

Engine, Repair using Short Block (Z 22 SE)

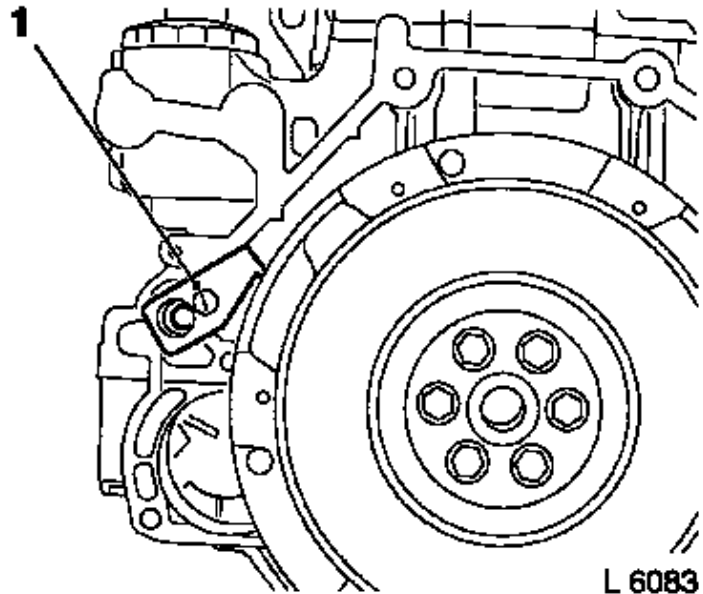


Remove

1. Remove engine
Note: See operation "Engine, Remove and Install".
2. Detach transmission from engine
Note: See operation "Manual Transmission and Engine, Separate and Reattach (Z 22 SE, MT)".

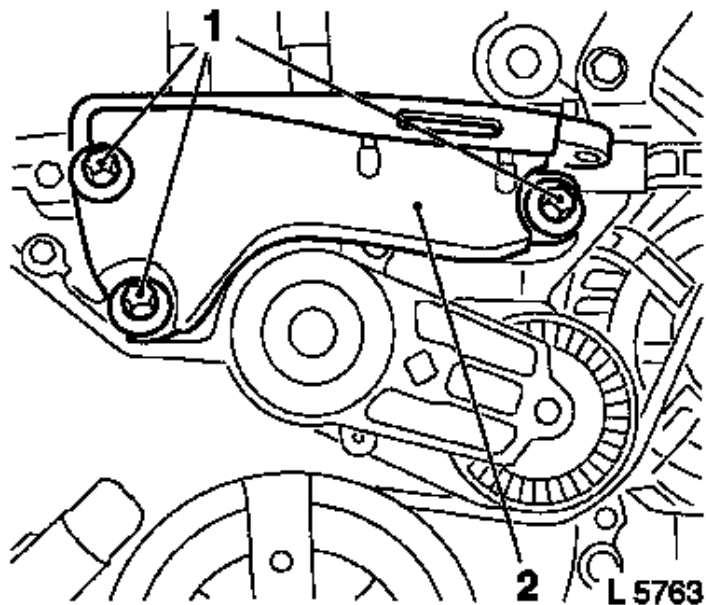
3. Place a drip tray underneath

4. Drain engine oil
 - Open oil drain plug
 - Install oil drain plug using a new oil seal
 - Tightening torque **25 Nm**



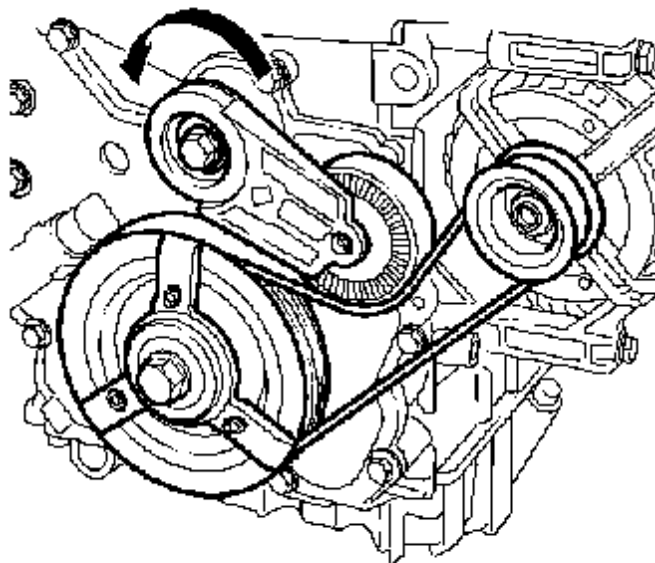
5. Detach flywheel
 - Attach **KM-652** (1)
 - 6x bolt
 - Detach **KM-652**

6. Detach engine damping block bracket (2)
 - 3x bolt (1)



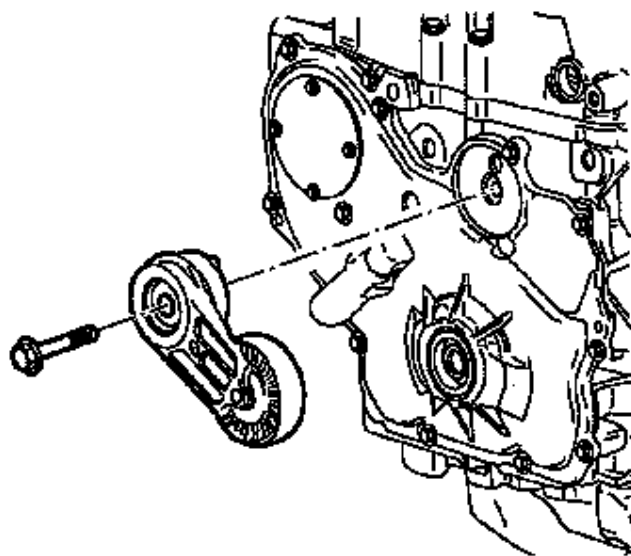
7. Remove ribbed V-belt
 - Mark running direction of ribbed V-belt

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



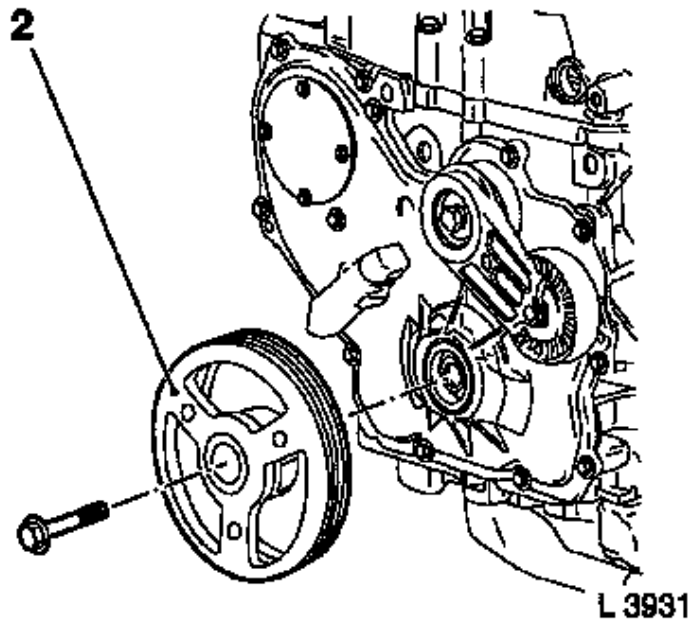
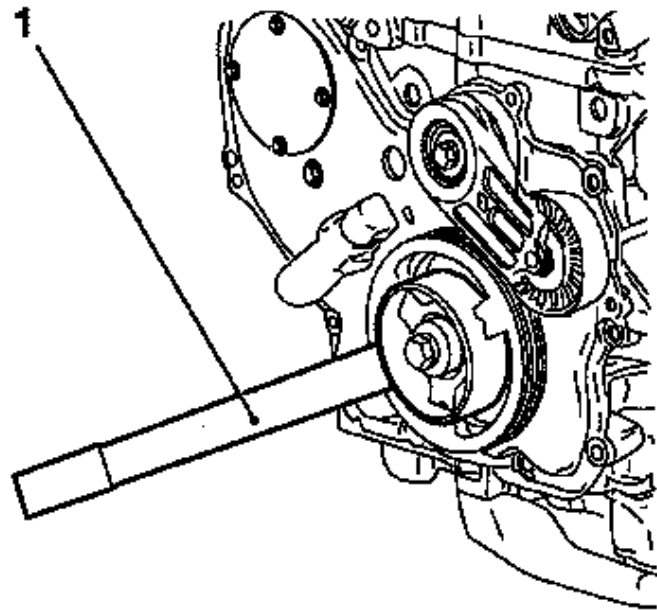
L0008730

8. Detach ribbed V-belt tensioner

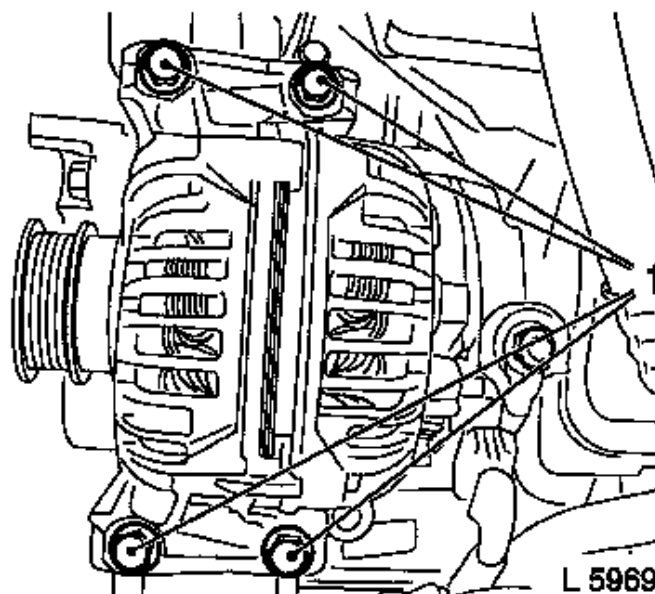


L 3932

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



10. Detach alternator
- 4x bolt (1)

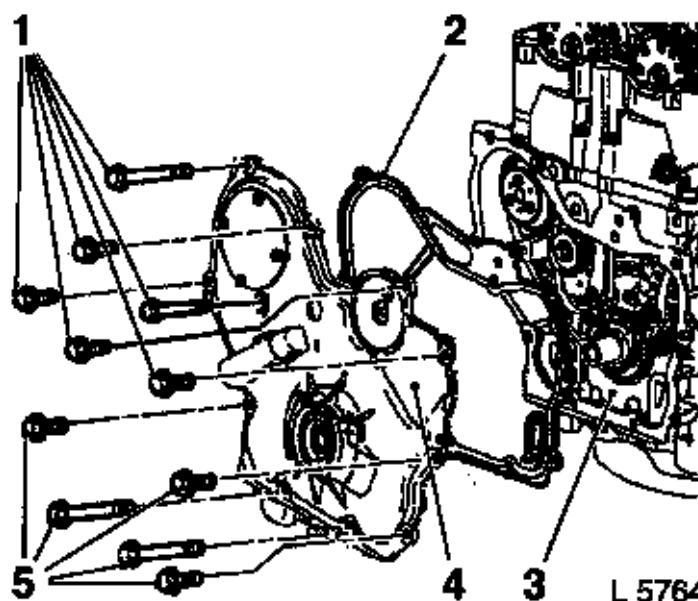


11. Detach timing case (4)

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

Important: Do not damage sealing surfaces.

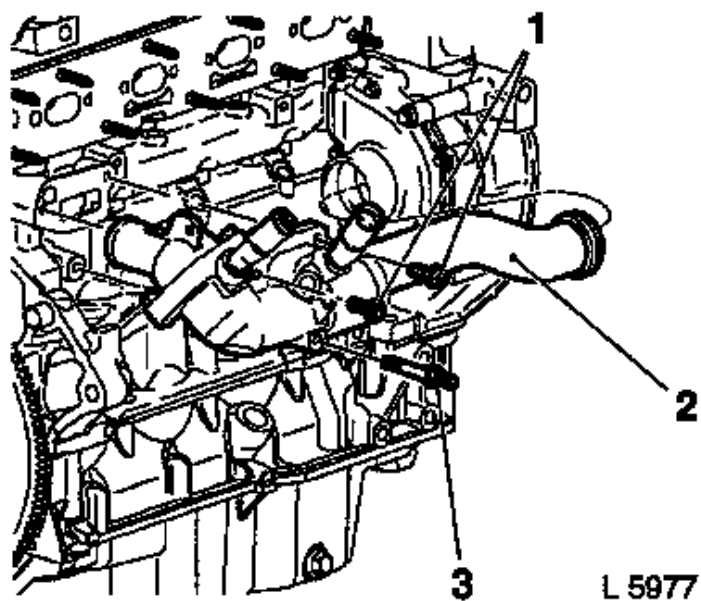
- Clean sealing surfaces



12. Detach thermostat housing

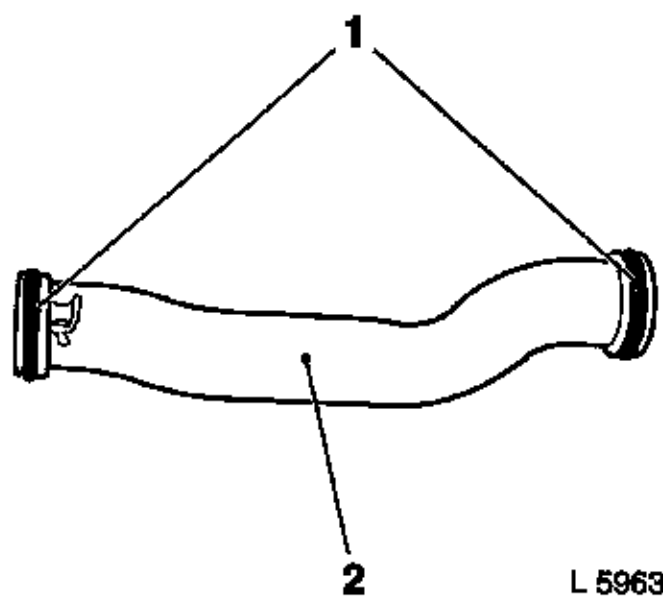
- Stud (3), 2x bolt (1)
- Take out together with coolant pipe (2)

13. Detach coolant pipe



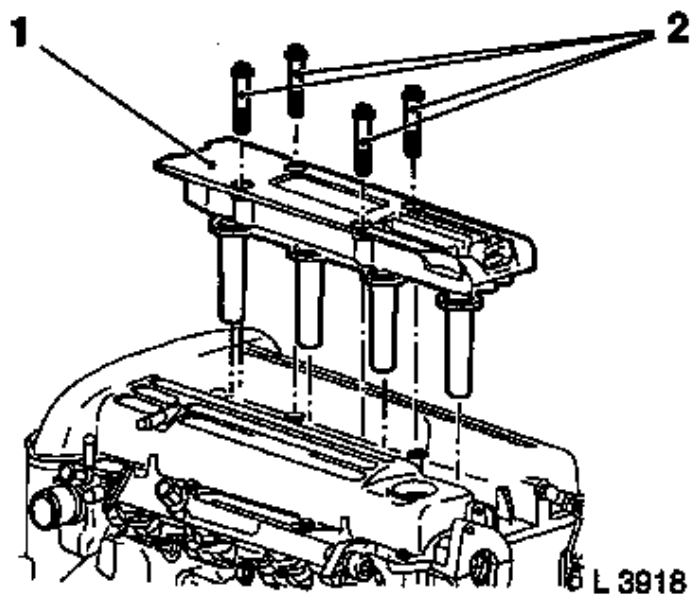
14. Attach coolant pipe (2)

- Use new seals (1)
 - Coat oil seals with silicone grease (white)
- Note:** Lug on coolant pipe engages in cut out on thermostat housing.



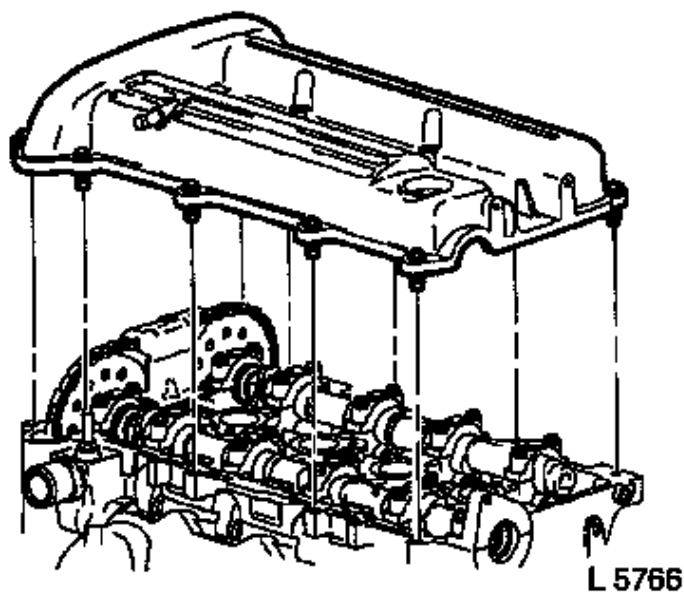
15. Detach ignition module (1)

- 4x bolt (2)



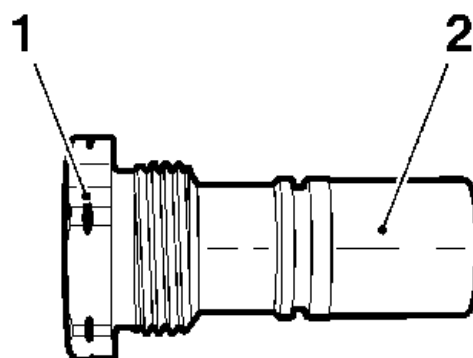
16. Detach cylinder head cover

- Detach ground cable
- 12x bolt



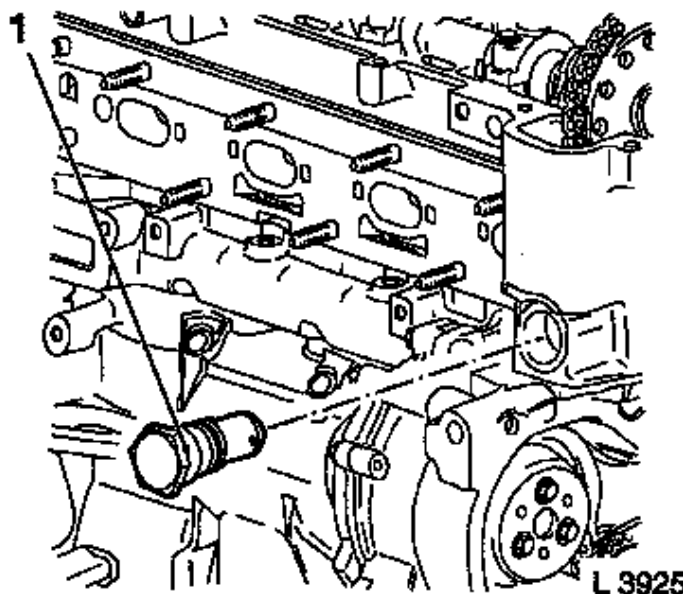
17. Note:

If there is no marking (1) on 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 guide rail (part number 24 449 448).

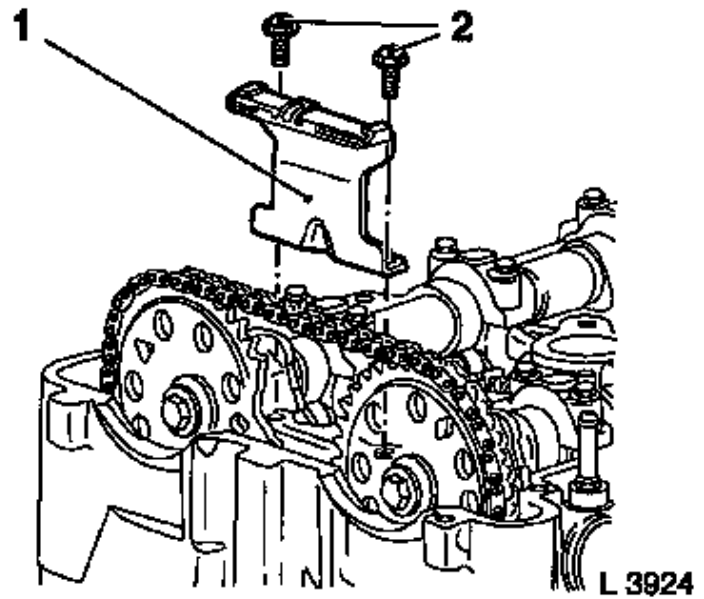


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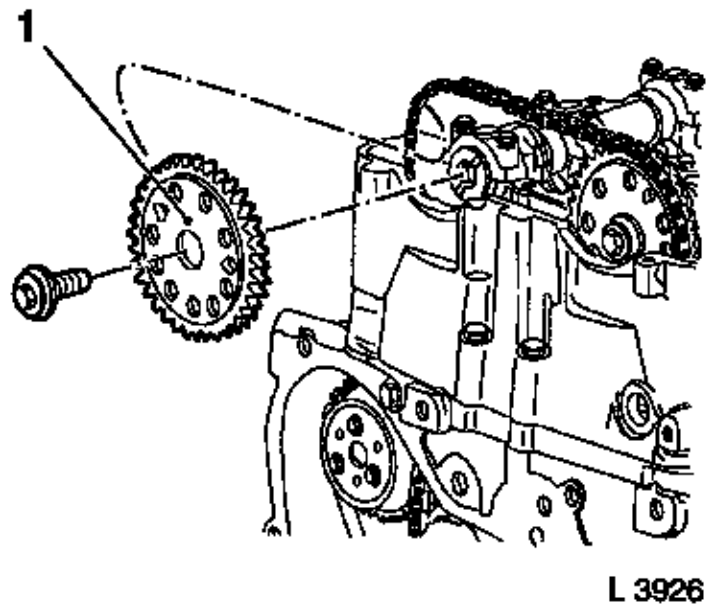
18. Remove camshaft timing chain tensioner
(1)



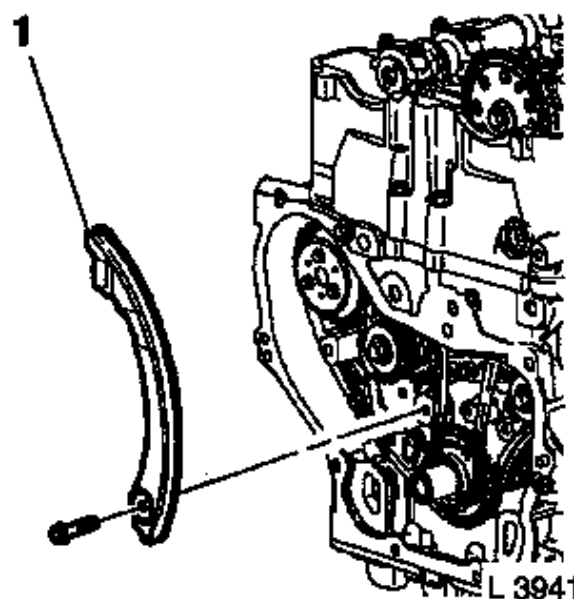
19. Remove guide rail (1)
• 2x bolt (2)



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

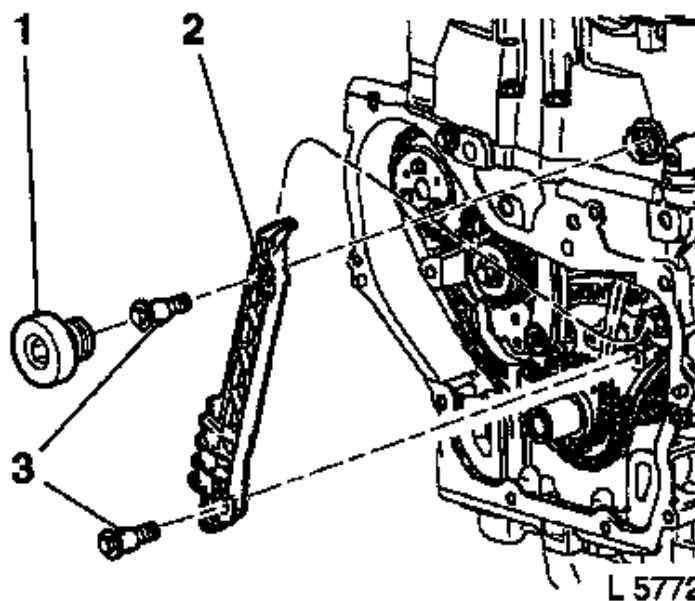


21. Remove camshaft timing chain tensioner rail (1)
- Lift out to top



22. Remove camshaft timing chain guide rail (2)

- Remove screw plug (1)
- 2x bolt (3)

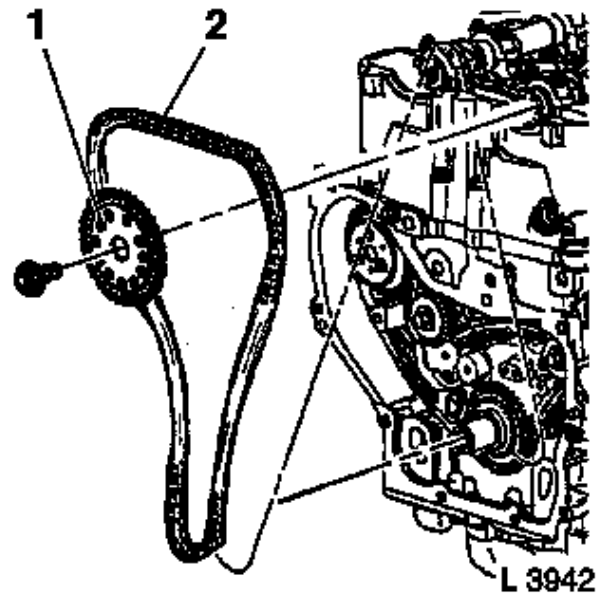


23. Remove intake camshaft sprocket (1)

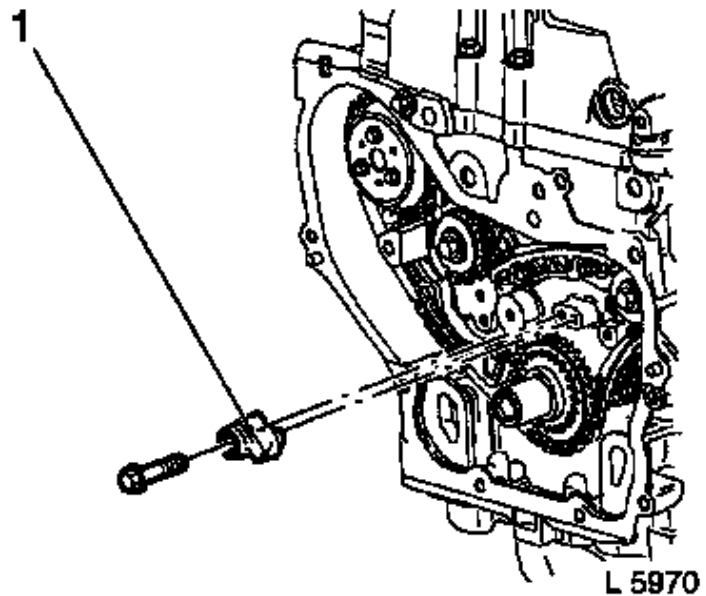
- Hold intake camshaft by hexagon

24. Take out camshaft timing chain (2)

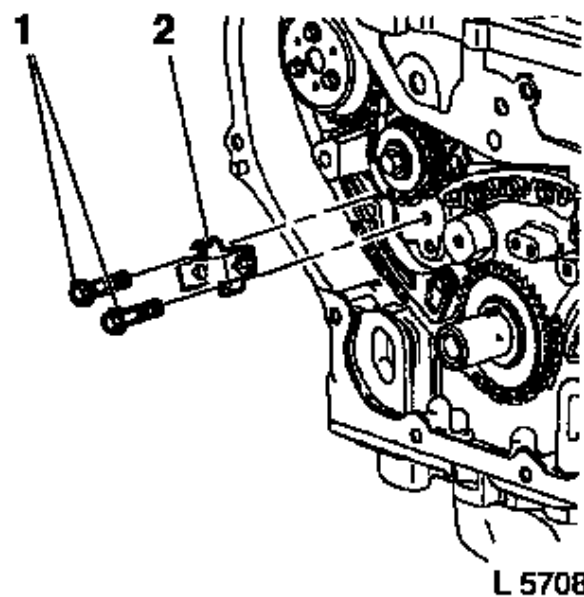
- Take out camshaft timing sprocket



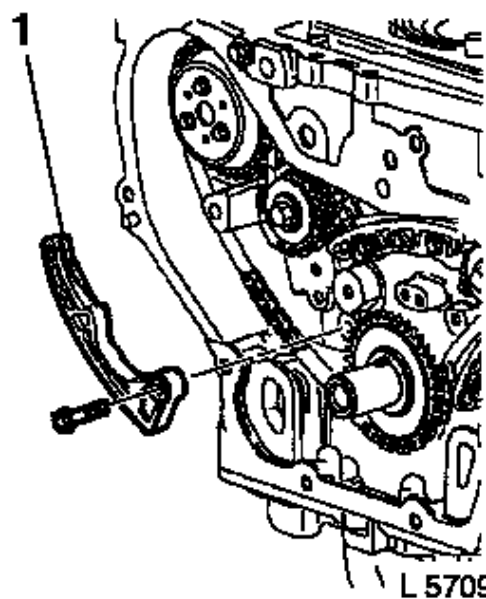
25. Remove oil splash nozzle (1)



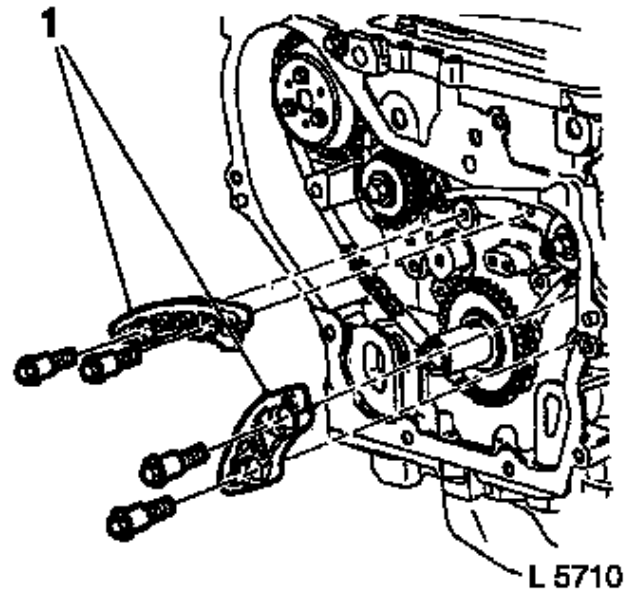
26. Remove balancer shaft timing chain tensioner (2)
• 2x bolt (1)



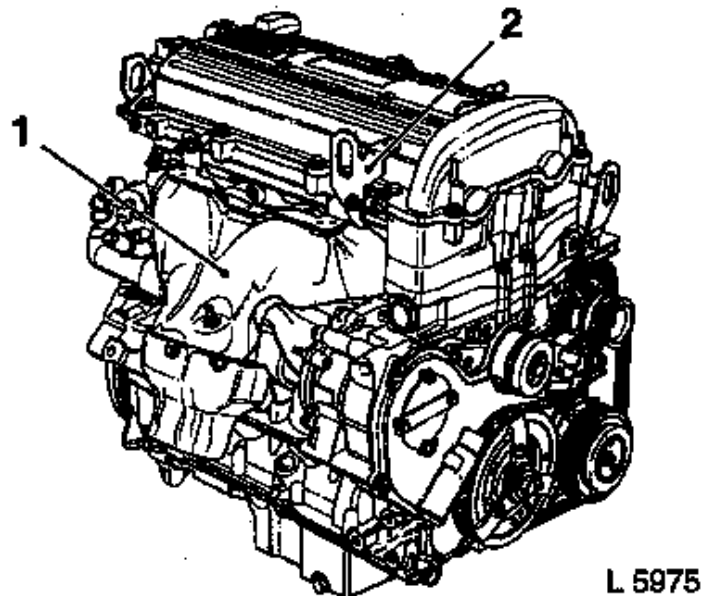
27. Remove balancer shaft timing chain tensioner rail (1)



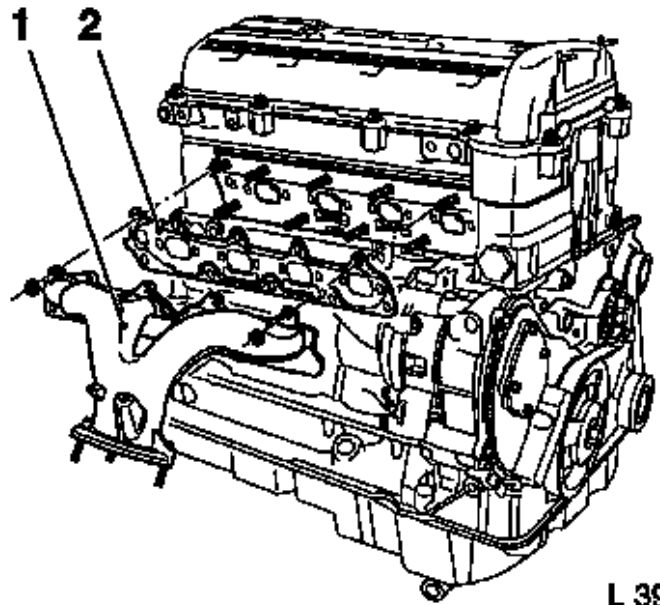
28. Remove balancer shaft timing chain guide rails (1)
- 2 off
 - 4x bolt
29. Take out balancer shaft timing chain
- Take out balancer shaft timing sprocket



30. Detach upper heat shield (1)
- Detach engine lifting eye (2)
 - Nut
 - 3x stud

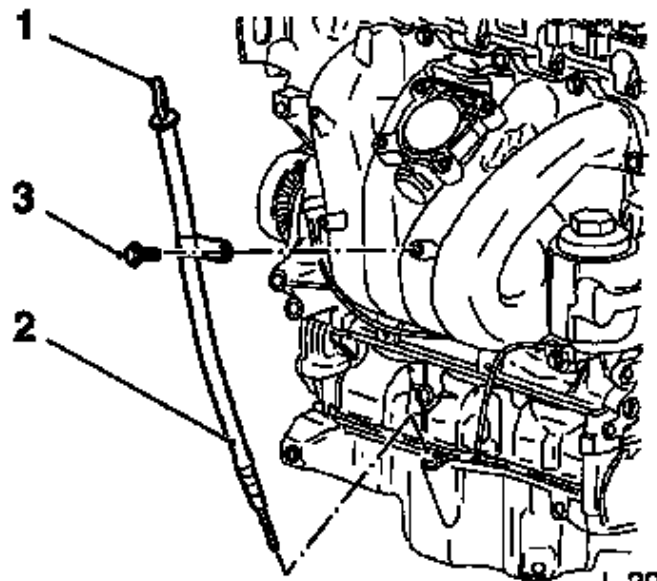


31. Detach exhaust manifold (1)
- 10x nut
 - Remove gasket (2)



L 3915

- 32.** Remove oil dipstick guide tube (2)
- Detach knock sensor wiring harness connector from oil dipstick guide tube
 - Clip
 - Pull oil dipstick out of oil dipstick tube (1)
 - 2x clip
 - Bolt (3)
 - Pull oil dipstick guide tube out of oil pan



L 3921

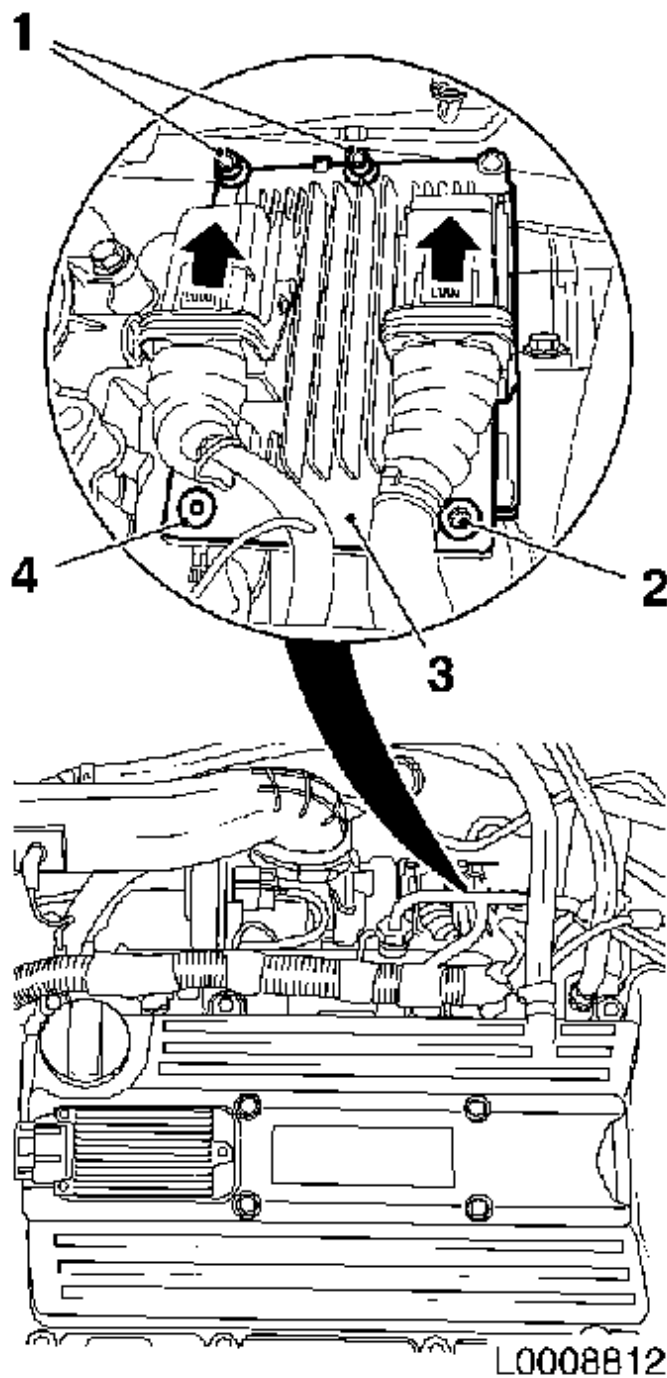
- 33.** Drill out shear bolt (4)
- Centre-punch
 - Pre-drill
 - Use a 3 mm drill
 - Max. depth 10 mm
 - Drill out
 - Use a 6.5 mm drill
 - Until head of bolt comes free
- 34.** Remove retaining bolt (2)
- 35.** Remove bridge piece (3)

- Reposition ground cable to one side

36. Remove retaining bolts (1)

- 2x bolt

37. Take out engine control unit.

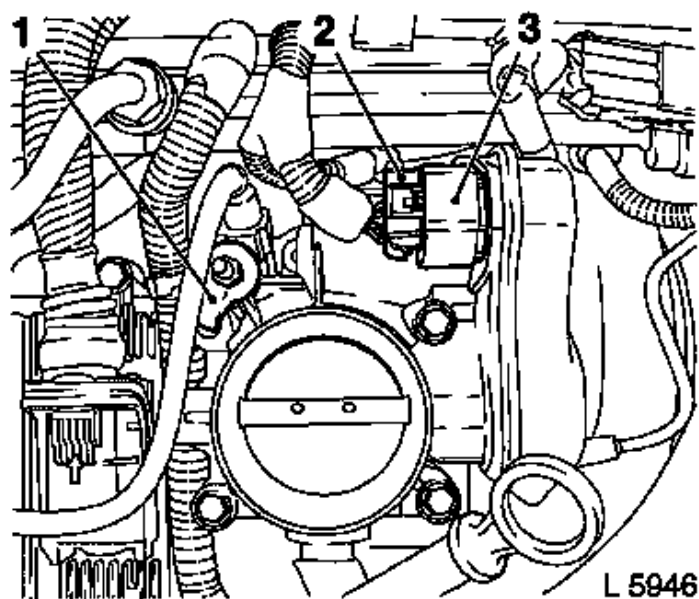


38. Detach wiring harness bracket (1)

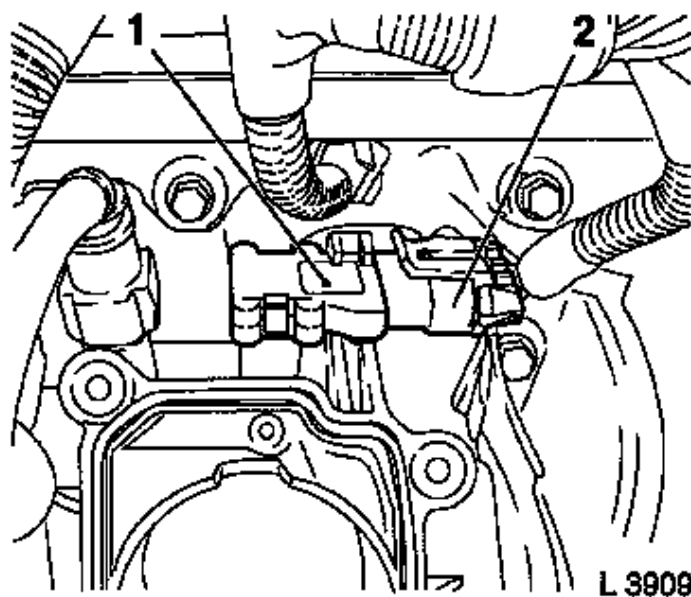
- Nut

39. Detach throttle body wiring harness connector (3)

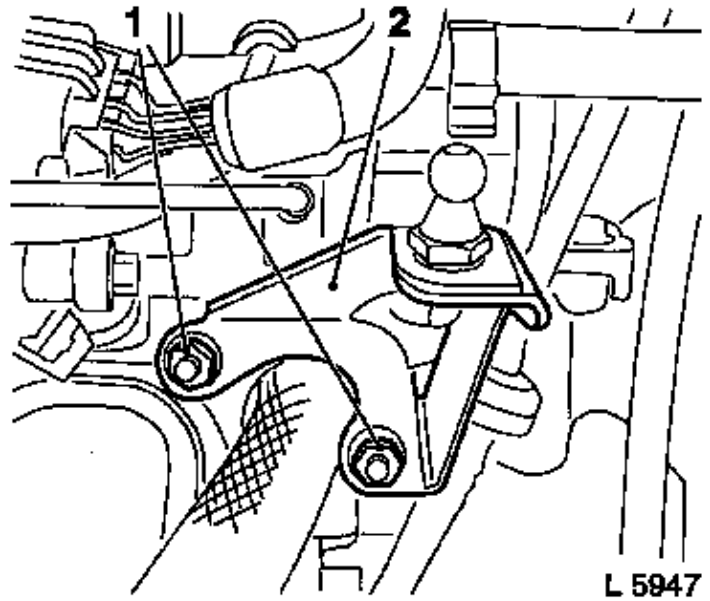
- Release wiring harness connector (2)



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

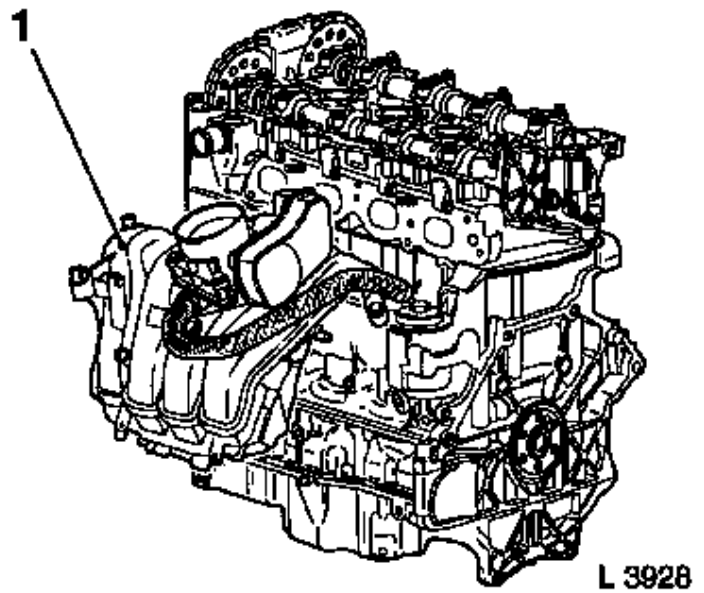


41. Unbolt exhaust gas recirculation pipe
- Engine cover bracket (2)
 - 2x nut (1)
 - 2x bolt



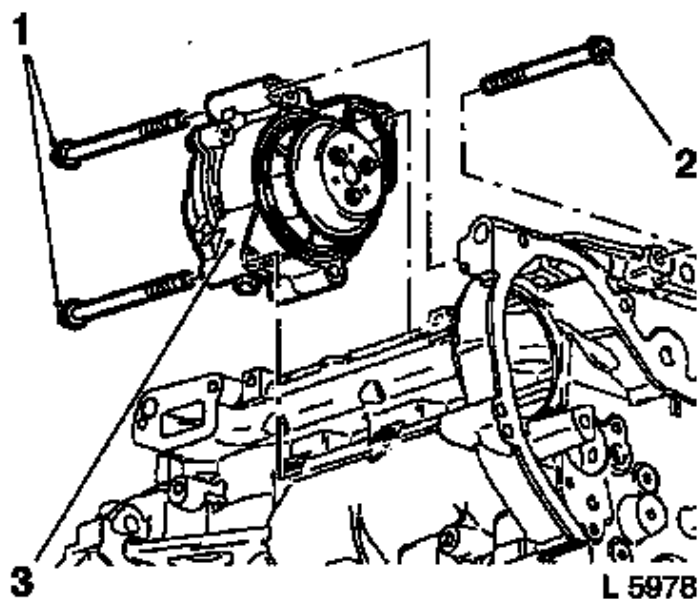
42. Detach intake manifold (1)

- 4x clip
- 5x bolt, 2x nut

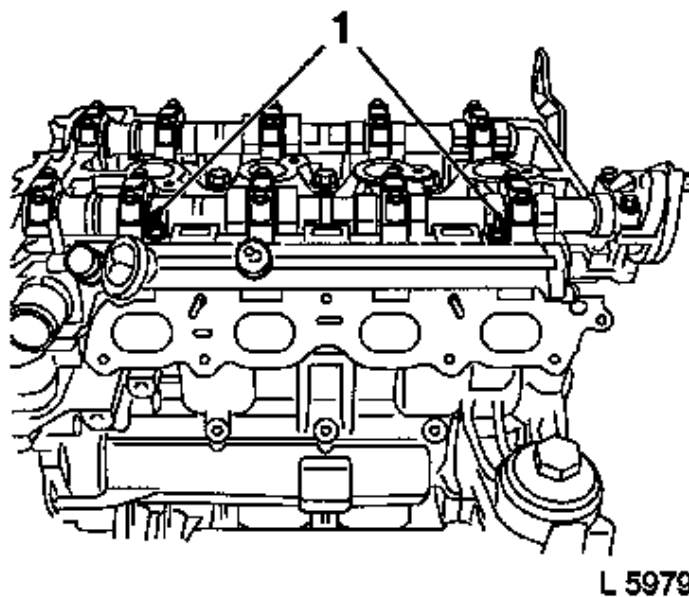


43. Remove coolant pump (3)

- 3x bolt (2) and (3)

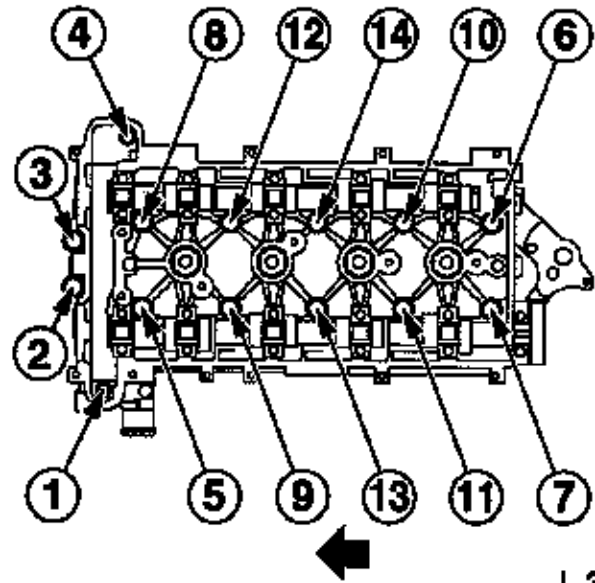


44. Remove fuel distribution pipe
- 2x bolt (1)



Important: Cylinder head must only be removed when engine is cold, i.e. at room temperature.

45. Detach cylinder head
- 4x Torx bolt and 10x hexagon bolt
- Note:** Undo bolts in order shown.

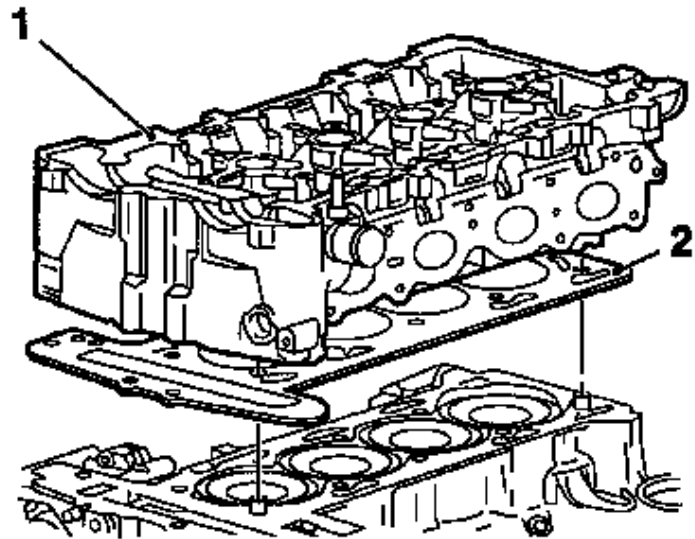


L 3943

46. Remove cylinder head (1)

Note: 2x technician required.

- Place cylinder head on wooden blocks
- Take off cylinder head gasket (2)



L 3944

Important: If securing ring for oil cooler adaptor, becomes loose while removing top cover, then counter-hold using Holding Wrench **KM-6416**.

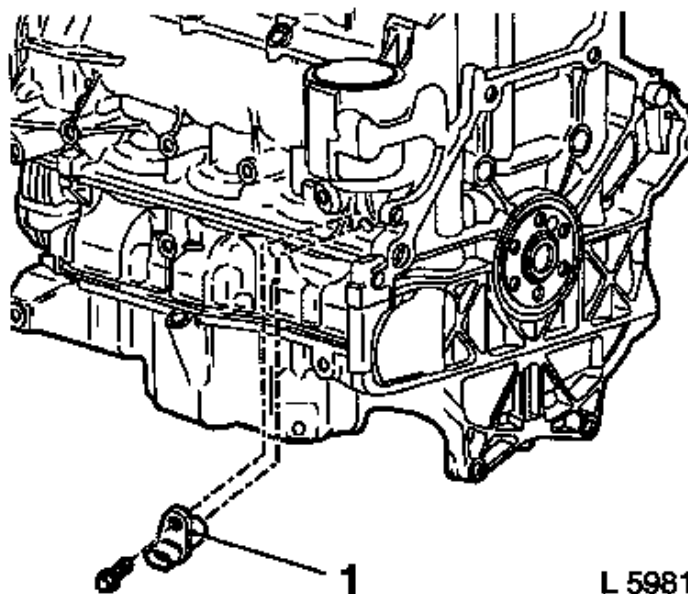
47. Remove top cover from oil filter housing

- Use Oil filter Wrench **KM-6150**
- Remove, then discard O ring
- Remove oil filter element

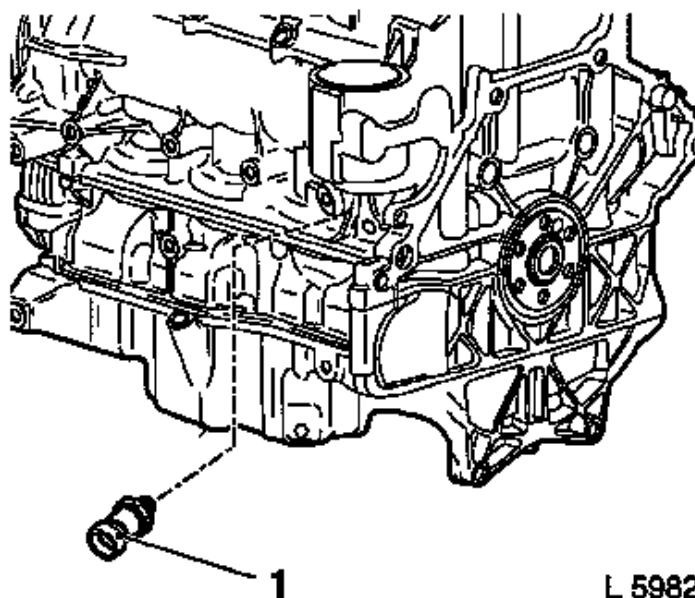
48. Remove oil cooler adaptor from oil filter housing

- Remove securing ring
- Use Remover/Installer **KM-6264**
- Remove, then discard 2x sealing ring

49. Remove crankshaft pickup (1)



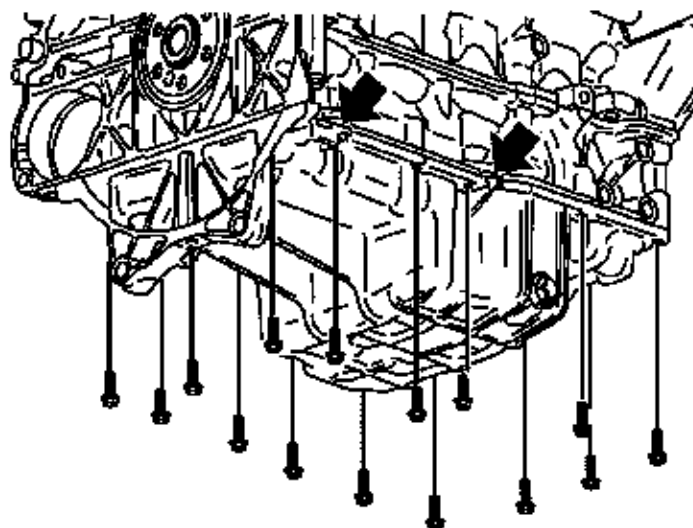
50. Remove oil pressure switch (1)



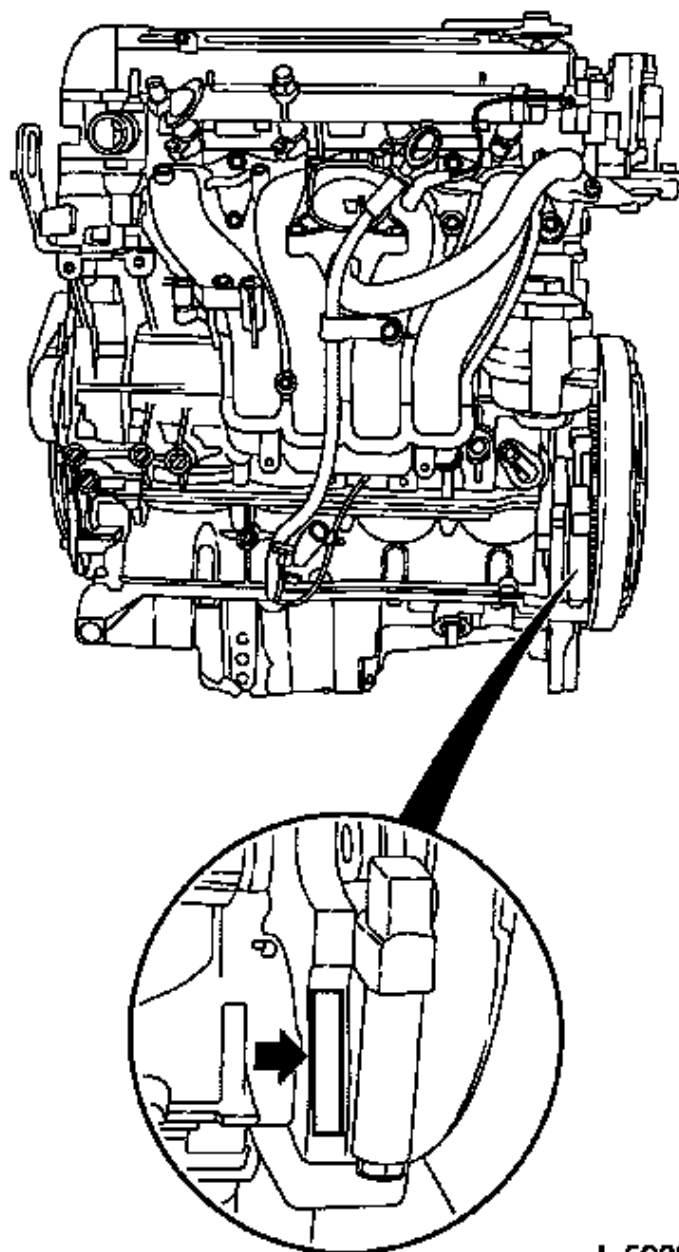
51. Remove oil pan

- Rotate engine on assembly stand 180°
- 15x bolt

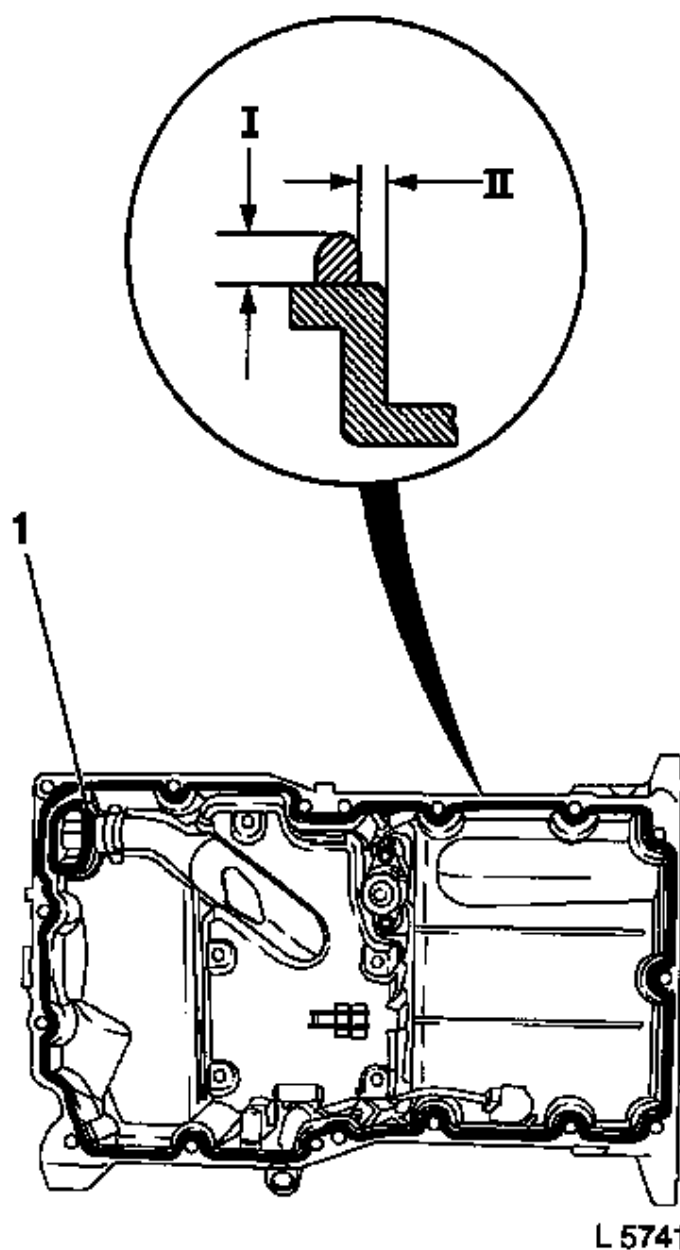
Note: Use a suitable tool to evenly prise it off at leverage points (arrow).

**L 5721****Install**

52. Stamp on engine number
 - Use numbered punches on cylinder block base plate (arrow)
53. Clean sealing surfaces
 - Cylinder block base plate, oil pan
54. Recut 15x thread

**L 5983****55. Install oil pan**

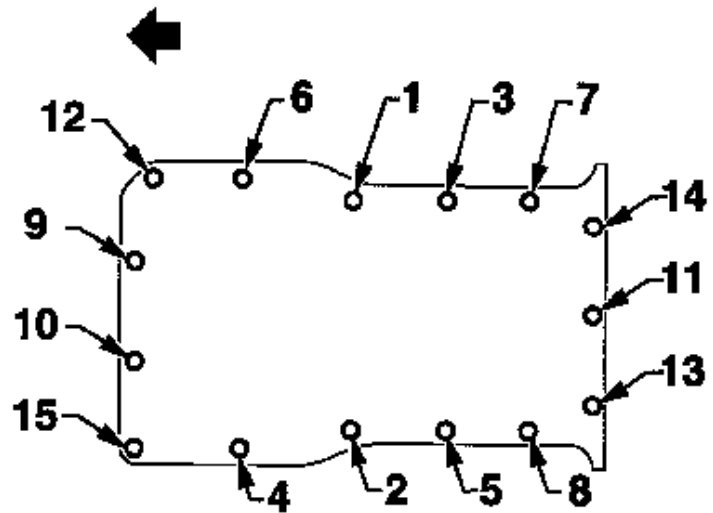
- Apply bead of silicone sealant to sealing surfaces of oil pan
- Apply an additional bead of silicone sealant centrally to oil intake pipe connection (1)



56. Tighten all bolts loosely

Note: Observe tightening sequence.

- To cylinder block base plate **23 Nm**
- To transmission housing **23 Nm**

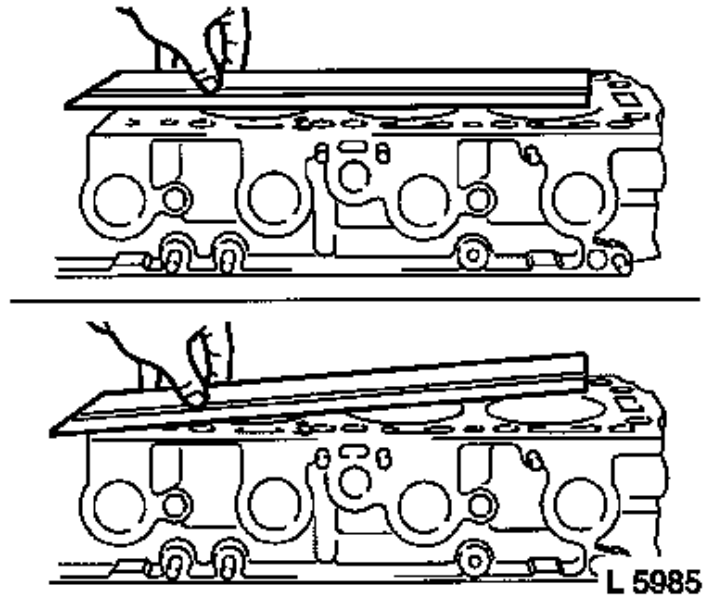


L 5742

57. Install oil pressure switch
 - Use a new oil seal
 - Tightening torque **18 Nm**
58. Install crankshaft pickup
 - Use a new oil seal
 - Tightening torque **9 Nm**

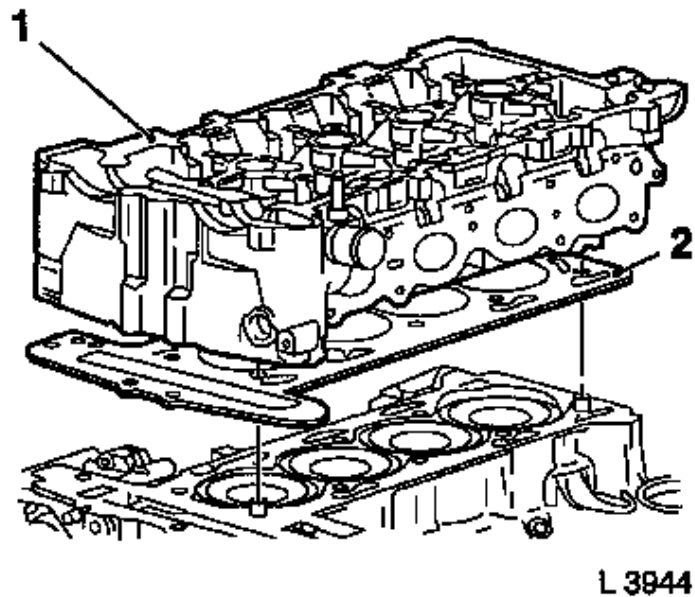
Important: Observe correct installation side of new sealing rings, ridge sides uppermost.

59. Install oil cooler adaptor with 2x new sealing ring to oil filter housing
 - Rotate engine on assembly stand 180°
 - Use Remover/Installer **KM-6264**
 - Install, then secure securing ring **120 Nm**
60. Install top cover with new O ring to oil filter housing
 - Install oil filter element
 - Use Oil filter Wrench **KM-6150**
 - Secure top cover **25 Nm**
61. Recut M8 thread
 - 4x bolt, 4x bolt hole
62. Clean sealing surfaces and bores
 - Cylinder block, cylinder head
63. Check for plane surface
 - Cylinder head
 - Use a straight edge, feeler gauges

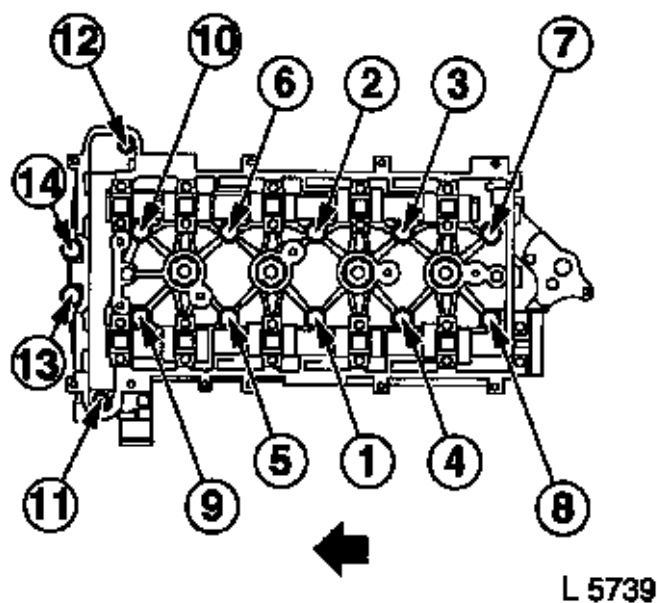


64. Move piston into centre position
- Attach rotational vibration damper
 - Turn engine in normal direction of rotation
 - Detach rotational vibration damper

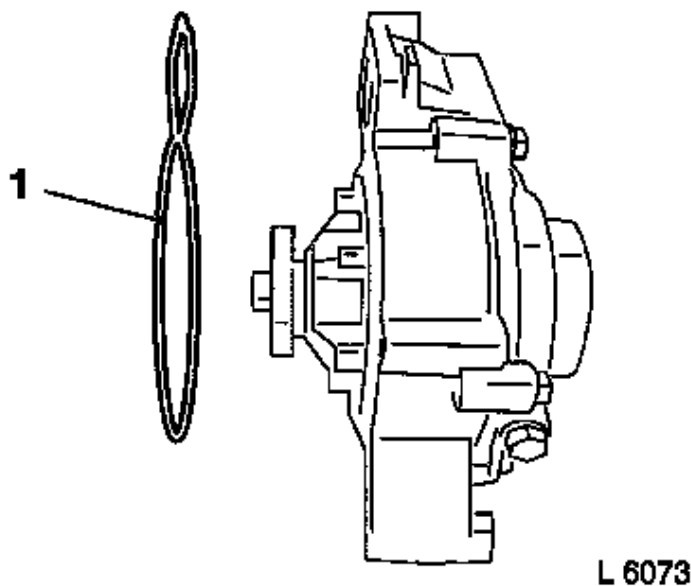
65. Place cylinder head (1) in place
- Note:** 2x technician required.
- Fit a new cylinder head gasket (2)
- Note:** OBEN/TOP mark must face upwards.



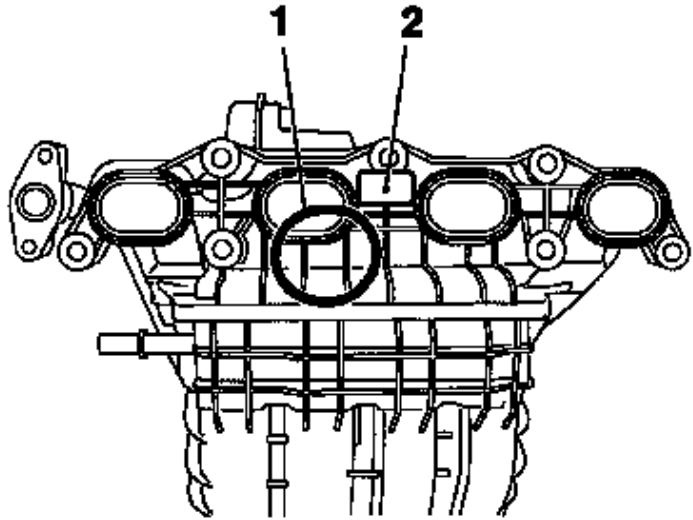
66. Attach cylinder head
- Use new cylinder head bolts
- Note:** Observe tightening sequence.
- Tightening torque M10 bolts **30 Nm + 60° + 60° + 35°**
 - Coat thread of M8 bolts with thread locking compound
 - Tightening torque **35 Nm**
67. Install fuel distribution pipe
- Tightening torque **9 Nm**



68. Install coolant pump
- Use a new seal (1)
 - **Note:** Note different bolt lengths.
 - Tightening torque **23 Nm**
69. Clean sealing surface
- Exhaust manifold



70. Attach intake manifold
- Use new gaskets (1) and (2)
 - Tightening torque **9 Nm**
 - Attach 4x clip

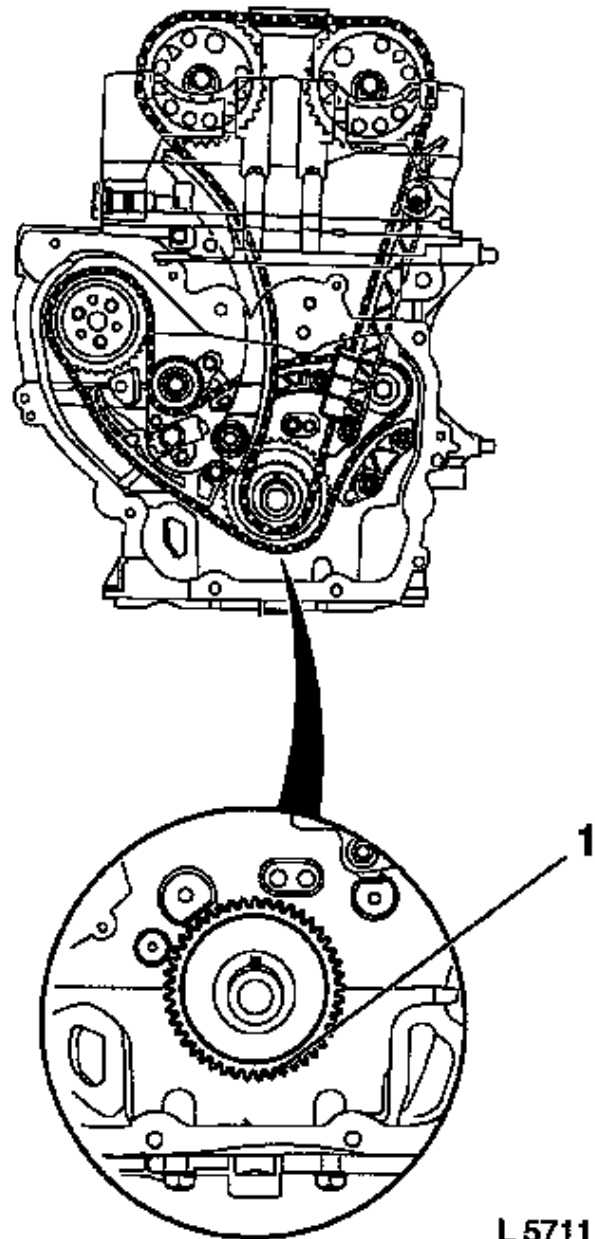
**L 5738**

71. Attach exhaust gas recirculation pipe
 - Clean sealing surfaces
 - Use a new gasket
 - Tightening torque **9 Nm**
 - Attach engine cover bracket
 - Tightening torque **8 Nm**
72. Attach wiring harness connector for intake manifold pressure sensor
73. Attach wiring harness connector for throttle body
 - Secure wiring harness connectors
74. Attach wiring harness bracket
 - Tightening torque **8 Nm**
75. Clean engine control unit
 - Clean engine control unit and plug contacts with compressed air
76. Install engine control unit
 - 2x bolt
 - Tightening torque **9 Nm**
 - Attach and secure wiring harness connector
 - Note:** Check for proper seating and good electrical contact.
 - Attach bridge piece with a new shear bolt
 - Route ground cable
 - Bolt
 - Tightening torque **10 Nm**
77. Install exhaust manifold
 - Use a new gasket
 - Use new nuts
 - Tightening torque **12 Nm**
 - Wait for 30 seconds
 - Tightening torque **12 Nm**
78. Attach upper heat shield

- 3x stud
- Attach engine lifting eye
 - Nut
- Tightening torque **23 Nm**

79. Align crankshaft

- Insert balancer shaft timing sprocket
- **Note:** Note identification markings.
- Attach rotational vibration damper
- Rotate crankshaft in normal direction of rotation until marking (1) on balancer shaft timing sprocket is at uppermost position
- Detach rotational vibration damper



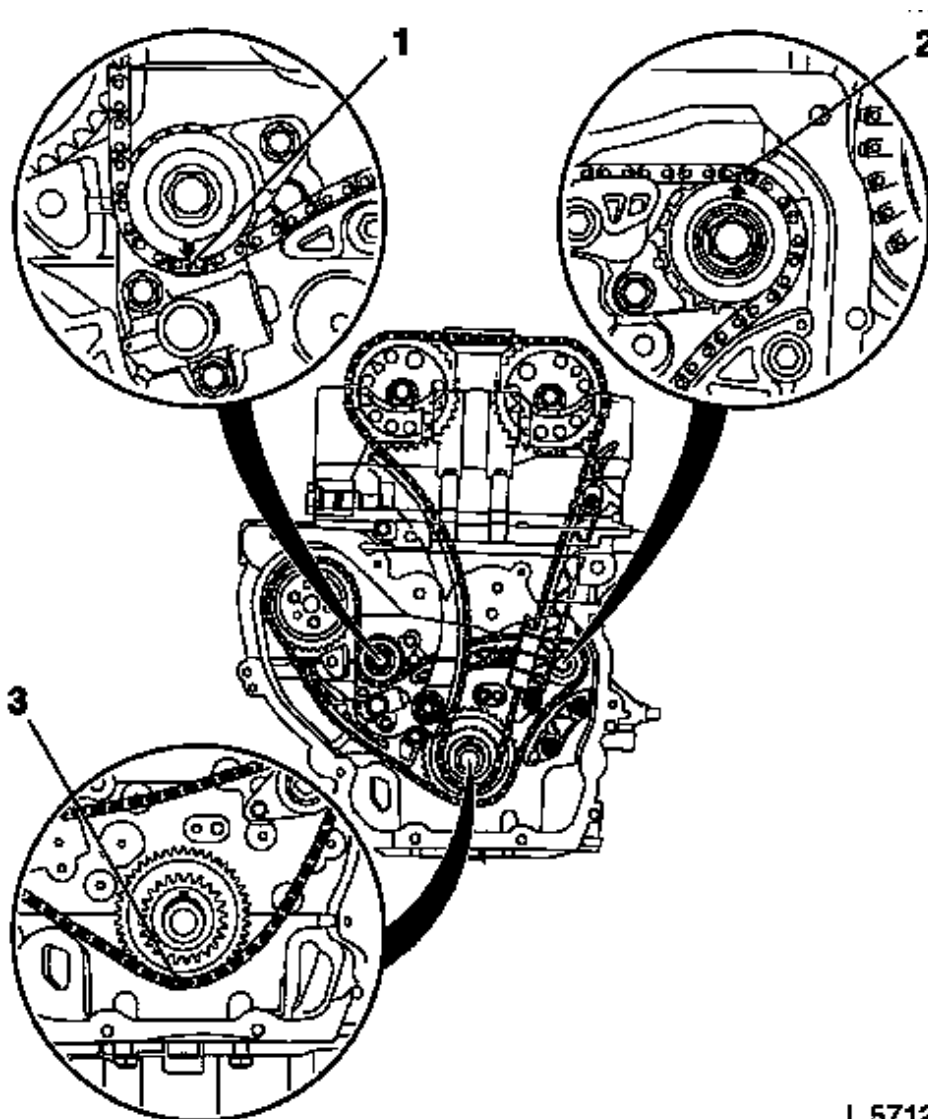
L 5711

80. Install balancer shaft timing chain

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

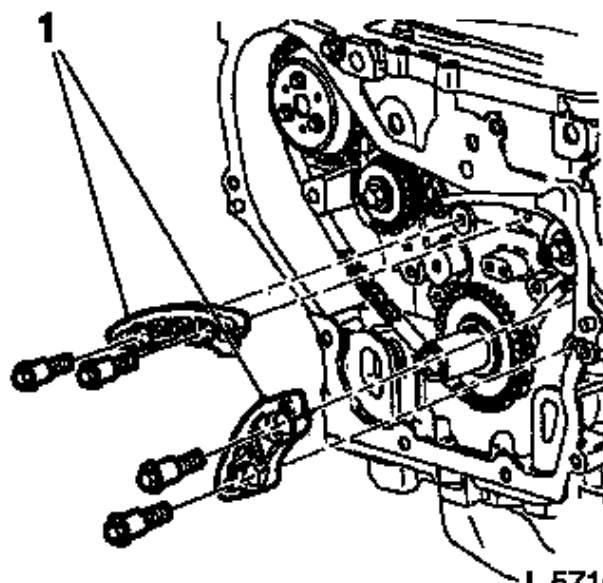
- Lay timing chain in place
 - Chain link (2), copper coloured to

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



L 5712

81. Install balancer shaft timing chain guide rails (1)
 - Tightening torque **10 Nm**
82. Install balancer shaft timing chain tensioner rail
 - Tightening torque **10 Nm**



L 5710

83. Install balancer shaft timing chain tensioner

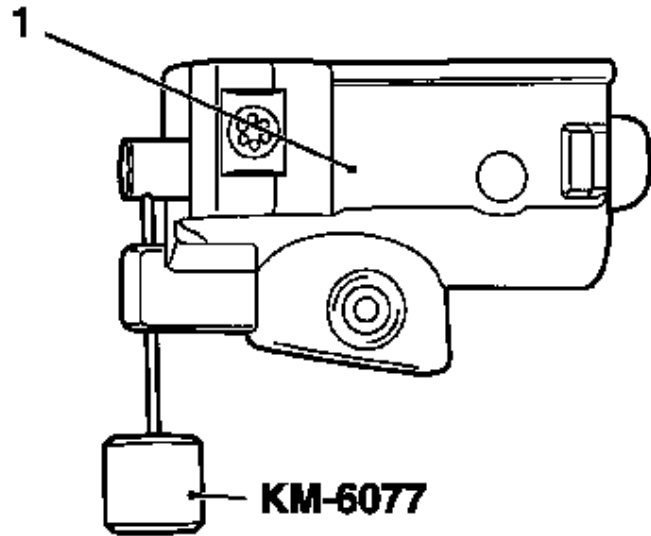
- Lock chain tensioner (1) with **KM-6077**
 - Rotate piston clockwise, press it in and insert **KM-6077** into designated bores
- Tightening torque **10 Nm**
- Take out **KM-6077**
- Remove plastic wedge

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

- If TDC markings no longer line up with coloured chain links – refit balancer shaft timing chain

84. Install oil splash nozzle

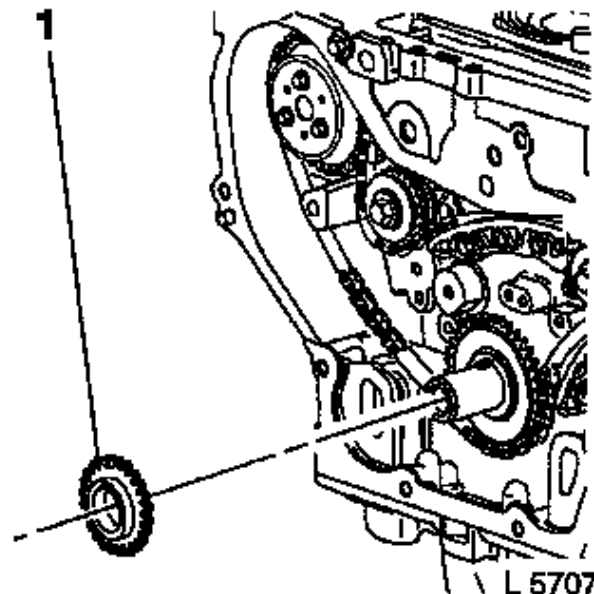
- Tightening torque **10 Nm**



L 5713

85. Insert camshaft timing sprocket (1)

Note: Note correct installation position.



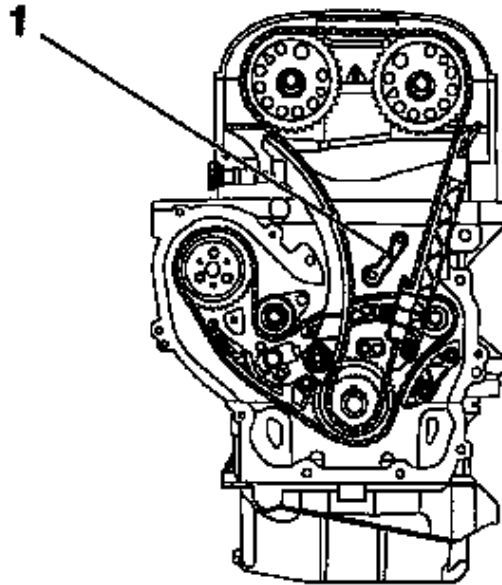
L 5707

86. Insert camshaft timing chain

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

87. Install intake camshaft sprocket

- Lay camshaft timing chain onto camshaft sprocket
- Use a new bolt
- Hold intake camshaft by hexagon
 - Tightening torque **85 Nm + 30° + 15°**

**L 3946****88. Fit camshaft timing chain**

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

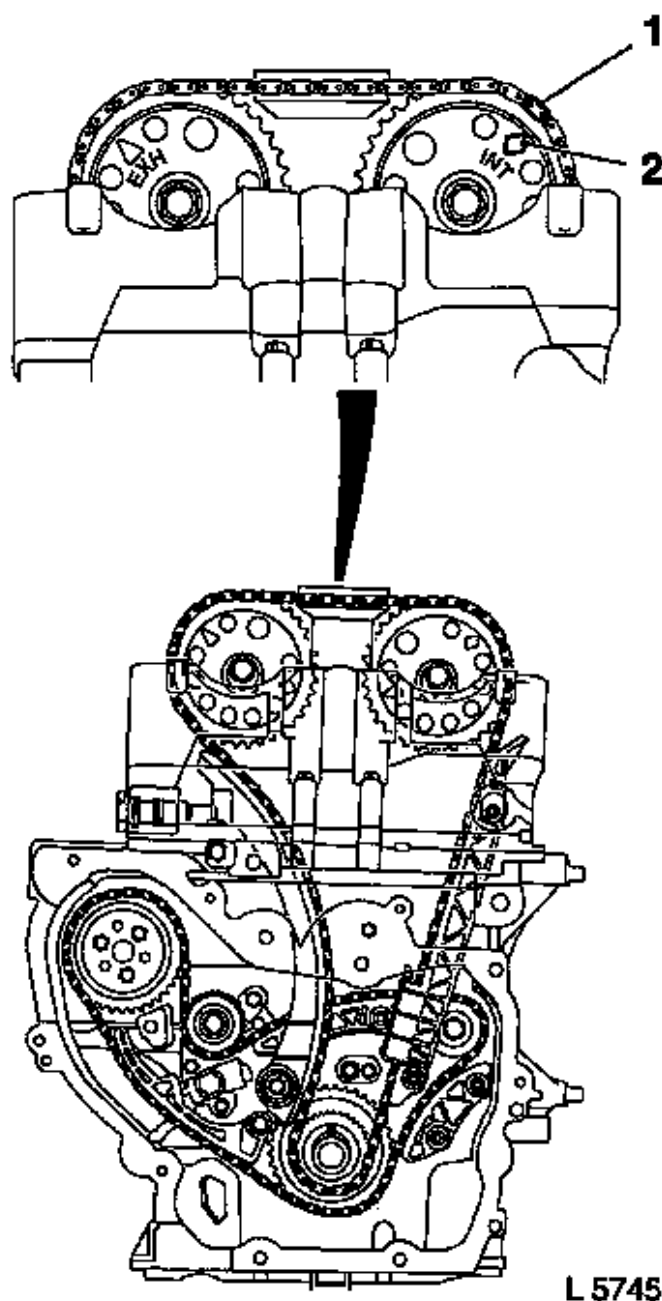
- Chain link, copper colour (1) to INT marking (2) on intake camshaft sprocket

89. Install camshaft timing chain tensioner rail

- Tightening torque **10 Nm**

90. Install camshaft timing chain guide rail

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

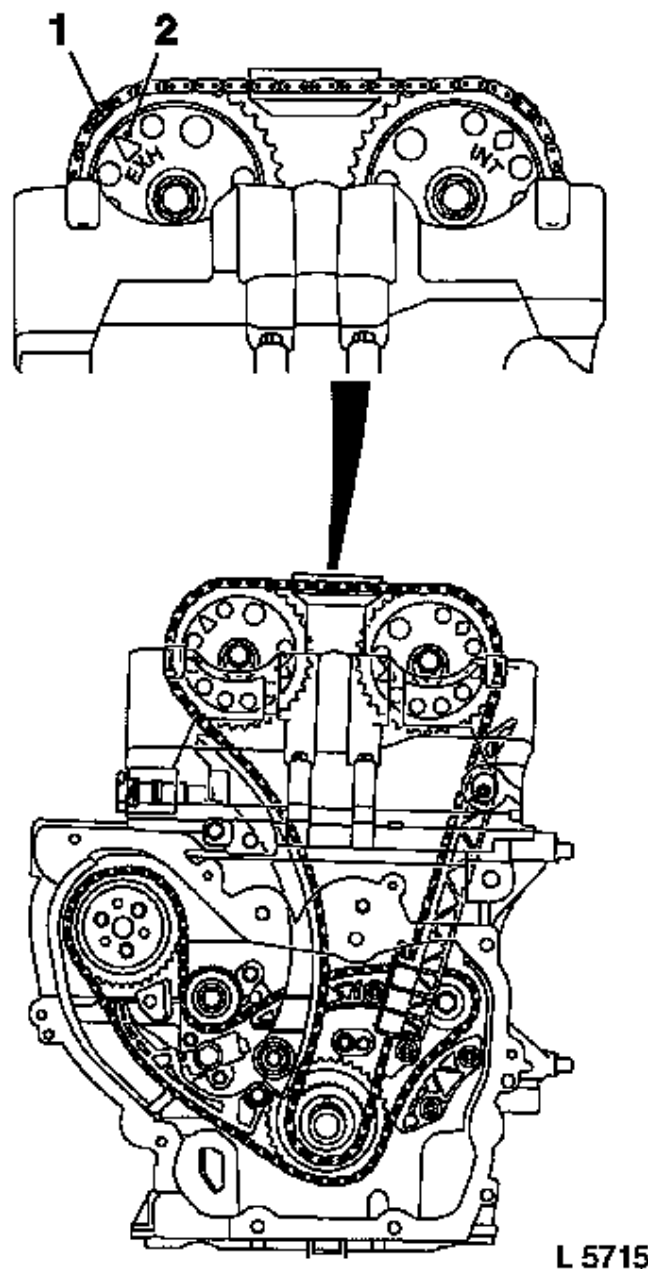


L 5745

91. Secure camshaft timing chain

Note: Check that TDC reference points line up.

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



92. Install exhaust camshaft sprocket

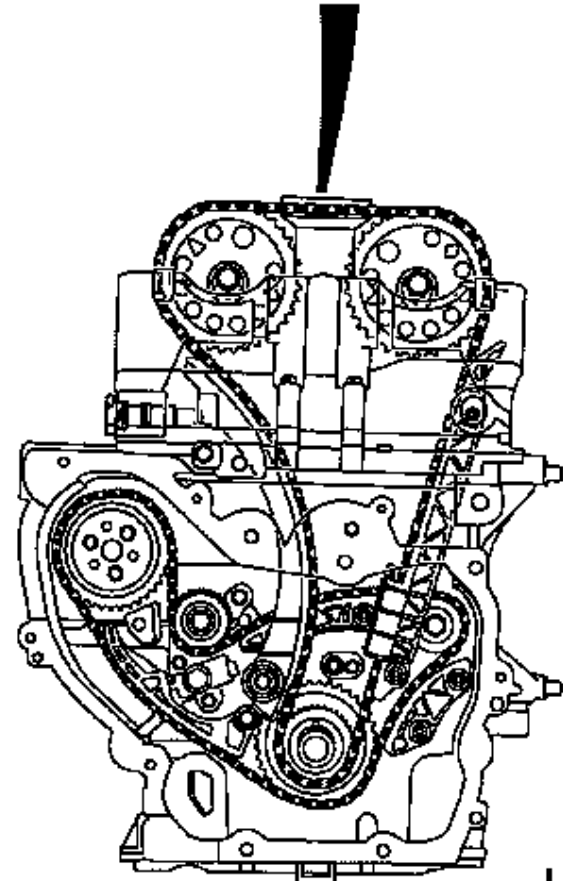
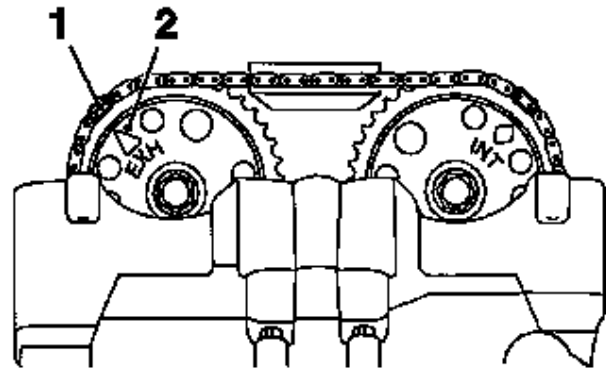
Note: Check that TDC reference points line up.

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

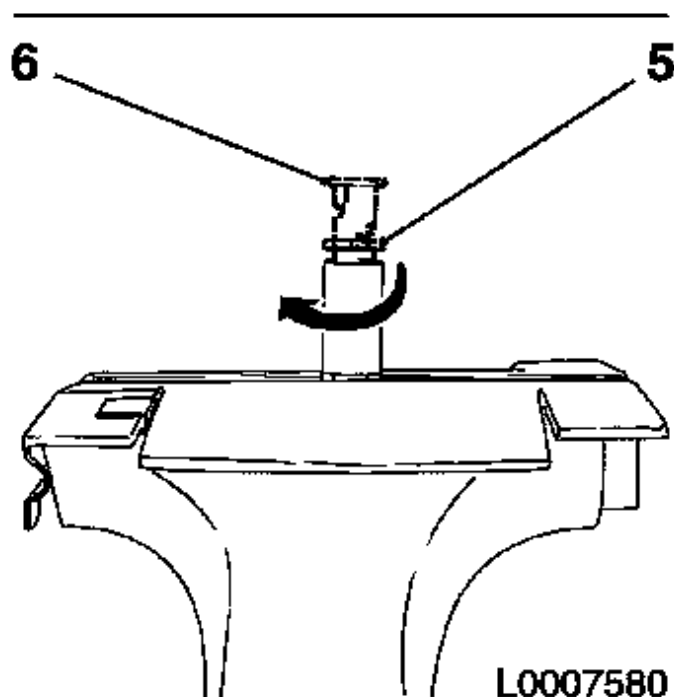
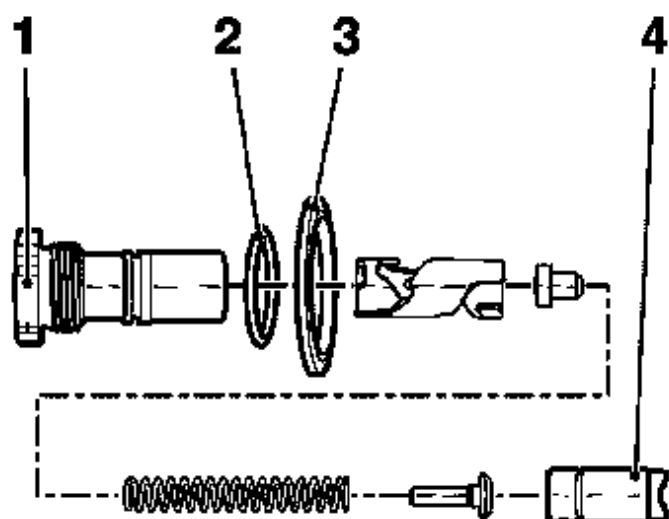
93. Recut 2x thread

94. Install guide rail

- Coat bolts with thread locking compound, red then insert them
 - Tightening torque **8 Nm**

**L 5715****95. Install camshaft timing chain tensioner**

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



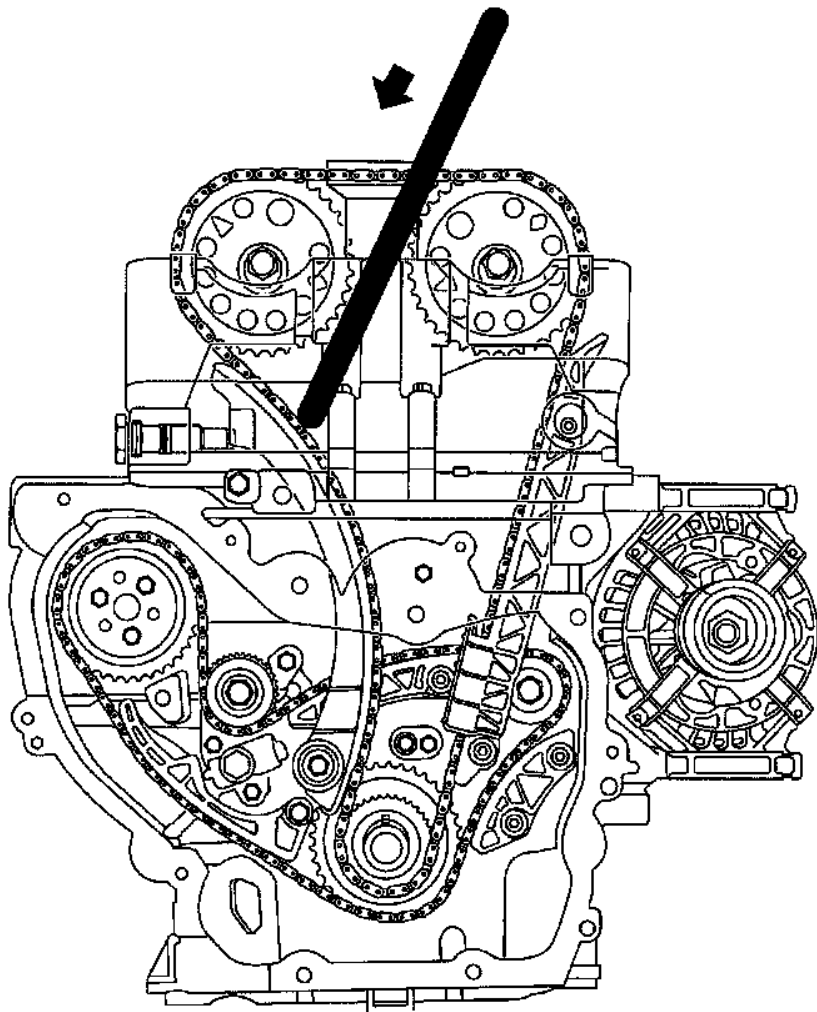
Important: Failure to follow this instruction could cause camshaft timing chain to jump.

96.

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

Note: If TDC markings no longer line up with coloured

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

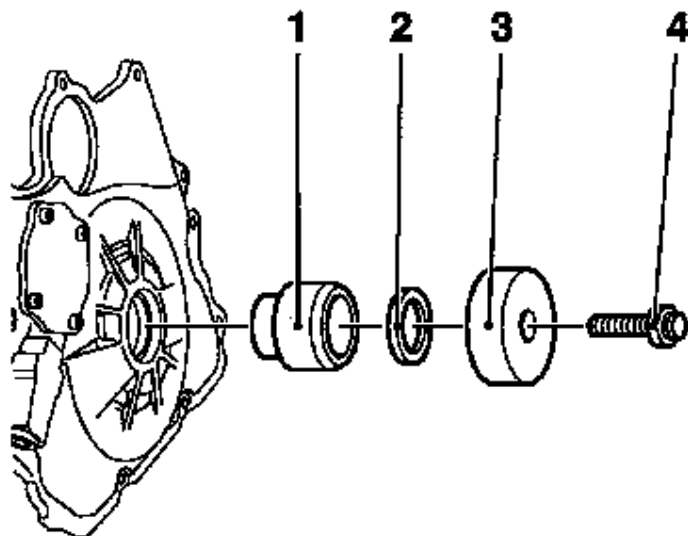


J 0935

97. Install timing case

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

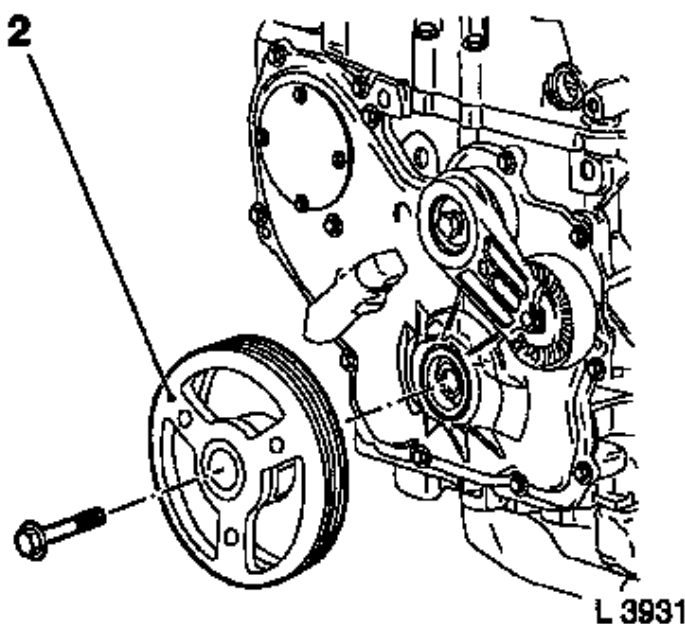
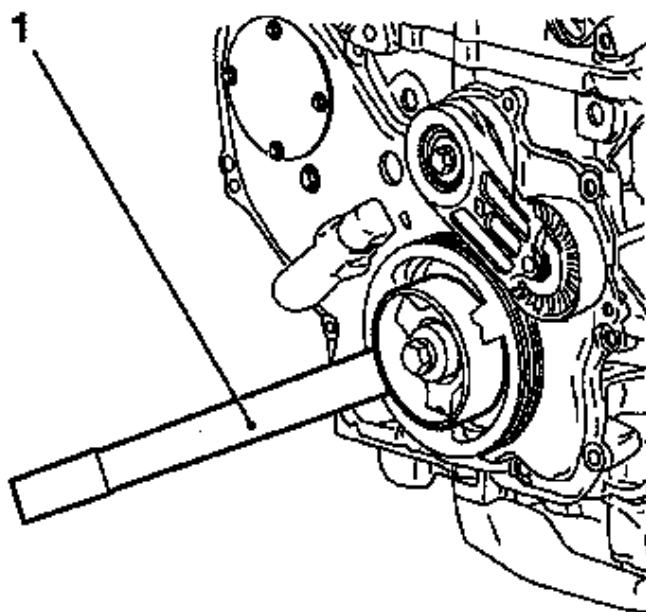
- Use a new gasket
- Tightening torque **21 Nm**
- Install crankshaft front oil seal (2)
 - Slide protective sleeve (1) from **KM-6105** (3) onto connecting rod journal
 - Coat sealing lips with silicone grease, white
 - Slide oil seal over protective sleeve onto connecting rod journal
 - Use **KM-6105**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



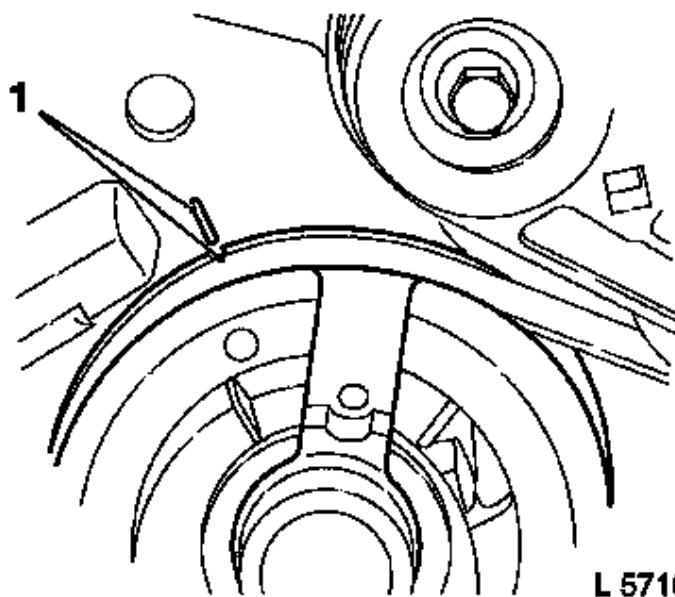
L 3952

98. Attach 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°**

**99. Check valve timing**

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

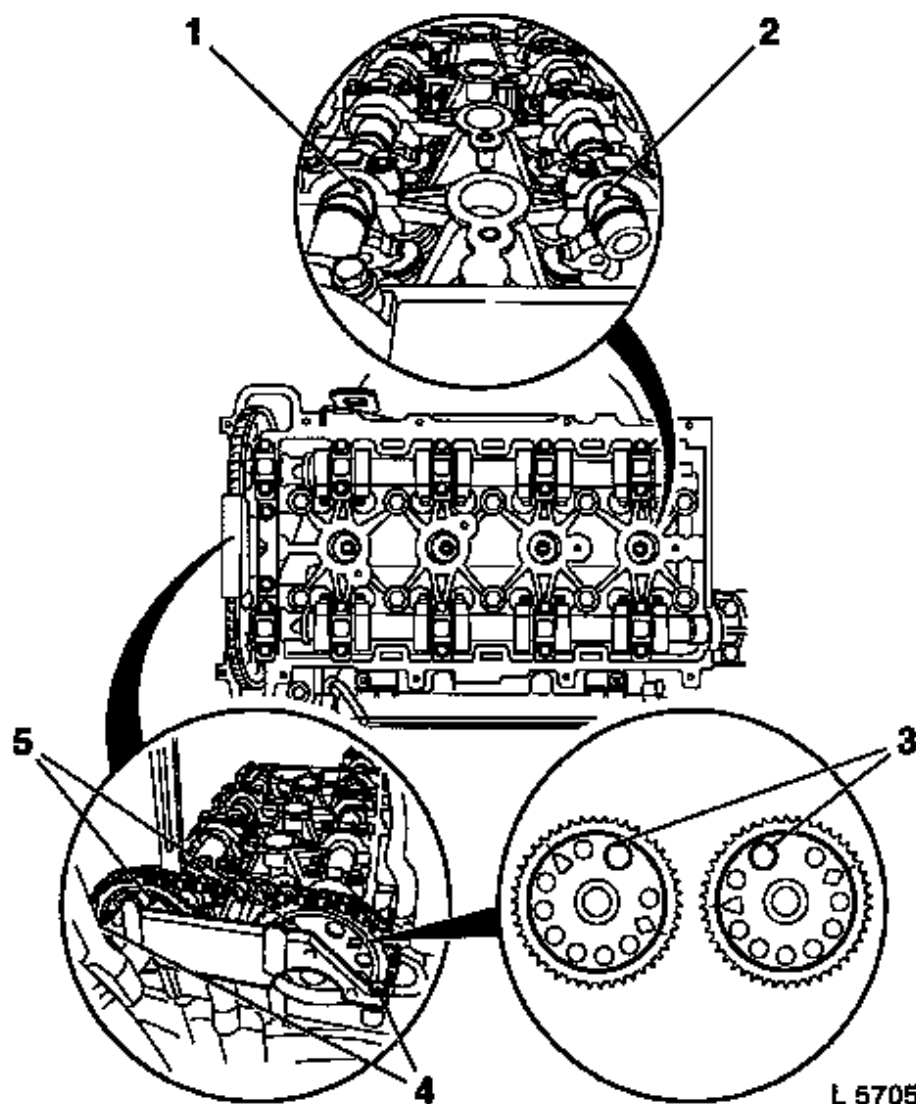


100. Note:
In this position cams
(1) and (2) of
cylinder no. 4 point
upwards.

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

101. Attach compressor
- Tightening
torque **22 Nm**

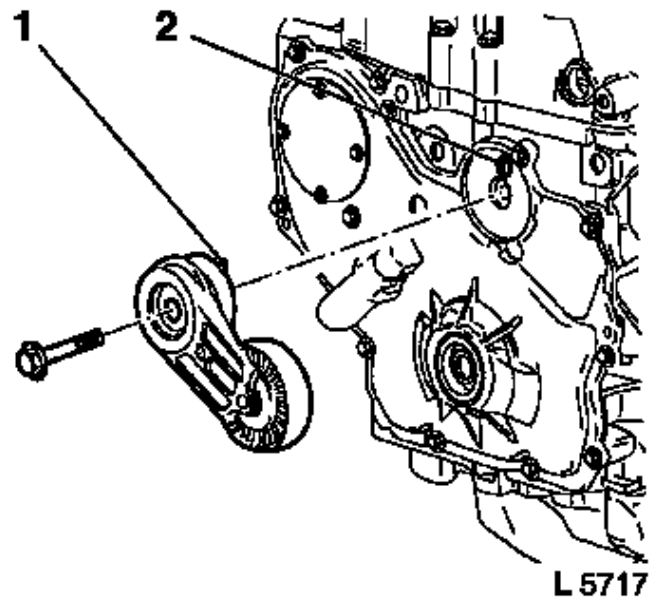
102. Attach alternator
- Tightening
torque **21 Nm**



103. Attach ribbed V-belt tensioner

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

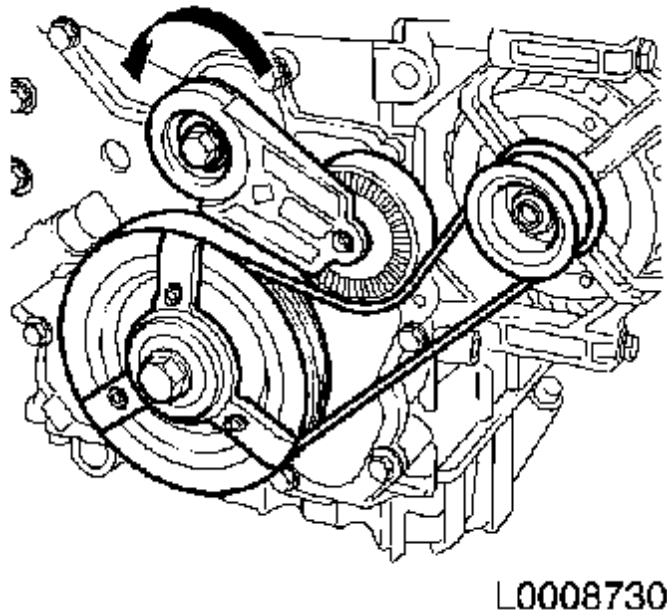
- Tightening torque **43 Nm**

**104. Install ribbed V-belt**

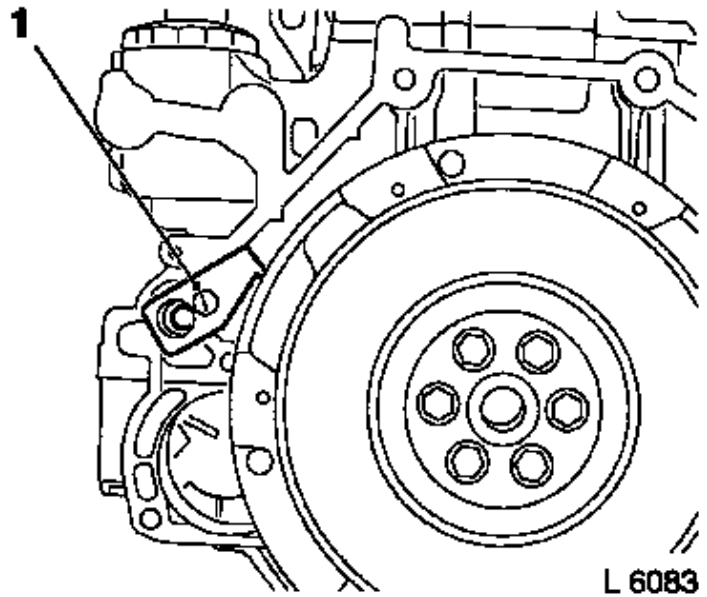
- Lay ribbed V-belt in place
- **Note:** Note running direction and installation position of ribbed V-belt.
- Tension ribbed V-belt tensioner in direction of arrow with **KM-6151**

105. Attach engine damping block bracket

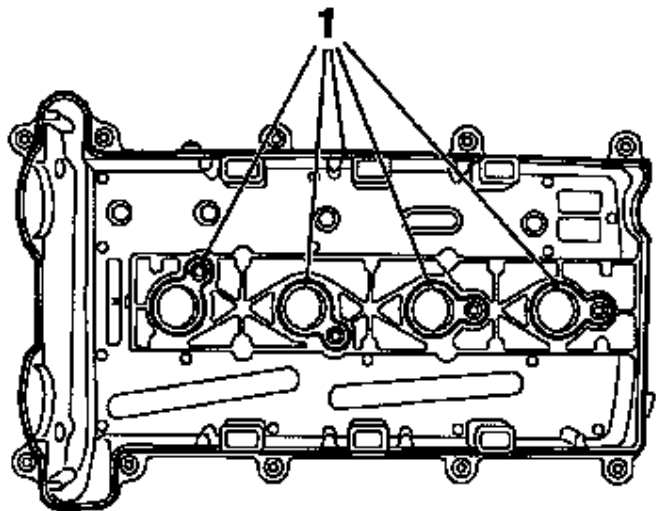
- Tightening torque **50 Nm**

**106. Attach drive plate**

- Recut thread in crankshaft
- Use new bolts
- Tightening torque **50 Nm + 25°**
 - Immobilise drive plate via starter ring gear with **KM-652** (1)



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



- 109.** Attach thermostat housing
- Use a new oil seal
 - Insert with coolant pipe
 - Tightening torque **9 Nm**
- 110.** Attach transmission to engine
- See operation "Manual Transmission and Engine, Separate and Reattach"
- 111.** Install engine
- See operation "Engine, Remove and Install"
- 112.** Fill up with engine oil and correct as required