

**ENGINE****Engine - Repair Instructions - S85****00 ENGINE GENERAL****00 DANGER OF POISONING IF OIL IS INGESTED/ABSORBED THROUGH THE SKIN****Danger of poisoning!**

Ingesting oil or absorbing through the skin may cause poisoning!

Possible symptoms are:

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

**Protective measures/rules of conduct:**

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

**First aid measures:**

- Do not induce vomiting.

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

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

**00 RISK OF INJURY IF OIL COMES INTO CONTACT WITH EYES AND SKIN****Danger of injury!**

Contact with eyes or skin may result in injury!

Possible symptoms are:

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

**Protective measures/rules of conduct:**

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

**First aid measures:**

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

**NOTE: Do not use solvents/thinners.**

**00 SAFETY INSTRUCTIONS FOR HANDLING OIL**

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

**Recycling:**

Observe country-specific waste-disposal regulations.

**Measures if oil is unintentionally released:**

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

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

**11 00... SERVICE - ENGINE OIL (S85)**

**IMPORTANT:**

- Perform engine oil service only when engine is at normal operating temperature (>70 °C engine oil temperature).

- An exact engine oil level is only determined with the engine oil temperature = 70 °C.
- The engine oil temperature can be read out on the instrument cluster.
- Observe the exact engine oil filling capacity.
- Overfilling the engine with engine oil will result in engine damage.
- Inspection and drip-off times must be observed.

**NOTE:** On the S85 engine, an oil sump for engine oil is installed with separate oil chambers. At an engine oil service solely the oil quantity from the main oil sump (rear oil chamber) is drained. The engine oil from the front oil chamber is continuously delivered to the main oil sump by a separate oil pump. For this reason, it is necessary to operate the engine for at least one minute at idle speed directly before an engine oil service.

**IMPORTANT:** When working on the ending oil, coolant or fuel circuits, you must always protect the alternator against dirt contamination.

**Risk of damage!** For this reason the alternator must be covered with suitable materials.

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

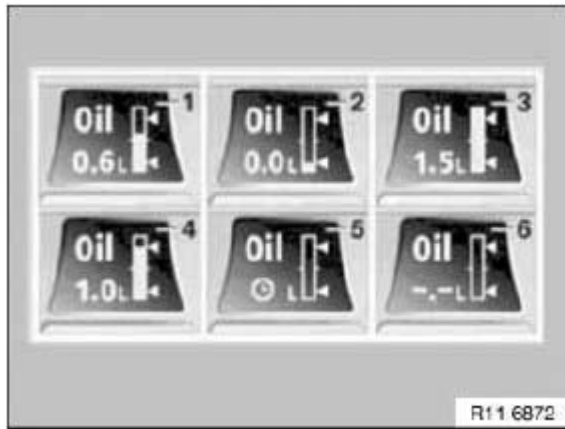
Necessary preliminary tasks:

- Remove underbody protection. See 51 47 490 REMOVING AND INSTALLING / REPLACING FRONT UNDERBODY PROTECTION (M5) or 51 47 490 REMOVING AND INSTALLING / REPLACING FRONT UNDERBODY PROTECTION (M6).
- M5: Loosen service flaps. See 51 47 490 REMOVING AND INSTALLING / REPLACING FRONT UNDERBODY PROTECTION.
- M6: Loosen engine guard.

**S85 engine with screw plug (up to 03/07).**

Explanation of the instrument display:

1. Engine oil level OK.
2. Engine oil level at maximum.
3. Engine oil level too high (= 0.5 litres overfilled).
4. Engine oil level at maximum.
5. Quick measurement is running: engine oil level is being measured.
6. No value can be currently measured (engine oil temperature = 70 °C).

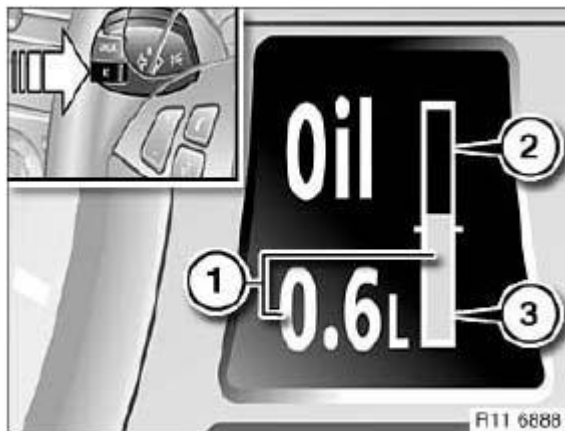


**Fig. 1: Explanation Of Instrument Displays**

Courtesy of BMW OF NORTH AMERICA, INC.

Run engine at idle speed. Repeatedly press on-board computer button on turn indicator lever until the display for the engine oil level can be read off on the instrument display. Press the on-board computer button for longer than three seconds: displayed value is reset

Run the engine at idle speed until the engine oil level has been remeasured (engine oil temperature = 70 °C). The required engine oil temperature for an engine oil service has therefore been reached. Measuring range from minimum (3) to maximum (2) = 1 liter.



**Fig. 2: Measuring Range From Minimum To Maximum**

Courtesy of BMW OF NORTH AMERICA, INC.

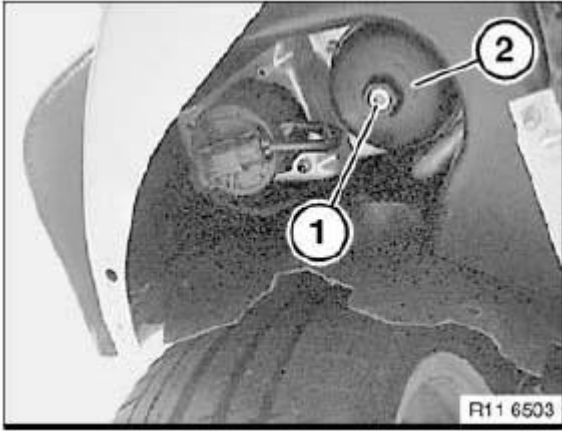
**WARNING: Risk of scalding!**

Release screw plug (1) on oil filter cover (2). Tightening torque 11 42 2AZ. See **11 42 OIL FILTER AND PIPES**.

**Installation note:** Replace sealing ring.

Release oil filter cap (2). Tightening torque 11 42 1AZ. See **11 42 OIL FILTER AND PIPES** .

**Installation note:** Renew oil filter element and all sealing rings.



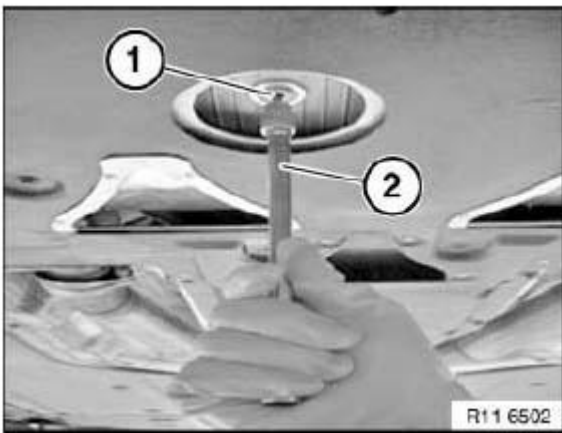
**Fig. 3: Identifying Oil Drain Plug And Oil Filter Housing**  
Courtesy of BMW OF NORTH AMERICA, INC.

**WARNING: Risk of scalding!**

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

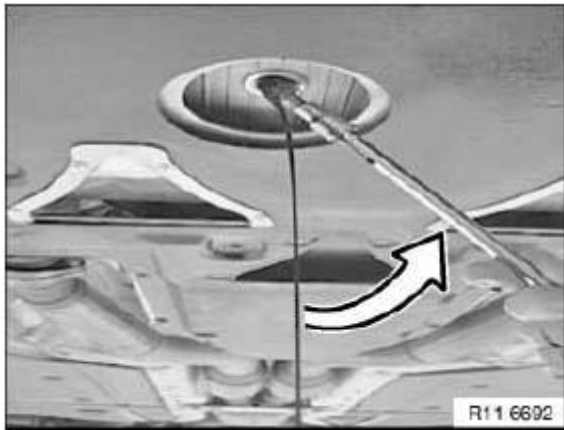
Loosen screw plug (1) with nut and a long extension (2). Tightening torque 11 13 1AZ. See **11 13 OIL PAN** .

**Installation note:** Replace sealing ring.



**Fig. 4: Identifying Screw Plug With Socket And Long Extension**  
Courtesy of BMW OF NORTH AMERICA, INC.

Tilt long extension (1) with nut and screw plug in direction of arrow. Catch and dispose of drained engine oil in a suitable collecting vessel.



**Fig. 5: Disposing Of Engine Oil With Suitable Equipment**  
Courtesy of BMW OF NORTH AMERICA, INC.

Pour in engine oil.

**IMPORTANT:** To ensure engine oil can not be overfilled, firstly fill the engine with 8 litres engine oil.

Park vehicle on a horizontal surface. Start engine and run at idle speed until engine oil temperature = 70 °C. Press the on-board computer button for longer than three seconds: Remeasure the engine oil level.

Measuring range from minimum (3) to maximum (2) = 1 liter.

1. Engine oil level (+ 0.6 liter).
2. Range for maximum.
3. Range for minimum.



**Fig. 6: Measuring Range From Minimum To Maximum**  
**Courtesy of BMW OF NORTH AMERICA, INC.**

The filled quantity of engine oil is 0.6 litres above the permissible minimum. Top-up quantity to be calculated:  
 $1 \text{ liter} - 0.6 \text{ liter (display)} = 0.4 \text{ litres top-up quantity.}$

**IMPORTANT: A top-up quantity less than 0.5 liter is not displayed on the instrument cluster. This means that a renewed query of the engine oil level again gives the value + 0.6 litres.**

Run engine at operating temperature for one minute at idle speed.

**Pre-delivery check / engine replacement** Carry out distance reset by only using the diagnosis system.

**Service - engine oil** Distance RESET can only be carried out using the diagnosis system or instrument cluster. Precise measurement of the filled quantity of engine oil can be read out from the diagnosis system, in the DME in the test module (oil level measurement). Top up engine oil, if necessary.

**Engine oil overfilled**

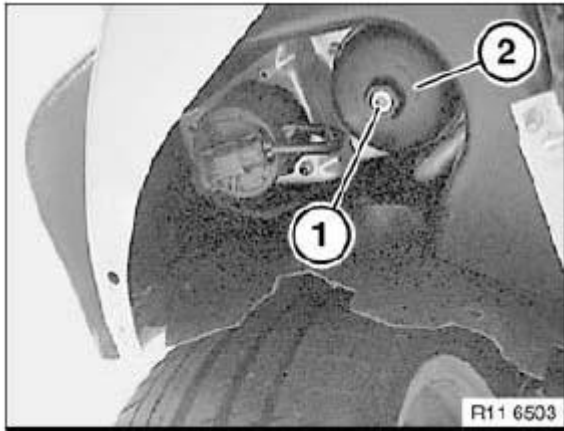
Start engine and run at idle speed (engine oil temperature = 70 °C). Run engine at idle speed. Repeatedly press on-board computer button on turn indicator lever until the display for the engine oil level can be read off on the instrument display. Press the on-board computer button for longer than three seconds: displayed value is reset

Run the engine at idle speed until the engine oil level has been remeasured (engine oil temperature = 70 °C). The required engine oil temperature for an engine oil service has therefore been reached

**NOTE:** On overfilled level value up to 0.5 litres can be displayed on the instrument cluster. A further overfilling of more than 0.5 litres can only be read out using the diagnosis system. The diagnosis system can display an overfill of up to 3.5 litres. When overfilling is suspected, we recommend correction of the oil filling by using the diagnosis system.

On the diagnosis system select the following steps:

- Complete vehicle
- Powertrain
- Engine electronics
- Oil supply
- Oil condition sensor



**Fig. 7: Identifying Oil Drain Plug And Oil Filter Housing**  
Courtesy of BMW OF NORTH AMERICA, INC.

Switch off engine and loosen engine guard. Release screw plug (1) on oil filter cover (2). Tightening torque 11 42 2AZ. See 11 42 OIL FILTER AND PIPES .

**NOTE:** Drained oil quantity in the oil filter housing: approx. 0.4 litres Repeat this operation several times as required.

Reassemble the vehicle.

**S85 engine with two screw plug (from 03/07).**

It is no longer necessary to read out the engine oil level.

Perform engine oil service only when engine is at normal operating temperature (>70 °C engine oil temperature).

**WARNING: Risk of scalding!**

Release screw plug (1) on oil filter cover (2). Tightening torque 11 42 2AZ. See 11 42 OIL FILTER AND PIPES .

**Installation note:** Replace sealing ring.

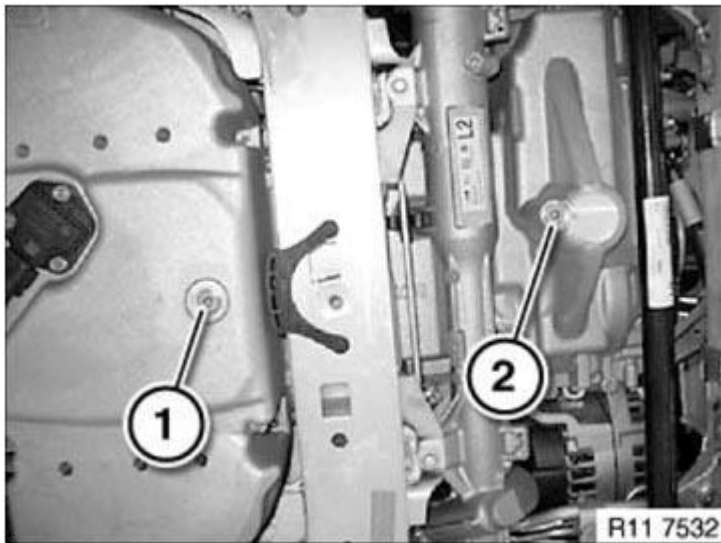
Release oil filter cap (2). Tightening torque 11 42 1AZ. See 11 42 OIL FILTER AND PIPES .

**Installation note:** Renew oil filter element and all sealing rings.

Release screw (1). Tightening torque 11 13 1AZ. See 11 13 OIL PAN .

**Installation note:** Replace sealing ring.





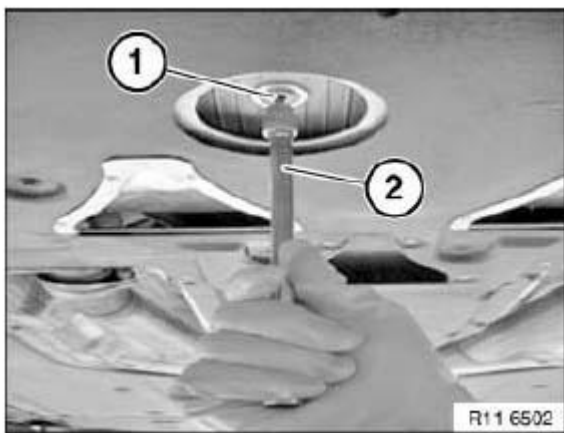
**Fig. 8: Identifying Sealing Rings And Screws**  
Courtesy of BMW OF NORTH AMERICA, INC.

**WARNING: Risk of scalding!**

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

Loosen screw plug (1) with nut and a long extension (2). Tightening torque 11 13 lAZ. See **11 13 OIL PAN** .

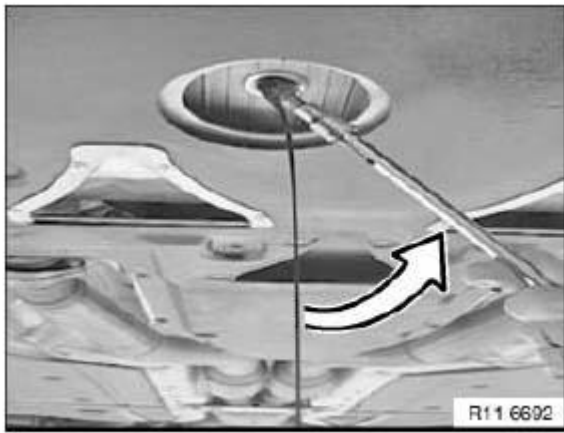
**Installation note:** Replace sealing ring.



**Fig. 9: Identifying Screw Plug With Socket And Long Extension**  
Courtesy of BMW OF NORTH AMERICA, INC.

Tilt long extension (1) with nut and screw plug in direction of arrow. Catch and dispose of drained engine oil in

a suitable collecting vessel.



**Fig. 10: Disposing Of Engine Oil With Suitable Equipment**  
Courtesy of BMW OF NORTH AMERICA, INC.

Pour in engine oil. Park vehicle on a horizontal surface. Start engine and run at idle speed until engine oil temperature = 70 °C. Press the on-board computer button for longer than three seconds: Remeasure the engine oil level.

#### **11 00 039 CHECKING COMPRESSION OF ALL CYLINDERS (S85)**

##### **Special tools required:**

- 11 0 224
- 11 0 235

##### **IMPORTANT: High tension - mortal danger!**

Disconnect all supply leads from ignition coils (interrupt power supply to ignition coils).

Check Schrader valve on special tool 110 235 for correct seating (engine damage).

The throttle valves cannot be opened by opening the throttle.

A compression check is carried out exclusively by means of the idle actuators.

A compression check is only possible with the diagnosis tester.

##### *Necessary preliminary tasks:*

- Remove microfilter housing. See **64 31 061 REMOVING AND INSTALLING/REPLACING LEFT OR RIGHT MICROFILTER HOUSING LOWER SECTION** or **64 31 061 REMOVING AND INSTALLING/REPLACING LEFT OR RIGHT MICROFILTER HOUSING LOWER SECTION (M6)** .

- Release coolant tank and place to one side
- Remove all spark plugs.
- Connect diagnosis tester.

1. Service function.
2. Drive.
3. Engine electronics
4. Switch off fuel injection.

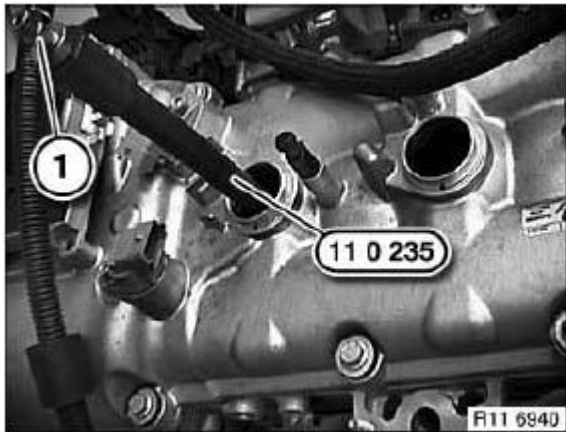
**IMPORTANT: Fuel injectors are switched off.**

5. Actuate starter motor for 8 seconds.

Screw special tool 110 235 into spark plug hole.

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

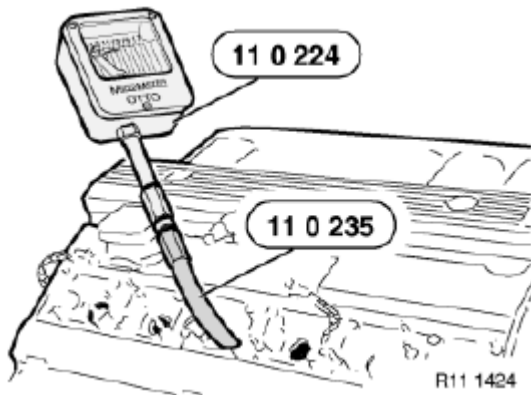
Connection (1) for diagnosis tester or special tool 11 0 224.



**Fig. 11: Identifying Special Tool 110 235**  
Courtesy of BMW OF NORTH AMERICA, INC.

Connect special tool 110 224 or 25 bar pressure adapter to diagnosis tester.

Compression pressure.



**Fig. 12: Identifying Special Tool 110 224 And 110 235**  
 Courtesy of BMW OF NORTH AMERICA, INC.

Now clear the fault memory.

## 11 00 050 REMOVING AND INSTALLING ENGINE (S85)

*Necessary preliminary tasks:*

- Remove underbody protection. See **51 47 490 REMOVING AND INSTALLING / REPLACING FRONT UNDERBODY PROTECTION (M5)** or **51 47 490 REMOVING AND INSTALLING / REPLACING FRONT UNDERBODY PROTECTION (M6)** .
- Remove both front wheels.
- Remove fresh air duct. See **64 31 053 REMOVING AND INSTALLING OR REPLACING FRESH AIR DUCT (M5)** or **64 31 053 REMOVING AND INSTALLING OR REPLACING FRESH AIR DUCT (M6)** .
- Remove SMG transmission [23]. **23 00 613 REMOVING AND INSTALLING TRANSMISSION (M5)** or **23 00 018 REMOVING AND INSTALLING TRANSMISSION (M6)** .
- Remove front wall. See **41 33 040 REPLACING FRONT WALL (M5)** .
- Remove **oil filter housing**.
- Drain coolant.
- Remove module carrier with radiator.
- Remove expansion tank.
- Detach coolant hose from auxiliary water pump.
- Draw off hydraulic fluid [32].
- Remove fluid reservoir with lines for steering gear.
- Draw off A/C system. **64 50 009 DRAWING OFF, EVACUATING AND FILLING A/C SYSTEM (R 134A) (M5)** or **64 50 009 DRAWING OFF, EVACUATING AND FILLING A/C SYSTEM (R 134A) (M6)** .
- Detach lines from A/C compressor. See **64 52 523 REPLACING A/C SYSTEM COMPRESSOR (M5)** or **64 52 523 REPLACING A/C SYSTEM COMPRESSOR (M6)** .
- Disconnect all plug connections in electronics box.

- Remove both intake filter housings. See **13 71 000 REMOVING AND INSTALLING LEFT INTAKE FILTER HOUSING (S85)** or **13 71 020 REMOVING AND INSTALLING RIGHT INTAKE FILTER HOUSING (S85)**
- Remove **intake air manifold**.
- Disconnect hose for crankcase ventilation.
- Disconnect hose for suction jet pump.
- Remove heat shield on front axle carrier.
- Release steering spindle. See **32 31 070 REMOVING AND INSTALLING / REPLACING LOWER SECTION OF STEERING SPINDLE (M5)** or **32 31 070 REMOVING AND INSTALLING/REPLACING LOWER SECTION OF STEERING SPINDLE (M6)** .
- Remove left and right **oxygen sensors**.
- Remove left and right temperature sensors [17, 62].
- Release grounding strap on engine support arm.
- Unscrew left and right engine mounts. See **ENGINE SUSPENSION** .
- Carefully lift out engine with two persons.

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

#### **11 00 670 SECURING ENGINE IN INSTALLATION POSITION (S85)**

##### **Special tools required:**

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

**WARNING: Danger of injury!**

Observe following instructions relating to special tool:

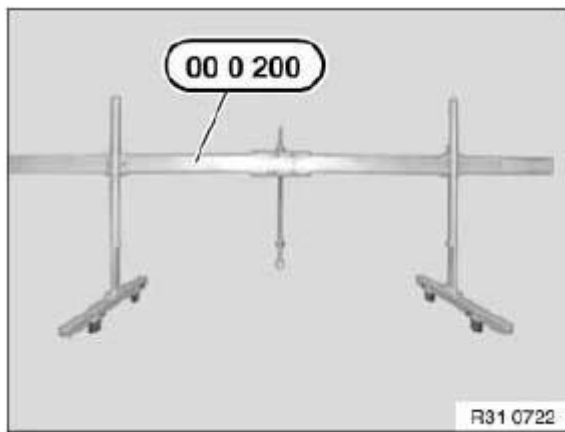
1. Prior to each use, check the special tools for defects, modifications and operational reliability.
2. Damaged/modified special tools must not be used!
3. No changes or modifications may be made to the special tools!
4. Keep special tools dry, clean and free of grease.

##### *Necessary preliminary tasks:*

- Secure engine bonnet/hood in service position

- Remove both intake filter housings. See **13 71 000 REMOVING AND INSTALLING LEFT INTAKE FILTER HOUSING (S85)** or **13 71 020 REMOVING AND INSTALLING RIGHT INTAKE FILTER HOUSING (S85)**
- Remove tension strut on spring strut dome. See **51 71 373 REMOVING AND INSTALLING/REPLACING TENSION STRUT ON SPRING STRUT DOME (M5)** or **51 71 373 REMOVING AND INSTALLING/REPLACING TENSION STRUT ON SPRING STRUT DOME (M6)** .

Assemble transverse member 00 0 200 with special tools 00 0 202, 00 0 204, 00 0 208.



**Fig. 13: Identifying Transverse Member 00 0 200**  
Courtesy of BMW OF NORTH AMERICA, INC.

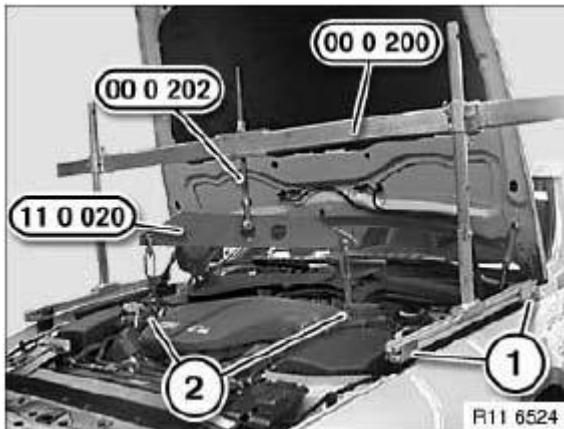
**IMPORTANT:** Avoid a change of engine position in the transversal or longitudinal direction. Always make sure there is sufficient clearance between the engine (or its attachment parts) and the body.

**IMPORTANT:** Risk of damage!

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

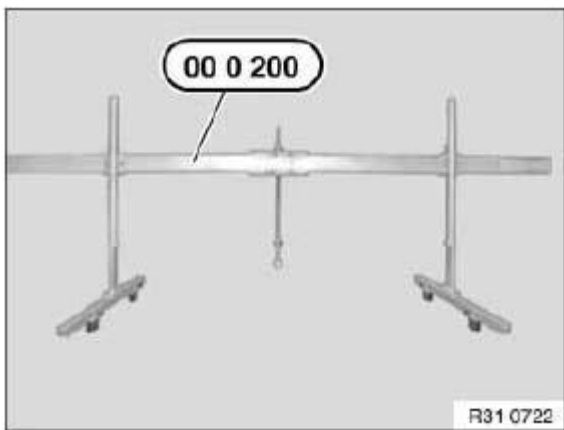
Secure special tool 11 0 020 to spindle 00 0 202.

Attach suitable chains to special tool 11 0 020 and suspend from both engine suspension eyes (2).



**Fig. 14: Identifying Special Tool 11 0 020, Transverse Member And Engine Suspension Eyes**  
Courtesy of BMW OF NORTH AMERICA, INC.

**WARNING: Danger of injury!**  
Tighten down all adjusting screws and nuts on transverse member 00 0 200.



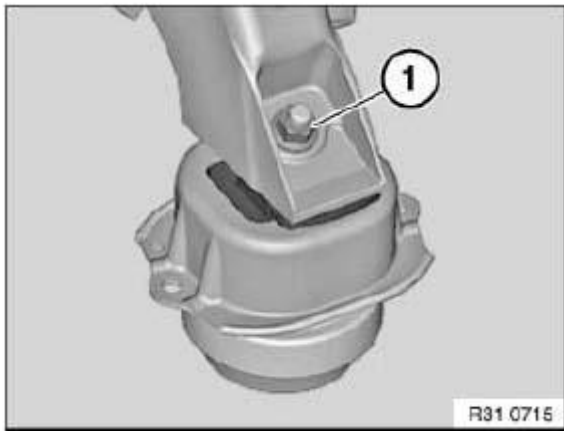
**Fig. 15: Identifying Transverse Member 00 0 200**  
Courtesy of BMW OF NORTH AMERICA, INC.

Unscrew nuts (1).

Raise engine approx. 10 mm with transverse member.

*Installation:*

Replace self-locking nuts.



**Fig. 16: Identifying Nut**

Courtesy of BMW OF NORTH AMERICA, INC.

### 11 0 091 INSTALLING REPLACEMENT ENGINE (S85)

*Necessary preliminary tasks:*

- Remove and install engine.

**NOTE:** Use a 5W-30 engine oil for the running-in procedure in a replacement engine. Running-in engine oil must be changed at 2000 km for a 10W-60 engine oil incl. engine oil filter.

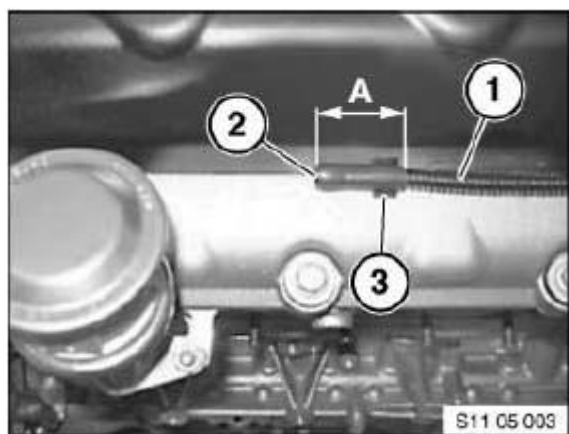
*Installation:*

Modifying check valves, refer to memory entries in DME.

In engines where it is not possible to connect check valves, replace the vacuum-controlled check valves with self-opening check valves.

Vacuum lines will then no longer be required.



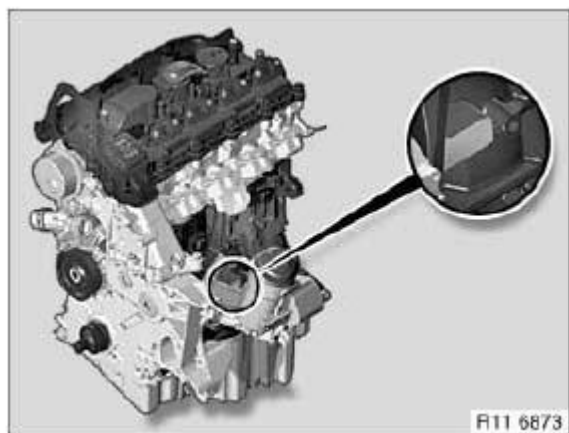


**Fig. 17: Identifying Check Valve**  
Courtesy of BMW OF NORTH AMERICA, INC.

### ENGINE IDENTIFICATION

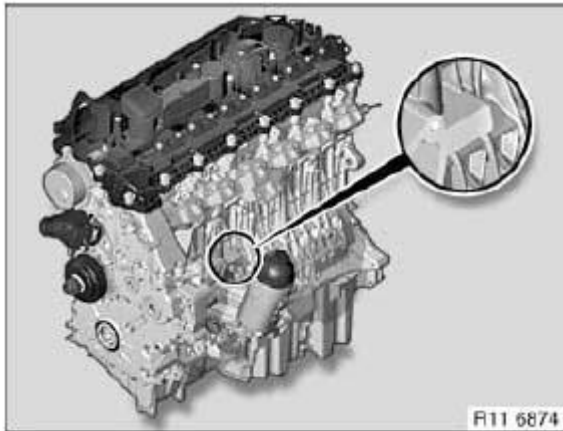
Drive in engine numbers at marked surface with impact tool.

M47 / M47TU / M47T2



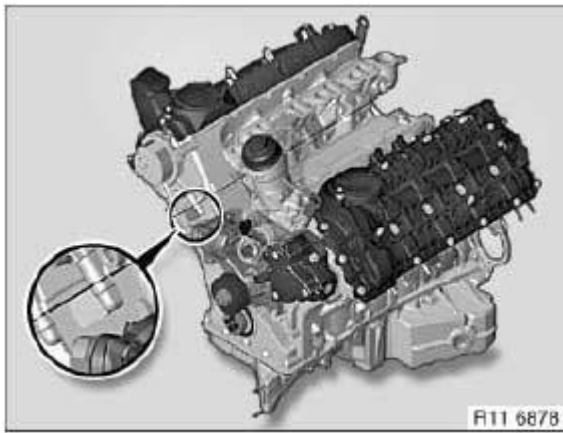
**Fig. 18: Identifying Engine Identification Number Location - M47 / M47TU / M47T2**  
Courtesy of BMW OF NORTH AMERICA, INC.

M57 / M57TU / M57T2



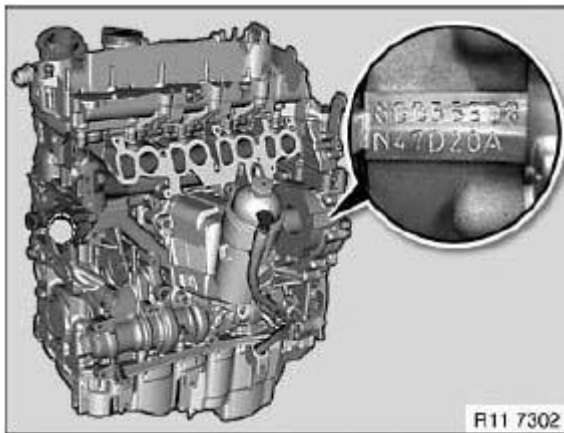
**Fig. 19: Identifying Engine Identification Number Location - M57 / M57TU / M57T2**  
Courtesy of BMW OF NORTH AMERICA, INC.

M67 / M67TU



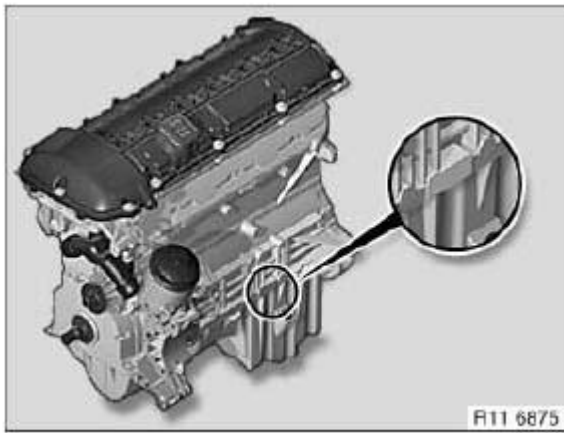
**Fig. 20: Identifying Engine Identification Number Location - M67 / M67TU**  
Courtesy of BMW OF NORTH AMERICA, INC.

N47



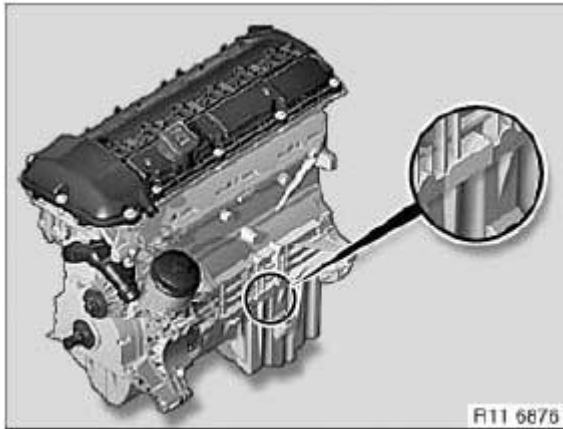
**Fig. 21: Identifying Engine Identification Number Location - N47**  
Courtesy of BMW OF NORTH AMERICA, INC.

M52 / M52TU



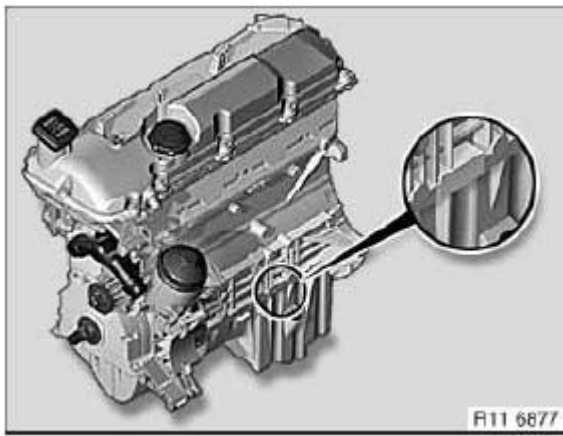
**Fig. 22: Identifying Engine Identification Number Location - M52 / M52TU**  
Courtesy of BMW OF NORTH AMERICA, INC.

M54



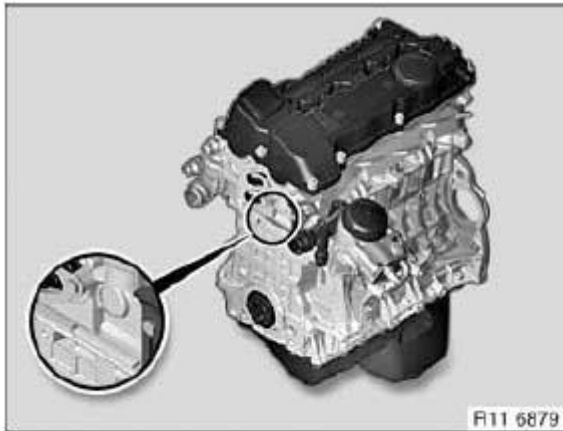
**Fig. 23: Identifying Engine Identification Number Location - M54**  
Courtesy of BMW OF NORTH AMERICA, INC.

M56



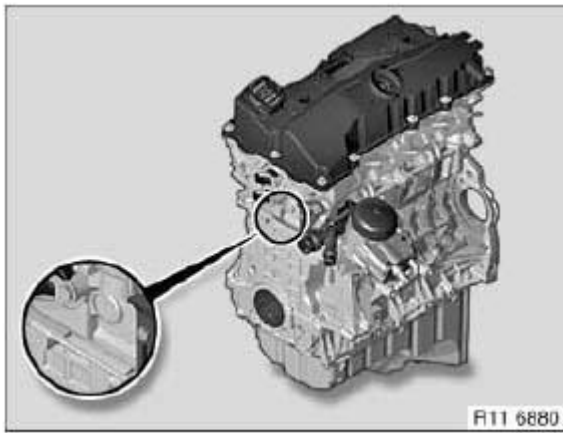
**Fig. 24: Identifying Engine Identification Number Location - M56**  
Courtesy of BMW OF NORTH AMERICA, INC.

N40 / N45



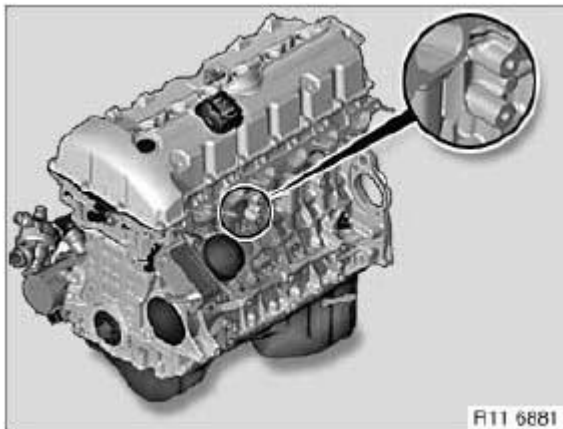
**Fig. 25: Identifying Engine Identification Number Location - N40 / N45**  
Courtesy of BMW OF NORTH AMERICA, INC.

N42 / N46 / N46T



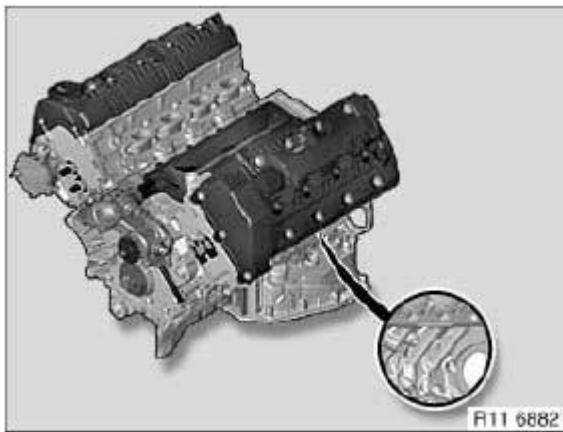
**Fig. 26: Identifying Engine Identification Number Location - N42 / N46 / N46T**  
Courtesy of BMW OF NORTH AMERICA, INC.

N51 / N52 / N52K / N53 / N54



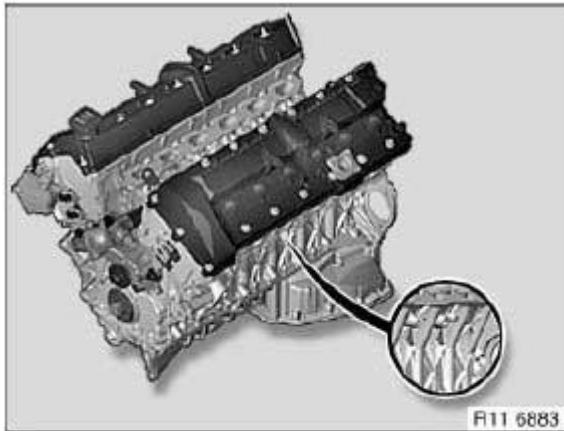
**Fig. 27: Identifying Engine Identification Number - N51 / N52 / N52K / N53 / N54**  
Courtesy of BMW OF NORTH AMERICA, INC.

N62



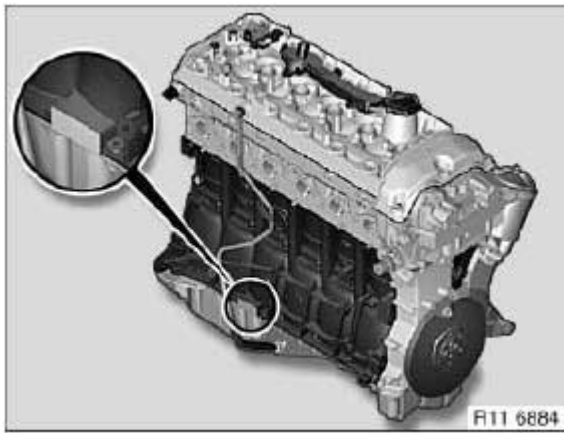
**Fig. 28: Identifying Engine Identification Number Location - N62**  
Courtesy of BMW OF NORTH AMERICA, INC.

N73



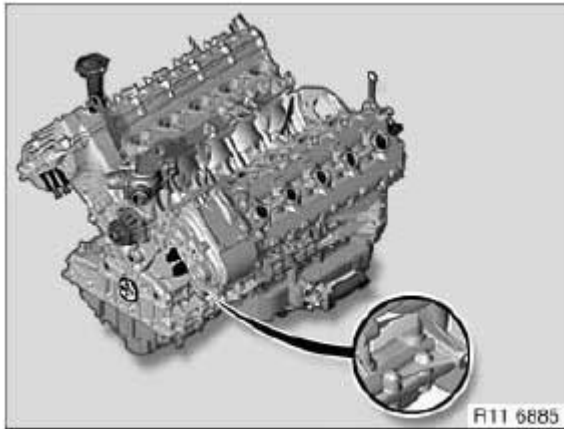
**Fig. 29: Identifying Engine Identification Number Location - N73**  
Courtesy of BMW OF NORTH AMERICA, INC.

S54



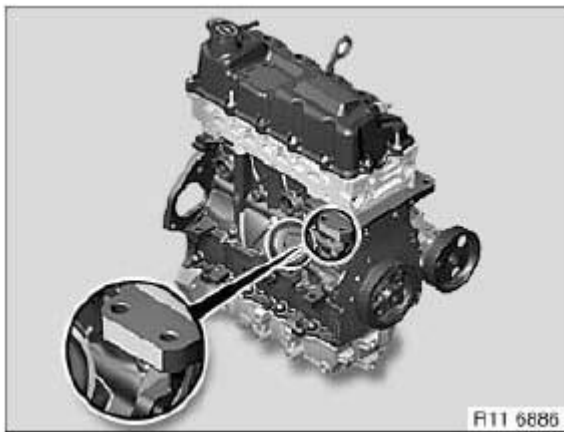
**Fig. 30: Identifying Engine Identification Number Location - S54**  
Courtesy of BMW OF NORTH AMERICA, INC.

S85



**Fig. 31: Identifying Engine Identification Number Location - S58**  
Courtesy of BMW OF NORTH AMERICA, INC.

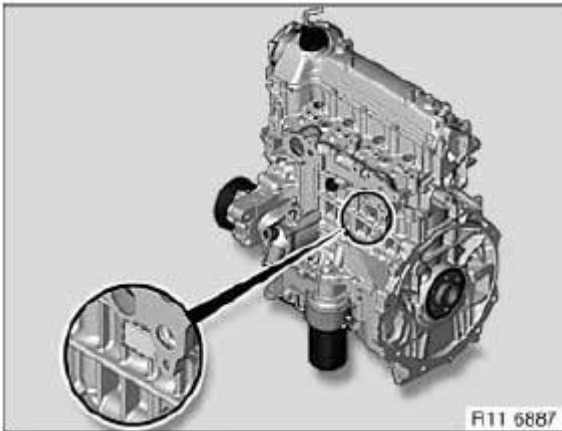
W10/W11



**Fig. 32: Identifying Engine Identification Number Location - W10/W11**  
Courtesy of BMW OF NORTH AMERICA, INC.

W17





**Fig. 33: Identifying Engine Identification Number Location - W17**  
Courtesy of BMW OF NORTH AMERICA, INC.

Assemble engine.

#### **MOUNTING ENGINE ON ASSEMBLY STAND (S85)**

##### **Special tools required:**

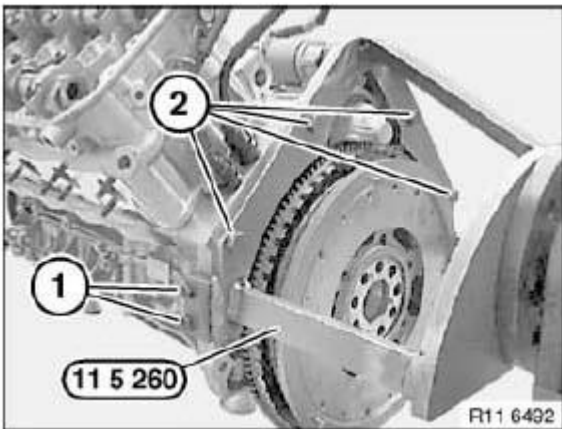
- 00 2 300
- 11 5 260

##### *Necessary preliminary tasks:*

- Remove **engine**.

Secure special tool 11 5 260 to crankcase with bolts (1 and 2).

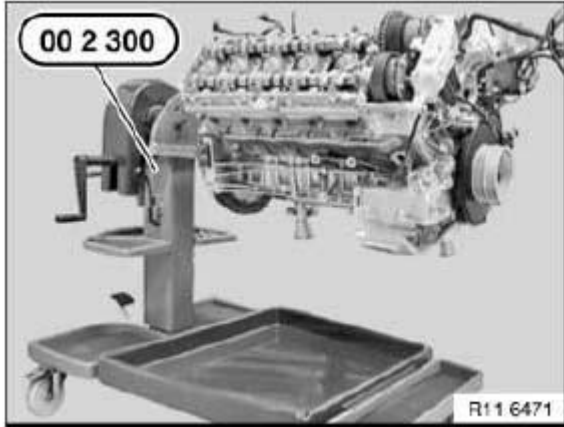
Tighten screws (1 and 2) uniformly.



**Fig. 34: Identifying Special Tool 11 5 260 And Screws**

Courtesy of BMW OF NORTH AMERICA, INC.

Secure engine with special tool 11 5 260 to special tool 00 2 300.



**Fig. 35: Identifying Special Tool 00 2 300**

Courtesy of BMW OF NORTH AMERICA, INC.

## **12 CYLINDER HEAD WITH COVER**

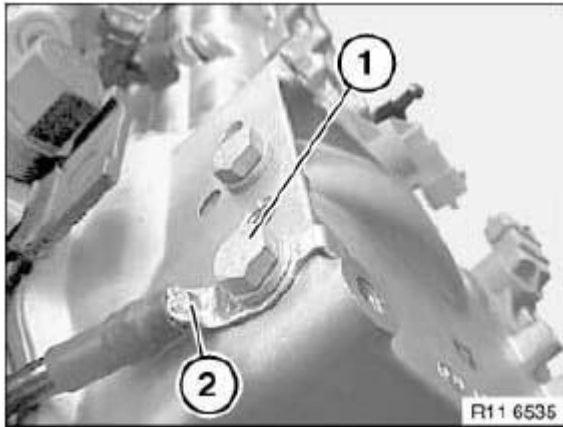
### **11 12 005 REMOVING AND INSTALLING / SEALING LEFT CYLINDER HEAD COVER (S85)**

*Necessary preliminary tasks:*

- Remove **intake air manifold**.
- Remove **IGNITION COILS (S85)** .
- Disconnect plug connection for ion control unit.
- Disconnect plug connection at camshaft sensors.

Release screw (1).

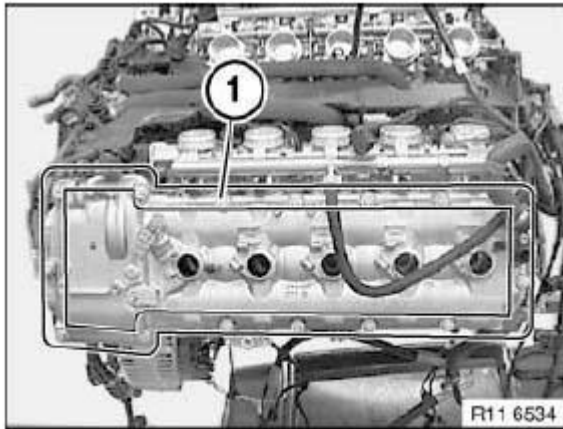
Lay ground strap (2) to one side.



**Fig. 36: Identifying Ground Strap**

Courtesy of BMW OF NORTH AMERICA, INC.

Release screws along line (1).



**Fig. 37: Identifying Cylinder Head Cover**

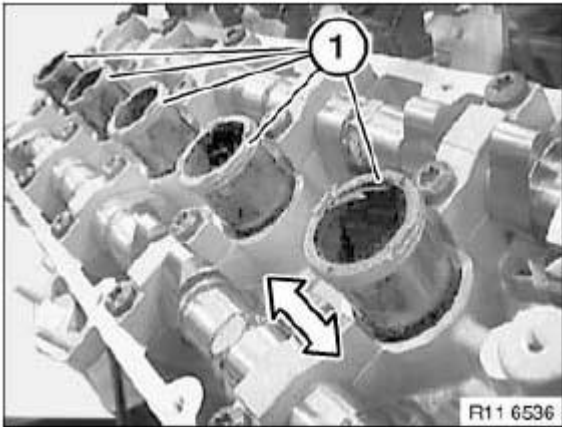
Courtesy of BMW OF NORTH AMERICA, INC.

Remove spark plug tube (1) in direction of arrow.

*Installation:*

Check rubber on spark plug tube (1) for damage; replace spark plug tube (1) if necessary.

Apply a light coating of engine oil to spark plug tube (1) prior to installation.



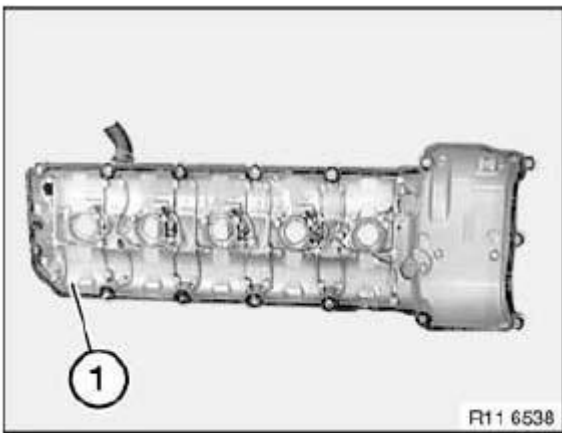
**Fig. 38: Removing Spark Plug Tube**  
Courtesy of BMW OF NORTH AMERICA, INC.

*Installation:*

Replace seal (1).

Align gasket (1) on cylinder head cover groove.

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

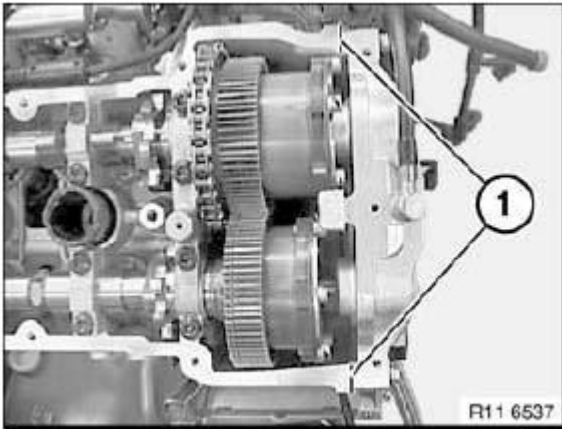


**Fig. 39: Identifying Seal**  
Courtesy of BMW OF NORTH AMERICA, INC.

*Installation:*

Clean seal residue from sealing surfaces.

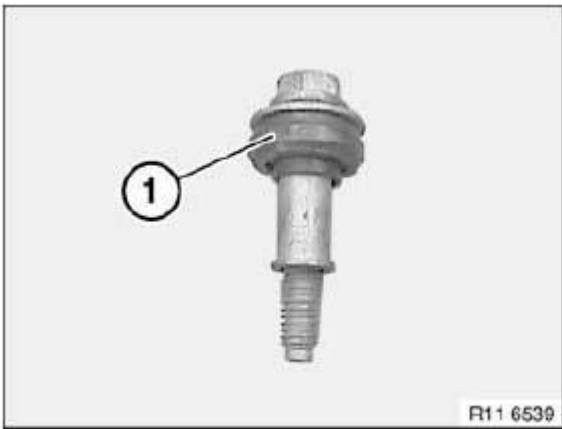
Coat contact surfaces of joint (1) with Drei Bond 1209.



**Fig. 40: Identifying Contact Surfaces Of Cylinder Head Cover Joint**  
Courtesy of BMW OF NORTH AMERICA, INC.

*Installation:*

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

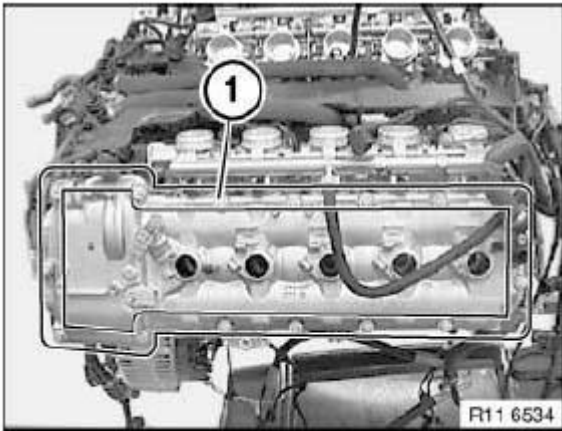


**Fig. 41: Identifying Decoupling Element**  
Courtesy of BMW OF NORTH AMERICA, INC.

Fit cylinder head cover.

Align spark plug tubes.

Tighten down all retaining elements diagonally from inside to outside.



**Fig. 42: Identifying Cylinder Head Cover**  
Courtesy of BMW OF NORTH AMERICA, INC.

Assemble engine.

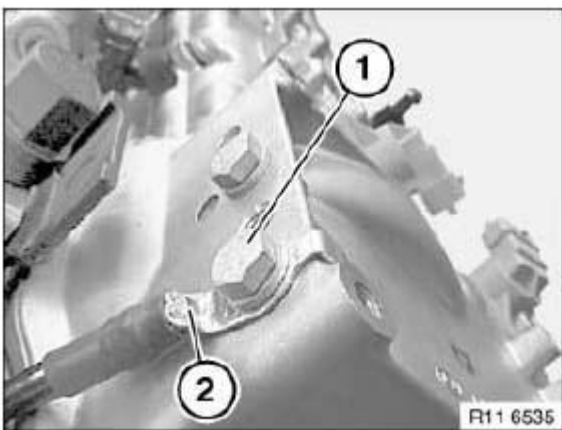
#### 11 12 005 REMOVING AND INSTALLING / SEALING RIGHT CYLINDER HEAD COVER (S85)

*Necessary preliminary tasks:*

- Remove intake air manifold.
- Remove rod-type ignition coils .
- Disconnect plug connection for ion control unit.
- Disconnect plug connection at camshaft sensors.

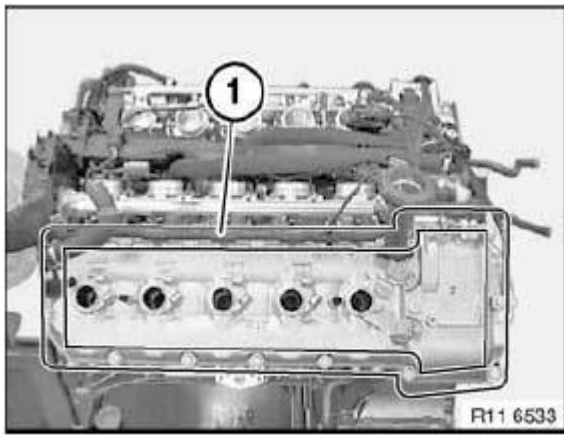
Release screw (1).

Lay ground strap (2) to one side.



**Fig. 43: Identifying Ground Strap**  
Courtesy of BMW OF NORTH AMERICA, INC.

Release screws along line (1).



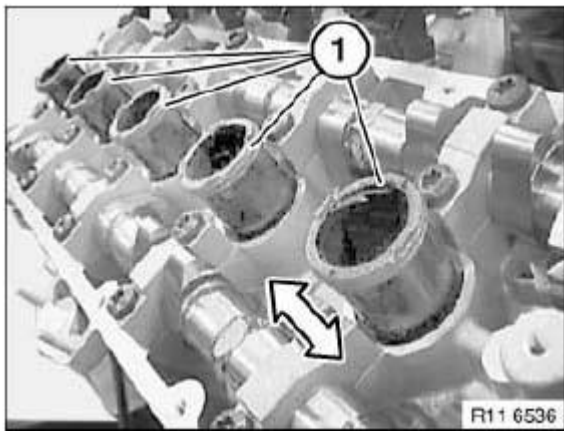
**Fig. 44: Identifying Cylinder Head Cover**  
Courtesy of BMW OF NORTH AMERICA, INC.

Remove spark plug tube (1) in direction of arrow.

*Installation:*

Check rubber on spark plug tube (1) for damage; replace spark plug tube (1) if necessary.

Apply a light coating of engine oil to spark plug tube (1) prior to installation.



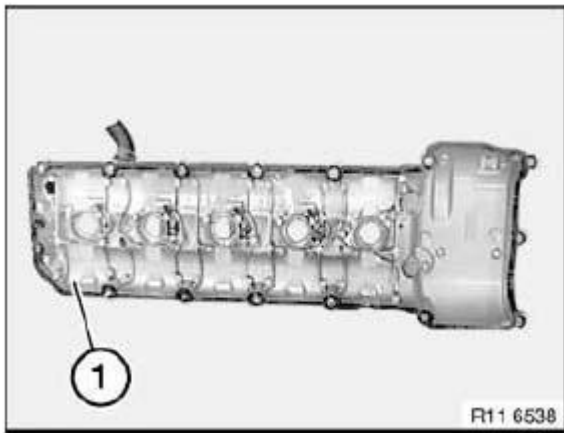
**Fig. 45: Removing Spark Plug Tube**  
Courtesy of BMW OF NORTH AMERICA, INC.

*Installation:*

Replace seal (1).

Align gasket (1) on cylinder head cover groove.

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

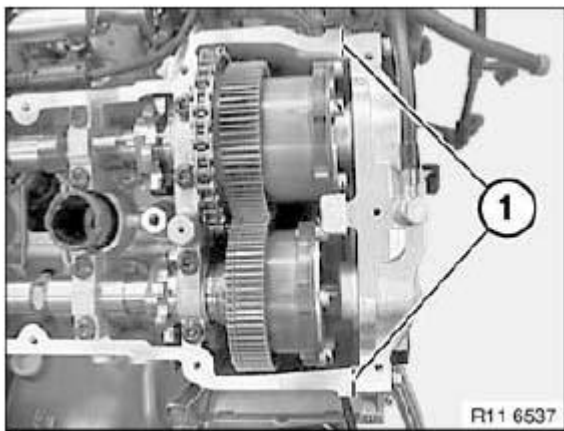


**Fig. 46: Identifying Gasket On Cylinder Head Cover Groove**  
Courtesy of BMW OF NORTH AMERICA, INC.

*Installation:*

Clean seal residue from sealing surfaces.

Coat contact surfaces of joint (1) with Drei Bond 1209 (refer to BMW Parts Service).

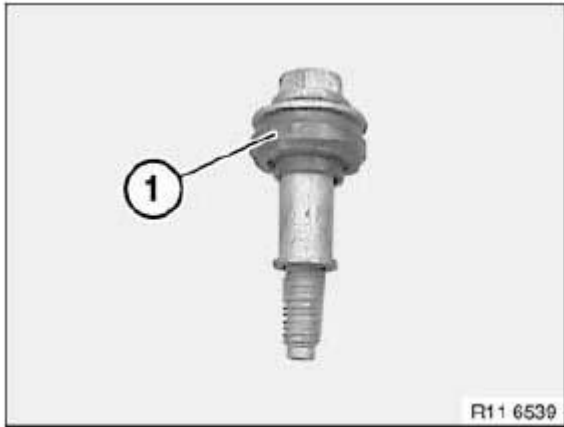


**Fig. 47: Identifying Contact Surfaces Of Cylinder Head Cover Joint**  
Courtesy of BMW OF NORTH AMERICA, INC.

*Installation:*

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



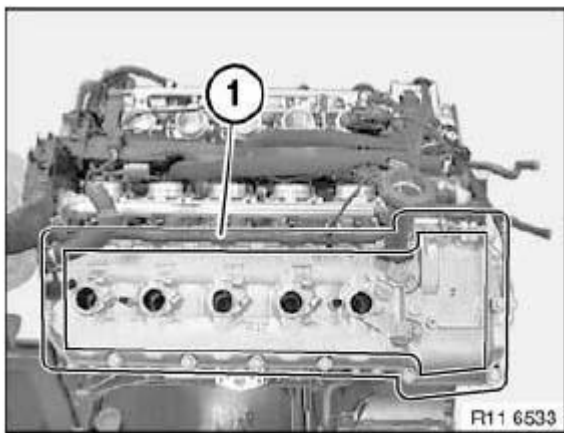


**Fig. 48: Identifying Decoupling Element**  
Courtesy of BMW OF NORTH AMERICA, INC.

Fit cylinder head cover.

Align spark plug tubes.

Tighten down all retaining elements diagonally from inside to outside.



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

Assemble engine.

## 11 12 105 REMOVING AND INSTALLING LEFT CYLINDER HEAD (S85)

### Special tools required:

- 11 5 210
- 11 5 220
- 11 5 352

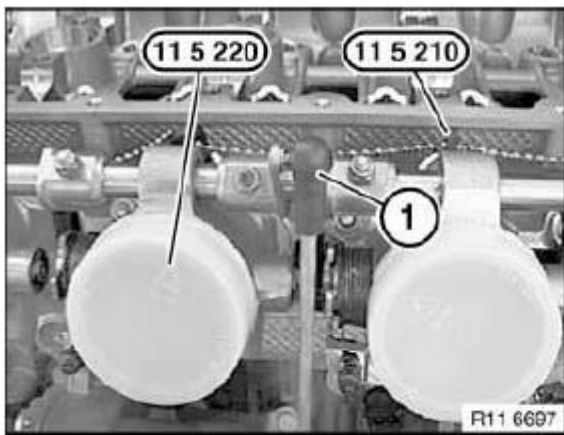
*Necessary preliminary tasks:*

- Remove **EXHAUST SYSTEM** .
- Remove left exhaust manifold. See **18 40 010 REMOVING AND INSTALLING/REPLACING LEFT EXHAUST MANIFOLD (S85)**
- Unfasten engine wiring harness and lay to one side.
- Remove left **cylinder head cover**.
- Remove **left inlet camshaft**.
- Remove **left exhaust camshaft**.

Attach special tool 11 5 220.

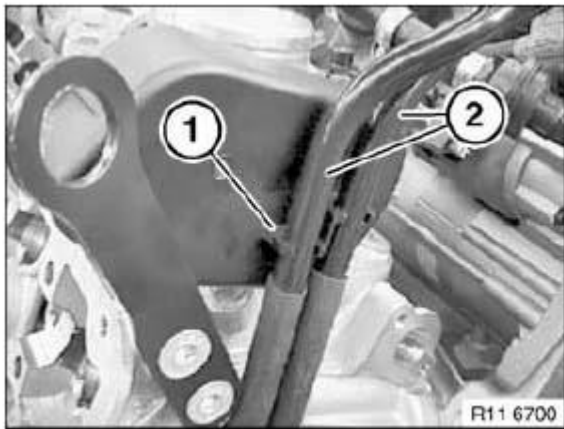
Insert special tool 11 5 210.

Unclip linkage (1).



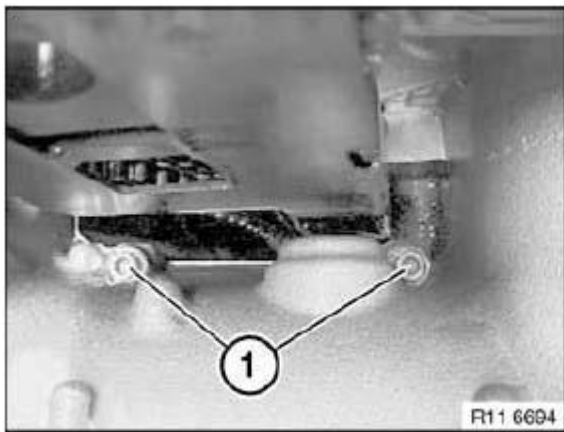
**Fig. 50: Identifying Special Tool 11 5 220 And 11 5 210**  
Courtesy of BMW OF NORTH AMERICA, INC.

Detach hoses (2) from holder (1).



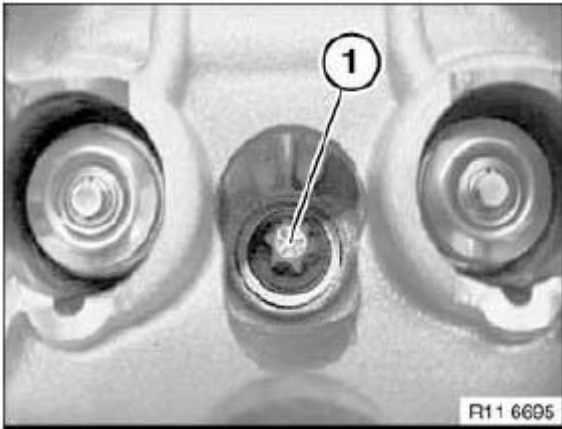
**Fig. 51: Identifying Hoses And Holder**  
Courtesy of BMW OF NORTH AMERICA, INC.

Release screws (1).



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

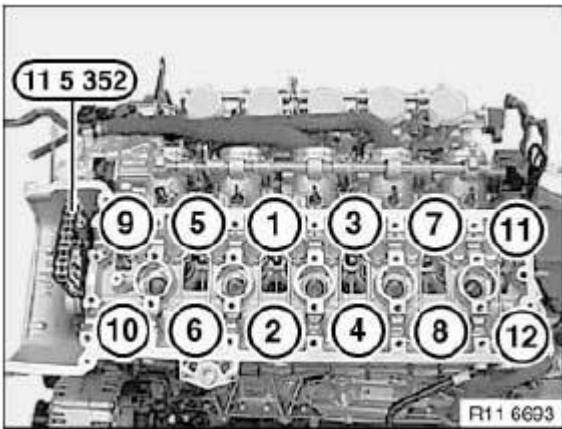
Cylinder head bolt (1) with shim.



**Fig. 53: Identifying Cylinder Head Bolt**  
Courtesy of BMW OF NORTH AMERICA, INC.

Do not remove special tool 115 352.

Release cylinder head bolts from outside to inside in sequence (12 to 1).



**Fig. 54: Identifying Cylinder Head Bolts Removal Sequence**  
Courtesy of BMW OF NORTH AMERICA, INC.

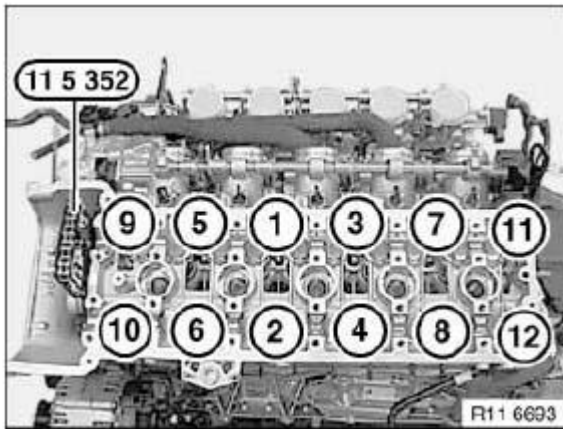
**NOTE:** Replace cylinder head gasket.  
Check cylinder head for water leaks.

*Installation:*

Fit new cylinder head screws.

Tighten down cylinder head bolts from inside to outside in sequence (1 to 12).

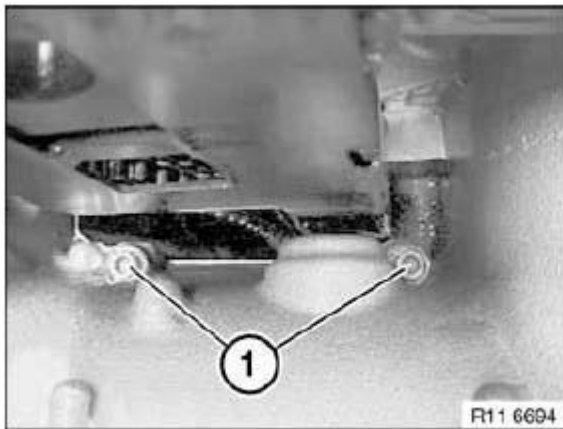
Tightening torque 11 12 1AZ. See CYLINDER HEAD WITH COVER .



**Fig. 55: Identifying Cylinder Head Bolts Tightening Sequence**  
Courtesy of BMW OF NORTH AMERICA, INC.

Insert screws (1).

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



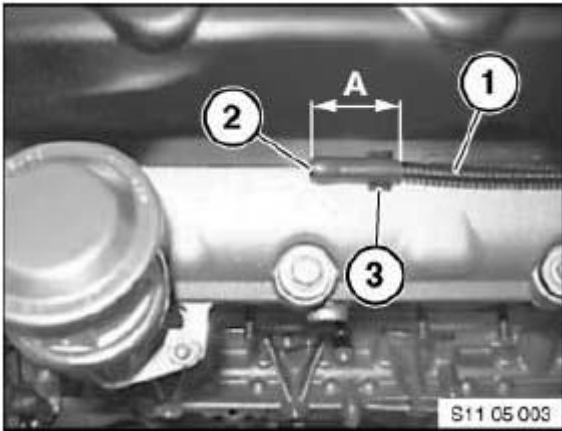
**Fig. 56: Identifying Screws**  
Courtesy of BMW OF NORTH AMERICA, INC.

*Installation:*

Modifying check valves, refer to memory entries in DME.

In engines where it is not possible to connect check valves, replace the vacuum-controlled check valves with self-opening check valves.

Vacuum lines will then no longer be required.



**Fig. 57: Identifying Check Valve**

Courtesy of BMW OF NORTH AMERICA, INC.

Assemble engine.

## 11 12 106 REMOVING AND INSTALLING RIGHT CYLINDER HEAD (S85)

### Special tools required:

- 115 210
- 115 220
- 115 351

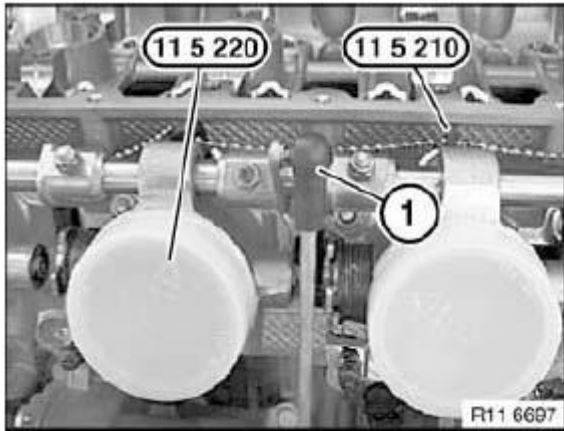
### Necessary preliminary tasks:

- Remove **EXHAUST SYSTEM** .
- Remove **RIGHT** exhaust manifold.
- Unfasten engine wiring harness and lay to one side.
- Remove **right** cylinder head cover.
- Remove **Right Inlet Camshaft**.
- Remove **Right Exhaust Camshaft**.

Attach special tool 11 5 220.

Insert special tool 115 210.

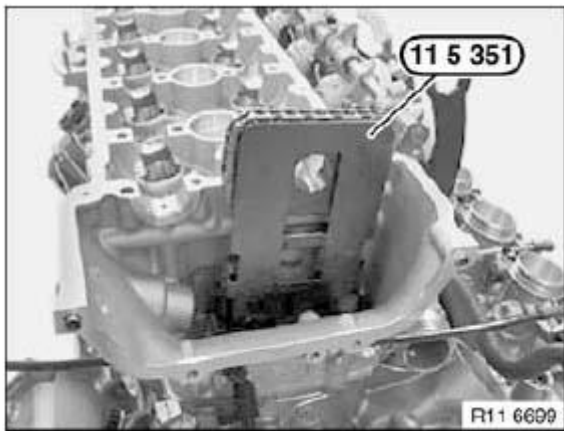
Unclip linkage (1).



**Fig. 58: Identifying Special Tool 11 5 220, 115 210 And Linkage**  
Courtesy of BMW OF NORTH AMERICA, INC.

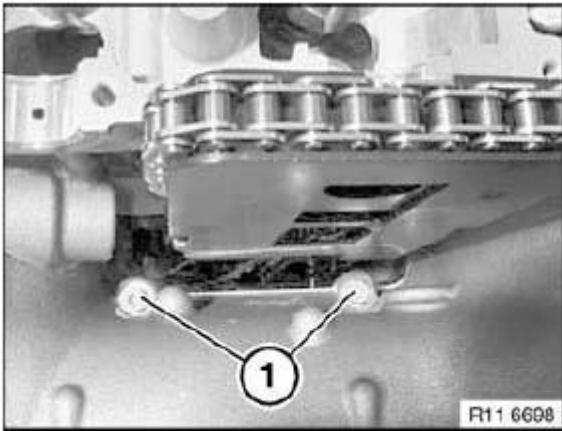
Do not remove special tool 11 5 351.

**NOTE:** Remove and install cylinder head with special tool 11 5 351.



**Fig. 59: Identifying Special Tool 11 5 351**  
Courtesy of BMW OF NORTH AMERICA, INC.

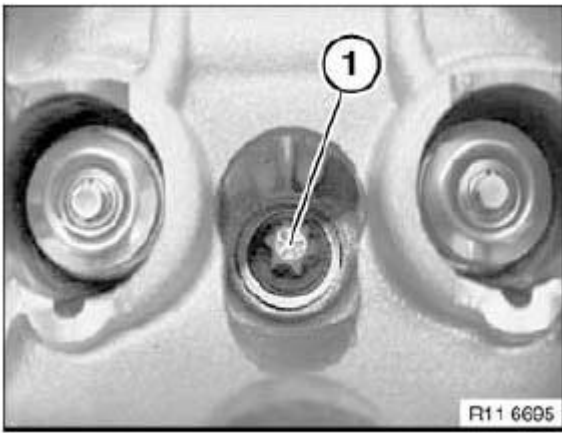
Release screws (1).



**Fig. 60: Identifying Screws**

Courtesy of BMW OF NORTH AMERICA, INC.

Cylinder head bolt (1) with shim.

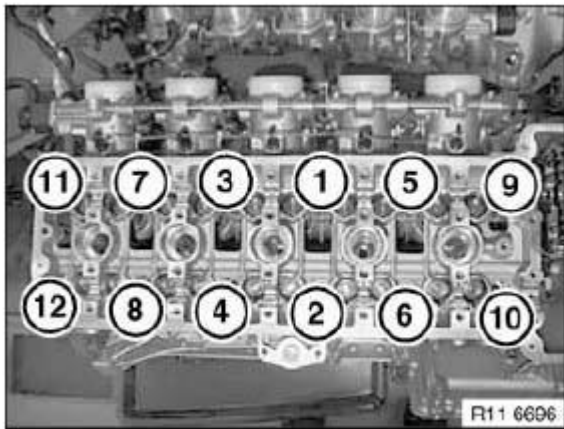


**Fig. 61: Identifying Cylinder Head Bolt**

Courtesy of BMW OF NORTH AMERICA, INC.

Release cylinder head bolts from outside to inside in sequence (12 to 1).





**Fig. 62: Identifying Cylinder Head Bolts Removal Sequence**  
Courtesy of BMW OF NORTH AMERICA, INC.

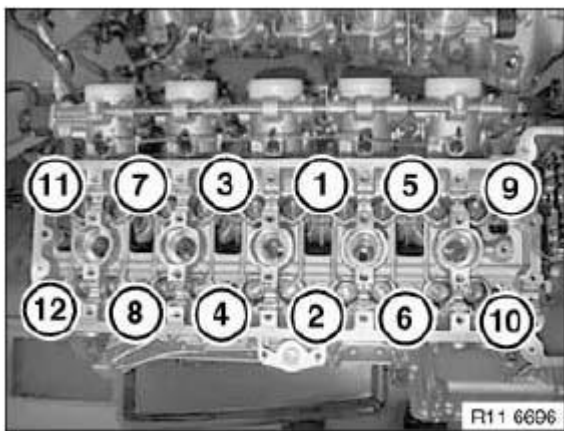
**NOTE:**        **Replace cylinder head gasket.**  
                     **Check cylinder head for water leaks.**

*Installation:*

Fit new cylinder head screws.

Tighten down cylinder head bolts from inside to outside in sequence (1 to 12).

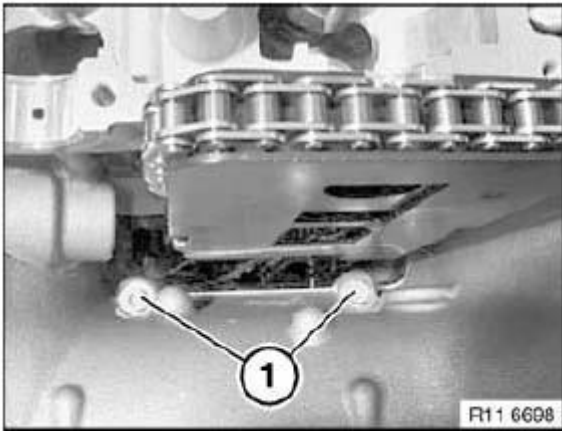
Tightening torque, see 11 12 1AZ in **CYLINDER HEAD WITH COVER** .



**Fig. 63: Identifying Cylinder Head Bolts Tightening Sequence**  
Courtesy of BMW OF NORTH AMERICA, INC.

Insert screws (1).

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



**Fig. 64: Identifying Screws**

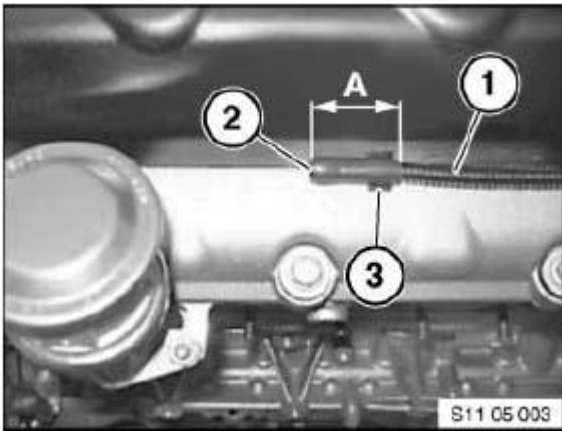
Courtesy of BMW OF NORTH AMERICA, INC.

*Installation:*

Modifying check valves, refer to memory entries in DME.

In engines where it is not possible to connect check valves, replace the vacuum-controlled check valves with self-opening check valves.

Vacuum lines will then no longer be required.



**Fig. 65: Identifying Check Valve**

Courtesy of BMW OF NORTH AMERICA, INC.

Assemble engine.

**11 12 112 REPLACING BOTH CYLINDER HEAD GASKETS (S85)**

*Necessary preliminary tasks:*

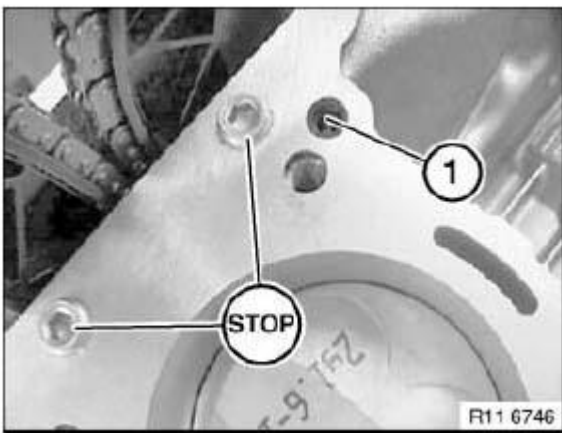
- Remove Left Cylinder Head.
- Remove Right Cylinder Head.
- Check cylinder head for leaks.

**IMPORTANT: Do not open screw plugs.**

**The screw plug must always be replaced if it is opened by mistake.**

*Installation:*

If necessary, replace non-return valve with spacer sleeve (1).



**Fig. 66: Identifying Spacer Sleeve**

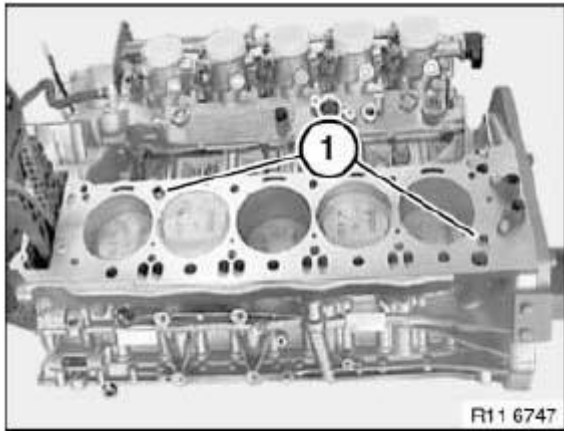
Courtesy of BMW OF NORTH AMERICA, INC.

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

*Installation:*

Clean sealing surfaces.

Illustration shows cyl. 6-10.

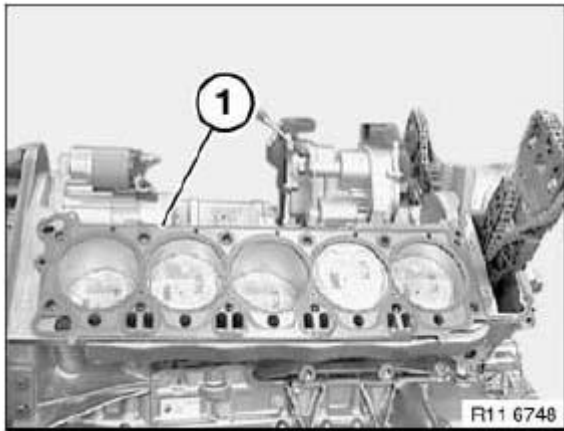


**Fig. 67: Identifying Dowel Sleeves**

Courtesy of BMW OF NORTH AMERICA, INC.

Replace head gasket (1).

**NOTE:** Illustration shows cyl. 1-5.



**Fig. 68: Identifying Head Gasket**

Courtesy of BMW OF NORTH AMERICA, INC.

**NOTE:** There is no oversize gasket for the S85 engine.

Assemble engine.

## 11 12 729 CHECKING CYLINDER HEAD FOR WATER LEAKS (S85)

**Special tools required:**

- 11 5 230
- 11 5 231

- 11 5 233
- 11 5 235
- 11 5 237

**NOTE:** Special tool 115 230 can be used for both cylinder heads.

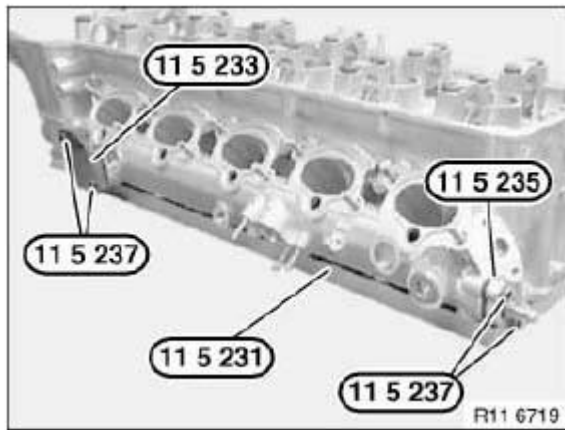
*Necessary preliminary tasks:*

- Remove left cylinder head or right cylinder head.
- Disassemble cylinder head.

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

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

Secure special tool 11 5 233 with special tool 11 5 237.



**Fig. 69: Identifying Special Tools 11 5 231, 11 5 233, 11 5 235 And 11 5 237**  
Courtesy of BMW OF NORTH AMERICA, INC.

**NOTE:** Immerse cylinder head in a water bath.

Test pressure: 4.5 bar.

Check cylinder head for escaping air (cracks).

If necessary, add cleaning agent to water bath.

Assemble engine.

## 13 OIL PUMP

**11 13 000 REMOVING AND INSTALLING OR REPLACING OIL SUMP (S85)***Recycling:*

Catch and dispose of used oil in a suitable container.

Observe country-specific waste-disposal regulations.

*Necessary preliminary tasks:*

- Drain **engine oil**.
- Secure **engine in installation position**.
- Lower **FRONT AXLE (M5)** or **FRONT AXLE (M6)** .
- Remove **ribbed V-belt**.
- Release 4x transmission bolts.

Release screws (4).

Unfasten hose clip (3).

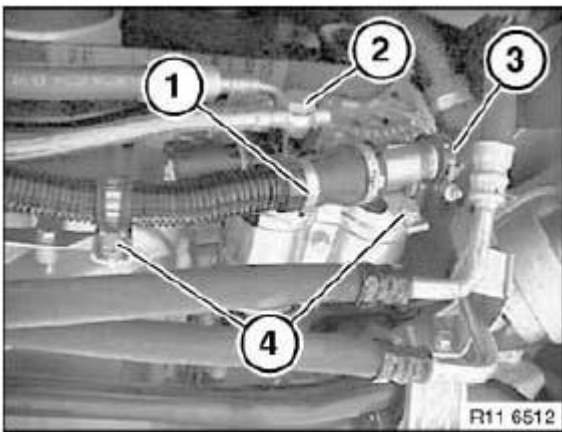
Remove hose (1).

Unfasten banjo bolt (2).

*Installation:*

Replace sealing rings.

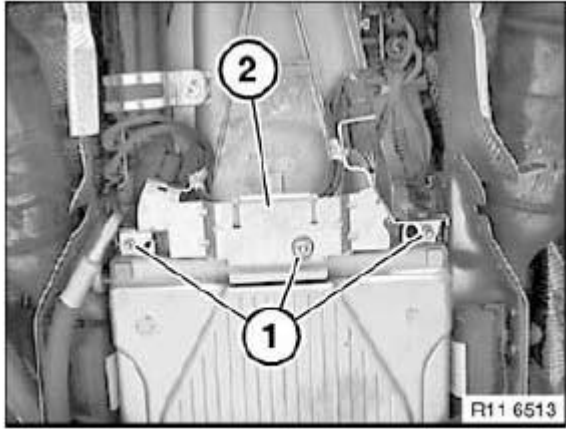
Tightening torque 11 36 3AZ. See **VARIABLE CAMSHAFT CONTROL** .



**Fig. 70: Identifying Hose Clip, Hose And Banjo Bolt**  
Courtesy of BMW OF NORTH AMERICA, INC.

Unscrew nuts (1).

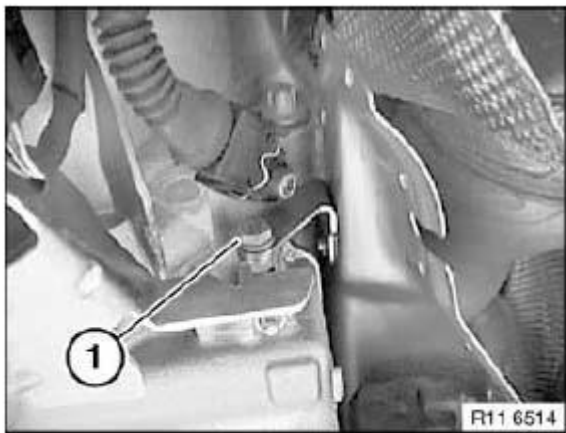
Release oxygen sensor holder (2), remove if necessary.



**Fig. 71: Identifying Oxygen Sensor Holder**  
Courtesy of BMW OF NORTH AMERICA, INC.

Release screw (1) on heat shield on left and right.

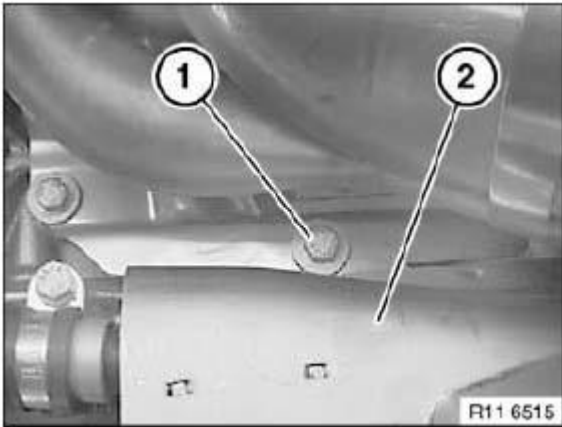
If necessary, remove crankshaft sensor.



**Fig. 72: Identifying Screw On Heat Shield**  
Courtesy of BMW OF NORTH AMERICA, INC.

Release screw (1) on heat shield on left and right.

Remove heat shield (2) on left and right.



**Fig. 73: Identifying Heat Shield**

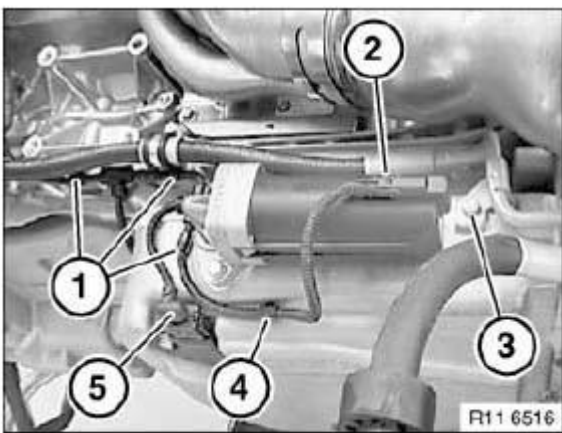
Courtesy of BMW OF NORTH AMERICA, INC.

Disconnect plug connection (2).

Disconnect plug connection (5).

Release cable from holders (1 and 4).

Release screw (5).

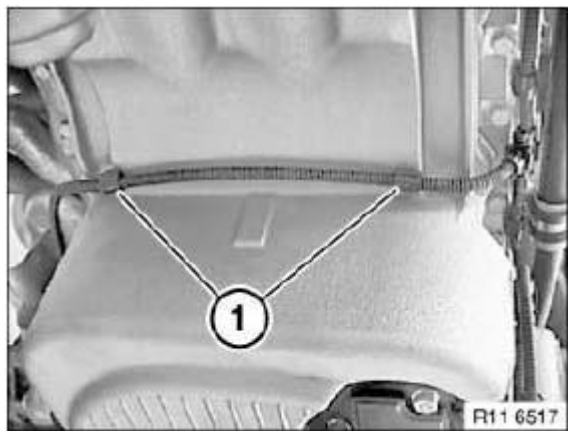


**Fig. 74: Identifying Plug Connections And Holders**

Courtesy of BMW OF NORTH AMERICA, INC.

Detach cable from bracket (1).





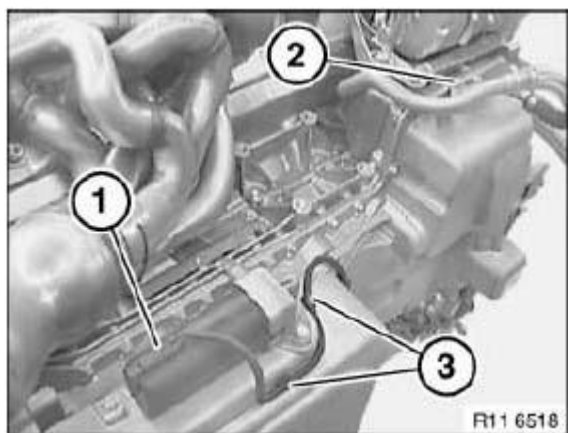
**Fig. 75: Identifying Bracket**

Courtesy of BMW OF NORTH AMERICA, INC.

Disconnect plug connection (1).

Detach cable from bracket (3).

Release screw (2).



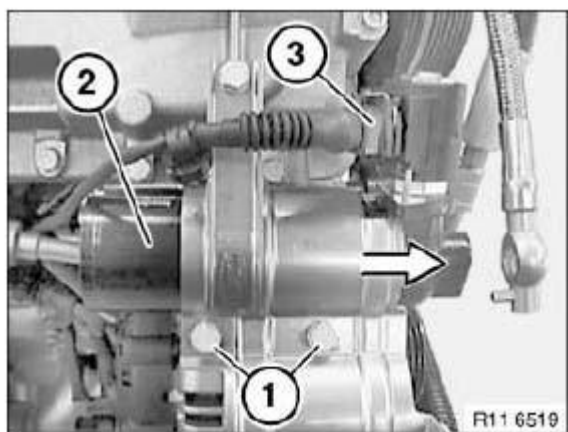
**Fig. 76: Identifying Plug Connection And Bracket**

Courtesy of BMW OF NORTH AMERICA, INC.

Disconnect plug connection (3).

Release screws (1).

Remove VANOS pressure accumulator in direction of arrow.

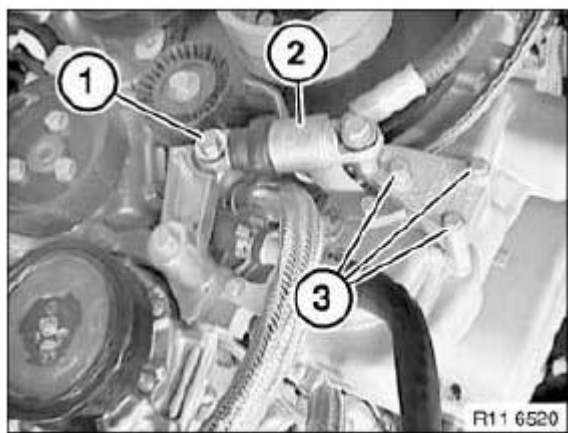


**Fig. 77: Removing VANOS Pressure Accumulator**  
Courtesy of BMW OF NORTH AMERICA, INC.

Release screw (1).

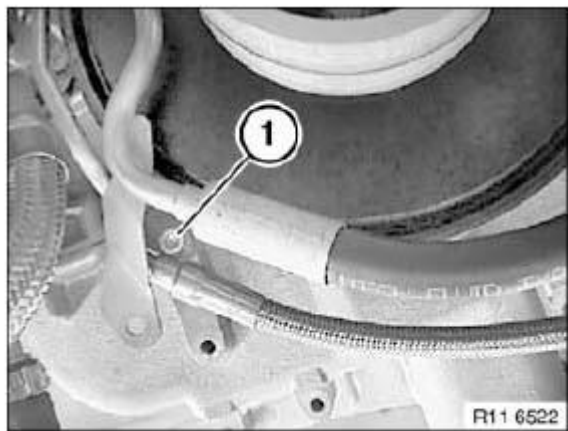
Release screws (3).

Remove belt tensioner (2).



**Fig. 78: Identifying Belt Tensioner**  
Courtesy of BMW OF NORTH AMERICA, INC.

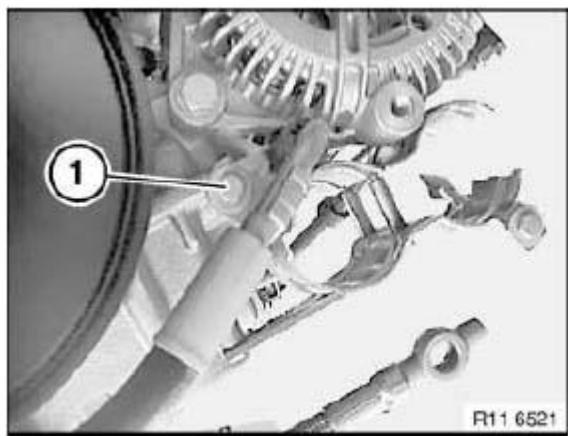
Release screw (1).



**Fig. 79: Identifying Screw**

Courtesy of BMW OF NORTH AMERICA, INC.

Release screw (1).



**Fig. 80: Identifying Screw**

Courtesy of BMW OF NORTH AMERICA, INC.

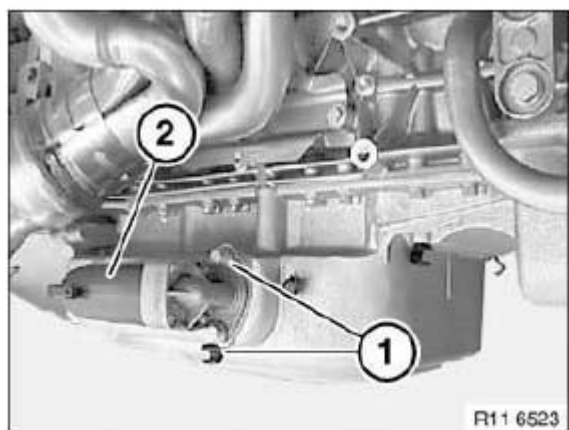
**NOTE:** Illustration shows right return pump.  
The procedure for the left return pump is identical.

Release screws (1).

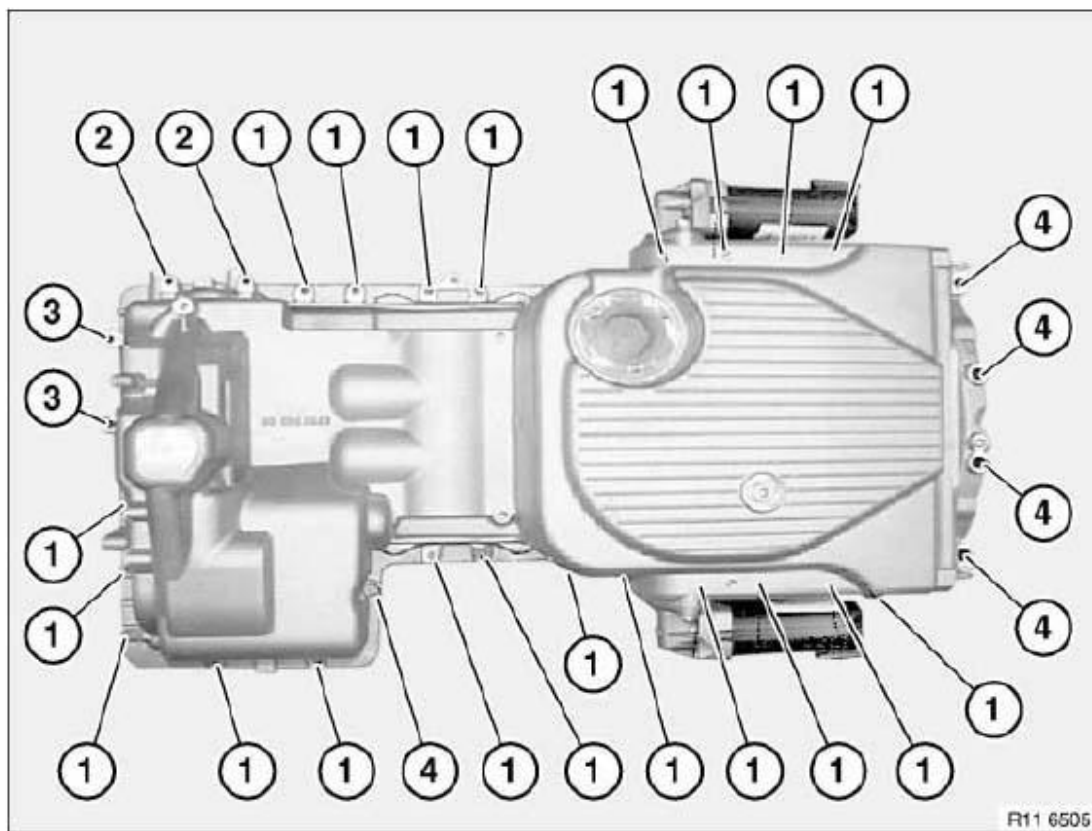
Remove electric oil pump (2).

*Installation:*

Replace O-ring.



**Fig. 81: Identifying Electric Oil Pump**  
Courtesy of BMW OF NORTH AMERICA, INC.



Overview of oil sump screw/bolt connections

- 1 M6x22 hexagon bolt (23 x)
- 2 M6x40 hexagon bolt (2 x)
- 3 M6x75 hexagon socket screw (2 x)
- 4 M6x22 hexagon socket screw (5 x)

**Fig. 82: Overview Of Oil Sump Screw/Bolt Connections**  
Courtesy of BMW OF NORTH AMERICA, INC.

Replace oil sump gasket.

Assemble engine.

## 14 HOUSING COVER

### 11 14 005 REPLACING FRONT CRANKSHAFT RADIAL SEAL (S85)

#### Special tools required:

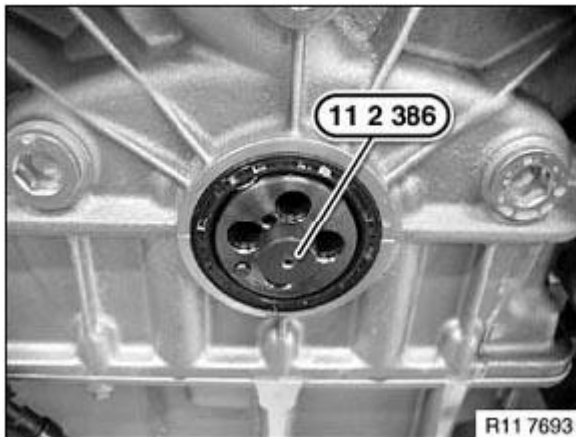
- 11 5 331
- 11 5 332
- 11 5 333
- 11 7 231
- 23 0 490

**IMPORTANT:** A radial shaft seal is damaged if it is supplied without a support bushing.  
Sealing lip of radial shaft seal is highly sensitive.  
Sealing lip must not be kinked.  
Do not touch the sealing lip with your fingers.  
The functional reliability of the radial shaft seal is no longer guaranteed and it must not be fitted.

#### *Necessary preliminary tasks:*

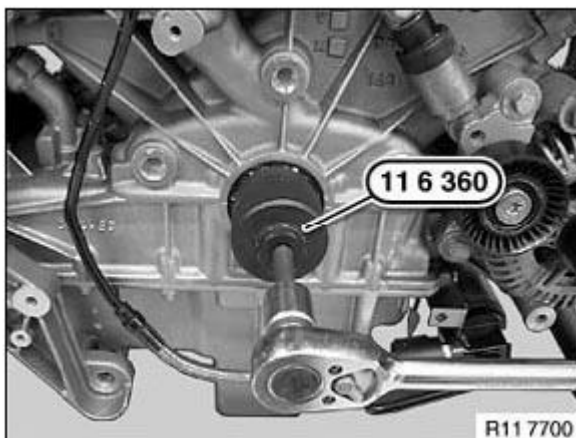
- Remove fan cowl with electric fan. See **17 11 035 REMOVING AND INSTALLING/REPLACING FAN COWL WITH ELECTRIC FAN (M5)** or **17 11 035 REMOVING AND INSTALLING/REPLACING FAN COWL WITH ELECTRIC FAN (M6)** .
- Remove **vibration damper**.
- Remove radiator. See **REMOVING RADIATOR COVER (M5)** or **17 11 000 REMOVING AND INSTALLING RADIATOR (M6)** .

Lay special tool 11 2 386 on crankshaft.



**Fig. 83: Identifying Special Tool (11 2 386) On Crankshaft**  
 Courtesy of BMW OF NORTH AMERICA, INC.

Screw special tool 11 6 360 to 80 Nm into radial shaft seal. Release radial seal from housing. Repeat the operation several times if necessary.

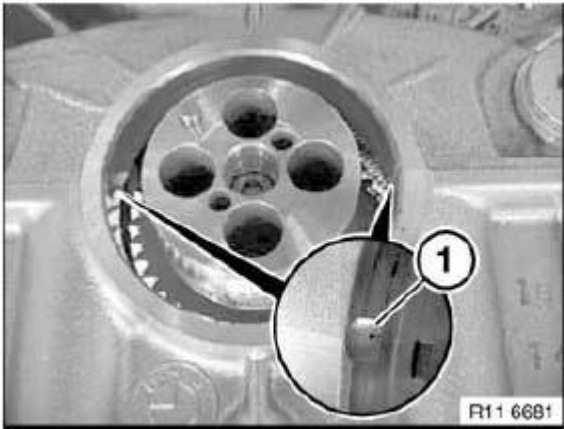


**Fig. 84: Screwing Special Tool (11 6 360) Into Radial Seal**  
 Courtesy of BMW OF NORTH AMERICA, INC.

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

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

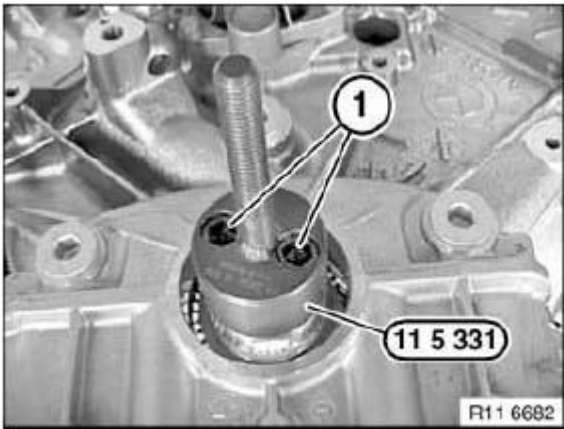
Apply Drei Bond 2.1 sealant to sealant outlet (1) on left and right.



**Fig. 85: Identifying Sealant Outlet**  
Courtesy of BMW OF NORTH AMERICA, INC.

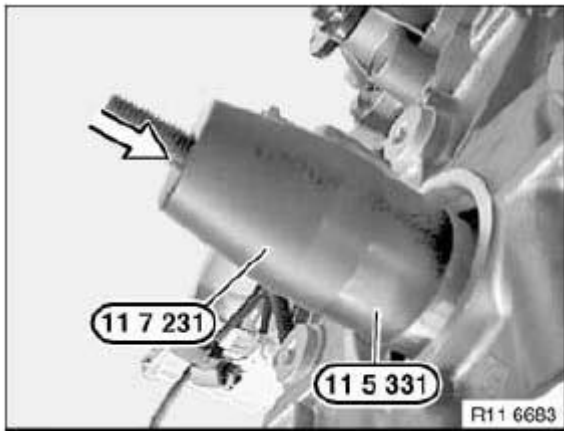
Secure special tool 11 5 331 with screws (1).

**IMPORTANT:** Pay attention to dowel pin.



**Fig. 86: Identifying Special Tool 11 5 331**  
Courtesy of BMW OF NORTH AMERICA, INC.

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



**Fig. 87: Pushing Special Tool 11 7 231 Onto Special Tool 11 5 331**  
Courtesy of BMW OF NORTH AMERICA, INC.

*Installation:*

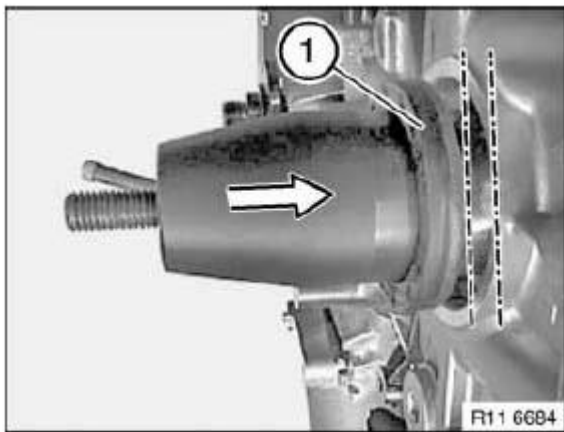
Remove support ring from radial shaft seal.

**IMPORTANT: Sealing lip of radial shaft seal is highly sensitive.  
Sealing lip must not be kinked.  
Do not touch the sealing lip with your fingers.**

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

Position radial shaft seal approx. 5 mm before crankcase.

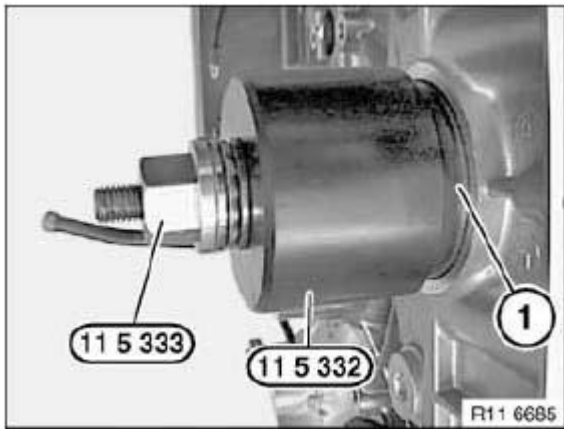
Remove special tool 11 7 231.



**Fig. 88: Pushing Radial Shaft Seal**  
Courtesy of BMW OF NORTH AMERICA, INC.

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





**Fig. 89: Identifying Radial Shaft Seal, Special Tools 11 5 332 And 11 5 333**  
 Courtesy of BMW OF NORTH AMERICA, INC.

Assemble engine.

Setting time of radial shaft seal approx. 1 hour.

Correct engine oil level if necessary.

#### **11 14 151 REPLACING CRANKSHAFT RADIAL SEAL (S85)**

##### **Special tools required:**

- 11 5 311
- 11 5 312
- 11 5 313
- 23 0 490

**IMPORTANT:** A radial shaft seal is damaged if it is supplied without a support bushing. The sealing lip of the radial shaft seal is highly sensitive and must not be kinked.  
 Do not touch the sealing lip with your fingers.  
 The functional reliability of the radial shaft seal is no longer guaranteed and it must not be fitted.

##### *Necessary preliminary tasks:*

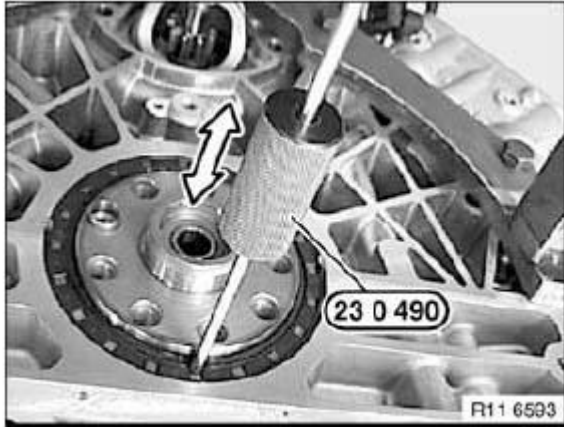
- Remove transmission. See **REMOVING AND INSTALLING TRANSMISSION (M5)** or **REMOVING AND INSTALLING TRANSMISSION (M6)** .
- Remove clutch. See **REMOVING AND INSTALLING/REPLACING CLUTCH (M5)** or **REMOVING AND INSTALLING/REPLACING CLUTCH (M6)** .
- Remove **flywheel**.

Drill a 3 mm hole into radial shaft seal.

**IMPORTANT: Risk of damage! Remove drilling chips immediately**

Screw in special tool 23 0 490.

Drive out radial shaft seal with impact weight.

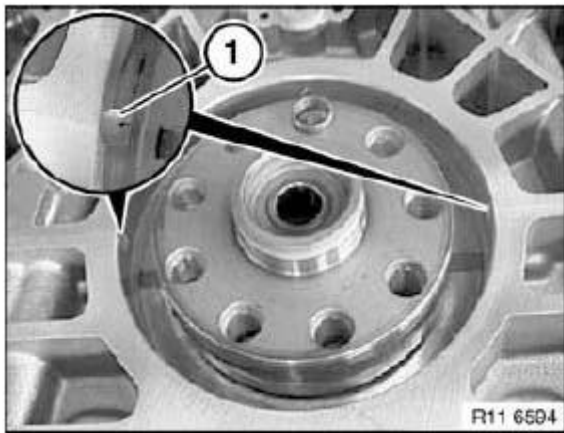


**Fig. 90: Screwing In Special Tool 23 0 490**  
Courtesy of BMW OF NORTH AMERICA, INC.

**IMPORTANT: Risk of damage! Remove drilling chips immediately**

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

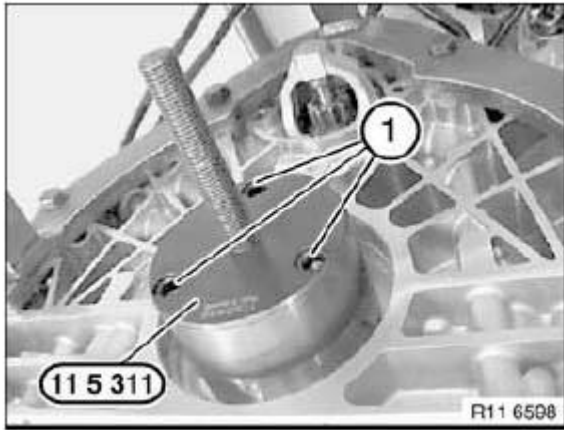
Apply Drei Bond sealant 1209 to sealant outlet (1) on left and right.



**Fig. 91: Identifying Sealant Outlet**  
Courtesy of BMW OF NORTH AMERICA, INC.

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

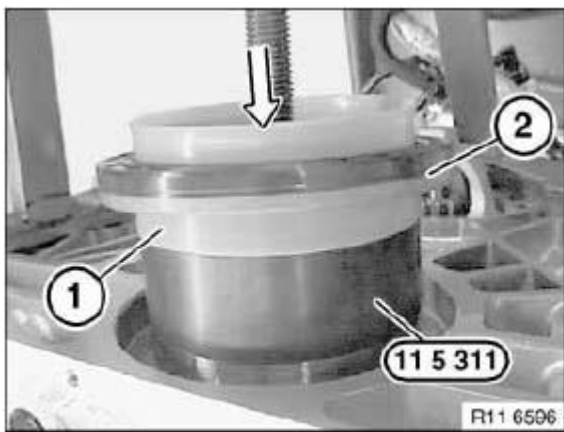
Mount special tool 11 5 311 with bolts (1).



**Fig. 92: Identifying Special Tool 11 5 311**  
Courtesy of BMW OF NORTH AMERICA, INC.

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

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

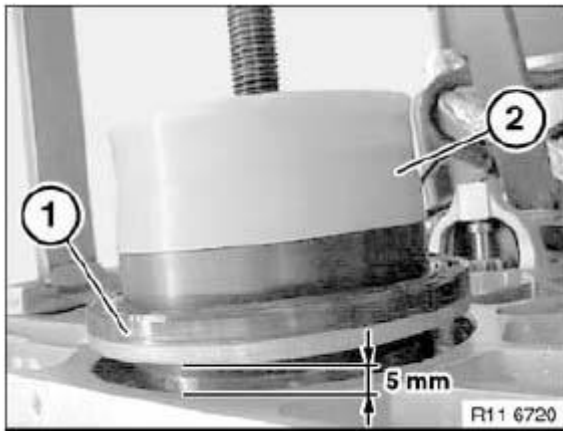


**Fig. 93: Pushing Radial Shaft Seal Over Support Ring Onto Special Tool 11 5 311**  
Courtesy of BMW OF NORTH AMERICA, INC.

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

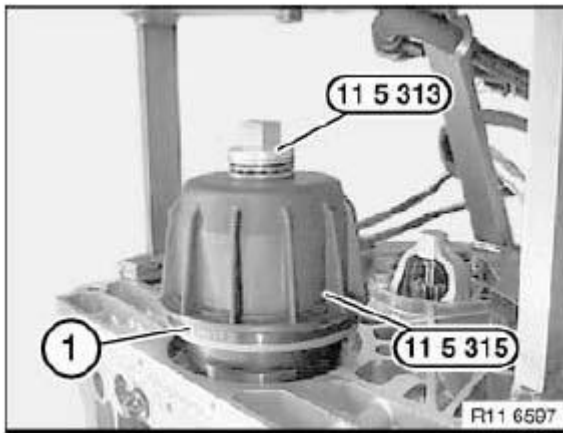
Remove support ring (2).

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



**Fig. 94: Identifying Radial Shaft Seal Position And Support Ring**  
Courtesy of BMW OF NORTH AMERICA, INC.

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



**Fig. 95: Identifying Radial Shaft Seal, Special Tools 11 5 312 And 11 5 313**  
Courtesy of BMW OF NORTH AMERICA, INC.

Assemble engine.

Settling time of radial shaft seal approx. 1 hour.

Correct engine oil level if necessary.

## 21 CRANKSHAFT WITH BEARING

### 11 21 500 REPLACING CRANKSHAFT (S85)

Special tools required:

- 00 9120

- 00 9130
- 11 4 370
- 11 5 311
- 11 5 312
- 11 5 313
- 11 5 331
- 11 5 332
- 11 5 333
- 11 7 231
- 11 9 360

**IMPORTANT:** Unscrew all fit bolts first before releasing the crankshaft lower section.

**Altered settling behavior at the crankcase!**

**If the main bearing channel is opened after engine operation, all main bearing shells must be replaced with special repair bearing shells marked with an (R). There are two different groups of main bearing shells.**

*Necessary preliminary tasks:*

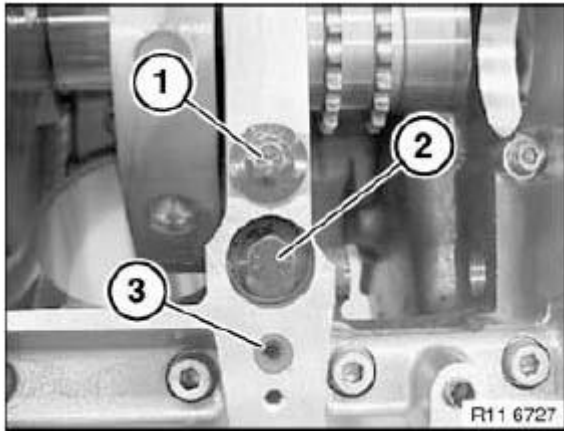
- Remove engine.
- Mount engine on assembly stand.
- Remove flywheel.
- Remove oil pan.
- Remove engine oil pump.
- Remove VANOS high-pressure pump.
- Remove left cylinder head or right cylinder head.
- Remove all pistons.
- Remove vibration damper.
- Remove both timing chains.

**IMPORTANT:** Unscrew all M8 fit bolts (2) first before releasing the crankshaft lower section - risk of damage!

Release all bearing block bolts (1) from inside outwards.

*Installation:*

Replace fine-mesh strainer (3).



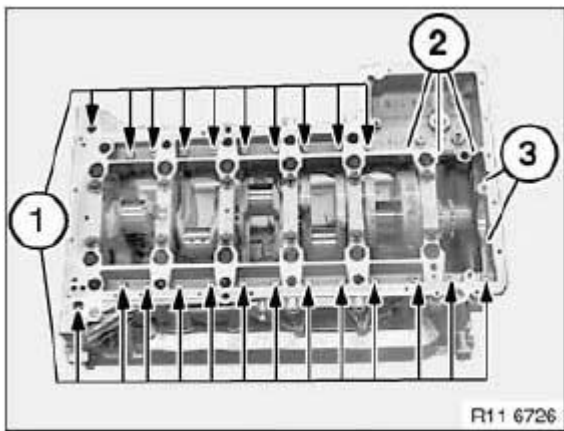
**Fig. 96: Identifying Bearing Block Bolts And Fine-Mesh Strainer**  
Courtesy of BMW OF NORTH AMERICA, INC.

Release screws (3).

Unfasten screws (2).

Bolts (1) from inside outwards.

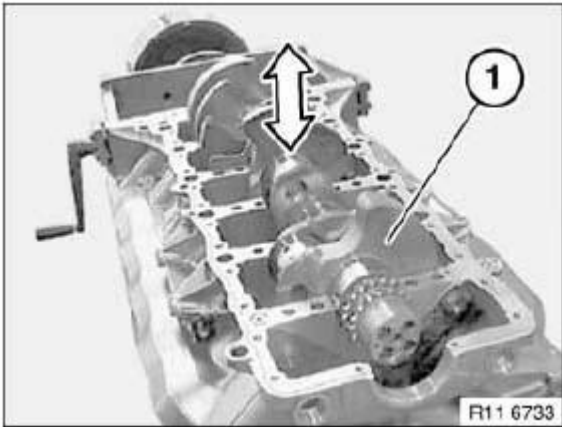
Lift out bedplate.



**Fig. 97: Identifying Screws And Bolts**  
Courtesy of BMW OF NORTH AMERICA, INC.

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

**NOTE:**      **Weight of crankshaft approx. 22 kg.**



**Fig. 98: Levering Out Crankshaft**

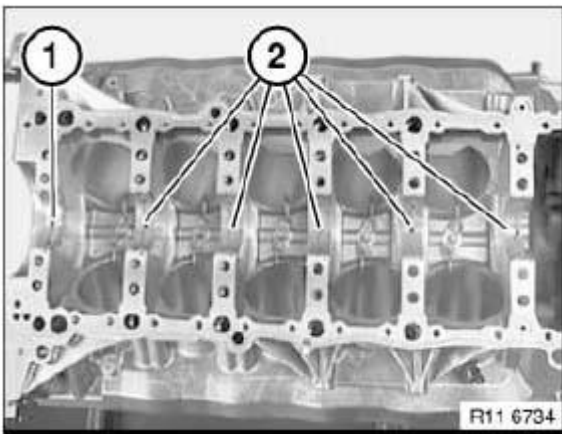
Courtesy of BMW OF NORTH AMERICA, INC.

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

Replace all bearing shells (1 and 2).

*Installation:*

Replace main bearing shells.



**Fig. 99: Identifying Bearing Shells**

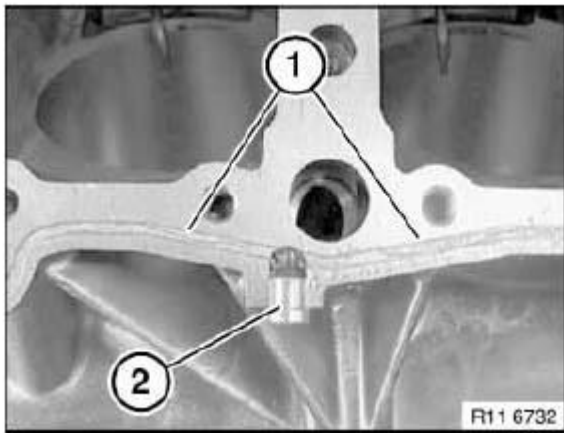
Courtesy of BMW OF NORTH AMERICA, INC.

Remove sealing compound from joint (1).

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

*Installation:*

Replace nozzles (2).



**Fig. 100: Identifying Nozzles**

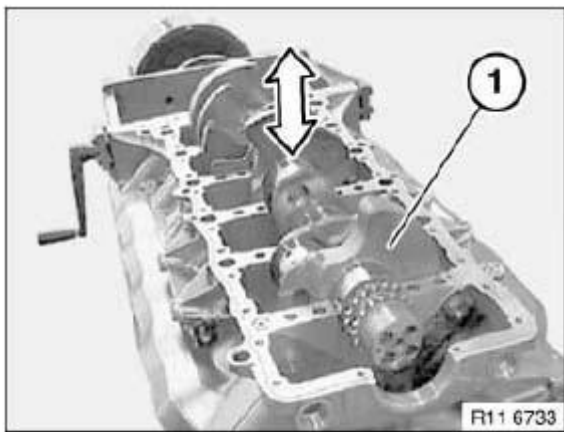
Courtesy of BMW OF NORTH AMERICA, INC.

*Installation:*

Apply a light coating of engine oil to bearing shells.

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

**NOTE:** Weight of crankshaft approx. 22 kg.



**Fig. 101: Laying Crankshaft Into Crankcase**

Courtesy of BMW OF NORTH AMERICA, INC.

**IMPORTANT:** Adhere without fail to the specified sequence of bedplate bolt connections.  
Risk of damage to crankshaft.  
Leaks at bedplate/crankcase.

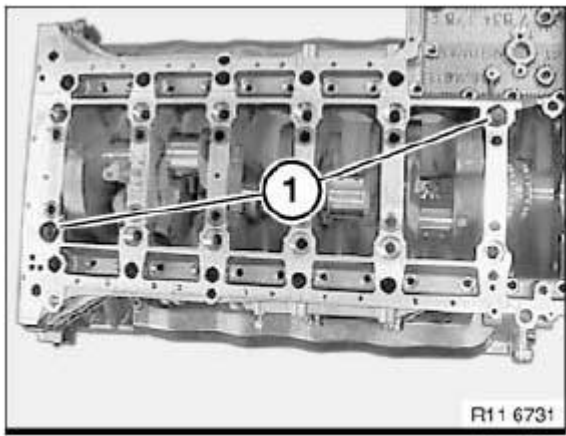


**NOTE:** There are no more dowel sleeves in the crankcase.  
Position bedplate on crankcase.

**IMPORTANT:** Do not use new bolts.  
If new bolts are used, observe special tightening/torque specifications.

Position lower section diagonally on bearing blocks (1 and 6) using two fit bolts (1).

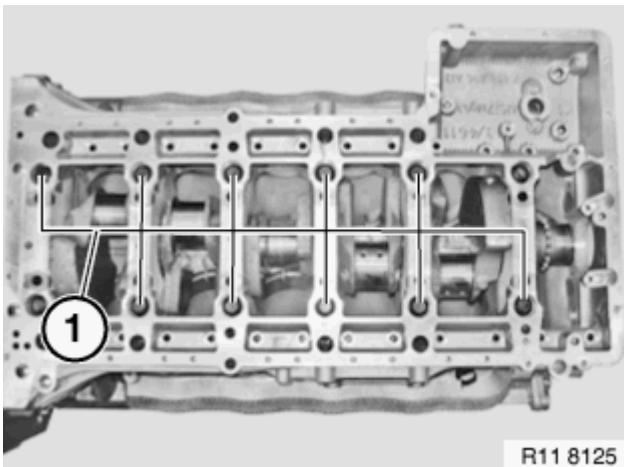
Join fit bolts (1) to 8 Nm.



**Fig. 102: Identifying Fit Bolts**

Courtesy of BMW OF NORTH AMERICA, INC.

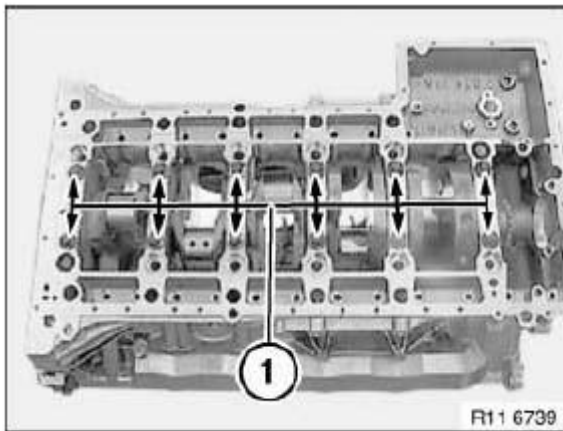
Insert remaining 10 fit bolts (1) and join to 8 Nm.



**Fig. 103: Inserting Remaining 10 Fit Bolts**

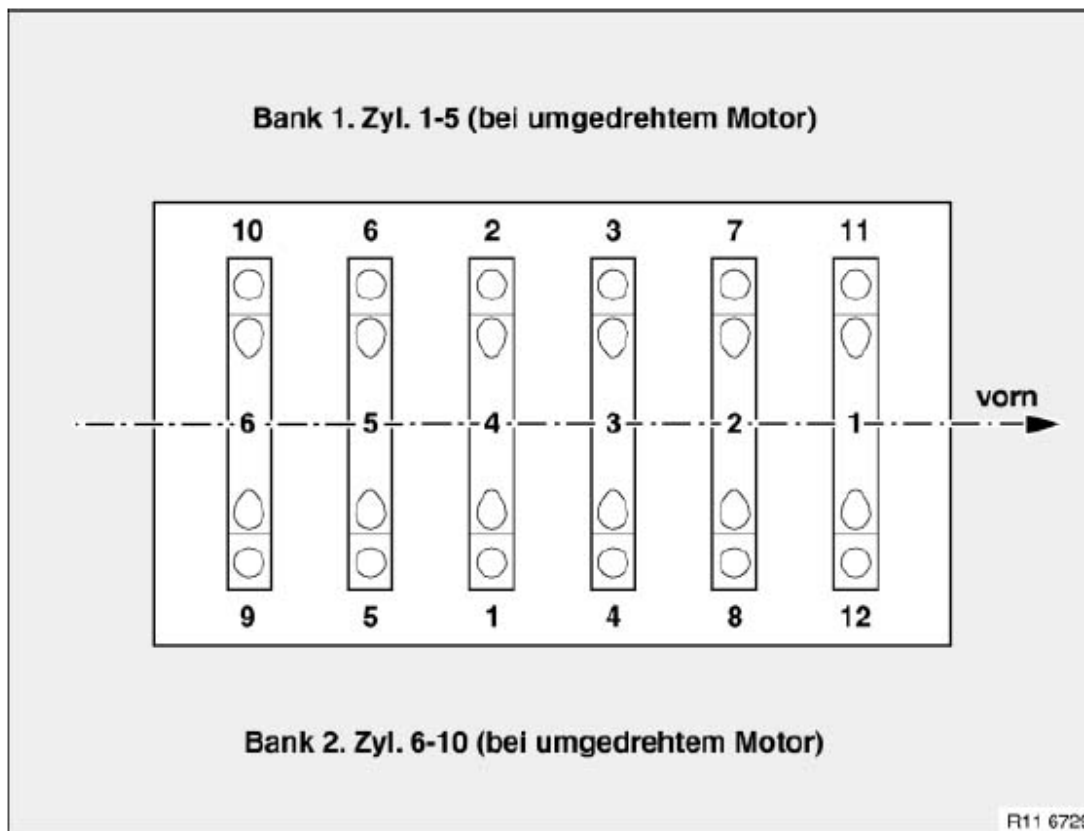
Courtesy of BMW OF NORTH AMERICA, INC.

Insert all M11 bolts (1).



**Fig. 104: Identifying M11 Bolts**

Courtesy of BMW OF NORTH AMERICA, INC.



**Fig. 105: Identifying Tightening Sequence Of M11 And M8 Fit Bolts**

Courtesy of BMW OF NORTH AMERICA, INC.

Tightening sequence of M11 and fit bolts

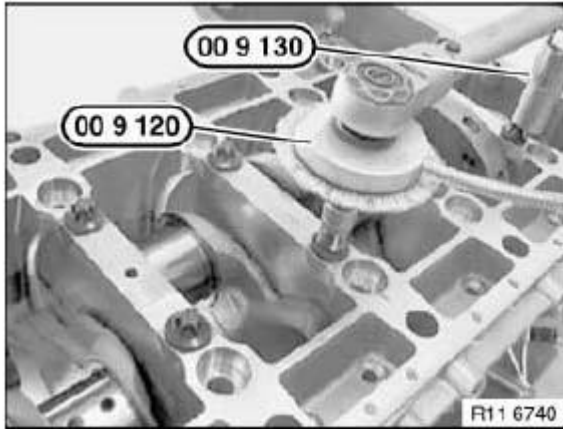
Bearing blocks (1 to 6).

Tightening sequence (1 to 12).

Tighten M11 bolts with special tools 00 9 120 and 00 9 130.

Tightening torque 11 11 1AZ. See **ENGINE BLOCK**.

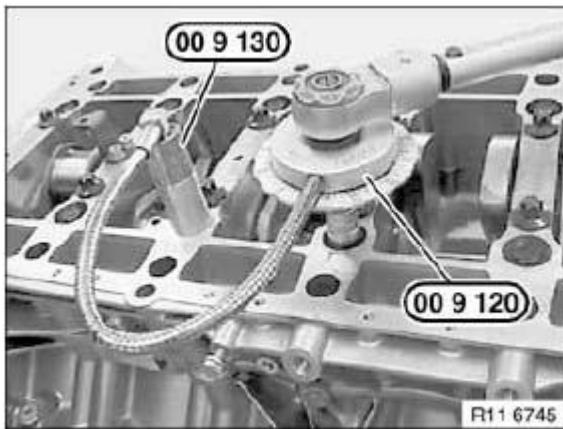
Observe tightening/torque sequence.



**Fig. 106: Identifying Special Tools 00 9 120 And 00 9 130**  
Courtesy of BMW OF NORTH AMERICA, INC.

Tighten fit bolts with special tools 00 9 120 and 00 9 130.

Tightening torque 11 11 2AZ. See **ENGINE BLOCK**.



**Fig. 107: Identifying Special Tools 00 9 120 And 00 9 130**  
Courtesy of BMW OF NORTH AMERICA, INC.

Insert screws (1).

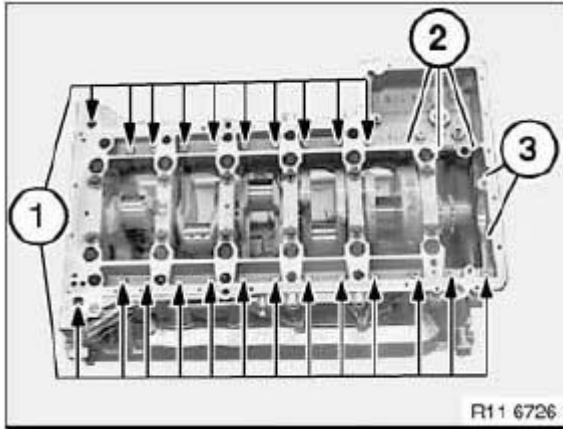
Tightening torque: 11 11 3AZ. See **ENGINE BLOCK**

Insert screws (2).

Tightening torque: 11 11 4AZ. See ENGINE BLOCK

Insert screws (3).

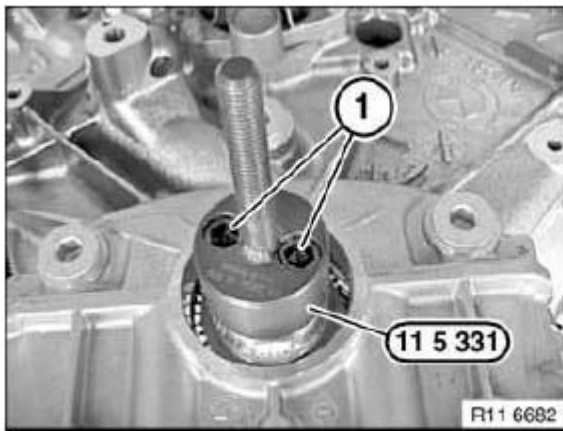
Tightening torque 11 11 5AZ. See ENGINE BLOCK .



**Fig. 108: Identifying Screws**

Courtesy of BMW OF NORTH AMERICA, INC.

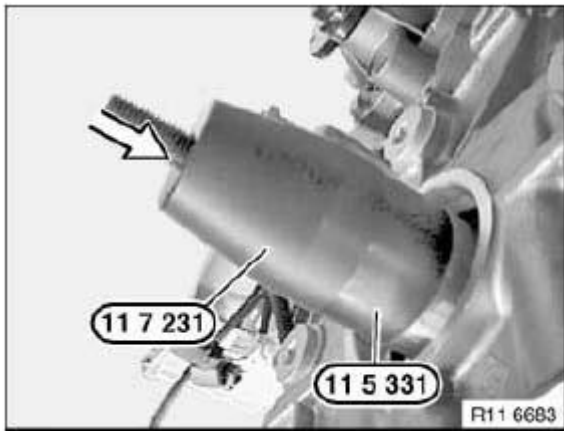
Secure special tool 11 5 331 with bolts (1). **Important!** Pay attention to dowel pin.



**Fig. 109: Identifying Special Tool 11 5 331**

Courtesy of BMW OF NORTH AMERICA, INC.

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



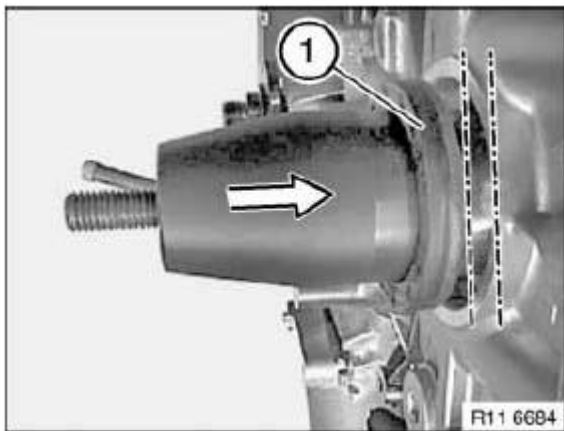
**Fig. 110: Pushing Special Tool 11 7 231 Onto Special Tool 11 5 331**  
Courtesy of BMW OF NORTH AMERICA, INC.

**Installation:** Remove support ring from radial shaft seal.

**Important!** Sealing lip of radial shaft seal is highly sensitive. Sealing lip must not be kinked. Do not touch the sealing lip with your fingers.

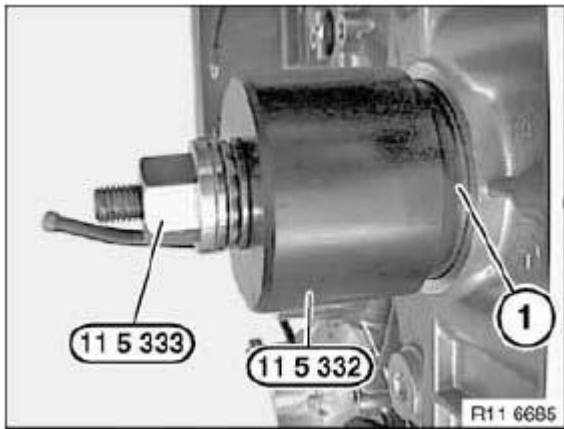
Push radial shaft seal (1) uniformly by way of fitting aid 11 7 231 onto special tool 11 5 331.

Position radial shaft seal approx. 5 mm before crankcase. Remove special tool 11 7 231.



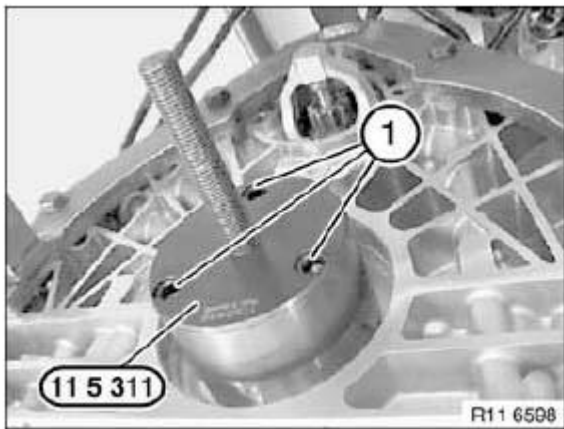
**Fig. 111: Pushing Radial Shaft Seal**  
Courtesy of BMW OF NORTH AMERICA, INC.

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



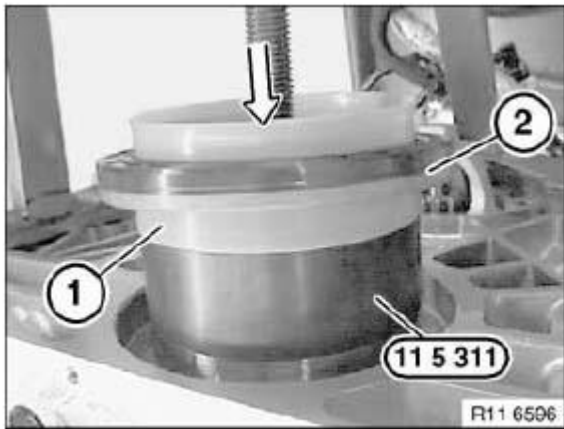
**Fig. 112: Identifying Radial Shaft Seal, Special Tools 11 5 332 And 11 5 333**  
 Courtesy of BMW OF NORTH AMERICA, INC.

**Important!** Pay attention to fitting sleeve. Special tool 11 5 311 must rest flat on crankshaft (pay attention to fitting sleeve). Install special tool 11 5 311 with bolts (1).



**Fig. 113: Identifying Special Tool 11 5 311**  
 Courtesy of BMW OF NORTH AMERICA, INC.

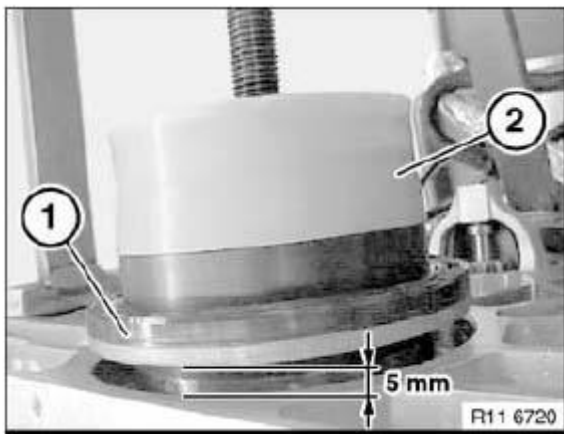
Position support ring (1) with radial shaft seal (2) on special tool 11 5 311. Push radial shaft seal (2) uniformly in direction of arrow over support ring onto special tool 11 5 311.



**Fig. 114: Pushing Radial Shaft Seal Over Support Ring Onto Special Tool 11 5 311**  
 Courtesy of BMW OF NORTH AMERICA, INC.

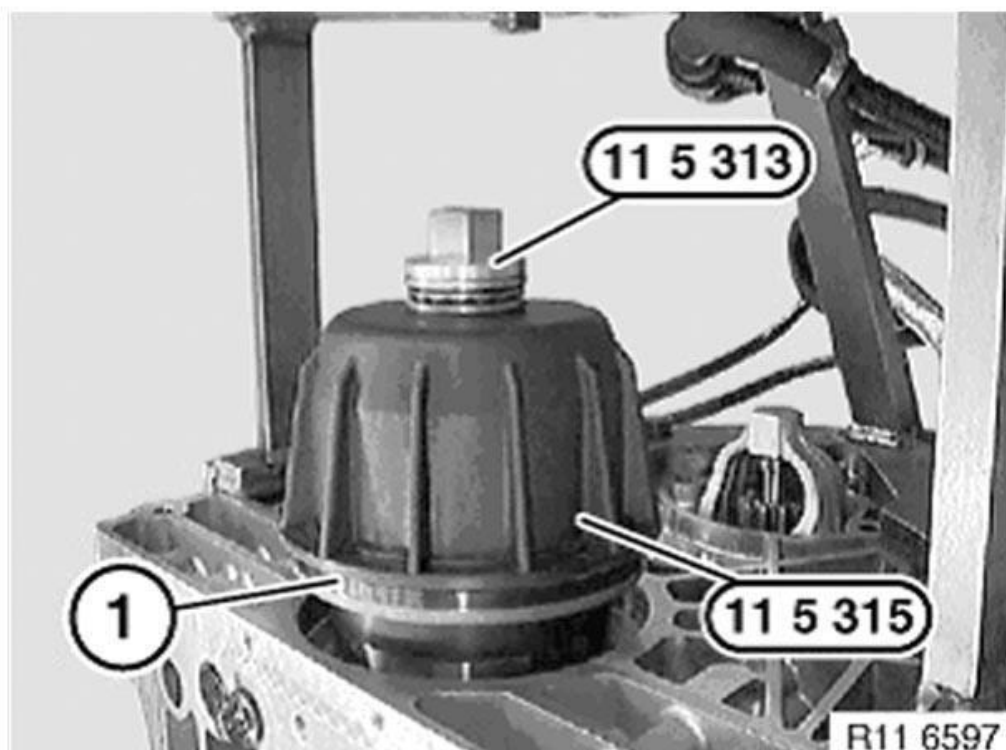
Position radial shaft seal (1) approx. 5 mm before crankcase. Remove support ring (2).

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



**Fig. 115: Identifying Radial Shaft Seal Position And Support Ring**  
 Courtesy of BMW OF NORTH AMERICA, INC.

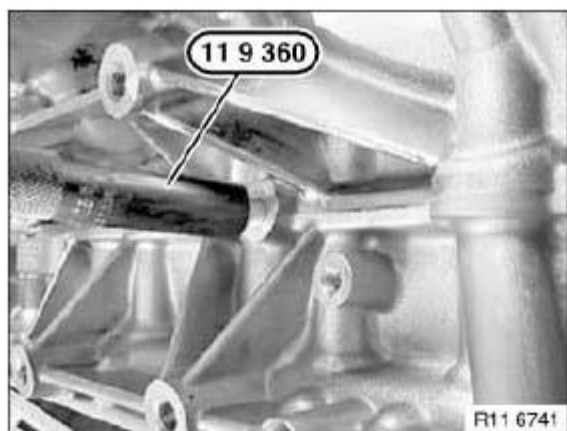
Press in radial shaft seal (1) with special tools 11 5 312 and 11 5 313.



**Fig. 116: Pressing/Removing Radial Shaft Seal**  
Courtesy of BMW OF NORTH AMERICA, INC.

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

**Installation:** Always replace injector nozzles.

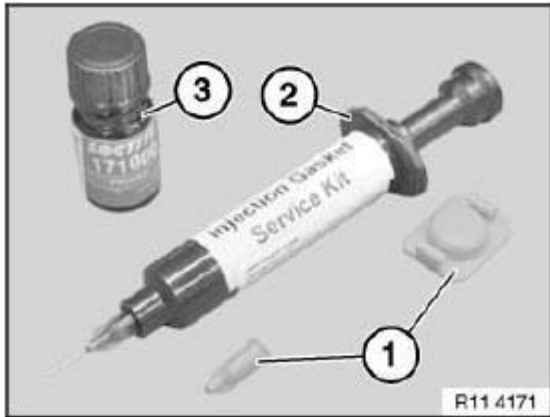




**Fig. 117: Identifying Special Tool 119 360**

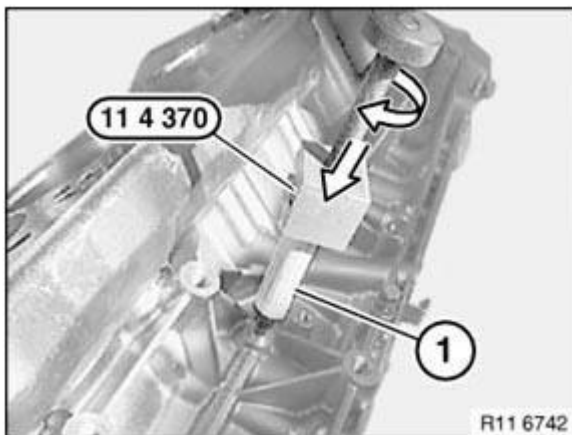
Courtesy of BMW OF NORTH AMERICA, INC.

**Installation:** Use primer 1.5 and liquid sealing compound 1.6. Prepare liquid sealing compound (2) in special tool 11 4 370. Screw on nozzle (1) for injecting liquid sealing compound.

**Fig. 118: Identifying Injector, Sealing Compound And Bottle**

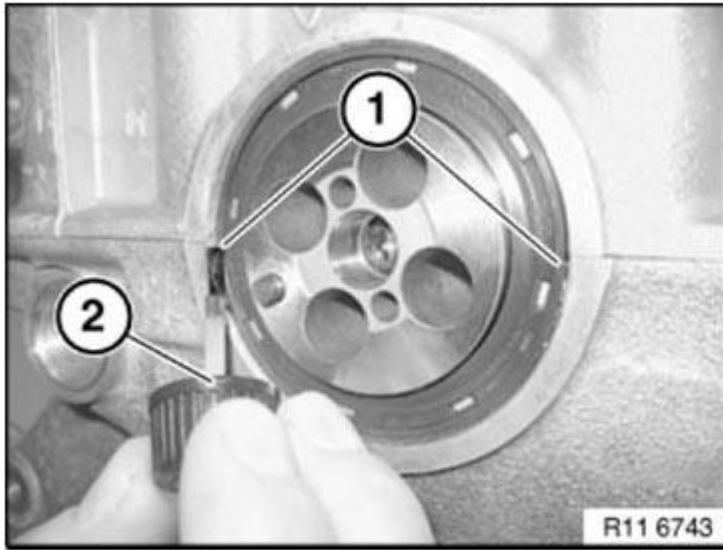
Courtesy of BMW OF NORTH AMERICA, INC.

Press sealing compound cartridge (1) in direction of arrow onto nozzle at 90°. Slowly and evenly insert sealing compound (1) with special tool 11 4 370 in direction of arrow.

**Fig. 119: Pressing Sealing Compound Cartridge Onto Nozzle**

Courtesy of BMW OF NORTH AMERICA, INC.

Stop (seal off) escaping liquid sealing compound with primer (2) 1.5 at outlet bore (1). The procedure is identical as on the rear radial shaft seal.



**Fig. 120: Applying Liquid Sealing Compound At Outlet Bore**  
 Courtesy of BMW OF NORTH AMERICA, INC.

Assemble engine.

#### 11 21 531 REPLACING ALL CRANKSHAFT MAIN BEARINGS (S85)

Special tools required:

- 00 2 590

#### **IMPORTANT:** 1. Repair crankcase used / crankshaft used

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

Altered settling behavior at the crankcase.

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

#### 2. Repair crankcase used / crankshaft new

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

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

#### 3. Repair crankcase new / crankshaft used

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

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

#### 4. Repair crankcase new / crankshaft new

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

The bearing shells provided with the crankcase must be used.

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

*Necessary preliminary tasks:*

- **Engine** removed.
- Remove **crankshaft**.

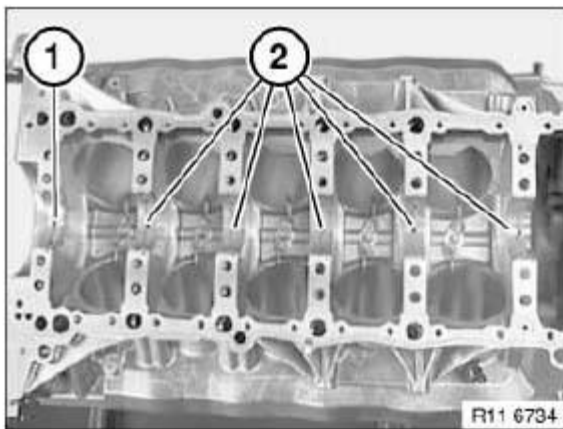
*Installation:*

Bearing shell (1) is a guide bearing.

Remove bearing shells (1) and (2).

Observe bearing classification.

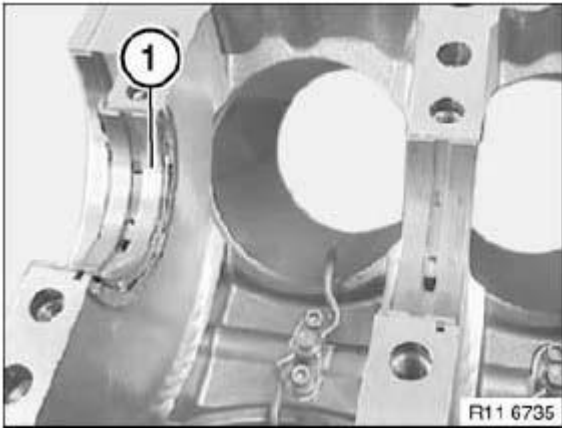
Determine bearing play with special tool 00 2 590.



**Fig. 121: Identifying Bearing Shells**

Courtesy of BMW OF NORTH AMERICA, INC.

Lay step bearing (1) on 6th bearing block.

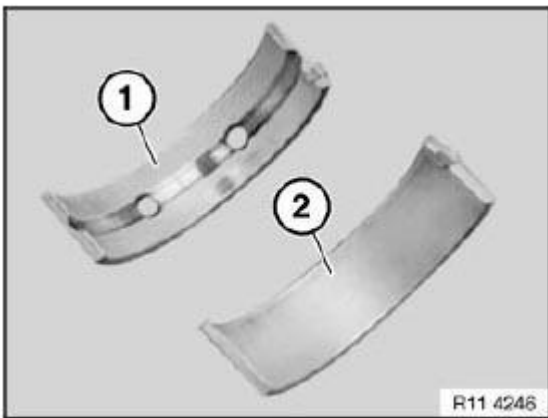
**Fig. 122: Identifying Step Bearing On 6th Bearing Block**

Courtesy of BMW OF NORTH AMERICA, INC.

*Installation:*

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

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

**Fig. 123: Identifying Bearing Shell**

Courtesy of BMW OF NORTH AMERICA, INC.

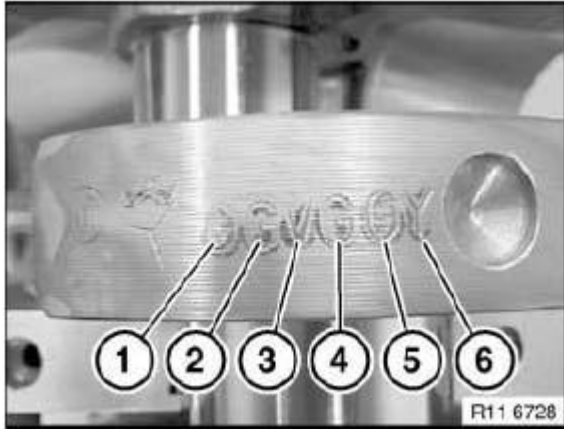
Bearing classification on bedplate bearing block.

Observe color allocation on crankshaft (1 to 6).

V= Violet.

G = Green.

Y= Yellow.



**Fig. 124: Identifying Color Allocation On Crankshaft (Bedplate Bearing Block)**  
Courtesy of BMW OF NORTH AMERICA, INC.

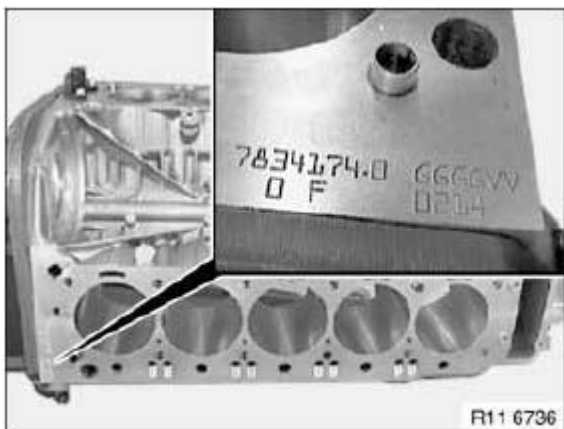
Bearing classification on crankcase bearing block.

Observe color allocation in crankcase (1 to 6).

V= Violet.

G = Green.

Y= Yellow.



**Fig. 125: Identifying Color Allocation On Crankshaft (Crankcase Bearing Block)**  
Courtesy of BMW OF NORTH AMERICA, INC.

Lay plastic thread (Plastigage) on crankshaft.

Fit and bolt down bedplate.

**NOTE:** Do not twist crankshaft.

Remove bedplate.

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

Crankshaft bearing clearance radial.



**Fig. 126: Identifying Plastic Thread (Plastigage) On Crankshaft**  
Courtesy of BMW OF NORTH AMERICA, INC.

Assemble engine.

## 11 21 571 REPLACING GROOVED BALL BEARINGS IN CRANKSHAFT (S85)

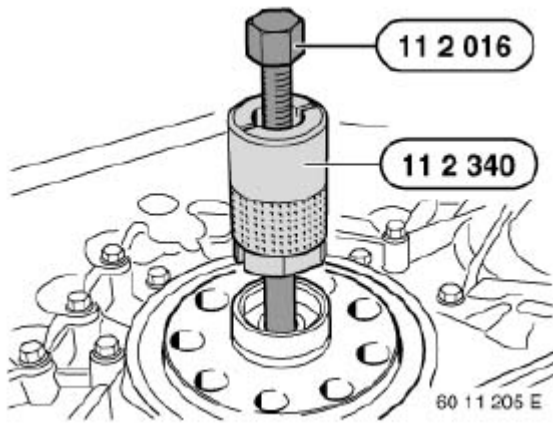
**Special tools required:**

- 00 5 500
- 11 2 016
- 11 2 340
- 11 2 350

*Necessary preliminary tasks:*

- Remove transmission. See **REMOVING AND INSTALLING TRANSMISSION (M5)** or **REMOVING AND INSTALLING TRANSMISSION (M6)** .
- Remove clutch. See **REMOVING AND INSTALLING/REPLACING CLUTCH (M5)** or **REMOVING AND INSTALLING/REPLACING CLUTCH (M6)** .

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

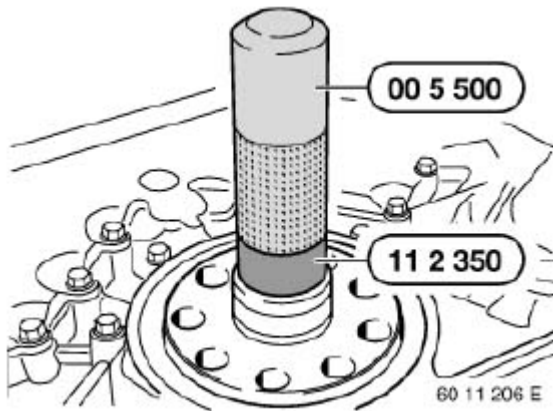


**Fig. 127: Identifying Special Tool 11 2 340 And 11 2 016**  
 Courtesy of BMW OF NORTH AMERICA, INC.

*Installation:*

Replace guide bearing.

Drive in guide bearing as far as it will go with special tools 11 2 350 and 00 5 500.



**Fig. 128: Identifying Special Tools 11 2 350 And 00 5 500**  
 Courtesy of BMW OF NORTH AMERICA, INC.

Assemble engine.

**11 22 500 REMOVING AND INSTALLING/REPLACING FLYWHEEL (S85 6-SPEED MANUAL GEARBOX)**

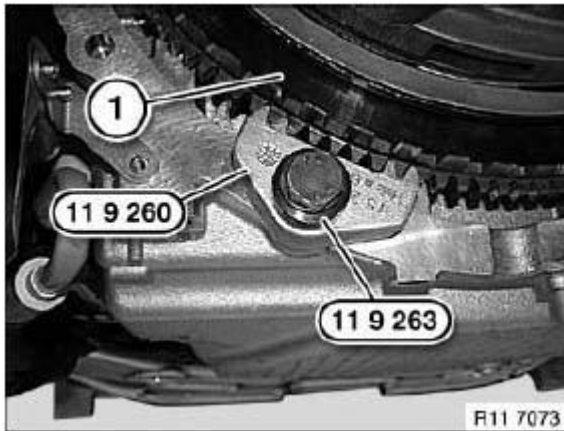
**Special tools required:**

- 11 4 180
- 11 9 260
- 11 9 263

*Necessary preliminary tasks:*

- Remove transmission. See **REMOVING AND INSTALLING TRANSMISSION (M5)** or **REMOVING AND INSTALLING TRANSMISSION (M6)** .
- Remove clutch. See **REMOVING AND INSTALLING/REPLACING CLUTCH (M5)** or **REMOVING AND INSTALLING/REPLACING CLUTCH (M6)** .

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



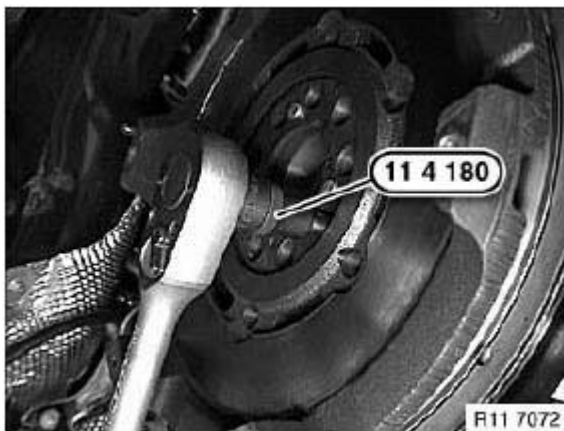
**Fig. 129: Identifying Special Tools 11 9 263, 11 9 260 And Flywheel**  
Courtesy of BMW OF NORTH AMERICA, INC.

*Installation:*

Fit new flywheel screws.

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

Release flywheel screws with special tool 11 4 180.



**Fig. 130: Identifying Special Tool 11 4 180**



Courtesy of BMW OF NORTH AMERICA, INC.

Assemble engine.

## 11 22 500 REMOVING AND INSTALLING/REPLACING FLYWHEEL (S85)

### Special tools required:

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

### Necessary preliminary tasks:

- Remove transmission. See REMOVING AND INSTALLING TRANSMISSION (M5) or REMOVING AND INSTALLING TRANSMISSION (M6) .
- Remove clutch. See REMOVING AND INSTALLING/REPLACING CLUTCH (M5) or REMOVING AND INSTALLING/REPLACING CLUTCH (M6) .

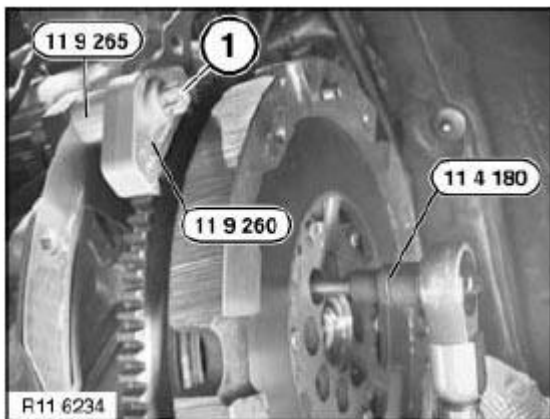
Secure flywheel with special tools 11 9 265 and 11 9 260.

Release flywheel screws with special tool 11 4 180.

### Installation:

Fit new flywheel screws.

Tightening torque 11 22 1AZ. See ENGINE - TIGHTENING TORQUES .



**Fig. 131: Identifying Special Tools 11 9 265, 11 4 180 And 11 9 260**  
Courtesy of BMW OF NORTH AMERICA, INC.

Assemble engine.

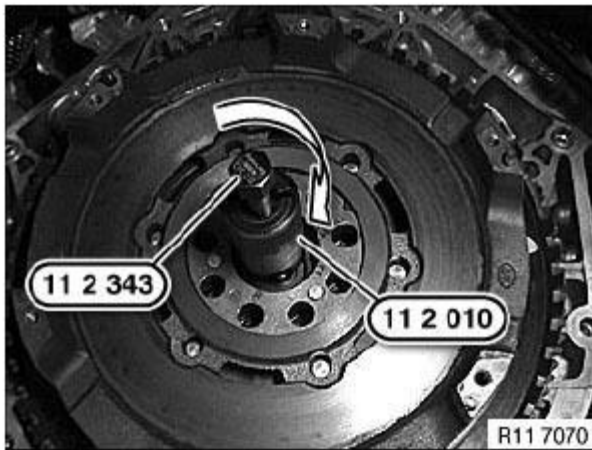
**11 22 513 REPLACING ROLLER BEARING FOR DUAL-MASS FLYWHEEL****Special tools required:**

- 00 5 500
- 11 2 010
- 11 2 343
- 11 2 350

**NOTE:** Flywheel removed!

Position special tool 11 2 010 in roller bearing.

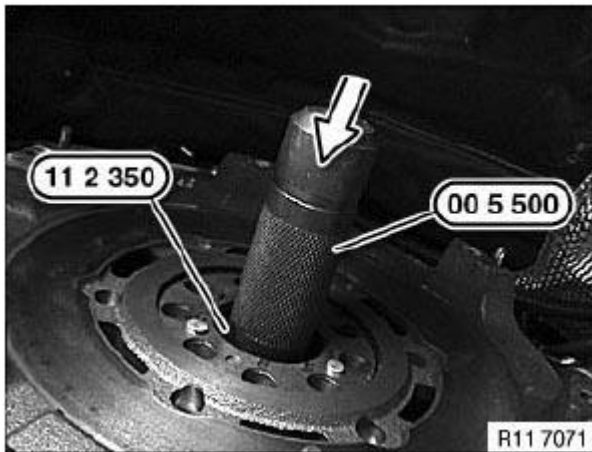
Twist out roller bearing with special tool 11 2 343.



**Fig. 132: Twisting Out Roller Bearing With Special Tool 11 2 343**  
Courtesy of BMW OF NORTH AMERICA, INC.

Assemble special tools 11 2 350 and 00 5 500.

Drive in roller bearing with special tools 11 2 350 and 00 5 500 in direction of arrow as far as it will go.



**Fig. 133: Driving In Roller Bearing With Special Tools 11 2 350 And 00 5 500**  
Courtesy of BMW OF NORTH AMERICA, INC.

Assemble engine.

## 23 VIBRATION DAMPER

### 11 23 010 REMOVING AND INSTALLING / REPLACING VIBRATION DAMPER (S85)

#### Special tools required:

- 00 9 120
- 11 0 280
- 11 9 260
- 11 9 263

#### Necessary preliminary tasks:

- Remove fan cowl with electric fan. See **17 11 035 REMOVING AND INSTALLING/REPLACING FAN COWL WITH ELECTRIC FAN (M5)** or **17 11 035 REMOVING AND INSTALLING/REPLACING FAN COWL WITH ELECTRIC FAN (S85)** .
- Remove **A/C compressor drive belt**.
- Remove **alternator drive belt**.

Release screw (1).

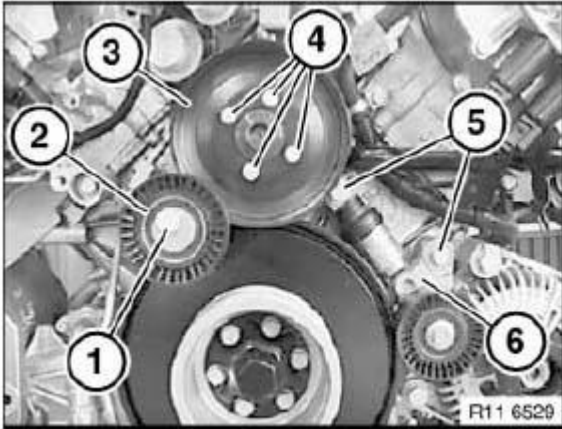
Remove idler pulley (2).

Release screws (4).

Remove belt pulley (3).

Release screws (5).

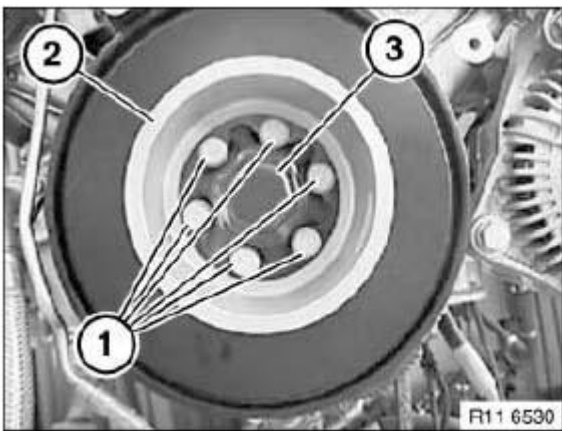
Remove belt tensioner (6).



**Fig. 134: Identifying Idler Pulley, Belt Pulley And Belt Tensioner**  
Courtesy of BMW OF NORTH AMERICA, INC.

Release screws (1).

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

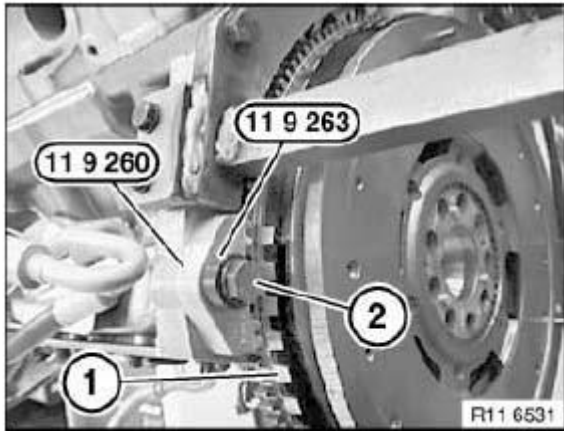


**Fig. 135: Identifying Cover And Belt Pulley**  
Courtesy of BMW OF NORTH AMERICA, INC.

**NOTE:** Engine or transmission removed.

Secure special tool 11 9 260 to flywheel (1).

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

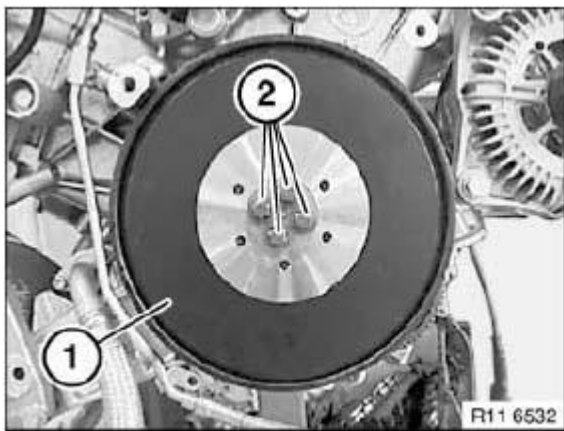


**Fig. 136: Identifying Special Tool 11 9 260, 11 9 263 And Flywheel**  
Courtesy of BMW OF NORTH AMERICA, INC.

Release screws (2).

Remove vibration damper (1).

Tightening torque 11 23 1AZ. See **ENGINE - TIGHTENING TORQUES** .



**Fig. 137: Identifying Vibration Damper**  
Courtesy of BMW OF NORTH AMERICA, INC.

**NOTE:** Engine or transmission installed.

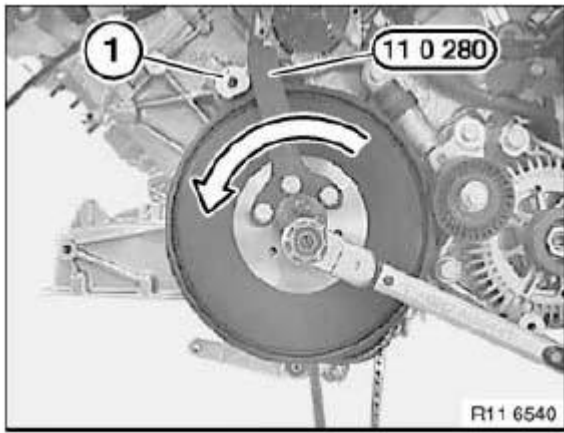
Attach special tool 11 0 280 to vibration damper.

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

Release all stress bolts in direction of arrow.

*Installation:*

Replace stress bolts.



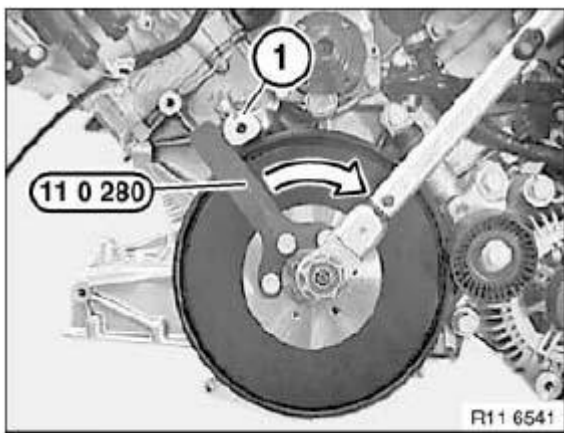
**Fig. 138: Releasing Stress Bolts**

Courtesy of BMW OF NORTH AMERICA, INC.

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

Tighten stress bolts with special tool 00 9 120.

Tightening torque 11 23 1AZ. See **ENGINE - TIGHTENING TORQUES**.



**Fig. 139: Tightening Stress Bolts**

Courtesy of BMW OF NORTH AMERICA, INC.

Assemble engine.

## 24 CONNECTING ROD WITH BEARINGS

### 11 24 571 REPLACING ALL CONNECTING ROD BEARINGS (S85)

Special tools required:

- 00 9 120

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

*Necessary preliminary tasks:*

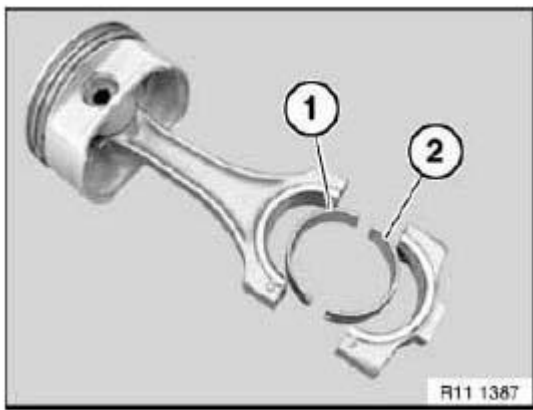
- Remove all pistons.

Install new conrod bearing shells.

*Installation:*

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

Install all pistons.



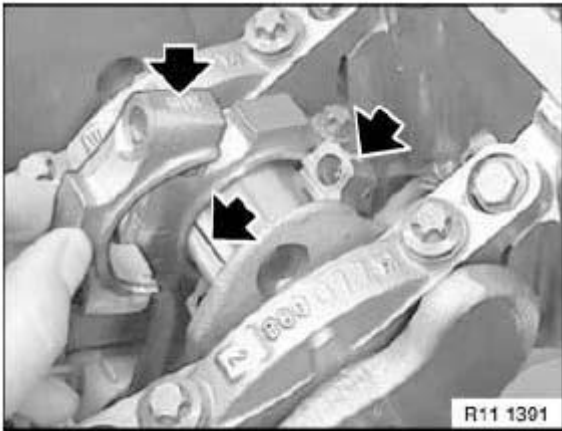
**Fig. 140: Identifying One Blue And One Red Bearing Shell**  
Courtesy of BMW OF NORTH AMERICA, INC.

**NOTE:** Check conrod bearing clearance.

Piston in BDC position.

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

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



**Fig. 141: Locating Bearing Caps**

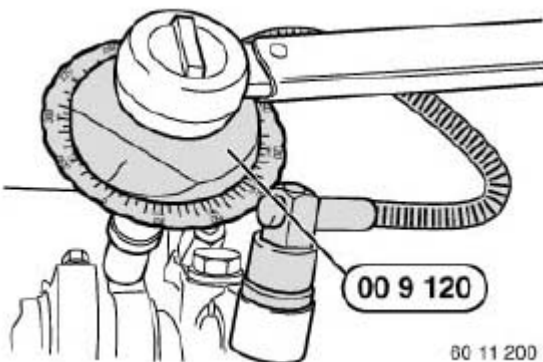
Courtesy of BMW OF NORTH AMERICA, INC.

**IMPORTANT: Do not distort conrods or crankshaft.**

Use the old conrod bearing bolts to check conrod clearance.

Tighten down conrod bolts with special tool 00 9 120.

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



**Fig. 142: Identifying Special Tool 00 9 120**

Courtesy of BMW OF NORTH AMERICA, INC.

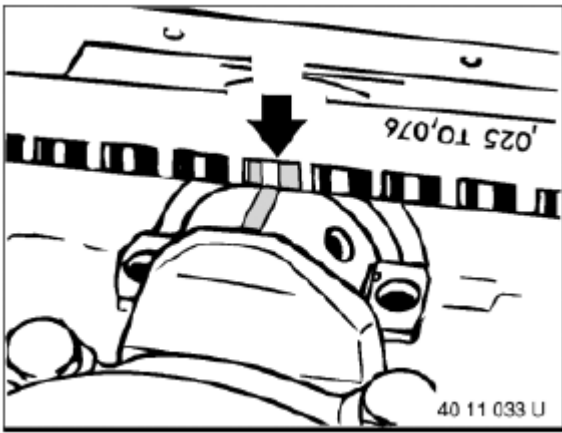
Remove conrod bearing cap and read off bearing clearance at width of pinched plastic thread on measuring scale.

Conrod bearing clearance: Refer to ENGINE - TECHNICAL DATA .

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



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



**Fig. 143: Identifying Plastic Thread (Plastigage)**  
Courtesy of BMW OF NORTH AMERICA, INC.

Assemble engine.

## 25 PISTON WITH RINGS AND PIN

### 11 25 530 REMOVING AND INSTALLING/REPLACING ALL PISTONS (S85)

Special tools required:

- 00 9 120
- 11 4 492
- 11 5 250
- 11 5 341
- 11 5 342
- 11 5 343
- 11 5 344
- 11 9 500
- 12 2 100

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

**IMPORTANT:** If pistons, conrods and bearing shells are reused, they must be reinstalled in the same places.  
Piston and piston pin are matched to each other and can only be replaced as a pair.  
Connecting rod and connecting rod bearing cap are cracked.

Identification is effected by means of identical pairing letters on the connecting rod big end.

Mixing up the components will result in engine damage.

Setting of special tool 115 343 must not be altered.

*Necessary preliminary tasks:*

- Remove engine.
- Mount engine on assembly stand.
- Remove intake air manifold.
- Remove left cylinder head or right cylinder head.
- Remove engine oil sump.
- Remove oil pump.
- Remove VANOS high-pressure pump.

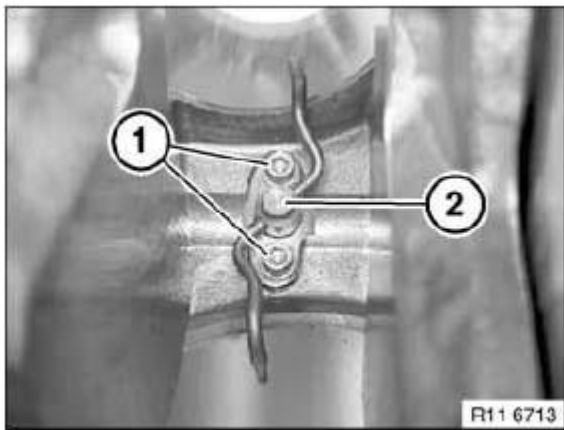
Do not bend oil nozzle (2) at outlets.

It is not possible to adjust the nozzles.

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

Release screws (1).

Oil nozzle (2)

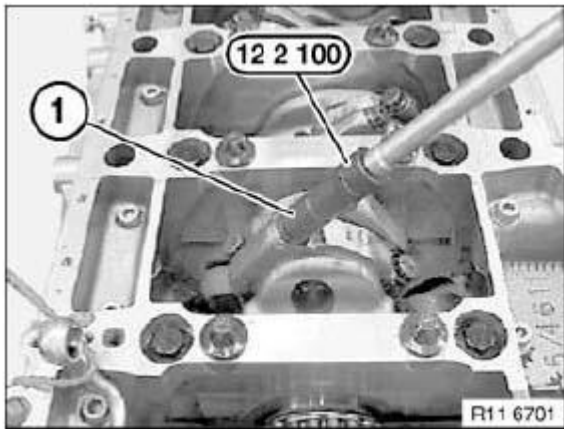


**Fig. 144: Identifying Oil Nozzle**

Courtesy of BMW OF NORTH AMERICA, INC.

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

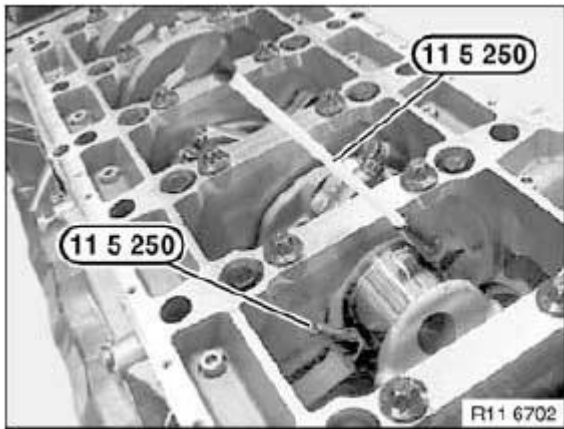
Remove connecting rod bearing cap with bearing shell.



**Fig. 145: Identifying Connecting Rod Bolts And Special Tool 12 2 100**  
Courtesy of BMW OF NORTH AMERICA, INC.

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

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



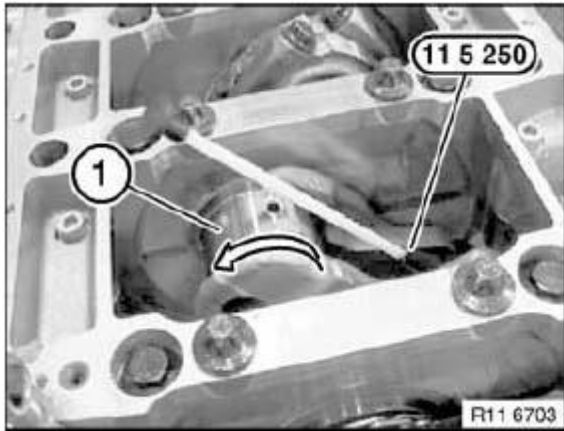
**Fig. 146: Identifying Special Tool 11 5 250**  
Courtesy of BMW OF NORTH AMERICA, INC.

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

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

Depiction of function on cylinders 1-5.

**IMPORTANT: Risk of damage to oil nozzle.**



**Fig. 147: Rotating Crankshaft**

Courtesy of BMW OF NORTH AMERICA, INC.

Clamp special tool 11 5 341 in a vice.

**NOTE:** Piston and piston pin are optimized to each other.  
There are two different inside diameters on the piston pin.

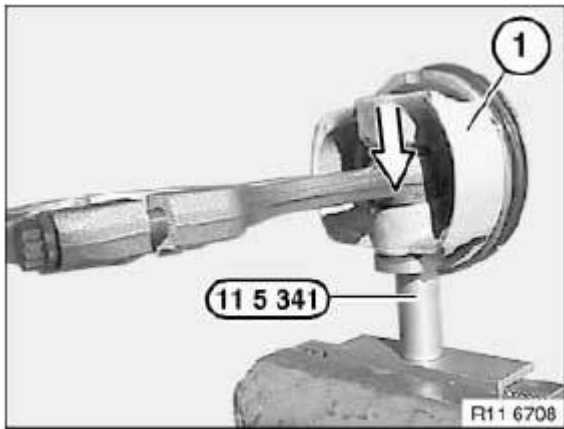
Screw matching special tool 11 5 342 into special tool 11 5 341.



**Fig. 148: Identifying Special Tool 11 5 341 And 11 5 342**

Courtesy of BMW OF NORTH AMERICA, INC.

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

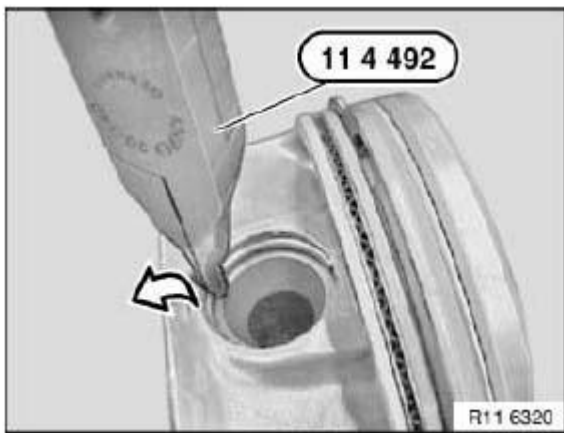


**Fig. 149: Securing Piston With Conrod To Special Tool 11 5 341**  
Courtesy of BMW OF NORTH AMERICA, INC.

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

**WARNING: Protective goggles must be worn.**

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

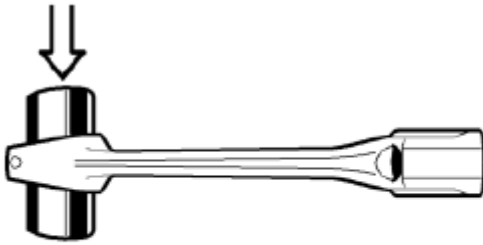


**Fig. 150: Levering Out Piston Circlip With Special Tool 11 4 492**  
Courtesy of BMW OF NORTH AMERICA, INC.

If necessary, replace connecting rods.

#### *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.



R11 4212

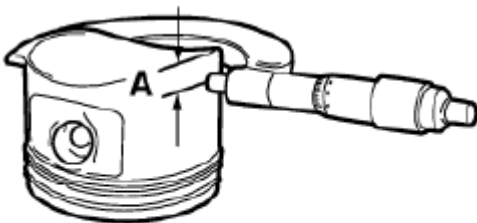
**Fig. 151: Pressing Piston Pin**

Courtesy of BMW OF NORTH AMERICA, INC.

Measure piston installation clearance:

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

Piston diameter at measuring point A.



88 11 051 U

**Fig. 152: Measuring Piston Diameter**

Courtesy of BMW OF NORTH AMERICA, INC.

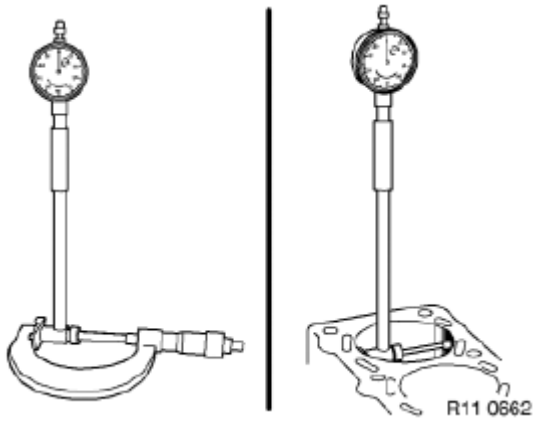
Adjust micrometer to cylinder bore of engine block. Set internal caliper on micrometer to zero. Measure bottom, center and top of cylinder bore in direction of travel and direction of engine rotation.

Diameter of cylinder bore.

Piston installation clearance.

Total permissible wear tolerance.

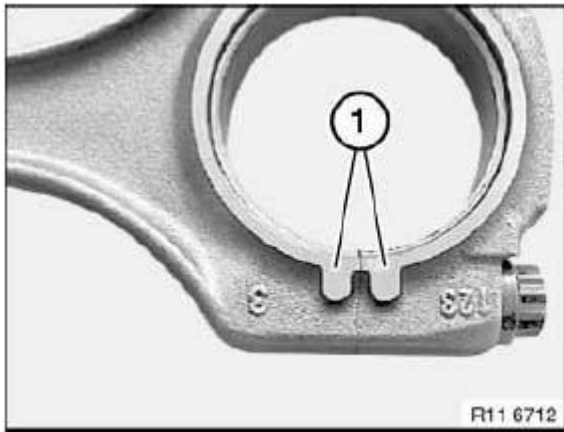
If necessary, replace piston.



**Fig. 153: Measuring Cylinder Bore**

Courtesy of BMW OF NORTH AMERICA, INC.

**IMPORTANT:** The connecting rods are not symmetrical.  
Pay attention to elevation to direction of travel arrow.



**Fig. 154: Identifying Connecting Rod Elevation**

Courtesy of BMW OF NORTH AMERICA, INC.

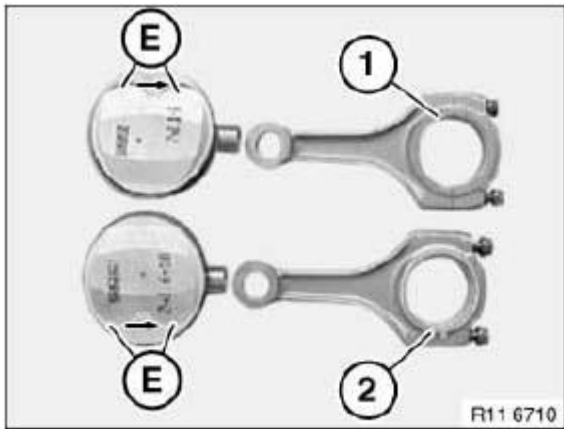
Make sure the connecting rod is in the correct installation position during preliminary installation.

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

On cylinders 1 -5 the elevation (1) must point rearwards **against** the arrow.

Valve pockets (E) point to inlet side.

Arrow direction is identical to direction of travel.



**Fig. 155: Identifying Connecting Rod Elevation - Cylinders 6-10 And 1-5 (1 Of 2)**  
 Courtesy of BMW OF NORTH AMERICA, INC.

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

On cylinders 1-5 the elevation (1) must point rearwards **against** the arrow.

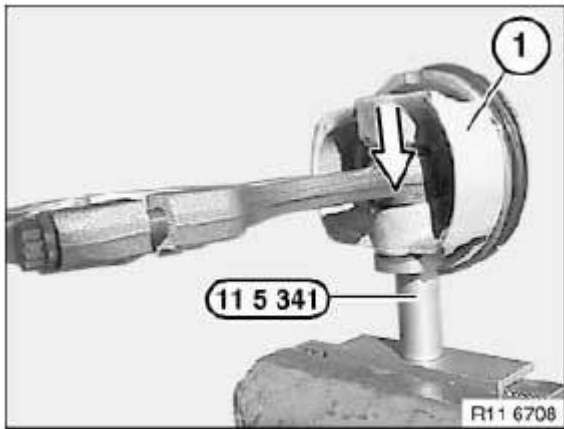
**IMPORTANT: No elevations on the connecting rod big end are permitted to point to each other during installation, risk of damage to connecting rod.**



**Fig. 156: Identifying Connecting Rod Elevation - Cylinders 6-10 And 1-5 (2 Of 2)**  
 Courtesy of BMW OF NORTH AMERICA, INC.

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





**Fig. 157: Securing Piston With Conrod To Special Tool 11 5 341**  
Courtesy of BMW OF NORTH AMERICA, INC.

**WARNING: Protective goggles must be worn.**

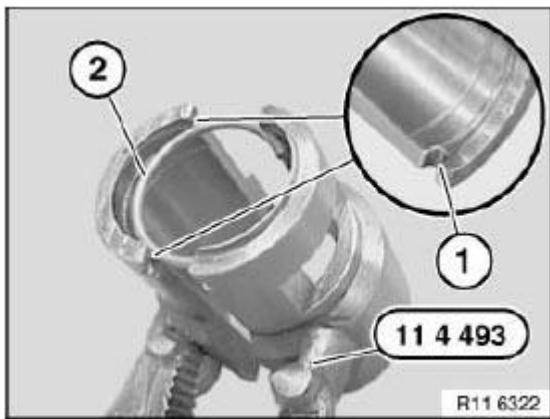
**IMPORTANT: Setting of special tool 11 5 343 must not be altered.**

*Installation:*

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

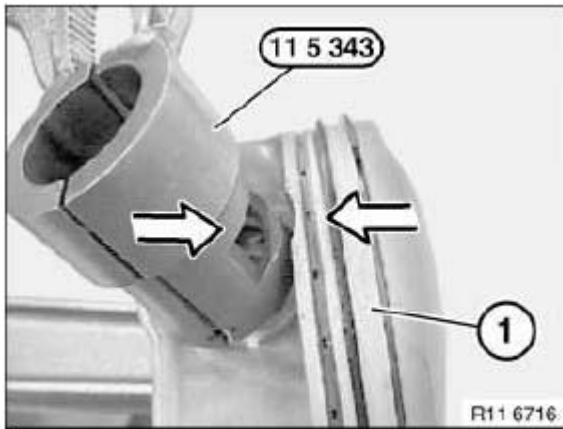
Insert piston circlip (2) into groove (1) of special tool 11 5 343.

**NOTE:** Illustration shows N52.



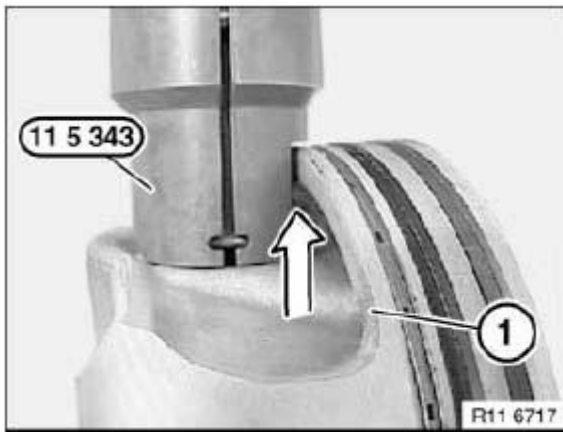
**Fig. 158: Identifying Piston Circlip And Special Tool 11 5 343**  
Courtesy of BMW OF NORTH AMERICA, INC.

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



**Fig. 159: Positioning Special Tool 11 5 343 With Window To Opening On Piston (1 Of 2)**  
Courtesy of BMW OF NORTH AMERICA, INC.

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

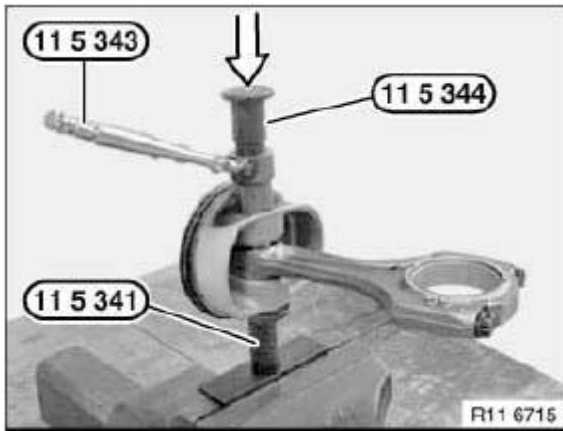


**Fig. 160: Positioning Special Tool 11 5 343 With Window To Opening On Piston (2 Of 2)**  
Courtesy of BMW OF NORTH AMERICA, INC.

**WARNING: Protective goggles must be worn.**

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

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



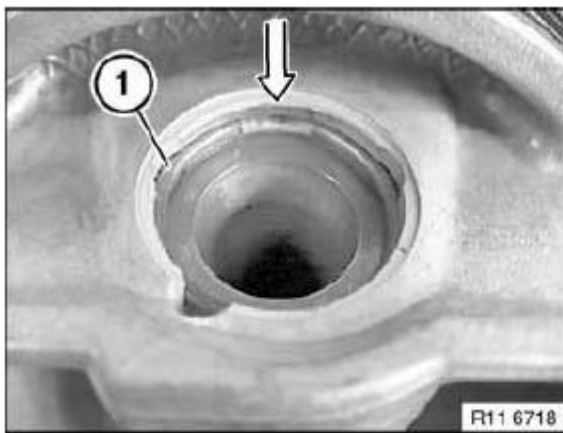
**Fig. 161: Driving In Piston Circlip**

Courtesy of BMW OF NORTH AMERICA, INC.

*Installation:*

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

It must still be possible for piston pin to moved easily



**Fig. 162: Installing Piston Circlip**

Courtesy of BMW OF NORTH AMERICA, INC.

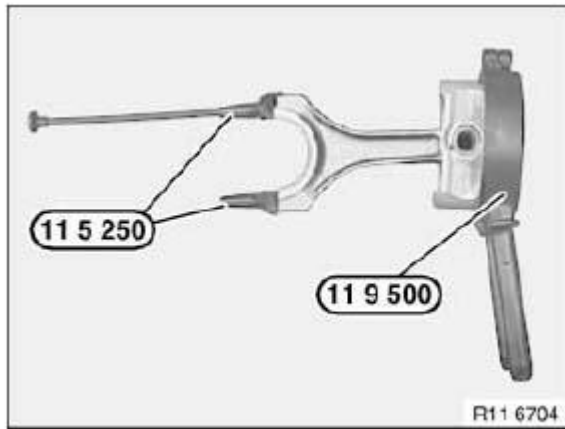
Install all piston rings.

Install all bearing shells.

Screw special tool 11 5 250 into connecting rod.

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

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



**Fig. 163: Identifying Special Tool 11 5 250**  
Courtesy of BMW OF NORTH AMERICA, INC.

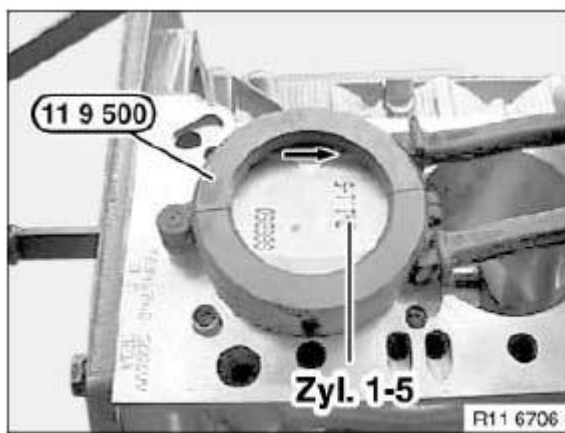
Insert piston with conrod in cylinder.

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

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

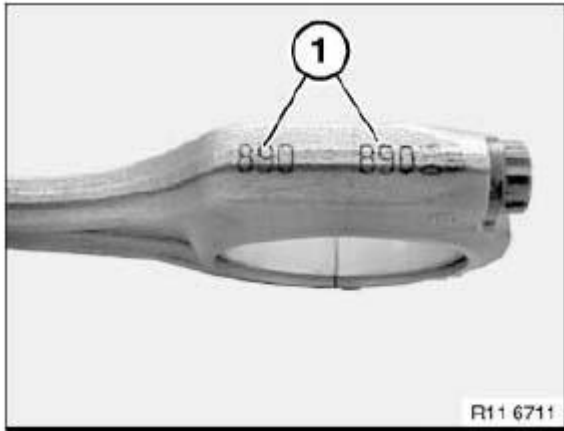
Piston cyl. 1-5 right side, cyl. 6-10 left side.

Press in piston with special tool 119 500.



**Fig. 164: Identifying Special Tool 119 500**  
Courtesy of BMW OF NORTH AMERICA, INC.

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



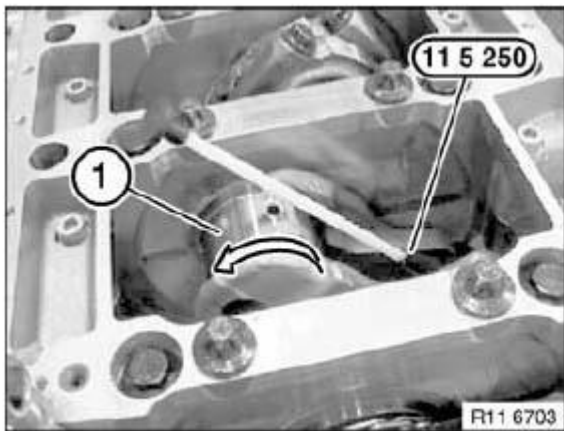
**Fig. 165: Identifying Connecting Rod With Pairing Letters**  
Courtesy of BMW OF NORTH AMERICA, INC.

**IMPORTANT:** Risk of damage to oil nozzle.

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

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

**NOTE:** Depiction of function on cylinders 1-5.

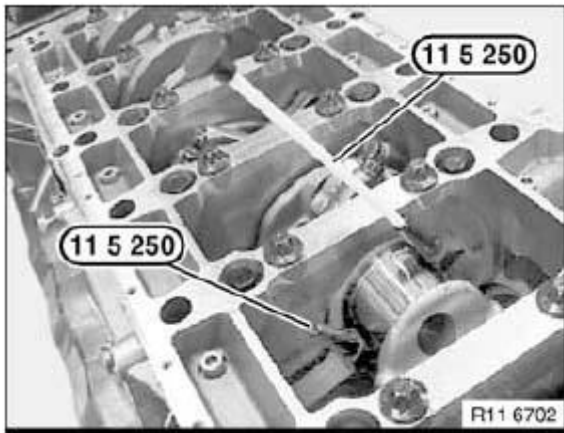


**Fig. 166: Rotating Crankshaft**  
Courtesy of BMW OF NORTH AMERICA, INC.

Moisten conrod bearing shell and crank pin slightly with engine oil.

Assemble conrod and crank pin.

Remove special tool 11 5 250.

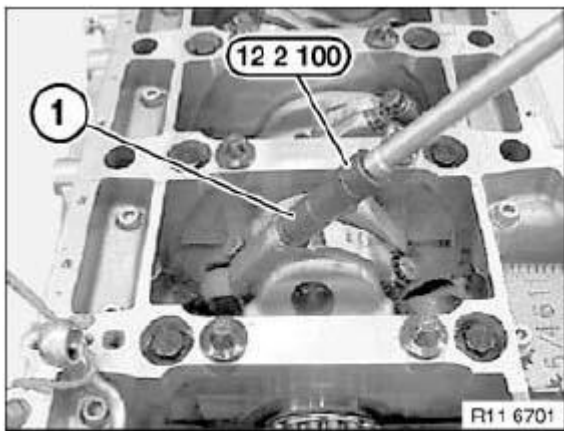


**Fig. 167: Identifying Special Tool 11 5 250**  
Courtesy of BMW OF NORTH AMERICA, INC.

Install connecting rod bearing cap with bearing shell.

Secure connecting rod bolts (1) with special tools 12 2 100 and 00 9 120.

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



**Fig. 168: Identifying Connecting Rod Bolts And Special Tools 12 2 100**  
Courtesy of BMW OF NORTH AMERICA, INC.

Assemble engine.

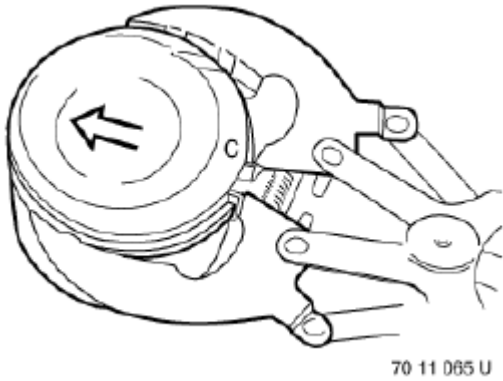
## 11 25 671 REPLACING PISTON RINGS ON ALL PISTONS (S85)

*Necessary preliminary tasks:*

- Remove engine.
- Remove all pistons.

Remove piston rings with a piston-ring compressing pliers.

**NOTE:** It might not be possible to find the identification on used piston rings. Put aside piston rings in correct sequence and installation position.



**Fig. 169: Removing Piston Rings With Piston-Ring Compressing Pliers**  
Courtesy of BMW OF NORTH AMERICA, INC.

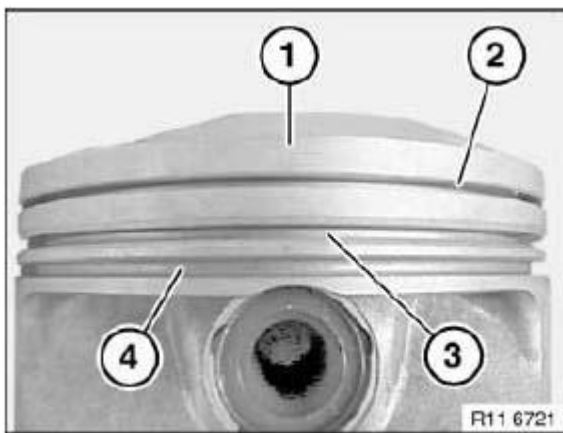
*Installation:*

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

Groove (2), plain compression ring.

Groove (3), stepped ring.

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

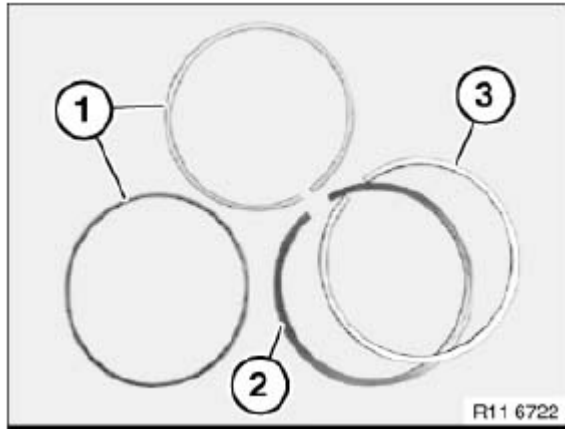


**Fig. 170: Identifying Plain Compression Ring, Stepped Ring And Bevel-Edged Oil Control Ring Groove**  
Courtesy of BMW OF NORTH AMERICA, INC.

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

Piston ring (2), stepped ring.

Piston ring (3), plain compression ring.



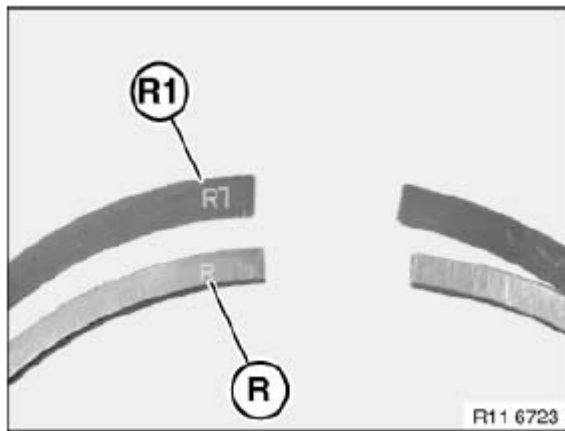
**Fig. 171: Identifying Plain Compression, Stepped And Bevel-Edged Oil Control Piston Ring**  
Courtesy of BMW OF NORTH AMERICA, INC.

*Installation:*

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

Plain compression ring is marked with (R).

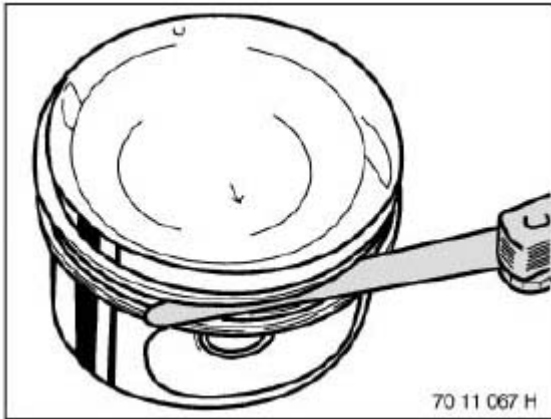
Stepped ring is marked with (R1).



**Fig. 172: Identifying Mark On Plain Compression Ring**  
Courtesy of BMW OF NORTH AMERICA, INC.

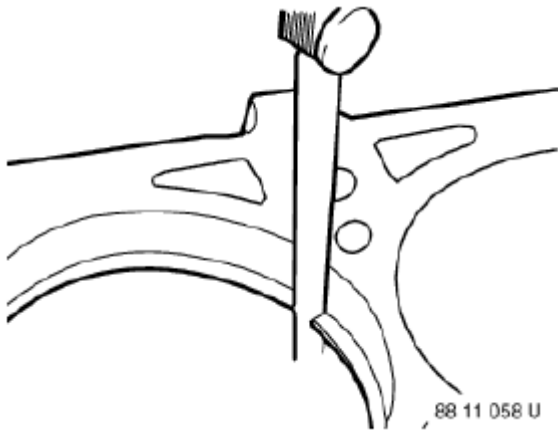
Measure axial play.





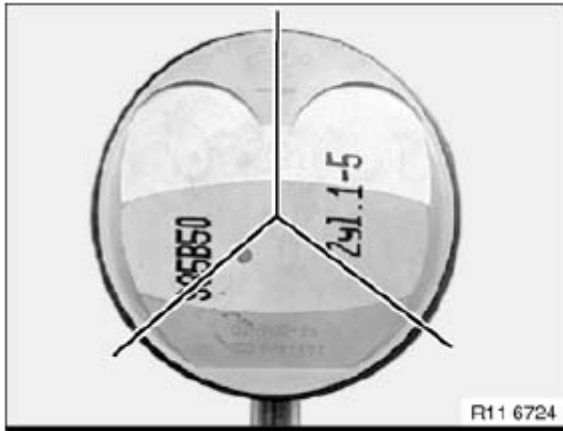
**Fig. 173: Measuring Axial Play**  
 Courtesy of BMW OF NORTH AMERICA, INC.

Measure end clearance.



**Fig. 174: Measuring Ring End Clearance**  
 Courtesy of BMW OF NORTH AMERICA, INC.

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



**Fig. 175: Identifying Piston Ring Contact Point Offset Position**  
Courtesy of BMW OF NORTH AMERICA, INC.

Assemble engine.

## 28 V-RIBBED BELT WITH TENSIONER

### 11 28 010 REPLACING ALTERNATOR DRIVE BELT (S85)

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

*Necessary preliminary tasks:*

- Remove fan cowl with electric fan. See 17 11 035 REMOVING AND INSTALLING/REPLACING FAN COWL WITH ELECTRIC FAN (M5) or 17 11 035 REMOVING AND INSTALLING/REPLACING FAN COWL WITH ELECTRIC FAN (M6).
- Remove drive belt for A/C system.

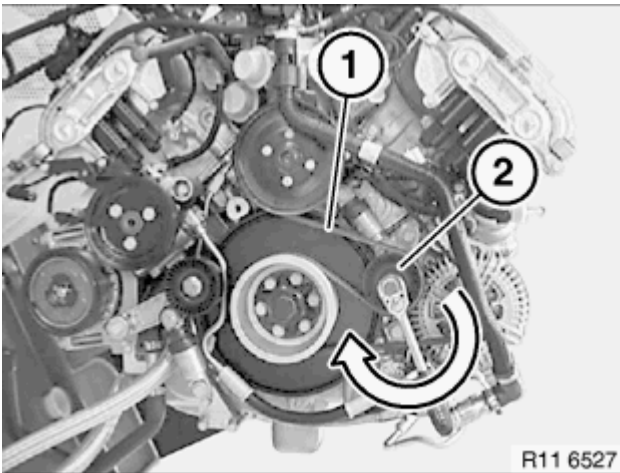
Press down tensioning device (2) with ratchet in direction of arrow.

Remove drive belt (1).

*Installation:*

Observe direction of rotation if reusing the drive belt.

Ensure drive belt is in correct installation position.



**Fig. 176: Pressing Down Tensioning Device With Ratchet**  
Courtesy of BMW OF NORTH AMERICA, INC.

Assemble engine.

#### 11 28 020 REPLACING TENSIONING DEVICE FOR ALTERNATOR DRIVE BELT (S85)

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

*Necessary preliminary tasks:*

- Remove fan cowl with electric fan. See **17 11 035 REMOVING AND INSTALLING/REPLACING FAN COWL WITH ELECTRIC FAN (M5)** or **17 11 035 REMOVING AND INSTALLING/REPLACING FAN COWL WITH ELECTRIC FAN (M6)** .
- Remove **A/C compressor drive belt**.
- Remove **alternator drive belt**.

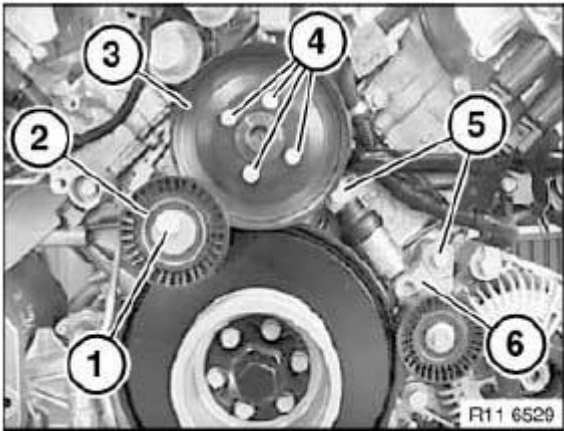
Release screws (5).

Remove belt tensioner (6).

*Installation:*

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

The lettering TOP must point upwards.



**Fig. 177: Identifying Belt Tensioner**

Courtesy of BMW OF NORTH AMERICA, INC.

Assemble engine.

#### **11 28 050 REPLACING DRIVE BELT FOR A/C COMPRESSOR (S85)**

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

*Necessary preliminary tasks:*

- Remove fan cowl with electric fan. See **17 11 035 REMOVING AND INSTALLING/REPLACING FAN COWL WITH ELECTRIC FAN (M5)** or **17 11 035 REMOVING AND INSTALLING/REPLACING FAN COWL WITH ELECTRIC FAN (M6)** .

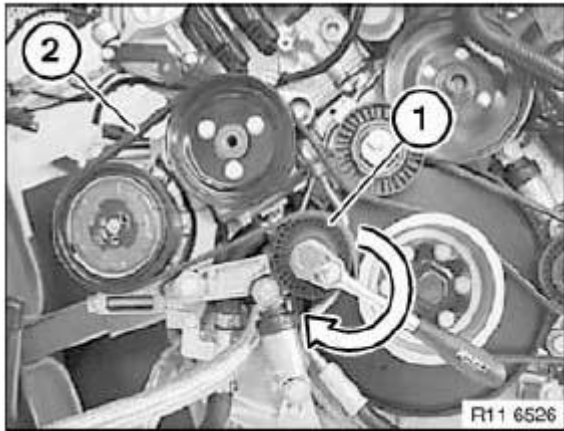
Press down tensioning device (1) with ratchet in direction of arrow.

Remove ribbed V-belt (2).

*Installation:*

Observe direction of rotation if reusing the drive belt.

Ensure drive belt is in correct installation position.



**Fig. 178: Pressing Down Tensioning Device With Ratchet**  
 Courtesy of BMW OF NORTH AMERICA, INC.

Assemble engine.

#### 11 28 060 REMOVING AND INSTALLING BELT TENSIONER FOR A/C COMPRESSOR (S85)

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

*Necessary preliminary tasks:*

- Remove fan cowl with electric fan. See 17 11 035 REMOVING AND INSTALLING/REPLACING FAN COWL WITH ELECTRIC FAN (M5) or 17 11 035 REMOVING AND INSTALLING/REPLACING FAN COWL WITH ELECTRIC FAN (M6) .
- Remove A/C compressor drive belt.

Release screw (1).

Release screw for power steering high-pressure line.

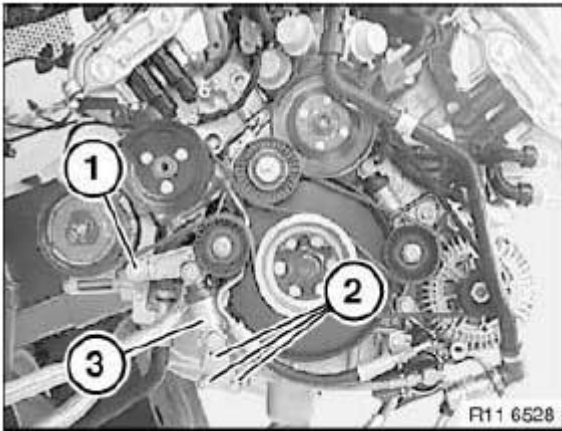
Release screws (2).

Remove belt tensioner (3) with fixture.

*Installation:*

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

The lettering TOP must point upwards.



**Fig. 179: Identifying Belt Tensioner**

Courtesy of BMW OF NORTH AMERICA, INC.

Assemble engine.

## 31 CAMSHAFT

### 11 31 032 REMOVING AND INSTALLING OR REPLACING LEFT INLET CAMSHAFTS (S85)

#### Special tools required:

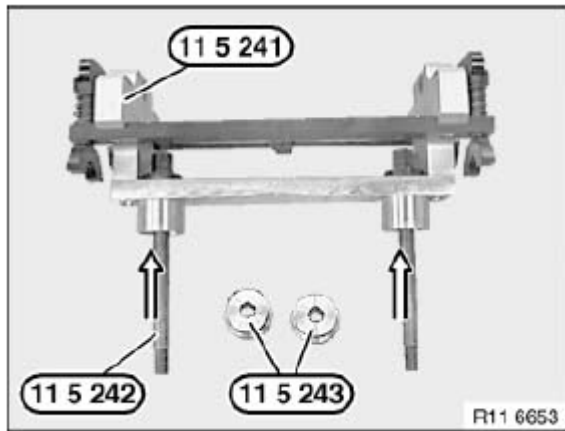
- 11 5 241
- 11 5 242
- 11 5 243

#### *Necessary preliminary tasks:*

- Remove left cylinder head cover
- Remove left VANOS adjustment unit
- Remove left VANOS exhaust gear
- Remove left VANOS inlet gear

**IMPORTANT:** Use only special tool 11 5 241 to remove and install camshafts.

To remove and install inlet camshafts, insert special tool 11 5 243 in direction of arrow in special tool 11 5 241.



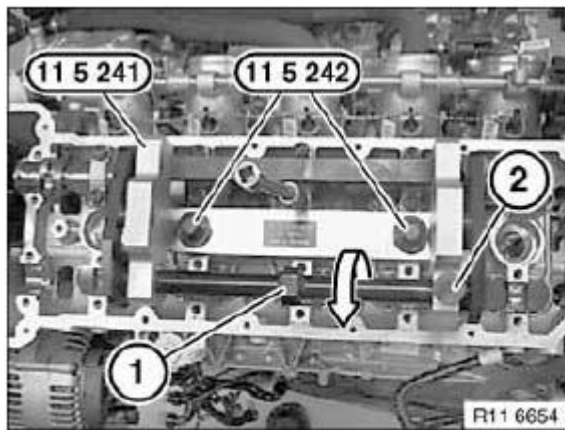
**Fig. 180: Inserting Special Tool 11 5 243 In Special Tool 11 5 241**  
 Courtesy of BMW OF NORTH AMERICA, INC.

Secure special tool 11 5 241 to cylinder head on left with special tool 11 5 242.

**IMPORTANT: Screw in special tool 11 5 242 to max 30 Nm.**

Pretension eccentric shaft (1) at hexagon head in direction of arrow.

Lock (2) must snap audibly into place.



**Fig. 181: Pretensioning Eccentric Shaft At Hexagon Head**  
 Courtesy of BMW OF NORTH AMERICA, INC.

Release screws (1).

Tightening torque 11 31 4AZ. See CAMSHAFT .

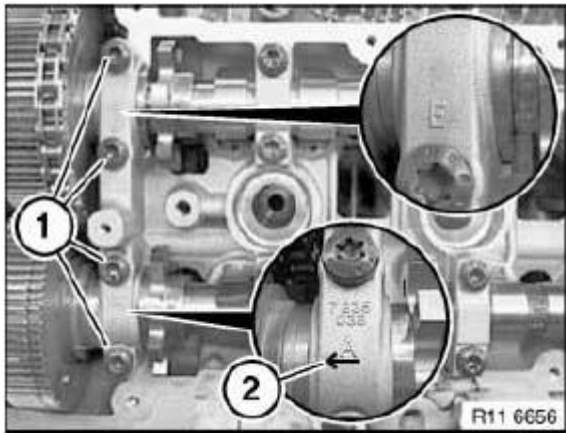
E Inlet camshaft.

A Exhaust camshaft.

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

*Installation:*

Lubricate all bearing points with engine oil.



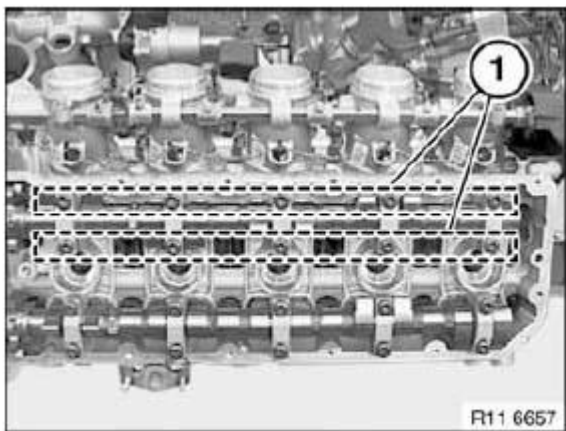
**Fig. 182: Identifying Screws**

Courtesy of BMW OF NORTH AMERICA, INC.

Release screws along lines (1).

Tightening torque 11 31 4AZ. See CAMSHAFT .

**NOTE:** Illustration does not show special tool 11 5 241.



**Fig. 183: Identifying Lines**

Courtesy of BMW OF NORTH AMERICA, INC.

Release lock on special tool 11 5 241.



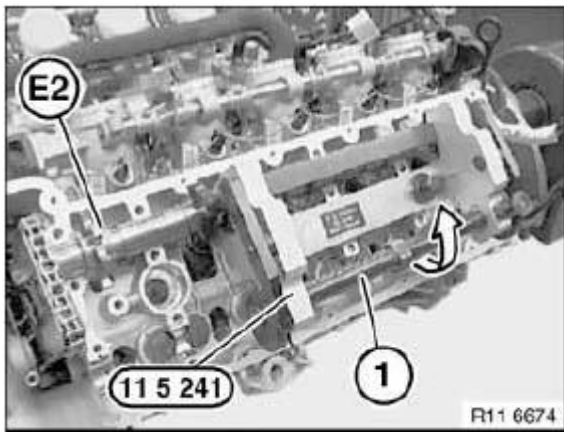
Relieve tension on eccentric shaft (1) at hexagon head in direction of arrow.

Inlet camshaft is pressed upwards by valve springs.

**IMPORTANT: Inlet camshaft must lift off uniformly in upward direction.**

Remove special tool 11 5 241.

Remove inlet camshaft.



**Fig. 184: Relieving Tension On Eccentric Shaft At Hexagon Head**  
Courtesy of BMW OF NORTH AMERICA, INC.

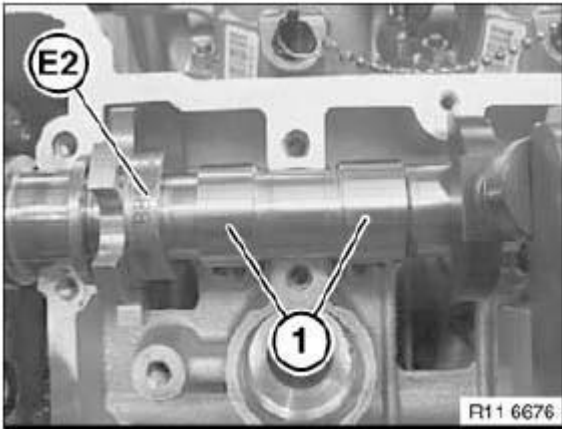
Insert inlet camshaft, cylinders 6-10.

Designation (E2) on Dihedron points upwards.

Cams (1) on 6th cylinder point downwards.

*Installation:*

Lubricate all bearing points with engine oil.



**Fig. 185: Identifying Cams**

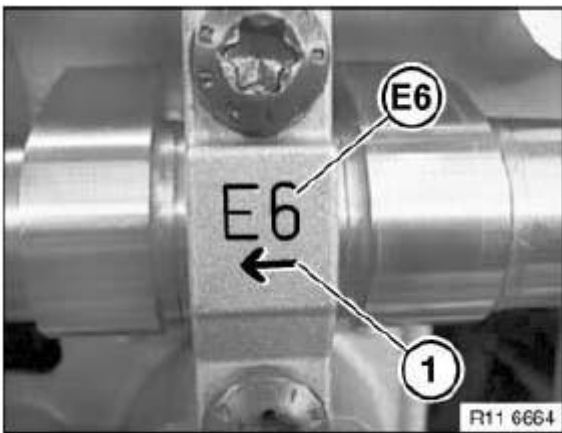
Courtesy of BMW OF NORTH AMERICA, INC.

*Installation:*

All bearing shells are assigned to one cylinder.

E and A from (1 to 10), e.g. E 6= inlet side on 6th cylinder.

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



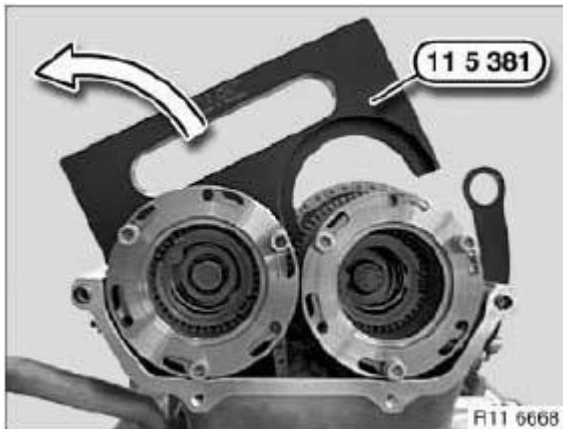
**Fig. 186: Identifying Designation (E6) On Dihedron**

Courtesy of BMW OF NORTH AMERICA, INC.

*Installation:*

Arrangement of bearing shells, cylinders 6 to 10.

**IMPORTANT: Mixing them up will result in increased wear - risk of damage!**



**Fig. 187: Installing Bearing Shells**

Courtesy of BMW OF NORTH AMERICA, INC.

Mount special tool 11 5 241 with special tool 11 5 242.

Pretension eccentric shaft (1) at hexagon head in direction of arrow.

**IMPORTANT: Inlet camshaft is pressed upwards by valve springs.**

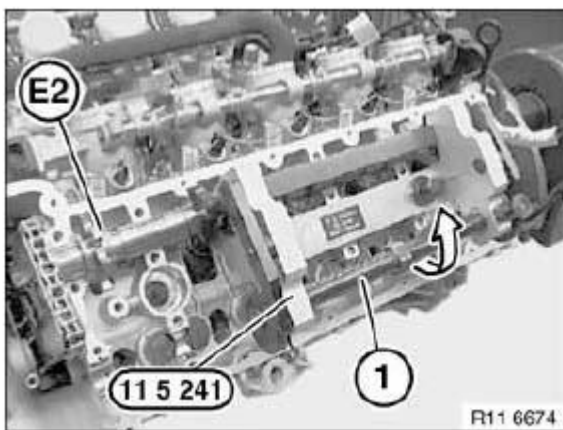
Lock must snap audibly into place.

Install all bearing caps by numbers.

Tightening torque 11 31 4AZ. See CAMSHAFT .

Adjust valve timing.

Assemble engine.



**Fig. 188: Pretensioning Eccentric Shaft At Hexagon Head**

Courtesy of BMW OF NORTH AMERICA, INC.

**11 31 034 REMOVING AND INSTALLING / REPLACING RIGHT INLET CAMSHAFT (S85)****Special tools required:**

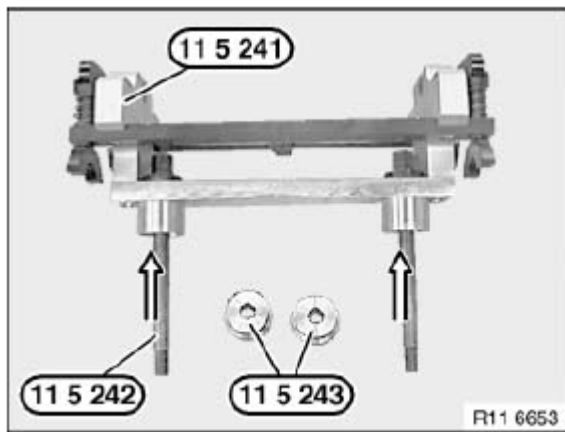
- 11 5 241
- 11 5 242
- 11 5 243

*Necessary preliminary tasks:*

- Remove right cylinder head cover.
- Remove right VANOS adjustment unit.
- Remove right VANOS exhaust gear.
- Remove right VANOS inlet gear.

**IMPORTANT:** Use only special tool 11 5 241 to remove and install camshafts.

To remove and install inlet camshafts, insert special tool 11 5 243 in direction of arrow in special tool 11 5 241.



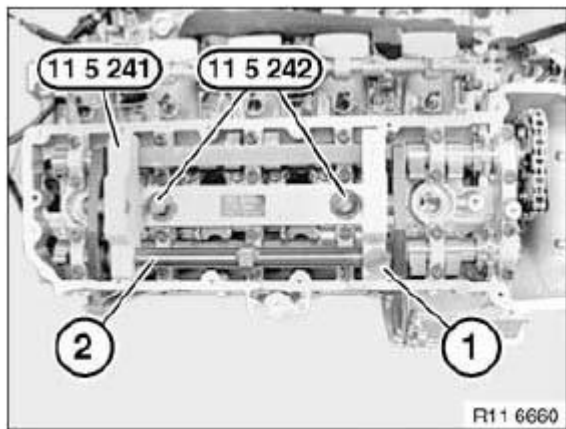
**Fig. 189: Inserting Special Tool 11 5 243 In Special Tool 11 5 241**  
Courtesy of BMW OF NORTH AMERICA, INC.

Secure special tool 11 5 241 to cylinder head on right with special tool 11 5 242.

**IMPORTANT:** Screw in special tool 11 5 242 to max. 30 Nm.

Rotate eccentric shaft (2) at hexagon head and pretension.

Lock (1) must snap clearly and audibly into place.



**Fig. 190: Identifying Special Tool 11 5 241 And Eccentric Shaft**  
 Courtesy of BMW OF NORTH AMERICA, INC.

Release screws (1).

Tightening torque 11 31 4AZ. See CAMSHAFT .

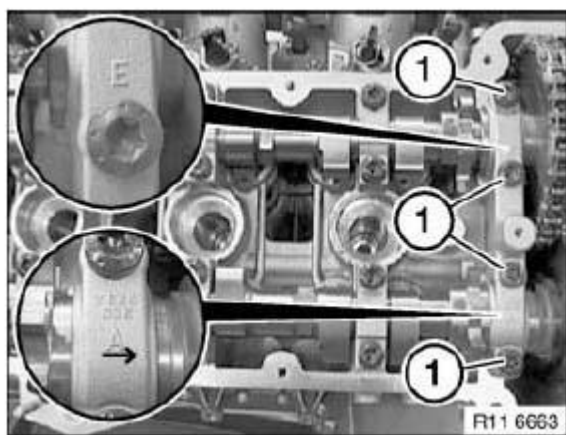
E Inlet camshaft.

A Exhaust camshaft.

**IMPORTANT: Risk of mix-up with cylinder bank 6-10.**  
**Arrow must point in direction of travel to chain drive.**

*Installation:*

Lubricate all bearing points with engine oil.

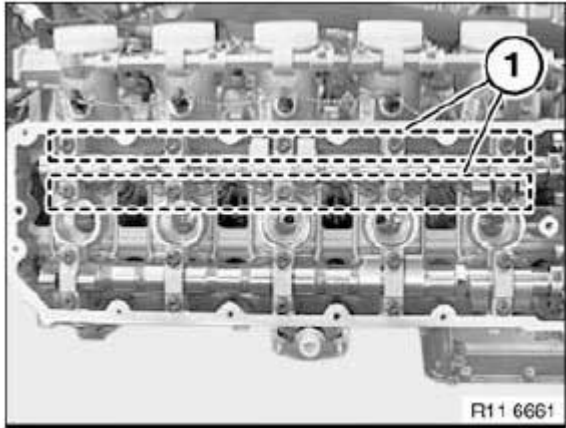


**Fig. 191: Identifying Screws**  
 Courtesy of BMW OF NORTH AMERICA, INC.

Release screws along lines (1).

Tightening torque: 11 31 4AZ. See CAMSHAFT .

**NOTE:** Illustration does not show special tool 11 5 241.



**Fig. 192: Identifying Lines**

Courtesy of BMW OF NORTH AMERICA, INC.

Release lock on special tool 11 5 241.

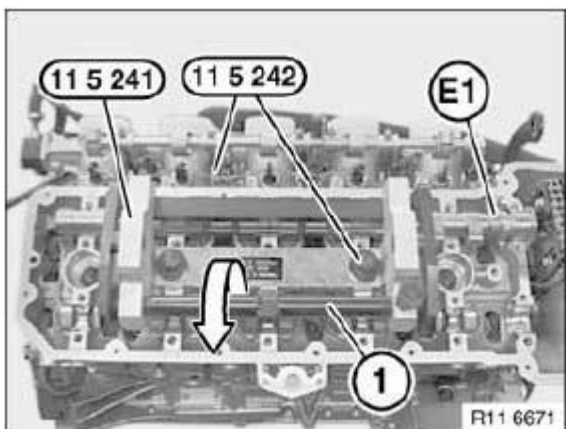
Relieve tension on eccentric shaft (1) at hexagon head in direction of arrow.

Inlet camshaft is pressed upwards by valve springs.

**IMPORTANT:** Inlet camshaft must lift off uniformly in upward direction.

Remove special tools 11 5 241 and 11 5 242.

Remove inlet camshaft.



**Fig. 193: Relieving Tension On Eccentric Shaft At Hexagon Head**  
Courtesy of BMW OF NORTH AMERICA, INC.

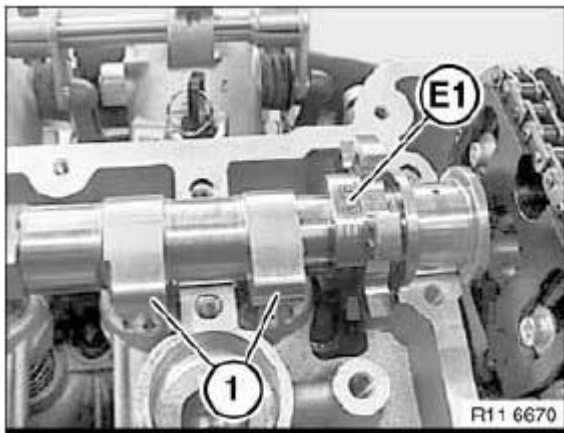
Insert inlet camshaft, cylinders 1-5.

Designation (E1) on dihedron points upwards.

Cams (1) point sideways to exhaust side.

*Installation:*

Lubricate all bearing points with engine oil.



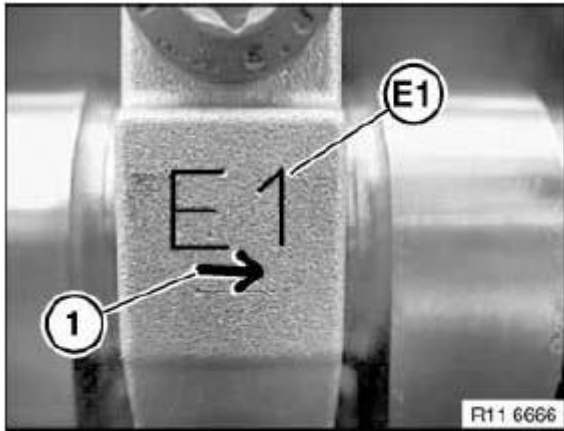
**Fig. 194: Identifying Cams**  
Courtesy of BMW OF NORTH AMERICA, INC.

*Installation:*

All bearing shells are assigned to one cylinder.

E and A from (1 to 10), e.g. E 1 = inlet side on 1st cylinder.

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

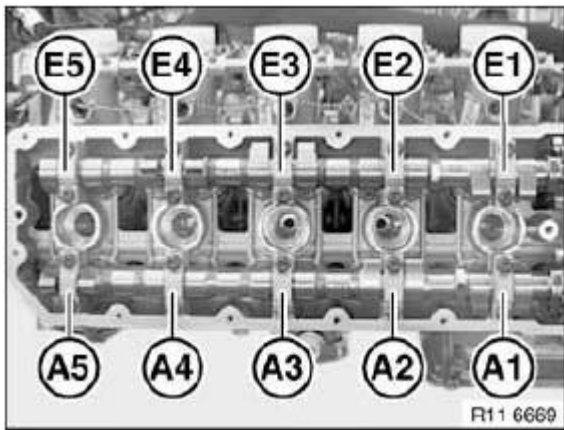


**Fig. 195: Identifying Designation (E1) On Dihedron**  
 Courtesy of BMW OF NORTH AMERICA, INC.

*Installation:*

Arrangement of bearing shells, cylinders 1 to 10.

**IMPORTANT: Mixing them up will result in increased wear - risk of damage!**



**Fig. 196: Identifying Installation Sequence Of Bearing Shells**  
 Courtesy of BMW OF NORTH AMERICA, INC.

Mount special tool 11 5 241 with special tool 11 5 242.

Pretension eccentric shaft (1) at hexagon head in direction of arrow.

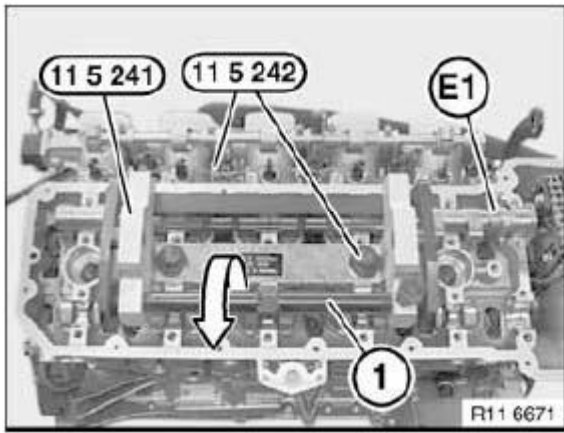
**IMPORTANT: Inlet camshaft is pressed upwards by valve springs.**

Lock must snap audibly into place.

Install all bearing caps by numbers.



Tightening torque 11 31 4AZ. See CAMSHAFT .



**Fig. 197: Pretensioning Eccentric Shaft At Hexagon Head**  
 Courtesy of BMW OF NORTH AMERICA, INC.

Adjust valve timing.

Assemble engine.

### **11 31 036 REMOVING AND INSTALLING / REPLACING LEFT EXHAUST CAMSHAFT (S85)**

#### **Special tools required:**

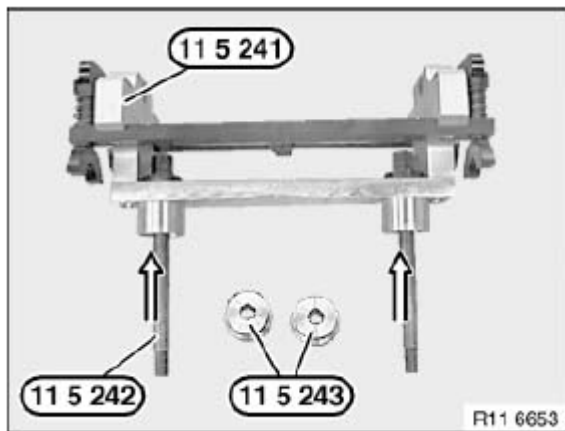
- 11 5 241
- 11 5 242
- 11 5 243

#### *Necessary preliminary tasks:*

- Remove left cylinder head cover.
- Remove left VANOS adjustment unit.
- Remove left VANOS exhaust gear

**IMPORTANT:** Use only special tool 11 5 241 to remove and install camshafts.

To remove and install the exhaust camshafts, special tool 11 5 243 is not required and must be removed from special tool 11 5 241.



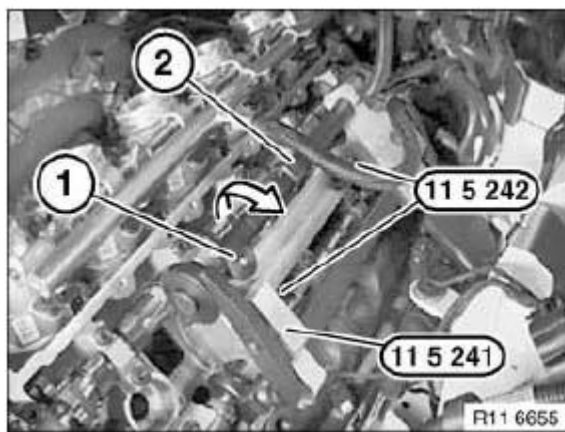
**Fig. 198: Identifying Special Tool 11 5 241, 11 5 242 And 11 5 243**  
 Courtesy of BMW OF NORTH AMERICA, INC.

Secure special tool 11 5 241 to cylinder head on left with special tool 11 5 242.

**IMPORTANT: Screw in special tool 11 5 242 to max. 30 Nm.**

Pretension eccentric shaft (2) at hexagon head in direction of arrow.

Lock (1) must snap audibly into place.



**Fig. 199: Pretensioning Eccentric Shaft At Hexagon Head**  
 Courtesy of BMW OF NORTH AMERICA, INC.

Release screws (1).

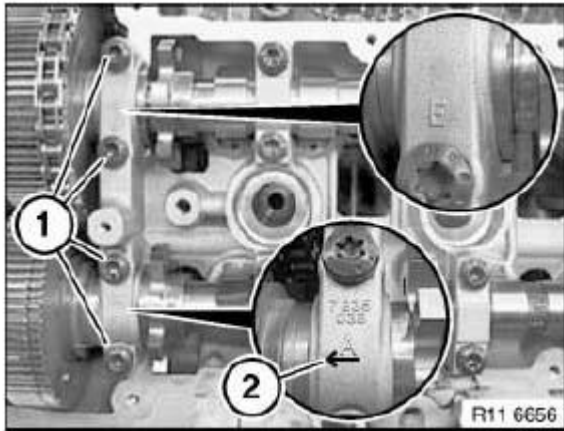
Tightening torque: 11 31 7AZ. See **CAMSHAFT** .

E Inlet camshaft.

A Exhaust camshaft.

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

Remove bearing caps.



**Fig. 200: Identifying Screws**  
Courtesy of BMW OF NORTH AMERICA, INC.

*Installation:*

Lubricate all bearing points with engine oil.

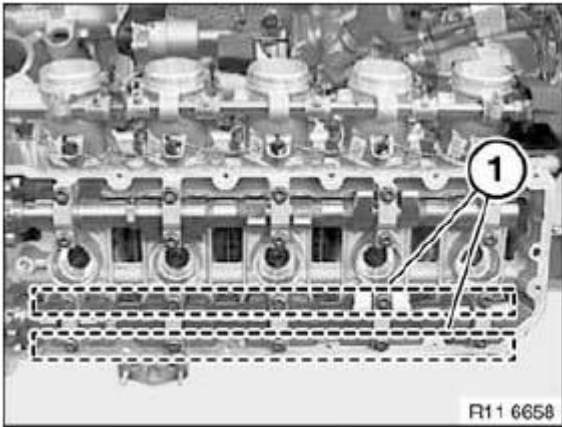
Release screws along lines (1).

Tightening torque 11 31 4AZ. See CAMSHAFT .

*Installation:*

Lubricate all bearing points with engine oil.

**NOTE:** Illustration does not show special tool 11 5 241.



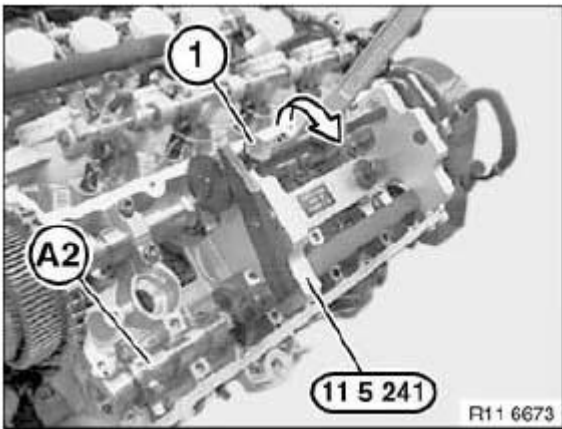
**Fig. 201: Identifying Lines**

Courtesy of BMW OF NORTH AMERICA, INC.

Release lock (1) on special tool 11 5 241.

Relieve tension on eccentric shaft at hexagon head in direction of arrow.

**IMPORTANT: Inlet camshaft is pressed upwards by valve springs.  
Exhaust camshaft must lift off uniformly in upward direction.**



**Fig. 202: Relieving Tension On Eccentric Shaft At Hexagon Head**

Courtesy of BMW OF NORTH AMERICA, INC.

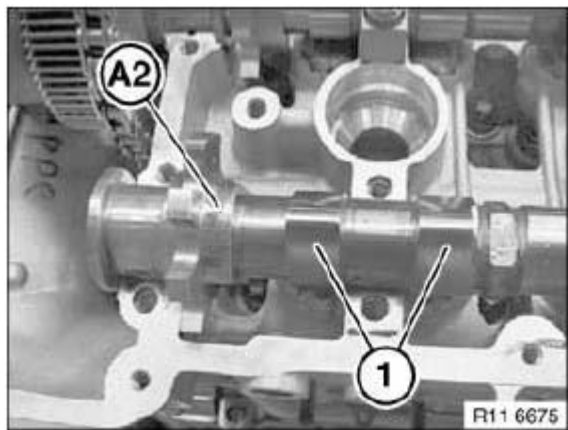
Insert exhaust camshaft, cylinders 6-10.

Designation (A 2) on dihedron points upwards.

Cams (1) on 6th cylinder point upwards.

*Installation:*

Lubricate all bearing points with engine oil.



**Fig. 203: Identifying Cams**

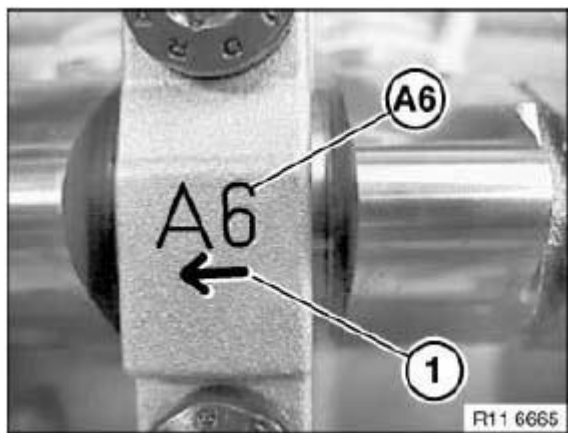
Courtesy of BMW OF NORTH AMERICA, INC.

*Installation:*

All bearing shells are assigned to one cylinder.

E and A from (1 to 10), e.g. A 6= exhaust side on 6th cylinder.

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



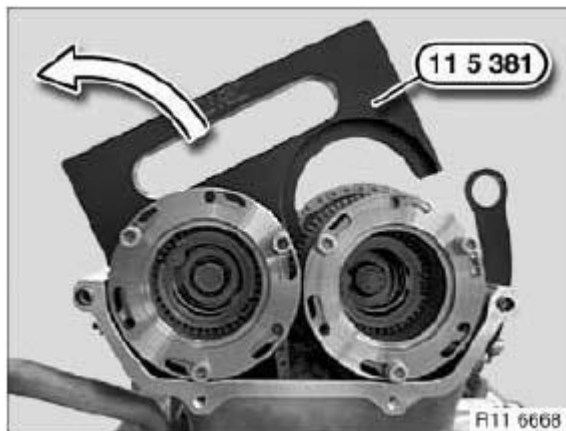
**Fig. 204: Identifying Designation (A6) On Dihedron**

Courtesy of BMW OF NORTH AMERICA, INC.

*Installation:*

Arrangement of bearing shells, cylinders 6 to 10.

**IMPORTANT: Mixing them up will result in increased wear - risk of damage!**



**Fig. 205: Installing Bearing Shells**

Courtesy of BMW OF NORTH AMERICA, INC.

Mount special tool 11 5 241 with special tool 11 5 242.

Pretension eccentric shaft at hexagon head in direction of arrow.

**IMPORTANT: Exhaust camshaft is pressed upwards by valve springs.**

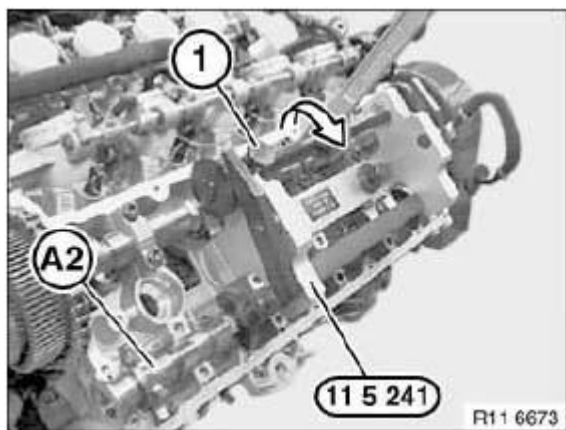
Lock (1) must snap audibly into place.

Install all bearing caps by numbers.

Tightening torque 11 31 4AZ.. See CAMSHAFT .

Adjust valve timing.

Assemble engine.



**Fig. 206: Pretensioning Eccentric Shaft At Hexagon Head**

Courtesy of BMW OF NORTH AMERICA, INC.

**11 31 038 REMOVING AND INSTALLING / REPLACING RIGHT EXHAUST CAMSHAFT (S85)****Special tools required:**

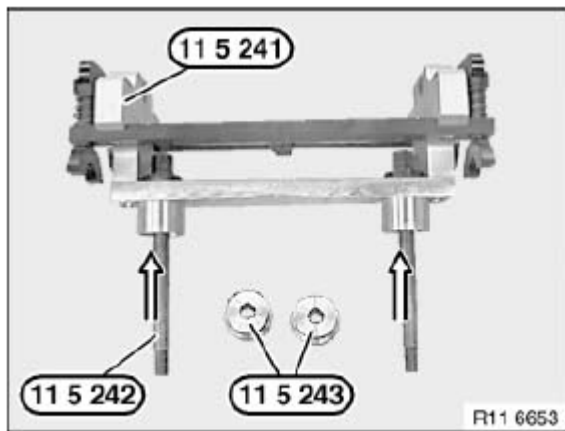
- 11 5 241
- 11 5 242
- 11 5 243

*Necessary preliminary tasks:*

- Remove right cylinder head cover.
- Remove right VANOS adjustment unit.
- Remove right VANOS exhaust gear.

**IMPORTANT:** Use only special tool 11 5 241 to remove and install camshafts.

To remove and install the exhaust camshafts, special tool 11 5 243 is not required and must be removed from special tool 11 5 241.



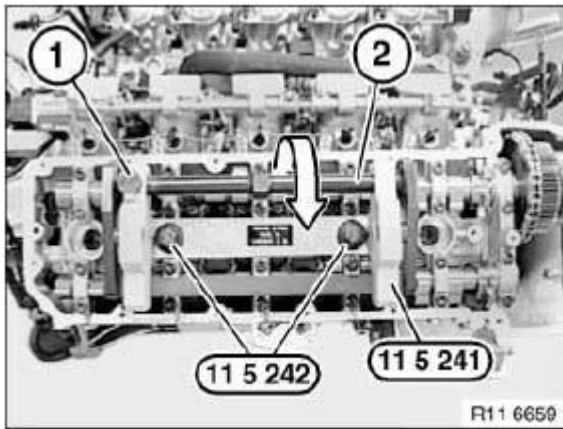
**Fig. 207: Identifying Special Tool 11 5 241, 11 5 242 And 11 5 243**  
Courtesy of BMW OF NORTH AMERICA, INC.

Secure special tool 11 5 241 to cylinder head on left with special tool 11 5 242.

**IMPORTANT:** Screw in special tool 11 5 242 to max. 30 Nm.

Pretension eccentric shaft (2) at hexagon head in direction of arrow.

Lock (1) must snap audibly into place.



**Fig. 208: Pretensioning Eccentric Shaft At Hexagon Head**  
 Courtesy of BMW OF NORTH AMERICA, INC.

Release screws (1).

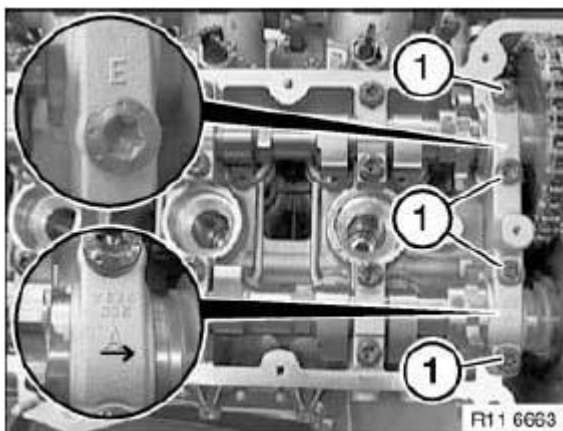
Tightening torque: 11 31 4AZ. See CAMSHAFT .

E Inlet camshaft.

A Exhaust camshaft.

**IMPORTANT: Risk of mix-up with cylinder bank 6-10.**  
**Arrow must point in direction of travel to chain drive.**

Remove bearing caps.



**Fig. 209: Identifying Screws**  
 Courtesy of BMW OF NORTH AMERICA, INC.

*Installation:*



Lubricate all bearing points with engine oil.

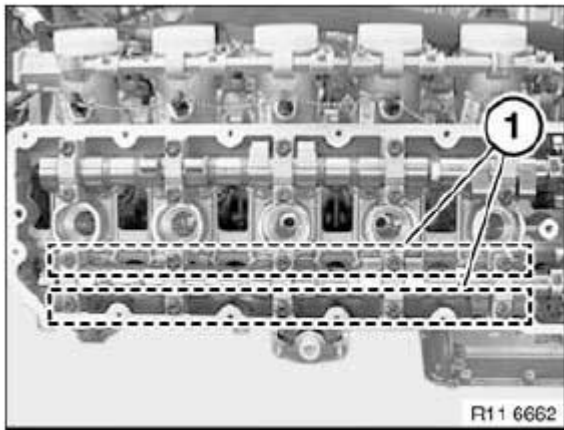
Release screws along lines (1).

Tightening torque: 11 31 4AZ. See CAMSHAFT .

*Installation:*

Lubricate all bearing points with engine oil.

**NOTE:** Illustration does not show special tool 11 5 241.



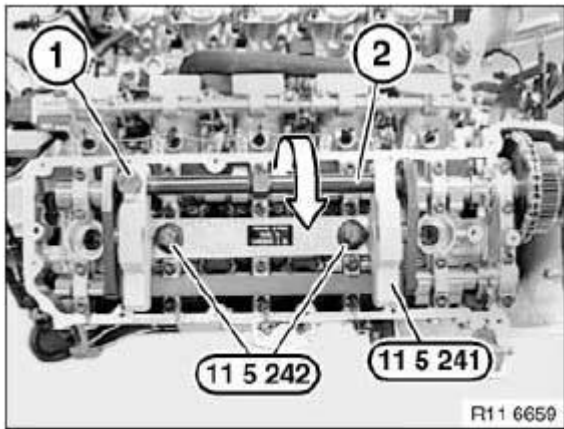
**Fig. 210: Identifying Lines**

Courtesy of BMW OF NORTH AMERICA, INC.

Release lock (1) on special tool 11 5 241.

Relieve tension on eccentric shaft at hexagon head in direction of arrow.

**IMPORTANT:** Inlet camshaft is pressed upwards by valve springs.  
Exhaust camshaft must lift off uniformly in upward direction.



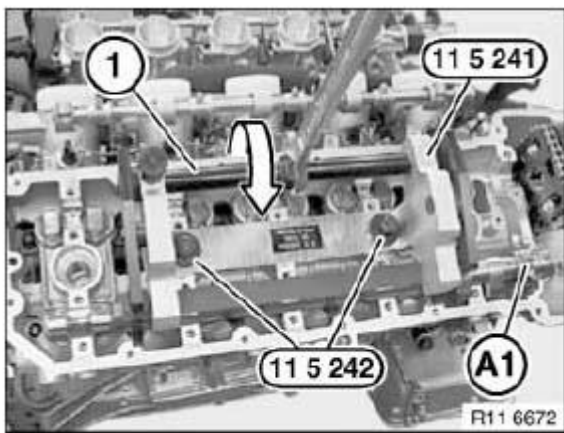
**Fig. 211: Relieving Tension On Eccentric Shaft At Hexagon Head (1 Of 2)**  
Courtesy of BMW OF NORTH AMERICA, INC.

Insert exhaust camshaft, cylinders 1-5.

Designation (A 2) on dihedron points upwards.

*Installation:*

Lubricate all bearing points with engine oil.



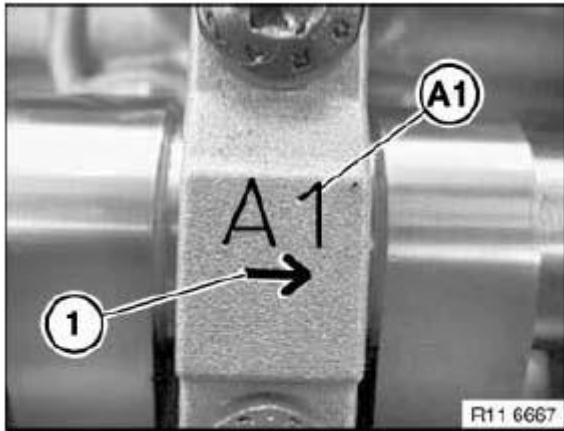
**Fig. 212: Relieving Tension On Eccentric Shaft At Hexagon Head (2 Of 2)**  
Courtesy of BMW OF NORTH AMERICA, INC.

*Installation:*

All bearing shells are assigned to one cylinder.

E and A from (1 to 10), e.g. A 1= exhaust side on 1st cylinder.

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

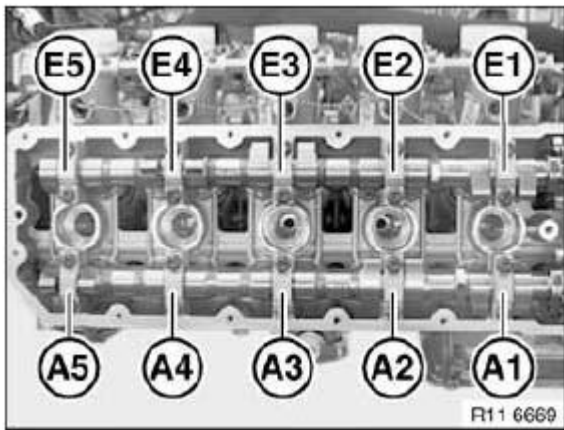


**Fig. 213: Identifying Designation (A1) On Dihedron**  
 Courtesy of BMW OF NORTH AMERICA, INC.

*Installation:*

Arrangement of bearing shells, cylinders 1 to 5.

**IMPORTANT: Mixing them up will result in increased wear - risk of damage!**



**Fig. 214: Identifying Installation Sequence Of Bearing Shells**  
 Courtesy of BMW OF NORTH AMERICA, INC.

Mount special tool 11 5 241 with special tool 11 5 242.

Pretension eccentric shaft (1) at hexagon head in direction of arrow.

**IMPORTANT: Exhaust camshaft is pressed upwards by valve springs.**

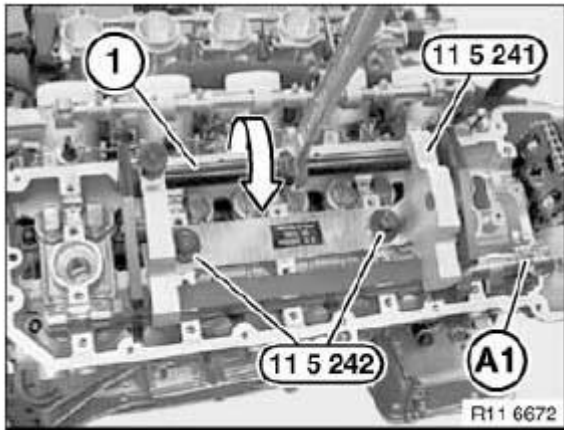
Lock must snap audibly into place.

Install all bearing caps by numbers.

Tightening torque 11 31 4AZ. See CAMSHAFT .

Adjust valve timing.

Assemble engine.



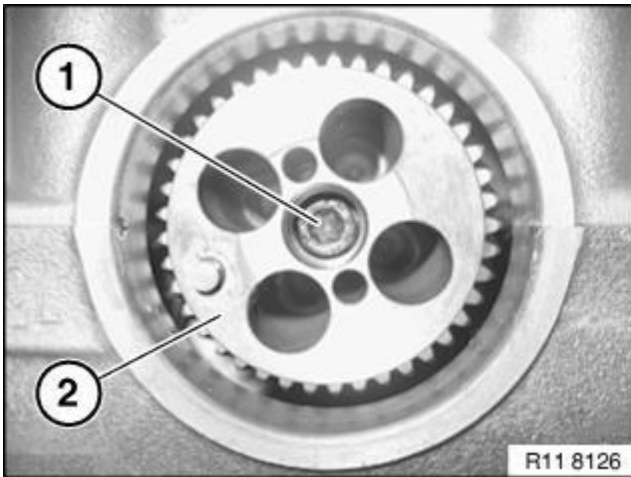
**Fig. 215: Pretensioning Eccentric Shaft At Hexagon Head**  
Courtesy of BMW OF NORTH AMERICA, INC.

#### 11 31 051 REPLACING BOTH TIMING CHAINS (S85)

Necessary preliminary tasks:

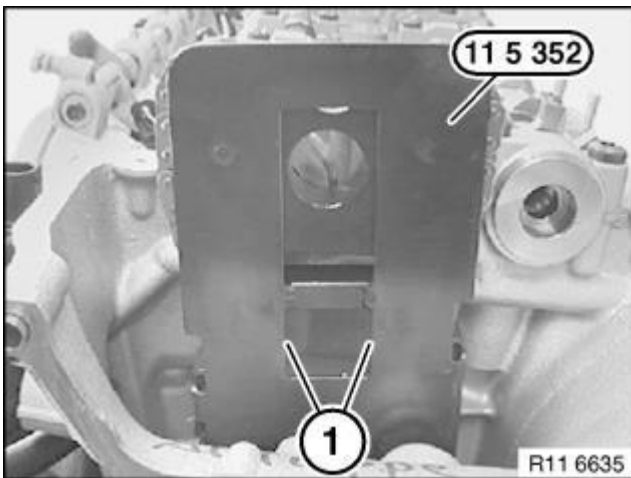
- Remove cylinder head cover on **left** and **right**.
- Remove **VANOS** gear.
- Remove **oil sump**.
- Remove **oil pump**.
- Remove **VANOS high-pressure pump**.
- Remove **vibration damper**.
- Remove **radial shaft seal at front**.

Release central screw (1). Remove gear (2) towards front.



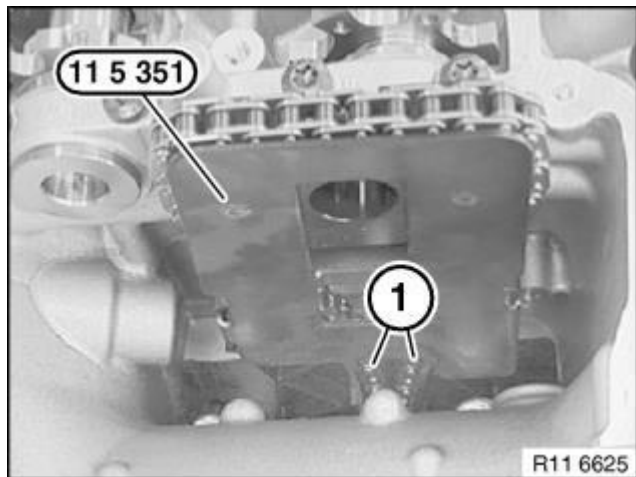
**Fig. 216: Remove Gear (2) Towards Front**  
Courtesy of BMW OF NORTH AMERICA, INC.

Remove special tool 11 5 352. Remove timing chain, cylinders 6 to 10, towards bottom.



**Fig. 217: Remove Special Tool 11 5 352 And Remove Timing Chain, Cylinders 6 To 10, Towards Bottom**  
Courtesy of BMW OF NORTH AMERICA, INC.

Remove special tool 11 5 351. Remove timing chain, cylinders 1 to 5, towards bottom.



**Fig. 218: Remove Special Tool 11 5 351 And Remove Timing Chain, Cylinders 1 To 5, Towards Bottom**  
 Courtesy of BMW OF NORTH AMERICA, INC.

**NOTE:** Check tensioning and slide rails for wear, replace if necessary. Assemble engine.

#### 11 31 072 CHECKING CAMSHAFT TIMING (S85)

##### Special tools required:

- 11 5 301
- 11 5 302
- 11 5 320

**IMPORTANT:** Do not crank engine in reverse direction.  
 Crank engine forward in clockwise direction only.  
 Risk of damage to VANOS gears.

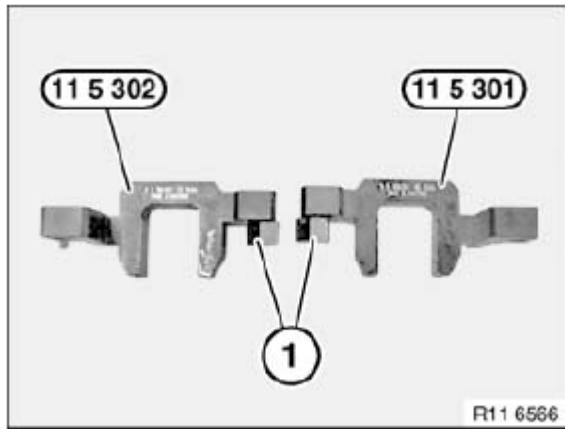
##### *Necessary preliminary tasks:*

- Remove fan cowl with electronic fan. See 17 11 035 REMOVING AND INSTALLING/REPLACING FAN COWL WITH ELECTRIC FAN (M5) or 17 11 035 REMOVING AND INSTALLING/REPLACING FAN COWL WITH ELECTRIC FAN (M6) .
- Remove left cylinder head cover.
- Remove right cylinder head cover.
- Remove all spark plugs. See 12 12 011 REPLACING ALL SPARK PLUGS (S85) .

**NOTE:** Prepare special tools.

Screw (1) acts as a spacer and is only used to check the timing.

Insert screw (1) in special tools 11 5 301 / E 1-5 and 11 5 302 / E 6-10.

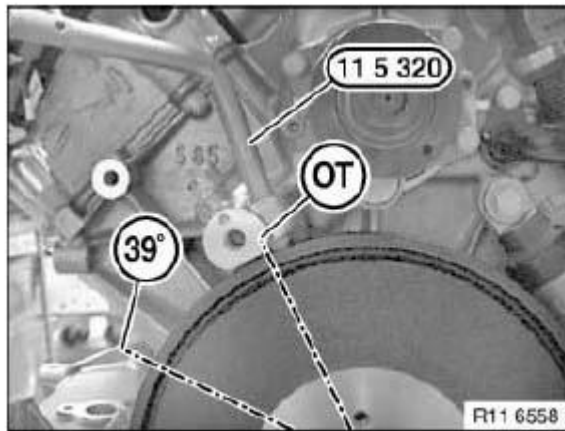


**Fig. 219: Identifying Special Tools 11 5 301 And 11 5 302**  
 Courtesy of BMW OF NORTH AMERICA, INC.

**IMPORTANT:** In 1st cylinder firing TDC position only the inlet camshafts of cylinders 1-5 and 6-10 can be checked.  
 In the 39° position only the exhaust camshafts of cylinders 1-5 and 6-10 can be checked.

Crank engine at central bolt until 1st cylinder firing TDC position appears on vibration damper.

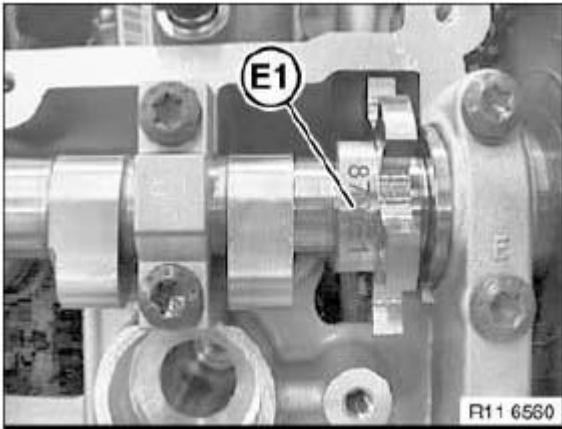
Secure vibration damper in position with special tool 11 5 320.



**Fig. 220: Identifying Special Tool 11 5 320**  
 Courtesy of BMW OF NORTH AMERICA, INC.

In camshaft position for cylinders 1-5, the designation E1 must be able to be read on the dihedron.

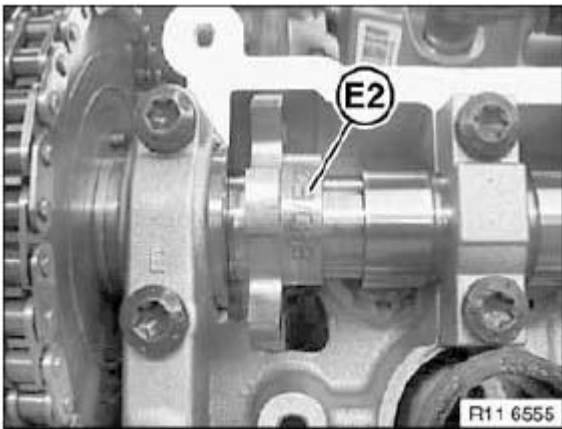
If necessary, crank engine at central bolt.



**Fig. 221: Identifying Designation (E1) On Dihedron**  
 Courtesy of BMW OF NORTH AMERICA, INC.

In camshaft position for cylinders 6-10, the designation E2 must be able to be read on the dihedron.

If necessary, crank engine at central bolt.



**Fig. 222: Identifying Designation (E2) On Dihedron**  
 Courtesy of BMW OF NORTH AMERICA, INC.

Position of camshaft in 1st cylinder firing TDC position.

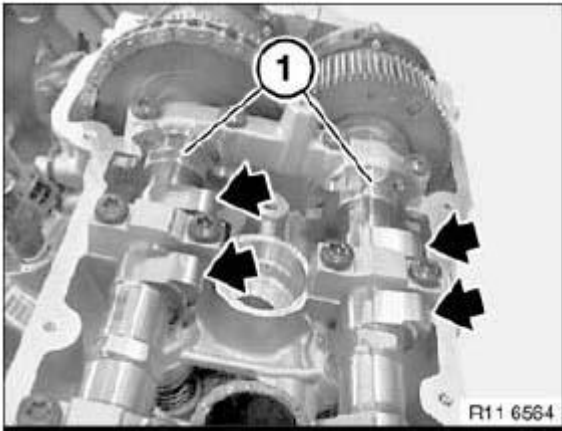
The cams at the 1st cylinder on the inlet camshaft point upwards at an angle.

The cams at the 1st cylinder on the exhaust camshaft point to the exhaust side at an angle.

Designation E1 must be legible on dihedron (1).

Designation A1 is only legible from above in the 39° position.





**Fig. 223: Locating Cams At 1st Cylinder On Inlet Camshaft**  
 Courtesy of BMW OF NORTH AMERICA, INC.

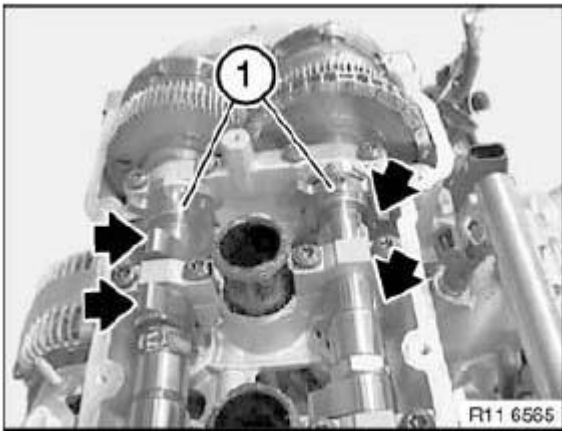
Position of camshaft firing TDC position 1st cylinder at cylinder 6-10.

The cams at the 6th cylinder of the inlet camshaft point downwards and open the engine valves.

The cams at the 6th cylinder of the exhaust camshaft point upwards at an angle.

Designation E2 must be legible on the dihedron (1).

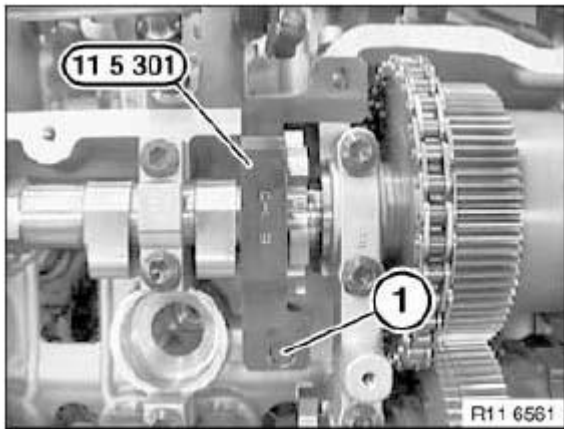
Designation A2 is only legible from above in the 39° position.



**Fig. 224: Locating Cams At 6th Cylinder Of Exhaust Camshaft**  
 Courtesy of BMW OF NORTH AMERICA, INC.

Attach special tool 11 5 301 E 1-5 with bolt (1) to inlet camshaft, 1st cylinder, at dihedron.

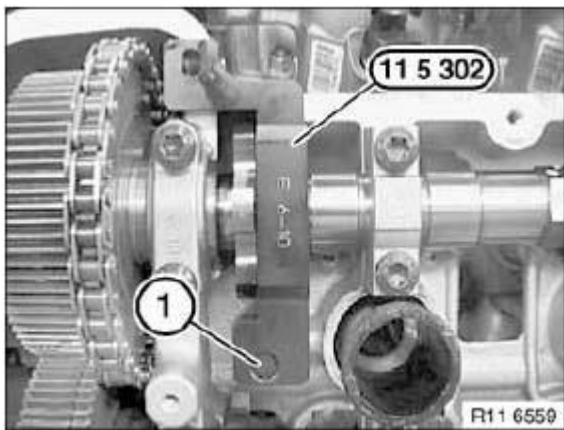
**NOTE:** The timing is correctly adjusted when special tools 11 5 301 and 11 5 302 rest flat on the cylinder head or protrude by up to 1.5 mm to the inlet and exhaust sides.



**Fig. 225: Identifying Special Tool 11 5 301**  
Courtesy of BMW OF NORTH AMERICA, INC.

Attach special tool 11 5 302 E 6-10 with bolt (1) to inlet camshaft, 6th cylinder, at dihedron.

**NOTE:** The timing is correctly adjusted when special tools 11 5 301 and 11 5 302 rest flat on the cylinder head or protrude by up to 1.5 mm to the inlet and exhaust sides.

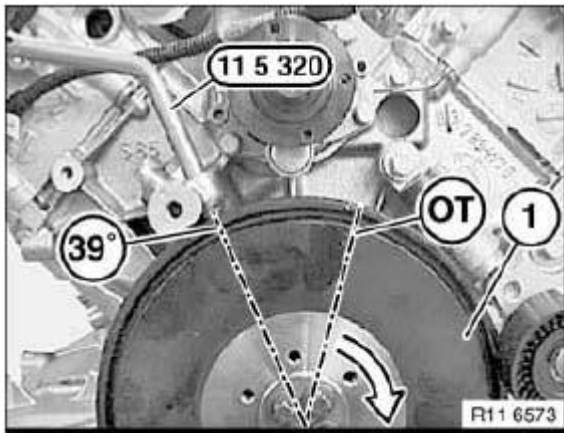


**Fig. 226: Identifying Special Tool 11 5 302**  
Courtesy of BMW OF NORTH AMERICA, INC.

**IMPORTANT:** In the 39° position only the exhaust camshafts of cylinders 1-5 and 6-10 can be checked.  
Remove all special tools.

Crank engine at central bolt.

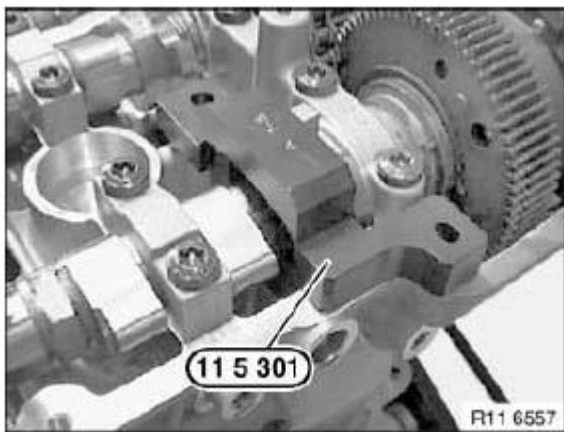
Secure special tool 11 5 320 to vibration damper (1) in the 39° position.



**Fig. 227: Identifying Special Tool 11 5 320 And Vibration Damper**  
 Courtesy of BMW OF NORTH AMERICA, INC.

Attach special tool 11 5 301 (A 1-5) to dihedron of exhaust camshaft, 1st cylinder.

**NOTE:** The timing is correctly adjusted when special tools 11 5 301 and 11 5 302 rest flat on the cylinder head or protrude by up to 1.5 mm to the inlet and exhaust sides.



**Fig. 228: Identifying Special Tool 11 5 301**  
 Courtesy of BMW OF NORTH AMERICA, INC.

Attach special tool 11 5 302 (A 6-10) to dihedron of exhaust camshaft, 6th cylinder.

**NOTE:** The timing is correctly adjusted when special tools 11 5 301 and 11 5 302 rest flat on the cylinder head or protrude by up to 1.5 mm to the inlet and exhaust sides.



**Fig. 229: Identifying Special Tool 11 5 302**  
Courtesy of BMW OF NORTH AMERICA, INC.

Remove all special tools.

Assemble engine in reverse sequence to its disassembly.

### **11 31 094 REMOVING AND INSTALLING / REPLACING LEFT HYDRAULIC CHAIN TENSIONER (S85)**

*Necessary preliminary tasks:*

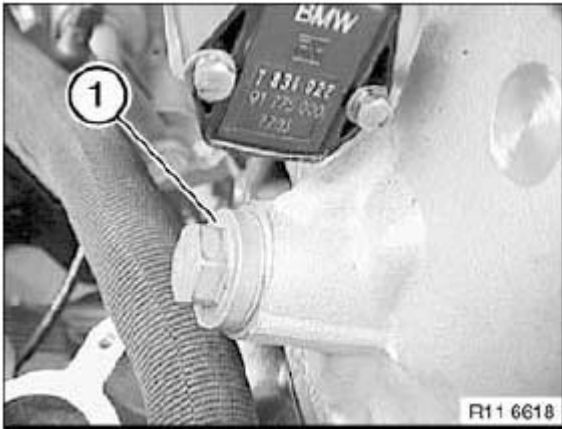
- Remove **LEFT INTAKE FILTER HOUSING (S85)** .
- Remove **intake air manifold**.
- Unfasten **WIRING HARNESS SECTION FOR ENGINE** and lay to one side.

Release chain tensioner (1).

*Installation:*

Replace sealing ring.

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



**Fig. 230: Identifying Chain Tensioner**

Courtesy of BMW OF NORTH AMERICA, INC.

Assemble engine.

### **11 31 095 REMOVING AND INSTALLING / REPLACING RIGHT HYDRAULIC CHAIN TENSIONER (S85)**

*Necessary preliminary tasks:*

- Remove air cleaner housing on right. See **13 71 020 REMOVING AND INSTALLING RIGHT INTAKE FILTER HOUSING (S85)** .

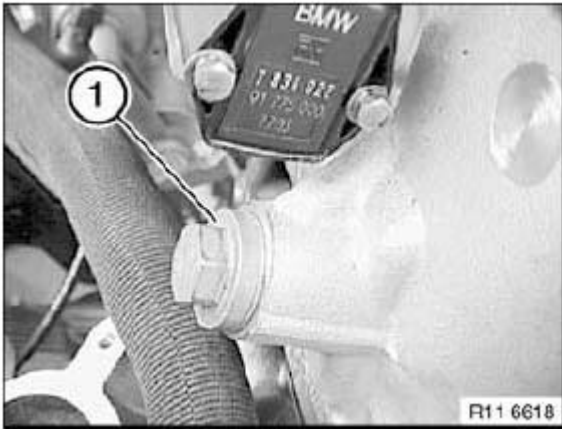
Release chain tensioner (1).

*Installation:*

Replace sealing ring.

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

**NOTE:**        **Illustration shows cylinders 6-10.**



**Fig. 231: Identifying Chain Tensioner**  
Courtesy of BMW OF NORTH AMERICA, INC.

Assemble engine.

### 11 31 575 ADJUSTING CAMSHAFT TIMING (S85)

#### Special tools required:

- 11 3 302
- 11 5 100
- 11 5 301
- 11 5 302
- 11 5 320

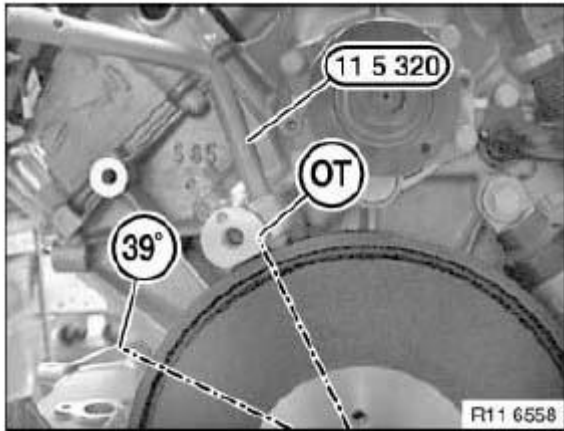
**IMPORTANT:** Do not crank engine in reverse direction.  
Crank engine forward in clockwise direction only.  
Risk of damage to VANOS gears.

#### *Necessary preliminary tasks:*

- Remove left VANOS adjustment unit.
- Remove right VANOS adjustment unit.

**IMPORTANT:** Both inlet and exhaust camshafts can be adjusted in the 1st cylinder firing TDC position.  
The procedure for checking timing is different from that for adjusting.

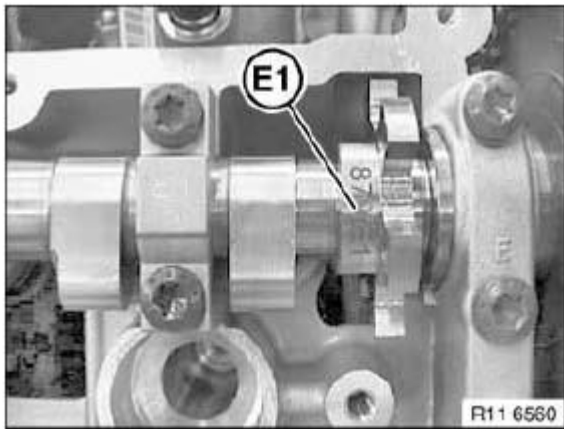
Secure special tool 115 320 to vibration damper in 1st cylinder firing TDC position.



**Fig. 232: Identifying Special Tool 115 320**  
Courtesy of BMW OF NORTH AMERICA, INC.

Position of inlet camshaft, cylinders 1-5.

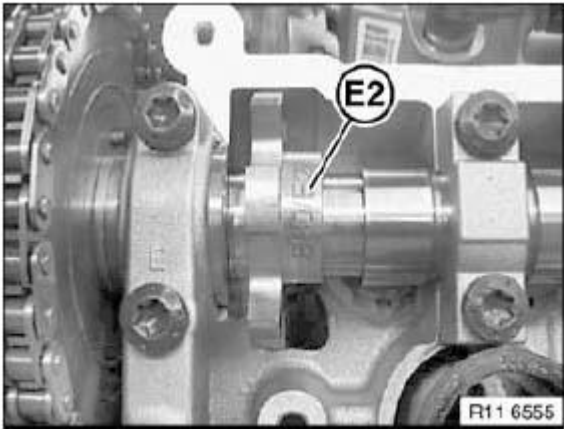
Designation (E1) on dihedron points upwards.



**Fig. 233: Identifying Designation (E1) On Dihedron Points Upwards**  
Courtesy of BMW OF NORTH AMERICA, INC.

Position of inlet camshaft, cylinders 6-10.

Designation (E2) on dihedron points upwards.

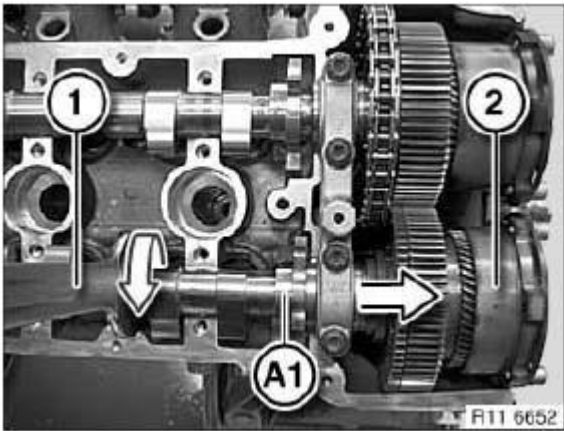


**Fig. 234: Identifying Designation (E2) On Dihedron Points Upwards**  
 Courtesy of BMW OF NORTH AMERICA, INC.

Rotate exhaust camshaft with open-end wrench (1) at hexagon head in direction of arrow until special tool A 11 5 301 can be attached.

Designation (A1) on dihedral points upwards.

**NOTE:** Exhaust VANOS gear (2) adjusted in direction of arrow (advance).



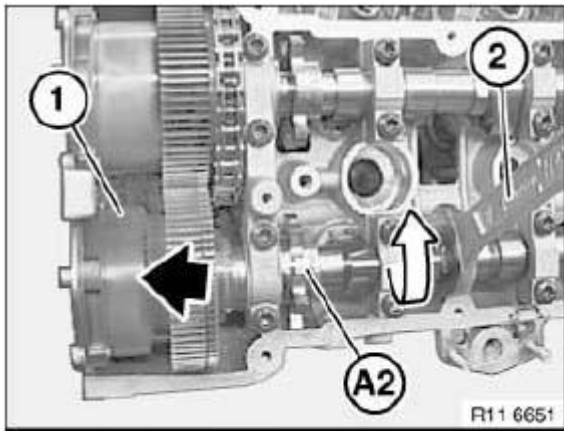
**Fig. 235: Rotating Exhaust Camshaft With Open-End Wrench**  
 Courtesy of BMW OF NORTH AMERICA, INC.

Rotate exhaust camshaft at hexagon head with an open-end wrench (2) in direction of arrow until special tool A 11 3 302 can be attached.

Designation (A2) on dihedral points upwards.

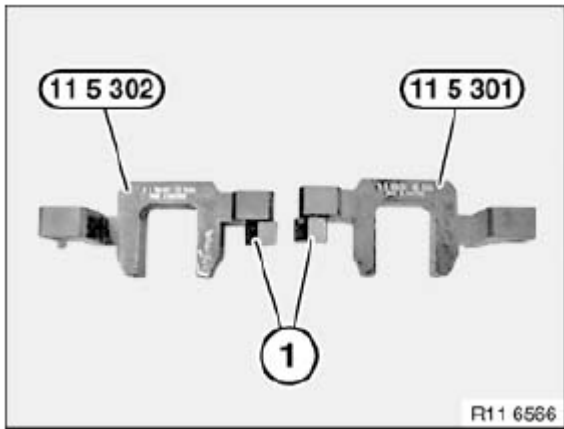
**NOTE:** Exhaust VANOS gear (1) adjusted in direction of arrow (advance).





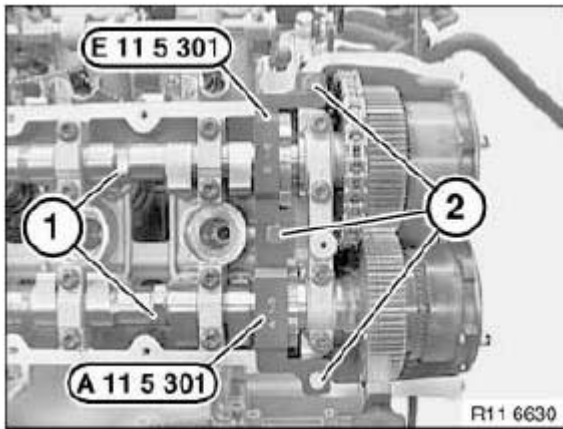
**Fig. 236: Rotating Exhaust Camshaft At Hexagon Head**  
Courtesy of BMW OF NORTH AMERICA, INC.

Remove spacers (1) from special tools E 11 5 301 and E 11 5 302.



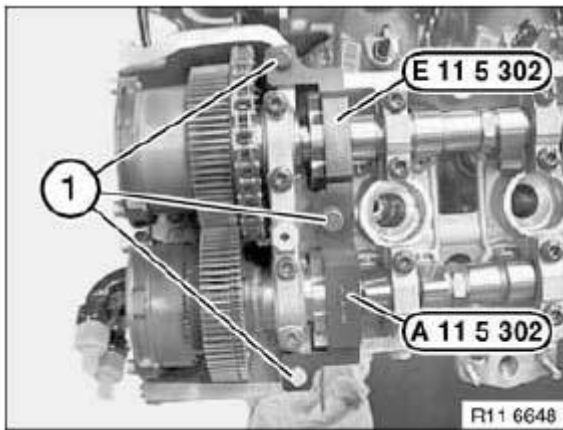
**Fig. 237: Identifying Spacers, Special Tools E 11 5 301 And A 11 5 302**  
Courtesy of BMW OF NORTH AMERICA, INC.

Attach cylinder (1-5) special tools A 11 5 301 and E 11 5 301, secure with bolts (2).



**Fig. 238: Identifying Special Tools A 11 5 301 And E 11 5 301**  
 Courtesy of BMW OF NORTH AMERICA, INC.

Attach cylinder (6-10) special tools A 11 5 302 and E 11 5 302, secure with bolts (1).



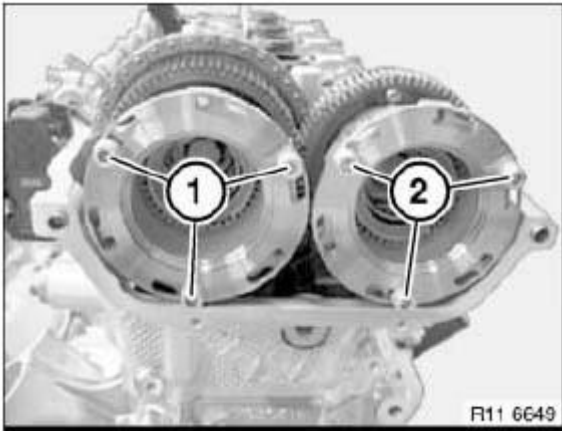
**Fig. 239: Identifying Special Tools A 11 5 302 And E 11 5 302**  
 Courtesy of BMW OF NORTH AMERICA, INC.

Release all hexagon socket screws with washers (1 and 2), cylinders 1-5 and 6-10.

*Installation:*

Replace hexagon socket screws with washers (1 and 2).

**NOTE:** Illustration shows cyl. 6-10.



**Fig. 240: Identifying Washers**

Courtesy of BMW OF NORTH AMERICA, INC.

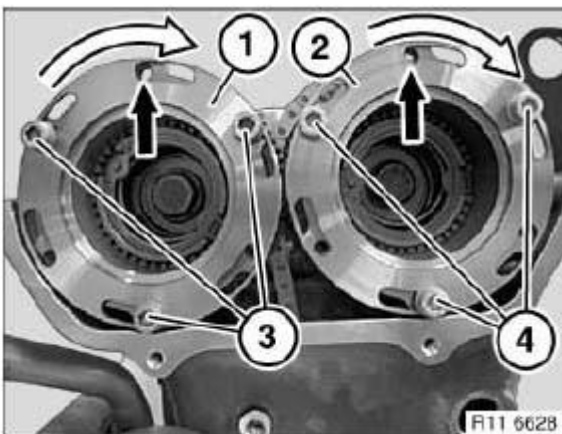
**IMPORTANT: Do not release central bolt, cyl. 1-5.**

Pull VANOS gear with outer sleeve forwards until inner sleeves (1 and 2) with elongated holes are at left stop.

Join hexagon socket screws with washers (3 and 4) to 5 Nm.

*Installation:*

Release hexagon socket screws with washers again through 90°.



**Fig. 241: Pulling VANOS Gear With Outer Sleeve Forwards (1 Of 2)**

Courtesy of BMW OF NORTH AMERICA, INC.

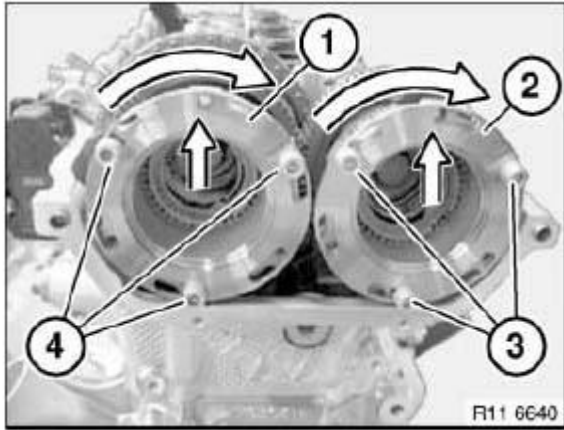
**IMPORTANT: Do not release central bolt, cyl. 6-10.**

Pull VANOS gear with outer sleeve forwards until inner sleeves (1 and 2) with elongated holes are at left stop.

Join hexagon socket screws with washers (3 and 4) to 5 Nm.

*Installation:*

Release hexagon socket screws with washers again through 90°.



**Fig. 242: Pulling VANOS Gear With Outer Sleeve Forwards (2 Of 2)**  
 Courtesy of BMW OF NORTH AMERICA, INC.

*Installation:*

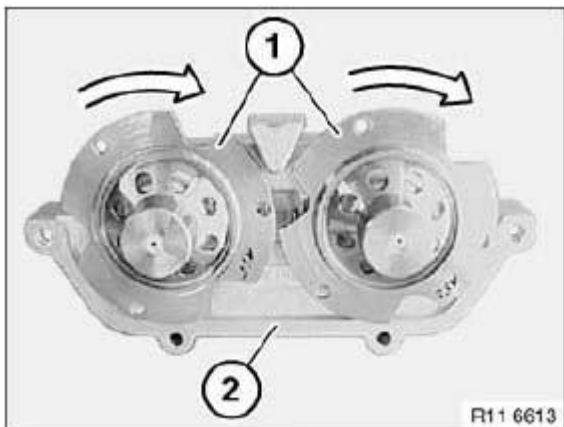
Both thrust bearing plates (1) on the VANOS adjustment unit can be rotated.

Both thrust bearing plates (1) must be retracted.

Clean sealing surfaces.

*Installation:*

Replace seal.



**Fig. 243: Identifying Thrust Bearing Plates**

Courtesy of BMW OF NORTH AMERICA, INC.

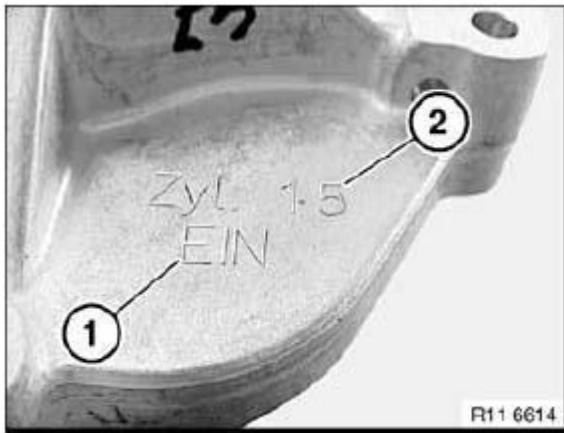
*Installation:*

VANOS adjustment units are marked to avoid being mixed up.

The lettering EIN (1) must point to the inlet camshaft.

Cylinder assignment (2), cyl. 1-5.

**IMPORTANT: Risk of mixing up parts!**

**Fig. 244: Identifying Lettering EIN On Inlet Camshaft (1 Of 2)**

Courtesy of BMW OF NORTH AMERICA, INC.

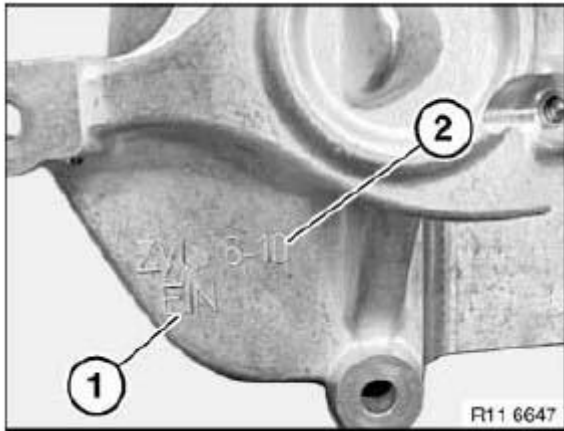
*Installation:*

VANOS adjustment units are marked to avoid being mixed up.

The lettering EIN (1) must point to the inlet camshaft.

Cylinder assignment (2), cyl. 6-10.

**IMPORTANT: Risk of mixing up parts!**



**Fig. 245: Identifying Lettering EIN On Inlet Camshaft (2 Of 2)**  
 Courtesy of BMW OF NORTH AMERICA, INC.

Insert seal.

Position VANOS adjustment unit (4) with both outer bolts (1).

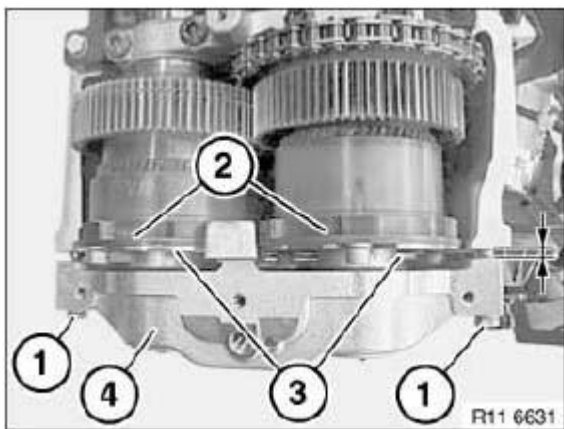
Both VANOS gears (2) are extended.

Align thrust bearing plates (3).

Push VANOS adjustment unit (4) forwards until thrust bearing plates (3) rest against VANOS gears (2).

*Installation:*

There is a visible gap of approx. 8 mm between VANOS adjustment unit and cylinder head.



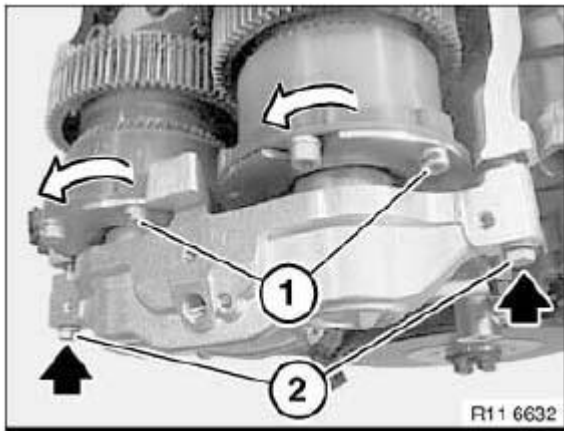
**Fig. 246: Identifying VANOS Adjustment Unit, Thrust Bearing Plates And VANOS Gears**  
 Courtesy of BMW OF NORTH AMERICA, INC.

Insert hexagon socket screws without washers (1) and join.

Release hexagon socket screws without washers (1) through 90° again.

**IMPORTANT: All hexagon socket screws with and without washers must be released through 90°.**

Screw in bolts (2) of VANOS adjustment unit uniformly in 1/2 turns.



**Fig. 247: Locating VANOS Adjustment Unit Bolts**  
Courtesy of BMW OF NORTH AMERICA, INC.

*Installation:*

Both outer sleeves rotate clockwise and retract approx. 8 mm.

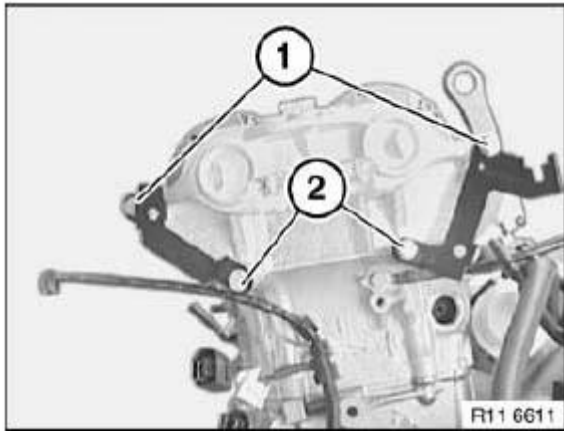
Both inner sleeves with elongated hole must rotate counterclockwise (see arrow).

**The procedure is identical for cylinders 1-5 and 6-10.**

*Installation:*

Check seal for correct seating.

Secure VANOS adjustment unit with screws (1 and 2).

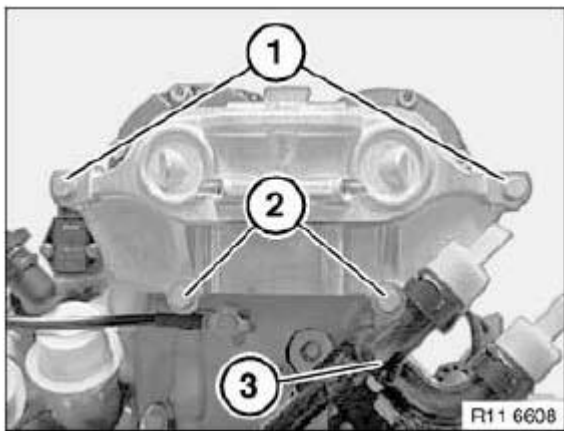


**Fig. 248: Identifying VANOS Adjustment Unit Screws (1 Of 2)**  
Courtesy of BMW OF NORTH AMERICA, INC.

*Installation:*

Check seal for correct seating.

Secure VANOS adjustment unit with screws (1 and 2).



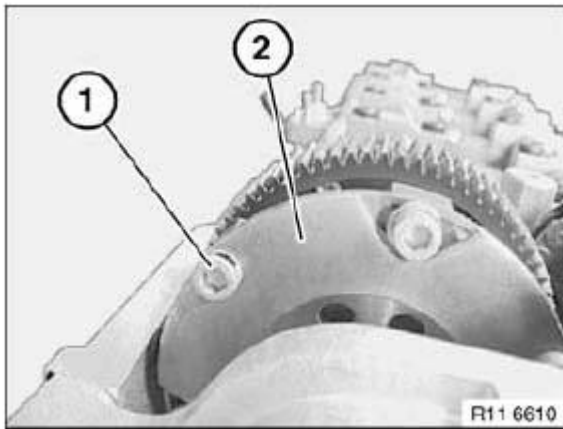
**Fig. 249: Identifying VANOS Adjustment Unit Screws (2 Of 2)**  
Courtesy of BMW OF NORTH AMERICA, INC.

Tighten down accessible hexagon socket screws of all camshafts at cylinders 1-5 and 6-10 with and without washers to **10 Nm**.

*Installation:*

Mark all screws which are already tightened down with a colored dot.





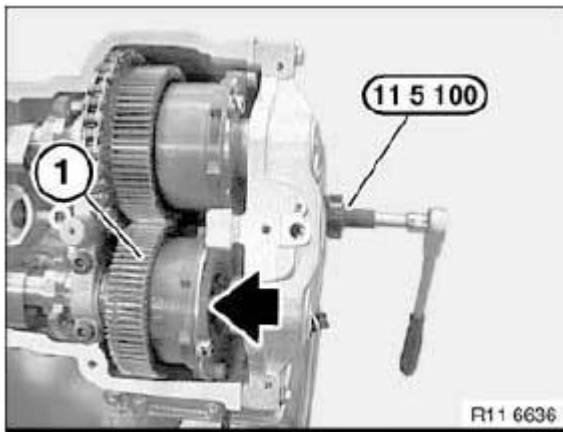
**Fig. 250: Identifying Hexagon Socket Screws**  
Courtesy of BMW OF NORTH AMERICA, INC.

**IMPORTANT: Remove all special tools - risk of damage!**

Continue cranking engine at central bolt or with special tool 11 5 100 **120° cms** until further hexagon socket screws with and without washers can be inserted on the VANOS gear and tighten down to **10 Nm**.

**NOTE:** First both the inlet camshafts are moved when the engine is cranked.

Both exhaust VANOS gears are moved in the direction of the arrow (retard stop).



**Fig. 251: Identifying Special Tool 11 5 100**  
Courtesy of BMW OF NORTH AMERICA, INC.

Check timing.

Assemble engine.

### 33 ROCKER ARM WITH BEARING MOUNT

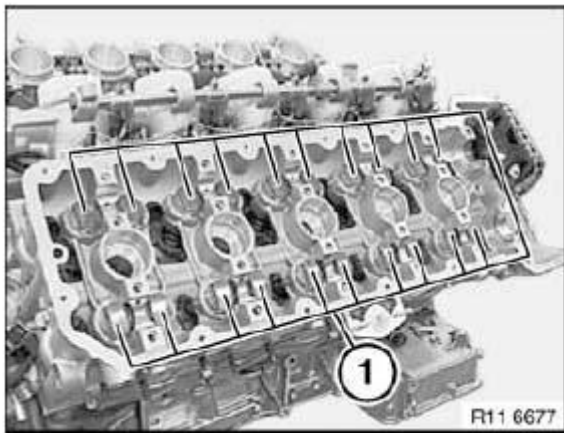
**11 33 062 REMOVING AND INSTALLING / REPLACING ALL HVCA (HYDRAULIC VALVE CLEARANCE ADJUSTMENT) ELEMENTS (S85)**

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

*Necessary preliminary tasks:*

- Remove left inlet camshaft and Right Inlet Camshaft.
- Remove exhaust camshaft. See 11 31 036 Removing And Installing / Replacing Left Exhaust Camshaft (S85) and 11 31 038 Removing And Installing / Replacing Right Exhaust Camshaft (S85)

Set HVCA elements (1) down in a clean and orderly manner.

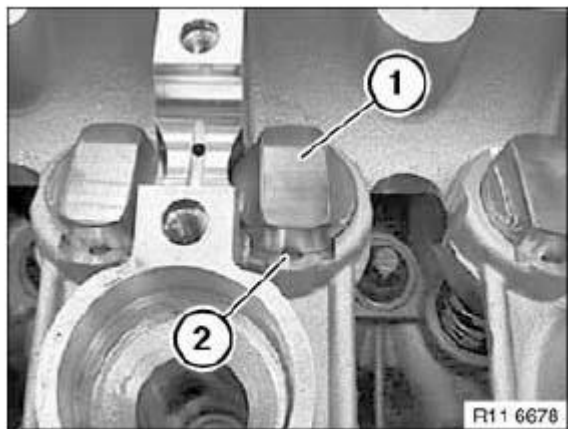


**Fig. 252: Identifying HVCA Elements**  
Courtesy of BMW OF NORTH AMERICA, INC.

Remove HVCA element (1) in upward direction.

*Installation:*

Turning lock (2) on cylinder head.

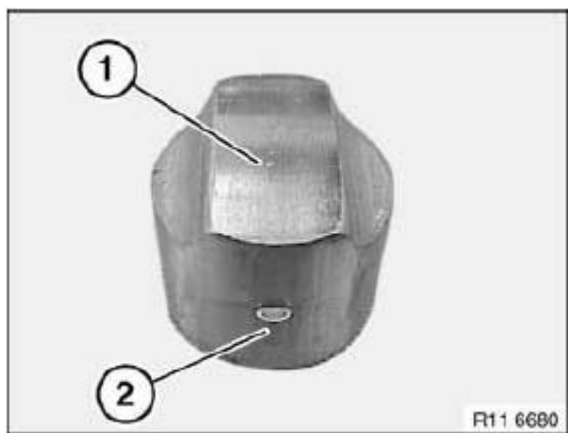


**Fig. 253: Identifying HVCA Elements And Lock**  
Courtesy of BMW OF NORTH AMERICA, INC.

Check surface (1) of HVCA element for damage.

*Installation:*

Turning lock (2) on HVCA element.

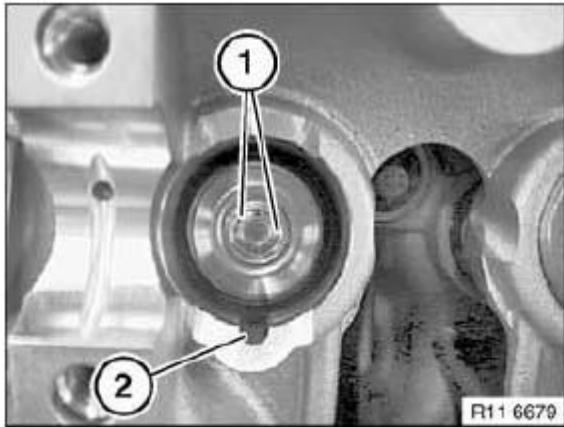


**Fig. 254: Identifying Surface Of HVCA Element**  
Courtesy of BMW OF NORTH AMERICA, INC.

*Installation:*

Check valve keys (1) for correct seating.

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



**Fig. 255: Identifying Valve Keys And Lock**  
Courtesy of BMW OF NORTH AMERICA, INC.

Assemble engine.

## 34 VALVES WITH SPRINGS

### 11 34 552 REMOVING AND INSTALLING / REPLACING ALL VALVES (S85)

Special tools required:

- 11 5 281
- 11 5 282
- 11 5 283
- 11 9 001
- 11 9 006
- 11 9 008
- 11 9 009

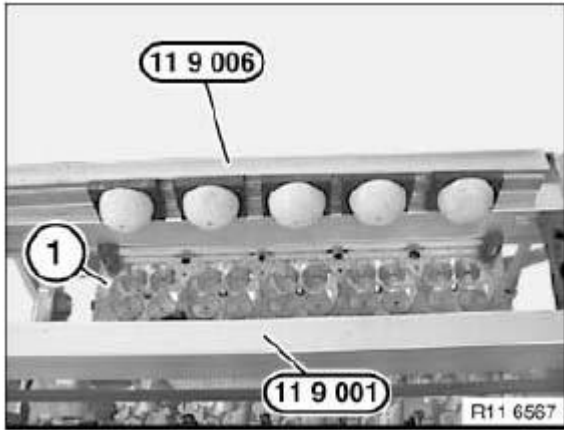
**IMPORTANT: Risk of damage to cylinder head.**  
**Use only the approved special tools.**  
**Plastic rings on the special tools must not be damaged.**

*Necessary preliminary tasks:*

- Remove intake air manifold.
- Remove cylinder head cover on left and right.
- Remove cylinder head on left or right. See 11 12 105 Removing And Installing Left Cylinder Head (S85) or 11 12 106 Removing And Installing Right Cylinder Head (S85).
- Remove all spark plugs. See 12 12 011 REPLACING ALL SPARK PLUGS (S85) .
- If necessary, remove and install engine.

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

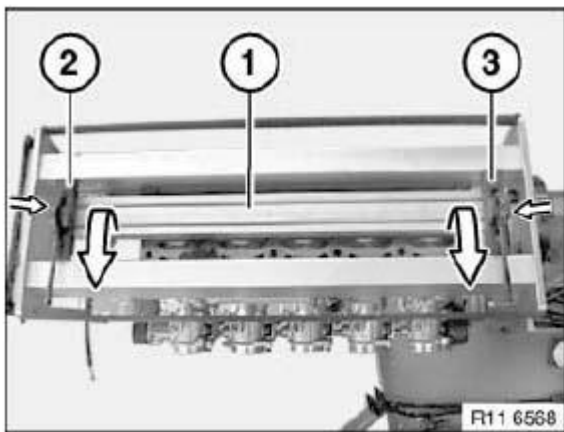
Prepare special tool 11 9 006 with special tool 11 9 008.



**Fig. 256: Identifying Special Tool 11 9 006, 11 9 008 And Cylinder Head**  
Courtesy of BMW OF NORTH AMERICA, INC.

Insert aluminum profile rail (1) and align.

Secure eccentric clamping levers (2 and 3).

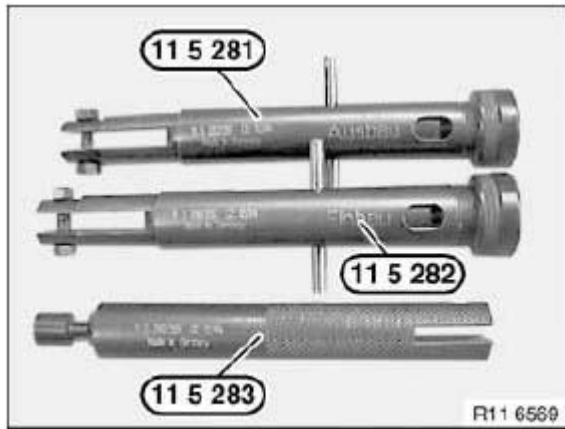


**Fig. 257: Inserting Aluminum Profile Rail**  
Courtesy of BMW OF NORTH AMERICA, INC.

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

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

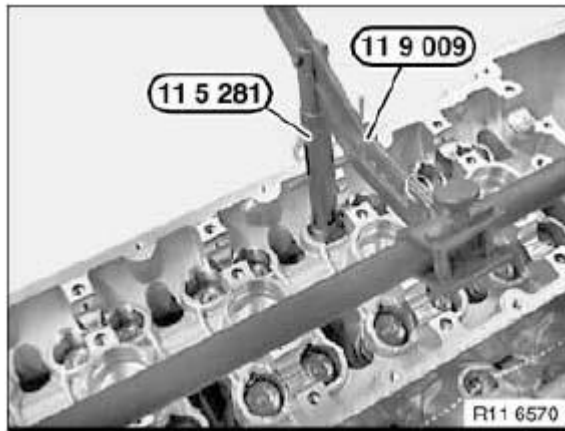
Special tool 11 5 283 for **securing** valve keys.



**Fig. 258: Identifying Special Tool 11 5 281, 11 5 282 And 11 5 283**  
Courtesy of BMW OF NORTH AMERICA, INC.

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

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



**Fig. 259: Identifying Special Tool 11 9 009 And 11 5 281**  
Courtesy of BMW OF NORTH AMERICA, INC.

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

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

Pretension lever (1) in direction of arrow.

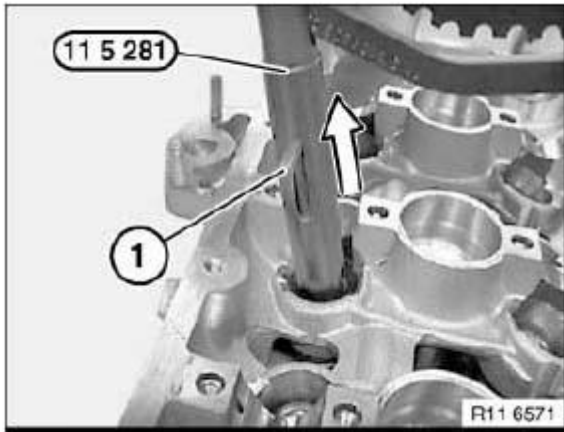
Release lever (1) in tensioned position.

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

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

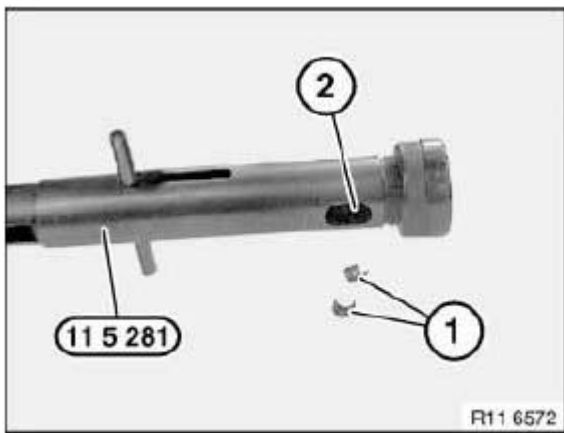
Pull back lever on special tool 11 5 281.

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



**Fig. 260: Pretensioning Lever**

Courtesy of BMW OF NORTH AMERICA, INC.



**Fig. 261: Identifying Valve Keys And Working Chamber**

Courtesy of BMW OF NORTH AMERICA, INC.

Remove special tool 11 9 006.

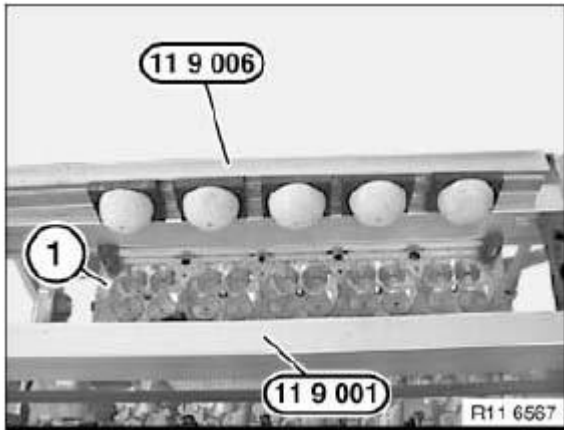
All the engine valves are now accessible.

*Installation:*

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

Check valve seat for damage.

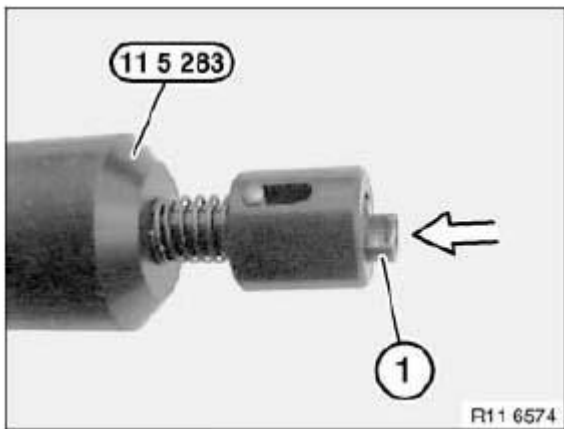
**IMPORTANT:** The cylinder head must be replaced if the valve seat is damaged.  
Remachining the valve seat ring is not permitted.



**Fig. 262: Identifying Special Tool 11 9 006 And Cylinder Head**  
Courtesy of BMW OF NORTH AMERICA, INC.

**IMPORTANT:** Use only special tool 11 5 282 to install the valve keys - risk of damage!

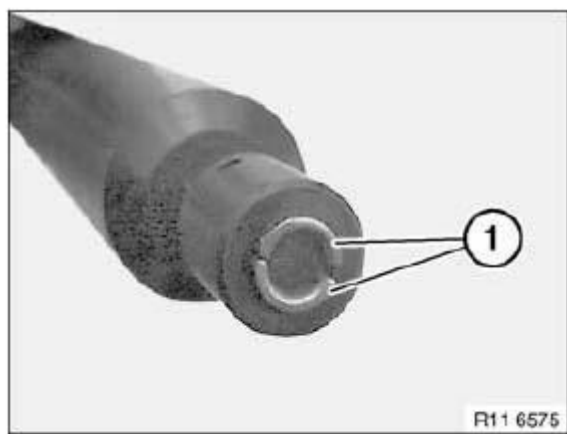
Press valve key (1) in direction of arrow into special tool 11 5 283.



**Fig. 263: Pressing Valve Key Into Special Tool 11 5 283**  
Courtesy of BMW OF NORTH AMERICA, INC.

Secure valve keys (1).

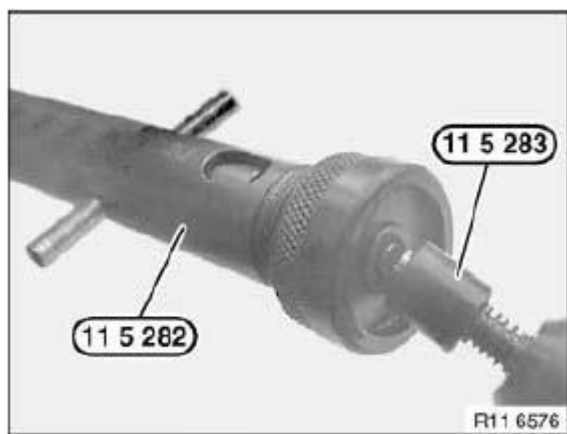




**Fig. 264: Identifying Valve Keys**

Courtesy of BMW OF NORTH AMERICA, INC.

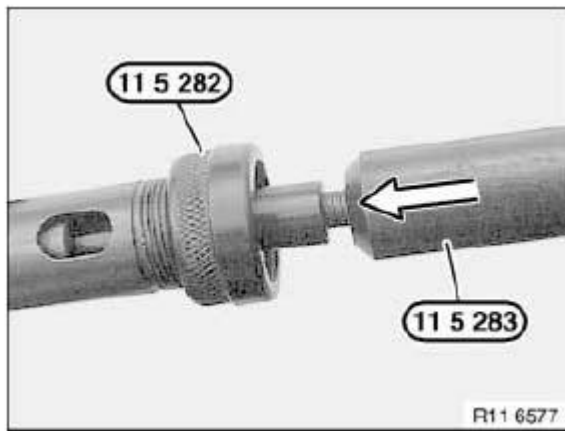
Press valve keys into special tool 11 5 282 with special tool 11 5 283.



**Fig. 265: Identifying Special Tool 11 5 282 And 11 5 283**

Courtesy of BMW OF NORTH AMERICA, INC.

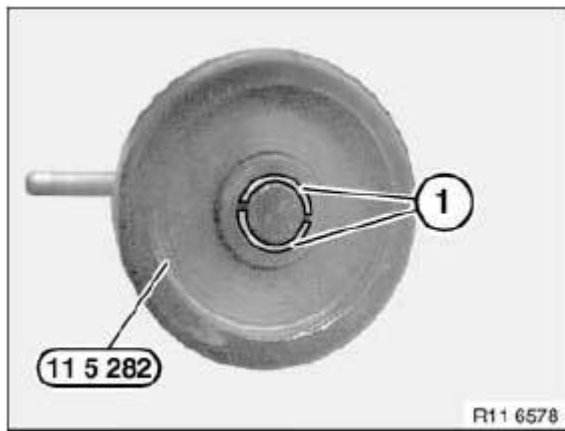
Press valve keys in direction of arrow into special tool 11 5 282 with special tool 11 5 283.



**Fig. 266: Pressing Valve Keys Into Special Tool 11 5 282 With Special Tool 11 5 283**  
Courtesy of BMW OF NORTH AMERICA, INC.

Make sure valve keys (1) are correctly positioned.

Special tool 11 5 282 is prepared.



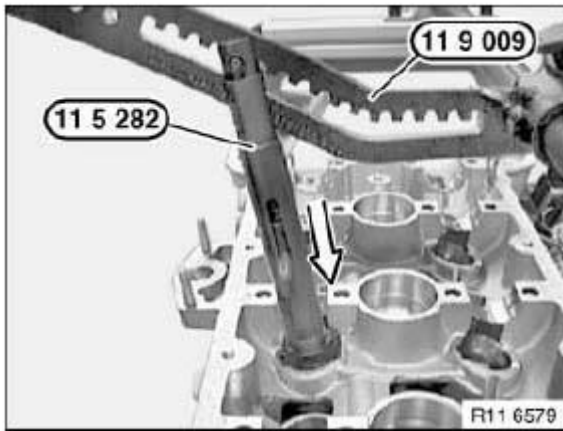
**Fig. 267: Identifying Valve Keys And Special Tool 11 5 282**  
Courtesy of BMW OF NORTH AMERICA, INC.

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

*Installation:*

Both valve keys are now pressed into their initial positions.

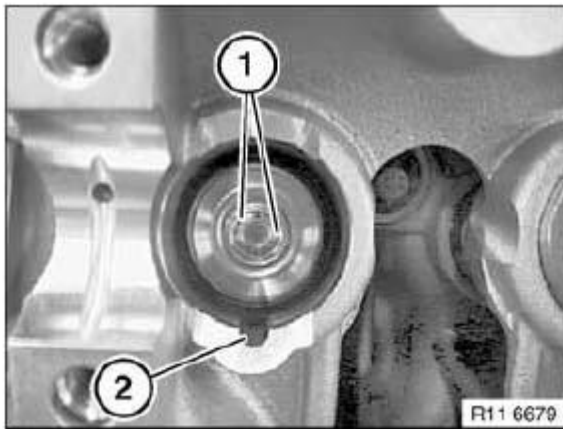
Check that valve keys are in correct installation position.



**Fig. 268: Pressing Down Special Tool 11 5 282 With Special Tool 11 9 009**  
 Courtesy of BMW OF NORTH AMERICA, INC.

*Installation:*

Check that valve keys are in correct installation position.



**Fig. 269: Identifying Valve Keys**  
 Courtesy of BMW OF NORTH AMERICA, INC.

Assemble engine.

**11 34 560 REPLACING ALL VALVE STEM SEALS (S85)**

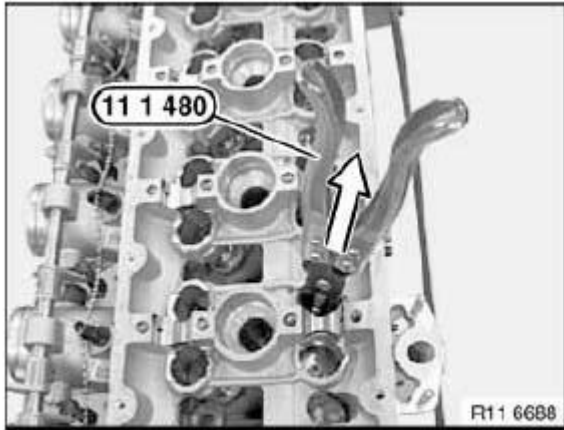
**Special tools required:**

- 11 1 480
- 11 5 270

*Necessary preliminary tasks:*

- Remove cylinder head. See **11 12 105 Removing And Installing Left Cylinder Head (S85)** or **11 12 106 Removing And Installing Right Cylinder Head (S85)**.
- Remove all valve springs.

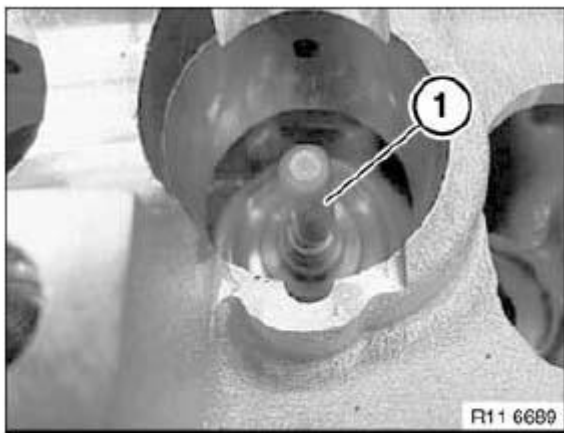
Remove valve stem seal with special tool 11 1 480 in direction of arrow.



**Fig. 270: Removing Valve Stem Seal With Special Tool 11 1 480**  
Courtesy of BMW OF NORTH AMERICA, INC.

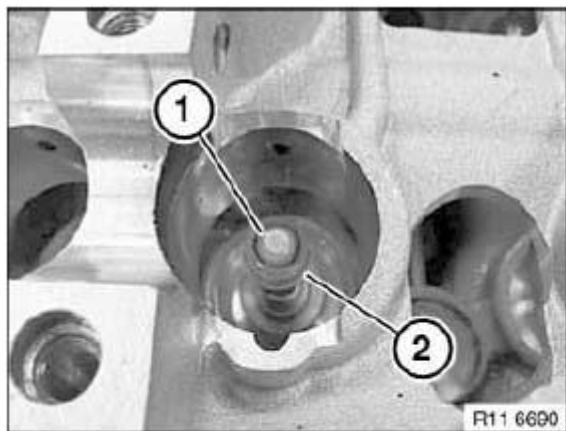
*Installation:*

Attach the mounting sleeve (1) supplied with the new part to the valve stem.



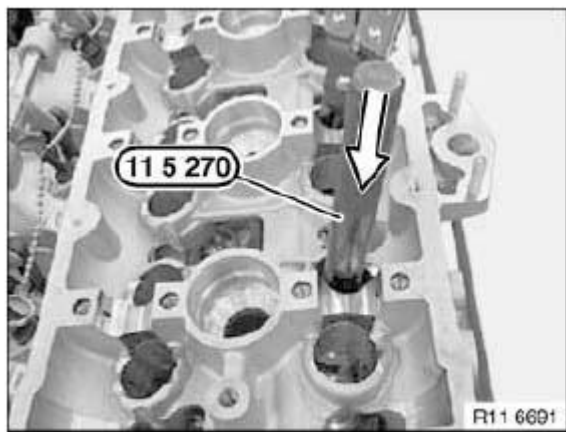
**Fig. 271: Identifying Mounting Sleeve**  
Courtesy of BMW OF NORTH AMERICA, INC.

Attach valve stem seal (2) over mounting sleeve (1).



**Fig. 272: Identifying Valve Stem Seal And Mounting Sleeve**  
Courtesy of BMW OF NORTH AMERICA, INC.

Press on valve stem seal with special tool 11 5 270 in direction of arrow as far as it will go.



**Fig. 273: Pressing On Valve Stem Seal With Special Tool 11 5 270**  
Courtesy of BMW OF NORTH AMERICA, INC.

Assemble engine.

### 11 34 715 REPLACING ALL VALVE SPRINGS (S85)

#### Special tools required:

- 11 5 281
- 11 5 282
- 11 5 283
- 11 9 001
- 11 9 006
- 11 9 008

- 11 9 009

**IMPORTANT:** Risk of damage to cylinder head.

Use only the approved special tools.

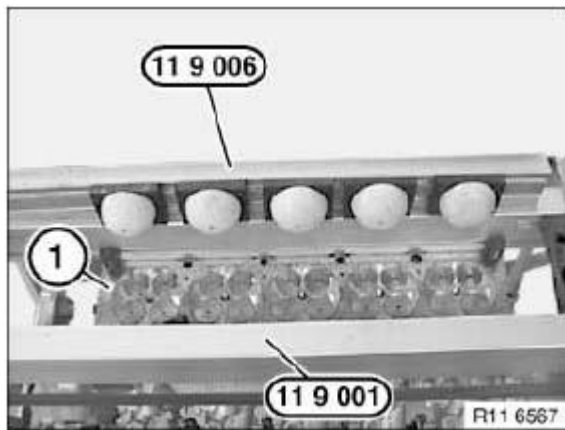
Plastic rings on the special tools must not be damaged.

*Necessary preliminary tasks:*

- Remove cylinder head. See 11 12 105 Removing And Installing Left Cylinder Head (S85) or 11 12 106 Removing And Installing Right Cylinder Head (S85).
- Remove all HVCA elements.

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

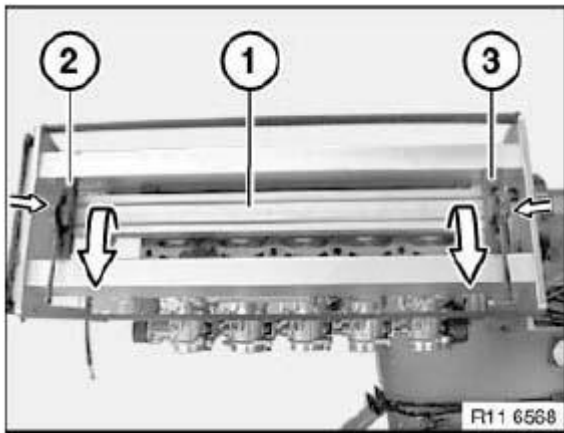
Prepare special tool 11 9 006 with special tool 11 9 008.



**Fig. 274: Identifying Special Tool 11 9 006 And Cylinder Head**  
Courtesy of BMW OF NORTH AMERICA, INC.

Insert aluminum profile rail (1) and align.

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



**Fig. 275: Inserting Aluminum Profile Rail**  
Courtesy of BMW OF NORTH AMERICA, INC.

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

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

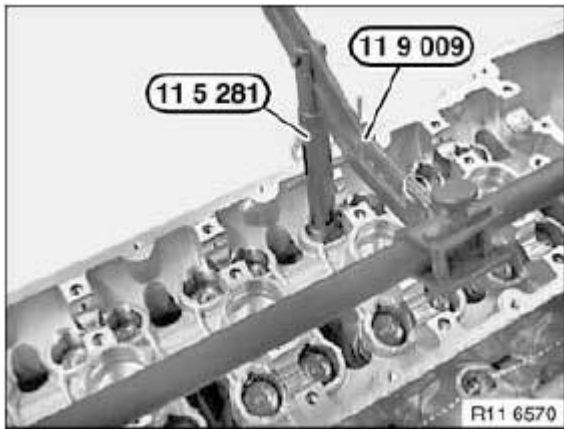
Special tool 11 5 283 for **securing** valve keys.



**Fig. 276: Identifying Special Tool 11 5 281, 11 5 282 And 11 5 283**  
Courtesy of BMW OF NORTH AMERICA, INC.

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

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



**Fig. 277: Identifying Special Tool 11 9 009 And 11 5 281**  
 Courtesy of BMW OF NORTH AMERICA, INC.

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

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

Pretension lever (1) in direction of arrow.

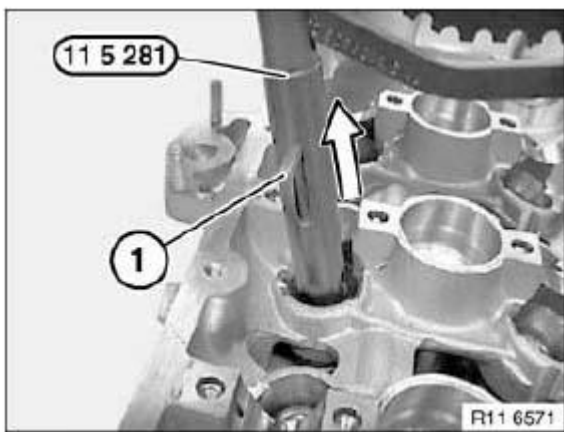
Release lever (1) in tensioned position.

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

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

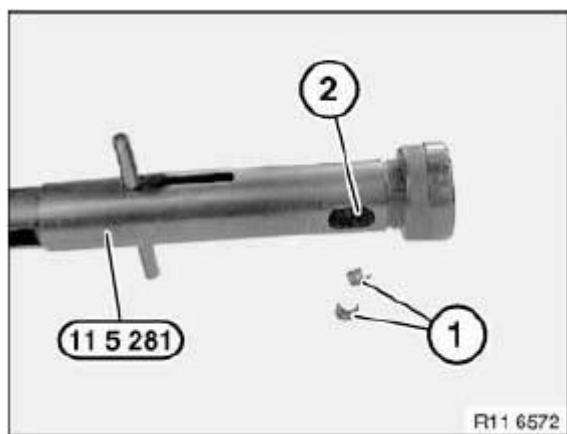
Pull back lever on special tool 11 5 281.

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



**Fig. 278: Pretensioning Lever**  
 Courtesy of BMW OF NORTH AMERICA, INC.



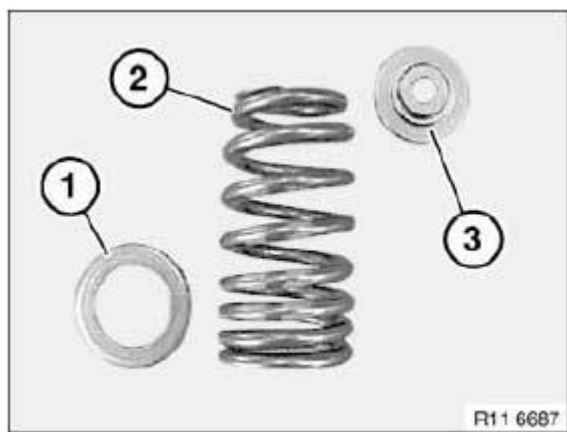


**Fig. 279: Identifying Valve Keys And Working Chamber**  
Courtesy of BMW OF NORTH AMERICA, INC.

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

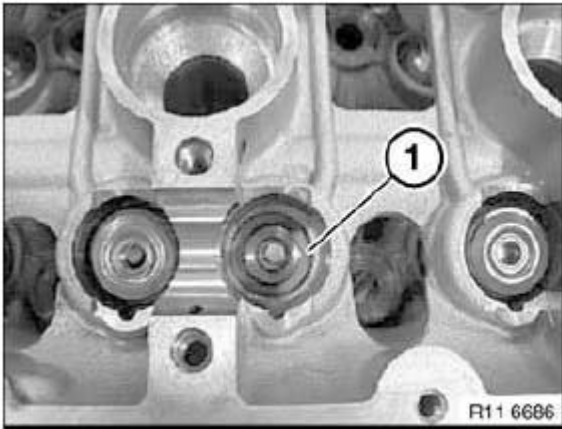
*Installation:*

Incorrect installation is not possible.



**Fig. 280: Identifying Lower/Upper Spring Plate And Progressive Valve Spring**  
Courtesy of BMW OF NORTH AMERICA, INC.

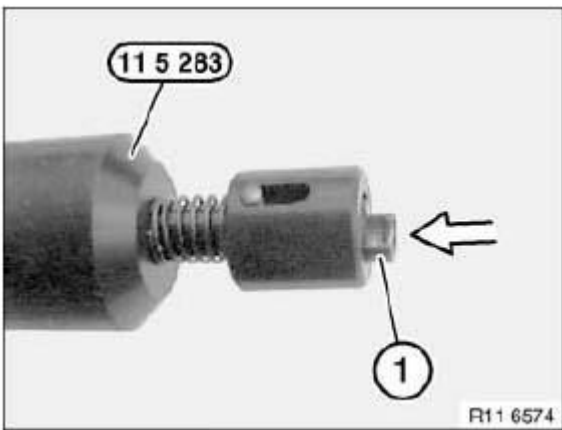
Insert lower spring plate (1).



**Fig. 281: Identifying Lower Spring Plate**  
Courtesy of BMW OF NORTH AMERICA, INC.

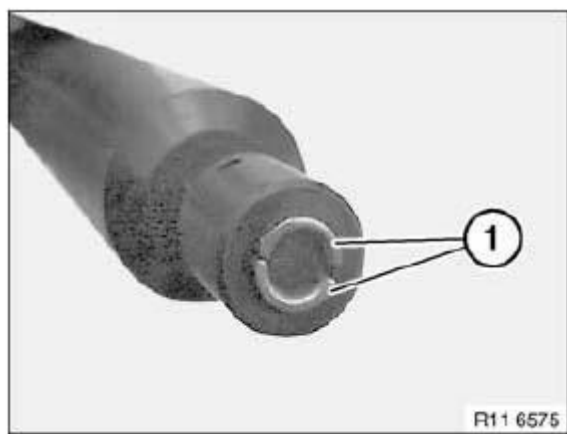
**IMPORTANT: Use only special tool 11 5 282 to install the valve keys - risk of damage!**

Press valve key (1) in direction of arrow into special tool 11 5 283.



**Fig. 282: Pressing Valve Key Into Special Tool 11 5 283**  
Courtesy of BMW OF NORTH AMERICA, INC.

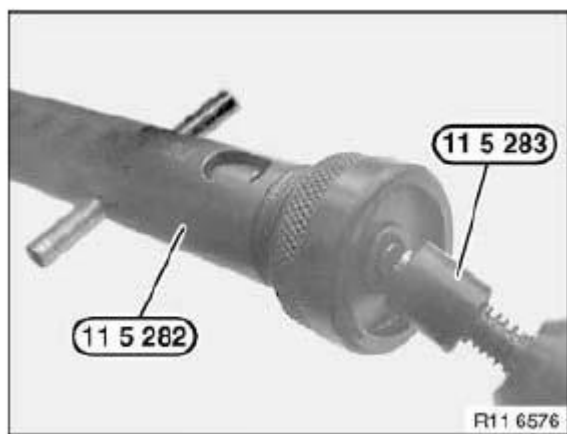
Secure valve keys (1).



**Fig. 283: Identifying Valve Keys**

Courtesy of BMW OF NORTH AMERICA, INC.

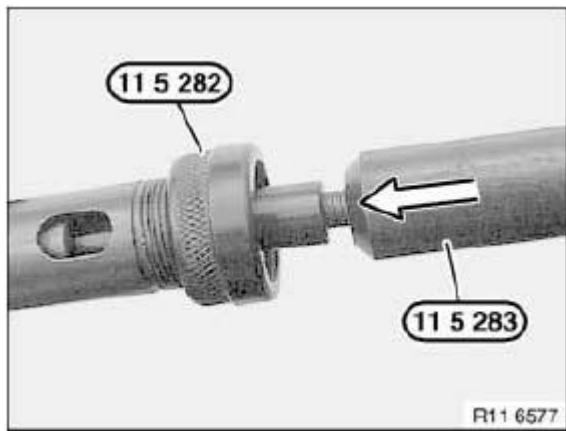
Press valve keys into special tool 11 5 282 with special tool 11 5 283.



**Fig. 284: Identifying Special Tool 11 5 282 And 11 5 283**

Courtesy of BMW OF NORTH AMERICA, INC.

Press valve keys into special tool 11 5 282 with special tool 11 5 283.

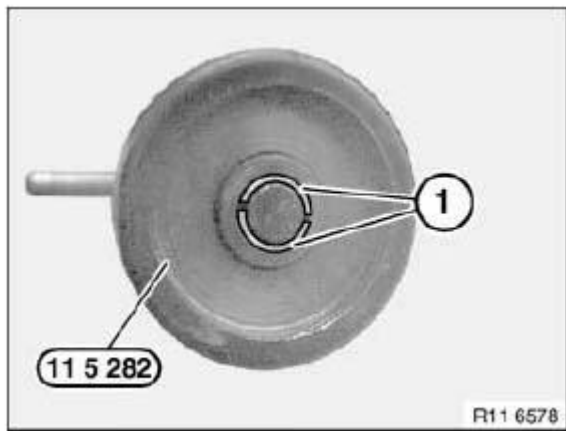


**Fig. 285: Pressing Valve Keys Into Special Tool 11 5 282 With Special Tool 11 5 283**  
Courtesy of BMW OF NORTH AMERICA, INC.

Special tool 11 5 282 is prepared for installation.

*Installation:*

Positioning of valve keys (1).

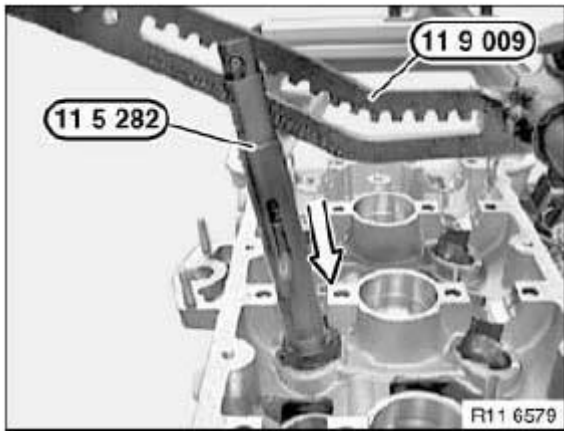


**Fig. 286: Identifying Valve Keys And Special Tool 11 5 282**  
Courtesy of BMW OF NORTH AMERICA, INC.

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

*Installation:*

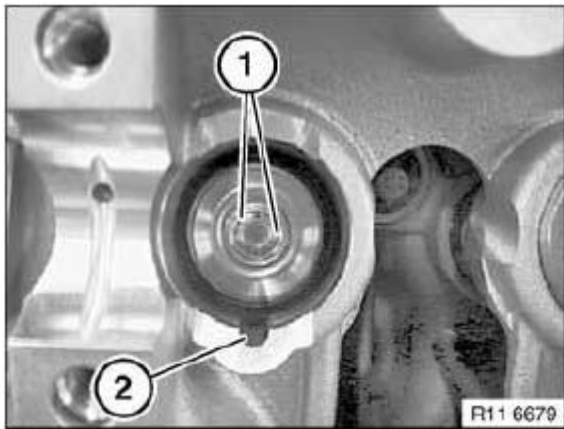
Both valve keys are now pressed into their initial positions.



**Fig. 287: Pressing Down Special Tool 11 5 282 With Special Tool 11 9 009**  
 Courtesy of BMW OF NORTH AMERICA, INC.

*Installation:*

Check that valve keys (1) are in correct installation position.



**Fig. 288: Identifying Valve Keys**  
 Courtesy of BMW OF NORTH AMERICA, INC.

Assemble engine.

## 36 VARIABLE CAMSHAFT TIMING

### 11 36 030 REMOVING AND INSTALLING / REPLACING LEFT VANOS ADJUSTMENT UNIT (S85)

Special tools required:

- 11 5 100

**IMPORTANT:** If the hexagon socket screws with washers are released by mistake, it will be

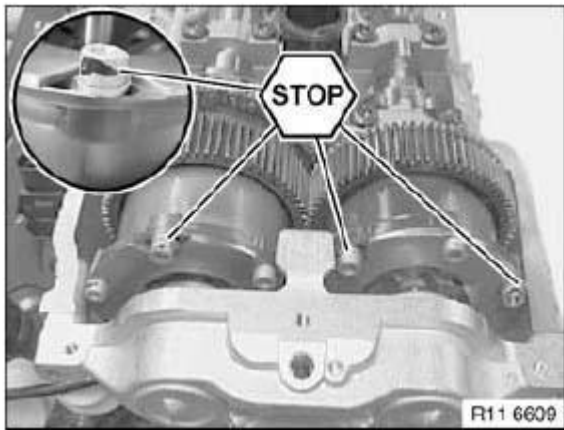
**necessary to readjust the timing.**

*Necessary preliminary tasks:*

- Remove intake air manifold.
- Remove right cylinder head cover.
- Remove fan cowl with electronic fan. See 17 11 035 REMOVING AND INSTALLING/REPLACING FAN COWL WITH ELECTRIC FAN (M5) or 17 11 035 REMOVING AND INSTALLING/REPLACING FAN COWL WITH ELECTRIC FAN (M6).
- Detach oil line from VANOS adjustment unit.
- Remove coolant hose from radiator inlet on right.

**IMPORTANT: 6 hexagon socket screws with washers must not be released.**

If the 6 hexagon socket screws with washers are released by mistake, it will be necessary to readjust the timing.

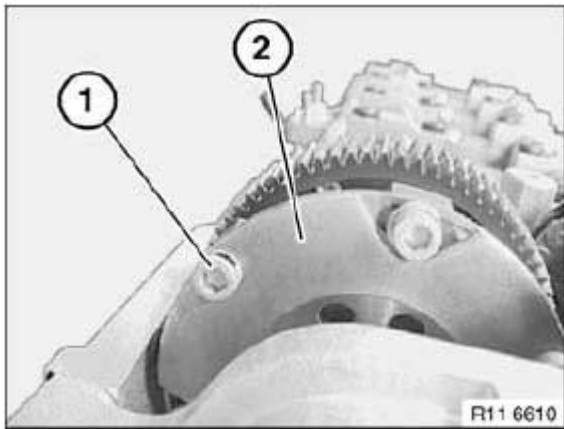


**Fig. 289: Identifying Hexagon Socket Screws**  
Courtesy of BMW OF NORTH AMERICA, INC.

**IMPORTANT: Hexagon socket screws (1) may fall into the engine compartment after they have been released (risk of damage).**

Release screws (1).

Crank engine at central bolt until 6 hexagon socket screws of the adjustment unit have been released.



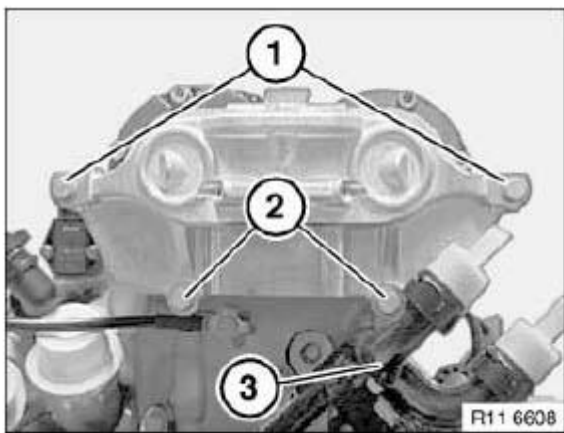
**Fig. 290: Identifying Hexagon Socket Screws**  
Courtesy of BMW OF NORTH AMERICA, INC.

Remove coolant pipe (3).

Release screws (1).

Unfasten screws (2).

Remove VANOS adjustment unit towards front.

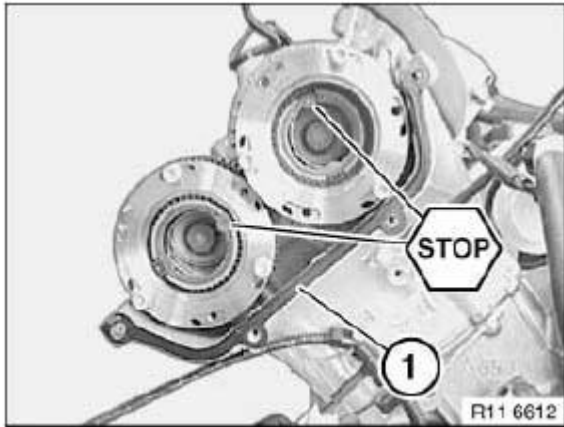


**Fig. 291: Identifying Coolant Pipe And Screws**  
Courtesy of BMW OF NORTH AMERICA, INC.

**IMPORTANT:** Do not open Seeger circlip rings of VANOS gears.

*Installation:*

Replace seal (1).



**Fig. 292: Identifying Seal**

Courtesy of BMW OF NORTH AMERICA, INC.

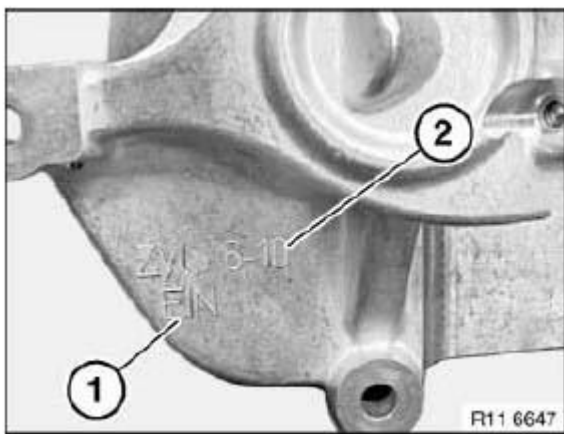
*Installation:*

VANOS adjustment units are marked to avoid being mixed up.

The lettering EIN (1) must point to the inlet camshaft.

Cylinder assignment (2), cyl. 1-5 or 6-10.

**IMPORTANT: Risk of mixing up parts!**



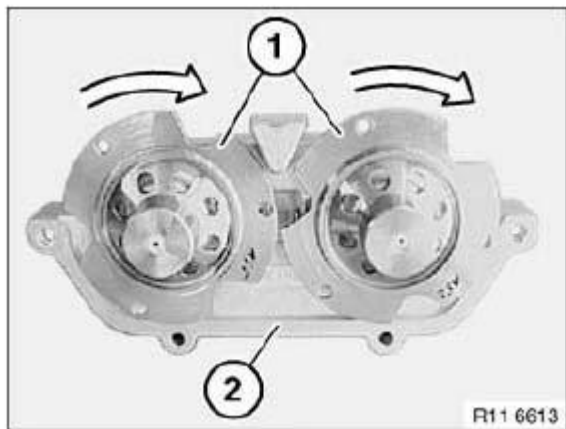
**Fig. 293: Identifying Lettering EIN On Inlet Camshaft**

Courtesy of BMW OF NORTH AMERICA, INC.

Check thrust bearing plates (1) for ease of movement before installing.

Clean sealing surface (2).





**Fig. 294: Checking Thrust Bearing Plates**  
Courtesy of BMW OF NORTH AMERICA, INC.

*Installation:*

Replace seal.

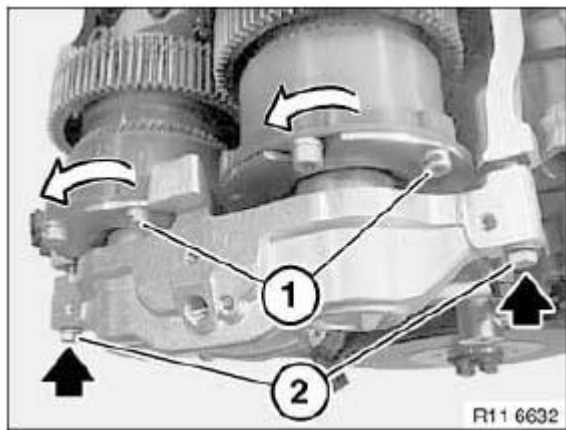
Insert screws (2).

Insert hexagon socket screws (1) without washers and secure to **10 Nm**.

*Installation:*

Mark all screws which are already tightened down with a colored dot.

Continue cranking engine at central bolt or with special tool 11 5 100 through **120° until further hexagon socket screws without washers can be inserted on the VANOS gear**.



**Fig. 295: Locating Hexagon Socket Screws**  
Courtesy of BMW OF NORTH AMERICA, INC.

Assemble engine.

There is air in the VANOS system once it is opened.

In the first few seconds after startup this results in a clearly discernible "rattling noise".

This rattling noise does "not" indicate incorrect assembly.

The rattling noise will disappear as soon as the oil pressure has built up and the system has vented.

Perform VANOS test.

### **11 36 040 REMOVING AND INSTALLING / REPLACING RIGHT VANOS ADJUSTMENT UNIT (S85)**

#### **Special tools required:**

- 11 5 100
- 11 5 320

**IMPORTANT: If the hexagon socket screws with washers are released by mistake, it will be necessary to readjust the timing.**

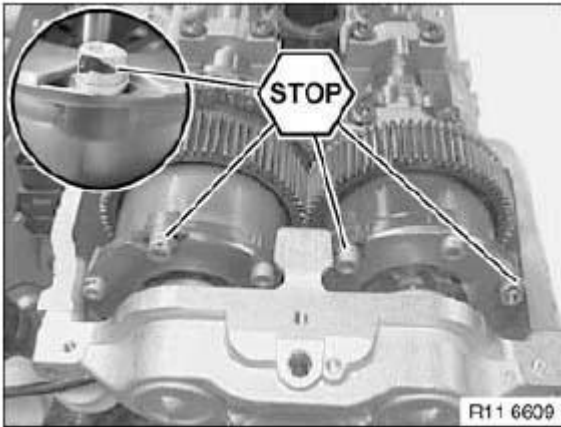
#### *Necessary preliminary tasks:*

- Remove intake air manifold.
- Remove right cylinder head cover
- Remove fan cowl with electronic fan. See 17 11 035 REMOVING AND INSTALLING/REPLACING FAN COWL WITH ELECTRIC FAN (M5) or 17 11 035 REMOVING AND INSTALLING/REPLACING FAN COWL WITH ELECTRIC FAN (M6) .
- Detach oil line from VANOS adjustment unit.
- Remove coolant hose from radiator inlet on right.

**IMPORTANT: 6 hexagon socket screws with washers must not be released.**

If the 6 hexagon socket screws with washers are released by mistake, it will be necessary to readjust the timing.

**NOTE: Illustration shows 6 to 10.**

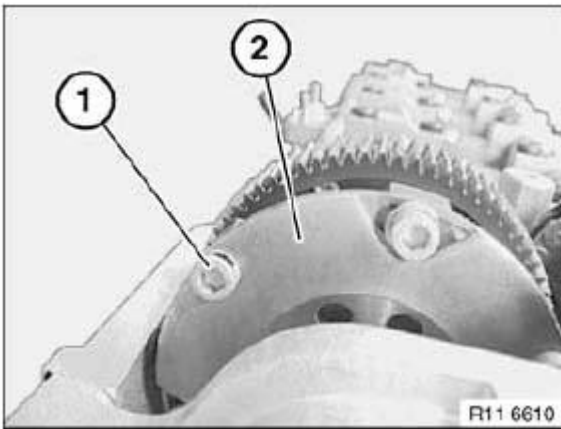


**Fig. 296: Identifying Hexagon Socket Screws**  
Courtesy of BMW OF NORTH AMERICA, INC.

**IMPORTANT:** Hexagon socket screws (1) may fall into the engine compartment after they have been released (risk of damage).

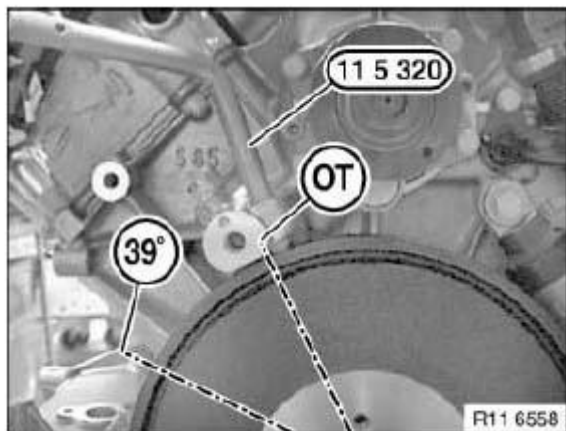
Release hexagon socket screws without washers (1).

Crank engine at central bolt until 6 hexagon socket screws of the adjustment unit have been released.



**Fig. 297: Identifying Hexagon Socket Screws**  
Courtesy of BMW OF NORTH AMERICA, INC.

**IMPORTANT:** Secure special tool 11 5 320 to vibration damper in 1st cylinder firing TDC position.

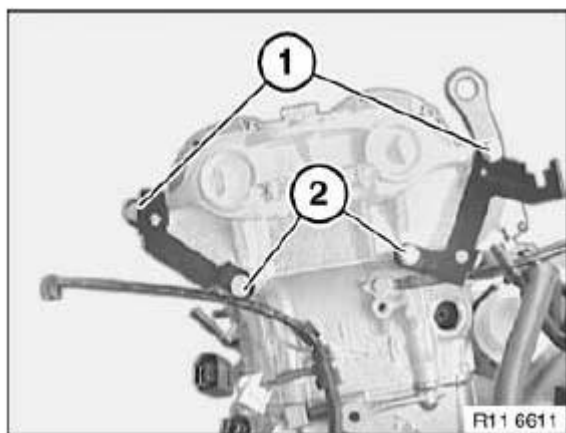


**Fig. 298: Identifying Special Tool 11 5 320**  
Courtesy of BMW OF NORTH AMERICA, INC.

Release bolts (1).

Release screws (2).

Remove VANOS adjustment unit towards front.

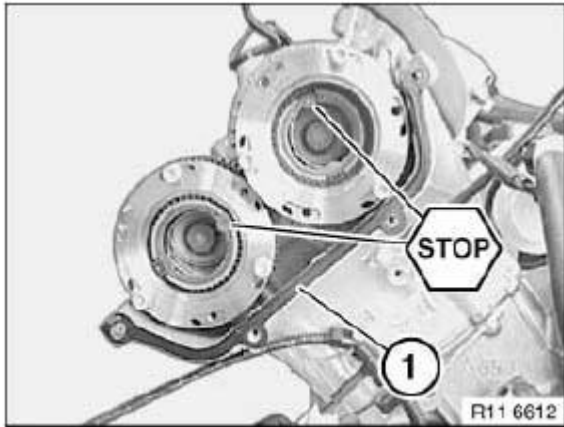


**Fig. 299: Identifying Bolts And Screws**  
Courtesy of BMW OF NORTH AMERICA, INC.

**IMPORTANT: Do not open Seeger circlip rings of VANOS gears.**

*Installation:*

Replace seal (1).



**Fig. 300: Identifying Seal**

Courtesy of BMW OF NORTH AMERICA, INC.

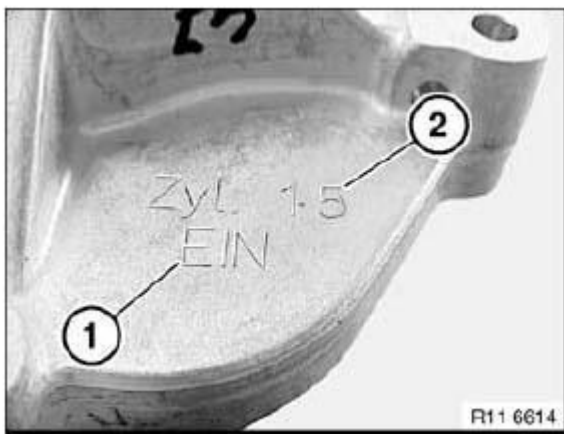
*Installation:*

VANOS adjustment units are marked to avoid being mixed up.

The lettering EIN (1) must point to the inlet camshaft.

Cylinder assignment (2), cyl. 1-5 or 6-10.

**IMPORTANT: Risk of mixing up**

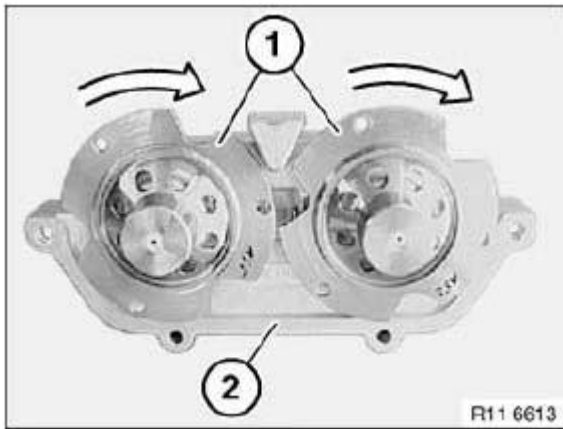


**Fig. 301: Identifying Lettering EIN On Inlet Camshaft**

Courtesy of BMW OF NORTH AMERICA, INC.

Check thrust bearing plates (1) for ease of movement before installing.

Clean sealing surface (2).



**Fig. 302: Checking Thrust Bearing Plates**  
Courtesy of BMW OF NORTH AMERICA, INC.

Insert screws (2).

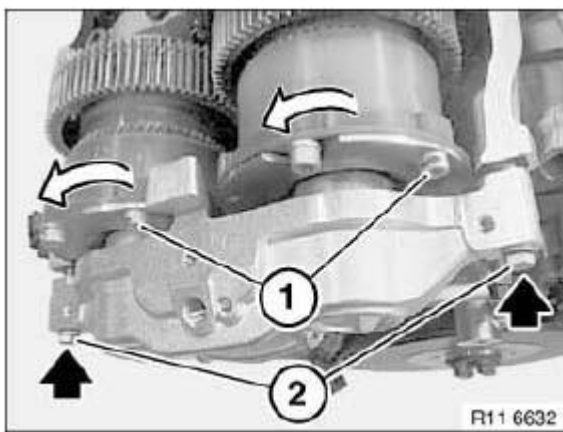
Insert hexagon socket screws (1) without washers.

Continue cranking engine at central bolt or with special tool 11 5 100 through **120° until further hexagon socket screws without washers can be inserted on the VANOS gear.**

Tighten all hexagon socket screws without washers (1) to **10 Nm.**

*Installation:*

Mark all hexagon socket screws which are already tightened down with a colored dot.



**Fig. 303: Locating Hexagon Socket Screws**  
Courtesy of BMW OF NORTH AMERICA, INC.

Assemble engine.

There is air in the VANOS system once it is opened.

In the first few seconds after startup this results in a clearly discernible "rattling noise".

This rattling noise does "not" indicate incorrect assembly.

The rattling noise will disappear as soon as the oil pressure has built up and the system has vented.

Carry out venting procedure with diagnosis tester.

Perform VANOS test.

### 11 36 109 REMOVING AND INSTALLING/REPLACING VANOS HIGH-PRESSURE OIL LINE (S85)

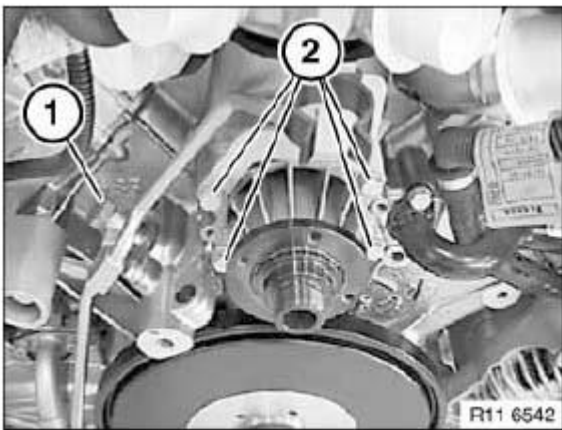
*Necessary preliminary tasks:*

- Remove **drive belt** from A/C compressor.
- Remove **drive belt** from alternator.
- Release power steering pump (do not remove). See **32 41 060 REMOVING AND INSTALLING/REPLACING VANE PUMP FOR POWER STEERING (M5)** or **32 41 060 REMOVING AND INSTALLING/REPLACING VANE PUMP FOR POWER STEERING (M6)** .
- Detach water hoses on right.
- Remove **oil pan**.
- Remove **oil pump**.
- Remove **VANOS high-pressure pump**.

Only release bolts (2) on water pump bracket.

Release banjo bolt (1).

Tightening torque: 11 36 5AZ. See **36 VARIABLE CAMSHAFT TIMING** .

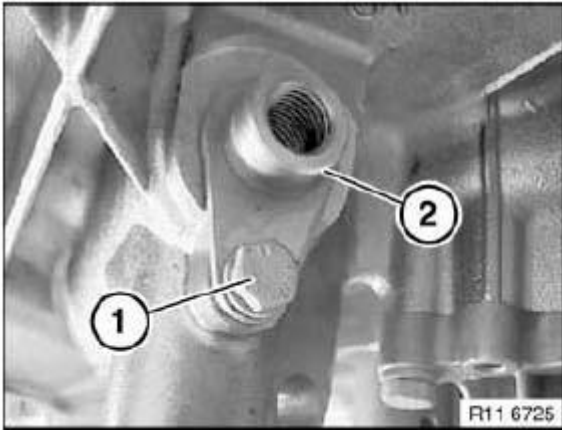


**Fig. 304: Identifying Water Pump Bracket Bolts**

Courtesy of BMW OF NORTH AMERICA, INC.

Release bolt (1).

Remove high-pressure line (2) towards top.



**Fig. 305: Identifying High-Pressure Line**  
Courtesy of BMW OF NORTH AMERICA, INC.

Assemble engine.

There is air in the VANOS system once it is opened.

In the first few seconds after startup this results in a clearly discernible "rattling noise".

This rattling noise does "not" indicate incorrect assembly.

The rattling noise will disappear as soon as the oil pressure has built up and the system has vented.

Carry out venting procedure with diagnosis tester.

Perform VANOS test.

## **11 36 140 REMOVING AND INSTALLING / REPLACING VANOS HIGH-PRESSURE PUMP (S85)**

**Special tools required:**

- 11 4 350
- 11 6251
- 11 6 252
- 11 6 254

**IMPORTANT: Risk of damage to the VANOS high-pressure line.**



**Do not crank engine while banjo bolt is released.**

*Necessary preliminary tasks:*

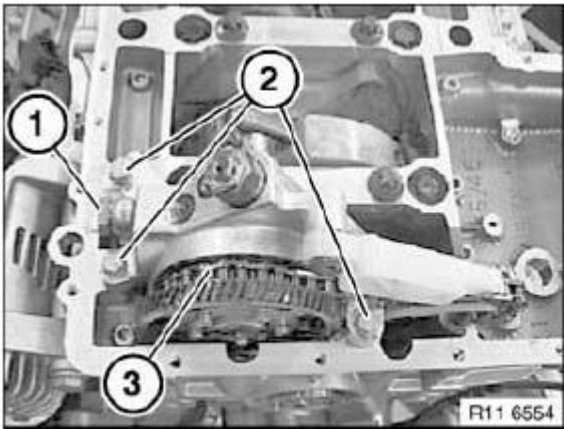
- Remove **engine oil sump**.
- Remove **oil pump**.

Release banjo bolt (1).

Tightening torque 11 36 4AZ. See **36 VARIABLE CAMSHAFT TIMING** .

Release screws (2).

Remove VANOS high-pressure pump (3).

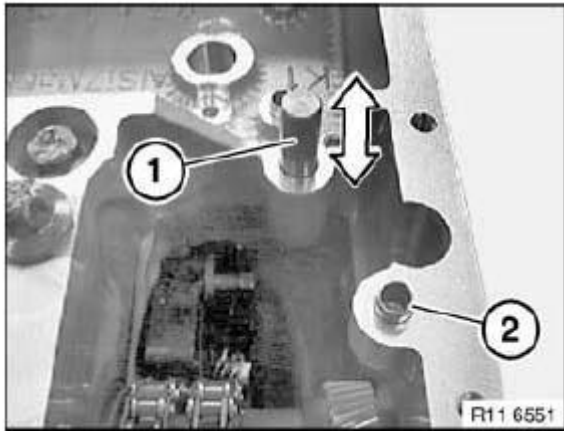


**Fig. 306: Identifying VANOS High-Pressure Pump**  
Courtesy of BMW OF NORTH AMERICA, INC.

**NOTE:**      **Engine installed.**

Secure piston (1) against falling out; remove if necessary.

Check adapter sleeve (2) for damage and secure seating; replace if necessary.

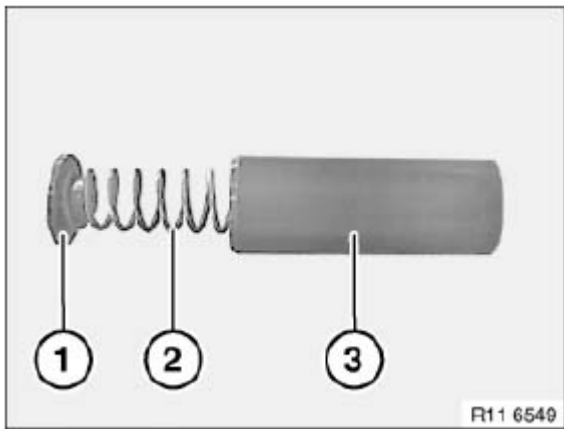


**Fig. 307: Identifying Piston And Adapter Sleeve**  
Courtesy of BMW OF NORTH AMERICA, INC.

*Installation:*

Arrangement, chain tensioner, oil pump.

1. Base valve
2. Spring
3. Piston



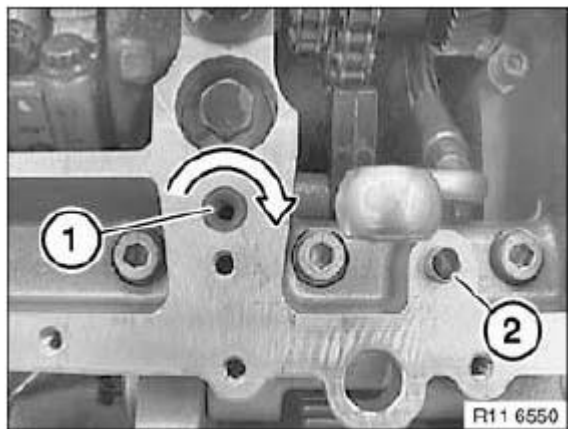
**Fig. 308: Identifying Base Valve, Spring And Piston**  
Courtesy of BMW OF NORTH AMERICA, INC.

*Installation:*

Replace fine-mesh strainer.

Remove fine-mesh strainer (1) with screwdriver in direction of arrow.

Check adapter sleeve (2) for damage and secure seating; replace if necessary.



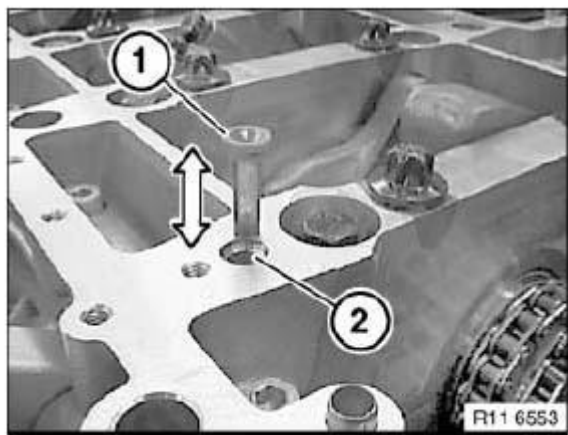
**Fig. 309: Removing Fine-Mesh Strainer (1 Of 2)**  
 Courtesy of BMW OF NORTH AMERICA, INC.

Remove and fine-mesh strainer (1) in direction of arrow.

Clean sealing surface (2).

*Installation:*

Replace fine-mesh strainer.



**Fig. 310: Removing Fine-Mesh Strainer (2 Of 2)**  
 Courtesy of BMW OF NORTH AMERICA, INC.

Check gear wheel (1) and sprocket wheel for damage, replace if necessary.

Release bolts (7).

Tightening torque 11 36 7AZ. See **36 VARIABLE CAMSHAFT TIMING** .

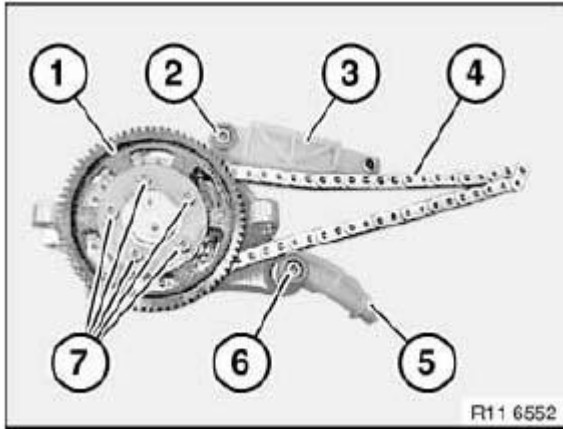
Release screw (2).

Check sliding rail (3) for damage; replace if necessary.

Check timing chain (4) for damage; replace if necessary.

Release bolt (6).

Check tensioning rail (5) for damage; replace if necessary.



**Fig. 311: Identifying Sliding Rail, Timing Chain And Tensioning Rail**

Courtesy of BMW OF NORTH AMERICA, INC.

**IMPORTANT: Low and high teeth of gear wheels.  
Replace gear wheel in pairs only.  
Old build date up to 12/05: low teeth.  
New build date from 12/05: high teeth.**

### Replacing gearwheels

*Necessary preliminary tasks:*

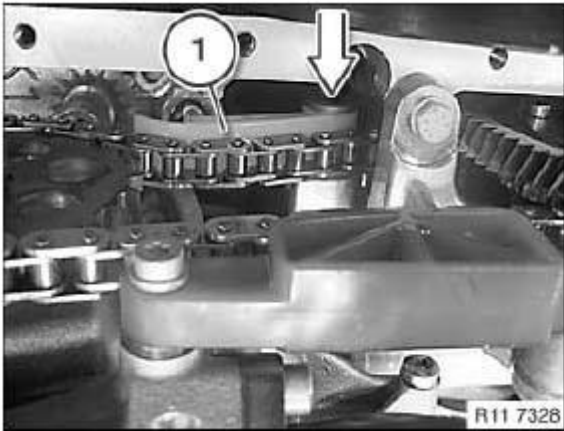
- Remove vibration damper.
- Remove radial shaft seal at front.

**IMPORTANT: VANOS high-pressure pump from 12/05**

**Spacer plates must not be fitted.**

Clamping rail (1) of oil pump with visible sleeve (see arrow).

It is not necessary to measure the oil pump chain.

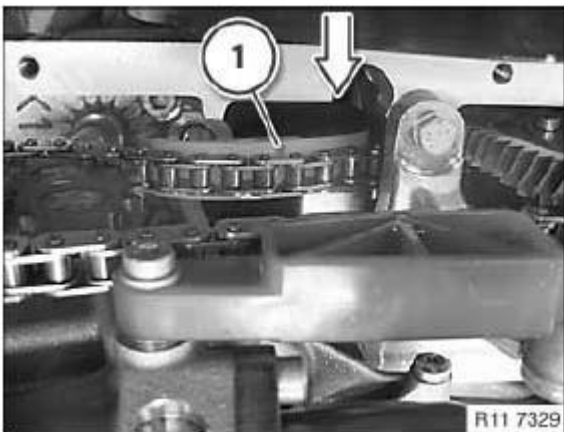


**Fig. 312: Clamping Rail Of Oil Pump With Visible Sleeve**  
Courtesy of BMW OF NORTH AMERICA, INC.

**IMPORTANT: VANOS high-pressure pump up to 12/05**

Clamping rail (1) of oil pump without visible sleeve (see arrow).

On the VANOS high-pressure pump up to 12/05, it is necessary to check the pretension on the oil pump chain.



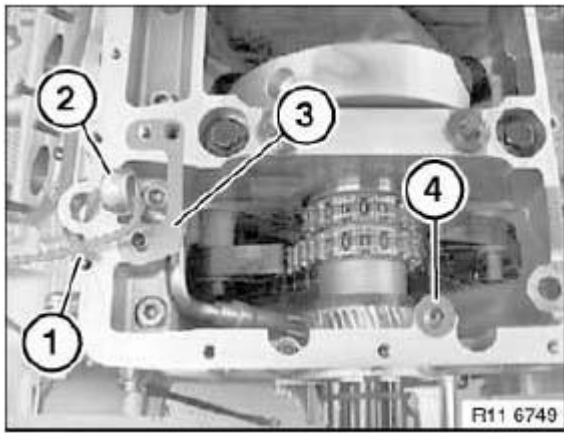
**Fig. 313: Clamping Rail Of Oil Pump Without Visible Sleeve**  
Courtesy of BMW OF NORTH AMERICA, INC.

**IMPORTANT: Spacer plates are only required if the oil pump chain demonstrates excessive tension.**  
**Low teeth of VANOS high-pressure pump before 12/05.**

Tie back VANOS high-pressure line (2) with cable tie (1).

Install spacer plate (3).

Install spacer (4).



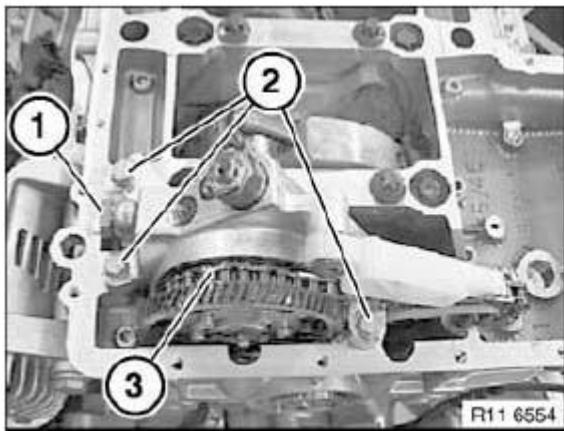
**Fig. 314: Identifying VANOS High-Pressure Line, Spacer Plate And Spacer**  
Courtesy of BMW OF NORTH AMERICA, INC.

Position VANOS high-pressure pump (3) on crankcase.

Insert screws (2).

Slide VANOS high-pressure pump in direction of crankshaft until gearwheel (3) has slight play.

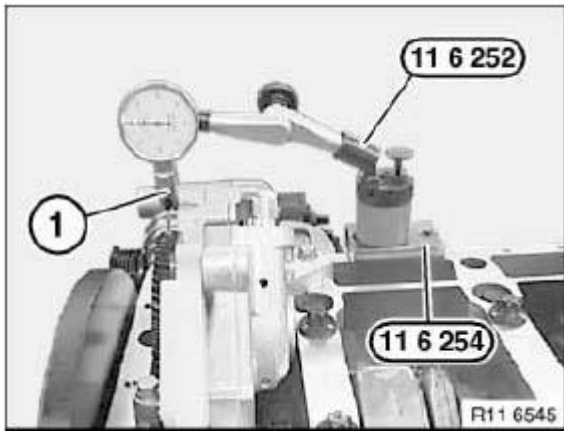
Initially tighten VANOS high-pressure pump with special tool 11 4 350 to **2 Nm**.



**Fig. 315: Identifying VANOS High-Pressure Pump**  
Courtesy of BMW OF NORTH AMERICA, INC.

Mount special tool 11 6 254 on crankcase.

Secure special tool 11 6 252 with magnetic base to special tool 11 6 254.

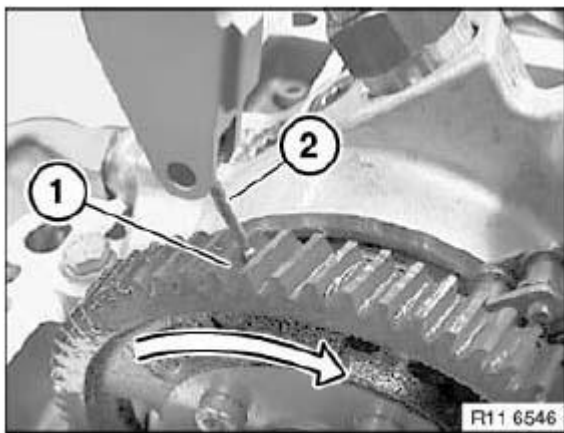


**Fig. 316: Identifying Special Tool 11 6 252 And 11 6 254**  
Courtesy of BMW OF NORTH AMERICA, INC.

Align special tool 11 6 251 with its measuring shaft (2) vertically to gearwheel (1).

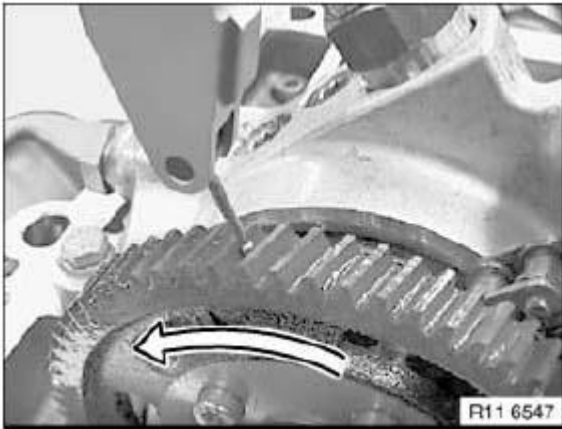
Rotate high-pressure pump gearwheel (1) up to stop.

Set special tool 11 6 251 to zero.



**Fig. 317: Rotating High-Pressure Pump Gearwheel (1 Of 2)**  
Courtesy of BMW OF NORTH AMERICA, INC.

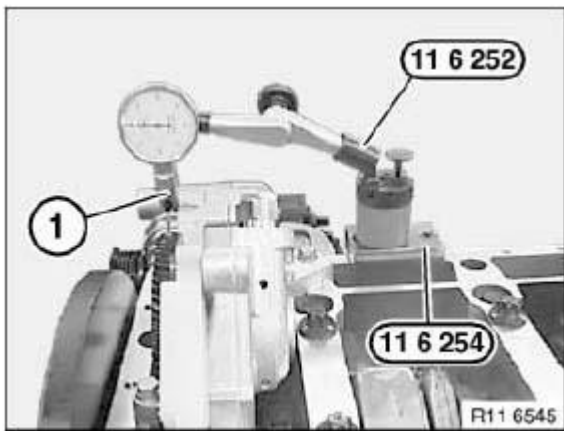
Rotate high-pressure pump gearwheel in direction of arrow up to stop.



**Fig. 318: Rotating High-Pressure Pump Gearwheel (2 Of 2)**  
 Courtesy of BMW OF NORTH AMERICA, INC.

Backlash at high-pressure pump **min. 0.06 to max. 0.08 mm.**

If necessary, correct VANOS high-pressure pump adjustment.

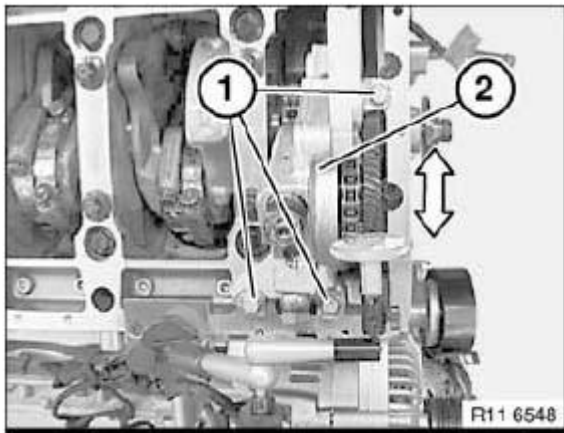


**Fig. 319: Identifying Special Tool 11 6 252 And 11 6 254**  
 Courtesy of BMW OF NORTH AMERICA, INC.

Adjustment of VANOS high-pressure pump (2) with a rubber mallet on pump housing.

Tightening torque 11 36 8AZ. See **36 VARIABLE CAMSHAFT TIMING** .





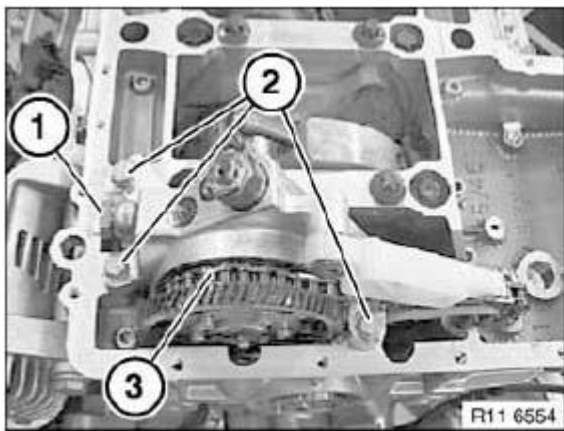
**Fig. 320: Adjusting VANOS High-Pressure Pump**  
Courtesy of BMW OF NORTH AMERICA, INC.

*Installation:*

Replace all sealing rings.

Install banjo bolt (1).

Tightening torque 11 36 4AZ. See **36 VARIABLE CAMSHAFT TIMING** .



**Fig. 321: Identifying VANOS High-Pressure Pump And Banjo Bolt**  
Courtesy of BMW OF NORTH AMERICA, INC.

Assemble engine.

There is air in the VANOS system once it is opened.

In the first few seconds after startup this results in a clearly discernible "rattling noise".

This rattling noise does "not" indicate incorrect assembly.

The rattling noise will disappear as soon as the oil pressure has built up and the system has vented.

Carry out venting procedure with diagnosis tester.

Perform VANOS test.

### **11 36 142 REMOVING AND INSTALLING / REPLACING LEFT INLET VANOS GEAR (S85)**

#### **Special tools required:**

- 11 3 302
- 11 5 100
- 11 5 291
- 11 5 292
- 11 5 302
- 11 5 320
- 11 5 352
- 11 5 370
- 11 5 381
- 11 5 382
- 11 5 410

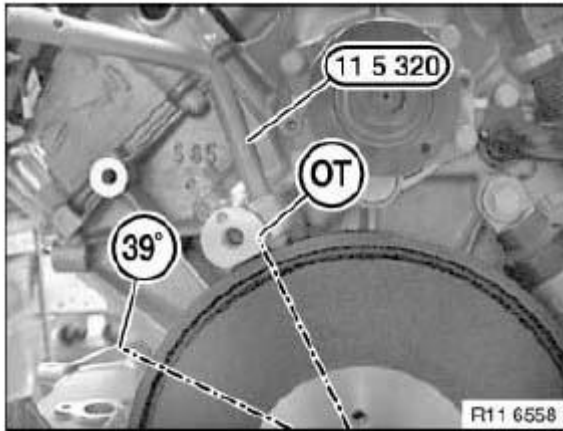
#### *Necessary preliminary tasks:*

- Remove left VANOS adjustment unit.

**IMPORTANT:** Both inlet and exhaust camshafts can be adjusted in the 1st cylinder firing TDC position.

The procedure for checking timing is different from that for adjusting.

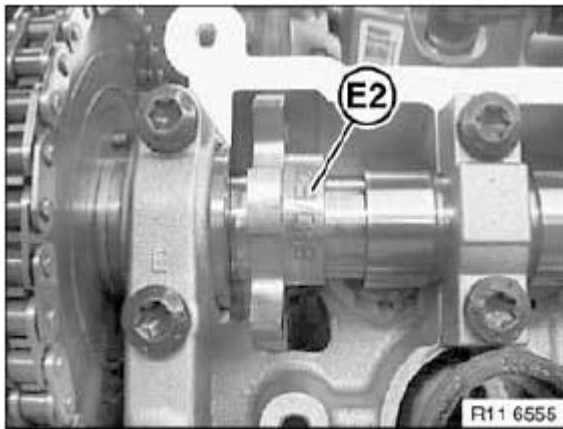
Secure special tool 11 5 320 to vibration damper in 1st cylinder firing TDC position.



**Fig. 322: Identifying Special Tool 11 5 320**  
Courtesy of BMW OF NORTH AMERICA, INC.

Position of inlet camshaft, cylinders 6-10.

Designation (E2) on dihedron points upwards.

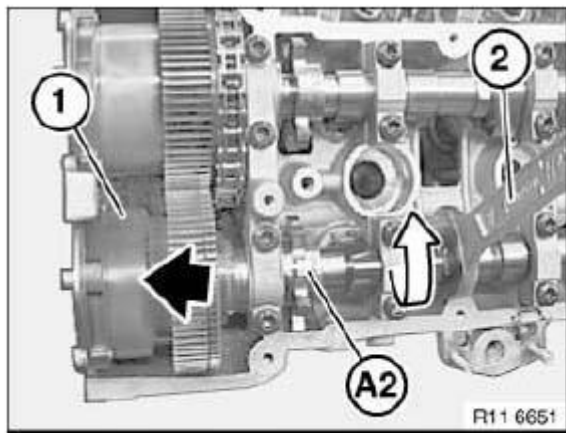


**Fig. 323: Identifying Designation On Dihedron Points Upwards**  
Courtesy of BMW OF NORTH AMERICA, INC.

Rotate exhaust camshaft at hexagon head with an open-end wrench (2) in direction of arrow until special tool A 11 3 302 can be attached.

Designation (A2) on dihedron points upwards.

**NOTE:** Exhaust VANOS gear (1) adjusted in direction of arrow (advance).



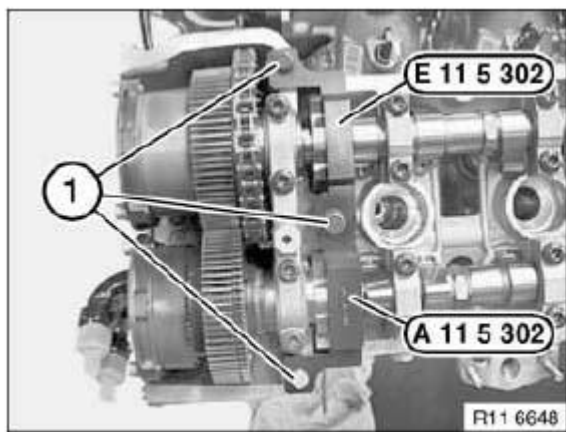
**Fig. 324: Rotating Exhaust Camshaft At Hexagon Head**  
Courtesy of BMW OF NORTH AMERICA, INC.

Disconnect inlet and exhaust camshafts.

Attach special tool A 11 5 302.

Attach special tool E 11 5 302 and secure with bolts (1).

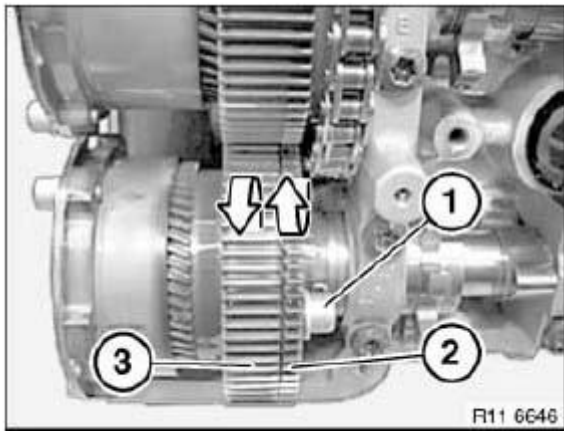
**IMPORTANT: Screw in bolts (1) without fail, risk of damage to camshafts.**



**Fig. 325: Identifying Special Tool A 11 5 302 And E 11 5 302**  
Courtesy of BMW OF NORTH AMERICA, INC.

**IMPORTANT: Removal/installation is not possible without hexagon socket screw (1).  
Hexagon socket screw (1) with washer must not be longer than 18 mm.  
Gearwheels (2 and 3) of exhaust VANOS gear are tensioned with a spring.**

Insert M8x18 hexagon socket screw (1) into exhaust VANOS gear.



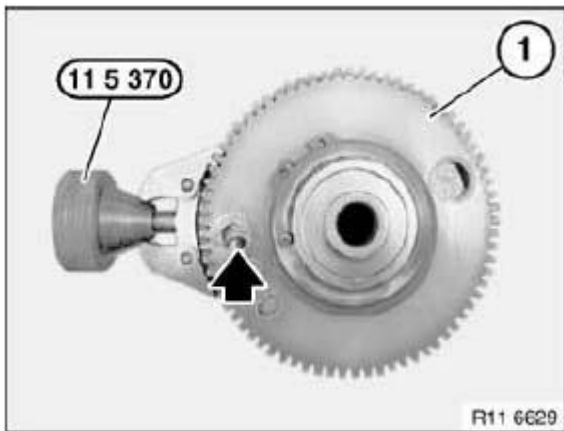
**Fig. 326: Identifying Gearwheels Of Exhaust VANOS Gear**  
 Courtesy of BMW OF NORTH AMERICA, INC.

*Installation:*

If the hexagon socket screw is released or forgotten by mistake, the gear teeth can be readjusted with special tool 11 5 370.

Screw in special tool 11 5 370 until gearwheel (1) lines up with bore (see arrow) on thread.

Failure to tension the exhaust VANOS gear will result in rattling noises at idle.

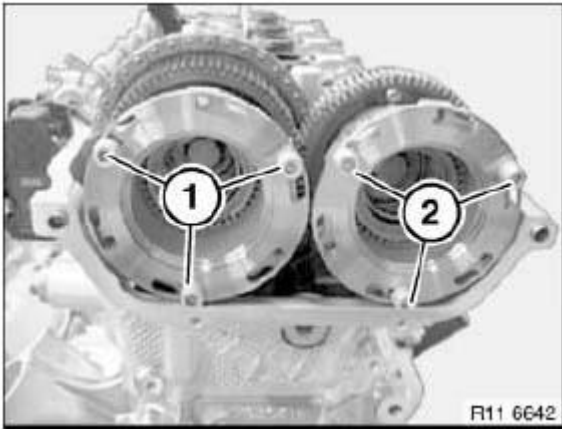


**Fig. 327: Identifying Special Tool 11 5 370 And Gearwheel**  
 Courtesy of BMW OF NORTH AMERICA, INC.

Release hexagon socket screws with washers (1 and 2).

*Installation:*

Replace hexagon socket screws with washers (1 and 2).



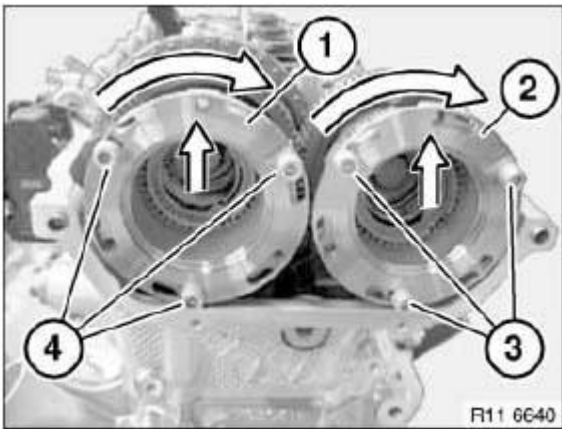
**Fig. 328: Identifying Washers**

Courtesy of BMW OF NORTH AMERICA, INC.

**IMPORTANT: Release central bolt only when inner sleeves (1 and 2) with elongated holes are at left stop.**

Pull VANOS gear with outer sleeve forwards until inner sleeves (1 and 2) with elongated holes are at left stop.

Join hexagon socket screws with washers (3 and 4) to 5 Nm.



**Fig. 329: Pulling VANOS Gear With Outer Sleeve Forwards**

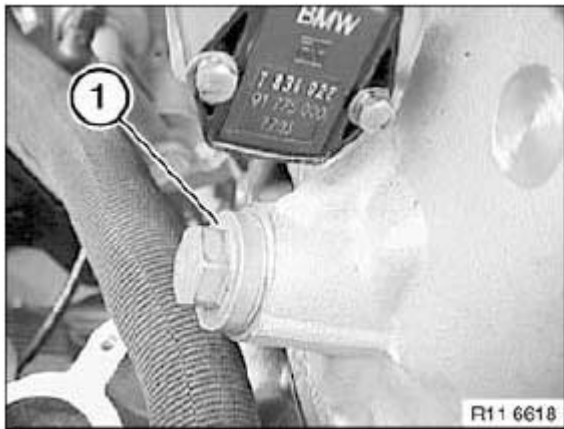
Courtesy of BMW OF NORTH AMERICA, INC.

Remove left chain tensioner.

*Installation:*

Replace sealing ring.

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



**Fig. 330: Identifying Left Chain Tensioner**  
Courtesy of BMW OF NORTH AMERICA, INC.

Remove screw plug for chain rail on left cylinder head.

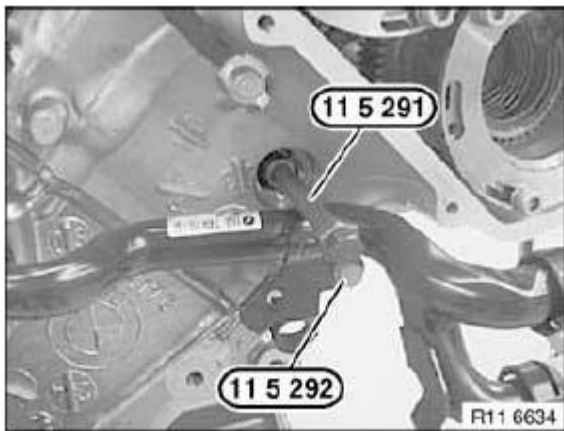
*Installation:*

Replace sealing ring.

Tightening torque 11 12 9AZ. See **CYLINDER HEAD WITH COVER**.

Insert special tool 11 5 291.

Secure bearing pin against falling out with special tool 11 5 292.



**Fig. 331: Identifying Special Tool 11 5 291 And 11 5 292**  
Courtesy of BMW OF NORTH AMERICA, INC.

Attach special tool 11 5 382.

Fit special tool 11 5 410 with bolts (3).

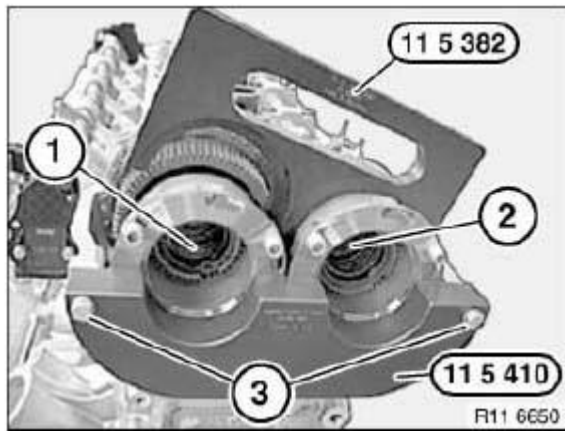
**IMPORTANT:** Release central bolts (1 and 2) with special tools 11 5 410 and 11 5 382 only.

**NOTE:**

- If the special tool 11 5 410 cannot be fitted due to the hexagon socket screws being unfavorably positioned, it is necessary to remove the two or if necessary four hexagon socket screws.

Release central bolts (1 and 2).

Remove special tool 11 5 410



**Fig. 332: Identifying Special Tool 11 5 382 And 11 5 410**

Courtesy of BMW OF NORTH AMERICA, INC.

**NOTE:**

- If the central bolt is released, the removed hexagon socket screws are reinstalled with a joining torque of 5 Nm.

*Installation:*

Replace central bolts (1 and 2).

**IMPORTANT: Danger of injury!**

*Installation:*

If the VANOS gear is to be reused, the special tool 11 5 382 must not be removed.

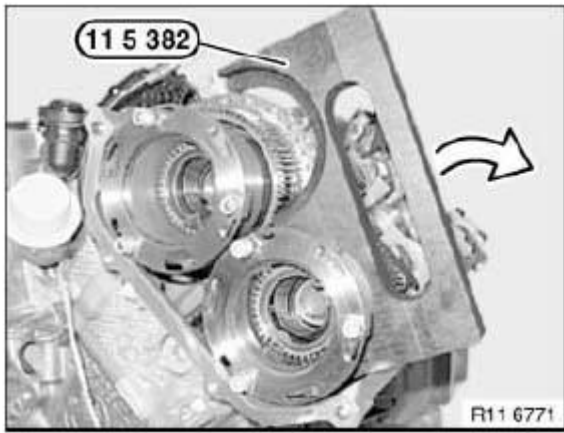
VANOS gear is tensioned.

Tilt special tool 11 5 382 in direction of arrow.

If the VANOS gear is to be replaced by a new part, the special tool 11 5 382 can be removed.



Remove VANOS gear with special tool 11 5 382.



**Fig. 333: Tilting Special Tool 11 5 382**  
Courtesy of BMW OF NORTH AMERICA, INC.

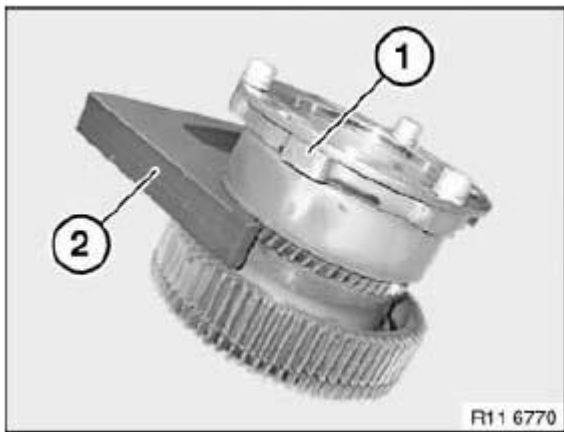
**IMPORTANT: Danger of injury!**

*Installation:*

If the VANOS gear is to be reused, the special tool 11 5 381 must not be removed.

VANOS gear is tensioned.

Set down VANOS gear (1) with special tool (2).



**Fig. 334: Identifying VANOS Gear And Special Tool**  
Courtesy of BMW OF NORTH AMERICA, INC.

Remove both VANOS gears.

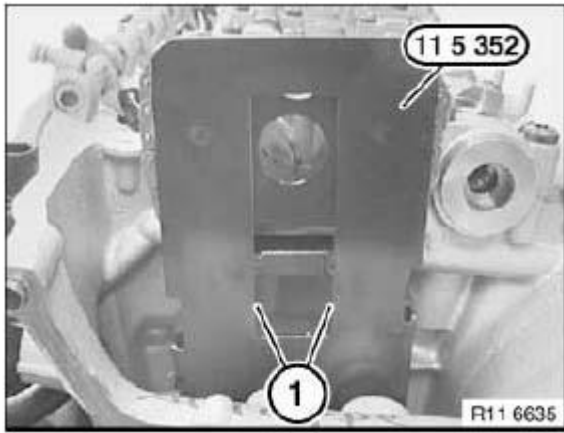
**IMPORTANT: Do not allow timing chain to fall into the engine compartment.**

**It is possible for the timing chain to become blocked on the VANOS high-pressure pump - risk of damage!**

Insert special tool 11 5 352 into chain drive.

Press sliding rails (1) together.

Pretension timing chain with special tool 11 5 352.



**Fig. 335: Identifying Special Tool 11 5 352 And Sliding Rails**  
Courtesy of BMW OF NORTH AMERICA, INC.

*Installation:*

Position inlet VANOS gear (1) so that one of the three screws with washers points downwards.

Position exhaust VANOS gear (2) so that one of the three screws with washers points downwards.

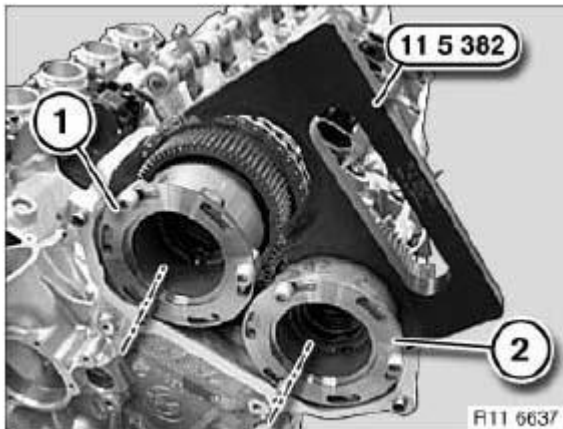
M8x18 hexagon socket screw points upwards.

Check that timing chain is in correct installation position.

Insert central bolts (1 and 2) without play.

*Installation:*

Replace central bolts (1 and 2).



**Fig. 336: Identifying Inlet VANOS Gear And Exhaust VANOS Gear**  
Courtesy of BMW OF NORTH AMERICA, INC.

Insert bearing pin with special tool 11 5 291 into sliding rail.

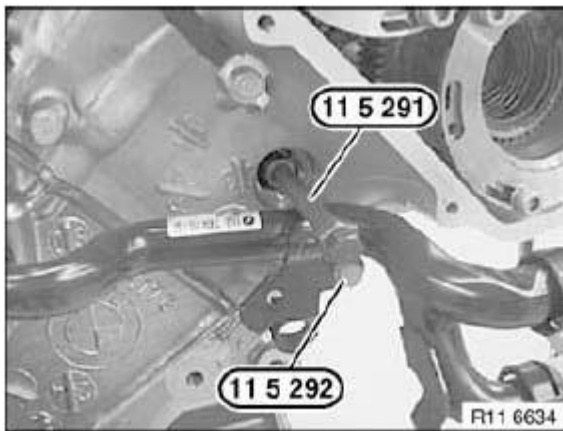
Remove special tools 11 5 291 and 11 5 292.

Install screw plug for chain rail on right cylinder head.

*Installation:*

Replace sealing ring.

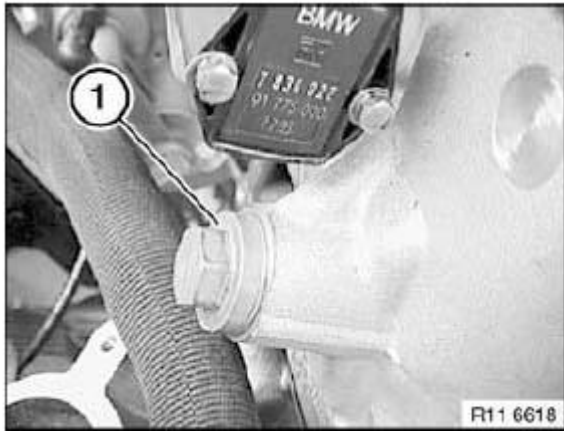
Tightening torque 11 12 9AZ. See **ENGINE - TIGHTENING TORQUES** .



**Fig. 337: Identifying Special Tools 11 5 291 And 11 5 292**  
Courtesy of BMW OF NORTH AMERICA, INC.

Insert chain tensioner with sealing ring.

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



**Fig. 338: Identifying Chain Tensioner**

Courtesy of BMW OF NORTH AMERICA, INC.

Insert special tool 11 5 382 between outer sleeve and gearwheel.

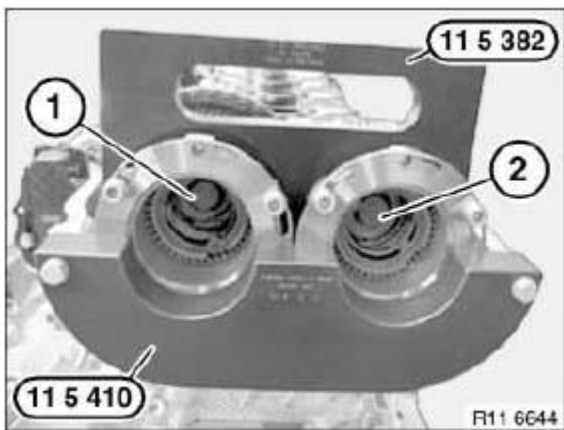
Fit special tool 11 5 410.

Remove M8x18 hexagon socket screw or special tool 11 5 370.

**IMPORTANT: Secure central bolts (1 and 2) with special tools 11 5 382 and 11 5 410 only.**

Tighten central bolts (1 and 2).

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

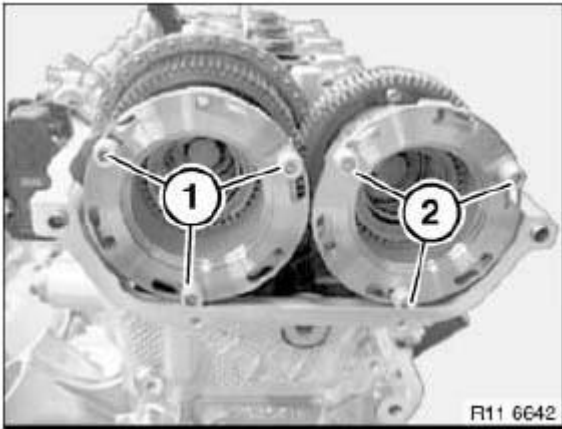


**Fig. 339: Identifying Special Tool 11 5 382 And Central Bolts**

Courtesy of BMW OF NORTH AMERICA, INC.

Remove special tools 11 5 382 and 11 5 410.

Release hexagon socket screws with washers (1 and 2) through 90°.



**Fig. 340: Identifying Hexagon Socket Screws With Washers**  
Courtesy of BMW OF NORTH AMERICA, INC.

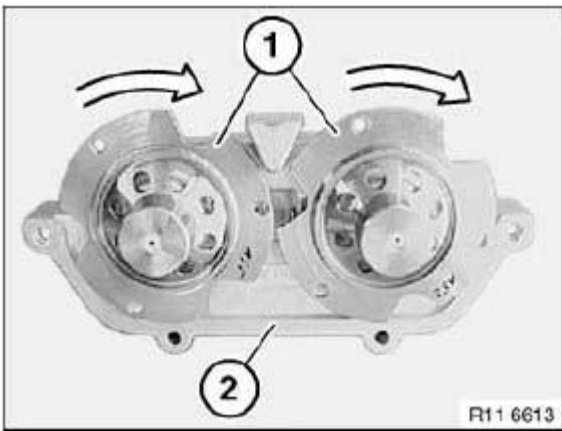
*Installation:*

Both thrust bearing plates (1) on the VANOS adjustment unit can be rotated.

Both thrust bearing plates (1) must be retracted.

Clean sealing surface (2).

Replace seal.



**Fig. 341: Installing Thrust Bearing Plates On VANOS Adjustment Unit**  
Courtesy of BMW OF NORTH AMERICA, INC.

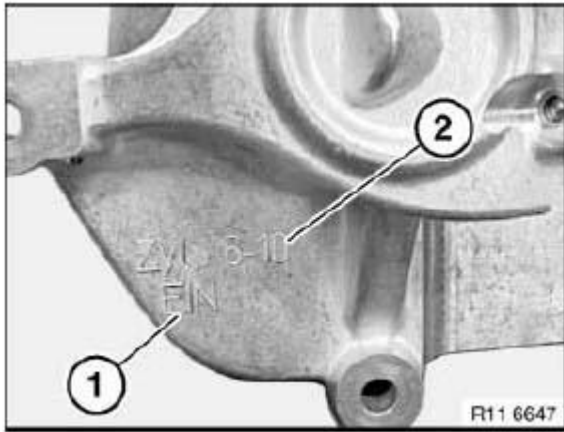
*Installation:*

VANOS adjustment unit is marked to avoid being mixed up.

The lettering EIN (1) must point to the inlet camshaft.

Cylinder assignment (2), cyl. 1-5 or 6-10.

**IMPORTANT: Risk of mixing up**



**Fig. 342: Identifying Lettering EIN On Inlet Camshaft**  
Courtesy of BMW OF NORTH AMERICA, INC.

Insert seal.

Position VANOS adjustment unit (4) with both outer bolts (1).

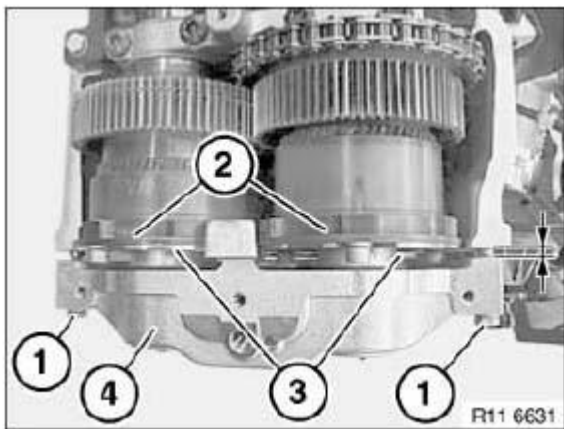
Both VANOS gears (2) are extended.

Align thrust bearing plates (3).

Push VANOS adjustment unit forwards until thrust bearing plates (3) rest against VANOS gears (2).

*Installation:*

There is a visible gap of approx. 8 mm between VANOS adjustment unit and cylinder head.



**Fig. 343: Identifying VANOS Adjustment Unit, Thrust Bearing Plates And VANOS Gears**  
Courtesy of BMW OF NORTH AMERICA, INC.

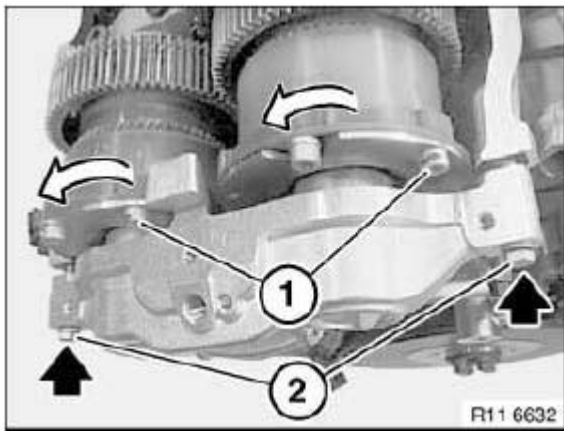
**NOTE:** Illustration shows cyl. 1 to 5.

Insert hexagon socket screws without washers (1) and join.

Release hexagon socket screws without washers (1) through 90° again.

**IMPORTANT:** All hexagon socket screws with and without washers must be released through 90°.

Screw in bolts (2) of VANOS adjustment unit uniformly in 1/2 turns.



**Fig. 344: Locating Hexagon Socket Screws**  
Courtesy of BMW OF NORTH AMERICA, INC.

*Installation:*

Both outer sleeves rotate clockwise and retract approx. 8 mm.

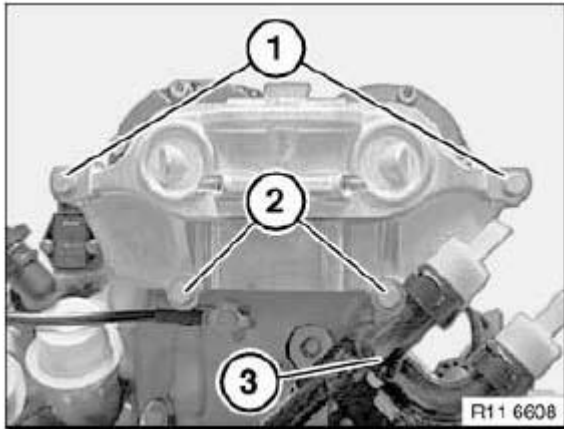
Both inner sleeves with elongated hole must rotate counterclockwise (see arrow).

**NOTE:** Illustration shows cyl. 1 to 5.

*Installation:*

Check seal for correct seating.

Secure VANOS adjustment unit with screws (1 and 2).



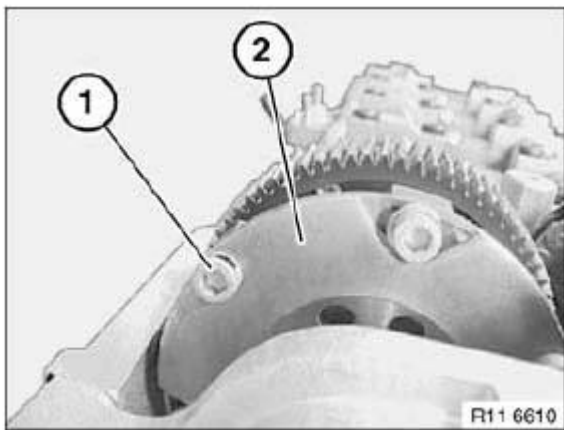
**Fig. 345: Identifying VANOS Adjustment Unit Screws**  
Courtesy of BMW OF NORTH AMERICA, INC.

Tighten down hexagon socket screws with and without washers to **10 Nm**.

*Installation:*

Mark all hexagon socket screws which are already tightened down with a colored dot.

**NOTE:** Illustration shows cyl. 1 to 5.



**Fig. 346: Identifying Hexagon Socket Screws**  
Courtesy of BMW OF NORTH AMERICA, INC.

**IMPORTANT:** Remove all special tools - risk of damage.

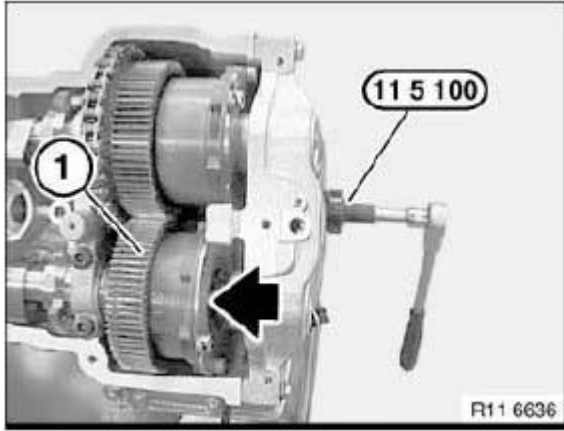
Continue cranking engine at central bolt or with special tool 11 5 100 **120° cms** until further hexagon sockets screws can be inserted on the VANOS gear and tighten to **10 Nm**.

**NOTE:** First both the inlet camshafts are moved when the engine is cranked.



Both exhaust VANOS camshafts are moved in the direction of the arrow (retard stop).

Illustration shows cyl. 1 to 5.



**Fig. 347: Identifying Special Tool 11 5 100**  
Courtesy of BMW OF NORTH AMERICA, INC.

Check timing.

Assemble engine.

### 11 36 144 REMOVING AND INSTALLING / REPLACING LEFT EXHAUST VANOS GEAR (S85)

#### Special tools required:

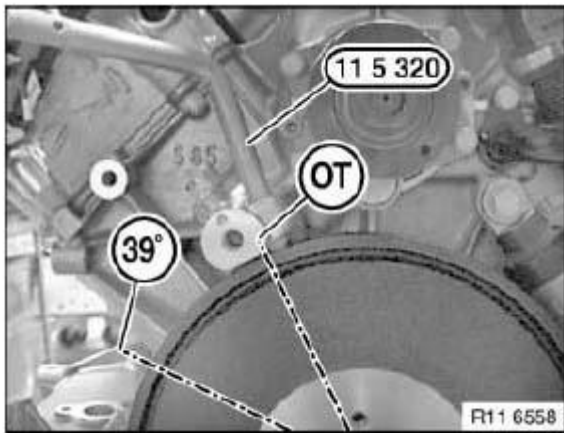
- 11 5 100
- 11 5 302
- 11 5 320
- 11 5 370
- 11 5 382
- 11 5 410

#### *Necessary preliminary tasks:*

- Remove left VANOS adjustment unit.

**IMPORTANT:** Both inlet and exhaust camshafts can be adjusted in the 1st cylinder firing TDC position.  
The procedure for checking timing is different from that for adjusting.

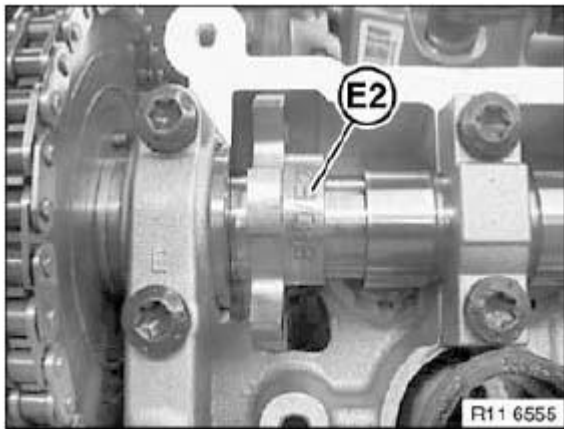
Secure special tool 11 5 320 to vibration damper in 1st cylinder firing TDC position.



**Fig. 348: Identifying Special Tool 11 5 320**  
 Courtesy of BMW OF NORTH AMERICA, INC.

Position of camshafts, cyl. 6-10, in 1st cylinder firing TDC position.

Dihedron of camshafts is vertical to cylinder axis, lettering of camshaft points upwards (E2).

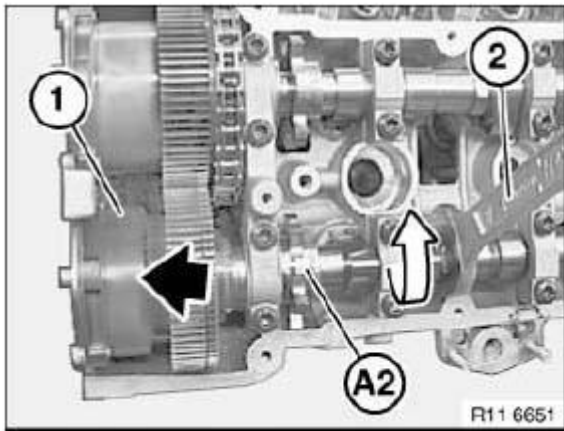


**Fig. 349: Identifying Designation On Dihedron Points Upwards**  
 Courtesy of BMW OF NORTH AMERICA, INC.

Rotate exhaust camshaft at hexagon head with an open-end wrench (2) in direction of arrow until special tool A 11 5 302 can be attached.

Designation (A2) on dihedron points upwards.

**NOTE:** Exhaust VANOS gear (1) adjusted in direction of arrow.



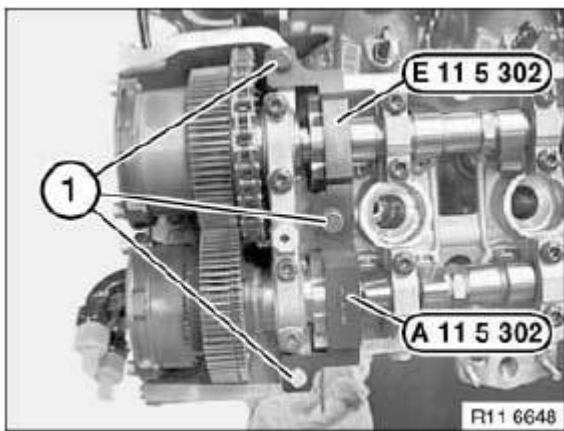
**Fig. 350: Rotating Exhaust Camshaft At Hexagon Head**  
Courtesy of BMW OF NORTH AMERICA, INC.

Disconnect inlet and exhaust camshafts.

**NOTE:** Rotate exhaust camshaft at hexagon head, attach special tool A 11 5 302.

Attach special tool E 11 5 302 and secure with bolts (1).

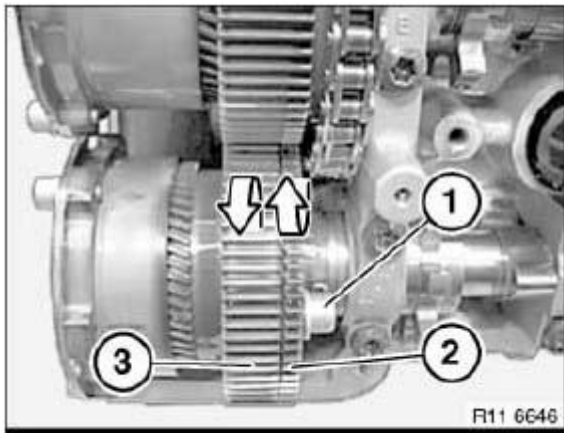
**IMPORTANT:** Screw in bolts (1) without fail, risk of damage to camshafts.



**Fig. 351: Identifying Special Tool E 11 5 302 And A 11 5 302**  
Courtesy of BMW OF NORTH AMERICA, INC.

**IMPORTANT:** Removal/installation is not possible without hexagon socket screw (1).  
Hexagon socket screw (1) with washer must not be longer than 18 mm.  
Gearwheels (2 and 3) of exhaust VANOS gear are tensioned with a spring.

Insert M8x18 hexagon socket screw (1) into VANOS gear.



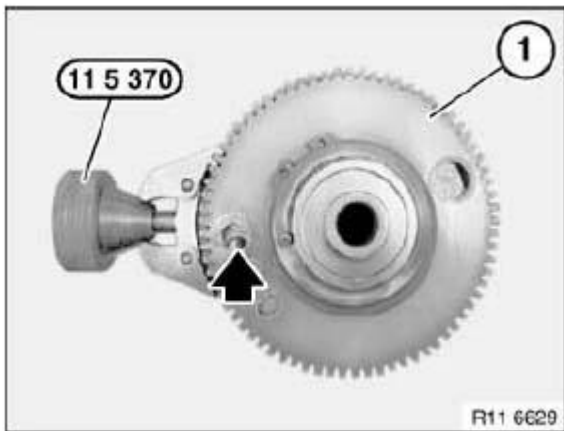
**Fig. 352: Identifying Gearwheels Of Exhaust VANOS Gear**  
Courtesy of BMW OF NORTH AMERICA, INC.

*Installation:*

If the hexagon socket screw is released or forgotten by mistake, the gear teeth can be readjusted with special tool 11 5 370.

Screw in special tool 11 5 370 until gearwheel (1) lines up with bore (see arrow) on thread.

Failure to tension the VANOS gear will result in rattling noises at idle.

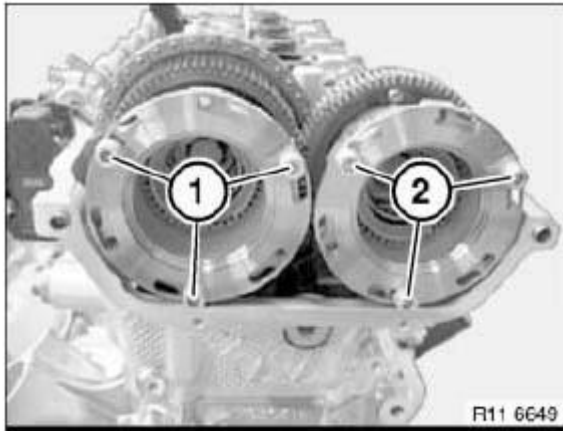


**Fig. 353: Identifying Special Tool 11 5 370 And Gearwheel**  
Courtesy of BMW OF NORTH AMERICA, INC.

Release hexagon socket screws with washers (1 and 2).

*Installation:*

Replace hexagon socket screws with washers (3 and 4).

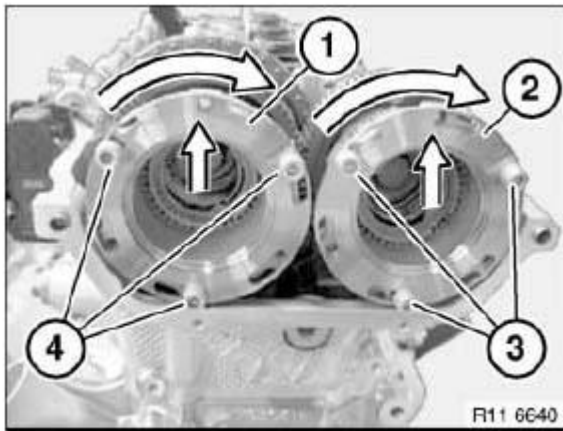


**Fig. 354: Identifying Hexagon Socket Screws With Washers**  
Courtesy of BMW OF NORTH AMERICA, INC.

**IMPORTANT:** Release central bolt only when inner sleeves (1 and 2) with elongated holes are at left stop.

Pull VANOS gear with outer sleeve forwards until inner sleeves (1 and 2) with elongated holes are at left stop.

Join hexagon socket screws with washers (3 and 4) to 5 Nm



**Fig. 355: Pulling VANOS Gear With Outer Sleeve Forwards**  
Courtesy of BMW OF NORTH AMERICA, INC.

Attach special tool 11 5 382.

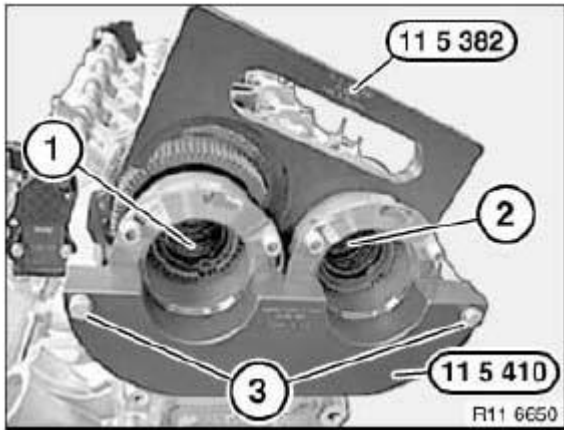
Fit special tool 11 5 410 with bolts (3).

**IMPORTANT:** Release central bolt (2) with special tools 11 5 410 and 11 5 382 only.

**NOTE:**

- If the special tool 11 5 410 cannot be fitted due to the hexagon socket

screws being unfavorably positioned, it is necessary to remove the two or if necessary four hexagon socket screws.



**Fig. 356: Identifying Special Tool 11 5 410 And 11 5 382**  
Courtesy of BMW OF NORTH AMERICA, INC.

Release central bolts (2).

Remove special tool 11 5 410.

**NOTE:**

- If the central bolt is released, the removed hexagon socket screws are reinstalled with a joining torque of 5 Nm.

*Installation:*

Replace central bolt (2).

**IMPORTANT: Danger of injury!**

*Installation:*

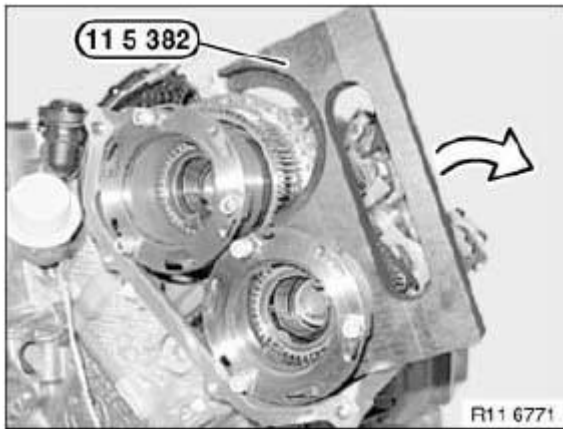
If the VANOS gear is to be reused, the special tool 11 5 382 must not be removed.

VANOS gear is tensioned.

Tilt special tool 11 5 382 in direction of arrow.

If the VANOS gear is to be replaced by a new part, the special tool 11 5 382 can be removed.

Remove VANOS gear with special tool 11 5 382.



**Fig. 357: Tilting Special Tool 11 5 382**  
Courtesy of BMW OF NORTH AMERICA, INC.

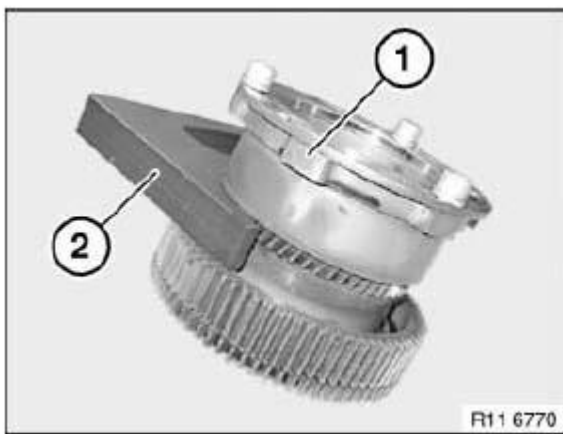
**IMPORTANT: Danger of injury!**

*Installation:*

If the VANOS gear is to be reused, the special tool 11 5 382 must not be removed.

VANOS gear is tensioned.

Set down VANOS gear (1) with special tool (2).



**Fig. 358: Identifying VANOS Gear And Special Tool**  
Courtesy of BMW OF NORTH AMERICA, INC.

Install exhaust VANOS gear (2) in position.

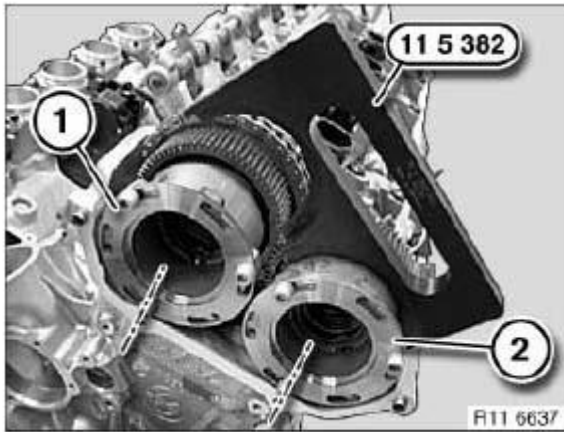
*Installation:*

M8x18 hexagon socket screw points upwards.

One of the three screws points downwards.

Insert central bolt, join slightly and then release again through 90°.

Remove M8x18 hexagon socket screw or special tool 11 5 370.



**Fig. 359: Identifying Exhaust VANOS Gear And Special Tool 11 5 382**  
Courtesy of BMW OF NORTH AMERICA, INC.

Insert special tool 11 5 382 between outer sleeve and gearwheel.

Fit special tool 11 5 410.

**IMPORTANT: Secure and release central bolt (2) with special tools 11 5 410 and 11 5 382 only.**  
**Risk of damage to VANOS gear.**

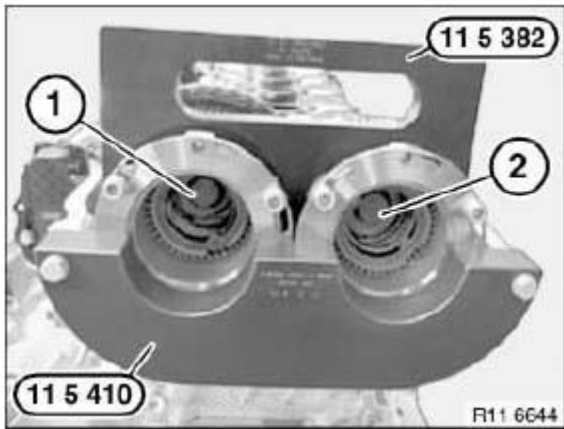
Tighten central bolt (2).

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

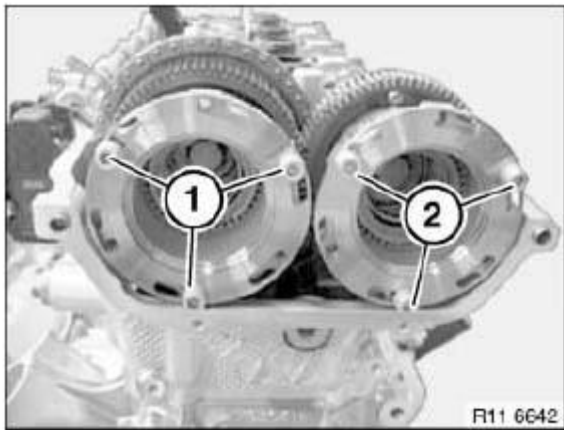
Remove special tools 11 5 410 and 11 5 382.

Release hexagon socket screws with washers (1 and 2) through 90°.





**Fig. 360: Identifying Special Tools 11 5 410 And 11 5 382**  
 Courtesy of BMW OF NORTH AMERICA, INC.



**Fig. 361: Identifying Hexagon Socket Screws With Washers**  
 Courtesy of BMW OF NORTH AMERICA, INC.

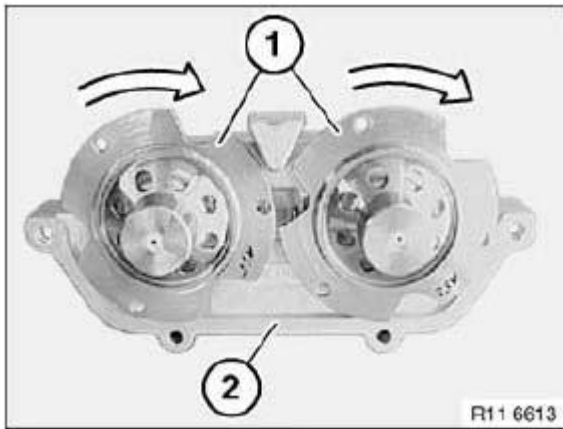
*Installation:*

Both thrust bearing plates (1) on the VANOS adjustment unit can be rotated.

Both thrust bearing plates (1) must be retracted.

Clean sealing surface (2).

Replace seal.



**Fig. 362: Installing Thrust Bearing Plates On VANOS Adjustment Unit**  
Courtesy of BMW OF NORTH AMERICA, INC.

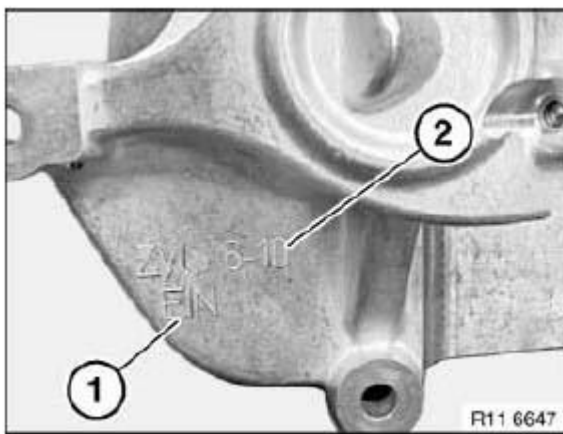
**IMPORTANT: Risk of mixing up**

*Installation:*

VANOS adjustment units are marked to avoid being mixed up.

The lettering EIN (1) must point to the inlet camshaft.

Cylinder assignment (2), cyl. 1-5 or 6-10.



**Fig. 363: Identifying Lettering EIN On Inlet Camshaft**  
Courtesy of BMW OF NORTH AMERICA, INC.

Insert seal.

Position VANOS adjustment unit (4) with both outer bolts (1).

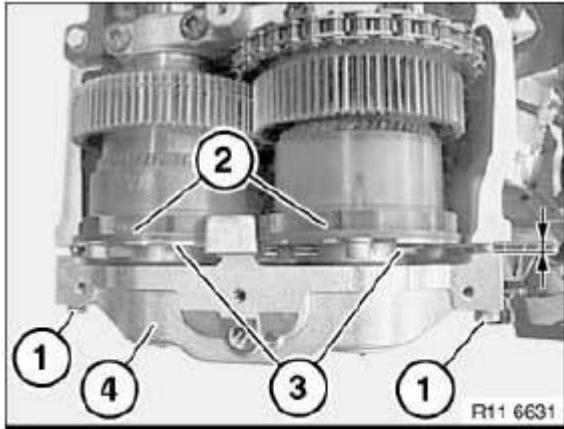
Both VANOS gears (2) are extended.

Align thrust bearing plates (3).

Push VANOS adjustment unit (4) forwards until thrust bearing plates (3) rest against VANOS gears (2).

*Installation:*

There is a visible gap of approx. 8 mm between VANOS adjustment unit and cylinder head.



**Fig. 364: Identifying VANOS Adjustment Unit, Thrust Bearing Plates And VANOS Gears**  
Courtesy of BMW OF NORTH AMERICA, INC.

**NOTE:** Illustration shows cyl. 1 to 5.

Insert hexagon socket screws (1) without washers and join to 5 Nm.

Release hexagon socket screws (1) without washers through 90° again.

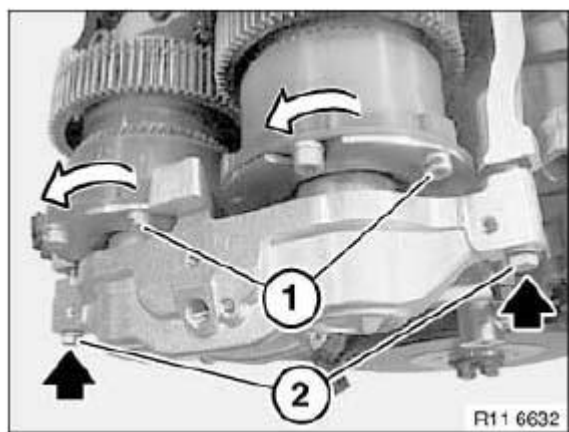
**IMPORTANT:** All hexagon socket screws with and without washers must be released through 90°.

Screw in bolts (2) of VANOS adjustment unit uniformly in 1/2 turns.

*Installation:*

Both outer sleeves rotate clockwise and retract approx. 8 mm.

Both inner sleeves with elongated hole must rotate counterclockwise (see arrow).

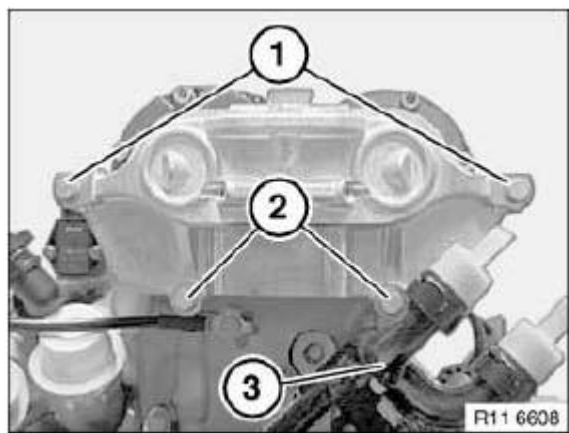


**Fig. 365: Locating Hexagon Socket Screws**  
 Courtesy of BMW OF NORTH AMERICA, INC.

*Installation:*

Check seal for correct seating.

Secure VANOS adjustment unit with screws (1 and 2).



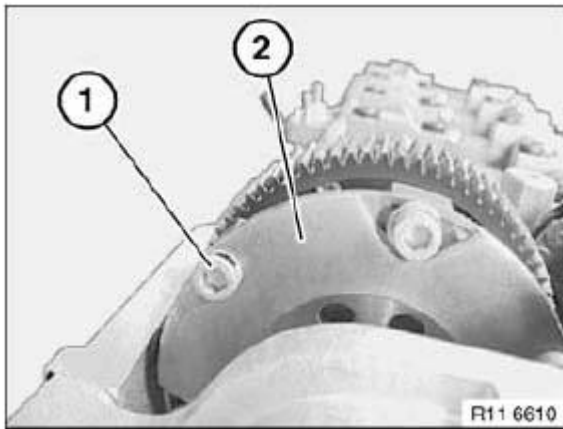
**Fig. 366: Identifying VANOS Adjustment Unit With Screws**  
 Courtesy of BMW OF NORTH AMERICA, INC.

Tighten down hexagon socket screws with and without washers to **10 Nm**.

*Installation:*

Mark all screws which are already tightened down with a colored dot.

**NOTE:** Illustration shows cyl. 1-5.



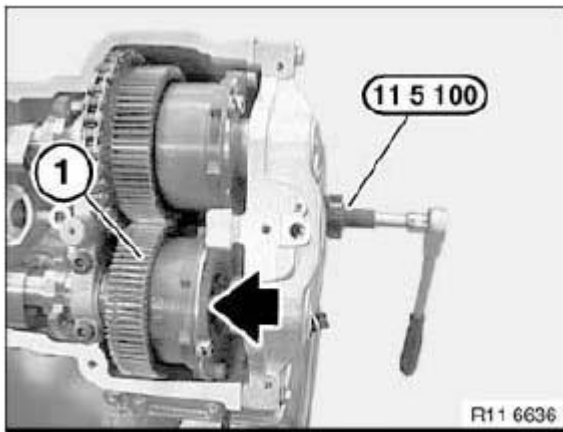
**Fig. 367: Identifying Hexagon Socket Screws**  
Courtesy of BMW OF NORTH AMERICA, INC.

**IMPORTANT: Remove all special tools risk of damage!**

Continue cranking engine at central bolt or with special tool 11 5 100 **120° cms** until further hexagon sockets screws can be inserted on the VANOS gear and tighten to **10 Nm**.

**NOTE:** First both the inlet camshafts are moved when the engine is cranked.

Both exhaust camshaft gears are moved in the direction of the arrow (retard stop).



**Fig. 368: Identifying Special Tool 11 5 100**  
Courtesy of BMW OF NORTH AMERICA, INC.

Check timing.

Assemble engine.

## 11 36 148 REMOVING AND INSTALLING / REPLACING RIGHT INLET VANOS GEAR (S85)

**Special tools required:**

- 11 5 100
- 11 5 291
- 11 5 292
- 11 5 301
- 11 5 320
- 11 5 351
- 11 5 370
- 11 5 381
- 11 5 410

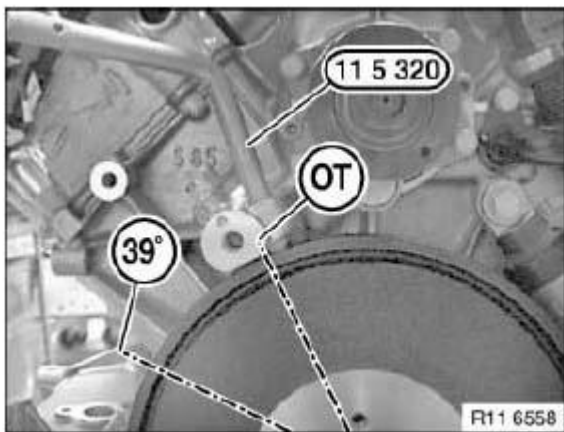
*Necessary preliminary tasks:*

- Remove right VANOS adjustment unit.

**IMPORTANT:** Both inlet and exhaust camshafts can be adjusted in the 1st cylinder firing TDC position.

The procedure for checking timing is different from that for adjusting.

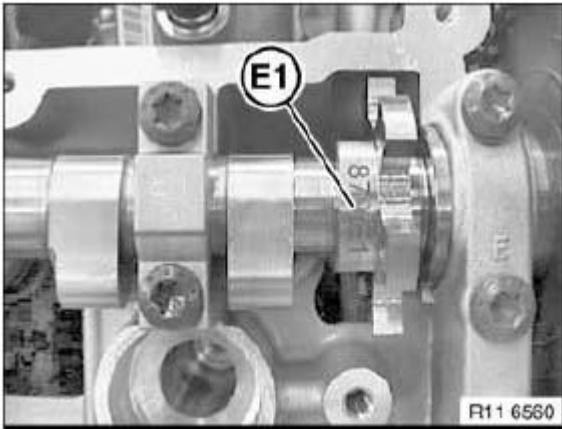
Secure special tool 11 5 320 to vibration damper in 1st cylinder firing TDC position.



**Fig. 369: Identifying Special Tool 11 5 320**  
Courtesy of BMW OF NORTH AMERICA, INC.

Position of inlet camshaft, cylinders 1-5.

Designation (E1) on dihedron points upwards.

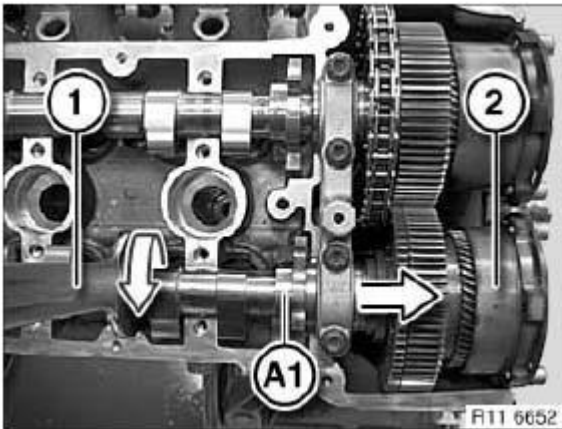


**Fig. 370: Identifying Designation (E1) On Dihedron Points Upwards**  
 Courtesy of BMW OF NORTH AMERICA, INC.

Rotate exhaust camshaft with open-end wrench (1) at hexagon head in direction of arrow until special tool A 11 5 301 can be attached.

Designation (A1) on dihedron points upwards.

**NOTE:** Exhaust VANOS gear (2) adjusted in direction of arrow (advance).



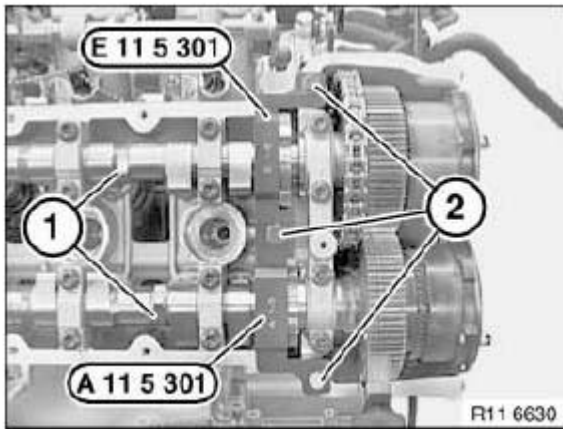
**Fig. 371: Rotating Exhaust Camshaft**  
 Courtesy of BMW OF NORTH AMERICA, INC.

Disconnect inlet and exhaust camshafts.

Attach special tool A 11 5 301.

Attach special tool E 11 5 301 and secure with bolts (2).

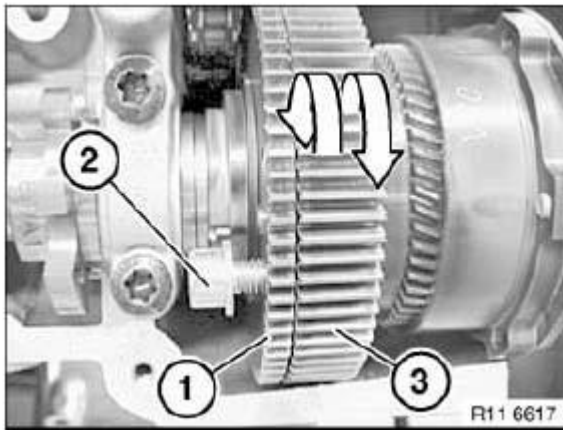
**IMPORTANT:** Screw in bolts (2) without fail, risk of damage to camshafts.



**Fig. 372: Identifying Special Tool A 11 5 301 And E 11 5 301**  
 Courtesy of BMW OF NORTH AMERICA, INC.

**IMPORTANT:** Removal/installation is not possible without hexagon socket screw (2).  
 Hexagon socket screw (2) with washer must not be longer than 18 mm.  
 Gearwheels (1 and 3) of exhaust VANOS gear are tensioned with a spring.

Insert M8x18 hexagon socket screw (2) into exhaust VANOS gear.



**Fig. 373: Identifying Gearwheels Of Exhaust VANOS Gear**  
 Courtesy of BMW OF NORTH AMERICA, INC.

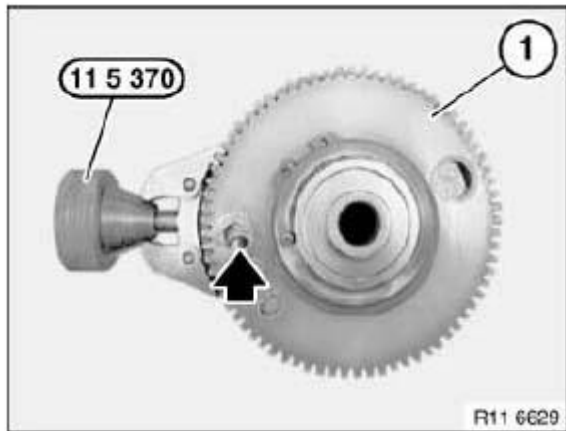
*Installation:*

If the hexagon socket screw is released or forgotten by mistake, the gear teeth can be readjusted with special tool 11 5 370.

Screw in special tool 11 5 370 until gearwheel (1) lines up with bore (see arrow) on thread.

Failure to tension the exhaust VANOS gear (1) will result in rattling noises at idle.





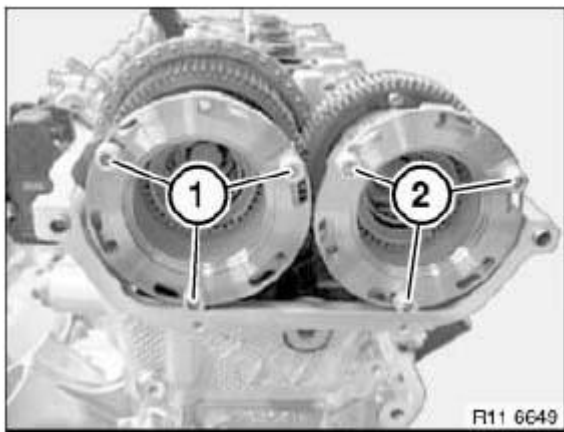
**Fig. 374: Identifying Special Tool 11 5 370 And Gearwheel**  
Courtesy of BMW OF NORTH AMERICA, INC.

Release all hexagon socket screws with washers (1 and 2).

*Installation:*

Replace hexagon socket screws with washers (1 and 2).

**NOTE:** Illustration shows cyl. 6-10.

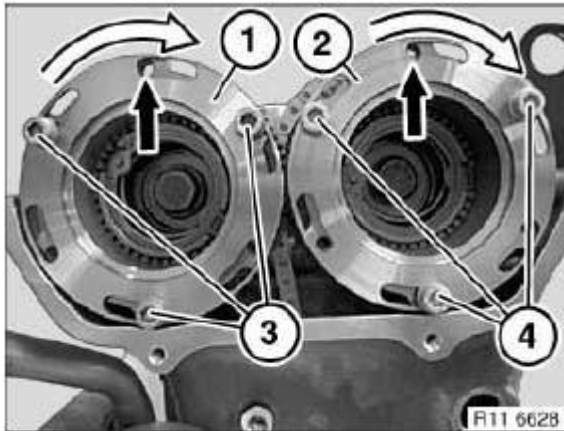


**Fig. 375: Identifying Hexagon Socket Screws With Washers**  
Courtesy of BMW OF NORTH AMERICA, INC.

**IMPORTANT:** Release central bolt only when inner sleeves (1 and 2) with elongated holes are at left stop.

Pull VANOS gear with outer sleeve forwards until inner sleeves (1 and 2) with elongated holes are at left stop.

Join hexagon socket screws with washers (3 and 4) to 5 Nm.



**Fig. 376: Pulling VANOS Gear With Outer Sleeve Forwards**  
Courtesy of BMW OF NORTH AMERICA, INC.

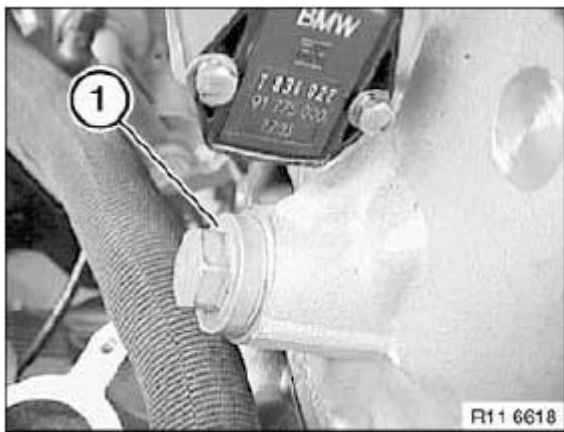
Remove right chain tensioner.

*Installation:*

Replace sealing ring.

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

**NOTE:** Illustration shows cyl. 6-10.



**Fig. 377: Identifying Right Chain Tensioner**  
Courtesy of BMW OF NORTH AMERICA, INC.

Remove screw plug for chain rail on right cylinder head.

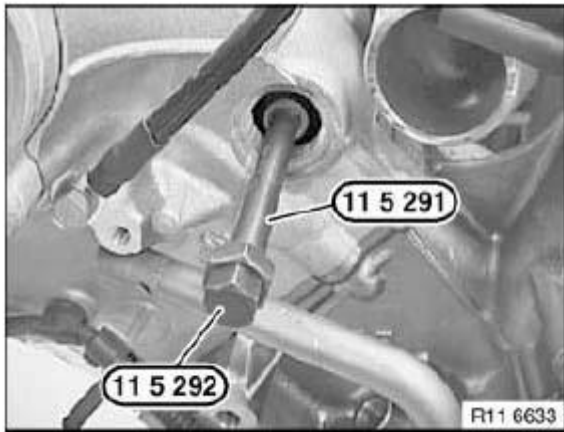
*Installation:*

Replace sealing ring.

Tightening torque 11 12 9AZ. See **ENGINE - TIGHTENING TORQUES**.

Insert special tool 11 5 291.

Secure bearing pin against falling out with special tool 11 5 292.



**Fig. 378: Identifying Special Tool 11 5 291 And 11 5 292**  
Courtesy of BMW OF NORTH AMERICA, INC.

Attach special tool 11 5 381.

Fit special tool 11 5 410 with bolts (3).

**IMPORTANT:** Release central bolts (1 and 2) with special tools 11 5 410 and 11 5 381 only.  
**Risk of damage to VANOS gear.**

**NOTE:**

- If the special tool 11 5 410 cannot be fitted due to the hexagon socket screws being unfavorably positioned, it is necessary to remove the two or if necessary four hexagon socket screws.

Release central bolts (1 and 2).

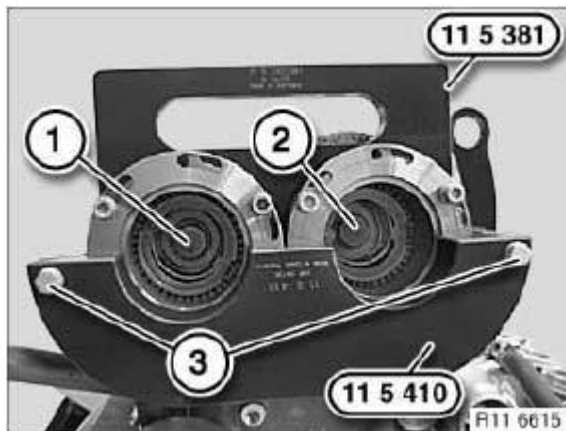
Remove special tool 11 5 410.

**NOTE:**

- If the central bolt is released, the removed hexagon socket screws are reinstalled with a joining torque of 5 Nm.

*Installation:*

Replace central bolts (1 and 2).



**Fig. 379: Identifying Special Tool 11 5 381, 11 5 410 And Central Bolts**  
 Courtesy of BMW OF NORTH AMERICA, INC.

**IMPORTANT: Danger of injury!**

*Installation:*

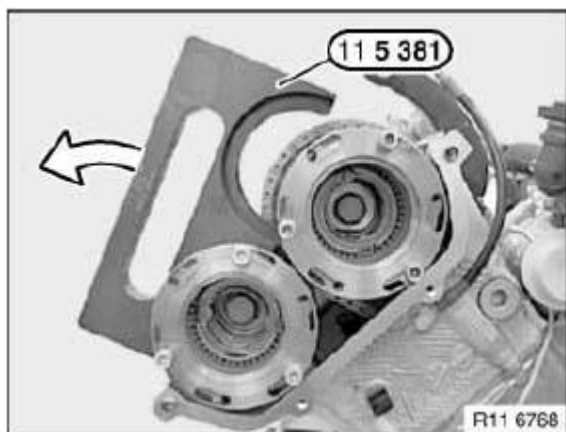
If the VANOS gear is to be reused, the special tool 11 5 381 must not be removed.

VANOS gear is tensioned.

Tilt special tool 11 5 381 in direction of arrow.

If the VANOS gear is to be replaced by a new part, the special tool 11 5 381 can be removed.

Remove VANOS gear with special tool 11 5 381.



**Fig. 380: Tilting Special Tool 11 5 381**  
 Courtesy of BMW OF NORTH AMERICA, INC.

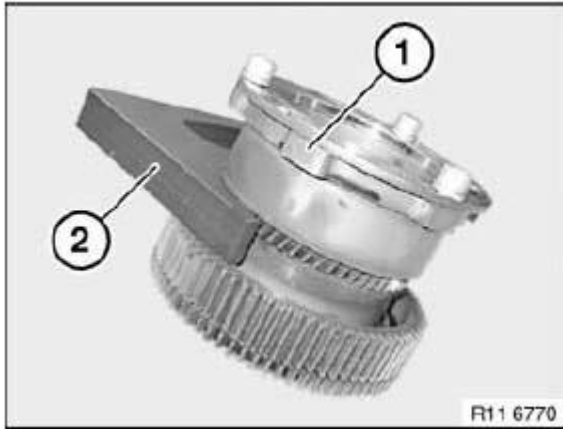
**IMPORTANT: Danger of injury!**

*Installation:*

If the VANOS gear is to be reused, the special tool 11 5 381 must not be removed.

VANOS gear is tensioned.

Set down VANOS gear (1) with special tool (2).



**Fig. 381: Identifying VANOS Gear And Special Tool**  
Courtesy of BMW OF NORTH AMERICA, INC.

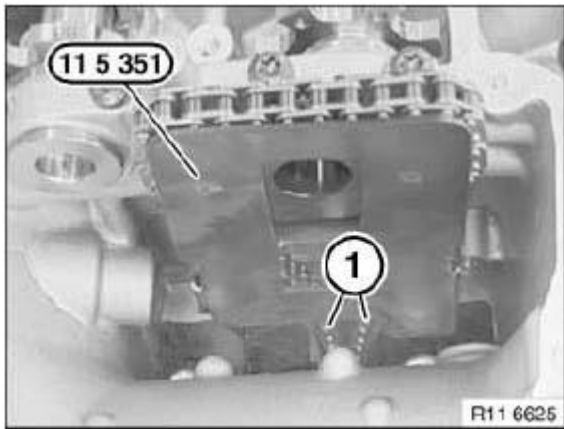
Remove both VANOS gears.

**IMPORTANT: Do not allow timing chain to fall into the engine compartment.  
It is possible for the timing chain to become blocked on the VANOS high-pressure pump - risk of damage!**

Insert special tool 11 5 351 into chain drive.

Press sliding rails (1) together.

Pretension timing chain with special tool 11 5 351.



**Fig. 382: Identifying Special Tool 11 5 351 And Sliding Rails**  
 Courtesy of BMW OF NORTH AMERICA, INC.

*Installation:*

Position inlet VANOS gear (2) so that one of the three screws with washers points downwards.

Position exhaust VANOS gear (1) so that one of the three screws with washers points downwards.

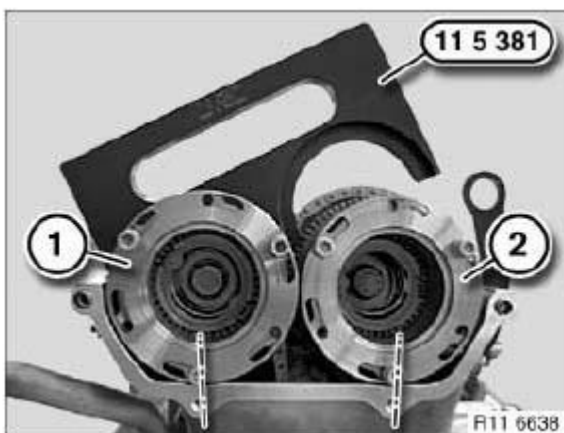
M8x18 hexagon socket screw points upwards.

Check that timing chain is in correct installation position.

Insert central bolts (1 and 2) without play.

*Installation:*

Replace central bolts (1 and 2).



**Fig. 383: Identifying Inlet VANOS Gear And Exhaust VANOS Gear**  
 Courtesy of BMW OF NORTH AMERICA, INC.

Insert bearing pin with special tool 11 5 291 into sliding rail.

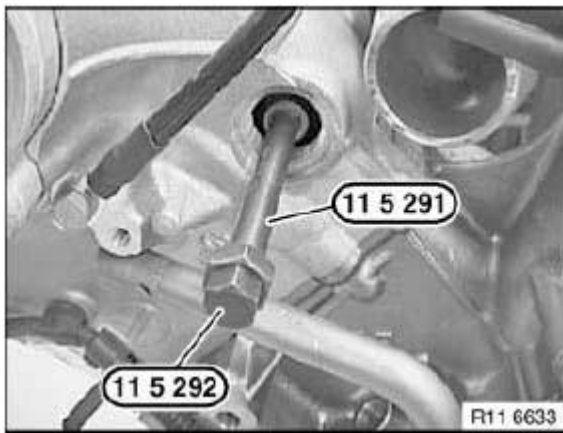
Tightening torque 11 31 2AZ. See **11 31 CAMSHAFT** .

Remove special tools 11 5 291 and 11 5 292.

Install screw plug for chain rail on right cylinder head.

**Installation:** Replace sealing ring.

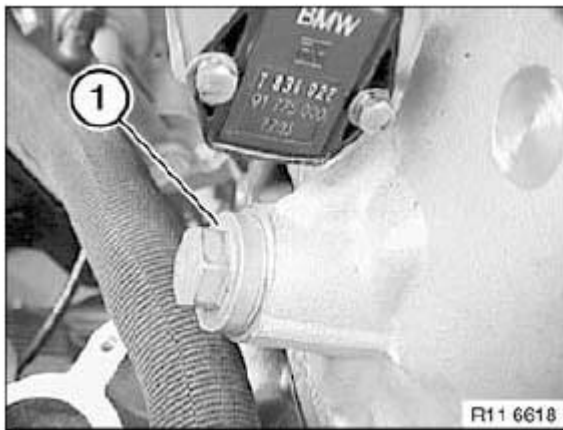
Tightening torque: 11 12 9AZ. See **11 12 CYLINDER HEAD WITH COVER** .



**Fig. 384: Identifying Special Tools 11 5 291 And 11 5 292**  
Courtesy of BMW OF NORTH AMERICA, INC.

Insert chain tensioner with sealing ring. Tightening torque: 11 31 1AZ. See **11 31 CAMSHAFT** .

**NOTE:** Illustration shows cyl. 6-10.

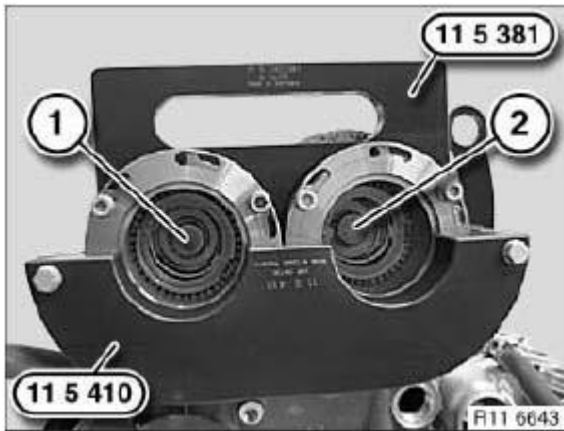


**Fig. 385: Identifying Chain Tensioner**  
Courtesy of BMW OF NORTH AMERICA, INC.

If necessary, remove transportation lock from VANOS gear. Insert special tool 11 5 381 between outer sleeve and gearwheel. Fit special tool 11 5 410. Remove M8x18 hexagon socket screw or special tool 11 5 370.

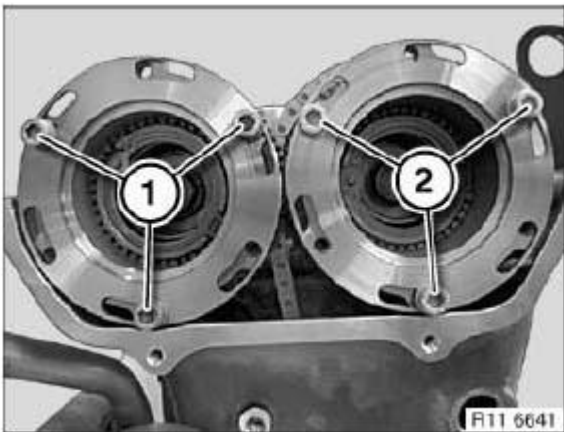
**IMPORTANT: Secure central bolts (1 and 2) with special tools 11 5 381 and 11 5 410 only.**

Tighten central bolts (1 and 2). Tightening torque: 11 36 1AZ. See 11 36 VARIABLE CAMSHAFT CONTROL .



**Fig. 386: Identifying Exhaust VANOS Gear And Special Tool 11 5 381 (2 Of 2)**  
Courtesy of BMW OF NORTH AMERICA, INC.

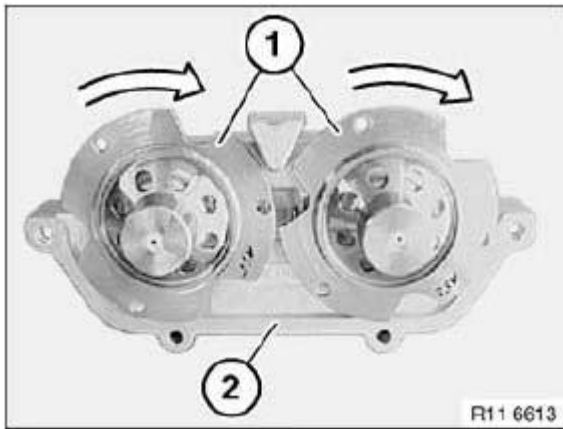
Remove special tools 11 5 381 and 11 5 410. Release hexagon socket screws with washers (1 and 2) through 90°.



**Fig. 387: Identifying Hexagon Socket Screws With Washers**  
Courtesy of BMW OF NORTH AMERICA, INC.

**Installation:** Both thrust bearing plates (1) on the VANOS adjustment unit can be rotated. Both thrust bearing plates (1) must be retracted. Clean sealing surface (2). Replace seal.

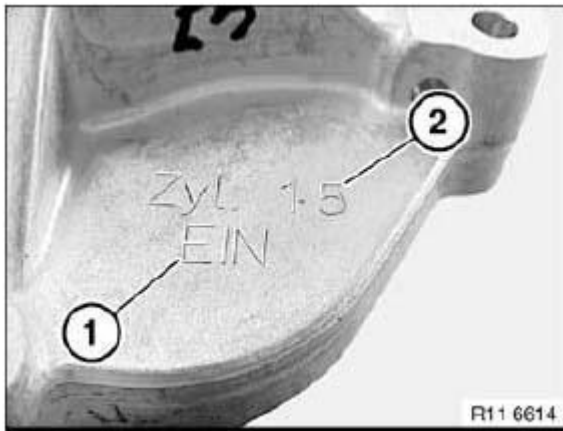




**Fig. 388: Identifying Thrust Bearing Plates**  
 Courtesy of BMW OF NORTH AMERICA, INC.

**Installation:** VANOS adjustment unit is marked to avoid being mixed up. The lettering EIN (1) must point to the inlet camshaft. Cylinder assignment (2), cyl. 1-5 or 6-10.

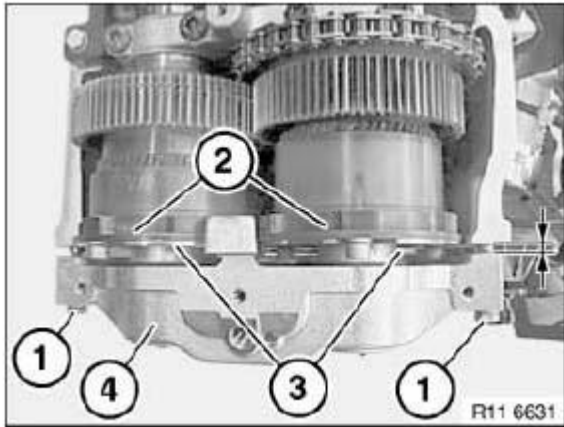
**IMPORTANT: Risk of mixing up parts!**



**Fig. 389: Identifying Lettering EIN On Inlet Camshaft (1 Of 2)**  
 Courtesy of BMW OF NORTH AMERICA, INC.

Insert seal. Position VANOS adjustment unit (4) with both outer bolts (1). Both VANOS gears (2) are extended. Align thrust bearing plates (3). Push VANOS adjustment unit forwards until thrust bearing plates (3) rest against VANOS gears (2).

**Installation:** There is a visible gap of approx. 8 mm between VANOS adjustment unit and cylinder head.



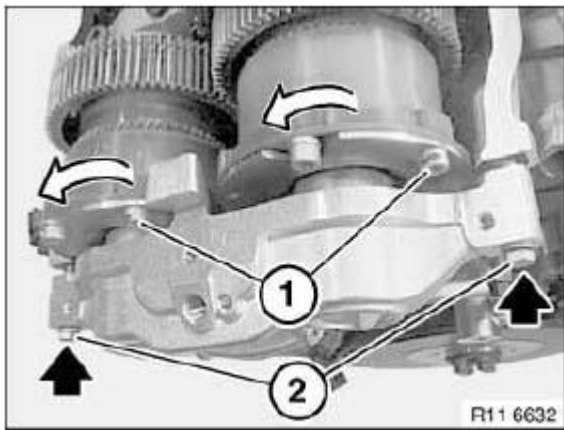
**Fig. 390: Identifying VANOS Adjustment Unit, Thrust Bearing Plates And VANOS Gears**  
Courtesy of BMW OF NORTH AMERICA, INC.

Insert hexagon socket screws without washers (1) and join. Release screws without washers (1) through 90° again.

**IMPORTANT:** All screws with and without washers must be released through 90°.

Screw in bolts (2) of VANOS adjustment unit uniformly in 1/2 turns.

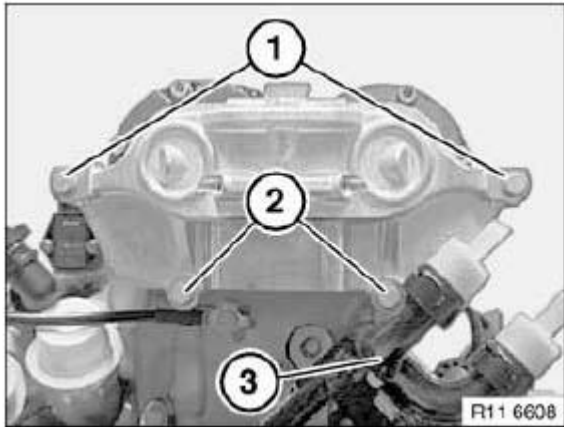
**Installation:** Both outer sleeves rotate clockwise and retract approx. 8 mm. Both inner sleeves with elongated hole must rotate counterclockwise (see arrow).



**Fig. 391: Locating VANOS Adjustment Unit Bolts**  
Courtesy of BMW OF NORTH AMERICA, INC.

**Installation:** Check seal for correct seating.

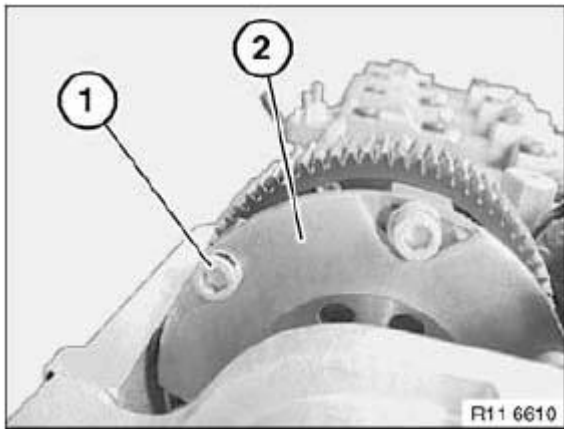
Secure VANOS adjustment unit with screws (1 and 2).



**Fig. 392: Identifying VANOS Adjustment Unit Screws**  
 Courtesy of BMW OF NORTH AMERICA, INC.

Tighten down hexagon socket screws with and without washers to 10 Nm.

**Installation:** Mark all screws which are already tightened down with a colored dot.

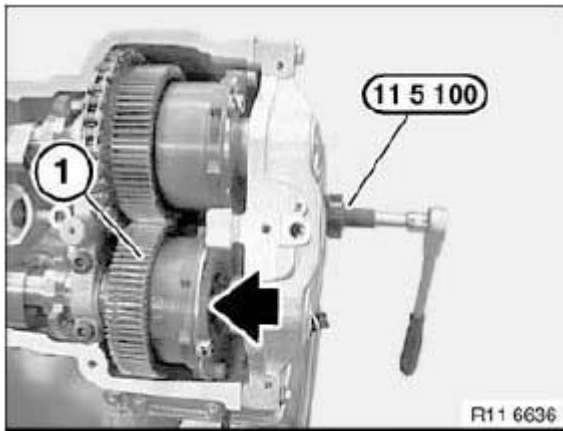


**Fig. 393: Identifying Hexagon Socket Screws**  
 Courtesy of BMW OF NORTH AMERICA, INC.

**IMPORTANT:** Remove all special tools - risk of damage.

Continue cranking engine at hexagon head or with special tool 11 5 100 120° camshaft until further hexagon sockets screws can be inserted on the VANOS gear and tighten to 10 Nm.

**NOTE:** First both the inlet camshafts are moved when the engine is cranked. Both exhaust VANOS camshafts are moved in the direction of the arrow (retard stop). Illustration shows cyl. 1 to 5.



**Fig. 394: Identifying Special Tool 11 5 100**  
Courtesy of BMW OF NORTH AMERICA, INC.

Check timing. Assemble engine.

### 11 36 150 REMOVING AND INSTALLING / REPLACING RIGHT EXHAUST VANOS GEAR (S85)

#### Special tools required:

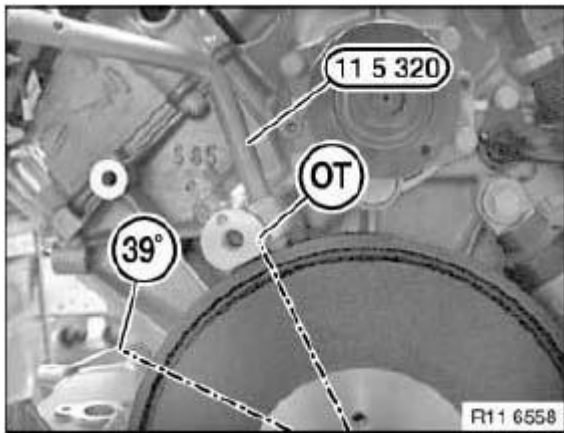
- 11 5 100
- 11 5 301
- 11 5 320
- 11 5 370
- 11 5 381
- 11 5 410

#### *Necessary preliminary tasks:*

- Remove right VANOS adjustment unit.

**IMPORTANT:** Both inlet and exhaust camshafts can be adjusted in the 1st cylinder firing TDC position.  
The procedure for checking timing is different from that for adjusting.

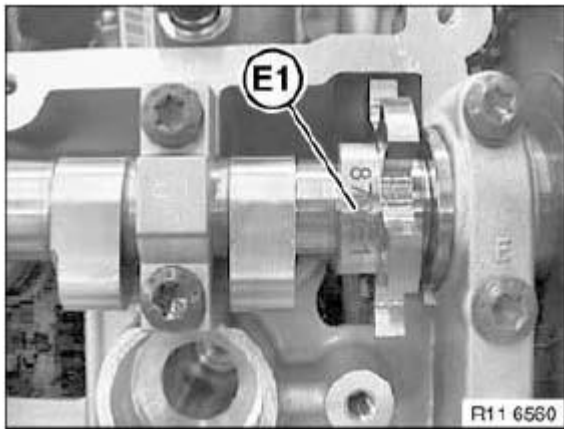
Secure special tool 11 5 320 to vibration damper in 1st cylinder firing TDC position.



**Fig. 395: Identifying Special Tool 11 5 320**  
 Courtesy of BMW OF NORTH AMERICA, INC.

Position of camshafts, cyl. 1-5, in 1st cylinder firing TDC position.

Dihedron of camshafts is vertical to cylinder axis, lettering of camshaft points upwards (E1).

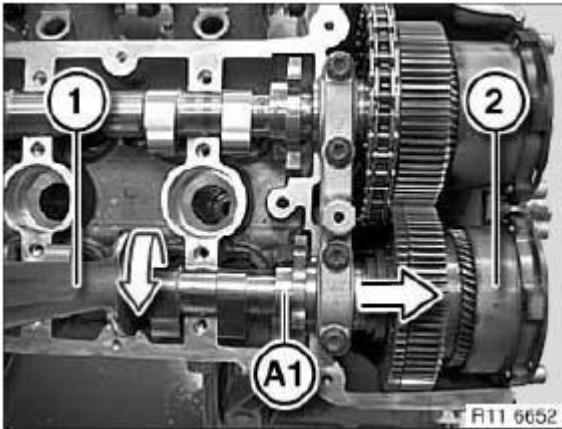


**Fig. 396: Identifying Designation (E1) On Dihedron Points Upwards**  
 Courtesy of BMW OF NORTH AMERICA, INC.

Rotate exhaust camshaft with open-end wrench (1) at hexagon head in direction of arrow until special tool A 11 5 301 can be attached.

Designation (A1) on dihedron points upwards.

**NOTE:** Exhaust VANOS gear (2) adjusted in direction of arrow (advance).



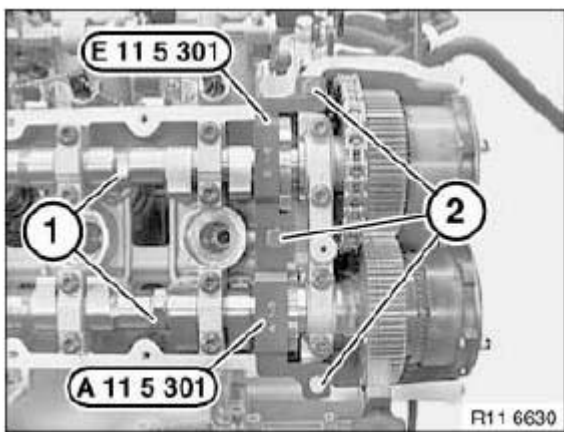
**Fig. 397: Rotating Exhaust Camshaft With Open-End Wrench At Hexagon Head**  
 Courtesy of BMW OF NORTH AMERICA, INC.

Disconnect inlet and exhaust camshafts.

Attach special tool A 11 5 301.

Attach special tool E 11 5 301 and secure with bolts (2).

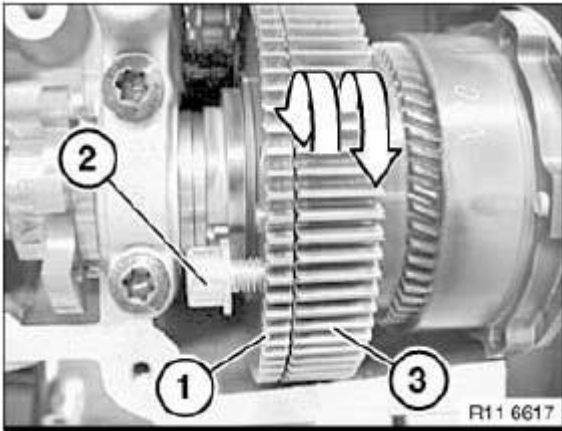
**IMPORTANT: Screw in bolts (2) without fail, risk of damage to camshafts.**



**Fig. 398: Identifying Special Tool A 11 5 301 And E 11 5 301**  
 Courtesy of BMW OF NORTH AMERICA, INC.

**IMPORTANT: Removal/installation is not possible without hexagon socket screw (2).  
 Hexagon socket screw (2) with washer must not be longer than 18 mm.  
 Gearwheels (1 and 3) of exhaust VANOS gear are tensioned with a spring.**

Insert M8x18 hexagon socket screw (2) into exhaust VANOS gear.



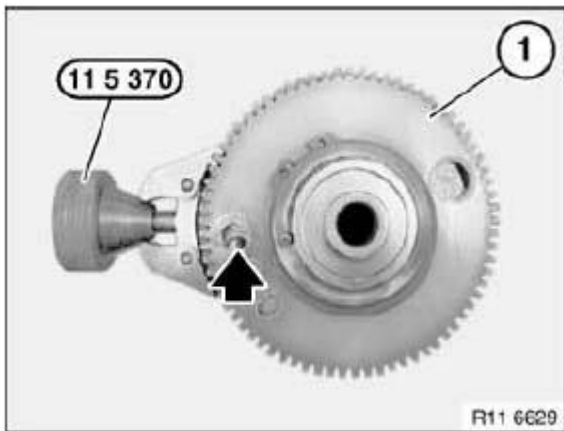
**Fig. 399: Identifying Gearwheels Of Exhaust VANOS Gear**  
 Courtesy of BMW OF NORTH AMERICA, INC.

*Installation:*

If the hexagon socket screw is released or forgotten by mistake, the gear teeth can be readjusted with special tool 11 5 370.

Screw in knurled screw on special tool 11 5 370 until gearwheel (1) lines up with bore (see arrow) on thread.

Failure to tension the exhaust VANOS gear (1) will result in rattling noises at idle.



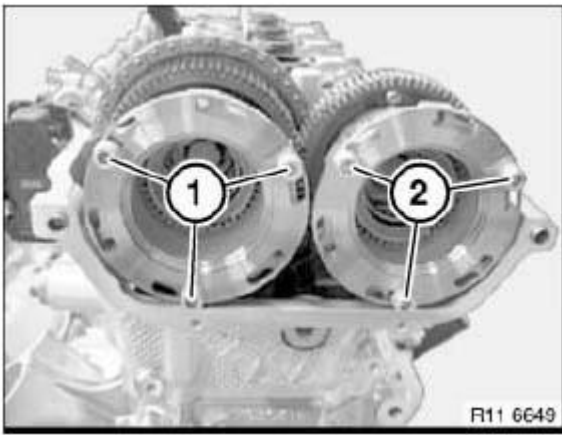
**Fig. 400: Identifying Special Tool 11 5 370 And Exhaust VANOS Gear**  
 Courtesy of BMW OF NORTH AMERICA, INC.

Release hexagon socket screws with washers (1 and 2).

*Installation:*

Replace hexagon socket screws with washers (1 and 2).

Illustration shows cyl. 6-10.

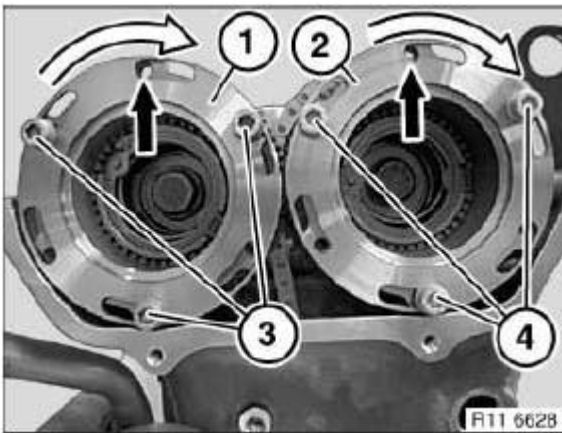


**Fig. 401: Identifying Hexagon Socket Screws With Washers**  
Courtesy of BMW OF NORTH AMERICA, INC.

**IMPORTANT: Release central bolt only when inner sleeve (1) with elongated holes is at left stop.**

Pull VANOS gear with outer sleeve forwards until inner sleeves (1 and 2) with elongated holes are at left stop.

Join screws (3 and 4) to 5 Nm.



**Fig. 402: Pulling VANOS Gear With Outer Sleeve Forwards**  
Courtesy of BMW OF NORTH AMERICA, INC.

Attach special tool 11 5 381.

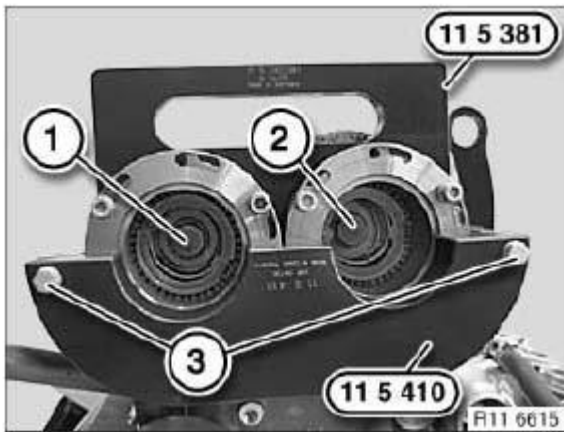
Fit special tool 11 5 410 with bolts (3).

**IMPORTANT: Release central bolts (1 and 2) with special tools 11 5 410 and 11 5 381 only.**



**Risk of damage to VANOS gear.****NOTE:**

- If the special tool 11 5 410 cannot be fitted due to the hexagon socket screws being unfavorably positioned, it is necessary to remove the two or if necessary four hexagon socket screws.



**Fig. 403: Identifying Special Tool 11 5 381 And 11 5 410**  
Courtesy of BMW OF NORTH AMERICA, INC.

Release central bolt (1).

Remove special tool 11 5 410.

**NOTE:**

- If the central bolt is released, the removed hexagon socket screws are reinstalled with a joining torque of 5 Nm.

*Installation:*

Replace central bolt (1).

**IMPORTANT: Danger of injury!***Installation:*

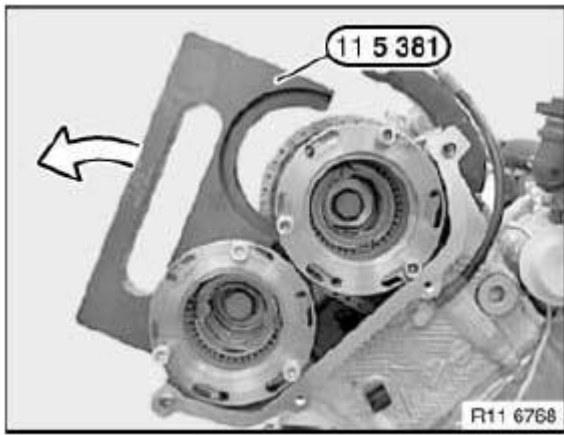
If the VANOS gear is to be reused, the special tool 11 5 381 must not be removed.

VANOS gear is tensioned.

Tilt special tool 11 5 381 in direction of arrow.

If the VANOS gear is to be replaced by a new part, the special tool 11 5 381 can be removed.

Remove VANOS gear with special tool 11 5 381.



**Fig. 404: Tilting Special Tool 11 5 381**  
Courtesy of BMW OF NORTH AMERICA, INC.

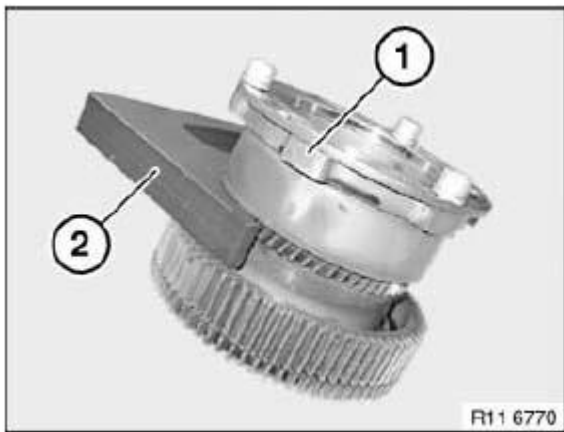
**IMPORTANT: Danger of injury!**

*Installation:*

If the VANOS gear is to be reused, the special tool 11 5 381 must not be removed.

VANOS gear is tensioned.

Set down VANOS gear (1) with special tool (2).



**Fig. 405: Identifying VANOS Gear And Special Tool**  
Courtesy of BMW OF NORTH AMERICA, INC.

Install exhaust VANOS gear (1) in position.

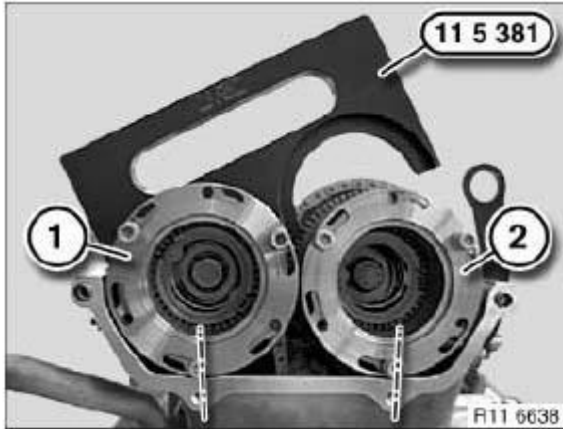
*Installation:*

M8x18 hexagon socket screw points upwards.

One of the three screws points downwards.

Insert central bolt, join slightly and then release again through 90°.

Remove M8x18 hexagon socket screw or special tool 11 5 370.



**Fig. 406: Identifying Exhaust VANOS Gear And Special Tool 11 5 381 (1 Of 2)**  
Courtesy of BMW OF NORTH AMERICA, INC.

Insert special tool 11 5 381 between outer sleeve and gearwheel.

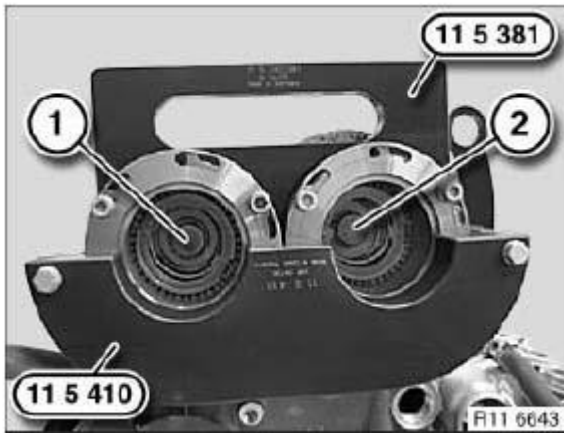
Fit special tool 11 5 410.

**IMPORTANT: Secure and release central bolt (1) with special tools 11 5 381 and 11 5 410 only.  
Risk of damage to VANOS gear.**

Tighten central bolt (1).

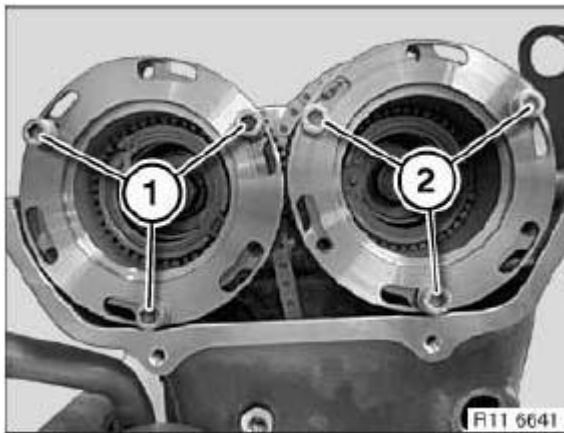
Tightening torque 11 36 1AZ. See **11 36 VARIABLE CAMSHAFT CONTROL** .

Remove special tools 11 5 410 and 11 5 381.



**Fig. 407: Identifying Exhaust VANOS Gear And Special Tool 11 5 381 (2 Of 2)**  
Courtesy of BMW OF NORTH AMERICA, INC.

Release hexagon socket screws with washers (1 and 2) through 90°.



**Fig. 408: Identifying Hexagon Socket Screws With Washers**  
Courtesy of BMW OF NORTH AMERICA, INC.

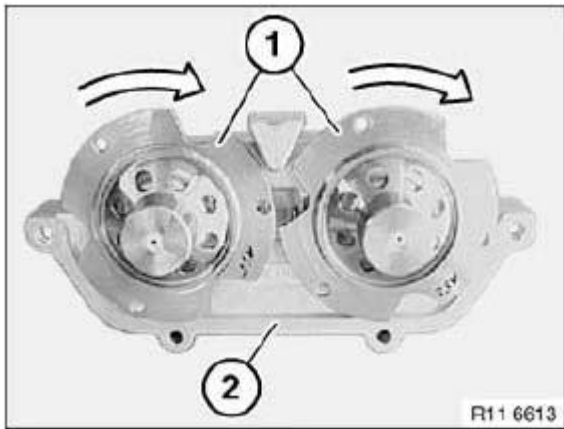
*Installation:*

Both thrust bearing plates (1) on the VANOS adjustment unit can be rotated.

Both thrust bearing plates (1) must be retracted.

Clean sealing faces (2).

Replace seal.



**Fig. 409: Installing Thrust Bearing Plates On VANOS Adjustment Unit**  
Courtesy of BMW OF NORTH AMERICA, INC.

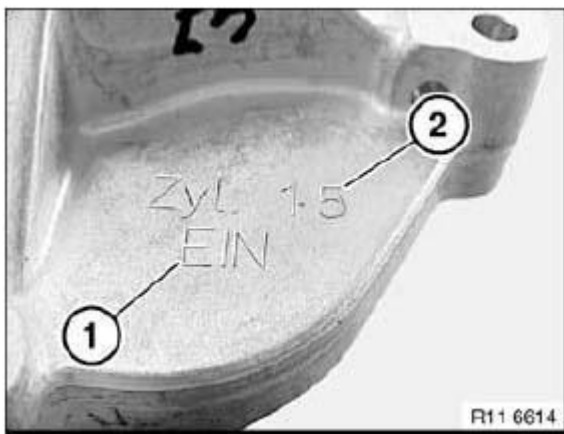
**IMPORTANT: Risk of mixing up**

*Installation:*

VANOS adjustment units are marked to avoid being mixed up.

The lettering EIN (1) must point to the inlet camshaft.

Cylinder assignment (2), cyl. 1-5 or 6-10.



**Fig. 410: Identifying Lettering EIN On Inlet Camshaft**  
Courtesy of BMW OF NORTH AMERICA, INC.

Insert seal.

Position VANOS adjustment unit (4) with both outer bolts (1).

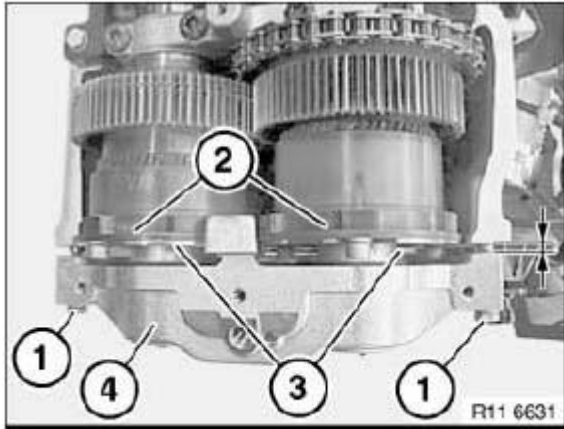
Both VANOS gears (2) are extended.

Align thrust bearing plates (3).

Push VANOS adjustment unit (4) forwards until thrust bearing plates (3) rest against VANOS gears (2).

*Installation:*

There is a visible gap of approx. 8 mm between VANOS adjustment unit (4) and cylinder head.



**Fig. 411: Identifying VANOS Adjustment Unit, Thrust Bearing Plates And VANOS Gears**  
Courtesy of BMW OF NORTH AMERICA, INC.

Insert hexagon socket screws without washers (1) and join to 5 Nm.

Release hexagon socket screws without washers (1) through 90° again.

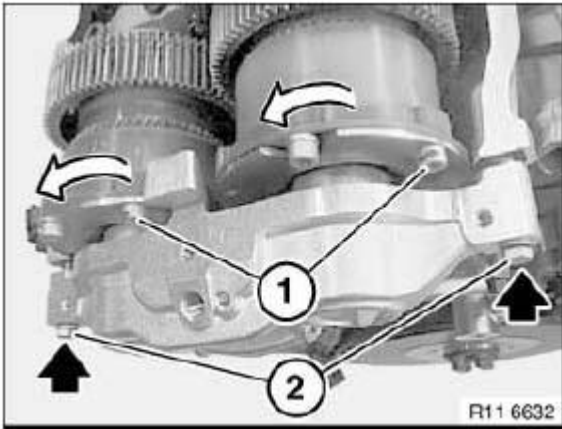
**IMPORTANT: All hexagon socket screws with and without washers must be released through 90°.**

Screw in bolts (2) of VANOS adjustment unit uniformly in 1/2 turns.

*Installation:*

Both outer sleeves rotate clockwise and retract approx. 8 mm.

Both inner sleeves with elongated hole must rotate counterclockwise (see arrow).

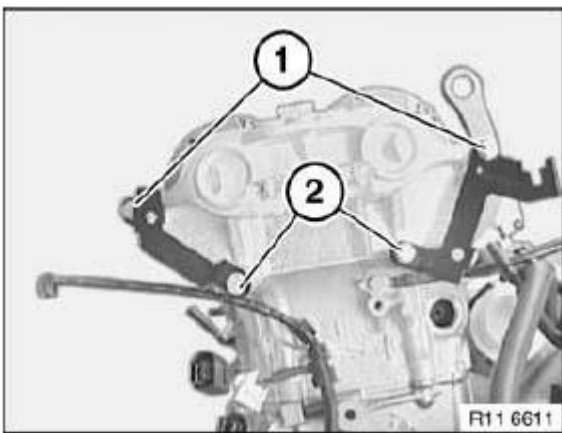


**Fig. 412: Rotating Inner Sleeves Counterclockwise**  
Courtesy of BMW OF NORTH AMERICA, INC.

*Installation:*

Check seal for correct seating.

Secure VANOS adjustment unit with screws (1 and 2).

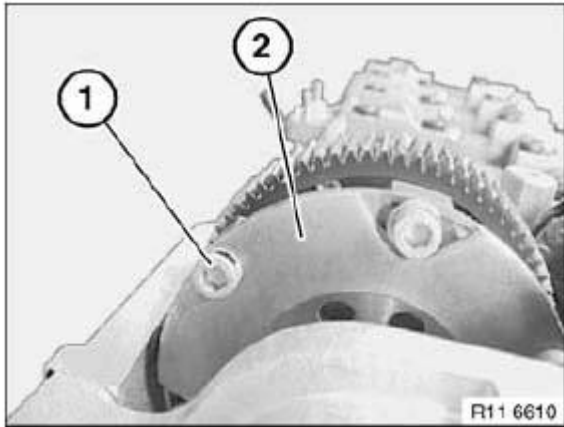


**Fig. 413: Identifying VANOS Adjustment Unit With Screws**  
Courtesy of BMW OF NORTH AMERICA, INC.

Tighten down hexagon socket screws with and without washers to **10 Nm**.

*Installation:*

Mark all screws which are already tightened down with a colored dot.



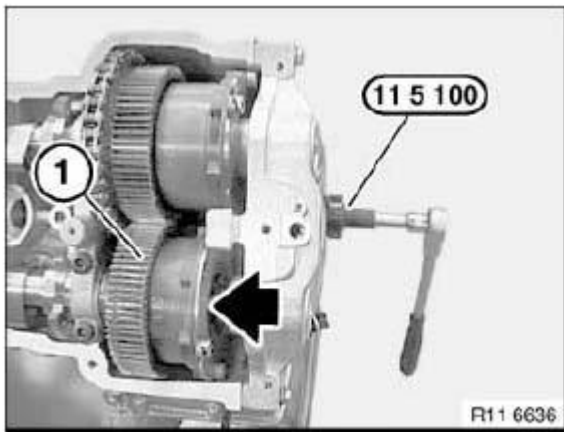
**Fig. 414: Identifying Hexagon Socket Screws**  
Courtesy of BMW OF NORTH AMERICA, INC.

**IMPORTANT: Remove all special tools risk of damage!**

Continue cranking engine at central bolt or with special tool 11 5 100 **120° cms** until further hexagon sockets screws can be inserted on the VANOS gear and tighten to **10 Nm**.

**NOTE:** First both the inlet camshafts are moved when the engine is cranked.

Both exhaust camshaft gears are moved in the direction of the arrow (retard stop).



**Fig. 415: Identifying Special Tool 11 5 100**  
Courtesy of BMW OF NORTH AMERICA, INC.

Check timing.

Assemble engine.

#### **11 36 512 CHECKING OIL PRESSURE OF VANOS ADJUSTMENT UNIT (S85)**



**Special tools required:**

- 11 5 361
- 11 5 362
- 11 5 363
- 11 5 364

**WARNING:** Tighten all screw connections to specified torque.  
Oil pressure at VANOS adjustment unit is approx. 80 bar.

*Necessary preliminary tasks:*

- Run engine up to normal operating temperature.
- Connect diagnosis tester.
- Work through "VANOS control pressure banks 1 and 2" test module.
- All setpoint values are stored in the test module.

VANOS oil pressure measurement can be carried out exclusively with the Group Tester One (GT1) in conjunction with the Measurement Interface Box (MIB).

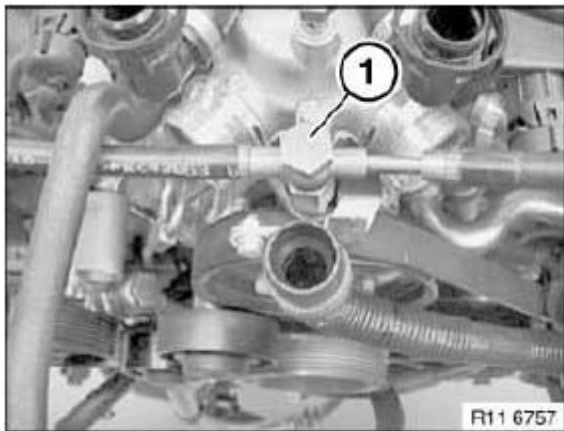
**NOTE:** Measurement at central line (VANOS oil pressure).

Release banjo bolt (1).

Tightening torque: 11 36 2AZ. See 11 36 VARIABLE CAMSHAFT CONTROL .

*Installation:*

Replace all sealing rings.



**Fig. 416: Identifying Banjo Bolt**  
Courtesy of BMW OF NORTH AMERICA, INC.

Screw in special tool 11 5 361 with ring connection.

Tightening torque 11 36 2AZ. See 11 36 VARIABLE CAMSHAFT CONTROL .

Secure special tool 11 5 364 at ring connection to 25 Nm.

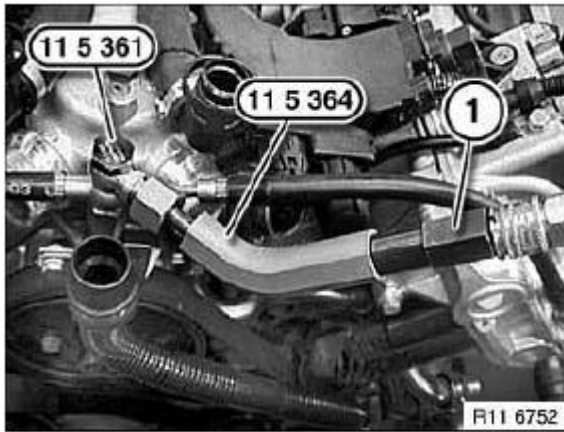
Screw down (400 bar) pressure sensor (1) at special tool 11 5 364 to 25 Nm.

*Installation:*

New sealing rings must be used between the pressure lines and the ring connection.

**NOTE:**        **Illustration shows intake air manifold removed.**

Follow diagnosis instructions.



**Fig. 417: Identifying Special Tool 11 5 364 And Pressure Sensor**  
Courtesy of BMW OF NORTH AMERICA, INC.

**NOTE:**        **Selective bank (1 and 2) measurement:**

Follow diagnosis instructions.

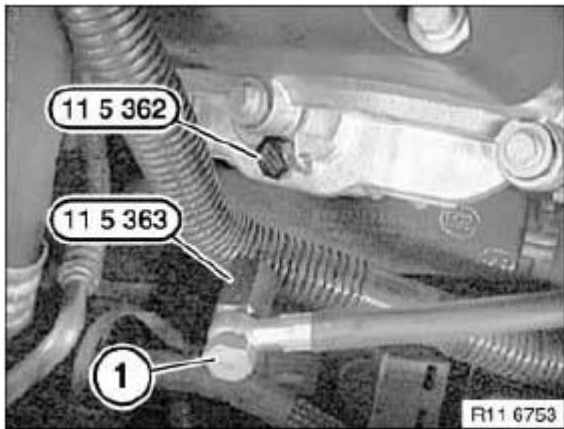
Disconnect VANOS high-pressure line from cylinder head.

Screw in special tool 11 5 362 with sealing ring on cylinder head.

Tighten special tool 11 5 362 to 25 Nm.

Bolt banjo bolt (1) with VANOS high-pressure line to special tool 11 5 363.

Tightening torque 11 36 2AZ.. See 11 36 VARIABLE CAMSHAFT CONTROL .



**Fig. 418: Identifying Special Tool 11 5 362 And 11 5 363**  
 Courtesy of BMW OF NORTH AMERICA, INC.

Assemble engine.

There is air in the VANOS system once it is opened.

In the first few seconds after startup this can result in a clearly discernible "rattling noise".

This rattling noise does "not" indicate incorrect assembly.

The rattling noise will disappear as soon as the oil pressure has built up and the system has vented.

Carry out venting procedure with diagnosis tester.

Perform VANOS test.

### **11 36 715 REMOVING AND INSTALLING / REPLACING SOLENOID VALVES ON LEFT VANOS ADJUSTMENT UNIT (S85)**

#### **Special tools required:**

- 11 5 400

#### *Necessary preliminary tasks:*

- Remove fan cowl with electronic fan. See **17 11 035 REMOVING AND INSTALLING/REPLACING FAN COWL WITH ELECTRIC FAN (M5)** or **17 11 035 REMOVING AND INSTALLING/REPLACING FAN COWL WITH ELECTRIC FAN (M6)** .
- Remove coolant hose from radiator inlet.

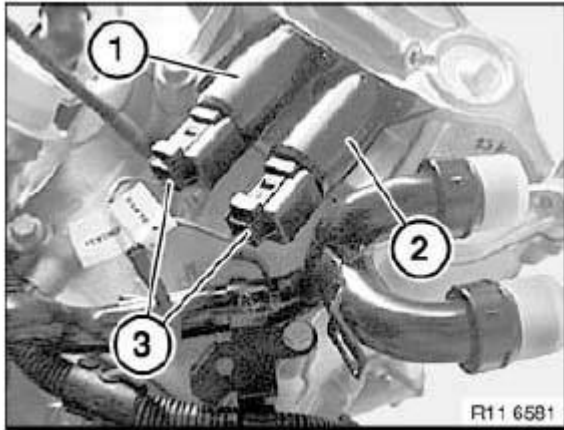
Disconnect plug connection (3).

Plug connections (3) for inlet and exhaust solenoid valves are identified with flags on the wiring harness.

**IMPORTANT: Risk of mixing up**

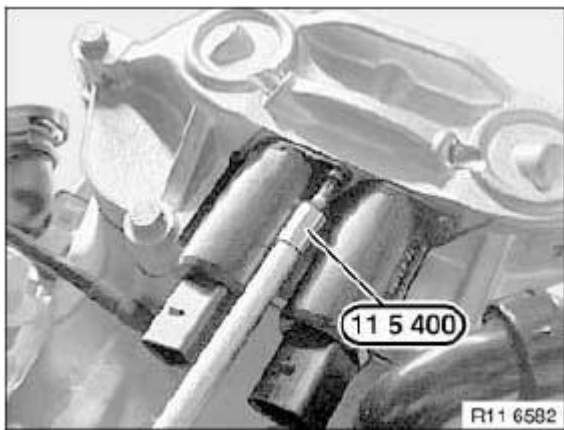
Solenoid valve (1), inlet adjustment.

Solenoid valve (2), exhaust adjustment.



**Fig. 419: Identifying Solenoid Valves And Plug Connection**  
Courtesy of BMW OF NORTH AMERICA, INC.

Release screw connection on solenoid valve with special tool 11 5 400.



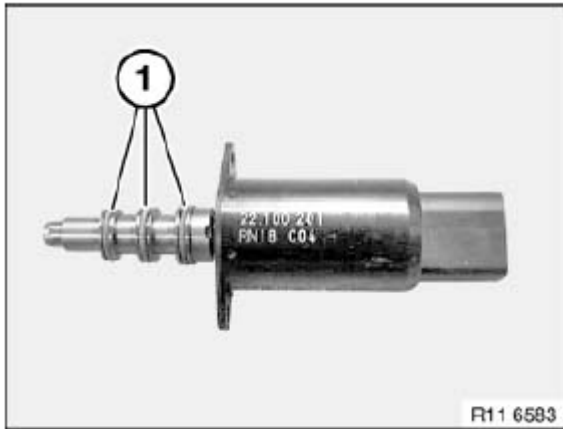
**Fig. 420: Identifying Special Tool 11 5 400**  
Courtesy of BMW OF NORTH AMERICA, INC.

*Installation:*

Sealing rings (1) cannot be replaced.

If one of the sealing rings (1) is damaged, the solenoid valve must be replaced.

Lightly lubricate sealing rings (1) with engine oil.



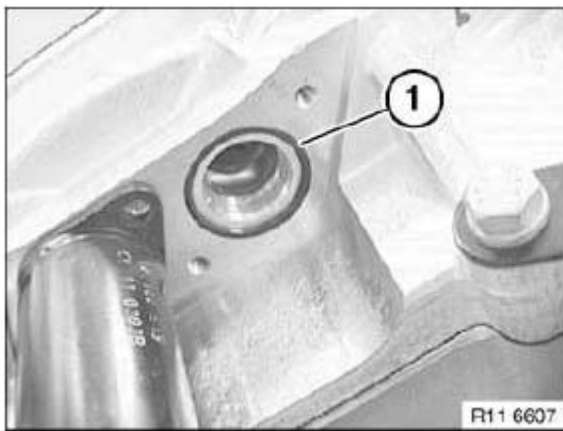
**Fig. 421: Identifying Sealing Rings**

Courtesy of BMW OF NORTH AMERICA, INC.

*Installation:*

Replace sealing ring (1).

Secure sealing ring (1) in groove; if necessary, secure against falling out with grease.



**Fig. 422: Identifying Sealing Ring**

Courtesy of BMW OF NORTH AMERICA, INC.

Assemble engine.

There is air in the VANOS system once it is opened.

In the first few seconds after startup this results in a clearly discernible "rattling noise".

This rattling noise does "not" indicate incorrect assembly.

The rattling noise will disappear as soon as the oil pressure has built up and the system has vented.

Carry out venting procedure with diagnosis tester.

Perform VANOS test.

### 11 36 720 REMOVING AND INSTALLING / REPLACING SOLENOID VALVES ON RIGHT VANOS ADJUSTMENT UNIT (S85)

#### Special tools required:

- 11 5 400

#### Necessary preliminary tasks:

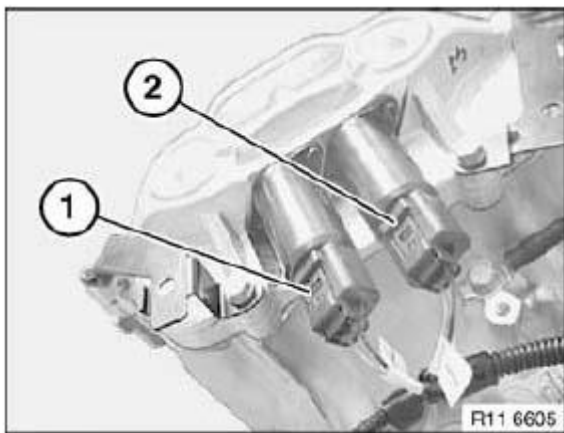
- Remove fan cowl with electronic fan. See 17 11 035 REMOVING AND INSTALLING/REPLACING FAN COWL WITH ELECTRIC FAN (M5) or 17 11 035 REMOVING AND INSTALLING/REPLACING FAN COWL WITH ELECTRIC FAN (M6) .
- Remove coolant hose from radiator inlet.

Disconnect plug connection (1) on solenoid valve for exhaust adjustment.

Disconnect plug connection (2) on solenoid valve for inlet adjustment.

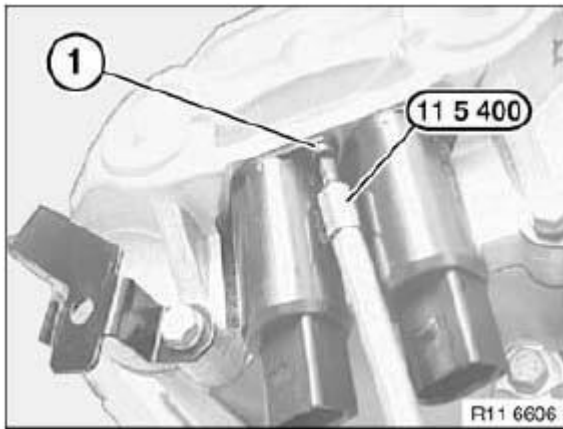
Plug connections (1 and 2) for inlet and exhaust solenoid valves are identified with flags on the wiring harness.

#### IMPORTANT: Risk of mixing up



**Fig. 423: Identifying Plug Connections**  
Courtesy of BMW OF NORTH AMERICA, INC.

Release screw connection (1) on solenoid valve with special tool 11 5 400.



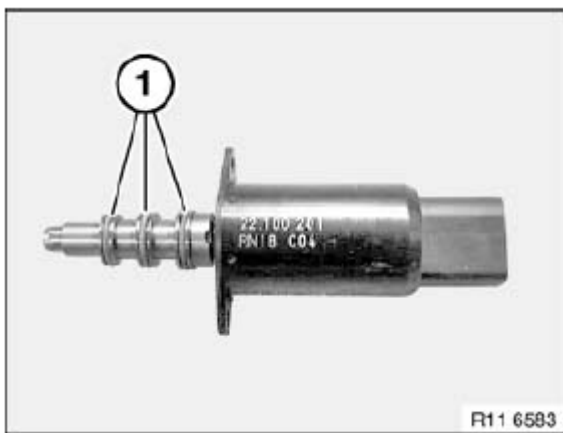
**Fig. 424: Identifying Special Tool 11 5 400**  
Courtesy of BMW OF NORTH AMERICA, INC.

*Installation:*

Sealing rings (1) cannot be replaced.

If one of the sealing rings (1) is damaged, the solenoid valve must be replaced.

Lightly lubricate sealing rings (1) with engine oil.

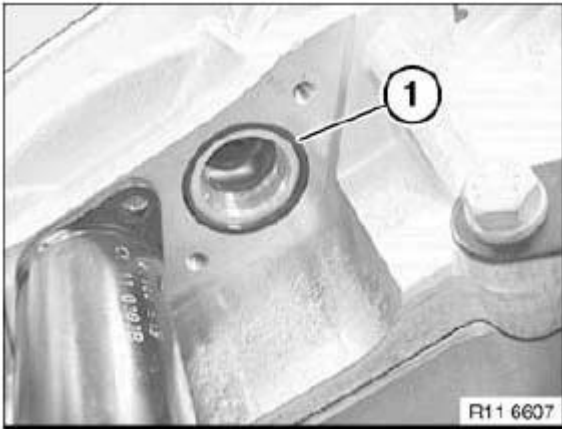


**Fig. 425: Identifying Sealing Rings**  
Courtesy of BMW OF NORTH AMERICA, INC.

*Installation:*

Replace sealing ring (1).

Secure sealing ring (1) in groove; if necessary, secure against falling out with grease.



**Fig. 426: Identifying Sealing Ring**

Courtesy of BMW OF NORTH AMERICA, INC.

Assemble engine.

There is air in the VANOS system once it is opened.

In the first few seconds after startup this results in a clearly discernible "rattling noise".

This rattling noise does "not" indicate incorrect assembly.

The rattling noise will disappear as soon as the oil pressure has built up and the system has vented.

Carry out venting procedure with diagnosis tester.

Perform VANOS test.

## 41 OIL PUMP WITH FILTER AND DRIVE

### 11 41 000 REMOVING AND INSTALLING / REPLACING OIL PUMP (S85)

*Necessary preliminary tasks:*

- Removing oil pan.

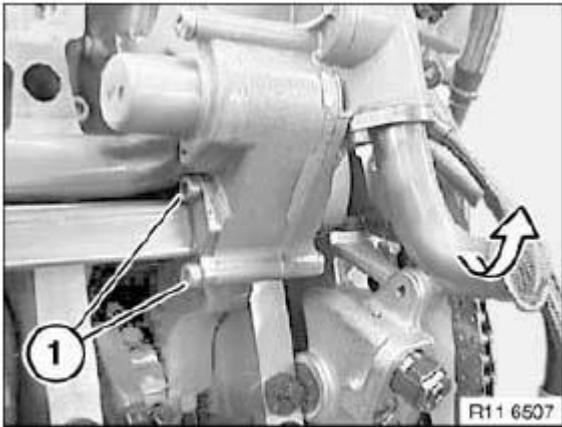
Release screws (1).

*Installation:*

Replace screws.

Clean threads before installation.





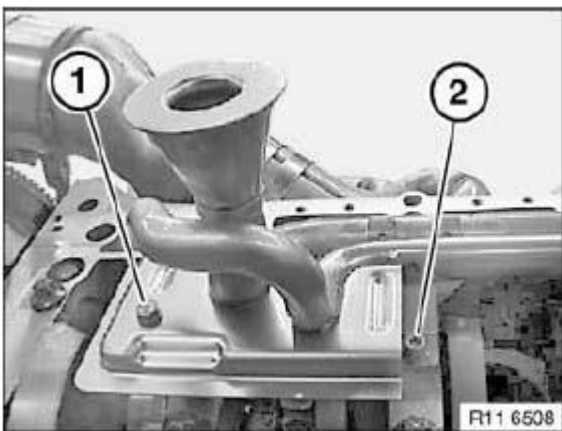
**Fig. 427: Identifying Screws (1 Of 2)**

Courtesy of BMW OF NORTH AMERICA, INC.

Release screw (1).

Release screw (2).

Detach oil pipes from oil pump.



**Fig. 428: Identifying Screws (1 Of 2)**

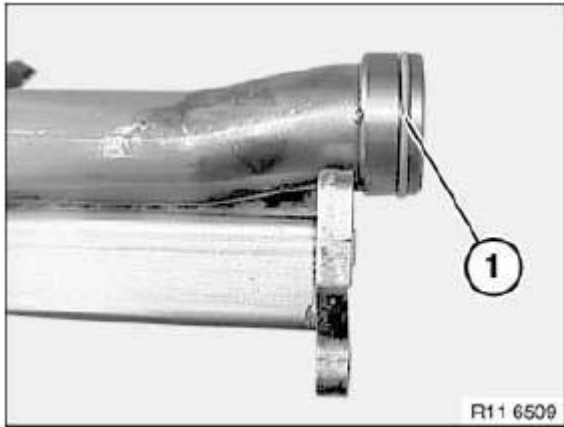
Courtesy of BMW OF NORTH AMERICA, INC.

*Installation:*

Replace sealing ring (1).

To aid installation, apply a thin coat of engine oil to sealing ring (1).

Clean all sealing surfaces.



**Fig. 429: Identifying Sealing Ring**

Courtesy of BMW OF NORTH AMERICA, INC.

Release screw (2).

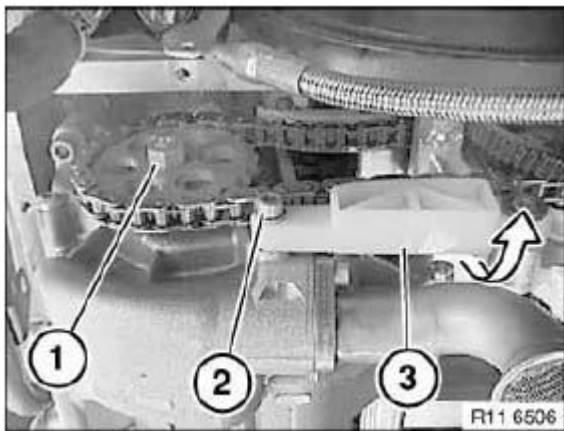
Fold sliding rail (3) downwards.

Unscrew nut (1).

Remove sprocket wheel from shaft.

*Installation:*

If reusing the sprocket wheel, check dihedron for damage and if necessary replace.

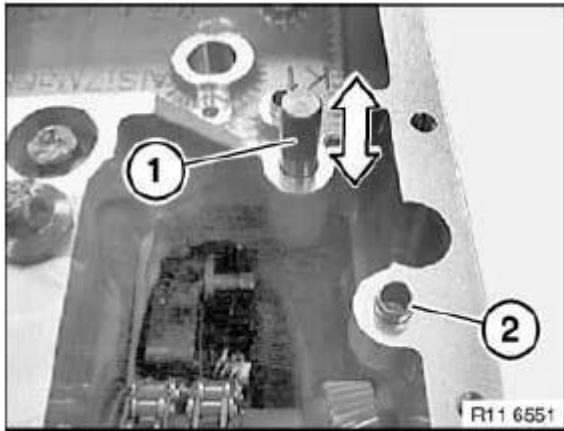


**Fig. 430: Identifying Sliding Rail And Screws**

Courtesy of BMW OF NORTH AMERICA, INC.

**IMPORTANT: Chain tensioner piston may fall out.**

Remove piston (1) in direction of arrow.



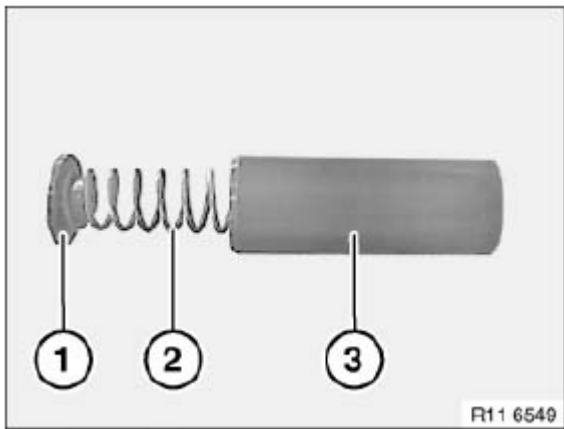
**Fig. 431: Removing Piston**

Courtesy of BMW OF NORTH AMERICA, INC.

*Installation:*

Arrangement, chain tensioner, oil pump.

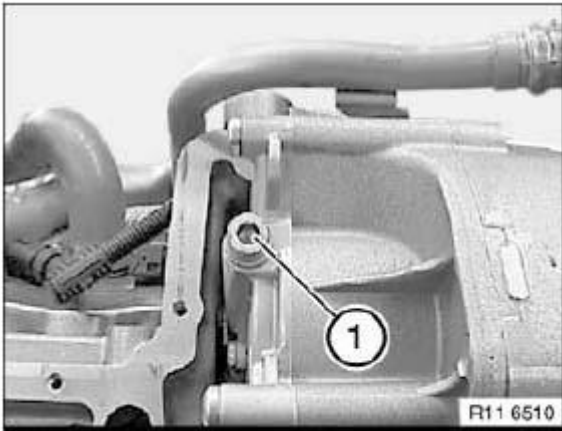
1. Base valve
2. Spring
3. Piston



**Fig. 432: Identifying Base Valve, Spring And Piston**

Courtesy of BMW OF NORTH AMERICA, INC.

Release screw (1) on oil pump.



**Fig. 433: Identifying Screw On Oil Pump**  
Courtesy of BMW OF NORTH AMERICA, INC.

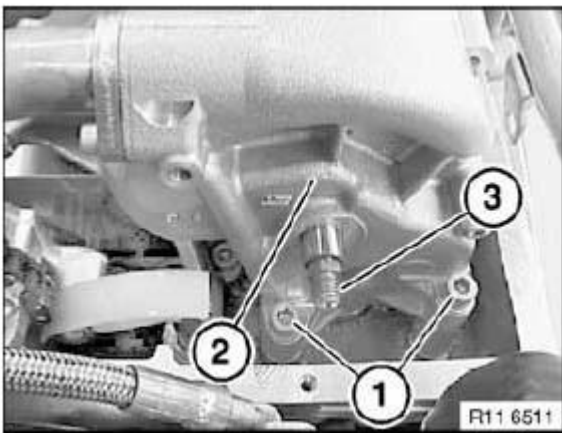
Release screws (1).

Remove oil pump (2).

*Installation:*

Check dihedron on oil pump shaft (3) for damage, replace oil pump if necessary.

Clean thread of oil pump shaft (3) with suitable means.



**Fig. 434: Identifying Oil Pump And Oil Pump Shaft**  
Courtesy of BMW OF NORTH AMERICA, INC.

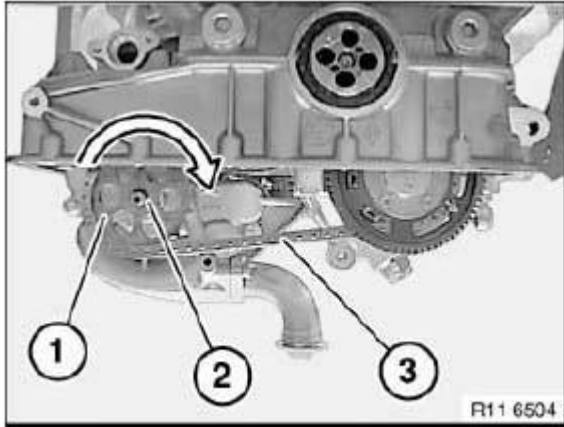
**IMPORTANT:** Two different versions of oil pump are fitted with different tightening torques.

Place sprocket wheel (1) with chain (3) on oil pump shaft (2).

Rotate oil pump shaft (2) with a screwdriver in direction of arrow until dihedrons of oil pump shaft and sprocket

wheel are flush.

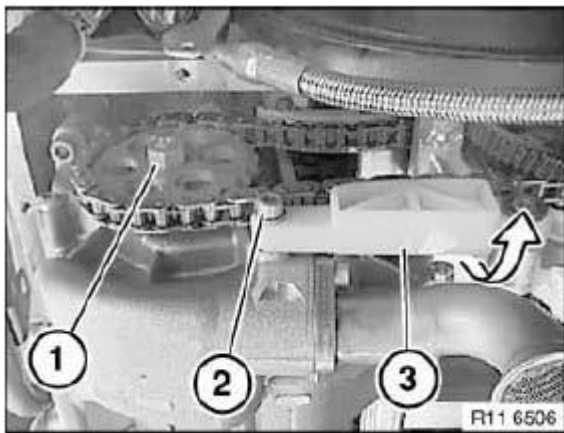
Coat thread (2) with Loctite 648.



**Fig. 435: Rotating Oil Pump Shaft**  
Courtesy of BMW OF NORTH AMERICA, INC.

Tighten nut(1).

Tightening torque 11 41 1AZ. See **ENGINE - TIGHTENING TORQUES** .



**Fig. 436: Identifying Oil Pump Shaft And Sprocket Wheel**  
Courtesy of BMW OF NORTH AMERICA, INC.

*Installation:*

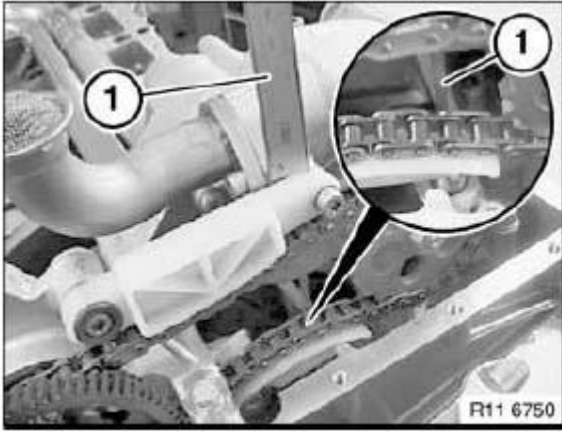
Check tensioning travel of chain tensioner.

Slide caliper gauge (1) as far as it will go on reverse side of sliding rail.

Adjust caliper gauge (1) to tensioning rail.

**NOTE:**        **Checking dimension: 72.5 to 80 mm.**

If the dimension 80 mm is exceeded, shims must be fitted on the VANOS high-pressure pump.



**Fig. 437: Identifying Caliper Gauge**

Courtesy of BMW OF NORTH AMERICA, INC.

Assemble engine.

#### 11 41 532 REPLACING TRANSMISSION OIL PUMP (GS7S47BG SMG)

**IMPORTANT:** It is essential to adhere to the exact filling capacities specified.

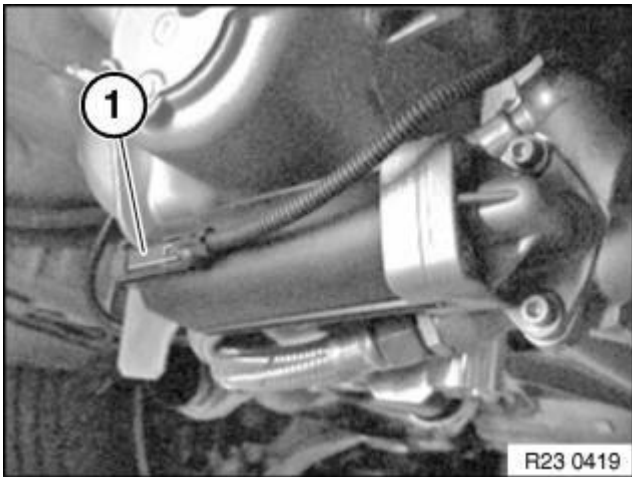
**Fill transmission at room temperature only (approx. 20 - 30 °C). See MANUAL TRANSMISSION - OPERATING FLUIDS .**

**Failure to comply with this instruction will result in serious damage to the transmission.**

Necessary preliminary tasks:

- Unscrew and remove splash guard.
- Remove reinforcement plate. See **31 10 010 REMOVING AND INSTALLING/REPLACING REINFORCEMENT PLATE (M5)** or **31 10 010 REMOVING AND INSTALLING/REPLACING REINFORCEMENT PLATE (M6)** .
- Remove heat shields.
- Drain transmission oil.

Disconnect connector (1).

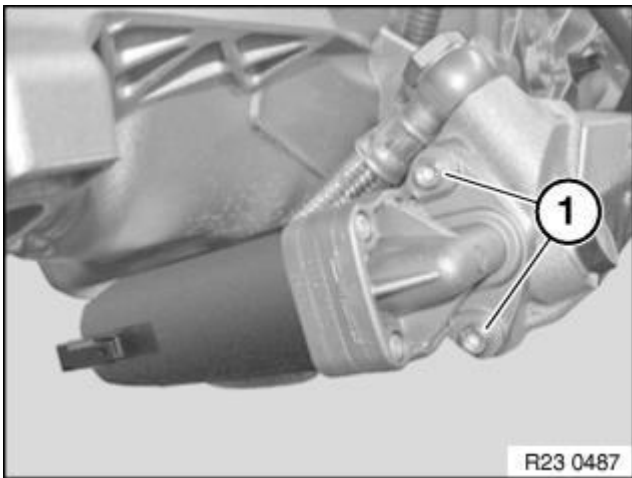


**Fig. 438: Disconnect Connector (1)**

Courtesy of BMW OF NORTH AMERICA, INC.

Release bolts (1). Installation: Replace screws.

Tightening torque 23 41 21AZ. See 11 41 OIL PUMP WITH STRAINER AND DRIVE .



**Fig. 439: Release Bolts (1)**

Courtesy of BMW OF NORTH AMERICA, INC.

## 42 OIL FILTER AND LINES

### 11 42 020 REMOVING AND INSTALLING, SEALING/REPLACING COMPLETE MAIN FLOW OIL FILTER (S85)

**IMPORTANT:** It is essential to adhere to the exact filling capacities specified.  
Overfilling the engine with engine oil will result in engine damage.

*Recycling:*

Catch and dispose of engine oil with suitable equipment.

Note national regulations.

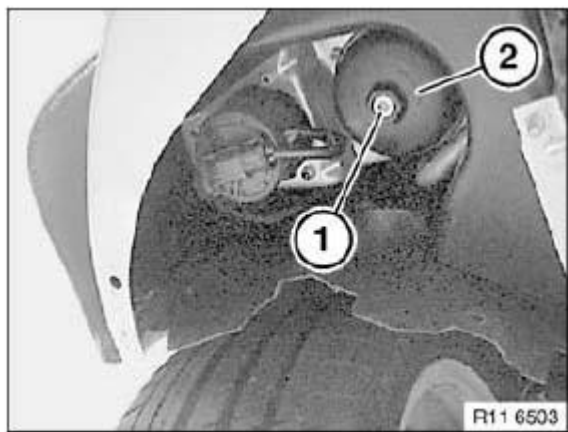
*Necessary preliminary tasks:*

- Remove fan cowl with electronic fan. See **17 11 035 REMOVING AND INSTALLING/REPLACING FAN COWL WITH ELECTRIC FAN (M5)** or **17 11 035 REMOVING AND INSTALLING/REPLACING FAN COWL WITH ELECTRIC FAN (M6)** .
- Remove front underbody protection. See **51 47 490 REMOVING AND INSTALLING / REPLACING FRONT UNDERBODY PROTECTION (M5)** or **51 47 490 REMOVING AND INSTALLING / REPLACING FRONT UNDERBODY PROTECTION (M6)** .
- Remove front right wheel arch trim. See **51 71 040 REMOVING AND INSTALLING/REPLACING FRONT LEFT OR RIGHT WHEEL ARCH COVER (M5)** or **51 71 040 REMOVING AND INSTALLING/REPLACING FRONT LEFT OR RIGHT WHEEL ARCH COVER (M6)** .
- Remove right air duct.
- Remove oil drain plug (1).

*Installation:*

Replace sealing ring.

Tightening torque 11 13 2AZ. See **ENGINE - TIGHTENING TORQUES** .



**Fig. 440: Identifying Oil Drain Plug**  
Courtesy of BMW OF NORTH AMERICA, INC.

Release nuts (1 and 2).

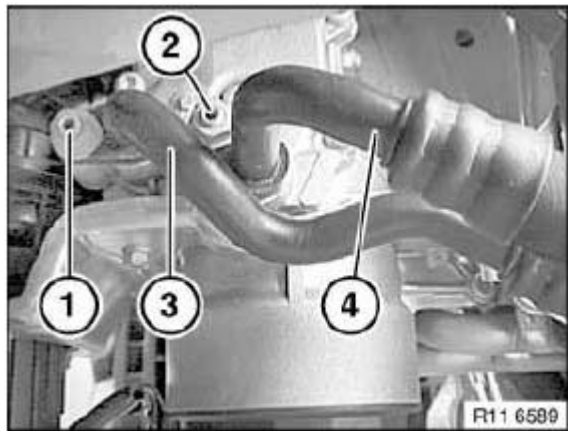
Tightening torque: 11 42 3AZ. See **11 42 OIL FILTER AND PIPES** .

Detach lines (3 and 4).



*Installation:*

Replace O-rings.



**Fig. 441: Identifying Nuts And Lines (1 Of 2)**  
Courtesy of BMW OF NORTH AMERICA, INC.

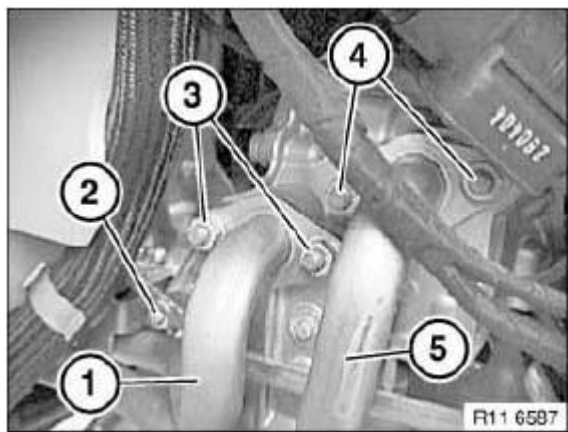
Slacken nut (2).

Release nuts (3 and 4).

Detach lines (1 and 5).

*Installation:*

Replace O-rings.



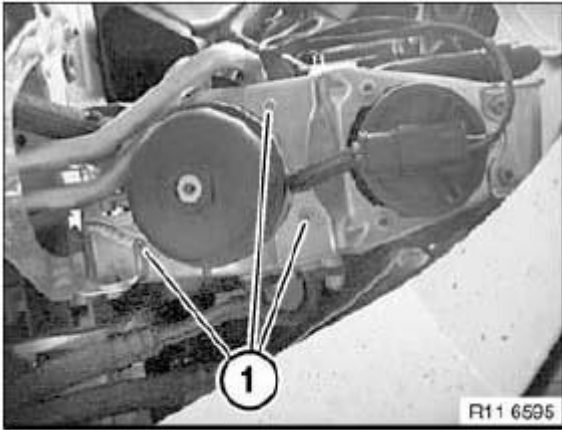
**Fig. 442: Identifying Nuts And Lines (2 Of 2)**  
Courtesy of BMW OF NORTH AMERICA, INC.

Unscrew nuts (1).

Lift out oil filter housing.

*Installation:*

Check rubber mount for damage.



**Fig. 443: Identifying Nuts**

Courtesy of BMW OF NORTH AMERICA, INC.

Assemble engine.

Park vehicle on a horizontal surface.

Allow engine at normal operating temperature to run for 3 minutes with increased revs (min. 1000 / max. 1500 RPM).

Read off engine oil level in instrument cluster or on Control Display.

Top up engine oil if necessary.

**11 42 080 REMOVING AND INSTALLING / REPLACING OIL PRESSURE HOSE (FEED) (S85)**

**IMPORTANT: It is essential to adhere to the exact filling capacities specified.  
Overfilling the engine with engine oil will result in engine damage.**

*Recycling:*

Catch and dispose of emerging engine oil with suitable equipment.

Note national regulations.

*Necessary preliminary tasks:*

- Remove fan cowl with electronic fan. See **17 11 035 REMOVING AND INSTALLING/REPLACING**

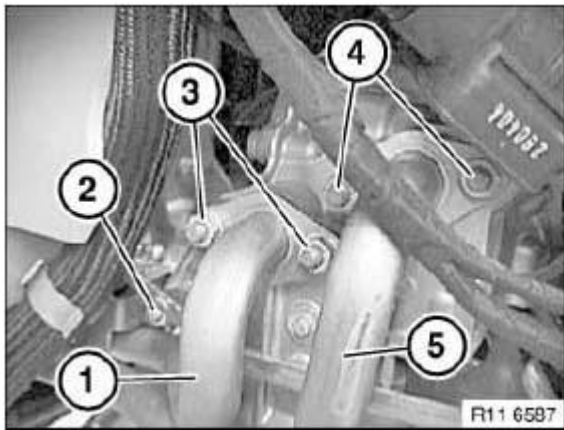
**FAN COWL WITH ELECTRIC FAN (M5) or 17 11 035 REMOVING AND INSTALLING/REPLACING FAN COWL WITH ELECTRIC FAN (M6) .**

- Remove front underbody protection. See **51 47 490 REMOVING AND INSTALLING / REPLACING FRONT UNDERBODY PROTECTION (M5)** or **51 47 490 REMOVING AND INSTALLING / REPLACING FRONT UNDERBODY PROTECTION**
- Remove **tensioning device** for A/C compressor.
- Remove front right wheel arch trim. See **51 71 040 REMOVING AND INSTALLING/REPLACING FRONT LEFT OR RIGHT WHEEL ARCH COVER (M5)** or **51 71 040 REMOVING AND INSTALLING/REPLACING FRONT LEFT OR RIGHT WHEEL ARCH COVER (M6)** .
- Remove right air duct.

Unscrew nut (2).

Unscrew nuts (3).

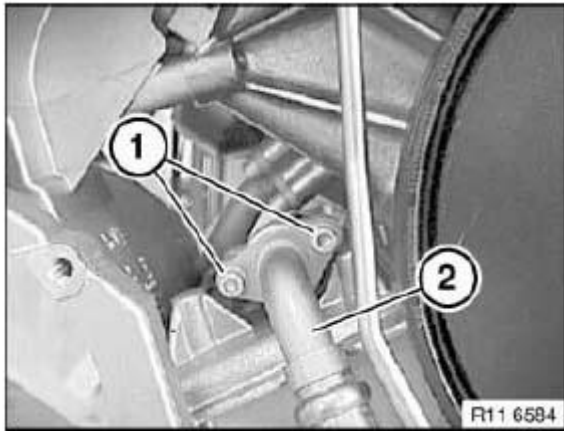
Detach pressure line (1).



**Fig. 444: Identifying Pressure Line (1 Of 2)**  
Courtesy of BMW OF NORTH AMERICA, INC.

Release screws (1).

Detach pressure line (2).



**Fig. 445: Identifying Pressure Line (2 Of 2)**  
Courtesy of BMW OF NORTH AMERICA, INC.

Assemble engine.

Park vehicle on a horizontal surface.

Allow engine at normal operating temperature to run for 3 minutes with increased revs (min. 1000 / max. 1500 RPM).

Read off engine oil level in instrument cluster or on Control Display.

#### **11 42 080 REMOVING AND INSTALLING / REPLACING OIL PRESSURE HOSE (RETURN) (S85)**

**IMPORTANT: It is essential to adhere to the exact filling capacities specified.  
Overfilling the engine with engine oil will result in engine damage.**

*Recycling:*

Catch and dispose of emerging engine oil with suitable equipment.

Note national regulations.

*Necessary preliminary tasks:*

- Remove fan cowl with electronic fan. See **17 11 035 REMOVING AND INSTALLING/REPLACING FAN COWL WITH ELECTRIC FAN (M5)** or **17 11 035 REMOVING AND INSTALLING/REPLACING FAN COWL WITH ELECTRIC FAN (M6)** .
- Remove front underbody protection. See **51 47 490 REMOVING AND INSTALLING / REPLACING FRONT UNDERBODY PROTECTION (M5)** or **51 47 490 REMOVING AND INSTALLING / REPLACING FRONT UNDERBODY PROTECTION (M6)** .
- Remove **tensioning device** for A/C compressor.
- Remove A/C compressor. See **64 52 523 REPLACING A/C SYSTEM COMPRESSOR (M5)** or **64 52**

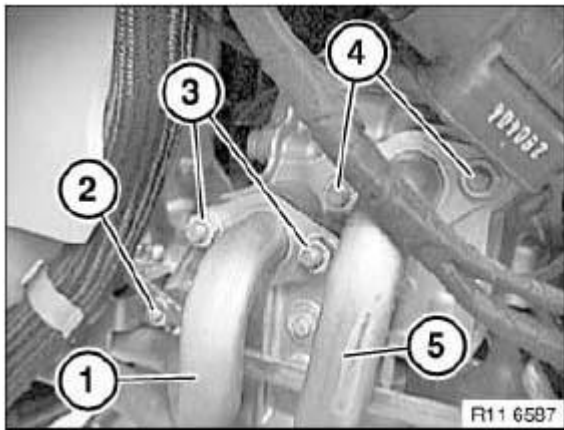
**523 REPLACING A/C SYSTEM COMPRESSOR (M6) .**

- Remove front right wheel arch trim. See **51 71 040 REMOVING AND INSTALLING/REPLACING FRONT LEFT OR RIGHT WHEEL ARCH COVER (M5)** or **51 71 040 REMOVING AND INSTALLING/REPLACING FRONT LEFT OR RIGHT WHEEL ARCH COVER (M6) .**
- Remove right air duct.

Unscrew nut (2).

Unscrew nuts (4).

Detach pressure line (5).



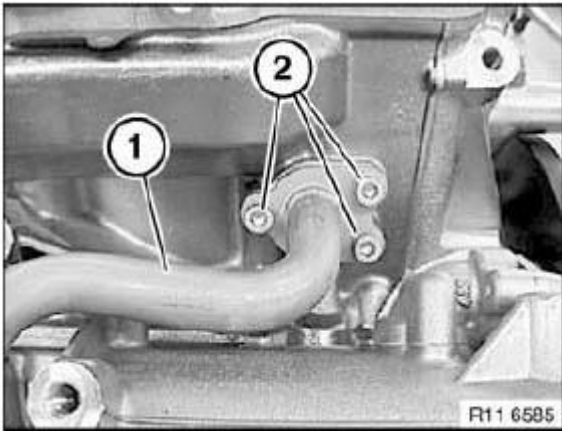
**Fig. 446: Identifying Pressure Line Nuts**  
Courtesy of BMW OF NORTH AMERICA, INC.

Release screws (2).

Detach pressure line (1).

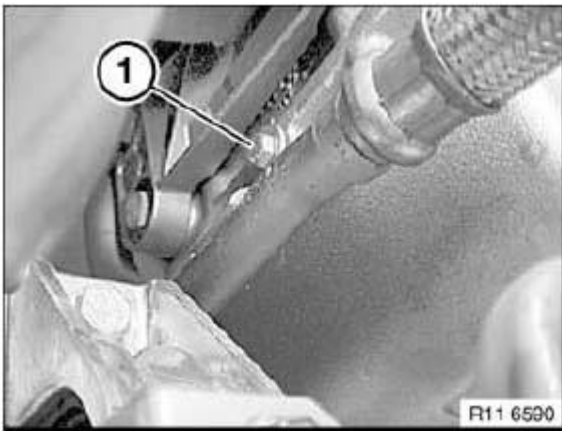
*Installation:*

Replace seal.



**Fig. 447: Identifying Pressure Line Screws**  
Courtesy of BMW OF NORTH AMERICA, INC.

Release screw (1).



**Fig. 448: Identifying Screw**  
Courtesy of BMW OF NORTH AMERICA, INC.

Assemble engine.

Park vehicle on a horizontal surface.

Allow engine at normal operating temperature to run for 3 minutes with increased revs (min. 1000 / max. 1500 RPM).

Read off engine oil level in instrument cluster or on Control Display.

## 11 42 095 REMOVING AND INSTALLING / SEALING OR REPLACING CONNECTING FLANGE (S85)

**IMPORTANT:** It is essential to adhere to the exact filling capacities specified.

**Overfilling the engine with engine oil will result in engine damage.**

*Recycling:*

Catch and dispose of emerging engine oil with suitable equipment.

Note national regulations.

*Necessary preliminary tasks:*

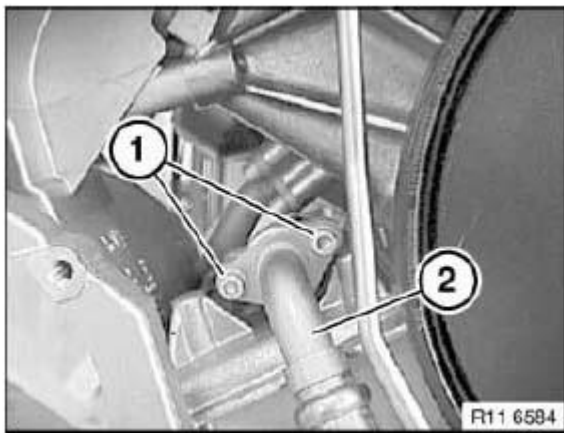
- Remove fan cowl with electronic fan. See **17 11 035 REMOVING AND INSTALLING/REPLACING FAN COWL WITH ELECTRIC FAN (M5)** or **17 11 035 REMOVING AND INSTALLING/REPLACING FAN COWL WITH ELECTRIC FAN (M6)** .
- Remove front underbody protection. See **51 47 490 REMOVING AND INSTALLING / REPLACING FRONT UNDERBODY PROTECTION (M5)** or **51 47 490 REMOVING AND INSTALLING / REPLACING FRONT UNDERBODY PROTECTION (M6)** .
- Remove **tensioning device** for A/C compressor.
- Disconnect **pressure line** (feed).
- Remove **engine oil sump**.
- Remove **engine oil pump**.

Release screws (1).

Detach pressure line (2).

*Installation:*

Replace O-ring.

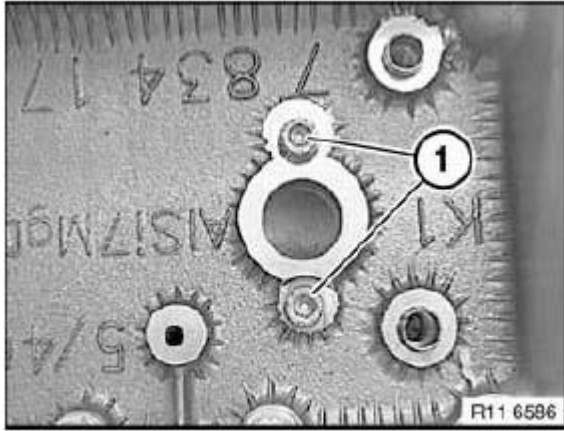


**Fig. 449: Identifying Pressure Line**  
Courtesy of BMW OF NORTH AMERICA, INC.

Release screws (2).

*Installation:*

Replace seal.



**Fig. 450: Identifying Screws**

Courtesy of BMW OF NORTH AMERICA, INC.

Assemble engine.

Park vehicle on a horizontal surface.

Allow engine at normal operating temperature to run for 3 minutes with increased revs (min. 1000 / max. 1500 RPM).

Read off engine oil level in instrument cluster or on Control Display.

## 51 WATER PUMP WITH DRIVE

### 11 51 000 REMOVING AND INSTALLING / REPLACING WATER PUMP (S85)

*Necessary preliminary tasks:*

- Remove fan cowl with electronic fan. See **17 11 035 REMOVING AND INSTALLING/REPLACING FAN COWL WITH ELECTRIC FAN (M5)** or **17 11 035 REMOVING AND INSTALLING/REPLACING FAN COWL WITH ELECTRIC FAN (M6)** .
- Remove radiator. See **REMOVING RADIATOR COVER (M5)** or **17 11 000 REMOVING AND INSTALLING RADIATOR (M6)** .
- Remove **A/C compressor drive belt**.
- Remove **alternator drive belt**.
- Remove **belt tensioner** for A/C compressor.

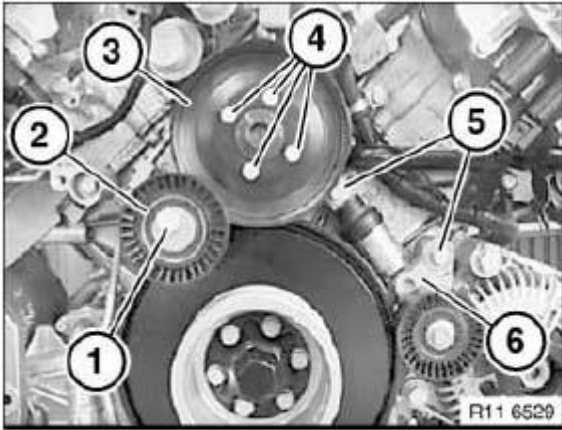
Release screw (1).



Remove idler pulley (2).

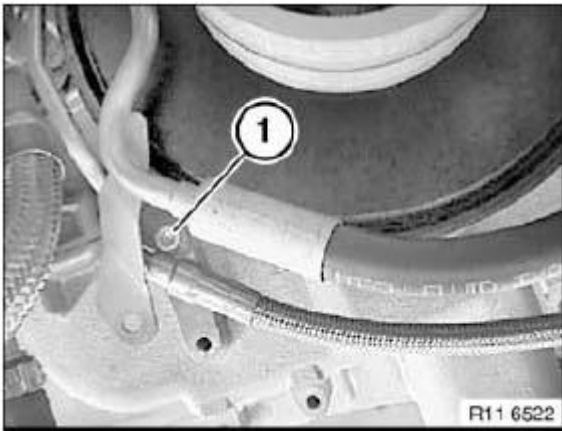
Release screws (4).

Remove belt pulley (3).



**Fig. 451: Identifying Idler Pulley And Belt Pulley**  
Courtesy of BMW OF NORTH AMERICA, INC.

Release screw (1) of VANOS high-pressure line.



**Fig. 452: Identifying Screw Of VANOS High-Pressure Line**  
Courtesy of BMW OF NORTH AMERICA, INC.

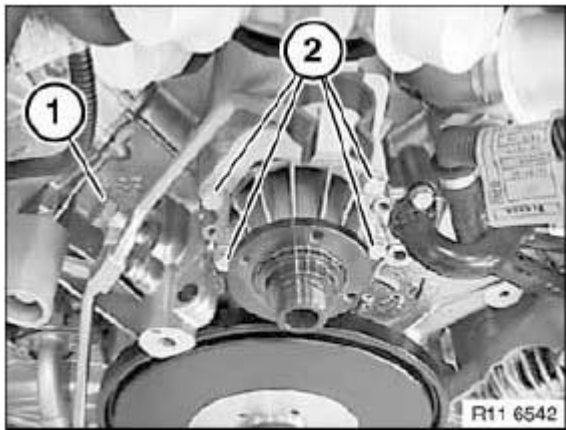
Release banjo bolt (1).

*Installation:*

Replace all sealing rings.

Tightening torque 11 36 5AZ. See **ENGINE - TIGHTENING TORQUES** .

Release screws (2).



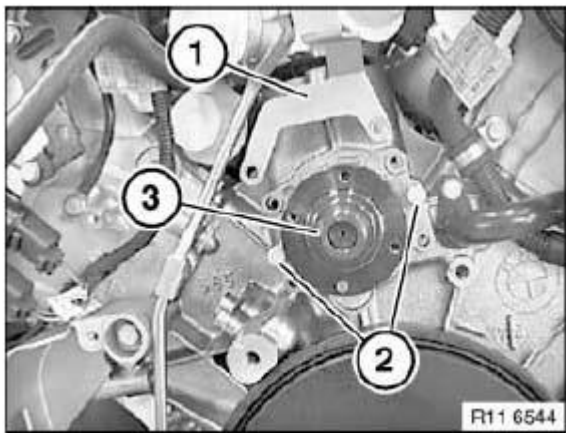
**Fig. 453: Identifying Banjo Bolt And Screws**  
Courtesy of BMW OF NORTH AMERICA, INC.

Pull bracket (1) with VANOS high-pressure line upwards until coolant pump (3) is freely accessible.

Insert bolts (2) of coolant pump (3).

Screw in bolts (2) uniformly in 1/2 turns.

Remove coolant pump (3) towards front.



**Fig. 454: Identifying Bracket And Coolant Pump**  
Courtesy of BMW OF NORTH AMERICA, INC.

Assemble engine.

Vent cooling system and check for leaks.

## 53 THERMOSTAT

**11 53 000 REMOVING AND INSTALLING/REPLACING COOLANT THERMOSTAT (S85)**

*Necessary preliminary tasks:*

- Remove intake air manifold.
- Drain coolant.

Release bolt on hose bracket (2).

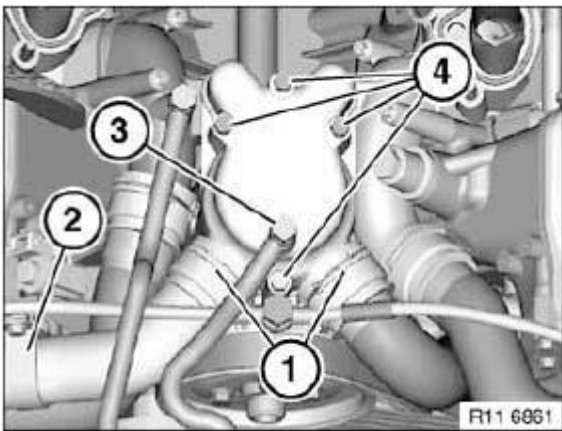
Unlock and detach water hoses (1).

Unfasten banjo bolt (3).

*Installation:*

Replace sealing rings.

Release screws (4).



**Fig. 455: Identifying Water Hoses, Hose Bracket And Banjo Bolt**  
Courtesy of BMW OF NORTH AMERICA, INC.

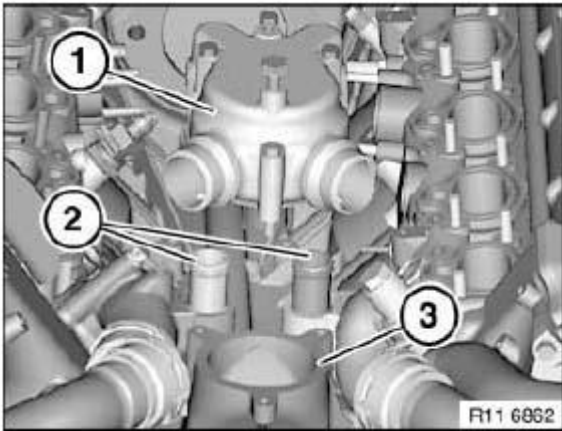
Remove thermostat housing with thermostat in upward direction.

Remove connecting pipes (2).

*Installation:*

Replace all O-rings on connecting pipes (2).

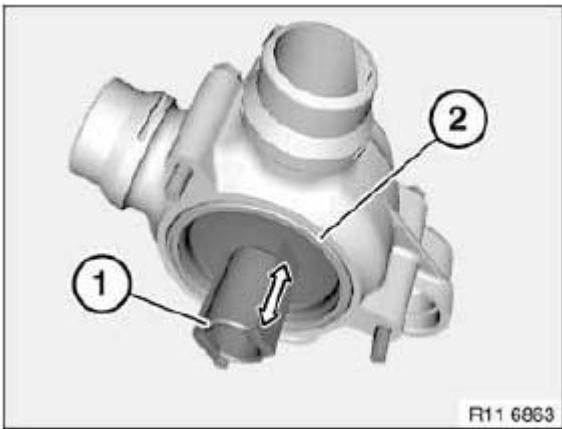
Clean sealing surface (3).



**Fig. 456: Identifying Connecting Pipes**  
Courtesy of BMW OF NORTH AMERICA, INC.

Remove thermostat (1) in direction of arrow.

Check rubber section (2) for damage.



**Fig. 457: Removing Thermostat**  
Courtesy of BMW OF NORTH AMERICA, INC.

Assemble engine.

Vent cooling system and check for leaks.

## 11 61 050 REMOVING AND INSTALLING AIR INTAKE MANIFOLD (S85)

**NOTE:** See 11 61 050 Removing And Installing Air Intake Manifold (S85).

## 61 INTAKE MANIFOLD

### 11 61 050 REMOVING AND INSTALLING AIR INTAKE MANIFOLD/PLENUM (S85)

**Special tools required:**

- 32 1 260

**IMPORTANT:** Do not use antiseize agents to install the air intake manifold.

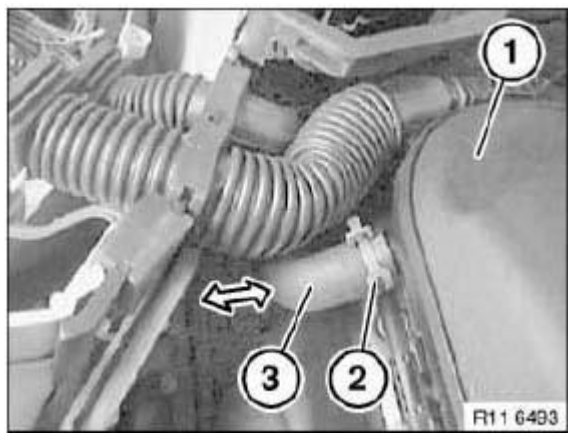
*Necessary preliminary tasks:*

- Remove trailing links. See **51 71 373 REMOVING AND INSTALLING/REPLACING TENSION STRUT ON SPRING STRUT DOME (M5)** or **51 71 373 REMOVING AND INSTALLING/REPLACING TENSION STRUT ON SPRING STRUT DOME (M6)** .
- Remove air filter housing on left and right. See **13 71 000 REMOVING AND INSTALLING LEFT INTAKE FILTER HOUSING (S85)** or **13 71 020 REMOVING AND INSTALLING RIGHT INTAKE FILTER HOUSING (S85)** .
- Remove microfilter housing. See **64 31 061 REMOVING AND INSTALLING/REPLACING LEFT OR RIGHT MICROFILTER HOUSING LOWER SECTION** or **64 31 061 REMOVING AND INSTALLING/REPLACING LEFT OR RIGHT MICROFILTER HOUSING LOWER SECTION (M6)** .

**NOTE:** Illustrations show bank 1 (cylinders 1 to 5).

Release spring clamps (2).

Detach hose (3) in direction of arrow.

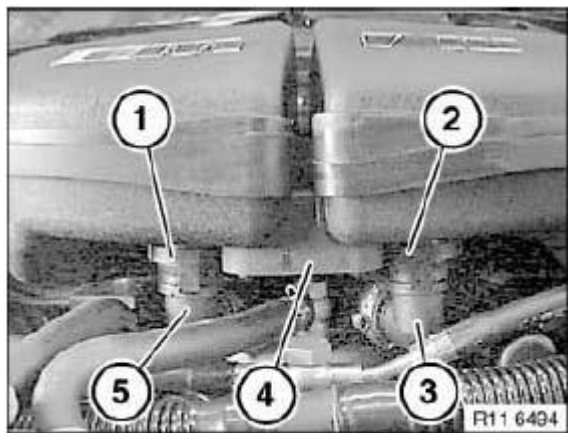


**Fig. 458: Detaching Hose**  
Courtesy of BMW OF NORTH AMERICA, INC.

Unlock and detach hose (5) from fastener (1).

Unlock and detach hose (3) from fastener (2).

Release spacer (4).

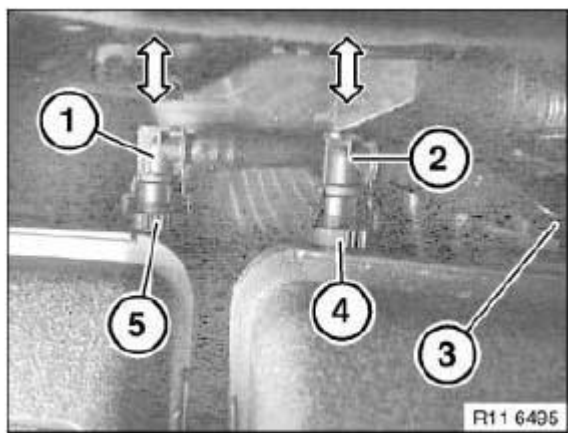


**Fig. 459: Identifying Hose And Spacer**  
Courtesy of BMW OF NORTH AMERICA, INC.

Unlock hose (1) from fastener (5) and detach in direction of arrow.

Unlock hose (2) from fastener (4) and detach in direction of arrow.

Detach hoses (1 and 2) retaining fixture (3).



**Fig. 460: Detaching Hoses From Fastener**  
Courtesy of BMW OF NORTH AMERICA, INC.

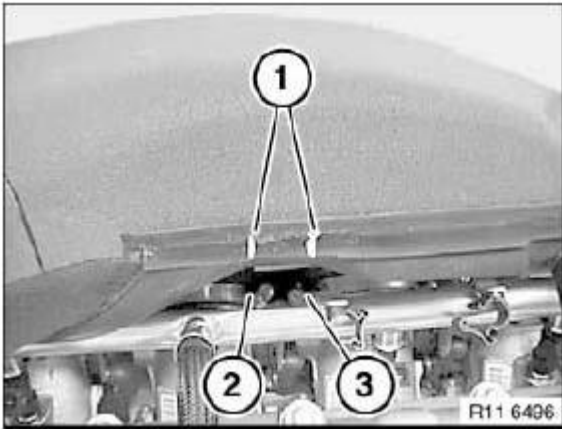
*Installation:*

Each hose clamp on the decoupling element is exactly positioned.

A marking (1) is provided in each case on the air intake manifold to ensure that all hose clamps are accessible.

Release all hose clamps.

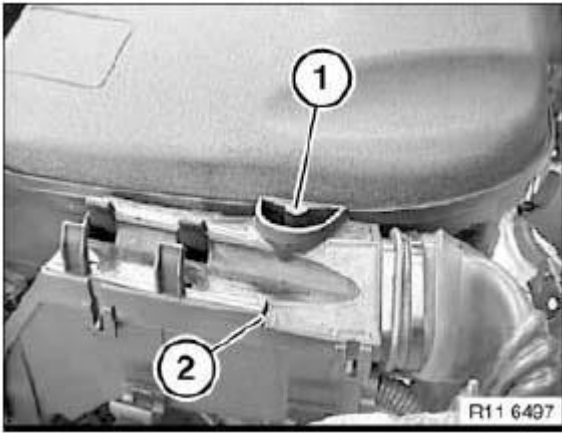
**NOTE:** Illustration shows hose clamps (2 and 3).



**Fig. 461: Identifying Hose Clamps**

Courtesy of BMW OF NORTH AMERICA, INC.

Disengage cable duct (2) with holder (1) from air intake manifold on right.



**Fig. 462: Identifying Cable Duct With Holder**

Courtesy of BMW OF NORTH AMERICA, INC.

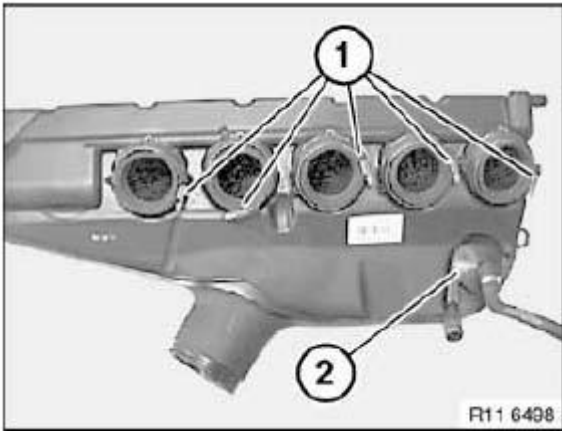
Lift air intake manifold slightly.

Disconnect hose connection (2) from cylinder head cover.

*Installation:*

Each hose clamp (1) has one installation position for improved installation and removal.

Replace faulty hose clamps.



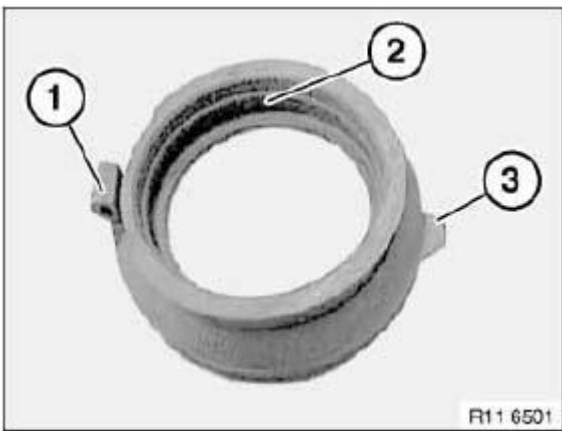
**Fig. 463: Identifying Hose Clamp**

Courtesy of BMW OF NORTH AMERICA, INC.

Decoupling element (2).

Guide lug (3) for installation position.

Retainer (1) for securing hose clamps.



**Fig. 464: Identifying Decoupling Element, Guide Lug And Retainer**

Courtesy of BMW OF NORTH AMERICA, INC.

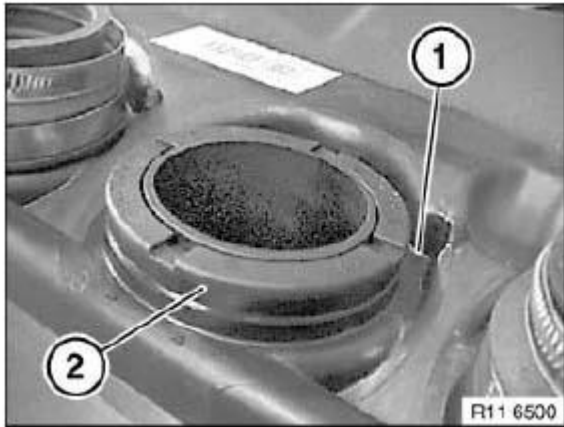
Opening (1) for positioning decoupling element.

*Installation:*

Snap into groove (2) when fitting decoupling element.

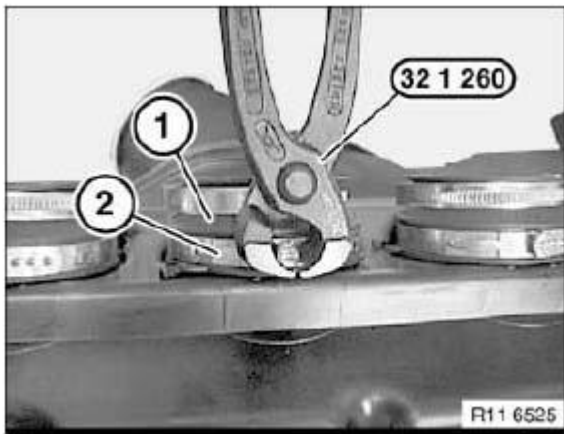
Do not use any antiseize agents or lubricants when fitting.





**Fig. 465: Identifying Opening For Positioning Decoupling Element**  
Courtesy of BMW OF NORTH AMERICA, INC.

Secure ear clamps (2) with special tool 32 1 260.



**Fig. 466: Identifying Ear Clamps And Special Tool 32 1 260**  
Courtesy of BMW OF NORTH AMERICA, INC.

**NOTE:** Assemble engine.  
Check function of DME.

## 78 EMISSION CONTROL, OXYGEN SENSOR

### 11 78 530 REPLACING LEFT OXYGEN CONTROL SENSOR (S85)

Special tools required:

- 11 7 030
- 11 9 150

**WARNING: Scalding hazard!**  
**Only perform these tasks after exhaust system has cooled down.**

*Necessary preliminary tasks:*

- Read out fault memory in Digital Motor Electronics (DME).
- Remove transmission underbody protection.
- Remove bottom left wheel arch trim.

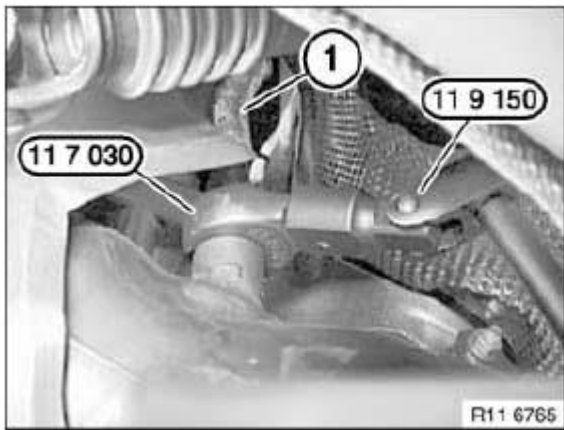
Remove oxygen control sensor (1) with special tools 11 7 030 and 11 9 150.

*Installation:*

When using special tools 11 7 030 and 11 9 150, **47 Nm** on torque wrench scale corresponds to an actual tightening torque of 50 Nm.

If the oxygen control sensor is reused, apply a thin and even coat of Never Seez Compound to the thread only.

The part of the oxygen control sensor which projects into the exhaust system branch (sensor ceramic) must not be cleaned or come into contact with lubricant.



**Fig. 467: Identifying Special Tools 11 7 030, 11 9 150 And Oxygen Control Sensor**  
Courtesy of BMW OF NORTH AMERICA, INC.

Check function of DME.

### **11 78 533 REPLACING RIGHT OXYGEN CONTROL SENSOR (S85)**

**Special tools required:**

- 11 7 030
- 11 9 150

**WARNING: Scalding hazard!**  
**Only perform these tasks after exhaust system has cooled down.**

*Necessary preliminary tasks:*

- Read out fault memory in Digital Motor Electronics (DME).
- Remove transmission underbody protection.
- Remove bottom right wheel arch trim.

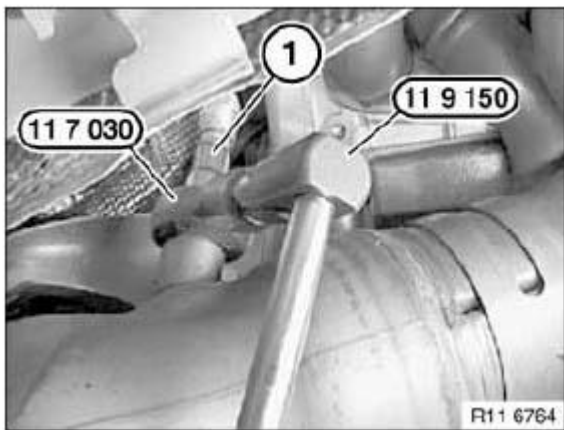
Remove oxygen control sensor (1) with special tools 11 7 030 and 11 9 150.

*Installation:*

When using special tools 11 7 030 and 11 9 150, **47 Nm** on torque wrench scale corresponds to an actual tightening torque of 50 Nm.

If the oxygen control sensor is reused, apply a thin and even coat of Never Seez Compound to the thread only.

The part of the oxygen control sensor which projects into the exhaust system branch (sensor ceramic) must not be cleaned or come into contact with lubricant.



**Fig. 468: Identifying Special Tools 11 7 030, 11 9 150 And Oxygen Control Sensor**  
Courtesy of BMW OF NORTH AMERICA, INC.

Check function of DME.

#### **11 78 540 REPLACING LEFT OXYGEN MONITOR SENSOR (S85)**

**Special tools required:**

- 11 7 030
- 11 9 150

**WARNING: Scalding hazard!**  
**Only perform these tasks after exhaust system has cooled down.**

*Necessary preliminary tasks:*

- Read out fault memory in Digital Motor Electronics (DME).
- Remove transmission underbody protection.

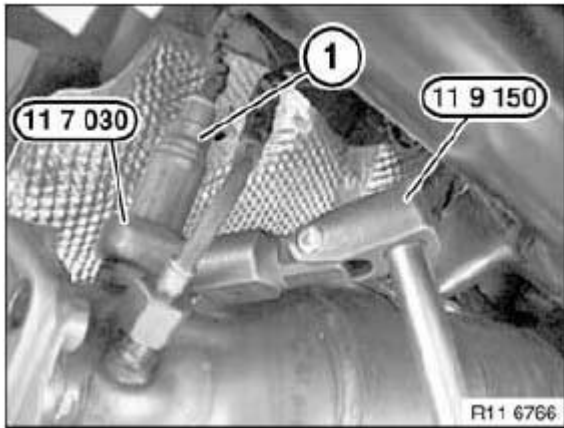
Remove oxygen monitor sensor (1) with special tools 11 7 030 and 11 9 150.

*Installation:*

When using special tools 11 7 030 and 11 9 150, **47 Nm** on torque wrench scale corresponds to an actual tightening torque of 50 Nm.

If the oxygen monitor sensor is reused, apply a thin and even coat of Never Seez Compound to the thread only.

The part of the oxygen monitor sensor which projects into the exhaust system branch (sensor ceramic) must not be cleaned or come into contact with lubricant.



**Fig. 469: Identifying Special Tools 11 7 030, 11 9 150 And Oxygen Monitor Sensor**  
Courtesy of BMW OF NORTH AMERICA, INC.

Check function of DME.

## **11 78 543 REPLACING RIGHT OXYGEN MONITOR SENSOR (S85)**

**Special tools required:**

- 11 7 030

**WARNING: Scalding hazard!**  
**Only perform these tasks after exhaust system has cooled down.**

*Necessary preliminary tasks:*

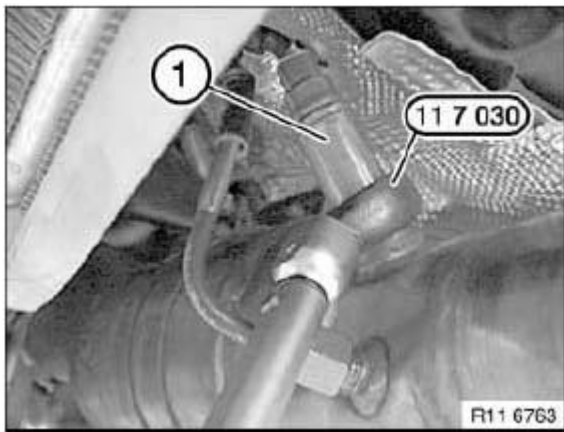
- Read out fault memory in Digital Motor Electronics (DME).
- Remove transmission underbody protection.

Remove oxygen monitor sensor (1) with special tool 11 7 030.

*Installation:*

If the oxygen monitor sensor is reused, apply a thin and even coat of Never Seez Compound to the thread only.

The part of the oxygen monitor sensor which projects into the exhaust system branch (sensor ceramic) must not be cleaned or come into contact with lubricant.



**Fig. 470: Identifying Special Tools 11 7 030 And Oxygen Monitor Sensor**  
Courtesy of BMW OF NORTH AMERICA, INC.

Check function of DME.