

GROUP 11A

ENGINE MECHANICAL

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GENERAL INFORMATION

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Item		3A92
Total displacement cm ³ (cu in)		1,193 (72.8)
Bore × stroke mm (in)		75.0 (2.95) × 90.0 (3.54)
Compression ratio		10.5
Combustion chamber		Pentroof type
Camshaft arrangement		DOHC
Valve timing	Intake opening	BTDC 41° – ATDC 9 °
	Intake closing	ABDC 19° – ABDC 69°
	Exhaust opening	BBDC 35°
	Exhaust closing	ATDC 5°
Fuel system		Electronically controlled multiport fuel injection
Ignition system		Electronic-controlled 3-coil

ENGINE DIAGNOSIS

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Symptom	Probable cause	Remedy
Compression is too low	Blown cylinder head gasket	Replace the gasket.
	Worn or damaged piston rings	Replace the rings.
	Worn piston or cylinder	Repair or replace the piston and/or the cylinder block.
	Worn or damaged valve seat	Repair or replace the valve and/or the seat ring
Drop in engine oil pressure	Engine oil level is too low	Check the engine oil level.
	Malfunction of engine oil pressure switch	Replace the engine oil pressure switch.
	Clogged oil filter	Install a new filter.
	Worn oil pump gears or cover	Replace the gears and/or the cover.
	Thin or diluted engine oil	Change the engine oil to the correct viscosity.
	Stuck (opened) oil relief valve	Repair the relief valve.
	Excessive bearing clearance	Replace the bearings.
Engine oil pressure too high	Stuck (closed) oil relief valve	Repair the relief valve.
Noisy valves	Incorrect valve clearance	Adjust valve clearance
	Thin or diluted engine oil (low engine oil pressure)	Change the engine oil.
	Worn or damaged valve stem or valve guide	Replace the valve and/or the guide.
Connecting rod noise/main bearing noise	Insufficient oil supply	Check the engine oil level.
	Thin or diluted engine oil	Change the engine oil.
	Excessive bearing clearance	Replace the bearings.

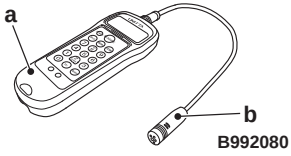
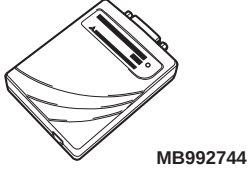
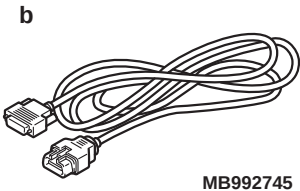
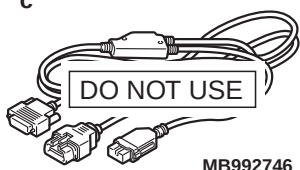
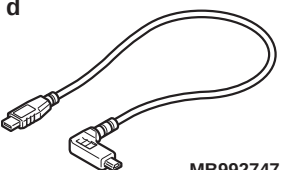
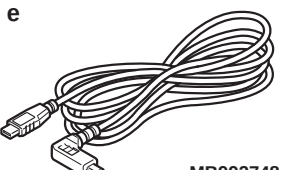
SERVICE SPECIFICATIONS

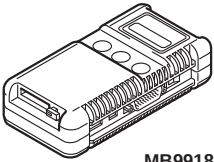
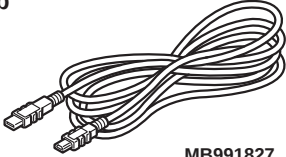
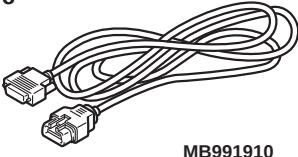
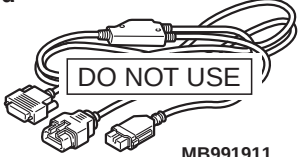
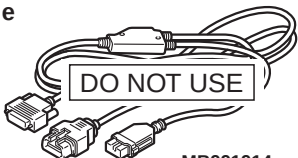
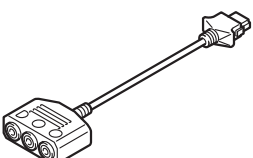
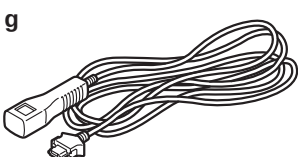
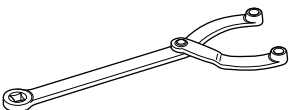
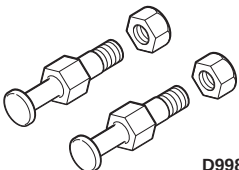
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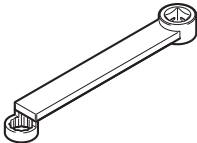
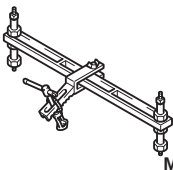
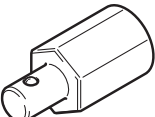
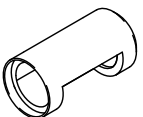
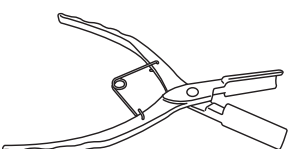
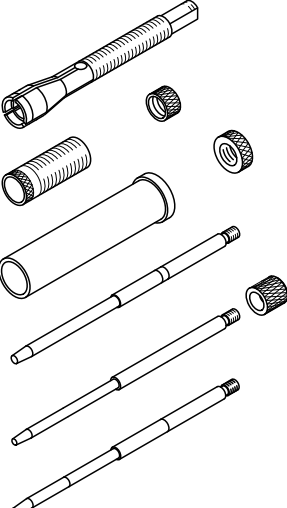
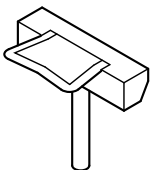
Item			Standard value	Limit
Drive belt tension (When checked)	Vibration frequency Hz	Vehicles without A/C	144 – 169	–
		Vehicles with A/C	143 – 169	–
	Tension N (lb)		490 – 686 (110.2 – 154.2)	–
	Deflection mm (in) [Reference]	Vehicles without A/C	8.3 – 10.5 (0.33 – 0.41)	–
		Vehicles with A/C	8.5 – 10.9 (0.34 – 0.42)	–
Drive belt tension (When adjusted)	Vibration frequency Hz	Vehicles without A/C	151 – 163	–
		Vehicles with A/C	150 – 163	–
	Tension N (lb)		539 – 637 (121.2 – 143.2)	–
	Deflection mm (in) [Reference]	Vehicles without A/C	8.8 – 9.9 (0.35 – 0.38)	–
		Vehicles with A/C	9.1 – 10.2 (0.36 – 0.40)	–
Drive belt tension (When replaced)	Vibration frequency Hz	Vehicles without A/C	192 – 202	–
		Vehicles with A/C	192 – 202	–
	Tension N (lb)		882 – 980 (198.3 – 220.3)	–
	Deflection mm (in) [Reference]	Vehicles without A/C	6.2 – 6.8 (0.25 – 0.26)	–
		Vehicles with A/C	6.3 – 6.9 (0.25 – 0.27)	–
Basic ignition timing			5° BTDC ± 3°	–
Ignition timing			Approximately 8° BTDC	–
Idle speed r/min			700 ± 50	–
CO contents %			0.5 or less	–
HC contents ppm			100 or less	–
Valve clearance mm (in)	cold engine	Intake	0.22 ± 0.04 (0.009 ± 0.001)	–
		Exhaust	0.30 ± 0.04 (0.012 ± 0.001)	–
Compression pressure kPa (psi)	at engine speed of 250 r/min		1,410 (205)	Minimum 950 (138)
Compression pressure difference of all cylinders kPa (psi)			–	Maximum 98 (14)
Intake manifold vacuum kPa (in Hg)			–	Minimum 60 (17)

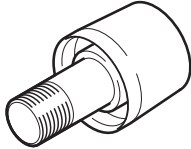
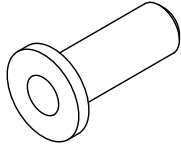
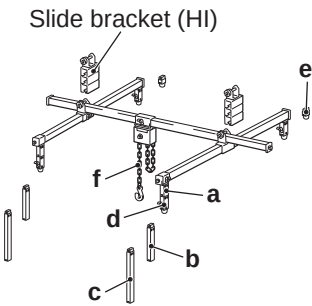
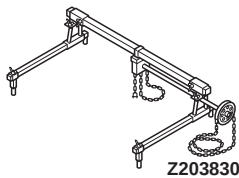
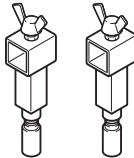
SPECIAL TOOLS

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Tool	Tool number and name	Supersession	Application
	MB992080 a: MB992081 b: MB992082 Belt tension meter set a: Belt tension meter b: Microphone assembly	Tool not available	Drive belt tension check
    	a. MB992744 b. MB992745 c. MB992746 d. MB992747 e. MB992748 a. Vehicle communication interface-Lite (V.C.I.-Lite) b. V.C.I.-Lite main harness A (for vehicles with CAN communication) c. V.C.I.-Lite main harness B (for vehicles without CAN communication) d. V.C.I.-Lite USB cable short e. V.C.I.-Lite USB cable long	—	• Checking the ignition timing • Checking the idle speed • Erasing the diagnostic trouble code

Tool	Tool number and name	Supersession	Application
a  MB991824 b  MB991827 c  MB991910 d  MB991911 e  MB991914 f  MB991825 g  MB991826 MB991958	MB991958 a. MB991824 b. MB991827 c. MB991910 d. MB991911 e. MB991914 f. MB991825 g. MB991826 M.U.T.-III sub-assembly a. Vehicle communication interface (V.C.I.) b. M.U.T.-III USB cable c. M.U.T.-III main harness A (Vehicles with CAN communication system) d. M.U.T.-III main harness B (Vehicles without CAN communication system) e. M.U.T.-III main harness C (for Chrysler models only) f. M.U.T.-III measurement adapter g. M.U.T.-III trigger harness	MB991824-KIT <i>NOTE: G: MB991826 M.U.T.-III Trigger Harness is not necessary when pushing V.C.I. ENTER key.</i>	⚠ CAUTION M.U.T.-III main harness A (MB991910) should be used. M.U.T.-III main harness B and C should not be used for this vehicle. • Checking the ignition timing • Checking the idle speed • Erasing the diagnostic trouble code
 B990767	MB990767 Front hub and flange yoke holder	MB990767-01	Holding the crankshaft pulley
 D998719	MD998719 Pin	MIT308239	

Tool	Tool number and name	Supersession	Application
 B991992	MB991992 Torque wrench adaptor	—	V.V.T. sprocket bolt removal and installation
 MD998772	MD998772 Valve spring compressor	General service tool	Valve spring compression
 B992090	MB992090 Retainer holder attachment	—	
	MB992089 Retainer holder C	—	
	MB992085 Valve stem seal pliers	—	Valve stem seal removal
 B992922	MB992922 Valve stem seal installer adjustable	—	Valve stem seal press-fitting
 D998727	MD998727 Oil pan FIPG cutter	MD998727-01	Oil pan removal

Tool	Tool number and name	Supersession	Application
 B991993	MB991993 Crankshaft front oil seal guide	—	Front oil seal installation
	MB990699 Differential oil seal installer	—	
 B991928 AI	MB991928 a: MB991929 b: MB991930 c: MB991931 d: MB991932 e: MB991933 f: MB991934 Engine hanger a: Joint (50) × 2 b: Joint (90) × 2 c: Joint (140) × 2 d: Foot (standard) × 4 e: Foot (short) × 2 f: Chain and hook assembly	Tool not available	Supporting the engine assembly
 Z203830	MB991895 Engine hanger	Tool not available	
 MB992906	MB992906 Engine hanger attachment	—	
 MB992336	MB992336 a: MB992353 × 2 b: MB992354 × 2 EV battery cart a: Rigid caster b: Swivel caster	—	Engine assembly removal and installation

ON-VEHICLE SERVICE**DRIVE BELT TENSION CHECK AND
ADJUSTMENT**

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DRIVE BELT TENSION CHECK**⚠ CAUTION**

- When checking the drive belt tension, make sure that the engine is cold.
- Check the drive belt tension after turning the crankshaft clockwise one turn or more.

Check the drive belt tension in the following procedure.

NOTE: For the vehicles without A/C, the check procedure is also same.

Standard value:

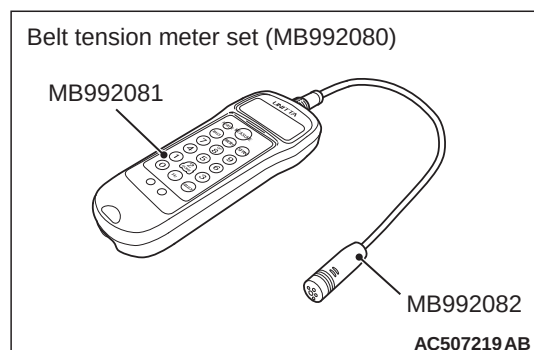
Item	When checked	When adjusted	When replaced
Vibration frequency Hz	144 – 169* ¹ 143 – 169* ²	151 – 163* ¹ 150 – 163* ²	192 – 202* ¹ 192 – 202* ²
Tension N (lb)	490 – 686 (110.2 – 154.2)	539 – 637 (121.2 – 143.2)	882 – 980 (198.3 – 220.3)
Deflection mm (in) [Reference]	8.3 – 10.5 (0.33 – 0.41)* ¹ 8.5 – 10.9 (0.34 – 0.42)* ²	8.8 – 9.9 (0.35 – 0.38)* ¹ 9.1 – 10.2 (0.36 – 0.40)* ²	6.2 – 6.8 (0.25 – 0.26)* ¹ 6.3 – 6.9 (0.25 – 0.27)* ²

NOTE:

- *¹: Vehicles without A/C
- *²: Vehicles with A/C

**<When the vibration frequency is measured:
Recommendation>**

1. Connect special tool microphone assembly (MB992082) to special tool belt tension meter (MB992081) of special tool belt tension meter set (MB992080).
2. Press the "POWER" button to turn on the power supply.
3. Press number key "1". Check to ensure that "No. 01" appears on the upper left of the display and that the following numeric values are displayed for individual items ("M", "W", and "S"):
 - M 000.9 g/m
 - W 010.0 mm/R
 - S 0100 mm



NOTE: If numeric values have not been entered (new tool), set them according to the belt specifications as shown below. Once you set them, you do not have to set them again. The settings remain undeleted even after battery replacement.

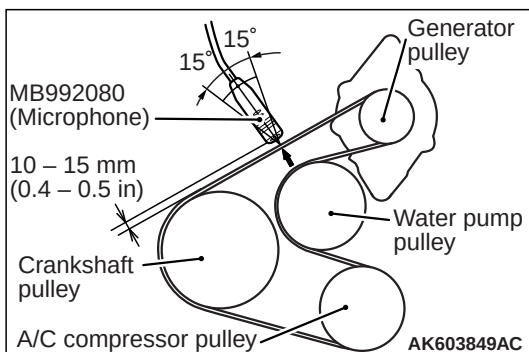
NOTE: This operation is to temporarily set the preset data such as the belt specifications, because if the measurement is taken without input of the belt specifications, conversion to tension value (N) cannot be made, resulting in judgment of error.

<Setting procedure>

- (1) Press down the "MASS" button till the belt mass select display appears.
 - (2) Press the "UP" or "DOWN" button to select "01 1.5GT 0.9" and press the "MEASURE" button to decide it. Check to ensure that "M 000.9 g/m" is displayed.
 - (3) Press the "WIDTH" button to change to the belt width input display.
 - (4) Press number keys "0", "1", "0", and "0" sequentially, and press the "SELECT" button to apply them. Check to ensure that "W 010.0 mm/R" appears on the display.
 - (5) Press the "SPAN" button to change to the span length input display.
 - (6) Press number keys "0", "1", "0", and "0" sequentially, and press the "SELECT" button to apply them. Check to ensure that "S 0100 mm" appears on the display.
4. Press "Hz" button twice to change the display to the frequency display (Hz).

⚠ CAUTION

- Do not let any contaminants such as water or oil get onto the microphone.
- If strong gusts of wind blow against the microphone or if there is loud sources of noise nearby, the values measured by the microphone may not correspond to actual values.
- If the microphone is touching the belt while the measurement is being made, the values measured by the microphone may not correspond to actual values.
- Do not take the measurement while the vehicle's engine is running.



5. Hold special tool MB992080 to the middle of the drive belt between the pulleys (at the place indicated by arrow) where it does not contact the drive belt [approximately 10 – 15 mm (0.4 – 0.5 inch) away from the rear surface of the belt] so that it is perpendicular to the drive belt (within an angle of $\pm 15^\circ$).
6. Press the "MEASURE" button.
7. Gently tap the middle of the drive belt between the pulleys (the place indicated by the arrow) with your finger as shown in the illustration.
8. Check that the vibration frequency of the drive belt is within the standard value.

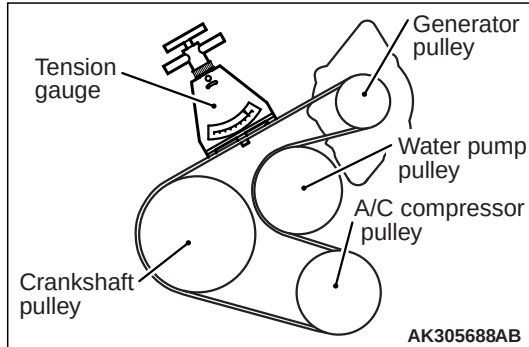
NOTE: To take the measurement repeatedly, fillip the drive belt again.

9. After the completion of the measurement, press and hold the "POWER" button to turn off the power supply.

<When tension is measured>

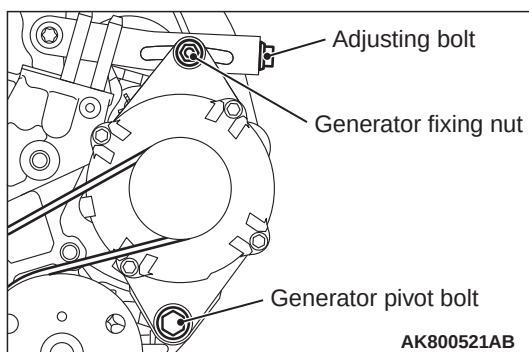
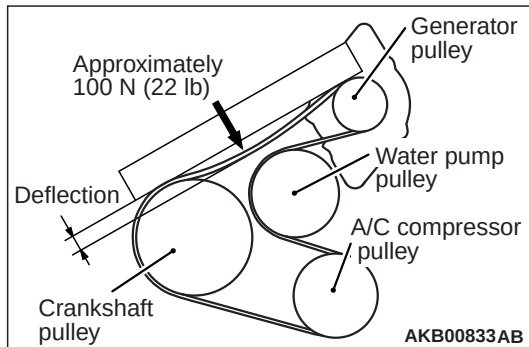
Use a belt tension gauge in the middle of the drive belt between the pulleys shown in the figure to check that the drive belt tension is within the standard value.

NOTE: Before inspection, remove the oil dipstick guide assembly (Refer to P.11A-44).



<When deflection is measured>

Apply approximately 100 N (22 pounds) of force to the middle of the drive belt between the pulleys (at the place indicated by the arrow) and check that the amount of deflection is within the standard value.



DRIVE BELT TENSION ADJUSTMENT

If not within the standard value, adjust the belt tension by the following procedure.

1. Loosen the nut for generator pivot bolt.
2. Loosen the generator fixing nut.
3. Temporarily tighten the generator fixing nut.

Tightening torque: 10 ± 3 N·m (89 ± 26 in-lb)

4. Use the adjusting bolt to adjust the belt tension and belt deflection to the standard values.
5. Tighten the nut for generator pivot bolt.

Tightening torque: 47 ± 5 N·m (35 ± 3 ft-lb)

6. Tighten the generator fixing nut.

Tightening torque: 23 ± 2 N·m (17 ± 1 ft-lb)

7. Tighten the adjusting bolt.

Tightening torque: 5.0 ± 1.0 N·m (44 ± 8 in-lb)

CAUTION

When checking the belt tension, turn the crankshaft clockwise one turn or more.

8. Check the belt tension, and readjust if necessary.

9. When the belt tension is adjusted by measuring the deflection, adjust it with a tool for vibration frequency measurement or tension measurement afterward.

IGNITION TIMING CHECK

M1111001703305

1. Before inspection, set the vehicle to the pre-inspection condition.

CAUTION

To prevent damage to scan tool (M.U.T.-III), always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool (M.U.T.-III).

2. Turn the ignition switch to the "LOCK" (OFF) position and then connect scan tool (M.U.T.-III) to the data link connector [Refer to GROUP 13A – Diagnostic Function, How to Connect the Scan Tool (M.U.T.-III) [P.13A-10](#)].
3. Set the timing light to the power supply line (terminal No. 3) of the ignition coil No. 1.

NOTE: The power supply line is looped and also longer than the other ones.

4. Start the engine and let it run at idle.
5. Select the item No. 2 on scan tool (M.U.T.-III) and measure engine idle speed and check that it is approximately 700 r/min.
6. Select No. 11 (actuator test function) of the scan tool (M.U.T.-III), and set the ignition timing to the basic ignition timing.
7. Check that basic ignition timing is within the standard value.
Standard value: 5° BTDC ± 3°
8. If the basic ignition timing is outside the standard value, inspect the MFI system (Refer to GROUP 13A – Diagnosis, Symptom Chart [P.13A-52](#)).

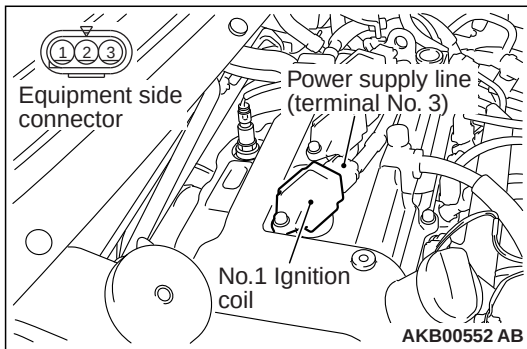
CAUTION

If the test is not cancelled, a forced driving will continue for 27 minutes. Driving under this condition may damage the engine.

9. Cancel the actuator test function item No. 11, Basic ignition timing set mode, on scan tool (M.U.T.-III)
10. Check that ignition timing is at the standard value.

Standard value: Approximately 8° BTDC

11. Remove the timing light.
12. Turn the ignition switch to the "LOCK" (OFF) position and then disconnect the scan tool (M.U.T.-III).



IDLE SPEED CHECK

M1111003503363

1. Before inspection, set the vehicle to the pre-inspection condition.

⚠ CAUTION

To prevent damage to scan tool (M.U.T.-III), always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool (M.U.T.-III).

2. Turn the ignition switch to the "LOCK" (OFF) position and then connect scan tool (M.U.T.-III) to the data link connector [Refer to GROUP 13A – Diagnostic Function, How to Connect the Scan Tool (M.U.T.-III) [P.13A-10](#)].
3. Set the timing light to the power supply line (terminal No. 3) of the ignition coil No. 1.

NOTE: The power supply line is looped and also longer than the other ones.

4. Start the engine and let it run at idle.
5. Check that ignition timing is at the standard value.

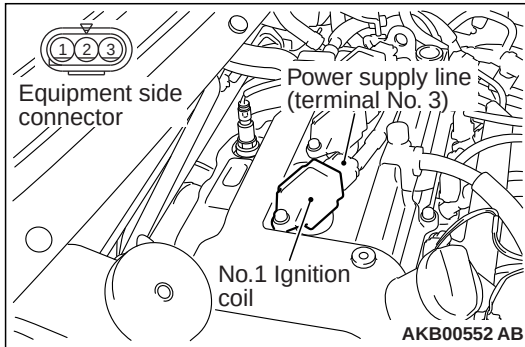
Standard value: Approximately 8° BTDC

6. Check the idle speed.

Standard value: 700 ± 50 r/min

NOTE:

- The idle speed is controlled automatically by the idle speed control system.
 - When using the scan tool (M.U.T.-III), select item No. 2 and take a reading of the idle speed.
7. If the idle speed is outside the standard value, inspect the MFI system (Refer to GROUP 13A – Diagnosis, Symptom Chart [P.13A-52](#)).
 8. Remove the timing light.
 9. Turn the ignition switch to "LOCK" (OFF) position and then disconnect the scan tool (M.U.T.-III).



IDLE MIXTURE CHECK

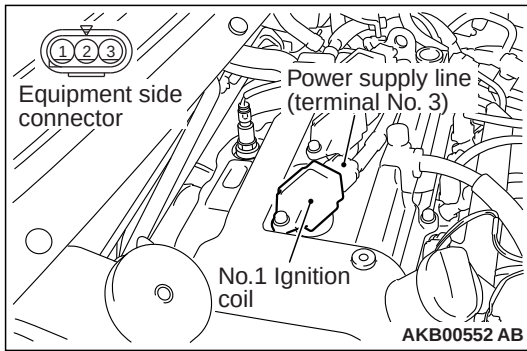
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1. Before inspection, set the vehicle to the pre-inspection condition.

⚠ CAUTION

To prevent damage to scan tool (M.U.T.-III), always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool (M.U.T.-III).

2. Turn the ignition switch to the "LOCK" (OFF) position and then connect scan tool (M.U.T.-III) to the data link connector [Refer to GROUP 13A – Diagnostic Function, How to Connect the Scan Tool (M.U.T.-III) [P.13A-10](#)].



3. Set the timing light to the power supply line (terminal No. 3) of the ignition coil No. 1.

NOTE: The power supply line is looped and also longer than the other ones.

4. Start the engine and let it run at idle.
5. Check that ignition timing is at the standard value.

Standard value: Approximately 8° BTDC

6. Run the engine at 2,000 – 3,000 r/min for 2 minutes.
7. Set the CO, HC tester.
8. Check the CO contents and the HC contents at idle.

Standard value

CO contents: 0.5 % or less

HC contents: 100 ppm or less

9. If there is a deviation from the standard value, inspect the MFI system (Refer to GROUP 13A – Diagnosis, Symptom Chart P.13A-52).
10. Remove the timing light and CO, HC tester.
11. Turn the ignition switch to the "LOCK" (OFF) position and then disconnect the scan tool (M.U.T.-III).

VALVE CLEARANCE CHECK AND ADJUSTMENT

M1111001502267

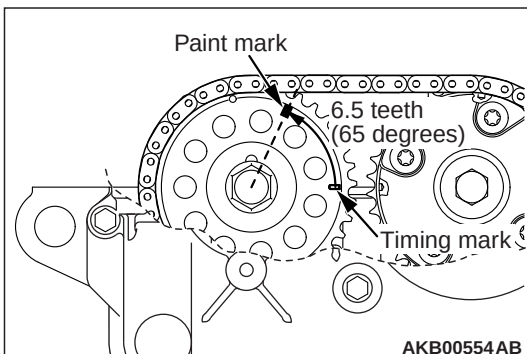
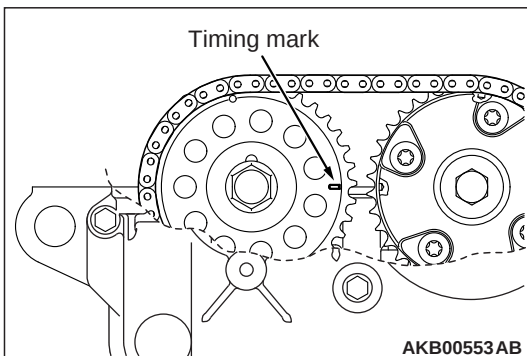
NOTE: Perform the valve clearance check and adjustment at the engine cold state.

1. Remove the cylinder head cover assembly (Refer to P.11A-22).

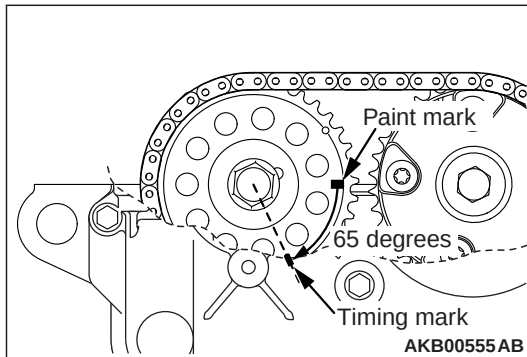
CAUTION

Turn the crankshaft always clockwise.

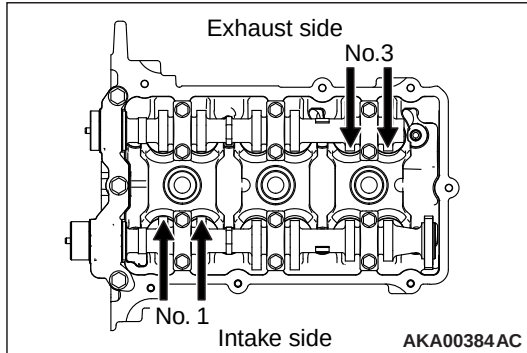
2. Turn the crankshaft clockwise, and align the timing mark on the exhaust camshaft sprocket against the upper face of the cylinder head as shown in figure. Therefore No.1 cylinder goes to the compression top dead center.



3. Apply the paint mark to the 6.5th tooth (65 degrees) counterclockwise from the timing mark on the exhaust camshaft sprocket.



4. Turn the crankshaft clockwise 130 degrees, and align the paint mark against the upper face of the cylinder head as shown in figure.

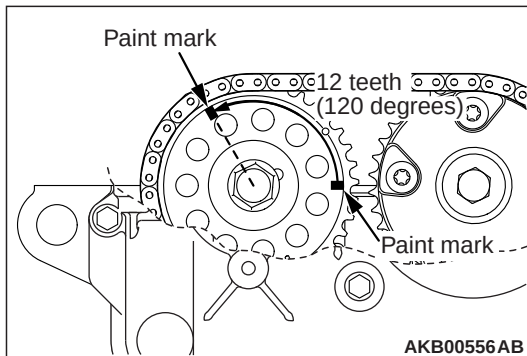


5. Using a thickness gauge, measure the valve clearance with the arrow shown in figure. If deviated from the standard value, make note for the valve clearance.

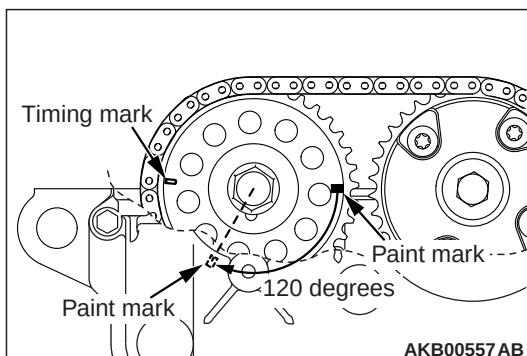
Standard value [cold engine]:

Intake valve 0.22 ± 0.04 mm (0.009 ± 0.001 inch)

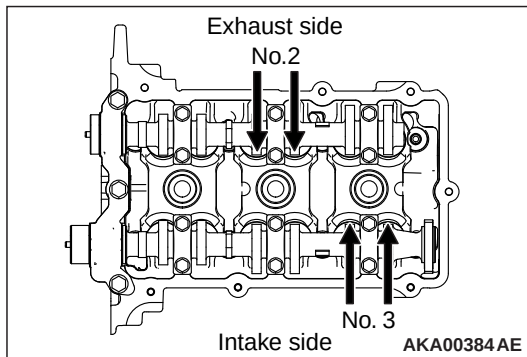
Exhaust valve 0.30 ± 0.04 mm (0.012 ± 0.001 inch)



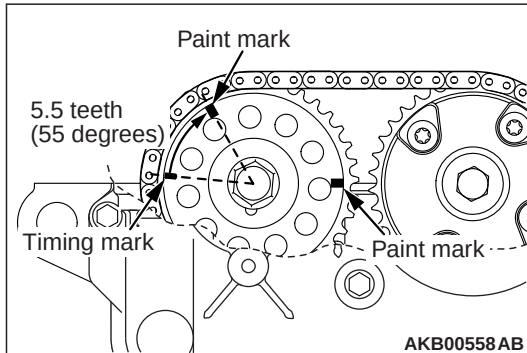
6. Apply the paint mark to the 12th tooth (120 degrees) counterclockwise from the paint mark.



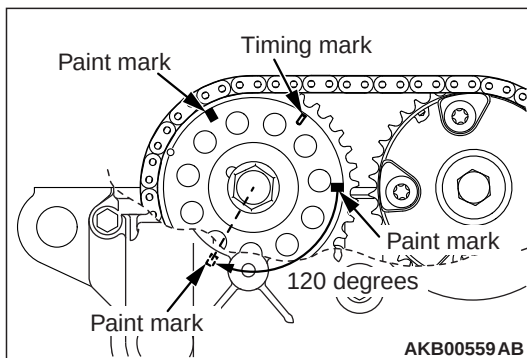
7. Turn the crankshaft clockwise 240 degrees, and align the paint mark against the upper face of the cylinder head as shown in figure.



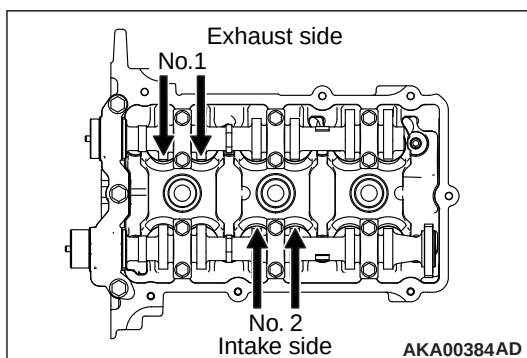
8. Check the valve clearance with the arrow shown in figure. In the same procedure as 5.



9. Apply the paint mark to the 5.5th tooth (55 degrees) clockwise from the timing mark on the exhaust camshaft sprocket.

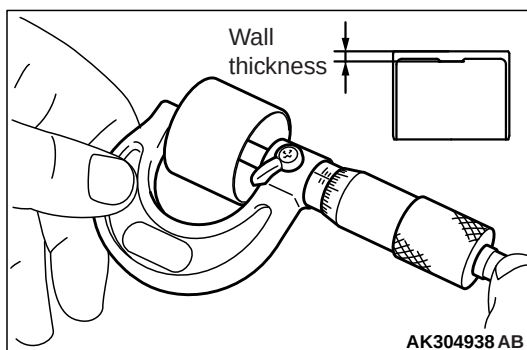


10. Turn the crankshaft clockwise 240 degrees, and align the paint mark against the upper face of the cylinder head as shown in figure.



11. Check the valve clearance with the arrow shown in figure. In the same procedure as 5.

12. If the valve clearance is deviated from the standard value, remove the camshaft and the valve tappet (Refer to [P.11A-23](#)).



13. Using a micrometer, measure the thickness of the removed valve tappet.

14. Calculate the thickness of the newly installed valve tappet through the following equation.

A: Thickness of new valve tappet

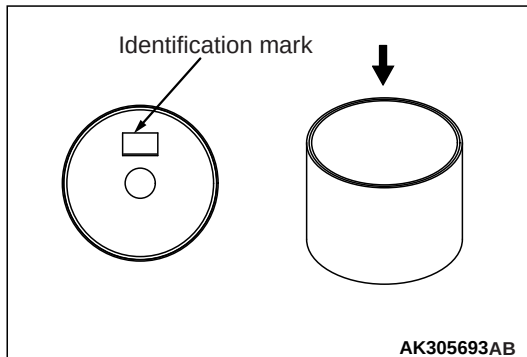
B: Thickness of old valve tappet

C: Measured valve clearance

Equation

Intake valve: $A = B + [C - 0.22 \text{ mm (0.009 in)}]$

Exhaust valve: $A = B + C - 0.30 \text{ mm (0.012 in)}$



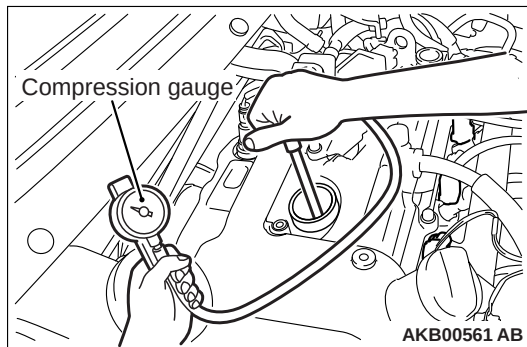
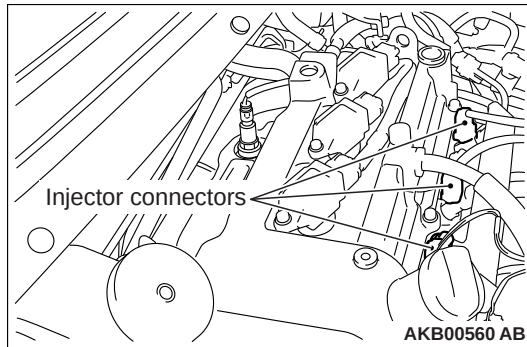
NOTE: The valve tappet ranges 5.10 – 5.70 mm (0.2008 – 0.2244 inch) and has 31 types per 0.02 mm (0.0008 inch). The thickness below a decimal point is stamped on the reverse side of the valve tappet.

Example: In case of 5.40 mm (0.2126 inch), "40" is stamped.

15. Install the valve tappet selected through the procedure 14.

16. Install the camshaft (Refer to [P.11A-23](#)).

17. Install the cylinder head cover assembly (Refer to [P.11A-22](#)).



COMPRESSION PRESSURE CHECK

M1111002604230

- Before inspection, set the vehicle to the pre-inspection condition.
- Disconnect the connector of the ignition coil, and then remove all of the ignition coils and spark plugs (Refer to GROUP 11B – Generator and Ignition System [P.11B-10](#)).
- Disconnect the all of the injector connectors.

⚠ CAUTION

- Keep away from the spark plug hole when cranking.
 - If compression is measured with water, oil, fuel, etc., that has come from cracks inside the cylinder, these materials will become heated and will gush out from the spark plug hole, which is dangerous.
- Cover the spark plug hole with a shop towel etc., and after the engine has been cranked, check that no foreign material is adhering to the shop towel.
 - Set compression gauge to one of the spark plug holes.
 - Cranking the engine with the accelerator pedal fully depressed, measure the compression pressure.

Standard value [at engine speed of 250 r/min]: 1,410 kPa (205 psi)

Limit [at engine speed of 250 r/min]: Minimum 950 kPa (138 psi)

- Measure the compression pressure for all the cylinders, and check that the pressure differences of the cylinders are below the limit.

Limit: Maximum 98 kPa (14 psi)

- If there is a cylinder with compression or a compression difference that is outside the limit, pour a small amount of engine oil through the spark plug hole, and repeat the operations in steps from 5 to 7.

- (1) If the compression increases after oil is added, the cause of the malfunction is a worn or damaged piston ring and/or cylinder inner surface.
- (2) If the compression does not rise after oil is added, the cause is a burnt or defective valve seat, or pressure is leaking from the gasket.

- Connect all of the injector connectors.

10. Install all of the spark plugs and ignition coils (Refer to GROUP 11B – Generator and Ignition System [P.11B-10](#)).

⚠ CAUTION

To prevent damage to scan tool (M.U.T.-III), always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool (M.U.T.-III).

11. Turn the ignition switch to the "LOCK" (OFF) position and then connect scan tool (M.U.T.-III) to the data link connector [Refer to GROUP 13A – Diagnostic Function, How to Connect the Scan Tool (M.U.T.-III) [P.13A-10](#)].
12. Use the scan tool (M.U.T.-III) to erase the diagnostic trouble codes (Refer to GROUP 13A – Diagnostic Function, How to Read and Erase Diagnostic Trouble Codes [P.13A-10](#)).

NOTE: This will erase the diagnostic trouble codes resulting from the injector connectors being disconnected.

MANIFOLD VACUUM CHECK

M1111002702640

1. Before inspection, set the vehicle to the pre-inspection condition.

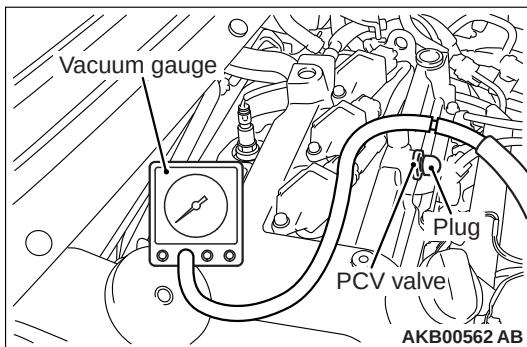
⚠ CAUTION

To prevent damage to scan tool (M.U.T.-III), always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool (M.U.T.-III).

2. Turn the ignition switch to the "LOCK" (OFF) position and then connect scan tool (M.U.T.-III) to the data link connector [Refer to GROUP 13A – Diagnostic Function, How to Connect the Scan Tool (M.U.T.-III) [P.13A-10](#)].
3. Disconnect the ventilation hose from the positive crankcase ventilation (PCV) valve, and then connect a vacuum gauge to the ventilation hose. Plug the PCV valve.
4. Start the engine and check that idle speed is approximately 700 r/min.
5. Check the inlet manifold vacuum.

Limit: Minimum 60 kPa (17 in Hg)

6. Turn the ignition switch to the "LOCK" (OFF) position.
7. Remove the vacuum gauge and then connect the ventilation hose to the PCV valve.
8. Disconnect the scan tool (M.U.T.-III).

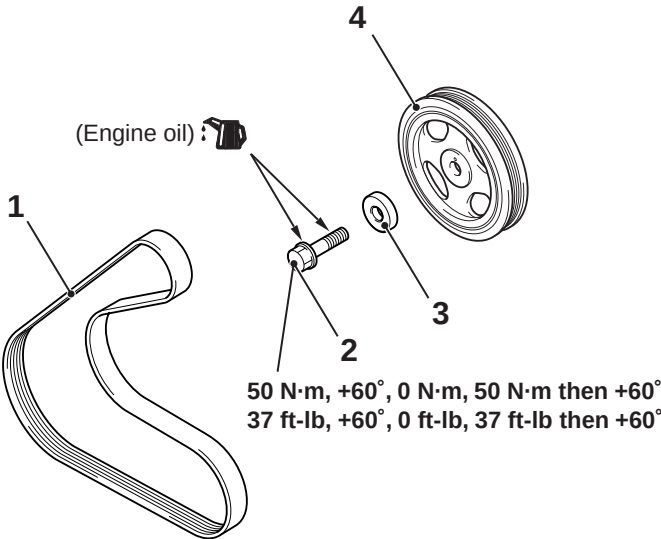


CRANKSHAFT PULLEY

REMOVAL AND INSTALLATION

M1112001604939

Pre-removal Operation Engine Room Under Cover Front Removal (Refer to GROUP 51 – Under Cover P.51-15).	Post-installation Operation - Drive Belt Tension Check and Adjustment (Refer to P.11A-8). - Engine Room Under Cover Front Installation (Refer to GROUP 51 – Under Cover P.51-15).
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Removal steps		Removal steps (Continued)	
<<A>> >>B<< <>	1. Drive belt • Front wheelhouse splash shield (Refer to GROUP 42A – Splash Shield P.42A-10).	<<C>>	• A/C compressor suction hose clamp (Refer to GROUP 55A – Refrigerant Line P.55A-49) <Vehicles with A/C>.
		<<D>> >>A<< <<D>> >>A<< <<D>> >>A<<	2. Crankshaft pulley center bolt 3. Crankshaft pulley washer 4. Crankshaft pulley

REMOVAL SERVICE POINTS

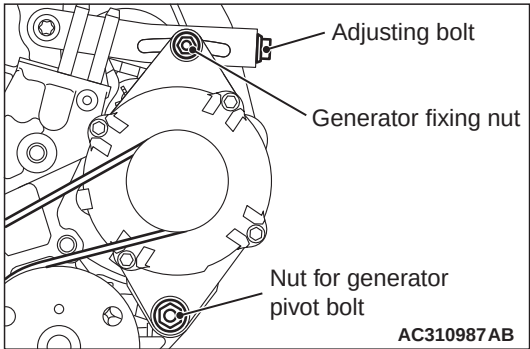
<<A>> DRIVE BELT REMOVAL

1. Loosen the nut for generator pivot bolt and generator fixing nut.

CAUTION

To reuse the drive belt, draw an arrow indicating the rotating direction (clockwise) on the back of the belt using chalk, etc.

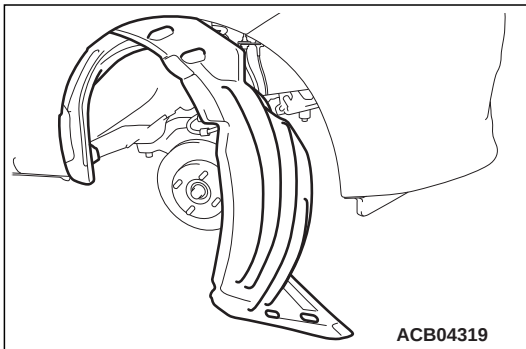
2. Turn the adjusting bolt in the counterclockwise direction (to the left) to remove the drive belt.



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**<> FRONT WHEELHOUSE SPLASH SHIELD
REMOVAL**

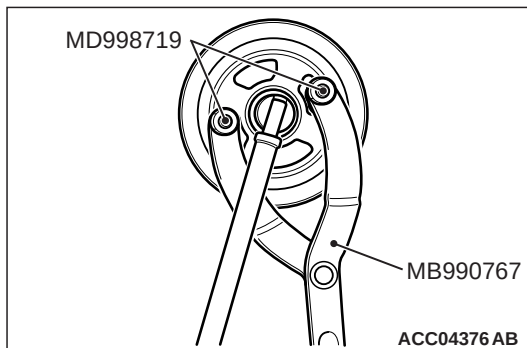
Remove the securing clips on the vehicle front side to create sufficient clearance for the removal and installation of the crankshaft pulley.

**<<C>> A/C COMPRESSOR SUCTION HOSE
CLAMP REMOVAL**

Disconnect the clamp of the A/C compressor suction hose from the side member to create sufficient clearance for the removal and installation of the crankshaft pulley center bolt.

**<<D>> CRANKSHAFT PULLEY CENTER
BOLT/CRANKSHAFT PULLEY
WASHER/CRANKSHAFT PULLEY REMOVAL**

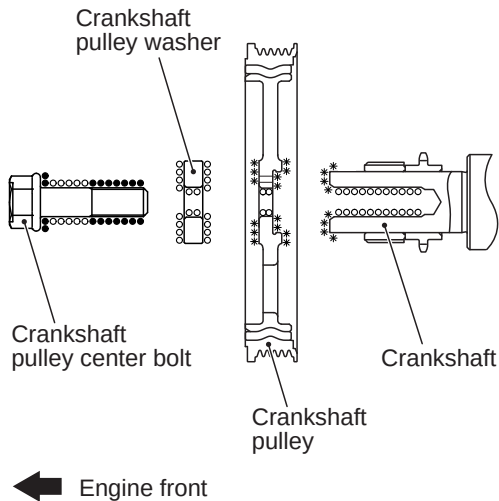
1. Use the following special tools to support the crankshaft pulley.
 - Front hub and flange yoke holder (MB990767)
 - Pin (MD998719)
2. Loosen the crankshaft pulley center bolt and remove the crankshaft pulley washer and crankshaft pulley.



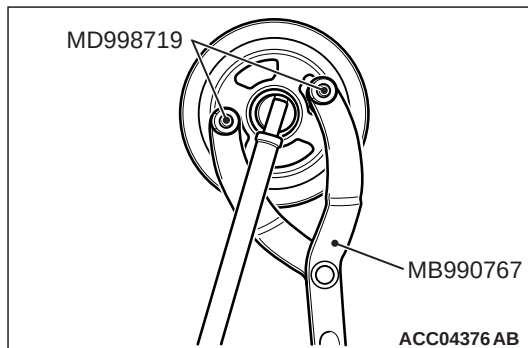
INSTALLATION SERVICE POINT

>>A<< CRANKSHAFT PULLEY/CRANKSHAFT PULLEY WASHER/CRANKSHAFT PULLEY CENTER BOLT INSTALLATION

- : Wipe clean with a rag.
- * : Wipe clean with a rag and degrease.
- : Wipe clean with a rag, degrease and apply a small amount of engine oil.

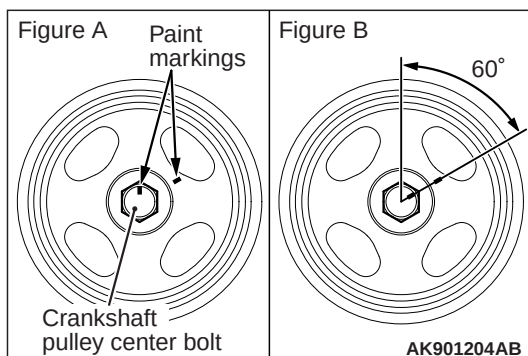


1. Using a rag, wipe dirt on the crankshaft thread hole and the crankshaft pulley washer.
2. Using a rag, wipe dirt on the crankshaft pulley and then degrease the place specified in the illustration.
NOTE: Perform degreasing to prevent the friction resistance from decreasing in the compressed area due to the residual oil.
3. Install the crankshaft pulley.
4. Apply the minimum amount of engine oil to the crankshaft bolt threads and the seating surface.



5. Use the following special tools as during removal to support the crankshaft pulley.
 - Front hub and flange yoke holder (MB990767)
 - Pin (MD998719)
6. Tighten the crankshaft pulley center bolt to the specified torque.

Tightening torque: 50 N·m (37 ft-lb)



7. As shown in figure A, put a paint mark on one angle of the crankshaft pulley center bolt. Then, put a paint mark on the crankshaft pulley on the extended line of the angle next to the marked angle.

CAUTION

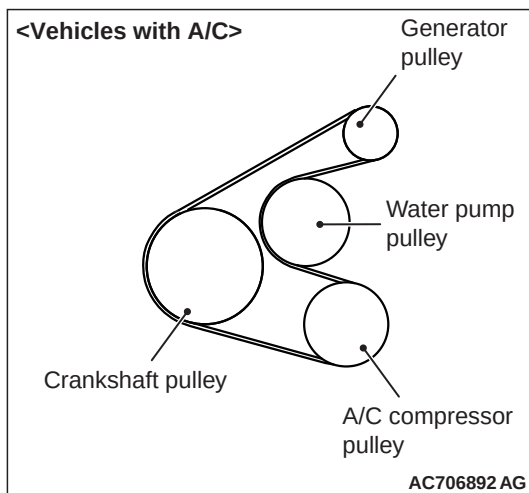
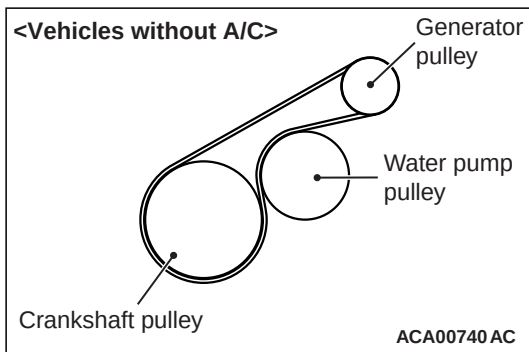
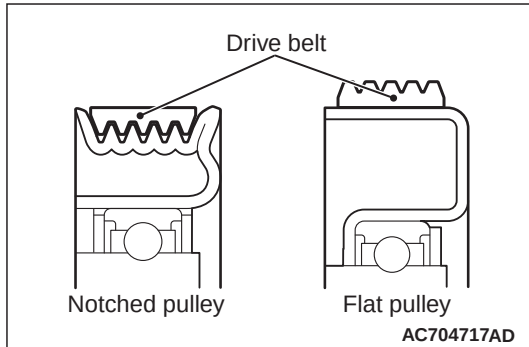
- When the tightening angle is smaller than the specified tightening angle, the appropriate tightening capacity cannot be secured.
 - When the tightening angle is larger than the specified tightening angle, remove the bolt to start from the beginning again according to the procedure.
8. Tighten the crankshaft pulley center bolt in a 60°, and check that the paint mark on the crankshaft pulley center bolt aligns with the paint mark on the crankshaft pulley as shown in figure B.

9. Loosen the crankshaft pulley center bolt completely after steps 6 to 8, and then repeat steps 6 to 8.

>>B<< DRIVE BELT INSTALLATION

CAUTION

- To reuse the drive belt, install it by aligning the arrow mark on the backside of belt marked at the removal with the rotating direction.
- Check that the notches of notched pulley and notches of drive belt are fit correctly.
- Check that the drive belt is installed in the center of flat surface of flat pulley.



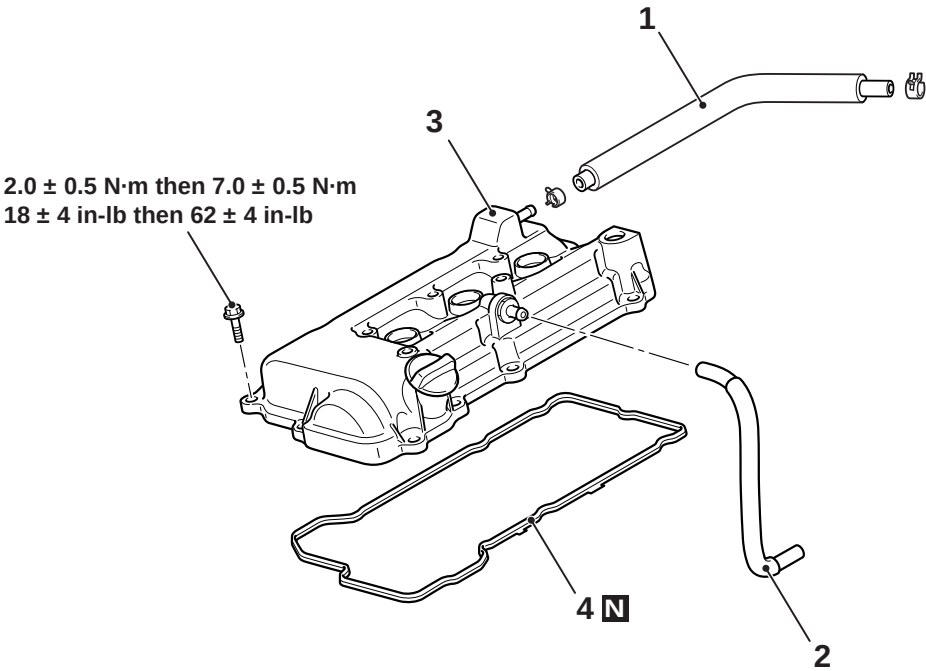
Install the drive belt to each pulley as shown in the figure.

ROCKER COVER ASSEMBLY

REMOVAL AND INSTALLATION

M1112010000137

Pre-removal Operation - Air Cleaner Assembly Removal (Refer to GROUP 15 – Air Cleaner P.15-5). - Ignition Coil Removal (Refer to GROUP 11B – Generator and Ignition System P.11B-10).	Post-installation Operation - Ignition Coil Installation (Refer to GROUP 11B – Generator and Ignition System P.11B-10). - Air Cleaner Assembly Installation (Refer to GROUP 15 – Air Cleaner P.15-5).
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- Removal steps**
1. Breather hose
 2. PCV hose

- Removal steps (Continued)**
- >>A<<
3. Cylinder head cover assembly
 4. Cylinder head cover gasket

INSTALLATION SERVICE POINT

>>A<< CYLINDER HEAD COVER ASSEMBLY
INSTALLATION

For the installation procedure, refer to GROUP 11B – Oil Pan and Timing Chain Case [P.11B-23](#).

CAMSHAFT

REMOVAL AND INSTALLATION

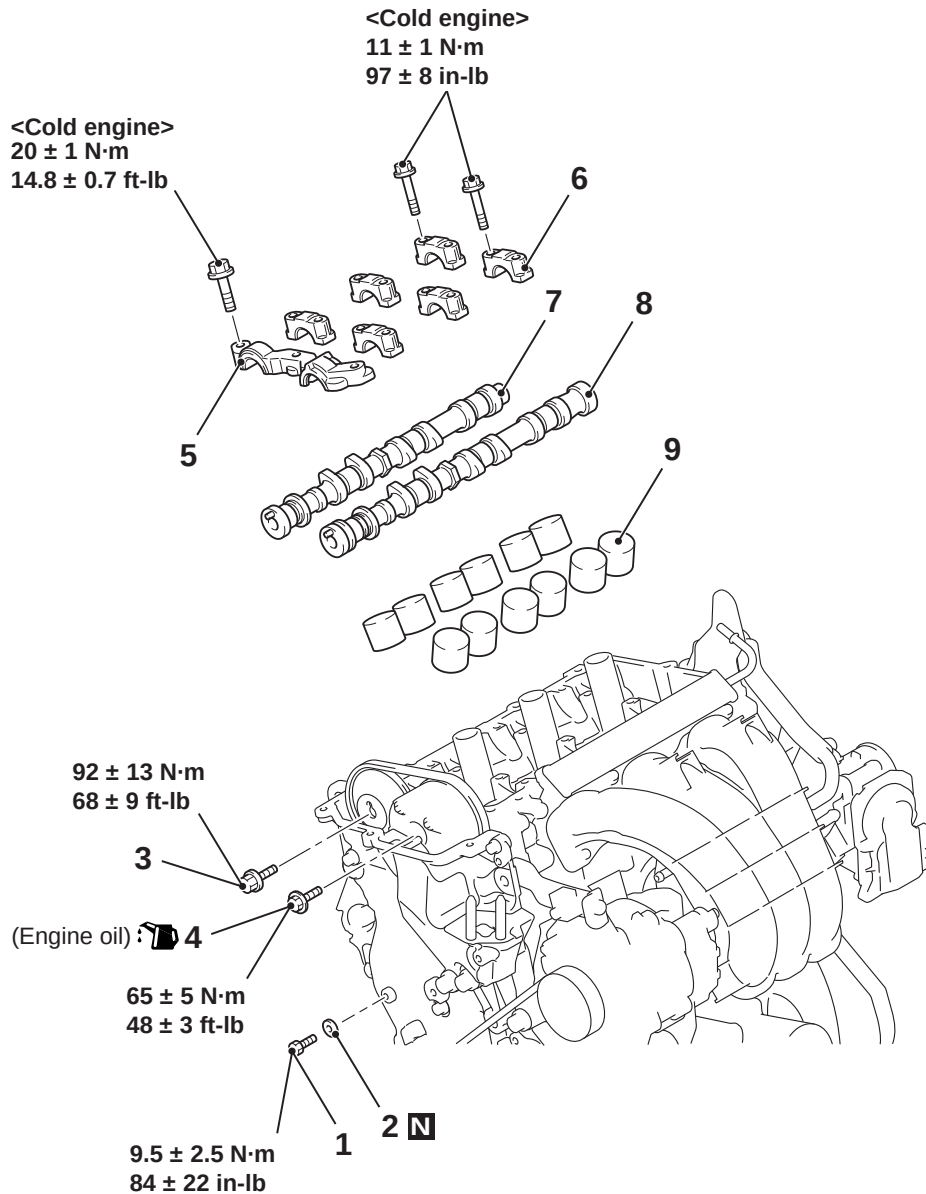
M1112007801686

Pre-removal operation

- Cylinder Head Cover Assembly Removal (Refer to [P.11A-22](#)).

Post-installation operation

- Valve Clearance Adjustment (Refer to [P.11A-13](#)).
- Cylinder Head Cover Assembly Installation (Refer to [P.11A-22](#)).



Removal steps

- | | | |
|-------------|----|----------------------------|
| <<A>> | 1. | Service hole bolt |
| <<A>> | 2. | Gasket |
| <<A>> >>B<< | 3. | Camshaft sprocket bolt |
| <<A>> >>B<< | 4. | V.V.T. sprocket bolt |
| <<A>> >>B<< | 5. | Front camshaft bearing cap |

Removal steps (Continued)

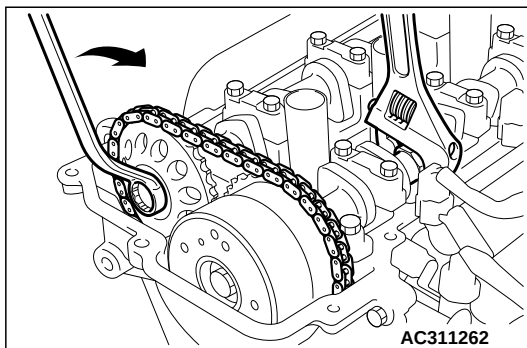
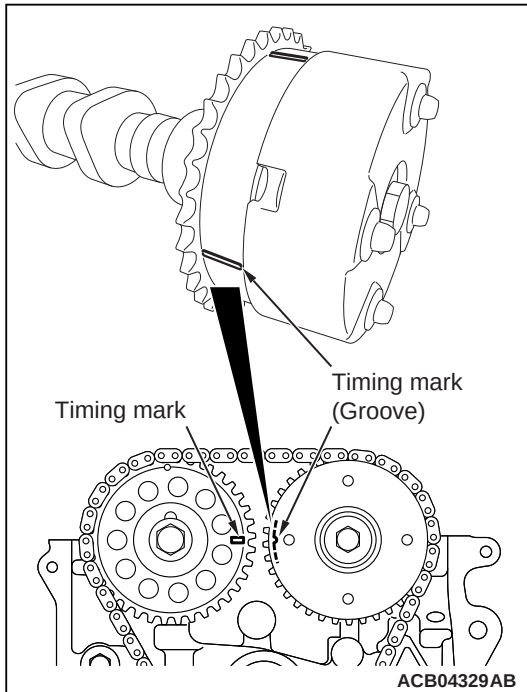
- | | | |
|-------------|----|----------------------|
| <<A>> >>B<< | 6. | Camshaft bearing cap |
| <<A>> >>B<< | 7. | Exhaust camshaft |
| <<A>> >>B<< | 8. | Intake camshaft |
| <> >>A<< | 9. | Valve tappet |

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REMOVAL SERVICE POINTS

<<A>> SERVICE HOLE BOLT/GAS-
KET/SPROCKET BOLT/CAMSHAFT BEARING
CAP/CAMSHAFT REMOVAL**⚠ CAUTION****Never turn the crankshaft counterclockwise.**

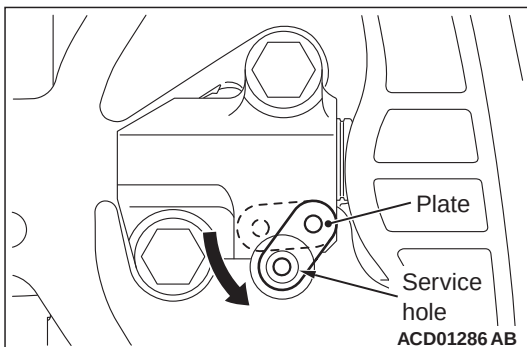
1. Turn the crankshaft clockwise, and align the timing mark of the camshaft sprocket and that of the V.V.T. sprocket assembly (the groove of V.V.T. sprocket assembly side face). Then set No.1 cylinder to the TDC.
2. Remove the service hole bolt and gasket from the timing chain case.



3. While holding the intake camshaft hexagonal area with a wrench or a similar tool, slightly turn the exhaust camshaft clockwise to tighten the timing chain at the timing chain tensioner side and shorten the plunger of the timing chain tensioner.

NOTE:

This allows the plate on the timing chain tensioner to move to the lower end position.

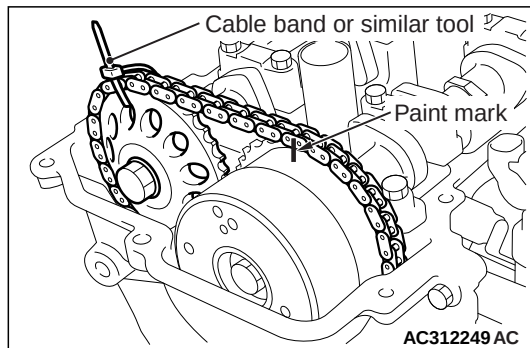
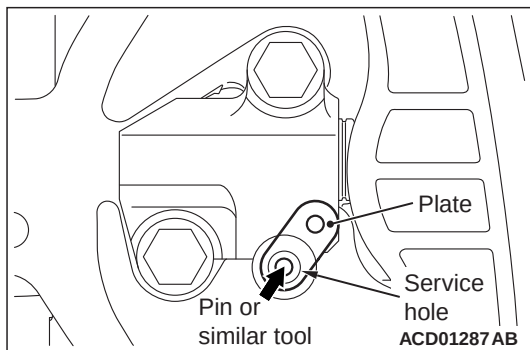
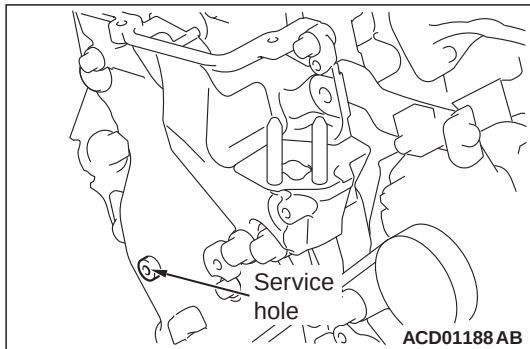


⚠ CAUTION

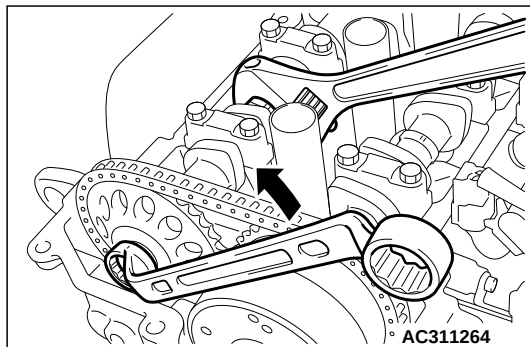
After a pin or a similar tool is inserted, never rotate the crankshaft. Otherwise, the timing chain will be out of alignment.

4. Insert a pin [3 mm (0.1 inch) in diameter] or a similar tool to the timing chain tensioner through the service hole as shown with the timing chain tensioner plunger compressed. If the inserted pin or a similar tool slides laterally, it may be disengaged from the plate hole. Repeat from step 3.

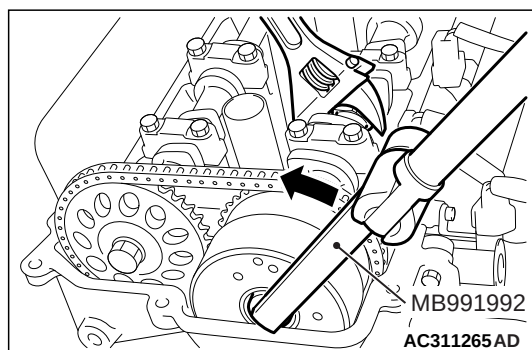
NOTE: Pull out the pin or a similar tool after installing the camshaft sprocket bolt.



5. Put a paint mark on the V.V.T sprocket and the timing chain.
6. Fix the camshaft sprocket and the timing chain using a cable band or a similar tool.



7. While holding the exhaust camshaft hexagonal area with a wrench or a similar tool, loosen the camshaft sprocket bolt.



8. While holding the intake camshaft hexagonal area using a wrench or a similar tool, use special tool torque wrench adapter (MB991992) to loosen the V.V.T. sprocket bolt.
9. Loosen the camshaft sprocket bolt and V.V.T. sprocket bolt immediately before they touch the inside of the timing chain case.

⚠ CAUTION

This action slackens the timing chain. If you attempt to remove the camshaft without doing this, the journal at the cylinder head side will be damaged.

10. Slide the camshaft sprocket towards the front of the engine to disengage the exhaust camshaft dowel pin.

Slide the V.V.T. sprocket assembly towards the front of the engine to disengage the intake camshaft dowel pin. This action slackens the timing chain.

NOTE: If the dowel pin is difficult to disengage, slide the sprocket towards the front of the engine by twisting the hexagonal portion to the right and left slightly with a wrench.

11. Loosen the front camshaft bearing cap mounting bolts, and then loosen each camshaft bearing cap mounting bolts in the order shown. Remove the front camshaft bearing cap and each camshaft bearing cap.

⚠ CAUTION

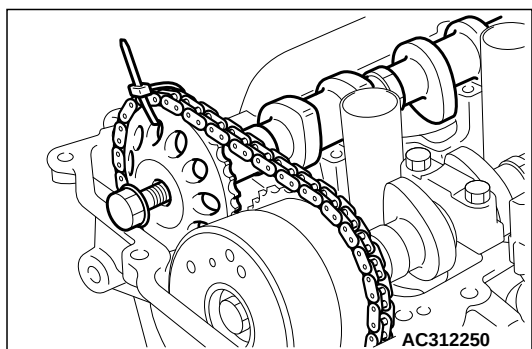
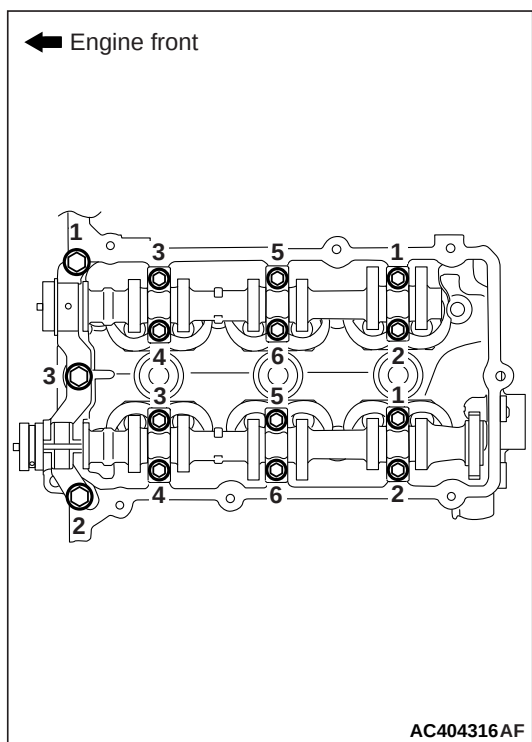
When you lift the camshaft forcibly, the journal may be damaged. Never use any tools, but lift it with your hands.

12. Lift the exhaust camshaft horizontally while rotating it slightly clockwise with your hands. Then remove it from the groove on the cylinder head.

NOTE: Holding the rear end of the exhaust camshaft facilitates lifting it.

⚠ CAUTION

Do not turn the crankshaft after removing the camshaft sprocket with the timing chain.



13. Remove the camshaft sprocket bolt, and then remove the exhaust camshaft.

⚠ CAUTION

Do not turn the crankshaft after removing the V.V.T. sprocket assembly with the timing chain.

14. Lift the intake camshaft vertically to remove the V.V.T. sprocket bolt. Then remove the intake camshaft.

⚠ CAUTION

After disconnecting the camshaft sprocket and the V.V.T. sprocket assembly (with the timing chain for each) from the camshaft, do not dislocate the camshaft sprocket, the V.V.T. sprocket assembly, and the timing chain.

15. After removal, place the camshaft sprocket and timing chain assembly, and the V.V.T. sprocket and timing chain assembly on the timing chain case assembly

<> VALVE TAPPET REMOVAL

To facilitate reassembly, attach a tag to each valve tappet removed that shows where it has been assembled.

INSTALLATION SERVICE POINTS

>>A<< VALVE TAPPET INSTALLATION

Reassemble each valve tappet to the correct location shown on the tag.

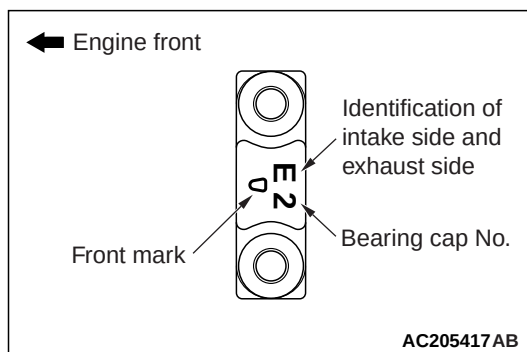
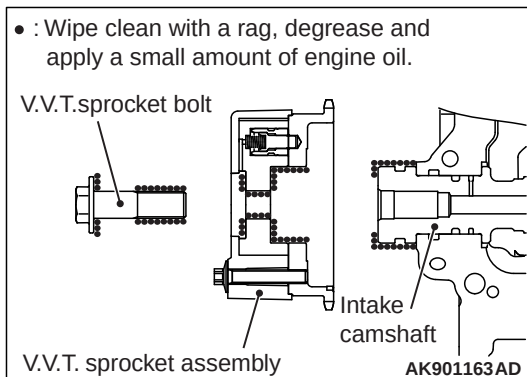
>>B<< CAMSHAFT/CAMSHAFT BEARING CAP/SPROCKET BOLT INSTALLATION

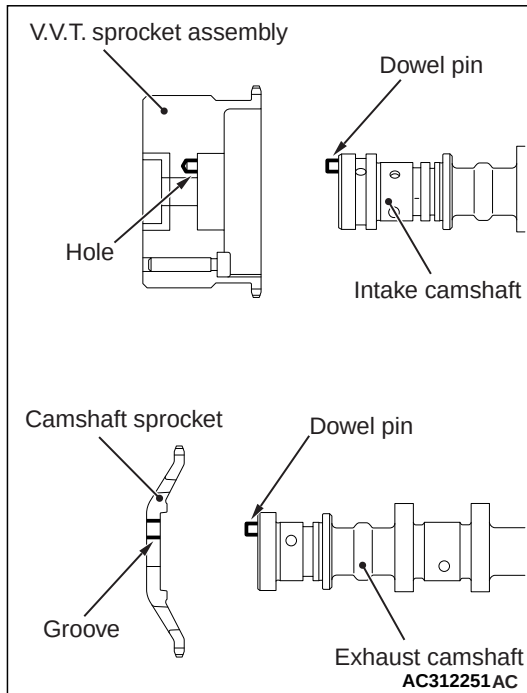
1. Apply a proper minimum quantity of engine oil to the following points.
 - Intake camshaft end
 - Insertion hole in V.V.T. sprocket assembly (all over inside and outside surfaces)
 - Threads and head of V.V.T. sprocket bolt
 - Bearing surface of V.V.T. sprocket bolt
2. Temporarily assemble the intake camshaft to the V.V.T. sprocket assembly (but do not engage the sprocket with the dowel pin).
3. Install the camshaft bearing cap at the intake side to secure the intake camshaft.
Camshaft bearing caps (No.2 to 4) are identical. To avoid confusion (bearing cap No. and intake/exhaust side), confirm each identification mark and face the front mark towards the direction shown before installing them.

Identification mark (engraved on the front and bearing caps No.2 – 4)

I: Intake side

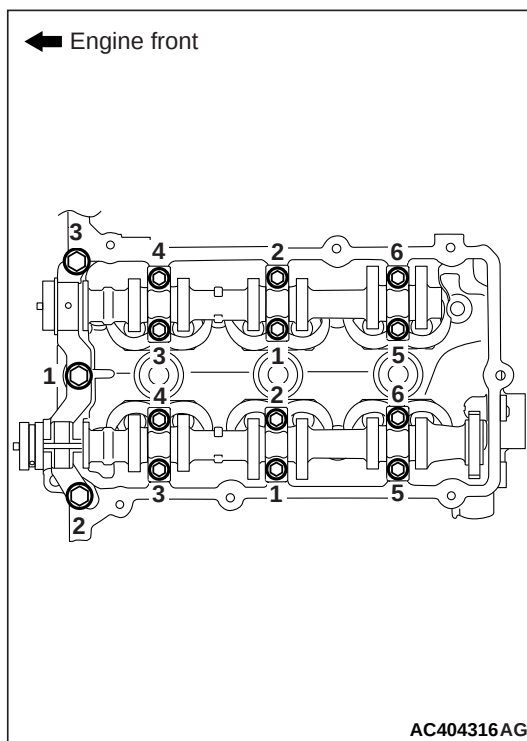
E: Exhaust side





4. Engage the V.V.T. sprocket with the dowel pin by twisting the hexagonal portion on the intake camshaft with a wrench slightly.
5. Rotate the exhaust camshaft counterclockwise with your hand slightly to engage it with the groove on the cylinder head journal (but do not engage the sprocket with the dowel pin).
6. Install the camshaft bearing cap and the front camshaft bearing cap at the exhaust side to secure the exhaust camshaft.
7. Engage the dowel pin with the hole on the camshaft sprocket by twisting the hexagonal portion on the exhaust camshaft with a wrench slightly.

NOTE: If it is difficult to insert the exhaust camshaft into the camshaft sprocket, check that the hole on the sprocket is aligned with the dowel pin. Then press in the sprocket again by twisting the camshaft to the right and left slightly.



8. Tighten each camshaft bearing cap mounting bolts to the specified torque in the order shown, and then tighten the front camshaft bearing cap mounting bolts as well.

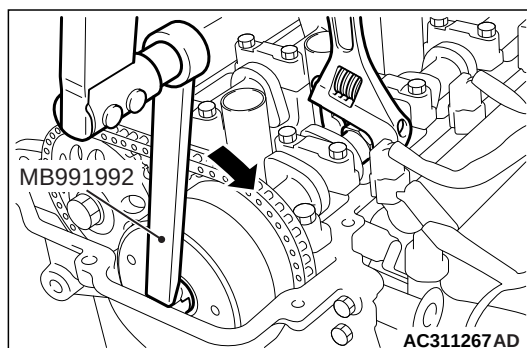
Tightening torque:

Camshaft bearing cap mounting bolts: 11 ± 1 N·m (97 $\pm$ 8 in·lb)

Front camshaft bearing cap mounting bolts: 20 ± 1 N·m (14.8 $\pm$ 0.7 ft·lb)

⚠ CAUTION

Check that the sprocket has been engaged with the dowel pin securely, and then tighten the bolt.



9. While holding the intake camshaft hexagonal area using a wrench or a similar tool, use special tool torque wrench adapter (MB991992) to tighten the V.V.T. sprocket bolt to the specified torque. Since the V.V.T. sprocket bolt is tightened by special tool, calculate the tightening torque by the following formula.

Tightening torque:

- $(65 \pm 5) \times \{L \div (L + 150)\}$ N·m
- 65 ± 5 : Tightening torque of the V.V.T. sprocket bolt (unit: N·m)

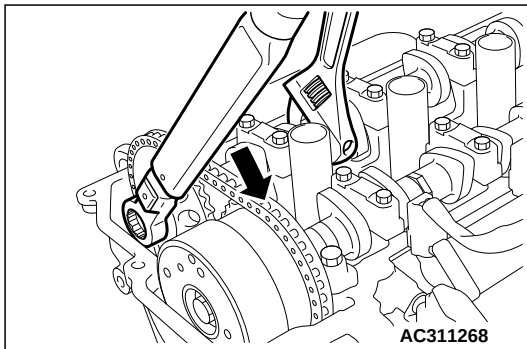
- L: Distance between the center of a torque wrench drive and of its handle (unit: mm)
- 150: Length of special tool (unit: mm)
- $(48 \pm 3) \times \{L \div (L + 5.9)\}$ ft-lb
- 48 ± 3 ft-lb: Tightening torque of the V.V.T. sprocket bolt (unit: ft-lb)
- L: Distance between the center of a torque wrench drive and of its handle (unit: inch)
- 5.9: Length of special tool (unit: inch)

⚠ CAUTION

- Check that the sprocket has been engaged with the dowel pin securely, and then tighten the bolt.
- After all of the sprocket bolts have been tightened, check that the sprockets are directly in line without any slant. If the engine is started while the sprockets are installed improperly, the engine will be damaged.

10. While holding the exhaust camshaft hexagonal area using a wrench or similar tool, tighten the camshaft sprocket bolt to the specified torque.

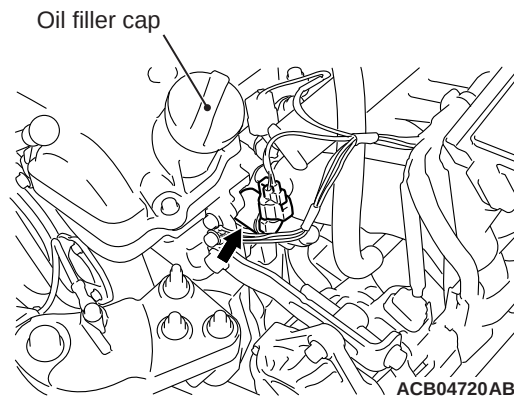
Tightening torque: 92 ± 13 N·m (68 ± 9 ft-lb)



OIL FEEDER CONTROL VALVE

REMOVAL AND INSTALLATION

M1112010600021



For the removal and installation procedures, refer to GROUP 11B – Camshaft [P.11B-40](#).

VALVE STEM SEAL

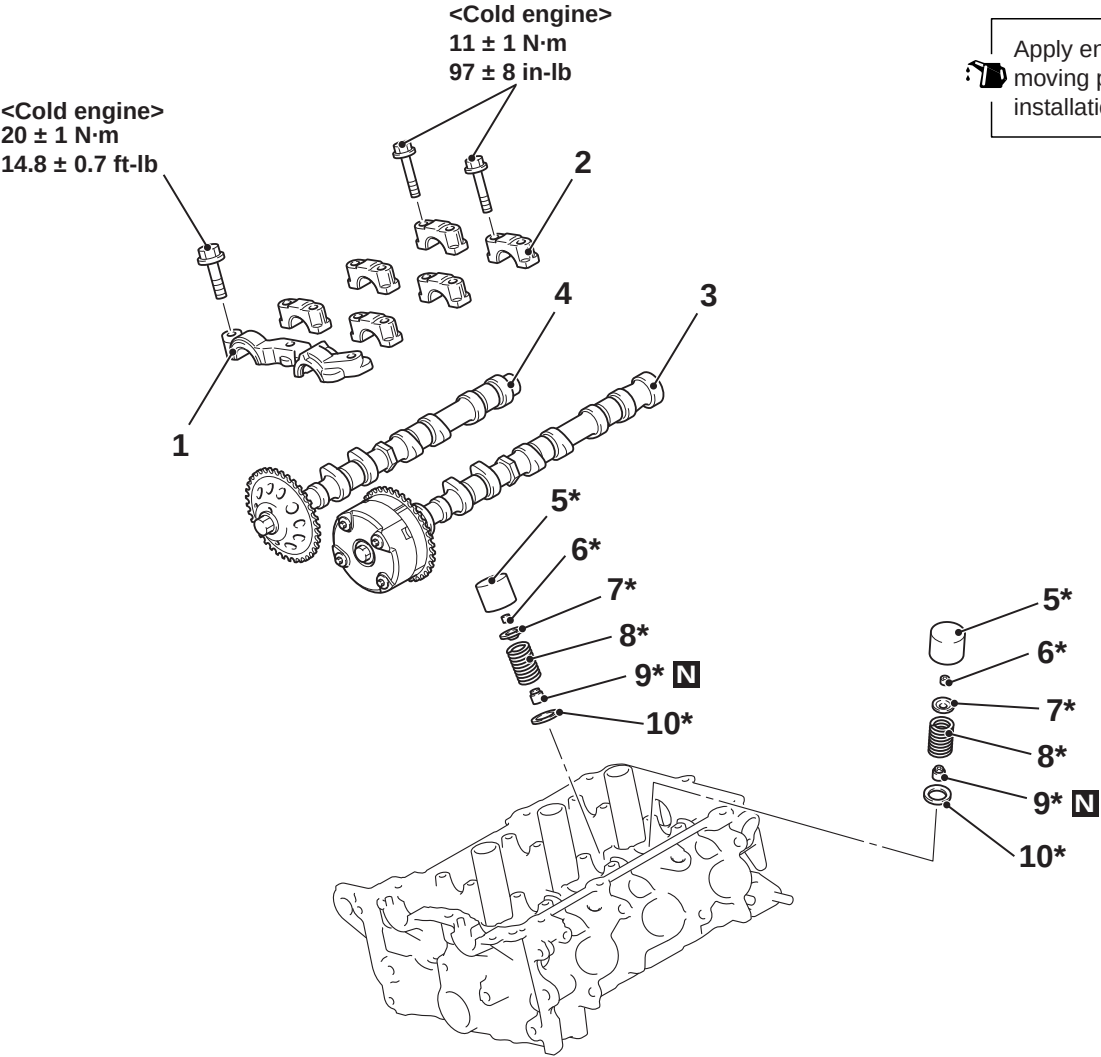
REMOVAL AND INSTALLATION

M1112008101884

CAUTION

*Remove and assemble the marked parts in each cylinder unit.

Pre-removal operation - Timing Chain Removal (Refer to P.11A-45). - Spark Plug Removal (Refer to GROUP 11B – Generator and Ignition System P.11B-10).	Post-installation operation - Spark Plug Installation (Refer to GROUP 11B – Generator and Ignition System P.11B-10). - Timing Chain Installation (Refer to P.11A-45).
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ACB03505AB

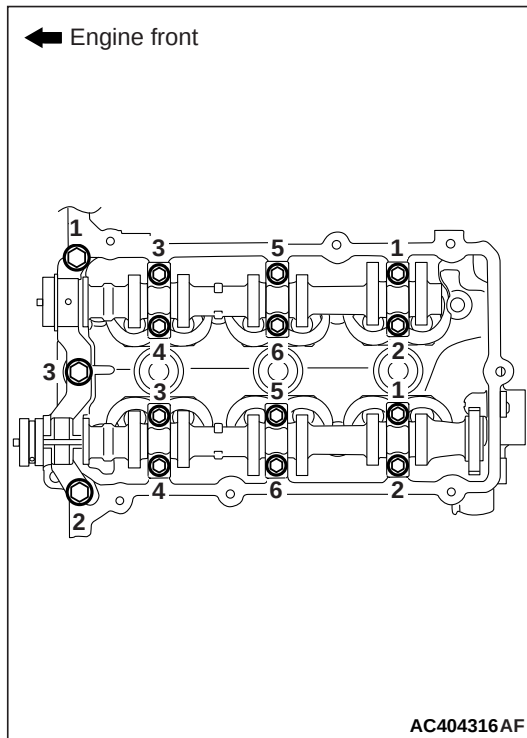
<<A>>	>>D<<	1.	Front camshaft bearing cap
<<A>>	>>D<<	2.	Camshaft bearing cap
		3.	Intake camshaft and V.V.T. sprocket assembly
		4.	Exhaust camshaft and camshaft sprocket assembly
<>	>>C<<	5.	Valve tappet

<<C>>	>>B<<	6.	Valve spring retainer lock
		7.	Valve spring retainer
		8.	Valve spring
<<D>>	>>A<<	9.	Valve stem seal
	>>A<<	10.	Valve spring seat

REMOVAL SERVICE POINTS

<<A>> CAMSHAFT BEARING CAP REMOVAL

Loosen the front camshaft bearing cap mounting bolts in the order shown, and then loosen each camshaft bearing cap mounting bolts as well. Remove the front camshaft bearing cap and each camshaft bearing cap.



<> VALVE TAPPET REMOVAL

To facilitate reassembly, attach a tag to each valve tappet removed that shows where it has been assembled.

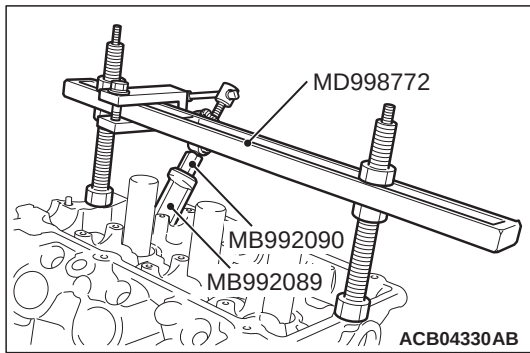
<<C>> VALVE SPRING RETAINER LOCK
REMOVAL

1. Temporarily install the oil pan which was removed at the timing chain case removal.

⚠ CAUTION

When supporting the engine assembly with a garage jack, be careful not to deform the oil pan.

2. Place a garage jack against the oil pan with a piece of wood in between to support the engine assembly.
3. Remove special tool engine hanger (MB991928 or MB991895) for holding the engine assembly, which have been attached when the timing chain case was removed.
4. Remove the brake booster vacuum pipe (Refer to GROUP 35A – Master Cylinder Assembly and Brake Booster Assembly [P.35A-28](#)).
5. Remove the engine hanger (Refer to GROUP 11B – Fuel and Emission Parts [P.11B-13](#)).



6. Screw in special tool retainer holder attachment (MB992090) to special tool valve spring compressor (MD998772), and assemble special tool retainer holder C (MB992089).

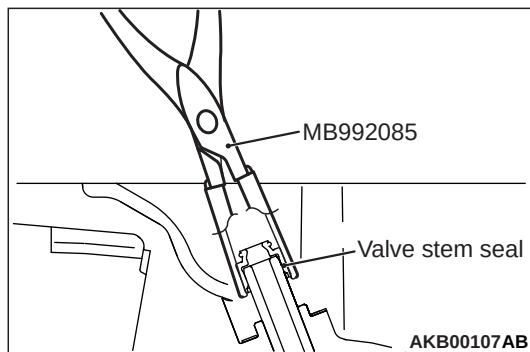
⚠ CAUTION

When removing the valve spring retainer lock, leave the piston of the cylinder in the TDC (Top Dead Center) position. The valve may fall into the cylinder if the piston is not properly in the TDC position.

7. Install special tool MD998772 (with special tools MB992090 and MB992089 attached) to the cylinder head and compress the valve spring. Then, remove the valve spring retainer lock.

<<D>> VALVE STEM SEAL REMOVAL

Use special tool valve stem seal pliers (MB992085) to nip the base of the stem seal (where the outside diameter is larger) securely, and remove it by twisting it to the left and right.



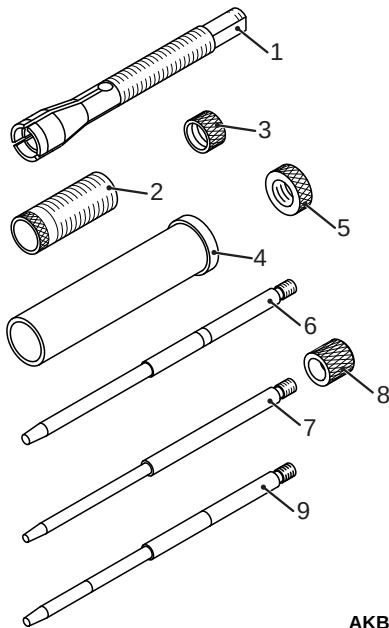
INSTALLATION SERVICE POINTS

>>A<< VALVE SPRING SEAT / VALVE STEM SEAL INSTALLATION

⚠ CAUTION

- The valve stem seal must not be reused.
 - Do not damage the tappet wall during assembly.
 - Be sure to use a special tool to install the valve stem seal. Poor installation causes oil loss via valve guides.
 - If oil is not applied, the valve stem seal may rise to the surface after it is press fitted.
1. Apply a small amount of engine oil to the press-fit part and lip part of the new valve stem seal.
 2. Use a special tool to install the valve stem seal, obeying the following procedures.

Valve stem seal installer adjustable
(MB992922)



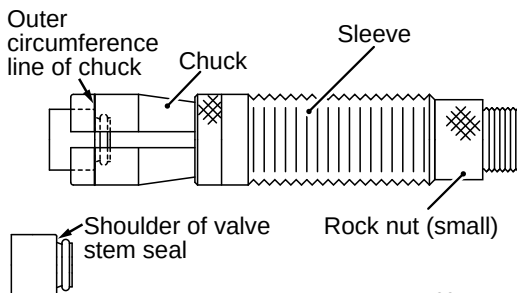
AKB00106AE

3. Special tool valve stem seal installer adjustable (MB992922) is composed of the components shown in the illustration.

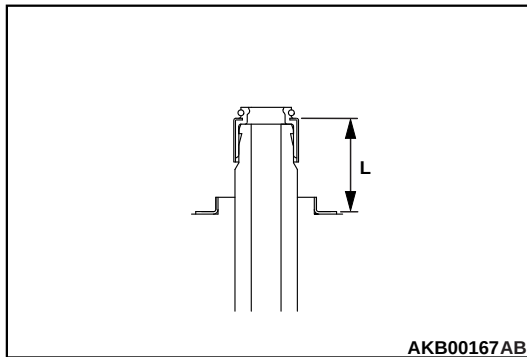
- 1: Chuck
- 2: Sleeve
- 3: Rock nut (small)
- 4: Outer pipe
- 5: Rock nut (large)
- 6: Guide pin (5.9)
- 7: Guide pin (4.9)
- 8: Cap
- 9: Guide pin (5.4)

4. Adjust the inside chuck diameter, obeying the following procedures.

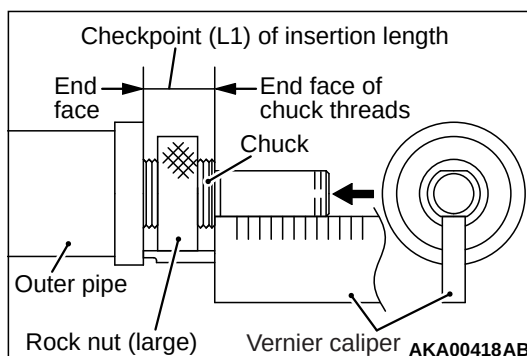
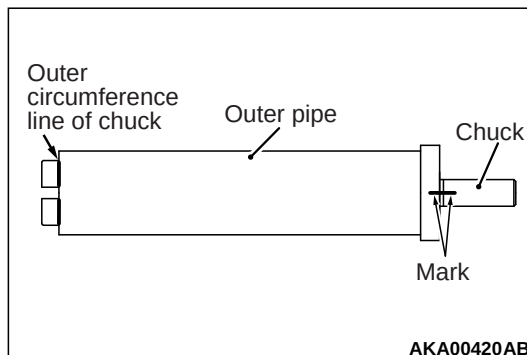
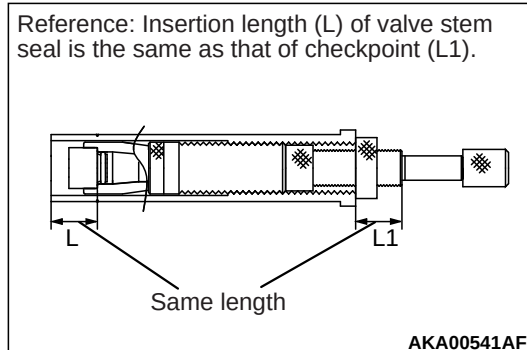
- (1) Install the sleeve to the chuck as shown in the illustration.
- (2) Install the shoulder of the valve stem seal to the chuck, aligning with the outer circumference line of the chuck as shown in the illustration.
- (3) Turn the sleeve to wring the chuck.
- (4) Stop the sleeve at the position where you can easily remove the valve stem seal by hand.
- (5) Use the (small) rock nut to fix the sleeve.



AKA00417AB



Reference: Insertion length (L) of valve stem seal is the same as that of checkpoint (L1).



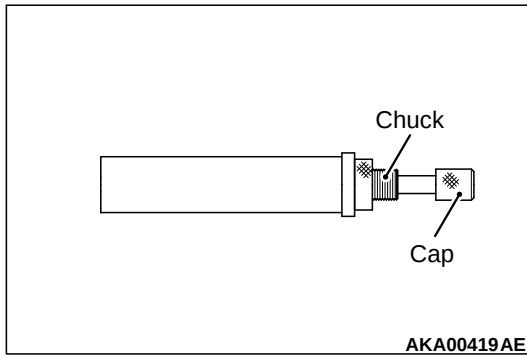
5. Adjust the stem seal insertion length, obeying the following procedures.

- (1) The position, in which the end face of the outer pipe is aligned with the outer circumference line of the chuck, is 0 mm of the insertion length. Insert the chuck and the sleeve into the outer pipe to fit the nut as shown in the illustration.
- (2) Turn the chuck to adjust the valve stem seal insertion length.

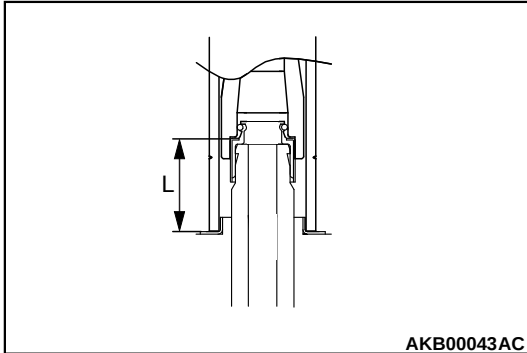
NOTE: The insertion length can change by 1 mm (0.04 inch) per the chuck turn.

To easily know how many times the chuck is turned, put the mark at the position shown in the illustration.

- (3) Use a vernier caliper to measure the checkpoint (L1) of the insertion length shown in the illustration. Check the insertion length.
 - 14.4 mm (0.57 inch)
- (4) Use the (large) rock nut to fix the sleeve.



6. Install the cap to the chuck.
7. Apply the engine oil to the valve stem seal to set the chuck.
8. Install the valve spring seat.



9. Use the plastic hammer to insert the valve stem seal.

>>B<< VALVE SPRING RETAINER LOCK INSTALLATION

In the same manner as removal, use special tool valve spring compressor (MD998772) attached to compress the valve spring, and install the valve spring retainer lock.

>>C<< VALVE TAPPET INSTALLATION

Reassemble each valve tappet to the correct location shown on the tag.

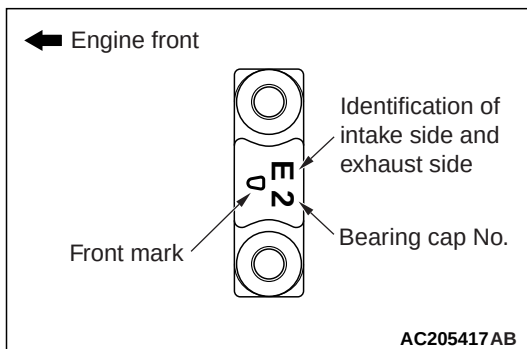
>>D<< CAMSHAFT BEARING CAP INSTALLATION

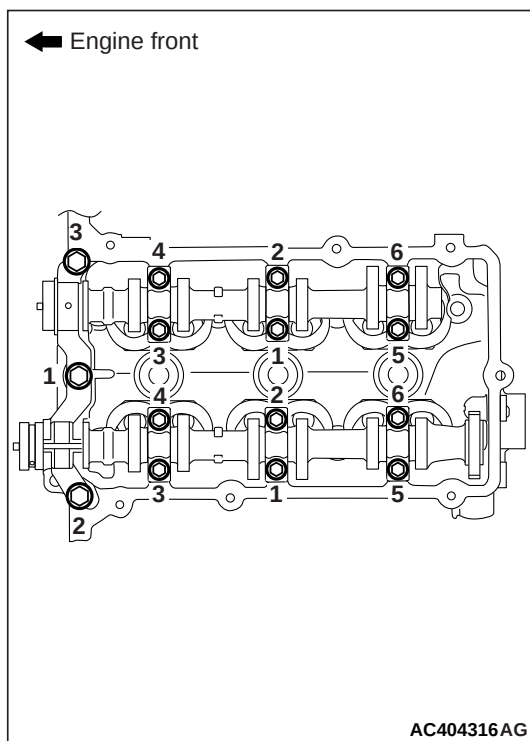
1. Camshaft bearing caps (No.2 to 4) are identical. To avoid confusion (bearing cap No. and intake/exhaust side), confirm each identification mark and face the front mark towards the direction shown before installing them.

Identification mark (engraved on the front and bearing caps No.2 – 4)

I: Intake side

E: Exhaust side





2. Tighten each camshaft bearing cap mounting bolts to the specified torque in the order shown, and then tighten the front camshaft bearing cap mounting bolts as well.

Tightening torque:

Camshaft bearing cap mounting bolts: 11 ± 1 N·m (97 $\pm$ 8 in-lb)

Front camshaft bearing cap mounting bolts: 20 ± 1 N·m (14.8 $\pm$ 0.7 ft-lb)

OIL PAN

REMOVAL AND INSTALLATION

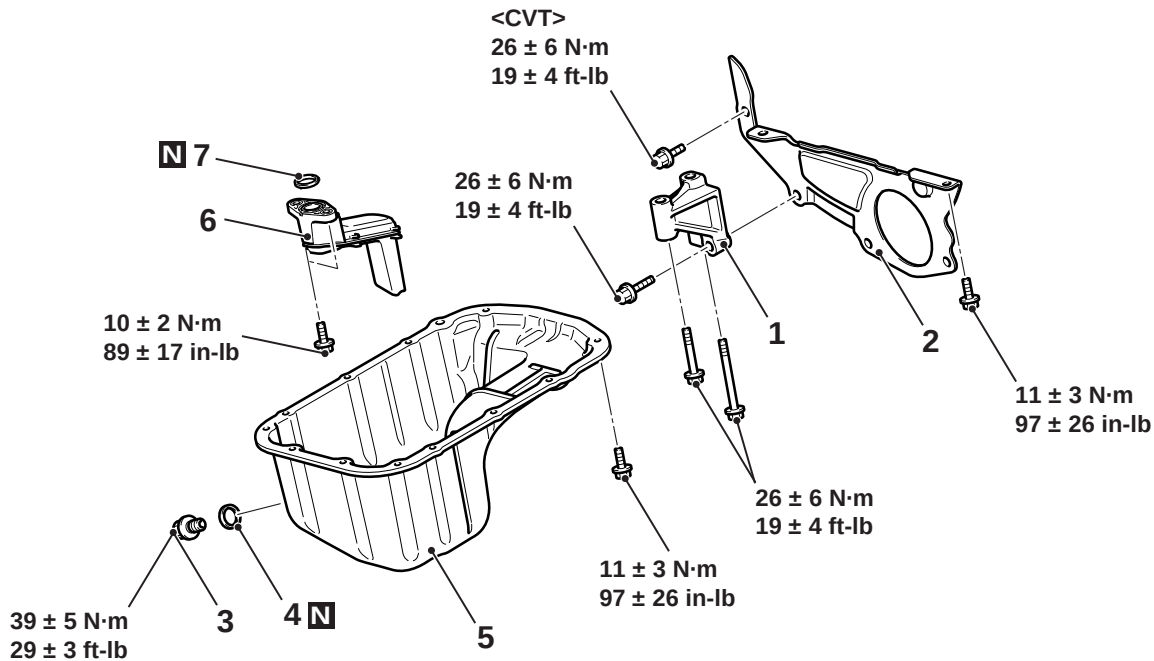
M1112002803494

Pre-removal Operation

- Engine Oil Draining (Refer to GROUP 12 – On-vehicle Service, Engine Oil Replacement [P.12-4](#)).
- Drive Belt Removal (Refer to [P.11A-18](#)) <Vehicles with A/C>.
- Starter Assembly Removal (Refer to GROUP 16 – Starting System, Starter Assembly [P.16-21](#)).
- Oil Dipstick Removal (Refer to GROUP 11B – Generator and Ignition System [P.11B-10](#)).

Post-installation Operation

- Oil Dipstick Installation (Refer to GROUP 11B – Generator and Ignition System [P.11B-10](#)).
- Starter Assembly Installation (Refer to GROUP 16 – Starting System, Starter Assembly [P.16-21](#)).
- Drive Belt Installation (Refer to [P.11A-18](#)) <Vehicles with A/C>.
- Engine Oil Refilling (Refer to GROUP 12 – On-vehicle Service, Engine Oil Replacement [P.12-4](#)).



ACB03574AB

<<A>>

Removal steps

- A/C compressor and clutch assembly, A/C compressor bracket (Refer to GROUP 55A – Compressor Assembly [P.55A-44](#)) <Vehicles with A/C>.
1. Transaxle stay
 2. Bell housing cover
 3. Oil drain plug

<> >>A<<

Removal steps (Continued)

4. Oil drain plug gasket
 5. Oil pan
 6. Oil strainer
 7. Oil strainer gasket
- Stiffener plate (Refer to GROUP 11B – Crankshaft and Cylinder Block [P.11B-63](#)).

REMOVAL SERVICE POINTS

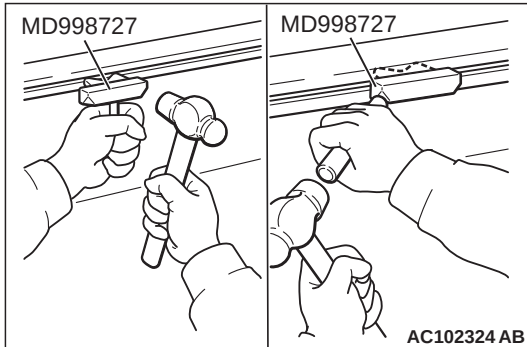
<<A>> A/C COMPRESSOR AND CLUTCH ASSEMBLY/A/C COMPRESSOR BRACKET REMOVAL

1. Remove the A/C compressor and clutch assembly together with the hose from the bracket.
2. Tie the removed A/C compressor and clutch assembly with a string at a position where they will not interfere with the removal and installation of oil pan.

3. Remove the A/C compressor bracket.

<> OIL PAN REMOVAL

1. Remove the oil pan mounting bolts.
2. Use special tool oil pan FIPG cutter (MD998727) to remove the oil pan.

**INSTALLATION SERVICE POINT****>>A<< OIL PAN INSTALLATION**

For the installation procedure, refer to GROUP 11B – Oil Pan and Timing Chain Case [P.11B-23](#).

INSPECTION

M1112002900919

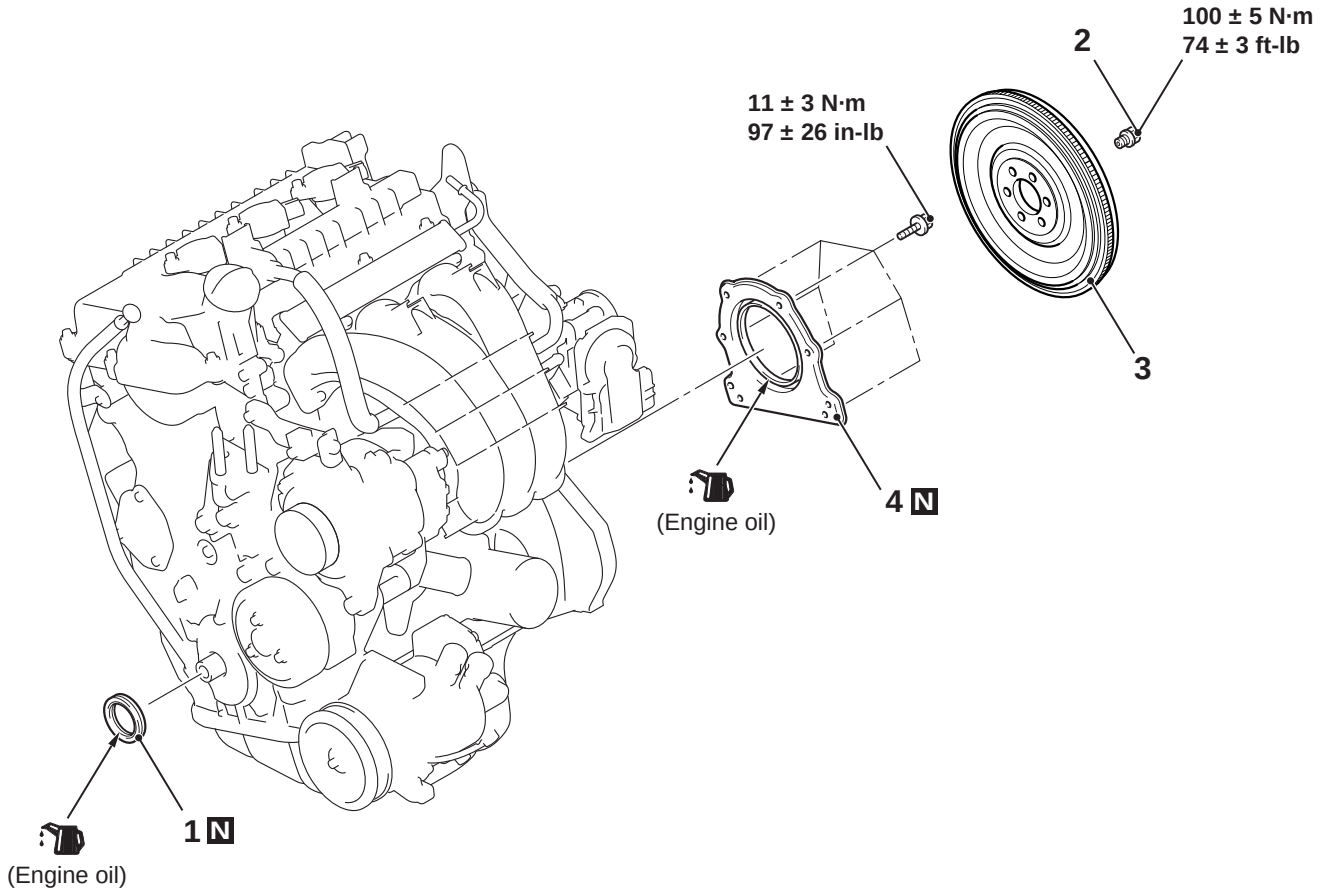
- Check the oil pan for cracks.
- Check the oil pan sealant-coated surface for damage and deformation.

CRANKSHAFT OIL SEAL

REMOVAL AND INSTALLATION

M1112003104275

<M/T>



ACB03577AB

Crankshaft front oil seal removal steps

- Crankshaft pulley (Refer to [P.11A-18](#)).

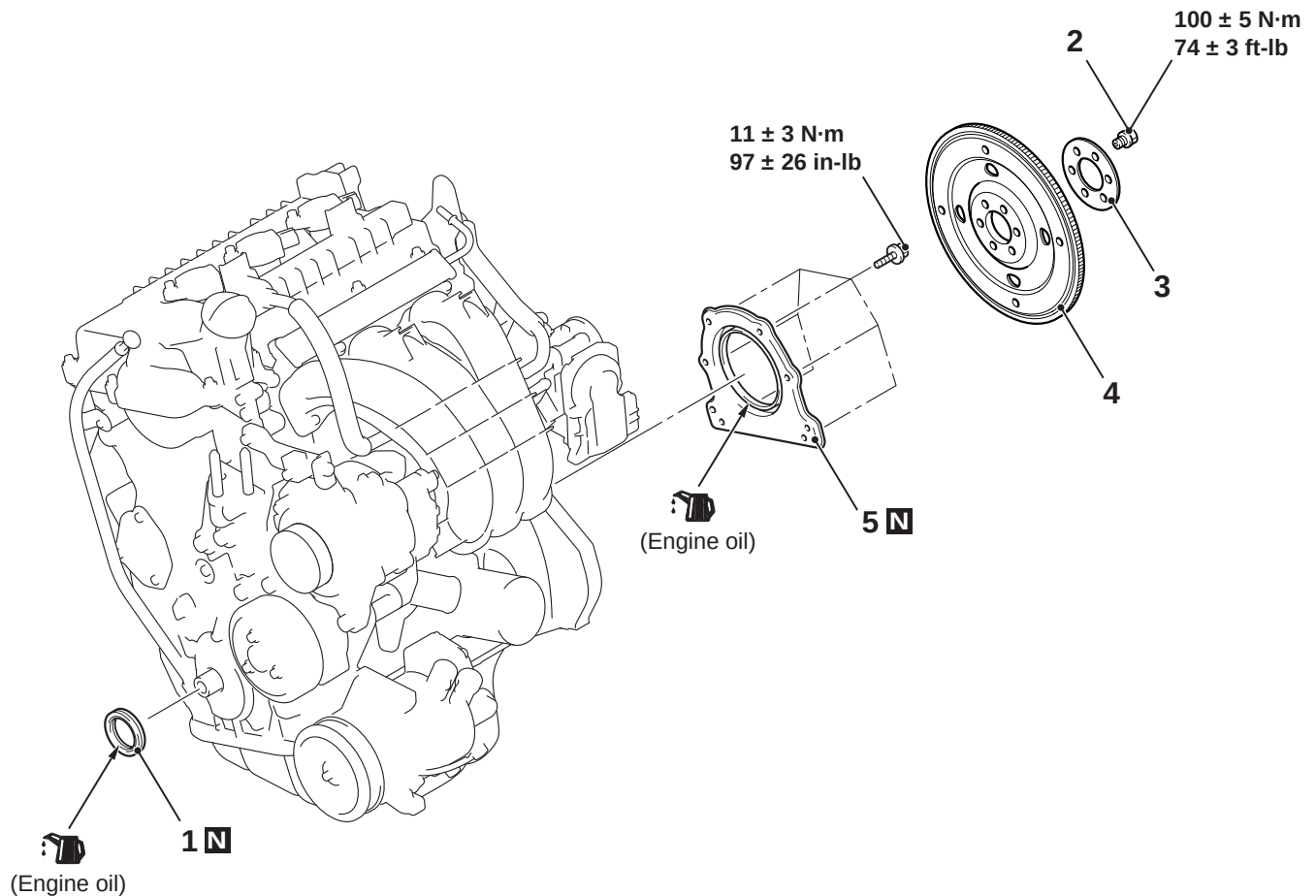
>>C<< 1. Front oil seal

Crankshaft rear oil seal removal steps

- Transaxle assembly (Refer to GROUP 22A – Transaxle Assembly [P.22A-12](#)).
- Clutch cover and disc (Refer to GROUP 21B – Clutch [P.21B-3](#)).
- Oil pan (Refer to [P.11A-37](#)).

<<A>> >>B<< 2. Flywheel bolt
3. Flywheel
>>A<< 4. Oil seal case

<CVT>



ACB03579AB

Crankshaft front oil seal removal steps

- Crankshaft pulley (Refer to [P.11A-18](#)).
- >>C<< 1. Front oil seal

Crankshaft rear oil seal removal steps

- Transaxle assembly (Refer to GROUP 23A – Transaxle Assembly [P.23A-138](#)).
 - Oil pan (Refer to [P.11A-37](#)).
- <<A>> >>B<< 2. Drive plate bolt
3. Adapter plate
4. Drive plate
- >>A<< 5. Oil seal case

REMOVAL SERVICE POINT**<<A>> FLYWHEEL BOLT/DRIVE PLATE BOLT REMOVAL**

For the removal procedure, refer to GROUP 11B – Crankshaft and Cylinder Block [P.11B-63](#).

INSTALLATION SERVICE POINTS**>>A<< OIL SEAL CASE INSTALLATION**

For the installation procedure, refer to GROUP 11B – Crankshaft and Cylinder Block [P.11B-63](#).

**>>B<< FLYWHEEL BOLT/DRIVE PLATE BOLT
INSTALLATION**

For the installation procedure, refer to GROUP 11B – Crankshaft and Cylinder Block [P.11B-63](#).

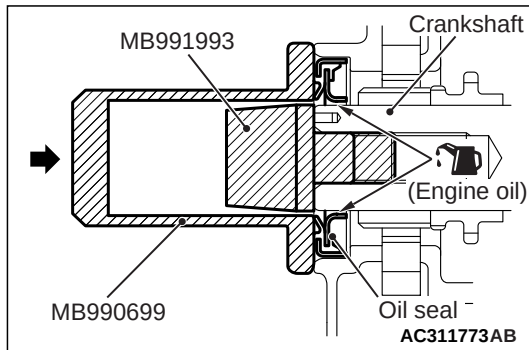
>>C<< FRONT OIL SEAL INSTALLATION

1. Apply a small amount of engine oil to the outer circumference of special tool crankshaft front oil seal guide (MB991993) and install it to the crankshaft.
2. Apply a small amount of engine oil to the entire inner circumference of the oil seal lip.

⚠ CAUTION

When installing the front oil seal, be careful to avoid damage to the front oil seal.

3. Using special tool differential oil seal installer (MB990699), drive the oil seal so that it is flush with the timing chain case.



CYLINDER HEAD GASKET

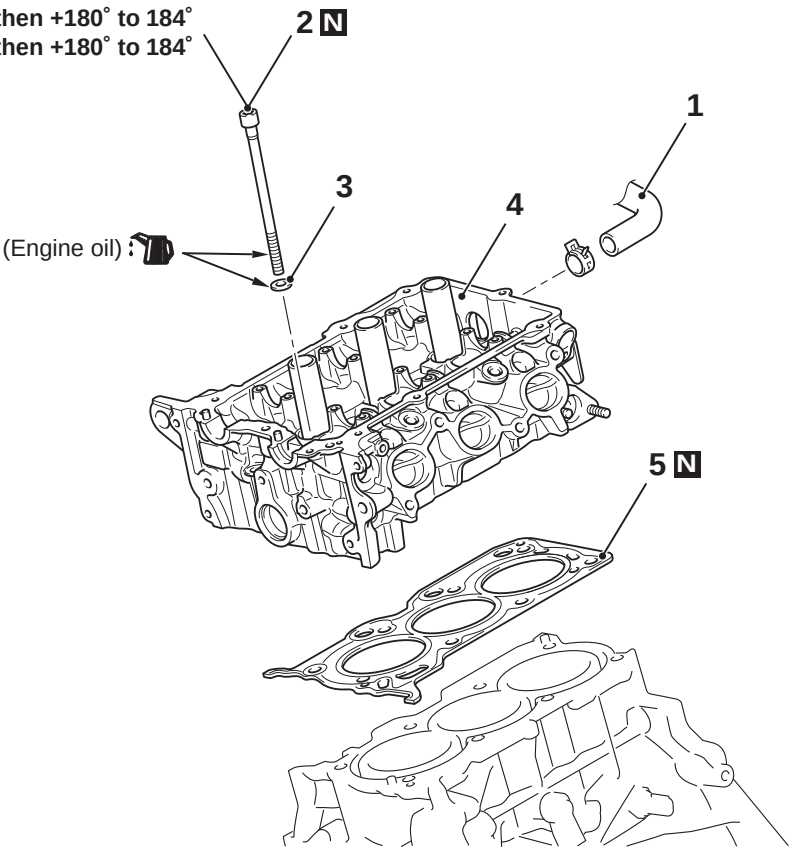
REMOVAL AND INSTALLATION

M1112004005263

Pre-removal Operation • Battery and Battery Tray Removal (Refer to GROUP 54A – Battery P.54A-7). • Intake Manifold Removal (Refer to GROUP 15 – Intake Manifold P.15-6). • Exhaust Manifold Removal (Refer to GROUP 15 – Exhaust Manifold P.15-8). • Intake Camshaft and V.V.T. Sprocket Assembly, Exhaust Camshaft and Camshaft Sprocket Assembly Removal (Refer to P.11A-30).	Post-installation Operation • Intake Camshaft and V.V.T. Sprocket Assembly, Exhaust Camshaft and Camshaft Sprocket Assembly Installation (Refer to P.11A-30). • Exhaust Manifold Installation (Refer to GROUP 15 – Exhaust Manifold P.15-8). • Intake Manifold Installation (Refer to GROUP 15 – Intake Manifold P.15-6). • Battery and Battery Tray Installation (Refer to GROUP 54A – Battery P.54A-7).
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<Cold engine>

24.5 ± 2.0 N·m then +180° to 184°
18.4 ± 0.7 ft·lb then +180° to 184°



ACB03506AB

- Removal steps**
- Radiator upper hose connection (Refer to GROUP 14 – Radiator [P.14-16](#)).
 - 1. Heater water hose A connection

<<A>>

>>B<<

>>B<<

>>A<<

>>A<<

Removal steps (Continued)

- 2. Cylinder head bolt
- 3. Cylinder head bolt washer
- 4. Cylinder head assembly
- 5. Cylinder head gasket

REMOVAL SERVICE POINT

<<A>> CYLINDER HEAD BOLT REMOVAL

- 1. Temporarily install the timing chain case assembly, engine mounting insulator and oil pan which was removed at the timing chain case removal.

2. Remove special tool engine hanger (MB991928 or MB991895) for holding the engine assembly, which have been attached when the timing chain case was removed.
3. Remove the brake booster vacuum pipe (Refer to GROUP 35A – Master Cylinder Assembly and Brake Booster Assembly [P.35A-28](#)).
4. Remove the engine hanger (Refer to GROUP 11B – Fuel and Emission Parts [P.11B-13](#)).
5. Loosen the cylinder head bolts in two or three steps.

⚠ CAUTION

When supporting the engine assembly with a garage jack, be careful not to deform the oil pan.

6. Place a garage jack against the oil pan with a piece of wood in between to support the engine assembly.
7. Remove the engine mounting insulator and timing chain case assembly.
8. Remove the cylinder head bolts.

INSTALLATION SERVICE POINTS

>>A<< CYLINDER HEAD GASKET/CYLINDER HEAD ASSEMBLY INSTALLATION

For the installation procedure, refer to GROUP 11B – Cylinder Head and Valves [P.11B-45](#).

>>B<< CYLINDER HEAD BOLT WASHER/CYLINDER HEAD BOLT INSTALLATION

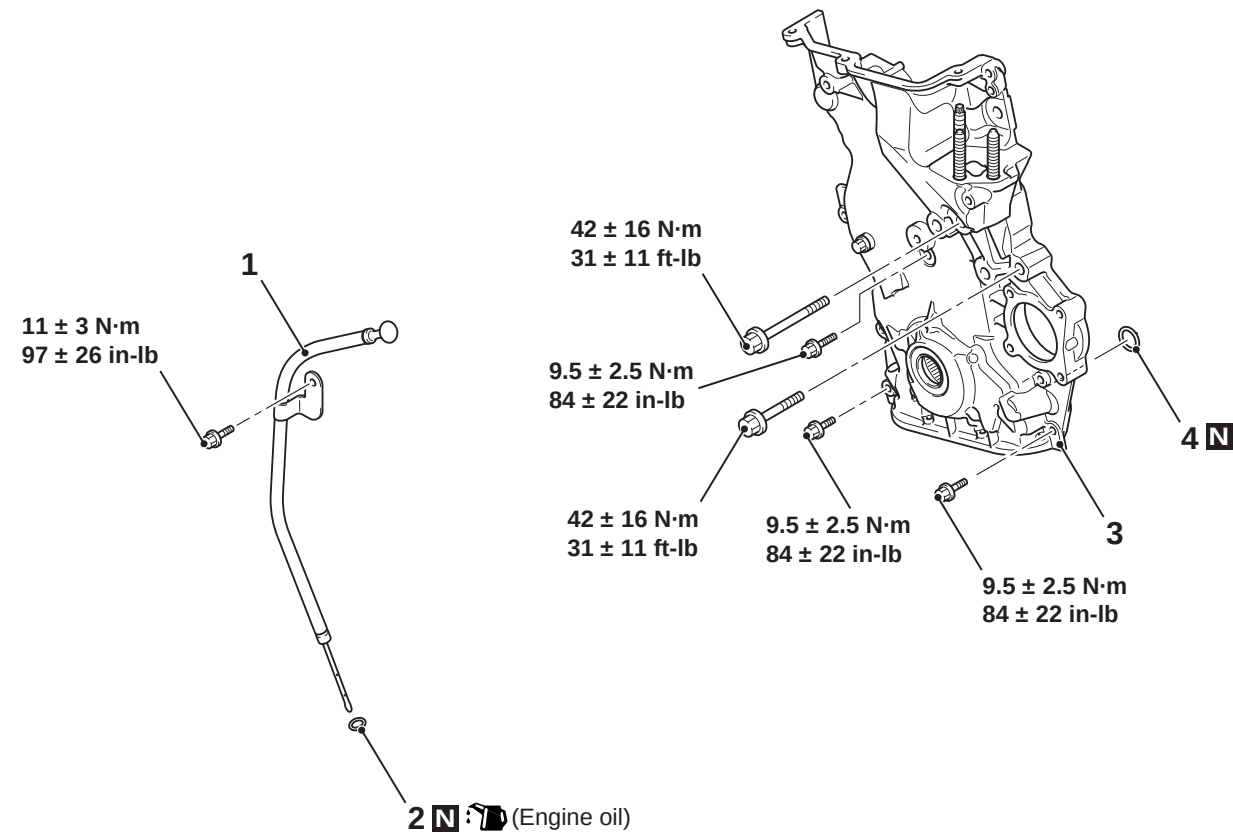
1. Apply a small amount of engine oil to the cylinder head bolt threads and the washers.
2. Temporarily install the cylinder head bolt and washer assembly onto the cylinder head.
3. Temporarily install the timing chain case assembly and engine mounting insulator.
4. Tighten the cylinder head bolts (Refer to GROUP 11B – Cylinder Head and Valves [P.11B-45](#)).
5. Install the engine hanger (Refer to GROUP 11B – Fuel and Emission Parts [P.11B-13](#)).
6. Install the brake booster vacuum pipe (Refer to GROUP 35A – Master Cylinder Assembly and Brake Booster Assembly [P.35A-28](#)).
7. Install special tool engine hanger (MB991928 or MB991895) for holding the engine assembly.
8. Remove the oil pan, engine mounting insulator and timing chain case assembly.

TIMING CHAIN CASE ASSEMBLY

REMOVAL AND INSTALLATION

M1112010200153

Pre-removal Operation • Crankshaft Pulley Removal (Refer to P.11A-18). • Generator Assembly Removal (Refer to GROUP 16 – Charging System, Generator Assembly P.16-16). • Water Pump Removal (Refer to GROUP 14 – Water Pump P.14-13). • Cylinder Head Cover Assembly Removal (Refer to P.11A-22).	Post-installation Operation • Cylinder Head Cover Assembly Installation (Refer to P.11A-22). • Water Pump Installation (Refer to GROUP 14 – Water Pump P.14-13). • Generator Assembly Installation (Refer to GROUP 16 – Charging System, Generator Assembly P.16-16). • Crankshaft Pulley Installation (Refer to P.11A-18).
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ACD01189 AB

Removal steps

1. Oil dipstick assembly
2. O-ring
- Oil pan (Refer to [P.11A-37](#)).

Removal steps (Continued)

- <<A>> >>B<< • Engine mounting insulator (Refer to GROUP 32 – Engine Mounting [P.32-2](#)).
- <> >>A<< 3. Timing chain case assembly
4. O-ring

REMOVAL SERVICE POINTS**<<A>> ENGINE MOUNTING INSULATOR
REMOVAL**

1. Secure special tool engine hanger (MB991928 or MB991895) for holding the engine assembly (Refer to GROUP 22A – Transaxle Assembly [P.22A-12](#)) <M/T> or (Refer to GROUP 23A – Transaxle Assembly [P.23A-138](#)) <CVT>.
2. Adjust the special tool not to allow the weight of the engine assembly to rest on the engine mounting insulator. Then remove the engine mounting insulator.

**<> TIMING CHAIN CASE ASSEMBLY
REMOVAL**

Remove the timing chain case assembly from above the vehicle.

INSTALLATION SERVICE POINTS**>>A<< TIMING CHAIN CASE ASSEMBLY INSTAL-
LATION**

For the installation procedure, refer to GROUP 11B – Oil Pan and Timing Chain Case [P.11B-23](#).

**>>B<< ENGINE MOUNTING INSULATOR
INSTALLATION**

Use special tool engine hanger (MB991928 or MB991895) as during removal to install the engine mounting insulator.

TIMING CHAIN**REMOVAL AND INSTALLATION**

M1112007202030

** CAUTION**

Never overhaul the V.V.T. sprocket assembly.

Pre-removal Operation

- Timing chain case assembly Removal (Refer to [P.11A-44](#)).

Post-installation Operation

- Timing chain case assembly Installation (Refer to [P.11A-44](#)).

For the removal and installation procedures, refer to GROUP 11B – Timing Chain [P.11B-30](#).

ENGINE ASSEMBLY

REMOVAL AND INSTALLATION

M1112001007044

⚠ CAUTION

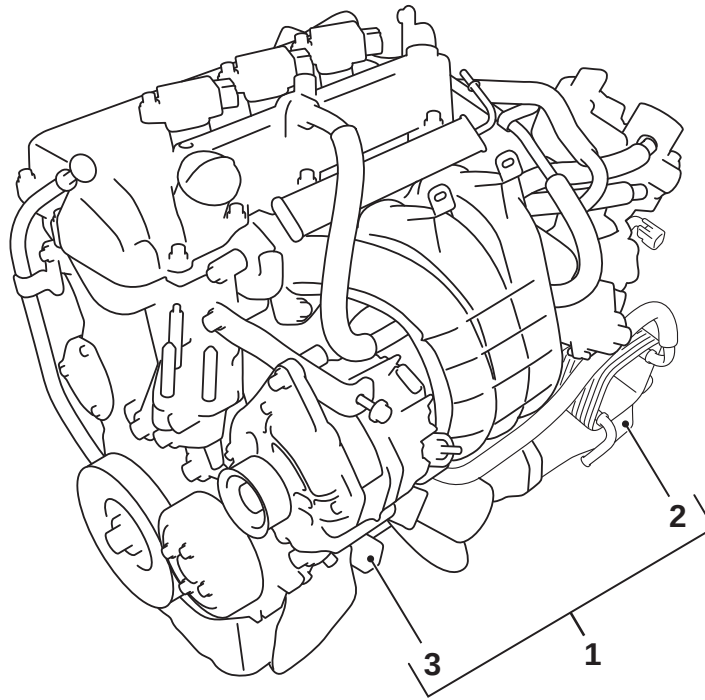
When the engine assembly is replaced, initialize the learned value using scan tool (M.U.T.-III) (Refer to GROUP 00 – Precautions before Service, Initialization Procedure for Learning Value in MFI Engine P.00-41).

Pre-removal Operation

- Fuel Line Pressure Reduction (Refer to GROUP 13A – On-vehicle Service, Reduce Pressurized Fuel Lines P.13A-641).
- Engine Room Under Cover Removal (Refer to GROUP 51 – Under Cover P.51-15).
- Engine Coolant Draining (Refer to GROUP 14 – On-vehicle Service, Engine Coolant Replacement P.14-6).
- Engine Oil Draining (Refer to GROUP 12 – On-vehicle Service, Engine Oil Replacement P.12-4).
- Transmission Oil Draining (Refer to GROUP 22A – On-vehicle Service, Transmission Oil Replacement P.22A-7) <M/T>.
- CVT Fluid Draining (Refer to GROUP 23A – On-vehicle Service, CVT Fluid Replacement P.23A-121) <CVT>.
- Starter Assembly Removal (Refer to GROUP 16 – Starting System, Starter Assembly P.16-21).
- Bell Housing Cover Removal (Refer to P.11A-37).
- Drive Shaft Assembly Removal (Refer to GROUP 26 – Drive Shaft Assembly P.26-20).
- Exhaust Manifold Removal (Refer to GROUP 15 – Exhaust Manifold P.15-8).
- Air Cleaner Assembly Removal (Refer to GROUP 15 – Air Cleaner P.15-5).
- Radiator Assembly Removal (Refer to GROUP 14 – Radiator P.14-16).

Post-installation Operation

- Radiator Assembly Installation (Refer to GROUP 14 – Radiator P.14-16).
- Air Cleaner Assembly Installation (Refer to GROUP 15 – Air Cleaner P.15-5).
- Exhaust Manifold Installation (Refer to GROUP 15 – Exhaust Manifold P.15-8).
- Drive Shaft Assembly Installation (Refer to GROUP 26 – Drive Shaft Assembly P.26-20).
- Bell Housing Cover Installation (Refer to P.11A-37).
- Starter Assembly Installation (Refer to GROUP 16 – Starting System, Starter Assembly P.16-21).
- Transmission Oil Refilling (Refer to GROUP 22A – On-vehicle Service, Transmission Oil Replacement P.22A-7). <M/T>.
- CVT Fluid Refilling (Refer to GROUP 23A – On-vehicle Service, CVT Fluid Replacement P.23A-121) <CVT>.
- Engine Oil Refilling (Refer to GROUP 12 – On-vehicle Service, Engine Oil Replacement P.12-4).
- Engine Coolant Refilling (Refer to GROUP 14 – On-vehicle Service, Engine Coolant Replacement P.14-6).
- Fuel Leak Check
- Engine Room Under Cover Installation (Refer to GROUP 51 – Under Cover P.51-15).



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|-------|---|-------------|--|
| >>C<< | Removal steps | <<A>> | |
| | <ul style="list-style-type: none"> • Control wiring harness connection • Brake booster vacuum hose connection (Refer to GROUP 35A – Master Cylinder Assembly and Brake Booster Assembly P.35A-28). • Purge hose connection (Refer to GROUP 11B – Fuel and Emission Parts P.11B-13). • Clutch cable connection (Refer to GROUP 21A – Clutch Control P.21A-5) <M/T>. • Gearshift cable and select cable connection (Refer to GROUP 22A – Transaxle Assembly P.22A-12) <M/T>. • Transaxle control cable connection (Refer to GROUP 23A – Transaxle Assembly P.23A-138) <CVT>. • Torque converter and drive plate coupling bolt (Refer to GROUP 23A – Transaxle Assembly P.23A-138) <CVT>. | <> | Removal steps (Continued) <ul style="list-style-type: none"> • A/C compressor and clutch assembly (Refer to GROUP 55A – Compressor Assembly P.55A-44) <Vehicles with A/C>. • Heater water hose A connection (Refer to P.11A-42). • Heater water hose B connection (Refer to GROUP 14 – Water Hose and Water Pipe P.14-15). • Fuel main pipe connection (Refer to GROUP 13A – Injector P.13A-651). • Engine mounting insulator (Refer to GROUP 32 – Engine Mounting P.32-2). • Transaxle mounting insulator (Refer to GROUP 32 – Transaxle Mounting P.32-3). |
| | | <> >>B<< | <ul style="list-style-type: none"> 1. Engine and transaxle assembly • Transaxle assembly coupling bolt (Refer to GROUP 22A – Transaxle Assembly P.22A-12) <M/T>. • Transaxle assembly coupling bolt (Refer to GROUP 23A – Transaxle Assembly P.23A-138) <CVT>. 2. Transaxle assembly 3. Engine assembly |

REMOVAL SERVICE POINTS

<<A>> A/C COMPRESSOR AND CLUTCH ASSEMBLY REMOVAL

1. Remove the A/C compressor and clutch assembly together with the hose from the bracket.
2. Tie the removed A/C compressor and clutch assembly with a string at a position where they will not interfere with the removal and installation of engine and transaxle assembly.

<> ENGINE MOUNTING
INSULATOR/TRANSAXLE MOUNTING
INSULATOR REMOVAL

1. Secure special tool engine hanger (MB991928 or MB991895) for holding the engine and transaxle assembly (Refer to GROUP 22A – Transaxle Assembly [P.22A-12](#)) <M/T> or (Refer to GROUP 23A – Transaxle Assembly [P.23A-138](#)) <CVT>.
2. Adjust the special tool not to allow the weight of the engine and transaxle assembly to rest on the engine mounting insulator and transaxle mounting insulator. Then remove the engine mounting insulator and transaxle mounting insulator.

<<C>> ENGINE AND TRANSAXLE ASSEMBLY
REMOVAL

1. Place special tool EV battery cart (MB992336) below the engine and transaxle assembly.

⚠ CAUTION

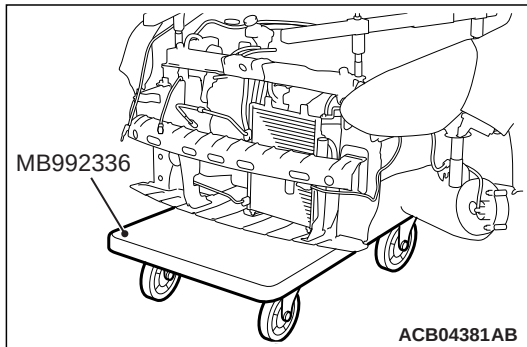
When supporting the engine and transaxle assembly with special tool, be careful not to deform the oil pan.

2. Place special tool (MB992336) against the oil pan with a piece of wood in between to support the engine and transaxle assembly.
3. Remove special tool engine hanger (MB991928 or MB991895).
4. Confirm that the cable, the hose and the harness connector are all disconnected.

⚠ CAUTION

Do not bend the fuel main pipe.

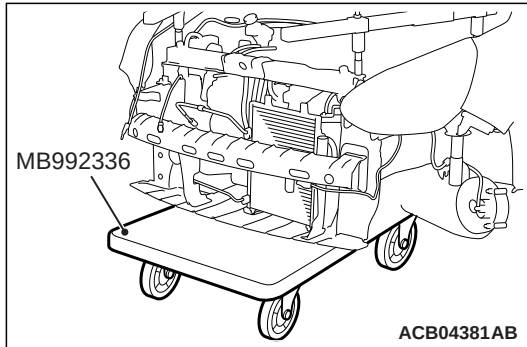
5. Raise the body slowly with a lift, and remove the engine and transaxle assembly.



INSTALLATION SERVICE POINTS

>>A<< ENGINE AND TRANSAXLE ASSEMBLY INSTALLATION

Use special tool EV battery cart (MB992336) as during removal to install the engine and transaxle assembly.



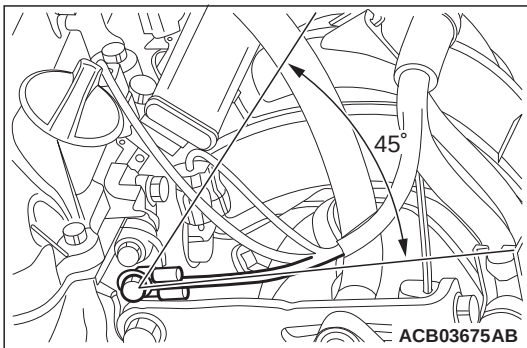
>>B<< TRANSAXLE MOUNTING INSULATOR/ENGINE MOUNTING INSULATOR INSTALLATION

Use special tool engine hanger (MB991928 or MB991895) as during removal to install the transaxle mounting insulator and engine mounting insulator.

>>C<< CONTROL WIRING HARNESS CONNECTION

1. Install the ground terminal to the timing chain case as shown.
2. Tighten the ground terminal mounting bolt to the specified torque.

Tightening torque: 9.0 ± 2.0 N·m (80 ± 17 in-lb)



NOTES