

1

Engine System (03.00)

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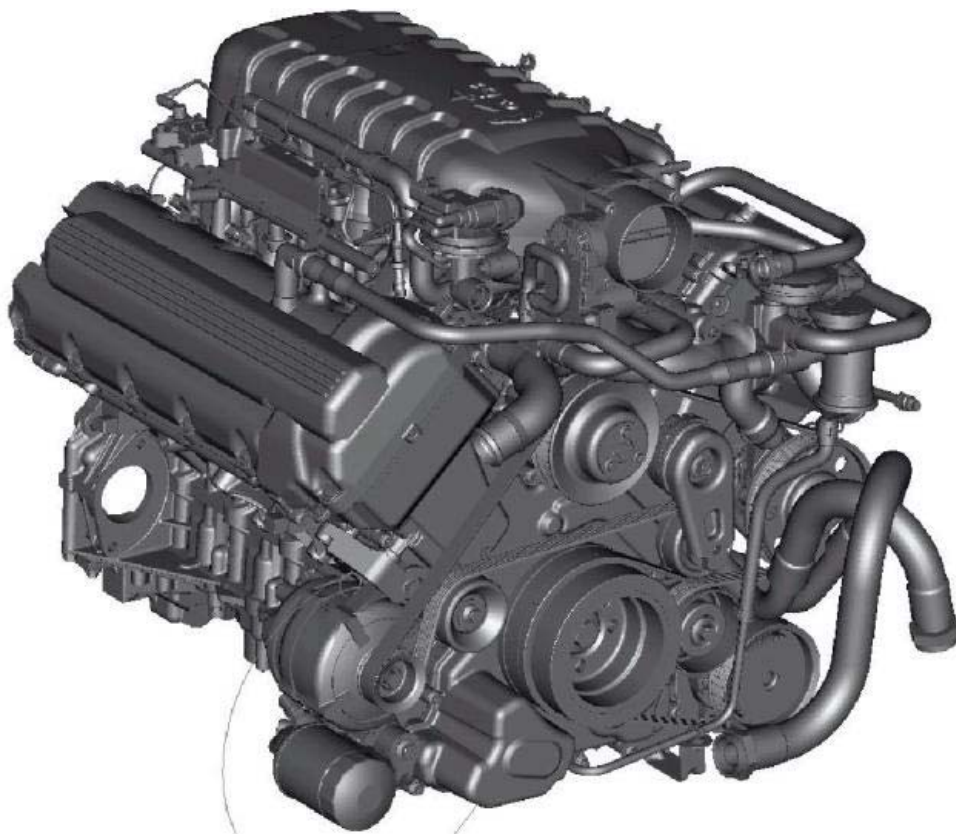


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Engine (03.00)

Engine Assembly (03.00)

Description



The engine is an all aluminium 4.3 litre 90° V8 configuration. The cylinder heads have dual overhead camshafts and four valves per cylinder. An electronic engine management system controls the sequential multi-port fuel injection and distributor-less ignition systems.

The engine uses the latest 'fast-burn' combustion technology. Heated oxygen sensors monitor the oxygen content of exhaust gasses. The engine management system uses the oxygen sensor signals together with other engine information to 'fine tune' fuelling levels and ignition timing. This helps to achieve the best possible fuel burn with minimum exhaust emissions.

Inlet camshaft variable timing to improve engine performance and emissions.

Inlet manifold is design with tuned length runners to improve volumetric efficiency and performance.

The engine is fitted with a dry sump to improve oil pickup during high speed cornering.

The exhaust system has hydroformed internals with a 4 into 2 into 1 design for improved engine tuning and lower backpressure. Additional oxygen sensors are placed after the catalysts so that long term catalyst efficiency can be monitored.

The engine runs on unleaded fuel only.

Maintenance

Engine Assembly-Renew

Repair Operation Time (ROT)	
Item	Code
Engine-Remove/Refit	03.00.AA

Removal

1. Remove engine (refer to Workshop Manual procedure 03.00.AC Engine Assembly - Remove for Access and Refit).
2. Remove torque tube (bolts x16 and heatsheild bracket).
3. Install engine lifting brackets.
4. Remove engine from subframe (nuts x2) using suitable lifting equipment.
5. Remove engine lifting brackets (refer to Figure 1).



Figure 1

Installation

1. Install engine lifting brackets to new engine.
2. Install engine to subframe (nuts x2) using suitable lifting equipment.
3. Remove engine lifting brackets (refer to Figure 2).

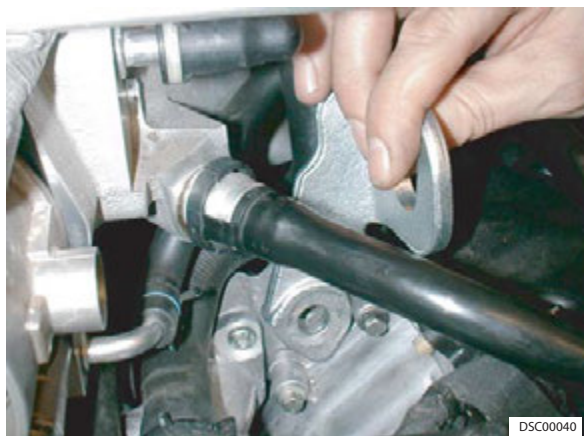


Figure 2

4. Install torque tube (bolts x16 and heatsheild bracket).
5. Install engine (refer to Workshop Manual procedure 03.00.AC Engine Assembly - Remove for Access and Refit).

Engine Assembly-Remove for Access and Refit

Repair Operation Time (ROT)	
Item	Code
Engine Assembly-Remove/Refit	03.00.AC

Removal

1. Remove transmission (refer to Workshop Manual procedure 07.03.AA Transaxle Assembly - Manual - Remove for Access and Refit).
2. Disconnect battery.
3. Raise vehicle on ramp.
4. Depressurise fuel rail (refer to Workshop Manual procedure 10.01.EK Fuel System - Depressurise).
5. Strap vehicle to ramp (front).

Throttle Duct Removal

6. Disconnect breather pipe quickfits (x2) from air cleaner duct (refer to Figure 1).



Figure 1

7. Remove throttle body duct for access (clips x3) (refer to Figure 2).
21. Disconnect top hose and unclip from body (refer to Figure 3).



Figure 2

Suspension Removal

8. Remove RH wheel arch liner (refer to Workshop Manual procedure 01.02.GB Wheel Arch Liner - Front - RH - Renew).
9. Remove LH wheel arch liner (refer to Workshop Manual procedure 01.02.FB Wheel Arch Liner - Front - LH - Renew).
10. Remove road wheel/s.
11. Remove brake callipers (tie aside).
12. Remove brake discs.
13. Remove anti-roll bar from links (nuts x2).
14. Remove front springs and dampers (refer to Workshop Manual procedure 04.03.AA Spring and Damper Assembly - Front Pair - Renew).
15. Disconnect track rod ends.
16. Remove level sensor link from bottom arm (nut x1).
17. Mark lower arm bolt and washer positions (to retain geometry).
18. Remove bottom arms (nut and bolt x4) with uprights and top arm.
19. Disconnect level sensor multiplug.

Cooling Removal

20. Drain coolant (refer to Workshop Manual procedure 03.03.AD Coolant - Drain and Refill).



Figure 3

22. Disconnect bottom hose and tie aside (refer to Figure 4).



Figure 4

23. Disconnect expansion tank to engine hose (quickfit).
24. Disconnect heater feed hose (quickfit) (refer to Figure 5).



Figure 5

25. Disconnect heater return hose (quickfit).
26. Disconnect expansion tank to engine (bleed) hose and body clips (x2).

Booster Hose Removal

27. Disconnect vacuum hose from booster.

P.A.S. Removal

28. Remove oil from reservoir (syringe).
29. Disconnect H.P. pipe from pump.
30. Remove PAS reservoir from bracket (bolt x1).
31. Remove hoses (x2) from PAS reservoir (refer to Figure 6).

**Figure 6**

32. Remove suction hose to body P-clip (bolt x1).
33. Remove pipes from steering rack (bolt x1).

Oil Tank Removal

WARNING
DO NOT GET USED ENGINE OIL ON YOUR SKIN.
USED ENGINE OIL CAN BE HARMFUL.

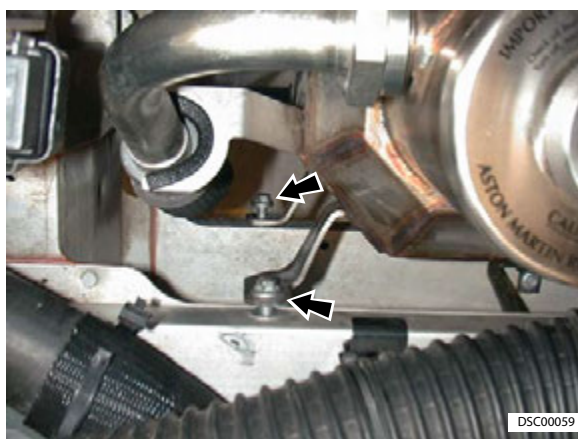
34. Drain oil tank.
35. Disconnect breather hose from tank (quickfit) (refer to Figure 7).

**Figure 7**

36. Disconnect oil pipes from tank (x3) (refer to Figure 8).

**Figure 8**

37. Remove oil tank (bolts x4) (refer to Figure 9).

**Figure 9**

38. Disconnect oil pipe from oil thermostat.

A/C Removal

39. Recover refrigerant (refer to Workshop Manual procedure 12.03.FA Refrigerant Gas - Recover/Recharge - Renew).
40. Disconnect compressor clutch multiplug (access).

41. Remove bolt (x1) HP pipe to bracket (refer to Figure 10). **Steering Removal**

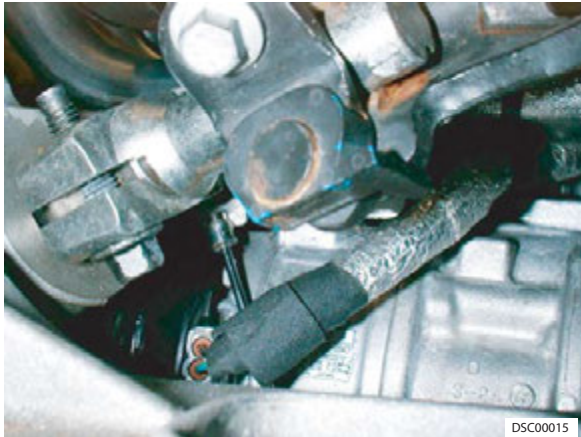


Figure 10

42. Remove pipes from compressor (bolts x2) and move aside (refer to Figure 11).



Figure 11

43. Remove bolts (x2) LP pipe to body P-clips and move aside (refer to Figure 12).



Figure 12

44. Disconnect steering column link to steering rack and tie aside (refer to Figure 13).

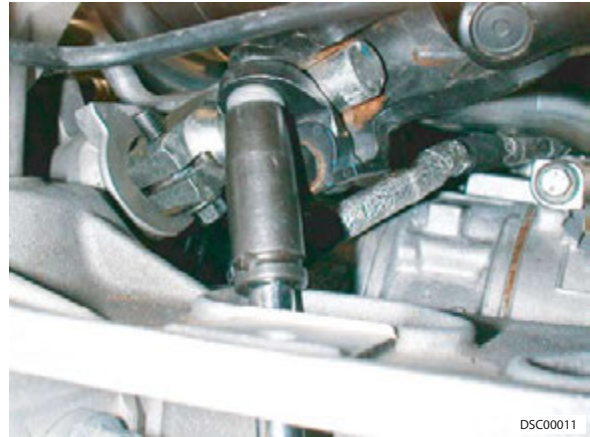


Figure 13

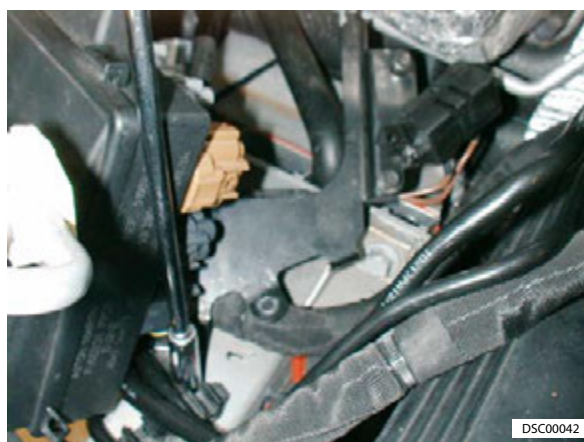
Electrical Removal

- 45. Disconnect RH indicator repeater light unit multiplug.
- 46. Remove fir tree clips (x4) for harness of repeater and screen wash system.
- 47. Remove fir tree clips ECM harness (x2).
- 48. Remove attachment bolts (x3) from cover plate (ECM and plate will drop down).
- 49. Disconnect ECM multiplugs (x3).
- 50. Remove ECM (refer to Figure 14).



Figure 14

51. Remove fuse box bracket fixings (bolt and nut) (allows movement) (refer to Figure 15).
57. Remove starter cable from floor stud (nut x1) (refer to Figure 17).

**Figure 15**

52. Remove battery lead (1x nut and rubber cover) from fuse box (2x leads).
53. Remove multiplugs (x10) from fusebox.
54. Remove earth terminal (1x nut and rubber cover) from fusebox (refer to Figure 16).

**Figure 16**

55. Remove fuse box from bracket (bolt x2).
56. Feed harness over engine.

**Figure 17**

58. Disconnect multiplugs (x3) RH side of engine bay (refer to Figure 18).

**Figure 18**

59. Remove earth wires from terminals (nuts x 3).

60. Disconnect multiplugs (x4) from inside of vehicle RH side of I.P. (refer to Figure 19).
2. Install subframe to body (refer to Figure 20).



Figure 19

61. Release grommet from body, feed harness from inside of vehicle.
62. Release harness from clips (x11) and position over engine.

Purge Removal

63. Remove bottom screws (x2) and loosen top screw of washer bottle.
64. Disconnect purge pipe from purge valve (move washer bottle aside).
65. Release pipe from support clips (x2) and move pipe over engine.

Fuel Pipe Removal

66. Remove fuel hose from rail (clip x1).

Clutch Pipe Removal

67. Remove clutch metal pipe from flexible.
68. Remove flexible hose grommet from support bracket.

Subframe/Engine Removal

69. Remove undertray.
70. Mark subframe position.
71. Remove harness clips (x2).
72. Remove load level sensor from subframe (nut and bolt).
73. Support torque tube with transmission jack.
74. Position trolley, support subframe, remove bolts (x12) raise vehicle.
75. Ensure A/C HP pipe is clear of engine as body is raised.

Installation

Install Subframe/Engine

1. Ensure A/C HP pipe is correct position as body is lowered.



Figure 20

3. Remove transmission jack.
4. Install harness clips (x2).
5. Install load level sensor.
6. Install undertray.
7. Lower ramp.

Cooling Install

8. Connect top hose and clip to body (refer to Figure 21).



Figure 21

9. Connect bottom hose (refer to Figure 22).



Figure 22

10. Connect expansion tank to engine hose.

11. Connect heater feed hose (quickfit) (refer to Figure 23).



Figure 23

12. Connect heater return hose (quickfit).

13. Connect expansion tank to engine (bleed) hose and body clips (x2).

14. Refill coolant (refer to Workshop Manual procedure 03.03.AD Coolant - Drain and Refill).

Booster Hose Install

15. Install vacuum hose to booster.

P.A.S. Install

16. Connect H.P. pipe to pump (renew O-ring).

17. Install PAS reservoir to bracket (bolt x1).

18. Install hoses (x2) to PAS reservoir (refer to Figure 24).



Figure 24

19. Install suction hose to body P-clip (bolt x1).

20. Install pipes to steering rack (bolt x1) and fit new O-rings (x2).

Oil Tank Install

21. Connect oil pipe from oil thermostat.

22. Install oil tank (bolts x4) (refer to Figure 25).

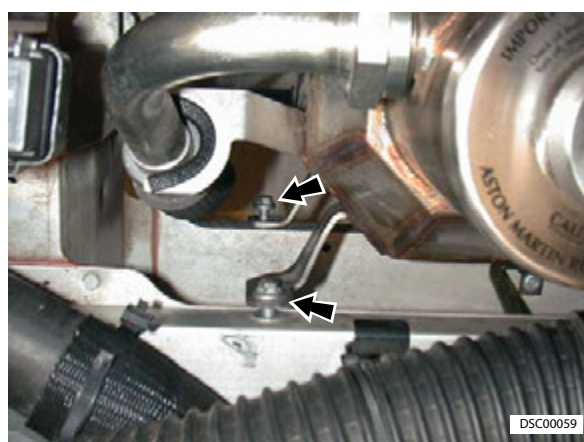


Figure 25

23. Connect breather hose to tank (quickfit) (refer to Figure 26).
26).



Figure 26

24. Connect oil pipes to tank (x3) (refer to Figure 27).



Figure 27

25. Fill tank with approximately amount of displaced oil and replace cap.

A/C Install

26. Fit new O-rings to A/C pipes (lubricate).



Figure 28

28. Install bolt (x1) HP pipe to bracket (refer to Figure 29).



Figure 29

29. Install bolts (x2) LP pipe to body P-clips (refer to Figure 30).



Figure 30

30. Connect compressor clutch multiplug.

31. Recharge refrigerant (refer to Workshop Manual procedure 12.03.FA Refrigerant Gas - Recover/Recharge - Renew).

Steering Install

32. Connect steering column link to steering rack (bolt x1) (refer to Figure 31).

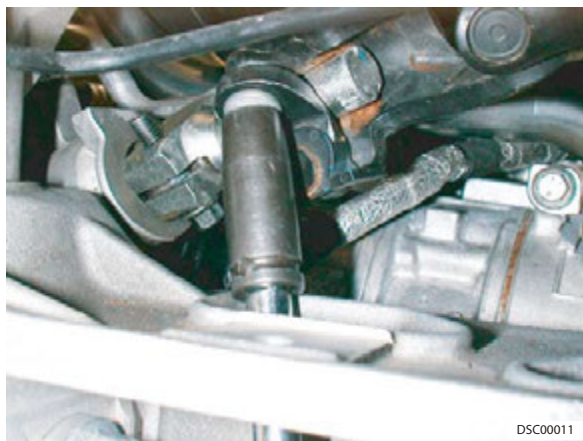


Figure 31

Electrical Install

33. Feed harness into inner wing area (refer to Figure 32).



Figure 32

34. Install fusebox to bracket.
35. Install earth lead to fusebox.
36. Install battery lead to fusebox (1x nut and rubber cover).

37. Install multiplugs to fuse box (refer to Figure 33).



Figure 33

38. Install fusebox bracket fixings (refer to Figure 34).



Figure 34

39. Install ECM and connect multiplugs to ECM (through cover plate) (refer to Figure 35).



Figure 35

40. Secure ECM and cover plate with bolts (x3) (refer to Figure 36).



Figure 36

45. Feed harness to inside of vehicle install grommet to body (refer to Figure 38).



Figure 38

41. Reclip ECM harness.

42. Reclip repeater light and screen wash system harness.

43. Connect repeater light multiplug.

44. Install starter cable to floor stud (nut x1) (refer to Figure 37).



Figure 37

46. Position harness to body and install clips (x11).

47. Connect multiplugs (x4) from inside of vehicle RH side of I.P. (refer to Figure 39).



Figure 39

48. Install earth wires to terminals (nuts x13).

49. Connect multiplugs (x3) RH side of engine bay (refer to Figure 40).



Figure 40

Purge Install

50. Connect purge pipe to purge valve.
51. Install bottom screws (x2) and tighten top screw of washer bottle.
52. Move pipe into position and install pipe to support clips (x2).

Fuel Install

53. Install fuel hose to rail (clip x1).

Clutch Pipe Install

54. Install clutch metal pipe from flexible.
55. Install flexible hose grommet to support bracket.
56. Bleed clutch.

Suspension Install

57. Install front springs and dampers. (refer to Workshop Manual procedure 04.03.AA Spring and Damper Assembly - Front Pair - Renew).
58. Install RH wheel arch liner (refer to Workshop Manual procedure 01.02.GB Wheel Arch Liner - Front - RH - Renew)
59. Install LH wheel arch liner (refer to Workshop Manual procedure 01.02.FB Wheel Arch Liner - Front - LH - Renew).
60. Install bottom arms (nut and bolt x4) with uprights and top arm.
61. Install level sensor link to bottom arm (nut x1).
62. Connect level sensor multiplug.
63. Connect track rod ends (nut x2).
64. Install anti-roll bar to links (nuts x2).
65. Install brake discs.
66. Install brake callipers.
67. Install road wheel/s

Throttle Duct Install

68. Connect breather pipe quickfits (x2) from air cleaner duct (refer to Figure 41).



Figure 41

69. Install throttle body duct (refer to Figure 42).



Figure 42

General Install

70. Remove strap - vehicle to ramp (front).
71. Lower vehicle on ramp.
72. Connect vehicle battery.
73. Top-up PAS fluid.
74. 4 wheel alignment check/adjust (refer to Workshop Manual procedure 04.00.AD 4 Wheel Alignment - Check and Adjust).
75. Install transmission (refer to Workshop Manual procedure 07.03.AA Transaxle Assembly - Manual - Remove for Access and Refit).
76. Use handbook procedure to check oil level.



ASTON MARTIN

Engine (03.00)

Engine Structure (03.01)

Description

Engine Block

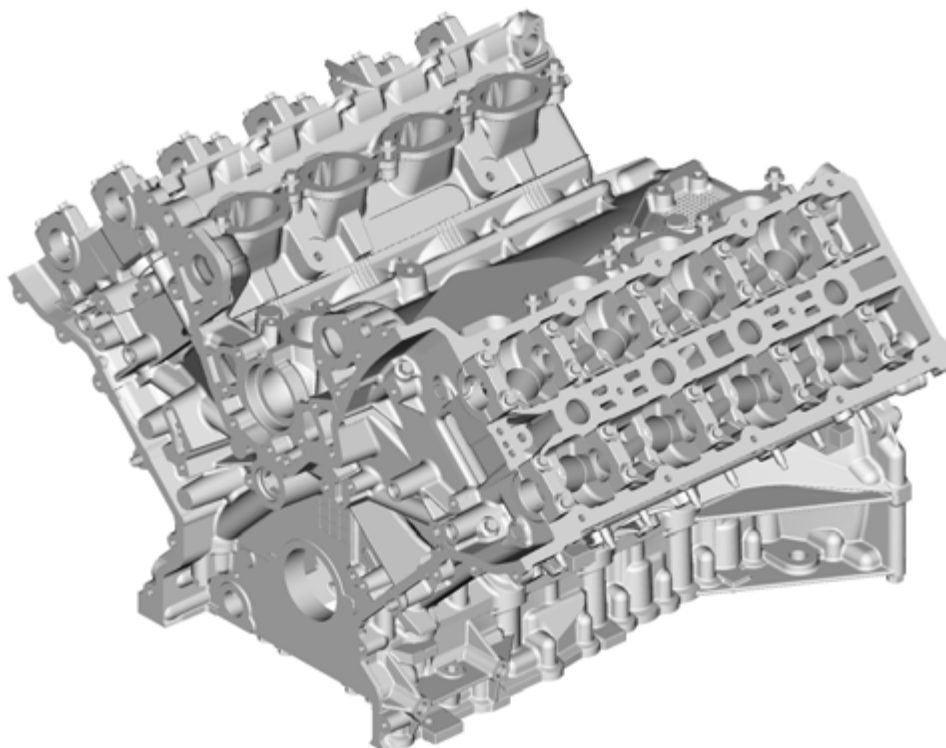


Figure 1 - Engine Block

The 4.3 and 4.7 litre engines have an eight cylinder 90 degree 'Enclosed V' configuration liquid cooled aluminium cylinder block with dry cast liners.

When you sit in the driving position, the right-hand cylinder bank is designated A-bank and the left-hand cylinder bank as B-bank. The cylinders are numbered as shown in Figure 2.

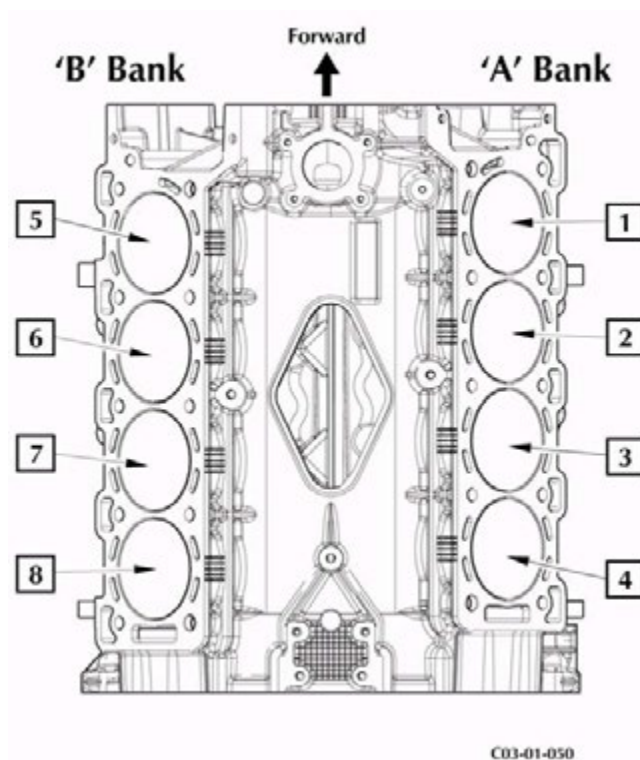


Figure 2 - Cylinder Numbers

Cylinder Block Drain Plug

The coolant drain plug is on the rear left side of the cylinder block.

On vehicles that have a cold climate package (for example: vehicles that operate in conditions regularly below -30°C) a cylinder block heater unit is installed instead of the drain plug (Refer to Figure 3).

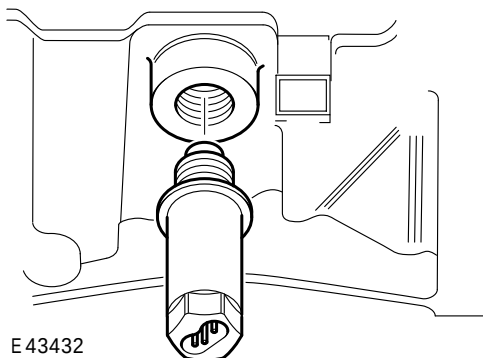


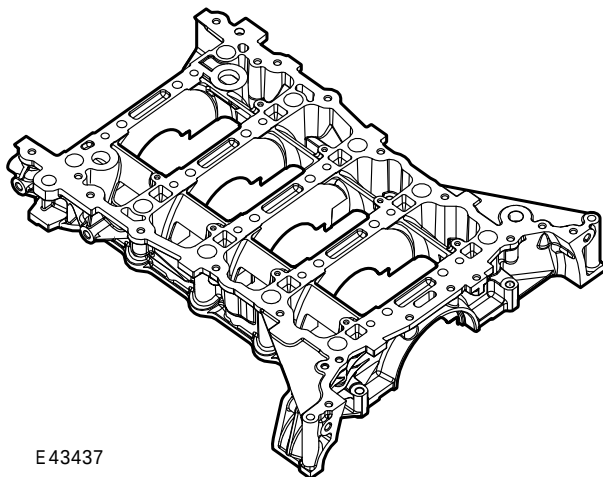
Figure 3 - Cylinder Block Heater

Knock Sensors

Two knock sensors (1) are installed into the cylinder block on the inboard side of each of the two cylinder banks. The electrical connector of each sensor is secured to the left-hand engine cover bracket (Refer to Figure 4).

These piezo-electric sensors send inputs to the ECM to indicate the detection and location of detonation during combustion.

Bedplate



E43437

This is a structural casting that is attached with bolts to the bottom of the cylinder block to attach the crankshaft and to further improve overall rigidity.

Main bearing clearance changes due to expansion are minimized by means of iron inserts cast into the bedplate main bearing supports.

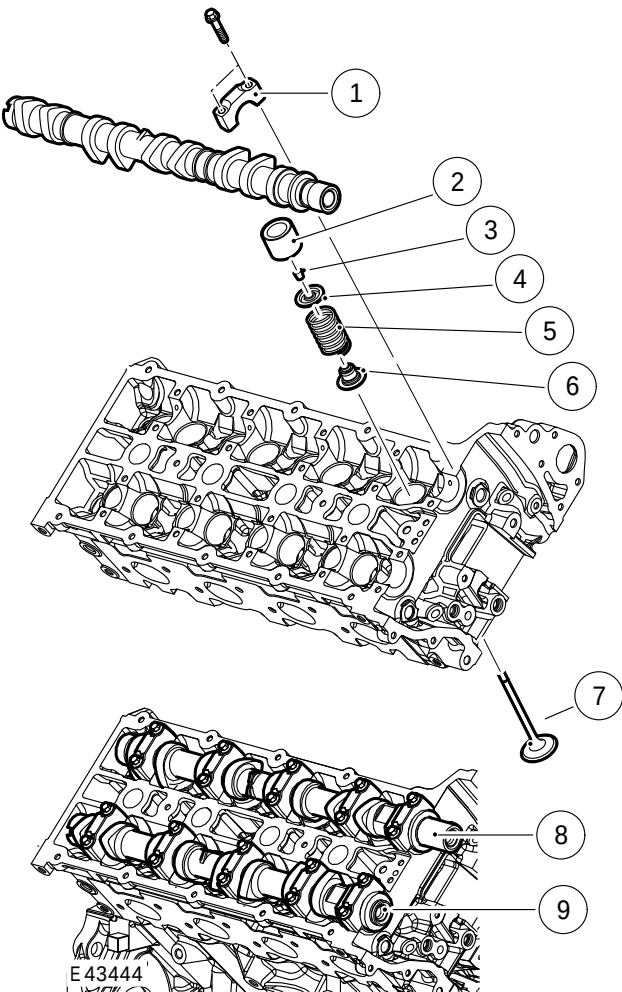
Two hollow dowels align the bedplate with the cylinder block and the joint is sealed by a continuous bead of sealant.

Engine Mountings

The engine is mounted at two points. At the front, on each side of the engine, there is a mounting bracket with a Hydramount mounted to the subframe.



Cylinder Heads



Item	Description	Item	Description
1.	Camshaft bearing cap	5.	Valve stem oil seal
2.	Tappet (No Shim)	6.	Valve
3.	Collet	7.	Inlet camshaft
4.	Valve spring cap	8.	Exhaust camshaft
	Valve spring		

The cylinder heads are unique to each cylinder bank and are attached with deep seated bolts, to the cylinder block. Two hollow dowels align each cylinder head with the cylinder block.

Each cylinder head gasket has a silicon beaded composite gasket with metal eyelets for the cylinder bores.

There are two overhead camshafts that operate four valves each cylinder with solid aluminium-alloy valve lifters. A steel shim in the top of each lifter gives adjustment of the valve clearances.

Collets, valve collars and spring seats locate the valve springs on the intake and exhaust valves. Valve stem seals are part of the spring seats.

Four 14mm diameter spark plugs are installed in recesses on the center-line of each cylinder head.

Inlet/Exhaust Manifolds

Intake air is filtered and passed through Mass Air Flow (MAF) meters. The air then passes through the throttle body into the eight-branch inlet manifold.

Specifications

Torque Figures				
Description			Nm.	lb/ft
Cylinder head	All	1.	20	15
	All	2.	35	26
	Bolts 1 to 10	3.	90°	
	Bolts 1 to 10	4.	90°	
	Bolts 11 and 12	5.	25	18

Torque Figures

Description	Nm.	lb/ft
EGR pipe and exhaust manifold flanges.	25	18
Camshaft position (CMP) sensor	7	5

Clearance Figures

Exhaust valve	0.23mm - 0.27mm
Inlet Valve clearance	0.18mm - 0.22mm

Maintenance**Upper Intake Manifold Assembly (LHD) - Renew**

Repair Operation Time (ROT)	
Item	Code
Upper Intake Manifold Assembly-Renew	LHD 03.01.BA

Removal

1. Depressurise fuel rail (see Workshop Manual procedure 10.01.EK Fuel System - Depressurise).
2. Coolant drain (see Workshop Manual procedure 03.03.AD Coolant - Drain and Refill).
3. Remove cross brace (bolts x4).

Removal RH Side

4. Remove coil cover.
5. Disconnect breather hose (quick fit) move aside.
6. Release harness fir tree clips (x3) from cylinder head and move aside.
7. Remove fuse box bracket fixings (bolt and nut) (allows movement).
8. Remove ECM (see Workshop Manual procedure 03.14.BB Engine Control Module - RH - Renew).
9. Remove battery lead (1x nut and rubber cover) from fuse box (2x leads).
10. Remove multiplugs (x10) from fusebox.
11. Remove earth terminal (x1 nut and rubber cover) from fusebox.
12. Remove fuse box from bracket (bolt x2).
13. Release harness fir tree clips (x3) from engine bracket.
14. Feed harness from inner wing and over engine.
15. Remove purge pipe P-clip (bolt x1) and move pipe aside.
16. Remove harness bracket from engine (bolts x2, nut x1).
17. Release fuel feed hose from rail (clip x1) and move aside.
18. Disconnect heater hose from pipe (quick fit).
19. Release heater hose (clips x2) and EGR vacuum line (clips x2) from bracket.
20. Release harness from coolant pipe bracket (fir tree x3).
21. Disconnect EGR (x1), fuel rail pressure sensor (x1) and injector (x4) multiplugs, move harness aside.

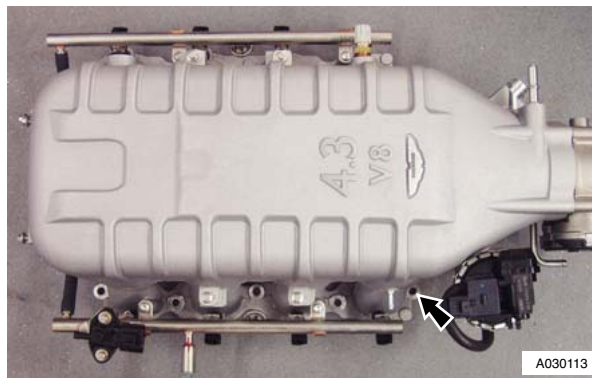
22. Remove coolant pipe bracket (nuts x2 and bolts x2).
23. Disconnect EGR vacuum pipe from sensor and manifold, move aside.

Removal LH Side

24. Remove corner cross brace.
25. Remove coil cover.
26. Disconnect breather hoses from cam cover (x2) for access.
27. Disconnect purge line from manifold (quickfit) and support clip for access.
28. Disconnect heater hose from pipe (quick fit).
29. Release heater hose (x2) and throttle body hose (x2) from support bracket.
30. Remove booster hose from manifold and support clip.
31. Remove harness support bracket (bolt x1, nut x2) release harness clips (fir tree x3).
32. Release pipe support bracket (nuts x2, bolts x2) move aside.
33. Disconnect injector multiplugs (x4).
34. Unclip injector harness from cam cover (x2).
35. Disconnect IAT multiplug.
36. Disconnect breather hose from manifold (quickfit).

Removal Manifold from Vehicle

37. Disconnect manifold heating hoses (x2).
38. Disconnect throttle body multiplug and harness clip.
39. Disconnect breather pipe quickfits (x2) from air cleaner duct.
40. Disconnect air cleaner duct (clip x1).
41. Disconnect EGR vacuum hose.
42. Disconnect EGR pipe union and tie aside.
43. Remove manifold bolts (x 10) (see Figure 1).

**Figure 1**

44. Remove bolts (x2) bracket to manifold (rear).
45. Move manifold (2x people) forward, remove bolt for purge line P-clip, remove manifold.
46. Remove gaskets and clean mating faces.



Removal Manifold Parts

47. Remove EGR valve (bolts x2) and gasket.
48. Remove IAT sensor.
49. Remove throttle body (bolts x4) and gasket.
50. Remove fuel rail (bolts x4) with injectors.

Installation

1. Install fuel rail (bolts x4) with injectors. (fit new O-rings to injectors).
2. Install throttle body (bolts x4) and new gasket.
3. Install IAT sensor.
4. Install EGR valve and new gasket.

Installation Manifold to Vehicle

5. Install new gaskets to cylinder block (glue in place).
6. Install manifold (allowing access to install bolt for purge line P-clip).
7. Install manifold bolts (x10) (torque and tightening sequence).
8. Install bolts (x2) bracket to manifold (rear).
9. Connect EGR pipe union.
10. Connect EGR vacuum hose.
11. Connect air cleaner duct (clip x1).
12. Connect breather pipe quickfits (x2) to air cleaner duct.
13. Connect throttle body multiplug and harness clip.
14. Connect manifold heating hoses (x2).

Installation RH Side

15. Connect EGR vacuum pipe to sensor and manifold.
 16. Install coolant pipe bracket (bolt x2, nut x2).
 17. Connect EGR (x1), fuel rail pressure sensor (x1) and injector multiplugs (x4).
 18. Refit harness to coolant pipe bracket (fir tree x3).
 19. Connect heater hose to pipe (quick fit).
 20. Refit heater hose (clip x2) and EGR vacuum lines (clips x2) to bracket.
 21. Install fuel feed pipe.
 22. Install purge pipe P-clip.
 23. Install harness bracket to engine.
 24. Feed harness into inner wing area.
 25. Install fusebox to bracket.
 26. Install earth lead to fusebox.
 27. Install battery lead to fusebox (1x nut and rubber cover).
 28. Install multiplugs to fuse box.
 29. Install fusebox bracket fixings.
 30. Refit harness fir tree clips to cylinder head.
 31. Refit engine breather hose.
 32. Install VVT solenoid multiplug, position coil and CMP harness (1x edge clip).
 33. Install ECM (see Workshop Manual procedure 03.14.BB Engine Control Module - RH - Renew).
 34. Install coil cover.
- ### Installation LH Side
35. Connect breather hose to manifold (quickfit).

36. Connect IAT multiplug.
37. Unclip injector harness from cam cover (x2).
38. Connect injector multiplugs (x4).
39. Install pipe support bracket (nuts x2, bolts x2).
40. Install harness support bracket (bolt x1, nut x2) release harness clips (fir tree x3).
41. Connect booster hose to manifold and support clip.
42. Connect heater hose from pipe (quick fit).
43. Install heater hose (x2) and throttle body hose (x2) from support bracket.
44. Connect purge line to manifold and into support clip.
45. Connect breather hoses (x2) to cam cover.
46. Install coil cover.
47. Install corner cross brace (torque bolts with vehicle on level ground).

Note: The installation is not handed

48. Refill coolant (see Workshop Manual procedure 03.03.AD Coolant - Drain and Refill).
49. Install cross brace. (torque bolts with vehicle on level ground).

Upper Intake Manifold Assembly (RHD) - Renew

Repair Operation Time (ROT)	
Item	Code
Upper Intake Manifold Assembly-Renew	RHD 03.01.BE

Removal

1. Depressurise fuel rail (see Workshop Manual procedure 10.01.EK Fuel System - Depressurise).
2. Coolant drain (see Workshop Manual procedure 03.03.AD Coolant - Drain and Refill).
3. Remove cross brace (bolts x4).

Removal RH Side

4. Remove coil cover.
5. Remove corner cross brace.
6. Disconnect breather hose (quick fit) move aside.
7. Remove purge pipe P-clip (bolt x1) and move pipe aside.
8. Remove harness bracket from engine (bolts x2, nut x1).
9. Release fuel feed hose from rail (clip x1) and move aside.
10. Disconnect heater hose from pipe (quick fit).
11. Release heater hose (clips x2) and EGR vacuum line (clips x2) from bracket.
12. Release harness from coolant pipe bracket (fir tree x3).
13. Disconnect EGR (x1), fuel rail pressure sensor (x1) and injector (x4) multiplugs, move harness aside.
14. Remove coolant pipe bracket (nuts x2 and bolts x2).
15. Disconnect EGR vacuum pipe from sensor and manifold, move aside.

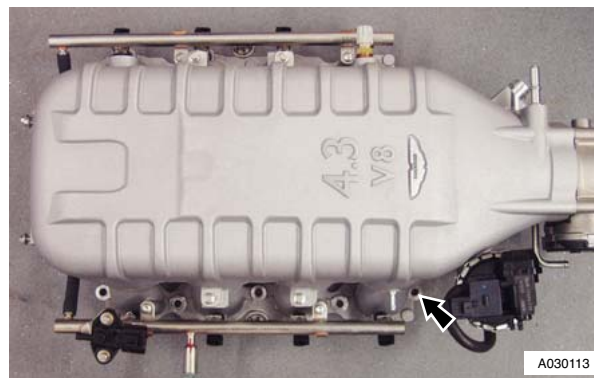
Removal LH Side

16. Remove coil cover.
17. Disconnect breather hoses from cam cover (x2) for access.
18. Release harness fir tree clips (x3) from cylinder head and move aside.
19. Remove fuse box bracket fixings (bolt and nut) (allows movement).
20. Remove ECM (see Workshop Manual procedure 03.13.ND Module - Power Train Control - RHD - Renew).
21. Remove battery lead (1x nut and rubber cover) from fuse box (2x leads).
22. Remove multiplugs (x10) from fusebox.
23. Disconnect purge line from manifold (quickfit) and support clip for access.
24. Remove earth terminal (1x nut and rubber cover) from fusebox.
25. Remove fuse box from bracket (bolt x2).
26. Release harness fir tree clips (x3) from engine bracket.
27. Feed harness from inner wing and over engine.
28. Disconnect heater hose from pipe (quick fit).
29. Release heater hose (x2) and throttle body hose (x2) from support bracket.
30. Remove booster hose from manifold and support clip.
31. Remove harness support bracket (bolt x1, nut x2) release harness clips (fir tree x3).
32. Release pipe support bracket (nuts x2, bolts x2) move aside.
33. Disconnect injector multiplugs (x4).
34. Unclip injector harness from cam cover (x2).
35. Disconnect IAT multiplug.
36. Disconnect breather hose from manifold (quickfit).

Removal Manifold from Vehicle

37. Remove booster hose from support bracket.
38. Disconnect manifold heating hoses (x2).
39. Disconnect throttle body multiplug and harness clip.
40. Disconnect breather pipe quickfits (x2) from air cleaner duct.
41. Disconnect air cleaner duct (clip x1).
42. Disconnect EGR vacuum hose.
43. Disconnect EGR pipe union and tie aside.

44. Remove manifold bolts (x 10) (see Figure 1)

**Figure 1**

45. Remove bolts (x2) bracket to manifold (rear).
46. Move manifold (2x people) forward, remove bolt for purge line P-clip, remove manifold.
47. Remove gaskets and clean mating faces.
48. Removal Manifold Parts
49. Remove EGR valve (bolts x2) and gasket.
50. Remove IAT sensor.
51. Remove throttle body (bolts x4) and gasket.
52. Remove fuel rail (bolts x4) with injectors.

Installation

1. Install fuel rail (bolts x4) with injectors. (fit new O-rings to injectors).
2. Install throttle body (bolts x4) and new gasket.
3. Install IAT sensor.
4. Install EGR valve and new gasket.
5. Installation Manifold to Vehicle
6. Install new gaskets to cylinder block (glue in place).
7. Install manifold (allowing access to install bolt for purge line P-clip).
8. Install manifold bolts (x10) (torque and tightening sequence).
9. Install bolts (x2) bracket to manifold (rear).
10. Connect EGR pipe union.
11. Connect EGR vacuum hose.
12. Connect air cleaner duct (clip x1).
13. Connect breather pipe quickfits (x2) to air cleaner duct.
14. Connect throttle body multiplug and harness clip.
15. Connect manifold heating hoses (x2).
16. Install booster hose to support bracket.

Installation RH Side

17. Connect EGR vacuum pipe to sensor and manifold.
18. Install coolant pipe bracket (bolt x2, nut x2).
19. Connect EGR (x1), fuel rail pressure sensor (x1) and injector multiplugs (x4).
20. Refit harness to coolant pipe bracket (fir tree x3).
21. Connect heater hose to pipe (quick fit).
22. Refit heater hose (clip x2) and EGR vacuum lines (clips x2) to bracket.



23. Install fuel feed pipe.
24. Install purge pipe P-clip.
25. Install harness bracket to engine.
26. Refit harness fir tree clips to cylinder head.
27. Refit engine breather hose.
28. Install VVT solenoid multiplug, position coil and CMP harness (1x edge clip).
29. Install corner cross brace (torque bolts with vehicle on level ground).
30. Install coil cover.

Installation LH Side

31. Connect breather hose to manifold (quickfit).
32. Connect IAT multiplug.
33. Install injector harness to cam cover (x2).
34. Connect injector multiplugs (x4).
35. Install pipe support bracket (nuts x2, bolts x2).
36. Install harness support bracket (bolt x1, nut x2) release harness clips (fir tree x3).
37. Connect booster hose to manifold and support clip.
38. Connect heater hose from pipe (quick fit).
39. Install heater hose (x2) and throttle body hose (x2) from support bracket.
40. Connect purge line to manifold and into support clip.
41. Connect breather hoses (x2) to cam cover.
42. Feed harness into inner wing area.
43. Install fusebox to bracket.
44. Install earth lead to fusebox.
45. Install battery lead to fusebox (1x nut and rubber cover).
46. Install multiplugs to fuse box.
47. Install fusebox bracket fixings.
48. Install ECM (see Workshop Manual procedure 03.13.ND Module - Power Train Control - RHD - Renew).
49. Install coil cover.
50. Refill coolant (see Workshop Manual procedure 03.03.AD Coolant - Drain and Refill).
51. Install cross brace. (torque bolts with vehicle on level ground).

Upper Intake Manifold Assembly Gasket (LHD) - Renew

Repair Operation Time (ROT)	
Item	Code
Upper Intake Manifold Assembly Gasket-Renew	LHD 03.01.BB

Removal

1. Depressurise fuel rail (see Workshop Manual procedure 10.01.EK Fuel System - Depressurise).
Note: The removal is not handed
2. Coolant drain (see Workshop Manual procedure 03.03.AD Coolant - Drain and Refill).

3. Remove cross brace (bolts x4).

Removal R/H Side

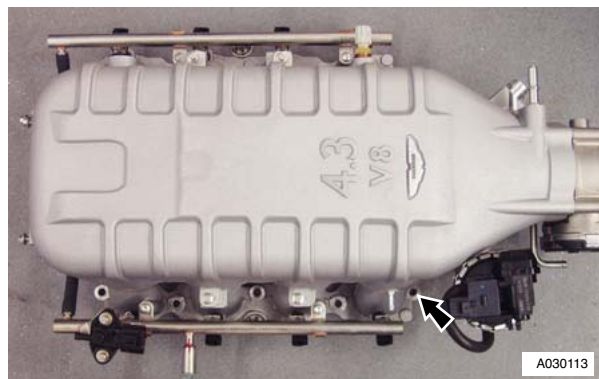
4. Remove coil cover.
5. Disconnect breather hose (quick fit) move aside.
6. Release (alt/inj) harness fir tree clips (x3) from cylinder head and move aside.
7. Remove fuse box bracket fixings (bolt and nut) (allows movement).
8. Remove ECM (see Workshop Manual procedure 03.13.NC Module - Power Train Control - Renew).
9. Remove battery lead (x1 nut and rubber cover) from fuse box (2x leads).
10. Remove multiplugs (x10) from fusebox.
11. Remove earth terminal (1x nut and rubber cover) from fusebox.
12. Remove fuse box from bracket (bolt x2).
13. Release harness fir tree clips (x3) from engine bracket.
14. Feed harness from inner wing and over engine to gain access to cam cover.
15. Remove purge pipe P-clip (bolt x1) and move pipe aside.
16. Remove harness bracket from engine (bolts x2, nut x1).
17. Release fuel feed hose from rail (clip x1) and move aside.
18. Disconnect heater hose from pipe (quick fit).
19. Release heater hose (clips x2) and EGR vacuum line (clips x2) from bracket.
20. Release (inj/alt) harness from coolant pipe bracket (fir tree x3).
21. Disconnect EGR (x1), fuel rail pressure sensor (x1) and injector multiplugs (x4), move harness aside.
22. Remove coolant pipe bracket (nuts x2 and bolts x2).
23. Disconnect EGR vacuum pipe from sensor and manifold, move aside.

Removal L/H Side

24. Remove corner cross brace.
25. Remove coil cover.
26. Disconnect breather hoses from cam cover (x2) for access.
27. Disconnect purge line from manifold (quickfit) and support clip for access.
28. Disconnect heater hose from pipe (quick fit).
29. Release heater hose (x2) and throttle body hose (x2) from support bracket.
30. Remove booster hose from manifold and support clip.
31. Remove harness support bracket (bolt x1, nut x2) release harness clips (fir tree x3).
32. Release pipe support bracket (nuts x2, bolts x2) move aside.
33. Disconnect injector multiplugs (x4).
34. Unclip injector harness from cam cover (x2).
35. Disconnect IAT multiplug.
36. Disconnect breather hose from manifold (quickfit).

Removal Manifold

37. Disconnect manifold heating hoses (x2).
38. Disconnect throttle body multiplug and harness clip.
39. Disconnect breather pipe quickfits (x2) from air cleaner duct.
40. Disconnect air cleaner duct (clip x1).
41. Disconnect EGR vacuum hose.
42. Disconnect EGR pipe union and tie aside.
43. Remove manifold bolts (x 10) (see Figure 1).

**Figure 1**

44. Remove bolts (x2) bracket to manifold (rear).
45. Move manifold (2x people) forward, remove bolt for purge line P-clip, remove manifold.
46. Remove gaskets and clean mating faces.

Installation**Manifold to Vehicle**

1. Install new gaskets to cylinder block (glue in place).
2. Install manifold (allowing access to install bolt for purge line P-clip).
3. Install manifold bolts (x10) (torque and tightening sequence).
4. Install bolts (x2) bracket to manifold (rear).
5. Connect EGR pipe union.
6. Connect EGR vacuum hose.
7. Connect air cleaner duct (clip x1).
8. Connect breather pipe quickfits (x2) to air cleaner duct.
9. Connect throttle body multiplug and harness clip.
10. Connect manifold heating hoses (x2).

Installation RH Side

11. Connect EGR vacuum pipe to sensor and manifold.
12. Install coolant pipe bracket (bolt x2, nut x2).
13. Connect EGR (x1), fuel rail pressure sensor (x1) and injector multiplugs (x4).
14. Refit (inj/alt) harness to coolant pipe bracket (fir tree x3).
15. Connect heater hose to pipe (quick fit).
16. Refit heater hose (clipx2) and EGR vacuum lines (clips x2) to bracket.
17. Install fuel feed pipe.
18. Install purge pipe P-clip.
19. Install harness bracket to engine.

20. Feed harness into inner wing area.
21. Install fusebox to bracket.
22. Install earth lead to fusebox.
23. Install battery lead to fusebox (1x nut and rubber cover).
24. Install multiplugs to fuse box.
25. Install fusebox bracket fixings.
26. Refit harness fir tree clips to cylinder head.
27. Refit engine breather hose.
28. Install VVT solenoid multiplug, position coil and CMP harness (1x edge clip).
29. Install ECM (see Workshop Manual procedure 03.13.NC Module - Power Train Control - Renew).
30. Install coil cover.

Installation LH Side

31. Connect breather hose to manifold (quickfit).
32. Connect IAT multiplug.
33. Unclip injector harness from cam cover (x2).
34. Connect injector multiplugs (x4).
35. Install pipe support bracket (nuts x2, bolts x2).
36. Install harness support bracket (bolt x1, nut x2) release harness clips (fir tree x3).
37. Connect booster hose to manifold and support clip.
38. Connect heater hose from pipe (quick fit).
39. Install heater hose (x2) and throttle body hose (x2) from support bracket.
40. Connect purge line to manifold and into support clip.
41. Connect breather hoses (x2) to cam cover.
42. Install coil cover.
43. Install corner cross brace (torque bolts with vehicle on level ground).

Note: The installation is not handed

44. Refill coolant (see Workshop Manual procedure 03.03.AD Coolant - Drain and Refill).
45. Install cross brace. (torque bolts with vehicle on level ground).

Upper Intake Manifold Assembly Gasket (RHD) - Renew

Repair Operation Time (ROT)		
Item	Code	
Upper Intake Manifold Assembly Gasket-Renew	RHD	03.01.BF

Removal

1. Depressurise fuel rail (see Workshop Manual procedure 10.01.EK Fuel System - Depressurise).
2. Coolant drain (see Workshop Manual procedure 03.03.AD Coolant - Drain and Refill).
3. Remove cross brace (bolts x4).

Removal RH Side

4. Remove coil cover.
5. Remove corner cross brace.

6. Disconnect breather hose (quick fit) move aside.
7. Remove purge pipe P-clip (bolt x1) and move pipe aside.
8. Remove harness bracket from engine (bolts x2, nut x1).
9. Release fuel feed hose from rail (clip x1) and move aside.
10. Disconnect heater hose from pipe (quick fit).
11. Release heater hose (clips x2) and EGR vacuum line (clips x2) from bracket.
12. Release harness from coolant pipe bracket (fir tree x3).
13. Disconnect EGR (x1), fuel rail pressure sensor (x1) and injector (x4) multiplugs, move harness aside.
14. Remove coolant pipe bracket (nuts x2 and bolts x2).
15. Disconnect EGR vacuum pipe from sensor and manifold, move aside.
40. Disconnect breather pipe quickfits (x2) from air cleaner duct.
41. Disconnect air cleaner duct (clip x1).
42. Disconnect EGR vacuum hose.
43. Disconnect EGR pipe union and tie aside.
44. Remove manifold bolts (x 10) (see Figure 1)

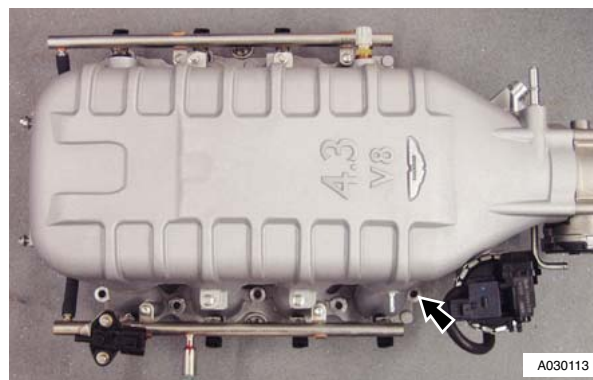


Figure 1

Removal LH Side

16. Remove coil cover.
17. Disconnect breather hoses from cam cover (x2) for access.
18. Release harness fir tree clips (x3) from cylinder head and move aside.
19. Remove fuse box bracket fixings (bolt and nut) (allows movement).
20. Remove ECM (see Workshop Manual procedure 03.13.ND Module - Power Train Control - RHD - Renew).
21. Remove battery lead (1x nut and rubber cover) from fuse box (2x leads).
22. Remove multiplugs (x10) from fusebox.
23. Disconnect purge line from manifold (quickfit) and support clip for access.
24. Remove earth terminal (1x nut and rubber cover) from fusebox.
25. Remove fuse box from bracket (bolt x2).
26. Release harness fir tree clips (x3) from engine bracket.
27. Feed harness from inner wing and over engine.
28. Disconnect heater hose from pipe (quick fit).
29. Release heater hose (x2) and throttle body hose (x2) from support bracket.
30. Remove booster hose from manifold and support clip.
31. Remove harness support bracket (bolt x1, nut x2) release harness clips (fir tree x3).
32. Release pipe support bracket (nuts x2, bolts x2) move aside.
33. Disconnect injector multiplugs (x4).
34. Unclip injector harness from cam cover (x2).
35. Disconnect IAT multiplug.
36. Disconnect breather hose from manifold (quickfit).

Removal Manifold from Vehicle

37. Remove booster hose from support bracket.
38. Disconnect manifold heating hoses (x2).
39. Disconnect throttle body multiplug and harness clip.

45. Remove bolts (x2) bracket to manifold (rear).
46. Move manifold (2x people) forward, remove bolt for purge line P-clip, remove manifold.
47. Remove gaskets and clean mating faces.

Installation

1. Install new gaskets to cylinder block (glue in place).
2. Install manifold (allowing access to install bolt for purge line P-clip).
3. Install manifold bolts (x10) (torque and tightening sequence).
4. Install bolts (x2) bracket to manifold (rear).
5. Connect EGR pipe union.
6. Connect EGR vacuum hose.
7. Connect air cleaner duct (clip x1).
8. Connect breather pipe quickfits (x2) to air cleaner duct.
9. Connect throttle body multiplug and harness clip.
10. Connect manifold heating hoses (x2).
11. Install booster hose to support bracket.

Installation RH Side

12. Connect EGR vacuum pipe to sensor and manifold.
13. Install coolant pipe bracket (bolt x2, nut x2).
14. Connect EGR (x1), fuel rail pressure sensor (x1) and injector multiplugs (x4).
15. Refit harness to coolant pipe bracket (fir tree x3).
16. Connect heater hose to pipe (quick fit).
17. Refit heater hose (clipx2) and EGR vacuum lines (clips x2) to bracket.
18. Install fuel feed pipe.
19. Install purge pipe P-clip.
20. Install harness bracket to engine.
21. Refit harness fir tree clips to cylinder head.
22. Refit engine breather hose.

23. Install VVT solenoid multiplug, position coil and CMP harness (1x edge clip).
24. Install corner cross brace (torque bolts with vehicle on level ground).
25. Install coil cover.

Installation LH Side

26. Connect breather hose to manifold (quickfit).
27. Connect IAT multiplug.
28. Install injector harness to cam cover (x2).
29. Connect injector multiplugs (x4).
30. Install pipe support bracket (nuts x2, bolts x2).
31. Install harness support bracket (bolt x1, nut x2) release harness clips (fir tree x3).
32. Connect booster hose to manifold and support clip.
33. Connect heater hose from pipe (quick fit).
34. Install heater hose (x2) and throttle body hose (x2) from support bracket.
35. Connect purge line to manifold and into support clip.
36. Connect breather hoses (x2) to cam cover.
37. Feed harness into inner wing area.
38. Install fusebox to bracket.
39. Install earth lead to fusebox.
40. Install battery lead to fusebox (1x nut and rubber cover).
41. Install multiplugs to fuse box.
42. Install fusebox bracket fixings.
43. Install ECM (see Workshop Manual procedure 03.13.ND Module - Power Train Control - RHD - Renew)
44. Install coil cover.
45. Refill coolant (see Workshop Manual procedure 03.03.AD Coolant - Drain and Refill).
46. Install cross brace. (torque bolts with vehicle on level ground).

Intake Manifold Assembly - Remove for Access and Refit (With Engine Removed)

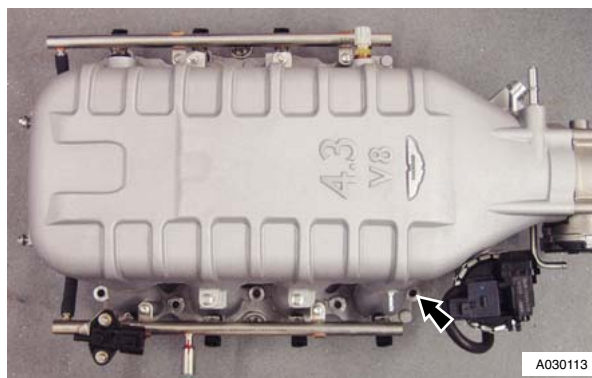
Repair Operation Time (ROT)	
Item	Code
Intake Manifold Assembly-Remove for access/Refit	03.01.DA

Removal

1. Remove RH coil cover.
2. Disconnect breather hose (quick fit).
3. Release alternator and injector harness fir tree clips (x3) from cylinder head.
4. Remove nut and bolts (x2) securing harness bracket to engine, remove bracket.
5. Release heater hose (clips x2) and EGR vacuum line (clips x2) from bracket.
6. Release alternator and injector harness fir tree clips (x3) from coolant pipe bracket.
7. Disconnect multiplugs from EGR valve, fuel rail pressure sensor and injectors (x4).
8. Remove nuts (x2) and bolts (x2) securing coolant pipe bracket, remove bracket.
9. Disconnect EGR vacuum pipe from sensor and manifold.
10. Remove LH coil cover.
11. Disconnect breather hoses (x2) from LH engine cover.
12. Disconnect purge line from manifold (quickfit) and support clip for access.
13. Disconnect heater hose from pipe (quick fit).
14. Release heater hose (x2) and throttle body hose (x2) from support bracket.
15. Remove bolt and nuts (x2) securing harness support bracket, release harness clips (fir tree x3). Remove bracket.
16. Remove nuts (x2) and bolts (x2) pipe support bracket.
17. Disconnect injector multiplugs (x4).
18. Release injector harness clips (x2) from LH engine cover.
19. Disconnect IAT multiplug.
20. Disconnect breather hose from manifold (quickfit).
21. Disconnect manifold heating hoses (x2).
22. Disconnect throttle body multiplug and harness clip.
23. Disconnect EGR vacuum hose.
24. Loosen and disconnect EGR pipe union from EGR valve.
25. Remove bolts (x2) securing EGR pipe to RH exhaust manifold, remove pipe, discard gasket.
26. Progressively loosen and remove bolts (x 10) securing intake manifold to cylinder heads (see Figure 1).
27. Carefully remove intake manifold from cylinder heads.
28. Remove and discard gaskets (x2).

Installation

1. Clean intake manifold and mating faces on cylinder heads.
2. Install new gaskets to cylinder block (glue in place).
3. Install intake manifold (allowing access to install bolt for purge line P-clip).
4. Install and torque tighten intake manifold bolts (x10) in the correct sequence.
5. Clean EGR pipe and mating face on exhaust manifold.

**Figure 1**

6. Install new gasket on exhaust manifold.
7. Install EGR pipe to exhaust manifold and EGR valve,.
8. Install EGR pipe to EGR valve, install pipe union. Do not torque tighten at this stage.
9. Install and torque tighten bolts (x2), EGR pipe to exhaust manifold. Torque tighten pipe union.
10. Connect EGR vacuum hose.
11. Connect throttle body multiplug and harness clip.
12. Connect manifold heating hoses (x2).
13. Connect EGR vacuum pipe to sensor and manifold.
14. Install coolant pipe bracket, install and torque tighten bolts (x2) and nuts (x2).
15. Connect multiplugs to EGR valve, fuel rail pressure sensor and injectors.
16. Install alternator and injector harness fir tree clips (x3) to coolant pipe bracket.
17. Install heater hose clips (x2) and EGR vacuum lines clips (x2) to bracket.
18. Install harness bracket to engine.
19. Refit harness fir tree clips to cylinder head.
20. Refit engine breather hose.
21. Install VVT solenoid multiplug, position coil and CMP harness (1x edge clip).
22. Install coil cover.
23. Connect breather hose to manifold (quickfit).
24. Connect IAT multiplug.
25. Secure injector harness clips (x2) to LH engine cover.
26. Connect injector multiplugs (x4).
27. Install pipe support bracket, install and tighten nuts (x2) and bolts(x2).
28. Install harness support bracket, install and tighten bolt (x1) and, nut (x1).
29. Install heater hoses (x2) and throttle body hoses (x2) in support bracket.
30. Connect breather hoses (x2) to engine cover.
31. Install coil cover.

4. Remove SAI pump and bracket assembly (see Workshop Manual procedure 03.08.DB/03.08.DJ Pump and Bracket Assembly - Secondary Air Injection - Renew).
5. Disconnect multiplugs (x2) from knock sensors.
6. Disconnect multiplug from camshaft timing sensor.
7. Remove RH/LH exhaust manifold (see Workshop Manual procedure 09.00.CC/09.00.CD Gasket - Exhaust Manifold - RH/LH - Renew).
8. Remove RH/LH intake camshaft (see Workshop Manual procedure 03.09.AT/03.09.AV Camshaft - Intake - RH/LH - Renew).
9. Remove RH exhaust camshaft bearing cap retaining bolts (x10) evenly and in stages (see Figure 1).

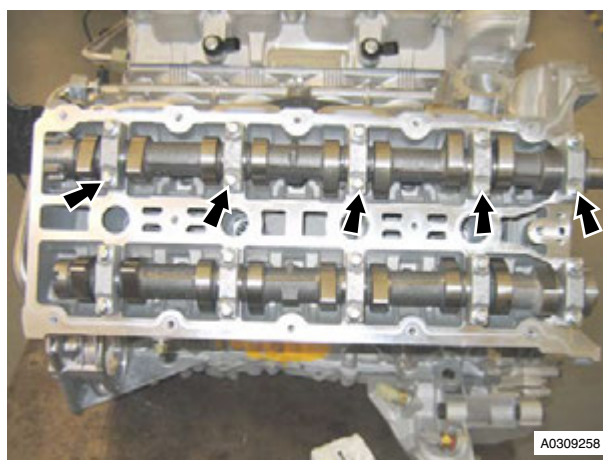


Figure 1

10. Note their orientation and markings and remove the RH exhaust camshaft bearing caps.
11. Remove RH exhaust camshaft (see Figure 2).



Figure 2

12. Remove bolts (x2) securing front end of RH cylinder head to cylinder block.

RH/LH Cylinder Head Gasket - Renew

Repair Operation Time (ROT)			
Item	Code		
Cylinder Head Gasket-Renew	RH-LHD	03.01.GU	
Cylinder Head Gasket-Renew	LH-LHD	03.01.GV	
Cylinder Head Gasket-Renew	RH-RHD	03.01.FU	
Cylinder Head Gasket-Renew	LH-RHD	03.01.FV	

Removal

1. Re-install front subframe to body, install and tighten bolts (x6), remove support trolley.
2. Install and tighten engine mounting nuts (x2).
3. With assistance, remove engine lifting beam (SPX M553D).

13. Remove bolts (x10), evenly and in stages securing RH cylinder head to cylinder block (see Figure 3).

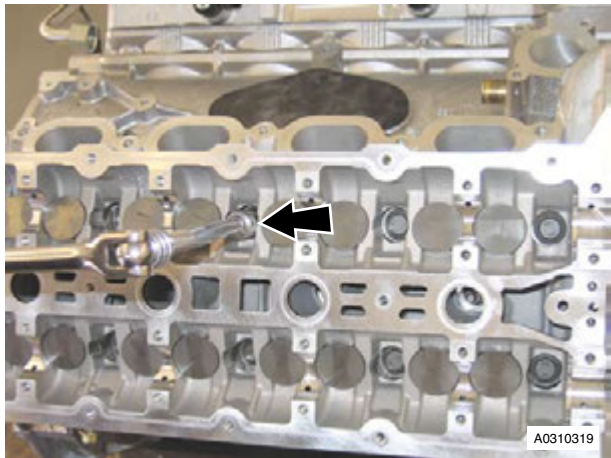


Figure 3

14. With assistance, remove RH cylinder head assembly.
15. Remove and discard cylinder head gasket.

Installation

1. Thoroughly clean RH cylinder head face and retaining bolt pockets.
2. Thoroughly clean RH cylinder block face.
3. Thoroughly clean and dry RH cylinder head retaining bolts.
4. Install new RH cylinder gasket, locate on dowels.
5. With assistance, install RH cylinder head, locate on dowels.
6. Install and torque tighten cylinder head bolts (x12) in the correct sequence.
7. Lubricate RH exhaust camshaft journals, camshaft lobes, bearing surfaces on cylinder head and bearing caps with clean engine oil.
8. Install RH exhaust camshaft, install bearing caps (x5) in their original positions.
9. Install bolts (x10) and torque tighten in the sequence specified.
10. Install sprocket retaining Torx bolt in camshaft.
11. Rotate camshaft accordingly and check each valve clearance using feeler gauges.
12. Remove sprocket retaining Torx bolt.
13. Install RH/LH intake camshaft (see Workshop Manual procedure 03.09.AT/03.09.AV Camshaft - Intake - RH/LH - Renew).
14. Install timing chain tensioning tool (303-532) into RH exhaust camshaft sprocket.
15. Apply a force to the tool (303-532) in an anti-clockwise direction and torque tighten RH sprocket Torx bolts. Remove special tool.
16. Connect multiplug to camshaft timing sensor.
17. Connect multiplugs (x2) to knock sensors.
18. Install SAI pump and bracket assembly (see Workshop Manual procedure 03.08.DB/03.08.DJ Pump and Bracket Assembly - Secondary Air Injection - Renew).

19. Install RH/LH exhaust manifold (see Workshop Manual procedure 09.00.CC/09.00.CD Gasket - Exhaust Manifold - RH/LH - Renew).
20. With assistance, position engine support beam (SPX M553D) and secure to engine.
21. Position trolley, support front subframe, remove bolts (x6), raise vehicle, remove trolley.
22. Install and torque tighten engine mounting nuts (x2).

RH/LH Cylinder Head - Overhaul

Repair Operation Time (ROT)		
Item	Code	
Cylinder Head-Overhaul	RH-LHD	03.01.GX
Cylinder Head-Overhaul	LH-LHD	03.01.GY
Cylinder Head-Overhaul	RH-RHD	03.01.FX
Cylinder Head-Overhaul	LH-RHD	03.01.FY

1. Remove cylinder head gasket - RH (see Workshop Manual procedure 03.01.GU Gasket - Cylinder Head - RH - Renew).
2. Remove Torx screws (x2) securing EGR tube to cylinder head, remove tube.
3. Remove and discard gasket.
4. Remove bolt securing camshaft timing sensor to cylinder head, remove sensor.
5. Remove bolts (x2) securing knock sensors (x2) to cylinder head, remove sensors.
6. Remove spark plugs from cylinder head.
7. Remove selective tappet buckets, keep in their fitted order.
8. Position valve spring compressor, compress valve spring (see Figure 1).

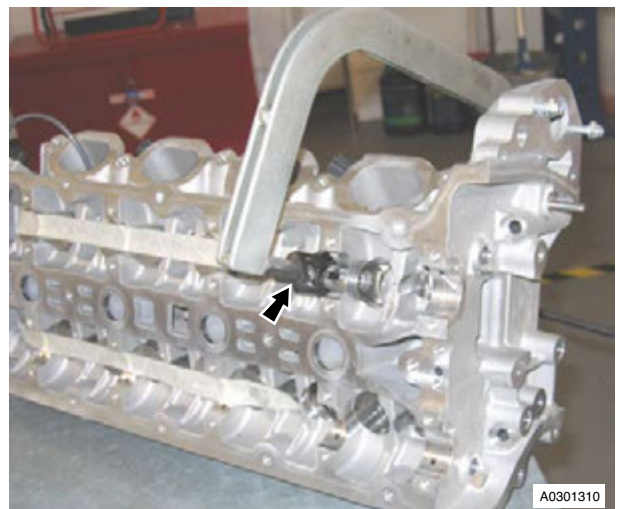


Figure 1

9. Remove collets (x2), release/remove spring compressor, collect collar and valve spring.
10. Remove valve from cylinder.
11. Remove valve stem oil seal.
12. Repeat procedure for remaining valve assemblies.
13. Keep valves and springs in their fitted order.



14. Inspect cylinder head face for warpage, across centre and from corner to corner.
15. Check condition and measure free length of valve springs.
16. Decarbonise combustion chambers and exhaust ports.
17. Measure valve stem diameters.
18. Use new valves and check valve guide clearance.

Installation

1. Clean cylinder head face and inlet/exhaust manifold faces. Use and air line to completely dry cylinder head surfaces.
2. Lubricate and install intake and exhaust valves (x16).
3. Install valve stem oil seals.
4. Install valve springs and collars.
5. Using valve spring compressor, compress valve spring, install collets.
6. Release/remove spring compressor.
7. Repeat procedure for remaining valve assemblies.
8. Install selective tappet buckets in their original fitted positions.
9. Lubricate intake camshaft bearings and journals with clean engine oil.
10. Install intake camshaft, install bearing caps (x5), install bolts (x10).
11. Torque tighten bearing cap bolts in the correct sequence.
12. Lubricate exhaust camshaft bearings and journals with clean engine oil.
13. Install exhaust camshaft, install bearing caps (x5), install bolts (x10).
14. Torque tighten bearing cap bolts in the correct sequence.
15. Install camshaft sprocket Torx bolts in intake and exhaust camshafts.
16. Rotate intake camshaft clockwise, check and log each valve clearance using feeler gauges.
17. Calculate the correct tappet bucket grade.
18. Repeat procedure for exhaust valve clearances.
19. Remove bearing cap bolts (x10), remove bearing caps (x5), remove intake camshaft.
20. Remove tappet buckets, install selected tappet buckets.
21. Repeat procedure for exhaust valve clearances.
22. Install intake camshaft, install bearing caps (x5), install bolts (x10).
23. Torque tighten bearing cap bolts in the correct sequence.
24. Rotate intake camshaft clockwise, re-check each valve clearance using feeler gauges.
25. Repeat procedure and re-check exhaust valve clearances.
26. Remove camshaft sprocket Torx bolts (x2).
27. Remove bearing cap bolts (x10), remove bearing caps (x5), remove intake camshaft.

28. Remove bearing cap bolts (x10), remove bearing caps (x5), remove exhaust camshaft.
29. Clean EGR tube.
30. Install new gasket, install EGR tube to cylinder head, install and torque tighten Torx screws (x2).
31. Clean Knock sensors (x2).
32. Install knock sensors (x2) to cylinder head, install and torque tighten bolts (x2).
33. Clean camshaft timing sensor.
34. Install camshaft timing sensor, install and torque tighten bolt.
35. Install spark plugs.
36. Install cylinder head gasket RH (see Workshop Manual procedure 03.01.GU Gasket - Cylinder Head - RH - Renew).

Cylinder Head (Engine Set) - Overhaul

Repair Operation Time (ROT)		
Item		Code
Cylinder Head (Engine Set)-Overhaul	LHD	03.01.GZ
Cylinder Head (Engine Set)-Overhaul	RHD	03.01.FZ

Removal

1. Remove cylinder head gaskets - engine set (see Workshop Manual procedure 03.10.AL Gasket - Cylinder Head - Engine Set - Renew).
2. Remove Torx screws (x4) securing EGR tubes to cylinder heads, remove tubes.
3. Remove and discard gaskets.
4. Remove bolts (x2) securing camshaft timing sensors to cylinder heads, remove sensors.
5. Remove bolts (x4) securing knock sensors (x4) to cylinder heads, remove sensors.
6. Remove spark plugs from cylinder heads (x8).
7. Remove selective tappet buckets, keep in their fitted order.
8. Position valve spring compressor, compress valve springs.
9. Remove collets, release/remove spring compressor, collect collars and valve springs.
10. Remove valves from cylinder heads.
11. Remove valve stem oil seals.
12. Keep valves and springs in their fitted order.
13. Inspect cylinder head face for warpage, across centre and from corner to corner.
14. Check condition and measure free length of valve springs.
15. Decarbonise combustion chambers and exhaust ports.
16. Use new valves and check valve guide clearances.

Installation

1. Clean cylinder head face and inlet/exhaust manifold faces. Use and air line to completely dry cylinder head surfaces.

2. Lubricate and install intake and exhaust valves (x16).
3. Install valve stem oil seals.
4. Install valve springs and collars.
5. Using valve spring compressor, compress valve spring, install collets.
6. Release/remove spring compressor.
7. Install selective tappet buckets in their original fitted positions.
8. Lubricate intake and exhaust camshaft bearings and journals with clean engine oil.
9. Install intake and exhaust camshafts, install bearing caps (x20), install bolts (x40).
10. Torque tighten bearing cap bolts in the correct sequence.
11. Install camshaft sprocket Torx bolts in intake and exhaust camshafts.
12. Rotate intake camshaft clockwise, check and log each valve clearance using feeler gauges.
13. Calculate the correct tappet bucket grade.
14. Remove bearing cap bolts (x40), remove bearing caps (x20), remove intake and exhaust camshafts.
15. Remove tappet buckets, install selected tappet buckets.
16. Install intake and exhaust camshafts, install bearing caps (x20), install bolts (x40).
17. Torque tighten bearing cap bolts in the correct sequence.
18. Rotate intake and exhaust camshafts clockwise, re-check each valve clearance using feeler gauges.
19. Remove camshaft sprocket Torx bolts (x4).
20. Remove bearing cap bolts (x40), remove bearing caps (x20), remove intake and exhaust camshafts.
21. Clean EGR tubes.
22. Install new gaskets, install EGR tubes to cylinder heads, install and torque tighten Torx screws (x4).
23. Clean Knock sensors (x4).
24. Install knock sensors (x4) to cylinder head, install and torque tighten bolts (x4).
25. Clean camshaft timing sensors.
26. Install camshaft timing sensor, install and torque tighten bolt.
27. Install spark plugs.
28. Install cylinder head gaskets - engine set (see Workshop Manual procedure 03.10.AL Gasket - Cylinder Head - Engine Set - Renew).

Valve Set (Engine Set) - Renew (including de-coke)

Repair Operation Time (ROT)	
Item	Code
Valve Set (Engine Set)-Renew	LHD 03.01.HA
Valve Set (Engine Set)-Renew	RHD 03.01.JA

Removal

1. Remove cylinder head gaskets - engine set (see Workshop Manual procedure 03.10.AL Gasket - Cylinder Head - Engine Set - Renew).
2. Remove spark plugs (x8).
3. Remove selective tappet buckets, keep in their fitted order.
4. Position valve spring compressor, compress valve spring.
5. Remove collets, release/remove spring compressor, collect collar and valve spring.
6. Remove valves from cylinder.
7. Remove valve stem oil seals.
8. Keep valves and springs in their fitted order.
9. Inspect cylinder head face for warpage, across centre and from corner to corner.
10. Check condition and measure free length of valve springs.
11. Decarbonise combustion chambers and exhaust ports.
12. Use new valves and check valve guide clearances.

Installation

1. Clean cylinder head face and inlet/exhaust manifold faces. Use an air line to completely dry cylinder head surfaces.
2. Lubricate and install intake and exhaust valves (x32).
3. Install valve stem oil seals.
4. Install valve springs and collars.
5. Using valve spring compressor, compress valve spring, install collets.
6. Release/remove spring compressor.
7. Install selective tappet buckets in their original fitted positions.
8. Lubricate intake and exhaust camshaft bearings and journals with clean engine oil.
9. Install intake and exhaust camshafts, install bearing caps (x20), install bolts (x40).
10. Torque tighten bearing cap bolts in the correct sequence.
11. Install camshaft sprocket Torx bolts in intake and exhaust camshafts.
12. Rotate intake camshaft clockwise, check and log each valve clearance using feeler gauges.
13. Calculate the correct tappet bucket grade.
14. Remove bearing cap bolts (x40), remove bearing caps (x20), remove intake and exhaust camshafts.
15. Remove tappet buckets, install selected tappet buckets.
16. Install intake and exhaust camshafts, install bearing caps (x20), install bolts (x40).
17. Torque tighten bearing cap bolts in the correct sequence.
18. Rotate intake and exhaust camshafts clockwise, re-check each valve clearance using feeler gauges.
19. Remove camshaft sprocket Torx bolts (x4).

20. Remove bearing cap bolts (x40), remove bearing caps (x20), remove intake and exhaust camshafts.
21. Install spark plugs.
22. Install cylinder head gaskets - engine set (see Workshop Manual procedure 03.10.AL Gasket - Cylinder Head - Engine Set - Renew).

Inlet Valve (Set) - Renew

Repair Operation Time (ROT)	
Item	Code
Inlet Valve (Set)-Renew	LHD 03.01.HB
Inlet Valve (Set)-Renew	RHD 03.01.JB

Removal

1. Remove cylinder head gaskets - engine set (see Workshop Manual procedure 03.10.AL Gasket - Cylinder Head - Engine Set - Renew).
2. Remove spark plugs from cylinder head.
3. Remove intake selective tappet buckets from cylinder heads, keep in their fitted order.
4. Position valve spring compressor, compress valve springs (see Figure 1).

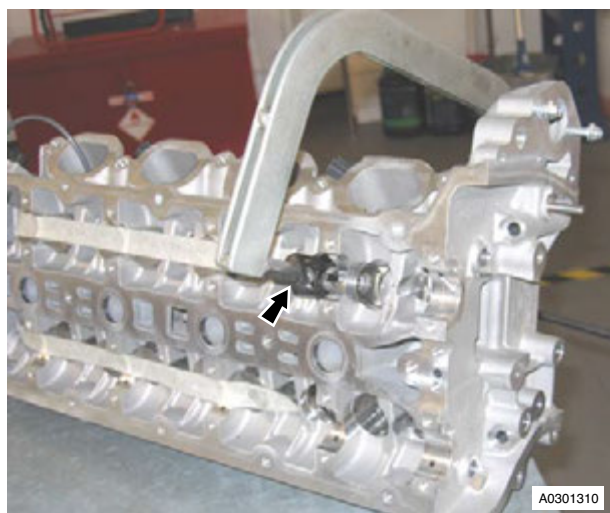


Figure 1

5. Remove collets (x2), release/remove spring compressor, collect collar and valve spring.
6. Remove intake valves from cylinder heads.
7. Remove valve stem oil seals.
8. Keep intake valves and springs in their fitted order.
9. Inspect condition and measure free length of valve springs.
10. Use new valves and check valve guide clearance.

Installation

1. Clean cylinder head face and inlet/exhaust manifold faces. Use an air line to completely dry cylinder head surfaces.
2. Lubricate and install intake valves (x16).
3. Install valve stem oil seals.
4. Install valve springs and collars.

5. Using valve spring compressor, compress valve spring, install collets.
6. Release/remove spring compressor.
7. Install intake selective tappet buckets in their original fitted positions.
8. Lubricate intake camshaft bearings and journals with clean engine oil.
9. Install intake camshafts, install bearing caps (x10), install bolts (x20).
10. Torque/tighten bearing cap bolts (x20) in the correct sequence.
11. Install camshaft sprocket Torx bolts in each intake camshaft.
12. Rotate each intake camshaft clockwise, check and log each valve clearance using feeler gauges.
13. Calculate the correct tappet bucket grade.
14. Remove bearing cap bolts (x20), remove bearing caps (x10), remove both intake camshafts.
15. Remove tappet buckets, install selected tappet buckets.
16. Install both intake camshafts, install bearing caps (x10), install bolts (x20).
17. Torque/tighten bearing cap bolts in the correct sequence.
18. Rotate intake camshafts clockwise, re-check each valve clearance using feeler gauges.
19. Remove intake camshaft sprocket Torx bolts (x2).
20. Remove bearing cap bolts (x20), remove bearing caps (x10), remove both intake camshafts.
21. Install spark plugs.
22. Install cylinder head gaskets - engine set (see Workshop Manual procedure 03.10.AL Gasket - Cylinder Head - Engine Set - Renew).

Exhaust Valve (Set) - Renew

Repair Operation Time (ROT)	
Item	Code
Exhaust Valve (Set)-Renew	LHD 03.01.HC
Exhaust Valve (Set)-Renew	RHD 03.01.JC

Removal

1. Remove cylinder head gaskets - engine set (see Workshop Manual procedure 03.10.AL Gasket - Cylinder Head - Engine Set - Renew).
2. Remove spark plugs from cylinder head.
3. Remove exhaust selective tappet buckets from cylinder heads, keep in their fitted order.

4. Position valve spring compressor, compress valve springs (see Figure 1).

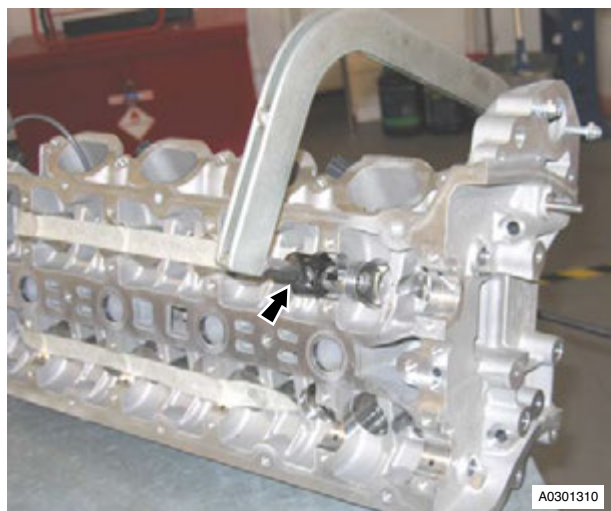


Figure 1

5. Remove collets (x2), release/remove spring compressor, collect collar and valve spring.
6. Remove exhaust valves from cylinder heads.
7. Remove valve stem oil seals.
8. Keep exhaust valves and springs in their fitted order.
9. Inspect condition and measure free length of valve springs.
10. Use new valves and check valve guide clearance.

Installation

1. Clean cylinder head face and inlet/exhaust manifold faces. Use and air line to completely dry cylinder head surfaces.
2. Lubricate and install exhaust valves (x16).
3. Install valve stem oil seals.
4. Install valve springs and collars.
5. Using valve spring compressor, compress valve spring, install collets.
6. Release/remove spring compressor.
7. Install exhaust selective tappet buckets in their original fitted positions.
8. Lubricate exhaust camshaft bearings and journals with clean engine oil.
9. Install exhaust camshafts, install bearing caps (x10), install bolts (x20).
10. Torque tighten bearing cap bolts (x20) in the correct sequence.
11. Install camshaft sprocket Torx bolts in each exhaust camshaft.
12. Rotate each exhaust camshaft clockwise, check and log each valve clearance using feeler gauges.
13. Calculate the correct tappet bucket grade.
14. Remove bearing cap bolts (x20), remove bearing caps (x10), remove both exhaust camshafts.
15. Remove tappet buckets, install selected tappet buckets.

16. Install both exhaust camshafts, install bearing caps (x10), install bolts (x20).
17. Torque tighten bearing cap bolts in the correct sequence.
18. Rotate exhaust camshafts clockwise, re-check each valve clearance using feeler gauges.
19. Remove exhaust camshaft sprocket Torx bolts (x2).
20. Remove bearing cap bolts (x20), remove bearing caps (x10), remove both exhaust camshafts.
21. Install spark plugs.
22. Install cylinder head gaskets - engine set (see Workshop Manual procedure 03.10.AL Gasket - Cylinder Head - Engine Set - Renew).

Spring (Valve Set) - Renew

Repair Operation Time (ROT)	
Item	Code
Spring (Valve Set)-Renew	LHD 03.01.HD
Spring (Valve Set)-Renew	RHD 03.01.JD

Removal

1. Remove cylinder head gaskets - engine set (see Workshop Manual procedure 03.10.AL Gasket - Cylinder Head - Engine Set - Renew).
2. Remove spark plugs from cylinder heads (x8).
3. Remove selective tappet buckets, keep in their fitted order.
4. Position valve spring compressor, compress valve springs (see Figure 1).

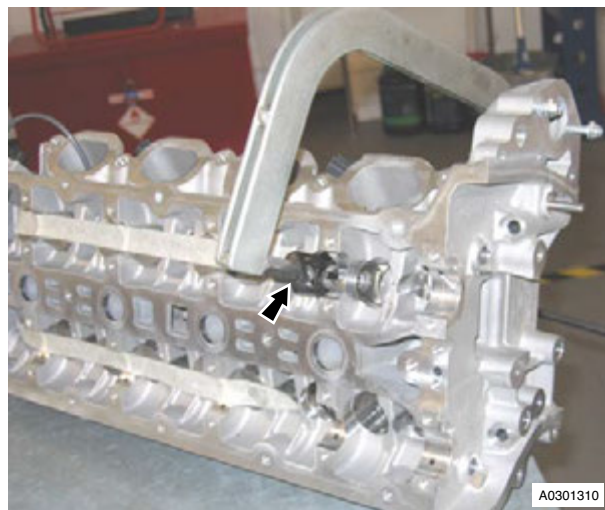


Figure 1

5. Remove collets, release/remove spring compressor, collect collars and valve springs.
6. Inspect cylinder head face for warpage, across centre and from corner to corner.

Installation

1. Clean cylinder head face and inlet/exhaust manifold faces. Use and air line to completely dry cylinder head surfaces.
2. Install valve springs and collars.



- Using valve spring compressor, compress valve spring, install collets.
- Release/remove spring compressor.
- Install selective tappet buckets in their original fitted positions.
- Lubricate intake and exhaust camshaft bearings and journals with clean engine oil.
- Install intake and exhaust camshafts, install bearing caps (x20), install bolts (x40).
- Torque tighten bearing cap bolts in the correct sequence.
- Install camshaft sprocket Torx bolts in intake and exhaust camshafts.
- Rotate intake camshaft clockwise, check and log each valve clearance using feeler gauges.
- Calculate the correct tappet bucket grade.
- Remove bearing cap bolts (x40), remove bearing caps (x20), remove intake and exhaust camshafts.
- Remove tappet buckets, install selected tappet buckets.
- Install intake and exhaust camshafts, install bearing caps (x20), install bolts (x40).
- Torque tighten bearing cap bolts in the correct sequence.
- Rotate intake and exhaust camshafts clockwise, re-check each valve clearance using feeler gauges.
- Remove camshaft sprocket Torx bolts (x4).
- Remove bearing cap bolts (x40), remove bearing caps (x20), remove intake and exhaust camshafts.
- Install spark plugs.
- Install cylinder head gaskets - engine set (see Workshop Manual procedure 03.10.AL Gasket - Cylinder Head - Engine Set - Renew).

Spring (Inlet Valve Set) - Renew

Repair Operation Time (ROT)		
Item	Code	
Spring (Inlet Valve Set)-Renew	LHD	03.01.HE
Spring (Inlet Valve Set)-Renew	RHD	03.01.JE

Removal

- Remove cylinder head gaskets - engine set (see Workshop Manual procedure 03.10.AL Gasket - Cylinder Head - Engine Set - Renew).
- Remove spark plugs from cylinder heads (x8).
- Remove intake selective tappet buckets, keep in their fitted order.

- Position valve spring compressor, compress valve springs (see Figure).

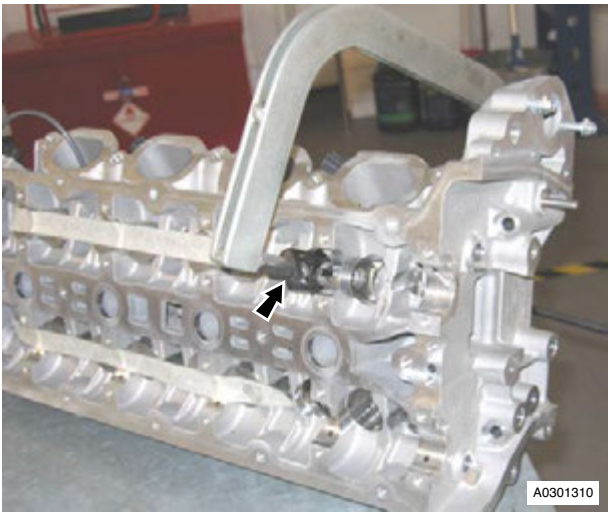


Figure 1

- Remove collets, release/remove spring compressor, collect collars and valve springs.
- Inspect cylinder head face for warpage, across centre and from corner to corner.

Installation

- Clean cylinder head face and inlet/exhaust manifold faces. Use an air line to completely dry cylinder head surfaces.
- Install intake valve springs and collars.
- Using valve spring compressor, compress valve spring, install collets.
- Release/remove spring compressor.
- Install intake selective tappet buckets in their original fitted positions.
- Lubricate both intake camshaft bearings and journals with clean engine oil.
- Install both intake camshafts, install bearing caps (x10), install bolts (x20).
- Torque tighten bearing cap bolts in the correct sequence.
- Install camshaft sprocket Torx bolts in both intake camshafts.
- Rotate intake camshafts clockwise, check and log each valve clearance using feeler gauges.
- Calculate the correct tappet bucket grade.
- Remove bearing cap bolts (x20), remove bearing caps (x10), remove both intake camshafts.
- Remove tappet buckets, install selected tappet buckets.
- Install intake camshafts, install bearing caps (x10), install bolts (x20).
- Torque tighten bearing cap bolts in the correct sequence.
- Rotate both intake camshafts clockwise, re-check each valve clearance using feeler gauges.
- Remove camshaft sprocket Torx bolts (x4).

18. Remove bearing cap bolts (x20), remove bearing caps (x10), remove both intake camshafts.
19. Install spark plugs.
20. Install cylinder head gaskets - engine set (see Workshop Manual procedure 03.10.AL Gasket - Cylinder Head - Engine Set - Renew).

Inlet and Exhaust Valve Seal (Engine Set) - Renew

Repair Operation Time (ROT)	
Item	Code
Inlet and Exhaust Valve Seal (Engine Set)-Renew	LHD 03.01.HF
Inlet and Exhaust Valve Seal (Engine Set)-Renew	RHD 03.01.JF

Removal

1. Remove cylinder head gaskets - engine set (see Workshop Manual procedure 03.10.AL Gasket - Cylinder Head - Engine Set - Renew).
2. Remove spark plugs (x8).
3. Remove selective tappet buckets, keep in their fitted order.
4. Position valve spring compressor, compress valve spring (see Figure 1).

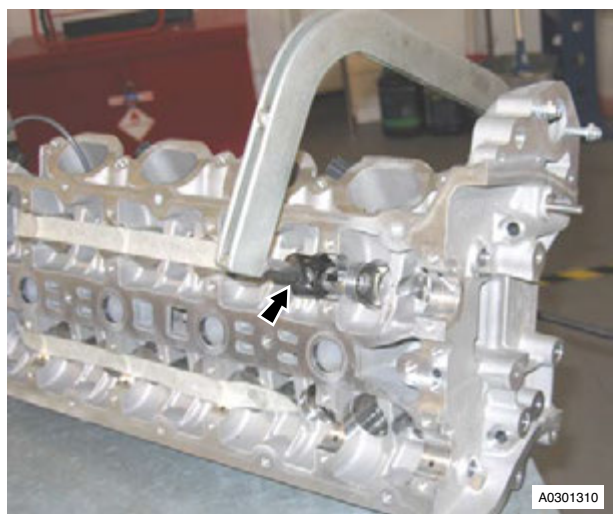


Figure 1

5. Remove collets (x2), release/remove spring compressor, collect collar and valve spring.
6. Remove valves from cylinder.
7. Remove valve stem oil seals.
8. Keep valves and springs in their fitted order.
9. Inspect cylinder head face for warpage, across centre and from corner to corner.

Installation

1. Clean cylinder head face and inlet/exhaust manifold faces. Use an air line to completely dry cylinder head surfaces.
2. Lubricate and install intake and exhaust valves (x32).

3. Install valve stem oil seals.
4. Install valve springs and collars.
5. Using valve spring compressor, compress valve spring, install collets.
6. Release/remove spring compressor.
7. Install selective tappet buckets in their original fitted positions.
8. Lubricate intake and exhaust camshaft bearings and journals with clean engine oil.
9. Install intake and exhaust camshafts, install bearing caps (x20), install bolts (x40).
10. Torque tighten bearing cap bolts in the correct sequence.
11. Install camshaft sprocket Torx bolts in intake and exhaust camshafts.
12. Rotate intake camshaft clockwise, check and log each valve clearance using feeler gauges.
13. Calculate the correct tappet bucket grade.
14. Remove bearing cap bolts (x40), remove bearing caps (x20), remove intake and exhaust camshafts.
15. Remove tappet buckets, install selected tappet buckets.
16. Install intake and exhaust camshafts, install bearing caps (x20), install bolts (x40).
17. Torque tighten bearing cap bolts in the correct sequence.
18. Rotate intake and exhaust camshafts clockwise, re-check each valve clearance using feeler gauges.
19. Remove camshaft sprocket Torx bolts (x4).
20. Remove bearing cap bolts (x40), remove bearing caps (x20), remove intake and exhaust camshafts.
21. Install spark plugs.
22. Install cylinder head gaskets - engine set (see Workshop Manual procedure 03.10.AL Gasket - Cylinder Head - Engine Set - Renew).

Spring (Valve Exhaust Set) - Renew

Repair Operation Time (ROT)	
Item	Code
Spring (Valve Exhaust Set)-Renew	LHD 03.01.HG
Spring (Valve Exhaust Set)-Renew	RHD 03.01.JG

Removal

1. Remove cylinder head gaskets - engine set (see Workshop Manual procedure 03.10.AL Gasket - Cylinder Head - Engine Set - Renew).
2. Remove spark plugs from cylinder heads (x8).
3. Remove exhaust selective tappet buckets, keep in their fitted order.



4. Position valve spring compressor, compress valve springs (see Figure).

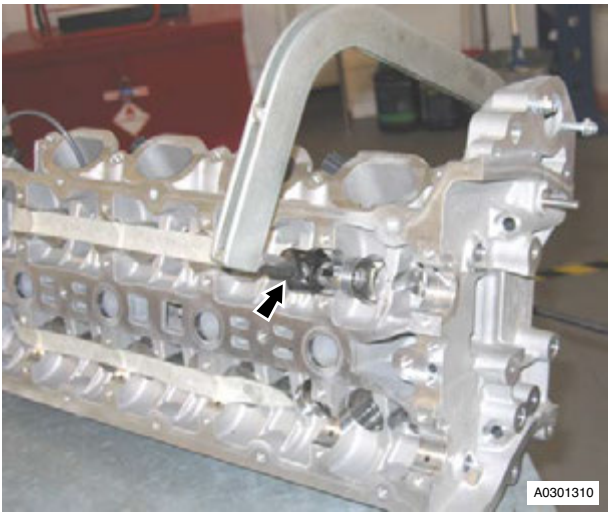


Figure 1

5. Remove collets, release/remove spring compressor, collect collars and valve springs.
6. Inspect cylinder head face for warpage, across centre and from corner to corner.

Installation

1. Clean cylinder head face and inlet/exhaust manifold faces. Use an air line to completely dry cylinder head surfaces.
2. Install exhaust valve springs and collars.
3. Using valve spring compressor, compress valve spring, install collets.
4. Release/remove spring compressor.
5. Install exhaust selective tappet buckets in their original fitted positions.
6. Lubricate both exhaust camshaft bearings and journals with clean engine oil.
7. Install both exhaust camshafts, install bearing caps (x10), install bolts (x20).
8. Torque/tighten bearing cap bolts in the correct sequence.
9. Install camshaft sprocket Torx bolts in both exhaust camshafts.
10. Rotate exhaust camshafts clockwise, check and log each valve clearance using feeler gauges.
11. Calculate the correct tappet bucket grade.
12. Remove bearing cap bolts (x20), remove bearing caps (x10), remove both exhaust camshafts.
13. Remove tappet buckets, install selected tappet buckets.
14. Install exhaust camshafts, install bearing caps (x10), install bolts (x20).
15. Torque/tighten bearing cap bolts in the correct sequence.
16. Rotate both exhaust camshafts clockwise, re-check each valve clearance using feeler gauges.
17. Remove camshaft sprocket Torx bolts (x4).

18. Remove bearing cap bolts (x20), remove bearing caps (x10), remove both exhaust camshafts.
19. Install spark plugs.
20. Install cylinder head gaskets - engine set (see Workshop Manual procedure 03.10.AL Gasket - Cylinder Head - Engine Set - Renew).

RH/LH Cylinder Head Gasket - Renew (with Engine Removed)

Repair Operation Time (ROT)		
Item	Code	
Cylinder Head Gasket-Renew	RH	03.01.HU
Cylinder Head Gasket-Renew	LH	03.01.HV

Removal

1. Remove SAI pump and bracket assembly (see Workshop Manual procedure 03.08.EB Pump and Bracket Assembly - Secondary Air Injection - Renew).
2. Disconnect multiplugs (x2) from knock sensors.
3. Disconnect multiplug from camshaft timing sensor.
4. Remove nuts (x8) securing RH/LH exhaust manifold to cylinder head.
5. Remove exhaust manifold, remove and discard gasket.
6. Remove RH/LH intake camshaft (see Workshop Manual procedure 03.09.BT/03.09.BV Camshaft - Intake - RH/LH - Renew With Engine Removed).
7. Remove RH exhaust camshaft bearing cap retaining bolts (x10) evenly and in stages (see Figure)

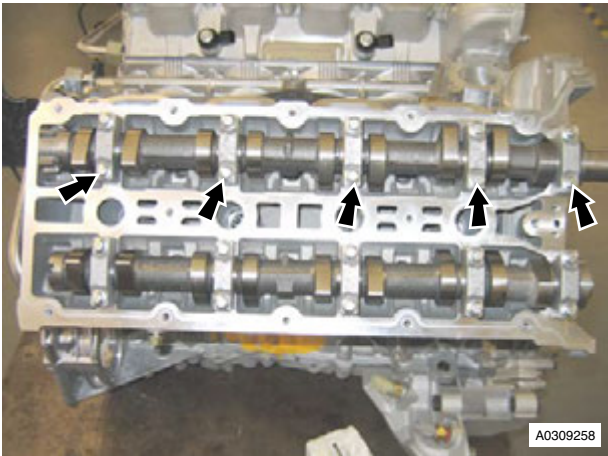


Figure 1

8. Note their orientation and markings and remove the RH/LH exhaust camshaft bearing caps.

9. Remove RH/LH exhaust camshaft (see Figure 2).



Figure 2

10. Remove bolts (x2) securing front end of RH/LH cylinder head to cylinder block.
11. Remove bolts (x10), evenly and in stages securing RH/LH cylinder head to cylinder block (see Figure 3).

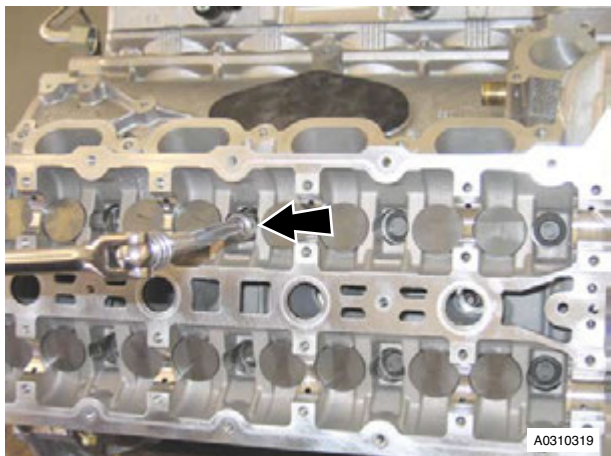


Figure 3

12. With assistance, remove RH/LH cylinder head assembly.
13. Remove and discard cylinder head gasket.

Installation

1. Thoroughly clean RH/LH cylinder head face and retaining bolt pockets.
2. Thoroughly clean RH/LH cylinder block face.
3. Thoroughly clean and dry RH cylinder head retaining bolts.
4. Install new RH/LH cylinder gasket, locate on dowels.
5. With assistance, install RH/LH cylinder head, locate on dowels.
6. Install and torque tighten cylinder head bolts (x12) in the correct sequence.
7. Lubricate RH exhaust camshaft journals, camshaft lobes, bearing surfaces on cylinder head and bearing caps with clean engine oil.
8. Install RH exhaust camshaft, install bearing caps (x5) in their original positions.
9. Install bolts (x10) and torque tighten in the sequence specified.
10. Install sprocket retaining Torx bolt in camshaft.

11. Rotate camshaft accordingly and check each valve clearance using feeler gauges.
12. Remove sprocket retaining Torx bolt.
13. Install RH intake camshaft (see Workshop Manual procedure 03.09.BT/03.09.BV) Camshaft - Intake - RH/LH - Renew With Engine Removed).
14. Install timing chain tensioning tool (303-532) into RH/LH exhaust camshaft sprocket.
15. Apply a force to the tool (303-532) in an anti-clockwise direction and torque tighten RH/LH sprocket Torx bolts. Remove special tool.
16. Connect multiplug to camshaft timing sensor.
17. Connect multiplugs (x2) to knock sensors.
18. Clean RH/LH exhaust manifold.
19. Install new RH/LH exhaust manifold gasket, install exhaust manifold.
20. Install and torque tighten RH/LH exhaust manifold nuts (x8).
21. Install SAI pump and bracket assembly (see Workshop Manual procedure 03.08.EB Pump and Bracket Assembly - Secondary Air Injection - Renew).

Cylinder Head Gasket (Engine Set) - Renew (with Engine Removed)

Repair Operation Time (ROT)	
Item	Code
Cylinder Head Gasket (Engine Set)- Renew	03.01.HW

Removal

1. Remove SAI pump and bracket assembly (see Workshop Manual procedure 03.08.EB Pump and Bracket Assembly - Secondary Air Injection - Renew).
2. Disconnect multiplugs (x4) from LH and RH knock sensors.
3. Disconnect multiplugs (x2) from LH and RH camshaft timing sensors.
4. Remove nuts (x8) securing LH exhaust manifold to cylinder head.
5. Remove LH exhaust manifold, remove and discard gasket.
6. Remove LH intake camshaft (see Workshop Manual procedure 03.09.BV Camshaft - Intake - LH - Renew With Engine Removed).

7. Remove LH exhaust camshaft bearing cap retaining bolts (x10) evenly and in stages (see Figure).

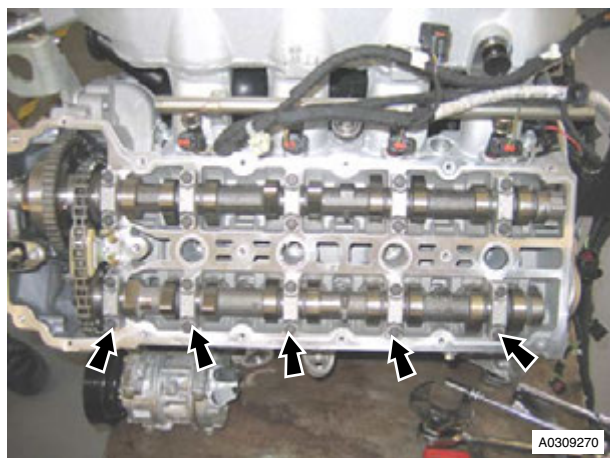


Figure 1

8. Note their orientation and markings and remove the LH exhaust camshaft bearing caps.
9. Remove LH exhaust camshaft (see Figure 2).



Figure 2

10. Remove bolts (x2) securing front end of LH cylinder head to cylinder block.
11. Remove bolts (x10), evenly and in stages securing LH cylinder head to cylinder block (see Figure 3).

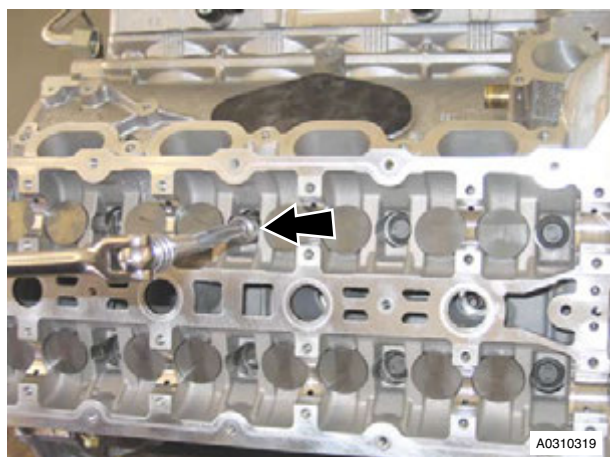


Figure 3

12. With assistance, remove LH cylinder head assembly.
13. Remove and discard cylinder head gasket.
14. Remove nuts (x8) securing RH exhaust manifold to cylinder head.
15. Remove LH exhaust manifold, remove and discard gasket.
16. Remove Torx bolts (x2), spacer on exhaust Torx bolt, securing RH intake and exhaust camshaft sprockets to camshafts (see Figure 4).

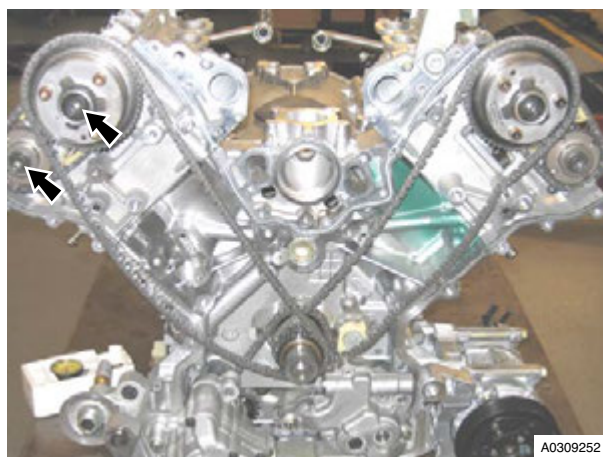


Figure 4

17. Remove bolts (x2) securing RH secondary timing chain tensioner to cylinder head (see Figure 5).

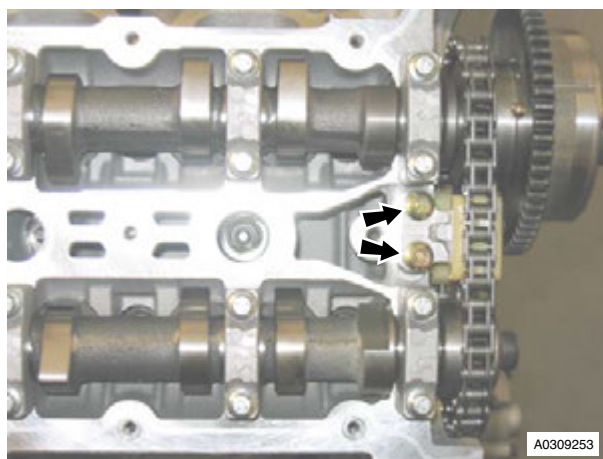


Figure 5

18. Remove RH camshaft sprockets complete with timing chain and tensioner from camshafts (see Figure 6).

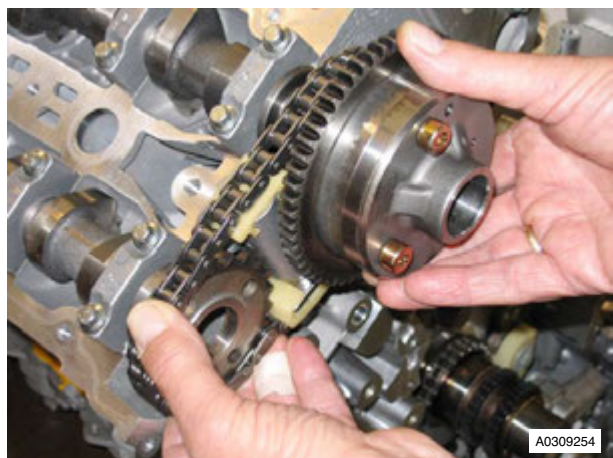


Figure 6

19. Remove bolts (x3) securing tool (303-1215) to cylinder head, remove special tool (see Figure 7).



Figure 7

20. Remove RH intake camshaft bearing cap retaining bolts (x10) evenly and in stages (see Figure 8).

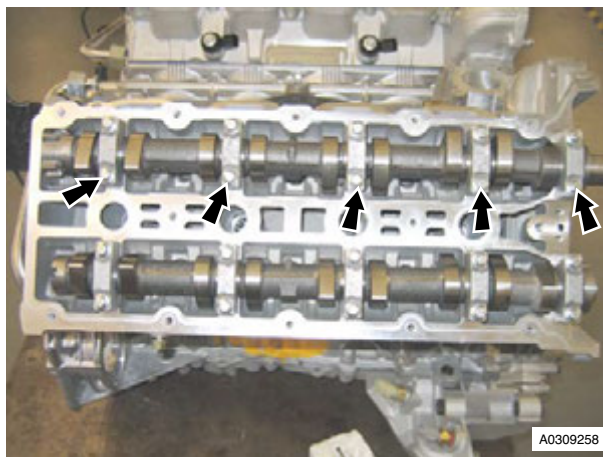


Figure 8

21. Note their orientation and markings and remove the RH intake camshaft bearing caps.
22. Remove RH intake camshaft (see Figure 9).



Figure 9

23. Remove RH exhaust camshaft bearing cap retaining bolts (x10) evenly and in stages (see Figure 10).

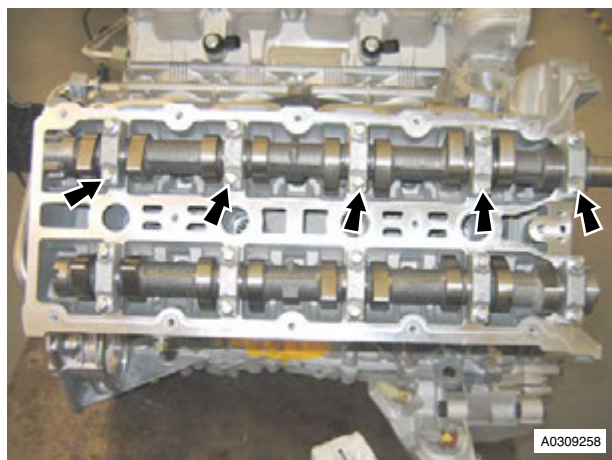


Figure 10

24. Note their orientation and markings and remove the RH exhaust camshaft bearing caps.
25. Remove RH exhaust camshaft (see Figure 11).



Figure 11

26. Remove bolts (x2) securing front end of RH cylinder head to cylinder block.
27. Remove bolts (x10), evenly and in stages securing RH cylinder head to cylinder block (see Figure 12).

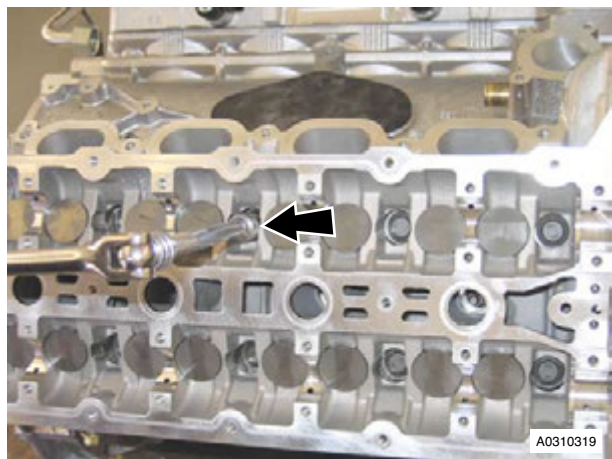


Figure 12

28. With assistance, remove RH cylinder head assembly.
29. Remove and discard cylinder head gasket.

Installation

1. Thoroughly clean LH and RH cylinder head faces and retaining bolt pockets.
2. Thoroughly clean LH and RH cylinder block faces.
3. Thoroughly clean and dry LH and RH cylinder head retaining bolts.
4. Install new RH cylinder gasket, locate on dowels.
5. With assistance, install RH cylinder head, locate on dowels.
6. Install and torque tighten cylinder head bolts (x12) in the correct sequence.
7. Lubricate camshaft journals, camshaft lobes, bearing surfaces on cylinder head and bearing caps with clean engine oil.
8. Install RH exhaust camshaft, install bearing caps (x5) in their original positions.
9. Install bolts (x10) and torque tighten in the sequence specified.
10. Install sprocket retaining Torx bolt in camshaft.
11. Rotate camshaft accordingly and check each valve clearance using feeler gauges.
12. Repeat procedure and install RH intake camshaft.
13. Remove sprocket retaining Torx bolt.
14. Rotate RH intake and exhaust camshafts until timing flats on each camshaft face uppermost.
15. Install tool (303-530) to RH cylinder head to secure camshafts, install and tighten bolts (x3).
16. Install new LH cylinder gasket, locate on dowels.
17. With assistance, install LH cylinder head, locate on dowels.
18. Install and torque tighten cylinder head bolts (x12) in the correct sequence.
19. Lubricate LH exhaust camshaft journals, camshaft lobes, bearing surfaces on cylinder head and bearing caps with clean engine oil.
20. Install LH exhaust camshaft, install bearing caps (x5) in their original positions.
21. Install bolts (x10) and torque tighten in the sequence specified.
22. Install sprocket retaining Torx bolt in LH exhaust camshaft.
23. Rotate LH exhaust camshaft accordingly and check each valve clearance using feeler gauges.
24. Remove sprocket retaining Torx bolt.
25. Install LH intake camshaft (see Workshop Manual procedure 03.09.BV Camshaft - Intake - LH - Renew With Engine Removed).
26. Install timing chain tensioning tool (303-532) into RH exhaust camshaft sprocket.
27. Apply a force to the tool (303-532) in an anti-clockwise direction and torque tighten RH sprocket Torx bolts. Remove special tool.
28. Connect multiplugs to LH and RH camshaft timing sensors.

-
29. Connect multiplugs (x4) to LH and RH knock sensors.
 30. Install SAI pump and bracket assembly (see Workshop Manual procedure 03.08.EB Pump and Bracket Assembly - Secondary Air Injection - Renew).
 31. Clean LH and RH exhaust manifolds.
 32. Install new LH and RH exhaust manifold gaskets.
 33. Install LH and RH exhaust manifolds, install and torque tighten nuts (x16).



ASTON MARTIN

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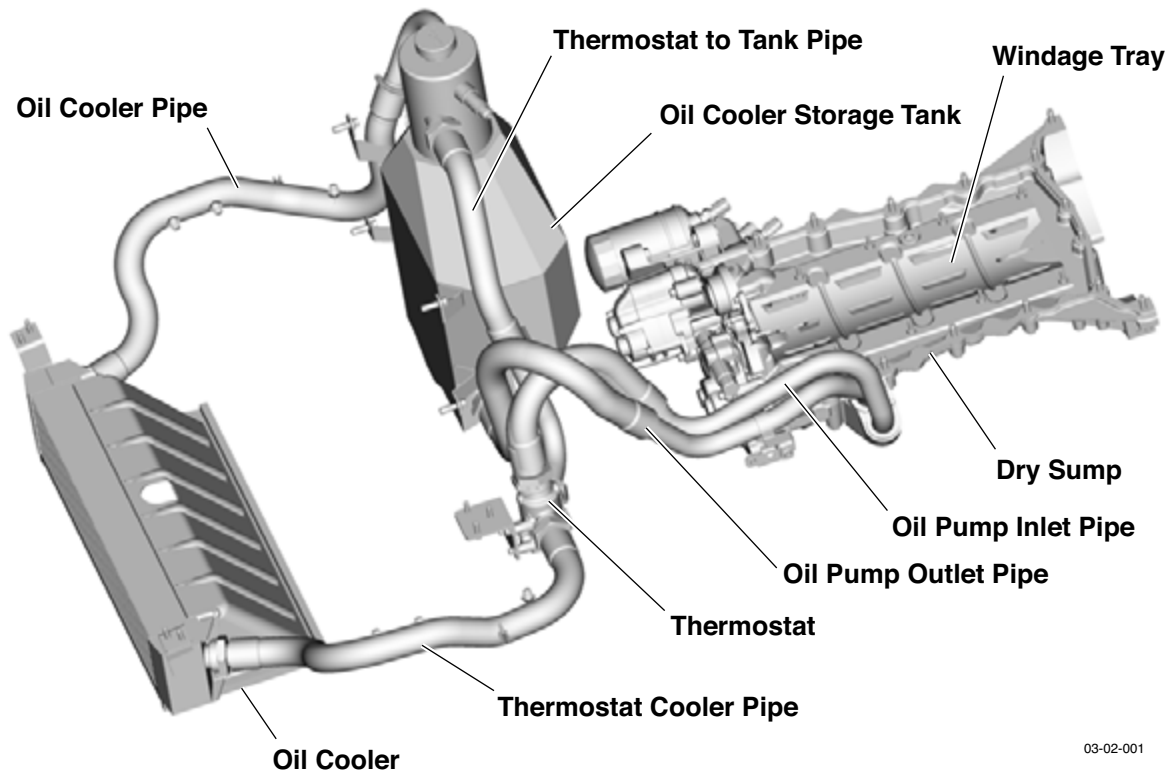


ASTON MARTIN

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Engine (03.00)

Lubrication System (03.02)



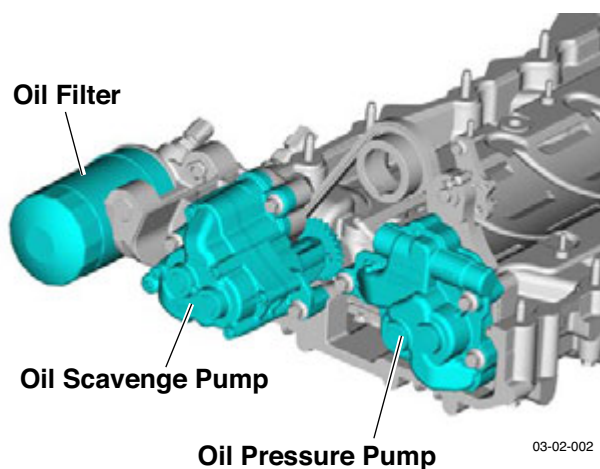
Dry Sump System

Unlike a wet sump system where oil is stored in the sump, a dry sump oiling system stores oil in a separate tank, leaving the sump essentially 'dry'.

Two internally-mounted pumps, are used to 'scavenge' (1) oil and deliver it to the storage tank, and then deliver (2) the oil through the engine.

The primary advantage of a dry sump system is its ability to make more power. With very little oil in the sump, the rotating assembly is not burdened with the weight of excess oil (windage). The windage tray or screen which serves to isolate sump oil from the rotating assembly, runs the full length of the sump. This keeps the rotating assembly free of windage and allows it to spin freely and make more power. In addition, the extra crankcase vacuum created by the dry sump pump helps to improve ring seal for additional power gain.

Other advantages of a dry sump system include increased oil capacity, more consistent oil pressure, the ability to easily add remote coolers, and adjustable oil pressure. And because the sump does not store oil, it can be relatively shallow in depth to allow lower engine placement for improved weight distribution and handling.



Specifications

Engine oil Europe/Aus/USA Castrol Edge Sport 10W-60

To achieve the required high performance of synthetic lubricants, do not mix with mineral oils.

Capacity	Europe (Litres)	UK (Pints)	USA (Qts.)
Full System	13	23	11
Service Fill	10	18	9

Torque Figures

Description	Nm	lb/ft
Oil filter	15 - 18	11-13
Sump plug	20 - 26	15-19
Sump bolts	20 - 22	15-16
Oil delivery pump bolts	19 - 23	14-17
Oil scavenger pump bolts	19 - 23	14-17
Oil scavenger filters	11 - 13	8-10
Oil temperature sensor	16 - 24	12-17
Oil pressure switch	11 - 15	8-11
Oil pump tensioner bracket	11 - 13	8-10

Engine Oil Specification

10W-60

Authority	Standard
API	SL/CF
ACEA	A3/B3/B4

Oil 10W-60 has both API and ACEA and therefore meets more demanding tests than either API or ACEA oils alone.

Maintenance

Oil Pressure Pump to Sump Gasket - Renew

Repair Operation Time (ROT)	
Item	Code
Oil Pressure Pump to Sump Gasket-Renew	03.02.AG

1. Remove crankshaft timing chain sprocket (refer to Workshop Manual procedure 03.09.AK Sprocket - Crankshaft - Renew).
2. Install guide pin through lower hole on chain tensioner.

3. Remove bolt that attaches the oil pressure pump chain tensioner assembly to engine bedplate (refer to Figure 1).

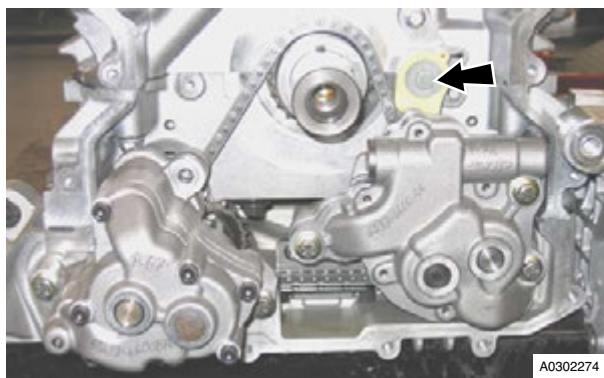


Figure 1

4. Remove tensioner assembly.
5. Remove bolts (x3) that attach the oil pressure pump to sump.
6. Release chain from oil pressure pump sprocket, remove oil pump.
7. Remove and discard oil pressure pump gasket.

Installation

1. Clean oil pressure pump and mating face on sump.
2. Install new gasket to sump, align to dowels (x2).
3. Position oil pressure pump, install chain on pump sprocket.
4. Install oil pressure pump, align to dowels (x2), Install and torque tighten bolts (x3).
5. Install chain tensioner, install and torque tighten bolt, remove guide pin.
6. Install crankshaft timing chain sprocket (refer to Workshop Manual procedure 03.09.AK Sprocket - Crankshaft - Renew).

Oil Pump Chain - Renew

Repair Operation Time (ROT)	
Item	Code
Oil Pump Chain-Renew	03.02.AJ

Removal

1. Remove oil pressure pump gasket (refer to Workshop Manual procedure 03.02.AG Gasket - Oil Pressure Pump to Sump - Renew)

2. Remove bolts (x3) that attach the oil scavenge pump to sump (refer to Figure 1).

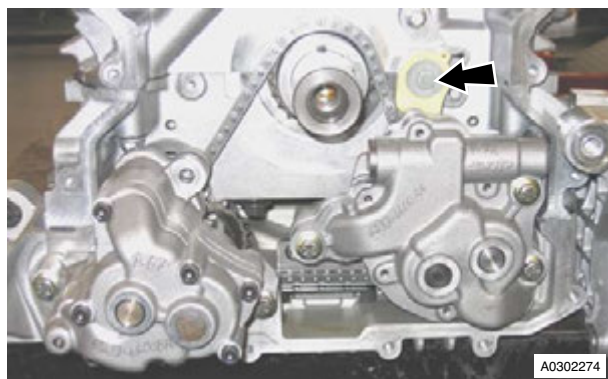


Figure 1

3. Remove oil scavenge pump, remove and discard gasket (refer to Figure 2).



Figure 2

4. Release chain from oil pump drive sprocket, remove chain (refer to Figure 3).

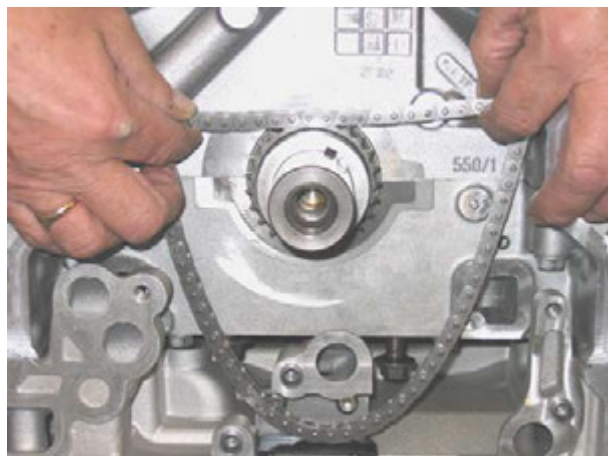


Figure 3

Installation

1. Clean oil scavenge pump and mating face on sump.
2. Install new oil scavenge pump gasket, align on dowels (x2).
3. Install chain onto oil scavenge pump sprocket.
4. Install oil scavenge pump, align to dowels (x2), install and torque tighten bolts (x3).
5. Install chain onto oil pump drive sprocket.
6. Install oil pressure pump gasket (refer to Workshop Manual procedure 03.02.AG Gasket - Oil Pressure Pump to Sump - Renew).

Oil Sump Pan - Renew

Repair Operation Time (ROT)	
Item	Code
Oil Sump Pan-Renew	03.02.BM

Removal

1. Remove oil sump (refer to Workshop Manual procedure 03.02.BN Pan - Oil Sump - Remove and Reseal).

WARNING
DO NOT GET USED ENGINE OIL ON YOUR SKIN.
USED ENGINE OIL CAN BE HARMFUL.

WARNING
DO NOT GET MINERAL OIL ON YOUR SKIN. MINERAL
OILS CAN BE HARMFUL.

2. Remove bolt that attach the crankshaft timing sensor, remove sensor (refer to Figure 1).

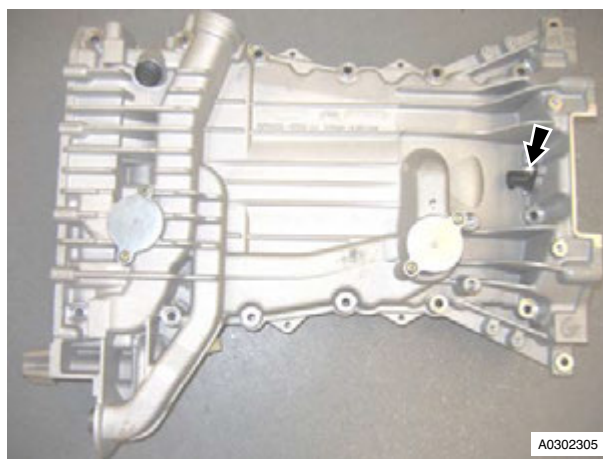


Figure 1

3. Remove oil pressure sensor (refer to Figure 2).

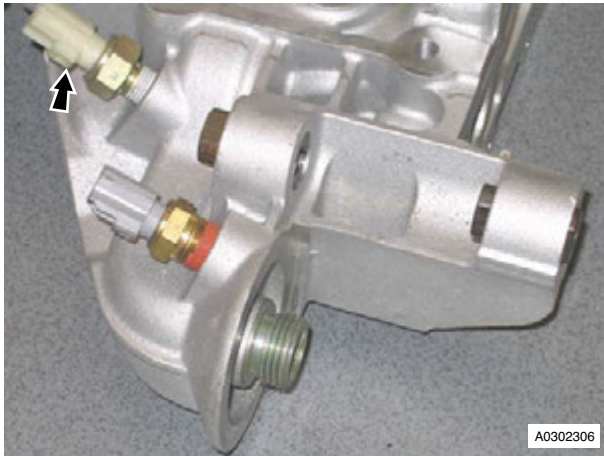


Figure 2

4. Remove engine electric coolant temperature sensor (refer to Figure 3).

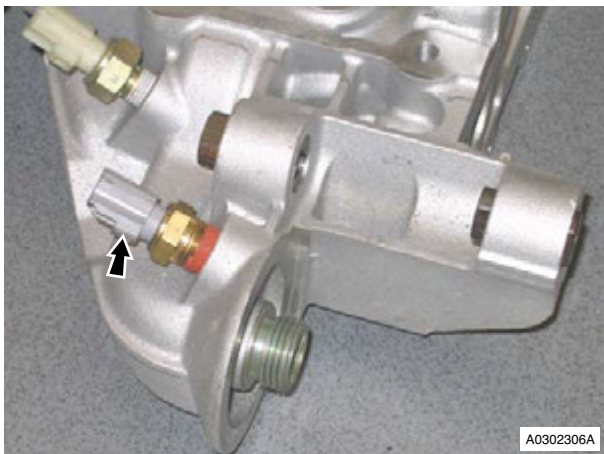


Figure 3

5. Remove Torx screws (x4) that attach the oil filter plates (x2) to sump. Remove plates (refer to Figure 4).

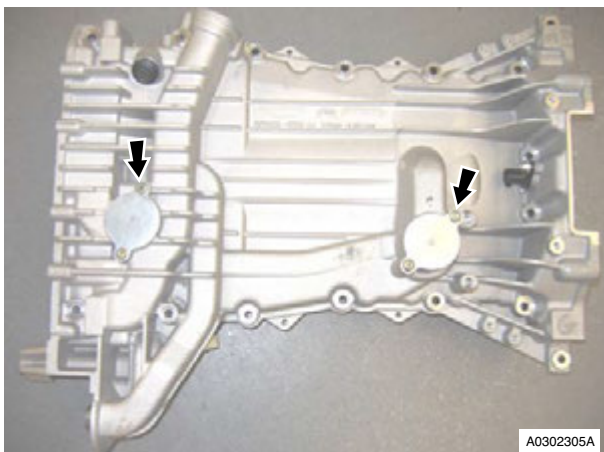


Figure 4

WARNING

**DO NOT GET USED ENGINE OIL ON YOUR SKIN.
USED ENGINE OIL CAN BE HARMFUL.**

6. Install suitable bolt and remove filters (x2) from sump (refer to Figure 5).



Figure 5

7. Remove oil filter adaptor (refer to Figure 6).

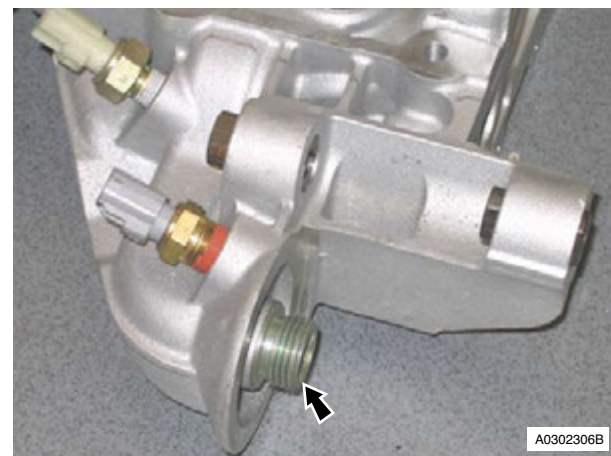


Figure 6

8. Press out alternator mounting bushes (x2) from sump (refer to Figure 7).

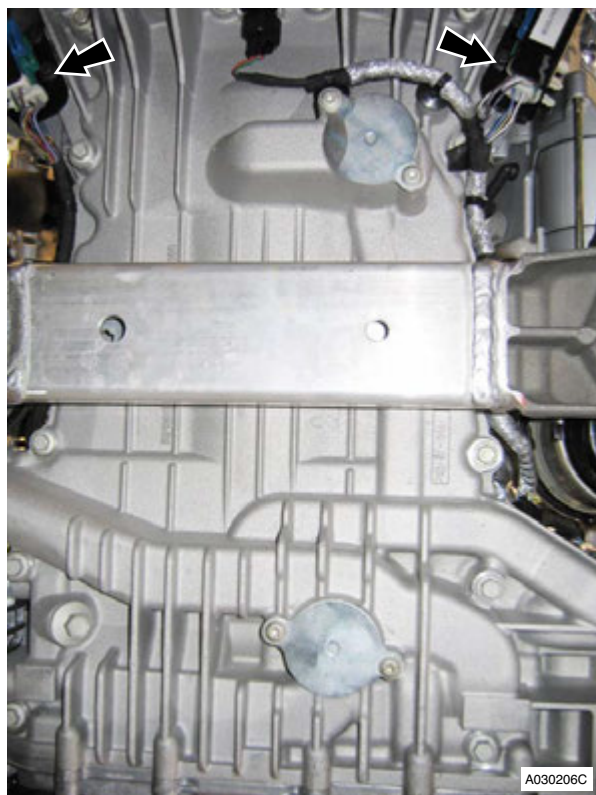


Figure 7

9. Remove dowels (x4) from sump for oil pressure and scavenge pumps location (refer to Figure 8).

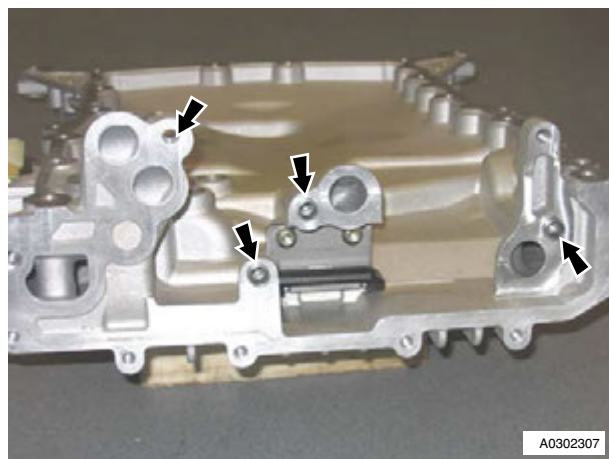


Figure 8

10. Remove Torx screws (x2) that attach the oil pump(s) chain guide, remove chain guide (refer to Figure 9).

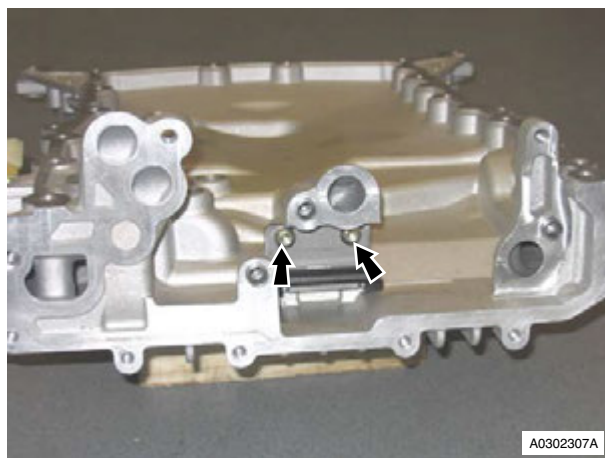


Figure 9

11. Remove oil plug from sump.

Installation

1. Clean chain guide, oil filter adaptor, filters (x2), sump plug, pump(s) dowels and crankshaft timing sensor.
2. Install alternator bushes.
3. Install oil filter adaptor.
4. Install filters (x2), install oil filter plates (x2), install and torque tighten Torx screws (x4).
5. Install oil plug.
6. Install oil pump(s) dowels (x4).
7. Clean old sealant from sensor threads (x2).
8. Apply sealant to engine electric coolant temperature sensor threads, install and torque tighten sensor.
9. Apply sealant to oil pressure sensor threads, install and torque tighten sensor.
10. Install oil pump(s) chain guide, Install and torque tighten Torx screws (x2).
11. Install crankshaft timing sensor, install and torque tighten bolt.
12. Install oil sump (refer to Workshop Manual procedure 03.02.BN Pan - Oil Sump - Remove and Reseal).

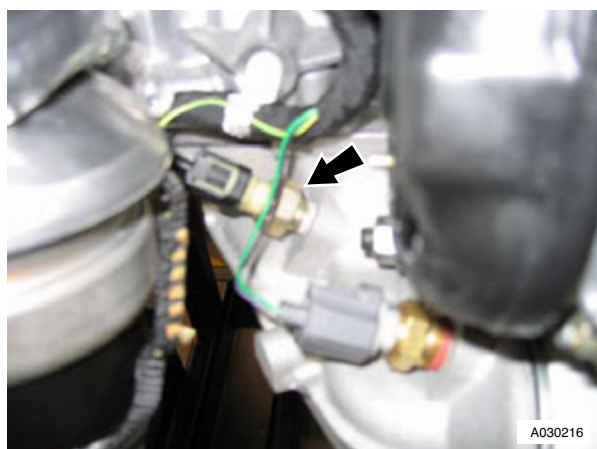
Oil Sump Pan - Remove and Reseal

Repair Operation Time (ROT)	
Item	Code
Oil Sump Pan-Remove and Reseal	03.02.BN

Removal

1. Remove oil pump(s) drive chain (refer to Workshop Manual procedure 03.02.AJ Chain - Oil Pump - Renew).

2. Disconnect multiplug from oil pressure sensor (refer to Figure 1).
4. Disconnect multiplug from crankshaft timing sensor (refer to Figure 3).



Figure

3. Disconnect multiplug from engine electric coolant temperature sensor (refer to Figure 2).



Figure 2

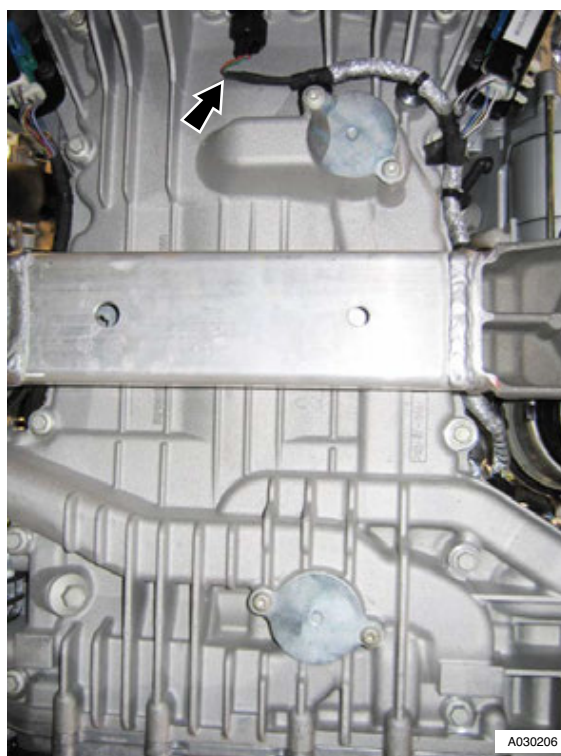


Figure 3

5. Release harness clips (x6) from sump (refer to Figure 4).

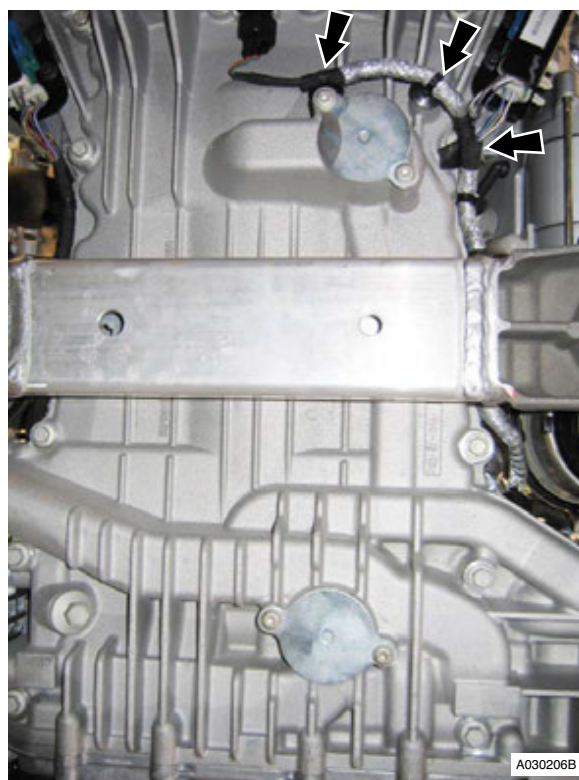


Figure 4

6. Remove bolts (x4) that attach the LH and RH HEGO sensor multiplug brackets to sump (refer to Figure 5).

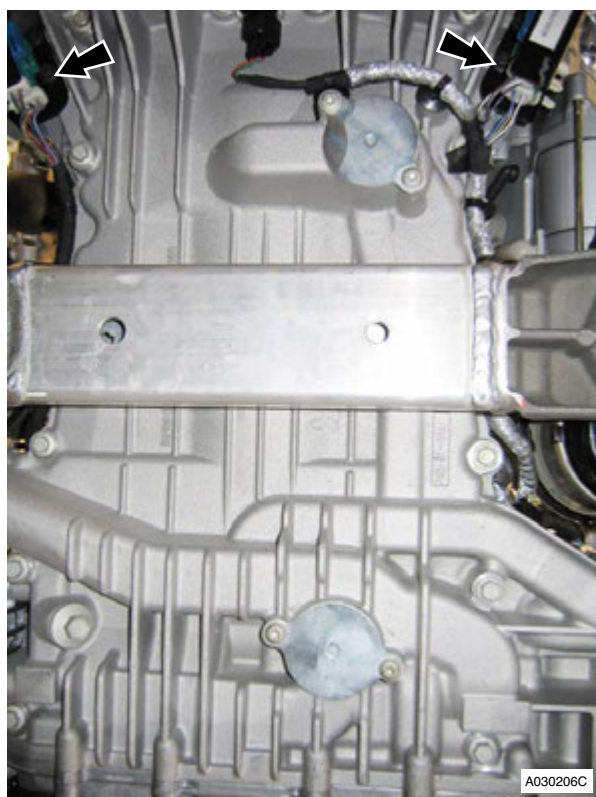


Figure 5

7. Disconnect multiplug from A/C compressor.
8. Remove bolts (x4) that attach the A/C compressor to mounting bracket. Tie compressor aside.

WARNING
DO NOT GET USED ENGINE OIL ON YOUR SKIN.
USED ENGINE OIL CAN BE HARMFUL.

9. Remove bolts (x2) that attach the inlet and outlet oil pipes to sump (refer to Figure 6).



Figure 6

10. Release both oil pipes together from sump, remove and discard O-ring seals from pipes.

11. Remove Torx bolts (x4) that attach the A/C compressor mounting bracket to engine bedplate and sump. Remove bracket (refer to Figure 7).

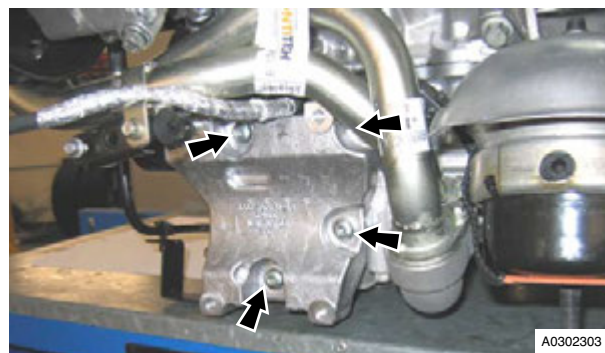


Figure 7

12. Note fitted position of clutch bleed tube bracket, remove bolts (x4) that attach the torque tube to sump (refer to Figure 8).



Figure 8



13. Remove bolts (x16) that attach the sump to engine bedplate (refer to Figure 9).

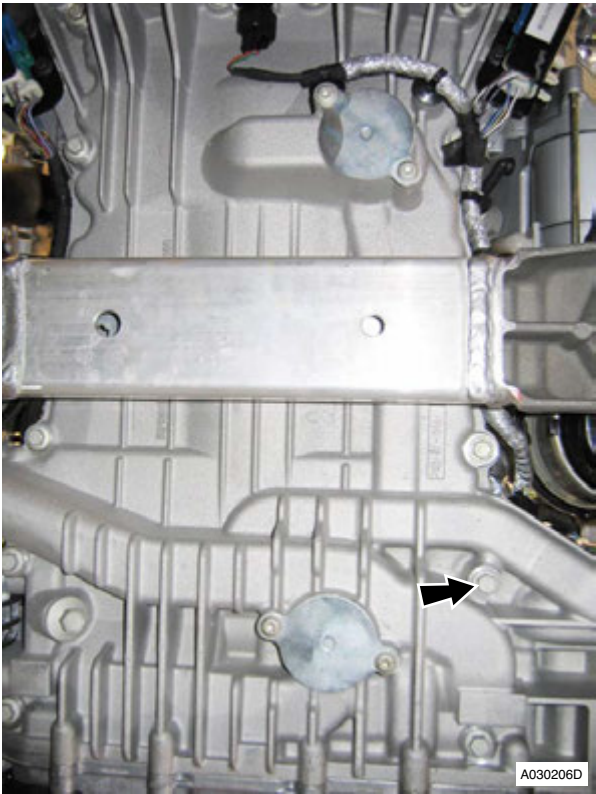


Figure 9

14. Release and remove sump.

Installation

1. Clean old sealant from sump flange and engine bedplate.
2. Ensure that sump flange and mating face on engine bedplate are clean and dry.
3. Apply a continuous 3mm diameter bead of RTV sealant to sump flange as recommended.
4. Ensure that there are no gaps in sealant track.
5. Install sump, install bolts (x16). Do not torque tighten at this stage.
6. Install bolts (x4), sump to torque tube, lightly tighten bolts and then loosen bolts.
7. Torque tighten sump bolts (x16) in the recommended sequence.
8. Torque tighten sump to torque tube bolts (x4).
9. Install A/C compressor mounting bracket, install and torque tighten Torx bolts (x4).

WARNING
DO NOT GET USED ENGINE OIL ON YOUR SKIN.
USED ENGINE OIL CAN BE HARMFUL.

10. Lubricate and install new O-ring seals to oil pipes.
11. Install oil pipes in sump, install and torque tighten bolts (x2)
12. Install compressor, install and torque tighten bolts (x4).

13. Connect multiplug to A/C compressor.
14. Install LH and RH HEGO sensor multiplug brackets to sump. Install and torque tighten bolts (x4).
15. Secure harness clips (x6) in sump.
16. Connect multiplug to crankshaft timing sensor.
17. Connect multiplug to engine electric coolant temperature sensor.
18. Connect multiplug to oil pressure sensor.
19. Install oil pump(s) drive chain (refer to Workshop Manual procedure 03.02.AJ Chain - Oil Pump - Renew).

Oil Cooler - Renew

Repair Operation Time (ROT)	
Item	Code
Oil Cooler - Renew	03.02.BX

Removal

1. Raise vehicle on ramp.
2. Remove undertray (refer to Workshop Manual procedure 01.02.NB Undertray - Front - Renew).

WARNING
DO NOT GET USED ENGINE OIL ON YOUR SKIN.
USED ENGINE OIL CAN BE HARMFUL.

3. Remove pipes from oil cooler (position container to catch oil) (refer to Figure).

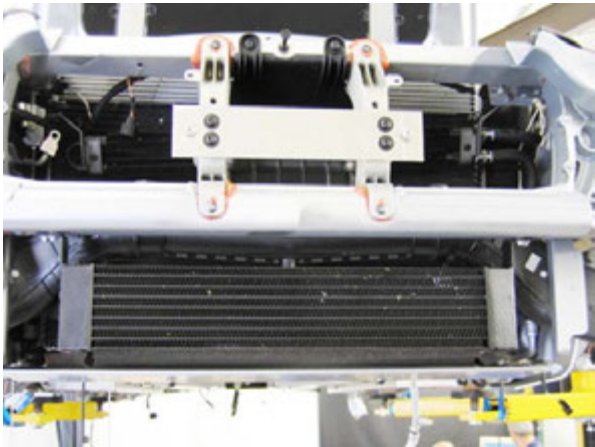


Figure 1

Caution
Make sure that all open ends of oil cooler pipes and oil cooler connections are plugged to prevent dirt or foreign material entering the lubrication system.

4. Remove oil cooler from body (bolts x4).
5. Remove duct from oil cooler (bolts x4).

Installation

1. Install duct from to cooler (bolts x4) (torque).
2. Install oil cooler to body (bolts x4) (torque).
3. Install pipes to oil cooler (torque).
4. Install undertray (refer to Workshop Manual procedure 01.02.NB Undertray - Front - Renew).
5. Lower vehicle on ramp.

6. Fill tank with approximately amount of displaced oil and replace cap.
7. Use handbook procedure to check oil level.
10. Remove bottom pipe (x1) from oil tank (refer to Figure 2).

Oil Cooler Tank Assembly - Renew

Repair Operation Time (ROT)	
Item	Code
Oil Cooler Tank Assembly - Renew	03.02.CA

Removal

1. Disconnect breather pipe quickfits (x2) from air cleaner duct.
2. Remove throttle body duct for access (clips x3).
3. Remove cap.
4. Disconnect top hose from engine (clip x1) tie aside (catch coolant).
5. Remove breather pipe from oil tank (quick fit) (refer to Figure 1).

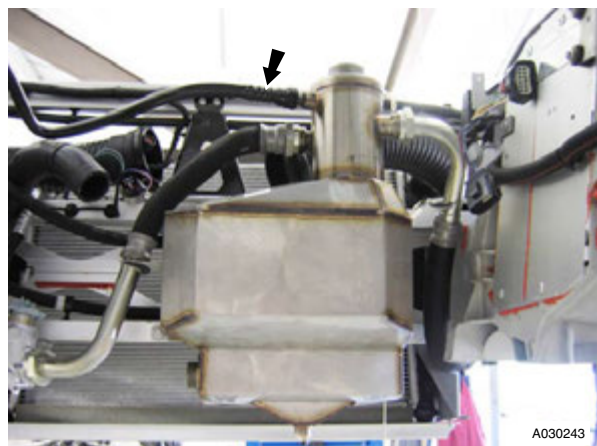


Figure 1

WARNING
DO NOT GET USED ENGINE OIL ON YOUR SKIN.
USED ENGINE OIL CAN BE HARMFUL.

6. Remove pipes (x2) from oil tank, tie aside.
7. Raise vehicle on ramp.
8. Remove undertray (refer to Workshop Manual procedure 01.02.NB Undertray - Front - Renew).
9. Drain oil tank.



Figure 2

11. Remove bolts (x3) that attach the oil thermostat to body (allows oil hose movement).
12. Lower ramp.
13. Remove bolts (x4) that attach the tank to body and lift out.

Installation

1. Position tank to body and fit bolts (x4) (torque).
2. Install oil pipes to tank (torque).
3. Connect breather hose.
4. Connect top hose to engine (clip x1).
5. Raise vehicle on ramp.
6. Install bottom oil pipe to tank (torque).
7. Install bolts (x3) that attach the oil thermostat to body (torque).
8. Install undertray (refer to Workshop Manual procedure 01.02.NB Undertray - Front - Renew).
9. Lower vehicle.
10. Install throttle body duct.
11. Connect breather pipe quickfits (x2) to air cleaner duct.
12. Fill tank with approximately amount of displaced oil and replace cap.
13. Use handbook procedure to check oil level.
14. Top up coolant.

Thermostat - Renew

Repair Operation Time (ROT)	
Item	Code
Thermostat - Renew	03.03.CB

Removal

1. Drain Coolant (refer to Workshop Manual procedure 03.03.AD Coolant - Drain and Refill).
2. Release breather valve (bolt x1) and tie aside.
3. Unclip engine harness for access (x4).
4. Remove one end of engine breather hoses for access (x3).

5. Remove breather valve bracket for access (nuts x2 bolt x1).
6. Remove thermostat housing from manifold (bolt x3).
7. Remove thermostat and sealing ring.
6. Remove pipe from oil cooler and pull out from inner wing (position container to catch oil) (refer to Figure 2).

Installation

1. Install new thermostat and sealing ring.
2. Install thermostat housing (torque).
3. Install breather valve bracket.
4. Install breather hoses (x3) and clip.
5. Clip engine harness.
6. Install breather valve.
7. Refill coolant (refer to Workshop Manual procedure 03.03.AD Coolant - Drain and Refill).

Oil Cooler Tank Pipe Assembly - Renew

Repair Operation Time (ROT)	
Item	Code
Oil Cooler Tank Pipe Assembly - Renew	03.02.CC

Removal

1. Remove oil pipe from oil tank (refer to Figure 1).



Figure 1

2. Raise vehicle on ramp.
3. Remove undertray (refer to Workshop Manual procedure 01.02.NB Undertray - Front - Renew).
4. Remove RH air filter box (refer to Workshop Manual procedure 03.12.DH Cleaner Assembly - Engine Air - RH - Renew).
5. Unclip pipe (x4) from inner wing.

WARNING

**DO NOT GET USED ENGINE OIL ON YOUR SKIN.
USED ENGINE OIL CAN BE HARMFUL.**

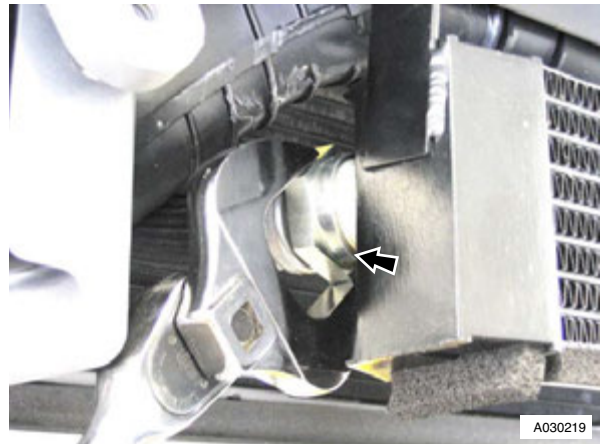


Figure 2

Installation

1. Install pipe to oil cooler (torque) through inner wing.
2. Clip pipe (x4) to inner wing.
3. Install undertray (refer to Workshop Manual procedure 01.02.NB Undertray - Front - Renew).
4. Install RH air filter box (refer to Workshop Manual procedure 03.12.DH Cleaner Assembly - Engine Air - RH - Renew).
5. Lower vehicle on ramp.
6. Install pipe to oil tank (torque) ensure correct alignment in oil tank bracket.
7. Fill tank with approximately amount of displaced oil and replace cap.
8. Use handbook procedure to check oil level.

Oil Thermostat to Tank Tube Assembly - Renew

Repair Operation Time (ROT)	
Item	Code
Oil Thermostat to Tank Tube Assembly - Renew	03.02.CD

Removal

1. Disconnect breather pipe quickfits (x2) from air cleaner duct.
2. Remove throttle body duct for access (clips x3).

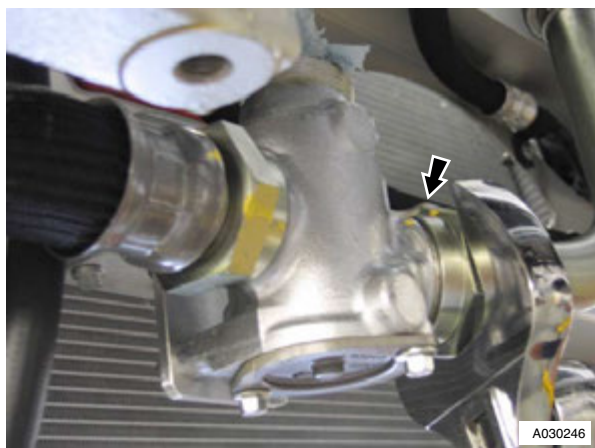
WARNING

**DO NOT GET USED ENGINE OIL ON YOUR SKIN.
USED ENGINE OIL CAN BE HARMFUL.**

- Remove pipes from oil tank (refer to Figure 1).

**Figure 1**

- Raise vehicle on ramp.
- Remove undertray (refer to Workshop Manual procedure. 01.02.NB Undertray - Front - Renew).
- Remove pipe from oil thermostat (position container to catch oil) (refer to Figure 2).

**Figure 2**

Installation

- Install pipe to oil thermostat (torque) ensure correct alignment in oil tank bracket.
- Install undertray (refer to Workshop Manual procedure 01.02.NB Undertray - Front - Renew).
- Lower vehicle on ramp.
- Install oil pipe to tank.
- Install throttle body duct.
- Connect breather pipe quickfits (x2) to air cleaner duct.
- Fill tank with approximately amount of displaced oil and replace cap.
- Use handbook procedure to check oil level.

Oil Pump Inlet Tube Assembly - Renew

Repair Operation Time (ROT)

Item	Code
Oil Pump Inlet Tube Assembly - Renew	03.02.CE

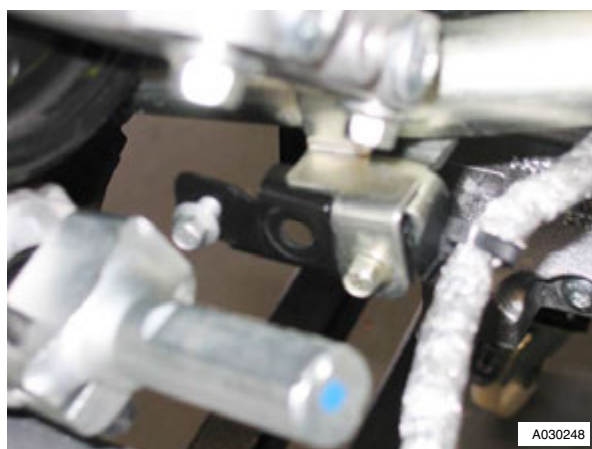
Removal

- Remove the PAS pump (refer to Workshop Manual procedure 03.05.AA Pump - Power Steering - Renew).

WARNING

**DO NOT GET USED ENGINE OIL ON YOUR SKIN.
USED ENGINE OIL CAN BE HARMFUL.**

- Remove pipe from oil controller (position container to catch oil).
- Remove bolt, pipes to bracket (refer to Figure 1).

**Figure 1**

- Remove LH exhaust manifold (refer to Workshop Manual procedure 09.00.CD Gasket - Exhaust Manifold - LH - Renew).
- Remove harness to pipe clip (refer to Figure 2).

**Figure 2**

- Remove bolts that attach the oil pipes to block.
- Release both pipes from block and remove inlet pipe.

Installation

- Renew O-ring on remaining oil pipe.
- Install inlet pipe and position both pipes into block.

3. Install bolts that attach the oil pipes to block (torque).
4. Install LH exhaust manifold (refer to Workshop Manual procedure 09.00.CD Gasket - Exhaust Manifold - LH - Renew).
5. Install bolt, pipes to bracket.
6. Install harness clip to pipe.
7. Install pipe to oil controller (torque).
8. Install P.A.S pump (refer to Workshop Manual procedure 03.05.AA Pump - Power Steering - Renew).
9. Fill tank with approximately amount of displaced oil and replace cap.
10. Use handbook procedure to check oil level.

Oil Pump Inlet Tube Assembly - Renew

Repair Operation Time (ROT)	
Item	Code
Oil Pump Inlet Tube Assembly - Renew	03.02.CE

Removal

1. Remove the PAS pump (refer to Workshop Manual procedure 03.05.AA Pump - Power Steering - Renew).

WARNING

**DO NOT GET USED ENGINE OIL ON YOUR SKIN.
USED ENGINE OIL CAN BE HARMFUL.**

2. Remove pipe from oil controller (position container to catch oil).
3. Remove bolt, pipes to bracket (refer to Figure 1).

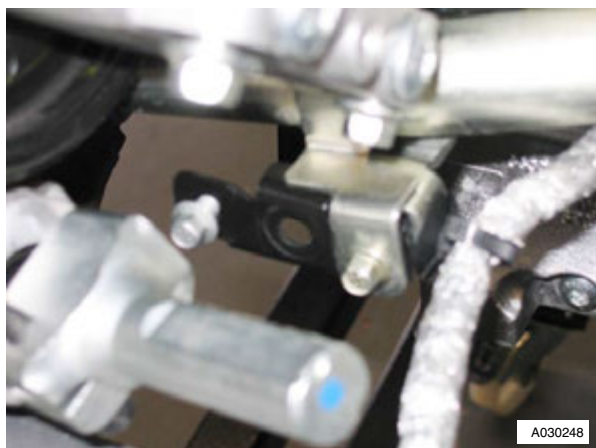


Figure 1

4. Remove LH exhaust manifold (refer to Workshop Manual procedure 09.00.CD Gasket - Exhaust Manifold - LH - Renew).

5. Remove harness to pipe clip (refer to Figure 2).



Figure 2

6. Remove bolts that attach the oil pipes to block.
7. Release both pipes from block and remove inlet pipe.

Installation

1. Renew O-ring on remaining oil pipe.
2. Install inlet pipe and position both pipes into block.
3. Install bolts that attach the oil pipes to block (torque).
4. Install LH exhaust manifold (refer to Workshop Manual procedure 09.00.CD Gasket - Exhaust Manifold - LH - Renew).
5. Install bolt, pipes to bracket.
6. Install harness clip to pipe.
7. Install pipe to oil controller (torque).
8. Install P.A.S pump (refer to Workshop Manual procedure 03.05.AA Pump - Power Steering - Renew).
9. Fill tank with approximately amount of displaced oil and replace cap.
10. Use handbook procedure to check oil level.

Oil Pump Outlet Tube Assembly - Renew

Repair Operation Time (ROT)	
Item	Code
Oil Pump Outlet Tube Assembly - Renew	03.02.CF

Removal

1. Remove PAS pump (refer to Workshop Manual procedure 03.05.AA Pump - Power Steering - Renew).

WARNING

**DO NOT GET USED ENGINE OIL ON YOUR SKIN.
USED ENGINE OIL CAN BE HARMFUL.**

2. Remove pipe from oil tank (position container to catch oil) (refer to Figure 1).

**Figure 1**

3. Remove bolt, pipes to bracket (refer to Figure 2).

**Figure 2**

4. Remove LH exhaust manifold (refer to Workshop Manual procedure 09.00.CD Gasket - Exhaust Manifold - LH - Renew).
5. Remove harness to pipe clip (refer to Figure 3).

**Figure 3**

6. Remove bolts that attach the oil pipes to block.
7. Release both pipes from block and remove outlet pipe.

Installation

1. Renew O-ring on remaining oil pipe.
2. Install outlet pipe and position both pipes into block.
3. Install bolts that attach the oil pipes to block (torque).
4. Install bolt, pipes to bracket.
5. Install harness clip to pipe.
6. Install pipe to oil tank (torque).
7. Install LH exhaust manifold (refer to Workshop Manual procedure 09.00.CD Gasket - Exhaust Manifold - LH - Renew).
8. Install P.A.S pump (refer to Workshop Manual procedure 03.05.AA Pump - Power Steering - Renew).
9. Fill tank with approximately amount of displaced oil and replace cap.
10. Use handbook procedure to check oil level.

Oil Thermostat Cooler Pipe Assembly - Renew

Repair Operation Time (ROT)	
Item	Code
Oil Thermostat Cooler Pipe Assembly - Renew	03.02.CG

Removal

1. Raise vehicle on ramp.
2. Remove undertray (refer to Workshop Manual procedure 01.02.NB Undertray - Front - Renew).
3. Remove LH air filter box (refer to Workshop Manual procedure 03.12.AB Air Filter Box LH Renew).

WARNING
DO NOT GET USED ENGINE OIL ON YOUR SKIN.
USED ENGINE OIL CAN BE HARMFUL.

4. Remove pipe from oil thermostat (position container to catch oil) (refer to Figure 1).

**Figure 1**

5. Unclip pipe (x4) from inner wing.



- Remove pipe from oil cooler and pull out from inner wing (position container to catch oil) (refer to Figure 2).
- Remove pipes from oil thermostat (position container to catch oil) (refer to Figure 1).

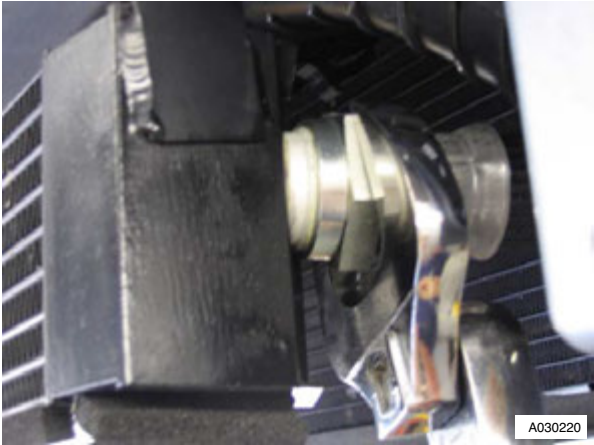


Figure 2

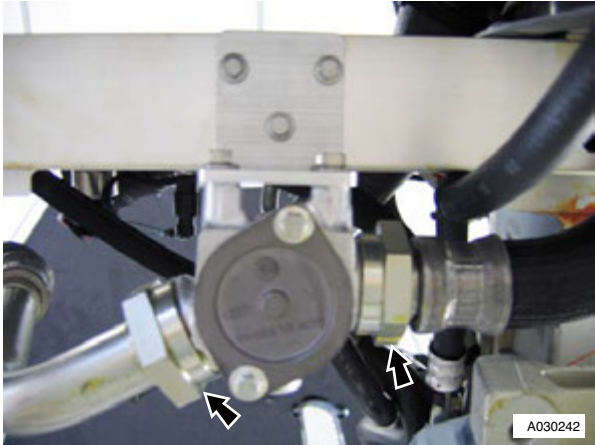


Figure 1

Installation

- Install pipe to oil cooler (torque) through inner wing.
- Clip pipe (x4) to inner wing.
- Install pipe to oil thermostat and ensure correct alignment in oil tank bracket.
- Install undertray (refer to Workshop Manual procedure 01.02.NB Undertray - Front - Renew).
- Lower vehicle on ramp.
- Install LH air filter box (refer to Workshop Manual procedure 03.12.AB Air Filter Box LH Renew).
- Fill tank with approximately amount of displaced oil and replace cap.
- Use handbook procedure to check oil level.

Oil Temperature Controller - Renew

Repair Operation Time (ROT)	
Item	Code
Oil Temperature Controller - Renew	03.02.CH

Remove

- Raise vehicle on ramp.
- Remove undertray (refer to Workshop Manual procedure 01.02.NB Undertray - Front - Renew).

WARNING
DO NOT GET USED ENGINE OIL ON YOUR SKIN.
USED ENGINE OIL CAN BE HARMFUL.

- Remove controller from body (bolts x2).

Install

- Install controller to body (bolts x2) (torque).
- Install pipes to oil thermostat (torque) ensure correct alignment in oil tank bracket.
- Install undertray (refer to Workshop Manual procedure 01.02.NB Undertray - Front - Renew).
- Fill tank with approximately amount of displaced oil and replace cap.
- Use handbook procedure to check oil level.
- Lower vehicle on ramp.

Oil Sump Pan - Renew (with Engine Removed)

Repair Operation Time (ROT)	
Item	Code
Oil Sump Pan-Renew (with Engine Removed)	03.02.CM

Removal

WARNING
DO NOT GET USED ENGINE OIL ON YOUR SKIN.
USED ENGINE OIL CAN BE HARMFUL.

- Remove oil sump (refer to Workshop Manual procedure 03.02.CN Pan - Oil Sump - Remove and Reseal With Engine Removed).

2. Remove bolt that attach the crankshaft timing sensor, remove sensor (refer to Figure 1).
5. Remove Torx screws (x4) that attach the oil filter plates (x2) to sump. Remove plates (refer to Figure 4).

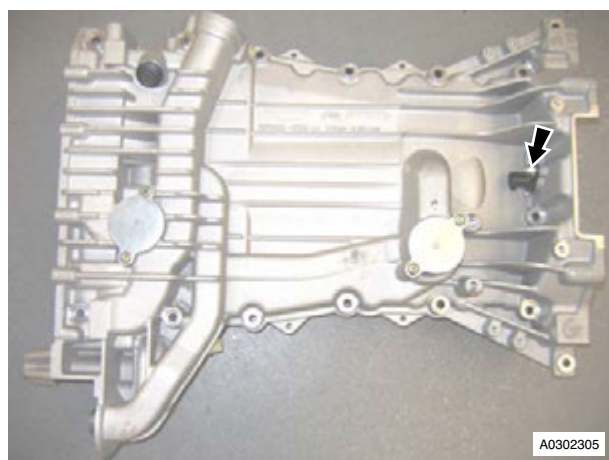


Figure 1

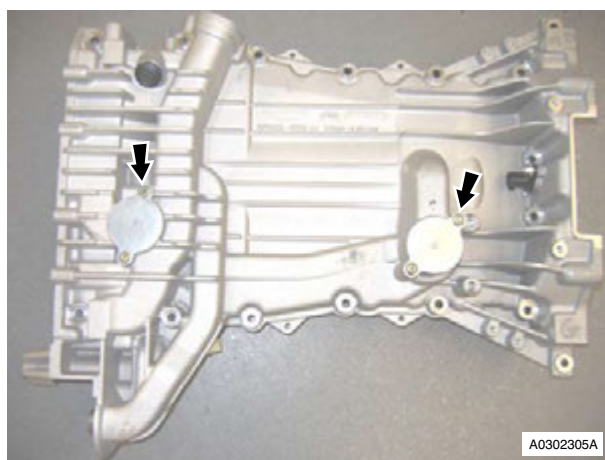


Figure 4

3. Remove oil pressure sensor (refer to Figure 2).



Figure 2

4. Remove engine electric coolant temperature sensor (refer to Figure 3).

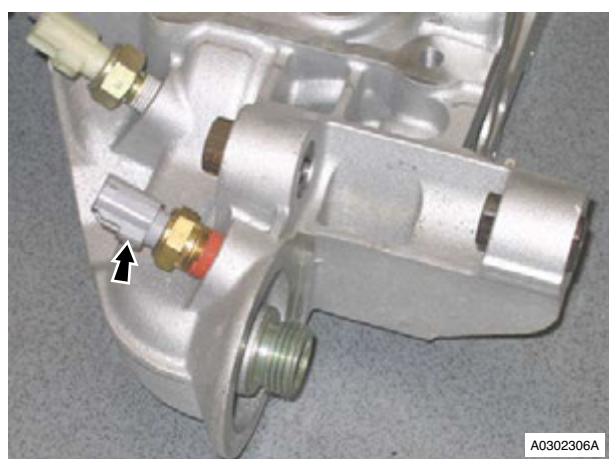


Figure 3

WARNING
DO NOT GET USED ENGINE OIL ON YOUR SKIN.
USED ENGINE OIL CAN BE HARMFUL.

6. Install suitable bolt and remove filters (x2) from sump (refer to Figure 5).



Figure 5

7. Remove oil filter adaptor (refer to Figure 6).

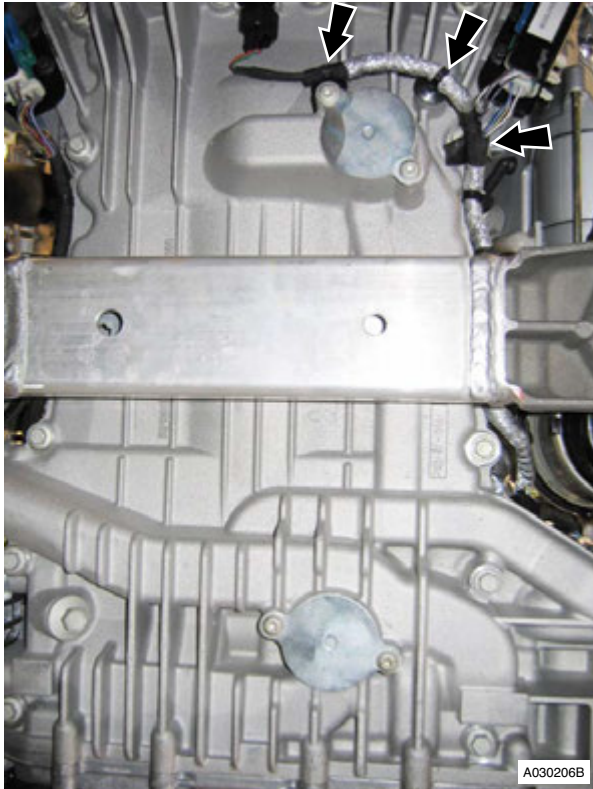


Figure 6

8. Press out alternator mounting bushes (x2) from sump (refer to Figure 7).

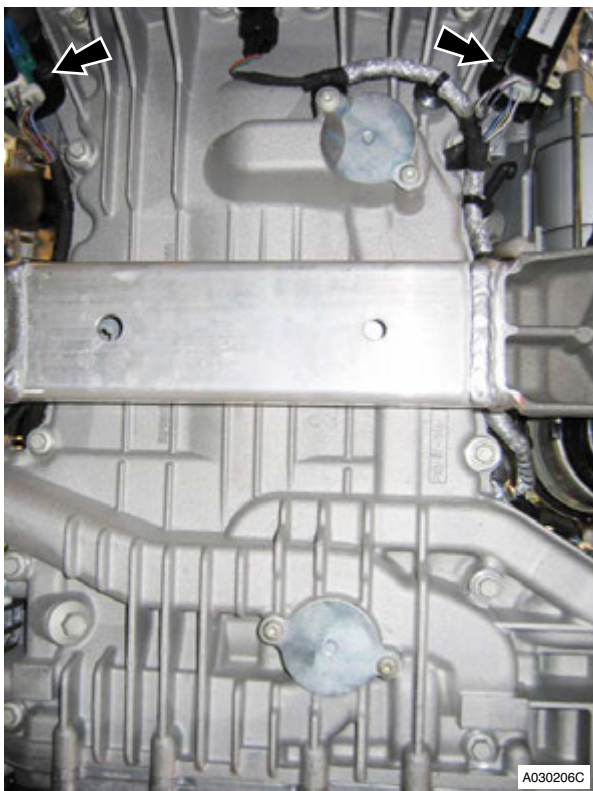


Figure 7

9. Remove dowels (x4) from sump for oil pressure and scavenge pumps location (refer to Figure 8).

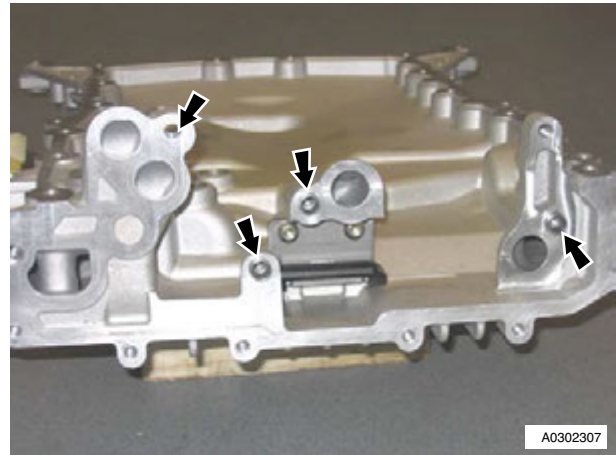


Figure 8

10. Remove Torx screws (x2) that attach the oil pump(s) chain guide, remove chain guide (refer to Figure 9).

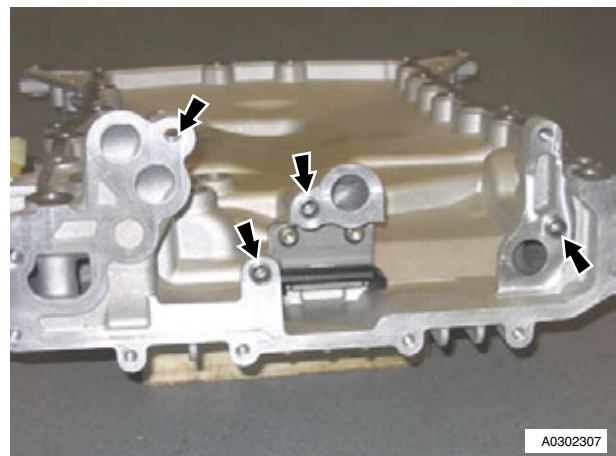


Figure 9

11. Remove oil plug from sump.

Installation

1. Clean chain guide, oil filter adaptor, filters (x2), sump plug, pump(s) dowels and crankshaft timing sensor.
2. Install alternator bushes.
3. Install oil filter adaptor.
4. Install filters (x2), install oil filter plates (x2), install and torque tighten Torx screws (x4).
5. Install oil plug.
6. Install oil pump(s) dowels (x4).
7. Clean old sealant from sensor threads (x2).
8. Apply sealant to engine electric coolant temperature sensor threads, install and torque tighten sensor.
9. Apply sealant to oil pressure sensor threads, install and torque tighten sensor.

10. Install oil pump(s) chain guide, Install and torque tighten Torx screws (x2).
 11. Install crankshaft timing sensor, install and torque tighten bolt.
 12. Install oil sump (refer to Workshop Manual procedure 03.02.CN Pan - Oil Sump - Remove and Reseal With Engine Removed).
3. Disconnect multiplug from engine electric coolant temperature sensor (refer to Figure 2).

Oil Sump Pan - Remove and Reseal (with Engine Removed)

Repair Operation Time (ROT)	
Item	Code
Oil Sump Pan-Remove and Reseal (with Engine Removed)	03.02.CN

Removal

WARNING
DO NOT GET USED ENGINE OIL ON YOUR SKIN.
USED ENGINE OIL CAN BE HARMFUL.

1. Remove oil pump(s) drive chain (refer to Workshop Manual procedure 03.02.BJ Chain - Oil Pump - Renew With Engine Removed).
2. Disconnect multiplug from oil pressure sensor (refer to Figure 1).

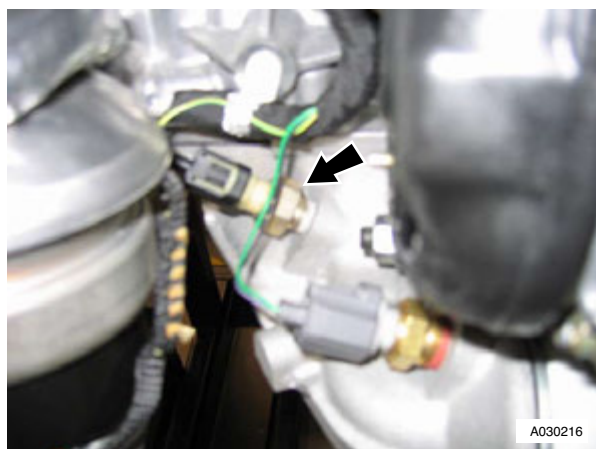


Figure 1

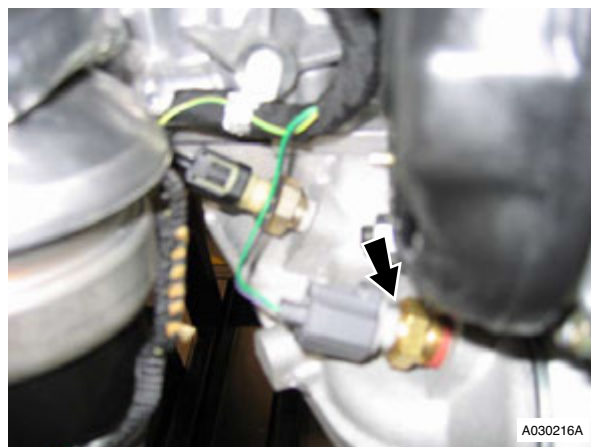


Figure 2

4. Disconnect multiplug from crankshaft timing sensor (refer to Figure 3).

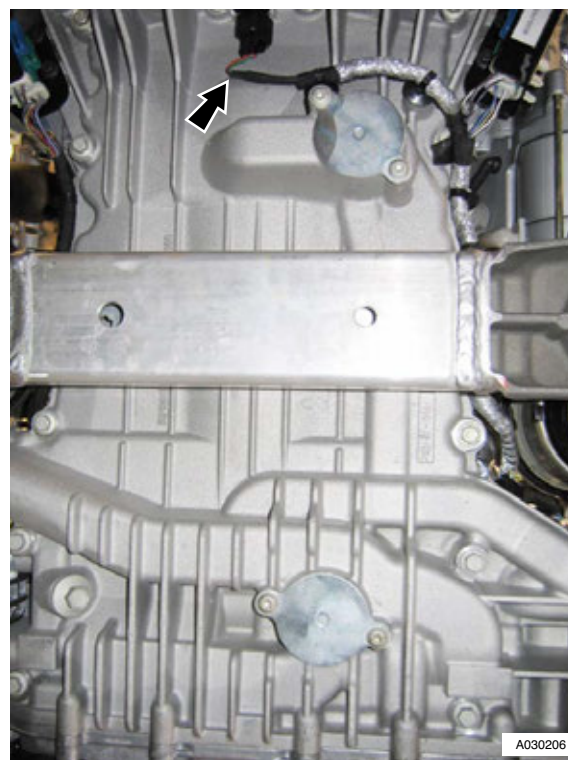


Figure 3

5. Release harness clips (x6) from sump (refer to Figure 4).
6. Remove bolts (x4) that attach the LH and RH HEGO sensor multiplug brackets to sump (refer to Figure 5).

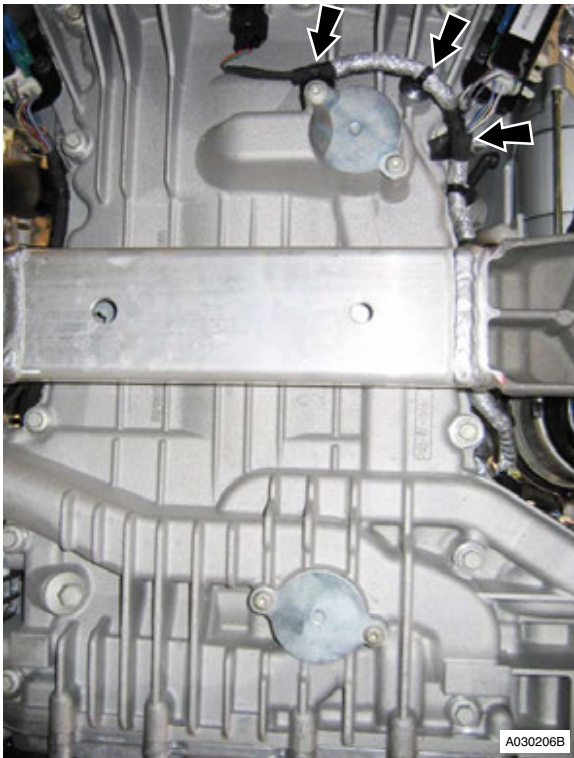


Figure 4

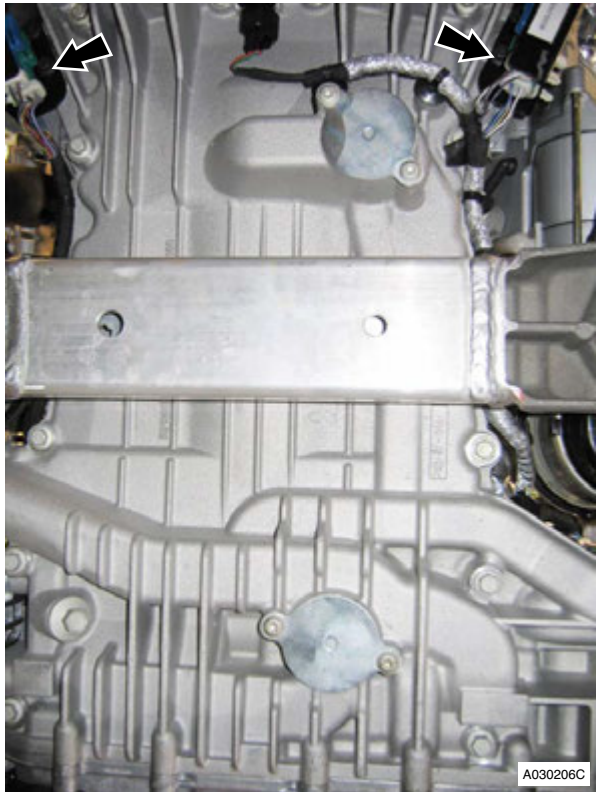


Figure 5

7. Disconnect multiplug from A/C compressor.
8. Remove bolts (x4) that attach the A/C compressor to mounting bracket. Tie compressor aside.

WARNING

**DO NOT GET USED ENGINE OIL ON YOUR SKIN.
USED ENGINE OIL CAN BE HARMFUL.**

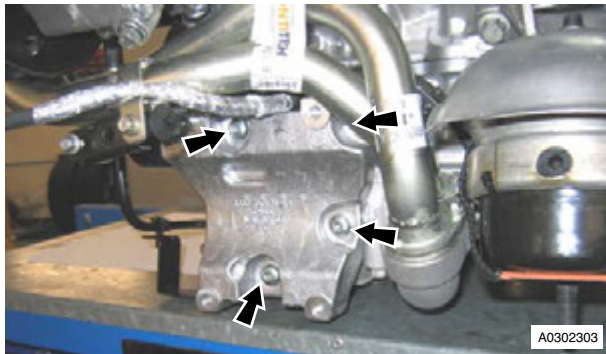
9. Remove bolts (x2) that attach the inlet and outlet oil pipes to sump (refer to Figure 6).



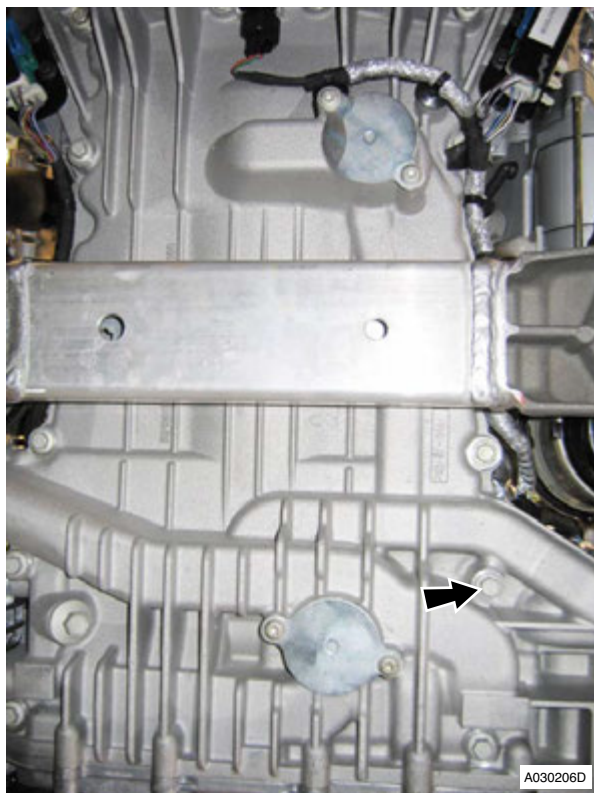
Figure 6

10. Release both oil pipes together from sump, remove and discard O-ring seals from pipes.

11. Remove Torx bolts (x4) that attach the A/C compressor mounting bracket to engine bedplate and sump. Remove bracket (refer to Figure 7).

**Figure 7**

12. Remove bolts (x16) that attach the sump to engine bedplate (refer to Figure 8).

**Figure 8**

13. Release and remove sump.

Installation

1. Clean old sealant from sump flange and engine bedplate.
2. Ensure that sump flange and mating face on engine bedplate are clean and dry.
3. Apply a continuous 3mm diameter bead of RTV sealant to sump flange as recommended.
4. Ensure that there are no gaps in sealant track.

5. Install sump, install and torque tighten bolts (x16) in the correct sequence.
6. Install A/C compressor mounting bracket, install and torque tighten Torx bolts (x4).
7. Lubricate and install new O-ring seals to oil pipes.
8. Install oil pipes in sump, install and torque tighten bolts (x2)
9. Install compressor, install and torque tighten bolts (x4).
10. Connect multiplug to A/C compressor.
11. Install LH and RH HEGO sensor multiplug brackets to sump. Install and torque tighten bolts (x4).
12. Secure harness clips (x6) in sump.
13. Connect multiplug to crankshaft timing sensor.
14. Connect multiplug to engine electric coolant temperature sensor.
15. Connect multiplug to oil pressure sensor.
16. Install oil pump(s) drive chain (refer to Workshop Manual procedure 03.02.BJ Chain - Oil Pump - Renew With Engine Removed).

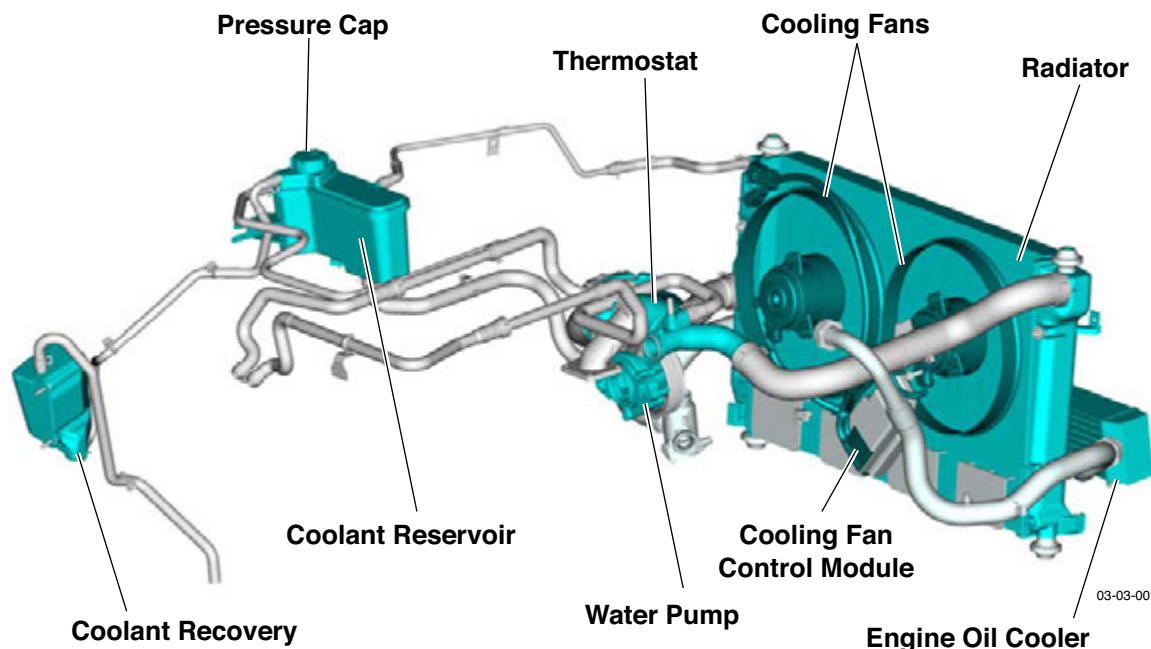


ASTON MARTIN

Engine (03.00)

Cooling System (03.03)

Description



- Water pump
- Thermostat
- Radiator
- Pressure cap

- Coolant Reservoir
- Electric cooling fans (x2)
- Cooling fan motor control module
- Engine oil cooler

Water Pump

The water pump is of a conventional design and is located at the front of the engine. It is driven by the accessory drive belt.

Thermostat

The thermostat allows rapid engine warm-up by redirecting coolant flow through the engine below 88°C (190.5°F).

The thermostat also assists in keeping the engine operating temperature within predetermined limits. The thermostat starts to open between 86°C - 90°C (186.8°F - 194°F) and is fully open at 102°C (215.5°F).

Cold Engine (Bypass Circuit) - When the engine is cold and the thermostat is closed coolant flows from the water pump through the engine block, through the cylinder heads and into the water cross-over housing. Coolant then passes through the secondary thermostat sealing plate and returns to the water pump.

Warm Engine (Cooling Module Circuit) - When the engine is warm and the thermostat is open coolant flows from the water pump, through the engine block, through the cylinder head and into the water cross-over housing. Coolant then passes through the upper coolant hose, through the radiator

and returns to the water pump through the lower coolant hose and water cross-over housing.

Radiator

The radiator is of aluminium construction with plastic end tanks. Foam seals are installed to the radiator to prevent the cooling air from by-passing the radiator core. The radiator is located by four isolator mountings and supported by the radiator support beams. A coolant drain plug is provided in the lower right-hand side for the draining of the coolant. The cooling fan shroud is attached to the radiator.

Cooling Fans

Two variable speed electric cooling fans are housed in the cooling fan pack for the cooling of the radiator. The speed of the electric cooling fans is adjusted by the Powertrain Control Module (PCM).

Coolant Reservoir

A pressurised coolant reservoir system is used which continuously removes any air from the cooling system. A continuous vent from the engine and radiator to the coolant expansion tank prevents air locks from forming in the



cooling system. No manual bleed points are provided on the system.

The coolant reservoir should be full when the coolant system is cold.

Engine Oil Cooler

The oil temperature is controlled by an air/oil cooler mounted at the front of the car. Engine oil is removed from the dry sump, with the scavenge pump. The oil is routed to a temperature controlled thermostat which controls the directional flow of the oil. With the thermostat closed the oil is routed directly to the oil tank. When the thermostat starts to open (at 105°C) the oil is routed via the air/oil cooler before entering the tank.

Specifications

Antifreeze Mix	50% OAT coolant/50% water
Pressure Cap	150kpa
Leakage Rates	30cm/min. 150-180kpa 60xcm/min. 10kpa
Water Pump	Up to 75kpa @ 150cm/h Pumps 4ltr/min. @ 1000rpm Pumps 240ltr/min. @ 7000rpm
Thermostat	Opens between 86°C - 90°C (186.8°F - 194°F) Fully open at 102°C

The anti-freeze is unique and cannot be mixed with other anti-freeze solutions. The OAT coolant/water mixture has a life of 150,000 miles or 5 years (which ever comes first).

Torque Figures

Description	Nm.	lb/ft
Condenser A/C pipes	8-10	6-8
Thermostat Housing	8-12	6-9
Thermostat housing support bracket	23-27	17-20
Water pump	23-27	17-20
Water pump pulley	23-27	17-20
Oil Cooler	50	36

Maintenance

Caution
'Spring-band' clips
'Spring-band' clips must be installed as detailed below:

All coolant hoses and spigots must be de-greased before assembly.

Coolant-Drain/Fill

Repair Operation Time (ROT)	
Item	Code
Coolant-Drain-Fill	03.03.AD

1. Raise vehicle on ramp.
 2. Remove front undertray (refer to Workshop Manual procedure 01.02.NB Undertray - Front - Renew).
 3. Position suitable container to collect coolant.
- WARNING**
DO NOT REMOVE THE PRESSURE CAP WHEN THE COOLANT IS HOT. ALLOW TIME FOR THE COOLANT / ENGINE TO COOL. TAKE PARTICULAR CARE TO AVOID BURNS FROM THE COOLING SYSTEM.
4. Remove pressure cap from coolant reservoir.
 5. Remove drain plug from radiator, allow coolant to drain.
 6. Installation
 7. Clean radiator drain plug.
 8. Install and tighten drain plug.
 9. Remove drain container.
 10. Install front undertray (refer to Workshop Manual procedure 01.02.NB Undertray - Front - Renew).
 11. Lower vehicle on ramp.
 12. Fill cooling system with specified coolant mix to maximum level in coolant reservoir.

13. Install and tighten pressure cap.

WARNING

DO NOT REMOVE THE PRESSURE CAP WHEN THE COOLANT IS HOT. ALLOW TIME FOR THE COOLANT / ENGINE TO COOL. TAKE PARTICULAR CARE TO AVOID BURNS FROM THE COOLING SYSTEM.

14. Run engine until normal operating temperature is reached.

15. Stop engine, allow to cool down.

16. Re-check coolant level, top-up as necessary.

Thermostat - Renew

Repair Operation Time (ROT)	
Item	Code
Thermostat - Renew	03.03.CB

Removal

1. Drain Coolant (refer to Workshop Manual procedure 03.03.AD Coolant - Drain and Refill).
2. Release breather valve (bolt x1) and tie aside.
3. Unclip engine harness for access (x4).
4. Remove one end of engine breather hoses for access (x3).
5. Remove breather valve bracket for access (nuts x2 bolt x1).
6. Remove thermostat housing from manifold (bolt x3).
7. Remove thermostat and sealing ring.

Installation

1. Install new thermostat and sealing ring.
2. Install thermostat housing (torque).
3. Install breather valve bracket.
4. Install breather hoses (x3) and clip.
5. Clip engine harness.
6. Install breather valve.
7. Refill coolant (refer to Workshop Manual procedure 03.03.AD Coolant - Drain and Refill).

Water Pump - Renew

Repair Operation Time (ROT)	
Item	Code
Water Pump - Renew	03.03.CD

Removal

1. Drain cooling system (refer to Workshop Manual procedure 03.03.AD Coolant - Drain and Refill).
2. Disconnect breather pipe quickfits (x2) from air cleaner duct.
3. Remove throttle body duct for access. (clips x3).

4. Remove pump pulley bolts (x3) (refer to Figure 1).



Figure 1

5. Release tensioner and slip belt from idler.
6. Remove pump pulley.
7. Remove pump (bolts x7) (refer to Figure 2).



Figure 2

Installation

1. Install pump (bolts x7) (torque), clean mating faces.
2. Fit pulley to pump with bolts.
3. Torque pulley bolts (bolt x3).
4. Release tensioner and slip belt on idler.
5. Install throttle body duct.
6. Connect breather pipe quickfits (x2) to air cleaner duct.
7. Refill cooling system (refer to Workshop Manual procedure 03.03.AD Coolant - Drain and Refill).

Water Pump Pulley - Renew

Repair Operation Time (ROT)	
Item	Code
Water Pump Pulley - Renew	03.03.CE

Removal

1. Battery isolation switch 'OFF'.
2. Disconnect breather pipe quickfits (x2) from air cleaner duct.

3. Remove throttle body duct for access. (clips x3).
4. Remove pump pulley bolts (x3) (refer to Figure 1).



Figure 1

3. Remove pipes from oil thermostat (position container to catch oil) (refer to Figure 1).

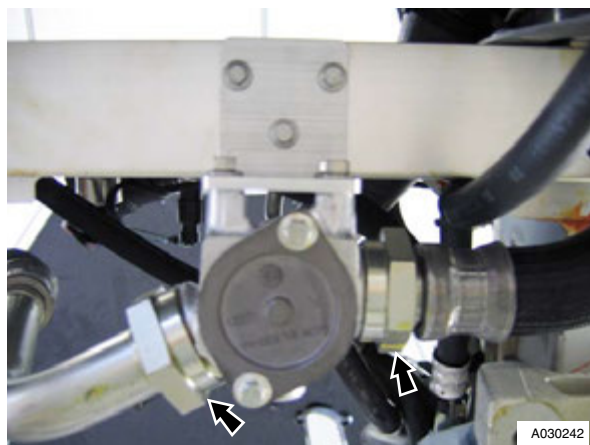


Figure 1

5. Release tensioner and slip belt from idler.
6. Remove pump pulley.

Installation

1. Fit pulley to pump with bolts.
2. Torque pulley bolts (bolt x3).
3. Release tensioner and slip belt on idler.
4. Install throttle body duct.
5. Connect breather pipe quickfits (x2) to air cleaner duct.
6. Battery isolation switch 'ON'.

Oil Temperature Controller - Renew

Repair Operation Time (ROT)	
Item	Code
Oil Temperature Controller - Renew	03.02.CH

Remove

1. Raise vehicle on ramp.
2. Remove undertray (refer to Workshop Manual procedure 01.02.NB Undertray - Front - Renew).

WARNING

**DO NOT GET USED ENGINE OIL ON YOUR SKIN.
USED ENGINE OIL CAN BE HARMFUL.**

4. Remove controller from body (bolts x2).

Install

1. Install controller to body (bolts x2) (torque).
2. Install pipes to oil thermostat (torque) ensure correct alignment in oil tank bracket.
3. Install undertray (refer to Workshop Manual procedure 01.02.NB Undertray - Front - Renew).
4. Fill tank with approximately amount of displaced oil and replace cap.
5. Use handbook procedure to check oil level.
6. Lower vehicle on ramp.

Radiator Fan and Motor Assembly - Remove and Install

Repair Operation Time (ROT)	
Item	Code
Radiator Fan and Motor Assembly - Remove and Install	03.03.DB

Removal

1. Open the boot..
2. Set the battery isolation switch to off.
3. Remove the radiator closing panel. (01.02.AA - Radiator Closing Panel).
4. Disconnect the two electrical connectors from the wiring harness for the radiator fan and motor assembly.
5. Remove the two bolts that attach the horn mount bracket to the body.
6. Move the horn assembly away.
7. Remove the two nuts that attach the radiator fan and motor assembly to the body.
8. Remove the radiator fan and motor assembly.

Installation

1. Install the radiator fan and motor assembly.
2. Install and tighten the two nuts that attach the radiator fan and motor assembly to the body.

3. Put the horn assembly into the correct position.
4. Install and tighten the two bolts that attach the horn mount bracket to the body.
5. Connect the two electrical connectors to the wiring harness for the radiator fan and motor assembly.
6. Install the radiator closing panel. (0102AA - Radiator Closing Panel).
7. Set the battery isolation switch to on.
8. Close the boot.

Radiator and Condenser Assembly - Renew

Repair Operation Time (ROT)	
Item	Code
Radiator and Condenser Assembly - Renew	03.03.EA

Removal

1. Remove cooling fan pack (refer to Workshop Manual procedure 03.03.DB Fan and Motor Assembly - Radiator - Renew).
2. Remove grille (refer to Workshop Manual procedure 01.08.AA Grille - Radiator - Renew).
3. Drain cooling system (refer to Workshop Manual procedure 03.03.AD Coolant - Drain and Refill).
4. Recover refrigerant (refer to Workshop Manual procedure 12.03.FA Refrigerant Gas - Recover/Recharge - Renew).
5. Remove bolts (x4), that attach the PAS fluid cooler to bonnet latch cross member. Tie fluid cooler aside.
6. Remove bolts (x6), and spacers (x2) that attach the bonnet latch cross member to body and position aside.
7. Disconnect top and bottom hose from radiator (clips x2).
8. Remove expansion tank hose from radiator (clip x1).
9. Remove bolts (x2), that attach the condenser pipe connections. Plug pipes and block connections.

Caution

Make sure that all open ends are plugged immediately after disconnecting refrigeration parts. If moist air or foreign material enters the refrigeration cycle, cooling ability will be lowered and abnormal noise or other faults may occur.

10. Remove radiator mounting rubbers (x4)
11. Remove foam seals from radiator (x3).

Installation

1. Install foam seals to radiator (x3).
2. Install rubber mounts to radiator (x4).
3. Clean pipe connections, remove plugs.
4. Install new 'O' rings to pipe connections. Connect pipes to condenser. Install and torque tighten bolts (x2).
5. Connect top and bottom hoses to radiator (clips x2).
6. Connect expansion tank hose to radiator (clip x1).

7. Install bonnet latch cross member, install spacers and bolts (torque).
8. Position PAS fluid cooler to cross member, install and torque tighten bolts (x4).
9. Install grill (refer to Workshop Manual procedure 01.08.AA Grille - Radiator - Renew).
10. Install cooling fan pack (refer to Workshop Manual procedure 03.03.DB Fan and Motor Assembly - Radiator - Renew).
11. Recharge refrigerant (refer to Workshop Manual procedure 12.03.FA Refrigerant Gas - Recover/Recharge - Renew).
12. Refill cooling system (refer to Workshop Manual procedure 03.03.AD Coolant - Drain and Refill).

Radiator Assembly - Renew

Repair Operation Time (ROT)	
Item	Code
Radiator Assembly - Renew	03.03.EB

Removal

1. Remove cooling fan pack (refer to Workshop Manual procedure 03.03.EB Fan and Motor Assembly Radiator - Renew)
2. Remove grille (refer to Workshop Manual procedure 01.08.AA Grille - Radiator - Renew).
3. Drain coolant (refer to Workshop Manual procedure 03.03.AD Coolant - Drain and Refill).
4. Remove bolt that attaches the PAS pipe bracket to bottom cross member.
5. Remove bolts (x6), and spacers (x2) that attach the bonnet latch cross member to body and position aside.
6. Disconnect top and bottom hose from radiator (clips x2).
7. Disconnect top and bottom hose from radiator (clips x2).
8. Remove expansion tank hose from radiator (clip x1).
9. Remove bolts (x2) that attach the radiator to condenser.
10. Unclip condenser from radiator and remove from vehicle (lugs x4) (support condenser).
11. Remove radiator mounting rubbers (x4)
1. Remove foam seals from radiator (x3).

Installation

1. Install foam seals to radiator (x3).
2. Install rubber mounts to radiator (x4).
3. Install radiator and clip to condenser (lugs x4).
4. Install condenser to radiator bolts x2 (torque).
5. Connect top and bottom hoses to radiator (clips x2).
6. Connect expansion tank hose to radiator (clip x1).
7. Install bonnet latch cross member, install spacers and bolts (torque).
8. Position PAS fluid cooler to cross member, install and torque tighten bolts (x4).



9. Install grill (refer to Workshop Manual procedure 01.08.AA Grille - Radiator - Renew).
10. Install cooling fan pack (refer to Workshop Manual procedure 03.03.EB Fan and Motor Assembly Radiator - Renew).
11. Raise vehicle
12. Install bottom radiator crossmember (bolts x4) (torque).
13. Install PAS pipe bracket to cross member (bolt x1).
14. Refill coolant (refer to Workshop Manual procedure 03.03.AD Coolant - Drain and Refill).

Air Conditioning Condenser - Renew

Repair Operation Time (ROT)	
Item	Code
Air Conditioning Condenser - Renew	03.03.EC

Removal

1. Recover refrigerant gas from A/C system (refer to Workshop Manual procedure 12.03.FA Refrigerant Gas - Recover/Recharge - Renew).
2. Remove grille (refer to Workshop Manual procedure 01.08.AA Grille - Radiator - Renew).
3. Remove slam panel (screws x12).
4. Remove bolts (x4), that attach the PAS fluid cooler to bonnet latch cross member. Tie fluid cooler aside.
5. Remove bolts (x6), and spacers (x2) that attach the bonnet latch cross member to body and position aside.
6. Remove bolts (x2), that attach the condenser pipe connections. Plug pipes and block connections.

Caution

Make sure open ends are plugged immediately after disconnecting refrigeration parts. If moist air or foreign material enters the refrigeration cycle, cooling ability will be lowered and abnormal noise or other faults may occur.

7. Remove and discard O-rings (x2) from pipe connections.
8. Remove bolts (x2), that attach the condenser to radiator, remove condenser.

Installation

1. Install condenser to radiator, install and torque tighten bolts (x2).
2. Clean pipe connections, remove plugs.
3. Install new O-rings to pipe connections. Connect pipes to condenser. Install and torque tighten bolts (x2).
4. Install bonnet latch cross member, install spacers and bolts (torque).
5. Position PAS fluid cooler to cross member, install and torque tighten bolts (x4).
6. Install slam panel.
7. Install grille (refer to Workshop Manual procedure 01.08.AA Grille - Radiator - Renew).

8. Refrigerant gas re-charge A/C system (refer to Workshop Manual procedure 12.03.FA Refrigerant Gas - Recover/Recharge - Renew).

Radiator Fan Modulator - Remove and Install

Repair Operation Time (ROT)	
Item	Code
Radiator Fan Modulator - Remove and Install	03.03.EC

Removal

1. Remove the radiator fan and motor assembly. (0303DB - Radiator Fan and Motor Assembly).
2. Disconnect the two electrical connectors from the radiator fan modulator.
3. Release the five fir tree clips that attach the wiring harness for the radiator fan modulator to the fan cowl.
4. Release the two electrical connectors for the radiator fan modulator from the mount.
5. Remove the screw that attaches the radiator fan modulator to the fan cowl.
6. Remove the radiator fan modulator.

Install

1. Install the radiator fan modulator.
2. Install and tighten the screw that attaches the radiator fan modulator to the fan cowl.
3. Attach the two electrical connectors for the radiator fan modulator to the mount.
4. Install the five fir tree clips that attach the wiring harness for the radiator fan modulator to the fan cowl.
5. Connect the two electrical connectors to the radiator fan modulator.
6. Install the radiator fan and motor assembly. (03.03.DB - Radiator Fan and Motor Assembly).

Expansion Tank Assembly - Renew

Repair Operation Time (ROT)	
Item	Code
Expansion Tank Assembly - Renew	03.03.FB

Remove

WARNING

DO NOT REMOVE THE PRESSURE CAP WHEN THE COOLANT IS HOT. ALLOW TIME FOR THE COOLANT / ENGINE TO COOL. TAKE PARTICULAR CARE TO AVOID BURNS FROM THE COOLING SYSTEM.

1. Using a syringe, remove coolant from expansion tank.
2. Remove bolts (x4), remove LH corner cross brace.
3. Release clips, disconnect coolant hoses (x3) from expansion tank.
4. Remove upper bolt and side nut that attaches the expansion tank.

5. Raise expansion tank sufficient to disconnect multiplug, release clip, disconnect hose.
6. Remove expansion tank.
8. Release the clip that attaches each of the two hoses (2) to the recovery tank and release the hoses (refer to Figure 1).

Install

1. Position expansion tank, connect multiplug, install hose and secure with clip.
2. Install nut and bolt, tighten to correct torque.
3. Install hoses (x3) on expansion tank, secure with clips (x3).
4. Install LH cross brace, install bolts (x4) (torque with vehicle on level ground).
5. Refill expansion tank to correct level with correct coolant fluid mixture.
6. Clean up any spilled coolant fluid.

Coolant Recovery Tank Assembly - Remove and Install

Repair Operation Time (ROT)	
Item	Code
Coolant Recovery Tank Assembly- Remove and Install	03.03.FD

Remove

1. Raise the vehicle and make it safe.
2. On Roadster vehicles, remove the centre undertray.
3. Remove the left side front wheel.
4. Remove the five or six M6 Torx-head screws that attach the rear of the wheelarch liner.
5. Remove the self-tapping screw that attaches the rear of the wheelarch liner into the wheelarch.
6. Turn the steering fully to the left.
7. Move the rear of the wheelarch liner away to get access to the recovery tank.

WARNING

DO NOT DISCONNECT THE HOSES WHEN THE COOLANT IS HOT. HOT COOLANT CAN CAUSE INJURY. LET THE COOLANT AND THE ENGINE COOL BEFORE YOU DO WORK.

Note: Put absorbent material around the work area to absorb spilled fluid.

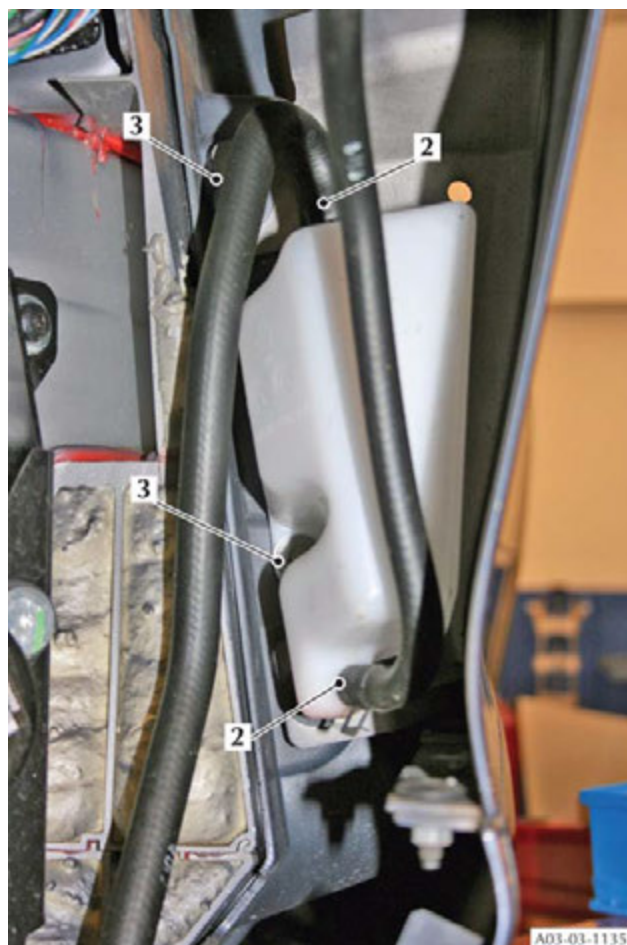


Figure 1

9. Remove the two M6 screws (3) that attach the recovery tank to the body and remove the recovery tank.

Install

1. Put the recovery tank in position on the body.
2. Install and tighten the two M6 attachment screws (3).
3. Connect the two hoses (2) to the recovery tank.
4. Put the clip back in position on each hose.
5. Put the wheelarch liner back into position.
6. Turn the steering to the centre position.
7. Install the self-tapping screw that attaches the rear of the wheelarch liner into the wheelarch.
8. Install the five or six M6 Torx-head screws that attach the rear of the wheelarch liner.
9. Install the front left roadwheel.
10. On Roadster vehicles, install the centre undertray.
11. Lower the vehicle.
12. Do a check of the coolant level and fill if necessary.



Engine Coolant Reservoir Hose - Renew

Repair Operation Time (ROT)	
Item	Code
Engine Coolant Reservoir Hose - Renew	03.03.KA

Removal

1. Drain cooling system (refer to Workshop Manual procedure 03.03.AD Coolant - Drain and Refill).
2. Remove screw and nut that attaches the expansion tank to body, move expansion tank aside (to access hose clip).
3. Release clip and disconnect hose from expansion tank.
4. Remove hose from engine (quickfit).
5. Release hose from body clip, remove hose.

Installation

1. Install hose, secure in body clip.
2. Install hose to expansion tank, secure with clip.
3. Install and secure hose to engine (quick fit).
4. Install and torque tighten screw and nut that attaches the expansion tank to body.
5. Refill cooling system (refer to Workshop Manual procedure 03.03.AD Coolant - Drain and Refill).

Water Inlet/Outlet Manifold - Renew

Repair Operation Time (ROT)	
Item	Code
Water Inlet/Outlet Manifold - Renew LHD	03.03.MH
Water Inlet/Outlet Manifold - Renew RHD	03.03.MJ

Removal

1. Remove reservoir bracket assembly - vacuum system (refer to Workshop Manual procedure 03.08.AE Reservoir and Bracket Assembly - Vacuum System - Renew).
2. Disconnect bottom hose (clip x1) (refer to Figure 1).



Figure 1

3. Disconnect top hose (clip x1) (refer to Figure 2).

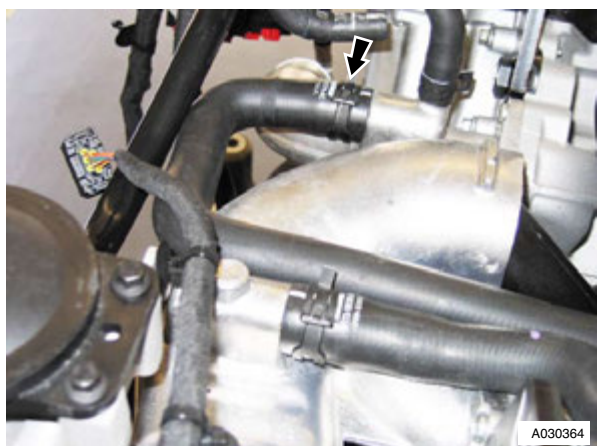


Figure 2

4. Disconnect expansion tank feed hose (quickfit) (refer to Figure 3).
7. Disconnect breather hose (quickfit) (refer to Figure 6).

**Figure 3**

5. Disconnect heater feed hose (clip x1) (refer to Figure 4).

**Figure 4**

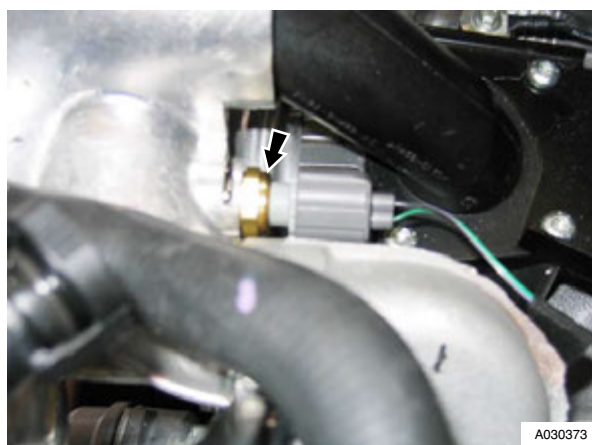
6. Disconnect heater return hose (clip x1) (refer to Figure 5).

**Figure 5****Figure 6**

8. Disconnect separator hose (clip x1) (refer to Figure 7).

**Figure 7**

9. Disconnect coolant temperature multiplug (refer to Figure 8).

**Figure 8**

10. Remove harness clips (x2).
11. Remove 4th bolt of vacuum tank bracket fixing (refer to Figure 9).

12. Remove coolant manifold (bolts x4) (refer to Figure 9). 4. Remove pump pulley bolts (x3) (refer to Figure 1).

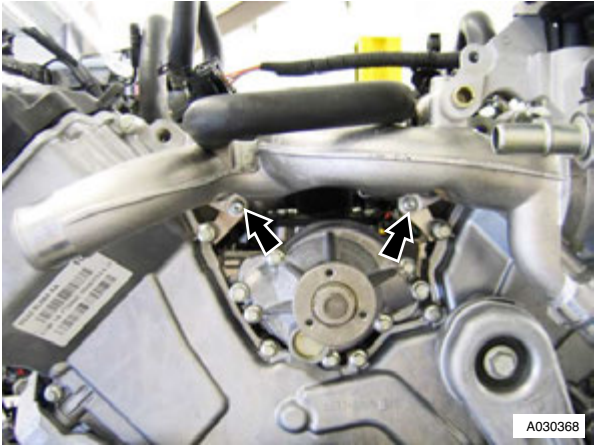


Figure 9



Figure 1

13. Remove old seals.
14. Remove bracket breather (bolt x1, nut x2).

Installation

1. Install bracket breather (bolt x1, nuts x2) (torque).
2. Clean gasket faces.
3. Install new seals.
4. Install coolant manifold (bolts x4) (torque).
5. Install 4th bolt of vacuum tank bracket fixing (torque).
6. Install harness clips (x2).
7. Connect coolant temp multiplug.
8. Connect separator hose (clip x1).
9. Connect breather hose (quickfit).
10. Connect heater return hose (clip x1).
11. Connect heater feed hose (clip x1).
12. Connect expansion tank feed hose (quickfit).
13. Disconnect top hose (clip x1).
14. Connect bottom hose (clip x1).
15. Install reservoir bracket assembly - vacuum system (refer to Workshop Manual procedure 03.08.AE Reservoir and Bracket Assembly - Vacuum System - Renew).

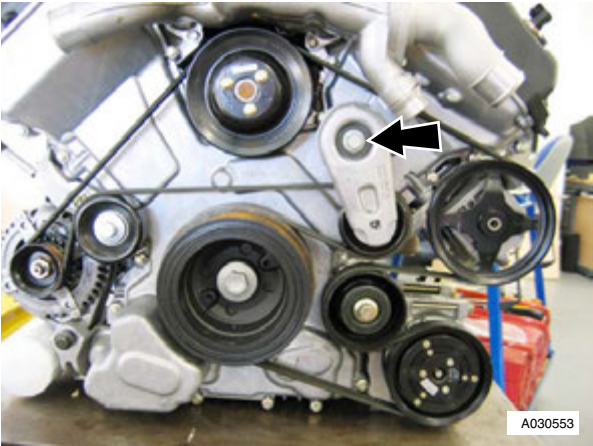


Figure 2

5. Release tensioner and slip belt from idler (refer to Figure 2).

6. Remove pump pulley.
7. Disconnect throttle body coolant hose (refer to Figure 3).

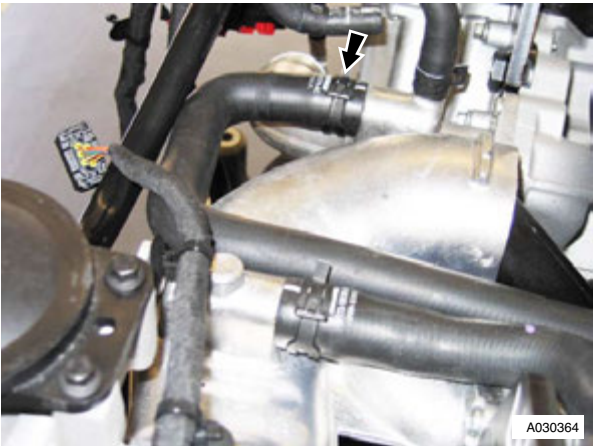


Figure 3

Engine Electric Coolant Temperature Sensor - Renew

Repair Operation Time (ROT)	
Item	Code
Engine Electric Coolant Temperature Sensor - Renew	03.03.GB

Removal

1. Drain Cooling system (refer to Workshop Manual procedure 03.03.AD Coolant - Drain and Refill).
2. Disconnect breather pipe quickfits (x2) from air cleaner duct.
3. Remove throttle body duct for access. (clips x3).

8. Remove sensor attachment clip (refer to Figure 4).

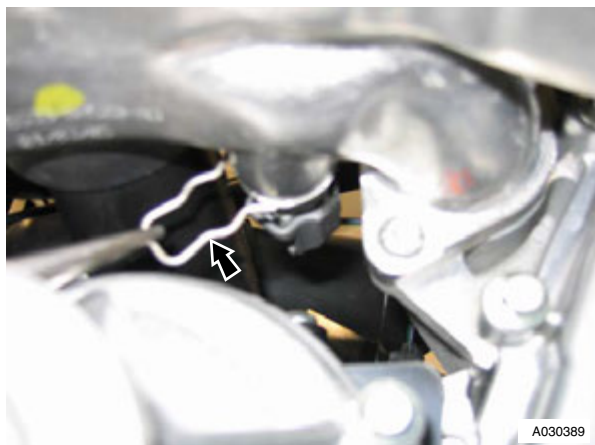


Figure 4

9. Remove sensor from housing with multiplug, then disconnect (refer to Figure 5).

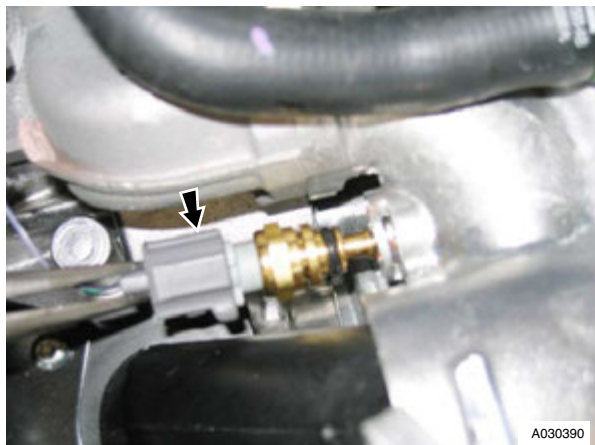


Figure 5

Installation

1. Clean seal area.
2. Install sensor, with multiplug connected.
3. Install sensor attachment clip.
4. Connect throttle body coolant hose.
5. Fit pulley to pump with bolts.
6. Release tensioner and slip belt on idler.
7. Torque pulley bolts (bolt x3).
8. Install throttle body duct.
9. Connect breather pipe quickfits (x2) to air cleaner duct.
10. Refill cooling system (refer to Workshop Manual procedure 03.03.AD Coolant - Drain and Refill).

Thermostat Cover - Renew

Repair Operation Time (ROT)	
Item	Code
Thermostat Cover - Renew	03.03.HB

Removal

1. Drain Coolant (refer to Workshop Manual procedure 03.03.AD Coolant - Drain and Refill).
2. Release breather valve (bolt x1) and tie aside.
3. Disconnect breather pipe quickfits (x2) from air cleaner duct.
4. Remove throttle body duct for access. (clips x3).
5. Unclip engine harness for access (x4).
6. Remove one end of engine breather hoses for access (x3).
7. Remove breather valve bracket for access (nuts x2 bolt x1).
8. Remove thermostat housing from manifold (bolt x3).
9. Remove thermostat and sealing ring.

Installation

1. Install thermostat and sealing ring.
2. Install thermostat housing (torque).
3. Install breather valve bracket.
4. Install breather hoses (x3) and clip.
5. Clip engine harness.
6. Install breather valve.
7. Install throttle body duct.
8. Connect breather pipe quickfits (x2) to air cleaner duct.
9. Refill coolant (refer to Workshop Manual procedure 03.03.AD Coolant - Drain and Refill).



ASTON MARTIN

Engine (03.00)

Fuel Charging System (03.04)

Safety Precautions

Operations on fuel system result in fuel liquid and vapour being present in the working environment. This presents a very serious risk and the following precautions must be strictly observed:

WARNING

OPERATIONS ON REFUELLING AND THE FUEL SYSTEM MUST ONLY BE PERFORMED BY PERSONNEL WHO HAVE COMPLETED TRAINING ON FUEL HANDLING.

WARNING

SMOKING MUST NOT BE ALLOWED NEAR THE WORKING AREA. "NO SMOKING" SIGNS MUST BE POSTED AROUND THE WORKING AREA.

WARNING

ANY OPERATION WHICH COULD INVOLVE SPARKS OR NAKED LIGHTS (E.G. BATTERY TESTING, WELDING, METAL GRINDING, ETC.) MUST NOT BE ALLOWED NEAR THE WORKING AREA.

WARNING

A CO2 FIRE EXTINGUISHER MUST BE AVAILABLE CLOSE AT HAND.

WARNING

DRY SAND MUST BE AVAILABLE CLOSE AT HAND TO SOAK UP ANY ACCIDENTAL FUEL SPILLAGE.

WARNING

IF NECESSARY, EMPTY THE FUEL INTO AN EXPLOSION PROOF CONTAINER USING SUITABLE FIREPROOF FUEL HANDLING EQUIPMENT.

WARNING

THE WORKING AREA MUST BE WELL VENTILATED.

WARNING

DISCONNECT THE BATTERY BEFORE COMMENCING WORK ON THE FUEL SYSTEM.

WARNING

DEPRESSURISE THE FUEL SYSTEM BEFORE DISCONNECTING ANY FUEL LINES.

Maintenance

Fuel Rails - Renew

Repair Operation Time (ROT)	
Item	Code
Fuel Rails-Renew	03.01.BZ

Removal

1. Depressurise fuel rail (see Workshop Manual procedure 10.01.EK Fuel System - Depressurise).

Note: Removal Not Handed

2. Coolant drain (see Workshop Manual procedure 03.03.AD Coolant - Drain and Refill).
3. Remove cross brace (bolts x4).

Removal RH Side

4. Remove coil cover.
5. Disconnect breather hose (quick fit) move aside.
6. Release harness fir tree clips (x3) from cylinder head and move aside.
7. Remove fuse box bracket fixings (bolt and nut) (allows movement).
8. Remove ECM (see Workshop Manual procedure 03.14.BB Engine Control Module - RH Renew).
9. Remove battery lead (1x nut and rubber cover) from fuse box (2x leads).
10. Remove multiplugs (x10) from fusebox.
11. Remove earth terminal (1x nut and rubber cover) from fusebox.
12. Remove fuse box from bracket (bolt x2).
13. Release harness fir tree clips (x3) from engine bracket.
14. Feed harness from inner wing and over engine to gain access to cam cover.
15. Remove purge pipe P-clip (bolt x1) and move pipe aside.
16. Remove harness bracket from engine (bolts x2, nut x1).
17. Release fuel feed hose from rail (clip x1) and move aside.
18. Disconnect heater hose from pipe (quick fit).
19. Release heater hose (clips x2) and EGR vacuum line (clips x2) from bracket.
20. Release harness from coolant pipe bracket (fir tree x3).
21. Disconnect EGR (x1), fuel rail pressure sensor (x1) and injector multiplugs (x4), move harness aside.
22. Remove coolant pipe bracket (nuts x2 and bolts x2).
23. Disconnect EGR vac pipe from sensor and manifold, move aside.

Removal LH Side

24. Remove corner cross brace.
25. Remove coil cover.
26. Disconnect breather hoses from cam cover (x2) for access.
27. Disconnect purge line from manifold (quickfit) and support clip for access.

28. Disconnect heater hose from pipe (quick fit).
29. Release heater hose (x2) and throttle body hose (x2) from support bracket.
30. Remove booster hose from manifold and support clip.
31. Remove harness support bracket (bolt x1, nut x2) release harness clips (fir tree x3).
32. Release pipe support bracket (nuts x2, bolts x2) move aside.
33. Disconnect injector multiplugs (x4).
34. Unclip injector harness from cam cover (x2).
35. Disconnect IAT multiplug.
36. Disconnect breather hose from manifold (quickfit).

Removal - Manifold From Vehicle

37. Disconnect manifold heating hoses (x2).
38. Disconnect throttle body multiplug and harness clip.
39. Disconnect breather pipe quickfits (x2) from air cleaner duct.
40. Disconnect air cleaner duct (clip x1).
41. Disconnect EGR vacuum hose.
42. Disconnect EGR pipe union and tie aside.
43. Remove manifold bolts (x 10).
44. Remove bolts (x2) bracket to manifold (rear).

WARNING

THE INTAKE MANIFOLD IS HEAVY. TO AVOID PERSONAL INJURY OR DAMAGE TO THE INTAKE MANIFOLD, INTAKE MANIFOLD REMOVAL / INSTALLATION IS A TWO PERSON OPERATION.

45. Move manifold (2x people) forward, remove bolt for purge line T-clip, remove manifold.
46. Remove gaskets and clean mating faces.

Removal - Manifold Parts

47. Remove Injector to rail clips (x8) (see Figure 1).

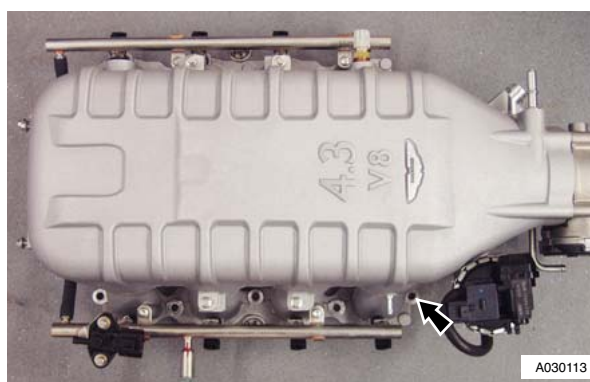


Figure 1

48. Remove fuel rail (bolts x4).

Installation

1. Install clips and new O-rings to injectors.
2. Install fuel rail (bolts x4).

Installation Manifold to Vehicle

3. Install new gaskets to cylinder block (glue in place).

WARNING

THE INTAKE MANIFOLD IS HEAVY. TO AVOID PERSONAL INJURY OR DAMAGE TO THE INTAKE MANIFOLD, INTAKE MANIFOLD REMOVAL / INSTALLATION IS A TWO PERSON OPERATION.

4. Install manifold (allowing access to install bolt for purge line P-clip).
5. Install manifold bolts (x10) (torque and tightening sequence).
6. Install bolts (x2) bracket to manifold (rear).
7. Connect EGR pipe union.
8. Connect EGR vacuum hose.
9. Connect air cleaner duct (clip x1).
10. Connect breather pipe quickfits (x2) to air cleaner duct.
11. Connect throttle body multiplug and harness clip.
12. Connect manifold heating hoses (x2).

Installation RH Side

13. Connect EGR vac pipe to sensor and manifold.
14. Install coolant pipe bracket (bolt x2, nut x2).
15. Connect EGR (x1), fuel rail pressure sensor (x1) and injector multiplugs (x4).
16. Refit harness to coolant pipe bracket (fir tree x3).
17. Connect heater hose to pipe (quick fit).
18. Refit heater hose (clipx2) and EGR vacuum lines (clips x2) to bracket.
19. Install fuel feed pipe.
20. Install purge pipe P-clip.
21. Install harness bracket to engine.
22. Feed harness into inner wing area.
23. Install fusebox to bracket.
24. Install earth lead to fusebox.
25. Install battery lead to fusebox (1x nut and rubber cover).
26. Install multiplugs to fuse box.
27. Install fusebox bracket fixings.
28. Refit harness fir tree clips to cylinder head.
29. Refit engine breather hose.
30. Install VVT solenoid multiplug, position coil and CMP harness (1x edge clip).
31. Install ECM (see Workshop Manual procedure 03.14.BB XREF: 319 Engine Control Module - RH Renew
32. Install coil cover.

Installation LH Side

33. Connect breather hose to manifold (quickfit).
34. Connect IAT multiplug.
35. Unclip injector harness from cam cover (x2).
36. Connect injector multiplugs (x4).
37. Install pipe support bracket (nuts x2, bolts x2).
38. Install harness support bracket (bolt x1, nut x2) release harness clips (fir tree x3).
39. Connect booster hose to manifold and support clip.

40. Connect heater hose from pipe (quick fit).
41. Install heater hose (x2) and throttle body hose (x2) from support bracket.
42. Connect purge line to manifold and into support clip.
43. Connect breather hoses (x2) to cam cover.
44. Install coil cover.
45. Install corner cross brace (torque bolts with vehicle on level ground).

Installation Not Handed

46. Refill coolant (see Workshop Manual procedure 03.03.AD Coolant - Drain and Refill).
47. Install cross brace (torque bolts with vehicle on level ground).

Fuel Injection Pressure Sensor - Renew

Repair Operation Time (ROT)	
Item	Code
Fuel Injection Pressure Sensor-Renew	03.04.CB

Removal

1. Depressurise fuel rail (see Workshop Manual procedure 10.01.EK Fuel System - Depressurise).
2. Disconnect vacuum hose.
3. Remove sensor from fuel rail (bolts x2).
4. Disconnect multiplug.

Installation

1. Install sensor to fuel rail (bolts x2) (torque).
2. Connect multiplug.
3. Connect vacuum hose.

Fuel Temperature Sensor - Renew

Repair Operation Time (ROT)	
Item	Code
Fuel Temperature Sensor-Renew	03.04.DB

Removal

1. Depressurise fuel rail (see Workshop Manual procedure 10.01.EK Fuel System - Depressurise).
2. Disconnect vacuum hose.
3. Remove sensor from fuel rail (bolts x2).
4. Disconnect multiplug.

Installation

1. Install sensor to fuel rail (bolts x2) (torque).
2. Connect multiplug.
3. Connect vacuum hose.

Fuel Injector Engine Set - Renew

Repair Operation Time (ROT)	
Item	Code
Fuel Injector Engine Set-Renew	03.04.FB

Removal

1. Remove LH injectors (see Workshop Manual procedure 03.04.GH Injector - Fuel - LH Bank - Engine Set - Renew).
2. Remove coils (see Workshop Manual procedure 03.07.HC Coil Assembly - Engine Set - RH - Renew).
3. Disconnect breather hose (quick fit) move aside.
4. Release harness fir tree clips (x3) from cylinder head and move aside.
5. Remove fuse box bracket fixings (bolt and nut) (allows movement).
6. Remove ECM (see Workshop Manual procedure 03.14.BB Engine Control Module - RH Renew).
7. Remove battery lead (1x nut and rubber cover) from fuse box (2x leads).
8. Remove multiplugs (x10) from fusebox.
9. Remove earth terminal (1x nut and rubber cover) from fusebox.
10. Remove fuse box from bracket (bolt x2).
11. Release harness fir tree clips (x3) from engine bracket.
12. Feed harness from inner wing and over engine to gain access to cam cover.
13. Remove purge pipe P-clip (bolt x1) and move pipe aside.
14. Remove harness bracket from engine (bolts x2, nut x1).
15. Release fuel feed hose from rail (clip x1) and move aside.
16. Disconnect heater hose from pipe (quick fit).
17. Release heater hose (clips x2) and EGR vacuum line (clips x2) from bracket.
18. Release harness from coolant pipe bracket (fir tree x3).
19. Disconnect EGR (x1), fuel rail pressure sensor (x1) and injector multiplugs (x4), move harness aside.
20. Remove coolant pipe bracket (nuts x2 and bolts x2).
21. Disconnect EGR vac pipe from sensor and manifold, move aside.

22. Remove Injector to rail clips (see Figure 1).

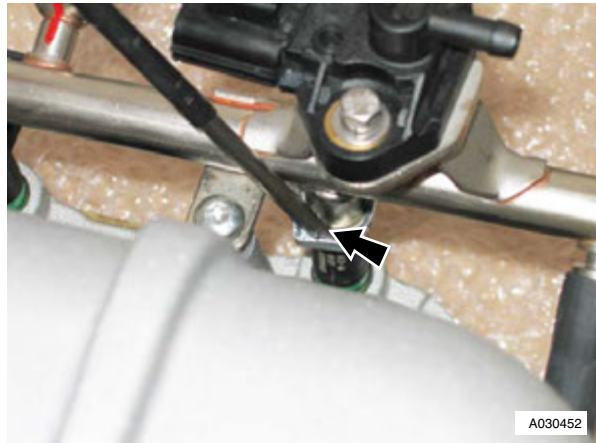


Figure 1

23. Remove fuel rail bolts (x2) and lift rail (tie aside) (see Figure 2).

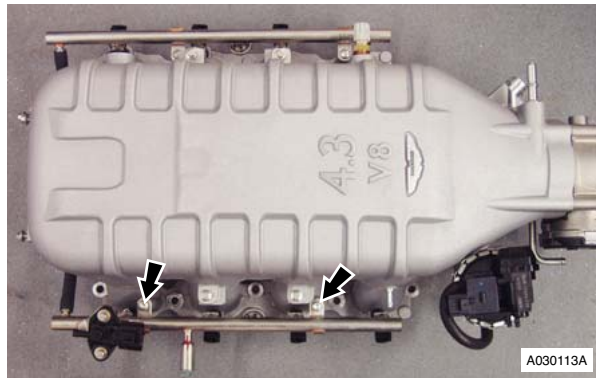


Figure 2

24. Remove injectors from manifold.

Installation

1. Install clips on to new injectors then fit injectors into manifold.
2. Install rail onto injectors (taking care each injector is aligned correctly and the clip seats properly) and fit bolts (x2) (torque).
3. Connect EGR vac pipe to sensor and manifold.
4. Install coolant pipe bracket (bolt x2, nut x2).
5. Connect EGR (x1), fuel rail pressure sensor (x1) and injector multiplugs (x4).
6. Refit harness to coolant pipe bracket (fir tree x3).
7. Connect heater hose to pipe (quick fit).
8. Refit heater hose (clipx2) and EGR vac lines (clips x2) to bracket.
9. Install fuel feed pipe.
10. Install purge pipe P-clip.
11. Install harness bracket to engine.
12. Feed harness into inner wing area.
13. Install fusebox to bracket.
14. Install earth lead to fusebox.
15. Install battery lead to fusebox (1x nut and rubber cover).
16. Install multiplugs to fuse box.

17. Install fusebox bracket fixings.
18. Refit harness fir tree clips to cylinder head.
19. Refit engine breather hose.
20. Install VVT solenoid multiplug, position coil and CMP harness (1x edge clip).
21. Install LH injectors (see Workshop Manual procedure 03.04.GH Injector - Fuel - LH Bank - Each - Renew).
22. Install ECM (see Workshop Manual procedure 03.14.BB Engine Control Module - RH Renew).
1. Install coils (see Workshop Manual procedure 03.07.HC Coil Assembly - Engine Set - RH - Renew).

Fuel Injector - Each - LH Bank - Renew

Repair Operation Time (ROT)	
Item	Code
Fuel Injector-Each-LH Bank-Renew	LHD 03.04.GD
Fuel Injector-Each-LH Bank-Renew	RHD 03.04.GL

Removal

1. Depressurise fuel rail (see Workshop Manual procedure 10.01.EK Fuel System - Depressurise).
2. Remove corner cross brace.
3. Disconnect breather hoses from cam cover (x2) for access.
4. Disconnect purge line from manifold (quickfit) and support clip for access.
5. Disconnect heater hose from pipe (quick fit).
6. Release heater hose (x2) and throttle body hose (x2) from support bracket.
7. Remove booster hose from manifold and support clip.
8. Remove harness support bracket (bolt x1, nut x2) release harness clips (fir tree x3).
9. Release pipe support bracket (nuts x2, bolts x2) move aside.
10. Disconnect IAT multiplug.
11. Disconnect injector multiplugs (x4).
12. Unclip injector harness from cam cover (x2).
13. Disconnect breather hose from manifold (quickfit).
14. Remove Injector to rail clip (for injector to be changed).
15. Remove fuel rail bolts (x2) and lift rail with remaining injectors (tie aside).
16. Remove injector from manifold.

Installation

1. Install new O-rings to remaining injectors (lube O-rings).
2. Install clip to new injector then injector into rail.
3. Install rail (with injectors) to manifold (bolt x2) (torque) (taking care each injector is aligned correctly).
4. Connect breather hose to manifold (quickfit).
5. Connect IAT multiplug.
6. Unclip injector harness from cam cover (x2).
7. Connect injector multiplugs (x4).
8. Install pipe support bracket (nuts x2, bolts x2).

9. Install harness support bracket (bolt x1, nut x2) release harness clips (fir tree x3).
10. Connect booster hose to manifold and support clip.
11. Connect heater hose from pipe (quick fit).
12. Install heater hose (x2) and throttle body hose (x2) from support bracket.
13. Connect purge line to manifold and into support clip.
14. Connect breather hoses (x2) to cam cover.
15. Install corner cross brace (torque bolts with vehicle on level ground).

Fuel Injector - Each - RH Bank - Renew

Repair Operation Time (ROT)	
Item	Code
Fuel Injector-Each-RH Bank-Renew	LHD 03.04.GF
Fuel Injector-Each-RH Bank-Renew	RHD 03.04.GM

Removal

1. Depressurise fuel rail (see Workshop Manual procedure 10.01.EK Fuel System - Depressurise).
2. Disconnect breather hose (quick fit) move aside.
3. Release harness fir tree clips (x3) from cylinder head and move aside.
4. Remove fuse box bracket fixings (bolt and nut) (allows movement).
5. Remove ECM (see Workshop Manual procedure 03.14.BB Engine Control Module - RH Renew).
6. Remove battery lead (1x nut and rubber cover) from fuse box (2x leads).
7. Remove multiplugs (x10) from fusebox.
8. Remove earth terminal (1x nut and rubber cover) from fusebox.
9. Remove fuse box from bracket (bolt x2).
10. Release harness fir tree clips (x3) from engine bracket.
11. Feed harness from inner wing and over engine to gain access to cam cover.
12. Remove purge pipe P-clip (bolt x1) and move pipe aside.
13. Remove harness bracket from engine (bolts x2, nut x1).
14. Release fuel feed hose from rail (clip x1) and move aside.
15. Disconnect heater hose from pipe (quick fit).
16. Release heater hose (clips x2) and EGR vacuum line (clips x2) from bracket.
17. Release harness from coolant pipe bracket (fir tree x3).
18. Disconnect EGR (x1), fuel rail pressure sensor (x1) and injector multiplugs (x4), move harness aside.
19. Remove coolant pipe bracket (nuts x2 and bolts x2).
20. Disconnect EGR vac pipe from sensor and manifold, move aside.
21. Remove Injector to rail clip (for injector to be changed).
22. Remove fuel rail bolts (x2) and lift rail with remaining injectors (tie aside).
23. Remove injector from manifold.



Installation

1. Install new O-rings to remaining injectors (lube O-ringP-clips).
2. Install clip to new injector then injector into rail.
3. Install rail (with injectors) to manifold (bolt x2) (torque) (taking care each injector is aligned correctly).
4. Connect EGR vac pipe to sensor and manifold.
5. Install coolant pipe bracket (bolt x2, nut x2).
6. Connect EGR (x1), fuel rail pressure sensor (x1) and injector multiplugs (x4).
7. Refit harness to coolant pipe bracket (fir tree x3).
8. Connect heater hose to pipe (quick fit).
9. Refit heater hose (clipx2) and EGR vacuum lines (clips x2) to bracket.
10. Install fuel feed pipe.
11. Install purge pipe P-clip.
12. Install harness bracket to engine.
13. Feed harness into inner wing area.
14. Install fusebox to bracket.
15. Install earth lead to fusebox.
16. Install battery lead to fusebox (1x nut and rubber cover).
17. Install multiplugs to fuse box.
18. Install fusebox bracket fixings.
19. Refit harness fir tree clips to cylinder head.
20. Refit engine breather hose.
21. Install VVT solenoid multiplug, position coil and CMP harness (1x edge clip).
22. Install ECM (see Workshop Manual procedure 03.14.BB Engine Control Module - RH Renew).

Engine Set - Fuel Injector - LH Bank - Renew

Repair Operation Time (ROT)		
Item	Code	
Engine Set-Fuel Injector-LH Bank-Renew	LHD	03.04.GH
Engine Set-Fuel Injector-LH Bank-Renew	RHD	03.04.GN

Removal

1. Depressurise fuel rail (see Workshop Manual procedure 10.01.EK Fuel System - Depressurise).
2. Remove corner cross brace.
3. Disconnect breather hoses from cam cover (x2) for access.
4. Disconnect purge line from manifold (quickfit) and support clip for access.
5. Disconnect heater hose from pipe (quick fit).
6. Release heater hose (x2) and throttle body hose (x2) from support bracket.
7. Remove booster hose from manifold and support clip.
8. Remove harness support bracket (bolt x1, nut x2) release harness clips (fir tree x3).

9. Release pipe support bracket (nuts x2, bolts x2) move aside.
10. Disconnect IAT multiplug.
11. Disconnect injector multiplugs (x4).
12. Unclip injector harness from cam cover (x2).
13. Disconnect breather hose from manifold (quickfit).
14. Remove Injector to rail clips.
15. Remove fuel rail bolts (x2) and lift rail (tie aside).
16. Remove injectors from manifold.

Installation

1. Install clips on to new injectors then fit injectors into manifold.
2. Install rail onto injectors (taking care each injector is aligned correctly and the clip seats properly) and fit bolts (x2) (torque).
3. Connect breather hose to manifold (quickfit).
4. Connect IAT multiplug.
5. Unclip injector harness from cam cover (x2).
6. Connect injector multiplugs (x4).
7. Install pipe support bracket (nuts x2, bolts x2).
8. Install harness support bracket (bolt x1, nut x2) release harness clips (fir tree x3).
9. Connect booster hose to manifold and support clip.
10. Connect heater hose from pipe (quick fit).
11. Install heater hose (x2) and throttle body hose (x2) from support bracket.
12. Connect purge line to manifold and into support clip.
13. Connect breather hoses (x2) to cam cover.
14. Install corner cross brace (torque bolts with vehicle on level ground).

Engine Set - Fuel Injector - RH Bank - Renew

Repair Operation Time (ROT)		
Item	Code	
Engine Set-Fuel Injector-RH Bank-Renew	LHD	03.04.GK
Engine Set-Fuel Injector-RH Bank-Renew	RHD	03.04.GP

Removal

1. Depressurise fuel rail (see Workshop Manual procedure 10.01.EK Fuel System - Depressurise).
2. Disconnect breather hose (quick fit) move aside.
3. Release harness fir tree clips (x3) from cylinder head and move aside.
4. Remove fuse box bracket fixings (bolt and nut) (allows movement).
5. Remove ECM (see Workshop Manual procedure 03.14.BB Engine Control Module - RH Renew).
6. Remove battery lead (1x nut and rubber cover) from fuse box (2x leads).
7. Remove multiplugs (x10) from fusebox.

8. Remove earth terminal (1x nut and rubber cover) from fusebox.
9. Remove fuse box from bracket (bolt x2).
10. Release harness fir tree clips (x3) from engine bracket.
11. Feed harness from inner wing and over engine to gain access to cam cover.
12. Remove purge pipe P-clip (bolt x1) and move pipe aside.
13. Remove harness bracket from engine (bolts x2, nut x1).
14. Release fuel feed hose from rail (clip x1) and move aside.
15. Disconnect heater hose from pipe (quick fit).
16. Release heater hose (clips x2) and EGR vacuum line (clips x2) from bracket.
17. Release harness from coolant pipe bracket (fir tree x3).
18. Disconnect EGR (x1), fuel rail pressure sensor (x1) and injector multiplugs (x4), move harness aside.
19. Remove coolant pipe bracket (nuts x2 and bolts x2).
20. Disconnect EGR vac pipe from sensor and manifold, move aside.
21. Remove Injector to rail clips.
22. Remove fuel rail bolts (x2) and lift rail (tie aside).
23. Remove injectors from manifold.

Installation

1. Install clips on to new injectors then fit injectors into manifold.
2. Install rail onto injectors (taking care each injector is aligned correctly and the clip seats properly) and fit bolts (x2) (torque).
3. Connect EGR vac pipe to sensor and manifold.
4. Install coolant pipe bracket (bolt x2, nut x2).
5. Connect EGR (x1), fuel rail pressure sensor (x1) and injector multiplugs (x4).
6. Refit harness to coolant pipe bracket (fir tree x3).
7. Connect heater hose to pipe (quick fit).
8. Refit heater hose (clipx2) and EGR vac lines (clips x2) to bracket.
9. Install fuel feed pipe.
10. Install purge pipe P-clip.
11. Install harness bracket to engine.
12. Feed harness into inner wing area.
13. Install fusebox to bracket.
14. Install earth lead to fusebox.
15. Install battery lead to fusebox (1x nut and rubber cover).
16. Install multiplugs to fuse box.
17. Install fusebox bracket fixings.
18. Refit harness fir tree clips to cylinder head.
19. Refit engine breather hose.
20. Install VVT solenoid multiplug, position coil and CMP harness (1x edge clip).
21. Install ECM (see Workshop Manual procedure 03.14.BB Engine Control Module - RH Renew).

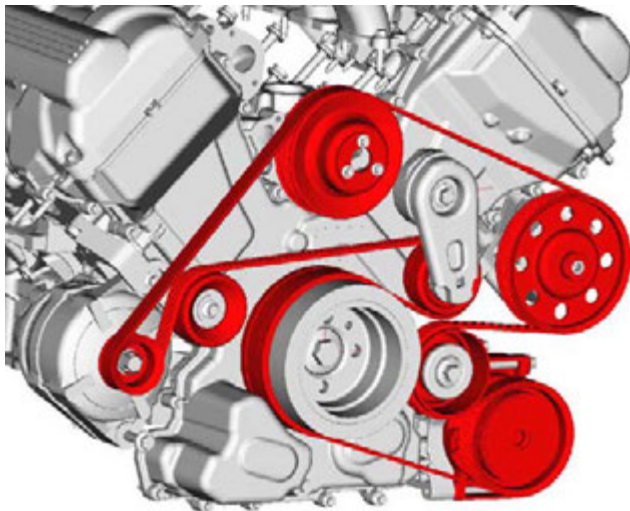


ASTON MARTIN

Engine (03.00)

Accessory Drive System (03.05) Specifications

Description



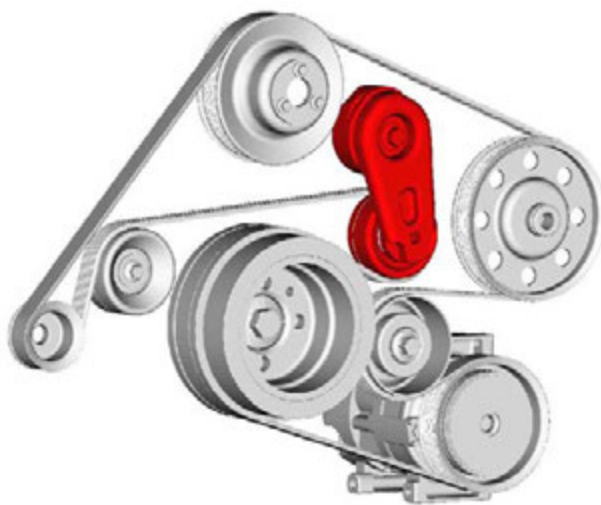
Auxiliary Drives

A damper pulley installed to the front of the crankshaft drives a 'polyvee' drive belt to power all of the engine auxiliaries.

- Air Conditioning Compressor
- Alternator
- Power Steering Pump
- Water Pump

Automatic Belt Tensioner

The automatic belt tensioner consists of an idler pulley which is free to rotate on a bearing, located at the end of a spring-loaded pivot arm. The pivot arm can be turned clockwise (viewed from the front of the engine) for belt removal and installation.



Torque Figures

Description	Nm	lb/ft
Belt Tensioner	34-46	25.1-34
Idler Pulleys	34-46	25.1-34

Maintenance

Drive Belt-Renew

Repair Operation Time (ROT)	
Item	Code
Drive Belt-Renew	03.05.AB

Remove

1. Remove throttle body duct for access. (clips x3).
2. Disconnect breather pipe quickfits (x2) from air cleaner duct.
3. Release tensioner and slip belt from idler.
4. Remove tensioner from engine (bolt x1).
5. Remove belt from engine.

Install

1. Fit belt to engine.
2. Install tensioner to engine (bolt x1) (torque).
3. Release tensioner and slip belt on idler.
4. Install throttle body duct.
5. Connect breather pipe quickfits (x2) to air cleaner duct.

Engine Drive Belt and Bracket Assembly Oil Pump Tensioner-Renew

Repair Operation Time (ROT)	
Item	Code
Engine Drive Belt and Bracket Assembly Oil Pump Tensioner-Renew	03.05.AE

Remove

1. Set the battery isolation switch to 'OFF'.
2. Release the three clips and remove the throttle body duct for access..
3. Disconnect the two 'quickfit' breather pipe connections from the air cleaner duct.



4. Release the tensioner and remove the belt from the idler (see Figure 1).
5. Remove the bolt (2) that attaches the idler (1) to the engine (refer to Figure 1)..

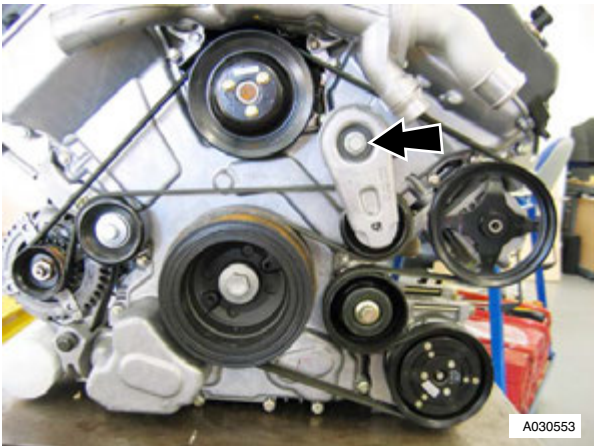


Figure 1

5. Remove the bolt that attaches the tensioner to the engine and remove.

Install

1. Install tensioner to engine (bolt x1) (torque).
2. Release tensioner and slip belt on idler.
3. Install throttle body duct.
4. Connect breather pipe quickfits (x2) to air cleaner duct.
5. Battery isolation switch 'ON'.

Idler Pulley-Renew

Repair Operation Time (ROT)	
Item	Code
Idler Pulley-Renew	03.05.BF

Removal

1. Set the battery isolation switch to 'OFF'.
2. Release the three clips and remove the throttle body duct for access.
3. Disconnect the two 'quick-fit' breather pipe connectors from the air cleaner duct.
4. Release the tensioner and remove the belt from the idler.

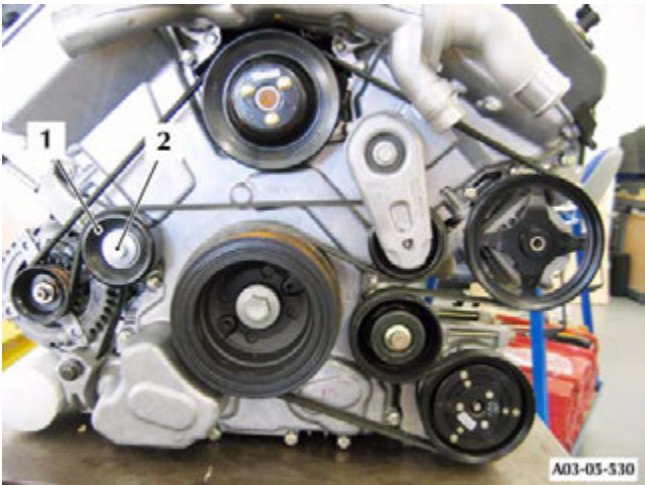


Figure 1

6. Remove the idler.

Install

1. Install idler to engine (bolt x1) (torque).
2. Release tensioner and slip belt on idler.
3. Install throttle body duct.
4. Connect breather pipe quickfits (x2) to air cleaner duct.
5. Battery isolation switch 'ON'.

Engine Drive Belt Idler Assembly-Renew

Repair Operation Time (ROT)	
Item	Code
Engine Drive Belt Idler Assembly-Renew	03.05.BG

Removal

1. Set the battery isolation switch to 'OFF'.
2. Release the three clips and remove the throttle body duct for access.
3. Disconnect the two 'quick-fit' breather pipe connectors from the air cleaner duct.

4. Release the tensioner and remove the belt from the idler (see Figure 1).

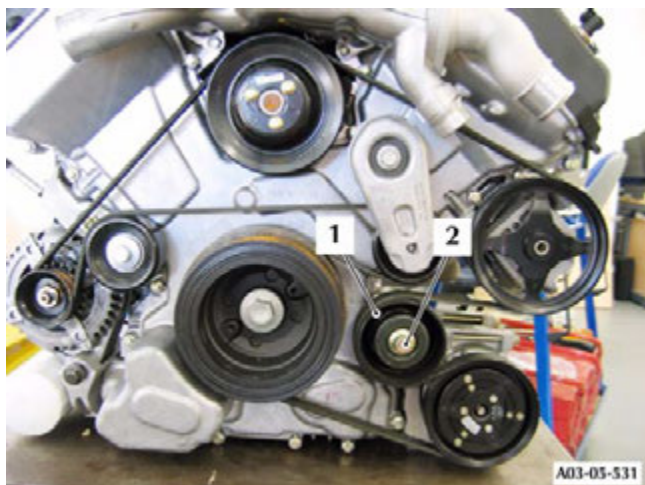


Figure 1

5. Remove the bolt that attaches the idler to the engine.
6. Remove the idler.

Installation

1. Put the idler in position on the engine.
2. Install and torque the bolt that attaches the idler.
3. Release the tensioner and put the belt on the idler.
4. Install the duct for the throttle body.
5. Connect the two 'quick-fit' connectors for the breather pipes to the air cleaner duct.
6. Set the battery isolation switch to 'ON'.



ASTON MARTIN

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Engine (03.00)

Engine Cranking System (03.06)

5. Install RH exhaust manifold (see Workshop Manual procedure 09.00.CA Manifold - Exhaust - RH - Renew).

Maintenance

Starter Motor-Renew

Repair Operation Time (ROT)	
Item	Code
Starter motor-Renew	03.06.AB

Removal

1. Remove RH exhaust manifold (see Workshop Manual procedure 09.00.CA Manifold - Exhaust - RH - Renew).
2. Switch battery isolation switch 'OFF'.
3. Remove battery cable from starter motor.
4. Disconnect solenoid multiplug from starter motor (see Figure 1).



Figure 1

5. Remove starter motor bolts (x2) (see Figure 2).



Figure 2

Installation

1. Install starter motor bolts (x2).
2. Connect solenoid multiplug to starter motor.
3. Install battery cable from starter motor.
4. Switch battery isolation switch 'ON'.



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Engine (03.00)

Ignition System (03.07)

Maintenance

Coil Assembly-Engine Set - LH-Renew

Repair Operation Time (ROT)		
Item	Code	
Coil Assembly-Engine Set-Renew	LH	03.07.GB

Procedure to follow.



ASTON MARTIN

Engine (03.00)

Emission Control (03.08)**Maintenance****Vacuum Outlet Hose Assembly-Renew**

Repair Operation Time (ROT)	
Item	Code
Vacuum Outlet Hose Assembly-Renew	03.08.AC

Removal

1. Remove inlet manifold (see Workshop Manual procedure 03.01.BB Gasket - Manifold Assembly - Intake Upper - Renew).
2. Disconnect hose from vacuum reservoir.
3. Disconnect hose from SAI module.
4. Unclip from bracket and remove hose.

Installation

1. Install hose and clip to bracket.
2. Connect hose to SAI module.
3. Connect hose to vacuum reservoir.
4. Install inlet manifold (see Workshop Manual procedure 03.01.BB Gasket - Manifold Assembly - Intake Upper - Renew).

Secondary Air Injection Pump Tube-Renew

Repair Operation Time (ROT)	
Item	Code
Secondary Air Injection Pump Tube-Renew	03.08.AD

Removal

1. Remove inlet manifold (see Workshop Manual procedure 03.01.BB Gasket - Manifold Assembly - Intake Upper - Renew).
2. Disconnect hose from SAI module and remove hose (quickfit).

Installation

1. Install hose and connect to SAI module (quickfit).
2. Install inlet manifold (see Workshop Manual procedure 03.01.BB Gasket - Manifold Assembly - Intake Upper - Renew).

Vacuum System Reservoir and Bracket Assembly-Renew

Repair Operation Time (ROT)	
Item	Code
Vacuum System Reservoir and Bracket Assembly-Renew	03.08.AE

Removal

1. Remove inlet manifold (see Workshop Manual procedure 03.01.BB Gasket - Manifold Assembly - Intake Upper - Renew).

2. Disconnect vacuum hose from reservoir.
3. Unclip harness from bracket.
4. Remove reservoir (bolts x3).

Installation

1. Install reservoir (bolts x3) (torque).
2. Clip harness to bracket.
3. Connect hose to SAI module.
4. Connect vacuum hose to reservoir.
5. Install inlet manifold (see Workshop Manual procedure 03.01.BB Gasket - Manifold Assembly - Intake Upper - Renew).

Oil Tank Breather Hose-Renew

Repair Operation Time (ROT)	
Item	Code
Oil Tank Breather Hose-Renew	03.08.AH

Removal

1. Disconnect hose from cam cover (quickfit).
2. Disconnect hose from oil tank (quickfit) and remove hose from clip.

Installation

1. Install hose to clip and connect to oil tank (quickfit).
2. Connect hose to cam cover (quickfit).

Air Cleaner to Rocker Cover Hose-Renew

Repair Operation Time (ROT)	
Item	Code
Air Cleaner to Rocker Cover Hose-Renew	03.08.AJ

Removal

1. Disconnect hose from cam cover (quickfit).
2. Disconnect hose from air duct (quickfit) and remove hose from clip.

Installation

1. Install hose to clip and connect to air duct (quickfit).
2. Connect hose to cam cover (quickfit).

Oil Separator Tube Assembly-Renew

Repair Operation Time (ROT)	
Item	Code
Oil Separator Tube Assembly-Renew	03.08.AK

Removal

1. Release clip and disconnect air cleaner duct from throttle body.
2. Disconnect hose from oil separator (clip x1).
3. Raise vehicle on ramp.
4. Unclip hose from bracket.
5. Position container to collect any oil spillage.



6. Disconnect hose from engine (quickfit) and remove hose.

Installation

1. Connect hose to engine (quickfit).
2. Clip hose to bracket.
3. Remove drain container.
4. Lower vehicle on ramp.
5. Install hose to oil separator (quickfit).
6. Install throttle body to air cleaner duct (clip x1).
7. Fill tank with approximately amount of displaced oil and replace cap.
8. Use handbook procedure to check oil level.

Oil Separator Assembly-Renew

Repair Operation Time (ROT)	
Item	Code
Oil Separator Assembly-Renew	03.08.CA

Removal

1. Release clip and disconnect air cleaner duct from throttle body.
2. Disconnect hoses from oil separator (clips x2).
3. Remove separator (bolt x1) (place cloth to catch oil)

Installation

1. Install separator (bolt x1) (torque).
2. Install hoses to oil separator (clips x2).
3. Install throttle body to air cleaner duct (clip x1).
4. Use handbook procedure to check oil level.

Emissions Separator Hose-Renew

Repair Operation Time (ROT)	
Item	Code
Emissions Separator Hose-Renew	03.08.DA

Removal

1. Move throttle body to air cleaner duct for access (clip x1).
2. Disconnect hose from oil separator (clips x1).
3. Disconnect hose from engine and remove (clips x1).

Installation

1. Connect hose to engine (clips x1).
2. Install hose to oil separator (clips x1).
3. Install throttle body to air cleaner duct (clip x1).
4. Use handbook procedure to check oil level.

Secondary Air Injection Pump and Bracket Assembly-Renew

Repair Operation Time (ROT)	
Item	Code
Secondary Air Injection Pump and Bracket Assembly-Renew	03.08.DB

Removal

1. Disconnect vehicle battery.

2. Remove inlet manifold assembly (see Workshop Manual procedure 03.01.BA Manifold Assembly - Intake Upper - Renew).
3. Disconnect breather tube to secondary air pump (quickfit).
4. Disconnect vacuum tube from solenoid valve.
5. Disconnect vacuum tubes (x2) from actuator valves.
6. Loosen unions and disconnect secondary air injection tubes (x2).
7. Disconnect multiplug, air injection pump. Release multiplug from mounting bracket.
8. Release harness and vacuum tube fir tree clips (x6) from mounting bracket.
9. Remove bolts (x3), securing secondary air injection pump assembly to engine.
10. Remove secondary air injection pump assembly.

Installation

1. Position secondary air injection pump assembly, install and torque tighten bolts (x3).
2. Secure harness and vacuum tube fir tree clips (x6) in mounting bracket.
3. Secure multiplug in bracket, connect multiplug.
4. Connect and torque tighten secondary air tube unions (x2).
5. Connect vacuum tubes to solenoid and actuator valves (x3).
6. Connect breather tube to secondary air injection pump.
7. Install inlet manifold assembly (see Workshop Manual procedure 03.01.BA Manifold Assembly - Intake Upper - Renew).
8. Connect vehicle battery.

PCV Valve Assembly-Renew

Repair Operation Time (ROT)	
Item	Code
PCV Valve Assembly-Renew	03.08.DC

Removal

1. Disconnect breather tube from PCV valve.
2. Remove bolts (x2) securing PCV valve, remove PCV valve.

Installation

1. Clean PCV valve and mating face.
2. Install PCV valve, install and torque tighten bolts (x2).
3. Connect breather tube to PCV valve.

Crank Vent Hose-Renew

Repair Operation Time (ROT)	
Item	Code
Crank Vent Hose-Renew	03.08.DD

Removal

1. Disconnect hose from cam cover (quickfit).

2. Disconnect hose from oil separator (quickfit) and remove.

Installation

1. Install hose to oil separator (quickfit).
2. Connect hose to cam cover (quickfit).

Exhaust Valve to Exhaust Manifold Tube Assembly-Renew

Repair Operation Time (ROT)	
Item	Code
Exhaust Valve to Exhaust Manifold Tube Assembly-Renew	03.08.DE

Removal

1. Raise vehicle on ramp.
2. Remove flange nuts (x2) on RH exhaust manifold. Remove and discard gasket.
3. Lower vehicle.
4. Undo tube union connection (x1) at exhaust valve, remove tube.

Installation

1. Clean flange and pipe connections.
2. Align tube and loosely connect at the valve.
3. Raise vehicle.
4. Fit new gasket to manifold flange.
5. Install tube assembly. install and torque tighten nuts (x2).
6. Lower vehicle on ramp.
7. Torque tighten valve union connection.

Oil Separator to Inlet Manifold Hose-Renew

Repair Operation Time (ROT)	
Item	Code
Oil Separator to Inlet Manifold Hose-Renew	03.08.DF

Removal

1. Disconnect hose from throttle body adaptor assembly (quickfit).
2. Disconnect hose from PCV valve (quickfit), remove hose.

Installation

1. Install hose to PCV valve (quickfit).
2. Connect hose to throttle body adapter assembly (quickfit).

EGR Module-Renew

Repair Operation Time (ROT)	
Item	Code
EGR Module-Renew	03.08.DH

Removal

1. Disconnect vacuum tube and multiplug from EGR module.

2. Loosen and disconnect pipe union, EGR module to exhaust manifold.
3. Remove bolts (x2) securing EGR module to inlet manifold, remove EGR module, discard gasket.

Installation

1. Clean EGR module and mating face on inlet manifold.
2. Install EGR module with new gasket, install and torque tighten bolts (x2).
3. Clean EGR module pipe and union connection.
4. Install and torque tighten pipe union.
5. Connect multiplug and vacuum tube to EGR module.



ASTON MARTIN

Engine (03.00)

Valve Train (03.09)

Specifications

Torque Figures

Description	Nm	lb/ft
Front Lifting Eye Attachment operated (M12)	25-35	18.5-26
Camshaft Caps (M6) all to:	5	3.7
then to:	9-11	6.5-8.1
Secondary Chain Tensioner (M6)	9-13	6.5-8.1
Primary Chain Guide (M6)	9-13	6.5-8.1
Primary Chain Tensioner Blade Pivot	9-13	6.5-8.1
Primary Chain Tensioner	9-13	6.5-8.1
Bush Carrier ("A" Bank) (M8)	19-23	14-17
Bush Carrier ("B" Bank) (M8)	19-23	14-17
(M6)	9-13	6.5-8.1
Exhaust Cam Sprocket Bolt	20	14.8
then 90° more, $\pm 5^\circ$		
Front Cover:		
Bolts 1 to 7, 9 to 18 and 20 to 27	11-13	6.5-8.1
Bolts 8 and 9	9-11	6.5-8.1

Maintenance

Left Side Timing Chain Arm Assembly - Remove and Install

Repair Operation Time (ROT)	
Item	Code
Left Side Timing Chain Arm Assembly - Remove and Install	03.09.AA

Remove

WARNING
DO NOT GET USED ENGINE OIL ON YOUR SKIN.
USED ENGINE OIL CAN BE HARMFUL.

1. Remove the engine timing cover. (03.10.AF - Engine Timing Cover).

2. Remove the two screws that attach the special tool to the engine.

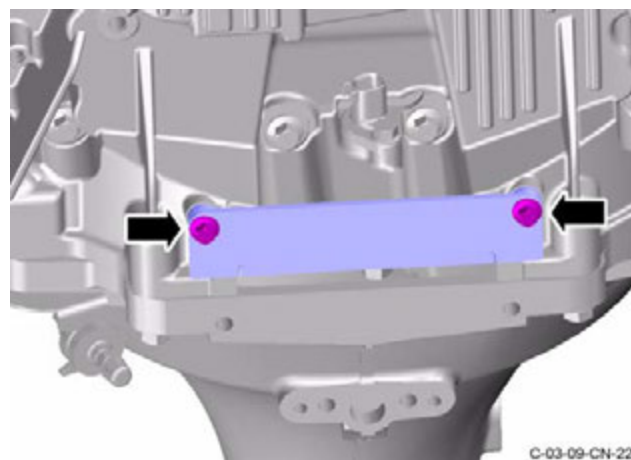


Figure 1

3. Remove the special tool from the flywheel.

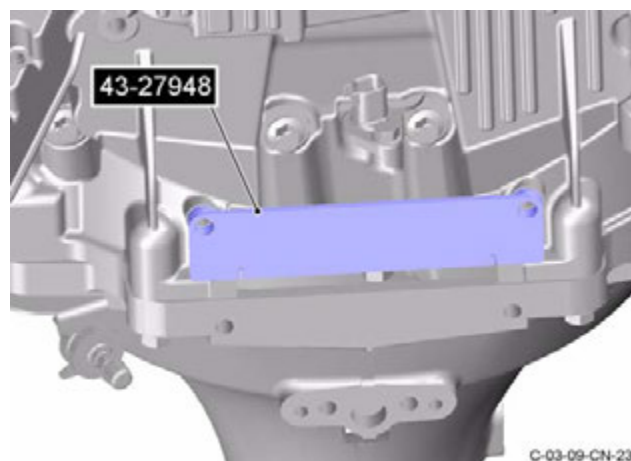


Figure 2

4. Turn the crankshaft clockwise until the machined flat areas on the camshafts are parallel to the face of the cylinder head.

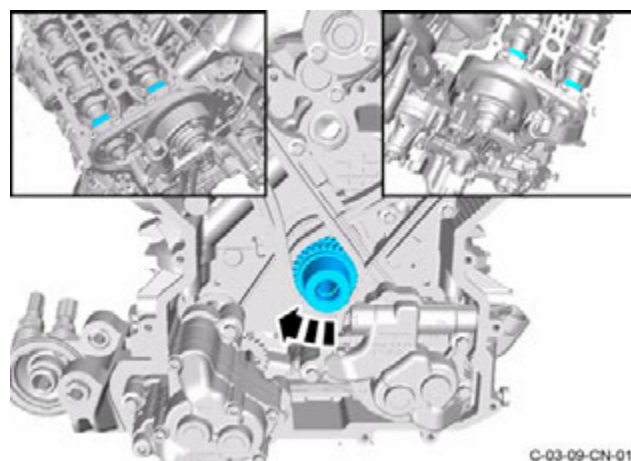


Figure 3

5. Install the special tool on the right side camshaft.

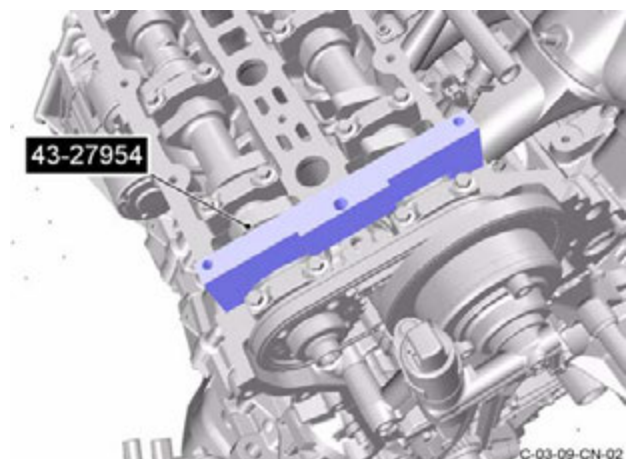


Figure 4

6. Install and tighten the three screws that attach the special tool to the cylinder head.

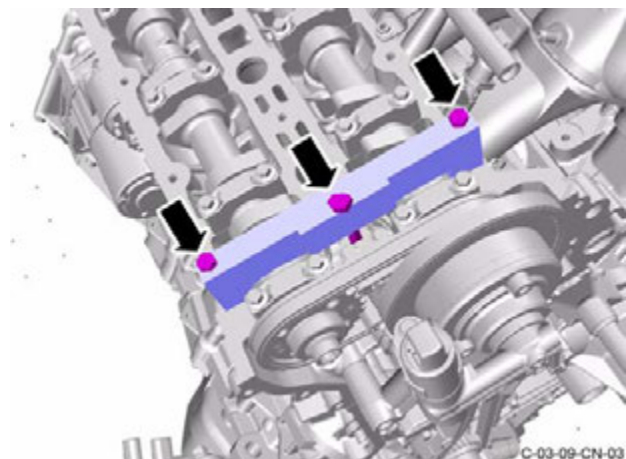


Figure 5

7. Install the special tool on the left side camshaft.

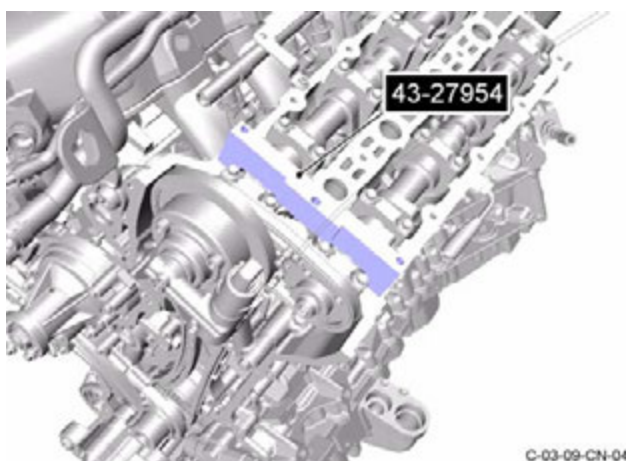


Figure 6

8. Install and tighten the three screws that attach the special tool to the cylinder head.

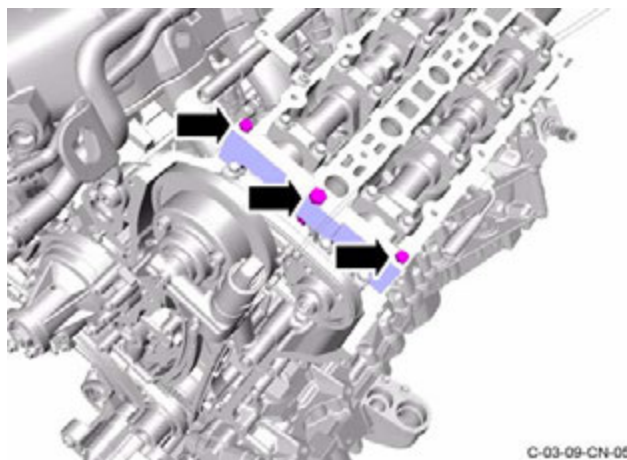


Figure 7

9. Use the applicable equipment to lift the vehicle and make it safe.
10. Loosen the two socket cap screws that attach the teeth to the special tool.



Figure 8

11. Install the special tool onto the flywheel.

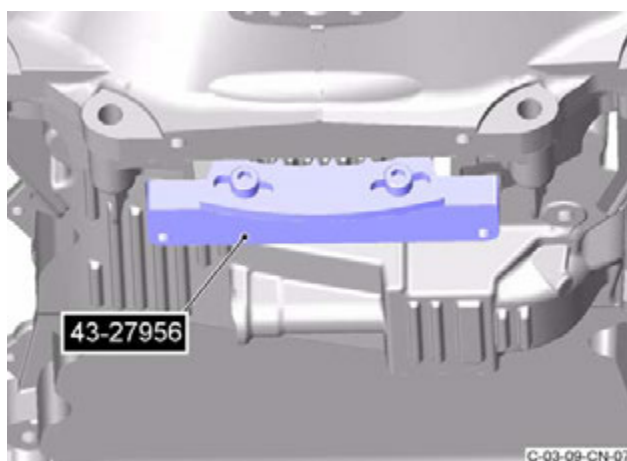


Figure 9

12. Install and tighten the two socket cap screws that attach the special tool to the engine.

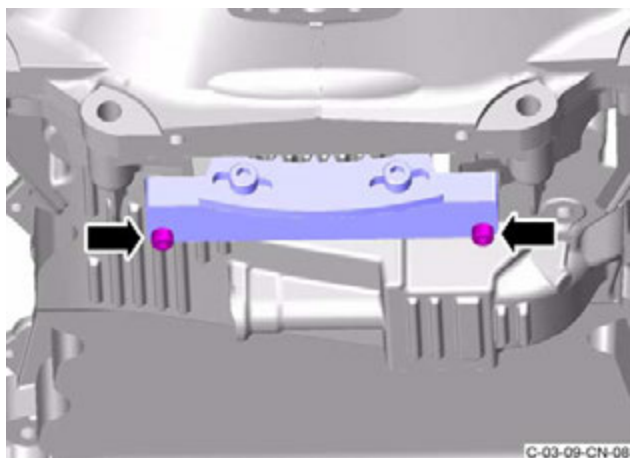


Figure 10

13. Tighten the two socket cap screws that attach the teeth to the special tool.

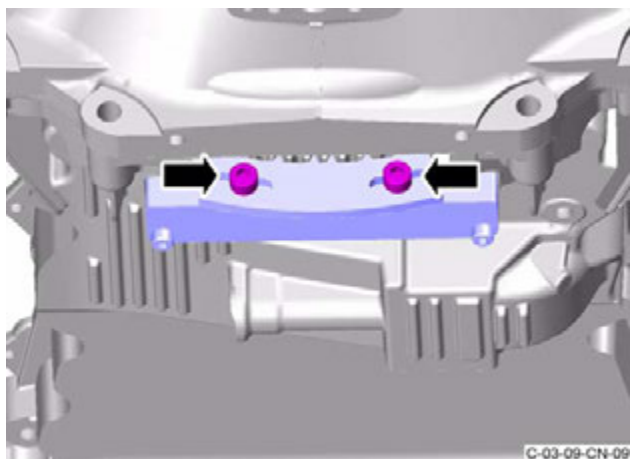


Figure 11

14. Lower the vehicle.

15. Remove the two bolts that attach the left side bush carrier for the Variable Camshaft Timing (VCT) to the engine.

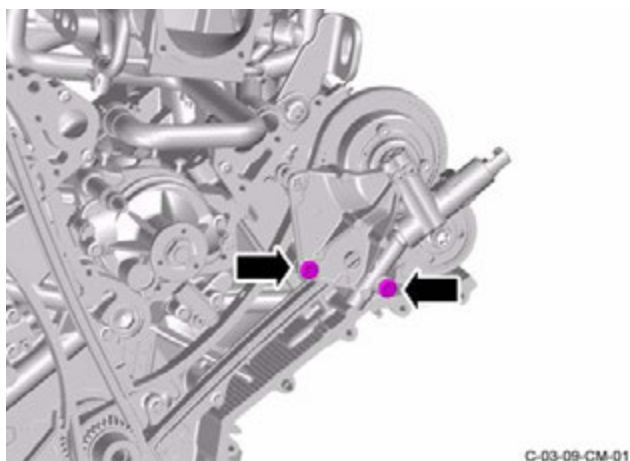


Figure 12

16. Remove the nut that attaches the left side bush carrier for the VCT to the engine.

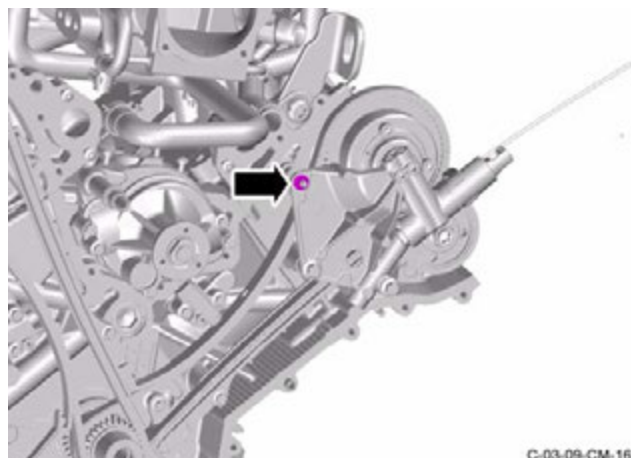


Figure 13

17. Remove the left side bush carrier for the VCT.

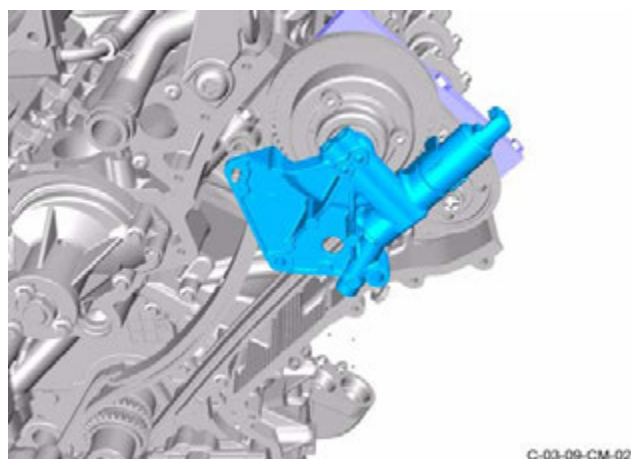


Figure 14

18. Loosen the two bolts that attach the timing chain tensioner to the engine.

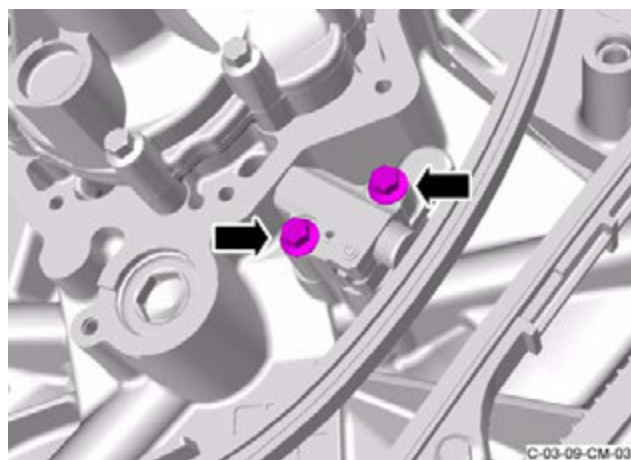


Figure 15

19. Release the ratchet lock on the timing chain tensioner and push the piston into the tensioner housing.

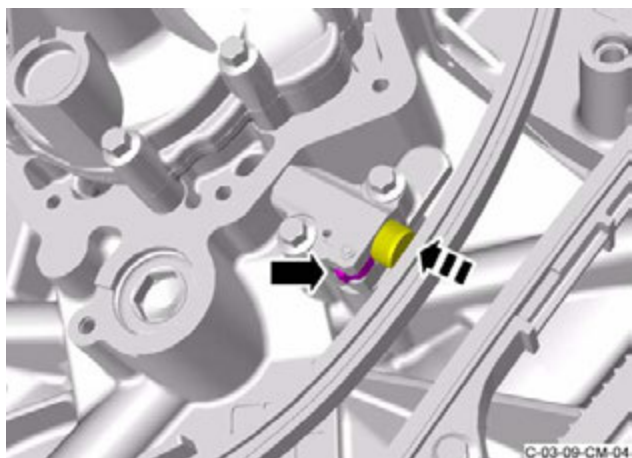


Figure 16

22. Remove the timing chain tensioner.

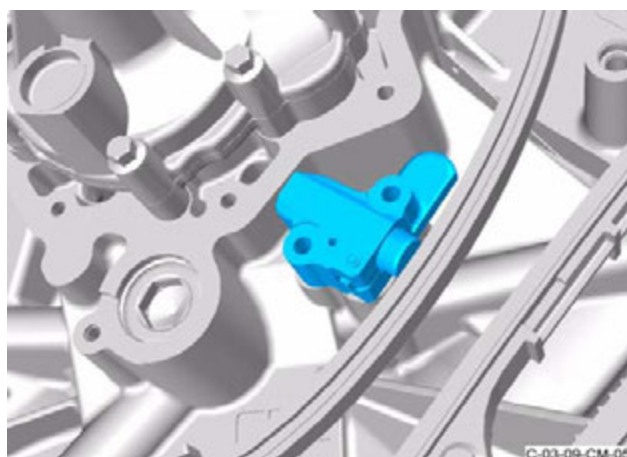


Figure 19

20. Install an applicable pin into the timing chain tensioner.



Figure 17

23. Remove the special bolt that attaches the tensioner arm to the engine.

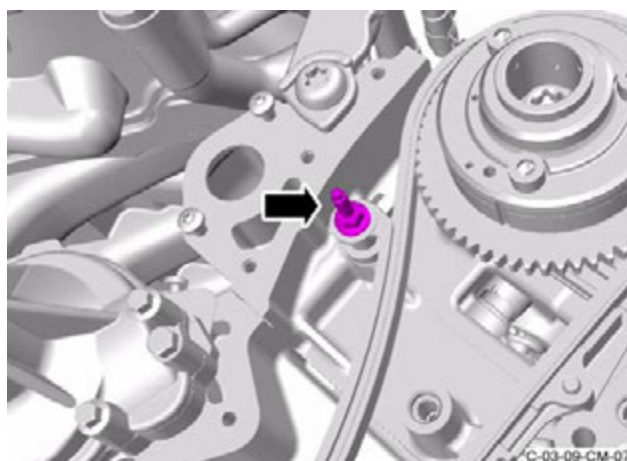


Figure 20

21. Remove the two bolts that attach the timing chain tensioner to the engine.

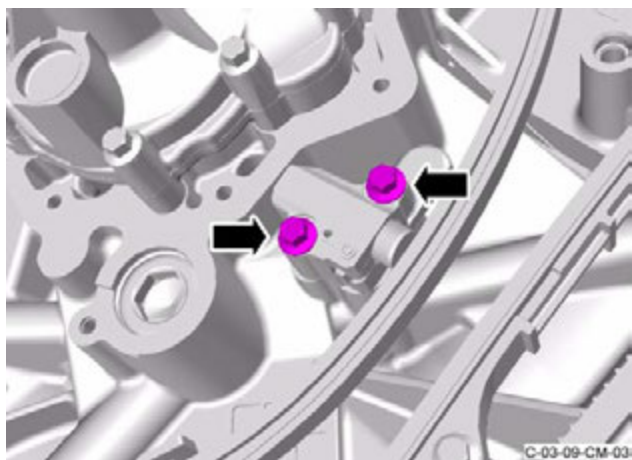


Figure 18

24. Remove the tensioner arm.

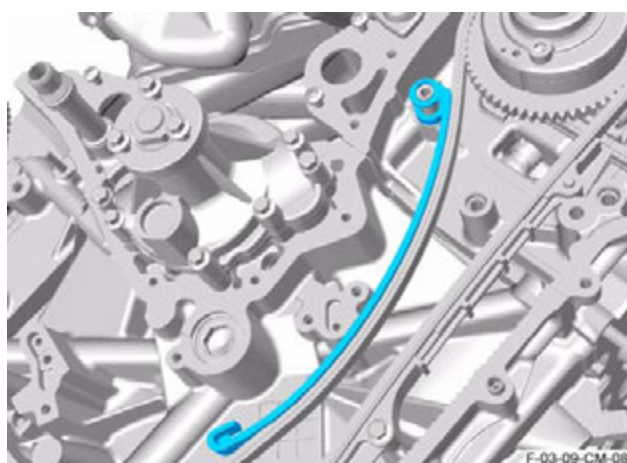


Figure 21

25. Loosen the two Torx bolts that attach the camshaft sprockets to the camshafts.

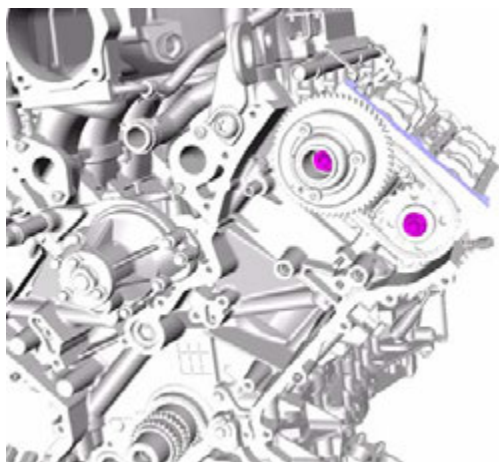


Figure 22

Install

1. Install the tensioner arm (refer to Figure 21).
2. Install the special bolt that attaches the tensioner arm to the engine and torque the bolt to 11 Nm (refer to Figure 20).
3. Install the timing chain tensioner (refer to Figure 19).
4. Install the two bolts that attach the timing chain tensioner to the engine and torque the bolts to 11 Nm (refer to Figure 18).
5. Install the special tool on the exhaust camshaft sprocket.

Note: You must use the special tool to hold the timing chain in the correct position during the subsequent two steps of the procedure.

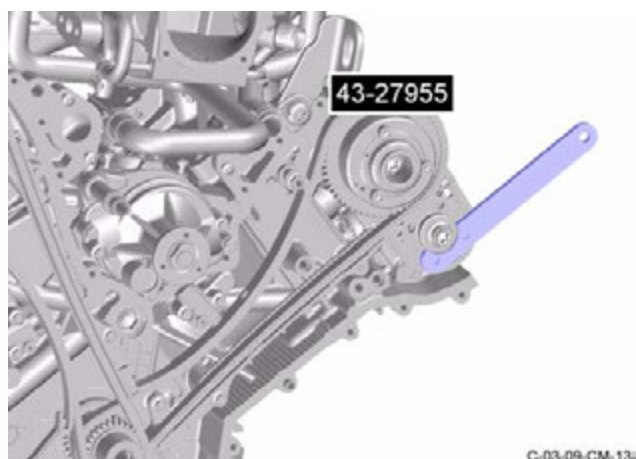


Figure 23

6. Use the special tool to turn the exhaust sprocket counterclockwise until there is tension in the chain.

Note: Make sure that the tensioner is fully operated but do not use too much force.

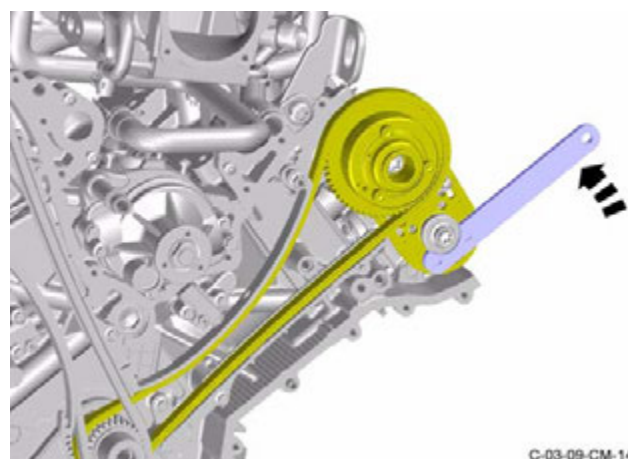


Figure 24

7. Release the pin from the timing chain tensioner and let the tension piston gradually apply tension to the timing chain.



Figure 25

Note: Make sure that you torque the bolt that attaches the sprocket to the exhaust camshaft first in the step that follows.

8. Torque the two Torx bolts that attach the camshaft sprockets to the camshafts to 20 Nm.

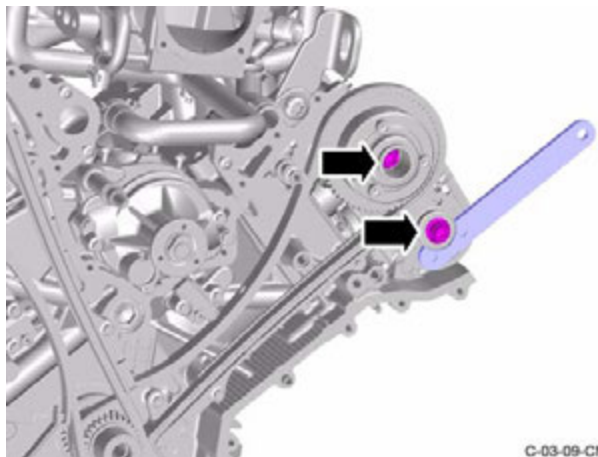


Figure 26

Note: Make sure that you torque the bolt that attaches the sprocket to the exhaust camshaft first in the step that follows.

9. Tighten the two Torx bolts that attach the camshaft sprockets to the camshafts 90 degrees more (refer to Figure 26).
10. Remove the special tool from the exhaust camshaft sprocket (refer to Figure 23).
11. Install the left side bush carrier for the VCT.

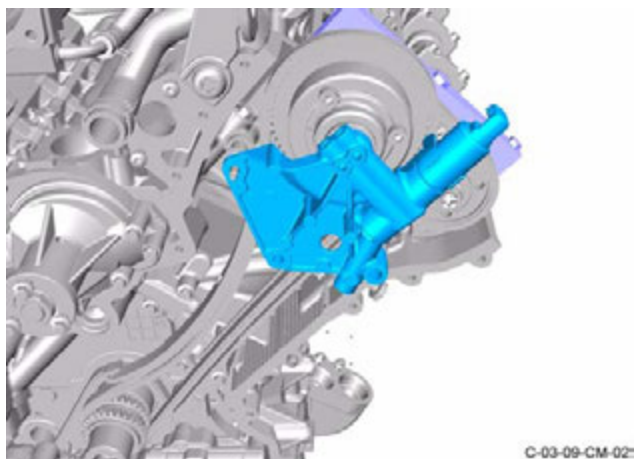


Figure 27

12. Install the two bolts that attach the left side bush carrier for the VCT to the engine. Torque the two bolts to 21 Nm.

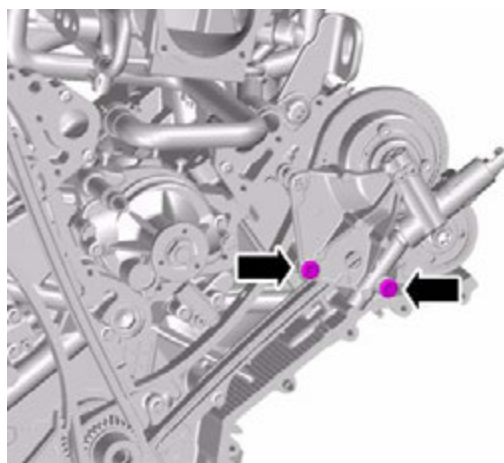


Figure 28

13. Install and torque the nut that attaches the left side bush carrier for the VCT to the engine to 11 Nm.

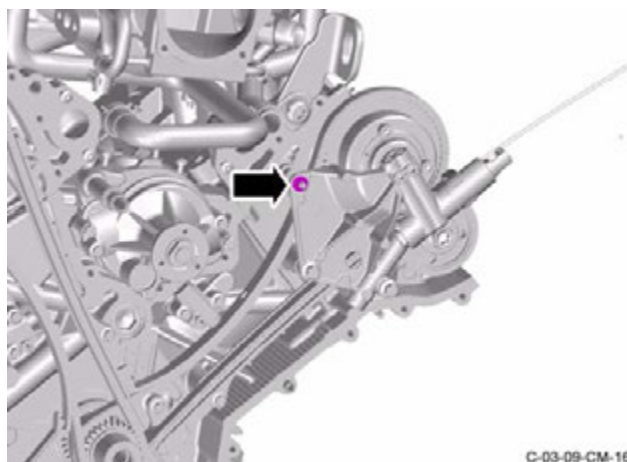


Figure 29

14. Use the applicable equipment to lift the vehicle and make it safe.
15. Remove the two socket cap screws that attach the special tool to the engine.

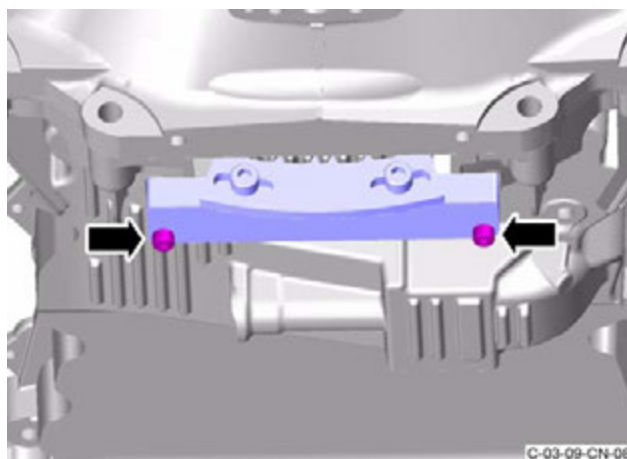


Figure 30

16. Remove the special tool from the flywheel.

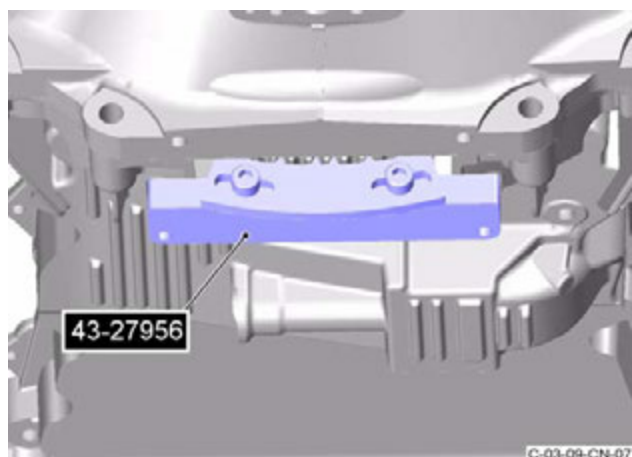


Figure 31

17. Lower the vehicle.

18. Remove the three screws that attach the special tool to the cylinder head.

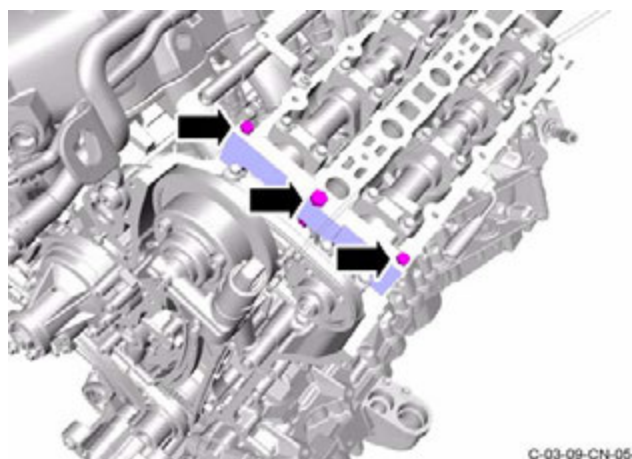


Figure 32

19. Remove the special tool from the left side camshaft.

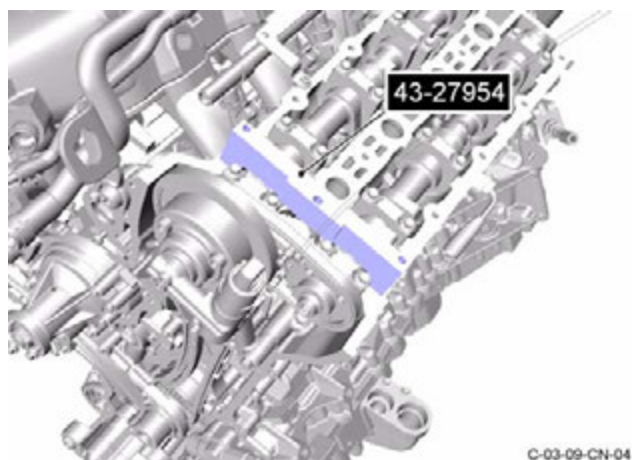


Figure 33

20. Remove the three screws that attach the special tool to the cylinder head.

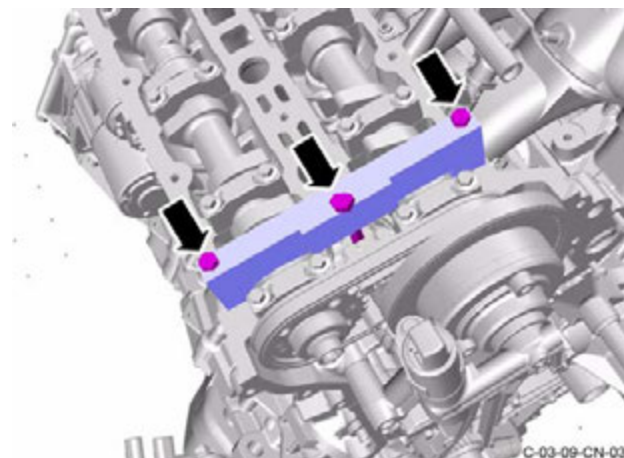


Figure 34

21. Remove the special tool from the right side camshaft.

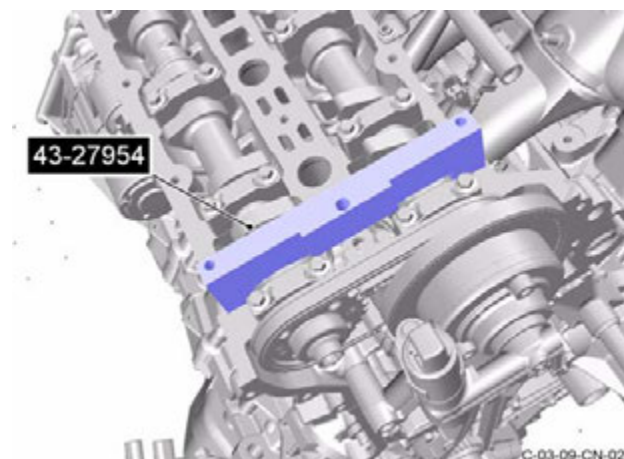


Figure 35

Caution:

During the step that follows, if you feel any increase in resistance, do not force the crankshaft. If you do you can damage the engine. If you cannot turn the crankshaft, you must do the engine timing procedure again.

22. Turn the crankshaft two full revolutions clockwise.

23. Use the applicable equipment to lift the vehicle and make it safe.



24. Install the special tool onto the flywheel.

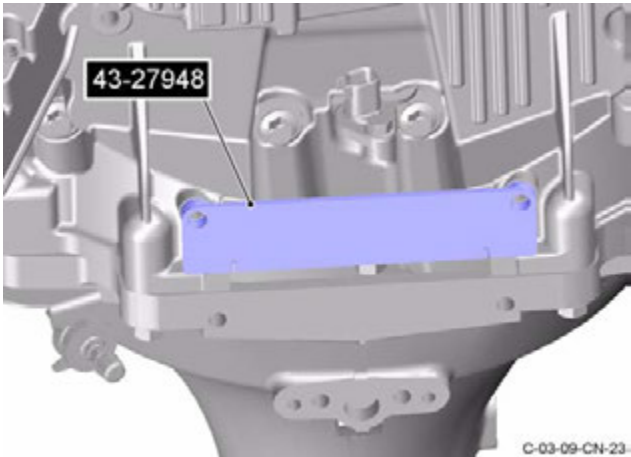


Figure 36

25. Install and tighten the two screws that attach the special tool to the engine.

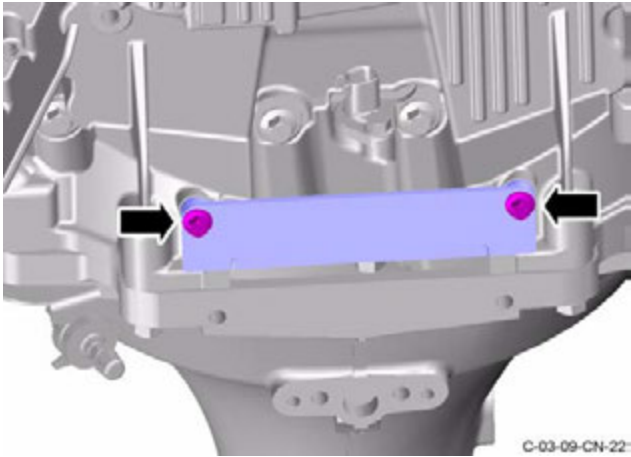


Figure 37

26. Install the engine timing cover (refer to procedure 03.10.AF - Engine Timing Cover).

Right Side Timing Chain Arm Assembly - Remove and Install

Repair Operation Time (ROT)	
Item	Code
Right Side Timing Chain Arm Assembly - Remove and Install	03.09.AB

Remove

WARNING

DO NOT GET USED ENGINE OIL ON YOUR SKIN. USED ENGINE OIL CAN BE HARMFUL.

1. Remove the engine timing cover. (03.10.AF - Engine Timing Cover).

2. Remove the two screws that attach the special tool to the engine.

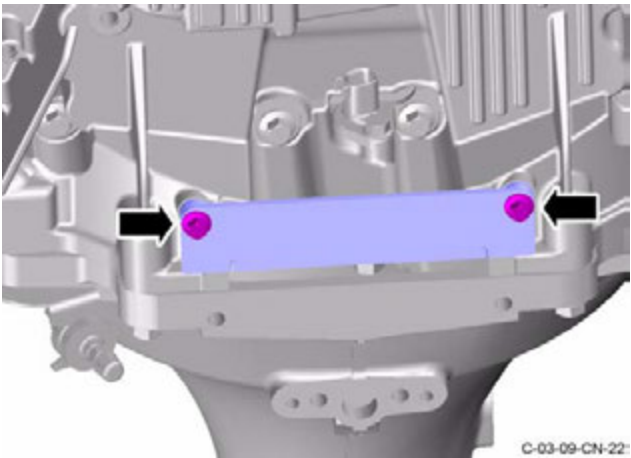


Figure 1

3. Remove the special tool from the flywheel.

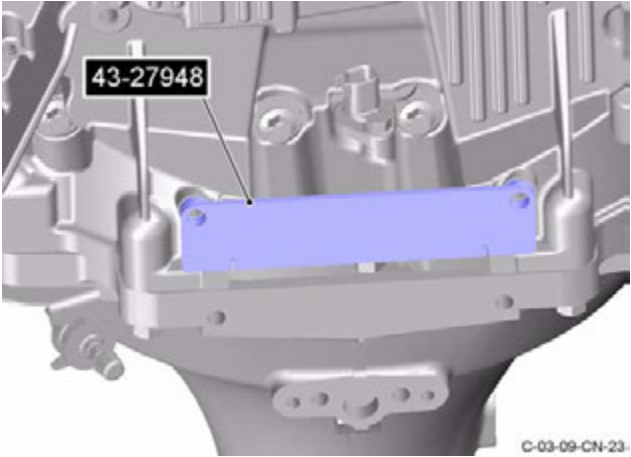


Figure 2

4. Turn the crankshaft clockwise until the machined flat areas on the camshafts are parallel to the face of the cylinder head.

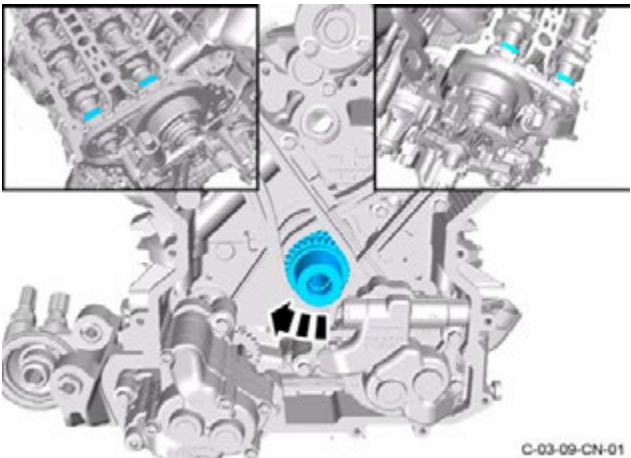


Figure 3

5. Install the special tool on the right side camshaft.

Note: If necessary, use special tool 303-530-04 with this step.

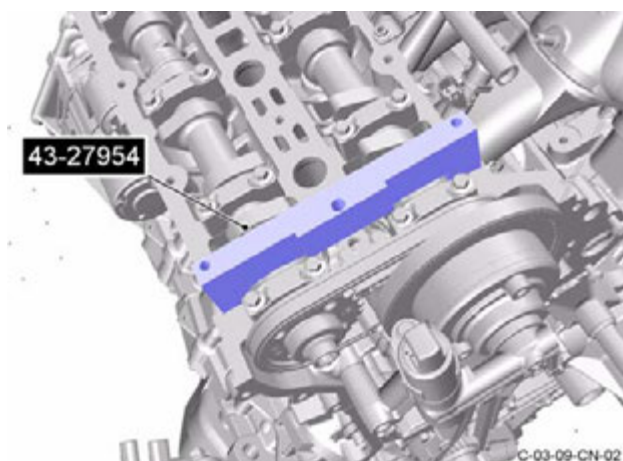


Figure 4

6. Install and tighten the three screws that attach the special tool to the cylinder head.

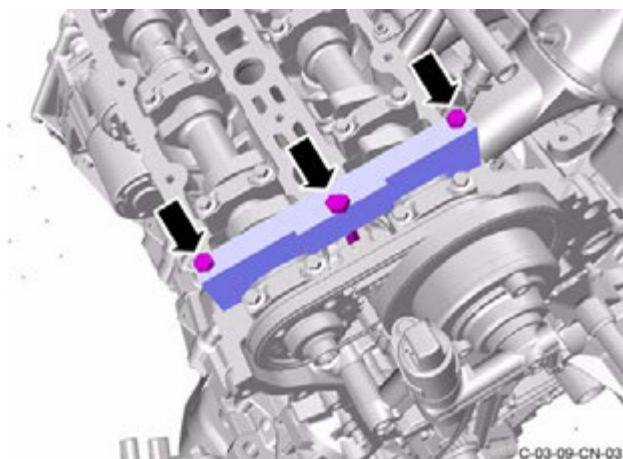


Figure 5

7. Install the special tool on the left side camshaft.

Note: If necessary, use special tool 303-530-04 with this step.

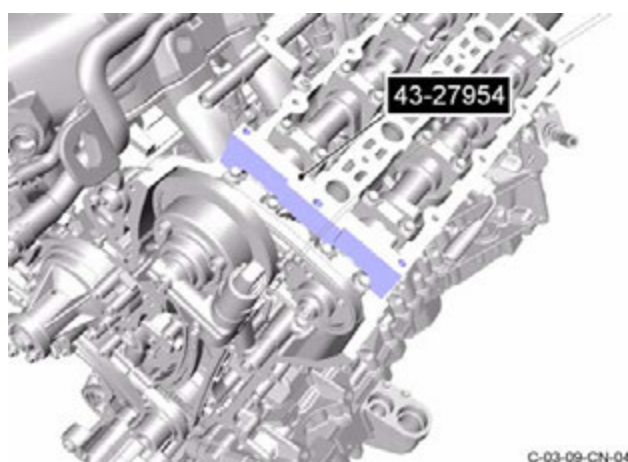


Figure 6

8. Install and tighten the three screws that attach the special tool to the cylinder head.

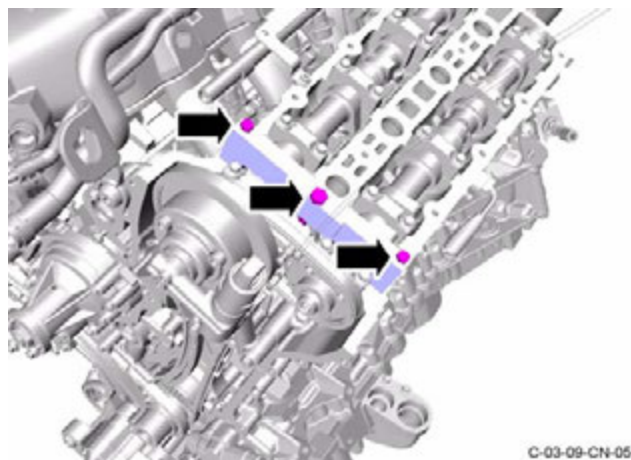


Figure 7

9. Use the applicable equipment to lift the vehicle and make it safe.
10. Loosen the two socket cap screws that attach the teeth to the special tool.



Figure 8

11. Install the special tool onto the flywheel.

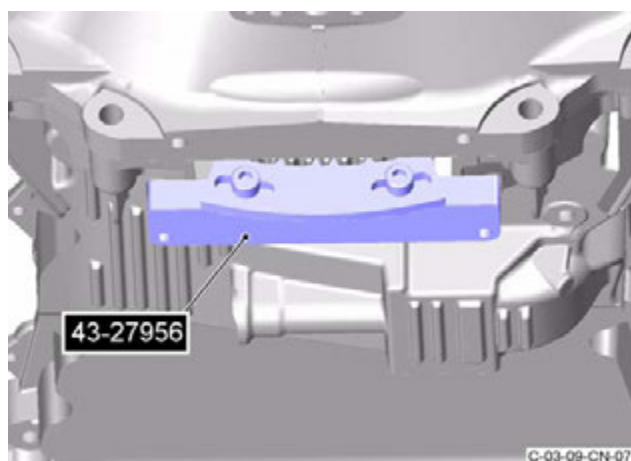


Figure 9

12. Install and tighten the two socket cap screws that attach the special tool to the engine.

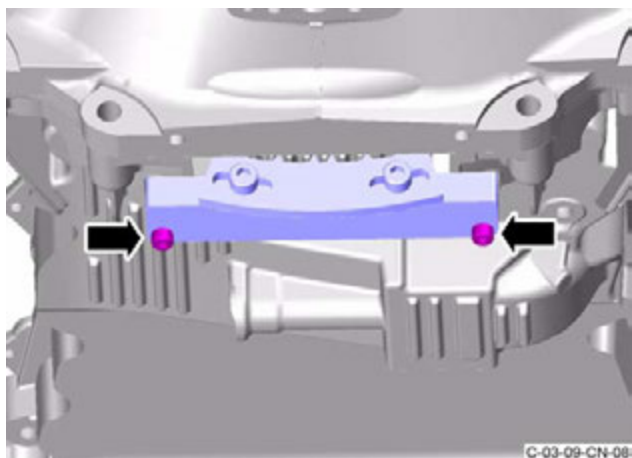


Figure 10

13. Tighten the two socket cap screws that attach the teeth to the special tool.

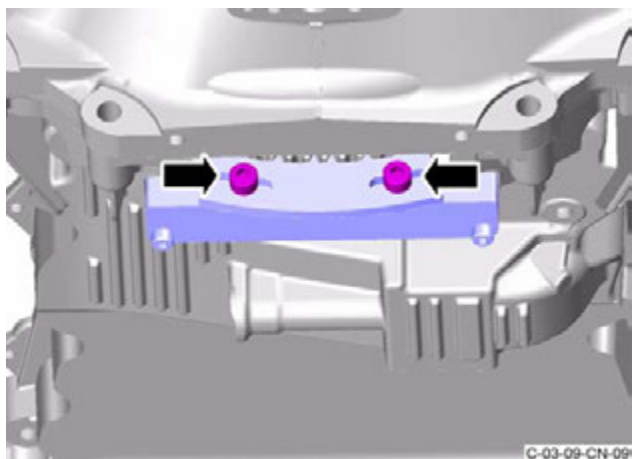


Figure 11

14. Lower the vehicle.

15. Remove the three screws that attach the right side bush carrier for the Variable Camshaft Timing (VCT) to the engine.

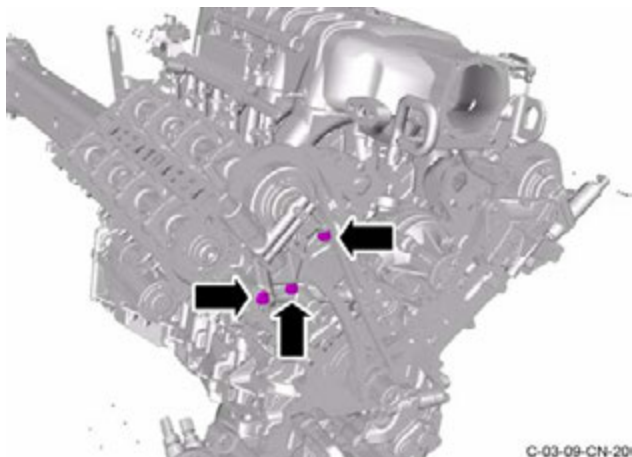


Figure 12

16. Remove the right side bush carrier for the VCT.

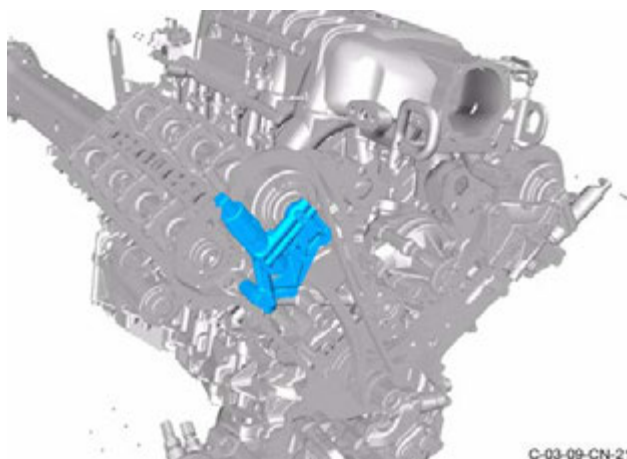


Figure 13

17. Loosen the two screws that attach the timing chain tensioner to the engine.

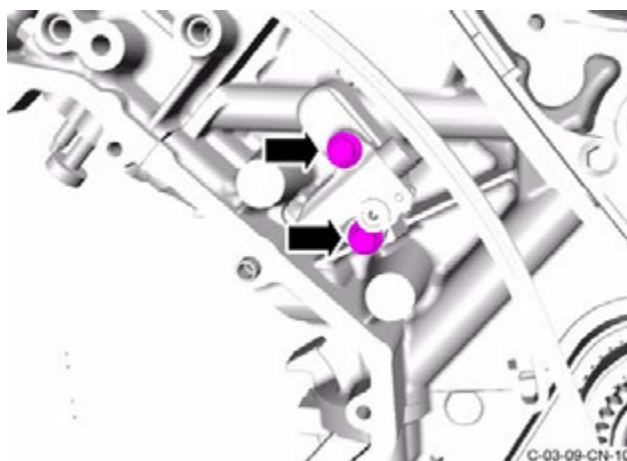


Figure 14

18. Release the ratchet lock on the timing chain tensioner and push the piston into the tensioner housing.

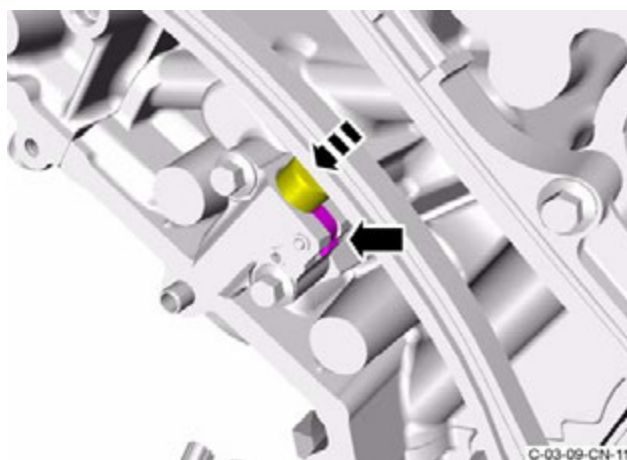


Figure 15

19. Install an applicable pin into the timing chain tensioner. 22. Remove the bolt that attaches the tensioner arm to the engine.



Figure 16

20. Remove the two bolts that attach the timing chain tensioner to the engine.

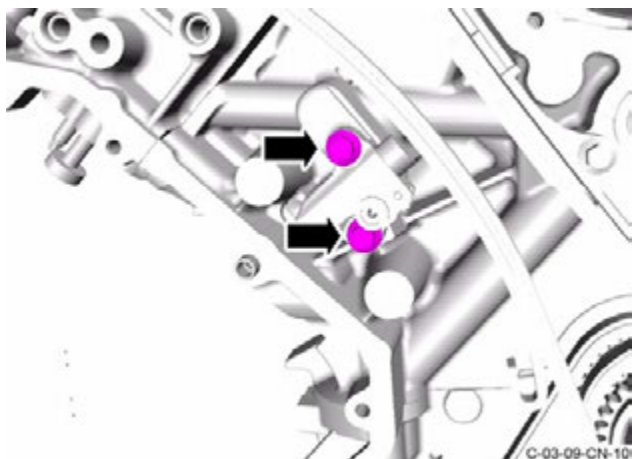


Figure 17

21. Remove the timing chain tensioner.

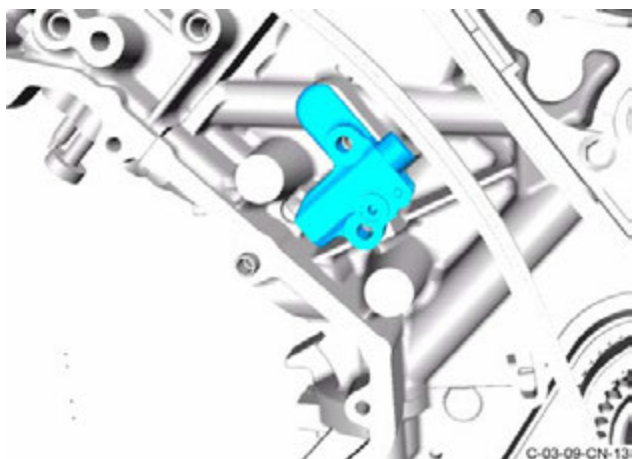


Figure 18

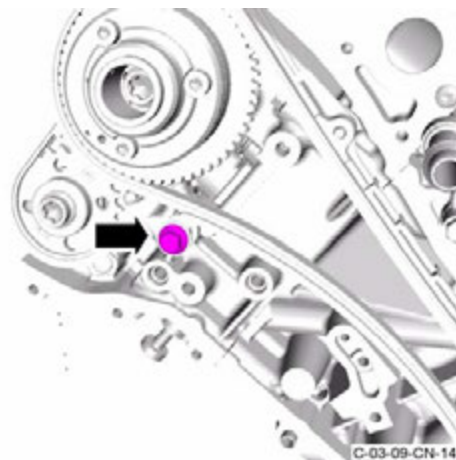


Figure 19

23. Remove the tensioner arm.



Figure 20

24. Loosen the two Torx bolts that attach the camshaft sprockets to the camshafts.

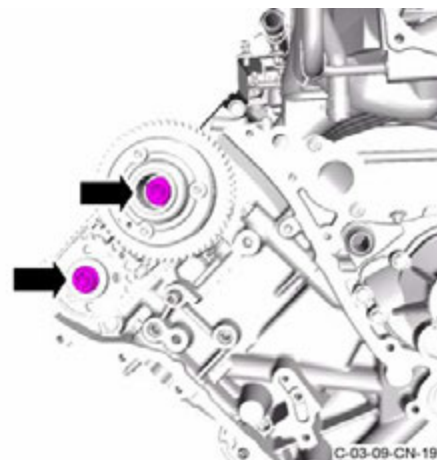


Figure 21

Install

1. Install the tensioner arm (refer to Figure 20).

2. Install and torque the special bolt that attaches the tensioner arm to the engine to 11 Nm (refer to Figure 19).
3. Install the timing chain tensioner (refer to Figure 18).
4. Install and torque the two bolts that attach the timing chain tensioner to the engine to 11 Nm (refer to Figure 17).
5. Install the special tool on the exhaust camshaft sprocket.

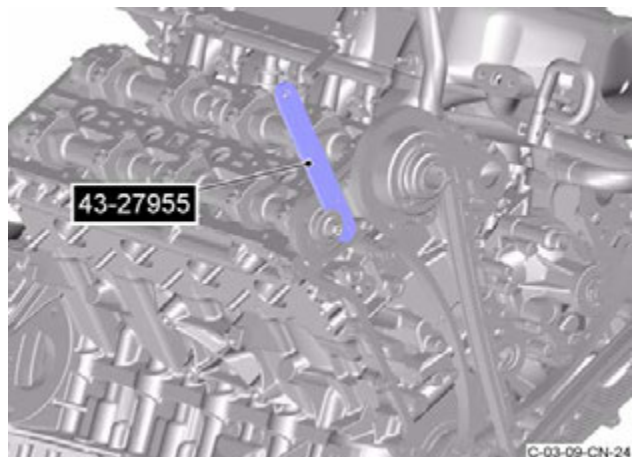


Figure 22

Note: You must use the special tool to hold the timing chain in the correct position during the subsequent two steps of the procedure.

6. Use the special tool to turn the exhaust sprocket counterclockwise until the chain is tight.

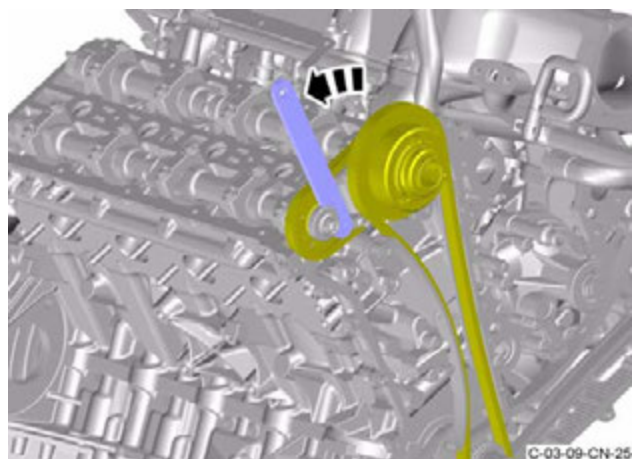


Figure 23

7. Release the pin from the timing chain tensioner and let the tension piston gradually tension the timing chain.

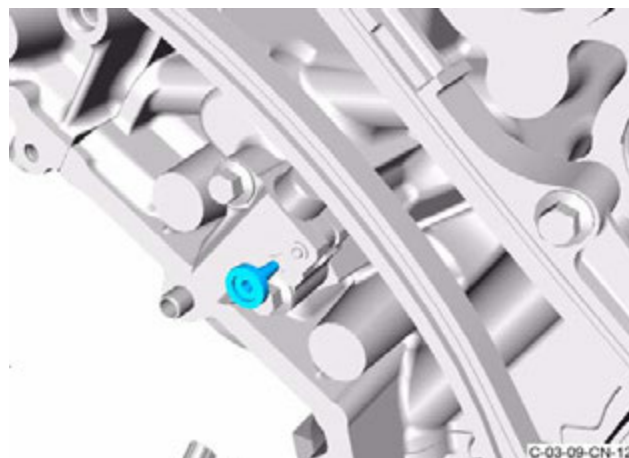


Figure 24

Note: Make sure that the tensioner is fully operated but do not use too much force.

Note: Make sure that you torque the bolt that attaches the sprocket to the exhaust camshaft first in the step that follows.

8. Torque the two Torx bolts that attach the camshaft sprockets to the camshafts to 20 Nm.

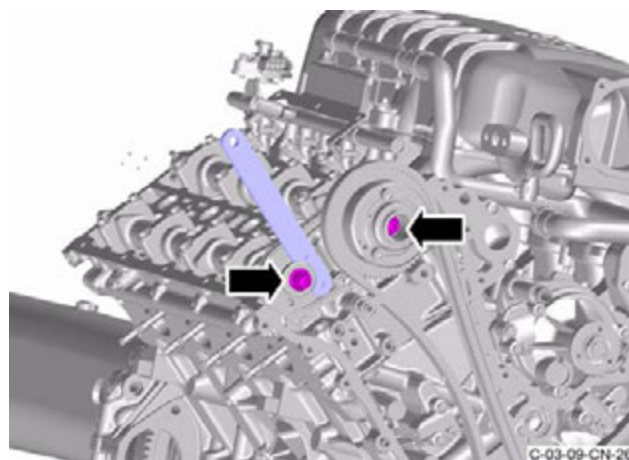


Figure 25

Note: Make sure that you torque the bolt that attaches the sprocket to the exhaust camshaft first in the step that follows.

9. Torque the two Torx bolts that attach the camshaft sprockets to the camshafts 90 degrees more (refer to Figure 25).

10. Remove the special tool from the exhaust camshaft sprocket.

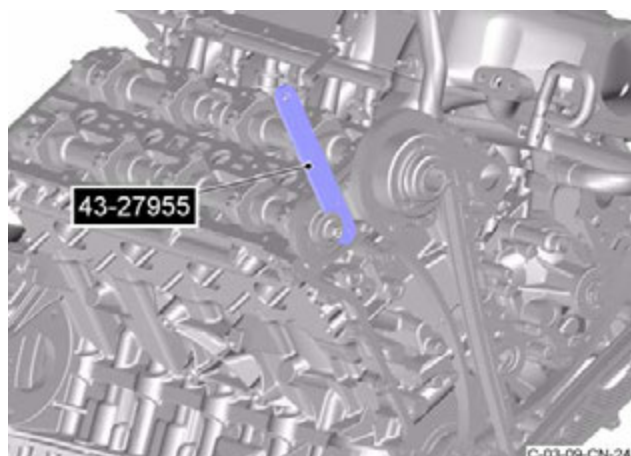


Figure 26

11. Install the right side bush carrier for the VCT.

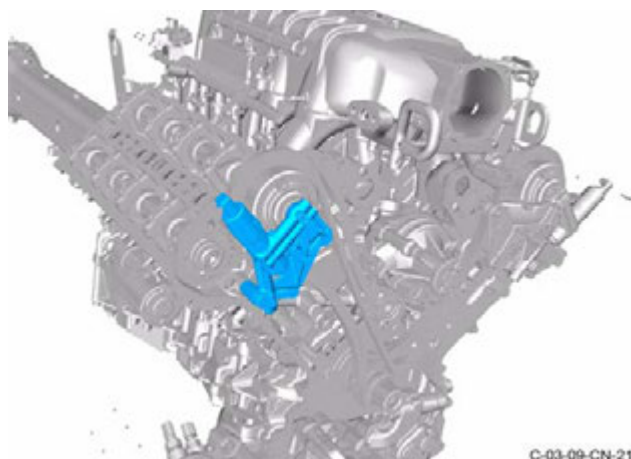


Figure 27

12. Install the three bolts that attach the right side bush carrier for the VCT to the engine. Torque the three bolts to 21 Nm.

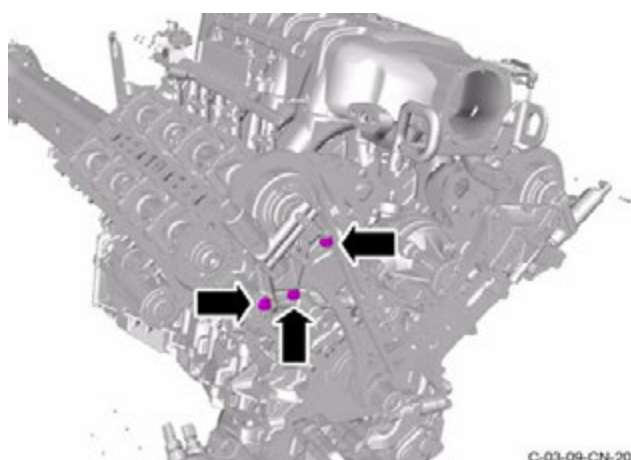


Figure 28

13. Use the applicable equipment to lift the vehicle and make it safe.

14. Remove the two socket cap screws that attach the special tool to the engine.

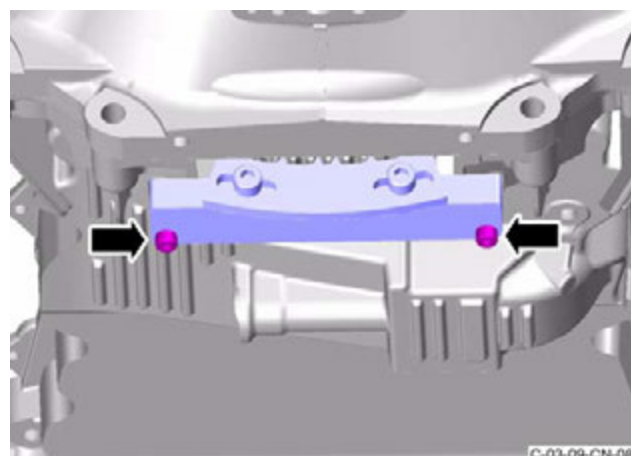


Figure 29

15. Remove the special tool from the flywheel.

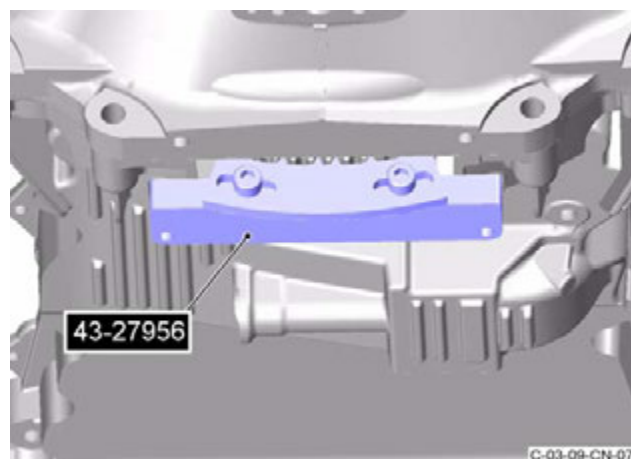
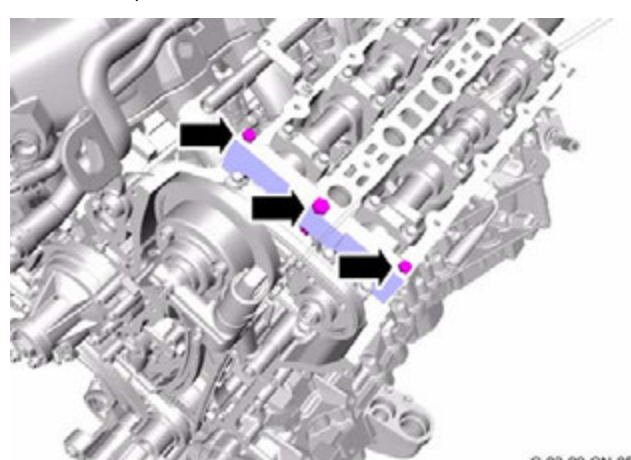


Figure 30

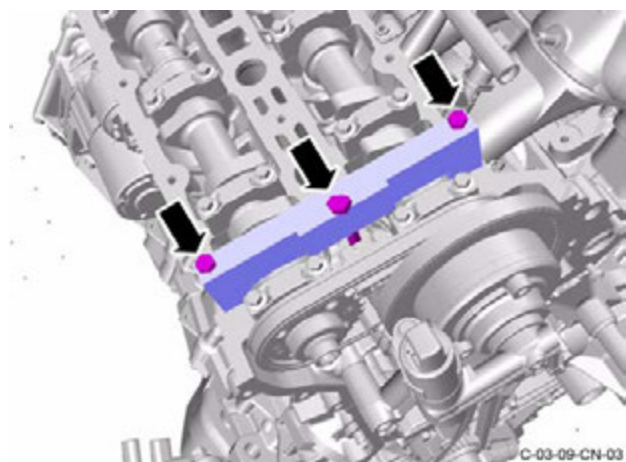
16. Lower the vehicle.

17. Remove the three screws that attach the special tool to the left cylinder head.



18. Remove the special tool from the left cylinder head.

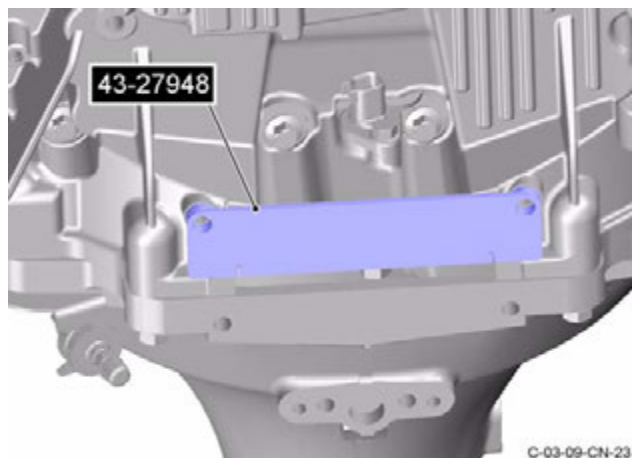
19. Remove the three screws that attach the special tool to the right cylinder head.



20. Remove the special tool from the right cylinder head.

Caution: During the step that follows, if you feel any increase in resistance, do not force the crankshaft. If you do you can damage the engine. If you cannot turn the crankshaft, you must do the engine timing procedure again.

21. Turn the crankshaft two full revolutions clockwise.
22. Use the applicable equipment to lift the vehicle and make it safe.
23. Install the special tool onto the flywheel.



24. Install and tighten the two screws that attach the special tool to the engine.
25. Install the engine timing cover (refer to procedure 03.10.AF - Engine Timing Cover).

RH/LH Secondary Tensioner Assembly - Remove and Install

Repair Operation Time (ROT)		
Item		Code
Secondary Tensioner Assembly-Renew	LH-LHD	03.09.AR
Secondary Tensioner Assembly-Renew	RH-LHD	03.09.AS

Repair Operation Time (ROT)

Item		Code
Secondary Tensioner Assembly-Renew	LH-RHD	03.09.CR
Secondary Tensioner Assembly-Renew	RH-RHD	03.09.CS

Remove

WARNING

DO NOT GET USED ENGINE OIL ON YOUR SKIN. USED ENGINE OIL CAN BE HARMFUL.

1. Remove the left and right primary timing chains (refer to Workshop Manual procedure 03.09.AM/03.09.AN/03.09.CM/03.09.CN Chain - Timing Primary - LH/RH - Renew).
2. Remove the two M12 Torx bolts that attach the inlet and exhaust camshaft sprockets to the camshafts (refer to Figure 1).

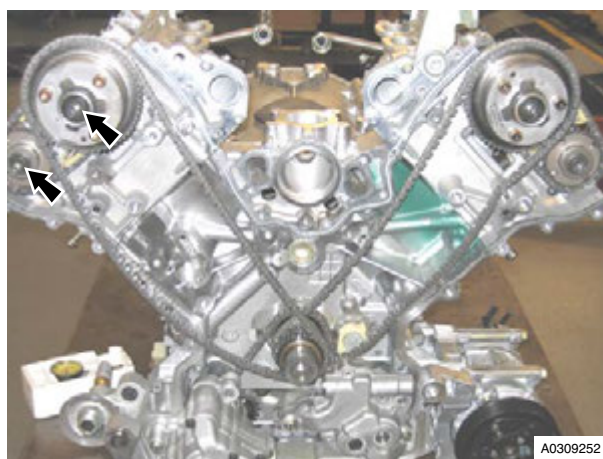


Figure 1

3. Collect the spacer from the bolt on the exhaust camshaft.
4. Remove the two M6 bolts that attach the secondary timing chain tensioner to the cylinder head (refer to Figure 2).

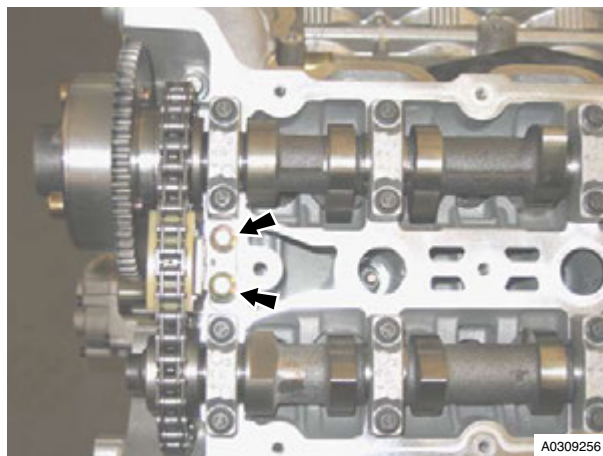


Figure 2

5. Release and remove camshaft sprockets complete with timing chain and tensioner from camshafts (refer to Figure 3).



Figure 3

6. Remove the secondary timing chain and tensioner from the sprockets (refer to Figure 4).

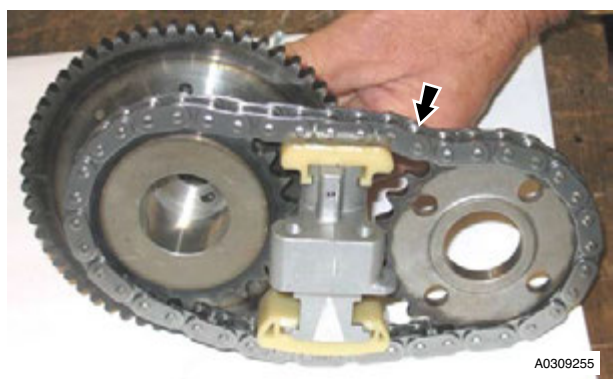


Figure 4

Install

1. Clean the camshaft sprockets and the tensioner.
2. Install the secondary timing chain and tensioner to the camshaft sprockets.
3. Install the secondary timing chain assembly onto the camshafts.
4. Install the spacer onto the exhaust Torx bolt.
5. Install the M12 exhaust Torx bolt to attach the exhaust camshaft sprocket. Do not tighten at this step.
6. Install the M12 inlet Torx bolt to attach the inlet camshaft sprocket. Do not tighten at this step.
7. Install and torque the two M6 bolts that attach the secondary tensioner.
8. Install the left primary timing chain guide.
9. Install and torque the M6 bolt that attaches the guide.
10. Make sure that the timing chain has no tension on the tensioner side of the timing chain.
11. Install the primary timing chain.
12. Install the tensioner blade for the primary timing chain.
13. Install and torque tighten the M6 bolt that attaches the tensioner blade.
14. Install the tensioner assembly for the primary timing chain.
15. Install and torque the two M6 bolts that attach the tensioner assembly.
16. Release the tension on the timing chain tensioner piston. Remove retaining special tool.
17. Install the timing chain tensioning tool (303-532) into the exhaust camshaft sprocket.

Caution

Apply an opposite force to the sprockets and chain while you tighten the sprocket bolts.

18. Apply a force to the tool (303-532) in a counterclockwise direction and torque the two M12 sprocket Torx bolts.
19. Remove the special tool (303-532).
20. Install the left and right primary timing chains (refer to Workshop Manual procedure 03.09.AM/03.09.AN/03.09.CM/03.09.CN Chain - Timing Primary - LH/RH - Renew).

Right and Left Intake Camshaft - Remove and Install

Repair Operation Time (ROT)

Item	Code	
Intake Camshaft - Renew	Right-LHD	03.09.AT
Intake Camshaft - Renew	Left-LHD	03.09.AV
Intake Camshaft - Renew	Right-RHD	03.09.CT
Intake Camshaft - Renew	Left-RHD	03.09.CV

Remove

WARNING

**DO NOT GET USED ENGINE OIL ON YOUR SKIN.
USED ENGINE OIL CAN BE HARMFUL.**

1. Remove the right and left secondary timing chain tensioners (refer to Workshop Manual procedure 03.09.AS/03.09.AR03.09.CS/03.09.CR Tensioner Assembly - Secondary - RH/LH - Renew).
2. Remove the three bolts that attach the tool (303-530) to the cylinder head.

3. Remove the special tool (refer to Figure 1 - Right side shown).

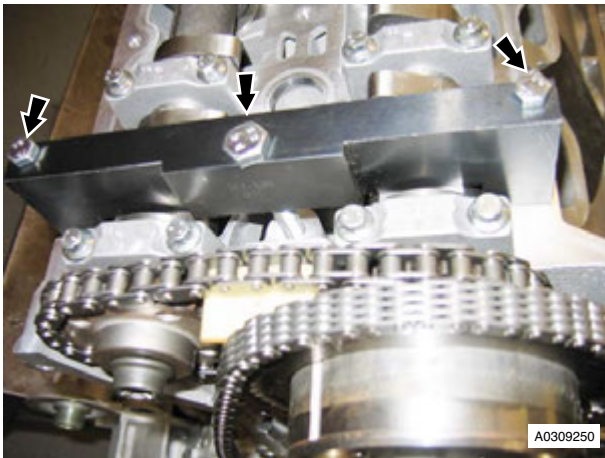


Figure 1 (Right Side Shown)

4. Collect the spacer (303-530/04) if used.
5. Loosen the bolts that attach the ten intake camshaft bearing caps gradually, in steps (refer to Figure 2 - Right side shown).

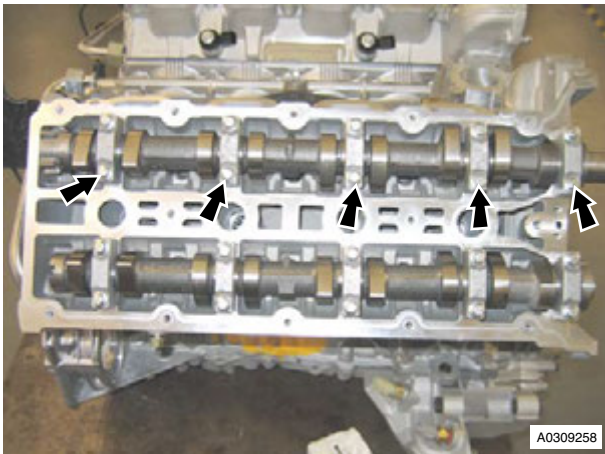


Figure 2 (Right Side Shown)

6. Record the installed direction and positions and remove the five right intake bearing caps.

7. Remove the right intake camshaft (refer to Figure 3 - Right side shown).



Figure 3 (Right Side Shown)

Install

1. Apply clean engine oil to the items that follow:
 - The camshaft journals
 - The camshaft lobes
 - The bearing surfaces on the cylinder head
 - The bearing caps.
2. Install the right intake camshaft.
3. Install the five bearing caps in their initial positions.

Caution

Tighten the bearing cap bolts gradually in a diagonal sequence to correctly seat the camshaft bearing caps.

4. Install and torque the ten bolts in the sequence shown in Figure 3.

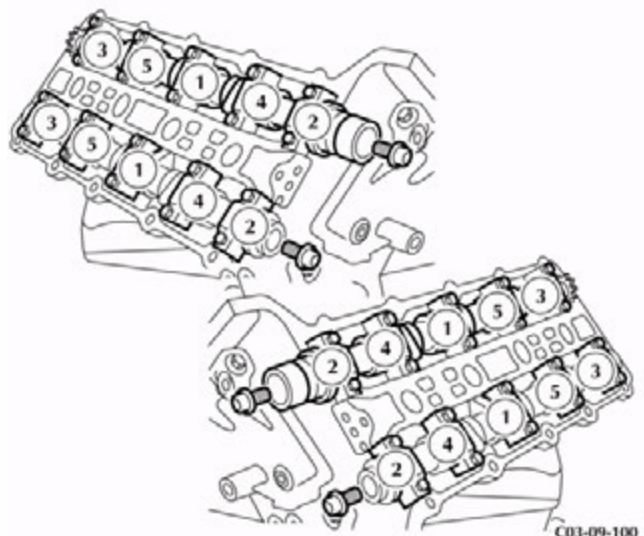


Figure 3

5. Install the M12 Torx bolt to attach the sprocket to the camshaft.
6. Rotate the camshaft as necessary and measure and record each valve clearance.
7. Do steps 4 to 6 again.
8. Calculate the necessary tappet grade for each valve.

9. Install the correct tappets.
10. Do steps 1 to 4 again.
11. Rotate the camshaft as necessary and measure each valve clearance again.
12. Remove the M12 sprocket attachment Torx bolt.
13. Install the right and left tensioner for the secondary timing chain (refer to Workshop Manual procedure 03.09.AS/03.09.AR/03.09.CS/03.09.CR Tensioner Assembly - Secondary - RH/LH - Renew).

Right and Left Exhaust Camshaft - Remove and Install

Repair Operation Time (ROT)		
Item	Code	
Exhaust Camshaft-Renew	RH-LHD	03.09.AU
Exhaust Camshaft-Renew	LH-LHD	03.09.AW
Exhaust Camshaft-Renew	RH-RHD	03.09.CU
Exhaust Camshaft-Renew	LH-RHD	03.09.CW

Remove

WARNING
DO NOT GET USED ENGINE OIL ON YOUR SKIN.
USED ENGINE OIL CAN BE HARMFUL.

1. Remove the right and left secondary timing chain tensioner (refer to Workshop Manual procedure 03.09.AS/03.09.AR/03.09.CS/03.09.CR Tensioner Assembly - Secondary - RH/LH - Renew).
2. Remove the three bolts that attach the tool (303-530) to the cylinder head.
3. Remove the special tool (refer to Figure 1 - Right side shown).

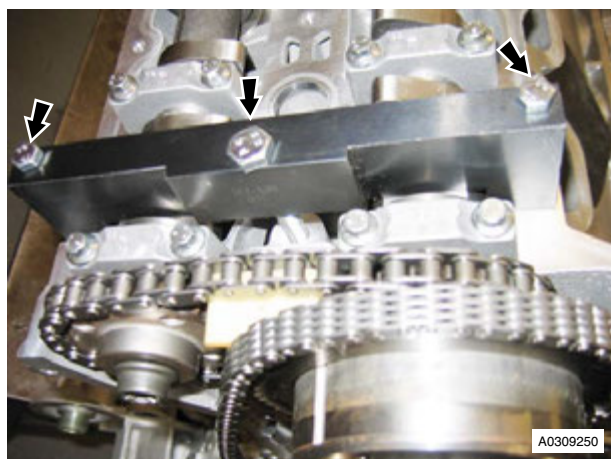


Figure 1 (Right Side Shown)

4. Collect the spacer (303-530/04) if used.

5. Loosen the bolts that attach the ten exhaust camshaft bearing caps gradually, in steps (refer to Figure 2 - Right side shown).

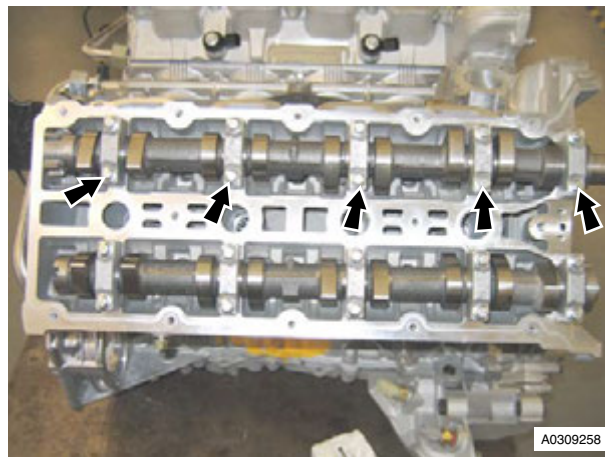


Figure 2

6. Record the installed direction and positions and remove the five right exhaust bearing caps.
7. Remove the right exhaust camshaft (refer to Figure 3 - Right side shown).



Figure 3

Install

1. Apply clean engine oil to the items that follow:
 - The camshaft journals
 - The camshaft lobes
 - The bearing surfaces on the cylinder head
 - The bearing caps.
2. Install the right exhaust camshaft.
3. Install the five bearing caps in their initial positions.

Caution

Tighten the bearing cap bolts gradually in a diagonal sequence to correctly seat the camshaft bearing caps.

4. Install and torque the ten bolts in the sequence specified as shown in Figure 4.

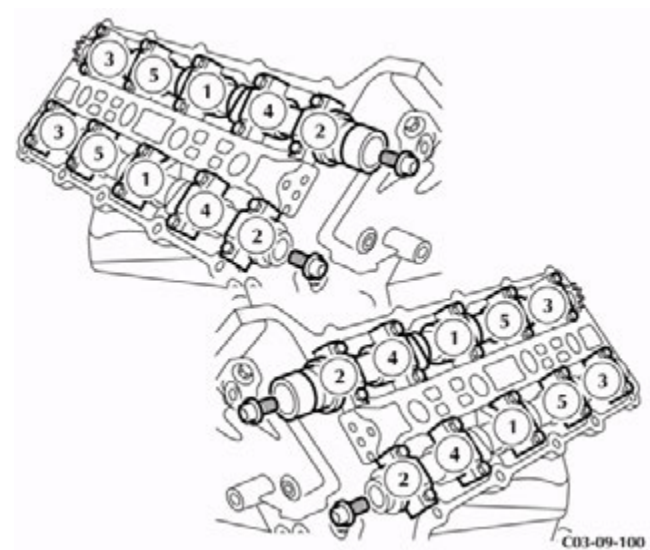


Figure 4

5. Install the Torx bolt to attach the sprocket to the camshaft.
6. Rotate the camshaft as necessary and measure and record each valve clearance.
7. Do steps 4 to 6 again.
8. Calculate the necessary tappet grade for each valve.
9. Install the correct tappets.
10. Do steps 1 to 4 again.
11. Rotate the camshaft as necessary and measure each valve clearance again.
12. Remove the sprocket attachment Torx bolt.
13. Install right and left secondary timing chain tensioner (refer to Workshop Manual procedure 03.09.AS/03.09.AR03.09.CS/03.09.CR Tensioner Assembly - Secondary - RH/LH - Renew).

RH/LH Secondary Timing Chain-Renew

Repair Operation Time (ROT)		
Item	Code	
Secondary Timing Chain - Renew	LH-LHD	03.09.AY
Secondary Timing Chain - Renew	RH-LHD	03.09.AZ
Secondary Timing Chain - Renew	LH-RHD	03.09.CY
Secondary Timing Chain - Renew	RH-RHD	03.09.CZ

Remove

1. Remove the left and right primary timing chain (refer to Workshop Manual procedure 03.09.AM/03.09.AN/03.09.CM/03.09.CN Chain - Timing Primary - LH/RH - Renew).

2. Remove the two Torx bolts that attach the inlet and exhaust camshaft sprockets to camshafts (refer to Figure 1).

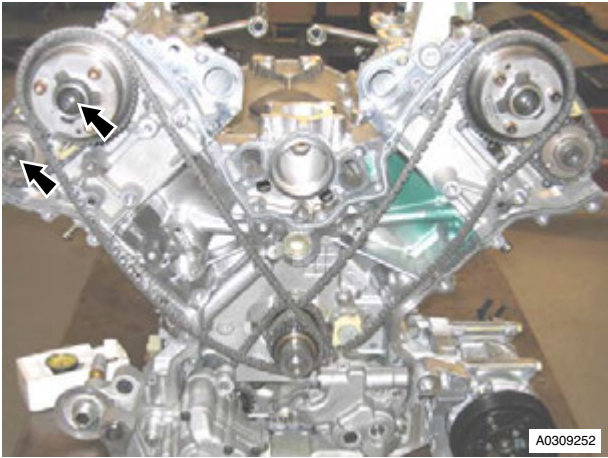


Figure 1

3. Collect the spacer from the bolt on the exhaust camshaft.
4. Remove the two M6 bolts that attach the secondary timing chain tensioner to the cylinder head (refer to Figure 2).

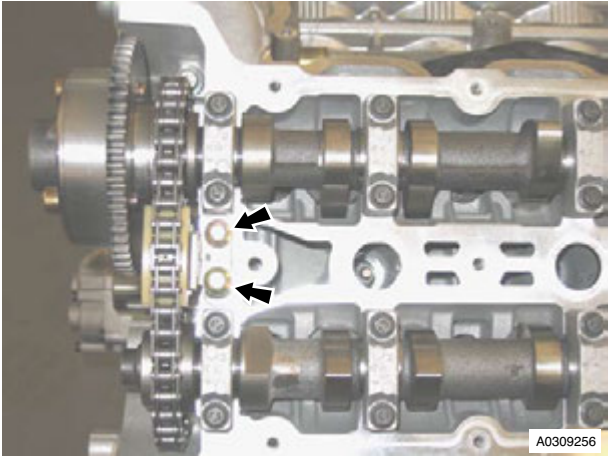


Figure 2

5. Release and remove the camshaft sprockets complete with timing chain and tensioner from camshafts (refer to Figure 3).



Figure 3

6. Remove secondary timing chain and tensioner from sprockets (refer to Figure 4).

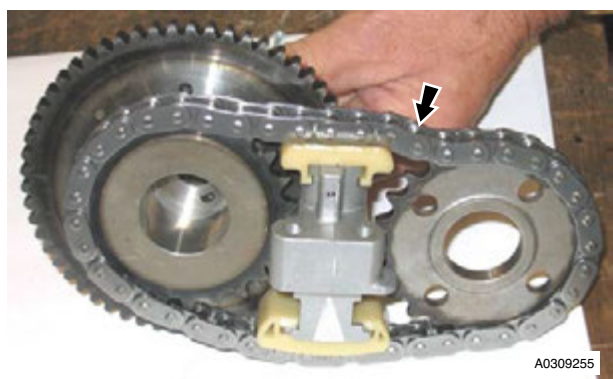


Figure 4

Install

1. Clean the camshaft sprockets and tensioner.
2. Install the secondary timing chain and tensioner on to the camshaft sprockets.
3. Install the secondary timing chain assembly onto the camshafts.
4. Install the spacer onto the M12 exhaust Torx bolt.
5. Install the exhaust M12 Torx bolt to attach the exhaust camshaft sprocket. Do not tighten at this step.
6. Install the inlet M12 Torx bolt to attach the inlet camshaft sprocket. Do not tighten at this step.
7. Install and torque tighten the two M6 secondary tensioner bolts.
8. Install the left primary timing chain guide.
9. Install and torque the M6 bolt that attaches the left primary timing chain guide.
10. Make sure that there is no tension in the chain at the tensioner side.
11. Install the primary timing chain.
12. Install primary timing chain tensioner blade.
13. Install and torque the M6 bolt that attaches the tensioner blade.
14. Install the primary timing chain tensioner assembly.
15. Install and torque tighten the two M6 bolts that attach the tensioner assembly.
16. Release tension on the timing chain tensioner piston, remove retaining special tool.
17. Install timing chain tensioning tool (303-532) into exhaust camshaft sprocket.
18. Apply a force to the tool (303-532) in an anti-clockwise direction and torque tighten sprocket Torx bolts. Remove special tool.
19. Install LH/RH primary timing chain (refer to Workshop Manual procedure 03.09.AM/03.09.AN/03.09.CM/03.09.CN Chain - Timing Primary - LH/RH - Renew).

Caution

Apply an opposite force to the sprockets and chain while you tighten the sprocket bolts

RH/LH Secondary Tensioner Assembly-Renew (with Engine Removed)

Repair Operation Time (ROT)

Item	Code	
Secondary Tensioner Assembly-Renew LH	03.09.BR	
Secondary Tensioner Assembly-Renew RH	03.09.BS	

Remove

WARNING

DO NOT GET USED ENGINE OIL ON YOUR SKIN. USED ENGINE OIL CAN BE HARMFUL.

1. Remove the LH/RH primary timing chain (refer to Workshop Manual procedure 03.09.BM/03.09.BN/03.09.CM/03.09.CN Timing Chain - Primary - LH/RH - Renew With Engine Removed).
2. Remove the two Torx head bolts, (there is a spacer on the exhaust Torx bolt), that attach the inlet and exhaust camshaft sprockets to the camshafts (refer to Figure 1).

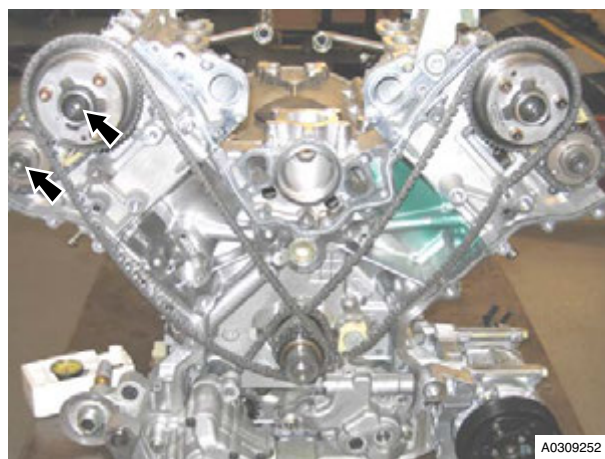


Figure 1

3. Remove the two bolts that attach the secondary timing chain tensioner to the cylinder head (refer to Figure 2).

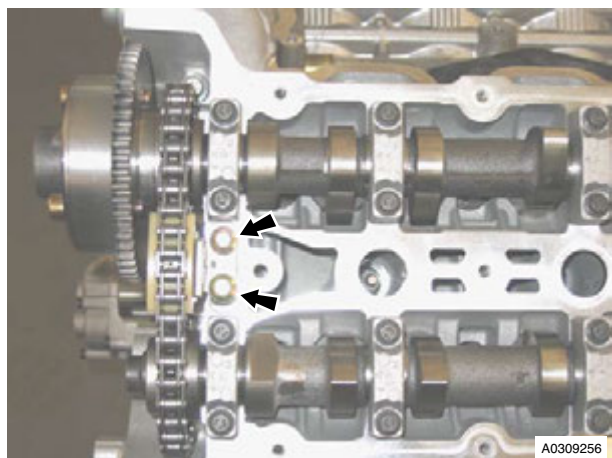


Figure 2

4. Release and remove the camshaft sprockets complete with the timing chain and tensioner from the camshafts (refer to Figure 3).



Figure 3

5. Remove the secondary timing chain and tensioner from the sprockets (refer to Figure 4).

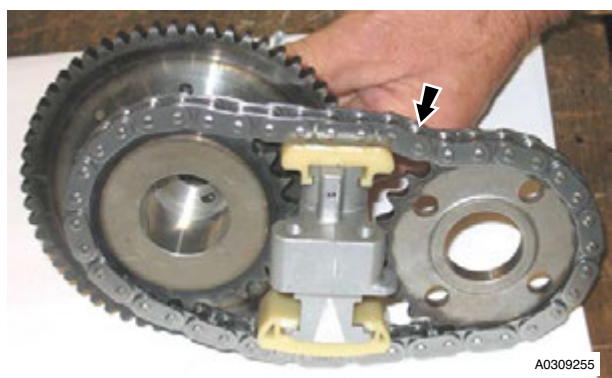


Figure 4

Install

1. Clean the camshaft sprockets and tensioner.
2. Install the secondary timing chain and tensioner to the camshaft sprockets.

3. Install the secondary timing chain assembly onto the camshafts.
4. Install the spacer onto the M12 exhaust Torx bolt.
5. Install the exhaust M12 Torx bolt to attach the exhaust camshaft sprocket. Do not tighten at this step.
6. Install the inlet M12 Torx bolt to attach the inlet camshaft sprocket. Do not tighten at this step.
7. Install and torque tighten the two secondary tensioner bolts.
8. Install the left-side primary timing chain guide.
9. Install and torque the bolt that attaches the chain guide.
10. Make sure that the timing chain slack is on the tensioner side of the timing chain.
11. Install the primary timing chain.
12. Install the tensioner blade for the primary timing chain.
13. Install and torque the bolt that attaches the tensioner blade.
14. Install the primary timing chain tensioner assembly.
15. Install and torque the two bolts that attach the primary chain tensioner.
16. Release the tension on the timing chain tensioner piston. Remove the retaining special tool.
17. Install the timing chain tensioning tool (303-532) on the exhaust camshaft sprocket.
18. Apply a force to the special tool (303-532) in a counterclockwise direction and torque the sprocket Torx bolts. Remove the special tool.
19. Install the the left and right primary timing chain (refer to Workshop Manual procedure 03.09.BM/03.09.BN/03.09.CM/03.09.CN Timing Chain - Primary - LH/RH - Renew With Engine Removed).

RH/LH Intake Camshaft Renew With Engine Removed

Repair Operation Time (ROT)		
Item	Code	
Intake Camshaft-Renew	LH	03.09.BT
Intake Camshaft-Renew	RH	03.09.BV

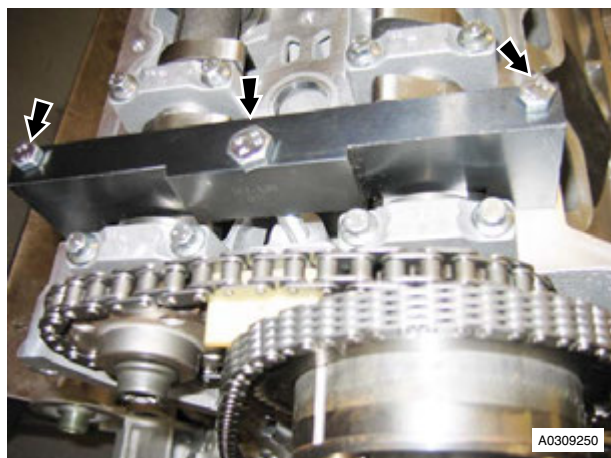
Remove

WARNING

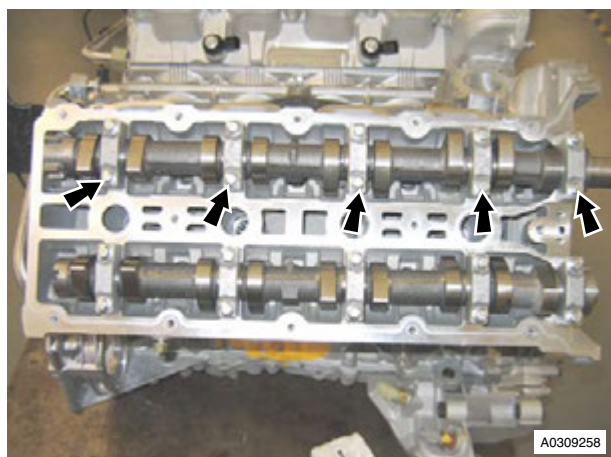
**DO NOT GET USED ENGINE OIL ON YOUR SKIN.
USED ENGINE OIL CAN BE HARMFUL.**

1. Remove the left and right secondary timing chain tensioner (refer to Workshop Manual procedure 03.09.BS/03.09.BR Tensioner Assembly - Secondary - RH/LH - Renew With Engine Removed).
2. Remove the three bolts that attach the tool (303-530) to the cylinder head.

3. Remove the special tool (refer to Figure 1 - Right side shown).

**Figure 1**

4. Collect the spacer (303-530/04) if used.
5. Loosen the bolts that attach the ten intake camshaft bearing caps gradually in steps (refer to Figure 2 - Right side shown).

**Figure 2**

6. Record the installed direction and positions and remove the five right intake bearing caps.

7. Remove the right intake camshaft (refer to Figure 3 shown..

**Figure 3**

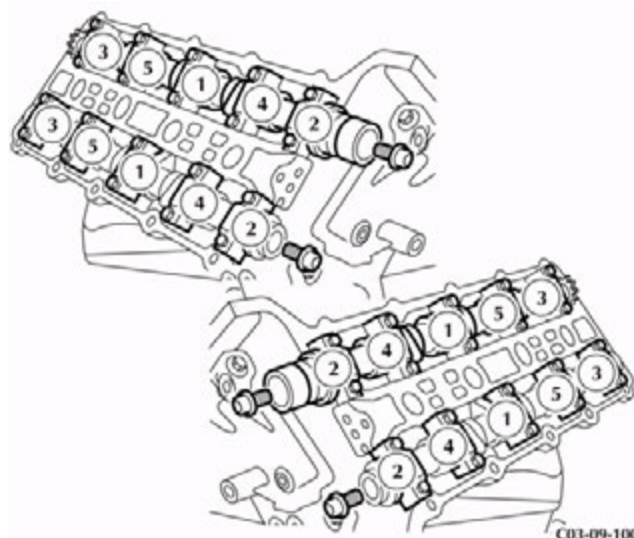
Install

1. Apply clean engine oil to the items that follow:
 - The camshaft journals
 - The camshaft lobes
 - The bearing surfaces on the cylinder head
 - The bearing caps.
2. Install the right intake camshaft.
3. Install the five bearing caps in their initial positions.

Caution

Tighten the bearing cap bolts gradually in a diagonal sequence to correctly seat the camshaft bearing caps.

4. Install and torque the ten bolts in the sequence specified as shown in Figure 4.

**Figure 4**

5. Install the Torx bolt to attach the sprocket to the camshaft.
6. Rotate the camshaft as necessary and measure and record each valve clearance.
7. Do steps 4 to 6 again.
8. Calculate the necessary tappet grade for each valve.



9. Install the correct tappets.
10. Do steps 1 to 4 again.
11. Rotate the camshaft as necessary and measure each valve clearance again.
12. Remove the sprocket attachment Torx bolt.
13. Install the right and left secondary timing chain tensioner (refer to Workshop Manual procedure 03.09.BS/03.09.BR Tensioner Assembly - Secondary - RH/LH - Renew With Engine Removed).

RH/LH Exhaust Camshaft-Renew (with Engine Removed)

Repair Operation Time (ROT)		
Item	Code	
Exhaust Camshaft-Renew	LH	03.09.BW
Exhaust Camshaft-Renew	RH	03.09.BU

Remove

WARNING
DO NOT GET USED ENGINE OIL ON YOUR SKIN.
USED ENGINE OIL CAN BE HARMFUL.

1. Remove the left and right secondary timing chain tensioner (refer to Workshop Manual procedure 03.09.BR/03.09.BS Tensioner Assembly - Secondary - LH/RH - Renew With Engine Removed).
2. Remove the three bolts that attach the tool (303-530) to the cylinder head.
3. Remove the special tool (refer to Figure 1 - Left side shown)..

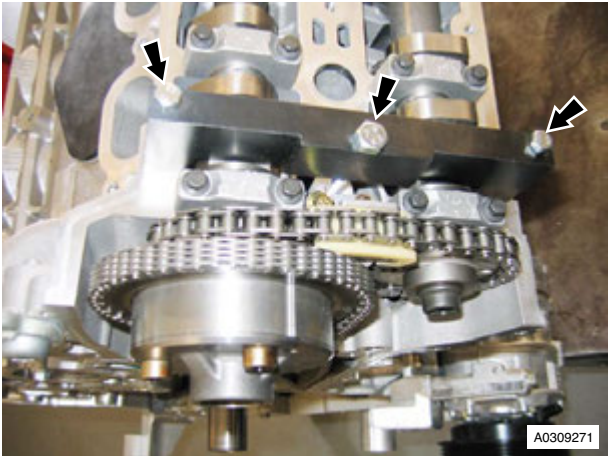


Figure 1

4. Collect the spacer (303-530/04) if used.
5. Loosen the bolts that attach the ten exhaust camshaft bearing caps gradually in steps (refer to Figure 2 - left side shown).

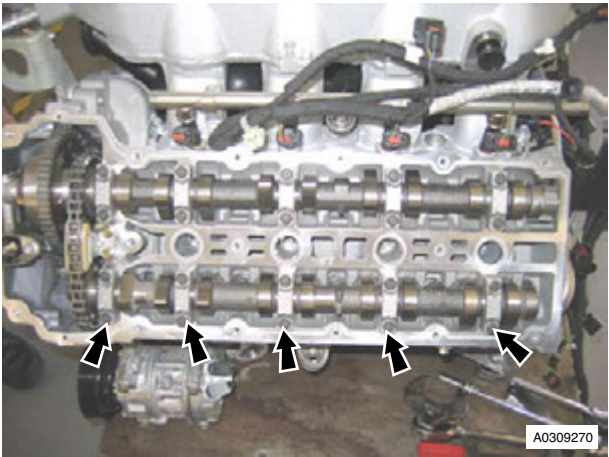


Figure 2

6. Record the installed direction and positions and remove the five right exhaust bearing caps.
7. Remove the right exhaust camshaft (refer to Figure 3 - Right side shown.)..
7. Do steps 4 to 6 again.
8. Calculate the necessary tappet grade for each valve.
9. Install the correct tappets.
10. Do steps 1 to 4 again.
11. Rotate the camshaft as necessary and measure each valve clearance again.
12. Remove the sprocket attachment Torx bolt.
13. Install left and right secondary timing chain tensioner (refer to Workshop Manual procedure 03.09.BR/ 03.09.BS Tensioner Assembly - Secondary - LH/RH - Renew With Engine Removed).



Figure 3

Install

1. Apply clean engine oil to the items that follow:
 - The camshaft journals
 - The camshaft lobes
 - The bearing surfaces on the cylinder head
 - The bearing caps.
2. Install the right exhaust camshaft.
3. Install the five bearing caps in their initial positions.

Caution

Tighten the bearing cap bolts gradually in a diagonal sequence to correctly seat the camshaft bearing caps.

4. Install and torque the ten bolts in the sequence shown in Figure 4.

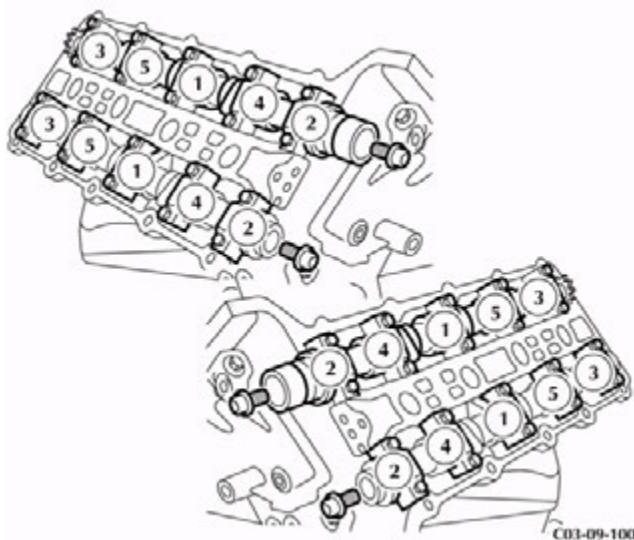


Figure 4

5. Install the Torx bolt to attach the sprocket to the camshaft.
6. Rotate the camshaft as necessary and measure and record each valve clearance.

RH/LH Secondary Timing Chain-Renew (with Engine Removed)

Repair Operation Time (ROT)		
Item	Code	
Secondary Timing Chain-Renew	LH	03.09.BY
Secondary Timing Chain-Renew	RH	03.09.BZ

Remove

WARNING
DO NOT GET USED ENGINE OIL ON YOUR SKIN.
USED ENGINE OIL CAN BE HARMFUL.

1. Remove the left and right primary timing chain (refer to Workshop Manual procedure 03.09.BM/03.09.BN Timing Chain - Primary - LH/RH - Renew With Engine Removed).
2. Remove the two M12 Torx bolts that attach the inlet and exhaust camshaft sprockets to camshafts (refer to Figure 1)..



Figure 1

3. Collect the spacer from the bolt on the exhaust camshaft.
4. Remove the two M6 bolts that attach the secondary timing chain tensioner to the cylinder head (refer to Figure 2).

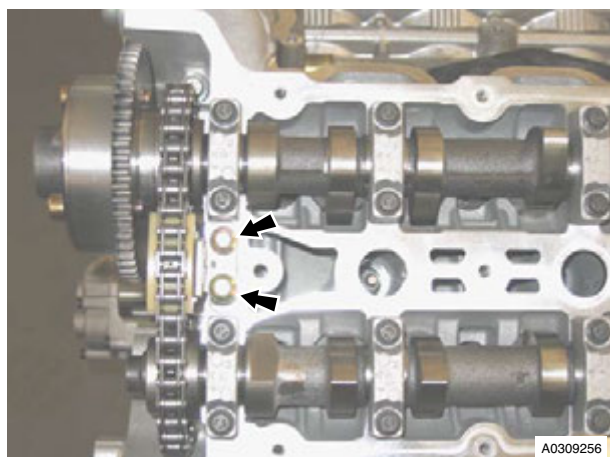


Figure 2

5. Release and remove the camshaft sprockets complete with the timing chain and tensioner from camshafts (refer to Figure 3)..



Figure 3

6. Remove secondary timing chain and tensioner from sprockets (refer to Figure 4).

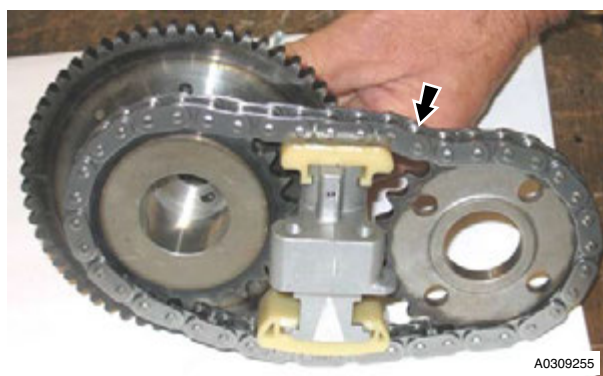


Figure 4

Install

1. Clean the camshaft sprockets and the tensioner.
2. Install the secondary timing chain and tensioner to camshaft sprockets.
3. Install the secondary timing chain assembly onto the camshafts.
4. Install the spacer onto the M12 exhaust Torx bolt.
5. Install the exhaust M12 Torx bolt to attach the exhaust camshaft sprocket. Do not tighten at this step.
6. Install the inlet M12 Torx bolt to attach the inlet camshaft sprocket. Do not tighten at this step.
7. Install and torque the two M6 secondary tensioner attachment bolts.
8. Install the left guide for the primary timing chain.
9. Install and torque the M6 bolt that attaches the left guide.
10. Make sure that the timing chain slack is on the tensioner side of the timing chain.
11. Install the primary timing chain.
12. Install the primary timing chain tensioner blade.

13. Install and torque the M6 attachment bolt for the tensioner blade.
14. Install the tensioner assembly for the primary timing chain.
15. Install and torque the two M6 bolts that attach the tensioner assembly.
16. Release the tension on the piston of the timing chain tensioner.
17. Remove the retaining special tool.
18. Install the timing chain tensioning tool (303-532) into the exhaust camshaft sprocket.

Caution

Apply an opposite force to the sprockets and chain while you tighten the sprocket bolts

19. Apply a force to the tool (303-532) in a counterclockwise direction and torque the M12 sprocket Torx bolts.
20. Remove the special tool.
21. Install the left and right primary timing chain (refer to Workshop Manual procedure 03.09.BM/03.09.BN Timing Chain - Primary - LH/RH - Renew With Engine Removed).

RH/LH Intake Camshaft Sprocket and Housing Assembly-Renew

Repair Operation Time (ROT)		
Item	Code	
Intake Camshaft Sprocket and Housing Assembly - Renew	RH-LHD	03.09.CE
Intake Camshaft Sprocket and Housing Assembly - Renew	LH-LHD	03.09.CF
Intake Camshaft Sprocket and Housing Assembly - Renew	RH-RHD	03.09.DG
Intake Camshaft Sprocket and Housing Assembly - Renew	LH-RHD	03.09.DH

Remove

WARNING

**DO NOT GET USED ENGINE OIL ON YOUR SKIN.
USED ENGINE OIL CAN BE HARMFUL.**

1. Remove the left and right primary timing chain (refer to Workshop Manual procedure 03.09.AN/03.09.AM/03.09.CN/03.09.CM Chain - Timing Primary - RH/LH - Renew).

2. Remove the two M12 Torx bolts that attach the inlet and exhaust camshaft sprockets to camshafts (refer to Figure 1).



Figure 1

3. Collect the spacer from the bolt on the exhaust camshaft.
4. Remove the two M6 bolts that attach the secondary timing chain tensioner to the cylinder head (refer to Figure 2).

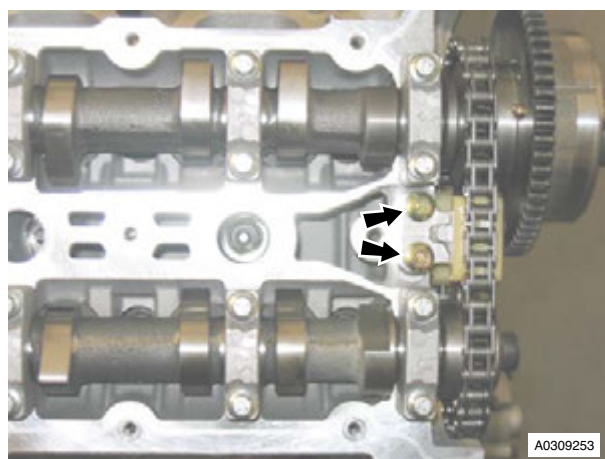


Figure 2

5. Release and remove the two camshaft sprockets complete with the timing chain and tensioner from the camshafts (refer to Figure 3).



Figure 3

6. Remove the intake sprocket housing assembly from the secondary timing chain (refer to Figure 4).

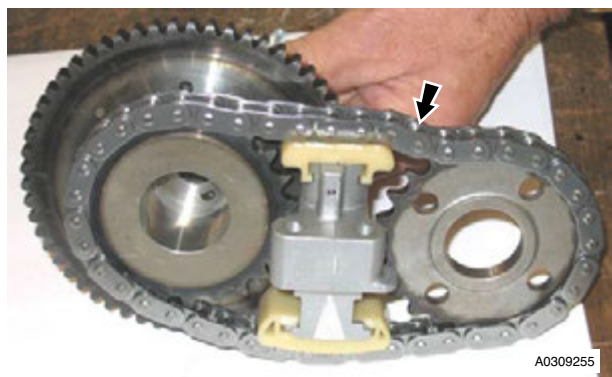


Figure 4

Install

1. Clean the two camshaft sprockets and the tensioner.
2. Install intake sprocket housing assembly and exhaust sprocket into secondary timing chain.
3. Install secondary timing chain tensioner onto timing chain.
4. Install secondary timing chain assembly onto camshafts.
5. Install the spacer onto the M12 exhaust Torx bolt.
6. Install the exhaust M12 Torx bolt to attach the exhaust camshaft sprocket. Do not tighten at this step.
7. Install the inlet M12 Torx bolt to attach the inlet camshaft sprocket. Do not tighten at this step.
8. Install and torque tighten secondary tensioner bolts (x2).
9. Install RH primary timing chain guide, install and torque tighten bolt.
10. Make sure that the timing chain slack is on the tensioner side of the timing chain.
11. Install primary timing chain.
12. Install primary timing chain tensioner blade, install and torque tighten bolt.

13. Install primary timing chain tensioner assembly, install and torque tighten bolts (x2).
14. Release tension on the timing chain tensioner piston, remove retaining special tool.
15. Install timing chain tensioning tool (303-532) into exhaust camshaft sprocket.

Caution

Apply an opposite force to the sprockets and chain while you tighten the sprocket bolts

16. Apply a force to the tool (303-532) in an anti-clockwise direction and torque tighten sprocket Torx bolts. Remove special tool.
17. Install RH/LH primary timing chain (refer to Workshop Manual procedure 03.09.AN/03.09.AM/03.09.CN/03.09.CM Chain - Timing Primary - RH/LH - Renew).

Left Side Primary Chain - Remove and Install

Repair Operation Time (ROT)	
Item	Code
Left Side Primary Chain - Remove and Install	03.09.CM

Remove

1. Remove the right side primary timing chain. (refer to procedure 03.09.CN - Right Side Primary Timing Chain)
2. Remove the two bolts that attach the left side bush carrier for the Variable Camshaft Timing (VCT) to the engine.

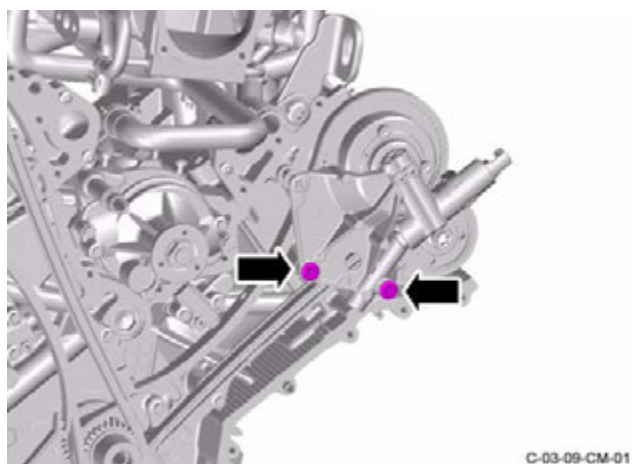


Figure 1

3. Remove the nut that attaches the left side bush carrier for the VCT to the engine.
6. Release the ratchet lock on the timing chain tensioner and push the piston into the tensioner housing.

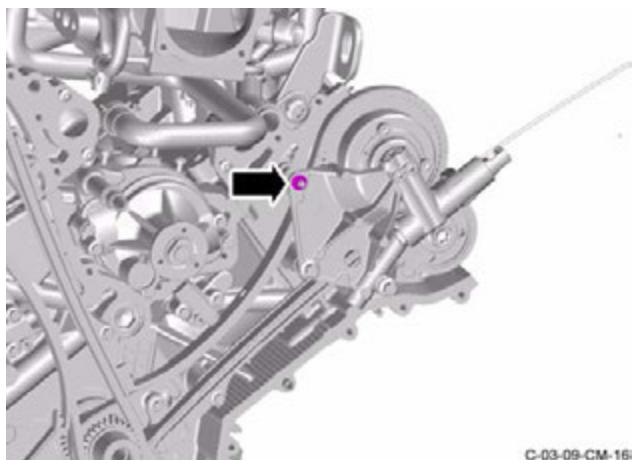


Figure 2

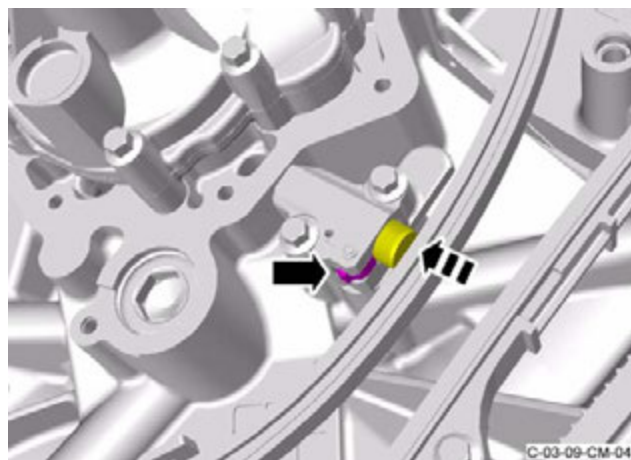


Figure 5

4. Remove the left side bush carrier for the VCT.

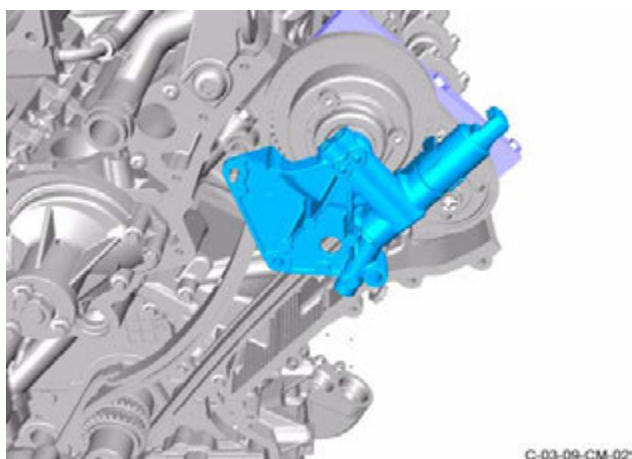


Figure 3



Figure 6

5. Loosen the two bolts that attach the timing chain tensioner to the engine.
8. Remove the two bolts that attach the timing chain tensioner to the engine.

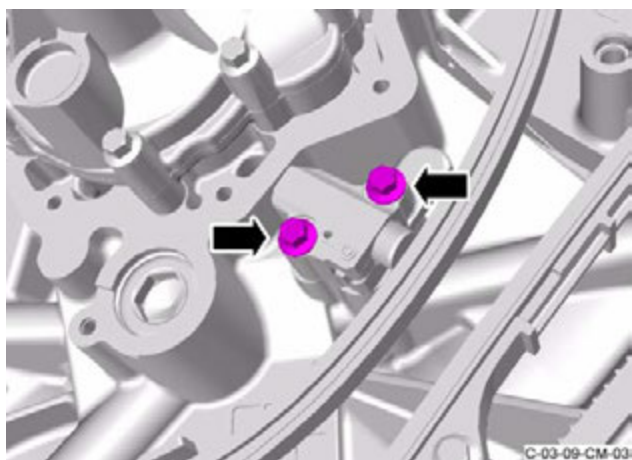


Figure 4

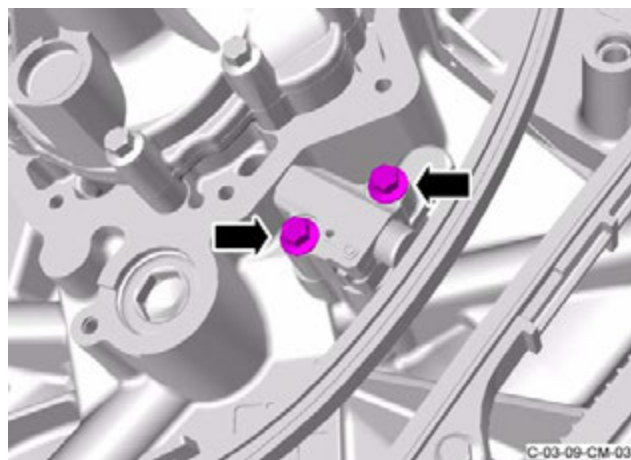


Figure 7

9. Remove the timing chain tensioner.

10. Remove the special pivot bolt for the tensioner arm from the engine.

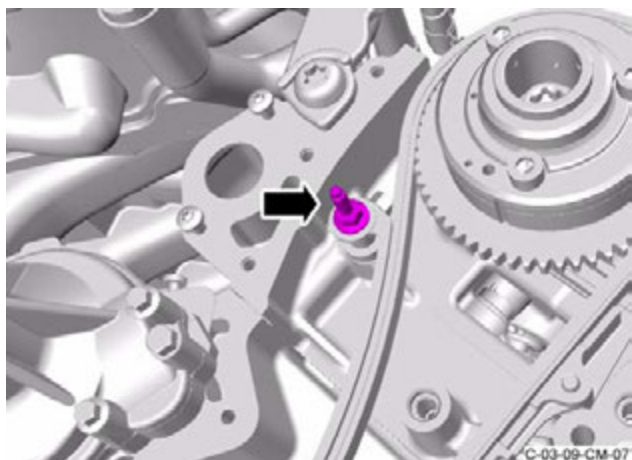


Figure 8

11. Remove the tensioner arm.

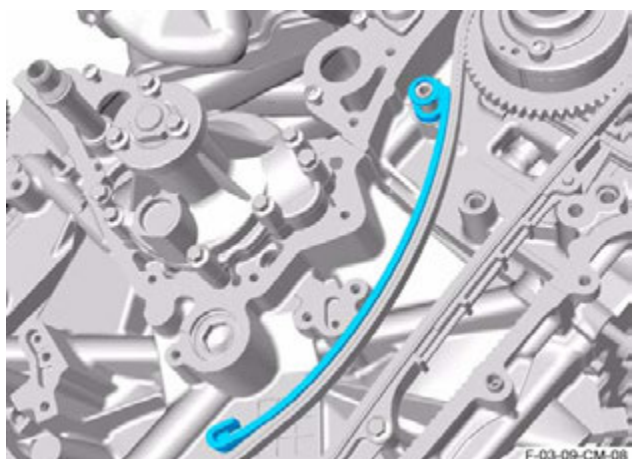


Figure 9

12. Remove the bolt that attaches the timing chain guide to the engine.

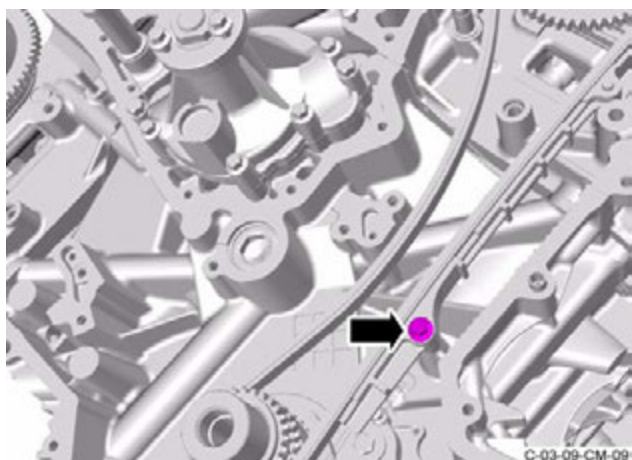


Figure 10

13. Remove the timing chain guide.

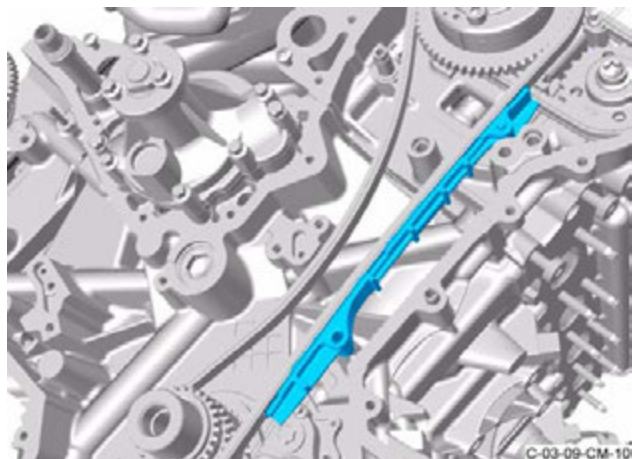


Figure 11

14. Remove the timing chain.

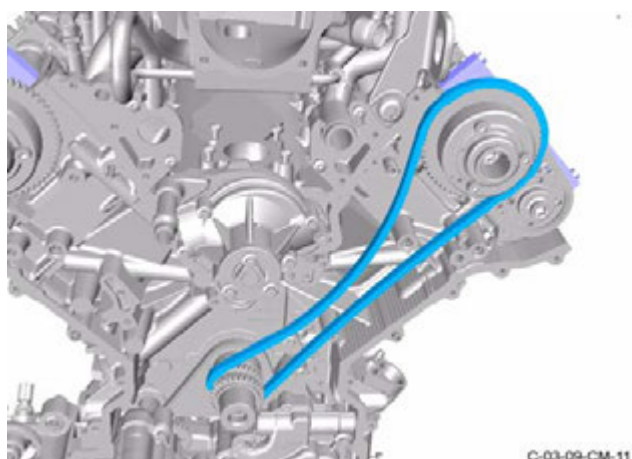


Figure 12

15. Loosen the two Torx bolts that attach the camshaft sprockets to the camshafts.

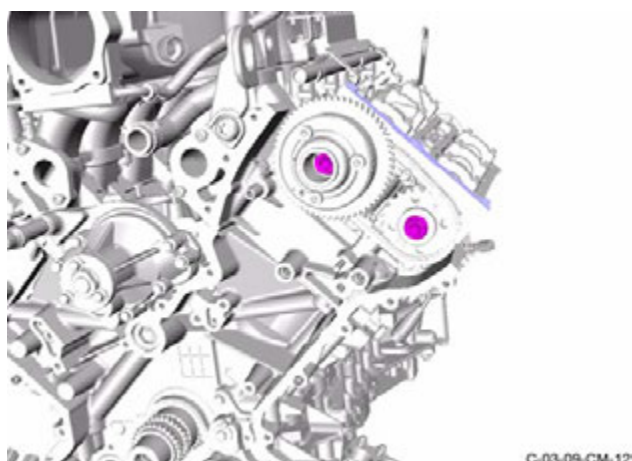
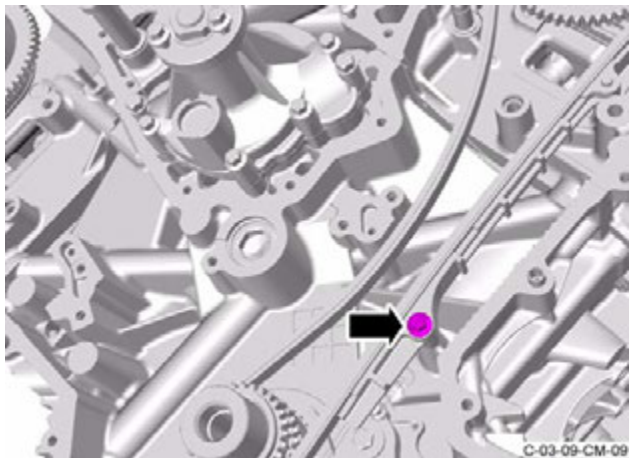


Figure 13

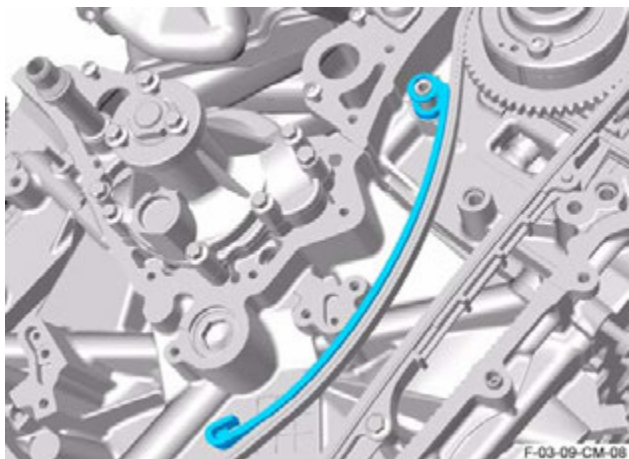
Install

1. If you have moved the crankshaft after you have removed the timing chain, make sure that you set the crankshaft with the left bank rear piston (4B) at 135 degrees after top dead centre.

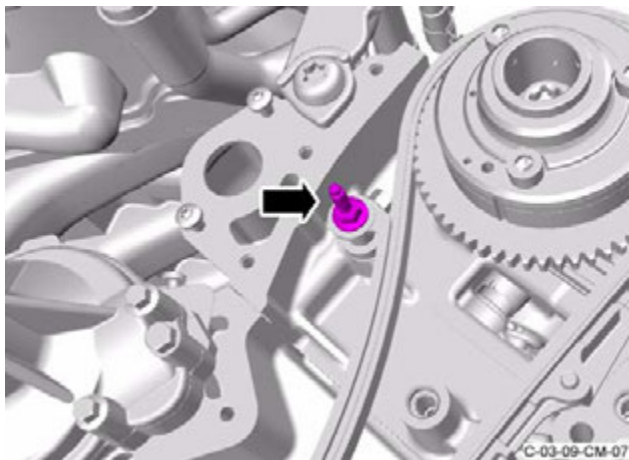
2. Install the timing chain (refer to Figure 12).
3. Install the timing chain guide (refer to Figure 11).
4. Install the bolt that attaches the timing chain guide to the engine. Torque the bolt to 11 Nm.



5. Install the tensioner arm.



6. Install the bolt that attaches the tensioner arm to the engine. Torque the bolt to 11 Nm.



7. Install the timing chain tensioner.
8. Install and torque the two bolts that attach the timing chain tensioner to the engine to 11 Nm.
9. Install the special tool onto the exhaust camshaft sprocket.

10. Note: Use the special tool to hold the timing chain in the correct place during the next two steps of the procedure.
11. Use the special tool to turn the exhaust sprocket counterclockwise until there is tension in the chain.
12. Note: Make sure that the tensioner is fully operated but do not use too much force.
13. Release the pin from the timing chain tensioner and let the tension piston gradually tension the timing chain.
14. Note: Make sure that you torque the bolt that attaches the sprocket to the exhaust camshaft first in the step that follows.
15. Torque the two Torx bolts that attach the camshaft sprockets to the camshafts to 20 Nm.
16. Note: Make sure that you torque the bolt that attaches the sprocket to the exhaust camshaft first in the step that follows.
17. Tighten the two Torx bolts that attach the camshaft sprockets to the camshafts 90 degrees more.
18. Remove the special tool from the exhaust camshaft sprocket.
19. Install the left side bush carrier for the VCT.
20. Install the two bolts that attach the left side bush carrier for the VCT to the engine. Torque the two bolts to 21 Nm.
21. Install the nut that attaches the left side bush carrier for the VCT to the engine. Torque the nut to 11 Nm.
22. Install the right side primary timing chain. (refer to procedure 03.09.CN - Right Side Primary Timing Chain).

RH/LH Intake Camshaft Sprocket and Housing Assembly-Renew (with Engine Removed)

Repair Operation Time (ROT)		
Item		Code
Intake Camshaft Sprocket and Housing Assembly-Renew	RH	03.09.DE
Intake Camshaft Sprocket and Housing Assembly-Renew	LH	03.09.DF

Remove

WARNING
DO NOT GET USED ENGINE OIL ON YOUR SKIN.
USED ENGINE OIL CAN BE HARMFUL.

1. Remove the right and left primary timing chains (refer to Workshop Manual procedure 03.09.BN/03.09.BM Timing Chain - Primary - RH/LH - Renew With Engine Removed).

2. Collect the spacer from the bolt on the exhaust camshaft.

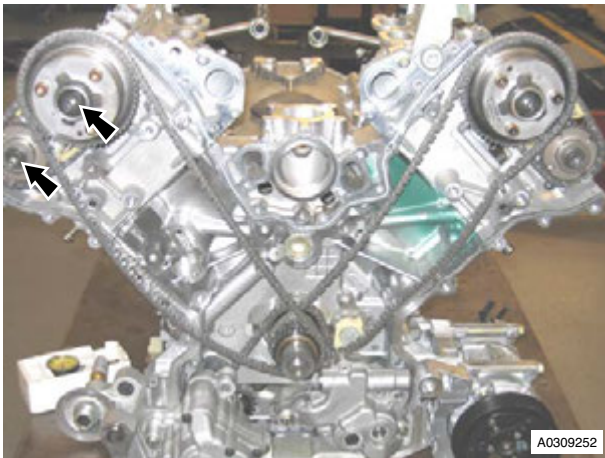


Figure 1

3. Remove the two M6 bolts that attach the secondary timing chain tensioner to the cylinder head (refer to Figure 2).

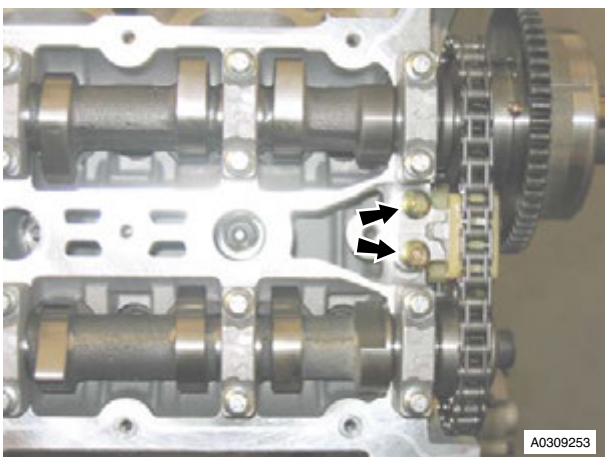


Figure 2

4. Release and remove camshaft sprockets complete with timing chain and tensioner from camshafts (refer to Figure 3).



Figure 3

5. Remove intake sprocket housing assembly from secondary timing chain (refer to Figure 4).

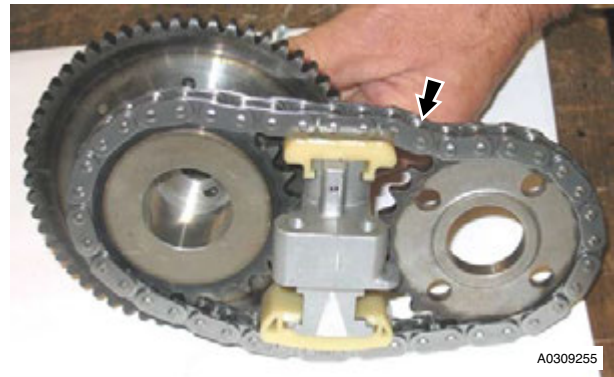


Figure 4

Install

1. Clean the two camshaft sprockets and the tensioner.
2. Install the intake sprocket housing assembly and the exhaust sprocket into the secondary timing chain.
3. Install the secondary timing chain tensioner onto the timing chain.
4. Install the secondary timing chain assembly onto the camshafts.
5. Install the spacer onto the M12 exhaust Torx bolt.
6. Install the exhaust M12 Torx bolt to attach the exhaust camshaft sprocket. Do not tighten at this step.
7. Install the inlet M12 Torx bolt to attach the inlet camshaft sprocket. Do not tighten at this step.
8. Install and torque the two M6 bolts that attach the secondary tensioner.
9. Install the guide for the right primary timing chain.
10. Install and torque the M6 bolt that attaches the guide.
11. Make sure that the timing chain slack is on the tensioner side of the timing chain.
12. Install the primary timing chain.
13. Install the tensioner blade for the primary timing chain.
14. Install and torque the M6 bolt that attaches the tensioner blade.
15. Install the primary timing chain tensioner assembly.
16. Install and torque the two M6 bolts that attach the tensioner assembly.
17. Release the tension from the timing chain tensioner piston and remove the retaining special tool.
18. Install the timing chain tensioning tool (303-532) into the exhaust camshaft sprocket.

Caution

Apply an opposite force to the sprockets and chain while you tighten the sprocket bolts.

19. Apply a force to the tool (303-532) in a counterclockwise direction and torque the two M12 sprocket Torx bolts.
20. Remove the special tool.
21. Install the left and right primary timing chain (refer to Workshop Manual procedure 03.09.BN/03.09.BM



Timing Chain - Primary - RH/LH - Renew With Engine
Removed).



ASTON MARTIN

Engine (03.00)**Engine Sealing (03.10)****Specifications****Torque Figures**

Description	Nm.	lb./ft.
Cam cover	10	7
Dipstick tube	6	4
Timing cover:		
Bolts 1 to 7, 9 to 18 and 20 to 27	12	9
Bolts 8 and 19	10	7
Crankshaft pulley bolt	320	236
Alternator mounting bracket	21	15.5
Alternator	40	30
Coolant manifold	9	6.5
Coolant pump	12	9
Coolant pump pulley	10 + 45°	7 + 45°
PAS pump	21	15.5
Accessory drive belt idler pulleys	40	30
Accessory drive belt tensioner	40	30
Heater hose brackets:		
M6 Bolts	12	9
M5 Nuts	5	3.7
Harness support brackets:		
M5 Nut	5	3.7
M6 Screw	10	7
M8 Screw	25	18.5

Maintenance**Engine Timing Cover - Renew**

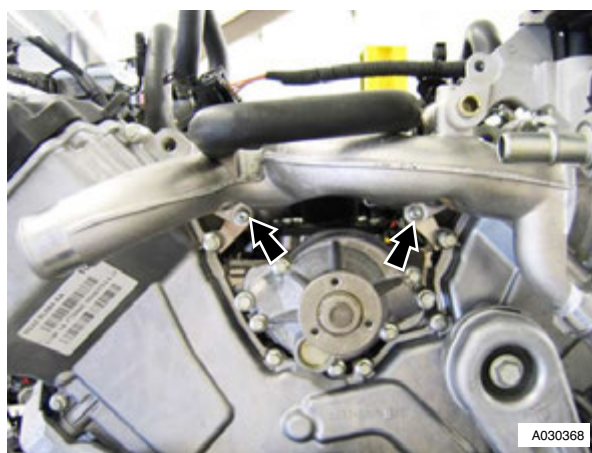
Repair Operation Time (ROT)		
Item	Code	
Engine Timing Cover-Renew	LHD	03.10.AF
Engine Timing Cover-Renew	RHD	03.10.CF

1. Remove the front subframe (refer to Workshop Manual procedure 02.01.BA Subframe Assembly - Front - Remove for Access and Refit).
2. Put an applicable container in position under the engine to collect drained oil.

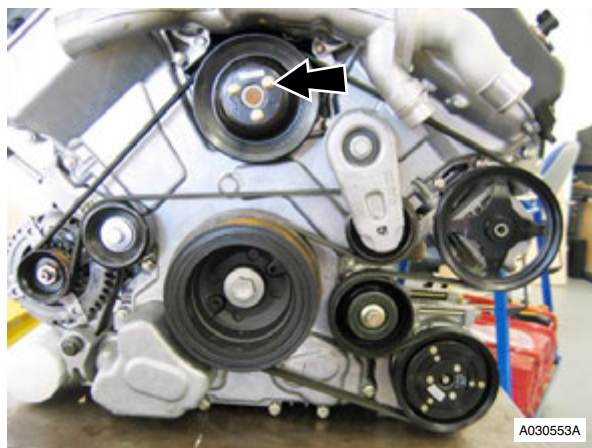
WARNING
DO NOT GET USED ENGINE OIL ON YOUR SKIN.
USED ENGINE OIL CAN BE HARMFUL.

3. Remove the sump drain plug and drain the oil from the engine.
4. Remove the oil tank assembly (refer to Workshop Manual procedure 03.02.CA Tank Assembly - Oil Cooler - Renew).
5. Drain cooling system (refer to Workshop Manual procedure 03.03.AD Coolant - Drain and Refill).
6. Remove the left cam cover (Refer to 'Left Side Cam Cover - Remove and Install', page 3-10-4)

7. Remove the outer and inner seals from the left cam cover.
8. Remove the right cam cover (Refer to 'Right Side Cam Cover - Remove and Install', page 3-10-9).
9. Remove the outer and inner seals from the right cam cover.
10. Release the clips and disconnect the two coolant hoses from the coolant manifold.
11. Release the clip and disconnect the hose from oil the separator.
12. Remove the four M6 Torx screws that attach the coolant manifold to the cylinder heads (Refer to Figure 1).

**Figure 1**

13. Release the coolant manifold from the coolant pipe.
14. Disconnect the electrical connector for the temperature sensor.
15. Remove the coolant manifold.
16. Remove and discard the two O-rings from the manifold.
17. Loosen the three M6 attachment screws for the water pump pulley (Refer to Figure 2).

**Figure 2**

18. Turn the auxiliary drive belt tensioner to release the tension from the drive belt.
19. Remove the drive belt.
20. Remove the three M6 screws that attach the water pump pulley and remove the pulley.

21. Remove the M10 bolt that attaches the auxiliary drive belt tensioner and remove tensioner (Refer to Figure 3).

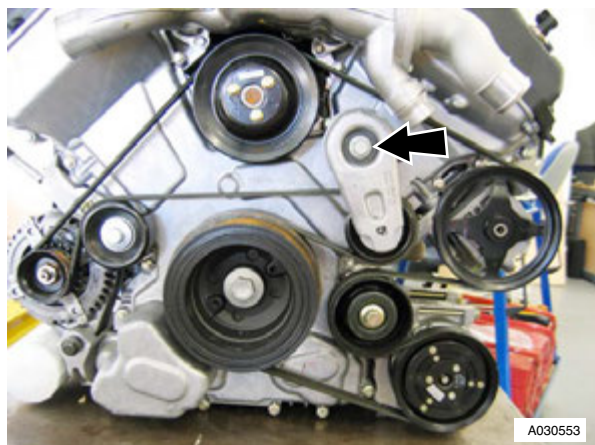


Figure 3

39. Remove the nut that attaches the battery cable to the alternator and remove the cable. (Refer to Figure 4).

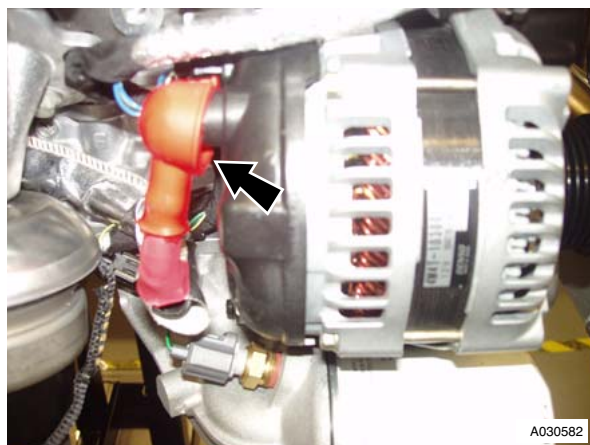


Figure 4

22. Remove the two bolts that attach the inspection cover to lower crankcase and remove the cover.
23. Install the tool (303-1185) to hold the flywheel. Install and tighten the two bolts.
24. Remove and discard the M16 screw that attaches the crankshaft pulley.
25. Install the thrust-button of tool (303 -1186) into crankshaft.
26. Put the tool into the pulley.
27. Attach the tool with the two bolts.
28. Turn the centre bolt clockwise to withdraw the pulley from the crankshaft.
29. Collect the crankshaft pulley, locking ring and the thrust button for the special tool.
30. Remove the special tool from the pulley.
31. Remove and discard the O-ring seal from the pulley.
32. Remove the bolt that attaches the alternator idler pulley and remove the pulley.
33. Remove the bolt that attaches the idler pulley for the air-conditioning compressor and remove the pulley.
34. Put an applicable container under the oil filter to collect drained oil.

WARNING
DO NOT GET USED ENGINE OIL ON YOUR SKIN.
USED ENGINE OIL CAN BE HARMFUL.

40. Disconnect the electrical connector from the alternator.
41. Remove the M8 bolt that attaches the top of the alternator.
42. Remove the M10 bolt and the nut that attaches the bottom of the alternator and remove the alternator.
43. Remove the three Torx bolts that attach the alternator mounting bracket to the cylinder block.
44. Remove the bracket (Refer to Figure 5).

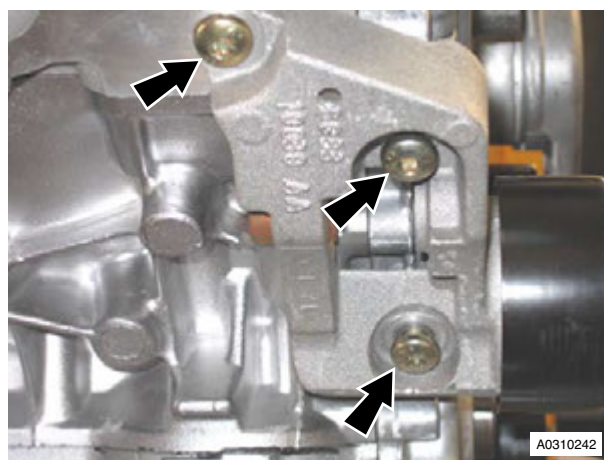


Figure 5

45. Remove the three M8 bolts that attach the PAS pump to the mounting bracket and move the pump away.

35. Remove the oil filter.
36. Release the oil separator drain tube from the timing cover.
37. Release the clip for the oil separator drain tube from the bracket.
38. Release the cover for the battery cable from the alternator.

46. Remove the four M8 Torx bolts that attach the PAS pump mounting bracket to the cylinder block and remove the bracket (refer to Figure 6).

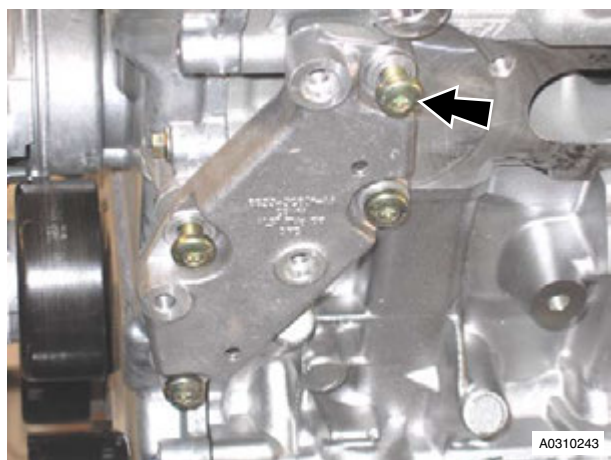


Figure 6

47. Remove the 27 M6 bolts that attach the timing cover to the engine.
48. Collect the bracket for the oil separator drain tube.
49. Remove the timing cover.

WARNING
DO NOT GET USED ENGINE OIL ON YOUR SKIN.
USED ENGINE OIL CAN BE HARMFUL.

50. Remove the outer and inner rubber seals from timing cover (Refer to Figure 7).



Figure 7

51. Remove the front crankshaft oil seal from the timing cover.

Install

1. Examine the condition of the seal in the John Guest cartridge connector for the oil return pipe. If there are signs that the connector has leaked, install a new John Guest cartridge kit (Refer to 'John Guest Cartridge in the Engine Timing Cover - Repair', page 3-10-14).
2. Clean the timing cover and the mating face on the engine.

Caution
Make sure the crankshaft front oil seal mating faces are clean and dry.

3. Install the inner and outer seals to the timing cover.
4. Apply 3mm x 12mm beads of sealant to the eight joints on the engine.
5. Install the timing cover. Put the oil separator drain tube bracket in position and install the 27 M6 bolts..
6. Torque the 27 bolts in the sequence shown in Figure 8.

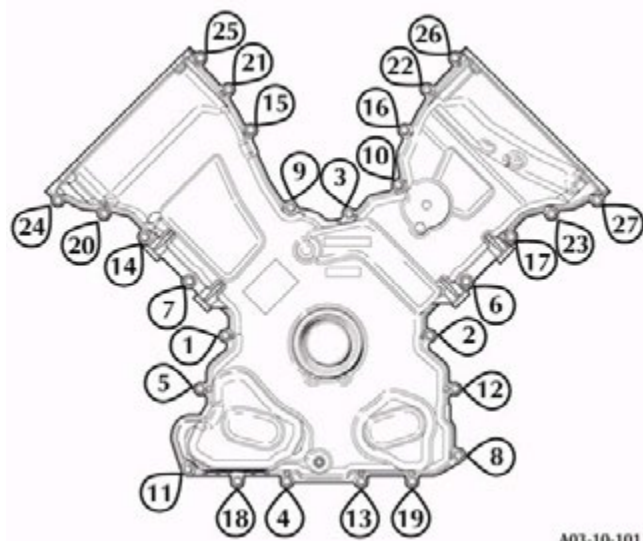


Figure 8

Caution
Do not remove the crankshaft front oil seal protector until the oil seal is correctly installed.

7. Use tool (303-750) to install the front crankshaft oil seal.
8. Remove the special tool and the seal protector.

Caution
Clean the thread in the crankshaft before you install a new crankshaft pulley bolt. If you do not you can not apply the correct torque to the bolt.

9. Use an M16 x 2 plug tap to clean the thread in the crankshaft.
10. Clean the crankshaft pulley and mating face on the crankshaft.
11. Lubricate and install a new O-ring seal in the crankshaft pulley.
12. Examine the crankshaft pulley and the taper collet for damage. Replace all damaged parts.
13. Install the crankshaft pulley, taper collet and a new pulley bolt.
14. Torque tighten the crankshaft pulley bolt.
15. Remove the special tool (303-1185) from the crankcase.
16. Install the inspection cover to the lower crankcase, install and tighten the two attachment bolts.
17. Install the PAS pump mounting bracket. install and torque tighten the four M8 Torx bolts.
18. Install the PAS pump. Install and torque the three M8 bolts.
19. Install the alternator mounting bracket. Install and torque tighten the three M8 Torx bolts.



20. Put the alternator in position.
21. Install the M8 bolt that attaches the top of the alternator.
22. Install the M10 nut and bolt that attaches the bottom of the alternator.
23. Torque tighten the alternator attachment bolts.
24. Connect the battery cable to the alternator.
25. Install and torque the nut that attaches the battery cable.
26. Install the cover for the cable connection.
27. Connect the electrical connector to the alternator.
28. Apply new engine oil to the seal on a new oil filter.
29. Install the new oil filter.
30. Install the drain tube for the oil separator into the clip in the bracket.
31. Install the drain tube for the oil separator into timing cover.
32. Install the idler pulley for the air conditioning compressor.
33. Install and torque the M10 bolt that attaches the idler pulley.
34. Install the alternator idler pulley.
35. Install and torque the M10 bolt that attaches the idler pulley.
36. Install the auxiliary drive belt tensioner.
37. Install and torque the M10 bolt that attaches the tensioner.
38. Put the water pump pulley in position.
39. Install the three M6 bolts that attach the water pump pulley.
40. Turn the auxiliary drive belt tensioner until you can install the drive belt.
41. Torque tighten the three M6 water pump pulley bolts.
42. Clean the coolant manifold and the mating faces on the cylinder heads.
43. Install two new O-ring seals into the coolant manifold.
44. Put the coolant manifold in position.
45. Connect the electrical connector for the temperature sensor.
46. Install the coolant pipe in the manifold.
47. Install and torque tighten the four M6 Torx bolts that attach the coolant manifold to the cylinder heads.
48. Connect the three coolant hoses to the coolant manifold and install the hose clips.
49. Connect the engine breather to the oil separator.
50. Clean the left and right cam covers.
51. Install the inner and outer seals on the left cam cover.
52. Install the left cam cover (Refer to 'Left Side Cam Cover - Remove and Install', page 3-10-4).
53. Install the inner and outer seals on the right cam cover.
54. Install the right cam cover (Refer to 'Right Side Cam Cover - Remove and Install', page 3-10-9).
55. Install the front subframe (refer to Workshop Manual procedure 02.01.BA Subframe Assembly - Front - Remove for Access and Refit).

56. Install the oil tank assembly (refer to Workshop Manual procedure 03.02.CA Tank Assembly - Oil Cooler - Renew).

57. Fill the cooling system (refer to Workshop Manual procedure 03.03.AD Coolant - Drain and Refill).

Left Side Cam Cover - Remove and Install

Repair Operation Time (ROT)	
Item	Code
Left Side Cam Cover - Remove and Install	03.10.AS

Removal

1. Disconnect the battery earth cable.
2. Remove the front crush brace. (Refer to procedure 01.01.LC - Front Crush Brace).
3. Remove the left side front crush bar for the body reinforcement. (Refer to procedure 01.01.AC - Left Side Front Crush Bar for the Body Reinforcement).
4. Disconnect the breather pipes from the cam cover and the oil tank Y-piece.
5. Use applicable caps to seal the open ports.
6. Remove the ignition coil cover.
7. Disconnect the electrical connector from each of the four ignition coils.
8. Disconnect the electrical connector from the Variable Valve Timing (VVT) solenoid.
9. Release the fir tree clip that attaches the wiring harness for the ignition coils.
10. Move the wiring harness for the ignition coils away.
11. Release the wiring harness for the injectors from the mounts.
12. Cut and remove the three cable ties that attach the rear of the wiring harness for the injectors.
13. Release the purge pipe and heater pipe from the two clips on the wiring harness bracket.
14. Remove the two nuts and three screws that attach the front bracket for the wiring harness.
15. Remove the three screws that attach the rear bracket for the wiring harness.
16. Cut and remove the four cable ties that attach the rear of the wiring harness to the front bracket.
17. Remove the rear bracket for the wiring harness.
18. Remove the front bracket for the wiring harness.
19. Remove the screw that attaches each of the four ignition coils.
20. Remove the four ignition coils.

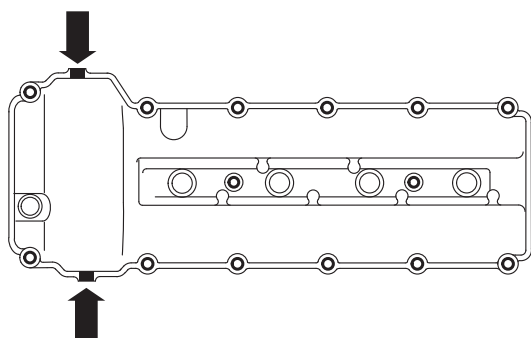
Note: When you remove the cam cover attachment bolts in the step that follows, record their installed positions in the cam cover.

21. Remove the 14 screws that attach the cam cover to the engine.

22. Remove and discard the seals for the 14 cam cover screws.
23. Remove the cam cover.
24. Remove the breather pipe stub.
25. Remove and discard the seal for the breather pipe stub.
26. Remove and discard the O-ring seal for the VVT solenoid.
27. Remove and discard the cam cover gasket.
28. Remove and discard the four O-ring seals from the spark plug wells.
29. Clean the component mating faces.

Install

1. Install four new O-ring seals in the spark plug wells.
2. Install a new O-ring seal for the VVT solenoid.
3. Install a new cam cover gasket.
4. Install a new seal for the breather pipe stub.
5. Install the breather pipe stub.
6. Apply a 6 mm diameter sphere of silicon RTV sealant at the positions shown in Figure C03-10-102.



C03-10-102

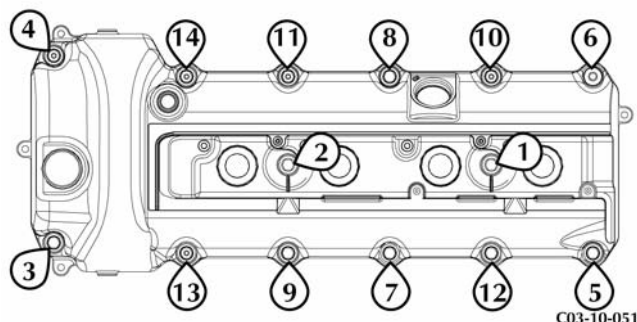
Figure C03-10-102

7. Install the cam cover.
8. Install new seals for the 14 cam cover screws.

CAUTION

Tighten the screws gradually and equally in the step that follows. If you do not, the cam cover gasket can be damaged.

9. Install and torque the 14 screws that attach the cam cover to the engine in the sequence shown to 10 Nm.



C03-10-051

Figure C03-10-051

10. Install the four ignition coils.

11. Install and torque the screw that attaches each of the four ignition coils to 5 Nm.
12. Install the front bracket for the wiring harness.
13. Install the rear bracket for the wiring harness.
14. Install and torque the three screws that attach the rear bracket for the wiring harness to 11 Nm.
15. Install and tighten the two nuts and three bolts that attach the front bracket for the wiring harness.
16. Install the purge pipe and heater pipe into the two clips on the wiring harness bracket.
17. Use four applicable cable ties to attach the rear of the wiring harness to the front bracket.
18. Install the wiring harness for the injectors into the mounts.
19. Install the fir tree clip that attaches the wiring harness for the ignition coils.
20. Connect the electrical connector to each of the four ignition coils.
21. Connect the electrical connector to the VVT solenoid.
22. Install the ignition coil cover.
23. Remove and discard the caps from the breather pipes.
24. Connect the breather pipes to the cam cover and the oil tank Y-piece.

CAUTION

Make sure that the vehicle is on its road wheels on level ground when you do the steps that follow. If you do not, the front of the vehicle can be twisted when the cross brace is tightened.

25. Install the left side front crush bar for the body reinforcement. (Refer to procedure 01.01.AC - Left Side Front Crush Bar for the Body Reinforcement).
26. Install the front crush brace. (Refer to procedure 01.01.LC - Front Crush Brace).
27. Connect the battery earth cable

Left Side Cam Cover Gasket - Renew

Repair Operation Time (ROT)		
Item	Code	
Cam Cover Gasket-Renew	LH-LHD	03.10.AJ
Cam Cover Gasket-Renew	LH-RHD	03.10.CJ

Removal

1. Remove the left cam cover (Refer to 'Left Side Cam Cover - Remove and Install', page 3-10-4).
2. Remove and discard the cam cover gasket.

Installation

1. Clean the mating faces of the cam cover and the cylinder head.
2. Put the new cam cover gasket in position.
3. Install the left cam cover (Refer to 'Left Side Cam Cover - Remove and Install', page 3-10-4).



Right Side Cam Cover Gasket - Renew

Repair Operation Time (ROT)		
Item	Code	
Cam Cover Gasket-Renew	RH-LHD	03.10.AK
Cam Cover Gasket-Renew	RH-RHD	03.10.CK

1. Remove the right cam cover (Refer to 'Right Side Cam Cover - Remove and Install', page 3-10-9).
2. Remove and discard the cam cover gasket.

Installation

1. Clean the mating faces of the cam cover and the cylinder head.
2. Put the new cam cover gasket in position.
3. Install the right cam cover (Refer to 'Right Side Cam Cover - Remove and Install', page 3-10-9).

Cylinder Head Gasket - Renew (Engine Set)

Repair Operation Time (ROT)		
Item	Code	
Cylinder Head Gasket - Renew (Engine Set)		03.10.AL

Removal

1. Remove the SAI pump and bracket assembly (refer to procedure 03.08.DB Pump and Bracket Assembly - Secondary Air Injection - Renew).
2. Disconnect the electrical connector from each of the two left and two right knock sensors.
3. Disconnect the electrical connector from the left and right camshaft timing sensors.
4. Remove the right exhaust manifold (refer to procedure 09.00.CC Gasket - Exhaust Manifold - RH - Renew).
5. Remove the left front wheel arch liner (refer to procedure 01.02.FB Wheel Arch Liner - Front - LH - Renew).
6. Remove the eight nuts that attach the left exhaust manifold to cylinder head.
7. Remove the left exhaust manifold. Remove and discard the gasket.
8. Remove the left intake camshaft (refer to Workshop Manual procedure 03.09.AV Camshaft - Intake - LH - Renew).

WARNING
DO NOT GET USED ENGINE OIL ON YOUR SKIN.
USED ENGINE OIL CAN BE HARMFUL.

9. Remove the 10 left exhaust camshaft bearing cap attachment bolts evenly and in steps (refer to Figure 1).

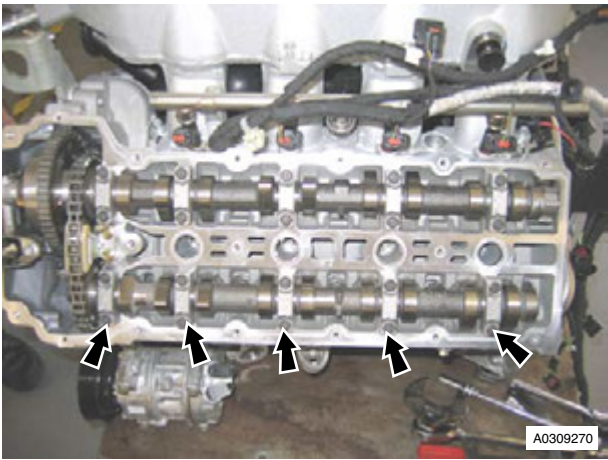


Figure 1

10. Record the positions and the markings of the bearing caps for the left exhaust camshaft .
11. Remove the bearing caps for the left exhaust camshaft.

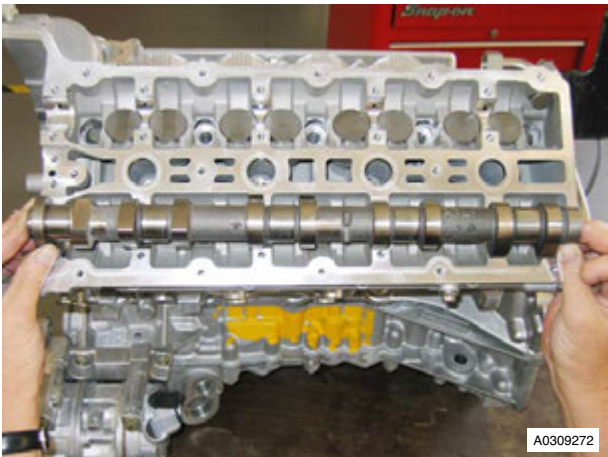
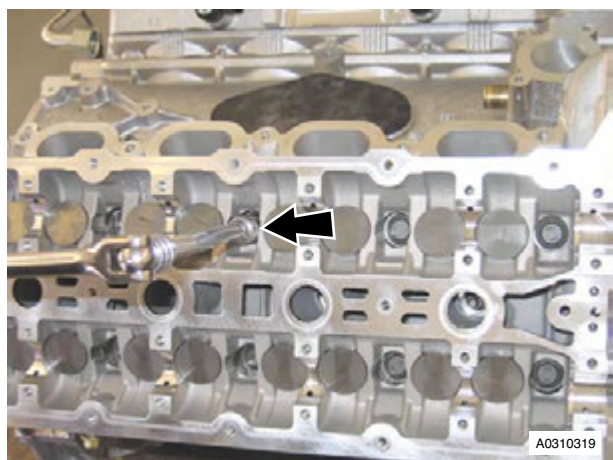


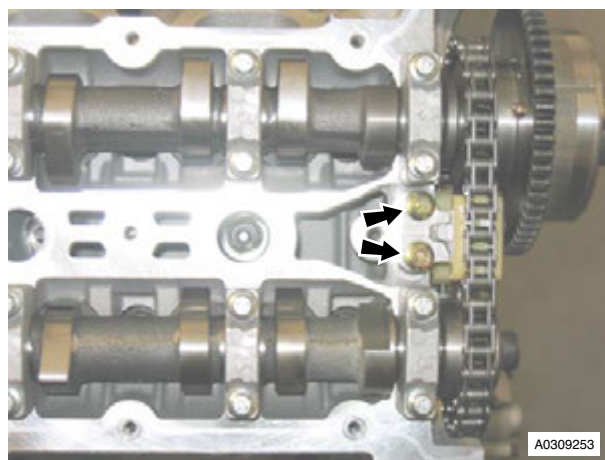
Figure 2

12. Remove the two bolts that attach the front end of the left cylinder head to the cylinder block.

13. Remove the 10 bolts evenly and in steps, that attach the left cylinder head to the cylinder block (refer to Figure 3).
17. Remove the two bolts that attach the right secondary timing chain tensioner to the cylinder head (refer to Figure 5).

**Figure 3**

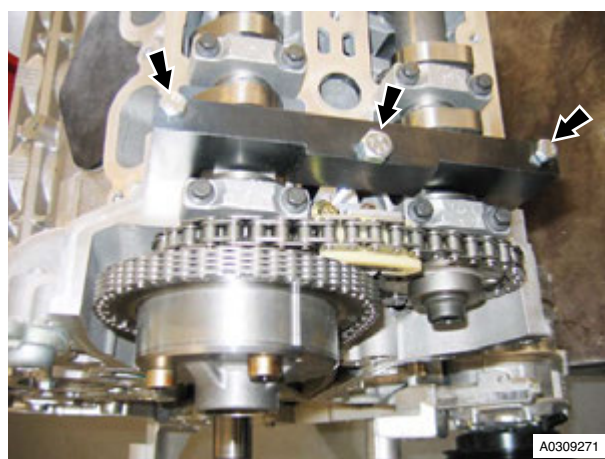
14. With the aid of one more person, remove the left cylinder head assembly.
15. Remove and discard the cylinder head gasket.
16. Remove the two Torx bolts, the spacer on the exhaust and the Torx bolt that attaches the right intake and exhaust camshaft sprockets to the camshafts (refer to Figure 4).

**Figure 4****Figure 5**

18. Remove the right camshaft sprockets complete with the timing chain and tensioner from the camshafts (refer to Figure 6).

**Figure 6**

19. Remove the three bolts that attach tool (303-530) to the cylinder head. Remove the special tool (refer to Figure 7).

**Figure 7**

20. Remove the ten bolts evenly and in steps, that attach the bearing caps for the right intake camshaft (refer to Figure 8).

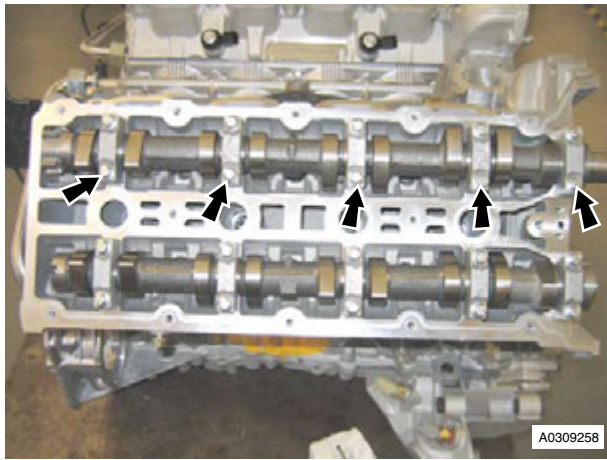


Figure 8

21. Record the positions and the markings of the bearing caps for the right intake camshaft.
22. Remove the right intake camshaft (refer to Figure 9).



Figure 9

23. Remove the ten bolts evenly and in steps, that attach the bearing caps for the right exhaust camshaft (refer to Figure 10).

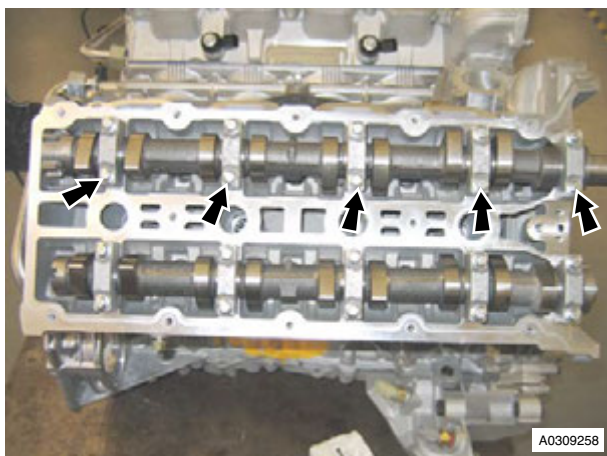


Figure 10

24. Record the positions and the markings of the bearing caps for the right exhaust camshaft.
25. Remove right exhaust camshaft (refer to Figure 11).



Figure 11

26. Remove the two bolts that attach the front end of the right cylinder head to the cylinder block.
27. Remove the ten bolts evenly and in steps, that attach the right cylinder head to the cylinder block (refer to Figure 12).

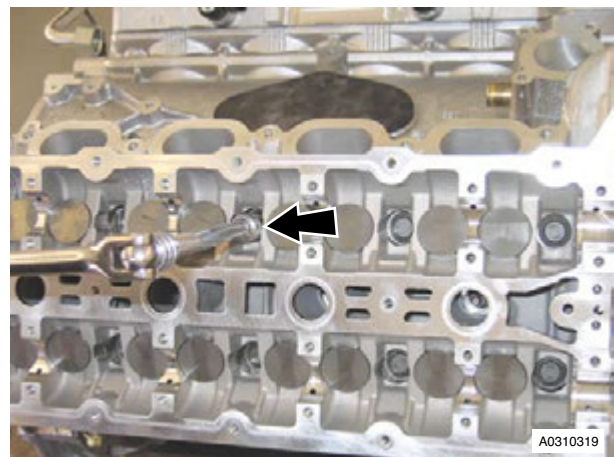


Figure 12

28. With the aid of one more person, remove the right cylinder head assembly.
29. Remove and discard the cylinder head gasket.

Installation

1. Fully clean the left and right cylinder head faces and the attachment bolt pockets.
2. Fully clean the left and right cylinder block faces.
3. Fully clean and dry the left and right cylinder head retaining bolts.
4. Install a new right cylinder gasket. Make sure that it is correctly engaged on the dowels.
5. With assistance, install the right cylinder head. Make sure it is correctly engaged on the dowels.
6. Install and torque tighten the 12 cylinder head bolts in the correct sequence.
7. Lubricate the camshaft journals, camshaft lobes, bearing surfaces on cylinder head and the bearing caps with clean engine oil.

8. Install the right exhaust camshaft.
9. Install the five bearing caps in their correct positions.
10. Install the ten bolts and torque tighten them in the sequence specified.
11. Install the Torx bolt that attaches the sprocket to the camshaft.
12. Rotate the camshaft and use feeler gauges to do a check of each valve clearance .
13. Do the procedure again and install the right intake camshaft.
14. Remove the Torx bolt that attaches the sprocket.
15. Rotate the right intake and exhaust camshafts until the timing flats on each camshaft face up.
16. Install tool (303-530) onto the right cylinder head to hold the camshafts. Install and tighten the three bolts.
17. Install a new left cylinder head gasket. Make sure that it is correctly engaged on the dowels.
18. With the aid of one more person, install the left cylinder head. Make sure that it is correctly engaged on the dowels.
19. Install and torque the 12 cylinder head bolts in the correct sequence.
33. Install SAI pump and bracket assembly (refer to Workshop Manual procedure 03.08.DB Pump and Bracket Assembly - Secondary Air Injection - Renew).
34. Clean the left exhaust manifold.
35. Install a new gasket for the left exhaust manifold .
36. Install the left exhaust manifold.
37. Install and torque tighten the eight nuts.
38. Install the left front wheel arch liner (refer to Workshop Manual procedure 01.02.FB Wheel Arch Liner - Front - LH - Renew).
39. Install the right exhaust manifold (refer to Workshop Manual procedure 09.00.CC Gasket - Exhaust Manifold - right - Renew).

Right Side Cam Cover - Remove and Install

Repair Operation Time (ROT)	
Item	Code
Right Side Cam Cover - Remove and Install	03.10.AT

Removal

20. Lubricate the left exhaust camshaft journals, camshaft lobes, bearing surfaces on the cylinder head and the bearing caps with clean engine oil.
21. Install left exhaust camshaft.
22. Install the five bearing caps in their correct positions.
23. Install the ten bolts and torque in the sequence specified.
24. Install the Torx bolt that attaches the sprocket to the left exhaust camshaft.
25. Rotate the left exhaust camshaft as necessary and use feeler guages to do a check of each valve clearance.
26. Remove the Torx bolt that attaches the sprocket.
27. Install the left intake camshaft (refer to Workshop Manual procedure 03.09.AV Camshaft - Intake - LH - Renew).
28. Install the timing chain tensioning tool (303-532) into the right exhaust camshaft sprocket.
29. Apply a force to the tool (303-532) in a counterclockwise direction to hold the sprocket and torque the right sprocket Torx bolts.
30. Remove the special tool.
31. Connect the electrical connectors to the left and right camshaft timing sensors.
32. Connect the electrical connector to each of the two left and two right knock sensors.
1. Disconnect the battery earth cable.
2. Remove the front crush brace. (Refer to procedure 01.01.LC - Front Crush Brace)
3. Remove the right side front crush bar for the body reinforcement. (Refer to procedure 01.01.AB - Right Side Front Crush Bar for the Body Reinforcement)
4. Remove the breather pipe from the cam cover.
5. Install applicable caps to seal the open ports.
6. Remove the ignition coil cover.
7. Disconnect the electrical connector from each of the four ignition coils.
8. Disconnect the electrical connector from the Variable Valve Timing (VVT) solenoid.
9. Release the fir tree clip that attaches the wiring harness for the ignition coils.
10. Move the wiring harness for the ignition coils away.
11. Release the wiring harness for the injectors from the mounts.
12. Cut and remove the three cable ties that attach the rear of the wiring harness for the injectors.
13. Remove the screw that attaches the purge pipe P-clip to the cam cover.
14. Move the purge-pipe P-clip away.
15. Release the purge pipe and heater pipe from the two clips on the wiring harness bracket.
16. Remove the two nuts and two screws that attach the front bracket for the wiring harness.
17. Remove the three screws that attach the rear bracket for the wiring harness.
18. Remove the rear bracket for the wiring harness.
19. Remove the front bracket for the wiring harness.

WARNING

**DO NOT GET USED ENGINE OIL ON YOUR SKIN.
USED ENGINE OIL CAN BE HARMFUL.**

Caution

Gradually tighten one bolt and then the next to correctly install the camshaft bearing caps in the step that follows.



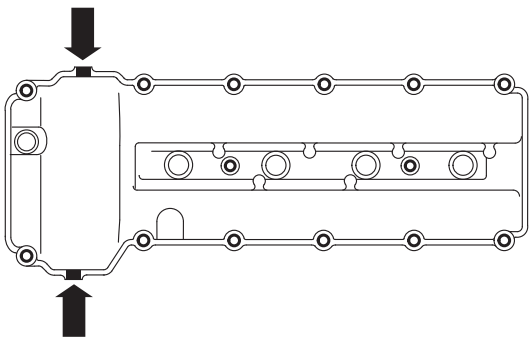
20. Remove the four screws that attach each ignition coil.
21. Remove the four ignition coils.

Note: When you remove the cam cover attachment screws in the step that follows, record their installed positions in the cam cover.

22. Remove the 14 screws that attach the cam cover to the engine.
23. Remove and discard the seals for the 14 cam cover screws.
24. Remove the cam cover.
25. Remove and discard the O-ring seal for the VVT solenoid.
26. Remove and discard the cam cover gasket.
27. Remove and discard the four O-ring seals from the spark plug wells.
28. Clean the component mating faces.

Install

1. Install four new O-ring seals in the spark plug wells.
2. Install a new O-ring seal for the VVT solenoid.
3. Install a new cam cover gasket.
4. Apply a 12 mm by 3 mm bead of sealant to the tri-joints shown.



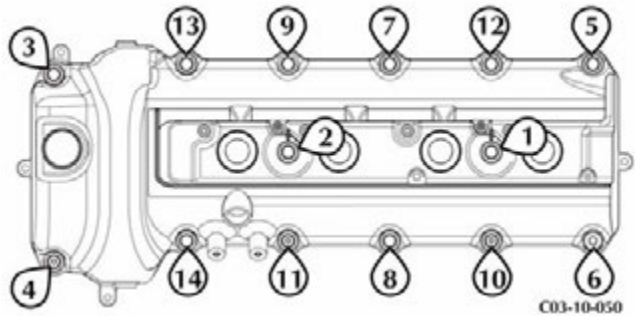
C03-10-101

Figure C03-10-101

5. Install the cam cover.
6. Install new seals for the 14 cam cover screws.

CAUTION
Tighten the screws gradually and equally in the step that follows. If you do not, the cam cover gasket can be damaged.

7. Install and torque the 14 screws that attach the cam cover to the engine in the sequence shown to 10 Nm.



8. Install the four ignition coils.
9. Install and torque the screw that attaches each of the four ignition coils to 5 Nm.
10. Install the front bracket for the wiring harness.
11. Install the rear bracket for the wiring harness.
12. Install and torque the three screws that attach the rear bracket for the wiring harness to 11 Nm.
13. Install and tighten the two nuts and three screws that attach the front bracket for the wiring harness.
14. Install the purge pipe and heater pipe into the two clips on the wiring harness bracket.
15. Put the purge pipe P-clip into the correct position.
16. Install and tighten the screw that attaches the purge pipe P-clip to the cam cover.
17. Use three applicable cable ties to attach the rear of the wiring harness to the front bracket.
18. Install the wiring harness for the injectors into the mounts.
19. Install the fir tree clip that attaches the wiring harness for the ignition coils.
20. Connect the electrical connectors to each of the four ignition coils.
21. Connect the electrical connector to the VVT solenoid.
22. Install the ignition coil cover.
23. Remove and discard the caps from the breather pipes.
24. Install the breather pipes to the cam cover.
25. Install the right side front crush bar for the body reinforcement. (0101AB - Right Side Front Crush Bar for the Body Reinforcement)
26. Install the front crush brace. (0101LC - Front Crush Brace)

Cam Cover - Vehicle Set - Remove and Install

Repair Operation Time (ROT)	
Item	Code
Cam Cover - Vehicle Set - Remove and Install	03.10.AW

Removal

1. Remove the left side cam cover (Refer to 'Left Side Cam Cover - Remove and Install', page 3-10-4).
2. Remove the right side cam cover (Refer to 'Right Side Cam Cover - Remove and Install', page 3-10-9).

Install

1. Install the left side cam cover (Refer to 'Left Side Cam Cover - Remove and Install', page 3-10-4).
2. Install the right side cam cover (Refer to 'Right Side Cam Cover - Remove and Install', page 3-10-9).

Engine Timing Cover-Renew (with Engine Removed)

Repair Operation Time (ROT)	
Item	Code
Engine Timing Cover-Renew	03.10.BF

Removal

1. Remove the engine assembly (refer Workshop Manual procedure 03.00.AA Engine Assembly - Renew).
2. Position drain container.
3. Remove the drain plug and drain the oil from the sump.
4. Remove the left cam cover (Refer to 'Left Side Cam Cover - Remove and Install', page 3-10-4).
5. Remove the right cam cover (Refer to 'Right Side Cam Cover - Remove and Install', page 3-10-9).
6. Release the hose clips and disconnect the two coolant hoses from the coolant manifold.
7. Release the hose clip and disconnect the hose from the oil separator.
8. Remove the four Torx bolts that attach the coolant manifold to cylinder heads (refer to Figure 1).

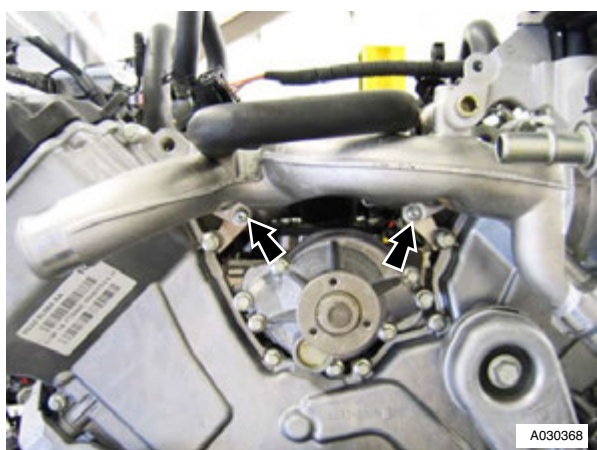


Figure 1

9. Release the coolant manifold from coolant pipe, disconnect the temperature sensor multiplug.
10. Remove the coolant manifold.
11. Remove and discard the two O-rings from the coolant manifold.

12. Loosen the three water pump pulley bolts (refer to Figure 2).

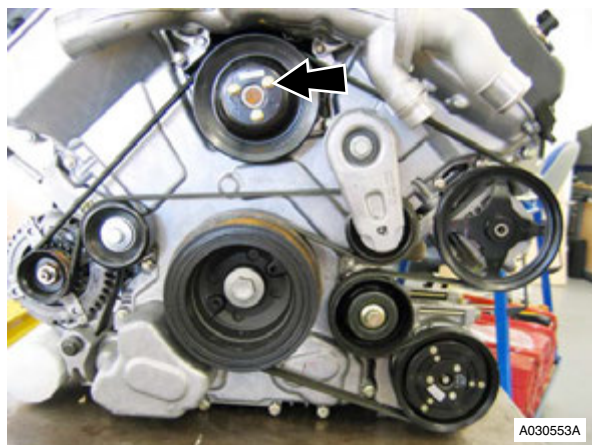


Figure 2

13. Use an applicable socket bar to release the auxiliary drive belt tensioner.
14. Remove the drive belt.
15. Remove the three bolts and remove the water pump pulley.
16. Remove the bolt that attaches the auxiliary drive belt tensioner.
17. Remove the tensioner (refer to Figure 3).

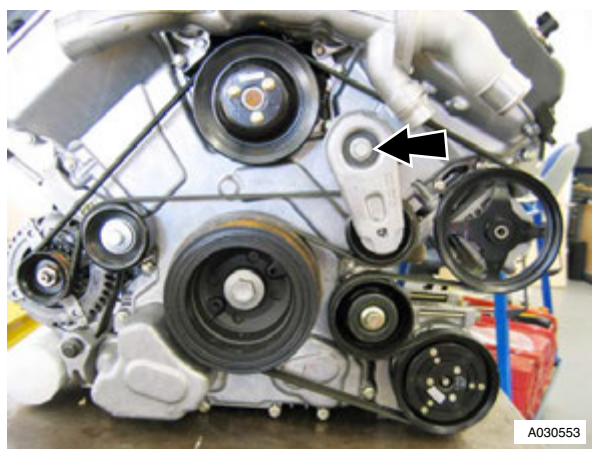


Figure 3

18. Remove the two bolts that attach the inspection cover to the lower crankcase. Remove the cover.
19. Install tool (303-1185) to hold flywheel. Install and tighten the two bolts.
20. Install the thrust button of tool (303-1186) into the crankshaft.
21. Put the tool in position in the pulley. Attach the tool with the two bolts. Tighten the centre bolt and remove the pulley from the crankshaft.
22. Collect the crankshaft pulley, locking ring and the special tool thrust button.
23. Remove the special tool from the pulley.
24. Remove and discard the O-ring seal from pulley.
25. Remove the bolt that attaches the alternator idler pulley.

26. Remove the pulley (refer to Figure 4).

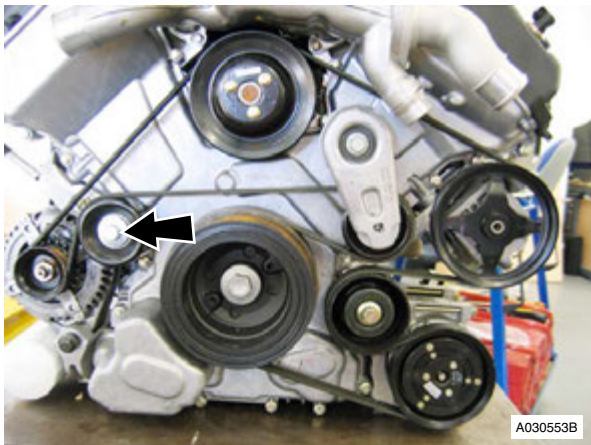


Figure 4

27. Remove the bolt that attaches the A/C compressor idler pulley. Remove the pulley (refer to Figure 5).

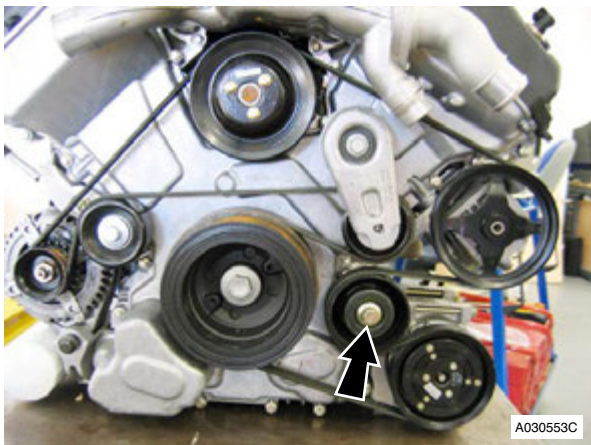


Figure 5

28. Position the drain tray.
29. Remove the oil filter.
30. Release the oil separator drain tube from the timing cover (refer to Figure 6).



Figure 6

31. Release the clip for the oil separator drain tube from the bracket.

32. Release the terminal cover on the alternator. Remove the nut that attaches the battery cable to the alternator. (refer to Figure 7).

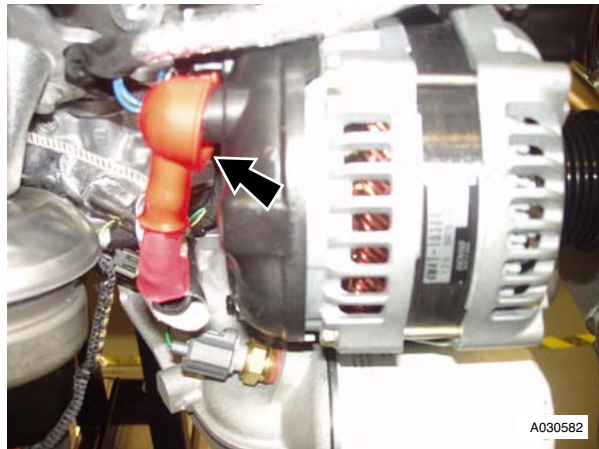


Figure 7

33. Disconnect the electrical connector from the alternator.
34. Remove the bolt and the nut and bolt that attach the alternator.
35. Remove the alternator.
36. Remove the three Torx bolts that attach the alternator mounting bracket to cylinder block. Remove the bracket (refer to Figure 8).

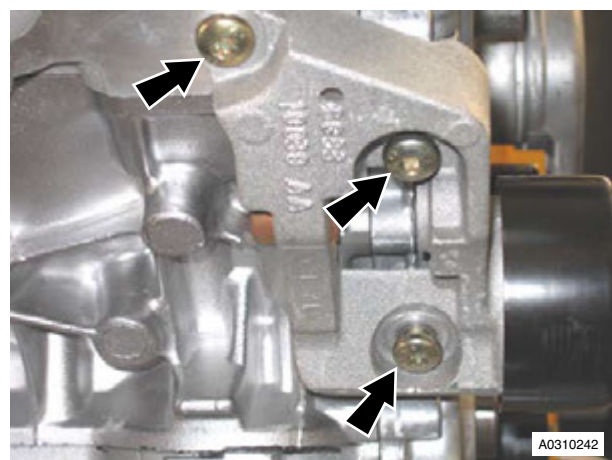


Figure 8

37. Remove the three bolts that attach the PAS pump to mounting bracket. Move the pump away.

38. Remove the four Torx bolts that attach the PAS pump mounting bracket to the cylinder block. Remove the bracket (refer to Figure 9).

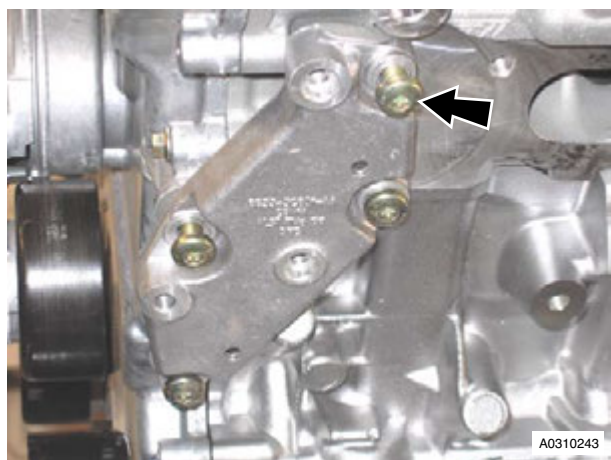


Figure 9

39. Remove the 27 bolts that attach the timing cover to the engine. Collect the bracket for the oil separator drain tube. Remove the timing cover.
40. Remove the outer and inner rubber seals from the timing cover (refer to Figure0).



Figure0

41. Remove the front crankshaft oil seal from timing cover.

Installation

1. Clean the timing cover and mating face on engine.

Caution

Make sure the crankshaft front oil seal mating faces are clean and dry.

2. Install the inner and outer seals into timing cover.
3. Apply 3mm x 12mm beads of sealant to the eight joints on the engine.
4. Install the timing cover. Put the oil separator drain tube bracket in position. Install the 27 bolts and torque the bolts in the specified sequence.

Caution

Do not remove the crankshaft front oil seal protector until the oil seal is correctly installed. If you do, the oil seal can be damaged.

5. Using tool (303-750), install front crankshaft oil seal. Remove special tool and seal protector.

Caution

The bolt thread in the crankshaft must be cleaned out before a new crankshaft pulley retaining bolt is installed.

6. Clean crankshaft pulley and mating face on crankshaft.
7. Lubricate and install new O-ring seal in crankshaft pulley.

Note: Check the crankshaft pulley and locking ring for damage.

8. Install crankshaft pulley, locking ring and new pulley bolt.
9. Torque tighten crankshaft pulley bolt. Remove special tool (303-1185) from crankcase.
10. Install inspection cover to lower crankcase, install and tighten bolts (x2).
11. Install PAS pump mounting bracket, install and torque tighten Torx bolts (x4).
12. Install PAS pump, install and torque tighten bolts (x3).
13. Install alternator mounting bracket, install and torque tighten Torx bolts (x3).
14. Install alternator, install bolt and nut/bolt and torque tighten
15. Connect battery cable, install and torque tighten nut, secure cover. Connect multiplug.
16. Lubricate seal, install new oil filter.
17. Install oil separator drain tube clip in bracket.
18. Install oil separator drain tube to timing cover.
19. Install A/C compressor idler pulley, torque tighten bolt.
20. Install alternator idler pulley, torque tighten bolt.
21. Install auxiliary drive belt tensioner, torque tighten bolt.
22. Install water pump pulley, install bolts (x3).
23. Using a suitable socket bar, release auxiliary drive belt tensioner, install drive belt.
24. Torque tighten water pump pulley bolts (x3).
25. Clean coolant manifold and mating faces on cylinder heads.
26. Install new O-ring seals (x2) to coolant manifold.
27. Position coolant manifold, connect temperature sensor multiplug, install coolant pipe in manifold.
28. Install and torque tighten Torx bolts (x4) that attach the coolant manifold to cylinder heads.
29. Connect coolant hoses (x3) to coolant manifold and secure clips.
30. Connect engine breather to oil separator.
31. Clean left and right cam covers.
32. Install the right cam cover (Refer to 'Right Side Cam Cover - Remove and Install', page 3-10-9).
33. Install left cam cover (Refer to 'Left Side Cam Cover - Remove and Install', page 3-10-4).
34. Install the engine assembly (refer to Workshop Manual procedure 03.00.AA Engine Assembly - Renew).



John Guest Cartridge in the Engine Timing Cover - Repair

16. Install the oil tank cap.
17. Close the bonnet.

Repair Operation Time (ROT)	
Item	Code
John Guest Cartridge in the Engine Timing Cover - Repair	03.10.??

Removal

1. Open the bonnet.
2. Raise the vehicle and make it safe.
3. On Roadster models, remove the front undertray (Refer to 'Centre Undertray - Remove and Install (Roadster Only)', page 1-2-1).
4. Put an approved container under the front cover to collect oil.
5. Disconnect the oil drain pipe from the John Guest cartridge.
6. Let the oil drain.
7. Use a trim tool as a lever to remove the plastic collet from the cartridge.

CAUTION:
Do not let the O-ring fall into the timing case in the step that follows. If the O-ring falls into the timing case, you will have to remove the case cover.

8. Remove and discard the O-ring from the cartridge.
9. Clean all unwanted oil from the cartridge.

Install

1. Apply a layer of oil to the new O-ring.

CAUTION:
Do not let the O-ring fall into the timing case in the step that follows. If the O-ring falls into the timing case, you will have to remove the case cover.

2. Carefully install the new O-ring in the cartridge. Make sure that the O-ring is in the correct position against the shoulder of the cartridge.
3. Install the new plastic collet into the cartridge.
4. Connect the oil pipe into the cartridge.
5. Clean all unwanted oil from the area around the cartridge.
6. Remove the container of drained oil.
7. On Roadster models, install the front undertray (Refer to 'Centre Undertray - Remove and Install (Roadster Only)', page 1-2-1).
8. Lower the vehicle.
9. Remove the cap from the oil tank.
10. Add oil to the oil tank to the correct level.
11. Install the cap on the oil tank.
12. Start and operate the engine for approximately five minutes.
13. Stop the engine.
14. Wait five minutes for the oil to drain back to the sump.
15. Do a check of the oil level. Add oil if necessary.

Engine (03.00)

Power Conversion (03.11)

Maintenance

Connecting Rod Bearing-Renew (Engine Set)

Repair Operation Time (ROT)	
Item	Code
Connecting Rod Bearing-Renew	03.11.AA

Removal

WARNING
DO NOT GET USED ENGINE OIL ON YOUR SKIN.
USED ENGINE OIL CAN BE HARMFUL.

1. Remove engine oil sump (see Workshop Manual procedure 03.02.BN Pan - Oil Sump - Remove and Re-seal).
2. Remove spark plugs (see Workshop Manual procedure 03.07.DB Spark Plugs - Engine Set - Renew).
3. Remove bolts (x8) securing windage tray to engine bedplate, remove windage tray.

Caution
Pistons, connecting rods and connecting rod bearings should be numbered to make sure they are reassembled in the same position.

4. Mark bearing caps and connecting rods for correct installation.
5. Rotate crankshaft clockwise to access number 1 cylinder connecting rod bolts.

Caution
Connecting rod bolts are torque tightened to yield and must be replaced.

6. Remove bolts securing bearing cap to connecting rod, remove bearing cap (see Figure 1).



Figure 1

7. Install special tools (303-535) to the connecting rod to prevent damage to crankshaft journal.
8. Move connecting rod upwards, remove bearing shell.
9. Record colour code on bearing shell edge.

10. Remove and discard bearing shell from cap.
11. Record colour code on bearing shell edge, discard bearing shell.
12. Wipe crankshaft journal, connecting rod and bearing cap using a lint free cloth.
13. Inspect crankshaft journal for damage.
14. Check crankshaft journal for ovality using a micrometer and record journal diameters.

Installation

Note: Connecting rod bearings are a selective fit by colour code on edge of bearing shell.

1. Select the correct colour coded bearing shells for each connecting rod crankshaft journal.
2. Install new selective bearing shell in connecting rod.
3. Lubricate crankshaft journal with clean engine oil.
4. Install connecting rod on crankshaft journal.
5. Remove special tools (303-535) from connecting rod.
6. Install new selective bearing shell in bearing cap.

Caution
When assembling connecting rods and connecting rod bearing caps it is imperative that bearing slots and tangs be located on the same side of the connecting rods.

7. Install bearing cap and new bolts (x2), torque tighten bearing cap bolts.
8. Repeat procedure for remaining connecting rod bearings.
9. Install windage tray to engine bedplate, install and torque tighten bolts (x8).
10. Install spark plugs (see Workshop Manual procedure 03.07.DB Spark Plugs - Engine Set - Renew).
11. Install engine oil sump (see Workshop Manual procedure 03.02.BN Pan - Oil Sump - Remove and re-seal).

Crankshaft Main Bearing-Renew (Engine Set)

Repair Operation Time (ROT)	
Item	Code
Crankshaft Main Bearing-Renew	03.11.AB

Removal

1. Remove bolts (x2), inspection cover to lower crankcase, remove cover.
2. Install tool (303-1185) to restrain flywheel, install and tighten bolts (x2).
3. Remove bolts (x6), clutch cover to flywheel.
4. Release clutch cover from dowels (x3), remove clutch cover, collect drive plate.
5. Remove and discard bolts (x8), flywheel to crankshaft flange.
6. Remove bolts (x2), collect tool (303-1185).

7. Release flywheel from dowel, remove flywheel.

WARNING
DO NOT GET USED ENGINE OIL ON YOUR SKIN.
USED ENGINE OIL CAN BE HARMFUL.

8. Remove engine sump (see Workshop Manual procedure 03.02.CN Pan - Oil Sump - Remove and re-seal With Engine Removed).
9. Remove bolts (x8) securing windage tray to engine bedplate, remove windage tray.
10. Mark bearing caps and connecting rods for correct installation (see Figure 1).



Figure 1

11. Rotate crankshaft clockwise to access number 1 cylinder connecting rod bolts.
12. Remove and discard bolts (x16) securing bearing caps to connecting rods, remove bearing caps (see Figure 2).



Figure 2

Caution
Connecting rod bolts are torque tightened to yield and must be replaced.

13. Install special tools (303-535) to the connecting rod to prevent damage to crankshaft journal.
14. Carefully push each connecting rod/piston assembly up each cylinder bore.
15. Secure Dial Test Indicator (DTI) on engine bedplate.
16. Push crankshaft fully rearwards.

17. Position DTI probe on crankshaft web and zero gauge.
18. Push crankshaft fully forwards and record reading on dial gauge.
19. Remove DTI gauge.
20. Noting their fitted positions, remove bolts (x34) securing engine bedplate to cylinder block (see Figure 3).

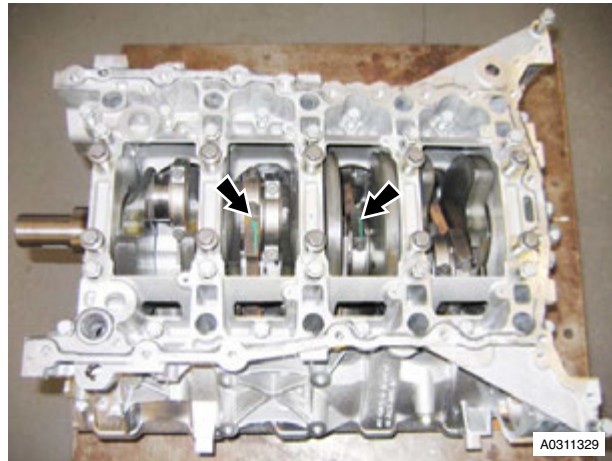


Figure 3

21. Carefully release and remove engine bedplate from cylinder block (see Figure 4).

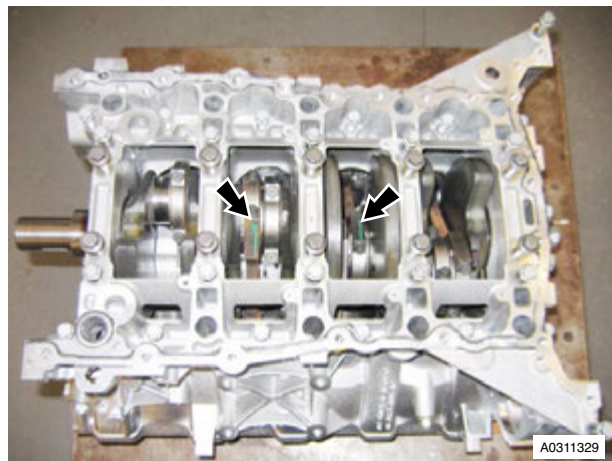


Figure 4

22. Carefully remove crankshaft from cylinder block.
23. Remove rear oil seal from crankshaft.

24. Note fitted position and remove crankshaft thrust washers (x2) from cylinder block (see Figure 5).

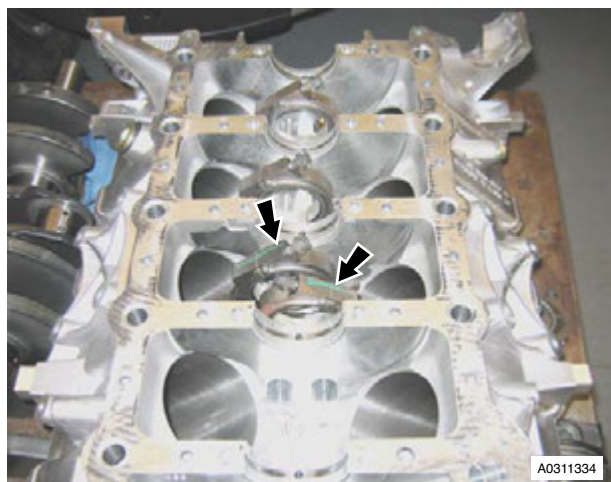


Figure 5

25. Remove main bearing shells (grooved) from cylinder block (see Figure 6).



Figure 6

26. Remove main bearing shells (plain) from engine bedplate (see Figure 7).

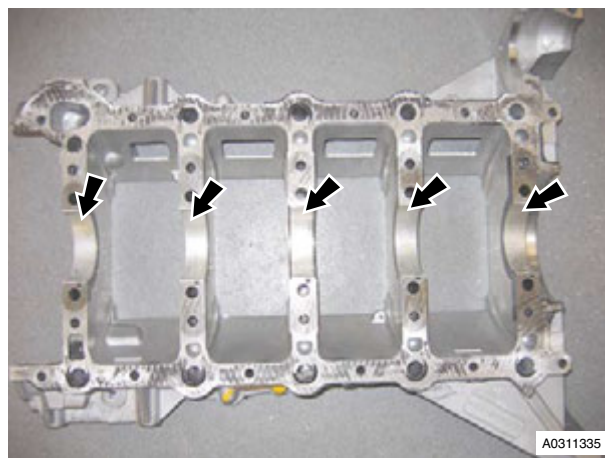


Figure 7

Note: Main bearing shells are selective by colour code with plain bearings in bedplate and grooved bearings in cylinder block

Installation

1. Clean crankshaft main bearing and connecting rod journals.
2. Clean bearing recess in cylinder block.

Caution

Use only a plastic scraper when removing old sealant and gaskets from engine components.

3. Clean old sealant from engine bedplate and bearing recesses.
4. Select the correct colour coded bearing shells for each main bearing journal.
5. Install selected main bearing shells in cylinder block and engine bedplate.
6. Install thrust washers in cylinder block.
7. Lubricate crankshaft journals with clean engine oil.
8. Position connecting rods and carefully lower crankshaft into cylinder block.

Caution

Avoid damage to any crankshaft bearing surfaces.

9. Carefully pull each connecting rod into place on crankshaft journals.

Caution

When assembling connecting rods and connecting rod bearing caps it is imperative that bearing slots and tangs be located on the same side of the connecting rods.

10. Install crankshaft retaining caps (303-534), install and lightly tighten bolts (x10) (see Figure 8).

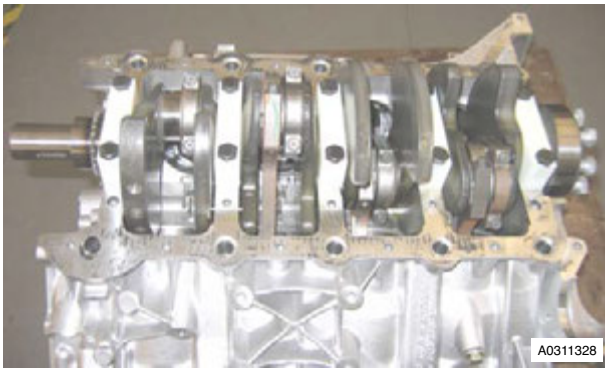


Figure 8

11. Install connecting rod bearing caps (x8), install and torque tighten retaining bolts.
12. Remove bolts securing crankshaft retaining caps (303-534), remove retaining caps (see Figure 9).

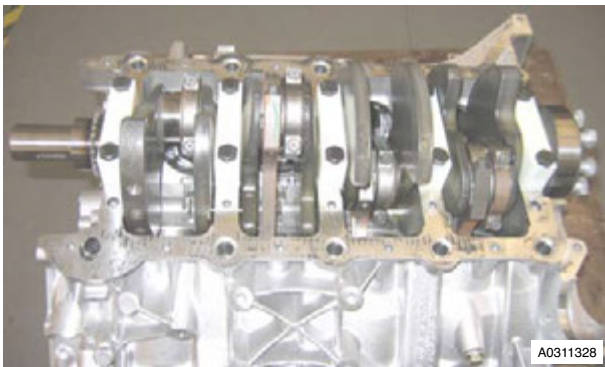


Figure 9

13. Apply a 2mm diameter continuous bead of sealant to cylinder block flange ensuring that there are no gaps in the sealant.
14. Install engine bedplate to cylinder block, install and torque tighten bolts (x34) in the correct sequence.

Caution

Do not lubricate engine bedplate retaining bolts.

Caution

Tighten engine bedplate retaining bolts in the sequence shown.

Caution

Do not rotate crankshaft until all engine bedplate retaining bolts are tightened to specification.

Caution

Engine bedplate retaining bolts must be tightened within twenty minutes of applying sealant.

15. Remove excess sealant from crankshaft rear oil seal aperture and front face of cylinder block.
16. Clean windage tray.
17. Install windage tray, install and torque tighten bolts (x8).

18. Ensure that oil seal protector is positioned correctly and install oil seal onto crankshaft flange.

Caution

Do not use any lubricant on crankshaft oil seals or seal protectors. Make sure all components are clean and dry.

19. Install tool (303-1189) to crankshaft, position nuts on tool against oil seal.
20. Ensure that oil seal and special are parallel to rear of engine.
21. To install oil seal, tighten nuts alternately on tool (303-1189) until oil seal correctly seated.
22. Remove special tool from crankshaft.
23. Check that the oil seal is located correctly.
24. Clean flywheel and mating face on crankshaft.
25. Install flywheel, align to dowel on crankshaft flange.
26. Install new bolts (x8), install tool (303-1185) to restrain flywheel. Torque tighten bolts (x8) in the correct sequence.
27. Clean clutch cover and drive plate.
28. Install clutch assembly on flywheel, align to dowels (x3).
29. Install bolts (x6), install clutch alignment tool, evenly torque tighten bolts (x6) in a diagonal sequence. Remove clutch alignment tool.
30. Remove bolts (x2), collect tool (303-1185).
31. Install inspection cover, install and torque tighten bolts (x2).
32. Install engine sump (see Workshop Manual procedure 03.02.CN Pan - Oil Sump - Remove and Reseal With Engine Removed).

Crankshaft Assembly-Renew

Repair Operation Time (ROT)

Item	Code
Crankshaft Assembly-Renew	03.11.CF

Removal

1. Remove bolts (x2), inspection cover to lower crankcase, remove cover.
2. Install tool (303-1185) to restrain flywheel, install and tighten bolts (x2).
3. Remove bolts (x6), clutch cover to flywheel.
4. Release clutch cover from dowels (x3), remove clutch cover, collect drive plate.
5. Remove and discard bolts (x8), flywheel to crankshaft flange.
6. Remove bolts (x2), collect tool (303-1185).
7. Release flywheel from dowel, remove flywheel.

WARNING

DO NOT GET USED ENGINE OIL ON YOUR SKIN. USED ENGINE OIL CAN BE HARMFUL.

8. Remove engine sump (see Workshop Manual procedure 03.02.CN Pan - Oil Sump - Remove and Reseal With Engine Removed).

9. Remove bolts (x8) securing windage tray to engine bedplate, remove windage tray.

Caution

Pistons, connecting rods and connecting rod bearings should be numbered to make sure they are reassembled in the same position.

10. Mark bearing caps and connecting rods for correct installation (see Figure 1).

**Figure 1**

11. Rotate crankshaft clockwise to access number 1 cylinder connecting rod bolts.

Remove bolts (x16) securing bearing caps to connecting rods, remove bearing caps (see Figure 2).

**Figure 2****Caution**

Connecting rod bolts are torque tightened to yield and must be replaced.

12. Install special tools (303-535) to the connecting rod to prevent damage to crankshaft journal.
13. Carefully push each connecting rod/piston assembly up each cylinder bore.
14. Secure Dial Test Indicator (DTI) on engine bedplate.
15. Push crankshaft fully rearwards.
16. Position DTI probe on crankshaft web and zero gauge.
17. Push crankshaft fully forwards and record reading on dial gauge.

18. Remove DTI gauge.

19. Noting their fitted positions, remove bolts (x34) securing engine bedplate to cylinder block (see Figure 3).

**Figure 3**

20. Carefully release and remove engine bedplate from cylinder block.

21. Carefully remove crankshaft from cylinder block.

22. Remove rear oil seal from crankshaft.

23. Note fitted position and remove crankshaft thrust washers (x2) from cylinder block (see Figure 4).

**Figure 4**

24. Remove main bearing shells (grooved) from cylinder block (see Figure 5).

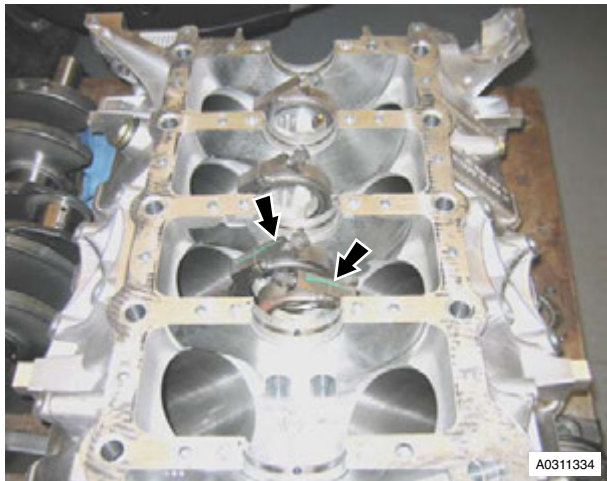


Figure 5

25. Remove main bearing shells (plain) from engine bedplate (see Figure 6).

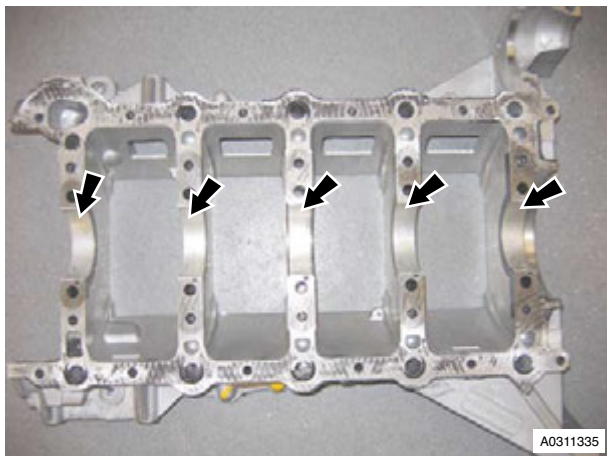


Figure 6

Installation

Note: Main bearing shells are selective by colour code with plain bearings in bedplate and grooved bearings in cylinder block

1. Clean crankshaft main bearing and connecting rod journals.
2. Clean bearing recess in cylinder block.

Caution

Use only a plastic scraper when removing old sealant and gaskets from engine components.

3. Clean old sealant from engine bedplate and bearing recesses.
4. Clean bearing shell locations in connecting rods and caps.
5. Select the correct colour coded bearing shells for each connecting rod crankshaft journal.
6. Select the correct colour coded bearing shells for each main bearing journal.

7. Install selected main bearing shells in cylinder block and engine bedplate.
8. Install thrust washers in cylinder block.
9. Install selected bearing shells in connecting rods and bearing caps.
10. Lubricate crankshaft journals with clean engine oil.
11. Position connecting rods and carefully lower crankshaft into cylinder block.
12. Install crankshaft retaining caps (303-534), install and lightly tighten bolts (x10).
13. Carefully pull each connecting rod into place on crankshaft journals.
14. Install connecting rod bearing caps (x8), install and torque tighten retaining bolts.

Caution

When assembling connecting rods and connecting rod bearing caps it is imperative that bearing slots and tangs be located on the same side of the connecting rods.

15. Remove bolts securing crankshaft retaining caps (303-534), remove retaining caps.
16. Apply a 2mm diameter continuous bead of sealant to cylinder block flange ensuring that there are no gaps in the sealant.
17. Install engine bedplate to cylinder block, install and torque tighten bolts (x34) in the correct sequence.

Caution

Do not lubricate engine bedplate retaining bolts.

Caution

Tighten engine bedplate retaining bolts in the sequence shown.

Caution

Do not rotate crankshaft until all engine bedplate retaining bolts are tightened to specification.

Caution

Engine bedplate retaining bolts must be tightened within twenty minutes of applying sealant.

18. Remove excess sealant from crankshaft rear oil seal aperture and front face of cylinder block.
19. Clean windage tray.
20. Install windage tray, install and torque tighten bolts (x8).
21. Ensure that oil seal protector is positioned correctly and install oil seal onto crankshaft flange.
22. Install tool (303-1189) to crankshaft, position nuts on tool against oil seal.
23. Ensure that oil seal and special are parallel to rear of engine.
24. To install oil seal, tighten nuts alternately on tool (303-1189) until oil seal correctly seated.
25. Remove special tool from crankshaft.
26. Check that the oil seal is located correctly.

Caution

Do not use any lubricant on crankshaft oil seals or seal protectors. Make sure all components are clean and dry.

27. Clean flywheel and mating face on crankshaft.
28. Install flywheel, align to dowel on crankshaft flange.
29. Install new bolts (x8), install tool (303-1185) to restrain flywheel. Torque tighten bolts (x8) in the correct sequence.
30. Clean clutch cover and drive plate.
31. Install clutch assembly on flywheel, align to dowels (x3).
32. Install bolts (x6), install clutch alignment tool, evenly torque tighten bolts (x6) in a diagonal sequence. Remove clutch alignment tool.
33. Remove bolts (x2), collect tool (303-1185).
34. Install inspection cover, install and torque tighten bolts (x2).
35. Install engine sump (see Workshop Manual procedure 03.02.CN Pan - Oil Sump - Remove and Reseal With Engine Removed).

Piston-Renew (Engine Set)

Repair Operation Time (ROT)	
Item	Code
Piston-Renew (Engine Set)	03.11.CG

Removal

WARNING
DO NOT GET USED ENGINE OIL ON YOUR SKIN.
USED ENGINE OIL CAN BE HARMFUL.

1. Remove cylinder head gaskets - engine set (see Workshop Manual procedure 03.01.HW Gasket - Cylinder Head - Engine Set - Renew With Engine Removed).
2. Remove crankshaft timing sprocket from crankshaft.
3. Install guide pin through lower hole on chain tensioner.
4. Remove bolt securing oil pressure pump chain tensioner assembly to engine bedplate (see Figure 1).

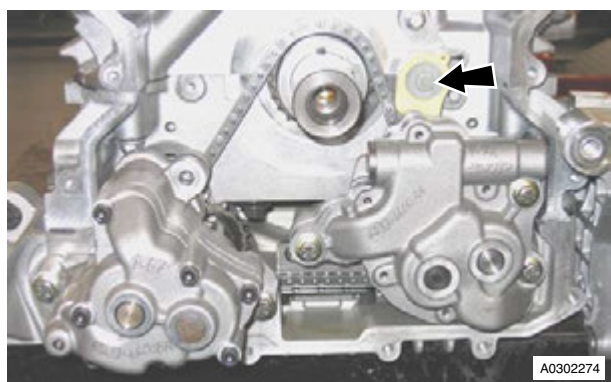


Figure 1

5. Remove tensioner assembly (see Figure 2).

6. Remove bolts (x3) securing oil pressure pump to sump (see Figure 3).

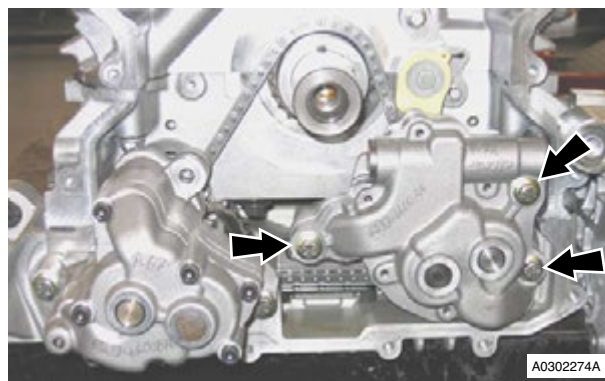


Figure 3

7. Release chain from oil pressure pump sprocket, remove oil pump.
8. Remove and discard oil pressure pump gasket.
9. Remove bolts (x3) securing oil scavenge pump to sump (see Figure 4).

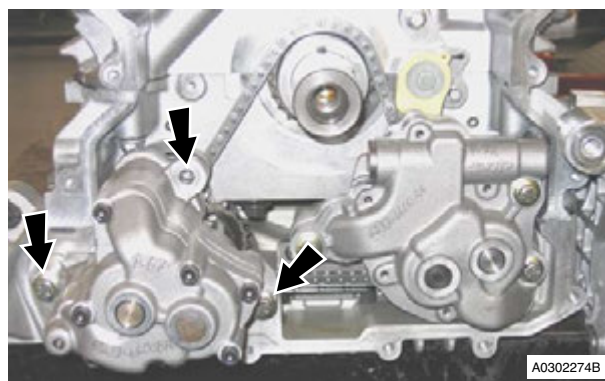


Figure 4

10. Release chain from oil scavenge pump sprocket, remove scavenge pump.

11. Remove and discard oil scavenge pump gasket (see Figure 5).



Figure 5

14. Disconnect multiplug from engine electric coolant temperature sensor (see Figure 7).

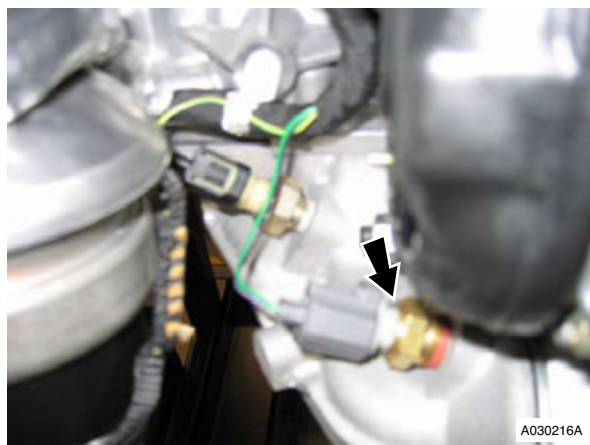


Figure 7

12. Remove oil pump(s) drive sprocket.
13. Disconnect multiplug from oil pressure sensor (see Figure 6).

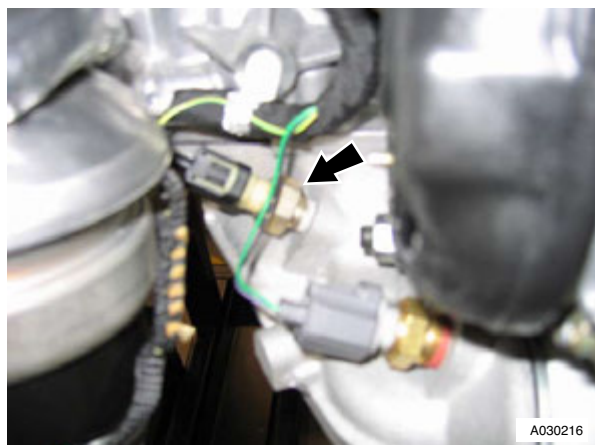


Figure 6

15. Disconnect multiplug from crankshaft timing sensor (see Figure 8).

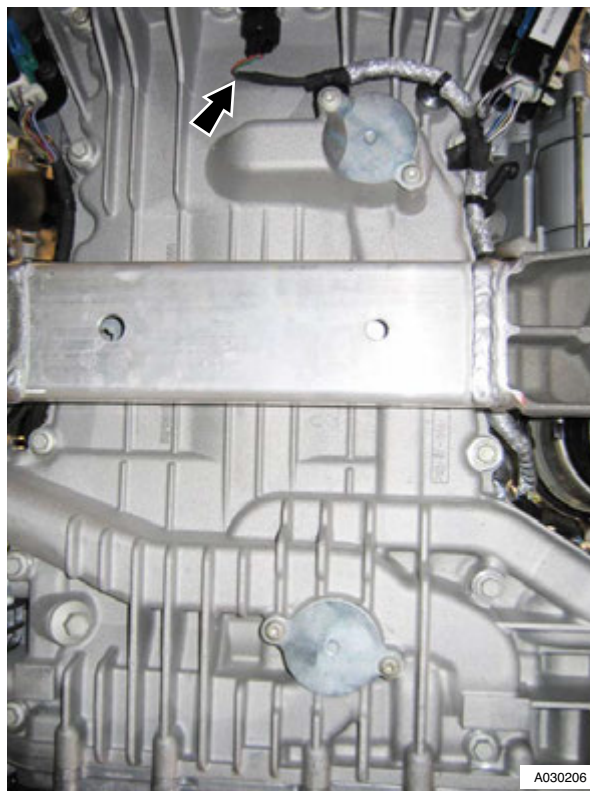


Figure 8

16. Release harness clips (x6) from sump (see Figure 9).

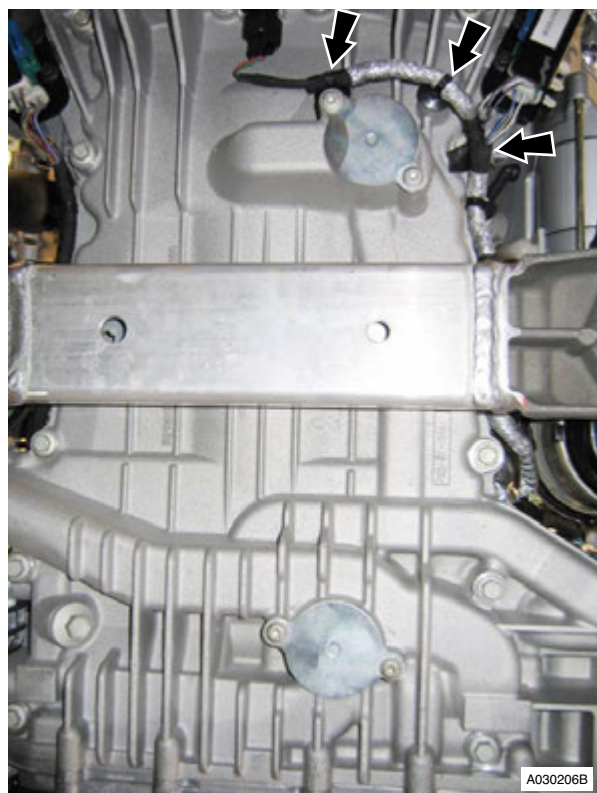


Figure 9

17. Remove bolts (x4) securing LH and RH HEGO sensor multiplug brackets to sump (see Figure 10).

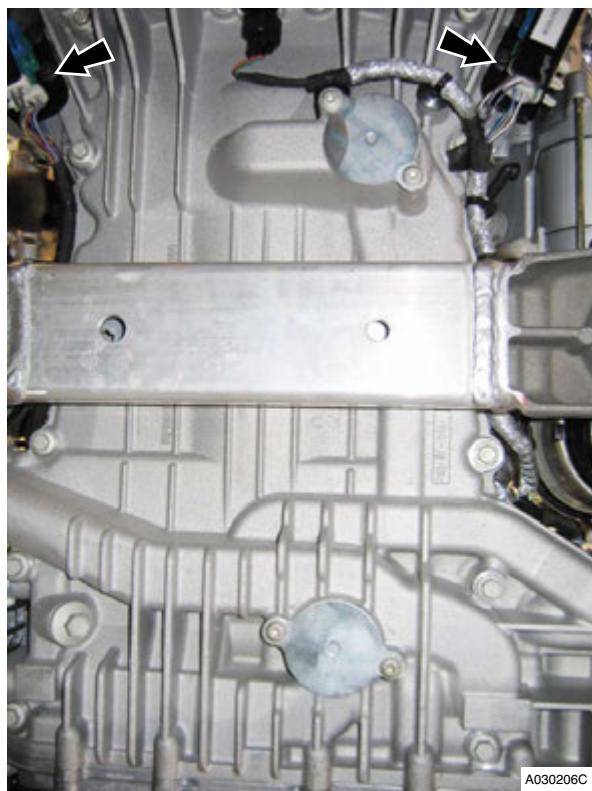


Figure 10

18. Disconnect multiplug from A/C compressor.

19. Remove bolts (x4) securing A/C compressor to mounting bracket. Remove compressor.

20. Remove bolts (x2) securing inlet and outlet oil pipes to sump (see Figure 11).



Figure 11

21. Release both oil pipes together from sump, remove and discard 'O' ring seals from pipes.

22. Remove Torx bolts (x4) securing A/C compressor mounting bracket to engine bedplate and sump. Remove bracket (see Figure 12).

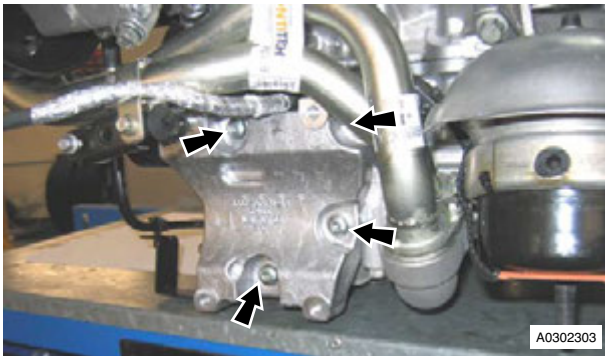


Figure 12

23. Remove bolts (x16) securing sump to engine bedplate (see Figure 13).

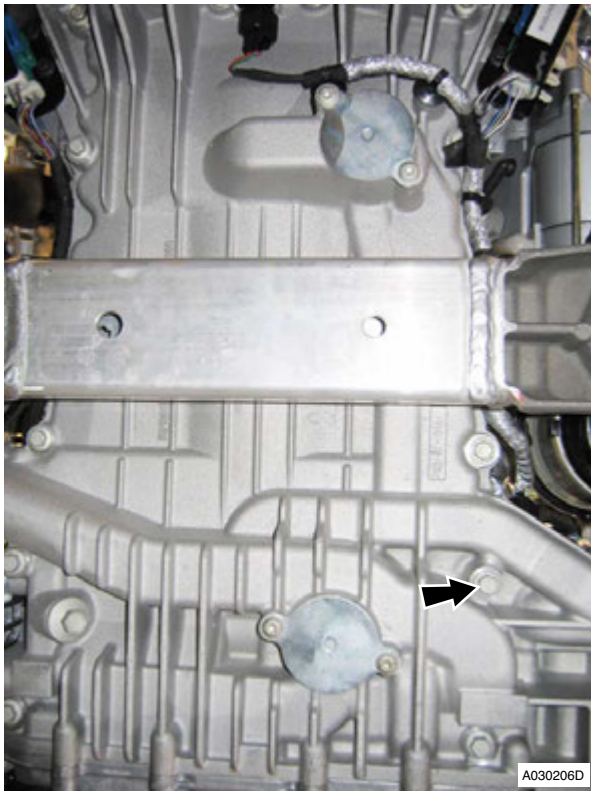


Figure 13

24. Release and remove sump.
25. Remove bolts (x8) securing windage tray to engine bedplate, remove windage tray.

26. Mark bearing caps and connecting rods for correct installation (see Figure 14).

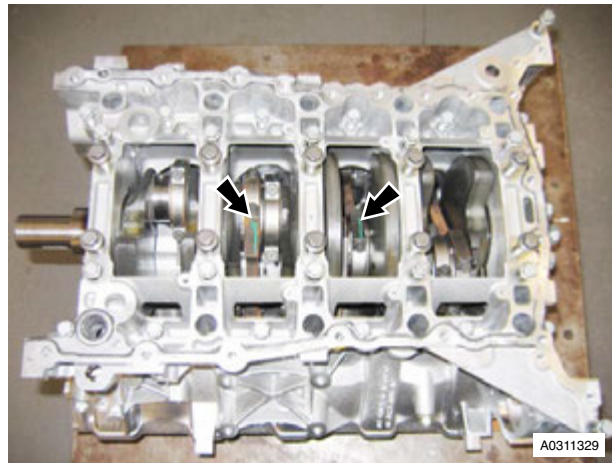


Figure 14

27. Rotate crankshaft clockwise to access number 1 cylinder connecting rod bolts.
28. Remove and discard bolts (x16) securing bearing caps to connecting rods, remove bearing caps (see Figure 15).



Figure 15

Caution

Connecting rod bolts are torque tightened to yield and must be replaced.

29. Install special tools (303-535) to the connecting rod to prevent damage to crankshaft journal.
30. Carefully push each connecting rod/piston assembly upwards and remove from cylinder block.
31. Remove special tools from connecting rods.
32. Install bearing caps on connecting rods, install and lightly tighten retaining bolts.

33. Note that piston grade number on crown and thick flange on connecting rod faces to front of engine on Right Hand bank (A) (see Figure 16).

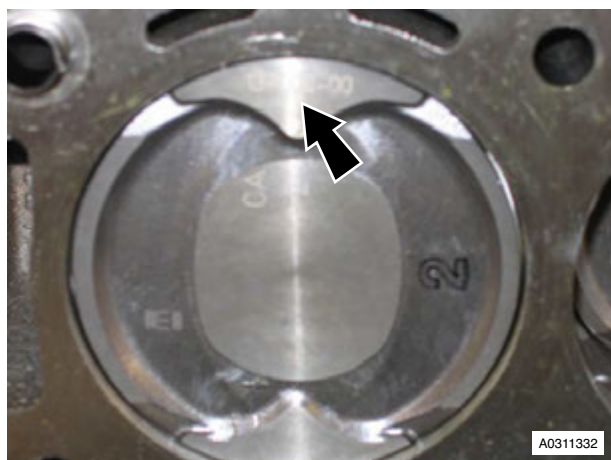


Figure 16

34. Note that piston grade number on crown and thick flange on connecting rod faces to front of engine on Left Hand bank (B) (see Figure 17).

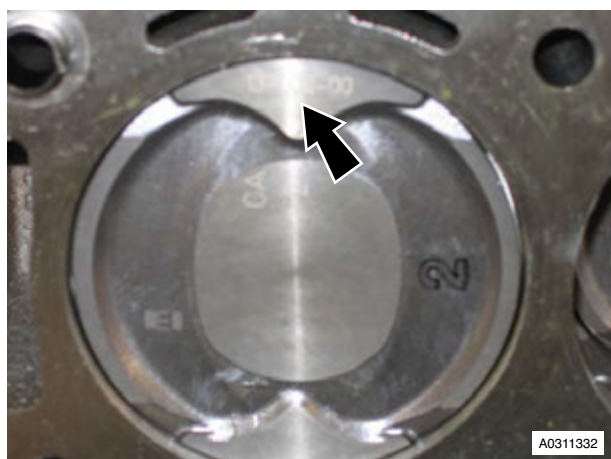


Figure 17

35. Remove circlip(s) securing gudgeon pin(s) in piston(s) and connecting rod(s). Remove piston(s) (see Figure 18).

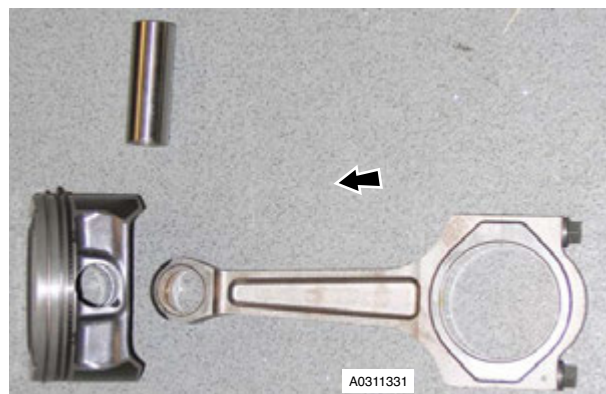


Figure 18

Installation

1. Clean the cylinder bores.
2. Use an expander and remove piston rings from pistons.
3. Install piston rings, (each set), in cylinder bores to a pre-determined depth and measure ring gaps.
4. Remove each piston ring set from cylinder bores and install on pistons
5. Clean connecting rods,
6. Install pistons on connecting rods in their correct orientation, install circlip(s).

Caution

Make sure the piston ring gaps are positioned at different positions opposite the thrust side of the piston before installation.

7. Correctly position ring gaps on pistons prior to installation.
8. Remove connecting rod bearing caps.
9. Install bearings in connecting rods and bearing caps.
10. Lubricate cylinder bores, pistons and rings with clean engine oil.
11. Install special tools (303-535) to the connecting rod to prevent damage to crankshaft journal.

Caution

Install pistons into cylinder block with the 'arrow' on the piston crown facing to the front of the engine.



12. Install piston ring clamp to each piston in turn and install in its respective cylinder bore. Remove piston ring clamp (see Figure 19).



Figure 19

13. Lubricate crankshaft journals with clean engine oil.
14. Carefully pull each connecting rod into place on each crankshaft journal.
15. Install bearing caps to their relevant connecting rods. Install and torque tighten retaining bolts (x16).

Caution

When assembling connecting rods and connecting rod bearing caps it is imperative that bearing slots and tangs be located on the same side of the connecting rods.

16. Clean windage tray.
17. Install windage tray, install and torque tighten bolts (x8).
18. Clean old sealant from sump flange and engine bedplate.
19. Ensure that sump flange and mating face on engine bedplate are clean and dry.
20. Apply a continuous 3mm diameter bead of RTV sealant to sump flange as recommended.
21. Ensure that there are no gaps in sealant track.
22. Install sump, install and torque tighten bolts (x16) in the correct sequence.
23. Install A/C compressor mounting bracket, install and torque tighten Torx bolts (x4).
24. Lubricate and install new O-ring seals to oil pipes.
25. Install oil pipes in sump, install and torque tighten bolts (x2).
26. Install compressor, install and torque tighten bolts (x4).
27. Connect multiplug to A/C compressor.
28. Install LH and RH HEGO sensor multiplug brackets to sump. Install and torque tighten bolts (x4).
29. Secure harness clips (x6) in sump.
30. Connect multiplug to crankshaft timing sensor.
31. Connect multiplug to engine electric coolant temperature sensor.
32. Connect multiplug to oil pressure sensor.
33. Clean oil scavenge pump and mating face on sump.
34. Install oil pump(s) drive sprocket.

35. Install new oil scavenge pump gasket, align on dowels (x2).
36. Install chain onto oil scavenge pump sprocket.
37. Install oil scavenge pump, align to dowels (x2), Install and torque tighten bolts (x3).
38. Install chain onto oil pump drive sprocket.
39. Clean oil pressure pump and mating face on sump.
40. Install new gasket to sump, align to dowels (x2).
41. Position oil pressure pump, install chain on pump sprocket.
42. Install oil pressure pump, align to dowels (x2), Install and torque tighten bolts (x3).
43. Install chain tensioner, install and torque tighten bolt, remove guide pin.
44. Install crankshaft timing sprocket.
45. Install cylinder head gaskets - engine set (see Workshop Manual procedure 03.01.HW Gasket - Cylinder Head - Engine Set - Renew With Engine Removed).

Piston-Renew

Repair Operation Time (ROT)	
Item	Code
Piston-Renew	03.11.CH

Removal

WARNING

DO NOT GET USED ENGINE OIL ON YOUR SKIN. USED ENGINE OIL CAN BE HARMFUL.

1. Remove cylinder head gaskets - engine set (see Workshop Manual procedure 03.01.HW Gasket - Cylinder Head - Engine Set - Renew With Engine Removed).
2. Remove crankshaft timing sprocket from crankshaft.
3. Install guide pin through lower hole on chain tensioner.
4. Remove bolt securing oil pressure pump chain tensioner assembly to engine bedplate (see Figure 1).

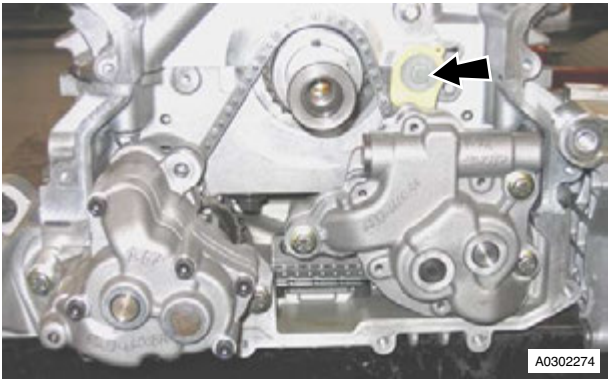


Figure 1

5. Remove tensioner assembly (see Figure 2).

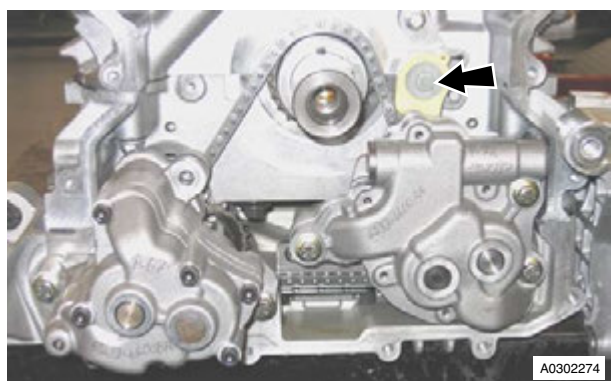


Figure 2

6. Remove bolts (x3) securing oil pressure pump to sump.
7. Release chain from oil pressure pump sprocket, remove oil pump.
8. Remove and discard oil pressure pump gasket.
9. Remove bolts (x3) securing oil scavenge pump to sump (see Figure 3).

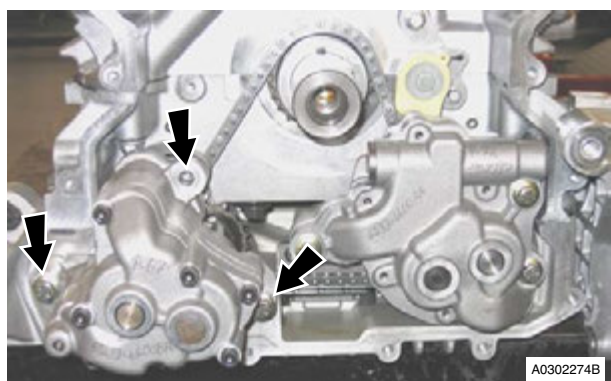


Figure 3

10. Release chain from oil scavenge pump sprocket, remove scavenge pump.
11. Remove and discard oil scavenge pump gasket (see Figure 4).



Figure 4

12. Remove oil pump(s) drive sprocket.

13. Disconnect multiplug from oil pressure sensor (see Figure 5).

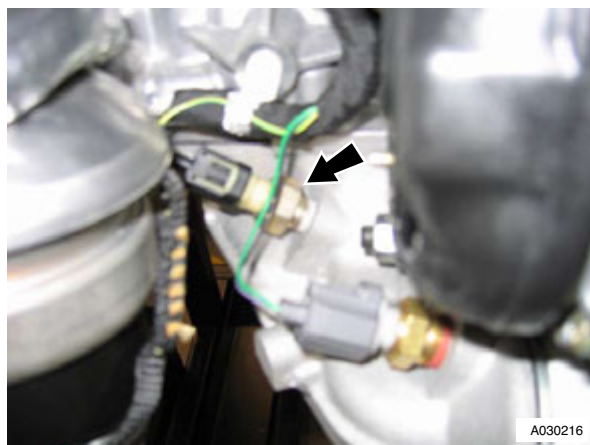


Figure 5

14. Disconnect multiplug from engine electric coolant temperature sensor (see Figure 6).

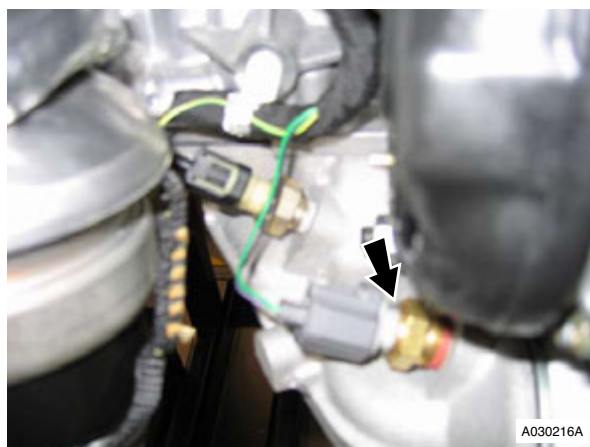


Figure 6

15. Disconnect multiplug from crankshaft timing sensor (see Figure 7).
17. Remove bolts (x4) securing LH and RH HEGO sensor multiplug brackets to sump (see Figure 9).

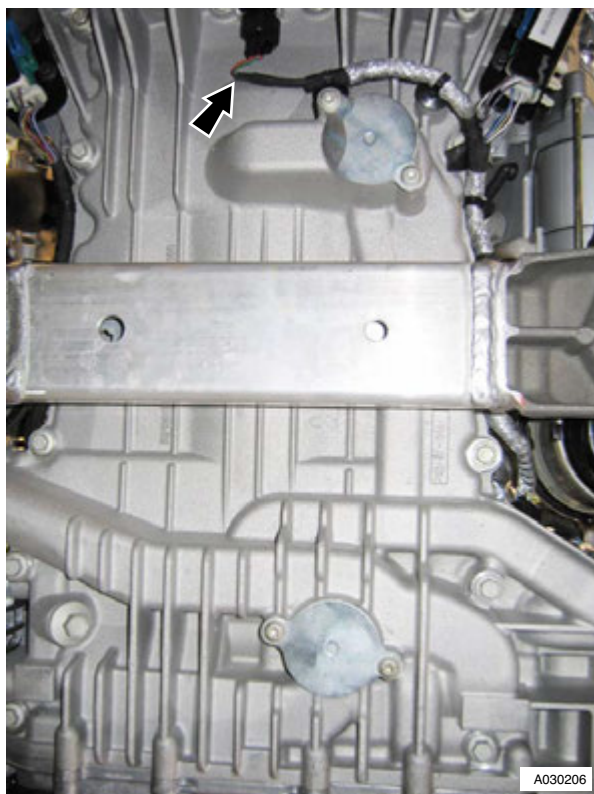


Figure 7

16. Release harness clips (x6) from sump (see Figure 8).

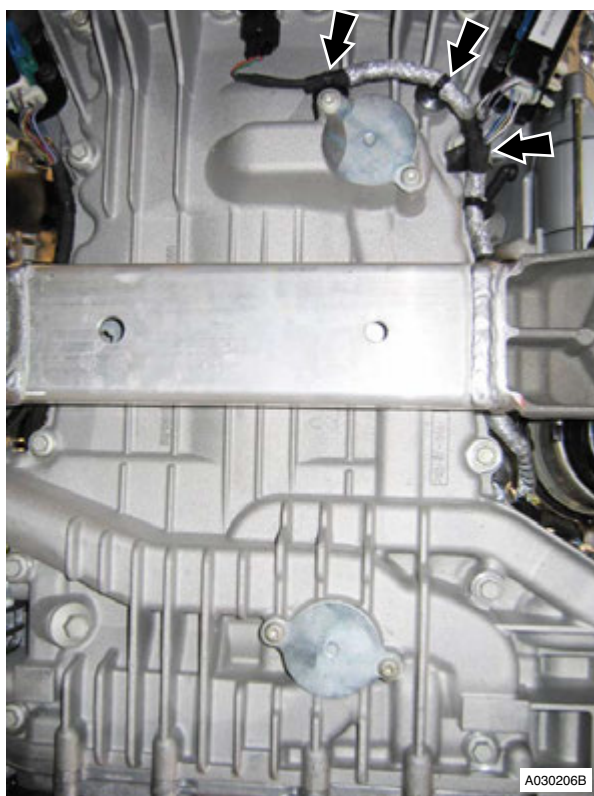


Figure 8

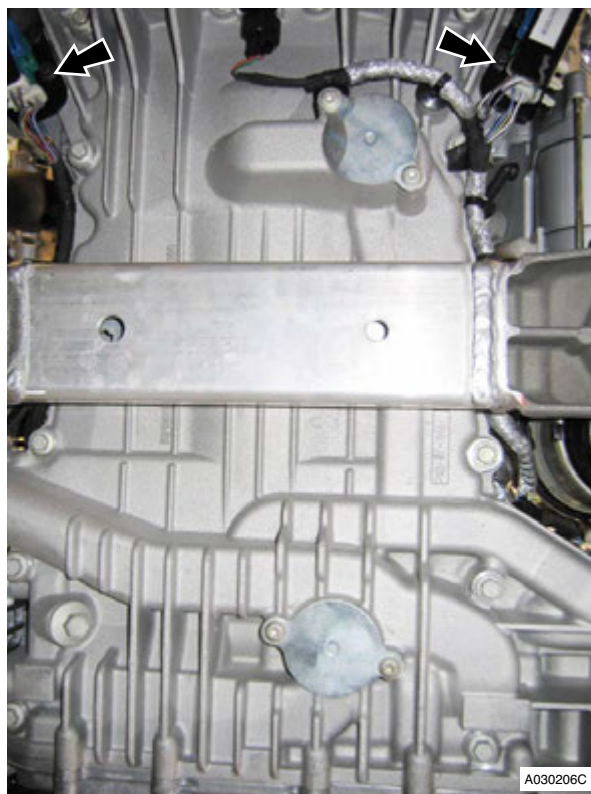


Figure 9

18. Disconnect multiplug from A/C compressor.
19. Remove bolts (x4) securing A/C compressor to mounting bracket. Remove compressor (see Figure 10).

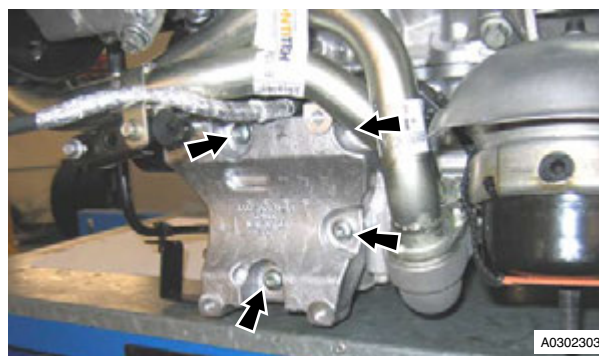


Figure 10

20. Remove bolts (x2) securing inlet and outlet oil pipes to sump (see Figure 11).



Figure 11

WARNING
DO NOT GET USED ENGINE OIL ON YOUR SKIN.
USED ENGINE OIL CAN BE HARMFUL.

21. Release both oil pipes together from sump, remove and discard O-ring seals from pipes.
22. Remove Torx bolts (x4) securing A/C compressor mounting bracket to engine bedplate and sump. Remove bracket (see Figure 12).

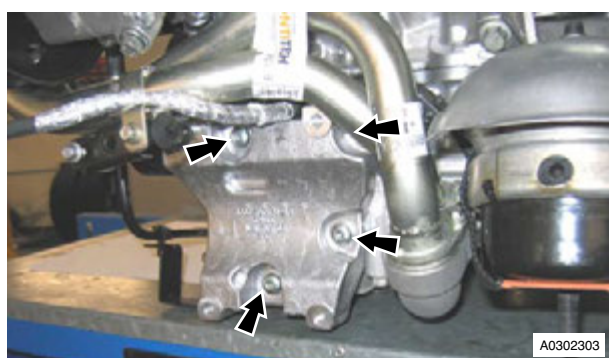


Figure 12

23. Remove bolts (x16) securing sump to engine bedplate (see Figure 13).

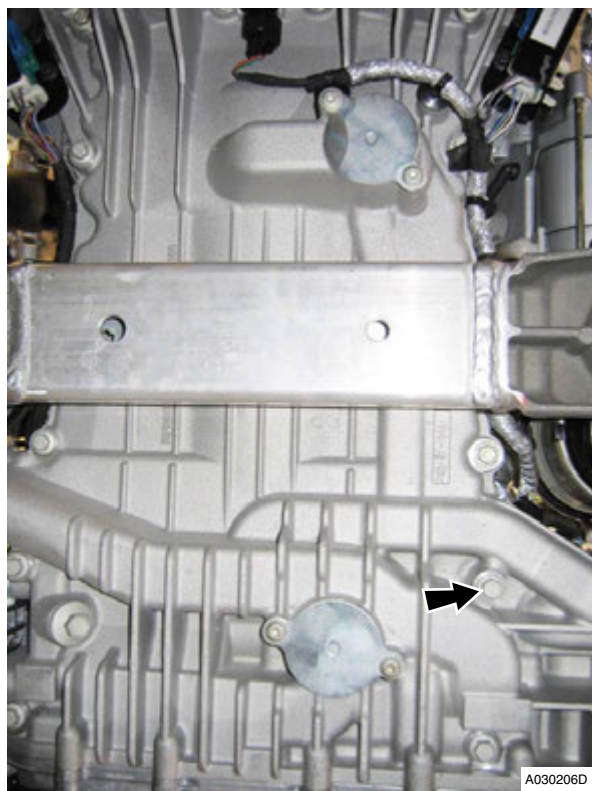


Figure 13

24. Release and remove sump.
25. Remove bolts (x8) securing windage tray to engine bedplate, remove windage tray.
26. Mark bearing caps and connecting rods for correct installation (see Figure 14).

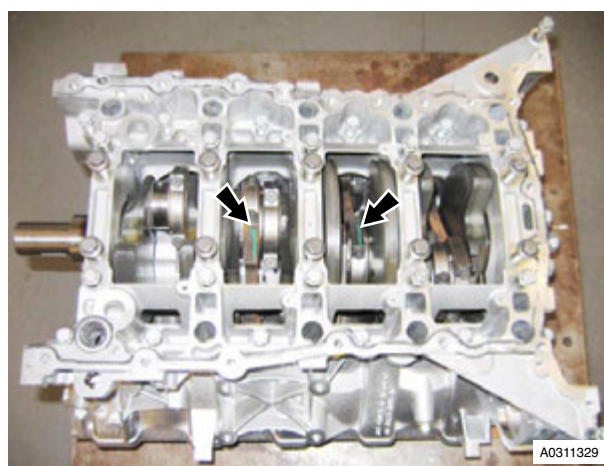


Figure 14

27. Rotate crankshaft clockwise to access number 1 cylinder connecting rod bolts.

28. Remove bolts (x2) securing bearing cap to connecting rod, remove bearing cap (see Figure 15).



Figure 15

Caution

Connecting rod bolts are torque tightened to yield and must be replaced.

29. Install special tools (303-535) to the connecting rod to prevent damage to crankshaft journal.
30. Carefully push connecting rod/piston assembly upwards and remove from cylinder bore.
31. Remove special tools from connecting rod.
32. Install bearing cap on connecting rod, install and lightly tighten retaining bolts.
33. Note that piston grade number on crown and thick flange on connecting rod faces to front of engine on RH bank (A) (see Figure 16).

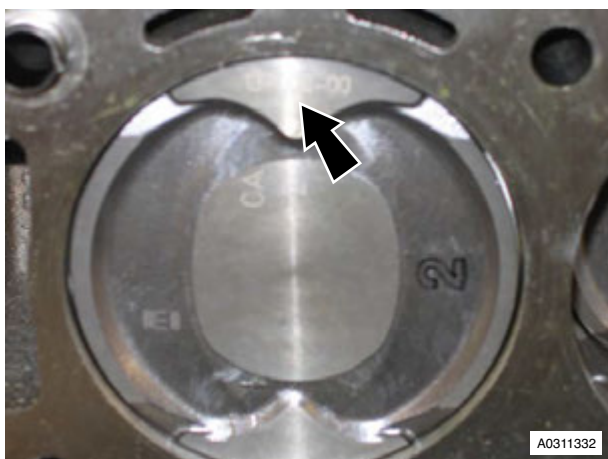


Figure 16

34. Note that piston grade number on crown and thick flange on connecting rod faces to front of engine on LH bank (B) (see Figure 7).

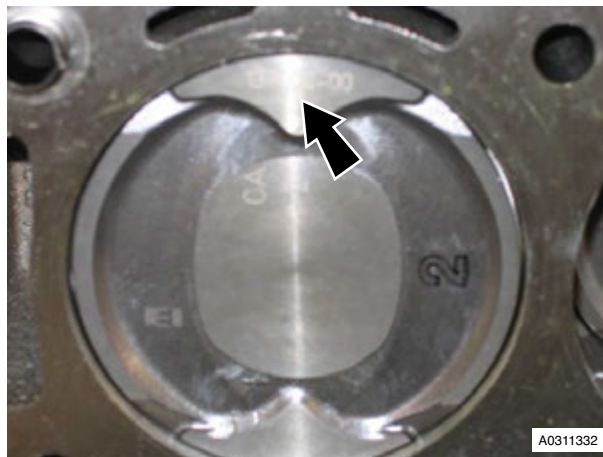


Figure 17

35. Remove circlip (x2) securing gudgeon pin in piston and connecting rod. Remove piston (see Figure 18).



Figure 18

Installation

1. Clean cylinder bore.
2. Use an expander and remove piston rings from piston.
3. Install piston rings in cylinder bore to a pre-determined depth and measure ring gaps.
4. Remove piston ring set from cylinder bore and install on piston.
5. Clean connecting rod.
6. Install piston on connecting rod in its correct orientation, install circlip(s).
7. Correctly position ring gaps on piston prior to installation.
8. Remove connecting rod bearing cap.
9. Install bearings in connecting rod and bearing cap.
10. Lubricate cylinder bore, piston and rings with clean engine oil.
11. Install special tools (303-535) to the connecting rod to prevent damage to crankshaft journal.

12. Install piston ring clamp to piston, install piston assembly in its cylinder bore. Remove piston ring clamp (see Figure 19).



Figure 19

Caution

Install pistons into cylinder block with the 'arrow' on the piston crown facing to the front of the engine.

13. Lubricate crankshaft journal with clean engine oil.
14. Carefully pull connecting rod into place on crankshaft journal.
15. Install bearing cap to connecting rod. Install and torque tighten retaining bolts (x2).
16. Clean windage tray.
17. Install windage tray, install and torque tighten bolts (x8).
18. Clean old sealant from sump flange and engine bedplate.
19. Ensure that sump flange and mating face on engine bedplate are clean and dry.
20. Apply a continuous 3mm diameter bead of RTV sealant to sump flange as recommended.
21. Ensure that there are no gaps in sealant track.
22. Install sump, install and torque tighten bolts (x16) in the correct sequence.
23. Install A/C compressor mounting bracket, install and torque tighten Torx bolts (x4).
24. Lubricate and install new 'O' ring seals to oil pipes.
25. Install oil pipes in sump, install and torque tighten bolts (x2)
26. Install compressor, install and torque tighten bolts (x4).
27. Connect multiplug to A/C compressor.
28. Install LH and RH HEGO sensor multiplug brackets to sump. Install and torque tighten bolts (x4).
29. Secure harness clips (x6) in sump.
30. Connect multiplug to crankshaft timing sensor.
31. Connect multiplug to engine electric coolant temperature sensor.
32. Connect multiplug to oil pressure sensor.
33. Clean oil scavenge pump and mating face on sump.
34. Install oil pump(s) drive sprocket.
35. Install new oil scavenge pump gasket, align on dowels (x2).

36. Install chain onto oil scavenge pump sprocket.
37. Install oil scavenge pump, align to dowels (x2), Install and torque tighten bolts (x3).
38. Install chain onto oil pump drive sprocket.
39. Clean oil pressure pump and mating face on sump.
40. Install new gasket to sump, align to dowels (x2).
41. Position oil pressure pump, install chain on pump sprocket.
42. Install oil pressure pump, align to dowels (x2), Install and torque tighten bolts (x3).
43. Install chain tensioner, install and torque tighten bolt, remove guide pin.
44. Install crankshaft timing sprocket.
45. Install cylinder head gaskets - engine set (see Workshop Manual procedure 03.01.HW Gasket - Cylinder Head - Engine Set - Renew With Engine Removed).

Additional Piston-Renew (Each)

Repair Operation Time (ROT)	
Item	Code
Additional Piston-Renew	03.11.CJ

Removal

WARNING
DO NOT GET USED ENGINE OIL ON YOUR SKIN.
USED ENGINE OIL CAN BE HARMFUL.

1. Mark bearing caps and connecting rods for correct installation.
2. Remove bolts (x2) securing bearing cap to connecting rod, remove bearing cap.

Caution
Connecting rod bolts are torque tightened to yield and must be replaced.

3. Install special tools (303-535) to the connecting rod to prevent damage to crankshaft journal.
4. Carefully push connecting rod/piston assembly upwards and remove from cylinder bore.
5. Remove special tools from connecting rod.
6. Install bearing cap on connecting rod, install and lightly tighten retaining bolts.
7. Remove circlip (x2) securing gudgeon pin in piston and connecting rod. Remove piston.

Installation

1. Clean cylinder bore.
2. Install piston rings in cylinder bore to a pre-determined depth and measure ring gaps.
3. Remove piston ring set from cylinder bore and install on piston.
4. Clean connecting rod.
5. Install piston on connecting rod in its correct orientation, install circlip(s).



6. Correctly position ring gaps on piston prior to installation.

Caution

Make sure the piston ring gaps are positioned at different positions opposite the thrust side of the piston before installation.

7. Remove connecting rod bearing cap.
8. Install bearings in connecting rod and bearing cap.
9. Lubricate cylinder bore, piston and rings with clean engine oil.
10. Install special tools (303-535) to the connecting rod to prevent damage to crankshaft journal.

Caution

Install pistons into cylinder block with the 'arrow' on the piston crown facing to the front of the engine.

11. Install piston ring clamp to piston, install piston assembly in its cylinder bore. Remove piston ring clamp.
12. Lubricate crankshaft journal with clean engine oil.
13. Carefully pull connecting rod into place on crankshaft journal.
14. Install bearing cap to connecting rod. Install and torque tighten retaining bolts (x2).

Piston Ring-Renew (Engine Set)

Repair Operation Time (ROT)	
Item	Code
Piston Ring-Renew	03.11.CK

Removal

WARNING

**DO NOT GET USED ENGINE OIL ON YOUR SKIN.
USED ENGINE OIL CAN BE HARMFUL.**

1. Remove cylinder head gaskets - engine set (see Workshop Manual procedure 03.01.HW Gasket - Cylinder Head - Engine Set - Renew With Engine Removed).
2. Remove crankshaft timing sprocket from crankshaft.
3. Install guide pin through lower hole on chain tensioner.
4. Remove bolt securing oil pressure pump chain tensioner assembly to engine bedplate (see Figure 1).

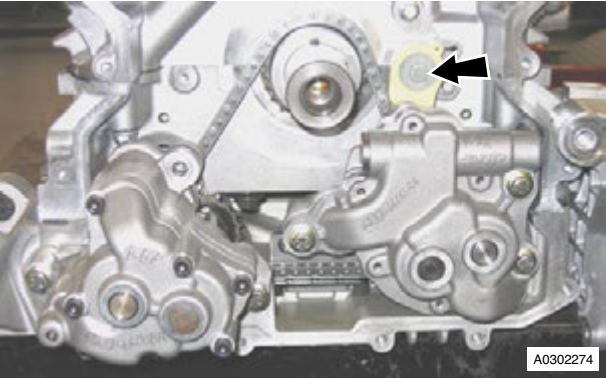


Figure 1

5. Remove tensioner assembly (see Figure 2).

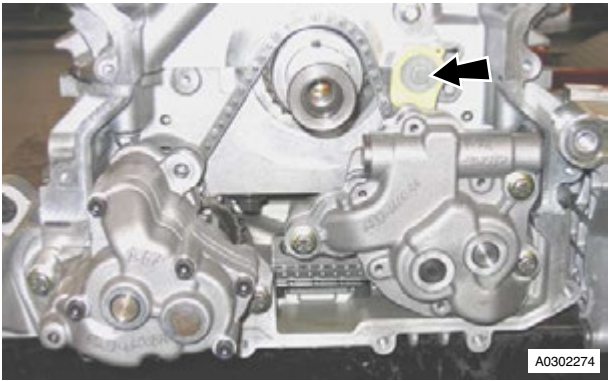


Figure 2

6. Remove bolts (x3) securing oil pressure pump to sump.
7. Release chain from oil pressure pump sprocket, remove oil pump.
8. Remove and discard oil pressure pump gasket.
9. Remove bolts (x3) securing oil scavenge pump to sump (see Figure 3).

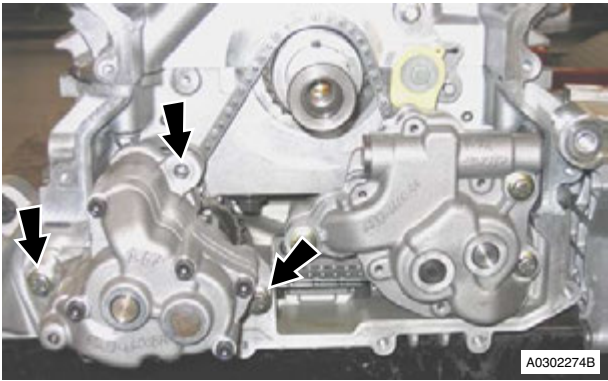


Figure 3

10. Release chain from oil scavenge pump sprocket, remove scavenge pump.

11. Remove and discard oil scavenge pump gasket (see Figure 4).



Figure 4

12. Remove oil pump(s) drive sprocket.
13. Disconnect multiplug from oil pressure sensor (see Figure 5).

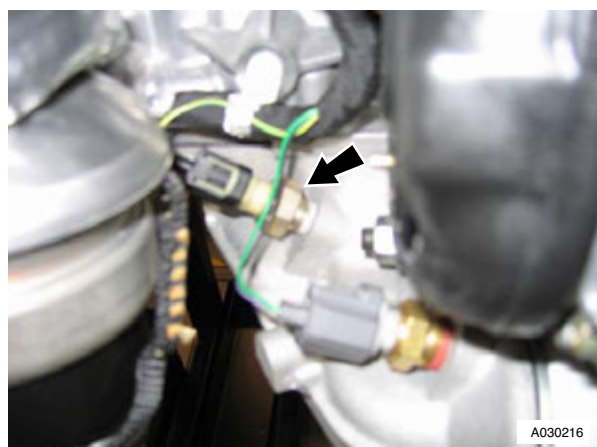


Figure 5

14. Disconnect multiplug from engine electric coolant temperature sensor (see Figure 6).



Figure 6

15. Disconnect multiplug from crankshaft timing sensor (see Figure 7).

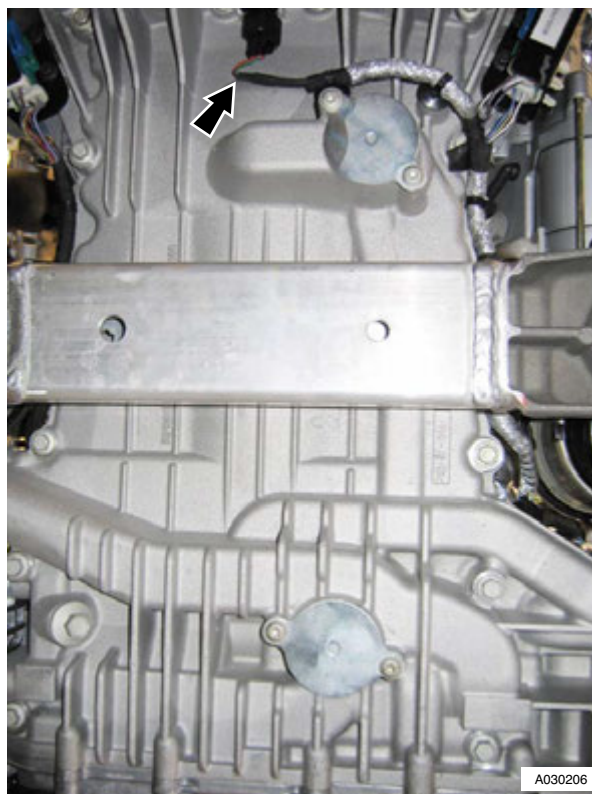


Figure 7

16. Release harness clips (x6) from sump (see Figure 8).

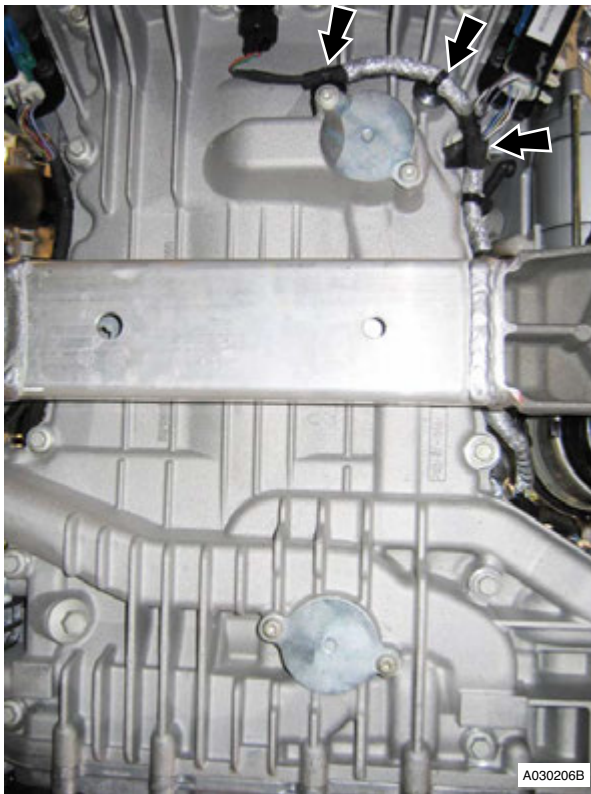


Figure 8

17. Remove bolts (x4) securing LH and RH HEGO sensor multiplug brackets to sump (see Figure 9).

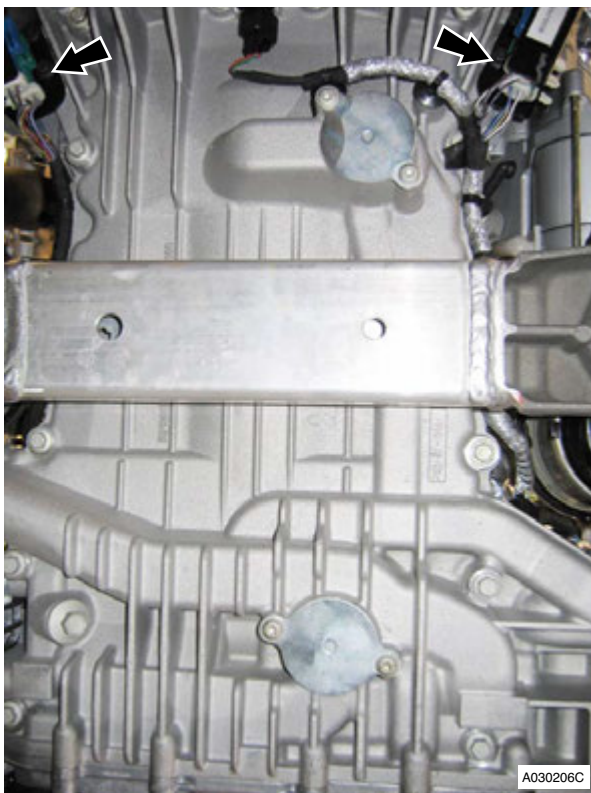


Figure 9

18. Disconnect multiplug from A/C compressor.

19. Remove bolts (x4) securing A/C compressor to mounting bracket. Remove compressor.

20. Remove bolts (x2) securing inlet and outlet oil pipes to sump (see Figure 10).



Figure 10

21. Release both oil pipes together from sump, remove and discard O-ring seals from pipes.

22. Remove Torx bolts (x4) securing A/C compressor mounting bracket to engine bedplate and sump. Remove bracket (see Figure 11).

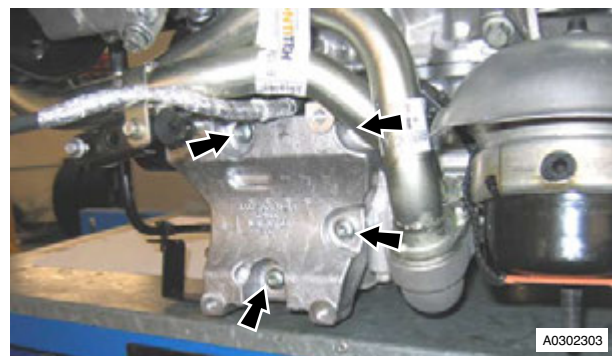


Figure 11

23. Remove bolts (x16) securing sump to engine bedplate (see Figure 12).

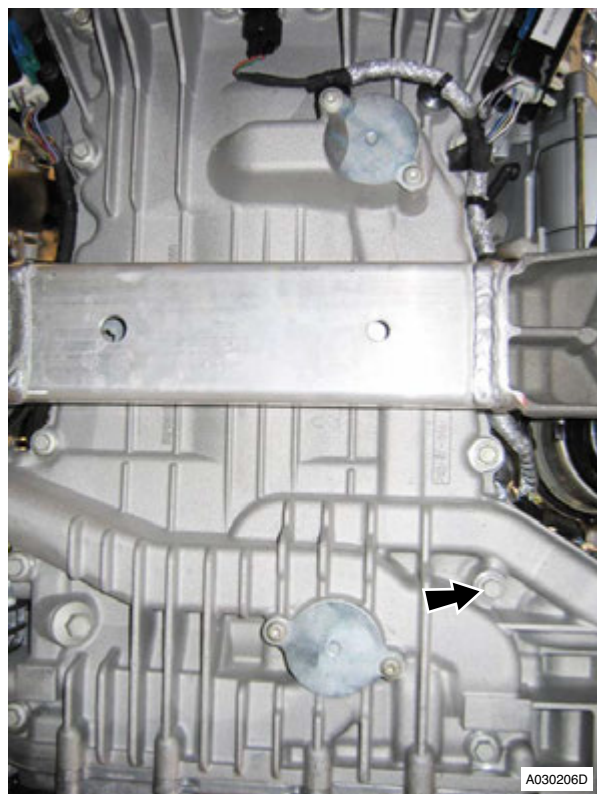


Figure 12

24. Release and remove sump.
25. Remove bolts (x8) securing windage tray to engine bedplate, remove windage tray.
26. Mark bearing caps and connecting rods for correct installation (see Figure 13).

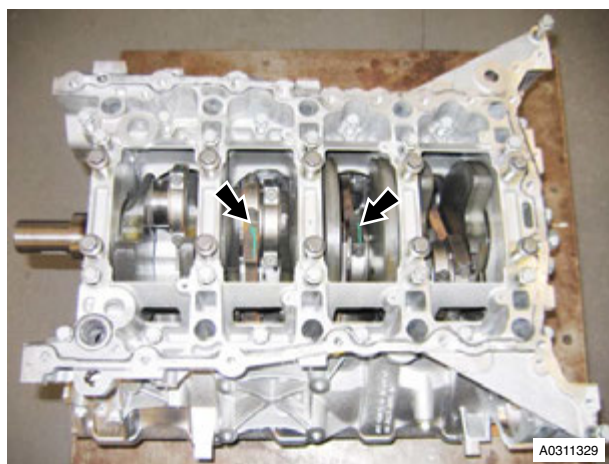


Figure 13

27. Rotate crankshaft clockwise to access number 1 cylinder connecting rod bolts.

28. Remove and discard bolts (x16) securing bearing caps to connecting rods, remove bearing caps (see Figure 14).



Figure 14

Caution

Connecting rod bolts are torque tightened to yield and must be replaced.

29. Install special tools (303-535) to the connecting rod to prevent damage to crankshaft journal.
30. Carefully push each connecting rod/piston assembly upwards and remove from cylinder block.
31. Remove special tools from connecting rods.
32. Install bearing caps on connecting rods, install and lightly tighten retaining bolts.
33. Note that piston grade number on crown and thick flange on connecting rod faces to front of engine on RH bank (A) (see Figure 15).

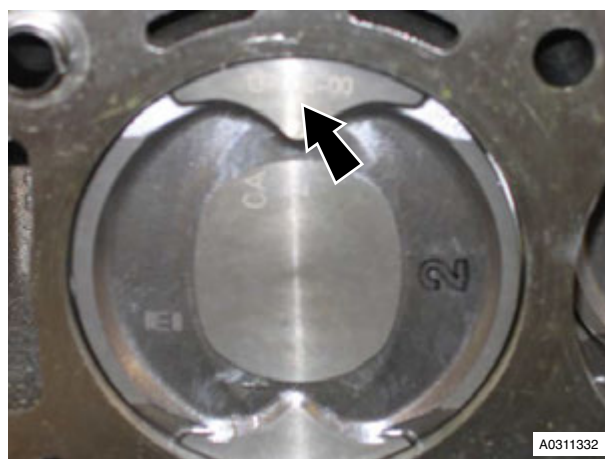


Figure 15

34. Note that piston grade number on crown and thick flange on connecting rod faces to front of engine on LH bank (B) (see Figure 16).

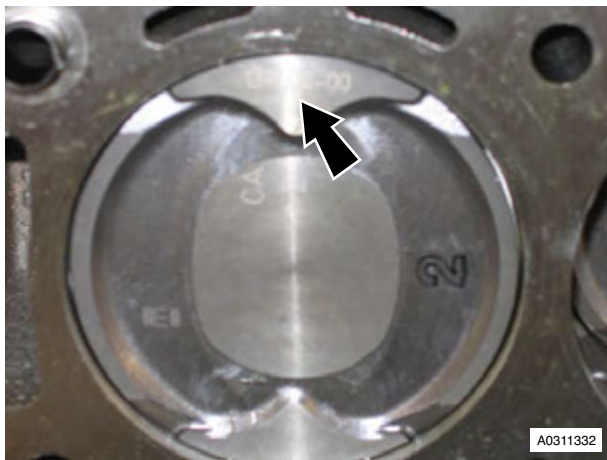


Figure 16

Installation

1. Clean cylinder bores.
2. Use an expander and remove and discard piston rings from pistons.
3. Clean pistons.
4. Install new piston rings, (each set), in cylinder bores to a pre-determined depth and measure ring gaps.
5. Remove each piston ring set from cylinder bores and install on pistons
6. Remove connecting rod bearing caps.
7. Install bearings in connecting rods and bearing caps.
8. Lubricate cylinder bores, pistons and rings with clean engine oil.
9. Install special tools (303-303-535) to the connecting rod to prevent damage to crankshaft journal.

Caution

Make sure the piston ring gaps are positioned at different positions opposite the thrust side of the piston before installation.

10. Correctly position ring gaps on pistons prior to installation.

11. Install piston ring clamp to each piston in turn and install in its respective cylinder bore. Remove piston ring clamp (see Figure 17).



Figure 17

12. Lubricate crankshaft journals with clean engine oil.

Caution

Install pistons into cylinder block with the 'arrow' on the piston crown facing to the front of the engine.

13. Carefully pull each connecting rod into place on each crankshaft journal.

Caution

When assembling connecting rods and connecting rod bearing caps it is imperative that bearing slots and tangs be located on the same side of the connecting rods.

14. Install bearing caps to their relevant connecting rods. Install and torque tighten retaining bolts (x16).
15. Clean windage tray.
16. Install windage tray, install and torque tighten bolts (x8).
17. Clean old sealant from sump flange and engine bedplate.
18. Ensure that sump flange and mating face on engine bedplate are clean and dry.
19. Apply a continuous 3mm diameter bead of RTV sealant to sump flange as recommended.
20. Ensure that there are no gaps in sealant track.
21. Install sump, install and torque tighten bolts (x16) in the correct sequence.
22. Install A/C compressor mounting bracket, install and torque tighten Torx bolts (x4).
23. Lubricate and install new O-ring seals to oil pipes.
24. Install oil pipes in sump, install and torque tighten bolts (x2)
25. Install compressor, install and torque tighten bolts (x4).
26. Connect multiplug to A/C compressor.
27. Install LH and RH HEGO sensor multiplug brackets to sump. Install and torque tighten bolts (x4).
28. Secure harness clips (x6) in sump.
29. Connect multiplug to crankshaft timing sensor.
30. Connect multiplug to engine electric coolant temperature sensor.
31. Connect multiplug to oil pressure sensor.

32. Clean oil scavenge pump and mating face on sump.
33. Install oil pump(s) drive sprocket.
34. Install new oil scavenge pump gasket, align on dowels (x2).
35. Install chain onto oil scavenge pump sprocket.
36. Install oil scavenge pump, align to dowels (x2), Install and torque tighten bolts (x3).
37. Install chain onto oil pump drive sprocket.
38. Clean oil pressure pump and mating face on sump.
39. Install new gasket to sump, align to dowels (x2).
40. Position oil pressure pump, install chain on pump sprocket.
41. Install oil pressure pump, align to dowels (x2), Install and torque tighten bolts (x3).
42. Install chain tensioner, install and torque tighten bolt, remove guide pin.
43. Install crankshaft timing sprocket.
44. Install cylinder head gaskets - engine set (see Workshop Manual procedure 03.01.HW Gasket - Cylinder Head - Engine Set - Renew With Engine Removed).

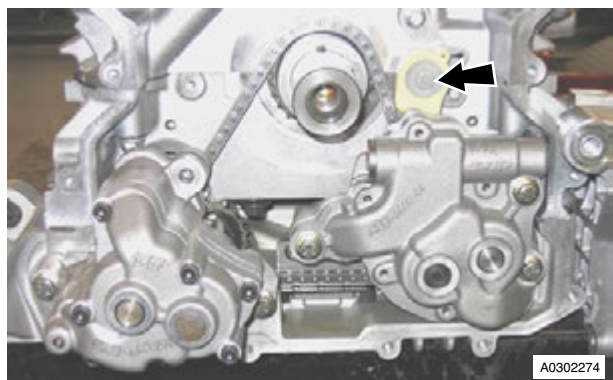
Piston Ring-One Piston Set-Renew

Repair Operation Time (ROT)	
Item	Code
Piston Ring Set-Renew	03.11.CL

Removal

WARNING
DO NOT GET USED ENGINE OIL ON YOUR SKIN.
USED ENGINE OIL CAN BE HARMFUL.

1. Remove cylinder head gaskets - engine set (see Workshop Manual procedure 03.01.HW Gasket - Cylinder Head - Engine Set - Renew With Engine Removed).
2. Remove crankshaft timing sprocket from crankshaft.
3. Install guide pin through lower hole on chain tensioner.
4. Remove bolt securing oil pressure pump chain tensioner assembly to engine bedplate (see Figure).
5. Remove tensioner assembly.
6. Remove bolts (x3) securing oil pressure pump to sump.
7. Release chain from oil pressure pump sprocket, remove oil pump.
8. Remove and discard oil pressure pump gasket.
9. Remove bolts (x3) securing oil scavenge pump to sump (see Figure 2).
10. Release chain from oil scavenge pump sprocket, remove scavenge pump.
11. Remove and discard oil scavenge pump gasket (see Figure 3).
12. Remove oil pump(s) drive sprocket.
13. Disconnect multiplug from oil pressure sensor (see Figure 4).



Figure

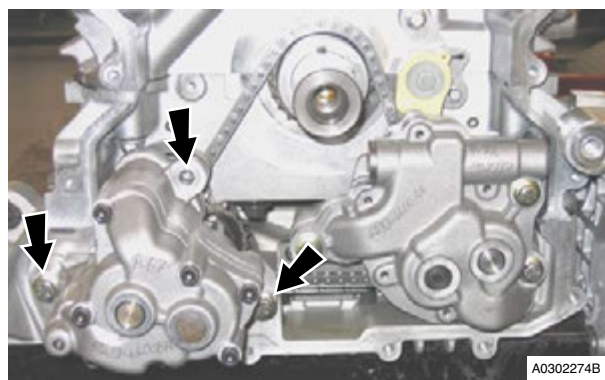


Figure 2



Figure 3

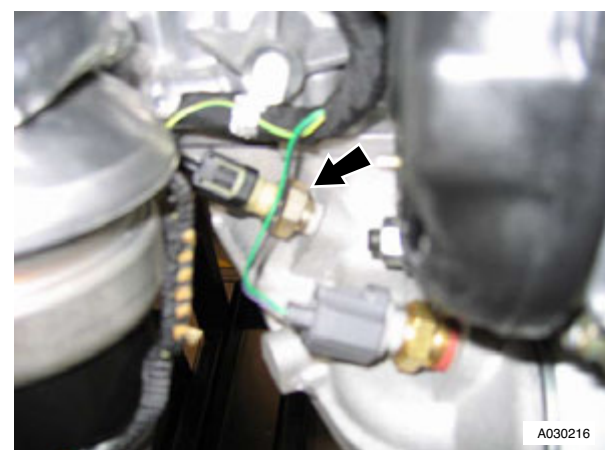


Figure 4

14. Disconnect multiplug from engine electric coolant temperature sensor (see Figure 5).

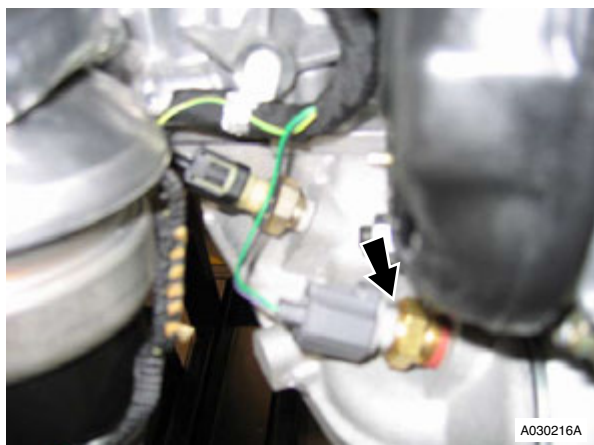


Figure 5

15. Disconnect multiplug from crankshaft timing sensor. (see Figure 6)

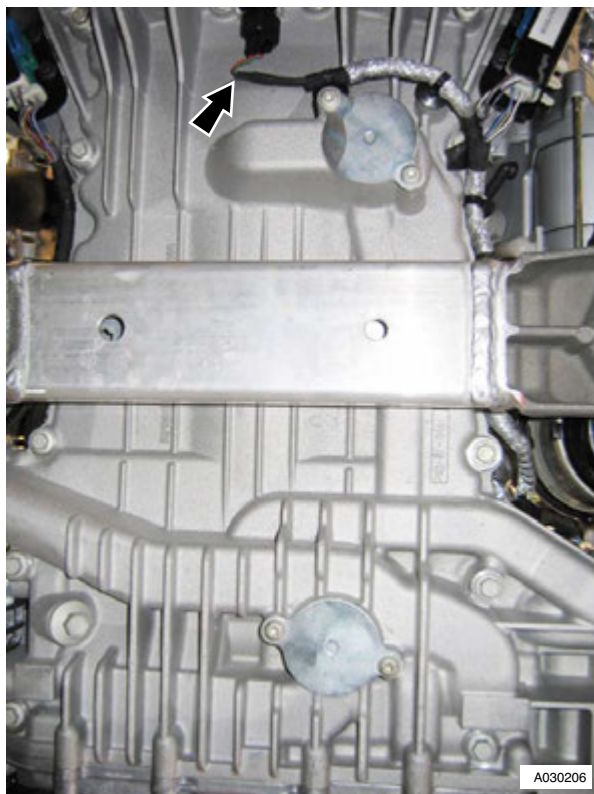


Figure 6

16. Release harness clips (x6) from sump (see Figure 7).

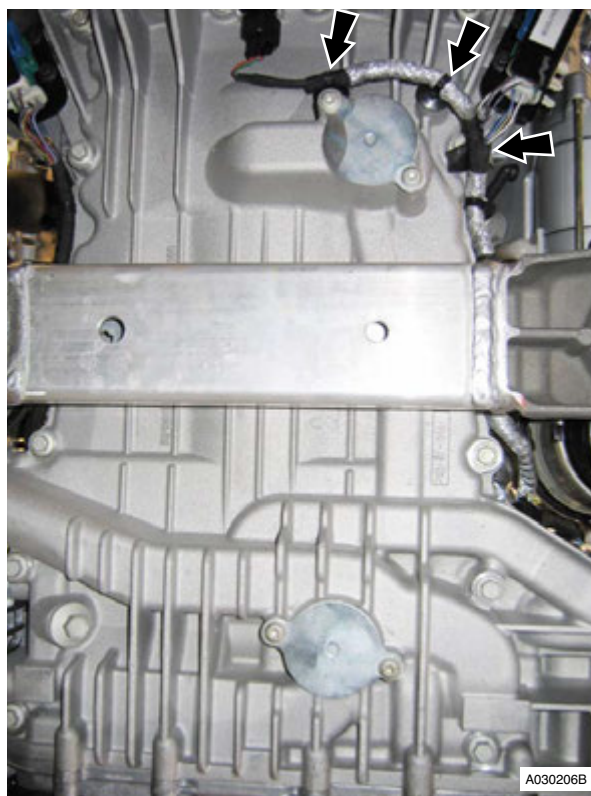
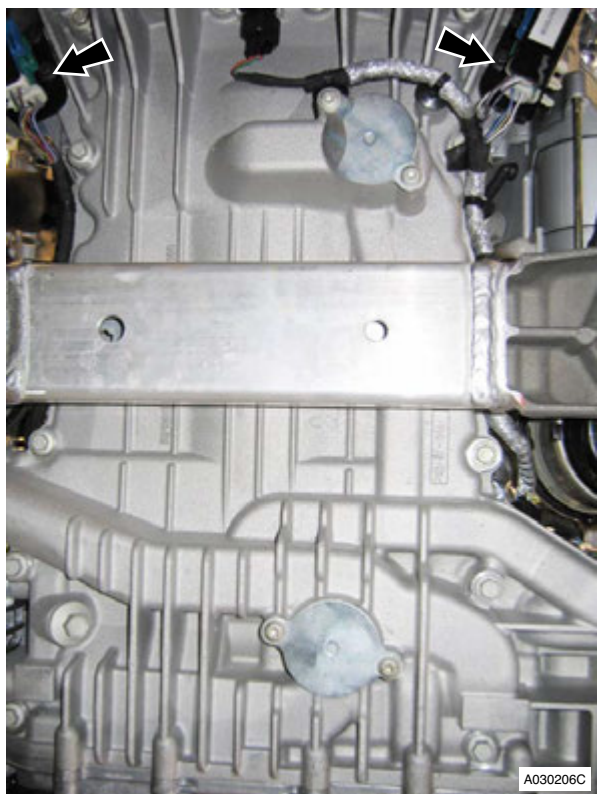


Figure 7

17. Remove bolts (x4) securing LH and RH HEGO sensor multiplug brackets to sump (see Figure 8).

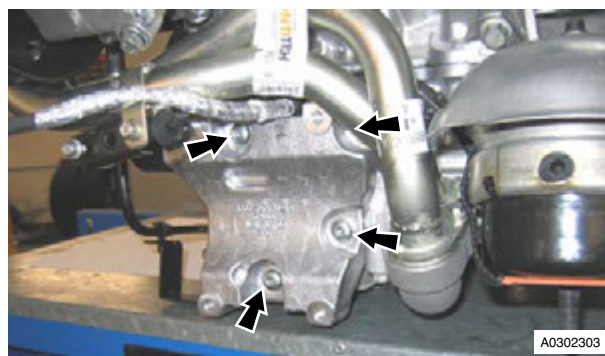
**Figure 8**

18. Disconnect multiplug from A/C compressor.
19. Remove bolts (x4) securing A/C compressor to mounting bracket. Remove compressor.
20. Remove bolts (x2) securing inlet and outlet oil pipes to sump (see Figure 9).

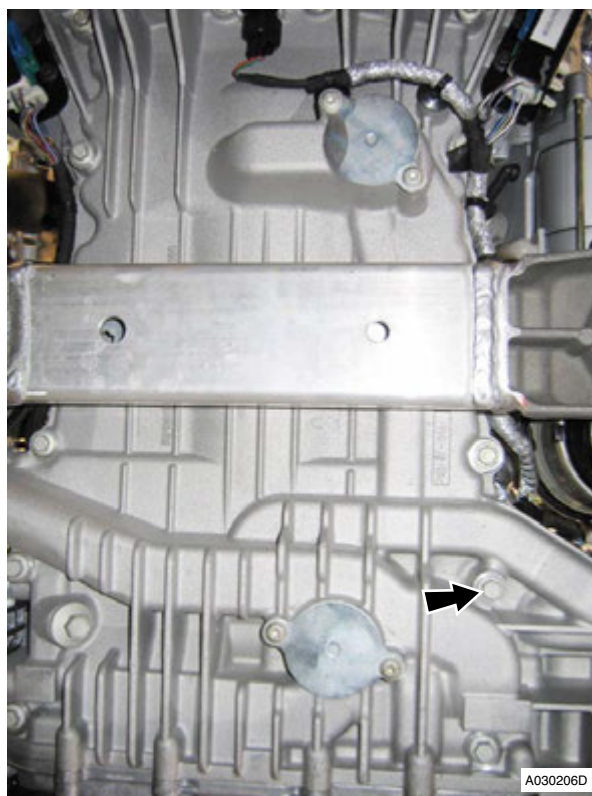
**Figure 9**

21. Release both oil pipes together from sump, remove and discard O-ring seals from pipes.

22. Remove Torx bolts (x4) securing A/C compressor mounting bracket to engine bedplate and sump. Remove bracket (see Figure 10).

**Figure 10**

23. Remove bolts (x16) securing sump to engine bedplate (see Figure 11).

**Figure 11**

24. Release and remove sump.
25. Remove bolts (x8) securing windage tray to engine bedplate, remove windage tray.

26. Mark bearing caps and connecting rods for correct installation (see Figure 12).



Figure 12

33. Note that piston grade number on crown and thick flange on connecting rod faces to front of engine on RH bank (A) (see Figure 14).

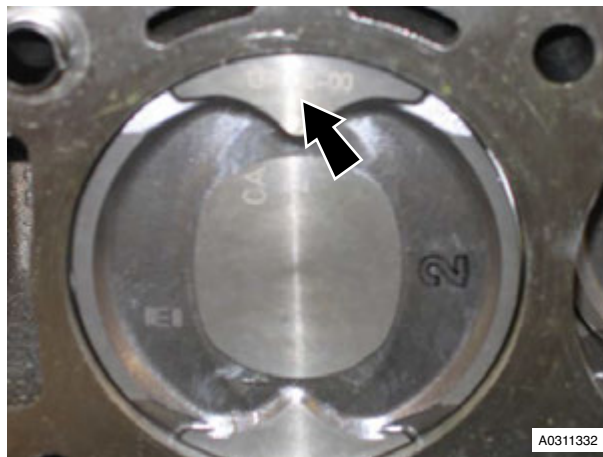


Figure 14

27. Rotate crankshaft clockwise to access number 1 cylinder connecting rod bolts.
28. Remove bolts (x2) securing bearing cap to connecting rod, remove bearing cap (see Figure 13).



Figure 13

34. Note that piston grade number on crown and thick flange on connecting rod faces to front of engine on LH bank (B) (see Figure 15).

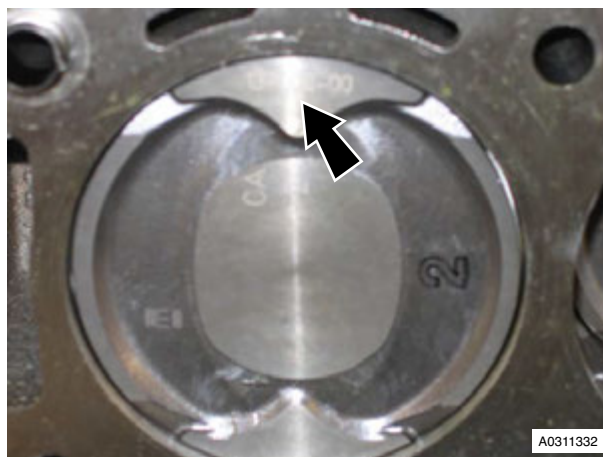


Figure 15

Caution

Connecting rod bolts are torque tightened to yield and must be replaced.

29. Install special tools (303-535) to the connecting rod to prevent damage to crankshaft journal.
30. Carefully push connecting rod/piston assembly upwards and remove from cylinder bore.
31. Remove special tools from connecting rod.
32. Install bearing cap on connecting rod, install and lightly tighten retaining bolts.

Installation

1. Clean cylinder bore.
2. Use an expander and remove piston rings from piston.
3. Install piston rings in cylinder bore to a pre-determined depth and measure ring gaps.
4. Remove piston ring set from cylinder bore and install on piston.
5. Clean connecting rod.
6. Correctly position ring gaps on piston prior to installation.

Caution

Make sure the piston ring gaps are positioned at different positions opposite the thrust side of the piston before installation.

7. Remove connecting rod bearing cap.
8. Install bearings in connecting rod and bearing cap.
9. Lubricate cylinder bore, piston and rings with clean engine oil.

10. Install special tools (303-535) to the connecting rod to prevent damage to crankshaft journal.
11. Install piston ring clamp to piston, install piston assembly in its cylinder bore. Remove piston ring clamp (see Figure 16).



Figure 16

Caution

Install pistons into cylinder block with the 'arrow' on the piston crown facing to the front of the engine.

12. Lubricate crankshaft journal with clean engine oil.
13. Carefully pull connecting rod into place on crankshaft journal.
14. Install bearing cap to connecting rod. Install and torque tighten retaining bolts (x2).
15. Clean windage tray.
16. Install windage tray, install and torque tighten bolts (x8).
17. Clean old sealant from sump flange and engine bedplate.

Caution

Use only a plastic scraper when removing old sealant and gaskets from engine components.

18. Ensure that sump flange and mating face on engine bedplate are clean and dry.
19. Apply a continuous 3mm diameter bead of RTV sealant to sump flange as recommended.
20. Ensure that there are no gaps in sealant track.
21. Install sump, install and torque tighten bolts (x16) in the correct sequence.
22. Install A/C compressor mounting bracket, install and torque tighten Torx bolts (x4).
23. Lubricate and install new O-ring seals to oil pipes.
24. Install oil pipes in sump, install and torque tighten bolts (x2).
25. Install compressor, install and torque tighten bolts (x4).
26. Connect multiplug to A/C compressor.
27. Install LH and RH HEGO sensor multiplug brackets to sump. Install and torque tighten bolts (x4).
28. Secure harness clips (x6) in sump.
29. Connect multiplug to crankshaft timing sensor.
30. Connect multiplug to engine electric coolant temperature sensor.

31. Connect multiplug to oil pressure sensor.
32. Clean oil scavenge pump and mating face on sump.
33. Install oil pump(s) drive sprocket.
34. Install new oil scavenge pump gasket, align on dowels (x2).
35. Install chain onto oil scavenge pump sprocket.
36. Install oil scavenge pump, align to dowels (x2), install and torque tighten bolts (x3).
37. Install chain onto oil pump drive sprocket.
38. Clean oil pressure pump and mating face on sump.
39. Install new gasket to sump, align to dowels (x2).
40. Position oil pressure pump, install chain on pump sprocket.
41. Install oil pressure pump, align to dowels (x2), install and torque tighten bolts (x3).
42. Install chain tensioner, install and torque tighten bolt, remove guide pin.
43. Install crankshaft timing sprocket.
44. Install cylinder head gaskets - engine set (see Workshop Manual procedure 03.01.HW Gasket - Cylinder Head - Engine Set - Renew With Engine Removed).

Piston Ring Set-Additional-Renew (Each)

Repair Operation Time (ROT)	
Item	Code
Piston Ring Set-Additional-Renew	03.11.CM

Removal**WARNING**

DO NOT GET USED ENGINE OIL ON YOUR SKIN. USED ENGINE OIL CAN BE HARMFUL.

1. Mark bearing cap and connecting rod for correct installation (see Figure 1).

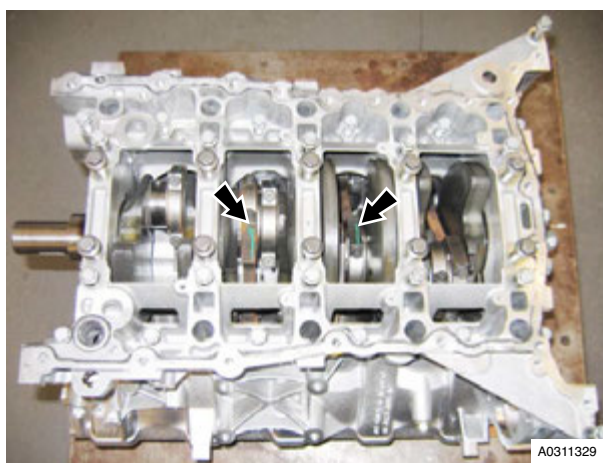


Figure 1



2. Remove bolts (x2) securing bearing cap to connecting rod, remove bearing cap (see Figure 2).



Figure 2

Caution

When using a 'two post' vehicle ramp, remove the screws that secure the rear section of the wheel arch liner to body. Hold back the rear section of the wheel arch liner to correctly position the foot of the vehicle lift.

3. Install special tools (303-535) to the connecting rod to prevent damage to crankshaft journal.
4. Carefully push connecting rod/piston assembly upwards and remove from cylinder bore.
5. Remove special tools from connecting rod.
6. Install bearing cap on connecting rod, install and lightly tighten retaining bolts.

Installation

1. Clean cylinder bore.
2. Install piston rings in cylinder bore to a pre-determined depth and measure ring gaps.
3. Remove piston ring set from cylinder bore and install on piston.
4. Clean connecting rod.
5. Correctly position ring gaps on piston prior to installation.

Caution

Make sure the piston ring gaps are positioned at different positions opposite the thrust side of the piston before installation.

6. Remove connecting rod bearing cap.
7. Install bearings in connecting rod and bearing cap.
8. Lubricate cylinder bore, piston and rings with clean engine oil.
9. Install special tools (303-535) to the connecting rod to prevent damage to crankshaft journal.

10. Install piston ring clamp to piston, install piston assembly in its cylinder bore. Remove piston ring clamp (see Figure 3).



Figure 3

11. Lubricate crankshaft journal with clean engine oil.
12. Carefully pull connecting rod into place on crankshaft journal.
13. Install bearing cap to connecting rod. Install and torque tighten retaining bolts (x2).

Connecting Rod-Renew (Engine Set)

Repair Operation Time (ROT)	
Item	Code
Connecting Rod-Renew	03.11.CN

Removal

WARNING
DO NOT GET USED ENGINE OIL ON YOUR SKIN.
USED ENGINE OIL CAN BE HARMFUL.

1. Remove cylinder head gaskets - engine set (see Workshop Manual procedure 03.01.HW Gasket - Cylinder Head - Engine Set - Renew With Engine Removed).
2. Remove crankshaft timing sprocket from crankshaft.
3. Install guide pin through lower hole on chain tensioner.
4. Remove bolt securing oil pressure pump chain tensioner assembly to engine bedplate (see Figure 1).

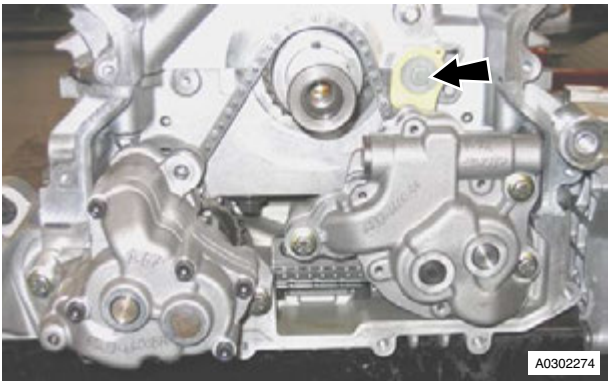
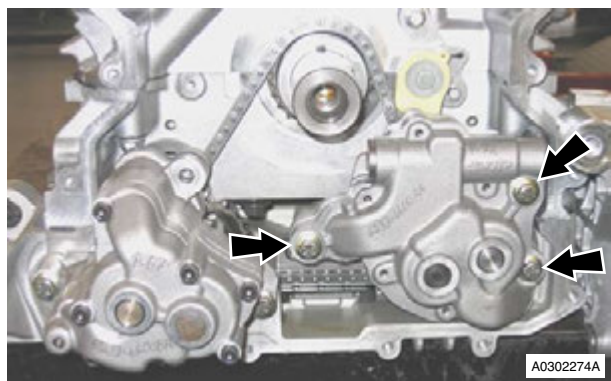


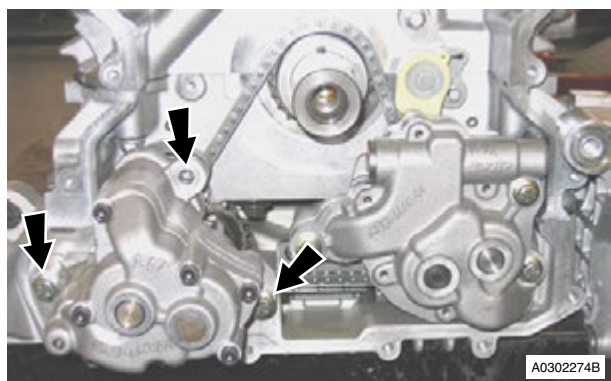
Figure 1

5. Remove tensioner assembly.

6. Remove bolts (x3) securing oil pressure pump to sump (see Figure 2).
11. Remove and discard oil scavenge pump gasket (see Figure 4).

**Figure 2**

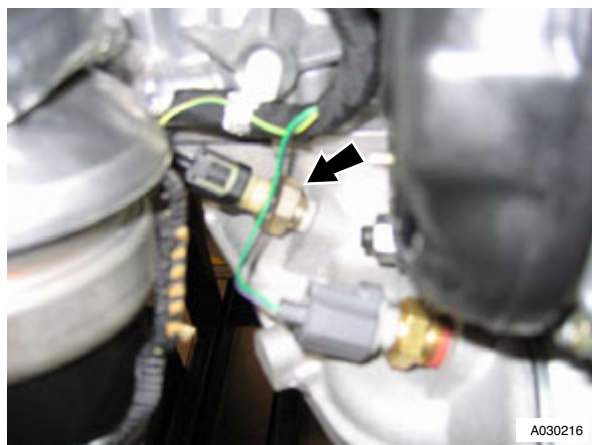
7. Release chain from oil pressure pump sprocket, remove oil pump.
8. Remove and discard oil pressure pump gasket.
9. Remove bolts (x3) securing oil scavenge pump to sump (see Figure 3).

**Figure 3**

10. Release chain from oil scavenge pump sprocket, remove scavenge pump.

**Figure 4**

12. Remove oil pump(s) drive sprocket.
13. Disconnect multiplug from oil pressure sensor (see Figure 5).

**Figure 5**

14. Disconnect multiplug from engine electric coolant temperature sensor (see Figure 6).

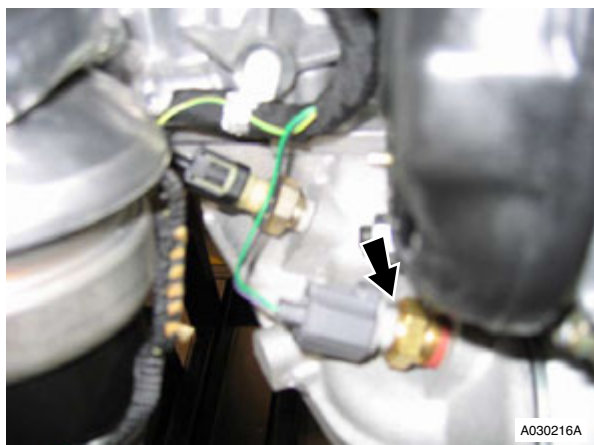


Figure 6

15. Disconnect multiplug from crankshaft timing sensor (see Figure 7).

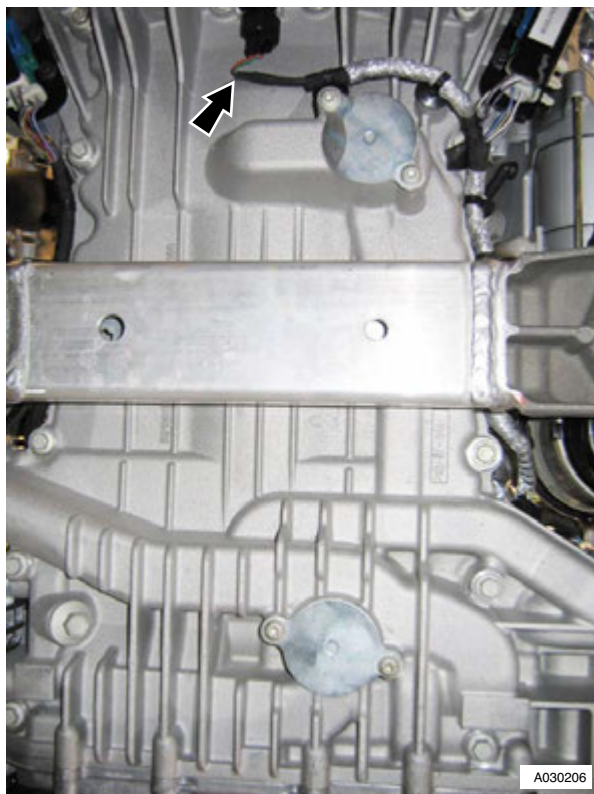


Figure 7

16. Release harness clips (x6) from sump (see Figure 8).

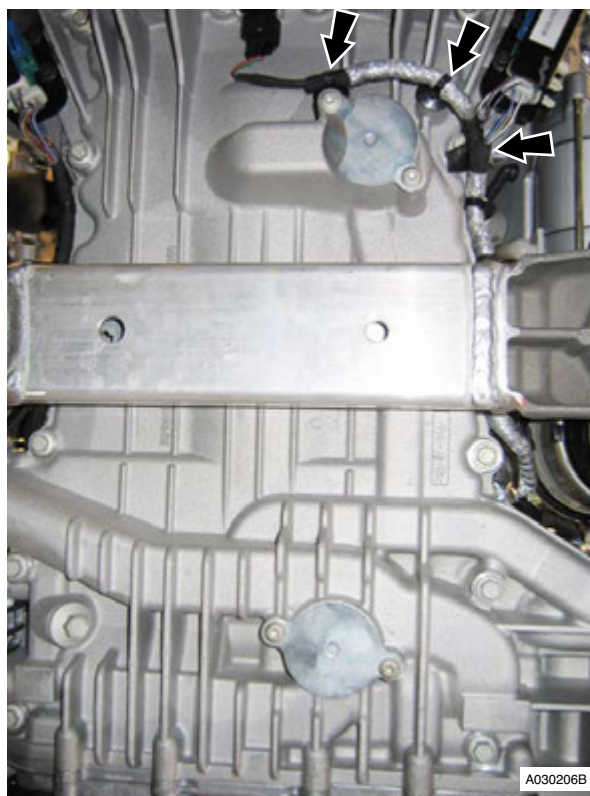


Figure 8

17. Remove bolts (x4) securing LH and RH HEGO sensor multiplug brackets to sump (see Figure 9).

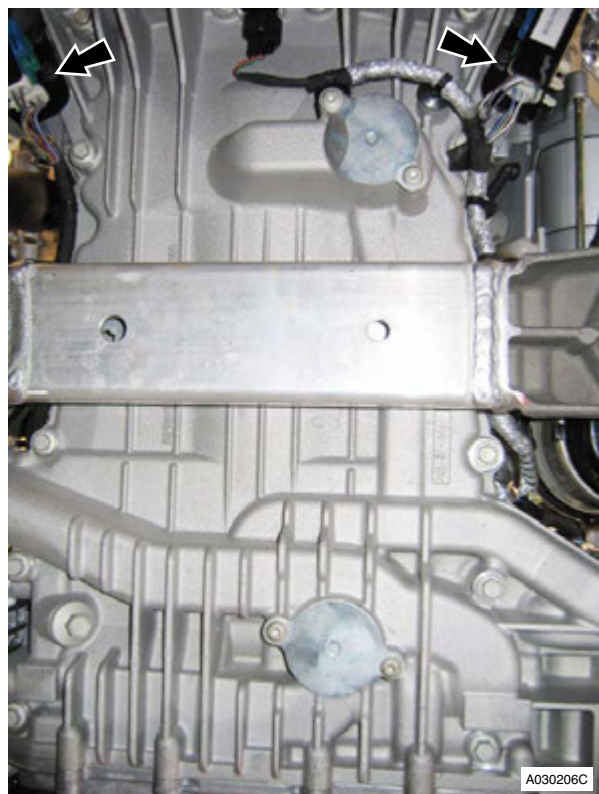


Figure 9

18. Disconnect multiplug from A/C compressor.
19. Remove bolts (x4) securing A/C compressor to mounting bracket. Remove compressor (see Figure 10).

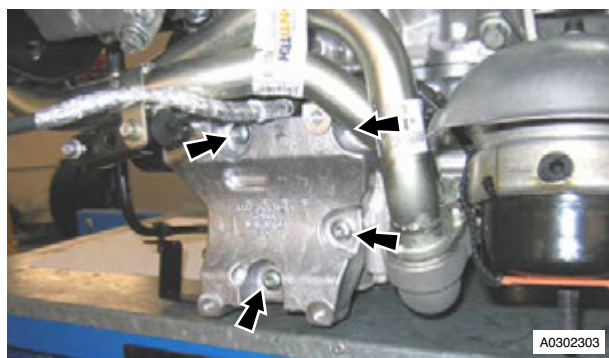


Figure 10

20. Remove bolts (x2) securing inlet and outlet oil pipes to sump (see Figure 11).



Figure 11

21. Release both oil pipes together from sump, remove and discard O-ring seals from pipes.
22. Remove Torx bolts (x4) securing A/C compressor mounting bracket to engine bedplate and sump. Remove bracket (see Figure 12).

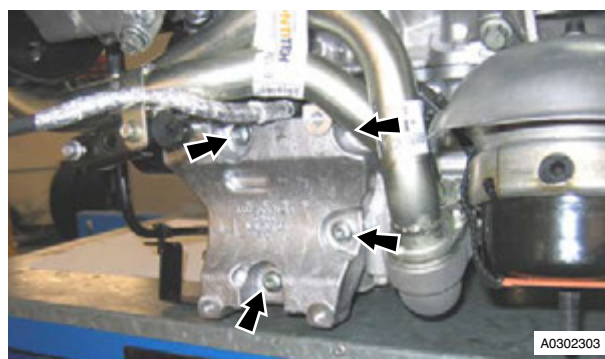


Figure 12

23. Remove bolts (x16) securing sump to engine bedplate (see Figure 13).

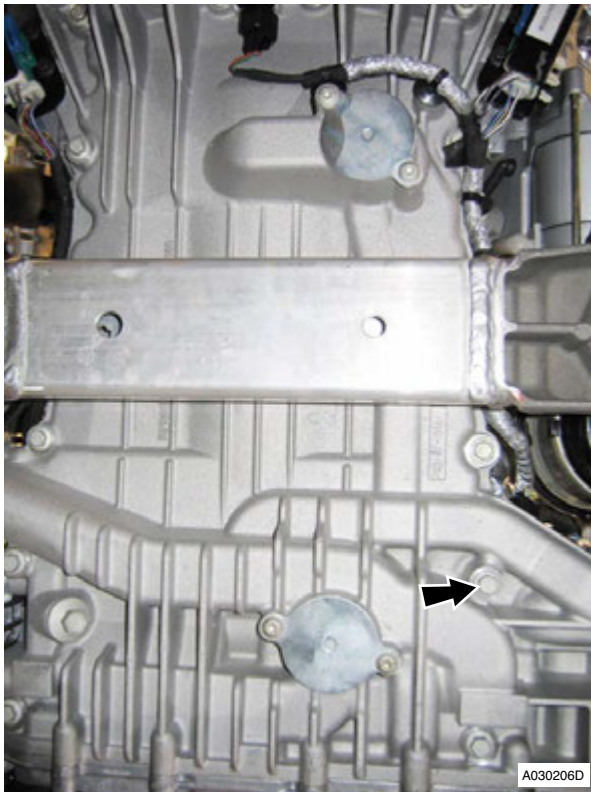


Figure 13

24. Release and remove sump.
25. Remove bolts (x8) securing windage tray to engine bedplate, remove windage tray.
26. Mark bearing caps and connecting rods for correct installation (see Figure 14).

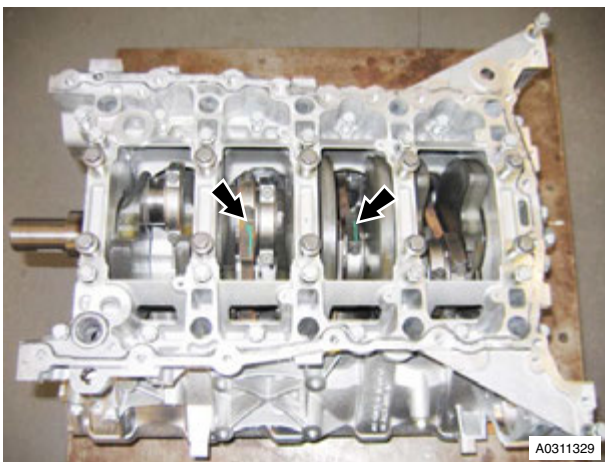


Figure 14

27. Rotate crankshaft clockwise to access number 1 cylinder connecting rod bolts.

28. Remove bolts (x16) securing bearing caps to connecting rods, remove bearing caps (see Figure 15).



Figure 15

Caution
Connecting rod bolts are torque tightened to yield and must be replaced.

29. Install special tools (303-535) to the connecting rod to prevent damage to crankshaft journal.
30. Carefully push each connecting rod/piston assembly upwards and remove from cylinder bores.
31. Remove special tools from connecting rods.
32. Install bearing caps on connecting rods, install and lightly tighten retaining bolts.
33. Note that piston grade number on crown and thick flange on connecting rod faces to front of engine on RH bank (A) (see Figure 16).

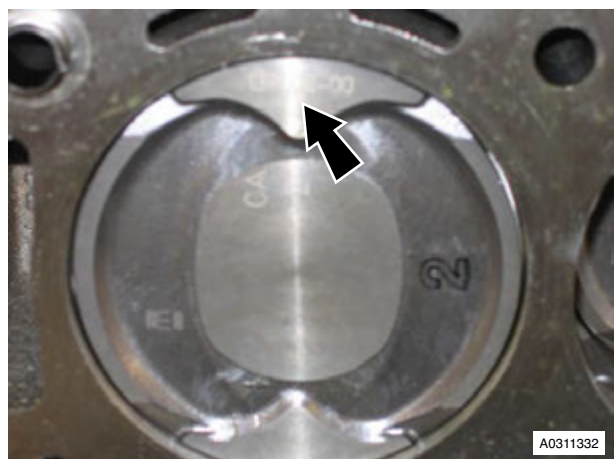


Figure 16

34. Note that piston grade number on crown and thick flange on connecting rod faces to front of engine on LH bank (B) (see Figure 17).

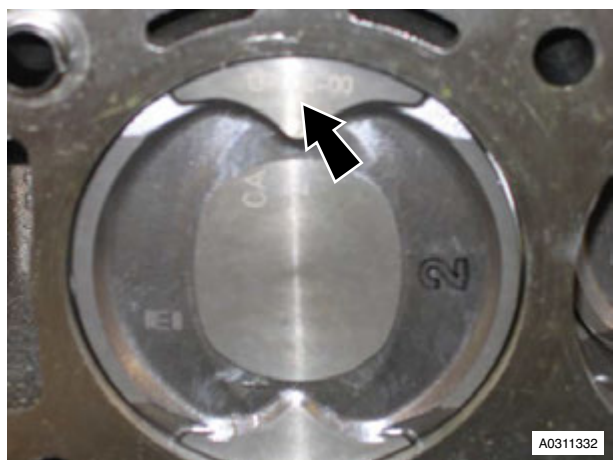


Figure 17

Installation

1. Clean cylinder bores.
2. Clean connecting rods,
3. Install pistons on connecting rods in their correct orientation, install circlip(s) (see Figure 18).



Figure 18

4. Correctly position ring gaps on pistons prior to installation.

Caution

Make sure the piston ring gaps are positioned at different positions opposite the thrust side of the piston before installation.

5. Remove connecting rod bearing caps.
6. Install bearings in connecting rods and bearing caps.
7. Lubricate cylinder bores, pistons and rings with clean engine oil.
8. Install special tools (303-535) to the connecting rod to prevent damage to crankshaft journal.

9. Install piston ring clamp to each piston in turn and install in its respective cylinder bore. Remove piston ring clamp (see Figure 19).



Figure 19

Caution

Install pistons into cylinder block with the 'arrow' on the piston crown facing to the front of the engine.

10. Lubricate crankshaft journals with clean engine oil.
11. Carefully pull each connecting rod into place on each crankshaft journal.
12. Install bearing caps to their relevant connecting rods. Install and torque tighten retaining bolts (x16).

Caution

When assembling connecting rods and connecting rod bearing caps it is imperative that bearing slots and tangs be located on the same side of the connecting rods.

13. Clean windage tray.
14. Install windage tray, install and torque tighten bolts (x8).
15. Clean old sealant from sump flange and engine bedplate.
16. Ensure that sump flange and mating face on engine bedplate are clean and dry.
17. Apply a continuous 3mm diameter bead of RTV sealant to sump flange as recommended.
18. Ensure that there are no gaps in sealant track.
19. Install sump, install and torque tighten bolts (x16) in the correct sequence.
20. Install A/C compressor mounting bracket, install and torque tighten Torx bolts (x4).
21. Lubricate and install new 'O' ring seals to oil pipes.
22. Install oil pipes in sump, install and torque tighten bolts (x2)
23. Install compressor, install and torque tighten bolts (x4).
24. Connect multiplug to A/C compressor.
25. Install LH and RH HEGO sensor multiplug brackets to sump. Install and torque tighten bolts (x4).
26. Secure harness clips (x6) in sump.
27. Connect multiplug to crankshaft timing sensor.
28. Connect multiplug to engine electric coolant temperature sensor.
29. Connect multiplug to oil pressure sensor.

30. Clean oil scavenge pump and mating face on sump.
31. Install oil pump(s) drive sprocket.
32. Install new oil scavenge pump gasket, align on dowels (x2).
33. Install chain onto oil scavenge pump sprocket.
34. Install oil scavenge pump, align to dowels (x2), Install and torque tighten bolts (x3).
35. Install chain onto oil pump drive sprocket.
36. Clean oil pressure pump and mating face on sump.
37. Install new gasket to sump, align to dowels (x2).
38. Position oil pressure pump, install chain on pump sprocket.
39. Install oil pressure pump, align to dowels (x2), Install and torque tighten bolts (x3).
40. Install chain tensioner, install and torque tighten bolt, remove guide pin.
41. Install crankshaft timing sprocket.
42. Install cylinder head gaskets - engine set (see Workshop Manual procedure 03.01.HW Gasket - Cylinder Head - Engine Set - Renew With Engine Removed).

Crankshaft Damper Pulley Assembly-Renew

Repair Operation Time (ROT)	
Item	Code
Crankshaft Damper Pulley Assembly-Renew	03.11.CP

Removal

1. Remove engine drive belt (see Workshop Manual procedure 03.05.AB Belt - Engine Drive - Renew).
2. Raise vehicle on ramp.
3. Remove bolts (x2), inspection cover to lower crankcase, remove cover.
4. Install tool (303-1185) to restrain flywheel, install and tighten bolts (x2).
5. Install thrust button of tool (303 -1186) in crankshaft, position tool in pulley, secure with bolts (x2). Tighten centre bolt, withdraw pulley from crankshaft.
6. Collect crankshaft pulley, locking ring and special tool thrust button.
7. Remove special tool from pulley.

8. Remove and discard O-ring seal from pulley (see Figure 1).

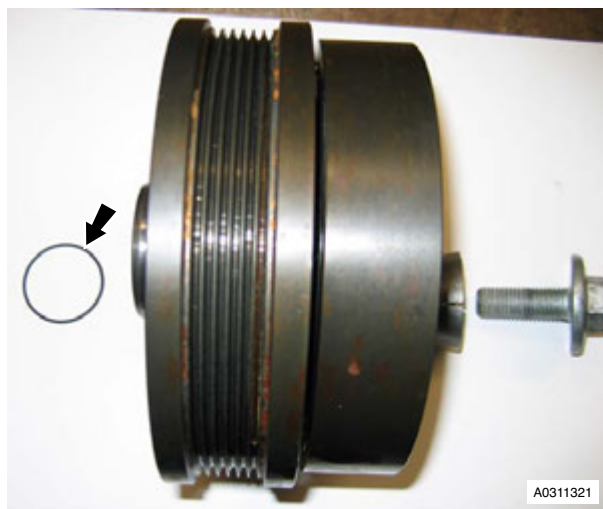


Figure 1

Installation

1. Clean crankshaft pulley, locking ring and mating face on crankshaft.

Caution

The bolt thread in the crankshaft must be cleaned out before a new crankshaft pulley retaining bolt is installed

2. Lubricate and install new O-ring seal in crankshaft pulley.
3. Install crankshaft pulley, locking ring and new pulley bolt.
4. Torque tighten crankshaft pulley bolt. Remove special tool (303-1185) from crankcase.
5. Install inspection cover to lower crankcase, install and tighten bolts (x2).
6. Lower vehicle on ramp.
7. Install engine drive belt (see Workshop Manual procedure 03.05.AB Belt - Engine Drive - Renew).

Crankshaft Front Oil Seal-Renew

Repair Operation Time (ROT)	
Item	Code
Crankshaft Front Oil Seal-Renew	03.11.CQ

Removal

1. Battery isolation switch 'OFF'.
2. Raise vehicle on ramp.
3. Remove crankshaft pulley (see Workshop Manual procedure 03.11.CP Pulley Assembly - Crankshaft Damper - Renew).

4. Install tool (303-1190) into crankshaft front oil seal (see Figure 1).
3. Position new oil seal (fitted dry). Install oil seal in timing cover using tool (303-750) (see Figure 3).



Figure 1

5. Tighten centre bolt of tool (303-1190) and withdraw oil seal from timing cover (see Figure 2).
4. Remove crankshaft oil seal protector.

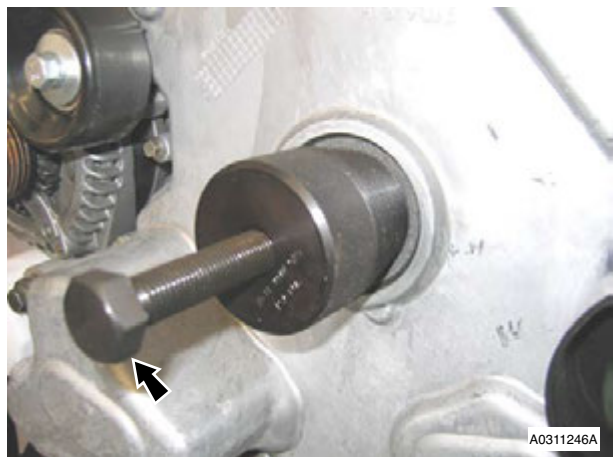


Figure 2

6. Remove seal from special tool.

Installation

1. Clean oil seal aperture in timing cover.

Caution

Caution: Make sure the crankshaft front oil seal mating faces are clean and dry.

Caution

Do not remove the crankshaft front oil seal protector until the oil seal is correctly installed.

2. Do NOT remove protector from oil seal.



Figure 3

5. Install crankshaft pulley (see Workshop Manual procedure 03.11.CP Pulley Assembly - Crankshaft Damper - Renew).
6. Lower vehicle on ramp.
7. Battery isolation switch 'ON'.

Rear Oil Crankshaft Seal-Renew

Repair Operation Time (ROT)	
Item	Code
Rear Oil Crankshaft Seal-Renew	03.11.CR

Removal

1. Remove clutch and flywheel assembly (see Workshop Manual procedure 08.00.AA Clutch and Flywheel Assembly - Renew).
2. Position tool (303 -1189) to crankshaft flange, screw in alignment bolts (x2) 1.5 turns (only).
3. Use tool and pierce holes (x3) in oil seal through holes in special tool for self-tapping screws
4. Install and tighten self-tapping screws (x3) into oil seal.
5. Tighten centre bolt of tool (303-1189) and withdraw crankshaft oil seal.
6. Remove oil seal from special tool, discard oil seal.

Installation

1. Clean oil seal aperture in cylinder block.

Caution

Do not use any lubricant on crankshaft oil seals or seal protectors. Make sure all components are clean and dry.

2. Ensure that oil seal protector is positioned correctly and install oil seal onto crankshaft flange.
3. Install tool (303-1189) to crankshaft, position nuts on tool against oil seal.



4. Ensure that oil seal and special are parallel to rear of engine.

Caution
Alternate nut tightening to correctly seat the crankshaft rear oil seal.

5. To install oil seal, tighten nuts alternately on tool (303-1189) until oil seal correctly seated.
6. Remove special tool from crankshaft.
7. Check that the oil seal is located correctly.
8. Install clutch and flywheel assembly (see Workshop Manual procedure 08.00.AA Clutch and Flywheel Assembly - Renew).

Cylinder Block-Renew

Repair Operation Time (ROT)	
Item	Code
Cylinder Block-Renew	03.11.CU

Removal

WARNING
DO NOT GET USED ENGINE OIL ON YOUR SKIN.
USED ENGINE OIL CAN BE HARMFUL.

1. Remove cylinder head gasket - engine set (see Workshop Manual procedure 03.01.HW Gasket - Cylinder Head - Engine Set - Renew With Engine Removed).
2. Remove crankshaft assembly.
3. Remove pistons and connecting rod assemblies from cylinder block.
4. Remove Torx screws (x4) securing engine oil cooling valves to cylinder block.
5. Remove engine oil cooling valves (x4).
6. Remove bolts (x5) securing water pump to cylinder block. Remove water pump, discard gasket.
7. Remove cylinder block valley cover.

Installation

1. Clean cylinder block valley cover and mating face on cylinder block.
2. Install cylinder block valley cover.
3. Clean engine oil cooling valves.
4. Install engine oil cooling valves in cylinder block.
5. Install and torque tighten Torx screws (x4).
6. Clean connecting rods and piston assemblies.
7. Correctly position ring gaps on pistons prior to installation.
8. Remove connecting rod bearing caps.
9. Install bearings in connecting rods and bearing caps.
10. Lubricate cylinder bores, pistons and rings with clean engine oil.
11. Install special tools (303-535) to the connecting rod to prevent damage to crankshaft journal.
12. Install crankshaft assembly.
13. Install new gasket, water pump, install and torque tighten bolts (x5).

14. Install cylinder head gasket - engine set (see Workshop Manual procedure 03.01.HW Gasket - Cylinder Head - Engine Set - Renew With Engine Removed).

Crankshaft Damper Pulley Assembly-Renew (with Engine Removed)

Repair Operation Time (ROT)	
Item	Code
Crankshaft Damper Pulley Assembly-Renew	03.11.DP

Removal

1. Remove engine assembly (see Workshop Manual procedure 03.00.AA Engine Assembly - Renew).
2. Release drive belt tensioner, release drive belt from idler pulley (see Figure 1).

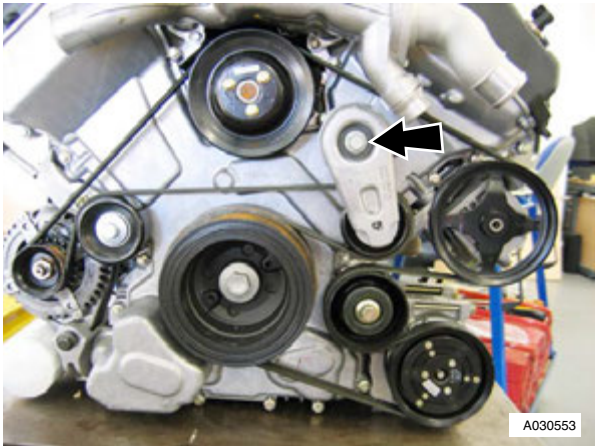
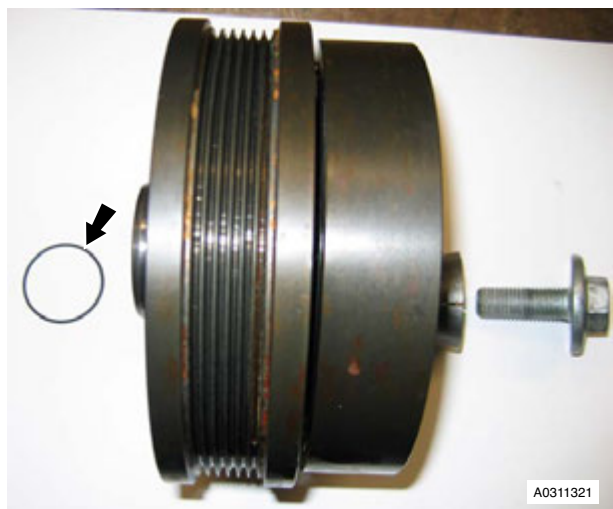


Figure 1

3. Remove bolt securing drive belt tensioner to engine timing cover, remove tensioner.
4. Remove drive belt from pulleys.
5. Remove bolts (x2), inspection cover to lower crankcase, remove cover.
6. Install tool (303-1185) to restrain flywheel, install and tighten bolts (x2).
7. Install thrust button of tool (303-1186) in crankshaft, position tool in pulley, secure with bolts (x2). Tighten centre bolt, withdraw pulley from crankshaft.
8. Collect crankshaft pulley, locking ring and special tool thrust button.
9. Remove special tool from pulley.

10. Remove and discard O-ring seal from pulley (see Figure 2).
2. Install tool (303-1190) into crankshaft front oil seal (see Figure 1).

**Figure 2**

Installation

1. Clean crankshaft pulley, locking ring and mating face on crankshaft.
2. Lubricate and install new O-ring seal in crankshaft pulley.
3. Install crankshaft pulley, locking ring and new pulley bolt.
4. Torque tighten crankshaft pulley bolt. Remove special tool (303-1185) from crankcase.
5. Install inspection cover to lower crankcase, install and tighten bolts (x2).
6. Install drive belt on pulleys.
7. Install drive belt tensioner, install and torque tighten bolt.
8. Release tensioner and install drive belt onto idler pulley.
9. Install engine assembly (see Workshop Manual procedure 03.00.AA Engine Assembly - Renew).

Crankshaft Front Oil Seal-Renew (with Engine Removed)

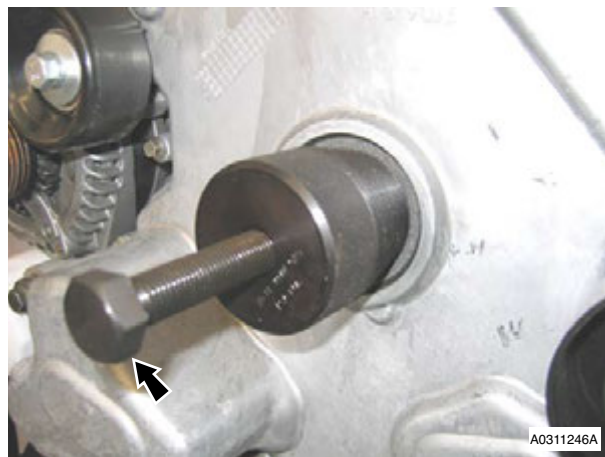
Repair Operation Time (ROT)	
Item	Code
Crankshaft Front Oil Seal-Renew	03.11.DQ

Removal

1. Remove crankshaft pulley (see Workshop Manual procedure 03.11.DP Pulley Assembly - Crankshaft Damper - Renew With Engine Removed).

**Figure 1**

3. Tighten centre bolt of tool (303-1190) and withdraw oil seal from timing cover (see Figure 2).

**Figure 2**

4. Remove seal from special tool.

Installation

1. Clean oil seal aperture in timing cover.

Caution

Make sure the crankshaft front oil seal mating faces are clean and dry.

Caution

Do not remove the crankshaft front oil seal protector until the oil seal is correctly installed.

2. Do NOT remove protector from oil seal.



3. Position new oil seal (fitted dry). Install oil seal in timing cover using tool (303-750) (see Figure 3).



Figure 3

4. Remove crankshaft oil seal protector.
5. Install crankshaft pulley (see Workshop Manual procedure 03.11.DP Pulley Assembly - Crankshaft Damper - Renew With Engine Removed).

Crankshaft Rear Oil Seal-Renew (with Engine Removed)

Repair Operation Time (ROT)	
Item	Code
Crankshaft Rear Oil Seal-Renew	03.11.DR

Removal

1. Remove engine assembly (see Workshop Manual procedure 03.00.AA Engine Assembly - Renew).
2. Remove bolts (x2), inspection cover to lower crankcase, remove cover.
3. Install tool (303-1185) to restrain flywheel, install and tighten bolts (x2).
4. Remove bolts (x6), clutch cover to flywheel.
5. Release clutch cover from dowels (x3), remove clutch cover, collect drive plate.
6. Remove and discard bolts (x8), flywheel to crankshaft flange.
7. Remove bolts (x2), collect tool (303-1185).
8. Release flywheel from dowel, remove flywheel.
9. Position tool (303-1189) to crankshaft flange, screw in alignment bolts (x2) 1.5 turns (only).
10. Use tool and pierce holes (x3) in oil seal through holes in special tool for self-tapping screws
11. Install and tighten self-tapping screws (x3) into oil seal.
12. Tighten centre bolt of tool (303-1189) and withdraw crankshaft oil seal.
13. Remove oil seal from special tool, discard oil seal.

Installation

1. Clean oil seal aperture in cylinder block.

Caution

Do not use any lubricant on crankshaft oil seals or seal protectors. Make sure all components are clean and dry

2. Ensure that oil seal protector is positioned correctly and install oil seal onto crankshaft flange.
3. Install tool (303-1189) to crankshaft, position nuts on tool against oil seal.
4. Ensure that oil seal and special are parallel to rear of engine.

Caution

Alternate nut tightening to correctly seat the crankshaft rear oil seal.

5. To install oil seal, tighten nuts alternately on tool (303-1189) until oil seal correctly seated.
6. Remove special tool from crankshaft.
7. Check that the oil seal is located correctly.
8. Clean flywheel and mating face on crankshaft.
9. Install flywheel, align to dowel on crankshaft flange.
10. Install new bolts (x8), install tool (303-1185) to restrain flywheel. Torque tighten bolts (x8) in the correct sequence.
11. Clean clutch cover and drive plate.
12. Install clutch assembly on flywheel, align to dowels (x3).
13. Install bolts (x6), install clutch alignment tool, evenly torque tighten bolts (x6) in a diagonal sequence. Remove clutch alignment tool.
14. Remove bolts (x2), collect tool (303-1185).
15. Install inspection cover, install and torque tighten bolts (x2).
16. Install engine assembly (see Workshop Manual procedure 03.00.AA Engine Assembly - Renew).

Engine (03.00)

Air Charging (03.12)**Maintenance****Clean Air Duct - Remove and Install**

Repair Operation Time (ROT)	
Item	Code
Clean Air Duct - Right Side - Remove and Install	03.12.BC
Clean Air Duct - Left Side - Remove and Install	03.12.BD

Remove

1. Raise the vehicle and make it safe.
2. Remove the front road wheel at the side for the clean air duct to be removed.
3. Apply protective tape to the wheelarch area of the front wing to prevent damage.
4. Remove the front outside screw that attaches the valance.
5. Move the valance away to get access to the wheelarch liner attachment screws (refer to Figure 1).

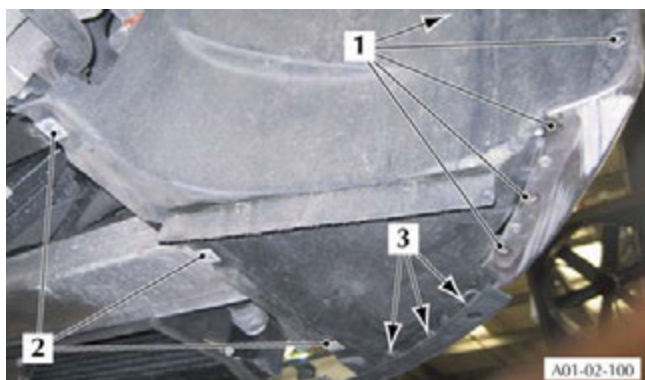


Figure 1 - Front Wheelarch Liner Attachment (Right side shown)

6. Remove the five screws (1) that attach the wheelarch liner to the bumper.
7. Remove the three M6 Torx screws (2) that attach the wheelarch liner to the front undertray.
8. Remove the three screws (3) that attach the wheelarch liner to the front valance.
9. Move the wheelarch liner away to get access to the clean air duct (duct).
10. Disconnect the clip that attaches the duct to the mass air-flow meter.
11. Remove the duct from the mass air-flow meter.
12. Lower the vehicle.
13. Disconnect the clip that attaches the duct to the throttle body adaptor.
14. Remove the duct from the throttle body adaptor.
15. Remove the duct from the support clip.

Install

1. Install the duct into the support clip.

2. Install the duct to the throttle body adaptor.
3. Install the clip to attach the duct to the throttle body adaptor.
4. Raise the vehicle and make it safe.
5. Connect the duct to the mass air-flow meter.
6. Install the clip to attach the duct to the mass air-flow meter.
7. Connect the duct to the mass air-flow meter.
8. Install the clip that attaches the duct to the mass air-flow meter.
9. Put the wheelarch liner into position.
10. Install the three screws (3) that attach the wheelarch liner to the front valance.
11. Install the three M6 Torx screws (2) that attach the wheelarch liner to the front undertray.
12. Install the five screws (1) that attach the wheelarch liner to the bumper.
13. Make sure that the valance is in the correct position.
14. Install the front outside screw that attaches the valance.
15. Remove the protective tape from the wheelarch area of the front wing.
16. Install the front right road wheel.
17. Lower the vehicle.

Engine Air Filter - Remove and Install

Repair Operation Time (ROT)	
Item	Code
Engine Air Filter - Right Side - Remove and Install	03.12.CB
Engine Air Filter - Left Side - Remove and Install	03.12.DB

Remove

1. Raise the vehicle and make it safe.
2. Remove the front road wheel at the side of the air filter to be removed.
3. Apply protective tape to the wheelarch area of the front wing to prevent damage.
4. Remove the front outside screw that attaches the valance.



5. Move the valance away to get access to the wheelarch liner attachment screws (refer to Figure 1).

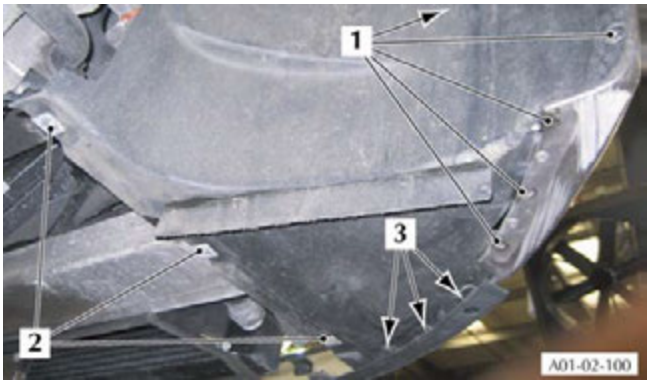


Figure 1 - Front Wheelarch Liner Attachment (Right side shown)

6. Remove the five screws (1) that attach the wheelarch liner to the bumper.
7. Remove the three M6 Torx screws (2) that attach the wheelarch liner to the front undertray.
8. Remove the three screws (3) that attach the wheelarch liner to the front valance.
9. Move the wheelarch liner away to get access to the air filter box.
10. Remove the seven self-tapping screws that attach the base of the air cleaner.
11. Remove the the base of the air cleaner.
12. Remove the air filter element.

Installation

1. Clean the air cleaner box and base.
2. Install the air filter element.
3. Remove the the base of the air cleaner.
4. Install the seven self-tapping screws that attach the base of the air cleaner.
5. Put the wheelarch liner back into position.
6. Install the three screws (3) that attach the wheelarch liner to the front valance (refer to Figure 1).
7. Install the three M6 Torx screws (2) that attach the wheelarch liner to the front undertray.
8. Install the five screws (1) that attach the wheelarch liner to the bumper.
9. Make sure that the valance is in the correct position.
10. Install the front outside screw that attaches the valance.
11. Remove the protective tape from the wheelarch.
12. Install the front road wheel.
13. Lower the vehicle.

Engine Air Cleaner Assembly - Remove and Install

Repair Operation Time (ROT)	
Item	Code
Engine Air Cleaner Assembly - Right Side - Remove and Install	03.12.DJ
Engine Air Cleaner Assembly - Left Side - Remove and Install	03.12.DH

Remove

1. Raise the vehicle and make it safe.
2. Remove the front road wheel at the side for the air filter box to be removed.
3. Apply protective tape to the wheelarch area of the front wing to prevent damage.
4. Remove the front outside screw that attaches the valance.
5. Move the valance away to get access to the wheelarch liner attachment screws (refer to Figure 1).

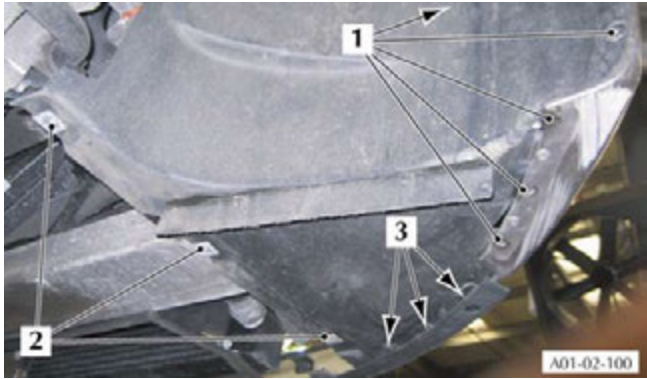


Figure 1 - Front Wheelarch Liner Attachment (Right side shown)

6. Remove the five screws (1) that attach the wheelarch liner to the bumper.
7. Remove the three M6 Torx screws (2) that attach the wheelarch liner to the front undertray.
8. Remove the three screws (3) that attach the wheelarch liner to the front valance.
9. Move the wheelarch liner away to get access to the air filter box.
10. Remove the self-tapping screw that attaches the mass air-flow meter to the air filter box.
11. Disconnect the mass air-flow meter from the air filter box.
12. Disconnect the air inlet duct from the air filter box .
13. Remove the three M6 screws that attach the air filter box.
14. Remove the air filter box.

Install

1. Put the air filter box in position.
2. Install the three M6 screws that attach the air box.
3. Connect the air inlet duct to the air filter box.
4. Connect the mass air-flow meter to the air filter box

5. Install the self-tapping screw that attaches the mass air-flow meter to the air filter box.
6. Put the wheelarch liner back into position.
7. Install the three screws (3) that attach the wheelarch liner to the front valance (refer to Figure 1).
8. Install the three M6 Torx screws (2) that attach the wheelarch liner to the front undertray.
9. Install the five screws (1) that attach the wheelarch liner to the bumper.
10. Make sure that the valance is in the correct position.
11. Install the front outside screw that attaches the valance.
12. Remove the protective tape from the wheelarch.
13. Install the front road wheel.
14. Lower the vehicle.



ASTON MARTIN

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Engine (03.00)

Evaporative Emissions (03.13)

Description

The evaporative loss system prevents escape of fuel vapours into the atmosphere.

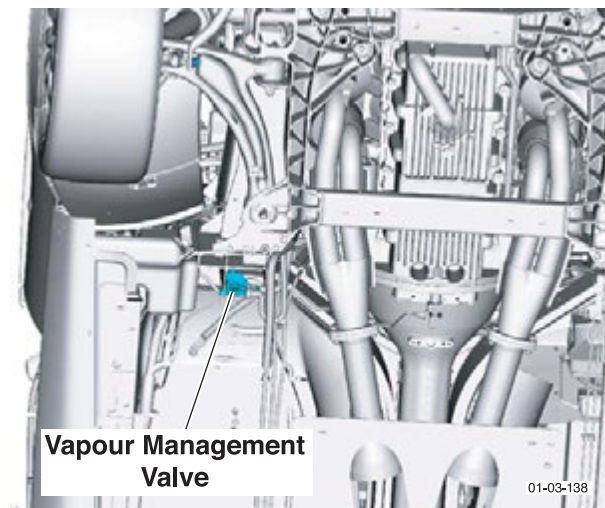
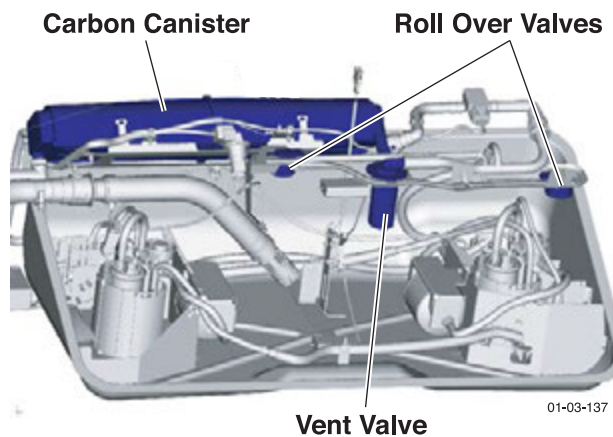
Fuel vapour is displaced from the fuel tank during filling. Vapour is also displaced due to fuel evaporation in higher temperatures. Displaced fuel vapour is absorbed in the carbon canister filter located on top of the fuel tank.

During normal engine running, absorbed fuel vapour is purged from the carbon canisters and mixed with the normal fuel/air charge in the inlet manifold.

System Operation

Displaced fuel vapour leaves the fuel tank via the normally open fill level vent valve and the roll over valves. It passes through the carbon canister where fuel hydrocarbons are absorbed. Clean air leaves the system via the normally open canister vent valve. This valve is only closed during diagnostic pressure testing of the fuel system.

During normal engine running, the single vapour management valve in the engine bay is periodically opened allowing fresh air flow into the open canister vent valve, through the carbon canister, through the vapour management valve and into the primary inlet manifold. This fresh air flow progressively purges any absorbed fuel vapour from the carbon canister.





ASTON MARTIN

Engine (03.00)

Engine Management System (03.14)

Maintenance

Right Engine Control Module - Renew

Repair Operation Time (ROT)		
Item	Code	
Engine Control Module - Renew	RH	03.14.BB

Removal

1. Disconnect the battery.
2. Raise the vehicle and make it safe.
3. Remove the right front wheel arch liner (refer to Workshop Manual procedure 01.02.GB Wheel Arch Liner - Front - RH - Renew).
4. Disconnect the electrical connector from the right indicator repeater light unit.
5. Remove the four fir-tree clips that attach the electrical harness for the indicator repeater and screen wash system.
6. Remove the two fir tree clips that attach the electrical harness for the ECM harness.
7. Remove the three screws that attach the ECM cover plate (the ECM and cover plate will fall).
8. Disconnect the three electrical connectors from the ECM.
9. Remove the ECM.

Installation

1. Put the ECM in position.
2. Connect the three electrical connectors to the ECM (through the cover plate).
3. Attach the ECM and the cover plate with the three screws.
4. Attach the ECM harness with the two fir-tree clips.
5. Attach the electrical harness for the repeater light and screen wash system with the three fir-tree clips.
6. Connect the electrical connector to the repeater light.
7. Install the wheel arch liner (refer to Workshop Manual procedure 01.02.GB Wheel Arch Liner - Front - RH - Renew).
8. Lower the vehicle.
9. Connect the battery.
10. Do a functional check of the WDS (refer to Workshop Manual procedure 00.06.AD WDS Operation - Check).

LH Front Lower Heated Exhaust Gas Oxygen (HEGO) Sensor - Renew

Repair Operation Time (ROT)		
Item	Code	
Front Lower Heated Exhaust Gas Oxygen (HEGO) Sensor - Renew	LH	03.14.CB

Removal

1. Raise vehicle on ramp.

WARNING
THE EXHAUST SYSTEM WILL BE VERY HOT AFTER OPERATION. LET THE EXHAUST SYSTEM COOL BEFORE YOU DO WORK. IF YOU DO NOT, SEVERE INJURY CAN OCCUR.

2. Remove rear exhaust silencer (refer to Workshop Manual procedure 09.00.KA Silencer and Bypass Valve Assembly - Remove for Access and Refit).
3. Disconnect multiplugs (x2), HEGO sensors.
4. Secure sufficient lengths of string to HEGO sensor multiplugs for assembly purposes.
5. Loosen LH and RH clamp nuts, catalysts to centre pipes.
6. With assistance, manoeuvre exhaust centre pipe assembly rearwards to release from catalysts.
7. Remove nuts (x3), catalyst to exhaust manifold.
8. Release and support weight of LH catalyst from exhaust manifold.
9. Manoeuvre HEGO sensor leads and remove cable tie. Release HEGO sensor leads from behind heat shield. Remove string from HEGO multiplugs.
10. Remove catalyst assembly.
11. Remove and discard gasket.
12. Remove HEGO sensors from catalyst.

Installation

1. Clean catalyst, mating joint faces and HEGO sensors.
2. Install and tighten HEGO sensor to catalyst.
3. Apply proprietary exhaust sealant around clamp joints.
4. Install new gasket to exhaust manifold.
5. Position catalyst, secure string (x2) to HEGO multiplugs, feed sensor leads behind heat shield. Install catalyst to exhaust manifold.
6. Install and tighten nuts (x3), catalyst to exhaust manifold.
7. Align centre pipe assembly to catalyst, tighten clamp nuts.
8. Remove string (x2), connect multiplugs (x2), HEGO sensors.
9. Install rear exhaust silencer (refer to Workshop Manual procedure 09.00.KA Silencer and Bypass Valve Assembly - Remove for Access and Refit).
10. Lower vehicle on ramp.

LH Front Upper Heated Exhaust Gas Oxygen (HEGO) Sensor - Renew

Repair Operation Time (ROT)		
Item	Code	
Front Upper Heated Exhaust Gas Oxygen (HEGO) Sensor - Renew	LH	03.14.EB



Removal

1. Raise vehicle on ramp.

WARNING

THE EXHAUST SYSTEM WILL BE VERY HOT AFTER OPERATION. LET THE EXHAUST SYSTEM COOL BEFORE YOU DO WORK. IF YOU DO NOT, SEVERE INJURY CAN OCCUR.

2. Remove rear exhaust silencer (refer to Workshop Manual procedure 09.00.KA Silencer and Bypass Valve Assembly - Remove for Access and Refit).
3. Disconnect multiplugs (x2), HEGO sensors.
4. Secure sufficient lengths of string to HEGO sensor multiplugs for assembly purposes.
5. Loosen LH and RH clamp nuts, catalysts to centre pipes.
6. With assistance, manoeuvre exhaust centre pipe assembly rearwards to release from catalysts.
7. Remove nuts (x3), catalyst to exhaust manifold.
8. Release and support weight of LH catalyst from exhaust manifold.
9. Manoeuvre HEGO sensor leads and remove cable tie. Release HEGO sensor leads from behind heat shield. Remove string from HEGO multiplugs.
10. Remove catalyst assembly.
11. Remove and discard gasket.
12. Remove HEGO sensors from catalyst.

Installation

1. Clean catalyst, mating joint faces and HEGO sensors.
2. Install and tighten HEGO sensor to catalyst.
3. Apply proprietary exhaust sealant around clamp joints.
4. Install new gasket to exhaust manifold.
5. Position catalyst, secure string (x2) to HEGO multiplugs, feed sensor leads behind heat shield. Install catalyst to exhaust manifold.
6. Install and tighten nuts (x3), catalyst to exhaust manifold.
7. Align centre pipe assembly to catalyst, tighten clamp nuts to.
8. Remove string (x2), connect multiplugs (x2), HEGO sensors.
9. Install rear exhaust silencer (refer to Workshop Manual procedure 09.00.KA Silencer and Bypass Valve Assembly - Remove for Access and Refit).
10. Lower vehicle on ramp.

RH Front Upper Heated Exhaust Gas Oxygen (HEGO) Sensor - Renew

Repair Operation Time (ROT)		
Item	Code	
Front Upper Heated Exhaust Gas Oxygen (HEGO) Sensor - Renew	RH	03.14.GB

Removal

1. Raise vehicle on ramp.

WARNING

THE EXHAUST SYSTEM WILL BE VERY HOT AFTER OPERATION. LET THE EXHAUST SYSTEM COOL BEFORE YOU DO WORK. IF YOU DO NOT, SEVERE INJURY CAN OCCUR

2. Remove rear exhaust silencer (refer to Workshop Manual procedure 09.00.KA Silencer and Bypass Valve Assembly - Remove for Access and Refit).
3. Disconnect multiplugs (x2), HEGO sensors.
4. Secure sufficient lengths of string to HEGO sensor multiplugs for assembly purposes.
5. Loosen LH and RH clamp nuts, catalysts to centre pipes.
6. With assistance, manoeuvre exhaust centre pipe assembly rearwards to release from catalysts.
7. Remove nuts (x3), catalyst to exhaust manifold.
8. Release and support weight of LH catalyst from exhaust manifold.
9. Manoeuvre HEGO sensor leads and remove cable tie. Release HEGO sensor leads from behind heat shield. Remove string from HEGO multiplugs.
10. Remove catalyst assembly.
11. Remove and discard gasket.
12. Remove HEGO sensors from catalyst.

Installation

1. Clean catalyst, mating joint faces and HEGO sensors.
2. Install and tighten HEGO sensor to catalyst.
3. Apply proprietary exhaust sealant around clamp joints.
4. Install new gasket to exhaust manifold.
5. Position catalyst, secure string (x2) to HEGO multiplugs, feed sensor leads behind heat shield. Install catalyst to exhaust manifold.
6. Install and tighten nuts (x3), catalyst to exhaust manifold.
7. Align centre pipe assembly to catalyst, tighten clamp nuts to.
8. Remove string (x2), connect multiplugs (x2), HEGO sensors.
9. Install rear exhaust silencer (refer to Workshop Manual procedure 09.00.KA Silencer and Bypass Valve Assembly - Remove for Access and Refit).
10. Lower vehicle on ramp.

RH Rear Lower Heated Exhaust Gas Oxygen (HEGO) Sensor - Renew

Repair Operation Time (ROT)		
Item	Code	
Rear Lower Heated Exhaust Gas Oxygen (HEGO) Sensor - Renew		03.14.JB

Removal

1. Raise vehicle on ramp.

WARNING
THE EXHAUST SYSTEM WILL BE VERY HOT AFTER OPERATION. LET THE EXHAUST SYSTEM COOL BEFORE YOU DO WORK. IF YOU DO NOT, SEVERE INJURY CAN OCCUR

2. Remove rear exhaust silencer (refer to Workshop Manual procedure 09.00.KA Silencer and Bypass Valve Assembly - Remove for Access and Refit).
 3. Disconnect multiplugs (x2), HEGO sensors.
 4. Secure sufficient lengths of string to HEGO sensor multiplugs for assembly purposes.
 5. Loosen LH and RH clamp nuts, catalysts to centre pipes.
 6. With assistance, manoeuvre exhaust centre pipe assembly rearwards to release from catalysts.
 7. Remove nuts (x3), catalyst to exhaust manifold.
 8. Release and support weight of LH catalyst from exhaust manifold.
 9. Manoeuvre HEGO sensor leads and remove cable tie. Release HEGO sensor leads from behind heat shield. Remove string from HEGO multiplugs.
 10. Remove catalyst assembly.
 11. Remove and discard gasket.
 12. Remove HEGO sensors from catalyst.
1. Disconnect the battery ground cable.
 2. Remove the wheel and tyre. (refer to Workshop Manual procedure 04.04.EC - Wheel and Tyre)
 3. Remove the six rear screws that attach the wheel-arch liner to the body.
 4. Remove the rear screw that attaches the wheel-arch liner to the body.
 5. Turn the steering fully to the right.
 6. Move the wheel arch liner to get access to the Powertrain Control Module (PCM).
 7. Disconnect the electrical connector from the direction indicator.
 8. Release the four fir-tree clips that attach the wiring harness for the direction indicator and the screen wash system.
 9. Release the two fir tree clips that attach the wiring harness for the PCM.
 10. Remove the three bolts that attach the PCM bottom bracket and PCM to the PCM top bracket.
 11. Disconnect the three electrical connectors from the PCM.
 12. Remove the PCM.

Install

1. Clean catalyst, mating joint faces and HEGO sensors.
 2. Install and tighten HEGO sensor to catalyst.
 3. Apply proprietary exhaust sealant around clamp joints.
 4. Install new gasket to exhaust manifold.
 5. Position catalyst, secure string (x2) to HEGO multiplugs, feed sensor leads behind heat shield. Install catalyst to exhaust manifold.
 6. Install and tighten nuts (x3), catalyst to exhaust manifold.
 7. Align centre pipe assembly to catalyst, tighten clamp nuts to.
 8. Remove string (x2), connect multiplugs (x2), HEGO sensors.
 9. Install rear exhaust silencer (refer to Workshop Manual procedure 09.00.KA Silencer and Bypass Valve Assembly - Remove for Access and Refit).
 10. Lower vehicle on ramp.
1. Put the PCM in position.
 2. Connect the three electrical connectors to the PCM.
 3. Align the PCM to the top bracket.
 4. Align the bottom bracket to the PCM.
 5. Install and tighten the three bolts that attach the PCM bottom bracket and PCM to the PCM top bracket.
 6. Install the two fir tree clips that attach the wiring harness for the PCM.
 7. Attach the four fir-tree clips that attach the wiring harness for the direction indicator and the screen wash system.
 8. Connect the electrical connector to the direction indicator.
 9. Put the wheel-arch liner into the correct position.
 10. Install and tighten the rear screw that attaches the wheel-arch liner to the body.
 11. Install and tighten the six rear screws that attach the wheel-arch liner to the body.
 12. Move the steering to the centre position.
 13. Connect the battery ground cable.
 14. Install the wheel and tyre. (04.04.EC - Wheel and Tyre)
 15. Connect AMDS.
 16. Use AMDS to do a test of the PCM. (00.06.AD - AMDS Operation Check)

Left Side Powertrain Control Module (PCM) (Coupe Only) - Remove and Install

Repair Operation Time (ROT)	
Item	Code
Left Side Powertrain Control Module (PCM) (Coupe) - Remove and Install	03.14.NA

Remove



Left Side Powertrain Control Module (PCM) (Roadster Only) - Remove and Install

Repair Operation Time (ROT)	
Item	Code
Left Side Powertrain Control Module (PCM) (Roadster) - Remove and Install	03.14.NA

Remove

1. Disconnect the battery ground cable.
2. Lift the vehicle on a four-post lift.
3. Remove the centre undertray. (refer to Workshop Manual procedure 01.02.MB - Centre Undertray)
4. Lower the vehicle.
5. Lift the vehicle on a two-post lift.
6. Remove the wheel and tyre. (refer to Workshop Manual procedure 04.04.EC - Wheel and Tyre)
7. Remove the six rear screws that attach the wheel-arch liner to the body.
8. Remove the rear screw that attaches the wheel-arch liner to the body.
9. Turn the steering fully to the right.
10. Move the wheel-arch liner to get access to the Powertrain Control Module (PCM).
11. Disconnect the electrical connector from the direction indicator.
12. Release the four fir tree clips that attach the wiring harness for the direction indicator and the screen wash system.
13. Release the two fir tree clips that attach the wiring harness for the PCM.
14. Remove the three screws that attach the PCM bottom bracket and PCM to the PCM top bracket.
15. Disconnect the three electrical connectors from the PCM.
16. Remove the PCM.

Install

1. Put the PCM in position.
2. Connect the three electrical connectors to the PCM.
3. Align the PCM with the top bracket.
4. Align the bottom bracket with the PCM.
5. Install and tighten the three screws that attach the PCM bottom bracket and PCM to the PCM top bracket.
6. Install the two fir tree clips that attach the wiring harness for the PCM.
7. Attach the four fir tree clips that attach the wiring harness for the indicator and the screen wash system.
8. Connect the electrical connector to the indicator.
9. Put the wheel-arch liner into the correct position.
10. Install and tighten the rear screw that attaches the wheel-arch liner to the body.

11. Install and tighten the six rear screws that attach the wheel-arch liner to the body.
12. Install the centre undertray. (refer to Workshop Manual procedure 01.02.MB - Centre Undertray)
13. Install the wheel and tyre. (refer to Workshop Manual procedure 04.04.EC - Wheel and Tyre)
14. Move the steering to the centre position.
15. Connect the battery ground cable.

Engine (03.00)

Throttle Control (03.16)

Description

Motorised Throttles

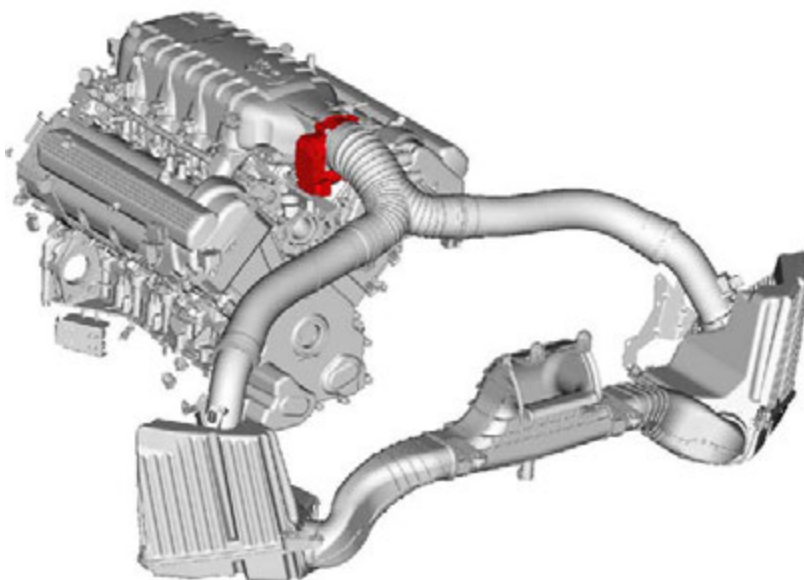
The motorised throttle allows accurate control of the inlet air.

A throttle position sensor (TPS) is incorporated into the throttle unit. During normal engine run, TPS signals are used by the PCM to indicate power demand from the engine. If not already at the desired position, the PCM will drive the throttle motor to open or close the throttle by the required amount.

At idle, the throttle butterfly is almost closed and idle speed is controlled by small throttle movements.

The throttle butterfly is spring loaded to fail in the idle position. In the event of the throttle butterfly spring failing, air flow will allow the throttle butterflies to fail in the idle position.

No set-up procedure is required.





ASTON MARTIN

Engine System (03.00)

Foot Operated Control (03.18)

Maintenance

Throttle Pedal Assembly-Renew

Repair Operation Time (ROT)	
Item	Code
Throttle Pedal Assembly-Renew	03.18.AC

Removal

1. Remove drivers seat (see Workshop Manual procedure 01.10.AB Seat Assembly - Front - LH - Remove for Access and Refit).
2. Remove securing bolts (3) (see Figure 1).

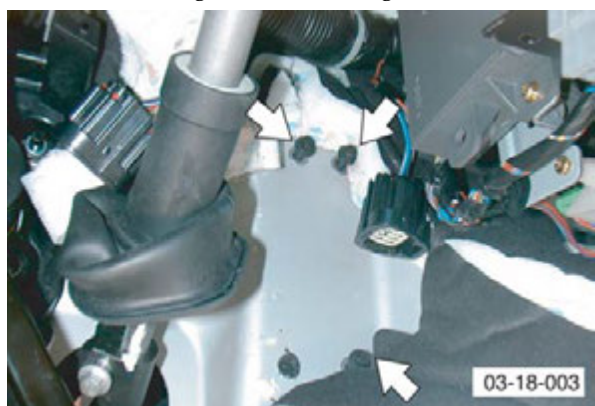


Figure 1

3. With unit free, disconnect two connectors (see Figure 2).

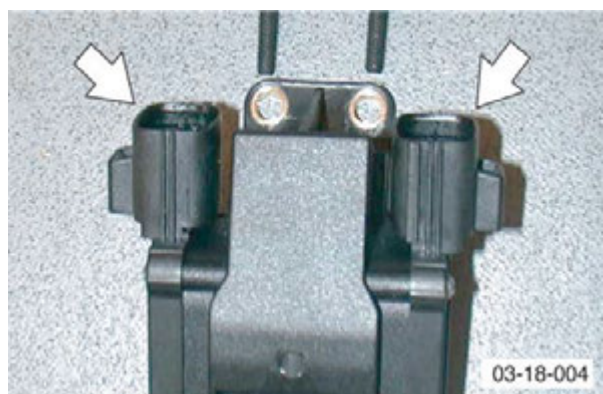


Figure 2

Installation

1. Connect two electrical connectors.
2. Position throttle unit and secure with three bolts.
3. Install drivers seat (see Workshop Manual procedure 01.10.AB Seat Assembly - Front - LH - Remove for Access and Refit).



ASTON MARTIN