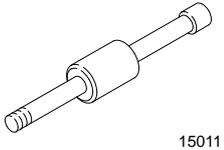
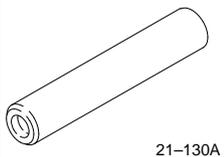
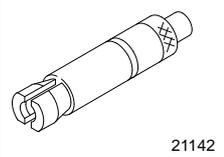
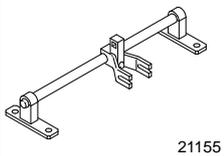
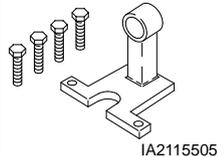
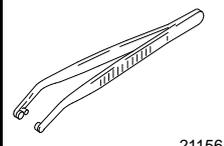
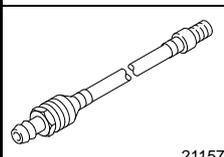
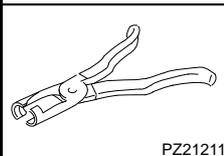
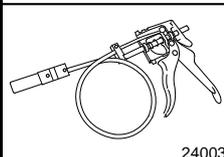


Valve Stem Oil Seals – Renew (all) (21 238 0)

(Cylinder heads fitted)

Special Tools

 15011	15-011 Slide hammer
 21-130A	21-130A Valve stem seal installer
 21142	21-142 Remover, valve stem oil seal
 21155	21-155 Valve spring compressor
 2115501	21-155-01 Adaptor for 21-155
 IA2115505	21-155-05 Adaptor for 21-155

 21156	21-156 Installer, valve collets
 21157	21-157 Adapter, air supply cylinder
 PZ21211	21-211 Valve stem seal pliers
 24003	24-003 Remover/installer, radiator hose clip

Proprietary Tools

4,5 mm Allen key
Angled torx key T30
Scraper
8,5 mm drill bit

Materials

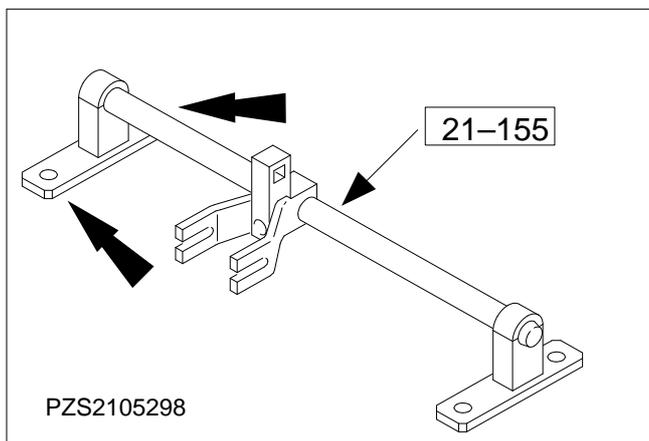
Hylosil sealer	WSK-M4G320-A
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Renew

1. General notes.

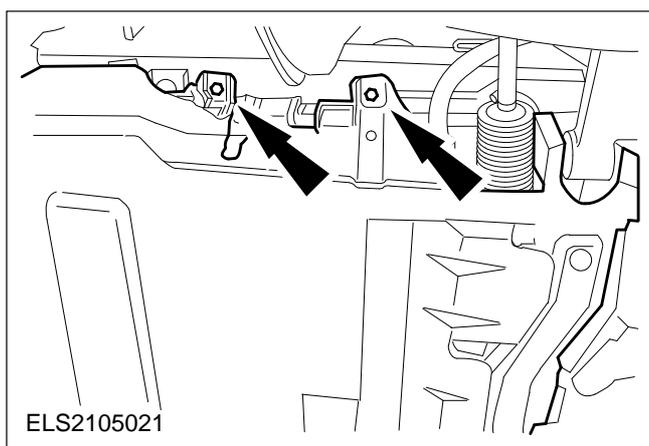
NOTE: Throughout the whole operation cover the engine openings to make sure that nothing falls into them.

- The position of ancillary components is described looking from the transmission towards the engine.
- The hydraulic lines are not separated.



2. Modify the valve spring compressor (special tool 21-155).

Drill out the two bores to a diameter of 8,5 mm.

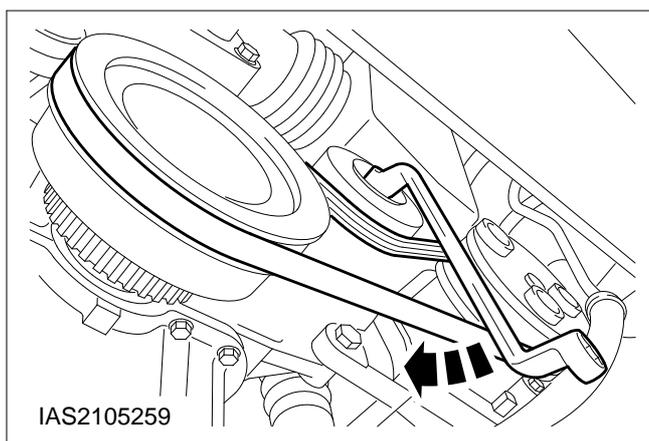


3. Standard preparatory measures:

- 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

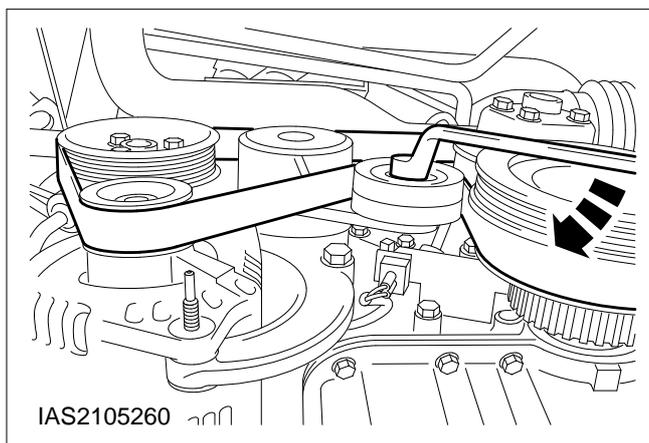
⚠ CAUTION: Disconnect the battery ground lead.

- 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.



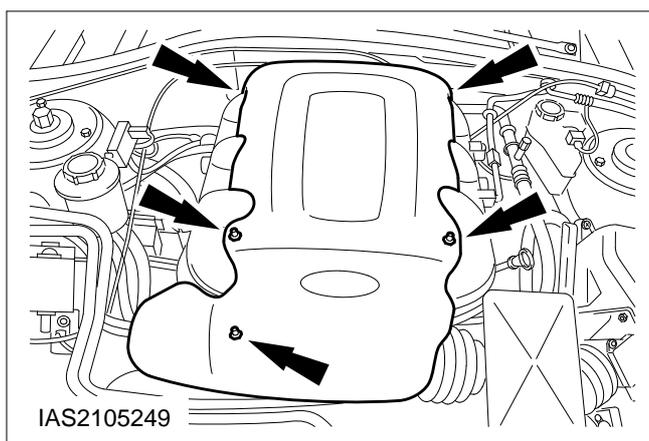
4. Remove the air conditioning multi-groove belt.

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

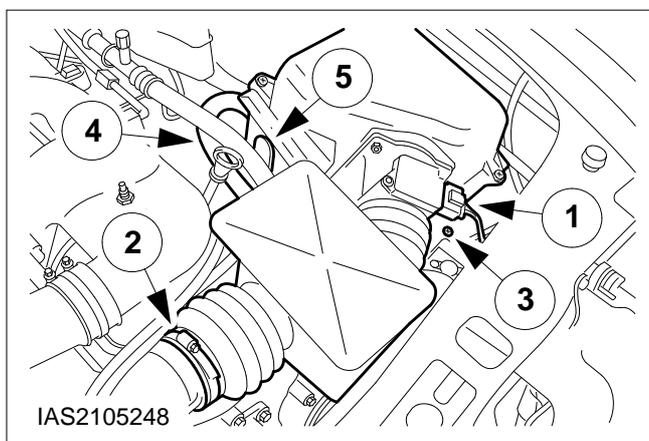


5. Remove the multi-groove belt for the alternator/power steering pump.

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

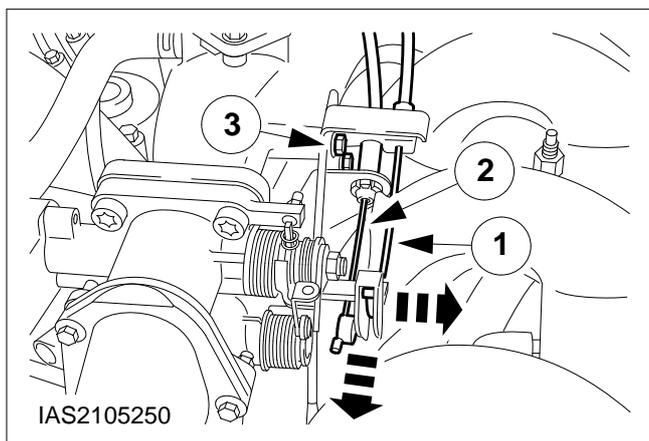


6. Remove the cover from the intake system.



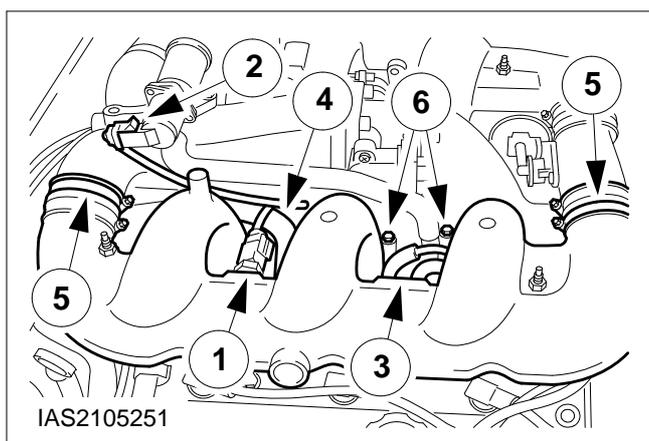
7. Remove the air cleaner.

- 1 Detach the MAF sensor plug.
 - 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.



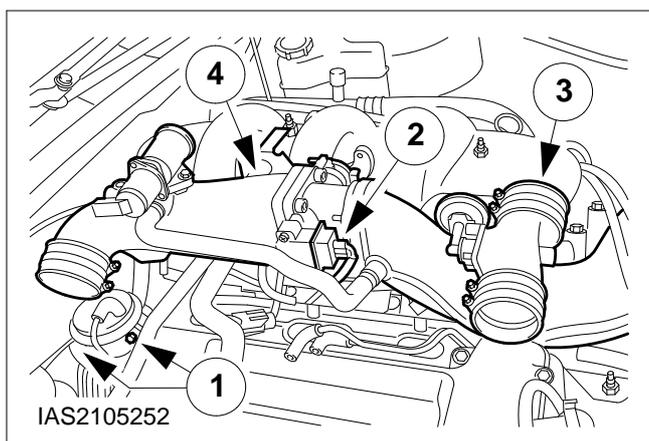
8. Detach the cables.

- 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.



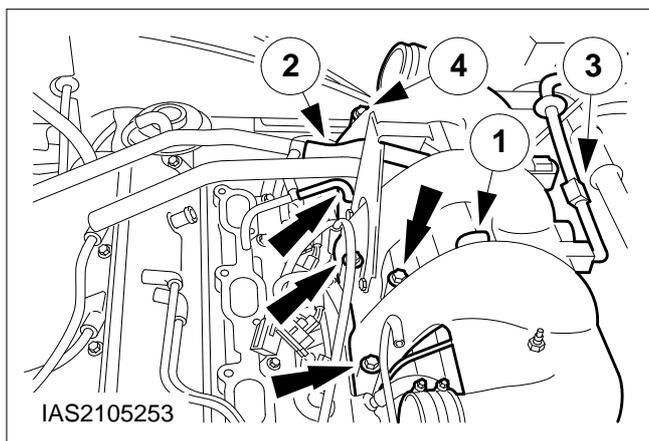
9. Remove the right-hand inlet manifold.

- 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).



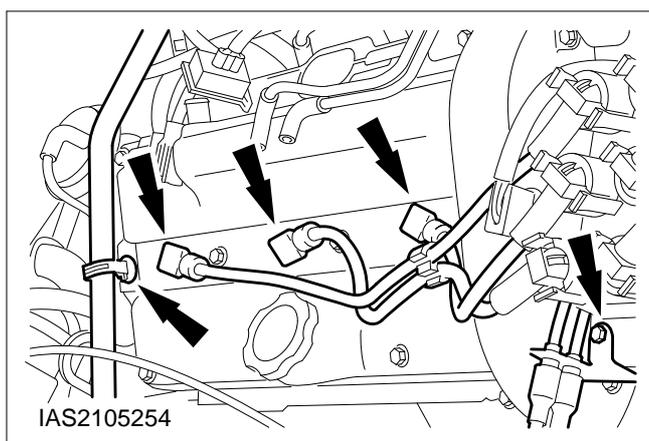
10. Remove the air intake plenum chamber.

- 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.



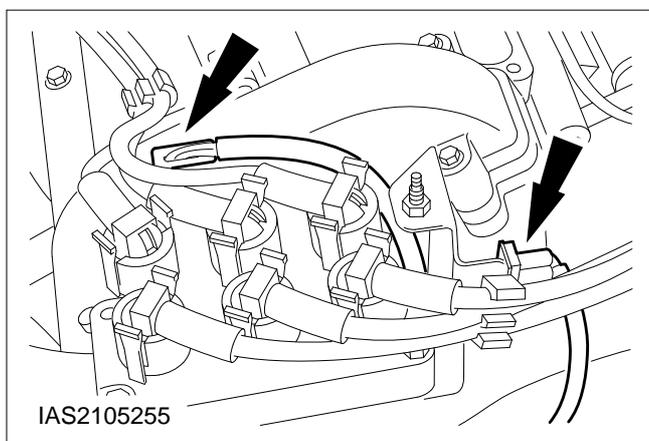
11. Remove the left-hand inlet manifold.

- 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.

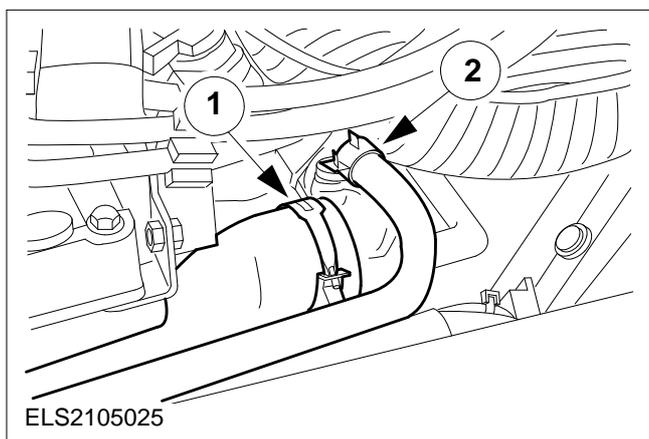


12. Detach the hose and pull off the spark plug connectors.

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

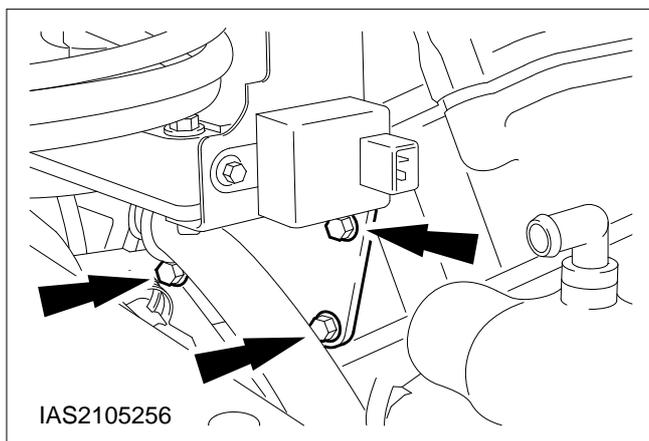


13. Disconnect the plugs.

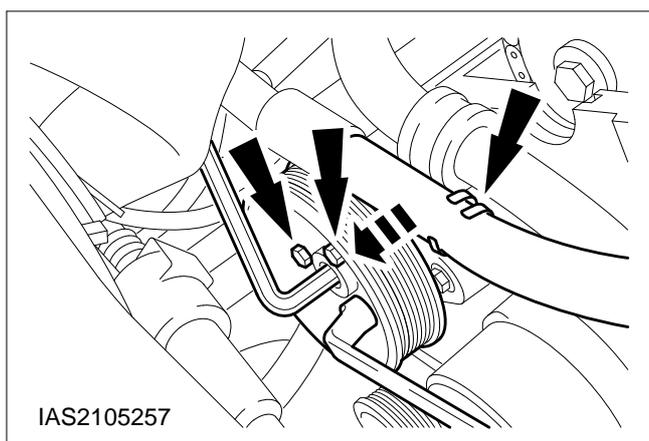


14. Detach the coolant hoses.

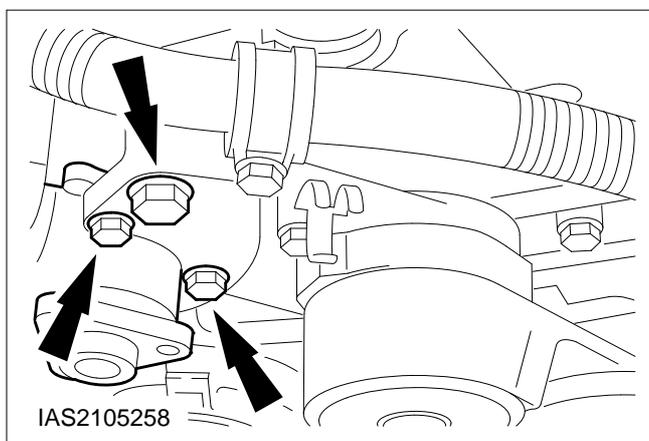
- 1 To the radiator.
- 2 To the expansion tank.



15. Remove the ignition coil.

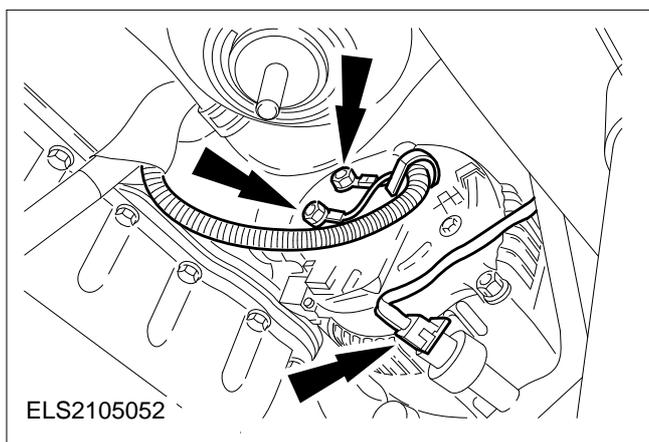


16. Remove the power steering pump pulley.

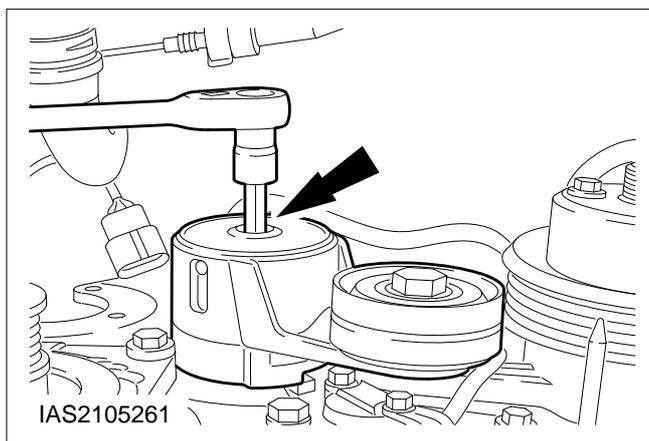


17. Remove the power steering pump pulley (five bolts) and detach the upper bolt from the bracket.

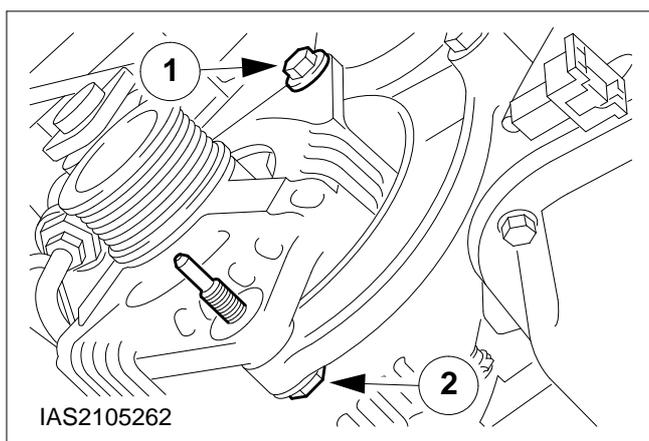
Raise the vehicle.



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

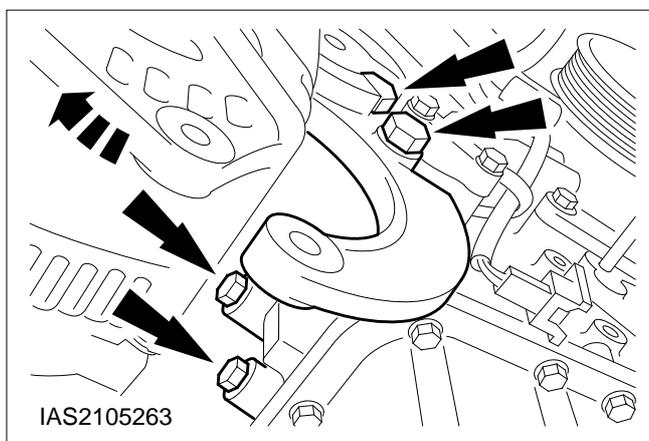


19. Remove the tensioning pulley of the alternator/power steering pump.



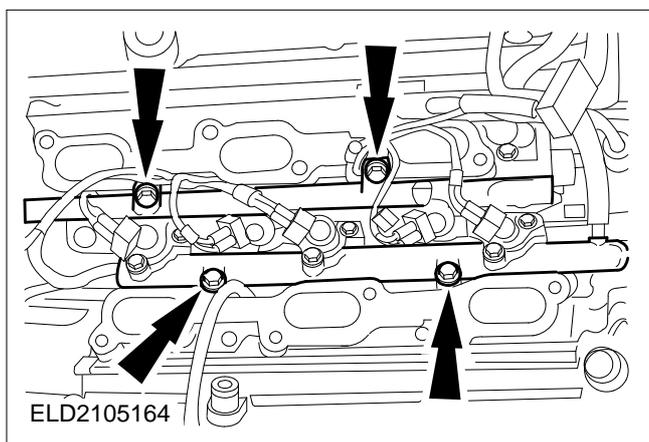
20. Remove the alternator.

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



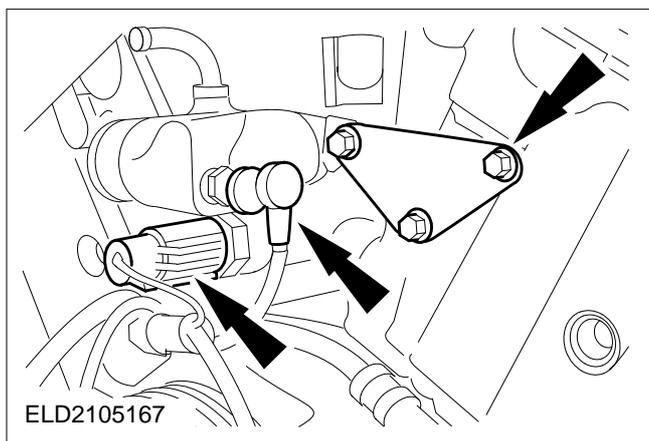
21. Remove the bracket of the alternator/power steering pump.

Swivel the alternator upwards and remove the bracket.



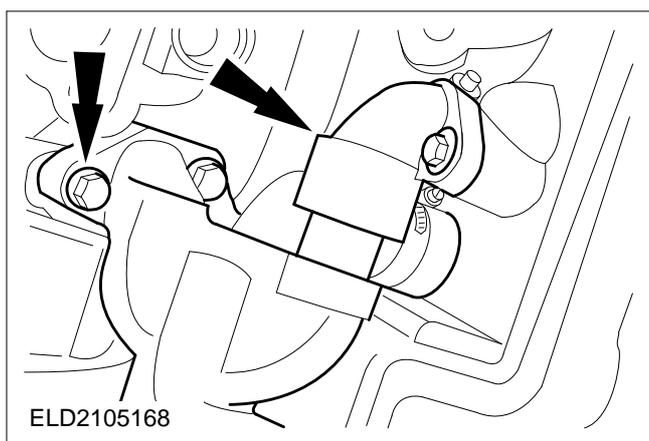
22. Remove the fuel rails.

Disconnect the fuel injection valve plugs.



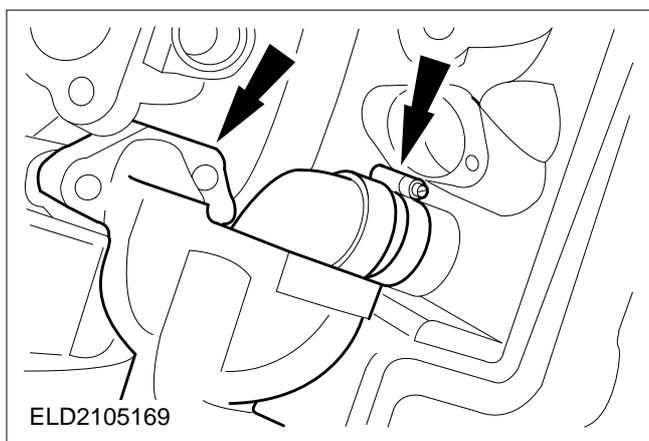
23. Detach the thermostat housing bracket and disconnect the plugs.

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



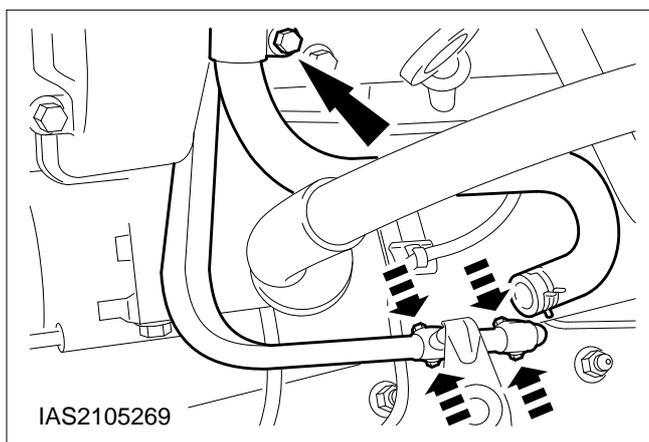
24. Detach the thermostat housing.

Take off the connector.

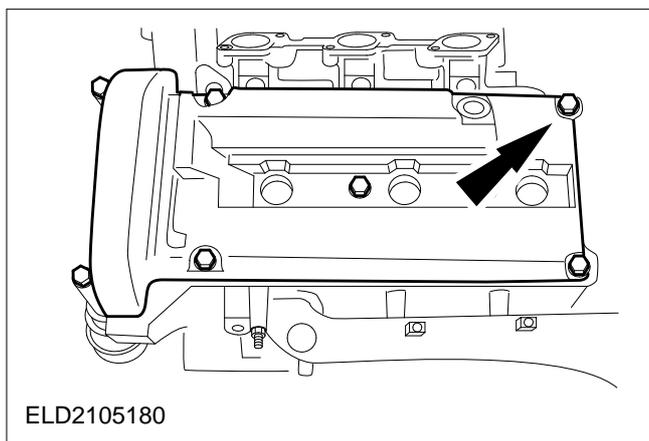


25. Remove the thermostat housing (continued).

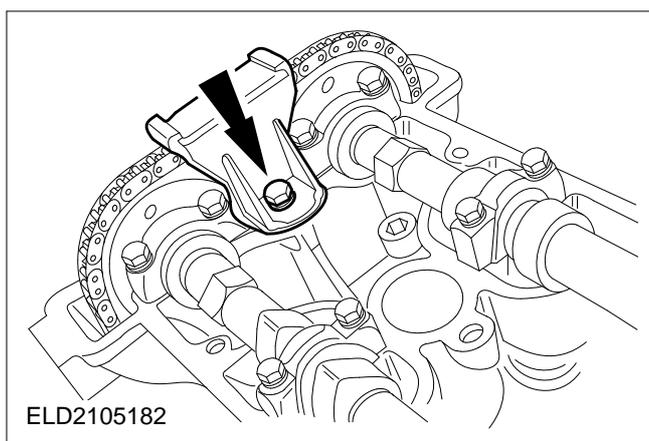
Detach the thermostat housing from the coolant hose and remove it.



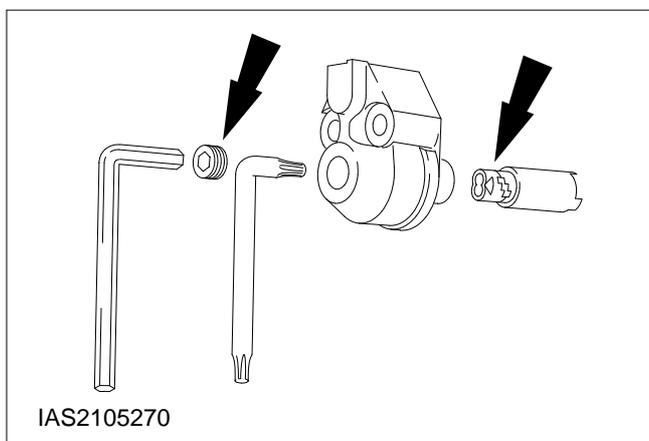
26. Remove the PCV bracket from the cylinder head cover and disconnect the fuel lines.



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



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



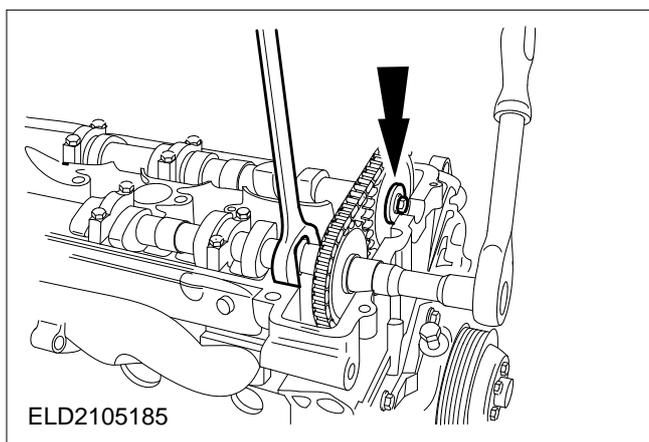
NOTE: The chain tensioner is immobilised once there is an audible click and when it has reached its stop.

29. Slacken the timing chains.

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

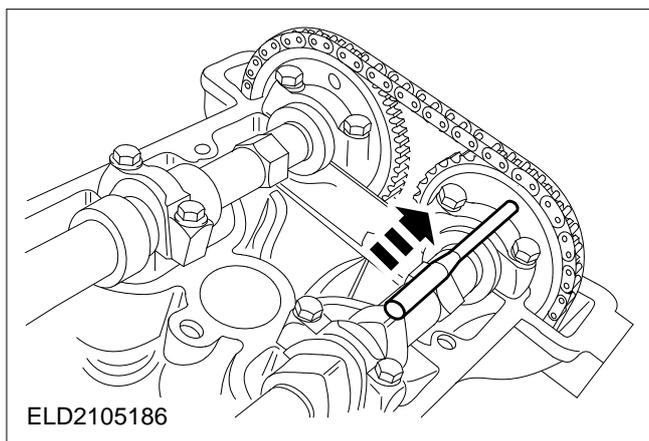
NOTE: Use the TORX T30 angled socket.

- Immobilise the chain tensioner by rotating it clockwise.



NOTE: Undo the camshaft sprocket bolts ten turns.

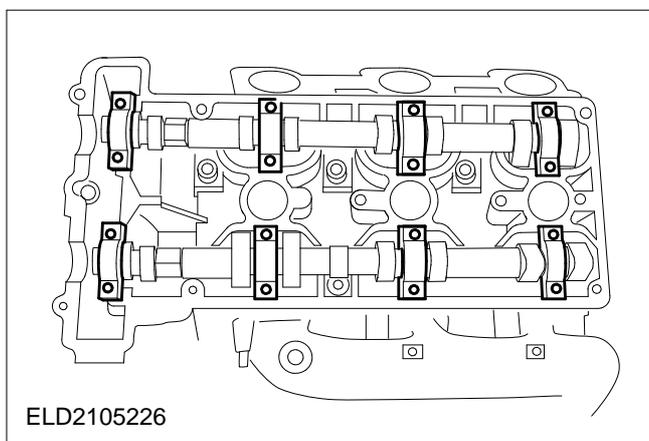
30. Remove the camshaft sprockets.



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

31. 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.

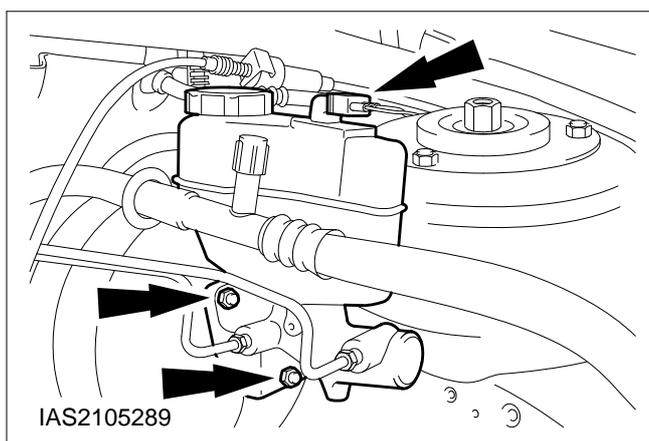


Remove the camshafts.

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

NOTE: Remove the bearing caps, hydraulic tappets and camshafts.

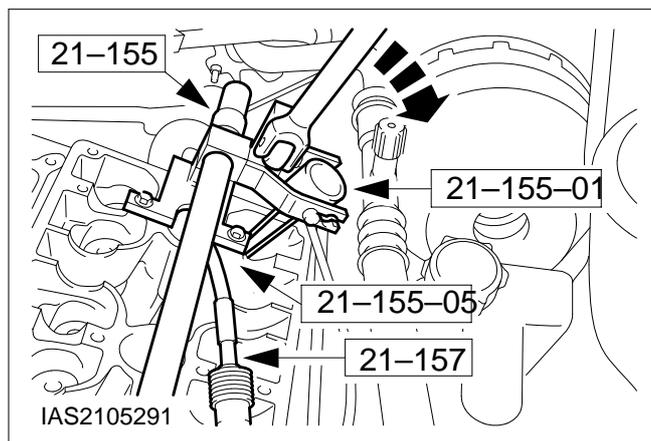
32. Remove the camshafts and hydraulic tappets.



NOTE: Do not bend the brake pipes.

33. Remove the brake master cylinder.

- Disconnect the plug for the brake fluid level sensor.
- Lower the brake master cylinder approximately 80 mm and tie it up.



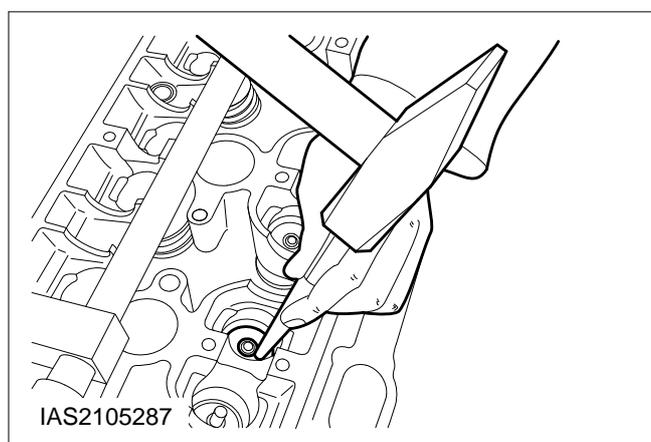
NOTE: When applying the compressed air hold both timing chains tight and guide them with the handle of a hammer as described in step 37.

NOTE: Connect a compressed air supply of 7 to 10 bar.

34. Attach the valve spring compressor and the adaptors.

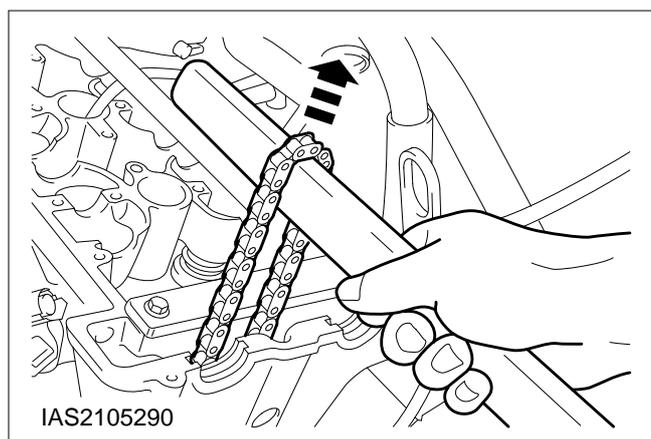
Before resetting adapter 21-155-01 to the next valve, undo the side bolts approximately 5 mm.

35. Screw the compressed air connector into the spark plug bore.

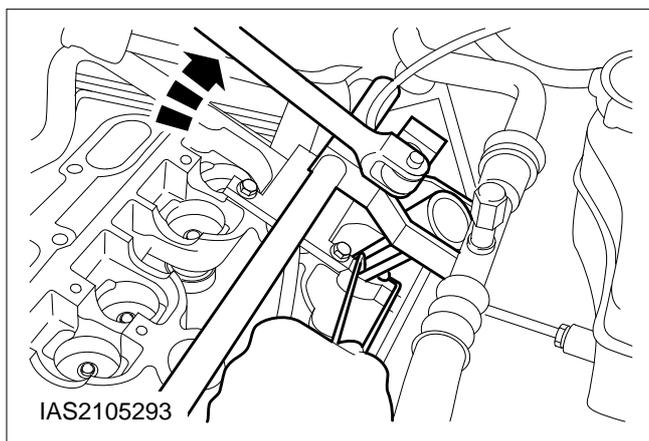


36. Loosen the valve spring retainer.

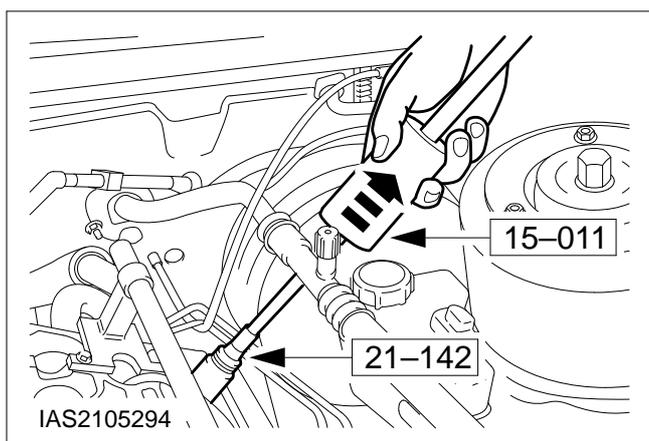
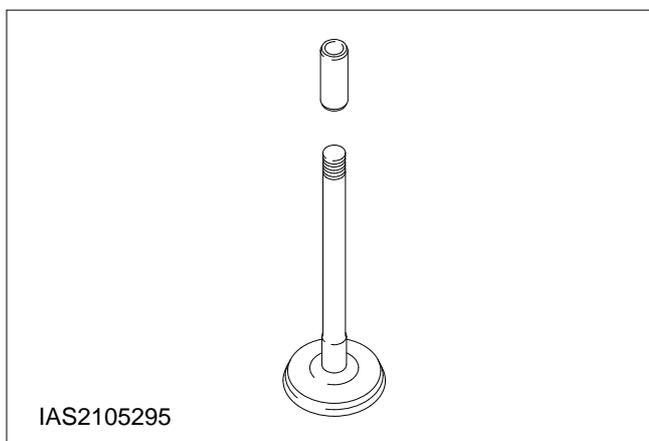
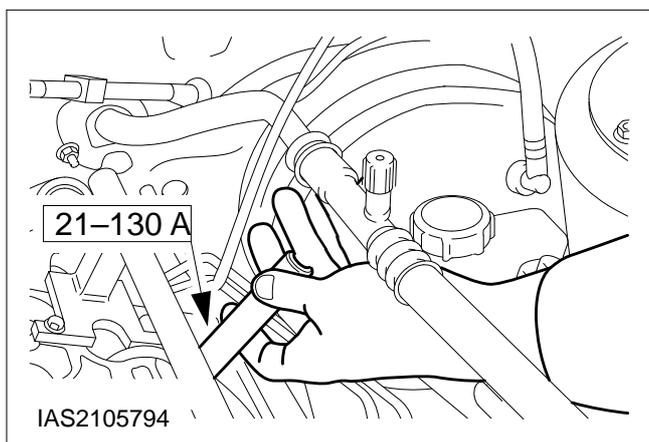
Loosen the valve spring retainer from the collets by tapping down on it.



37. Guide the timing chains.

**38. Remove the valve spring.**

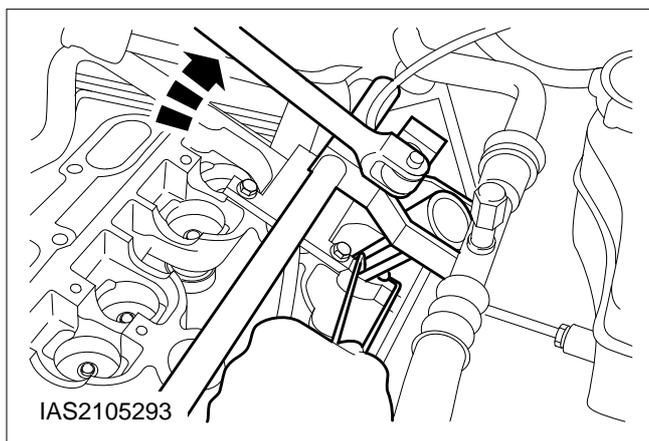
- Compress the valve spring and remove the valve collets.
- Remove the valve spring and the valve spring retainer.

**39. Remove the valve stem oil seal.****40. Protective sleeve for fitting the valve stem oil seals.**

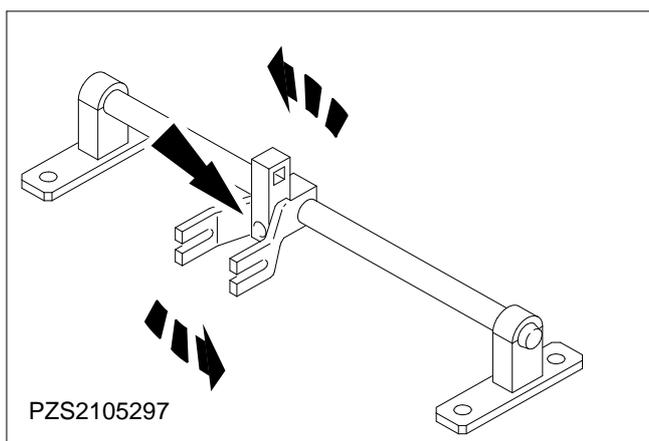
NOTE: Use a protective sleeve for fitting the valve stem oil seals.

41. Install a new valve stem oil seal.

- Install it using Special tool 21-130A.
- Remove the protective sleeve.

**42. Install the valve spring.**

- Insert the valve spring and the valve spring retainer.
- Compress the valve spring and fit the collets.
- Check that the valve collets are correctly seated.

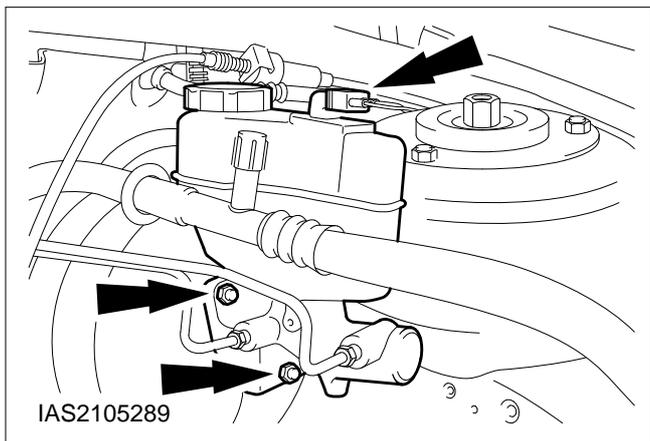
**43. Turn the fork on Special Tool 21–155 from inlet valve setting to exhaust valve setting.**

- Release the bolt.
- Turn the fork and tighten the bolt.

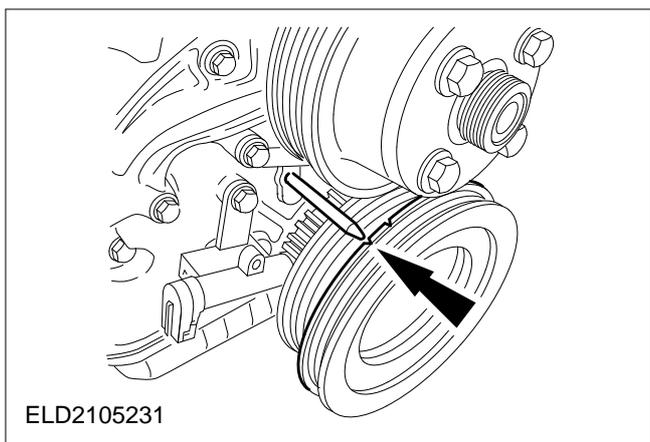
44. Repeat steps 35. to 43. on all cylinders.**45. Preparatory measures.**

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

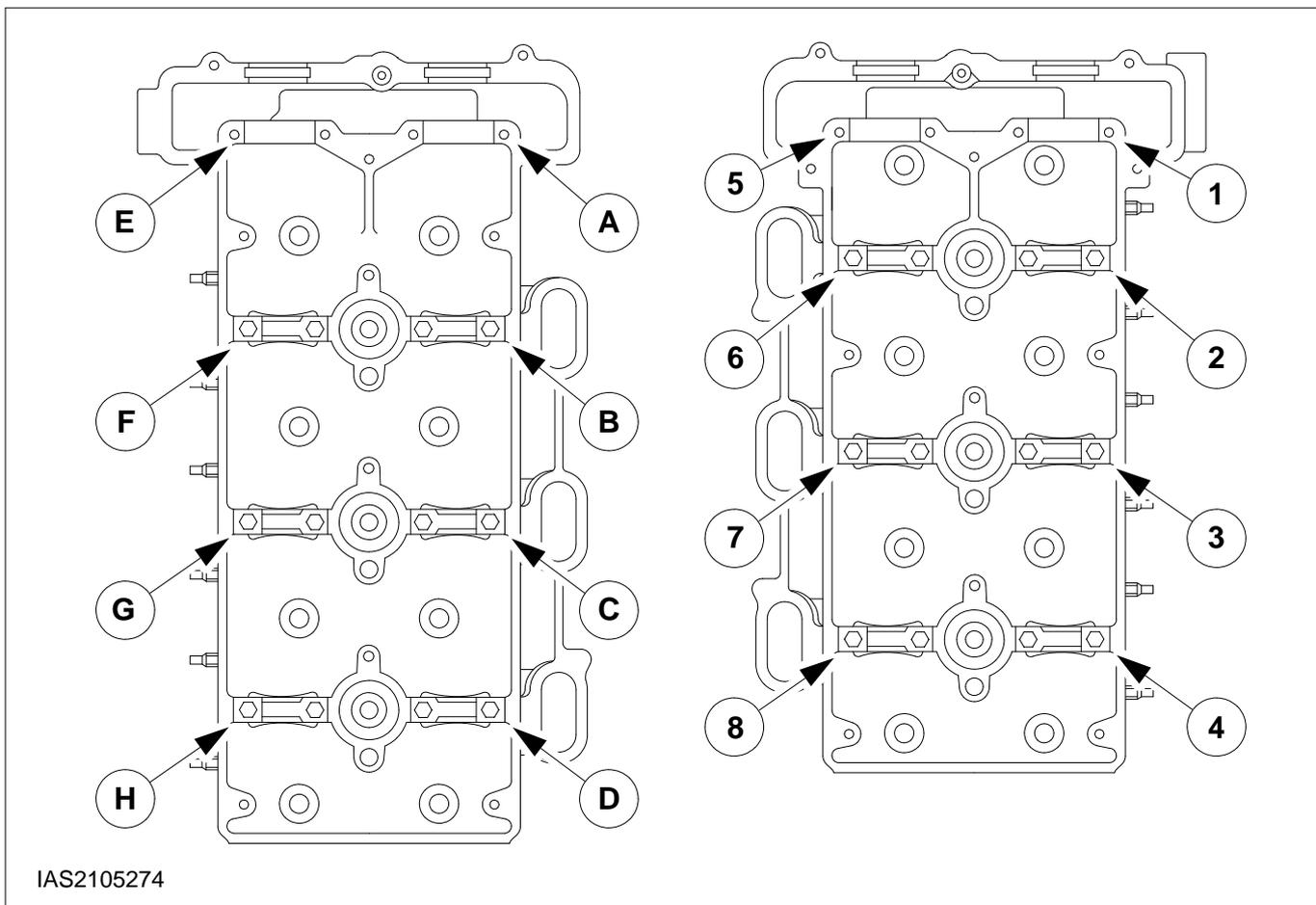
- Clean the mating faces of all ancillary components with a scraper, check them for damage and renew them as necessary.
- Clean the threaded bores and dry them.
- Renew all gaskets and self-locking nuts.



46. Fit the brake master cylinder.



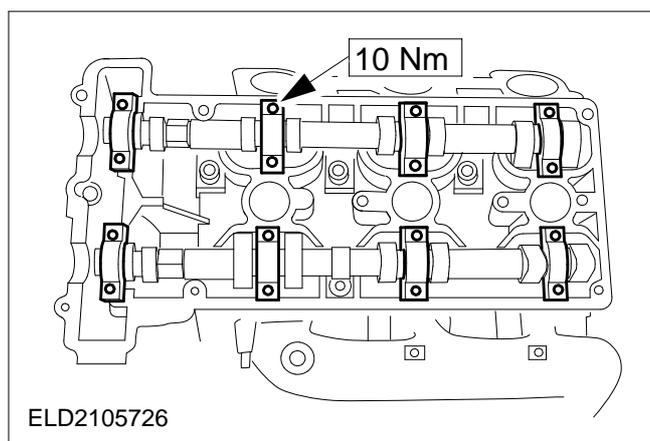
47. Set the engine to TDC.



Install the camshafts

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

48. Identification of the camshaft bearing caps.



49. Fit the hydraulic tappets.

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

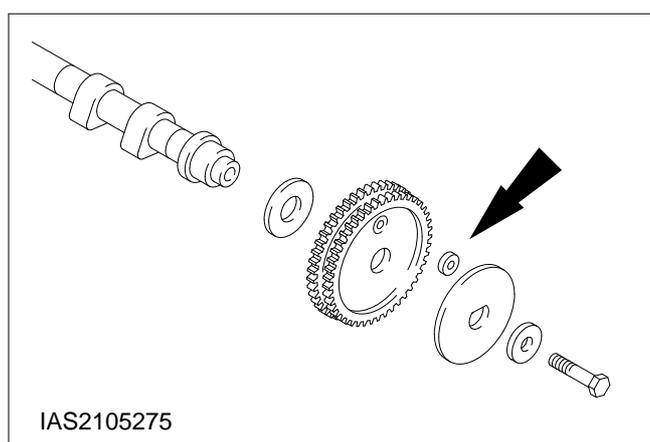
NOTE: The camshafts are numbered from right to left.

50. 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.

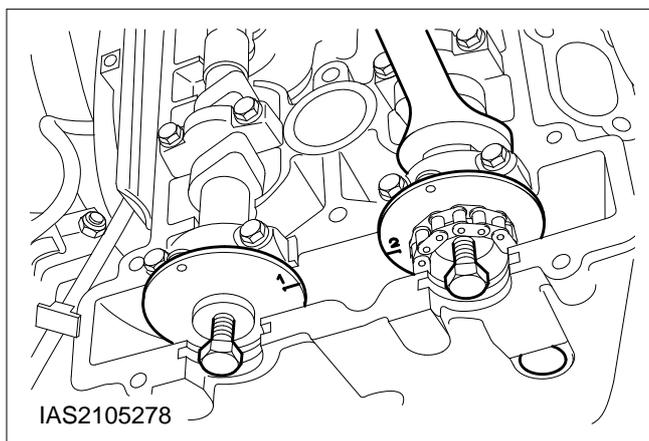
51. Install the camshafts for the left-hand cylinder head.

- 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.



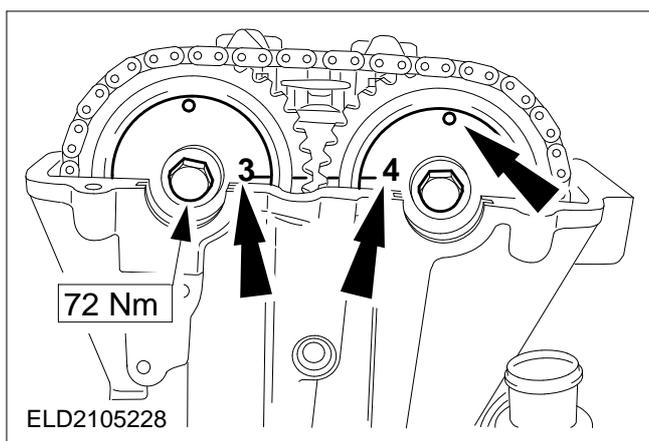
NOTE: The drive plate follower must engage in the bore on the camshaft sprocket.

52. Camshaft components.



53. Set the camshafts to the timing marks.

- Push on the thrust washers and drive plates, screw in the bolts a few turns.
- Set the camshafts to the timing marks.
- Remove the drive plates.



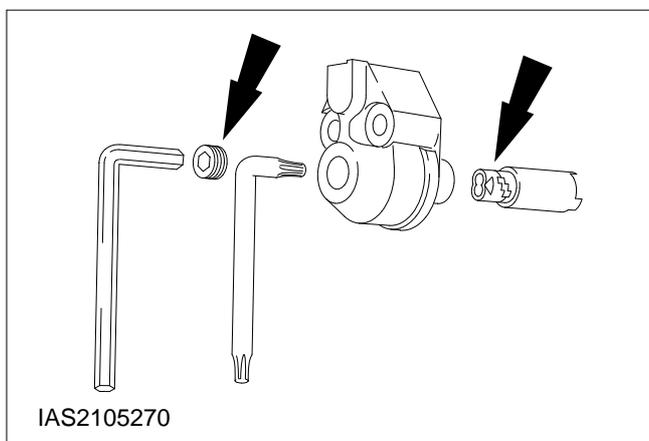
NOTE: Engine is set to TDC.

NOTE: Do not rotate the camshafts.

54. Attach the camshaft sprockets.

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).

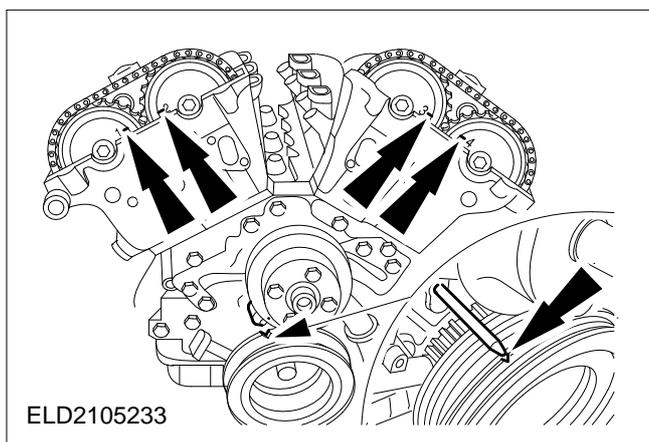


NOTE: The chain tensioner is released once there is an audible click and when it has reached its stop.

55. Tighten the timing chains.

NOTE: Use the TORX T30 angled socket.

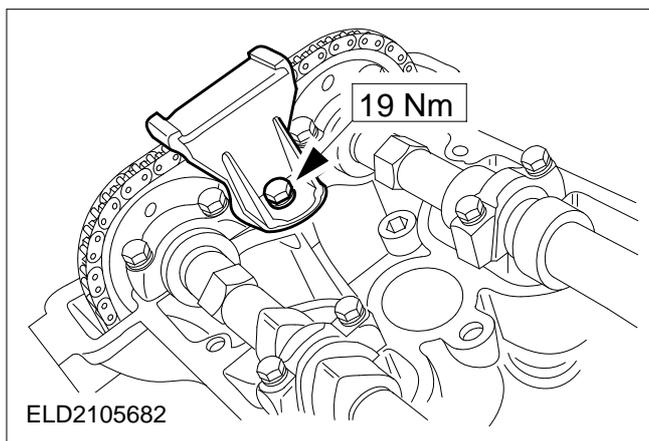
- Twist the chain tensioner anti-clockwise to release it.
- Screw the blanking plug (4,5 mm Allen key) into the chain tensioner.



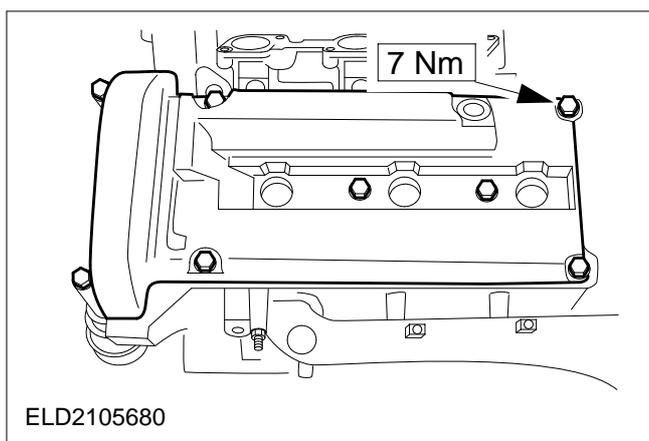
NOTE: Wait at least 15 minutes before turning the engine.

56. Carefully turn the engine through two rotations and check the valve timings.

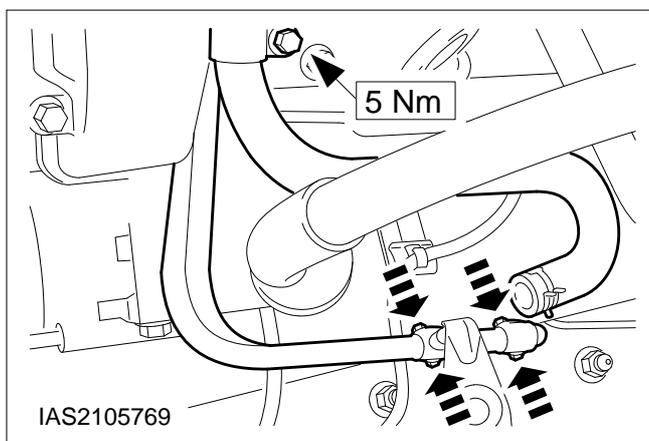
If necessary, follow steps 53. to 56. to correct the valve timings.



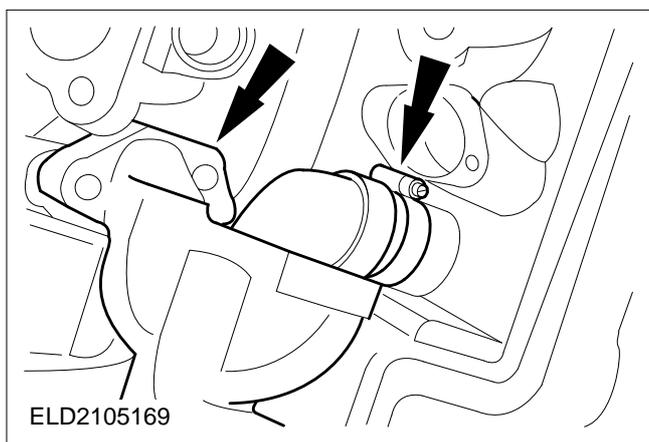
57. Fit the upper chain guides (left-hand side shown).



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

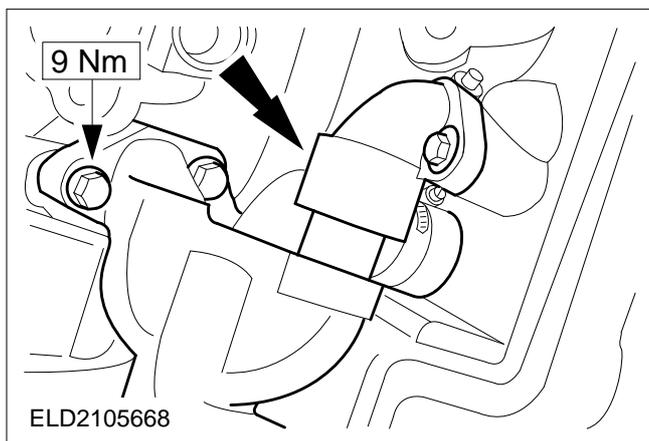


59. Attach the PCV bracket to the cylinder head cover and connect the fuel pipes.

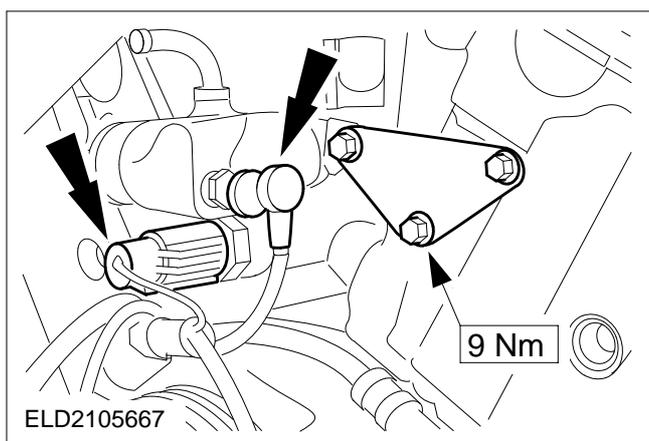


60. Fit the thermostat housing.

- 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.

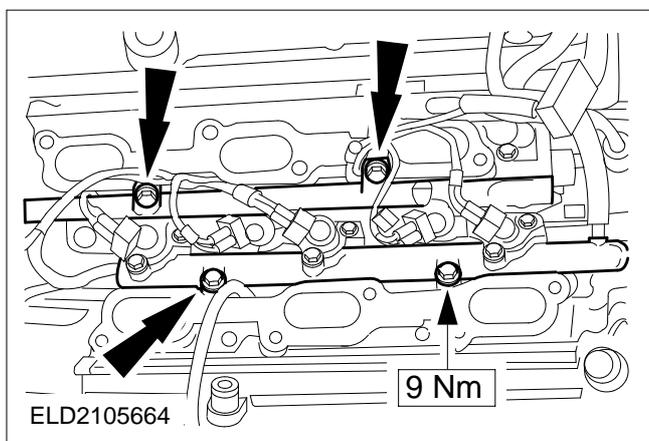


61. Fit the thermostat housing (continued).



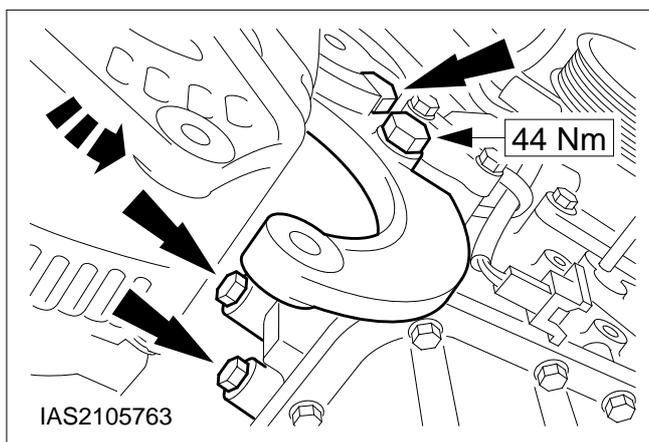
62. Connect the plugs and fit the thermostat housing bracket.

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

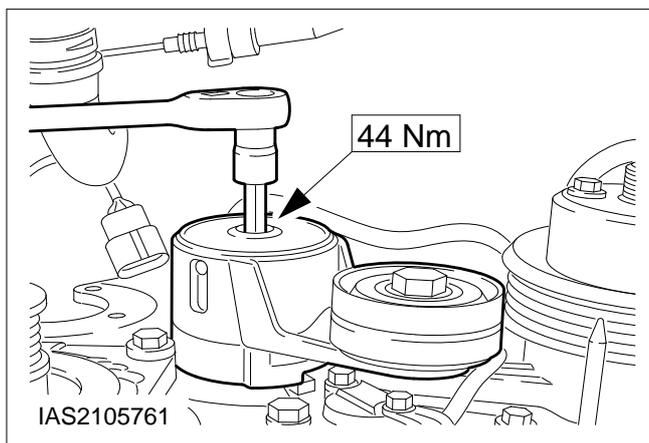


63. Fit the fuel rails.

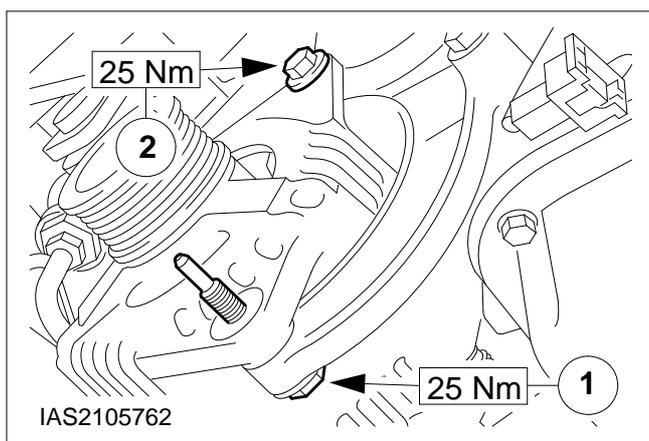
- Connect the fuel injection valve multiplugs.
- Raise the vehicle.



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

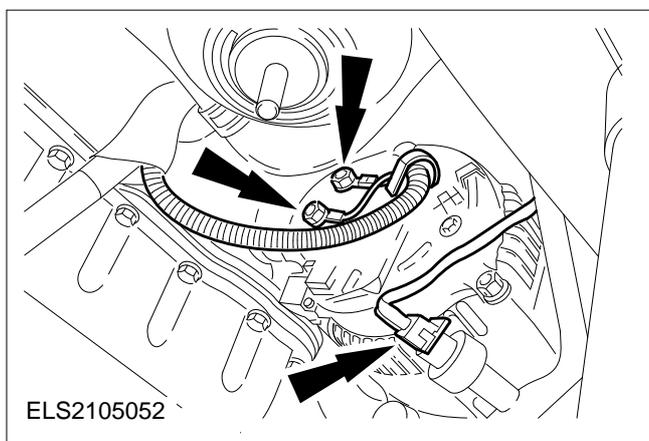


65. Fit the tensioning pulley for the alternator/power steering pump.



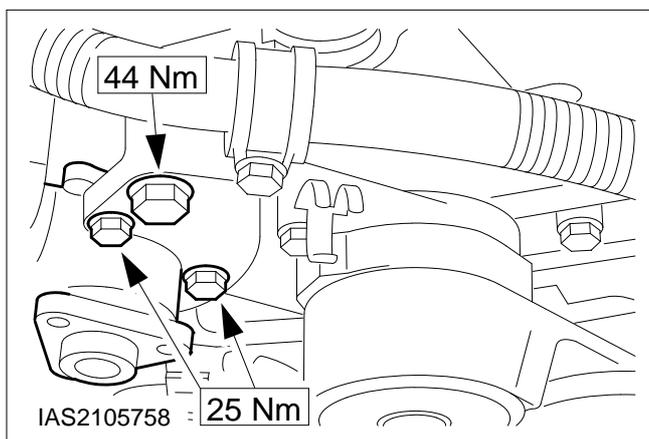
66. Fit the alternator.

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

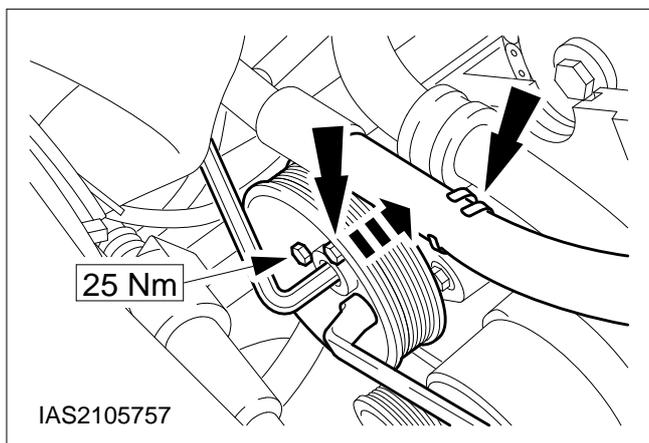


67. Connect the alternator and the PSP switch plug.

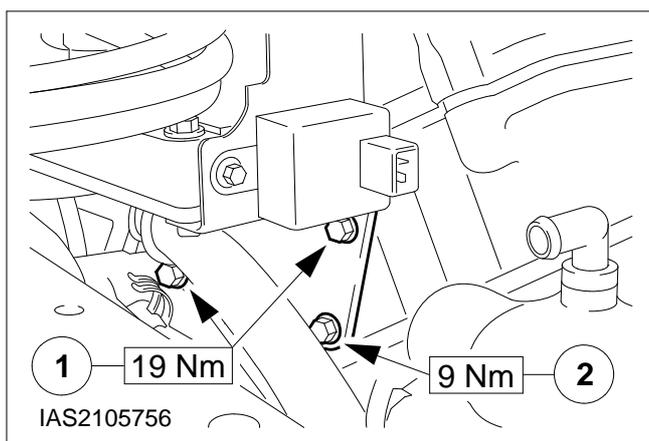
Lower the vehicle.



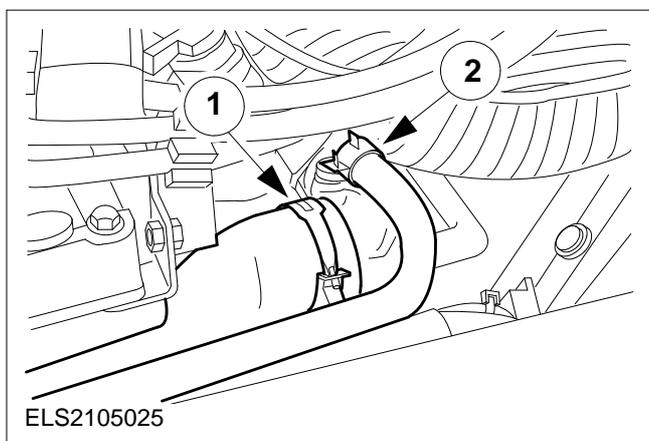
68. Insert the upper bolt of the bracket and fit the power steering pump (five bolts).



69. Fit the power steering pump pulley.

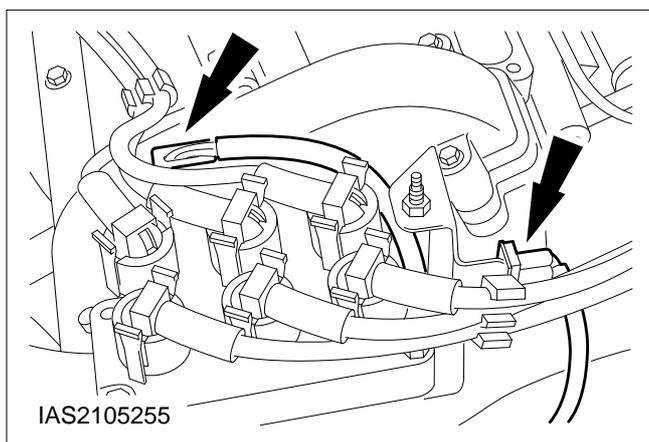


70. Fit the ignition coil.

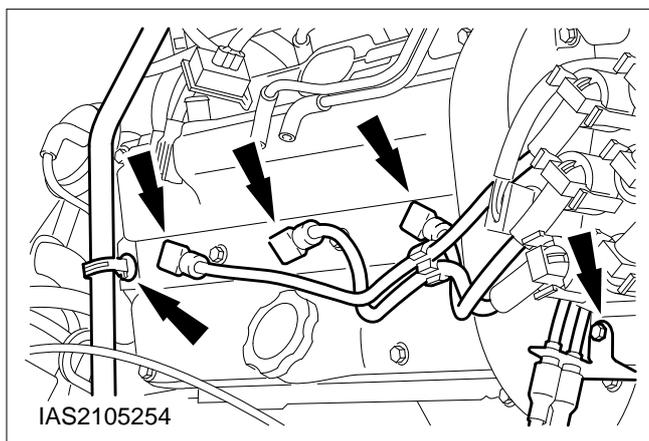


71. Attach the coolant hoses.

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

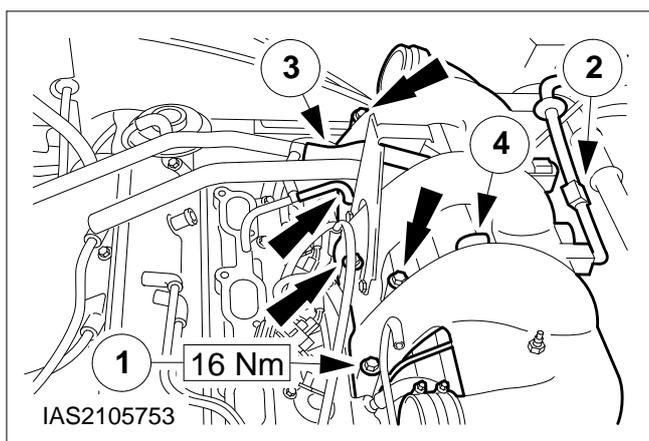


72. Connect the plugs.



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

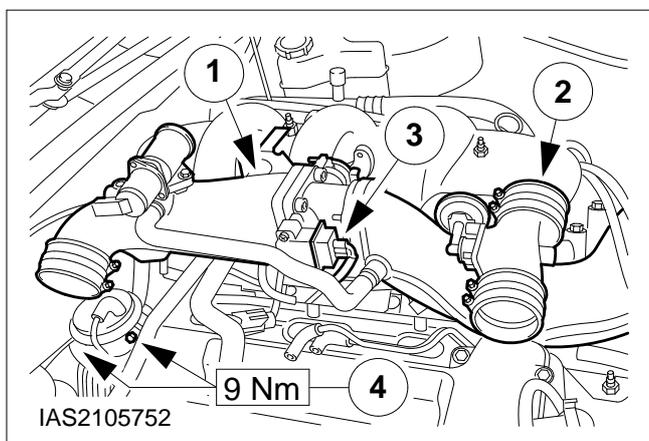
- Attach the bracket for the vacuum lines to the ignition coil.
- Push on the spark plug connectors (right-hand side shown).
- Connect the PCV hose and attach it to the cylinder head cover.



74. Fit the left-hand exhaust manifold.

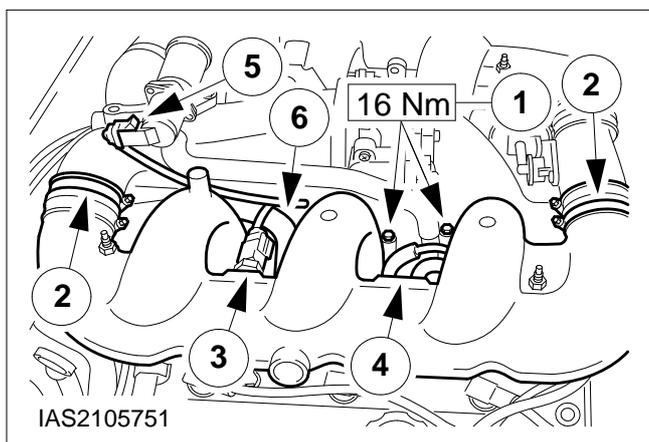
- 1 Fit the six bolts.
- 2 Fit the brake servo vacuum line.
- 3 Insert the PCV valve into the cylinder head cover.
- 4 Connect the vacuum hose.

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



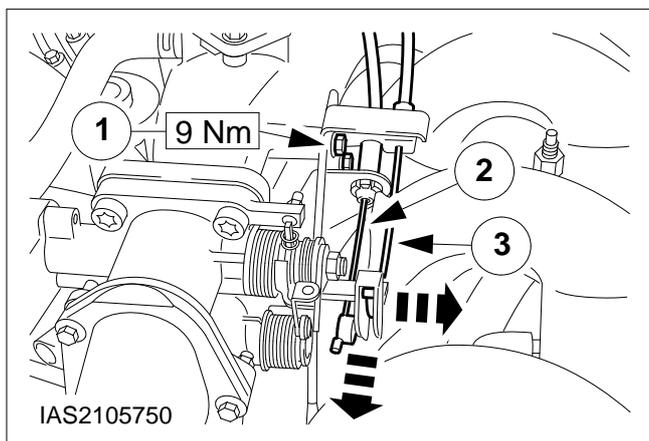
75. Fit the air intake plenum chamber.

- 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).



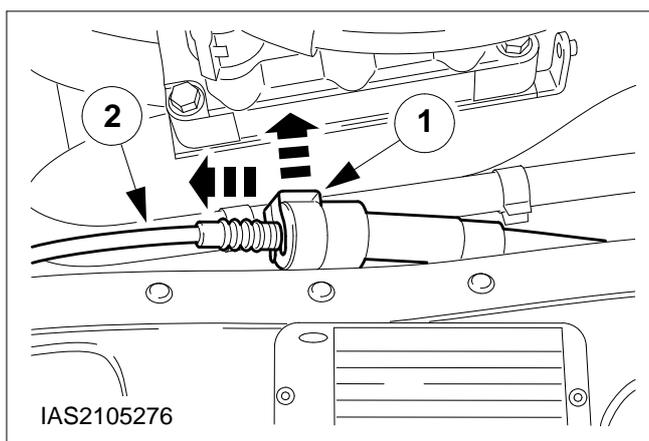
76. Attach the right-hand inlet manifold.

- 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.



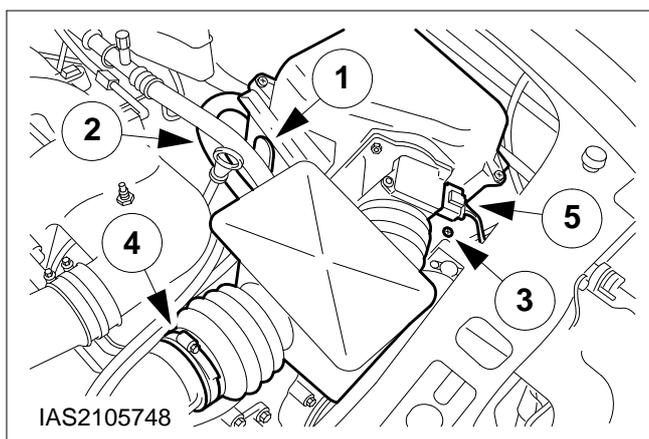
77. Attach the cables.

- 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.



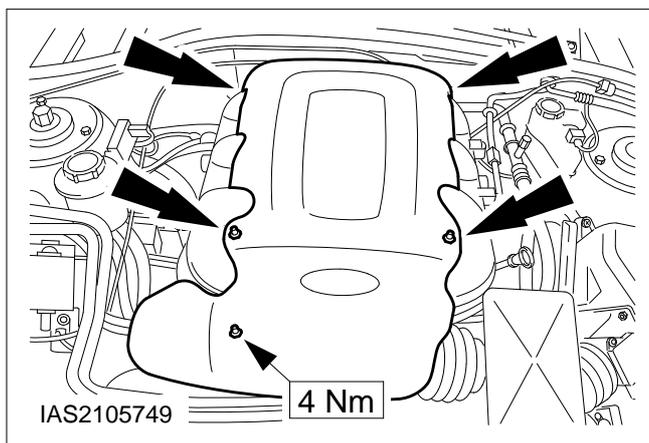
78. Adjust the throttle cable.

- 1 Pull off the clip from the throttle cable.
- 2 Pull the throttle cable adjuster 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.
- Check the routing of hoses and wiring for the intake system and correct them as necessary.

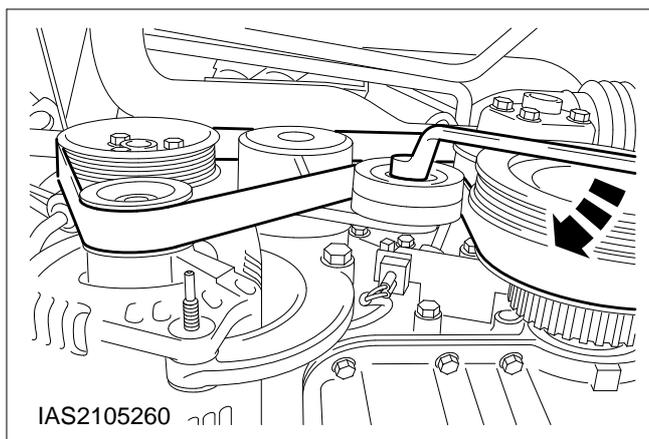


79. Fit the air cleaner.

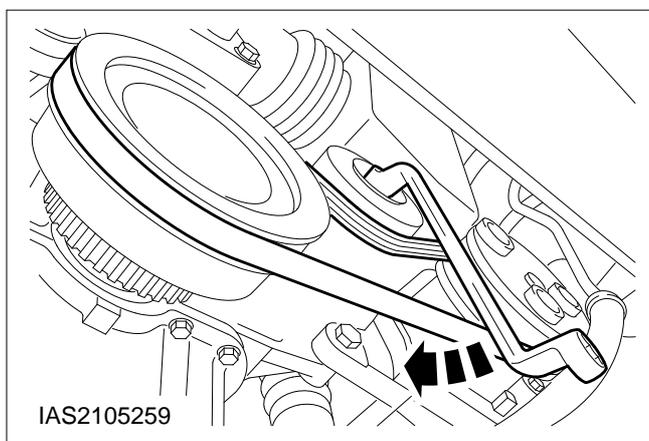
- Push the air cleaner into the grommets on the body and onto the intake pipe.
- 1 Fit the two rubber retainers.
 - 2 Attach the PCV hose.
 - 3 Insert the bolt for the intake pipe.
 - 4 Fit the intake hose.
 - 5 Fit the MAF sensor plug.

**80. Fit the intake system cover.**

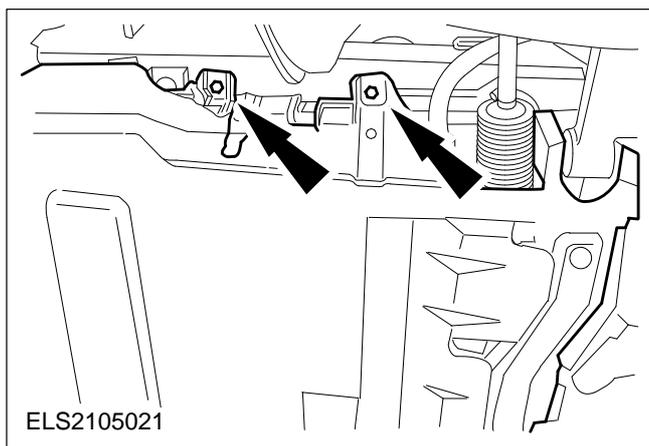
- Raise the vehicle.

**81. 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.

**82. Fit the air conditioning multi-groove belt.**

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



83. Standard finishing operations.

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