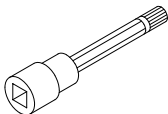
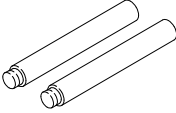
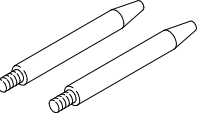
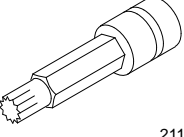
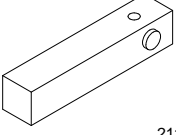
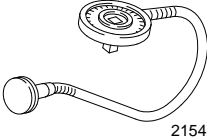
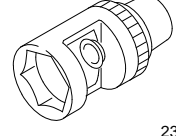


Cylinder Heads – Remove and Install (all) (21 164 0)

Special Tools

 21002	21-002 Splined head socket, cylinder head bolts
 21003	21-003 Cylinder head locating studs
 21128	21-128 Cylinder head guide studs
 21175	21-175 Wrench for M14 cylinder head bolts
 21183	21-183 Measuring fixture, cylinder liner protrusion

 21540	21-540 Bolt tightening angle gauge
 23043	23-043 Wrench for injectors

Materials

Copper seals for injectors: 1,5 mm thick and with an inside diameter of 17,5 mm.	Obtainable through: Bosch authorised dealerships
Lubricant	Hypoid oil SAE90
Coolant	ESD-M97B-49-A

Proprietary Tools

Dial indicator

Remove

1. Preparatory measures:

- Make a note of the radio keycode.
- Make a note of the preset radio stations.
- Detach the battery cover.

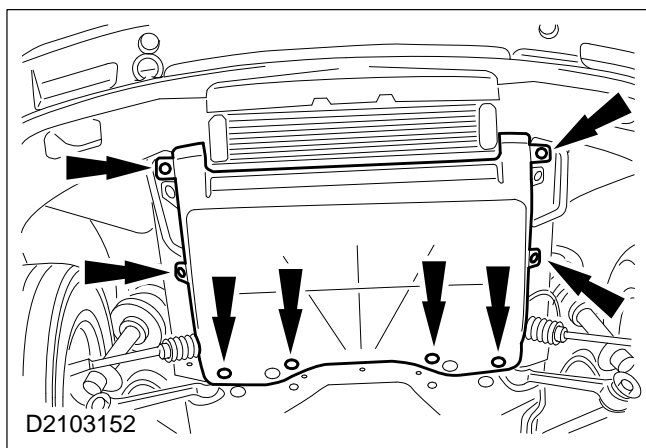


CAUTION: Disconnect the battery negative lead.



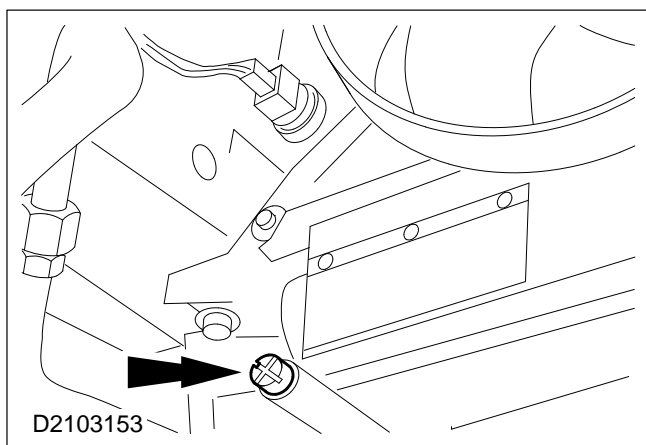
WARNING: Danger of scalding if the engine is warm.

Open the coolant expansion tank.



2. Raise the vehicle.

3. Remove the front engine undershield.

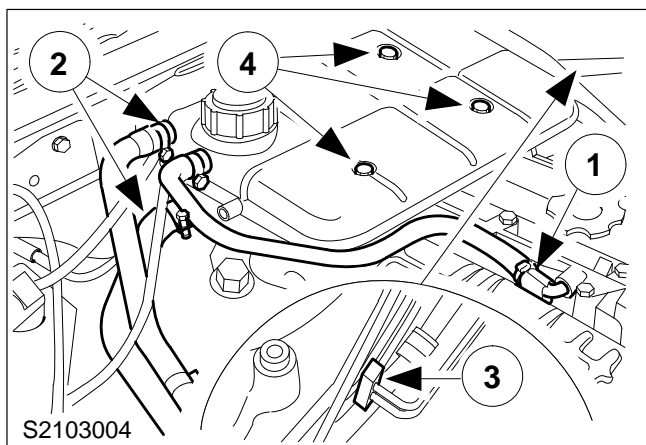


⚠ WARNING: Danger of scalding if the engine is warm.

4. Drain off the coolant.

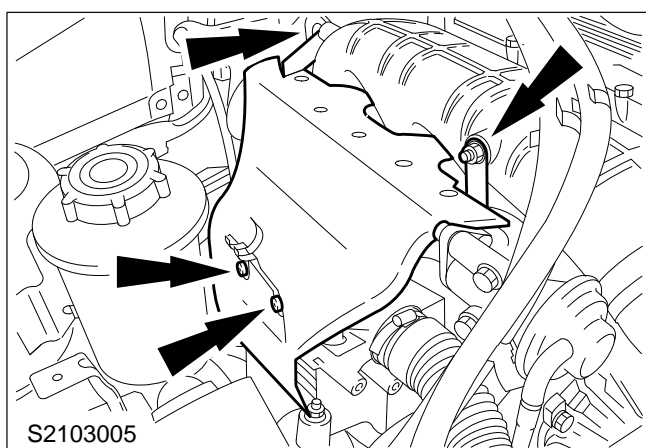
Screw the screw plug back in again once the coolant has been drained off.

5. Lower the vehicle.



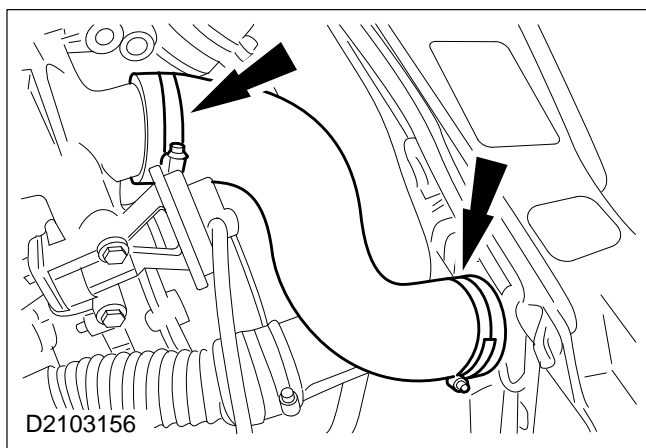
6. Remove the coolant expansion tank.

- 1 Detach the hose from the coolant collection pipe.
- 2 Detach the two hoses.
- 3 Disconnect the engine coolant level (ECL) sensor.
- 4 Remove the bolts.

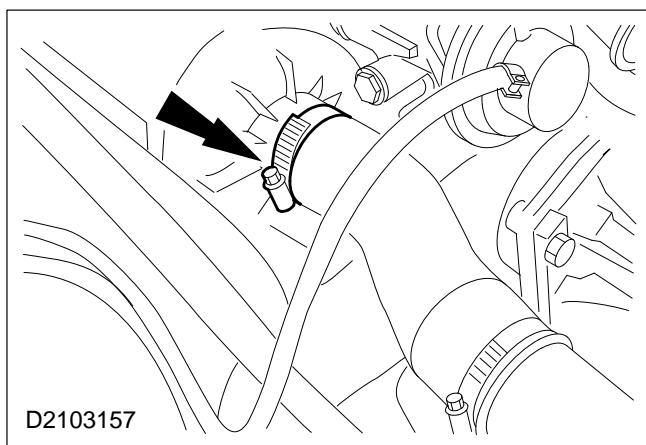


7. Remove the turbocharger heat shield.

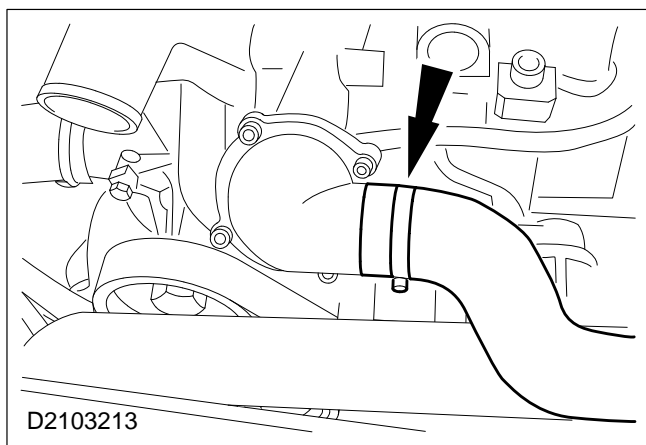
Unclip the hoses.



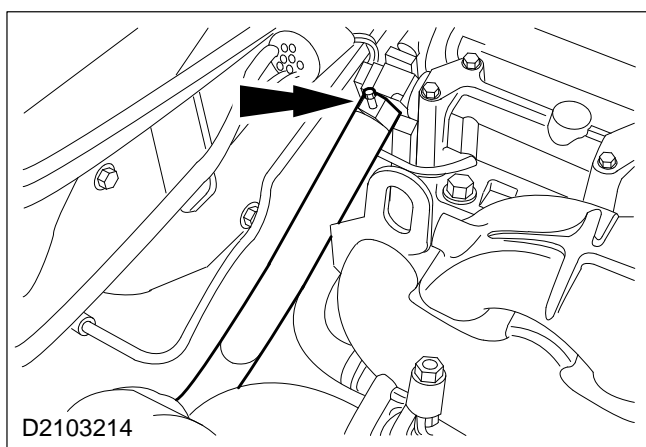
- 8. Remove the air hose between the inlet manifold and the intercooler.**



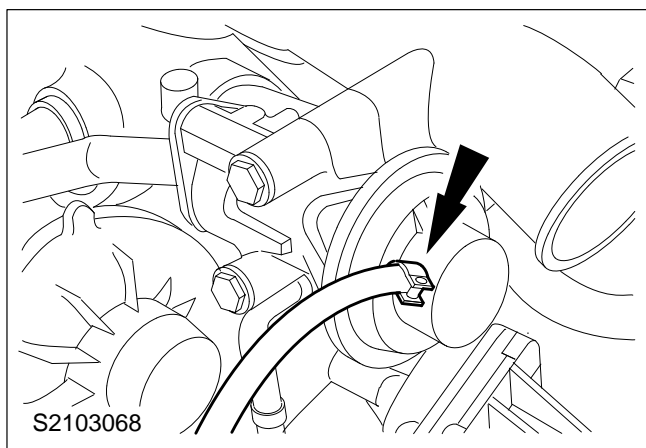
- 9. Detach the intake pipe from the turbocharger.**



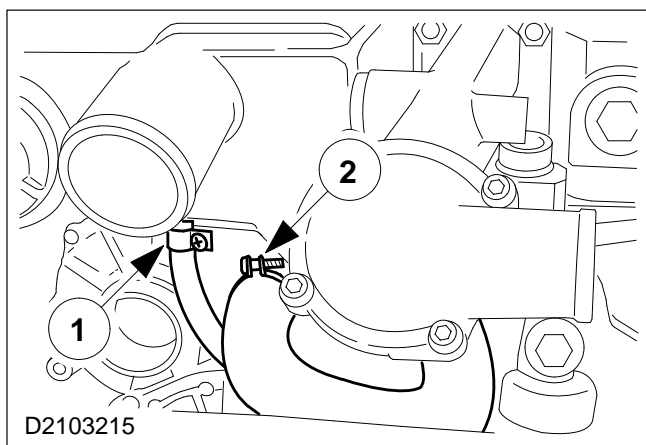
- 10. Detach the coolant hose.**



- 11. Detach the heater hose from the coolant collecting pipe.**

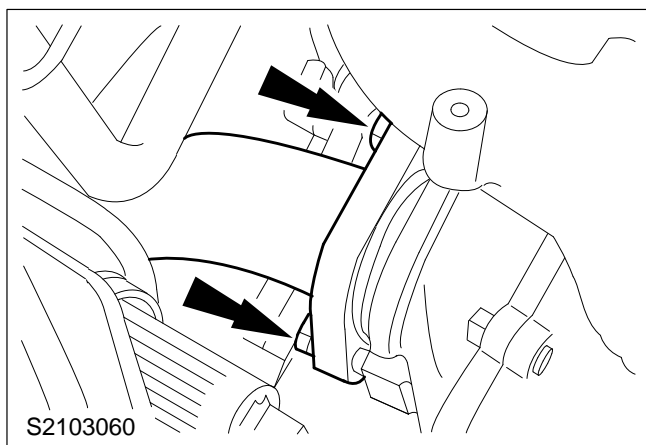


12. Pull off the vacuum hose from the exhaust gas recirculation valve (EGR valve).

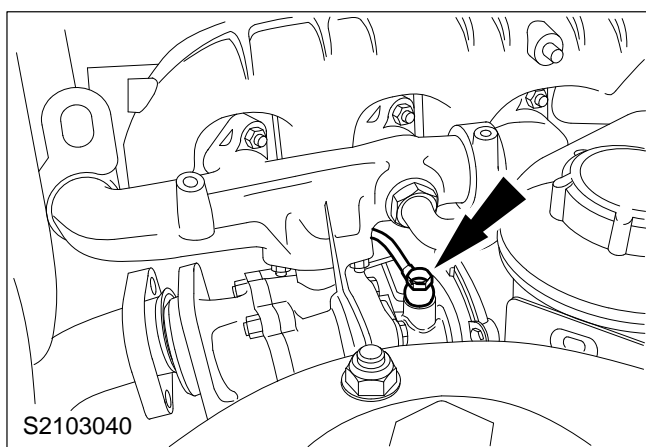


13. Disconnect the hoses.

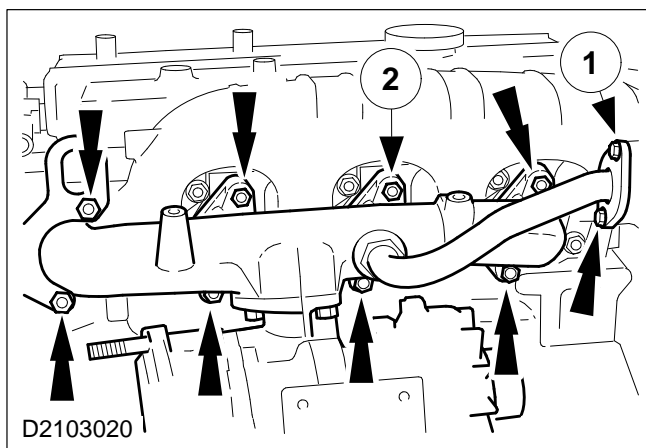
- 1 Hose from smoke limiter (SPL) to inlet manifold.
- 2 Coolant hose to coolant pump.



14. Detach the front exhaust pipe from the turbocharger.

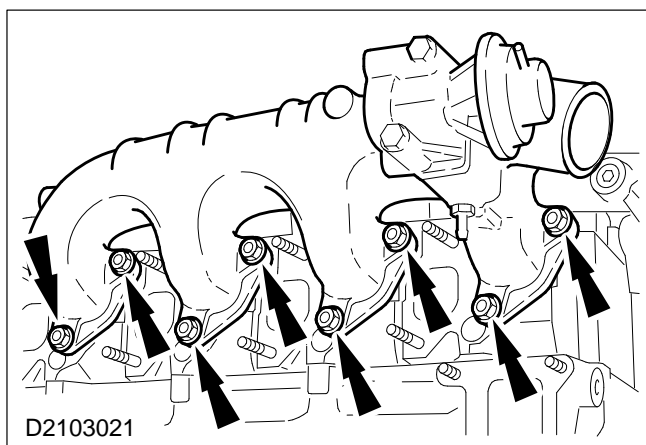


15. Detach the turbocharger oil feed pipe.



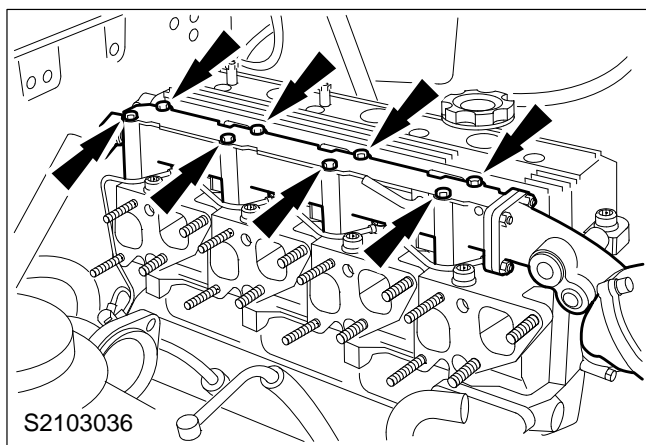
16. Remove the exhaust manifold and turbocharger.

- 1 Detach the pipe flange from the EGR valve.
- 2 Detach the exhaust manifold and remove it.

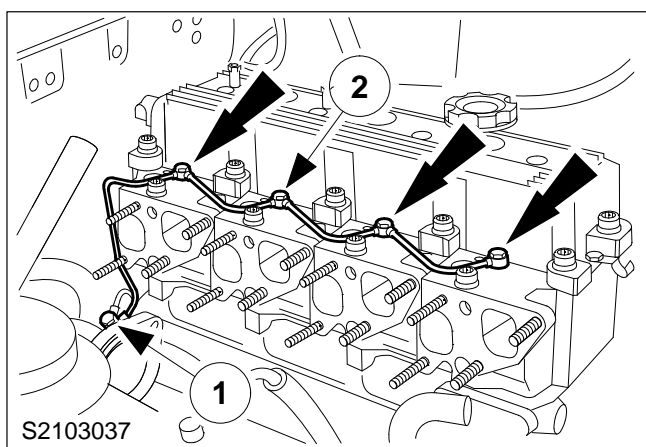


17. Remove the intake manifold and EGR valve.

Remove the intake/exhaust gasket.

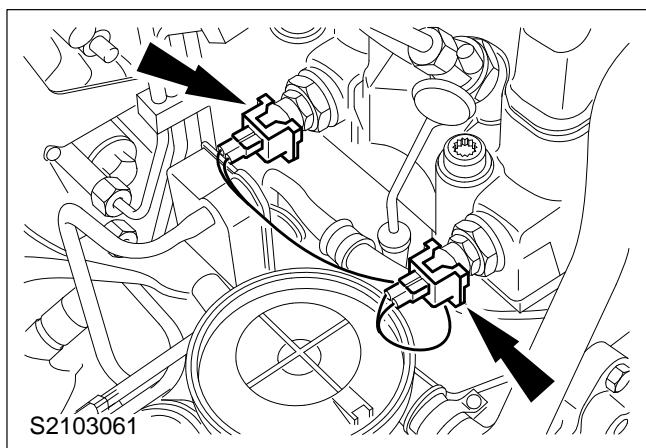


18. Remove the coolant collection pipe with the thermostat housing.

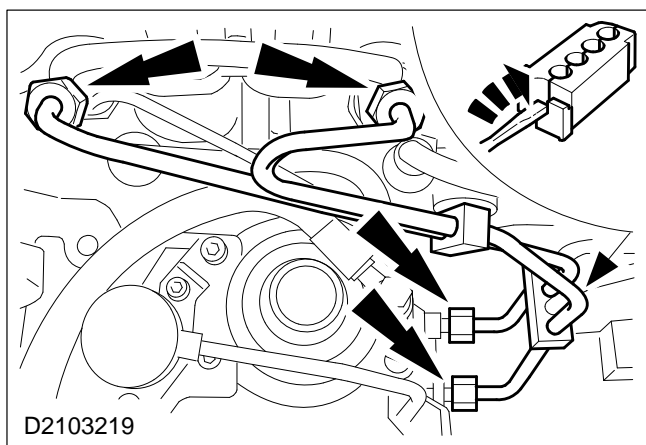


19. Remove the rocker arm oil feed pipe.

- 1 Oil supply to oil feed pipe.
- 2 Rocker arm oil feed pipe.

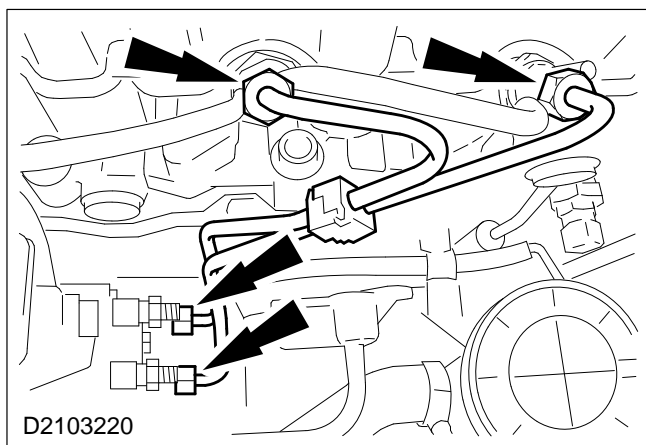


20. Pull off the engine temperature sensor (ECT sensor) connector and the coolant temperature gauge sender connector.

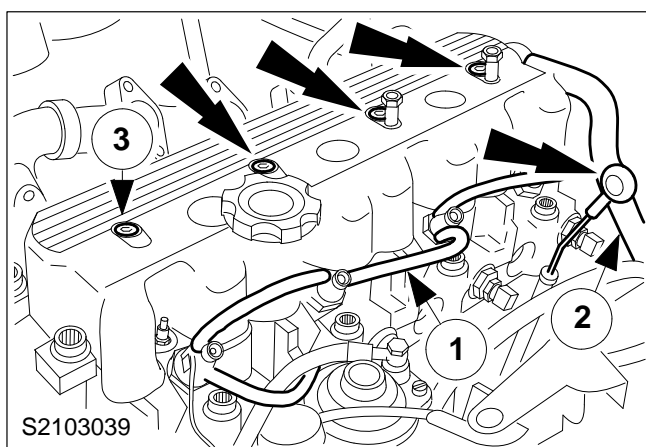


21. Remove the left-hand injector pipes.

Release and remove the retaining clip.



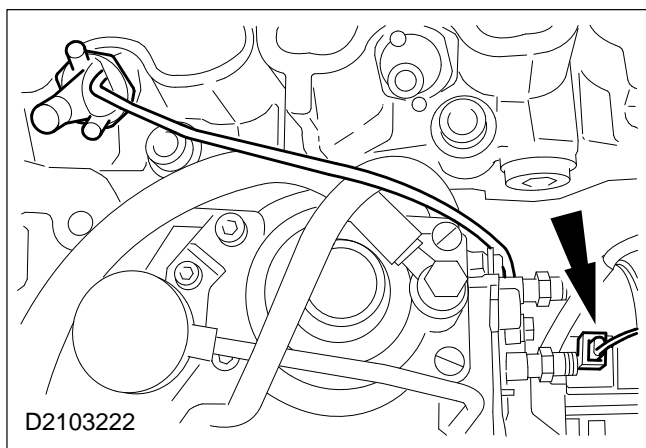
22. Remove the right-hand injector pipes.



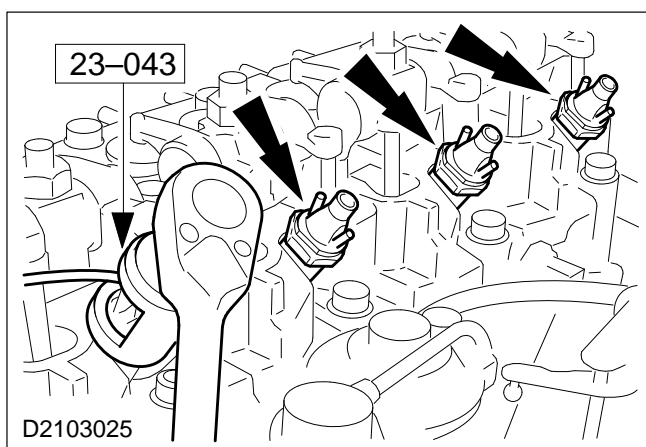
23. Remove the cylinder head cover and hoses.

- Withdraw the oil dipstick.

- 1 Disconnect the leak-off hoses.
- 2 Detach the crankcase ventilation hose.
- 3 Remove the bolts.

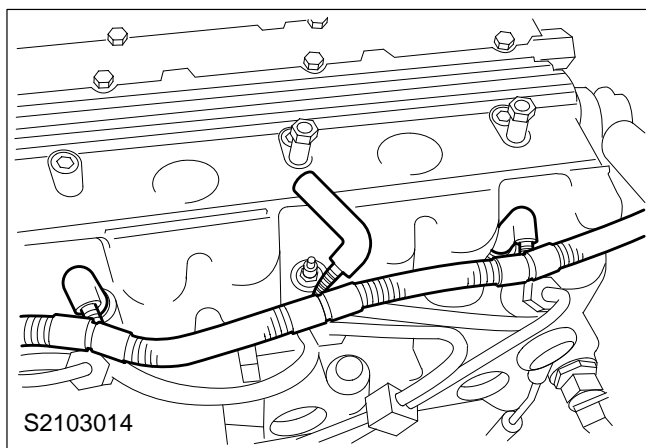


24. Pull off the connector for the injector needle lift sensor (NLS).

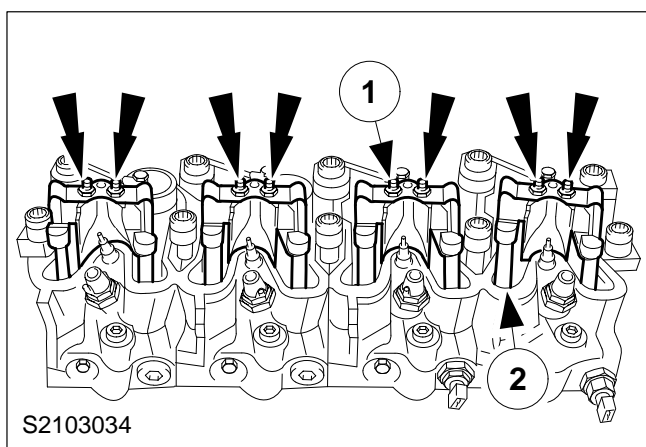


25. Remove the injectors using the special tool.

Cut the old oil seals and remove them.



26. Pull off the glow plug connectors.

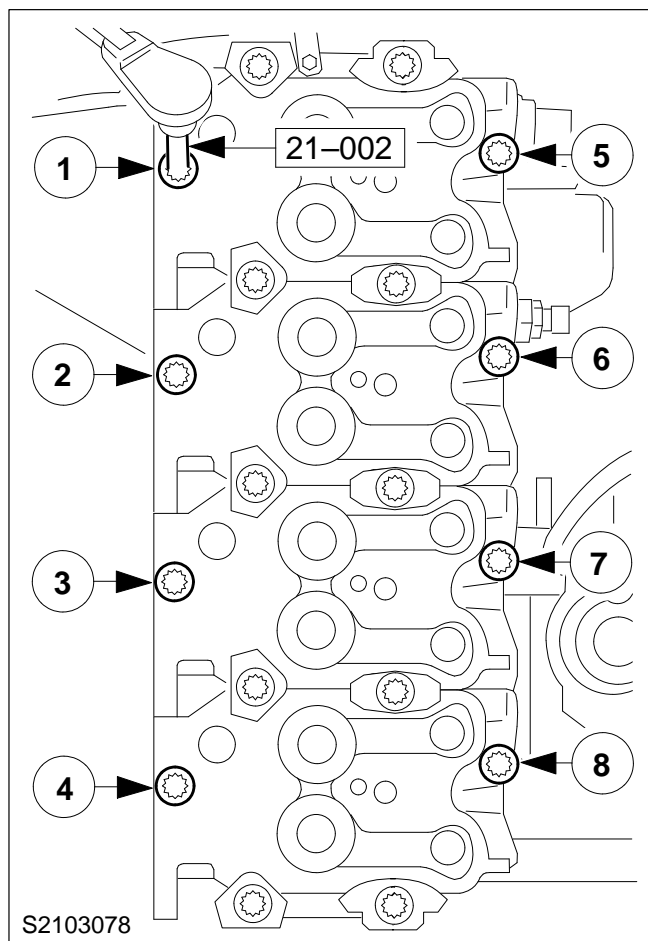


NOTE: Keep the rocker shafts and push rods in order.

27. Remove the rocker shafts.

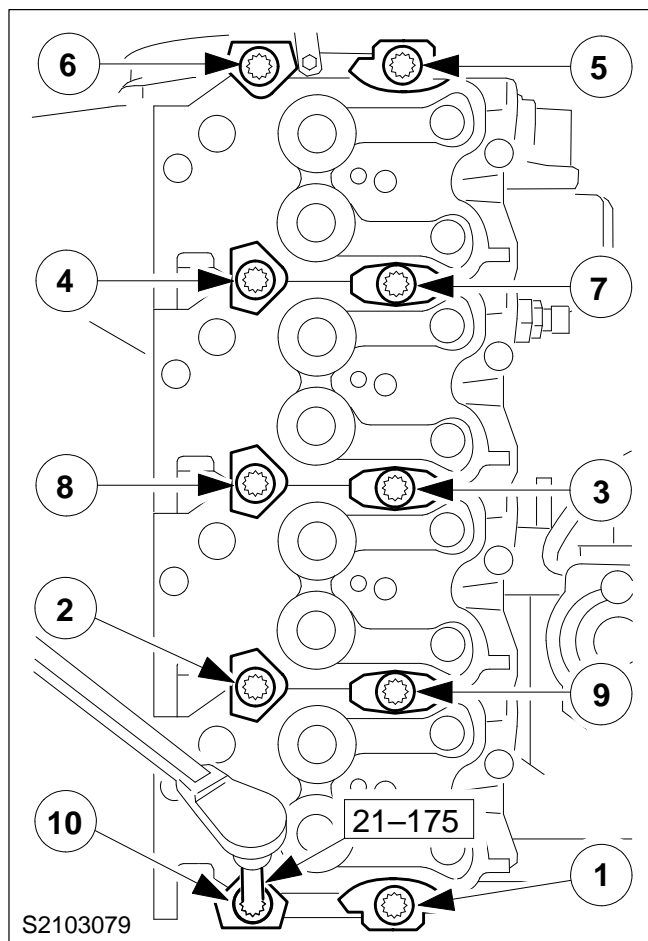
1 Rocker shafts.

2 Push rods.



NOTE: Bolt-slackening sequence.

28. Remove the outer M12 cylinder head bolts.

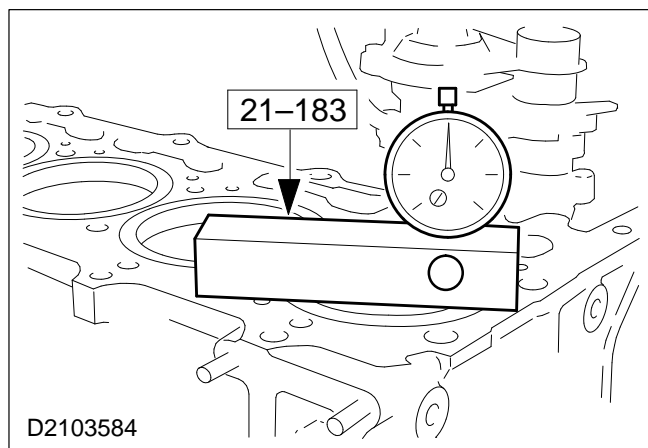


NOTE: Bolt-slackening sequence.

29. Detach the inner M14 cylinder head bolts and thrust elements.

NOTE: Keep the cylinder heads and end spacers in order.

- Remove the end spacers on the side.
- Working from the flywheel end, remove the cylinder heads one after the other.
- Remove the cylinder head gaskets.



Install

30. Measure the piston protrusion.

- Measure the piston protrusion of each individual cylinder at TDC using the measuring fixture and dial gauge.
- Measure the difference between the piston crown and the cylinder block.

NOTE: One measurement should be made for each cylinder on the axis of the piston pin at a distance of 5 mm from the edge of the piston.

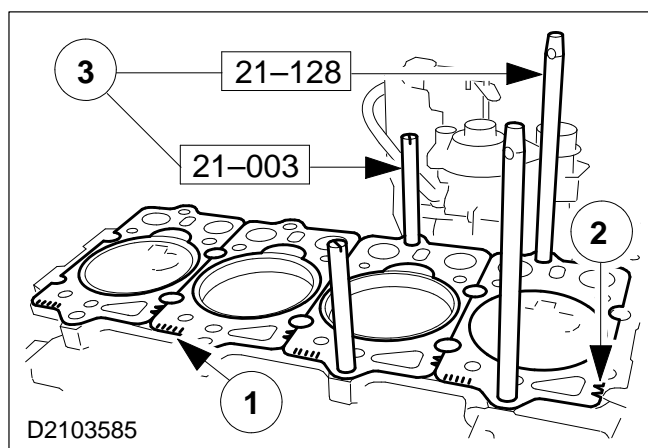
- The largest measurement determines the choice of all four cylinder head gaskets:

Piston protrusion → Cylinder head gasket thickness → Number of notch marks

0,53 – 0,62 mm → 1,42 → 1

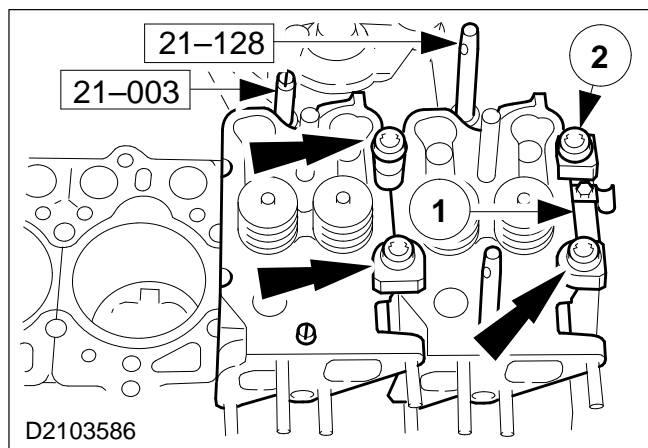
0,63 – 0,72 mm → 1,52 → 2

0,73 – 0,82 mm → 1,62 → 0



31. Fit the cylinder head gaskets.

- 1 Fit the new cylinder head gaskets with the inscription facing upwards.
- 2 Gasket thickness marking.
- 3 Screw in the guide studs.



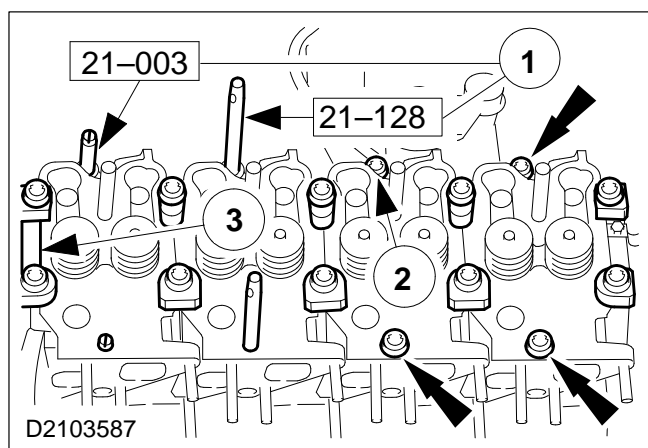
32. Fit the cylinder heads.

NOTE: Make sure that the thrust elements are positioned correctly. With used cylinder heads take the imprint as a guide.

- Fit the cylinder heads with the aid of the locating studs.
- Coat the cylinder head bolt heads and threads with hypoid oil SAE90.

1 Fit the end spacer.

2 Put the thrust elements in place and screw in the inner (M14) cylinder head bolts.



33. Fit the cylinder heads (cont.).

NOTE: Make sure that the pressure pads are positioned correctly. With used cylinder heads take the imprint as a guide.

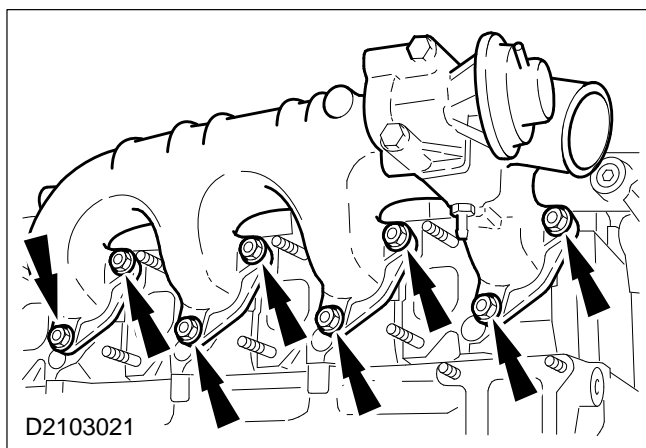
Coat the cylinder head bolt heads and threads with hypoid oil SAE90.

1 Transfer the locating studs and fit the cylinder heads.

2 Screw in the outer M12 cylinder head bolts.

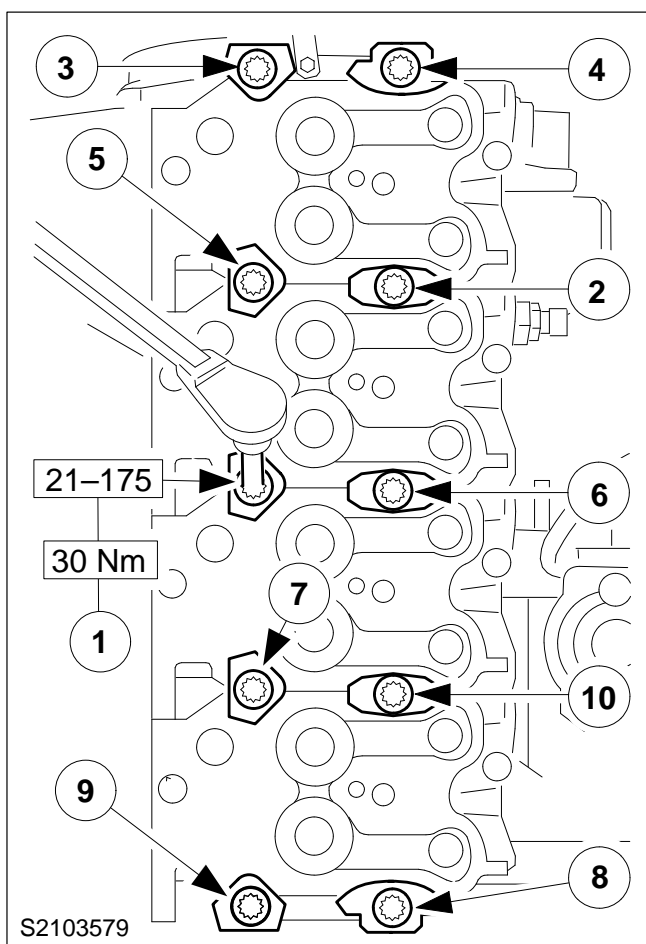
3 Fit the end spacer.

- Lay the thrust elements in place and screw in the inner M14 cylinder head bolts.
- Unscrew and remove the guide studs and screw in the outer M12 cylinder head bolts.



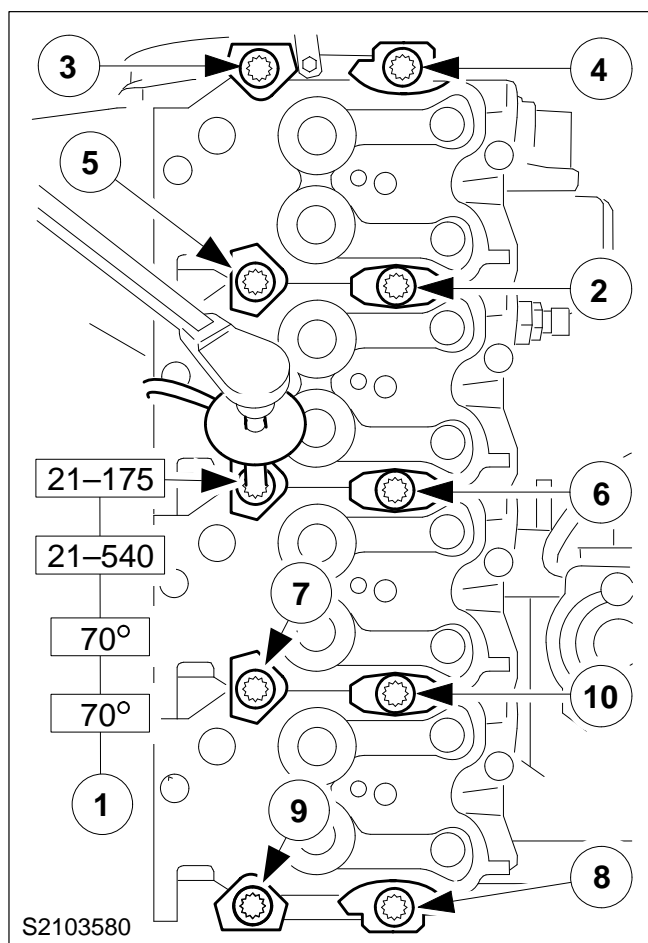
NOTE: Do up the retaining nuts lightly to align the cylinder heads.

34. Fit the intake manifold and EGR valve using the old gasket.



NOTE: Bolt-tightening sequence.

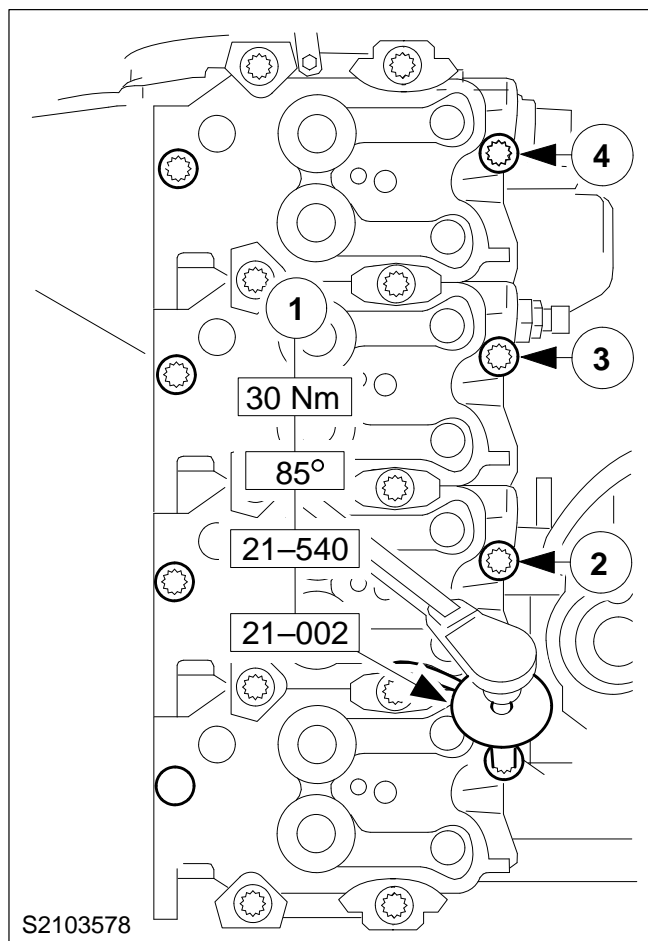
35. Pretighten the inner (M14) cylinder head bolts.



NOTE: Bolt-tightening sequence.

NOTE: The cylinder head bolts should be retorqued after the engine has reached normal operating temperature.

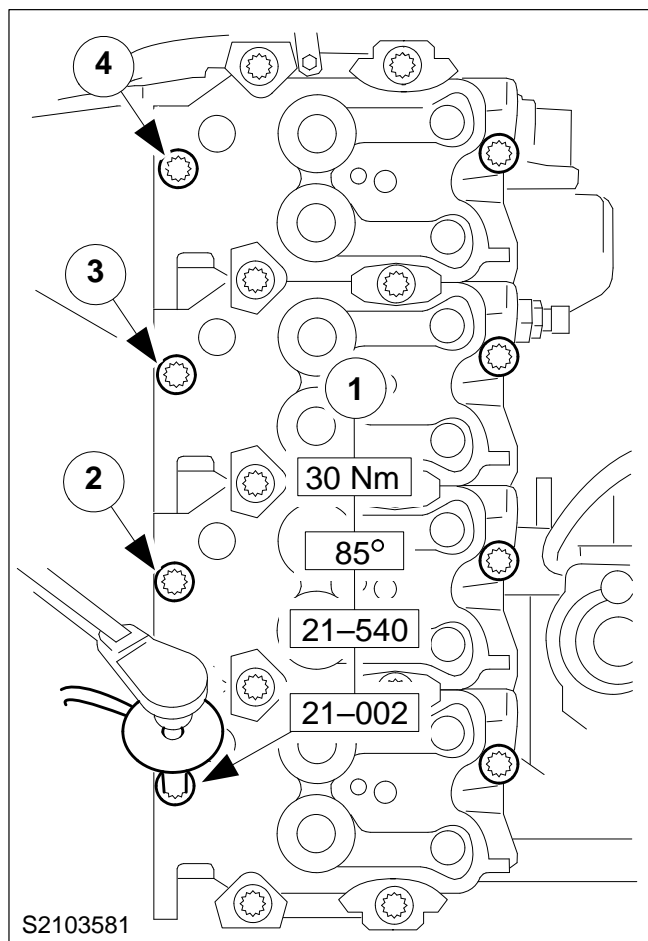
36. Tighten the inner (M14) cylinder head bolts in two stages.



NOTE: Bolt tightening sequence.

NOTE: The cylinder head bolts should be retorqued after the engine has reached normal operating temperature.

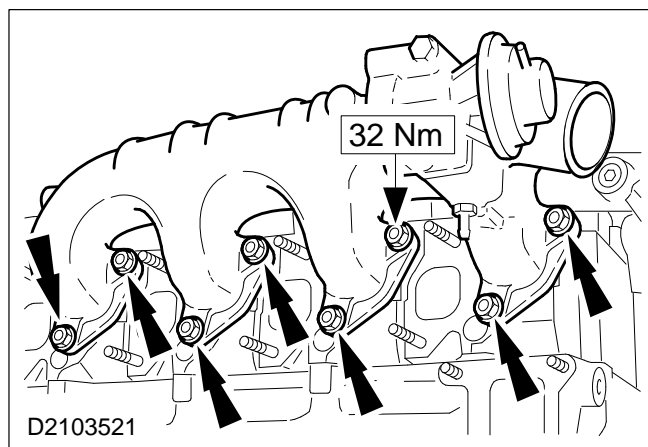
37. Tighten the outer M12 cylinder head bolts on the injector side in two stages.



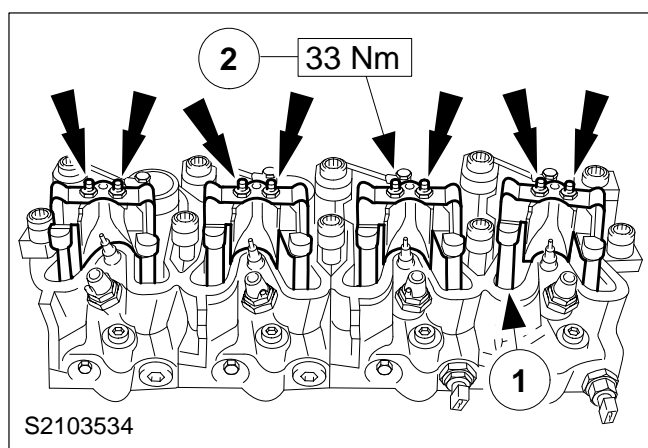
NOTE: Bolt-tightening sequence.

NOTE: The cylinder head bolts should be retorqued after the engine has reached normal operating temperature.

38. Tighten the outer M12 cylinder head bolts on the exhaust side on two stages.



39. Remove the intake manifold and old gasket, fit a new intake/exhaust gasket, fit the intake manifold and tighten the nuts.



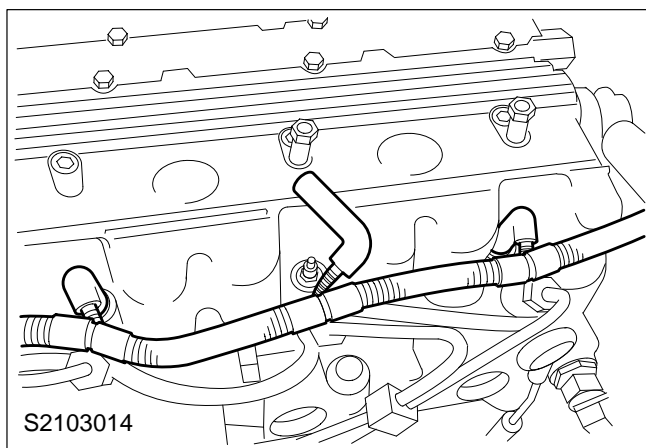
CAUTION: Do not turn the engine for 15 minutes.

40. Install the rocker shafts.

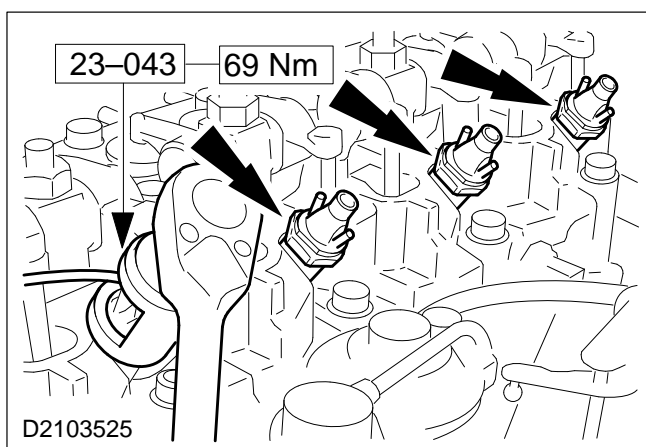
NOTE: Rotate the crankshaft to 20° before TDC.

NOTE: Keep to the installation sequence.

- 1 Insert the push rods.
- 2 Coat the nuts with hypoid oil SAE 90 and tighten them.



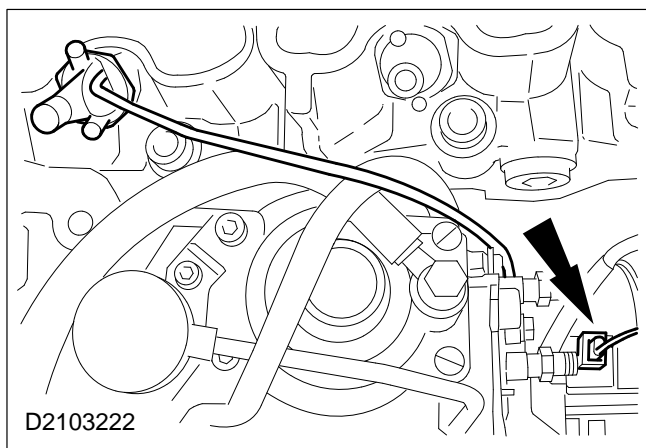
41. Push on the glow plug connectors.



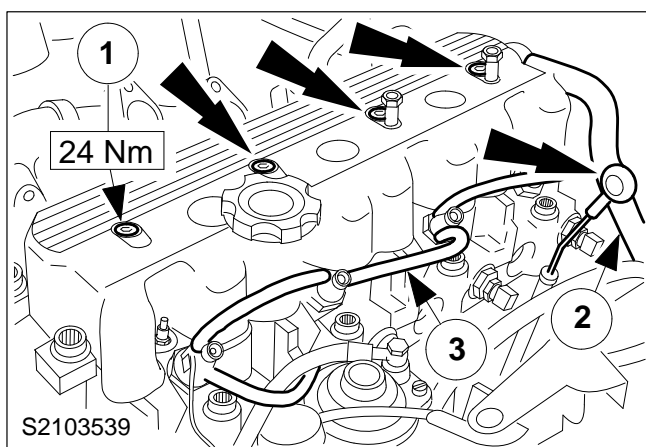
NOTE: Fit the injector with the NLS in the first cylinder.

42. Fit the injectors.

- Fit new copper oil seals (1,5 mm thick and with an internal diameter of 17,5 mm) to the injectors.
- Apply sealer (ESAM-1C-1014-A) to the fuel injector threads.
- Fit the injectors with new oil seals and tighten them.

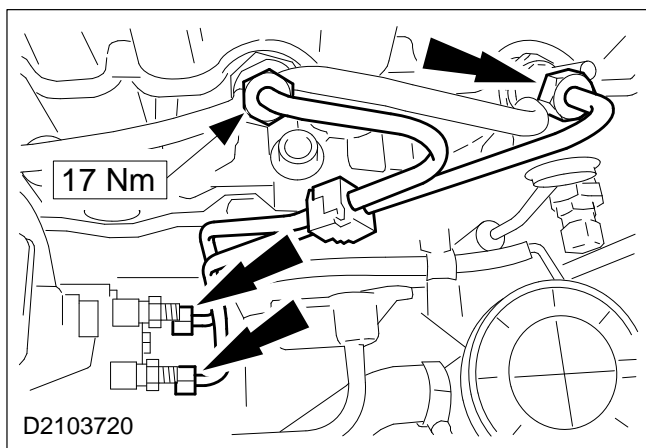


43. Join the NLS injector connector and push it into the bracket.

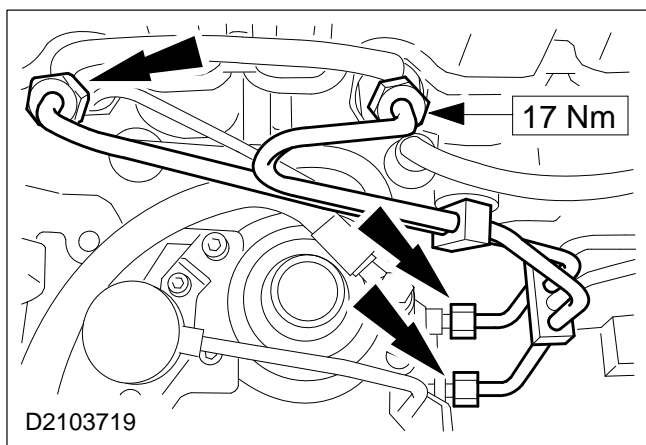


44. Install the cylinder head cover and the hoses.

- 1 Install the cylinder head cover using a new gasket.
 - 2 Fit the crankcase ventilation hose on the cylinder head cover.
 - 3 Connect the leak-off hoses.
- Insert the oil dipstick.

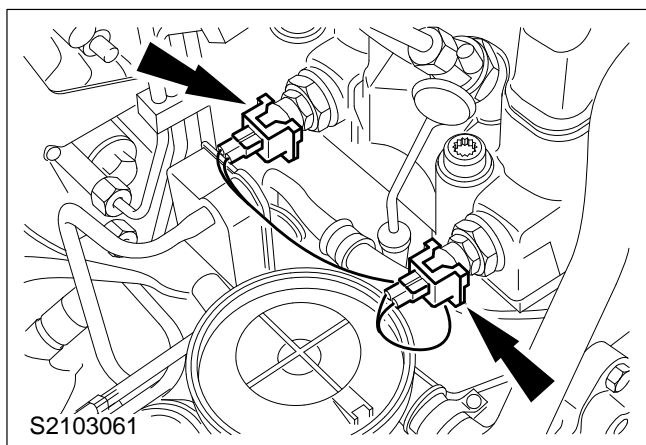


45. Fit the right-hand injector pipes.

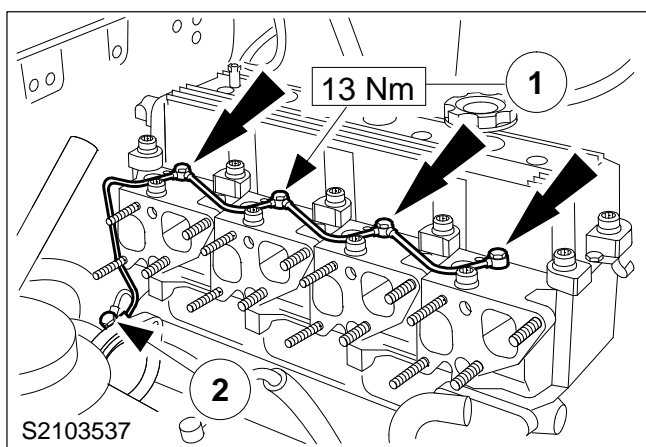


46. Fit the left-hand injector pipes.

Fit the retaining clip.



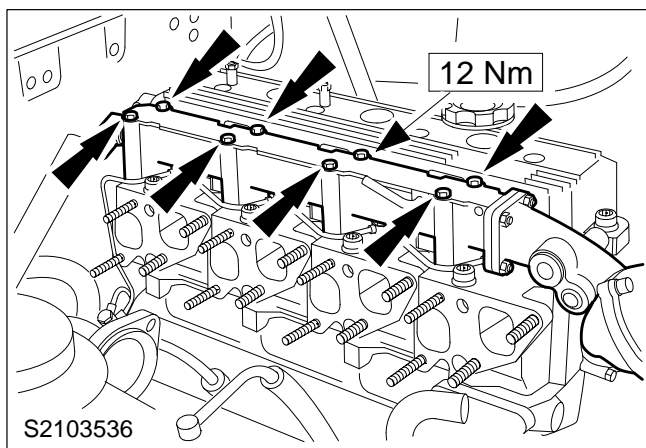
47. Connect the multiplugs of the ECT sensor and the temperature gauge sender unit.



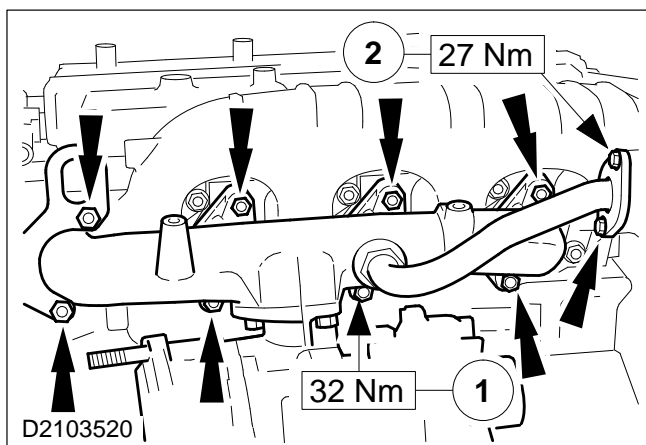
48. Install the rocker shaft oil feed pipe with new oil seals.

1 Rocker shaft oil feed pipe.

2 Oil supply oil feed pipe.

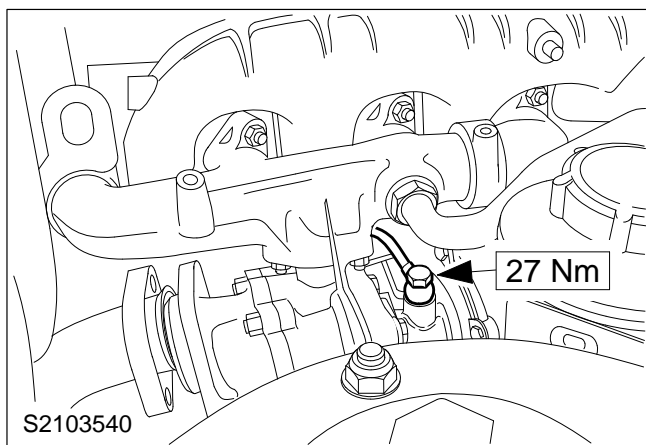


49. Fit the coolant collection pipe and thermostat housing using new gaskets.

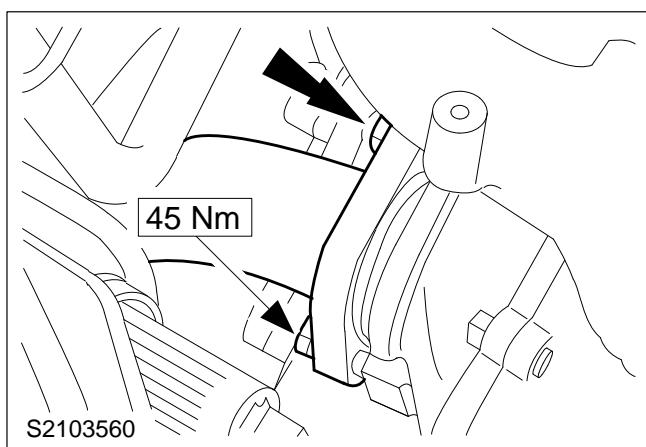


50. Install the exhaust manifold with turbocharger.

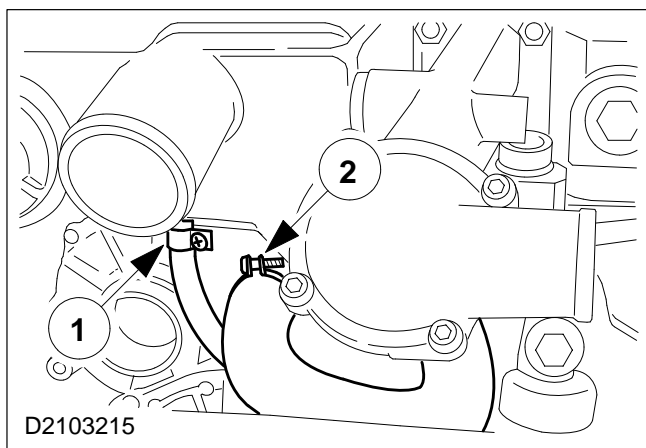
- 1 Exhaust manifold nuts.
- 2 Attach the pipe flange to the EGR valve.



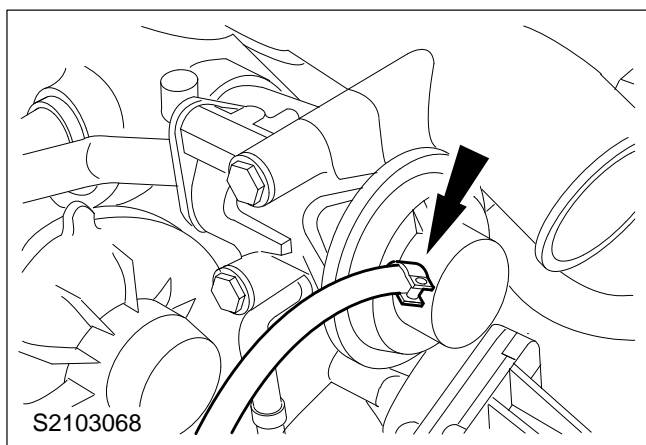
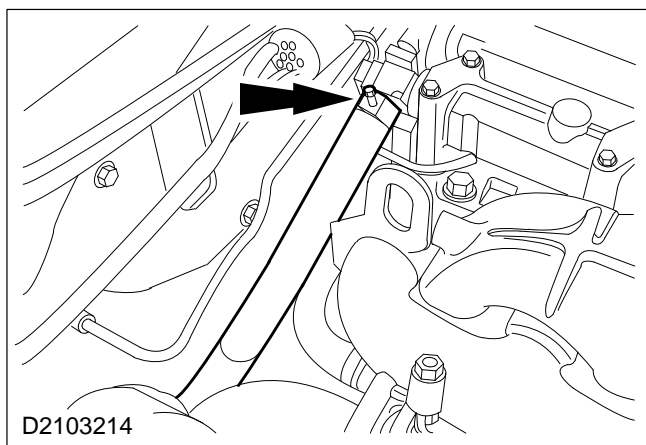
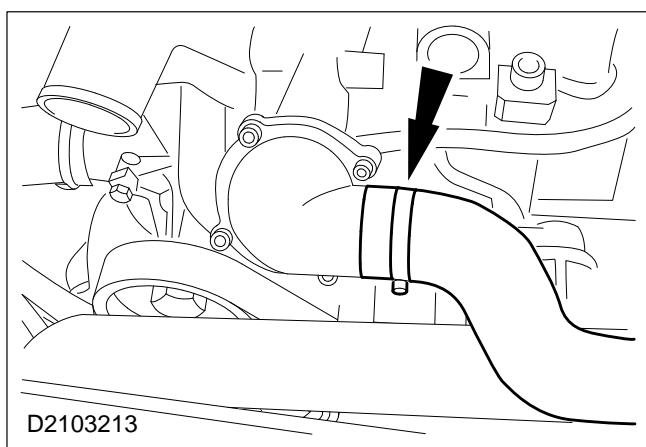
51. Install the turbocharger oil feed pipe using new seals.

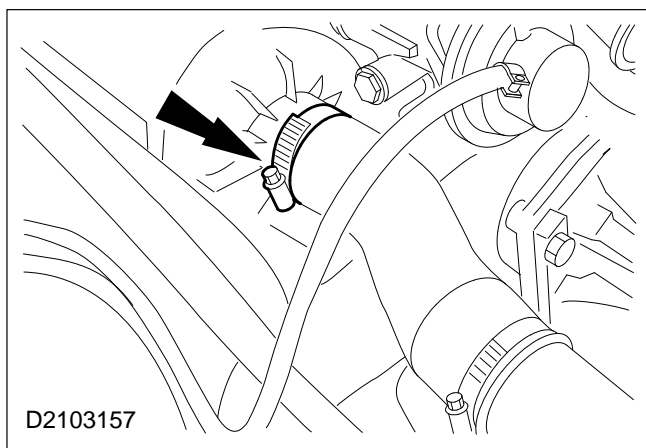


52. Attach the front exhaust pipe to the turbocharger.

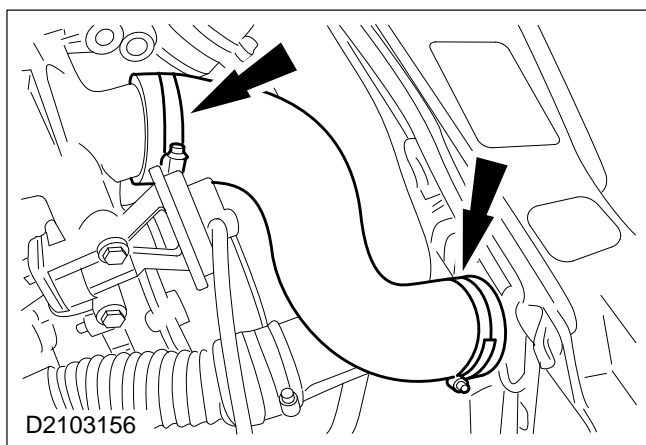
**53. Connect the hoses.**

- 1 SPL hose to the intake manifold.
- 2 Coolant hose to coolant pipe.

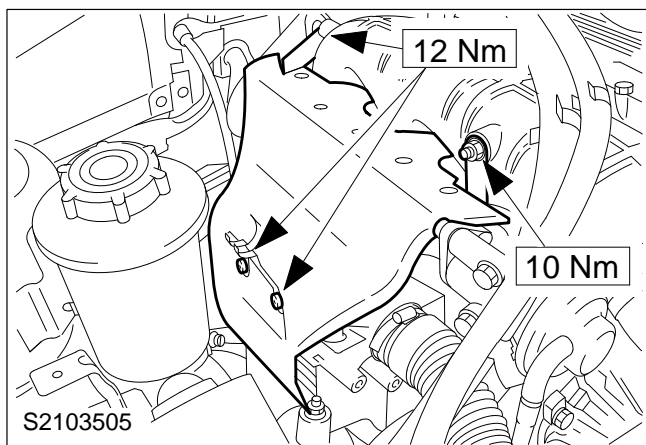
**54. Fit the vacuum hose.****55. Connect the heater hose to the coolant collector pipe.****56. Fit the coolant hose.**



57. Connect the intake pipe to the turbocharger.

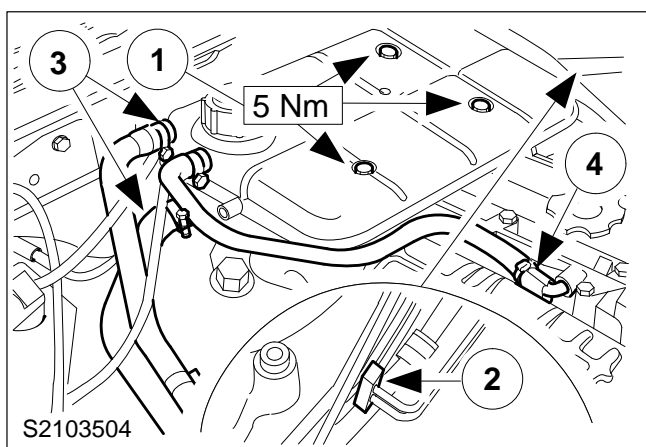


58. Fit the air hose between the inlet manifold and the intercooler.



59. Attach the turbocharger heat shield.

Clip the hoses in place.



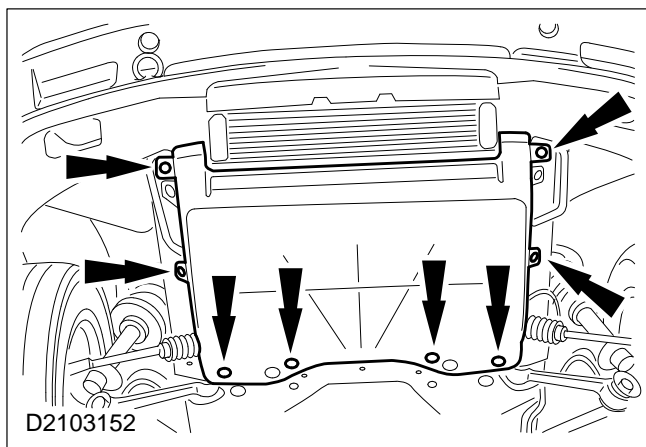
60. Fit the coolant expansion tank.

- 1 Screw in the bolts.
- 2 Connect the plug for the ECL sensor.
- 3 Connect the hoses.
- 4 Connect the coolant hose to the coolant collecting pipe.

NOTE: When the engine has reached normal operating temperature retorque the cylinder head bolts as described in Operation Number 21 161 1.

61. Finishing operations.

- Top up the coolant.
- Connect the battery negative lead.
- Fit the battery cover.
- Check the routing of the vacuum hoses and the wiring and secure them using cable ties as required.
- Remove the air from the cooling system.
- Check the fluid levels and rectify as necessary.
- Check the engine and cooling system for leaks (visual check).
- Enter the radio keycode.
- Reprogram the preset radio stations.
- Reset the clock.



62. Raise the vehicle.

63. Fit the front engine undershield.

64. Lower the vehicle.

65. Carry out a road test to enable the PCM to gather data.