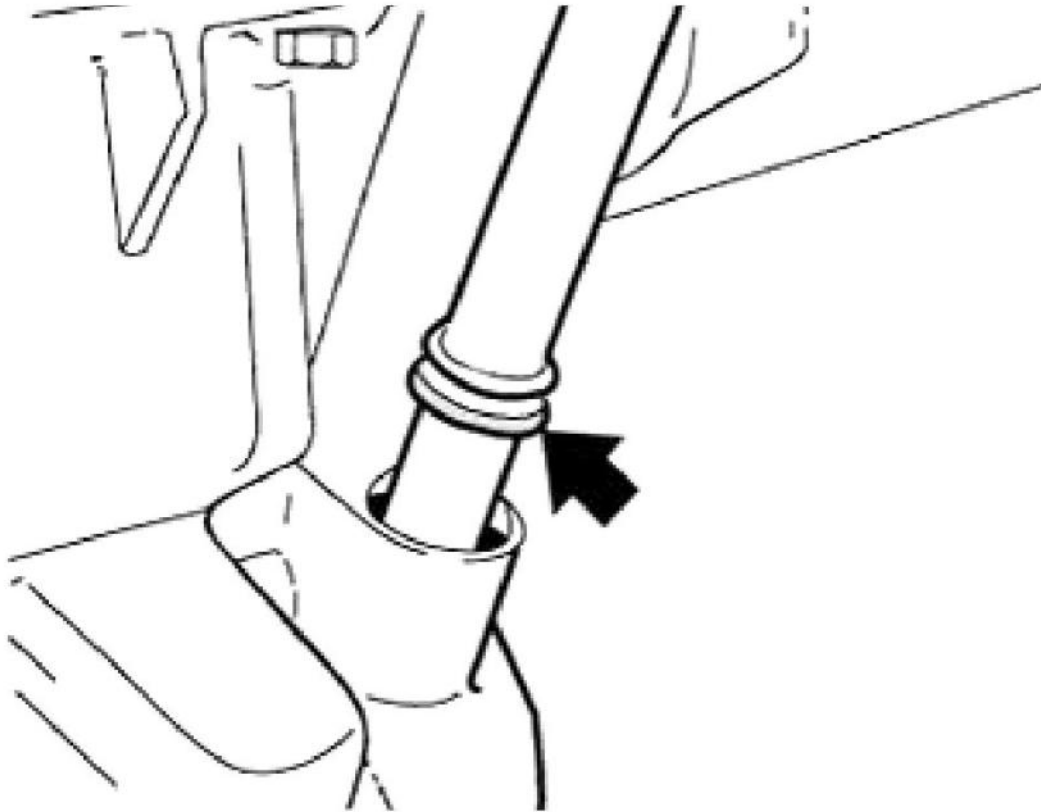


G03163930

Fig. 52: Removing Oil Dipstick Guide Tube
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Replace O-ring.



G03163931

Fig. 53: Replacing O-Ring

Courtesy of BMW OF NORTH AMERICA, INC.

Remove front end reinforcement. See **REINFORCEMENT CROSS BRACE**

Detach steering spindle from steering gear.

Remove vane pump for power steering unit (lines remain connected). See **POWER STEERING VANE PUMP (M52/M54)**

Disconnect plug connection to oil level sensor.

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

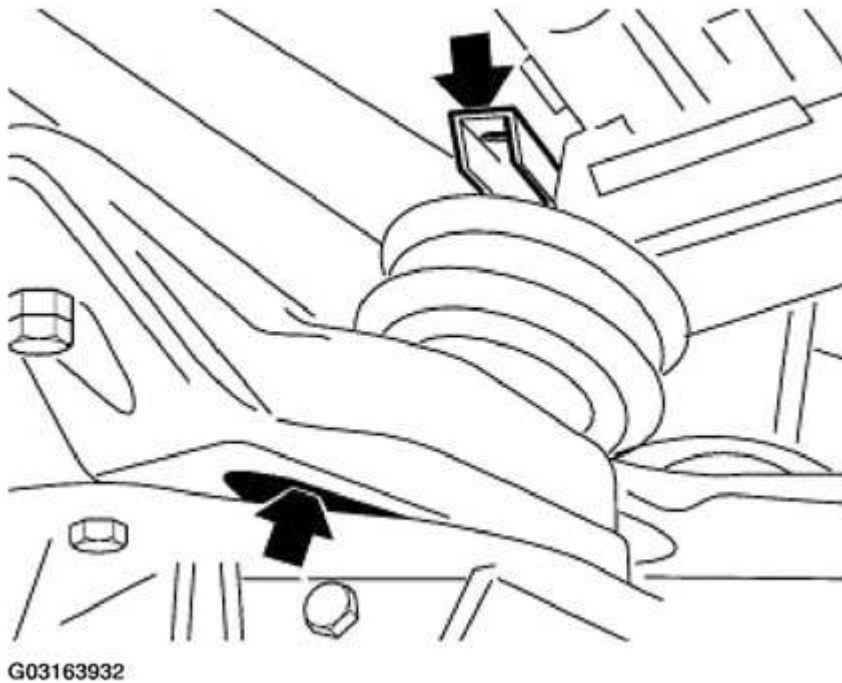


Fig. 54: Loosening Top And Unfasten Bottom Of Left And Right Engine Mounts
 Courtesy of BMW OF NORTH AMERICA, INC.

E46 4WD only

Remove left and right swivel bearings. See **RIGHT AXLE SHAFT BEARING PEDESTAL (E46 ALL WHEEL DRIVE VEHICLES)**

Remove output shafts. See **DRIVE AXLE SHAFTS (REAR, 2 WHEEL DRIVE MODELS)**

Remove front propeller shaft. See **26 20 000 REMOVING AND INSTALLING FRONT PROPELLER SHAFT (325XI)**

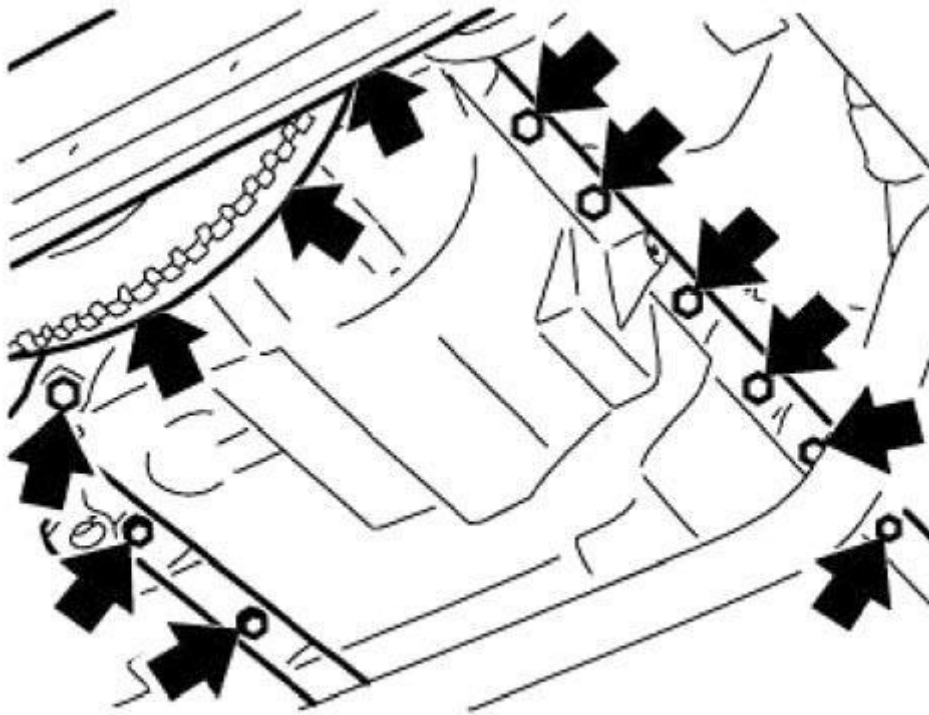
Remove front axle differential. See **DRIVE AXLE SHAFTS (REAR, 2 WHEEL DRIVE MODELS)**

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.

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.



G03163933

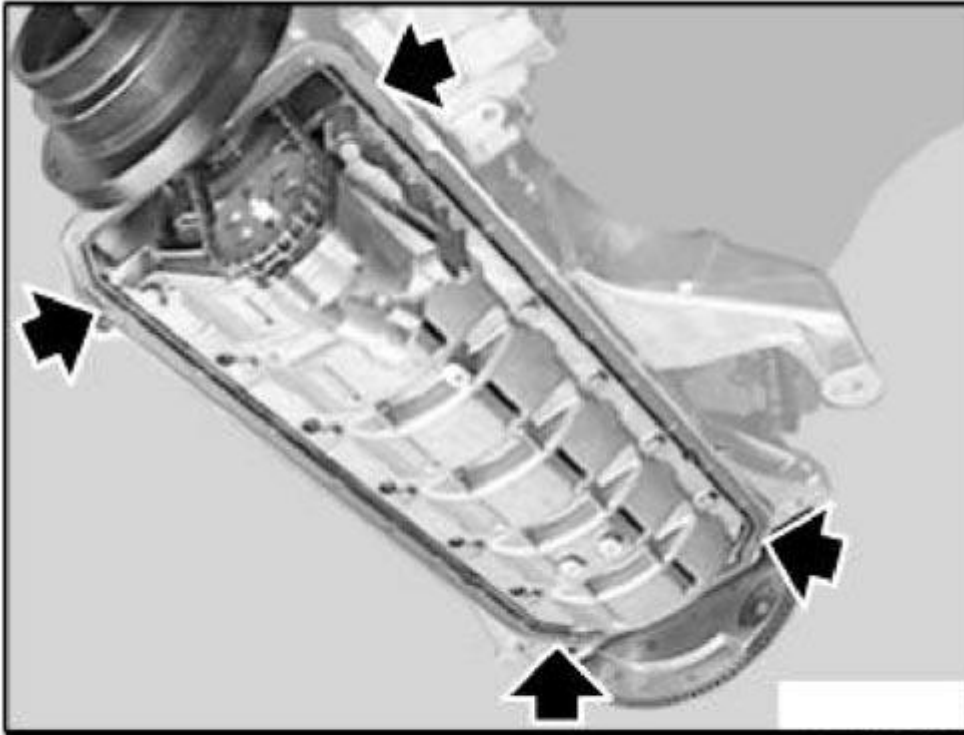
Fig. 55: Removing Oil Sump

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 to the area around seams.



G03163934

Fig. 56: Applying Coat Of Drei Bond
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 stage.
5. Tighten down screws in engine end.
6. Tighten down screws in transmission end.

HOUSING COVER

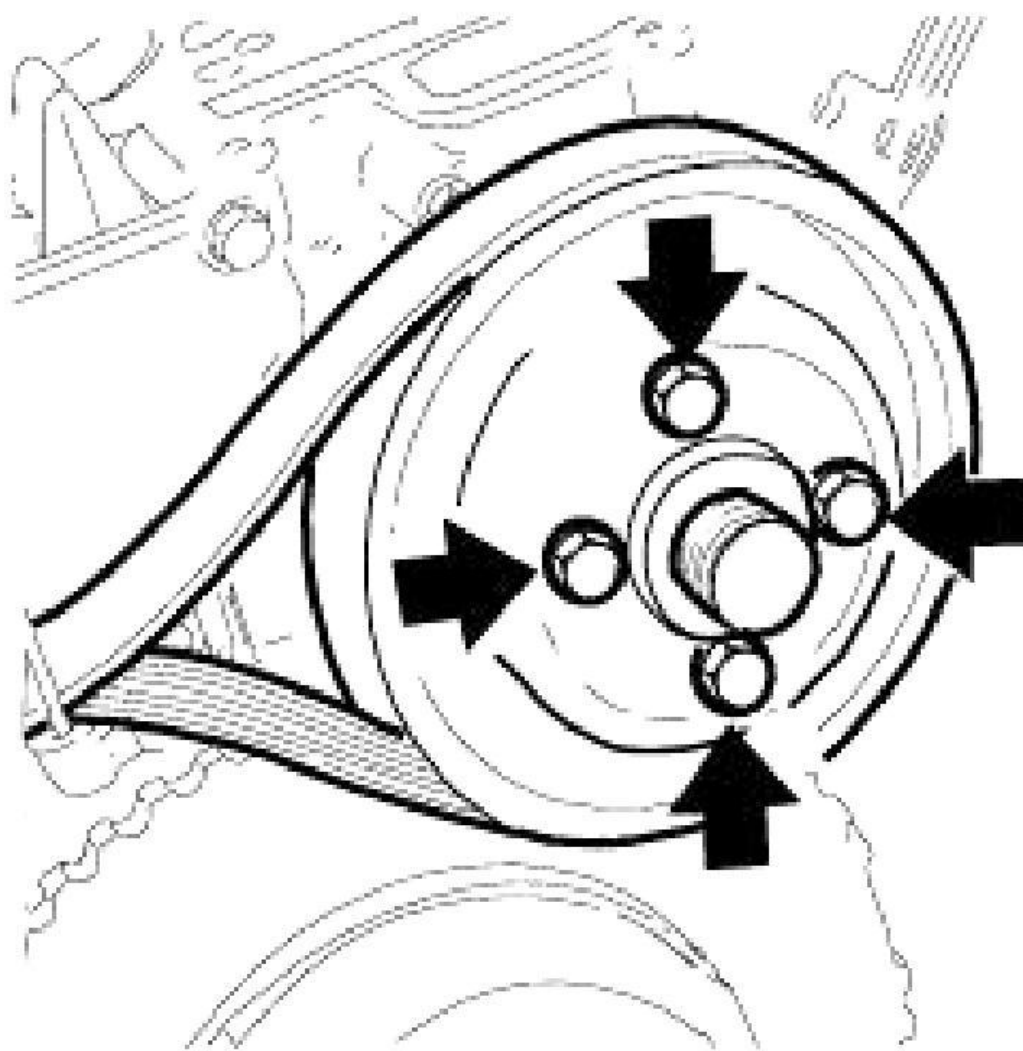
11 14 110 REMOVING AND INSTALLING LOWER TIMING CASE COVER (M52 / S52 / M52TU / M54)

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. See **11 28 010 Replacing alternator drive belt (M52 / S52 / M52TU / M54 / M56)**

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



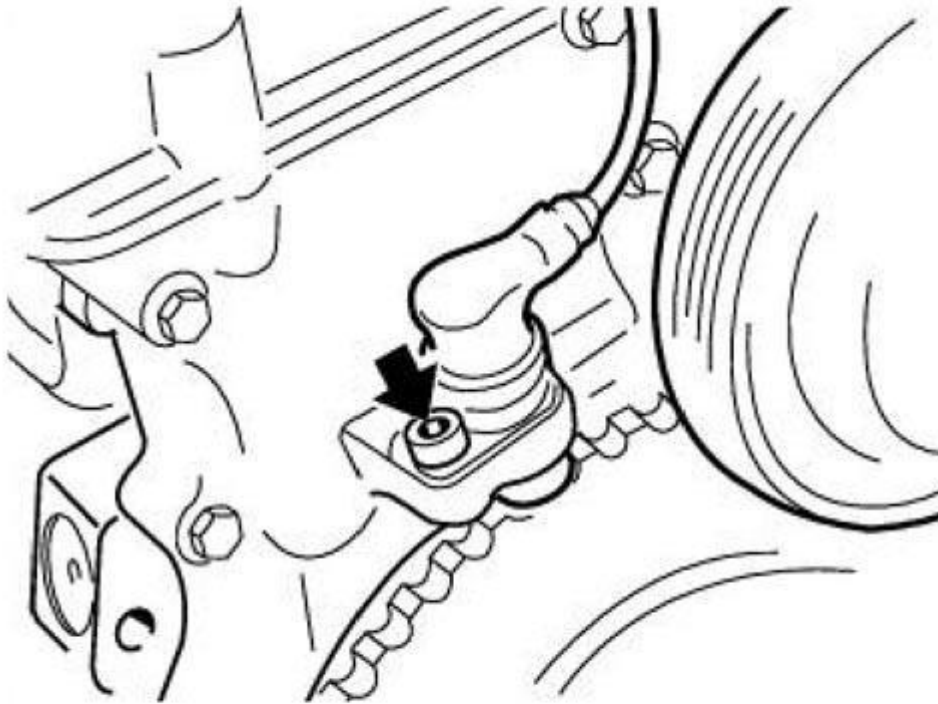
G03163935

Fig. 57: Identifying Screws

Courtesy of BMW OF NORTH AMERICA, INC.

M52 / S52 only

Unfasten engine speed sensor.



G03163936

Fig. 58: Unfastening Engine Speed Sensor

Courtesy of BMW OF NORTH AMERICA, INC.

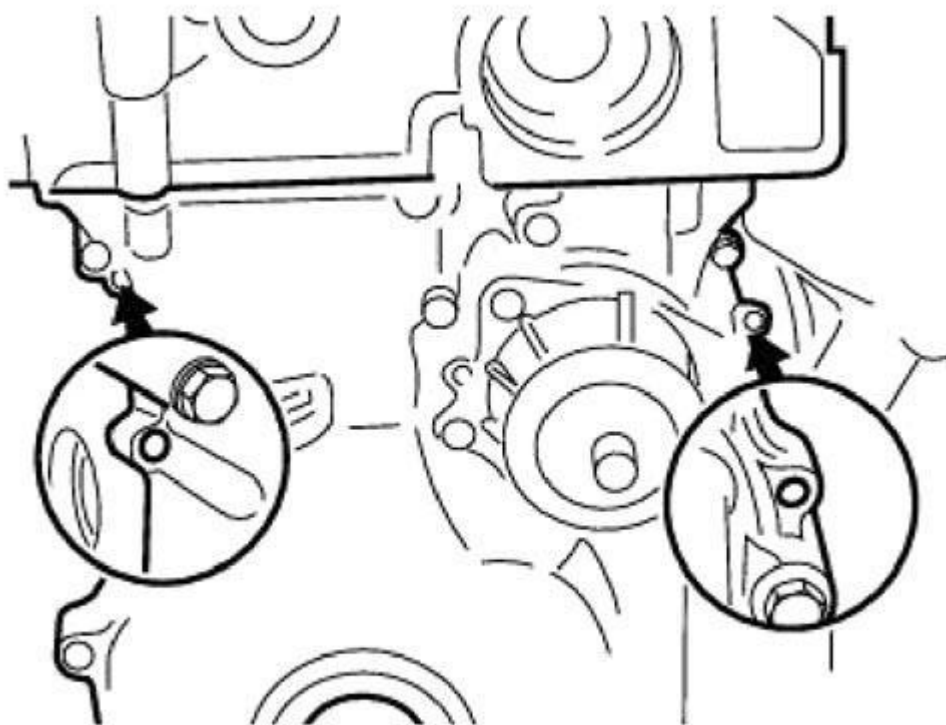
Remove vibration damper. See **11 23 010 Removing and installing or replacing vibration damper (M52TU / M54 / M56)**

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

Remove oil sump. See **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)

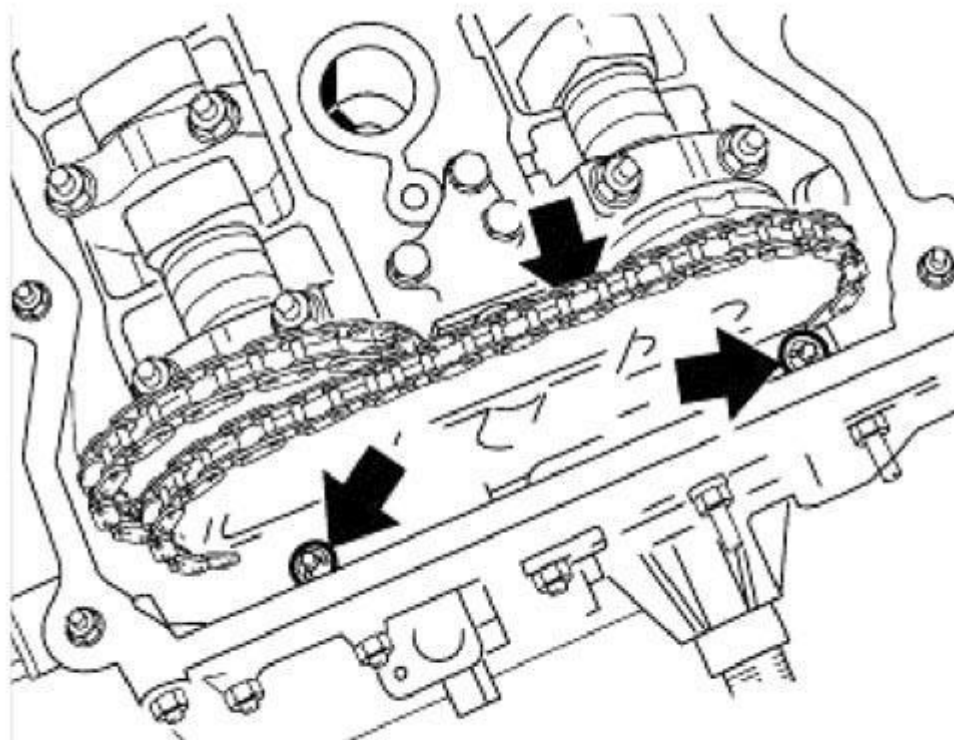


G03163937

Fig. 59: Identifying Dowel Pins

Courtesy of BMW OF NORTH AMERICA, INC.

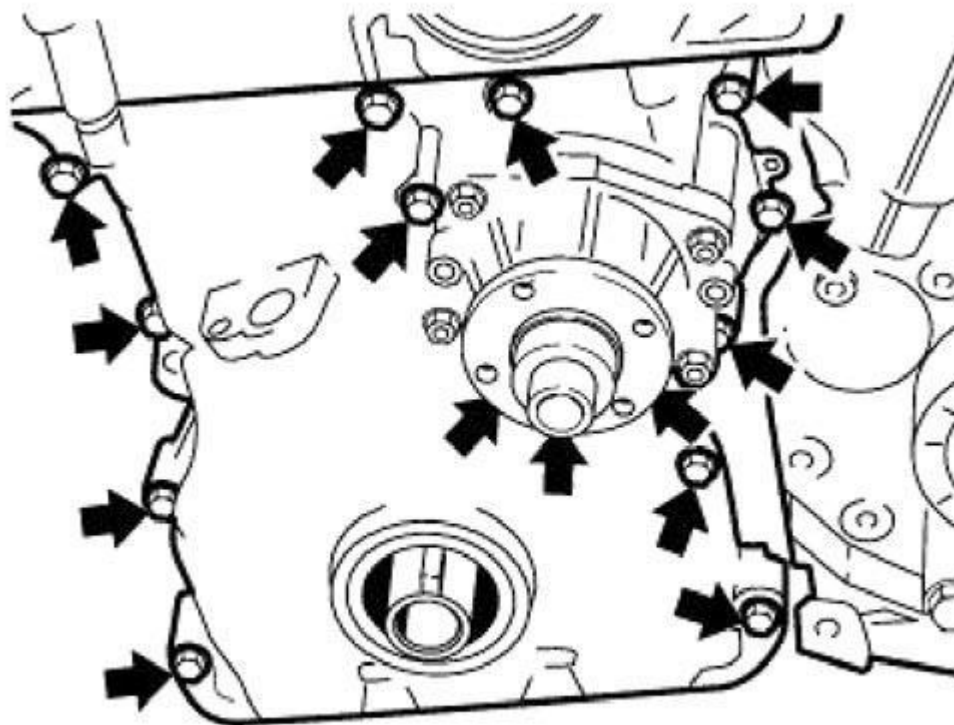
Unscrew timing case cover to cylinder head bolts.



G03163938

Fig. 60: Unscrewing Timing Case Cover
Courtesy of BMW OF NORTH AMERICA, INC.

Unfasten screws and remove timing case cover.



G03163939

Fig. 61: Removing Timing Case Cover

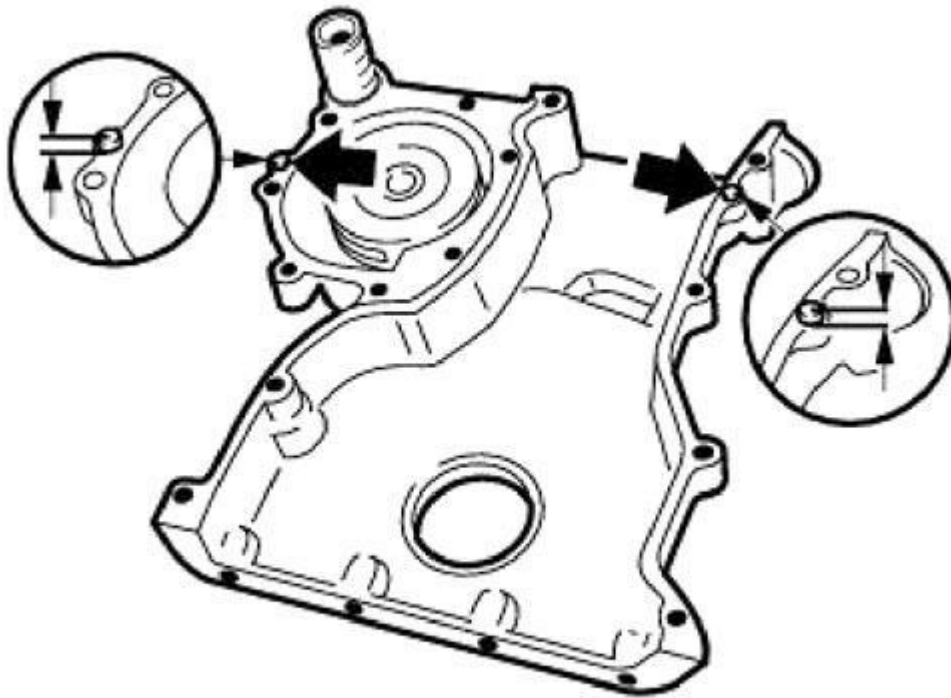
Courtesy of BMW OF NORTH AMERICA, INC.

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

Installation:

Clean sealing surfaces.

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

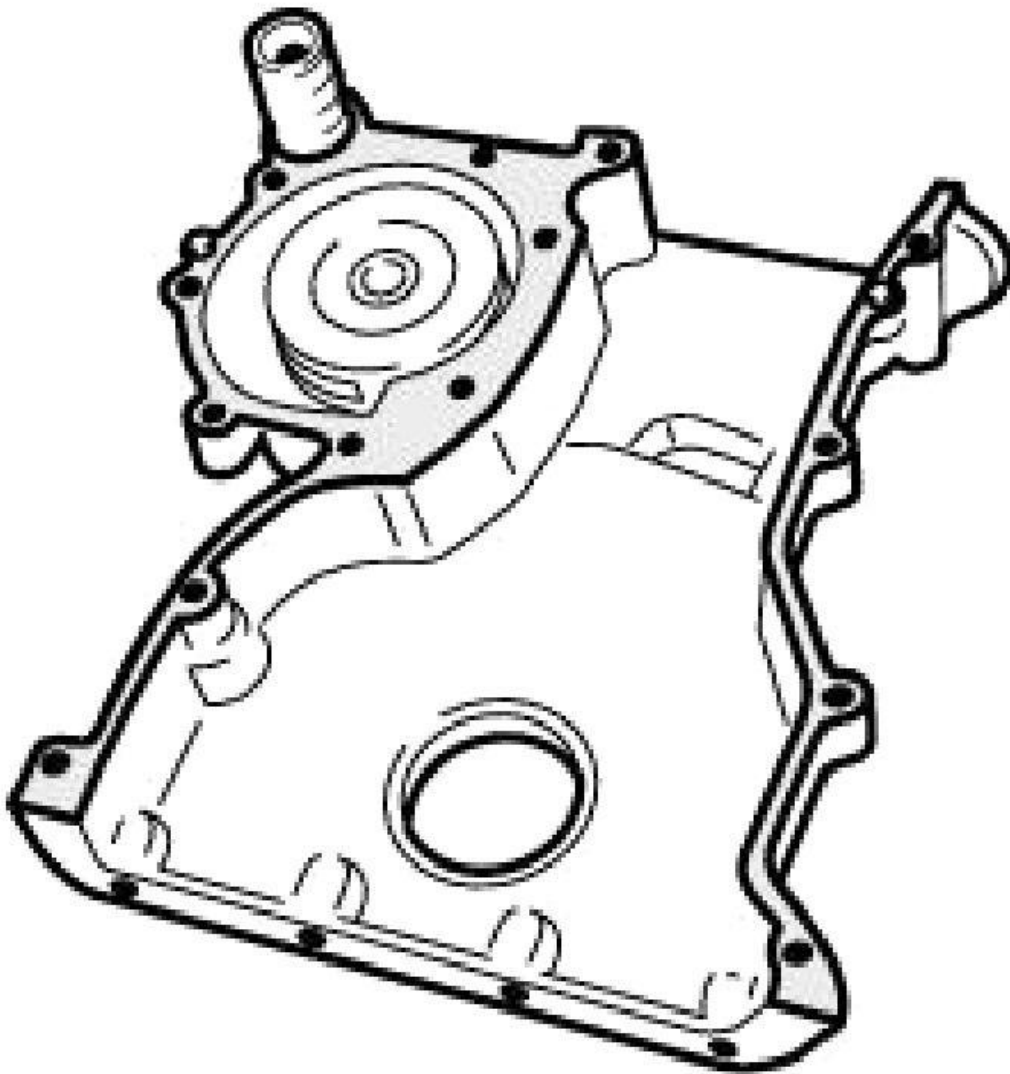


G03163940

Fig. 62: Identifying Timing Case Cover
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

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



G03163941

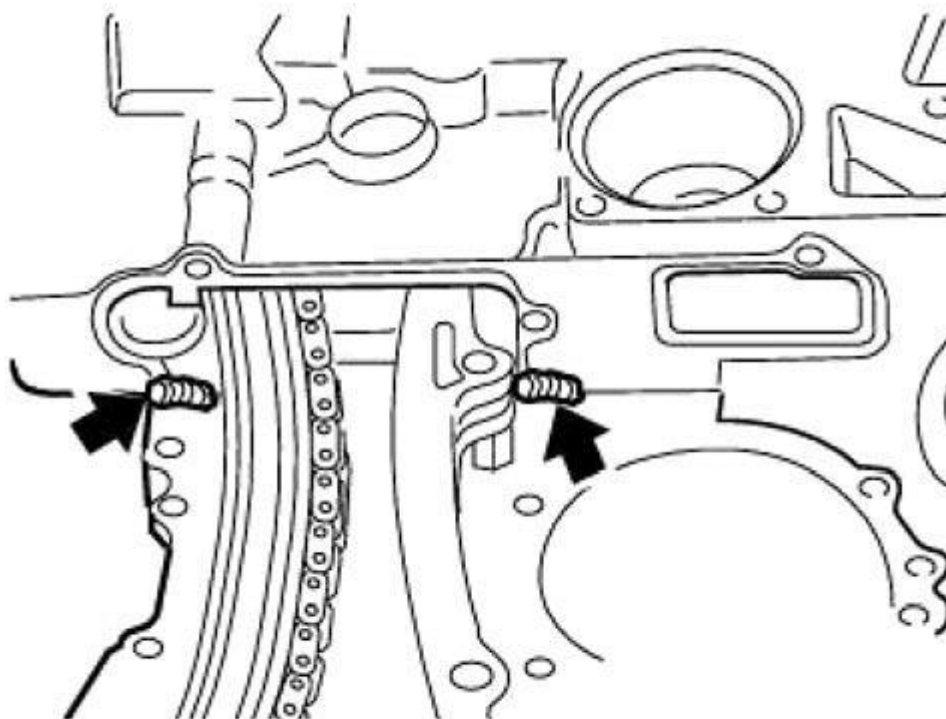
Fig. 63: Securing New Seals To Timing Case Cover
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Sealing faces clean and free of seal debris.

Apply Drei Bond 1209 sealing compound at following points:

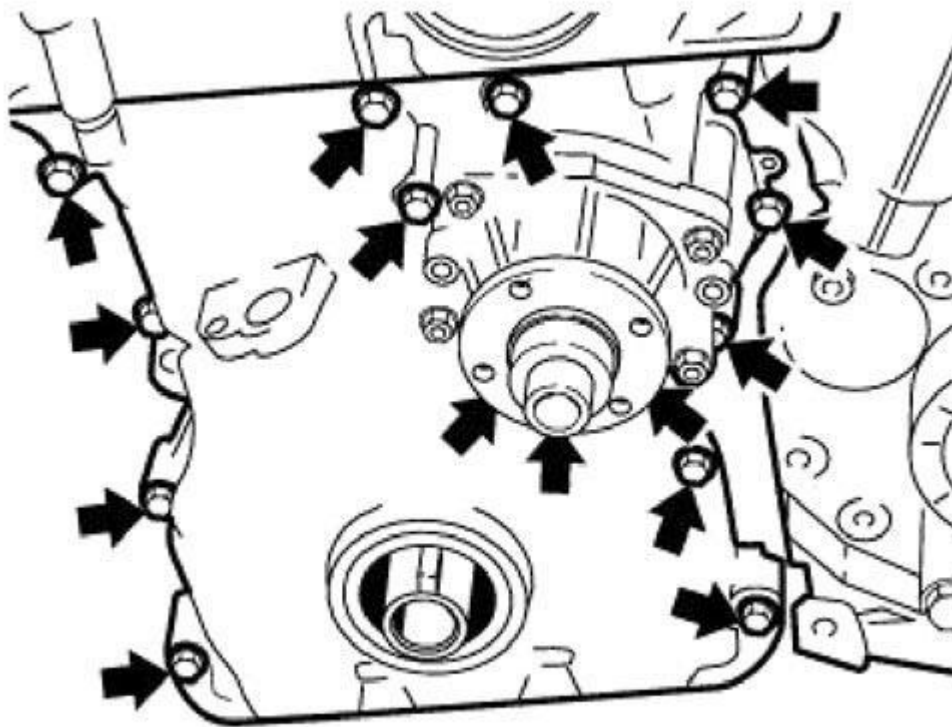
- A bead at the transitions to the cylinder head gasket on the left and right.
- Thinly and evenly to the entire sealing face of the timing case cover to the cylinder head gasket.



G03163942

Fig. 64: Identifying Bead**Courtesy of BMW OF NORTH AMERICA, INC.***Installation:*

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



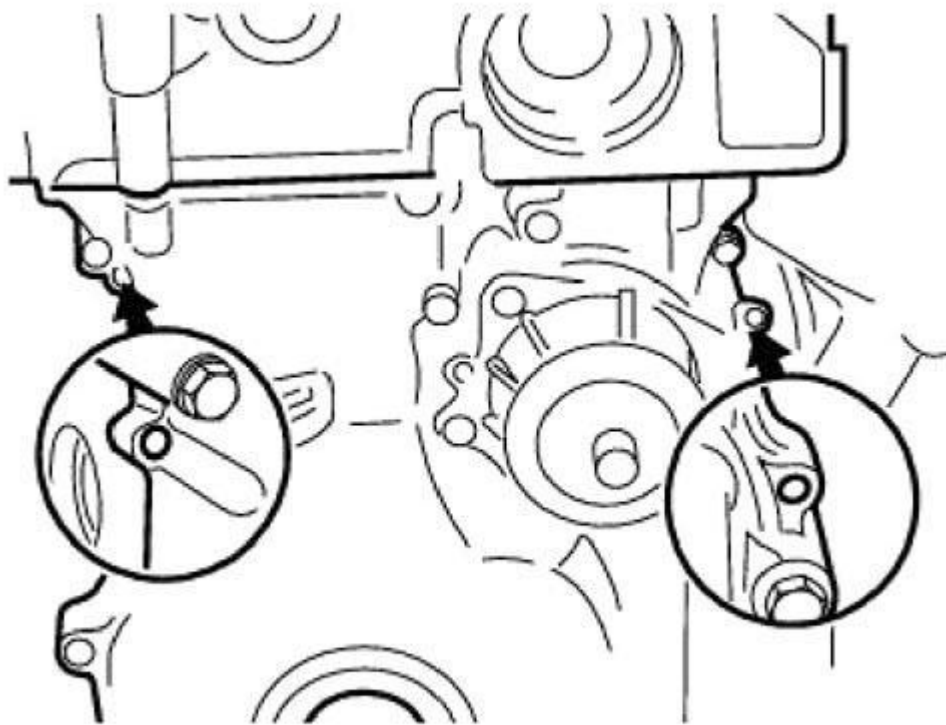
G03163943

Fig. 65: Inserting All Screws

Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Drive in dowel pins from front until flush.



G03163944

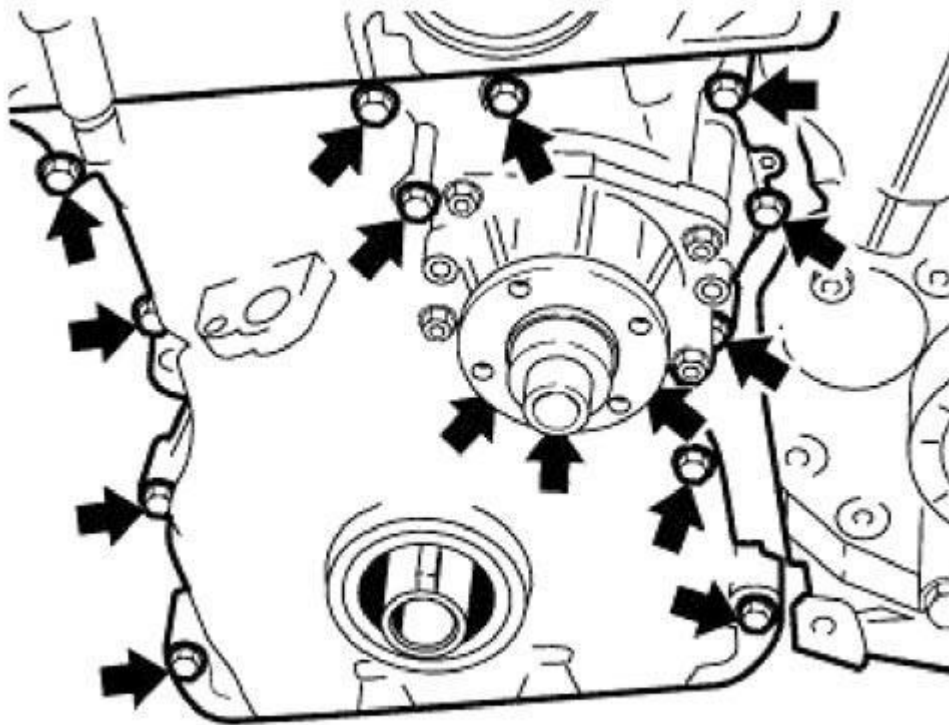
Fig. 66: Identifying Dowel Pins

Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Fully tighten all screws in alternate sequence.

IMPORTANT: Once all screws have been tightened down, retighten them in a second operation.

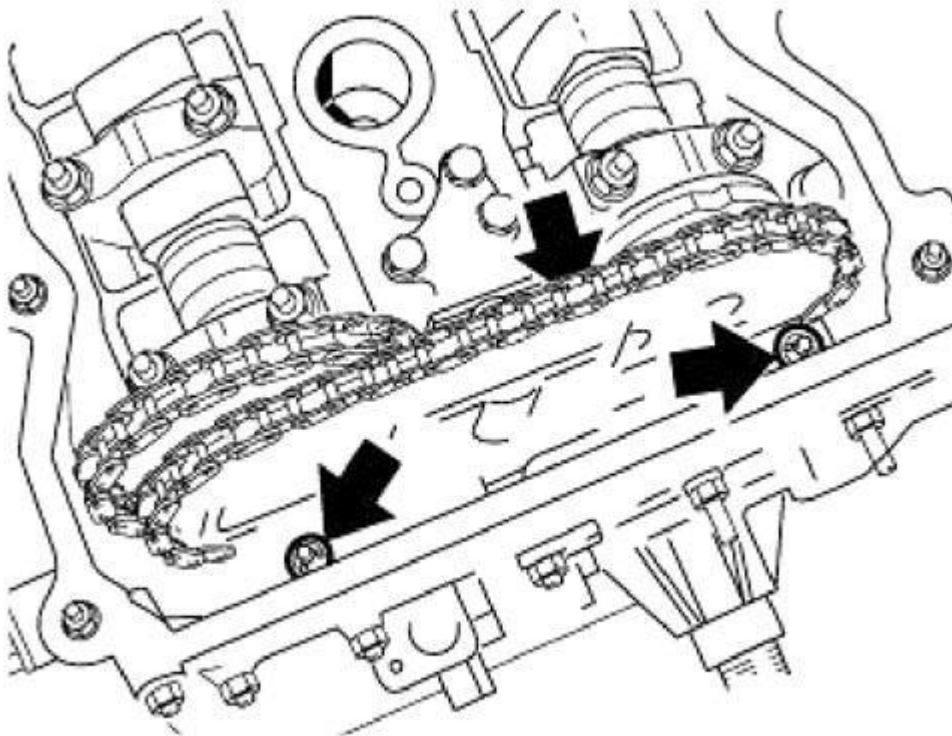


G03163945

Fig. 67: Tightening Screws

Courtesy of BMW OF NORTH AMERICA, INC.

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



G03163946

Fig. 68: Tightening Screw Connection For Timing Case Cover
 Courtesy of BMW OF NORTH AMERICA, INC.

Replace radial seal in lower timing case cover.

Assemble engine.

11 14 141 REPLACING RADIAL SEAL IN LOWER TIMING CASE COVER

Special tools required:

NOTE: For special tools, refer to ENGINE - SPECIAL TOOLS .

- 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. See 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.

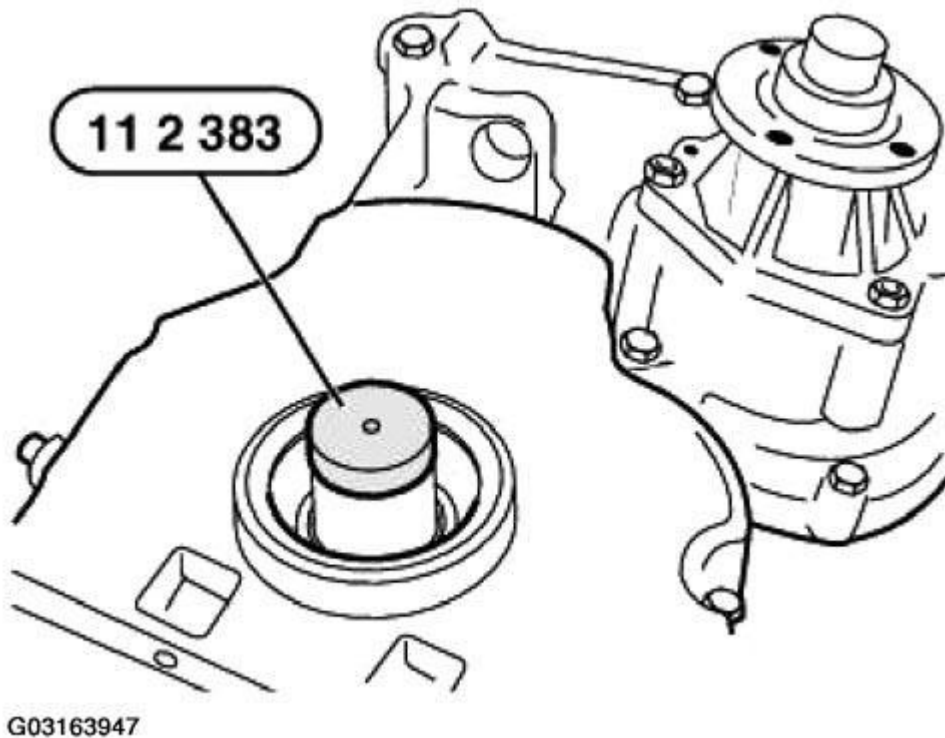


Fig. 69: Identifying Special Tool 11 2 383
Courtesy of BMW OF NORTH AMERICA, INC.

Fit special tool 11 2 385 to crankshaft.

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

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

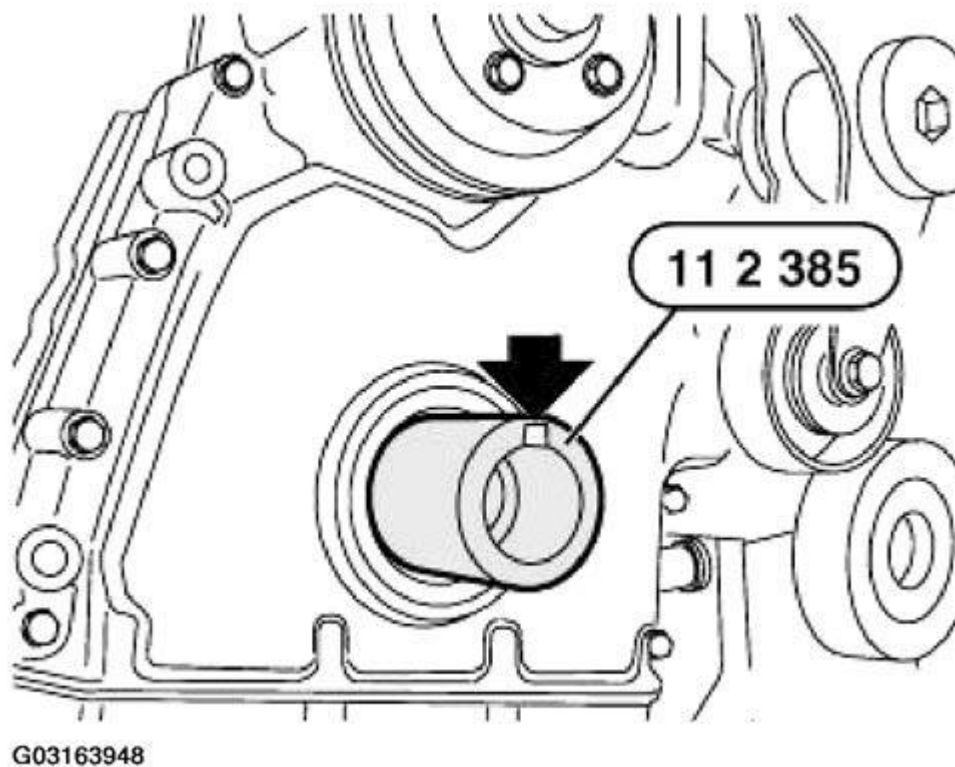


Fig. 70: Identifying Special Tool 11 2 385

Courtesy of BMW OF NORTH AMERICA, INC.

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

Remove radial seal by tightening screw on special tool.

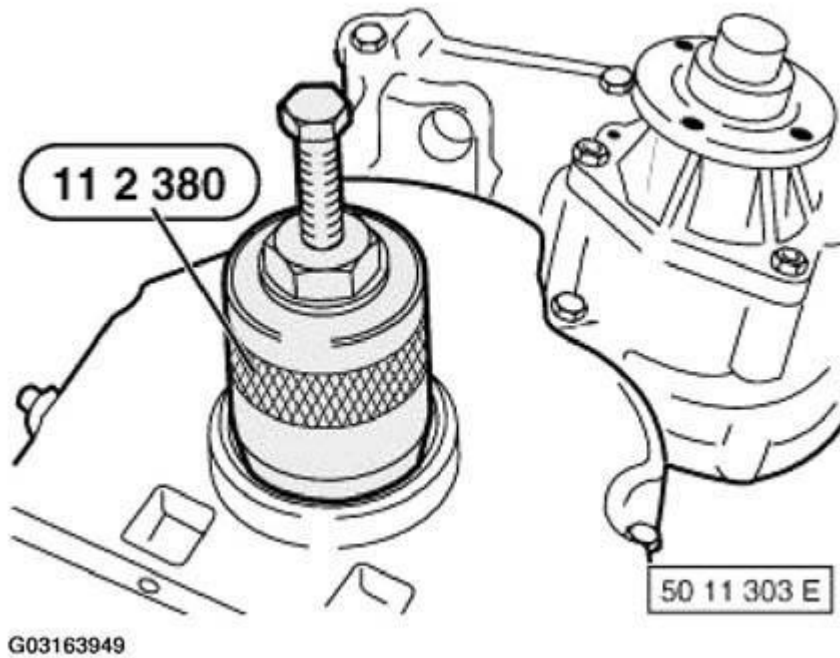


Fig. 71: Removing Radial Seal

Courtesy of BMW OF NORTH AMERICA, INC.

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.

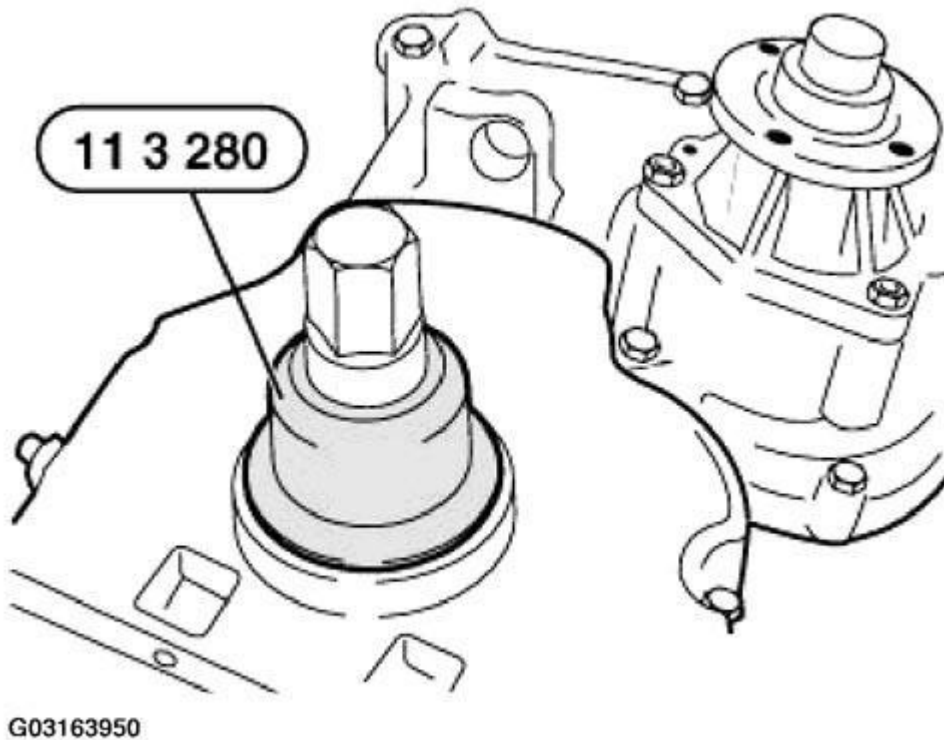


Fig. 72: Installing New Radial Seal Flush With Timing Case Cover
 Courtesy of BMW OF NORTH AMERICA, INC.

11 14 151 REPLACING CRANKSHAFT RADIAL SEAL (TRANSMISSION SIDE)

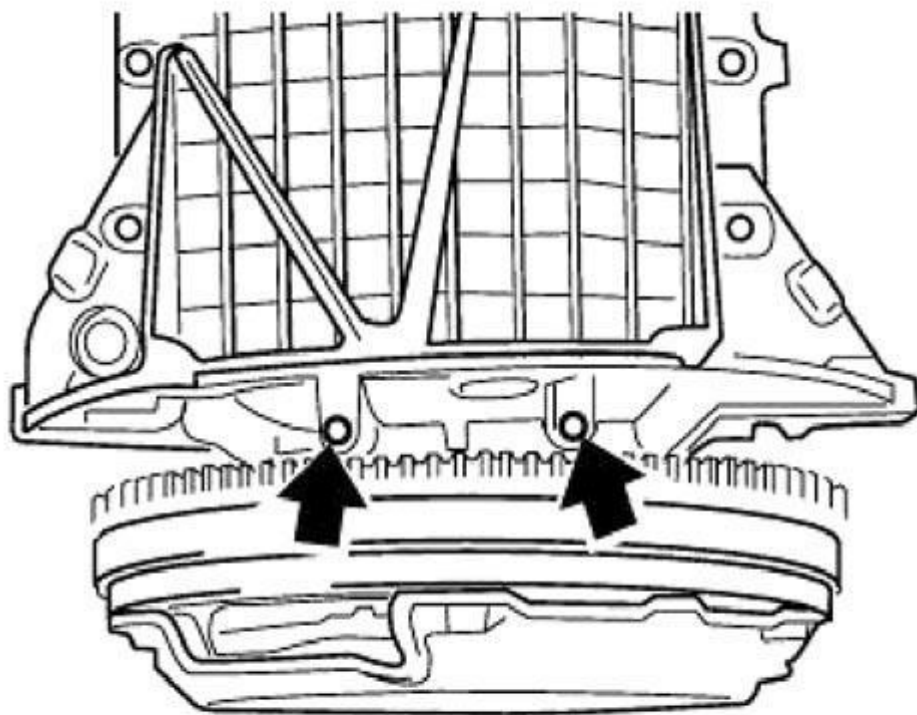
NOTE: This repair instruction is valid for the following engines:

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

Necessary preliminary tasks:

- Remove gearbox. See MANUAL TRANSMISSION
- Drain off engine oil
- Remove flywheel. See 11 22 500 Removing and installing or replacing flywheel (M52 / S52 / M52TU / M54 / S54)

Unfasten oil sump screws on transmission end.



G03163951

Fig. 73: Unfastening Oil Sump Screws
Courtesy of BMW OF NORTH AMERICA, INC.

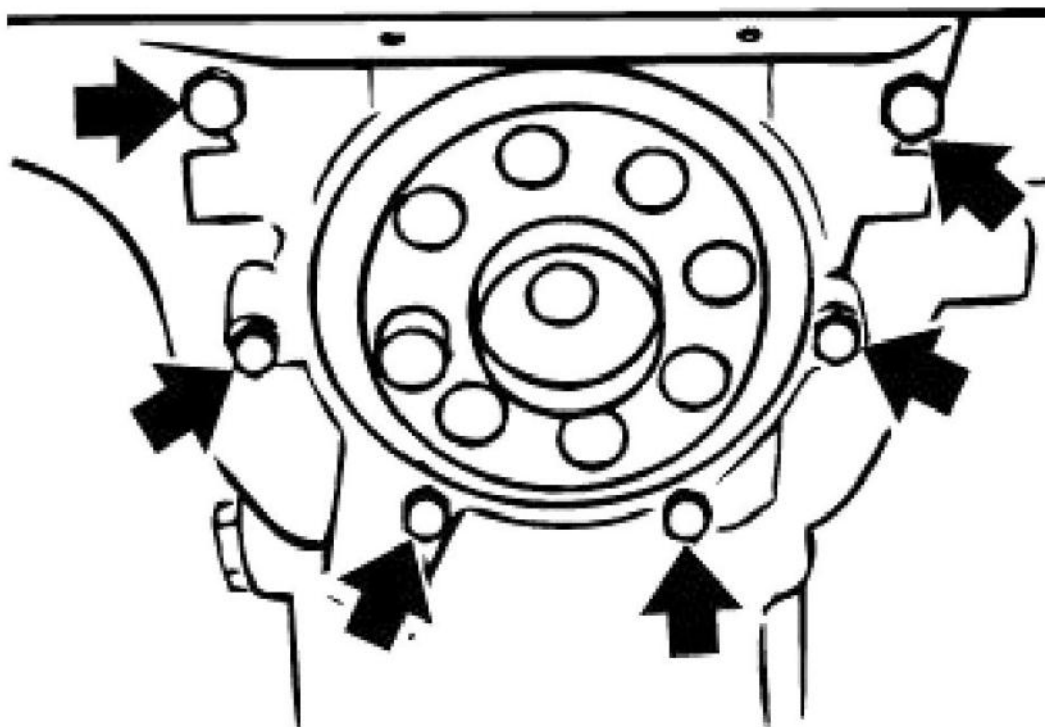
Loosen oil pan.

Release screws in end cover at rear.

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.

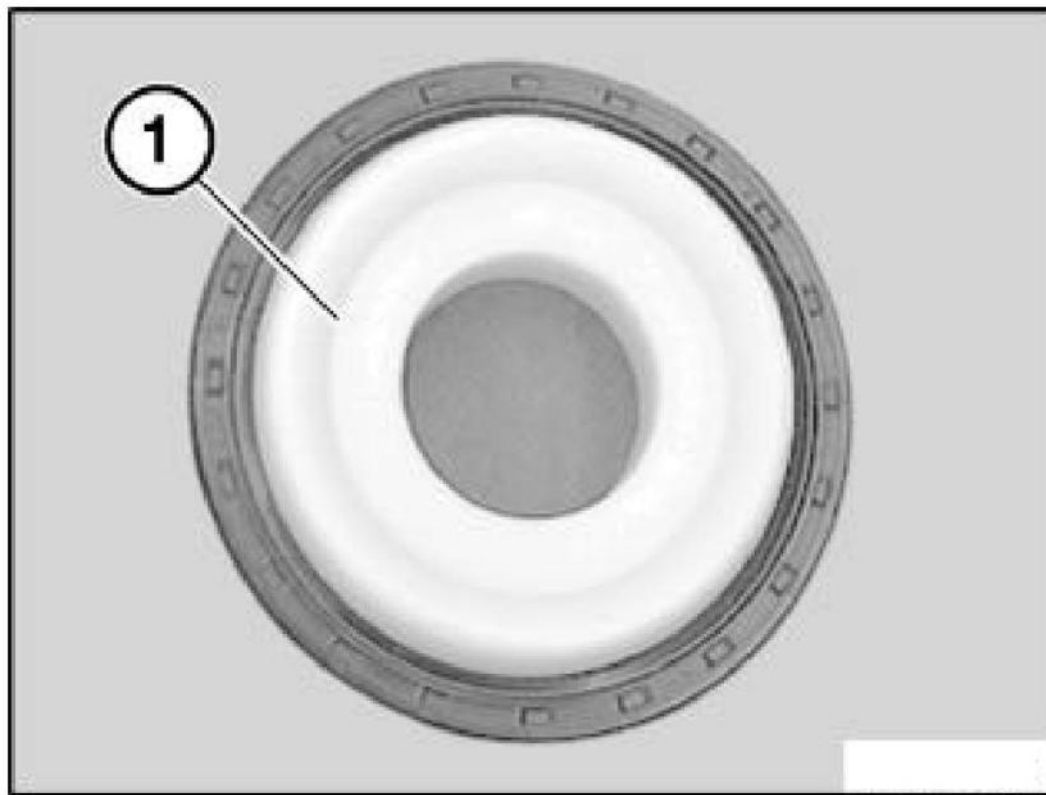


G03163952

Fig. 74: Removing Oil Sump And Replacing Oil Sump Gasket
Courtesy of BMW OF NORTH AMERICA, INC.

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.



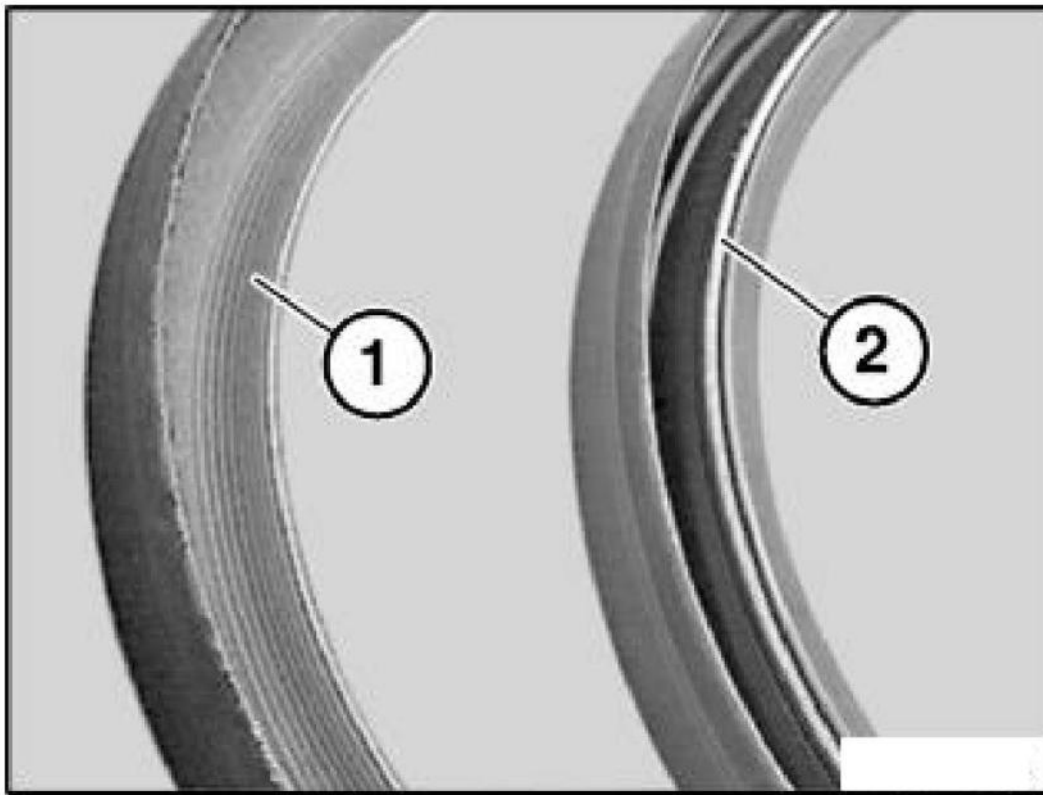
G03163953

Fig. 75: Identifying Radial Seal

Courtesy of BMW OF NORTH AMERICA, INC.

Distinguishing feature:

- (1) New version "without hose spring"
- (2) Old version "with hose spring"



G03163954

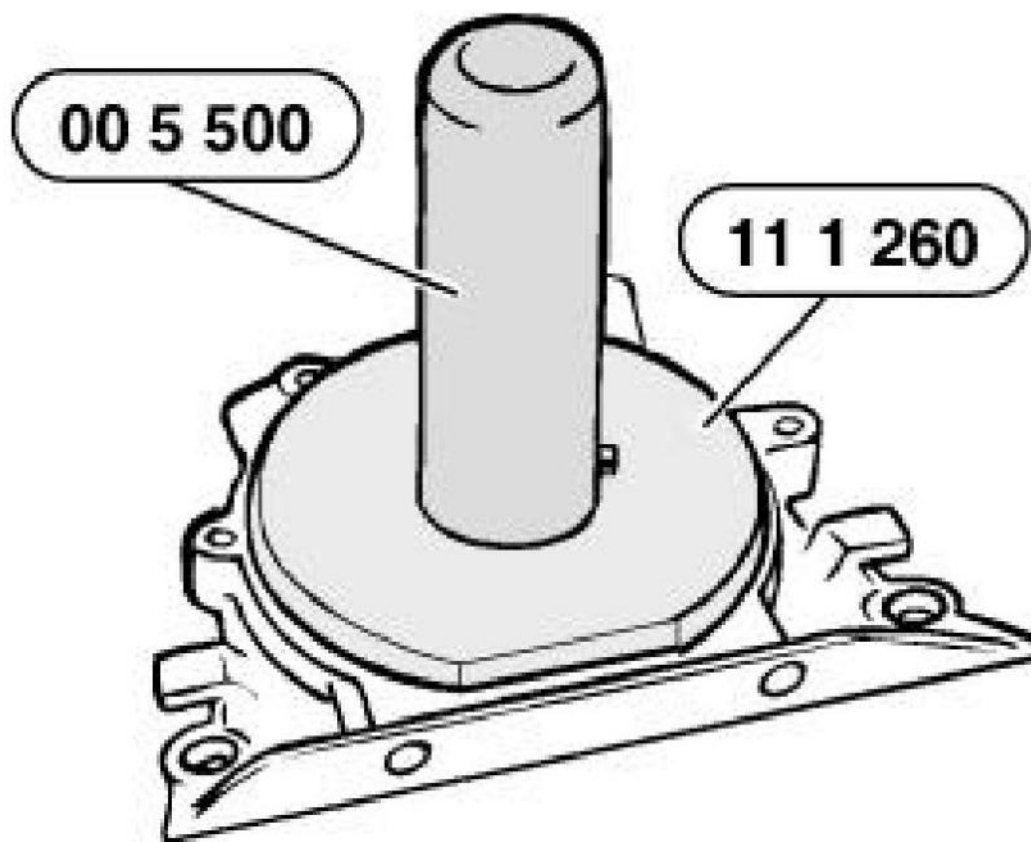
Fig. 76: Identifying Sealing Lip

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.



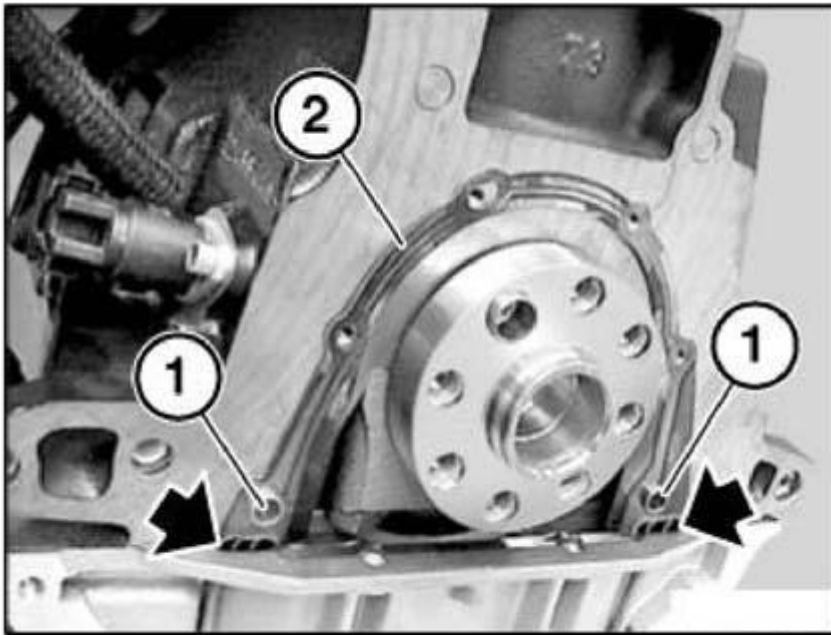
G03163955

Fig. 77: Identifying Special Tool 11 1 260 And 00 5 500
Courtesy of BMW OF NORTH AMERICA, INC.

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

Replace seal (2).

Apply thin, uniform coat of Drei Bond 1209 sealing compound to edges of joint on oil pan.

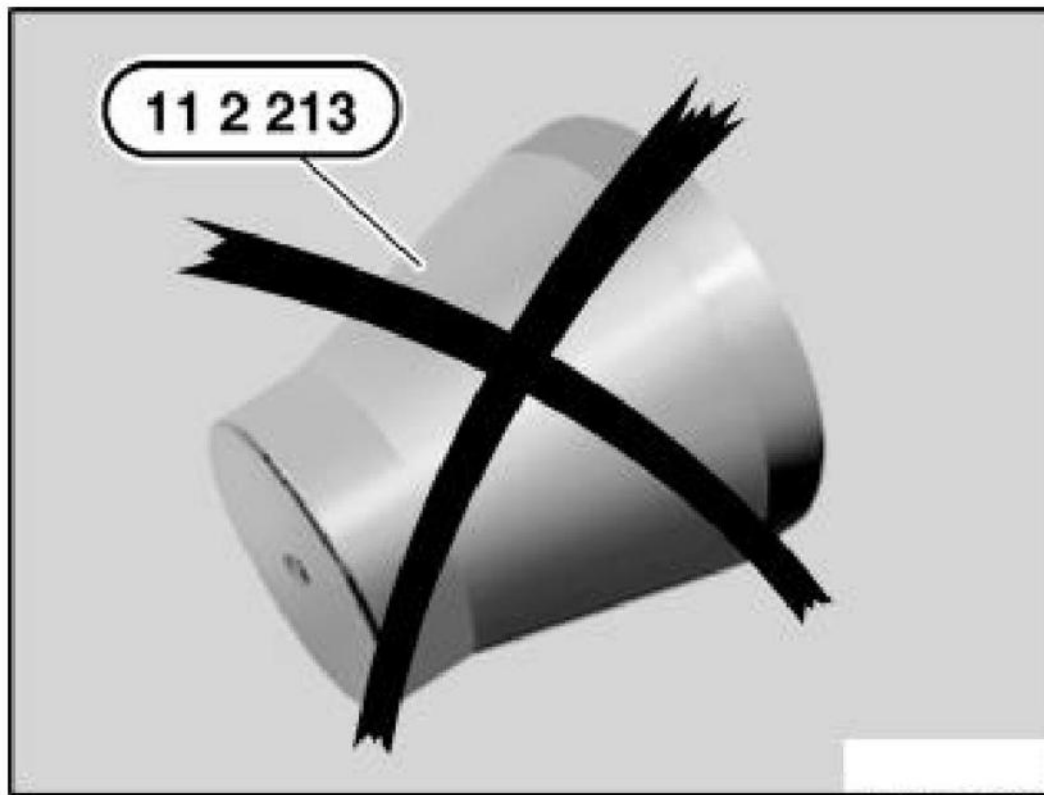


G03163956

Fig. 78: Checking Dowel Sleeves

Courtesy of BMW OF NORTH AMERICA, INC.

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



G03163957

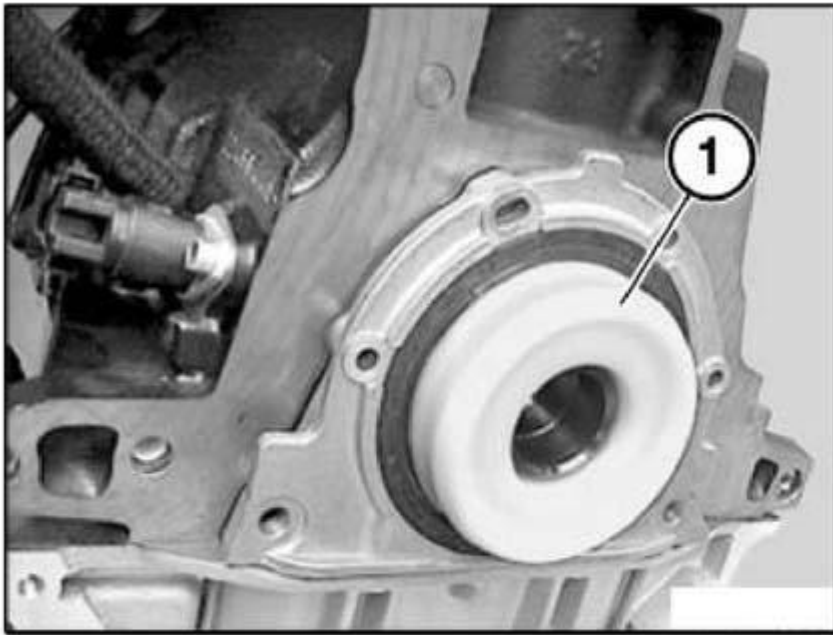
Fig. 79: Identifying Tool 11 2 213

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.

Lubricate contact face of crankshaft.

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



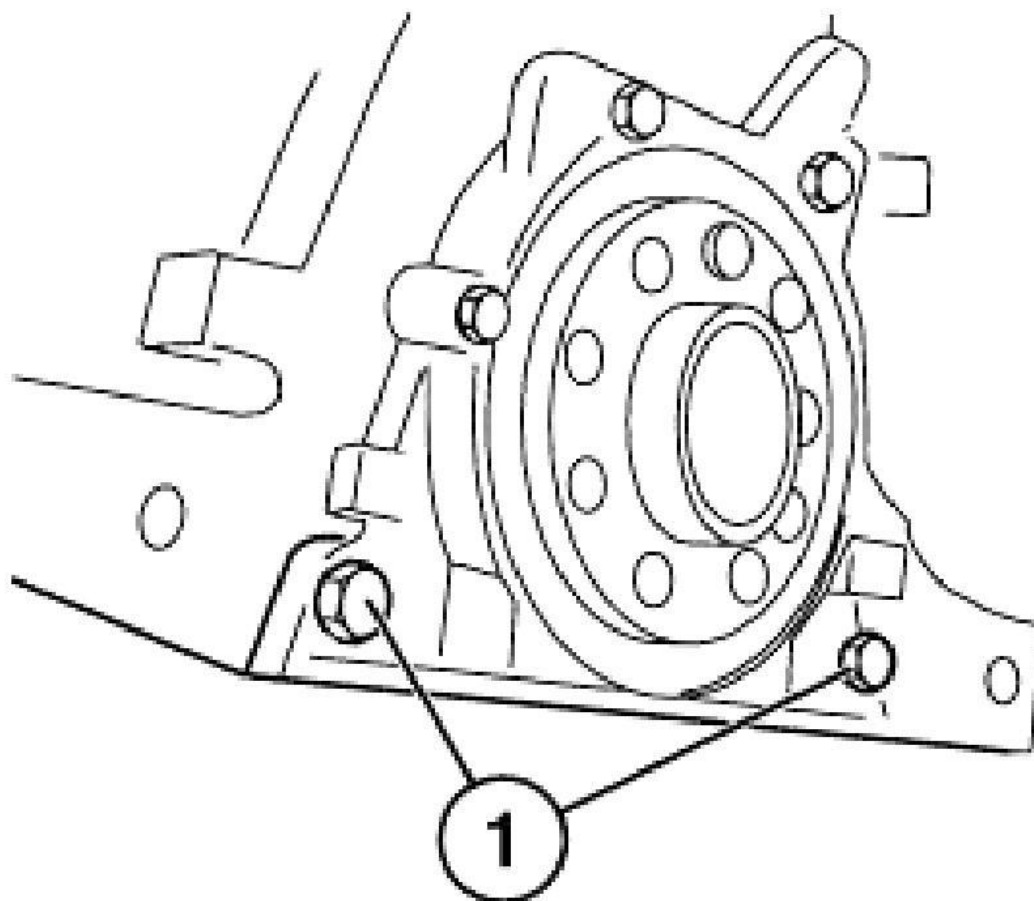
G03163958

Fig. 80: Pushing On End Cover With Support Bushing
Courtesy of BMW OF NORTH AMERICA, INC.

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

Replace screws (1).

Insert all screws and tighten down end cover.

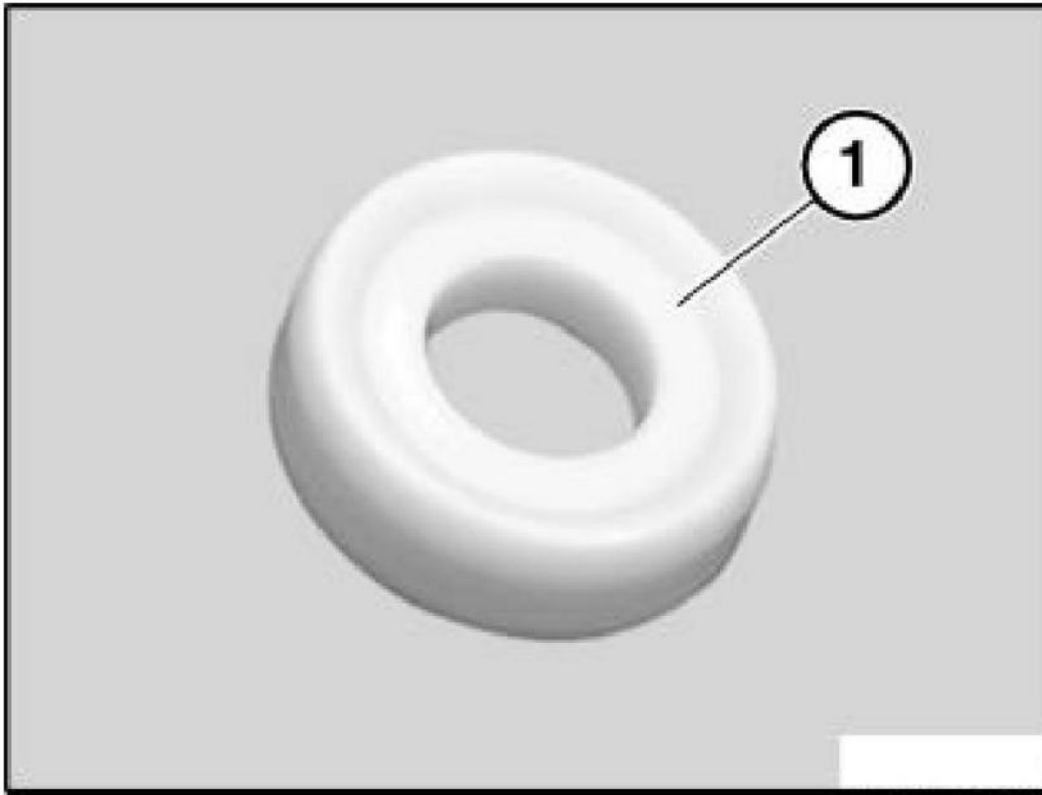


G03163959

Fig. 81: Inserting Screws And Tighten Down End Cover
Courtesy of BMW OF NORTH AMERICA, INC.

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).



G03163960

Fig. 82: Identifying Support Bushing

Courtesy of BMW OF NORTH AMERICA, INC.

CRANKSHAFT WITH BEARING

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

(engine removed)

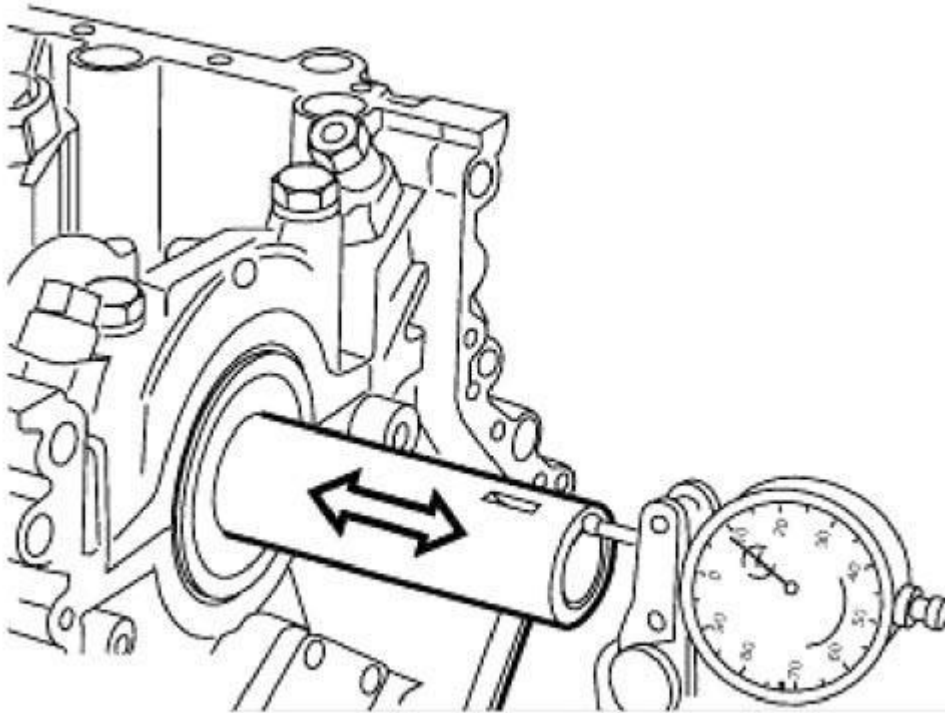
Necessary preliminary tasks:

- Removing cylinder head. See 11 12 100 Removing and installing/replacing cylinder head (M52TU / M54 / M56)
- Removing lower timing case cover. See 11 14 110 Removing and installing lower timing case cover (M52 / S52 / M52TU / M54)
- Removing all pistons. See 11 25 671 Replacing piston rings on all pistons (M52 / S52 / M52TU / M54 / M56)
- Remove end cover at rear; this operation is de section REPLACING CRANKSHAFT RADIAL

SEAL .

Checking axial clearance:

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



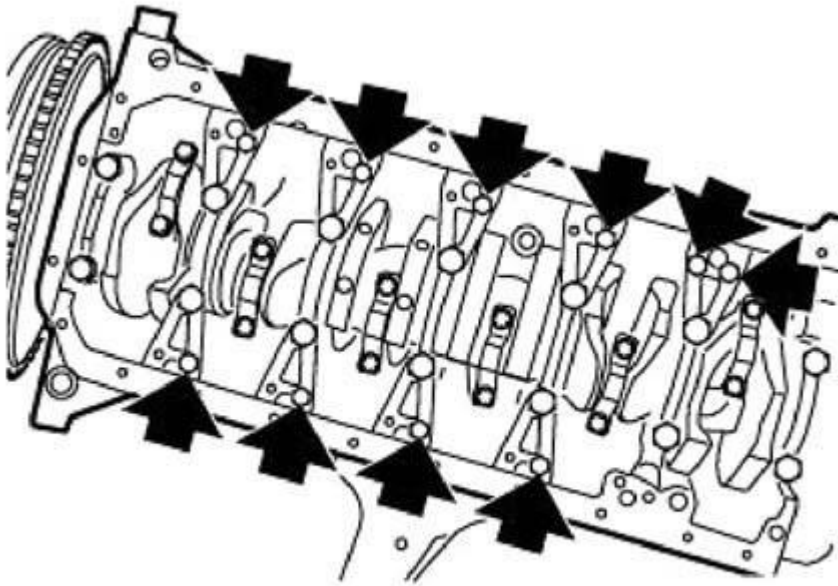
G03163961

Fig. 83: Checking Axial Clearance

Courtesy of BMW OF NORTH AMERICA, INC.

Unfasten screw connection on reinforcement plates.

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.



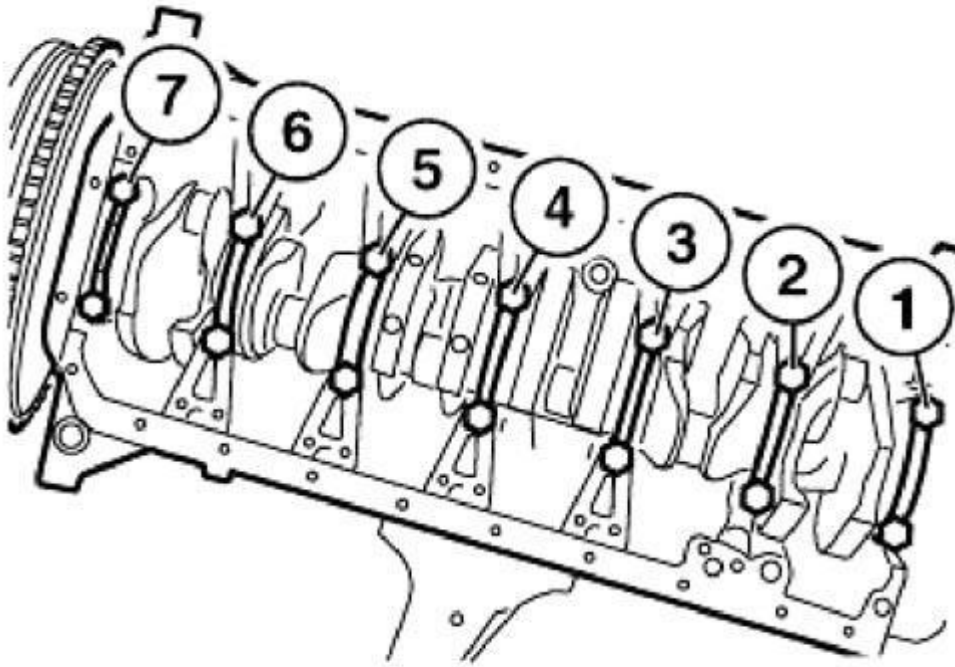
G03163962

Fig. 84: Unfastening Screw Connection On Reinforcement Plates
Courtesy of BMW OF NORTH AMERICA, INC.

Unfasten screw connection on main bearing.

Remove main bearing caps (1 to 7).

Lever out crankshaft.



G03163963

Fig. 85: Removing Main Bearing Caps

Courtesy of BMW OF NORTH AMERICA, INC.

If necessary, release incremental gear.

Installation:

Replace screws.

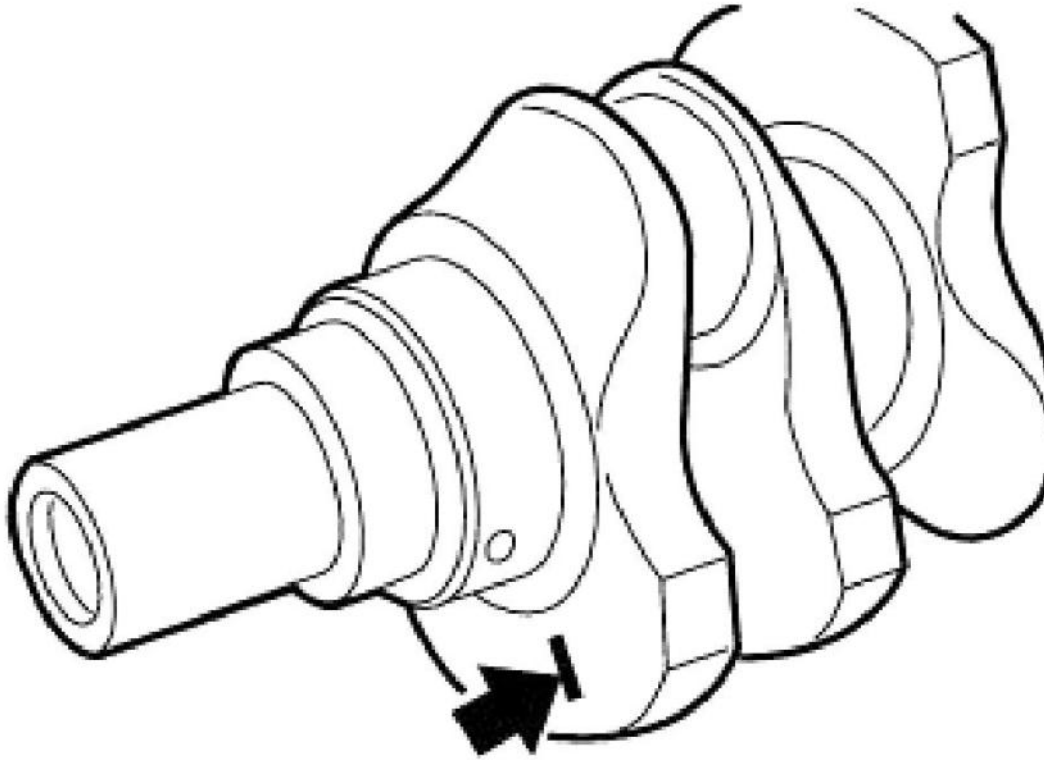
Install screws and tighten down in two passes.

Tightening torque; 5.0 N.m plus 45°.

IMPORTANT: Check grinding stage of crankshaft.

Replace main crankshaft bearing shells. Replace conrod bearing shells.

Replace grooved ball bearings in crankshaft.



G03163964

Fig. 86: Checking Grinding Stage Of Crankshaft
Courtesy of BMW OF NORTH AMERICA, INC.

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

Special tools required:

NOTE: For special tools, refer to **ENGINE - SPECIAL TOOLS** .

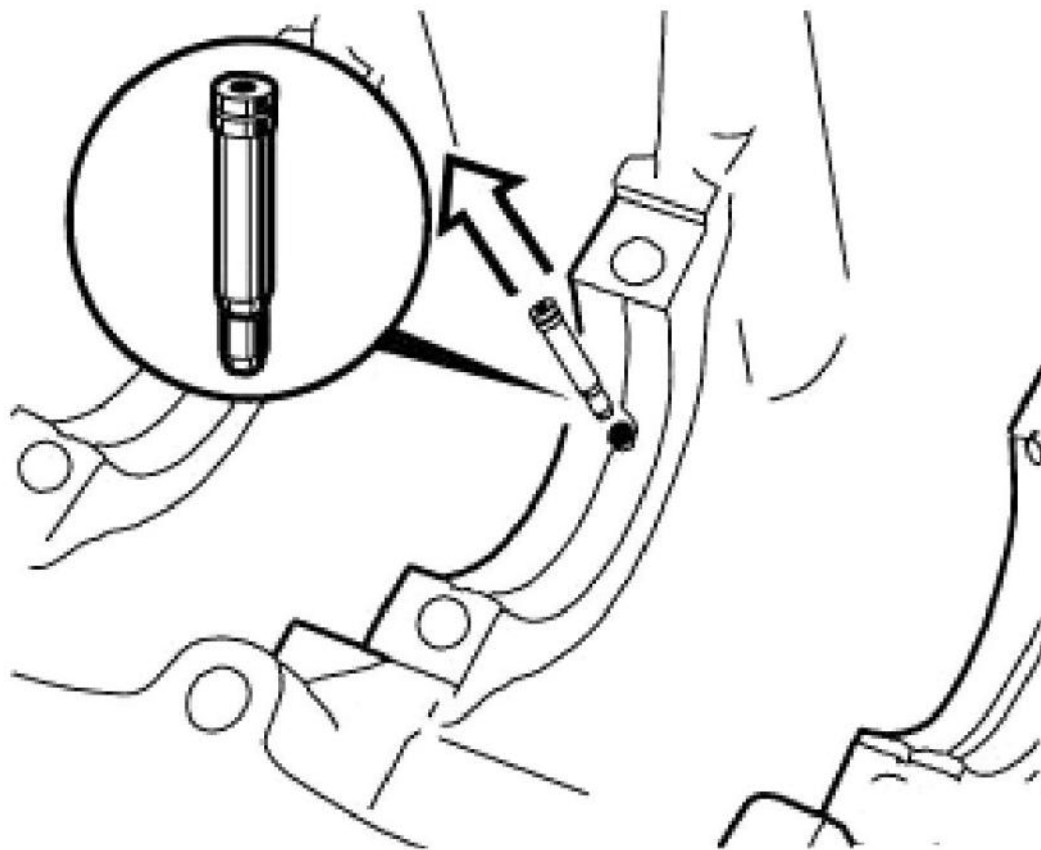
- 00 2 590
- 00 9 120
- 11 2 110

(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.



G03163965

Fig. 87: Identifying Injection Nozzles

Courtesy of BMW OF NORTH AMERICA, INC.

M52 B25 / B28

S52

M52TU B25 / B28

M54 B25 / B30

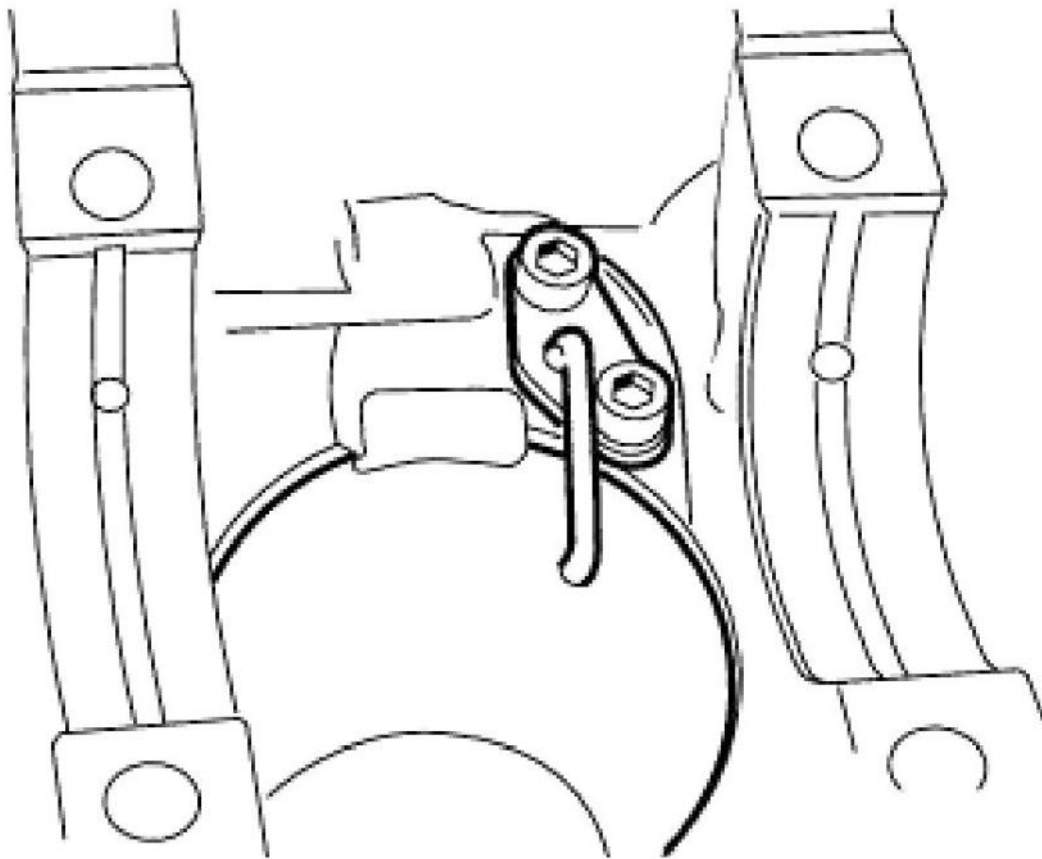
M56

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

Installation:

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

Replace screws.

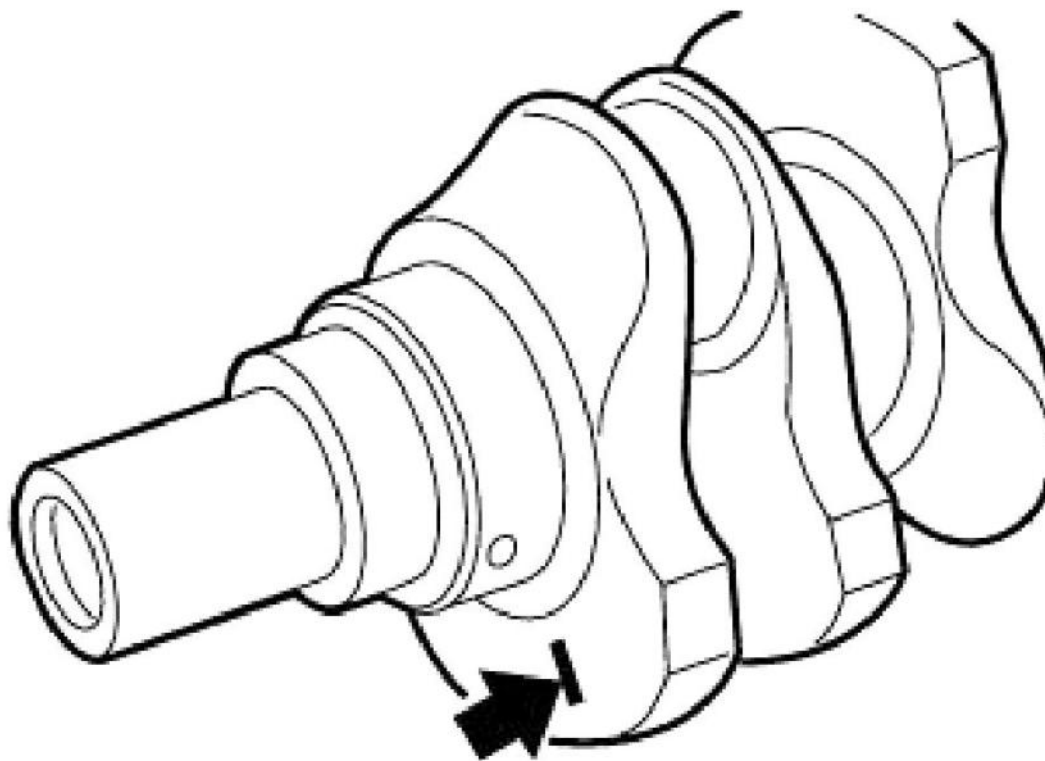


G03163966

Fig. 88: Replacing Screws

Courtesy of BMW OF NORTH AMERICA, INC.

IMPORTANT: Observe grinding stage of crankshaft.



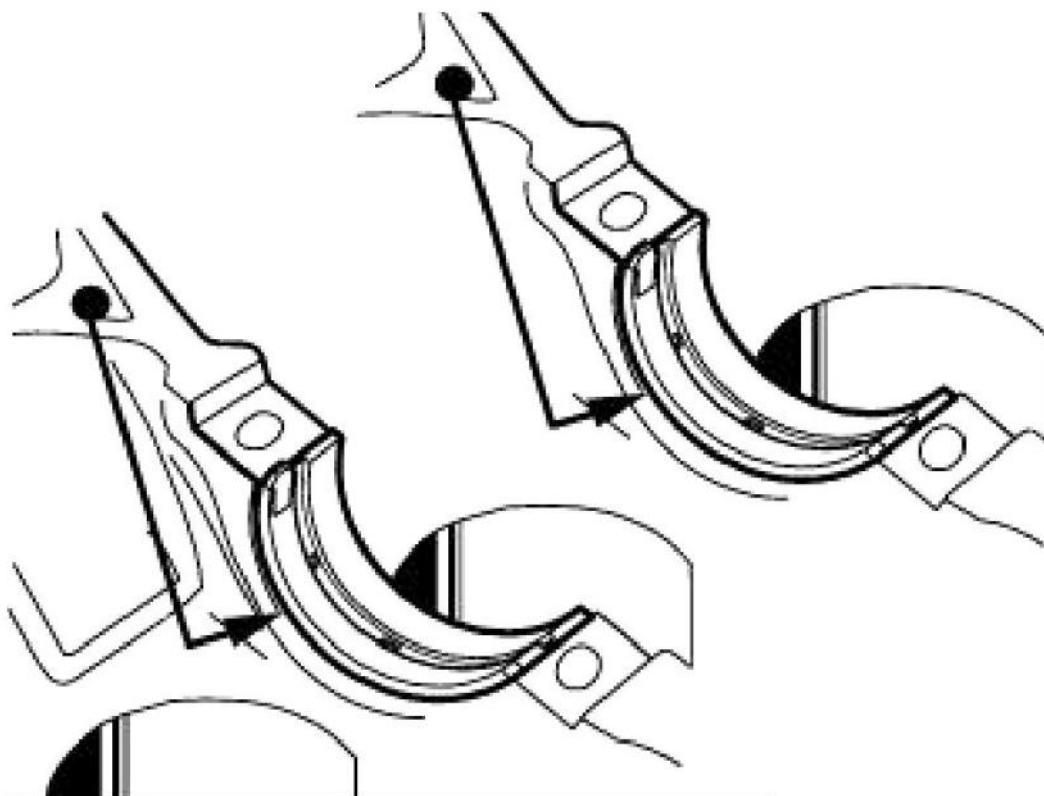
G03163967

Fig. 89: Observing 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.

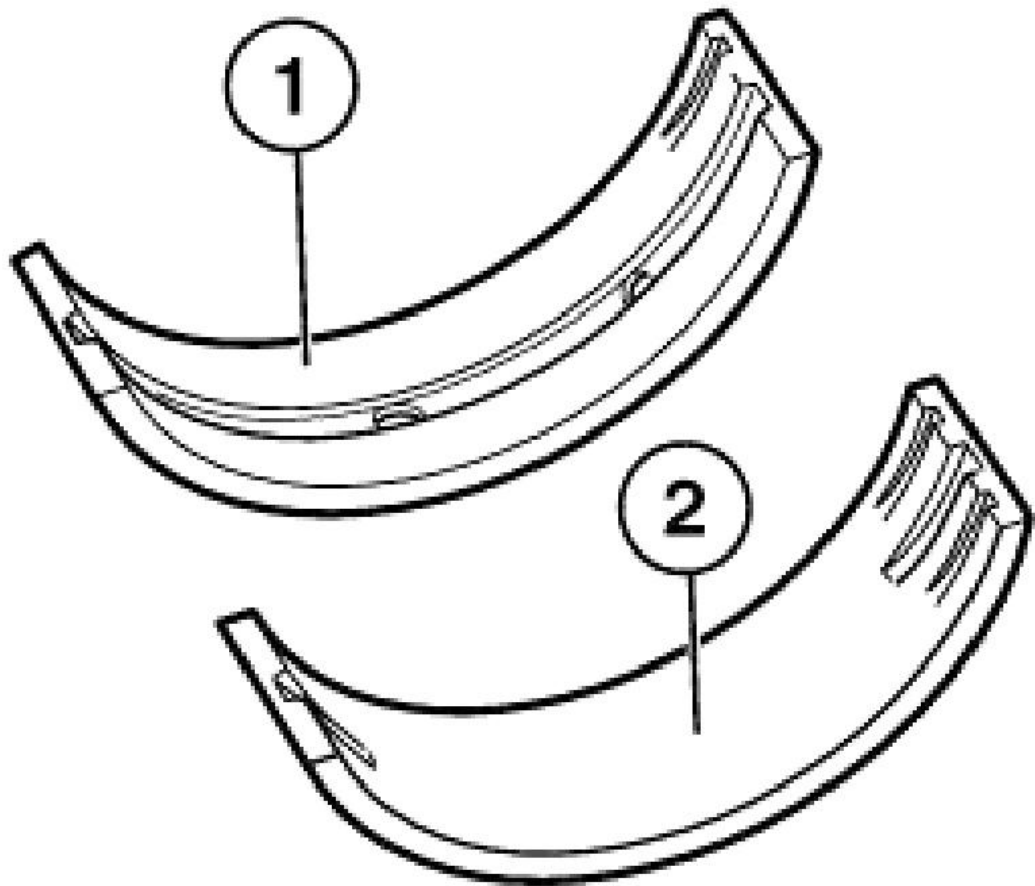


G03163968

Fig. 90: Inserting Bearing Shells With Yellow Color Coding
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE:

1. Install bearing shells with continuous lubricant one retaining lug in engine block.
2. Fit bearing shells without continuous lubricant two retaining lugs in bearing cover.

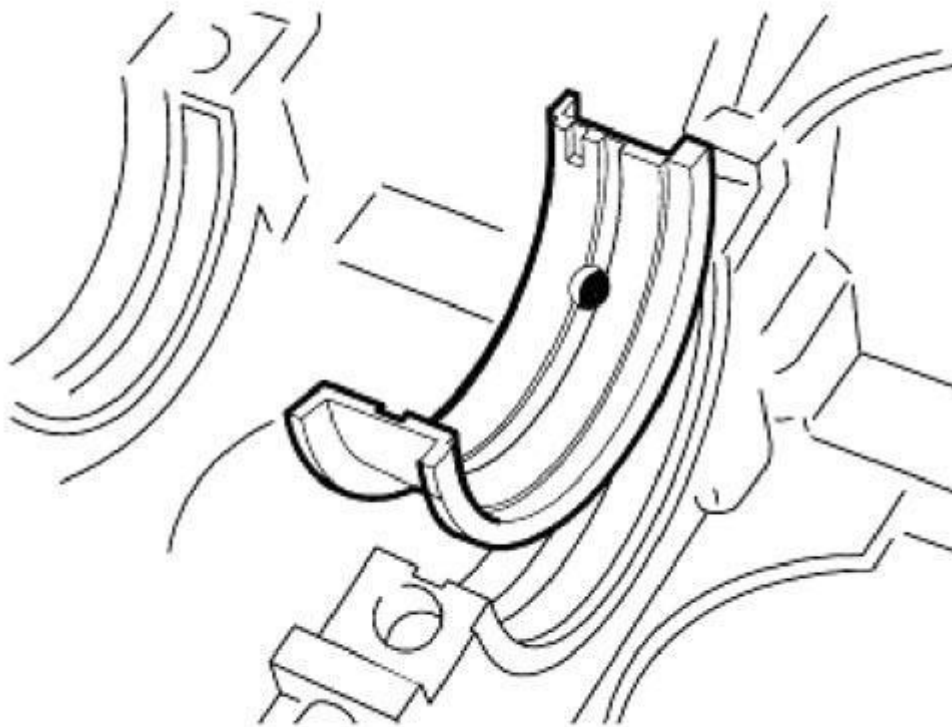


G03163969

Fig. 91: Installing 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.



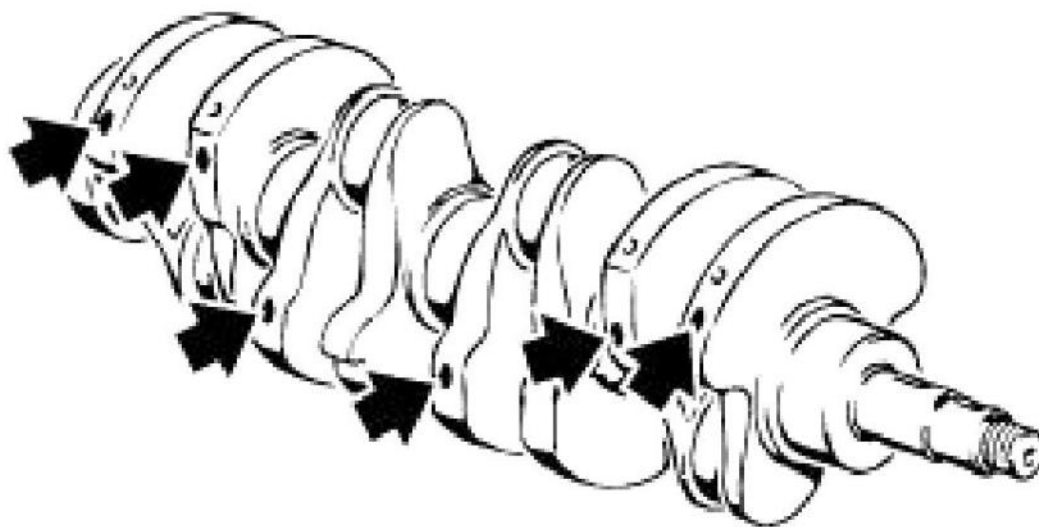
G03163970

Fig. 92: Inserting Pilot Bearing Shell

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.



G03163971

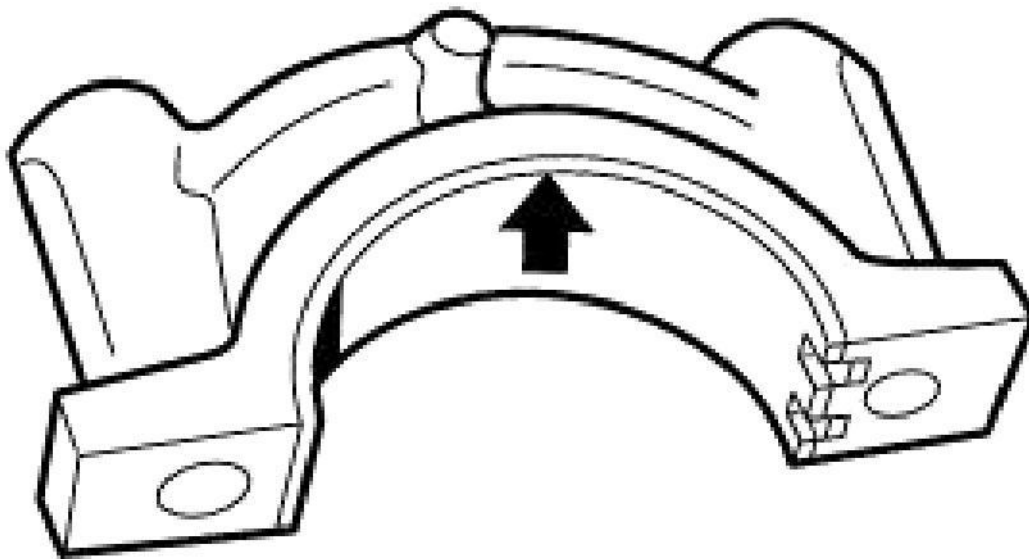
Fig. 93: Crankshaft Is Marked With Yellow, Green Or White Paint According To Tolerance Of The Main Journal

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.

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



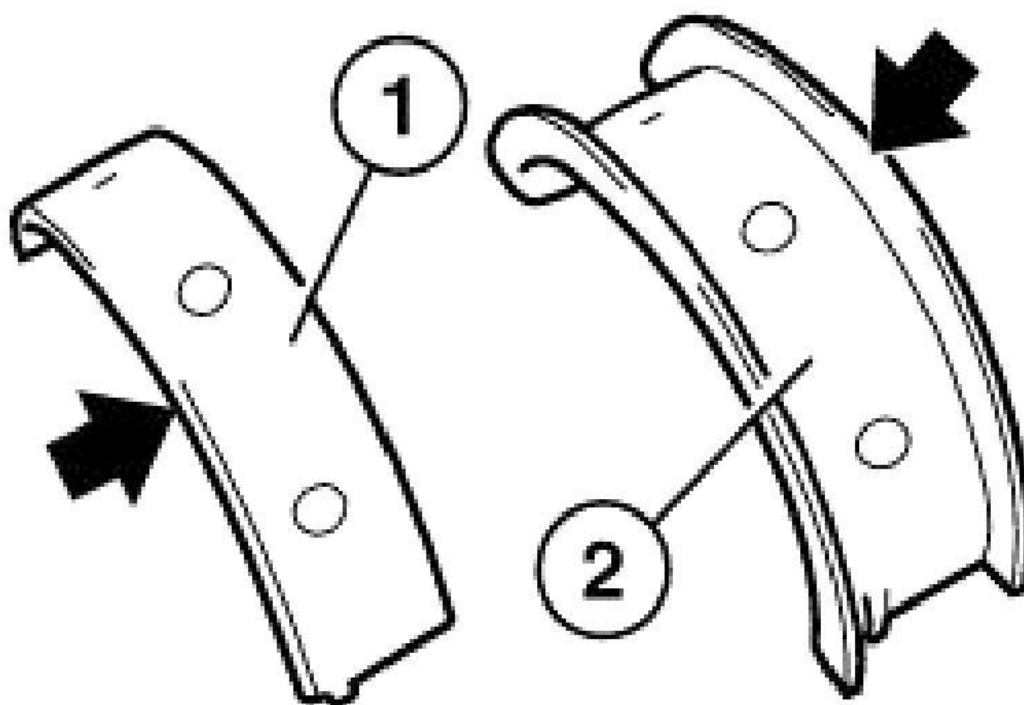
G03163972

Fig. 94: Inserting Main Bearing Shells
Courtesy of BMW OF NORTH AMERICA, INC.

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

1. Bearing shell
2. Guide bearing

Observe Grinding Stage Of Main Bearing Journals.



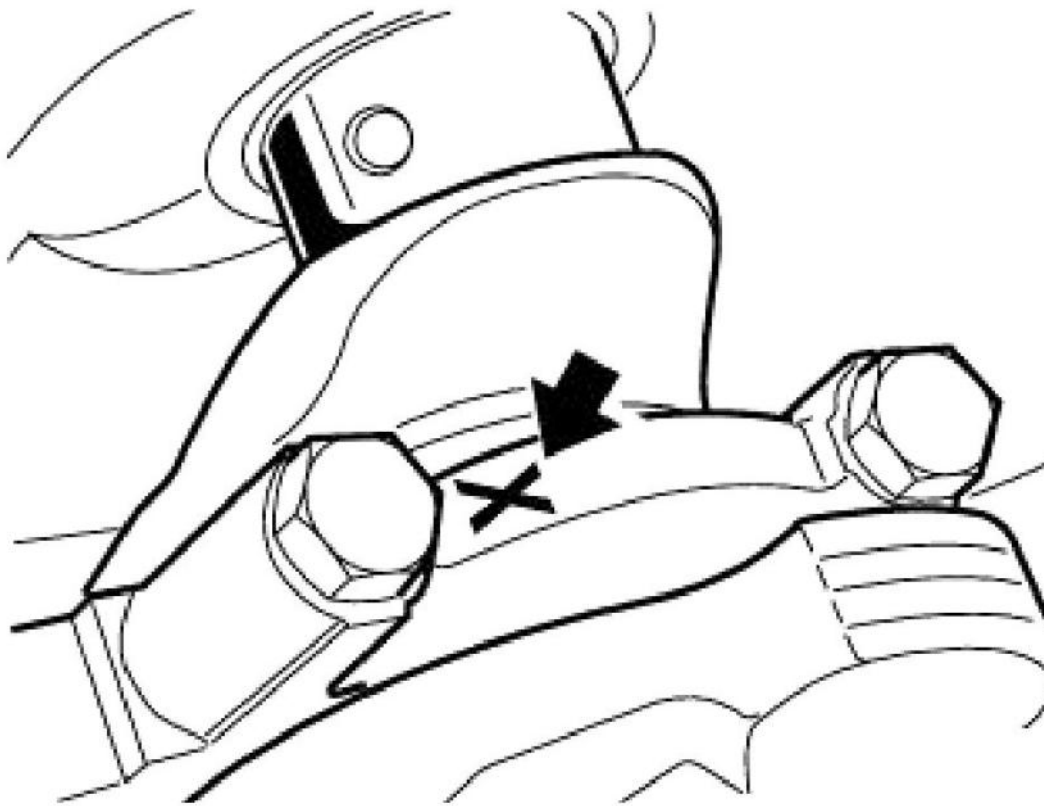
G03163973

Fig. 95: Observing Grinding Stage Of Main Bearing Journals
Courtesy of BMW OF NORTH AMERICA, INC.

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.

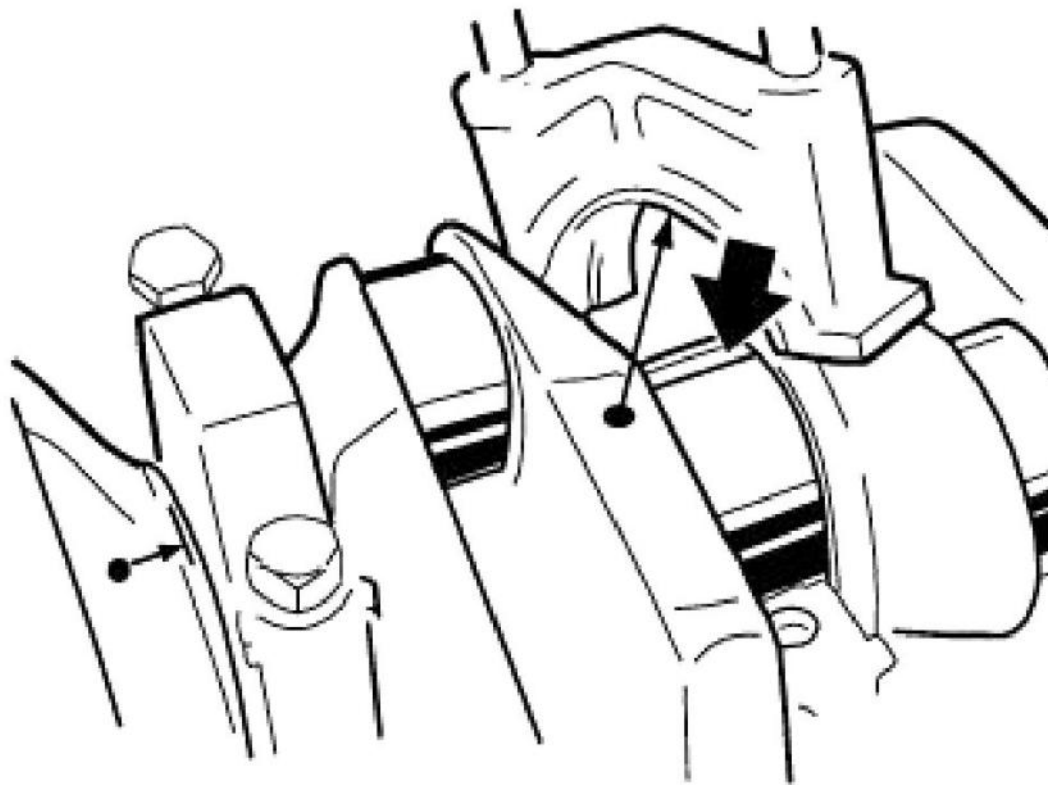


G03163974

Fig. 96: Identifying Bearing Caps

Courtesy of BMW OF NORTH AMERICA, INC.

Check Clearance On Main Crankshaft Bearing.



G03163975

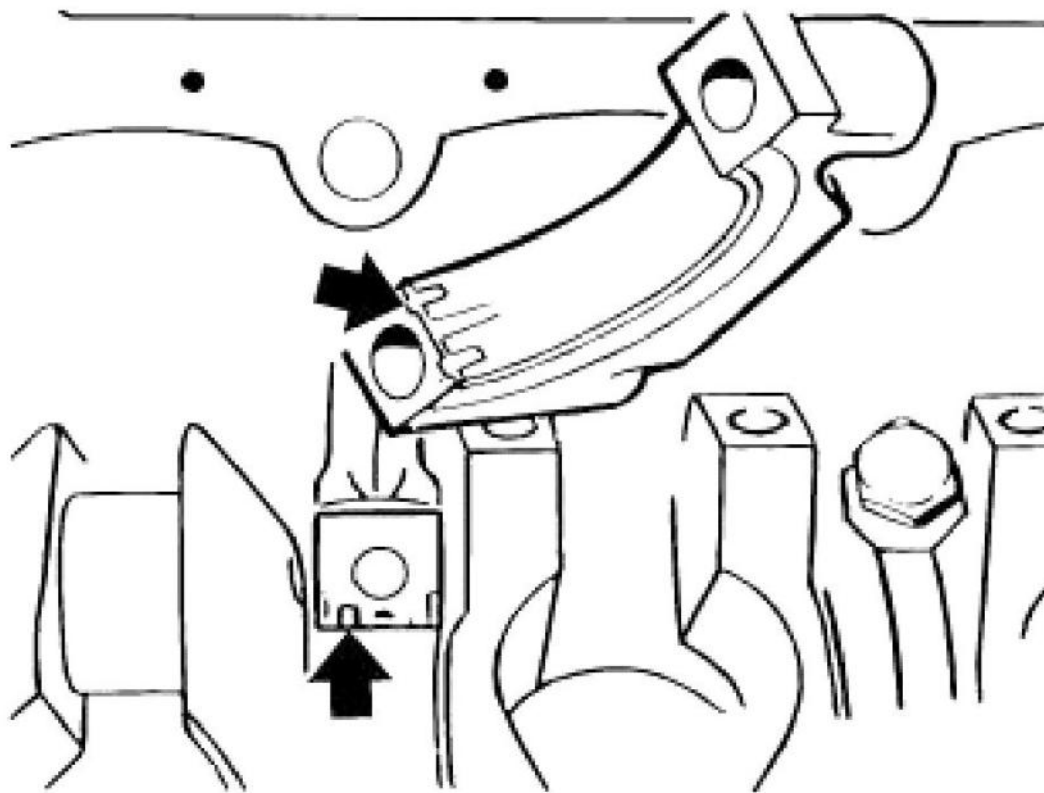
Fig. 97: Checking Clearance On Main Crankshaft Bearing
Courtesy of BMW OF NORTH AMERICA, INC.

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 one side.

Align main bearing cap flush with side of bearing seat.



G03163976

Fig. 98: Identifying Main Bearing Cap Grooves
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.

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

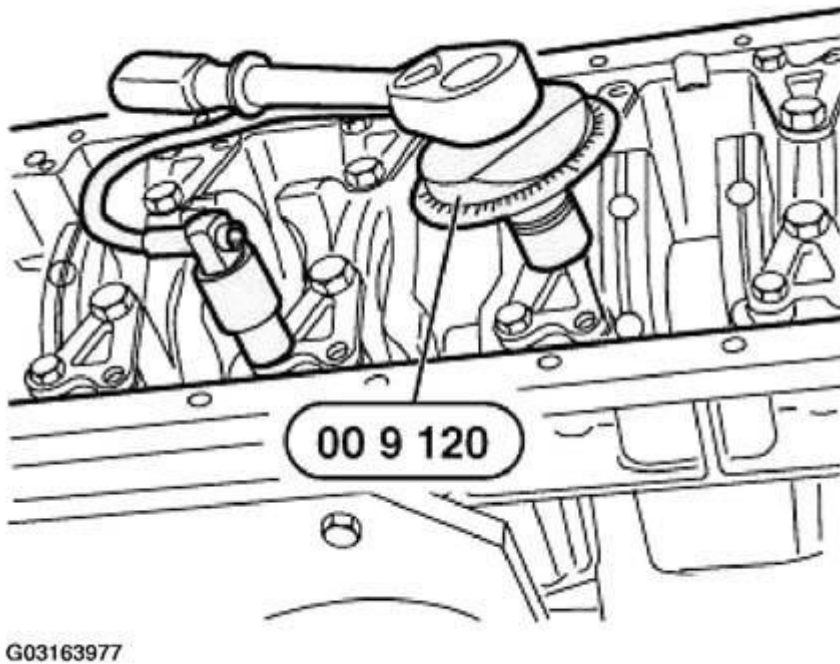
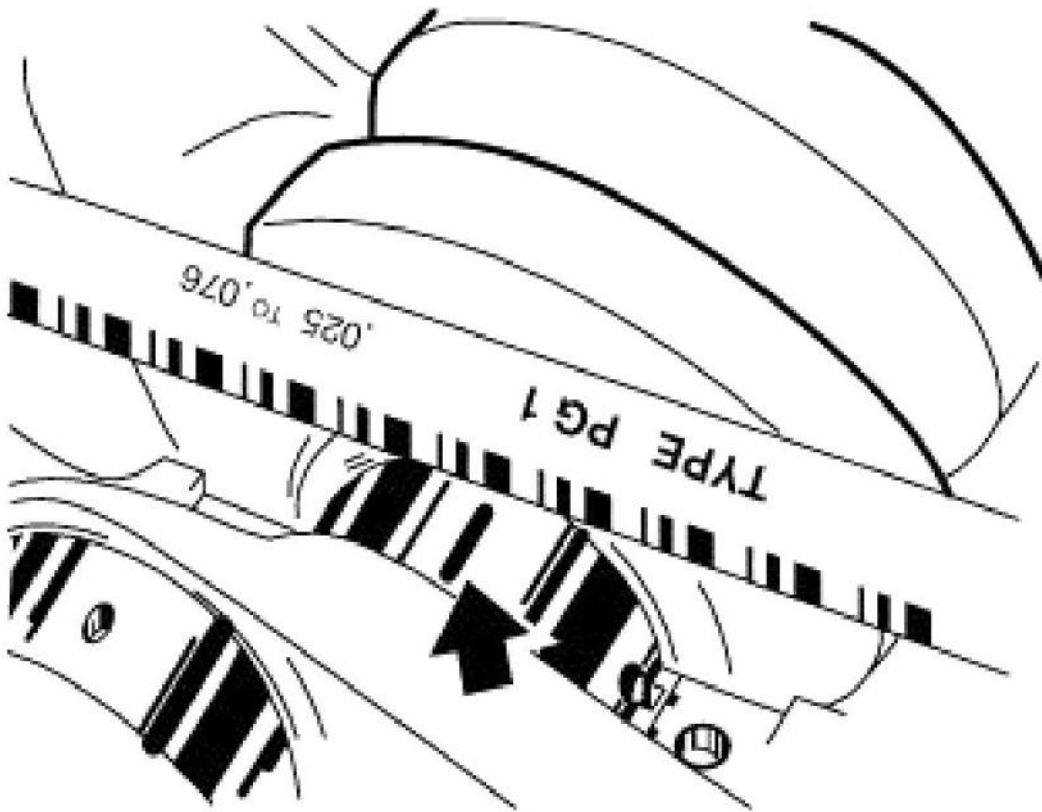


Fig. 99: Tightening Down Main Bearing Bolts With Special Tool 00 9 120
Courtesy of BMW OF NORTH AMERICA, INC.

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



G03163978

Fig. 100: Removing Main Bearing Cap
Courtesy of BMW OF NORTH AMERICA, INC.

Radial crankshaft bearing clearance; 0.020... 0.058 mm.

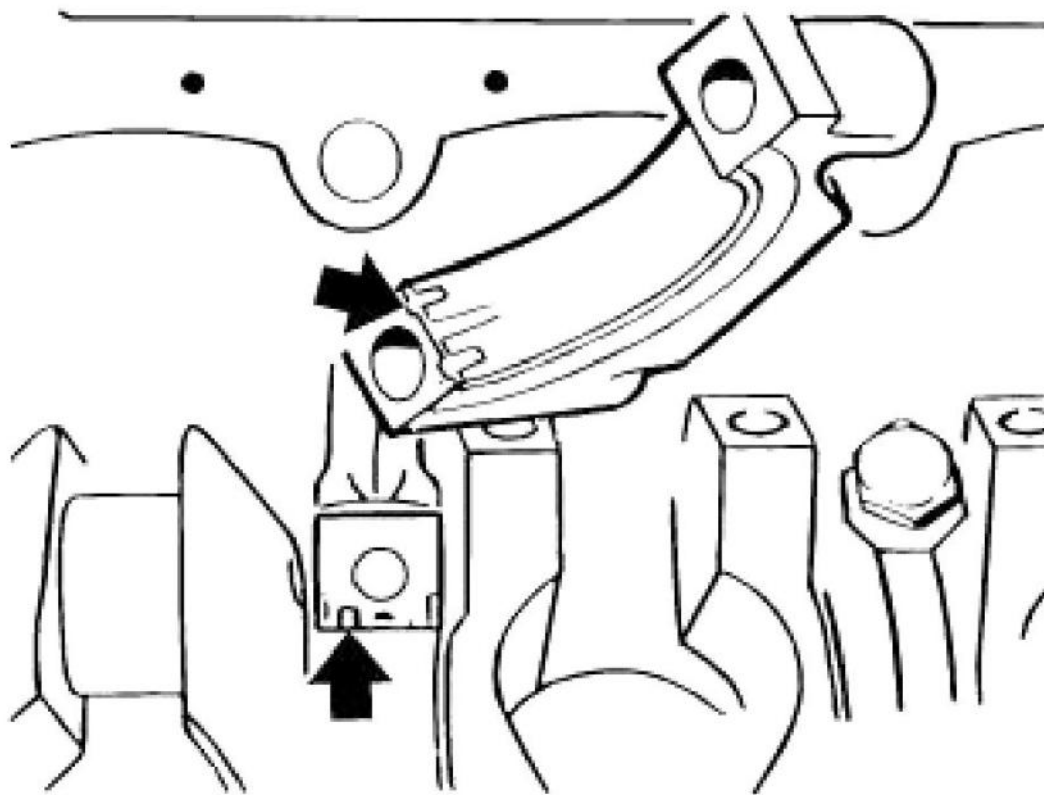
If necessary, to correct bearing clearance, fit new bearing shells with a different color coding.

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 one side.

Align main bearing cap flush with side of bearing seat.



G03163979

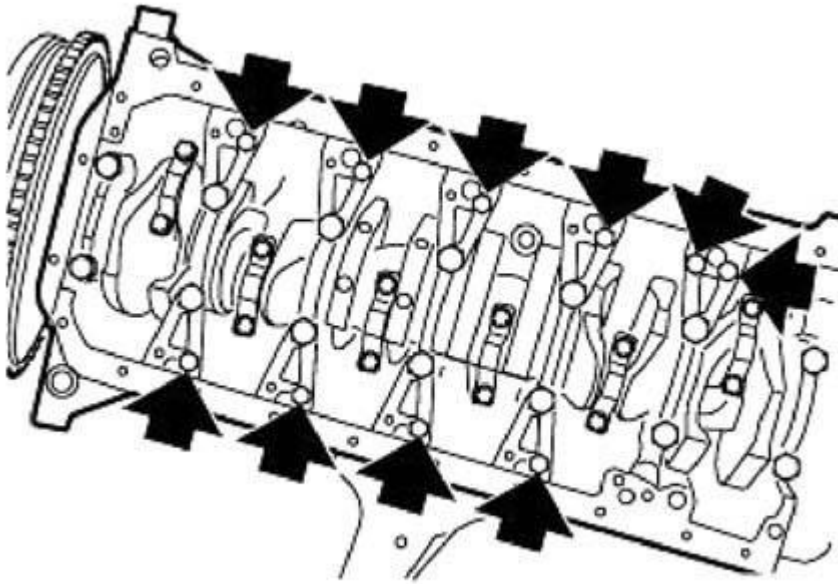
Fig. 101: Installing Main Bearing Cap
Courtesy of BMW OF NORTH AMERICA, INC.

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.



G03163980

Fig. 102: Tightening Down Screw Connection
 Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

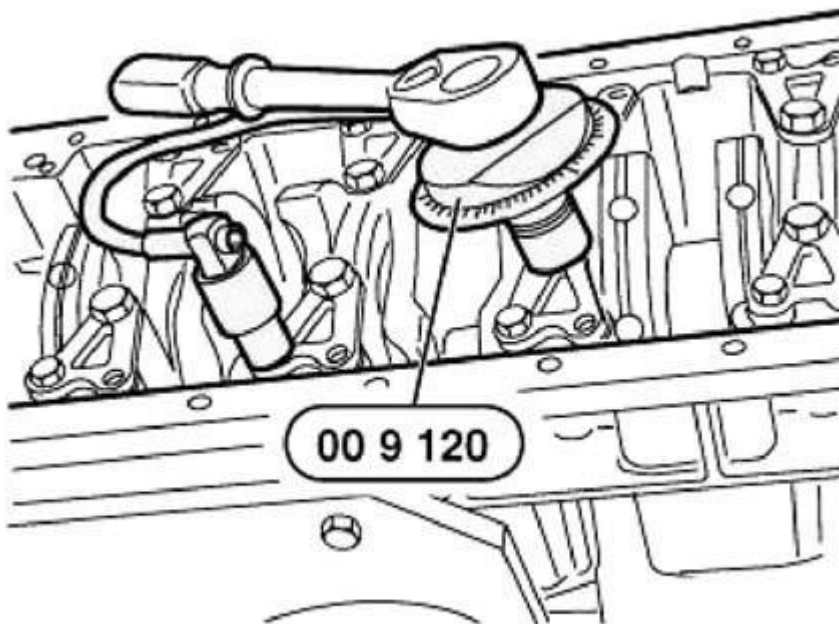
Install Reinforcement Plates And Fit Screws With Zero Backlash.

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 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 112110 Or With Special Tool 00 9 120 To Torsion Angle.



G03163981

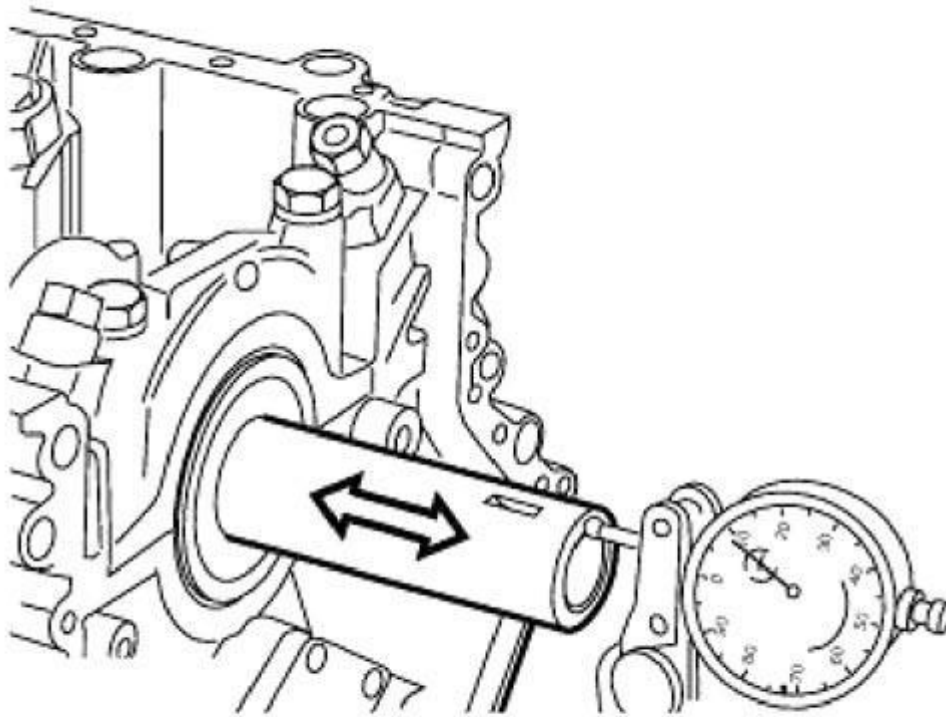
Fig. 103: Tightening Down All Screws Of Main Bearing Caps With Special Tool 112110 Or With Special Tool 00 9 120

Courtesy of BMW OF NORTH AMERICA, INC.

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

Check axial play.

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



G03163982

Fig. 104: Checking Axial Play

Courtesy of BMW OF NORTH AMERICA, INC.

11 21 571 REPLACING GROOVED BALL BEARING IN CRANKSHAFT (M52 / S52 / M52TU / M54 / S50 / S54)

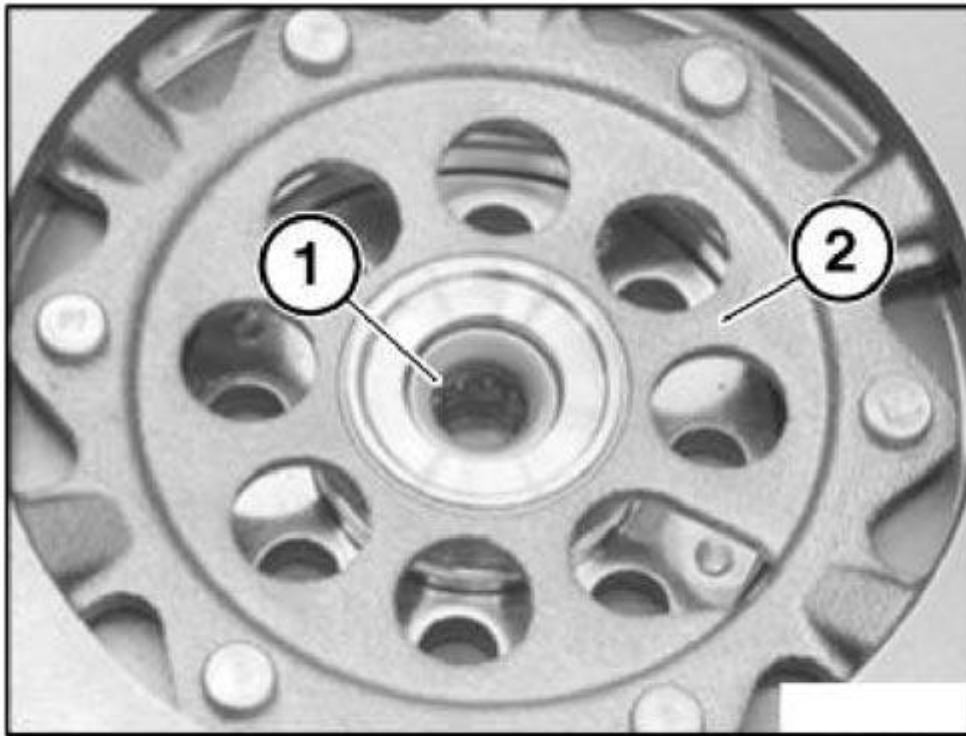
Special tools required:

NOTE: For special tools, refer to ENGINE - SPECIAL TOOLS .

- 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.

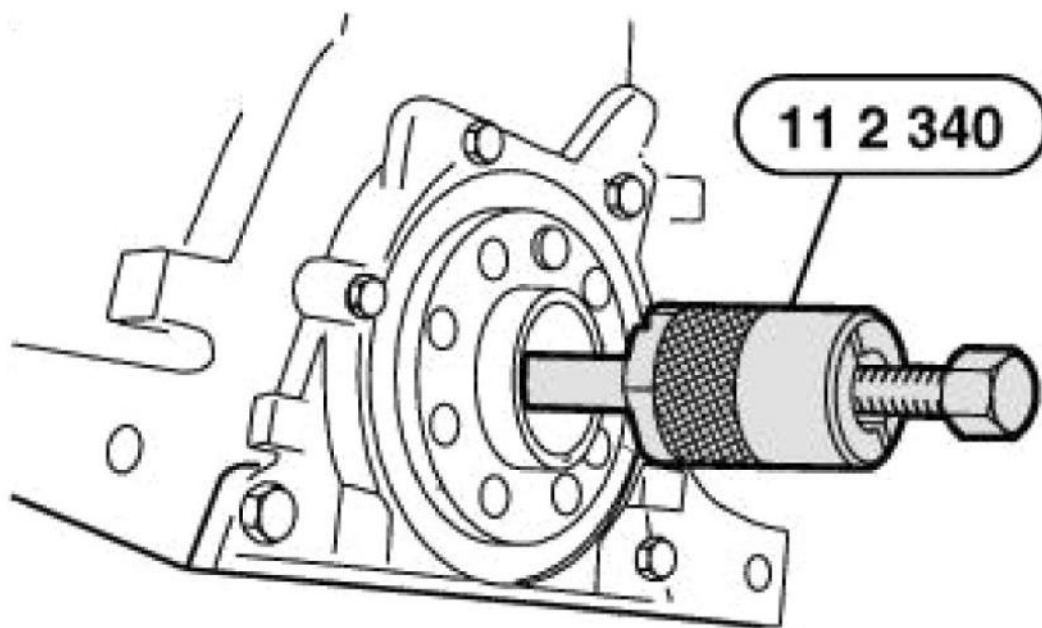


G03163983

Fig. 105: Identifying Needle Bearing In Dual-Mass Flywheel
Courtesy of BMW OF NORTH AMERICA, INC.

Version with grooved ball bearing:

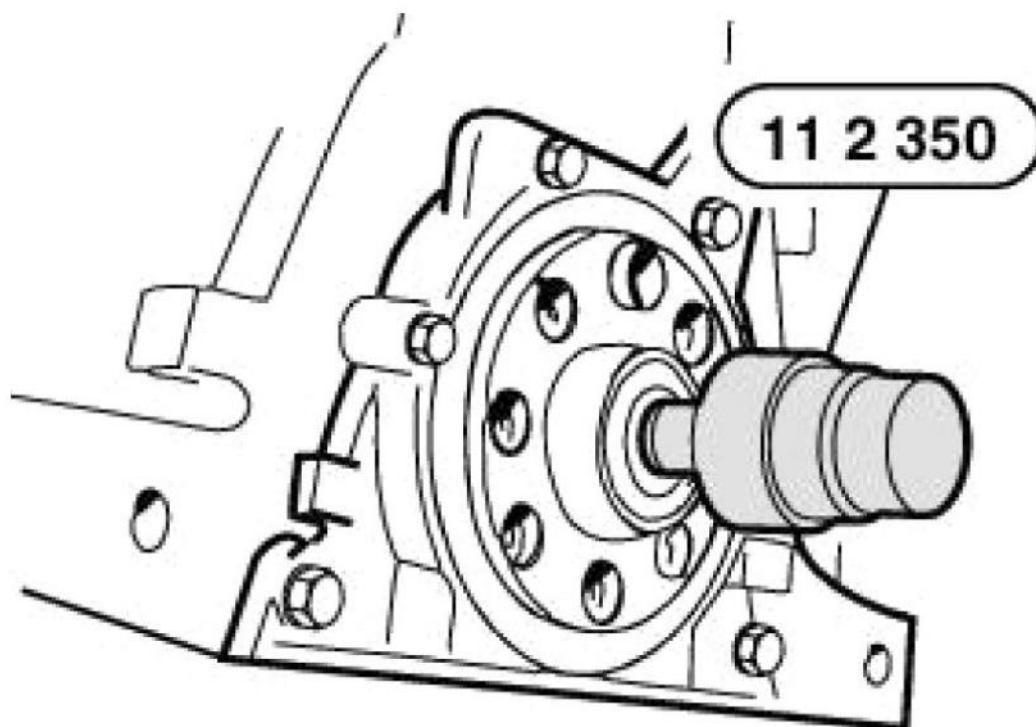
Remove guide bearing with special tool 11 2 340.



G03163984

Fig. 106: Removing Guide Bearing**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.



G03163985

Fig. 107: Installing New Thrust Bearing
Courtesy of BMW OF NORTH AMERICA, INC.

FLYWHEEL

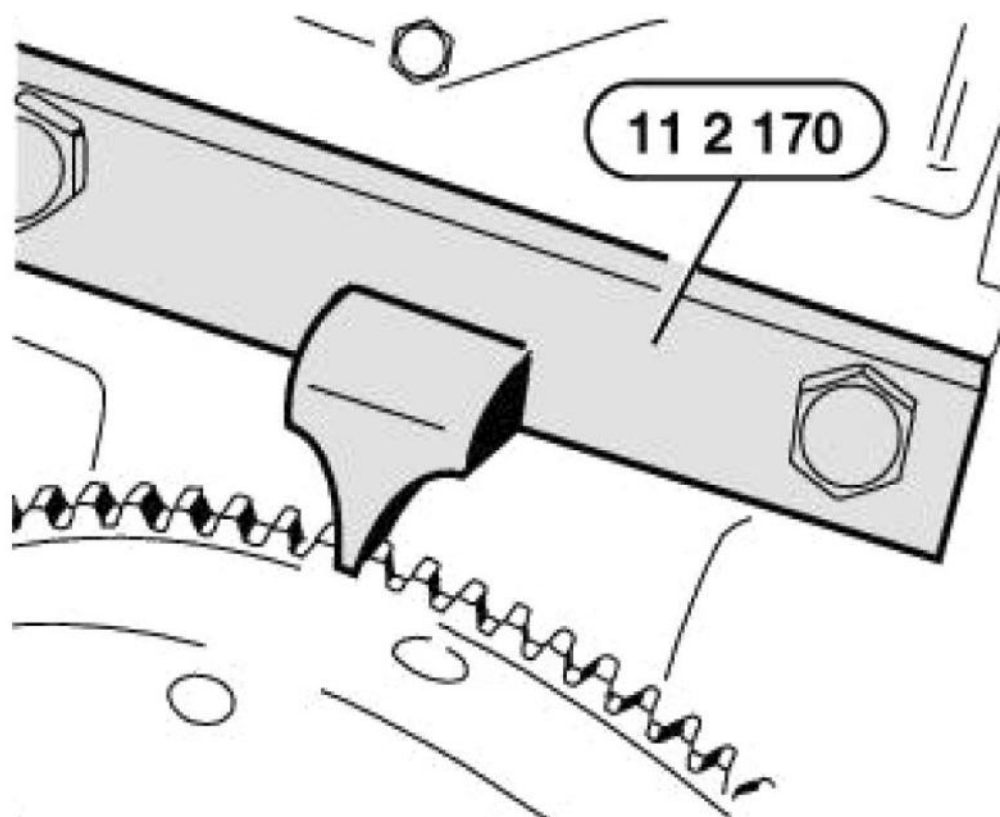
11 22 500 REMOVING AND INSTALLING OR REPLACING FLYWHEEL (M52 / S52 / M52TU / M54 / S54)

Special tools required:

NOTE: For special tools, refer to ENGINE - SPECIAL TOOLS .

- 11 2 170
(clutch removed)

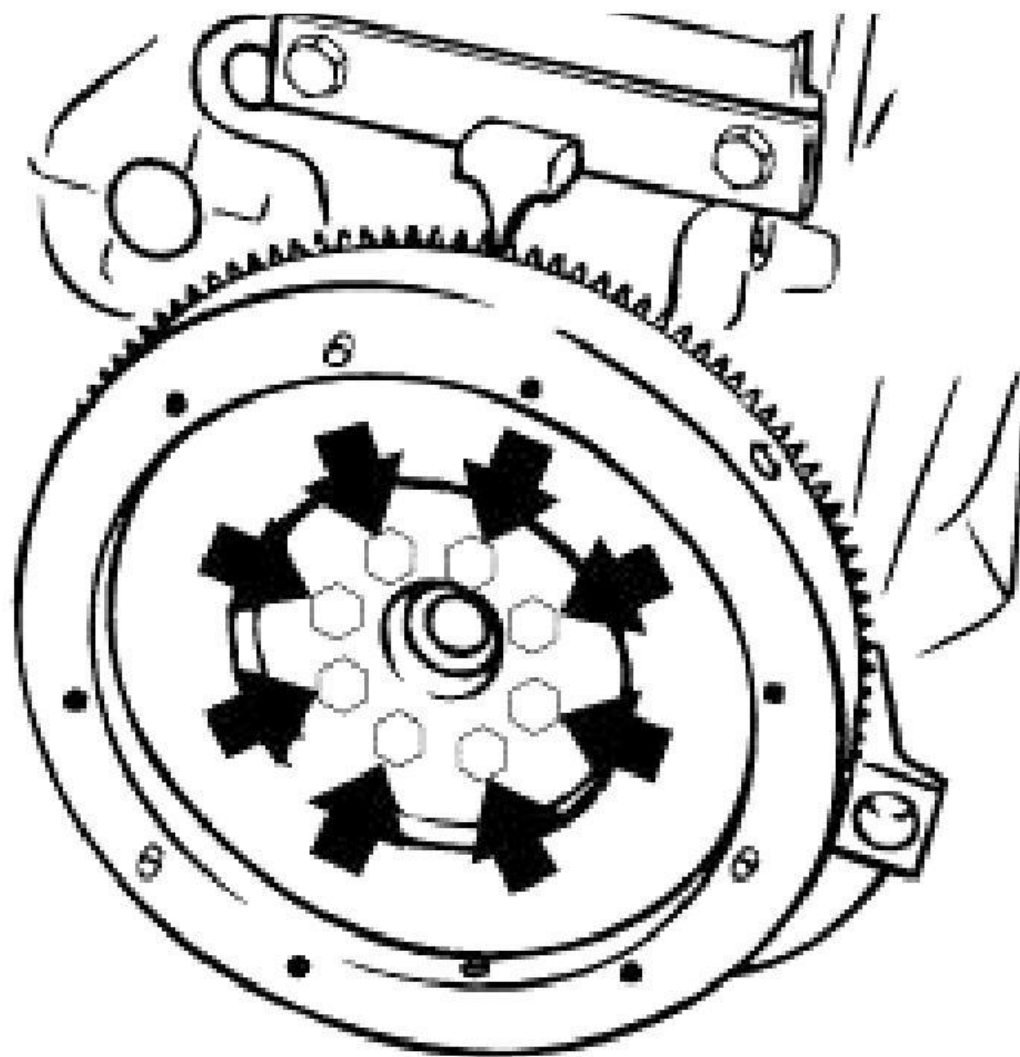
Lock flywheel with special tool 11 2 170.



G03163986

Fig. 108: Identifying Special Tool 11 2 170
 Courtesy of BMW OF NORTH AMERICA, INC.

Unfasten screws and remove flywheel.

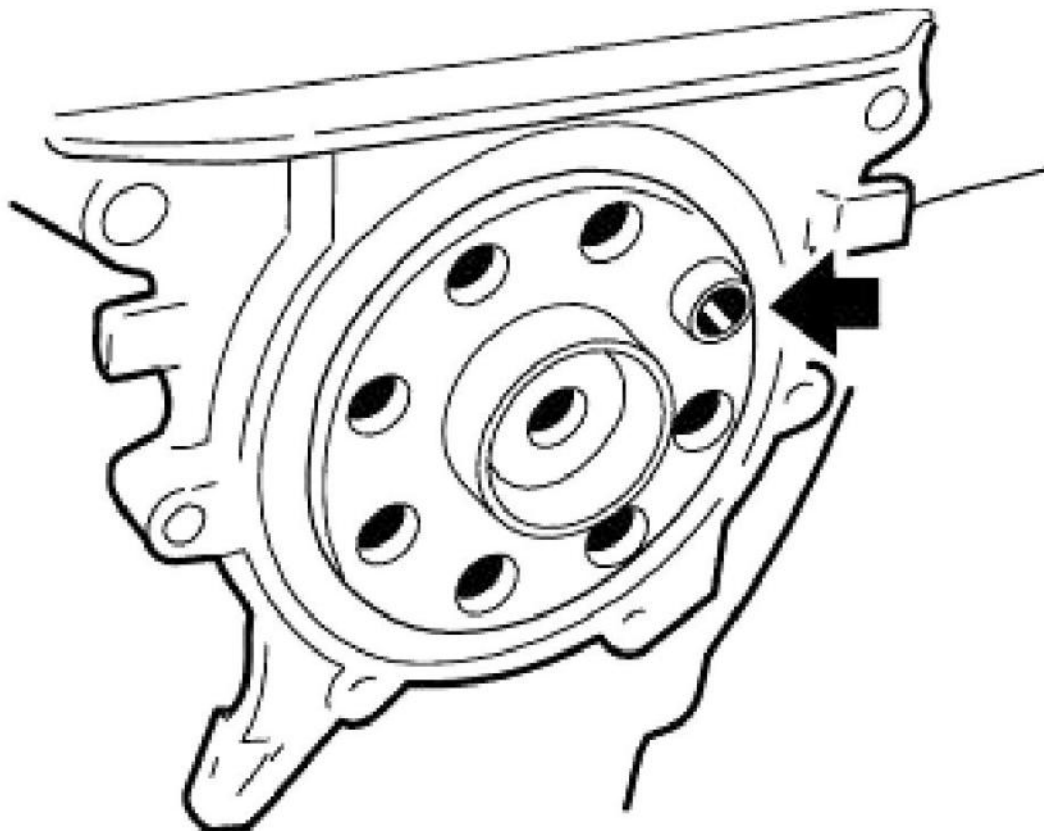


G03163987

Fig. 109: Unfastening Screws And Removing Flywheel
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Check dowel sleeve for damage and correct installation position.



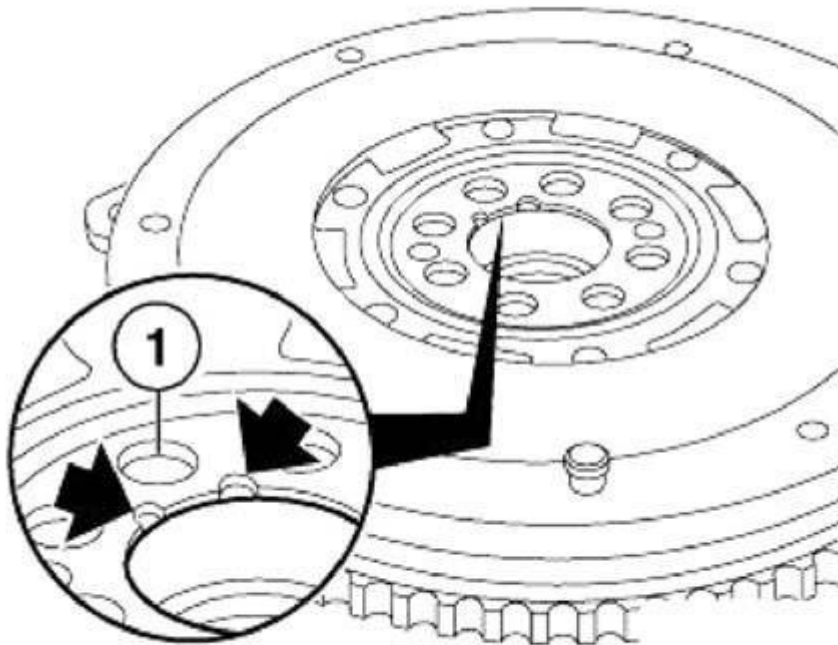
G03163988

Fig. 110: 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.

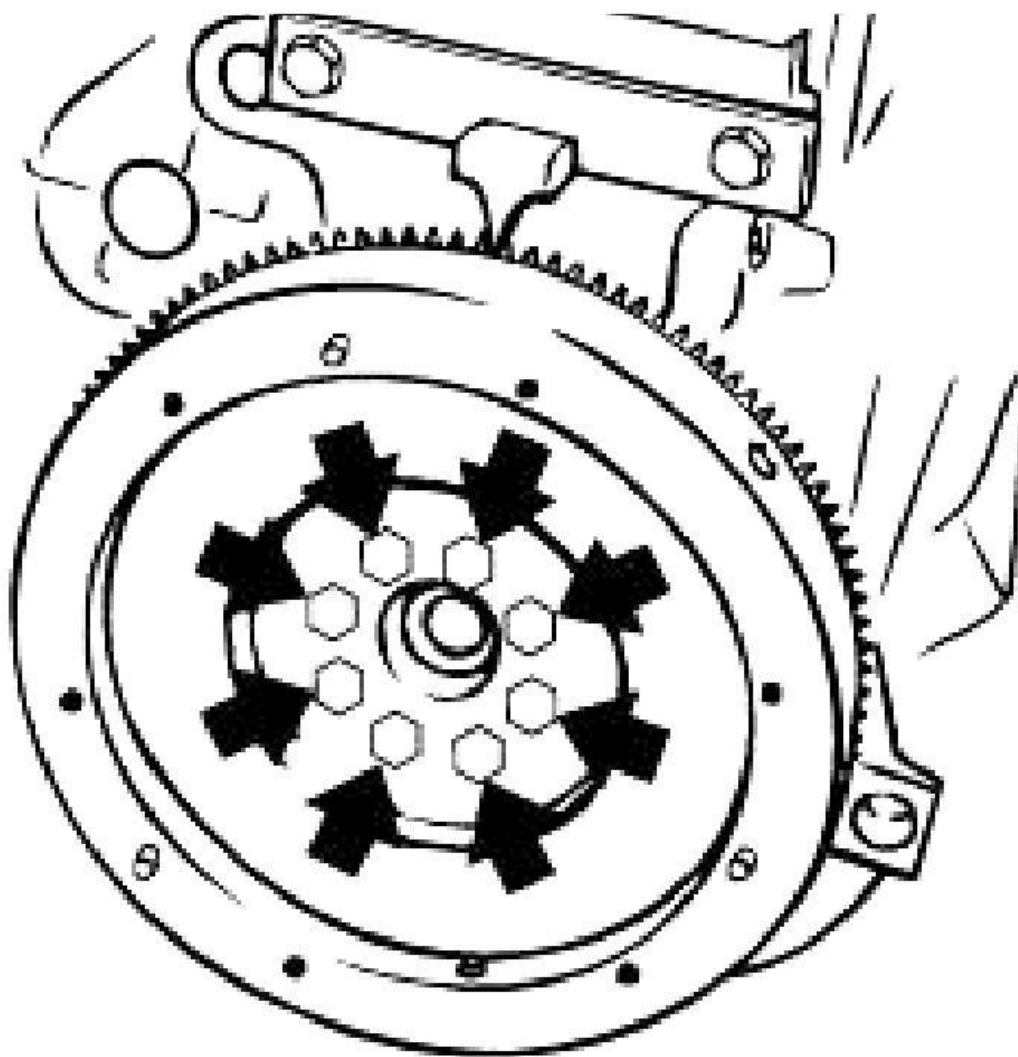


G03163989

Fig. 111: Positioning Of Dowel Sleeve In Dual-Mass Flywheel
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Clean thread and install new micro-encapsulated screws.



G03163990

Fig. 112: Installing New Micro-Encapsulated Screws
Courtesy of BMW OF NORTH AMERICA, INC.

Tightening torque, refer to 11 22 1AZ in **ENGINE - TIGHTENING TORQUES** .

11 22 513 REPLACING ROLLER BEARING FOR DUAL-MASS FLYWHEEL

Special tools required:

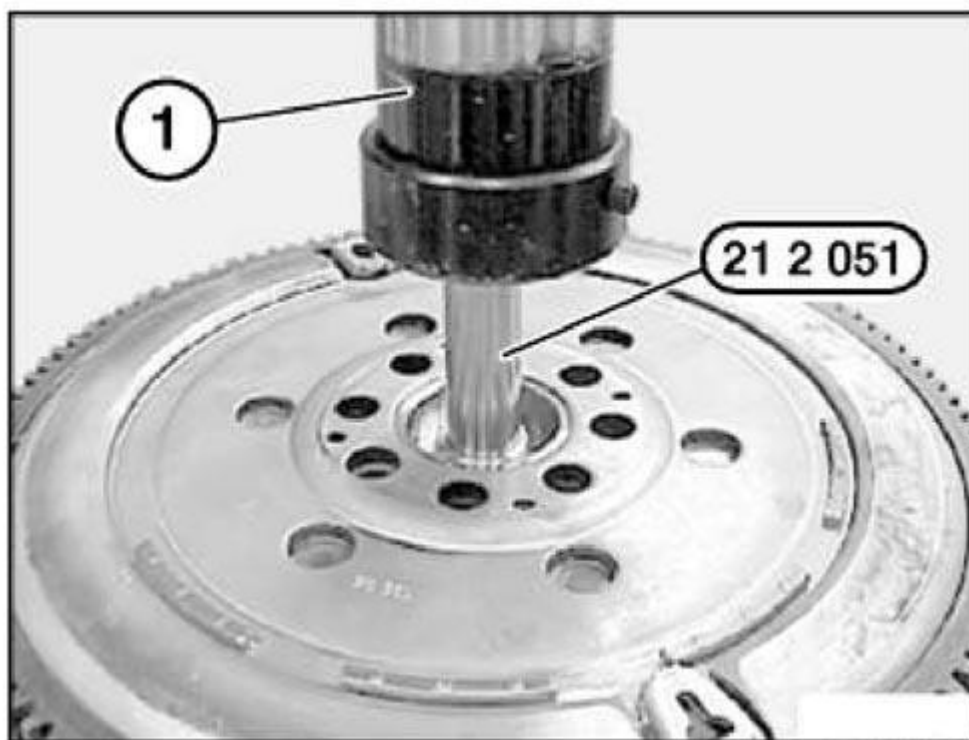
NOTE: For special tools, refer to **ENGINE - SPECIAL TOOLS** .

- 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.

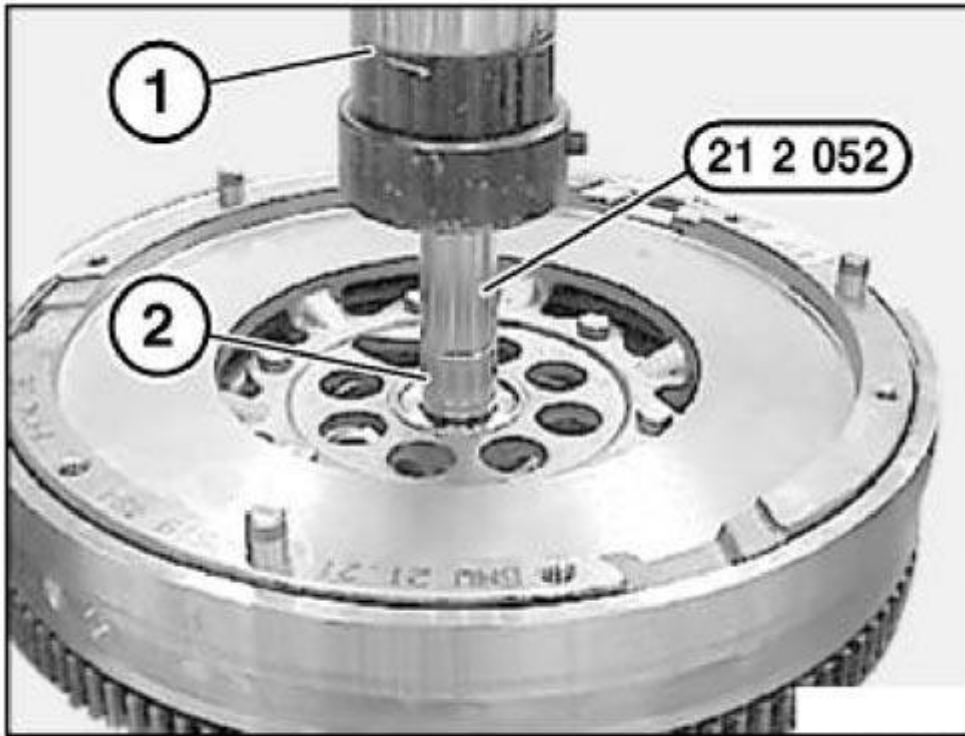
IMPORTANT: Risk of damage: Roller bearing must not be driven out.



G03163991

Fig. 113: Identifying Special Tool 21 2 051
Courtesy of BMW OF NORTH AMERICA, INC.

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



G03163992

Fig. 114: Identifying Special Tool 21 2 052)
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:

NOTE: For special tools, refer to ENGINE - SPECIAL TOOLS .

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

Necessary preliminary tasks:

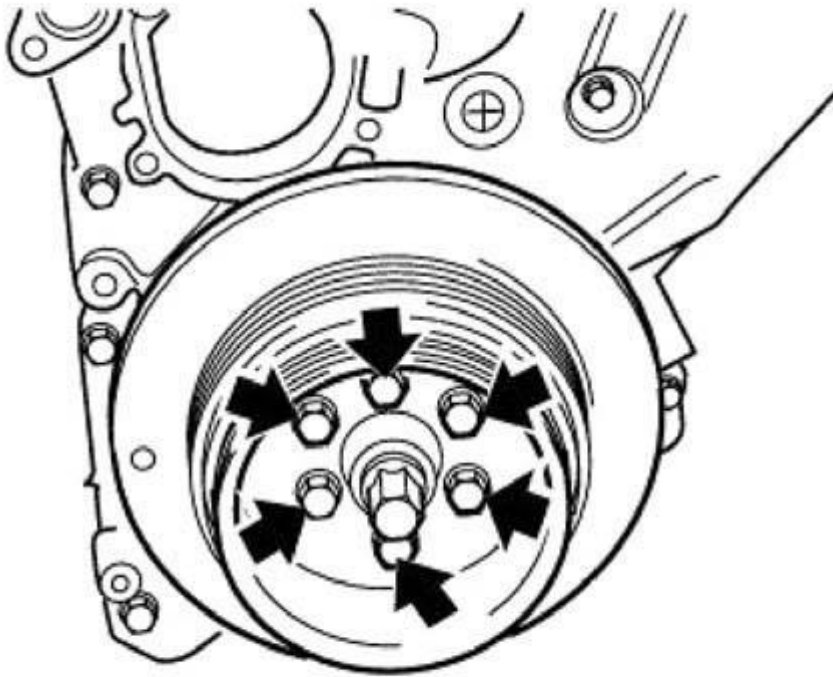
- Unscrew and remove splash shield. See 51 11 000 REMOVING AND INSTALLING COMPLETE FRONT BUMPER (FROM 10/01)
- Remove fan impeller with fan clutch and fan cowl. See 11 52 020 Removing and installing/replacing fan clutch (S52 / S54 / M52 / M52TU / M54 / M56)
- E83/E85/E60: Remove fan cowl with electric fan. See 11 52 020 Removing and installing/replacing fan clutch (S52 / S54 / M52 / M52TU / M54 / M56)
- Remove A/C compressor drive belt. See 11 28 050 Replacing A/C compressor drive belt (M52 / S52 / M52TU / M54 / M56)
- Remove alternator drive belt. See 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.



G03163993

Fig. 115: Unscrewing Vibration Damper Bolts
Courtesy of BMW OF NORTH AMERICA, INC.

Version 1

Vibration damper and hub for vibration damper are two parts:

Installation:

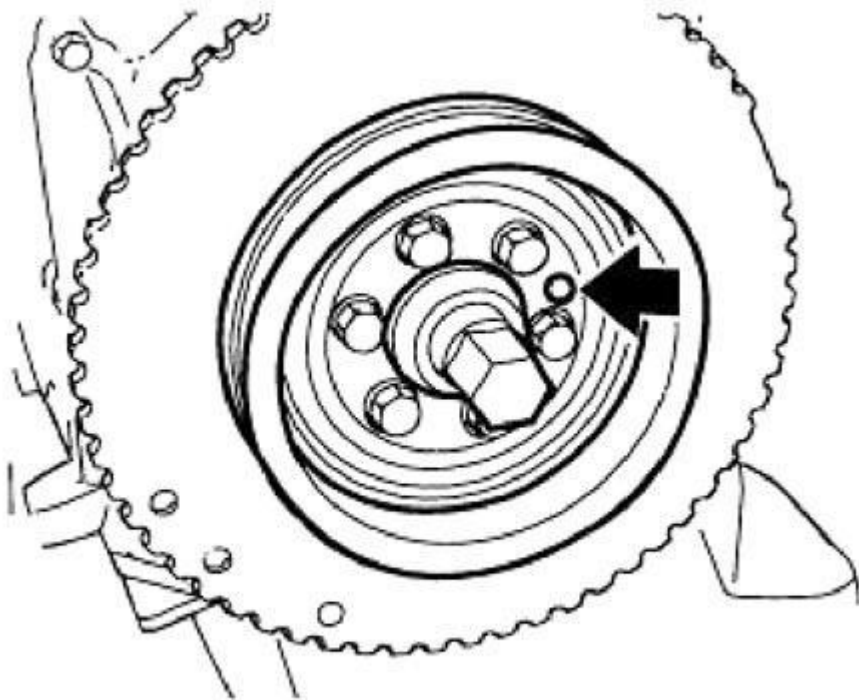
Align locating bore in vibration damper to dowel pin.

Install and tighten down screws.

Tightening torque, refer to 11 23 3AZ in **ENGINE - TIGHTENING TORQUES** .

Version 2

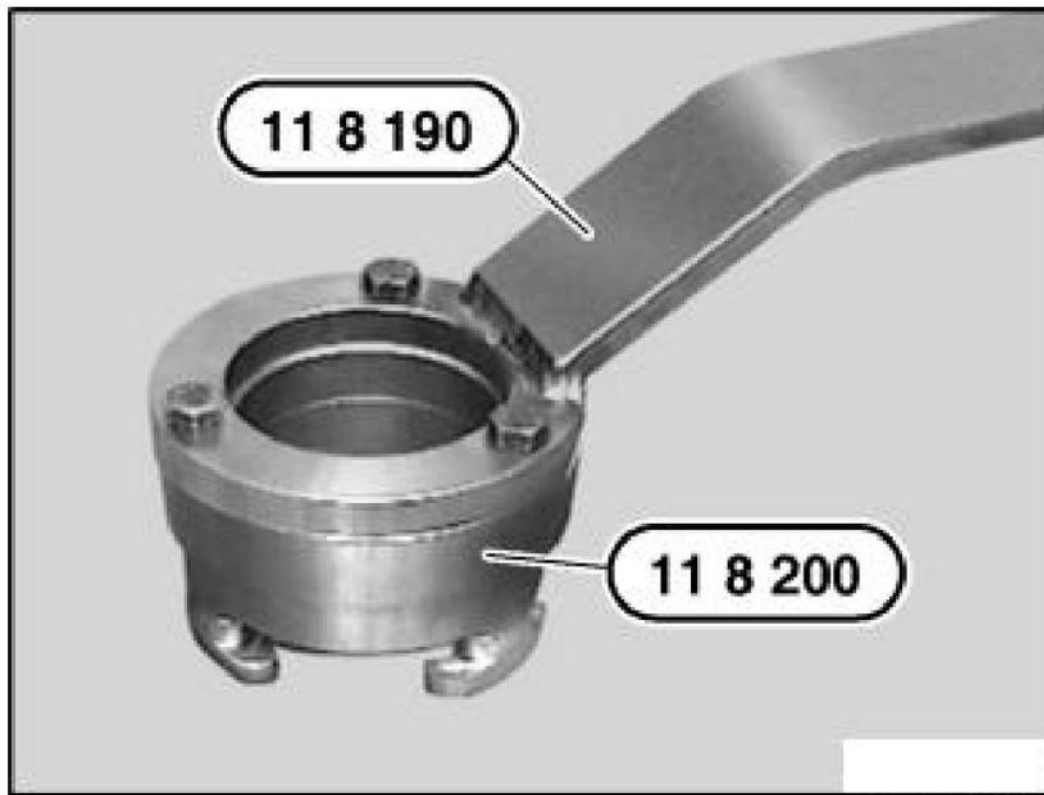
Vibration damper and hub for vibration damper are one part:



G03163994

Fig. 116: Identifying Vibration Damper And Hub
Courtesy of BMW OF NORTH AMERICA, INC.

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

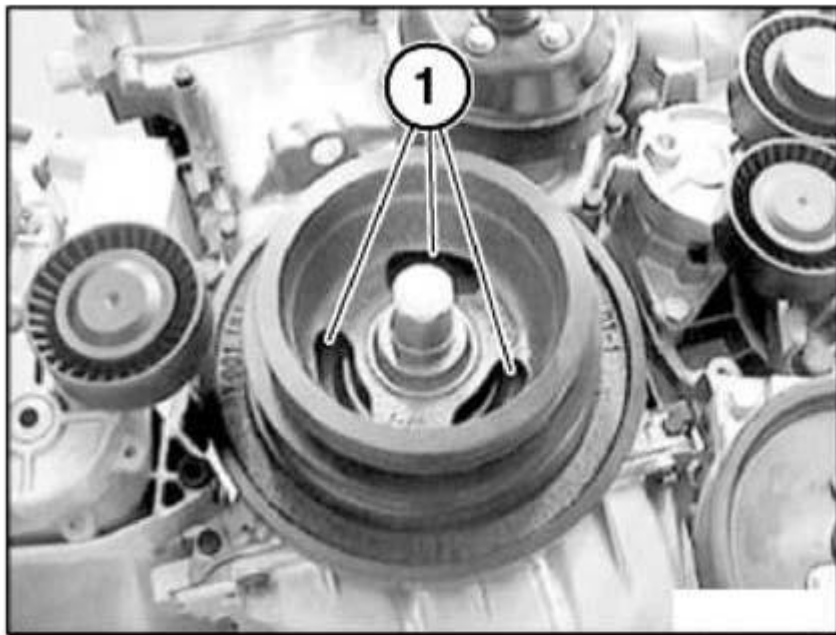


G03163995

Fig. 117: Identifying Special Tool 11 8 190 And 11 8 200
Courtesy of BMW OF NORTH AMERICA, INC.

Version 2

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



G03163996

Fig. 118: Special Tool 11 8 200 Must Snap Into Place In Openings (1)
Courtesy of BMW OF NORTH AMERICA, INC.

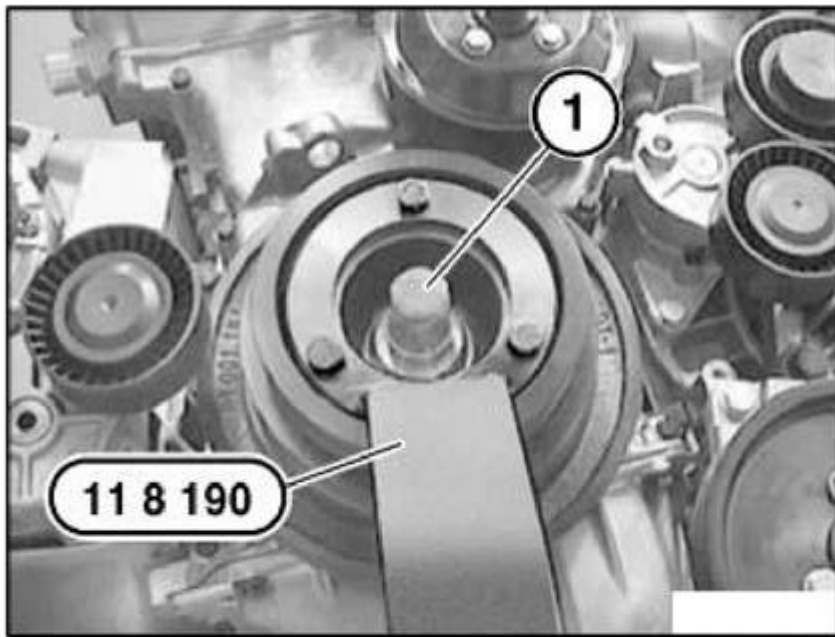
Version 2

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.

Release central screw (1).

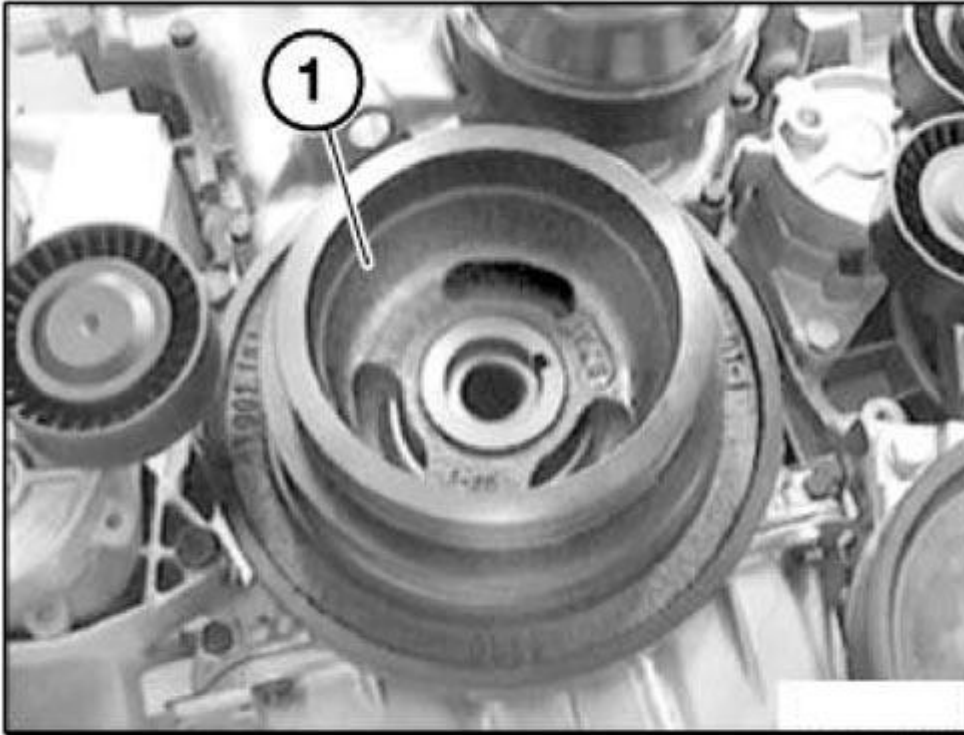


G03163997

Fig. 119: Releasing Central Screw**Courtesy of BMW OF NORTH AMERICA, INC.****Version 2**

Feed out special tools 11 8 190/11 8 200. Remove central screw and washer.

Carefully detach vibration damper (1) by hand.

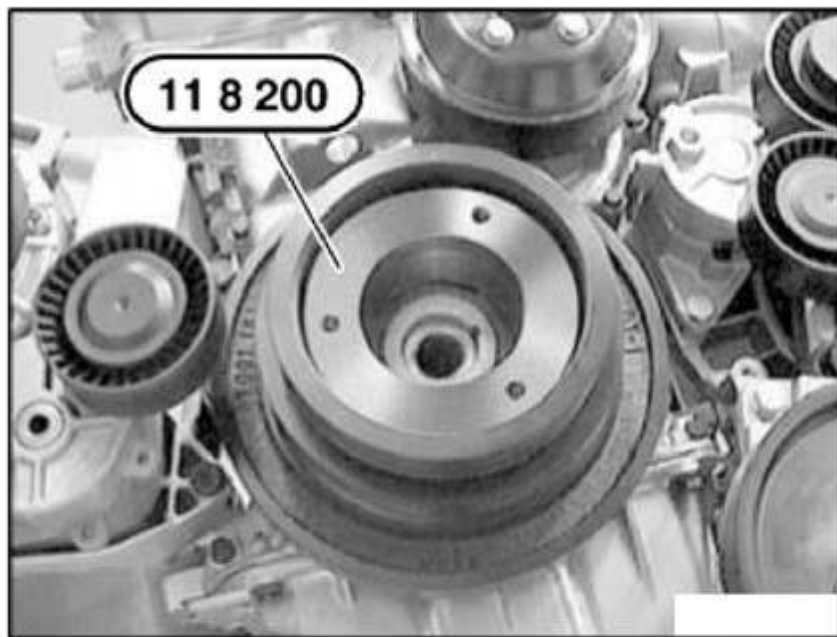


G03163998

Fig. 120: Detaching Vibration Damper
Courtesy of BMW OF NORTH AMERICA, INC.

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.



G03163999

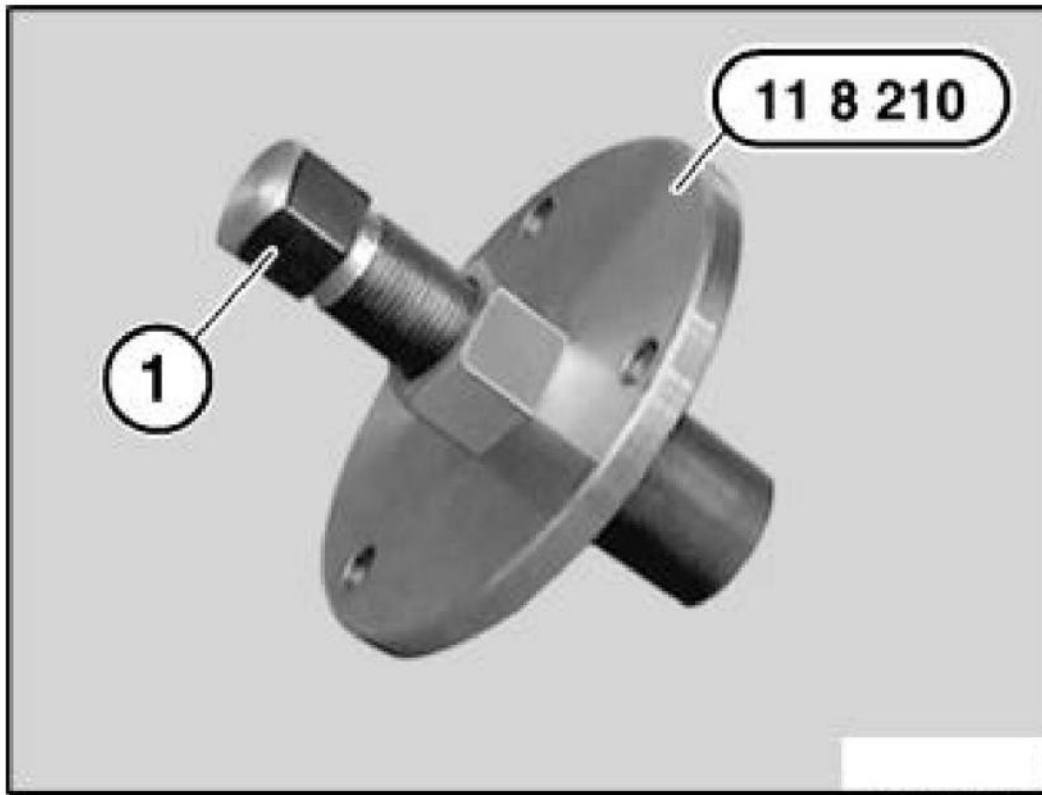
Fig. 121: Identifying Special Tool 11 8 200
Courtesy of BMW OF NORTH AMERICA, INC.

Version 2

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

Z3 only:

Screw in spindle (1) on special tool 11 8 210 approx. 15 mm and screw out again only after installation between special tool 11 8 200 and cooler.



G03164000

Fig. 122: Screwing In Spindle

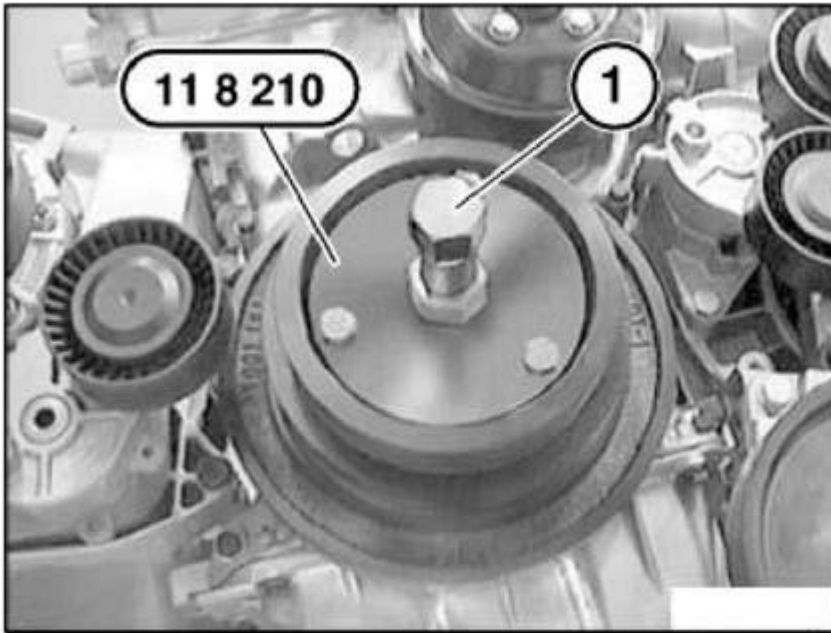
Courtesy of BMW OF NORTH AMERICA, INC.

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.



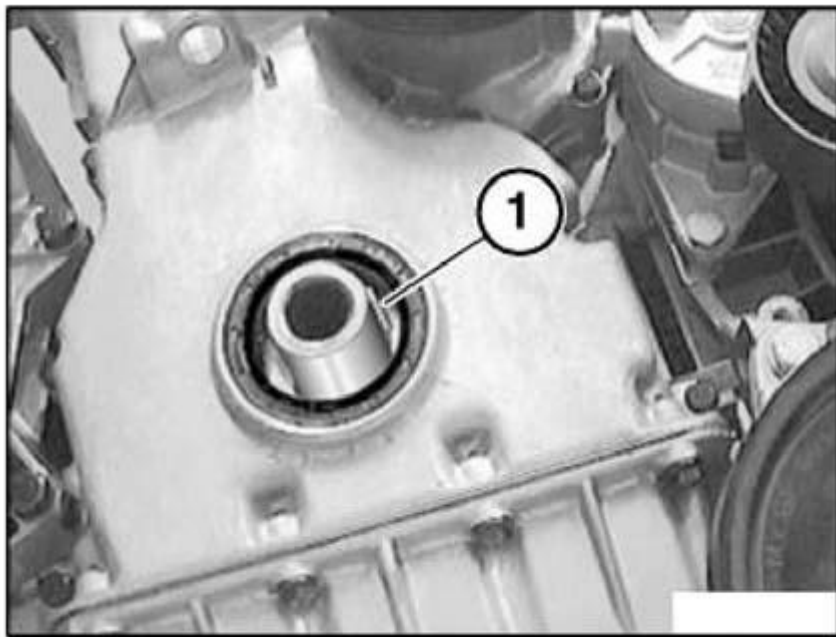
G03164001

Fig. 123: Detaching Vibration Damper By Turning Spindle
Courtesy of BMW OF NORTH AMERICA, INC.

Version 2

Installation:

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



G03164002

Fig. 124: Checking Featherkey For Damage
Courtesy of BMW OF NORTH AMERICA, INC.

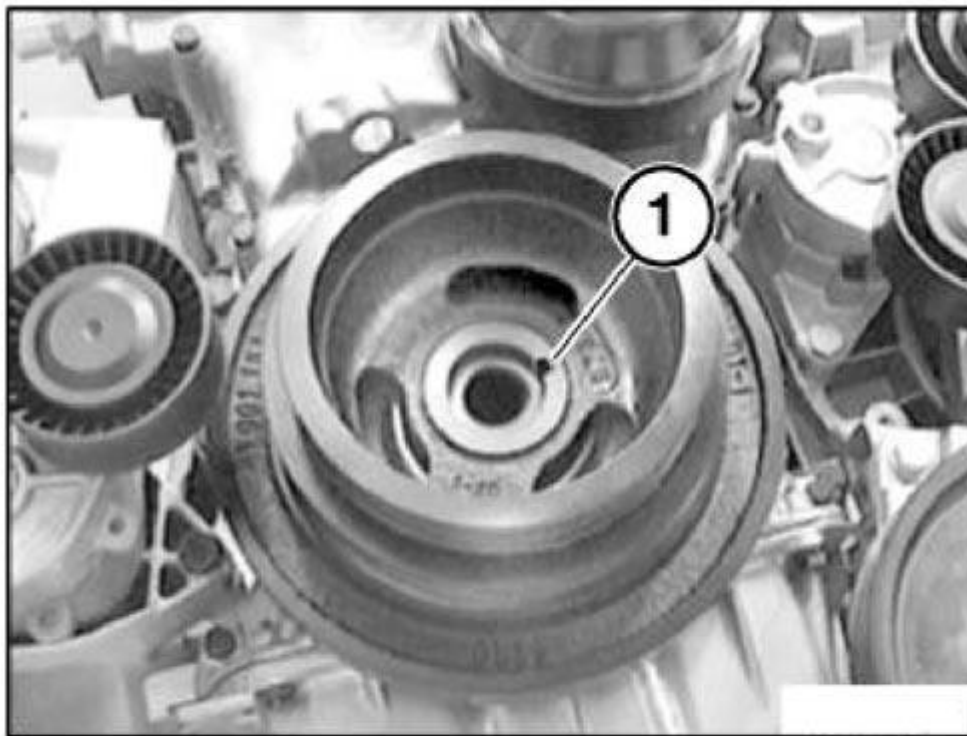
Replace radial seal in lower timing case cover.

Version 2

Installation:

Align groove (1) in vibration damper to featherkey.

Fit vibration damper.



G03164003

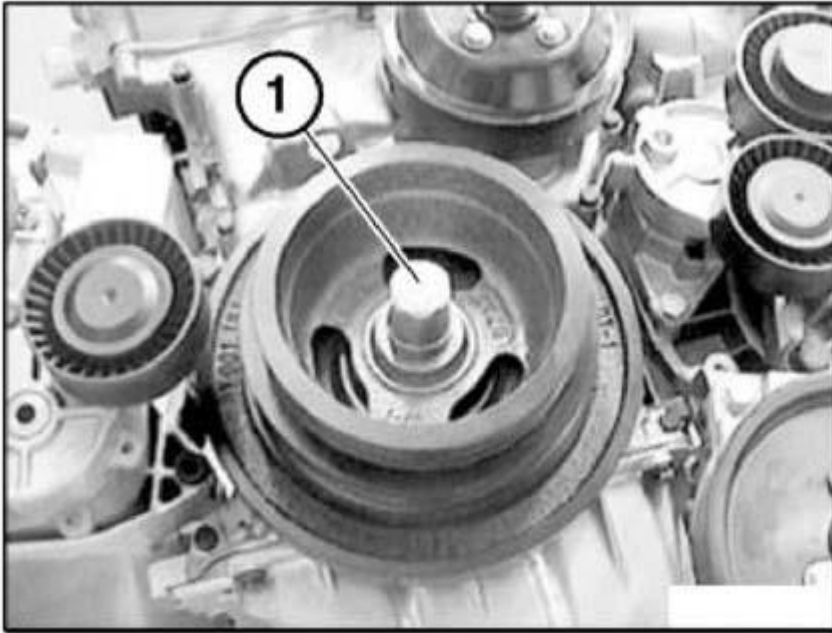
Fig. 125: Aligning Groove In Vibration Damper
Courtesy of BMW OF NORTH AMERICA, INC.

Version 2

Installation:

Replace central screw (1).

Install central screw and washer.



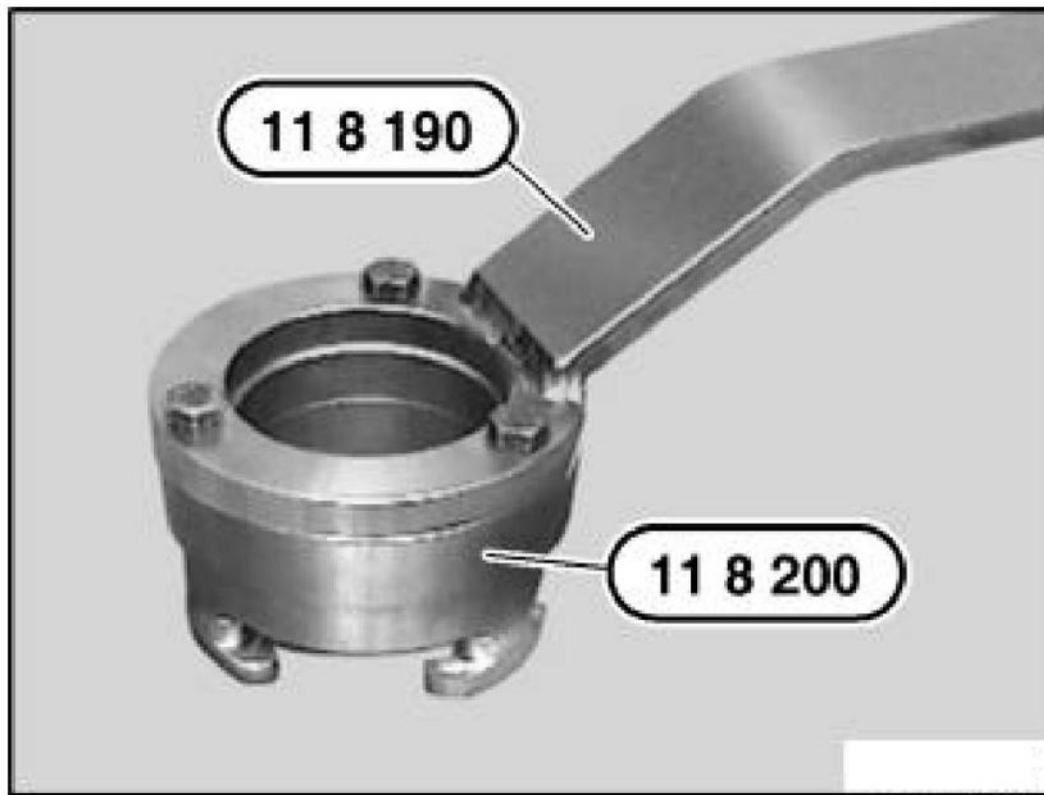
G03164004

Fig. 126: Replacing Central Screw
Courtesy of BMW OF NORTH AMERICA, INC.

Version 2

Installation:

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



G03164005

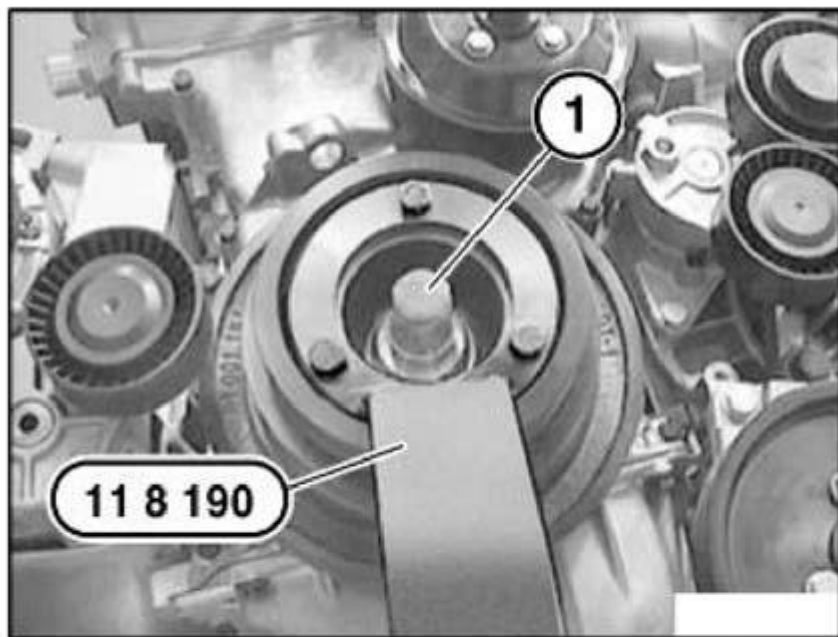
Fig. 127: Identifying Special Tool 11 8 190 And 11 8 200
Courtesy of BMW OF NORTH AMERICA, INC.

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.

Tighten down central screw (1).

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



G03164006

Fig. 128: Tightening Down Central Screw
Courtesy of BMW OF NORTH AMERICA, INC.

CONNECTING ROD WITH BEARING

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

Special tools required:

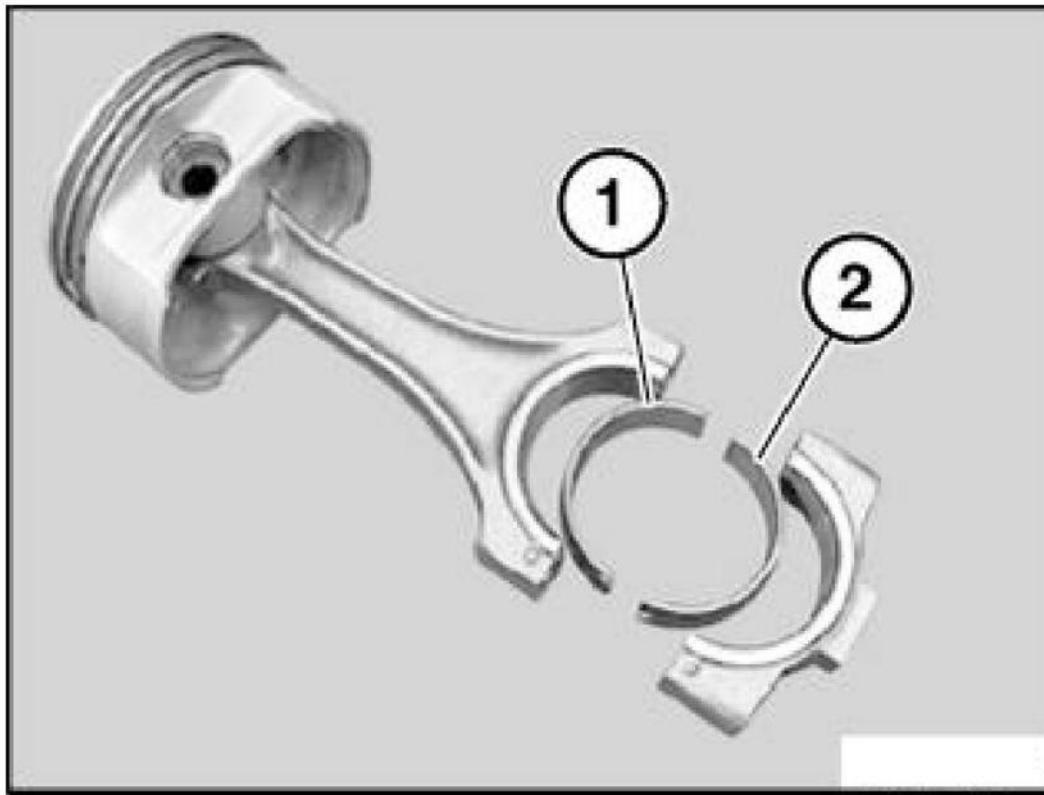
NOTE: For special tools, refer to ENGINE - SPECIAL TOOLS .

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

(piston removed)

IMPORTANT: Note grinding stages on crankshaft.

Install new conrod bearing shells.



G03164007

Fig. 129: Installing New Conrod Bearing Shells
Courtesy of BMW OF NORTH AMERICA, INC.

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

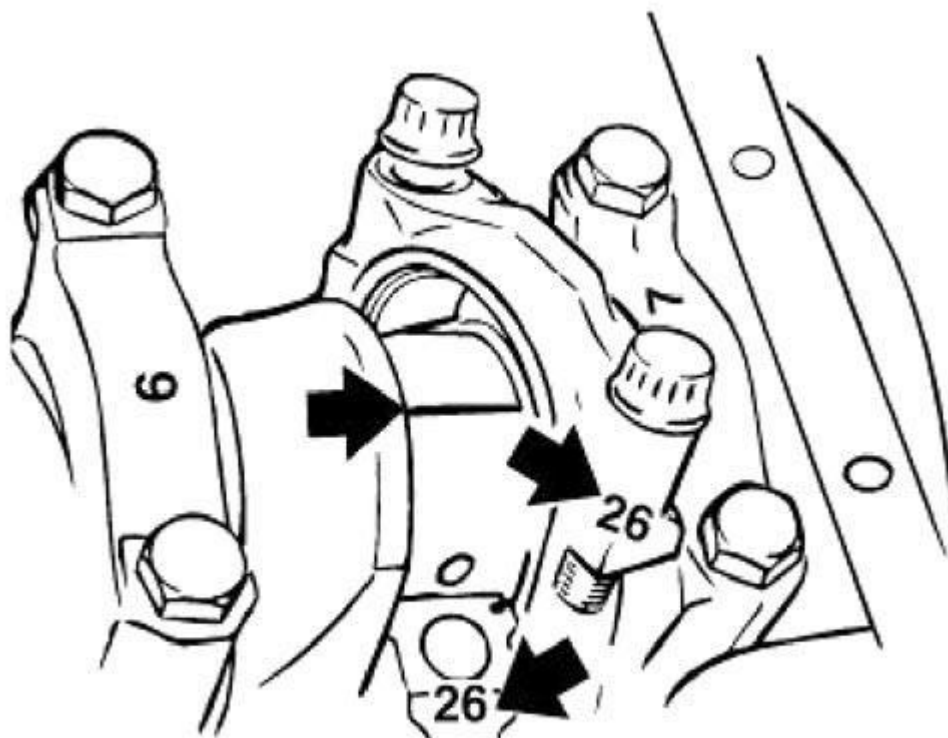
Install piston.

Check conrod bearing clearance.

Piston in BDC position.

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

Fit bearing caps so that pair numbers match up.



G03164008

Fig. 130: Fitting Bearing Caps So That Pair Numbers Match Up
Courtesy of BMW OF NORTH AMERICA, INC.

IMPORTANT: Do not distort conrods or crankshaft.

Use the old conrod bolts to check conrod clearance.

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

Tightening torque, refer to 11 24 1AZ in **ENGINE - TIGHTENING TORQUES**.

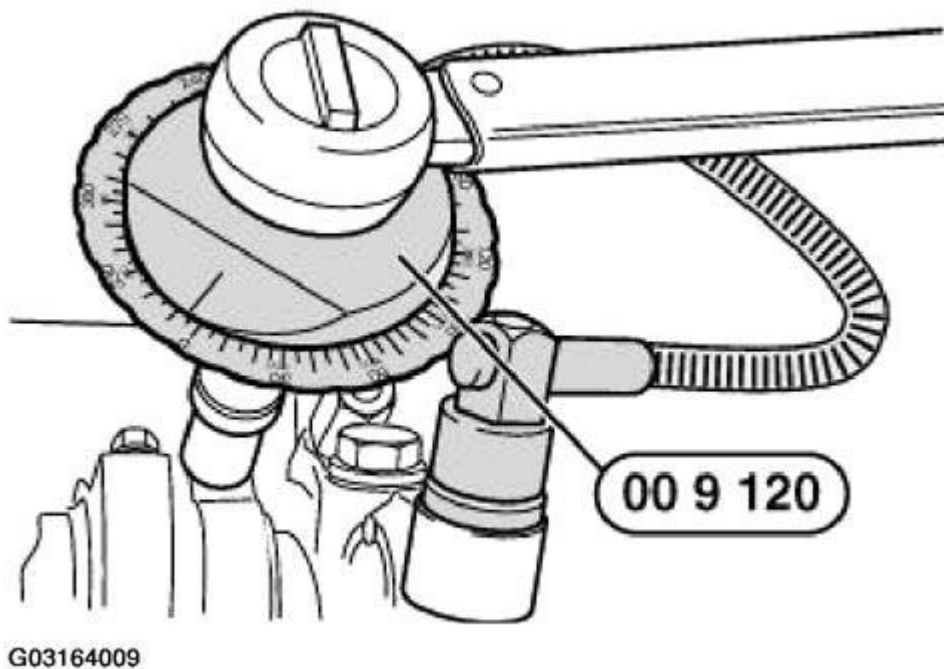
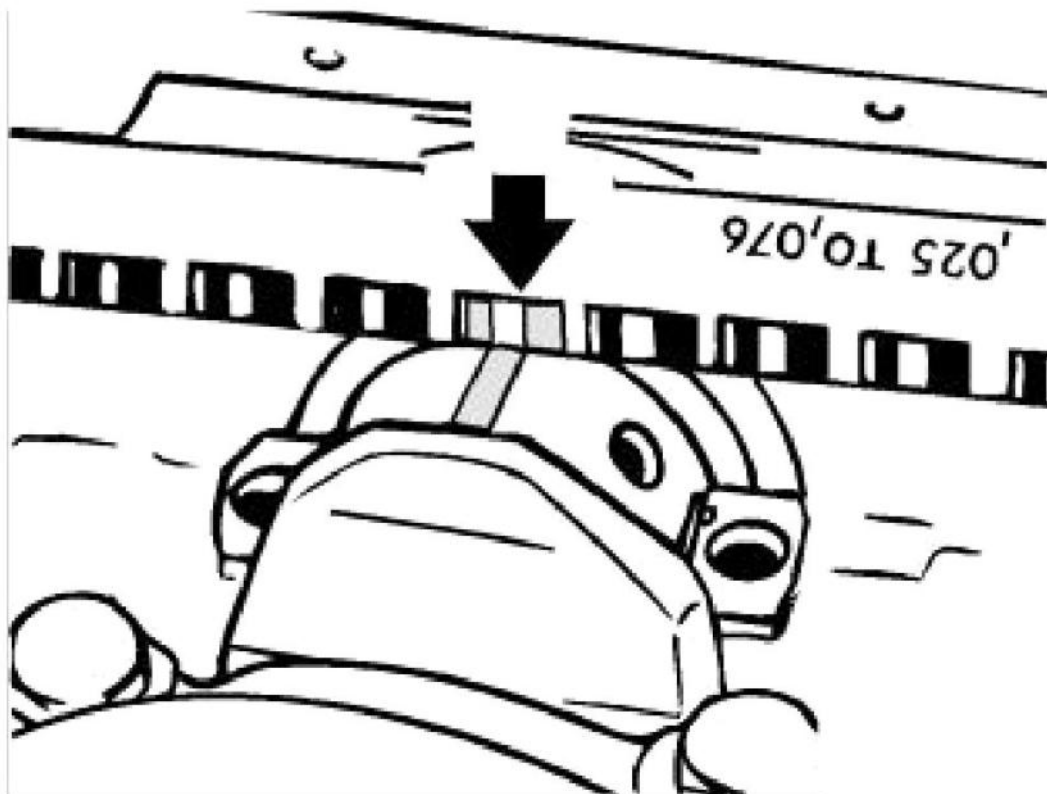


Fig. 131: Tightening Down Conrod Bolts
Courtesy of BMW OF NORTH AMERICA, INC.

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

Conrod bearing clearance.

- Remove plastic thread.



G03164010

Fig. 132: Removing Plastic Thread
 Courtesy of BMW OF NORTH AMERICA, INC.

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

Tightening torque, refer to 11 24 1AZ in **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:

NOTE: For special tools, refer to **ENGINE - SPECIAL TOOLS** .

- 00 9 120

- 11 2 110
- 11 2 260
- 11 2 470
- 11 3 480
- 11 8 141

(engine removed)

Remove cylinder head. See **11 12 100 Removing and installing/replacing cylinder head (M52TU / M54 / M56)**

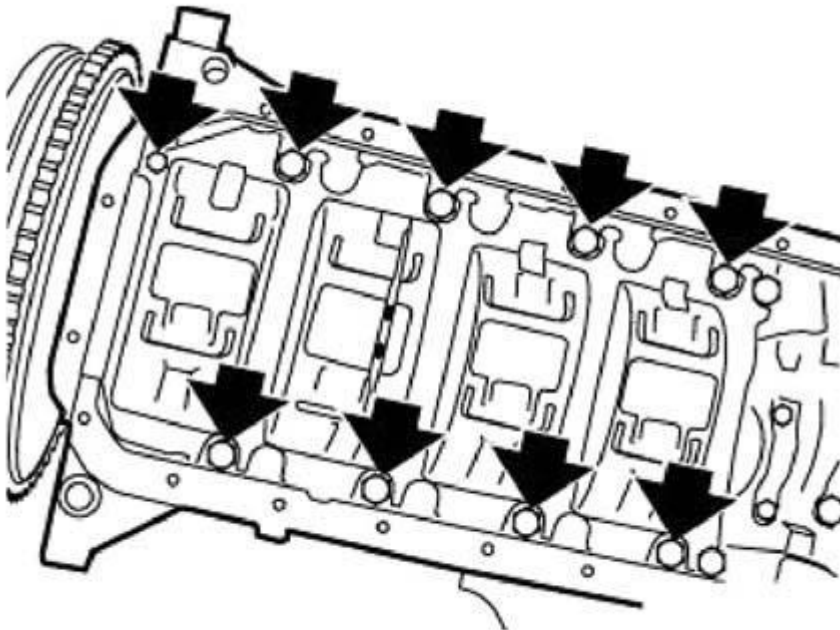
Removal:

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.

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



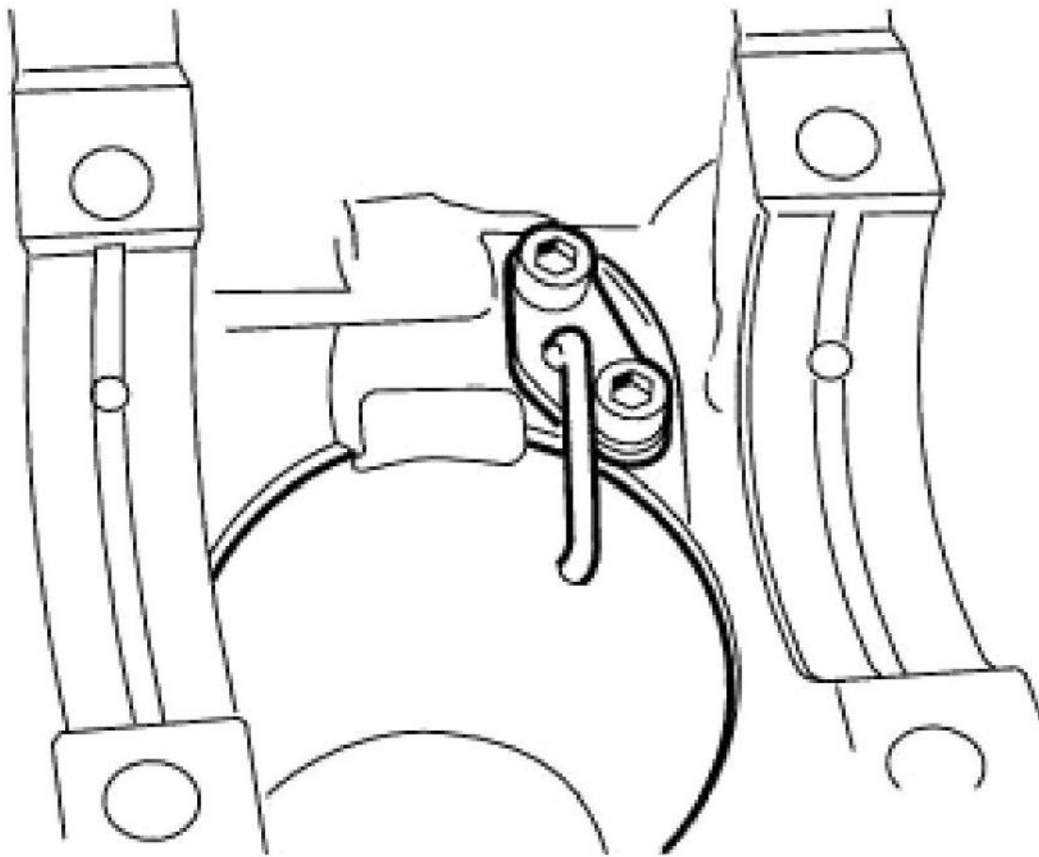
G03164011

Fig. 133: Removing Oil Pump

Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: Figure shows crankshaft removed.

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



G03164012

Fig. 134: Identifying Spray Nozzles For Piston Cooling

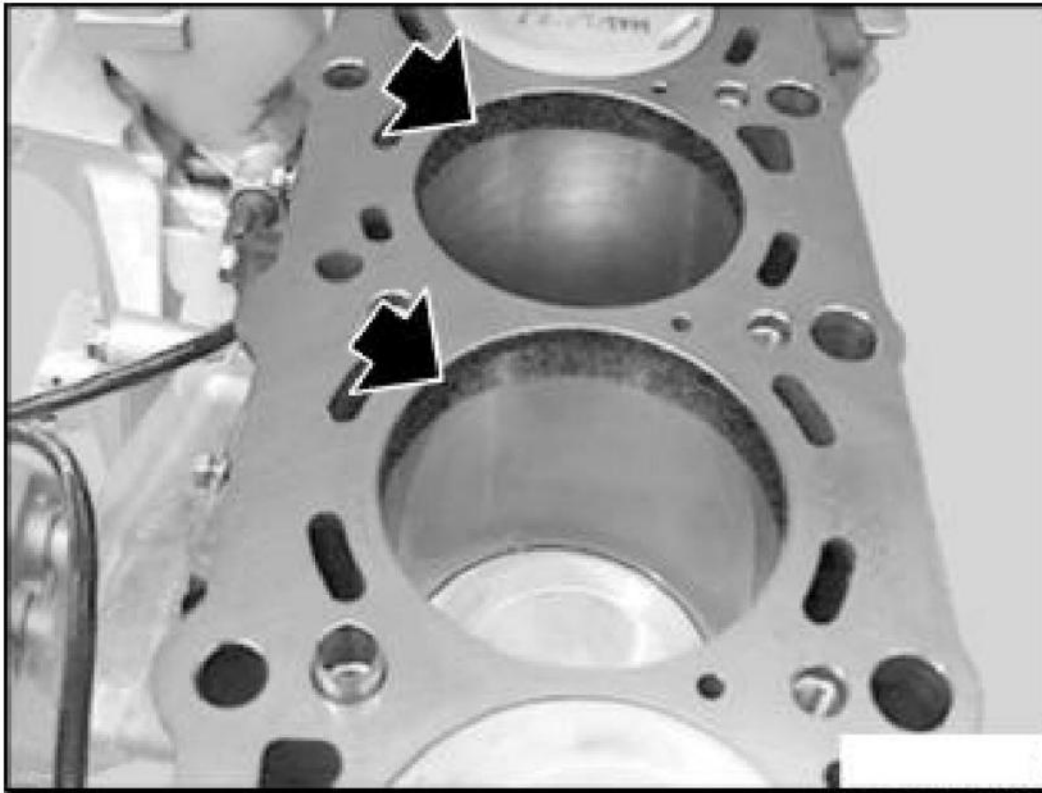
Courtesy of BMW OF NORTH AMERICA, INC.

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:

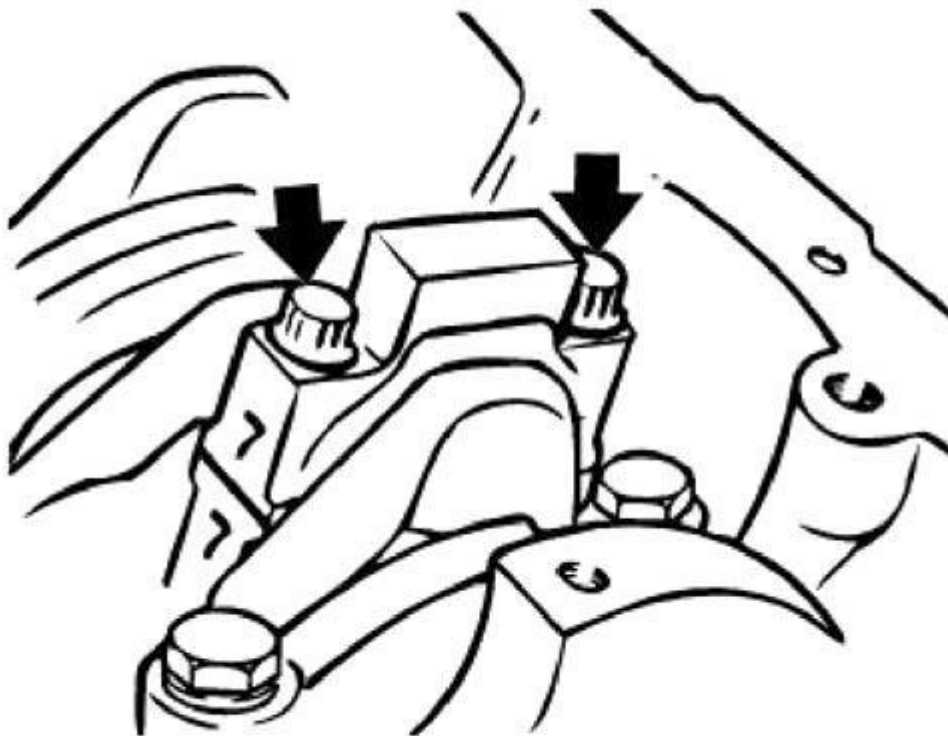
Carefully remove oil carbon residue from cylinder wall.



G03164013

Fig. 135: Removing Oil Carbon Residue From Cylinder Wall
Courtesy of BMW OF NORTH AMERICA, INC.

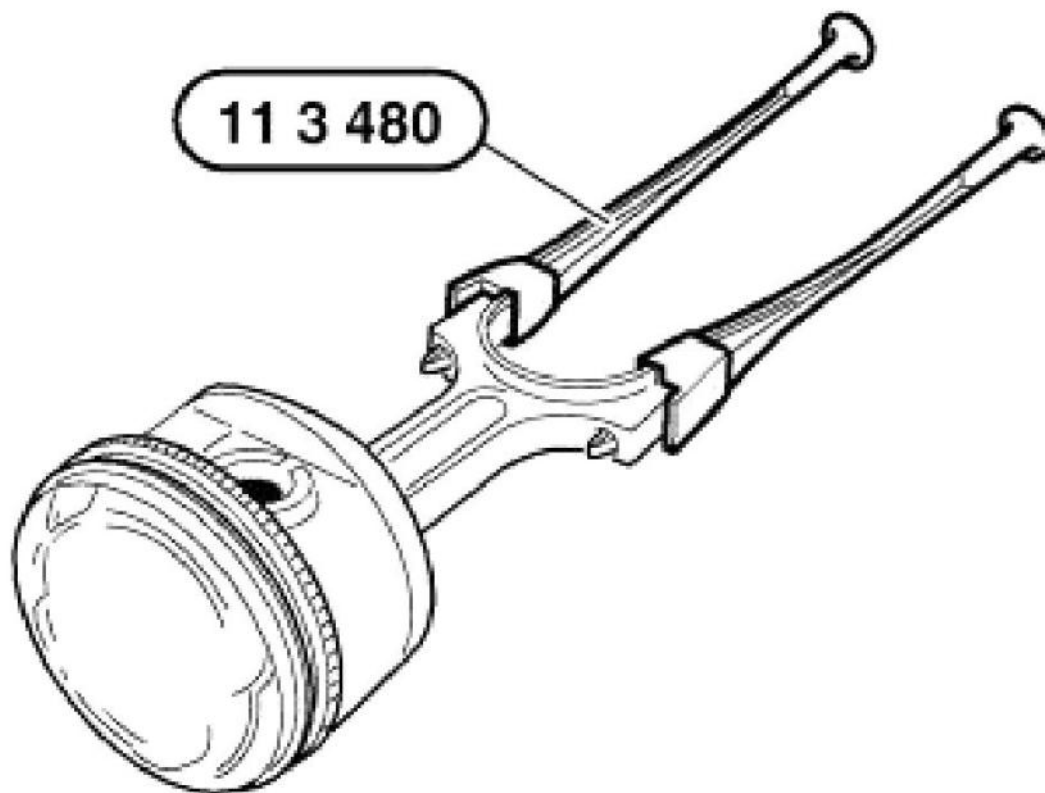
Unscrew conrod bearing cover.



G03164014

Fig. 136: Unscrewing Conrod Bearing Cover
Courtesy of BMW OF NORTH AMERICA, INC.

Insert special tool 11 3 480 in conrod.



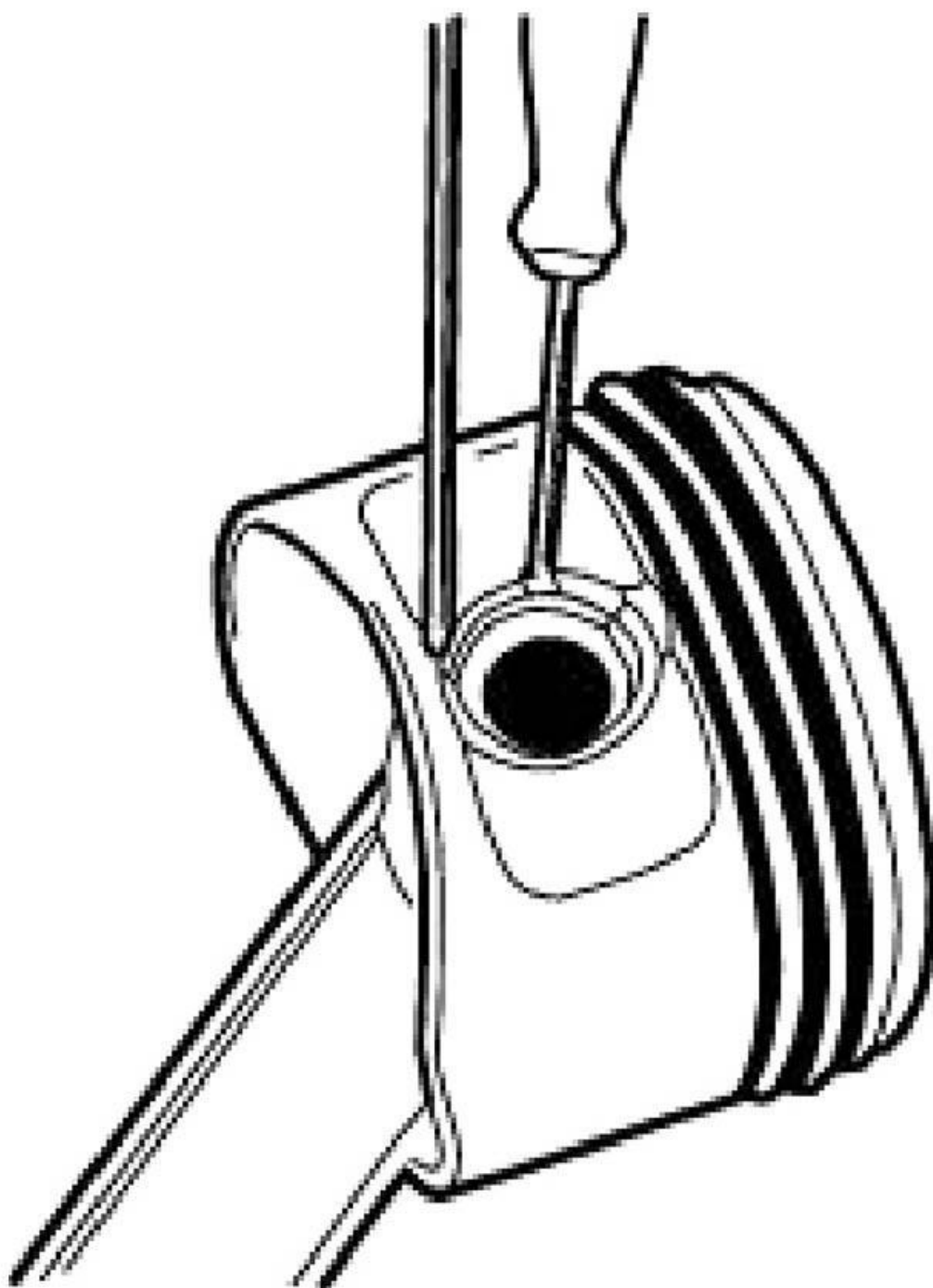
G03164015

Fig. 137: Inserting Special Tool 11 3 480
Courtesy of BMW OF NORTH AMERICA, INC.

Remove conrod with piston from cylinder head side.

Lift out retaining ring and press out piston pin.

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



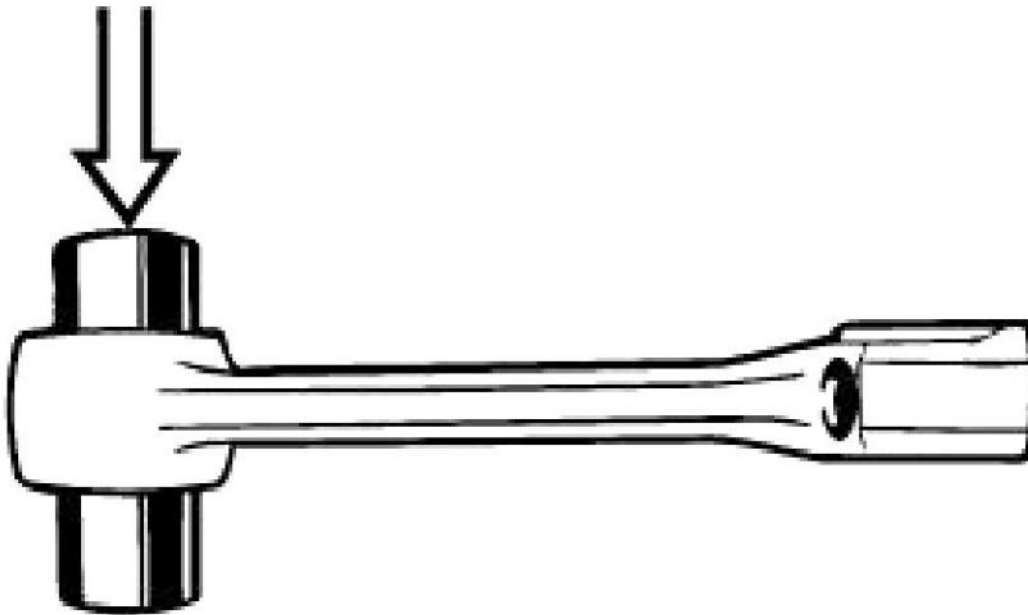
G03164016

Fig. 138: Identifying Piston And Piston Pin
Courtesy of BMW OF NORTH AMERICA, INC.

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.

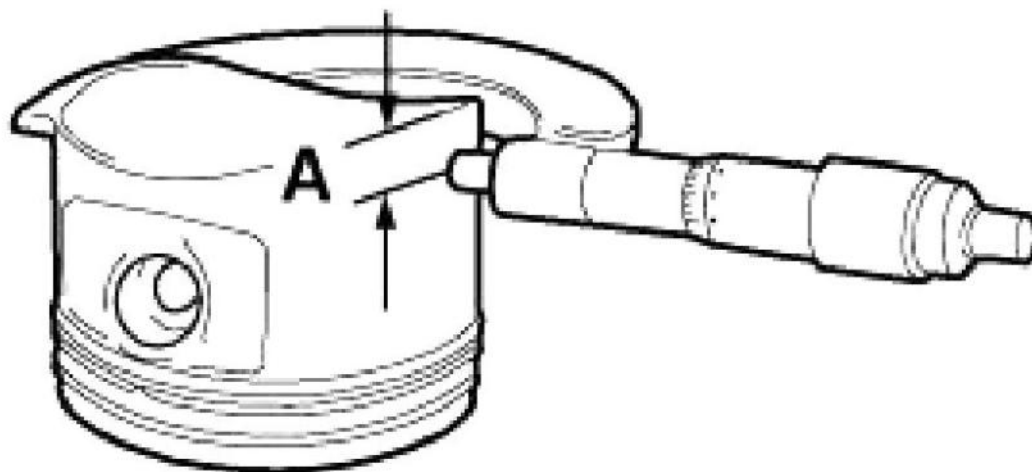


G03164017

Fig. 139: Identifying 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.

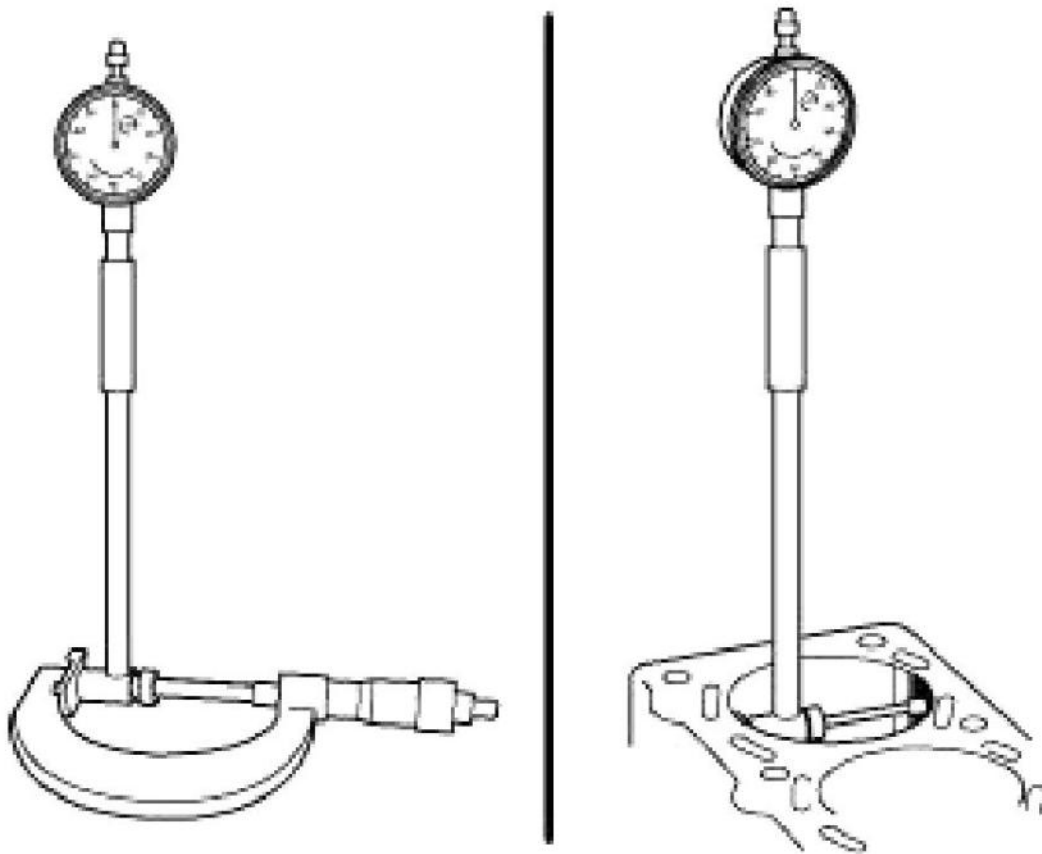


G03164018

Fig. 140: Measuring Piston Diameter With Micrometer
Courtesy of BMW OF NORTH AMERICA, INC.

Measurement A for M54, refer to **ENGINE - TECHNICAL DATA (M54)** . For other engine variants, see **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.



G03164019

Fig. 141: Adjusting Micrometer

Courtesy of BMW OF NORTH AMERICA, INC.

Diameter of cylinder bore for M54, refer to **ENGINE - TECHNICAL DATA (M54)** . For other engine variants, see **TECHNICAL DATA**.

Piston installation clearance for M54, refer to **ENGINE - TECHNICAL DATA (M54)** . For other engine variants, see **TECHNICAL DATA**.

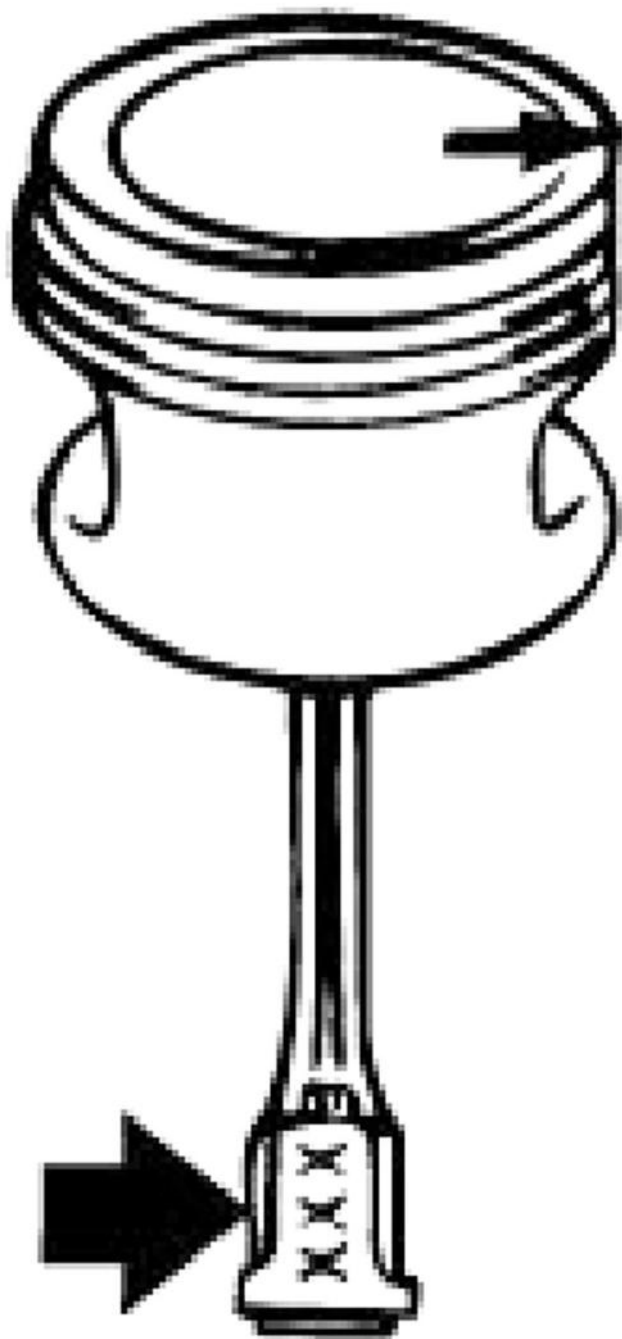
Total permissible wear tolerance for M54, refer to **ENGINE - TECHNICAL DATA (M54)** . For other engine variants, see **TECHNICAL DATA**.

Replace conrod bearing shells.

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

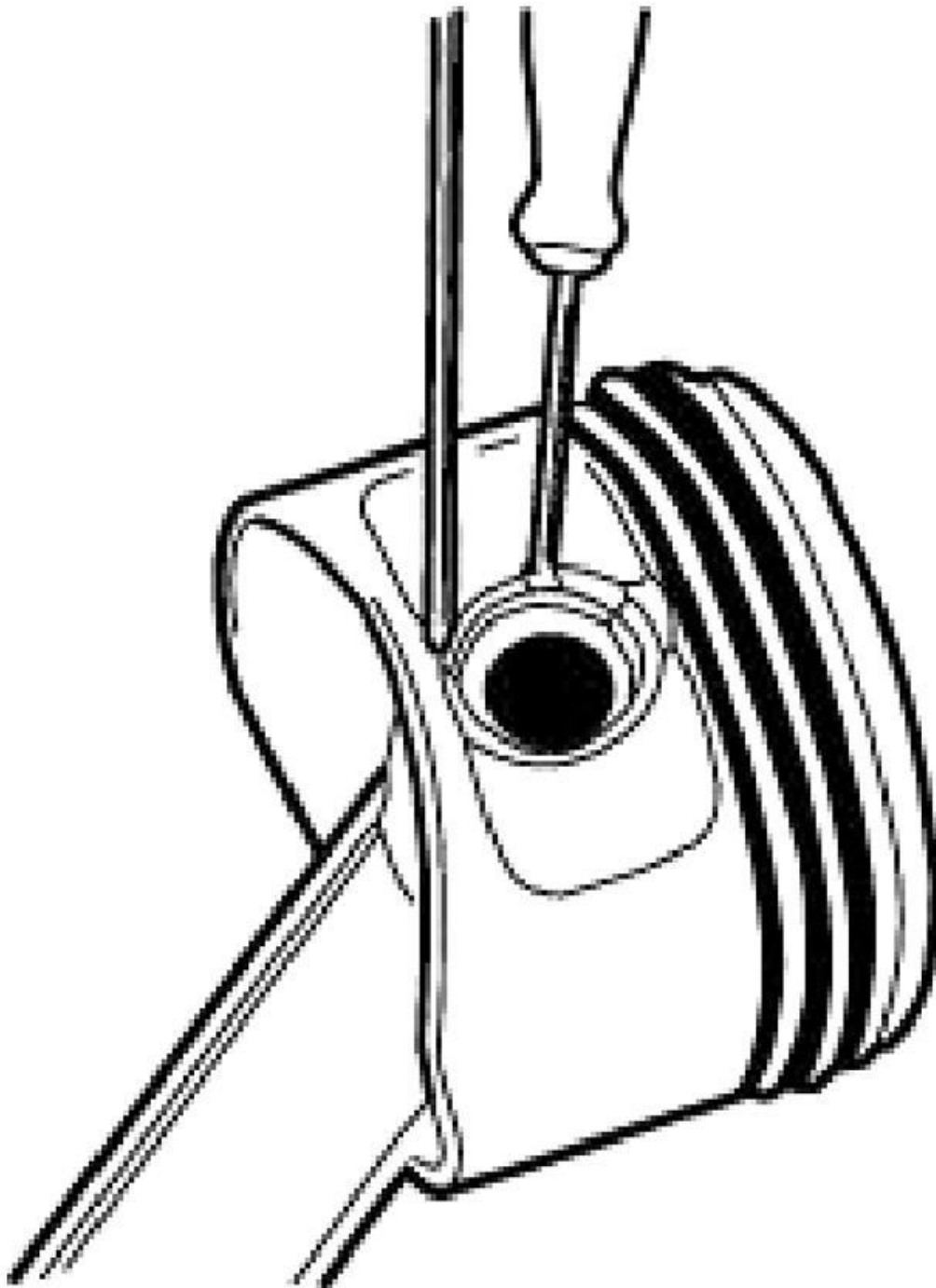
direction arrow on the piston point to the right.



G03164020

Fig. 142: Identifying Piston And Piston Pin
Courtesy of BMW OF NORTH AMERICA, INC.

Install snap ring so that opening is opposite recess.

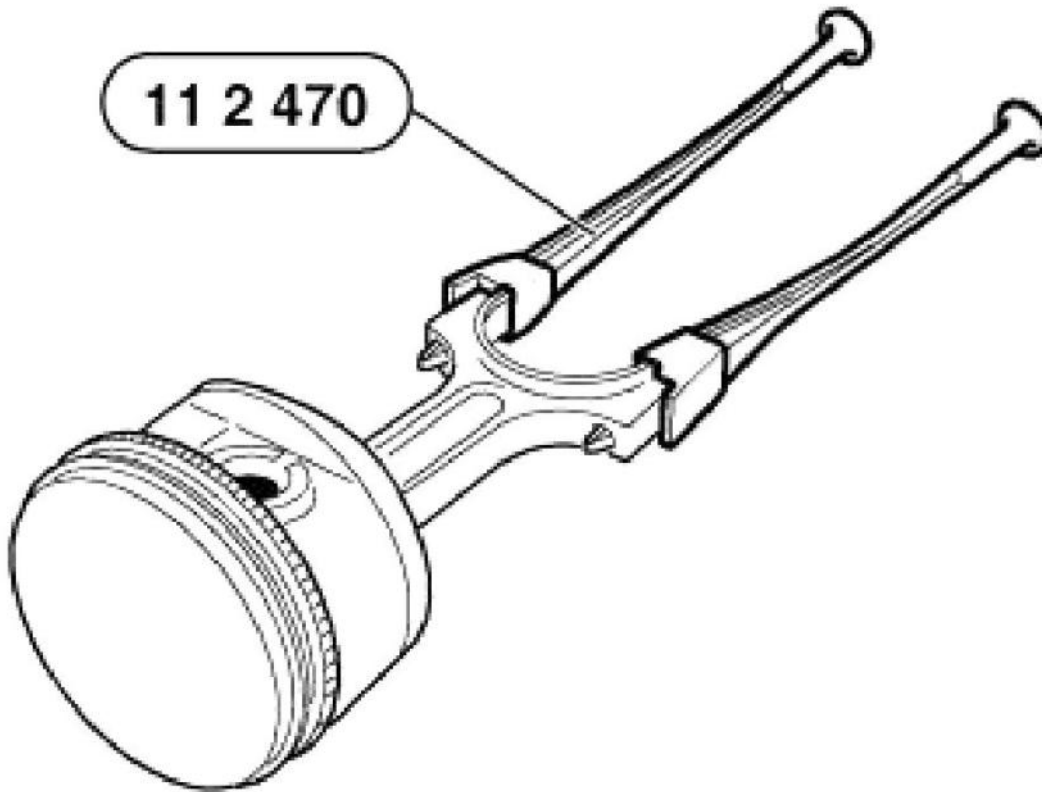


G03164021

Fig. 143: Installing Snap Ring

Courtesy of BMW OF NORTH AMERICA, INC.

Insert special tool 11 2 470 in conrod.



G03164022

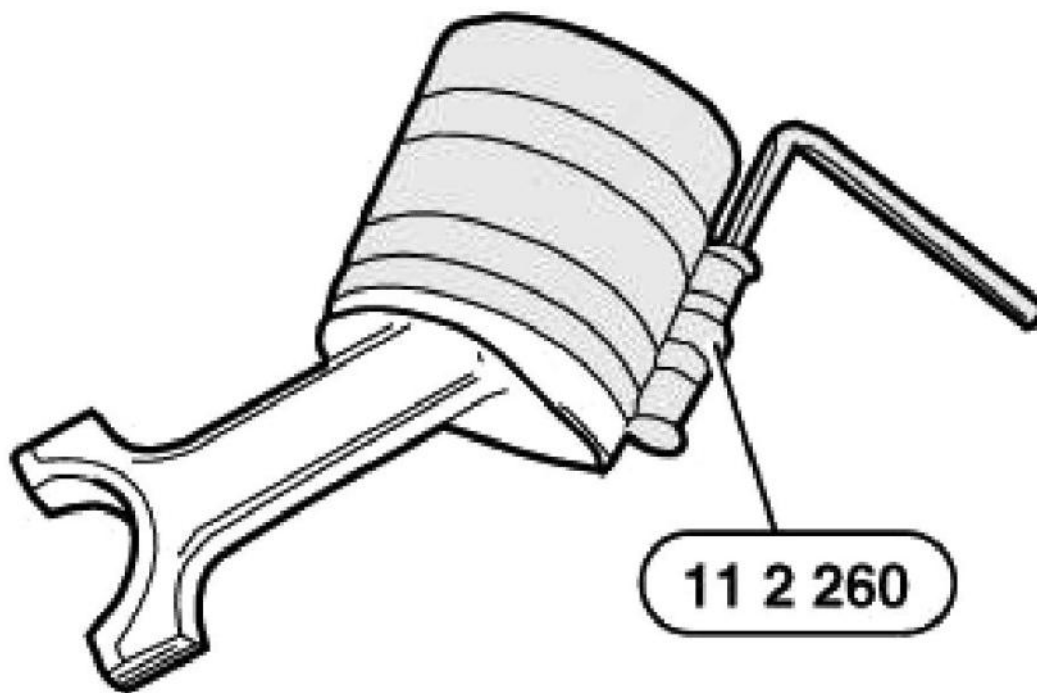
Fig. 144: Inserting Special Tool 11 2 470

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.



G03164023

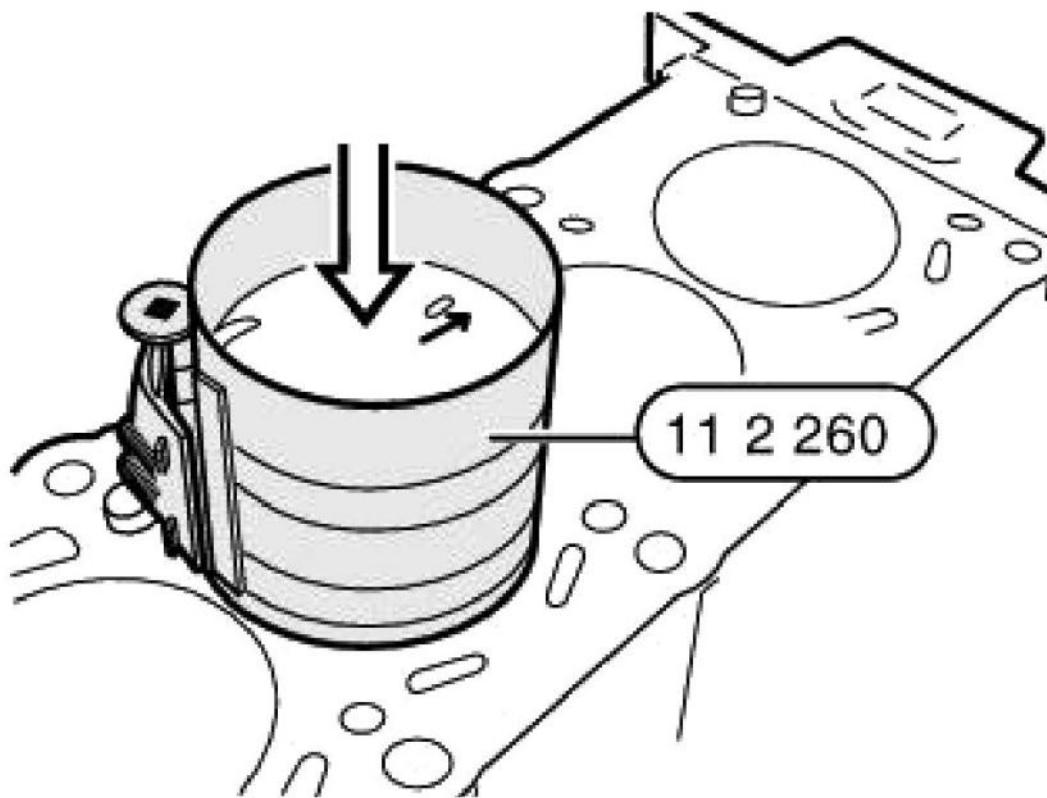
Fig. 145: Pressing Together Piston Rings With Special Tool 11 2 260
Courtesy of BMW OF NORTH AMERICA, INC.

Install piston so that arrow points to camshaft drive.

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

IMPORTANT: Danger of piston ring failure.

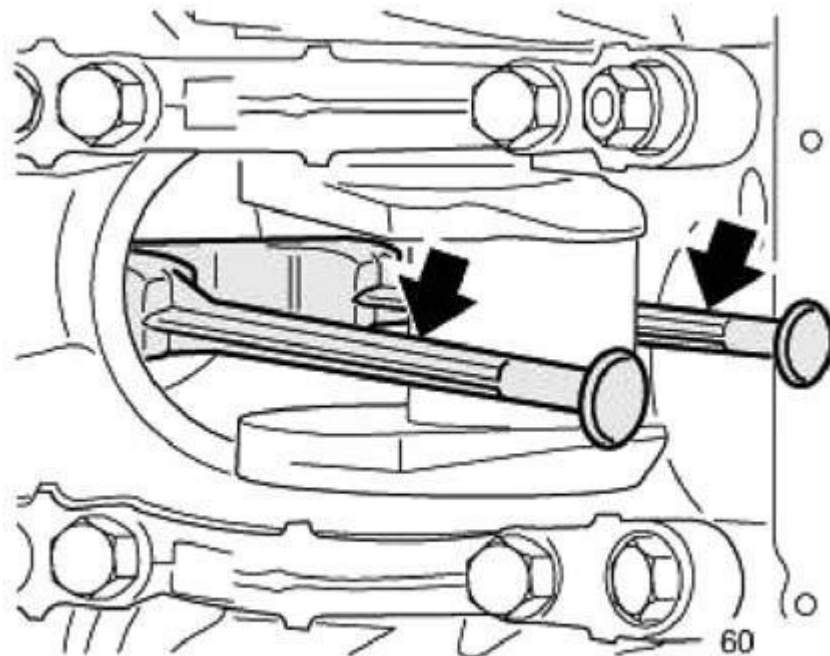
Press in piston only with finger force (do not knock in!).



G03164024

Fig. 146: Pressing In Piston Only With Finger Force
Courtesy of BMW OF NORTH AMERICA, INC.

Attach crankpin to connecting rod.



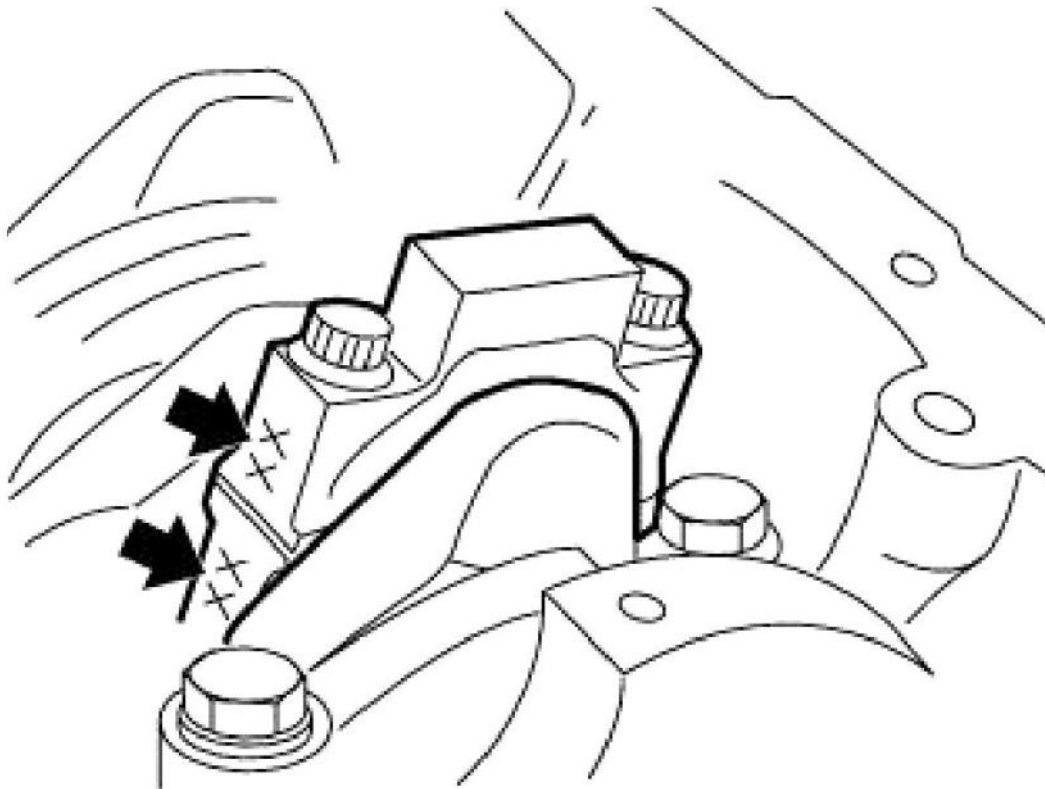
G03164025

Fig. 147: 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.



G03164026

Fig. 148: Installing New Conrod Bolts
Courtesy of BMW OF NORTH AMERICA, INC.

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

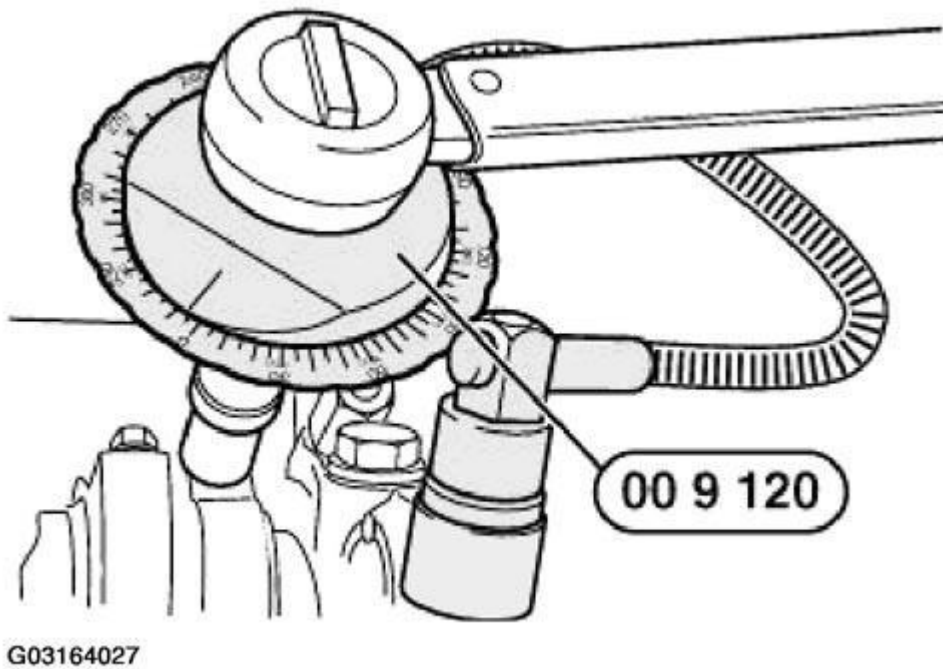


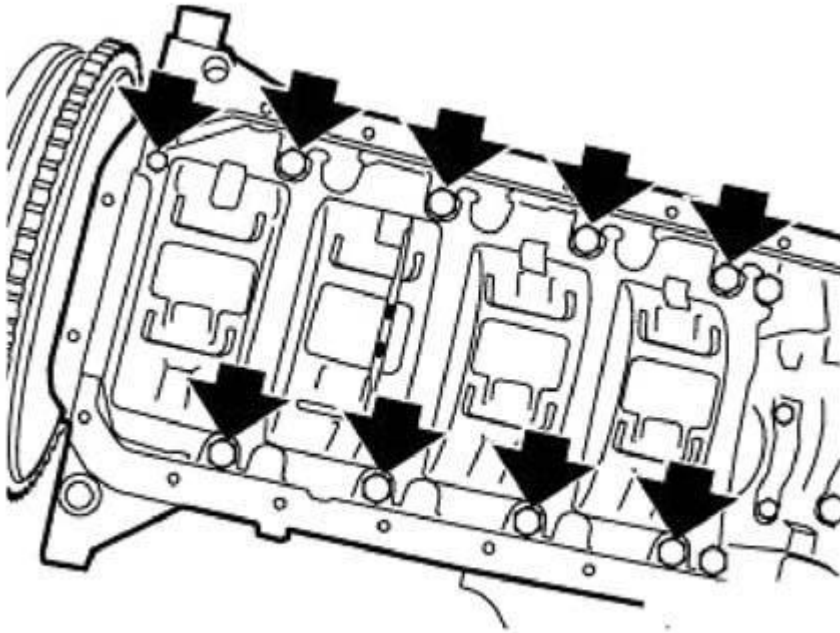
Fig. 149: Tightening Down Conrod Bolts With Special Tool 00 9 120
Courtesy of BMW OF NORTH AMERICA, INC.

Tightening torque, refer to 11 24 1AZ in **ENGINE - TIGHTENING TORQUES** .

Install oil pump.

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

Assemble engine.



G03164028

Fig. 150: Identifying Nut

Courtesy of BMW OF NORTH AMERICA, INC.

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

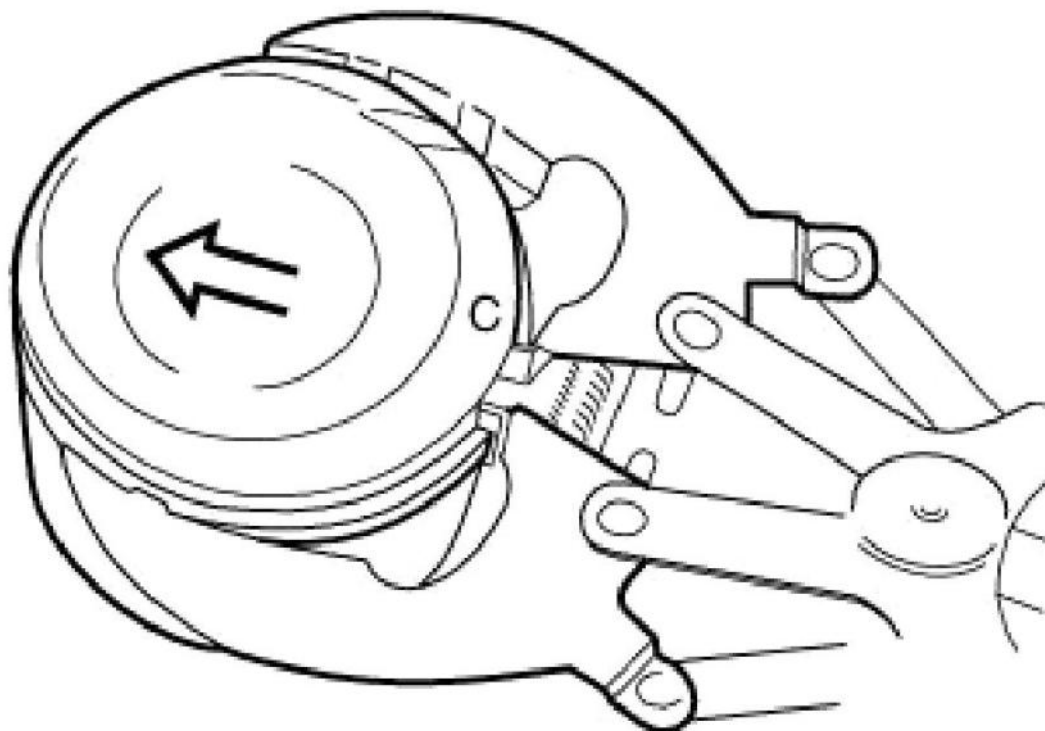
(piston removed)

Remove piston rings with a piston-ring compressing pliers.

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.

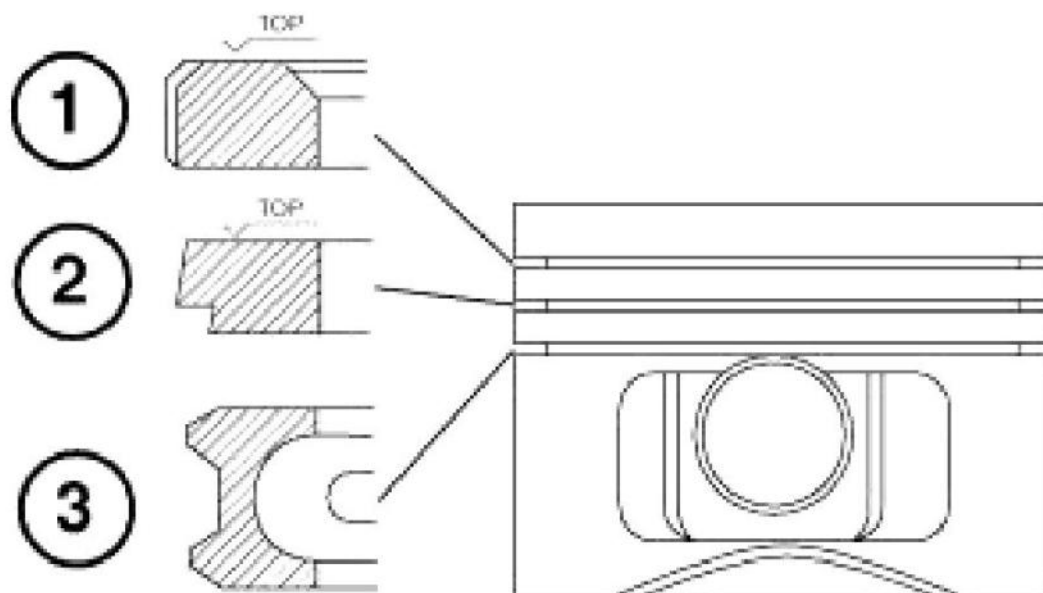


G03164029

Fig. 151: Installing New Pistons**Courtesy of BMW OF NORTH AMERICA, INC.***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

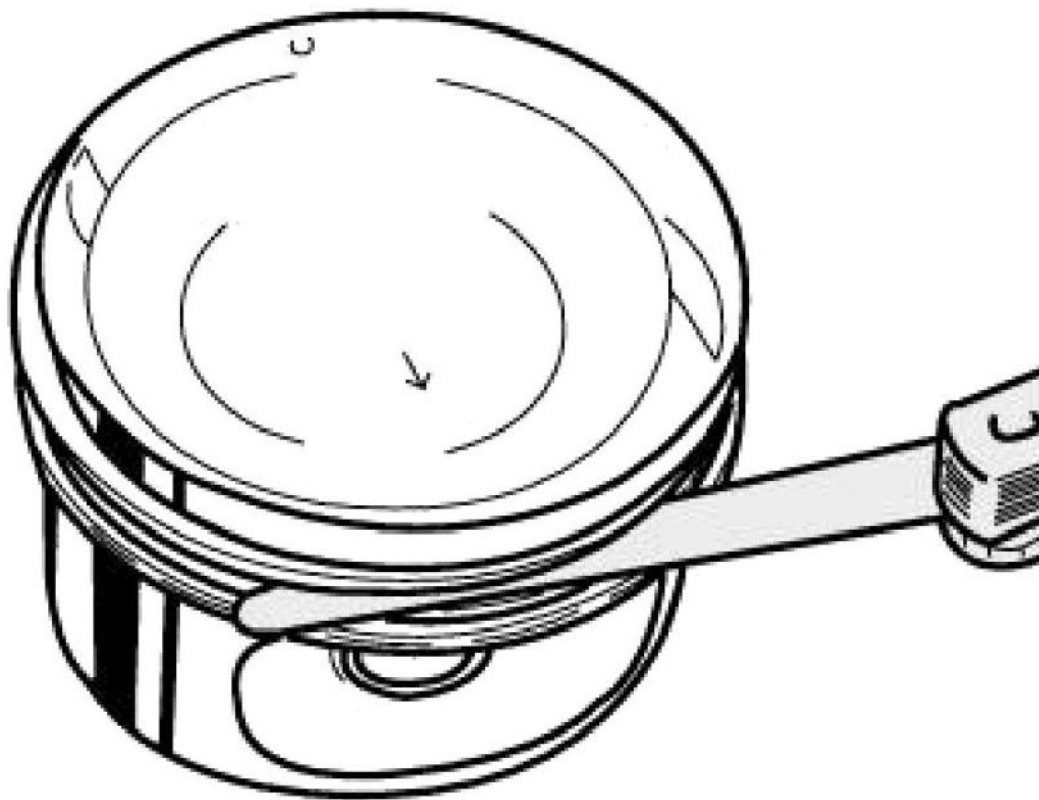


G03164030

Fig. 152: Identifying Piston Rings

Courtesy of BMW OF NORTH AMERICA, INC.

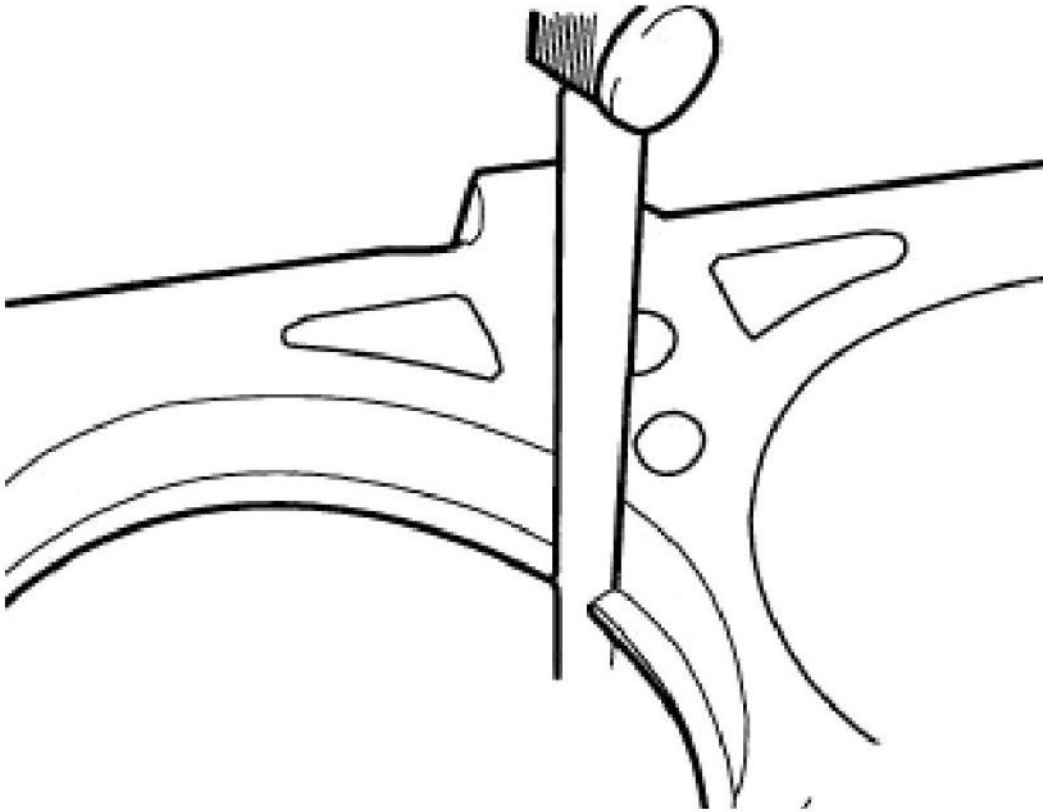
Measure axial play.



G03164031

Fig. 153: Measuring Axial Play
Courtesy of BMW OF NORTH AMERICA, INC.

Measure end clearance.



G03164032

Fig. 154: Measuring End Clearance

Courtesy of BMW OF NORTH AMERICA, INC.

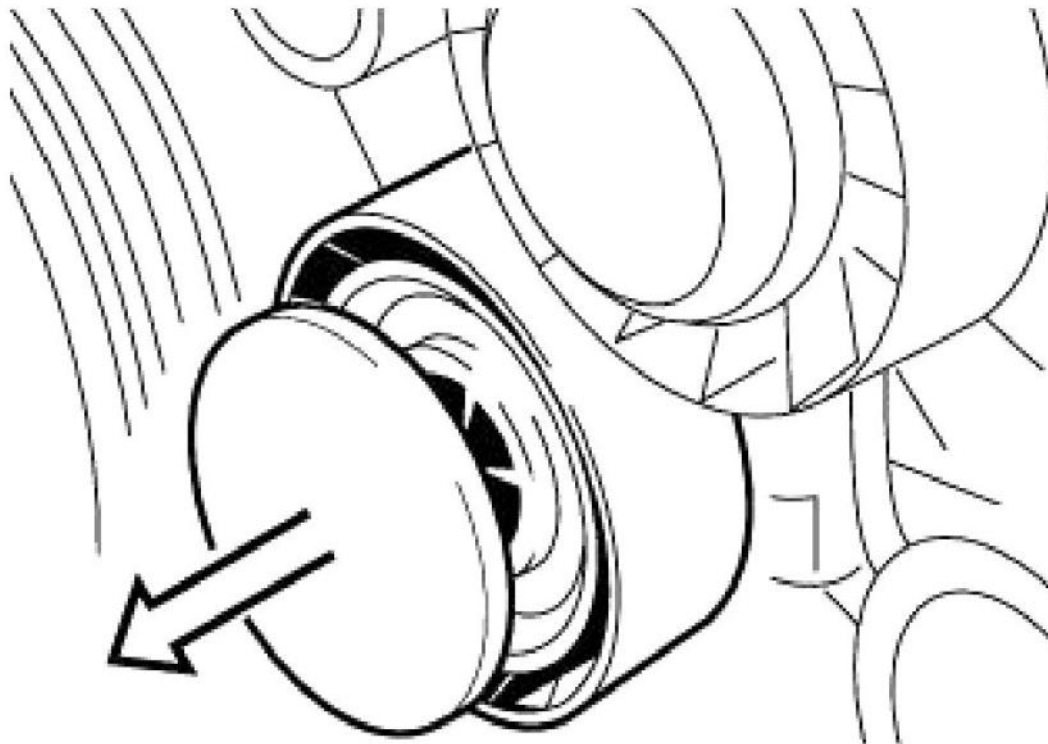
V RIBBED BELT W/TENS. DEFLECT ELEMENT**11 28 010 REPLACING ALTERNATOR DRIVE BELT (M52 / S52 / M52TU / M54 / M56)**

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. See **11 52 020 Removing and installing/replacing fan clutch (S52 / S54 / M52 / M52TU / M54 / M56)**
- Remove A/C compressor drive belt. See **11 28 050 Replacing A/C compressor drive belt (M52 / S52 / M52TU / M54 / M56)**
- E85/E60: Remove radiator cover
- E85/E60: Remove fan cowl

Remove cap from tensioning roller.

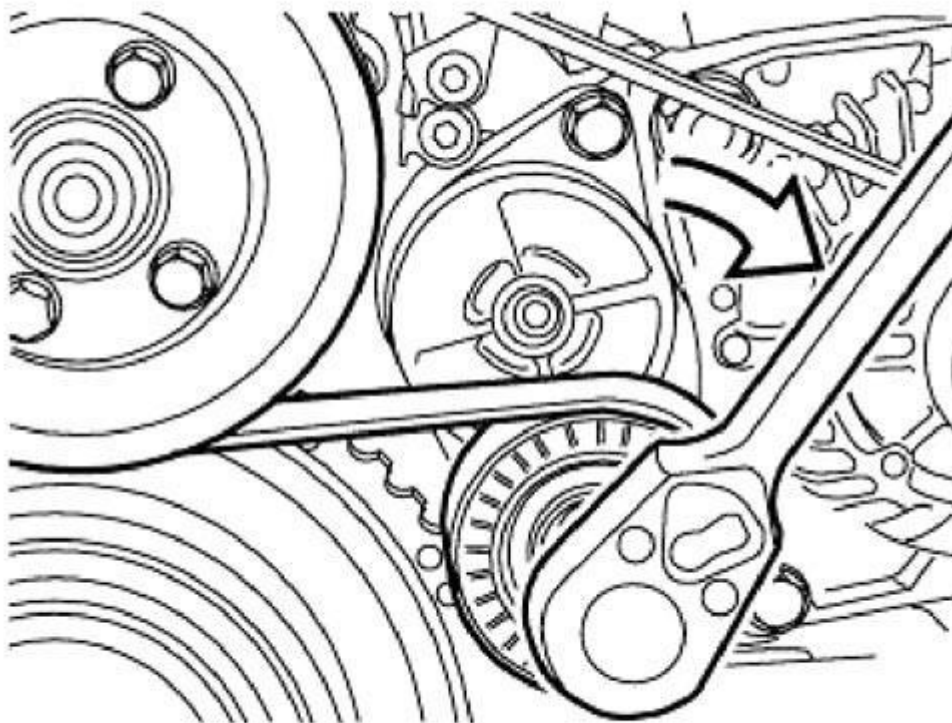


G03164033

Fig. 155: Removing Cap From Tensioning Roller
Courtesy of BMW OF NORTH AMERICA, INC.

Relieve tension on belt drive.

Remove drive belt.



G03164034

Fig. 156: Removing Drive Belt

Courtesy of BMW OF NORTH AMERICA, INC.

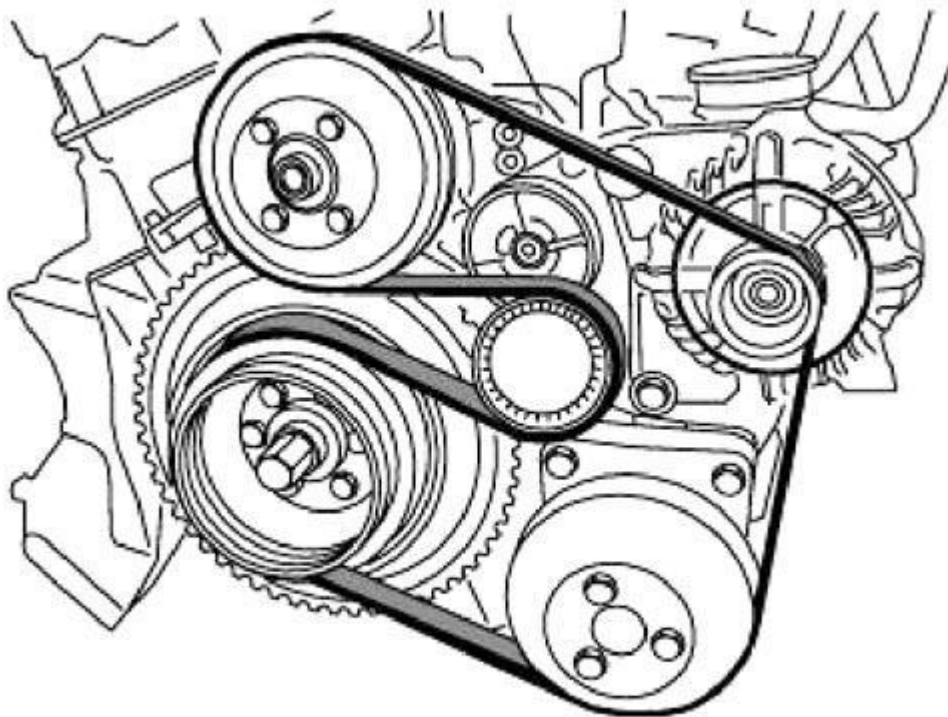
IMPORTANT: Drive belt must be replaced if fouled with hydraulic fluid.

Installation:

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

Installation:

Check that belt is correctly positioned on belt pulleys.

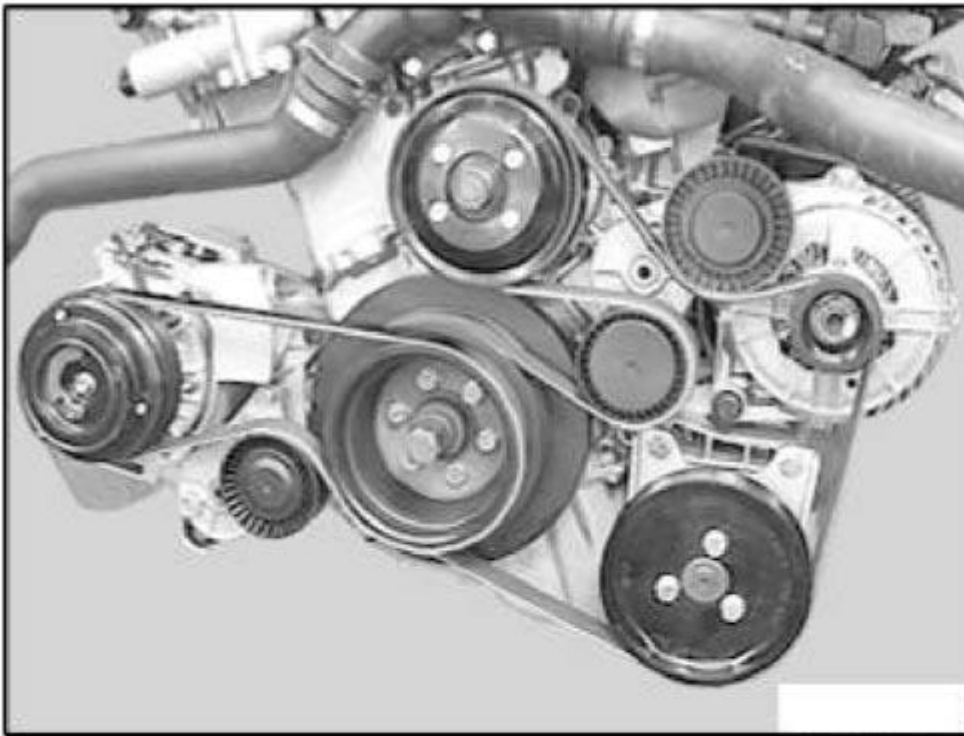


G03164035

Fig. 157: Checking Belt

Courtesy of BMW OF NORTH AMERICA, INC.

Version with auxiliary tensioning roller.



G03164036

Fig. 158: Identifying Auxiliary Tensioning Roller
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

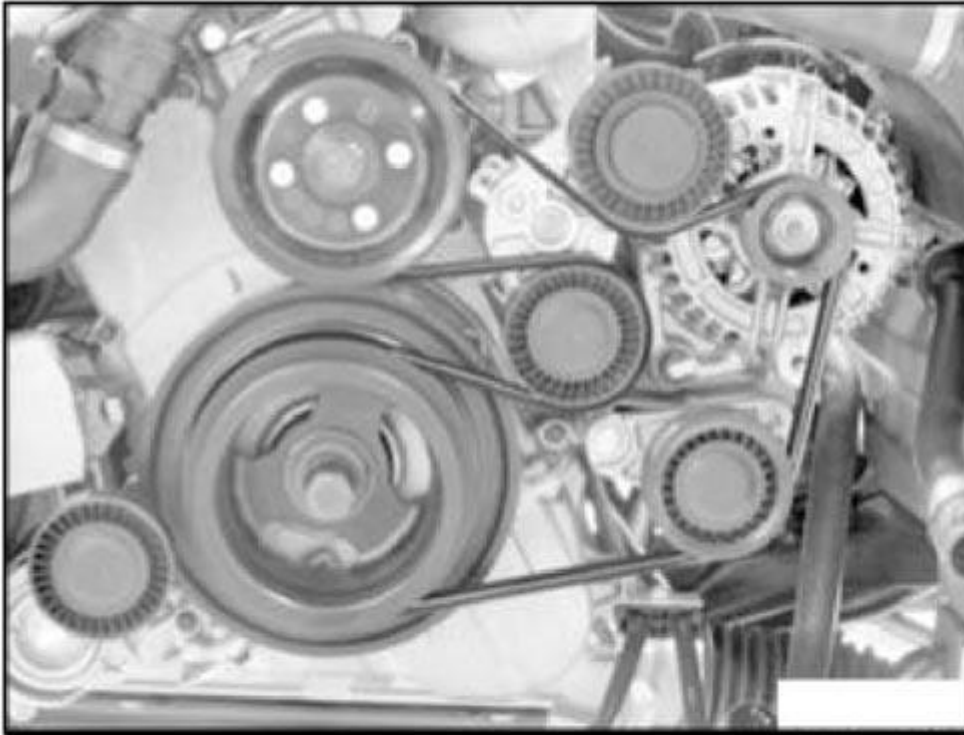
Locking device of auxiliary tensioning roller must snap into groove on alternator.



G03164037

Fig. 159: Installing Locking Device Of Auxiliary Tensioning Roller
Courtesy of BMW OF NORTH AMERICA, INC.

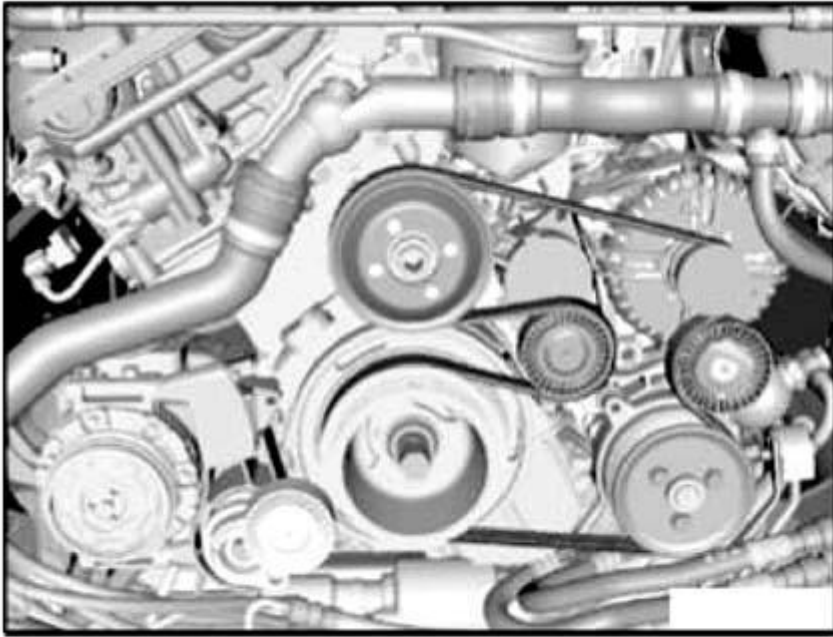
Version on E85.



G03164038

Fig. 160: Identifying Version E85
Courtesy of BMW OF NORTH AMERICA, INC.

Version on E60/E65.



G03164039

Fig. 161: Identifying Version E60/E65

Courtesy of BMW OF NORTH AMERICA, INC.

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

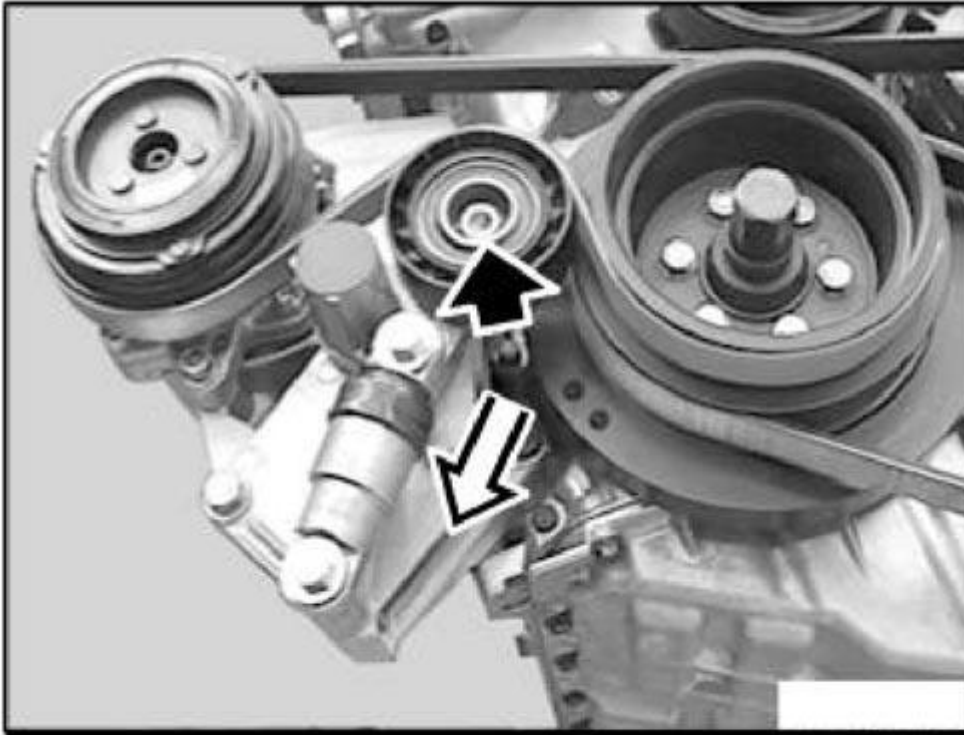
NOTE: If the drive belt is to be subsequently reused: Mark direction of travel and reinstall drive belt in same direction of travel.

Necessary preliminary tasks:

- If necessary, remove splash guard. See **51 11 000 REMOVING AND INSTALLING COMPLETE FRONT BUMPER (FROM 10/01)**

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.



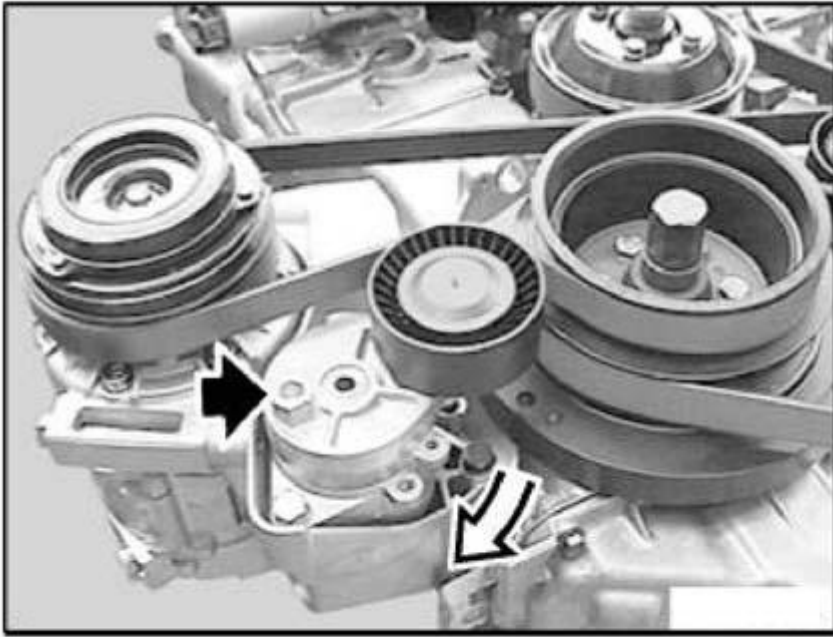
G03164040

Fig. 162: Removing Dust Cap

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.



G03164041

Fig. 163: Pressing Back Drive Belt Tensioner
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:

NOTE: For special tools, refer to ENGINE - SPECIAL TOOLS .

- 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.

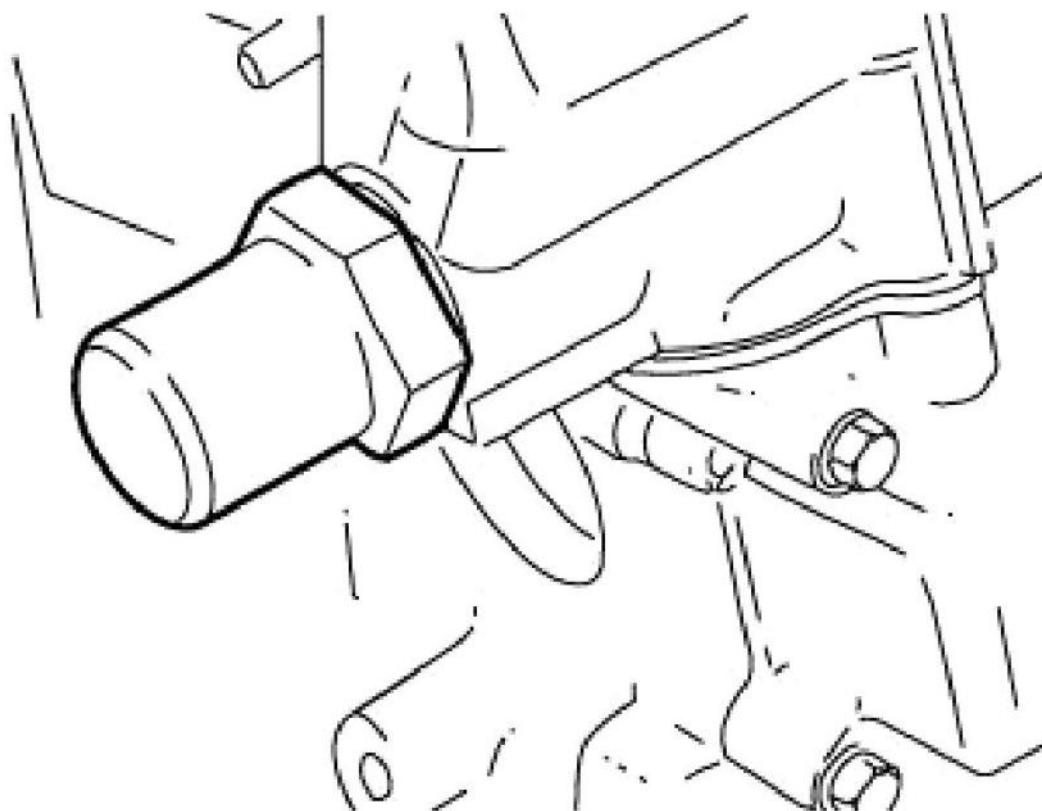
Removal

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

Remove VANOS adjustment unit.

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

Unfasten cylinder for chain tensioning piston.



G03164042

Fig. 164: 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.

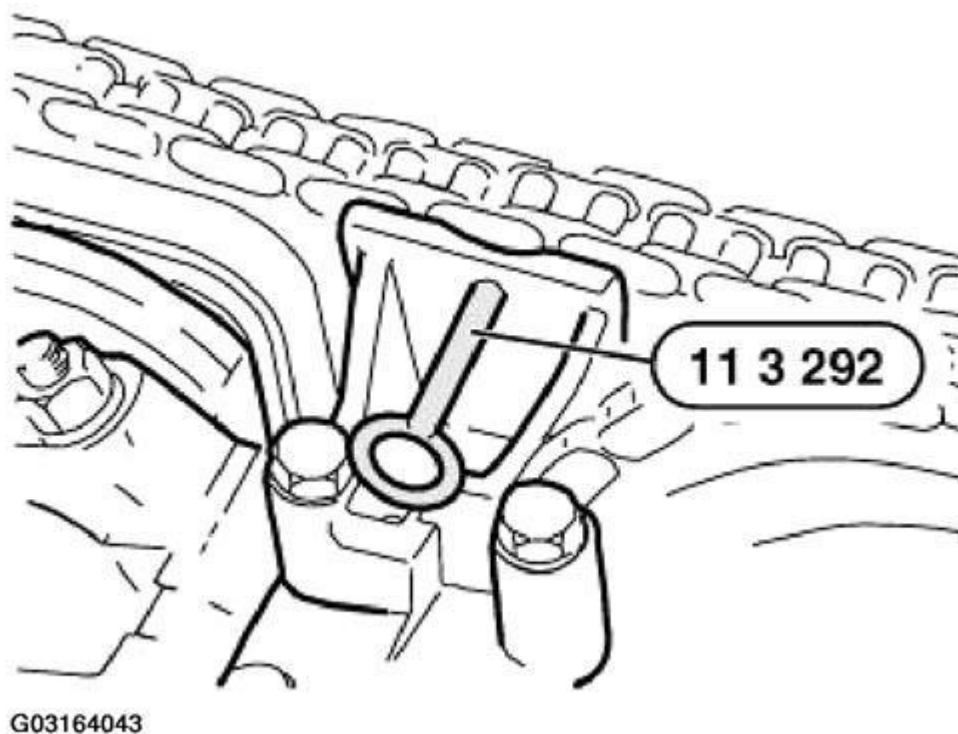
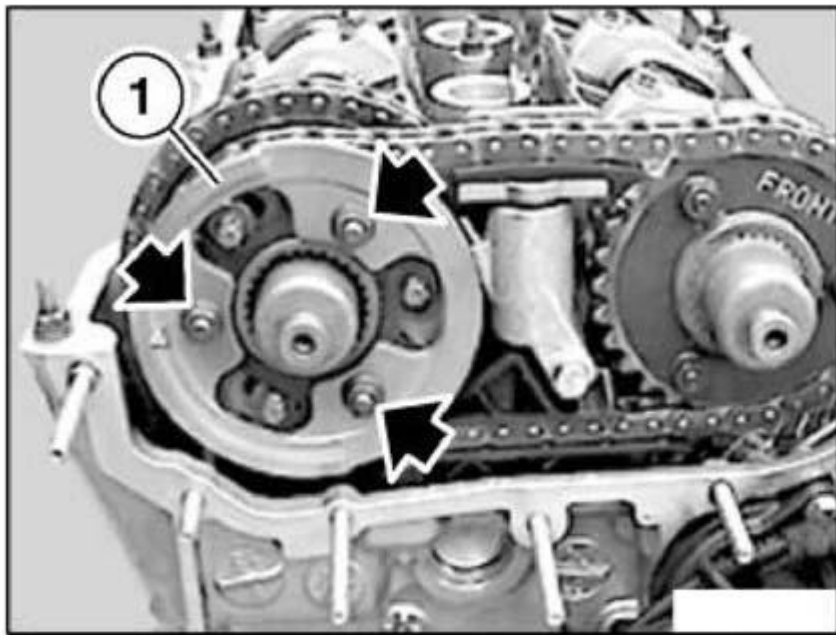


Fig. 165: Pressing Down Secondary Chain Tensioner
Courtesy of BMW OF NORTH AMERICA, INC.

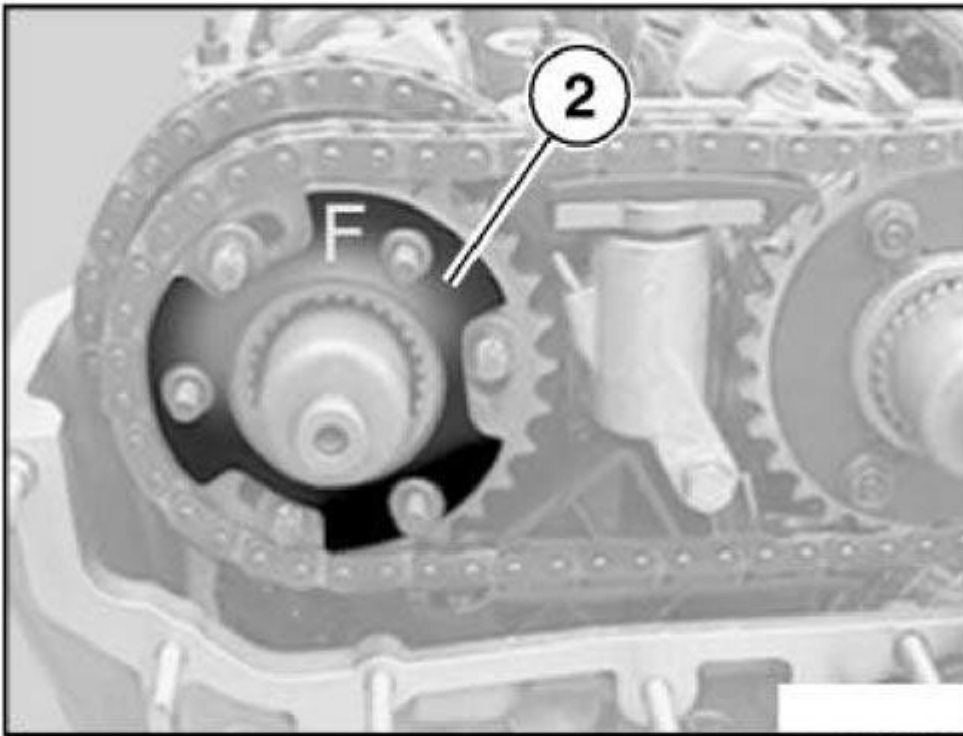
Release nuts, remove sensor gear (1).



G03164044

Fig. 166: Releasing Nuts Removing Sensor Gear
Courtesy of BMW OF NORTH AMERICA, INC.

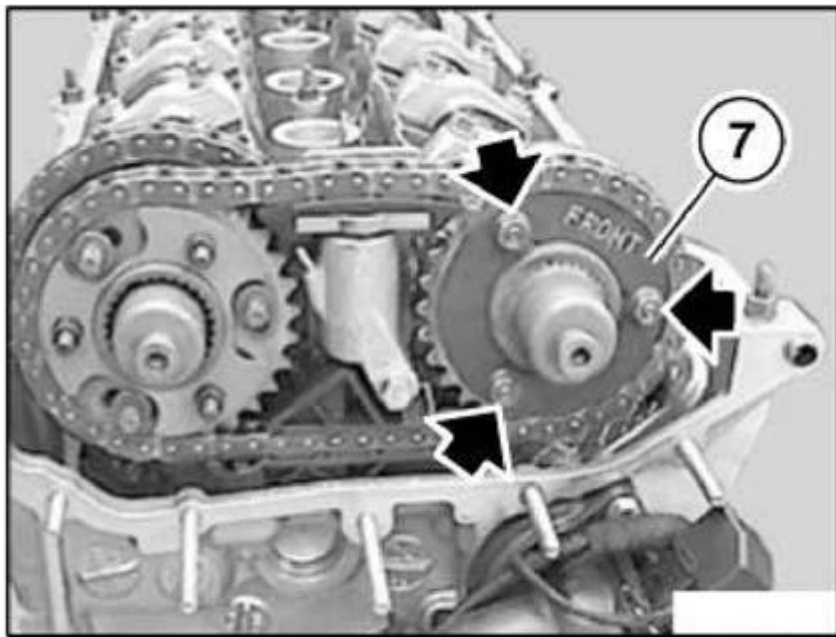
Remove plate spring (2).



G03164045

Fig. 167: Removing Plate Spring
Courtesy of BMW OF NORTH AMERICA, INC.

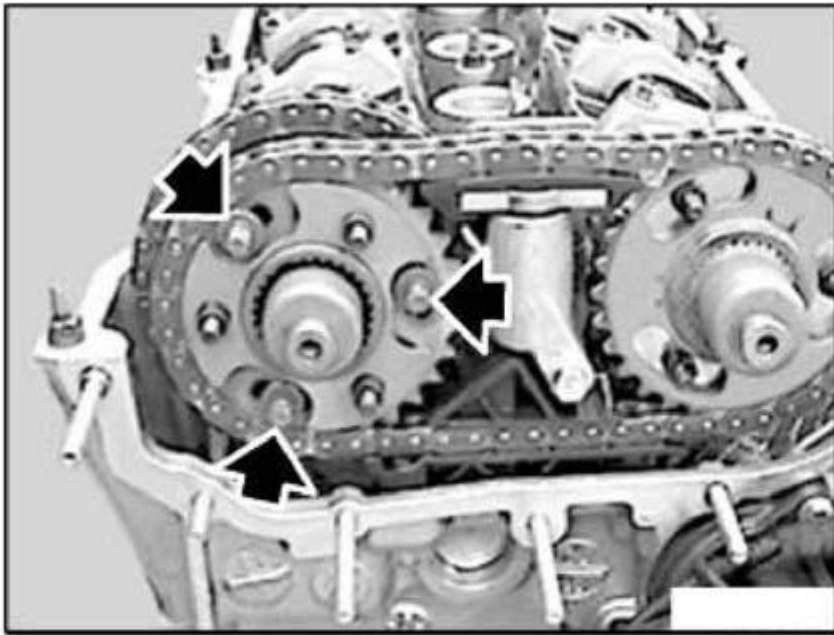
Release nuts on inlet side and remove corrugated washer (7).



G03164046

Fig. 168: Releasing Nuts On Inlet Side
Courtesy of BMW OF NORTH AMERICA, INC.

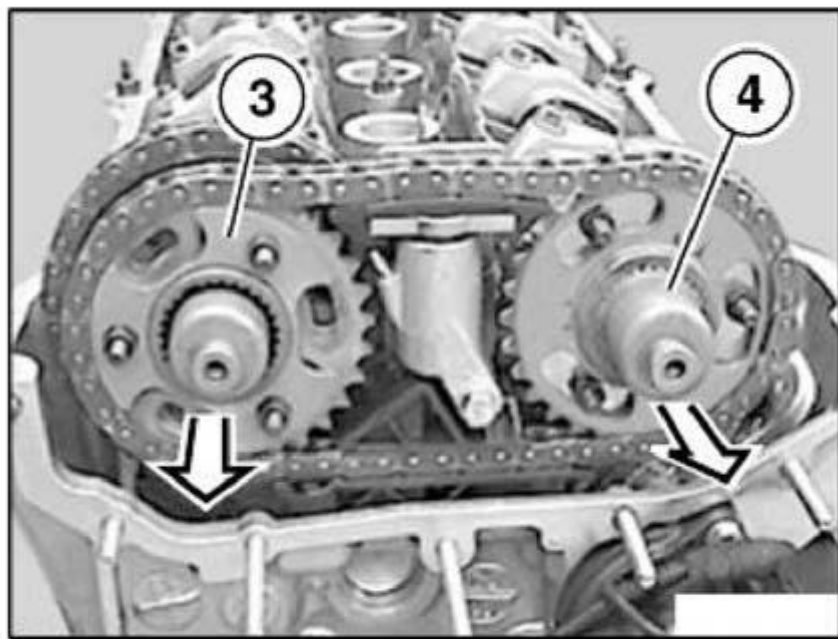
Unfasten screws.



G03164047

Fig. 169: 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).

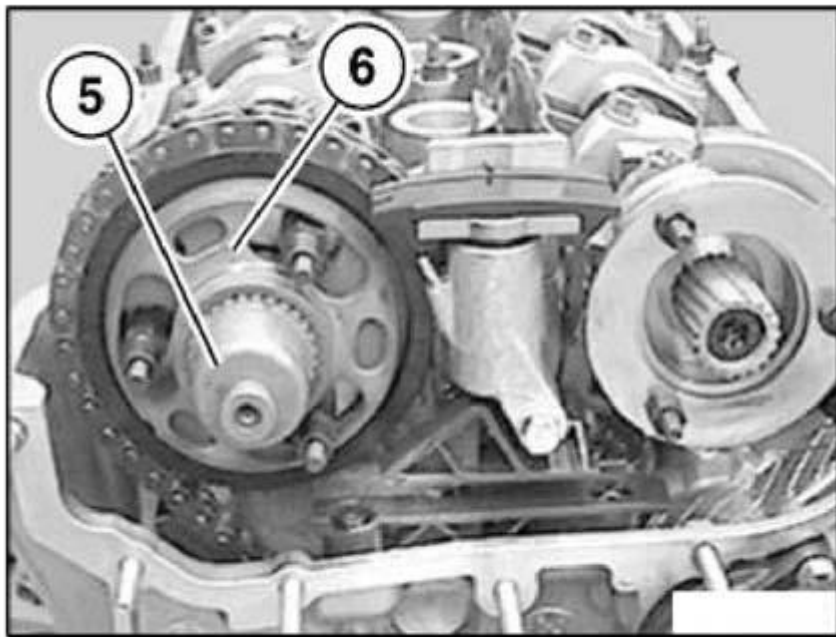


G03164048

Fig. 170: Identifying Friction Washer And Toothed Shaft
Courtesy of BMW OF NORTH AMERICA, INC.

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

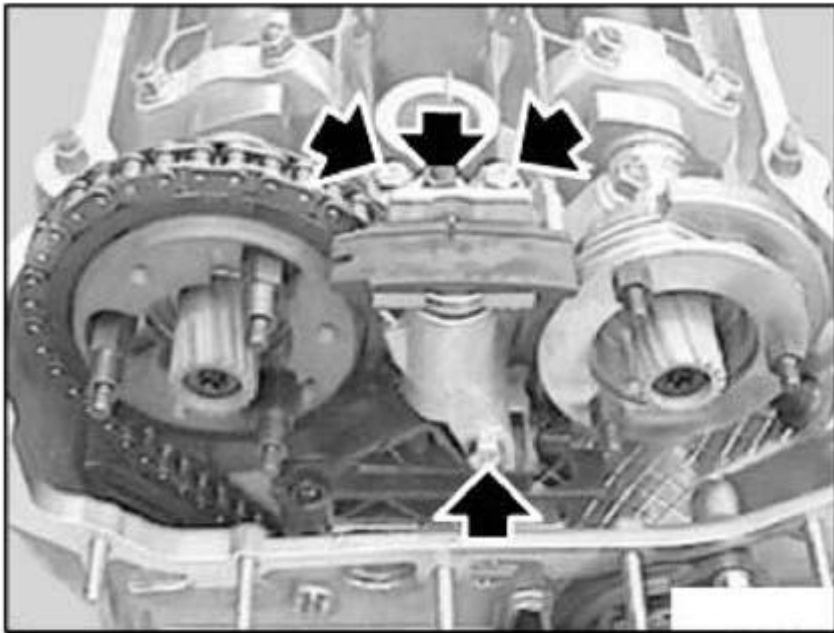
Remove toothed shaft (5) with toothed sleeve (6).



G03164049

Fig. 171: Removing Toothed Shaft With Toothed Sleeve
Courtesy of BMW OF NORTH AMERICA, INC.

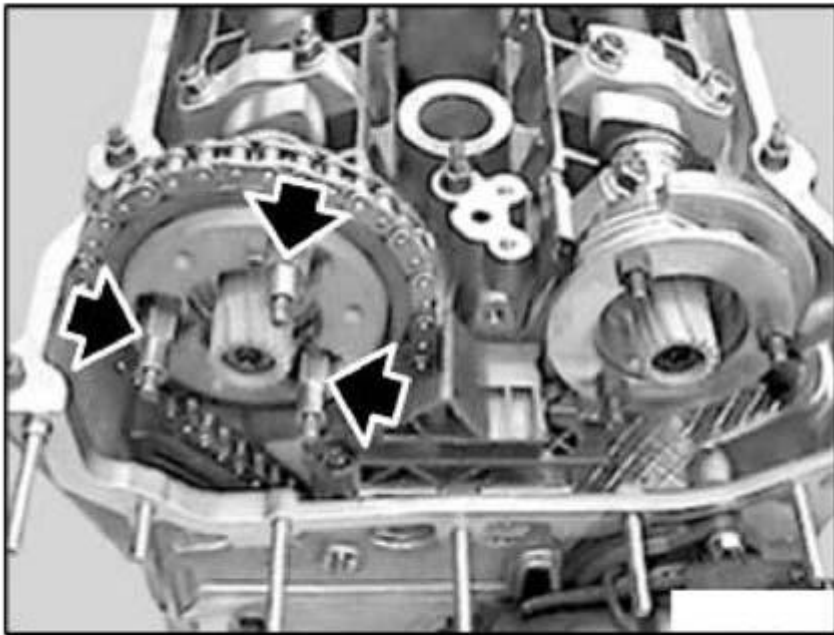
Unfasten screws. Remove secondary chain tensioner.



G03164050

Fig. 172: Unfastening Screws Removing Secondary Chain Tensioner
Courtesy of BMW OF NORTH AMERICA, INC.

Release screw-in pin.

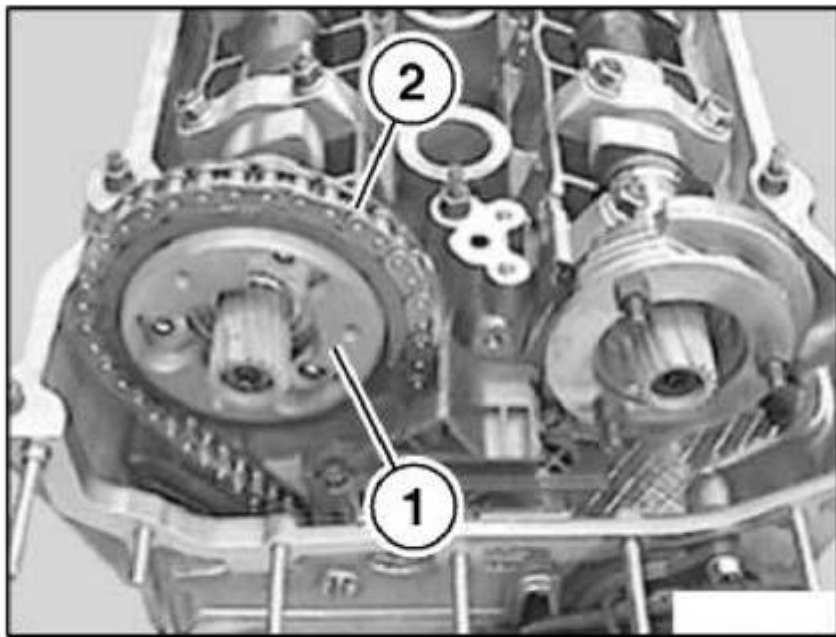


G03164051

Fig. 173: Releasing Screw-In Pin

Courtesy of BMW OF NORTH AMERICA, INC.

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

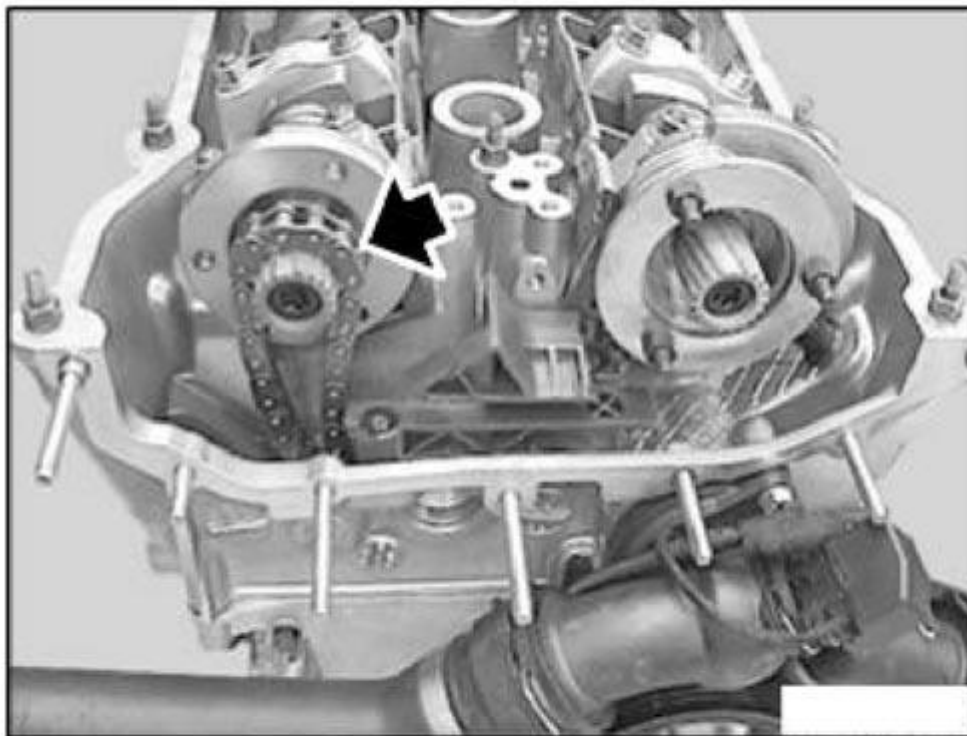


G03164052

Fig. 174: Feeding Chain Wheel

Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: Timing chain remains positioned over exhaust camshaft.

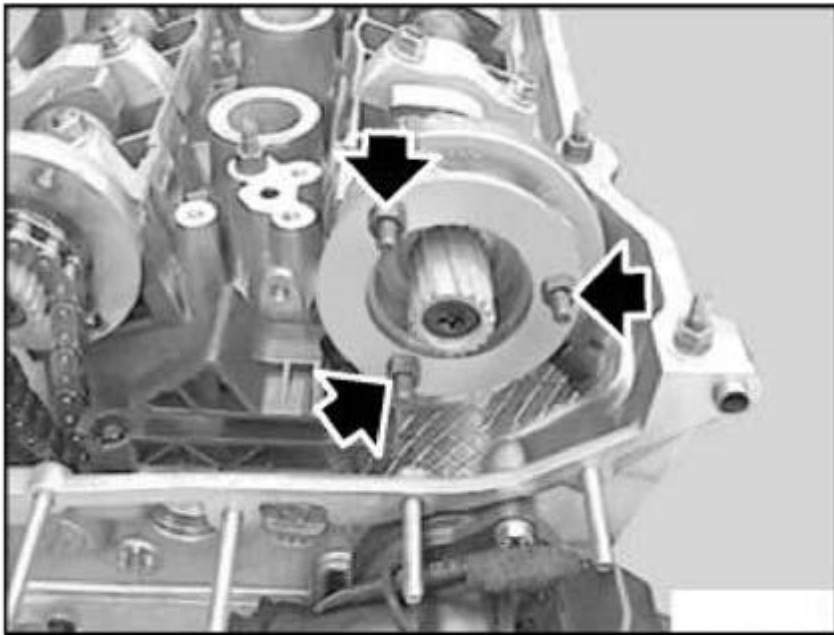


G03164053

Fig. 175: Identifying Timing Chain
Courtesy of BMW OF NORTH AMERICA, INC.

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

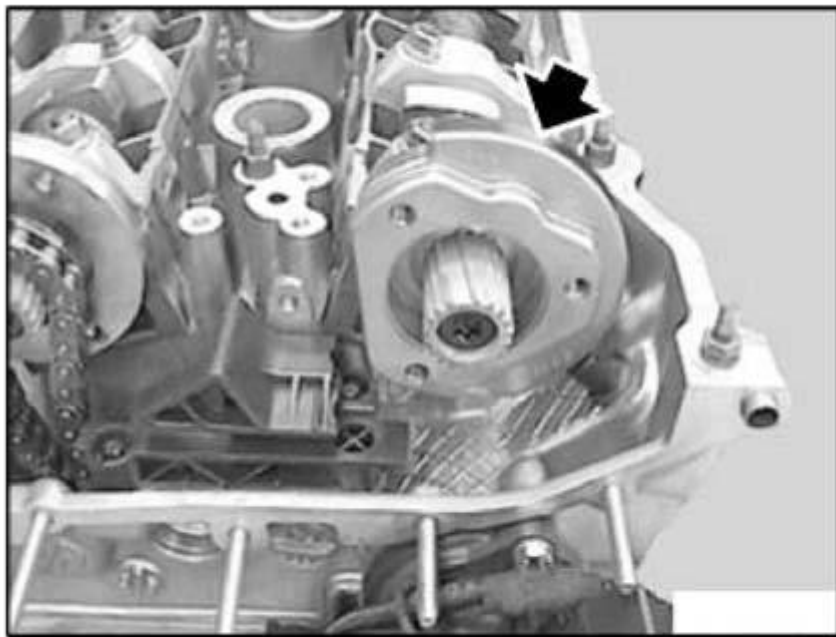
Remove thrust washer.



G03164054

Fig. 176: Removing Thrust Washer
Courtesy of BMW OF NORTH AMERICA, INC.

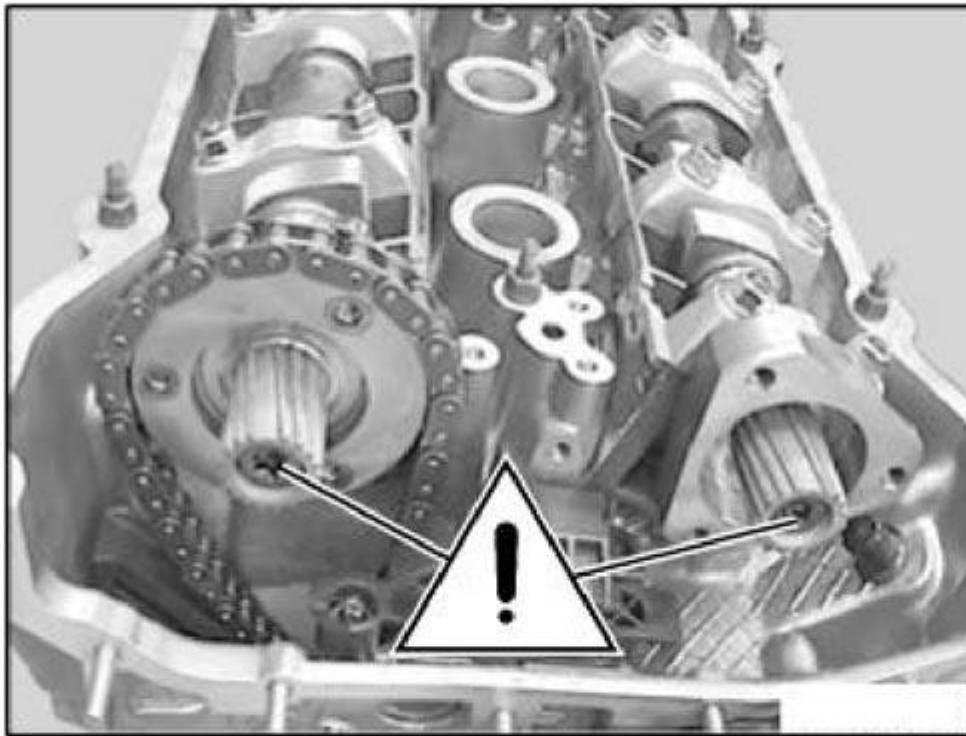
Remove sensor gear.



G03164055

Fig. 177: Removing Sensor Gear
Courtesy of BMW OF NORTH AMERICA, INC.

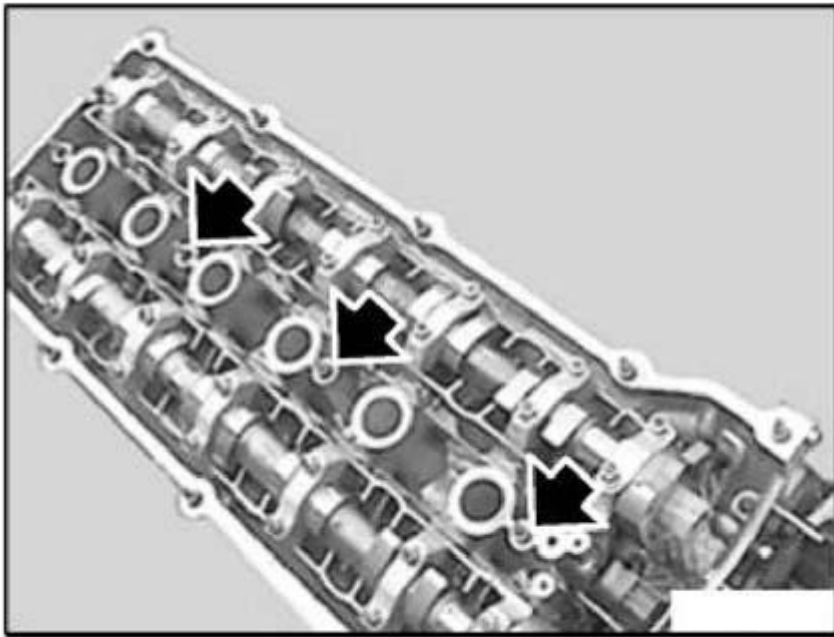
IMPORTANT: Do "not" release these screws.



G03164056

Fig. 178: Identifying Cam Shaft Screws
Courtesy of BMW OF NORTH AMERICA, INC.

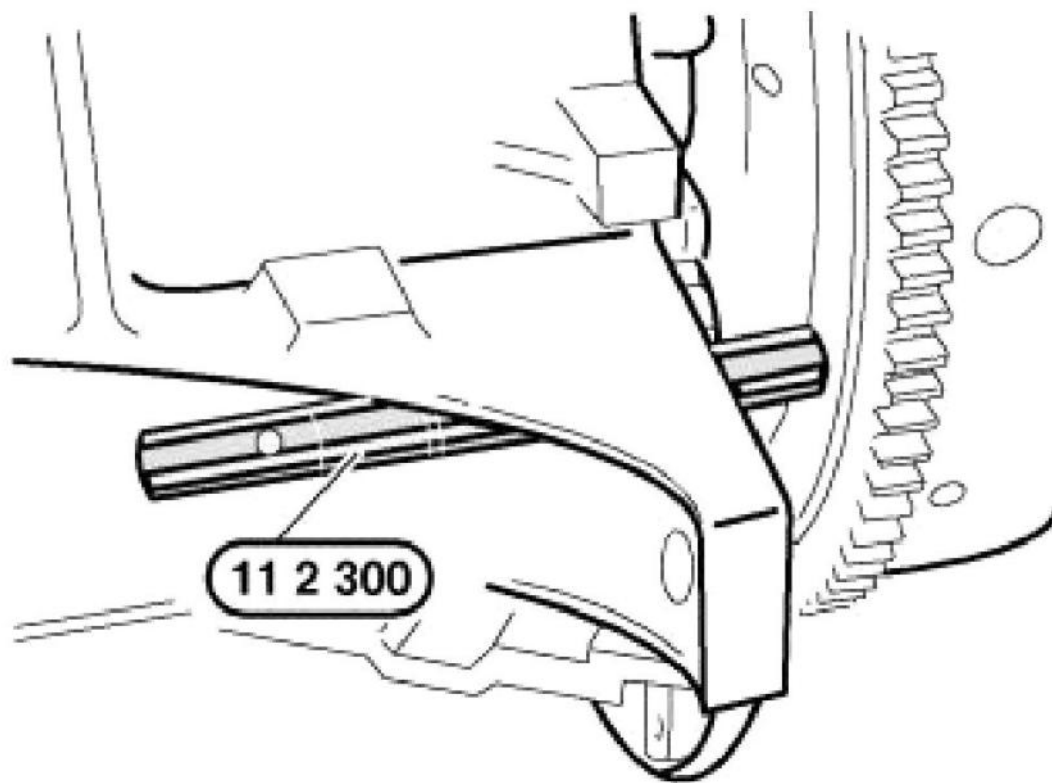
Unscrew studs.



G03164057

Fig. 179: Unscrewing Studs**Courtesy of BMW OF NORTH AMERICA, INC.**

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

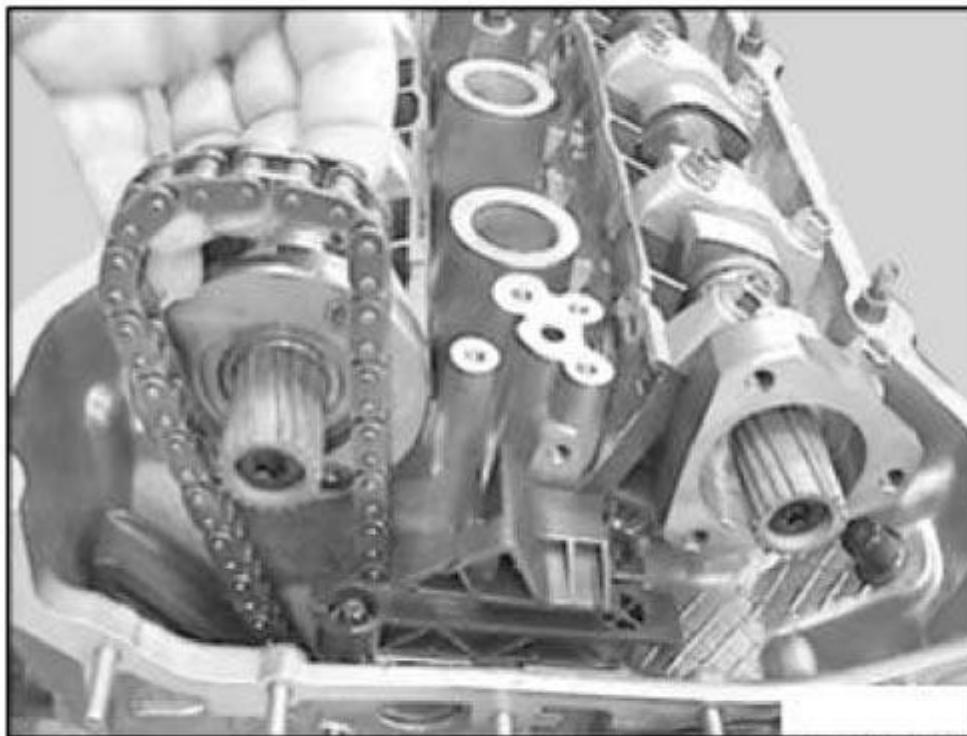


G03164058

Fig. 180: Pulling Special Tool 11 2 300
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.

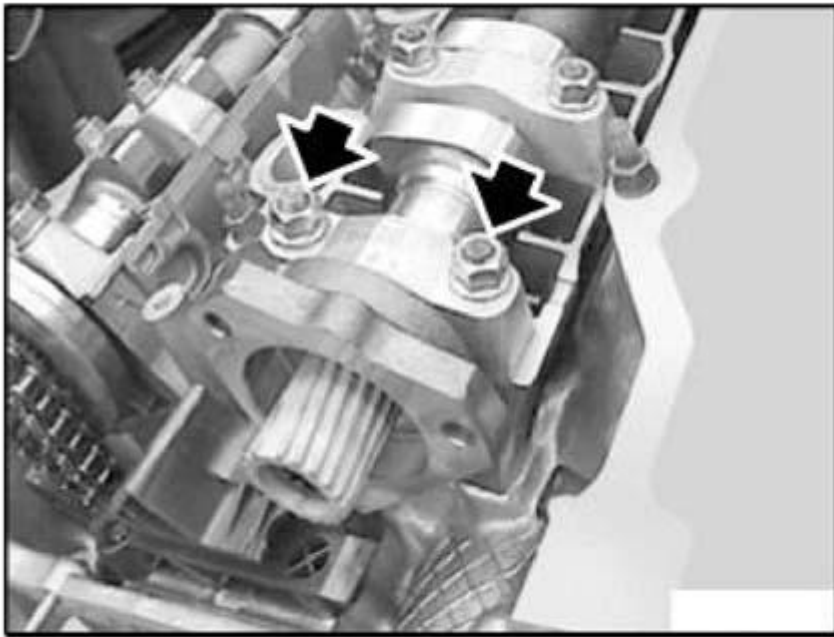


G03164059

Fig. 181: Lifting Timing Chain And Hold Under Tension
Courtesy of BMW OF NORTH AMERICA, INC.

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

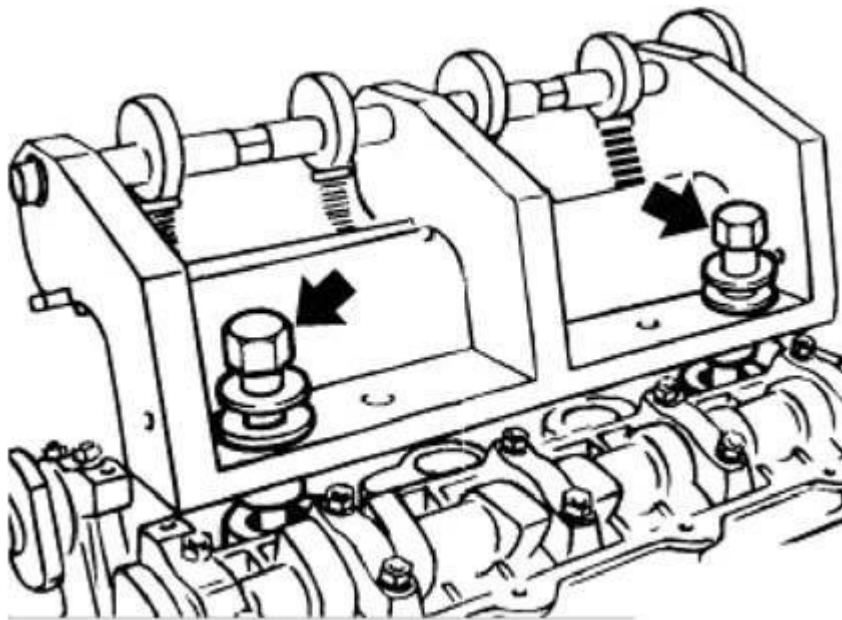
IMPORTANT: Bearing cap 1 of inlet camshaft is centered with adapter sleeves.
To prevent inlet camshaft from tilting in bearing strip, release nuts and remove bearing cap 1.



G03164060

Fig. 182: Identifying Bearing Cap
Courtesy of BMW OF NORTH AMERICA, INC.

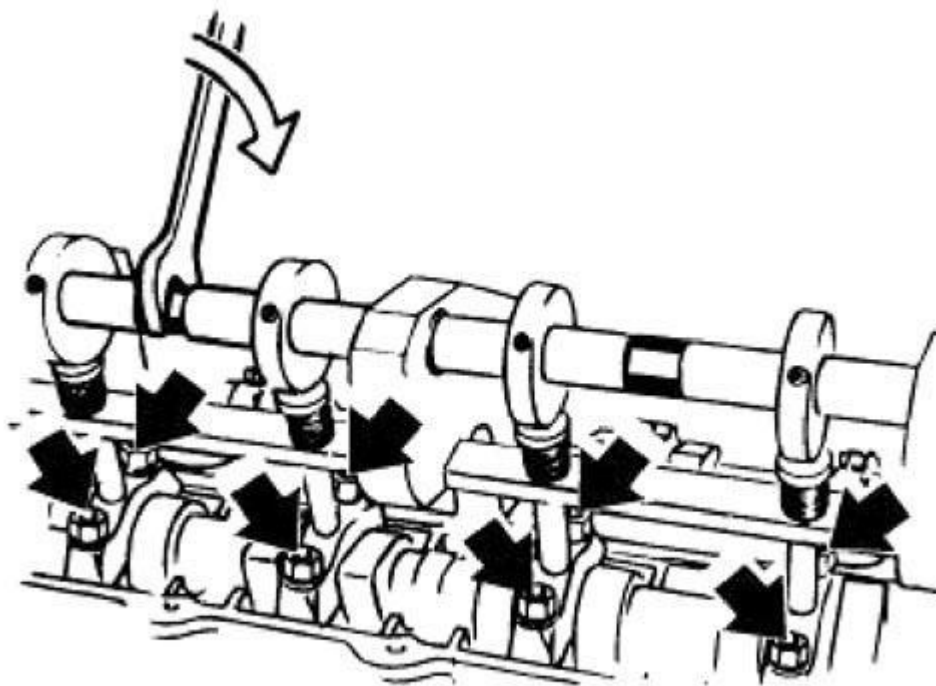
Fit special tool 11 3 260 to cylinder head and screw into spark plug threads in cylinders 1 and 4.



G03164061

Fig. 183: Identifying Cylinder Head**Courtesy of BMW OF NORTH AMERICA, INC.**

Turn the eccentric shaft to tension the bearing caps.



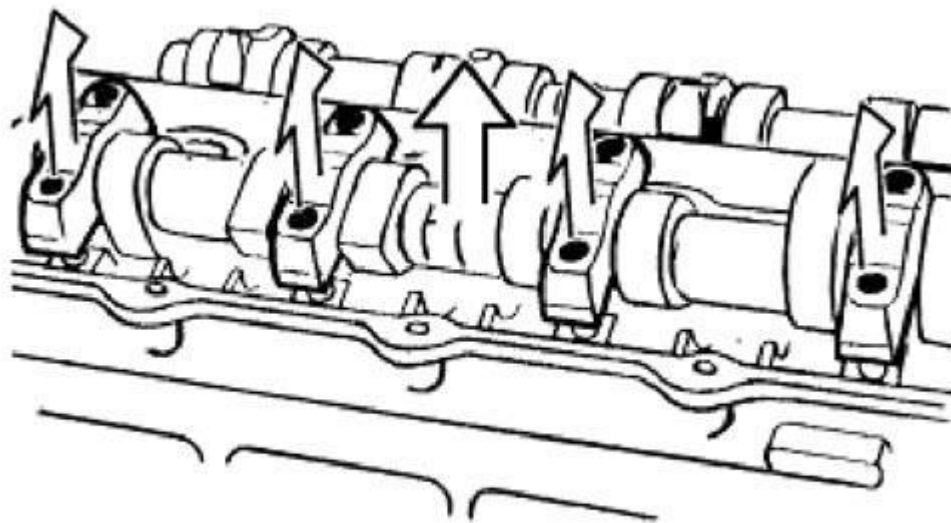
G03164062

Fig. 184: Turning The Eccentric Shaft To Tension The Bearing Caps
Courtesy of BMW OF NORTH AMERICA, INC.

Unfasten nuts on bearing cover.

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.



G03164063

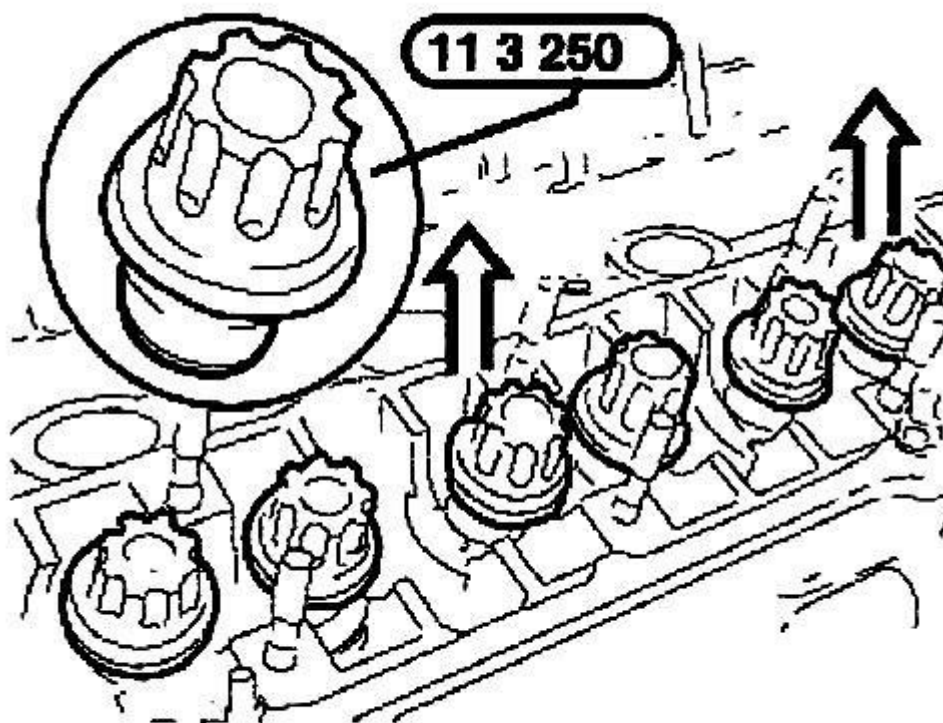
Fig. 185: Removing Bearing Covers

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.

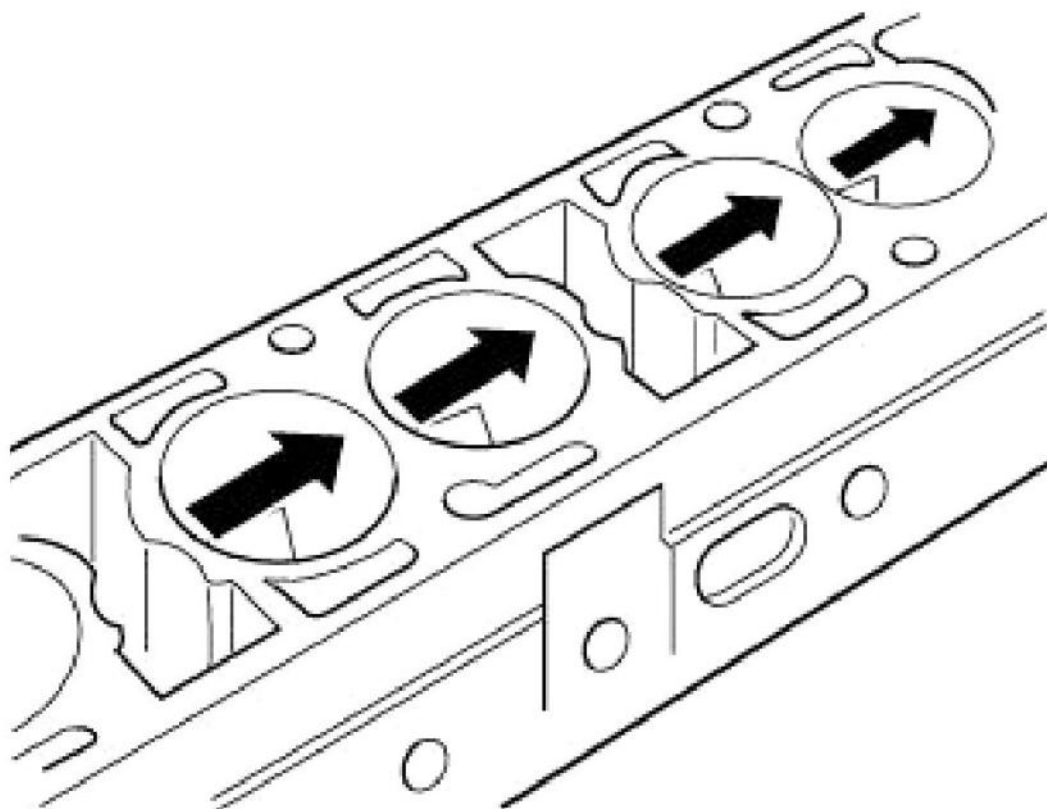


G03164064

Fig. 186: Identifying Bearing Strip With Bucket Tappet
Courtesy of BMW OF NORTH AMERICA, INC.

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

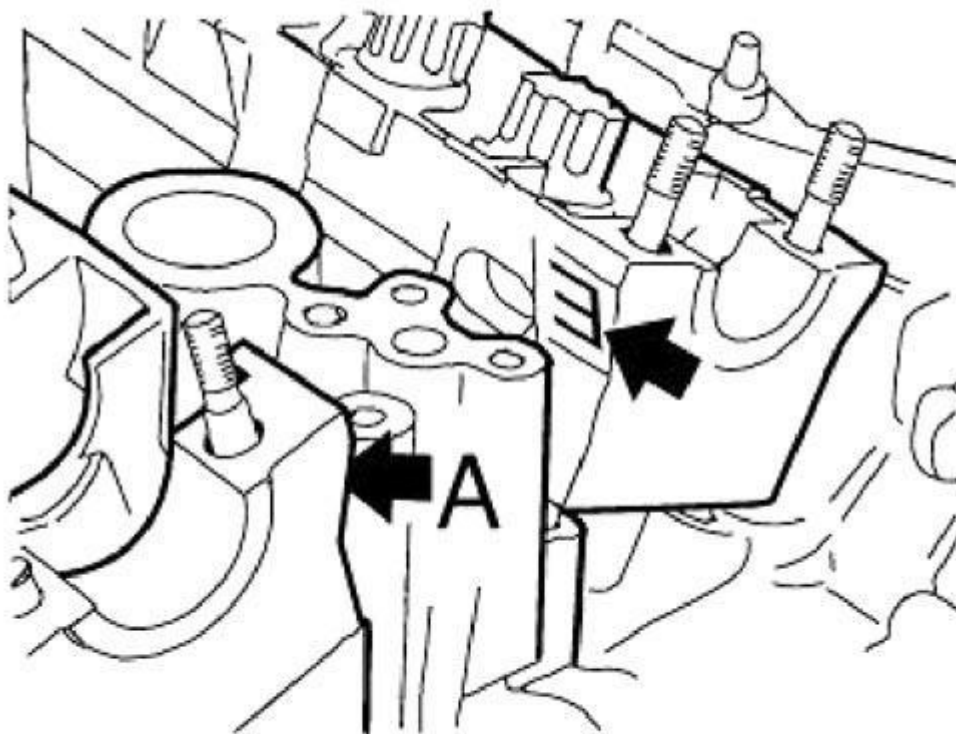
Check bearing points on bucket tappets for signs of wear (scoring).



G03164065

Fig. 187: 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.

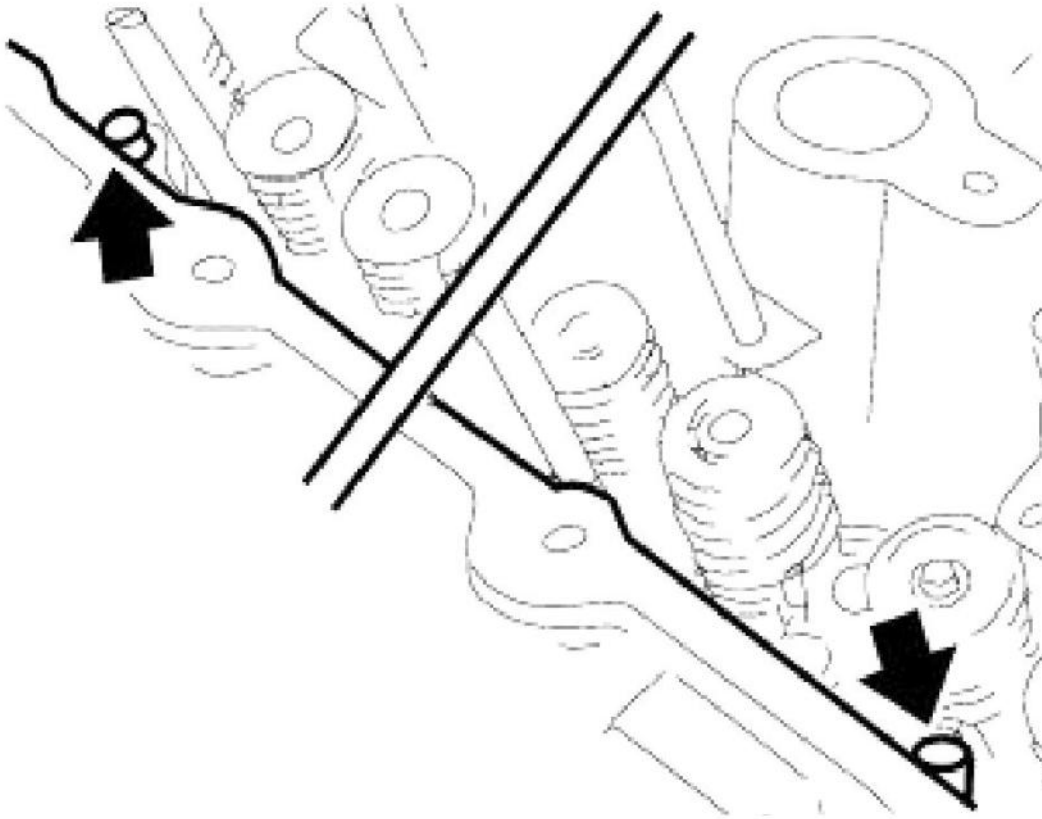


G03164066

Fig. 188: Bearing Strips Are Marked "A" For Exhaust Side And "E" For Inlet Side
Courtesy of BMW OF NORTH AMERICA, INC.

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

Install bearing strips.



G03164067

Fig. 189: 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.

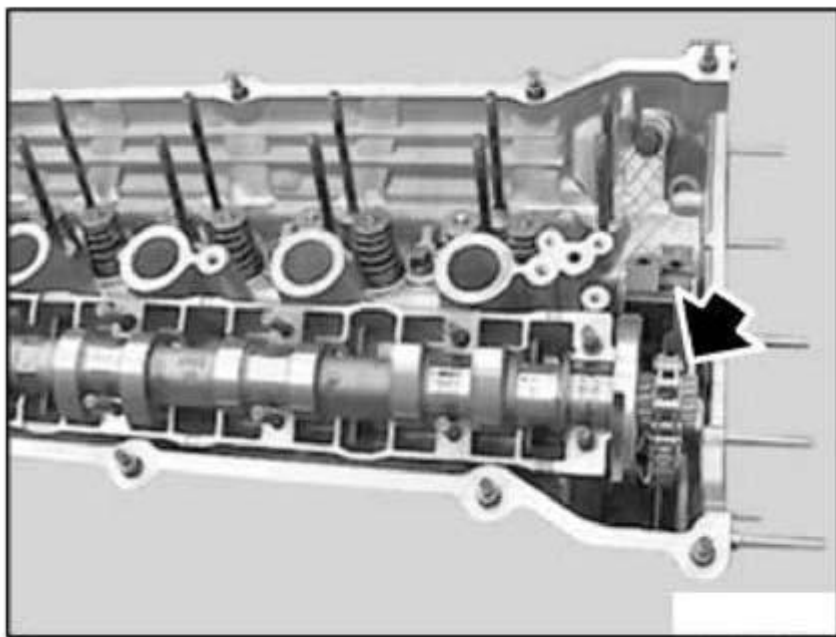
IMPORTANT: The bucket tappets expand when not subjected to load by the camshaft and therefore require some time before they can be pushed back down. During a rapid assembly sequence, the "closed" valves may still be open and be in contact with the piston.

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.

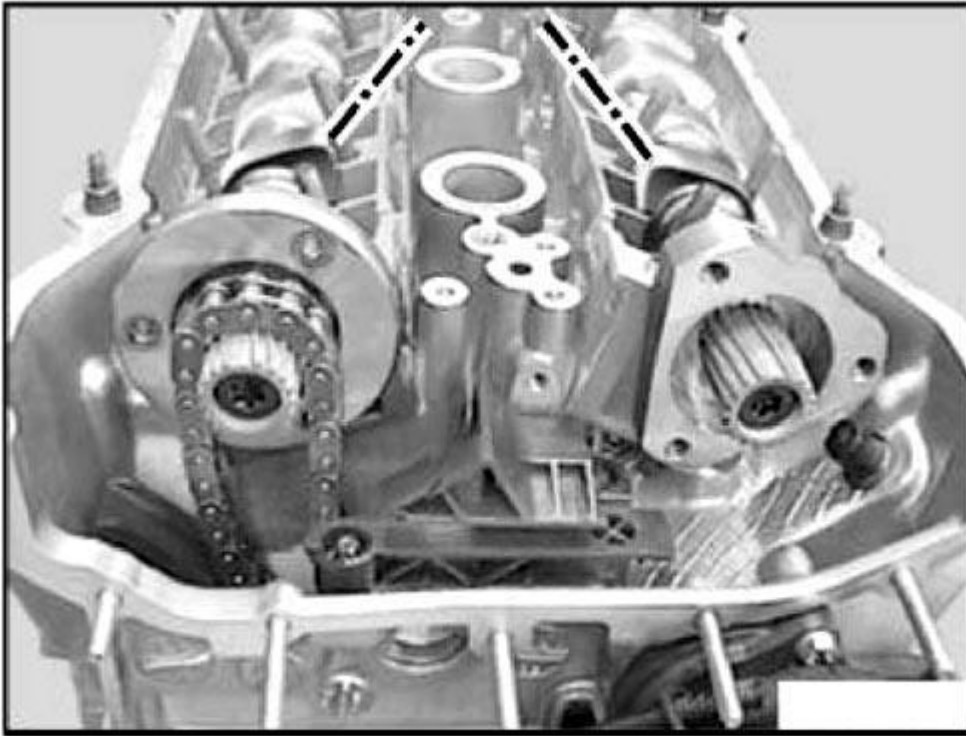
Position timing chain on exhaust camshaft.



G03164068

Fig. 190: Positioning Timing Chain On 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.

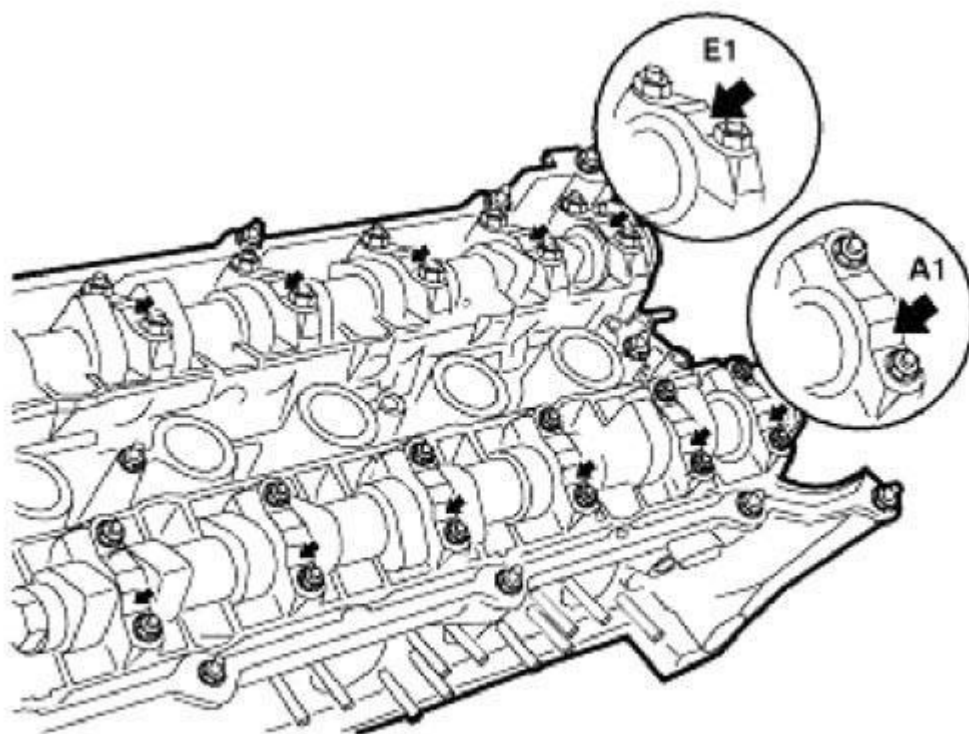


G03164069

Fig. 191: Installing Camshafts

Courtesy of BMW OF NORTH AMERICA, INC.

Fit bearing cover.



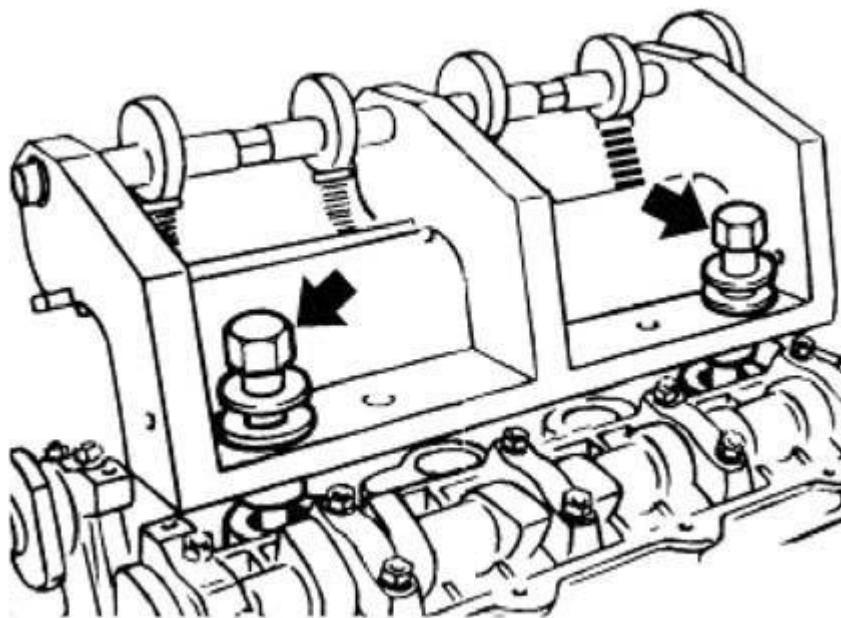
G03164070

Fig. 192: 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.

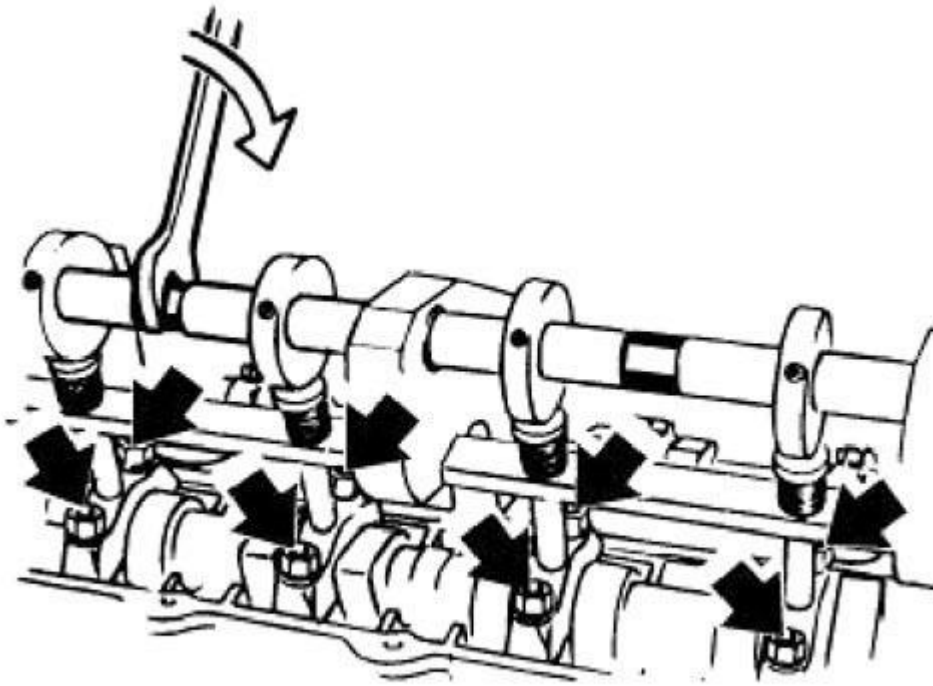


G03164071

Fig. 193: Fitting Special Tool 11 3 260 To Cylinder Head And Screwing Into Spark Plug Threads In Cylinders 1 And 4

Courtesy of BMW OF NORTH AMERICA, INC.

Turn the eccentric shaft to tension the bearing caps.



G03164072

Fig. 194: Turning The Eccentric Shaft To Tension The Bearing Caps
Courtesy of BMW OF NORTH AMERICA, INC.

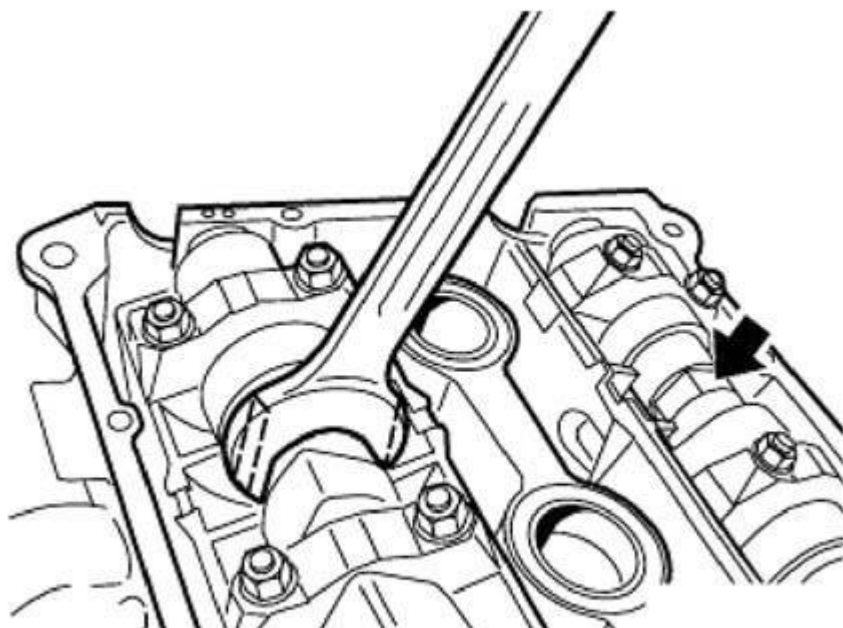
Tighten down bearing cover.

Tightening torque, refer to 11 31 1AZ in **ENGINE - TIGHTENING TORQUES** .

Remove special tool 11 3 260.

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

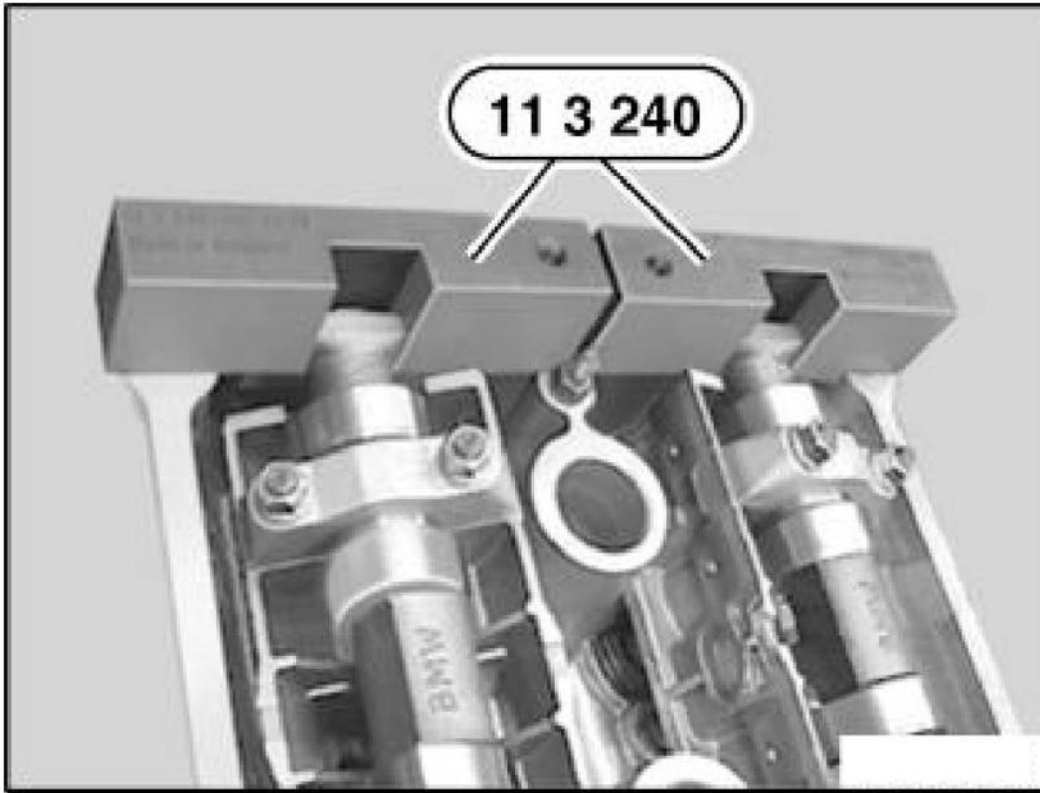
Align camshafts with open-end wrench.



G03164073

Fig. 195: Aligning Camshafts With Open-End Wrench
Courtesy of BMW OF NORTH AMERICA, INC.

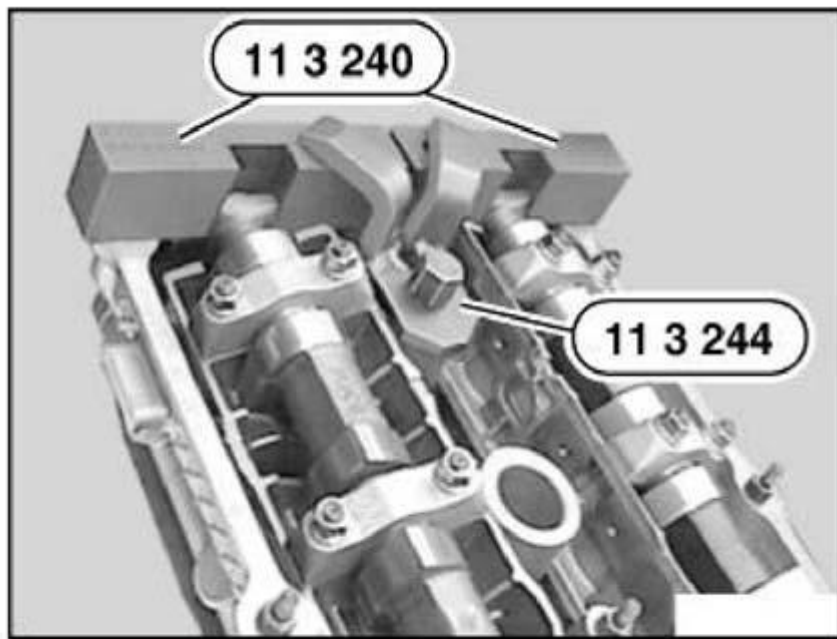
Fit special tool 11 3 240 to camshafts on cylinder 6. Align camshafts so that special tool 11 3 240 rests without gaps on cylinder head.



G03164074

Fig. 196: Identifying Special Tool 11 3 240
Courtesy of BMW OF NORTH AMERICA, INC.

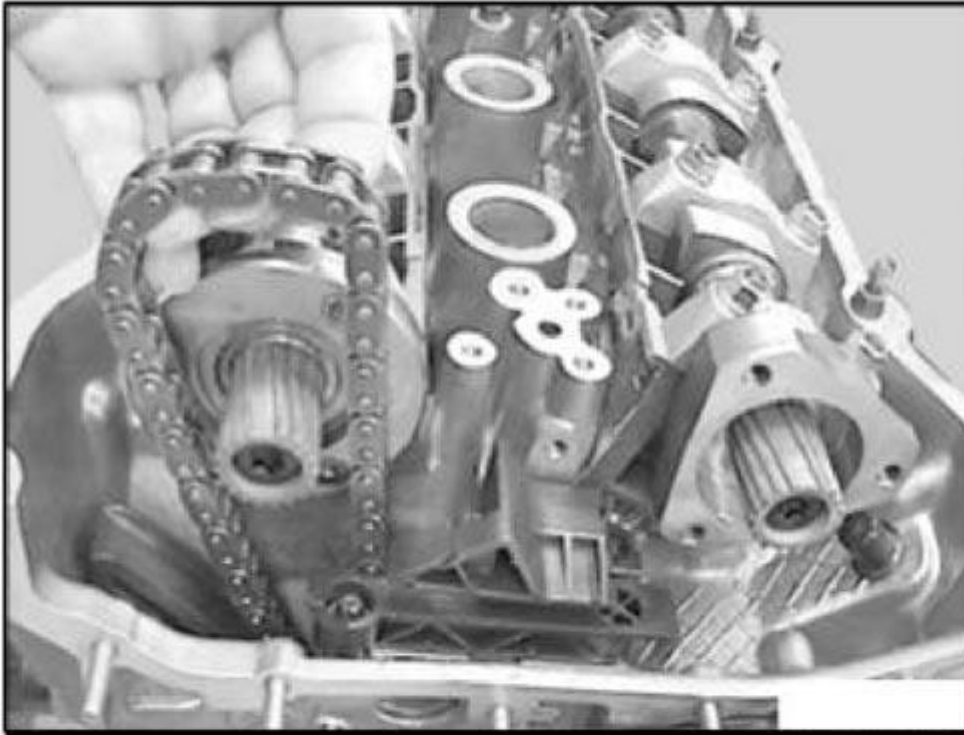
Attach special tool 11 3 244 to special tool 11 3 240 and locate by way of spark plug thread.



G03164075

Fig. 197: Attaching Special Tool 11 3 244 And 11 3 240
Courtesy of BMW OF NORTH AMERICA, INC.

Lift timing chain and hold under tension.



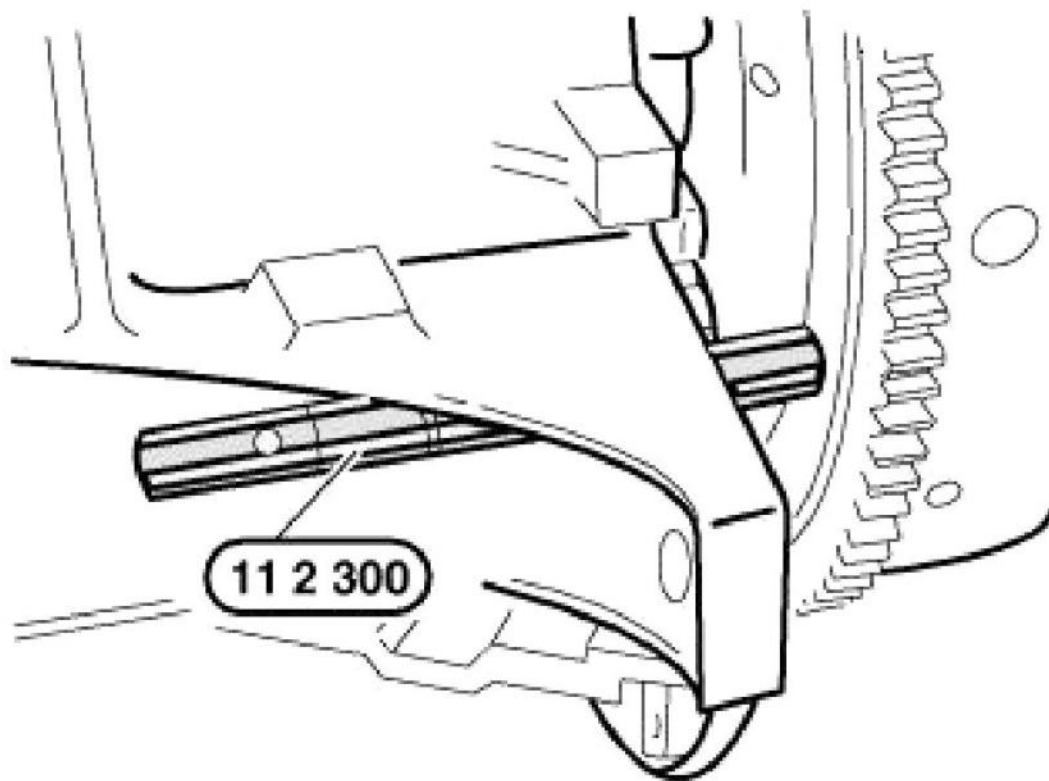
G03164076

Fig. 198: Lifting Timing Chain And Hold Under Tension
Courtesy of BMW OF NORTH AMERICA, INC.

Turn engine from 30° before TDC position in direction of rotation as far as TDC position.

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

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



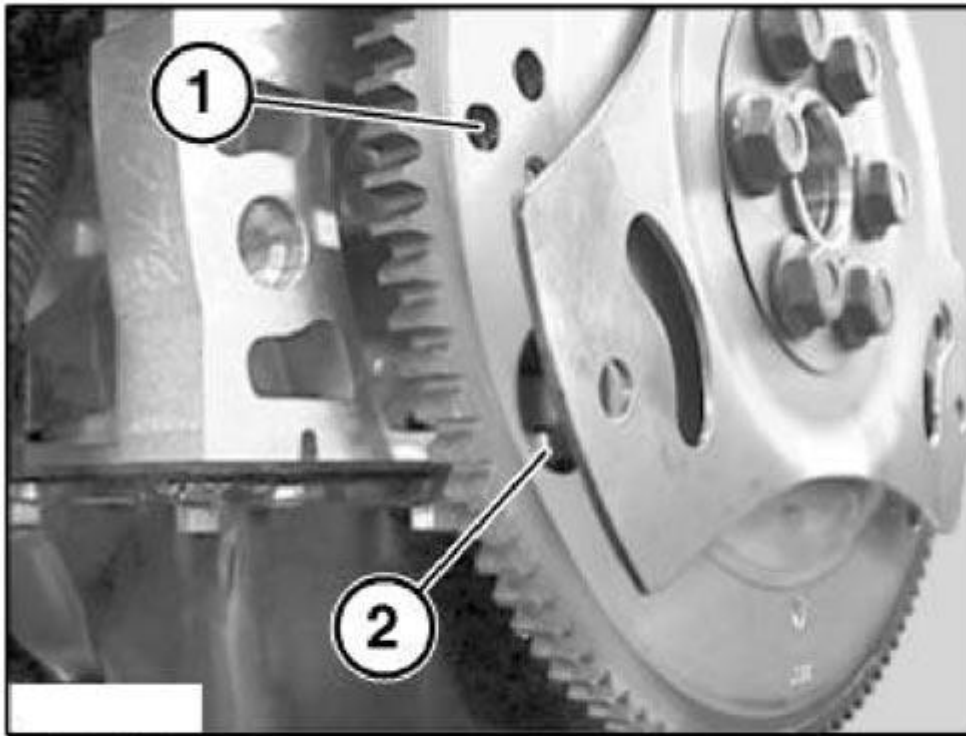
G03164077

Fig. 199: Removing Special Tool 11 2 300 Before Starting Engine
Courtesy of BMW OF NORTH AMERICA, INC.

Automatic transmissions only:

Illustration does not show automatic transmission.

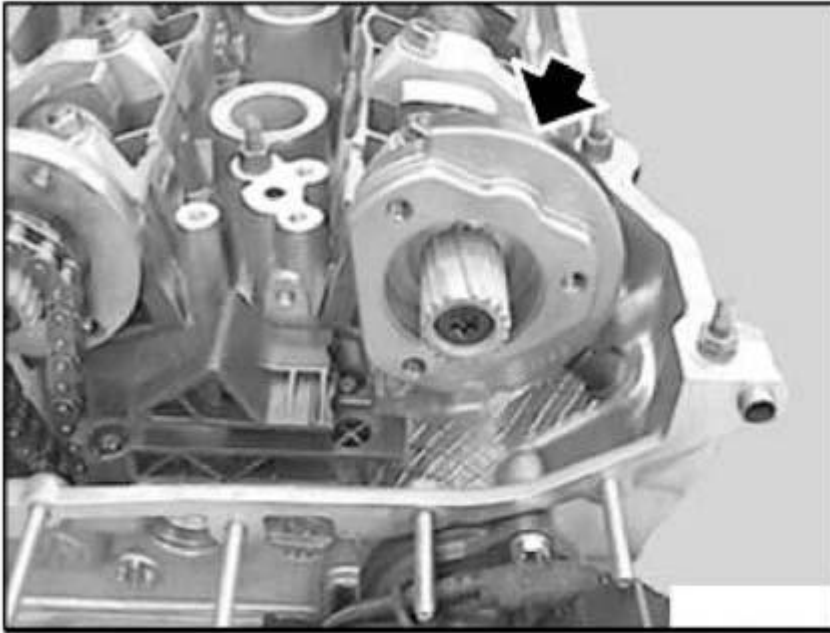
IMPORTANT: On engines with automatic transmissions, there is shortly before the special tool bore (1) a large bore (2) which can be confused with the special tool bore.



G03164078

Fig. 200: Identifying Special Tool Bore And Large Bore
Courtesy of BMW OF NORTH AMERICA, INC.

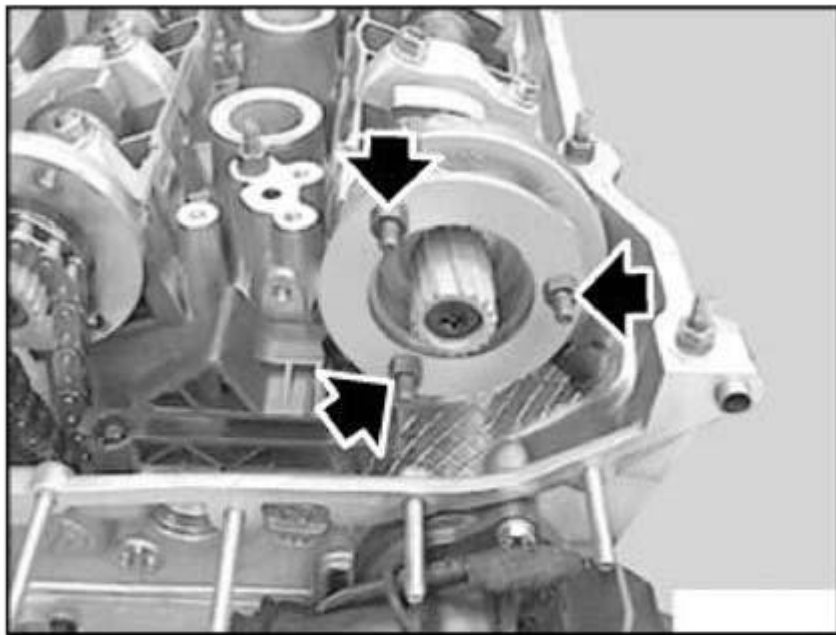
If special tool 11 2 300 is secured in the correct bore (1), the engine can no longer be cranked at the central bolt.
Position sensor gear on inlet camshaft.



G03164079

Fig. 201: Positioning Sensor Gear On Inlet Camshaft
Courtesy of BMW OF NORTH AMERICA, INC.

Fit thrust washer and tighten down with dowels.

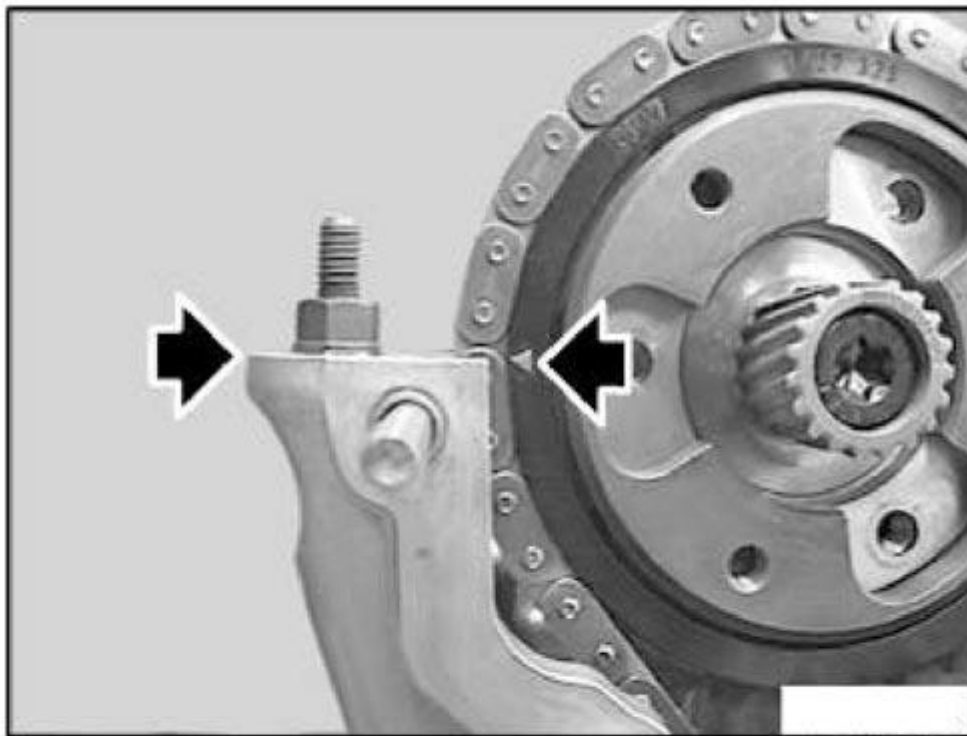


G03164080

Fig. 202: Fitting Thrust Washer**Courtesy of BMW OF NORTH AMERICA, INC.**

Tightening torque, refer to 11 31 11AZ in **ENGINE - TIGHTENING TORQUES** .

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

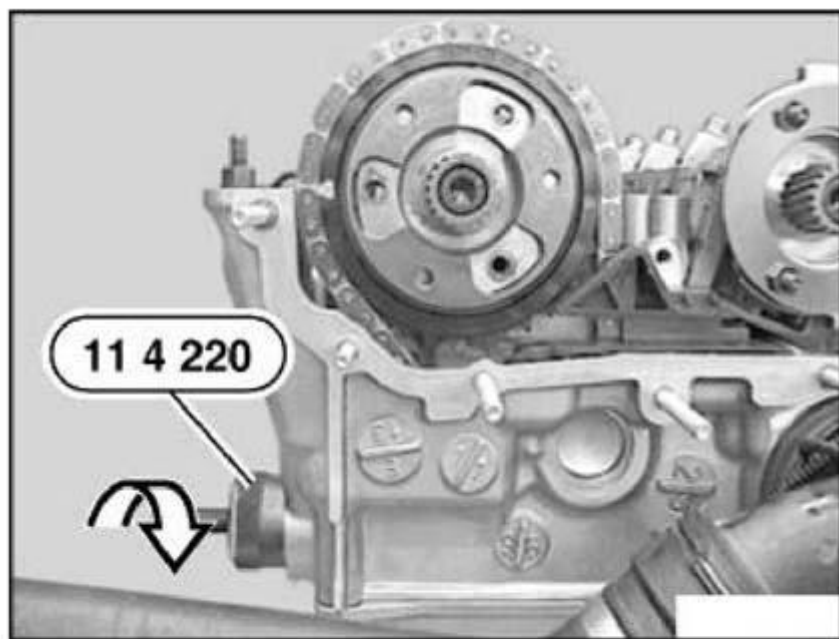


G03164081

Fig. 203: 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.

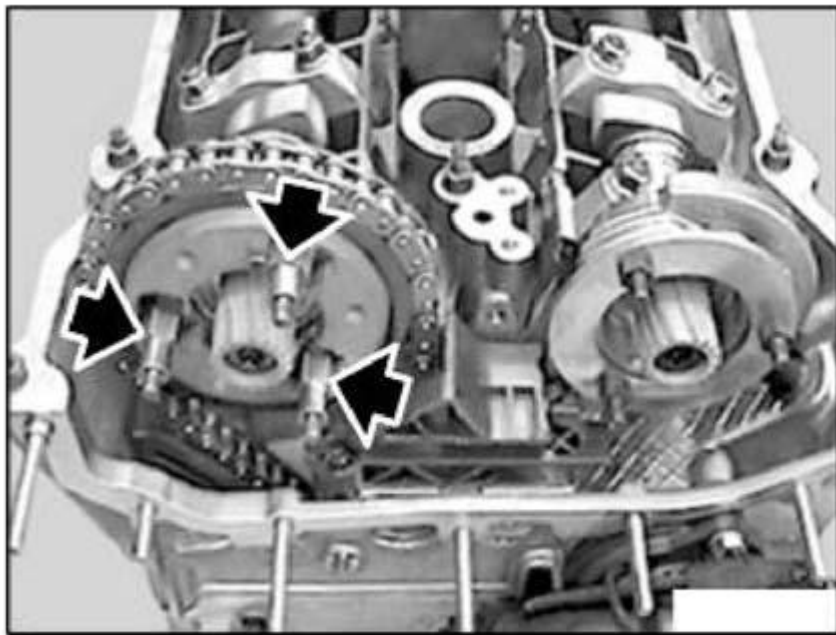
Check arrow on chain wheel to separating face of upper side of cylinder head, reposition chain wheel if necessary.



G03164082

Fig. 204: Inserting Special Tool 11 4 220
Courtesy of BMW OF NORTH AMERICA, INC.

Insert and tighten down screw-in pin.

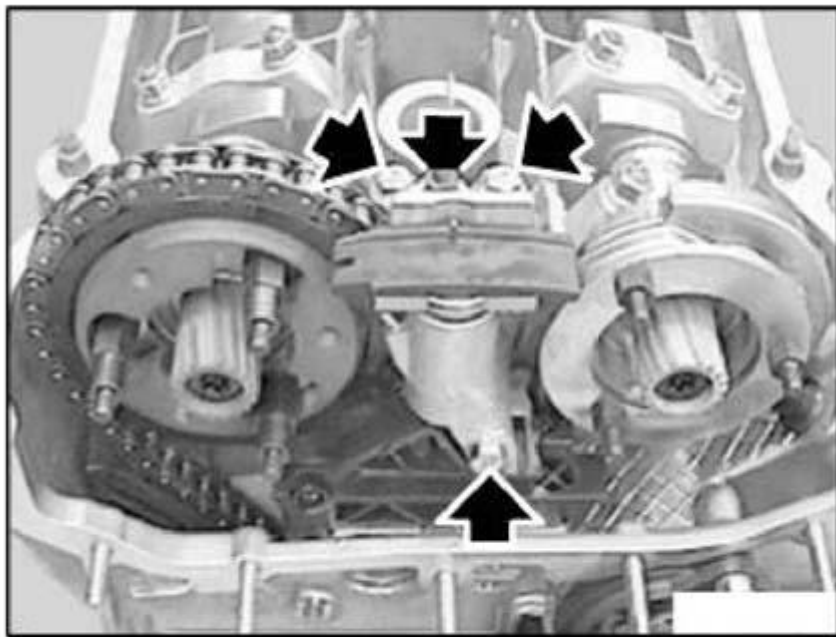


G03164083

Fig. 205: Inserting And Tighten Down Screw-In Pin
Courtesy of BMW OF NORTH AMERICA, INC.

Tightening torque, refer to 11 31 11AZ in **ENGINE - TIGHTENING TORQUES** .

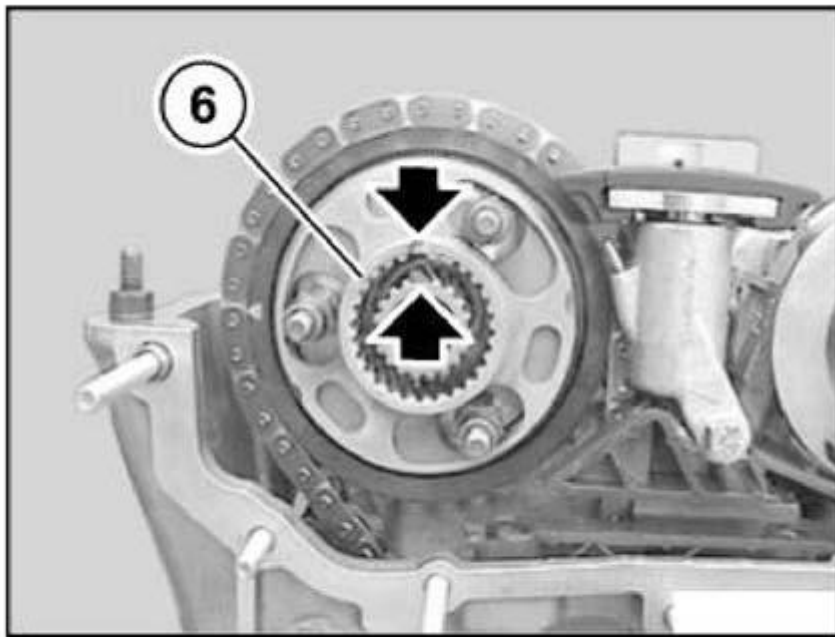
Install secondary chain tensioner.



G03164084

Fig. 206: 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.

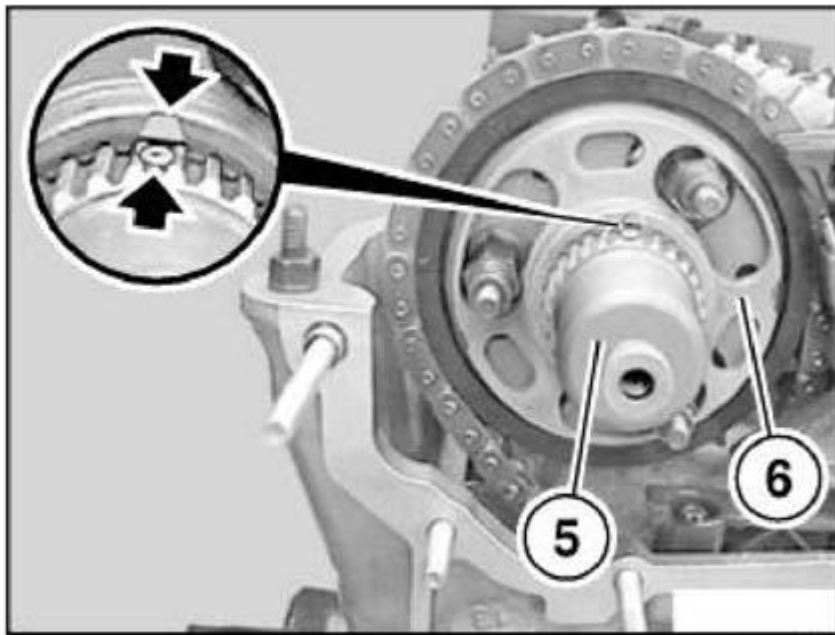


G03164085

Fig. 207: Fitting Toothed Sleeve And Align To Toothed Shaft
Courtesy of BMW OF NORTH AMERICA, INC.

Secure toothed shaft (5).

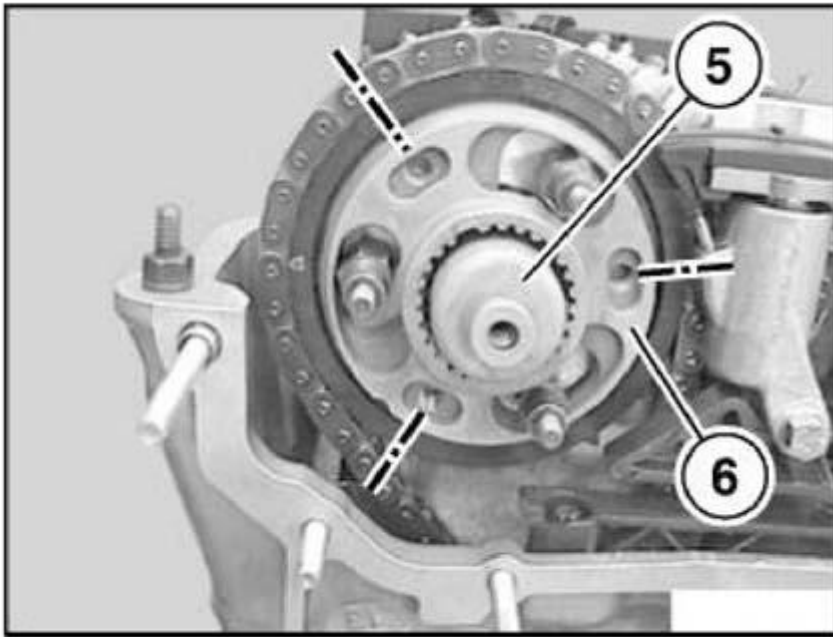
Insert pin of toothed shaft (5) into tooth gaps of splines on camshaft and toothed sleeve (6).



G03164086

Fig. 208: Inserting Pin Of Toothed Shaft**Courtesy of BMW OF NORTH AMERICA, INC.**

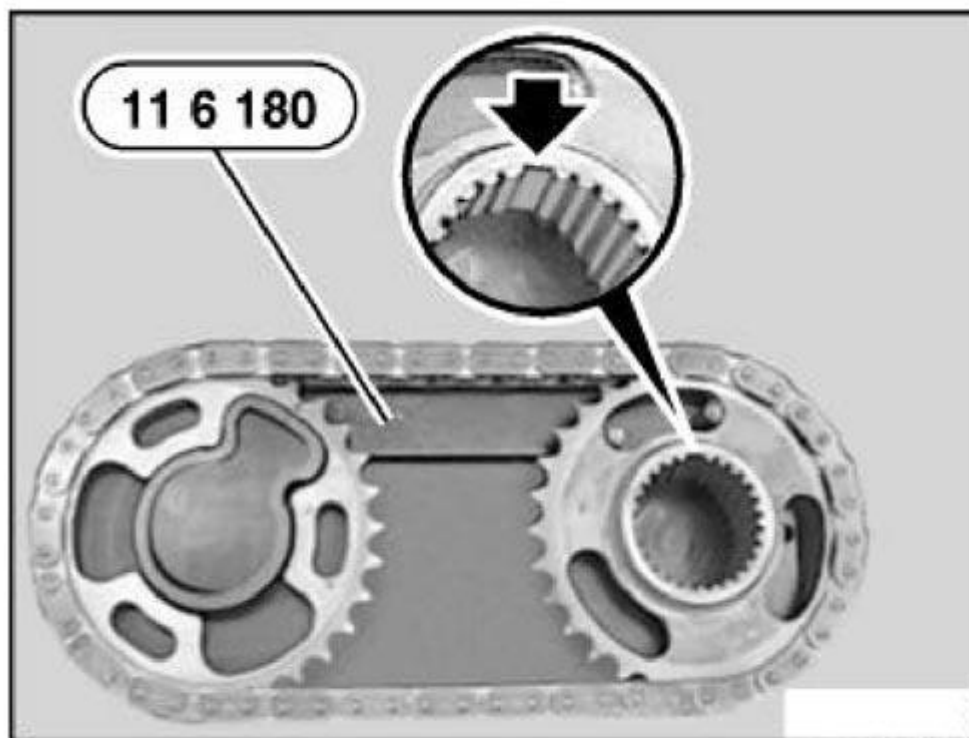
Push in toothed shaft (5) until the longitudinal holes in the toothed sleeve (6) are positioned centrally with respect to the thread.



G03164087

Fig. 209: Pushing In Toothed Shaft Until Longitudinal Holes
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.

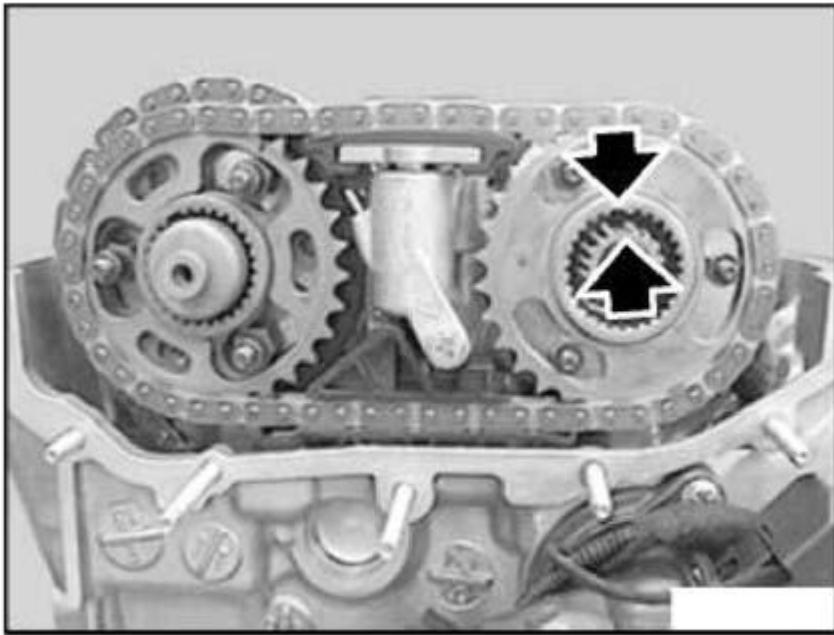


G03164088

Fig. 210: Identifying Special Tool 11 6 180
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.

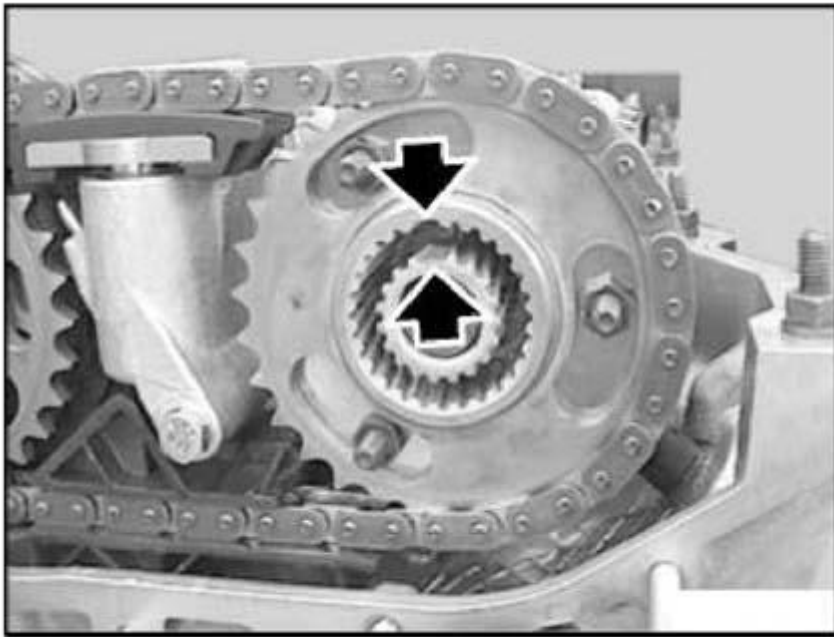
Remove chain with sprocket wheels positioned from special tool 11 6 180 and so that tooth spaces oppose each other on inlet side.



G03164089

Fig. 211: 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.

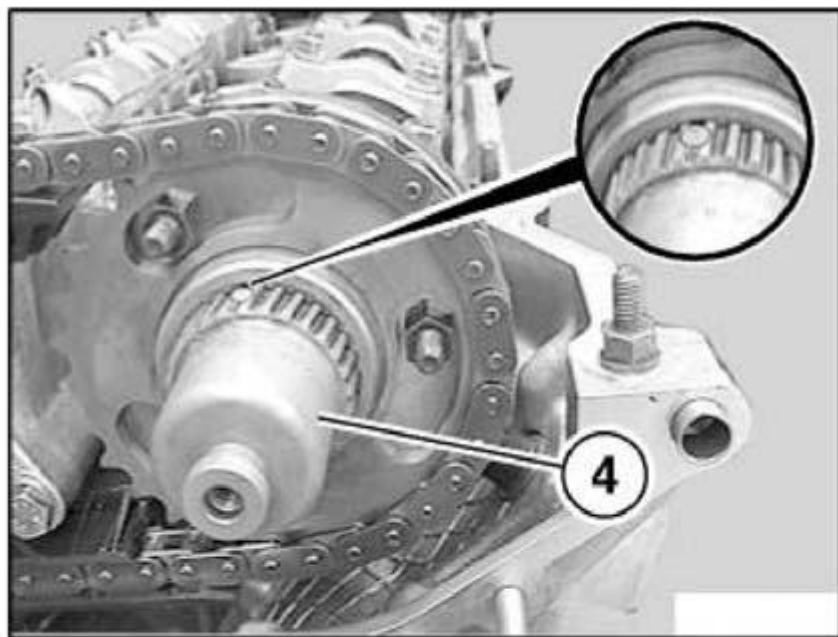


G03164090

Fig. 212: Aligning Chain With Sprocket Wheels
Courtesy of BMW OF NORTH AMERICA, INC.

Secure toothed shaft (4).

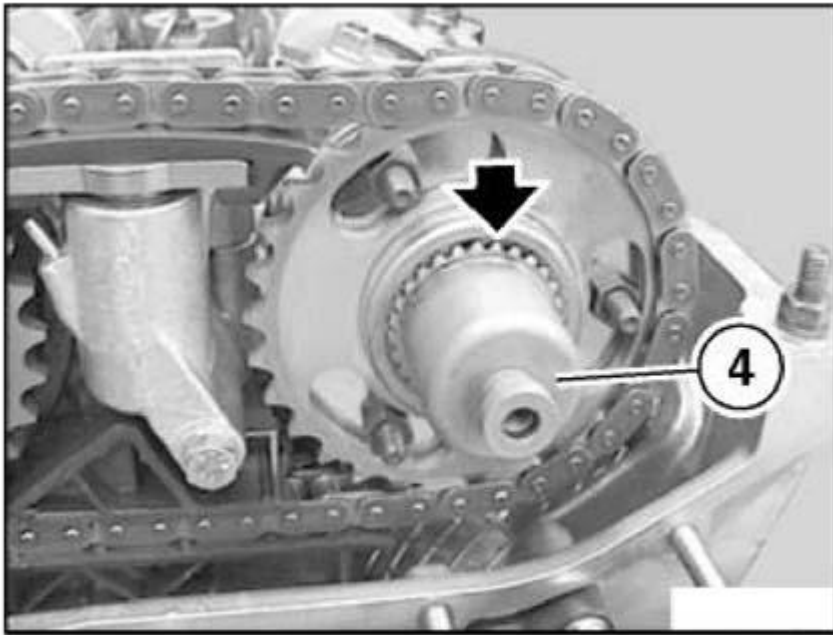
Insert pin of toothed shaft (4) into tooth gaps of splines on camshaft and chain wheel.



G03164091

Fig. 213: Inserting Pin Of Toothed Shaft
Courtesy of BMW OF NORTH AMERICA, INC.

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

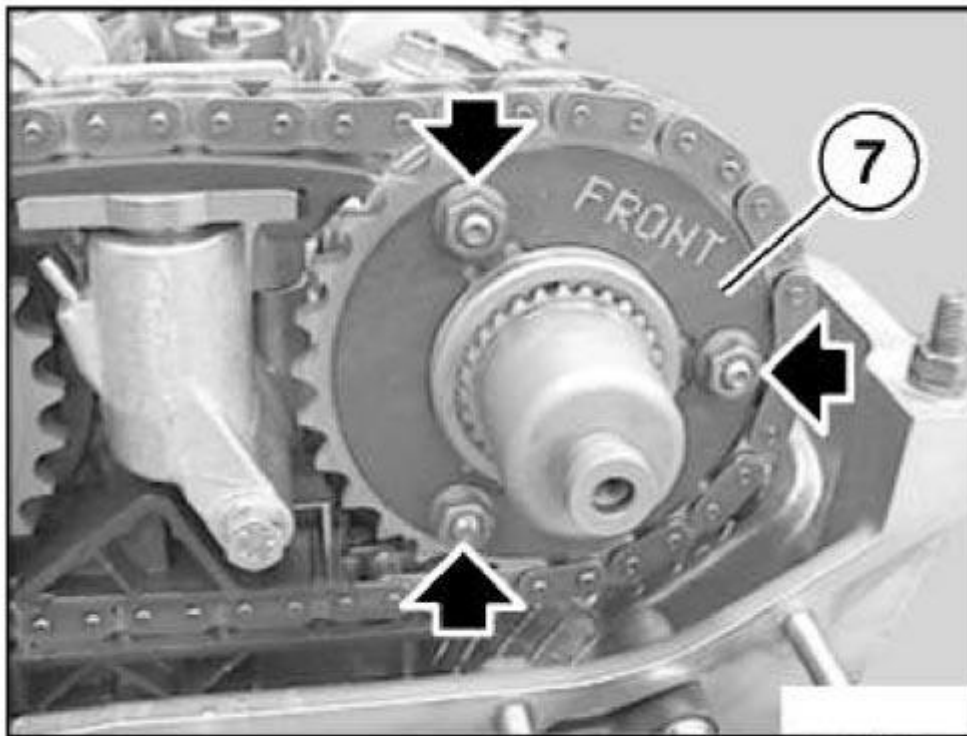


G03164092

Fig. 214: Pushing In Toothed Shaft**Courtesy of BMW OF NORTH AMERICA, INC.**

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

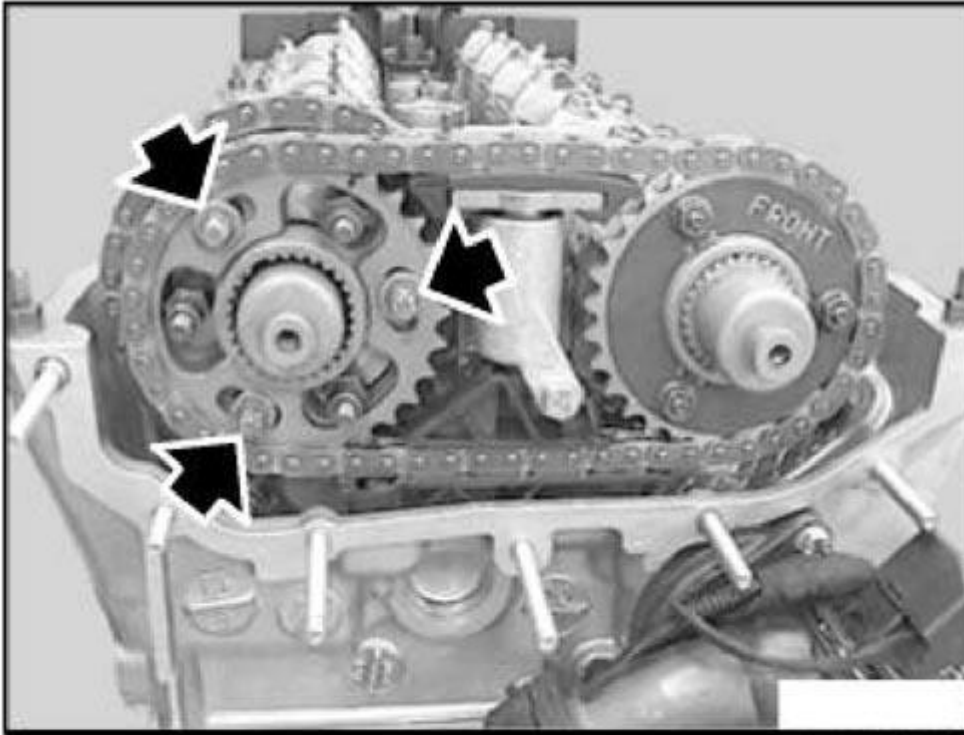
Install corrugated washer, tighten nuts by hand but do not tighten down fully yet.



G03164093

Fig. 215: Installing Corrugated Washer
Courtesy of BMW OF NORTH AMERICA, INC.

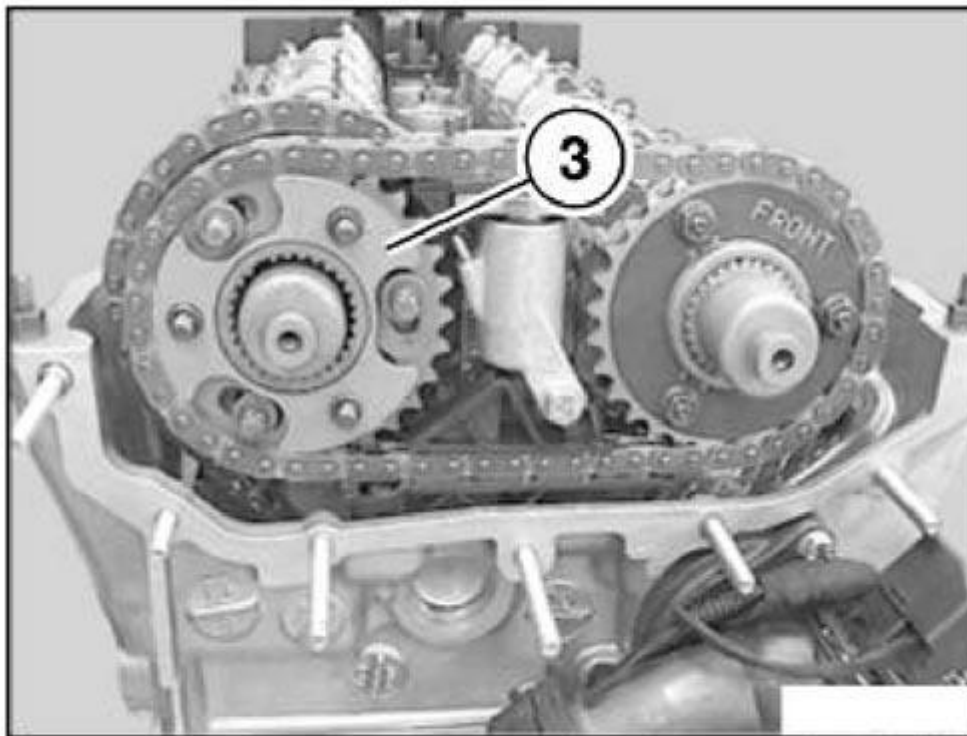
Insert screws on exhaust side, initially tighten to approx. 5 Nm and then slacken off again half a turn.



G03164094

Fig. 216: Inserting Screws On Exhaust Side
Courtesy of BMW OF NORTH AMERICA, INC.

Fit thrust washer (3).



G03164095

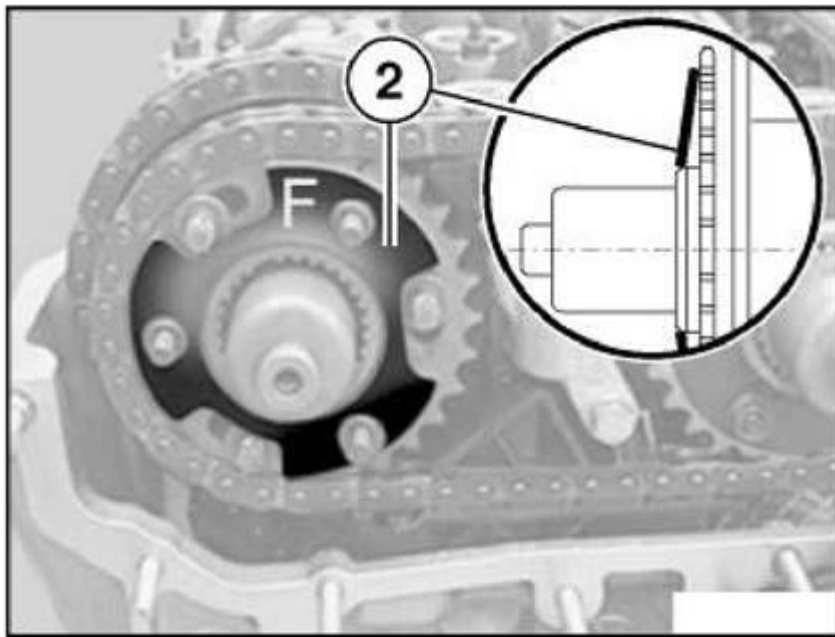
Fig. 217: Fitting Thrust Washer

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

Fit cup spring (2) in position.

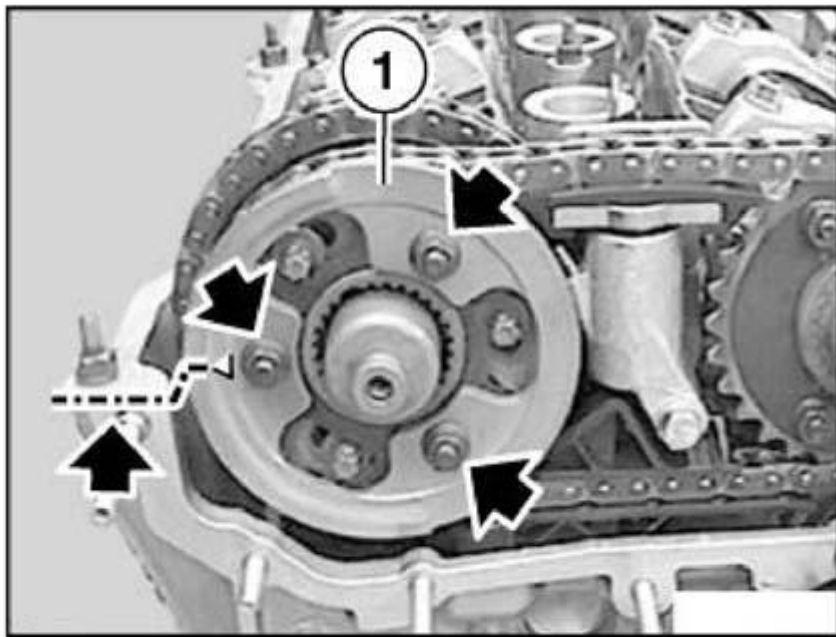


G03164096

Fig. 218: Fitting Cup Spring In Position
Courtesy of BMW OF NORTH AMERICA, INC.

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

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

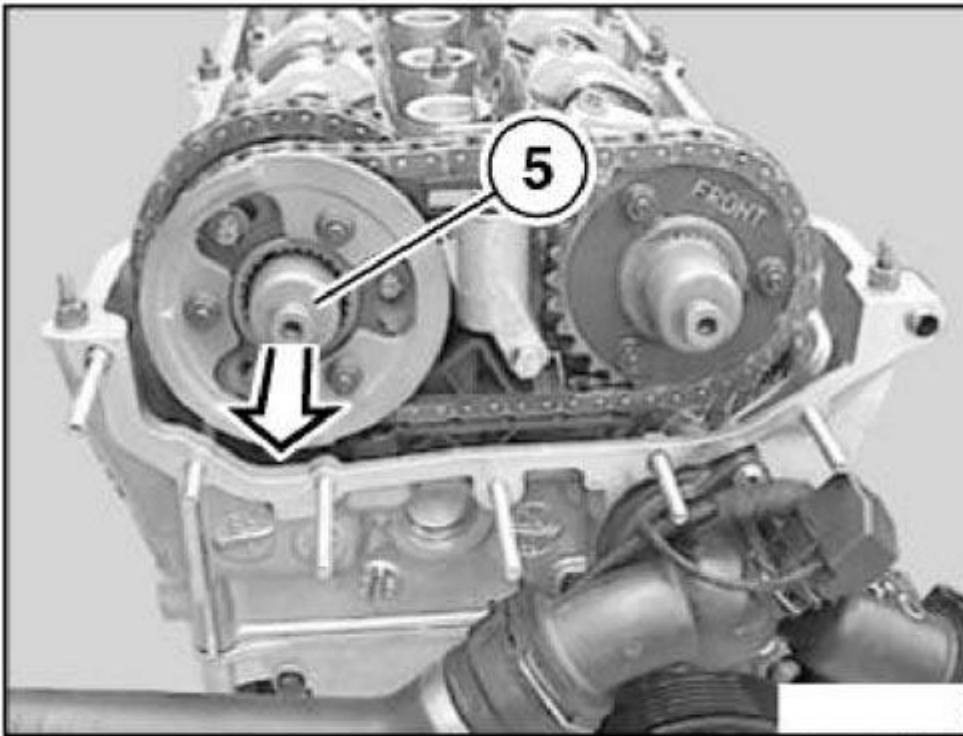


G03164097

Fig. 219: Installing Nuts

Courtesy of BMW OF NORTH AMERICA, INC.

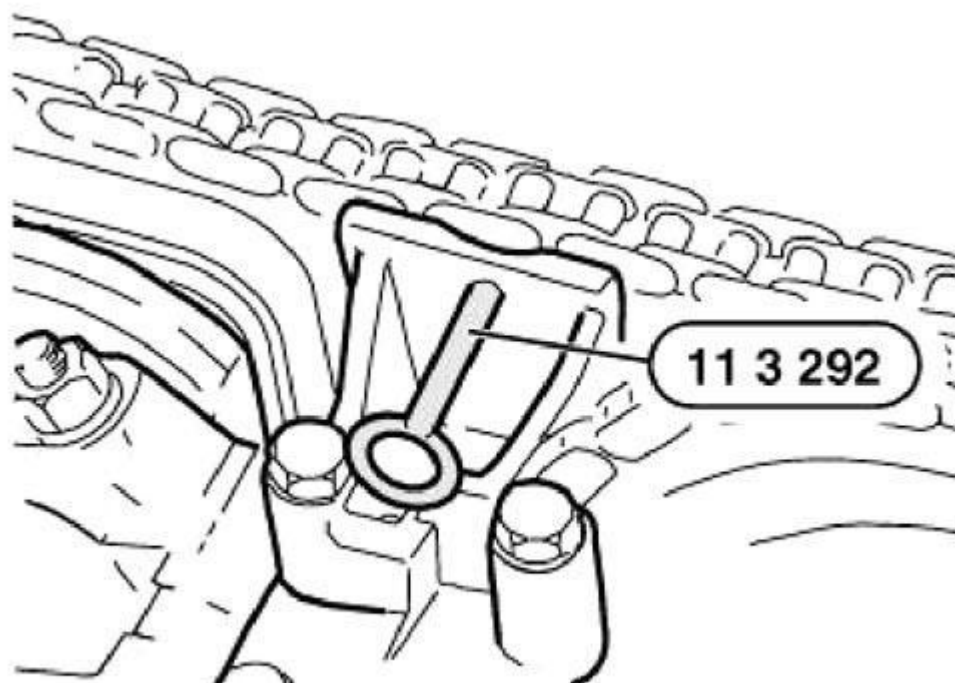
Withdraw toothed shaft (5) up to stop.



G03164098

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

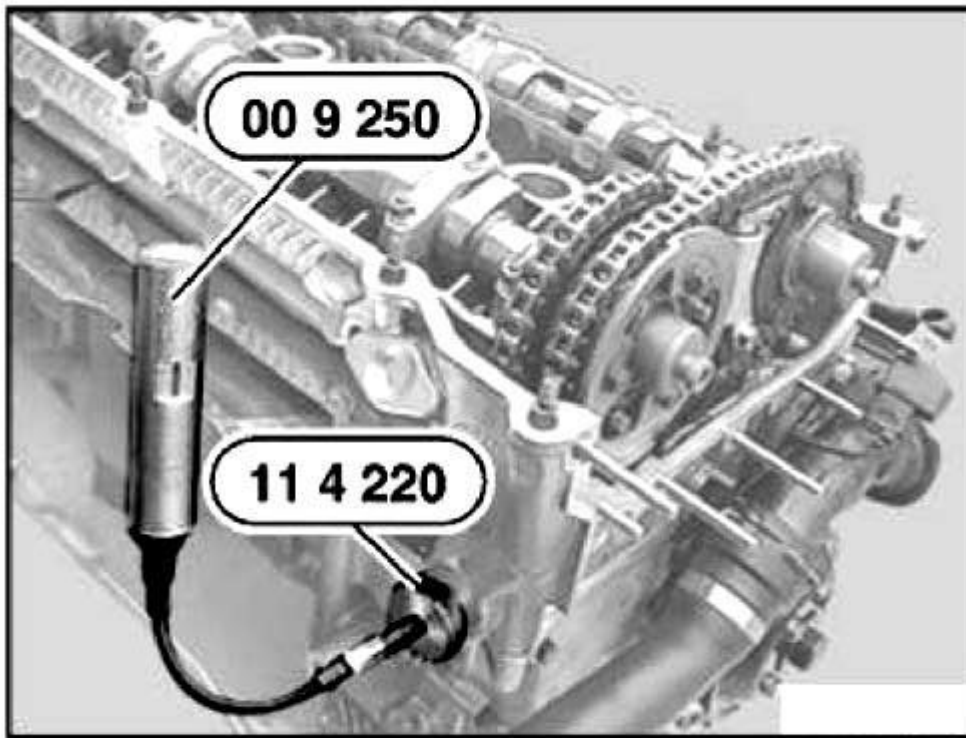
Press down secondary chain tensioner at top and remove special tool 11 3 292.



G03164099

Fig. 221: 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.

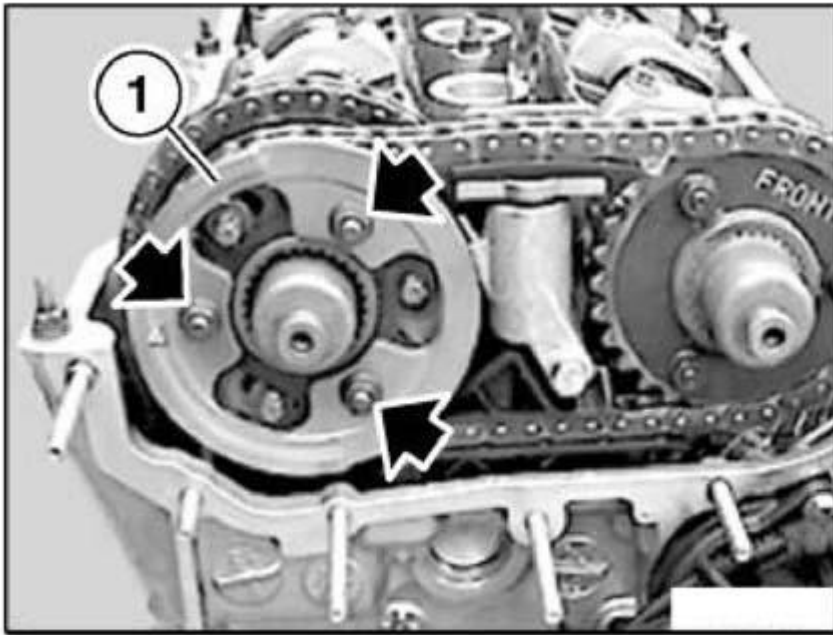


G03164100

Fig. 222: Identifying Special Tools 11 4 220 And 00 9 250
Courtesy of BMW OF NORTH AMERICA, INC.

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

IMPORTANT: Do not tighten down nuts fully.



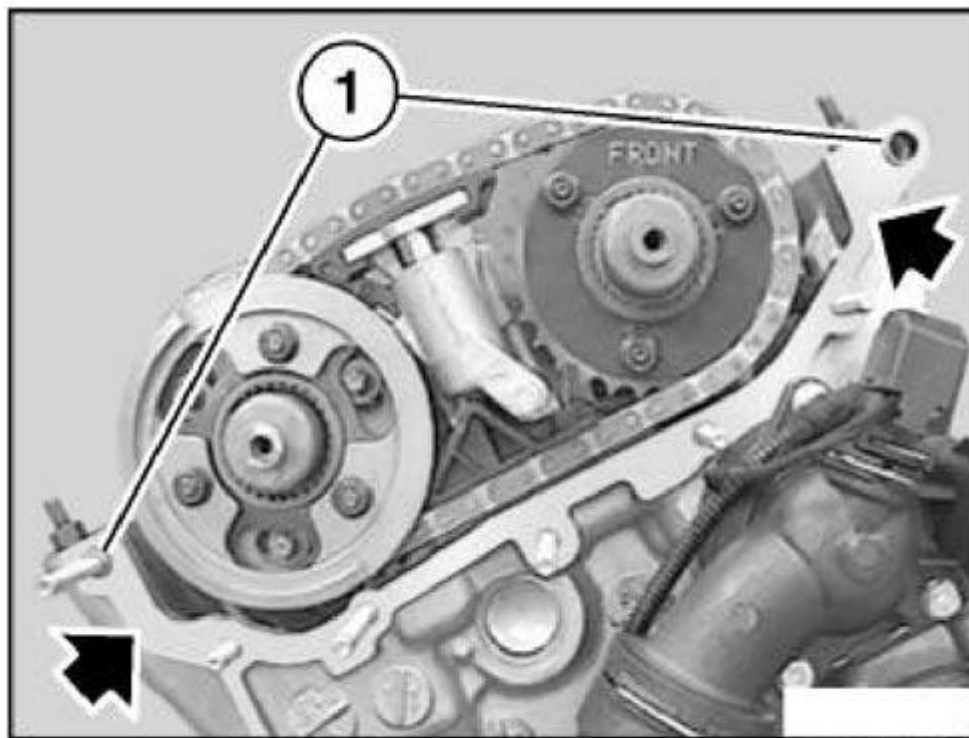
G03164101

Fig. 223: Pressing On Sensor Gear And Tighten Nuts
Courtesy of BMW OF NORTH AMERICA, INC.

Remove gasket.

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

Keep sealing face clean and free of oil.



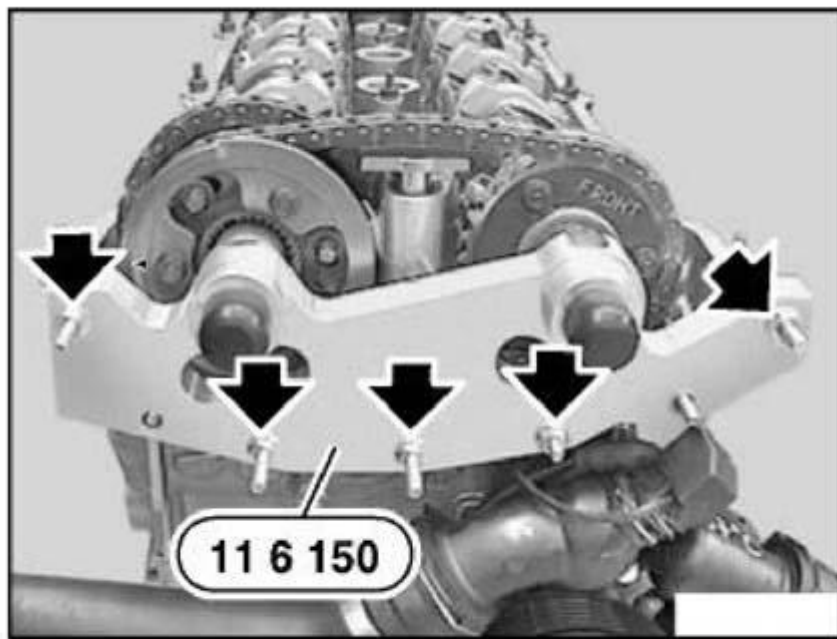
G03164102

Fig. 224: Checking Dowel Sleeves

Courtesy of BMW OF NORTH AMERICA, INC.

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.

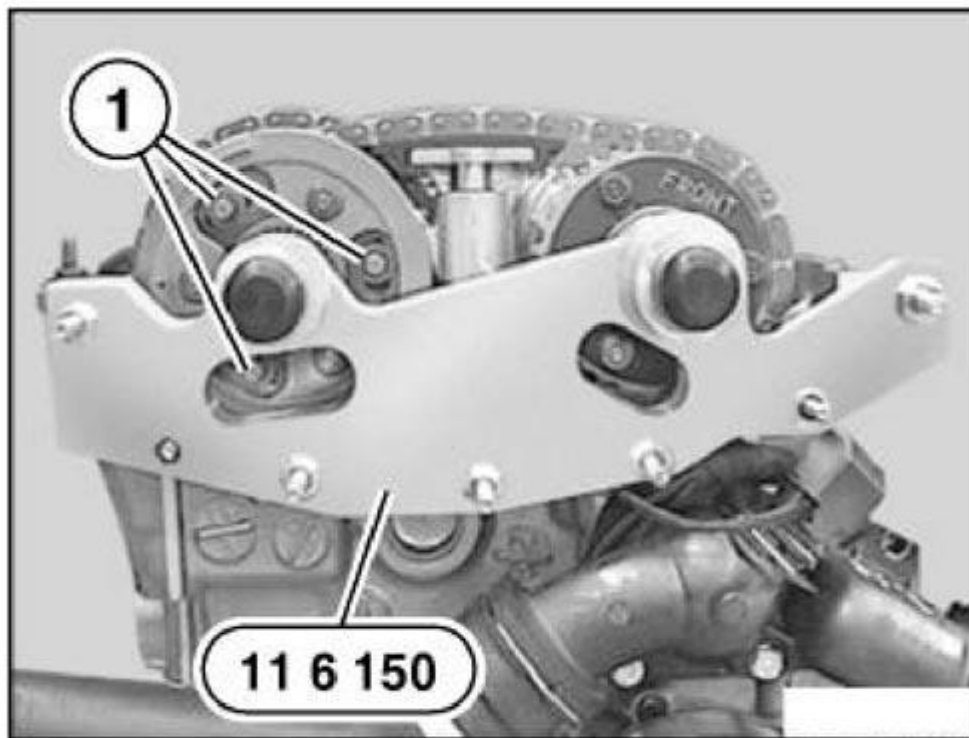
Attach special tool 11 6 150 "without gasket", tighten nuts by hand and then tighten down uniformly until special tool 11 6 150 is in full contact with cylinder head.



G03164103

Fig. 225: Fitting Special Tool 11 6 150
Courtesy of BMW OF NORTH AMERICA, INC.

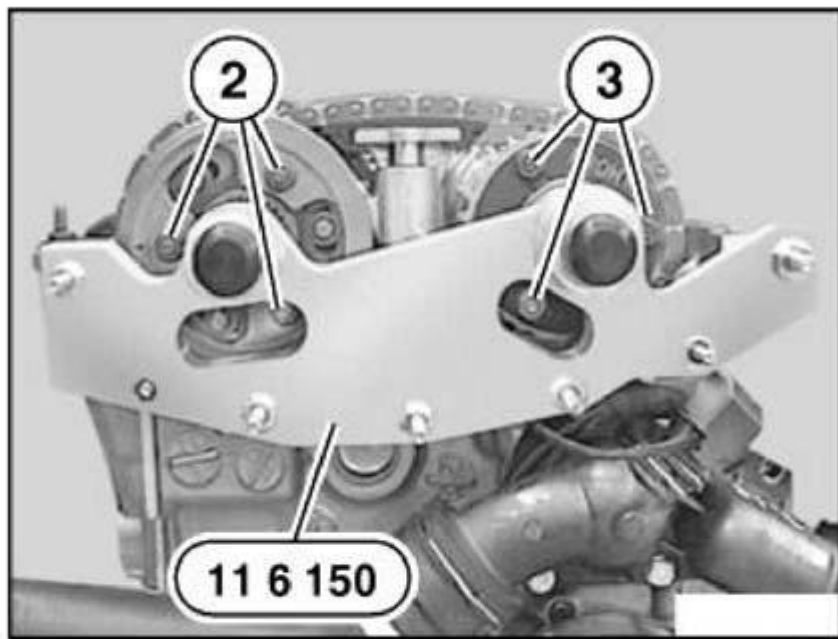
Insert screws (1) on exhaust side and initially tighten to approx. 5 Nm.



G03164104

Fig. 226: Inserting Screws On Exhaust Side
Courtesy of BMW OF NORTH AMERICA, INC.

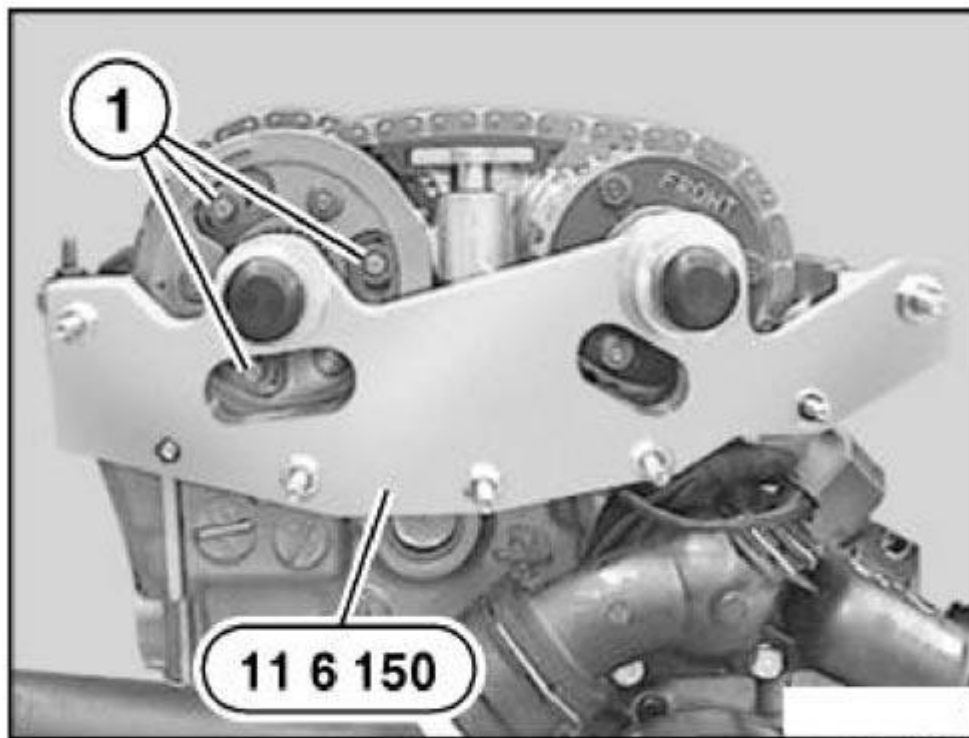
Initially tighten nuts (2) on exhaust side and nuts (3) on inlet side to approx. 5 Nm.



G03164105

Fig. 227: Tightening Nuts On Exhaust Side
Courtesy of BMW OF NORTH AMERICA, INC.

Tighten down screws (1) on exhaust side.



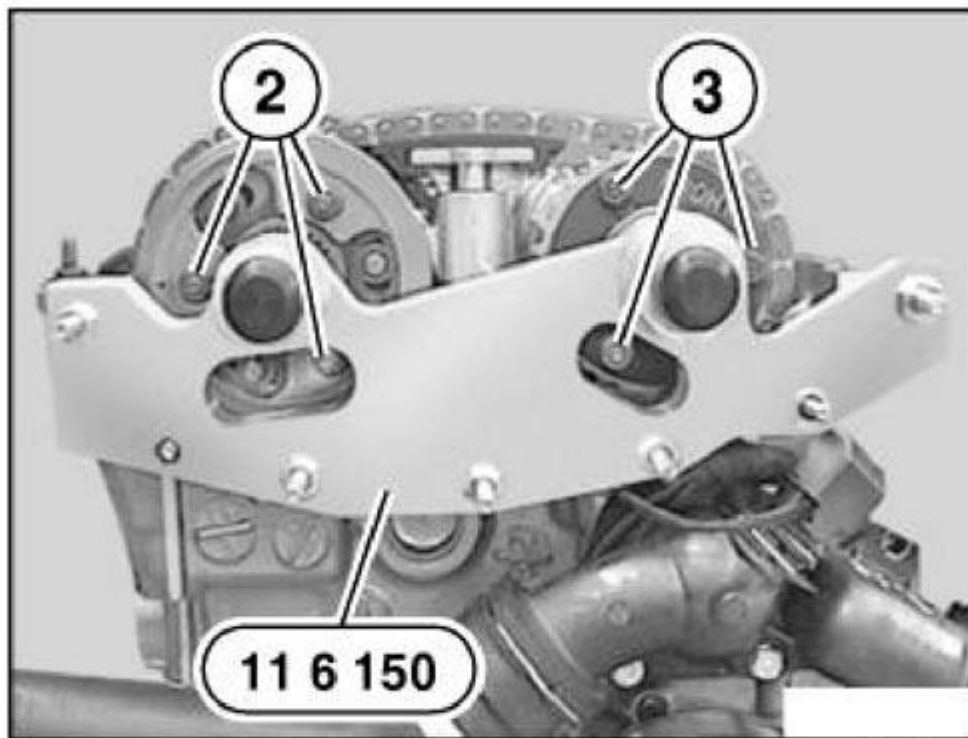
G03164106

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

Tightening torque, refer to 11 31 3AZ in **ENGINE - TIGHTENING TORQUES** .

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

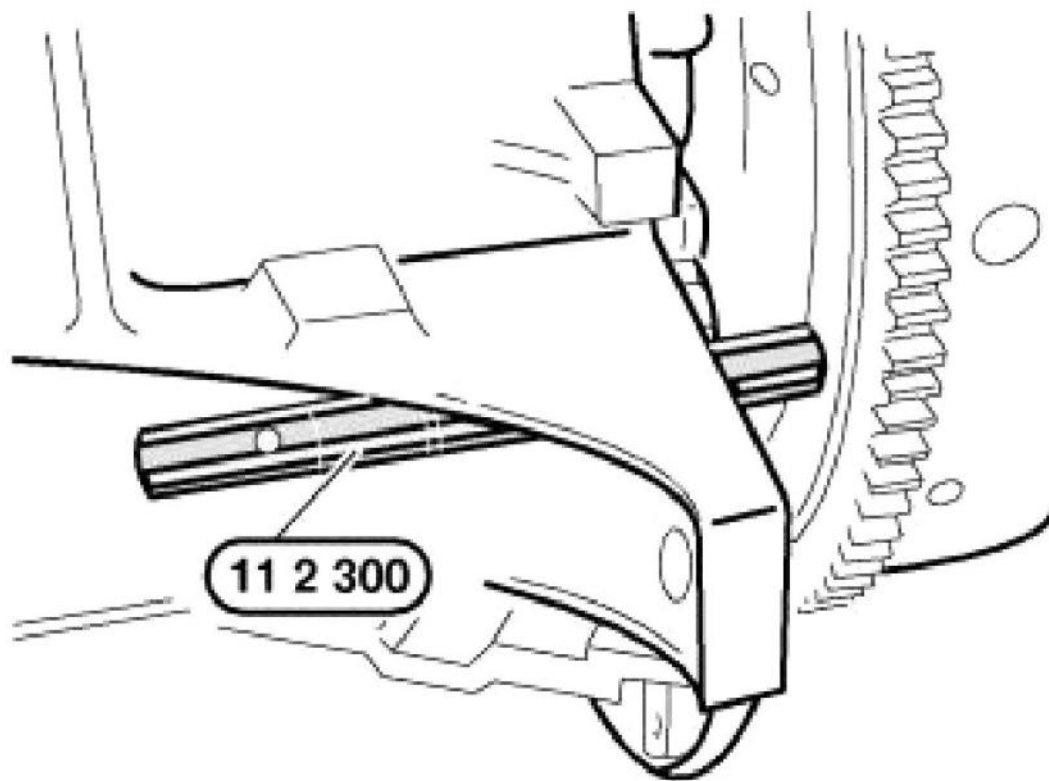
Tightening torque, refer to 11 31 11AZ in **ENGINE - TIGHTENING TORQUES** .



G03164107

Fig. 229: Tightening Down Nuts On Exhaust Side And Nuts
Courtesy of BMW OF NORTH AMERICA, INC.

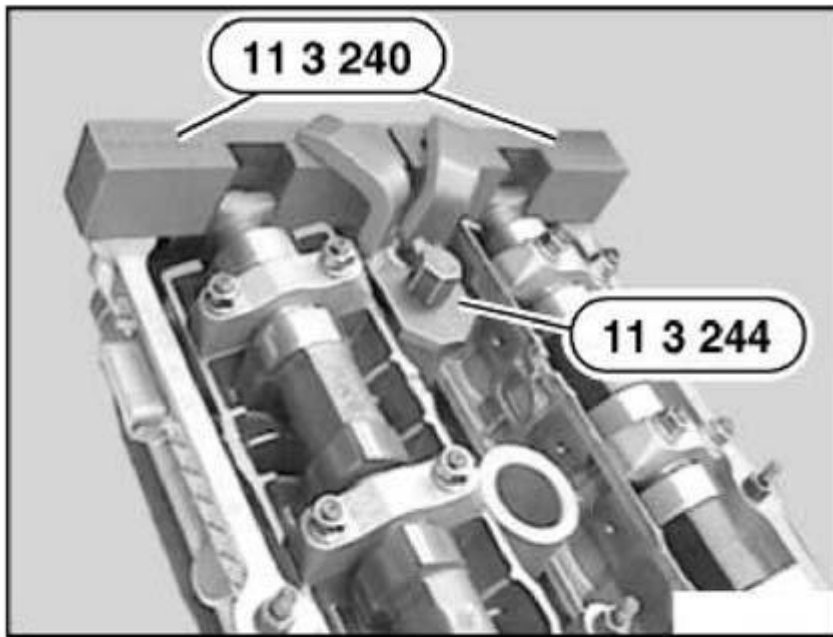
Pull special tool 11 2 300 back until flywheel is no longer secured in position.



G03164108

Fig. 230: Pulling Special Tool 11 2 300
Courtesy of BMW OF NORTH AMERICA, INC.

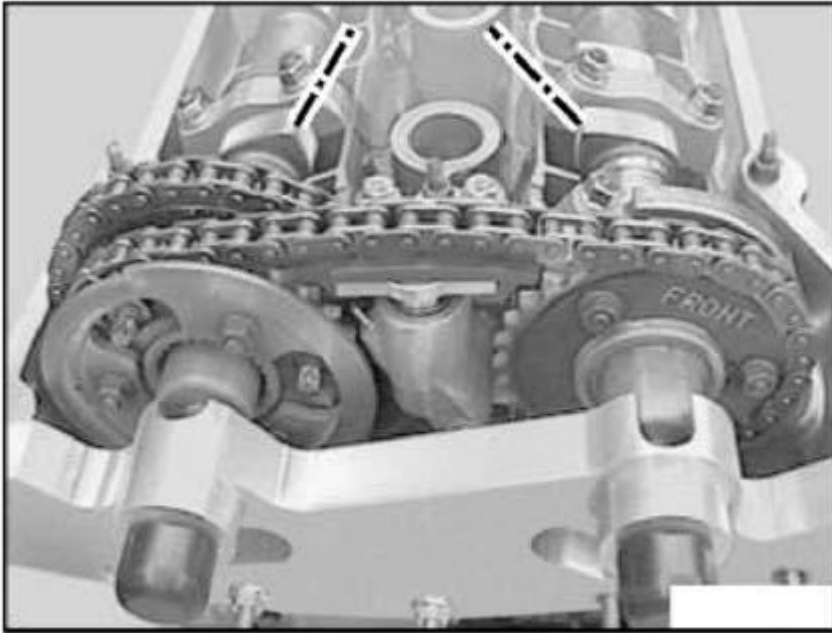
Remove special tool 11 3 244 and special tool 11 3 240.



G03164109

Fig. 231: Removing Special Tool 11 3 244 And 11 3 240
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.



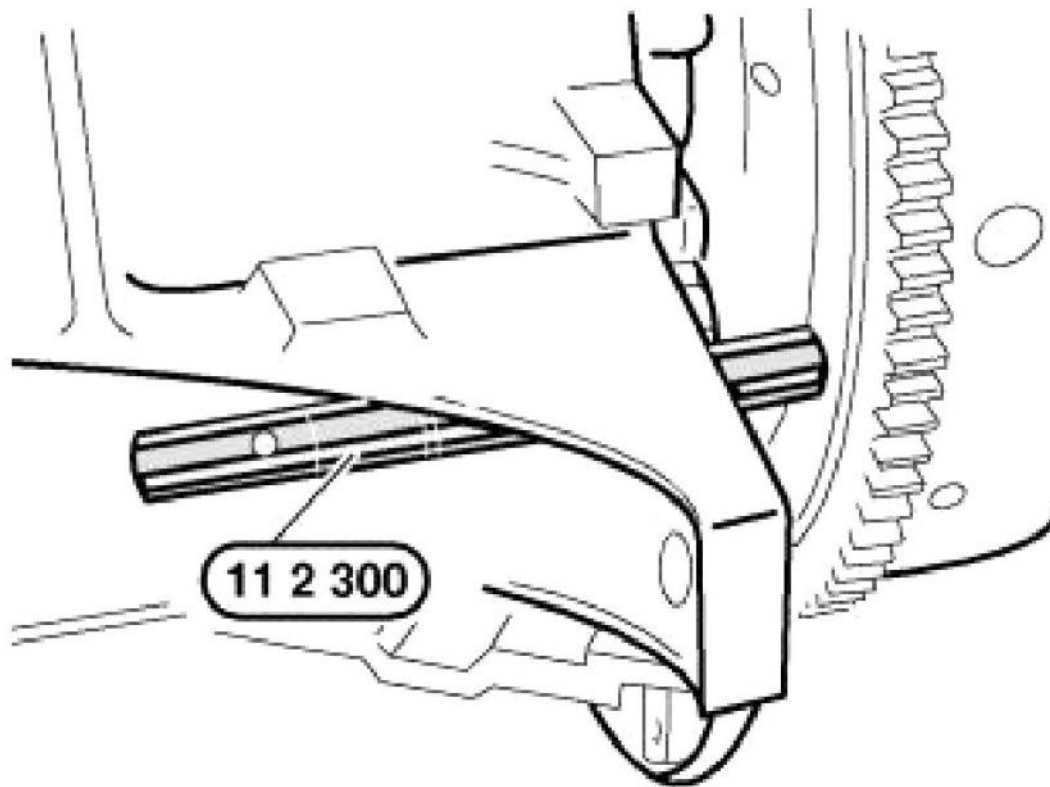
G03164110

Fig. 232: Identifying Cam Tips

Courtesy of BMW OF NORTH AMERICA, INC.

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

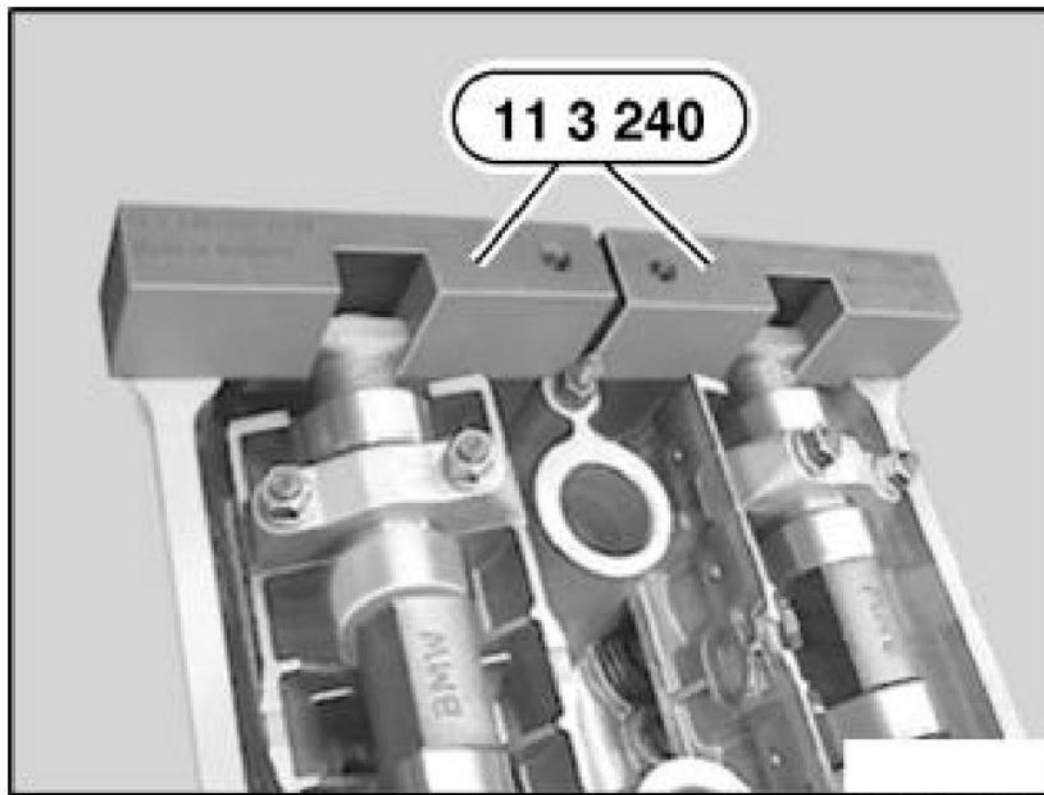
IMPORTANT: Do not turn the engine back. Remove special tool 11 2 300 before switching on the engine.



G03164111

Fig. 233: Removing Special Tool 11 2 300 Before Switching
Courtesy of BMW OF NORTH AMERICA, INC.

Fit special tool 11 3 240 to camshafts.

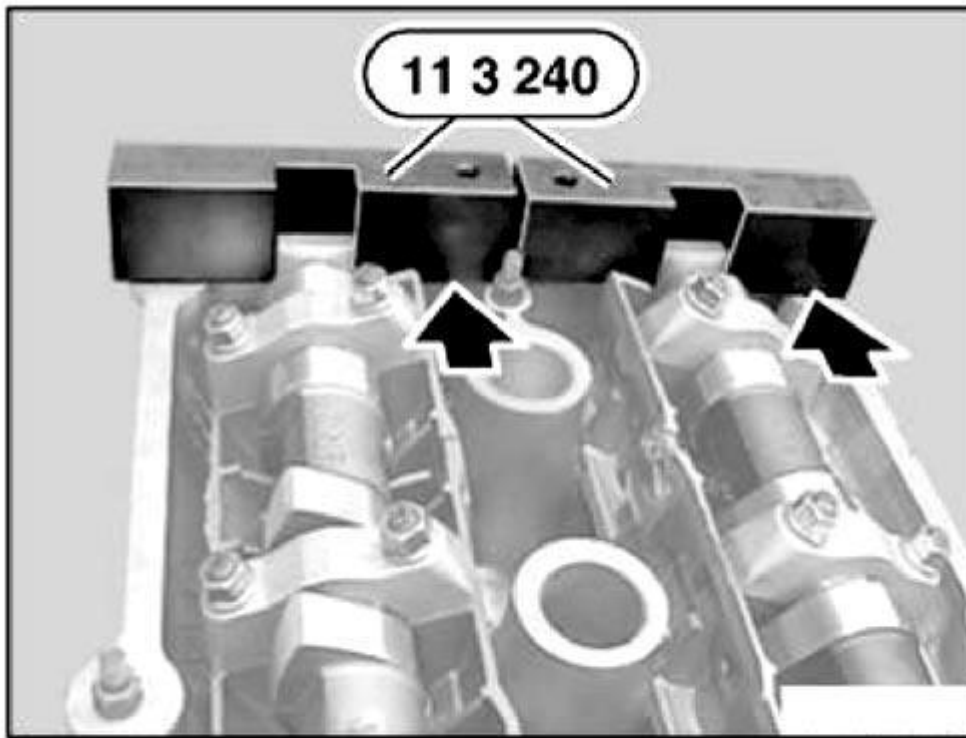


G03164112

Fig. 234: Fitting Special Tool 11 3 240
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.

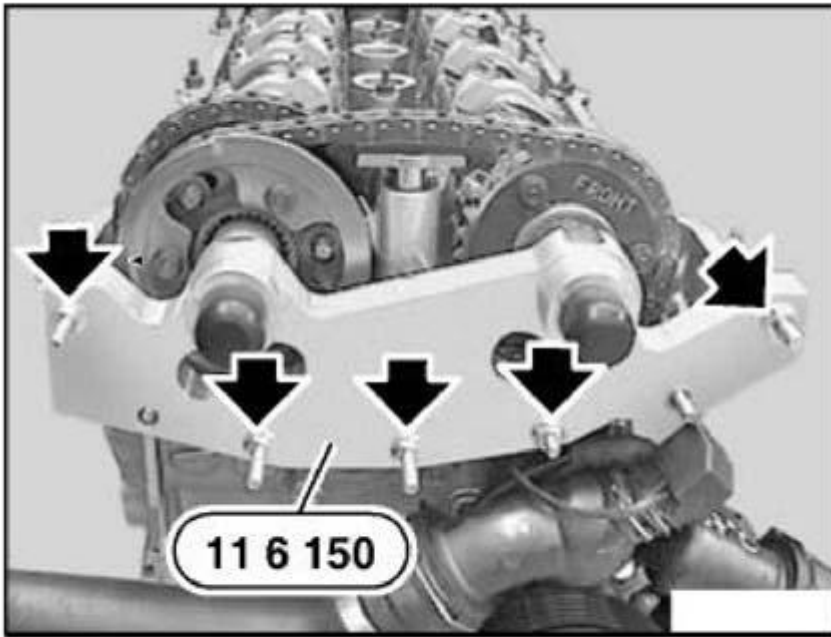
The timing must be reset if the special tool 11 3 240 protrudes to the exhaust side.



G03164113

Fig. 235: Identifying Special Tool 11 3 240
Courtesy of BMW OF NORTH AMERICA, INC.

Remove special tool 11 6 150.



G03164114

Fig. 236: Removing Special Tool 11 6 150
Courtesy of BMW OF NORTH AMERICA, INC.

Install VANOS adjustment unit.

Assemble engine.

11 31 005 CHECKING CAMSHAFT TIMING (M52TU / M54 / M56)

Special tools required:

NOTE: For special tools, refer to ENGINE - SPECIAL TOOLS .

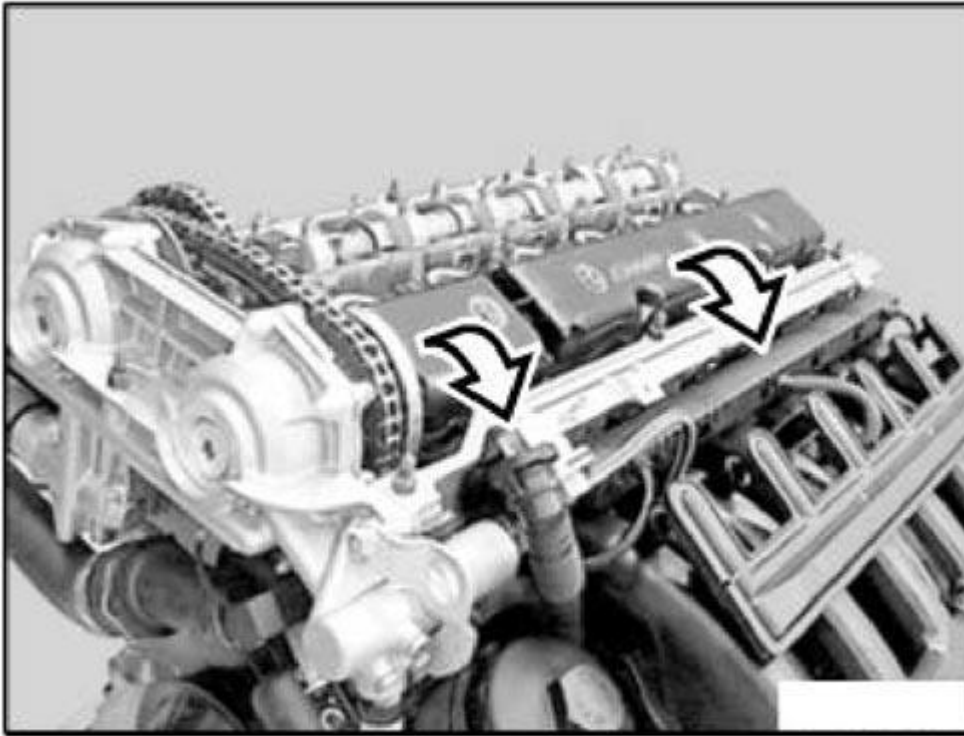
- 00 9 250
- 11 2 300
- 11 3 240
- 11 3 450
- 11 4 220

Necessary preliminary tasks:

- Remove fan impeller with fan clutch. See 11 52 020 Removing and installing/replacing fan clutch (S52 / S54 / M52 / M52TU / M54 / M56)

- E60: Remove fan cowl with electric fan
- Remove cylinder head cover. See **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**

Detach cover for inlet camshaft.

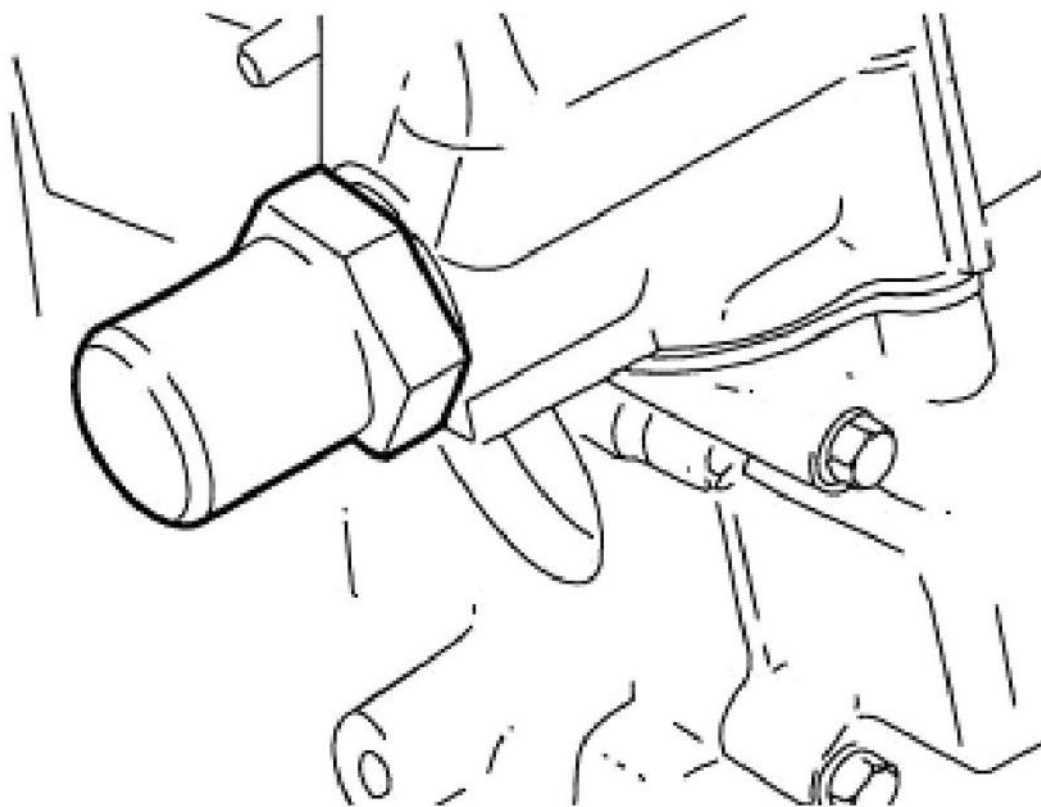


G03164115

Fig. 237: 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.



G03164116

Fig. 238: Removing Cylinder For Chain Tensioning Piston
Courtesy of BMW OF NORTH AMERICA, INC.

Install special tool 11 4 220.

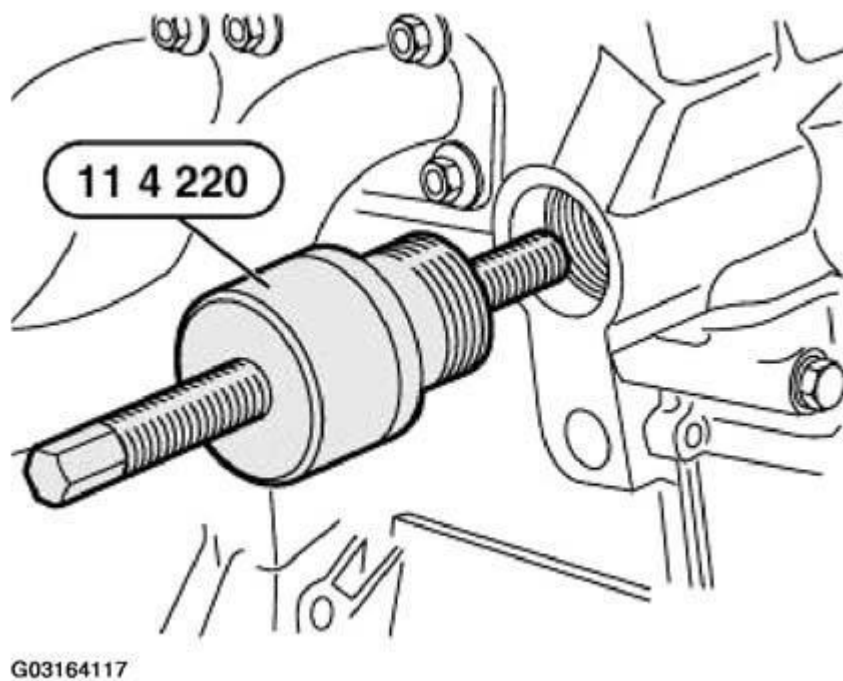
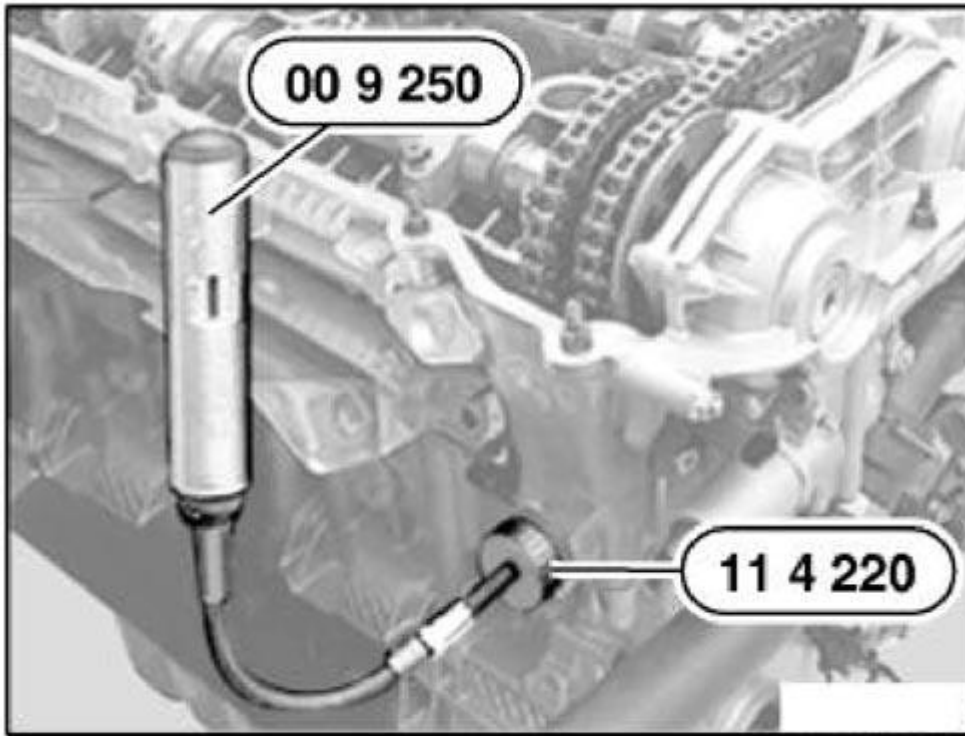


Fig. 239: Installing Special Tool 11 4 220
Courtesy of BMW OF NORTH AMERICA, INC.

Fit adjusting screw to bow cover.

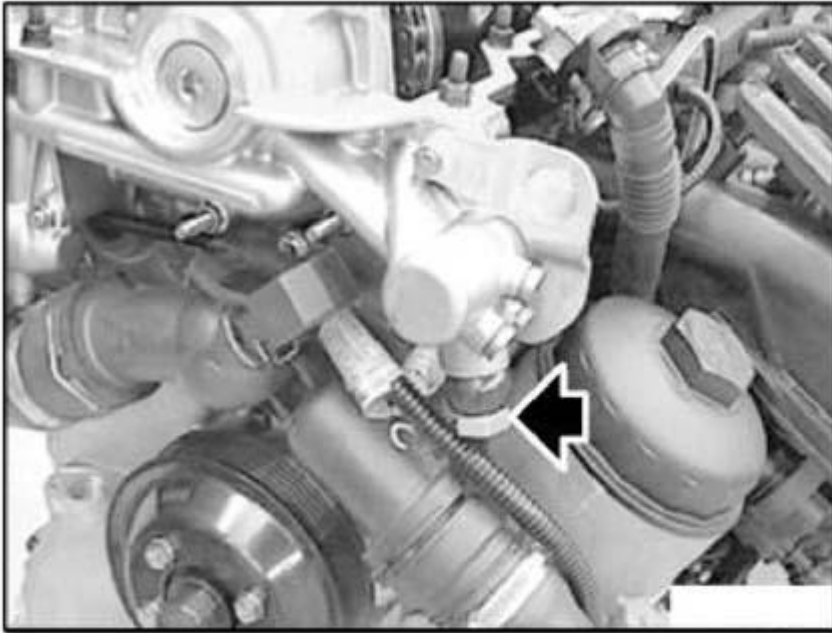
Preload tensioning rail with special tool 11 4 220 by rotating adjusting screw with special tool 00 9 250 or standard torque wrench to 0.7 Nm.



G03164118

Fig. 240: Identifying Special Tool 11 4 220 And 00 9 250
Courtesy of BMW OF NORTH AMERICA, INC.

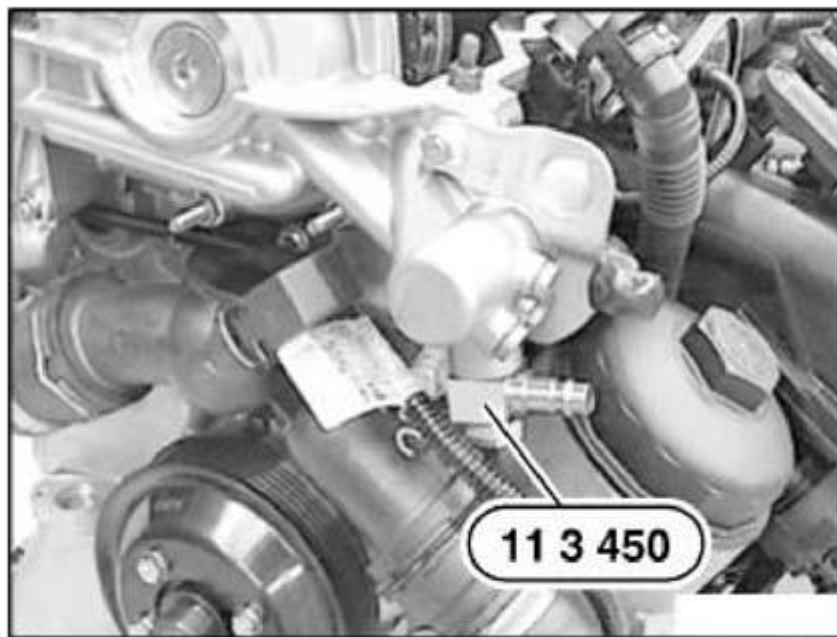
Unscrew oil pressure pipe.



G03164119

Fig. 241: Unscrewing Oil Pressure Pipe
Courtesy of BMW OF NORTH AMERICA, INC.

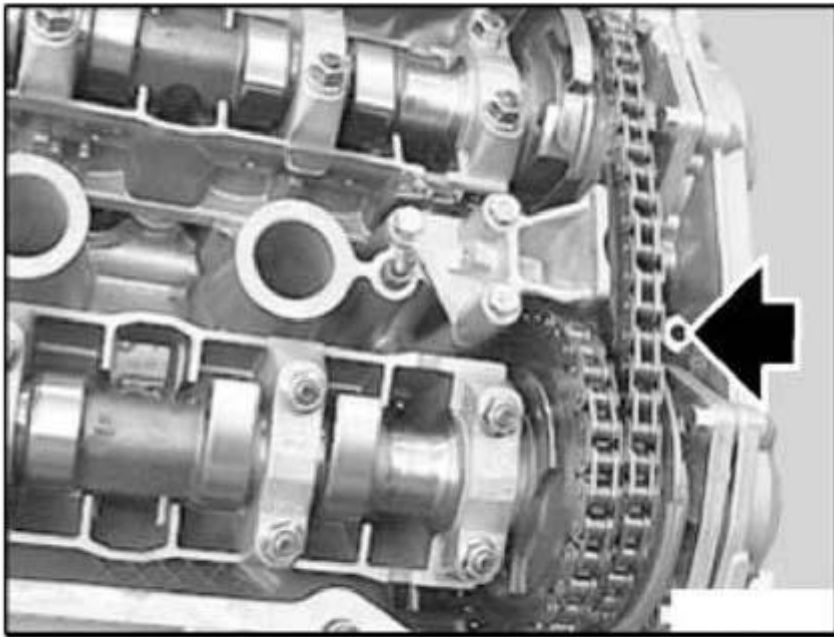
Mount special tool 11 3 450 with banjo bolt of oil pressure line.



G03164120

Fig. 242: Mounting Special Tool 11 3 450
Courtesy of BMW OF NORTH AMERICA, INC.

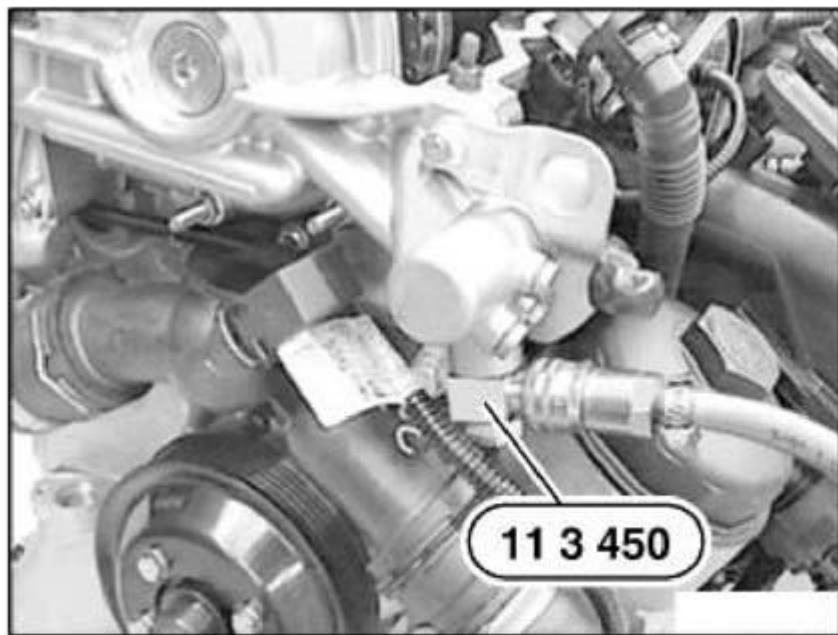
IMPORTANT: Cover double VANOS adjustment unit; when the compressed air supply is connected, several drops of oil are sprayed out of the bore.



G03164121

Fig. 243: Identifying VANOS Adjustment Unit
Courtesy of BMW OF NORTH AMERICA, INC.

Connect compressed air (2 to 8 bar).

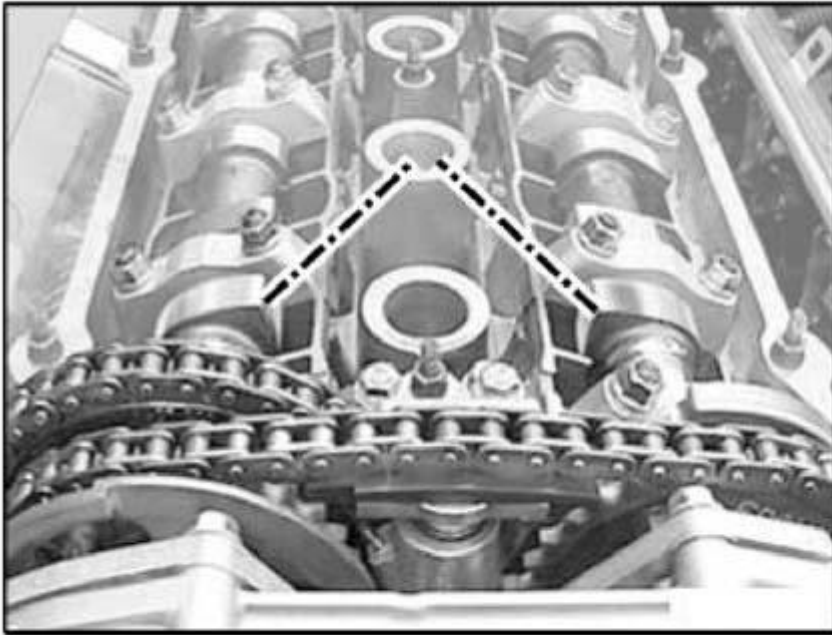


G03164122

Fig. 244: 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.

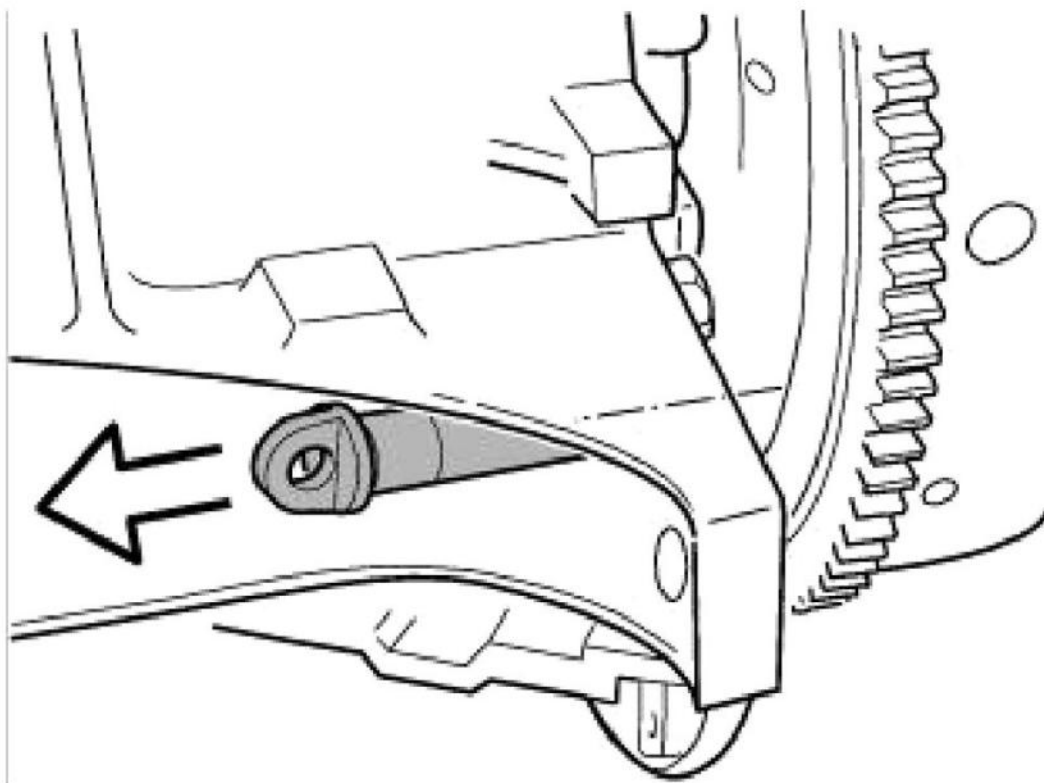


G03164123

Fig. 245: Identifying Cam Tips

Courtesy of BMW OF NORTH AMERICA, INC.

Pull dust guard out of the special tool bore.



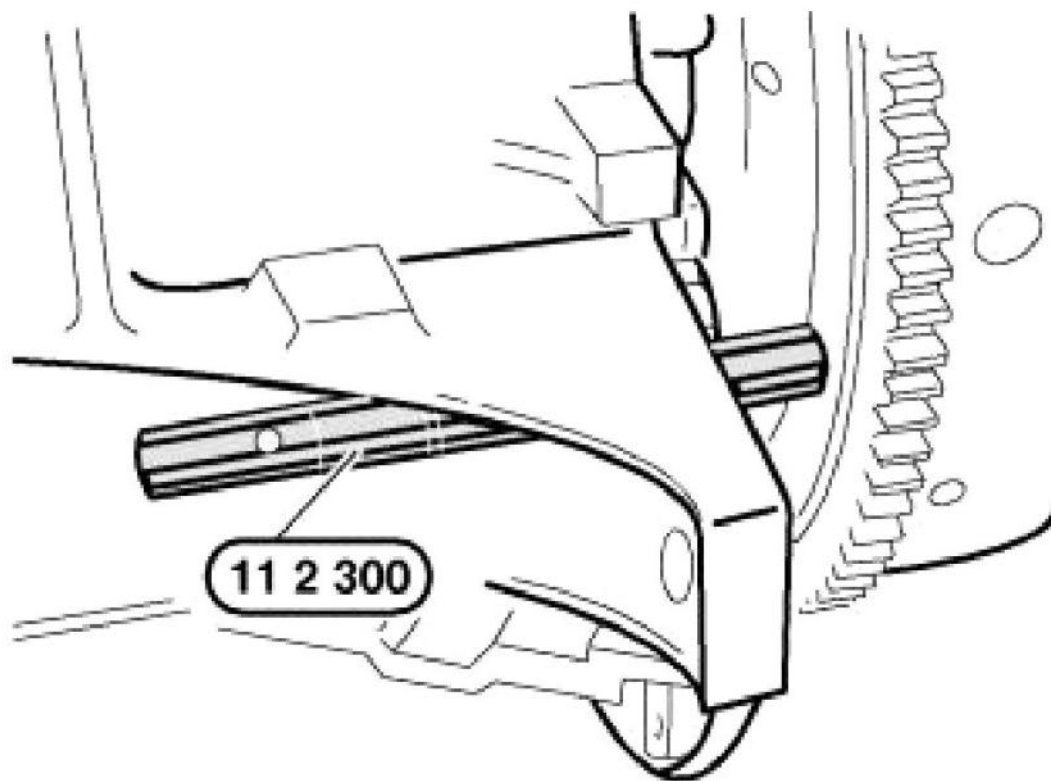
G03164124

Fig. 246: Pulling Dust Guard

Courtesy of BMW OF NORTH AMERICA, INC.

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

IMPORTANT: Do not turn the engine back. Remove special tool 11 2 300 before starting engine.



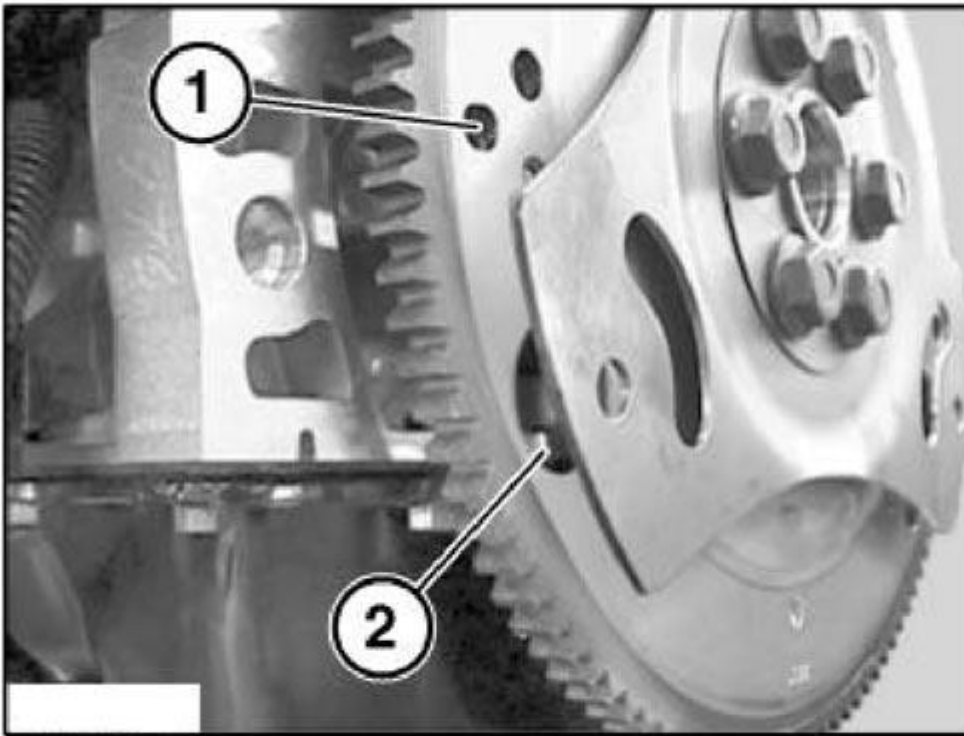
G03164125

Fig. 247: Installing Special Tool 11 2 300
Courtesy of BMW OF NORTH AMERICA, INC.

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)

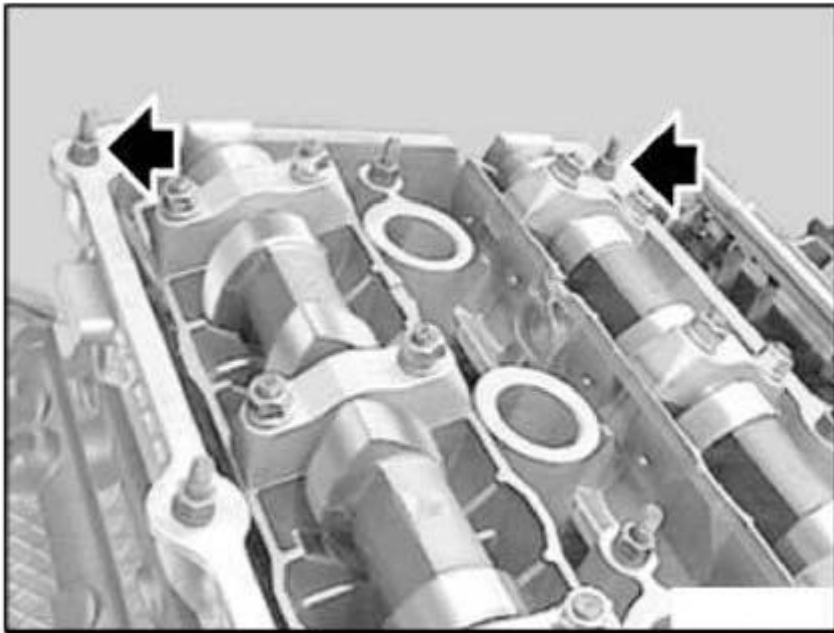


G03164126

Fig. 248: Identifying Special Tool Bore And Large 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.

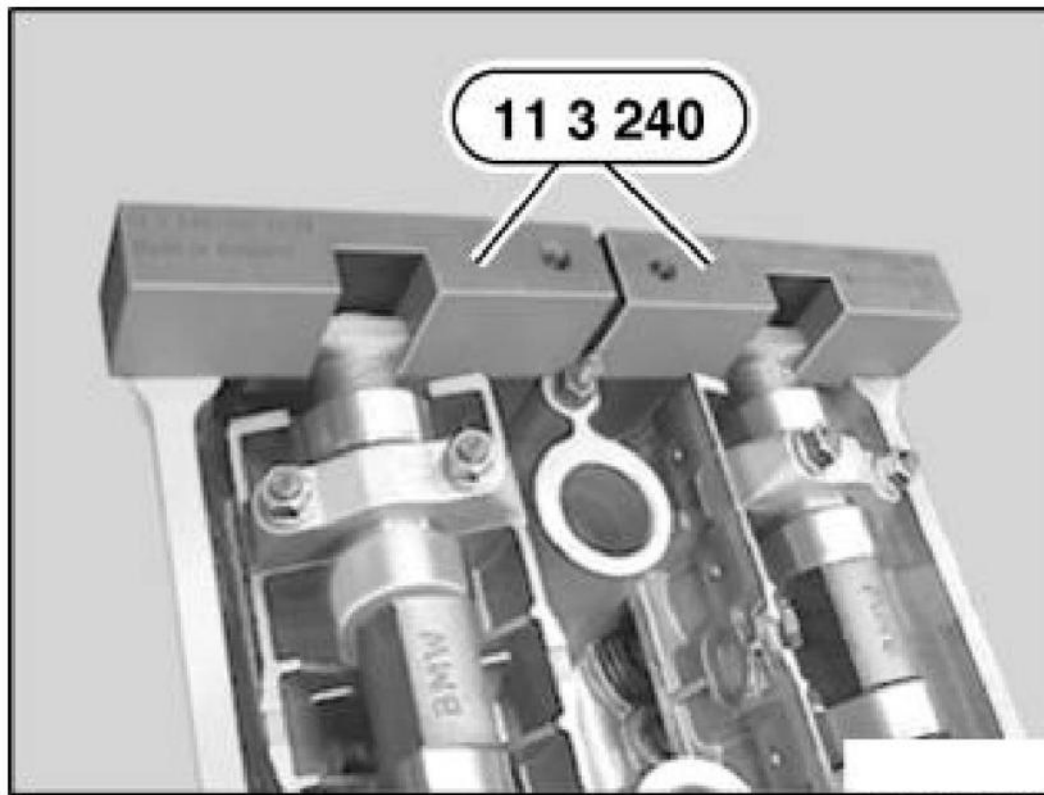


G03164127

Fig. 249: Unscrewing Studs

Courtesy of BMW OF NORTH AMERICA, INC.

Place special tool 11 3 240 on camshafts.

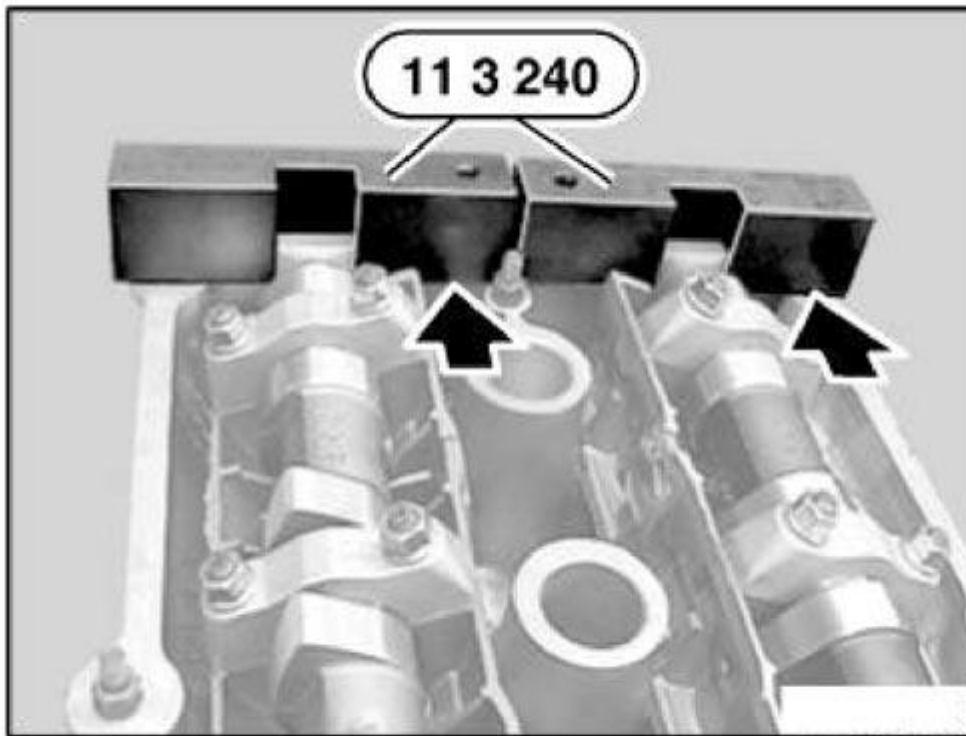


G03164128

Fig. 250: Placing Special Tool 11 3 240
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.

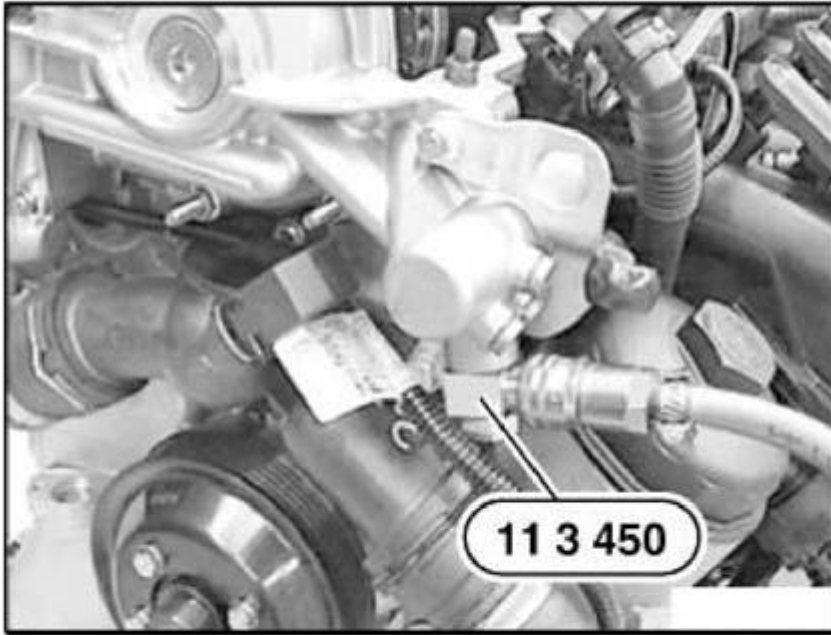


G03164129

Fig. 251: Identifying Special Tool 11 3 240
Courtesy of BMW OF NORTH AMERICA, INC.

If necessary, adjust camshaft timing.

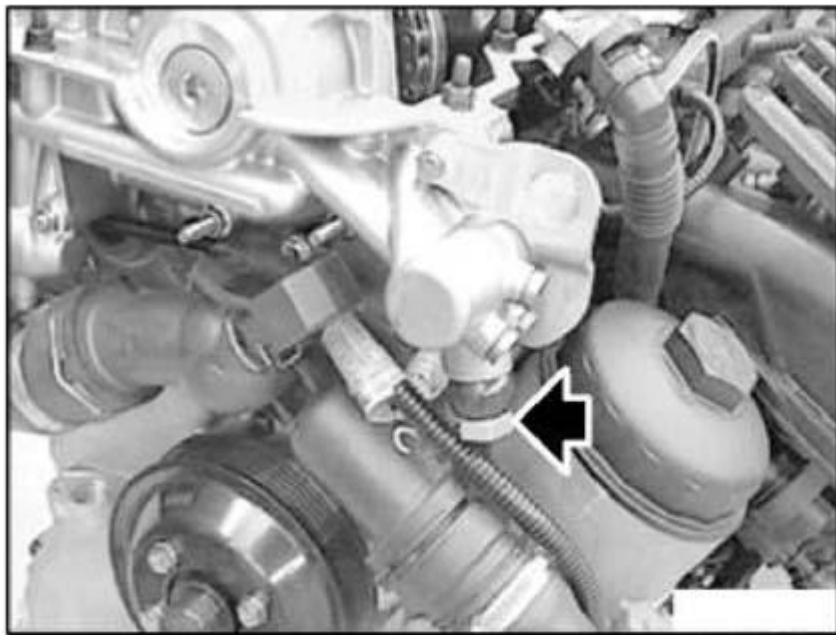
Detach compressed air connection. Remove special tool 11 3 450.



G03164130

Fig. 252: Detaching Compressed Air Connection
Courtesy of BMW OF NORTH AMERICA, INC.

Fit oil pressure line with new seals.

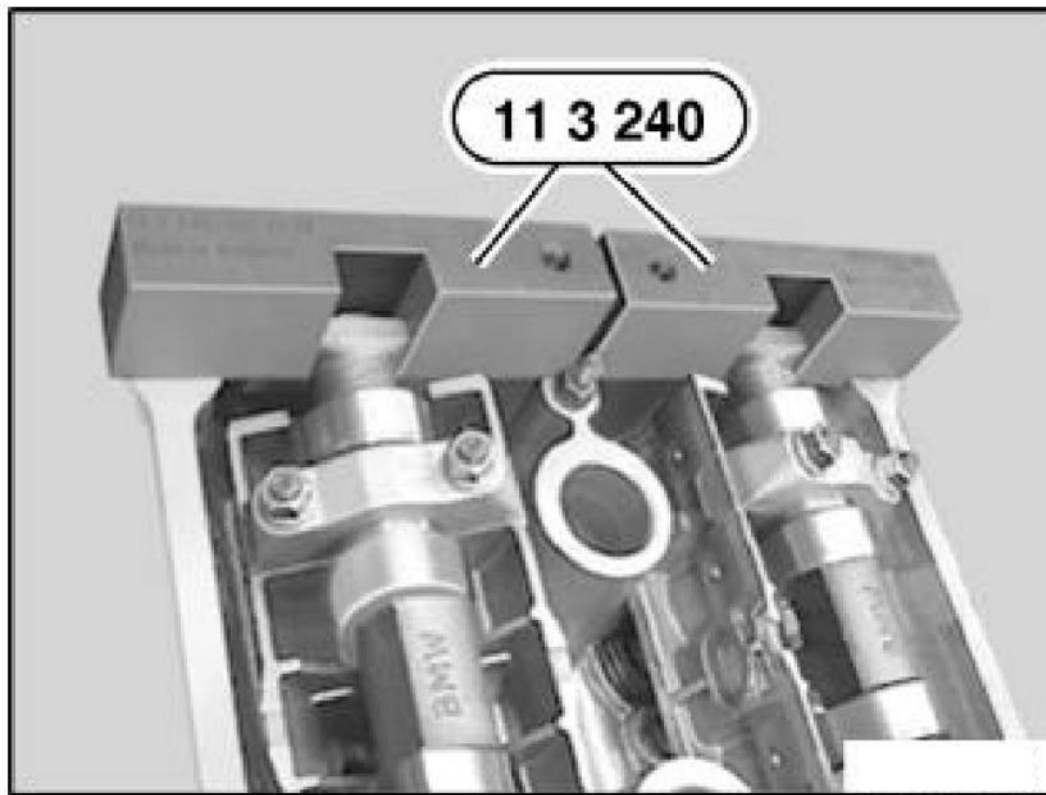


G03164131

Fig. 253: Fitting Oil Pressure Line With New Seals
Courtesy of BMW OF NORTH AMERICA, INC.

Tightening torque, refer to 11 36 2AZ in **ENGINE - TIGHTENING TORQUES** .

Remove special tool 11 3 240.

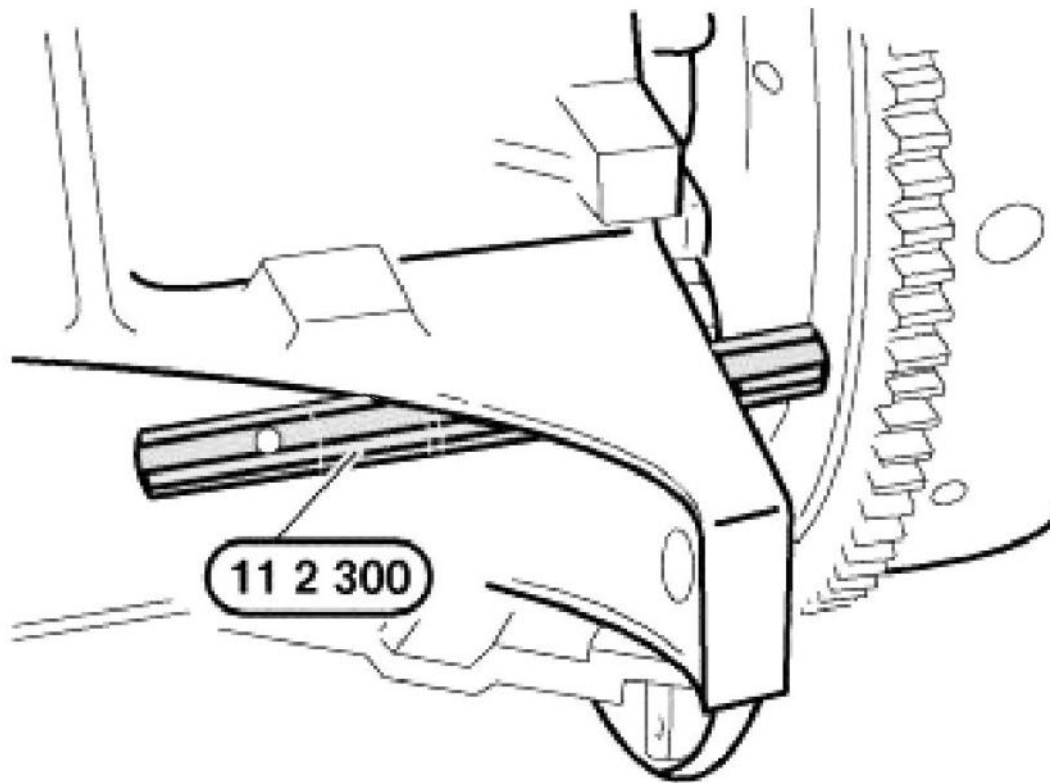


G03164132

Fig. 254: Removing Special Tool 11 3 240
Courtesy of BMW OF NORTH AMERICA, INC.

Remove special tool 11 2 300.

Install dust guard from inspection bore.



G03164133

Fig. 255: Installing Dust Guard From Inspection Bore
Courtesy of BMW OF NORTH AMERICA, INC.

Unfasten and remove special tool 11 4 220.

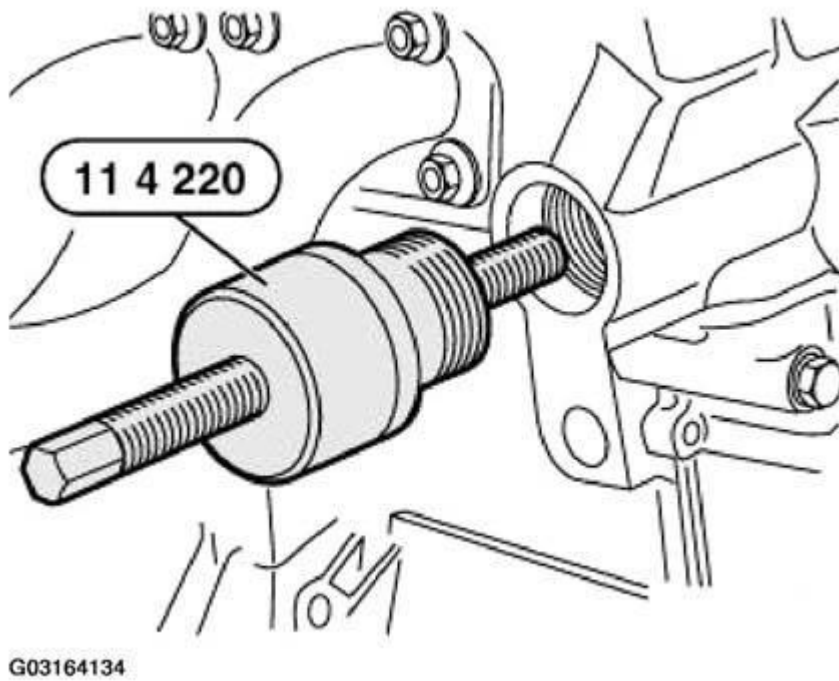
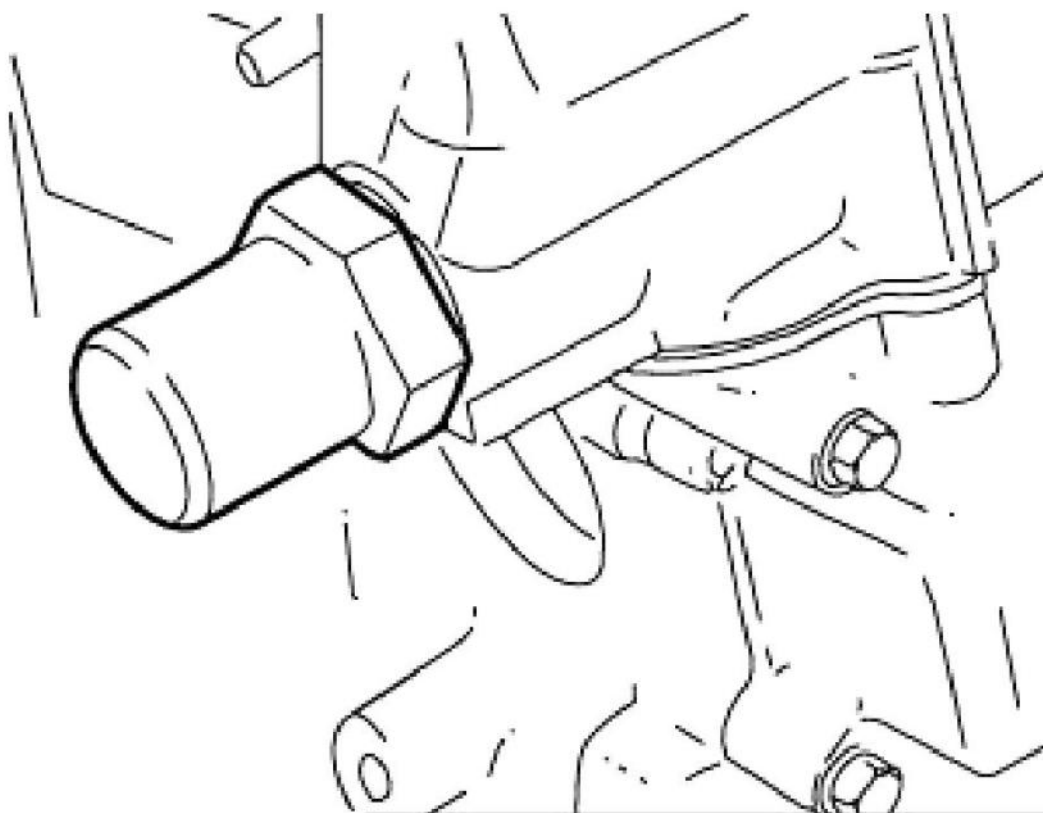


Fig. 256: Unfastening And Removing Special Tool 11 4 220
Courtesy of BMW OF NORTH AMERICA, INC.

Install cylinder for chain tensioning piston.



G03164135

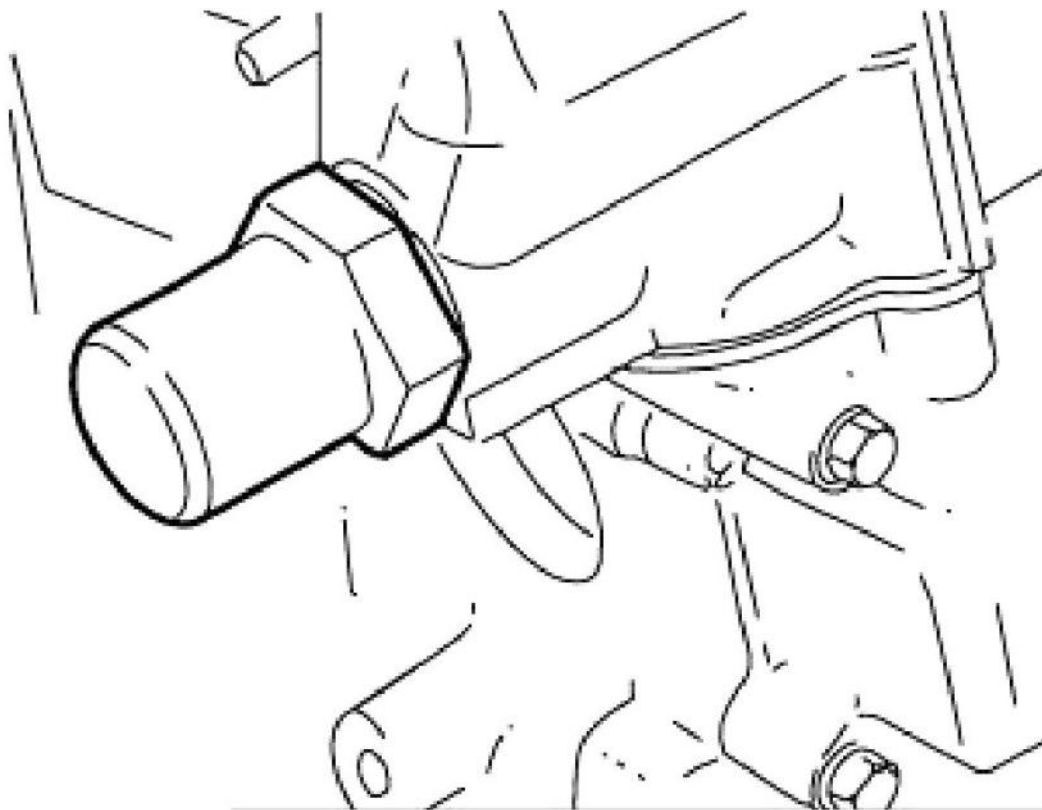
Fig. 257: Identifying Cylinder For Chain Tensioning Piston
Courtesy of BMW OF NORTH AMERICA, INC.

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.



G03164136

Fig. 258: Identifying Cylinder For Chain Tensioning Piston
Courtesy of BMW OF NORTH AMERICA, INC.

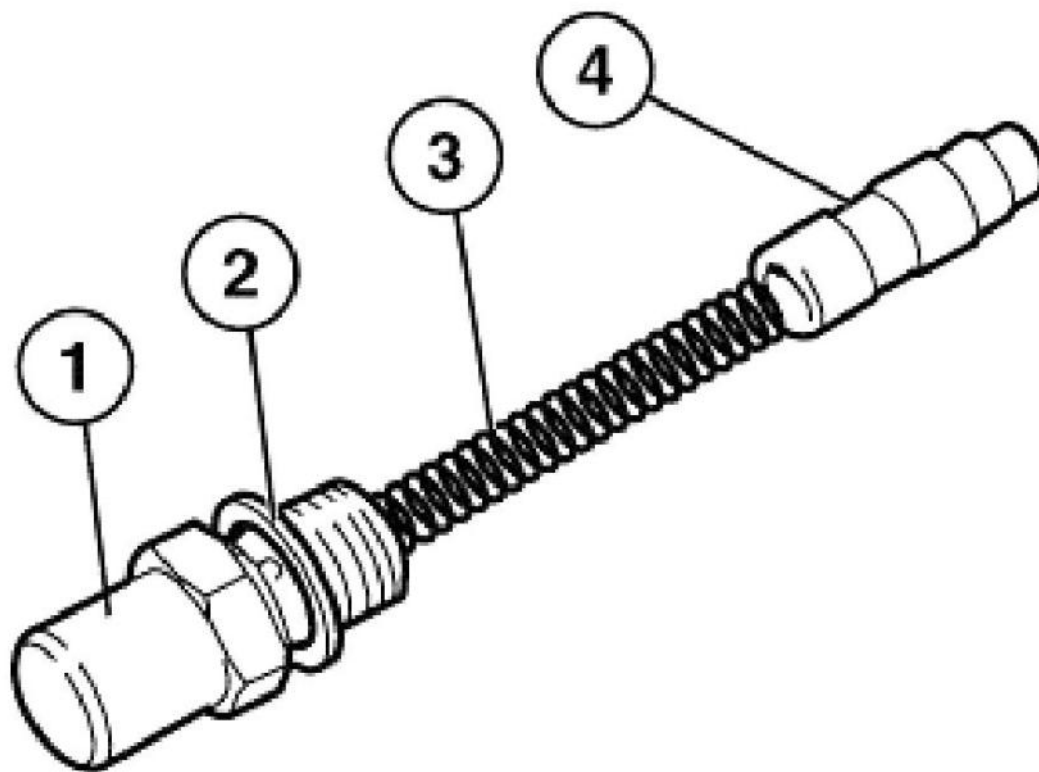
Installation:

Replace sealing ring.

Tightening torque, refer to 11 31 8AZ in **ENGINE - TIGHTENING TORQUES** .

Arrangement of components:

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



G03164137

Fig. 259: Identifying Sealing Ring And Spring
Courtesy of BMW OF NORTH AMERICA, INC.

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

Special tools required:

NOTE: For special tools, refer to ENGINE - SPECIAL TOOLS .

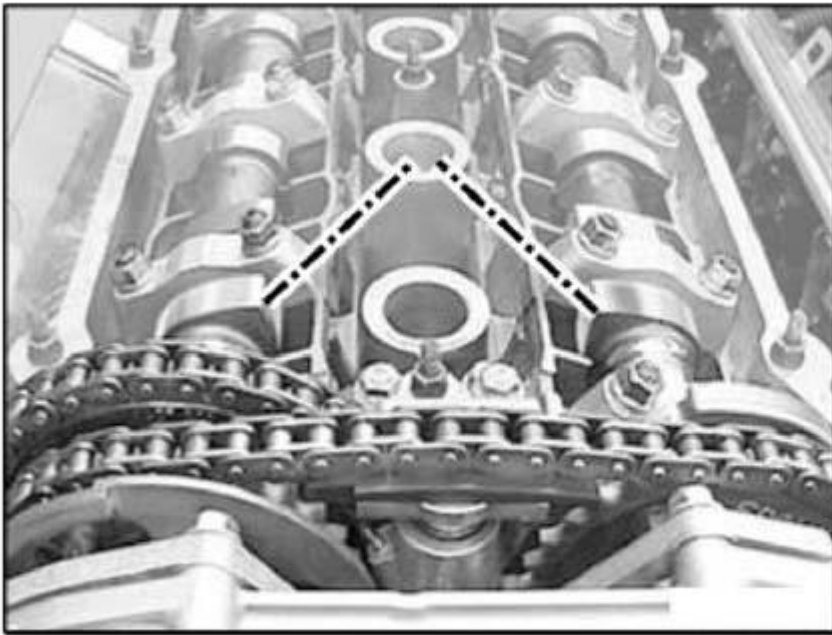
- 00 9 250
- 11 2 300
- 11 3 240
- 11 3 244
- 11 3 292
- 11 4 220
- 11 5 180
- 11 6 150

(refer to **OPERATION NO. 11 31 005**)

Before carrying out adjustment work:

Check camshaft timing.

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



G03164138

Fig. 260: Identifying Cam Tips

Courtesy of BMW OF NORTH AMERICA, INC.

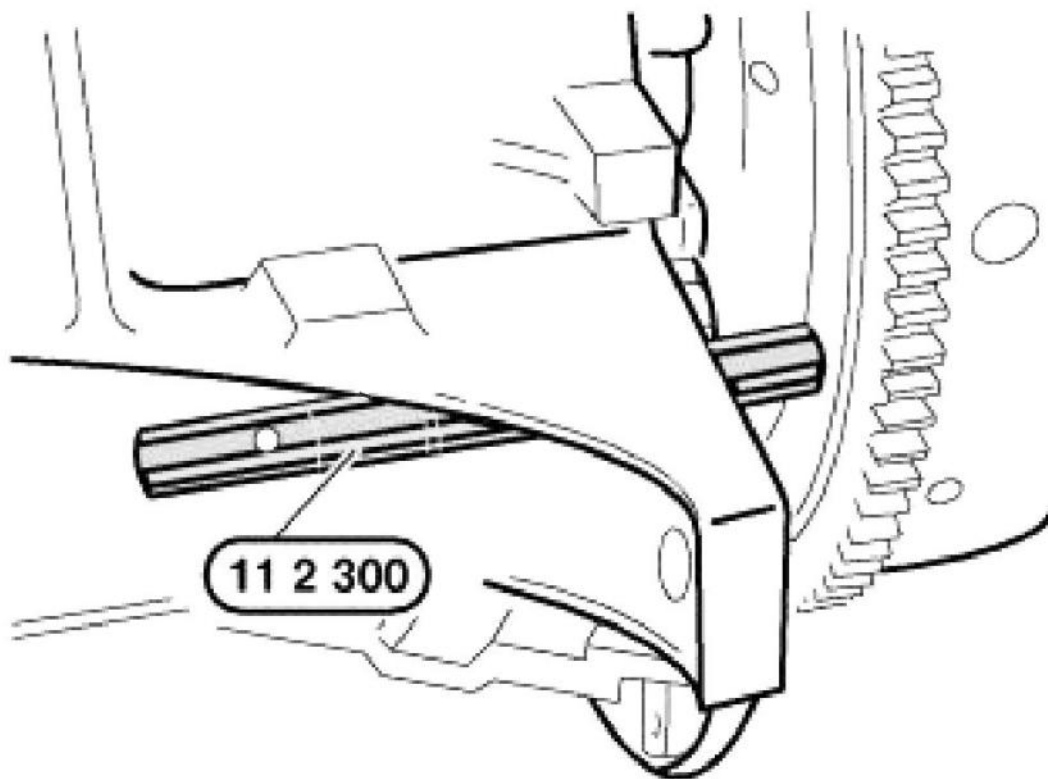
Secure crankshaft with special tool 11 2 300 in TDC position of 1st cylinder.

X3 only:

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

IMPORTANT: Do not turn the engine back.

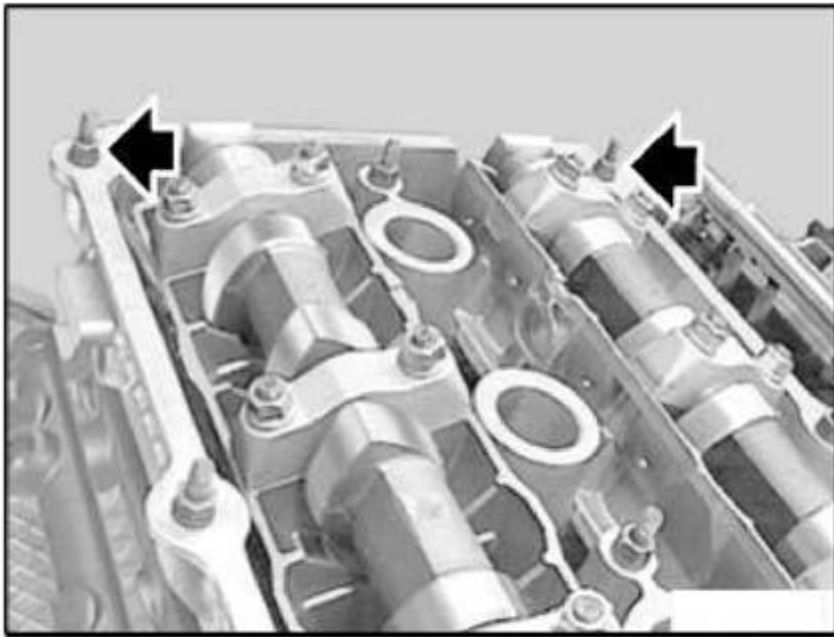
Remove special tools 11 2 300/11 5 180 before starting engine.



G03164139

Fig. 261: Identifying Special Tool 11 2 300
Courtesy of BMW OF NORTH AMERICA, INC.

Unscrew studs.



G03164140

Fig. 262: Unscrewing Studs**Courtesy of BMW OF NORTH AMERICA, INC.**

Remove double VANOS adjustment unit.

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

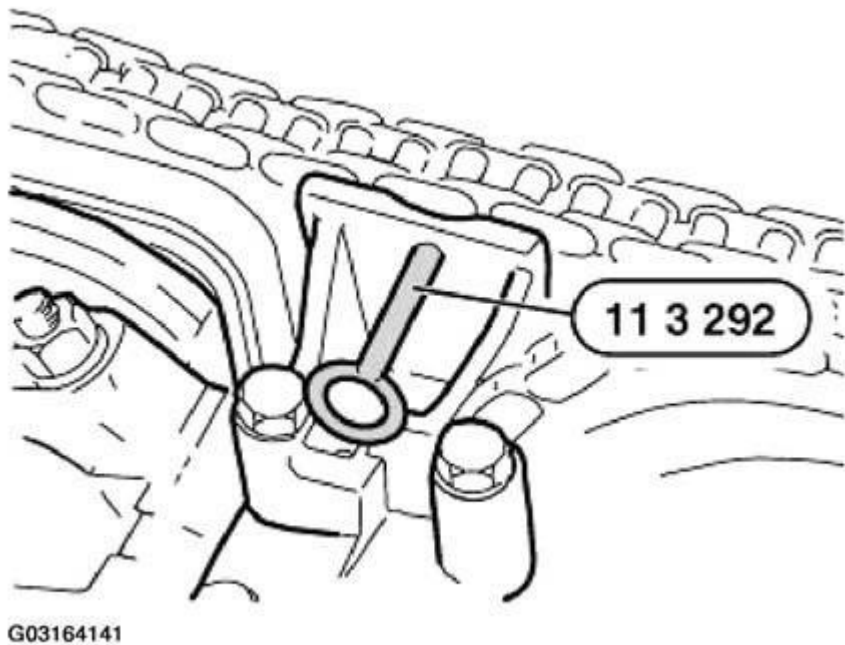
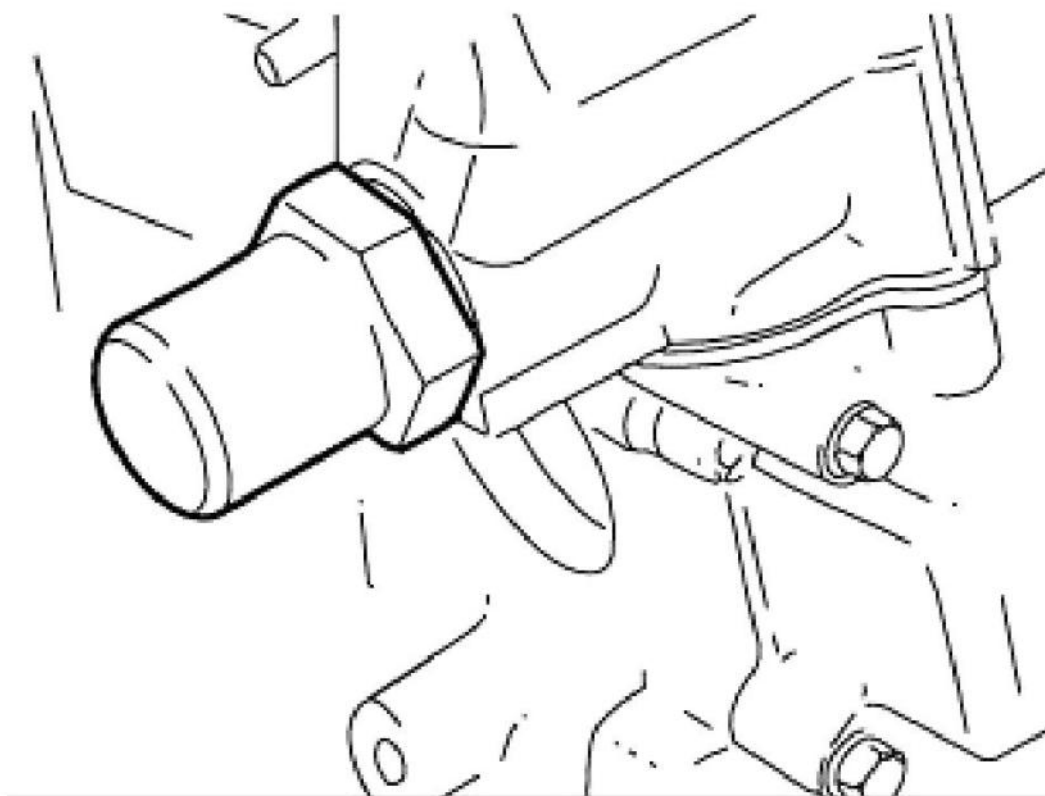


Fig. 263: Pressing Down Top Of Chain Tensioner And Lock Off With Special Tool
Courtesy of BMW OF NORTH AMERICA, INC.

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

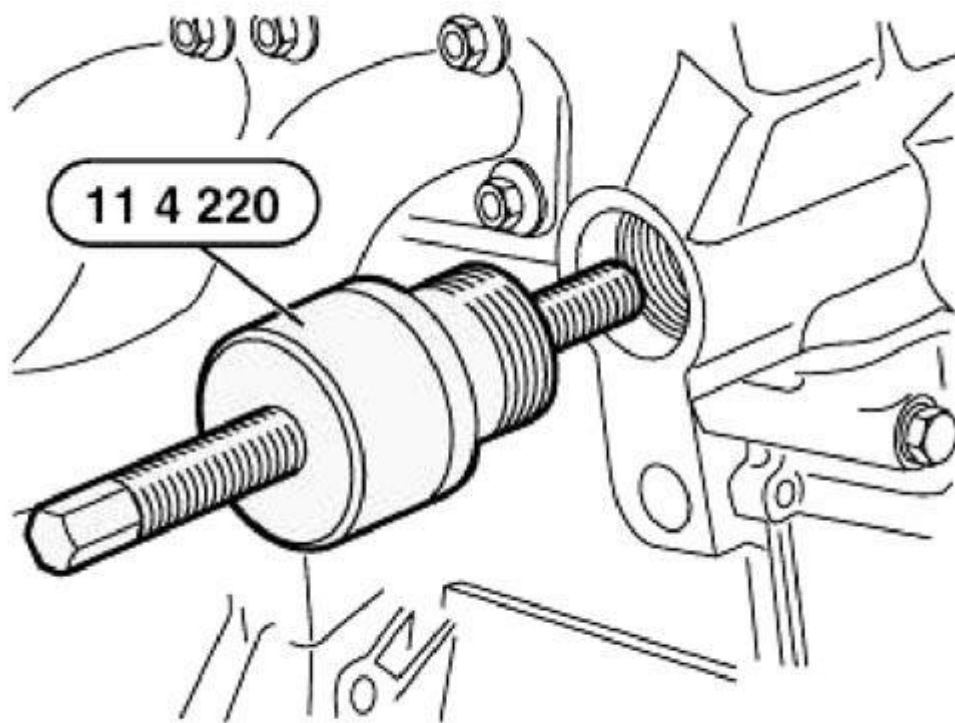
Remove cylinder for chain tensioning piston.



G03164142

Fig. 264: Removing Cylinder For Chain Tensioning Piston
Courtesy of BMW OF NORTH AMERICA, INC.

Install special tool 11 4 220.

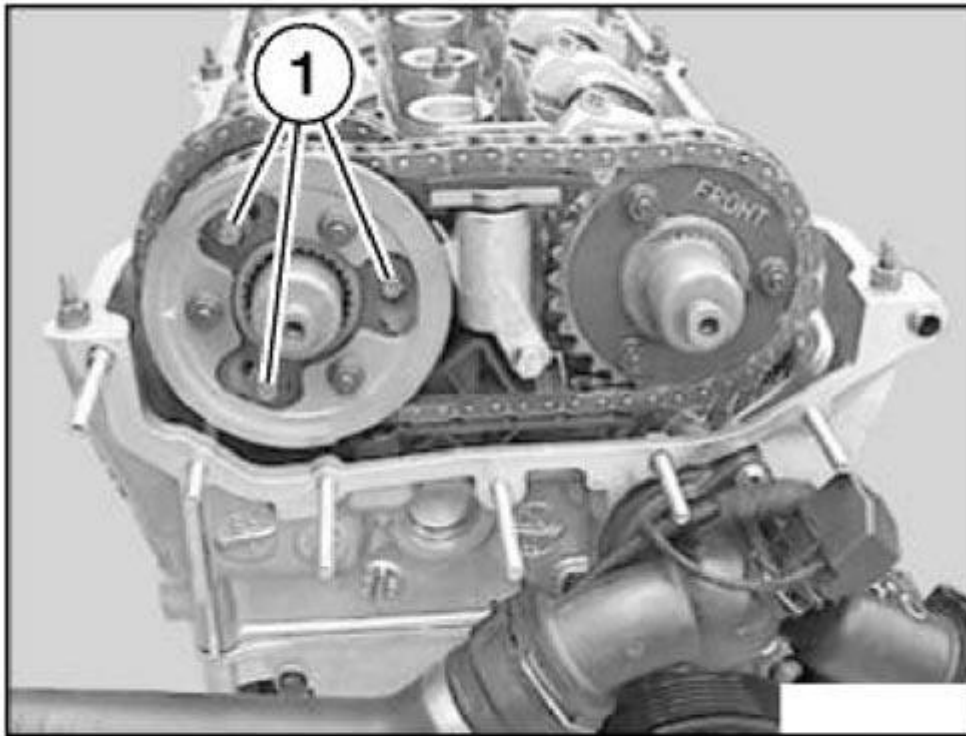


G03164143

Fig. 265: Installing Special Tool 11 4 220
 Courtesy of BMW OF NORTH AMERICA, INC.

Fit adjusting screw to bow cover.

Release screws (1) by half a turn.

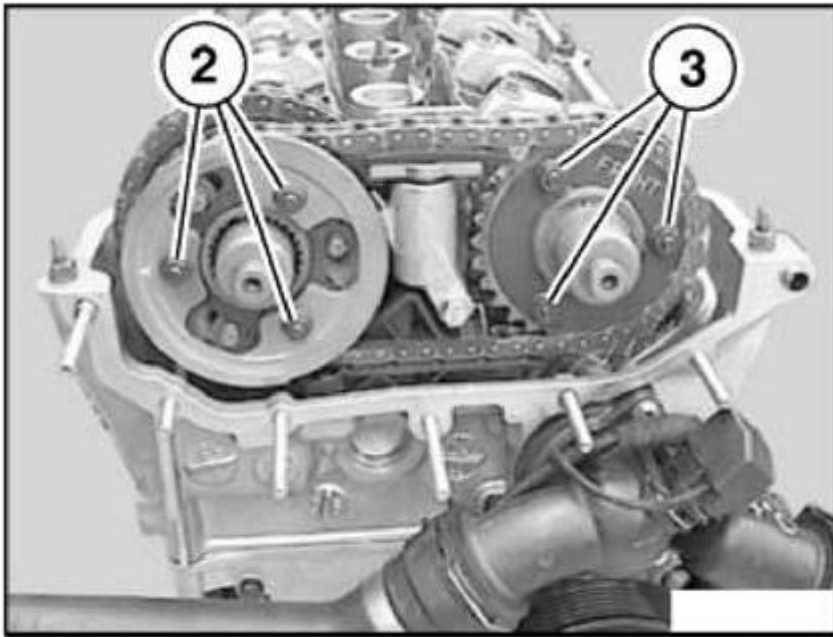


G03164144

Fig. 266: Releasing Screws**Courtesy of BMW OF NORTH AMERICA, INC.**

Release nuts (2) by two turns.

Release nuts (3) by one turn.



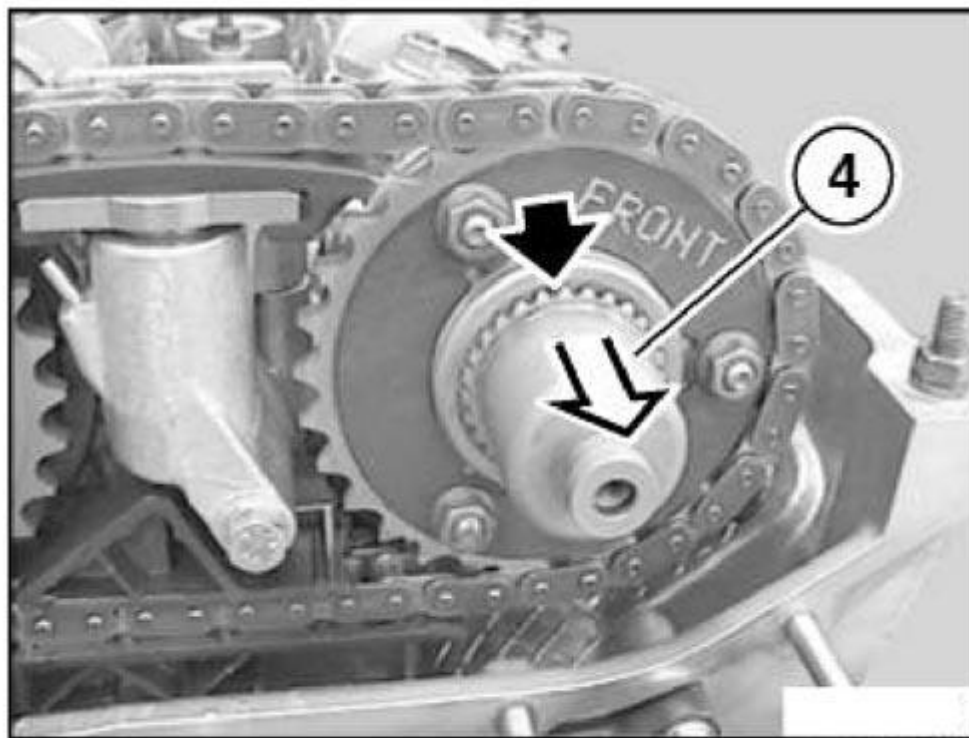
G03164145

Fig. 267: Releasing Nuts

Courtesy of BMW OF NORTH AMERICA, INC.

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

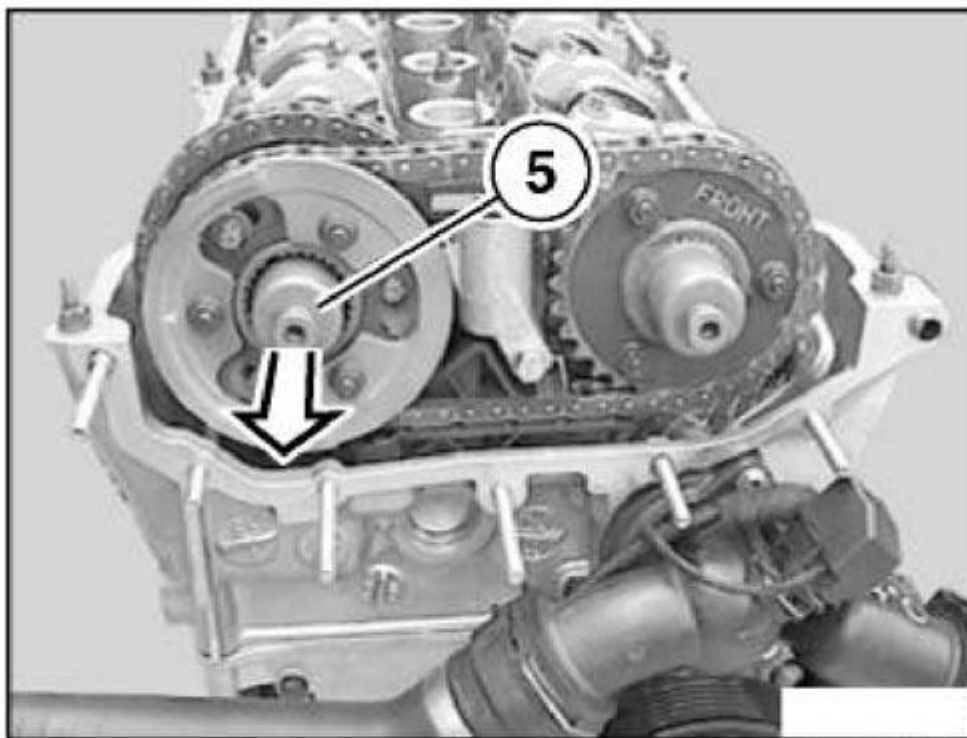
Pull out toothed shaft (4) until approx. 1 mm of splines can be seen.



G03164146

Fig. 268: Pulling Out Toothed Shaft
Courtesy of BMW OF NORTH AMERICA, INC.

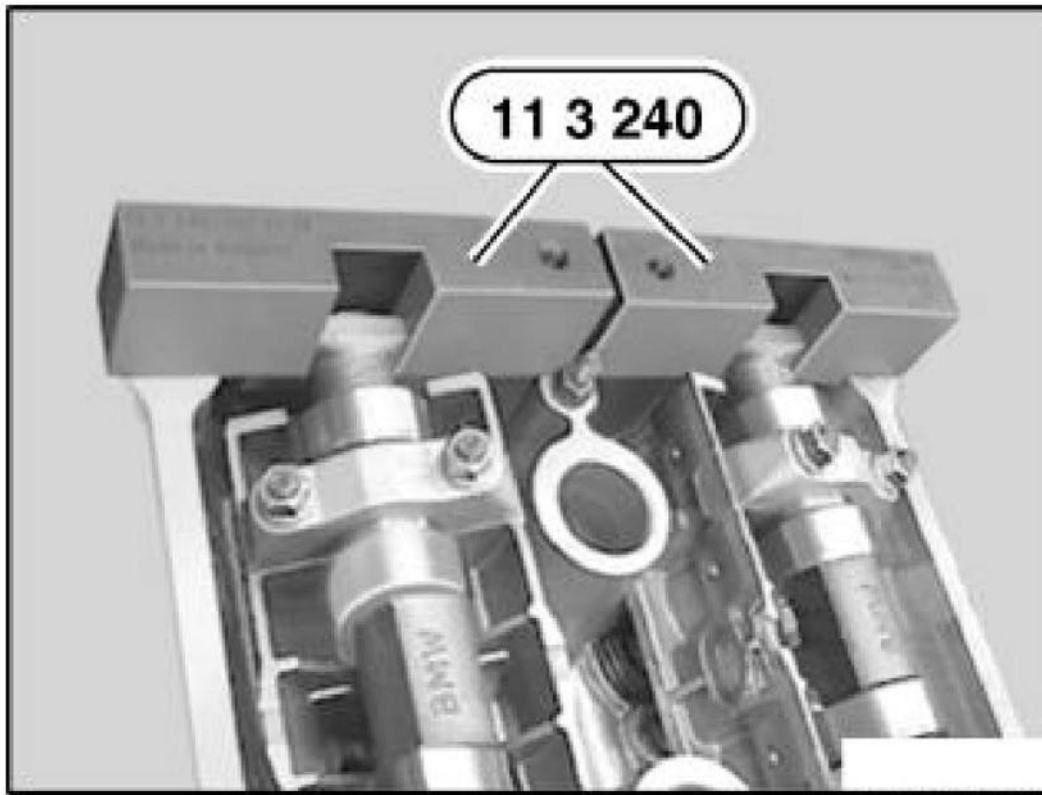
Withdraw toothed shaft (5) up to stop.



G03164147

Fig. 269: Removing Toothed Shaft
Courtesy of BMW OF NORTH AMERICA, INC.

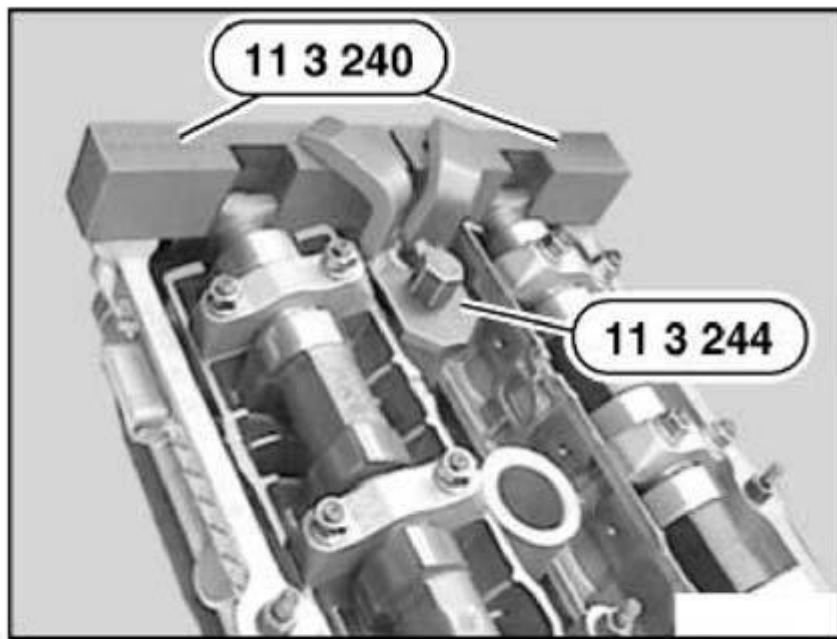
Fit special tool 11 3 240 to camshafts on cylinder 6. Align camshafts so that special tool 11 3 240 rests without gaps on cylinder head.



G03164148

Fig. 270: Fitting Special Tool 11 3 240
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.



G03164149

Fig. 271: Attaching Special Tools 11 3 244 And 11 3 240
Courtesy of BMW OF NORTH AMERICA, INC.

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

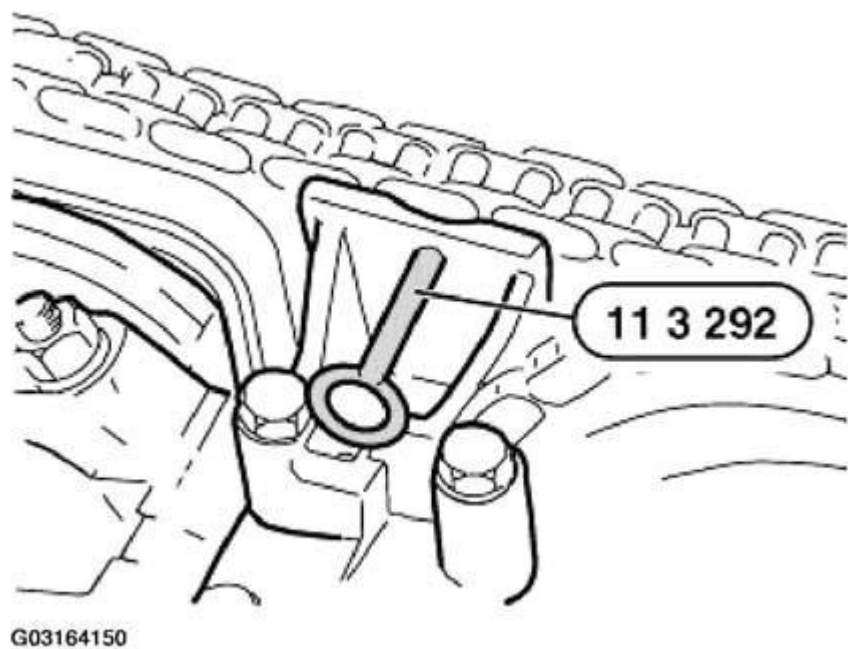
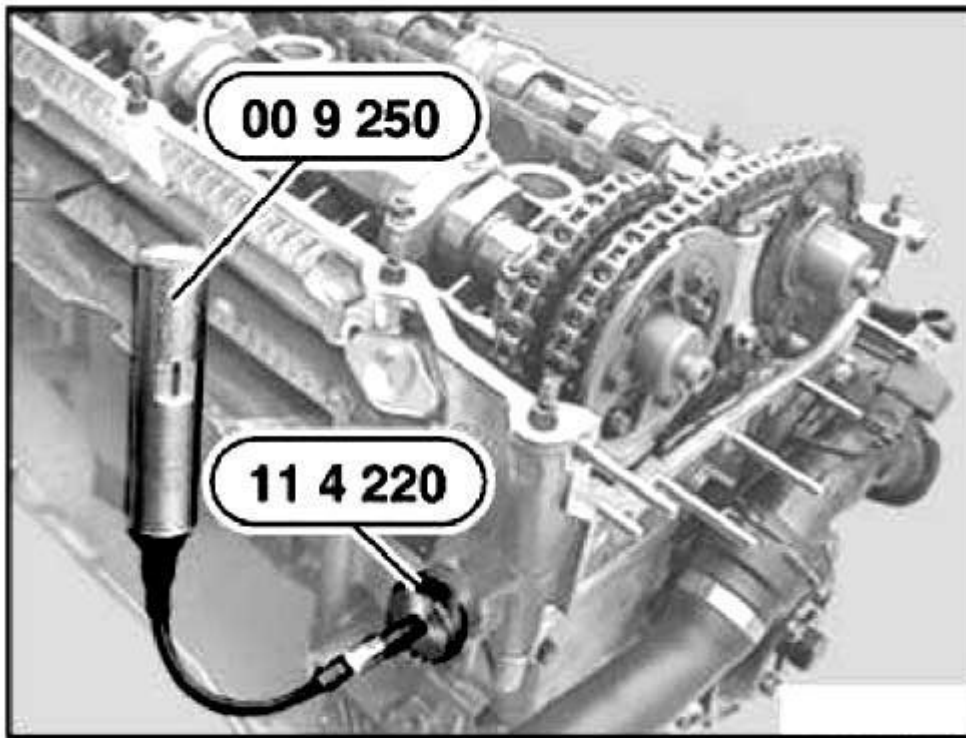


Fig. 272: Pressing Down Chain Tensioner At Top And Removing Special Tool
Courtesy of BMW OF NORTH AMERICA, INC.

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 Nm.

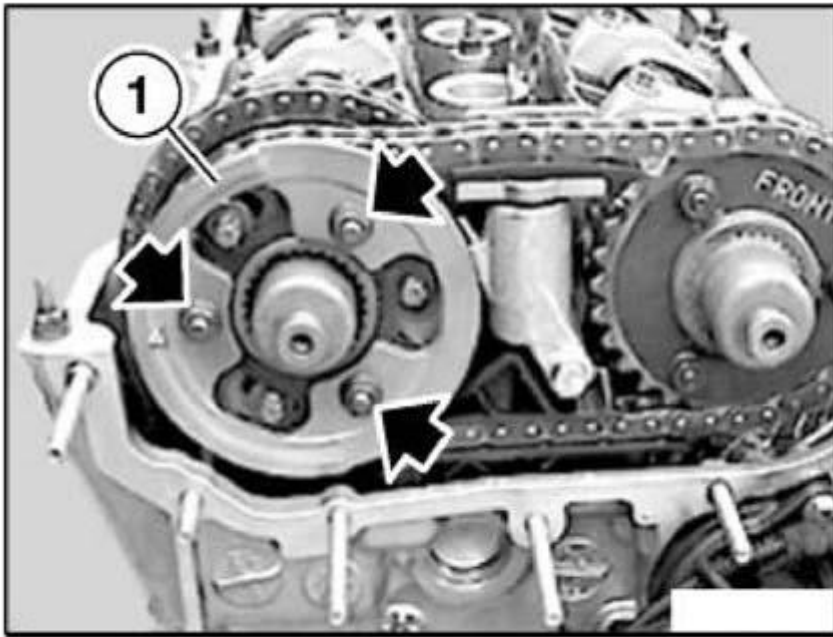


G03164151

Fig. 273: Identifying Special Tools 11 4 220 And 00 9 250
Courtesy of BMW OF NORTH AMERICA, INC.

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

IMPORTANT: Do not tighten down nuts fully.



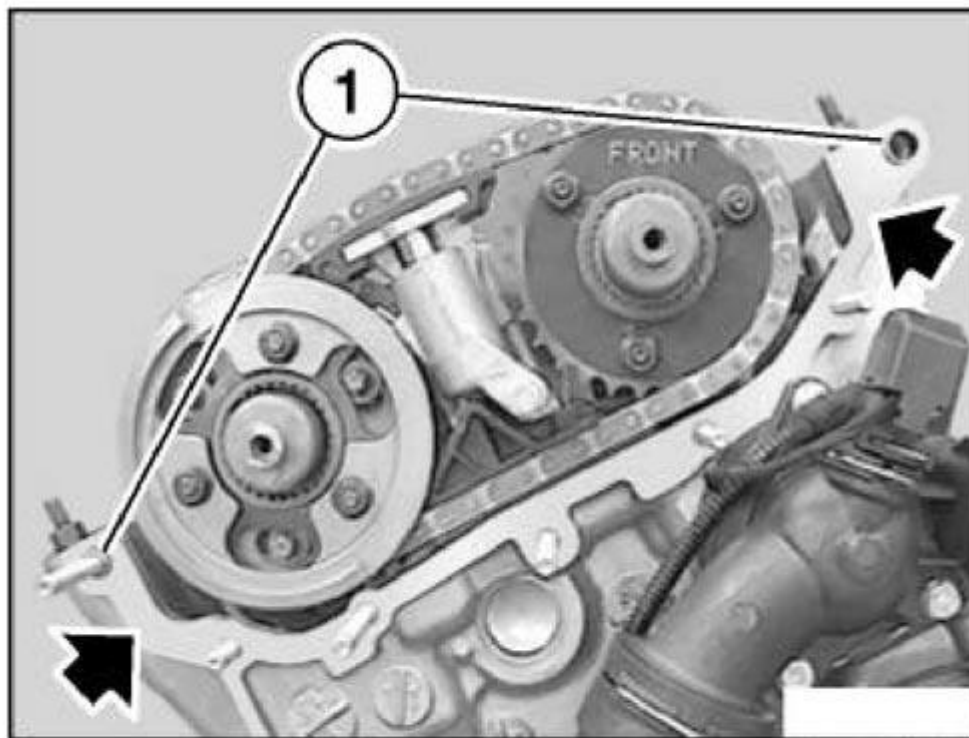
G03164152

Fig. 274: Identifying Sensor Gear
Courtesy of BMW OF NORTH AMERICA, INC.

Remove gasket.

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

Keep sealing face clean and free of oil.



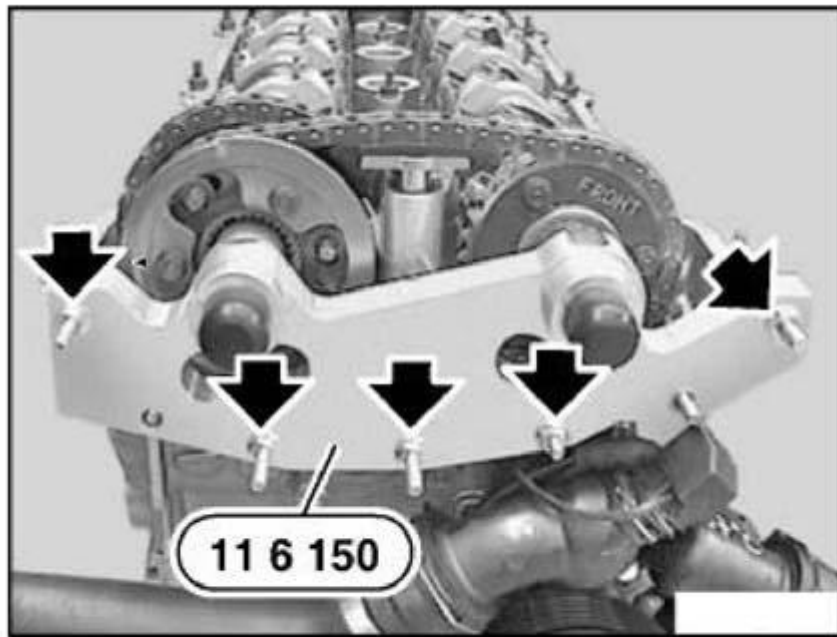
G03164153

Fig. 275: Checking Dowel Sleeves

Courtesy of BMW OF NORTH AMERICA, INC.

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.

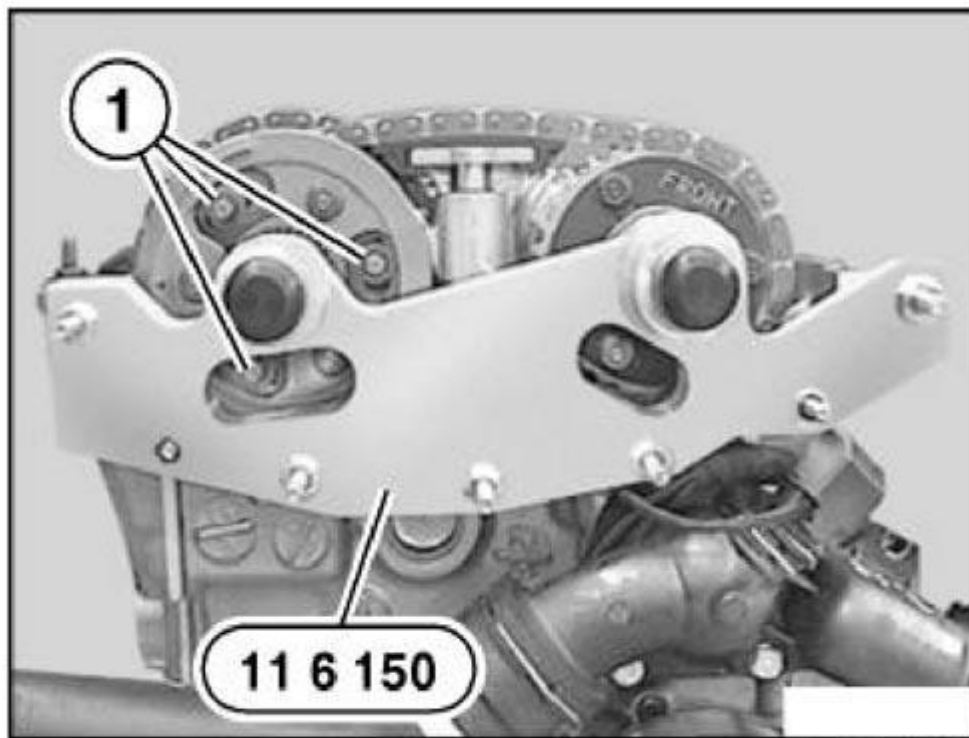
Attach special tool 11 6 150 "without gasket", tighten nuts by hand and then tighten down uniformly until special tool 11 6 150 is in full contact with cylinder head.



G03164154

Fig. 276: Attaching Special Tool 11 6 150
Courtesy of BMW OF NORTH AMERICA, INC.

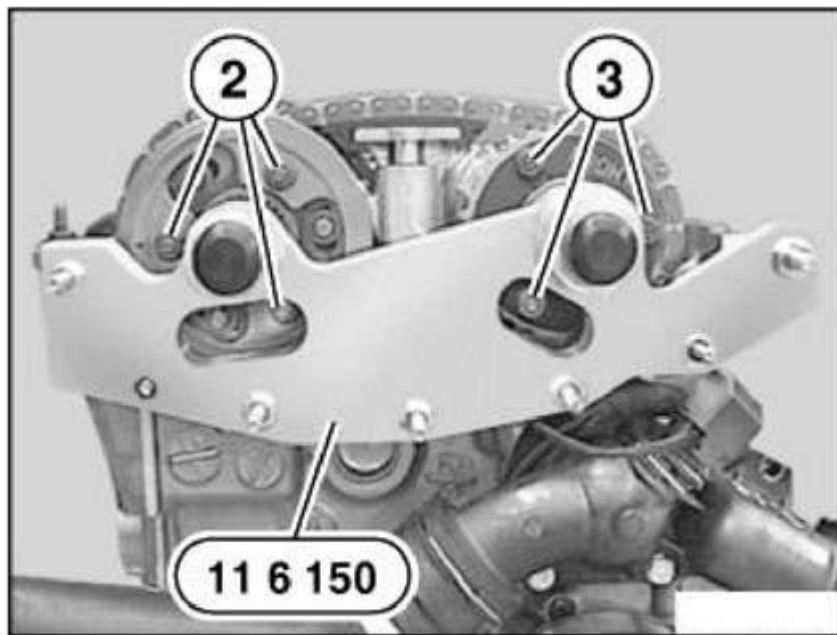
Insert screws (1) on exhaust side and initially tighten to approx. 5 Nm.



G03164155

Fig. 277: Inserting Screws On Exhaust Side
Courtesy of BMW OF NORTH AMERICA, INC.

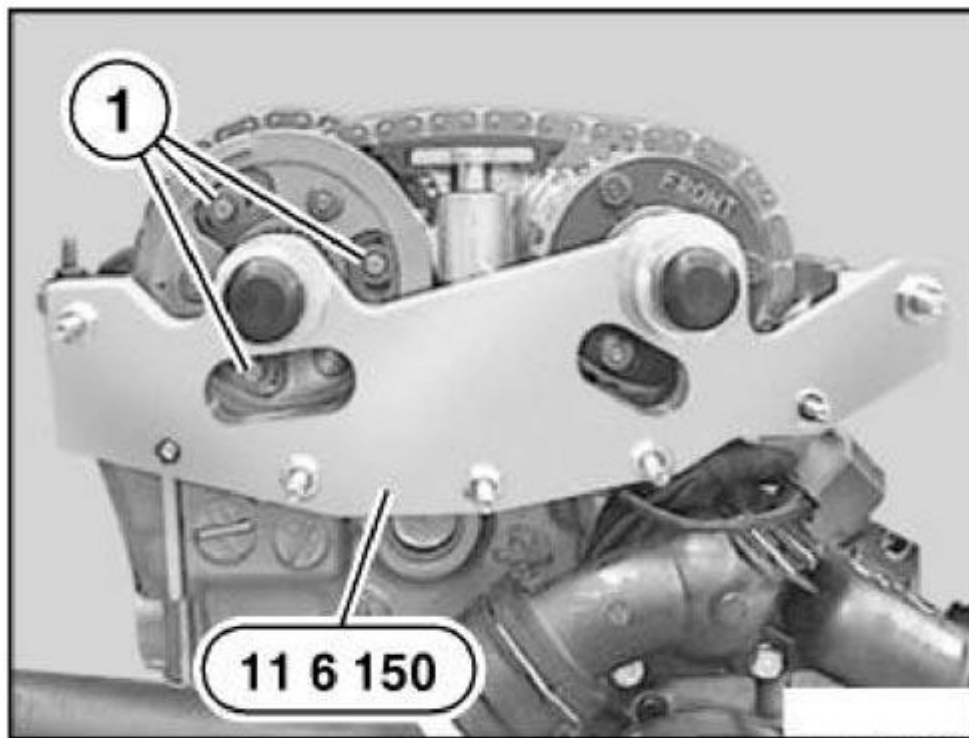
Initially tighten nuts (2) on exhaust side and nuts (3) on inlet side to approx. 5 Nm.



G03164156

Fig. 278: Tightening Nuts On Exhaust Side
Courtesy of BMW OF NORTH AMERICA, INC.

Tighten down screws (1) on exhaust side.

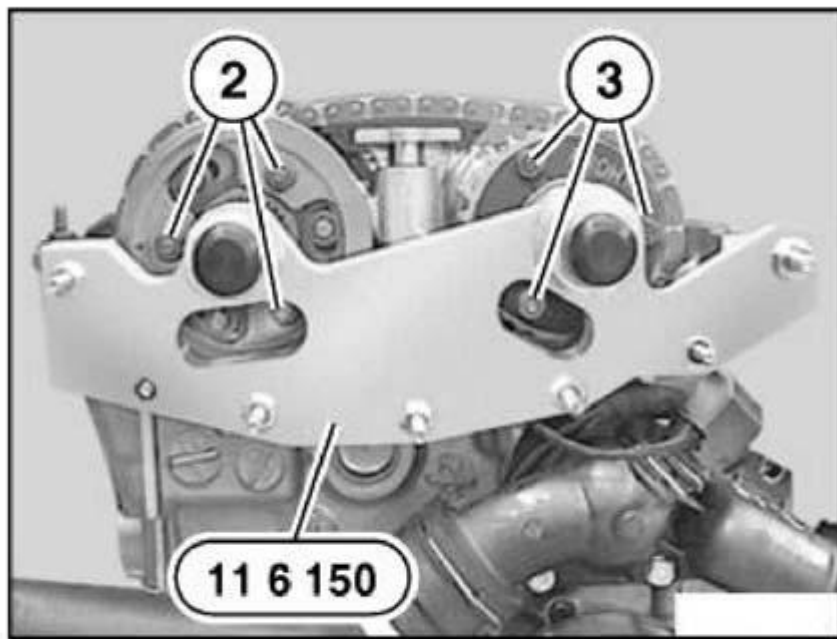


G03164157

Fig. 279: Tightening Down Screws On Exhaust Side
Courtesy of BMW OF NORTH AMERICA, INC.

Tightening torque, refer to 11 31 3AZ in **ENGINE - TIGHTENING TORQUES** .

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

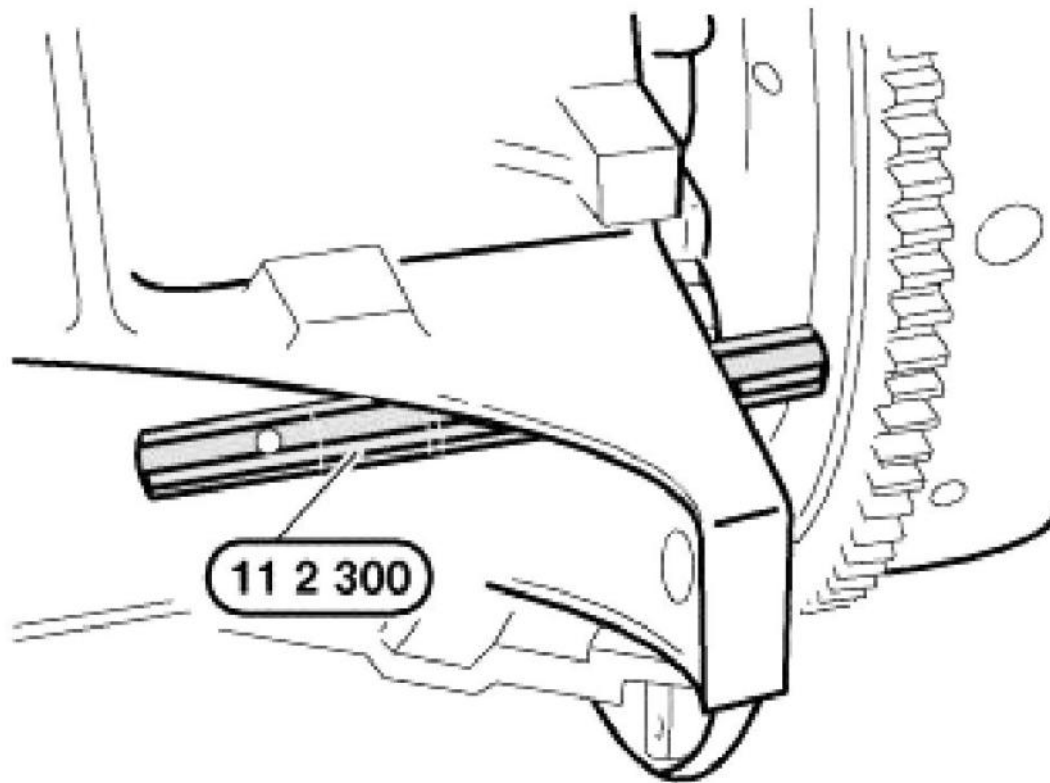


G03164158

Fig. 280: Tightening Down Nuts On Exhaust Side
Courtesy of BMW OF NORTH AMERICA, INC.

Tightening torque, refer to 11 31 11AZ in **ENGINE - TIGHTENING TORQUES** .

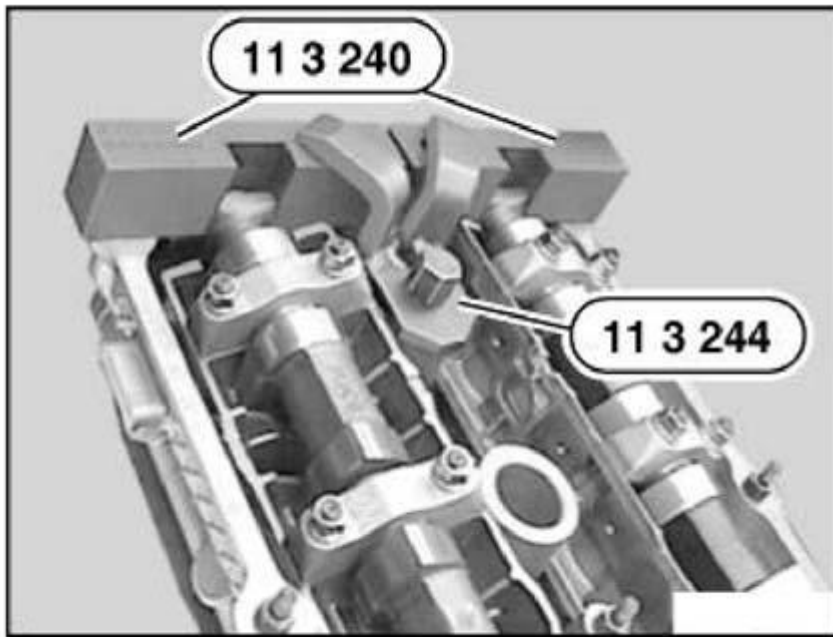
Pull special tool 11 2 300/11 5 180 back until flywheel is no longer secured.



G03164159

Fig. 281: Pulling Special Tool 11 2 300
Courtesy of BMW OF NORTH AMERICA, INC.

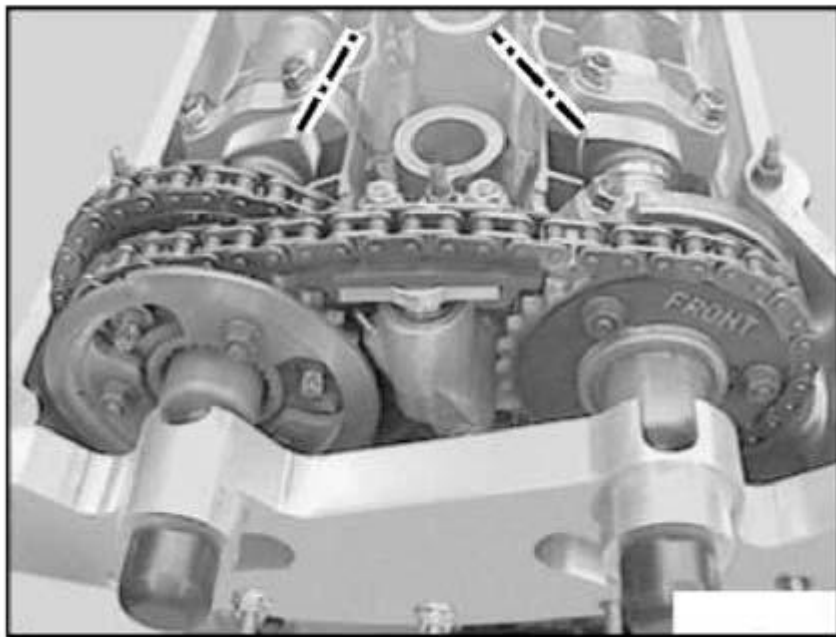
Remove special tool 11 3 244 and special tool 11 3 240.



G03164160

Fig. 282: Removing Special Tool 11 3 244 And 11 3 240
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.



G03164161

Fig. 283: Identifying Cam Tips

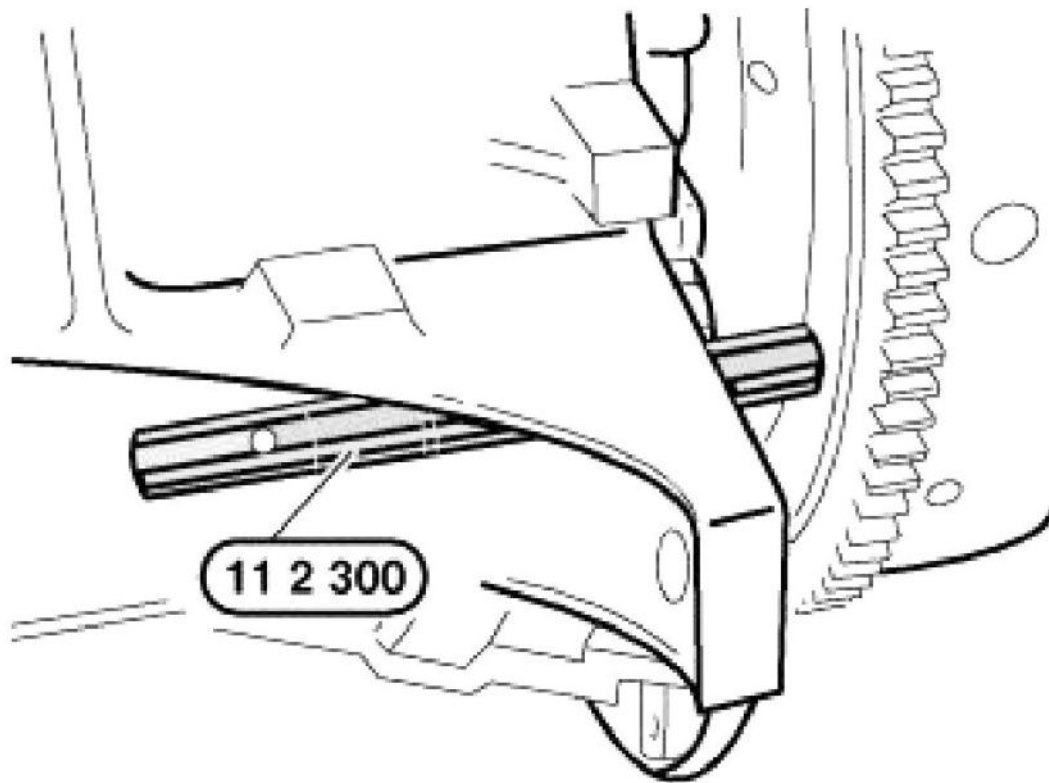
Courtesy of BMW OF NORTH AMERICA, INC.

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

X3 only:

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

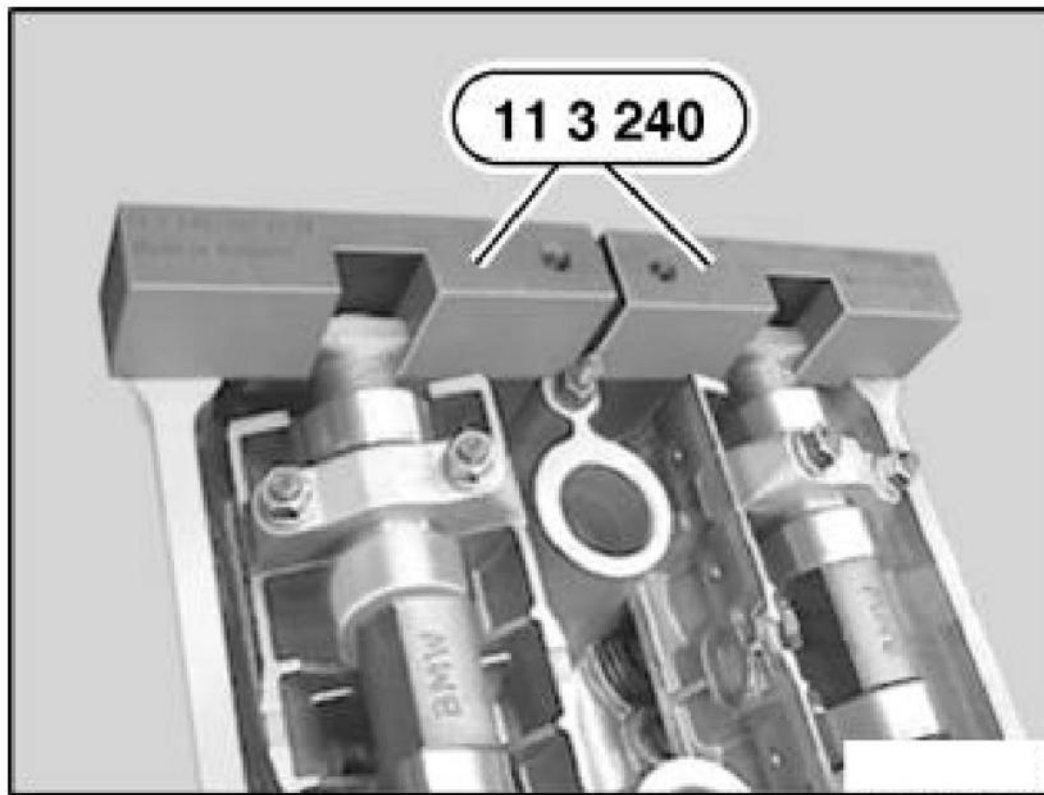
IMPORTANT: Do not turn the engine back. Remove special tools 11 2 300/ 11 5 180 before starting engine.



G03164162

Fig. 284: Removing Special Tools 11 2 300
Courtesy of BMW OF NORTH AMERICA, INC.

Fit special tool 11 3 240 to camshafts.

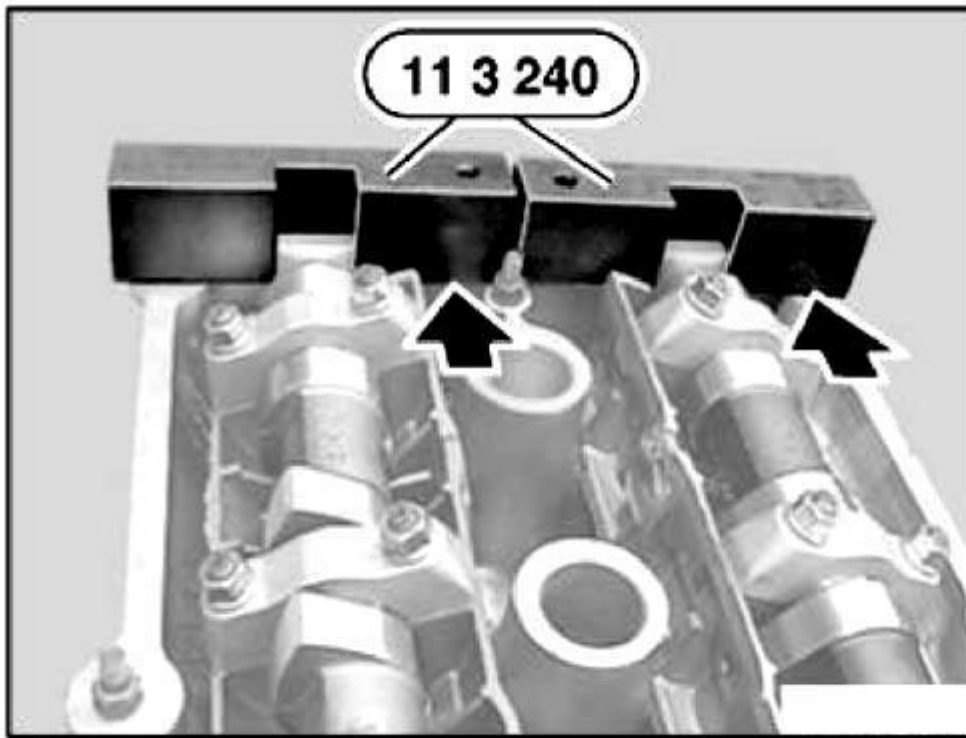


G03164163

Fig. 285: Fitting Special Tool 11 3 240
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.

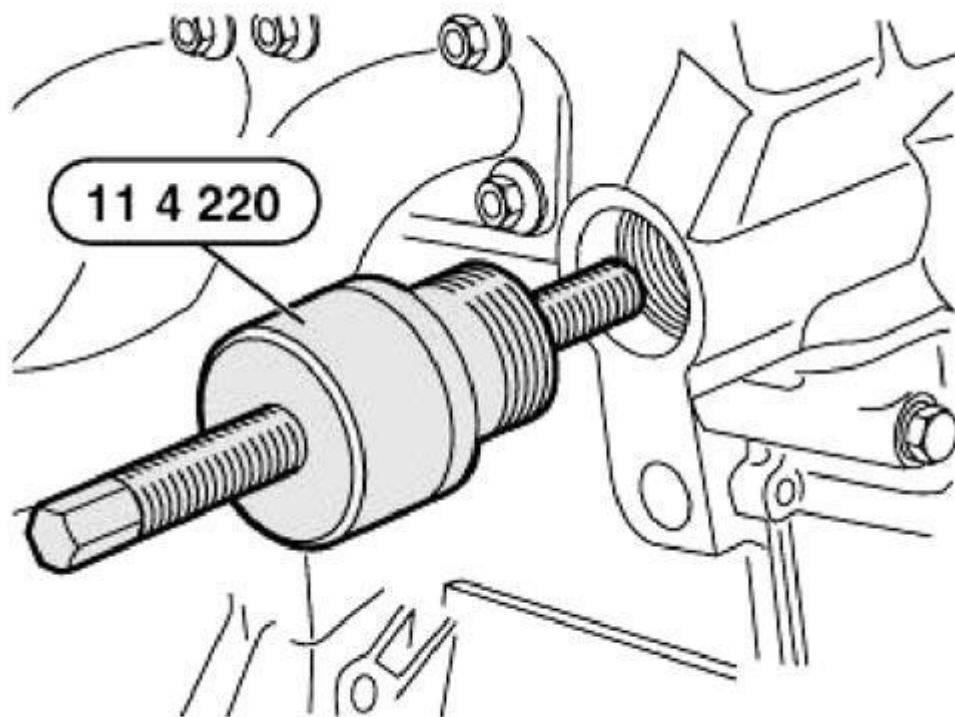
The timing must be reset if the special tool 11 3 240 protrudes to the exhaust side.



G03164164

Fig. 286: Identifying Special Tool 11 3 240
Courtesy of BMW OF NORTH AMERICA, INC.

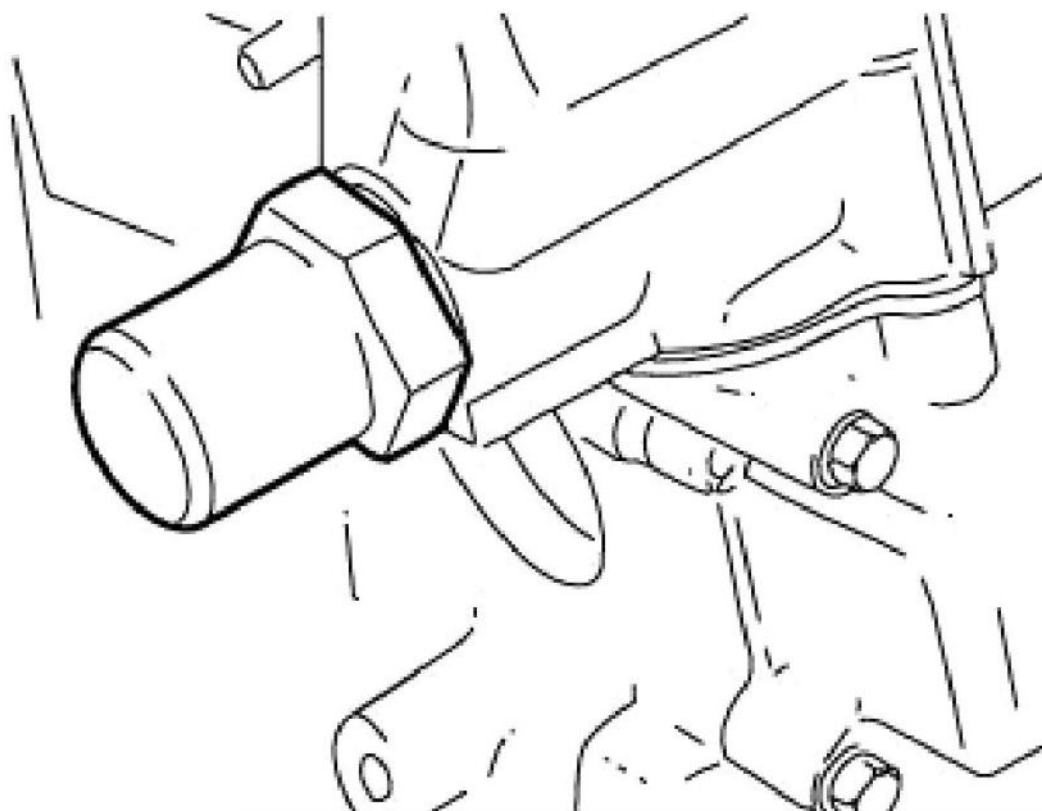
Unfasten and remove special tool 11 4 220.



G03164165

Fig. 287: Removing Special Tool 11 4 220
Courtesy of BMW OF NORTH AMERICA, INC.

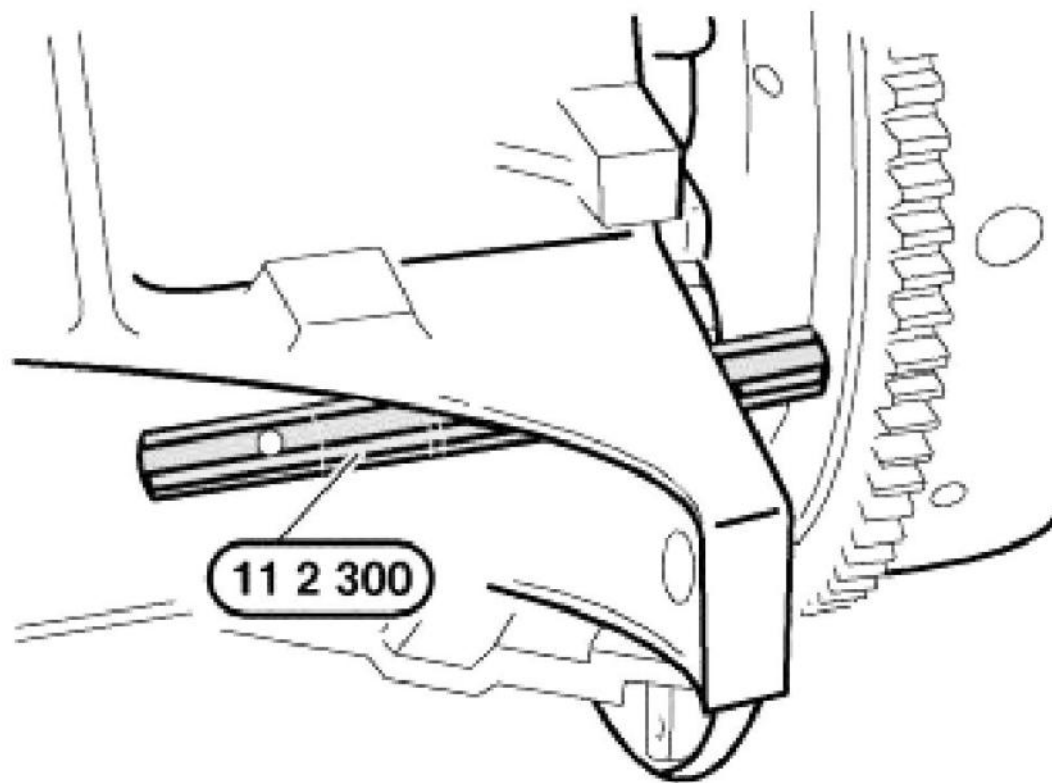
Install cylinder for chain tensioning piston.



G03164166

Fig. 288: Installing Cylinder For Chain Tensioning Piston
Courtesy of BMW OF NORTH AMERICA, INC.

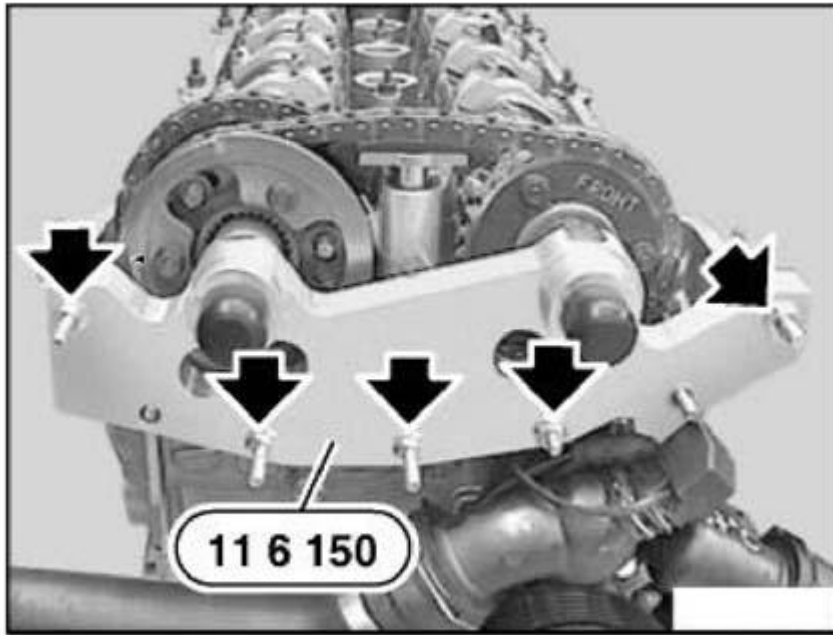
Remove special tool 11 2 300/11 5 180.



G03164167

Fig. 289: Removing Special Tool 11 2 300
Courtesy of BMW OF NORTH AMERICA, INC.

Remove special tool 11 6 150.



G03164168

Fig. 290: Removing Special Tool 11 6 150
Courtesy of BMW OF NORTH AMERICA, INC.

Install VANOS adjustment unit.

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**. Replace valve stem seals.

Remove valves from cylinder head.

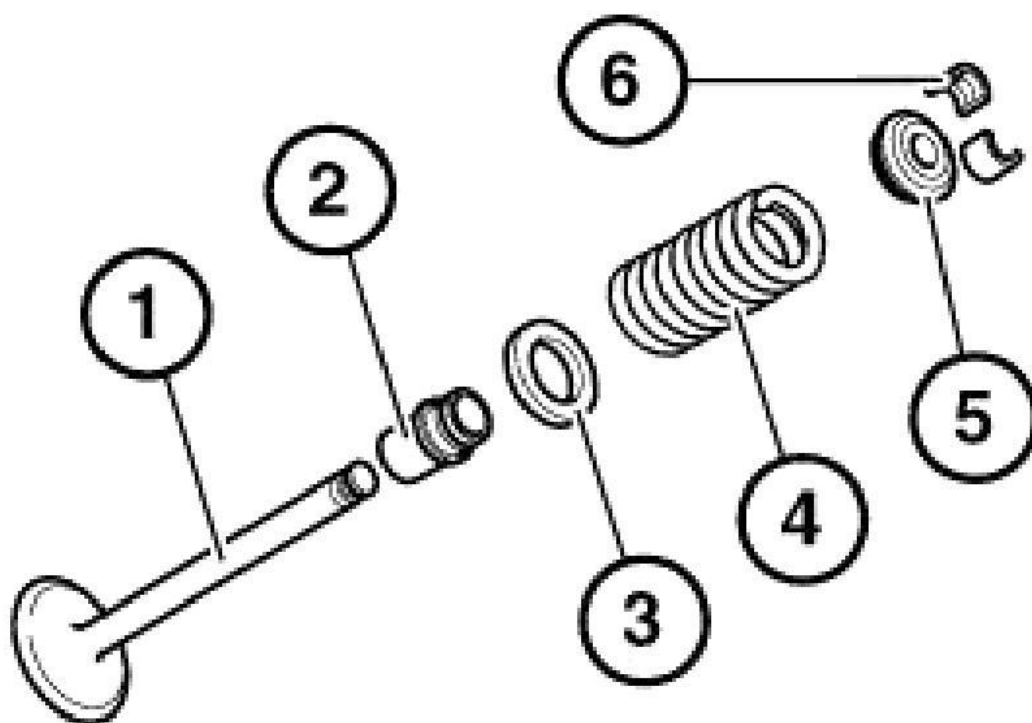
If necessary, check valve guide for wear.

If necessary, ream valve guide.

If necessary, remachine valve seat.

Arrangement:

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



G03164169

Fig. 291: Identifying Valve, Valve-Stem Seal And Valve Spring
Courtesy of BMW OF NORTH AMERICA, INC.

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

Special tools required:

NOTE: For special tools, refer to ENGINE - SPECIAL TOOLS .

- 11 1 200

- 11 1 480
- 11 1 960

(cylinder head removed)

Preliminary tasks are described in **DISASSEMBLING AND ASSEMBLING CYLINDER HEAD**. Remove all valve springs.

Remove valve stem seal with special tool 11 1 480.

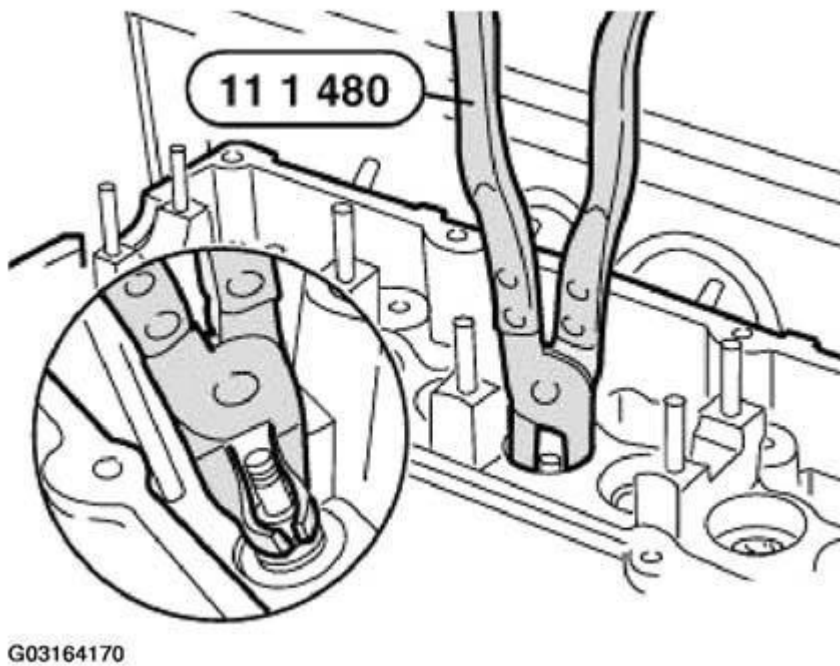


Fig. 292: Removing Valve Stem Seal With Special Tool 11 1 480
Courtesy of BMW OF NORTH AMERICA, INC.

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

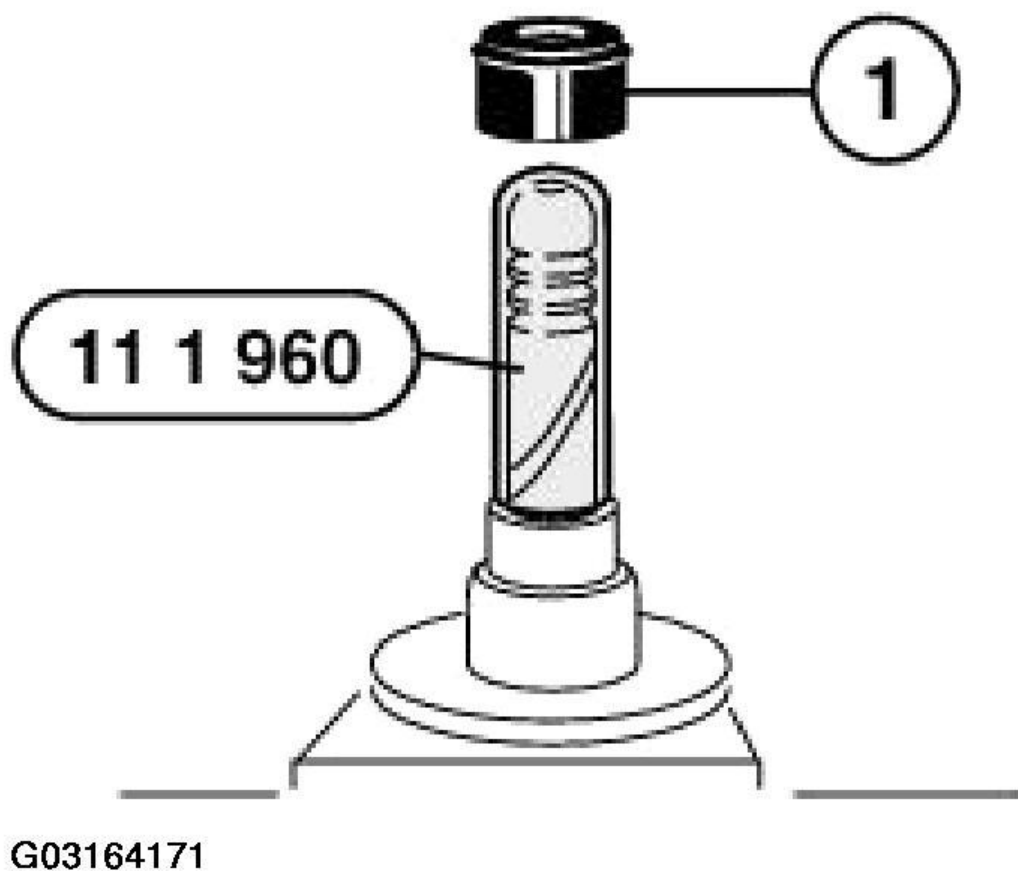
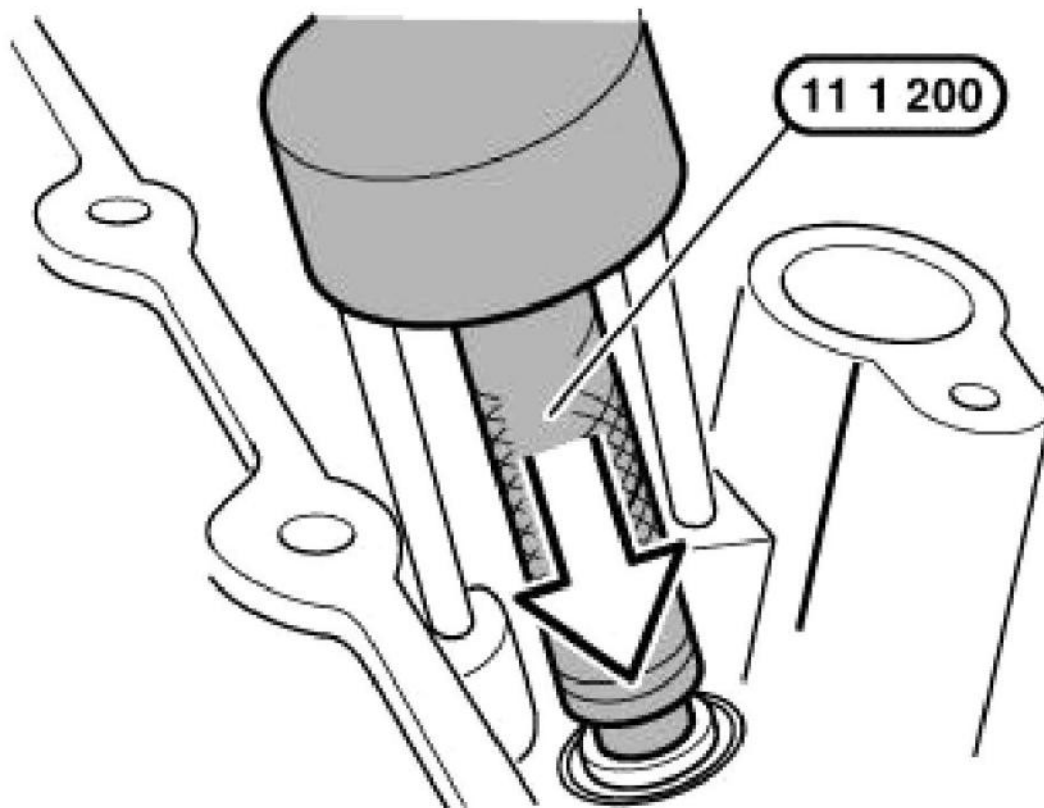


Fig. 293: Fitting Special Tool 11 1 960
Courtesy of BMW OF NORTH AMERICA, INC.

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

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



G03164172

Fig. 294: Pressing Valve Stem Seal Firmly Home
Courtesy of BMW OF NORTH AMERICA, INC.

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

Special tools required:

NOTE: For special tools, refer to ENGINE - SPECIAL TOOLS .

- 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**.

Brace bucket tappets with special tool 11 3 250.

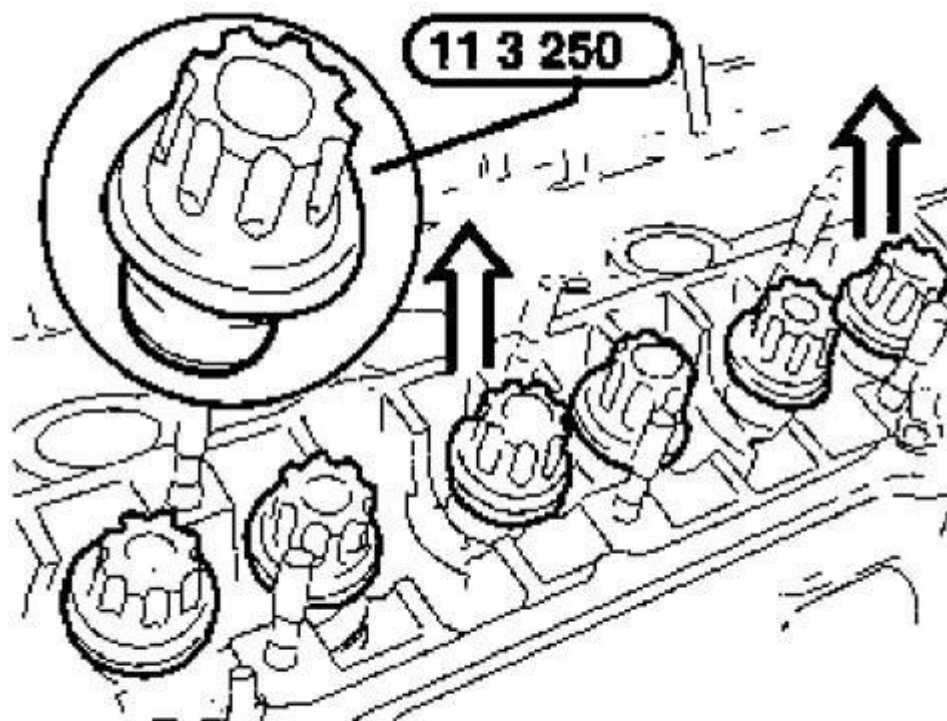


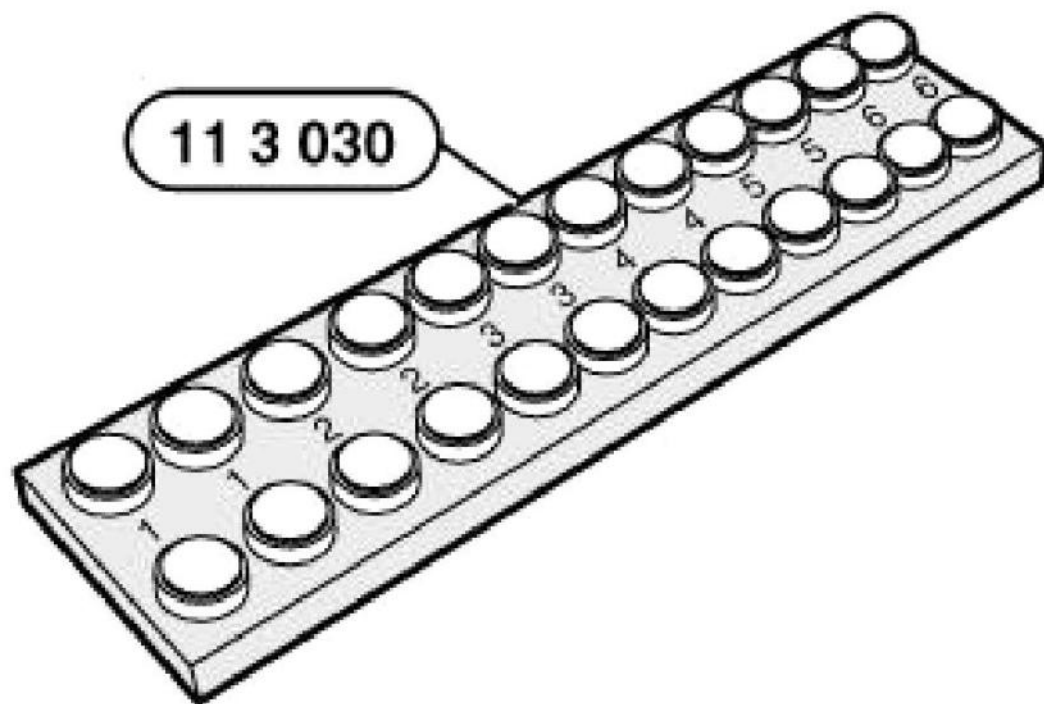
Fig. 295: Identifying Special Tool 11 3 250
Courtesy of BMW OF NORTH AMERICA, INC.

Lift out bearing strip with bucket tappet.

Installation:

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

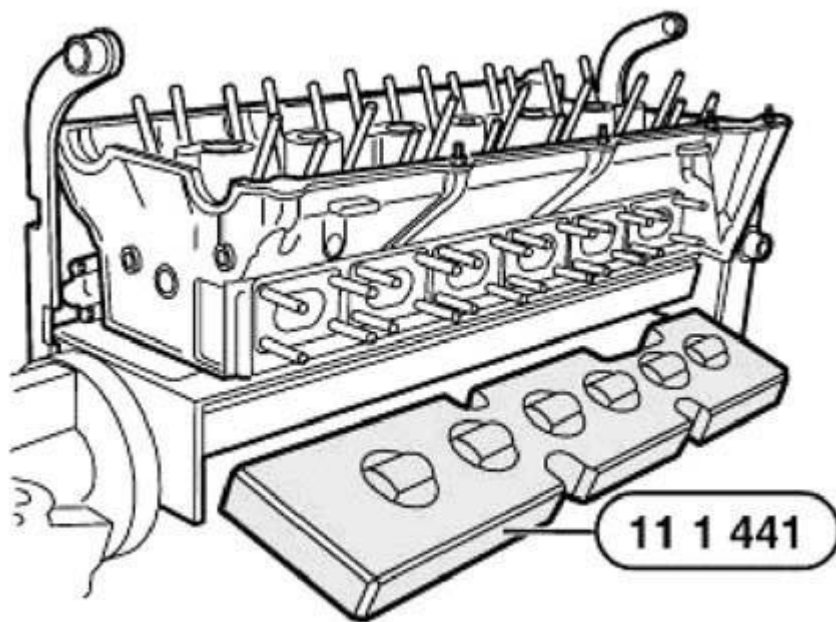
Arrange bucket tappets by cylinder and place on special tool 11 3 030 in correct order.



G03164174

Fig. 296: Identifying Special Tool 11 3 030
Courtesy of BMW OF NORTH AMERICA, INC.

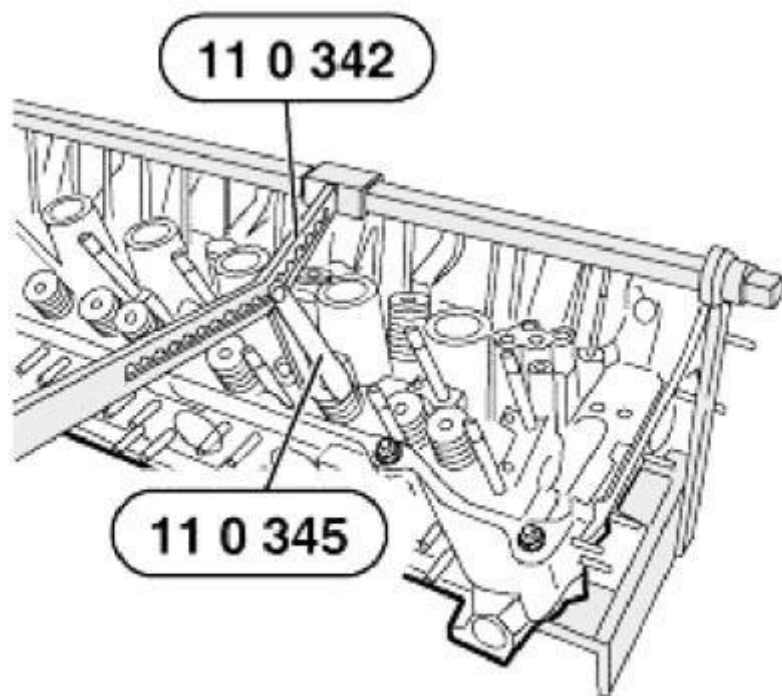
Insert special tool 11 1 441 from below in special tool 11 1 065 and secure with special tool 11 1 045.



G03164175

Fig. 297: Inserting Special Tool 11 1 441
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.

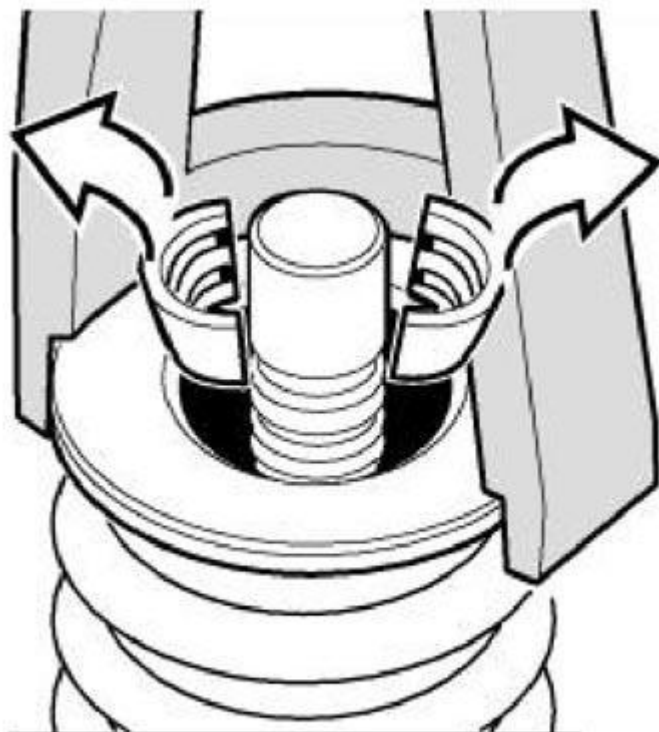


G03164176

Fig. 298: Aligning Special Tools 11 0 345 And 11 0 342
Courtesy of BMW OF NORTH AMERICA, INC.

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

Remove valve spring and plate spring.



G03164177

Fig. 299: Removing Valve Spring And Plate Spring
Courtesy of BMW OF NORTH AMERICA, INC.

Arrangement:

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

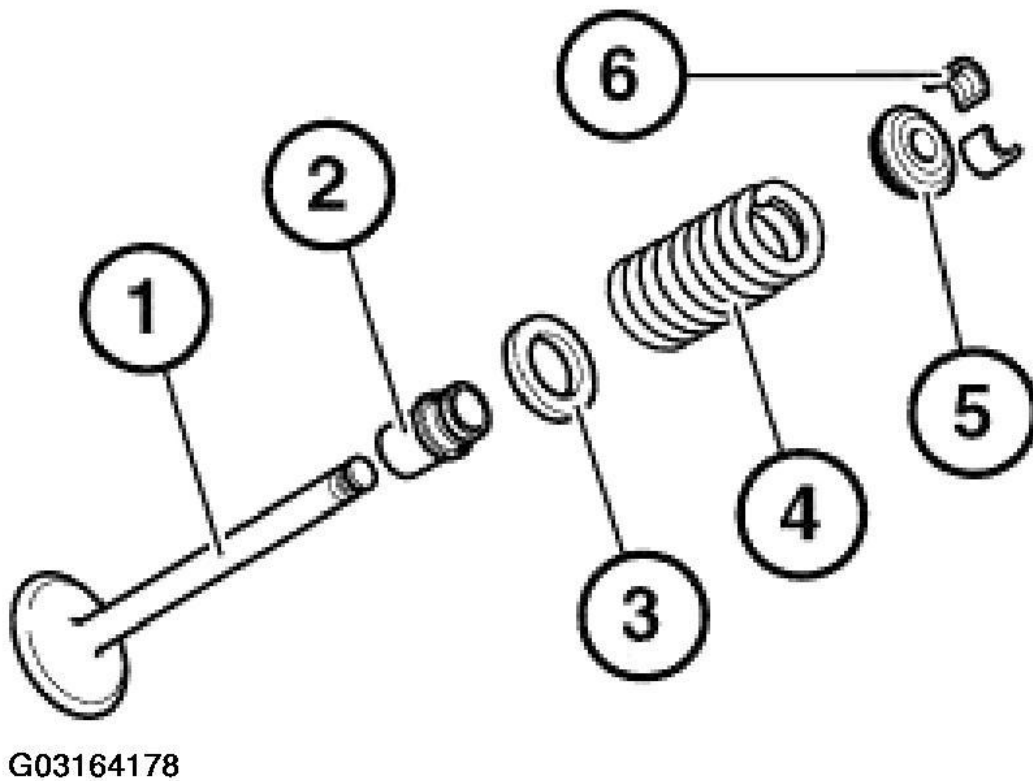


Fig. 300: Identifying Valve, Valve-Stem Seal And Valve Spring
Courtesy of BMW OF NORTH AMERICA, INC.

VARIABLE CAMSHAFT TIMING

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

Special tools required:

NOTE: For special tools, refer to ENGINE - SPECIAL TOOLS .

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

Necessary preliminary tasks:

- Remove intake filter housing with air-mass flow sensor. See **13 71 000 REMOVE AND INSTALLING INTAKE FILTER HOUSING (M52TU, M54)**
- Remove fan impeller with fan clutch and fan cowl. See **11 52 020 Removing and installing/replacing fan clutch (S52 / S54 / M52 / M52TU / M54 / M56)**
- **E60:** Remove fan cowl with electric fan
- Remove cylinder head cover. See **Cylinder head with cover**
- Remove spark plugs. See **12 12 011 REPLACING ALL SPARK PLUGS**

E85 only:

- Remove radiator cover
- Drain coolant from radiator

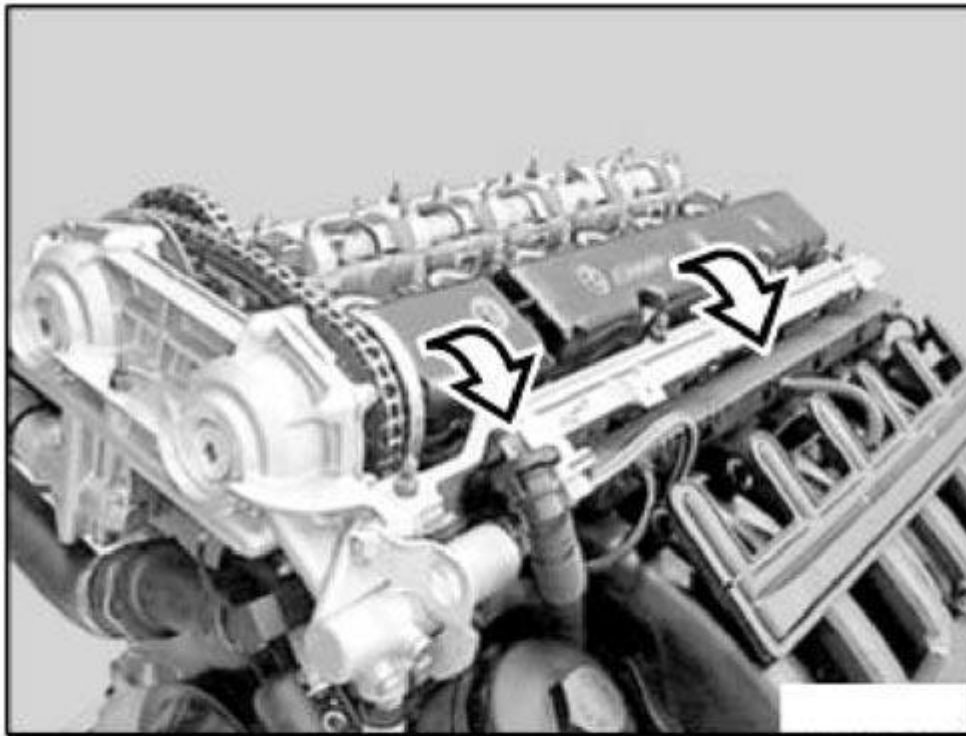
NOTE: **Protect drive belt against emerging coolant.**

- Remove right coolant hose.
- Remove solenoid valve for exhaust side

Removal:

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

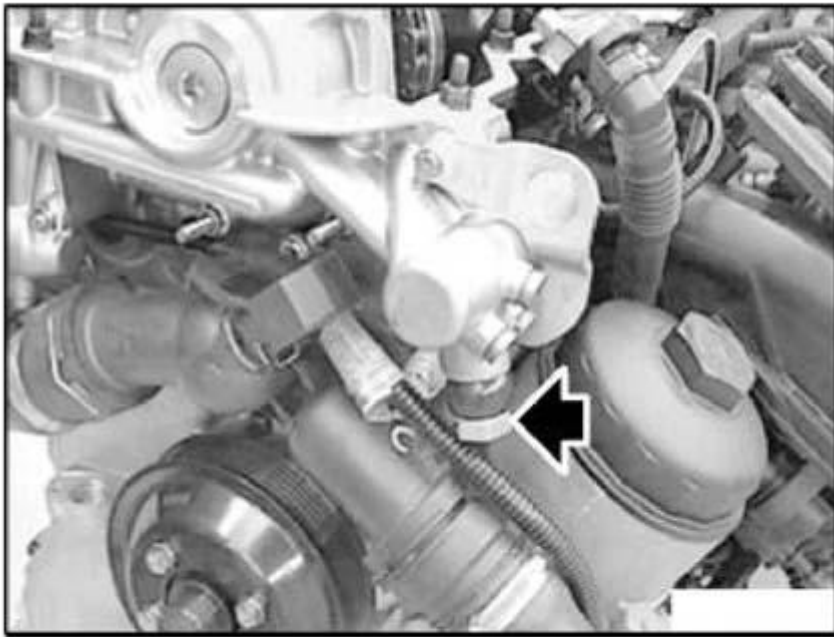
Detach plastic cover for inlet camshaft.



G03164179

Fig. 301: Detaching Plastic Cover
Courtesy of BMW OF NORTH AMERICA, INC.

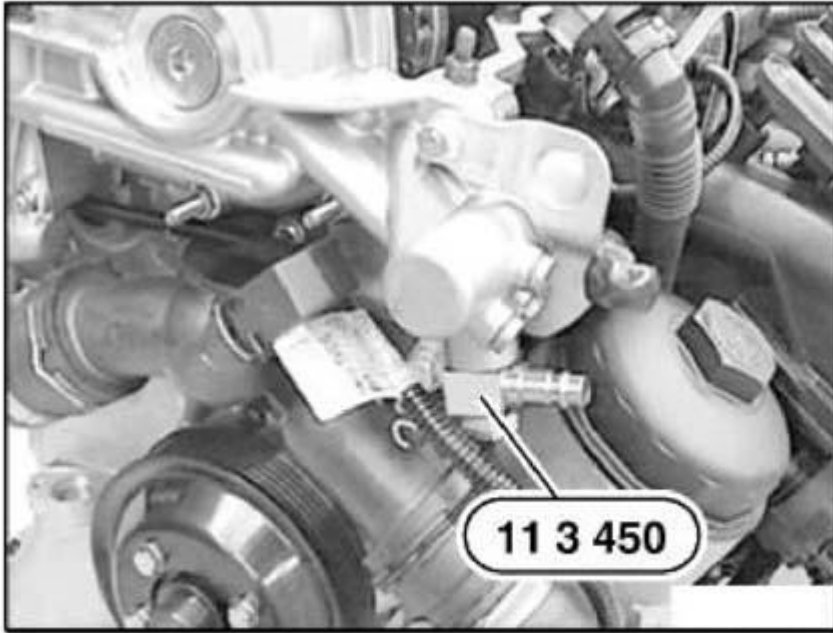
Unscrew oil pressure pipe.



G03164180

Fig. 302: Unscrewing Oil Pressure Pipe
Courtesy of BMW OF NORTH AMERICA, INC.

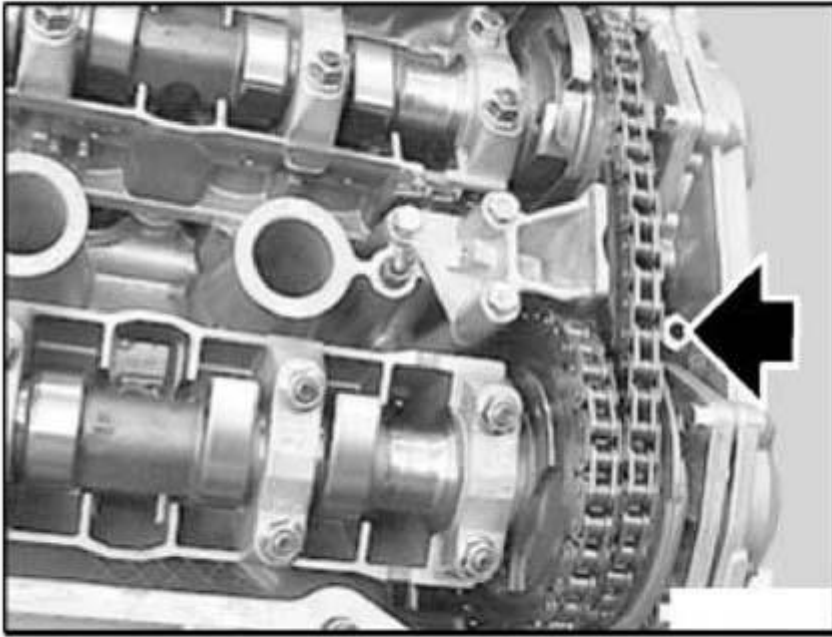
Mount special tool 11 3 450 with banjo bolt of oil pressure line.



G03164181

Fig. 303: Mounting Special Tool 11 3 450
Courtesy of BMW OF NORTH AMERICA, INC.

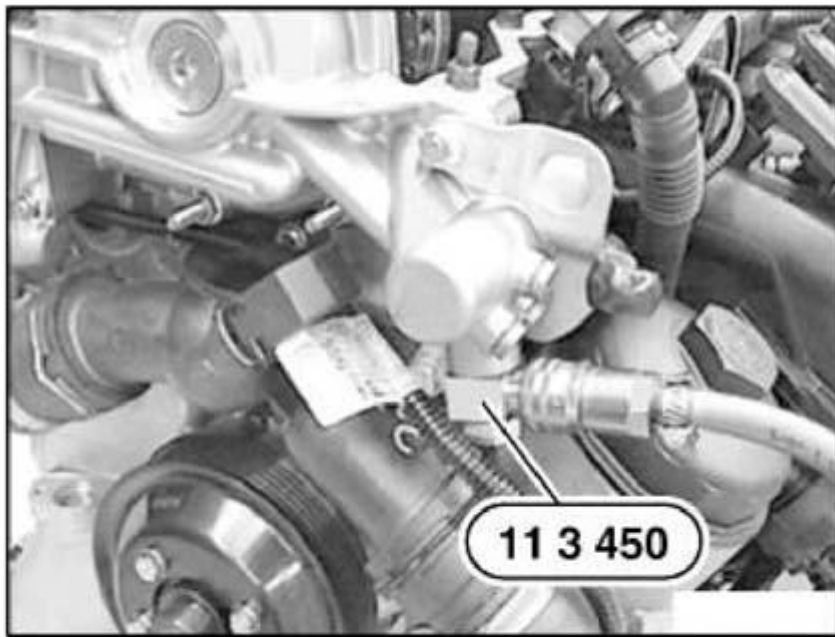
IMPORTANT: Cover double VANOS adjustment unit. When the compressed air supply is connected, several drops of oil are sprayed out of the bore.



G03164182

Fig. 304: Identifying Double VANOS Adjustment Unit
Courtesy of BMW OF NORTH AMERICA, INC.

Connect compressed air (2 to 8 bar).

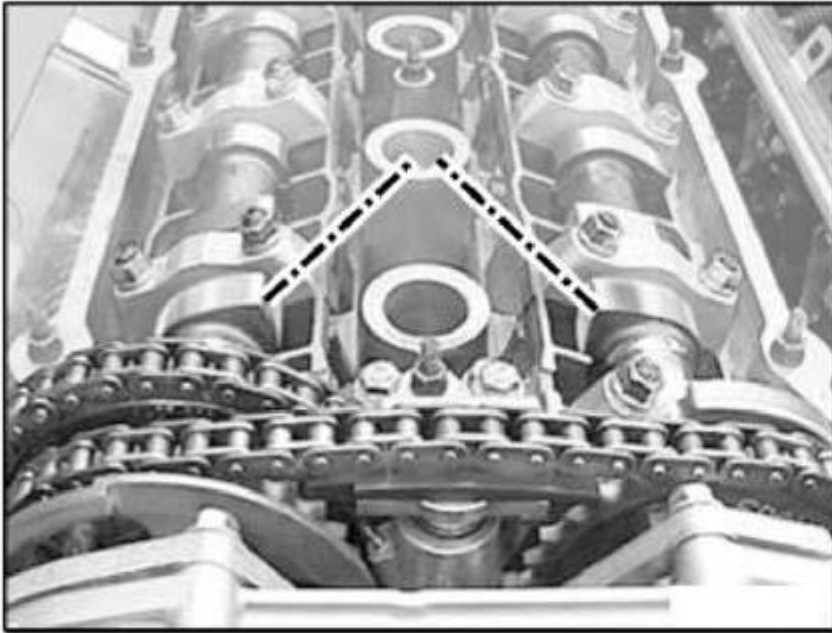


G03164183

Fig. 305: 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.

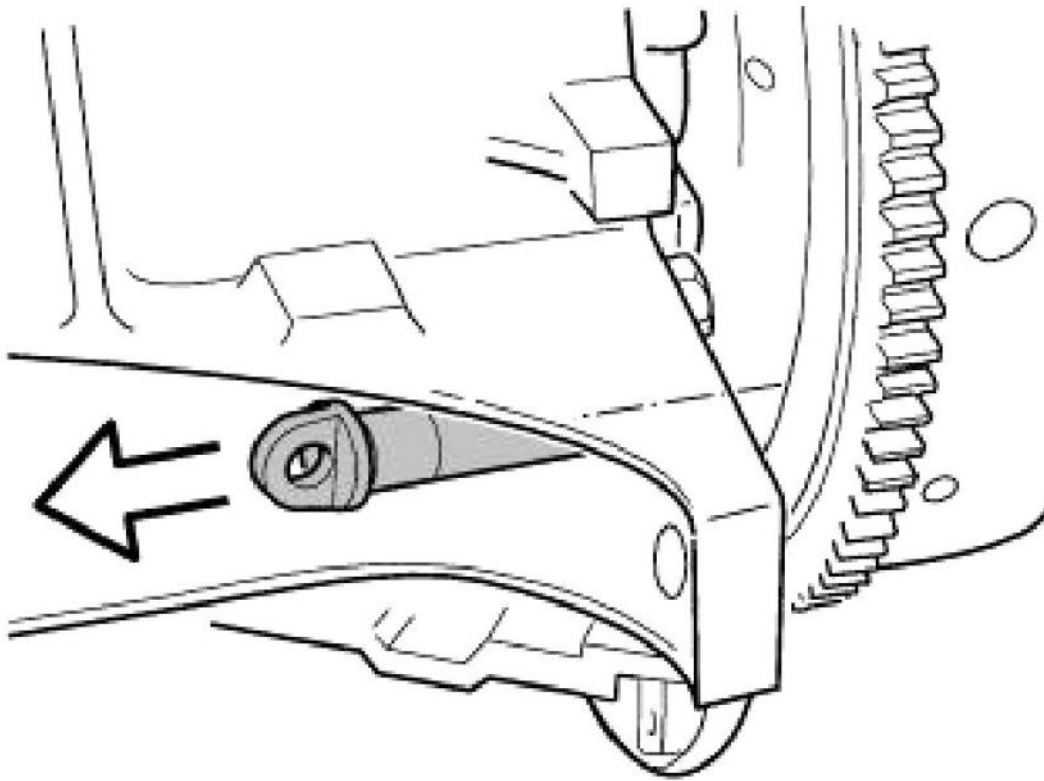


G03164184

Fig. 306: Identifying Cam Tips

Courtesy of BMW OF NORTH AMERICA, INC.

Pull dust guard out of the special tool bore.



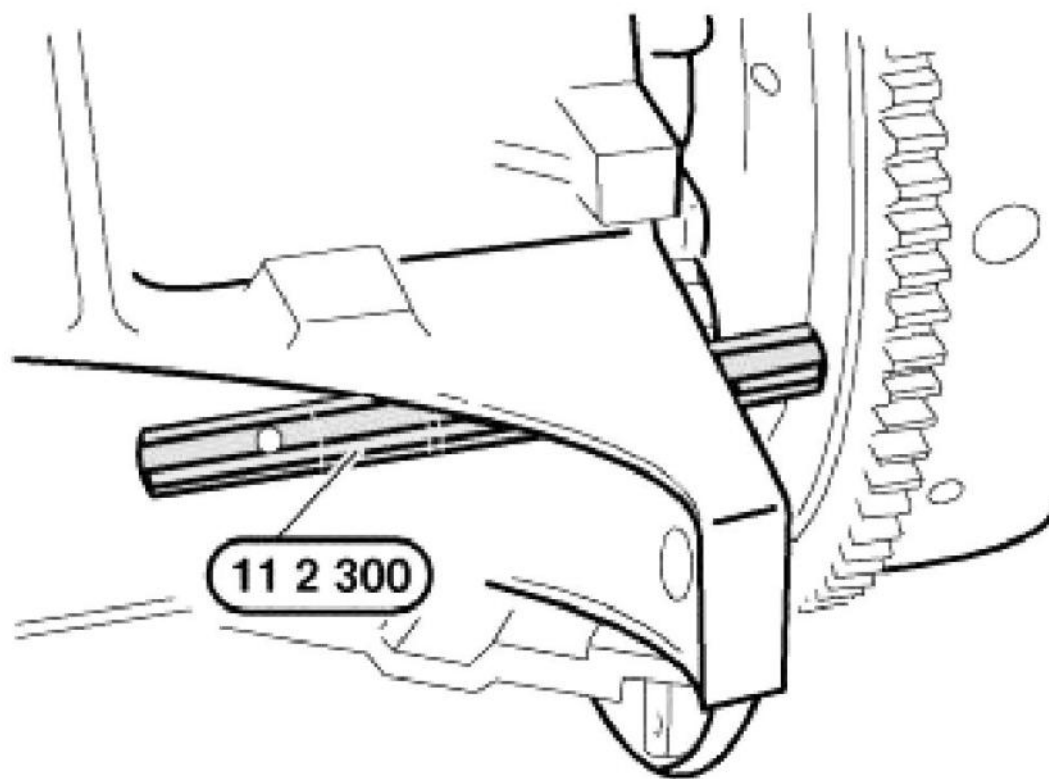
G03164185

Fig. 307: Pulling Dust Guard

Courtesy of BMW OF NORTH AMERICA, INC.

Secure crankshaft in firing TDC position with special tool .

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



G03164186

Fig. 308: Removing Special Tool 11 2 300

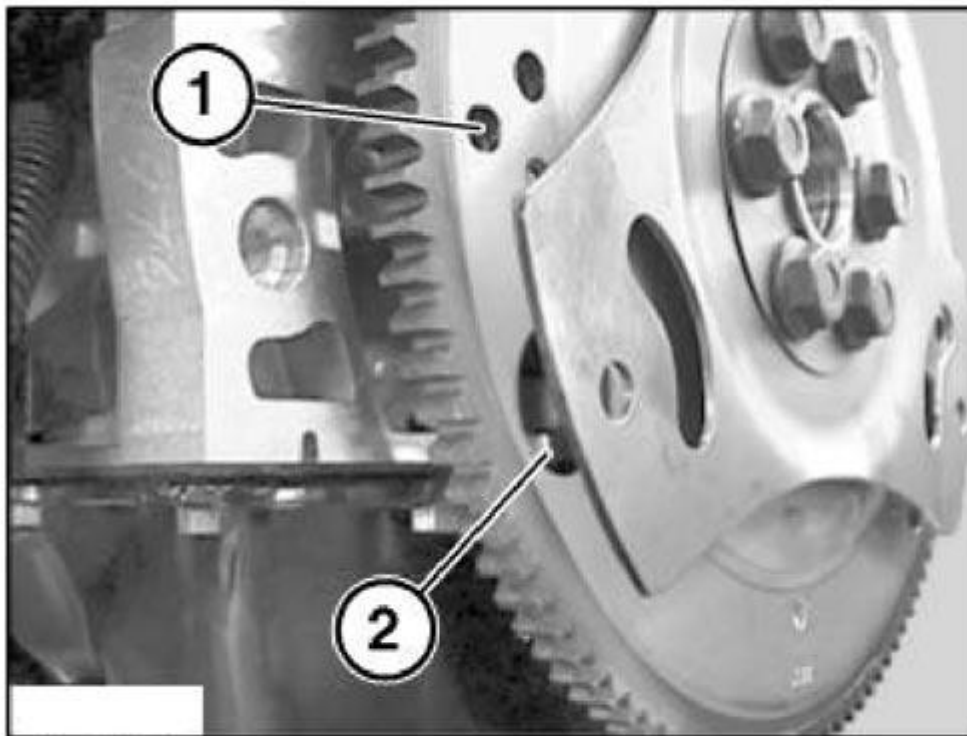
Courtesy of BMW OF NORTH AMERICA, INC.

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.

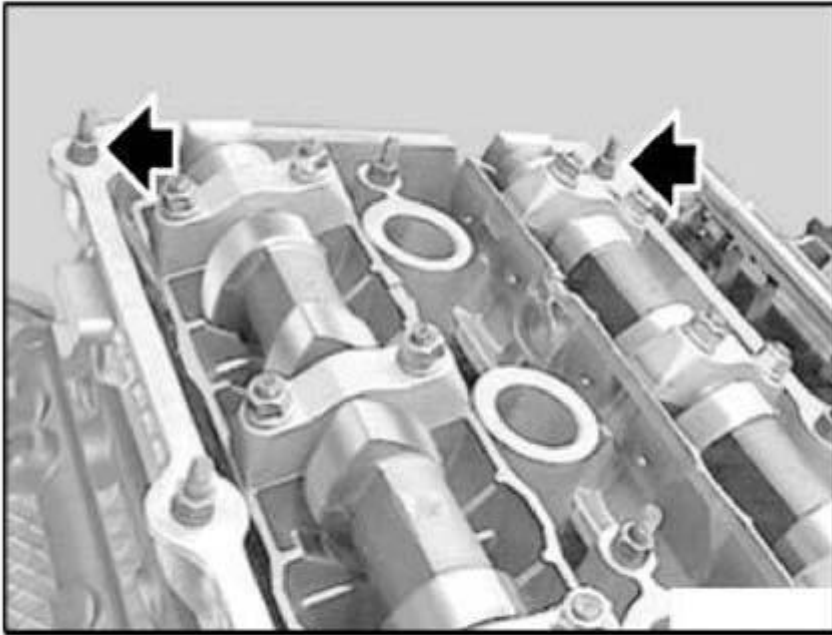
If special tool 11 2 300 is secured in the correct bore (1), the engine can no longer be cranked at the central bolt.



G03164187

Fig. 309: Identifying Tool Bore And Large Bore
Courtesy of BMW OF NORTH AMERICA, INC.

Unscrew studs.

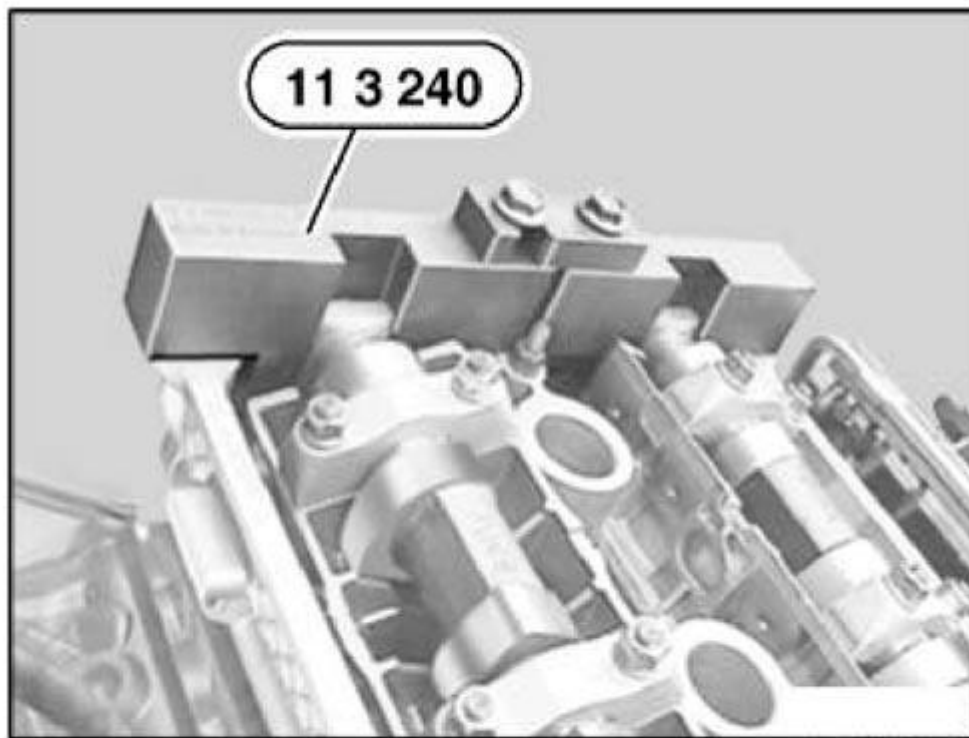


G03164188

Fig. 310: Unscrewing Studs

Courtesy of BMW OF NORTH AMERICA, INC.

Secure camshafts with special tool 11 3 240.

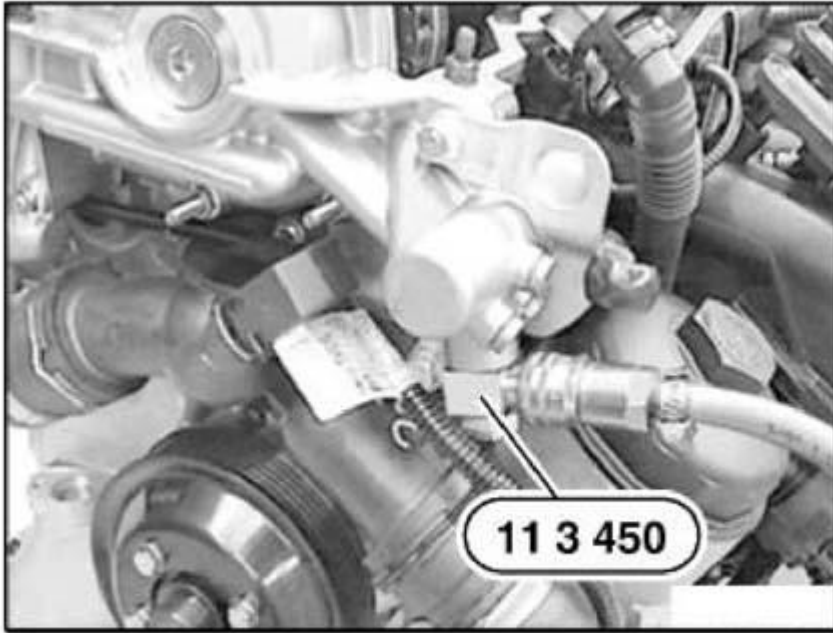


G03164189

Fig. 311: Identifying Special Tool 11 3 240
Courtesy of BMW OF NORTH AMERICA, INC.

Detach compressed air connection.

NOTE: **special tool 11 3 450 still remains fitted.**

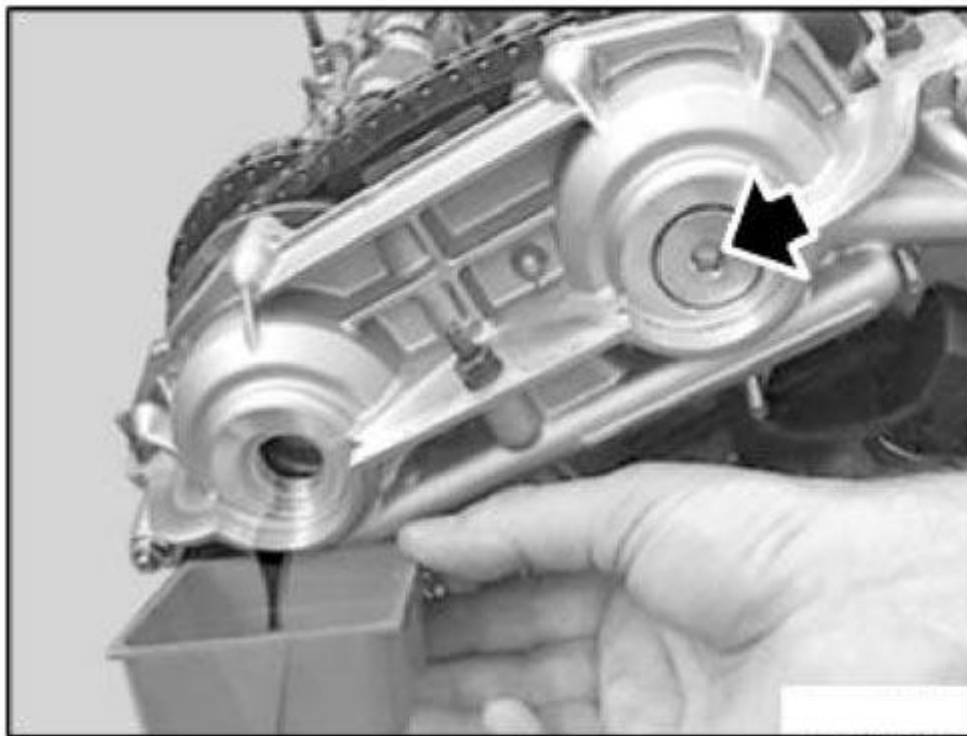


G03164190

Fig. 312: Identifying Special Tool 11 3 450
Courtesy of BMW OF NORTH AMERICA, INC.

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.

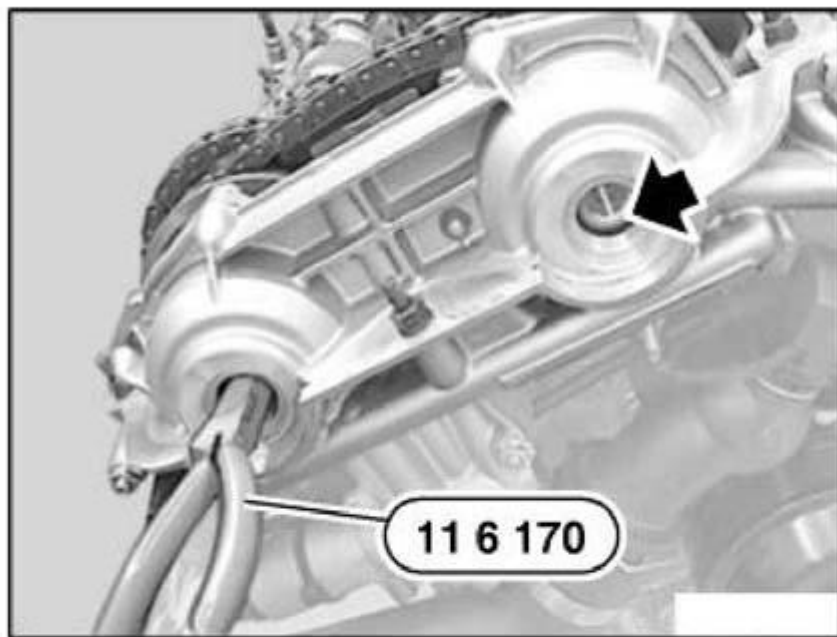
Remove screw plugs, catch escaping oil on inlet and exhaust sides.



G03164191

Fig. 313: Identifying Escaping Oil On Inlet And Exhaust Sides
Courtesy of BMW OF NORTH AMERICA, INC.

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



G03164192

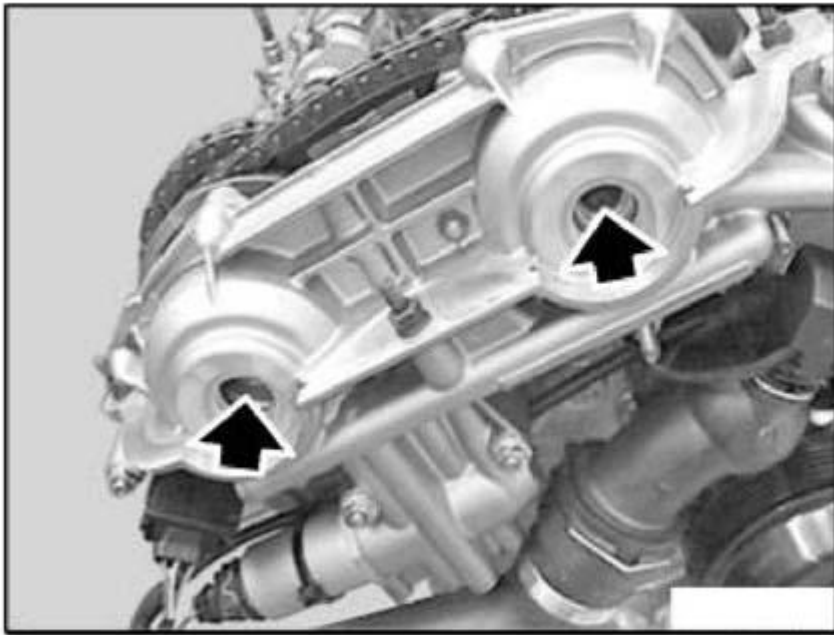
Fig. 314: Removing Sealing Caps
Courtesy of BMW OF NORTH AMERICA, INC.

E85:

Use commercially available offset flat nose pliers.

IMPORTANT: Left-hand threads.

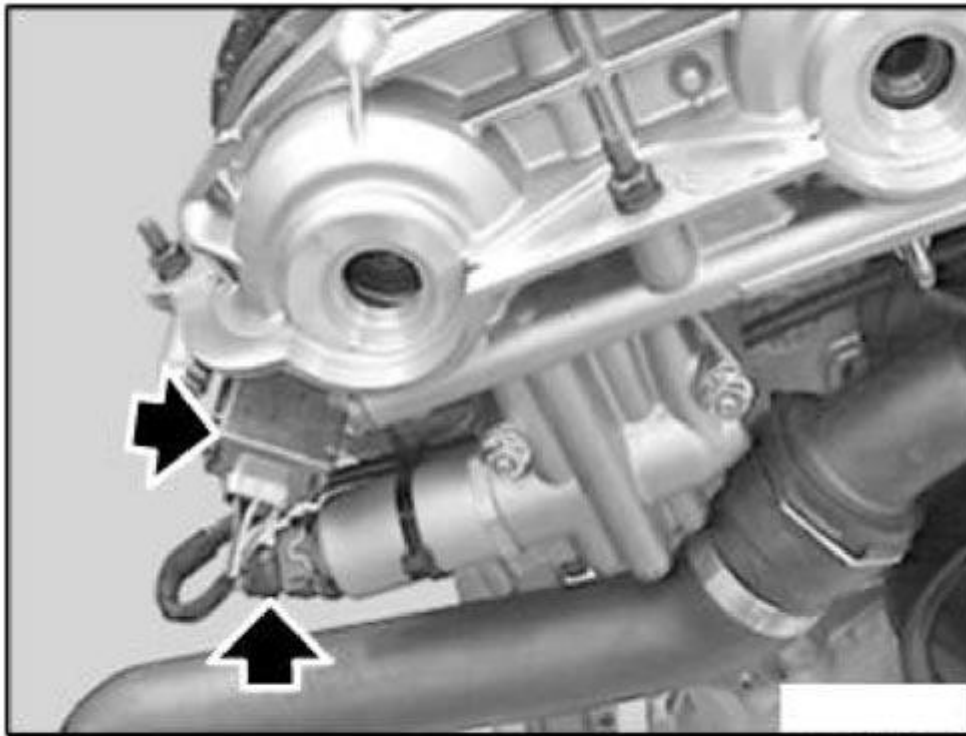
Release fitting screws on inlet and exhaust sides.



G03164193

Fig. 315: Releasing Fitting Screws**Courtesy of BMW OF NORTH AMERICA, INC.**

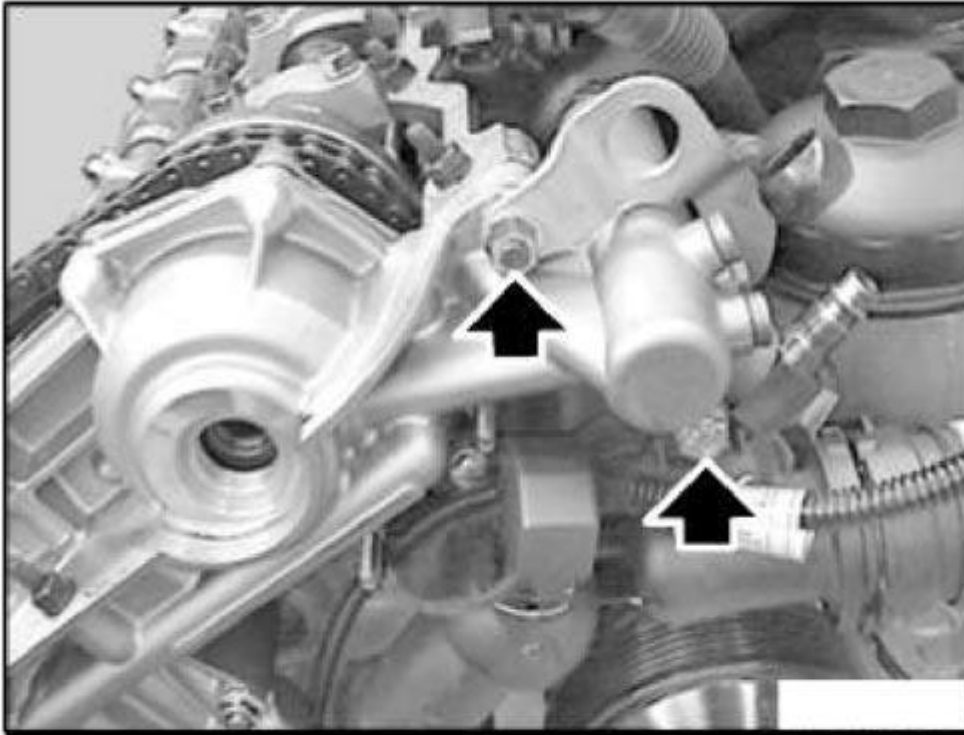
Detach plug connections from camshaft sensor and solenoid valves on exhaust and inlet sides.



G03164194

Fig. 316: Detaching Plug Connections
Courtesy of BMW OF NORTH AMERICA, INC.

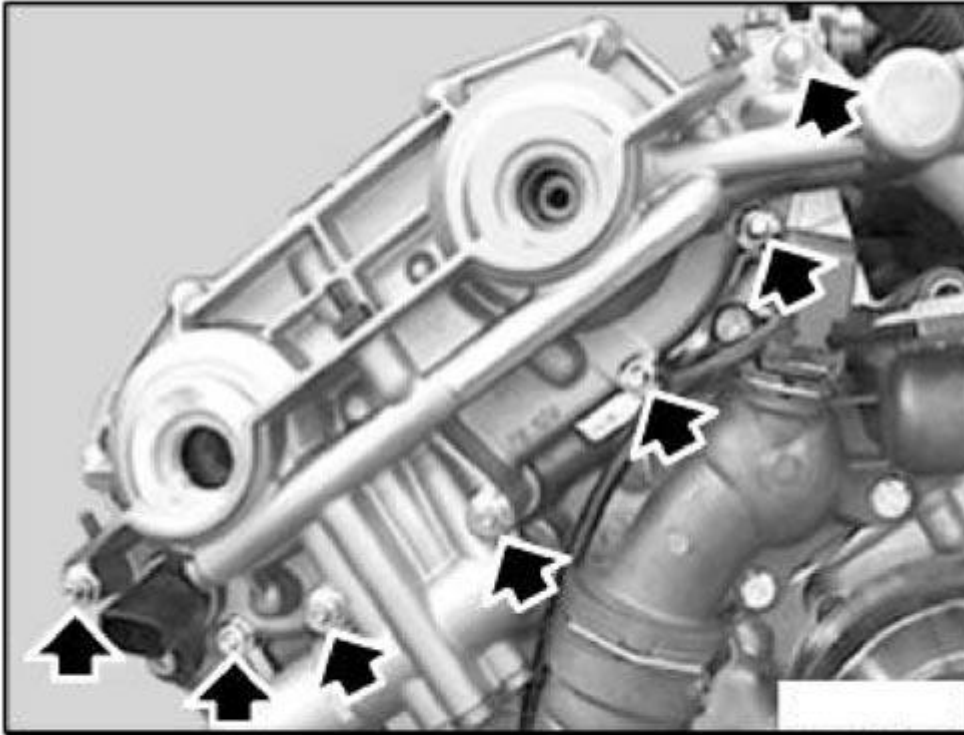
Unscrew suspension eye.



G03164195

Fig. 317: Unscrewing Suspension Eye
Courtesy of BMW OF NORTH AMERICA, INC.

Release nuts and remove double VANOS adjustment unit.



G03164196

Fig. 318: Releasing Nuts

Courtesy of BMW OF NORTH AMERICA, INC.

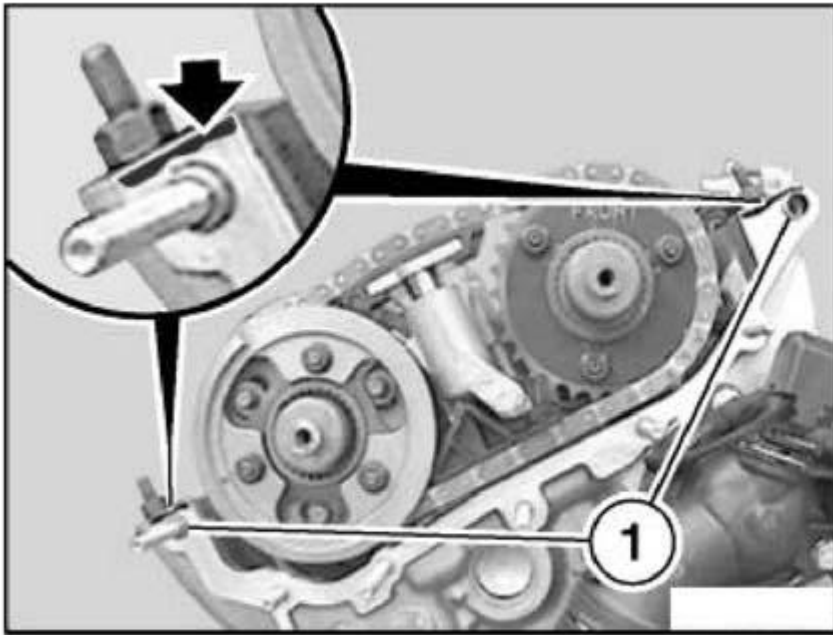
IMPORTANT: With double VANOS adjustment unit removed: Do not crank engine. The toothed shaft on the inlet side may move and slip out of the spline teeth, the inlet camshaft is thus no longer non-positively connected and the valves could rest on the piston.

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.

Keep sealing faces clean and free of oil. Apply a thin and even coat of sealing compound Drei Bond 1209 to contact surface edges of separating face between cylinder

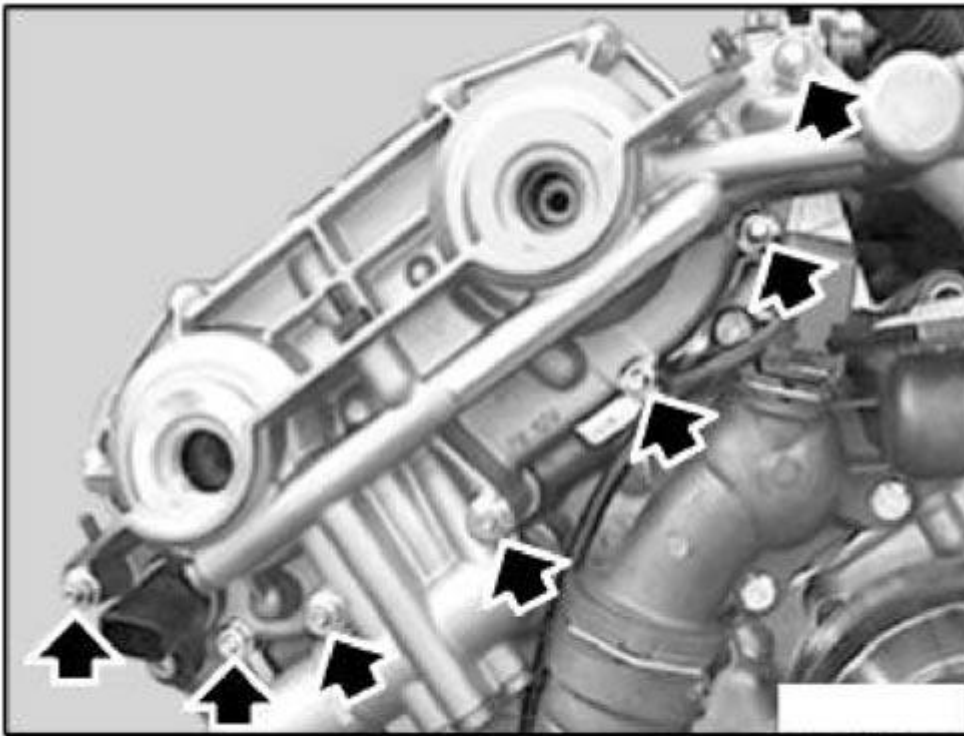


G03164197

Fig. 319: Checking Dowel Sleeves**Courtesy of BMW OF NORTH AMERICA, INC.**

head and double VANOS adjustment unit. Replace seal.

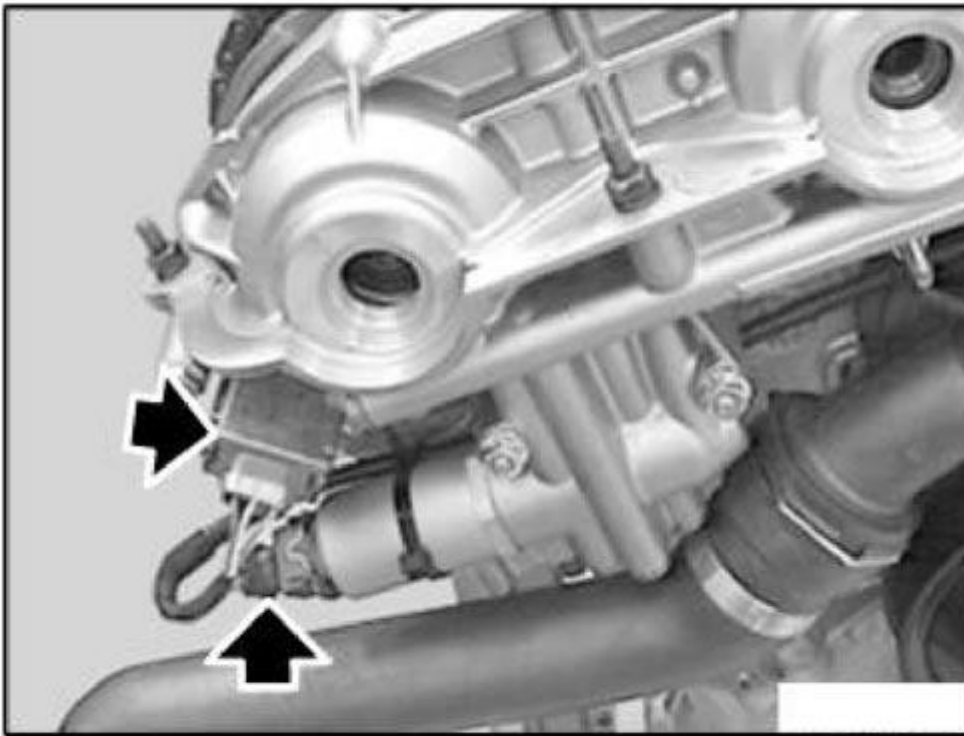
Install and secure double VANOS adjustment unit.



G03164198

Fig. 320: Installing And 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.

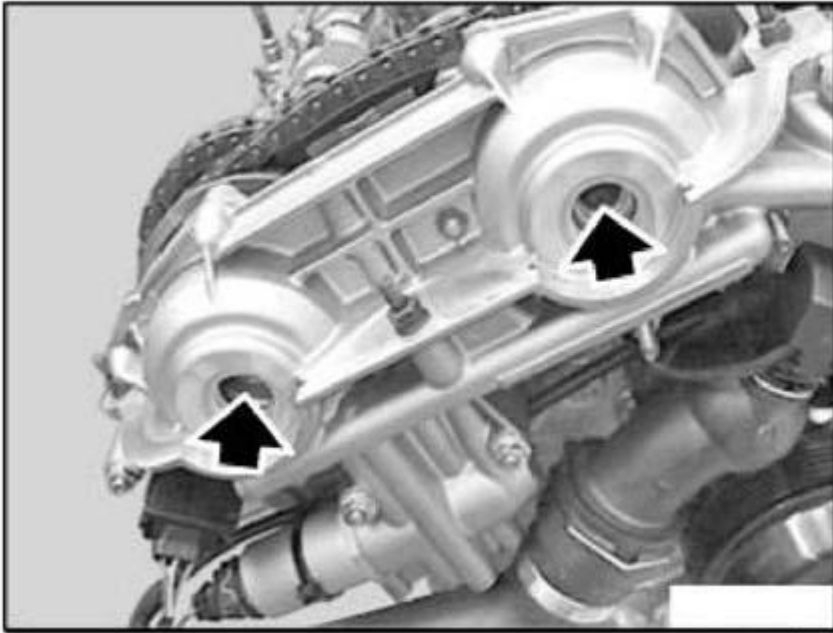


G03164199

Fig. 321: Attaching Plug Connections Of Camshaft Sensor
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.



G03164200

Fig. 322: Inserting Fitting Screws**Courtesy of BMW OF NORTH AMERICA, INC.**

Tightening torque, refer to 11 36 4AZ in **ENGINE - TIGHTENING TORQUES** .

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

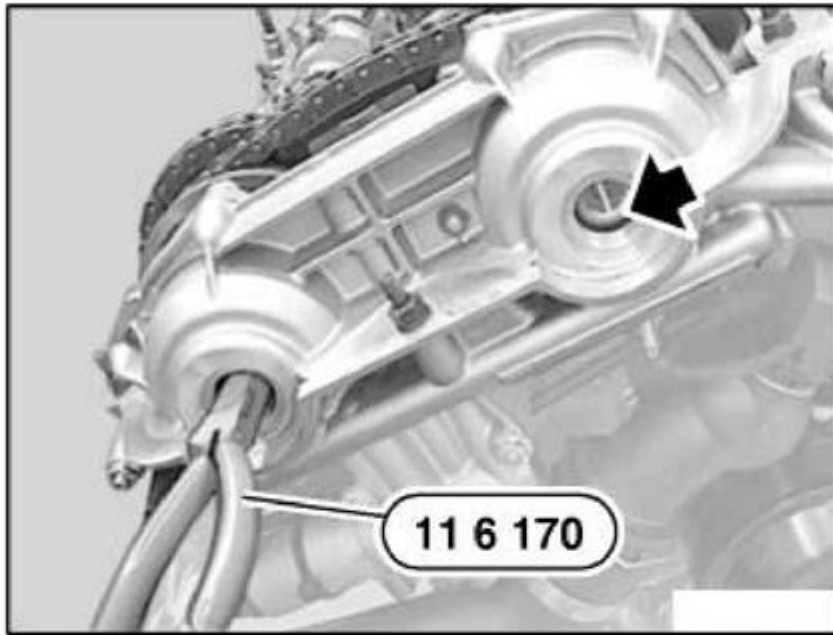
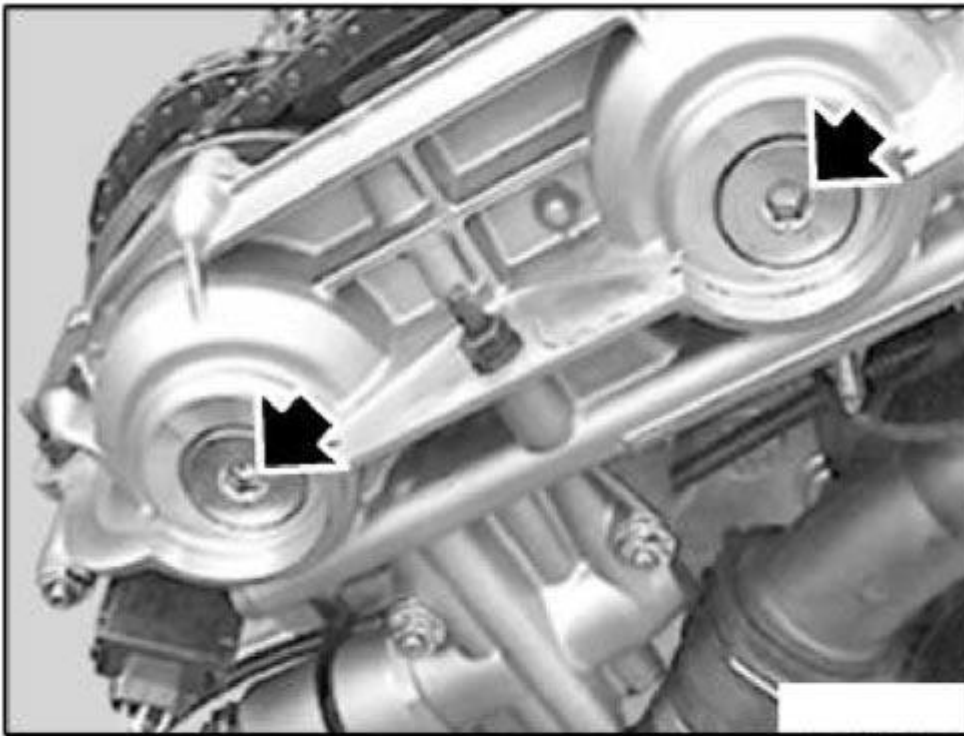


Fig. 323: Identifying Special Tool 11 6 170
Courtesy of BMW OF NORTH AMERICA, INC.

E85:

Use commercially available offset flat nose pliers.

Insert screw plugs with new sealing rings and tighten down.

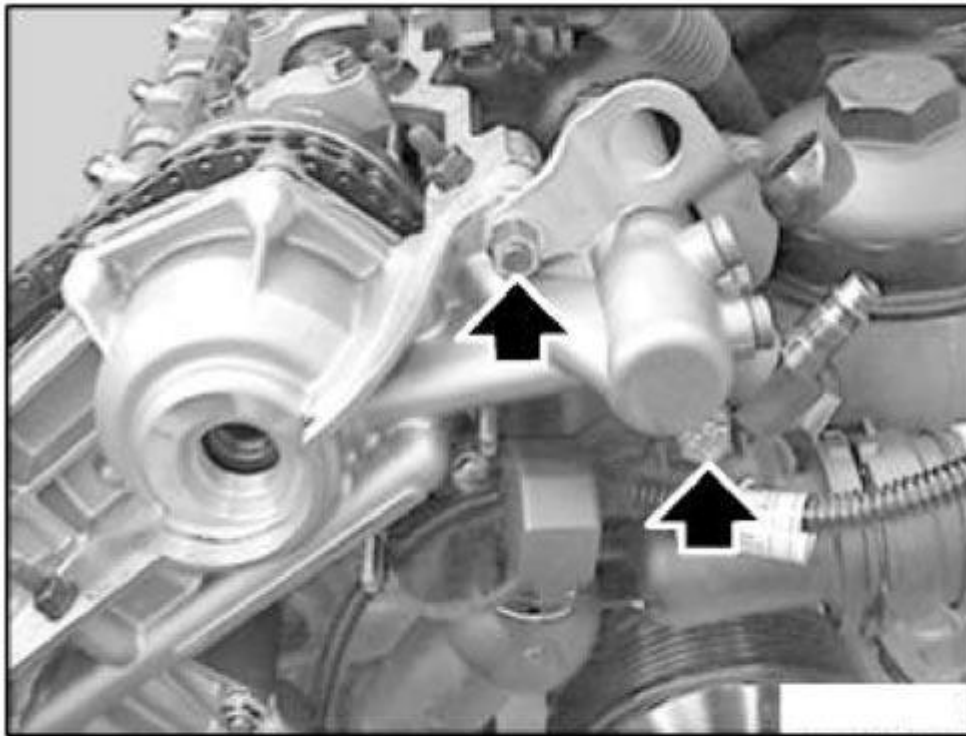


G03164202

Fig. 324: Inserting Screw Plugs With New Sealing Rings
Courtesy of BMW OF NORTH AMERICA, INC.

Tightening torque, refer to 11 36 3AZ in **ENGINE - TIGHTENING TORQUES** .

Fit suspension lug.



G03164203

Fig. 325: Fitting Suspension Lug

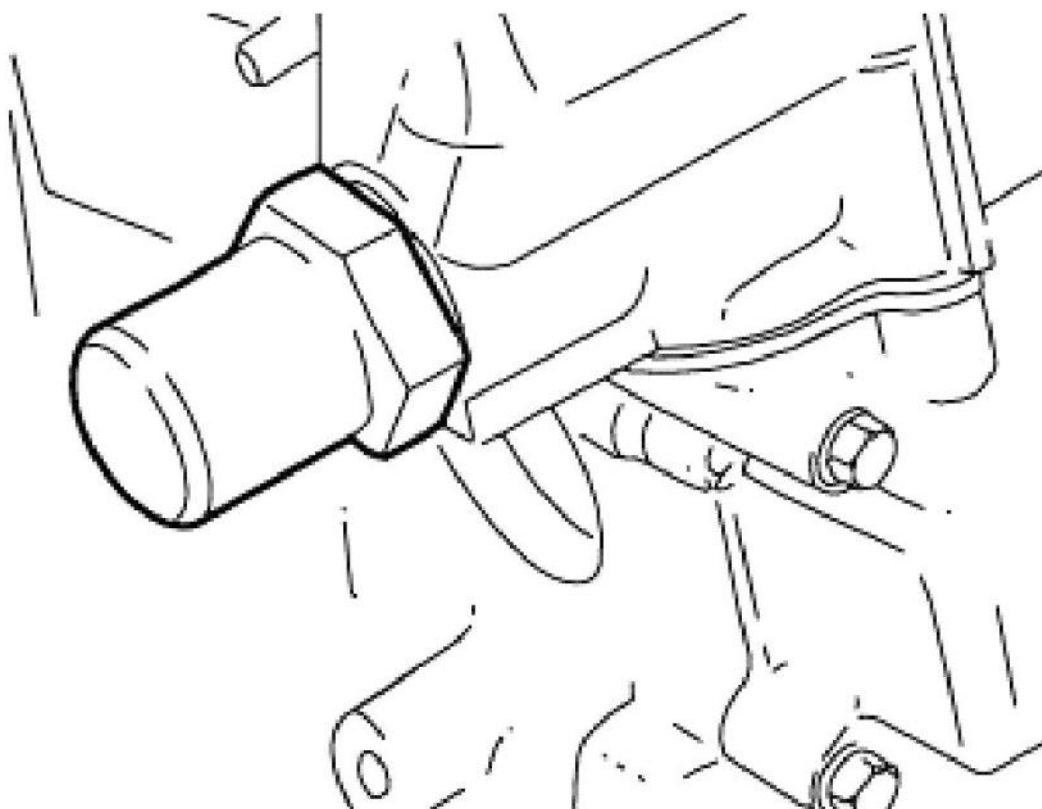
Courtesy of BMW OF NORTH AMERICA, INC.

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.

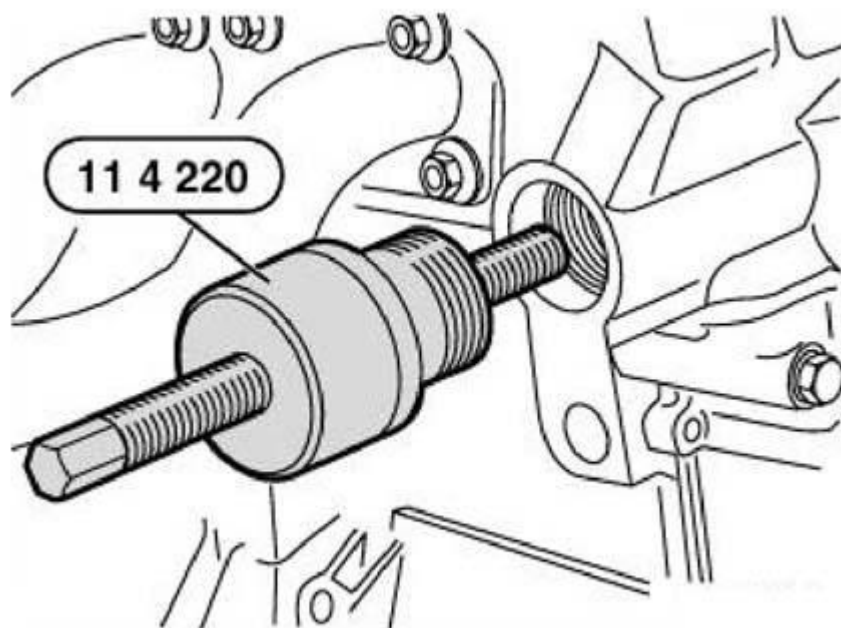
Remove cylinder for chain tensioning piston.



G03164204

Fig. 326: Removing Cylinder For Chain Tensioning Piston
Courtesy of BMW OF NORTH AMERICA, INC.

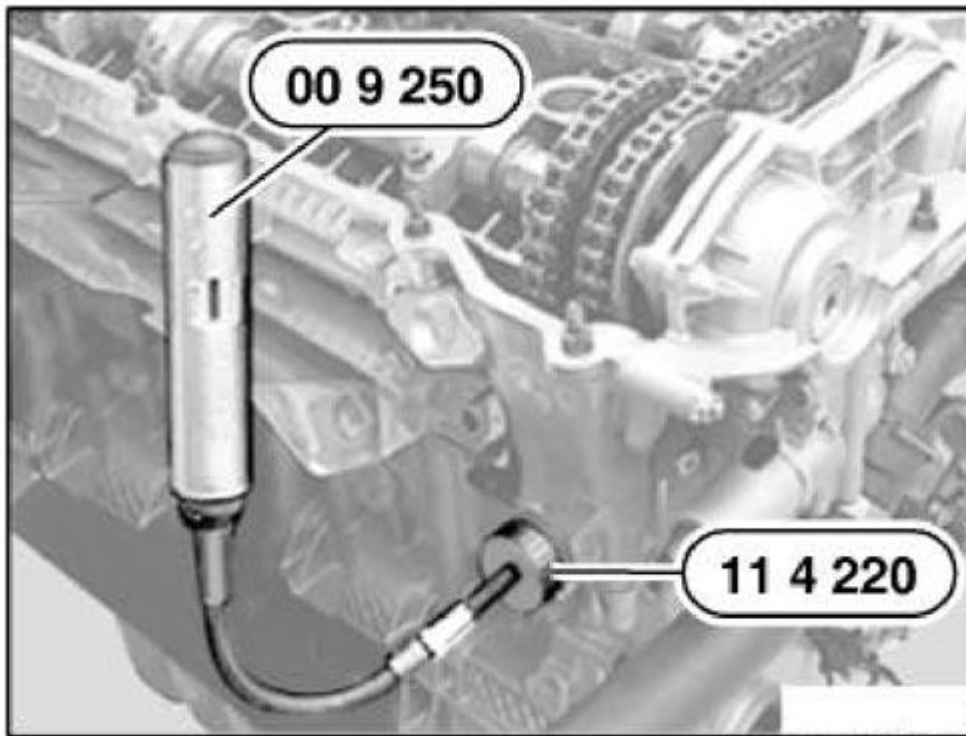
Insert special tool 11 4 220 in cylinder head and bring adjustment screw into contact with tensioning rail.



G03164205

Fig. 327: Inserting Special Tool 11 4 220
Courtesy of BMW OF NORTH AMERICA, INC.

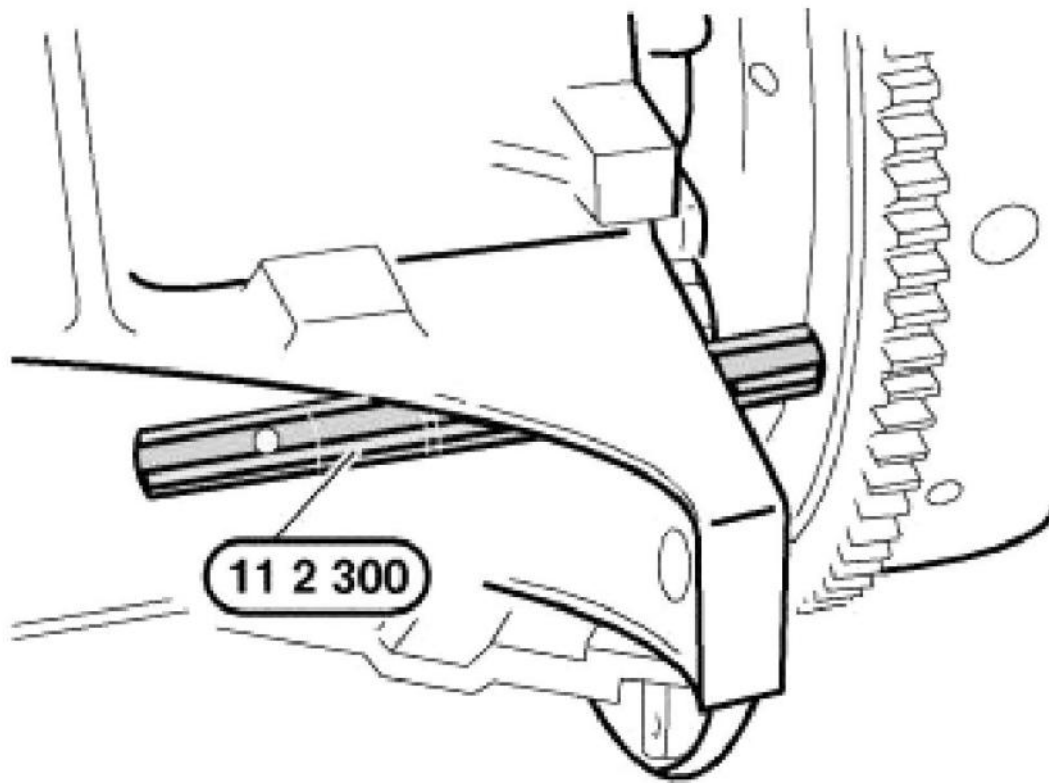
Preload tensioning rail with special tool 11 4 220 by rotating adjusting screw with special tool 00 9 250 or standard torque wrench to 0.7 Nm.



G03164206

Fig. 328: Identifying Special Tools 11 4 220 And 00 9 250
Courtesy of BMW OF NORTH AMERICA, INC.

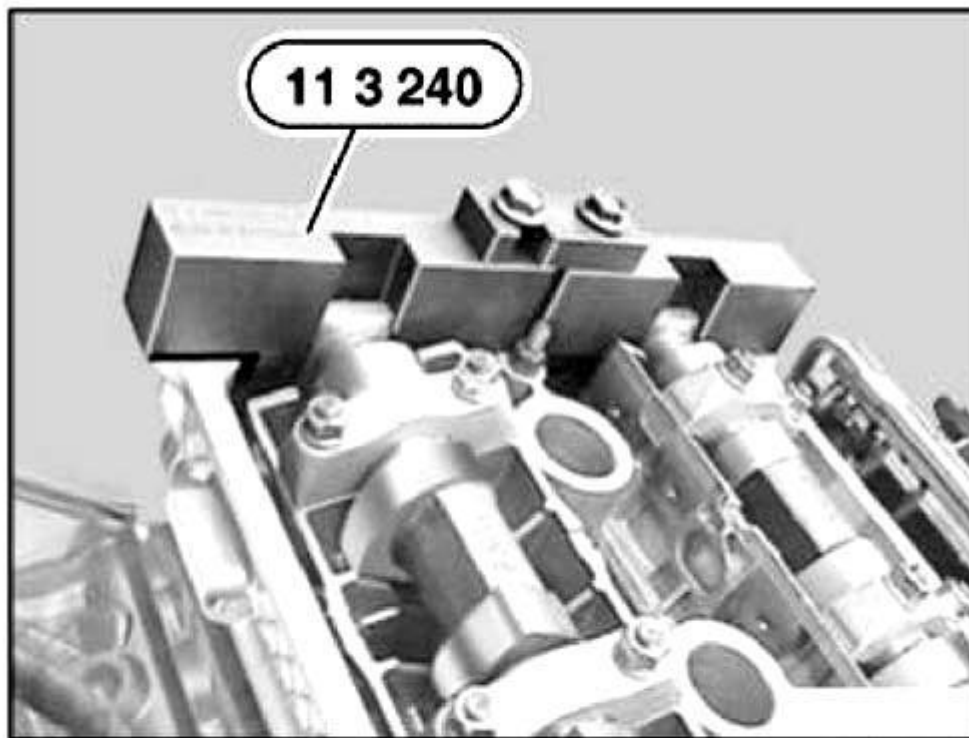
Pull special tool 11 2 300 back until flywheel is no longer secured in position.



G03164207

Fig. 329: Pulling Special Tool 11 2 300
Courtesy of BMW OF NORTH AMERICA, INC.

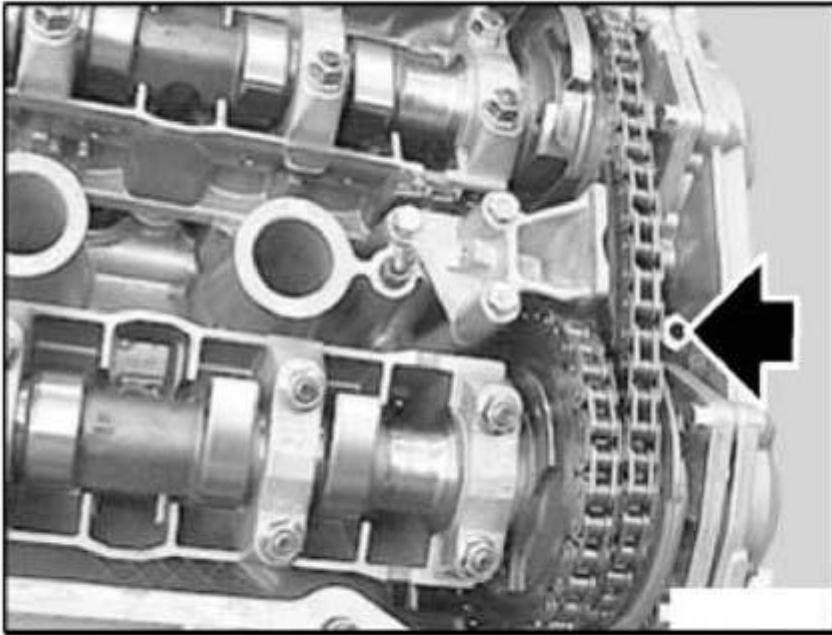
Remove special tool 11 3 240.



G03164208

Fig. 330: Removing Special Tool 11 3 240
Courtesy of BMW OF NORTH AMERICA, INC.

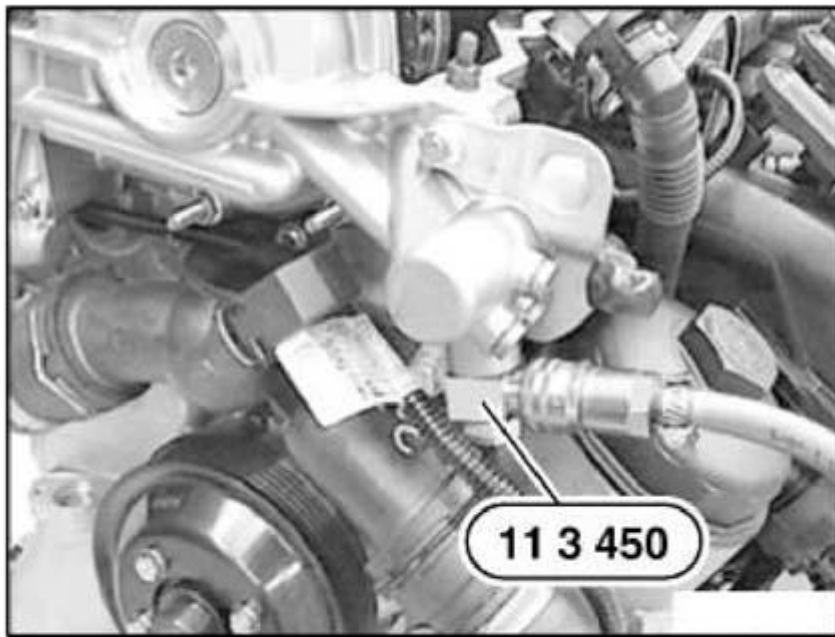
IMPORTANT: Cover double VANOS adjustment unit; when the compressed air supply is connected, several drops of oil are sprayed out of the bore.



G03164209

Fig. 331: Identifying VANOS Adjustment Unit
Courtesy of BMW OF NORTH AMERICA, INC.

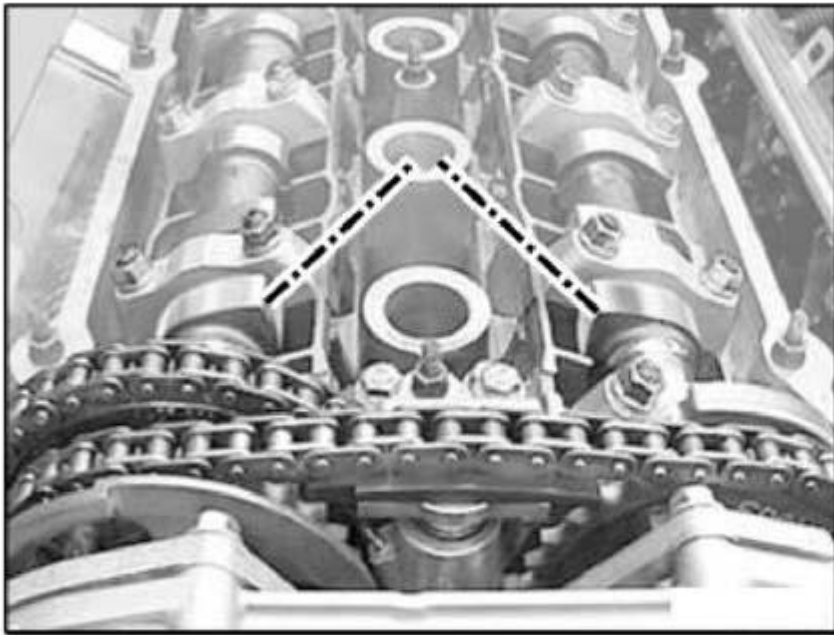
Connect compressed air (2 to 8 bar).



G03164210

Fig. 332: 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.

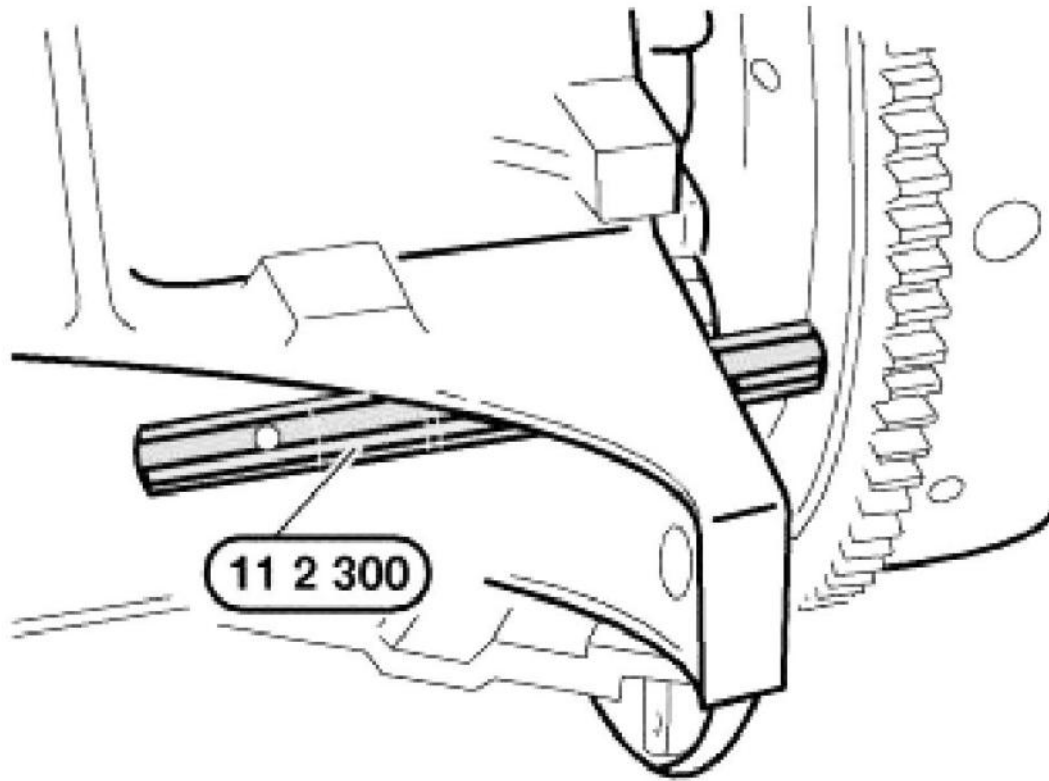


G03164211

Fig. 333: Identifying Cam Tips

Courtesy of BMW OF NORTH AMERICA, INC.

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



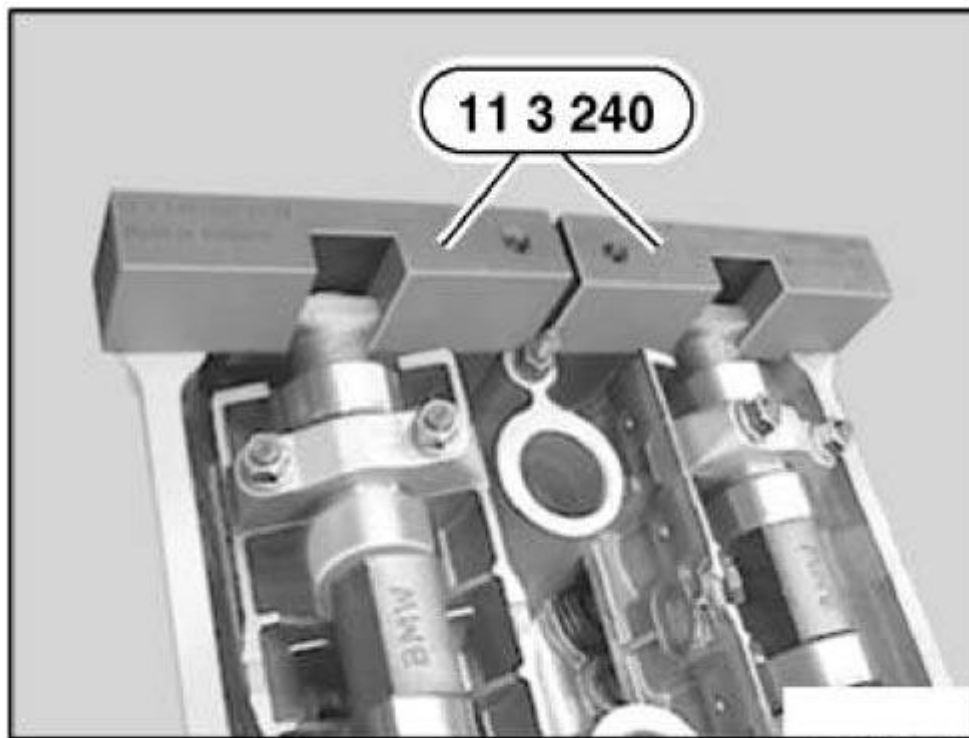
G03164212

Fig. 334: Removing Special Tool 11 2 300
 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.

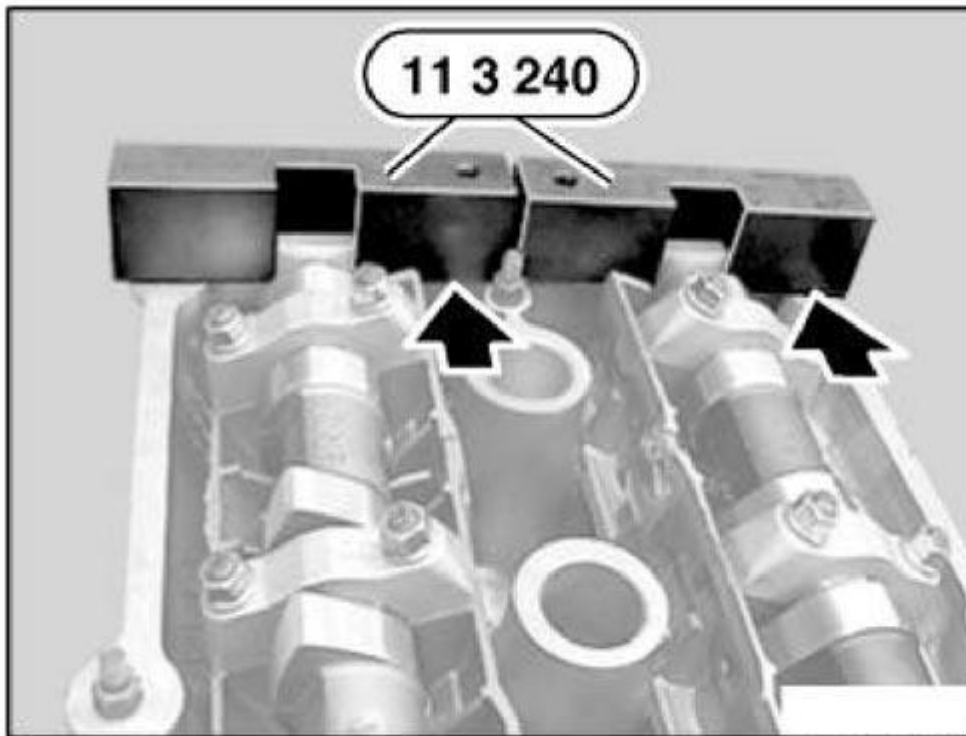


G03164213

Fig. 335: Fitting Special Tool 11 3 240
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.



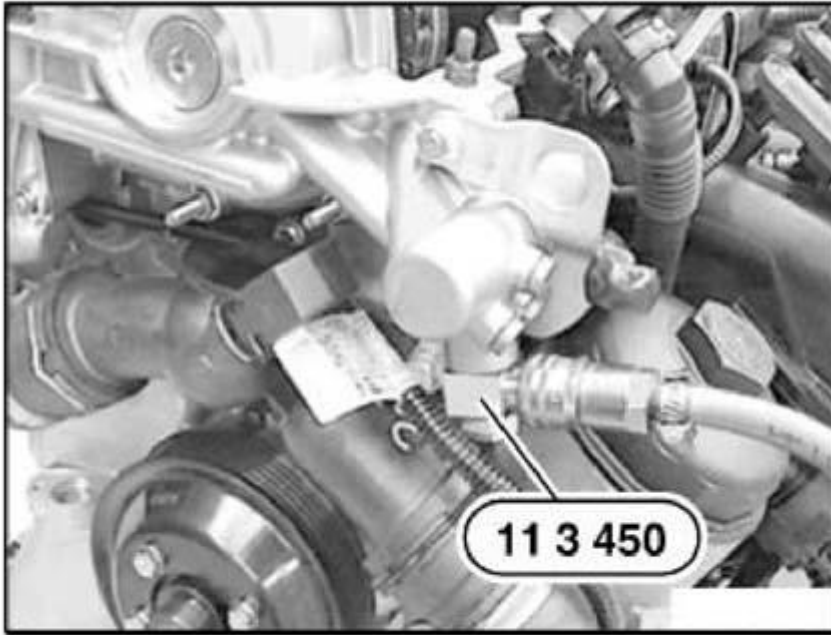
G03164214

Fig. 336: Identifying Special Tool 11 3 240
Courtesy of BMW OF NORTH AMERICA, INC.

If necessary, adjust camshaft timing.

Detach compressed air connection.

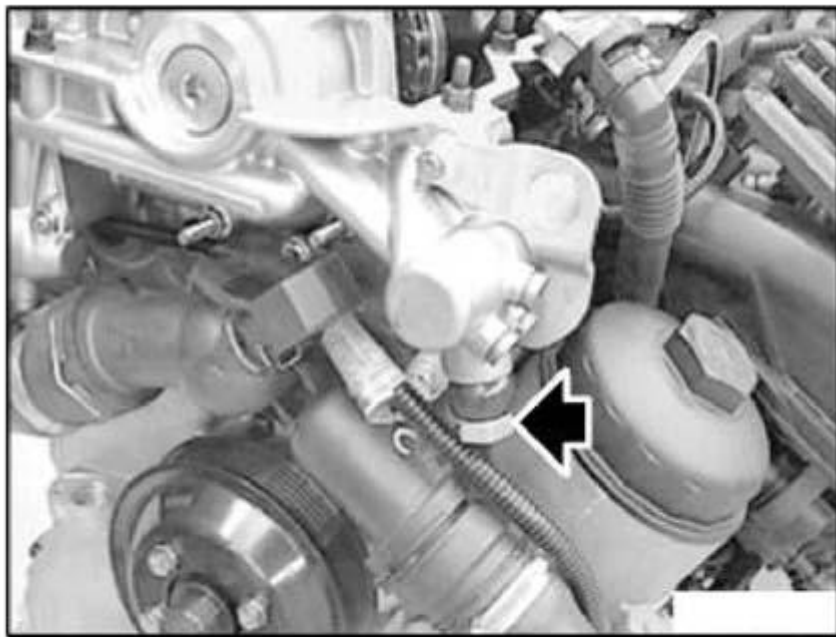
Remove special tool 11 3 450.



G03164215

Fig. 337: Removing Special Tool 11 3 450
Courtesy of BMW OF NORTH AMERICA, INC.

Fit oil pressure line with new seals.



G03164216

Fig. 338: Fitting Oil Pressure Line With New Seals
Courtesy of BMW OF NORTH AMERICA, INC.

Tightening torque, refer to 11 36 2AZ in **ENGINE - TIGHTENING TORQUES** .

Unfasten and remove special tool 11 4 220.

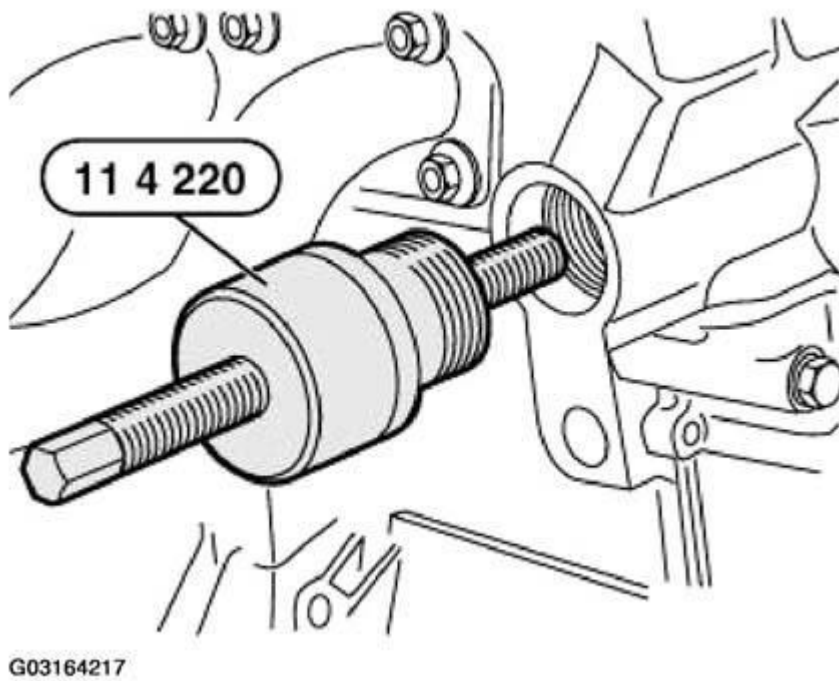
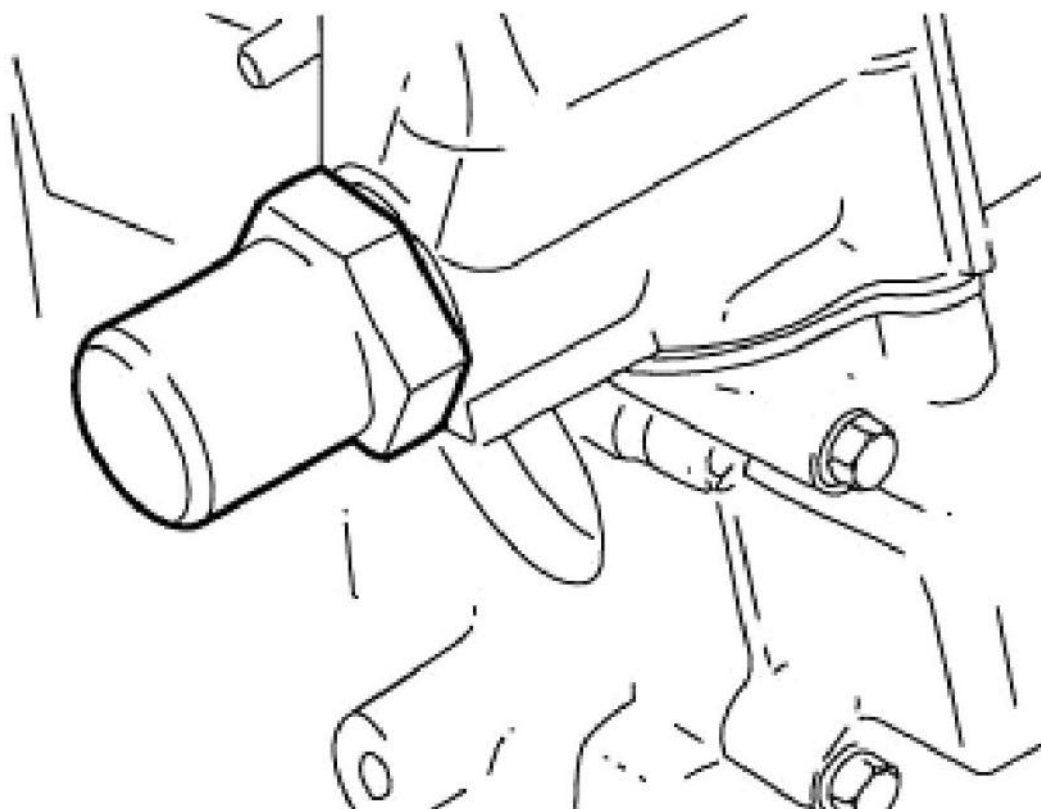


Fig. 339: Removing Special Tool 11 4 220
Courtesy of BMW OF NORTH AMERICA, INC.

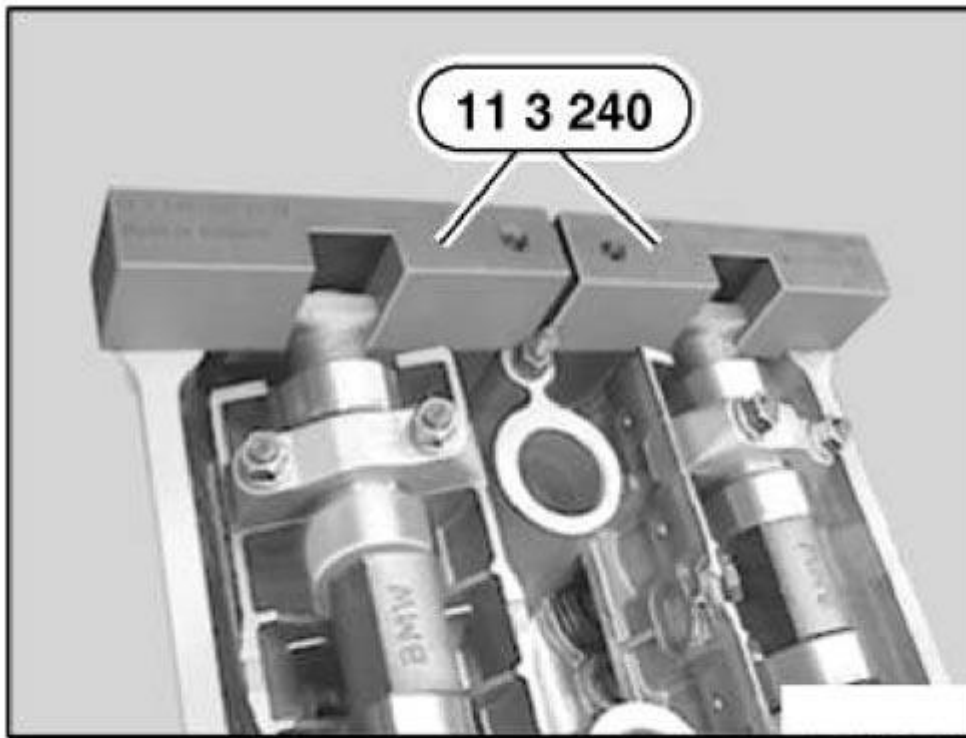
Install cylinder for chain tensioning piston.



G03164218

Fig. 340: Installing Cylinder For Chain Tensioning Piston
Courtesy of BMW OF NORTH AMERICA, INC.

Remove special tool 11 3 240.

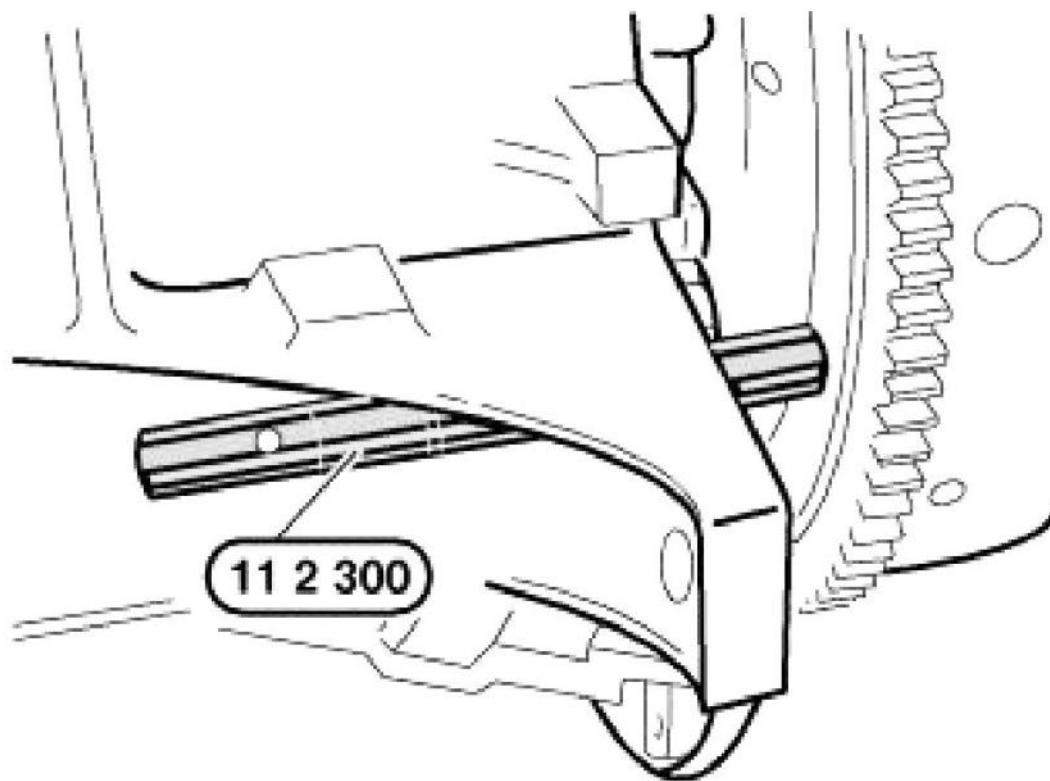


G03164219

Fig. 341: Removing Special Tool 11 3 240
Courtesy of BMW OF NORTH AMERICA, INC.

Remove special tool 11 2 300.

Assemble engine.



G03164220

Fig. 342: Removing Special Tool 11 2 300

Courtesy of BMW OF NORTH AMERICA, INC.

11 36 570 REPLACING SOLENOID VALVE FOR INLET SIDE ON VANOS ADJUSTMENT UNIT**Special tools required:****NOTE:** For special tools, refer to ENGINE - SPECIAL TOOLS .

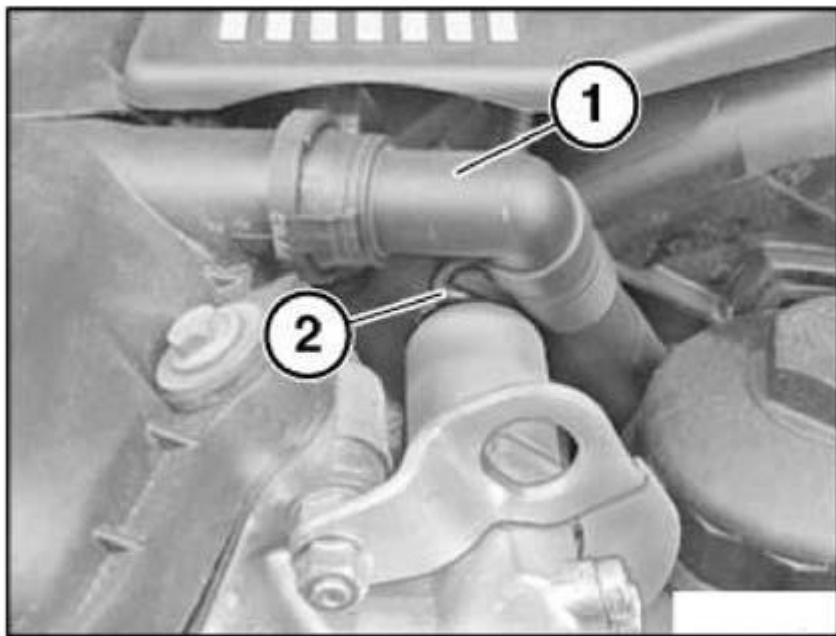
- 32 2 110

Necessary preliminary tasks:

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

Unlock hose (1) and detach.

Unlock plug (2) and remove.



G03164221

Fig. 343: Unlocking Hose And Plug
Courtesy of BMW OF NORTH AMERICA, INC.

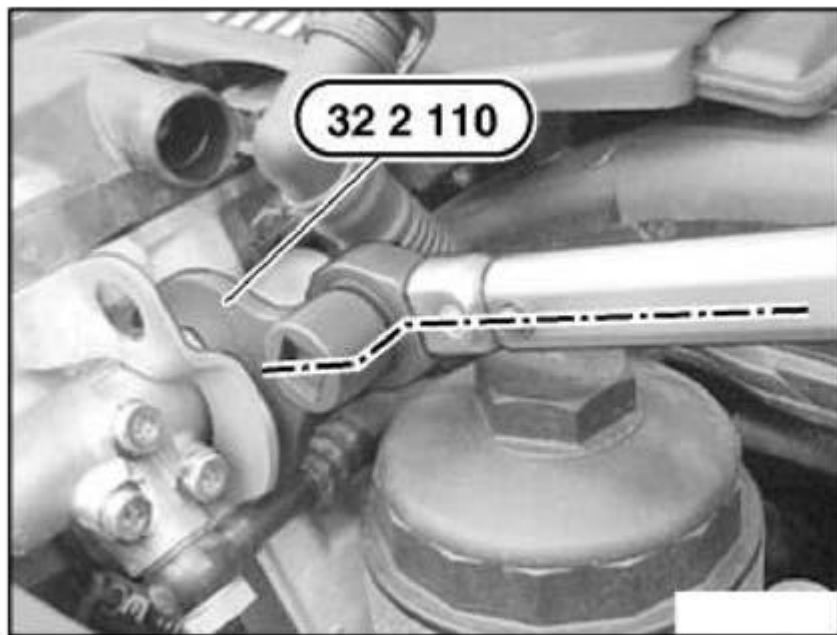
NOTE: Once it has been removed, oil drips from the solenoid valve.

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.



G03164222

Fig. 344: Releasing Solenoid Valve With Special Tool 32 2 110
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Tightening torque, refer to 11 36 1AZ in **ENGINE - TIGHTENING TORQUES** .

Now clear the fault memory.

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

Special tools required:

NOTE: For special tools, refer to **ENGINE - SPECIAL TOOLS** .

- 11 6 420

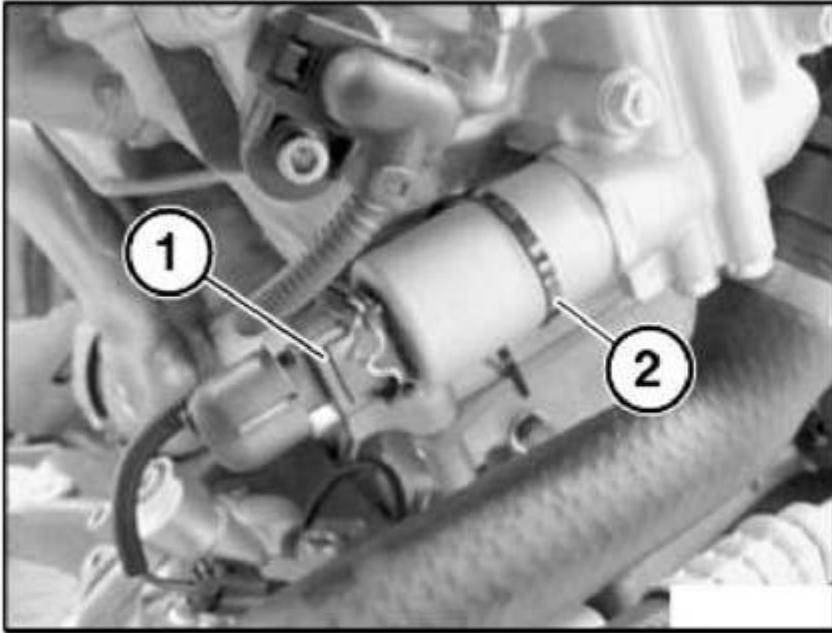
Necessary preliminary tasks:

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

E85 only:

- Remove fluid tank for windshield washer system. See **61 71 061 REPLACING FLUID TANK FOR WINDSHIELD WASHER SYSTEM**

Unlock plug (1) and remove. Cut through cable tie (2).



G03164223

Fig. 345: Unlocking Plug

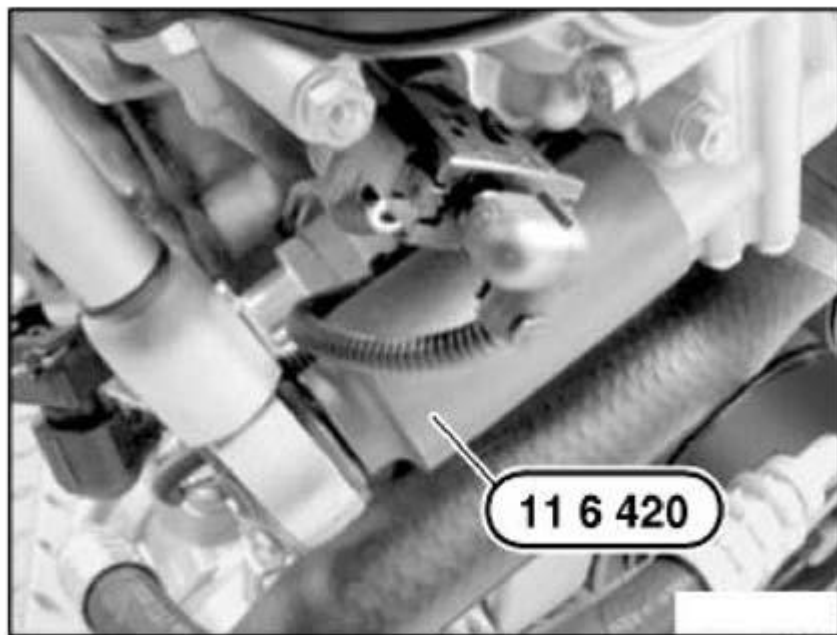
Courtesy of BMW OF NORTH AMERICA, INC.

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 11 6 420.



G03164224

Fig. 346: Releasing Solenoid Valve With Special Tool 11 6 420
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Tightening torque, refer to 11 36 1AZ in **ENGINE - TIGHTENING TORQUES** .

Now clear the fault memory.

OIL SUPPLY

11 40 000 CHECKING ENGINE OIL PRESSURE

Special tools required:

NOTE: For special tools, refer to **ENGINE - SPECIAL TOOLS** .

- 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.

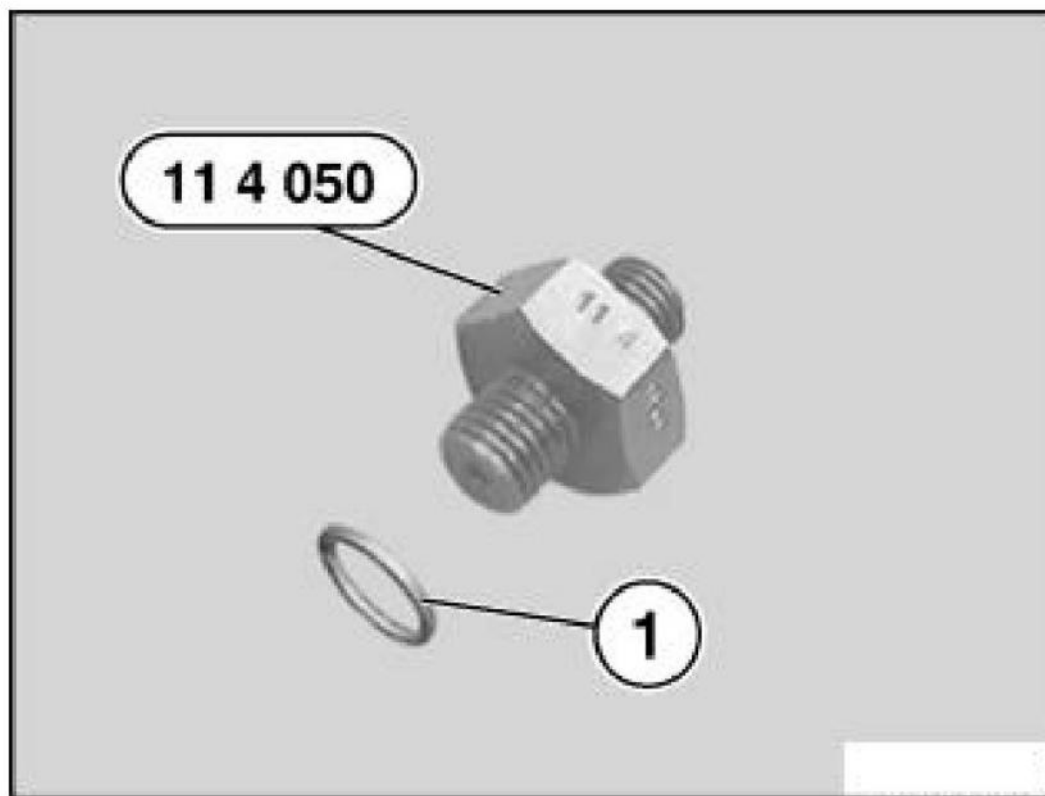
Tightening torque, refer to 11 42 2AZ in **ENGINE - TIGHTENING TORQUES**

Remove oil pressure switch. See **12 61 280 REMOVING AND INSTALLING/REPLACING OIL PRESSURE SWITCH (M52TU, M54, M56)**

Installation:

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

Install special tool 11 4 050 with sealing ring (1) in place of oil pressure switch.

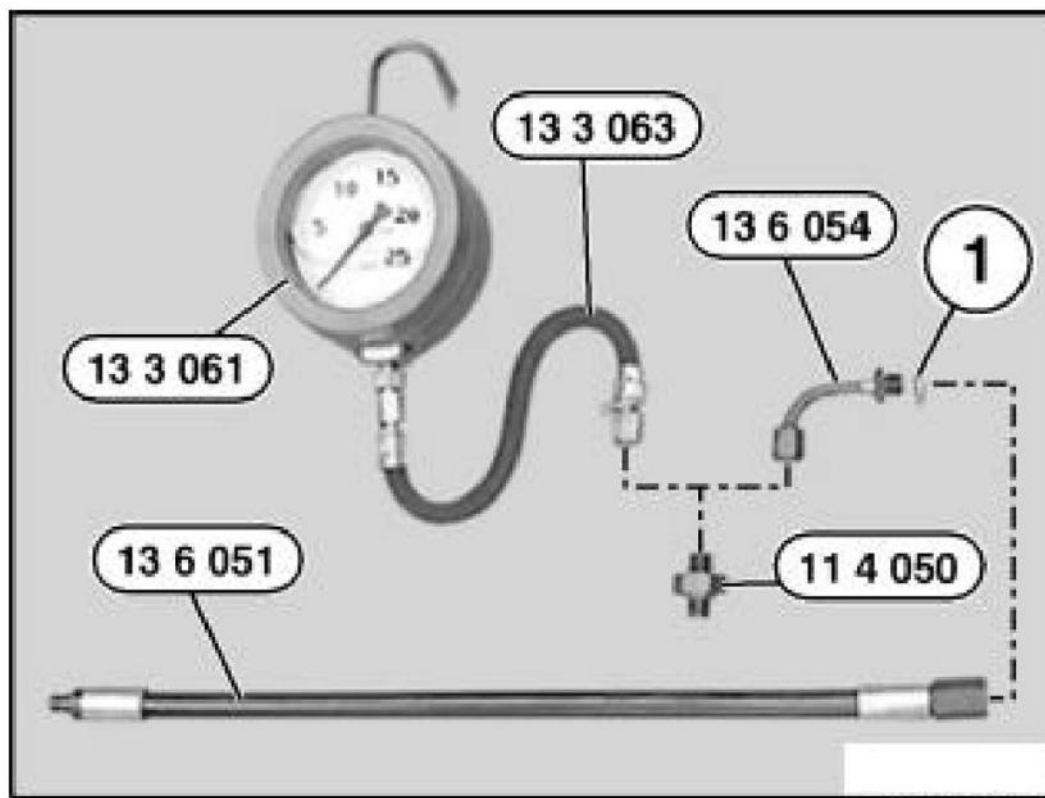


G03164225

Fig. 347: Installing Special Tool 11 4 050
Courtesy of BMW OF NORTH AMERICA, INC.

Checking engine oil pressure with DIS Tester

Attach special tool 11 6 054 with sealing ring (1) and special tool 13 6 051 and connect to DIS Tester.



G03164226

Fig. 348: Attaching Special Tools 11 6 054 And 13 6 051
 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).

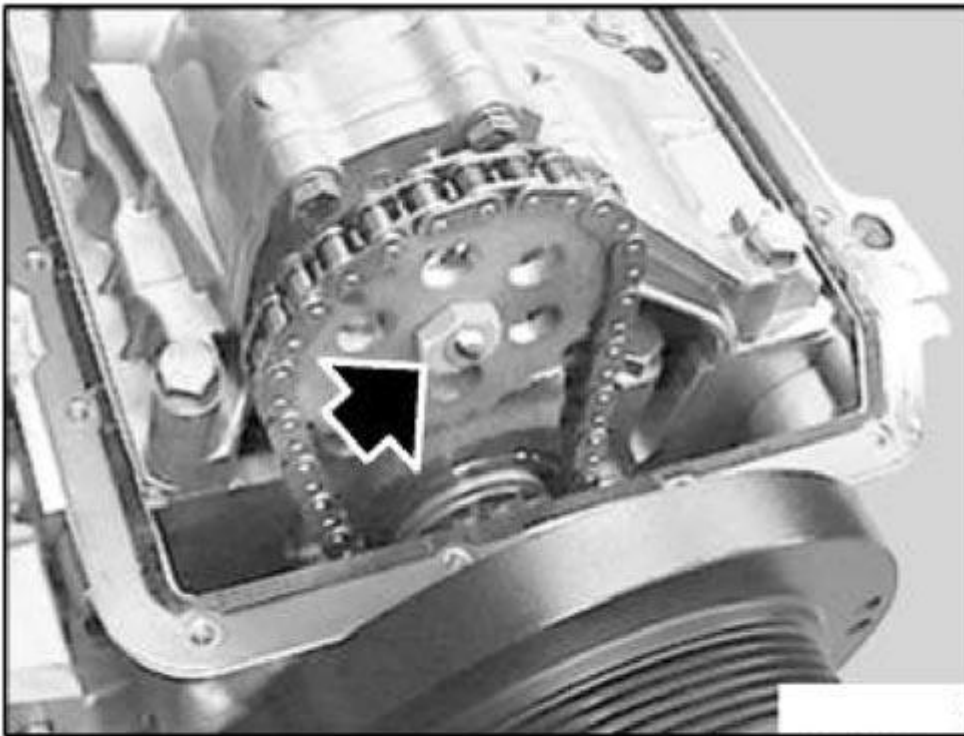
Start engine and check engine oil pressure.

OIL PUMP WITH FILTER AND DRIVE

11 41 000 REMOVING AND INSTALLING/REPLACING OIL PUMP (M52TU / M54 / M56)

Remove oil sump.

CAUTION: Left-hand threads. Unfasten nut.



G03164227

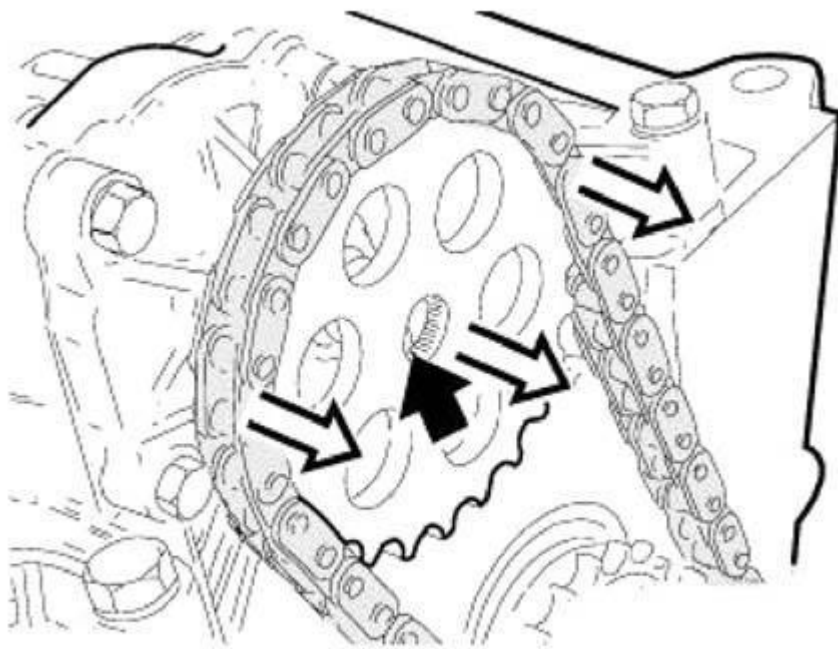
Fig. 349: Unfastening Nut**Courtesy of BMW OF NORTH AMERICA, INC.***Installation:*

Tightening torque, refer to 11 41 4AZ in **ENGINE - TIGHTENING TORQUES** .

Remove sprocket with chain.

Installation:

Align splines of chain wheel and oil pump shaft to each other.



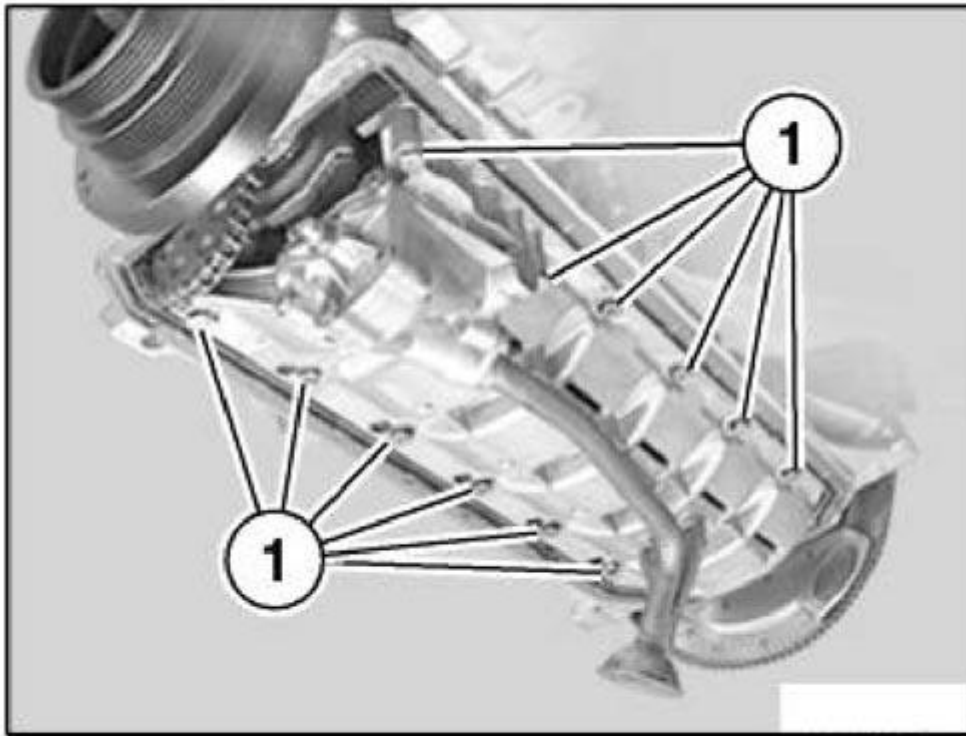
G03164228

Fig. 350: Aligning Splines Of Chain Wheel And Oil Pump Shaft
 Courtesy of BMW OF NORTH AMERICA, INC.

Version 1

Oil pump integrated in oil scraper:

Release screws (1), remove oil pump with oil scraper.



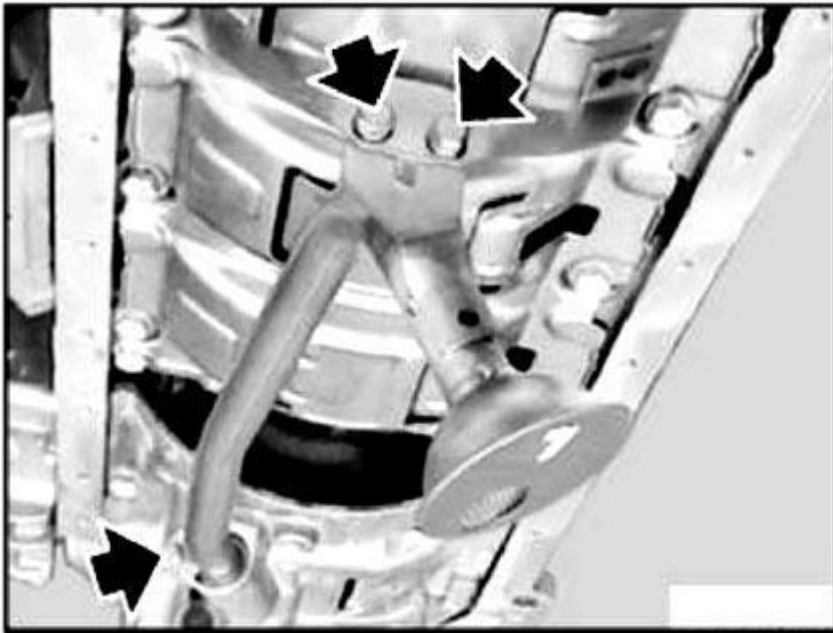
G03164229

Fig. 351: Removing Oil Pump With Oil Scraper
Courtesy of BMW OF NORTH AMERICA, INC.

Version 2

Oil pump and oil scraper - two parts:

Release screws and remove oil pump intake pipe.



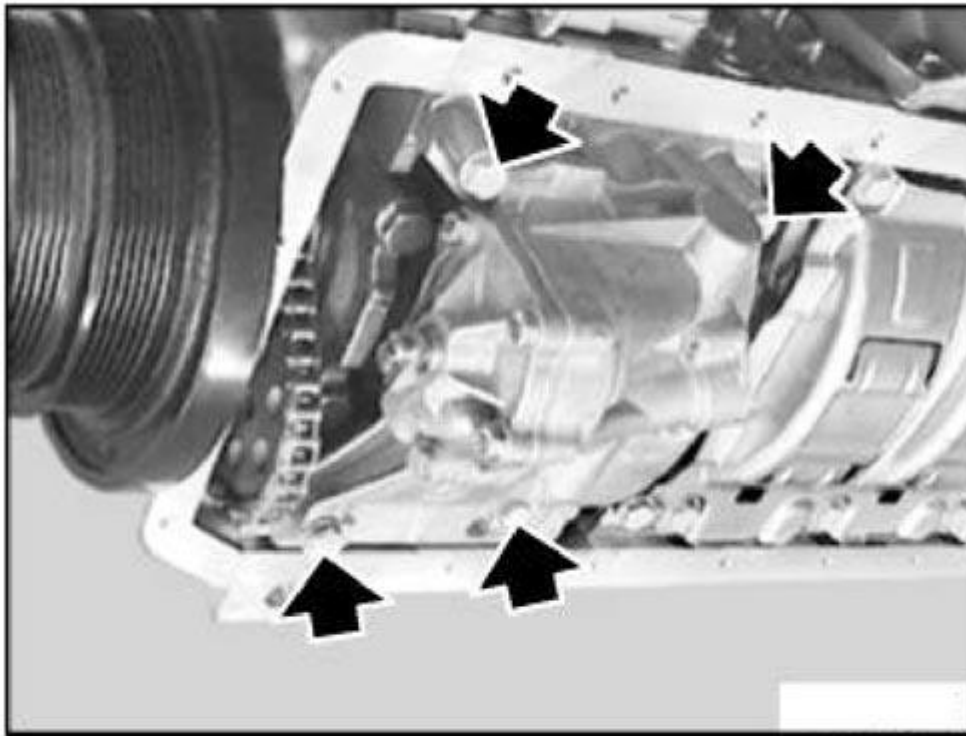
G03164230

Fig. 352: Removing Oil Pump Intake Pipe
Courtesy of BMW OF NORTH AMERICA, INC.

Version 2

Oil pump and oil scraper - two parts:

Release screws and remove oil pump.

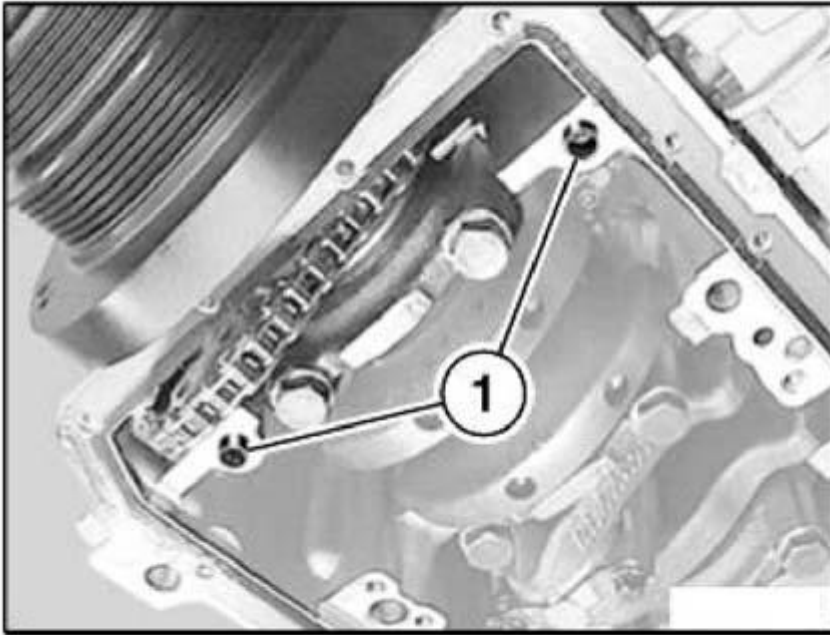


G03164231

Fig. 353: Releasing Screws And Removing Oil Pump
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

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

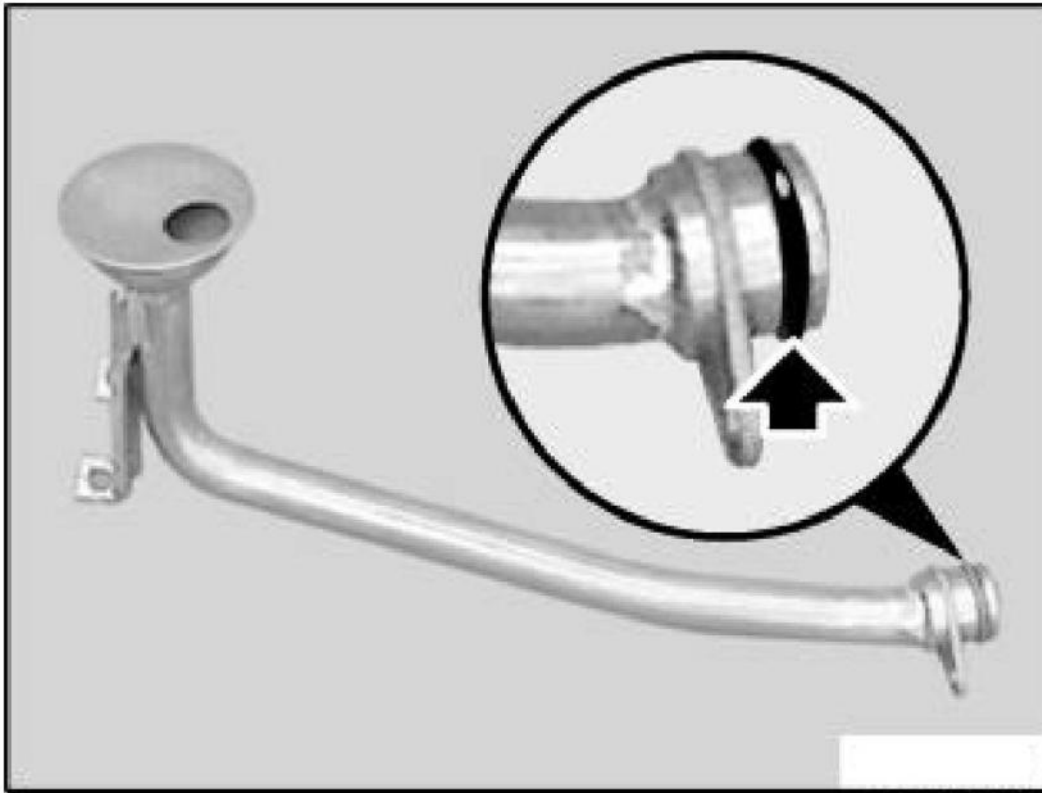


G03164232

Fig. 354: Checking Dowel Sleeves
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Replace O-ring on intake pipe.



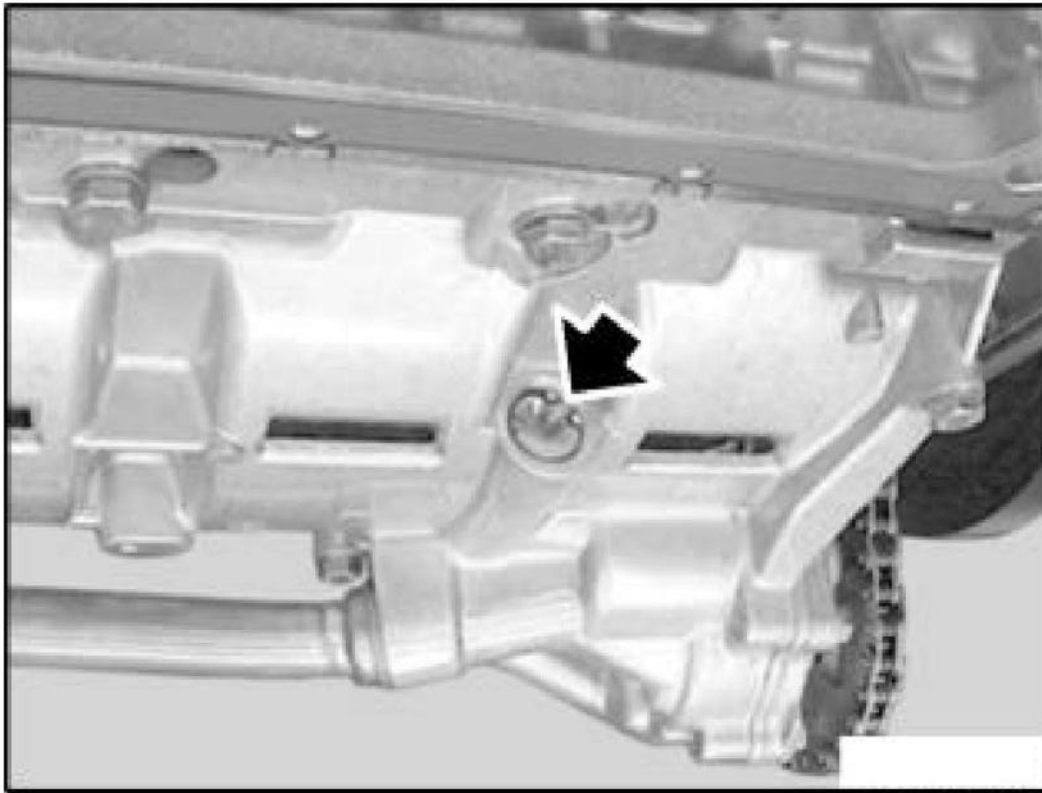
G03164233

Fig. 355: Replacing 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.



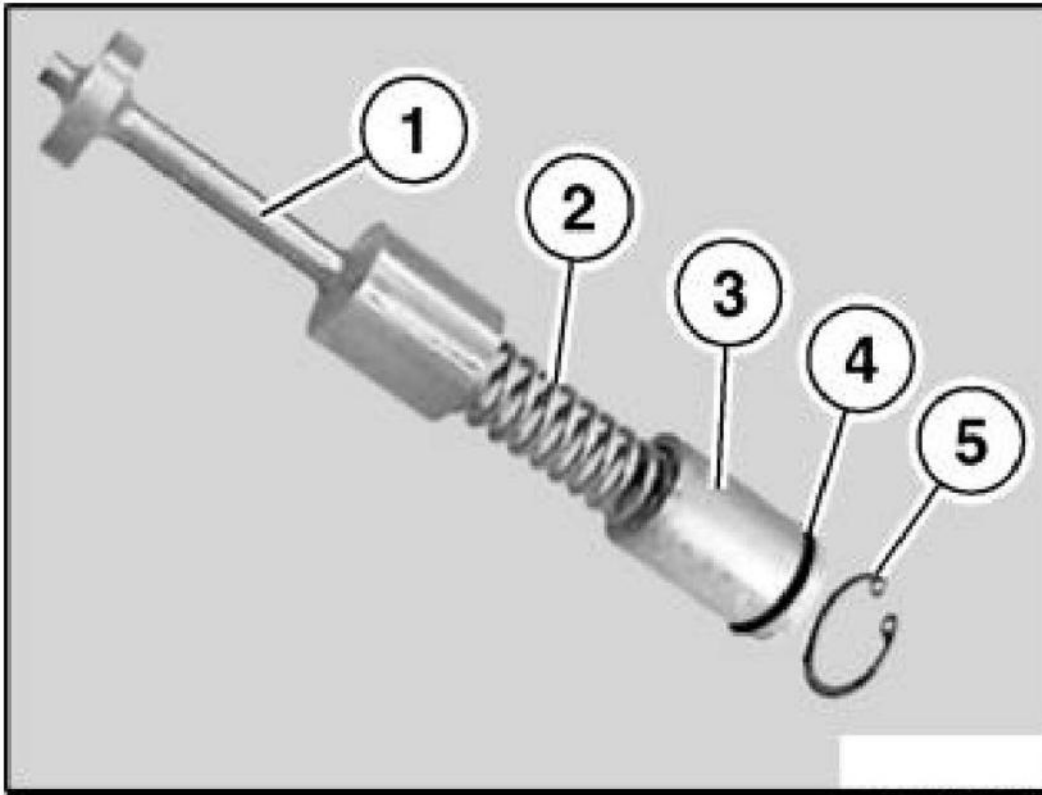
G03164234

Fig. 356: Removing Circlip

Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

1. Control plunger
2. Spring
3. Sleeve
4. O-ring (replace)
5. Circlip



G03164235

Fig. 357: Identifying Control Plunger, Spring And Sleeve
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. See **13 71 000 REMOVE AND INSTALLING INTAKE FILTER HOUSING (M52TU, M54)**

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 engine oil service.

Remove alternator. See **12 31 020 REMOVING AND INSTALLING OR REPLACING ALTERNATOR (M52, M52TU, S50US, S52, M54, M56)**

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). See **POWER STEERING VANE PUMP (M52/M54)**

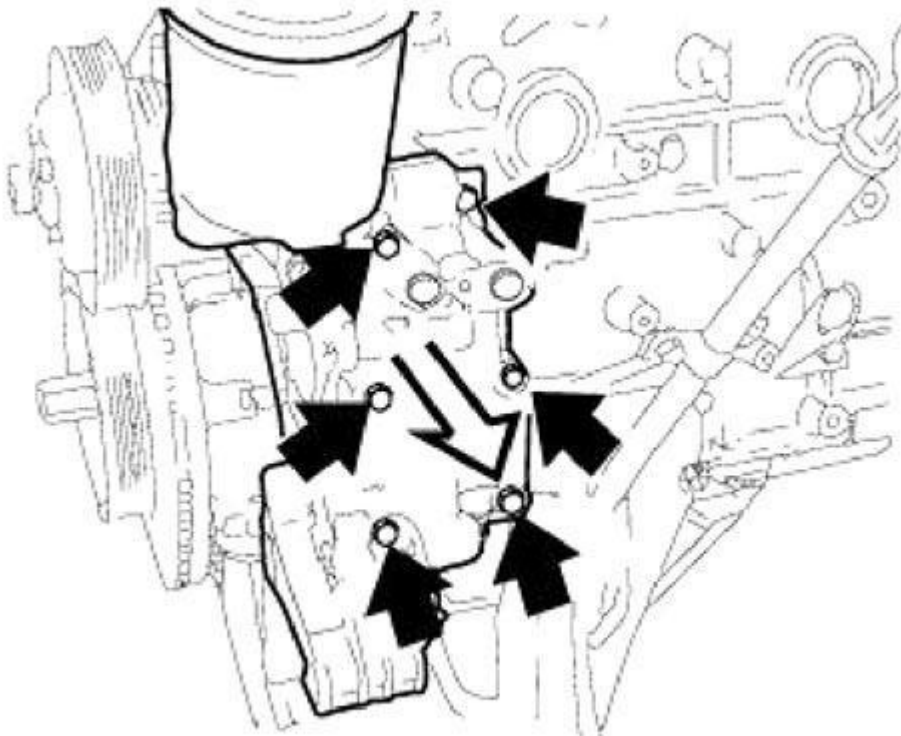
If necessary, remove alternator drive belt tensioner. See **12 31... REPLACING ALTERNATOR BELT PULLEY**

Remove connector for oil pressure switch. See **12 61 280 REMOVING AND INSTALLING/REPLACING OIL PRESSURE SWITCH (M52TU, M54, M56)**

If necessary, disconnect plug for oil temperature switch. See **12 61 250 REMOVING AND INSTALLING/REPLACING OIL TEMPERATURE SWITCH (M52TU, M54, M56)**

Disconnect oil pressure line for VANOS adjustment unit from oil filter housing. **11 36 570 Replacing solenoid valve for inlet side on VANOS adjustment unit** or **11 36 010 Removing and installing or replacing double VANOS adjustment unit (M52TU / M54 / M56)**

Unfasten screws and remove complete full-flow oil filter.

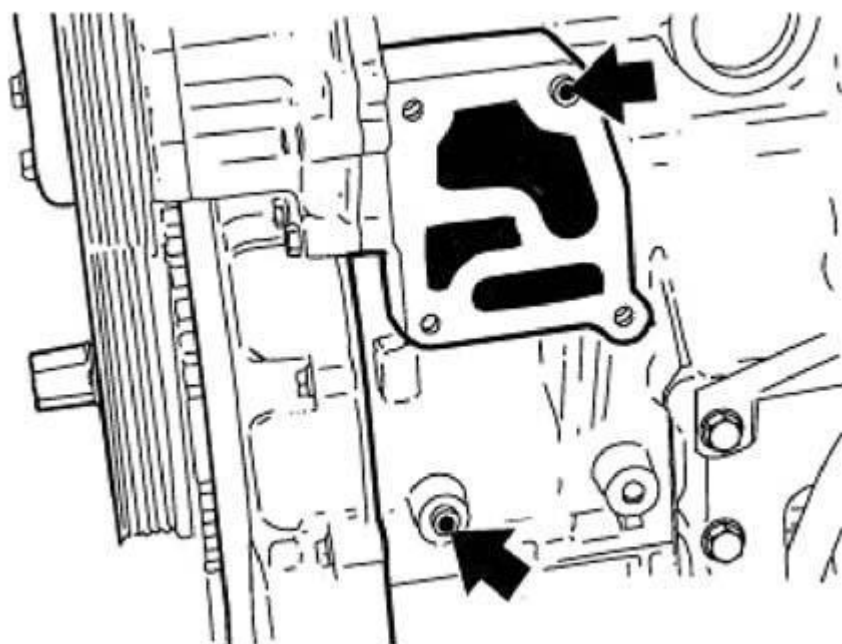


G03164236

Fig. 358: Unfastening Screws And Removing Complete Full-Flow Oil Filter
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Check dowel sleeves for damage and correct installation position.



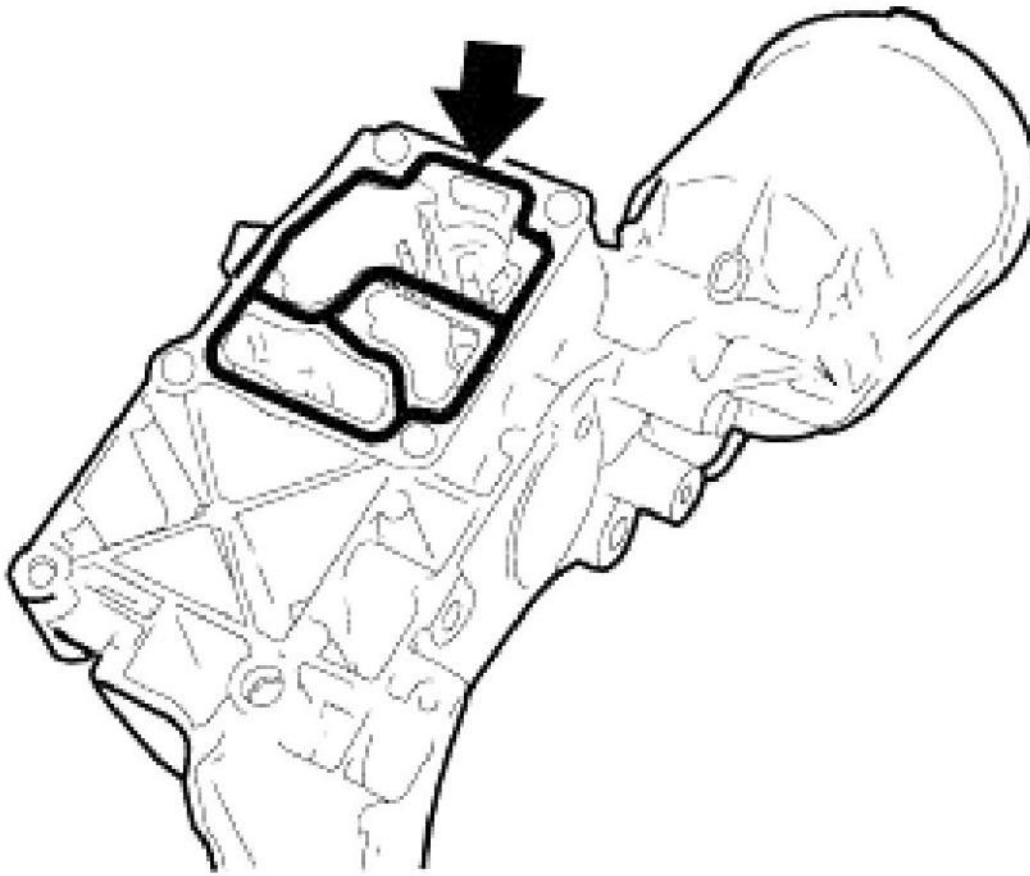
G03164237

Fig. 359: Checking Dowel Sleeves

Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Replace seal.



G03164238

Fig. 360: Replacing Seal

Courtesy of BMW OF NORTH AMERICA, INC.

Top up engine oil.

WATER PUMP WITH DRIVE

11 51 000 REMOVING AND INSTALLING COMPLETE WATER PUMP (M52 / S52 / M52TU / M54 / M56)

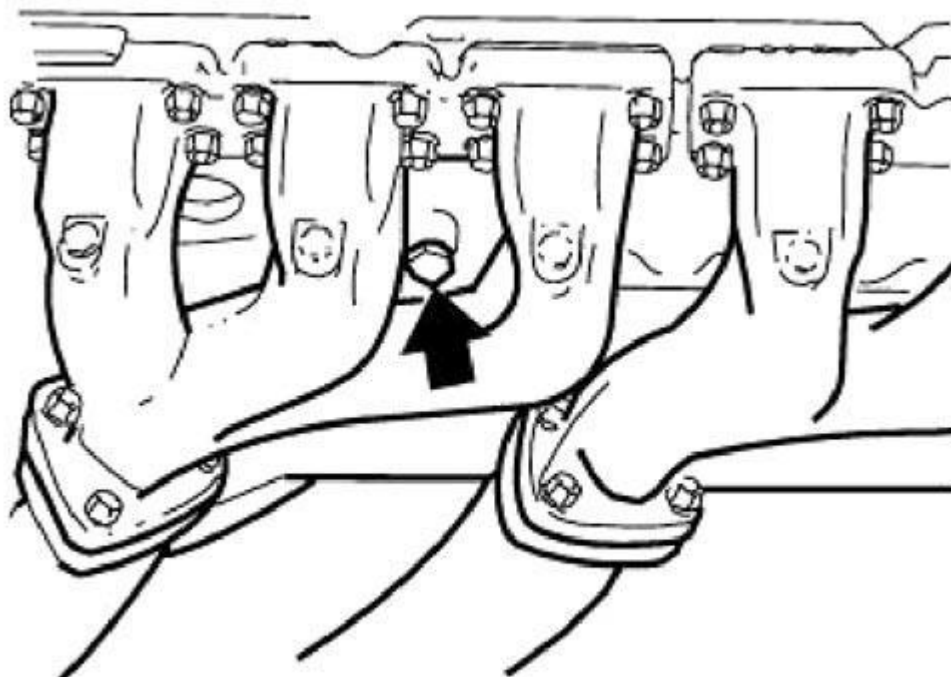
Remove alternator drive belt. See **11 28 010 Replacing alternator drive belt (M52 / S52 / M52TU / M54 / M56)**

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.



G03164239

Fig. 361: Locating Drain Plug and Exhaust manifold
Courtesy of BMW OF NORTH AMERICA, INC.

Drain and dispose of coolant.

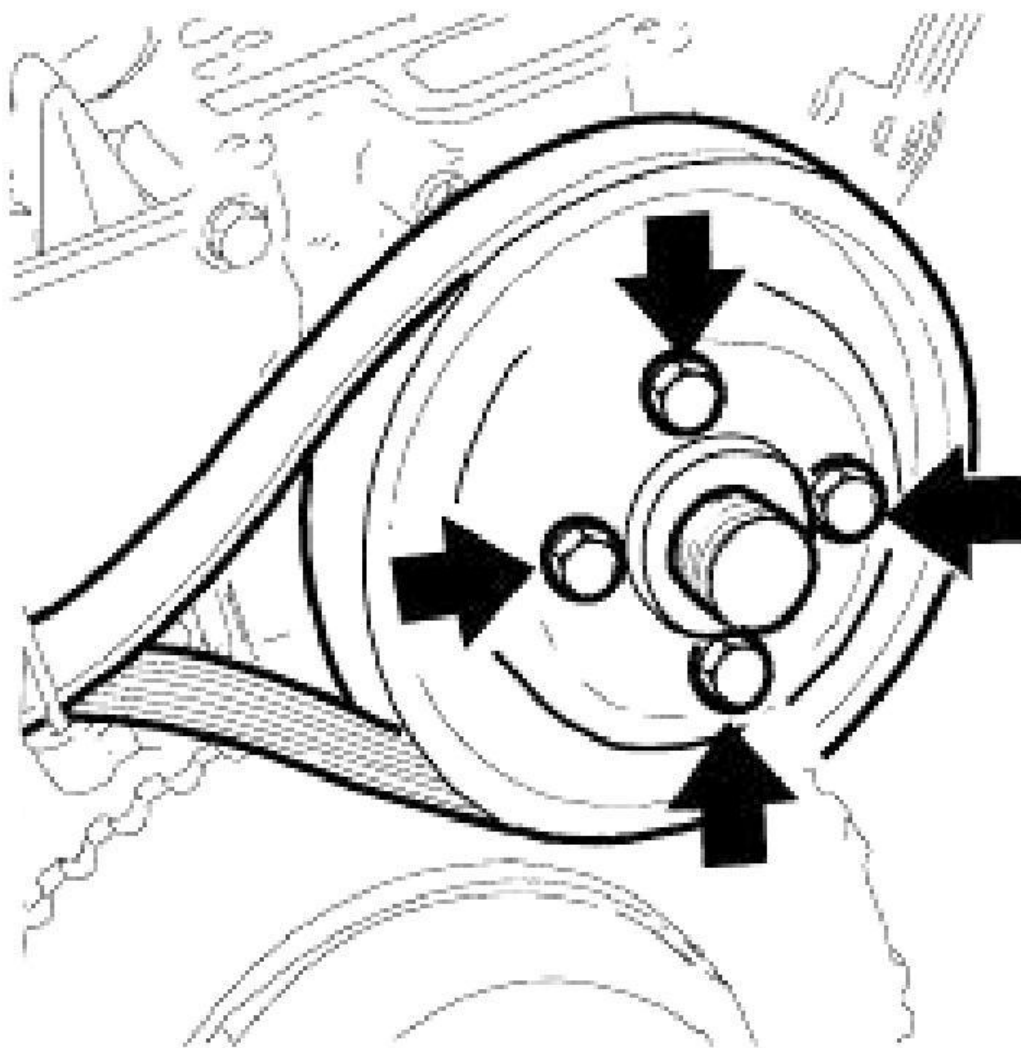
Installation:

Replace seal.

Tightening torque, refer to 11 11 5AZ in **ENGINE - TIGHTENING TORQUES** .

Vent cooling system and check for leaks.

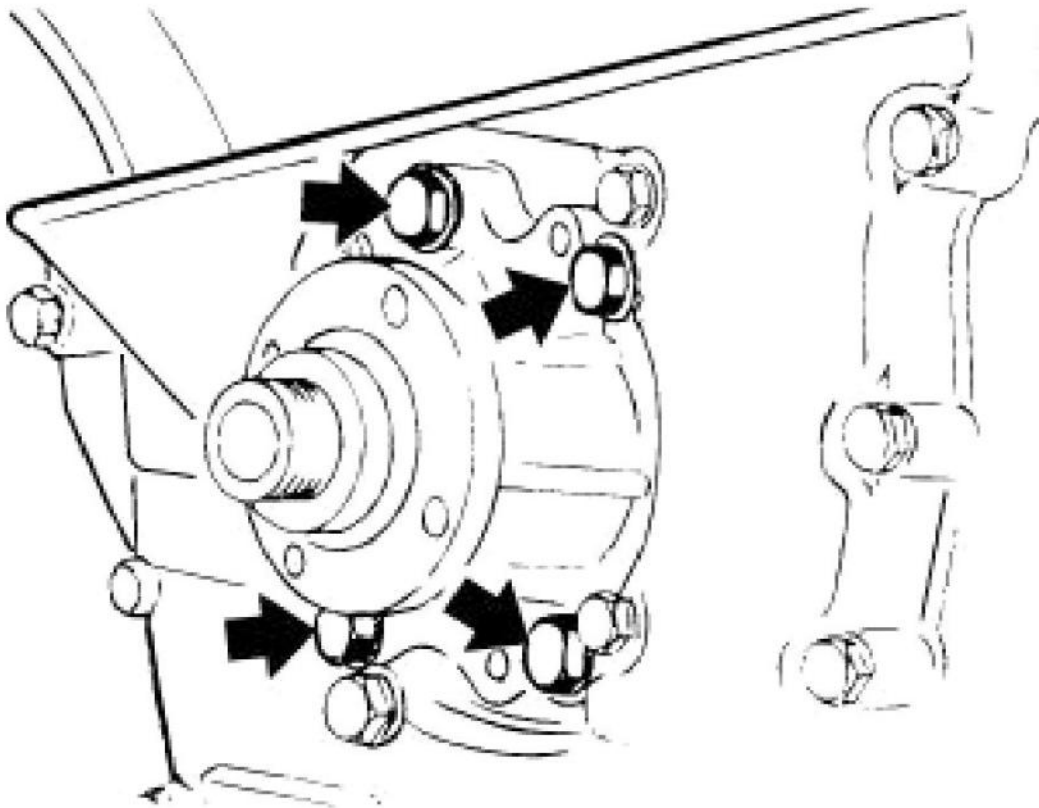
Release belt pulley.



G03164240

Fig. 362: Releasing Belt Pulley
Courtesy of BMW OF NORTH AMERICA, INC.

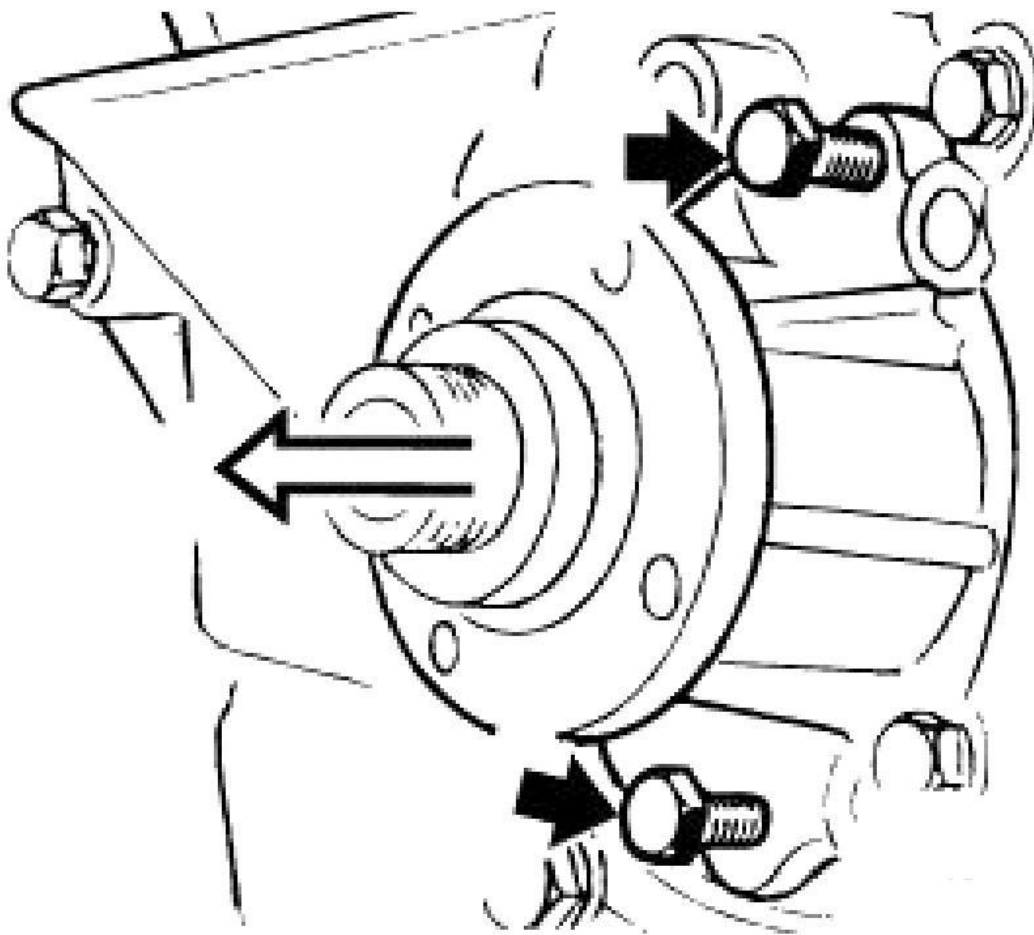
Release water pump.



G03164241

Fig. 363: 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.



G03164242

Fig. 364: Tightening Screws

Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Replace O-ring and coat with coolant as anti-friction agent.

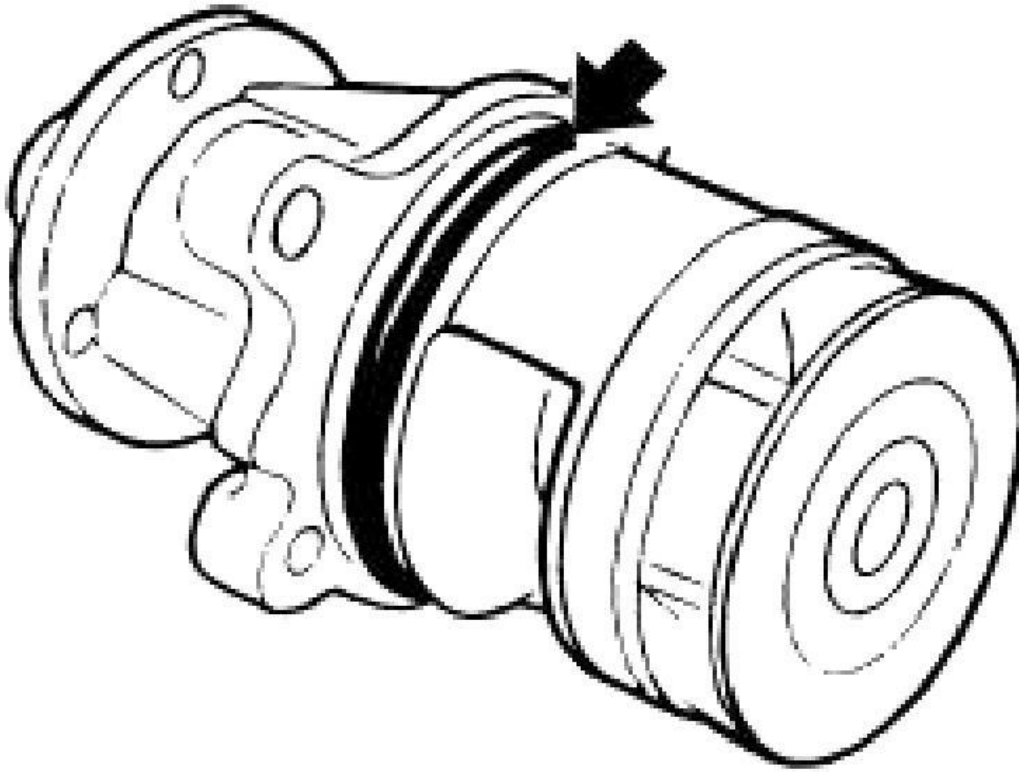
**G03164243**

Fig. 365: Replacing O-Ring And Coat With Coolant
Courtesy of BMW OF NORTH AMERICA, INC.

FAN

11 52 020 REMOVING AND INSTALLING/REPLACING FAN CLUTCH (S52 / S54 / M52 / M52TU / M54 / M56)

Special tools required:

NOTE: For special tools, refer to **ENGINE - SPECIAL TOOLS** .

- 11 5 030
- 11 5 040

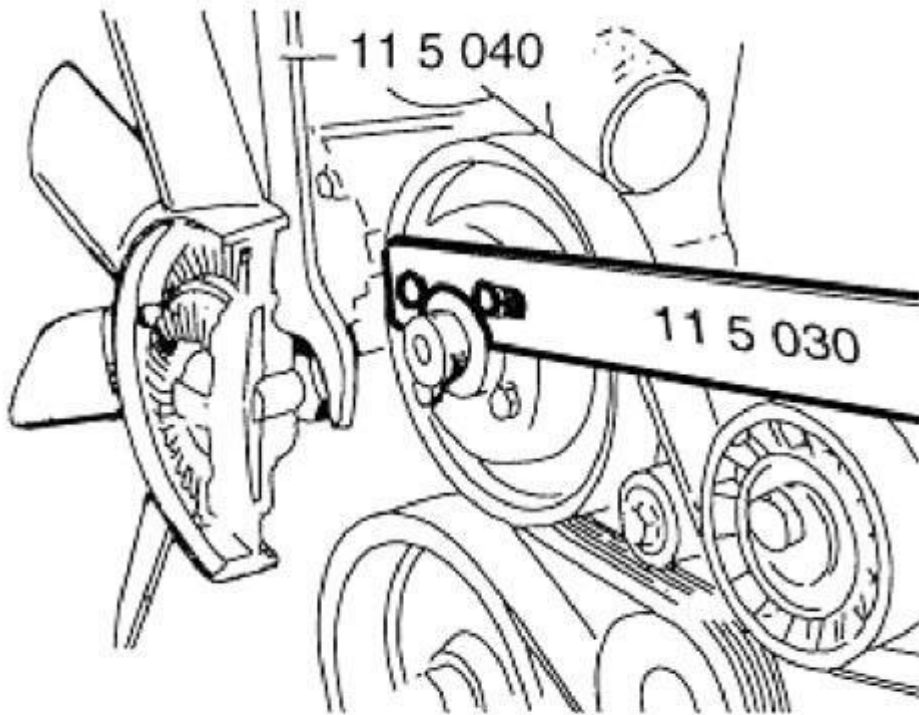
If necessary, remove air duct. See **13 72 001 REPLACING AIR CLEANER ELEMENT (M54)**

NOTE: S54

Remove engine underguard and release fan cowl. See 17 11 031 REPLACING FAN COWL M52TU / M54 AUTOMATIC WITH A/C SYSTEM

IMPORTANT: Left-hand threads.

Using special tool 11 5 030, grip pulley and unfasten cap nut from water pump using special tool 11 5 040.



G03164244

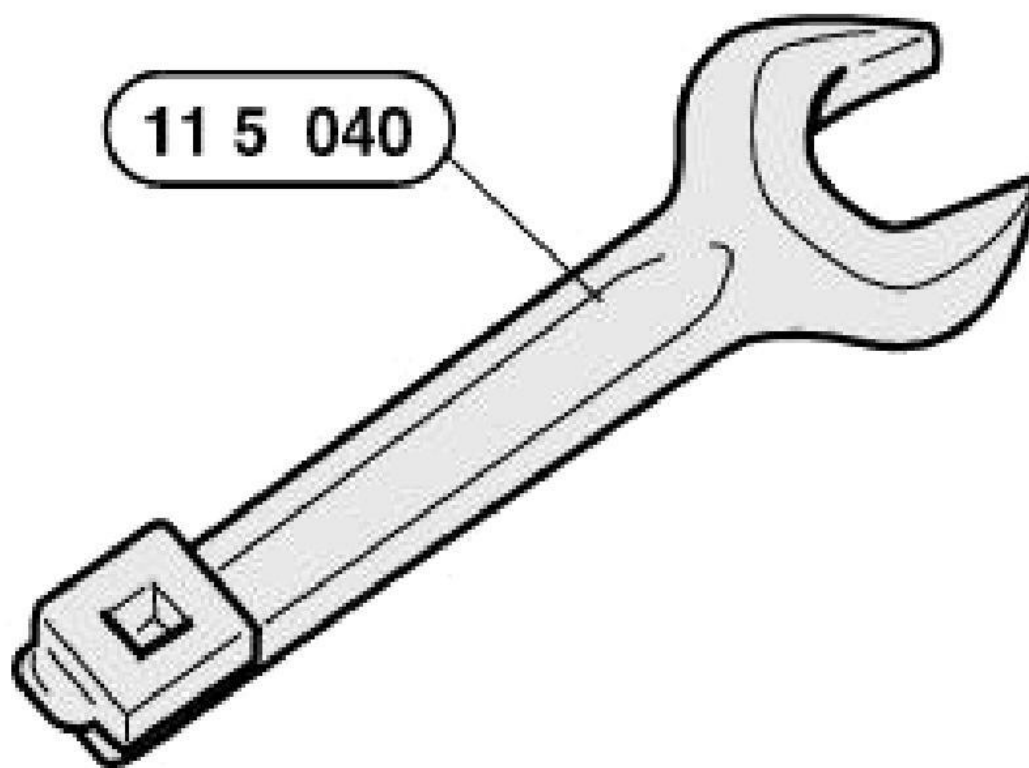
Fig. 366: Identifying Special Tools 11 5 030 And 11 5 040
Courtesy of BMW OF NORTH AMERICA, INC.

If necessary, unfasten fan cowl. See 17 11 031 REPLACING FAN COWL M52TU / M54 AUTOMATIC WITH A/C SYSTEM

Take the fan wheel with fan coupling off the water pump and remove.

Installation:

Tighten down fan impeller using special tool 11 5 040.



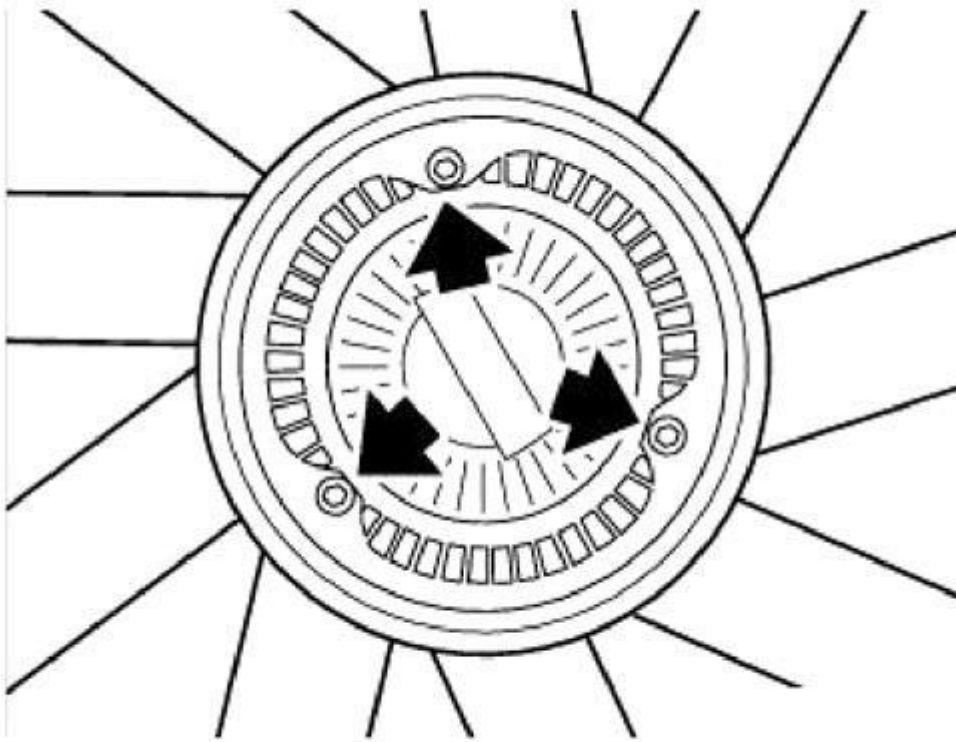
G03164245

Fig. 367: Tightening Down Fan Impeller Using Special Tool 11 5 040
Courtesy of BMW OF NORTH AMERICA, INC.

Tightening torque, refer to 11 52 1AZ in **ENGINE - TIGHTENING TORQUES** .

NOTE: When using special tool 11 5 040, 30 Nm on the torque wrench scale are equivalent to a tightening torque of 40 Nm.

Unfasten screws and detach fan from fan coupling.



G03164246

Fig. 368: Detaching Fan From Fan Coupling
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. See 11 52 020 Removing and installing/replacing fan clutch (S52 / S54 / M52 / M52TU / M54 / M56)

Drain and dispose of coolant.

NOTE: The water drain plug is located on the exhaust side on cylinder 2 in the engine block.

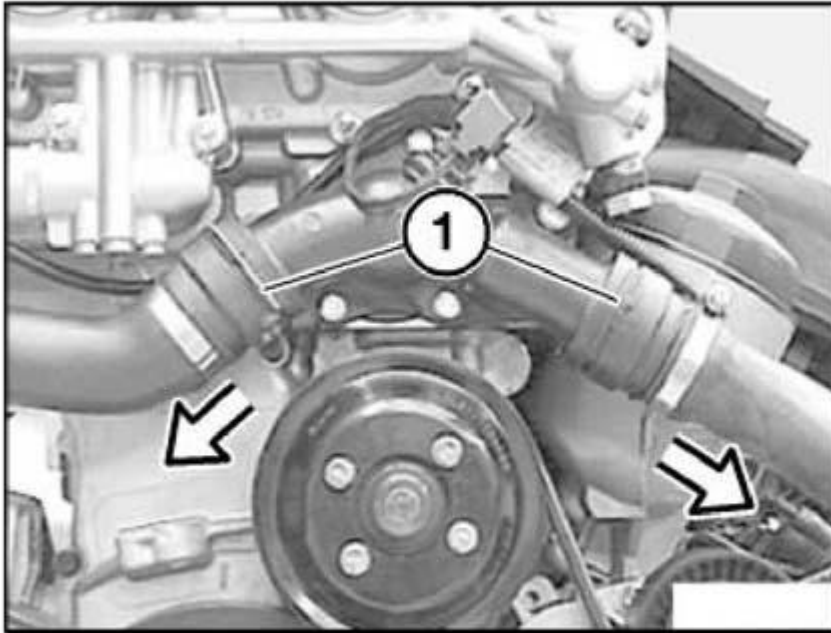
Installation:

Replacing sealing ring on water drain plug.

Tightening torque, refer to 11 11 5AZ in **ENGINE - TIGHTENING TORQUES** .

Vent cooling system and check for leaks.

Pull locks and disconnect water hoses.



G03164247

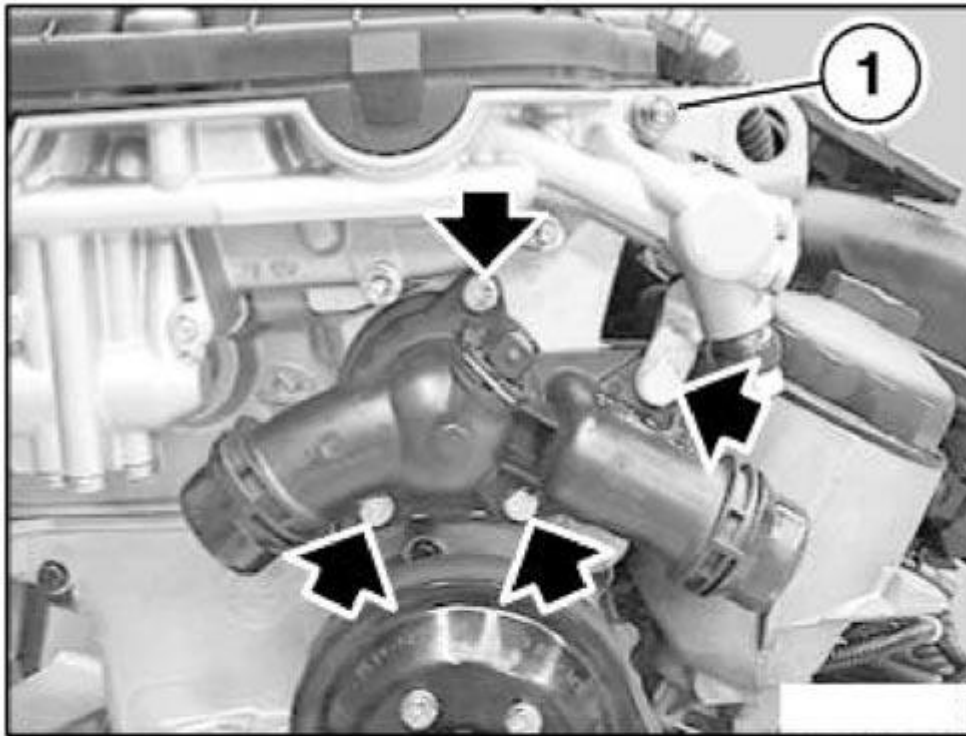
Fig. 369: Disconnecting Water Hoses
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Refer to general instructions for work on cooling system.

Loosen nut (1).

Release screws on thermostat housing, remove thermostat housing.



G03164248

Fig. 370: Releasing Screws On Thermostat Housing
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Keep sealing faces clean and free of oil.

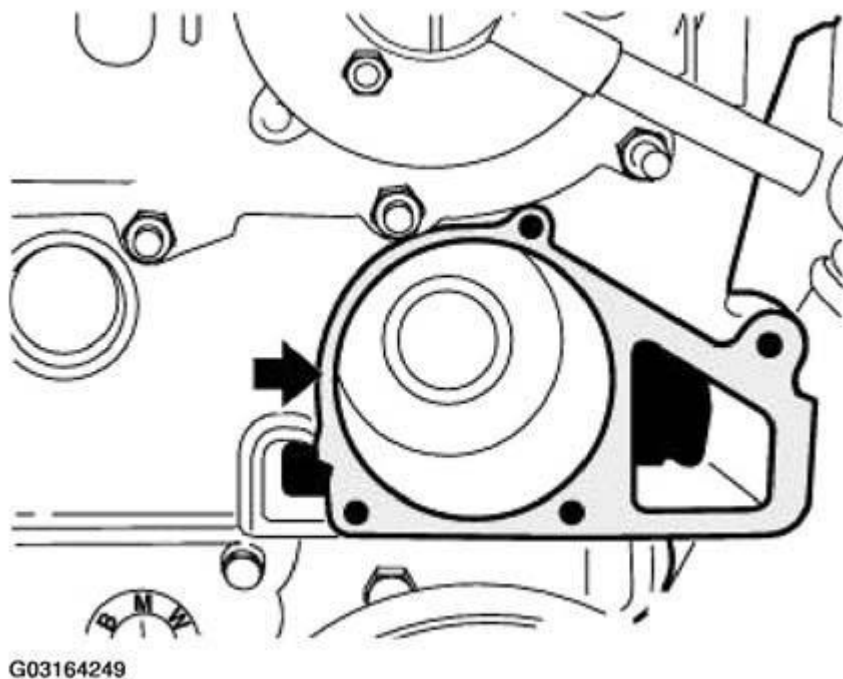


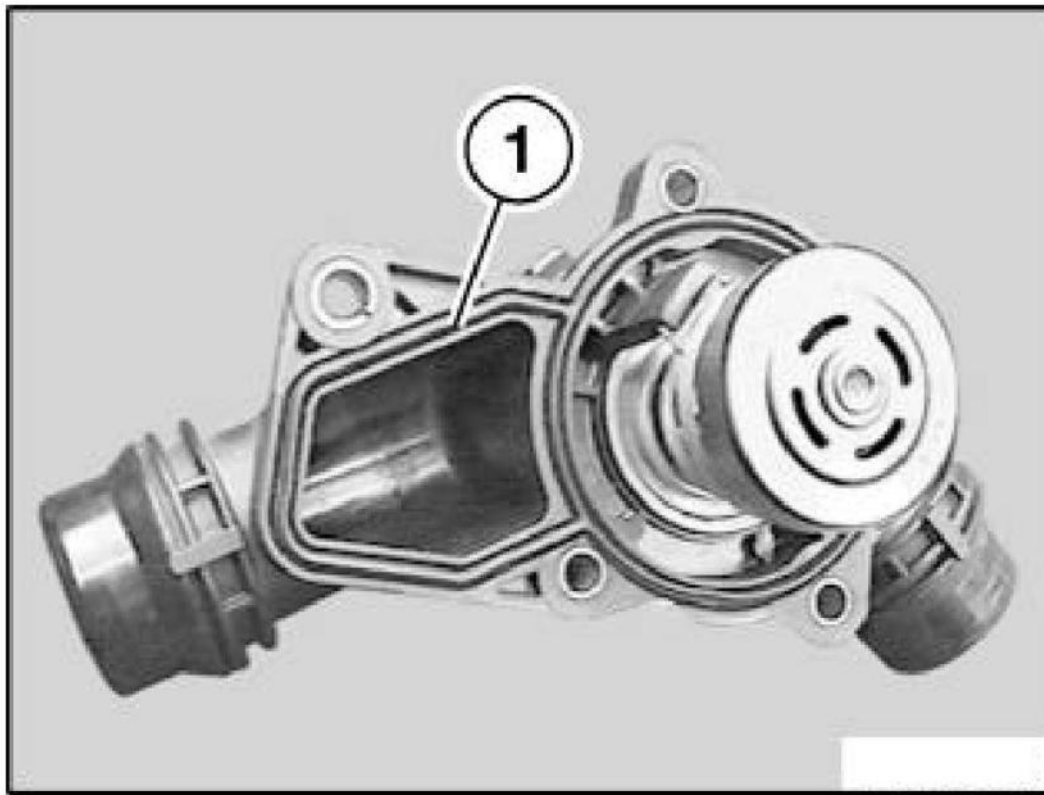
Fig. 371: Identifying Sealing Faces

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).



G03164250

Fig. 372: Replacing Seal

Courtesy of BMW OF NORTH AMERICA, INC.

11 53 000 REMOVING AND INSTALLING/REPLACING COOLANT THERMOSTAT (M52/S52)

Remove FAN COUPLING WITH FAN WHEEL AND FAN COWL.

Drain and dispose of coolant.

Installation:

Replace seal.

Tightening torque, 18 Ft. Lbs. (25 N.m)

Bleed cooling system and check for water leaks.

Unfasten water hoses.

Unscrew suspension eye.

Remove cable channel.

Unfasten thermostat housing.

Installation:

Keep sealing faces clean and free of oil.

Replace seal.

Installation:

Check installed direction.

Vent with arrow facing upwards

Replace seal.

INTAKE MANIFOLD**11 61 050 REMOVING AND INSTALLING INTAKE AIR MANIFOLD (M54)**

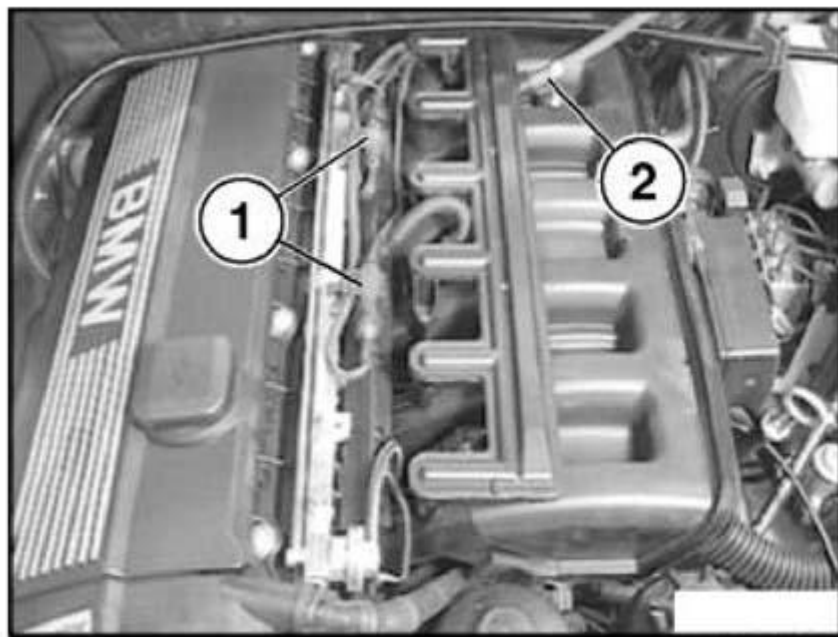
Instructions for disconnecting and connecting battery.

Disconnect negative battery lead.

Remove engine cover. See Fig. 9

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.



G03164251

Fig. 373: Unclipping Plug Connections And Detaching Battery Positive Lead
Courtesy of BMW OF NORTH AMERICA, INC.

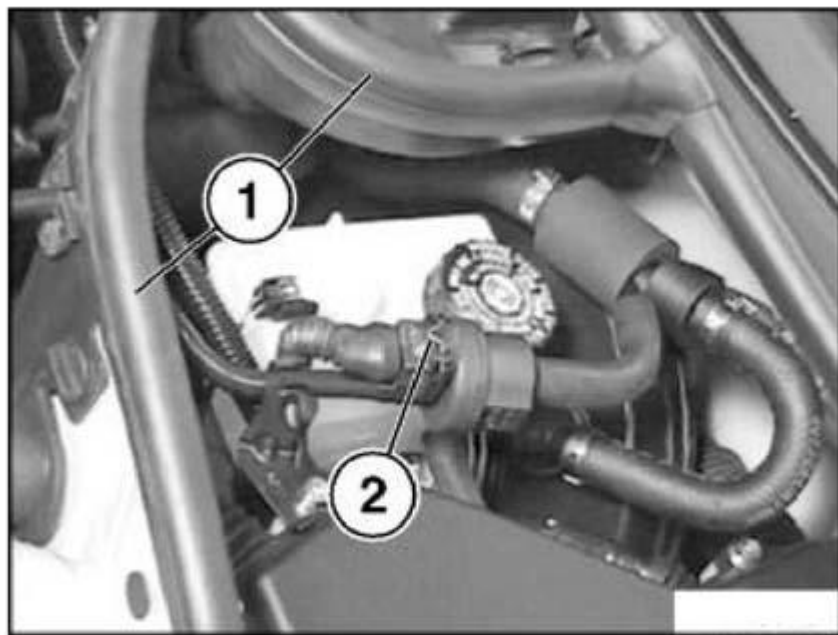
Detach battery positive lead from intake air manifold.

Detach retainer (2) from battery positive lead.

E46 only

Pull off complete rubber strip (1).

Disconnect plug connection (2) on solenoid valve.



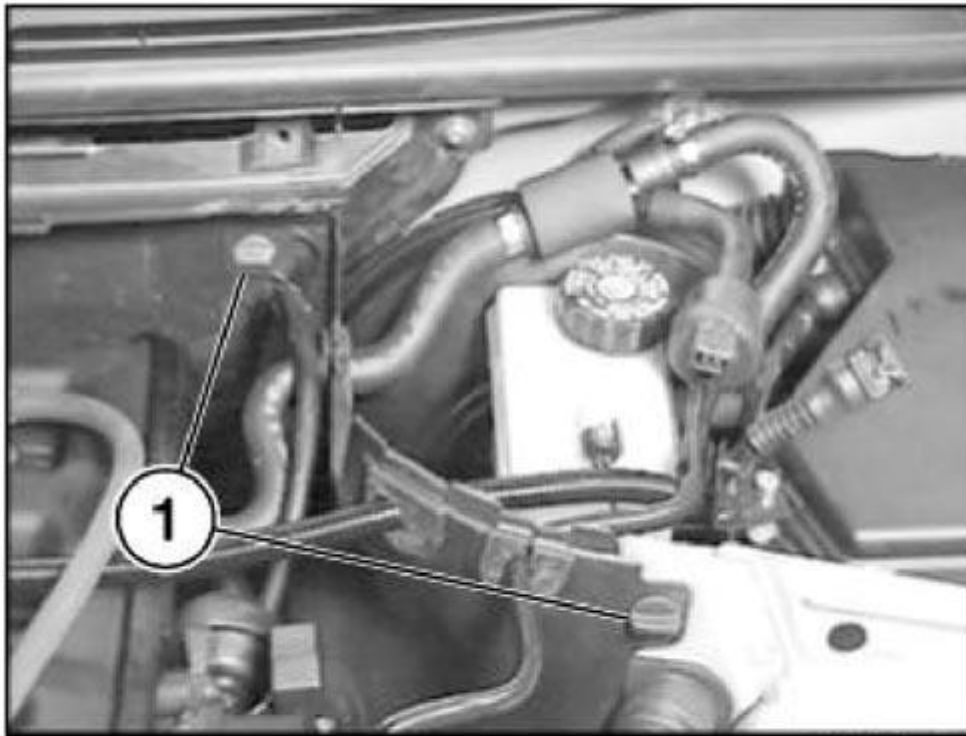
G03164252

Fig. 374: Disconnecting Plug Connection
Courtesy of BMW OF NORTH AMERICA, INC.

E46 only

Unclip cable penetrations from side trim panel.

Release locks (1) on side trim panel.

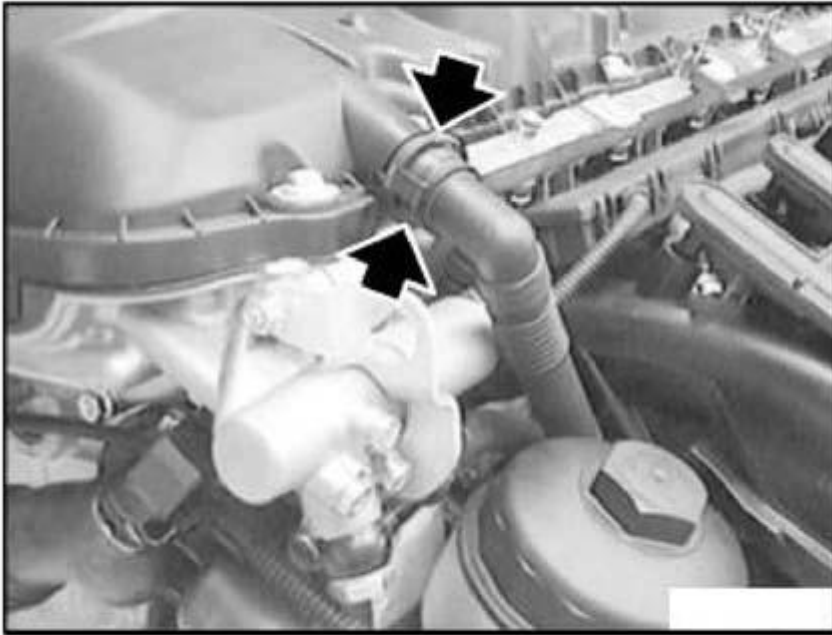


G03164253

Fig. 375: Releasing Locks On Side Trim Panel
Courtesy of BMW OF NORTH AMERICA, INC.

Pull out side trim panel towards top.

Press lock and detach vent hose from cylinder head cover.



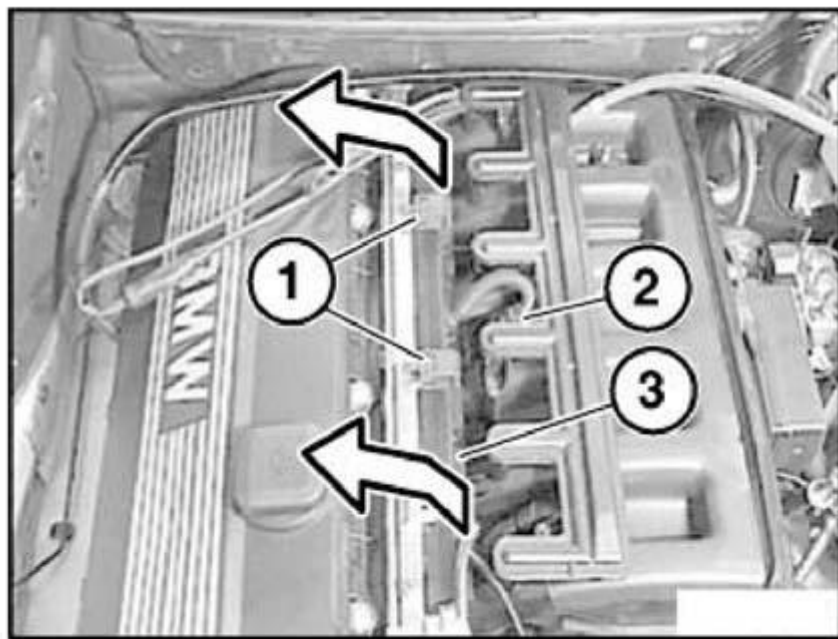
G03164254

Fig. 376: Pressing Lock And Detach Vent Hose From Cylinder Head Cover
Courtesy of BMW OF NORTH AMERICA, INC.

Pull off retainer (1).

Disconnect plug connection (2) for intake air temperature sensor.

Detach terminal strip (3) from fuel injectors and place to one side.

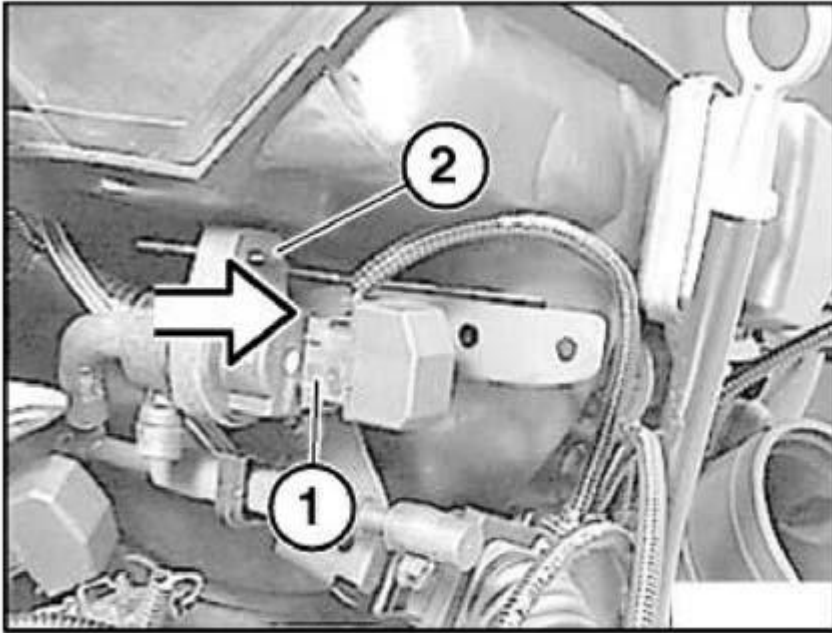


G03164255

Fig. 377: Disconnecting Plug Connection And Terminal Strip
Courtesy of BMW OF NORTH AMERICA, INC.

Disconnect plug connection (1) on tank venting valve.

Remove tank venting valve from retainer (2) on manifold.

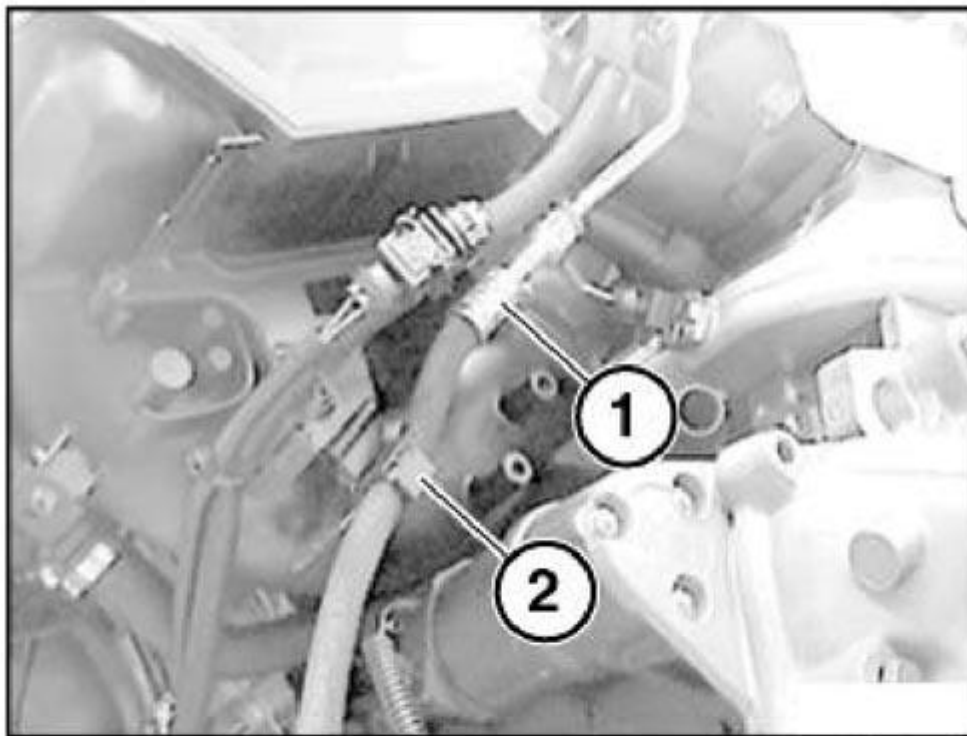


G03164256

Fig. 378: Removing Tank Venting Valve From Retainer
Courtesy of BMW OF NORTH AMERICA, INC.

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.



G03164257

Fig. 379: Unclipping Fuel Line From Holder
Courtesy of BMW OF NORTH AMERICA, INC.

Instructions for removing and installing fuel hoses.

Unclip fuel line (1) from holder (2).

Unlock fuel line (1).

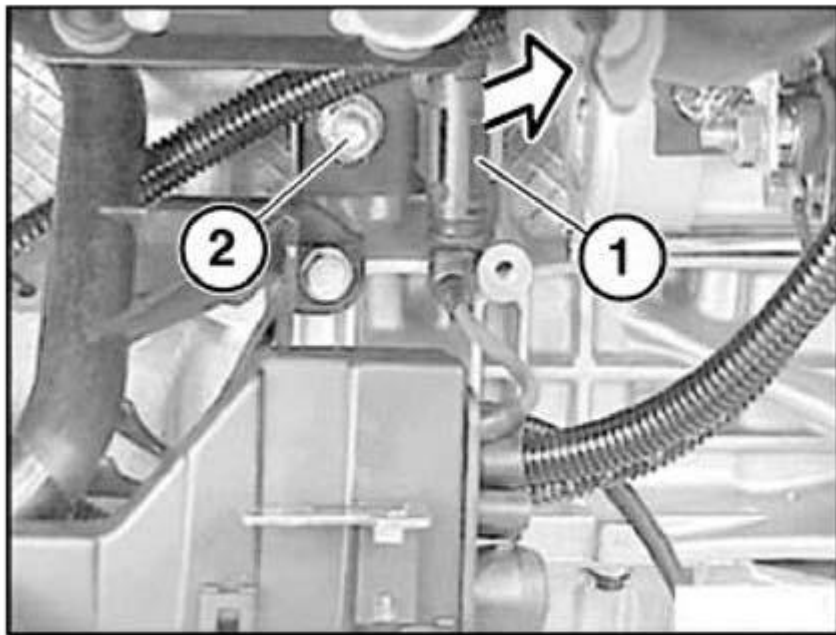
Loosen guide tube for dipstick.

Press lock and detach return line from guide tube for oil dipstick.

Remove throttle assembly. See **11 61 050 Removing and installing intake air manifold (M54)**

Disconnect plug connections and lay cable duct to one side.

Unclip plug connection (1) for knock sensors from holder.



G03164258

Fig. 380: Unclipping Plug Connection And Releasing Nut
Courtesy of BMW OF NORTH AMERICA, INC.

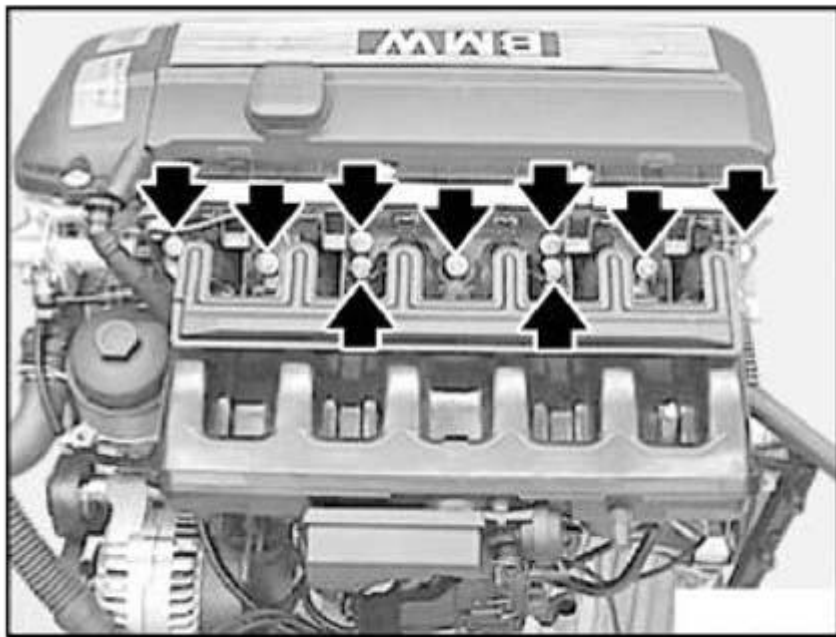
Release nut (2) on manifold support.

Release nuts on manifold.

NOTE: Engines with air injection:

Detach vacuum line on reverse side of intake air manifold.

Remove intake air manifold. See **11 61 050 Removing and installing intake air manifold (M54)**

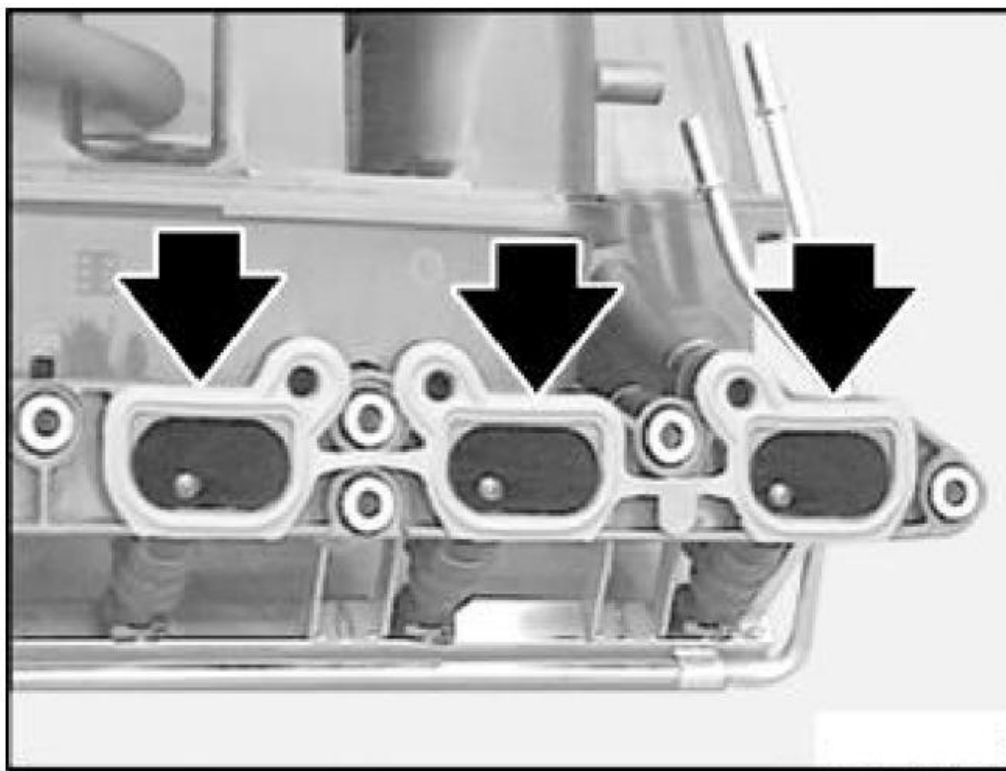


G03164259

Fig. 381: Removing Intake Air Manifold
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Check gaskets on all cylinders and replace if necessary.



G03164260

Fig. 382: Identifying Gaskets On All Cylinders
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Check rubber dampers and if necessary replace together with manifold support.

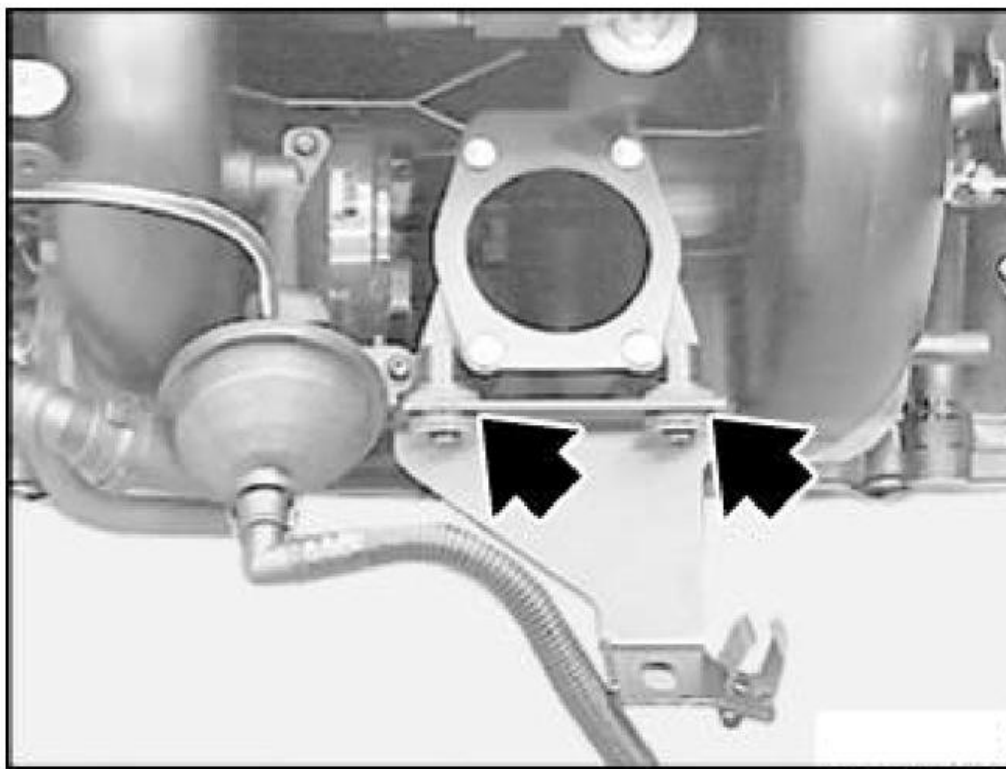
**G03164261**

Fig. 383: Checking Rubber Dampers
Courtesy of BMW OF NORTH AMERICA, INC.

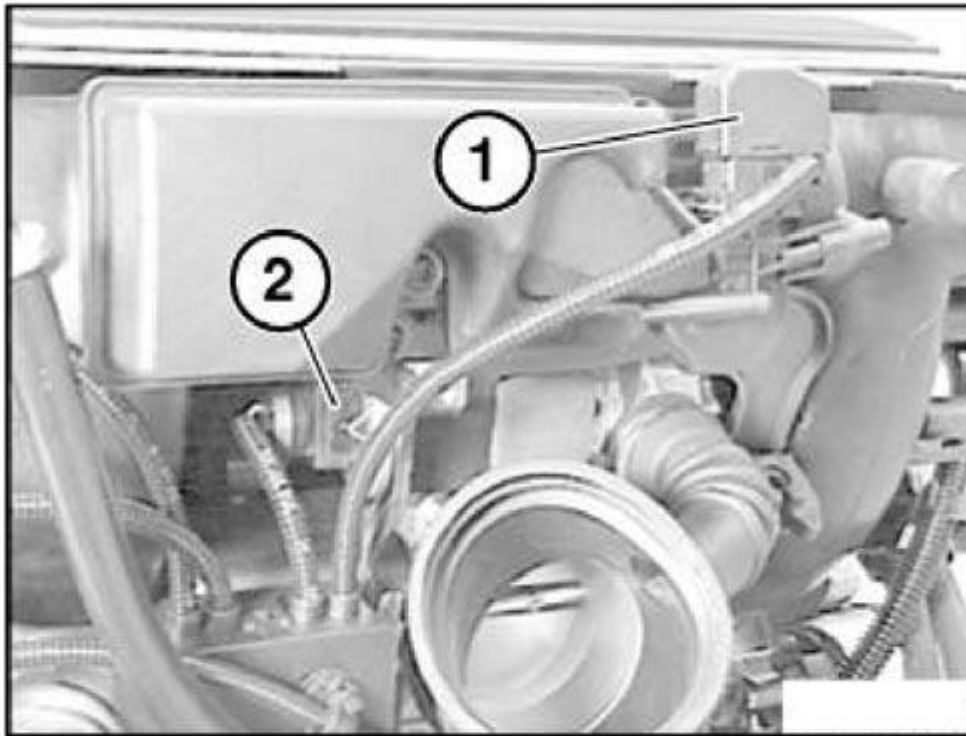
11 61 095 REMOVING AND INSTALLING/REPLACING DISA ADJUSTMENT UNIT

Turn off ignition.

E46 only:

Disconnect intake hose between air-mass flow sensor and connecting piece.

Unlock plug (1) and detach from DISA adjustment unit (DISA = differentiated air intake system).

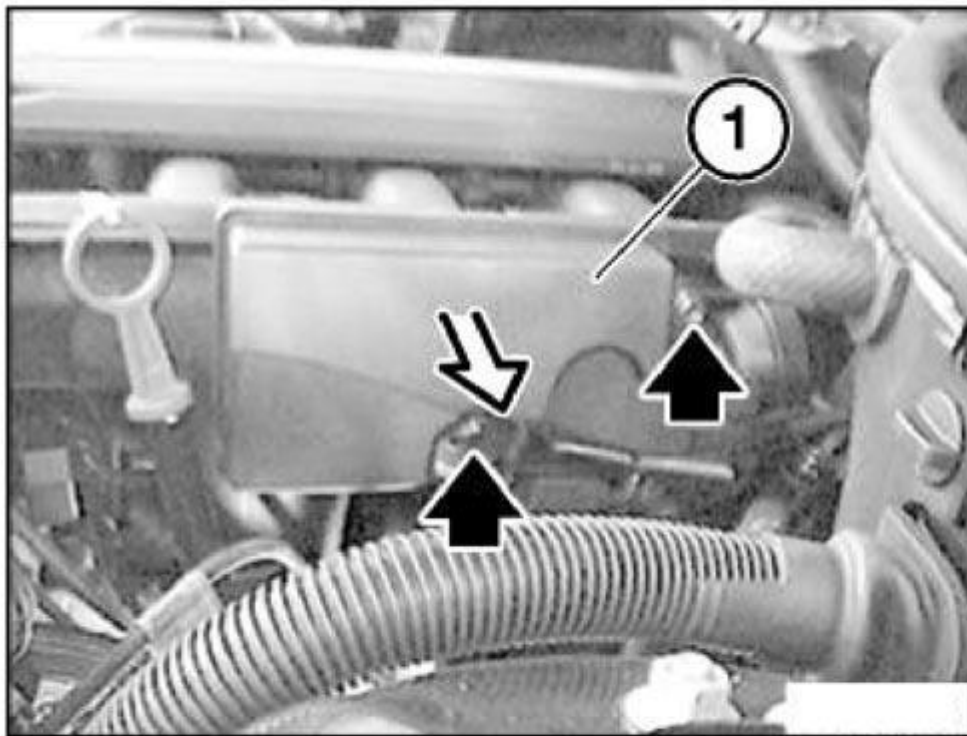


G03164262

Fig. 384: Unlocking Plug And Detach From DISA Adjustment Unit
Courtesy of BMW OF NORTH AMERICA, INC.

Release screws.

Withdraw DISA adjustment unit (1) from intake air manifold.



G03164263

Fig. 385: Removing DISA Adjustment Unit
Courtesy of BMW OF NORTH AMERICA, INC.

EXHAUST MANIFOLD

11 62 140 REMOVING AND INSTALLING BOTH EXHAUST MANIFOLDS WITH CATALYTIC CONVERTERS (M52TU / M54 / M56)

Special tools required:

NOTE: For special tools, refer to ENGINE - SPECIAL TOOLS .

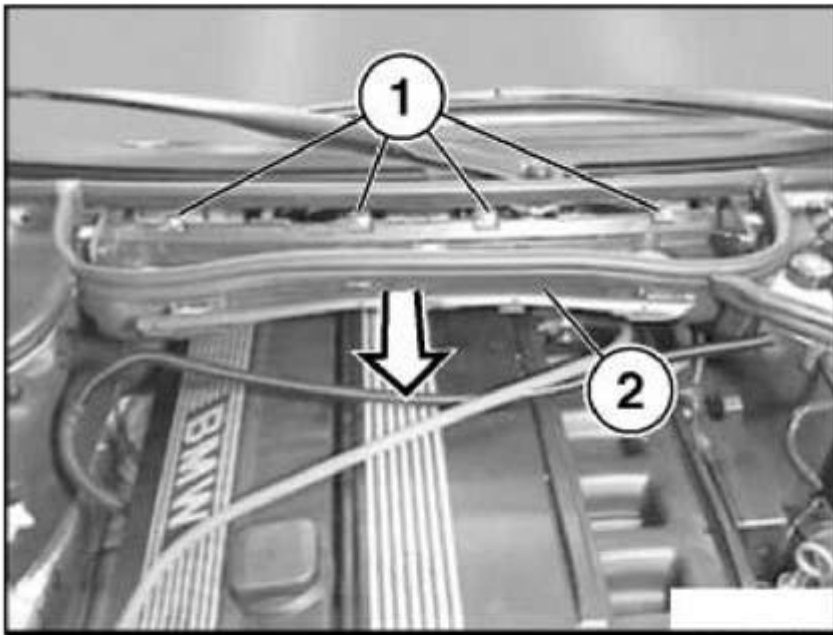
- 00 0 200
- 0 0 201
- 00 0 202
- 00 0 204
- 00 0 208

E46 only

Remove microfilter. See **64 31 010 REPLACING MICROFILTER FOR INTERIOR VENTILATION**

Open cable guide on lower section of microfilter housing (2) and feed out cable (s).

Release screws (1) and remove lower section of microfilter housing (2).



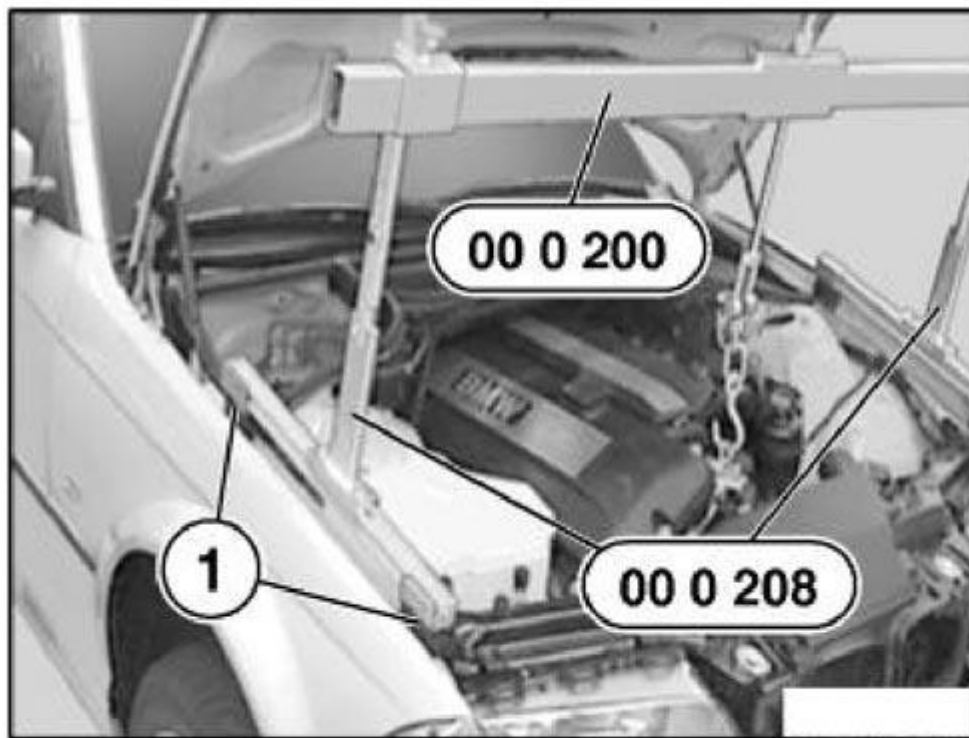
G03164264

Fig. 386: Removing Lower Section Of Microfilter Housing
Courtesy of BMW OF NORTH AMERICA, INC.

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

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

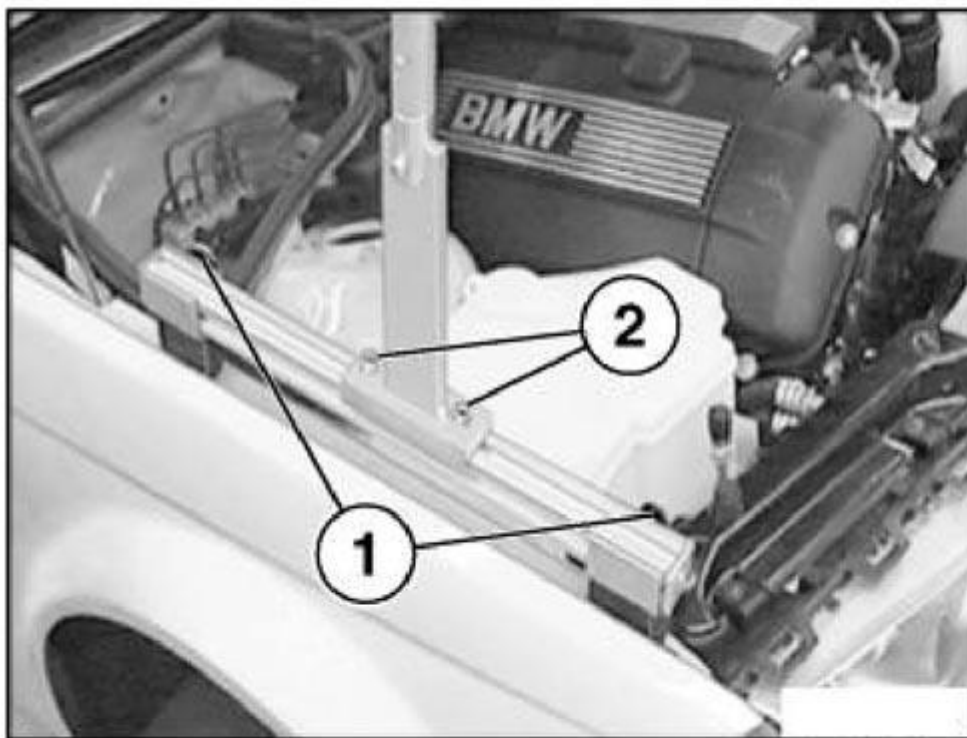
NOTE: **The supports (1) of special tool 00 0 208 must rest on the bolt connection of both side walls.**



G03164265

Fig. 387: Identifying Special Tools 00 0 200 And 00 0 208
Courtesy of BMW OF NORTH AMERICA, INC.

Tighten the screws (1 and 2).



G03164266

Fig. 388: Tightening Screws**Courtesy of BMW OF NORTH AMERICA, INC.**

Release nuts on engine mount on left and right.

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



G03164267

Fig. 389: Identifying Special Tool 00 0 200
Courtesy of BMW OF NORTH AMERICA, INC.

Remove exhaust system. See **Fig. 361** or **MANUAL TRANSMISSION**

NOTE: **Vehicles with front end reinforcement:**

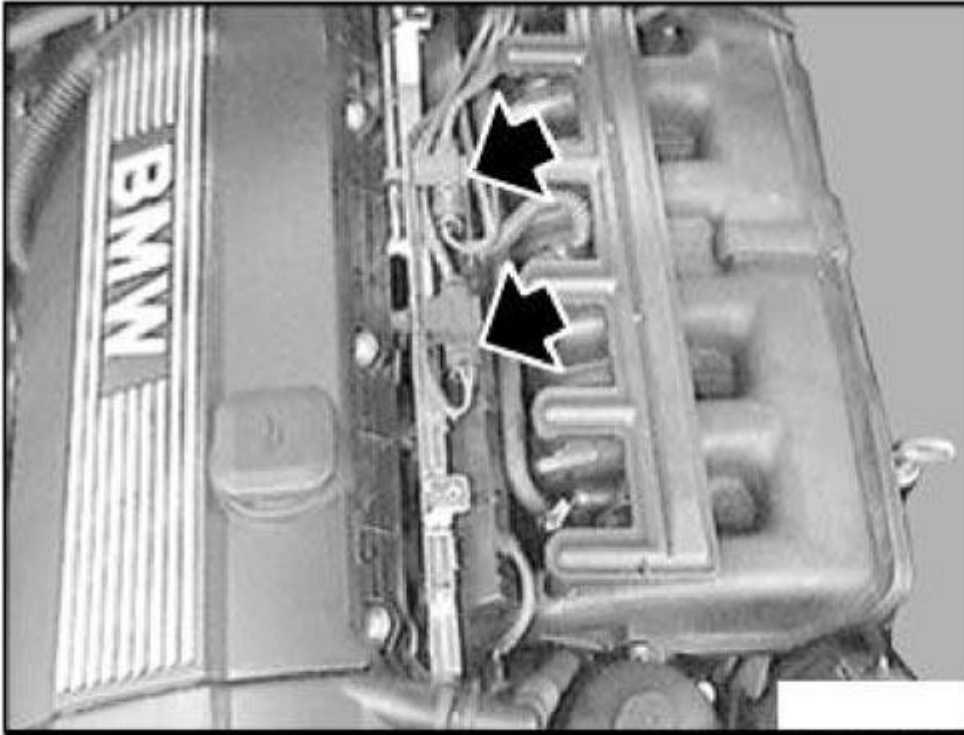
Remove front end reinforcement. See **51 71 374 REMOVING AND INSTALLING/REPLACING REINFORCEMENT PLATE ON FRONT AXLE SUPPORT**

Remove right engine support arm with engine mount.

NOTE: **The oxygen sensors are in danger of being damaged when the exhaust manifolds are removed and installed.**

If necessary, remove control sensors.

Remove cover from injection valves.



G03164268

Fig. 390: Removing Cover From Injection Valves
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: Monitor sensors must be marked, risk of mixing up cylinders 1-3 and 4-6.

Unclip the cable from the retainer. Disconnect plug connection. Unclip cable on rear side of engine from cable guide.

NOTE: Rear exhaust manifold with catalytic converter can only be removed after front exhaust manifold with catalytic converter has first been removed.

- Remove monitor sensor on front exhaust manifold. Sensor. See **OXYGEN SENSOR**
- Remove front exhaust manifold with catalytic converter. See **REMOVAL & INSTALLATION**
- Remove monitor sensor on rear exhaust manifold.
- Remove rear exhaust manifold with catalytic converter. **MANUAL TRANSMISSION**

Installation:

Clean sealing faces, replace gaskets.

Coat threads with copper paste.

Replace nuts.

Tightening torque, refer to 11 62 1AZ in ENGINE - TIGHTENING TORQUES .

EMISSION CONTROL, OXYGEN SENSOR

11 78 510 REPLACING OXYGEN CONTROL SENSOR (M52TU / M54 / M56)

Special tools required:

NOTE: For special tools, refer to ENGINE - SPECIAL TOOLS .

- 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:

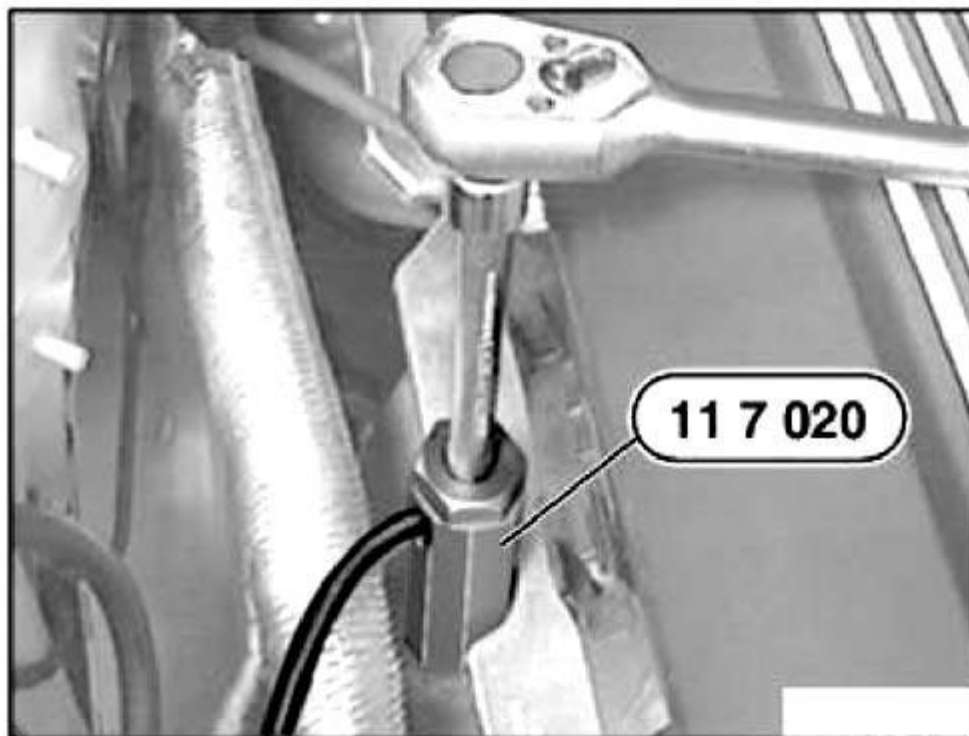
If necessary, remove lower section of microfilter housing.

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.



G03164269

Fig. 391: Identifying Special Tool 11 7 020
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

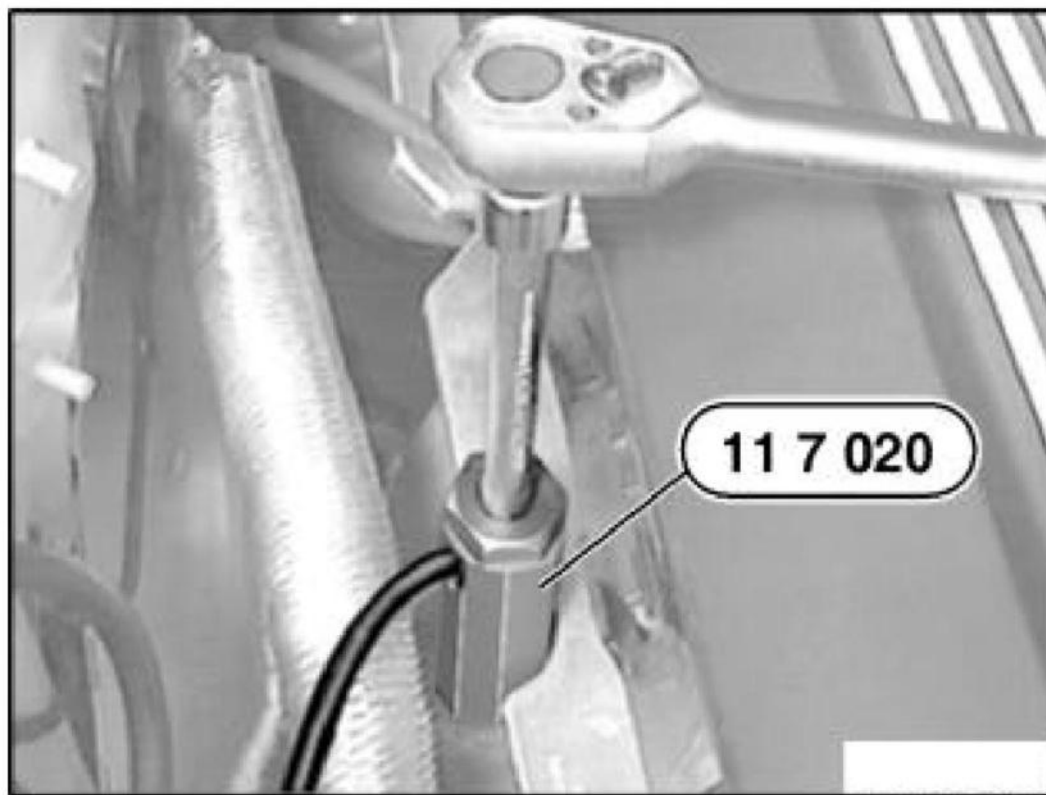
The threads of new oxygen sensors are already coated with Never Seez Compound.

If an oxygen sensor is used again, apply a thin and even coat of Never Seez Compound 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.



G03164270

Fig. 392: Identifying Special Tool 11 7 020
Courtesy of BMW OF NORTH AMERICA, INC.

Tightening torque, refer to 11 78 1AZ in **ENGINE - TIGHTENING TORQUES**.

Pay attention to cable routing of oxygen control sensor.

11 78 613 REPLACING BOTH OXYGEN MONITOR SENSORS (M52TU / M54 / M56)

Special tools required:

NOTE: For special tools, refer to **ENGINE - SPECIAL TOOLS**.

- 11 7 020
- 11 7 030

(for work step number 13 00 002)

Read out fault memory, clear if necessary.

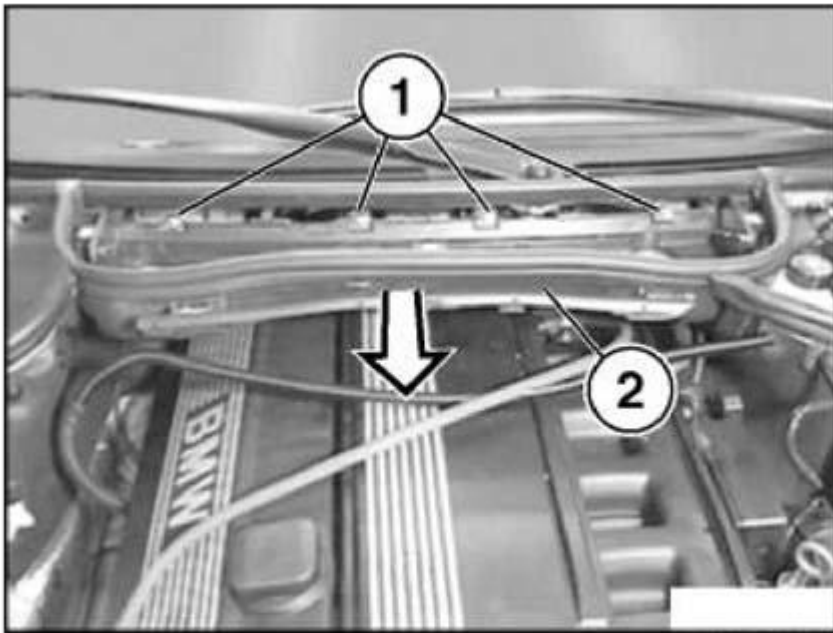
Illustrations show M54.

E46 only

Remove microfilter.

Open cable duct on lower section of microfilter housing (2) and feed out cable (s).

Release screws (1) and remove lower section of microfilter housing (2).



G03164271

Fig. 393: Releasing Screws

Courtesy of BMW OF NORTH AMERICA, INC.

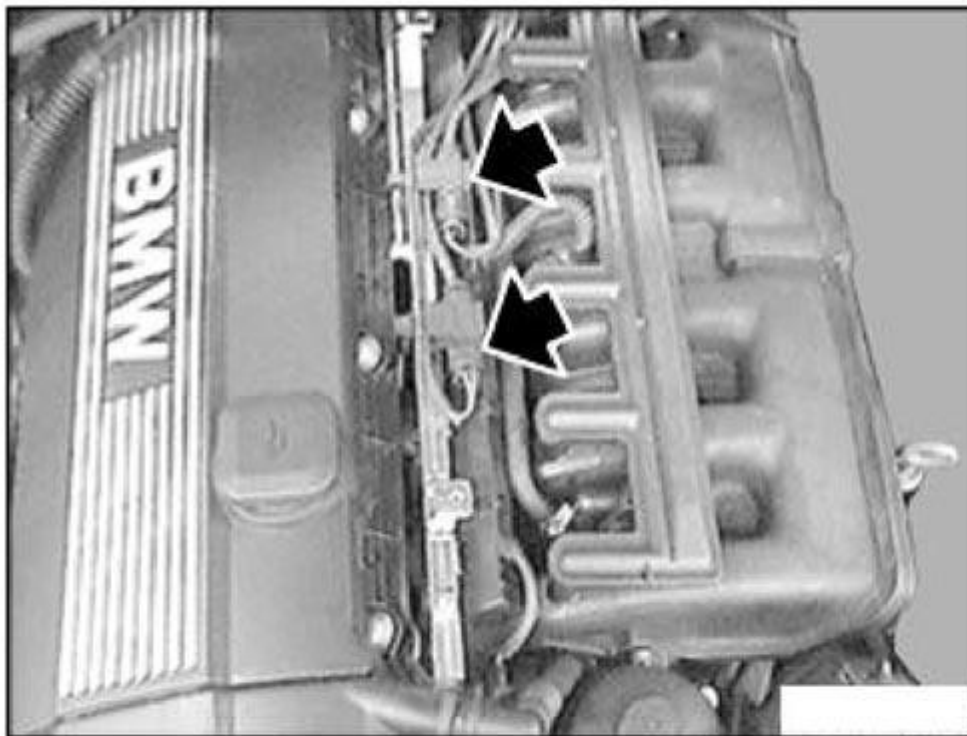
Remove cover from fuel injectors.

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.



G03164272

Fig. 394: Disconnecting Plug And Unclipping Cable On Rear Side Of Engine
Courtesy of BMW OF NORTH AMERICA, INC.

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.

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.

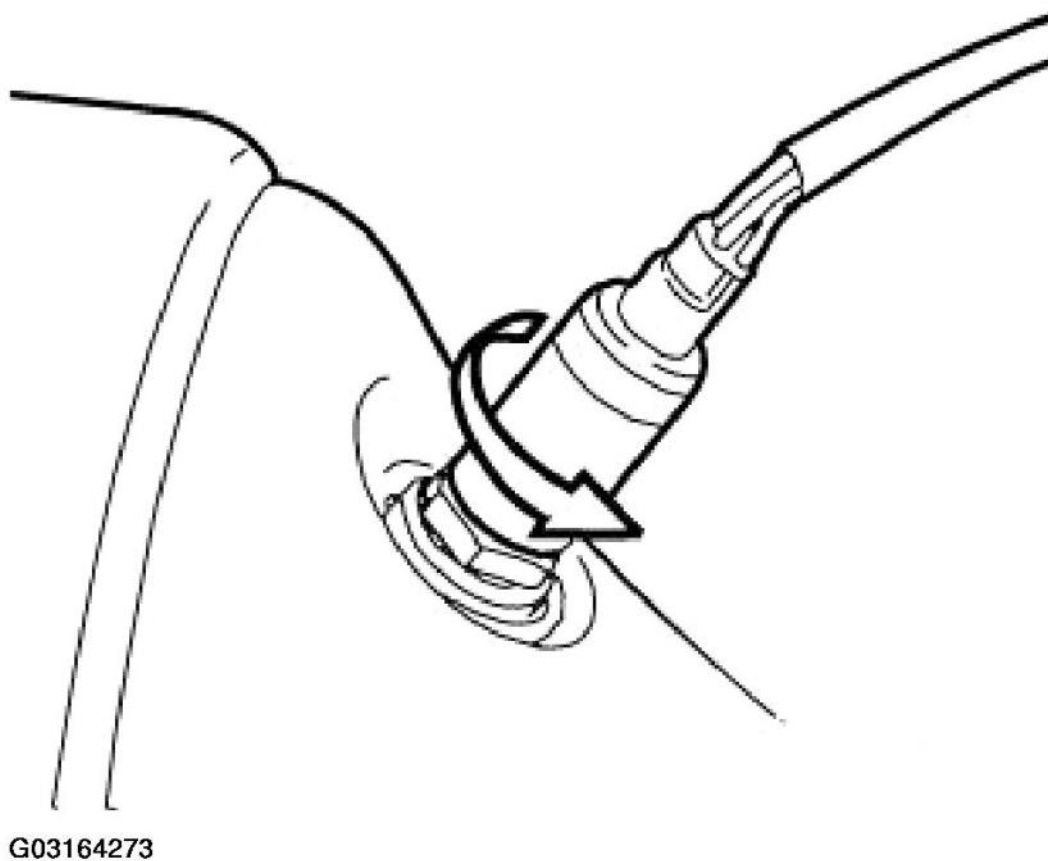


Fig. 395: Releasing Oxygen Monitor Sensor
Courtesy of BMW OF NORTH AMERICA, INC.

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 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.

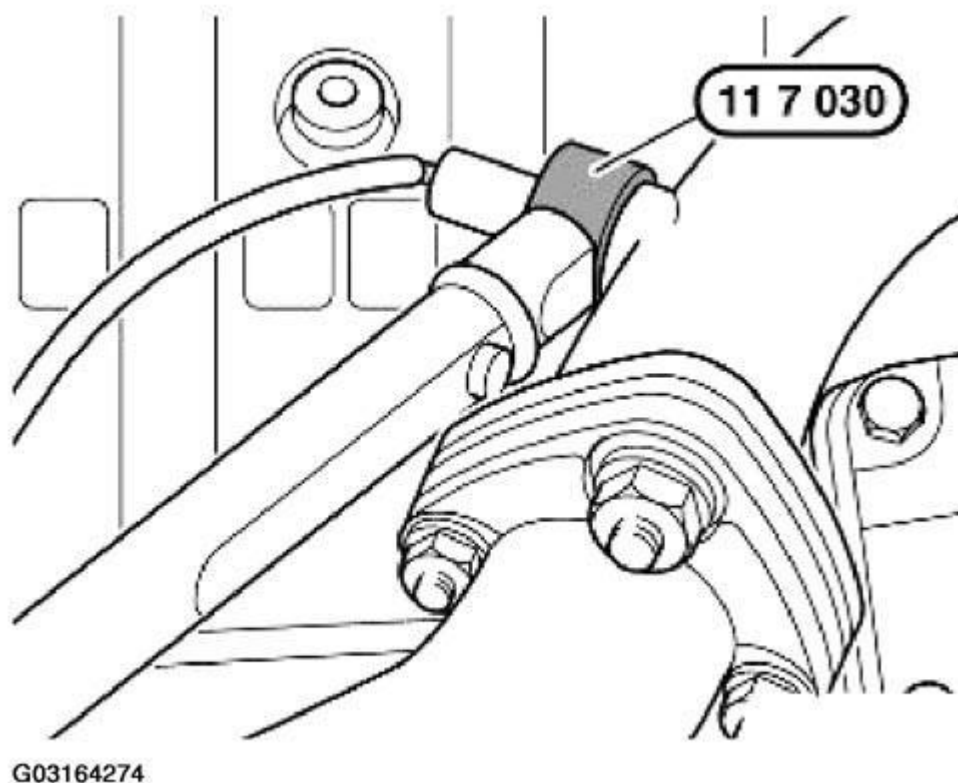


Fig. 396: Identifying Special Tool 11 7 030

Courtesy of BMW OF NORTH AMERICA, INC.

Secure oxygen monitor sensor for cylinders 4 to 6 with special tool 11 7 020.

Tightening torque, refer to 11 78 1AZ in **ENGINE - TIGHTENING TORQUES** .

Cover oxygen monitor sensors when applying underseal.

Pay attention to cable routing of oxygen monitor sensors.

POSITIVE CRANKCASE VENTILATION/OIL SEPARATOR

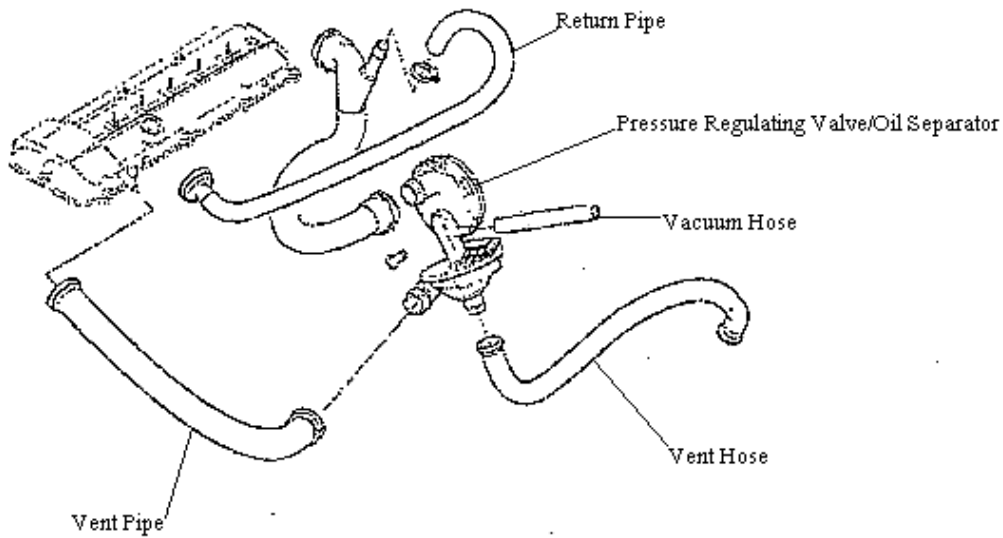


Fig. 397: Identifying Positive Crankcase Ventilation/Oil Separator Components
 Courtesy of BMW OF NORTH AMERICA, INC.

TECHNICAL DATA

NOTE: For M54/M56 technical data, refer to **ENGINE - TECHNICAL DATA** .

GENERAL SPECIFICATIONS (M52/M52TU/S52)

Application	Specification
2.5L⁽¹⁾	
Displacement	152 Cu. In. (2.5L)
Bore	3.310" (84 mm)
Stroke	2.950" (75 mm)
Compression Pressure	(1)
Compression Ratio	10.5:1
Fuel System	SFI
2.8L	
Displacement	170 Cu. In. (2.8L)
Bore	3.307" (84 mm)
Stroke	3.307" (84 mm)
Compression Pressure	(1)
Compression Ratio	10.2:1
Fuel System	SFI
3.2L	
Displacement	195 Cu. In. (3.2L)
Bore	3.401" (86.4 mm)

2000 BMW 328i

1999-2005 ENGINE Engine - Repair (M52/S52/M52TU/M54/M56)

Stroke	3.527" (89.6 mm)
Compression Pressure	(1)
Compression Ratio	10.5:1
Fuel System	SFI
(1) Additional 2.5L specifications are not available.	

OIL PUMP WITH STRAINER & DRIVE (OIL PRESSURE)

Oil pressure at idle speed with engine at operating temperature	min bar	0.5
Regulated pressure	bar	4.0

CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS

Application	In. (mm)
2.8L	
Crankshaft	
End Play	0.0031-0.0064 (0.080-0.163)
Runout	0.008 (0.20)
Main Bearings	
Journal Diameter	
Standard	
Yellow	2.3616-2.3618 (59.984-59.990)
Green	2.3613-2.3615 (59.977-59.983)
White	2.3611-2.3613 (59.971-59.977)
Undersize 1 - 0.001" (0.25 mm)	
Yellow	2.3517-2.3520 (59.733-59.740)
Green	2.3515-2.3517 (59.727-59.733)
White	2.3512-2.3514 (59.721-59.726)
Undersize 2 - 0.023" (0.59 mm)	
Yellow	2.3419-2.3421 (59.484-59.490)
Green	2.3416-2.3418 (59.477-59.483)
White	2.3414-2.3416 (59.471-59.477)
Journal Out-Of-Round	(1)
Journal Taper	(1)
Oil Clearance	0.0008-0.0023 (0.020-0.058)

2000 BMW 328i

1999-2005 ENGINE Engine - Repair (M52/S52/M52TU/M54/M56)

Connecting Rod Bearings	
Journal Diameter	
Standard	1.7707-1.7634 (44.975-44.791)
Undersize 1	1.7608-1.7614 (44.725-44.741)
Undersize 2	1.7509-1.7516 (44.475-44.491)
Journal Out-Of-Round	(1)
Journal Taper	(1)
Oil Clearance	0.0008-0.0022 (0.020-0.055)
3.2L	
Crankshaft	
End Play	0.0031-0.0064 (0.080-0.163)
Runout	0.008 (0.20)
Main Bearings	
Journal Diameter	
Standard	
Yellow	2.3616-2.3618 (59.984-59.990)
Green	2.3613-2.3615 (59.977-59.983)
White	2.3611-2.3613 (59.971-59.977)
Undersize 1 - 0.001" (0.25 mm)	
Yellow	2.3517-2.3520 (59.733-59.740)
Green	2.3515-2.3517 (59.727-59.733)
White	2.3512-2.3514 (59.721-59.726)
Undersize 2 - 0.019" (0.50 mm)	
Yellow	2.3419-2.3421 (59.484-59.490)
Green	2.3416-2.3418 (59.477-59.483)
White	2.3414-2.3416 (59.471-59.477)
Journal Out-Of-Round	(1)
Journal Taper	(1)
Oil Clearance	0.0008-0.0023 (0.020-0.058)
Connecting Rod Bearings	
Journal Diameter	
Standard	1.7716 (45.00)
Undersize 1	1.7618 (44.75)

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Undersize 2	1.7519 (44.50)
Journal Out-Of-Round	(1)
Journal Taper	(1)
Oil Clearance	0.0008-0.0022 (0.020-0.055)
(1) Information is not available from manufacturer.	

CONNECTING RODS

Application	In. (mm)
2.8L	
Bushing Pin Bore Diameter	
Outside	0.9449-0.9461 (24.000-24.031)
Inside	0.8663-0.8665 (22.005-22.010)
Crankpin Bore Diameter	
Red	1.8898-1.8901 (48.000-48.009)
Blue	1.8901-1.8904 (48.009-48.016)
Center-To-Center Length	(1)
Maximum Bend	0.0016 (0.040)
Maximum Twist	0.002 (0.05)
Side Play	(1)
3.2L	
Bushing Pin Bore Diameter	
Outside	0.9457-0.9446 (24.021-23.995)
Inside	0.8665-0.8659 (22.010-21.995)
Crankpin Bore Diameter	1.8898-1.8904 (48.000-48.016)
Center-To-Center Length	(1)
Maximum Bend	0.0016 (0.040)
Maximum Twist	0.002 (0.05)
Side Play	(1)
(1) Information is not available from manufacturer.	

PISTONS, PINS & RINGS

Application	In. (mm)
2.8L	
Piston	

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Clearance	
Standard	0.0004-0.0016 (0.010-0.040)
Maximum	0.0043 (0.11)
Diameter	
Standard	3.3063 (83.980)
Intermediate	3.3094 (84.060)
Oversize 1	3.3161 (84.230)
Oversize 2	3.3260 (84.480)
Pins	
Diameter	(1)
Piston Fit	(2)
Rod Fit	(1)
Rings	
No. 1 (Plain)	
End Gap	0.008-0.016 (0.20-0.40)
Side Clearance	0.0008-0.0023 (0.020-0.060)
No. 2 (Tapered)	
End Gap	0.008-0.016 (0.20-0.40)
Side Clearance	0.0008-0.0025 (0.020-0.065)
No. 3 (Oil)	
End Gap	0.016-0.055 (0.40-1.40)
Side Clearance	(1)
3.2L	
Piston	
Clearance	
Standard	0.0010-0.0022 (0.026-0.058)
Maximum	0.0043 (0.11)
Diameter	
Standard	3.4001 (86.365)
Oversize 1	3.4080 (86.565)
Pins	
Diameter	(1)
Piston Fit	(2)
Rod Fit	(1)
Rings	
No. 1 (Plain)	
End Gap	0.009-0.016 (0.25-0.40)
Side Clearance	0.0011-0.0025 (0.030-0.065)
No. 2 (Tapered)	
End Gap	0.008-0.016 (0.20-0.40)

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Side Clearance	0.0008-0.0021 (0.020-0.055)
No. 3 (Oil)	
End Gap	0.098-0.019 (0.25-0.50)
Side Clearance	0.0008-0.0021 (0.020-0.055)
(1) Information is not available from manufacturer.	
(2) Thumb pressure.	

CYLINDER BLOCK

Application	In. (mm)
2.8L	
Cylinder Bore Diameter	
Standard	3.3071-3.3076 (84.000-84.014)
Oversize 1 ⁽¹⁾	3.3170-3.3163 (84.250-84.234)
Oversize 2 ⁽²⁾	3.3268-3.3667 (84.500-85.514)
Maximum Taper	0.0004 (0.010)
Maximum Out-Of-Round	0.0004 (0.010)
3.2L	
Cylinder Bore Diameter	3.4015-3.3863 (86.400-86.014)
Maximum Taper	0.0004 (0.010)
Maximum Out-Of-Round	0.0002 (0.005)
(1) Aluminum block with cast iron liners or cast iron block.	
(2) Cast iron block only.	

VALVES & VALVE SPRINGS

Application	Specification
2.8L	
Intake Valves	
Face Angle	45°
Head Diameter	1.299" (33.0 mm)
Minimum Margin	(1)
Minimum Refinish Length	(1)
Stem Diameter	0.235" (5.975 mm)
Valve Tip Maximum Refinish	(1)
Exhaust Valves	
Face Angle	45°
Head Diameter	1.201" (30.5 mm)
Minimum Margin	

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	(1)
Minimum Refinish Length	(1)
Stem Diameter	0.234" (5.960 mm)
Valve Tip Maximum Refinish	(1)
Valve Springs	(1)
3.2L	
Intake Valves	
Face Angle	45°
Head Diameter	1.181" (30.0 mm)
Minimum Margin	(1)
Minimum Refinish Length	(1)
Stem Diameter	0.236" (6.0 mm)
Valve Tip Maximum Refinish	(1)
Exhaust Valves	
Face Angle	45°
Head Diameter	1.062" (27 mm)
Minimum Margin	(1)
Minimum Refinish Length	(1)
Stem Diameter	0.236" (6.0 mm)
Valve Tip Maximum Refinish	(1)
Valve Springs	(1)
(1) Information is not available from manufacturer.	

CYLINDER HEAD

Application	Specification
2.8L	
Cylinder Head Height	
New	5.512" (140.00 mm)
Minimum	5.500" (139.70 mm)
Maximum Warp	0.0012" (0.03 mm)
Maximum Grind	0.010-0.014" (0.25-0.35 mm)
Valve Seats	
Intake Valve	
Seat Angle	45°
Seat Width	0.055-0.075" (1.40-1.90 mm)
Maximum Seat Runout	0.0012" (0.03 mm)
Seat Diameter	1.275" (32.40 mm)
Exhaust Valve	
Seat Angle	45°

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Seat Width	0.055-0.075" (1.40-1.90 mm)
Maximum Seat Runout	0.0012" (0.03 mm)
Seat Diameter	1.157" (29.40 mm)
Valve Seat Inserts	
Intake	
Standard	
Insert Diameter	1.3426" (34.100 mm)
Bore Diameter	1.3386" (34.000 mm)
Oversize 1	
Insert Diameter	1.3504" (34.300 mm)
Bore Diameter	1.3465" (34.200 mm)
Oversize 2	
Insert Diameter	1.3583" (34.500 mm)
Bore Diameter	1.3544" (34.400 mm)
Exhaust	
Standard	
Insert Diameter	1.2441" (31.600 mm)
Bore Diameter	1.2402" (31.500 mm)
Oversize 1	
Insert Diameter	1.2520" (31.800 mm)
Bore Diameter	1.2481" (31.700 mm)
Oversize 2	
Insert Diameter	1.2599" (32.000 mm)
Bore Diameter	1.2559" (31.900 mm)
Installing Temperature	
Valve Seat Insert	-240°F (-150°C)
Cylinder Head	68°F (20°C)
Valve Guides	
Valve Guide Bore Diameter ⁽¹⁾	
Valve Guide I.D. (Installed)	
Standard	0.2362" (6.000 mm)
Oversize 1	0.2401" (6.100 mm)
Oversize 2	0.2440" (6.200 mm)
Valve Guide Installed Height ⁽²⁾	0.173-0.197" (4.40-5.00 mm)
Valve Stem-To-Guide Oil Clearance	(3)
3.2L	
Cylinder Head Height	
New	5.512" (140.00 mm)
Minimum	(1)
Maximum Warpage	(1)

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Maximum Grind	(1)
Valve Seats	
Intake Valve	
Seat Angle	45°
Seat Width	0.055-0.075" (1.40-1.90 mm)
Maximum Seat Runout	(1)
Seat Diameter	(1)
Exhaust Valve	
Seat Angle	45°
Seat Width	0.055-0.075" (1.40-1.90 mm)
Maximum Seat Runout	(1)
Seat Diameter	(1)
Valve Seat Inserts	(1)
Valve Guides	
Valve Guide Bore Diameter	(1)
Valve Guide I.D. (Installed)	
Standard	0.2362" (6.000 mm)
Oversize 1	0.2401" (6.100 mm)
Oversize 2	0.2440" (6.200 mm)
Valve Guide Installed Height	(1)
Valve Stem-To-Guide Oil Clearance	(3)
(1) Information is not available from the manufacturer.	
(2) Measured from valve guide collar to cylinder head, on camshaft side.	
(3) See CYLINDER HEAD under OVERHAUL.	

CAMSHAFT

Application	In. (mm)
2.8L	
Bore Diameter	(1)
End Play	0.006-0.013 (0.15-0.33)
Journal Diameter	1.18 (30.00)
Journal Runout	(1)
Lobe (Cam) Height	1.8504-1.8528 (47.000-47.060)
Lobe Lift	(1)
Oil Clearance	0.0008-0.0021 (0.020-0.054)
3.2L	
Bore Diameter	(1)
End Play	0.006-0.013 (0.15-0.33)

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Journal Diameter	(1)
Journal Runout	(1)
Lobe (Cam) Height	(1)
Lobe Lift	(1)
Oil Clearance	0.0008-0.0021 (0.020-0.054)
(1) Information is not available from manufacturer.	

VALVE LIFTERS

Application	In. (mm)
2.8L & 3.2L	
Bore Diameter	(1)
Lifter Diameter	(1)
Oil Clearance	(1)
(1) Information is not available from manufacturer.	