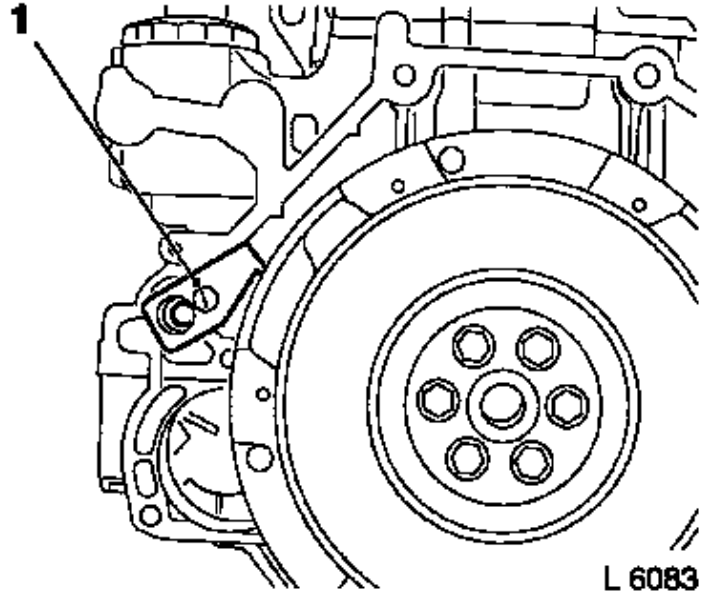


Crankshaft, Remove and Install (Engine Removed) (Z 22 SE)

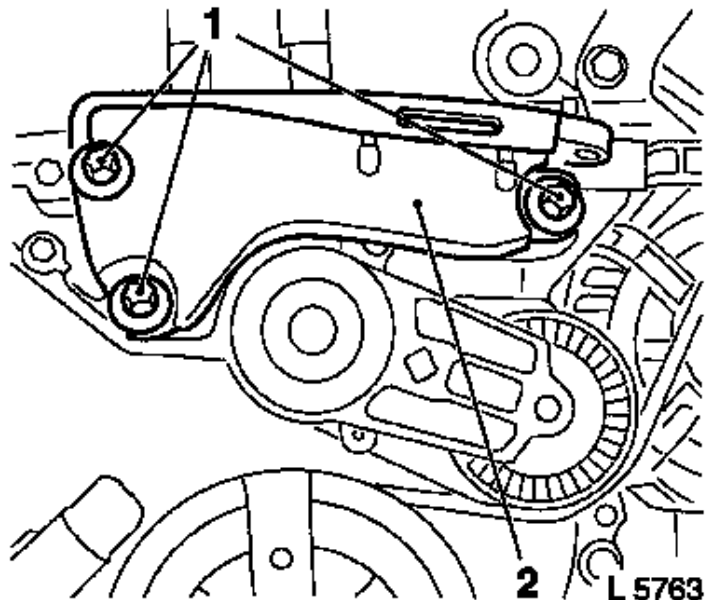


Remove

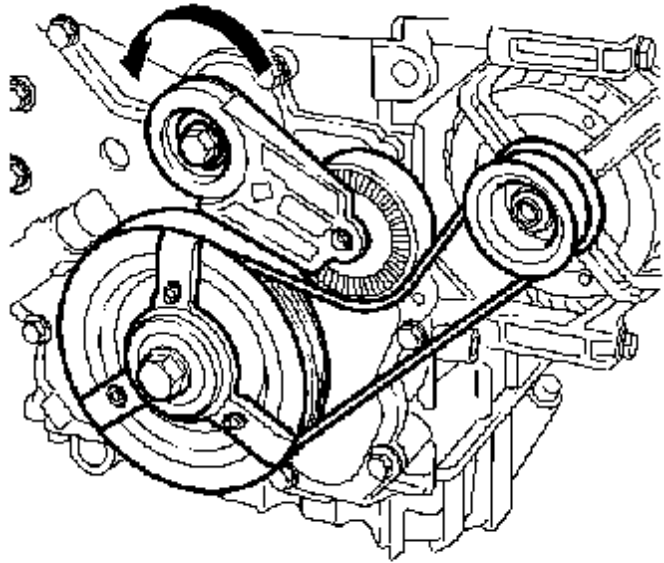
1. Remove the engine
Note: See operation "Engine, Remove and Install".
2. Separate the manual transmission from the engine.
Note: See operation "Manual Transmission and Engine, Separate and Reattach"
3. Place a drip tray underneath.
4. Drain the engine oil.
 - Open the oil drain plug.
 - Install the oil drain plug using a new oil seal.
 - Tightening torque **25 Nm**
5. Detach the flywheel.
 - Immobilise the flywheel via the starter ring gear with **KM-652** (1).
 - 6 bolts



6. Detach the engine damping block bracket (2).
 - 3 bolts (1)

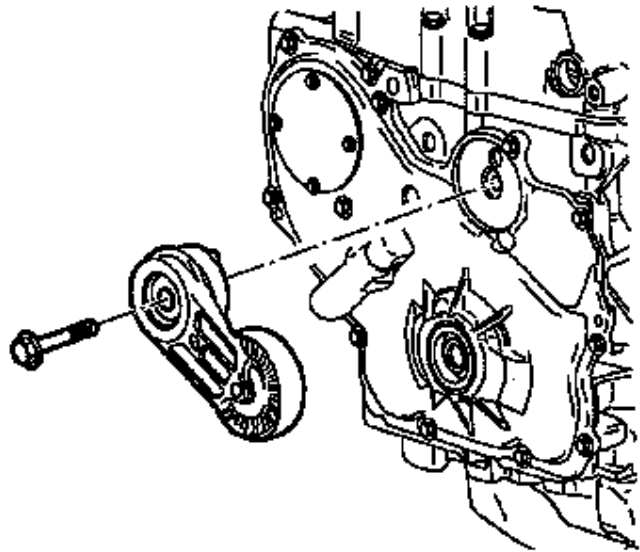


7. Remove the ribbed V-belt.
 - Mark the running direction of the ribbed V-belt.
 - Tension the ribbed V-belt tensioner in the direction of the arrow with **KM-6151**.
 - Take out the ribbed V-belt.



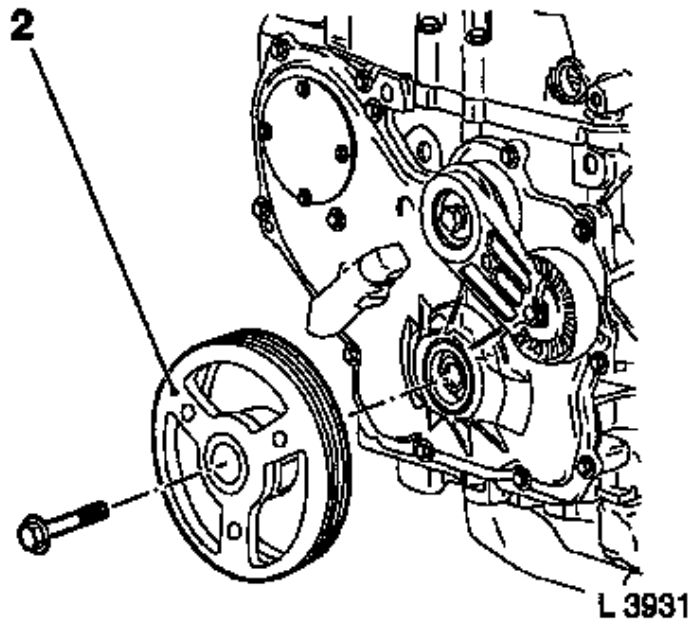
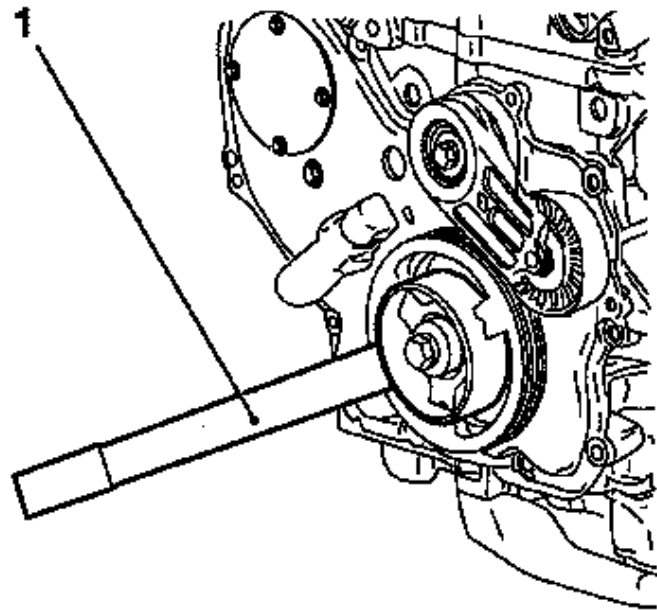
L0008730

8. Detach the ribbed V-belt tensioner.



L 3932

9. Detach the rotational vibration damper (2).
- Use holding adapter **KM-J-38122-A** in conjunction with **KM-956-1** (1) to hold.

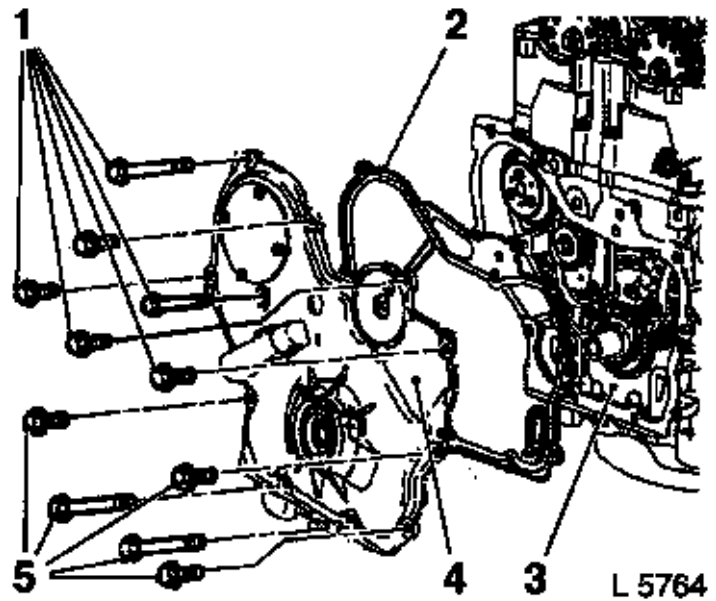


10. Detach the timing case (4).

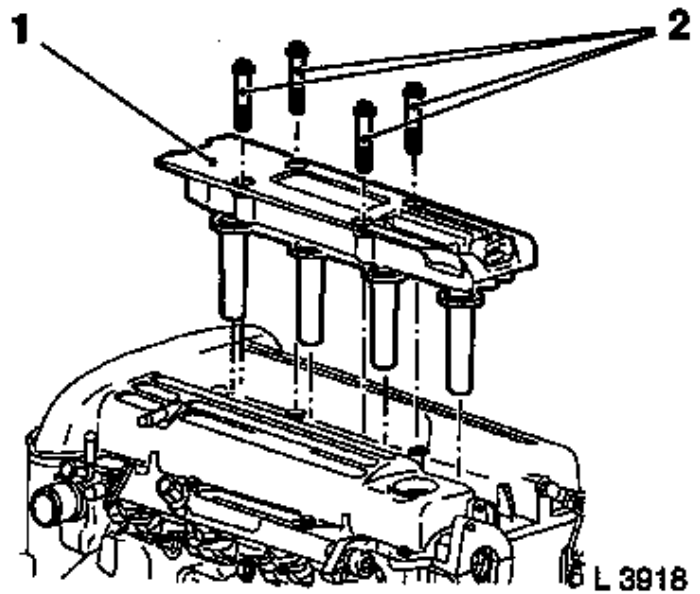
- 11 bolts (1) and (5)
- Remove the gasket (2).
- Note:** Cover the opening (3) in the timing case with a cloth.
- Use a suitable tool to remove the oil seal.

Important: Do not damage the sealing surfaces.

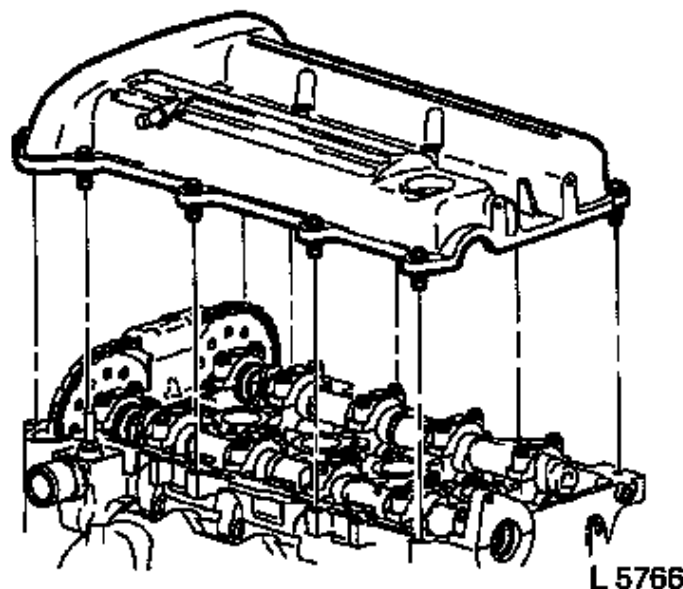
- Clean the sealing surfaces.



11. Detach the ignition module (1).
- 4 bolts (2)

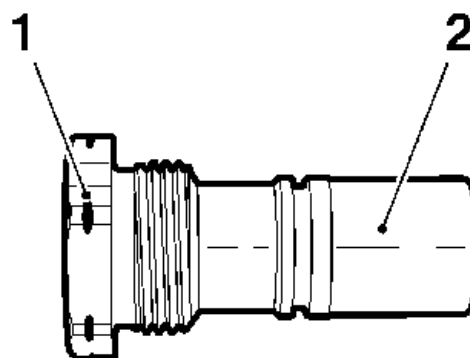


12. Detach the cylinder head cover.
- Detach the ground cable.
 - 12 bolts

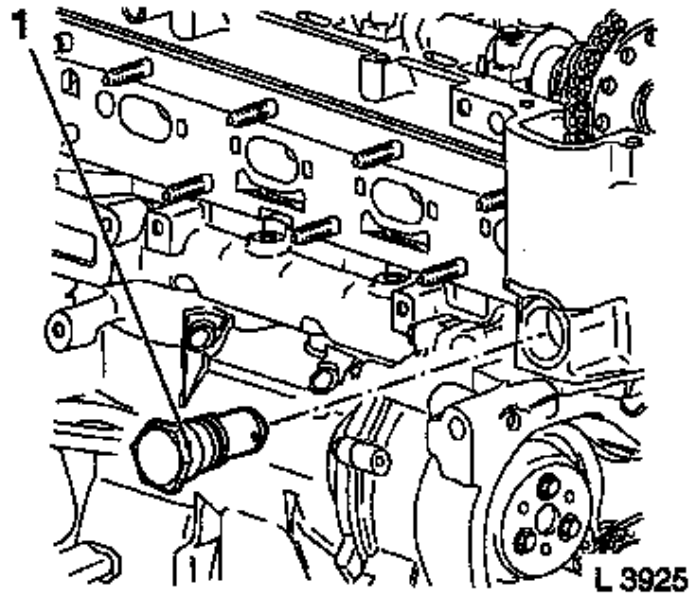


13. Note:

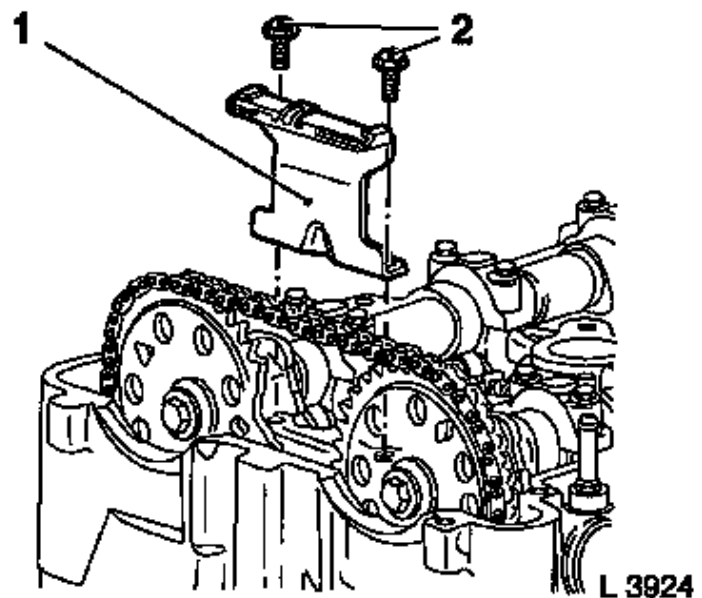
If there is no marking (1) on the camshaft timing chain tensioner (2), then it should be replaced with a new camshaft timing chain tensioner (part number 24 448 509) including a new camshaft timing chain tensioner rail (part number 24 449 448).



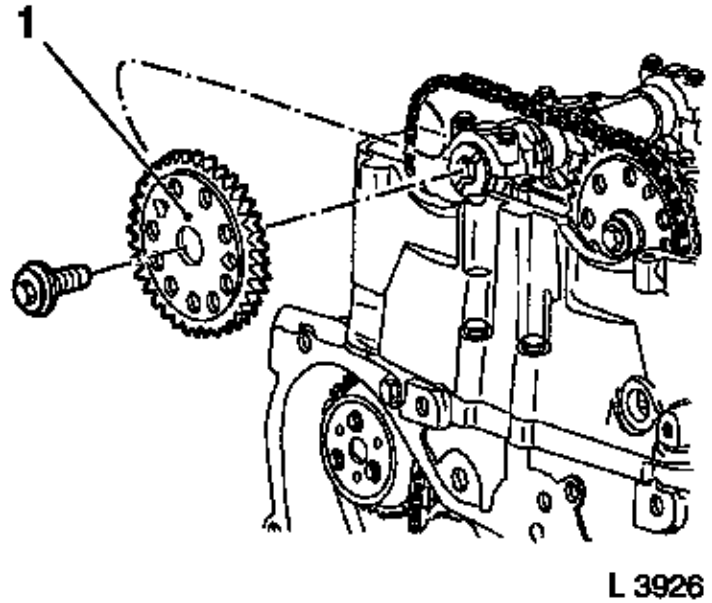
- 14.** Remove the camshaft timing chain tensioner (1).



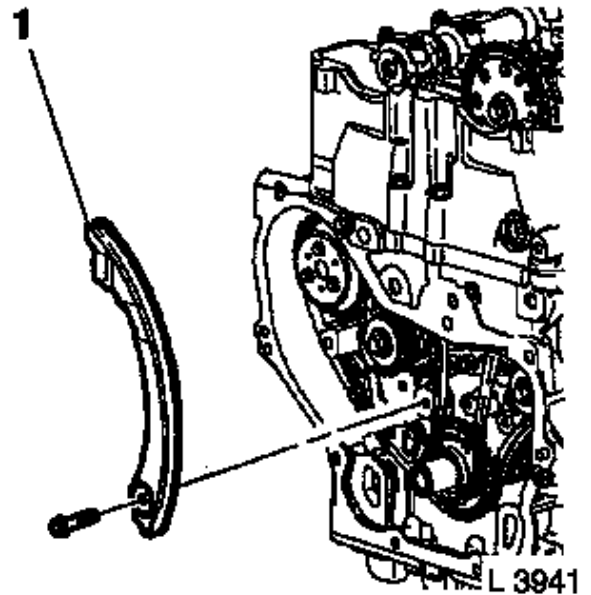
15. Remove the guide rail (1).
- 2 bolts (2)



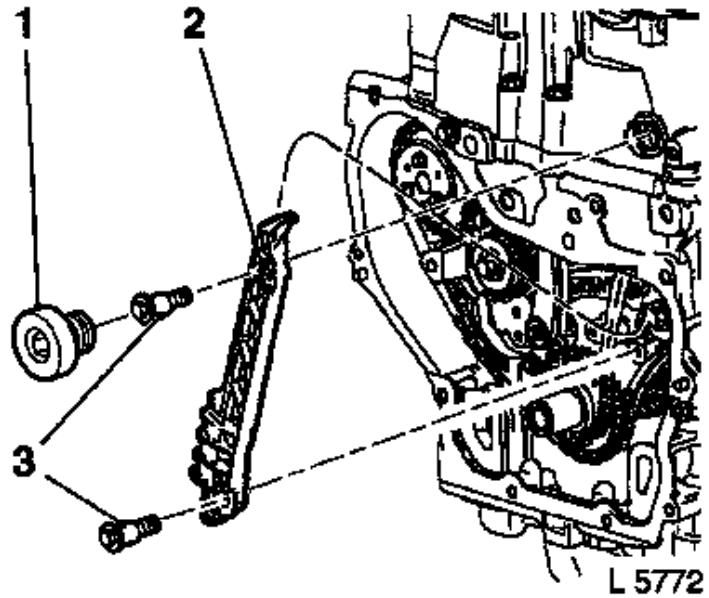
16. Remove the exhaust camshaft sprocket (1).
- Hold the exhaust camshaft by the hexagon.



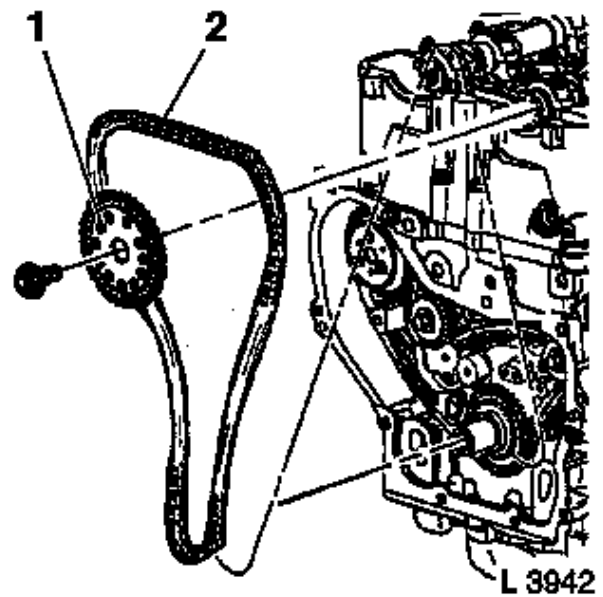
17. Remove the camshaft timing chain tensioner rail (1).
- Lift out to the top.



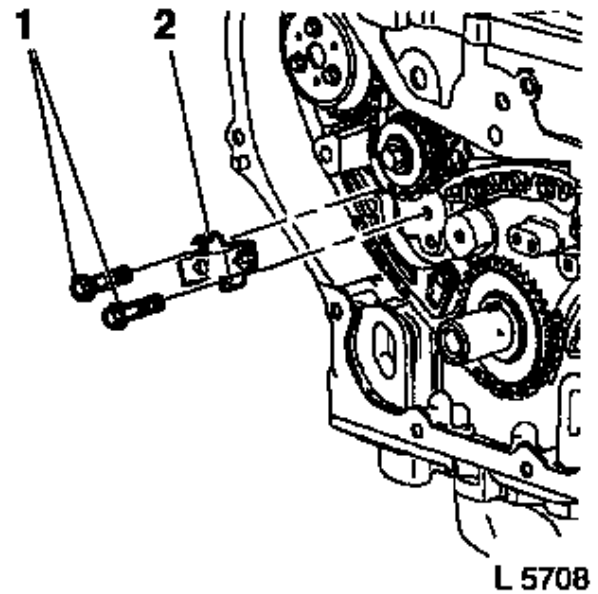
18. Remove the camshaft timing chain guide rail (2).
- Remove the screw plug (1).
 - 2 bolts (3)



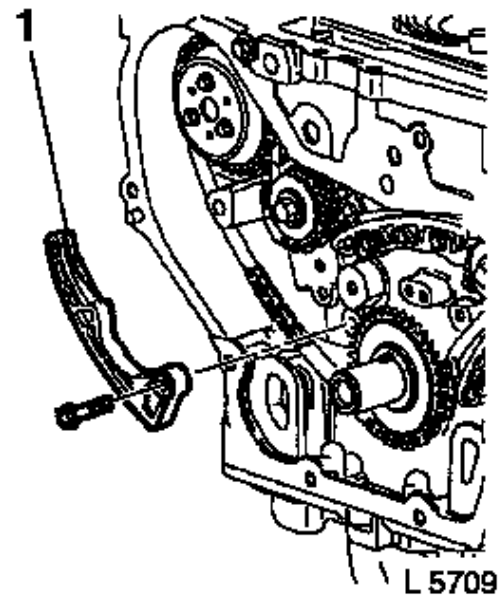
19. Remove the intake camshaft sprocket (1).
 - Hold the intake camshaft by the hexagon.
20. Take out the camshaft timing chain (2).
 - Take out the camshaft timing sprocket.



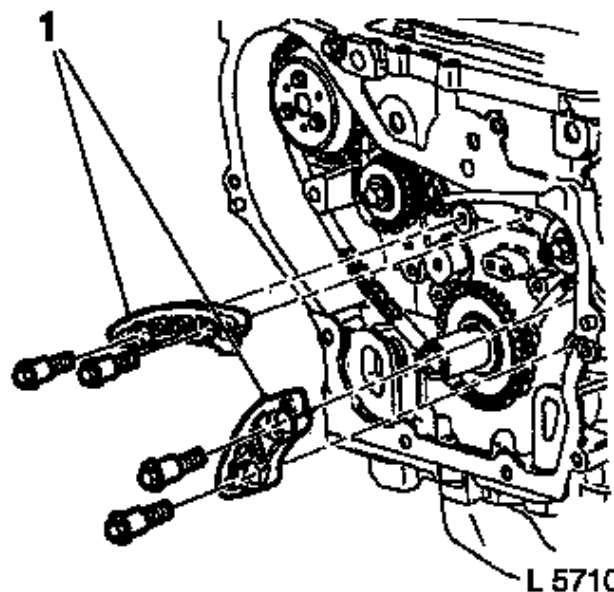
21. Remove the balancer shaft timing chain tensioner (2).
 - 2 bolts (1)



22. Remove the balancer shaft timing chain tensioner rail (1).



23. Remove the balancer shaft timing chain guide rails (1).
- 2 off
 - 4 bolts
24. Take out the balancer shaft timing chain.
- Take out the balancer shaft timing sprocket.



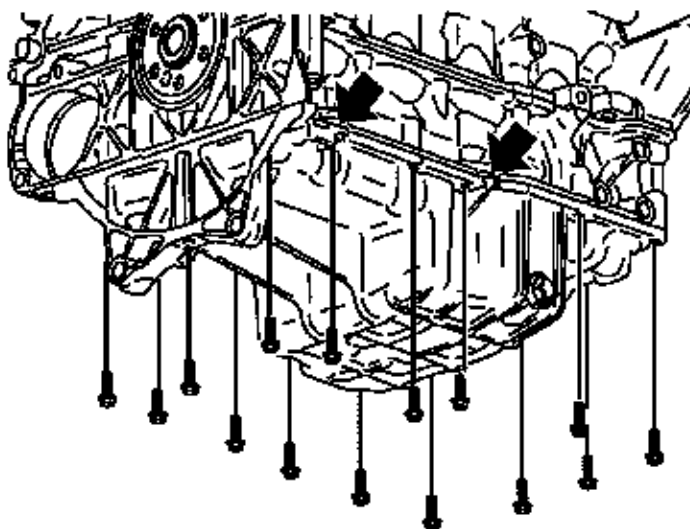
L 5710

25. Remove the oil pan.

- Rotate the engine on the assembly stand **180°**.

- 15 bolts

Note: Use a suitable tool to evenly prise it off at the leverage points (arrow).

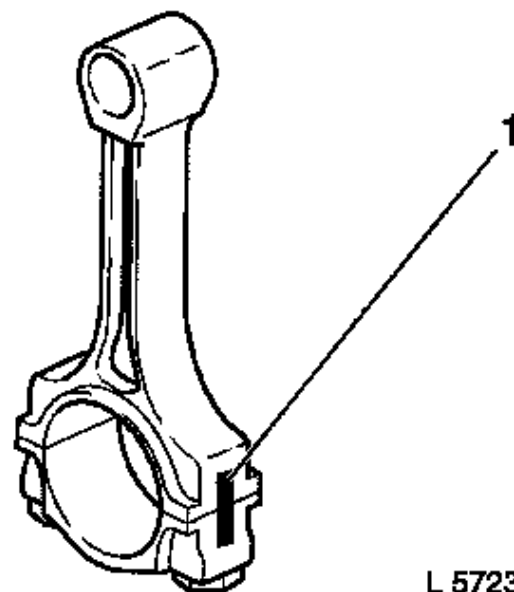


L 5721

26. Remove big-end bearing caps 1 and 4.

- Attach the rotational vibration damper to the crankshaft and set pistons 1 and 4 to BDC.
- Mark the connecting rod and big-end bearing cap (1).

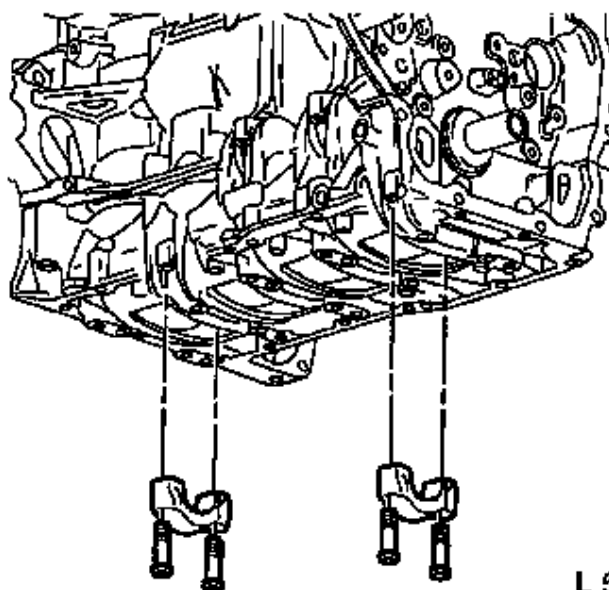
Note: Note the cylinder sequence.



27. Detach the big-end bearing caps.

Note: The broken surfaces of the connecting rods and the big-end bearing caps form a unique fit and must not be swapped or damaged. Do not put the parts down on the broken surfaces.

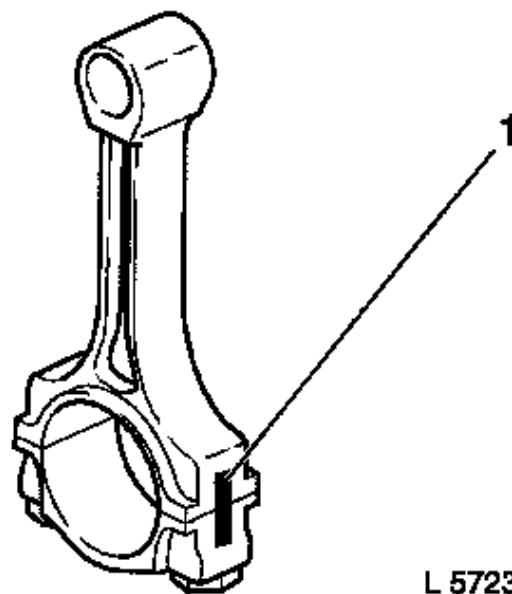
- 2 off
- 4 bolts



28. Remove big-end bearing caps 2 and 3.

- Rotate the crankshaft by the rotational vibration damper **180°**.
- Mark the connecting rod and big-end bearing cap (1).

Note: Note the cylinder sequence.

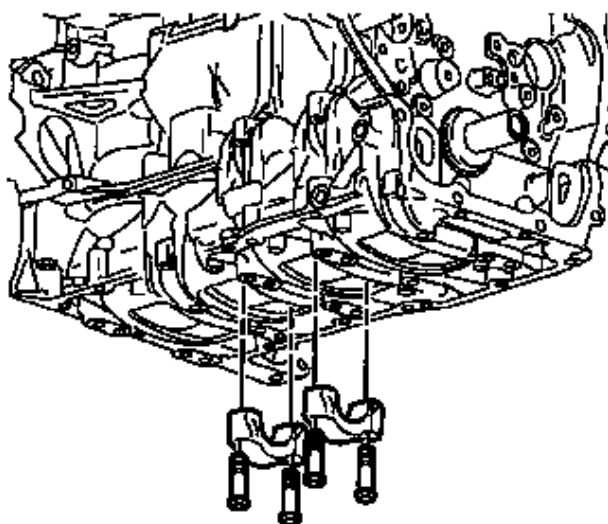


L 5723

29. Detach the big-end bearing caps.

Note: The broken surfaces of the connecting rods and the big-end bearing caps form a unique fit and must not be swapped or damaged. Do not put the parts down on the broken surfaces.

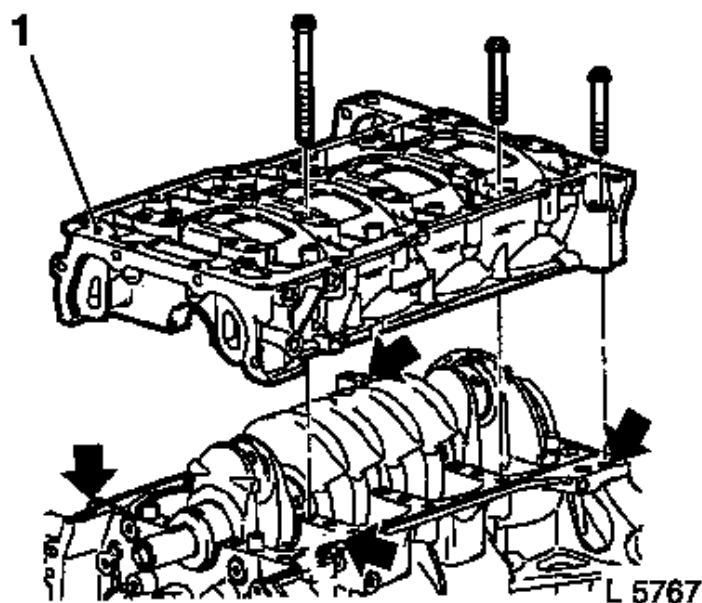
- 2 off
- 4 bolts
- Detach the rotational vibration damper.



L 5726

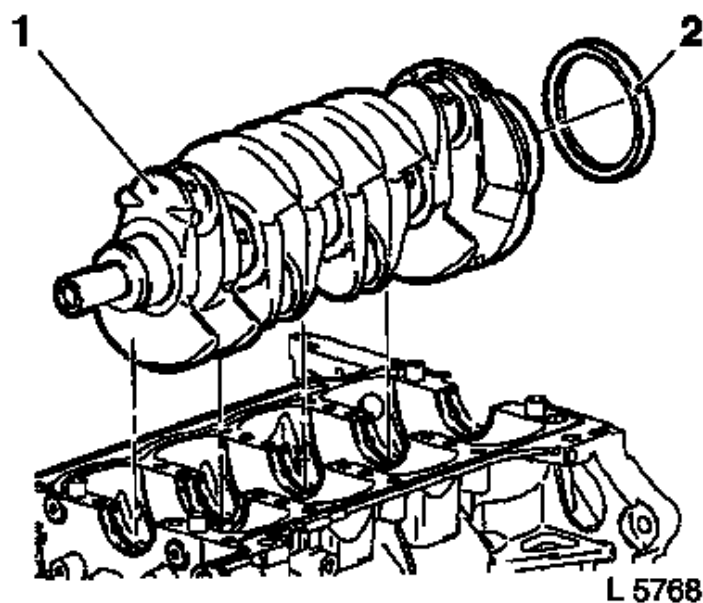
30. Remove the crankshaft.

- Detach the cylinder block base plate (1).
 - 30 bolts
- Note:** Use a suitable tool to evenly prise it off at the leverage points (arrow).



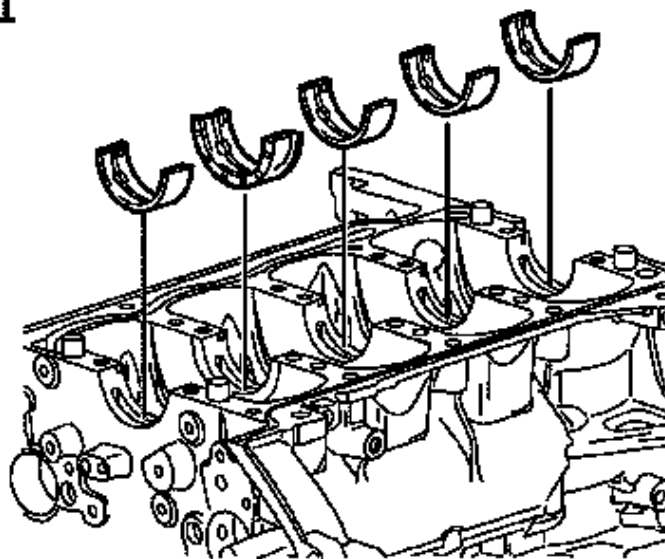
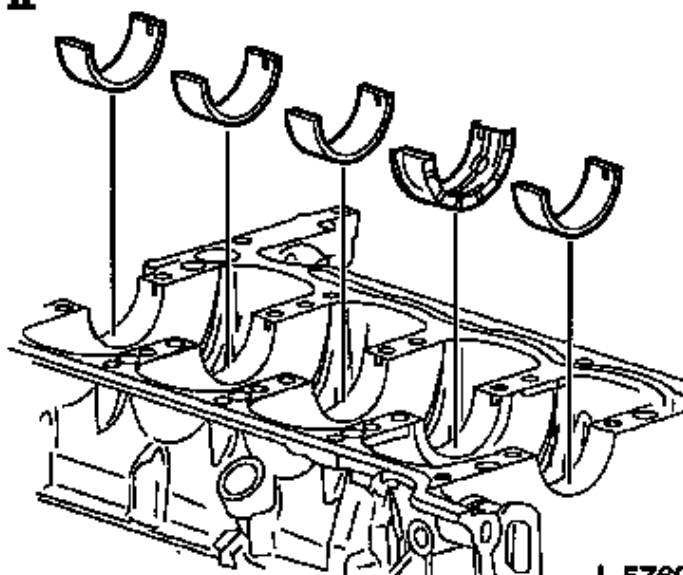
31. Remove the crankshaft rear oil seal (2).
Note: Place the crankshaft (1) down onto wooden blocks.

- Check the condition of the spring lock washer and renew as required.

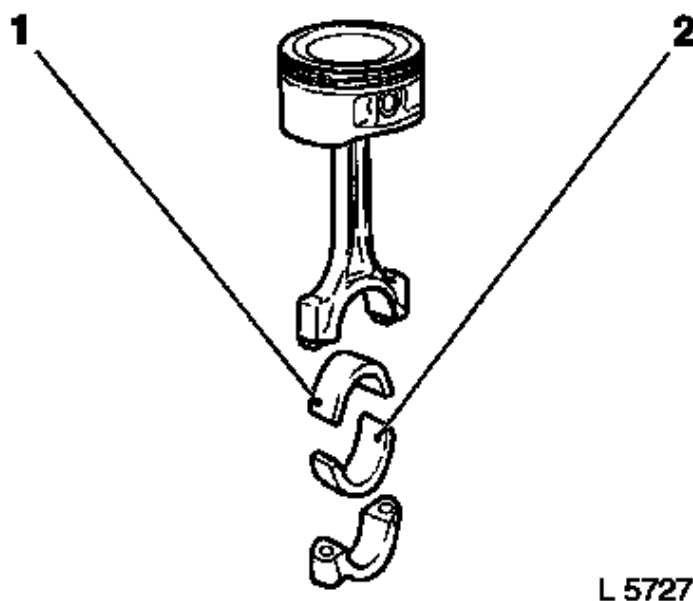


32. Take out the crankshaft bearing shells.

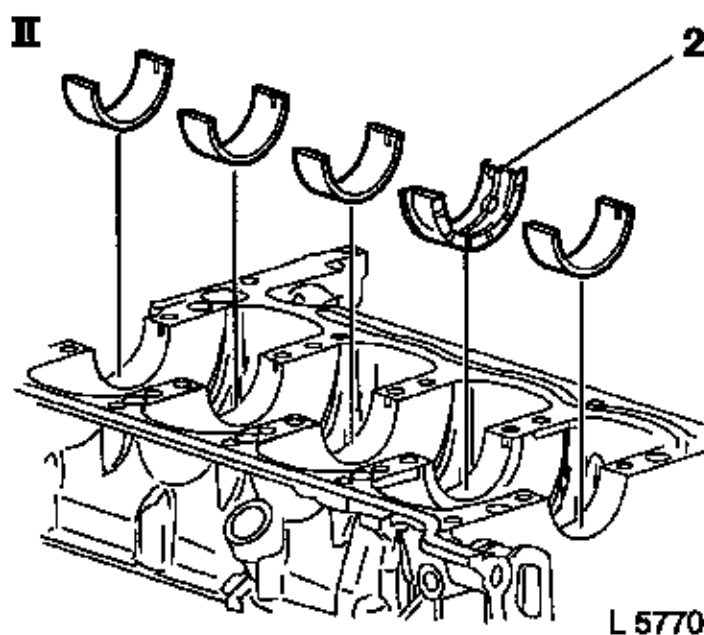
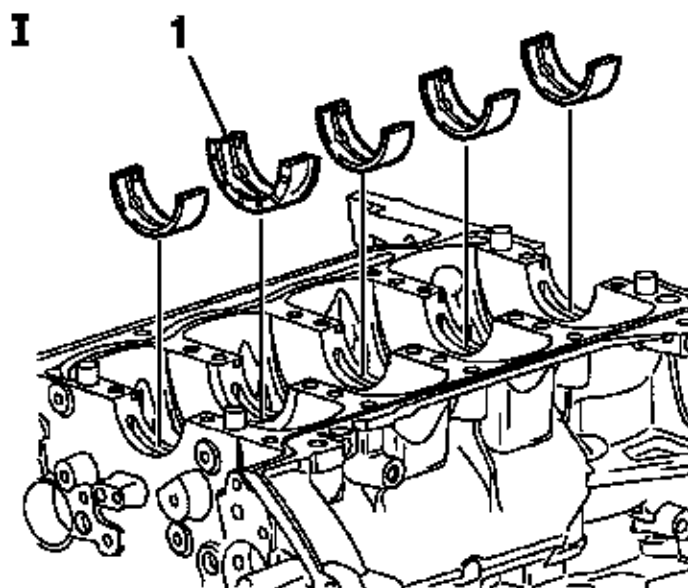
- From the cylinder block (I) and the cylinder block base plate (II).
Note: Note the installation position and allocation.
- Clean and visually inspect the components.

I**II****L 5769**

- 33.** Take out the big-end bearing shells (1) and (2).
- From the connecting rods and the big-end bearing caps
- Note:** Note the installation position and allocation.
- Clean and visually inspect the components.
- 34.** Clean the sealing surfaces.
- Cylinder block and cylinder block base plate

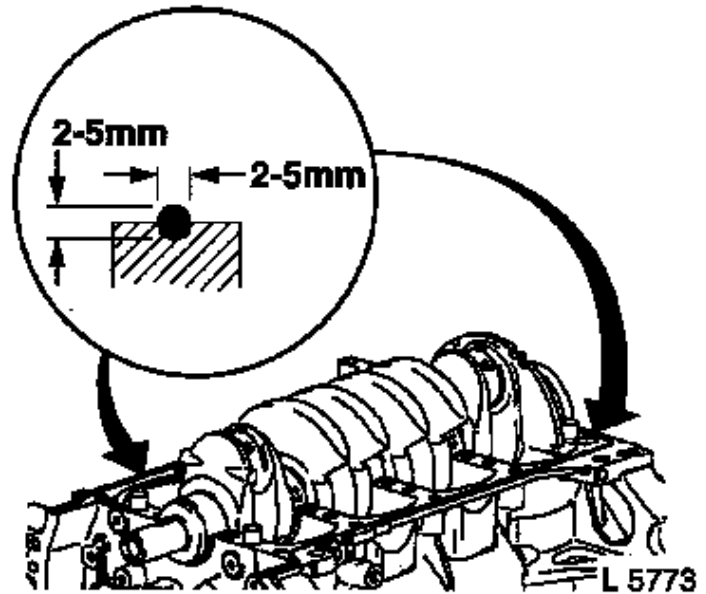
**Install**

35. Insert the big-end bearing shells.
 - Into the connecting rods and the big-end bearing caps
 - Coat the big-end bearing shells with engine oil.
36. Insert the crankshaft bearing shells.
 - Into the cylinder block and cylinder block base plate
 - Important:** Note the position of axial bearing (1) and (2).
 - Coat the crankshaft bearing shells with engine oil.
37. Insert the crankshaft.
 - Coat the crankshaft bearing journals with engine oil.

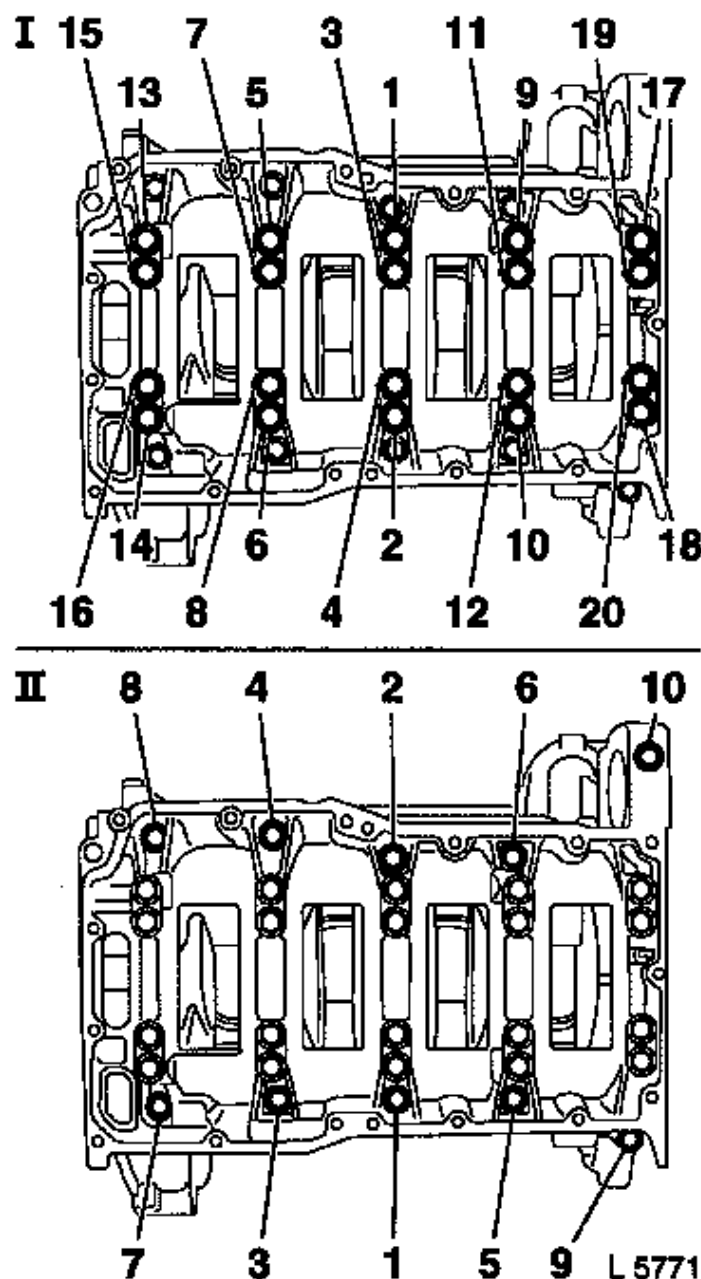


L 5770

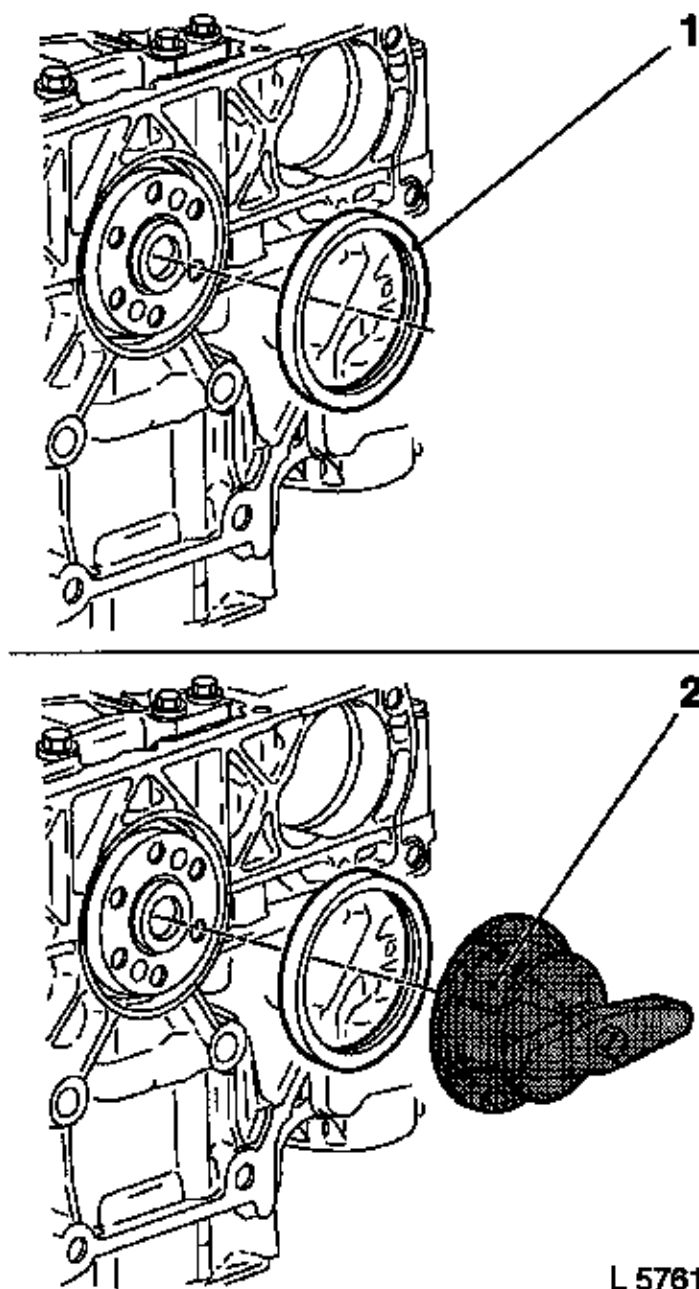
38. Clean the sealing surfaces.
39. Attach the cylinder block base plate.
 - Important:** The assembly process must be finished within 10 minutes of applying the sealant.
 - Renew the M10 bolts.
 - Note:** Apply an approx. **2 mm to 5 mm** bead of silicone sealant (grey) into the groove on the cylinder block.



40. Tighten all bolts loosely.
- Note:** Observe the tightening sequence.
- Tighten the M10 bolts (I) – tightening torque **20 Nm + 70° + 15°**
 - Tighten the M8 bolts (II) – tightening torque **23 Nm**
 - Remove any excessive sealant.



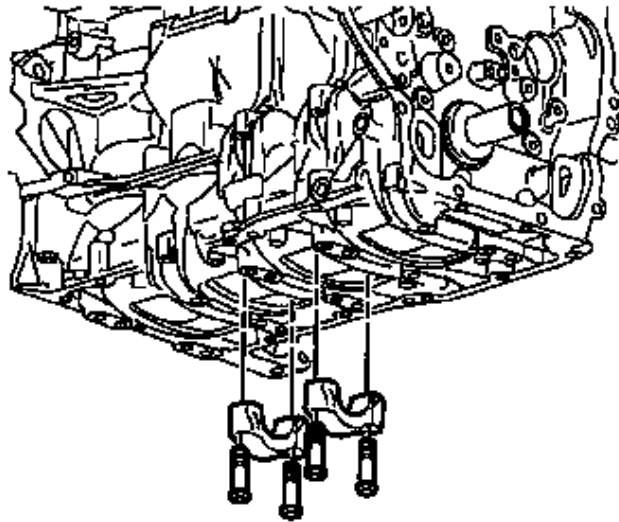
41. Install the crankshaft rear oil seal (1).
- Coat the sealing lip with silicone grease (white).
 - Turn back the installation tool **KM-J-42067** (2).
 - Slide the oil seal onto **KM-J-42067**.
 - Attach **KM-J-42067** to the crankshaft.
 - Press in the oil seal with **KM-J-42067** until **KM-J-42067** lies flush against the housing.
 - Detach **KM-J-42067**.



42. Install big-end bearing caps 2 and 3.

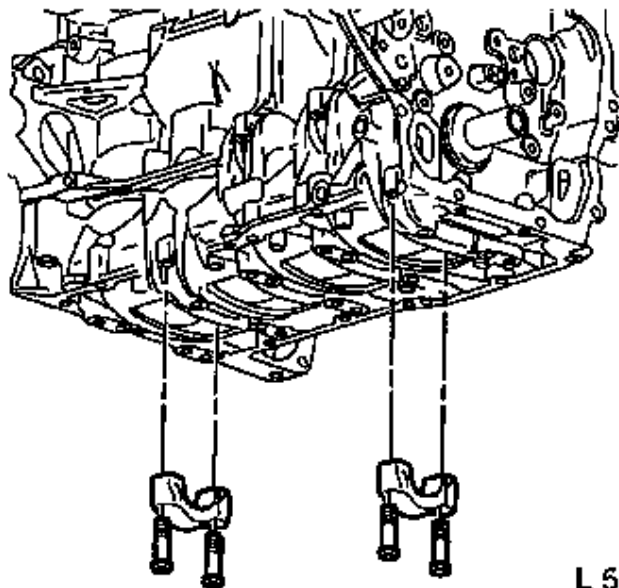
Note: Note the applied markings.

- Coat the big-end bearing journals with engine oil.
- Renew the bolts.
- Tightening torque **25 Nm + 50° + 50° + 10°**
- Attach the rotational vibration damper to the crankshaft.
- Rotate the crankshaft via the rotational vibration damper **180°** in the normal direction of rotation.



L 5726

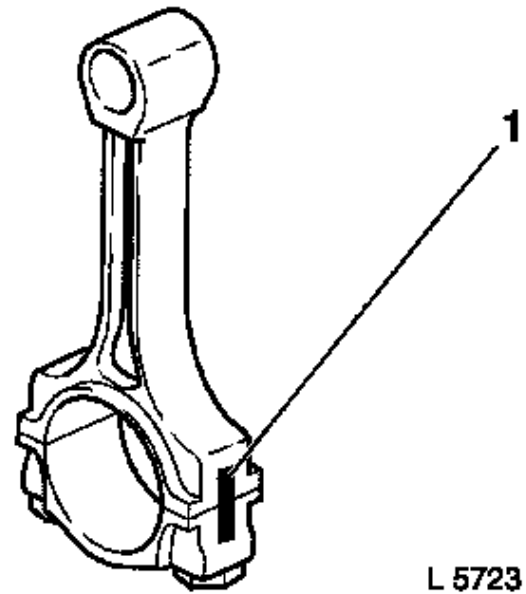
43. Install big-end bearing caps 1 and 4.
- Coat the big-end bearing journals with engine oil.



L 5722

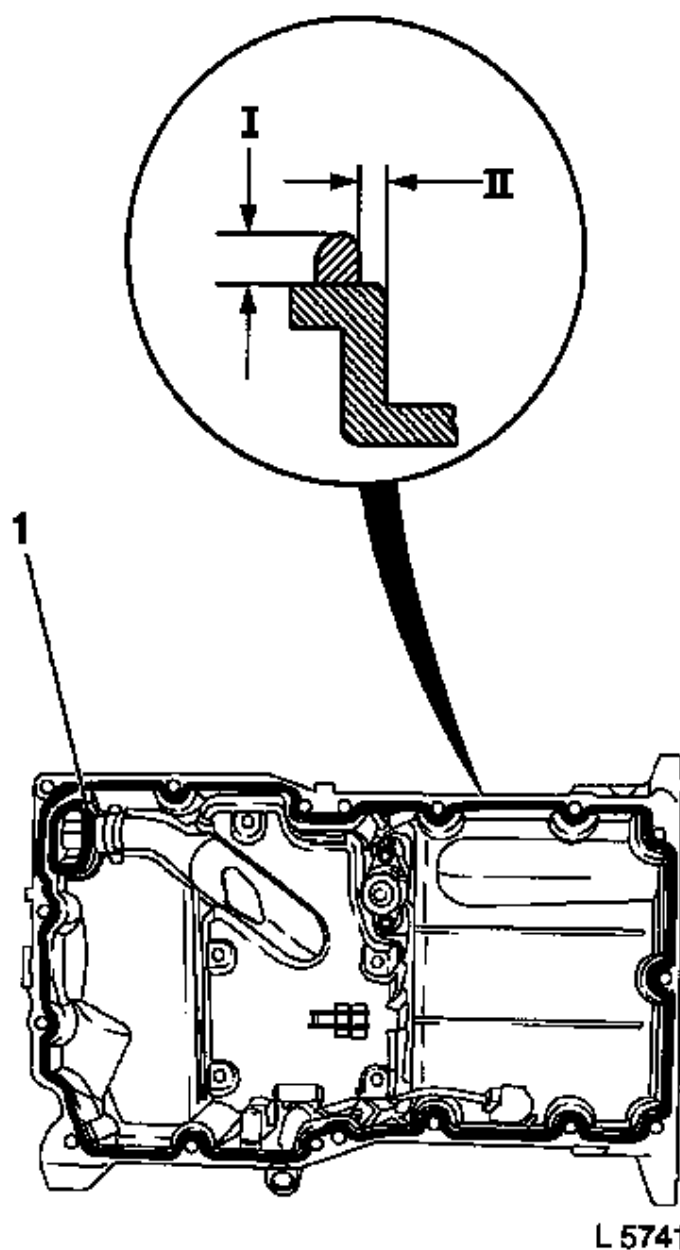
Important: Note the applied markings (1).

44. Renew the bolts.
- Tightening torque **25 Nm + 50° + 50° + 10°**
45. Clean the sealing surfaces.
- Cylinder block base plate, oil pan
46. Recut the thread.
- 15 off

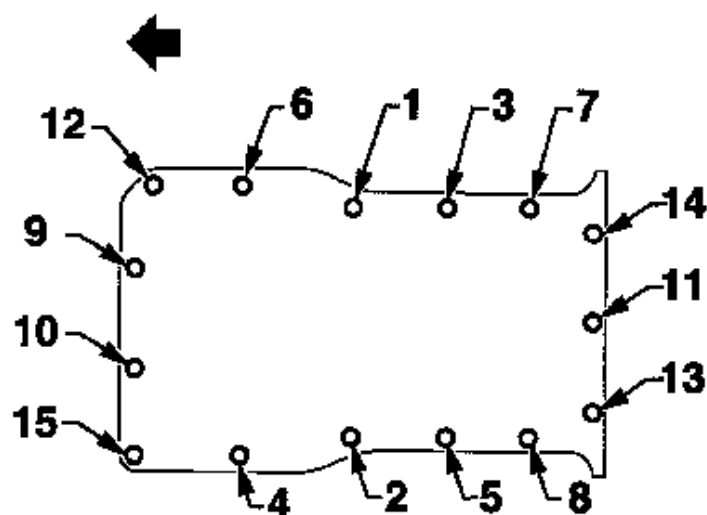


47. Install the oil pan.

- Apply a bead of silicone sealant (grey) (approx. **2 mm** to **2.5 mm** (dimension I) thick) at a spacing of **0.5 mm** to **1.5 mm** (dimension II) from the inner edge of the sealing surface to the sealing surfaces of the oil pan.
- Apply an additional bead of silicone sealant (grey) (approx. **2 mm** to **2.5 mm** (dimension I) thick) centrally to the oil intake pipe connection (1).



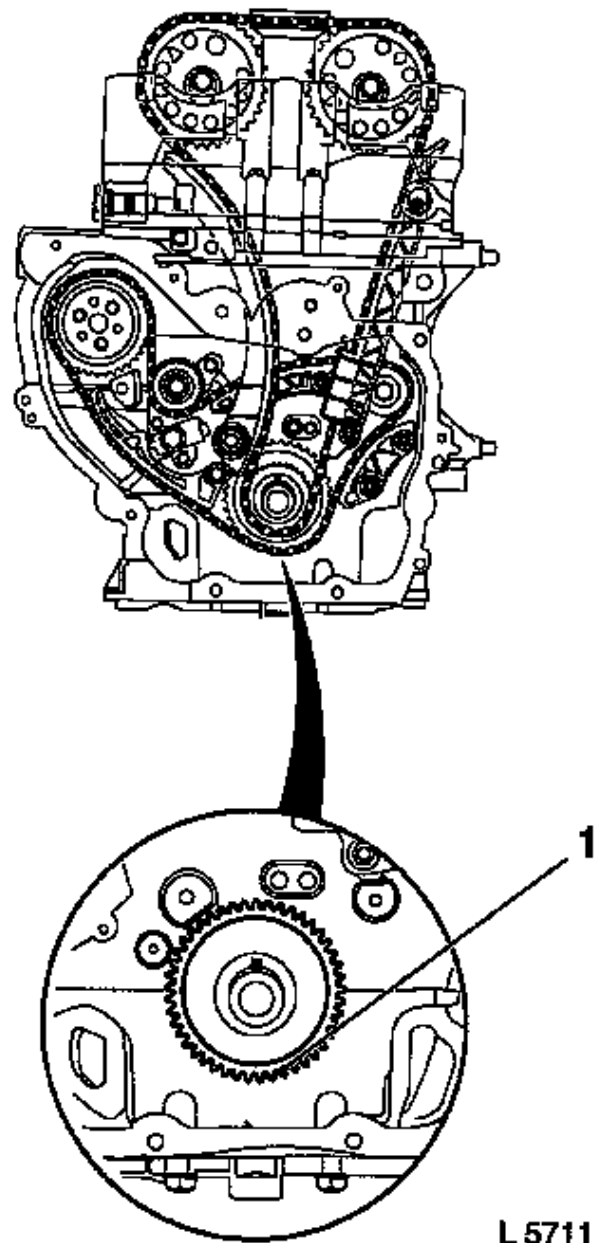
48. Note:
Observe the tightening sequence.
- Tighten all bolts loosely.
 - To the cylinder block base plate – tightening torque **23 Nm**
 - To the transmission housing – tightening torque **23 Nm**
49. Attach the wiring harness connector for the dynamic oil level check.



L 5742

50. Align the crankshaft.

- Insert the balancer shaft timing sprocket.
Note: Note the identification markings.
- Rotate the crankshaft in the normal direction of rotation until the marking (1) on the balancer shaft timing sprocket is approx. at 6 o'clock.
- Detach the rotational vibration damper.

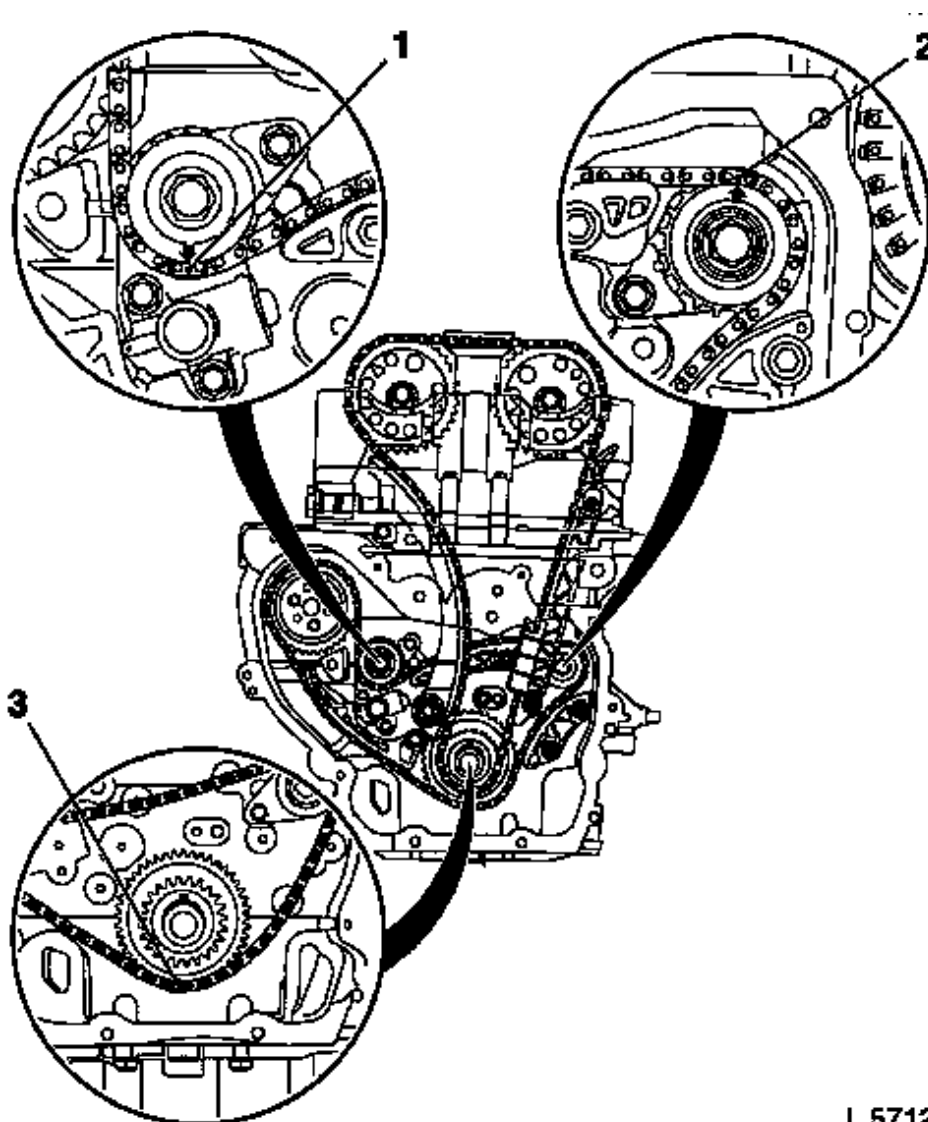


51. Install the balancer shaft timing chain.

Important: The TDC reference points on the timing chain are indicated by coloured links in the chain. These must line up with the markings on the timing sprockets.

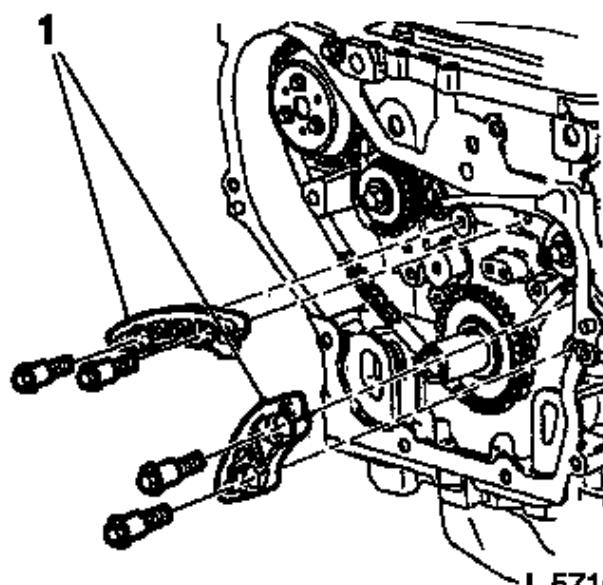
- Lay the timing chain in place.
 - Chain link (2) (copper)

- coloured) to the marking on the balancer shaft on the intake side of the engine.
- Secure the chain link (3) with a plastic wedge at the marking on the balancer shaft timing chain sprocket.
 - Chain onto coolant pump sprocket
 - Chain link (1) to the marking on the balancer shaft on the exhaust side of the engine.



L 5712

52. Install the balancer shaft timing chain guide rails (1).
 - Tightening torque **10 Nm**
53. Install the balancer shaft timing chain tensioner rail.
 - Tightening torque **9 Nm**



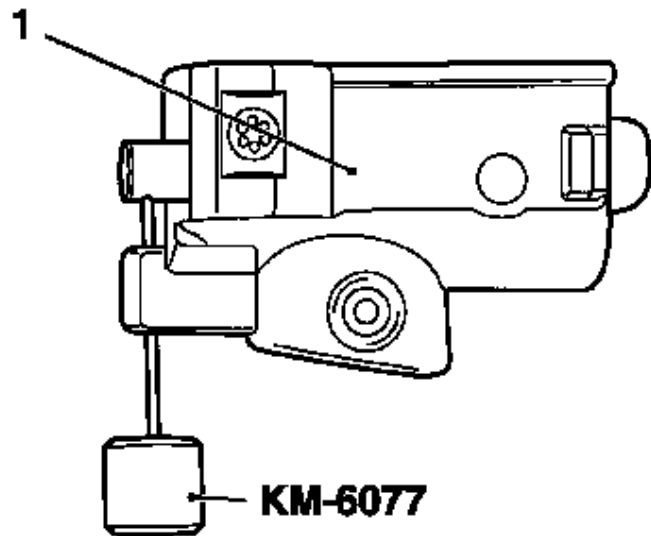
L 5710

54. Install the balancer shaft timing chain tensioner.

Note: If the TDC markings no longer line up with the coloured chain links – refit the balancer shaft timing chain.

After a single revolution of the engine the TDC markings will no longer line up with the coloured chain links.

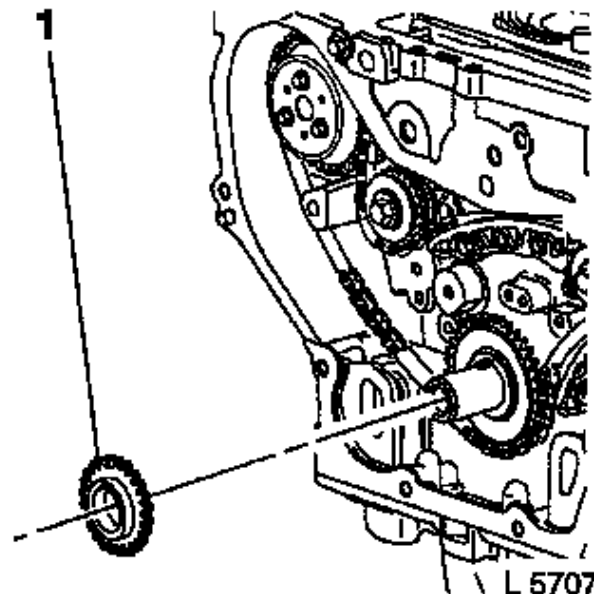
- Lock the chain tensioner (1) with **KM-6077**.
 - Rotate the piston clockwise, press it in and insert **KM-6077** into the designated bores.
- Tightening torque **10 Nm**
- Take out **KM-6077**.
- Remove the plastic wedge.



L 5713

Important: Note the correct installation position.

55. Insert the camshaft timing sprocket (1).



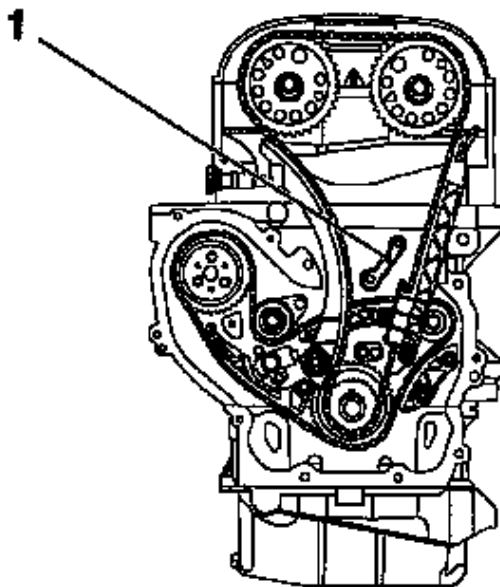
L 5707

56. Insert the camshaft timing chain.

Note: Working from the top left and right, insert the timing chain past the central web (1).

57. Install the intake camshaft sprocket.
- Lay the camshaft timing chain onto the camshaft sprocket.
 - Use a new bolt.
 - Hold the intake camshaft by the hexagon.
 - Tightening torque **85 Nm + 30° +**

15°



L 3946

58. Fit the camshaft timing chain.

Important: The TDC reference points on the timing chain are indicated by coloured links in the chain. These must line up with the markings on the timing sprockets.

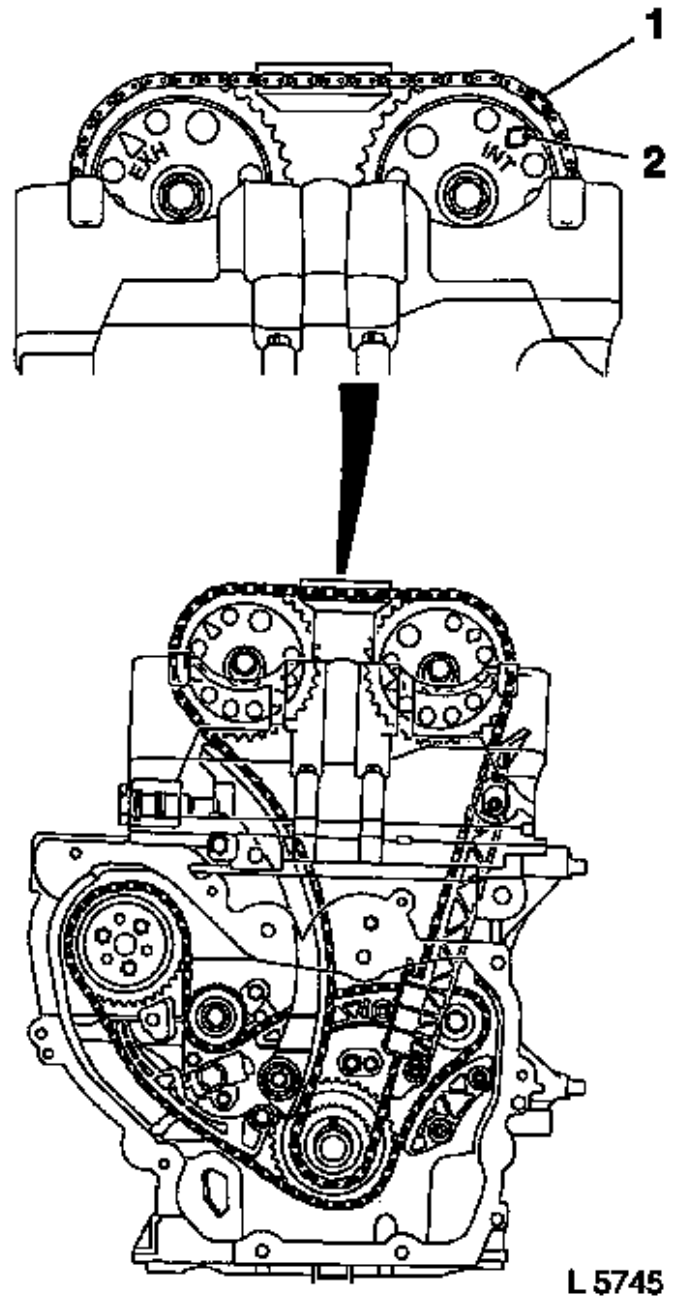
- Chain link (copper colour) (1) to INT marking (2) on the intake camshaft sprocket

59. Install the camshaft timing chain tensioner rail.

- Tightening torque **10 Nm**

60. Install the camshaft timing chain guide rail.

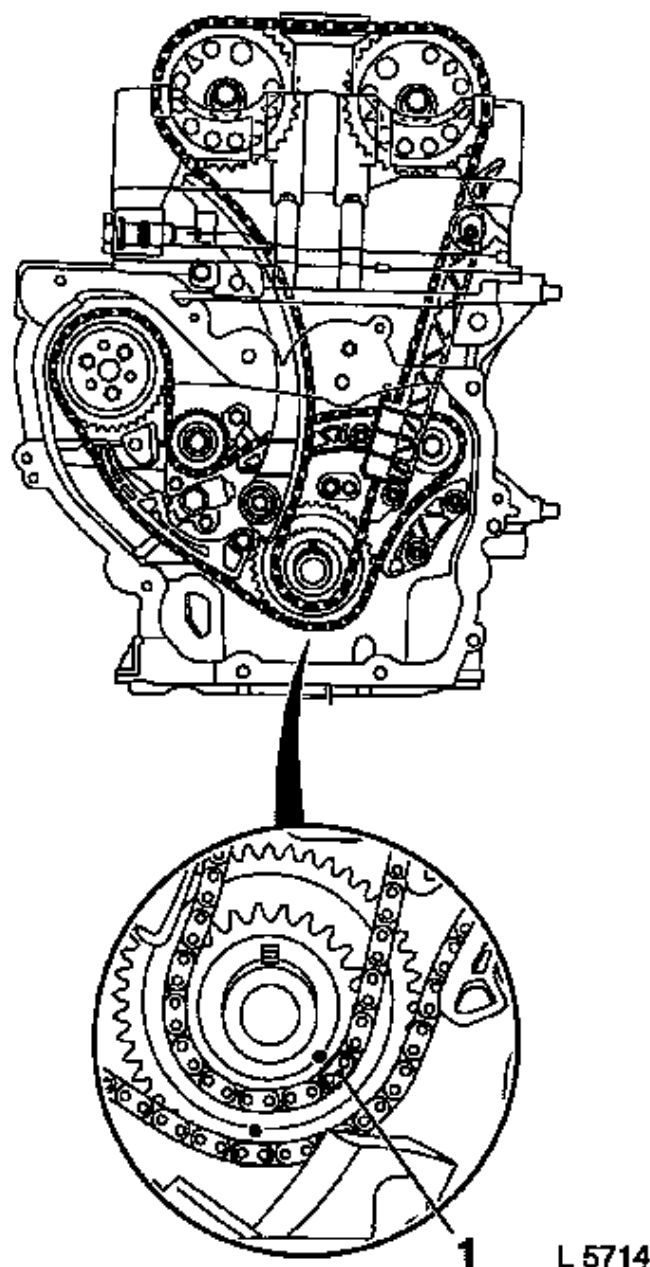
- Tightening torque **10 Nm**
- Install the screw plug.
 - Tightening torque **65 Nm**



61. Secure the camshaft timing chain.

Important: Check that the TDC reference points line up.

- Secure the chain link (1) with a plastic wedge at the marking on the camshaft timing chain sprocket



62. Install the exhaust camshaft sprocket.

Important: Check that the TDC reference points line up.

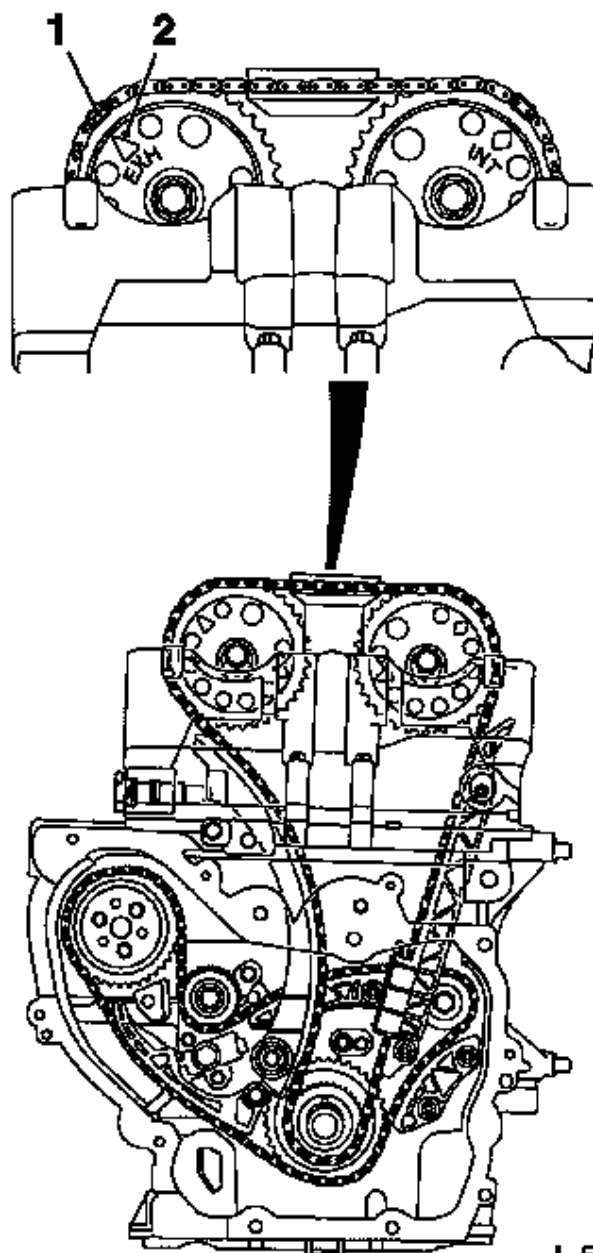
- Chain link (1) to EXH marking (2) on the exhaust camshaft sprocket
- Rotate the exhaust camshaft by the hexagon until the exhaust camshaft sprocket is seated in the guide.
- Use a new bolt.
- Hold the camshaft by the hexagon.
 - Tightening torque **85 Nm + 30° + 15°**

63. Recut the thread.

- 2 off

64. Install the guide rail.

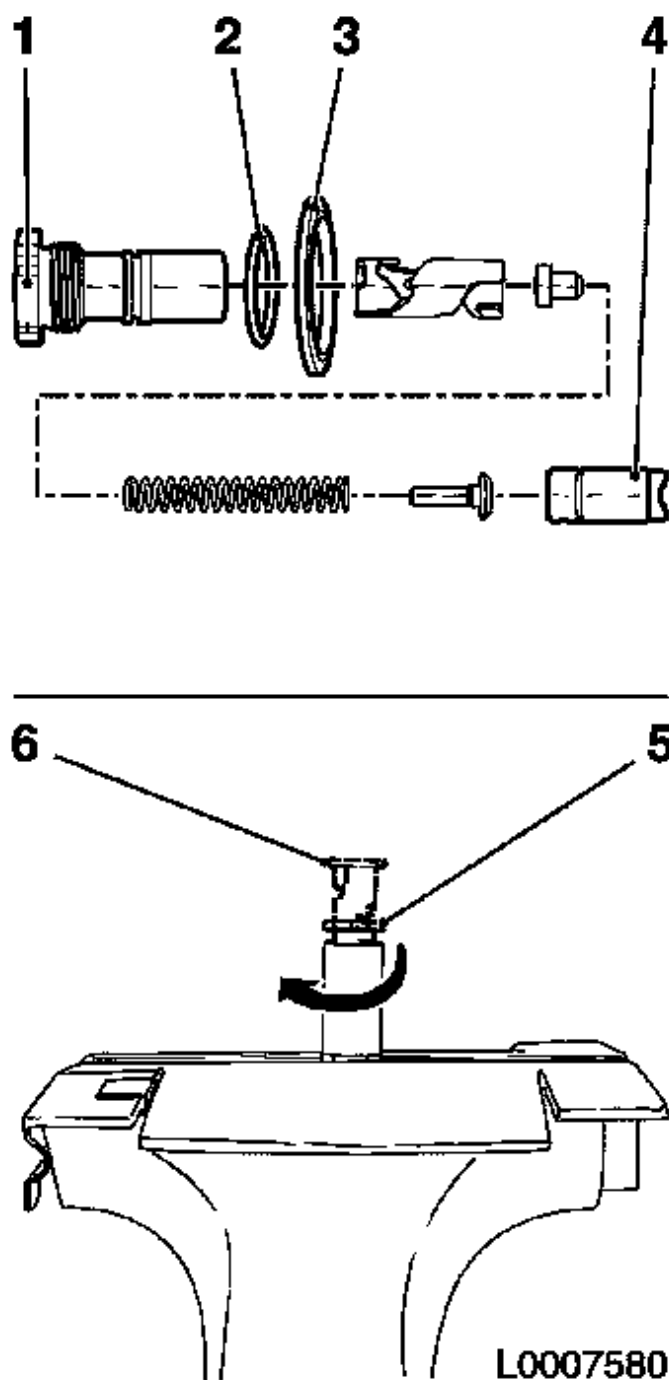
- Coat the bolts with thread locking compound (red) and insert them.
 - Tightening torque **8 Nm**



L 5715

65. Install the camshaft timing chain tensioner.

- Pull out the piston (4) from the housing (1).
 - Clamp the piston at the square into a vice.
 - Turn clockwise to lock the internal piston (6) in the last latch position (5).
 - Insert the piston into the housing.
- Use new oil seals (2) and (3).
- Tightening torque **75 Nm**



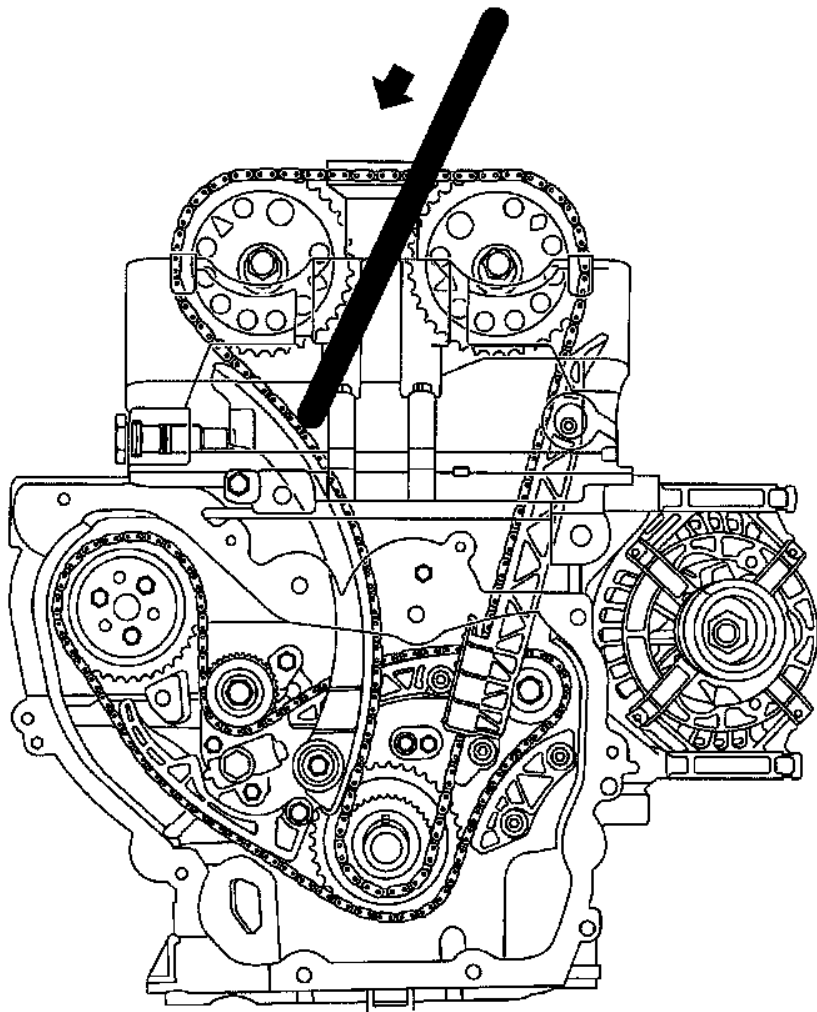
Important: Failure to follow this instruction could cause the camshaft timing chain to jump.

66.

Release the camshaft timing chain tensioner by pressing on the tensioner rail or the camshaft timing chain (using a blunt tool – e.g. a smooth-edged assembly lever).

Note: If the TDC markings no longer line up with the

coloured chain links, refit the camshaft timing chain. Once the crankshaft has been rotated another turn they will no longer line up.

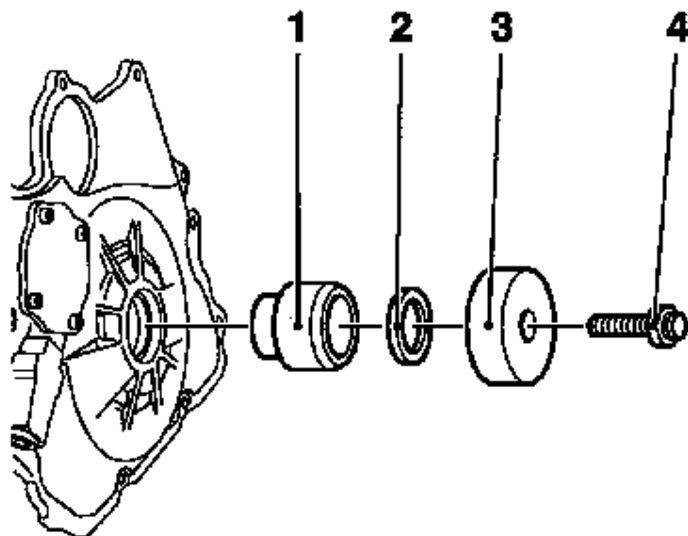


J 0935

67. Install the timing case.

Note: Remove the plastic wedge and the cloth from the opening in the timing case.

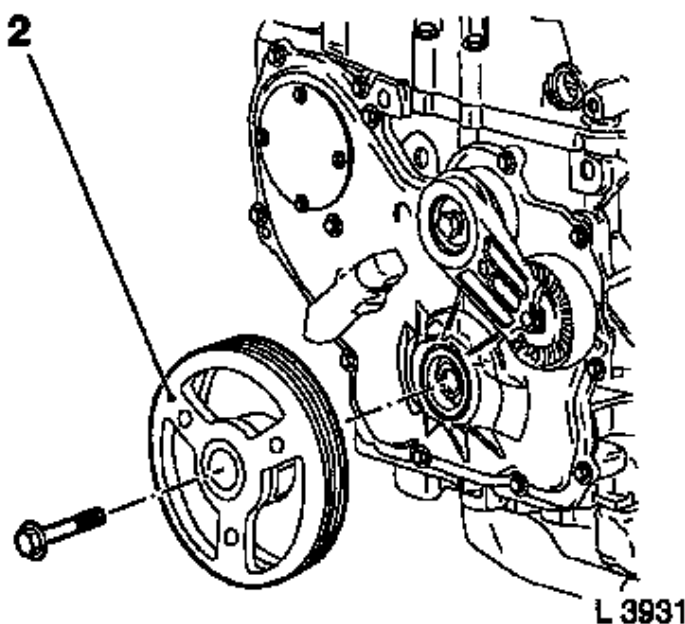
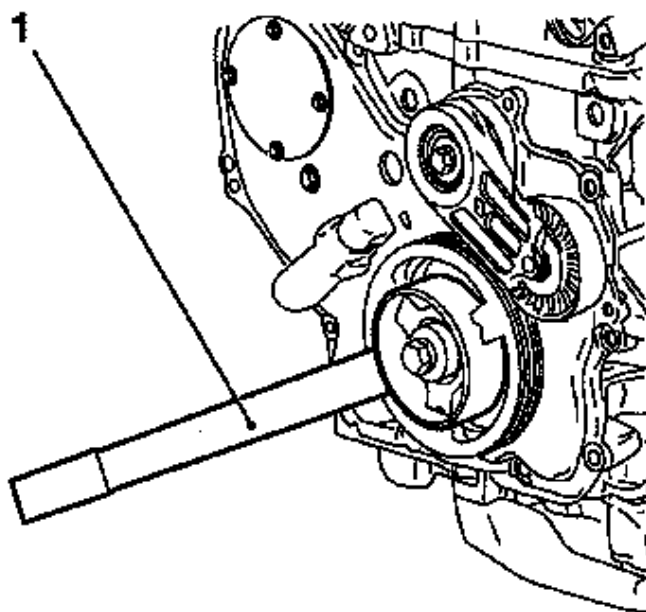
- Use a new gasket.
- Tightening torque **21 Nm**
- Install the crankshaft front oil seal (2).
 - Slide protective sleeve (1) from **KM-6105** (3) onto the connecting rod journal.
 - Coat the sealing lips with silicone grease (white).
 - Slide the oil seal over the protective sleeve onto the connecting rod journal.
 - Use **KM-6105** to press the oil seal into the timing case.
 - Use bolt (4) of the rotational vibration damper.
 - Take out **KM-6105**.



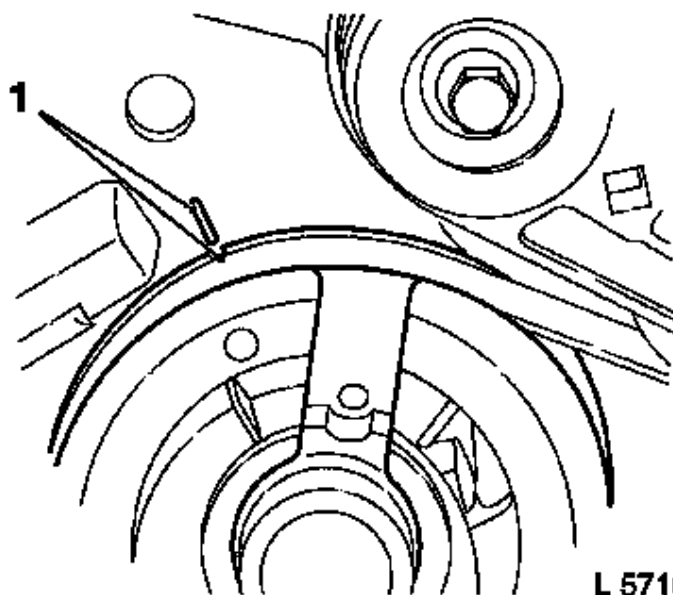
L 3952

68. Attach the rotational vibration damper (2).

- Use holding adapter **KM-J-38122-A** in conjunction with **KM-956-1** (1) to hold.
- Use a new bolt.
- Tightening torque **100 Nm + 75° + 15°**

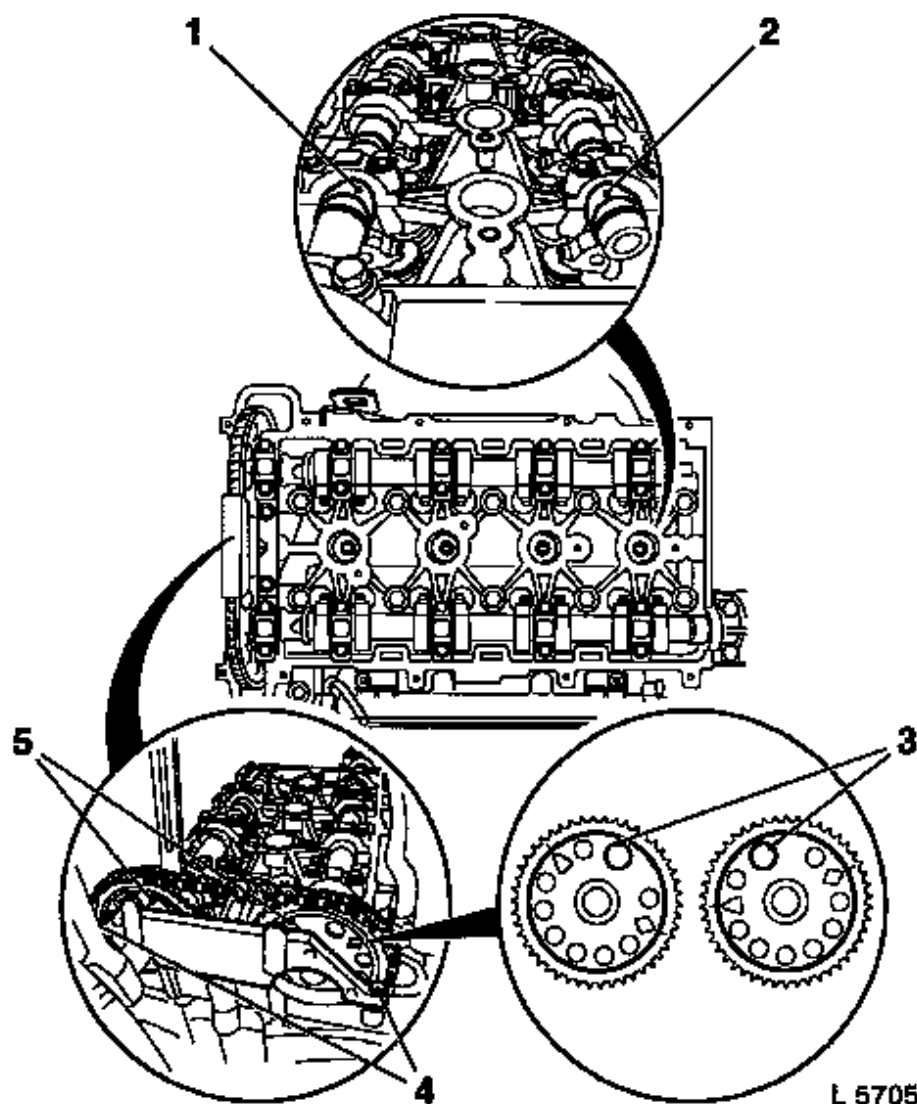
**69.** Check the valve timing.

- Use the retaining bolt of the rotational vibration damper to rotate the engine in the normal direction of rotation **720°**.
- Rotate the engine further in the normal direction of rotation to TDC on cylinder no. 4 (marking 1).

**70. Note:**

In this position the cams (1) and (2) of cylinder no. 4 must point upwards.

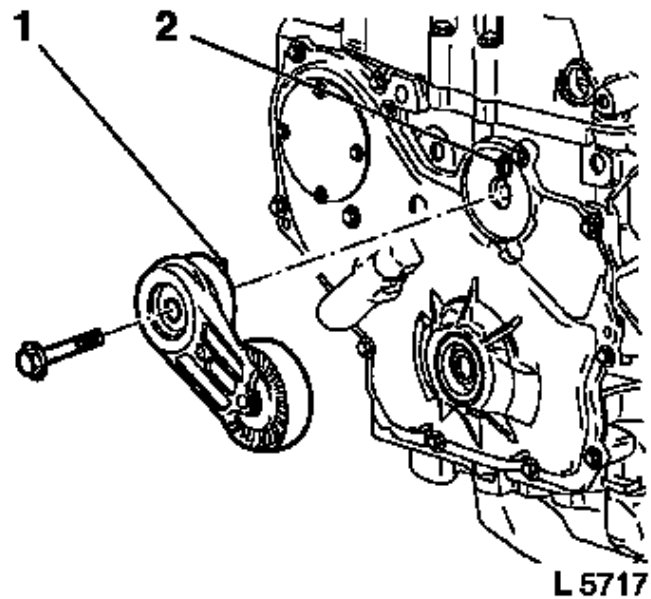
- Attach **KM-6148** with the enclosed bolts (4).
- Slide the positioning bolts (5) into the designated bores (3) on the camshaft sprockets.
- Detach **KM-6148**.



71. Attach the ribbed V-belt tensioner.

Note: The lug (1) of the ribbed V-belt tensioner engages into the bore in the timing case (2).

- Tightening torque **43 Nm**



72. Install the ribbed V-belt.

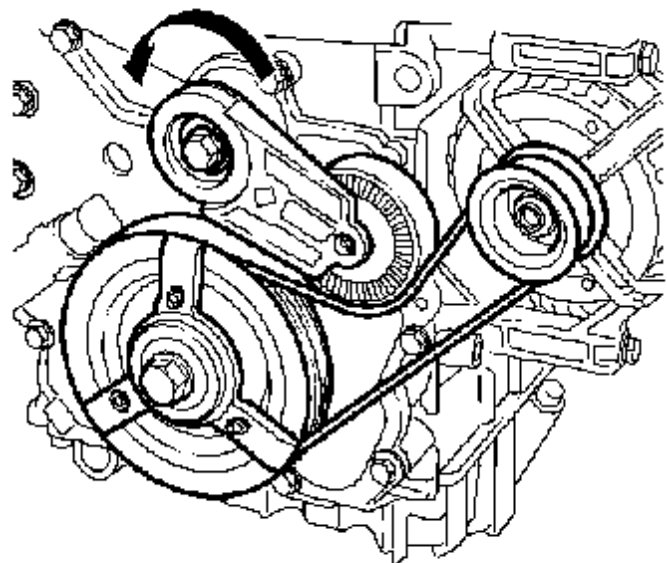
- Lay the ribbed V-belt in place.
- Note:** Note the running direction and installation position of the ribbed V-belt.
- Tension the ribbed V-belt tensioner in the direction of the arrow with **KM-6151**.

73. Attach the engine damping block bracket.

- Tightening torque **50 Nm**

74. Attach the flywheel.

- Recut the thread in the crankshaft.
- Use new bolts.
- Tightening torque **53 Nm + 25°**
- Detach **KM-652**.

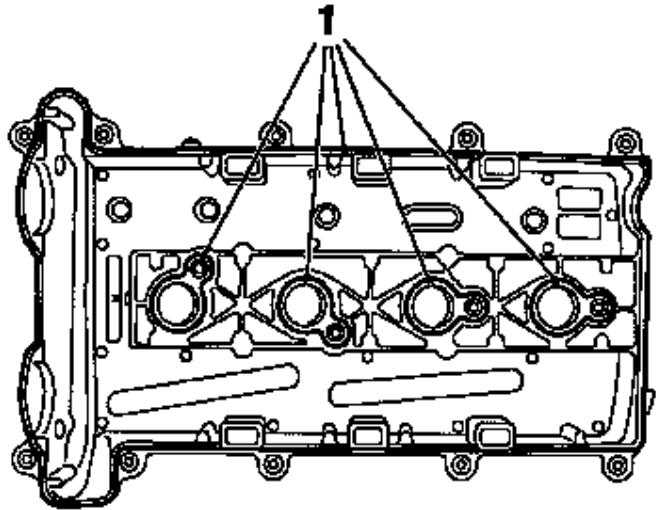


75. Attach the cylinder head cover

- Clean the sealing surfaces.
- Use new gaskets.
- Note:** The sealing lips of the seals (1) must be inserted into the groove on the cylinder head cover.
- Attach the ground cable
- Tightening torque **9 Nm**

76. Attach the ignition module.

- Tightening torque **9 Nm**



L 5706

77. Reattach the manual transmission to the engine.
Note: See operation "Manual Transmission and Engine, Separate and Reattach"
78. Install the engine.
Note: See operation "Engine, Remove and Install –"
79. Fill up with engine oil and correct as required.