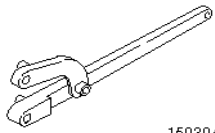


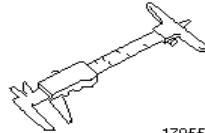
Cylinder Head - Remove And Install (21 163 0)

Special Tools



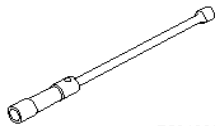
15030A

15-030 A Universal flange holding wrench



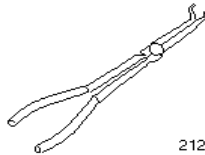
1705502

17-055-02 Depth gauge, combustion chamber height



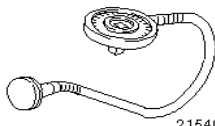
ES21202

21-202 Socket wrench, spark plugs



21226

21-226 Pliers, spark plug connectors



21540

21-540 Angle gauge

Workshop Equipment

Description	
Steel rule (500 mm)	

Materials

Description	Specification
Welding rod Ø 2,5 mm, length approx. 220 mm	
Spark plug lubricant 'Never-Seeze'	ESE-M1244-A
Engine oil	Refer to General Specifications
Coolant	ESD-M97B-49A
Cable ties	
Silicone grease	A960-M1C171-AA

Remove

1. Standard preparatory measures.



WARNING:

BEFORE OPENING THE COOLING SYSTEM ON A HOT ENGINE, COVER THE CAP OF THE COOLANT EXPANSION TANK WITH A THICK CLOTH TO PREVENT THE RISK OF SCALDING.

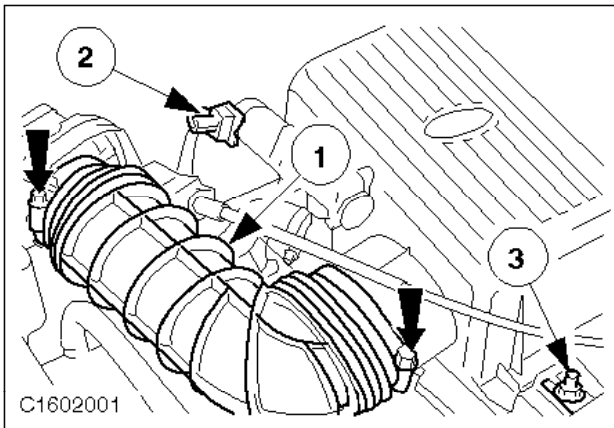
- Open the coolant expansion tank.
- Drain off the coolant at the radiator drain plug and refit and tighten the plug.
- Make a note of the radio keycode.
- Make a note of the pre-set radio stations.



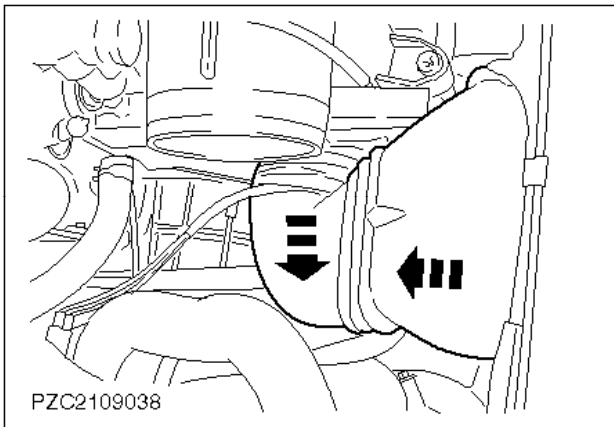
CAUTION:

Disconnect the battery negative lead.

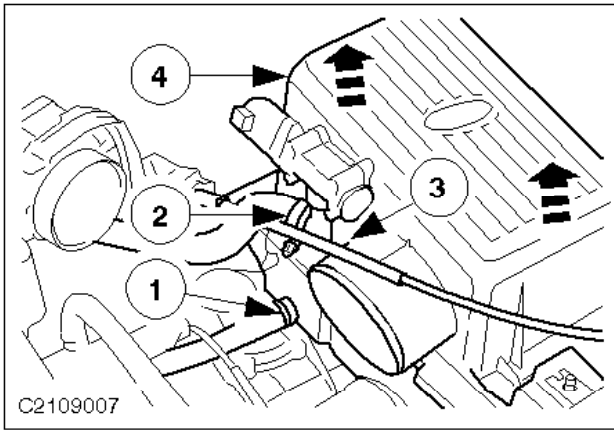
- Cut the cable ties where necessary and renew them on installation.
- Lay protective coverings on the fenders.



- ➡ 2. Remove the air cleaner.
- 1 Remove the intake hose.
 - 2 Disconnect the plug of the idle air control valve (IAC valve).
 - 3 Unscrew the nut.

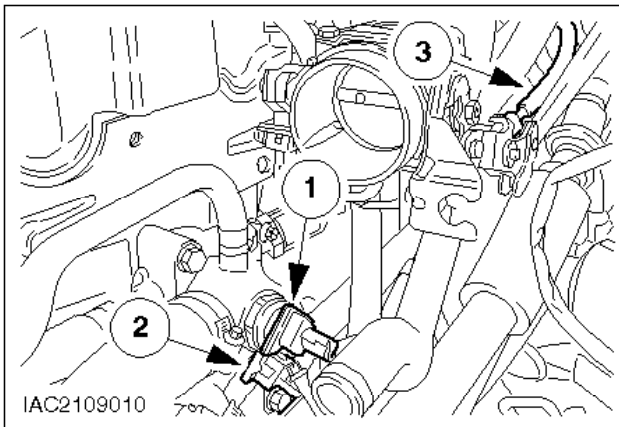


- ➡ 3. Detach the intake pipe from the lock panel.



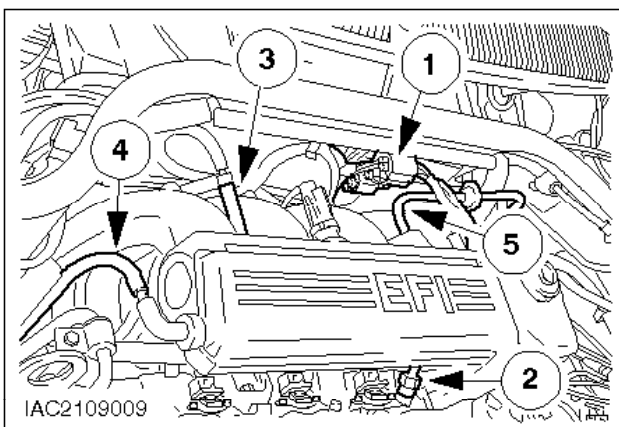
⌚ 4. Remove the air cleaner (continued).

- 1 Detach the positive crankcase ventilation (PCV) hose.
- 2 Disconnect the air hose from the IAC valve.
- 3 Detach the accelerator cable.
- 4 Lift out the air cleaner.



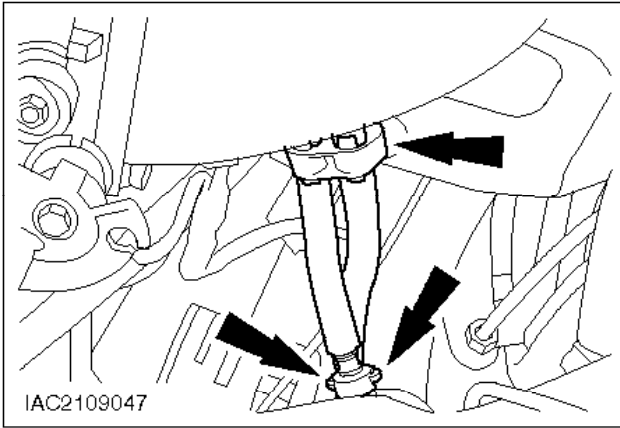
⌚ 5. Disconnect the plugs and the vacuum hose.

- 1 Disconnect the plug of the coolant temperature switch (ECT switch).
- 2 Disconnect the plug of the engine coolant temperature sensor (ECT sensor).
- 3 Disconnect the vacuum hose from the throttle body.



FUEL WILL ESCAPE. OBSERVE THE SAFETY REGULATIONS FOR HANDLING FUEL.

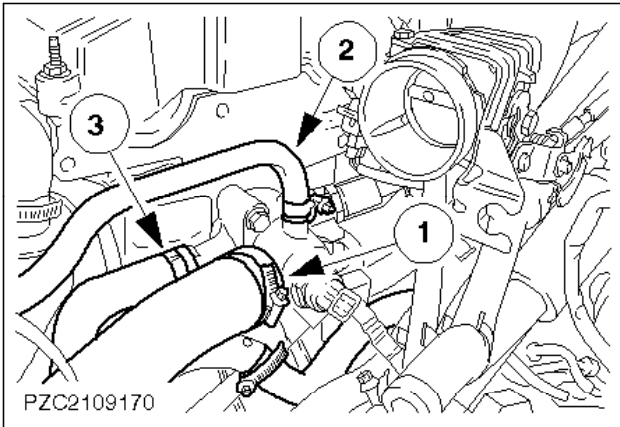
- 6. Disconnect the plugs, detach the fuel pipe and disconnect the vacuum hoses.
 - 1 Detach and disconnect the engine wiring loom plugs (x 2).
 - 2 Detach the fuel feed pipe.
 - 3 Disconnect the vacuum hose of the pulse air system.
 - 4 Disconnect the vacuum hose of the manifold absolute pressure sensor (MAP sensor).
 - 5 Disconnect the vacuum pipe for the brake servo.



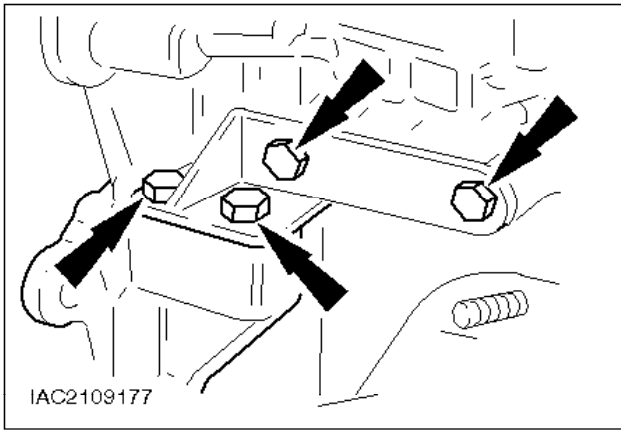
WARNING:

FUEL WILL ESCAPE. OBSERVE THE SAFETY REGULATIONS FOR HANDLING FUEL.

- 7. Disconnect the fuel return pipe and detach the fuel pipes from the intake pipe.

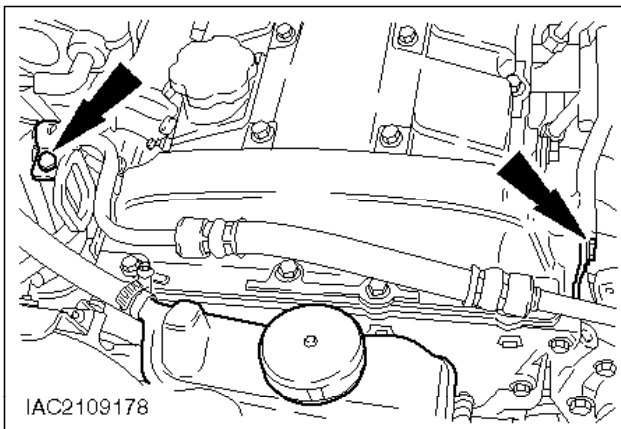


- 8. Detach the coolant hoses at the thermostat housing.
 - 1 From the radiator.
 - 2 From the vent.
 - 3 From the heater.



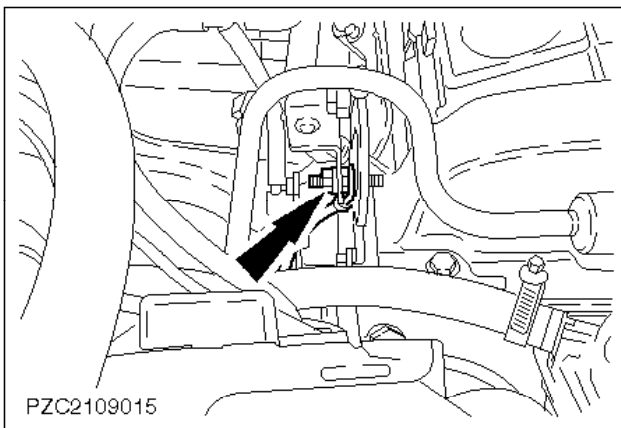
Only vehicles with air conditioning.

- 9. Detach the upper bracket of the power steering pump.



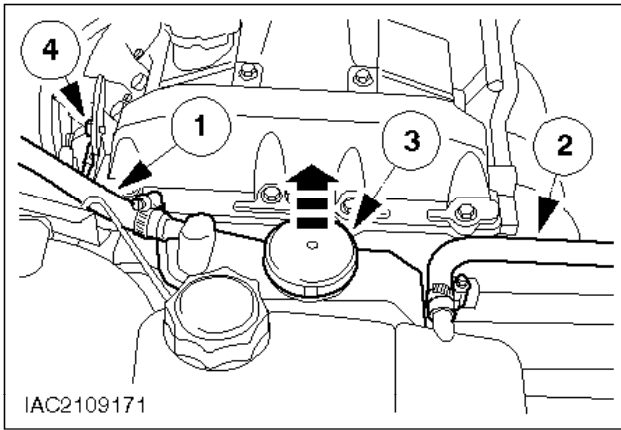
Only vehicles with air conditioning.

- 10. Detach the power steering pipe.



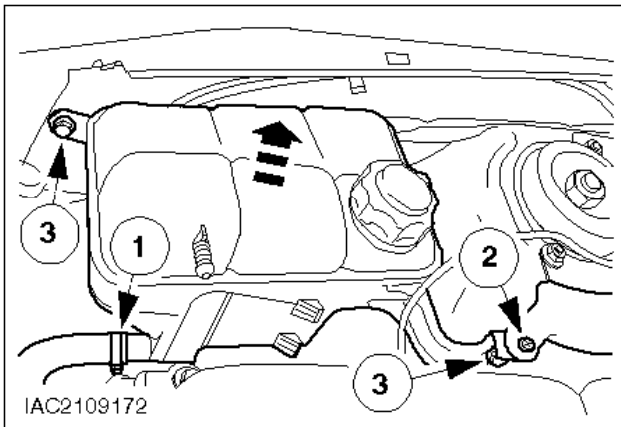
Only vehicles with air conditioning.

- 11. Detach the bracket of the power steering pipe.



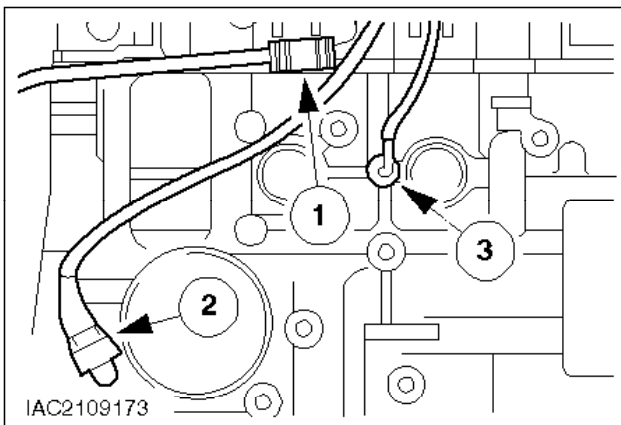
12. Detach the power steering reservoir.

- 1 Detach the upper hose from the power steering reservoir.
- 2 Detach the upper hose from the coolant expansion tank.
- 3 Lift out the power steering reservoir and place to one side.
- 4 Detach the ground cable from the engine lifting eye.



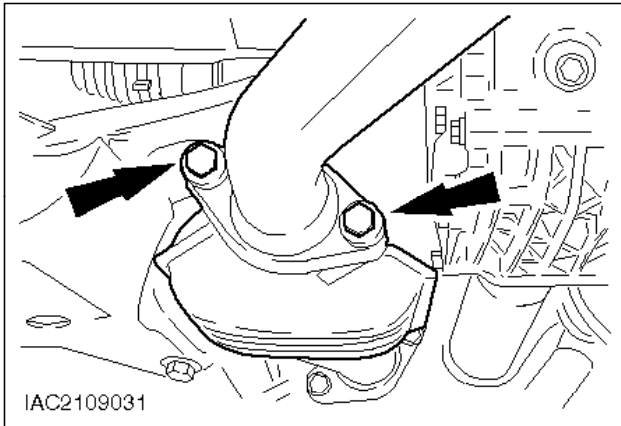
13. Remove the coolant expansion tank.

- 1 Detach the lower coolant hose from the expansion tank.
 - 2 Detach the bracket for the MAP sensor.
 - 3 Remove the expansion tank.
- Raise the vehicle.

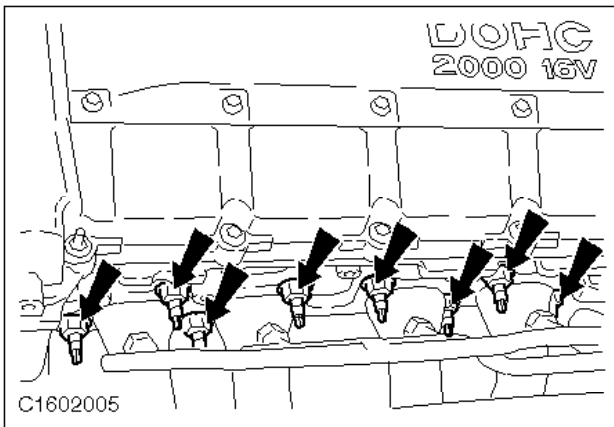


14. Detach the PCV pipe and disconnect the plug.

- 1 Detach the PCV pipe.
- 2 Disconnect the plug of the crankshaft position sensor (CKP sensor).
- 3 Disconnect the oil pressure switch plug.



- 15. Detach the exhaust manifold from the catalytic converter.

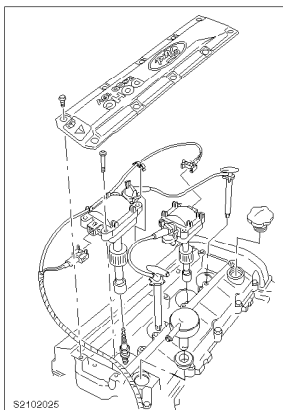


Note:

The exhaust manifold cannot be removed.

- 16. Detach the exhaust manifold from the cylinder head.

Pull the exhaust manifold off the studs and lay it to one side.





CAUTION:

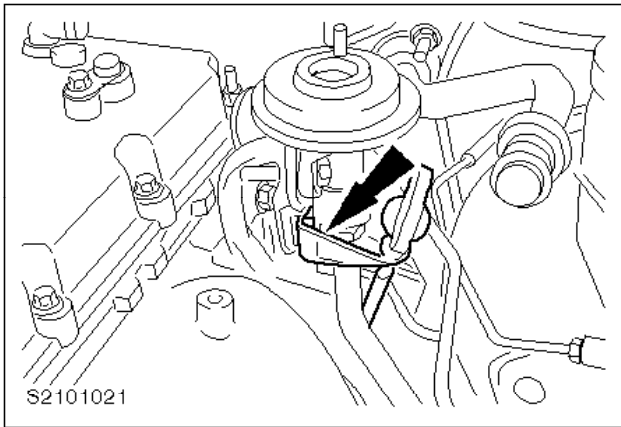
Do not pull on the cable when unplugging the spark plug connectors. If necessary disconnect the ignition cables from the ignition coil to prevent kinking of the cables. Slightly twist the spark plug connectors before pulling them off in order to release the seals.



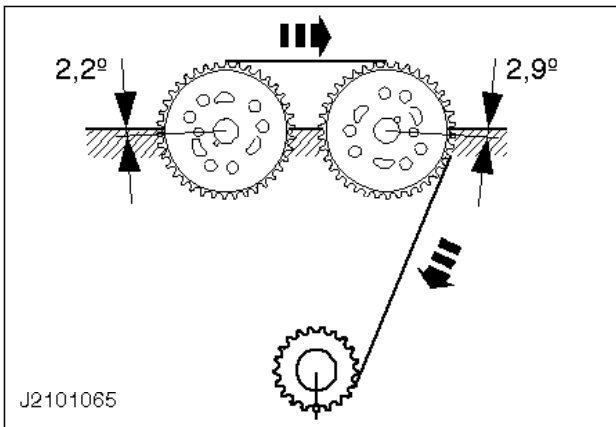
CAUTION:

Pull off the spark plug connectors in a straight line with the axis of the spark plug (use Special Tool 21-226 for angled spark plug connectors).

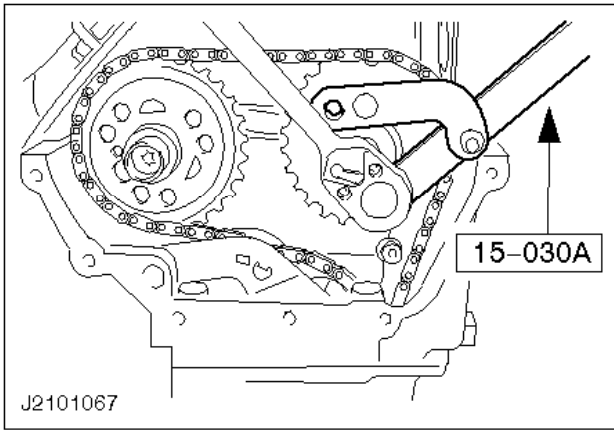
- ④ 17. Detach the cylinder head cover.
 - Detach the cover from the cylinder head cover.
 - Disconnect the plugs of the ignition coils and remove the engine wiring loom.
 - Remove the ignition coils and the spark plug connectors.
 - Remove the spark plugs using special tool 21-202.
 - Disconnect the positive crankcase ventilation.
 - Detach the cylinder head cover (11 bolts and 4 nuts).



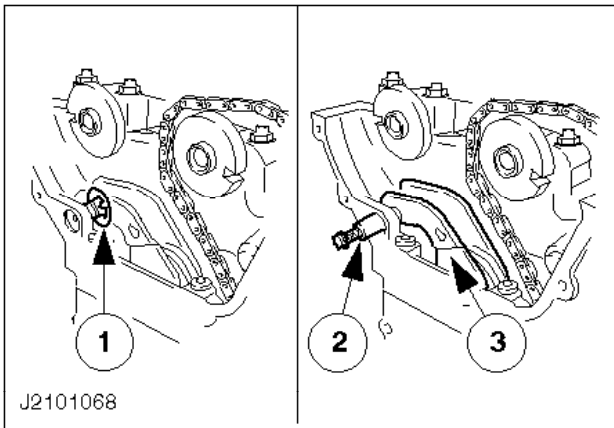
- ④ 18. Detach the upper timing chain cover (7 bolts).



- ④ 19. Turn the camshaft sprockets to the mark.

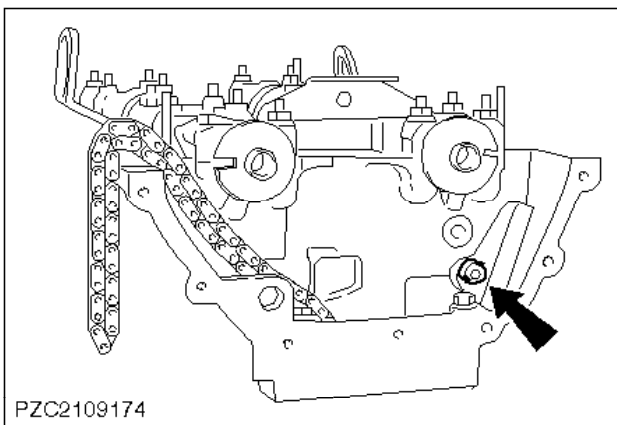


- ⌚ 20. Detach the camshaft sprockets.

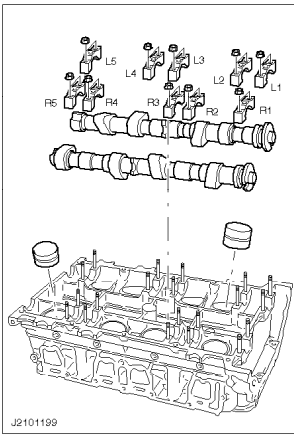


- ⌚ 21. Remove the chain tensioning arm.

- 1 Pull off the circlip with pliers.
- 2 Draw out the chain tensioner pivot pin using a bolt (M6).
- 3 Remove the chain tensioning arm from the housing.



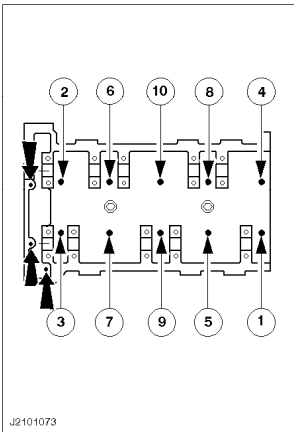
- ⌚ 22. Detach the upper chain guide.



Note:

Bolt slackening sequence: uniformly from camshaft cap five to one.

- 23. Remove the camshafts.
 - Detach the chain guide bracket with the front bearing caps.
 - Remove the hydraulic tappets and put them down in order.



CAUTION:

The cylinder head must be cooled to room temperature before the bolts are removed.

Note:

Remove the auxiliary bolts first (x 3).

Note:

Do not put the cylinder head down on its mating face.

- 24. Detach the cylinder head.

Renew the cylinder head bolts.

Install



CAUTION:

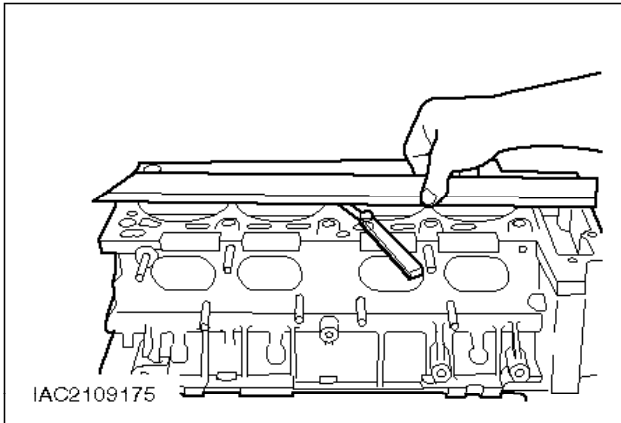
Do not damage the cylinder liner.

- 25. Remove the carbon around the upper edge of the cylinder.

Note:

No material must be worn away during cleaning.

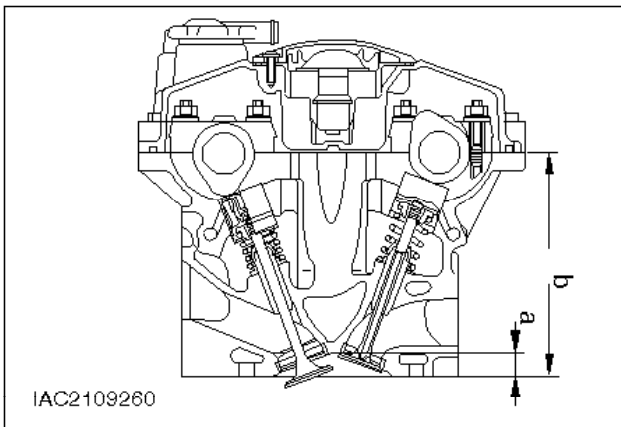
26. Clean the mating faces with a spatula.



Check the cylinder head evenness.

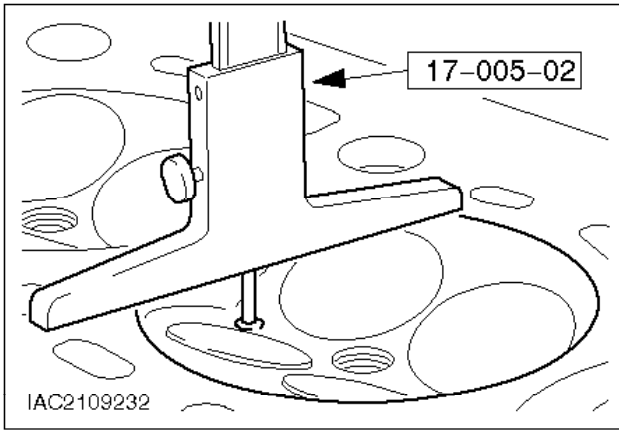
27. Check the cylinder head mating face for distortion.

- Lay the steel rule (at least 500 mm long and 5 mm wide) laterally across all the combustion chamber steps and in each case take measurements at three points.
- Permissible distortion at the combustion chamber steps: lateral 0,05 mm, longitudinal and diagonal 0,10 mm.
- Lay the steel rule lengthways across the cylinder head in the area of the combustion chambers at three points and check the measurements at all the combustion chamber steps.
- Lay the steel rule diagonally across the cylinder head and check the measurements at all the combustion chamber steps.
- If necessary rework the cylinder head as described in the next step.



28. Note on reworking the cylinder head.

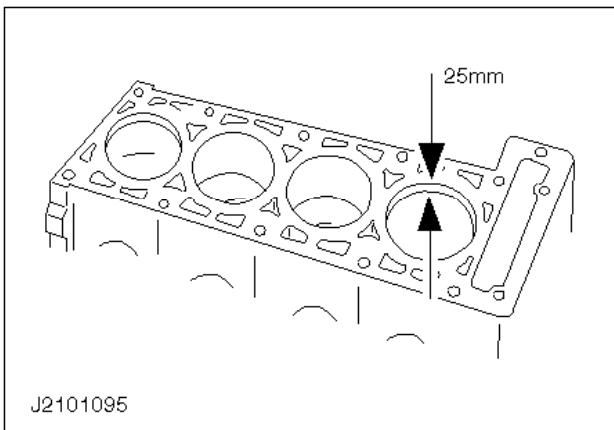
Maintain a peak-to-valley height (Rz) of 0,0135 micrometers when reworking. The cylinder head must not be reworked by more than 0,20 mm (milling or surface grinding). Measurements "a" and "b" must not be less than 13,80 mm (see next step) and 147,25 mm respectively.



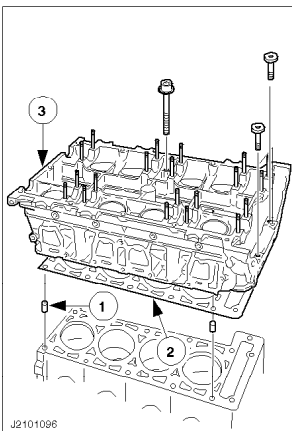
Note:

Remove any carbon deposits from the measuring point.

- 29. Location of the measuring point for dimension 'a' in the combustion chamber.

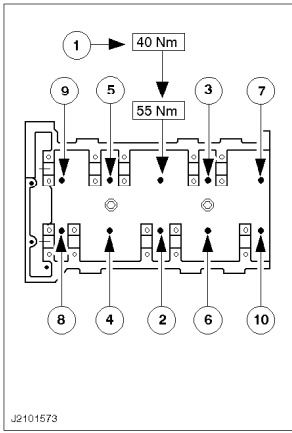


- 30. Set the piston of cylinder no. 1 to 25 mm before TDC.



- 31. Fit the cylinder head.

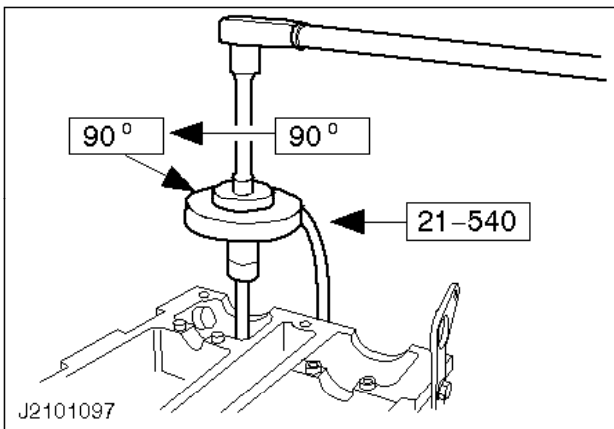
- 1 Fit the guide bushes.
- 2 Fit the cylinder head gasket.
- 3 Fit the cylinder head.



⚠ CAUTION:
Use new bolts.

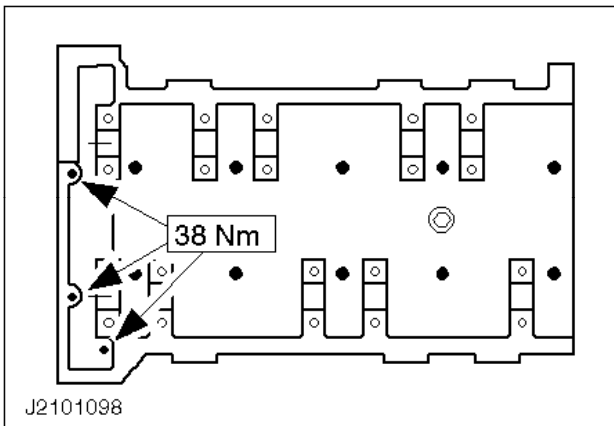
Note:
Tightening order.

- ⌚ 32. Tighten the cylinder head bolts.

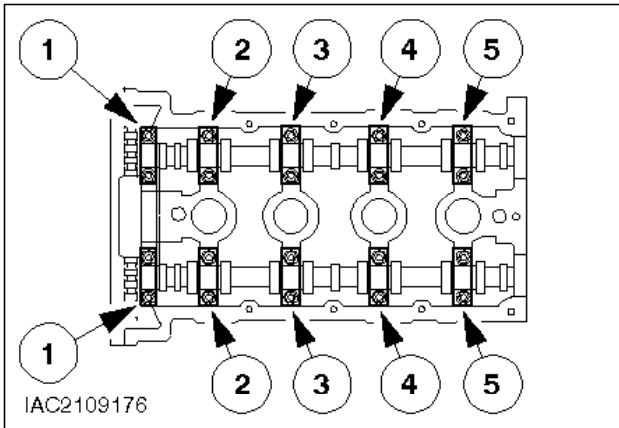


⚠ CAUTION:
The cylinder head bolts must not be retorqued.

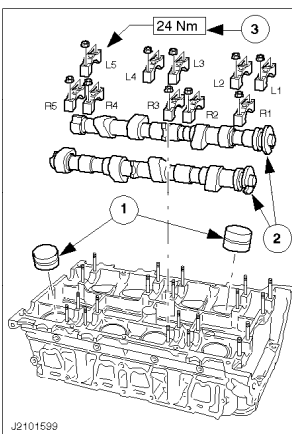
- ⌚ 33. Tighten the cylinder head bolts (continued).



- ⌚ 34. Tighten the cylinder head auxiliary bolts.



- ⌚ 35. Tightening sequence for camshaft bearing caps.



- ⌚ 36. Install the camshafts.



CAUTION:

When installing the camshafts, the piston of cylinder no. 1 must be approx. 25 mm before TDC.



CAUTION:

After the camshafts are installed, wait 15 minutes before cranking the engine.

- Oil the bearings.
- 1 Fit the hydraulic tappets.
- 2 Fit the camshafts so that none of the cams is at full lift.

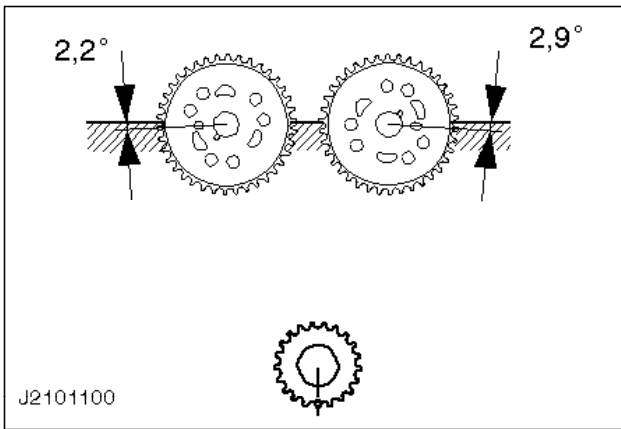
Note:

R is the inlet side and L is the exhaust side.

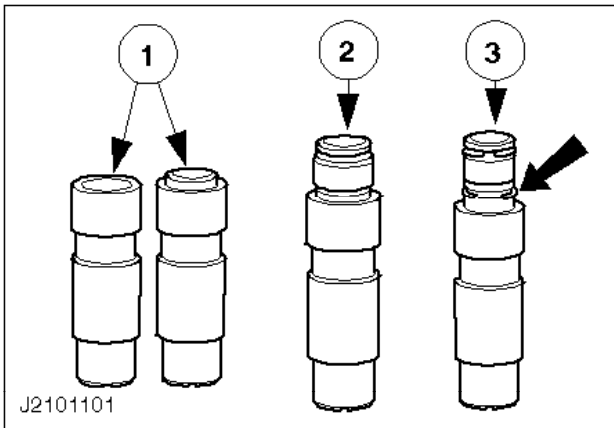
Note:

Follow the tightening sequence from the previous step.

- 3 Fit the camshaft bearing caps so that the position marks can be seen from behind.
- Fit the chain guide bracket with the front bearing caps.



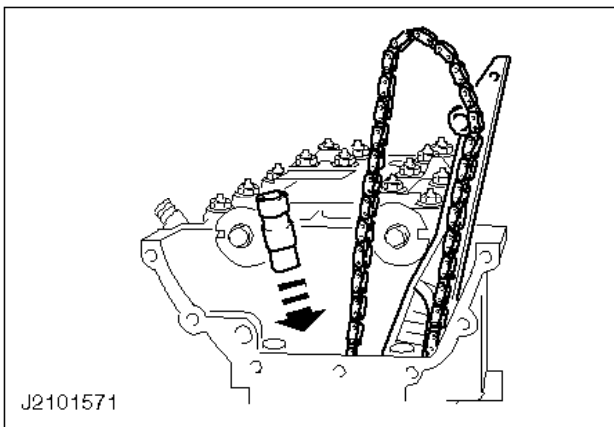
37. Turn the camshafts and crankshaft to TDC.



CAUTION:

Fully and partially released chain tensioner hydraulic plungers (new or used) must not be fitted.

38. Check the new chain tensioner hydraulic plunger.
- 1 Chain tensioner hydraulic plunger latched.
 - 2 Chain tensioner hydraulic plunger partially released.
 - 3 Chain tensioner hydraulic plunger fully released (the detent ring is visible).



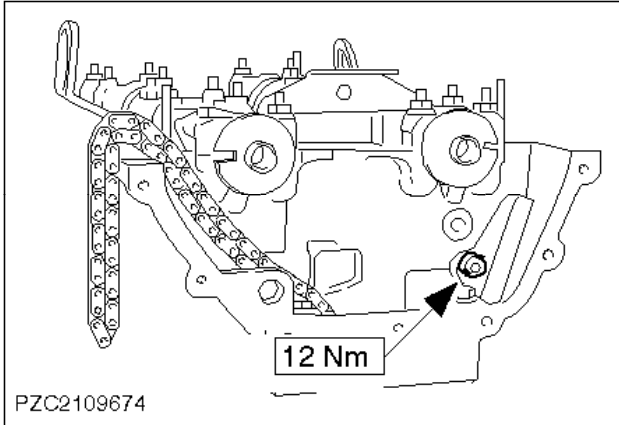


CAUTION:

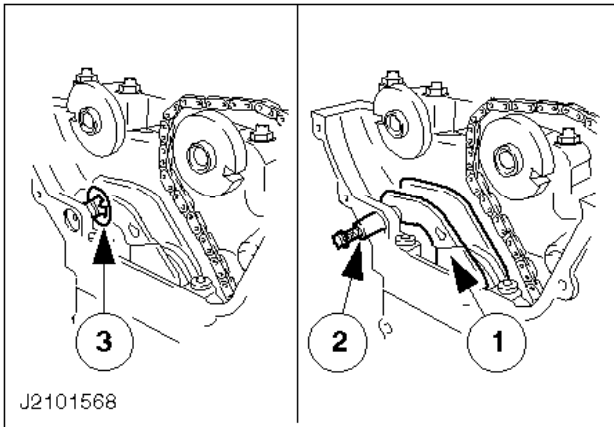
Only use a new, latched chain tensioner hydraulic plunger.

- ④ 39. Install the chain tensioner hydraulic plunger.
- 40. Fit the timing chain with the chain guide.

Do not tighten the chain guide yet.

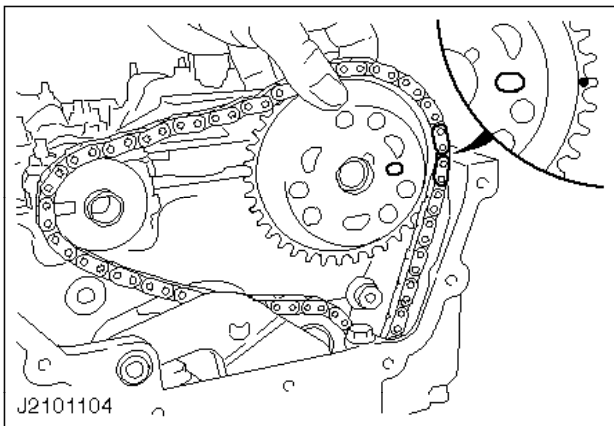


- ④ 41. Attach the upper timing chain guide.



- ④ 42. Install the chain tensioner.

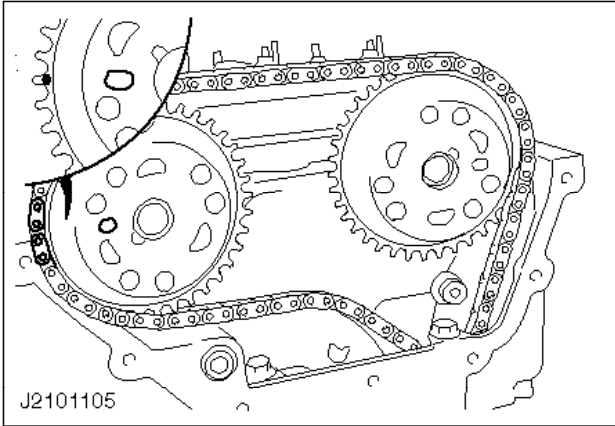
- 1 Fit the chain tensioner.
- 2 Fit the pivot pin.
- 3 Fit the circlip.



Note:

The timing chain must be taut on the long side. If necessary, turn the camshaft slightly.

- 43. Fit the timing chain at the top.

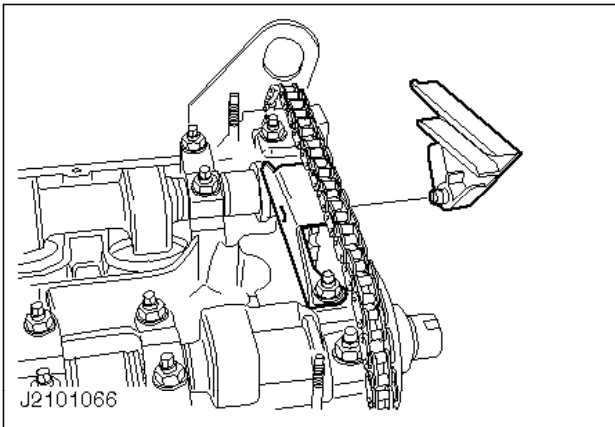


Note:

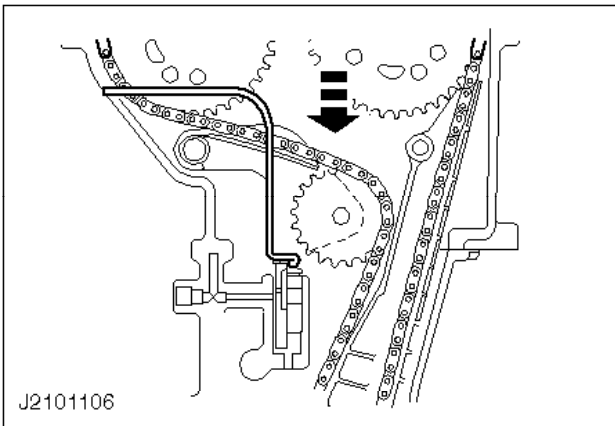
The timing chain may hang down slightly between the camshaft sprockets.

- 44. Fit the timing chain at the top (continued).

Screw in the bolts of the camshaft sprockets (do not tighten the bolts).

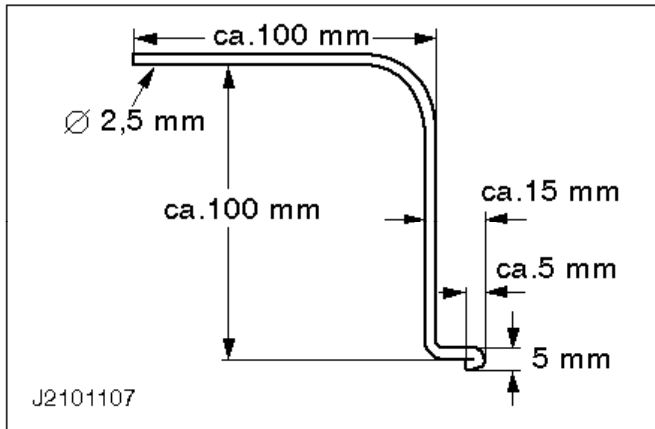


- 45. Attach the new upper chain guide rail to the bracket.



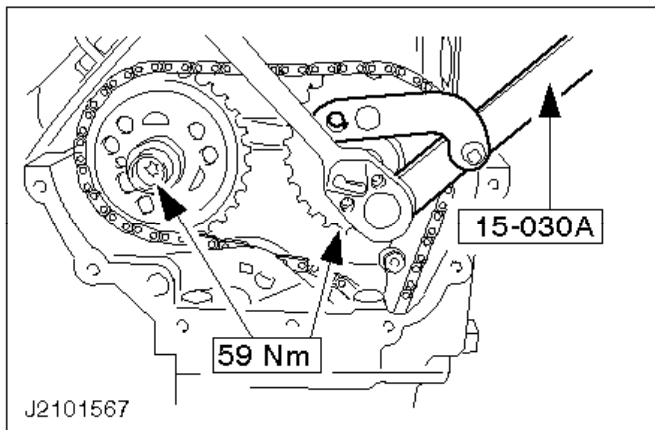
⌚ 46. Release the tappet of the chain tensioner.

- Press down the chain tensioning arm manually and release the tappet.
- If the chain tensioner mounting does not reach the tappet, the tappet must be relaxed using an auxiliary tool.



⌚ 47. Make the auxiliary tool.

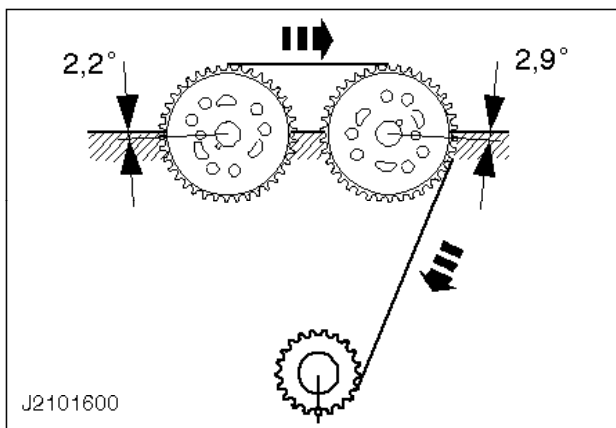
Use a piece of 2,5 mm welding rod approx. 220 mm in length.



Note:

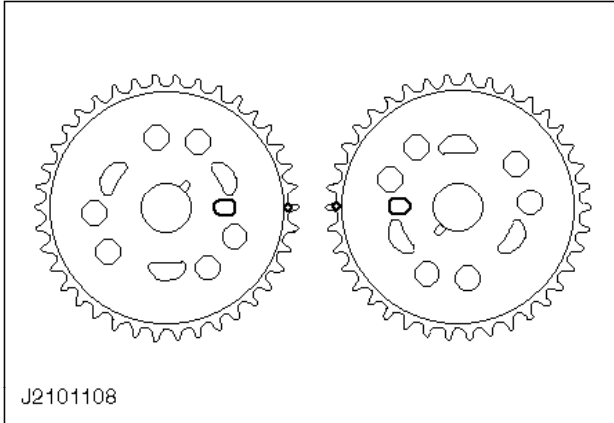
Counterhold with the special tool.

⌚ 48. Tighten the camshaft sprockets.



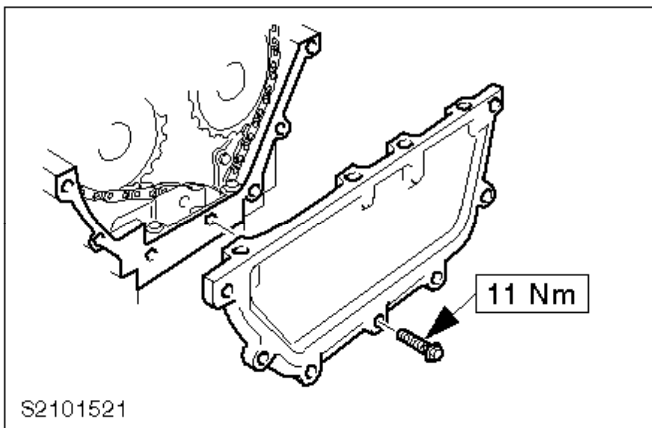
49. Check the valve timings.

- Crank the engine in the normal direction of rotation and set it to the mark.
- When the timing chain is released again, renew the chain tensioner hydraulic plunger.

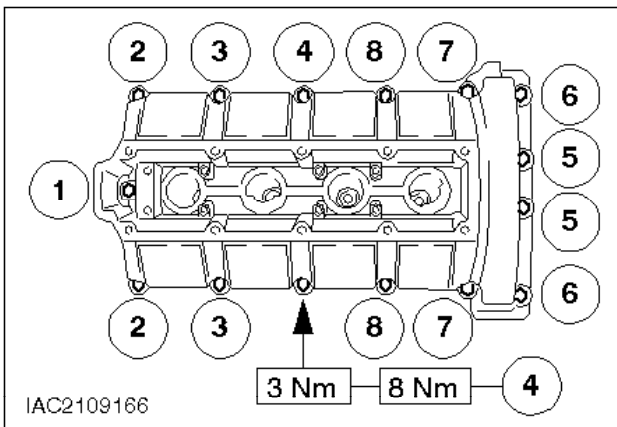


50. Check the valve timings (continued).

- Turn the engine in the normal direction of rotation to the next TDC.
- The marks on the camshaft sprockets must line up level with the top edge of the cylinder head.

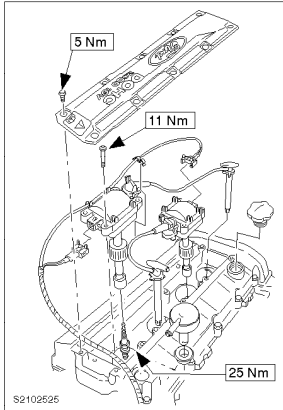


51. Attach the upper timing chain cover.



Note:
Tighten the bolts in the specified order.

- ⌚ 52. Install the cylinder head cover.



CAUTION:

Use a blunt object to apply the silicone grease (e.g. a plastic cable tie) to avoid damaging the spark plug connector seal.



CAUTION:

Push on the spark plug connectors in a straight line with the axis of the spark plug.

Note:

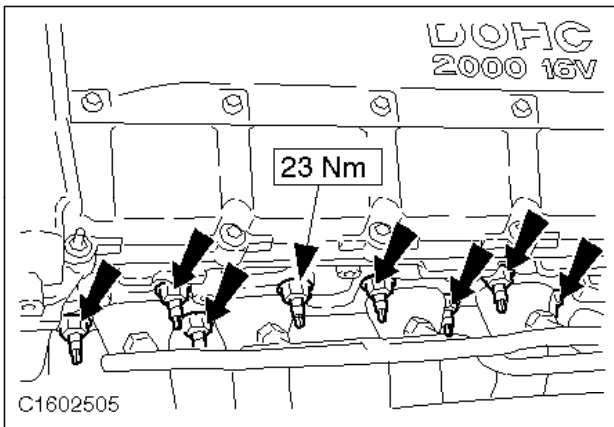
Coat the inside of the spark plug connectors to a depth of 5-10 mm with silicone grease (A960-M1C171-AA).

Note:

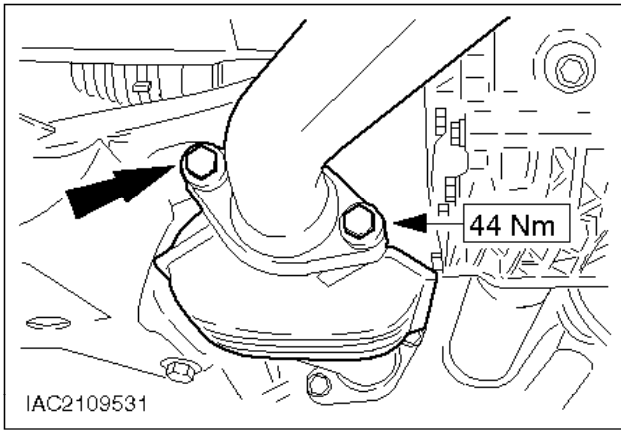
Apply lubricant 'Never Seeze' (ESE-M1244-A) to the spark plug thread.

- ⌚ 53. Fit the cover to the cylinder head cover.

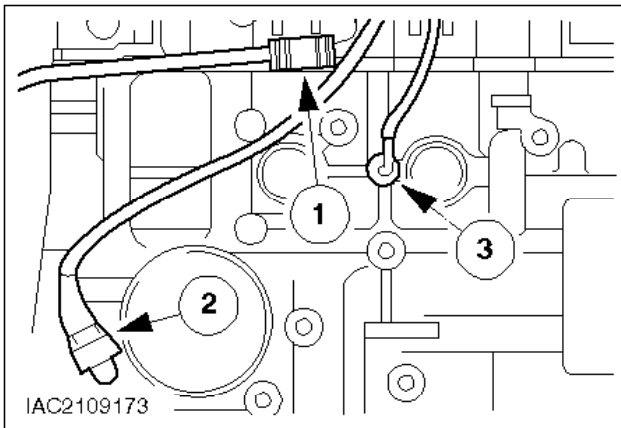
- Connect the positive crankcase ventilation.
- Install the spark plugs using special tool 21-202.
- Install the ignition coils and spark plug connectors.
- Lay the engine wiring loom in the cylinder head cover and connect the ignition coil plugs.
- Attach the cover to the cylinder head cover.



- ⌚ 54. Attach the exhaust manifold to the cylinder head.

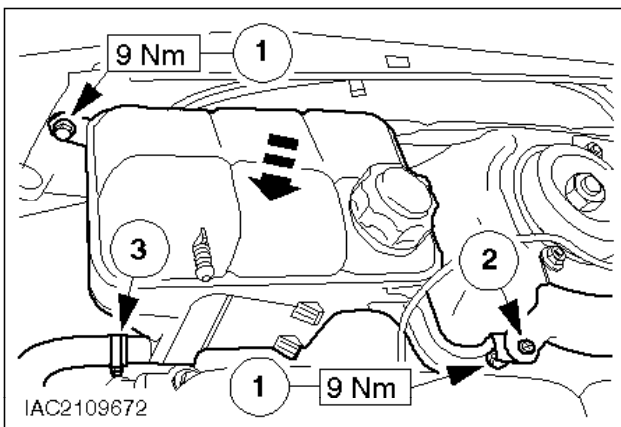


55. Attach the exhaust manifold to the catalytic converter.



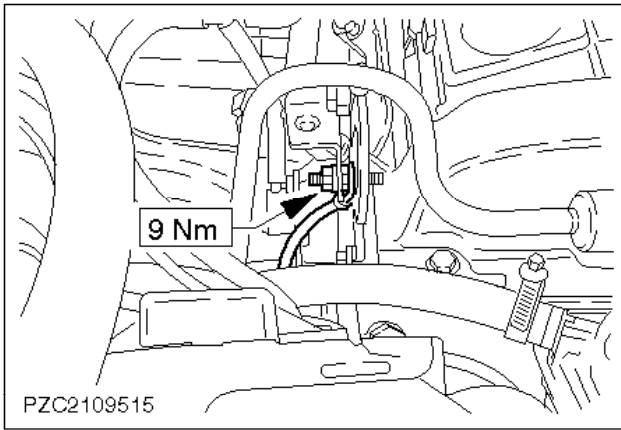
56. Attach the PCV pipe and connect the plugs.

- 1 Attach the PCV pipe.
- 2 Connect the plug to the CKP sensor.
- 3 Connect the plug to the oil pressure switch.



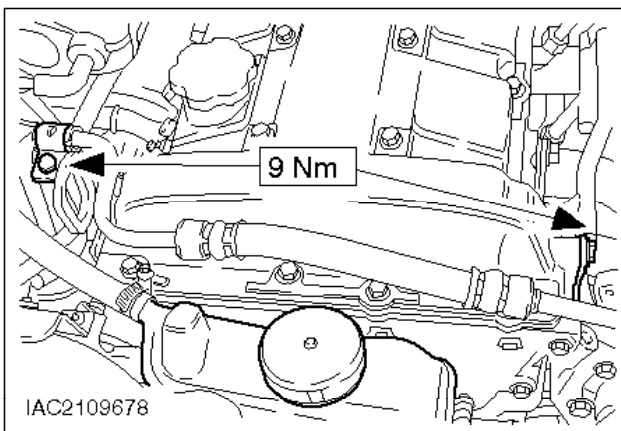
57. Install the coolant expansion tank.

- 1 Install the expansion tank.
- 2 Attach the bracket of the MAP sensor.
- 3 Connect the lower coolant hose to the expansion tank.



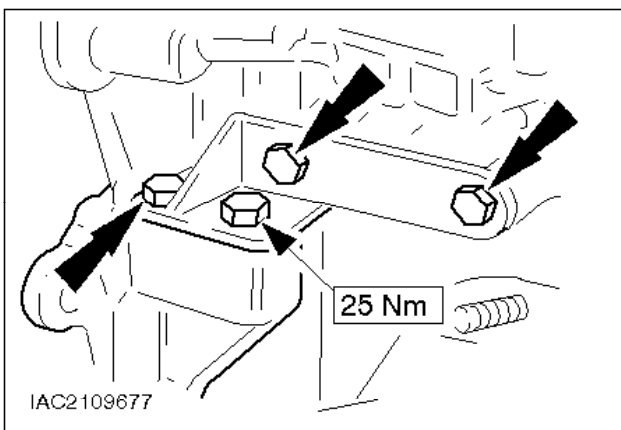
Only vehicles with air conditioning. 09-129">

- ⦿ 58. Attach the bracket for the power steering pipe.



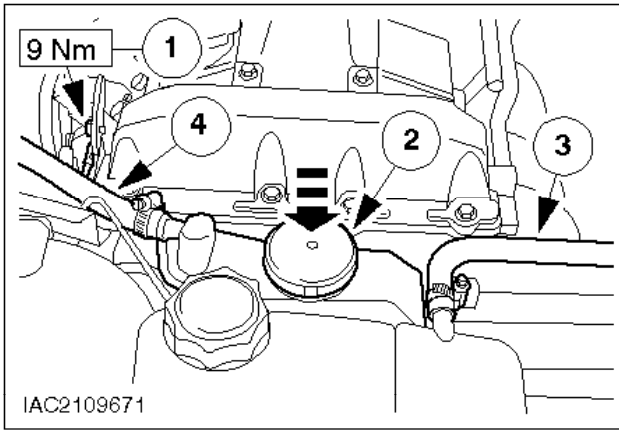
Only vehicles with air conditioning.

- ⦿ 59. Connect the power steering pipe.



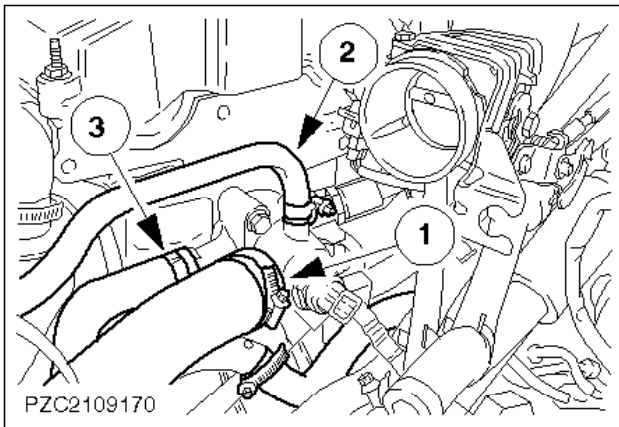
Only vehicles with air conditioning.

- ⦿ 60. Attach the upper bracket for the power steering pump.



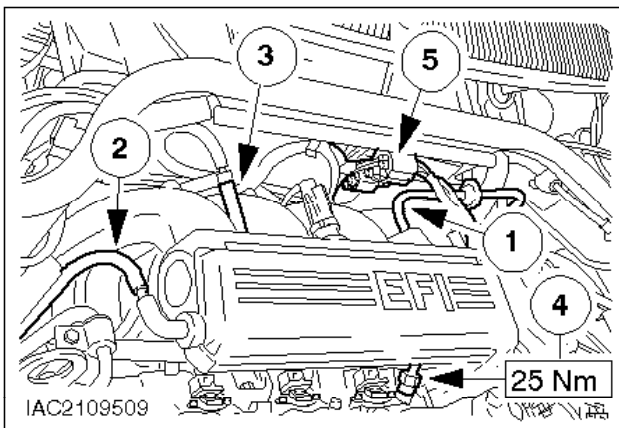
61. Fit the power steering reservoir.

- 1 Attach the ground cable to the engine lifting eye.
- 2 Slide the power steering reservoir onto the coolant expansion tank.
- 3 Connect the upper coolant hose to the coolant expansion tank.
- 4 Connect the upper hydraulic hose to the power steering reservoir.



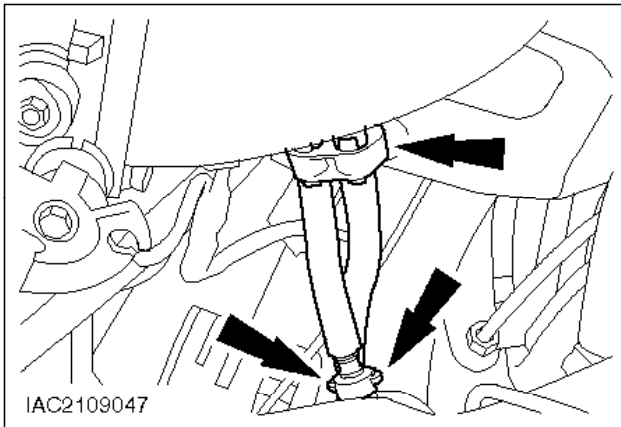
62. Connect the coolant hoses at the thermostat housing.

- 1 To the radiator.
- 2 To the vent.
- 3 To the heater.

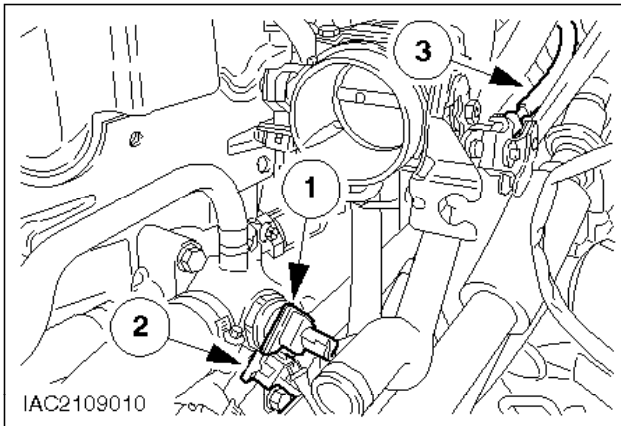


63. Connect the plugs, attach the fuel pipe and connect the vacuum hoses.

- 1 Connect the vacuum pipe for the brake servo.
- 2 Connect the vacuum hose of the pulse air system.
- 3 Connect the vacuum hose to the MAP sensor.
- 4 Connect the fuel feed pipe.
- 5 Connect the plugs of the engine wiring loom and attach them to the body (x 2).

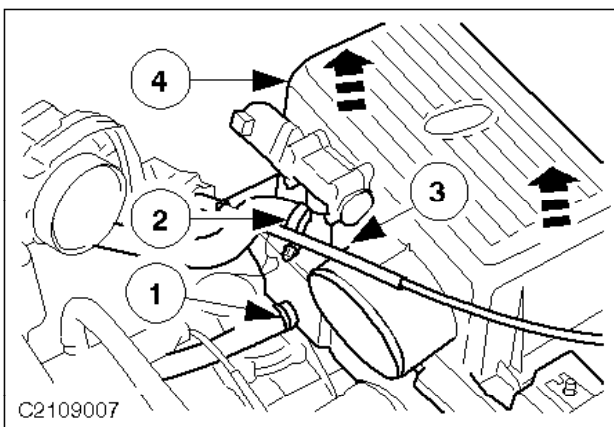


64. Connect the fuel return pipe and attach the fuel pipes to the intake pipe.



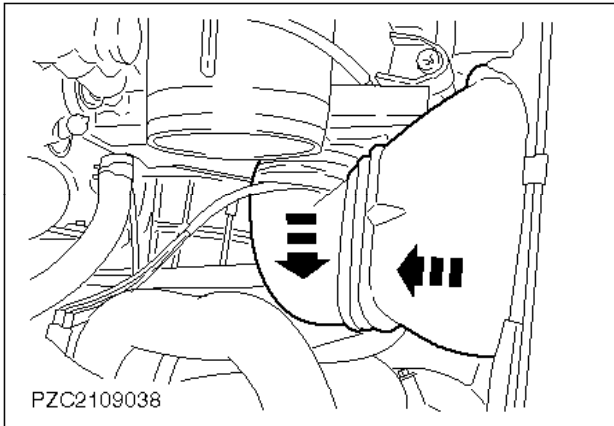
65. Connect the plugs and the vacuum hose.

- 1 Connect the plug to the CTS.
- 2 Connect the ECT sensor plug.
- 3 Connect the vacuum hose to the throttle body.

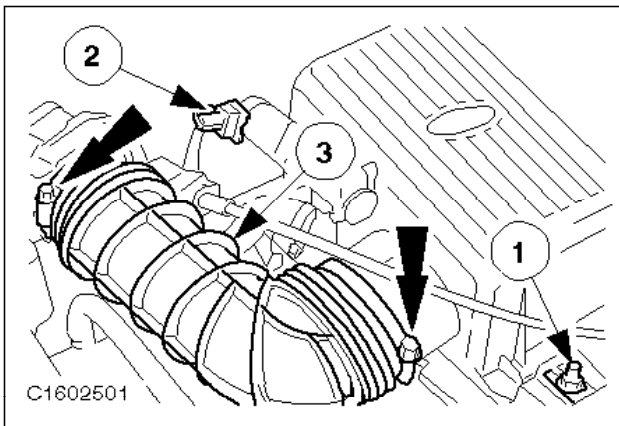


66. Install the air cleaner.

- 1 Insert the air cleaner.
- 2 Connect the throttle cable.
- 3 Connect the air hose to the IAC valve.
- 4 Connect the air hose for the PCV.



67. Attach the intake pipe to the lock panel.



68. Install the air cleaner (continued).

- 1 Screw on the nut.
- 2 Connect the plug to the IAC valve.
- 3 Fit the intake hose.

69. Standard finishing operations.

- Change the engine oil.
- Top up with coolant (ESD-M97B-49A) and close the expansion tank.
- Connect the battery negative lead.
- Check the fluid levels and rectify as necessary.
- Check the routing of vacuum hoses and wiring and secure with cable ties.
- Remove the protective coverings.
- Enter the radio keycode.
- Adjust the clock.
- Reprogram the radio stations.
- Carry out a road test to enable the PCM to collect data.