

117-24 Camshafts, Camshaft Timing

Camshaft Service (M62 TU Engine)

CAMSHAFT SERVICE (M62 TU ENGINE)

The camshafts can be removed with the cylinder heads mounted on the engine. Special tools are required to remove and install the VANOS units and to time the camshafts during reassembly. Read the procedures through before starting work.

Upper timing chain covers, removing and installing (M62 TU engine)

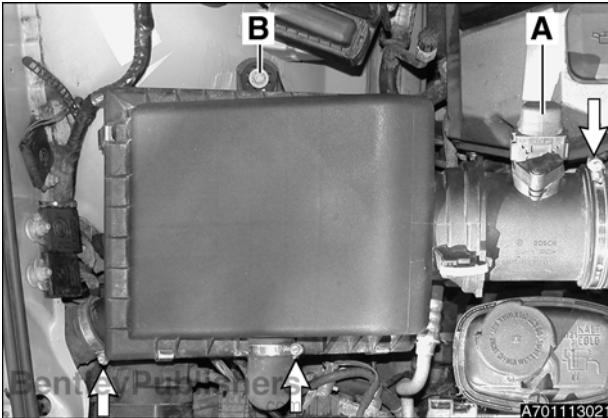
Removing

- Disconnect negative (-) battery cable.

CAUTION—

- Prior to disconnecting the battery, read the battery disconnection cautions in **001 Warnings and Cautions**.

- Remove upper engine cover (intake manifold cover). See **020 Maintenance**.
- Remove air filter housing assembly:
 - Loosen hose clamps (**arrows**). Detach air ducts.
 - Disconnect electrical connector from mass air flow sensor (**A**).
 - Remove filter housing mounting fastener (**B**) and remove filter housing with mass air flow sensor.

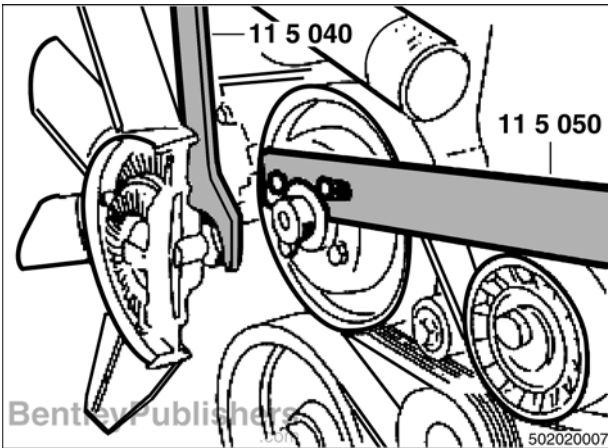


- Use BMW special tools 11 5 050 and 11 5 040 to loosen and remove cooling fan and clutch from coolant pump.

NOTE—

- 32 mm cooling fan nut has left-hand threads.

- If necessary, remove fan cowl from radiator.
- With engine fully cooled off, remove both cylinder head covers. See **113 Cylinder Head Removal and Installation**.
- Remove spark plugs. Use shop towels to plug spark plug holes and prevent anything from falling inside combustion chambers.



- Loosen and remove primary timing chain tensioner (**arrow**) from right upper timing chain cover.

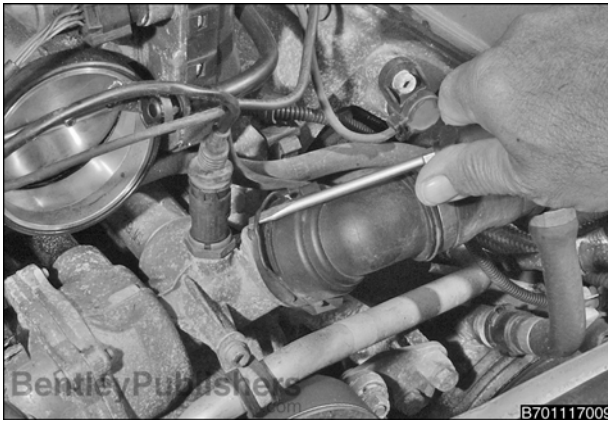
- Raise car and support safely.

WARNING—

- Make sure the car is stable and well supported at all times. Use a professional automotive lift or jack stands designed for the purpose. A floor jack is not adequate support.

- Remove lower engine cover (engine splash shield). See **020 Maintenance**.
- Drain engine coolant. See **170 Radiator and Cooling System**.



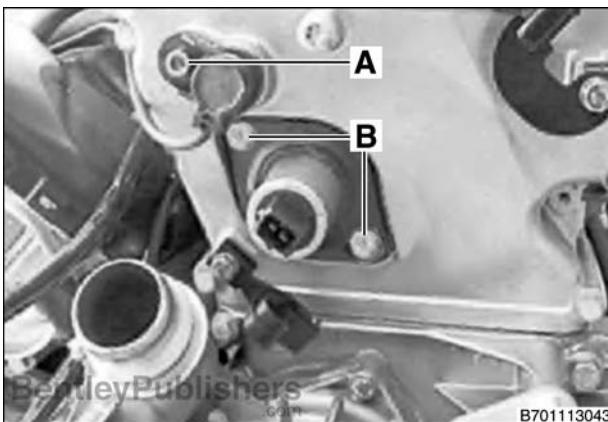


- Working in front of left cylinder head, pry out coolant hose locking clip. Detach hose from coolant pump and thermostat assembly.

CAUTION—

- Catch dripping coolant with shop towels. Do not allow coolant to drip on accessory belts.

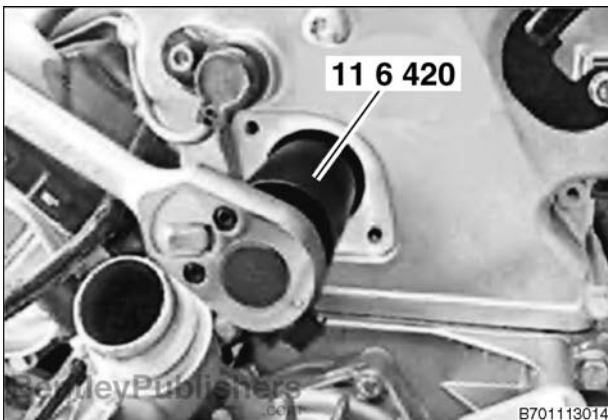
- Similarly, detach right coolant hose from coolant pump assembly.



- Working at front of left upper timing chain cover:
 - Remove left camshaft sensor mounting bolt (**A**) and remove sensor.
 - Detach left VANOS solenoid electrical connector. Then remove solenoid flange mounting bolts (**B**). Lift off flange.

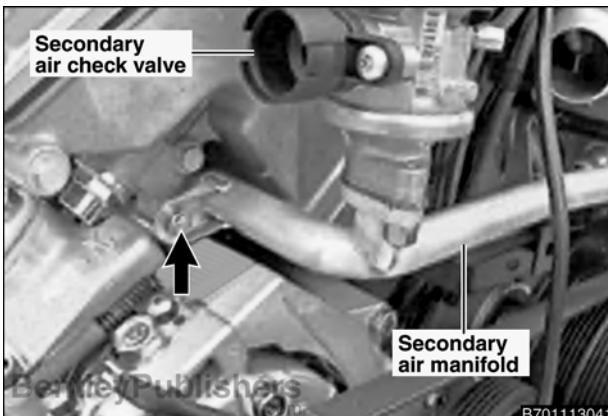
CAUTION—

- Catch dripping oil with shop towels. Do not allow oil to drip on accessory belts.



- Use 32 mm deep socket (BMW special tool 11 6 420) to remove left VANOS solenoid. Wipe with shop cloth and set aside.

- Similarly, remove right camshaft sensor and right VANOS solenoid valve and set aside.



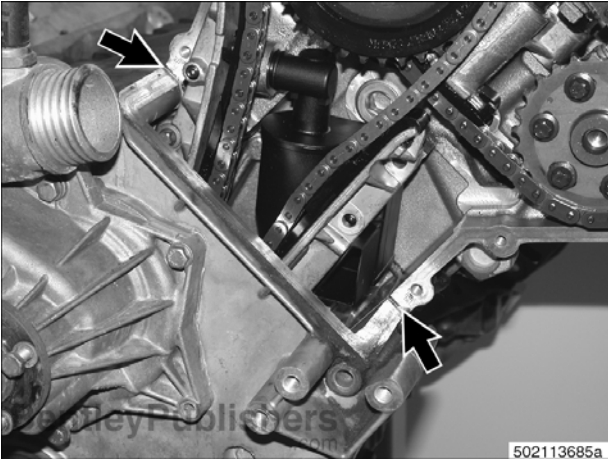
- Working in front of upper timing chain covers:
 - Detach air duct to secondary air injection check valve.
 - Remove secondary air injection manifold mounting bolt (**arrow**) under right cylinder head.
 - Similarly, remove manifold mounting nut under left cylinder head.
 - Detach manifold mounting bracket and lift out manifold.

- Unbolt dipstick tube from right upper timing chain cover.

- Remove both upper timing chain covers.

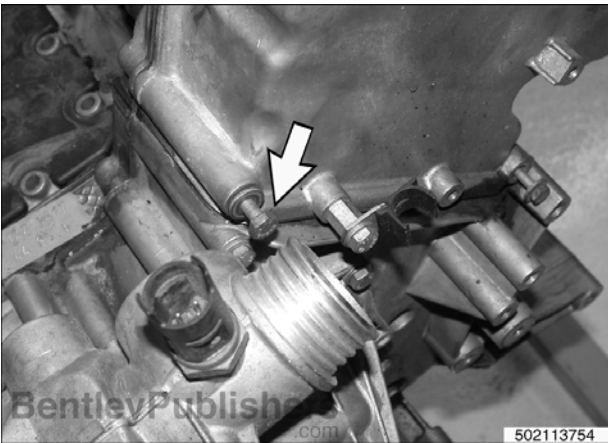
117-26 Camshafts, Camshaft Timing

Camshaft Service (M62 TU Engine)



Installing

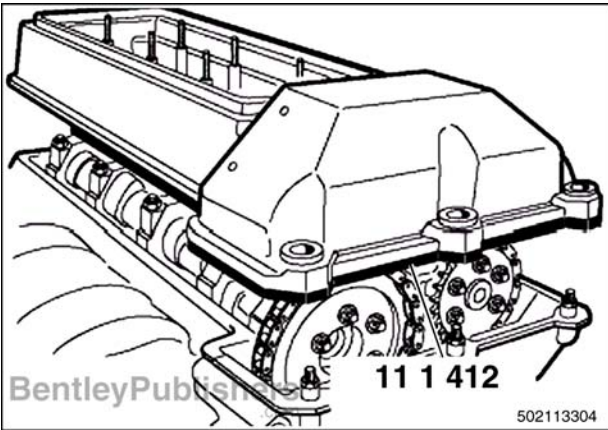
- Clean gasket residue from upper timing chain covers.
- Remove inner and outer gaskets from cylinder head covers and clean gasket residue from grooves.
- Apply 3-Bond 1209® sealant to joints between left cylinder head and lower timing chain cover (**arrows**).



- Using a new gasket, install left timing chain cover with lower right fastener inserted in cover (**arrow**). Position cover in place and tighten cover fasteners finger tight.

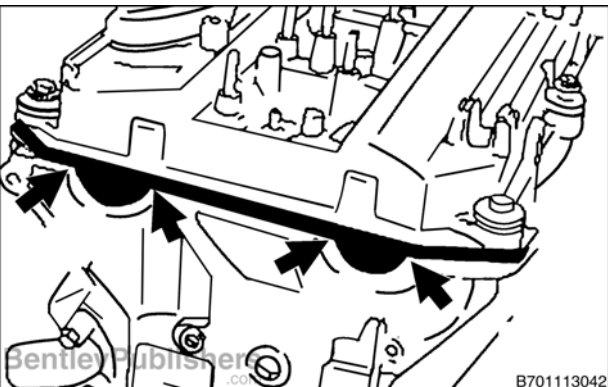
NOTE—

- It is not possible to install lower right fastener after cover is in place.



- Install spacer tool (BMW 11 1 412) in place of left cylinder head cover gasket. Place cover on cylinder head.
- Install left cylinder head cover fasteners and tighten uniformly in ½ turn steps.

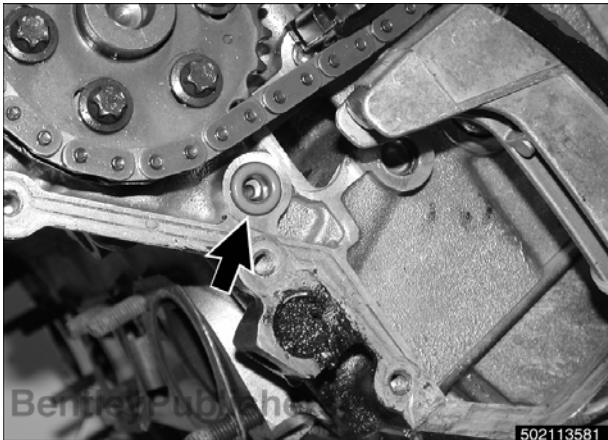
Tightening torque	
Cylinder head cover to cylinder head (M6)	10 Nm (7 ft-lb)



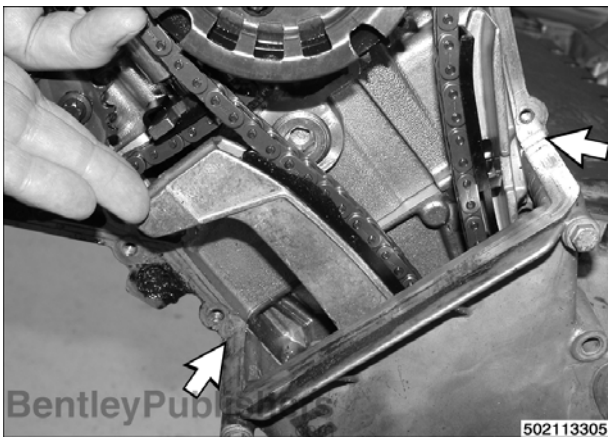
- Tighten left upper timing chain cover retaining bolts in two passes.

Tightening torque	
Timing chain cover to cylinder head (M6)	10 Nm (7 ft-lb)

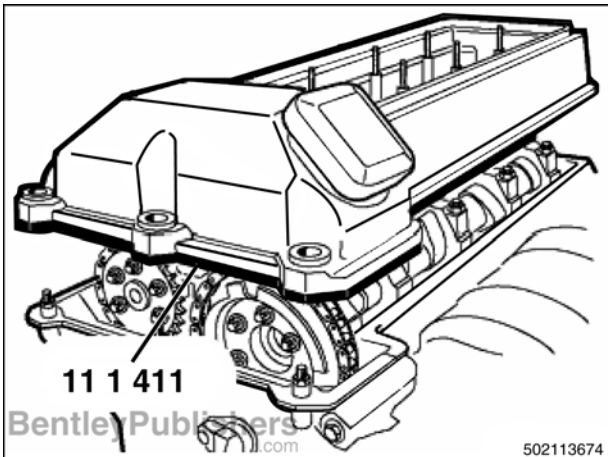
- Remove left cylinder head cover and BMW special tool 11 4 412.
- Reinstall cylinder head cover to left cylinder head using new gaskets. Be sure to use additional sealant at half-moon cutout corners (**arrows**). See **113 Cylinder Head Removal and Installation**.



- Replace sealing O-ring (**arrow**) in right cylinder head.



- Apply 3-Bond 1209® sealant to joints between cylinder head and lower timing chain cover (**arrows**).
- Using new gasket, position right upper timing chain cover in place and tighten cover fasteners finger tight.



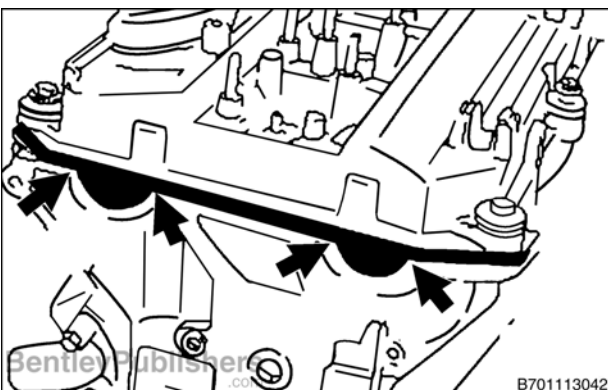
- Install spacer tool (BMW 11 1 411) in place of right cylinder head cover gasket. Place cover on cylinder head.
- Install right cylinder head cover fasteners and tighten uniformly in ½ turn steps.

Tightening torque	
Cylinder head cover to cylinder head (M6)	10 Nm (7 ft-lb)

- Tighten right upper timing chain cover mounting bolts in two passes.

Tightening torque	
Timing chain cover to cylinder head (M6)	10 Nm (7 ft-lb)

- Remove right cylinder head cover and BMW special tool 11 4 411.



- Reinstall cylinder head cover to right cylinder head using new gaskets. Be sure to use additional sealant at half-moon cutout corners (**arrows**). See **113 Cylinder Head Removal and Installation**.

117-28 Camshafts, Camshaft Timing

Camshaft Service (M62 TU Engine)

- Working at each upper timing chain cover:
 - Use 36 mm deep socket (BMW special tool 11 6 420) to reinstall VANOS solenoid. Wipe solenoid clean.
 - Clean solenoid flange sealing surface,
 - Lightly oil sealing lip of solenoid flange cover and install over solenoid.
 - Reattach solenoid electrical harness

Tightening torque	
VANOS solenoid to VANOS oil distributor M27 x 1.5	25 Nm (18 ft-lb)

- Reinstall left and right camshaft sensors.
- Install primary timing chain tensioner with new sealing washer.

Tightening torque	
Chain tensioner to right upper timing chain cover	40 Nm (30 ft-lb)

- Remainder of replacement is reverse of removal. Remember to:
 - Use new sealing O-rings when reattaching secondary air injection manifold.
 - Reattach cooling system hoses. Fill and bleed cooling system. See **170 Radiator and Cooling System**.

Right VANOS unit, removing (M62 TU engine)

- Disconnect negative (–) cable from battery.

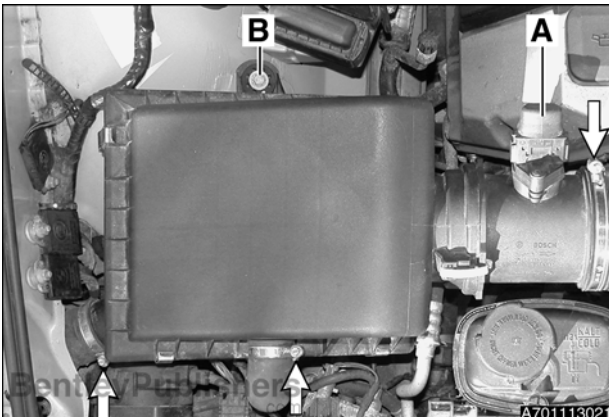
CAUTION—

- *Prior to disconnecting the battery, read the battery disconnection cautions in 001 Warnings and Cautions.*

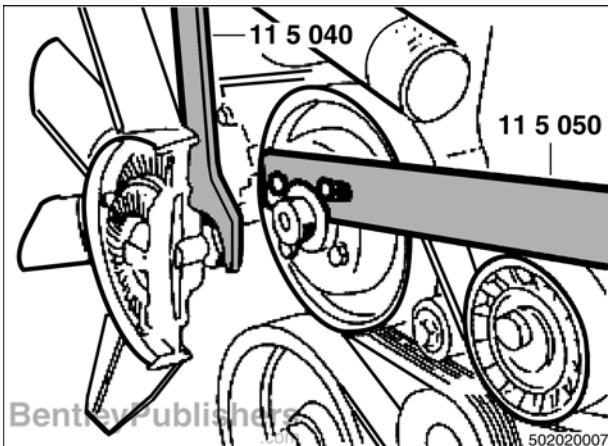
- Remove upper engine cover. See **020 Maintenance**.
- Raise car and support safely.

WARNING—

- *Make sure the car is stable and well supported at all times. Use a professional automotive lift or jack stands designed for the purpose. A floor jack is not adequate support.*



- Remove lower engine cover (engine splash shield). See **020 Maintenance**.
- With engine fully cooled off, drain engine coolant. See **170 Radiator and Cooling System**.
- ◀ Remove air filter housing assembly:
 - Loosen hose clamps (**arrows**). Detach air ducts.
 - Disconnect electrical connector from mass air flow sensor (**A**).
 - Remove filter housing mounting fastener (**B**) and remove filter housing with mass air flow sensor.



- Use BMW special tools 11 5 050 and 11 5 040 to loosen and remove cooling fan and clutch from coolant pump.

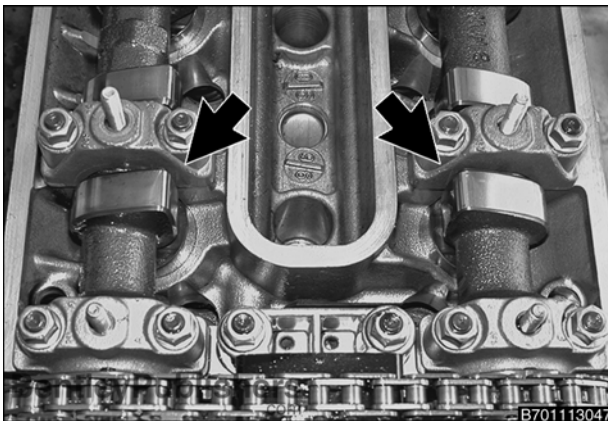
NOTE—

- 32 mm cooling fan nut has left-hand threads.
- If necessary, remove fan cowl from radiator.

- Remove both cylinder head covers. See **113 Cylinder Head Removal and Installation**.
- Remove spark plugs. Use shop towels to plug spark plug holes and prevent anything from falling inside combustion chambers.



- Remove retaining nuts (**arrows**) and remove oil lines from left and right cylinder heads.



- Using vibration damper (crankshaft center) bolt, turn crankshaft clockwise until cylinder 1 (passenger side front cylinder) is in TDC position:
 - Cylinder 1 camshaft lobes (**arrows**) point up and toward each other.



- Lock crankshaft in TDC position with BMW special tool 11 2 300 (**arrow**).

NOTE—

- Casting boss for special tool 11 2 300 is located at rear of engine oil pan.

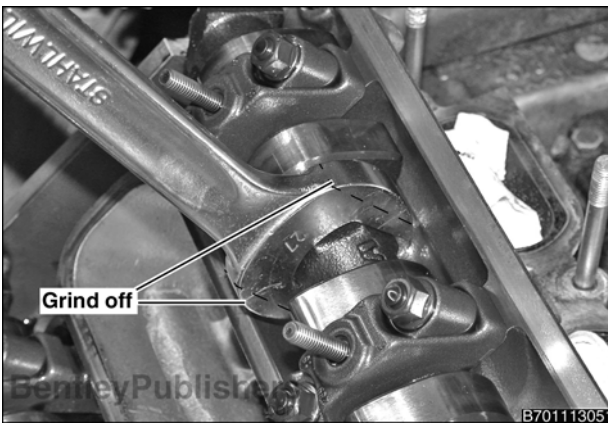
117-30 Camshafts, Camshaft Timing

Camshaft Service (M62 TU Engine)

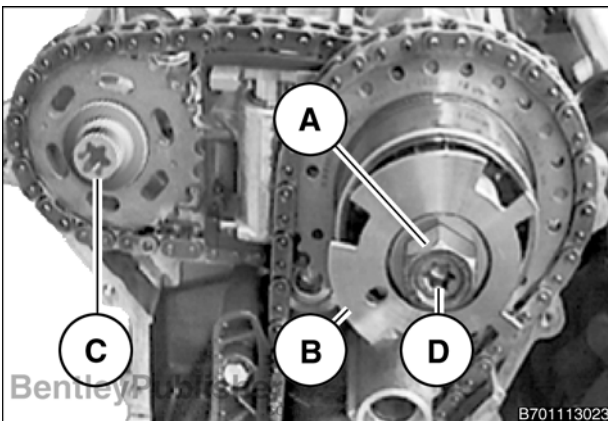


Remove timing chain tensioner (**arrow**) from right side upper timing chain cover.

Remove upper timing chain covers. See **Upper timing chain covers, removing and installing (M62 TU engine)** in this repair group.



In procedure steps that follow, use 27 mm open-end wrench to counterhold each camshaft at hexagonal casting before loosening camshaft sprocket fastener. If necessary, grind off outer edges of wrench jaws to prevent damage to cylinder head.

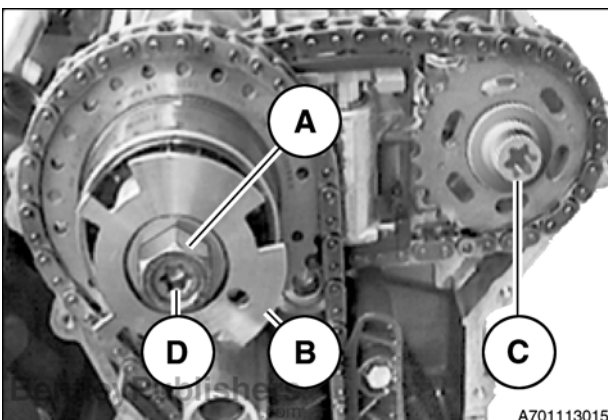


Working at right cylinder head, counterhold with 27 mm wrench:

- Remove right intake camshaft sensor impulse wheel mounting nut (**A**) (left-hand thread).
- Remove camshaft sensor impulse wheel (**B**).
- Loosen right exhaust camshaft sprocket bolt (**C**) approx. ½ turn (left-hand thread).
- Loosen right intake camshaft sprocket mounting bolt (**D**) approx. ½ turn (left-hand thread).

CAUTION—

• Sprocket mounting fasteners have left-hand thread.



Similarly, working at left cylinder head, counterhold with 27 mm wrench:

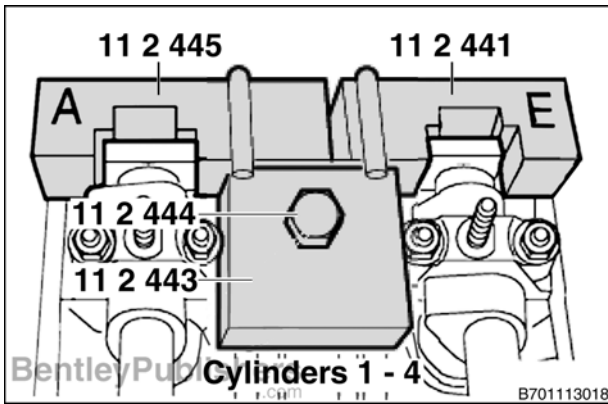
- Remove camshaft sensor impulse wheel mounting nut (**A**) (left-hand thread).
- Remove camshaft sensor impulse wheel (**B**).
- Loosen exhaust camshaft sprocket mounting bolt (**C**) approx. ½ turn (left-hand thread).
- Loosen intake camshaft sprocket mounting bolt (**D**) approx. ½ turn (left-hand thread).

CAUTION—

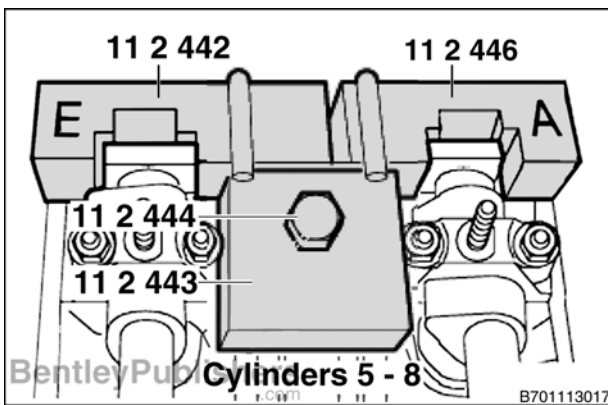
• Sprocket mounting fasteners have left-hand threads.

Camshafts, Camshaft Timing 117-31

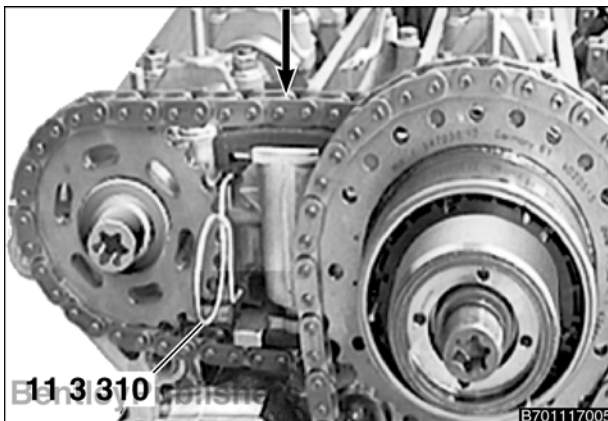
Camshaft Service (M62 TU Engine)



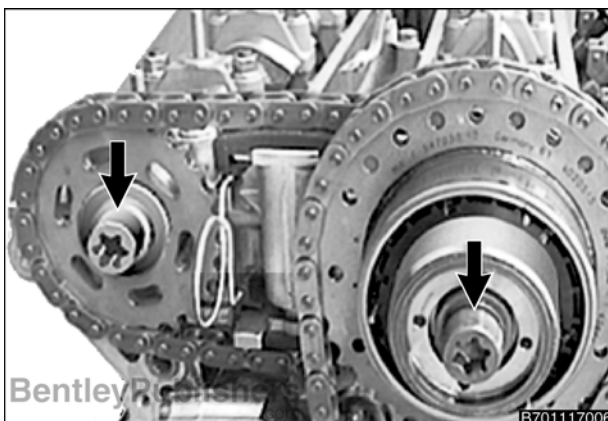
- Install camshaft locking tool set (BMW special tools 11 2 441, 11 2 445) on right cylinder head.
 - Make sure tools are flush against cylinder head surface.
 - Place BMW special tool 11 2 444 over camshaft locking tools and secure in place using special BMW bolt 11 2 443 screwed into spark plug hole.



- Install camshaft locking tool set (BMW special tools 11 2 442, 11 2 446) on left cylinder head.
 - Make sure tools are flush against cylinder head surface.
 - Place BMW special tool 11 2 444 over camshaft locking tools and secure in place using special BMW bolt 11 2 443 screwed into spark plug hole.



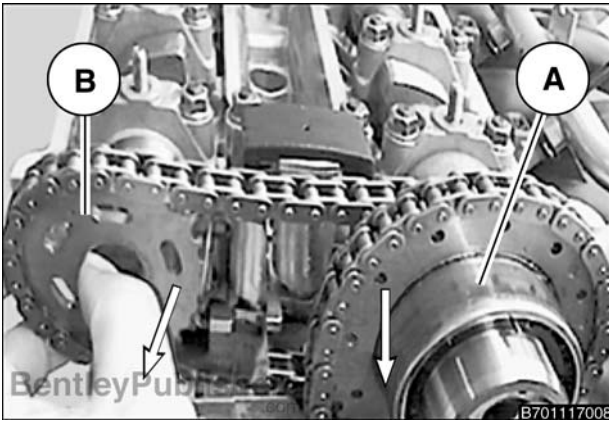
- Compress right cylinder bank secondary chain tensioner (**arrow**) and lock using BMW special tool 11 3 310.



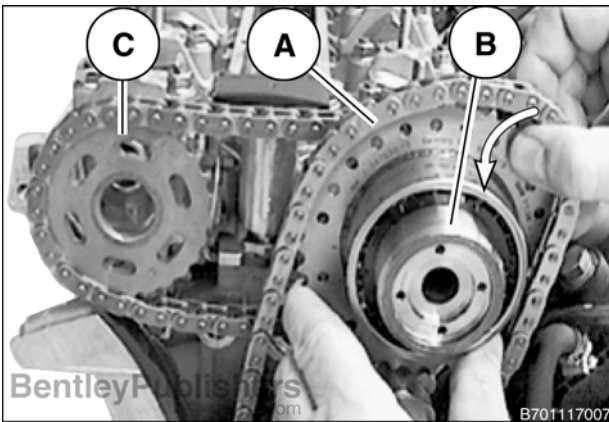
- Remove right intake and exhaust camshaft sprocket mounting bolts (**arrows**) (left-hand thread).

117-32 Camshafts, Camshaft Timing

Camshaft Service (M62 TU Engine)



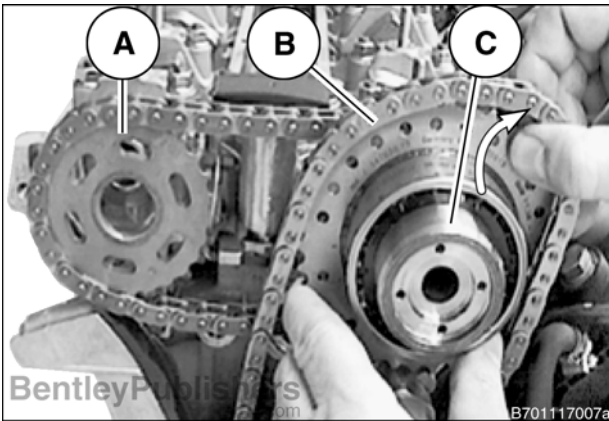
- Slide right VANOS unit and intake camshaft sprocket (A) and exhaust camshaft sprocket (B) forward and off camshafts (arrows).



- Working at front of right cylinder head:
 - Slip primary chain (A) off VANOS unit sprocket (B).
 - To prevent primary chain from dropping into lower housing, use stiff wire to suspend chain.
 - Remove exhaust camshaft sprocket (C), secondary timing chain, intake camshaft sprocket and VANOS assembly and set aside.

Right VANOS unit, installing (M62 TU engine)

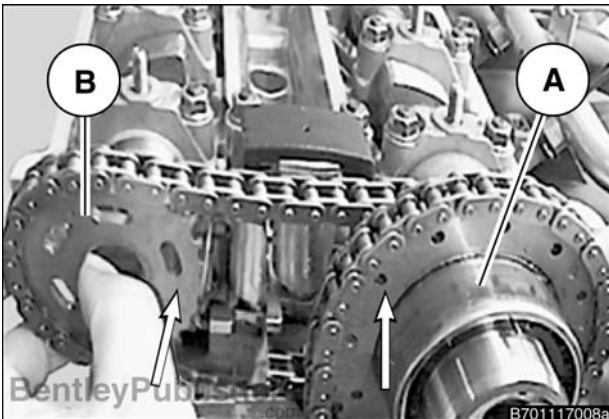
- Make sure camshaft and crankshaft locking tools, installed during VANOS unit removal, are still in place as before.



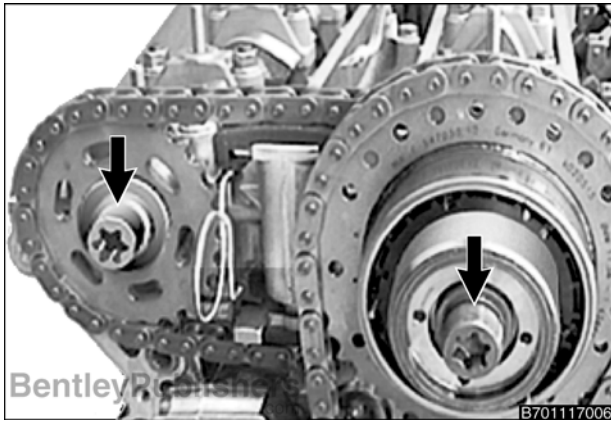
- Working at front of right cylinder head:
 - Position exhaust camshaft sprocket (A), secondary timing chain, intake camshaft sprocket and VANOS assembly in front of right cylinder head camshafts.
 - Pull up primary chain (B) and slip over VANOS unit sprocket assembly (C).

NOTE —

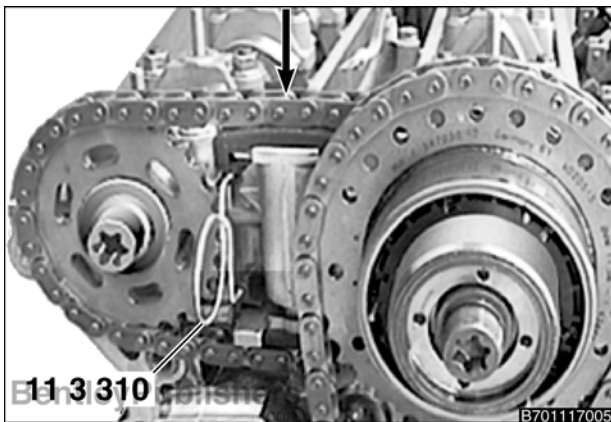
- Neither the location of slotted holes in the exhaust camshaft sprocket nor the position of the VANOS unit sprocket gears in relation to the chain is of any consequence.



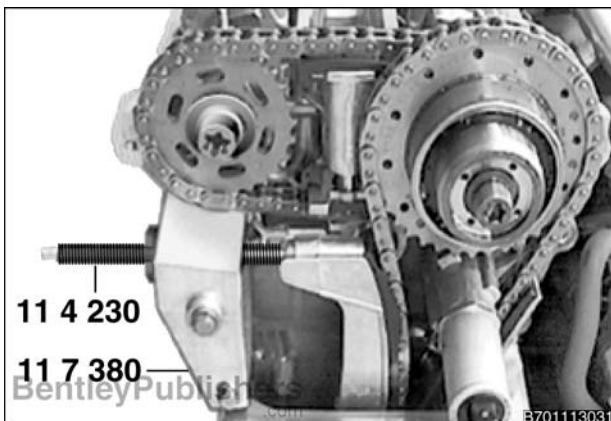
- Slide left VANOS unit and intake camshaft sprocket (A) and exhaust camshaft sprocket (B) on camshafts (arrows).



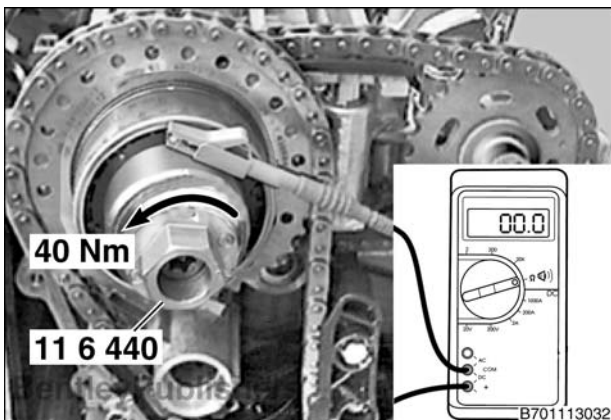
- Install right intake and exhaust camshaft sprocket mounting bolts (**arrows**) (left-hand thread). Hand tighten but do not torque yet.



- Compress right cylinder head secondary chain tensioner (**arrow**) and remove BMW special tool 11 3 310.



- Working at right cylinder head:
 - Bolt BMW special bracket 11 7 380 underneath exhaust camshaft sprocket.
 - Attach primary timing chain dummy tensioner (BMW special tool 11 4 230) to special bracket 11 7 380. Screw in adjusting screw but do not tighten yet.



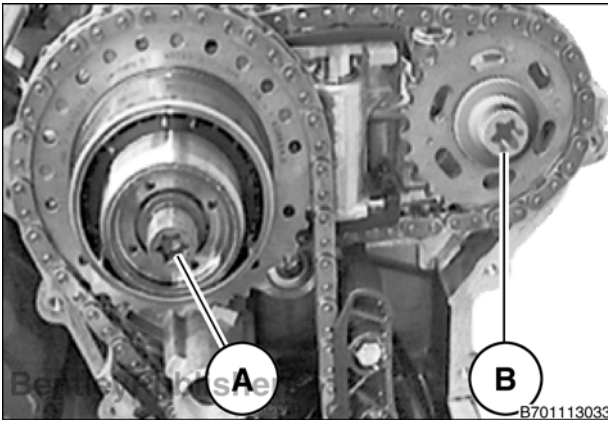
- Working at left cylinder head:
 - Connect multimeter to contact pin on left VANOS unit and to oil line on left cylinder head.
 - Set multimeter to acoustic continuity test.
 - Thread BMW special tool 11 6 440 to left VANOS unit shaft (left-hand thread).
 - Use torque wrench to tighten special tool 11 6 440 to 40 Nm (30 ft-lb) until acoustic signal sounds. This indicates VANOS unit has reached left-hand stop.
 - Remove special tool 11 6 440.

NOTE —

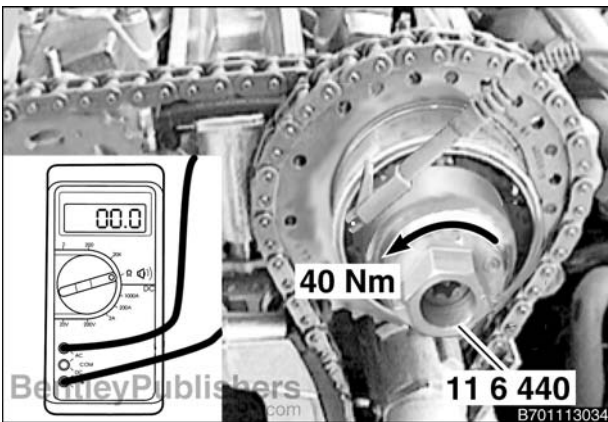
- Rotating the VANOS unit to the left forces out the oil.
- Metal-to-metal contact occurs inside the VANOS unit when it reaches the left-hand stop, causing the continuity tester to sound.

117-34 Camshafts, Camshaft Timing

Camshaft Service (M62 TU Engine)



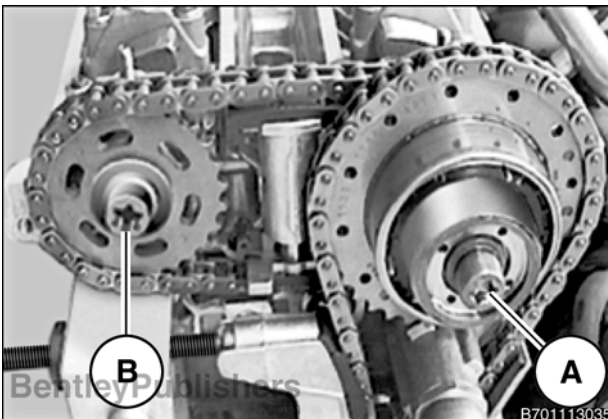
- Working at left cylinder head, use 27 mm open-end wrench to counterhold each camshaft:
 - Tighten left VANOS unit and intake camshaft sprocket mounting bolt (**A**) to an initial torque of 15 Nm (11 ft-lb) (left-hand thread). Back off ¼ turn.
 - Tighten left exhaust camshaft sprocket mounting bolt (**B**) to an initial torque of 15 Nm (11 ft-lb) (left-hand thread). Back off ¼ turn.



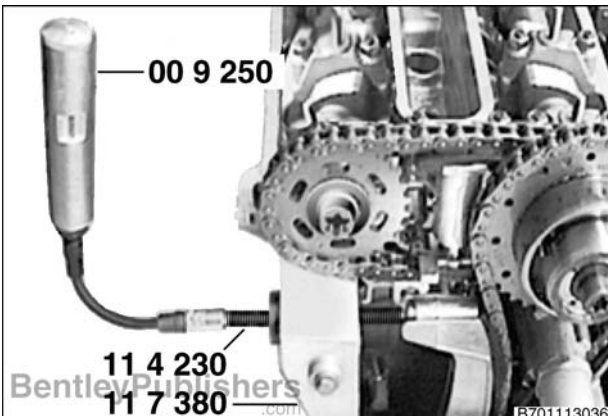
- Working at right cylinder head:
 - Connect multimeter to contact pin on left VANOS unit and to oil line on right cylinder head.
 - Set multimeter to acoustic continuity test.
 - Thread BMW special tool 11 6 440 to right VANOS unit shaft (left-hand thread).
 - Use torque wrench to tighten special tool 11 6 440 to 40 Nm (30 ft-lb) until acoustic signal sounds. This indicates VANOS unit has reached left-hand stop.
 - Remove special tool 11 6 440.

NOTE—

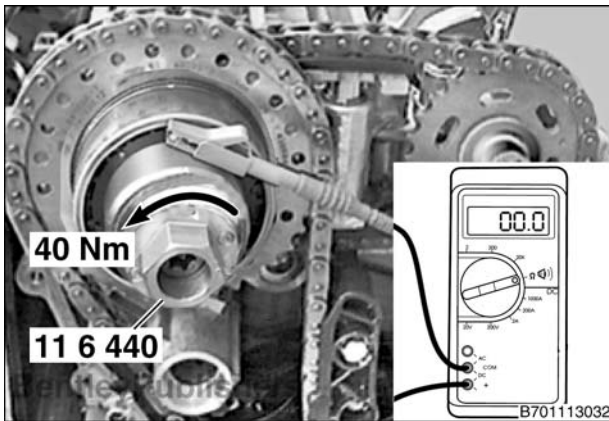
- Rotating the VANOS unit to the left forces out the oil.
- Metal-to-metal contact occurs inside the VANOS unit when it reaches the left-hand stop, causing the continuity tester to sound.



- Working at right cylinder head, use 27 mm open-end wrench to counterhold each camshaft:
 - Tighten right VANOS unit and intake camshaft sprocket mounting bolt (**A**) to an initial torque of 15 Nm (11 ft-lb) (left-hand thread). Back off ¼ turn.
 - Tighten right exhaust camshaft sprocket mounting bolt (**B**) to an initial torque of 15 Nm (11 ft-lb) (left-hand thread). Back off ¼ turn.

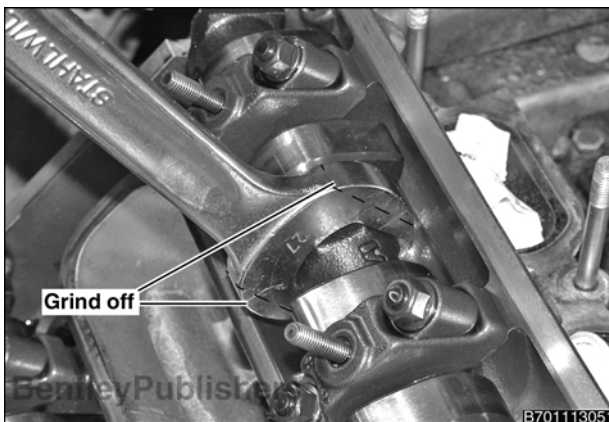


- Pretension primary timing chain tensioning rail:
 - Use low-torque wrench (BMW special tool 00 9 250 or equivalent) to tighten adjusting screw on dummy chain tensioner (special tool 11 4 230) to 0.7 Nm (6.3 in-lb).

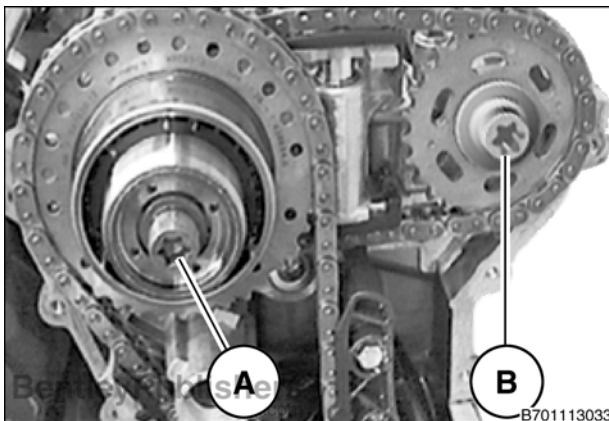


➤ Tensioning primary chain repositions VANOS units on both cylinder heads. Therefore, repeat steps for setting left-hand stop on left VANOS unit:

- Connect multimeter to contact pin on left VANOS unit and to oil line on left cylinder head.
- Set multimeter to acoustic continuity test.
- Thread BMW special tool 11 6 440 to left VANOS unit shaft (left-hand thread).
- Use torque wrench to tighten special tool 11 6 440 to 40 Nm (30 ft-lb) until acoustic signal sounds. This indicates VANOS unit has reached left-hand stop.
- Remove special tool 11 6 440.



➤ In procedure steps that follow, use 27 mm open-end wrench to counterhold each camshaft at hexagonal casting before tightening camshaft sprocket fastener. If necessary, grind off outer edges of wrench jaws to prevent damage to cylinder head.



➤ Working at left cylinder head, use 27 mm open-end wrench to counterhold each camshaft:

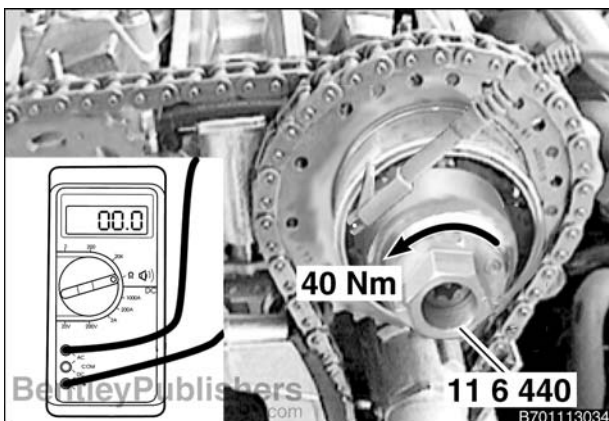
- Tighten left VANOS unit and intake camshaft sprocket mounting bolt (A) (left-hand thread).
- Tighten left exhaust camshaft sprocket mounting bolt (B) (left-hand thread).

CAUTION—

- Sprocket mounting fasteners have left-hand threads.

Tightening torques

Exhaust camshaft sprocket to exhaust camshaft (M12 x 1.5) (B)	125 Nm (92 ft-lb)
VANOS unit and intake camshaft sprocket to intake camshaft (M12 x 1.5) (A)	110 Nm (81 ft-lb)

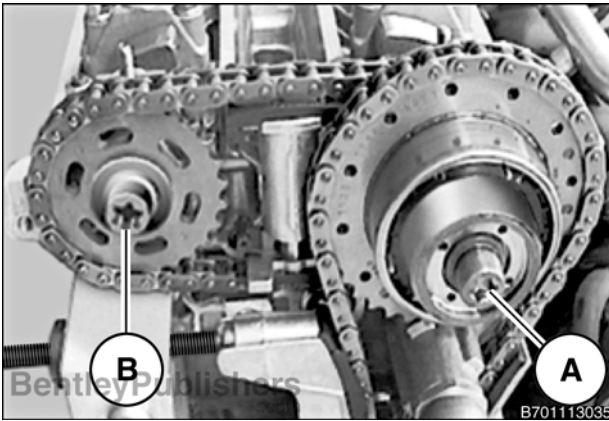


➤ Repeat steps for setting left-hand stop on right VANOS unit:

- Connect multimeter to contact pin on left VANOS unit and to oil line on right cylinder head.
- Set multimeter to acoustic continuity test.
- Thread BMW special tool 11 6 440 to right VANOS unit shaft (left-hand thread).
- Use torque wrench to tighten special tool 11 6 440 to 40 Nm (30 ft-lb) until acoustic signal sounds. This indicates VANOS unit has reached left-hand stop.
- Remove special tool 11 6 440.

117-36 Camshafts, Camshaft Timing

Camshaft Service (M62 TU Engine)



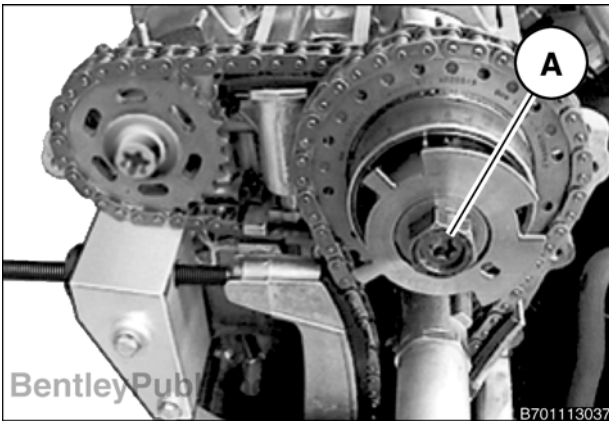
- Working at right cylinder head, use 27 mm open-end wrench to counterhold each camshaft:
 - Tighten right VANOS unit and intake camshaft sprocket mounting bolt (A) (left-hand thread).
 - Tighten right exhaust camshaft sprocket mounting bolt (B) (left-hand thread). Back off ¼ turn.

CAUTION—

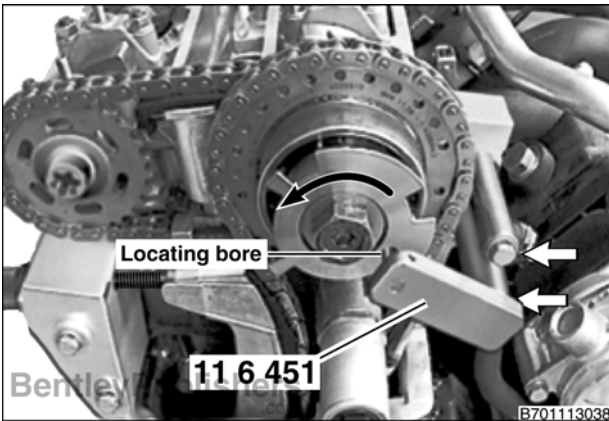
- Sprocket mounting fasteners have left-hand threads.

Tightening torques

Exhaust camshaft sprocket to exhaust camshaft (M12 x 1.5) (B)	125 Nm (92 ft-lb)
VANOS unit and intake camshaft sprocket to intake camshaft (M12 x 1.5) (A)	110 Nm (81 ft-lb)



- Install right camshaft sensor impulse wheel and mounting nut (A) (left-hand thread). Hand tighten nut.



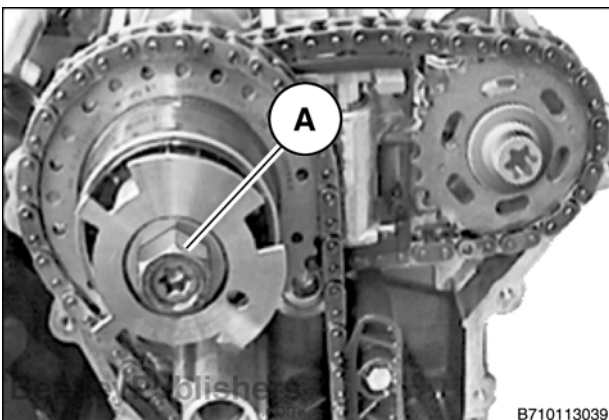
- Working at right cylinder head:
 - Align locating bore on impulse wheel with positioning pin on BMW special tool 11 6 451.
 - Insert special tool mounting bolts (**white arrows**) and hand tighten to cylinder head.
 - Press tool down firmly and tighten mounting bolts.
 - Counterhold intake camshaft with 27 mm open-end wrench and tighten impulse wheel mounting nut (left-hand thread, **black arrow**).
 - Remove special tool 11 6 451.

CAUTION—

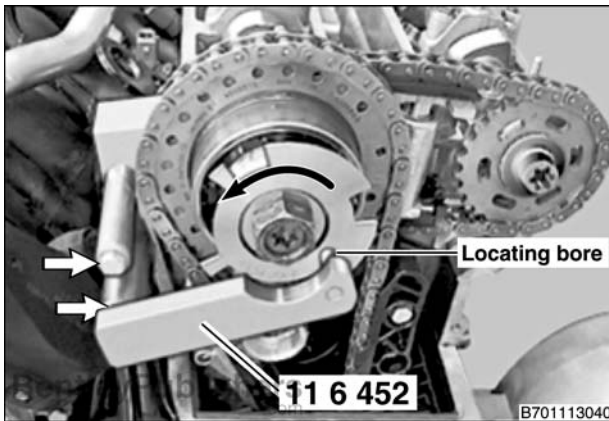
- Impulse wheel mounting nut has left-hand threads.

Tightening torques

Camshaft sensor impulse wheel to camshaft (M18 x 1.5)	40 Nm (30 ft-lb)
---	------------------



- Install left camshaft sensor impulse wheel and mounting nut (A) (left-hand thread). Hand tighten nut.



Working at left cylinder head:

- Align locating bore on camshaft impulse wheel with positioning pin on BMW special tool 11 6 452.
- Insert special tool mounting bolts (**white arrows**) and hand tighten to cylinder head.
- Press tool down firmly and tighten mounting bolts.
- Counterhold intake camshaft with 27 mm open-end wrench and tighten impulse wheel mounting nut (left-hand thread, **black arrow**).
- Remove special tool 11 6 451.

CAUTION—

- Impulse wheel mounting nut has left-hand threads.

Tightening torques

Camshaft impulse wheel to camshaft (M18 x 1.5)	40 Nm (30 ft-lb)
--	------------------

- Remove crankshaft and camshaft locking tools.
- Remove primary chain dummy tensioner (BMW special tool 11 4 230) and support bracket (BMW special tool 11 7 380) from right cylinder head.

Install oil supply lines and mounting nuts (**arrows**) to cylinder heads.

Tightening torque

Oil supply line to cylinder head	10 Nm (7 ft-lb)
----------------------------------	-----------------

- Install both upper timing chain covers. See **Upper timing chain covers, removing and installing (M62 TU engine)** in this repair group.
- Install primary timing chain tensioner with new sealing washer.

Tightening torque

Chain tensioner to right upper timing chain cover	40 Nm (30 ft-lb)
---	------------------

- Remainder of replacement is reverse of removal. Remember to:
 - Use new sealing O-rings when reattaching secondary air injection manifold.
 - Reattach cooling system hoses. Fill and bleed cooling system. See **170 Radiator and Cooling System**.



117-38 Camshafts, Camshaft Timing

Camshaft Service (M62 TU Engine)

Left VANOS unit, removing (M62 TU engine)

- Disconnect negative (–) cable from battery.

CAUTION—

- Prior to disconnecting the battery, read the battery disconnection cautions in **001 Warnings and Cautions**.

- Remove upper engine cover. See **020 Maintenance**.
- Raise car and support safely.

WARNING—

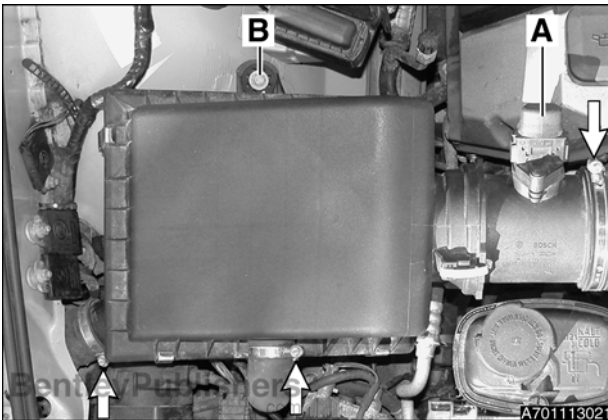
- Make sure the car is stable and well supported at all times. Use a professional automotive lift or jack stands designed for the purpose. A floor jack is not adequate support.

- Remove lower engine cover (engine splash shield). See **020 Maintenance**.
- With engine fully cooled off, drain engine coolant. See **170 Radiator and Cooling System**.



- Remove air filter housing assembly:

- Loosen hose clamps (**arrows**). Detach air ducts.
- Disconnect electrical connector from mass air flow sensor (**A**).
- Remove filter housing mounting fastener (**B**) and remove filter housing with mass air flow sensor.

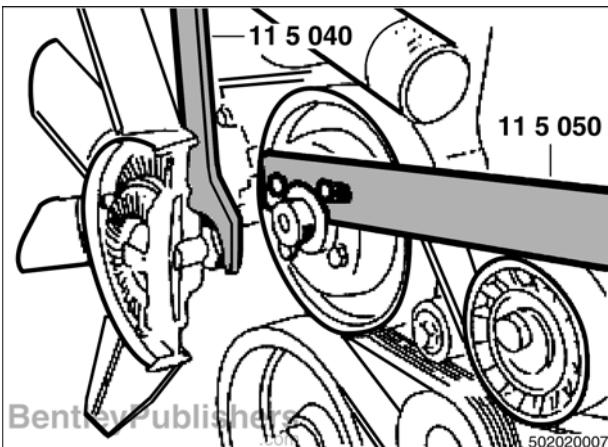


- Use BMW special tools 11 5 050 and 11 5 040 to loosen and remove cooling fan and clutch from coolant pump.

NOTE—

- 32 mm cooling fan nut has left-hand threads.
- If necessary, remove fan cowl from radiator.

- Remove both cylinder head covers. See **113 Cylinder Head Removal and Installation**.
- Remove spark plugs. Use shop towels to plug spark plug holes and prevent anything from falling inside combustion chambers.

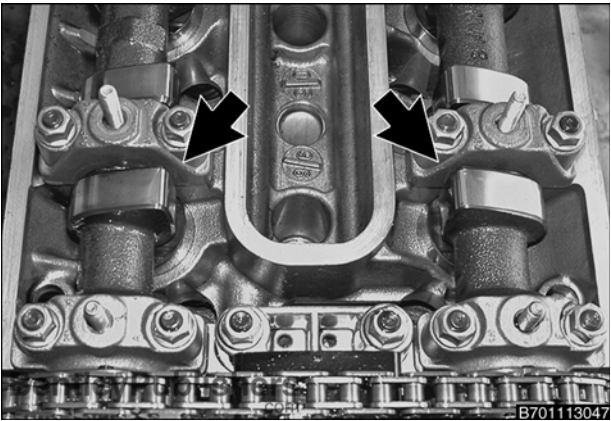


Camshafts, Camshaft Timing 117-39

Camshaft Service (M62 TU Engine)



- Remove retaining nuts (**arrows**) and remove oil lines from left and right cylinder heads.



- Using vibration damper (crankshaft center) bolt, turn crankshaft clockwise until cylinder 1 (passenger side front cylinder) is in TDC position:
 - Cylinder 1 camshaft lobes (**arrows**) point up and toward each other.



- Lock crankshaft in TDC position with BMW special tool 11 2 300 (**arrow**).

NOTE—

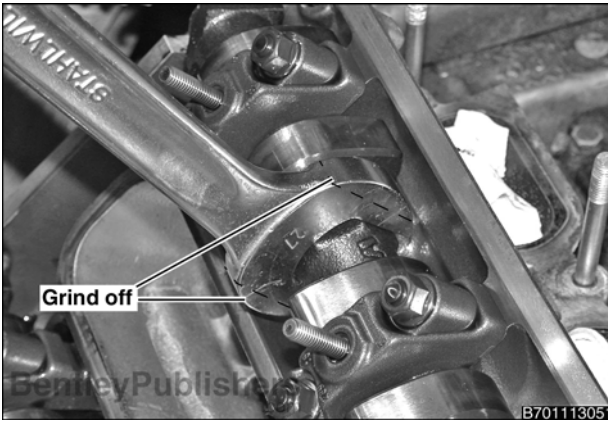
- Casting boss for special tool 11 2 300 is located at rear of engine oil pan.



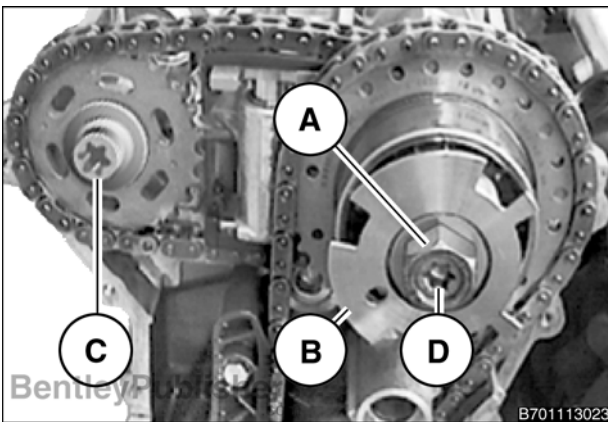
- Remove timing chain tensioner (**arrow**) from right side upper timing chain cover.
- Remove upper timing chain covers. See **Upper timing chain covers, removing and installing (M62 TU engine)** in this repair group.

117-40 Camshafts, Camshaft Timing

Camshaft Service (M62 TU Engine)



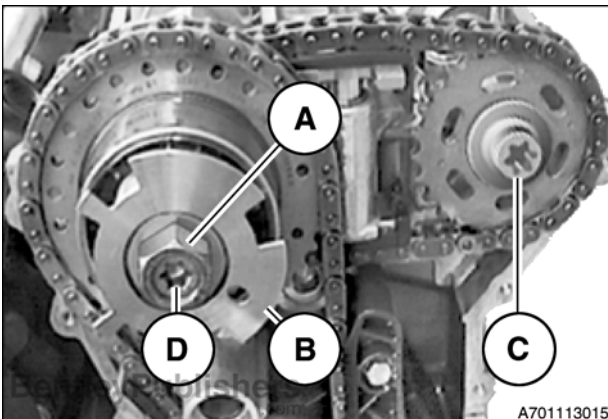
- In procedure steps that follow, use 27 mm open-end wrench to counterhold each camshaft at hexagonal casting before loosening camshaft sprocket fastener. If necessary, grind off outer edges of wrench jaws to prevent damage to cylinder head.



- Working at right cylinder head, counterhold with 27 mm wrench:
 - Remove right intake camshaft sensor impulse wheel mounting nut (A) (left-hand thread).
 - Remove camshaft sensor impulse wheel (B).
 - Loosen right exhaust camshaft sprocket bolt (C) approx. ½ turn (left-hand thread).
 - Loosen right intake camshaft sprocket mounting bolt (D) approx. ½ turn (left-hand thread).

CAUTION—

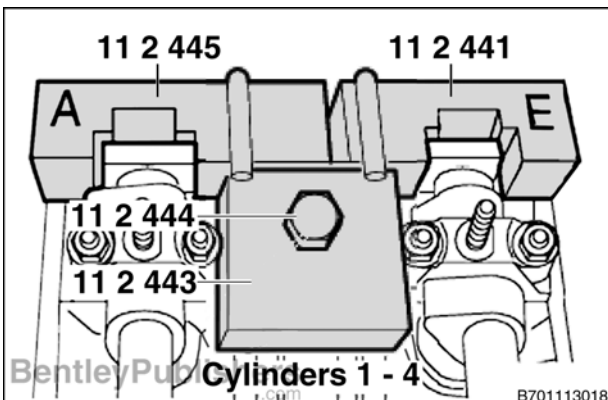
- Sprocket mounting fasteners have left-hand thread.



- Similarly, working at left cylinder head, counterhold with 27 mm wrench:
 - Remove camshaft sensor impulse wheel mounting nut (A) (left-hand thread).
 - Remove camshaft sensor impulse wheel (B).
 - Loosen exhaust camshaft sprocket mounting bolt (C) approx. ½ turn (left-hand thread).
 - Loosen intake camshaft sprocket mounting bolt (D) approx. ½ turn (left-hand thread).

CAUTION—

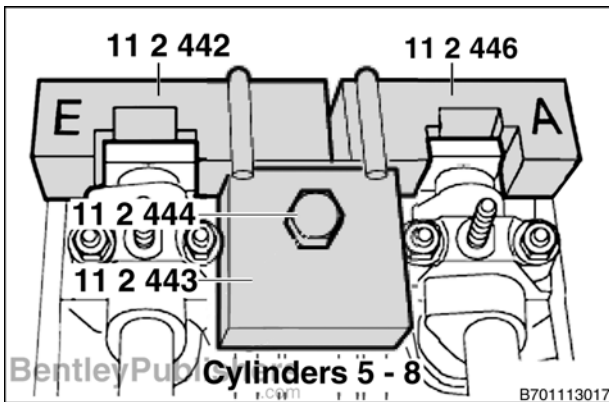
- Sprocket mounting fasteners have left-hand threads.



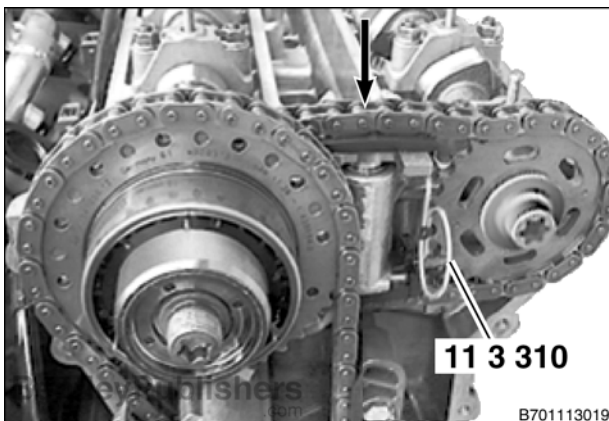
- Install camshaft locking tool set (BMW special tools 11 2 441, 11 2 445) on right cylinder head.
 - Make sure tools are flush against cylinder head surface.
 - Place BMW special tool 11 2 444 over camshaft locking tools and secure in place using special BMW bolt 11 2 443 screwed into spark plug hole.

Camshafts, Camshaft Timing 117-41

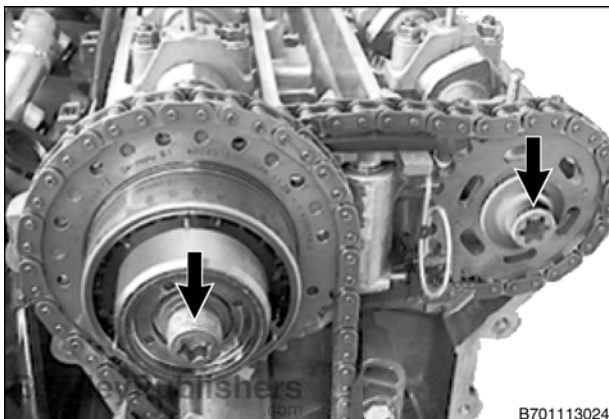
Camshaft Service (M62 TU Engine)



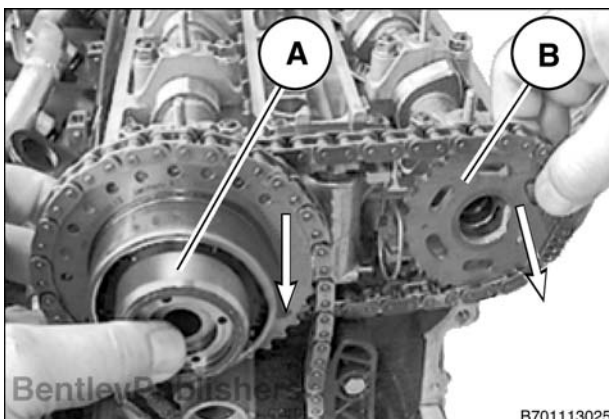
- Install camshaft locking tool set (BMW special tools 11 2 442, 11 2 446) on left cylinder head.
 - Make sure tools are flush against cylinder head surface.
 - Place BMW special tool 11 2 444 over camshaft locking tools and secure in place using special BMW bolt 11 2 443 screwed into spark plug hole.



- Compress left cylinder bank secondary chain tensioner (**arrow**) and lock using BMW special tool 11 3 310.



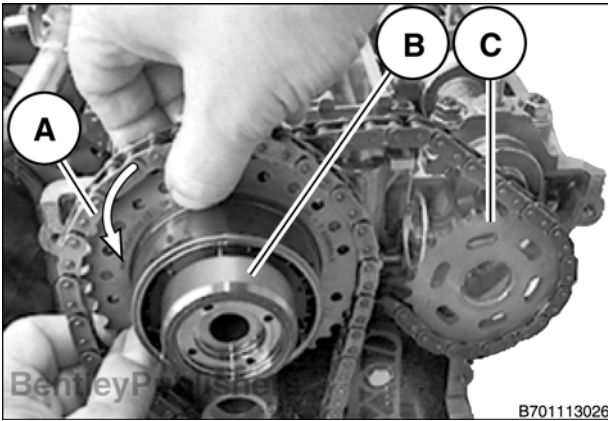
- Remove left intake and exhaust camshaft sprocket mounting bolts (**arrows**) (left-hand thread).



- Slide left VANOS unit and intake camshaft sprocket (A) and exhaust camshaft sprocket (B) forward and off camshafts (**arrows**).

117-42 Camshafts, Camshaft Timing

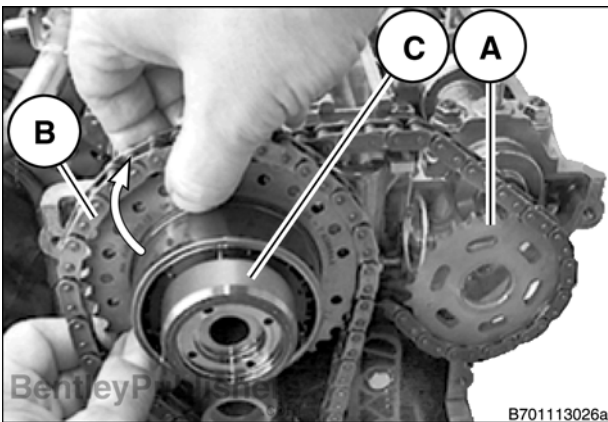
Camshaft Service (M62 TU Engine)



- Working at front of left cylinder head:
 - Slip primary chain (A) off VANOS unit sprocket (B).
 - To prevent primary chain from dropping into lower housing, use stiff wire to suspend chain.
 - Remove exhaust camshaft sprocket (C), secondary timing chain, intake camshaft sprocket and VANOS assembly and set aside.

Left VANOS unit, installing (M62 TU engine)

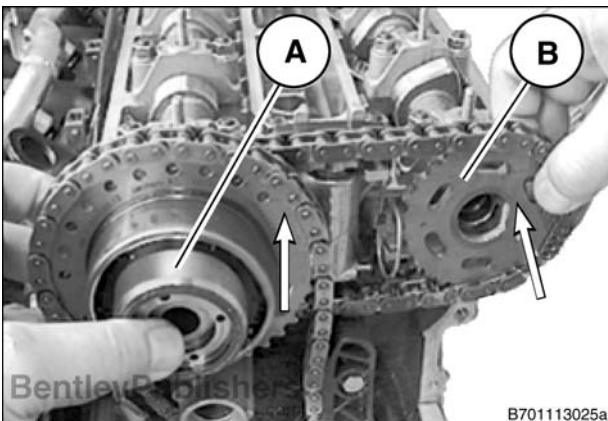
- Make sure camshaft and crankshaft locking tools, installed during VANOS unit removal, are still in place as before.



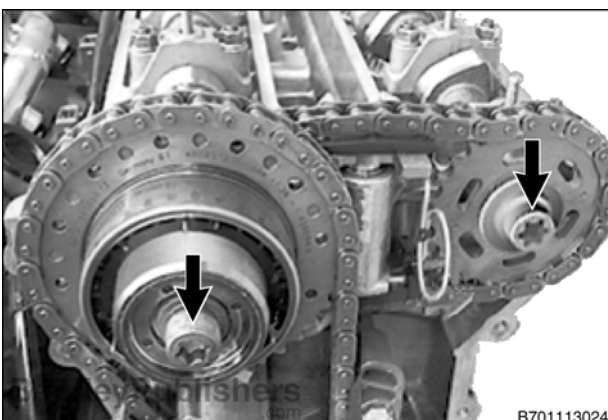
- Working at front of left cylinder head:
 - Position exhaust camshaft sprocket (A), secondary timing chain, intake camshaft sprocket and VANOS assembly in front of left cylinder head camshafts.
 - Pull up primary chain (B) and slip over VANOS unit sprocket assembly (C).

NOTE —

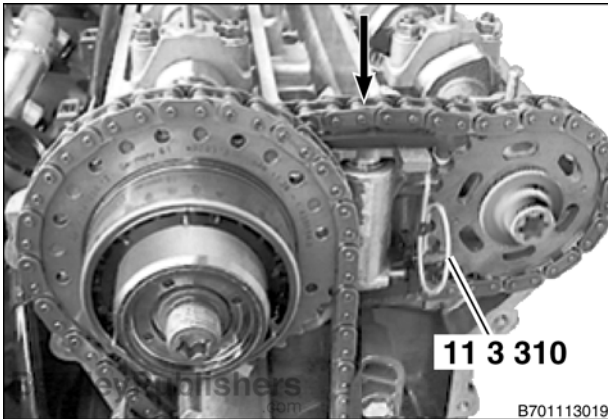
- Neither the location of slotted holes in the exhaust camshaft sprocket nor the position of the VANOS unit sprocket gears in relation to the chain is of any consequence.



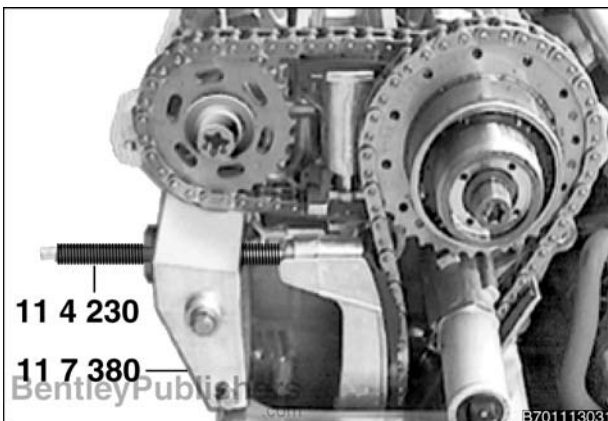
- Slide left VANOS unit and intake camshaft sprocket (A) and exhaust camshaft sprocket (B) on camshafts (arrows).



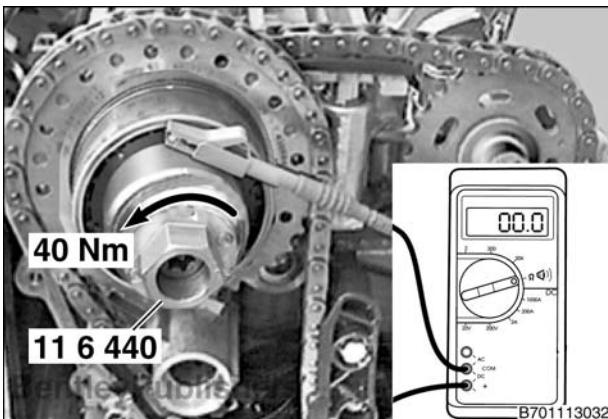
- Install left intake and exhaust camshaft sprocket mounting bolts (arrows) (left-hand thread). Hand tighten but do not torque yet.



- ◀ Compress left cylinder head secondary chain tensioner (**arrow**) and remove BMW special tool 11 3 310.



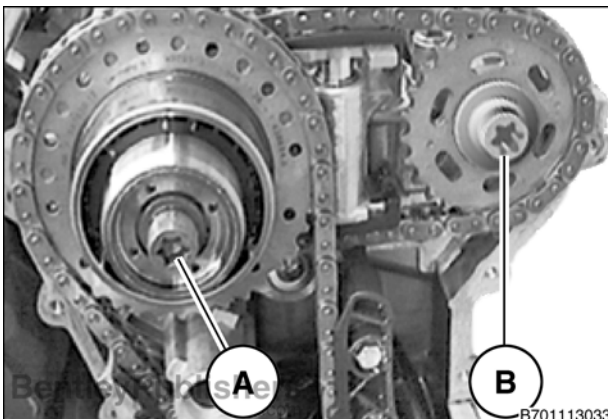
- ◀ Working at right cylinder head:
 - Bolt BMW special bracket 11 7 380 underneath exhaust camshaft sprocket.
 - Attach primary timing chain dummy tensioner (BMW special tool 11 4 230) to special bracket 11 7 380. Screw in adjusting screw but do not tighten yet.



- ◀ Working at left cylinder head:
 - Connect multimeter to contact pin on left VANOS unit and to oil line on left cylinder head.
 - Set multimeter to acoustic continuity test.
 - Thread BMW special tool 11 6 440 to left VANOS unit shaft (left-hand thread).
 - Use torque wrench to tighten special tool 11 6 440 to 40 Nm (30 ft-lb) until acoustic signal sounds. This indicates VANOS unit has reached left-hand stop.
 - Remove special tool 11 6 440.

NOTE —

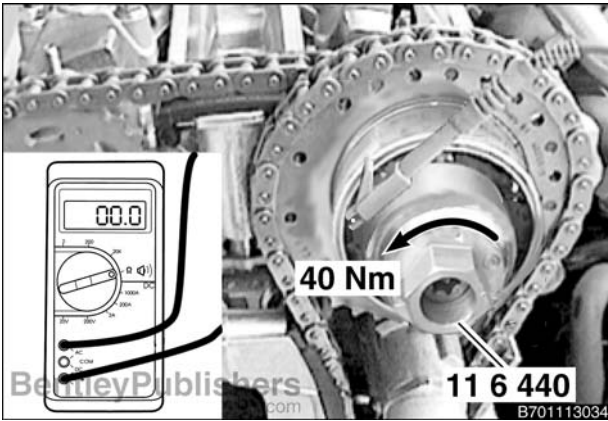
- Rotating the VANOS unit to the left forces out the oil.
- Metal-to-metal contact occurs inside the VANOS unit when it reaches the left-hand stop, causing the continuity tester to sound.



- ◀ Working at left cylinder head, use 27 mm open-end wrench to counterhold each camshaft:
 - Tighten left VANOS unit and intake camshaft sprocket mounting bolt (**A**) to an initial torque of 15 Nm (11 ft-lb) (left-hand thread). Back off ¼ turn.
 - Tighten left exhaust camshaft sprocket mounting bolt (**B**) to an initial torque of 15 Nm (11 ft-lb) (left-hand thread). Back off ¼ turn.

117-44 Camshafts, Camshaft Timing

Camshaft Service (M62 TU Engine)

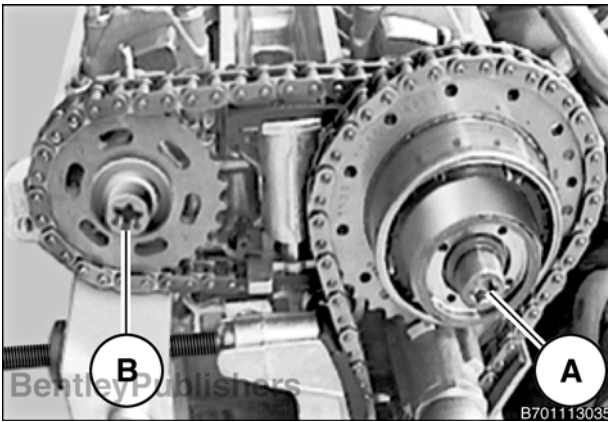


Working at right cylinder head:

- Connect multimeter to contact pin on left VANOS unit and to oil line on right cylinder head.
- Set multimeter to acoustic continuity test.
- Thread BMW special tool 11 6 440 to right VANOS unit shaft (left-hand thread).
- Use torque wrench to tighten special tool 11 6 440 to 40 Nm (30 ft-lb) until acoustic signal sounds. This indicates VANOS unit has reached left-hand stop.
- Remove special tool 11 6 440.

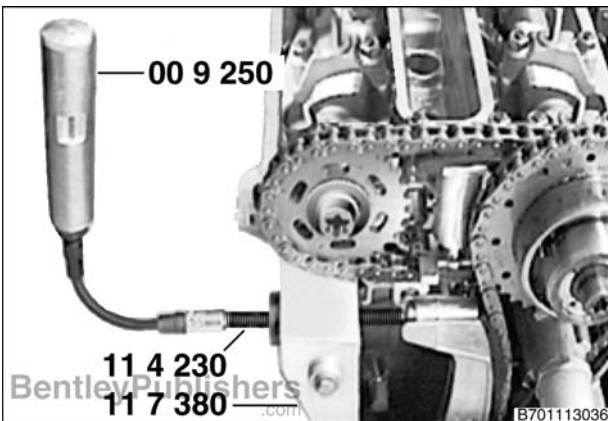
NOTE —

- Rotating the VANOS unit to the left forces out the oil.
- Metal-to-metal contact occurs inside the VANOS unit when it reaches the left-hand stop, causing the continuity tester to sound.



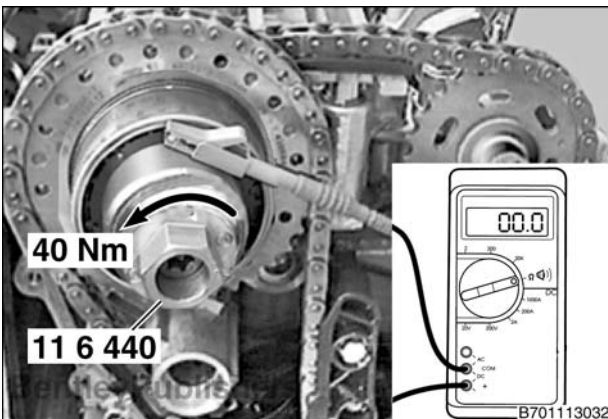
Working at right cylinder head, use 27 mm open-end wrench to counterhold each camshaft:

- Tighten right VANOS unit and intake camshaft sprocket mounting bolt (A) to an initial torque of 15 Nm (11 ft-lb) (left-hand thread). Back off ¼ turn.
- Tighten right exhaust camshaft sprocket mounting bolt (B) to an initial torque of 15 Nm (11 ft-lb) (left-hand thread). Back off ¼ turn.



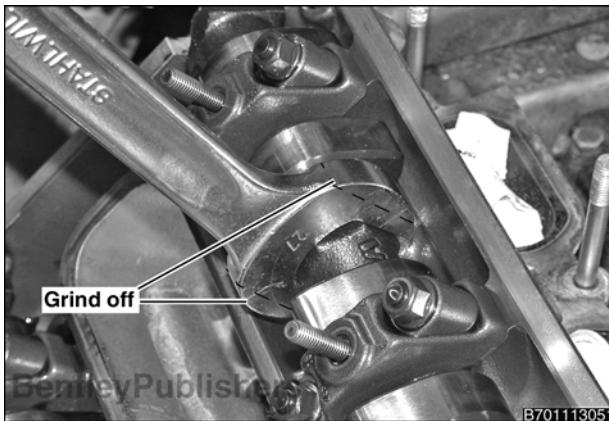
Pretension primary timing chain tensioning rail:

- Use low-torque wrench (BMW special tool 00 9 250 or equivalent) to tighten adjusting screw on dummy chain tensioner (special tool 11 4 230) to 0.7 Nm (6.3 in-lb).

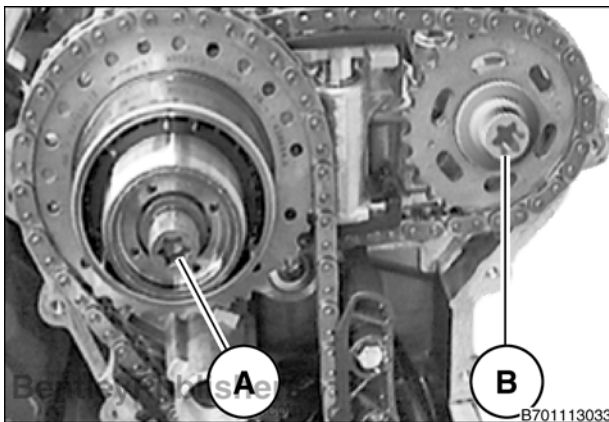


Tensioning primary chain repositions VANOS units on both cylinder heads. Therefore, repeat steps for setting left-hand stop on left VANOS unit:

- Connect multimeter to contact pin on left VANOS unit and to oil line on left cylinder head.
- Set multimeter to acoustic continuity test.
- Thread BMW special tool 11 6 440 to left VANOS unit shaft (left-hand thread).
- Use torque wrench to tighten special tool 11 6 440 to 40 Nm (30 ft-lb) until acoustic signal sounds. This indicates VANOS unit has reached left-hand stop.
- Remove special tool 11 6 440.



- ⚠ In procedure steps that follow, use 27 mm open-end wrench to counterhold each camshaft at hexagonal casting before tightening camshaft sprocket fastener. If necessary, grind off outer edges of wrench jaws to prevent damage to cylinder head.



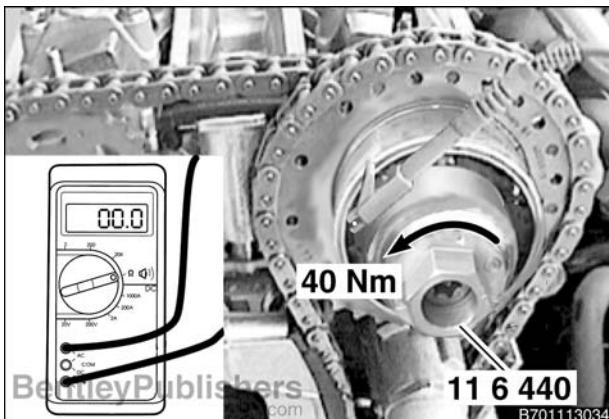
- ⚠ Working at left cylinder head, use 27 mm open-end wrench to counterhold each camshaft:
- Tighten left VANOS unit and intake camshaft sprocket mounting bolt (A) (left-hand thread).
 - Tighten left exhaust camshaft sprocket mounting bolt (B) (left-hand thread).

CAUTION—

- Sprocket mounting fasteners have left-hand threads.

Tightening torques

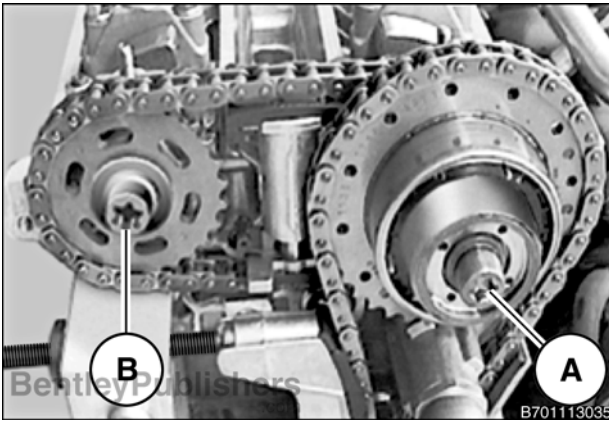
Exhaust camshaft sprocket to exhaust camshaft (M12 x 1.5) (B)	125 Nm (92 ft-lb)
VANOS unit and intake camshaft sprocket to intake camshaft (M12 x 1.5) (A)	110 Nm (81 ft-lb)



- ⚠ Repeat steps for setting left-hand stop on right VANOS unit:
- Connect multimeter to contact pin on left VANOS unit and to oil line on right cylinder head.
 - Set multimeter to acoustic continuity test.
 - Thread BMW special tool 11 6 440 to right VANOS unit shaft (left-hand thread).
 - Use torque wrench to tighten special tool 11 6 440 to 40 Nm (30 ft-lb) until acoustic signal sounds. This indicates VANOS unit has reached left-hand stop.
 - Remove special tool 11 6 440.

117-46 Camshafts, Camshaft Timing

Camshaft Service (M62 TU Engine)



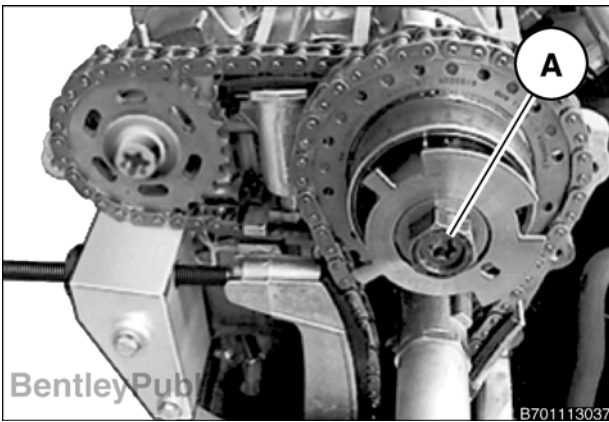
- Working at right cylinder head, use 27 mm open-end wrench to counterhold each camshaft:
 - Tighten right VANOS unit and intake camshaft sprocket mounting bolt (A) (left-hand thread).
 - Tighten right exhaust camshaft sprocket mounting bolt (B) (left-hand thread).

CAUTION—

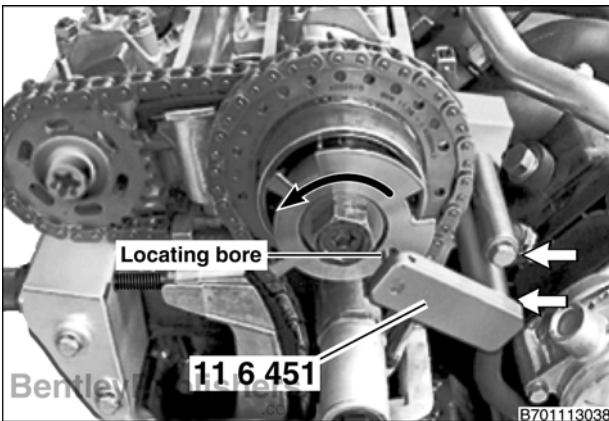
- Sprocket mounting fasteners have left-hand threads.

Tightening torques

Exhaust camshaft sprocket to exhaust camshaft (M12 x 1.5) (B)	125 Nm (92 ft-lb)
VANOS unit and intake camshaft sprocket to intake camshaft (M12 x 1.5) (A)	110 Nm (81 ft-lb)



- Install right camshaft sensor impulse wheel and mounting nut (A) (left-hand thread). Hand tighten nut.



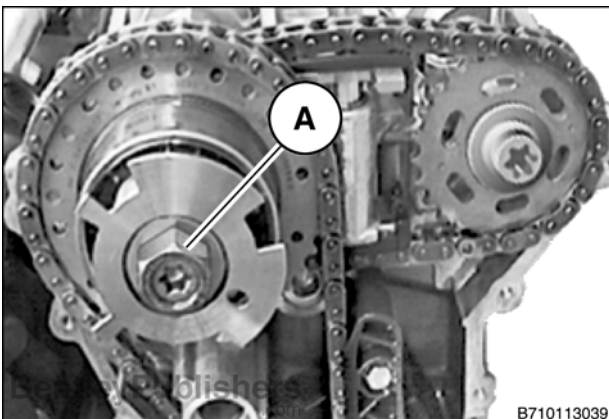
- Working at right cylinder head:
 - Align locating bore on impulse wheel with positioning pin on BMW special tool 11 6 451.
 - Insert special tool mounting bolts (**white arrows**) and hand tighten to cylinder head.
 - Press tool down firmly and tighten mounting bolts.
 - Counterhold intake camshaft with 27 mm open-end wrench and tighten impulse wheel mounting nut (left-hand thread, **black arrow**).
 - Remove special tool 11 6 451.

CAUTION—

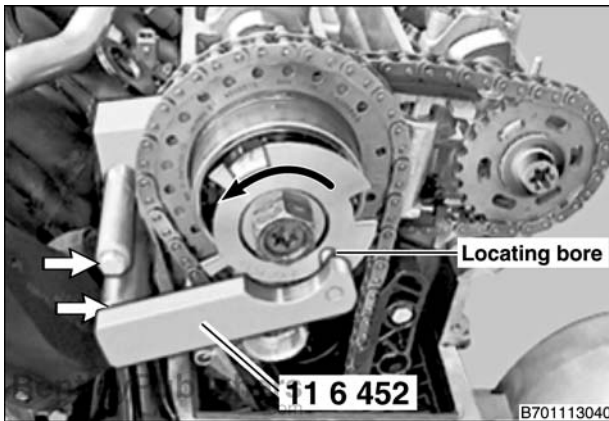
- Impulse wheel mounting nut has left-hand threads.

Tightening torques

Camshaft sensor impulse wheel to camshaft (M18 x 1.5)	40 Nm (30 ft-lb)
---	------------------



- Install left camshaft sensor impulse wheel and mounting nut (A) (left-hand thread). Hand tighten nut.



Working at left cylinder head:

- Align locating bore on camshaft impulse wheel with positioning pin on BMW special tool 11 6 452.
- Insert special tool mounting bolts (**white arrows**) and hand tighten to cylinder head.
- Press tool down firmly and tighten mounting bolts.
- Counterhold intake camshaft with 27 mm open-end wrench and tighten impulse wheel mounting nut (left-hand thread, **black arrow**).
- Remove special tool 11 6 451.

CAUTION—

- *Impulse wheel mounting nut has left-hand threads.*

Tightening torques

Camshaft impulse wheel to camshaft (M18 x 1.5)	40 Nm (30 ft-lb)
--	------------------

- Remove crankshaft and camshaft locking tools.
- Remove primary chain dummy tensioner (BMW special tool 11 4 230) and support bracket (BMW special tool 11 7 380) from right cylinder head.

Install oil supply lines and mounting nuts (**arrows**) to cylinder heads.

Tightening torque

Oil supply line to cylinder head	10 Nm (7 ft-lb)
----------------------------------	-----------------

- Install both upper timing chain covers. See **Upper timing chain covers, removing and installing (M62 TU engine)** in this repair group.
- Install primary timing chain tensioner with new sealing washer.

Tightening torque

Chain tensioner to right upper timing chain cover	40 Nm (30 ft-lb)
---	------------------

- Remainder of replacement is reverse of removal. Remember to:
 - Use new sealing O-rings when reattaching secondary air injection manifold.
 - Reattach cooling system hoses. Fill and bleed cooling system. See **170 Radiator and Cooling System**.

Camshafts, removing (M62 TU engine)

- Disconnect negative (–) cable from battery.

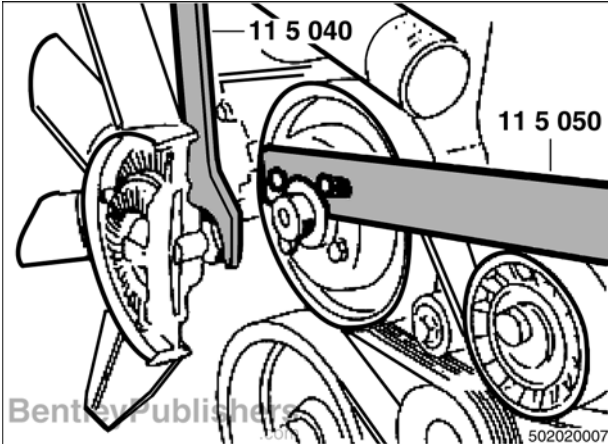
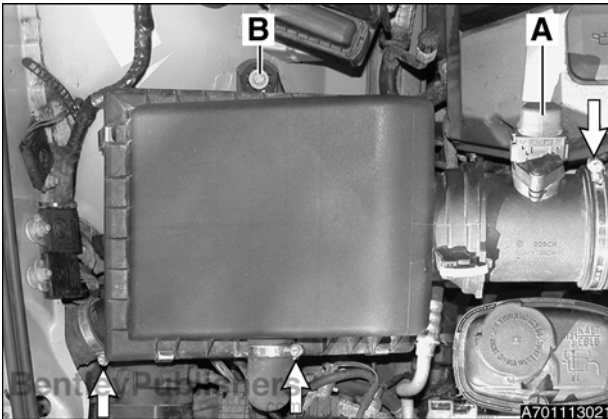
CAUTION—

- *Prior to disconnecting the battery, read the battery disconnection cautions in 001 Warnings and Cautions.*

- Remove upper engine cover. See **020 Maintenance**.

117-48 Camshafts, Camshaft Timing

Camshaft Service (M62 TU Engine)



- Raise car and support safely.

WARNING —

- Make sure the car is stable and well supported at all times. Use a professional automotive lift or jack stands designed for the purpose. A floor jack is not adequate support.

- Remove lower engine cover (engine splash shield). See **020 Maintenance**.
- With engine fully cooled off, drain engine coolant. See **170 Radiator and Cooling System**.

- ◀ Remove air filter housing assembly:
 - Loosen hose clamps (**arrows**). Detach air ducts.
 - Disconnect electrical connector from mass air flow sensor (**A**).
 - Remove filter housing mounting fastener (**B**) and remove filter housing with mass air flow sensor.

- ◀ Use BMW special tools 11 5 050 and 11 5 040 to loosen and remove cooling fan and clutch from coolant pump.

NOTE —

- 32 mm cooling fan nut has left-hand threads.
- If necessary, remove fan cowl from radiator.

- Remove both cylinder head covers. See **113 Cylinder Head Removal and Installation**.
- Remove spark plugs. Use shop towels to plug spark plug holes and prevent anything from falling inside combustion chambers.

- ◀ Remove timing chain tensioner (**arrow**) from right side upper timing chain cover.

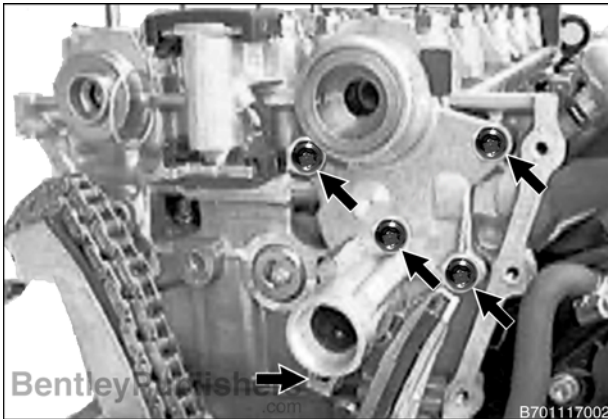
- Remove right and left upper timing chain covers. See **Upper timing chain covers, removing and installing (M62 TU engine)** in this repair group.

- Remove right VANOS unit. See **Right VANOS unit, removing (M62 TU engine)** in this repair group.

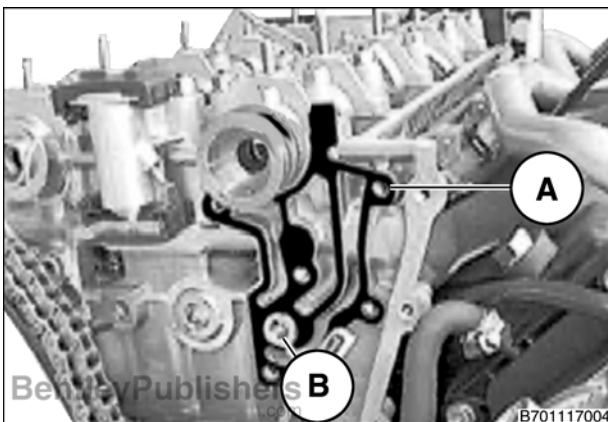
- Remove left VANOS unit. See **Left VANOS unit, removing (M62 TU engine)** in this repair group.

NOTE —

- During the previous 2 procedure steps, camshafts and crankshaft are locked at TDC using BMW special tools.



- Remove VANOS oil distributor from right intake camshaft:
 - Remove oil distributor mounting Torx bolts (**arrows**).
 - Rotate oil distributor back and forth carefully and pull back straight to disengage from sealing rings.

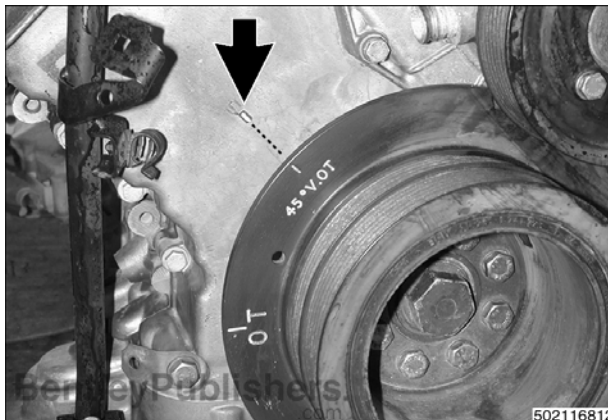


- Working at front of right cylinder head:
 - Peel off profile gasket (**A**) and discard.
 - Remove oil check-valve and set aside. If necessary, thread M10 x 1 bolt into valve to remove.

CAUTION—

- Oil check-valve is pressed lightly into head. When removing profile gasket, make sure check-valve does not fall out

- Similarly, remove VANOS oil distributor, profile gasket and oil check-valve from left cylinder head.



- Remove crankshaft locking tools (BMW special tool 11 2 300).
- Lift timing chain and hold under tension.

- Rotate crankshaft counterclockwise until 45° mark on crankshaft vibration damper is aligned with boss on lower timing chain cover (**arrow**).

- Remove camshaft locking tools.

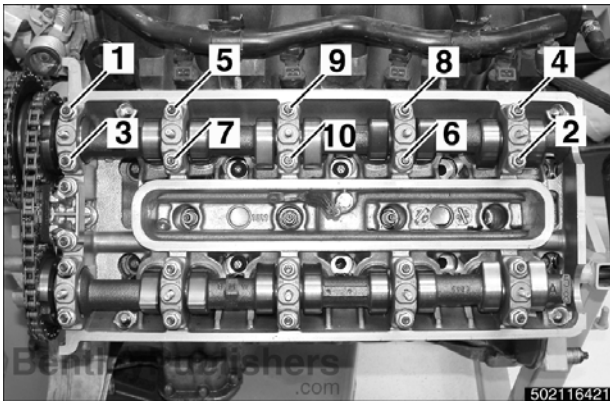


- In procedure steps that follow, camshaft are placed in removal position. Use 27 mm open-end wrench to rotate each camshaft at hexagonal casting. If necessary, grind off outer edges of wrench jaws to prevent damage to cylinder head.

- Rotate right exhaust camshaft until cylinder 2 exhaust cams point up.
- Rotate right intake camshaft until cylinder 1 intake cams point up.
- Rotate left exhaust camshaft until cylinder 6 exhaust cams point up.
- Rotate left intake camshaft until cylinder 8 intake cams point up.

117-50 Camshafts, Camshaft Timing

Camshaft Service (M62 TU Engine)



- Evenly loosen left intake camshaft bearing cap nuts in ½ turn stages in sequence 1 – 10.

CAUTION—

- Keep camshaft bearing caps in order. Mark locations and orientation of caps. Do not interchange between camshafts or between sides.

- Remove left exhaust camshaft by repeating process. Remove camshafts from cylinder head.
- Repeat camshaft removal process for right cylinder head.

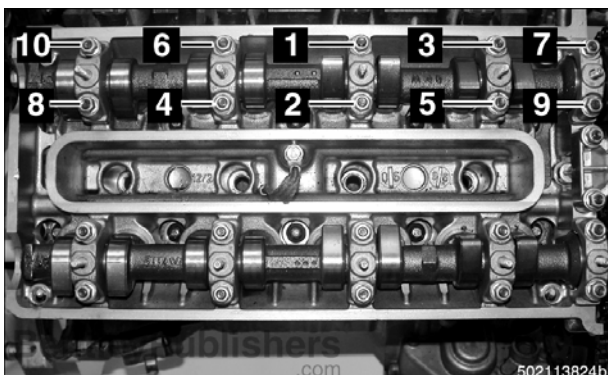
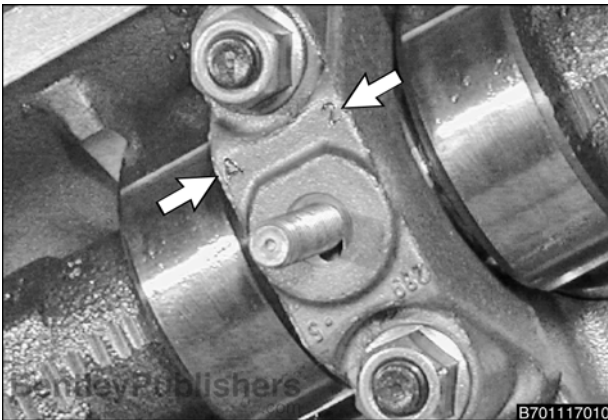
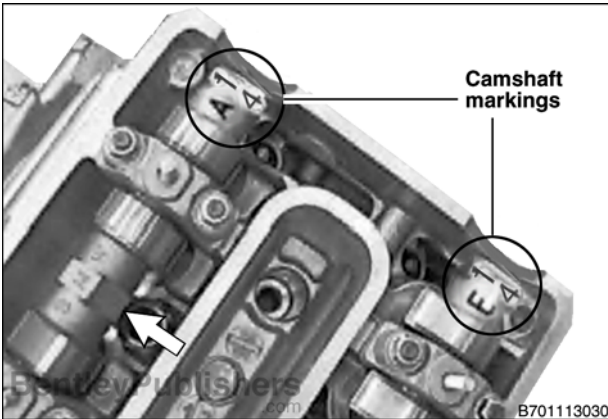
Camshafts, installing (M62 TU engine)

Right side camshafts, installing

CAUTION—

- Make sure the crankshaft, which was rotated approximately 45° opposite the direction of engine rotation from TDC, is still in that position before installing camshafts. This ensures that pistons are out of TDC position and prevents valve / piston contact.

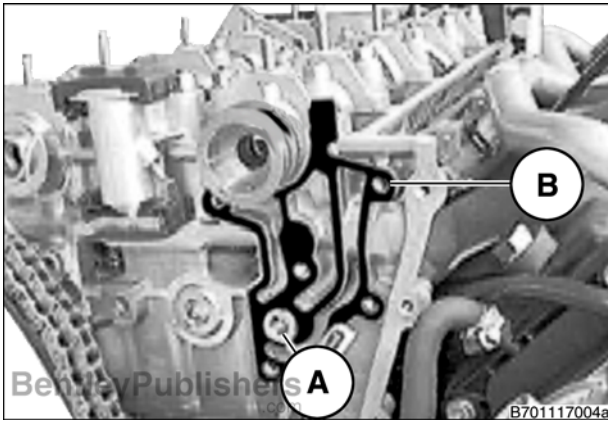
- Camshafts are marked at rear. Install camshafts into camshaft bearing saddles of cylinder head, noting the following:
 - Intake camshaft for left cylinder head (cylinders 1 – 4) is labelled E 1-4.
 - Exhaust camshaft for left cylinder head (cylinders 1 – 4) is labelled A 1-4.
- Use 27 mm open-end wrench on hexagonal casting (arrow) to rotate exhaust camshaft until cylinder 2 exhaust cam points up.
- Similarly, rotate intake camshaft until cylinder 1 intake cam points up.
- Install camshaft bearing caps according to stamped code (arrows) or according to location and orientation marks made previously:
 - E is intake side.
 - A is exhaust side.
 - Number 1 bearing cap is at front of engine.



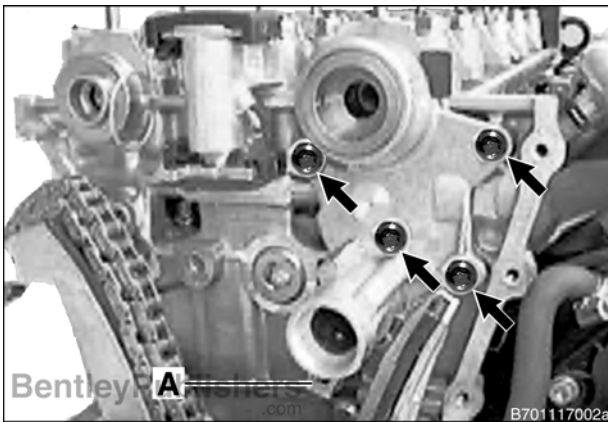
- Evenly tighten down camshaft bearing cap nuts in ½ turn steps in sequence 1 - 10.

Tightening torque

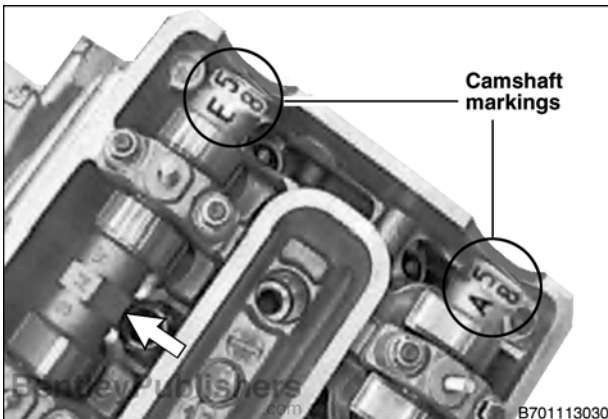
Camshaft bearing cap to cylinder head	14 Nm (10 ft-lb)
---------------------------------------	------------------



- ◀ Working at front of right cylinder head:
 - Replace sealing O-ring and press in oil check-valve (**A**). Make sure M10 x 1 threads face out.
 - Press new profile gasket into groove in cylinder head.
- Prior to reinstalling VANOS oil distributor, inspect sealing ring seating surface inside oil distributor unit:
 - Traces of wear on rings up to depth of approx. 0.1 - 0.2 mm (0.04 - 0.08 in) are normal.
 - If there is pitting or scoring in longitudinal direction, replace compression rings and oil distributor.



- ◀ Reinstall right VANOS oil distributor.
 - Make sure VANOS oil distributor sealing ring gaps are at top.
 - Lightly oil sliding surface of sealing rings and oil distributor bore.
 - Press oil distributor over sealing rings straight.
 - Install upper oil distributor mounting Torx bolts.
 - Replace sealing O-ring on lower mounting bolt (**A**) and install.



Left side camshafts, installing

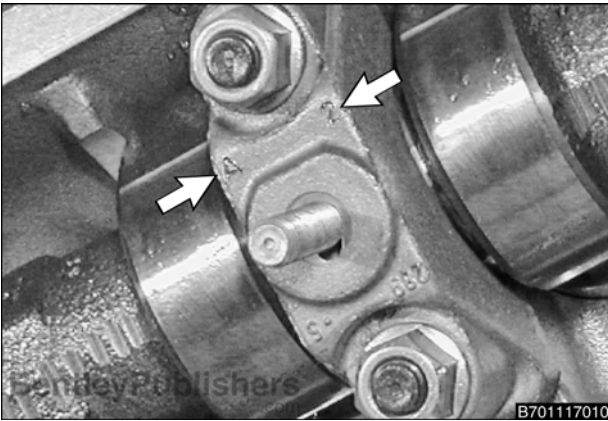
CAUTION—

- Make sure the crankshaft, which was rotated approximately 45° opposite the direction of engine rotation from TDC, is still in that position before installing camshafts. This ensures that pistons are out of TDC position and prevents valve / piston contact.

- ◀ Camshafts are marked at rear. Install camshafts into camshaft bearing saddles of cylinder head, noting the following:
 - Intake camshaft for left cylinder head (cylinders 5 – 8) is labelled E 5–8.
 - Exhaust camshaft for left cylinder head (cylinders 5 – 8) is labelled A 5 – 8.
- Use 27 mm open-end wrench on hexagonal casting (**arrow**) to rotate exhaust camshaft until cylinder 6 exhaust cam points up.
- Similarly, rotate intake camshaft until cylinder 8 intake cam points up.

117-52 Camshafts, Camshaft Timing

Camshaft Service (M62 TU Engine)

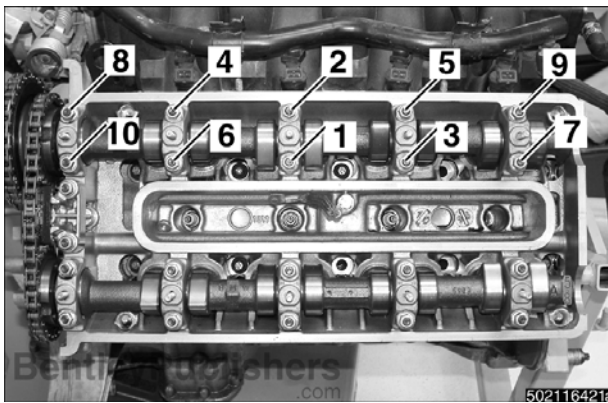


Install camshaft bearing caps according to stamped code (**arrows**) or according to location and orientation marks made previously:

- E is intake side.
- A is exhaust side.
- Number 1 bearing cap is at front of engine.

CAUTION—

- Be sure to reinstall caps in locations and orientation marked previously.

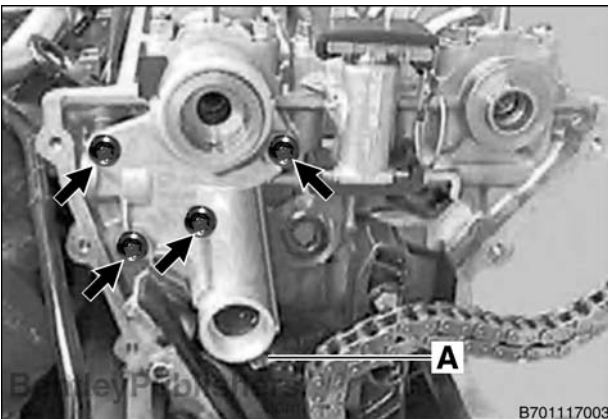


Evenly tighten down bearing cap nuts in ½ turn steps in sequence 1 - 10.

Tightening torque

Camshaft bearing cap to cylinder head	14 Nm (10 ft-lb)
---------------------------------------	------------------

- Working at front of left cylinder head:
 - Replace sealing O-ring and press in oil check-valve. Make sure M10 x 1 threads face out.
 - Press new profile gasket into groove in cylinder head.
- Prior to reinstalling VANOS oil distributor, inspect sealing ring seating surface inside oil distributor unit:
 - Traces of wear on rings up to depth of approx. 0.1 - 0.2 mm (0.04 - 0.08 in) are normal.
 - If there is pitting or scoring in longitudinal direction, replace compression rings and oil distributor.



- Reinstall left VANOS oil distributor.
 - Make sure VANOS oil distributor sealing ring gaps are at top.
 - Lightly oil sliding surface of sealing rings and oil distributor bore.
 - Press oil distributor over sealing rings straight.
 - Install upper oil distributor mounting Torx bolts.
 - Replace sealing O-ring on lower mounting bolt (**A**) and install.

Timing chains and tensioners, installing

- Install VANOS units. See **Right VANOS unit, installing (M62 TU engine)** and **Left VANOS unit, installing (M62 TU engine)** in this repair group. Set camshaft timing.
- Install upper timing chain covers.
- Install primary timing chain tensioner with new sealing washer.

Tightening torque

Chain tensioner to timing chain cover	65 Nm (48 ft-lb)
---------------------------------------	------------------

- Install both cylinder head covers. See **113 Cylinder Head Removal and Installation**.



Camshaft timing, checking and adjusting (M62 TU engine)

- Disconnect negative (–) cable from battery.

CAUTION—

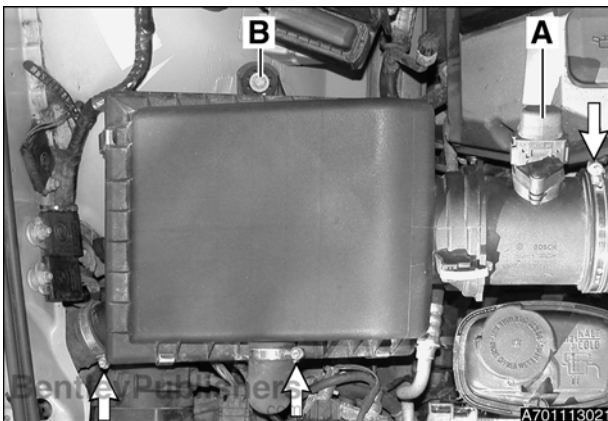
- Prior to disconnecting the battery, read the battery disconnection cautions in **001 Cautions and Warnings**.

- Remove upper engine cover. See **020 Maintenance**.

- Raise car and support safely.

WARNING—

- Make sure the car is stable and well supported at all times. Use a professional automotive lift or jack stands designed for the purpose. A floor jack is not adequate support.



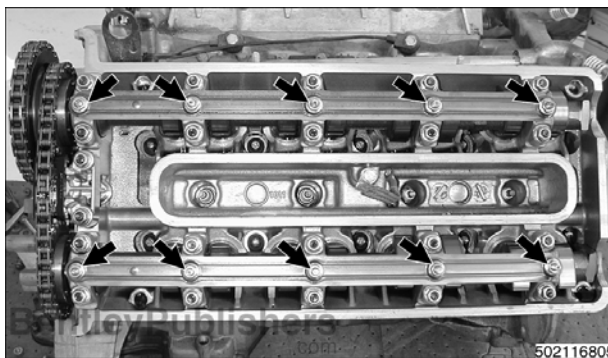
- Remove lower engine cover (engine splash shield). See **020 Maintenance**.

- ◀ Remove air filter housing assembly:
 - Loosen hose clamps (**arrows**). Detach air ducts.
 - Disconnect electrical connector from mass air flow sensor (**A**).
 - Remove filter housing mounting fastener (**B**) and remove filter housing with mass air flow sensor.

- With engine fully cooled off, remove both cylinder head covers. See **113 Cylinder Head Removal and Installation**.

- Remove spark plugs. Use shop towels to plug spark plug holes and prevent anything from falling inside combustion chambers.

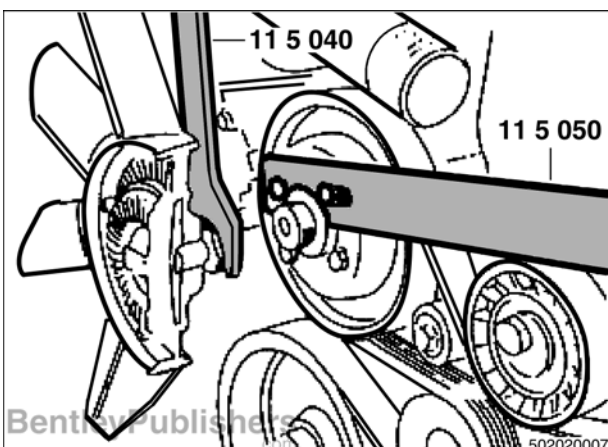
- ◀ Remove retaining nuts (**arrows**) and remove oil lines from left and right cylinder heads.



- ◀ Use BMW special tools 11 5 050 and 11 5 040 to loosen and remove cooling fan and clutch from coolant pump.

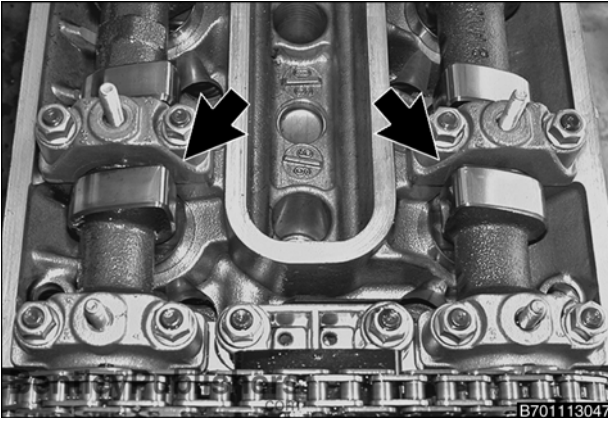
NOTE—

- 32 mm cooling fan nut has left-hand threads.
- necessary, remove fan cowl from radiator.



117-54 Camshafts, Camshaft Timing

Camshaft Service (M62 TU Engine)



Using vibration damper (crankshaft center) bolt, turn crankshaft clockwise until cylinder 1 (passenger side front cylinder) is in TDC position:

- Cylinder 1 camshaft lobes (**arrows**) point up and toward each other.



Lock crankshaft in TDC position with BMW special tool 11 2 300 (**arrow**).

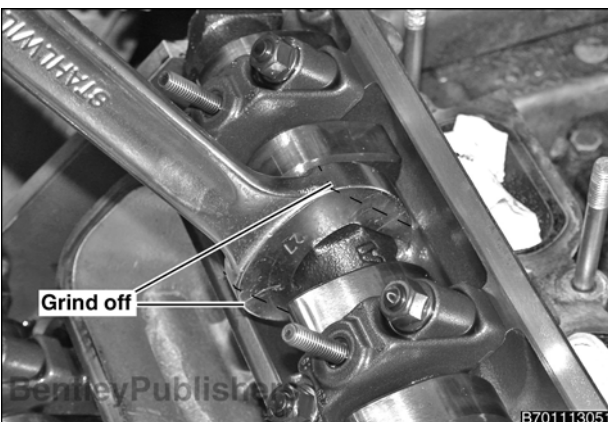
NOTE—

- Casting boss for special tool 11 2 300 is located at rear of engine oil pan.



Remove timing chain tensioner (**arrow**) from right side upper timing chain cover.

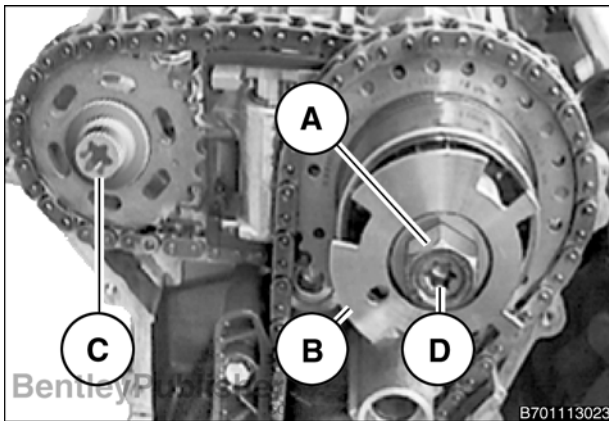
- Remove upper timing chain covers. See **Upper timing chain covers, removing and installing (M62 TU engine)** in this repair group.



In procedure steps that follow, use 27 mm open-end wrench to counterhold each camshaft at hexagonal casting before loosening camshaft sprocket fastener. If necessary, grind off outer edges of wrench jaws to prevent damage to cylinder head.

Camshafts, Camshaft Timing 117-55

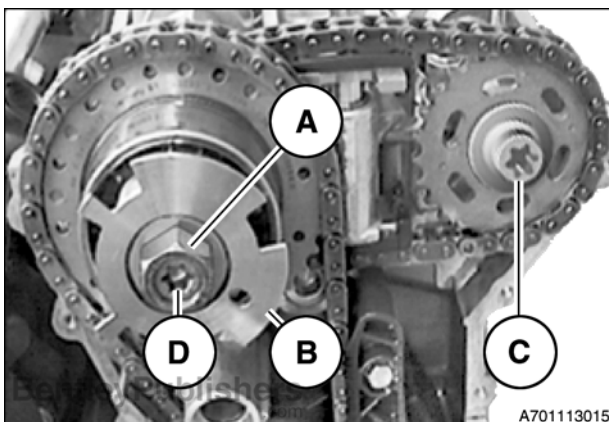
Camshaft Service (M62 TU Engine)



- Working at right cylinder head, counterhold with 27 mm wrench:
- Remove right intake camshaft sensor impulse wheel mounting nut (A) (left-hand thread).
 - Remove camshaft sensor impulse wheel (B).
 - Loosen right exhaust camshaft sprocket bolt (C) approx. ½ turn (left-hand thread).
 - Loosen right intake camshaft sprocket mounting bolt (D) approx. ½ turn (left-hand thread).

CAUTION—

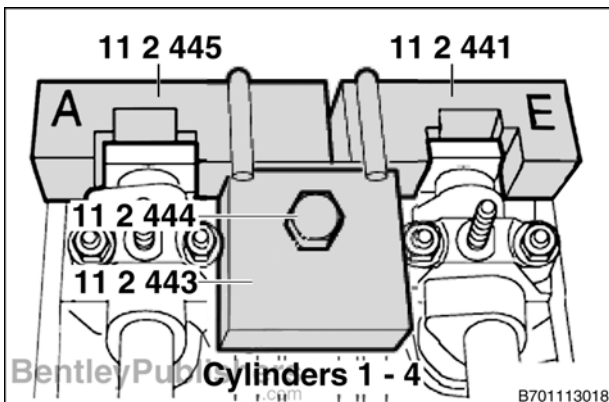
- Sprocket mounting fasteners have left-hand thread.



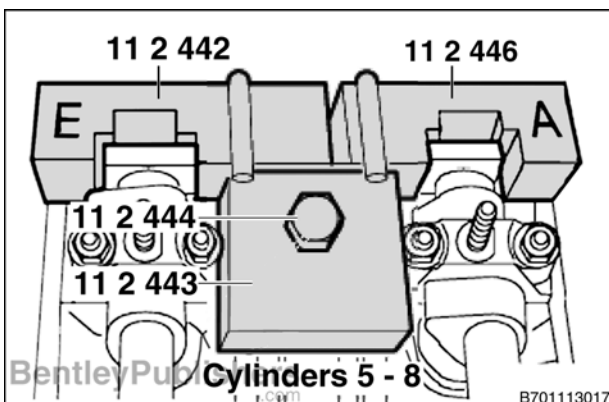
- Similarly, working at left cylinder head, counterhold with 27 mm wrench:
- Remove camshaft sensor impulse wheel mounting nut (A) (left-hand thread).
 - Remove camshaft sensor impulse wheel (B).
 - Loosen exhaust camshaft sprocket mounting bolt (C) approx. ½ turn (left-hand thread).
 - Loosen intake camshaft sprocket mounting bolt (D) approx. ½ turn (left-hand thread).

CAUTION—

- Sprocket mounting fasteners have left-hand threads.



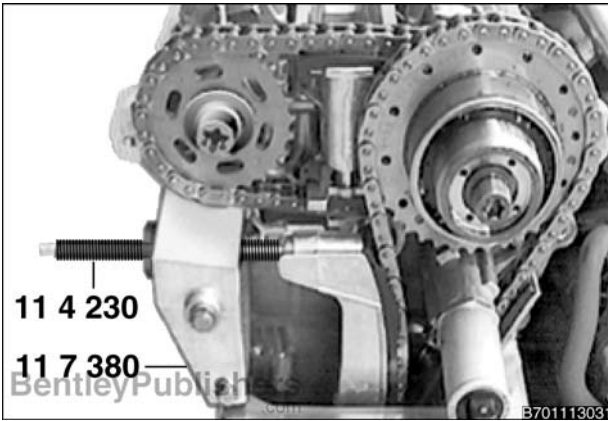
- Install camshaft locking tool set (BMW special tools 11 2 441, 11 2 445) on right cylinder head.
- Make sure tools are flush against cylinder head surface.
 - Place BMW special tool 11 2 444 over camshaft locking tools and secure in place using special BMW bolt 11 2 443 screwed into spark plug hole.



- Install camshaft locking tool set (BMW special tools 11 2 442, 11 2 446) on left cylinder head.
- Make sure tools are flush against cylinder head surface.
 - Place BMW special tool 11 2 444 over camshaft locking tools and secure in place using special BMW bolt 11 2 443 screwed into spark plug hole.

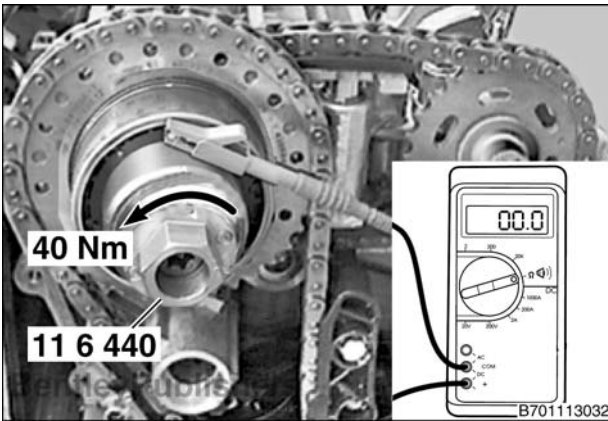
117-56 Camshafts, Camshaft Timing

Camshaft Service (M62 TU Engine)



Working at right cylinder head:

- Bolt BMW special bracket 11 7 380 underneath exhaust camshaft sprocket.
- Attach primary timing chain dummy tensioner (BMW special tool 11 4 230) to special bracket 11 7 380. Screw in adjusting screw but do not tighten yet.

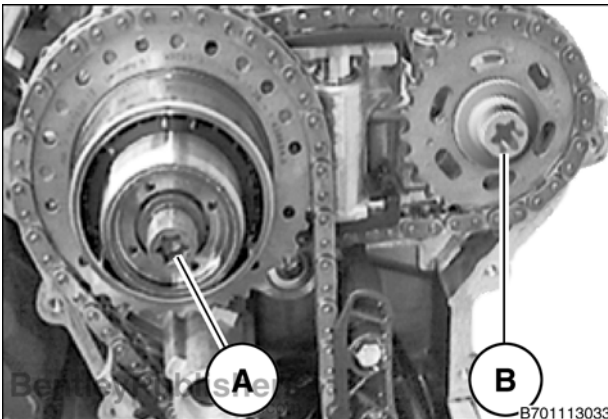


Working at left cylinder head:

- Connect multimeter to contact pin on left VANOS unit and to oil line on left cylinder head.
- Set multimeter to acoustic continuity test.
- Thread BMW special tool 11 6 440 to left VANOS unit shaft (left-hand thread).
- Use torque wrench to tighten special tool 11 6 440 to 40 Nm (30 ft-lb) until acoustic signal sounds. This indicates VANOS unit has reached left-hand stop.
- Remove special tool 11 6 440.

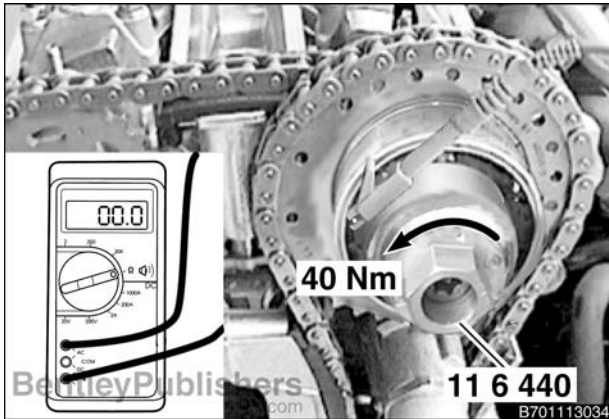
NOTE —

- *Rotating the VANOS unit to the left forces out the oil.*
- *Metal-to-metal contact occurs inside the VANOS unit when it reaches the left-hand stop, causing the continuity tester to sound.*



Working at left cylinder head, use 27 mm open-end wrench to counterhold each camshaft:

- Tighten left VANOS unit and intake camshaft sprocket mounting bolt (A) to an initial torque of 15 Nm (11 ft-lb) (left-hand thread). Back off ¼ turn.
- Tighten left exhaust camshaft sprocket mounting bolt (B) to an initial torque of 15 Nm (11 ft-lb) (left-hand thread). Back off ¼ turn.

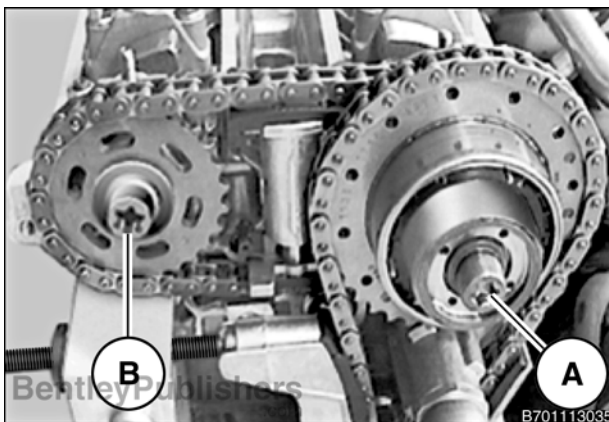


Working at right cylinder head:

- Connect multimeter to contact pin on left VANOS unit and to oil line on right cylinder head.
- Set multimeter to acoustic continuity test.
- Thread BMW special tool 11 6 440 to right VANOS unit shaft (left-hand thread).
- Use torque wrench to tighten special tool 11 6 440 to 40 Nm (30 ft-lb) until acoustic signal sounds. This indicates VANOS unit has reached left-hand stop.
- Remove special tool 11 6 440.

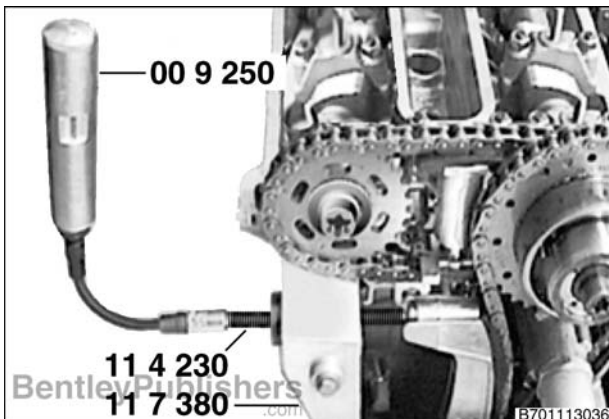
NOTE —

- Rotating the VANOS unit to the left forces out the oil.
- Metal-to-metal contact occurs inside the VANOS unit when it reaches the left-hand stop, causing the continuity tester to sound.



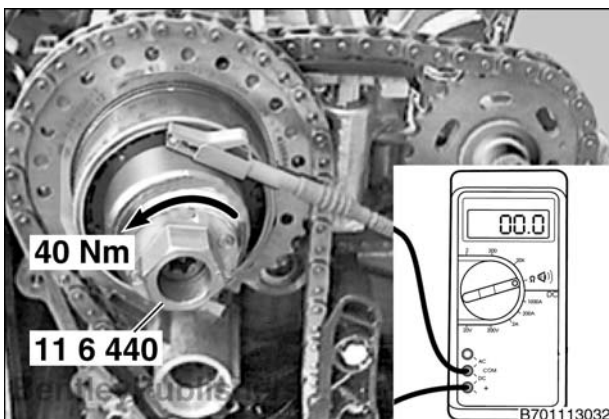
Working at right cylinder head, use 27 mm open-end wrench to counterhold each camshaft:

- Tighten right VANOS unit and intake camshaft sprocket mounting bolt (A) to an initial torque of 15 Nm (11 ft-lb) (left-hand thread). Back off ¼ turn.
- Tighten right exhaust camshaft sprocket mounting bolt (B) to an initial torque of 15 Nm (11 ft-lb) (left-hand thread). Back off ¼ turn.



Pretension primary timing chain tensioning rail:

- Use low-torque wrench (BMW special tool 00 9 250 or equivalent) to tighten adjusting screw on dummy chain tensioner (special tool 11 4 230) to 0.7 Nm (6.3 in-lb).

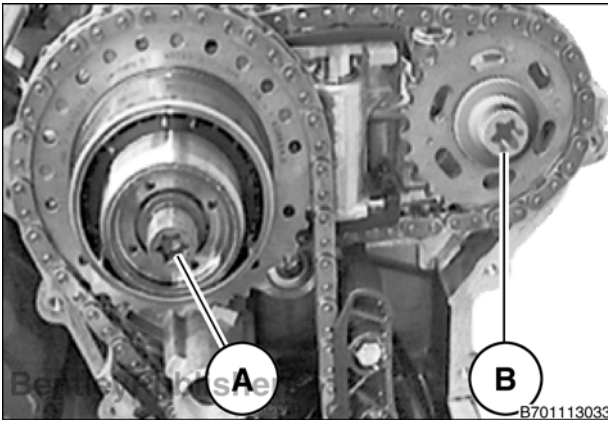


Tensioning primary chain repositions VANOS units on both cylinder heads. Therefore, repeat steps for setting left-hand stop on left VANOS unit:

- Connect multimeter to contact pin on left VANOS unit and to oil line on left cylinder head.
- Set multimeter to acoustic continuity test.
- Thread BMW special tool 11 6 440 to left VANOS unit shaft (left-hand thread).
- Use torque wrench to tighten special tool 11 6 440 to 40 Nm (30 ft-lb) until acoustic signal sounds. This indicates VANOS unit has reached left-hand stop.
- Remove special tool 11 6 440.

117-58 Camshafts, Camshaft Timing

Camshaft Service (M62 TU Engine)



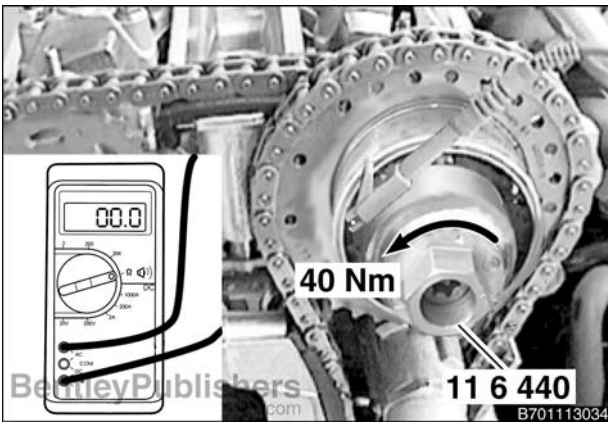
- ⚠ Working at left cylinder head, use 27 mm open-end wrench to counterhold each camshaft:
 - Tighten left VANOS unit and intake camshaft sprocket mounting bolt (A) (left-hand thread).
 - Tighten left exhaust camshaft sprocket mounting bolt (B) (left-hand thread).

CAUTION—

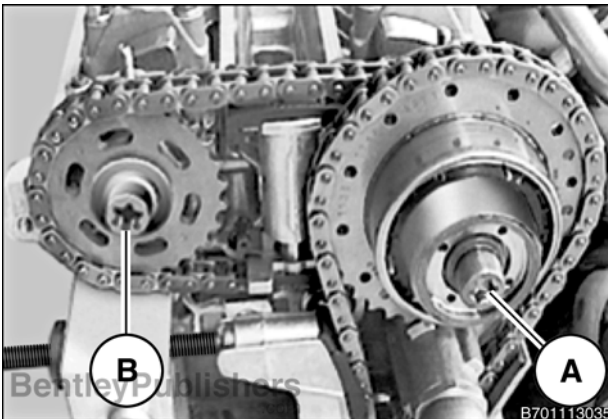
- Sprocket mounting fasteners have left-hand threads.

Tightening torques

Exhaust camshaft sprocket to exhaust camshaft (M12 x 1.5) (B)	125 Nm (92 ft-lb)
VANOS unit and intake camshaft sprocket to intake camshaft (M12 x 1.5) (A)	110 Nm (81 ft-lb)



- ⚠ Repeat steps for setting left-hand stop on right VANOS unit:
 - Connect multimeter to contact pin on left VANOS unit and to oil line on right cylinder head.
 - Set multimeter to acoustic continuity test.
 - Thread BMW special tool 11 6 440 to right VANOS unit shaft (left-hand thread).
 - Use torque wrench to tighten special tool 11 6 440 to 40 Nm (30 ft-lb) until acoustic signal sounds. This indicates VANOS unit has reached left-hand stop.
 - Remove special tool 11 6 440.



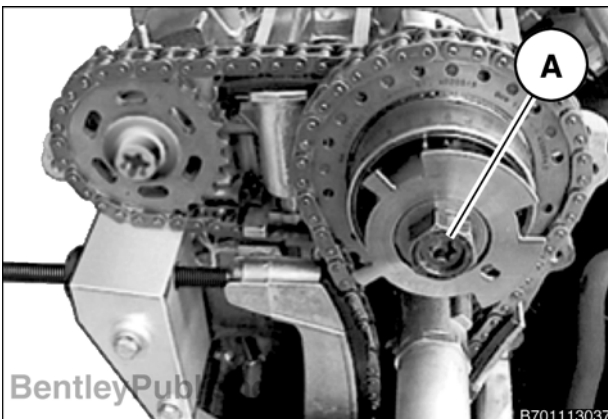
- ⚠ Working at right cylinder head, use 27 mm open-end wrench to counterhold each camshaft:
 - Tighten right VANOS unit and intake camshaft sprocket mounting bolt (A) (left-hand thread).
 - Tighten right exhaust camshaft sprocket mounting bolt (B) (left-hand thread).

CAUTION—

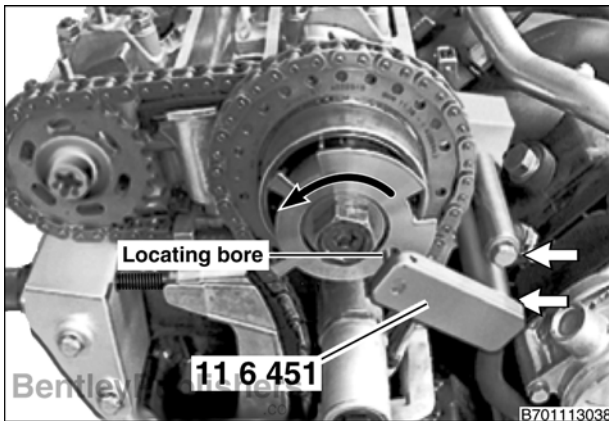
- Sprocket mounting fasteners have left-hand threads.

Tightening torques

Exhaust camshaft sprocket to exhaust camshaft (M12 x 1.5) (B)	125 Nm (92 ft-lb)
VANOS unit and intake camshaft sprocket to intake camshaft (M12 x 1.5) (A)	110 Nm (81 ft-lb)



- ⚠ Install right camshaft sensor impulse wheel and mounting nut (A) (left-hand thread). Hand tighten nut.



Working at right cylinder head:

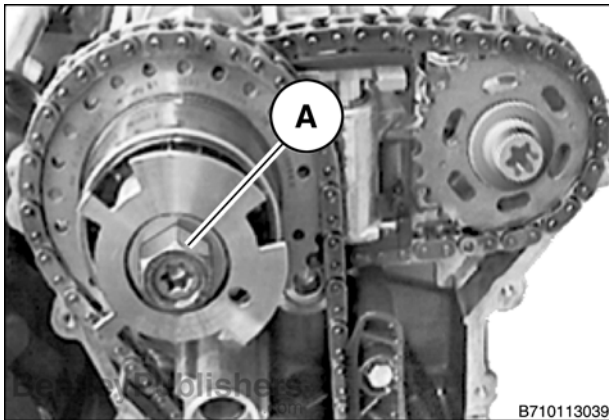
- Align locating bore on impulse wheel with positioning pin on BMW special tool 11 6 451.
- Insert special tool mounting bolts (**white arrows**) and hand tighten to cylinder head.
- Press tool down firmly and tighten mounting bolts.
- Counterhold intake camshaft with 27 mm open-end wrench and tighten impulse wheel mounting nut (left-hand thread, **black arrow**).
- Remove special tool 11 6 451.

CAUTION—

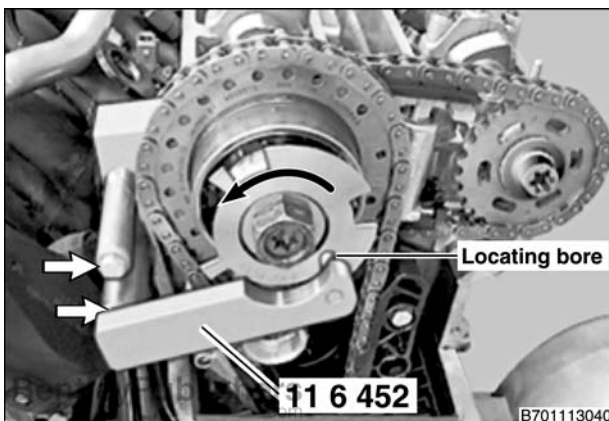
- *Impulse wheel mounting nut has left-hand threads.*

Tightening torques

Camshaft sensor impulse wheel to camshaft (M18 x 1.5)	40 Nm (30 ft-lb)
---	------------------



Install left camshaft sensor impulse wheel and mounting nut (**A**) (left-hand thread). Hand tighten nut.



Working at left cylinder head:

- Align locating bore on camshaft impulse wheel with positioning pin on BMW special tool 11 6 452.
- Insert special tool mounting bolts (**white arrows**) and hand tighten to cylinder head.
- Press tool down firmly and tighten mounting bolts.
- Counterhold intake camshaft with 27 mm open-end wrench and tighten impulse wheel mounting nut (left-hand thread, **black arrow**).
- Remove special tool 11 6 451.

CAUTION—

- *Impulse wheel mounting nut has left-hand threads.*

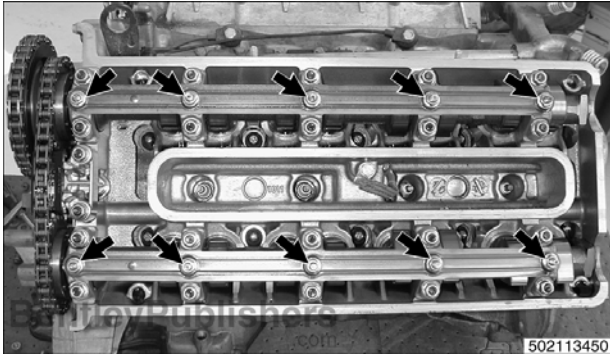
Tightening torques

Camshaft impulse wheel to camshaft (M18 x 1.5)	40 Nm (30 ft-lb)
--	------------------

— Remove crankshaft and camshaft locking tools.

117-60 Camshafts, Camshaft Timing

Camshaft Service (M62 TU Engine)



- Remove primary chain dummy tensioner (BMW special tool 11 4 230) and support bracket (BMW special tool 11 7 380) from right cylinder head.

- Install oil supply lines and mounting nuts (**arrows**) to cylinder heads.

Tightening torque	
Oil supply line to cylinder head	10 Nm (7 ft-lb)

Oil supply line to cylinder head	10 Nm (7 ft-lb)
----------------------------------	-----------------

- Install both upper timing chain covers. See **Upper timing chain covers, removing and installing (M62 TU engine)** in this repair group.

- Install primary timing chain tensioner with new sealing washer.

Tightening torque	
Chain tensioner to right upper timing chain cover	40 Nm (30 ft-lb)

Chain tensioner to right upper timing chain cover	40 Nm (30 ft-lb)
---	------------------

- Remainder of replacement is reverse of removal. Remember to:
 - Use new sealing O-rings when reattaching secondary air injection manifold.
 - Reattach cooling system hoses. Fill and bleed cooling system. See **170 Radiator and Cooling System**.

