

Crank mechanism, assembling

Special tools: [951 2767](#) , [999 1801](#) , [999 5676](#)

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Tightening torque

For tightening torques not in the text, see [Tightening torque](#) .

Cleaning

Ensure that the all components are completely clean.

Blow clean the oil ducts in the block, intermediate section and sump.

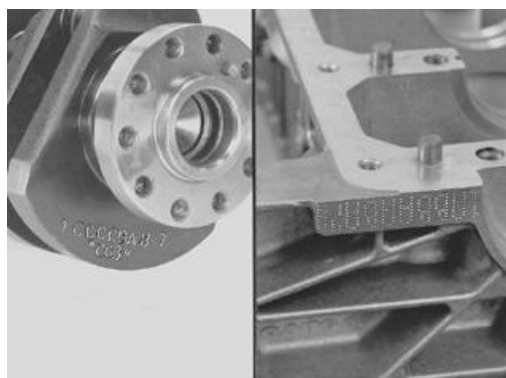
Classification of main bearings

Wipe clean the bearing recesses in the block and the intermediate section.

Check that the components are clean and undamaged.

Check the classification of the block and crankshaft.

The classification marking is at the rear edge of the block and the crankshaft. The classification is read from digits 1 to 7. The first letter after digit 1 is the classification of main bearing 1. The bearing positions are numbered starting at the front of the engine.



Selecting bearings

Cylinder block classification / Crankshaft classification	A small diameter		B medium- diameter		C large diameter	
	block	intermediate section	block	intermediate section	block	intermediate section
A small	yellow medium	yellow medium	yellow medium	blue thick	blue thick	blue thick
B	red thin	yellow	yellow	yellow	yellow	blue thick

medium		medium	medium	medium	medium	
C	red thin	red thin	red thin	yellow	yellow	yellow
large				medium	medium	medium

Install the main bearings in the cylinder block and the intermediate section. See the table.
The axial bearing is positioned at bearing recess 5.

For example: The marking on the block at bearing recess 1 is B. The marking on the crankshaft at the corresponding bearing recess is C.

Therefore the bearing in the block is marked red and the bearing in the intermediate section is marked yellow.

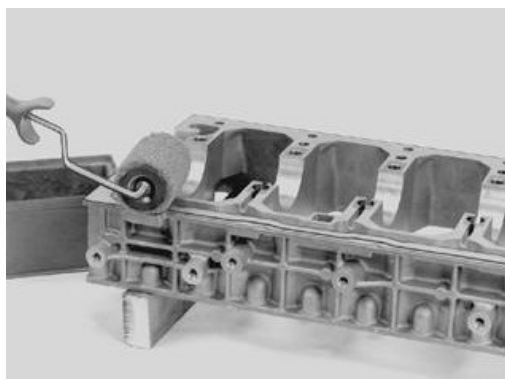
Note! The thickest of the bearing caps must always be installed in the intermediate section. This is keep the centre line as straight as possible.

The intermediate section

Wipe the surfaces dry.

Apply liquid gasket 11 61 059 to the intermediate section. The surface must be completely covered without any excess. Use roller [951 2767](#)

Thoroughly lubricate all the bearing shells and the surface of the axial bearing.

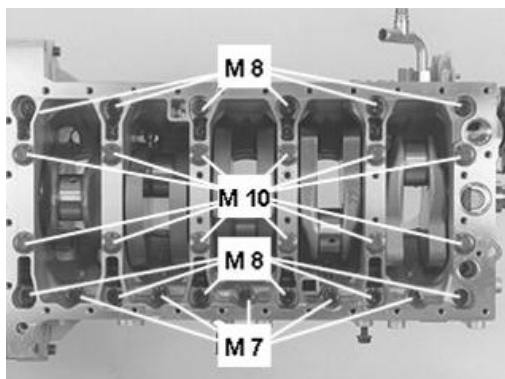


Tightening the intermediate section

Install the two old screws for the flywheel and carrier plate at the rear edge of the crankshaft. Lift these and the front of the crankshaft. Carefully position the crankshaft in the block. The crankshaft must not be turned before the intermediate section has been torque tightened. Position the intermediate section. Install all screws. Draw the intermediate section down towards the block.

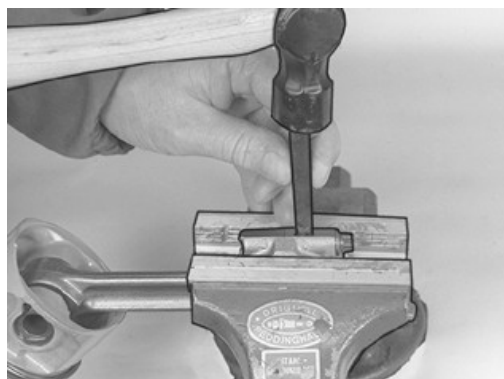
Note! Use new M10 screws.

Tighten in the numerical order illustrated.
Tighten the screws in the following order.



1. All M10 screws.....20 Nm
2. All M10 screws.....45 Nm
3. All M8 screws.....24 Nm
4. All M7 screws.....17 Nm
5. Angle-tighten all M10 screws.....90°

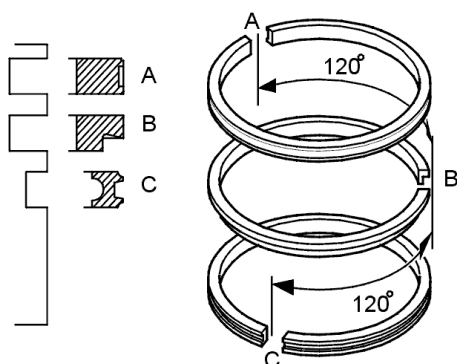
Marking the connecting rod (where applicable)



Assemble the connecting rod. Check that the cover is facing the correct direction. Tighten to 20 Nm.

Secure the large end of the connecting rod in a vice with soft jaws (copper or aluminium).

Mark both halves with the cylinder number. Use a centre punch or number punch.



Installing piston rings

Use piston ring pliers.

Turn the piston rings so that the openings are offset as illustrated.

A=Compression ring. The text on the piston ring must be upwards.

B=Scraper ring. Chamfered edge must face downwards.

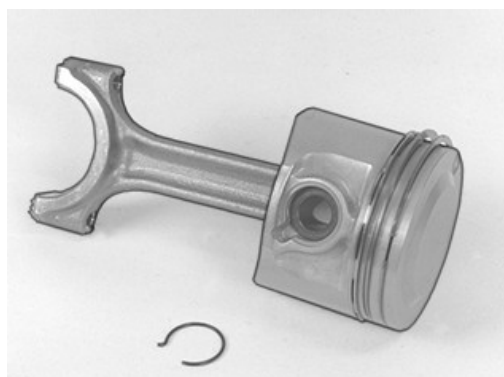
C=Oil ring. Three sections, identical on all sides.

First install the expander ring (C), then the two other rings over the expander ring.

Caution! Ensure that the piston rings can be turned easily.

Note! Incorrect positioning increases oil consumption.

Assembling pistons and connecting rods



There is an arrow on top of the piston. This must be turned forwards in the cylinder block.

The connecting rods are symmetrical and can be turned freely. Marked rods however must be turned in the same direction.

Assemble the connecting rod and piston with the piston pin.

Check that the classification and any numbering for each cylinder and piston diameter correspond.

Install both the snap rings on the piston pin.
Check that the snap rings are positioned correctly in the piston.

Wipe clean around the bearing recess in the connecting rod and the cap.

Install the bearing shells.

If new bearing shells are used, these must be checked for colour coding.

Note! The bearing shell with a black colour coding on the side must be installed in the connecting rod.

Caution! If reusing the bearing shells, they must be installed in the same position as before.

Installing the pistons in the cylinder bores

Use a cylinder ring compressor.

Lubricate the cylinder bore, the pistons and the bearing shells.

Turn the crankshaft so that the connecting rod pin is at bottom dead centre (BDC) for the cylinder the piston is to be inserted in.

Ensure that the engine is in a position where the cylinder bore forms as vertical a line as possible.

Note! The arrow on top of the piston must point forwards. Ensure that the classifications correspond!

Carefully press or tap the piston down (using the shaft of a hammer or similar).

When the piston has released from the piston ring compressor, remove it and press the piston down until the connecting rod reaches the connecting rod pin.

Tightening the connecting rod cover

Turn the engine 180° in the stand.

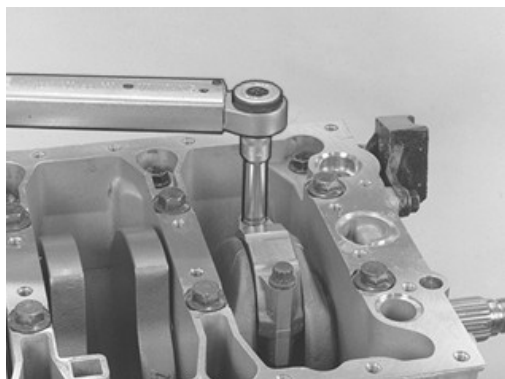
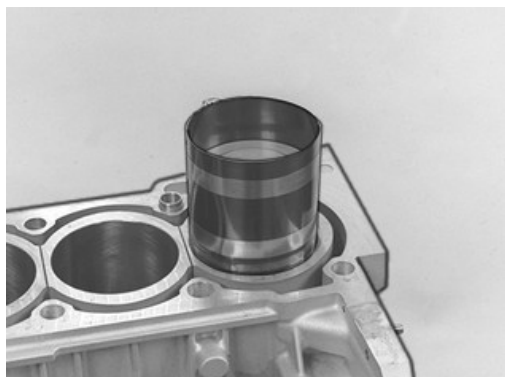
Install the cover. Check that any markings correspond.

Lubricate and install new seals. Tighten in two stages:

1. 20 Nm.
2. Angle-tighten 90°.

Check that the connecting rod can be moved sideways.

Note! The crankshaft must not be rotated before



the connecting rod cover has been tightened.

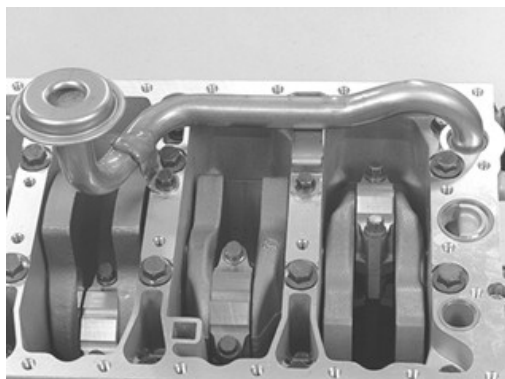
Installing the oil pump suction pipe

Install a new sealing ring on the suction pipe. Carefully press the suction pipe down into the intermediate section.

Check that the sealing ring is correctly positioned.

Tighten.

Install new sealing rings for the sump oil ducts.



Installing the sump

Wipe the surfaces dry.

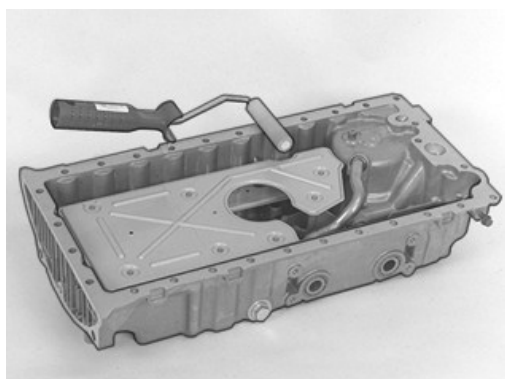
Apply liquid gasket 11 61 059 to the sump. Use roller [951 2767](#).

The surface must be completely covered without any excess.

Position the pan and install all screws

Caution! Check that the rear edge of the sump is in line with the rear edge of the cylinder block. Permissible tolerance ± 0.025 mm. Use a steel ruler and feeler gauge.

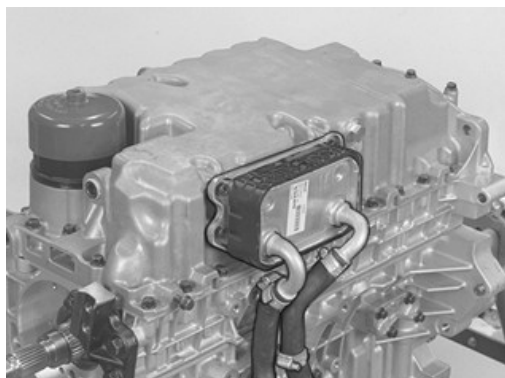
Tighten the screws from the rear of the pan and forward.



Installing the oil cooler

Install new sealing rings in the sump.

Install the oil cooler. Tighten.

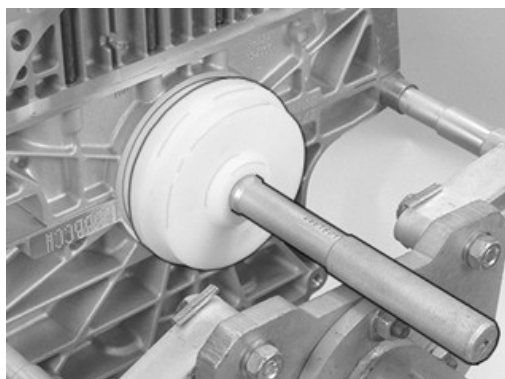


Installing the rear crankshaft seal

Use standard handle [999 1801](#) and drift [999 5676](#).

Lubricate the drift face and thread the sealing ring onto the drift.

Tap in the seal until the drift bottoms against the



block.

Installing the cylinder head

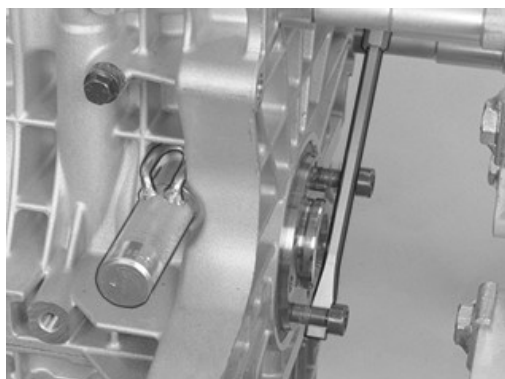
Special tools: [951 2050](#) , [951 2767](#) , [999 5450](#) , [999 5451](#) , [999 5452](#) , [999 5454](#) , [999 5718](#) , [999 5719](#)

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Tightening torques

For tightening torques not in the text see [Tightening torque](#) .

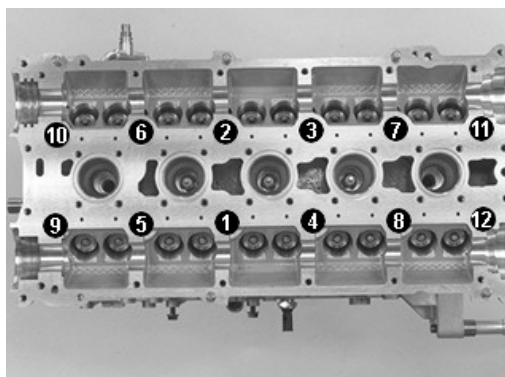
Aligning the crankshaft



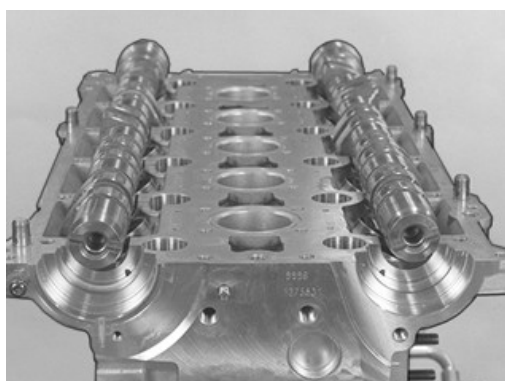
Turn the crankshaft counter-clockwise (viewed from the rear of the engine) until the piston in cylinder 1 reaches top dead centre (TDC). Continue turning counter-clockwise until the piston in cylinder 1 is approximately 2-3 cm before top dead centre (BTDC). Install the crankshaft stop [999 5451](#) . Ensure that it bottoms out against the cylinder block. Now turn the crankshaft clockwise (viewed from the rear of the engine) until the crankshaft counter-weight is in contact with the crankshaft stop.

Installing the cylinder head

Install a new cylinder head gasket.
Install the cylinder head.
Use new screws.
Lubricate and install all the screws.
Tighten the screws in the following order.
Tighten the screws alternately from the middle and outwards.

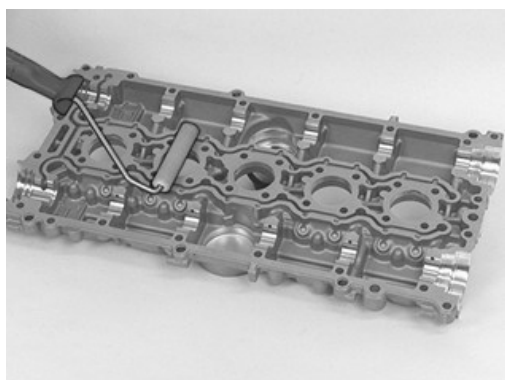


1. 20 Nm
2. 60 Nm
3. Angle-tighten 130°. Use protractor [951 2050](#).



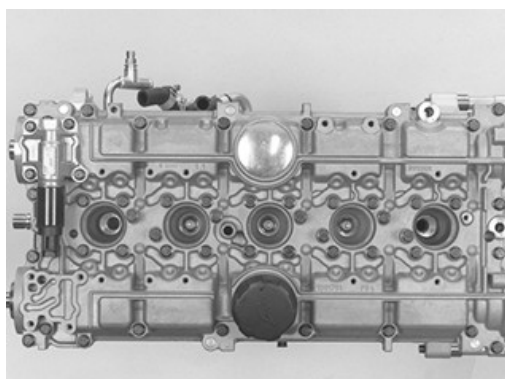
Installing tappets and camshafts

Lubricate the valve guide wells.
 Install all tappets.
 Lubricate the camshaft bearing seats.
 Install the intake camshaft. Ensure that the groove at the back of the camshaft is above an imaginary centre line
 Position the exhaust camshaft. Ensure that the groove at the back of the camshaft is below an imaginary centre line.



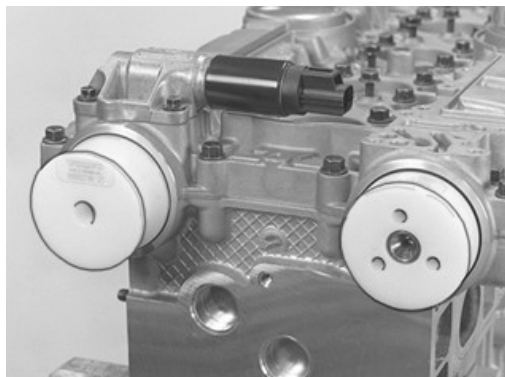
Applying liquid gasket

Install new O-rings around the spark plug wells at the cylinder head.
 Apply liquid gasket 11 61 059 to the camshaft cover. The surface must be completely covered without any excess. Use roller [951 2767](#)
 Note! Ensure that no liquid gasket gets in to the oil ducts.



Installing the camshaft covers

Lubricate the camshaft lobes, the camshaft bearing surfaces and the tappets.
 Install the camshaft cover.
 Install press tool [999 5454](#) (x2).
 Draw the camshaft cover alternately down, keeping it parallel to the cylinder head with press tool
 Install all the screws and tighten.
 Remove the press tools.
 Install the variable valve timing solenoid with a new gasket. Tighten.

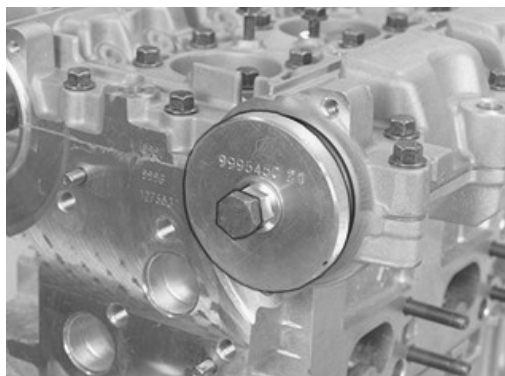


Installing the front camshaft seal

Use drift [999 5718](#) at the camshaft where the variable valve timing unit is to be placed and drift [999 5719](#) at camshafts without variable valve timing.

Lubricate the surface of the seal that the camshaft rotates against.

Tap in the seal until the drift bottoms against the end of the camshaft.



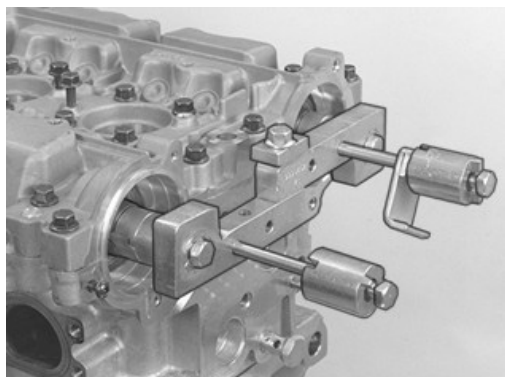
Installing the rear camshaft seal

Use drift [999 5450](#).

Lubricate the surface of the seal that the camshaft rotates against.

Press in the seal until the drift bottoms out.

Note! If there are grooves on the camshaft the seal can be pressed in a further 2 mm, by reversing the sleeve.



Securing the camshafts

Use camshaft adjustment tool [999 5452](#).

Separate the camshaft adjustment tool into two units.

Note! The camshafts must not be turned more than is listed in the text below. The valves may be damaged!

Install the exhaust camshaft section of the adjustment tool. Counterhold the adjustment tool and screw it into place at the rear of the camshaft.

Screw the adjustment tool sections together into one.

Check that the screws retaining the adjustment tool to the camshafts and the screws holding the tool together are well tightened.

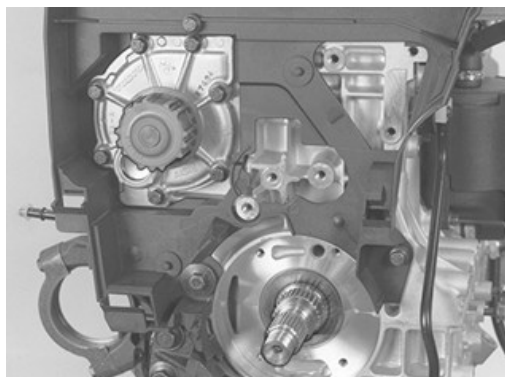
Assembling the belt drive

Special tools: [999 5747](#)

Note! As the illustrations in this service information are used for different model years

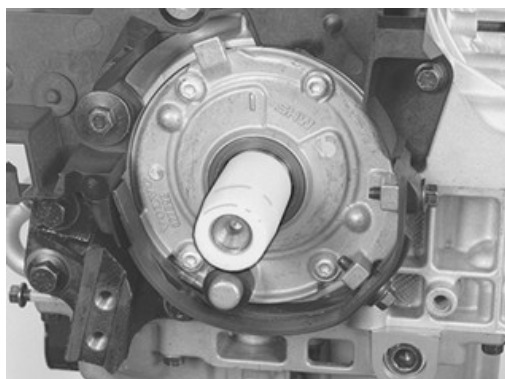
and / or models, some variation may occur.
However, the essential information in the illustrations is always correct.

Installing the water pump



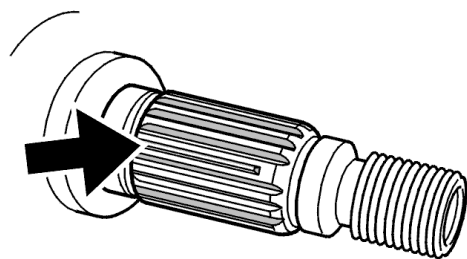
Install the rear timing cover.
Screw into place at the three mounting points.
Install the water pump with a new gasket.
Apply thread sealant, P/N 11-61 056, to all the screws for the water pump. Tighten crosswise.

Installing the oil pump



Use a new gasket and a new O-ring around the oil pump housing.
Screw sliding sleeve 999 5747 into place at the front of the crankshaft journal.
Press in the pump over the sliding sleeve.
Apply thread sealant, P/N 11-61 56, to all the screws for the oil pump.
Install the screws as a guide.
Carefully tap in the oil pump with a rubber mallet.
Tighten the oil pump crosswise to 10 Nm.
Remove sliding sleeve 999 5747.

Installing the crankshaft timing gear pulley

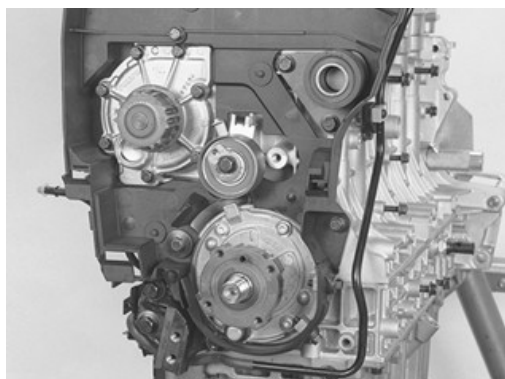


Note! The timing gear pulley can only be installed in one position on the crankshaft journal splines (see the illustration).

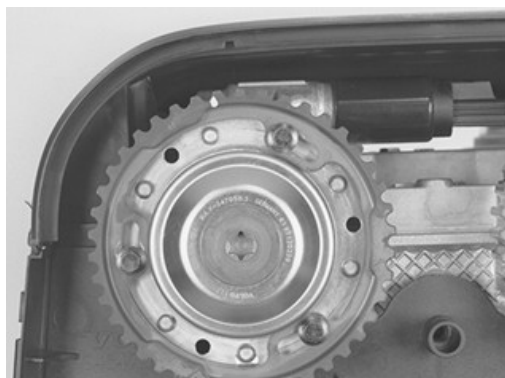
Carefully tap in the timing gear pulley with a rubber mallet.

Installing the idler pulley and belt tensioner

Install the idler pulley. Tighten.
Install the belt tensioner and the centre screw so that the fork on the tensioner is centred over the cylinder block rib. Do not tighten.



Install the fuel delivery line.



Installing the timing gear pulley for the camshafts

Timing gear pulleys with variable valve timing unit

Slacken off, but do not remove, the screws which secure the timing gear pulley to the variable valve timing unit.

Press the variable valve timing unit and timing gear pulley onto the camshaft.

Install the centre screw which secures the variable valve timing unit to the camshaft. Do not tighten.

Position the upper timing cover.

Turn the timing gear pulley clockwise until the screws at the oval holes are in their respective limit positions.

Hold the variable valve timing unit. Turn clockwise until the timing gear pulley marking is 1 cog before the marking on the upper timing cover.

Check that the timing gear pulley is still in the limit position in the oval holes.

Tighten the centre screw for the variable valve timing unit to 120 Nm.

Note! Check that the variable valve timing unit does not rotate when tightening.

Install the centre plug. Tighten to 35 Nm.

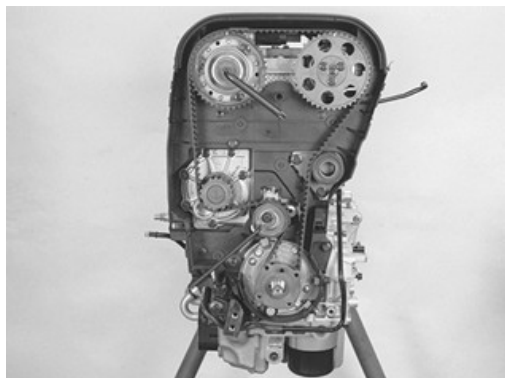
Timing gear pulleys without variable valve timing units

Install the timing gear pulley on the camshaft with two screws. Do not tighten.

Check that the markings on the timing gear pulley and the upper timing cover correspond.

Installing the timing belt

Tighten the centre screw on the timing belt



tensioner to 5 Nm.

Turn the variable valve timing unit clockwise until stop. Use a Tx 55 torx wrench applied at the centre plug.

Hold the variable valve timing unit secure in the limit position.

Install the timing belt.

Note! Adjust the timing gear pulleys so that the screws are not at a limit position in the oval holes.

Check that the markings on the timing gear pulleys and the upper timing cover correspond.

[Tighten the timing belt](#)

Turn the eccentric on the tensioner counter-clockwise until the tensioner indicator reaches its limit position. Ensure that the centre screw does not rotate.

Tighten the three screws securing the timing gear pulley to the variable valve timing unit.

Tighten to 10 Nm.

Install the third screw at the timing gear pulley without variable valve timing. Tighten the screws to 20 Nm.

Note! The variable valve timing unit must not be released from the limit position until after the timing gear pulleys have been tightened.

Turn the eccentric back (clockwise) so that the indicator reaches the marked position in the centre of the window. Remember to hold the centre screw secure at the same time.

Secure the eccentric. Tighten the centre screw to 20 Nm.

Check that the indicator is in the correct position.

[Remove](#)

- the camshaft adjustment tools [999 5451](#)
- the crankshaft stop [999 5452](#) .

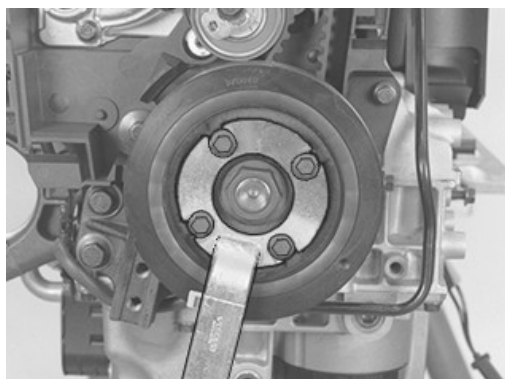
Install the plug with a new blind cover plug.

Tighten to 40 Nm.

[Check](#)

Press the toothed belt to check that the indicator on the tensioner moves easily.

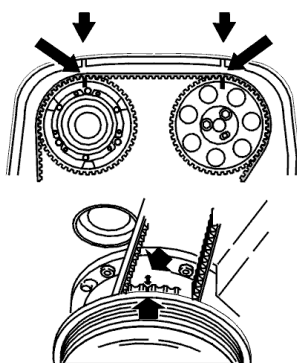
[Installing the vibration damper](#)



Install the vibration damper. Use counterhold [999 5433](#) .
Tighten the centre nut. Tighten to 180 Nm.
Remove counterhold 999 5433.
Tighten the four screws. Tighten to 25 Nm.
Angle-tighten 30°.

Check

Turn the crankshaft two turns.
Check that the markings on the crankshaft and camshaft timing gear pulley correspond with the marking on the upper timing cover and on the oil pump.



Engine [block](#), installing components

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Installing engine [block](#) components

Note! Always use new seal washers and gaskets!

Install

- thermostat housing (B52x4x)
- knock sensor (KS)
- flame trap
- the pipe screw for the water-heated crankcase ventilation.

[If in doubt about the order of assembly see:](#)

B5xx4x.....[Exposing the engine \[body\]\(#\)](#)

B6xx4x.....[Exposing the engine \[body\]\(#\)](#)

Install the flywheel and carrier plate. See [Crankshaft seal rear, replacing](#) .

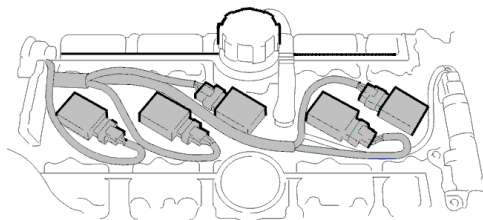
[For the correct tightening torques see:](#)

B5xx4x.....[Tightening torque](#)

B6xx4x.....[Tightening torque](#)

The ignition coil alignment and the wiring routing follows the illustrations below.

[B5xx4x](#)



[B6xx4x](#)

