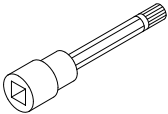
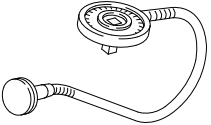
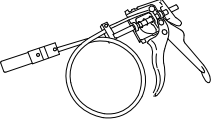


Cylinder Heads – Remove and Install (all) (21 164 0)

Special Tools

 <p>21002</p>	<p>21-002 Splined head socket, cylinder head bolts</p>
 <p>21540</p>	<p>21-540 Angle gauge, bolt tightening</p>
 <p>24003</p>	<p>24-003 Installer/remover, coolant hose clamp</p>

Proprietary Tools

4,5 mm Allen key
Angled T30 TORX socket
Scraper
Workshop straight-edge 400x5 mm
Feeler gauges

Materials

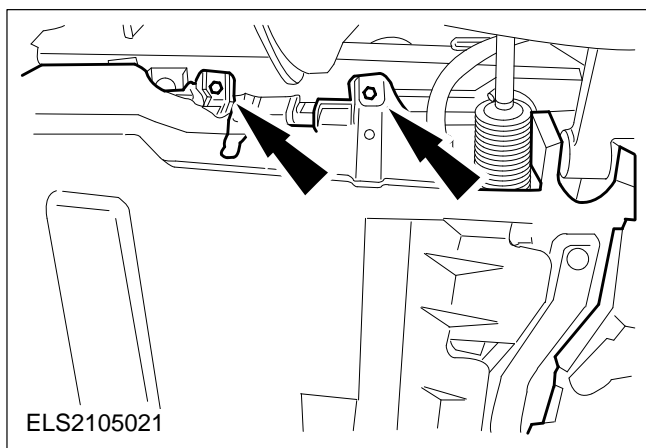
Hylosil sealer	WSK-M4G320-A
----------------	--------------

Remove

1. General notes.

NOTE: Throughout the whole operation cover the engine openings to make sure that nothing falls into them.

- Lay components aside in the right order.
- The position of ancillary components is described looking from the transmission to the engine.
- The hydraulic lines are not separated.

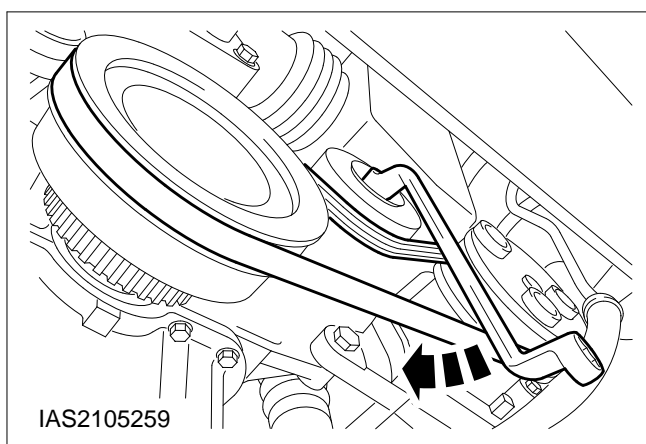


2. Standard preparatory measures:

- Lay protective covers over the fenders.
- Make a note of the radio keycode.
- Make a note of the preset radio stations.
- Detach the battery cover

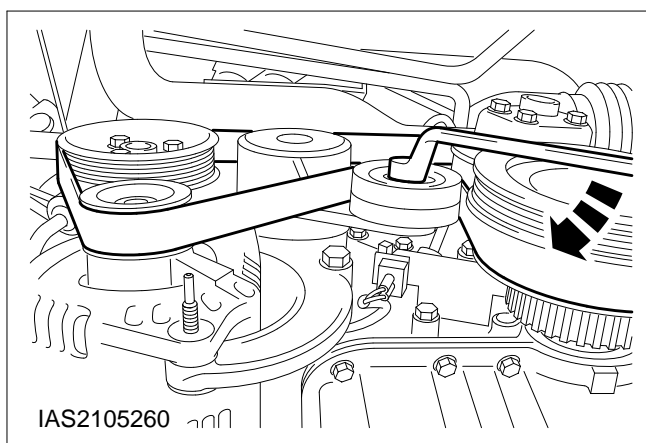
⚠ CAUTION: Disconnect the battery ground lead.

- Cut the cable ties if necessary and renew them during installation.
- Open the coolant expansion tank.
- Raise the vehicle.
- Detach the engine undershield.
- Drain the engine oil by removing the drain plug, and screw the plug back in with a new seal.
- Drain the coolant by removing the radiator drain plug, and screw the plug back in with a new seal.



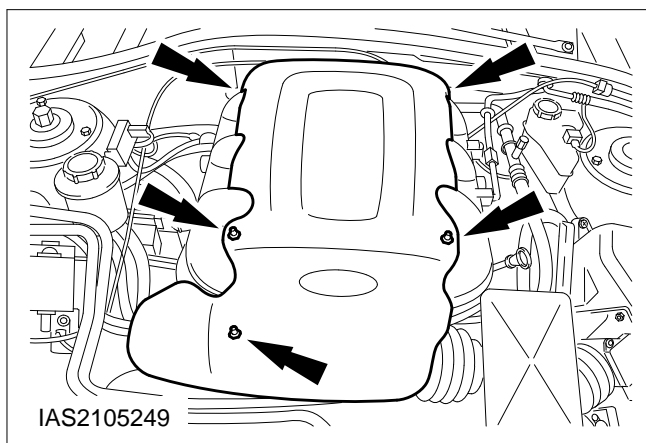
3. Fit the air conditioning multi-groove belt.

- Take the pressure off the belt by turning the tensioning pulley clockwise.
- Remove the multi-groove belt.

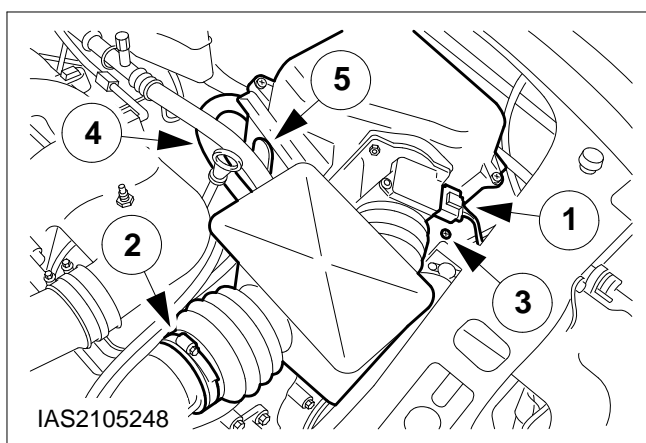


4. Remove the alternator/power steering multi-groove belt.

- Take the pressure off the belt by turning the tensioning pulley clockwise.
- Remove the multi-groove belt.
- Lower the vehicle.

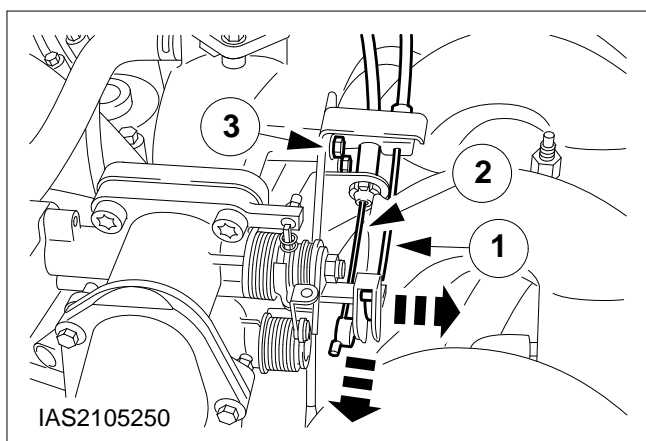


5. Remove the intake system cover.



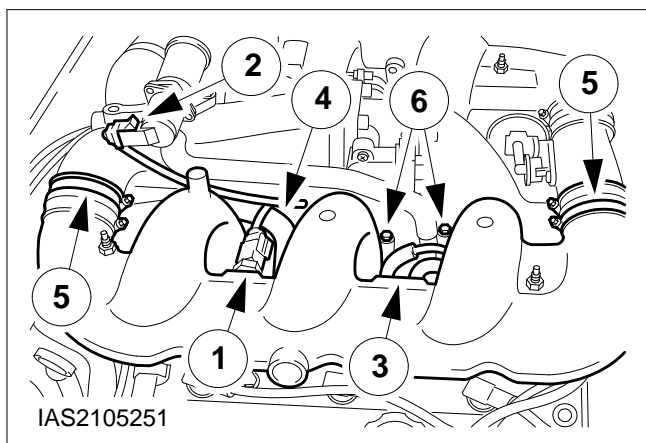
6. Remove the air cleaner.

- 1 Disconnect the mass air flow (MAF) sensor multiplug.
 - 2 Remove the intake hose.
 - 3 Remove the bolt from the intake pipe.
 - 4 Remove the positive crankcase ventilation (PCV) hose.
 - 5 Remove the two rubber retainers.
- Pull the air cleaner off the intake pipe and pull it upwards out of the grommets on the body.



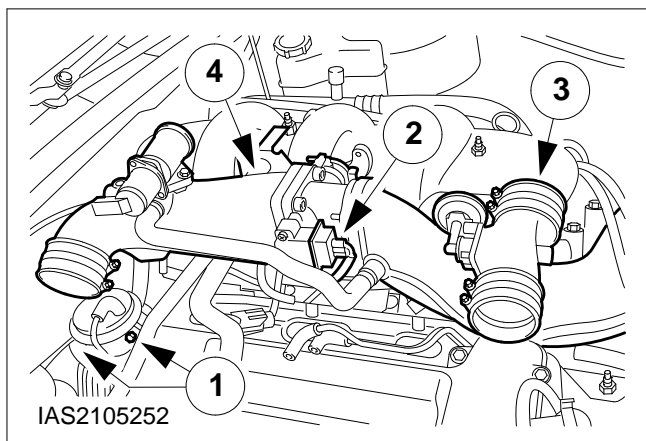
7. Detach the cables.

- 1 Unhook the throttle cable and detach it from the bracket.
- 2 Unhook the cable of the speed control system.
- 3 Detach the bracket for the speed control system cable.



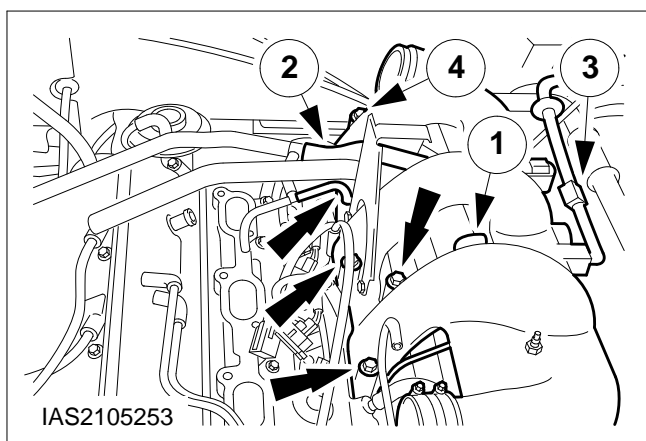
8. Remove the right-hand inlet manifold.

- 1 Disconnect the multiplug from the intake air temperature sensor (IAT sensor).
- 2 Disconnect the plug from the idle air control (IAC) valve.
- 3 Disconnect the two vacuum hoses.
- 4 Remove the PCV hose and the vacuum hose.
- 5 Remove the connecting hoses.
- 6 Remove the bolts and pull the inlet manifold off the intake air plenum chamber (six bolts).



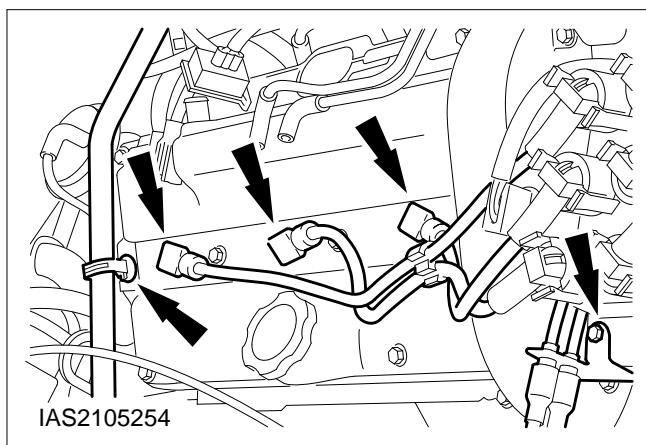
9. Remove the air intake plenum chamber.

- 1 Remove the EGR valve from the air intake plenum chamber (two bolts):
- 2 Disconnect the plug from the throttle position (TP) sensor.
- 3 Remove the variable resonance induction system (VRIS).
- 4 Detach the intake air plenum chamber from the left-hand inlet manifold and lift it out.



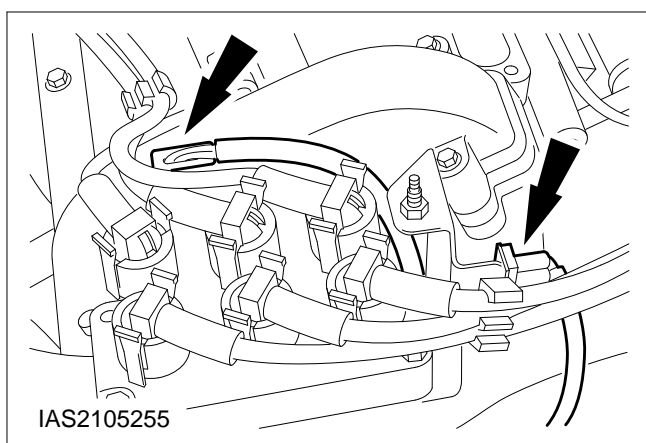
10. Remove the left-hand inlet manifold.

- 1 Disconnect the vacuum hose.
- 2 Disconnect the PCV valve from the cylinder head cover.
- 3 Remove the brake servo vacuum line.
- 4 Remove the six bolts.

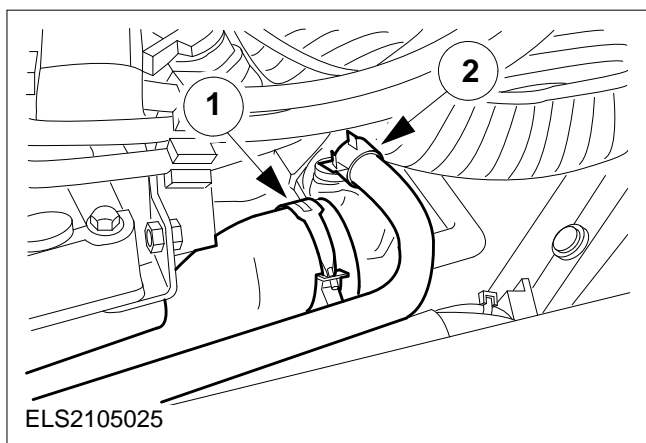


11. Detach the hose and pull off the spark plug connectors.

- Detach the PCV hose from the cylinder head cover and disconnect it.
- Pull off the spark plug connectors (right-hand side shown).
- Detach the bracket for the vacuum lines from the ignition coil.

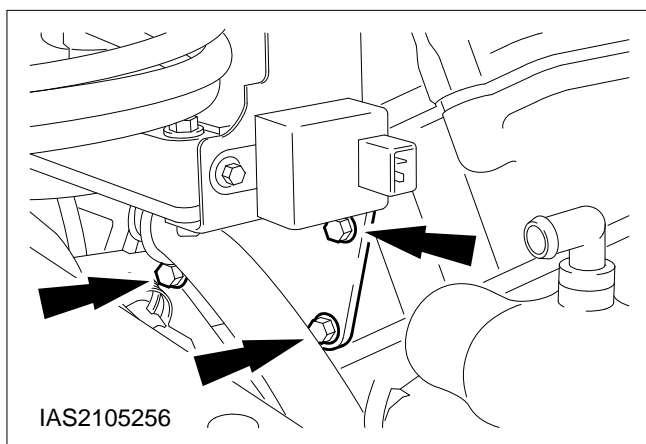


12. Disconnect the plugs.

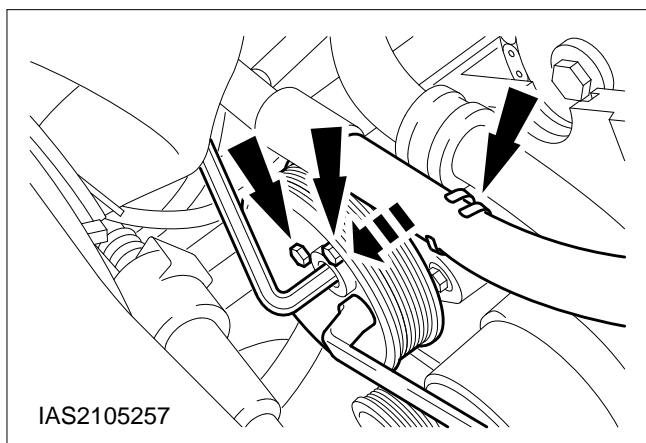


13. Detach the coolant hoses.

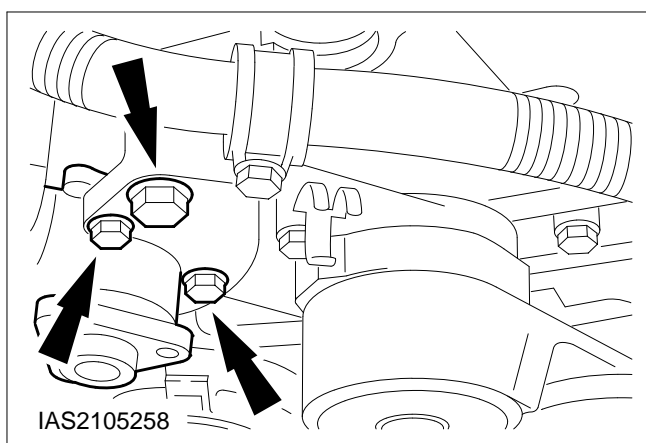
- 1 To the radiator.
- 2 To the expansion tank.



14. Remove the ignition coil.

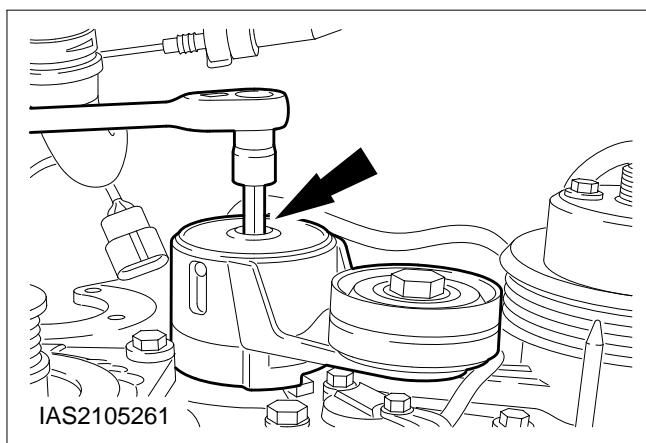


- 15. Remove the power steering pump pulley and detach the coolant hose from its bracket.**

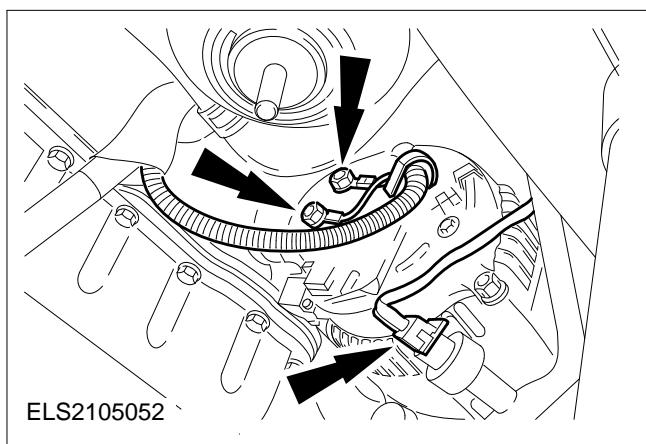


- 16. Remove the power steering pump (five bolts) and remove the upper bolt from the bracket.**

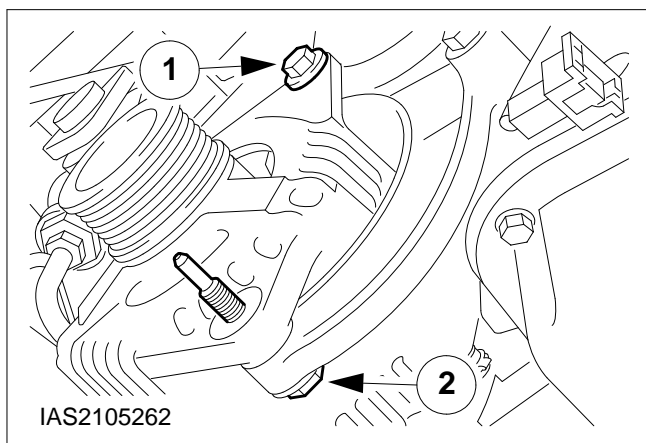
Raise the vehicle.



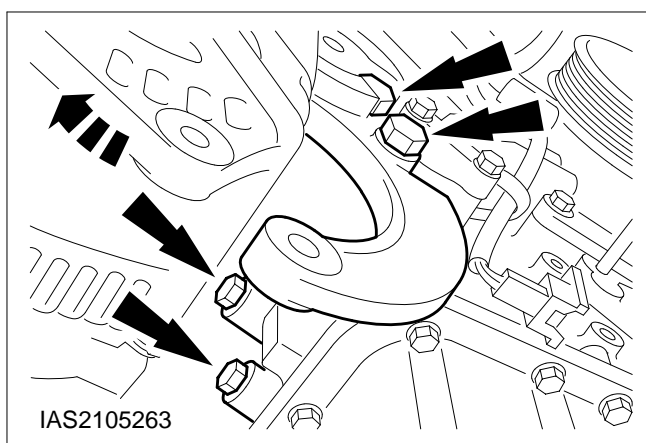
- 17. Remove the tensioning pulley for the alternator/power steering pump.**



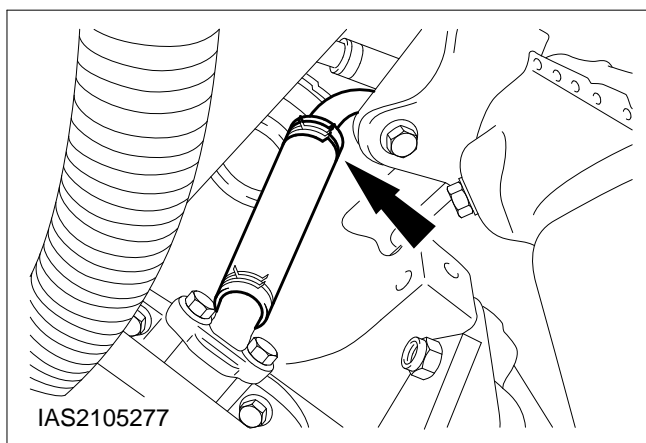
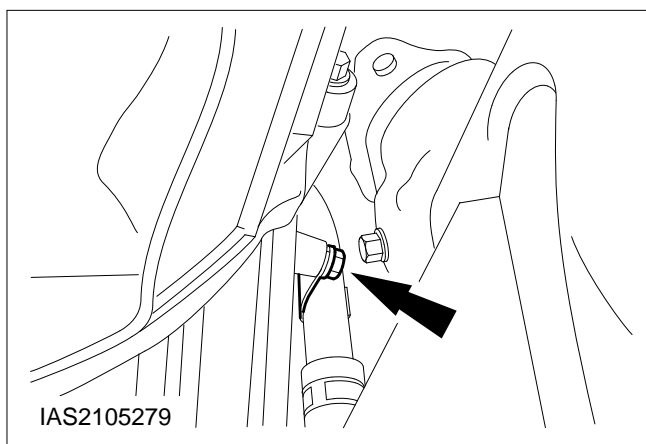
- 18. Disconnect the alternator and the power steering pressure (PSP) switch plug.**

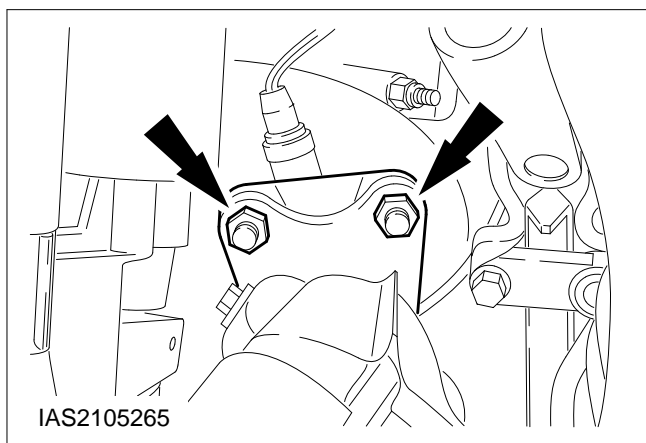
**19. Remove the alternator.**

- 1 Undo the upper bolt.
- 2 Remove the lower bolt.

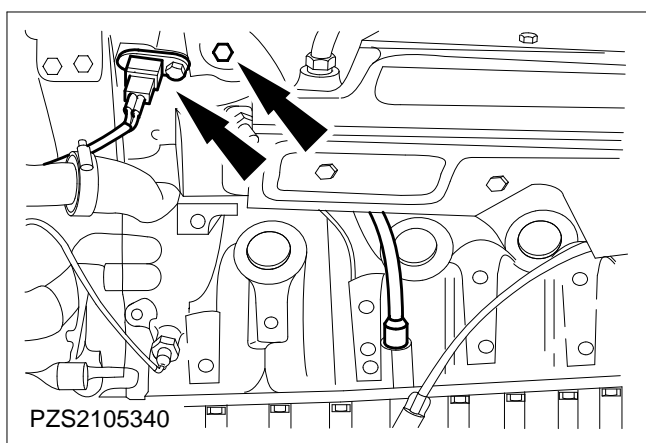
**20. Remove the bracket for the alternator/power steering pump.**

Swivel the alternator upwards and remove the bracket.

**21. Remove the PCV hoses (left-hand side shown).****22. Remove the bolt from the coolant pipe for the oil cooler.**

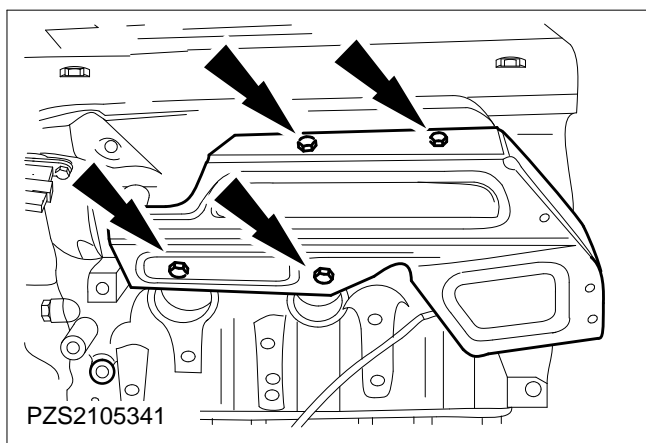


23. Detach the exhaust manifold from the catalytic converter.

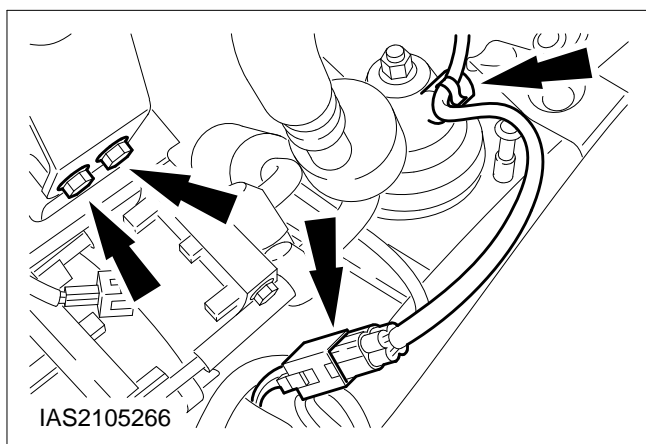


24. Disconnect the camshaft position (CMP) sensor plug and remove the dipstick.

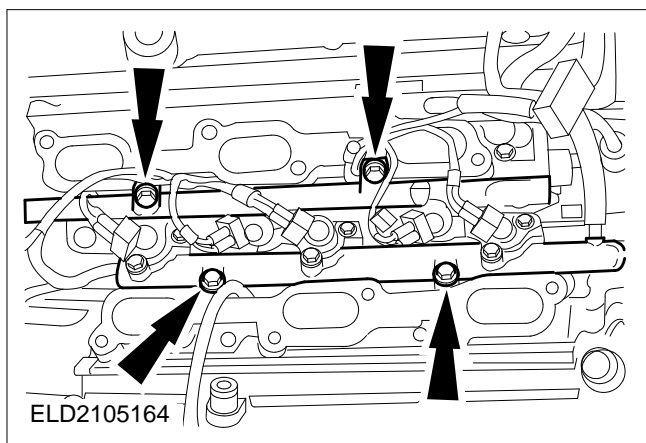
Lower the vehicle.



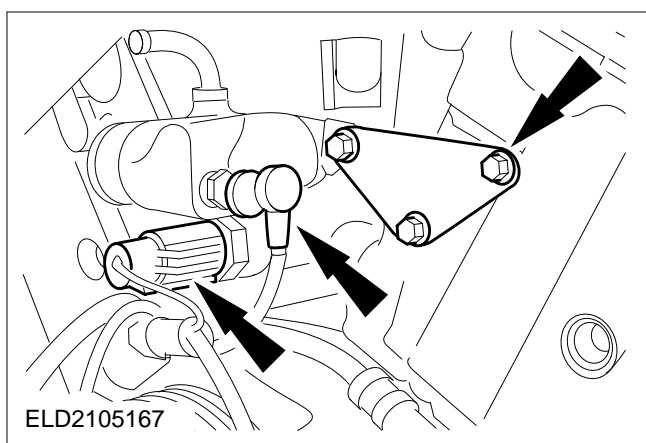
25. Remove the heat shields (left-hand side shown).



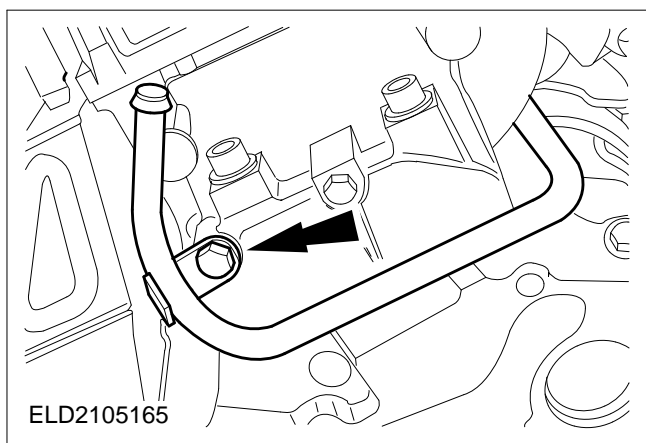
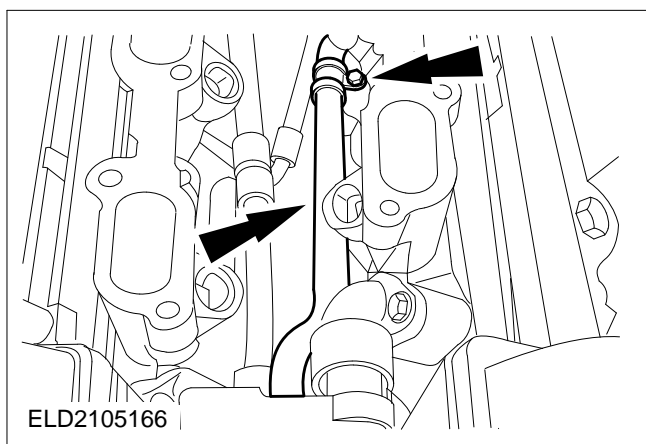
26. Disconnect the HO2S sensor and detach it from the engine mounting, and remove the left-hand lifting eye.

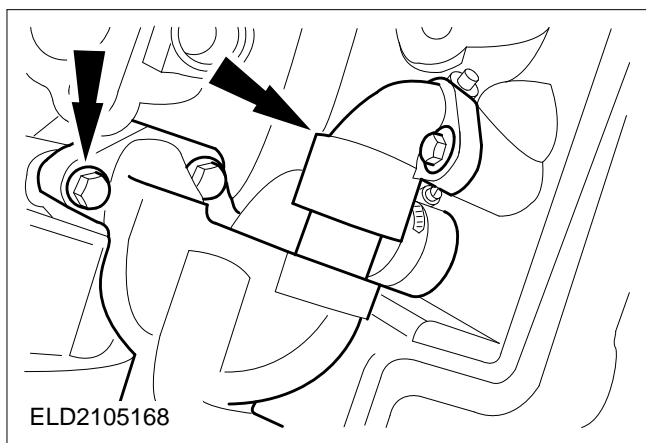
**27. Remove the fuel rails.**

Disconnect the fuel injection valve plugs.

**28. Disconnect the plugs and detach the thermostat housing bracket.**

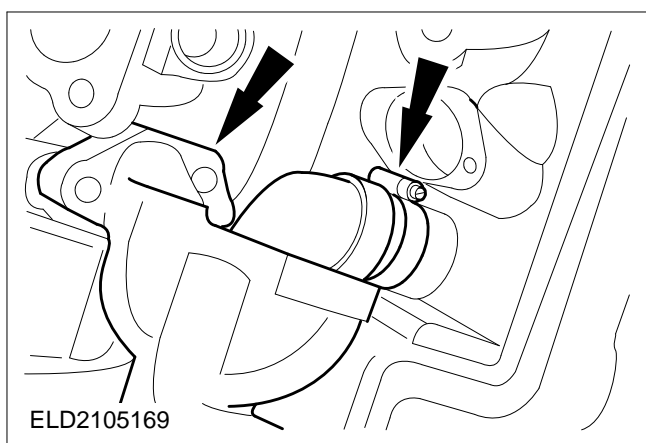
- Thermostat housing bracket.
- Temperature gauge sender unit plug.
- Engine coolant temperature (ECT) sensor plug.

**29. Remove the coolant pipe.****30. Remove the coolant pipe (continued).**



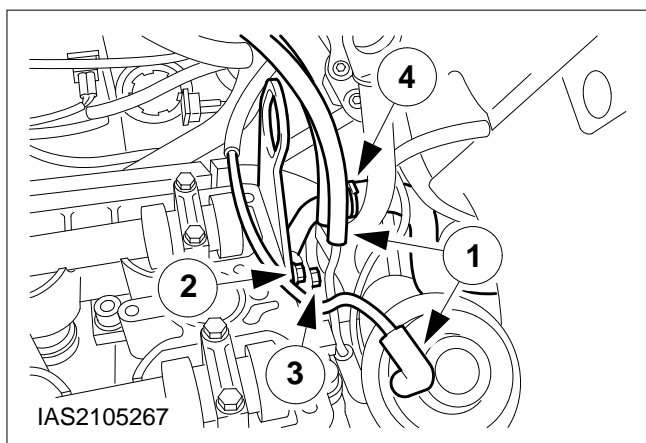
31. Detach the thermostat housing.

Take off the connector.



32. Remove the thermostat housing (continued).

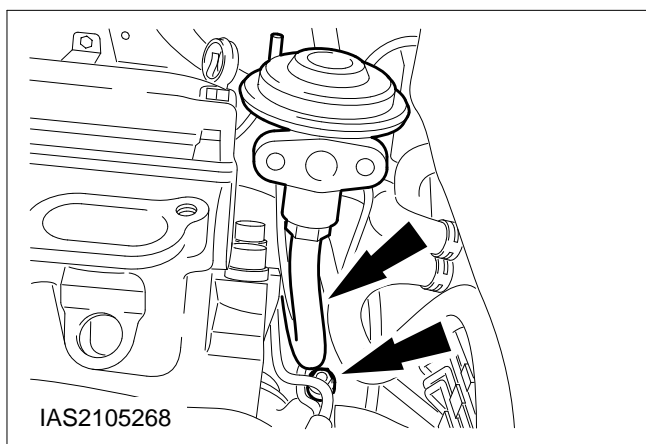
Detach the thermostat housing from the coolant hose and remove it.



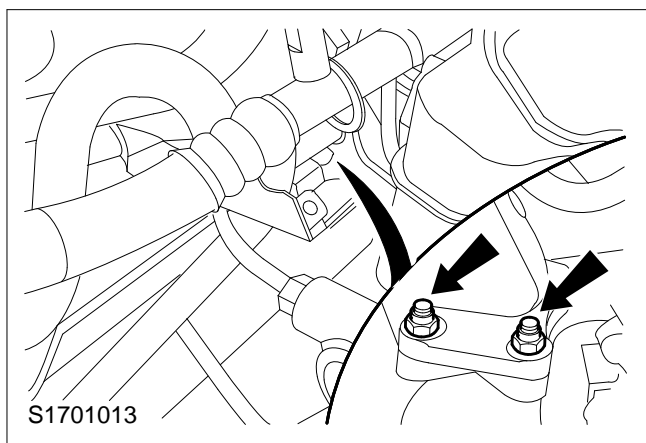
33. Remove the hoses, the engine lifting eye and the coolant line.

NOTE: The hoses have different diameters.

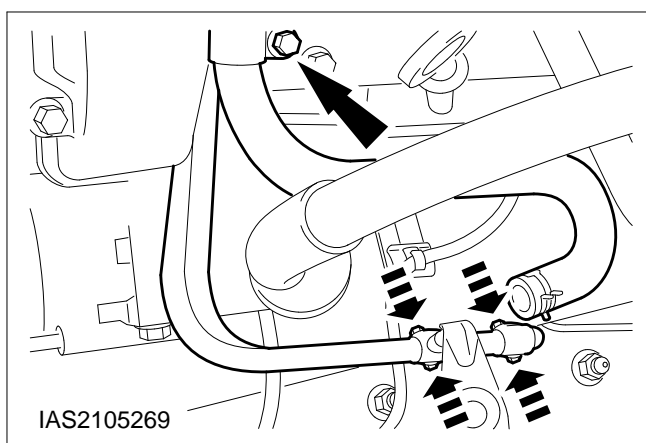
- 1 Pull off the EGR vacuum hose.
- 2 Remove the engine lifting eye (two bolts).
- 3 Remove the coolant line.
- 4 Detach the coolant hose.



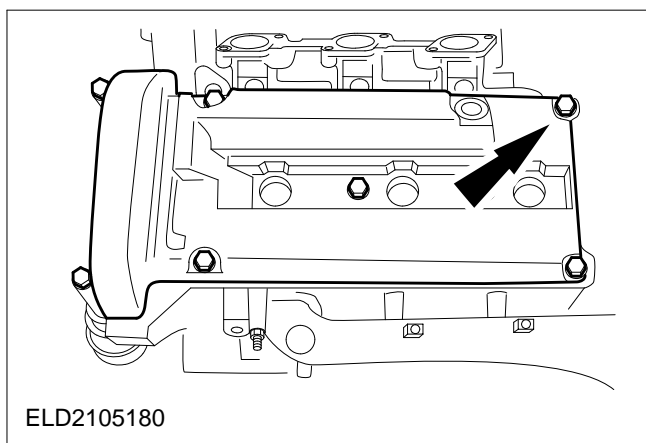
34. Detach the EGR valve from the exhaust manifold (two bolts).



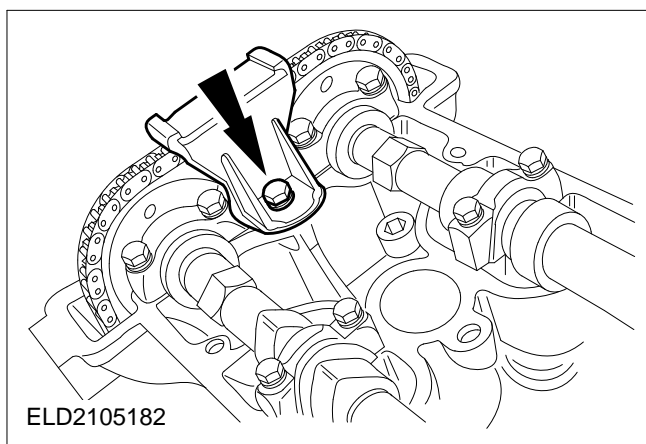
35. Detach the exhaust manifold from the catalytic converter (left-hand side shown).



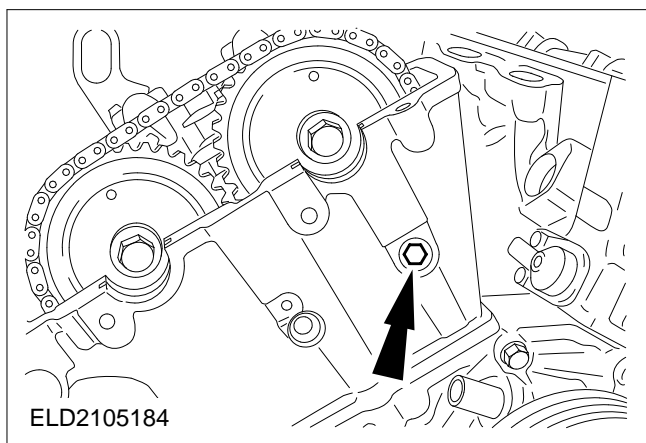
36. Remove the PCV bracket from the cylinder head cover and disconnect the fuel lines.



37. Remove the cylinder head covers (left-hand side shown).

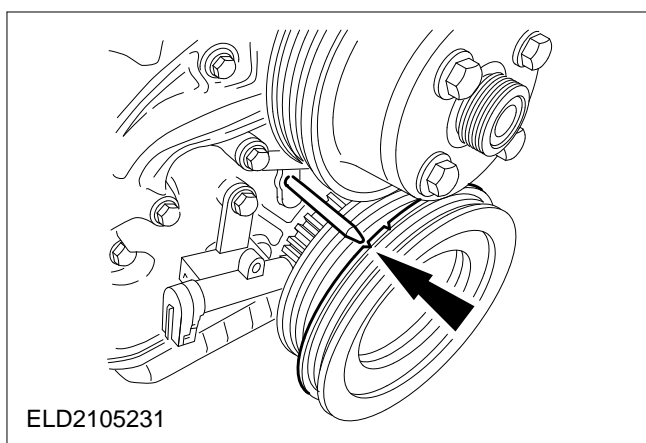


38. Remove the upper chain guides (left-hand side shown).

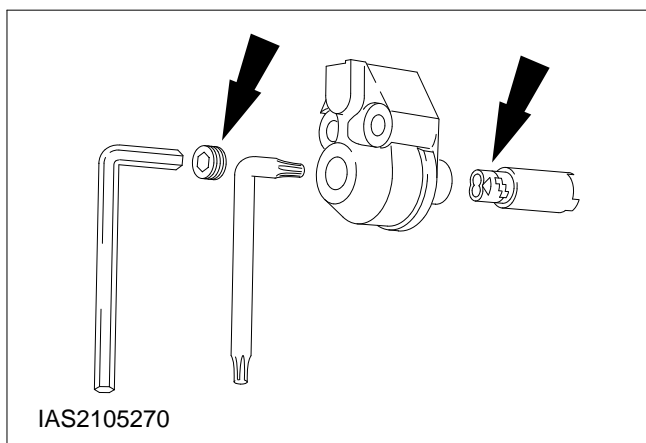


39. Remove the timing chain guide on the right-hand cylinder head.

- Evenly prise out the blanking plug with a screwdriver.
- Remove the chain guide bolt.



40. Set the engine to TDC.



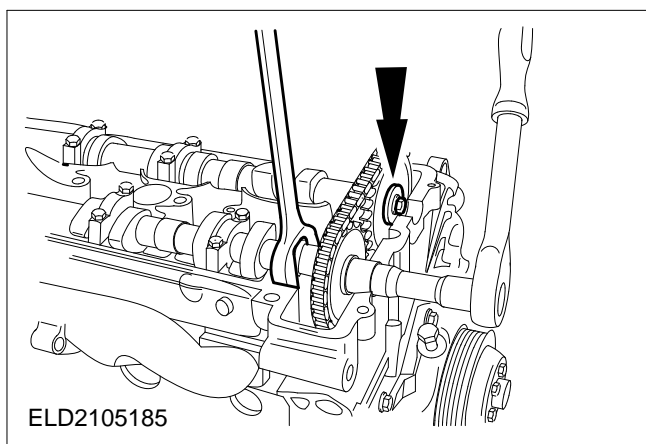
NOTE: The chain tensioner is immobilised once there is an audible click and when it has reached its stop.

41. Slacken the timing chains.

- Remove the blanking plug from the chain tensioner using a 4,5 mm Allen key.

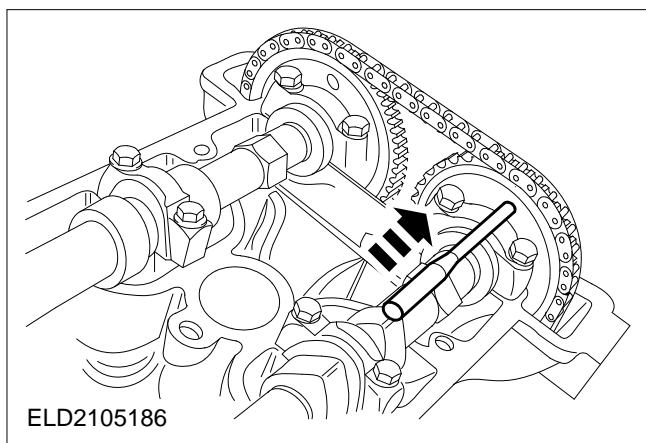
NOTE: Use the TORX T30 angled socket.

- Immobilise the chain tensioner by rotating it clockwise.



NOTE: Undo the camshaft sprocket bolts ten turns.

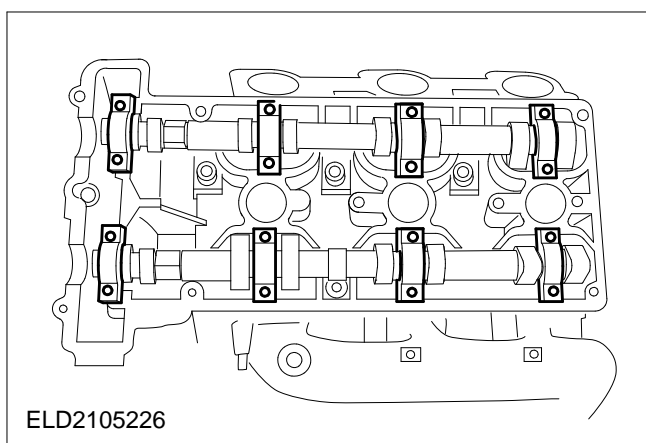
42. Remove the camshaft sprockets.



NOTE: Hold the timing chain to prevent it falling in.

43. Remove the camshaft sprockets (continued).

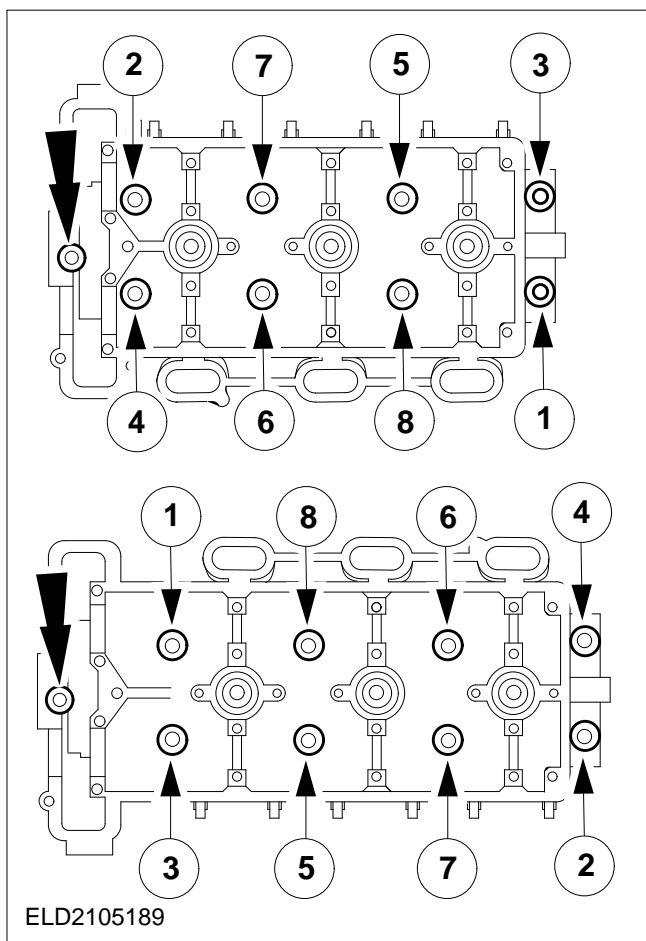
- Lightly tap on the drive plates to loosen them from the camshaft sprockets.
- Remove the camshaft sprocket bolts.
- Remove the camshaft sprockets, the drive plates and thrust washers and lay them to one side in order.



NOTE: Loosening sequence: working diagonally from the outside inwards.

NOTE: Remove the camshaft bearing caps and the camshafts.

44. Remove the camshaft bearing caps and take out the camshafts and hydraulic tappets.




45. Remove the cylinder heads (left-hand side shown).

Guide the timing chains and the chain guides out through the timing chain housing.

Install

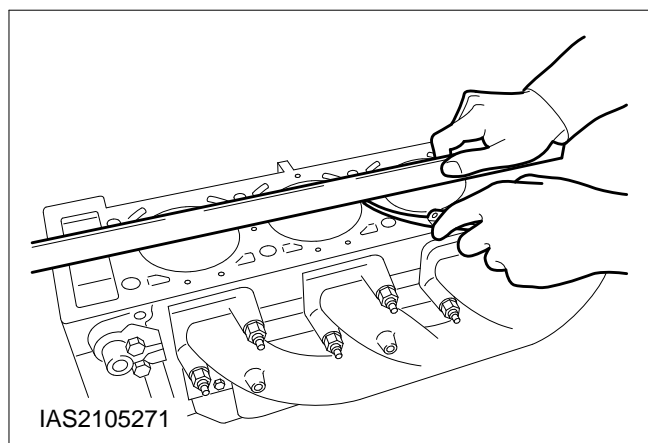
46. Preparatory measures.

 **CAUTION:** Do not damage the cylinder bore.

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

NOTE: During cleaning take care not to damage the mating faces.

- Clean the mating faces of all ancillary components with a scraper, check them for damage and renew them as necessary.
- Clean the threaded bores and dry them.
- Renew all gaskets and self-locking nuts.

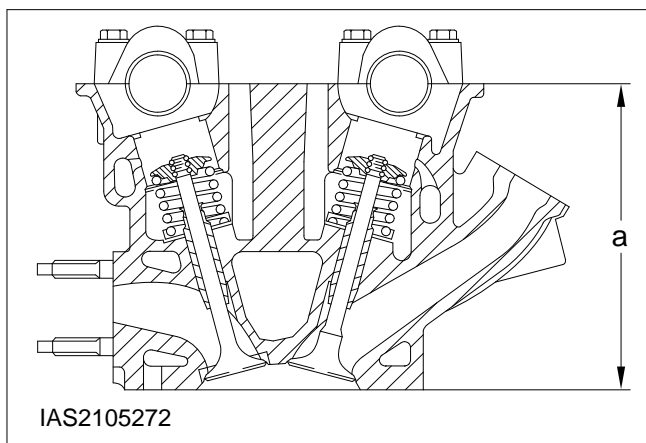


Check the cylinder head distortion.

NOTE: The straight-edge needs to be at least 400 mm by 5 mm.

47. Check the cylinder head mating face for distortion.

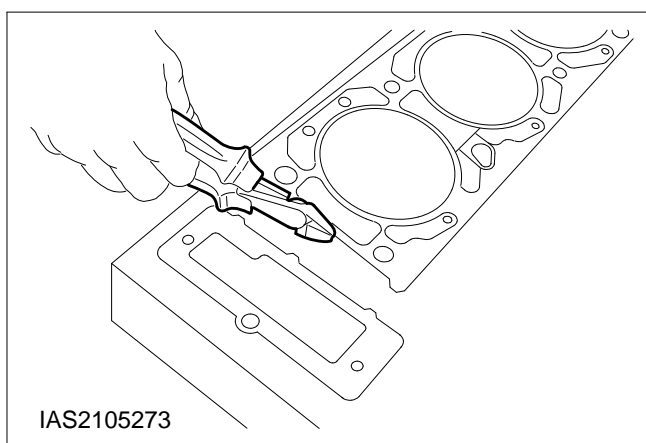
- Permissible distortion at the mating face between combustion chambers: along the length 0,02 mm, across the width and diagonally 0,06 mm.
- Lay the straight-edge across all of the mating faces between the combustion chambers and check each one in three different places.
- In three different places lay the straight-edge along the cylinder head in the region of the combustion chambers, and check each of the mating faces between the combustion chambers.
- Lay the straight-edge diagonally across the cylinder head and check all mating faces between the combustion chambers.
- If necessary rework the cylinder head as described in step 48.



48. Note – reworking the cylinder head.

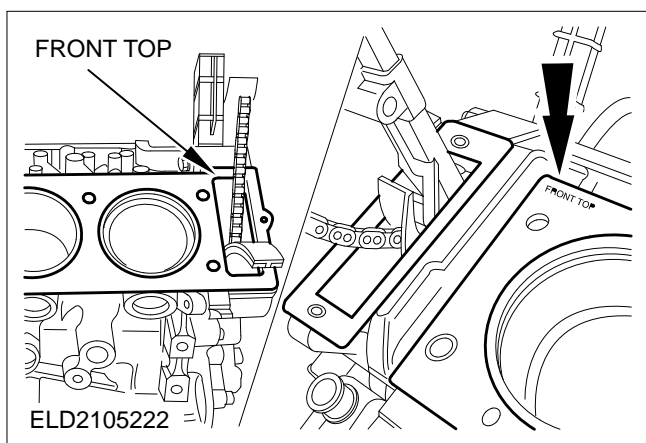
NOTE: Make sure that the average peak-to-valley height Rz stays at a value of 0,0135 mm after reworking.

The cylinder head must only be reworked to a maximum depth of 0,13 mm. In doing this, measurement "a" must be no less than 141,9 mm.



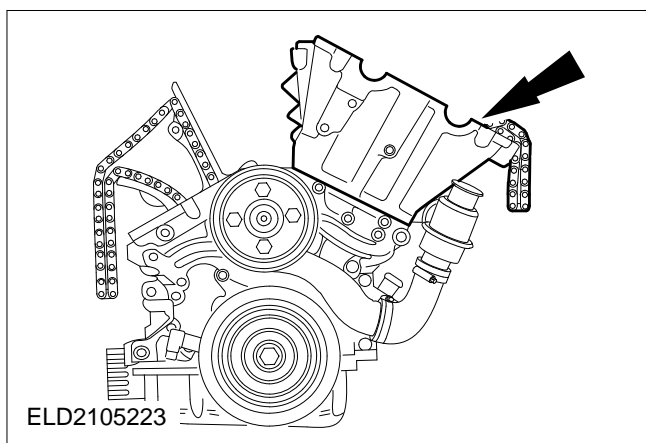
49. Prepare the left-hand cylinder head for installation.

- Cut the cylinder head gasket at the indicated cut points.
- Cut off any protruding corners and smooth off any sharp edges.



NOTE: FRONT TOP marking.

50. Fit the cylinder head gasket.

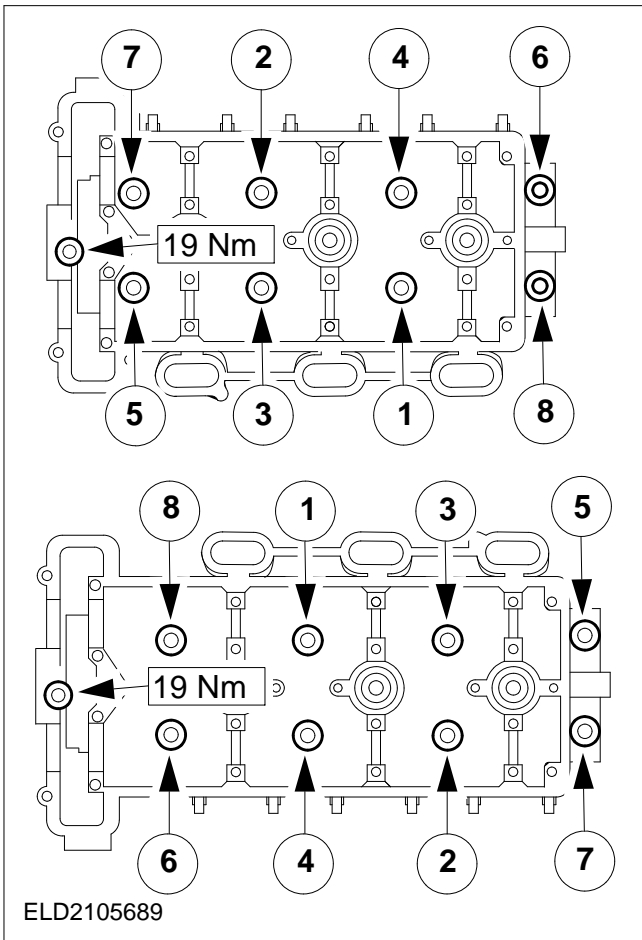


NOTE: Secure the timing chains against falling in.

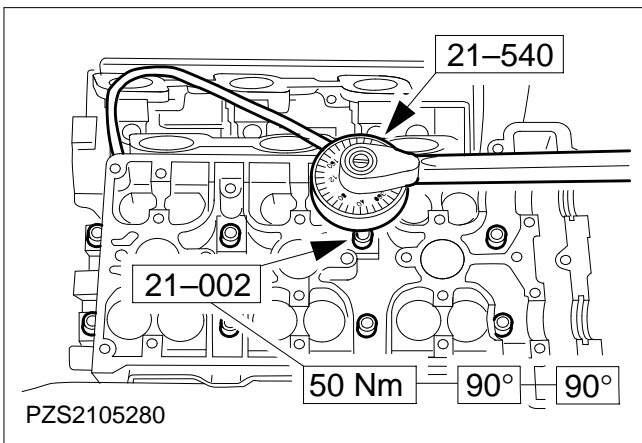
NOTE: Use new bolts.

51. Fit the cylinder heads (left-hand side shown).

Guide the timing chains and the chain guides through the timing chain housing and fit the exhaust manifold into the catalytic converter.

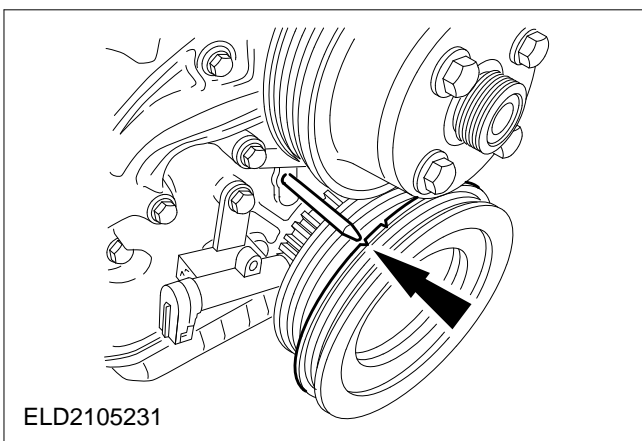


52. Cylinder head tightening sequence.

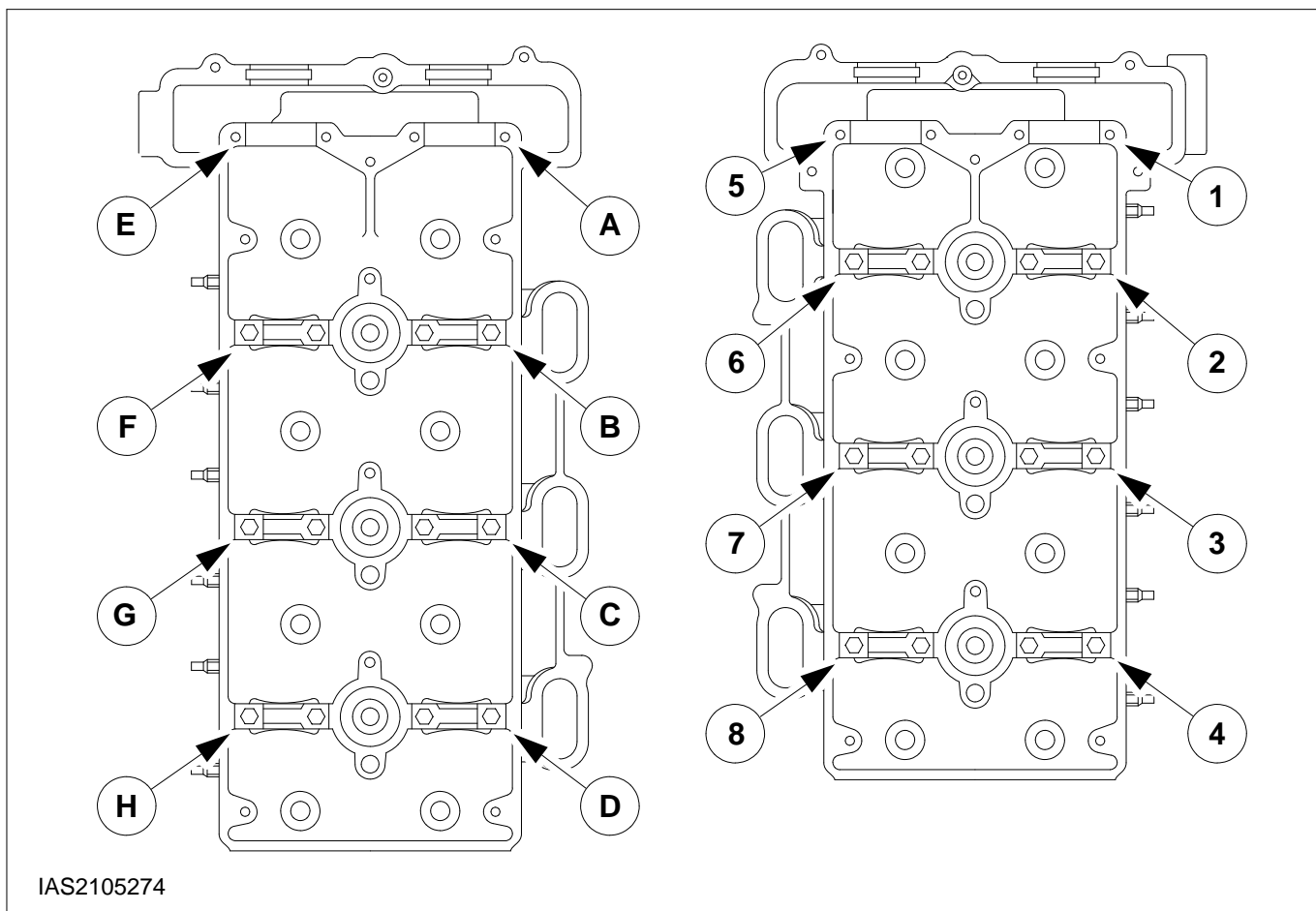


53. Tighten the cylinder head bolts.

Fit the additional bolts as described in step 52.

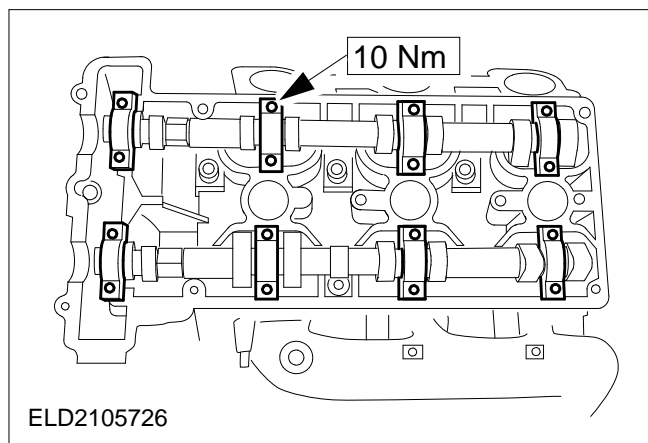


54. Set the engine to TDC.



NOTE: The wider contact areas of camshaft bearing caps 1 and 5 and A and E point towards the middle.

55. Identification of the camshaft bearing caps.



56. Fit the hydraulic tappets.

NOTE: Tightening sequence: evenly, working diagonally from the inside outwards.

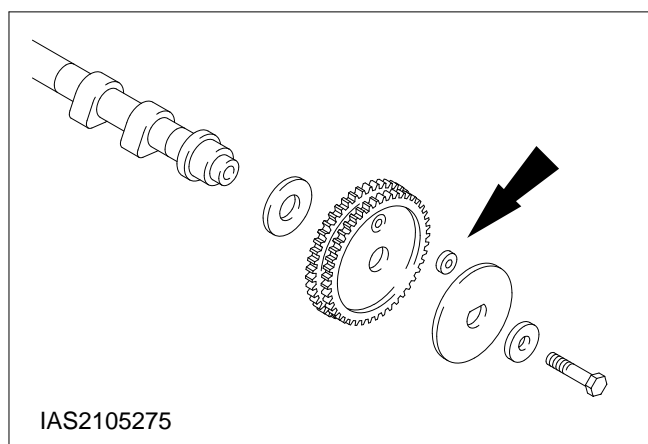
NOTE: The camshafts are numbered from right to left.

57. Install the camshafts for the right-hand cylinder head.

- The inlet cams on camshaft 1 must be vertical at cylinder no. 1.
- The exhaust cams on camshaft 2 must be vertical at cylinder no. 1.
- Fit the camshaft bearing caps.

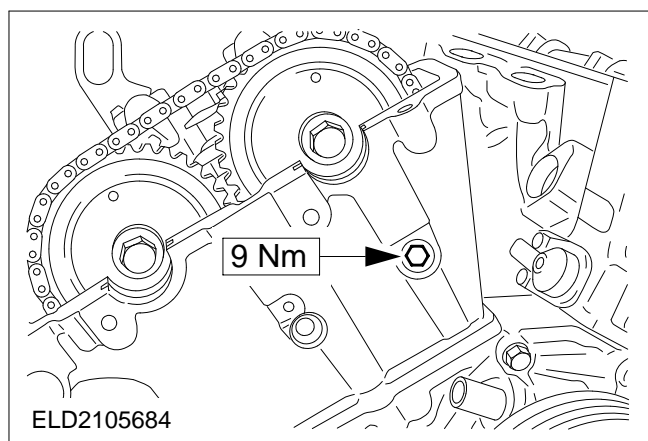
58. Install the camshafts for the left-hand cylinder head.

- The inlet cams on camshaft 3 must be vertical at cylinder no. 6.
- The exhaust cams on camshaft 4 must be vertical at cylinder no. 4.
- Fit the camshaft bearing caps.



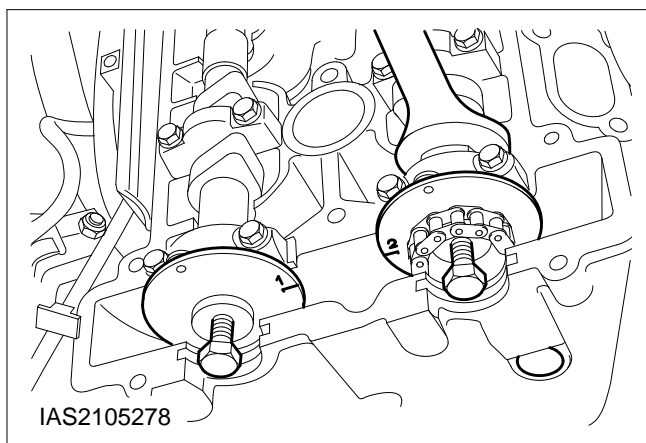
NOTE: The drive plate follower must engage in the bore on the camshaft sprocket.

59. Camshaft components.



60. Fit the chain guide for the right-hand cylinder head.

- Screw in the chain guide bolt.
- Press in the blanking plug with a new seal.



61. Set the camshafts to the timing marks.

- Push on the thrust washers and drive plates and secure them with bolts against falling in.
- Rotate the camshafts to the timing marks.
- Remove the drive plates.

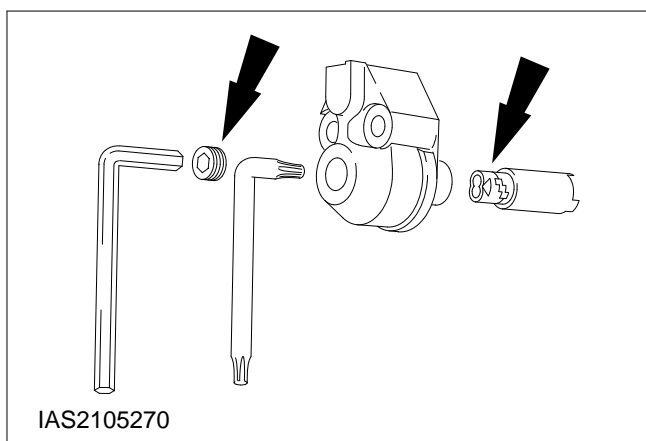
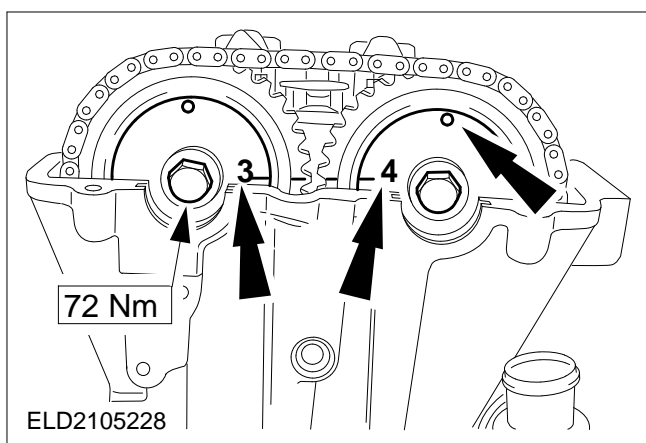
NOTE: Engine must be set to TDC.

NOTE: Do not rotate the camshafts.

62. Fit the camshaft sprockets together with the drive plates.

NOTE: The timing chain must be tight between the camshaft sprockets.

- Pull the timing chain tight on the driving run (the opposite side to the chain tensioner), and working from this side attach the camshaft sprockets (do not yet tighten the bolts).

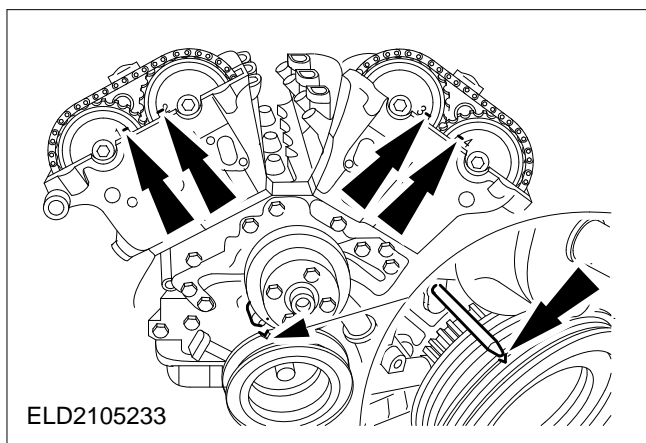


NOTE: The chain tensioner is released once there is an audible click and when it has reached its stop.

63. Tighten the timing chains.

NOTE: Use the TORX T30 angled socket.

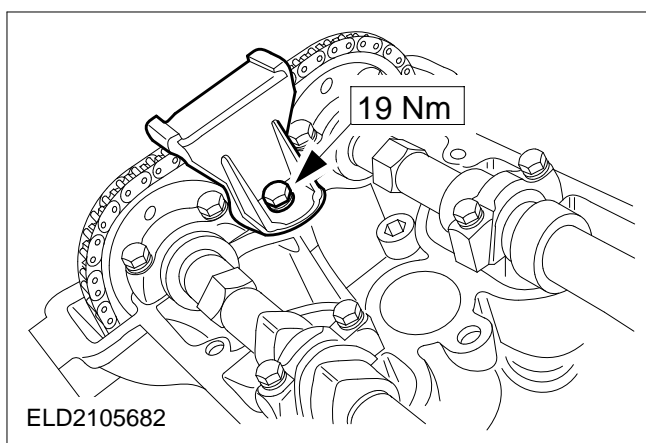
- Twist the chain tensioner anti-clockwise to release it.
- Screw the blanking plug (4,5 mm Allen key) into the chain tensioner.



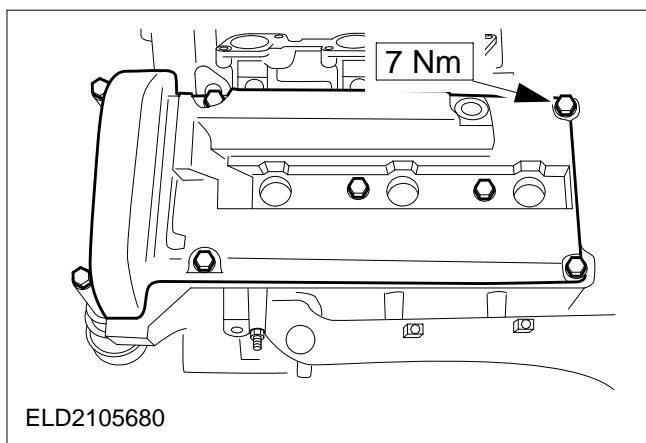
NOTE: Wait at least 15 minutes before turning the engine.

64. Turn the engine through two rotations and check the valve timings.

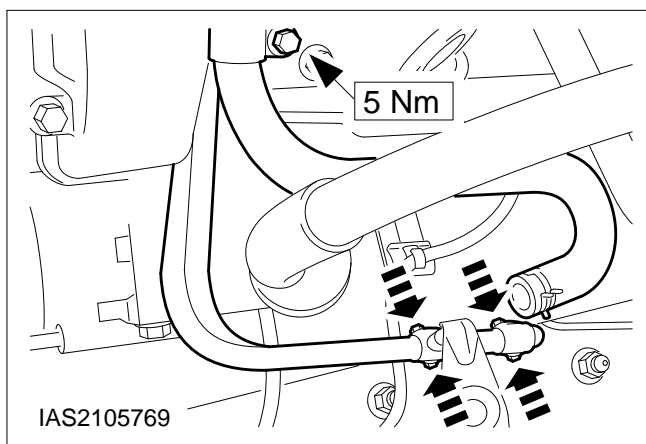
If necessary, follow steps 61. to 64. to correct the valve timings.



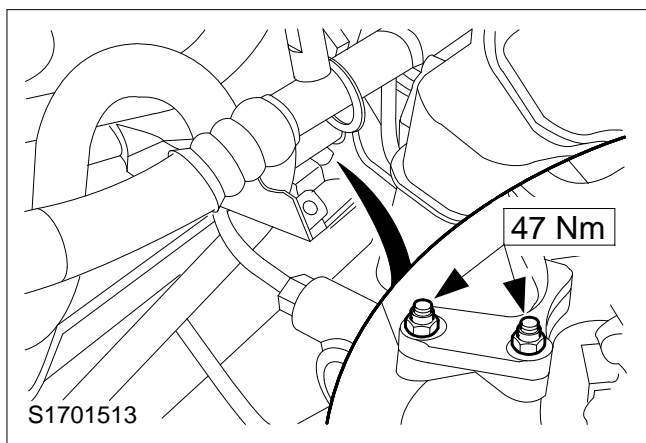
65. Fit the upper chain guides (left-hand side shown).



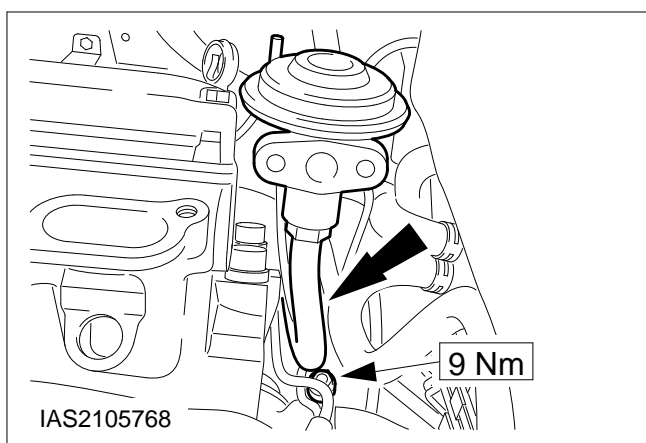
66. Fit the cylinder head covers (left-hand side shown).



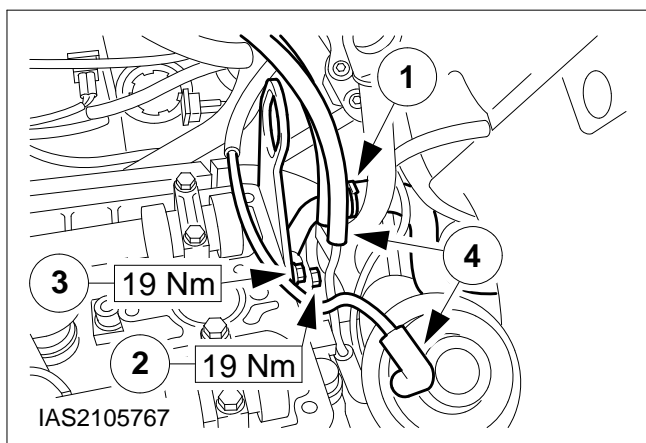
67. Attach the PCV bracket to the cylinder head cover and connect the fuel pipes.



68. Attach the exhaust manifolds to the catalytic converter (left-hand side shown).



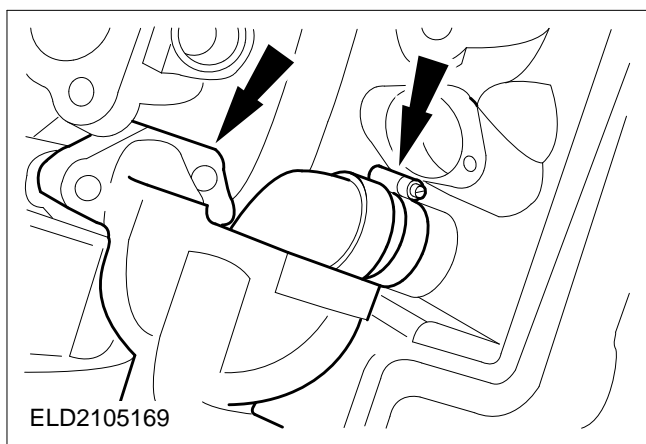
69. Attach the EGR valve to the exhaust manifold (two bolts).



70. Attach the hoses, the coolant line and the right-hand engine lifting eye.

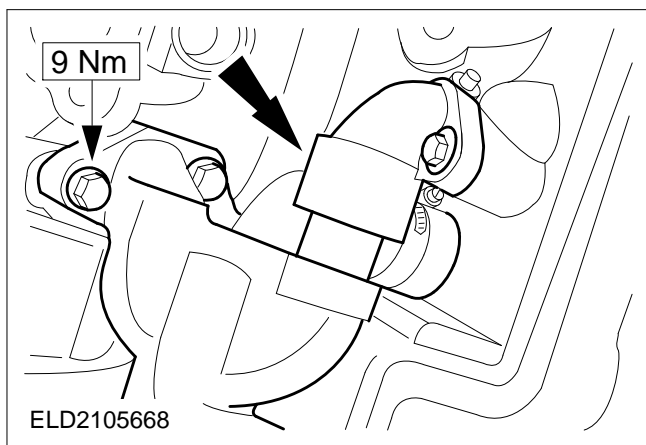
NOTE: The hoses have different diameters.

- 1 Fit the coolant hose.
- 2 Attach the coolant lines.
- 3 Attach the engine lifting eye (two bolts).
- 4 Push on the EGR valve vacuum hoses.

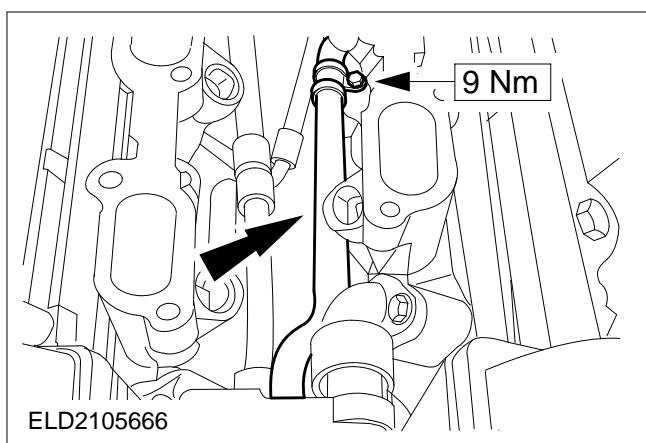


71. Fit the thermostat housing.

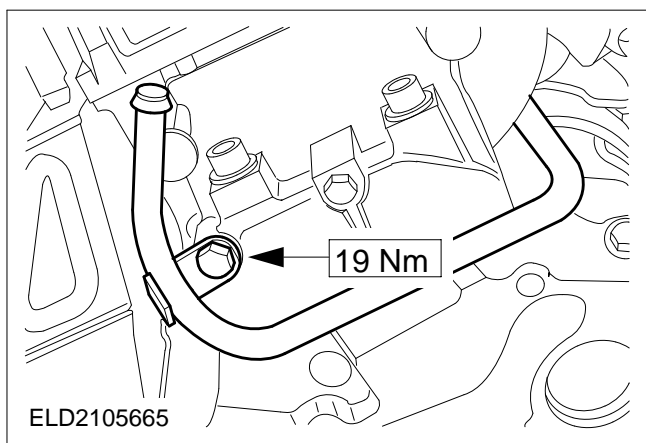
- Lubricate the coolant hose and the oil seals with liquid soap.
- Move the thermostat housing into installation position and at the same time insert and attach the coolant hose.



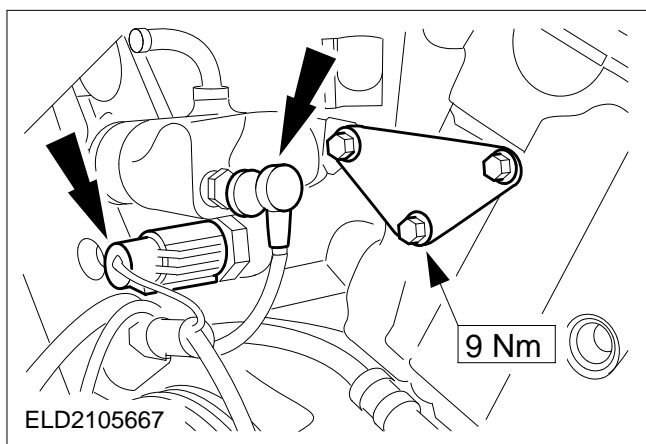
72. Fit the thermostat housing (continued).



73. Fit the coolant pipe.

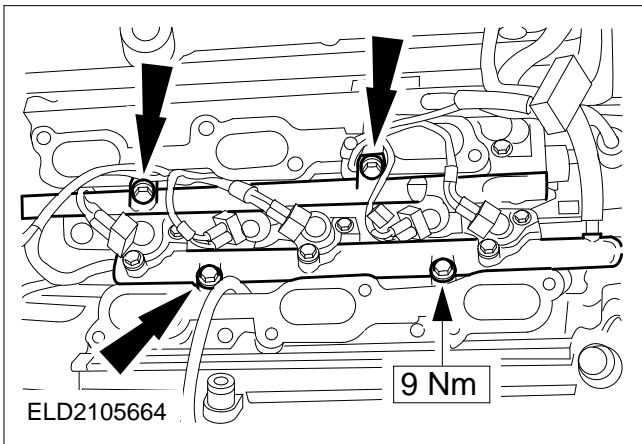


74. Fit the coolant pipe (continued).

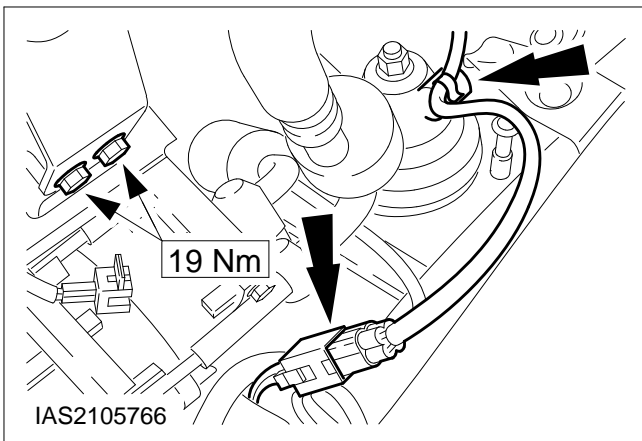
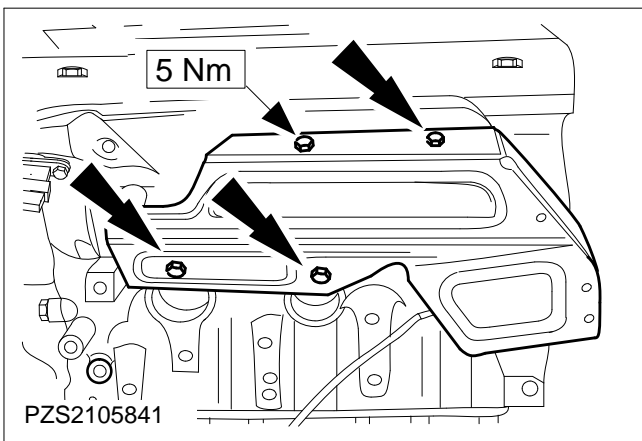
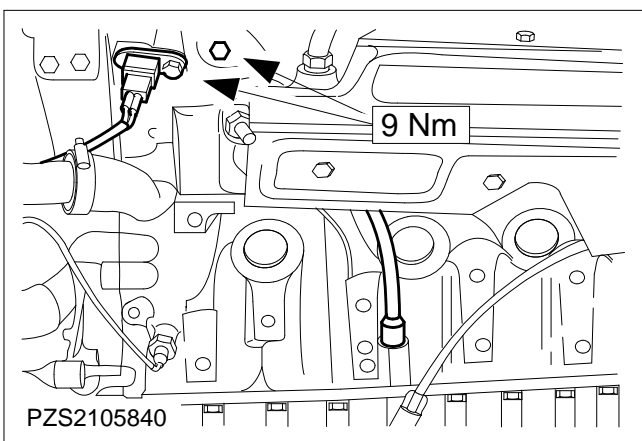


75. Connect the plugs and fit the thermostat housing bracket.

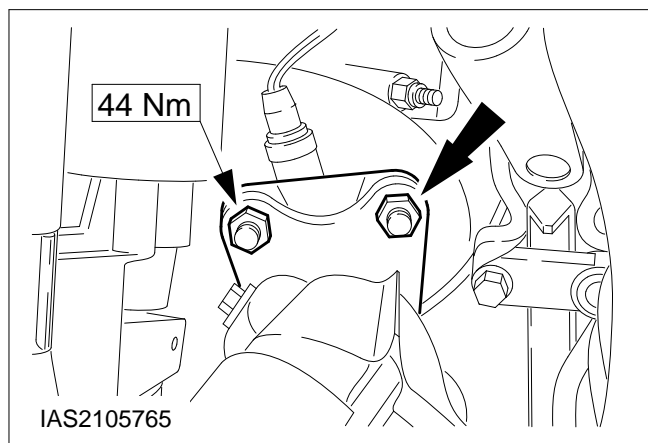
- ECT sensor plug.
- Temperature gauge sender unit plug.
- Thermostat housing bracket

**76. Fit the fuel rails.**

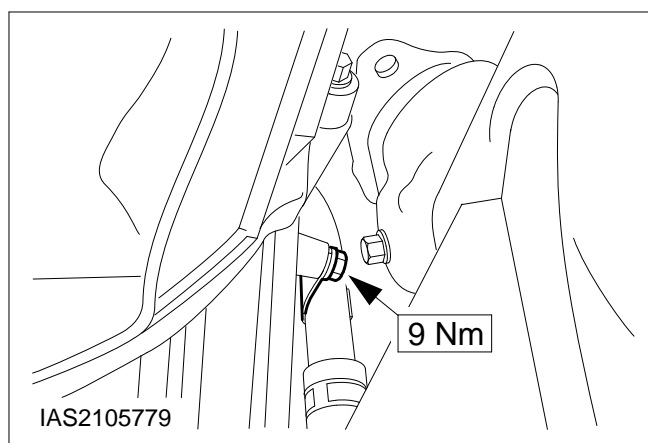
Connect the fuel injection valve multiplugs.

**77. Attach the engine lifting eye, connect the HO2S and attach it to the engine mounting.****78. Fit the heat shields (left-hand side shown).****79. Connect the CMP sensor multiplug and attach the dipstick.**

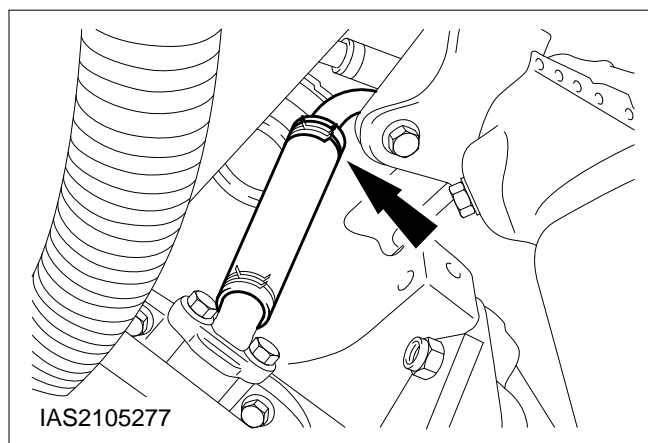
Raise the vehicle.



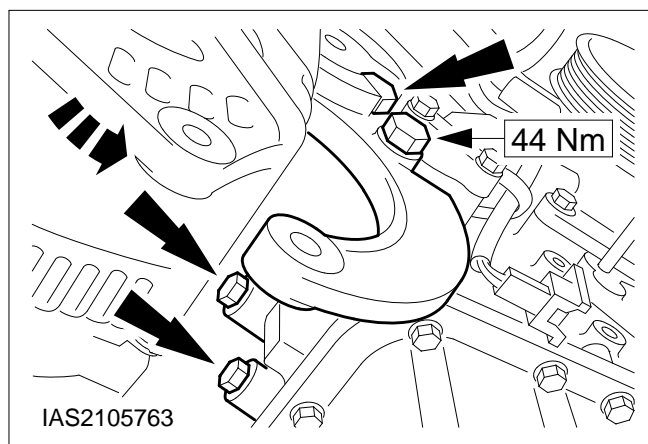
80. Attach the exhaust manifold to the catalytic converter.



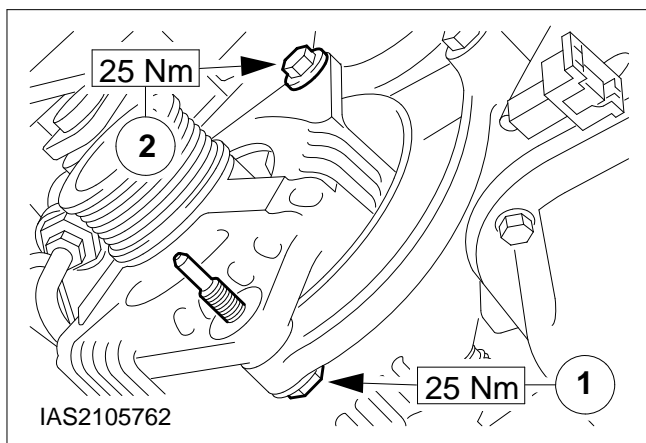
81. Fit the bolt on the coolant line for the oil cooler.



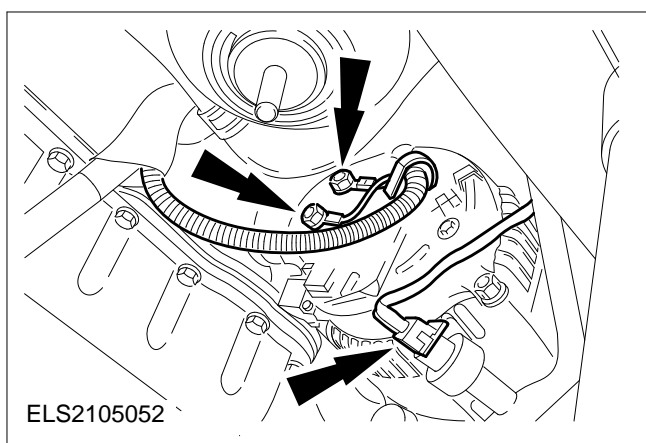
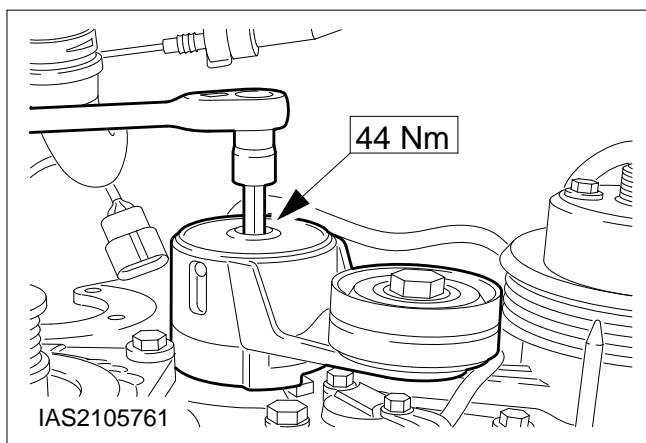
82. Attach the PCV hoses (left-hand side shown).



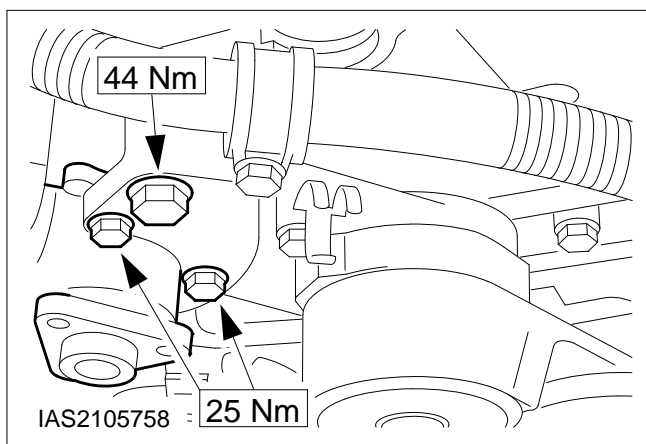
83. Fit the bracket for the alternator/power steering pump.

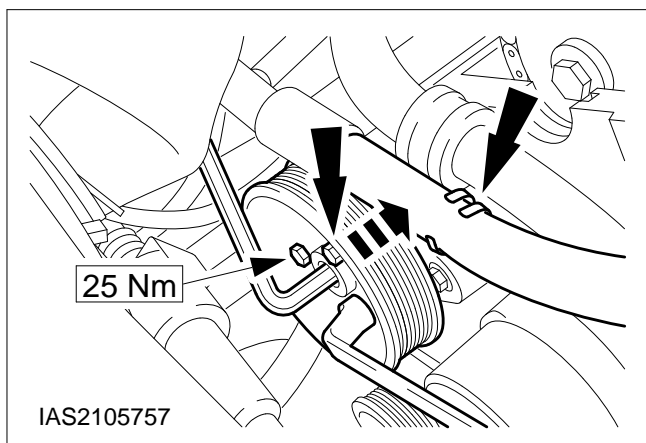
**84. Fit the alternator.**

- 1 Screw in and tighten the lower bolt.
- 2 Tighten the upper bolt.

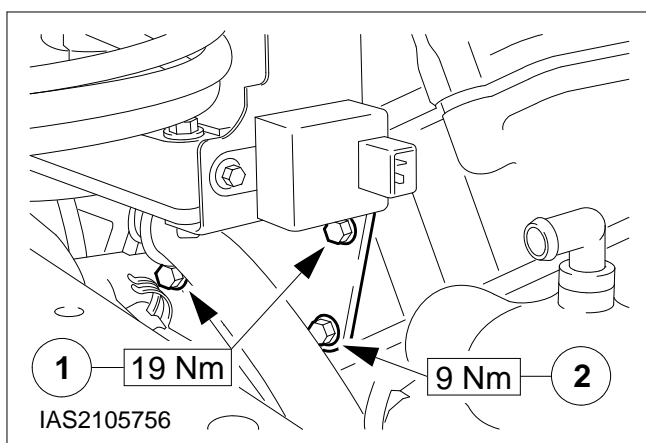
**85. Connect the alternator and the PSP switch plug.****86. Fit the tensioning pulley for the alternator/power steering pump.**

Lower the vehicle.

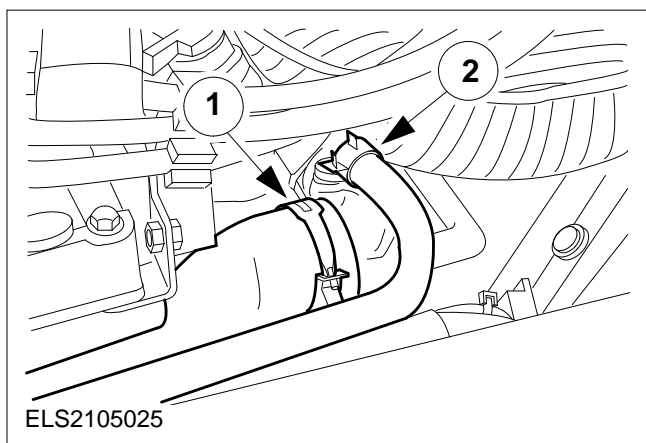
**87. Insert the upper bolt of the bracket and fit the power steering pump (five bolts).**



88. Fit the power steering pump pulley and attach the coolant hose to the bracket.

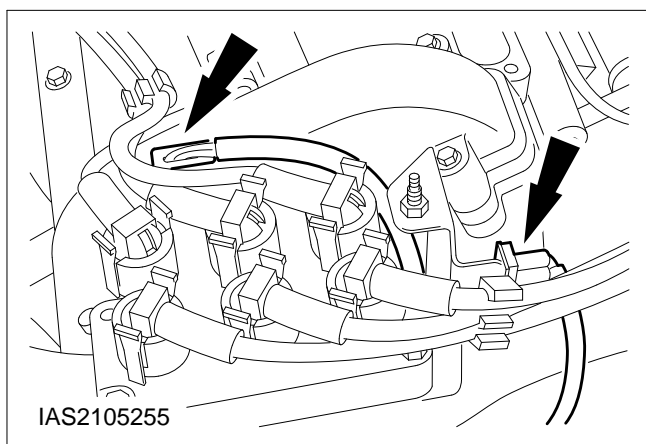


89. Fit the ignition coil.

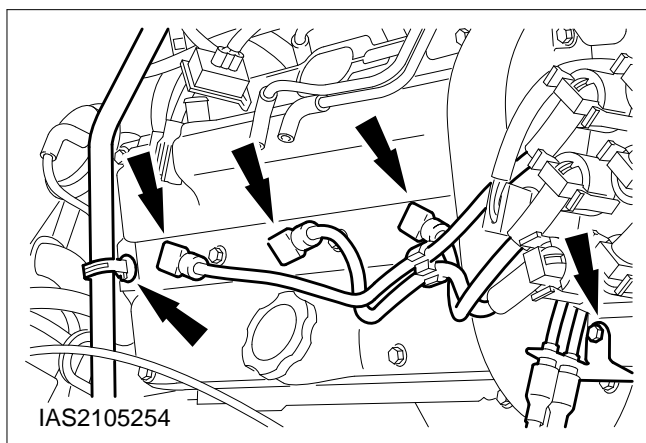


90. Attach the coolant hoses.

- 1 To the radiator.
- 2 To the expansion tank.

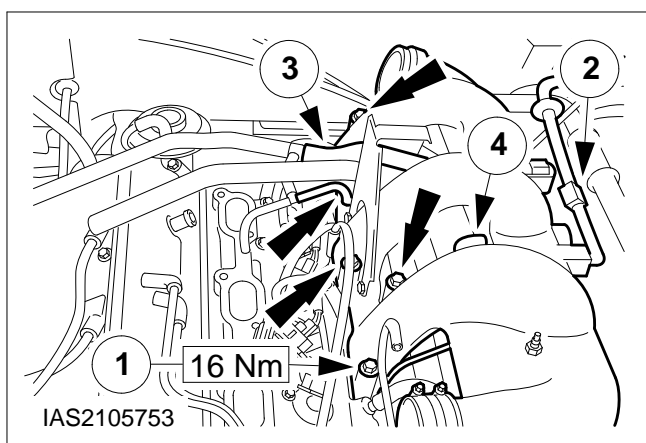


91. Connect the plugs.



92. Push on the spark plug connectors and attach the vacuum hoses.

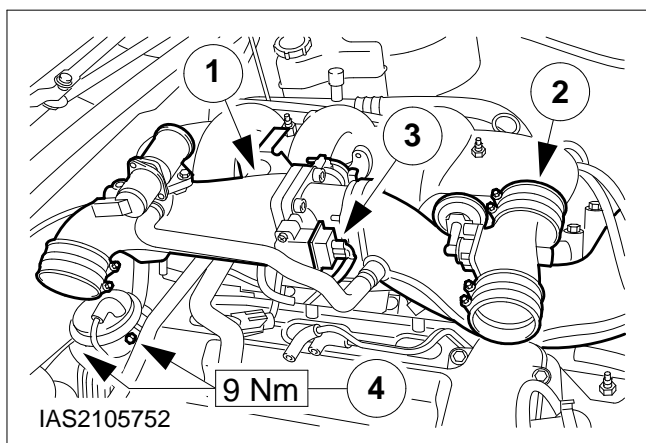
- Attach the bracket for the vacuum lines to the ignition coil.
- Push on the spark plug connectors (right-hand side shown).
- Connect the PCV hose and attach it to the cylinder head cover.



93. Fit the left-hand exhaust manifold.

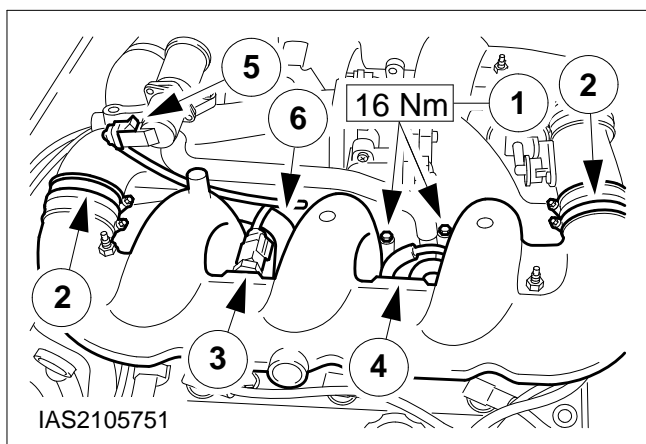
- 1 Fit the six bolts.
- 2 Fit the brake servo vacuum line.
- 3 Insert the PCV valve into the cylinder head cover.
- 4 Connect the vacuum hose.

Locate the wiring and hoses for the air intake plenum chamber and the right-hand inlet manifold in installation position.



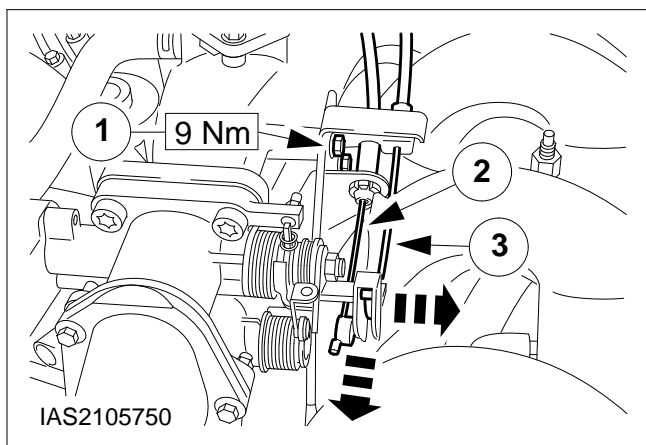
94. Fit the air intake plenum chamber.

- 1 Push the air intake plenum chamber onto the left-hand inlet manifold.
- 2 Attach the VRIS.
- 3 Connect the TP sensor plug.
- 4 Attach the EGR valve to the inlet manifold (two bolts).

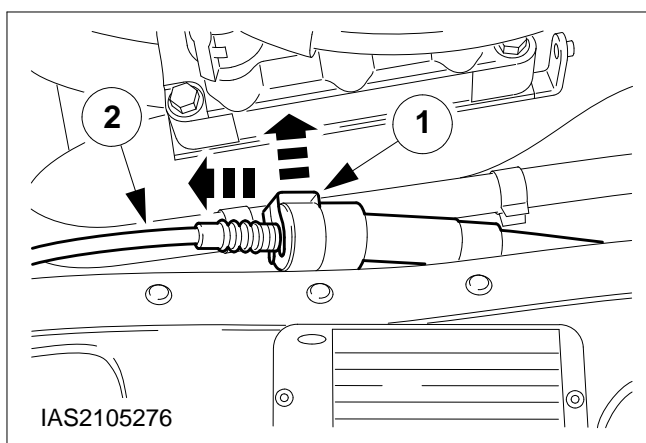


95. Attach the right-hand inlet manifold.

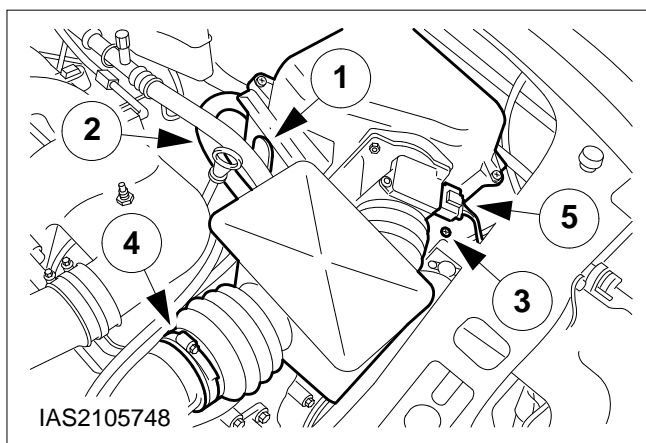
- 1 Push the inlet manifold onto the air intake plenum chamber and fit the six bolts.
- 2 Fit the connecting hoses.
- 3 Connect the IAT sensor multiplug.
- 4 Push on the two vacuum hoses.
- 5 Connect the IAC valve multiplug.
- 6 Push on the PCV hose and the vacuum hose.

**96. Attach the cables.**

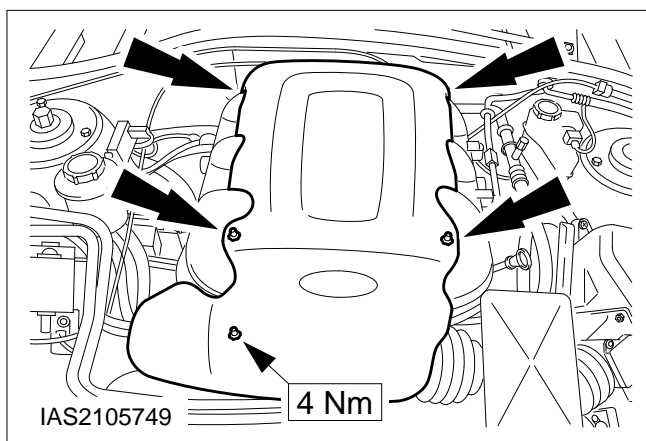
- 1 Fit the bracket for the speed control system cable.
- 2 Hook the speed control system cable in place.
- 3 Attach the throttle cable to the bracket and hook it in place.

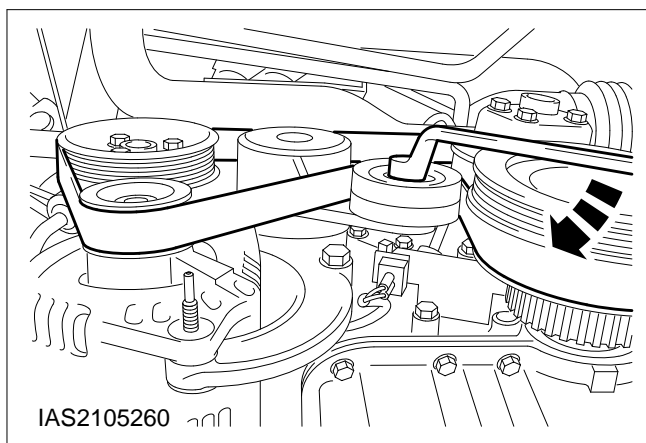
**97. Adjust the throttle cable.**

- 1 Pull off the clip from the throttle cable.
- 2 Pull the throttle cable out a few notches.
 - Fully depress the accelerator pedal once and push the clip back in place.
 - Check whether the throttle valve opens fully when the accelerator pedal is fully depressed, and repeat the adjustment if necessary.

**98. Fit the air cleaner.**

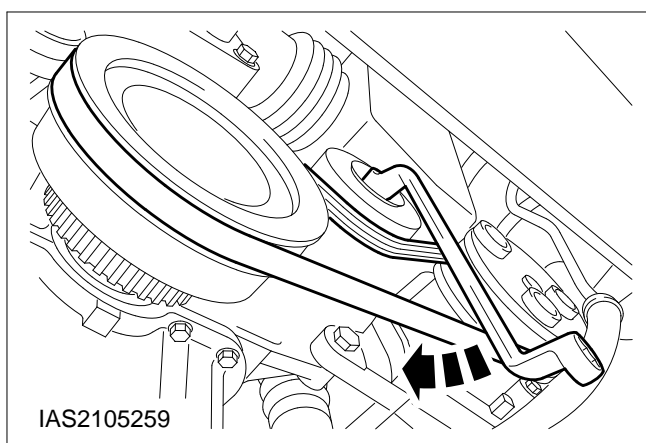
- Push the air cleaner into the grommets on the body and onto the intake pipe.
- 1 Fit the two rubber retainers.
 - 2 Attach the PCV hose.
 - 3 Insert the bolt for the intake pipe.
 - 4 Fit the intake hose.
 - 5 Connect the MAF plug.
- Raise the vehicle.

**99. Fit the intake system cover.**



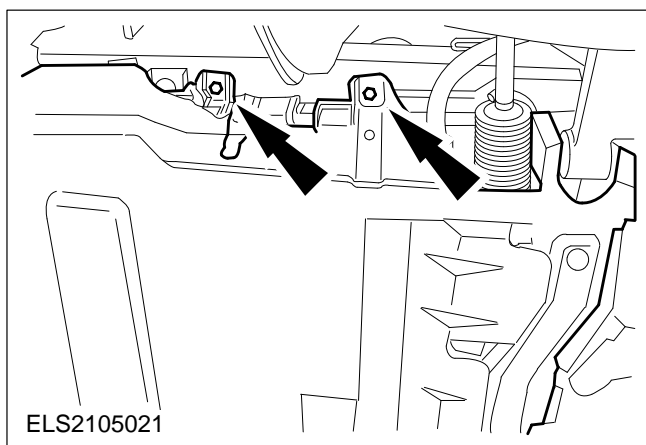
100. Fit the multi-groove belt for the alternator/power steering pump.

- Take the pressure off the belt by turning the tensioning pulley clockwise.
- Fit the multi-groove belt.



101. Fit the air conditioning multi-groove belt.

- Take the pressure off the belt by turning the tensioning pulley clockwise.
- Fit the multi-groove belt.



102. Standard finishing operations.

- Renew the oil filter.
- Attach the engine undershield (left-hand side shown).
- Connect the battery ground lead.
- Attach the battery cover.
- Enter the radio keycode.
- Reprogramme the preset radio stations.
- Reset the clock.
- Check the routing of hoses and wiring and secure them with cable ties if necessary.
- Top up the engine oil.
- Fill up with coolant and close the coolant reservoir.
- Screw in the coolant reservoir filler plug.
- Carry out a road test to enable the PCM module to collect data.
- After the road test check the fluid levels and correct them if necessary.