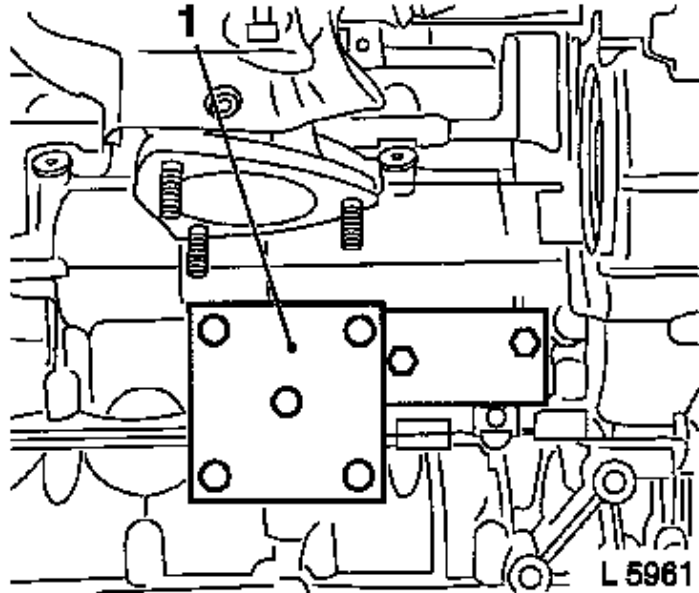


Balancer Shafts, Remove and Install (Engine Removed) (Z 22 SE)

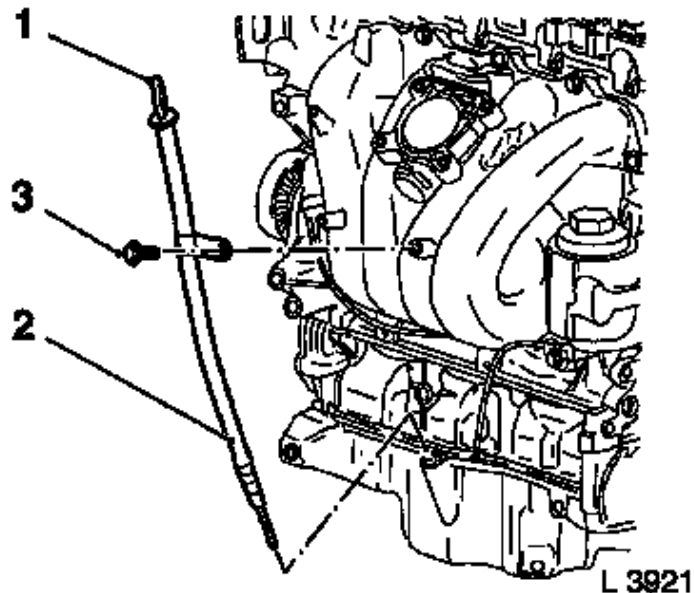


Remove

1. Remove the engine
Note: See operation "Engine, Remove and Install".
2. Attach the adapter **KM-412-27** (1) on the exhaust side.

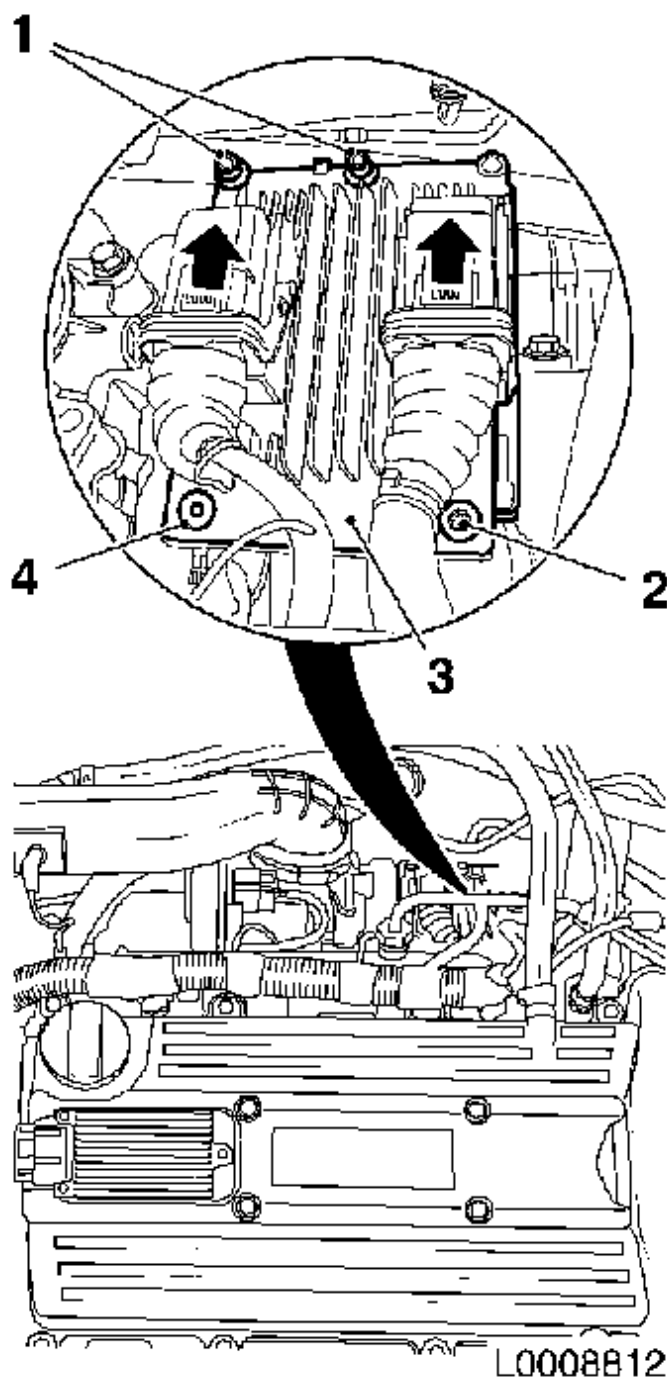


3. Remove the oil dipstick guide tube (2).
 - Pull the oil dipstick out of the oil dipstick guide tube.
 - 1 bolt (3)
 - Pull the oil dipstick guide tube out of the oil pan.

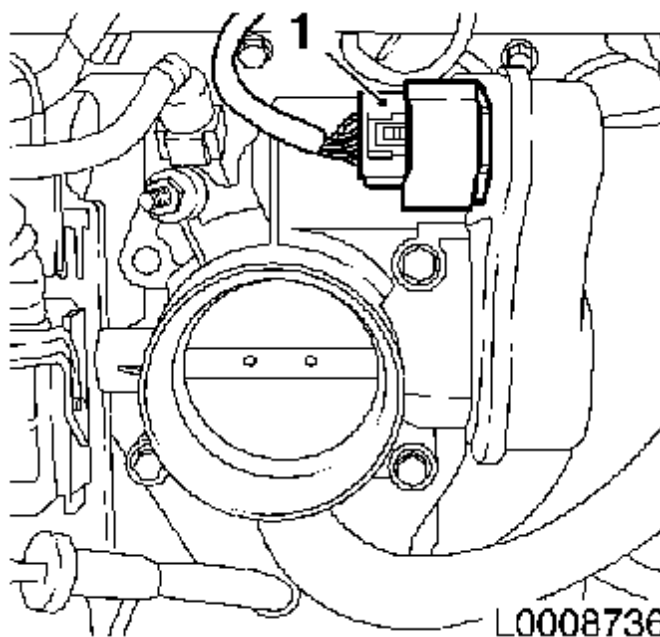


4. Drill out the shear bolt (4).
 - Centre-punch
 - Pre-drill
 - Use a 3 mm drill.
 - Max. depth 10 mm
 - Drill out

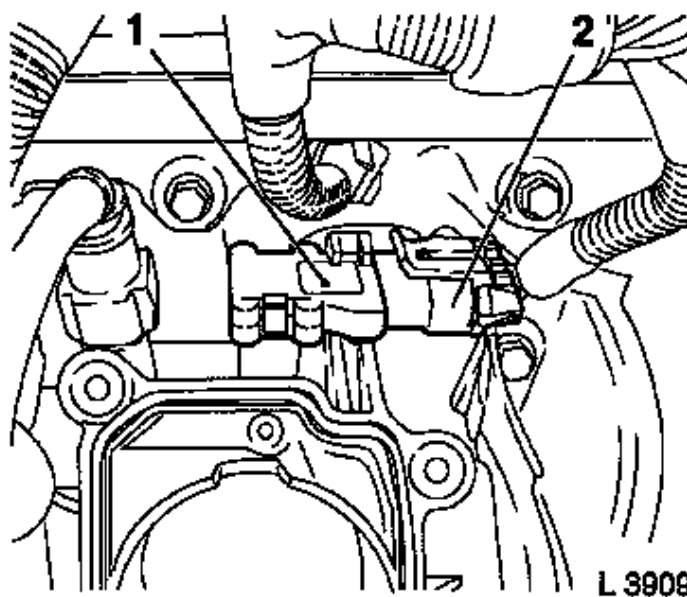
- Use a 6.5 mm drill.
 - Until the head of the bolt comes free.
5. Remove retaining bolt (2).
 6. Remove the bridge piece (3).
 - Reposition the ground cable to one side.
 7. Remove the retaining bolts (1).
 - 2 bolts
 8. Take out the engine control unit.



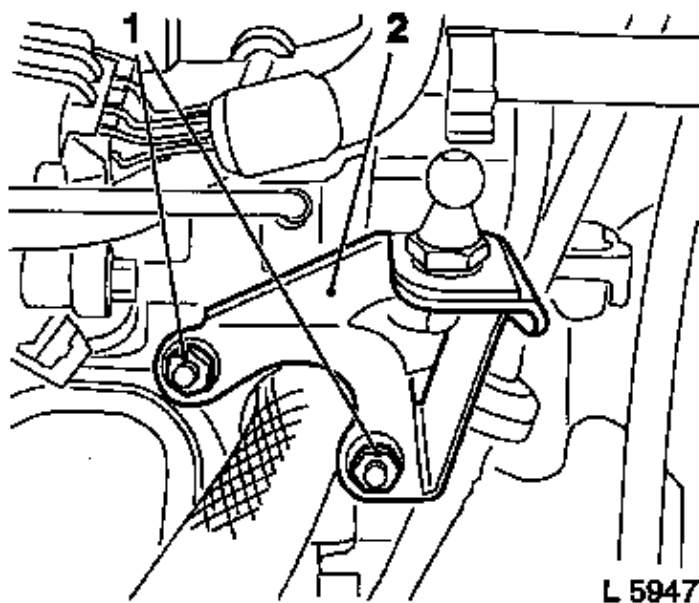
9. Detach the throttle body wiring harness connector (1).
 - Release the wiring harness connector.



10. Detach the wiring harness connector (2) from the intake manifold pressure sensor (1).

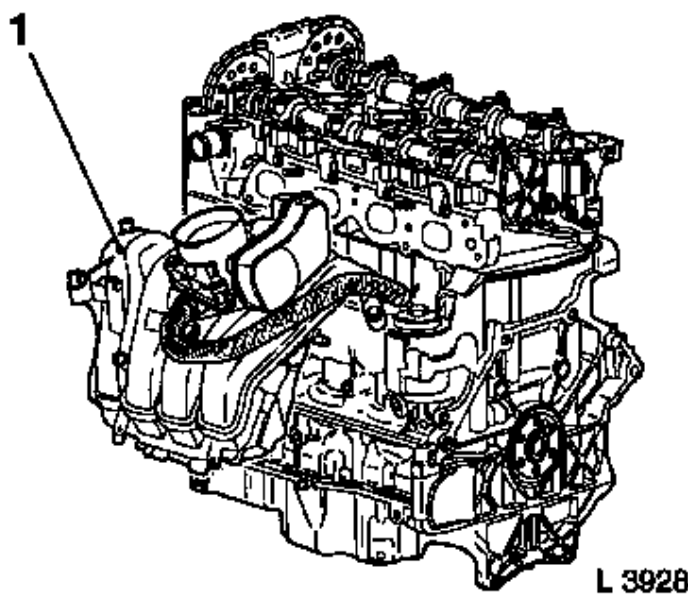


11. Unbolt the exhaust gas recirculation pipe.
- Engine cover bracket (2)
 - 2 nuts (1)
 - 2 bolts



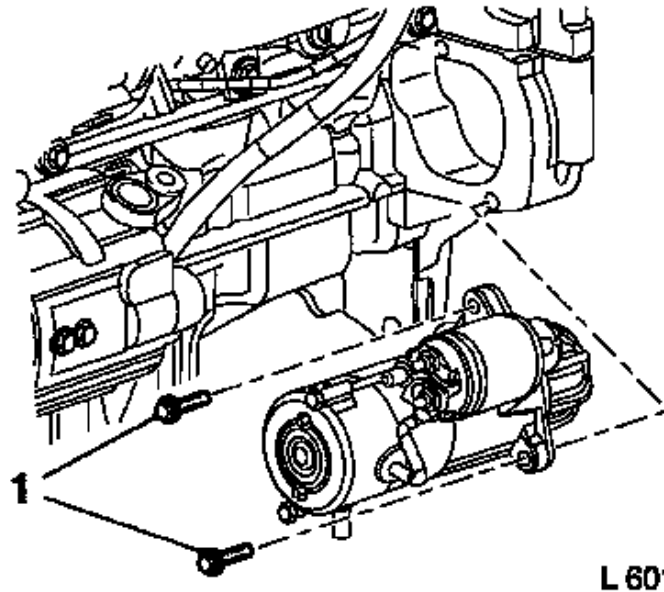
12. Detach the intake manifold (1).

- 4 clips
- 5 bolts, 2 nuts

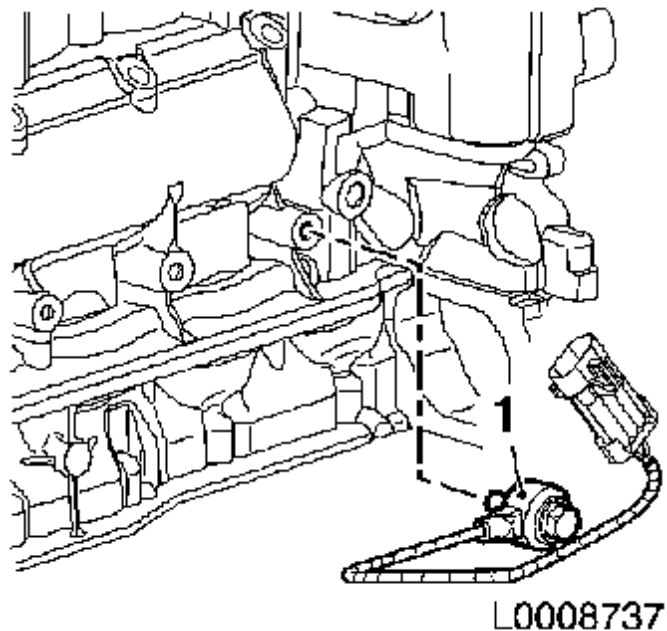


13. Remove the starter.

- 2 bolts



14. Remove the knock sensor (1).
 - Detach the wiring harness connector.

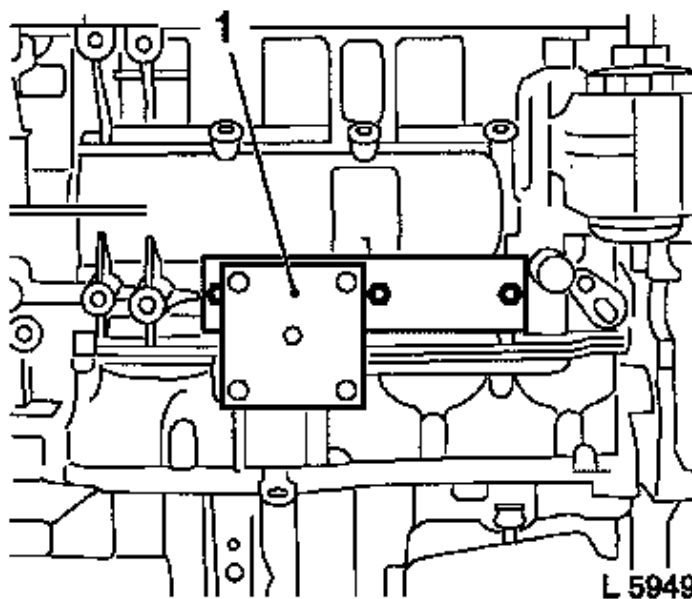


15. Attach the adapter **KM-412-27** (1) on the intake side.
16. Attach the engine to the assembly stand **KM-412**.

Note: 2 technicians required

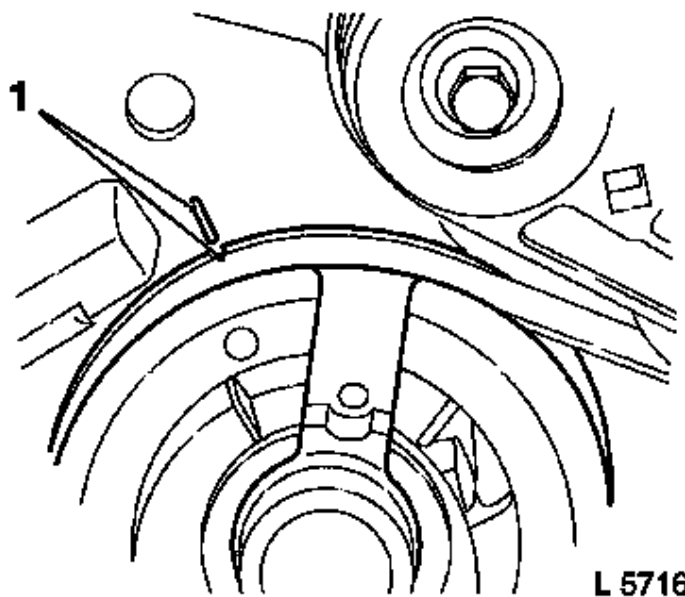
 - Detach the retaining cables from the engine lifting eyes.
17. Place a drip tray underneath.
18. Drain the engine oil.
 - Open the oil drain plug.
 - Install the oil drain plug using a new oil seal.

- Tightening torque **25 Nm**



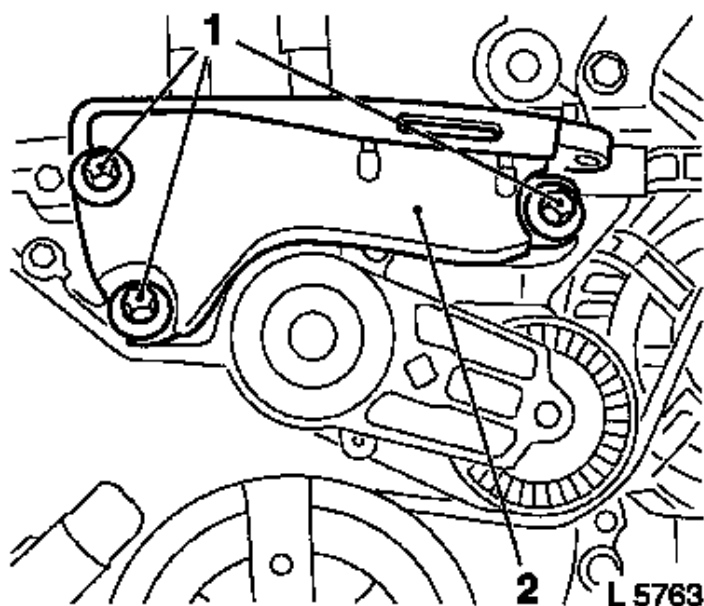
19. Align the crankshaft.

- Rotate the crankshaft in the normal direction of rotation to TDC on cylinder no. 4 (marking 1).



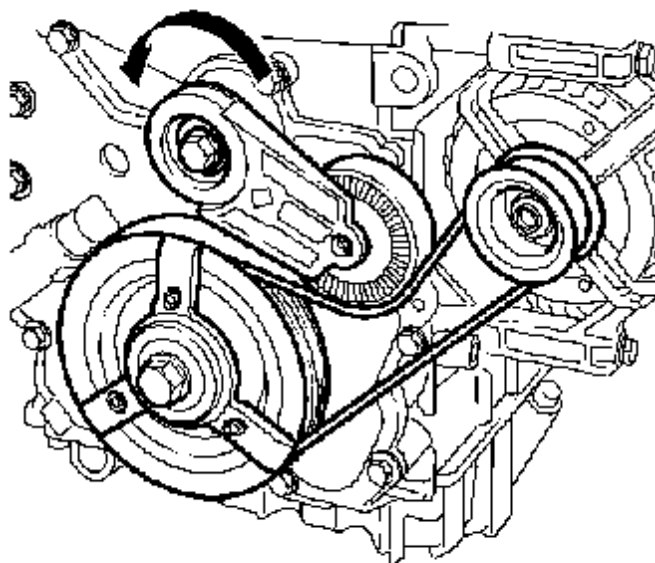
20. Detach the engine damping block bracket (2).

- 3 bolts (1)

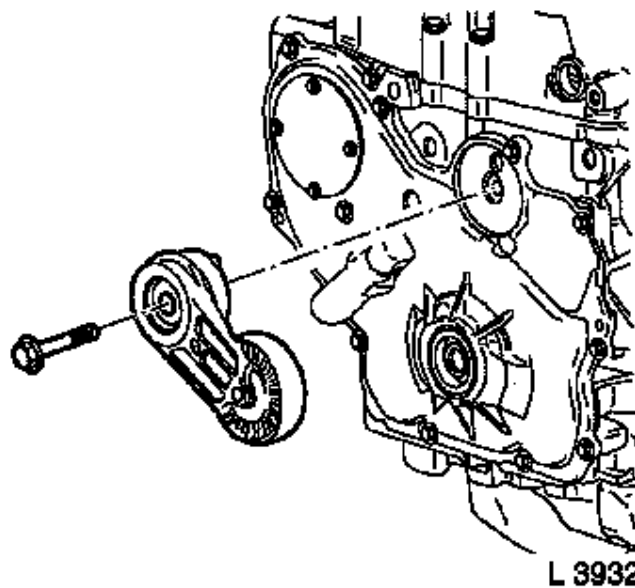


21. Remove the ribbed V-belt.

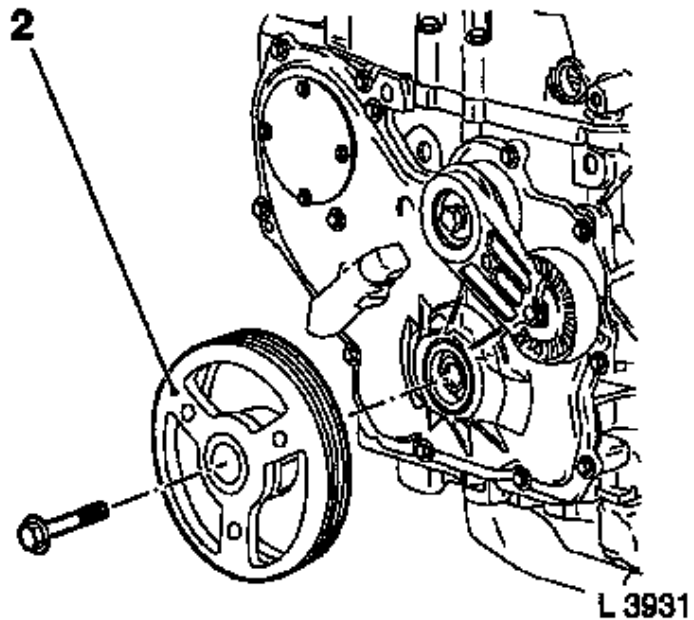
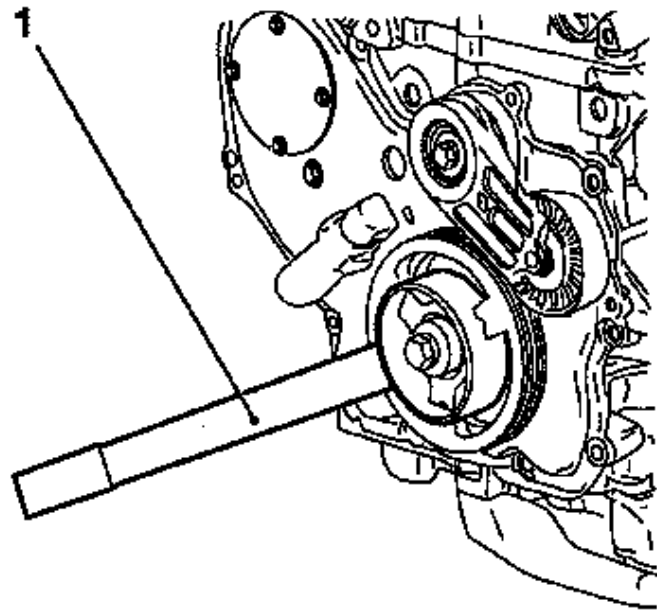
- Mark the running direction of the ribbed V-belt.
- Tension the ribbed V-belt tensioner in the direction of the arrow with **KM-6151**.
 - Take out the ribbed V-belt.



22. Detach the ribbed V-belt tensioner.



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

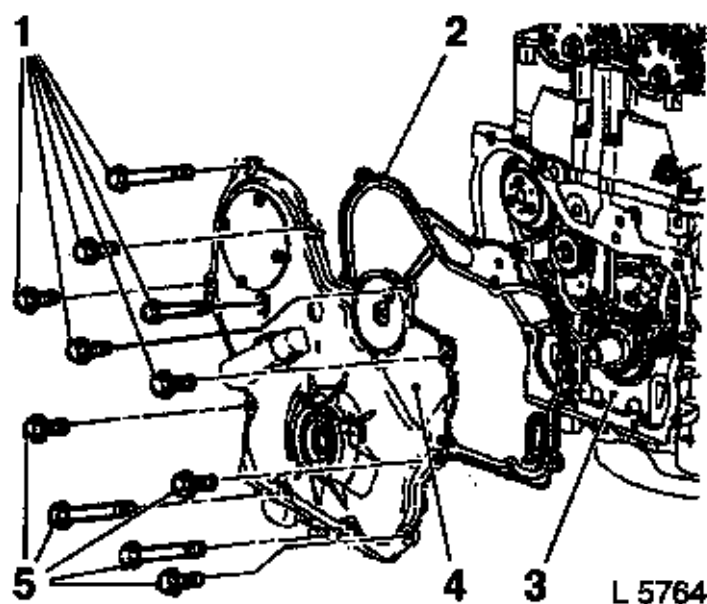


24. Detach the timing case (4).

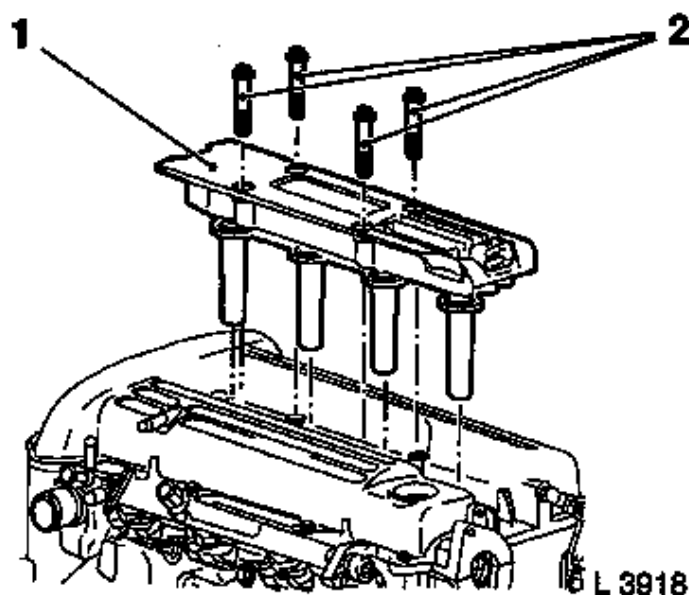
- 11 bolts (1) and (5)
 - Remove the gasket (2).
- Note:** Cover the opening (3) in the timing case with a cloth.
- Use a suitable tool to remove the oil seal.

Important: Do not damage the sealing surfaces.

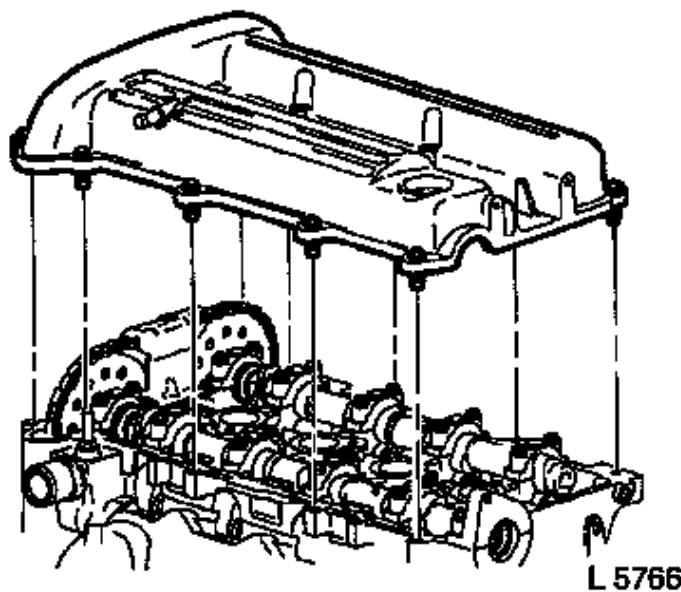
- Clean the sealing surfaces.



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

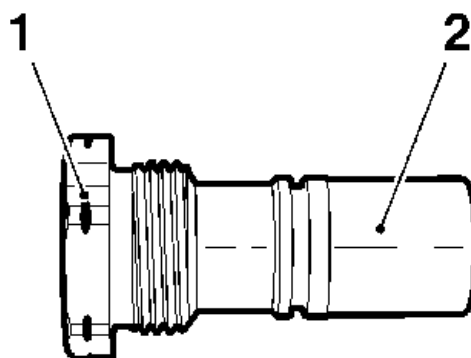


26. Detach the cylinder head cover.
- Detach the ground cable.
 - 14 bolts



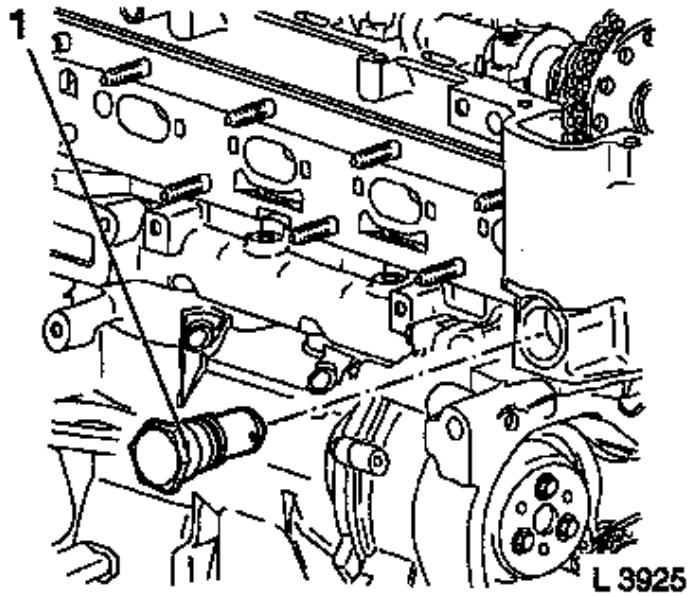
27. Note:

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).

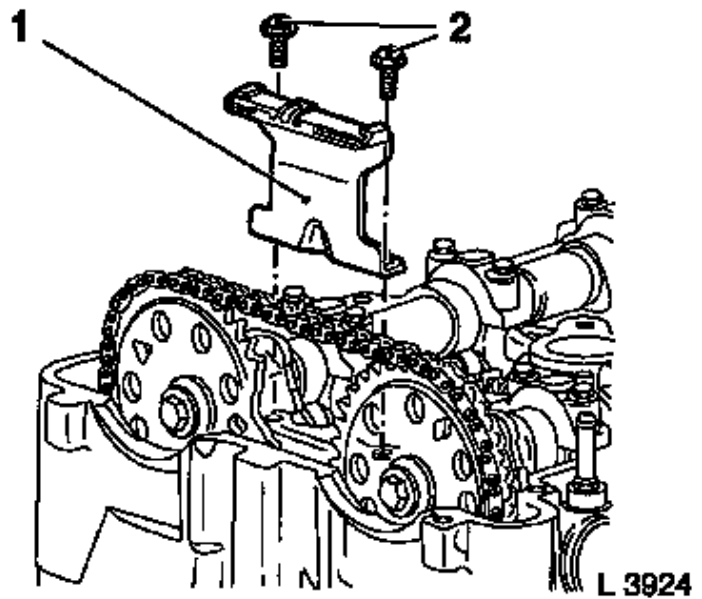


L0008542

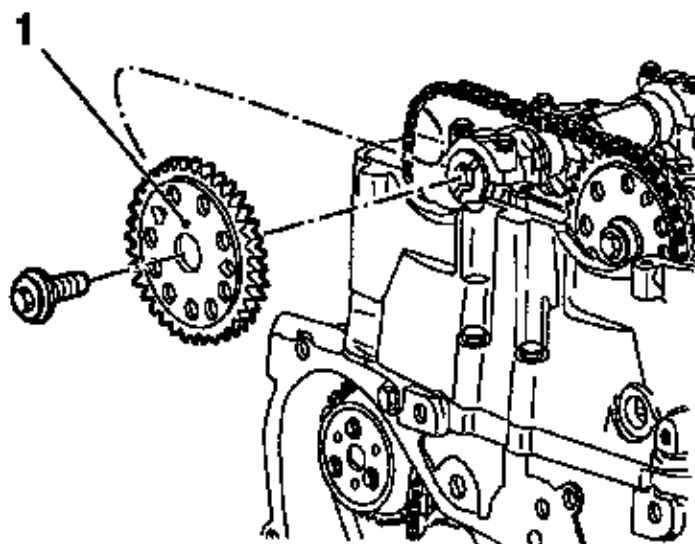
- 28.** Remove the camshaft timing chain tensioner (1).



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

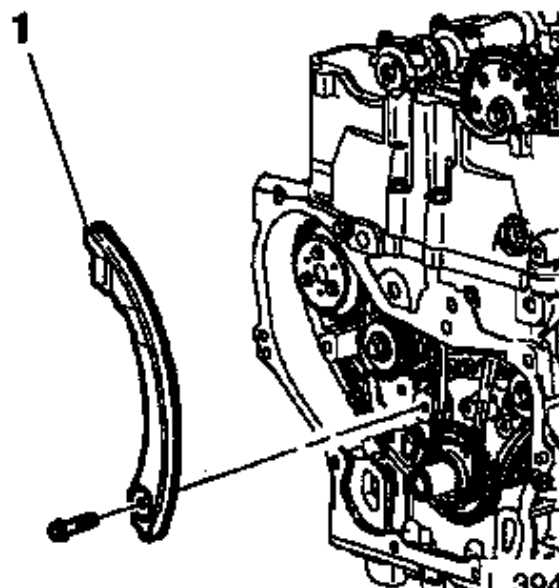


30. Remove the exhaust camshaft sprocket (1).
- Hold the exhaust camshaft by the hexagon.



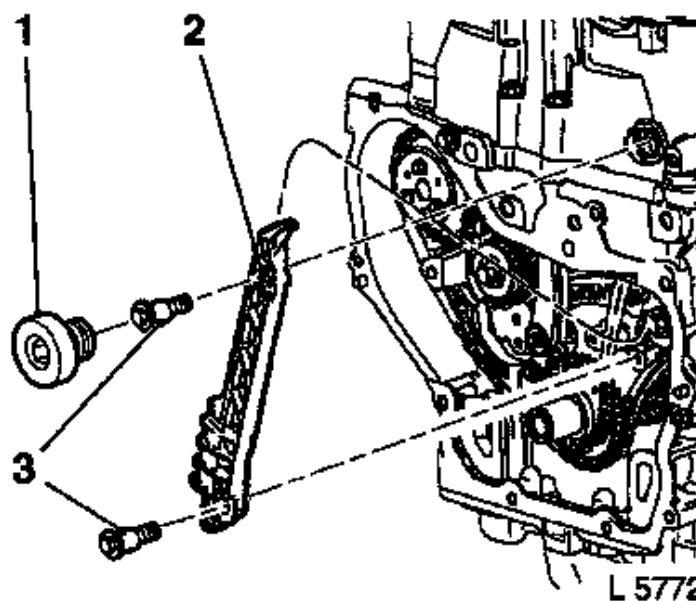
L 3926

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

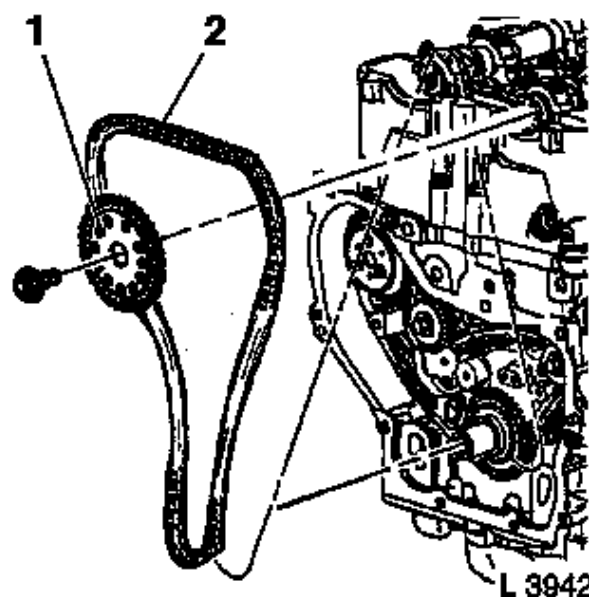


L 3941

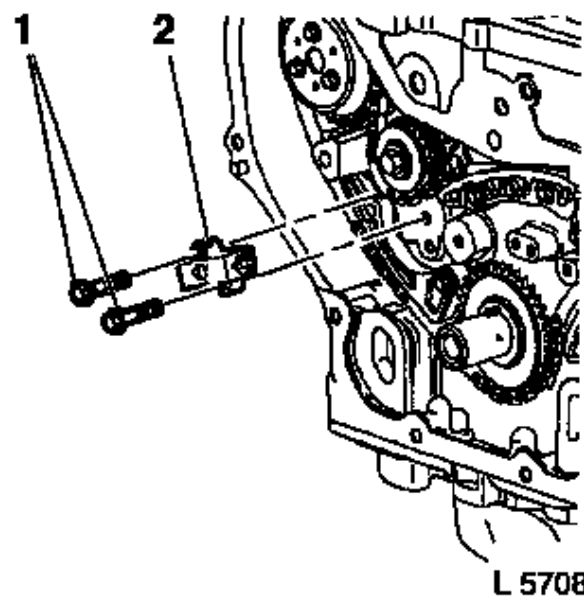
32. Remove the camshaft timing chain guide rail (2).
- Remove the screw plug (1).
 - 2 bolts (3)



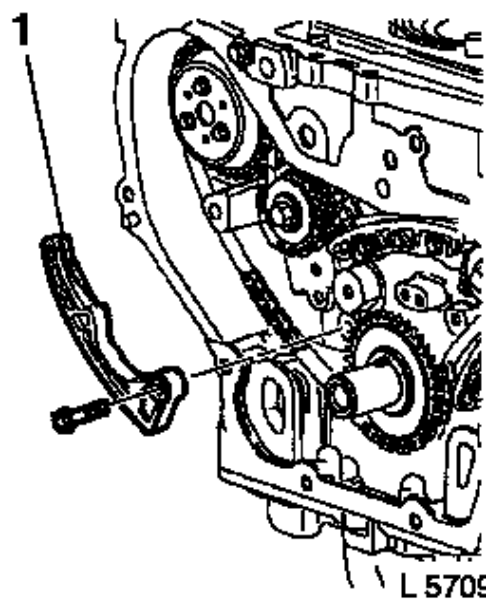
33. Remove the intake camshaft sprocket (1).
- Hold the intake camshaft by the hexagon.
34. Take out the camshaft timing chain (2).



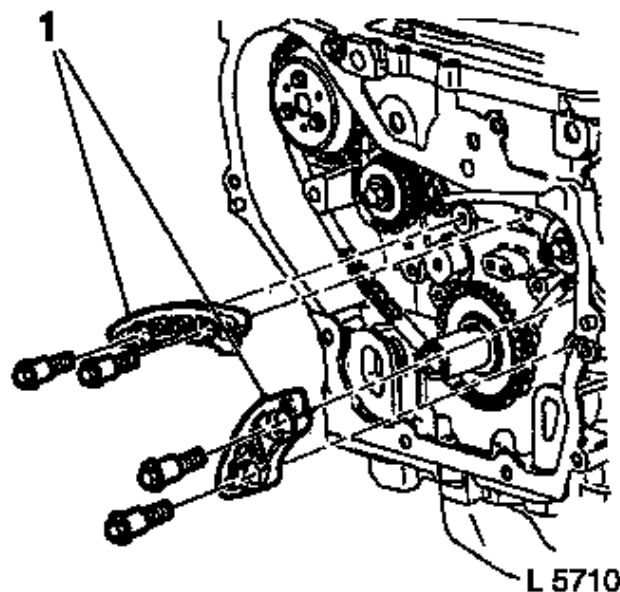
35. Remove the balancer shaft timing chain tensioner (2).
- 2 bolts (1)



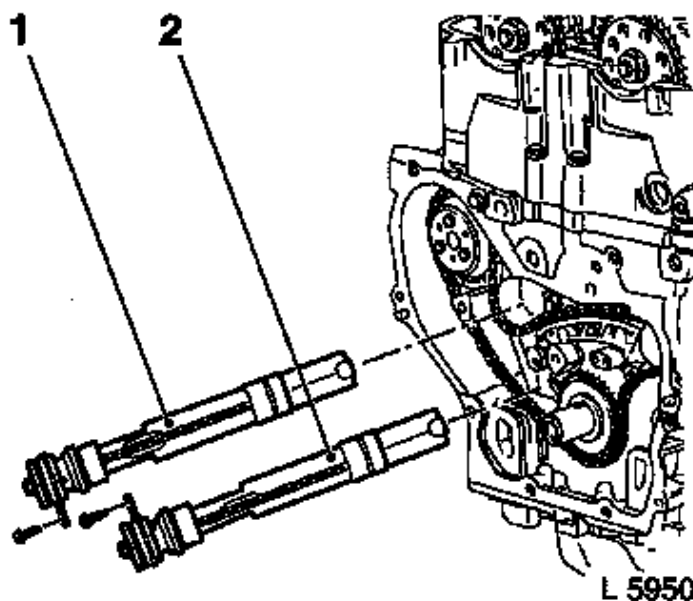
36. Remove the balancer shaft timing chain tensioner rail (1).



37. Remove the balancer shaft timing chain guide rails (1).
- 2 off
 - 4 bolts
38. Take out the balancer shaft timing chain.



39. Remove the balancer shaft on the exhaust side (1).
40. Remove the balancer shaft on the intake side (2).

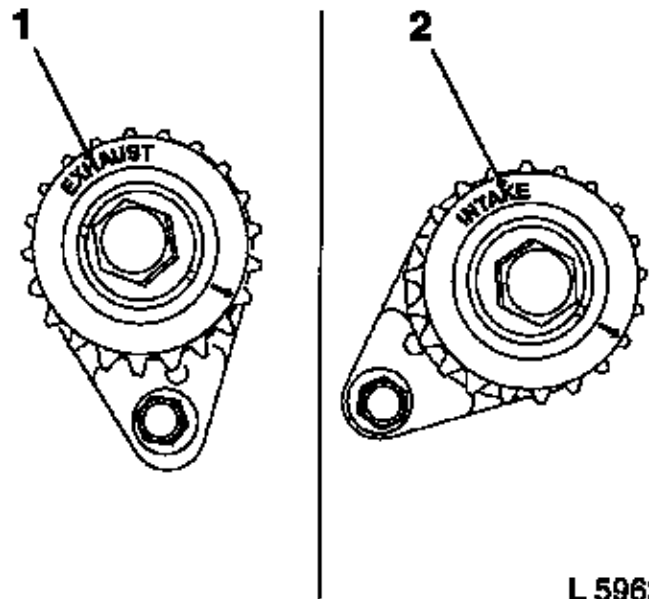
**Install**

41. Install the balancer shaft on the intake side.
- Important:** Note the identification marking (2) – do not mix up.
- Coat the sliding surfaces with engine oil.
 - Tightening torque **9 Nm**
 - Rotate the balancer shaft once (check for ease of movement).

42. Install the balancer shaft on the exhaust side.

Important: Note the identification marking (1) – do not mix up.

- Coat the sliding surfaces with engine oil.
- Tightening torque **9 Nm**
- Rotate the balancer shaft once (check for ease of movement).

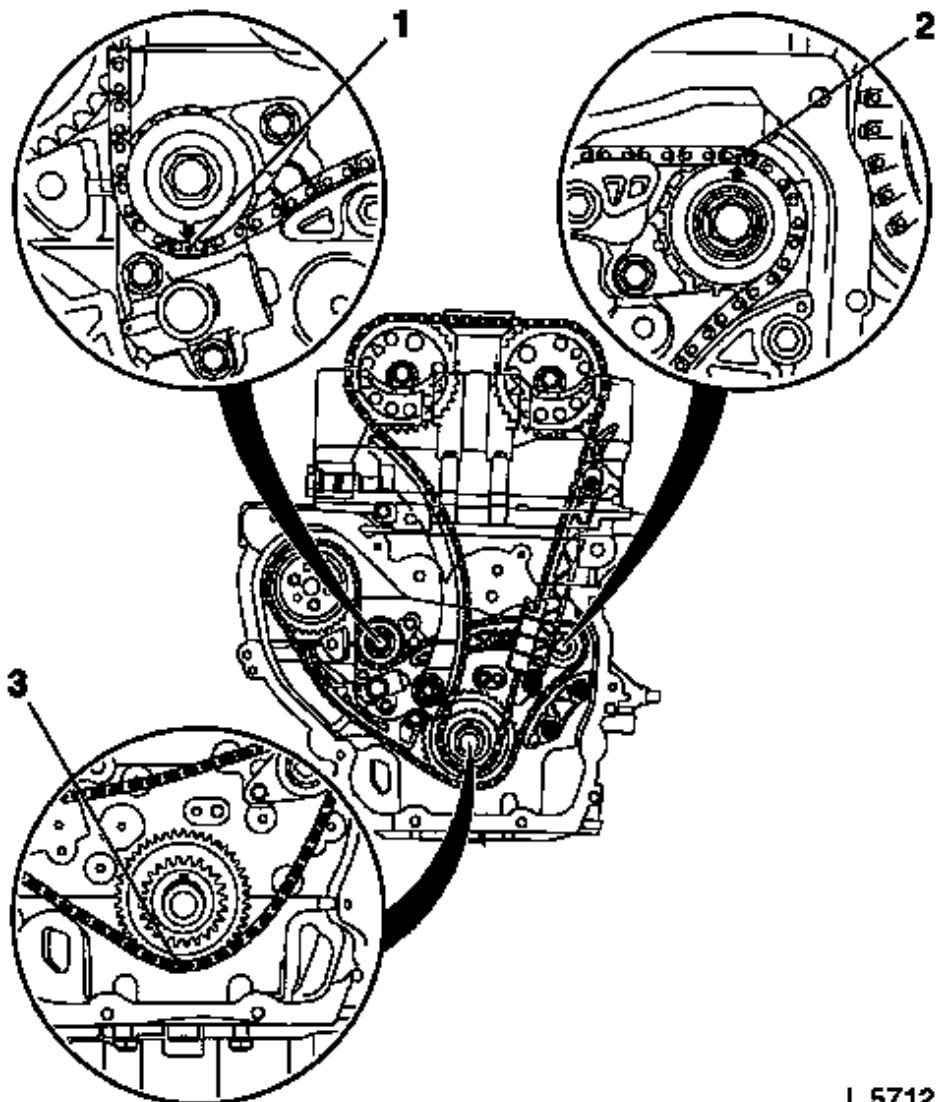


L 5962

43. 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.

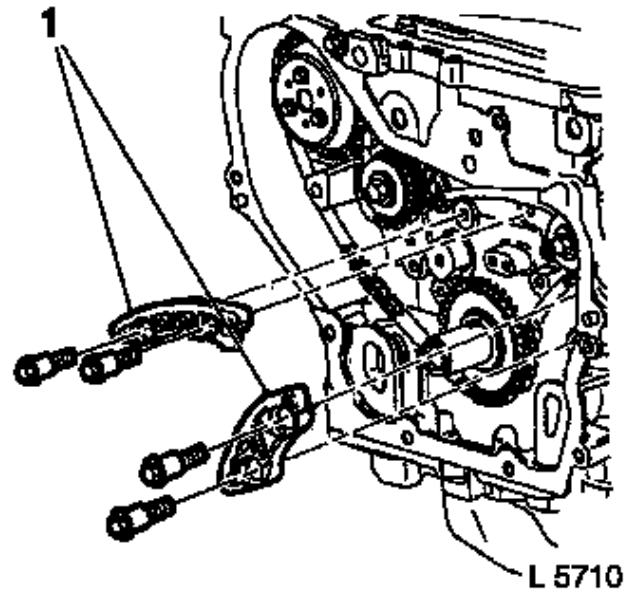
- Lay the timing chain in place.
 - Chain link (2) (copper coloured) to the marking on the balancer shaft on the intake side of the engine.
 - Secure the chain link (3) with a plastic wedge at the marking on the balancer shaft timing chain sprocket.
 - Chain onto coolant pump sprocket
 - Chain link (1) to the



L 5712

marking on
the balancer
shaft on the
exhaust side
of the
engine.

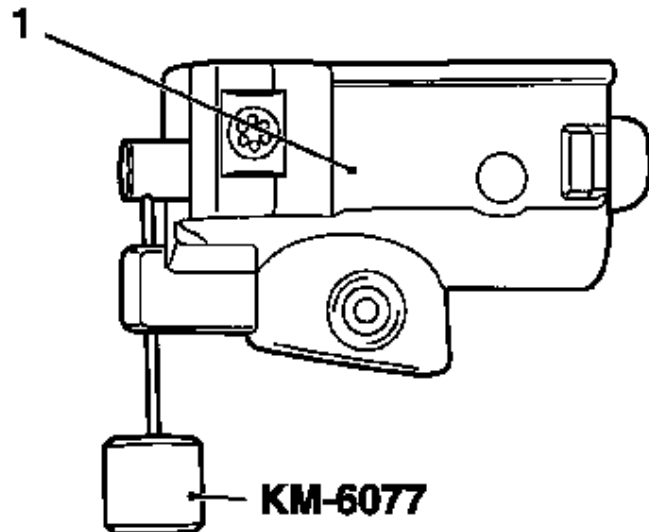
44. Install the balancer shaft timing chain guide rails (1).
 - Tightening torque **10 Nm**
45. Install the balancer shaft timing chain tensioner rail.
 - Tightening torque **9 Nm**



46. Install the balancer shaft timing chain tensioner.
 - 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**.

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

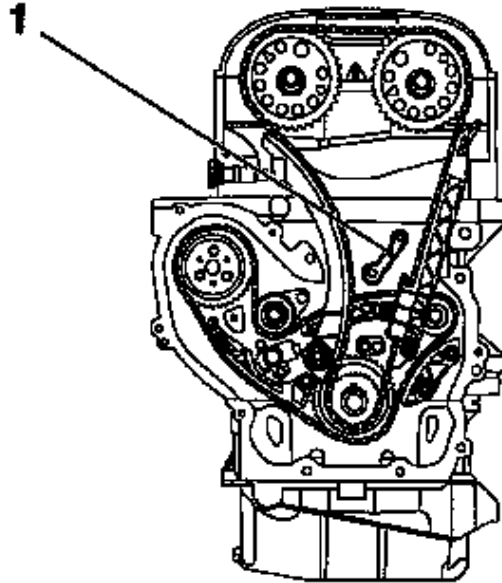
 - If the TDC markings no longer line up with the coloured chain links – refit the camshaft timing chain.



47. Insert the camshaft timing chain.

Note: Working from the top left and right, insert the timing chain past the central web (1).
48. 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**

49. 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.

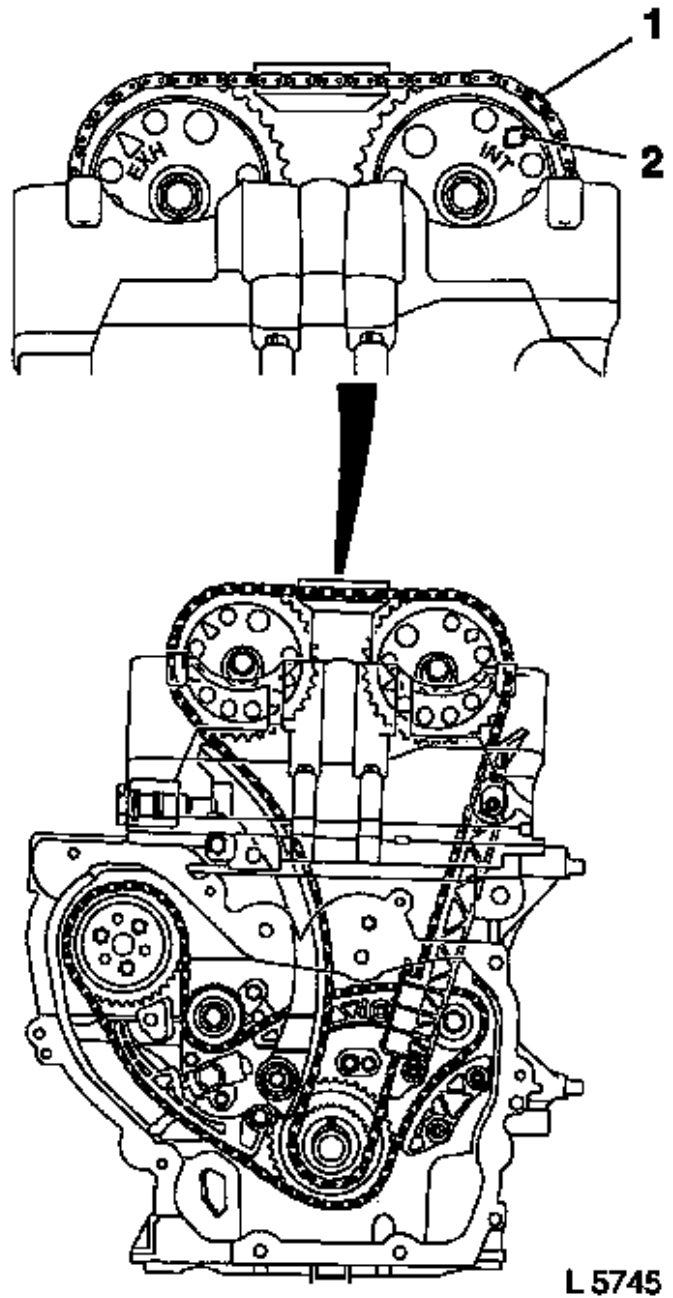
- Chain link (copper colour) (1) to INT marking (2) on the intake camshaft sprocket

50. Install the camshaft timing chain tensioner rail.

- Insert from above.
- Tightening torque **10 Nm**

51. Install the camshaft timing chain guide rail.

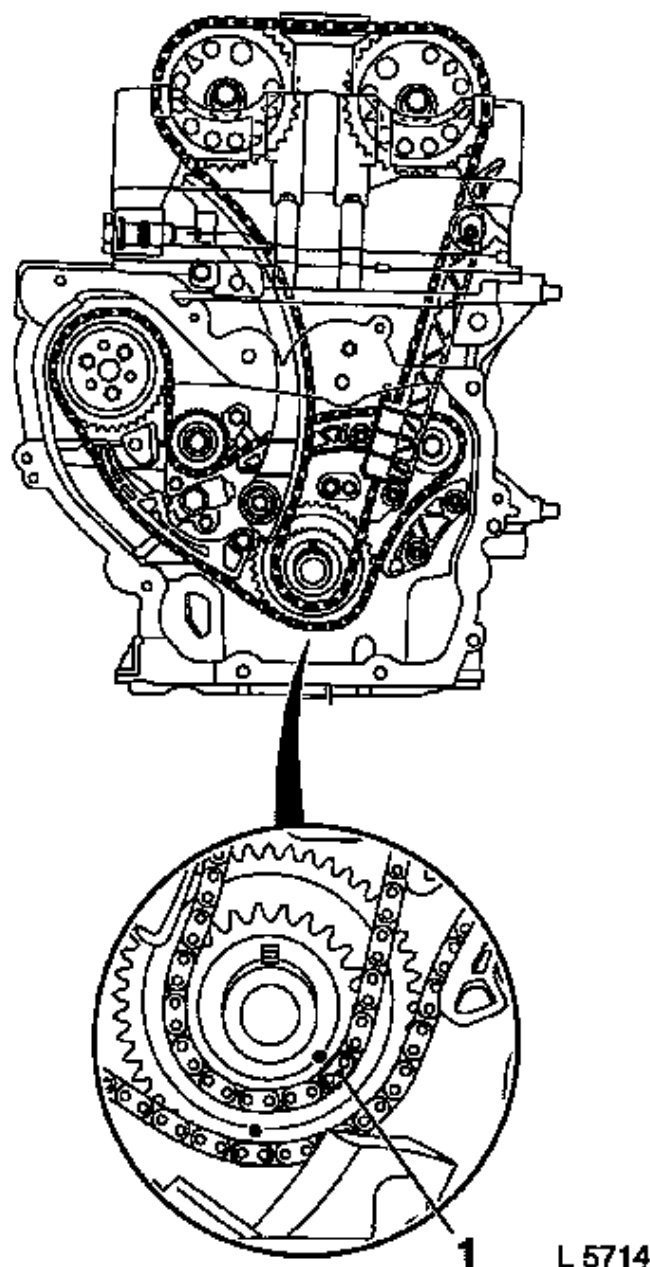
- Tightening torque **10 Nm**
- Install the screw plug.
 - Tightening torque **65 Nm**



52. 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



53. Install the exhaust camshaft sprocket.

Important: Check that the TDC reference points line up.

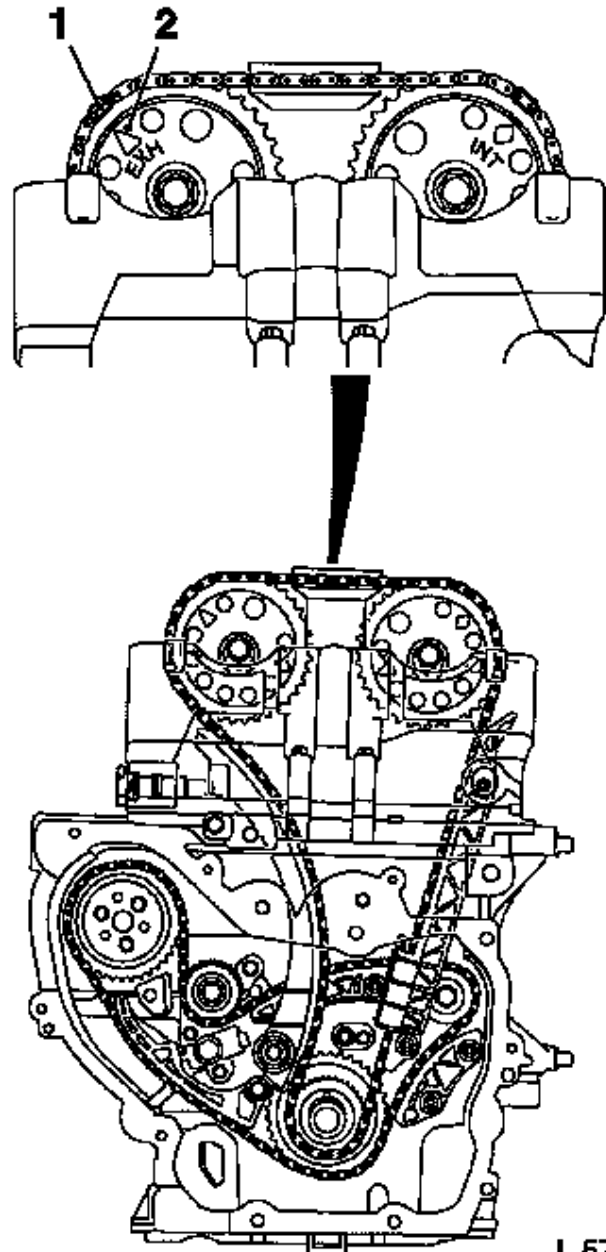
- Chain link (1) to EXH marking (2) on the exhaust camshaft sprocket
- Rotate the exhaust camshaft by the hexagon until the exhaust camshaft sprocket is seated in the guide.
- Use a new bolt.
- Hold the camshaft by the hexagon.
 - Tightening torque **85 Nm + 30° + 15°**

54. Recut the thread.

- 2 off

55. Install the guide rail.

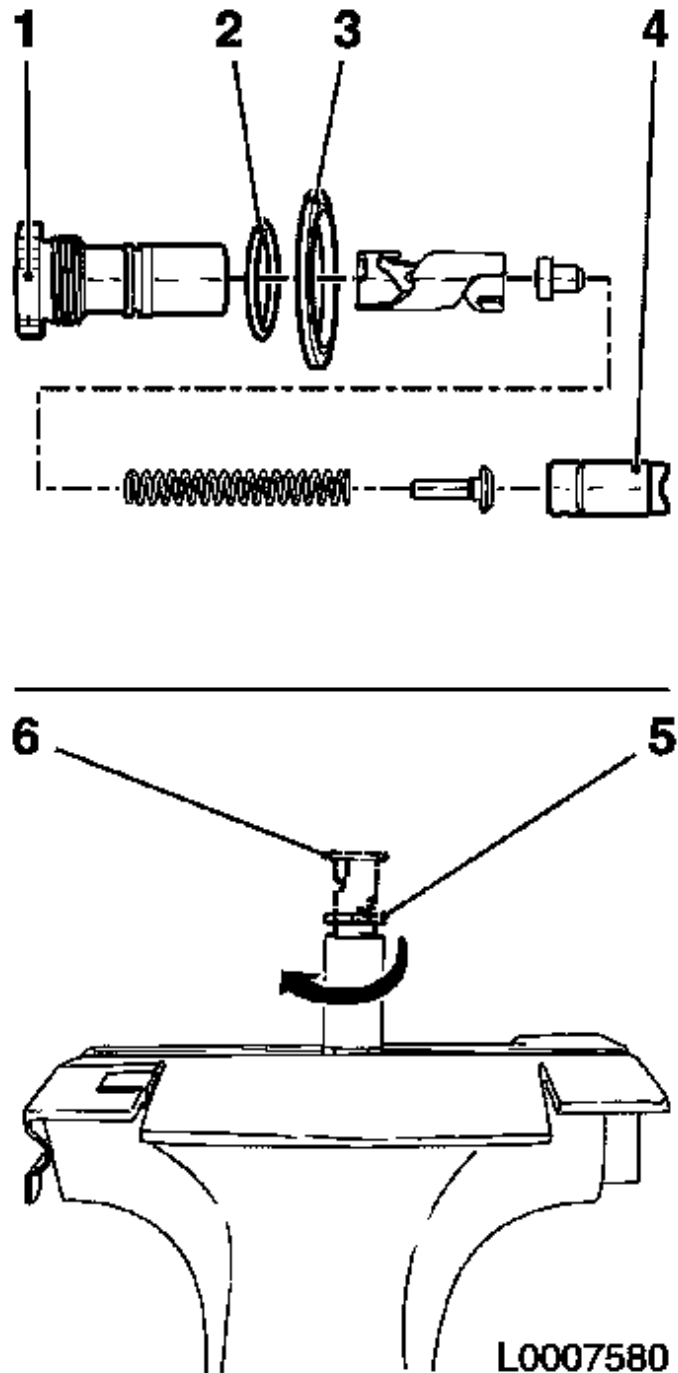
- Coat the bolts with thread locking compound (red) and insert them.
 - Tightening torque **8 Nm**



L 5715

56. 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**



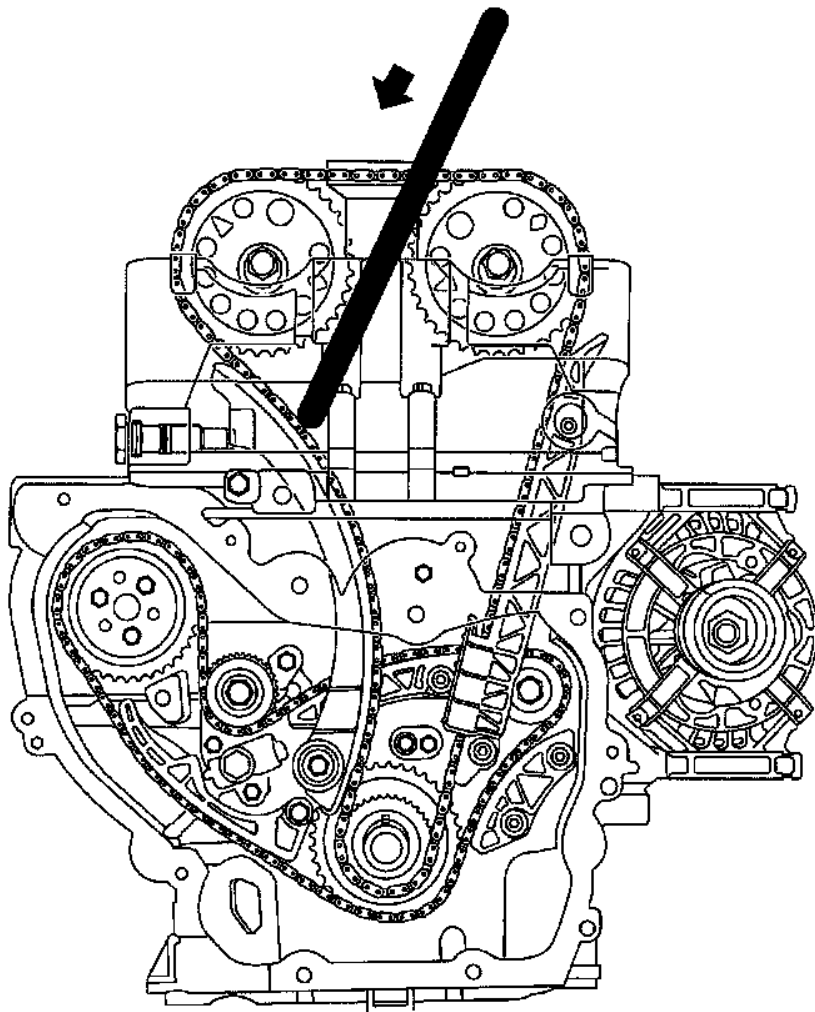
Important: Failure to follow this instruction could cause the camshaft timing chain to jump.

57.

Release the camshaft timing chain tensioner by pressing on the tensioner rail or the camshaft timing chain (using a blunt tool – e.g. a rounded 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.

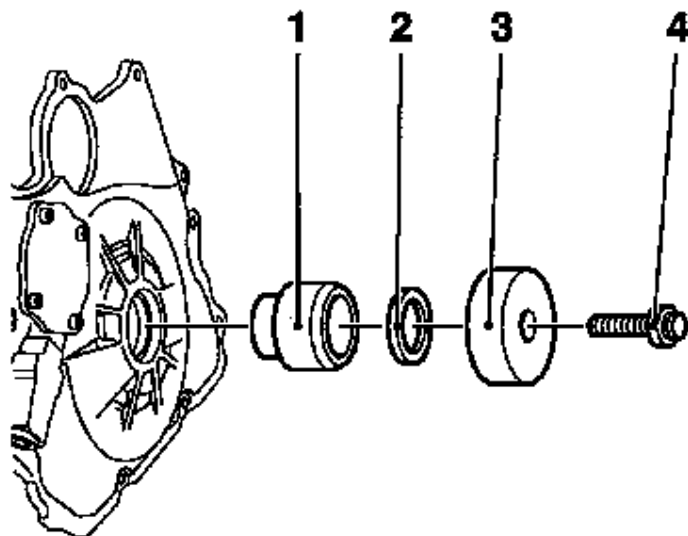


J 0935

58. Install the timing case.

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

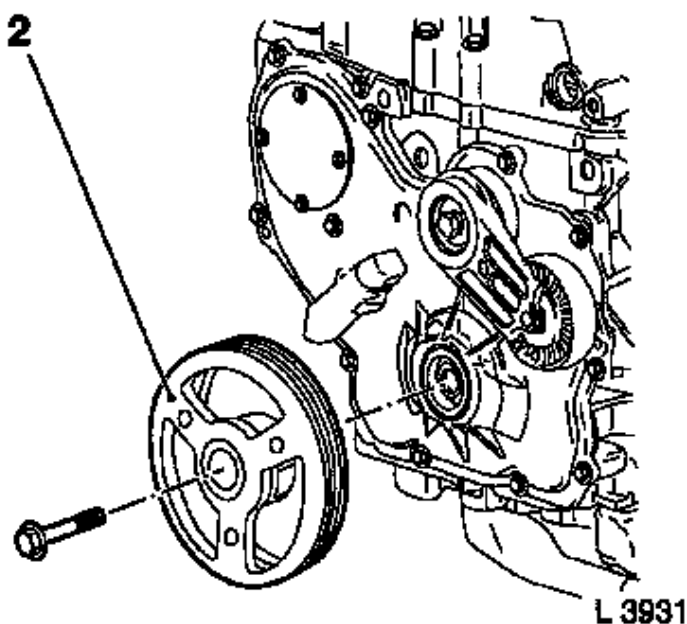
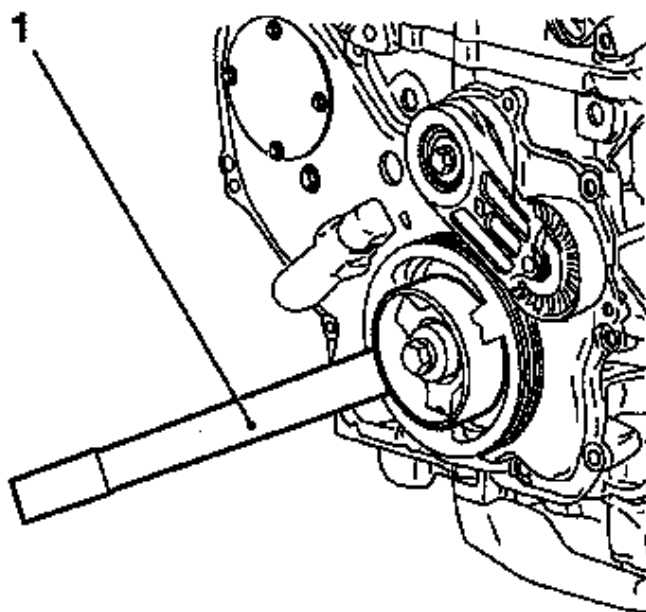
- Use a new gasket.
- Tightening torque **21 Nm**
- Install the crankshaft front oil seal (2).
 - Slide protective sleeve (1) from **KM-6105** (3) onto the connecting rod journal.
 - Coat the sealing lips with silicone grease (white).
 - Use **KM-6105** to press the oil seal into the timing case.
 -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



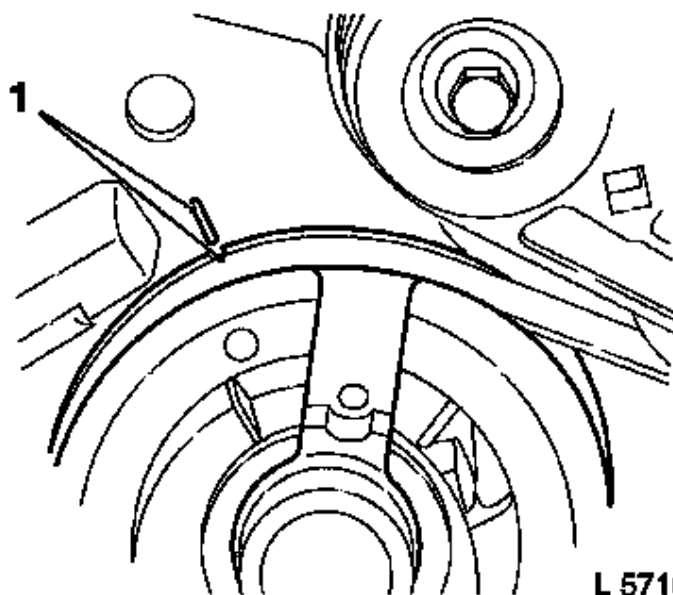
L 3952

59. 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°**

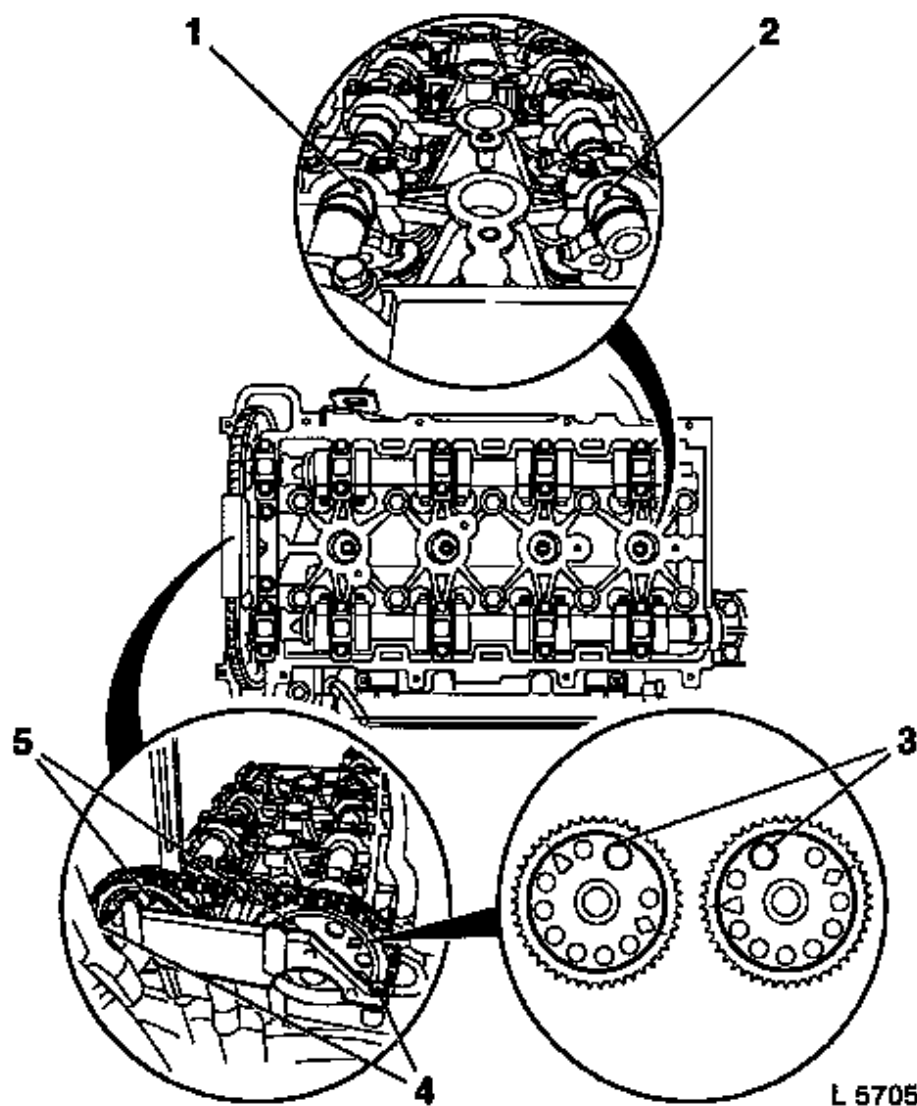
**60.** Check the valve timing.

- 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).

**61. Note:**

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

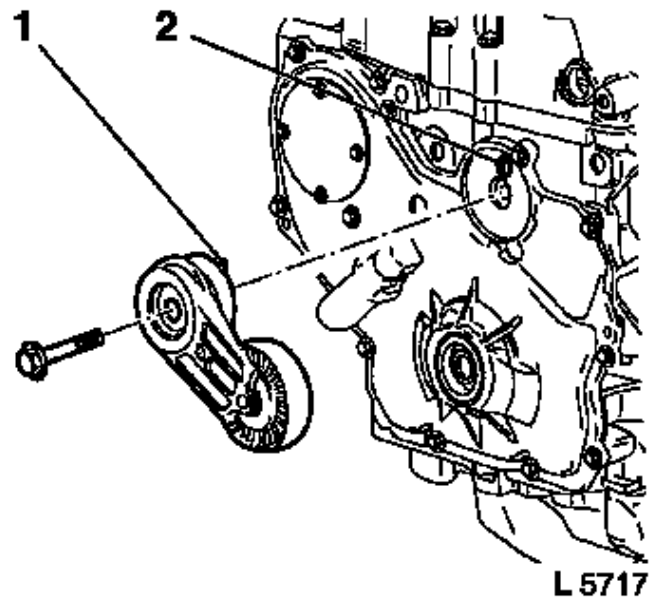
- Attach **KM-6148** with the enclosed bolts (4).
- Slide the positioning bolts (5) into the designated bores (3) on the camshaft sprockets.
- Detach **KM-6148**.



62. 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**

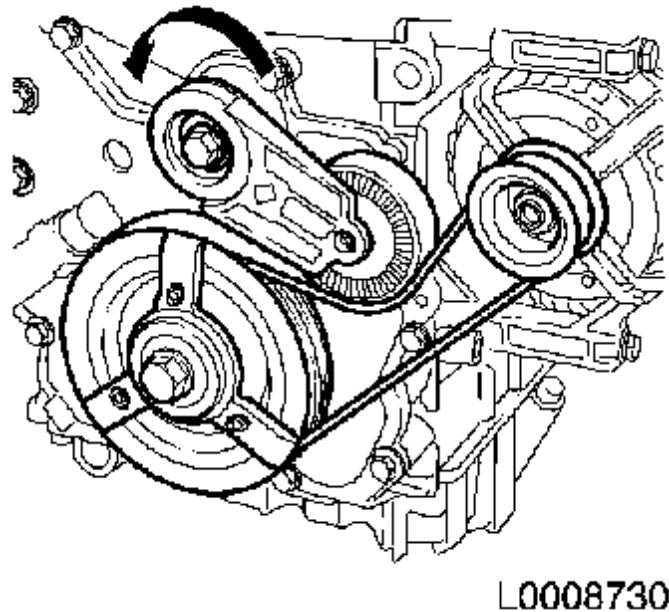


63. Install the ribbed V-belt.

- 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**.

64. Attach the engine damping block bracket.

- Tightening torque **50 Nm**

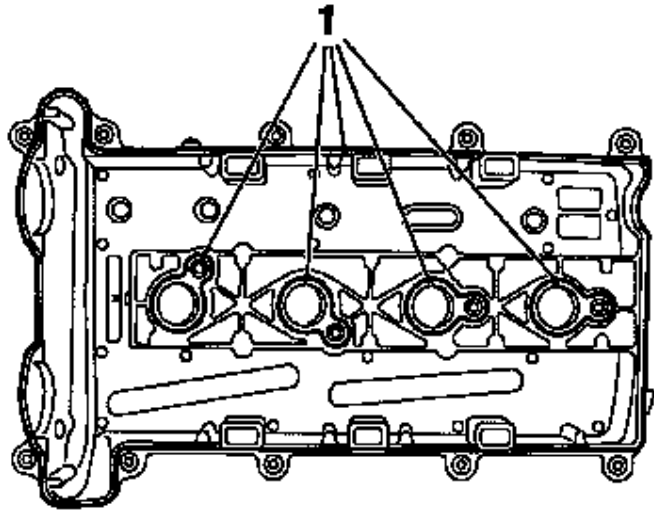


65. Attach the cylinder head cover

- 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**

66. Attach the ignition module.

- Tightening torque **9 Nm**



L 5706

67. Attach and secure the ignition module wiring harness connector.
68. Detach the engine from the assembly stand **KM-412**.
 - Note:** 2 technicians required
 - Carefully set down the engine.
69. Detach the adapter **KM-412-27** on the left-hand side.
70. Install the knock sensor.
 - Important:** The knock sensor must make full contact with the cylinder block across its entire contact surface – ensure utmost cleanliness. Make sure that the tightening torque is exactly as specified.
 - Tightening torque **23 Nm**
 - Attach the wiring harness connector.
71. Attach the intake manifold.
 - Use new gaskets.
 - Tightening torque **9 Nm**
 - Attach the 4 clips.
72. Attach the exhaust gas recirculation pipe.
 - Clean the sealing surfaces.
 - Use a new gasket.
 - Tightening torque **9 Nm**
 - Attach the engine cover bracket.
 - Tightening torque **8 Nm**
73. Attach the wiring harness connector for the intake manifold pressure sensor.
74. Attach the wiring harness connector for the throttle body.
 - Secure the wiring harness connector(s).
75. Clean the engine control unit.
 - Clean the engine control unit and the plug contacts with compressed air.
76. Install the engine control unit.
 - 2 bolts
 - Tightening torque **9 Nm**
 - Attach and secure the wiring harness connector.
 - Note:** Check for proper seating and good electrical contact.

- Attach the bridge piece with a new shear bolt.
 - Route the ground cable.
- 1 bolt
 - Tightening torque **10 Nm**

77. Install the oil dipstick guide tube.

- Use new oil seals.
 - Coat the oil seals with silicone grease (white).
- Insert the oil dipstick guide tube as far as the stop into the oil pan.
- Tightening torque **9 Nm**
- Insert the oil dipstick.
- Attach the knock sensor wiring harness to the oil dipstick guide tube.

78. Detach the adapter **KM-412-27** on the right-hand side.

79. Install the engine.

Note: See operation "Engine, Remove and Install".

80. Fill up with engine oil and correct as required.