

GROUP 11A

ENGINE MECHANICAL <2.0L ENGINE>

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GENERAL DESCRIPTION

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The 4G94 (2.0L) engine is an in-line four-cylinder engine. The cylinder numbers are assigned as 1-2-3-4 from the front of the engine (timing belt side). This engine's firing order is 1, 3, 4, 2.

ITEMS			SPECIFICATIONS
Type			In-line SOHC
Number of cylinders			4
Bore mm (in)			81.5 (3.21)
Stroke mm (in)			95.8 (3.77)
Total displacement cm ³ (cu. in)			1,999 (122.0)
Compression ratio			9.5
Firing order			1-3-4-2
Valve timing	Intake valve	Opens (BTDC)	2°
		Closes (ABDC)	58°
	Exhaust valve	Opens (BBDC)	58°
		Closes (ATDC)	10°
Lubrication system			Pressure feed, full-flow filtration
Oil pump type			Trochoid type

ENGINE DIAGNOSIS

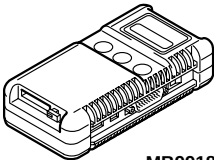
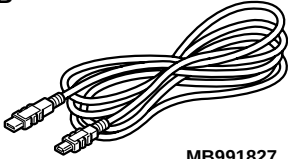
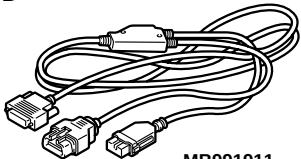
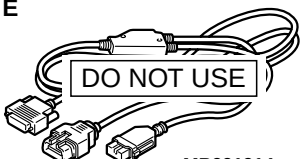
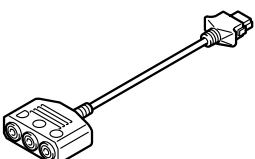
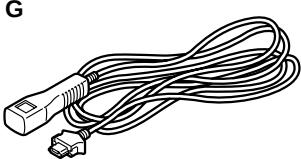
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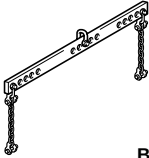
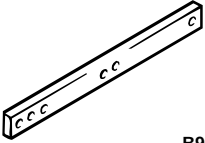
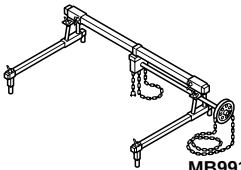
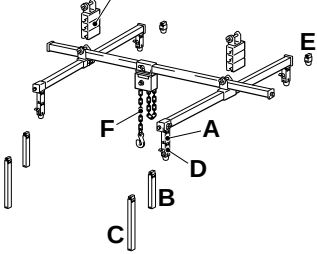
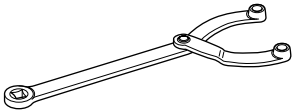
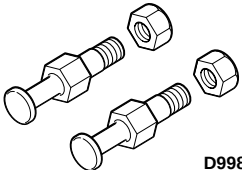
SYMPTOM	PROBABLE CAUSE	REMEDY
Compression is too low	Blown cylinder head gasket	Replace the gasket.
	Worn or damaged piston rings	Replace the rings.
	Worn piston or cylinder	Repair or replace the piston and/or the cylinder block.
	Worn or damaged valve seat	Repair or replace the valve and/or the seat ring.
	Worn or damaged valve guide	Replace the valve guide.
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. Be sure to use the correct viscosity.
	Stuck (open) 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.

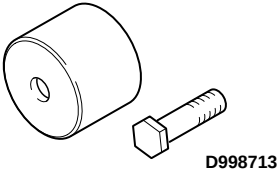
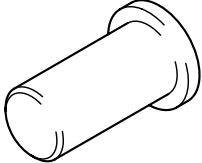
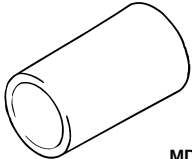
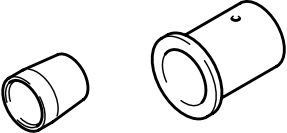
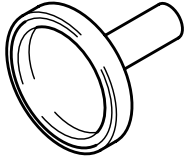
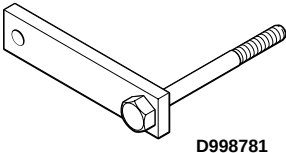
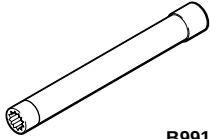
SYMPTOM	PROBABLE CAUSE	REMEDY
Noisy valves	Malfunction of lash adjuster (including entry of air into high pressure chamber)	Check the lash adjuster.
	Thin or diluted engine oil (low engine oil pressure)	Change the engine oil. Be sure to use the correct viscosity.
	Worn or damaged valve stem or valve guide	Replace the valve and/or the guide.
Connecting rod noise/main bearing noise	Insufficient oil supply	Check the engine oil level.
	Low engine oil pressure	Refer to engine oil pressure drop symptoms above.
	Thin or diluted engine oil	Change the engine oil. Be sure to use the correct viscosity.
	Excessive bearing clearance	Replace the bearings.
Noisy timing belt	Incorrect belt tension	Adjust the belt tension and/or replace the timing belt.
Excessive engine rolling and vibration	Loose engine roll stopper (Front, Rear) Loose transaxle mount bracket Loose engine mount bracket Loose center member	Retighten.
	Broken transaxle mount insulator Broken engine mount insulator Broken engine roll stopper insulator	Replase.

SPECIAL TOOLS

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TOOL	TOOL NUMBER AND NAME	SUPERSESSON	APPLICATION
A  MB991824 B  MB991827 C  MB991910 D  MB991911 E  MB991914 F  MB991825 G  MB991826 MB991958	MB991958 Scan tool (MUT-III sub assembly) A: MB991824 Vehicle communication interface (V.C.I.) B: MB991827 MUT-III USB cable C: MB991910 MUT-III main harness A (vehicles with CAN communication system) D: MB991911 MUT-III main harness B (vehicles without CAN communication system) E: MB991914 MUT-III main harness C (for Daimler Chrysler models only) F: MB991825 MUT-III measurement adapter G: MB991826 MUT-III trigger harness	MB991824-KIT <i>NOTE: G: MB991826 MUT-III Trigger Harness is not necessary when pushing V.C.I. ENTER key.</i>	• Drive belt tension check • Ignition timing check • Idle mixture check • Curb Idle speed check CAUTION MUT-III Main Harness B (MB991911) should be used. MUT-III main harness A and C should not be used for this vehicle.

TOOL	TOOL NUMBER AND NAME	SUPERSESION	APPLICATION
 B991454	MB991454 Engine hanger balancer	MZ203827-01	When the engine hanger is used: Supporting the engine assembly during removal and installation of the transaxle assembly <i>NOTE: Special tool MB991454 is a part of engine hanger attachment set MB991453.</i>
 B991527	MB991527 Hanger	Tool not available	
 MB991895	MB991895 Engine hanger	Tool not available	
SLIDE BRACKET (HI)  B991928	MB991928 Engine hanger A: MB991929 Joint (50) × 2 B: MB991930 Joint (90) × 2 C: MB991931 Joint (140) × 2 D: MB991932 Foot (standard) × 4 E: MB991933 Foot (short) × 2 F: MB991934 Chain and hook assembly	Tool not available	
 B990767	MB990767 End yoke holder	MB990767-01	• Holding the camshaft sprocket • Holding the crankshaft pulley
 D998719	MD998719 Crankshaft pulley holder pin	General service tool	

TOOL	TOOL NUMBER AND NAME	SUPERSESSION	APPLICATION
 D998713	MD998713 Camshaft oil seal installer	MD998713-01	Installation of the camshaft oil seal
	MD998304 Crankshaft front oil seal installer	MD998304-01	Installation of the crankshaft front oil seal
 MD998305	MD998305 Crankshaft front oil seal guide	MD998305-01	
	MD998717 Crankshaft front oil seal installer	MD998717-01	Press-in of the crankshaft front oil seal
	MD998718 Crankshaft rear oil seal installer	MD998718-01	Press-fitting the crankshaft rear oil seal
 D998781	MD998781 Flywheel stopper	General service tool	Securing the drive plate
 B991654	MB991653 Cylinder head bolt wrench	General service tool	Removal and installation of the cylinder head bolt

ON-VEHICLE SERVICE

DRIVE BELT (FOR GENERATOR, POWER STEERING OIL PUMP AND A/C COMPRESSOR) (CHECK CONDITION)

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Generator Drive Belt Tension Check

<When using scan tool MB991958>

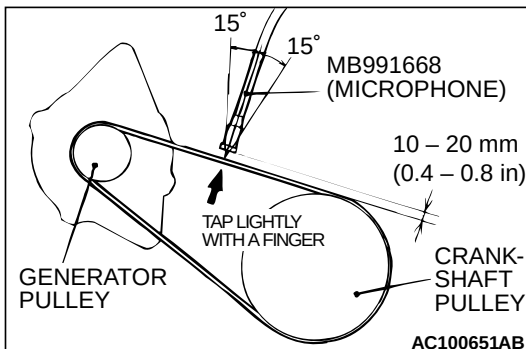
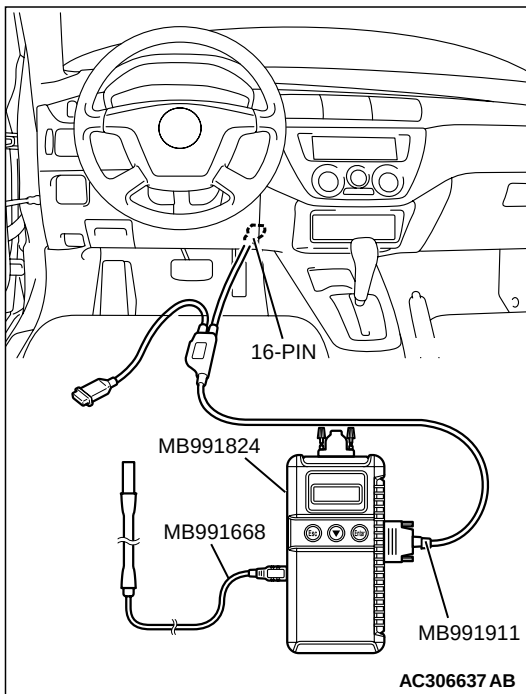
Required Special Tools:

- MB991668: Belt Tension Meter Set
- MB991958: Scan Tool (MUT-III Sub Assembly)
 - MB991824: V.C.I.
 - MB991911: MUT-III Main Harness B

⚠ CAUTION

To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

1. Connect special tool MB991668 to scan tool MB991958.
2. Connect scan tool MB991958 to the data link connector.
3. Turn the ignition switch to the "ON" position and select scan tool MB991958 "Belt Tension Measurement" from the menu screen.



4. Hold special tool MB991668 (microphone) near the center of the drive belt between the pulleys (at the place indicated by the arrow), about 10 – 20 mm (0.4 – 0.8 inch) away from the rear surface of the belt and perpendicular to the belt (within an angle of ± 15 degree angle).

⚠ CAUTION

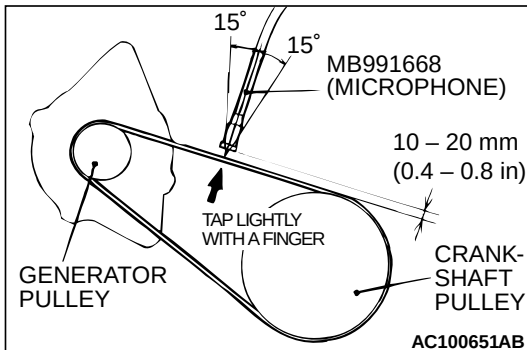
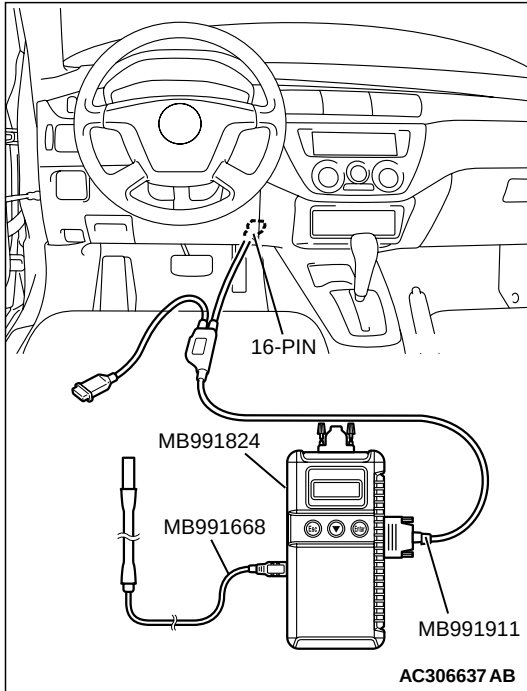
- The temperature of the surface of the belt should be as close as possible to underhood temperature.
 - Do not let any contaminants such as water or oil get onto the microphone.
 - If strong gusts of wind blow against the microphone or if there are any loud sources of noise nearby, the values measured 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. Gently tap the middle of the belt between the pulleys (the place indicated by the arrow) with your finger as shown in the illustration, and check that the vibration frequency of the belt is within the standard value.

Standard value:

ITEMS	WHEN CHECKED	DURING ADJUSTMENT	DURING REPLACEMENT
Vibration frequency Hz	151 – 195	163 – 185	213 – 246

<When using scan tool MB991958>**Required Special Tools:**

- MB991668: Belt Tension Meter Set
- MB991958: Scan Tool (MUT-III Sub Assembly)
 - MB991824: V.C.I.
 - MB991911: MUT-III Main Harness B



CAUTION

To prevent damage to scan tool MB991824, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991824.

1. Connect special tool MB991668 to scan tool MB991824.
2. Connect scan tool MB991911 to scan tool MB991824.
3. Connect scan tool MB991911 to the data link connector.
4. Turn the ignition switch to the "ON" position and select "Belt Tension" from the menu scan tool MB991824 screen.

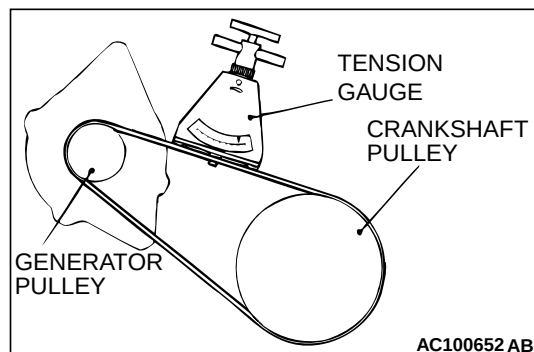
5. Hold special tool MB991668 (microphone) near the center of the drive belt between the pulleys (at the place indicated by the arrow), about 10 – 20 mm (0.4 – 0.8 inch) away from the rear surface of the belt and perpendicular to the belt (within an angle of ± 15 degree angle).

CAUTION

- The temperature of the surface of the belt should be as close as possible to underhood temperature.
 - 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 are any 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.
6. Gently tap the middle of the belt between the pulleys (the place indicated by the arrow) with your finger as shown in the illustration, and check that the vibration frequency of the belt is within the standard value.

Standard value:

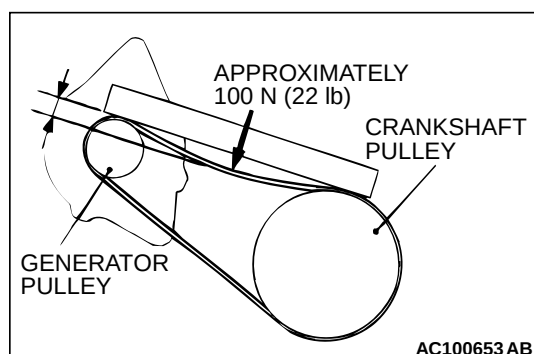
ITEMS	WHEN CHECKED	DURING ADJUSTMENT	DURING REPLACEMENT
Vibration frequency Hz	151 – 195	163 – 185	213 – 246

**<When using the tension gauge>**

Use a belt tension gauge to check that the belt tension is within the standard value.

Standard value:

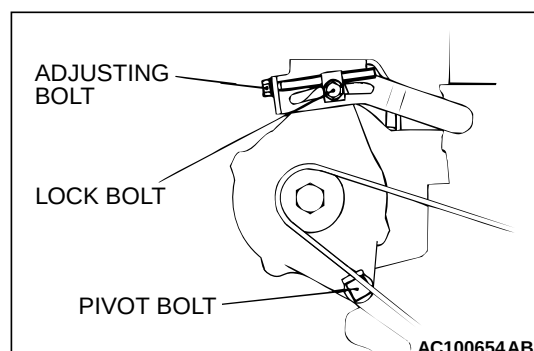
ITEMS	WHEN CHECKED	DURING ADJUSTMENT	DURING REPLACEMENT
Tension N (lb)	294 – 490 (66 – 110)	343 – 441 (77 – 99)	588 – 784 (132 – 176)

**<Belt deflection check>**

Apply approximately 100 N (22 pound) 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.

Standard value:

ITEMS	WHEN CHECKED	DURING ADJUSTMENT	DURING REPLACEMENT
Deflection (Reference value) mm (in)	9.7 – 12.7 (0.38 – 0.50)	10.3 – 11.8 (0.41 – 0.47)	6.7 – 8.5 (0.26 – 0.34)

**Generator Drive Belt Tension Adjustment**

1. Loosen the nut of the generator pivot bolt.
2. Loosen the lock bolt.
3. Turn the adjusting bolt to adjust the belt vibration frequency, belt tension or deflection to the standard value.

⚠ CAUTION

Check after turning the crankshaft one or more rotations clockwise.

Standard value:

ITEMS	WHEN CHECKED	DURING ADJUSTMENT	DURING REPLACEMENT
Vibration frequency Hz	151 – 195	163 – 185	213 – 246
Tension N (lb)	294 – 490 (66 – 110)	343 – 441 (77 – 99)	588 – 784 (132 – 176)
Deflection (Reference value) mm (in)	9.7 – 12.7 (0.38 – 0.50)	10.3 – 11.8 (0.41 – 0.47)	6.7 – 8.5 (0.26 – 0.34)

4. Tighten the lock bolt.

Tightening torque: 23 ± 2 N·m (16 ± 2 ft-lb)

5. Tighten the nut of the generator pivot bolt.

Tightening torque: 44 ± 10 N·m (33 ± 7 ft-lb)

6. Tighten the adjusting bolt.

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

Power Steering Oil Pump and A/C Compressor Drive Belt Tension Check and Adjustment

Check the drive belt tension by the following procedure.

<When using scan tool MB991502 or MB991958>

Required Special Tools:

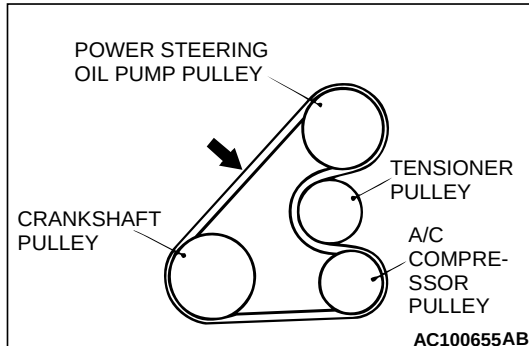
- MB991502: Scan Tool (MUT-II)
- MB991958: Scan Tool (MUT-III Sub Assembly)
 - MB991824: V.C.I.
 - MB991911: MUT-III Main Harness B
- MB991668: Belt Tension Meter Set

Gently tap the middle of the belt between the pulleys (the location indicated by the arrow) with your finger as shown in the illustration, and check that the vibration frequency of the belt is within the standard value.

NOTE: Refer to [P.11A-7](#) for details on the method of measuring the vibration frequency using the scan tool.

<When using a tension gauge>

Use a belt tension gauge to check that the belt tension is within the standard value.



<Belt deflection check>

Apply approximately 100 N (22 pound) 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.

Standard value:

ITEMS	WHEN CHECKED	DURING ADJUSTMENT	DURING REPLACEMENT
Vibration frequency Hz	151 – 195	163 – 185	213 – 246
Tension N (lb)	294 – 490 (66 – 110)	343 – 441 (77 – 99)	588 – 784 (132 – 176)
Deflection (Reference value) mm (in)	9.7 – 12.7 (0.38 – 0.50)	10.3 – 11.8 (0.41 – 0.46)	6.7 – 8.5 (0.26 – 0.33)

if the tension or deflection is outside the standard value, adjust by the following procedure.

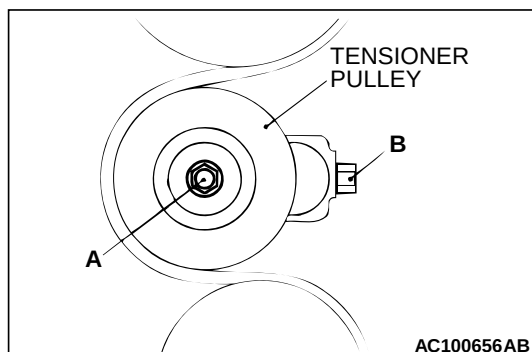
1. Loosen the tension pulley fixing nut A behind the tension pulley.
2. Adjust the belt deflection amount using the adjusting bolt B.
3. Tighten the fixing nut A.

Tightening torque: 26 ± 4 N·m (19 ± 3 ft-lb)

⚠ CAUTION

Check after turning the crankshaft one or more rotations clockwise.

4. Check the belt deflection amount and tension, and readjust if necessary.



IGNITION TIMING CHECK

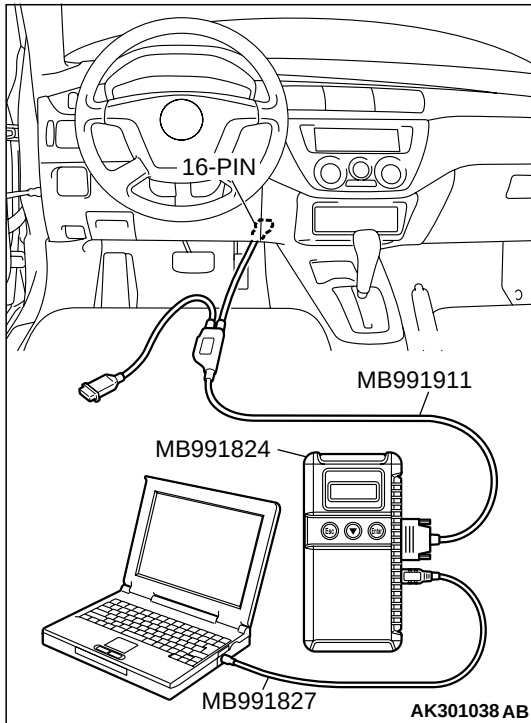
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Required Special Tools:

- MB991958: Scan Tool (MUT-III Sub Assembly)
 - MB991824: V.C.I.
 - MB991827: MUT-III USB Cable
 - MB991911: MUT-III Main Harness B

1. Before checks, set the vehicle in the following conditions:
 - Engine coolant temperature: 80 – 95°C (176 – 203°F)
 - Lights and all accessories: OFF
 - Transaxle: Neutral (P range on vehicles with A/T)

NOTE: Vehicles for Canada, the headlight, taillight, etc. remain lit even when the lighting switch is in "OFF" position but this is no problem for checks.



CAUTION

To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

2. Connect scan tool MB991958 to the data link connector.
3. Set up a timing light.
4. Start the engine and run it at idle.
5. Check that the idle speed is approximately 700 r/min.
6. Select scan tool MB991958 MFI actuator test "item number 17."
7. Check that basic ignition timing is within the standard value.

Standard value: 5° BTDC ± 3°

8. If the basic ignition timing is not within the standard value, check the following items:
 - Is the MFI system diagnostic trouble code is output
 - Timing belt cover and crankshaft position sensor installation conditions
 - Crankshaft sensing blade condition

CAUTION

If the actuator test is not canceled, the forced drive will continue for 27 minutes. Driving in this state could lead to engine failure.

9. Press the clear key on scan tool MB991958 (select forced-drive stop mode), and cancel the actuator test.
10. Check that the actual ignition timing is at the standard value.

Standard value: Approximately 10° BTDC

NOTE: Ignition timing fluctuates about ± 7° Before Top Dead Center, even under normal operating condition.

NOTE: It is automatically further advanced by about 5° to 10° Before Top Dead Center at higher altitudes.

IDLE MIXTURE CHECK

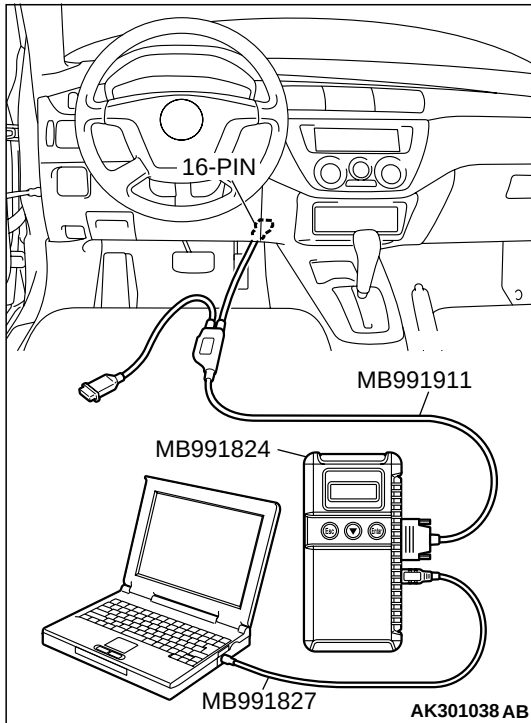
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Required Special Tools:

- MB991958: Scan Tool (MUT-III Sub Assembly)
 - MB991824: V.C.I.
 - MB991827: MUT-III USB Cable
 - MB991911: MUT-III Main Harness B

1. Before checks, set the vehicle in the following conditions:
 - Engine coolant temperature: 80 – 95°C (176 – 203°F)
 - Lights and all accessories: OFF
 - Transaxle: Neutral (P range on vehicles with A/T)

NOTE: Vehicles for Canada, the headlight, taillight, etc. remain lit even when the lighting switch is in "OFF" position but this is no problem for checks.

**⚠ CAUTION**

To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

2. Connect scan tool MB991958 to the data link connector.
3. Confirm basic ignition timing is within the standard value. (Refer to Ignition Timing Check [P.11A-12.](#))

Standard value: 5° BTDC ± 3°

4. Increase engine speed to 2,500 r/min for 2 minutes.
5. Set the CO/HC tester.
6. Check the CO and HC contents at idle.

Standard value:

CO contents: 0.5 % or less

HC contents: 100 ppm or less

7. If the CO and HC contents do not remain inside the standard value, check the following items:
 - If the MFI system diagnostic trouble code is output
 - Closed-loop control (When the closed-loop control is carried out normally, the output signal of the heated oxygen sensor changes between 0 – 400 mV and 600 – 1,000 mV at idle.)
 - Fuel pressure
 - Injector(s)
 - Ignition coil, spark plug cable, spark plug
 - EGR system and EGR valve leak
 - Evaporative emission system
 - Compression pressure

NOTE: Replace the catalytic converter when the CO and HC contents do not remain inside the standard value, even though the result of the inspection is normal for all items.

CURB IDLE SPEED CHECK

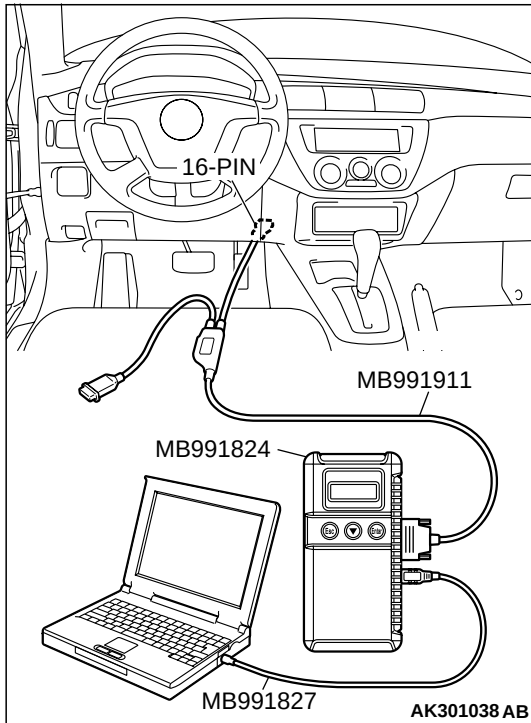
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Required Special Tools:

- MB991958: Scan Tool (MUT-III Sub Assembly)
 - MB991824: V.C.I.
 - MB991827: MUT-III USB Cable
 - MB991911: MUT-III Main Harness B

1. Before checks, set the vehicle in the following conditions:
 - Engine coolant temperature: 80 – 95°C (176 – 203°F)
 - Lights and all accessories: OFF
 - Transaxle: Neutral (P range on vehicles with A/T)

NOTE: Vehicles for Canada, the headlight, taillight, etc. remain lit even when the lighting switch is in "OFF" position but this is no problem for checks.



CAUTION

To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

2. Connect scan tool MB991958 to the data link connector.
3. Confirm basic ignition timing is within the standard value. (Refer to Ignition Timing Check P.11A-12.)

Standard value: 5° BTDC ± 3°

4. Start the engine.
5. Run the engine at idle for 2 minutes.
6. Check the idle speed. Select MFI service data item number 22 and take a reading of the idle speed.

Curb idle speed: 700 ± 100 r/min

NOTE: The idle speed is controlled automatically by the idle air control system.

7. If the idle speed is outside the standard value, refer to GROUP 13A, Multiport Fuel Injection (MFI) <2.0L Engine> – Multiport Fuel Injection (MFI) Diagnosis – Symptom Chart P.13A-32.

COMPRESSION PRESSURE CHECK

M1111002600584

1. Before checks, check that the engine oil, starter and battery are normal. Also, set the vehicle to the following conditions:
 - Engine coolant temperature: 80 – 95°C (176 – 203°F)
 - Lights and all accessories: OFF
 - Transaxle: Neutral (P range on vehicles with A/T)

NOTE: Vehicles for Canada, the headlight, taillight, etc. remain lit even when the lighting switch is in "OFF" position but this is no problem for checks.

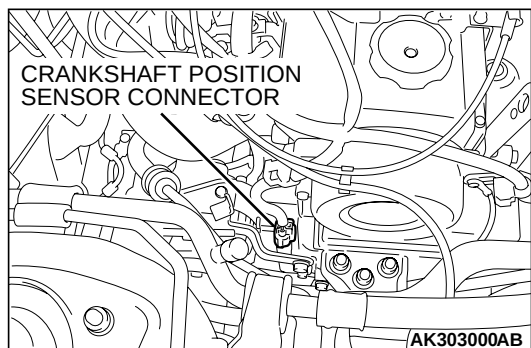
2. Disconnect the spark plug cables.
3. Remove all of the spark plugs.
4. Disconnect the crankshaft position sensor connector.

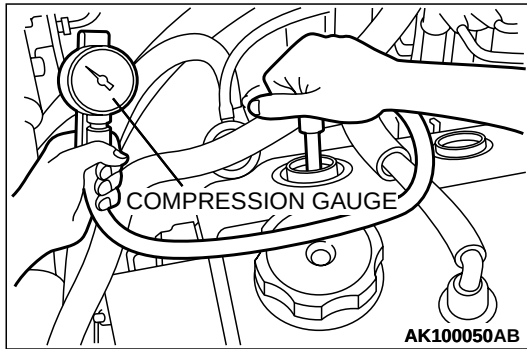
NOTE: Doing this will prevent the engine control module from carrying out ignition and fuel injection.

WARNING

Keep your distance from the spark plug hole when cranking. Oil, fuel, etc., may spray out from the spark plug hole and may cause serious injury.

5. Cover the spark plug holes with a shop towel etc. Crank the engine for a few seconds to clear debris from a round the spark plug holes. After the engine has been cranked, check for foreign material adhering to the shop towel.





6. Install the compression gauge to one of the spark plug holes.
7. Crank the engine with the throttle valve fully open and measure the compression pressure.
Standard value (at engine speed of 200 r/min): 1,618 kPa (234 psi)
Minimum limit (at engine speed of 200 r/min): 1,176 kPa (170 psi)
8. Measure the compression pressure for all the cylinders, and check that the pressure differences of the cylinders are below the limit.
Limit: 98 kPa (14 psi)
9. 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 6 to 8.
 - (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.
10. Connect the crankshaft position sensor connector.
11. Install the spark plugs and spark plug cables.
12. Use the scan tool to erase the diagnostic trouble codes.

NOTE: This will erase the diagnostic trouble code resulting from the crankshaft position sensor connector being disconnected.

NOTE: If the negative (–) cable has been disconnected from the battery terminal in order to erase the diagnostic trouble code, operate the engine at idle for approximately 10 minutes after restarting.

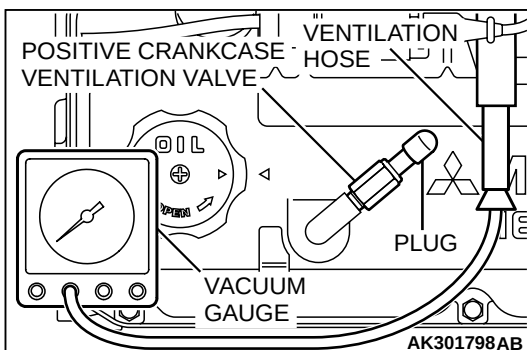
MANIFOLD VACUUM CHECK

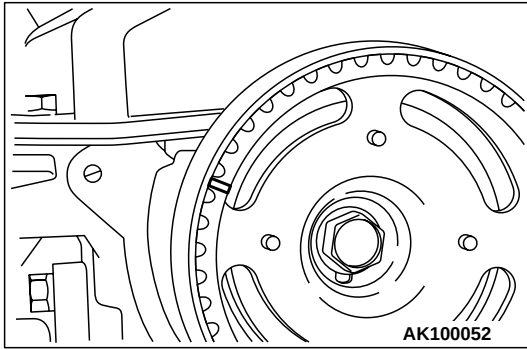
M1111002700547

1. Start the engine and allow it to warm up until the temperature of the engine coolant reaches 80 – 95°C (176 – 203°F).
2. Connect an engine tachometer.
3. Disconnect the ventilation hose from the positive crankcase ventilation (PCV) valve, and connect a vacuum gauge to the ventilation hose.
4. Plug the PCV valve.
5. Start the engine and check that idle speed is within specification. Then check the vacuum gauge reading.

Idle speed: 700 ± 100 r/min

Minimum limit: 60 kPa (18 in Hg)





TIMING BELT TENSION ADJUSTMENT

M1111002800038

1. Remove the timing belt upper cover.
2. Turn the crankshaft clockwise to set the No.1 cylinder to the top dead compression center.

⚠ CAUTION

As the purpose of this procedure is to apply the proper amount of tension to the timing belt by means of the cam drive torque, be sure not to rotate the crankshaft counter-clockwise.

3. Remove the access cover.
4. Loosen the timing belt tensioner fixing bolt to apply tension to the belt by means of the force of the tensioner spring.

⚠ CAUTION

Loosen the bolt 1/4 to 1/2 turn. If the belt is loosened more than necessary, the bolt may fall inside the cover.

5. Tighten the timing belt tensioner fixing bolt.
6. Install the access cover.
7. Install the timing belt upper cover.

LASH ADJUSTER CHECK

M1111002900455

If an abnormal noise (chattering noise) is heard by malfunction of the lash adjuster immediately after starting the engine and does not disappear, it might be the lash adjusters. Perform the following check.

NOTE: An abnormal noise due to malfunction of the lash adjuster is produced immediately after starting the engine and changes with the engine speed, irrespective of the engine load. If, the abnormal noise is not produced immediately after starting the engine or does not change with the engine speed, or it changes with the engine load, the lash adjuster is not the cause for the abnormal noise.

NOTE: When the lash adjuster is malfunctioning, the abnormal noise is rarely eliminated by running the engine at idle speed. However, the abnormal noise may disappear only when seizure is caused by oil sludge in the engine whose oil is not maintained properly.

1. Start the engine.
2. Check if the abnormal noise produced immediately after starting the engine changes with the change in the engine speed.

If the abnormal noise is not produced immediately after starting the engine or it does not change with the engine speed, the lash adjuster is not the cause for the noise.

Therefore, investigate other causes. The abnormal noise is probably caused by some other parts than the engine proper if it does not change with the engine speed. (In this case, the lash adjuster is in good condition.)

3. With the engine idling, change the engine load (shift from N to D range, for example) to make sure that there is no change in the level of abnormal noise.
If there is a change in the level of abnormal noise, suspect a tapping noise due to worn crankshaft bearing or connecting rod bearing. (In this case, the lash adjuster is in good condition.)
4. After completion of warm-up, run the engine at idle to check for abnormal noise.
If the noise is reduced or disappears, clean the lash adjuster (Refer to GROUP 11B – Engine Overhaul <2.0L Engine> – Rocker Arms and Camshaft – Inspection [P.11B-21](#).) It is suspected that the noise is due to collapse of the lash adjuster. If there is no change in the level of the abnormal noise, proceed to step 5.
5. Run the engine to bleed the lash adjuster system. (Refer to.)
6. If the abnormal noise does not disappear after air bleeding operation, clean the lash adjuster (Refer to GROUP 11B – Engine Overhaul <2.0L Engine> – Rocker Arms and Camshaft – Inspection [P.11B-21](#).)

Bleeding lash adjuster system

NOTE: Parking the vehicle on a grade for a long time may drain oil from the lash adjuster, causing air to enter the high pressure chamber when starting the engine.

NOTE: After parking for many hours, oil may drain from the oil passage and take time before oil is supplied to the lash adjuster, causing air to enter the high pressure chamber.

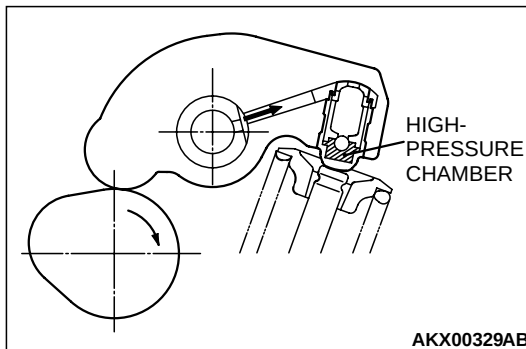
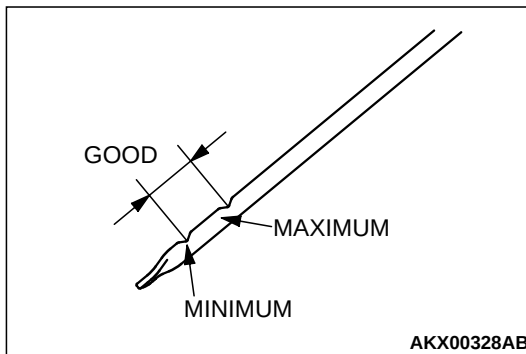
NOTE: In the above cases, abnormal noise can be eliminated by bleeding the lash adjuster system.

1. Check engine oil. Add or change oil as required.

NOTE: If the engine oil level is low, air is sucked from the oil screen, causing air to enter the oil passage.

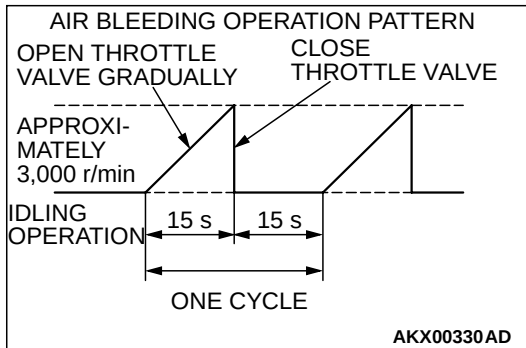
NOTE: If the engine oil level is higher than specification, oil may be stirred by the crankshaft, causing oil to be mixed with air creating aerated (foaming) oil.

NOTE: If oil is deteriorated, air is not easily separated from oil, increasing the quantity of air contained in oil.



NOTE: If air mixed with oil enters the high pressure chamber inside the lash adjuster from the above causes, air in the high pressure chamber is compressed excessively while the valve is being opened, resulting in an abnormal noise when the valve closes.

This is the same phenomenon as that observed when the valve clearance has become excessive. The lash adjuster can resume normal function when air entered the lash adjuster is removed.



2. Idle the engine for one to three minutes to warm it up.
3. Repeat the operation pattern, shown in left figure, at no load to check for abnormal noise. (Usually the abnormal noise is eliminated after repetition of the operation 10 to 30 times. If, however, no change is observed in the level of abnormal noise after repeating the operation more than 30 times, suspect that the abnormal noise is due to some other factors.)
4. After elimination of abnormal noise, repeat the operation shown in left figure five more times.
5. Run the engine at idle for one to three minutes to make sure that the abnormal noise has been eliminated.

ENGINE ASSEMBLY

REMOVAL AND INSTALLATION

M1112001000913

CAUTION

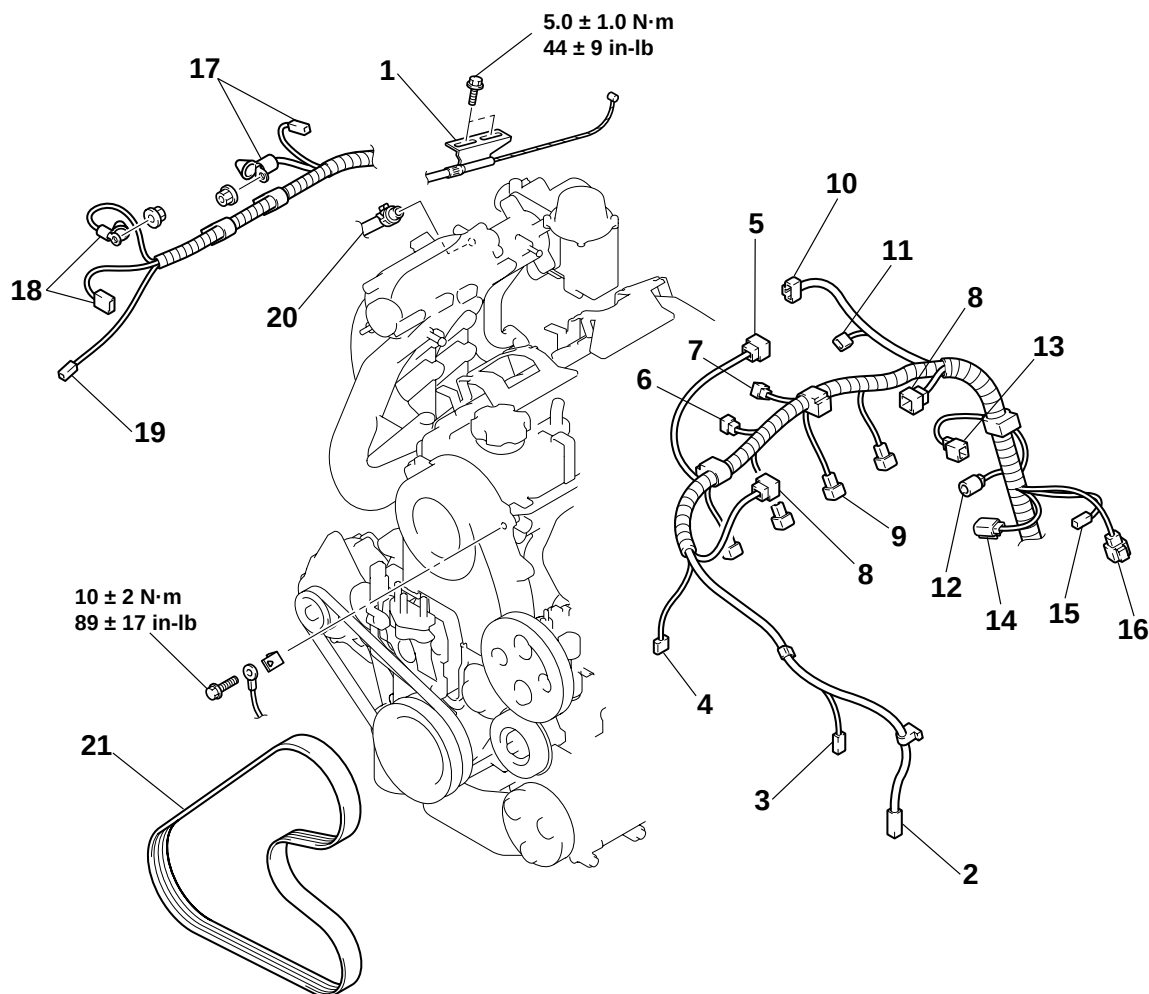
*: Indicates parts which should be temporarily tightened, and then fully tightened after installing the engine into the vehicle.

Pre-removal Operation

- Fuel Line Pressure Reduction [Refer to GROUP 13A, On-vehicle Service – Fuel Pump Relay Disconnection (How to Reduce Pressurized Fuel Lines) [P.13A-908.](#)]
- Under Cover Removal
- Engine Oil Draining [Refer to GROUP 00, Maintenance Service – Engine Oil (Change) [P.00-51.](#)]
- Engine Coolant Draining (Refer to GROUP 14, On-vehicle Service – Engine Coolant Replacement [P.14-25.](#))
- Air Cleaner Removal (Refer to GROUP 15, Air Cleaner [P.15-4.](#))
- Hood Removal (Refer to GROUP 42, Hood [P.42-7.](#))
- Radiator Removal (Refer to GROUP 14, Radiator [P.14-29.](#))
- Front Exhaust Pipe Removal (Refer to GROUP 15, Exhaust Pipe and Main Muffler [P.15-13.](#))
- Battery and Battery Tray Removal

Post-installation Operation

- Front Exhaust Pipe Installation (Refer to GROUP 15, Exhaust Pipe and Main Muffler [P.15-13.](#))
- Radiator Installation (Refer to GROUP 14, Radiator [P.14-29.](#))
- Air Cleaner Installation (Refer to GROUP 15, Air Cleaner [P.15-4.](#))
- Drive Belt Tension Adjustment [Refer to GROUP 00, Maintenance Service – Drive Belts (Check Condition) [P.00-45.](#)]
- Engine Oil Refilling [Refer to GROUP 00, Maintenance Service – Engine Oil (Change) [P.00-51.](#)]
- Engine Coolant Refilling (Refer to GROUP 14, On-vehicle Service – Engine Coolant Replacement [P.14-25.](#))
- Accelerator Cable Adjustment (Refer to GROUP 17, On-vehicle Service – Accelerator Cable Check and Adjustment [P.17-6.](#))
- Hood Installation (Refer to GROUP 42, Hood [P.42-7.](#))
- Battery and Battery Tray Installation



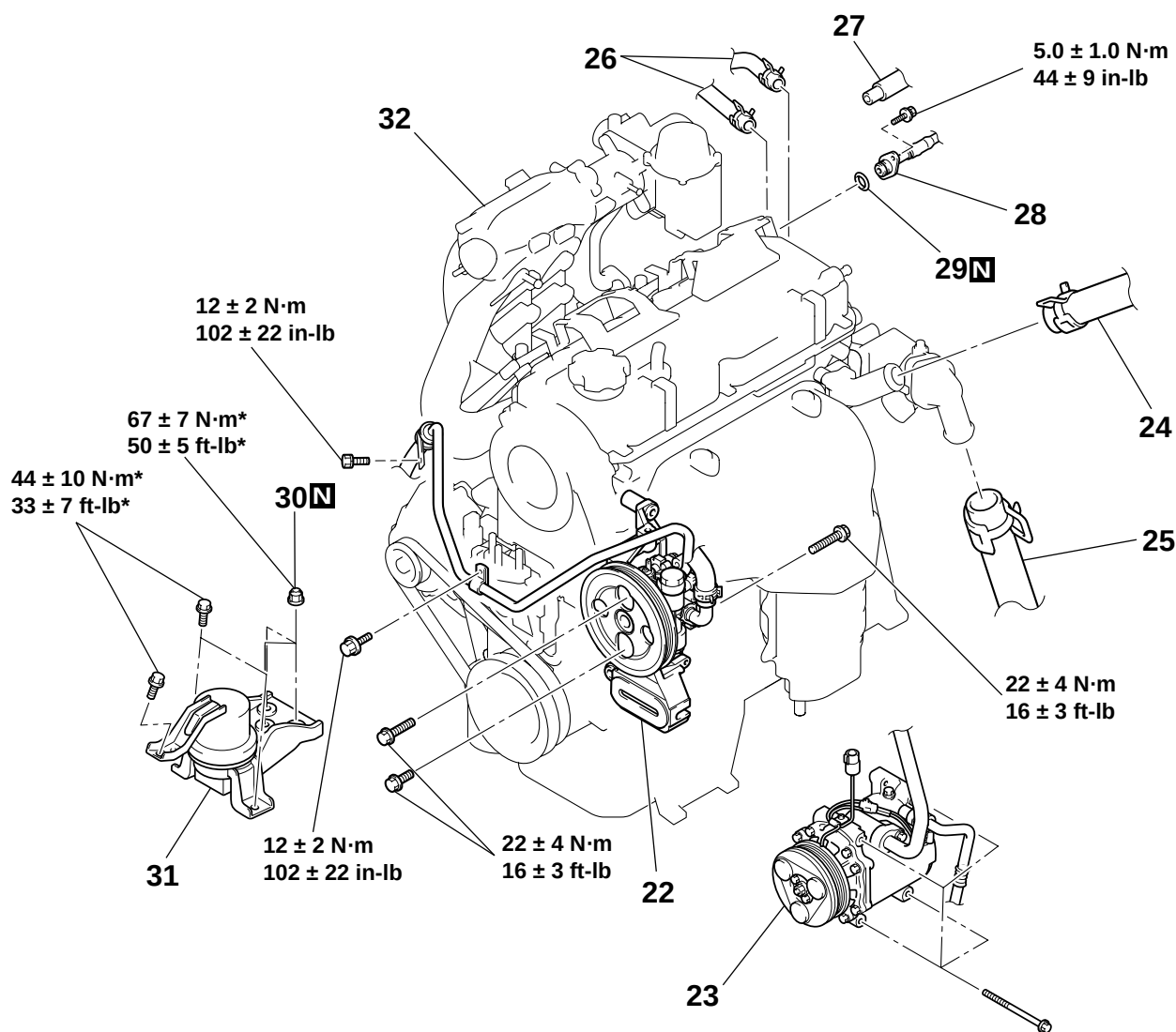
AC100306AB

REMOVAL STEPS

1. ACCELERATOR CABLE
CONNECTION
2. A/C COMPRESSOR
CONNECTOR
3. POWER STEERING OIL
PRESSURE SWITCH
CONNECTOR
4. CRANKSHAFT POSITION
SENSOR CONNECTOR
5. MANIFOLD ABSOLUTE
PRESSURE SENSOR
CONNECTOR
6. EVAPORATIVE EMISSION
PURGE SOLENOID
CONNECTOR
7. EGR SOLENOID VALVE
CONNECTOR
8. IGNITION COIL CONNECTOR
9. INJECTOR CONNECTOR
10. THROTTLE POSITION SENSOR
CONNECTOR

REMOVAL STEPS (Continued)

11. IDLE AIR CONTROL MOTOR
CONNECTOR
12. ENGINE COOLANT
TEMPERATURE SENSOR
CONNECTOR
13. CAMSHAFT POSITION
SENSOR CONNECTOR
14. KNOCK SENSOR CONNECTOR
15. ENGINE COOLANT
TEMPERATURE GAUGE UNIT
CONNECTOR
16. HEATED OXYGEN SENSOR
CONNECTOR
17. STARTER CONNECTOR
18. GENERATOR CONNECTOR
19. OIL PRESSURE SWITCH
CONNECTOR
20. BRAKE BOOSTER VACUUM
HOSE CONNECTION
21. POWER STEERING OIL PUMP
AND A/C COMPRESSOR DRIVE
BELT



AC308426AB

<<A>>	22. POWER STEERING OIL PUMP AND BRACE ASSEMBLY	>>C<<	27. PURGE HOSE CONNECTION
<>	23. A/C COMPRESSOR	>>C<<	28. FUEL HIGH-PRESSURE HOSE CONNECTION
<<C>> >>D<<	24. RADIATOR UPPER HOSE CONNECTION	<<D>>	29. O-RING
<<C>> >>D<<	25. RADIATOR LOWER HOSE CONNECTION	<<D>>	• TRANSAXLE ASSEMBLY
<<C>> >>D<<	• RADIATOR ASSEMBLY (REFER TO GROUP 14 P.14-29.)	<<E>> >>B<<	30. SELF-LOCKING NUTS
	26. HEATER HOSE CONNECTION	<<F>> >>A<<	31. ENGINE FRONT MOUNTING BRACKET
			32. ENGINE ASSEMBLY

Required Special Tools:

- MB991454: Engine Hanger Balancer
- MB991527: Hanger
- MB991895: Engine Hanger
- MB991928: Engine Hanger

REMOVAL SERVICE POINTS

<<A>> POWER STEERING OIL PUMP AND BRACE ASSEMBLY REMOVAL

Remove the power steering oil pump and brace assembly from the engine with the hose attached.

NOTE: Place the removed power steering oil pump in a place where it will not be a hindrance when removing and installing the engine assembly, and secure it with a cord or wire.

<> A/C COMPRESSOR REMOVAL

Remove the compressor from the compressor bracket with the hose still attached.

NOTE: Place the removed A/C compressor where it will not be a hindrance when removing and installing the engine assembly, and secure it with a cord or wire.

<<C>> RADIATOR UPPER HOSE/RADIATOR LOWER HOSE REMOVAL

After alignment marks are made on radiator hoses and hose clamps, remove hoses.

<<D>> TRANSAXLE ASSEMBLY REMOVAL

CAUTION

Do not remove the flywheel mounting bolt shown by the arrow. If this bolt is removed, the flywheel will become out of balance and may be damaged.

<M/T>: Refer to GROUP 22A [P.22A-16](#).

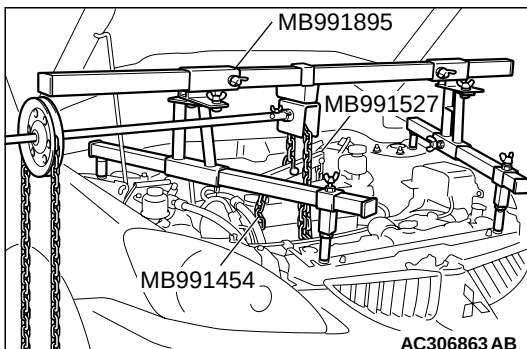
<A/T>: Refer to GROUP 23A [P.23A-351](#).

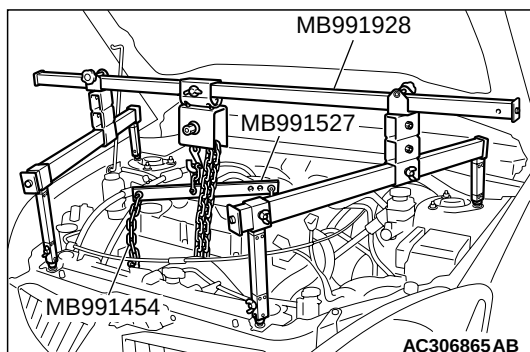
<<E>> ENGINE FRONT MOUNTING BRACKET REMOVAL

1. Support the engine with a floor jack.
2. Remove the following special tool.

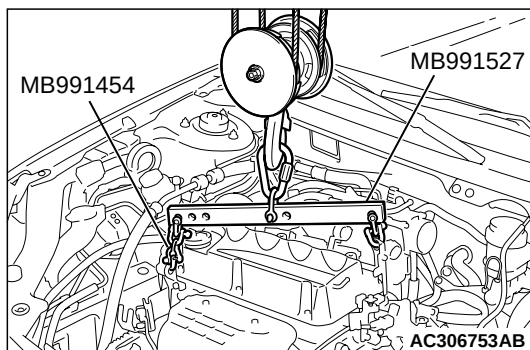
(1) <Special tool MB991895 is used>

Remove special tool MB991895.





- (2) <Special tool MB991928 is used>
Remove special tool MB991928.



3. Hold the engine assembly with a chain block, etc.
4. Place a garage jack against the engine oil pan with a piece of wood in between so that the weight of the engine assembly is no longer being applied to the engine front mounting bracket.
5. Loosen the engine front mounting bracket mounting nuts and bolts, and remove the engine front mounting bracket.

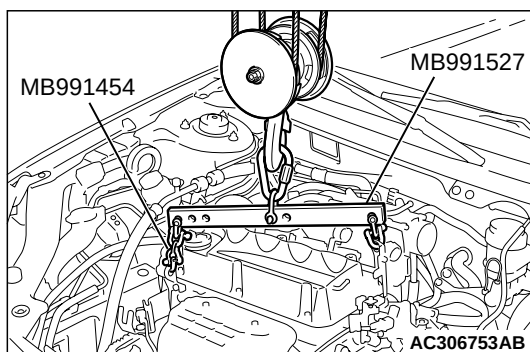
<<F>> ENGINE ASSEMBLY REMOVAL

After checking that all cables, hoses and harness connectors, etc., are disconnected from the engine, use the chain block to slowly lift the engine assembly upward from the engine compartment.

INSTALLATION SERVICE POINTS

>>A<< ENGINE ASSEMBLY INSTALLATION

Install the engine assembly, being careful not to pinch the cables, hoses or wiring harness connectors.

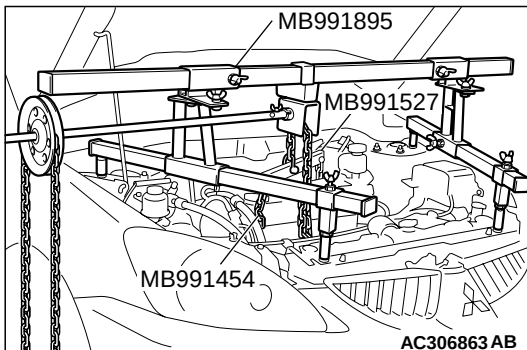


**>>B<< ENGINE FRONT MOUNTING BRACKET
INSTALLATION**

1. Place a garage jack against the engine oil pan with a piece of wood in between, and install the engine front mounting bracket while adjusting the position of the engine.
2. Support the engine assembly with a garage jack.
3. Remove the chain block.
4. Use the following special tool as during removal to support the engine.

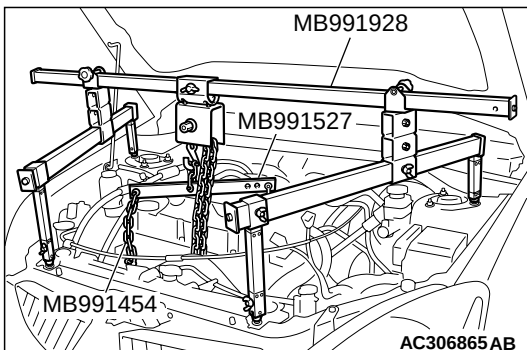
(1) <Special tool MB991895 is used>

Set special tool MB991895. (Refer to GROUP 23A, Transaxle Assembly [P.23A-351](#)).



(2) <Special tool MB991928 is used>

Set special tool MB991928. (Refer to GROUP 23A, Transaxle Assembly [P.23A-351](#)).

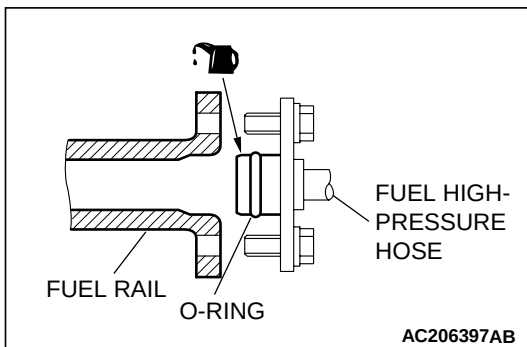


>>C<< O-RING/FUEL HIGH-PRESSURE INSTALLATION

⚠ CAUTION

Do not allow any engine oil to enter the fuel rail.

1. Apply a small amount of new engine oil to the O-ring.
2. While turning the fuel high-pressure hose to the right and left, slide it into the fuel rail. Be careful not to damage the O-ring. After installing, check that the hose turns smoothly.
3. If the hose does not turn smoothly, the O-ring is probably binding. Disconnect the fuel high-pressure hose and check the O-ring for damage. Replace if necessary.
4. Re-insert the fuel rail and confirm the hose turns smoothly.



**>>D<< RADIATOR LOWER HOSE/RADIATOR UPPER HOSE
INSTALLATION**

1. Slide the hose onto the water inlet fitting and thermostat case.
2. Align the marks on the radiator hose and hose clamp made during removal when installing.

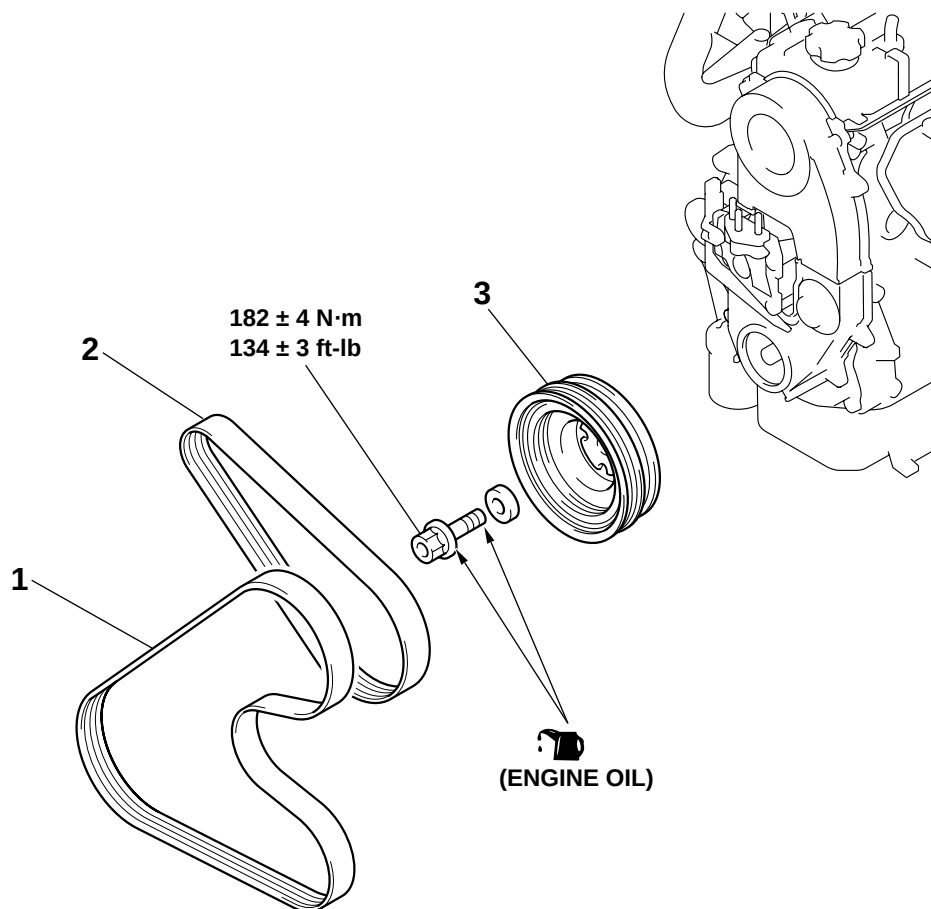
CRANKSHAFT PULLEY

REMOVAL AND INSTALLATION

M1112001600506

Pre-removal and Post-installation Operation

- Under Cover Removal and Installation
- Drive Belt Tension Check and Adjustment (Refer to [P.11A-7.](#))



AC100305AB

REMOVAL STEPS

1. POWER STEERING OIL PUMP DRIVE BELT

<<A>> >>A<<

REMOVAL STEPS (Continued)

2. ALTERNATOR DRIVE BELT
3. CRANKSHAFT PULLEY

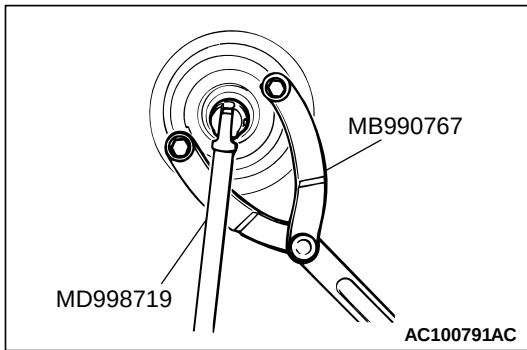
Required Special Tools:

- MB990767: End Yoke Holder
- MD998719: Crankshaft Pulley Holder

REMOVAL SERVICE POINT

<<A>> CRANKSHAFT PULLEY REMOVAL

Use special tools MD998719 and MB990767 to remove the crankshaft pulley.



INSTALLATION SERVICE POINT

>>A<< CRANKSHAFT PULLEY INSTALLATION

1. Clean the tapped holes on crankshaft to eliminate oil fouled, etc.
2. Apply engine oil at the contact surfaces and threads on crankshaft bolts.
3. Use the same special tool as in the removal procedure to retain crankshaft pulley, and tighten crankshaft bolts to the specified torque.

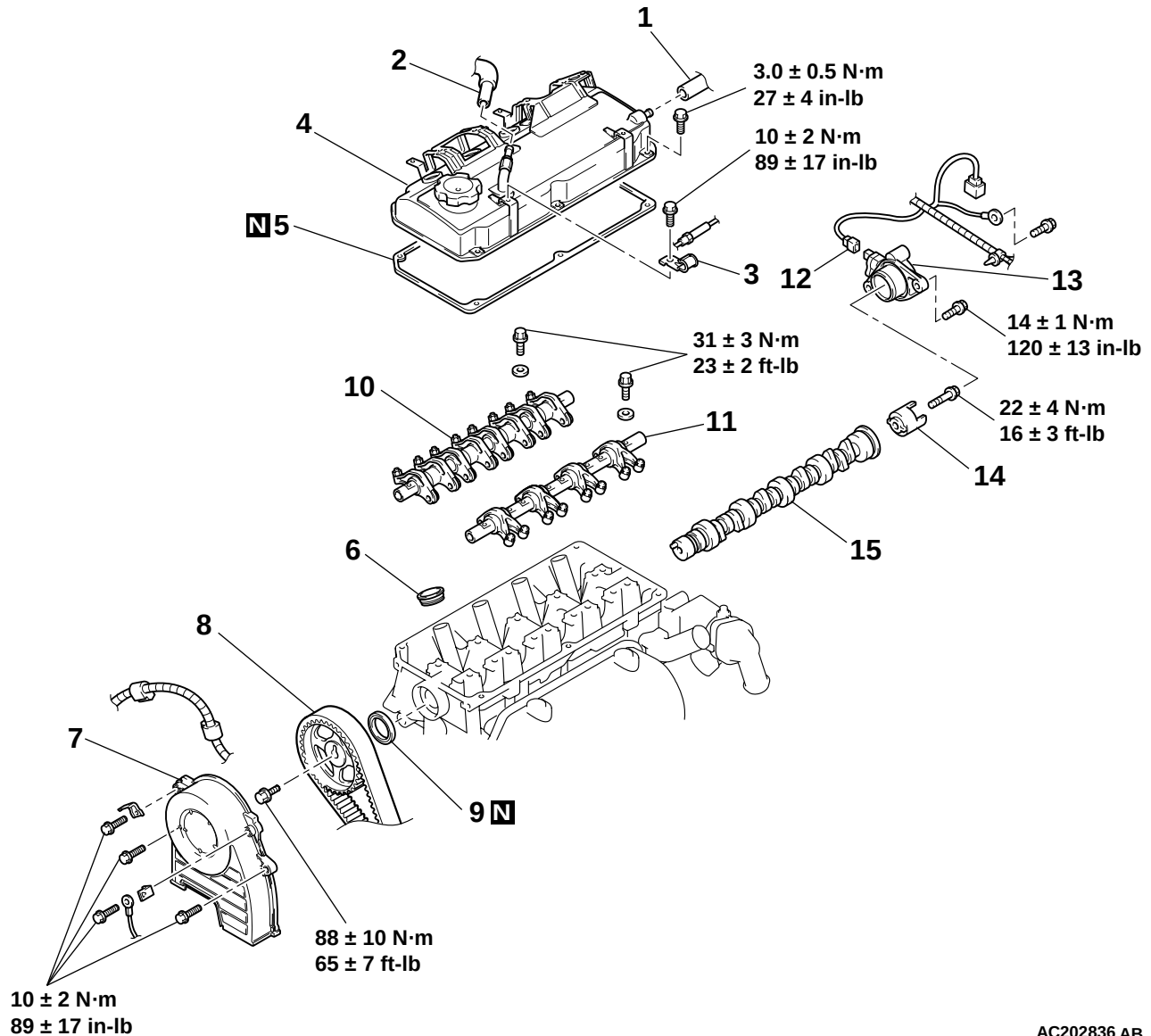
CAMSHAFT AND CAMSHAFT OIL SEAL

REMOVAL AND INSTALLATION

M1112001900530

Pre-removal and Post-installation Operation

- Air Cleaner Removal and Installation (Refer to GROUP 15 P.15-4.)
- Ignition Coil Removal and Installation (Refer to GROUP 16 P.16-50.)



AC202836 AB

REMOVAL STEPS

1. BREATHER HOSE CONNECTION <>
2. PCV HOSE CONNECTION <>
3. ACCELERATOR CABLE CLAMP
4. ROCKER COVER
5. ROCKER COVER GASKET
6. SPARK PLUG GUIDE
7. TIMING BELT FRONT UPPER COVER
8. CAMSHAFT SPROCKET

REMOVAL STEPS (Continued)

9. CAMSHAFT OIL SEAL <<A>>
10. INTAKE ROCKER ARM AND SHAFT ASSEMBLY
11. EXHAUST ROCKER ARM AND SHAFT ASSEMBLY
12. CAMSHAFT POSITION SENSOR CONNECTOR
13. CAMSHAFT POSITION SENSOR SUPPORT

<<A>> >>B<<

REMOVAL STEPS (Continued)

14. CAMSHAFT POSITION SENSOR
SENSING CYLINDER
15. CAMSHAFT

Required Special Tools:

- MB990767: End Yoke Holder
- MD998713: Camshaft Oil Seal Installer
- MD998719: Crankshaft Pulley Holder Pin

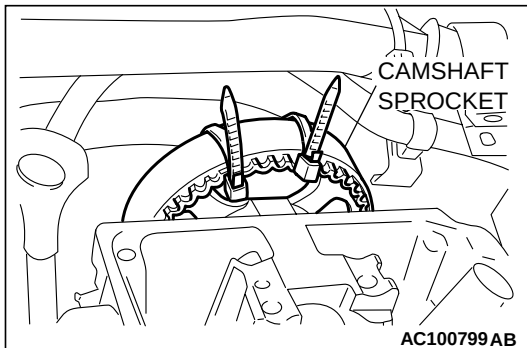
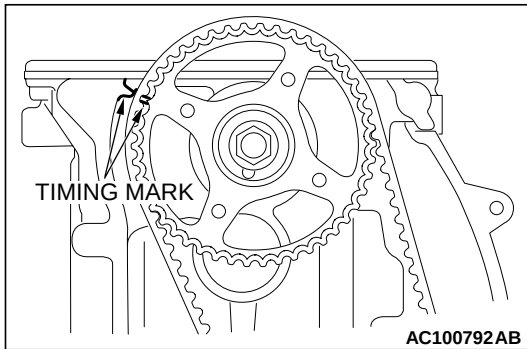
REMOVAL SERVICE POINTS

<<A>> CAMSHAFT SPROCKET REMOVAL

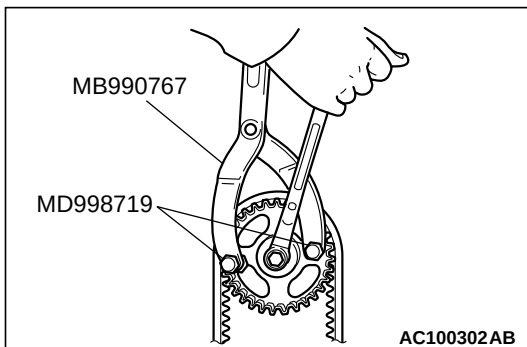
⚠ CAUTION

Always turn the crankshaft in the forward direction (clockwise).

1. Turn the crankshaft in the forward direction (clockwise) to align the timing mark so that No.1 cylinder is at TDC on the compression stroke.



2. Secure the camshaft sprocket and the timing belt with tie-wraps to prevent slippage between the camshaft sprocket and the timing belt.



3. Use the special tools MB990767 and MD998719 to stop the camshaft sprocket from turning.

⚠ CAUTION

Do not turn the crankshaft after the camshaft sprocket is removed.

4. Remove the camshaft sprocket.

<> ROCKER ARM AND SHAFT ASSEMBLY REMOVAL

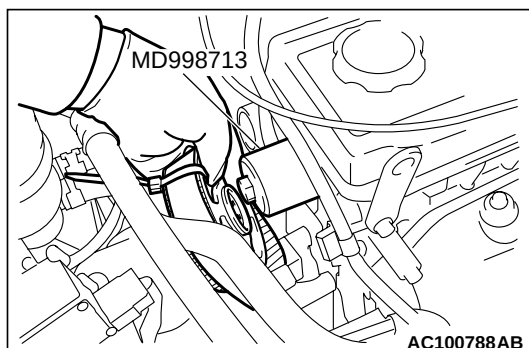
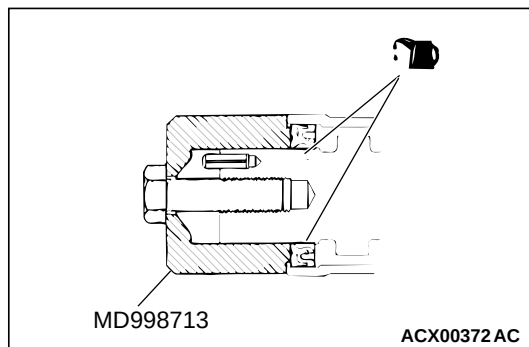
 CAUTION

Never disassemble the rocker arm and shaft assembly.
Loosen the rocker arm and shaft assembly mounting bolt, and then remove the rocker arm and shaft assembly with the bolt still attached.

INSTALLATION SERVICE POINTS

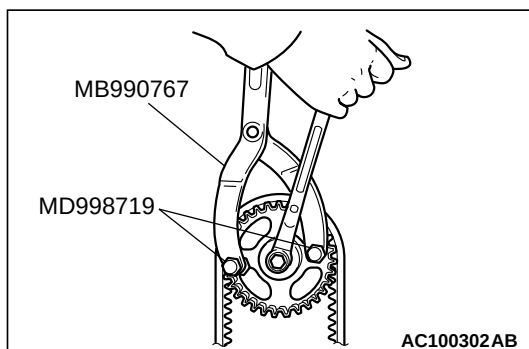
>>A<< CAMSHAFT OIL SEAL INSTALLATION

1. Apply engine oil to the camshaft oil seal lip.
2. Use special tool MD998713 to install the camshaft oil seal.



>>B<< CAMSHAFT SPROCKET INSTALLATION

Use special tools MD998719 and MB990767 in the same way as during removal to install the camshaft sprocket.



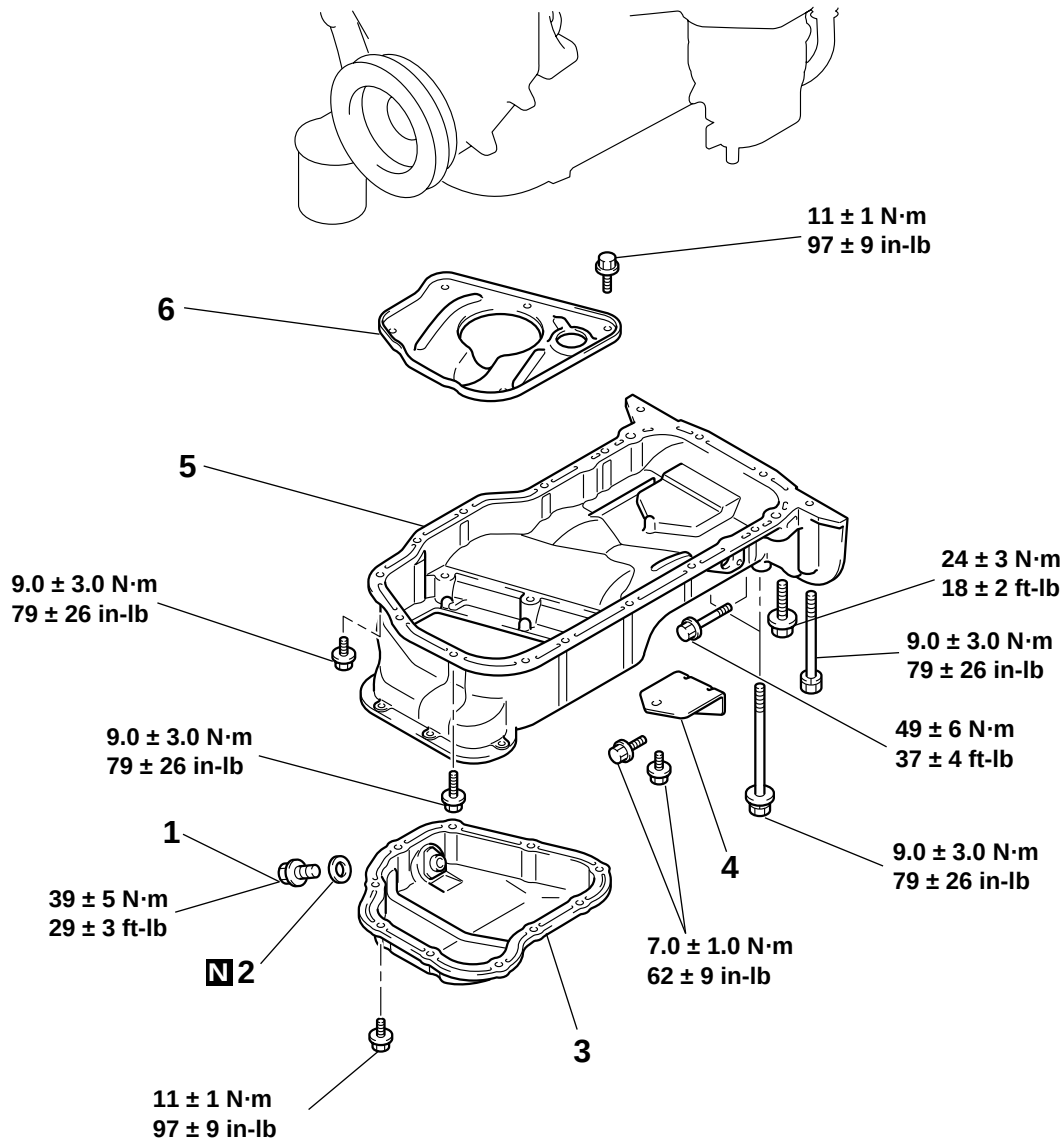
OIL PAN

REMOVAL AND INSTALLATION

M1112002800730

Pre-removal and Post-installation operation

- Under Cover Removal and Installation
- Engine Oil Draining and Refilling [Refer to GROUP 00, Maintenance Service – Engine Oil (Change) P.00-51.]
- Front Exhaust Pipe Removal and Installation (Refer to GROUP 15, Exhaust Pipe and Main Muffler P.15-13.)



AC100798 AB

REMOVAL STEPS

- <<A>> >>C<< 1. DRAIN PLUG
>>B<< 2. DRAIN PLUG GASKET
3. LOWER OIL PAN

REMOVAL STEPS (Continued)

- <> >>A<< 4. COVER
>>A<< 5. UPPER OIL PAN
6. BAFFLE PLATE

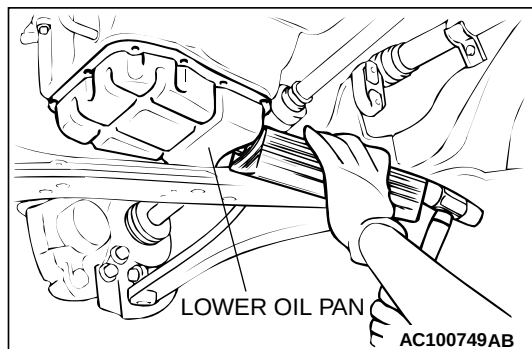
REMOVAL SERVICE POINTS

<<A>> LOWER OIL PAN REMOVAL

⚠ CAUTION

Do not use oil pan remover (MD998727) because the upper oil pan is aluminum.

Use a wood block and hammer tapping against the lower oil pan to loosen it.

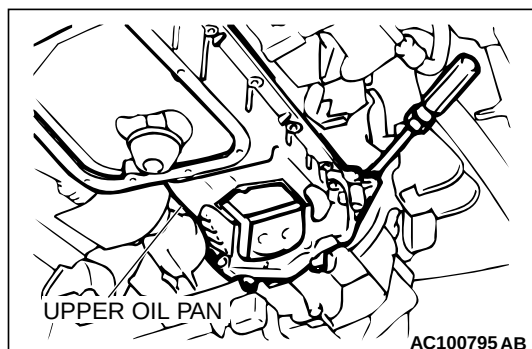


<> UPPER OIL PAN REMOVAL

⚠ CAUTION

Do not use oil pan remover (MD998727) because the upper oil pan is aluminum.

When individual mounting bolts are removed, insert a pry bar into the gap (as shown in the figure) between upper oil pan and cylinder block, and pry off upper oil pan.

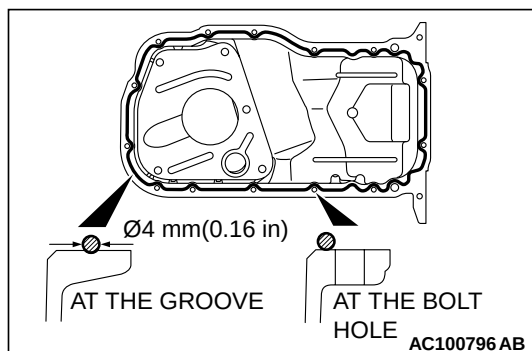


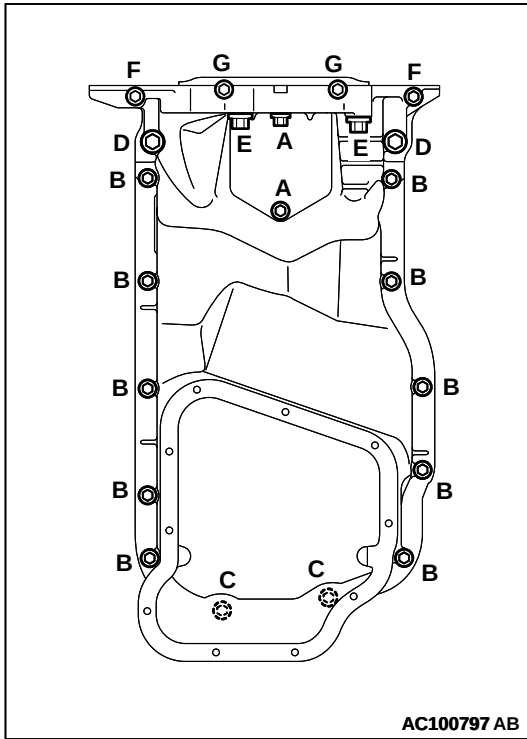
INSTALLATION SERVICE POINTS

>>A<< UPPER OIL PAN INSTALLATION

1. With scraper or wire brush, etc., remove residual gasket sealant from the attached on upper oil pan and cylinder block.
2. Apply sealant on the mounting surface of upper oil pan without any gap as indicated in the figure, and install oil pan on cylinder block.

Specified sealant: 3M™ AAD Part No.8672, 8704, 3M™ AAD Part No.8679/8678 or equivalent





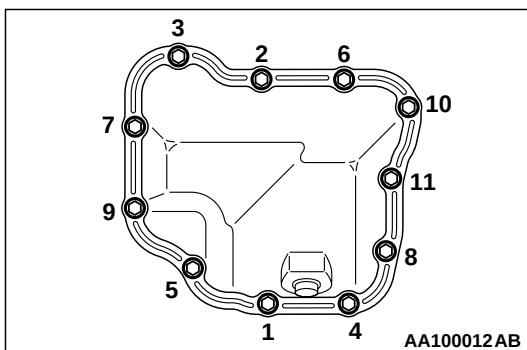
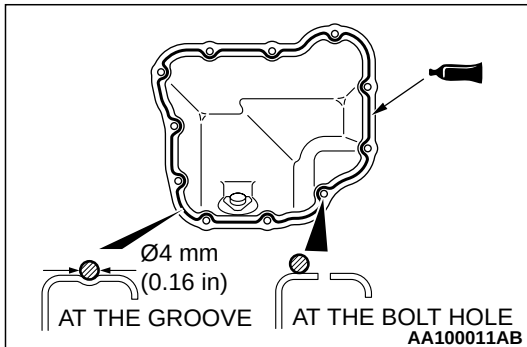
3. Using the letter symbols in the table below, install the upper oil pan using the correct bolt. Refer to the table for proper torque.

Designation	Symbol	Qty	Diameter × length mm (in)	Tightening torque
Flange Bolt	A	2	6 × 10 (0.2 × 0.4)	7.0 ± 1.0 N·m (62 ± 9 in-lb)
	B	10	6 × 18 (0.2 × 0.7)	9.0 ± 3.0 N·m (79 ± 26 in-lb)
	C	2	6 × 22 (0.2 × 0.9)	
	D	2	8 × 40 (0.3 × 1.6)	24 ± 3 N·m (18 ± 2 ft-lb)
	E	2	10 × 40 (0.4 × 1.6)	49 ± 6 N·m (37 ± 4 ft-lb)
Bolts with Washers	F	2	6 × 50 (0.2 × 2.0)	9.0 ± 3.0 N·m (79 ± 26 in-lb)
	G	2	6 × 127 (0.2 × 5.0)	

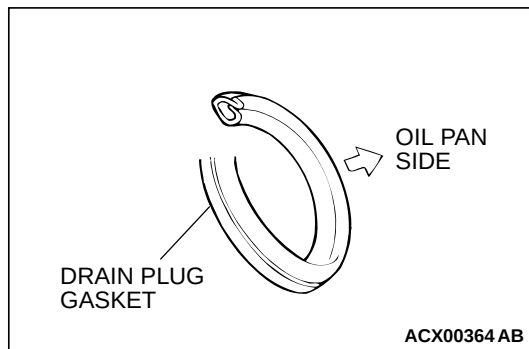
>>B<< LOWER OIL PAN INSTALLATION

1. With scraper or wire brush, etc., remove residual gasket sealant from the attached on lower oil pan.
2. Apply sealant on the mounting surface of lower oil pan without any gap as indicated in the figure, and install lower oil pan to the upper oil pan.

Specified sealant: 3M™ AAD Part No.8672, 8704, 3M™ AAD Part No.8679/8678 or equivalent



3. According to the sequence specified in the figure, tighten mounting bolts of lower oil pan to the specified torque.



>>C<< DRAIN PLUG GASKET INSTALLATION

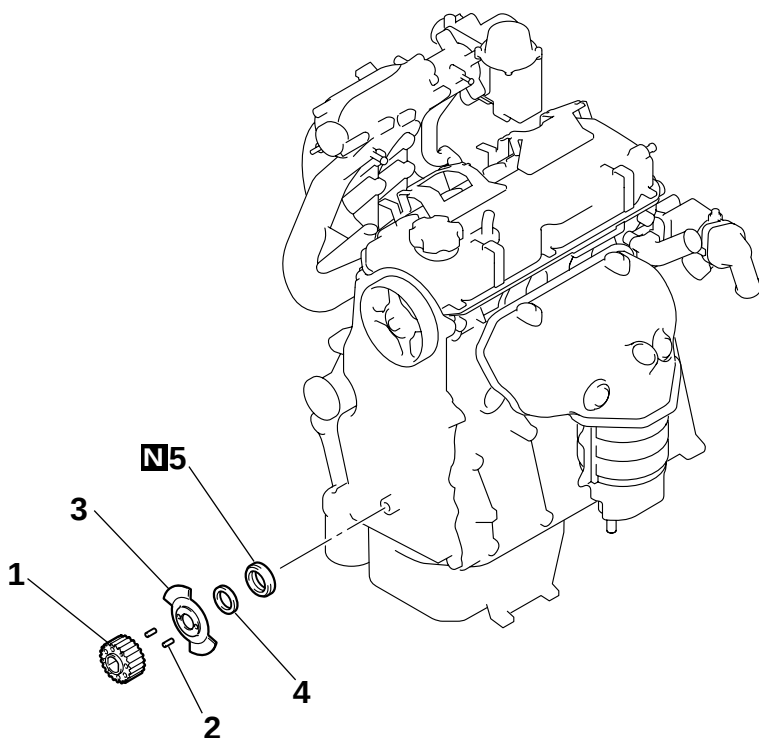
Gasket should be replaced with a new one, and install it in the direction specified in the figure.

Specified torque: 39 ± 5 N·m (29 ± 3 ft-lb)

CRANKSHAFT OIL SEAL

REMOVAL AND INSTALLATION <FRONT OIL SEAL>

M1112003400489



AC100955 AB

REMOVAL STEPS

- TIMING BELT (REFER TO [P.11A-45.](#))
- CRANK ANGLE SENSOR (REFER TO GROUP 16, CRANK ANGLE SENSOR [P.16-52.](#))

REMOVAL STEPS (Continued)

- >>B<< 1. CRANKSHAFT SPROCKET
- >>B<< 2. SPRING PIN
- >>B<< 3. CRANKSHAFT SENSING BLADE
- >>B<< 4. CRANKSHAFT SPACER
- >>A<< 5. CRANKSHAFT FRONT OIL SEAL

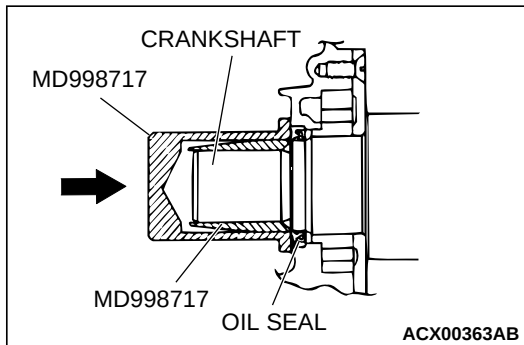
Required Special Tool:

- MD998717: Crankshaft Front Oil Seal Installer

INSTALLATION SERVICE POINTS

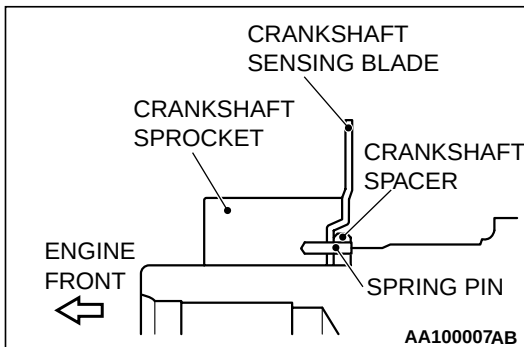
>>A<< CRANKSHAFT FRONT OIL SEAL INSTALLATION

1. Apply a small amount of engine oil to the oil seal lip and then insert.
2. Using special tool MD998717, tap the oil seal into the front case.



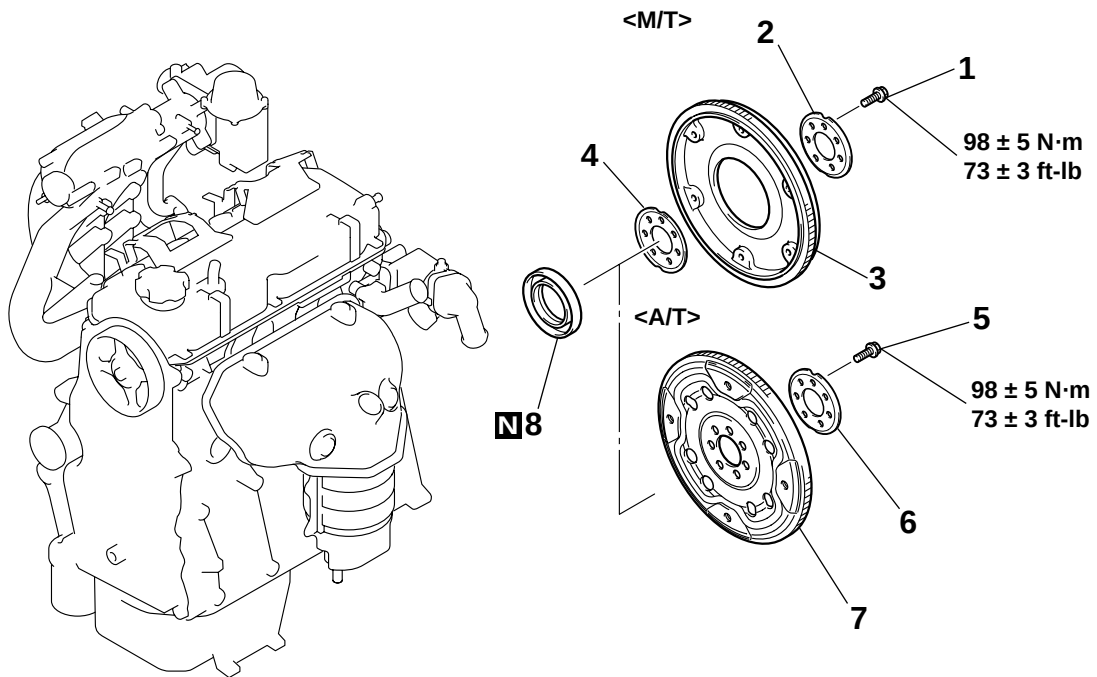
>>B<< CRANKSHAFT SPACER/CRANKSHAFT SENSING BLADE/SPRING PIN/CRANKSHAFT SPROCKET INSTALLATION

1. Remove oil and lubricant from the mounting surfaces on crankshaft, crankshaft spacer, crankshaft sensing blade and crankshaft sprocket.
2. Assemble spring pin, crankshaft sensing blade and crankshaft spacer together. Install crankshaft sprocket assembly onto the crankshaft.



REMOVAL AND INSTALLATION <REAR OIL SEAL>

M1112003700457



AC100955AB

REMOVAL STEPS

- OIL PAN (REFER TO P.11A-31.)
- TRANSAXLE ASSEMBLY (M/T: REFER TO GROUP 22A, TRANSAXLE ASSEMBLY P.22A-16.)(A/T: REFER TO GROUP 23A, TRANSAXLE ASSEMBLY P.23A-351.)
- CLUTCH COVER AND DISC <M/T> (REFER TO GROUP 21B, CLUTCH P.21B-2.)

<<A>> >>B<<

<<A>> >>B<<

>>A<<

REMOVAL STEPS (Continued)

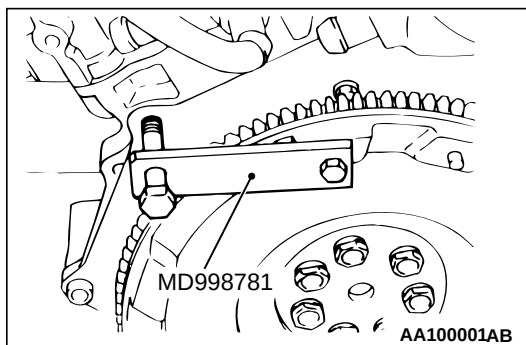
1. FLYWHEEL BOLT <M/T>
2. ADAPTER PLATE <M/T>
3. FLYWHEEL ASSEMBLY <M/T>
4. ADAPTER PLATE <M/T>
5. DRIVE PLATE BOLT <A/T>
6. ADAPTER PLATE <A/T>
7. DRIVE PLATE <A/T>
8. CRANKSHAFT REAR OIL SEAL

Required Special Tools:

- MD998718: Crankshaft Rear Oil Seal Installer
- MD998781: Flywheel Stopper

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

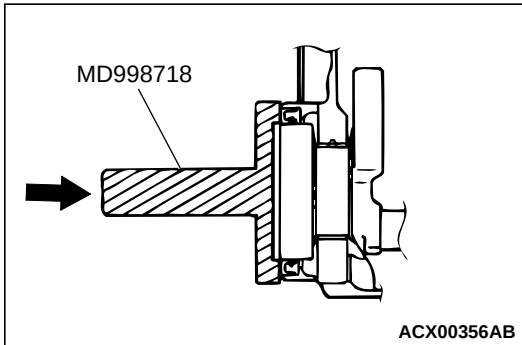
Use the special tool MD998781 to secure the flywheel or drive plate, and remove the bolts.



INSTALLATION SERVICE POINTS

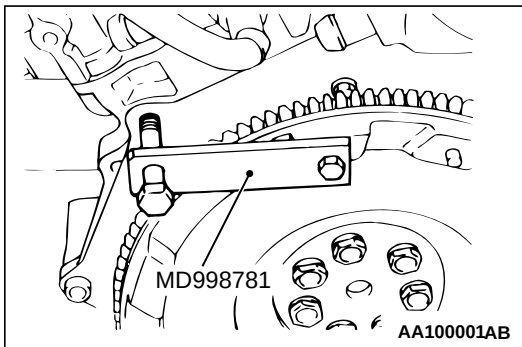
>>A<< CRANKSHAFT REAR OIL SEAL INSTALLATION

1. Apply a small amount of engine oil to the entire circumference of the oil seal lip.
2. Use special tool MD998718 to tap in the oil seal as shown in the illustration.



>>B<< DRIVE PLATE BOLT <A/T>/FLYWHEEL BOLT <M/T> INSTALLATION

Use the special tool MD998781 to hold the flywheel or drive plate in the same manner as removal. Then install the bolts.



CYLINDER HEAD GASKET

REMOVAL AND INSTALLATION

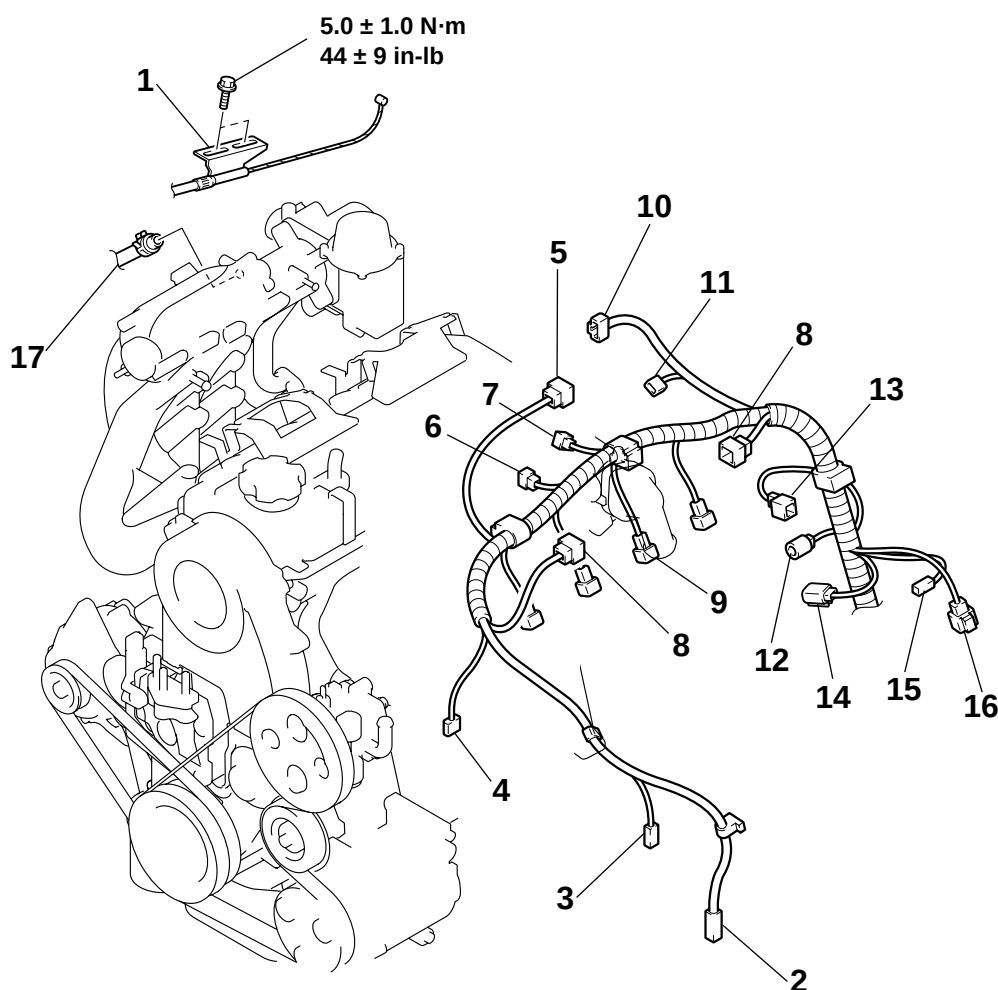
M1112004000826

Pre-removal Operation

- Fuel Line Pressure Releasing (Refer to GROUP 13A, On-vehicle Service [P.13A-908.](#))
- Engine Coolant Draining (Refer to GROUP 14, On-vehicle Service – Engine Coolant Replacement [P.14-25.](#))
- Under Cover Removal
- Air Cleaner Removal (Refer to GROUP 15, Air Cleaner [P.15-4.](#))
- Exhaust Manifold Removal (Refer to GROUP 15, Exhaust Manifold [P.15-11.](#))
- Water Hose and Pipe Removal (Refer to GROUP 14, Water Hose and Pipe [P.14-38.](#))

Post-installation Operation

- Water Hose and Pipe Installation (Refer to GROUP 14, Water Hose and Pipe [P.14-38.](#))
- Exhaust Manifold Installation (Refer to GROUP 15, Exhaust Manifold [P.15-11.](#))
- Air Cleaner Installation (Refer to GROUP 15, Air Cleaner [P.15-4.](#))
- Engine Coolant Refilling (Refer to GROUP 14, On-vehicle Service – Engine Coolant Replacement [P.14-25.](#))
- Accelerator Cable Adjustment (Refer to GROUP 17, On-vehicle Service [P.17-6.](#))
- Under Cover Installation



AC100308AB

REMOVAL STEPS

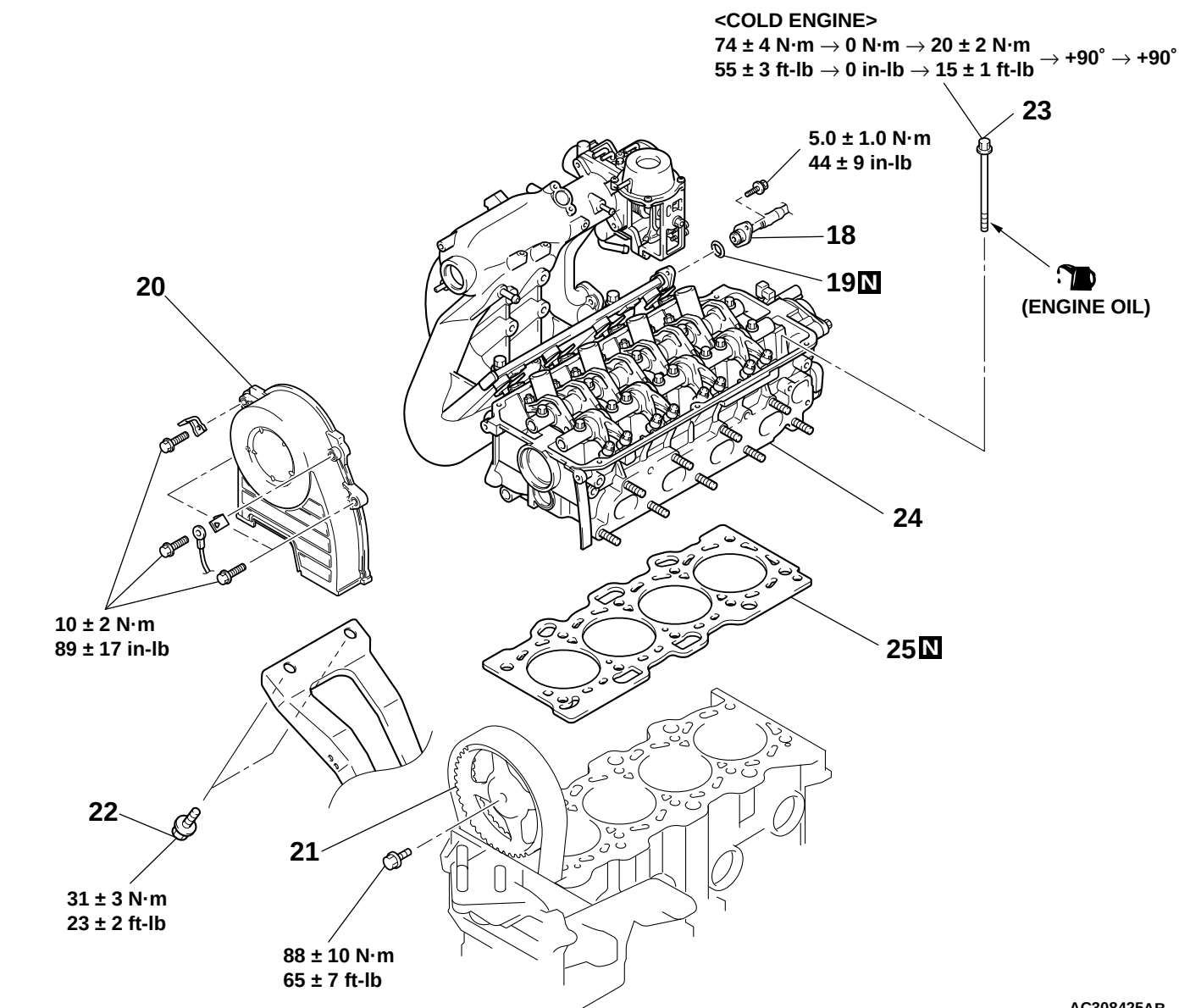
1. ACCELERATOR CABLE CONNECTION
2. A/C COMPRESSOR CONNECTOR
3. POWER STEERING OIL PRESSURE SWITCH CONNECTOR

REMOVAL STEPS (Continued)

4. CRANKSHAFT POSITION SENSOR CONNECTOR
5. MANIFOLD ABSOLUTE PRESSURE SENSOR CONNECTOR
6. EVAPORATIVE EMISSION PURGE SOLENOID CONNECTOR

REMOVAL STEPS (Continued)

7. EGR SOLENOID VALVE
CONNECTOR
8. IGNITION COIL CONNECTOR
9. INJECTOR CONNECTOR
10. THROTTLE POSITION SENSOR
CONNECTOR
11. IDLE AIR CONTROL MOTOR
CONNECTOR
12. ENGINE COOLANT
TEMPERATURE SENSOR
CONNECTOR
13. CAMSHAFT POSITION SENSOR
CONNECTOR
14. KNOCK SENSOR CONNECTOR
15. ENGINE COOLANT
TEMPERATURE GAUGE UNIT
CONNECTOR
16. HEATED OXYGEN SENSOR
CONNECTOR
17. BRAKE BOOSTER VACUUM
HOSE CONNECTION



AC308425AB

REMOVAL STEPS

- >>D<< 18. FUEL HIGH-PRESSURE HOSE CONNECTION
- >>D<< 19. O-RING
- >>D<< 20. TIMING BELT FRONT UPPER COVER
- <<A>> >>C<< 21. CAMSHAFT SPROCKET

REMOVAL STEPS (Continued)

- <> >>B<< 22. INTAKE MANIFOLD STAY CONNECTING BOLTS
- >>B<< 23. CYLINDER HEAD BOLTS
- >>B<< 24. CYLINDER HEAD ASSEMBLY
- >>A<< 25. CYLINDER HEAD GASKET

Required Special Tools:

- MB991653: Cylinder Head Bolt Wrench
- MD998719: Crankshaft Pulley Holder Pin
- MB990767: End Yoke Holder

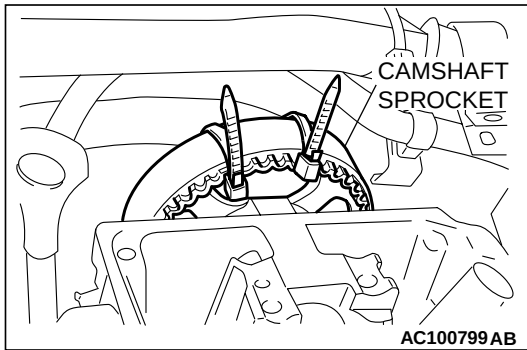
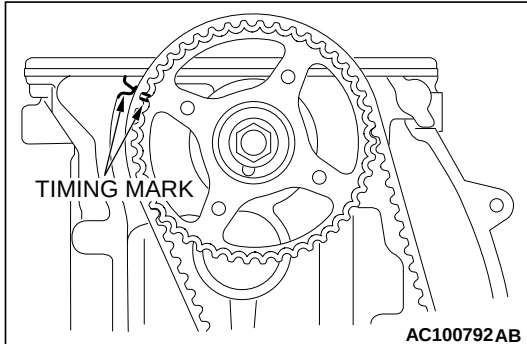
REMOVAL SERVICE POINTS

<<A>> CAMSHAFT SPROCKET REMOVAL

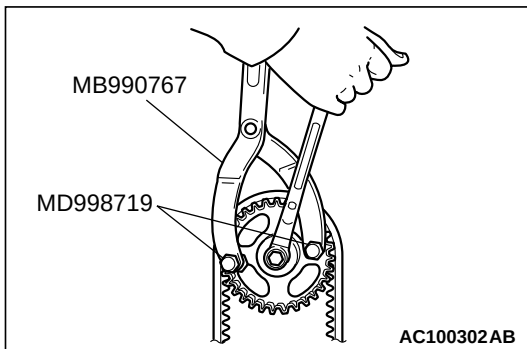
CAUTION

Always turn the crankshaft in the forward direction (clockwise).

1. Turn the crankshaft in the forward direction (clockwise) to align the timing mark so that number 1 cylinder is at TDC on the compression stroke.



2. Secure the camshaft sprocket and the timing belt with tie-wraps to prevent slippage between the camshaft sprocket and the timing belt.



3. Use special tools MB990767 and MD998719 to stop the camshaft sprocket from turning.

CAUTION

Do not turn the crankshaft after the camshaft sprocket is removed.

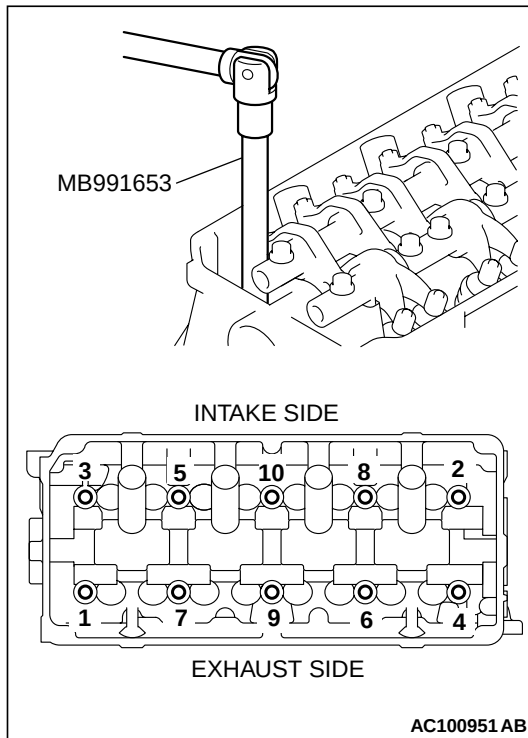
4. Remove the camshaft sprocket.

<> CYLINDER HEAD BOLTS REMOVAL

⚠ CAUTION

Be careful not to damage or deform the plug guides when removing the cylinder head bolts. Plug guides cannot be replaced separately.

Using special tool MB991653, loosen the bolts in two or three steps in the order of the numbers shown in the illustration, then remove the bolts. Remove the cylinder head assembly.



INSTALLATION SERVICE POINTS

>>A<< CYLINDER HEAD GASKET INSTALLATION

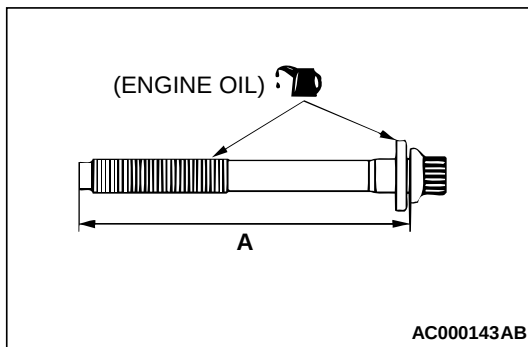
1. Wipe off all oil and grease from the gasket mounting surface.
2. Match the shapes of the cylinder head holes with their respective cylinder head gasket holes.

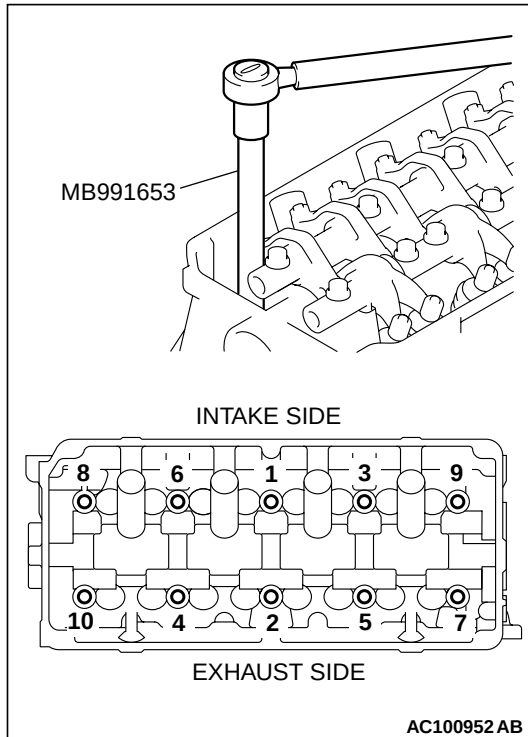
>>B<< CYLINDER HEAD ASSEMBLY/CYLINDER HEAD BOLTS INSTALLATION

1. Before installing the cylinder head bolts, check if length (A) is within limits. If it is outside the limit, replace the bolts.

Limit (A): 99.4 mm (3.91 inches)

2. Apply a small amount of engine oil to the thread section and the washer of the cylinder head bolt.



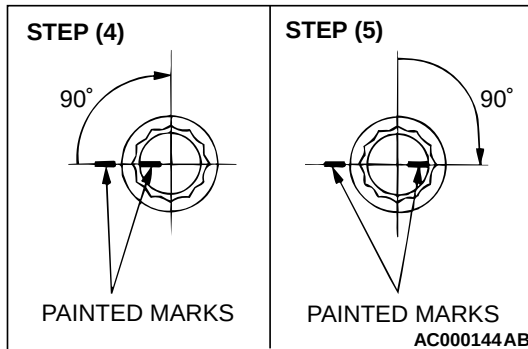


CAUTION

- Always tighten cylinder head bolts at a 90 degree angle.
- If it is less than 90 degree angle, the bolt will loosen.
- If it is more than 90 degree angle, remove the head bolt and repeat the procedure from step 1.

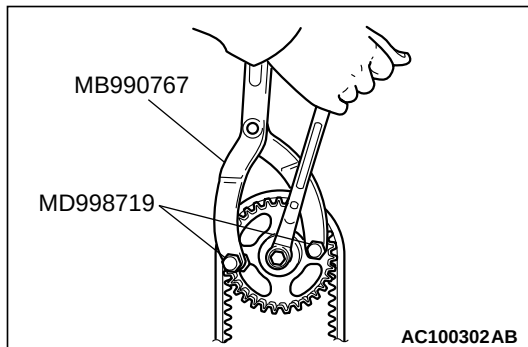
3. Using special tool MB991653, tighten the bolts by the following procedure.

STEP	OPERATION	REMARKS
(1)	Tighten to 74 ± 4 N·m (55 ± 3 ft-lb)	Tighten in the order shown in the illustration.
(2)	Fully loosen.	Loosen in the reverse order of that shown in the illustration.
(3)	Tighten to 20 ± 2 N·m (15 ± 1 ft-lb)	Tighten in the order shown in the illustration.
(4)	Apply paint tighten 90°	Mark the head of the cylinder head bolt and cylinder head with a paint mark. Tighten in the order shown in the illustration.
(5)	Tighten 90°	Tighten in the order shown in the illustration. Check that the painted mark of the head bolt is aligned with that of the cylinder head.



>>C<< CAMSHAFT SPROCKET INSTALLATION

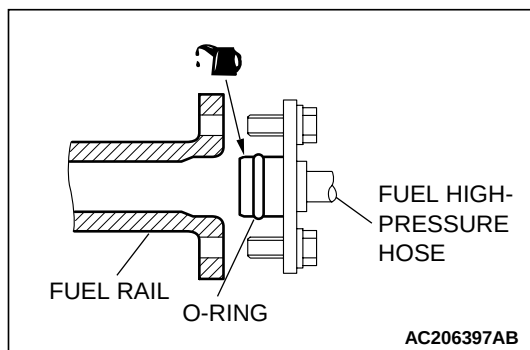
Use special tools MD998719 and MB990767 in the same way as during removal to install the camshaft sprocket.



>>D<< O-RING/FUEL HIGH-PRESSURE HOSE
INSTALLATION CAUTION

Do not allow engine oil to enter the fuel rail.

1. Apply a small amount of new engine oil to the O-ring.
2. While turning the fuel high-pressure hose to the right and left, slide it into the fuel rail. Be careful not to damage the O-ring. After installing, check that the hose turns smoothly.
3. If the hose does not turn smoothly, the O-ring is probably binding. Disconnect the fuel high-pressure hose and check the O-ring for damage.
4. Re-insert the fuel rail and confirm the hose turns smoothly.



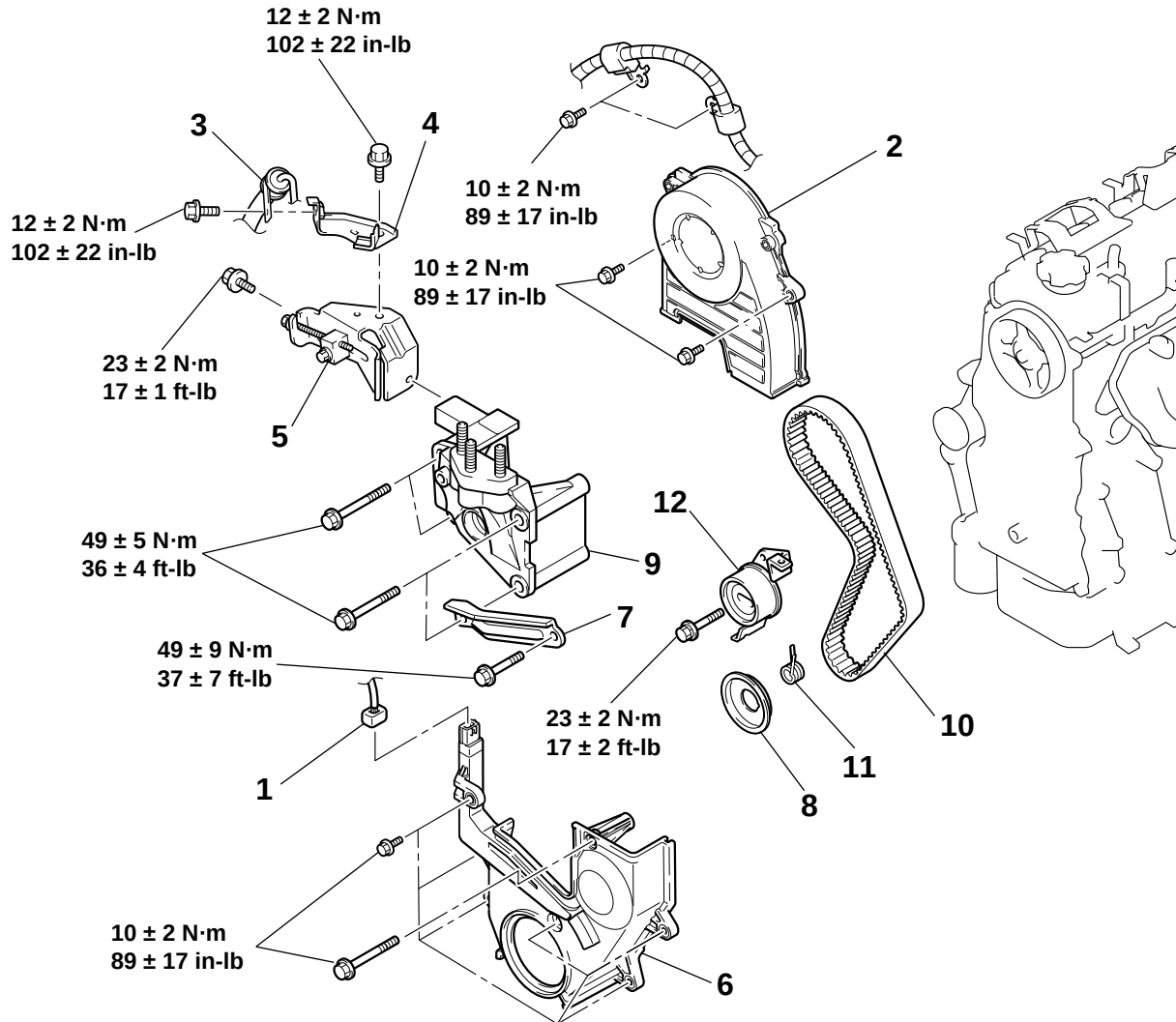
TIMING BELT

REMOVAL AND INSTALLATION

M1112004300797

Pre-removal and Post-installation Operation

- Under Cover (LH) Removal and Installation
- Engine Mount Bracket Removal (Refer to GROUP 32, Engine Mounting P.32-4.)
- Crankshaft Pulley Removal and Installation (Refer to P.11A-26.)



AC309191AB

REMOVAL STEPS

1. CRANKSHAFT POSITION SENSOR CONNECTION
2. TIMING BELT FRONT UPPER COVER
3. PRESSURE HOSE CLAMP
4. POWER STEERING OIL LINE BRACKET
5. GENERATOR ADJUSTING BRACE
6. TIMING BELT LOWER COVER

REMOVAL STEPS (Continued)

7. POWER STEERING OIL PUMP BRACKET STAY
8. FLANGE
9. ENGINE SUPPORT BRACKET
- TIMING BELT TENSION ADJUSTMENT
10. TIMING BELT
11. TENSIONER SPRING
12. TIMING BELT TENSIONER

>>C<<

>>B<<

<<A>> >>A<<

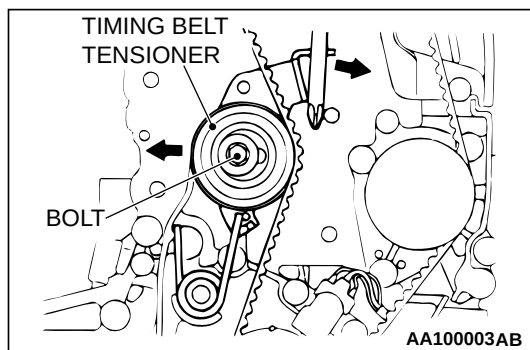
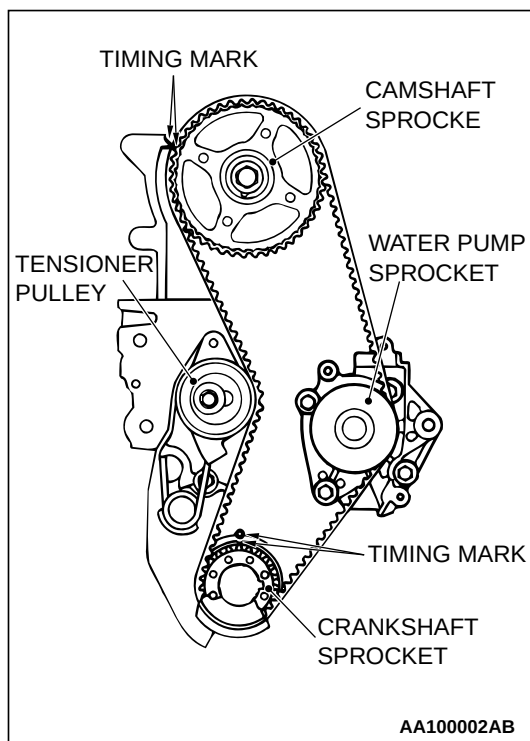
REMOVAL SERVICE POINT

<<A>> TIMING BELT REMOVAL

⚠ CAUTION

The crankshaft should always be turned only clockwise.

1. Turn the crankshaft clockwise (right turn) to align each timing mark and to set the number 1 cylinder at compression top dead center.



2. Loosen the tension pulley fixing bolt.

⚠ CAUTION

If the timing belt is to be re-used, use chalk to mark (on its flat side) an arrow indicating the clockwise direction.

3. Place a screwdriver against the tensioner pulley and pry it fully back in the direction of the arrow.
4. Temporarily tighten the tensioner pulley bolt.
5. Remove the timing belt.

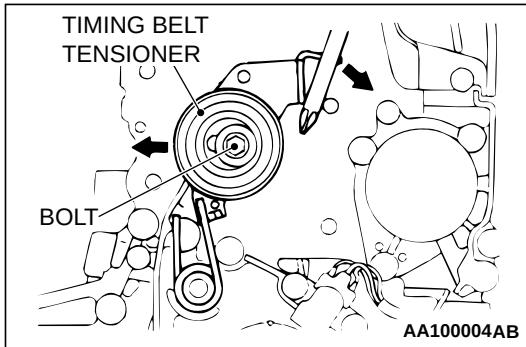
INSTALLATION SERVICE POINTS

>>A<< TIMING BELT INSTALLATION

⚠ CAUTION

After installing the timing belt, try to rotate the camshaft sprocket in the reverse direction. Recheck to be sure that the belt is fully tensioned and that each timing mark is in the proper position.

1. With the timing belt tensioner pulley bolt loosened, use a screwdriver to pry the tensioner pulley as close to the engine mount as possible. Then temporarily tighten tensioner bolt.
2. Align each of the camshaft and crankshaft sprocket timing marks.
3. Install the timing belt in the following order, while making sure that the tension side of the belt is not loose.
 - (1) Crankshaft sprocket
 - (2) Water pump sprocket
 - (3) Camshaft sprocket
 - (4) Tensioner pulley



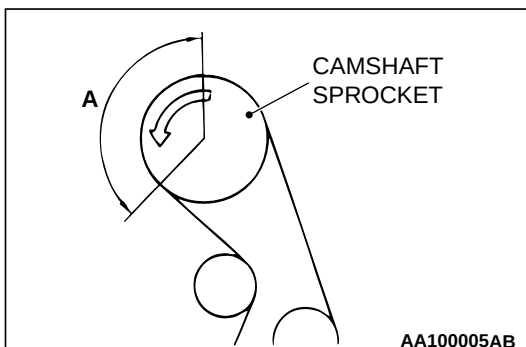
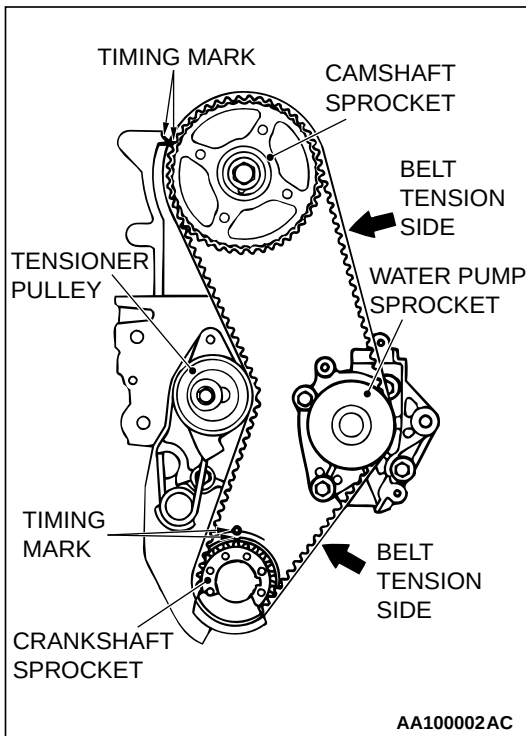
>>B<< TIMING BELT TENSION ADJUSTMENT

1. Initially loosen the fixing bolt of the tensioner pulley fixed to the engine mount side by 1/4-1/2 turn, and use the force of the tensioner spring to apply tension to the belt.

⚠ CAUTION

As the purpose of this procedure is to apply the proper amount of tension to the tension side of the timing belt by using the cam driving torque, turn the crankshaft only by the amount given below. Be sure not to turn the crankshaft in the opposite direction (counter clockwise).

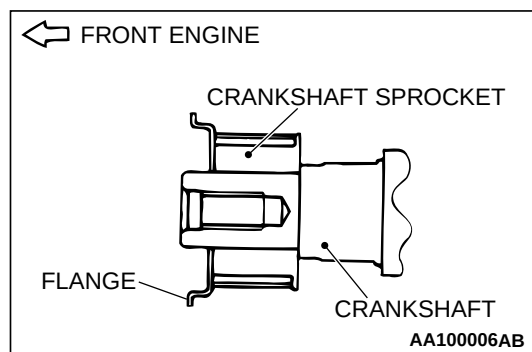
2. Turn the crankshaft in the proper rotation direction (clockwise) for two rotations, and recheck to be sure that the timing marks on each sprocket are aligned.



3. After checking to be sure that no belt teeth in the section marked with A are lifted up and that the teeth in each sprocket are engaged, secure the tensioner pulley.

>>C<< FLANGE INSTALLATION

Install the flange as shown in the illustration.



SPECIFICATIONS

FASTENER TIGHTENING SPECIFICATIONS

M1112005800115

ITEMS	SPECIFICATIONS
Accelerator cable clamp attaching bolt	10 ± 2 N·m (89 ± 17 in-lb)
Accelerator cable plate attaching bolt	5.0 ± 1.0 N·m (44 ± 9 in-lb)
Baffle plate attaching bolt	11 ± 1 N·m (97 ± 9 in-lb)
Camshaft position sensor sensing cylinder attaching bolt	22 ± 4 N·m (16 ± 3 ft-lb)
Camshaft position sensor support attaching bolt	14 ± 1 N·m (120 ± 13 in-lb)
Camshaft sprocket attaching bolt	88 ± 10 N·m (65 ± 7 ft-lb)
Crankshaft pulley attaching bolt	182 ± 4 N·m (134 ± 3 ft-lb)
Cylinder head attaching bolt	74 ± 4 N·m → 0 N·m → 20 ± 2 N·m → +90° → +90° (55 ± 3 ft-lb → 0 in-lb → 15 ± 1 ft-lb → +90° → +90°)
Drive plate attaching bolt <A/T>	98 ± 5 N·m (73 ± 3 ft-lb)
Engine mount insulator to frame bolt	44 ± 10 N·m (33 ± 7 ft-lb)
Engine mount bracket to engine nut	67 ± 7 N·m (50 ± 5 ft-lb)
Engine support bracket attaching nut	49 ± 5 N·m (36 ± 4 ft-lb)
Fuel high-pressure hose attaching bolt	5.0 ± 1.0 N·m (44 ± 9 in-lb)
Flywheel attaching bolt <M/T>	98 ± 5 N·m (73 ± 3 ft-lb)
Generator adjusting brace attaching bolt	23 ± 2 N·m (17 ± 1 ft-lb)
Ground wire attaching bolt	10 ± 2 N·m (89 ± 17 in-lb)
Intake manifold stay attaching bolt	31 ± 3 N·m (23 ± 2 ft-lb)
Lower oil pan attaching bolt	11 ± 1 N·m (97 ± 9 in-lb)
Oil pan cover attaching bolt	7.0 ± 1.0 N·m (62 ± 9 in-lb)
Oil pan drain plug	39 ± 5 N·m (29 ± 3 ft-lb)
Power steering oil pump attaching bolt	22 ± 4 N·m (16 ± 3 ft-lb)
Power steering oil pump bracket stay attaching bolt	49 ± 9 N·m (37 ± 7 ft-lb)
Power steering oil line bracket bolt	12 ± 2 N·m (102 ± 22 in-lb)
Pressure hose attaching bolt	12 ± 2 N·m (102 ± 22 in-lb)

ITEMS		SPECIFICATIONS
Pressure tube attaching bolt		12 ± 2 N·m (102 ± 22 in-lb)
Rocker arm and shaft assembly attaching bolt		31 ± 3 N·m (23 ± 2 ft-lb)
Rocker cover attaching bolt		3.0 ± 0.5 N·m (27 ± 4 in-lb)
Timing belt tensioner attaching bolt		23 ± 3 N·m (17 ± 2 ft-lb)
Timing belt lower cover attaching bolt		10 ± 2 N·m (89 ± 17 in-lb)
Timing belt front upper cover attaching bolt		10 ± 2 N·m (89 ± 17 in-lb)
Upper oil pan attaching bolt	M6 × 10	7.0 ± 1.0 N·m (62 ± 9 in-lb)
	M6 × 18, M6 × 22	9.0 ± 3.0 N·m (79 ± 26 in-lb)
	M8 × 40	24 ± 3 N·m (18 ± 2 ft-lb)
	M10 × 40	49 ± 6 N·m (37 ± 4 ft-lb)
	M6 × 50, M6 × 127	9.0 ± 3.0 N·m (79 ± 26 in-lb)

SERVICE SPECIFICATIONS

M1111000300617

ITEM	STANDARD VALUE	LIMIT
Actual ignition timing at idle	Approximately 10° BTDC	—
Auto-tensioner pushrod movement mm (in)	Within 1 (0.04)	—
Auto-tensioner rod protrusion mm (in)	3.8 – 4.5 (0.15 – 0.18)	—
Basic ignition timing at idle	5° BTDC ± 3°	—
CO content %	0.5 or less	—
Compression pressure (200 r/min) kPa (psi)	1,618 (234)	Minimum 1,176 (170)
Compression pressure difference of all cylinder kPa (psi)	—	98 (14)
Curb idle speed r/min	700 ± 100	—
Cylinder head bolt shank length mm (in)	—	99.4 (3.91)
HC contents ppm	100 or less	—
Intake manifold vacuum at curb idle kPa (in Hg)	—	Minimum 60 (18)
Timing belt B tension mm (in)	5 – 7 (0.2 – 0.3)	—

SEALANTS

M1111000500387

ITEM	SPECIFIED SEALANT
Engine upper oil pan	3M™ AAD Part No.8672, 8704, 3M™ AAD Part No.8679/8678 or equivalent
Engine lower oil pan	

NOTES