

SECTION 11

ENGINE

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General

The following servicing guidelines have been prepared for vehicles which use the 4G63-MIVEC-T/C engine. Other servicing guidelines remain unchanged.

Servicing standards

Item	Standard level	Limit
Revolutions when idling r/min	800±50	-
Compression pressure kPa - r/min	1000-250	650-250
Cylinder head bolt (length of shaft) mm	-	99.4
Timing belt B tension (when checked)	Vibration cycle Hz	52 ~ 92
	Level of give mm	5 ~ 10
Timing belt B tension (when tuned)	Vibration cycle Hz	76 ~ 92
	Level of give mm	5 ~ 7
Timing belt B tension (when changed)	Vibration cycle Hz	76 ~ 92
	Level of give mm	5 ~ 7
Level of auto-tensioner rod projection mm	3.8 ~ 4.5	-

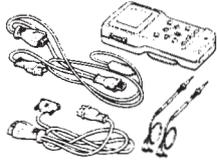
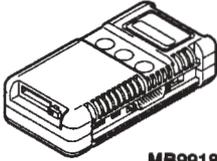
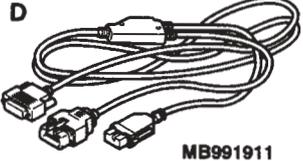
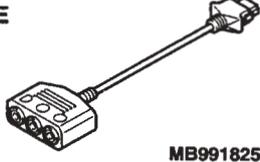
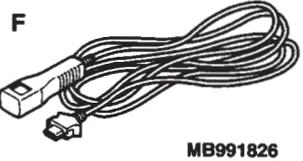
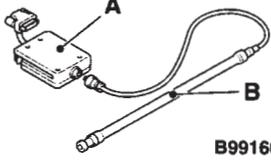
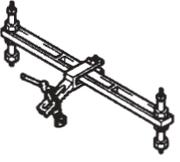
Sealants

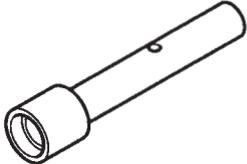
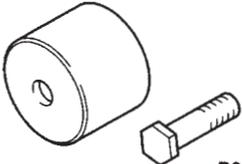
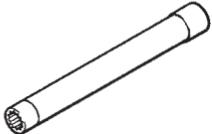
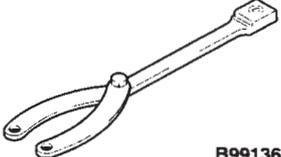
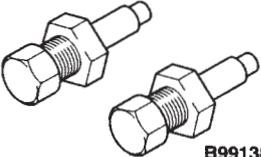
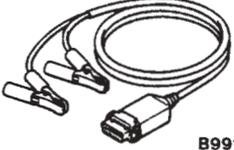
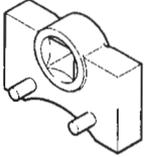
Location	Name
Rocker cover gasket	Semi-dry sealant: Three bond 1207D (MZ100168) (contents: 150g)
Cylinder head	
Camshaft position sensor support	Semi-dry sealant: Three bond 1207F (MZ100191) (contents: 150g)

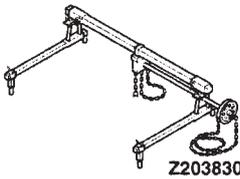
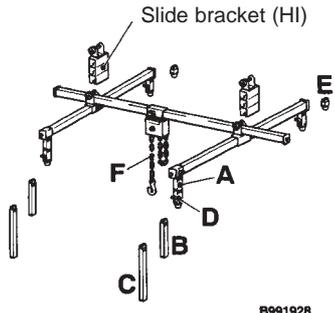
Note

The code inside the brackets () is the actual product number.

Special tools

Tool	Number	Name	Function
	<p>MB991502</p>	<p>MUT-II Sub ASSY</p>	<p>Checking and adjusting the tension in timing belt B</p> <p>Note If a MUT-III main harness A is connected to a vehicle not fitted with CAN, there is a chance that a pulse signal will be entered in the simulated vehicle speed line, when the MUT-III is</p>
<p>A</p>  <p>MB991824</p> <p>B</p>  <p>MB991827</p> <p>C</p>  <p>DO NOT USE</p> <p>MB991910</p> <p>D</p>  <p>MB991911</p> <p>E</p>  <p>MB991825</p> <p>F</p>  <p>MB991826</p> <p>MB991955</p>	<p>MB991955 A: MB991824 B: MB991827 C: MB991910 D: MB991911 E: MB991825 F: MB991826</p>	<p>MUT-III Sub ASSY A: Vehicle Communication Interface (VCI) B: USB cable C: MUT-III Main harness A (For vehicles fitted with CAN) D: MUT-III Main harness B (For vehicles not fitted with CAN) E: Adaptor F: Trigger harness</p>	
 <p>A</p> <p>B</p> <p>B991668</p>	<p>MB991668 A: MB991969 B: MB991670</p>	<p>Belt tension meter set A: Tension meter cartridge B: Mic ASSY</p>	<ul style="list-style-type: none"> • Checking the tension in the drive belt. (Use in conjunction with VCI) • Checking the tension in the balancer timing belt. Adjusting (Use in conjunction with VCI)
 <p>AC204024</p>	<p>MD998772</p>	<p>Valve spring compressor</p>	<p>Compression of the valve spring.</p>

Tool	Number	Name	Function
	MD998737	Valve stem seal installer	Valve stem seal installation
 <p>D998713</p>	MD998713	Camshaft oil seal installer	Camshaft oil seal installation
 <p>B991654</p>	MB991654	Cylinder head bolt wrench	Cylinder head bolt removal, installation
 <p>B991367</p>	MB991367	Special spanner	Holding the crankshaft sprocket
 <p>B991385</p>	MB991385	Pins	
 <p>B991704</p>	MB991704	Battery harness	Checking and adjustment of the tension in the balancer timing belt (Use in conjunction with VCI or MUT-II)
 <p>D998738</p>	MD998738	Adjusting bolt	Holding the tensioner arm or the auto-tensioner adjuster
 <p>D998767</p>	MD998767	Tensioner pulley socket wrench	Adjusting the tension of the timing belt

Tool	Number	Name	Function
 <p>B991454</p>	MB991454	Engine hanger balancer	Holding the engine assembly while the transmission assembly is removed/installed
 <p>Z203830</p>	Recommended tools MZ203830 panzai or MZ203831 safe vehicle handling	Mechanical engine hanger	
 <p>Slide bracket (HI)</p> <p>A B C D E F</p> <p>B991928</p>	MB991928 A: MB991929 B: MB991930 C: MB991931 D: MB991932 E: MB991933 F: MB991934	Engine hanger A: joint (50) x2 B: joint (90) x2 C: joint (140) x2 D: Foot (standard) x4 E: Foot (short) x4 F: Chain and hook ASSY	

Engine tuning

1. Checking revolutions when the engine is idling

The standard revolutions for when the engine is idling have been changed. Other servicing guidelines remain unchanged.

Standard revolutions: 800 ± 50 r/min

2. Checking compression pressure

The standard for compression pressure and the limit for compression pressure have been changed. Other servicing guidelines remain unchanged.

Standard compression pressure: 1000 kPa – 250 r/min

Compression pressure limit: 650 kPa – 250r/min

Camshaft, valve stem seal

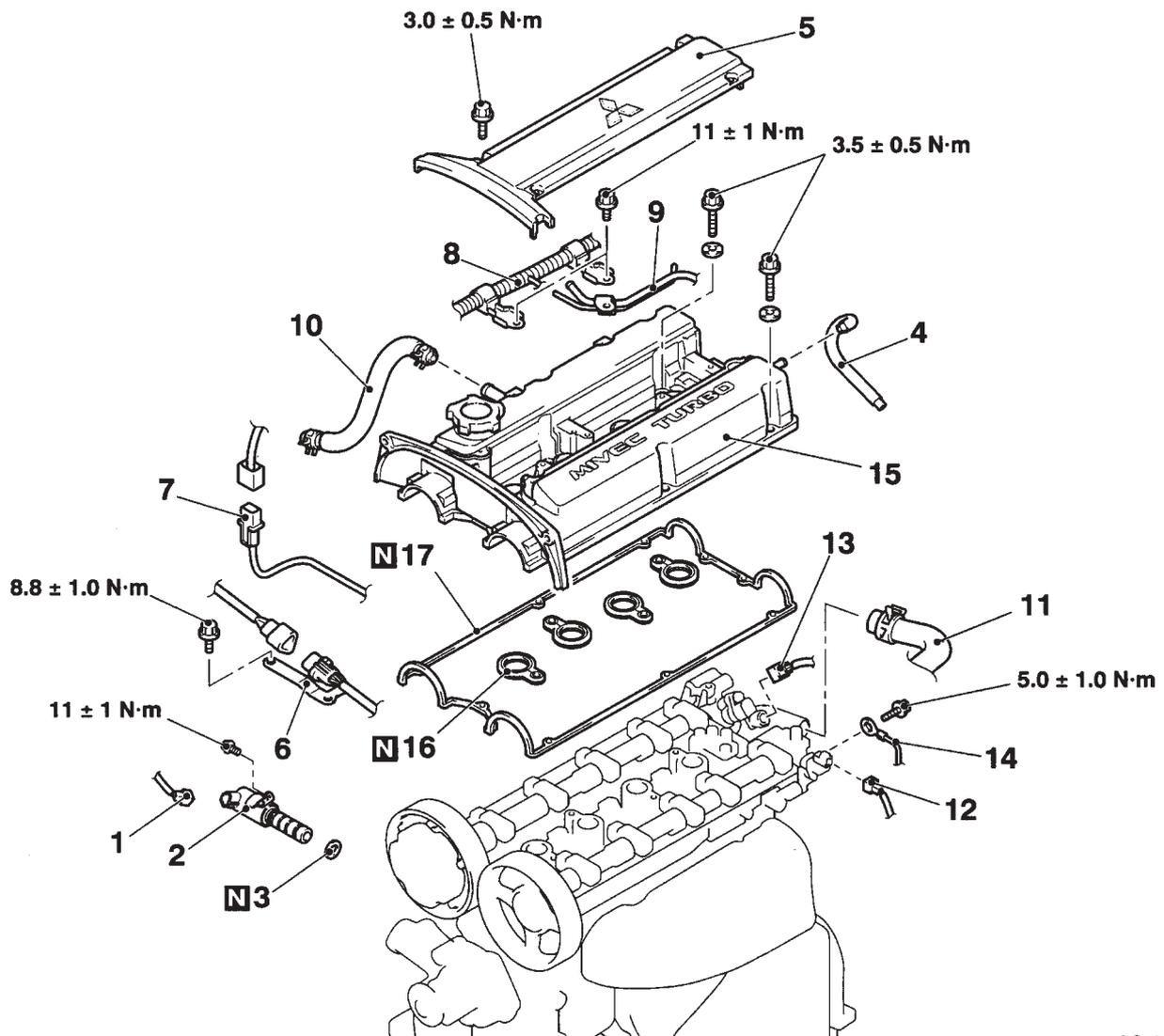
Removal and fitting

Caution

1. If Brembo brake callipers are being used take care that they are not scratched by other components or tools because there is a chance that the paint might peel off. In addition, if any brake fluid gets on the callipers, it should be wiped off immediately.
2. Parts marked with * should be removed and then fitted for each cylinder in turn.

Jobs to be completed before removal and after fitting

- Removal and refitting of the undercover (Ref Section 51: Front bumper)
- Checking the tension of the drive belt (only after fitting)
- Draining and refilling of the coolant
- Removal and refitting of the air duct
- Removal and refitting of air pipe C
- Removal and refitting of the timing belt (refer to P11-20)

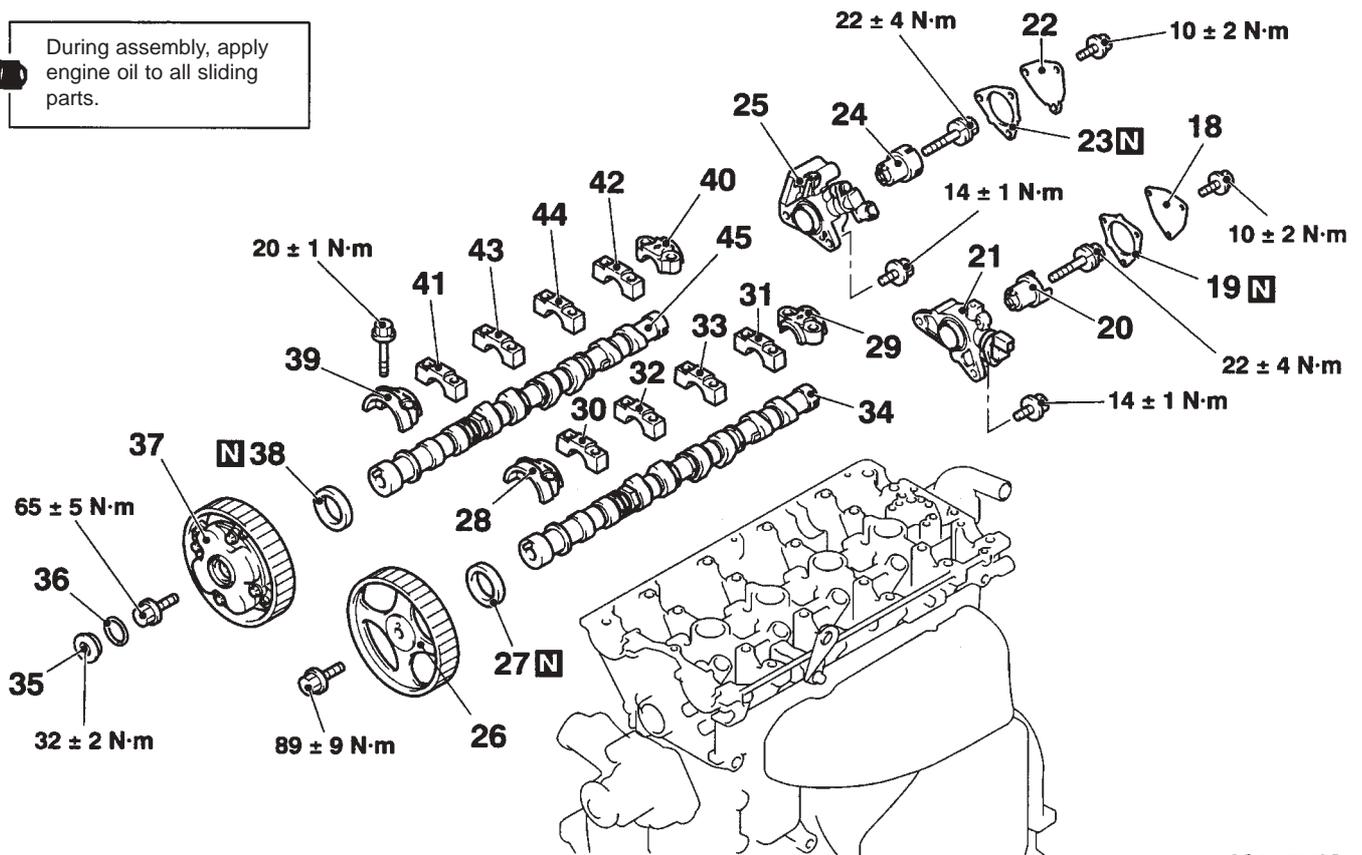


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Removal procedure

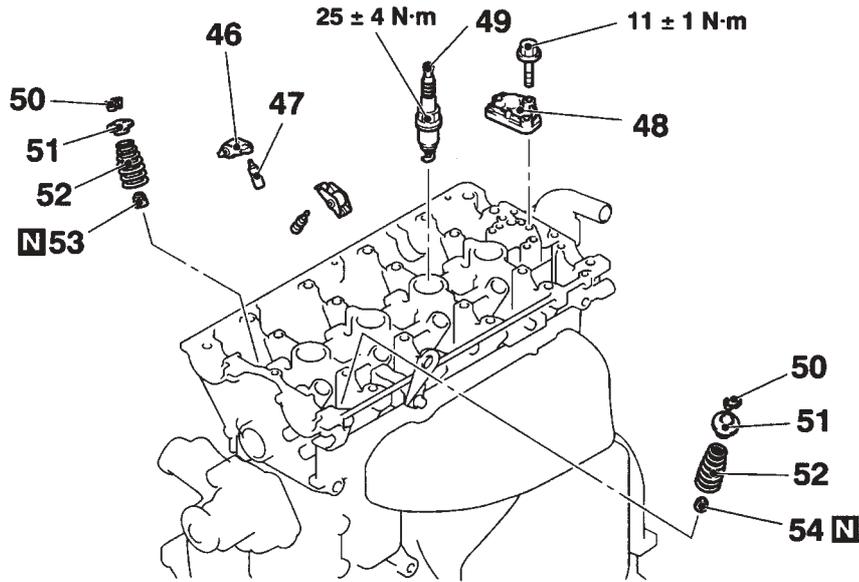
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| <p>1. Oil feeder control valve connector</p> <p>▶ O ◀ 2. Oil feeder control valve</p> <p>▶ O ◀ 3. O-ring</p> <p>4. Breather hose</p> <ul style="list-style-type: none"> • Secondary air control valve (refer to Section 15-2: Secondary Air Control System) <p>5. Centre cover</p> <ul style="list-style-type: none"> • Ignition coil <p>6. O₂ sensor connector</p> <p>7. Crank angle sensor connector</p> | <p>8. Connection of the control harness</p> <p>9. Vacuum hose</p> <p>10. PCV hose</p> <p>◀ A ▶ ▶ N ◀ 11. Connection of the radiator upper hose</p> <p>12. Camshaft position sensor connector (exhaust side)</p> <p>13. Camshaft position sensor connector (inlet side)</p> <p>14. Connection of the earth cable</p> <p>▶ M ◀ 15. Rocker cover ASSY</p> <p>16. Spark plug hole gasket</p> <p>17. Rocker cover gasket</p> |
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During assembly, apply engine oil to all sliding parts.



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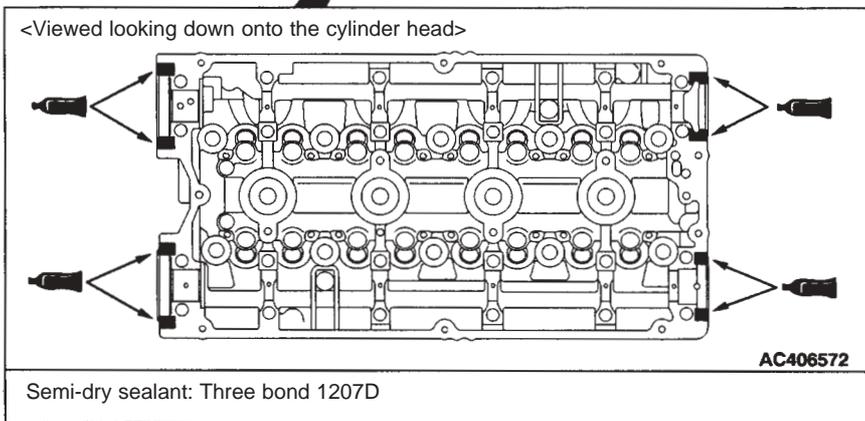
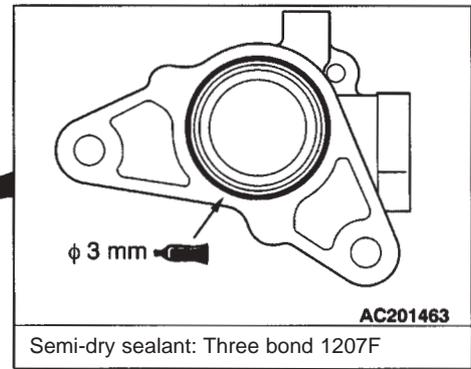
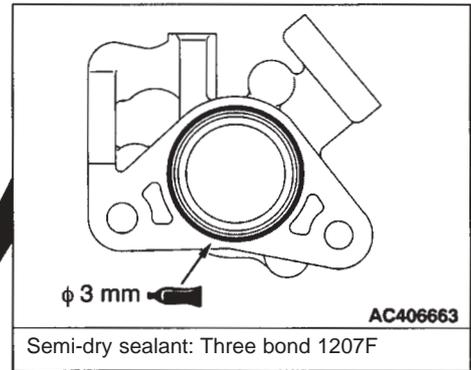
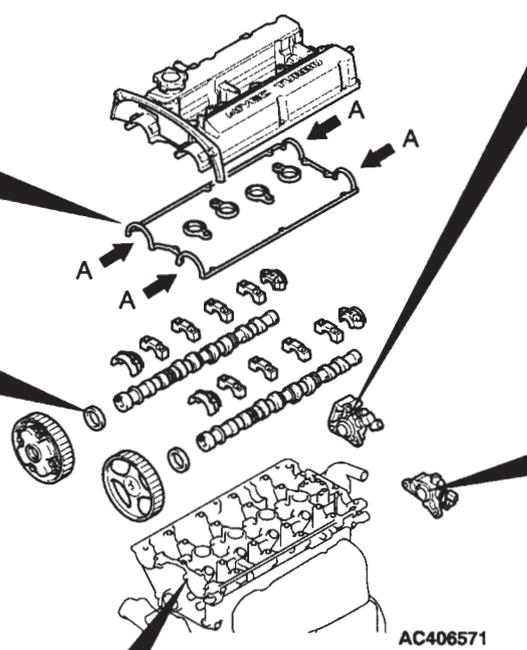
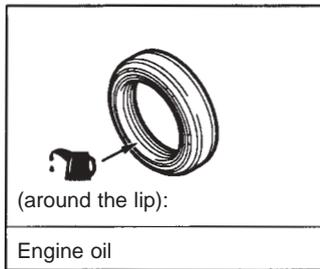
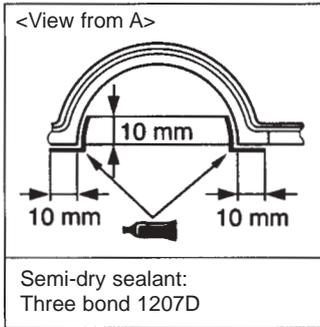
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| 18. Camshaft position sensor support cover | ▶ F ◀ 30. Camshaft bearing cap No. 2 |
| 19. Camshaft position sensor support cover gasket | ▶ F ◀ 31. Camshaft bearing cap No. 5 |
| ▶ L ◀ 20. Camshaft position sensing cylinder (exhaust side) | ▶ F ◀ 32. Camshaft bearing cap No. 3 |
| ▶ J ◀ 21. Camshaft position sensor support | ▶ F ◀ 33. Camshaft bearing cap No. 4 |
| 22. Camshaft position sensor support cover | ▶ E ◀ 34. Exhaust camshaft |
| 23. Camshaft position sensor support cover gasket | 35. Camshaft sprocket cap |
| ▶ K ◀ 24. Camshaft position sensing cylinder (inlet side) | 36. Washer |
| ▶ J ◀ 25. Camshaft position sensor support | ◀ B ▶ ▶ H ◀ 37. Camshaft sprocket (inlet side) |
| ◀ B ▶ ▶ I ◀ 26. Camshaft sprocket (exhaust side) | ▶ G ◀ 38. Camshaft oil seal |
| ▶ G ◀ 27. Camshaft oil seal | ▶ F ◀ 39. Camshaft bearing cap front |
| ▶ F ◀ 28. Camshaft bearing cap front | ▶ F ◀ 40. Camshaft bearing cap rear right |
| ▶ F ◀ 29. Camshaft bearing cap rear left | ▶ F ◀ 41. Camshaft bearing cap No. 2 |
| | ▶ F ◀ 42. Camshaft bearing cap No. 5 |
| | ▶ F ◀ 43. Camshaft bearing cap No. 3 |
| | ▶ F ◀ 44. Camshaft bearing cap No. 4 |
| | ▶ E ◀ 45. Inlet camshaft |

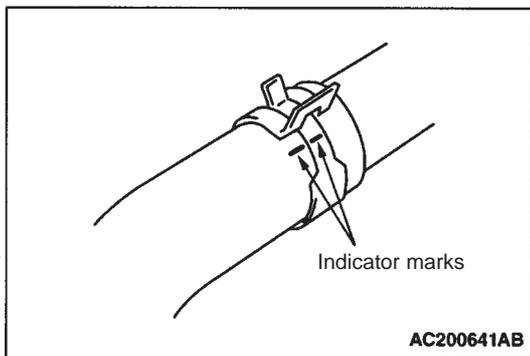


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| | 46. Rocker arm | | 51. Valve spring retainer |
| ▶ D ◀ | 47. Rush adjuster | ▶ B ◀ | 52. Valve spring |
| | 48. Oil delivery body | ▶ A ◀ | 53. Inlet valve stem seal |
| | 49. Spark plug | ▶ A ◀ | 54. Exhaust valve stem seal |
| ◀ C ▶ | ▶ C ◀ 50. Valve spring retainer lock | | |

Locations for the application of lubricant and seals

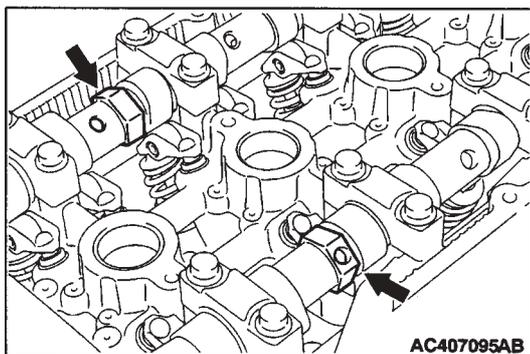




Removal guidelines

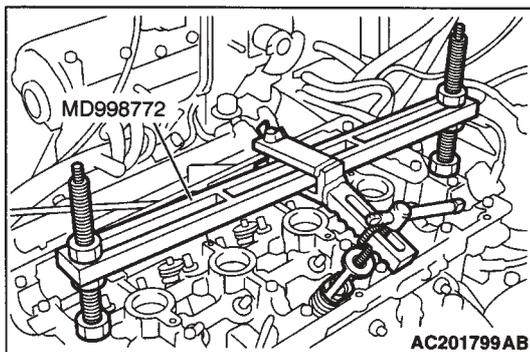
◀ A ▶ **Detaching the radiator upper hose**

Align the indicator marks on the radiator upper hose and the hose clamp, and then detach the radiator upper hose.



◀ B ▶ **Removing the camshaft sprockets**

Grip the hexagonal part of the camshaft with a wrench, loosen the mounting bolt, and remove the camshaft sprocket.

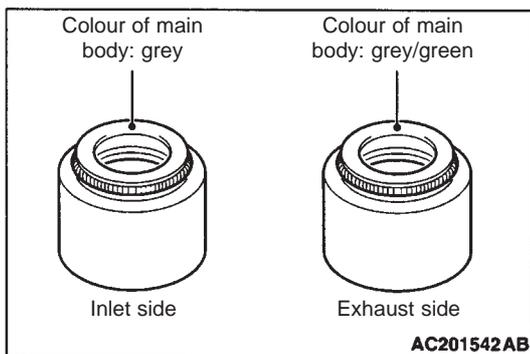


◀ C ▶ **Removing the valve spring retainer lock**

Compress the valve spring using the special tool for compressing valve springs (MD998772), and remove the valve spring retainer lock.

Caution

When removing the valve spring retainer lock, each cylinder piston should be in the top dead centre position. If pistons are not in the top dead centre position, valves could fall into the cylinders.



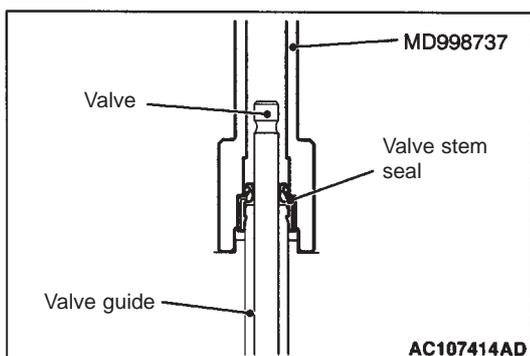
Fitting guidelines

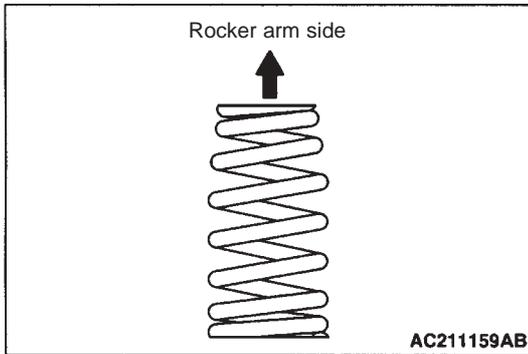
▶ A ◀ **Fitting the exhaust valve stem seals and the inlet valve stem seals**

1. Inlet valve stem seals and exhaust valve stem seals can be distinguished by checking the colour of the rubber parts.
2. Apply a small quantity of engine oil to the valve stem seals.
3. Place the valve stem component into the guides, and then insert a new valve stem seal into the valve stem guide by using the special tool for installing valve stem seals.

Caution

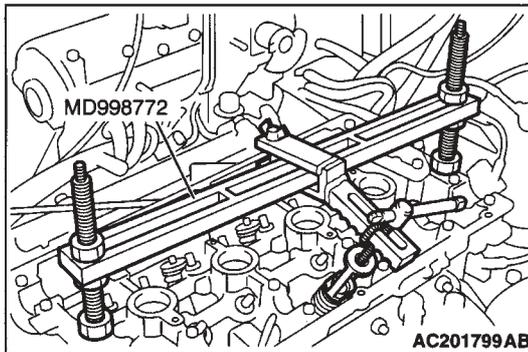
- (1) Valve stem seals cannot be re-used.
- (2) Please use the special tool for installing valve stem seals (MD998737) because oil could leak if the valve stem seals are not fitted correctly.





▶ B ◀ Fitting the valve spring

Fit the valve spring so that the end of the valve spring which has the smaller radius is on the rocker arm side.



▶ C ◀ Fitting the valve spring retainer lock

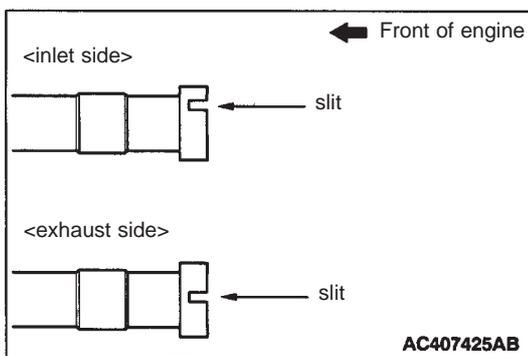
In the same way as when the valve spring retainer lock was removed, compress the valve spring using the special tool for compressing valve springs (MD998772), and fit the valve spring retainer lock.

▶ D ◀ Fitting the rush adjuster

Caution

If a rush adjuster is being reused, it must be washed and inspected before fitting.

(Ref: Engine Service Manual)

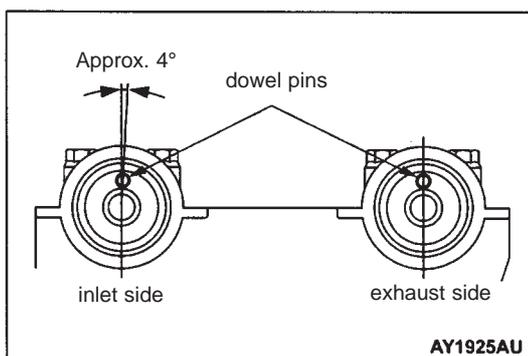


▶ E ◀ Fitting the camshaft

1. Remove any sealant from the cylinder head.
2. Apply engine oil to the camshaft cams and journals.
3. Fit the camshaft to the cylinder head.

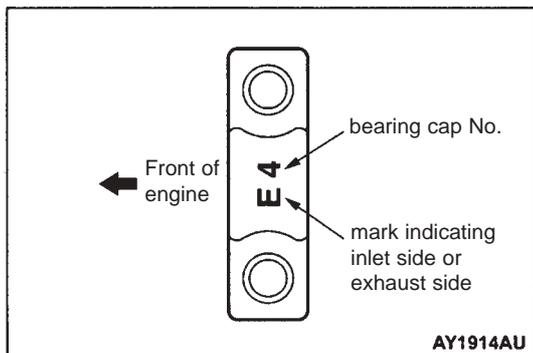
Caution

Ensure that the inlet and exhaust sides are not the wrong way round.



▶ F ◀ Fitting the camshaft bearing cap No.4, the camshaft bearing cap No.3, the camshaft bearing cap No.5, the camshaft bearing cap No.2, the rear camshaft bearing cap, and the front camshaft bearing cap

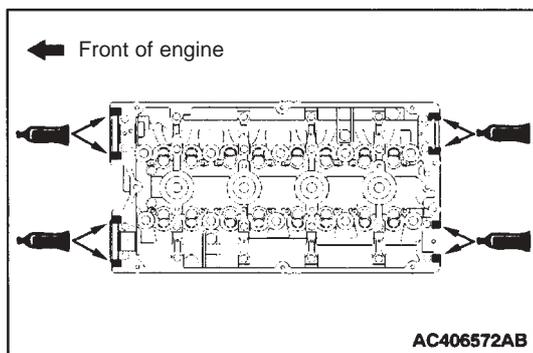
1. Set the camshaft dowel pins in the position shown in the diagram.



- Because camshaft bearing caps Nos. 2~5 are the same shape, check the identification marks on them so that the bearing cap number and the inlet and exhaust sides are not mistaken. Then fit them in the direction shown in the diagram.

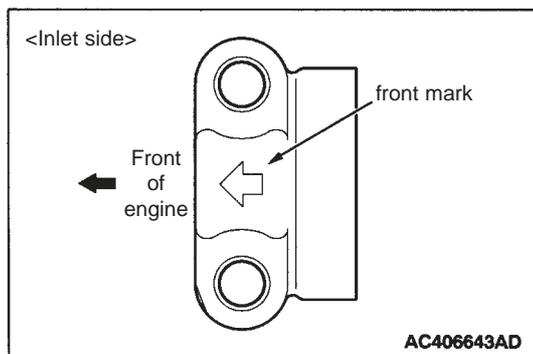
Identification marks (stamped on the front bearing cap, and on bearing cap Nos. 2~5).

- I: inlet side
- E: exhaust side



- Apply sealant at the 8 places shown in the diagram of the top view of the cylinder head.

Semi-dry sealant: Three bond 1207D



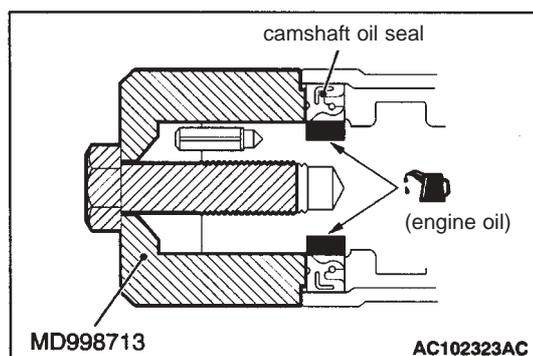
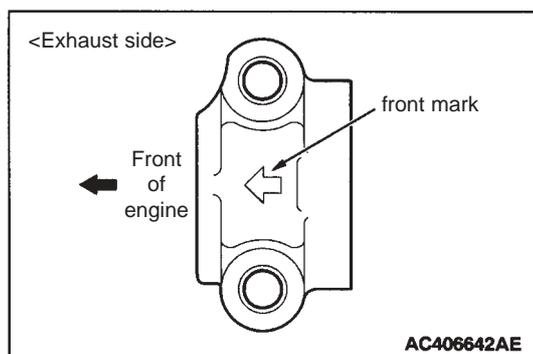
- Fit the rear camshaft bearing cap in the direction indicated by the front mark.
- In just the same way as for bearing caps Nos. 2~5, check the identification marks on the front camshaft bearing cap so that the exhaust side and the inlet side are not mistaken.
- Tighten the bearing cap mounting bolts gradually, 2~3 turns at a time, to the specified torque.

Tightening torque: 20 ± 1 N•m

- Check that the rocker arm has been fitted correctly.

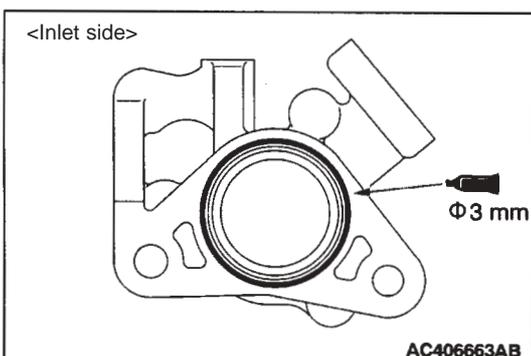
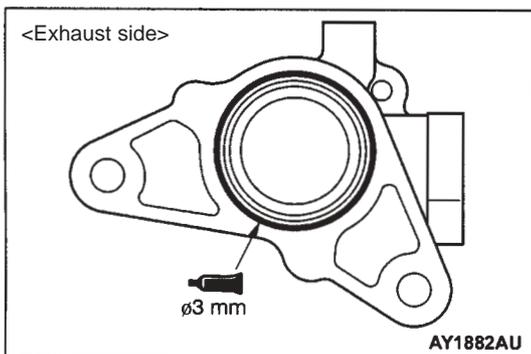
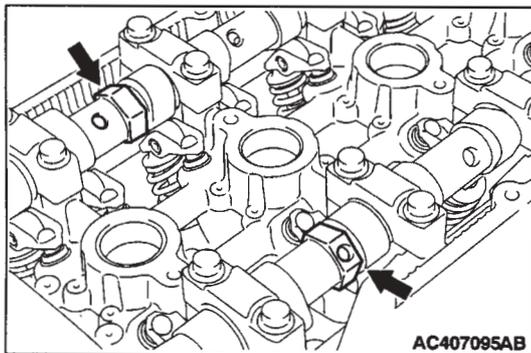
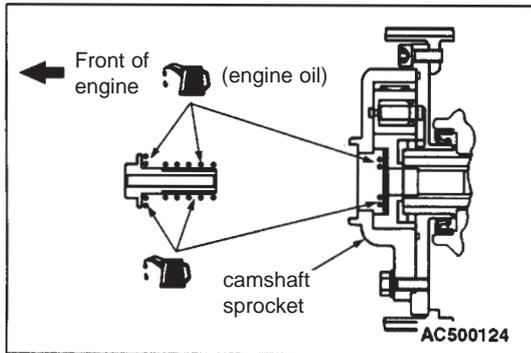
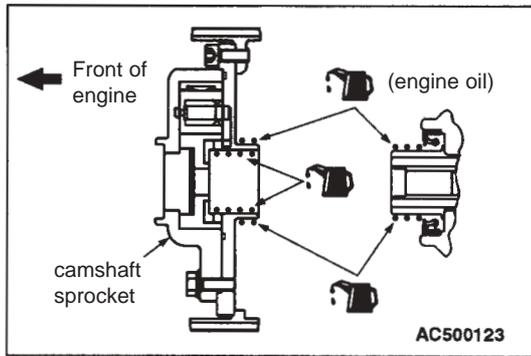
Note

Completely wipe away any sealant that has been squeezed out.



▶ G ◀ Fitting the camshaft oil seal

- Apply engine oil around the entire circumference of the oil seal lip.
- Insert the oil seal using the special tool for installing the camshaft oil seal (MD998713), as shown in the diagram.



► H ◀ Fitting the camshaft sprocket (inlet side)

1. Apply engine oil to the edges of the camshaft, and to the parts of the camshaft sprocket which will make contact with the camshaft.
2. Match up the camshaft dowel pins with the dowel pin holes in the camshaft sprocket, and fit the camshaft into the camshaft sprocket.
3. Hold the hexagonal part of the camshaft with a wrench, and check that the camshaft sprocket cannot be twisted.

Note

This operation is necessary because it is impossible to check by looking whether the camshaft dowel pins are inserted into the dowel pin holes in the camshaft sprocket.

4. Apply engine oil to the screw thread and the underside of the camshaft sprocket mounting bolt, and in the same way as when the camshaft sprocket was removed, hold the camshaft in place using a wrench and tighten the bolt to the specified torque.

Tightening torque: $65 \pm 5 \text{ N}\cdot\text{m}$

► I ◀ Fitting the camshaft sprocket (exhaust side)

In the same way as when the camshaft sprocket was removed, hold the hexagonal part of the camshaft with a wrench and tighten the bolt to the specified torque.

Tightening torque: $89 \pm 9 \text{ N}\cdot\text{m}$

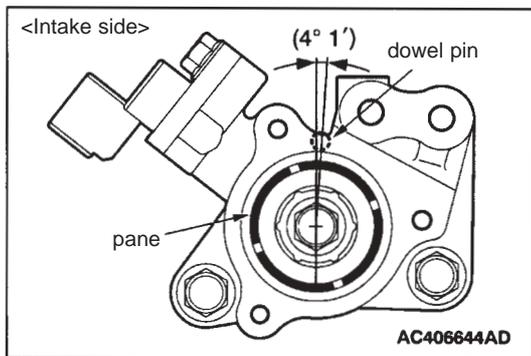
► J ◀ Fitting the camshaft position sensor support

1. Remove any sealant from the camshaft position sensor support.
2. As shown in the diagram, apply sealant to the flange of the camshaft position sensor support, and then fit it to the cylinder head.

Semi-dry sealant: Three bond 1207F

3. Tighten the mounting bolts for the camshaft position sensor support to the specified torque.

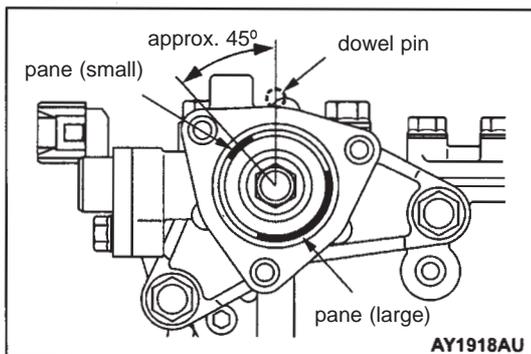
Tightening torque: $14 \pm 1 \text{ N}\cdot\text{m}$



► **K ◀ Fitting the camshaft position sensing cylinder (inlet side)**

1. Set the inlet camshaft dowel pin in the position shown in the diagram (No.1 cylinder compression top dead centre).
2. Tighten the mounting bolts for the camshaft position sensing cylinder to the specified torque.

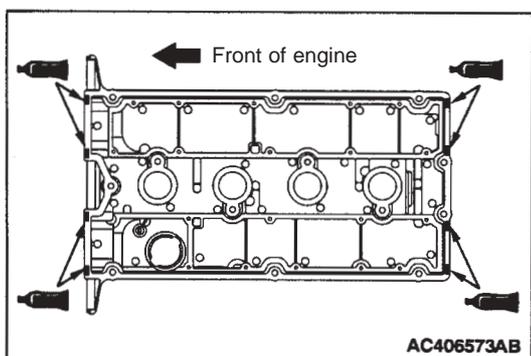
Tightening torque: 22 ± 4 N•m



► **L ◀ Fitting the camshaft position sensing cylinder (exhaust side)**

1. Set the exhaust camshaft dowel pin in the position shown in the diagram (No.1 cylinder compression top dead centre).
Note
Under pressure from the exhaust valve spring, it will turn slightly in an anti-clockwise direction.
2. As shown in the diagram, fit the pane (small) of the camshaft position sensing cylinder (exhaust side) so that it is in a position approximately 45° to the exhaust camshaft dowel pin.
3. Tighten the mounting bolts for the camshaft position sensing cylinder to the specified torque.

Tightening torque: 22 ± 4 N•m

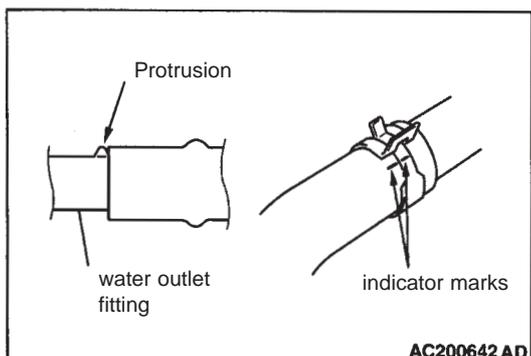


► **M ◀ Fitting the locker cover assembly**

1. Apply sealant to the 8 places on the rocker cover gasket as shown in the diagram.

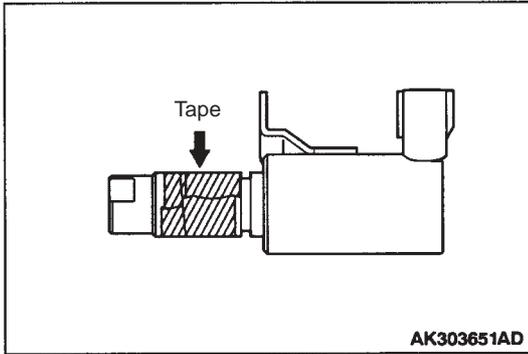
Semi-dry sealant: Three bond 1207D

2. Fit the rocker cover assembly onto the cylinder head.



► **N ◀ Connecting the radiator upper hose**

1. Insert the radiator upper hose as far as the protrusion on the water outlet fitting.
2. Match up the indicator marks on the radiator upper hose and the hose clamp, in order to fit the radiator upper hose.



▶ O ◀ Fitting the O-ring/oil feeder control valve

Caution

1. Do not re-use O-rings.
2. When fitting O-rings, first wind some non-adhesive tape (seal tape etc) around the oil channel of the oil feeder control valve, in order to prevent damage to the O-ring. If the O-ring touches the oil it could start an oil leak.

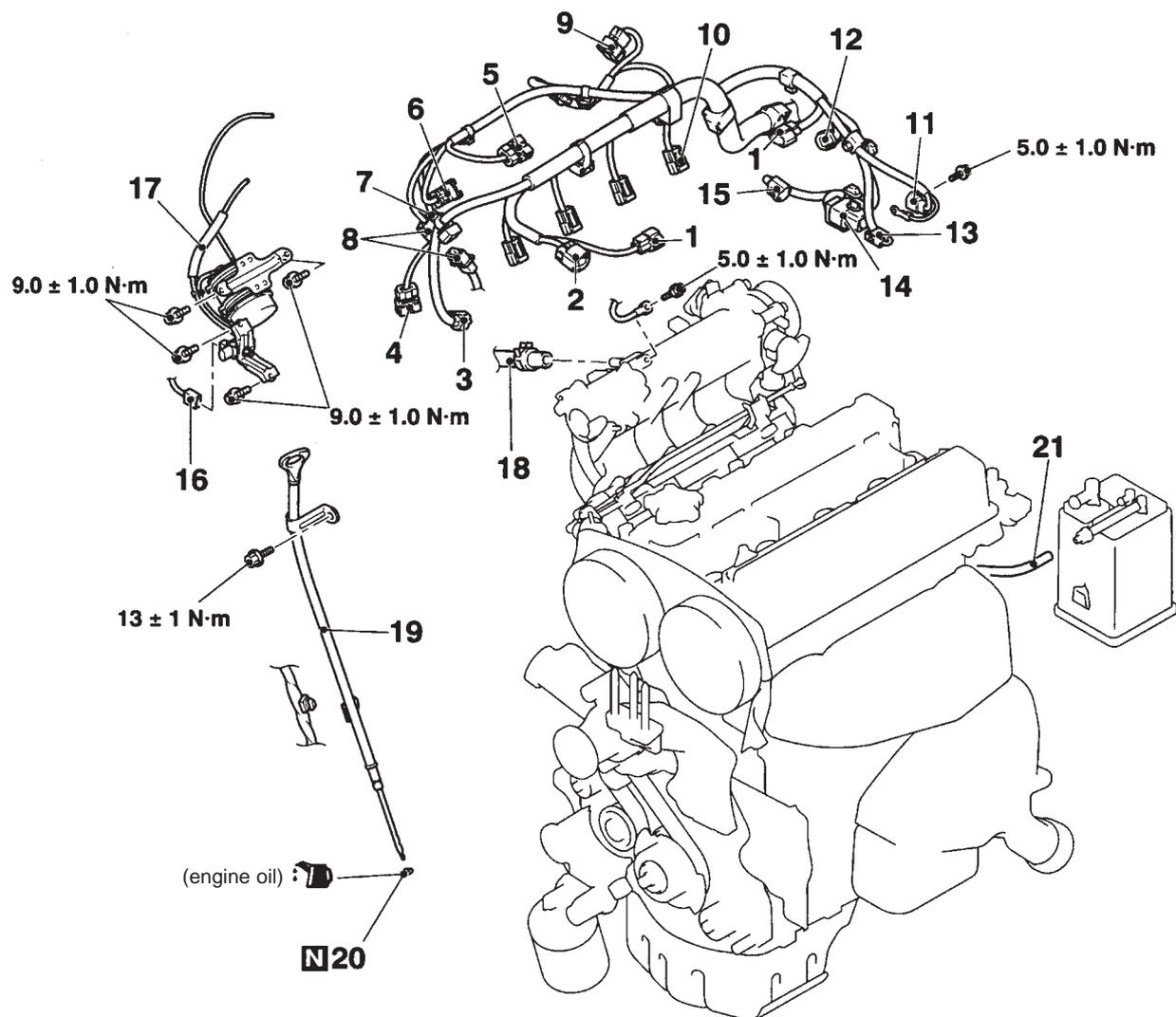
1. Apply engine oil to the O-ring on the oil feeder control valve.
2. Fit the oil feeder control valve to the cylinder head.
3. Tighten the mounting bolts for the oil feeder control valve to the specified torque.

Tightening torque: 11 ± 1 N•m

Cylinder head gasket Removal and fitting

Jobs to be completed before removal and after fitting

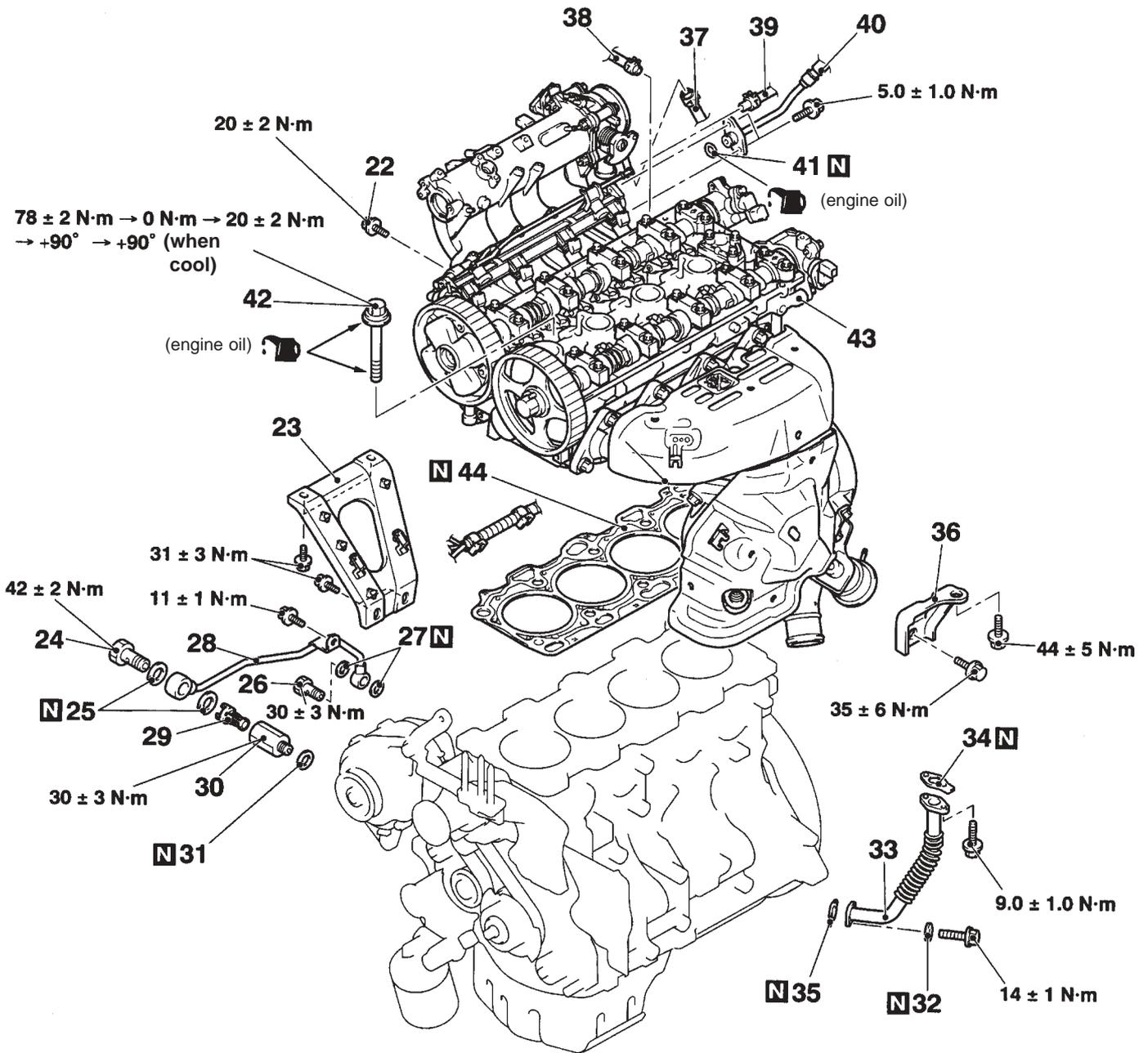
- Measures to prevent fuel leaking. <Only before removal>
- Check for fuel dripping. <Only after fitting>
- Removal and refitting of the strut tower bar.
- Removal and refitting of the valence. (Ref Section 51: Front bumper)
- Check the tension of the drive belt. <Only after fitting>
- Adjustment of the axle letter cable. <Only after fitting>
- Draining and replacing the engine oil.
- Draining and replacing the coolant.
- Removal and refitting of the air cleaner.
- Removal and refitting of air pipe C.
- Removal and refitting of the battery and the battery tray.
- Removal and refitting of the centre cover. (Ref P11-5)
- Removal and refitting of the axle letter cable.
- Removal and refitting of the radiator.
- Removal and refitting of the front exhaust pipe.
- Removal and refitting of the timing belt. (Ref P11-20)



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Removal procedure

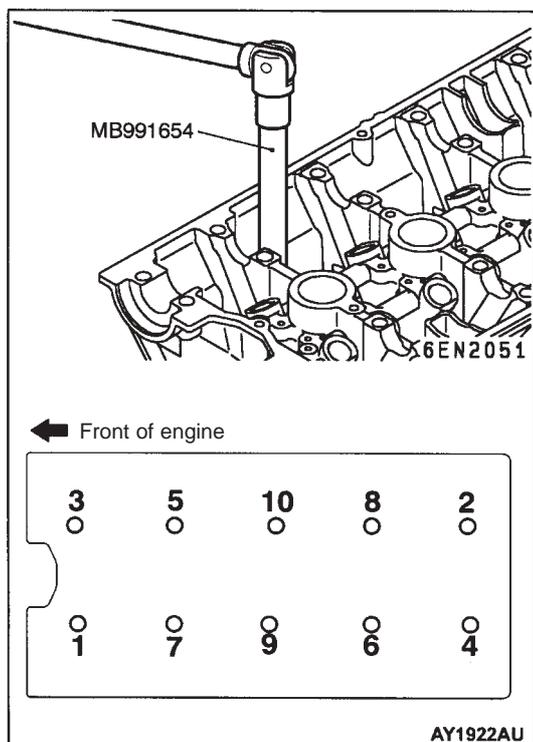
- | | |
|---|---|
| <ol style="list-style-type: none"> 1. Ignition coil connector 2. O₂ sensor connector 3. Oil feeder control valve connector 4. Crank angle sensor connector 5. Manifold absolute pressure sensor connector 6. Fuel pressure solenoid valve connector 7. Knock sensor connector 8. Purge control solenoid valve connector 9. Throttle position sensor connector 10. Injector connector 11. Exhaust camshaft position sensor connector | <ol style="list-style-type: none"> 12. Inlet camshaft position sensor connector 13. Water temperature gauge unit connector 14. Joint control harness and transmission harness 15. Water temperature sensor connector 16. Secondary air control solenoid valve connector 17. Vacuum tank, solenoid valve, vacuum pipe and hose assembly 18. Brake booster vacuum hose connection 19. Oil level gauge and guide assembly 20. O-ring 21. Purge hose connection |
|---|---|



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- 22. Alternator bracket connection
- 23. Inlet manifold stay
- ▶ E ◀ 24. Eye bolt
- 25. Gasket
- 26. Eye bolt
- 27. Gasket
- 28. Oil feeder control valve pipe
- 29. Filter
- 30. Oil pipe joint
- 31. Gasket
- 32. Oil return pipe gasket
- 33. Oil return pipe
- 34. Oil return pipe gasket

- ▶ D ◀ 35. Oil return pipe gasket
- 36. Exhaust fitting bracket
 - Water outlet fitting and thermostat case assembly (Refer to Section 14: Water hose pipe)
- 37. Water hose connection
- 38. Heater hose connection
- 39. Fuel return hose connection
- ▶ C ◀ 40. Fuel high pressure hose connection
- ▶ C ◀ 41. O-ring
- ◀ A ▶ ▶ B ◀ 42. Cylinder head bolt
- ▶ B ◀ 43. Cylinder head assembly
- ▶ A ◀ 44. Cylinder head gasket



Removal guidelines

▶ A ◀ Removing the cylinder head bolts

Use the special wrench for cylinder head bolts (MB991654) to turn the bolts 2~3 times in order to loosen them, before removing them in the numerical order as shown in the diagram.

Fitting guidelines

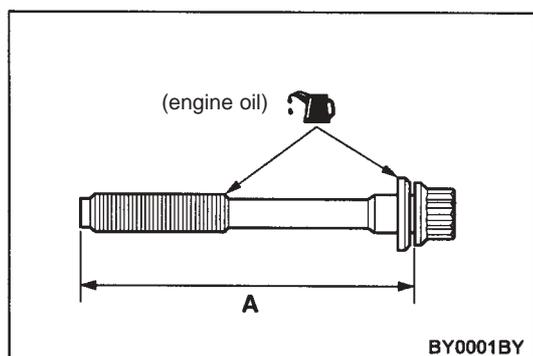
▶ A ◀ Fitting the cylinder head gasket

1. Remove the gaskets which have been stuck onto the surface of the gasket.

Caution

Do not allow any foreign matter to get into the channels for coolant or oil, or into the cylinder.

2. Fit the cylinder head gasket to the cylinder head, so that the holes in the cylinder head gasket match up with the holes in the cylinder head.

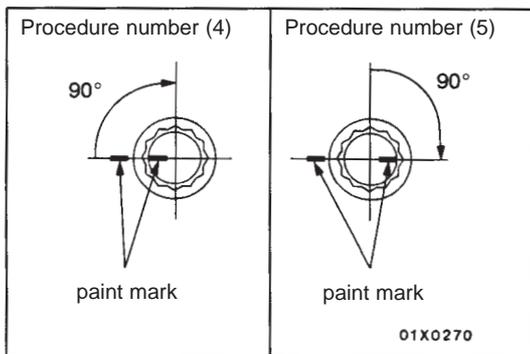
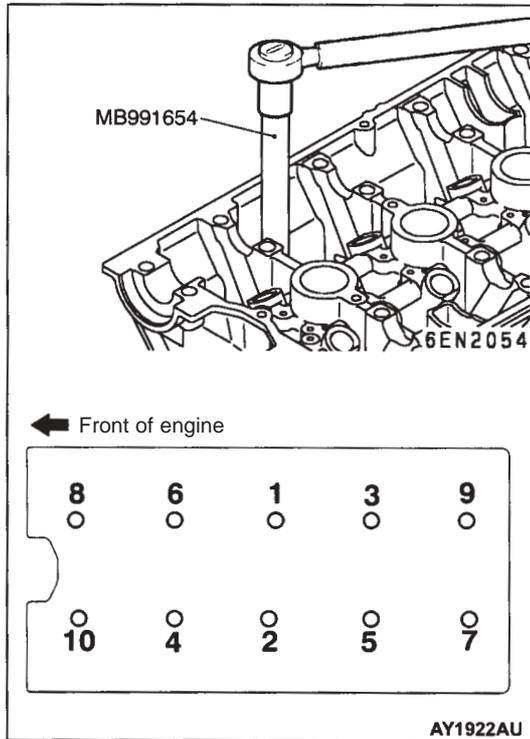


▶ B ◀ Fitting the cylinder head bolts

1. Check that the length of the body of cylinder head bolts is less than the maximum permitted. If the length is in excess of the maximum permitted, replace the bolt with a brand new one.

Maximum length (A): 99.4mm

2. Apply a small amount of engine oil to the screw thread of the bolt, and to the washer.



3. Use the special wrench for cylinder head bolts (MB991654) to (loosely) tighten the bolts in the following order.
 - (1) In the order shown in the diagram, tighten the bolts to $78 \pm 2 \text{ N}\cdot\text{m}$.
 - (2) In reverse order to that shown in the diagram, completely loosen the bolts.
 - (3) In the order shown in the diagram, tighten the bolts to $20 \pm 2 \text{ N}\cdot\text{m}$.

- (4) Make a paint mark on the top of the cylinder head bolt, and on the cylinder head, and tighten them to 90° as shown in the diagram.
- (5) Tighten the bolts to 90° as shown in the diagram, and check that the paint mark on the top of the cylinder head bolt and the paint mark on the cylinder head are in line.

Caution

- 1) If a bolt is tightened to an angle of less than 90° it has not been tightened sufficiently.
- 2) If the angle of tightening exceeds the regulation level, remove the bolt and start again from procedure number (1).

► C ◀ **Fitting the O-ring/fuel high pressure hose**

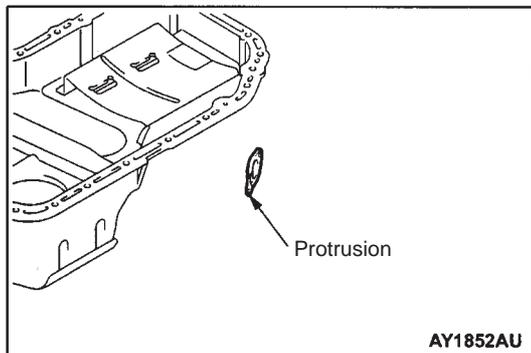
1. Apply a little fresh engine oil to the O-ring.

Caution

Ensure that engine oil does not get inside the delivery pipe.

2. Without damaging the O-ring, twist the fuel high pressure hose to fit it to the delivery pipe, making sure that it is twisted smoothly.
3. If the hose cannot be twisted smoothly, there is a possibility that it may be biting into the O-ring, so remove the fuel high pressure hose, and check for any damage to the O-ring. If the O-ring is undamaged, reinsert it into the delivery pipe and check once more whether the hose can be turned smoothly.
4. Tighten the mounting bolts for the fuel high pressure hose to the specified torque.

Tightening torque: $5.0 \pm 1.0 \text{ N}\cdot\text{m}$.

**▶ D ◀ Fitting the oil return pipe gasket**

Replace the gasket with a new one, and fit it to the protruded part shown in the diagram.

Note:

For the oil return pipe gasket on the turbocharger side, there is no direction for slotting it in.

▶ E ◀ Fitting the eyebolts

Caution

When tightening the eyebolts, hold the oil pipe joint in place with a spanner so that it does not turn round as the eyebolts are tightened.

TIMING BELT, TIMING BELT B

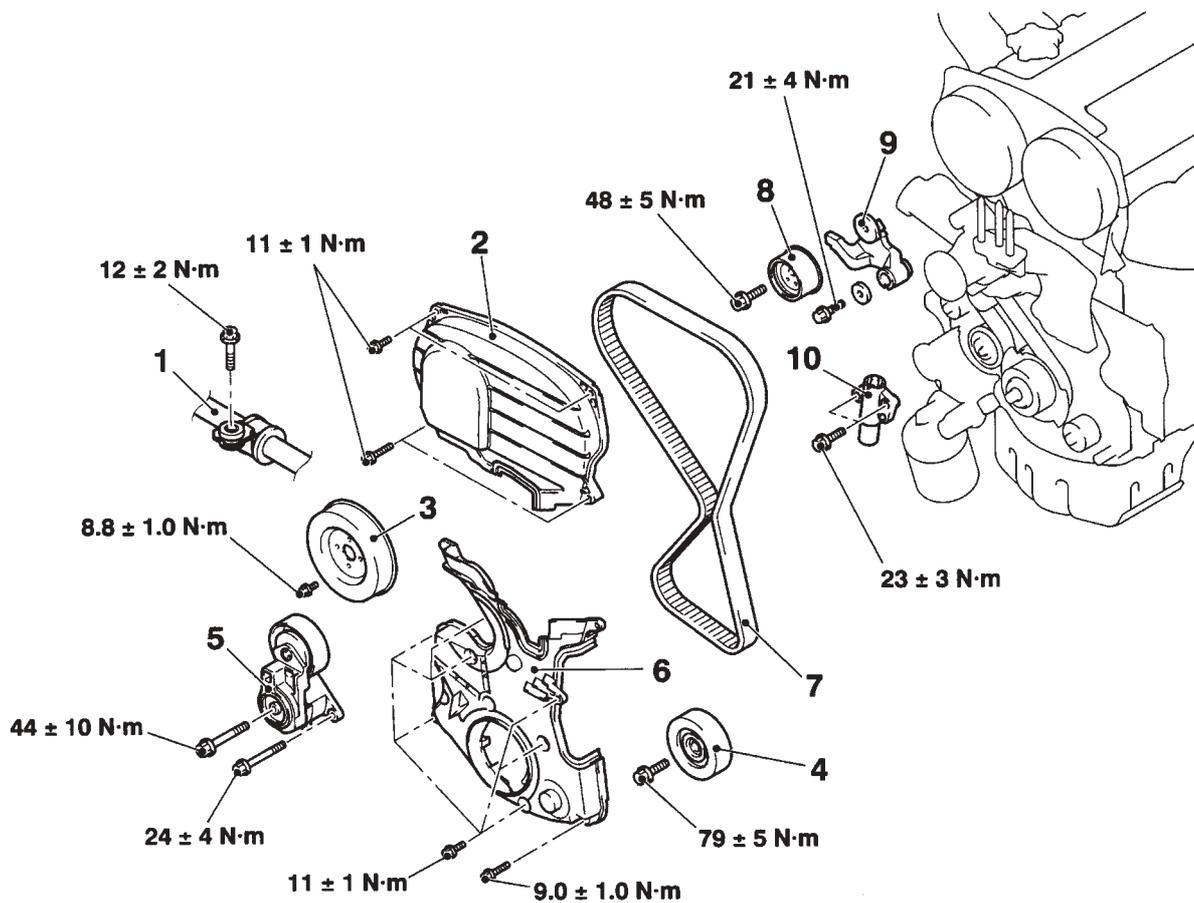
Removal and fitting

Caution

If Brembo brake callipers are being used take care that they are not scratched by other components or tools because there is a chance that the paint might peel off. In addition, if any brake fluid gets on the callipers, it should be wiped off immediately.

Jobs to be completed before removal and after fitting

- Removal and refitting of the valence. (Ref Section 51: Front bumper)
- Removal and refitting of the LH side cover.
- Checking and adjustment of the tension of the drive belt. <Only after fitting>
- Removal and refitting of the crankshaft pulley.
- Removal and refitting of the cross member bar.
- Removal and refitting of the front exhaust pipe.

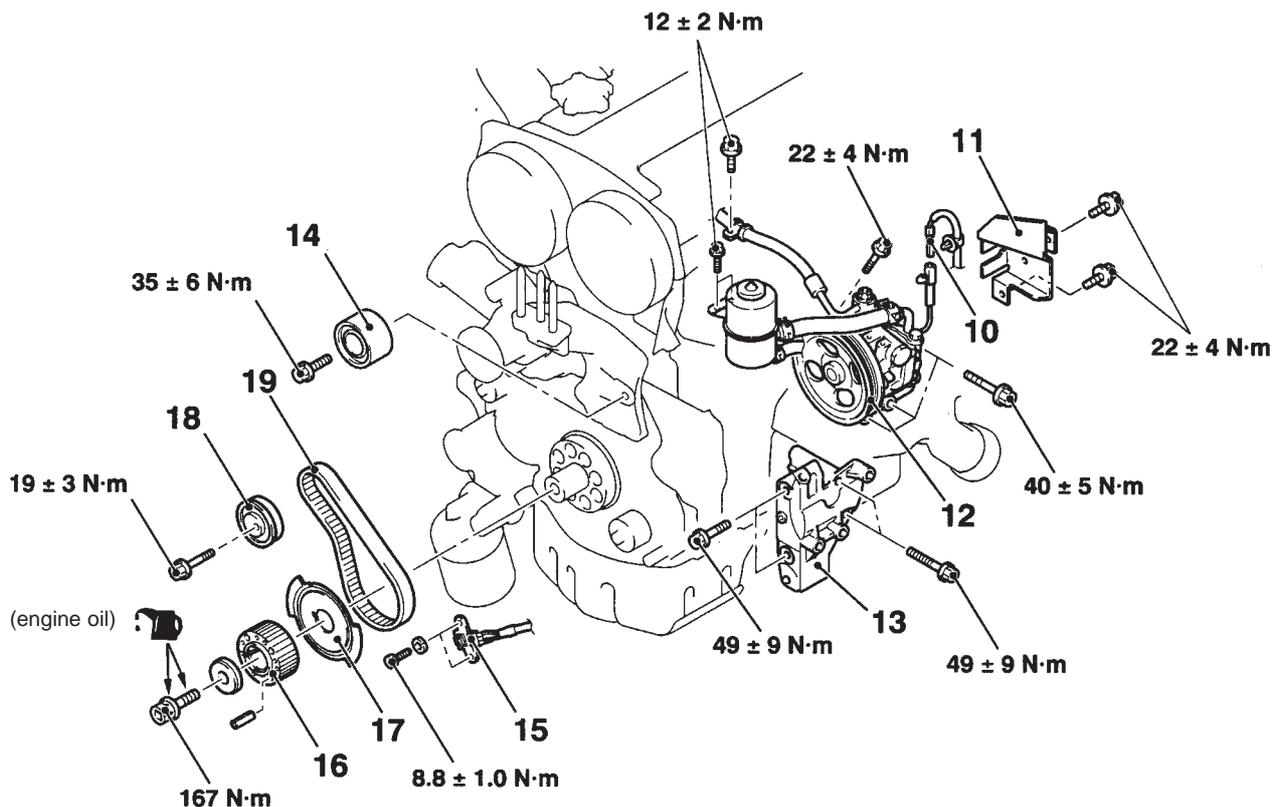


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Removal procedure

1. Pressure hose connection
2. Timing belt front upper cover
3. Water pump pulley
4. Idler pulley
5. Drive belt auto-tensioner
6. Timing belt front lower cover

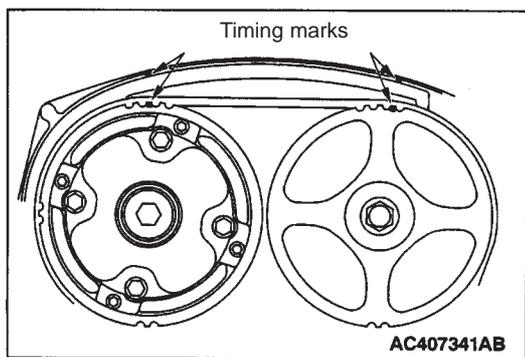
- Remove the engine mount bracket
- ▶ G ◀ • Adjust the tension of the timing belt <Only after fitting>
- ◀ A ▶ ▶ F ◀ 7. Timing belt
- ▶ E ◀ 8. Tensioner pulley
- 9. Tensioner arm
- ▶ D ◀ 10. Auto-tensioner



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- ◀ B ▶ 10. Power steering oil pressure switch connector
- 11. Heat protector
- 12. Power steering oil pump ASSY
- 13. Power steering oil pump bracket
- 14. Idler pulley
- 15. Crank angle sensor

- ◀ C ▶ ▶ C ▶ 16. Crankshaft sprocket
- ▶ C ▶ 17. Crankshaft sensing blade
- ▶ B ▶ • Adjust the tension of the timing belt B <Only after fitting>
- ▶ A ▶ 18. Timing belt B tensioner
- ◀ D ▶ ▶ A ▶ 19. Timing belt B



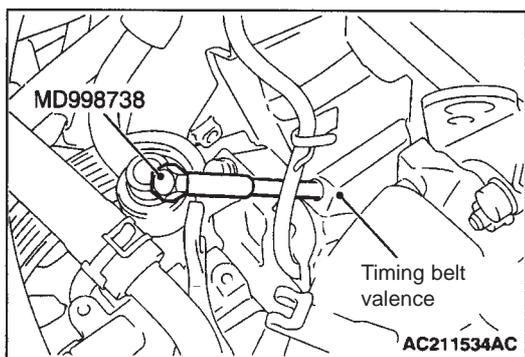
Removal guidelines

◀ A ▶ **Removing the timing belt**

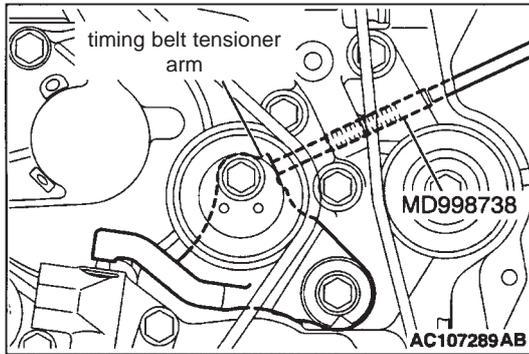
1. Turn the crankshaft in a clockwise direction, and match up all the timing marks until the No.1 cylinder is in the compressor top dead centre position.

Caution

Turn the crankshaft in the normal way.



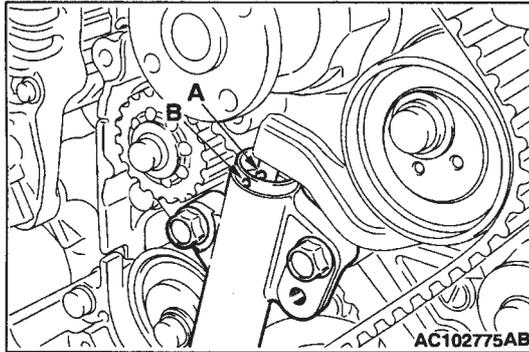
2. Remove the rubber plug from the rear cover of the timing belt, and prepare the special tool for adjusting bolts (MD998738).



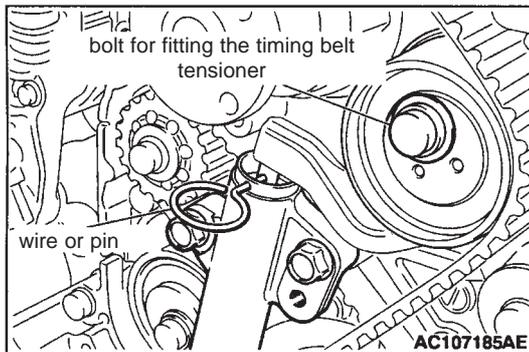
- Twist the special tool for adjusting bolts (MD998738) by hand until it touches the tensioner arm.

Caution

The special tool for adjusting bolts (MD998738) can be slowly twisted at a rate of about 30° per second but if it is suddenly twisted the auto-tensioner rod cannot be easily withdrawn, and this may lead to problems with twisting and the possibility that the special tool for adjusting bolts (MD998738) may become bent.



- Twist the special tool for adjusting bolts (MD998738) a little, and align the auto-tensioner rod with setting hole A, and the tensioner cylinder with setting hole B.



- Insert a wire or a pin into the aligned holes.
- Remove the special tool for adjusting bolts (MD998738), and then loosen the bolt for fitting the timing belt tensioner, and remove the timing belt.

Caution

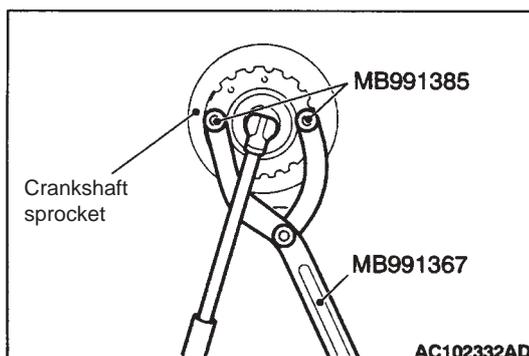
If a timing belt is being re-used, check and make a note of the direction of the arrows indicating the rotational direction (clockwise direction) on the back of the belt.

◀ B ▶ Removing the power steering oil pump ASSY

Remove the power steering oil pump ASSY from its bracket, with the hose intact.

Note

Secure the removed power steering oil pump ASSY with string, and put it somewhere where it will not hinder the removal or fitting of the timing belt.



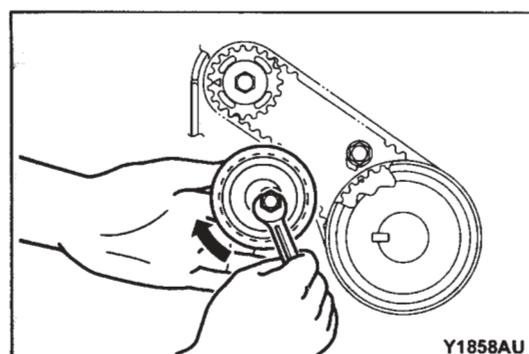
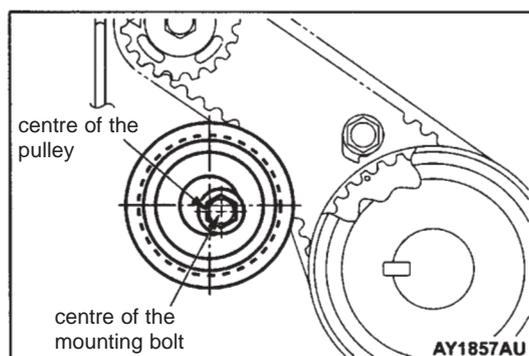
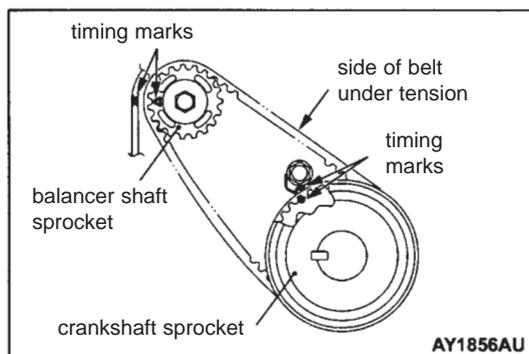
◀ C ▶ Removing the crankshaft sprocket

- Hold the crankshaft sprocket in place using the special spanner (MB991367) and the special pin (MB991385).
- Remove the crankshaft sprocket.

◀ D ▶ Removing timing belt B

Caution

If planning to re-use a timing belt B, ensure that it will be refitted the same way round, by marking the back of the belt with chalk arrows indicating the direction of movement.

**Fitting guidelines**▶ A ◀ **Fitting timing belt B and the timing belt B tensioner**

1. Check that the timing marks for the crankshaft sprocket and the balancer shaft sprocket are aligned.
2. Fit timing belt B onto the crankshaft sprocket and the balancer shaft sprocket. Ensure that the side of the belt under tension is not slack.

3. As a temporary step, fit the timing belt B tensioner pulley so that its centre is to the upper left of the centre of the mounting bolt, and so that the flange of the pulley is facing towards the front of the engine.
4. Adjust the tension of timing belt B.

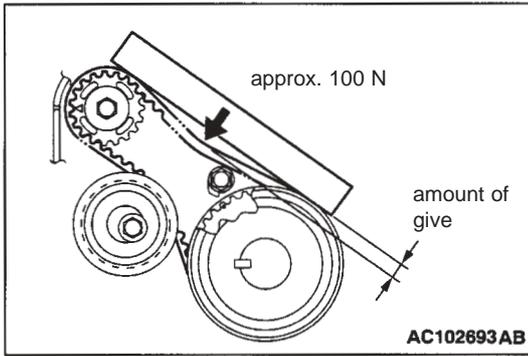
▶ B ◀ **Adjusting the tension of timing belt B**

1. Hold the timing belt B tensioner between fingertips and in the direction of the arrows, apply tension torque (3.0 ± 0.4 N·m) to timing belt B until the side of the belt under tension becomes taught. In this condition, tighten the mounting bolt to the specified torque, and fit the tensioner.

Tightening torque: 19 ± 3 N·m

Caution

When tightening the mounting bolt, ensure that the tensioner does not turn round with it. If the tensioner turns with the mounting bolt, it could cause the tension in the belt to become too high.



2. <Measuring the amount of give>

- (1) As shown in the diagram, apply a force of about 100N to the middle of the belt between the sprockets (indicated by the arrow), and check that the amount of give is as specified.

Specified values:

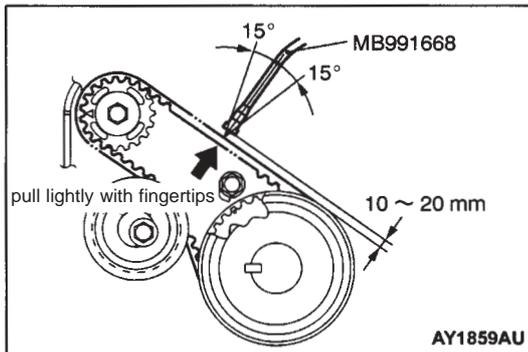
<when adjusted> 5~7mm

<when replaced> 5~7mm

- (2) If the specified values are not met, readjust the tension of the belt.

3. <When using MUT-II/III>

- (1) Connect the special belt tension meter set (MB991668) to the MUT-II/III.
- (2) Connect the special battery harness (MB991704) to the MUT-II/III, and also connect it to the batteries.
- (3) Give the crankshaft two turns in a clockwise direction, and check that the No.1 cylinder is in the top dead centre position, and that the timing marks on each sprocket are aligned.
- (4) Select the "belt tension measurement" option from the display on the MUT-II/III.



- (5) As shown in the diagram hold the special belt tension meter set (MB991668) in the middle of the belt between the sprockets (indicated by the arrow), 10~20mm away from the outer side of the belt and vertically to the belt (not leaning more than $\pm 15^\circ$ away from vertical).

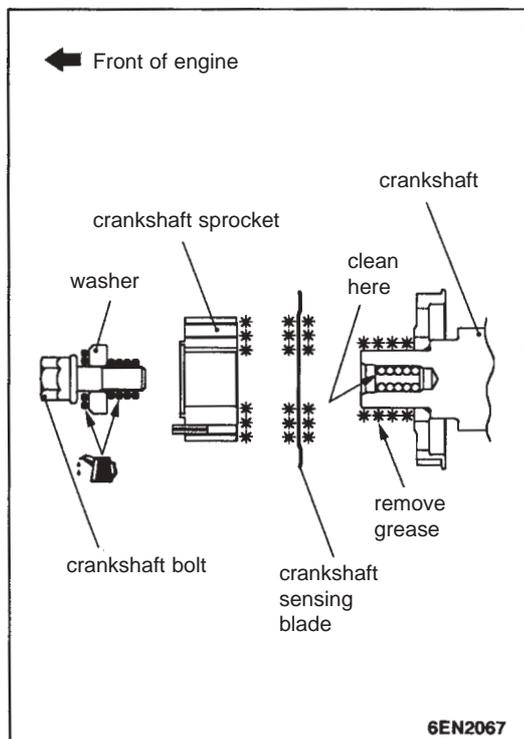
- (6) As shown in the diagram, lightly pull the middle of the belt between the sprockets (indicated by the arrow) using fingertips and check that the vibration frequency of the belt is within the limits specified.

Specified values: 76 ~ 92 Hz

Caution

- (1) **The meter may give an incorrect reading if the microphone is affected by a strong wind, or if there are loud noises nearby, while testing is taking place.**
- (2) **The meter may give an incorrect reading if testing is performed while the microphone is touching the belt.**

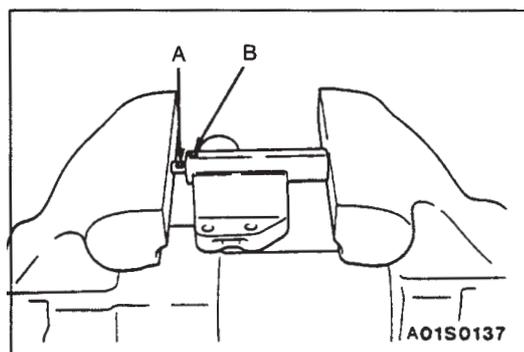
- (7) If the specified values are not met, readjust the tension of the belt.



► C ◀ Fitting the crankshaft sensing blade and the crankshaft sprocket

1. Clean, and remove any grease from the crankshaft sensing blade, the crankshaft sprocket, and the surface of the crankshaft to which the crankshaft sprocket will be fitted.
2. Fit the crankshaft sensing blade and the crankshaft sprocket in the direction shown in the diagram.
3. Clean the screw hole in the crankshaft.
4. Place the washer with the larger surface side in the direction as shown in the diagram, and fit it to the crankshaft bolt.
5. Apply a small quantity of engine oil to the top and to the screw thread parts of the crankshaft bolt.
6. In the same way as when it was removed, hold the crankshaft sprocket using the special tool, and tighten the crankshaft bolt to the specified torque.

Tightening torque: 167 N·m

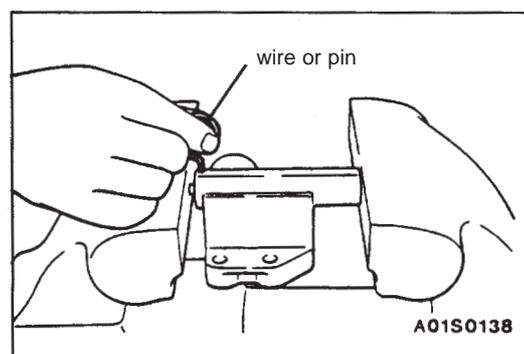


► D ◀ Fitting the auto-tensioner

1. If the auto-tensioner rod remains in an extended state, install it using the following procedure.
 - (1) Using a press or a vice, slowly compress the auto-tensioner rod and align the rod with setting hole A and the tensioner cylinder with setting hole B.

Caution

If the speed of compression is too fast, there is a chance that the rod may break, so carry out this operation slowly.



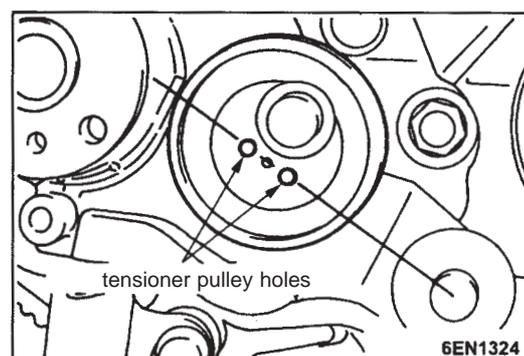
- (2) Insert a wire or pin into the aligned holes.

Note

If a brand new or a replacement auto-tensioner is being used, use a pin to set the auto-tensioner in place.

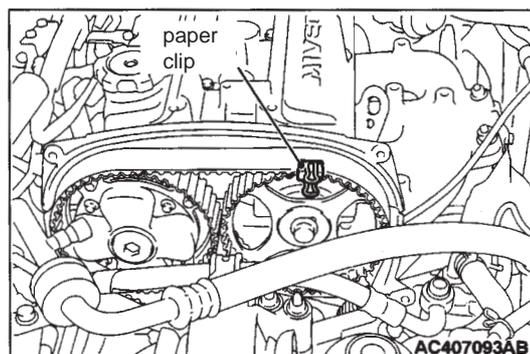
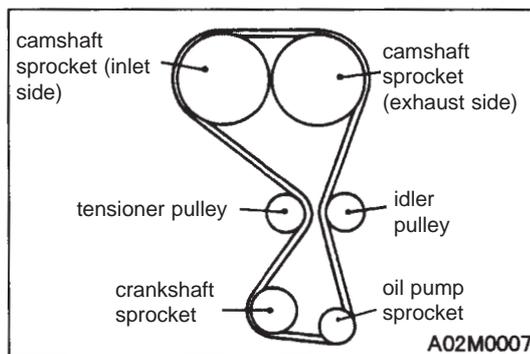
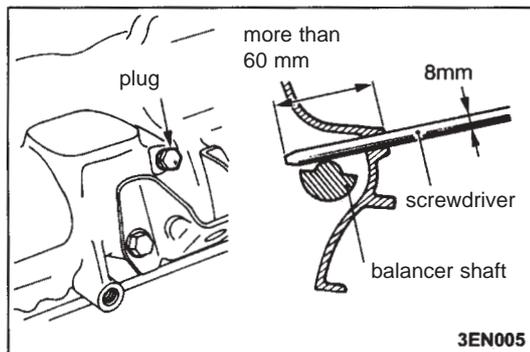
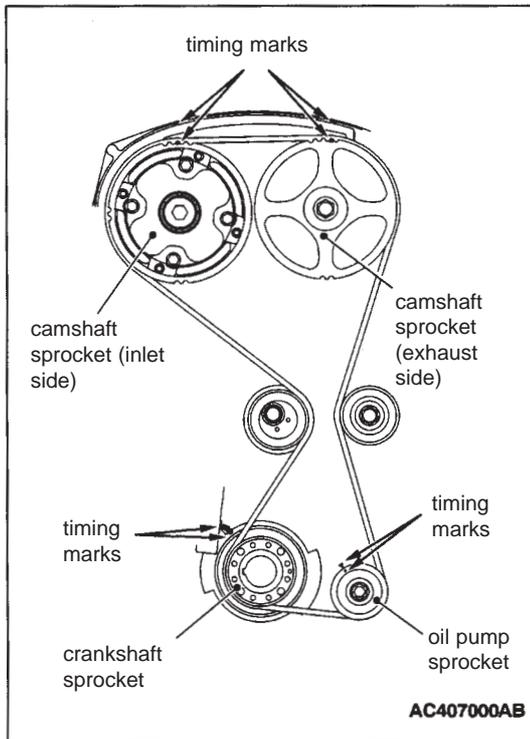
2. Fit the auto-tensioner into the engine and tighten the mounting bolt to the specified torque. Do not remove the wire or pin until the tension of the timing belt has been adjusted.

Tightening torque: 23 ± 3 N·m



► E ◀ Fitting the tensioner pulley

As a temporary step, fit the tensioner pulley as shown in the diagram.



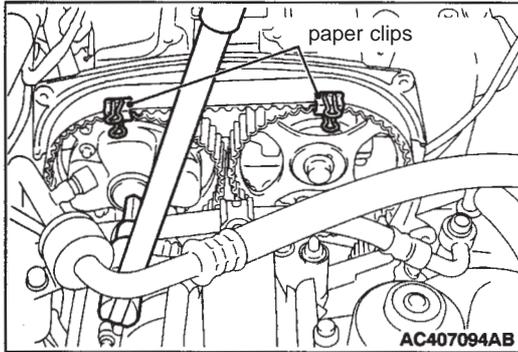
► F ◀ Fitting the timing belt

1. Check that all the timing marks for the camshaft sprocket, the crankshaft sprocket and the oil pump sprocket are aligned.

2. After the timing marks for the oil pump sprocket have been aligned, remove the plug from the cylinder block and insert a positdrive (+) with a diameter of 8 mm into the plug hole. Check that more than 60 mm of the shaft of the screwdriver can be inserted. If the screwdriver strikes the balancer shaft and can only be inserted to a depth of 20 ~ 25 mm, turn the sprocket one complete turn, realign the timing marks, and check that more than 60 mm of the screwdriver can be inserted. Do not remove the screwdriver until the timing belt has been fitted.

3. Install the timing belt in accordance with the following guidelines so that the side that is under tension does not get slack.
 - (1) Fit the timing belt around the crankshaft sprocket first, then the oil pump sprocket and then fit it around the idler pulley.

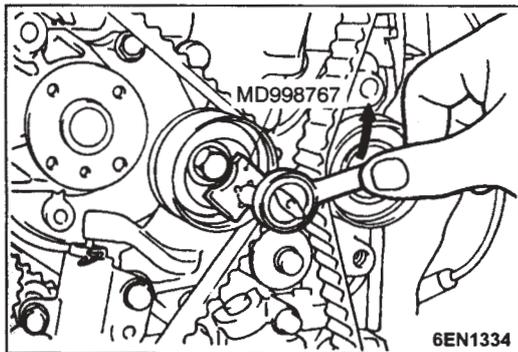
- (2) Fit the timing belt around the camshaft sprocket (exhaust side) and hold it in place with a paper clip at the position shown in the diagram.



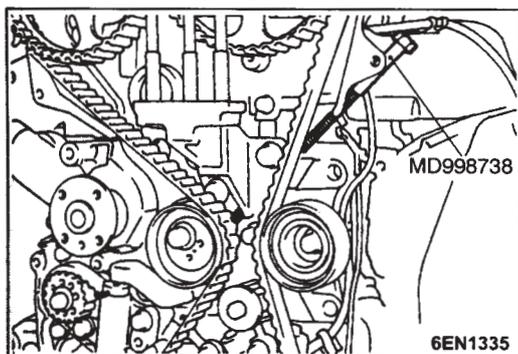
- (3) Use a wrench to align the timing marks on the rocker cover and the camshaft sprocket, and whilst doing so, fit the timing belt around the camshaft sprocket (inlet side) and hold it in place with a paper clip at the position shown in the diagram.
- (4) Fit the timing belt around the tensioner pulley.
- (5) Remove the two paper clips.

Caution

After the timing belt has been installed, apply some force in an anti-clockwise direction to the camshaft sprocket and check once more that all the timing marks are in the correct position when the side of the belt under tension is taught.



4. Using the special wrench for the tensioner pulley socket (MD998767), tense the timing belt by turning the tensioner pulley in the direction shown in the diagram, and temporarily tighten the mounting bolt for the tensioner pulley.
5. Check that all the timing marks are aligned.
6. Remove the screwdriver, and replace the plug.
7. Adjust the tension of the timing belt.



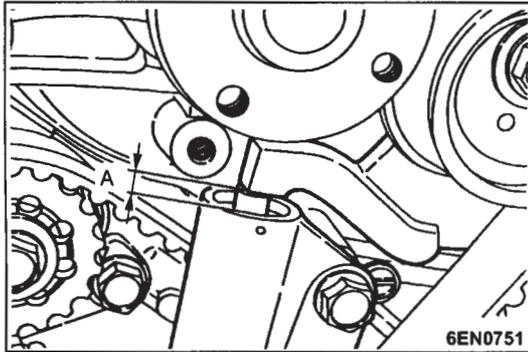
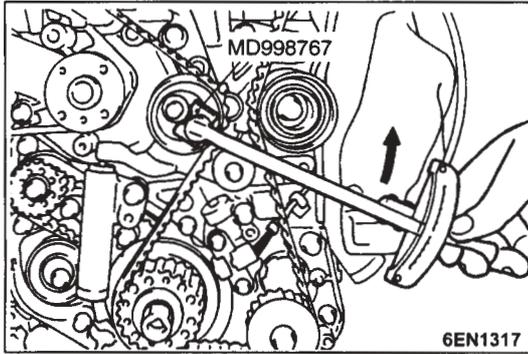
► G ◀ Adjusting the tension of the timing belt

1. Remove the rubber plug from the rear cover of the timing belt and put the special adjusting bolt (MD998738) in position. Slowly twist the adjusting bolt a little at a time, so that the wire or pin inserted when fitting the auto-tensioner, only moves a little.

Caution

There is a possibility that the wire or pin inserted in the auto-tensioner may break if the adjusting bolt is twisted with a spanner or a similar tool, so it must be twisted by hand.

2. Turn the crankshaft a quarter turn in an anti-clockwise direction.
3. Turn the crankshaft in a clockwise direction, realign all the timing marks and set the No.1 cylinder in the top dead centre position.
4. Loosen the mounting bolt for the tensioner pulley which had been temporarily tightened.



5. Using the special wrench for the tensioner pulley socket (MD998767) or a torque wrench, apply tension torque (3.5 N·m) to the timing belt in the direction shown in the diagram, and tighten the mounting bolt for the tensioner pulley to the specified torque.

Tightening torque: 48 ± 5 N·m

Caution

When tightening the installed bolt, take care that the tensioner pulley does not turn around with it. If the pulley does turn around with the bolt, the tension of the belt will become too strong.

6. Remove the wire or pin which had been inserted when the auto-tensioner was fitted.
7. Remove by hand the special adjusting bolt (MD998738) which had been fitted in step 1.
8. Turn the crankshaft two complete turns in a clockwise direction, and leave it for about 15 minutes.
9. Reinsert the wire or pin which had been removed in step 6, and check that it can be easily pulled out again. If the wire or pin can be easily pulled out the tension of the timing belt is just right, so the wire or pin should be removed completely. At this point check that the auto-tensioner rod is not projecting more than the amount specified.

Specified projection (A): 3.8 ~ 4.5 mm

10. If the wire or pin cannot be easily pulled out, repeat steps 1 to 8 until the tension of the timing belt is just right.
11. Recheck that the timing marks on all of the sprockets are in line.

Caution

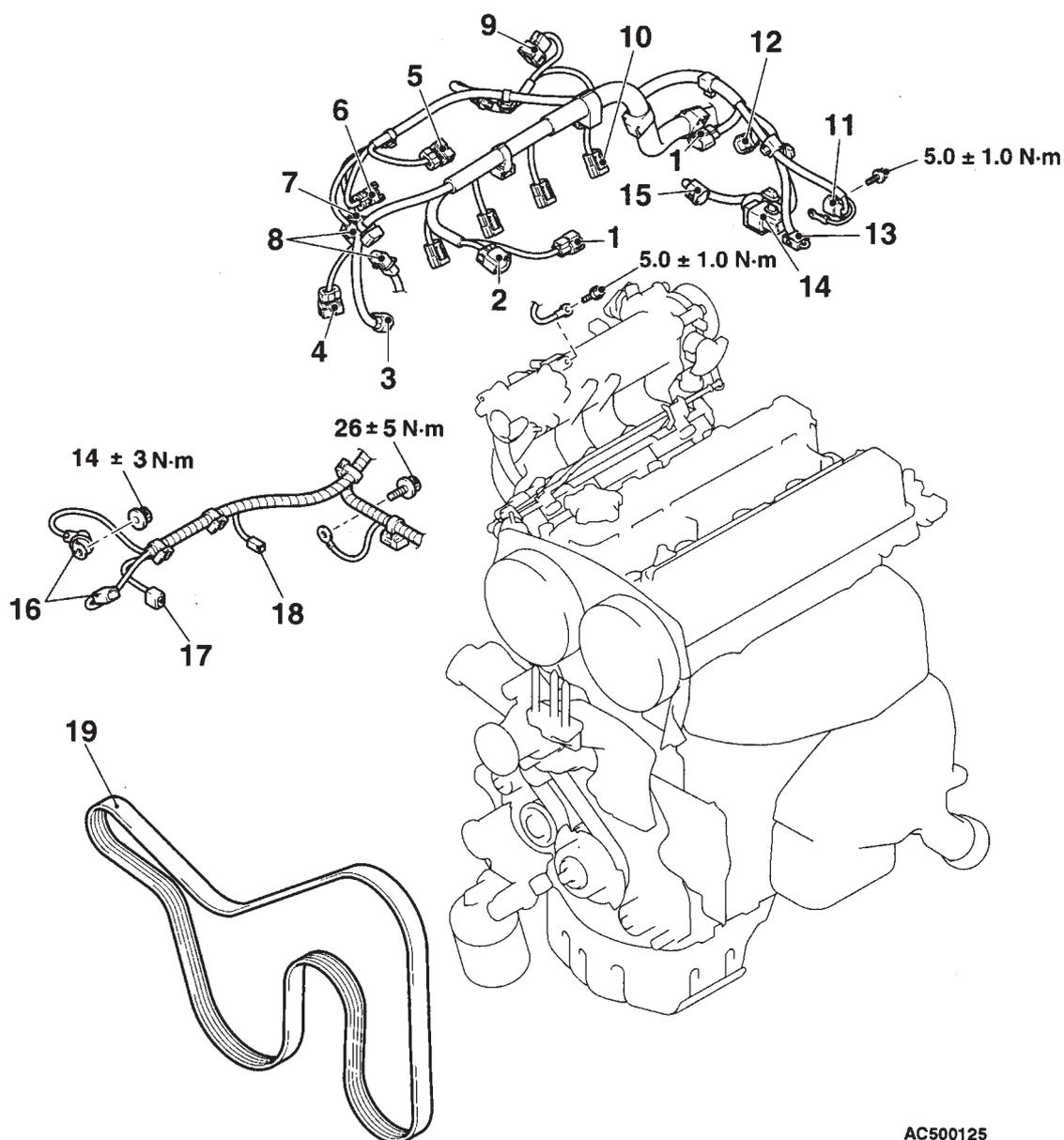
If the crankshaft bolt is turned in an anti-clockwise direction, the tightening torque of the crankshaft bolt must be checked, and if it is loose, it must be retightened.

ENGINE ASSY

Removal and fitting

Jobs to be completed before removal and after fitting

- Measures to prevent fuel leaking. <Only before removal>
- Check for fuel dripping. <Only after fitting>
- Removal and refitting of the bonnet.
- Removal and refitting of the strut tower bar.
- Removal and refitting of the valence. (Ref Section 51: Front bumper)
- Checking the tension of the drive belt. <Only after fitting>
- Adjustment of the axle letter cable. <Only after fitting>
- Draining and replacing the engine oil.
- Draining and replacing the coolant.
- Removal and refitting of the air cleaner.
- Removal and refitting of air pipe C.
- Removal and refitting of the battery and the battery tray.
- Removal and refitting of the centre cover. (Ref P11-5)
- Removal and refitting of the axle letter cable.
- Removal and refitting of the radiator.
- Removal and refitting of the front exhaust pipe.



AC500125

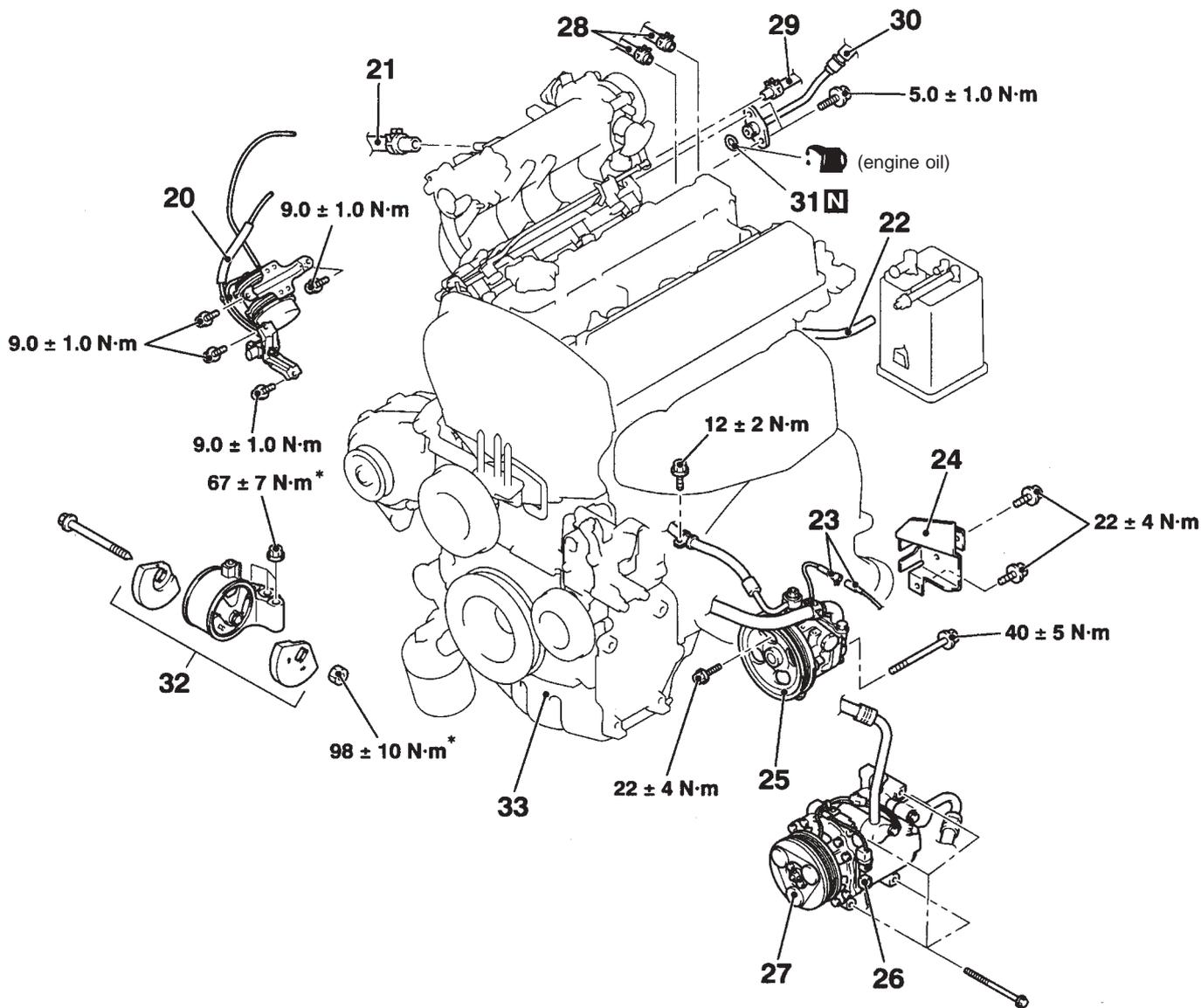
Removal procedure

- | | |
|--|---|
| <ul style="list-style-type: none"> 1. Ignition coil connector 2. O₂ sensor connector 3. Oil feeder control valve connector 4. Crank angle sensor connector 5. Manifold absolute pressure sensor connector 6. Fuel pressure solenoid valve connector 7. Knock sensor connector 8. Purge control solenoid valve connector 9. Throttle position connector 10. Injector connector | <ul style="list-style-type: none"> 11. Exhaust cam position sensor connector 12. Inlet cam position sensor connector 13. Water temperature gauge unit connector 14. Joint control harness and transmission harness 15. Water temperature sensor connector 16. Alternator connector and terminal 17. Secondary air control solenoid valve connector 18. Engine oil pressure switch connector 19. Drive belt |
|--|---|



Caution

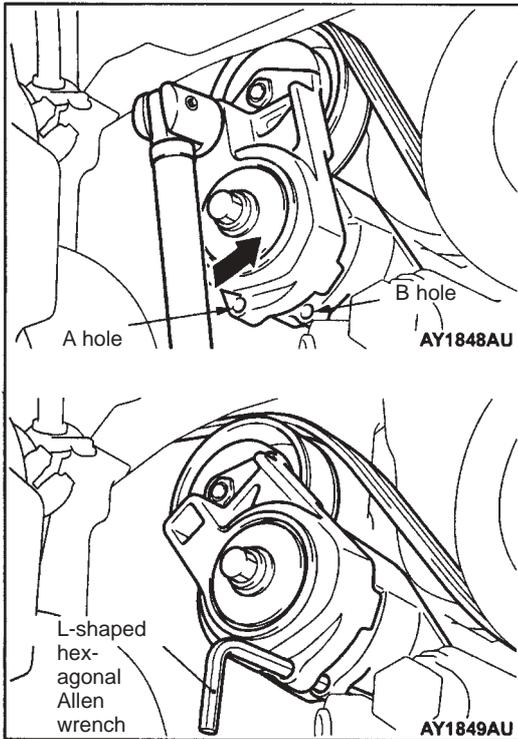
Parts marked * should be temporarily tightened, and then tightened properly when the full weight of the engine is being supported by the chassis.



AC407015AB

- 20. Vacuum tank, solenoid valve, vacuum pipe and hose ASSY
- 21. Brake booster vacuum hose connection
- 22. Purge hose connection
- 23. Power steering oil pressure switch connector
- 24. Heat protector
- ◀ B ▶ 25. Power steering oil pump
- 26. A/C compressor connector
<For cars fitted with A/C>
- ◀ B ▶ 27. A/C compressor <For cars fitted with A/C>

- 28. Heater hose connection
- 29. Fuel return hose connection
- ▶ D ◀ 30. Fuel high pressure hose connection
- ▶ D ◀ 31. O-ring
- ◀ C ▶ ▶ C ◀ • Transfer ASSY, transmission ASSY
- ◀ D ▶ ▶ B ◀ 32. Engine mount bracket & stopper ASSY
- ◀ E ▶ ▶ A ◀ 33. Engine ASSY



Removal guidelines

◀ A ▶ Removing the drive belt

The following operations are necessary because the engine uses a serpentine drive system with auto-tensioner.

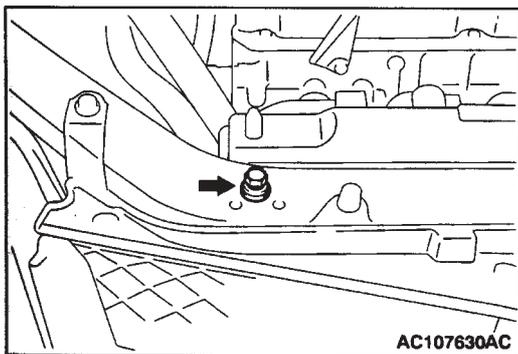
1. Insert a 12.7sq spinner handle into the auto-tensioner tool hole, and turn the auto-tensioner in an anti-clockwise direction before it reaches the stopper.
2. Align hole A and hole B, insert an L-shaped hexagonal Allen Key, to hold the position, and remove the drive belt.

Caution

If planning to re-use the drive belt, ensure that it will be refitted the same way round, by marking the back of the belt with chalk arrows indicating the direction of movement.

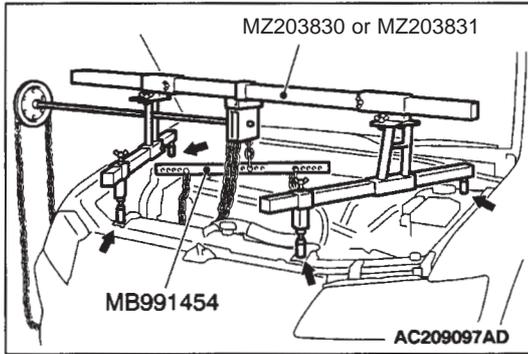
◀ B ▶ Removing the power steering oil pump and the A/C compressor

1. Remove the power steering oil pump and the A/C compressor from the bracket with the hoses intact.
2. Secure the removed power steering oil pump and the removed A/C compressor with string, and put them somewhere where they will not hinder the removal or fitting of the engine ASSY.



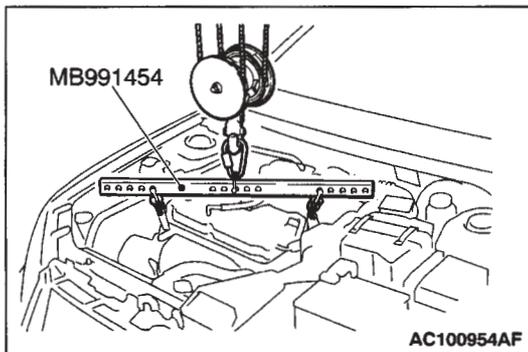
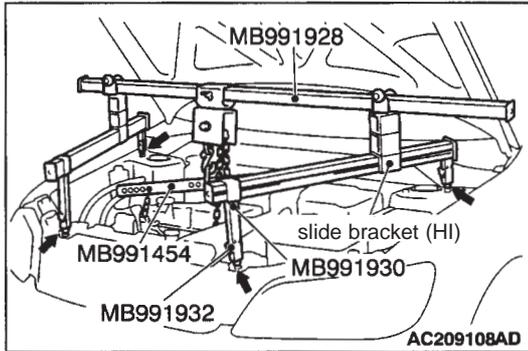
◀ C ▶ Removing the transfer ASSY and the transmission ASSY

1. In order to prepare the special mechanical engine hanger (MZ203830, MZ203831 or MB991928), the radiator support upper insulator mounting bolts should be tightened on the chassis (2 places).
2. Remove the transfer ASSY and the transmission ASSY.



◀ D ▶ Removing the engine mount bracket & stopper ASSY

1. Support the engine using a garage jack.
2. Remove the special mechanical engine hanger (MZ203830, MZ203831 or MB991928).



3. Hold the engine ASSY using a chain block.
4. Support the engine oil pan component with the garage jack through the engine block, so that the weight of the engine is not taken by the engine mount bracket.
5. Loosen the nuts and bolts and remove the engine mount bracket and stopper ASSY.

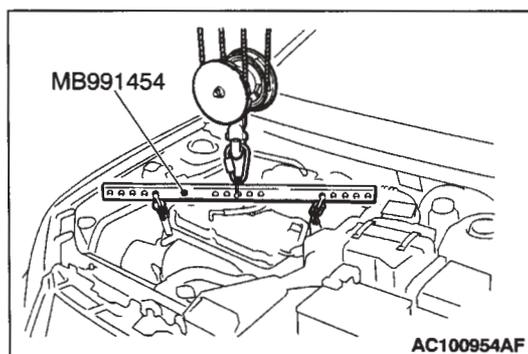
◀ E ▶ Removing the engine ASSY

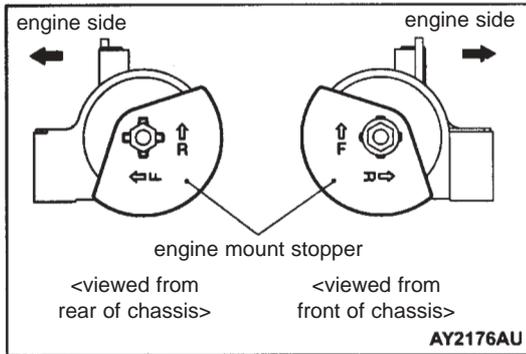
After checking that all of the cables, hoses and harness connectors etc have been disconnected, slowly hoist the engine using a chain block and remove the engine from the engine compartment.

Fitting guidelines

▶ A ◀ Fitting the engine ASSY

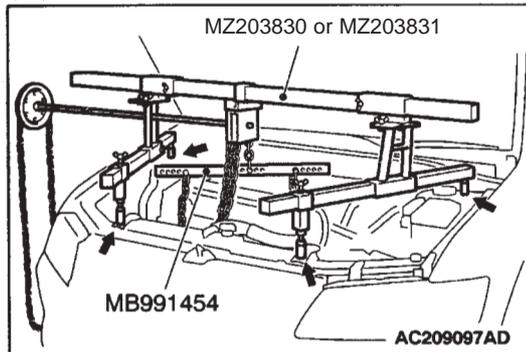
Install the engine whilst checking that cables, hoses and harness connectors etc will not be squashed beneath it.



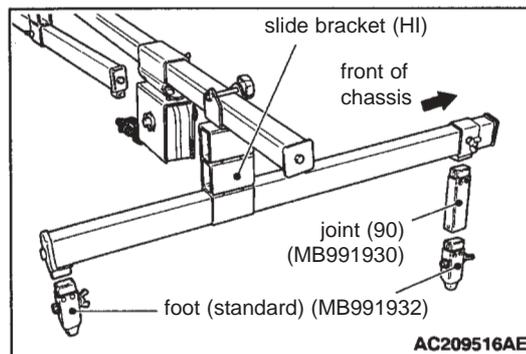


► B ◀ Fitting the engine mount bracket & stopper ASSY

1. Support the engine oil pan component with the garage jack through the engine block, and fit the engine mount bracket & stopper ASSY whilst checking the position of the engine. Fix the engine mount stopper so that the arrow points in the direction shown in the diagram.
2. Support the engine ASSY with a garage jack.
3. Remove the chain block.
4. In the same way as when it was removed, hold the engine ASSY with the special tool.



- (1) <When using the special mechanical engine hanger (MZ203830 or MZ203831)>
Install the special mechanical engine hanger (MZ203830 or MZ203831).

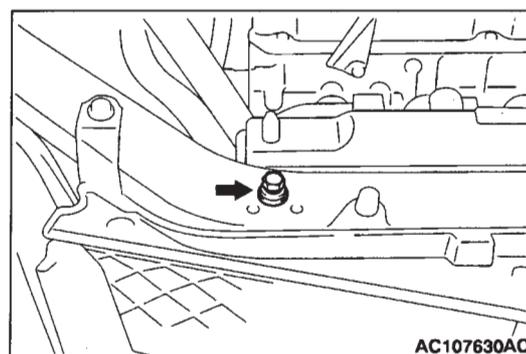
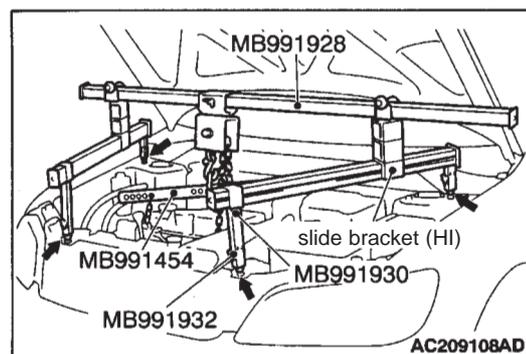


- (2) <When using the special engine hanger (MB991928)>

Fit the following parts to the base hanger.

- Slide bracket (HI)
- Foot (standard) (MB991932)
- Joint (90) (MB991930)

Install the special engine hanger (MB991928)



► C ◀ Fitting the transfer ASSY and the transmission ASSY

1. Fit the transfer ASSY and the transmission ASSY.
2. Remove the radiator support upper insulator mounting bolts from the chassis (2 places).

◀ D ▶ Fitting the O-ring and the fuel high pressure hose

1. Apply a little fresh engine oil to the O-ring.

Caution

Ensure that no engine oil gets inside the deliver pipe.

2. Without damaging the O-ring, fit the fuel high pressure hose to the delivery pipe by twisting it from left to right. Ensure that the hose is twisted smoothly.
3. If the hose cannot be twisted smoothly, there is a possibility that it may be biting into the O-ring, so remove the fuel high pressure hose, and check for any damage to the O-ring. If the O-ring is undamaged, reinsert it into the delivery pipe and check once more whether the hose can be turned smoothly.
4. Tighten the mounting bolts for the fuel high pressure hose, to the specified torque.

Tightening torque: 5.0 ± 1.0 N•m.