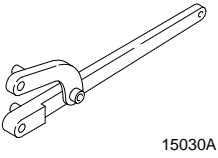
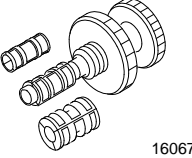
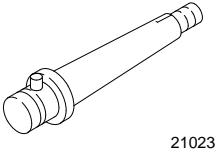
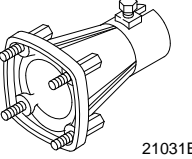
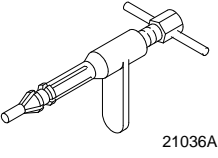
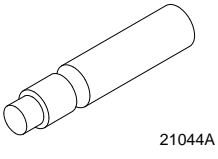
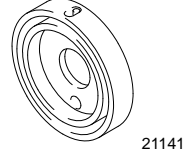
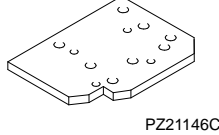
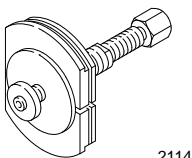
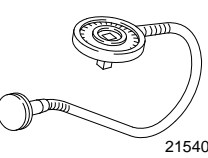


Engine Assembly – Dismantle and Assemble (engine removed) (21 134 8)**Special Tools**

 15030A	15-030A Universal flange-holding wrench
 16067	16-067 Locator for clutch disc
 21023	21-023 Universal mounting spindle for assembly stand
 21031B	21-031B Mounting bracket
 21036A	21-036A Remover for pilot bearing
 21044A	21-044A Installer/locator for pilot bearing/clutch disc
 21141	21-141 Installer for radial oil seal

 PZ21146C	21-146C Mounting plate
 21147	21-147 Remover for vibration damper
 21540	21-540 Angle gauge

Materials

Plastigage	Obtainable through: Replacement Services Limited, 16, Euston Street, Freemans Industrial Estate, Leicester LE2 7ST
Sealer Loctite 518	WSK-M2G348-A5
Sealer Hylosil 502	WSK-M4G320-A

Workshop Equipment

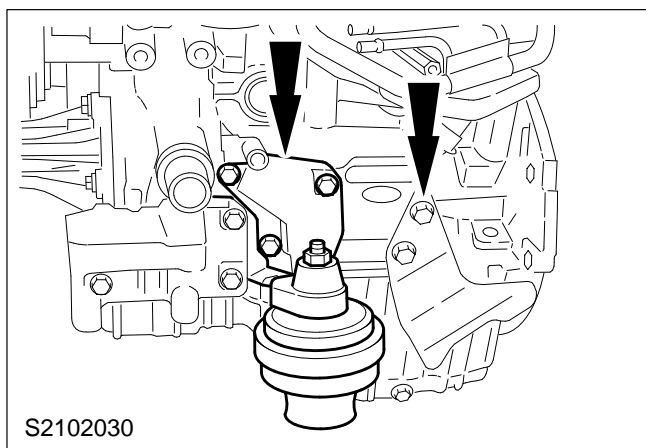
Assembly stand	
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Proprietary Tools

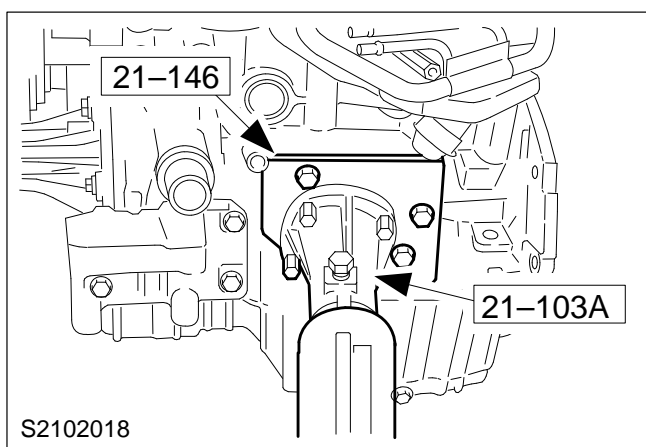
Dial gauge
Magnetic fixture
Piston ring compressor
Oil filter strap wrench

Dismantle**1. Preparatory measures.**

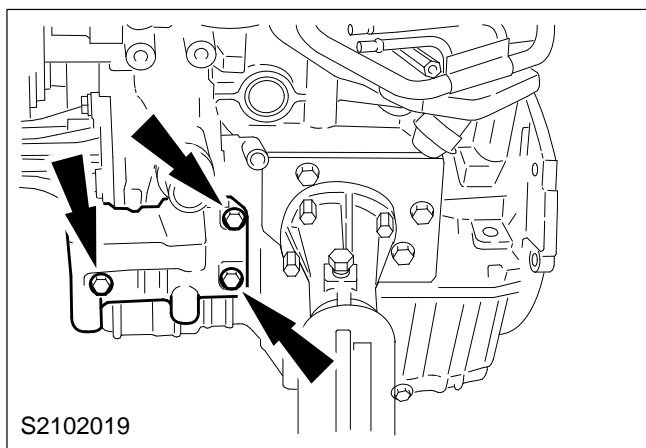
- Drain off the engine oil.
- Remove the oil dipstick tube.



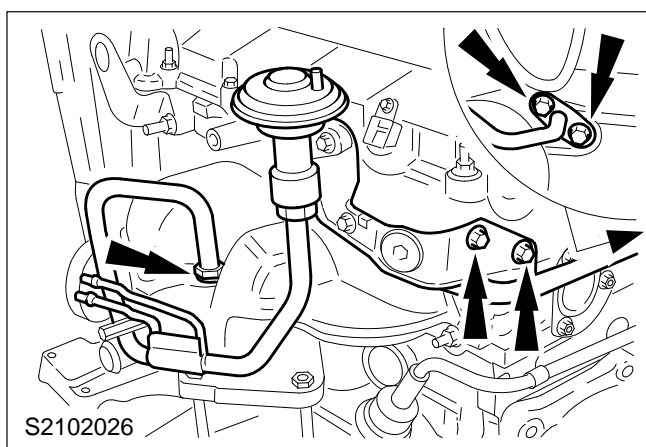
2. Detach the engine mounting bracket with the engine mounting.



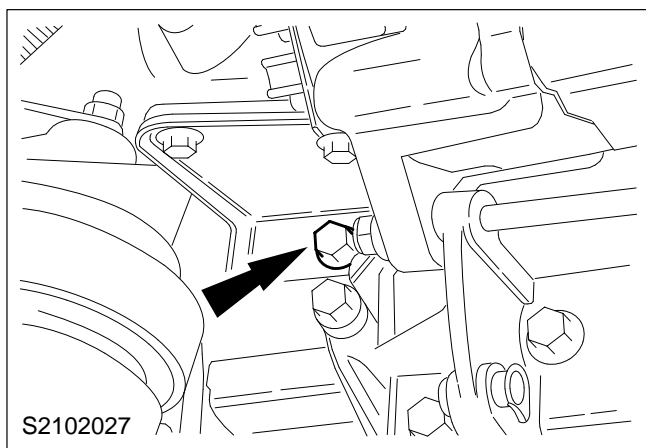
3. Attach the engine to the assembly stand.



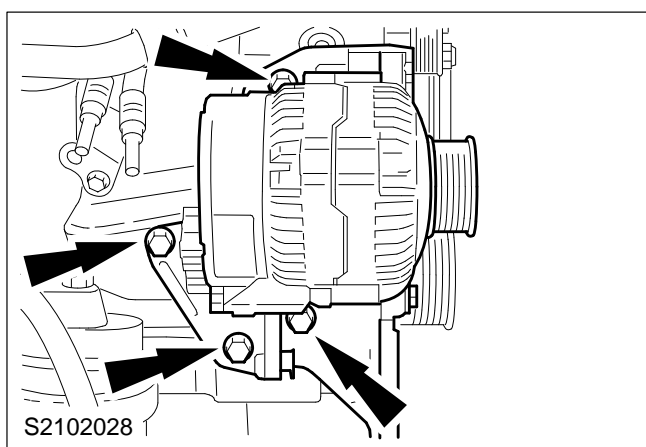
4. Detach the bracket.



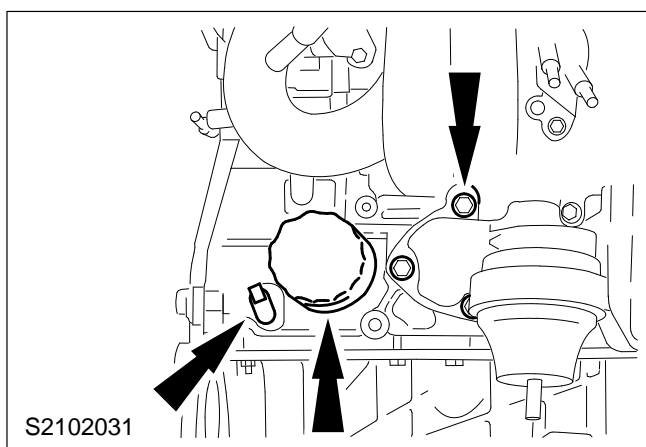
5. Detach the EGR system.



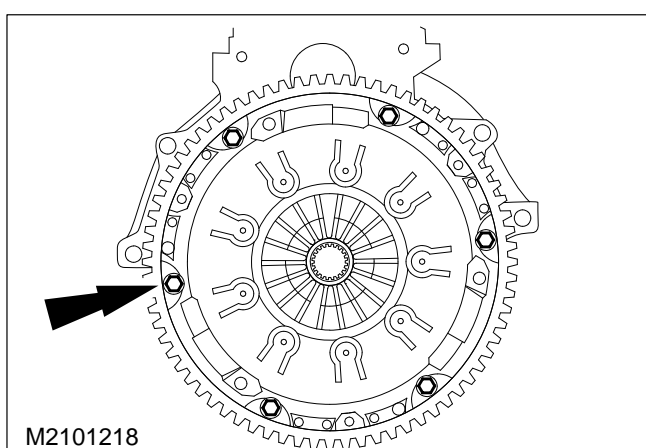
- 6. Detach the inlet manifold bracket from the engine.**



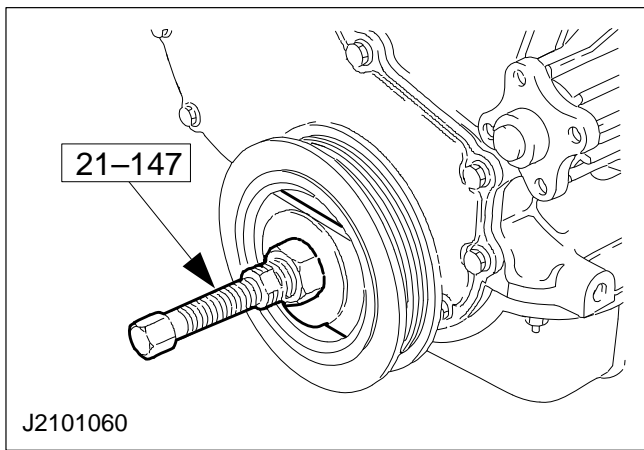
- 7. Detach the alternator and bracket.**



- 8. Detach the engine mounting bracket with the engine mounting.**
- 9. Detach the crankshaft position sensor (CKP sensor).**
- 10. Detach the oil filter.**

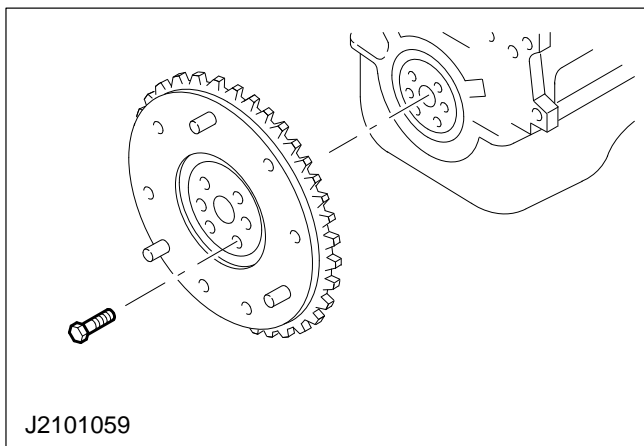


- 11. Detach the clutch.**



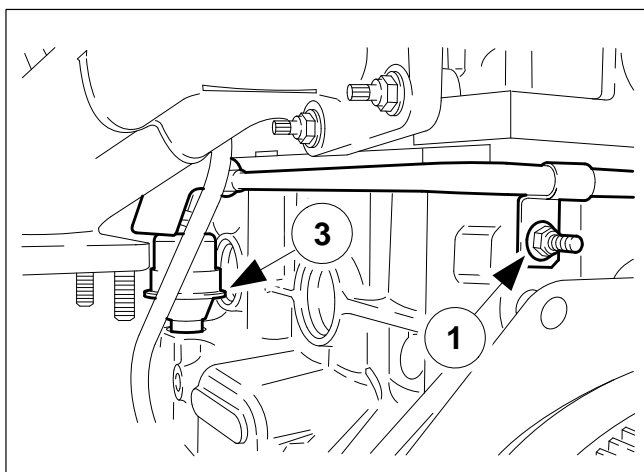
12. Detach the crankshaft belt pulley/vibration damper.

- Immobilise the flywheel using Special Tool 21-168.
- Remove the bolt.
- Pull it off using the special tool.



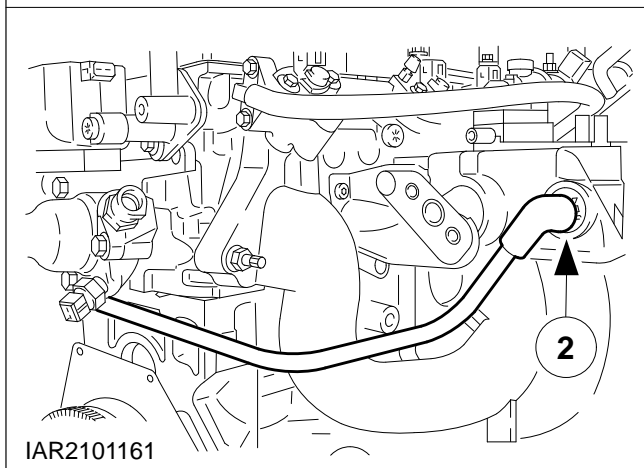
13. Detach the flywheel.

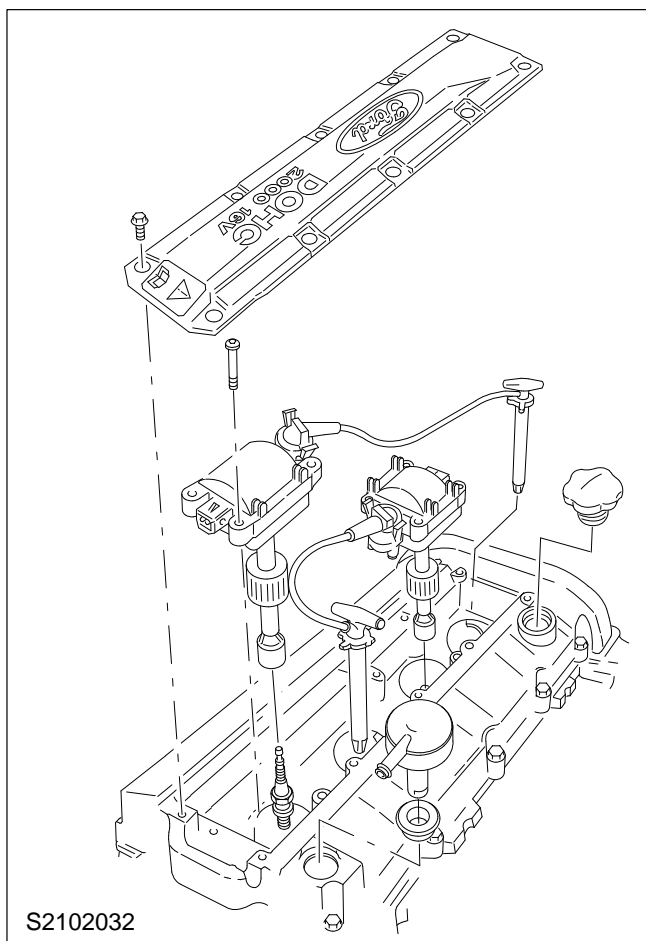
- Remove the bolts.
- Remove the flywheel.



14. Detach the crankcase breather (PCV) tube.

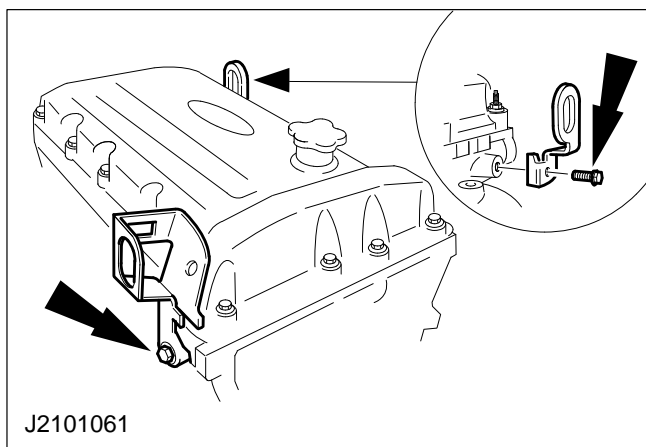
- 1 Detach the bracket from the cylinder head.
- 2 Disconnect the tube from the inlet manifold.
- 3 Lever it off exhaust manifold.





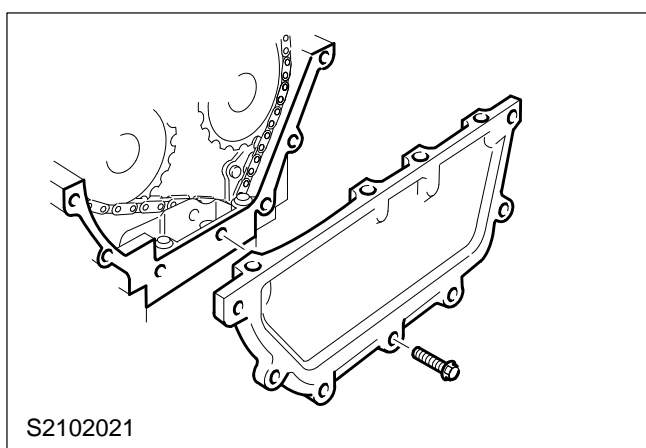
15. Remove the spark plugs.

- Detach the ignition coil cover.
- Disconnect the spark plug connectors.
- Remove the ignition coils (two bolts each).
- Remove the spark plugs.

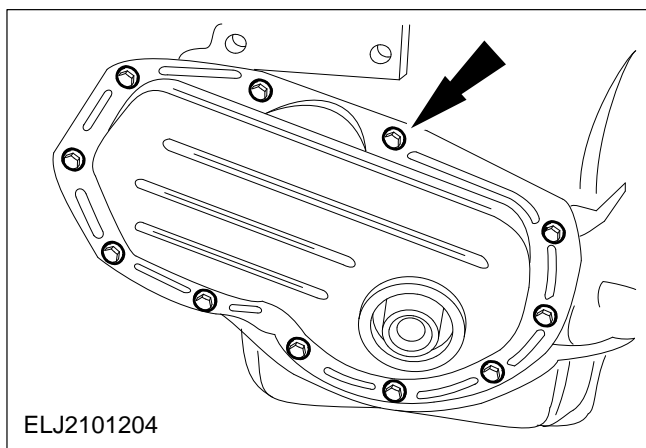


16. Detach the engine lifting eyes.

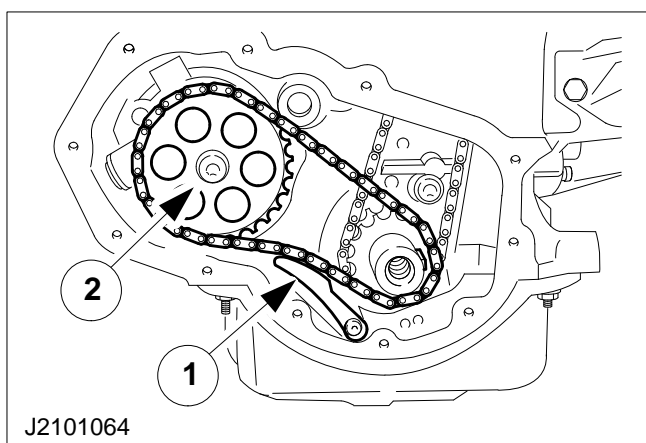
17. Detach the cylinder head cover (eleven bolts and four nuts).



18. Detach the upper timing chain cover.

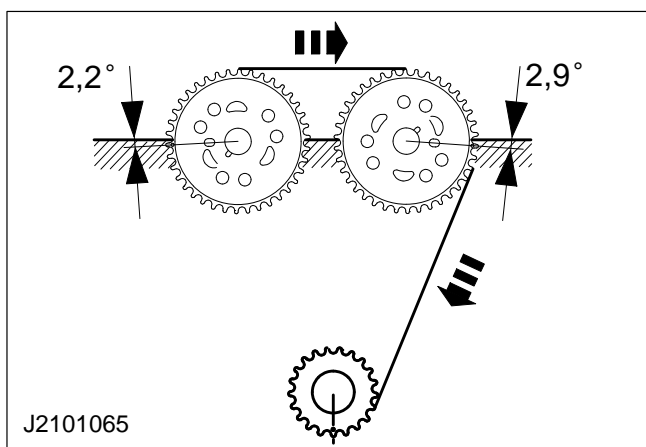


19. Detach the lower timing chain cover.

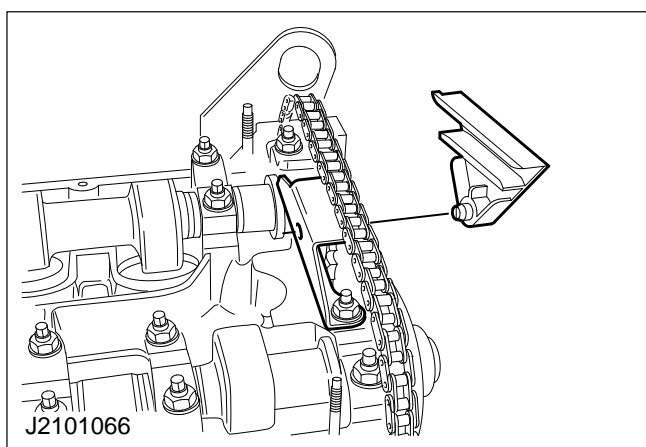


20. Detach the oil pump sprocket and chain.

- 1 Remove the chain tensioner for the oil pump chain.
- 2 Remove the oil pump sprocket with the chain.

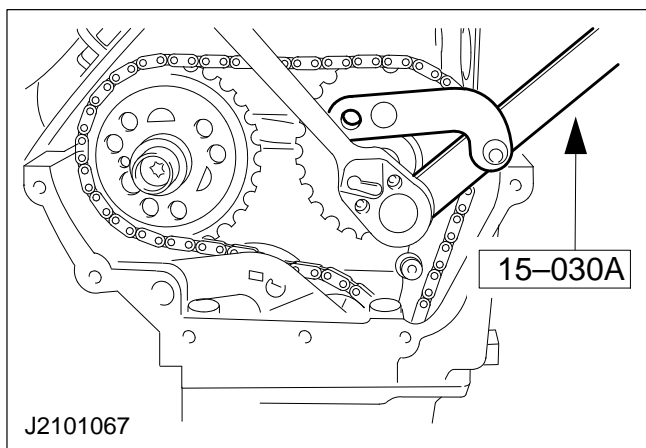


21. Set the camshaft sprockets to the marks.

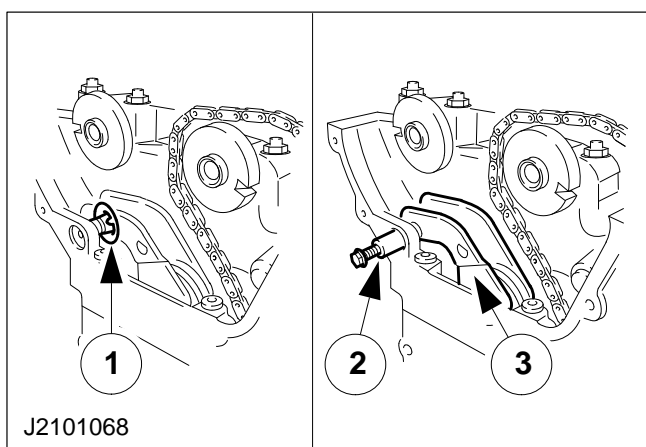


NOTE: The chain guide must be renewed during installation.

22. Remove the upper chain guide rail.

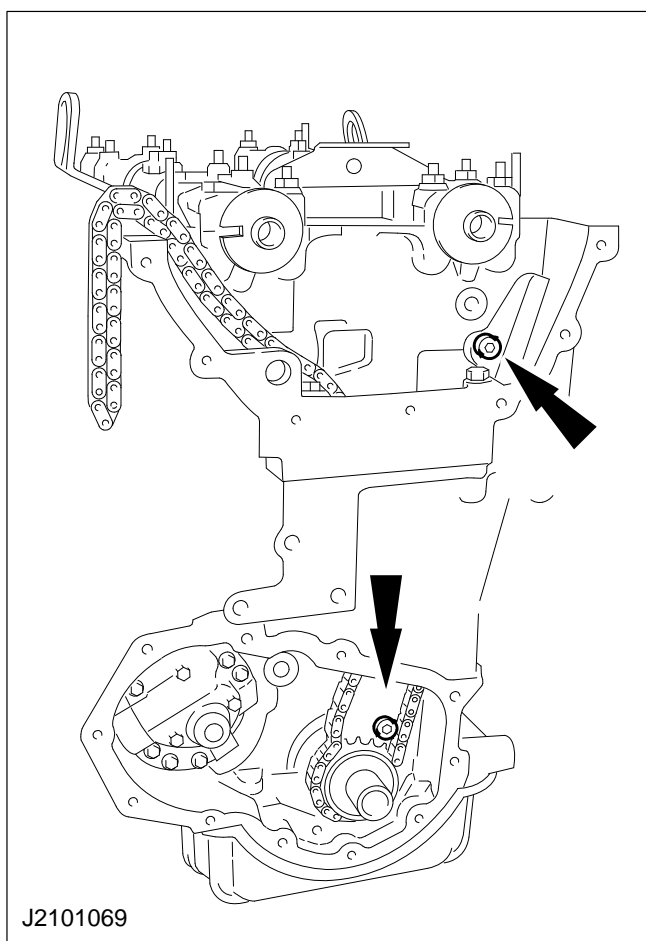


23. Remove the camshaft sprockets.

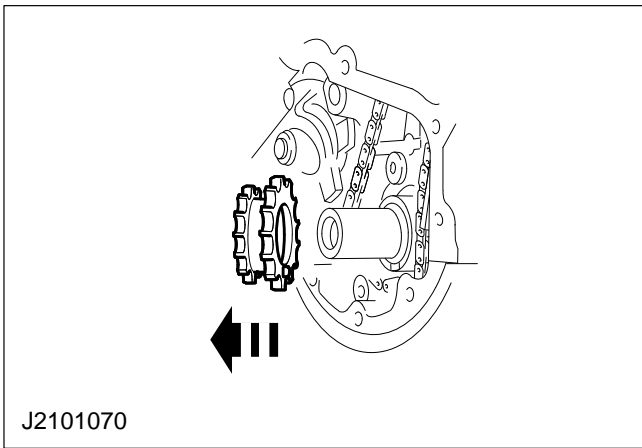


24. Remove the chain tensioner arm.

- 1 Remove the retaining ring with a pair of pliers.
- 2 Withdraw the chain tensioner pivot pin with a bolt (M6).
- 3 Remove the chain tensioner arm from the housing.

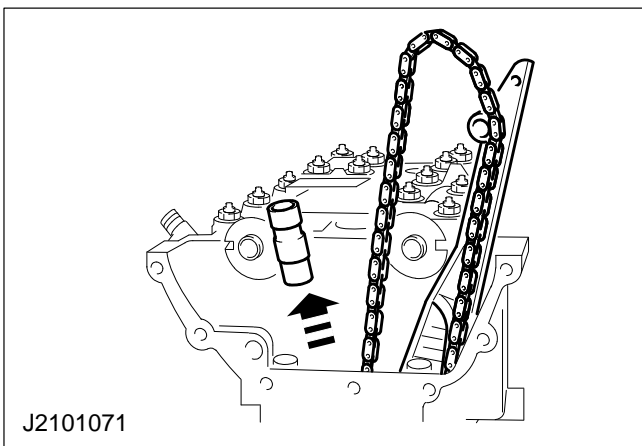


25. Release the chain guide.



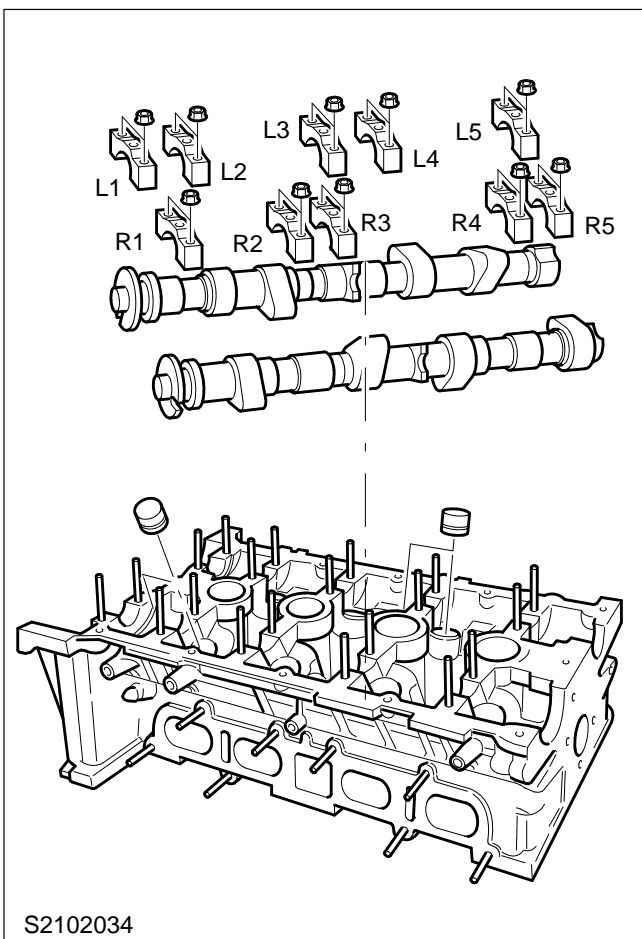
26. Remove the timing chain.

- Remove the Woodruff key from the crankshaft.
- Remove the crankshaft chain sprocket with the timing chain.



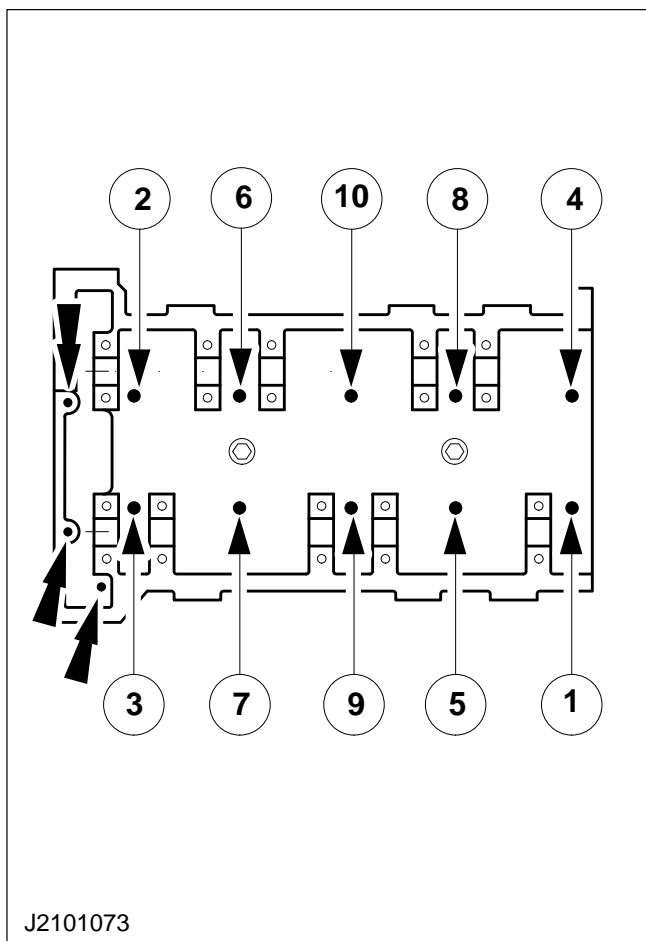
⚠ CAUTION: Do not reuse the oil-filled plunger.

27. Remove the chain tensioner plunger and the timing chain.



28. Remove the camshafts.

- Detach the chain guide bracket with the front bearing caps.
- Remove the hydraulic tappets and keep them in order.

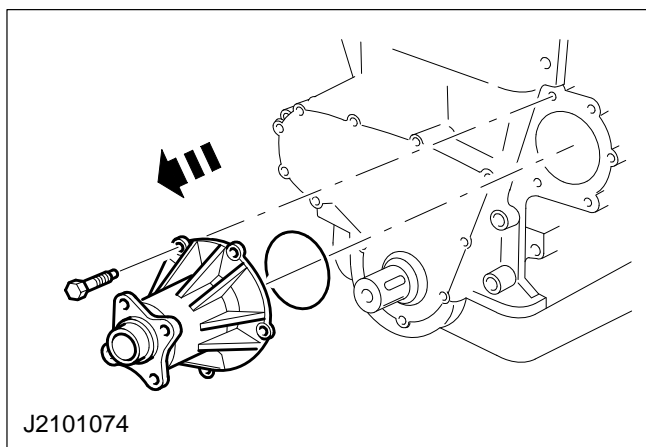


NOTE: Release the three auxiliary bolts first.

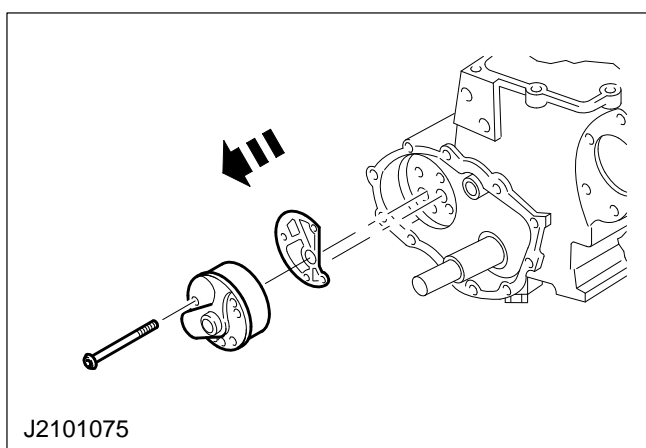
CAUTION: Cylinder head bolts should not be re-used.

29. Detach the cylinder head.

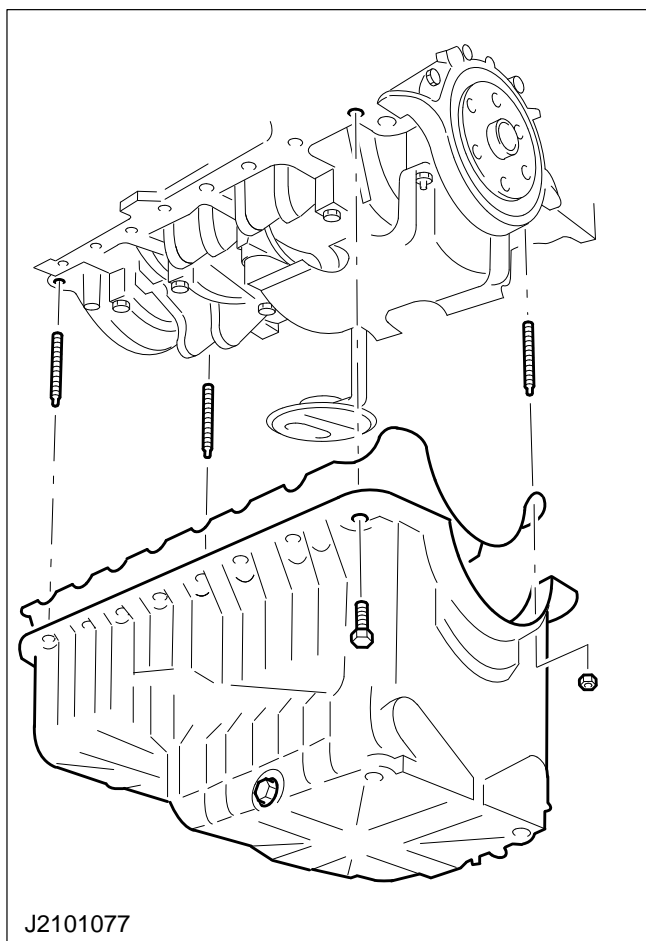
CAUTION: Before the bolts are released, the cylinder head must have cooled to at least 30 °C.



30. Detach the water pump.

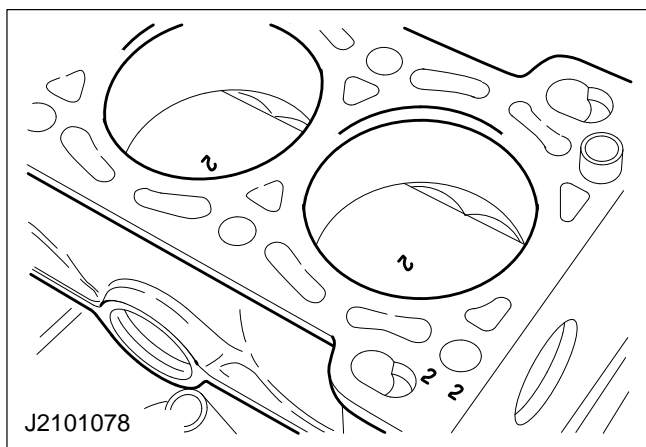


31. Detach the oil pump.



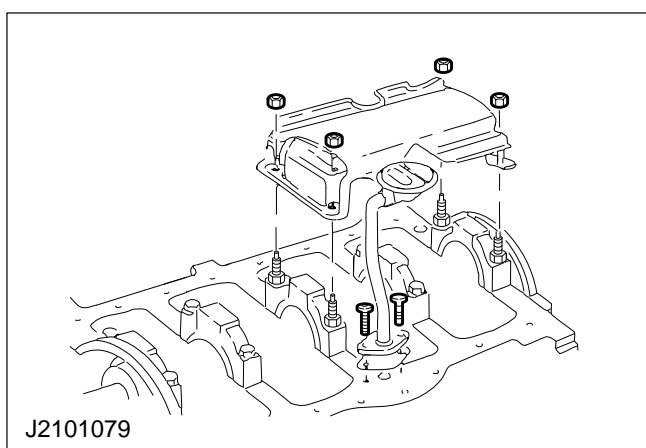
⚠ CAUTION: Oil sludge and abraded particles must not get into the engine.

32. Remove the sump downwards.

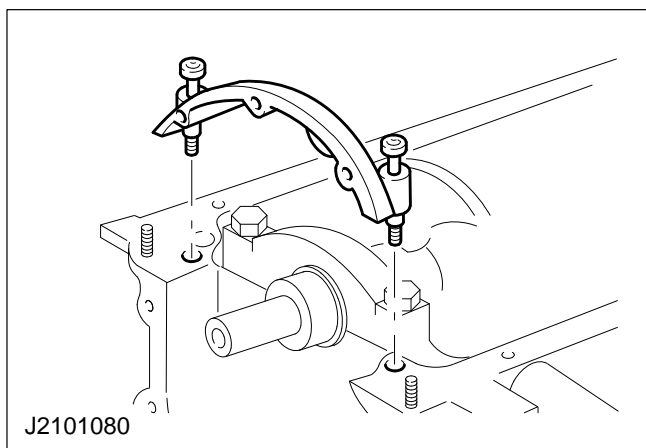


⚠ CAUTION: Do not damage the cylinder bore.

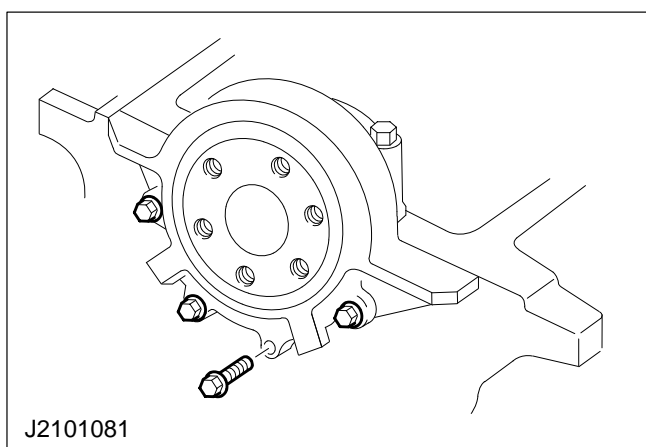
33. Remove the carbon from the upper edge of the cylinder bore.



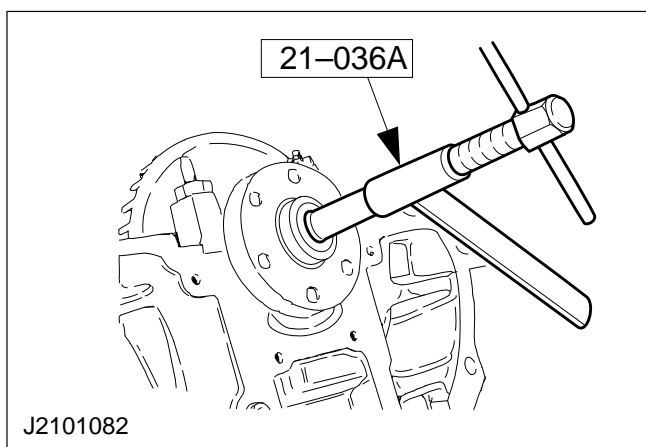
34. Detach the oil intake pipe and oil baffle.



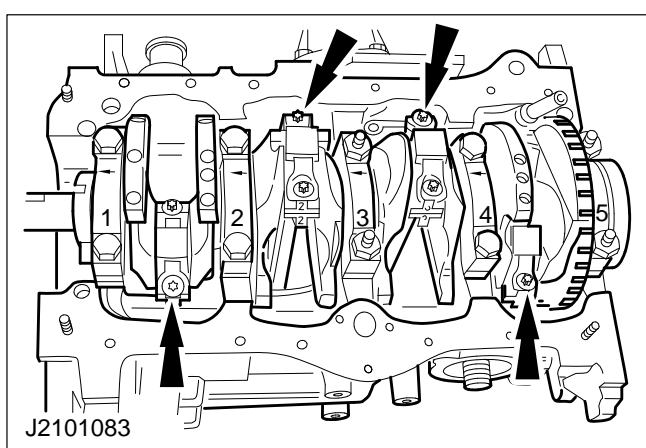
35. Detach the crankshaft front oil seal housing.



36. Detach the crankshaft rear oil seal housing.

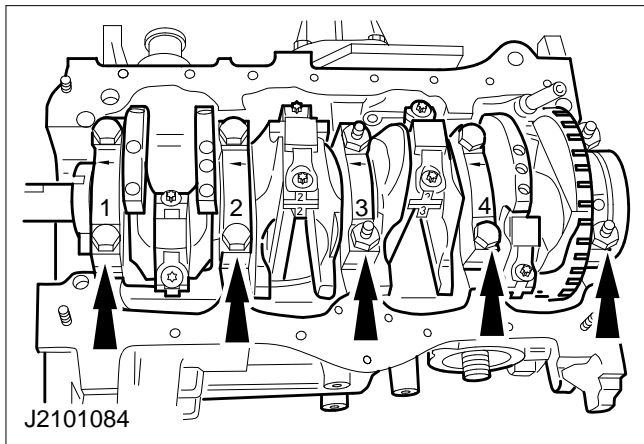


37. Remove the crankshaft pilot bearing.



38. Remove the pistons.

- Detach the big-end bearing caps.
- Remove the big-end bearing shells from the big-end bearing caps and connecting rods and mark them.
- Press out the pistons with the connecting rods.



39. Remove the crankshaft.

- Detach the main bearing caps.
- Remove the crankshaft.
- Remove the bearing shells and thrust half rings and keep them in order or mark them for further use.

Assemble

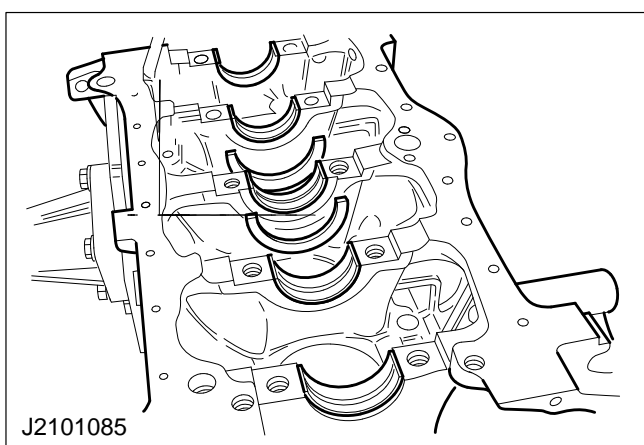
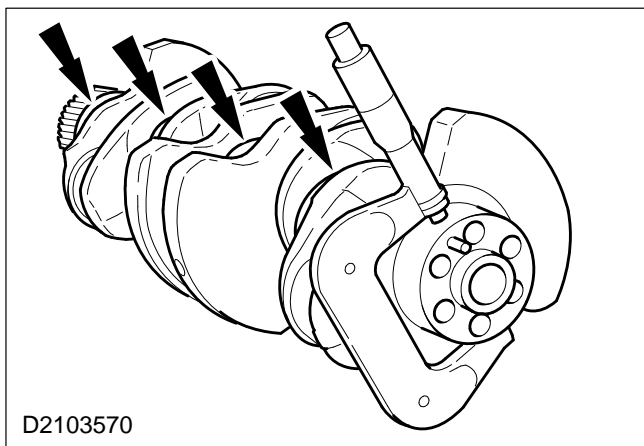
40. Preparatory measures.

- Clean all the mating faces and reusable parts thoroughly and check them for damage.
- When applicable, the upper and lower timing chain covers are renewed complete with the radial oil seal in place.

NOTE: If the measurements are not as specified in the technical data, the crankshaft must be overhauled or changed.

41. Measure the diameters of the main and big-end bearing journals using a proprietary micrometer screw.

Repeat each measurement at 90°.



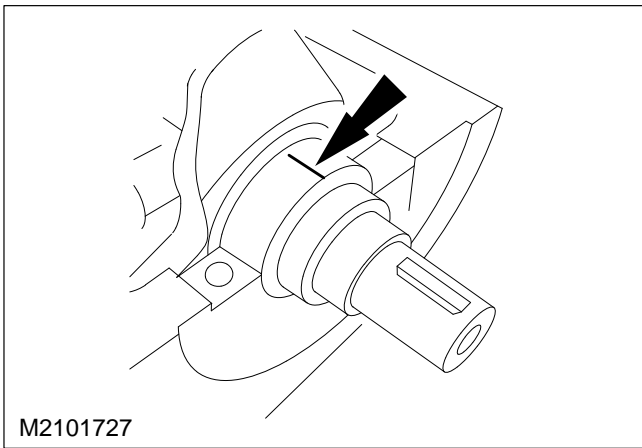
Measure bearing clearance



CAUTION: Do not damage the crankshaft bearings during fitment.

42. Fit the crankshaft.

- Place the grooved bearing shells in the cylinder block.
- Place the crankshaft dry in the cylinder block.

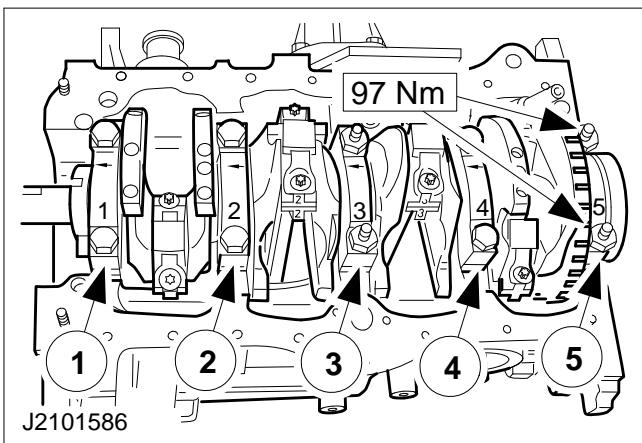


CAUTION: The crankshaft must not be turned during the measuring operation.

43. Measure the crankshaft main bearing clearance.

NOTE: The point at which the measurement is made must be dry.

- Lay a length of Plastigage thread on the bearing journal across the bearing.
- Fit the bearing cap (see sub-operation 42.).



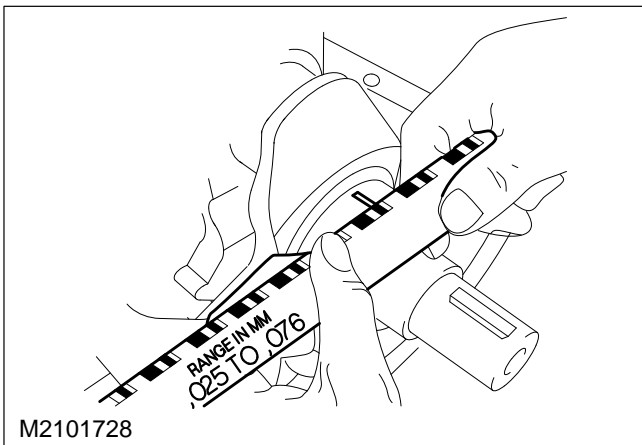
NOTE: Measure the clearance of the bearings in turn in numerical order (1 – 5).

44. Measure the crankshaft main bearing clearance (continued).

- Fit the bearing cap with the associated bearing shell, with the arrow pointing towards the timing chain end, and secure it.

NOTE: The bearing cap numbering starts at the timing chain end.

- Fit the bearing cap.

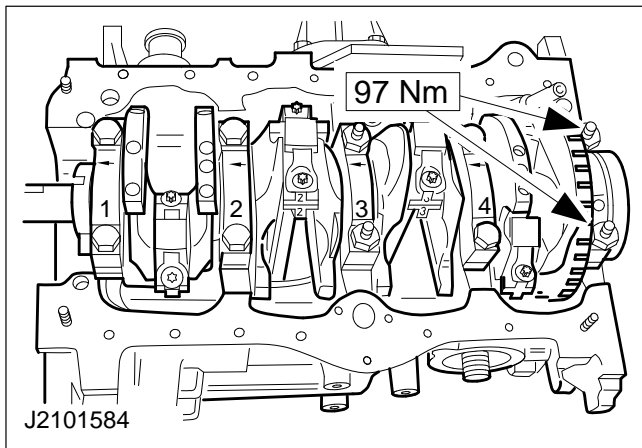


NOTE: If the specified bearing clearance is not achieved, on a standard cylinder block and with a crankshaft which is a maximum of 0,02 mm undersize, the next largest bearing shells may be fitted. The bearing clearance must not have been more than 0,098 mm however.

45. Measure the crankshaft main bearing clearance (continued).

- Compare the Plastigage thread with the Plastigage scale.
- The reading corresponds to the bearing clearance.

NOTE: If the specified bearing clearance of 0,011 – 0,048 mm is not obtained, the bearing shells should be changed and the measuring operation repeated from sub-operation 42. onwards.



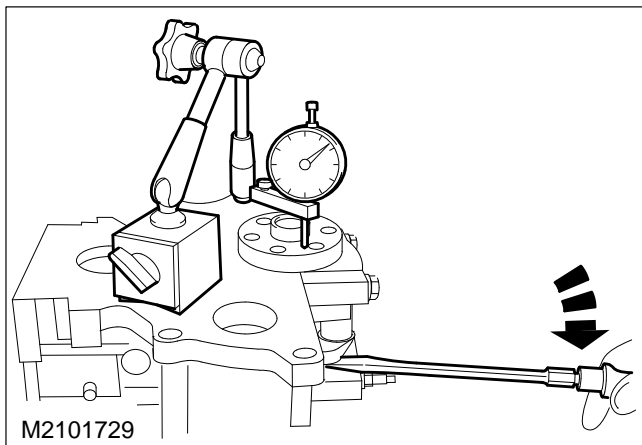
NOTE: Fit the bolts with the threaded pins in bearings 3 and 5.

46. Fit the crankshaft.

- Lubricate the main bearing journals and bearing shells and the threads and contact faces of all the bolts with engine oil.
- Fit the crankshaft.
- Fit the thrust half rings with the copper-coloured side facing the crankshaft.
- Coat the contact faces and the sides of the rear main bearing cap with sealer.
- Fit the crankshaft main bearing caps with the associated bearing shells.

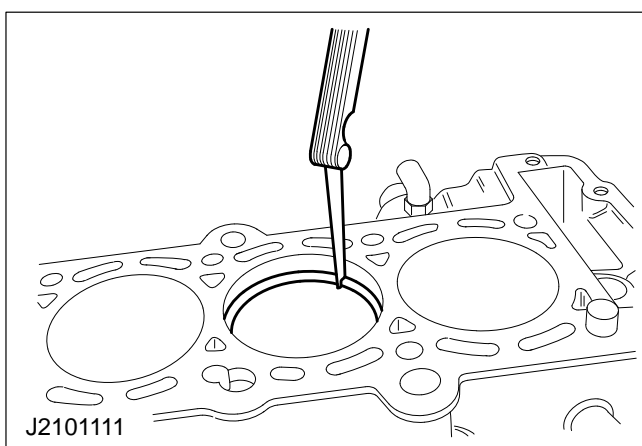
NOTE: The bearing cap numbering starts at the timing chain end, to which the arrows also point.

- Tighten the bolts.



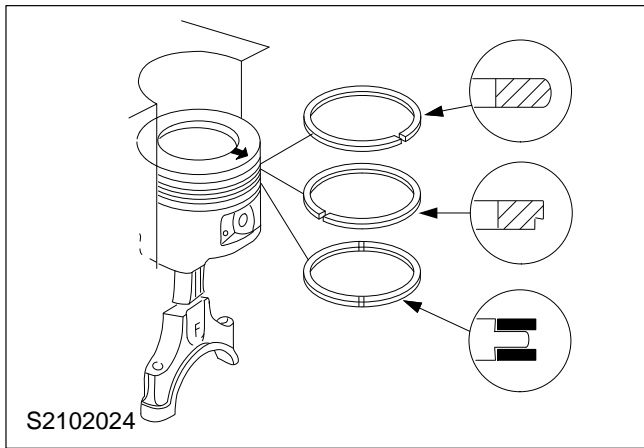
47. Check the crankshaft end float.

- Set up a dial indicator.
- Measure the end float by lifting the crankshaft with the aid of a screwdriver.
- Correct the end float as necessary by fitting new thrust half rings to main bearing no. 3.



48. Check the piston ring gaps.

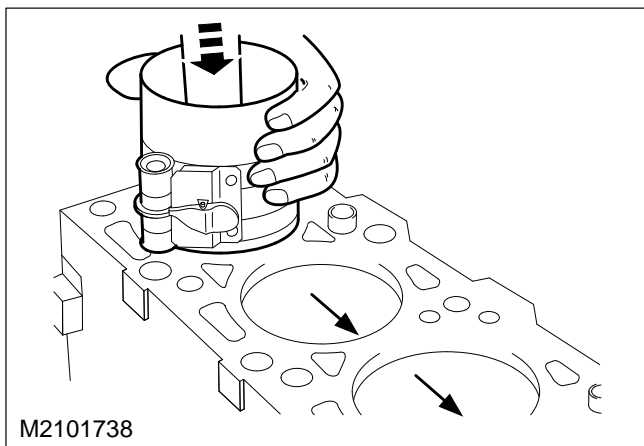
The figures indicated in the Technical Data are for a gauge ring used in production. The figures measured in the cylinder can exceed these by 0,15 mm.



CAUTION: The maximum width of the piston rings corresponds to the diameter of the cylinder bore + 1,7 mm.

49. Arrangement of the piston rings.

CAUTION: The upper piston rings are coated with molybdenum. This coating must not be damaged.



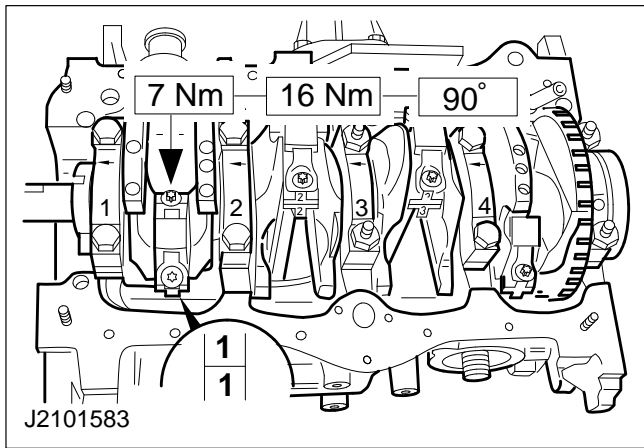
NOTE: The connecting rod numbering 1 to 4 starts at the timing chain end. The arrow on the piston crown points towards the timing case.

50. Install the pistons.

- Lubricate the pistons and cylinder liner bores with engine oil.
- Distribute the piston ring gaps uniformly around the circumference; this also applies to the elements of the oil control ring.
- Compress the piston rings using a proprietary piston ring compressor.
- Press pistons 1 and 4 into the cylinders using the handle of a hammer. The big-end bearing journal must be at BDC.
- Lubricate the bearing shells with engine oil.
- Fit the appropriate bearing shells in the connecting rod and bearing cap.
- Use new connecting rod bolts (bolt head marking "KX120" on connecting rods with side groove).
- Fit the bearing caps.
- Turn the crankshaft 180°, fit pistons 2 and 3.

51. Measure the big-end bearing clearance.

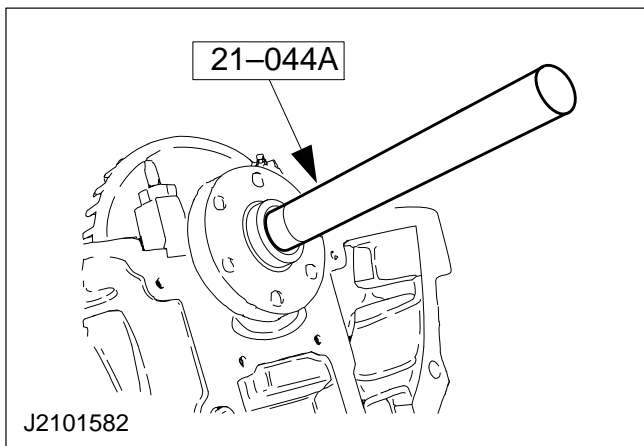
Measure the big-end bearing clearance as described in sub-operations 42. to 45.



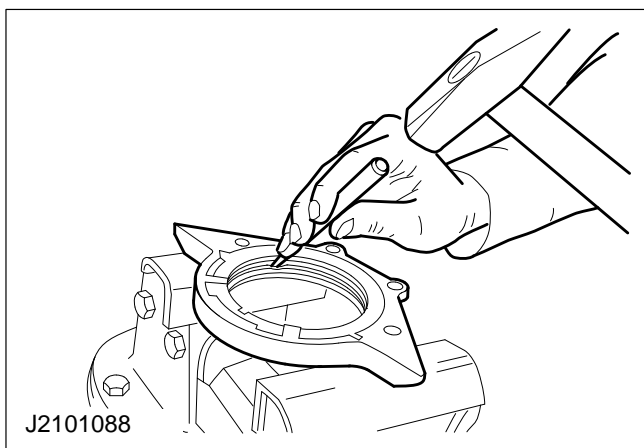
NOTE: The connecting rods and their bearing caps have the same numbers.

52. Fit the bearing caps.

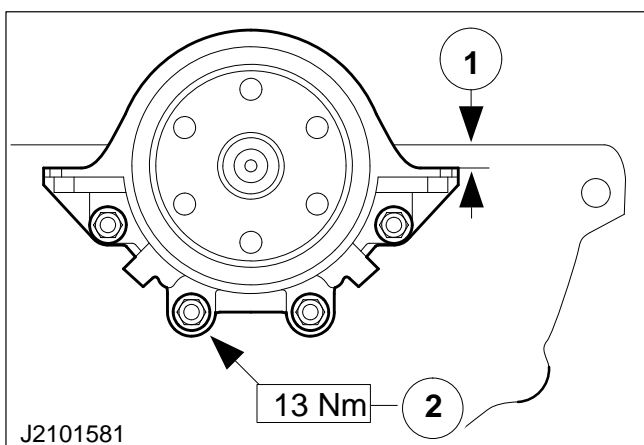
- Lubricate the bearing shells and bearing journals with engine oil.
- Fit the associated bearing caps and bearing shells and secure them.



53. Install the crankshaft pilot bearing.



54. Remove the oil seal from the rear oil seal housing.



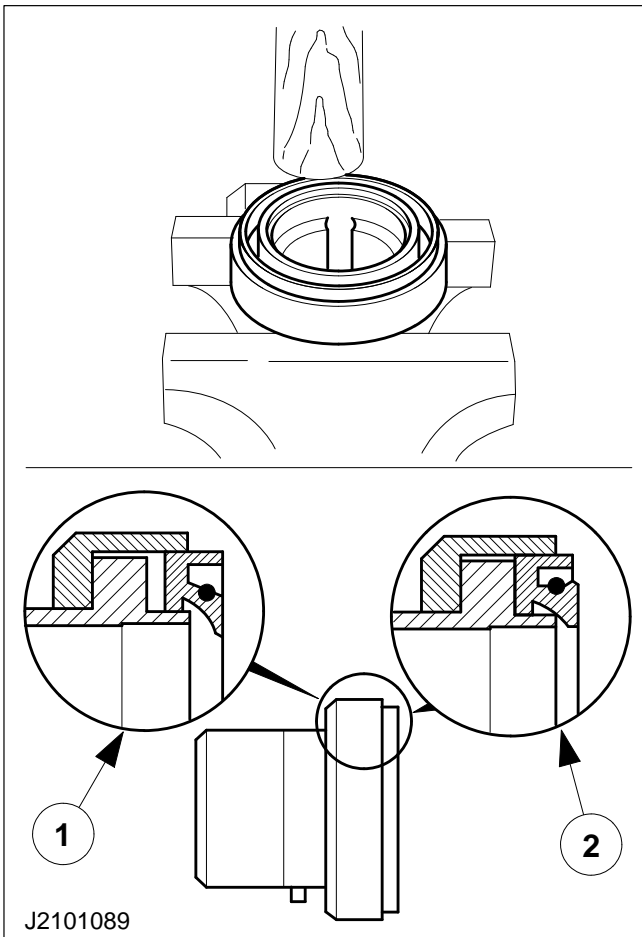
Install the rear oil seal housing

55. Align the oil seal housing.

- Fit the oil seal housing using a new gasket and screw in the bolts loosely.

1 The mating face of the oil seal housing must be below the mating face of the cylinder block. The difference in height must not exceed 0,46 mm.

2 Tighten the bolts.



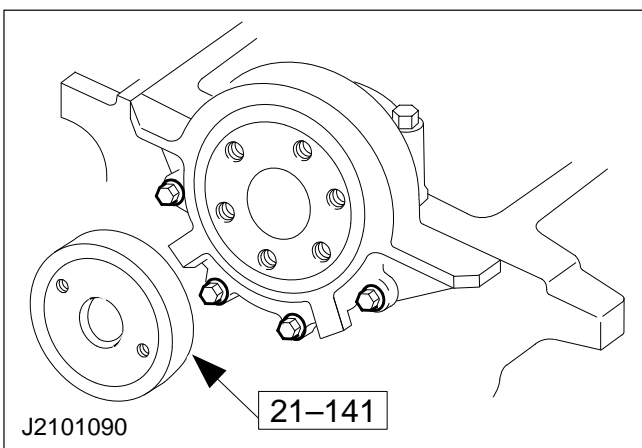
56. General description of the procedure for fitting a radial oil seal into a special tool with a guide sleeve.

⚠ CAUTION: The radial oil seal must be fitted into the tool as far as the shoulder.

- For correct fitment, the special tool is placed on a vice and the radial oil seal is pressed in using the handle of a hammer.

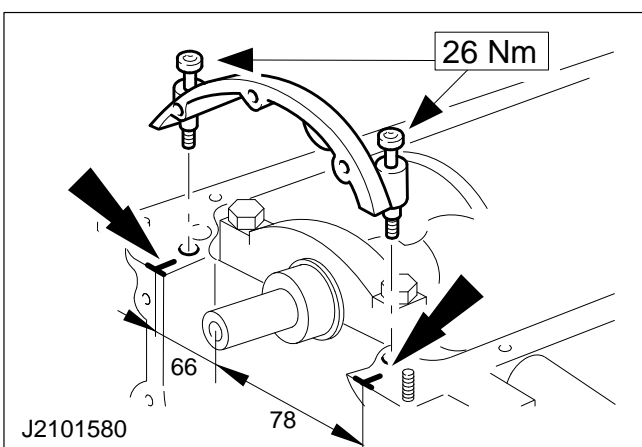
1 Incorrect fitment.

2 Correct fitment.



57. Fit the crankshaft rear oil seal.

Pull in the oil seal using two flywheel bolts.

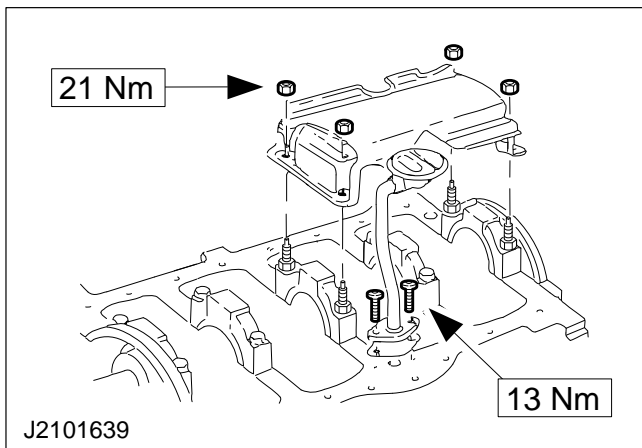


NOTE: Do not remove any excess sealer before installing the sump.

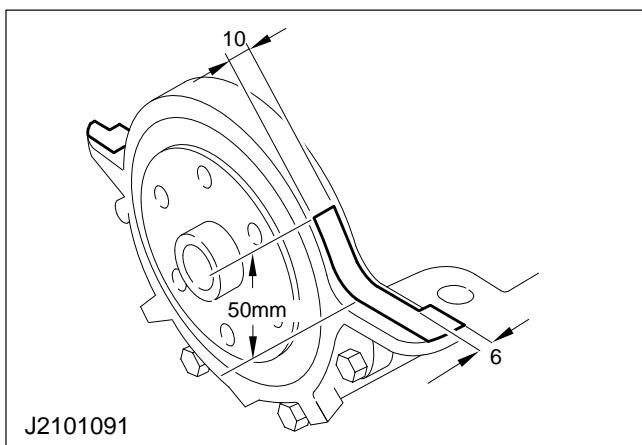
58. Fit the crankshaft front oil seal housing.

- Use sealer (WSK-M2G348-A5).
- Apply four beads of sealer, each 3-5 mm diameter and 10 mm long.

NOTE: After installing the oil seal carrier the sealer must stand proud adequately at the front and sides.

**59. Fit the oil baffle.**

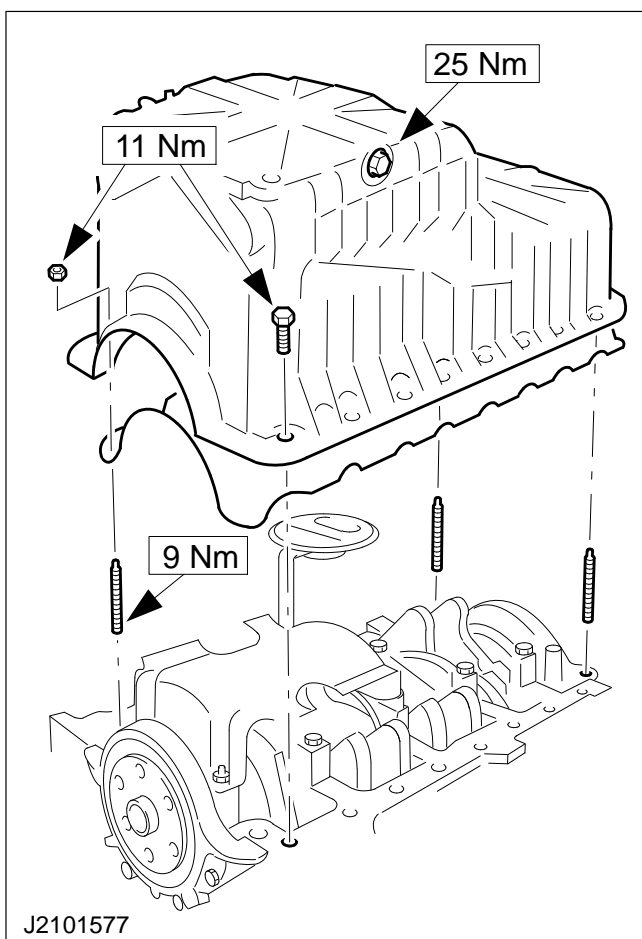
NOTE: Fit the oil baffle so that the oil dipstick and oil strainer can be fitted.

60. Fit the oil strainer.**Install the sump**

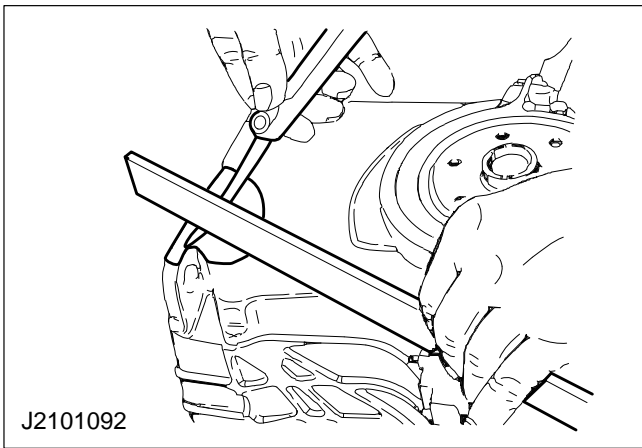
NOTE: The bead of sealer must cover the mating face gaps.

61. Apply sealing compound to the cylinder block on the flywheel side.

- Use sealer (WSK-M4G320-A).
- Apply a bead of sealer with a thickness of 3 – 5 mm and a width of 10 mm on both sides.

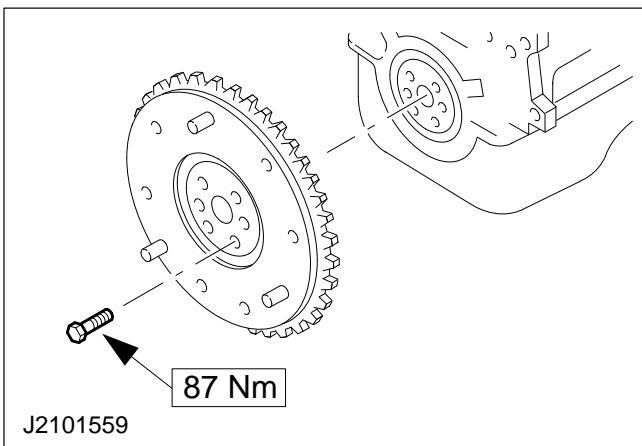
**62. Fit the sump using a new gasket.**

- Align the sump as described in sub-operation 63.
- Tighten the three nuts and the twelve bolts.



63. Align the sump.

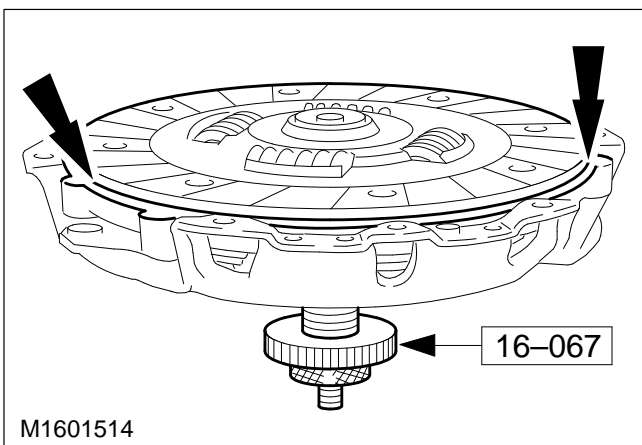
- Align the sump so that it stands a maximum of 0,25 mm short or 0,1 mm proud.
- Measure the difference in height using a steel straightedge and a feeler gauge; make a note of the measurement.
- Reduce the difference to zero when installing the engine by using shims (see Technical Data).



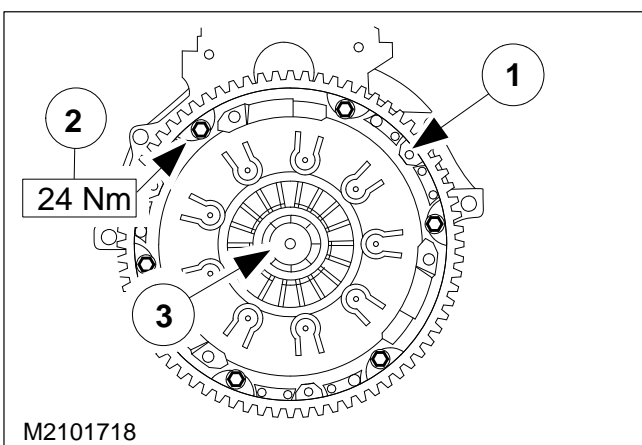
NOTE: It can only be fitted in one position.

⚠ CAUTION: Use new bolts.

64. Fit the flywheel.

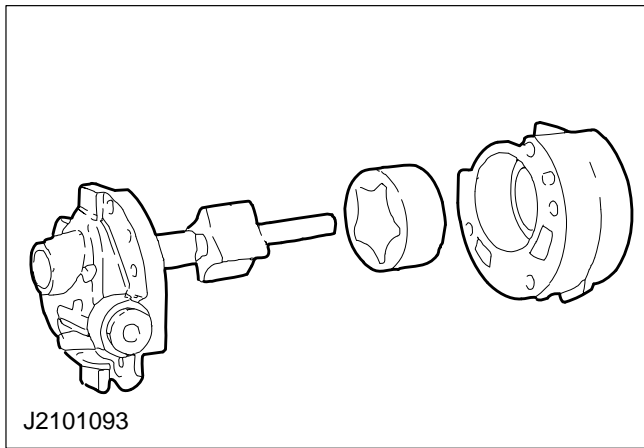


65. Centre the clutch disc on the pressure plate.



66. Fit the clutch assembly.

- 1 Fit the clutch pressure plate with the centred clutch disc.
- 2 Tighten the six bolts uniformly, working diagonally.
- 3 Remove the special tool.



⚠ CAUTION: A new oil pump must be filled with oil and turned over by hand before it is fitted.

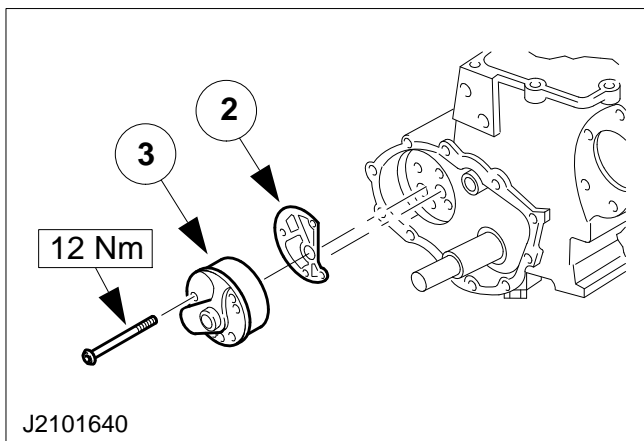
67. Clean the oil pump.

Dismantle the oil pump.

NOTE: If excessively worn, the oil pump is only changed complete.

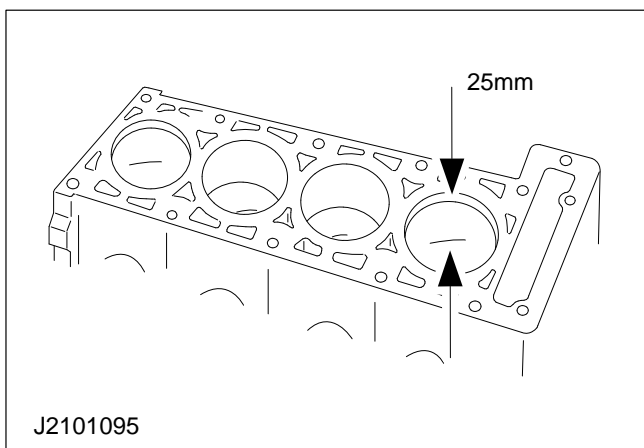
68. Reassemble the oil pump.

NOTE: The dot marks must face outwards.



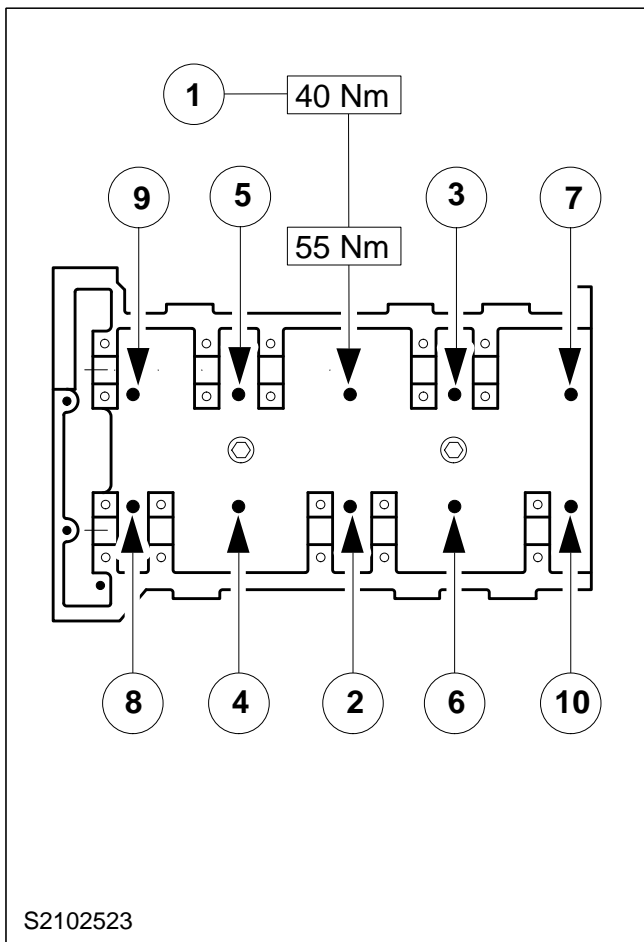
NOTE: The passages of the oil pump must not be covered by the gasket.

69. Fit the oil pump using a new gasket.



Install the cylinder head

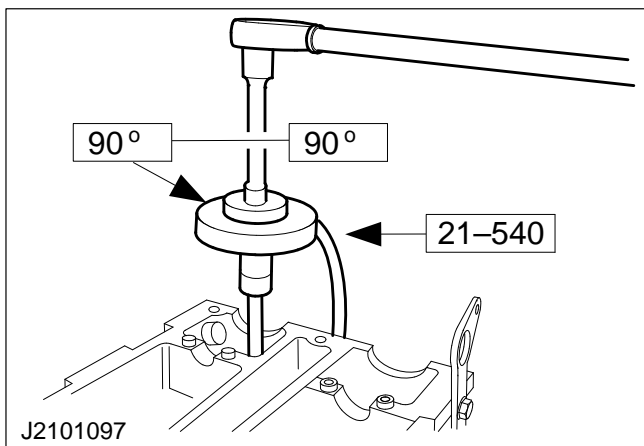
70. Bring the piston of cylinder no. 1 to a point 25 mm before TDC.



CAUTION: Use new bolts.

71. Fit the cylinder head and tighten the bolts.

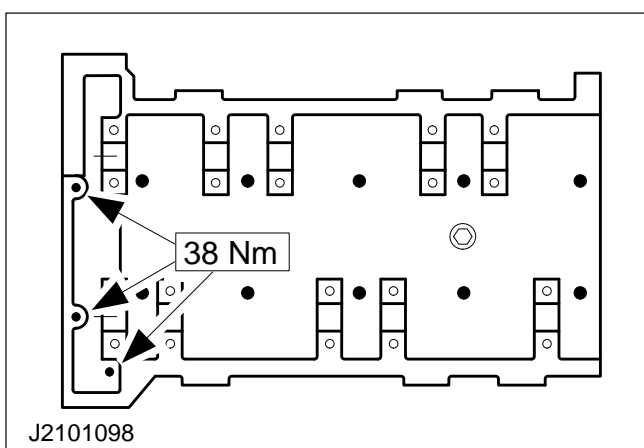
Fit the cylinder head gasket.



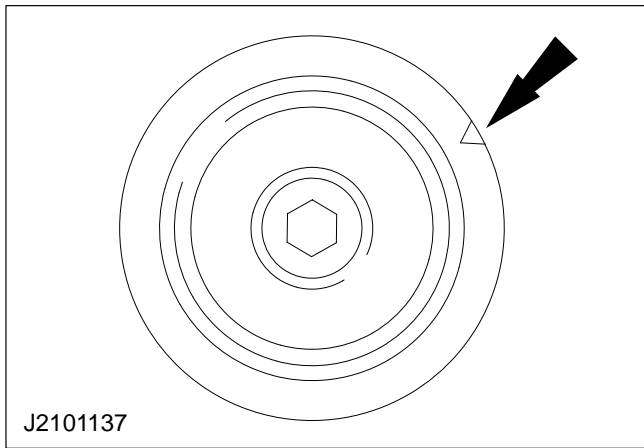
CAUTION: The cylinder head bolts must not be retorqued.

72. Tighten the cylinder head bolts (continued).

Tighten twice through 90°.



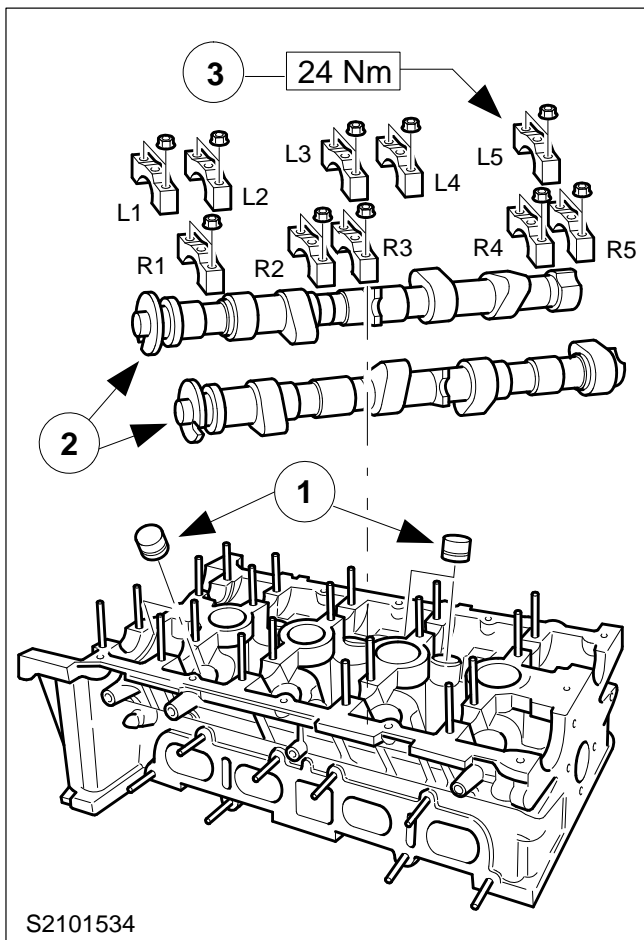
73. Tighten the auxiliary cylinder head bolts.



Install the camshafts

74. Bring the piston of cylinder no. 1 to a point approximately 25 mm before TDC.

Position of the crankshaft belt pulley/vibration damper.



75. Install the camshafts.

CAUTION: Before the camshafts are installed, the piston of cylinder no. 1 must be at a point approximately 25 mm before TDC.

CAUTION: After installation of the camshafts, it is imperative to wait 15 minutes before the engine is turned.

- Oil the bearings.

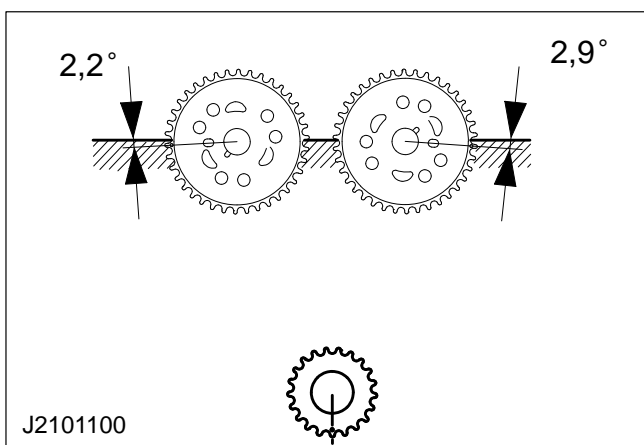
1 Fit the hydraulic tappets.

2 Fit the camshafts so that none of the cams is at full lift.

NOTE: R is the inlet side, L is the exhaust side.

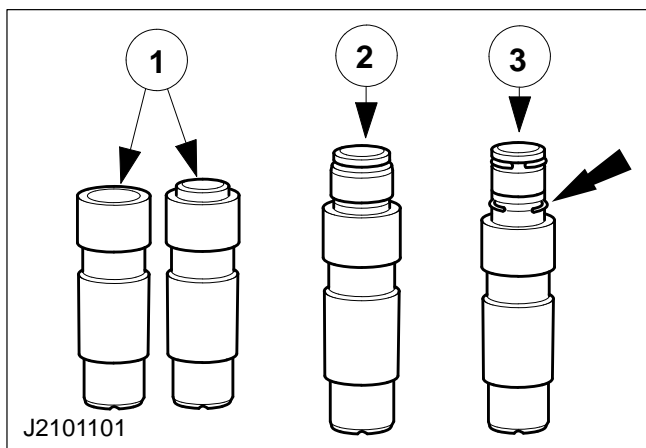
3 Fit the camshaft bearing caps so that the position markings can be read from the rear.

- Fit the chain guide bracket with the front bearing caps.



Install the timing chain

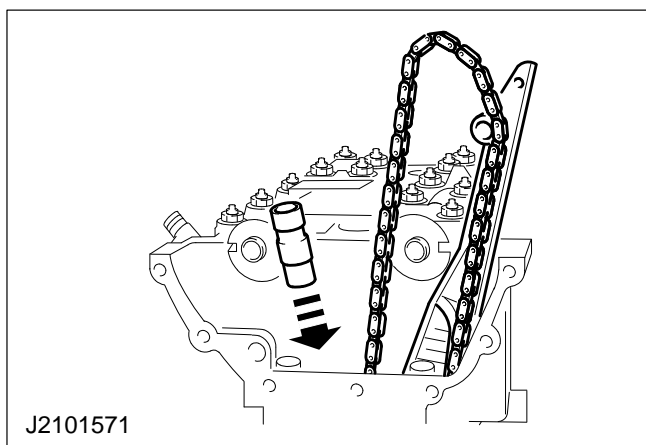
76. Bring the camshafts and crankshaft to TDC.



⚠ CAUTION: Fully and partially released plungers (whether new or used) must not be fitted.

77. Check the new chain tensioner plunger.

- 1 Plunger latched.
- 2 Plunger partially latched.
- 3 Plunger fully released (the detent ring is visible).

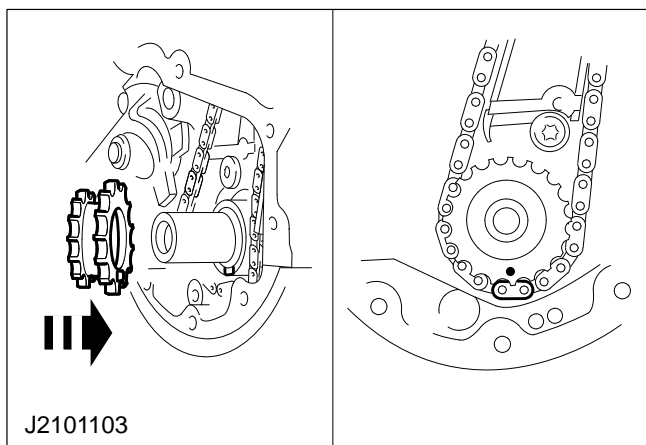


78. Install the chain tensioner plunger.

⚠ CAUTION: Only use a new latched plunger.

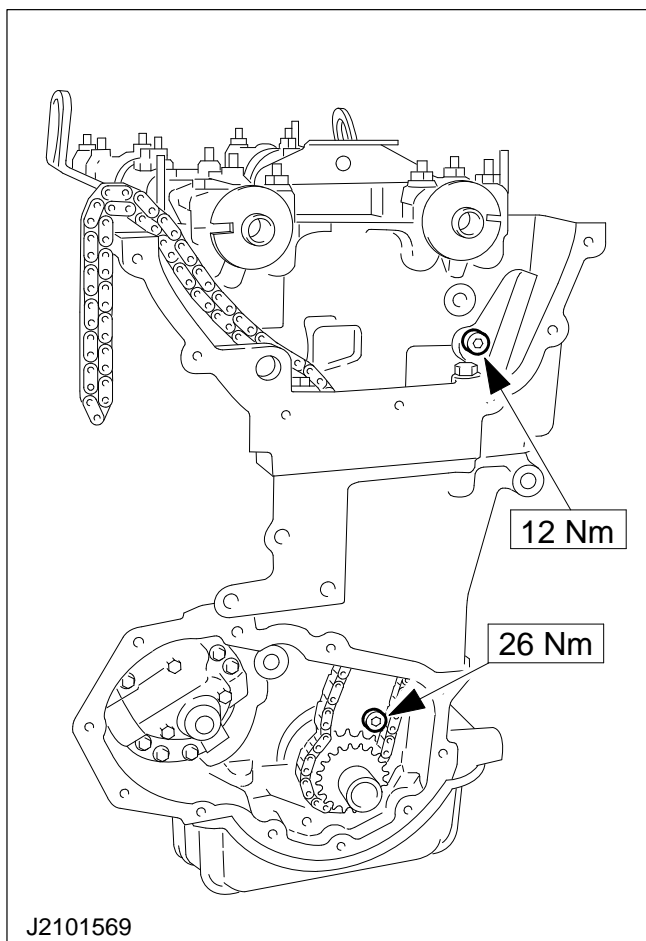
79. Insert the timing chain with the chain guide.

Do not secure the chain guide yet.

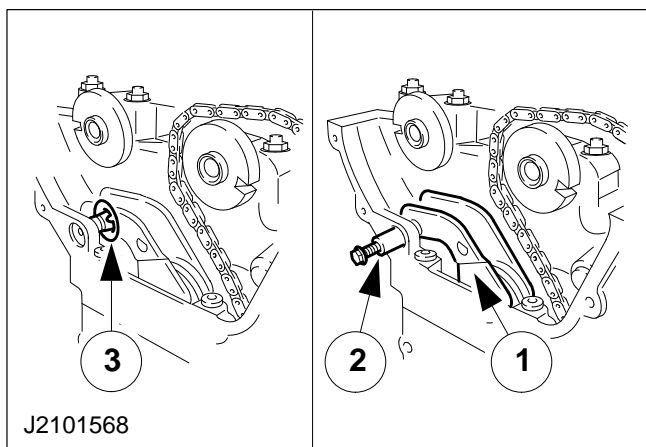


80. Fit the timing chain at the bottom.

- Slide the sprocket on approximately 10 mm.
- Lay the timing chain around the inner sprocket.
- Fit the Woodruff key in the crankshaft.

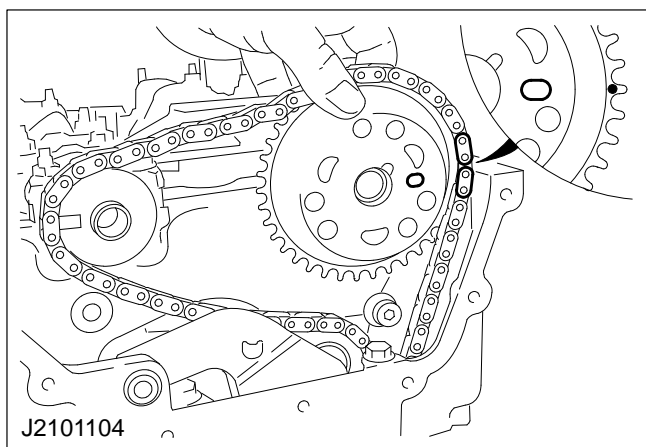


81. Tighten the timing chain guide rail bolts.



82. Install the chain tensioner.

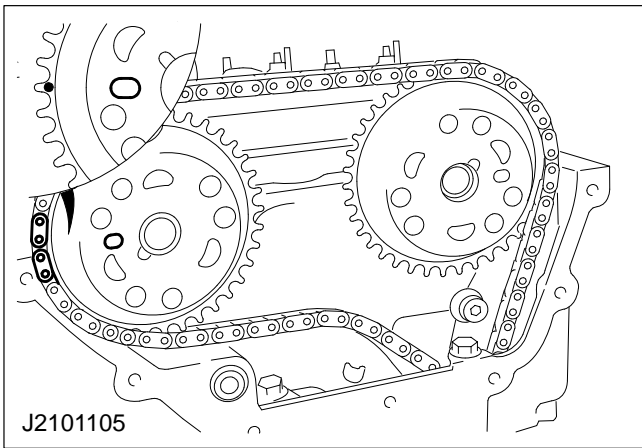
- 1 Insert the chain tensioner.
- 2 Insert the pin.
- 3 Fit the circlip.



83. Fit the timing chain at the top.

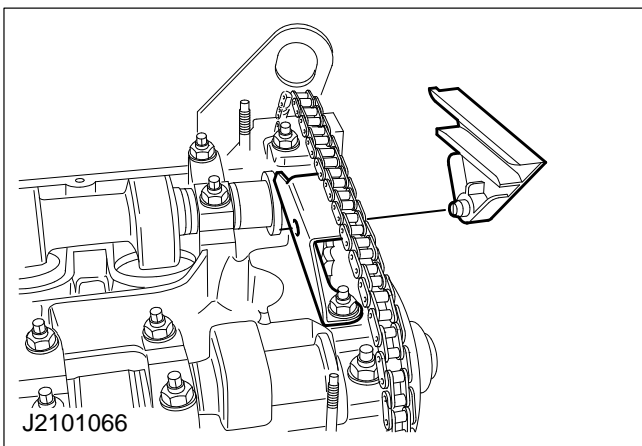
NOTE: The timing chain must be taut on the long side.

If necessary, turn the camshaft slightly.

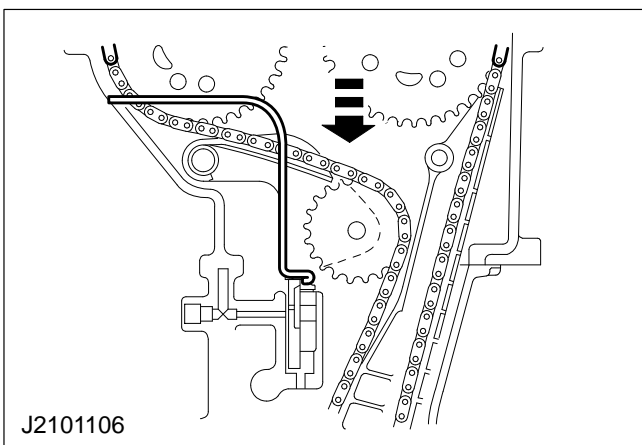


NOTE: The timing chain may sag slightly between the camshaft sprockets.

84. Fit the timing chain at the top (continued).



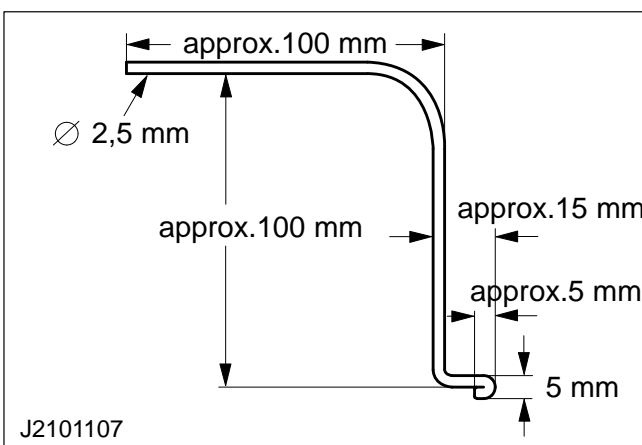
85. Clip a new upper chain guide into the bracket.



NOTE: If the chain tensioner arm does not reach the oil-filled plunger, the plunger must be released using an auxiliary tool.

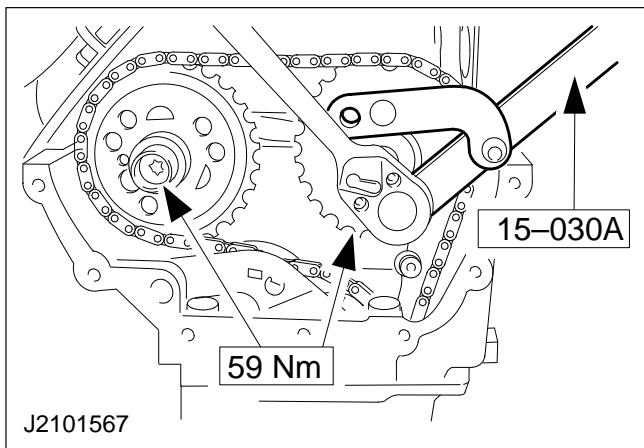
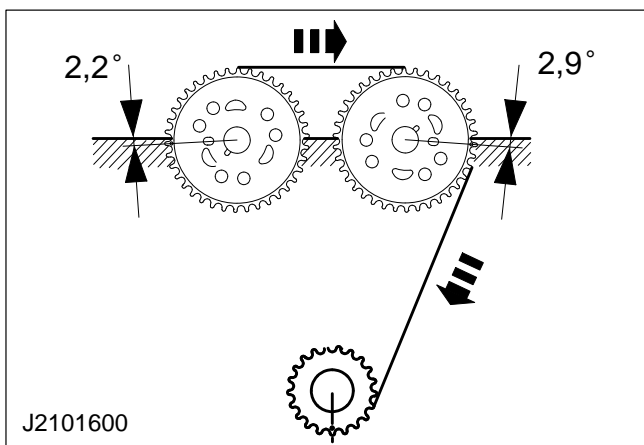
86. Release the chain tensioner plunger.

Press the chain tensioner arm down by hand and unlatch the oil-filled plunger.



87. Fabricate an auxiliary tool.

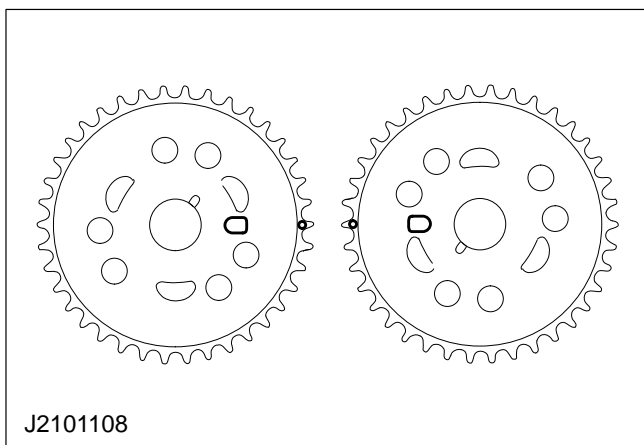
Use a 120 mm length of 2,5 mm welding rod.

**88. Tighten the camshaft sprockets.**

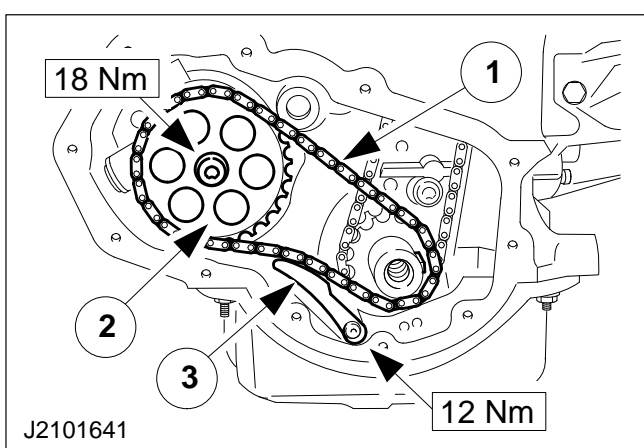
NOTE: If it is necessary to correct the valve timings, i.e. release the timing chain, a new oil-filled plunger must also be fitted for the chain tensioner.

89. Check the valve timings.

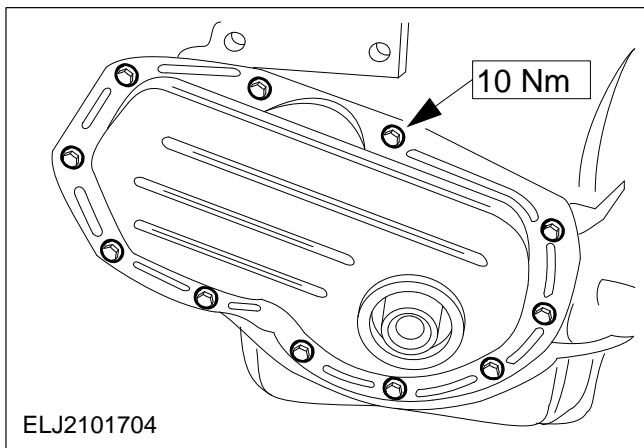
Turn the engine in the normal direction of rotation and line up the sprockets on the mark.

**90. Additional check.**

- 1 Turn the engine in the normal direction of rotation to the next TDC position.
- 2 The markings on the camshaft sprockets must be exactly opposite each other at the height of the cylinder head top edge.

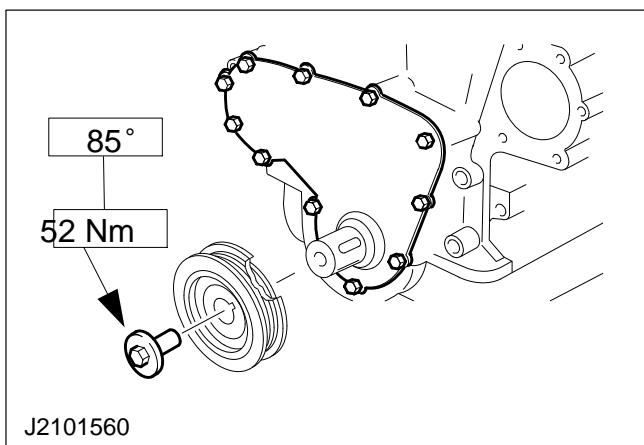
**91. Install the oil pump drive assembly.**

- 1 Lay the chain around the crankshaft driving sprocket.
- 2 Fit the oil pump sprocket with the chain to the oil pump.
- 3 Fit the chain tensioner.

**92. Fit the lower timing chain cover.**

NOTE: Use a new cover with an integral gasket and radial oil seal.

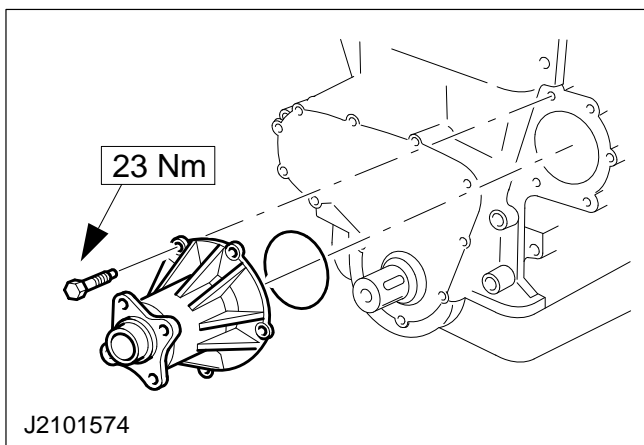
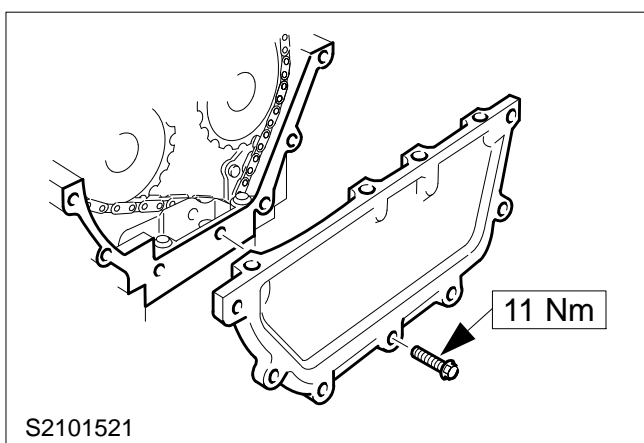
- Fit the cover with the centring cap.
- Tighten the bolts.
- Remove the centring cap.



CAUTION: Keep to the torque settings without fail. Use Special Tool 21-540.

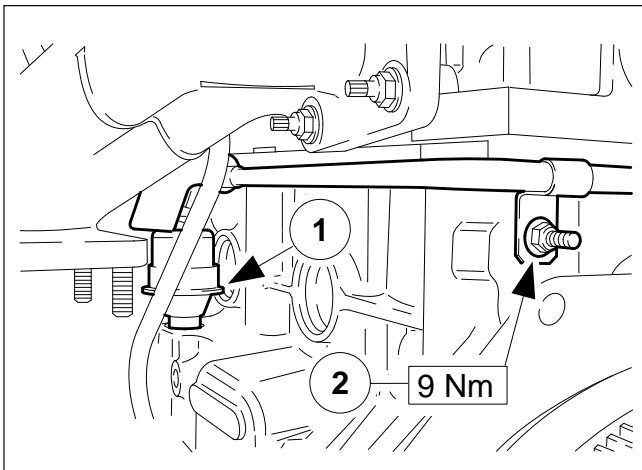
93. Fit the crankshaft vibration damper.

Immobilise the engine.

**94. Fit the water pump with a new gasket.**

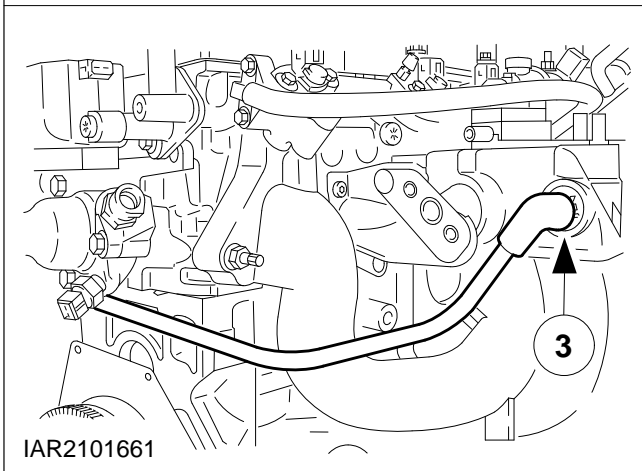
NOTE: The upper edge of the cover must be a maximum of 0,13 mm below the mating face of the cylinder head cover.

95. Fit the upper timing chain cover.

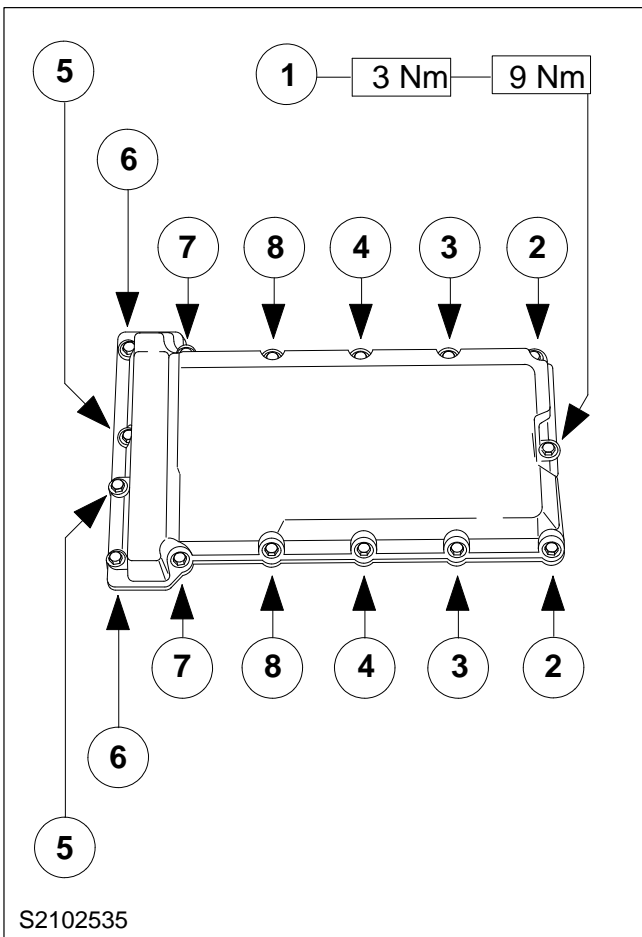


96. Connect the crankcase breather (PCV) pipe.

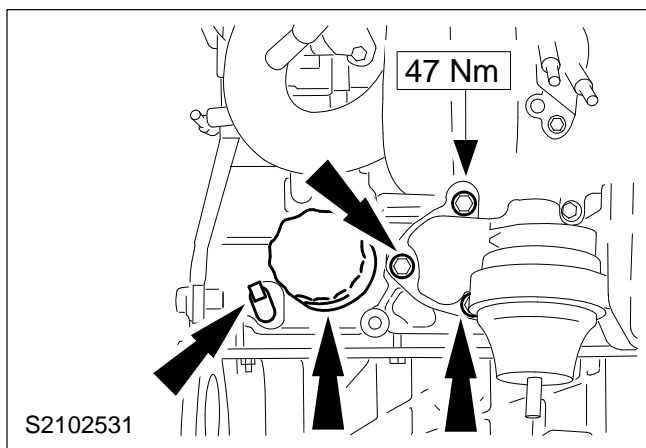
- 1 Press it into the exhaust manifold.
- 2 Attach the bracket to the cylinder head.
- 3 Connect it to the inlet manifold.



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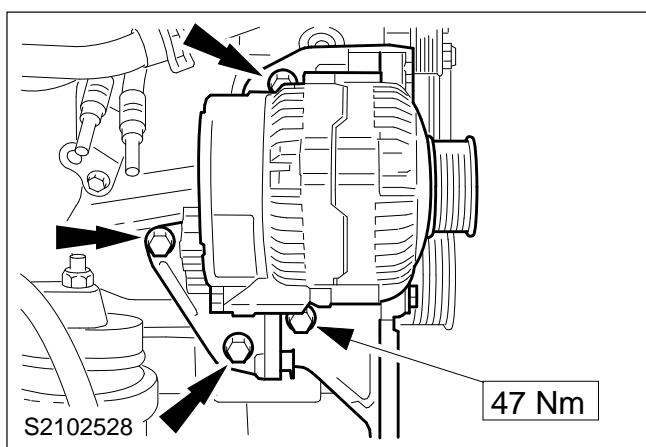
97. Fit the cylinder head cover with a new gasket (11 bolts and 4 nuts).



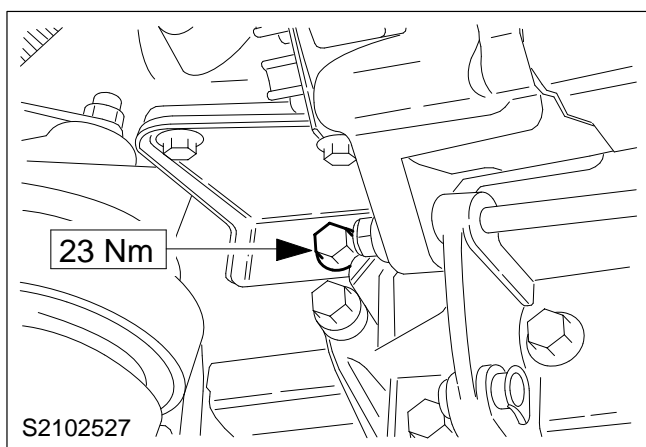
98. Attach the engine mounting bracket with the engine mounting.

99. Attach the CKP sensor.

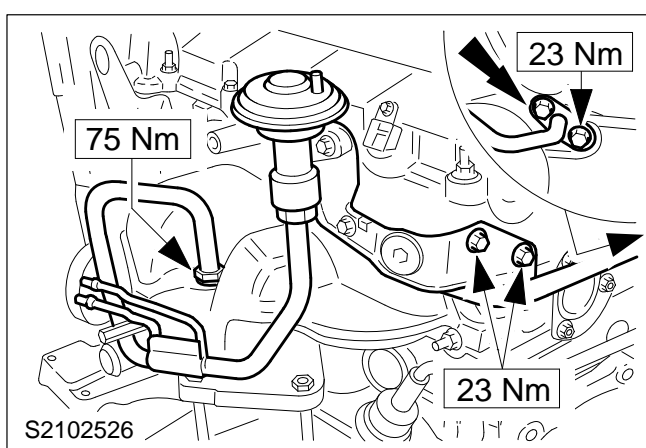
100. Attach the oil filter.



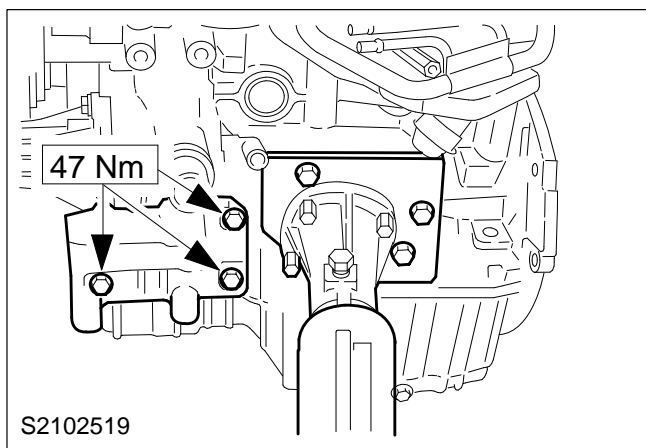
101. Attach the alternator and bracket.



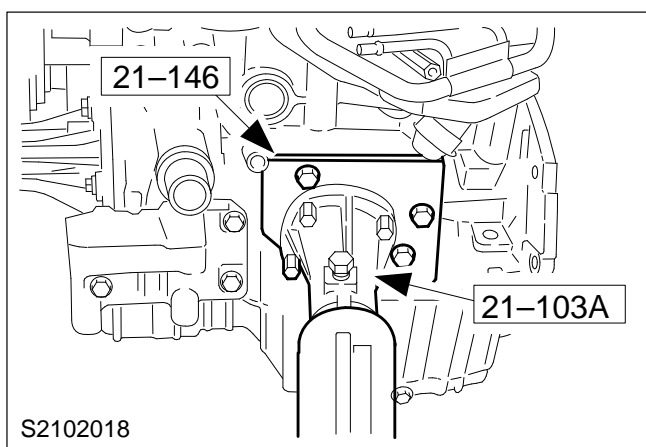
102. Attach the inlet manifold bracket.



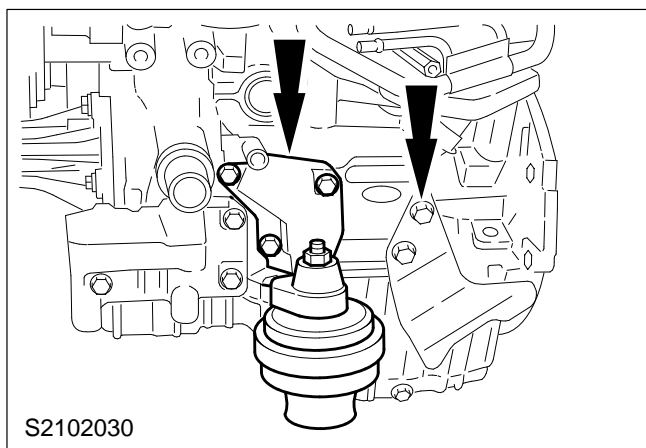
103. Attach the EGR system.



104. Install the brackets for the air conditioning compressor and the exhaust.



105. Detach the engine from the assembly stand.



106. Attach the engine mounting bracket with the engine mounting.

107. Finishing operations.

Fill up with engine oil.