GROUP 11A

ENGINE MECHANICAL <2.4L ENGINE>

CONTENTS

GENERAL DESCRIPTION

M1111000100840

The 4G69 (2.4L) 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 is fired in the order of the 1, 3, 4 and 2 cylinders.

ITEM			SPECIFICATION
Type			In-line SOHC
Number of cylinders			4
Bore mm (in)			87 (3.43)
Stroke mm (in)			100.0 (3.94)
Total displacement cm^3 (cu in)			2,378 (145.1)
Compression ratio			9.5
Firing order			1 –3 –4 –2
Counterbalance shaft			Equipped
Valve timing	Intake valve	Opens (BTDC)	6° <Low speed>
			20° <High speed cam>
		Closes (ABDC)	38° <Low speed cam>
			72° <High speed cam>
	Exhaust valve	Opens (BBDC)	60°
		Closes (ATDC)	16°
Lubrication system			Pressure feed, full-flow filtration
Oil pump type			Involute gear type

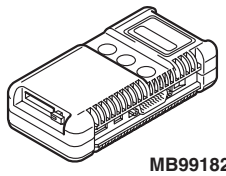
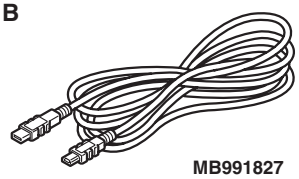
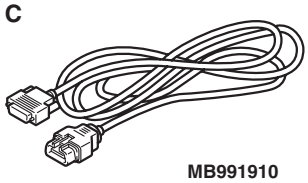
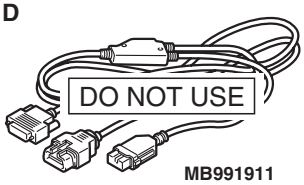
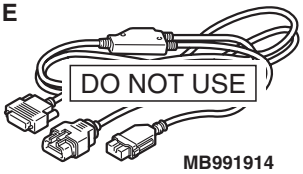
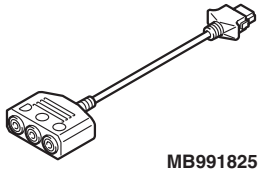
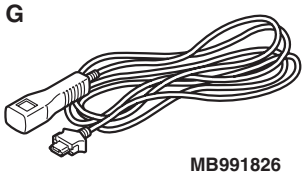
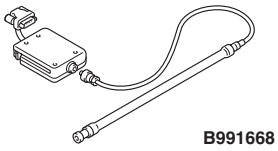
ENGINE DIAGNOSIS

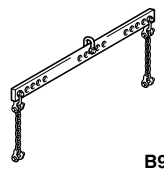
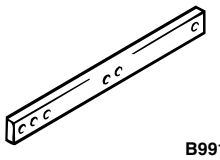
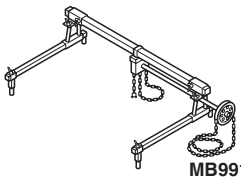
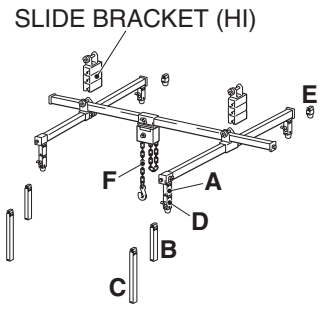
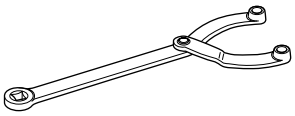
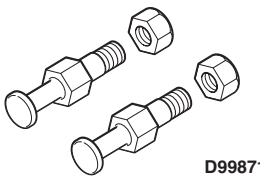
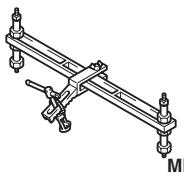
M1111000700358

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 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
	Low engine oil pressure	Refer to engine oil pressure drop symptoms above
	Thin or diluted engine oil	Change the engine oil
	Excessive bearing clearance	Replace the bearings

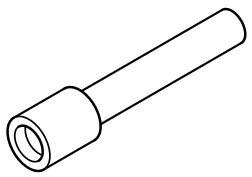
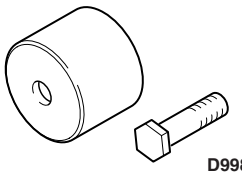
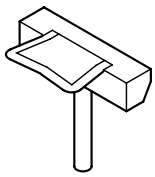
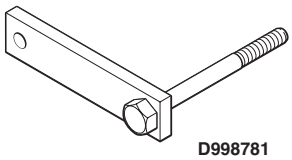
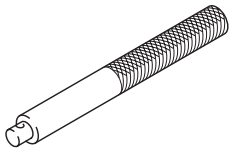
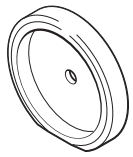
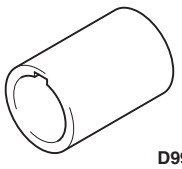
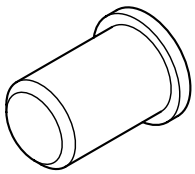
SPECIAL TOOLS

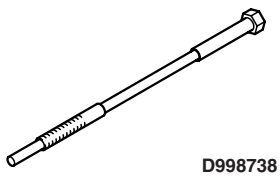
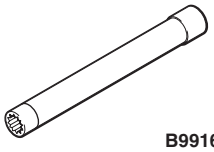
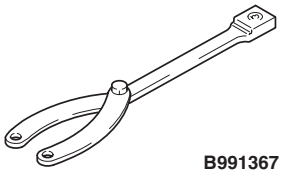
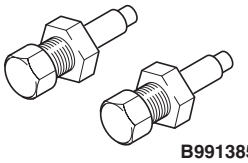
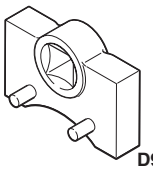
M1111000601053

TOOL	TOOL NUMBER AND NAME	SUPERSESSION	APPLICATION
A  MB991824 B  MB991827 C  MB991910 D  DO NOT USE MB991911 E  DO NOT USE 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 *NOTE: G: MB991826 MUT-III Trigger Harness is not necessary when pushing V.C.I. ENTER key.*	• Drive belt tension check • Ignition timing check • Curb idle speed check • Idle mixture check **⚠ CAUTION** **For vehicles with CAN communication, use MUT-III main harness A to send simulated vehicle speed. If you connect MUT-III main harness B instead, the CAN communication does not function correctly.**
 B991668	MB991668 Belt tension meter set	Tool not available	Drive belt tension check [used together with scan tool (MUT-III sub assembly)]

TOOL	TOOL NUMBER AND NAME	SUPERSESSION	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 *NOTE: Special tool MB991454 is a part of engine hanger attachment set MB991453.*
 B991527	MB991527 Hanger	Tool not available	
 MB991895	MB991895 Engine hanger	Tool not available	
 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 Front hub and flange yoke holder	MB990767-01	Holding the camshaft sprocket
 D998719	MD998719 Pin	MIT308239	
 MD998772	MD998772 Valve spring compressor	General service tool	Compressing valve spring

TSB Revision

TOOL	TOOL NUMBER AND NAME	SUPERSESSION	APPLICATION
	MB991999 Valve stem seal installer	–	Valve stem seal installation
 D998713	MD998713 Camshaft oil seal installer	MD998713-01	Camshaft oil seal installation
 D998727	MD998727 Oil pan FIPG cutter	MD998727-01	Oil pan removal
 D998781	MD998781 Flywheel stopper	General service tool	Supporting the A/T drive plate
	MB990938 Installer bar	MB990938-01	Crankshaft rear oil seal installation
 D998776	MD998776 Crankshaft rear oil seal installer	MD998776-01	
 D998285	MD998285 Crankshaft front oil seal guide	MD998285-01	Crankshaft front oil seal installation
	MD998375 Crankshaft front oil seal installer	MD998375-01	

TOOL	TOOL NUMBER AND NAME	SUPERSESSION	APPLICATION
 D998738	MD998738 Adjusting bolt	MD998738-01	Supporting the timing belt tensioner arm and timing belt tensioner adjuster
 B991654	MB991654 Cylinder head bolt wrench (12)	General service tool	Removal and installation of cylinder head bolt
 B991367	MB991367 Special spanner	MB991367-01	Holding the crankshaft camshaft drive sprocket
 B991385	MB991385 Pin	MIT217213	
 D998767	MD998767 Tensioner wrench	MD998752-01	Valve timing belt tension adjustment

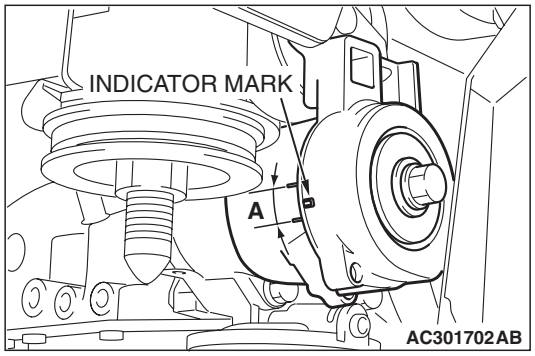
ON-VEHICLE SERVICE

DRIVE BELT TENSION CHECK

M1111003100968

⚠ CAUTION

Check the drive belt tension after turning the crankshaft clockwise one turn or more.



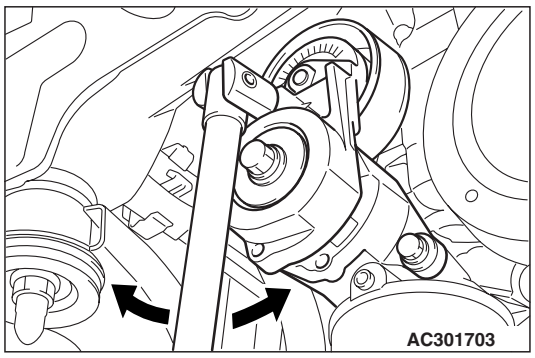
1. Make sure that the indicator mark is within the area marked with A in the illustration.
2. If the mark is out of the area, replace the drive belt. (Refer to P.11A-25).

   NOTE: The drive belt tension adjustment is not necessary, as the engine is equipped with an auto-tensioner.

AUTO-TENSIONER CHECK

M1111003000444

OPERATION CHECK



1. Turn OFF the engine, then check to see that the drive belt is not protruding from the pulley width of the auto-tensioner.
2. Remove the drive belt. (Refer to P.11A-25).
3. Securely insert the spindle handle or ratchet handle at a 12.7 mm (1/2-inch) angle into the jig hole of the auto tensioner. Turn the auto-tensioner to the left and right to check and see that there is no binding.
4. If there are any problems in the procedure 1 or 3, replace the auto-tensioner. (Refer to P.11A-50).
5. Install the drive belt. (Refer to P.11A-25).

FUNCTION CHECK

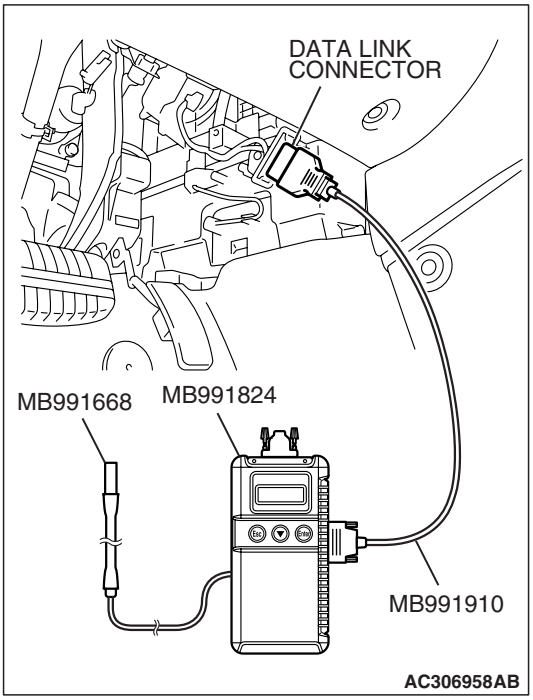
You can verify if the auto-tensioner is defective or not by checking the drive belt tension.

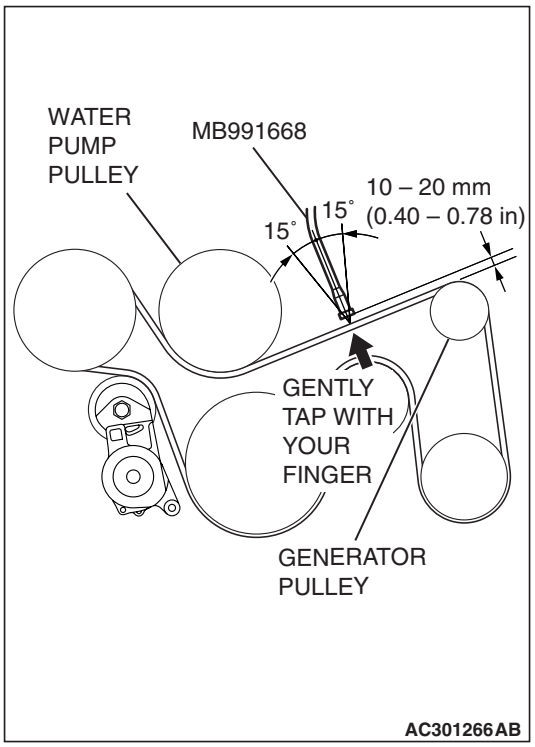
When using scan tool MB991958

Required Special Tools:

- MB991668: Belt Tension Meter Set
- MB991958: Scan Tool (MUT-III Sub Assembly)
  - MB991824: V.C.I.
  - MB991910: MUT-III Main Harness A

1. Check the drive belt tension. (Refer to P.11A-8).
2. Measure the drive belt tension vibration frequency by the following procedures:





⚠ 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 MB991910 to scan tool MB991824.
(3) Connect scan tool MB991910 to the data link connector.
(4) Turn the ignition switch to the "ON" position and select "Belt Tension" from the scan tool menu.

⚠ CAUTION

- **The temperature of the surface of the belt should be as close to normal operating temperature as possible.**
- **Do not allow any contaminants such as water or oil to 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.**

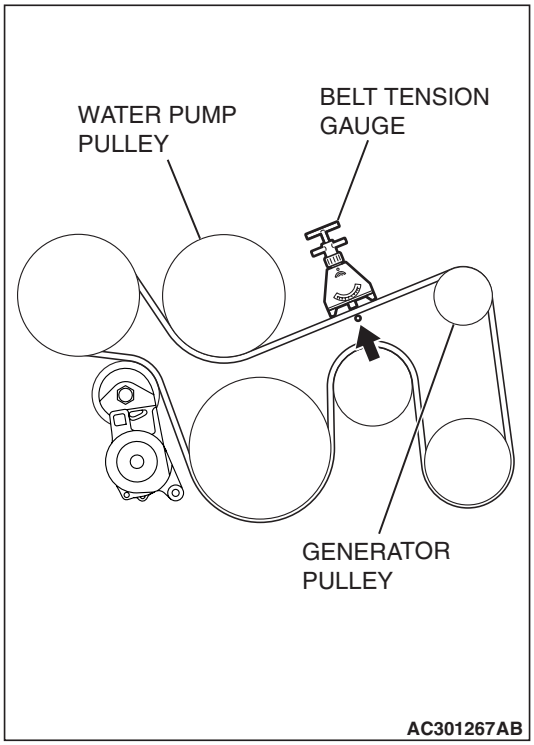
(5) Hold special tool MB991668 to the middle of the drive belt between the pulleys (at the place indicated by arrow), approximately 10 –20 mm (0.40 –0.78 inch) away from the rear surface of the belt so that it is perpendicular to the belt (within ±15 degrees).
(6) Gently tap the middle of the belt between the pulleys (the place indicated by the arrow) with your finger as shown in the illustration, and measure that the vibration frequency of the belt is within the standard value.

Standard value: 120 –154 Hz

3. If not within the standard value, replace the auto-tensioner. (Refer to P.11A-50).

When using a tension gauge

1. Check the drive belt tension. (Refer to P.11A-8).



2. Use a belt tension gauge in the middle of the belt between the pulleys (at the place indicated by the arrow) to measure that the belt tension is within the standard value.

   Standard value: 340 –562 N

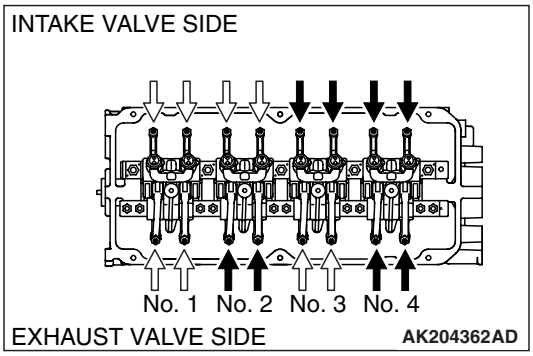
3. If not within the standard value, replace the auto-tensioner. (Refer to P.11A-50).

VALVE CLEARANCE CHECK AND ADJUSTMENT

M1111001500391

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

   NOTE: On 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 and adjustment.
2. Remove all of the ignition coils.
3. Remove the rocker cover.
4. Turn the crankshaft clockwise until the notch on the pulley is lined up with the "T" mark on the timing indicator.
5. Move the rocker arms on the No.1 and No.4 cylinders up and down by hand to determine which cylinder has its piston at the top dead center on the compression stroke.
   If both intake and exhaust valve rocker arms have a valve lash, the piston in the cylinder corresponding to these rocker arms is at the top dead center on the compression stroke.
6. Valve clearance inspection and adjustment can be performed on rocker arms indicated by white arrow mark when the No.1 cylinder piston is at the top dead center on the compression stroke, and on rocker arms indicated by black arrow mark when the No.4 cylinder piston is at the top dead center on the compression stroke.
7. Measure the valve clearance.
   If the valve clearance is not as specified, loosen the rocker arm lock nut and adjust the clearance using a thickness gauge while turning the adjusting screw.



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Standard value (hot engine):
Intake side: 0.20 mm (0.008 inch)
Exhaust side: 0.30 mm (0.012 inch)

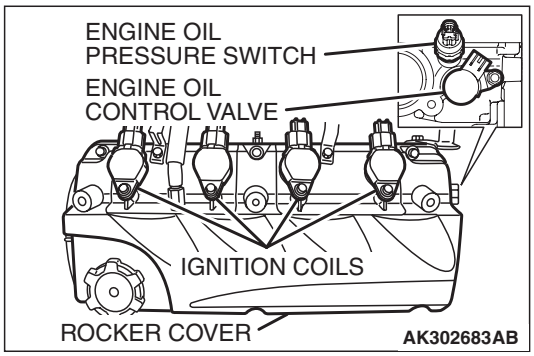
8. While holding the adjusting screw with a screwdriver to prevent it from turning, tighten the lock nut to the specified torque.

Tightening torque: 9 ±1 N· m (80 ±9 in-lb)

9. Turn the crankshaft 360 degrees to line up the notch on the crankshaft pulley with the "T" mark on the timing indicator.
10. Repeat steps (7) and (8) on other valves for clearance adjustment.
11. Install the rocker cover.
12. Install the ignition coils.

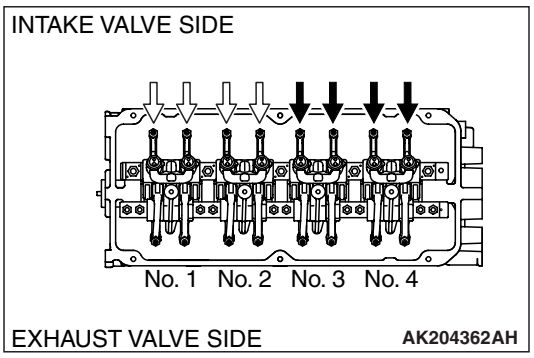
ROCKER ARM PISTON OPERATION CHECK

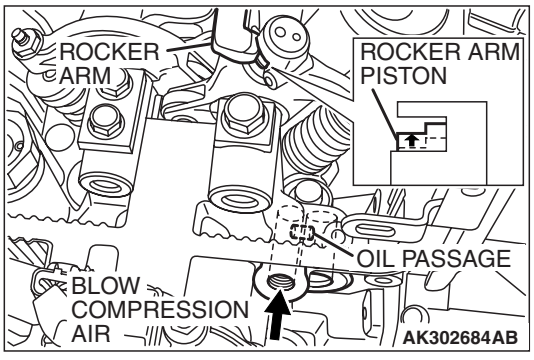
M1111051000153



1. Remove all of the ignition coils.
2. Remove the rocker cover.
3. Remove the engine oil control valve.
4. Remove the engine oil pressure switch.
5. Turn the crankshaft clockwise until the notch on the crankshaft pulley is lined up with "T" mark on the lower cover of timing belt.
6. Move the rocker arms on the No.1 and No.4 cylinders up and down by hand to determine which cylinder has its piston at the top dead center on the compression stroke.

NOTE: The rocker arm piston operation check can be performed on rocker arms indicated by white arrow mark when the No.1 cylinder piston is at the top dead center on the compression stroke, and on rocker arms indicated by black arrow mark when the No.4 cylinder piston is at the top dead center on the compression stroke.





7. While shutting up the oil passage hole at the depth of the engine oil control valve's installation hole by finger not to leak air, blow compressed air into the engine oil pressure switch's installation hole by air blowgun. At this time, confirm that the rocker arm piston can operate.

NOTE: To fully confirm the check, prevent the compression air from leaking as much as possible by installing the O-ring to the end of air blowgun.

8. Turn the crankshaft clockwise until the notch on the crankshaft pulley is lined up with the "T" mark on the lower cover of timing belt.
9. Confirm the rest of the rocker arm pistons under the procedure 7.

10. When the rocker arm piston does not operate, replace the rocker arm assembly.
11. Install the engine oil pressure switch and the engine oil control valve. (Refer to Camshaft and Valve Stem Seal – Removal and Installation P.11A-27.)
12. Install the rocker cover.
13. Install all of the ignition coils.

IGNITION TIMING CHECK

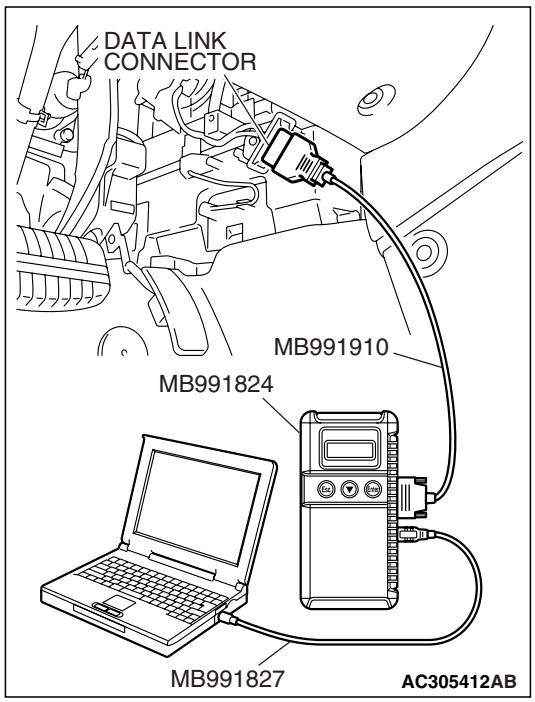
M1111001701268

Required Special Tool:
MB991958: Scan Tool (MUT-III Sub Assembly)
- MB991824: V.C.I.
- MB991827: MUT-III USB Cable
- MB991910: MUT-III Main Harness A

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

NOTE: On 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 the timing light to the power supply line (terminal No. 1) of the ignition coil No. 2.

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

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 actuator test "item number 4".
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:
- Diagnostic 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.

CURB IDLE SPEED CHECK

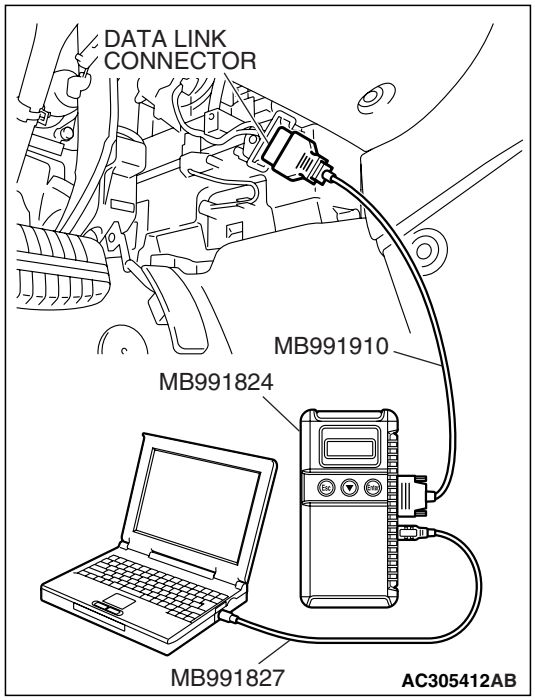
M1111003501152

Required Special Tool:
MB991958: Scan Tool (MUT-III Sub Assembly)
- MB991824: V.C.I.
- MB991827: MUT-III USB Cable
- MB991910: MUT-III Main Harness A

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

NOTE: On 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. Check the basic ignition timing.

   Standard value: 5° BTDC ±3°
4. Start the engine.
5. Run the engine at idle for 2 minutes.
6. Check the idle speed. Select item number 2 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) <2.4L Engine> – Multiport Fuel Injection (MFI) Diagnosis –Symptom Chart P.13A-46.

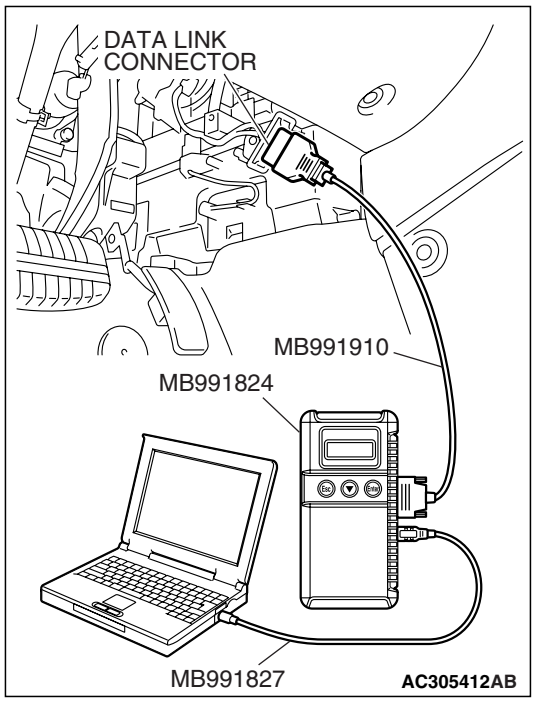
IDLE MIXTURE CHECK

M1111002100880

Required Special Tool:
MB991958: Scan Tool (MUT-III Sub Assembly)
- MB991824: V.C.I.
- MB991827: MUT-III USB Cable
- MB991910: MUT-III Main Harness A

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

NOTE: On 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. Check that the basic ignition timing is within the standard value.

   Standard value: 5° BTDC ±3°
4. Start the engine and increase the engine speed to 2,500 r/min for 2 minutes.
5. Set the CO, HC tester.
6. Check the CO contents and the 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:

   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.
- Diagnostic 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 pressures
- Injector
- Ignition coil, spark plug
- EGR system
- Evaporative emission system
- Compression pressure

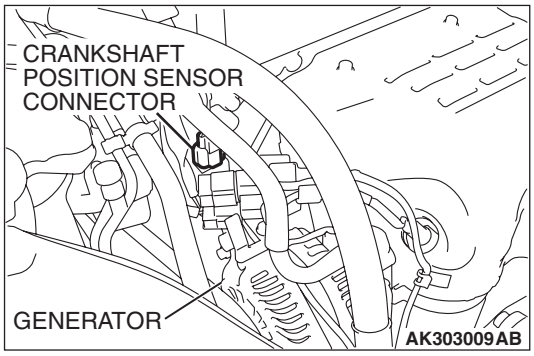
COMPRESSION PRESSURE CHECK

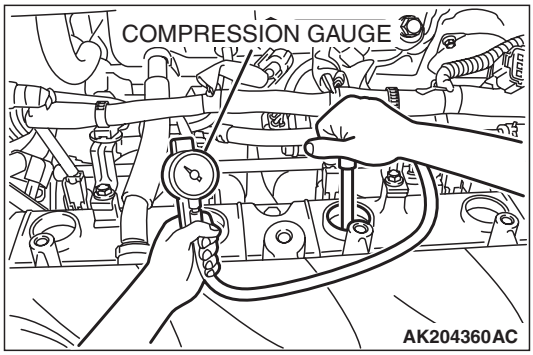
M1111002601338

Required Special Tool:
MB991958: Scan Tool (MUT-III Sub Assembly)
- MB991824: V.C.I.
- MB991827: MUT-III USB Cable
- MB991910: MUT-III Main Harness A

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

   NOTE: On 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. Remove all of the ignition coils and spark plugs.





3. 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.

4. Cover the spark plug hole with a shop towel etc., during cranking. After the engine has been cranked, check for foreign material adhering to the shop towel.
5. Set a compression gauge to one of the spark plug holes.
6. Crank the engine with the throttle valve fully open and measure the compression pressure.

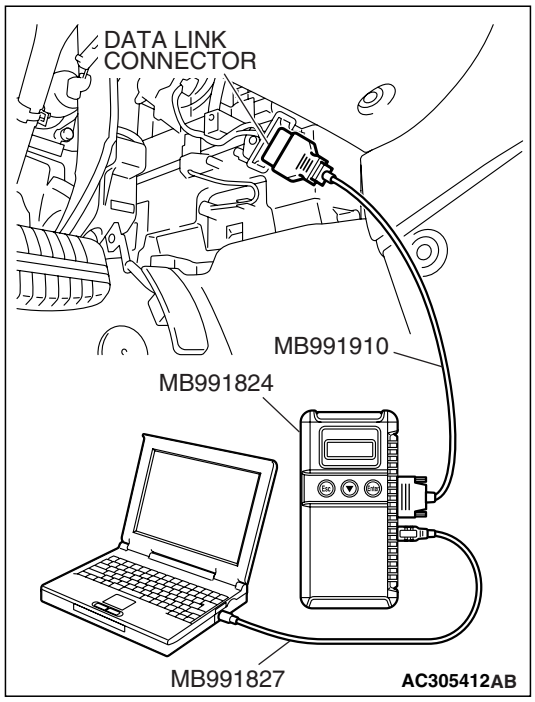
   Standard value (at engine speed of 200 r/min): 1,560 kPa (226 psi)

   Minimum limit (at engine speed of 200 r/min): 1,130 kPa (164 psi)

7. 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)

8. 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.
9. Connect the crankshaft position sensor connector.
10. Install the spark plugs and ignition coils.



11. Use the scan tool MB991958 to erase the diagnostic trouble codes.

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

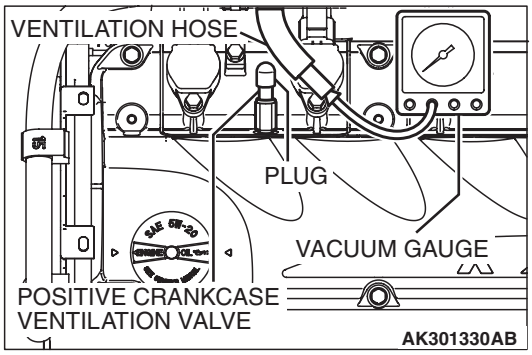
MANIFOLD VACUUM CHECK

M1111002700978

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)



ENGINE ASSEMBLY

REMOVAL AND INSTALLATION

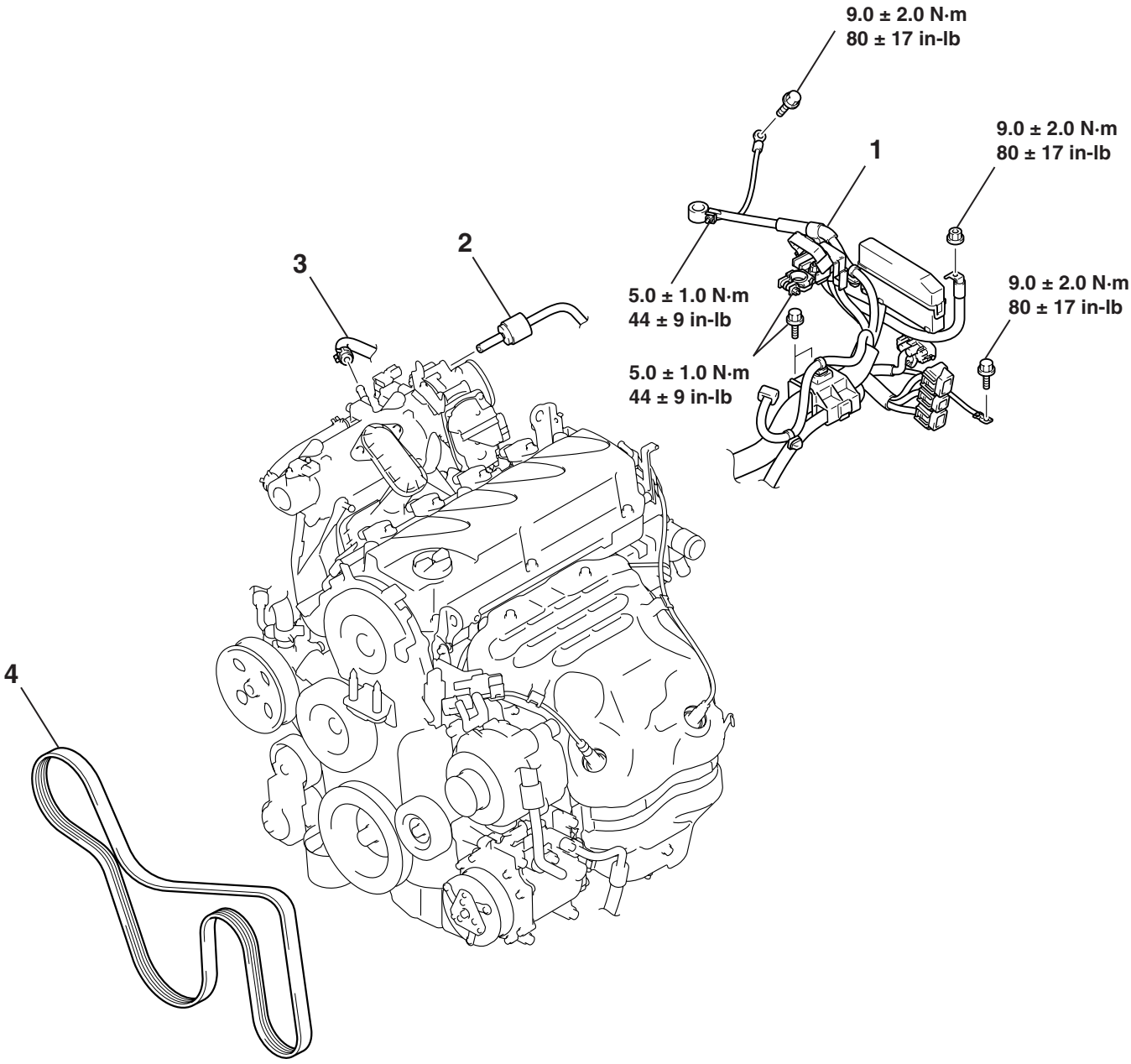
M1112001001864

⚠ CAUTION

- **When the engine assembly replacement is performed, use scan tool MB991958 to initialize the learning value (Refer to GROUP 00, Initialization Procedure for Learning Value in MFI Engine P.00-30).**
- ***: indicates parts which should be temporarily tightened, and then fully tightened with the engine weight applied on the vehicle body.**

Pre-removal Operation	Post-installation Operation
• Side Under Cover Removal (Refer to GROUP 51, Under Cover P.51-8). • Fuel Line Pressure Reduction [Refer to GROUP 13A, On-vehicle Service –Fuel Pump Connector Disconnection (How to Reduce Pressurized Fuel Lines) P.13A-1200]. • Engine Oil Draining (Refer to GROUP 12, On-vehicle Service –Engine Oil Replacement P.12-3). • Engine Coolant Draining (Refer to GROUP 14, On-vehicle Service –Engine Coolant Replacement P.14-22). • Transmission Oil Draining (Refer to GROUP 22A, On-vehicle Service –Transmission Oil Replacement P.22A-10) <M/T>. • Transmission Fluid Draining (Refer to GROUP 23A, On-vehicle Service –Transmission Fluid Change P.23A-381) <A/T>. • Hood Removal (Refer to GROUP 42, Hood P.42-7). • ECM <M/T> or PCM <A/T> Removal [Refer to GROUP 13A, Engine Control Module (ECM) and Powertrain Control Module (PCM) P.13A-1214]. • Air Cleaner Removal (Refer to GROUP 15, Air Cleaner P.15-4). • Battery and Battery Tray Removal • Radiator Assembly Removal (Refer to GROUP 14, Radiator P.14-26). • Front No.1 Exhaust Pipe Removal (Refer to GROUP 15, Exhaust Pipe and Main Muffler P.15-23). • Front No.2 Exhaust Pipe Removal (Refer to GROUP 15, Exhaust Pipe and Main Muffler P.15-23).	• Front No.2 Exhaust Pipe Installation (Refer to GROUP 15, Exhaust Pipe and Main Muffler P.15-23). • Front No.1 Exhaust Pipe Installation (Refer to GROUP 15, Exhaust Pipe and Main Muffler P.15-23). • Radiator Assembly Installation (Refer to GROUP 14, Radiator P.14-26). • Battery and Battery Tray Installation • Air Cleaner Installation (Refer to GROUP 15, Air Cleaner P.15-4). • ECM <M/T> or PCM <A/T> Installation [Refer to GROUP 13A, Engine Control Module (ECM) and Powertrain Control Module (PCM) P.13A-1214]. • Hood Installation (Refer to GROUP 42, Hood P.42-7). • Transmission Oil Refilling (Refer to GROUP 22A, On-vehicle Service –Transmission Oil Replacement P.22A-10) <M/T>. • Transmission Fluid Refilling (Refer to GROUP 23A, On-vehicle Service –Transmission Fluid Change P.23A-381) <A/T>. • Engine Coolant Refilling (Refer to GROUP 14, On-vehicle Service –Engine Coolant Replacement P.14-22). • Engine Oil Refilling (Refer to GROUP 12, On-vehicle Service –Engine Oil Replacement P.12-3). • Fuel Leak Check • Drive Belt Tension Check (Refer to P.11A-8). • Side Under Cover Installation (Refer to GROUP 51, Under Cover P.51-8). • Front Wheel Alignment Check and Adjustment (Refer to GROUP 33, On-vehicle Service –Front Wheel Alignment Check and Adjustment P.33-6).

TSB Revision



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REMOVAL STEPS

1. CONTROL WIRING HARNESS CONNECTION
2. EVAPORATIVE EMISSION PURGE HOSE CONNECTION

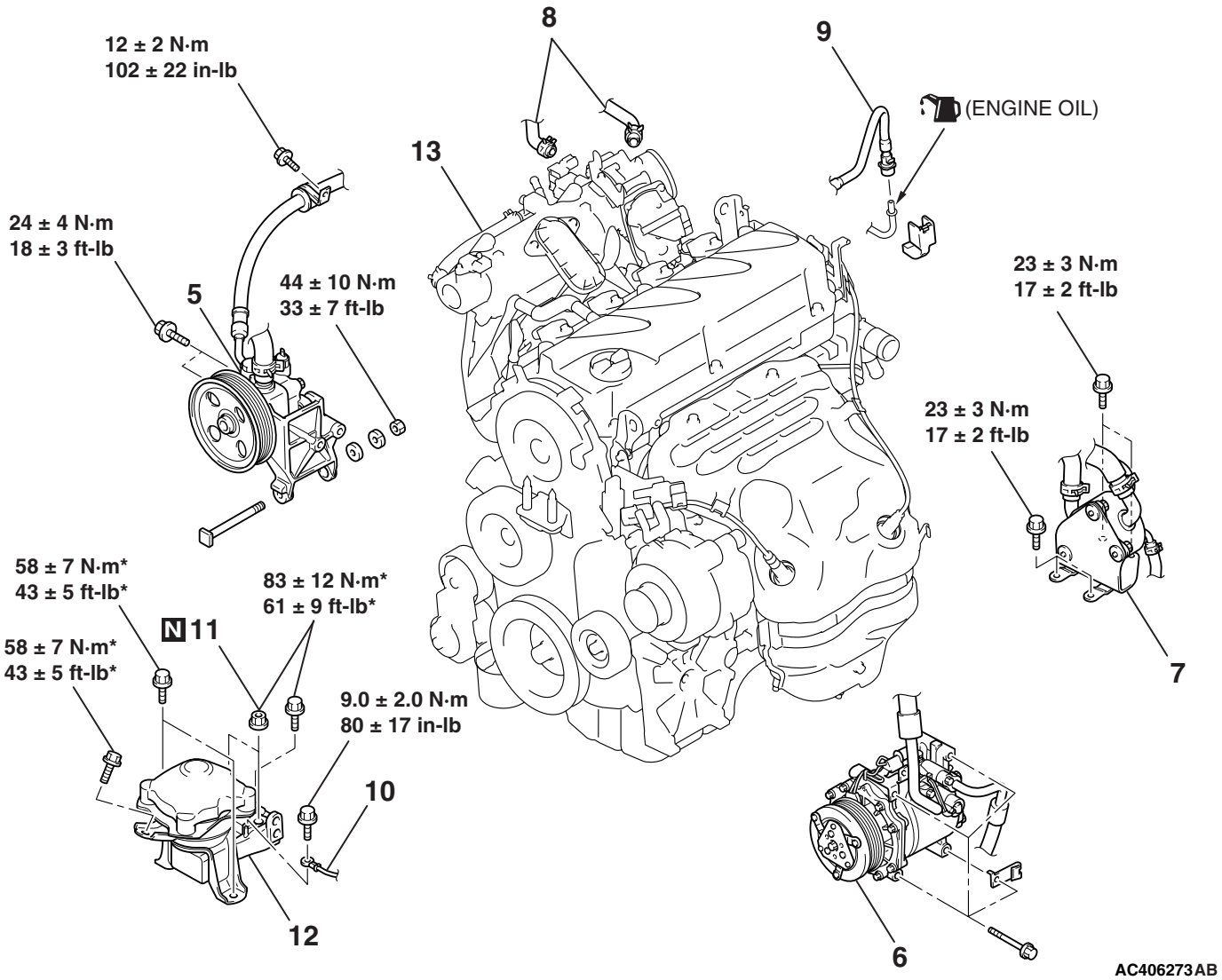
<<A>>

>>E<<

REMOVAL STEPS (Continued)

3. BRAKE BOOSTER VACUUM HOSE CONNECTION
4. DRIVE BELT

TSB Revision



REMOVAL STEPS

<<B>> 5. POWER STEERING OIL PUMP AND BRACKET ASSEMBLY
<<C>> 6. A/C COMPRESSOR AND CLUTCH ASSEMBLY
<<D>> 7. ATF WARMER (TRANSMISSION FLUID COOLER) AND BRACKET ASSEMBLY <A/T>
8. HEATER WATER HOSES CONNECTION
<<E>> >>D<< 9. FUEL HIGH-PRESSURE HOSE CONNECTION

REMOVAL STEPS (Continued)

<<F>> >>C<< • TRANSAXLE ASSEMBLY
10. GROUNDING CABLE CONNECTION
<<G>> • POWER STEERING OIL RESERVOIR
11. JAM NUTS
<<H>> >>B<< 12. ENGINE FRONT MOUNTING BRACKET
<<I>> >>A<< 13. ENGINE ASSEMBLY

Required Special Tools:

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

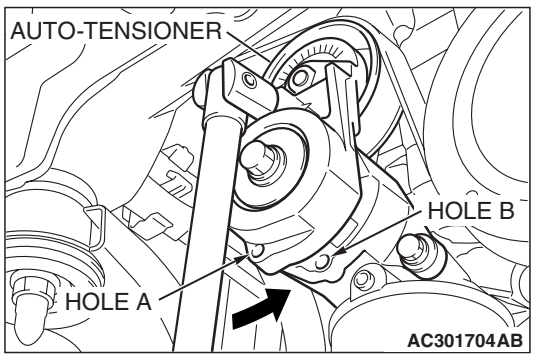
TSB Revision

REMOVAL SERVICE POINTS

<<A>> DRIVE BELT REMOVAL

The following operations are required due to the serpentine drive system with the drive belt auto-tensioner.

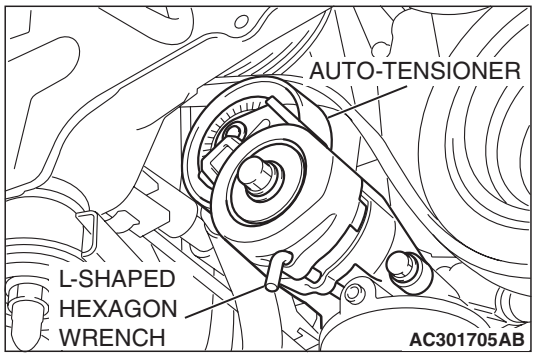
1. Securely insert the spindle handle or ratchet handle at a 12.7 mm (1/2-inch) angle into the jig hole of the auto-tensioner.
2. Rotate the auto-tensioner counterclockwise and align hole A with hole B.



⚠ CAUTION

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

3. Insert an L-shaped hexagon wrench, etc. into the hole to secure its position, and then remove the drive belt.



<<B>> POWER STEERING OIL PUMP AND BRACKET ASSEMBLY REMOVAL

1. With the hose installed, remove the power steering oil pump and bracket assembly from the engine assembly.
2. After removing the power steering oil pump and bracket assembly, secure it with a cord in a location where it does not interfere with engine assembly removal.

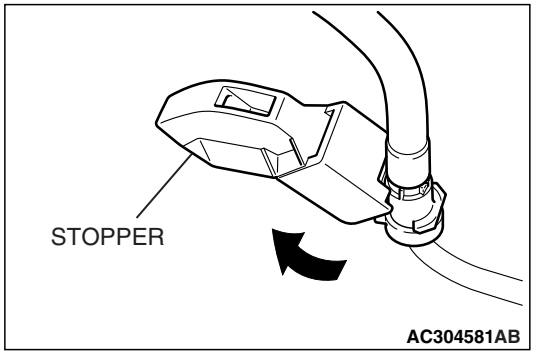
<<C>> A/C COMPRESSOR AND CLUTCH ASSEMBLY REMOVAL

1. With the hose installed, remove the A/C compressor and clutch assembly from the bracket.
2. After removing the A/C compressor and clutch assembly, secure it with a cord in a location where it does not interfere with engine assembly removal.

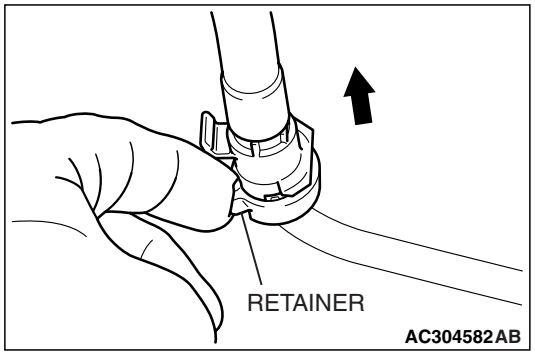
<<D>> ATF WARMER (TRANSMISSION FLUID COOLER) AND BRACKET ASSEMBLY REMOVAL

With the hose installed, remove the ATF warmer (transmission fluid cooler) and bracket assembly from the transmission case front roll stopper bracket.

<<E>> FUEL HIGH-PRESSURE HOSE DISCONNECTION



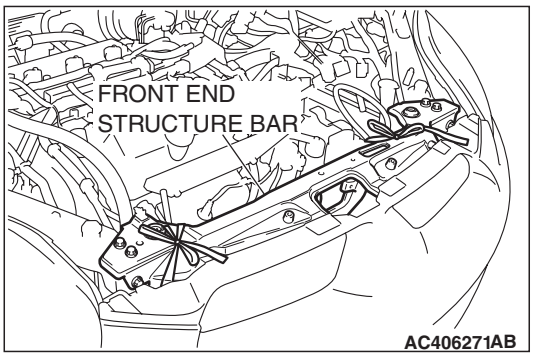
1. Remove the fuel high-pressure hose stopper.



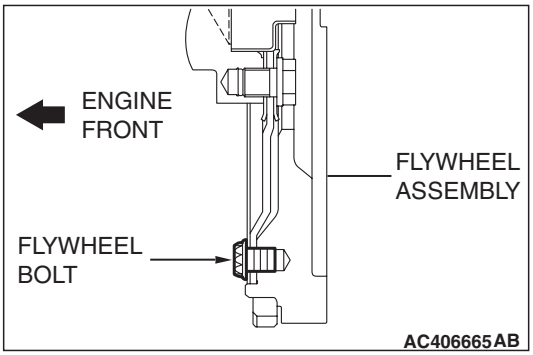
2. Pull up the retainer and remove the fuel high-pressure hose in the direction shown.

   NOTE: If the retainer is released, install it after removing the fuel high-pressure hose.

<<F>> TRANSAXLE ASSEMBLY REMOVAL



1. Secure the A/C condenser and front end structure bar with a cord in a location where it does not interfere with engine assembly removal.



⚠ CAUTION

M/T: Do not remove the flywheel bolt. If this bolt is removed, the flywheel assembly will become out of balance and damaged.

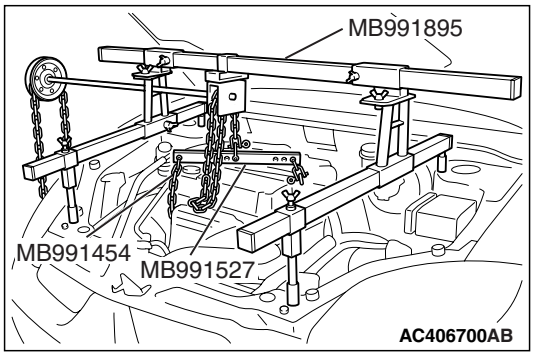
2. Remove the transaxle assembly. (M/T: Refer to GROUP 22A, Transaxle Assembly P.22A-17, A/T: Refer to GROUP 23A, Transaxle Assembly P.23A-401).

<<G>> POWER STEERING OIL RESERVOIR REMOVAL

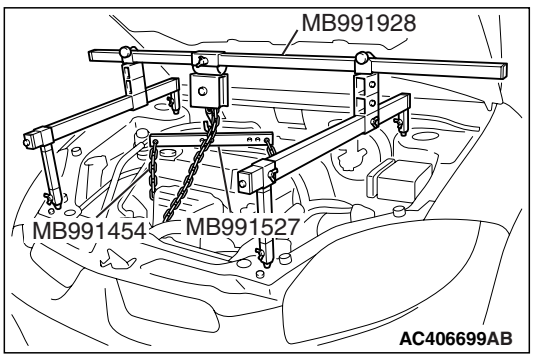
1. With the hose installed, remove the power steering oil reservoir from the vehicle. (Refer to GROUP 37, Power Steering Hoses P.37-59).
2. After removing the power steering oil reservoir, secure it with a cord in a location where it does not interfere with engine front mounting bracket removal.

<<H>> ENGINE FRONT MOUNTING BRACKET REMOVAL

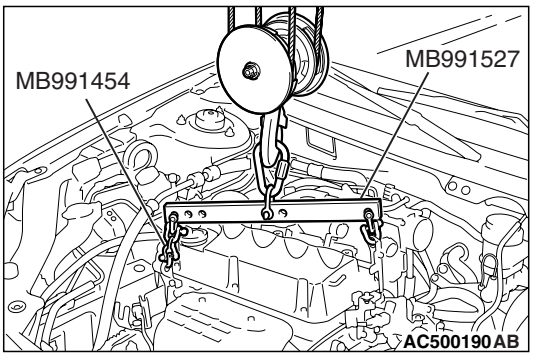
1. Support the engine with a garage jack.
2. Remove the following special tool.
   (1) <Special tool MB991895 is used>
   Remove special tool MB991895.



   (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.



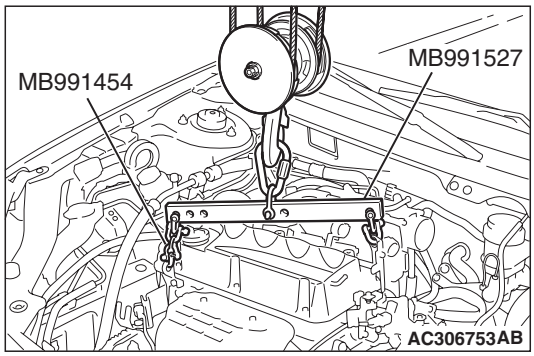
<<I>> ENGINE ASSEMBLY REMOVAL

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

INSTALLATION SERVICE POINTS

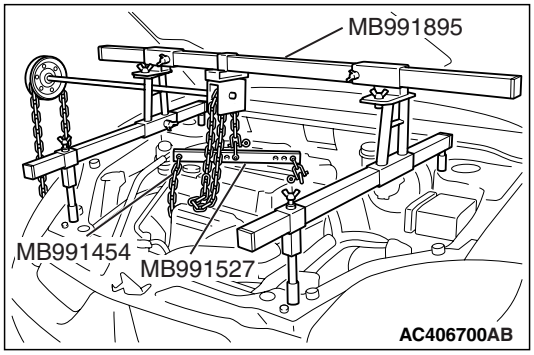
>>A<< ENGINE ASSEMBLY INSTALLATION

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

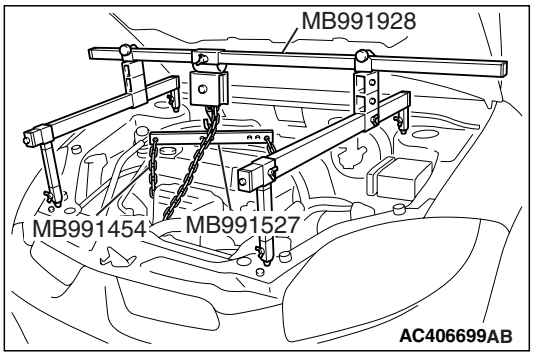


>>B<< ENGINE FRONT MOUNTING BRACKET INSTALLATION

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. (M/T: Refer to GROUP 22A, Transaxle Assembly P.22A-17, A/T: Refer to GROUP 23A, Transaxle Assembly P.23A-401).

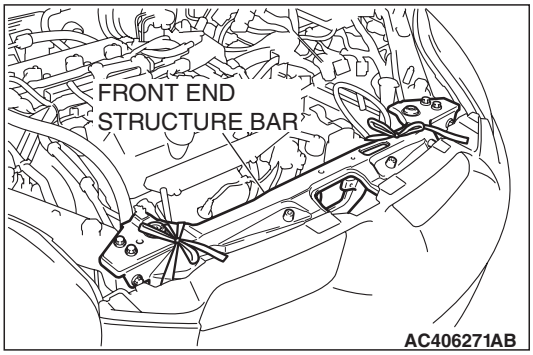


   (2) <Special tool MB991928 is used>
   Set special tool MB991928. (M/T: Refer to GROUP 22A, Transaxle Assembly P.22A-17, A/T: Refer to GROUP 23A, Transaxle Assembly P.23A-401).



>>C<<TRANSAXLE ASSEMBLY INSTALLATION

1. Install the transaxle assembly. (M/T: Refer to GROUP 22A, Transaxle Assembly P.22A-17, A/T: Refer to GROUP 23A, Transaxle Assembly P.23A-401).



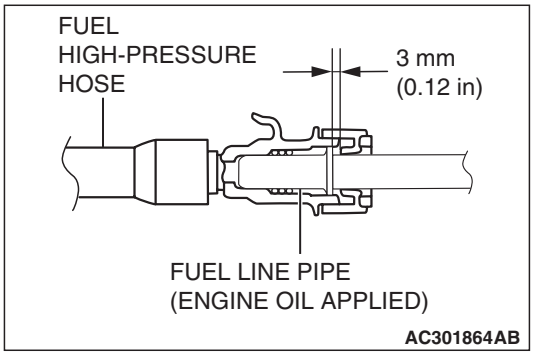
2. Remove the cord securing the A/C condenser and the front end structure bar

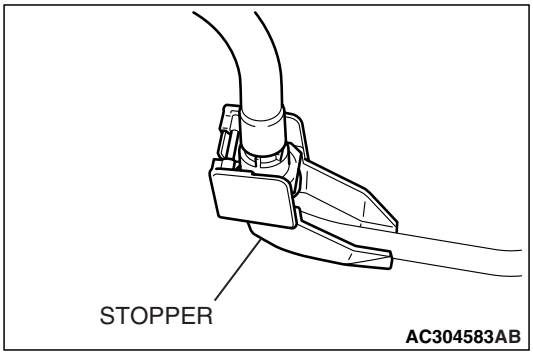
>>D<< FUEL HIGH-PRESSURE HOSE CONNECTION

⚠ CAUTION

After connecting the fuel high-pressure hose, slightly pull it to ensure that it is installed securely. Also confirm that there is a play of approximately 3 mm (0.12 inch). Then install the stopper securely.

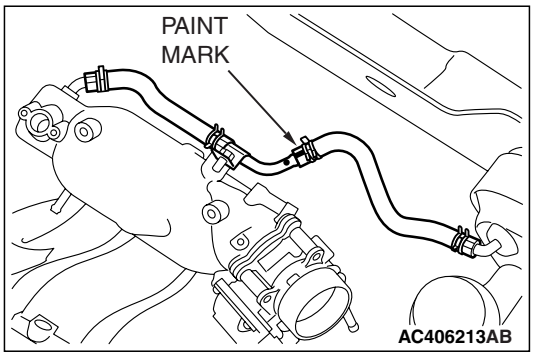
Apply a small amount of engine oil to the fuel line pipe and then install the fuel high-pressure hose.





>>E<< BRAKE BOOSTER VACUUM HOSE CONNECTION

Insert vacuum hose with its paint mark facing upward.

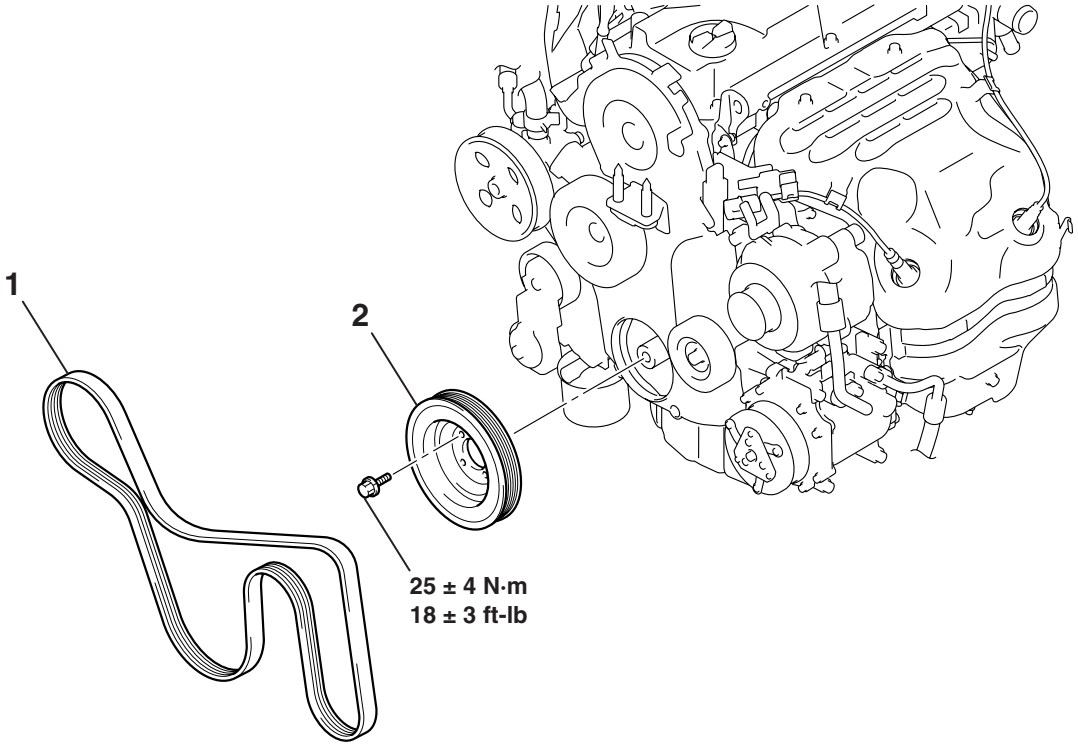


CRANKSHAFT PULLEY

REMOVAL AND INSTALLATION

M1112001600915

Pre-removal Operation	Post-installation Operation
• Side Under Cover Removal (Refer to GROUP 51, Under Cover P.51-8).	• Drive Belt Tension Check (Refer to P.11A-8). • Side Under Cover Installation (Refer to GROUP 51, Under Cover P.51-8).



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REMOVAL STEPS

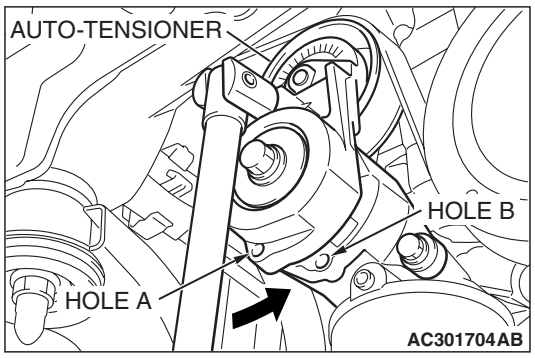
<<A>> 1. DRIVE BELT
2. CRANKSHAFT DAMPER PULLEY

REMOVAL SERVICE POINT

<<A>> DRIVE BELT REMOVAL

The following operations are required due to the serpentine drive system with the drive belt auto-tensioner.

1. Securely insert the spindle handle or ratchet handle at a 12.7 mm (1/2-inch) angle into the jig hole of the auto-tensioner.
2. Rotate the auto-tensioner counterclockwise and align hole A with hole B.



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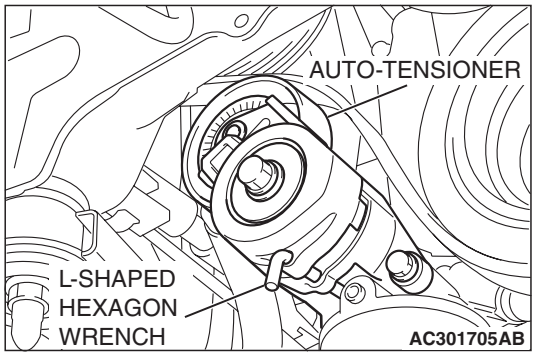

⚠ CAUTION

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

3. Insert an L-shaped hexagon wrench, etc. into the hole to secure its position, and then remove the drive belt.

CAMSHAFT AND VALVE STEM SEAL

REMOVAL AND INSTALLATION

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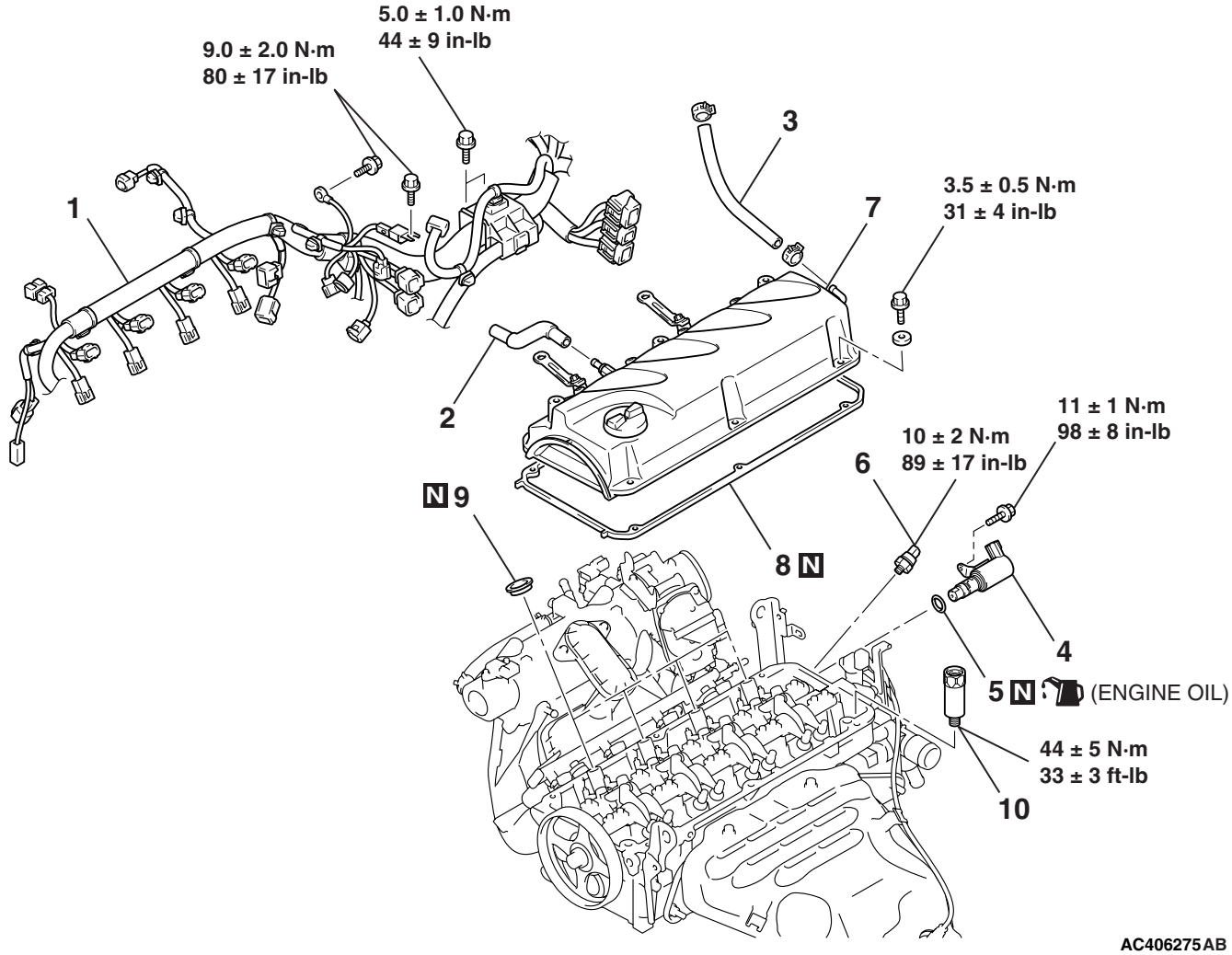
⚠ CAUTION

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

Pre-removal Operation	Post-installation Operation
• ECM <M/T> or PCM <A/T> Removal [Refer to GROUP 13A, Engine Control Module (ECM) and Powertrain Control Module (PCM) P.13A-1214]. • Air Cleaner Removal (Refer to GROUP 15, Air Cleaner P.15-4). • Battery and Battery Tray Removal • Ignition Coils Removal (Refer to GROUP 16, Ignition System –Ignition Coil P.16-42). • Timing Belt Upper Cover Removal (Refer to P.11A-50).	• Timing Belt Upper Cover Installation (Refer to P.11A-50). • Ignition Coils Installation (Refer to GROUP 16, Ignition System –Ignition Coil P.16-42). • Battery and Battery Tray Installation • Air Cleaner Installation (Refer to GROUP 15, Air Cleaner P.15-4). • ECM <M/T> or PCM <A/T> Installation [Refer to GROUP 13A, Engine Control Module (ECM) and Powertrain Control Module (PCM) P.13A-1214]. • Drive Belt Tension Check (Refer to P.11A-8). • Valve Clearance Check and Adjustment (Refer to P.11A-10).



CAMSHAFT REMOVAL STEPS

1. CONTROL WIRING HARNESS CONNECTION
2. ROCKER COVER PCV HOSE CONNECTION

CAMSHAFT REMOVAL STEPS

3. ROCKER COVER BREATHER HOSE CONNECTION

>>K<< 4. ENGINE OIL CONTROL VALVE

>>K<< 5. O-RING

>>J<< 6. ENGINE OIL PRESSURE SWITCH

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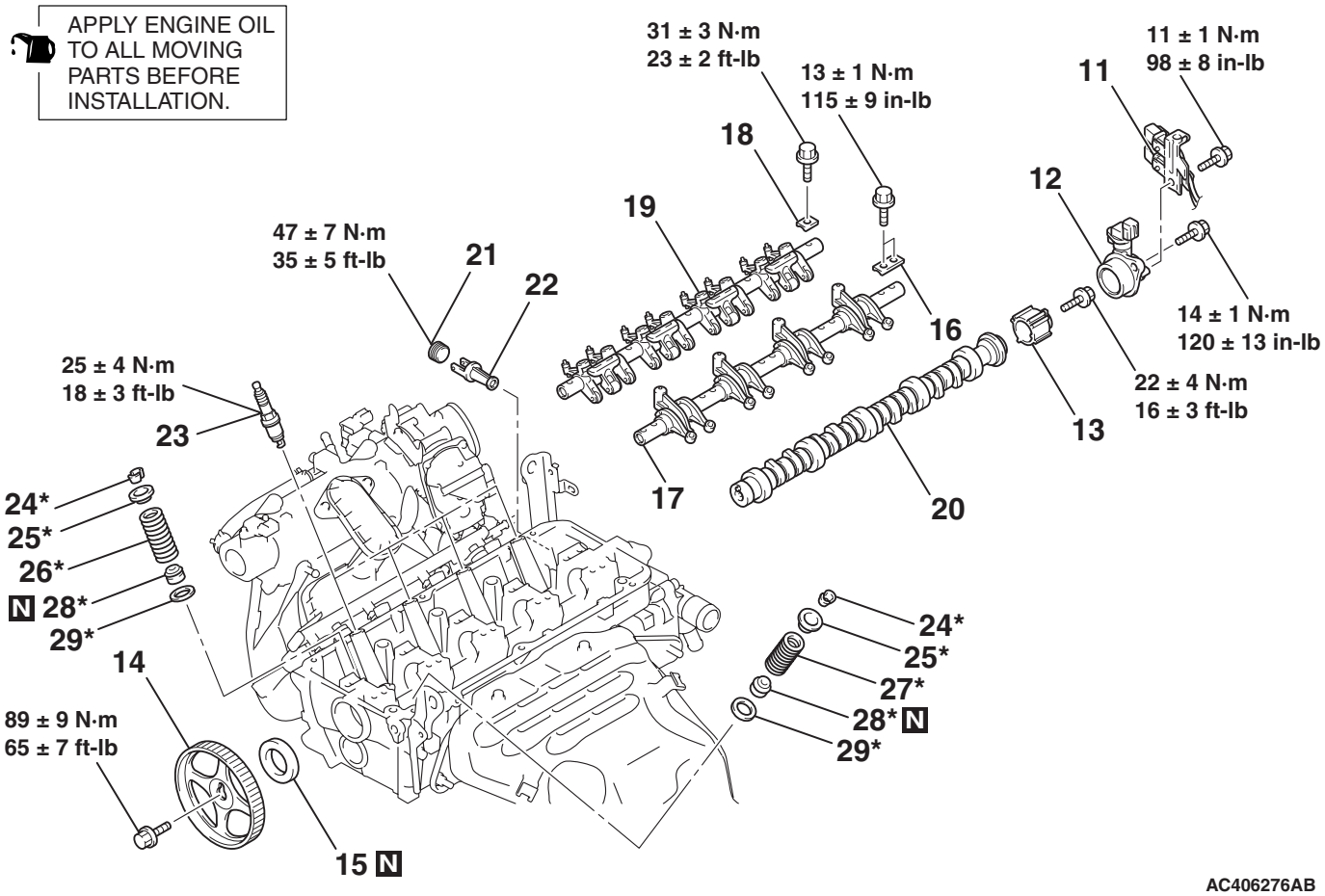
CAMSHAFT REMOVAL STEPS

7. ROCKER COVER ASSEMBLY
8. ROCKER COVER GASKET
9. SPARK PLUG GUIDE OIL SEALS
10. ACCUMULATOR ASSEMBLY

- VALVE TIMING BELT (REFER TO P.11A-50).



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CAMSHAFT REMOVAL STEPS

11. CONNECTOR BRACKET
>>I<< 12. CAMSHAFT POSITION SENSOR SUPPORT
13. CAMSHAFT POSITION SENSING CYLINDER
<<A>> >>H<< 14. CAMSHAFT SPROCKET
>>G<< 15. CAMSHAFT OIL SEAL
>>F<< 16. EXHAUST ROCKER ARM SHAFT CAPS
<<B>> >>F<< 17. EXHAUST ROCKER ARM AND SHAFT ASSEMBLY
>>E<< 18. INTAKE ROCKER ARM SHAFT CAPS
<<B>> >>E<< 19. INTAKE ROCKER ARM AND SHAFT ASSEMBLY
<<C>> >>D<< 20. CAMSHAFT

CAMSHAFT REMOVAL STEPS

- WATER INLET FITTING AND THERMOSTAT CASE ASSEMBLY (REFER TO GROUP 14, WATER HOSE AND WATER PIPE P.14-36).

21. CYLINDER HEAD PLUG
22. ENGINE OIL CONTROL VALVE FILTER

VALVE STEM SEAL REMOVAL STEPS

1. CONTROL WIRING HARNESS CONNECTION
2. ROCKER COVER PCV HOSE CONNECTION
3. ROCKER COVER BREATHER HOSE CONNECTION
7. ROCKER COVER ASSEMBLY
8. ROCKER COVER GASKET
9. SPARK PLUG GUIDE OIL SEALS

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VALVE STEM SEAL REMOVAL STEPS (Continued)

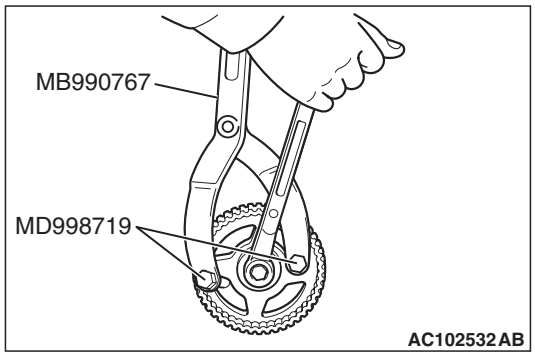
>>**F**<< 16. EXHAUST ROCKER ARM SHAFT CAPS
<<**B**>> >>**F**<< 17. EXHAUST ROCKER ARM AND SHAFT ASSEMBLY
>>**E**<< 18. INTAKE ROCKER ARM SHAFT CAPS
<<**B**>> >>**E**<< 19. INTAKE ROCKER ARM AND SHAFT ASSEMBLY
23. SPARK PLUGS
<<**D**>> >>**C**<< 24. VALVE SPRING RETAINER LOCKS
25. VALVE SPRING RETAINERS
>>**B**<< 26. INTAKE VALVE SPRINGS
>>**B**<< 27. EXHAUST VALVE SPRINGS
>>**A**<< 28. VALVE STEM SEALS
29. VALVE SPRING SEATS

Required Special Tools:

- MB990767: Front Hub and Flange Yoke Holder
- MB991999: Valve Stem Seal Installer
- MD998713: Camshaft Oil Seal Installer
- MD998719: Pin
- MD998772: Valve Spring Compressor

REMOVAL SERVICE POINTS

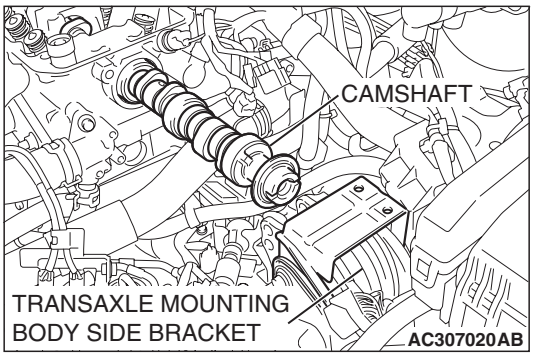
<<A>> CAMSHAFT SPROCKET REMOVAL



1. Hold the camshaft sprocket with special tools MB990767 and MD998719.
2. Loosen the camshaft sprocket mounting bolt and remove the camshaft sprocket.

<<B>> EXHAUST ROCKER ARM AND SHAFT ASSEMBLY/INTAKE ROCKER ARM AND SHAFT ASSEMBLY REMOVAL

⚠ CAUTION
Never disassemble the exhaust rocker arm and shaft assembly, and intake rocker arm and shaft assembly.



<<C>> CAMSHAFT REMOVAL

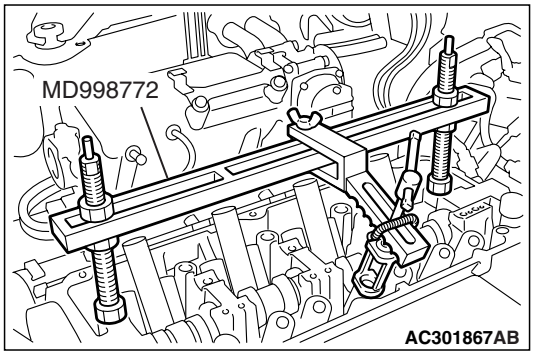
1. Raise the transaxle assembly until the camshaft and transaxle mounting body side bracket do not touch it.
2. Remove the camshaft.

<<D>> VALVE SPRING RETAINER LOCKS REMOVAL

⚠ CAUTION

When removing valve spring retainer locks, leave the piston of each 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.

Use special tool MD998772 to compress the valve spring and then remove the valve spring retainer locks.



INSTALLATION SERVICE POINTS

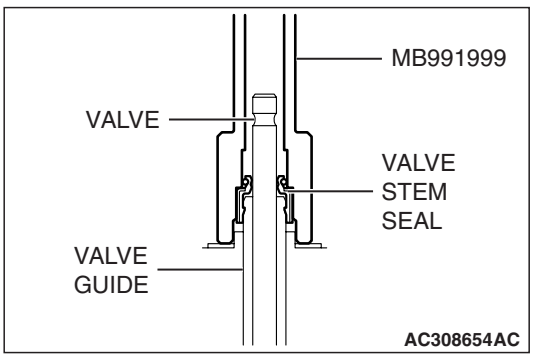
>>A<< VALVE STEM SEALS INSTALLATION

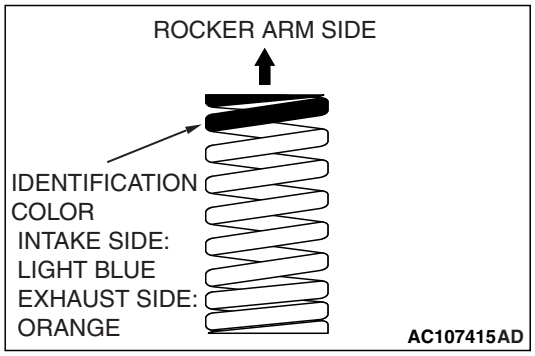
1. Apply a small amount of engine oil to the valve stem seals.

⚠ CAUTION

- **Do not re-use the valve stem seal.**
- **The special tool MB991999 must be used to install the valve stem seal. Improper installation could result in oil leaking past the valve guide.**

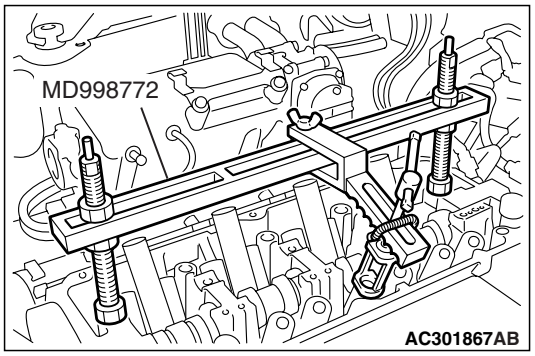
2. Use special tool MB991999 to fill a new valve stem seal in the valve guide using the valve stem area as a guide.





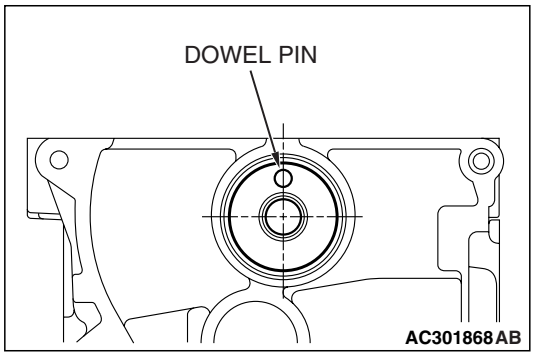
>>B<< EXHAUST VALVE SPRINGS/INTAKE VALVE SPRINGS INSTALLATION

Install the valve springs with the identification color painted end facing the rocker arm.



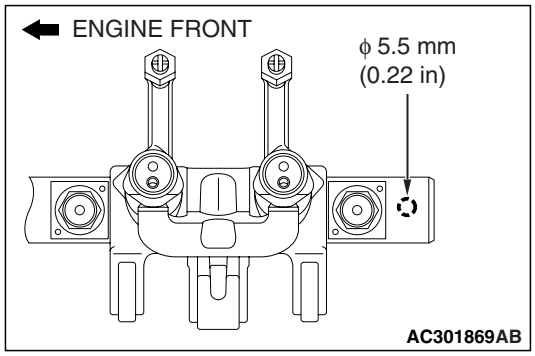
>>C<< VALVE SPRING RETAINER LOCKS INSTALLATION

Use special tool MD998772 to compress the valve spring and then install the valve spring retainer lock in the same manner as removal.



>>D<< CAMSHAFT INSTALLATION

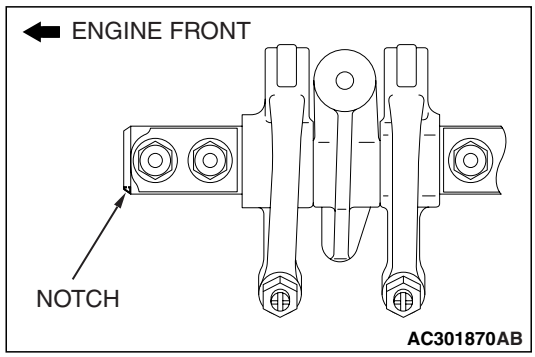
Set the dowel pin of the camshaft in the position shown in the figure.



>>E<< INTAKE ROCKER ARM AND SHAFT ASSEMBLY/INTAKE ROCKER ARM SHAFT CAPS INSTALLATION

1. Place the intake rocker shaft so that its 5.5 mm (0.22 inch) hole faces toward the cylinder head.
2. Install the intake rocker arm shaft caps.
3. Tighten the intake rocker shaft mounting bolts to the specified torque.

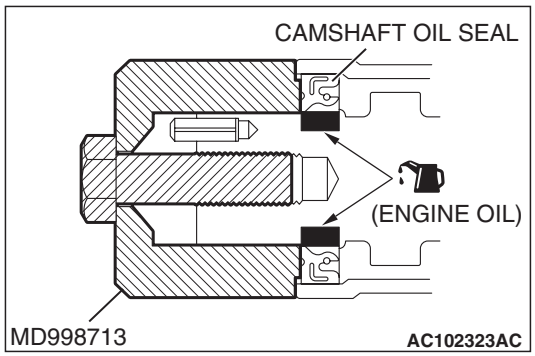
Tightening torque: 31 ±3 N· m (23 ±2 ft-lb)



>>F<< EXHAUST ROCKER ARM AND SHAFT ASSEMBLY/EXHAUST ROCKER ARM SHAFT CAPS INSTALLATION

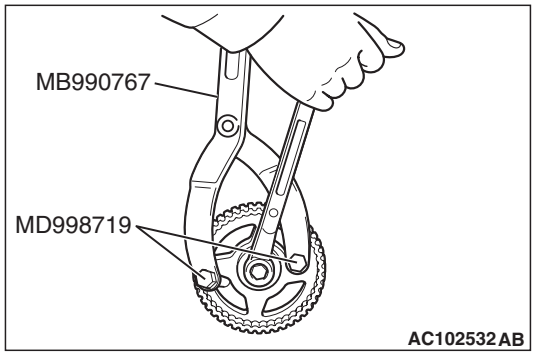
1. Install the exhaust rocker shaft so that its notch is positioned as shown.
2. Install the exhaust rocker arm shaft caps.
3. Tighten the exhaust rocker shaft mounting bolts to the specified torque.

Tightening torque: 13 ±1 N· m (115 ±9 in-lb)



>>G<< CAMSHAFT OIL SEAL INSTALLATION

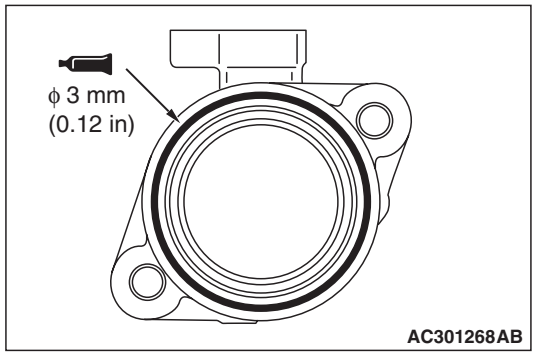
1. Apply engine oil to the entire inner diameter of the oil seal lip.
2. Use special tool MD998713 to press-fit the oil seal as shown.



>>H<< CAMSHAFT SPROCKET INSTALLATION

1. Hold the camshaft sprocket with special tools MB990767 and MD998719 in the same manner as removal.
2. Tighten the camshaft sprocket mounting bolt to the specified torque.

   Tightening torque: 89 ±9 N· m (65 ±7 ft-lb)



>>I<< CAMSHAFT POSITION SENSOR SUPPORT INSTALLATION

1. Remove old sealant from the camshaft position sensor support and cylinder head surfaces.
2. Apply sealant to the camshaft position sensor support flange in a continuous bead as shown in the illustration.

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

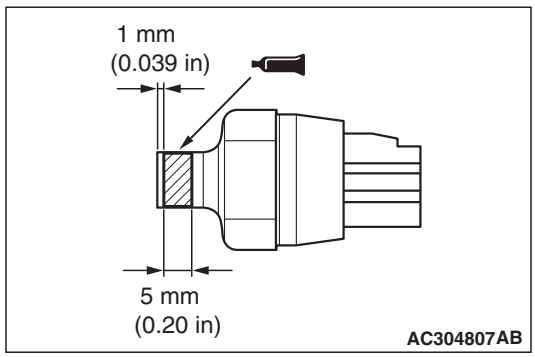
   NOTE: Install the camshaft position sensor support within 15 minutes after applying the sealant.
3. Install the camshaft position sensor support to the cylinder head.

⚠ CAUTION

Wait at least one hour for the sealant to set. Never start the engine or let engine oil or coolant touch the adhesion surface during that time.

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

   Tightening torque: 14 ±1 N· m (120 ±13 in-lb)

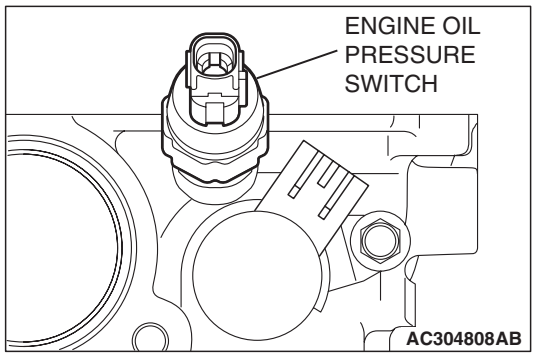


>>J<< ENGINE OIL PRESSURE SWITCH INSTALLATION

1. Remove old sealant from the engine oil pressure switch and cylinder head surfaces.
2. Apply sealant to the thread of the engine oil pressure switch as shown.

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

   NOTE: Install the engine oil pressure switch within 15 minutes after applying the sealant.



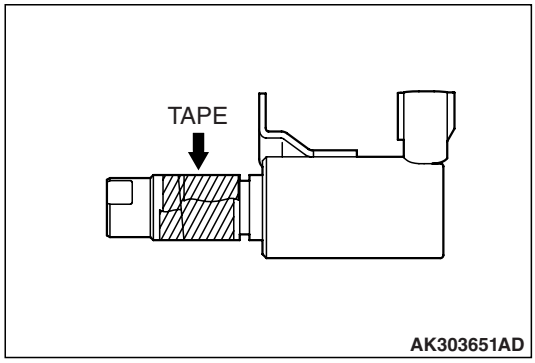
⚠ CAUTION

Wait at least one hour for the sealant to set. Never start the engine or let engine oil or coolant touch the adhesion surface during that time.

3. Tighten the engine oil pressure switch to the specified torque as shown.

   Tightening torque: 10 ±2 N· m (89 ±17 in-lb)

>>K<< O-RING/ENGINE OIL CONTROL VALVE INSTALLATION



⚠ CAUTION

- **Never re-use the O-ring.**
- **Before installing O-ring, wind sealing tape around the oil passages cut-out area of engine oil control valve, to prevent damage. If the O-ring is damaged, it can cause an oil leak.**

1. Apply a small amount of engine oil to the O-ring and then install it to the engine oil control valve.
2. Assemble the engine oil control valve to the cylinder head.
3. Tighten the engine oil control valve mounting bolt to the specified torque.

   Tightening torque: 11 ±1 N· m (98 ±8 in-lb)

OIL PAN

REMOVAL AND INSTALLATION

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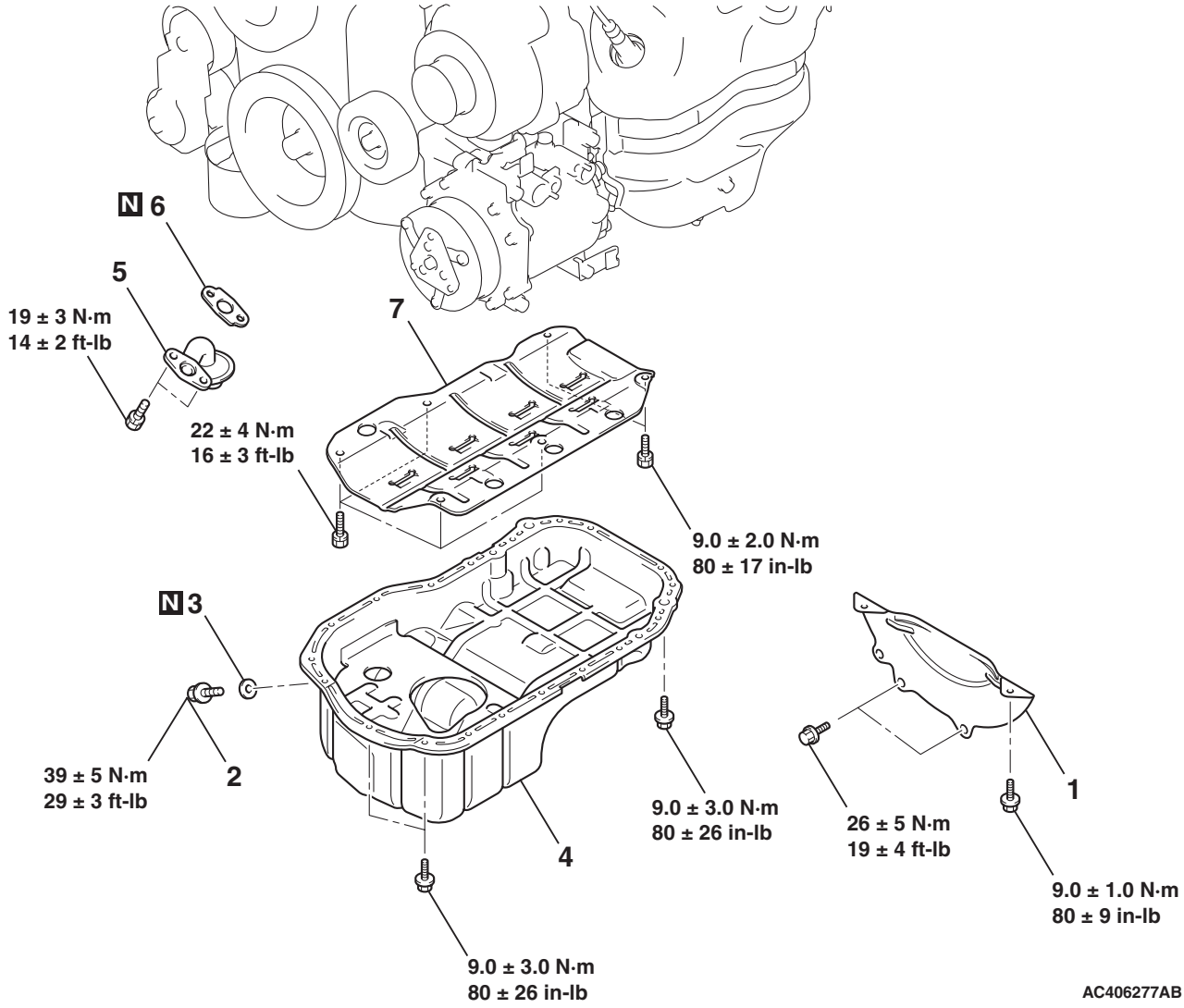
Pre-removal Operation	Post-installation Operation
• Side Under Cover Removal (Refer to GROUP 51, Under Cover P.51-8). • Engine Oil Draining (Refer to GROUP 12, On-vehicle Service –Engine Oil Replacement P.12-3). • Front No.1 Exhaust Pipe Removal (Refer to GROUP 15, Exhaust Pipe and Main Muffler P.15-23). • Front No.2 Exhaust Pipe Removal (Refer to GROUP 15, Exhaust Pipe and Main Muffler P.15-23).	• Front No.2 Exhaust Pipe Installation (Refer to GROUP 15, Exhaust Pipe and Main Muffler P.15-23). • Front No.1 Exhaust Pipe Installation (Refer to GROUP 15, Exhaust Pipe and Main Muffler P.15-23). • Engine Oil Refilling (Refer to GROUP 12, On-vehicle Service –Engine Oil Replacement P.12-3). • Side Under Cover Installation (Refer to GROUP 51, Under Cover P.51-8).



REMOVAL STEPS

1. TORQUE CONVERTER HOUSING FRONT LOWER COVER
2. ENGINE OIL PAN DRAIN PLUG
>>**B**<< 3. ENGINE OIL PAN DRAIN PLUG GASKET
<<**A**>> >>**A**<< 4. ENGINE OIL PAN

REMOVAL STEPS (Continued)

5. ENGINE OIL PAN STRAINER
6. ENGINE OIL PAN STRAINER GASKET
7. BAFFLE PLATE

Required Special Tool:

- MD998727: Oil Pan FIPG cutter

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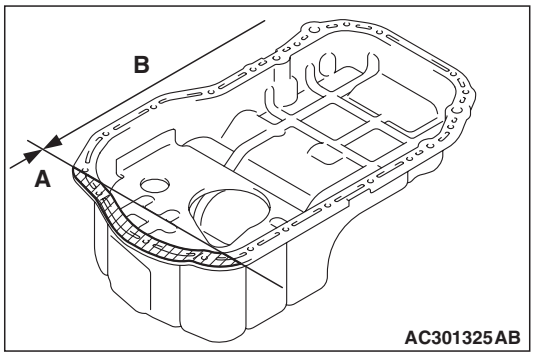
REMOVAL SERVICE POINT

<<A>> ENGINE OIL PAN REMOVAL

1. Remove the engine oil pan mounting bolts.

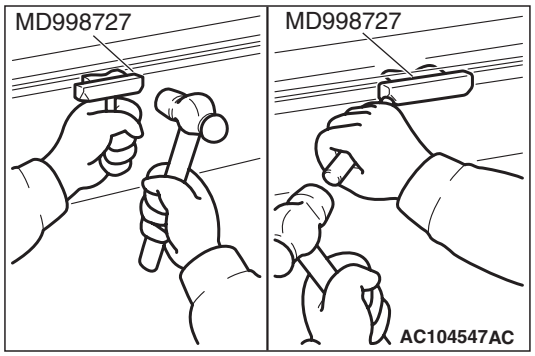


⚠ CAUTION

Do not use special tool MD998727 in area A of the engine oil pan. Using the special tool in area A may cause deformation of the front case because the front case is made of aluminum.

2. Tap special tool MD998727 into the range (B) between the cylinder block and the engine oil pan, and then slide the tool sideways.

   NOTE: If any sounding parts interfere with the removal, there is no need to use special tool MD998727.



3. Remove the engine oil pan.

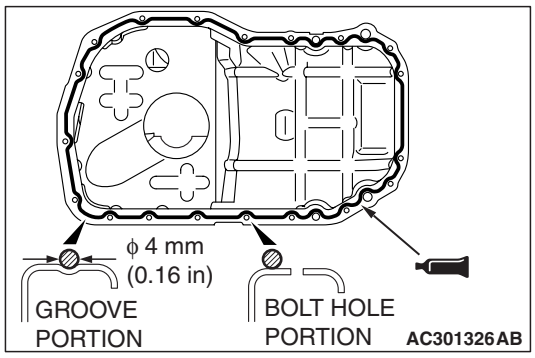
INSTALLATION SERVICE POINTS

>>A<< ENGINE OIL PAN INSTALLATION

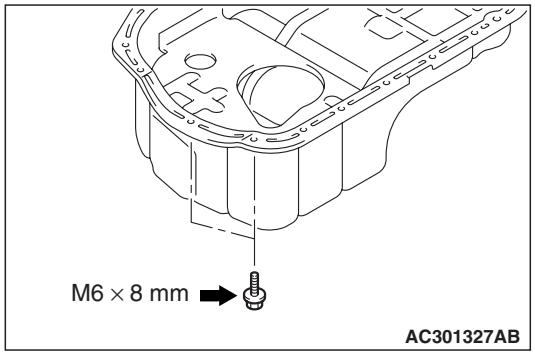
1. Remove sealant from the engine oil pan, front case and cylinder block surfaces.
2. Apply a bead of the sealant to the cylinder block mating surface of the engine oil pan as shown.

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

   NOTE: Install the engine oil pan within 15 minutes after applying sealant.



3. Assemble the engine oil pan to the cylinder block.

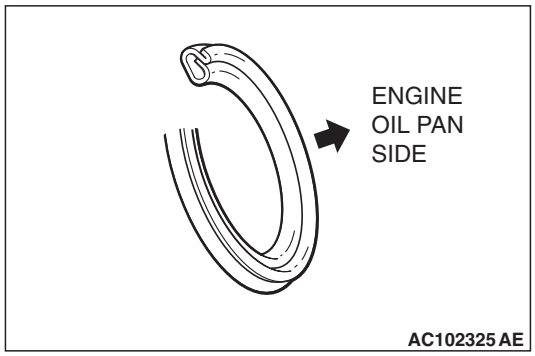


⚠ CAUTION

Wait at least one hour. Never start the engine or let engine oil or coolant touch the sealant surface during that time.

4. Tighten the engine oil pan mounting bolts to the specified torque. Be careful when installing, as the bolts indicated in the illustration have different lengths from the other bolts.

Tightening torque: 9.0 ±3.0 N· m (80 ±26 in-lb)



>>B<< ENGINE OIL PAN DRAIN PLUG GASKET INSTALLATION

Replace the gasket with a new gasket. Install the new gasket in the direction shown in the illustration.

INSPECTION

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

CRANKSHAFT OIL SEAL

REMOVAL AND INSTALLATION

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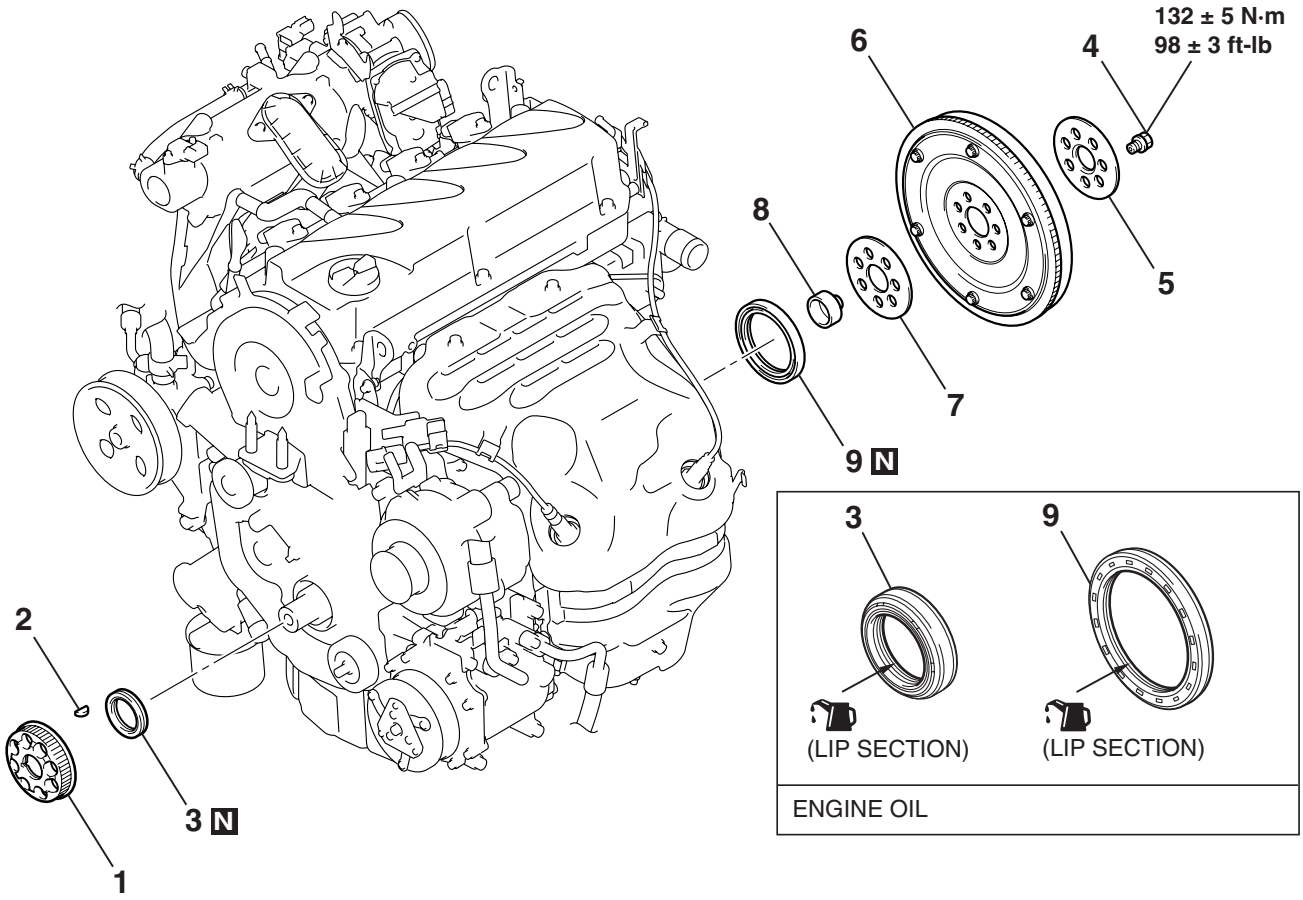
<M/T>



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CRANKSHAFT FRONT OIL SEAL REMOVAL STEPS

- VALVE TIMING BELT AND BALANCER TIMING BELT (REFER TO P.11A-50).

>>D<< 1. CRANKSHAFT BALANCER SHAFT DRIVE SPROCKET
2. CRANKSHAFT KEY
>>C<< 3. CRANKSHAFT FRONT OIL SEAL

CRANKSHAFT REAR OIL SEAL REMOVAL STEPS

<<A>>
- TRANSAXLE ASSEMBLY
- CLUTCH COVER AND CLUTCH DISC (REFER TO GROUP 21B, CLUTCH P.21B-2).

<<B>> >>B<< 4. FLYWHEEL BOLTS
5. FLYWHEEL ADAPTER PLATE
6. FLYWHEEL ASSEMBLY
7. FLYWHEEL ADAPTER PLATE
8. CRANKSHAFT BUSHING
>>A<< 9. CRANKSHAFT REAR OIL SEAL

Required Special Tools:

- MB990938: Installer Bar
- MD998285: Crankshaft Front Oil Seal Guide
- MD998375: Crankshaft Front Oil Seal Installer
- MD998776: Crankshaft Rear Oil Seal Installer
- MD998781: Flywheel Stopper

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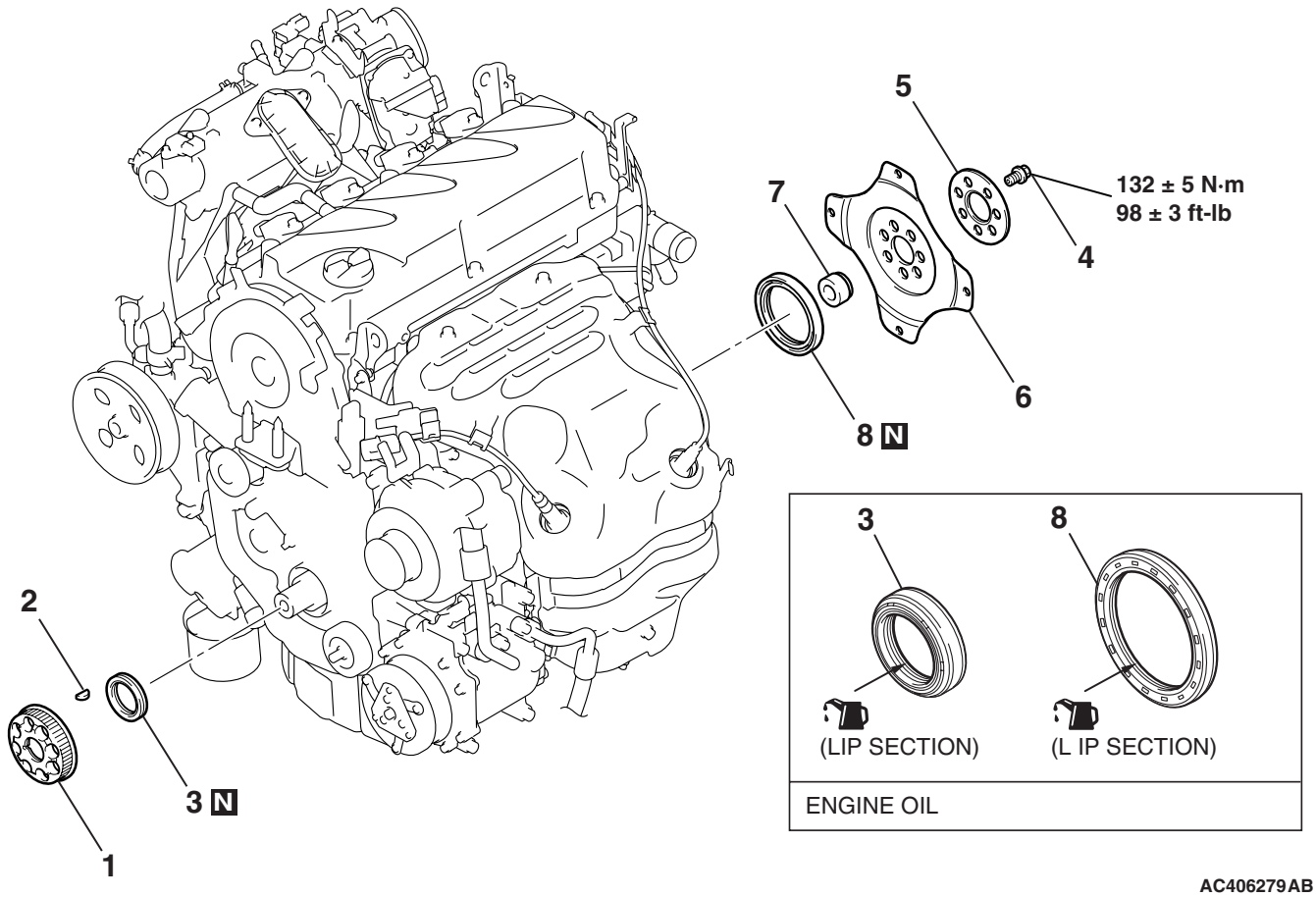
<A/T>



CRANKSHAFT FRONT OIL SEAL REMOVAL STEPS

- VALVE TIMING BELT AND BALANCER TIMING BELT (REFER TO P.11A-50).

>>D<< 1. CRANKSHAFT BALANCER SHAFT DRIVE SPROCKET
2. CRANKSHAFT KEY
>>C<< 3. CRANKSHAFT FRONT OIL SEAL

CRANKSHAFT REAR OIL SEAL REMOVAL STEPS

- TRANSAXLE ASSEMBLY (REFER TO GROUP 23A, TRANSAXLE ASSEMBLY P.23A-401).

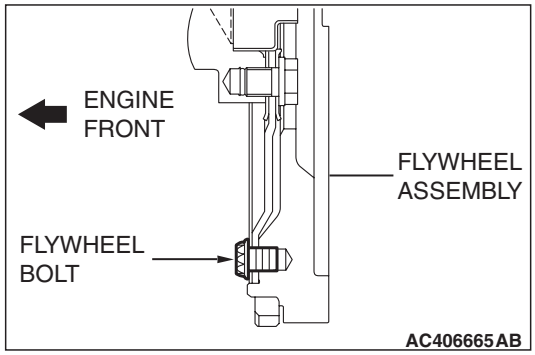
<<B>> >>B<< 4. A/T DRIVE PLATE BOLTS
5. A/T DRIVE PLATE ADAPTER PLATE
6. A/T DRIVE PLATE
7. CRANKSHAFT BUSHING
>>A<< 8. CRANKSHAFT REAR OIL SEAL

Required Special Tools:

- MB990938: Installer Bar
- MD998285: Crankshaft Front Oil Seal Guide
- MD998375: Crankshaft Front Oil Seal Installer
- MD998776: Crankshaft Rear Oil Seal Installer
- MD998781: Flywheel Stopper

REMOVAL SERVICE POINTS

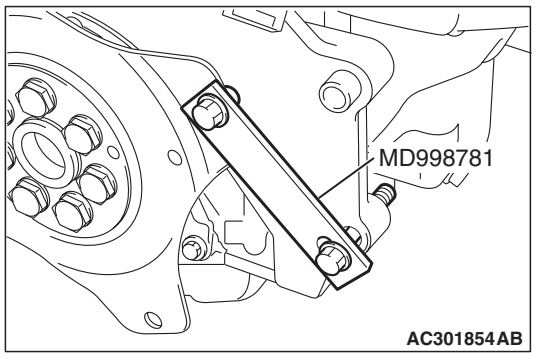
<<A>> TRANSAXLE ASSEMBLY REMOVAL



⚠ CAUTION
Do not remove the flywheel bolt. If this bolt is removed, the flywheel assembly will become out of balance and damaged.

Refer to GROUP 22A, Transaxle Assembly P.22A-17.

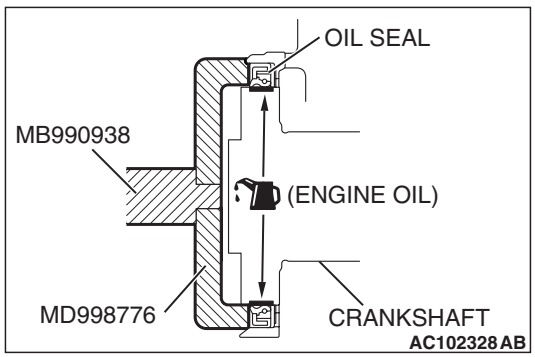
<<B>> FLYWHEEL BOLTS/A/T DRIVE PLATE BOLTS REMOVAL



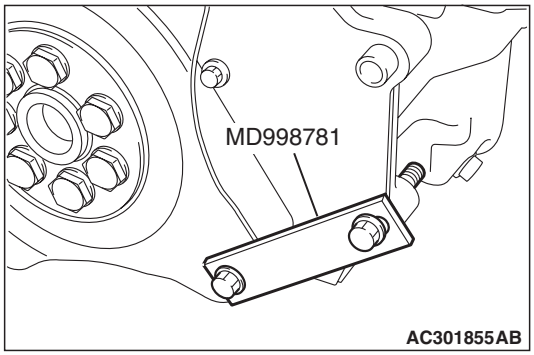
1. Use special tool MD998781 to secure the flywheel assembly or A/T drive plate.
2. Remove the flywheel bolts or A/T drive plate bolts.

INSTALLATION SERVICE POINTS

>>A<< CRANKSHAFT REAR OIL SEAL INSTALLATION



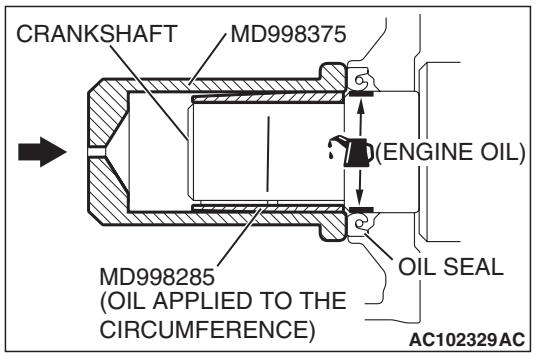
1. Apply a small amount of engine oil to the entire inner diameter of the oil seal lip.
2. Use special tools MB990938 and MD998776 to press-fit the oil seal.



>>B<< FLYWHEEL BOLTS/A/T DRIVE PLATE BOLTS INSTALLATION

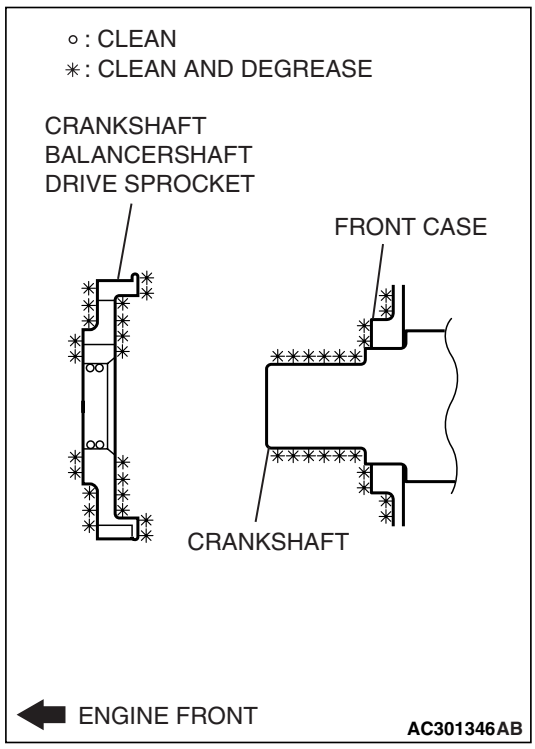
1. Use special tool MD998781 to secure the flywheel assembly or A/T drive plate in the same manner as removal.
2. Tighten the flywheel bolts or A/T drive plate bolts to the specified torque.

   Tightening torque: 132 ±5 N· m (98 ±3 ft-lb)



>>C<< CRANKSHAFT FRONT OIL SEAL INSTALLATION

1. Apply a small amount of engine oil to the outer diameter of special tool MD998285 and install it to the crankshaft.
2. Apply a small amount of engine oil to the entire inner diameter of the oil seal lip.
3. Use special tool MD998375 to press-fit the oil seal.



>>D<< CRANKSHAFT BALANCER SHAFT DRIVE SPROCKET INSTALLATION

1. Clean or degrease the front case, the crankshaft and the crankshaft balancer shaft drive sprocket as shown.

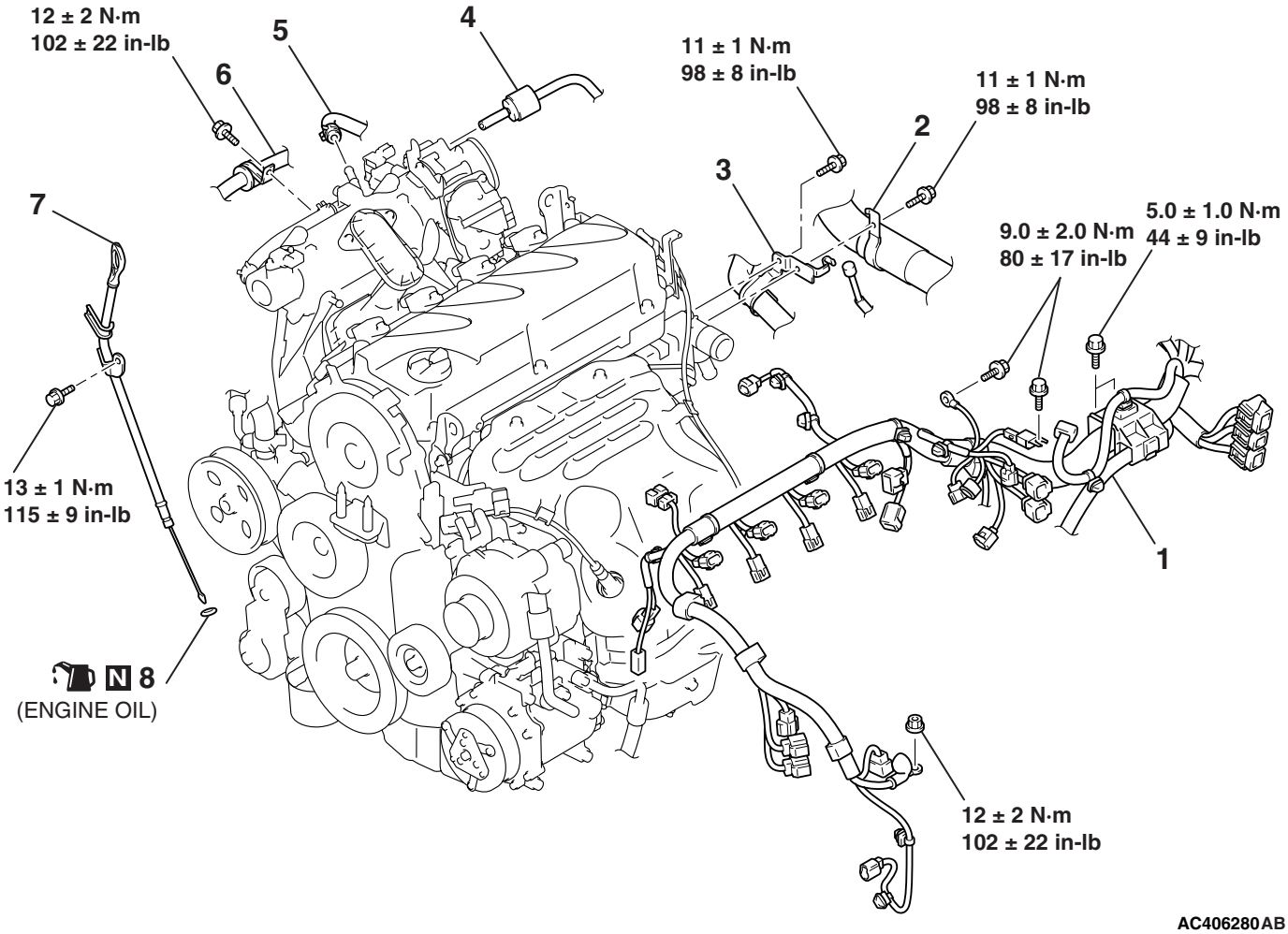
   NOTE: Also clean the degreased surfaces.
2. Install the crankshaft balancer shaft drive sprocket in the direction shown in the illustration.

CYLINDER HEAD GASKET

REMOVAL AND INSTALLATION

M1112004001517

Pre-removal Operation	Post-installation Operation
• Fuel Line Pressure Reduction [Refer to GROUP 13A, On-vehicle Service –Fuel Pump Connector Disconnection (How to Reduce Pressurized Fuel Lines) P.13A-1200]. • Engine Coolant Draining (Refer to GROUP 14, On-vehicle Service –Engine Coolant Replacement P.14-22). • ECM <M/T> or PCM <A/T> Removal [Refer to GROUP 13A, Engine Control Module (ECM) and Powertrain Control Module (PCM) P.13A-1214]. • Air Cleaner Removal (Refer to GROUP 15, Air Cleaner P.15-4). • Battery and Battery Tray Removal	• Battery and Battery Tray Installation • Air Cleaner Installation (Refer to GROUP 15, Air Cleaner P.15-4). • ECM <M/T> or PCM <A/T> Installation [Refer to GROUP 13A, Engine Control Module (ECM) and Powertrain Control Module (PCM) P.13A-1214]. • Engine Coolant Refilling (Refer to GROUP 14, On-vehicle Service –Engine Coolant Replacement P.14-22). • Fuel Leak Check



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REMOVAL STEPS
1. CONTROL WIRING HARNESS CONNECTION
2. RADIATOR LOWER HOSE CLAMP
3. WATER HOSE CLAMP <A/T>
4. EVAPORATIVE EMISSION PURGE HOSE CONNECTION

REMOVAL STEPS (Continued)

>>F<< 5. BRAKE BOOSTER VACUUM HOSE CONNECTION
6. PRESSURE HOSE CLAMP
7. ENGINE OIL DIPSTICK AND DIPSTICK GUIDE
8. O-RING

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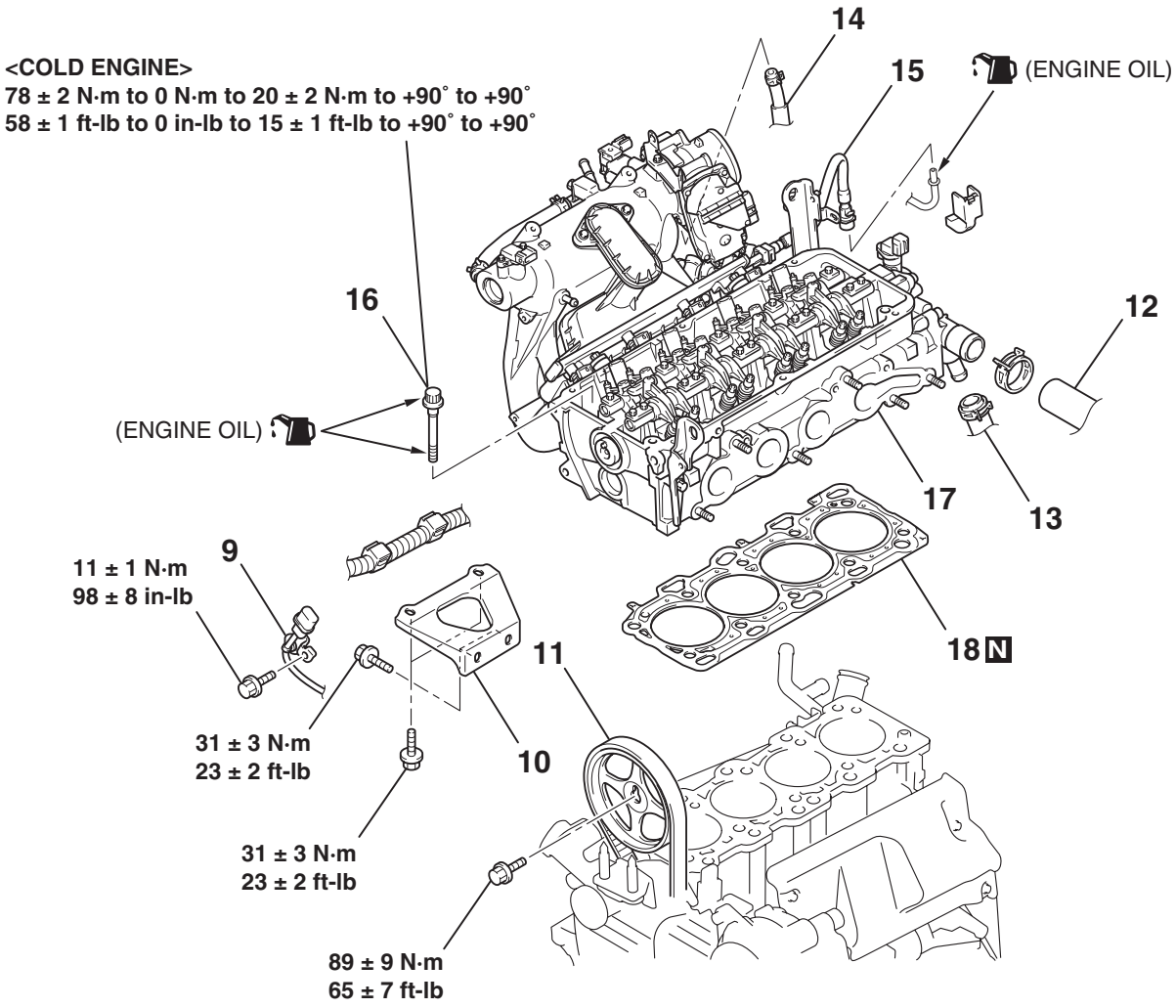

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REMOVAL STEPS

9. KNOCK SENSOR CONNECTION
10. INTAKE MANIFOLD STAY
- EXHAUST MANIFOLD (REFER TO GROUP 15, EXHAUST MANIFOLD P.15-17).
- TIMING BELT UPPER COVER (REFER TO P.11A-50).
- ENGINE FRONT MOUNTING BRACKET (REFER TO GROUP 32, ENGINE MOUNT P.32-4).

<<A>> >>E<< 11. CAMSHAFT SPROCKET
<<B>> >>D<< 12. RADIATOR UPPER HOSE CONNECTION

REMOVAL STEPS (Continued)

13. WATER COOLER HOSE CONNECTION <A/T>
14. WATER HOSE CONNECTION
- WATER INLET FITTING AND THERMOSTAT CASE ASSEMBLY (REFER TO GROUP 14, WATER HOSE AND WATER PIPE P.14-36).

<<C>> >>C<< 15. FUEL HIGH-PRESSURE HOSE CONNECTION
- ROCKER COVER ASSEMBLY (REFER TO P.11A-27).

<<D>> >>B<< 16. CYLINDER HEAD BOLTS
17. CYLINDER HEAD ASSEMBLY
>>A<< 18. CYLINDER HEAD GASKET

Required Special Tools:

- MB990767: Front Hub and Flange Yoke Holder
- MB991654: Cylinder Head Bolt Wrench (12)
- MD998719: Pin
- MD998738: Adjusting Bolt

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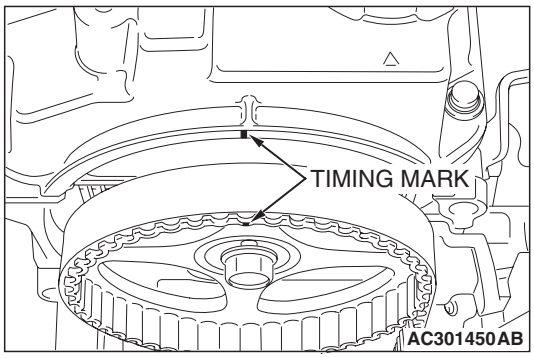
REMOVAL SERVICE POINTS

<<A>> CAMSHAFT SPROCKET REMOVAL

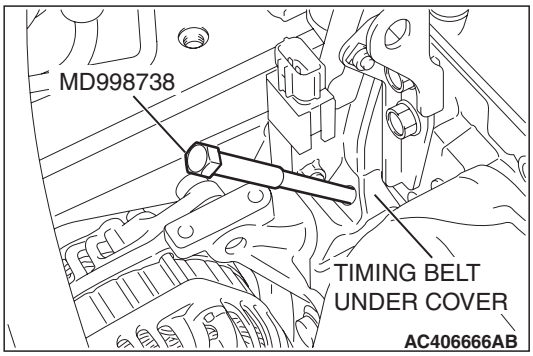
⚠ CAUTION

Never turn the crankshaft counterclockwise.

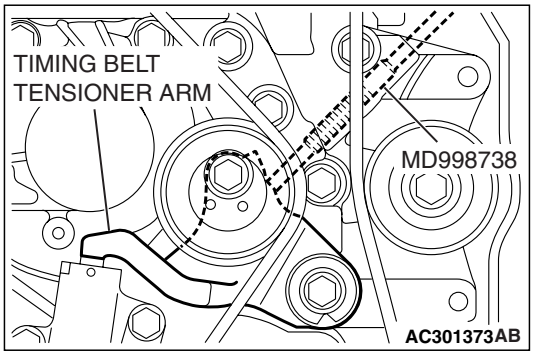
1. Turn the crankshaft clockwise, align the timing marks on the camshaft sprocket to set number 1 cylinder to TDC of its compression stroke.



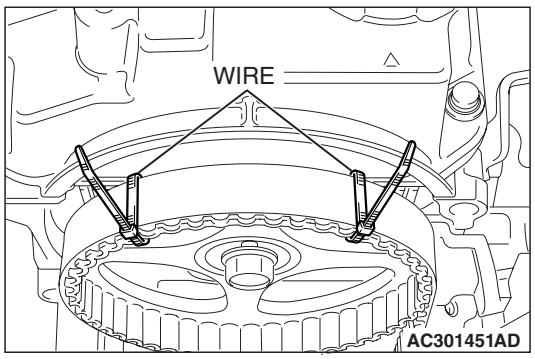
2. Remove the timing belt under cover rubber plug and then set special tool MD998738.

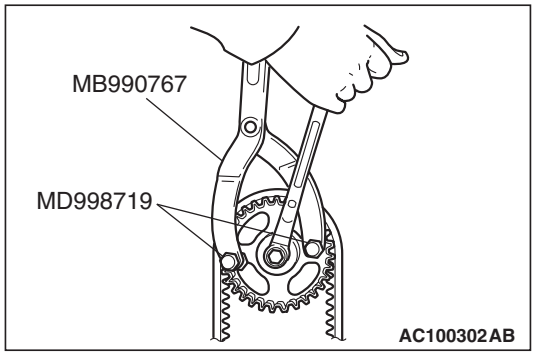


3. Screw in special tool MD998738 until it contacts the timing belt tensioner arm.



4. Secure the camshaft sprocket and valve timing belt with wire to prevent slippage between the camshaft sprocket and valve timing belt.





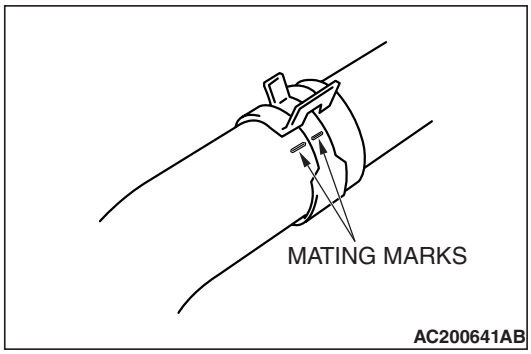
5. Hold the camshaft sprocket with special tools MB990767 and MD998719.

⚠ CAUTION

Do not rotate the crankshaft after camshaft sprocket removal.

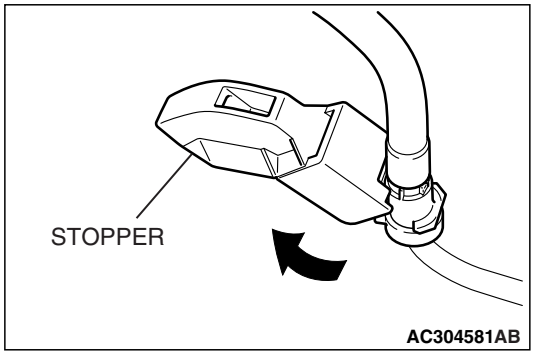
6. Remove the camshaft sprocket with the valve timing belt and place it on the timing belt lower cover.

<<B>> RADIATOR UPPER HOSE DISCONNECTION

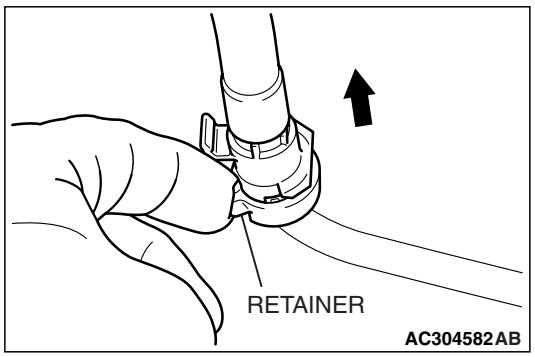


Make mating marks on the radiator upper hose and the hose clamp. Disconnect the radiator upper hose.

<<C>> FUEL HIGH-PRESSURE HOSE DISCONNECTION



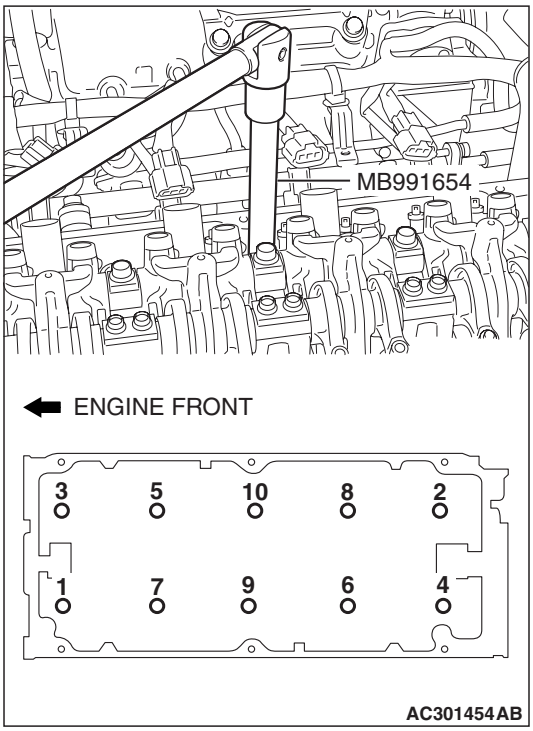
1. Remove the fuel high-pressure hose stopper.



2. Pull up the retainer and remove the fuel high-pressure hose in the direction shown.

   NOTE: If the retainer is released, install it after removing the fuel high-pressure hose.

<<D>> CYLINDER HEAD BOLTS REMOVAL



Use special tool MB991654 to loosen the cylinder head bolts in two or three steps in the order shown in the illustration. If the cylinder head bolts cannot be pulled out due to the washer being trapped in the valve spring, raise the bolt slightly, then remove it while holding it with a magnet.

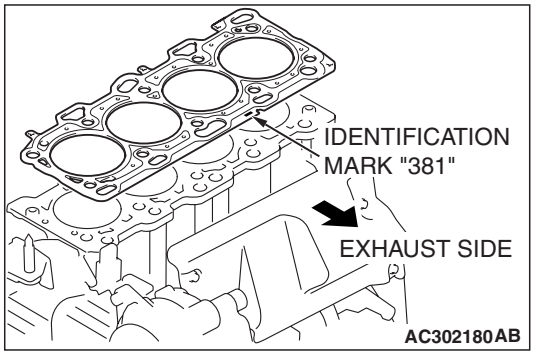
INSTALLATION SERVICE POINTS

>>A<< CYLINDER HEAD GASKET INSTALLATION

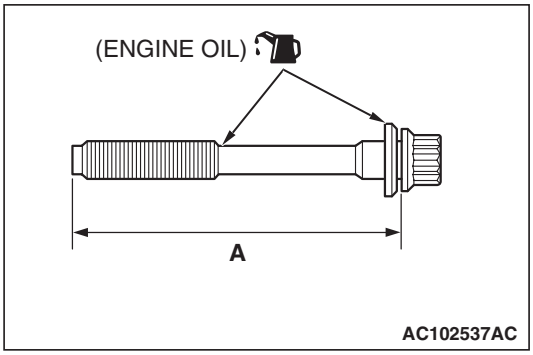
⚠ CAUTION

Do not allow any foreign materials get into the coolant passages, oil passages and cylinder.

1. Degrease the cylinder head gasket mounting surface.
2. Assemble to the cylinder block so the cylinder head gasket identification mark of "381" is at the top surface and on the exhaust side.



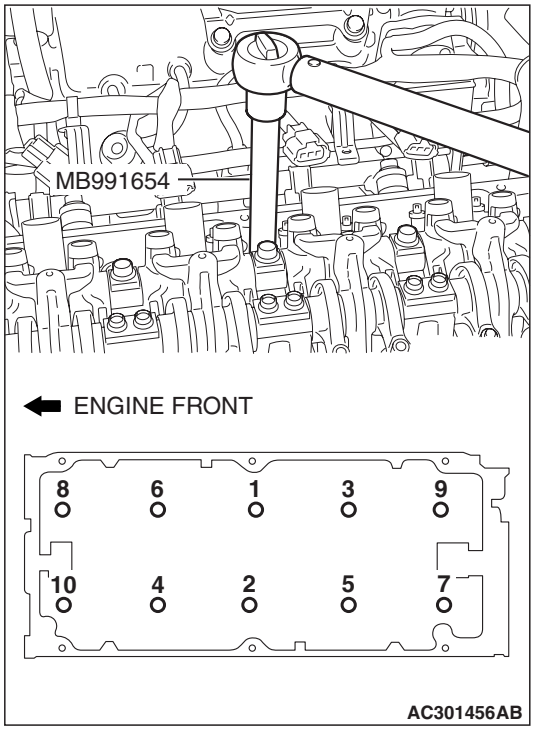
>>B<< CYLINDER HEAD BOLTS INSTALLATION



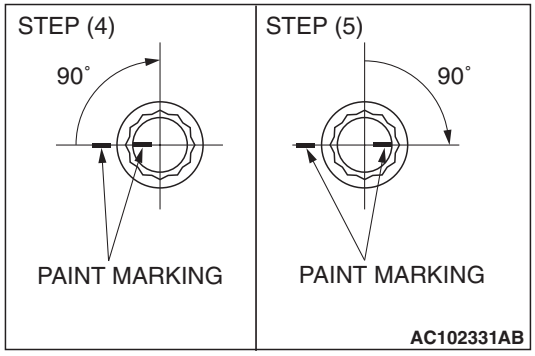
1. Check that the nominal length of each cylinder head bolt meets the limit. If it exceeds the limit, replace the bolt with a new one.

   Limit (A): 99.4 mm (3.91 inches)

2. Apply a small amount of engine oil to the thread of the bolts and to the washers.



3. Use special tool MB991654 to tighten the cylinder head bolts in the following procedures.
   (1) Tighten the bolts to 78 ±2 N· m (58 ±1 ft-lb) in the order shown.
   (2) Loosen the bolts fully in the reverse sequence of that shown.
   (3) Tighten the bolts to 20 ±2 N· m (15 ±1 ft-lb) in the order shown.
   (4) Reconfirm all bolts tightened firmly.



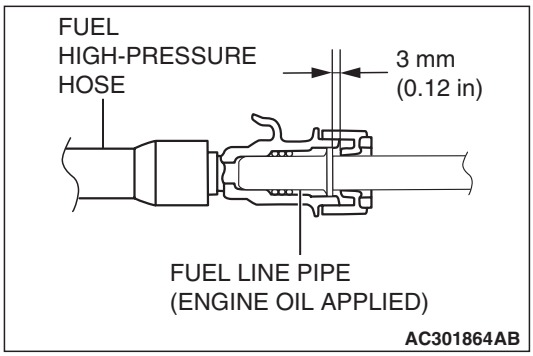
   (5) Apply a paint mark to the heads of the cylinder head bolts and cylinder head, then tighten 90 degrees as shown.

⚠ CAUTION

- **The bolt is not tightening sufficiently if the tightening angle is less than 90 degrees.**
- **If the tightening angle exceeds the standard specification, remove the bolt and start over from step 1.**

   (6) Tighten 90 degrees as shown, then check to see that the paint mark on the head of the cylinder head bolt and the paint mark on the cylinder head are aligned.

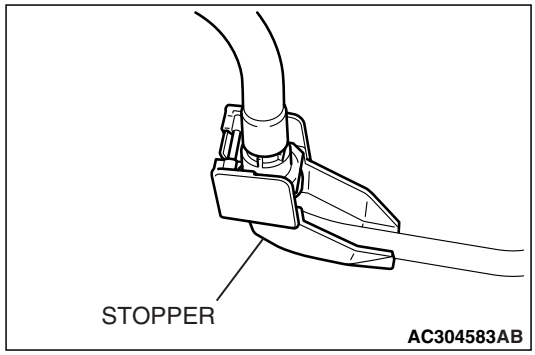
>>C<< FUEL HIGH-PRESSURE HOSE CONNECTION



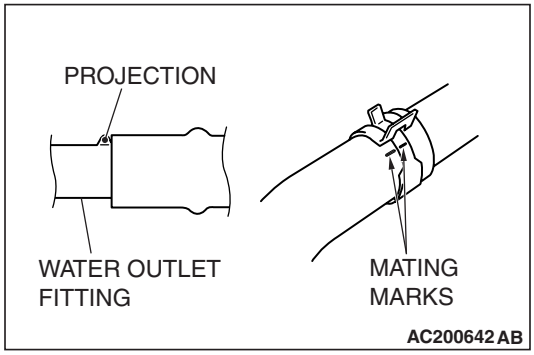
⚠ CAUTION

After connecting the fuel high-pressure hose, slightly pull it to ensure that it is installed securely. Also confirm that there is a play approximately 3 mm (0.12 inch). Then install the stopper securely.

Apply a small amount of engine oil to the fuel line pipe and then install the fuel high-pressure hose.

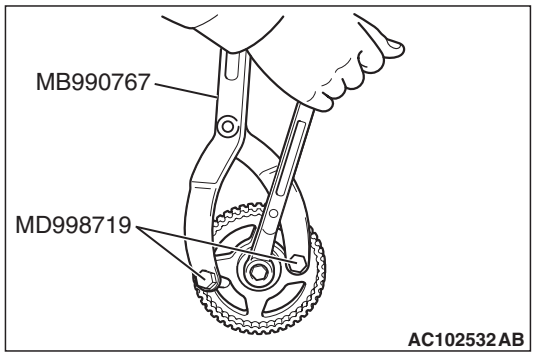


>>D<< RADIATOR UPPER HOSE CONNECTION



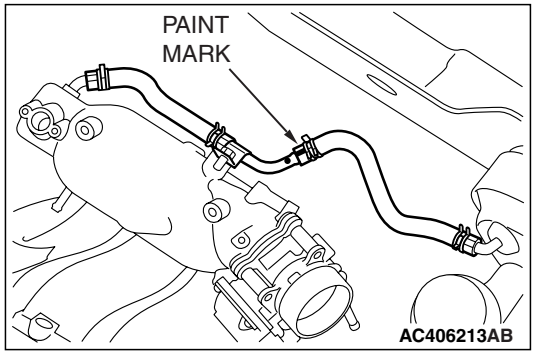
1. Insert radiator upper hose until it contacts the projection on the water outlet fitting.
2. Align the mating marks on the radiator upper hose and hose clamp, and then secure the radiator upper hose.

>>E<< CAMSHAFT SPROCKET INSTALLATION



1. Hold the camshaft sprocket with special tools MB990767 and MD998719 in the same manner as removal.
2. Tighten the camshaft sprocket mounting bolt to the specified torque.

Tightening torque: 89 ±9 N· m (65 ±7 ft-lb)



>>F<< BRAKE BOOSTER VACUUM HOSE CONNECTION

Insert the vacuum hose with its paint mark facing upward.

TIMING BELT

REMOVAL AND INSTALLATION

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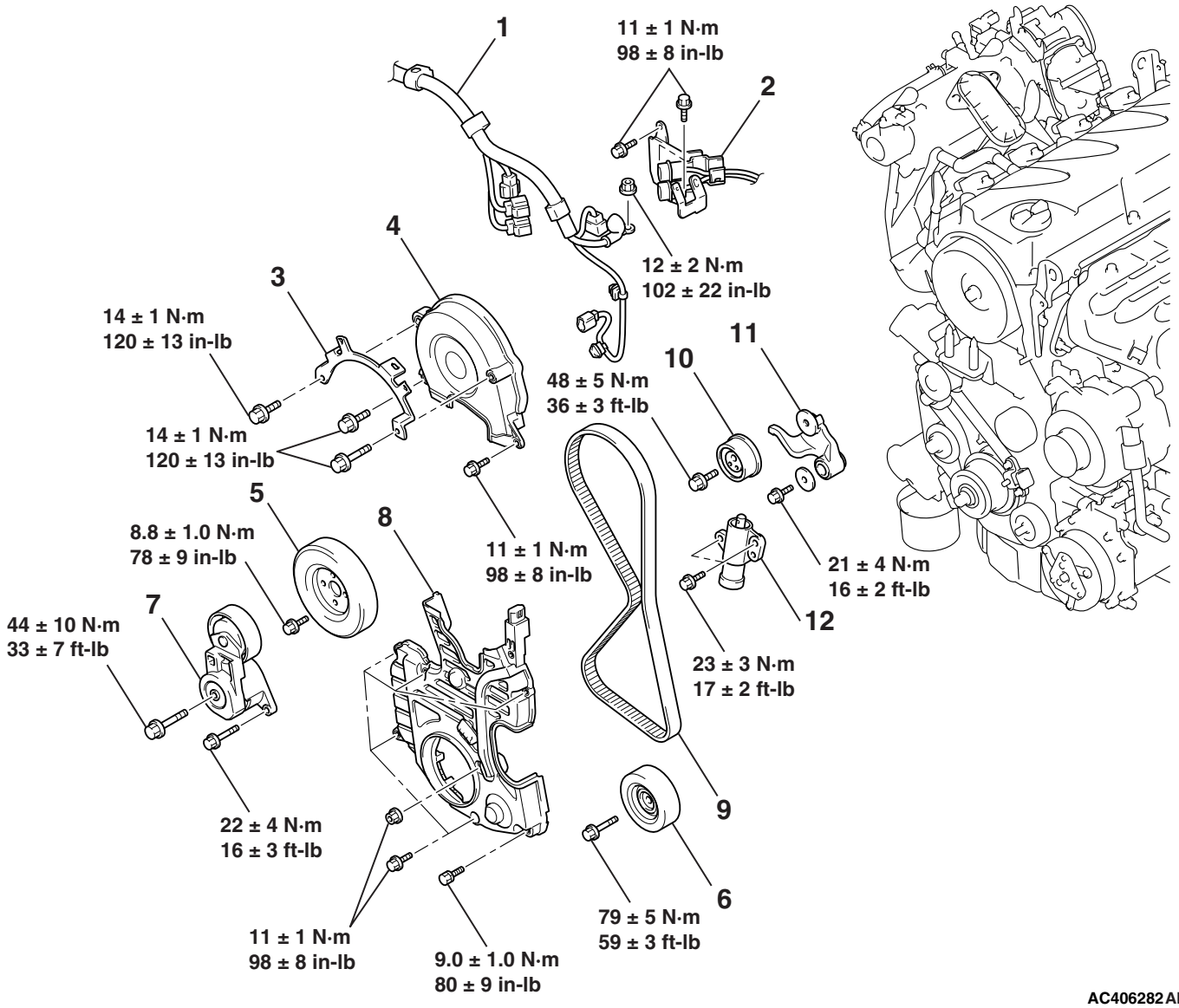
Pre-removal Operation	Post-installation Operation
• Side Under Cover Removal (Refer to GROUP 51, Under Cover P.51-8). • Crankshaft Shaft Damper Pulley Removal (Refer to P.11A-25).	• Crankshaft Shaft Damper Pulley Installation (Refer to P.11A-25). • Drive Belt Tension Check (Refer to P.11A-8). • Side Under Cover Installation (Refer to GROUP 51, Under Cover P.51-8).



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REMOVAL STEPS

1. CONTROL WIRING HARNESS CONNECTION
2. CONNECTOR BRACKET
3. HARNESS BRACKET
4. TIMING BELT UPPER COVER
   - ENGINE FRONT MOUNTING BRACKET (REFER TO GROUP 32, ENGINE MOUNT P.32-4).
5. WATER PUMP PULLEY
6. IDLER PULLEY

<<A>> >>F<< >>E<< >>D<< >>G<<

REMOVAL STEPS (Continued)

7. AUTO-TENSIONER
8. TIMING BELT LOWER COVER
   - VALVE TIMING BELT TENSION ADJUSTMENT (INSTALLATION ONLY)
9. VALVE TIMING BELT
10. TIMING BELT TENSIONER PULLEY
11. TIMING BELT TENSIONER ARM
12. TIMING BELT TENSIONER ADJUSTER

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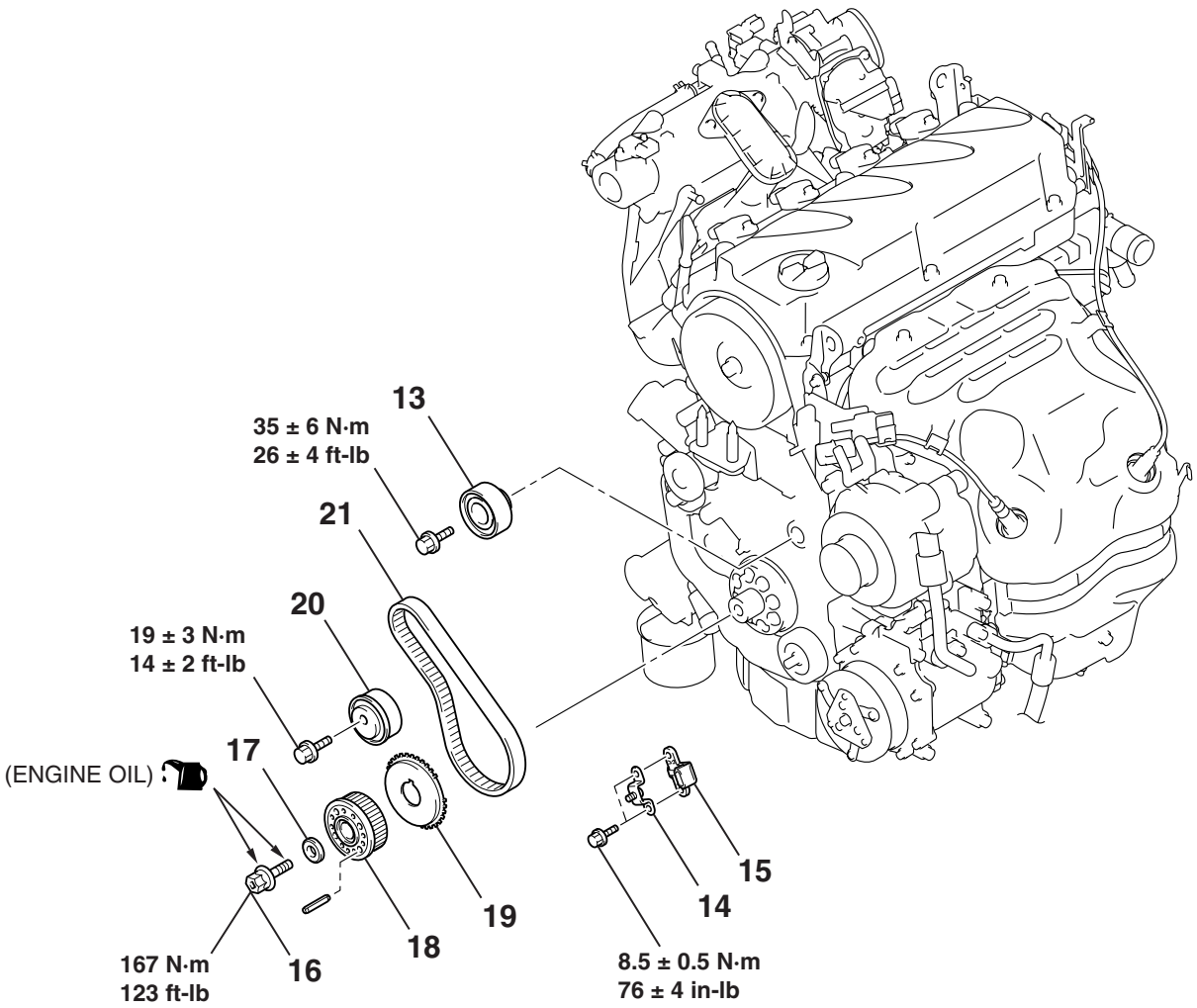

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REMOVAL STEPS

13. TIMING BELT IDLER PULLEY
14. TIMING BELT LOWER COVER BRACKET
15. CRANKSHAFT POSITION SENSOR

<<B>> >>C<< 16. CRANKSHAFT PULLEY CENTER BOLT

<<B>> >>C<< 17. CRANKSHAFT PULLEY WASHER

<<B>> >>C<< 18. CRANKSHAFT CAMSHAFT DRIVE SPROCKET

REMOVAL STEPS (Continued)

>>C<< 19. CRANKSHAFT ANGLE SENSING BLADE

>>B<< • BALANCER TIMING BELT TENSION ADJUSTMENT (INSTALLATION ONLY)

>>A<< 20. BALANCER TIMING BELT TENSIONER

<<C>> >>A<< 21. BALANCER TIMING BELT

Required Special Tools:

- MB991367: Special Spanner
- MB991385: Pin
- MD998738: Adjusting Bolt
- MD998767: Tensioner Wrench

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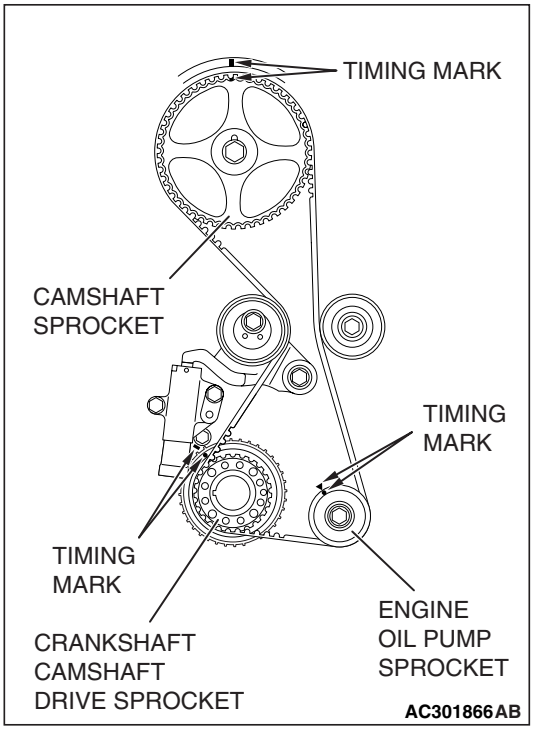
REMOVAL SERVICE POINTS

<<A>> VALVE TIMING BELT REMOVAL

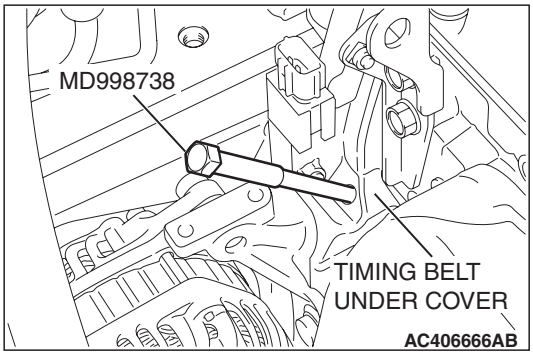
⚠ CAUTION

Never turn the crankshaft counterclockwise.

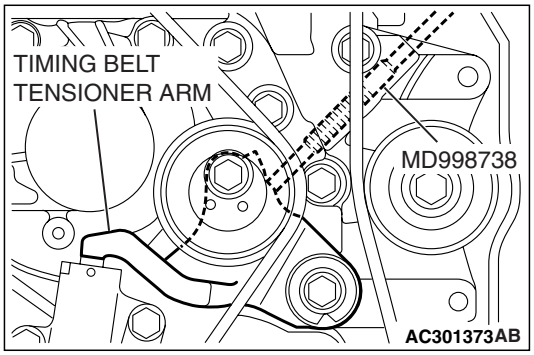
1. Turn the crankshaft clockwise, align each timing mark to set number 1 cylinder to TDC of its compression stroke.



2. Remove the timing belt under cover rubber plug and then set special tool MD998738.

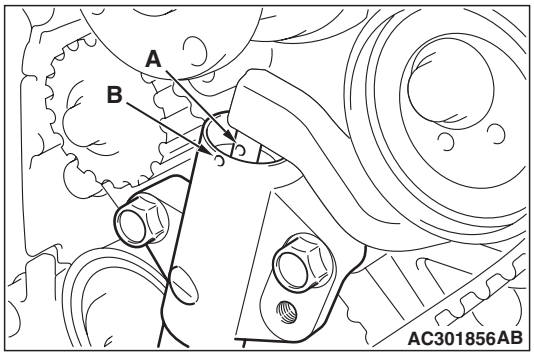


3. Screw in special tool MD998738 by hand until it contacts the timing belt tensioner arm.

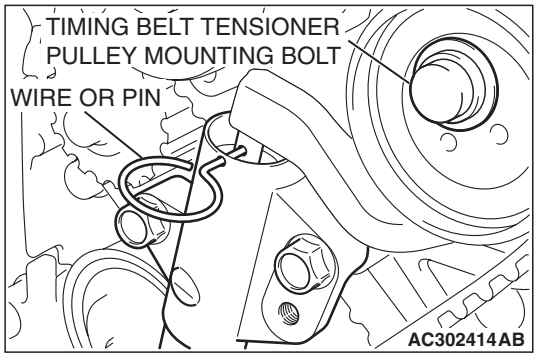


⚠ CAUTION

Special tool MD998738 must be gradually installed at a rate of 30 degrees per second. If it is screwed in all at once, the timing belt tensioner adjuster rod will not easily retract and special tool MD998738 may bend.



4. Gradually screw in special tool MD998738 and then align the timing belt tensioner adjuster rod set hole A with the timing belt tensioner adjuster cylinder set hole B.



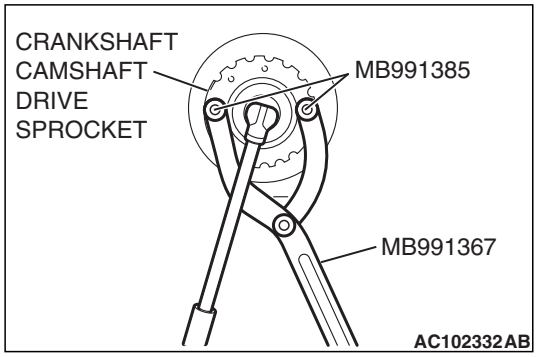
5. Insert a wire or pin in the set hole aligned.

⚠ CAUTION

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

6. After removal of special tool MD998738, loosen the timing belt tensioner pulley mounting bolt and remove the valve timing belt.

<<B>> CRANKSHAFT PULLEY CENTER BOLT/CRANKSHAFT PULLEY WASHER/CRANKSHAFT CAMSHAFT DRIVE SPROCKET REMOVAL



1. Hold the crankshaft camshaft drive sprocket with special tools MB991367 and MB991385.
2. Loosen the crankshaft pulley center bolt and remove the crankshaft pulley washer and crankshaft camshaft drive sprocket.

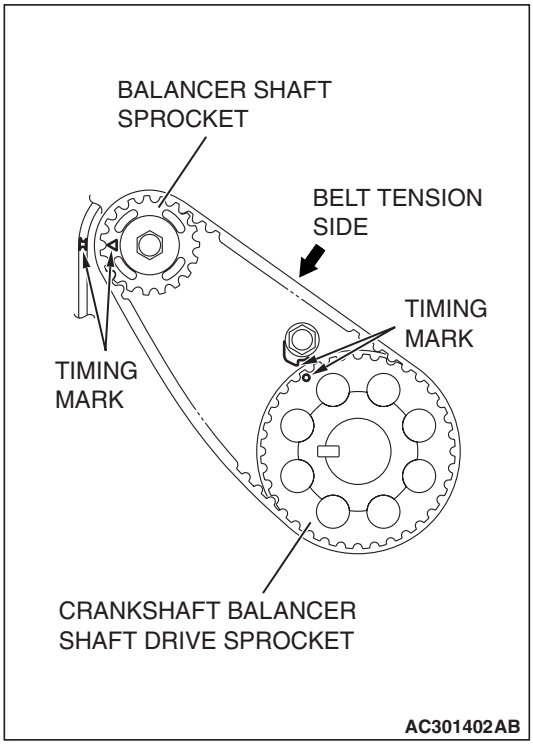
<<C>> BALANCER TIMING BELT REMOVAL

⚠ CAUTION

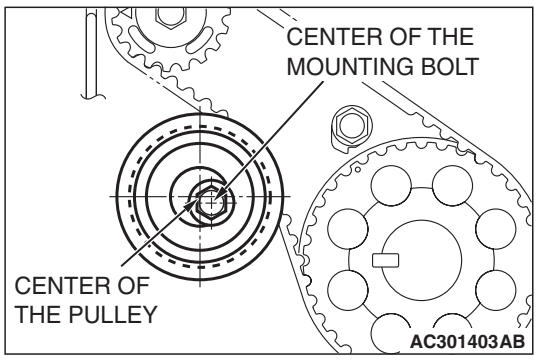
To reuse the balancer timing belt, draw an arrow indicating the rotating direction on the back of the belt using chalk, etc.

INSTALLATION SERVICE POINTS

>>A<< BALANCER TIMING BELT/BALANCER TIMING BELT TENSIONER INSTALLATION



1. Ensure that the crankshaft balancer shaft drive sprocket timing marks and balancer shaft sprocket timing marks are aligned.
2. Install the balancer timing belt on the crankshaft balancer shaft drive sprocket and balancer shaft sprocket. There should be no slack on the tension side.

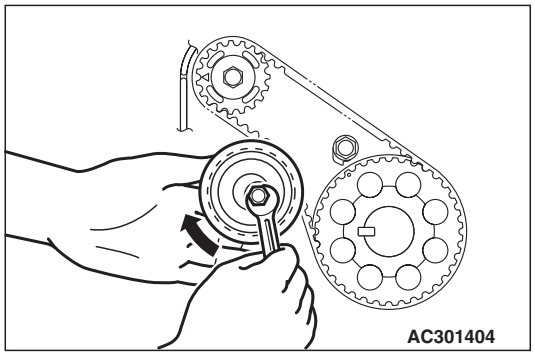


3. Assemble and temporarily secure the center of the pulley of the balancer timing belt tensioner so that it is at the top left from the center of the assembling bolt, and the pulley flange is at the front-side of the engine.
4. Adjust the balancer timing belt tension.

>>B<< BALANCER TIMING BELT TENSION ADJUSTMENT

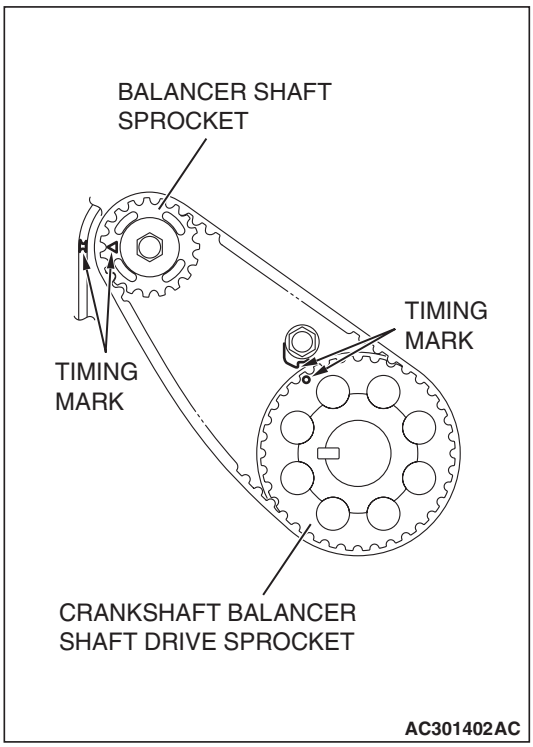
⚠ CAUTION

When tightening the mounting bolts, ensure that the tensioner does not rotate with the bolts. Allowing it to rotate with the bolts can cause excessive tension of the belt.

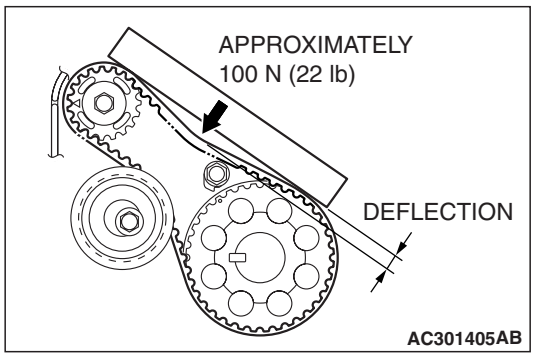


1. Lift with your fingers the balancer timing belt tensioner in the direction of the arrow. Apply a tensile torque of [3.0 ±0.4 N· m (26 ±4 in-lb)] to the balancer timing belt so the belt is tense without any looseness. Tighten the assembling bolt to the specified torque in this state. Then, fix the balancer timing belt tensioner.

   Tightening torque: 19 ±3 N· m (14 ±2 ft-lb)



2. Turn the crankshaft clockwise two turns to set number 1 cylinder to TDC of its compression stroke and check that sprocket timing marks are aligned.

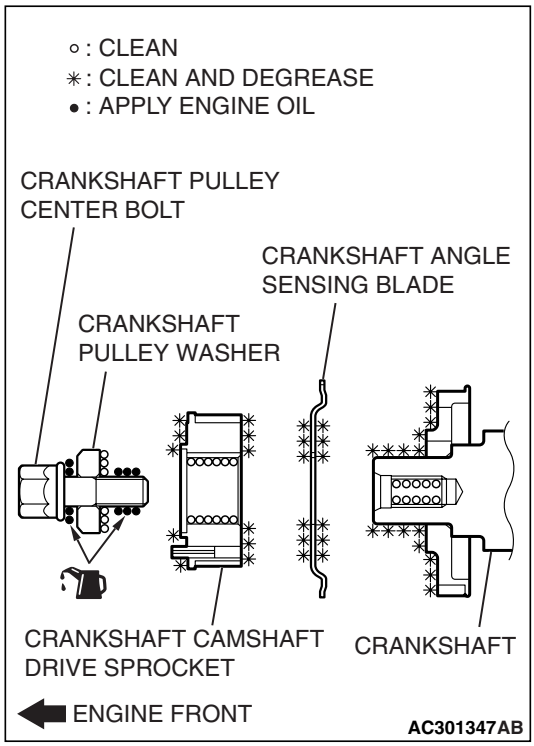


3. Apply a pressure of approximately 100 N (22 pounds) at the center (arrow area) between the sprocket as shown in the figure, then inspect whether the belt deflection is within the standard value.

   Standard value:
   <When adjusting> 5 –7 mm (0.20 –0.27 inch)
   <When replacing> 5 –7 mm (0.20 –0.27 inch)

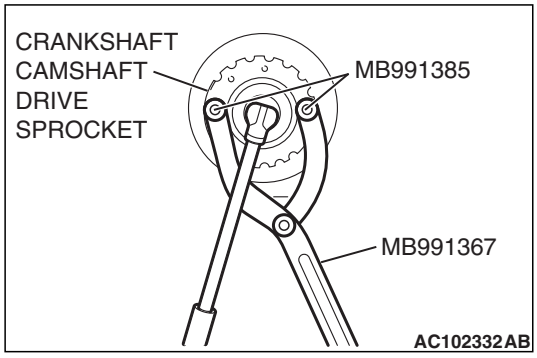
4. If not within the standard value, adjust the belt tension again.

>>C<< CRANKSHAFT ANGLE SENSING BLADE/CRANKSHAFT CAMSHAFT DRIVE SPROCKET/CRANKSHAFT PULLEY WASHER/CRANKSHAFT PULLEY CENTER BOLT INSTALLATION



1. Clean or degrease the crankshaft, the crankshaft angle sensing blade, the crankshaft camshaft drive sprocket and crankshaft pulley washer as shown.

   NOTE: Also clean the degreased surfaces.
2. Install the crankshaft angle sensing blade and crankshaft camshaft drive sprocket in the direction shown.
3. Place the larger chamfer side of the crank shaft pulley washer in the direction shown in the Figure, and then assemble on the crank shaft pulley center bolt.
4. Apply a small amount of engine oil to the crank shaft pulley center bolt bearing surface and screw.

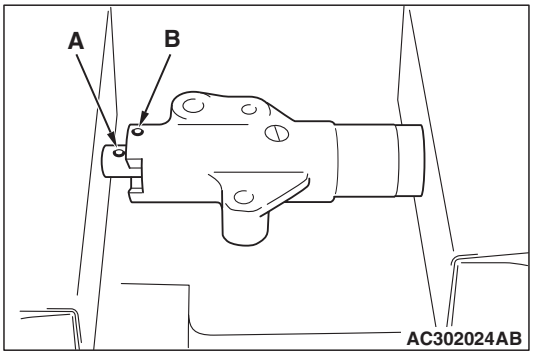


5. Hold the crankshaft camshaft drive sprocket with special tools MB991367 and MB991385 in the same manner as removal.
6. Tighten the crankshaft pulley center bolt to the specified torque.

   Tightening torque: 167 N·m (123 ft-lb)

>>D<< TIMING BELT TENSIONER ADJUSTER INSTALLATION

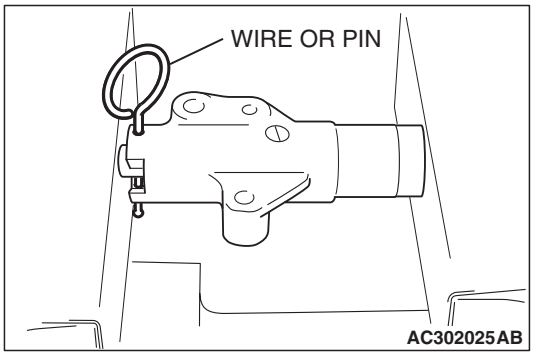
1. Set according to the following procedures with the timing belt tensioner adjuster rod fully extended.



⚠ CAUTION

If the rod is compressed too quickly, it may be damaged.

(1) Slowly compress the timing belt tensioner adjuster rod using a press or vice, then align set hole A of the rod with set hole B of the timing belt tensioner adjuster cylinder.



(2) Insert a wire or pin in the set hole aligned.

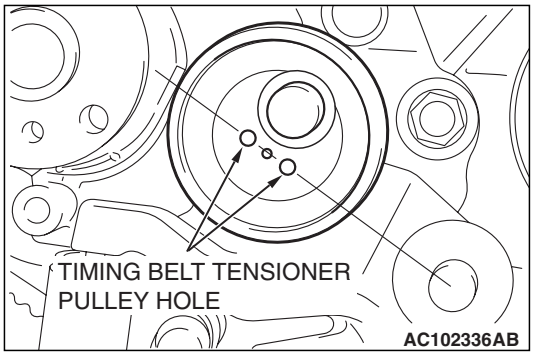
NOTE: When replacing the timing belt tensioner adjuster with new parts, the timing belt tensioner adjuster is set with a pin.

2. Install the timing belt tensioner adjuster to the engine and then tighten the mounting bolts to the specified torque. Do not remove the wire or pin until the tension of the valve timing belt is adjusted.

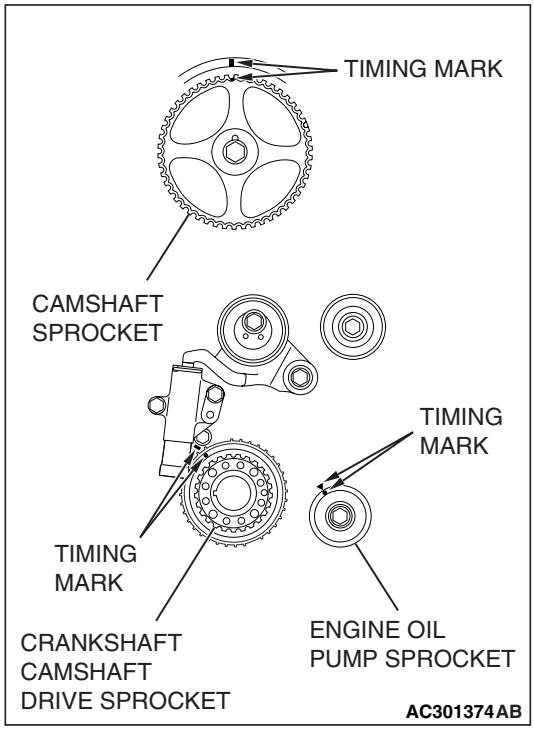
Tightening torque: 23 ±3 N· m (17 ±2 ft-lb)

>>E<< TIMING BELT TENSIONER PULLEY INSTALLATION

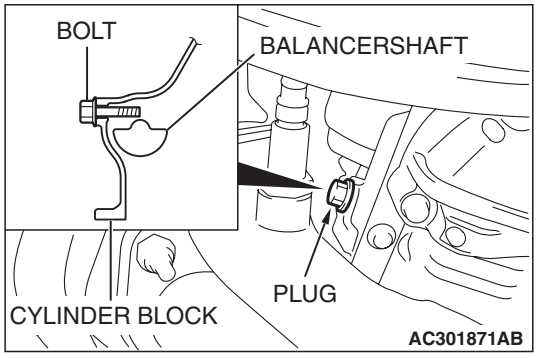
Temporarily tighten the timing belt tensioner pulley as shown.



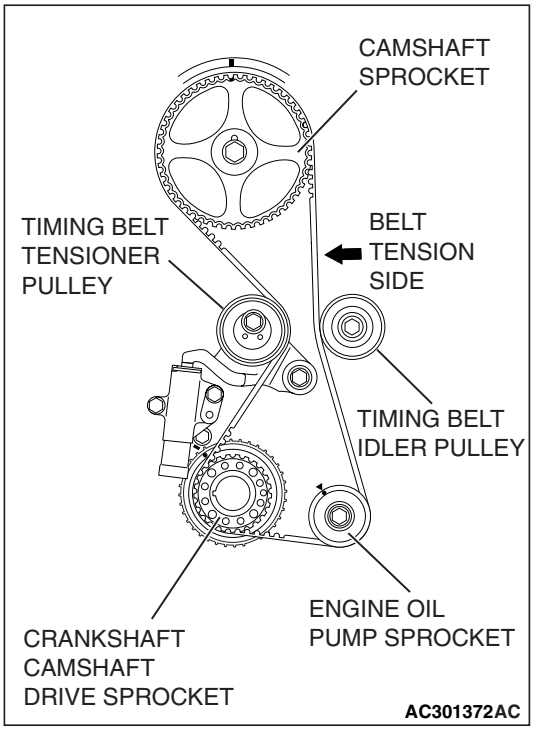
>>F<< VALVE TIMING BELT INSTALLATION



1. Align the timing marks on the camshaft sprocket, crankshaft camshaft drive sprocket and engine oil pump sprocket.



2. Adjust the timing mark of the engine oil pump sprocket. Unplug the cylinder block plug. Insert a bolt (M6, section width 10 mm, nominal length 45 mm) in the plug hole. If the bolt comes in contact with the balancer shaft, turn the engine oil sprocket one rotation. Re-adjust the timing mark and then check to see that the bolt fits. Do not remove the bolt until the valve timing belt is assembled.

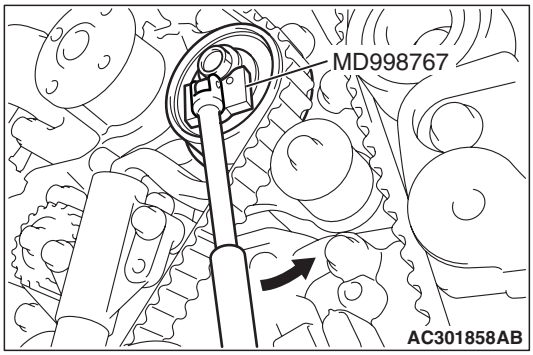


3. Install the valve timing belt in the following manner so that the tensile force of the belt is not lax.
   (1) Place the valve timing belt on the timing belt tensioner pulley and crankshaft camshaft driver sprocket and then support it with your left hand so it does not slide.
   (2) Place the valve timing belt on the engine oil pump sprocket while pulling it with the right hand.
   (3) Place the valve timing belt on the timing belt idler pulley.

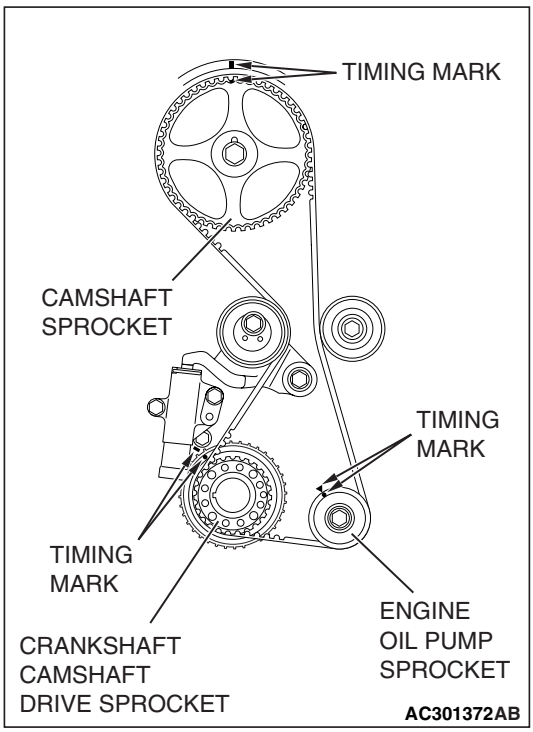
⚠ CAUTION

Install the valve timing belt. Then apply reverse rotation (counterclockwise rotation) pressure to the cam shaft sprocket. Re-check to see that each timing mark is aligned while the tension side of the belt is right.

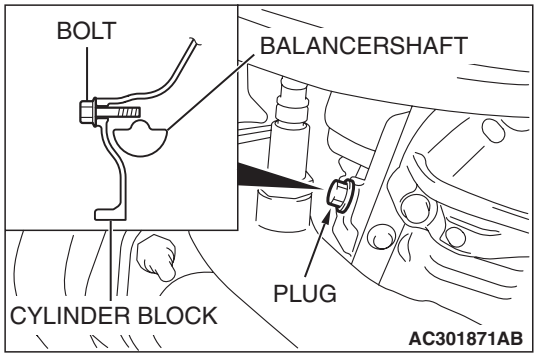
   (4) Place the valve timing belt on the camshaft sprocket.



4. Turn the timing belt tensioner pulley in the direction shown in the figure using special tool MD998767 to apply tension to the valve timing belt. Then temporarily tighten and fix the timing belt tensioner pulley mounting bolt.

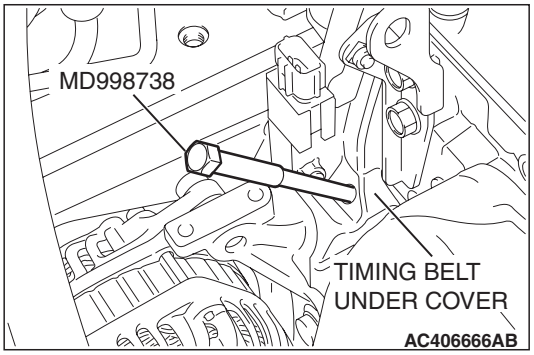


5. Check that the timing marks are aligned.



6. Remove the bolt inserted in Step 2 above, then assemble the cylinder block plug.
7. Tighten the cylinder block plug to the specified torque.
   Tightening torque: 30 ±3 N· m (23 ±2 ft-lb)
8. Adjust the valve timing belt tension.

>>G<< VALVE TIMING BELT TENSION ADJUSTMENT

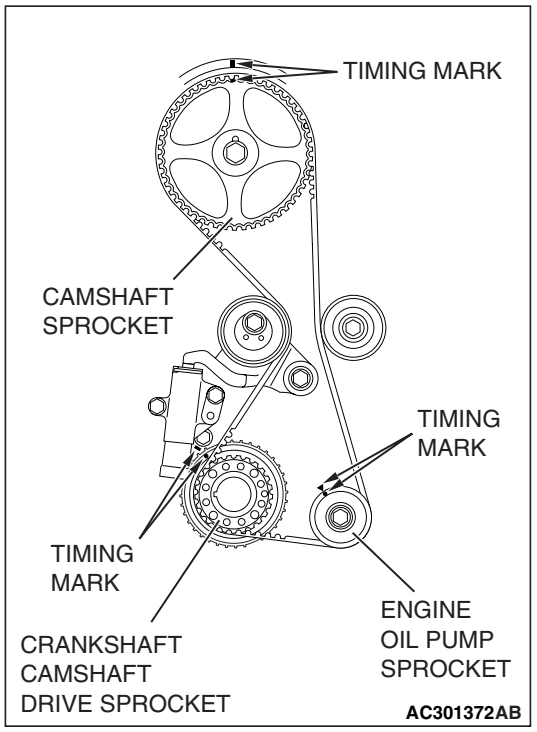


1. Set special tool MD998738 used when removing the valve timing belt.

⚠ CAUTION

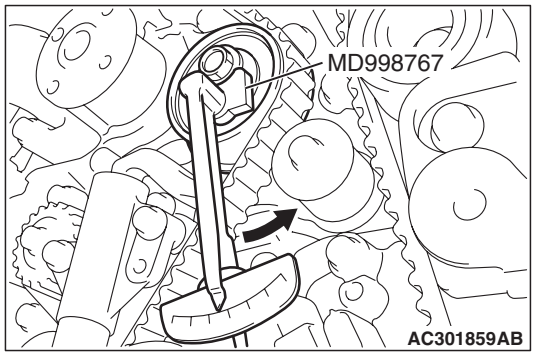
Always screw in special tool MD998738 by hand, since use of a spanner or other tools may damage the wire or pin inserted in the timing belt tensioner adjuster.

2. Gradually screw in special tool MD998738 until the wire or pin inserted in the timing belt tensioner adjuster lightly moves.
3. Turn the crankshaft 1/4 turn counterclockwise.
4. Turn the crankshaft clockwise, and align each timing mark to set number 1 cylinder to TDC of its compression stroke.
5. Loosen the timing belt tensioner pulley mounting bolt.



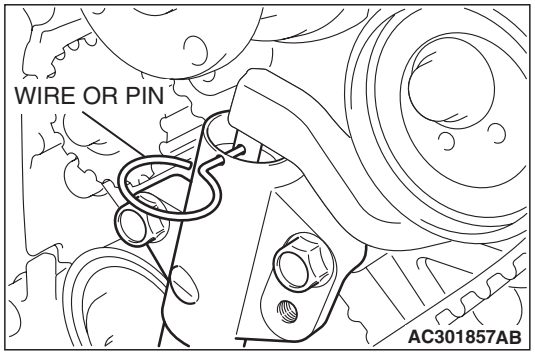
⚠ CAUTION

When tightening the mounting bolt, ensure that the timing belt tensioner pulley does not rotate with the bolt. Allowing it to rotate with the bolt can cause deficient tension of the belt.

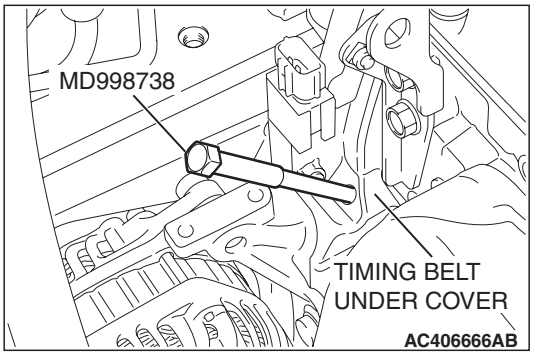


6. With special tool MD998767 and torque wrench, apply tension torque [3.5 N· m (31 in-lb)] to the valve timing belt, and tighten the timing belt tensioner pulley mounting bolt to the specified torque.

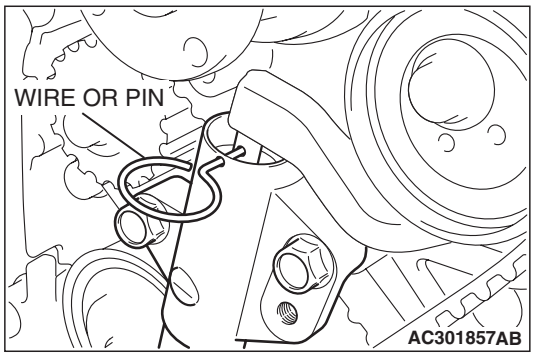
   Tightening torque: 48 ±5 N· m (36 ±3 ft-lb)



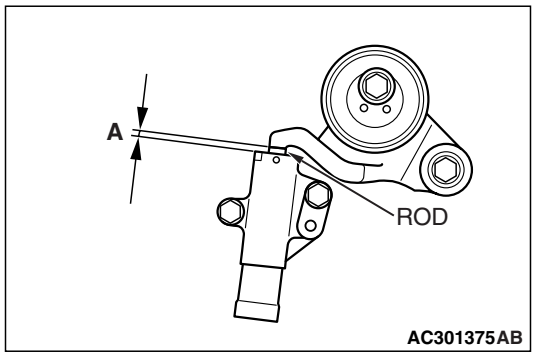
7. Remove the wire or pin inserted to timing belt tensioner adjuster.



8. Remove special tool MD998738, and install the rubber plug to the timing belt under cover.
9. Rotate crankshaft clockwise two turns, and leave it for about 15 minutes.



10. Insert the wire or pin removed in Step 7 again, and ensure that it can be pulled out easily. When the wire or pin can be easily removed, appropriate tension is applied on timing belt. In this case, remove wire or pin.



Also when the projection of timing belt tensioner adjuster rod (A) is within the standard value, appropriate tension is applied.

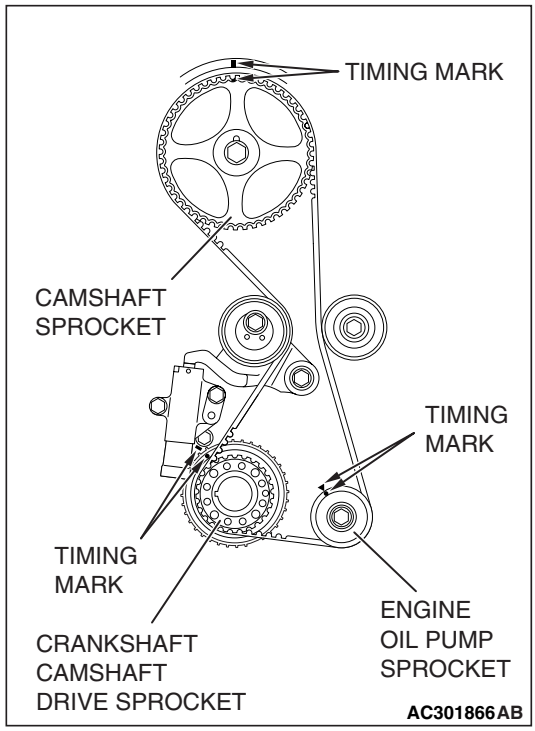
Standard value (A): 3.8 –4.5 mm (0.15 –0.17 inch)

11. If wire or pin cannot be easily pulled out, repeat Step 1 through Step 9 to reach proper valve timing belt tension.

⚠ CAUTION

Always check the tightening torque of the crank shaft pulley center bolt when turning the crank shaft pulley center bolt counterclockwise. Re-tighten if it is loose.

12. Check again that the timing marks on sprockets are aligned.



INSPECTION

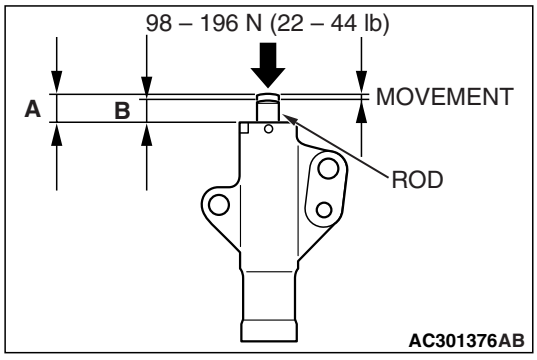
M1112004400642

TIMING BELT TENSIONER ADJUSTER CHECK

1. Check for oil leak from seal, and replace it if a leak is detected.
2. Check for wear or damage at the top of the rod. Replace it, if required.
3. Hold the timing belt tensioner adjuster by hand, and press the top end of the rod onto the metal (e.g. cylinder block) with 98 –196 N (22 –44 pounds) of pressure, and measure the movement of the rod.

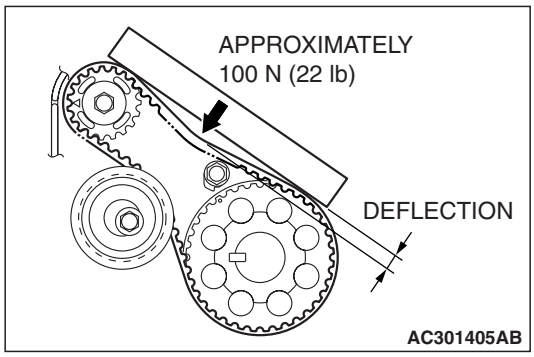
   Standard value: Within 1 mm (0.039 inch)
   A: Length when it is free (not pressed)
   B: Length when it is pressed
   A –B: Movement

4. If the measured value is out of the standard value, replace the timing belt tensioner adjuster.



BALANCER TIMING BELT TENSION CHECK

Check the balancer timing belt tension in the following procedures.



1. Apply a pressure of approximately 100 N (22 pounds) at the center (arrow area) between the sprocket as shown in the figure, then inspect whether the flexure is within the standard value.

   Standard value: 5 – 10 mm (0.20 – 0.39 inch)

2. If not within the standard value, adjust the belt tension. (Refer to P.11A-50).

SPECIFICATIONS

FASTENER TIGHTENING SPECIFICATIONS

M1111003800536

ITEM	SPECIFICATION
Camshaft and valve stem seal	
Accumulator assembly	44 ±5 N· m (33 ±3 ft-lb)
Camshaft position sensing cylinder bolt	22 ±4 N· m (16 ±3 ft-lb)
Camshaft position sensor support bolt	14 ±1 N· m (120 ±13 in-lb)
Camshaft sprocket bolt	89 ±9 N· m (65 ±7 ft-lb)
Connector bracket bolt	11 ±1 N· m (98 ±8 in-lb)
Control wiring harness bolt	9.0 ±2.0 N· m (80 ±17 in-lb)
Control wiring harness protector bolt	5.0 ±1.0 N· m (44 ±9 in-lb)
Cylinder head plug	47 ±7 N· m (35 ±5 ft-lb)
Engine oil control valve bolt	11 ±1 N· m (98 ±8 in-lb)
Engine oil pressure switch	10 ±2 N· m (89 ±17 in-lb)
Exhaust rocker arm shaft bolt	13 ±1 N· m (115 ±9 in-lb)
Intake rocker arm shaft bolt	31 ±3 N· m (23 ±2 ft-lb)
Rocker cover assembly bolt	3.5 ±0.5 N· m (31 ±4 in-lb)
Spark plug	25 ±4 N· m (18 ±3 ft-lb)
Crankshaft oil seal	
A/T drive plate bolt	132 ±5 N· m (98 ±3 ft-lb)
Flywheel bolt	132 ±5 N· m (98 ±3 ft-lb)
Crankshaft pulley	
Crankshaft damper pulley bolt	25 ±4 N· m (18 ±3 ft-lb)
Cylinder head gasket	
Camshaft sprocket bolt	89 ±9 N· m (65 ±7 ft-lb)
Control wiring harness bolt	9.0 ±2.0 N· m (80 ±17 in-lb)
Control wiring harness protector bolt	5.0 ±1.0 N· m (44 ±9 in-lb)
Cylinder head bolt <Cold engine>	78 ±2 N· m to 0 N· m to 20 ±2 N· m to +90° to +90° to (58 ±1 ft-lb to 0 in-lb to 15 ±1 ft-lb to +90° to +90°)
Engine oil dipstick guide bolt	13 ±1 N· m (115 ±9 in-lb)
Generator terminal nut	12 ±2 N· m (102 ±22 in-lb)
Intake manifold stay bolt	31 ±3 N· m (23 ±2 ft-lb)
Knock sensor connector bracket bolt	11 ±1 N· m (98 ±8 in-lb)
Pressure hose clamp bolt	12 ±2 N· m (102 ±22 in-lb)
Radiator lower hose clamp bolt	11 ±1 N· m (98 ±8 in-lb)
Water hose clamp bolt	11 ±1 N· m (98 ±8 in-lb)
Engine assembly	
ATF warmer (transmission fluid cooler) bracket bolt	23 ±3 N· m (17 ±2 ft-lb)
Battery terminal nut	5.0 ±1.0 N· m (44 ±9 in-lb)
Control wiring harness bolt and nut	9.0 ±2.0 N· m (80 ±17 in-lb)

TSB Revision

ITEM		SPECIFICATION
Control wiring harness protector bolt		5.0 ±1.0 N· m (44 ±9 in-lb)
Engine front mounting bracket bolt	M10	58 ±7 N· m (43 ±5 ft-lb)
Engine front mounting bracket bolt and nut	M12	83 ±12 N· m (61 ±9 ft-lb)
Grounding cable bolt		9.0 ±2.0 N· m (80 ±17 in-lb)
Power steering oil pump bracket bolt		24 ±4 N· m (18 ±3 ft-lb)
Power steering oil pump bracket nut		44 ±10 N· m (33 ±7 ft-lb)
Pressure hose clamp bolt		12 ±2 N· m (102 ±22 in-lb)
Oil pan		
Baffle plate bolt (bolt, washer assembled)	M6	9.0 ±2.0 N· m (80 ±17 in-lb)
	M8	22 ±4 N· m (16 ±3 ft-lb)
Engine oil pan bolt		9.0 ±3.0 N· m (80 ±26 in-lb)
Engine oil pan drain plug		39 ±5 N· m (29 ±3 ft-lb)
Engine oil pan strainer bolt		19 ±3 N· m (14 ±2 ft-lb)
Torque converter housing front lower cover bolt (bolt, flange)	M10	26 ±5 N· m (19 ±4 ft-lb)
Torque converter housing front lower cover bolt (bolt, washer assembled)	M6	9.0 ±1.0 N· m (80 ±9 in-lb)
Timing belt		
Auto-tensioner bolt (bolt, washer assembled)	M8	22 ±4 N· m (16 ±3 ft-lb)
	M10	44 ±10 N· m (33 ±7 ft-lb)
Balancer timing belt tensioner bolt		19 ±3 N· m (14 ±2 ft-lb)
Connector bracket bolt		11 ±1 N· m (98 ±8 in-lb)
Crankshaft pulley center bolt		167 N· m (123 ft-lb)
Cylinder block plug		30 ±3 N· m (23 ±2 ft-lb)
Generator terminal nut		12 ±2 N· m (102 ±22 in-lb)
Idler pulley bolt		79 ±5 N· m (59 ±3 ft-lb)
Timing belt idler pulley bolt		35 ±6 N· m (26 ±4 ft-lb)
Timing belt lower cover bolt (bolt, flange)	M6	11 ±1 N· m (98 ±8 in-lb)
Timing belt lower cover bolt (bolt, washer assembled)	M6	9.0 ±1.0 N· m (80 ±9 in-lb)
Timing belt lower cover bracket bolt		8.5 ±0.5 N· m (76 ±4 in-lb)
Timing belt lower cover nut		11 ±1 N· m (98 ±8 in-lb)
Timing belt tensioner adjuster bolt		23 ±3 N· m (17 ±2 ft-lb)
Timing belt tensioner arm bolt		21 ±4 N· m (16 ±2 ft-lb)
Timing belt tensioner pulley bolt		48 ±5 N· m (36 ±3 ft-lb)
Timing belt upper cover bolt (bolt, flange)	M6	11 ±1 N· m (98 ±8 in-lb)
	M8	14 ±1 N· m (120 ±13 in-lb)
Water pump pulley bolt		8.8 ±1.0 N· m (78 ±9 in-lb)

SERVICE SPECIFICATIONS

M1111000300844

ITEM		STANDARD VALUE	LIMIT
Drive belt tension	Vibration frequency Hz (Reference)	120 – 154	–
	Tension N (Reference)	340 – 562	–
Valve clearance (at hot) mm (in)	Intake valve	0.20 (0.008)	–
	Exhaust valve	0.30 (0.012)	–
Actual ignition timing at idle		Approximately 10° BTDC	–
Basic ignition timing at idle		5° BTDC ±3°	–
CO content%		0.5 or less	–
HC contents ppm		100 or less	–
Curb idle speed r/min		700 ±100	–
Compression pressure (250 – 400 r/min) kPa (psi)		1,560 (226)	Minimum 1,130 (164)
Intake manifold vacuum at curb idle kPa (in Hg)		–	Minimum 60 (18)
Cylinder block heater unit internal resistance Ω		28 – 40	–
Cylinder head bolt nominal length mm (in)		–	99.4 (3.91)
Balancer timing belt tension (When adjusted)	Deflection mm (in)	5 – 7 (0.20 – 0.27)	–
Balancer timing belt tension (When replaced)	Deflection mm (in)	5 – 7 (0.20 – 0.27)	–
Balancer timing belt tension (When checked)	Deflection mm (in)	5 – 10 (0.20 – 0.39)	–
Timing belt tensioner adjuster rod protrusion amount mm (in)		3.8 – 4.5 (0.15 – 0.17)	–
Timing belt tensioner adjuster rod movement mm (in)		Within 1 (0.039)	–

SEALANTS

M1111000500428

ITEM	SPECIFIED SEALANT
Camshaft position sensor support	3M™ AAD Part No.8672, 3M™ AAD Part No.8679/8678 or equivalent
Engine oil pressure switch	
Engine oil pan	3M™ AAD Part No.8672, 8704, 3M™ AAD Part No.8679/8678 or equivalent