

2010 ENGINE

Engine Mechanical <3.8L> - Galant

GENERAL DESCRIPTION

The 6G75 (3.8 L MIVEC) engine is a six-cylinder engine. The cylinder numbers are assigned as 1-3-5 for the right bank and 2-4-6 for the left bank from the front of the engine (timing belt side). This engine is fired in the order of 1-2-3-4-5-6 cylinders.

ITEM SPECIFICATION

ITEM			SPECIFICATION
Type			V type, overhead camshaft
Number of cylinders			6
Bore mm (in)			95.0 (3.74)
Stroke mm (in)			90.0 (3.54)
Total displacement cm ³ (cu. in)			3,828 (233.6)
Compression ratio			10.5
Firing order			1-2-3-4-5-6
Valve timing	Intake valve	Opens (BTDC)	-2° <Low speed cam A>
			0° <Low speed cam B>
			15° <High speed cam>
		Closes (ABDC)	50° <Low speed cam A>
			52° <Low speed cam B>
			69° <High speed cam>
Exhaust valve	Opens (BBDC)	57°	
	Closes (ATDC)	19°	
Lubrication system			Pressure feed, full-flow filtration
Oil pump type			Trochoid type

ENGINE DIAGNOSIS

SYMPTOM CHART

SYMPTOMS	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
	Engine oil level is too low	Check the engine oil level.
	Malfunction of engine oil pressure switch	Replace the engine oil pressure switch.

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Drop in engine oil pressure	Clogged oil filter	Install a new filter.
	Worn oil pump gears or cover	Replace the gears and/or the cover.
	Thin or diluted engine oil	Change the engine oil to the correct viscosity.
	Stuck (opened) oil relief valve	Repair the relief valve.
	Excessive bearing clearance	Replace the bearings.
Engine oil pressure too high	Stuck (closed) oil relief valve	Repair the relief valve.
Noisy valves	Incorrect valve clearance <Intake side>	Adjust valve clearance
	Malfunction of lash adjuster (including entry of air into high pressure chamber) <Exhaust side>	Check the lash adjuster.
	Thin or diluted engine oil (low engine oil pressure)	Change the engine oil.
	Worn or damaged valve stem or valve guide	Replace the valve and/or the guide.
Connecting rod noise/main bearing noise	Insufficient oil supply	Check the engine oil level.
	Thin or diluted engine oil	Change the engine oil.
	Excessive bearing clearance	Replace the bearings.

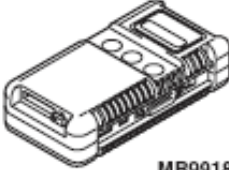
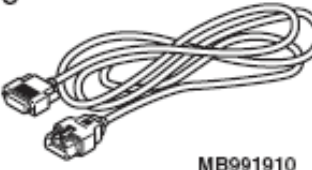
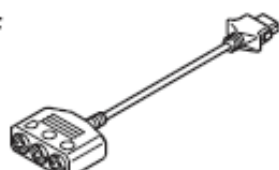
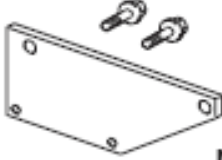
SPECIAL TOOLS

SPECIAL TOOLS CHART

TOOL	TOOL NUMBER AND NAME	SUPERSESSION	APPLICATION
	MB992080 Belt tension meter set		
	A. MB992081 Belt tension meter B. MB992082 Microphone assembly	Tool not available	Drive belt tension check
	MB991958 Scan tool (M.U.T.-III sub assembly) A. MB991824 Vehicle communication interface (V.C.I.)		

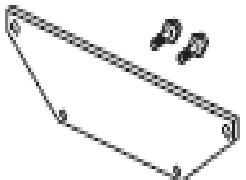
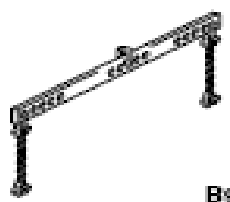
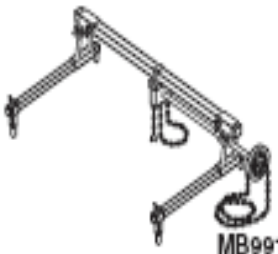
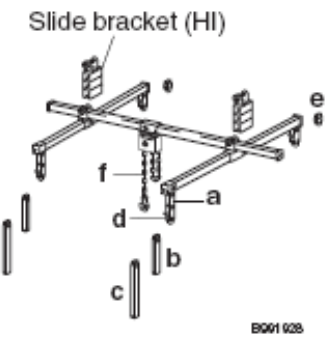
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A  MB991824 B  MB991827 C  MB991910 D  MB991911 E  MB991914 F  MB991825 G  MB991826 MB991958	B. MB991827 M.U.T.-III USB cable C. MB991910 M.U.T.-III main harness A (Vehicles with CAN communication system) D. MB991911 M.U.T.-III main harness B (Vehicles without CAN communication system) E. MB991914 M.U.T.-III main harness C (for Chrysler models only) F. MB991825 M.U.T.-III adapter harness G. MB991826 M.U.T.-III trigger harness	MB991824-KIT NOTE: G: MB991826 M.U.T.-III Trigger Harness is not necessary when pushing V.C.I. ENTER key.	CAUTION: For vehicles with CAN communication, use M.U.T.-III main harness A to send simulated vehicle speed. If you connect M.U.T.-III main harness B instead, the CAN communication does not function correctly. • Ignition timing check • Curb idle speed check • Idle mixture check • Erasing the diagnostic trouble code
 MB992012	MB992012 Engine hanger plate A	General service tool	

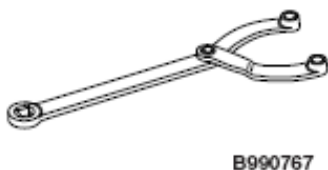
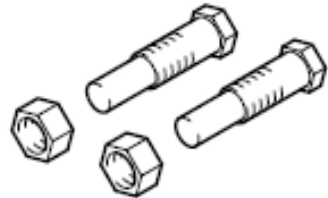
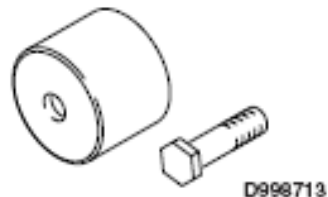
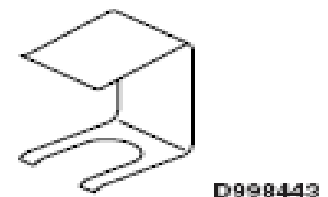
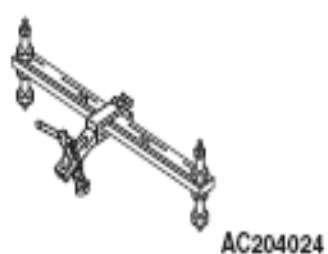
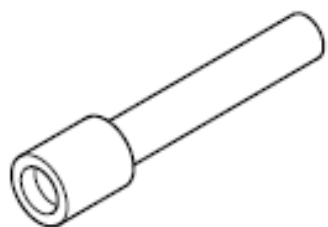
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 MB992013	MB992013 Engine hanger plate B	General service tool	Supporting the engine assembly
 MB991454	MB991454 Engine hanger balancer	MZ203827-01	
 MB991895	MB991895 Engine hanger	Tool not available	
 Slide bracket (HI) Joint (50) x2 Joint (90) x2 Joint (140) x2 Foot (standard) x4 Foot (short) x2 BO91 028	MB991928 Engine hanger A. MB991929 Joint (50) x2 B. MB991930 Joint (90) x2 C. MB991931 Joint (140) x2 D. MB991932 Foot (standard) x4 E. MB991933 Foot (short) x2	Tool not available	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.

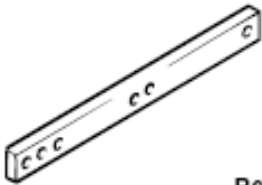
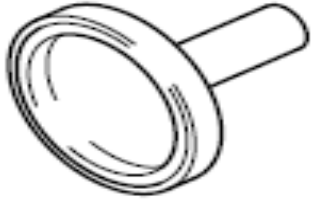
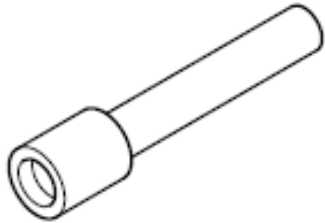
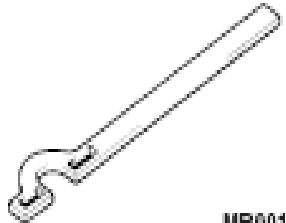
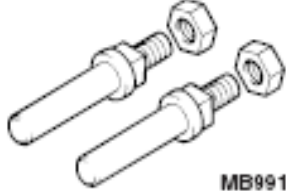
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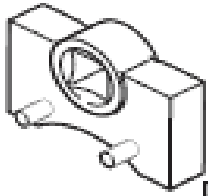
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	F. MB991934 Chain and hook assembly		
 B990767	MB990767 Front hub and flange yoke holder	MB990767-01	
	MD998715 Crankshaft pulley holder pin	MIT308239	Holding the camshaft sprocket
 D998713	MD998713 Camshaft oil seal installer	MD998713-01	Press-in of the camshaft oil seal
 D998443	MD998443 Auto-lash adjuster holder	MD998443-01	Holding the auto-lash adjuster
 AC204024	MD998772 Valve spring compressor	General service tool	Compressing valve spring
	MB991999 Valve stem seal installer	-	Valve stem seal installer

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 B991527	MD998717 Crankshaft front oil seal installer	MD998717-01	Press-in of the crankshaft front oil seal
 D998781	MD998781 Flywheel stopper	General service tool	Securing the drive plate
	MD998718 Crankshaft rear oil seal installer	MD998718-01	Press-fitting the crankshaft rear oil seal
	MD998051 Cylinder head bolt wrench	MD998051-01 or General service tool	Cylinder head bolt removal and installation
 MB991800	MB991800 Pulley holder	MB991800-01	Holding the crankshaft pulley
 MB991802	MB991802 Pin B	MB991802-01	
	MD998767 Tension pulley socket wrench	MD998752-01	Timing belt tension adjustment

 D998767			
 MD998769 Crankshaft pulley spacer	General service tool	Rotating the crankshaft when installing the timing belt	

ON-VEHICLE SERVICE

DRIVE BELT (FOR GENERATOR, POWER STEERING OIL PUMP AND AIR CONDITIONING) TENSION CHECK AND ADJUSTMENT

GENERATOR DRIVE BELT TENSION CHECK

CAUTION:

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

< WHEN USING SPECIAL TOOL MB992080: RECOMMENDATION >

Required Special Tools:

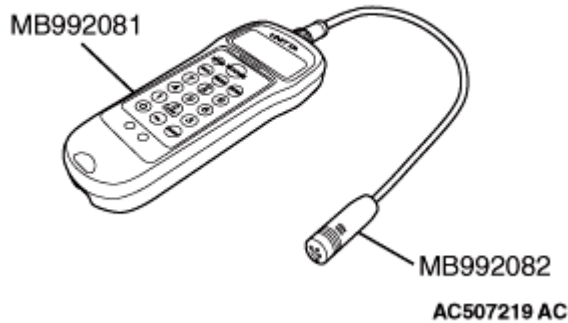
- MB992080: Belt tension meter set
 - MB992081: Belt tension meter
 - MB992082: Microphone assembly

1. Connect the special tool MB992082 to the special tool MB992081 of the Special tool MB992080.
2. Press the "POWER" button to turn on the power supply.
3. Press the numeral key of "1" and check that "No. 1" appears on the upper left of the display.

NOTE:

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

BELT TENSION METER SET (MB992080)

**Fig. 1: Identifying Belt Tension Meter Set (MB992080)**

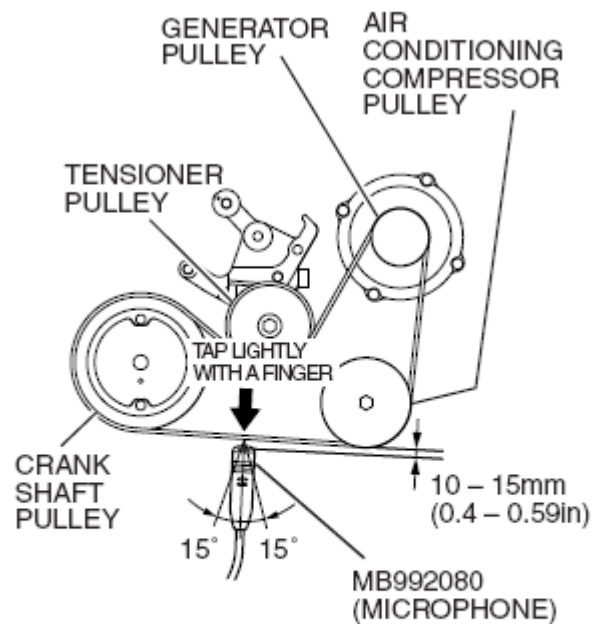
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

4. Press "Hz" button twice to change the display to the frequency display (Hz).

CAUTION:

- 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 MB992080 to the middle of the drive belt between the pulleys (at the place indicated by arrow in figure), approximately 10 - 15 mm (0.4 - 0.59 inch) away from the rear surface of the belt so that it is perpendicular to the belt (within an angle of ± 15 degree).
 6. Press the "MEASURE" button.
 7. Gently tap the middle of the belt between the pulleys (the place indicated by the arrow in figure) with your finger as shown in the illustration, and measure that the vibration frequency of the belt is within the standard value.

Standard value: 143 - 169 Hz



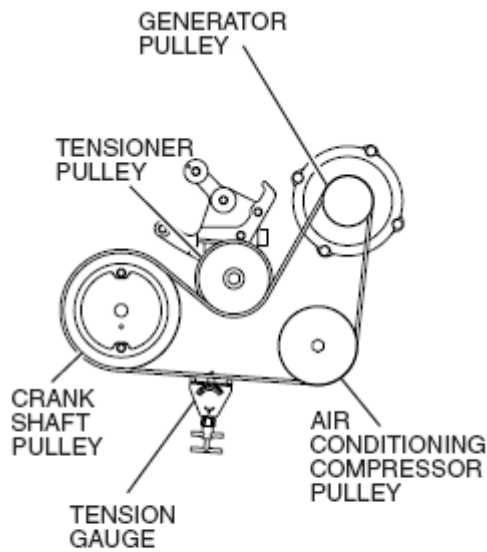
AC600756 AB

Fig. 2: Locating Special Tool MB992080 Between Pulleys
 Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

< WHEN USING THE TENSION GAUGE >

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

Standard value: 490 - 686 N (110 - 154 pounds)



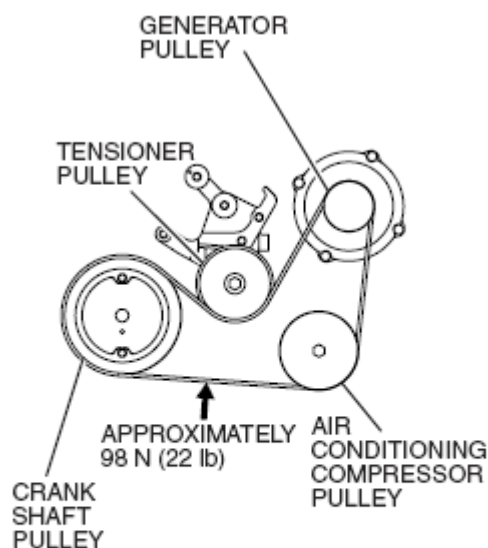
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Fig. 3: Checking Belt Tension Using Belt Tension Gauge
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

< BELT DEFLECTION CHECK>

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

Standard value: 8.4 - 10.7 mm (0.33 - 0.42 inch)



AK303694AB

Fig. 4: Checking Belt Deflection

Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

GENERATOR DRIVE BELT TENSION ADJUSTMENT

If the vibration frequency, tension or deflection is outside the standard value, adjust by the following procedure.

1. Loosen the tensioner pulley fixing nut.
2. With the tensioner pulley fixing nut temporarily tightened to 15 ± 5 N.m (11 ± 4 ft-lb), set the belt tension or deflection amount to the standard value using the adjusting bolt.

Standard value:**ADJUSTMENT CHART**

ITEM	DURING ADJUSTMENT	DURING REPLACEMENT
Vibration frequency Hz	150 - 163	180 - 202
Tension N (lb)	539 - 637 (121 - 143)	785 - 981 (176 - 221)
Deflection (Reference) mm (in)	8.9 - 10.1 (0.35 - 0.40)	6.2 - 7.5 (0.24 - 0.30)

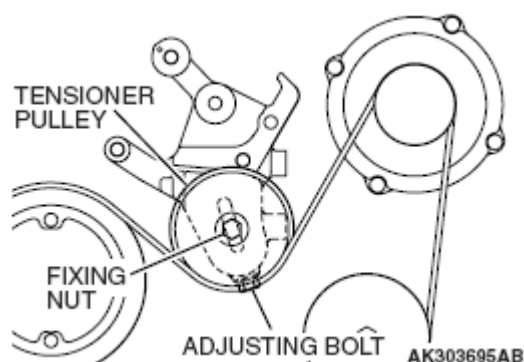


Fig. 5: Identifying Tensioner Pulley, Fixing Nut And Adjusting Bolt
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

3. Tighten the tension pulley fixing nut.

Tightening torque: 49 ± 10 N.m (36 ± 7 ft-lb)

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

POWER STEERING DRIVE BELT TENSION CHECK

CAUTION:

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

< WHEN THE VIBRATION FREQUENCY IS MEASURED: RECOMMENDATION >

Required Special Tools:

- MB992080: Belt tension meter set
 - MB992081: Belt tension meter
 - MB992082: Microphone assembly

With your finger tip lightly tap the center of the drive belt between the pulleys in the location shown by the arrow in the illustration and then measure the belt vibration frequency.

Standard value: 124 - 160 Hz

NOTE: For information regarding the vibration frequency measurement method using special tool MB992080. Refer to GENERATOR DRIVE BELT TENSION CHECK.

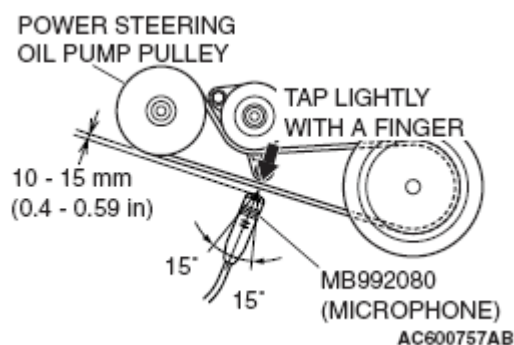


Fig. 6: Checking Power Steering Drive Belt Tension
 Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

< WHEN TENSION IS MEASURED >

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

Standard value: 294 - 490 N (66 - 110 pounds)

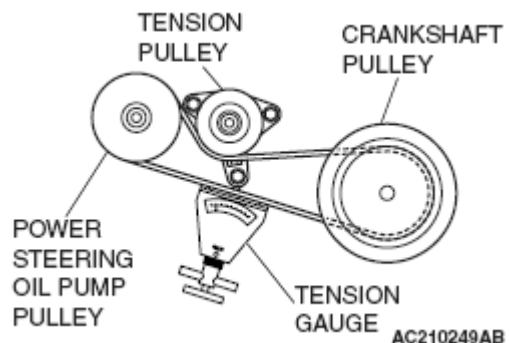
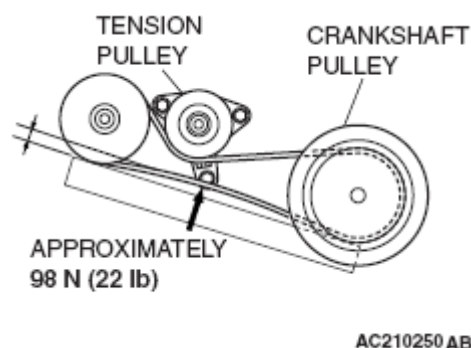


Fig. 7: Checking Belt Tension Within Standard Value
 Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

< WHEN DEFLECTION IS MEASURED >

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

Standard value: 12.3 - 16.2 mm (0.48 - 0.64 inch)

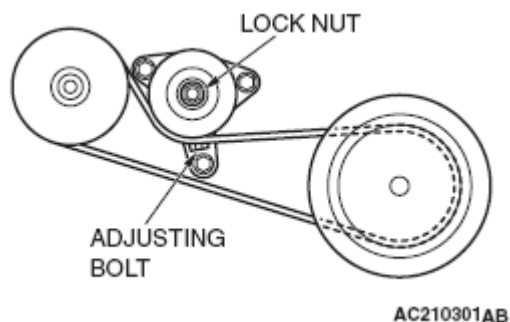
**Fig. 8: Checking Belt Deflection**

Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

POWER STEERING DRIVE BELT TENSION ADJUSTMENT

If the vibration frequency, tension or deflection is outside the standard value, adjust by the following procedure.

1. Loosen the tensioner pulley lock nut.
2. Adjust the belt tension to the standard value by turning the adjusting bolt. The tension will increase when turning the adjusting bolt clockwise, and decrease when turning counterclockwise.

**Fig. 9: Identifying Lock Nut And Adjusting Bolt**

Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

Standard value:**ADJUSTMENT CHART**

ITEM	DURING ADJUSTMENT	DURING REPLACEMENT
Vibration frequency Hz	134 - 151	160 - 189
Tension N (lb)	343 - 441 (77 - 99)	490 - 686 (110 - 154)
Deflection (Reference) mm (in)	13.2 - 15.1 (0.52 - 0.59)	9.6 - 12.3 (0.38 - 0.48)

3. Tighten the lock nut to the specified torque.

Tightening torque: 49 ± 9 N.m (36 ± 7 ft-lb)

4. Tighten the adjusting bolt.

Tightening torque: 5.0 ± 1.0 N.m (44 ± 9 in-lb)

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

5. Check the belt vibration frequency, tension or deflection amount, and readjust if necessary.
6. When the belt tension is adjusted by measuring the belt deflection, adjust it with a tool for vibration frequency measurement or tension measurement afterward.

VALVE CLEARANCE CHECK AND ADJUSTMENT

Refer to INTAKE AND EXHAUST VALVE CLEARANCE (INSPECT AND ADJUST) .

ROCKER ARM PISTON OPERATION CHECK <INTAKE SIDE>

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 the "T" mark on the lower cover of timing belt.

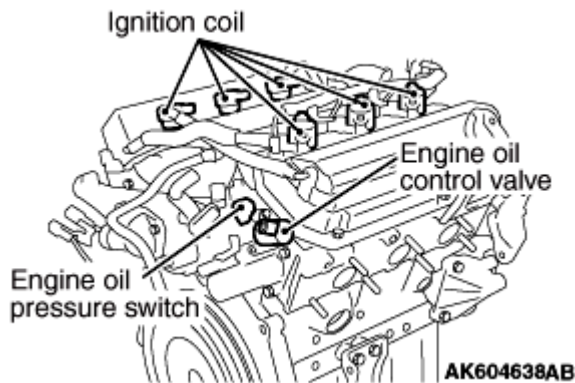


Fig. 10: Identifying Ignition Coil, Engine Oil Pressure Switch And Engine Oil Control Valve
 Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

6. 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.

NOTE: If the rocker arm of No. 6 cylinder at the intake side is moved up and down

and the rocker arm is moved, No. 1 cylinder is at top dead center on compression stroke. If the rocker arm of No. 6 cylinder at the intake side is moved up and down and the rocker arm is not moved, No. 4 cylinder is at top dead center on compression stroke.

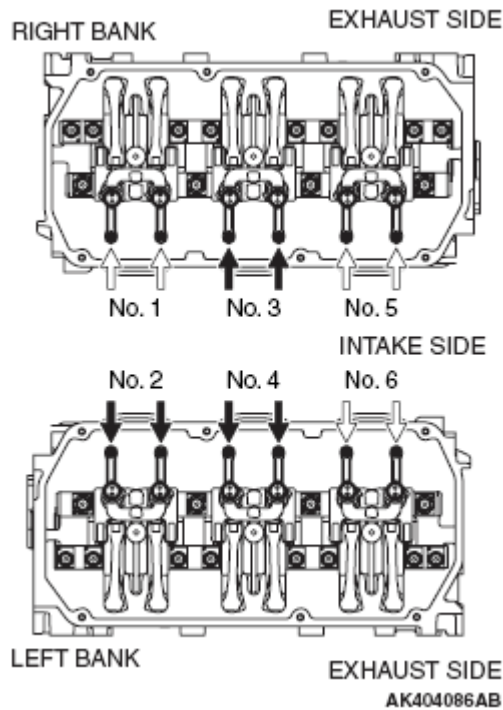


Fig. 11: Locating Rocker Arms

Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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 bind vinyl tape to the end of air blowgun. The compression air pressure is required more than 620 kPa (90 psi).

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 assy.

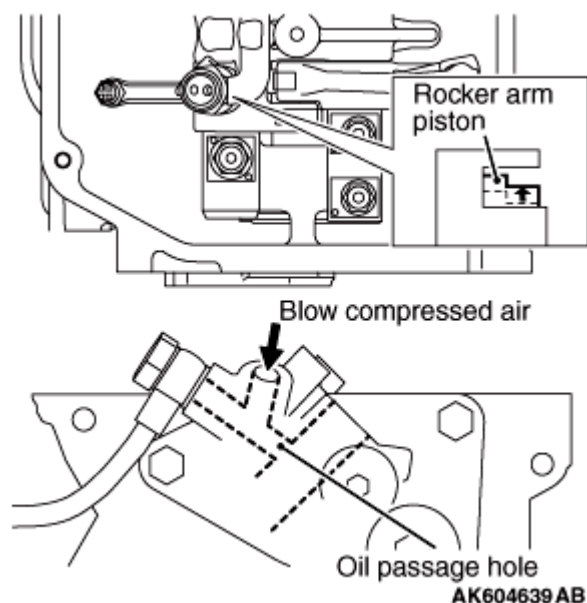


Fig. 12: Identifying Rocker Arm Piston

Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

11. Install the engine oil pressure switch and the engine oil control valve. (Refer to illustrations in **REMOVAL AND INSTALLATION**.)
12. Install the rocker cover.
13. Install all of the ignition coils.

IGNITION TIMING CHECK

Required Special Tool:

MB991958: Scan Tool (M.U.T.-III Sub Assembly)

- MB991824: V.C.I.
- MB991827: M.U.T.-III USB Cable
- MB991910: M.U.T.-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 vehicle 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. 4.

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 680 r/min.
6. Select scan tool MB991958 actuator test "item number 11".
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.

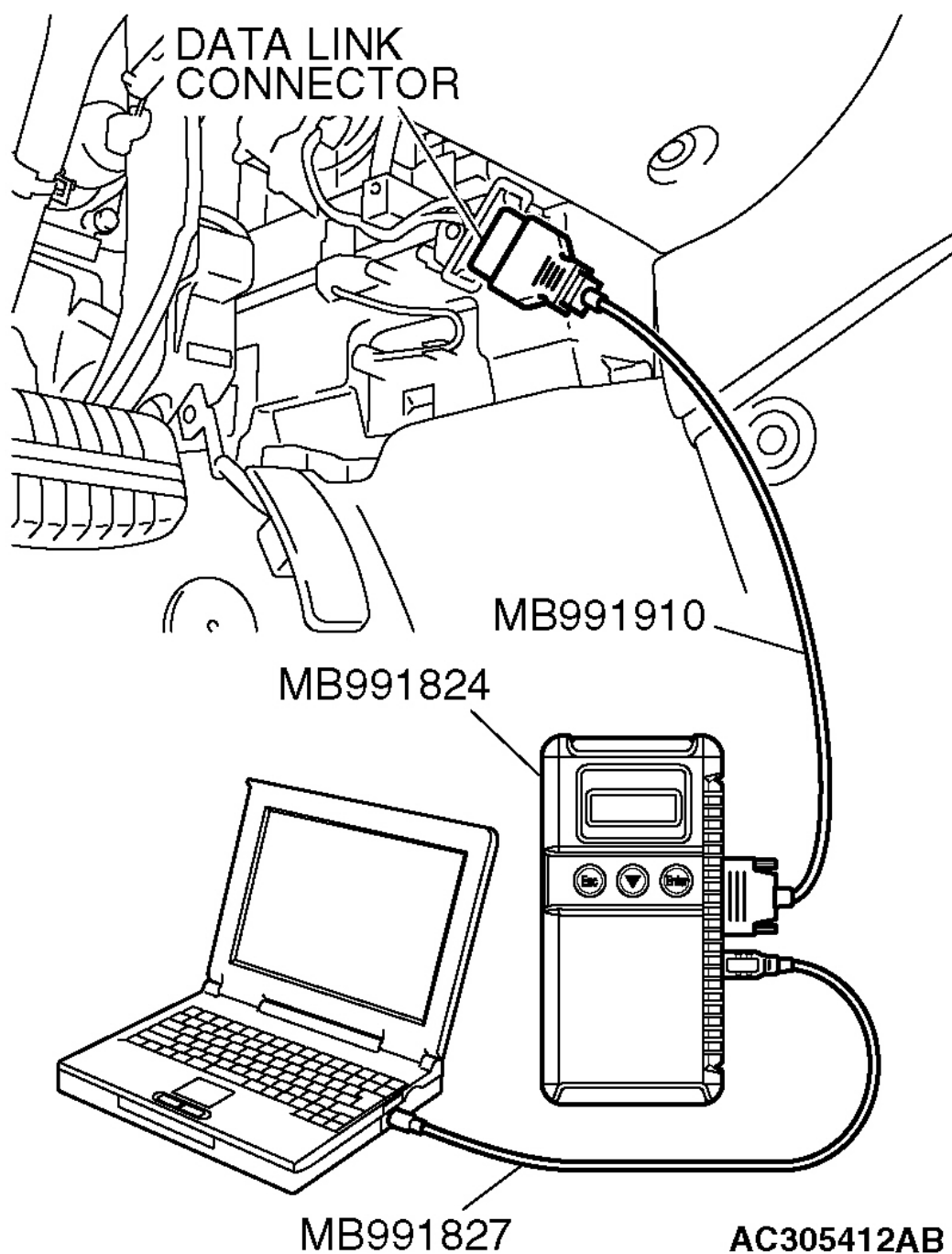


Fig. 13: Connecting Scan Tool MB991910 To Data Link Connector
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

9. Cancel the actuator test function item No. 11, Basic ignition timing set mode, on the scan tool

MB991958.

10. Check that the actual ignition timing is at the standard value.

Standard value: Approximately 10° BTDC

NOTE: Ignition timing fluctuates about $\pm 7^\circ$, even under normal operating condition.

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

NOTE: Wait till approximately 1 minute passes after the engine started, and check the ignition timing when the engine stabilized.

11. Remove the timing light.
12. Turn the ignition switch to the "LOCK" (OFF) position and disconnect the scan tool MB991958.

CURB IDLE SPEED CHECK

Required Special Tool:

MB991958: Scan Tool (M.U.T.-III Sub Assembly)

- MB991824: V.C.I.
- MB991827: M.U.T.-III USB Cable
- MB991910: M.U.T.-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
 - Transmission: Neutral (P range on vehicle 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. 4.

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

4. Start the engine.
5. Check the actual ignition timing.

Standard value: Approximately 10° BTDC

6. Run the engine at idle for 2 minutes.

NOTE: Ignition timing fluctuates about $\pm 7^\circ$, even under normal operating condition.

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

7. Check the idle speed. Select item number 2 and take a reading of the idle speed.

Curb idle speed: 680 $\pm$ 100 r/min

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

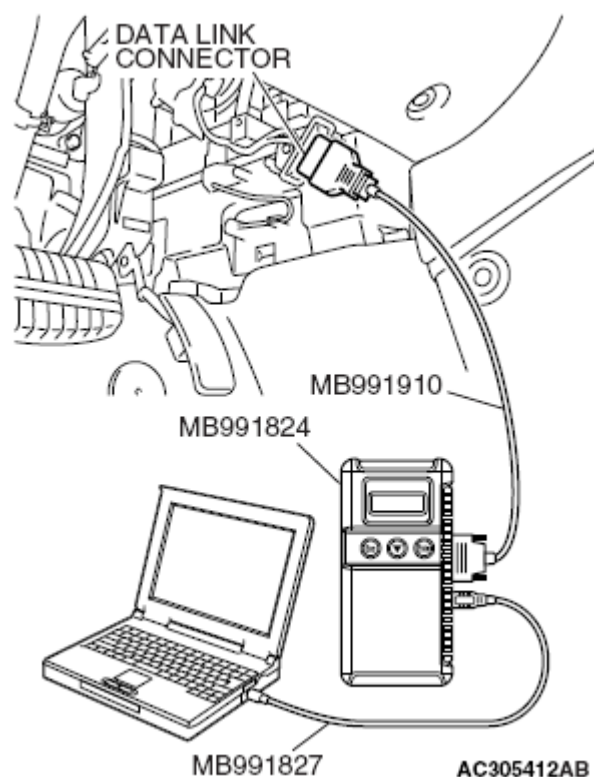


Fig. 14: Connecting Scan Tool MB991910 To Data Link Connector
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

8. If the idle speed is outside the standard value, refer to **SYMPTOM CHART** .
9. Remove the timing light.
10. Turn the ignition switch to the "LOCK" (OFF) position and disconnect the scan tool MB991958.

IDLE MIXTURE CHECK

Required Special Tool:

MB991958: Scan Tool (M.U.T.-III Sub Assembly)

- MB991824: V.C.I.
- MB991827: M.U.T.-III USB Cable
- MB991910: M.U.T.-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
 - Transmission: Neutral (P range on vehicle 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. 4.

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

4. Start the engine and increase the engine speed to 2,000 - 3,000 r/min for 2 minutes.
5. Check that the actual ignition timing is within the standard value.

Standard value: Approximately 10° BTDC

NOTE: **Ignition timing fluctuates about $\pm 7^\circ$, even under normal operating condition.**

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

6. Set the CO, HC tester.
7. Check the CO contents and the HC contents at idle.

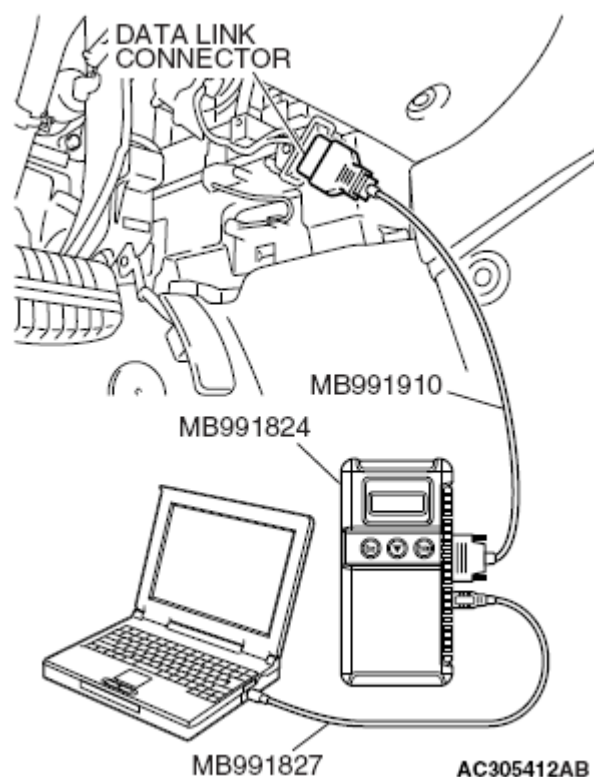
Standard value:**CO contents: 0.5 % or less****HC contents: 100 ppm or less**

Fig. 15: Connecting Scan Tool MB991910 To Data Link Connector
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

8. If the CO and HC contents do not remain inside the standard value, inspection the MFI system. (Refer to **SYMPTOM CHART** .)
9. Remove the CO, HC tester and the timing light.
10. Turn the ignition switch to the "LOCK" (OFF) position and disconnect the scan tool MB 991958.

COMPRESSION PRESSURE CHECK**Required Special Tool:**

MB991958: Scan Tool (M.U.T.-III Sub Assembly)

- MB991824: V.C.I.

- MB991827: M.U.T.-III USB Cable
- MB991910: M.U.T.-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
 - Transmission: Neutral (P range on vehicle 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.

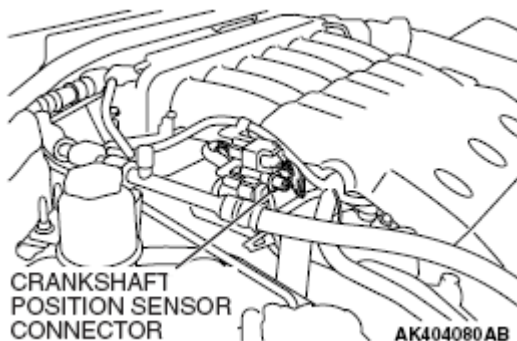


Fig. 16: Identifying Crankshaft Position Sensor Connector
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

5. Set compression gauge to one of the spark plug holes.
6. Crank the engine and measure the compression pressure.

Standard value (at engine speed of 200 r/min): 1,520 kPa (220 psi)

Minimum limit (at engine speed of 200 r/min): 1,110 kPa (161 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)

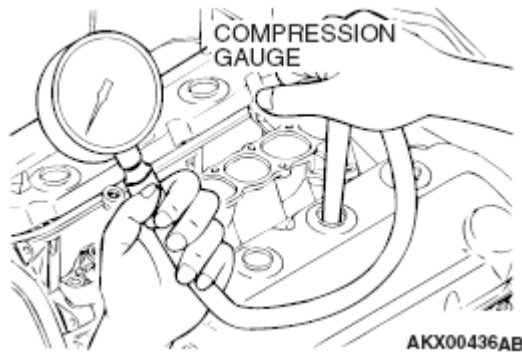


Fig. 17: Installing Compression Gauge To Spark Plug Hole
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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 5 to 7.
 1. If the compression increases after oil is added, the cause of the malfunction is a worn or damaged piston ring and/or cylinder inner surface.
 2. If the compression does not rise after oil is added, the cause is a burnt or defective valve seat, or pressure is leaking from the gasket.
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.

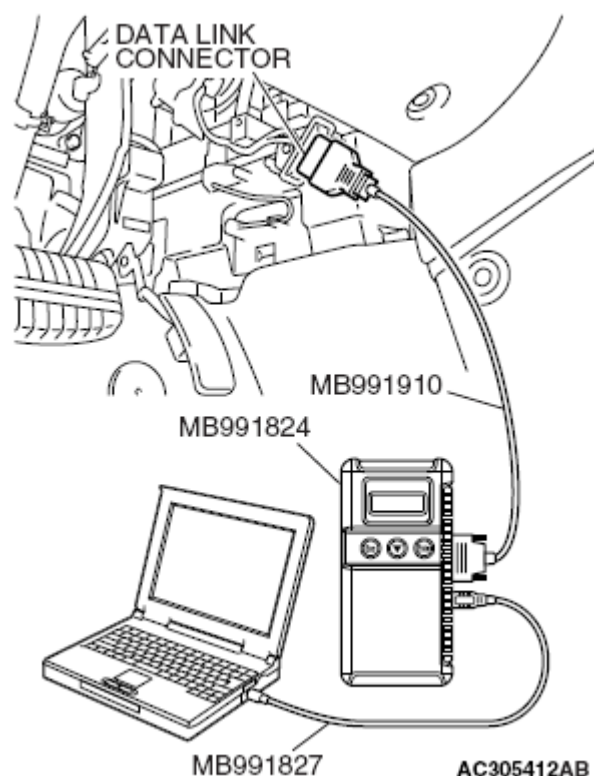


Fig. 18: Connecting Scan Tool MB991910 To Data Link Connector
 Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

MANIFOLD VACUUM CHECK

Required Special Tool:

MB991958: Scan Tool (M.U.T.-III Sub Assembly)

- MB991824: V.C.I.
- MB991827: M.U.T.-III USB Cable
- MB991910: M.U.T.-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. Turn the ignition switch to the "LOCK" (OFF) position and connect the scan tool MB991958 to the data link connector.

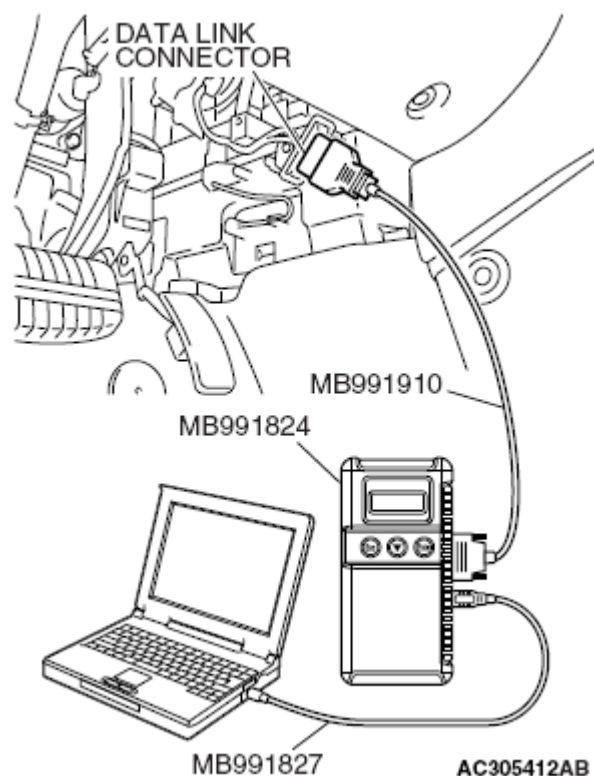


Fig. 19: Connecting Scan Tool MB991910 To Data Link Connector
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

3. Disconnect the ventilation hose from the positive crankcase ventilation (PCV) valve, and then connect a vacuum gauge to the ventilation hose. Plug the PCV valve.
4. Start the engine and check that idle speed is approximately 680 r/min.
5. Check the intake manifold vacuum.

Limit: Minimum 60 kPa (18 in Hg)

6. Turn the ignition switch to the "LOCK" (OFF) position.
7. Remove the vacuum gauge and then connect the ventilation hose to the PCV valve.
8. Disconnect scan tool MB991958 from the data link connector.

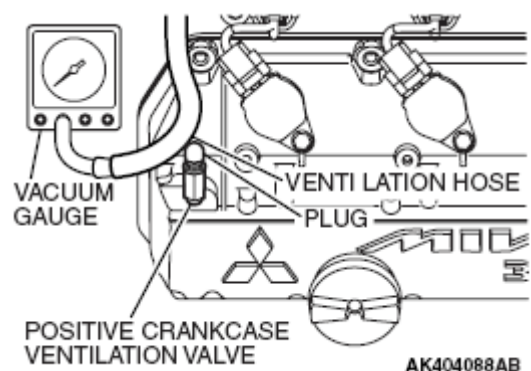


Fig. 20: Identifying Ventilation Hose, Positive Crankcase Ventilation (PCV) Valve And Vacuum Gauge

Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

LASH ADJUSTER CHECK

If an abnormal noise (chattering noise) suspected to be caused by malfunction of the lash adjuster is produced immediately after starting the engine and does not disappear, perform the following check.

- NOTE:** Parking the vehicle on a grade for a long time may decrease oil in the lash adjuster, causing air to enter the high pressure chamber when starting the engine.
- NOTE:** After parking for many hours, oil may run out from the oil passage and take time before oil is supplied to the lash adjuster, causing air to enter the high pressure chamber.
- NOTE:** In the above cases, abnormal noise can be eliminated by bleeding the lash adjuster system.
- NOTE:** The lash adjuster is installed in exhaust side only.
- NOTE:** An abnormal noise due to malfunction of the lash adjuster is produced immediately after starting the engine and changes with the engine speed, irrespective of the engine load. If, the abnormal noise is not produced immediately after starting the engine or does not change with the engine speed, or it changes with the engine load, the lash adjuster is not the cause for the abnormal noise.
- NOTE:** When the lash adjuster is malfunctioning, the abnormal noise is rarely eliminated by continuing the warming-up of the engine at idle speed. However, the abnormal noise may disappear only when seizure is caused by oil sludge in the engine whose oil is not maintained properly.

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

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

3. With the engine idling, change the engine load (shift from N to D range, for example) to make sure that there is no change in the level of abnormal noise.

If there is a change in the level of abnormal noise, suspect a tapping noise due to worn crankshaft bearing or connecting rod bearing (In this case, the lash adjuster is in good condition.).

4. After completion of warm-up, run the engine at idle to check for abnormal noise.

If the noise is reduced or disappears, clean the lash adjuster (Refer to **INSPECTION**). As it is suspected that the noise is due to seizure of the lash adjuster. If there is no change in the level of the abnormal noise, proceed to step 5.

5. Run the engine to bleed the lash adjuster system (Refer to **BLEEDING LASH ADJUSTER SYSTEM**).
6. If the abnormal noise does not disappear after air bleeding operation, clean the lash adjuster (Refer to **INSPECTION**).

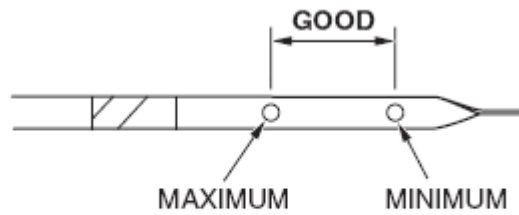
Bleeding lash adjuster system

1. Check engine oil and add or change oil if required.

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

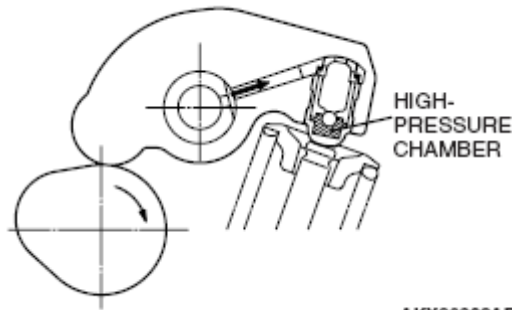
NOTE: If the engine oil level is higher than specification, oil may be stirred by the crankshaft, causing oil to be mixed with a large quantity of air.

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



AC205268AB

Fig. 21: Identifying Oil Level Marks On Dipstick
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.



AKX00329AB

Fig. 22: Identifying High Pressure Chamber
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

NOTE: If air mixed with oil enters the high pressure chamber inside the lash adjuster from the above causes, air in the high pressure chamber is compressed excessively while the valve is opened, resulting in an abnormal noise when the valve closes. This is the same phenomenon as that observed when the valve clearance has become excessive. The lash adjuster can resume normal function when air entered the lash adjuster is removed.

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

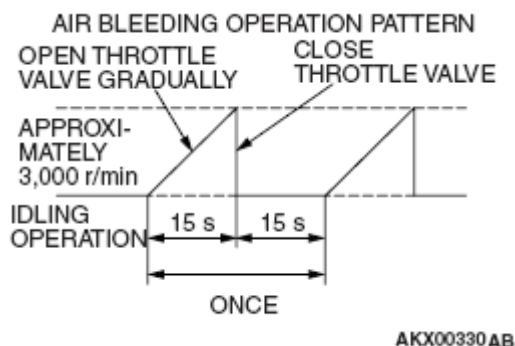


Fig. 23: Identifying Air Bleeding Operation Pattern

Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

ENGINE ASSEMBLY

REMOVAL AND INSTALLATION

CAUTION:

- When the engine assembly replacement is performed, use scan tool MB991958 to initialize the learning value (Refer to INITIALIZATION PROCEDURE FOR LEARNING VALUE IN MFI ENGINE).
- *: indicates parts which should be temporarily tightened, and then fully tightened with the engine weight applied on the vehicle body.

2010 Mitsubishi Galant ES

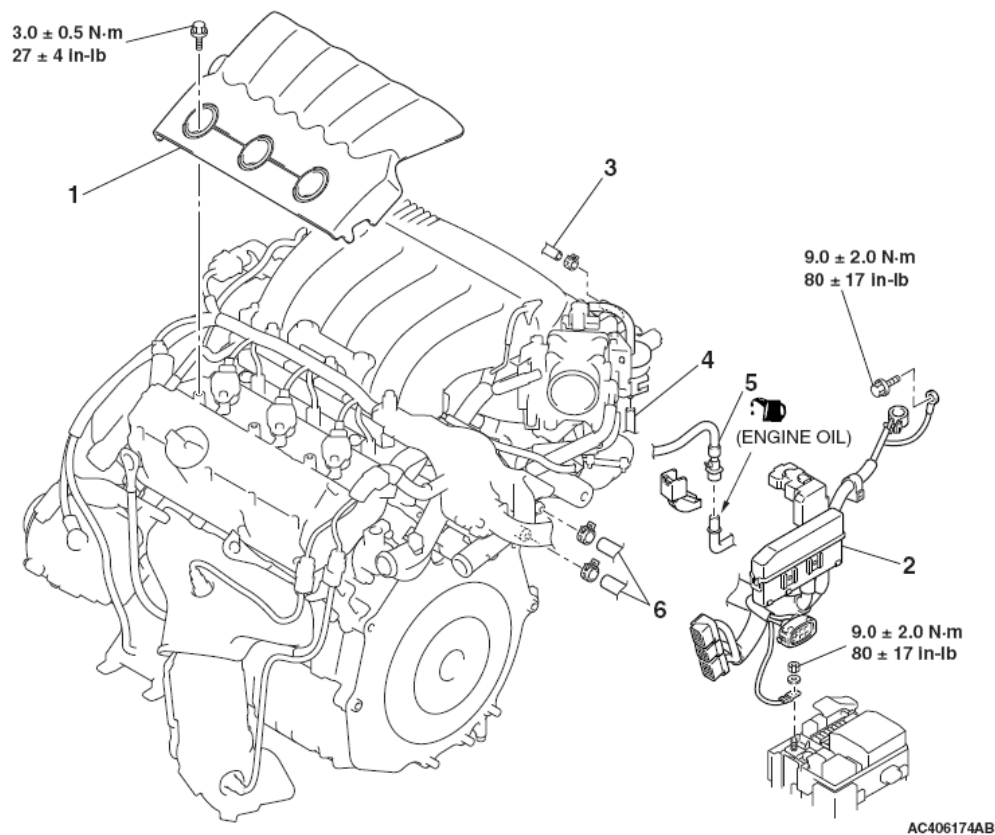
2010 ENGINE Engine Mechanical <3.8L> - Galant

Pre-removal Operation

- Side Under Cover Removal
- Radiator Grille Removal
- Fuel Line Pressure Reduction
- Engine Coolant Draining
- Engine Oil Draining
- Hood Removal
- Powertrain Control Module Removal
- Air Cleaner Removal
- Front Exhaust Pipe Removal
- Strut Tower Bar Removal
- Battery and Battery Tray Removal

Post-installation Operation

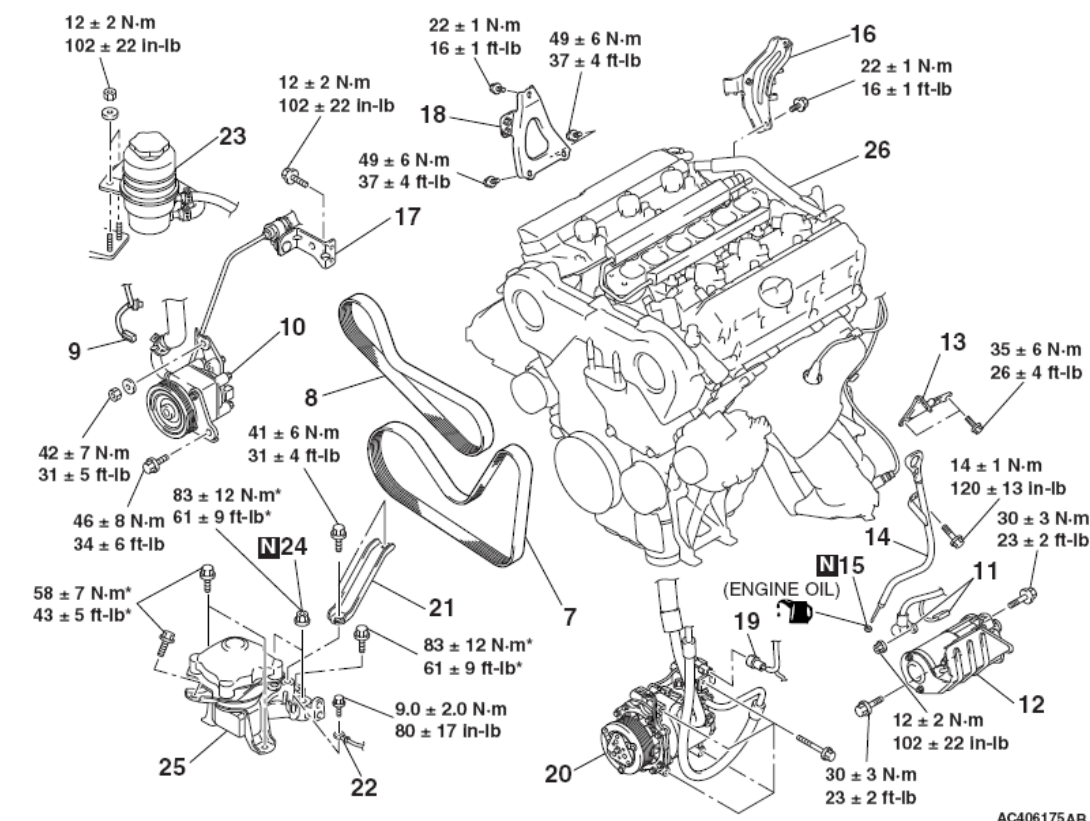
- Right Bank Exhaust Manifold Installation
- Battery and Battery Tray Installation
- Strut Tower Bar Installation
- Front Exhaust Pipe Installation
- Air Cleaner Installation
- Powertrain Control Module Installation
- Hood Installation
- Drive Belt Tension Check and Adjustment
- Engine Oil Refilling
- Engine Coolant Refilling
- Fuel Leak Check
- Radiator Grille Installation
- Side Under Cover Installation



REMOVAL STEPS

- | | |
|---|---------------------------------|
| 1. ENGINE COVER | • DRIVE SHAFT |
| 2. CONTROL WIRING HARNESS CONNECTION | • EXHAUST MANIFOLD (RIGHT BANK) |
| 3. VACUUM HOSE CONNECTION <> | • RADIATOR |
| 4. EVAPORATIVE EMISSION PURGE HOSE CONNECTION | |
| <<A>> >>C<< 5. FUEL HIGH-PRESSURE HOSE CONNECTION <<C>> | |
| 6. HEATER HOSE CONNECTION | |

Fig. 24: Identifying Engine Assembly Components With Torque Specifications (1 Of 2)
 Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.



- | | | |
|---|-------------|--|
| • INTAKE MANIFOLD PLENUM | | 17. POWER STEERING PRESSURE HOSE CLAMP BRACKET |
| <<E>> | | 18. INTAKE MANIFOLD PLENUM STAY (REAR) |
| 7. GENERATOR DRIVE BELT | <<E>> | • TRANSAXLE ASSEMBLY |
| 8. POWER STEERING OIL PUMP DRIVE BELT | <<F>> | 19. A/C COMPRESSOR ASSEMBLY CONNECTOR |
| 9. POWER STEERING PRESSURE SWITCH CONNECTOR | <<G>> | 20. A/C COMPRESSOR ASSEMBLY |
| <<D>> | | 21. ENGINE MOUNTING STAY |
| 10. POWER STEERING OIL PUMP | | 22. GROUNDING CABLE CONNECTION |
| 11. STARTER CONNECTOR AND TERMINAL | | 23. POWER STEERING OIL RESERVOIR |
| <<E>> | | 24. SELF-LOCKING NUTS |
| <<E>> | | 25. ENGINE FRONT MOUNTING BRACKET |
| 12. STARTER ASSEMBLY | | 26. ENGINE ASSEMBLY |
| 13. ENGINE HANGER | | |
| 14. ENGINE OIL DIPSTICK ASSEMBLY | <<H>> >>B<< | |
| 15. O-RING | | |
| <<E>> | | |
| 16. THROTTLE BODY STAY | <<I>> >>A<< | |

Fig. 25: Identifying Engine Assembly Components With Torque Specifications (2 Of 2)
 Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

Required Special Tools:

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

- MB992012: Engine Hanger Plate A
- MB992013: Engine Hanger Plate B

REMOVAL SERVICE POINTS

<<A>> FUEL HIGH-PRESSURE HOSE DISCONNECTION

1. Remove the fuel high-pressure hose stopper.

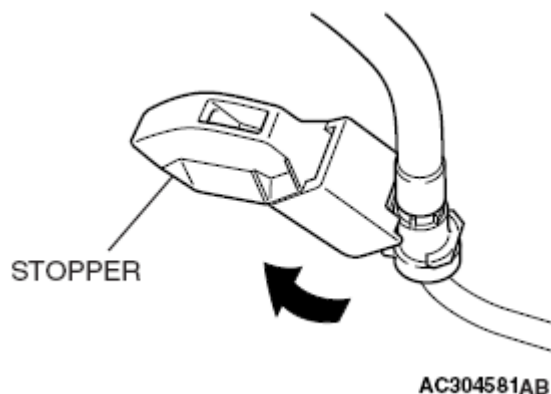


Fig. 26: Removing Fuel High-Pressure Hose Stopper

Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

2. Remove the fuel high-pressure hose in the direction shown in the figure while the retainer is pulled up.

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

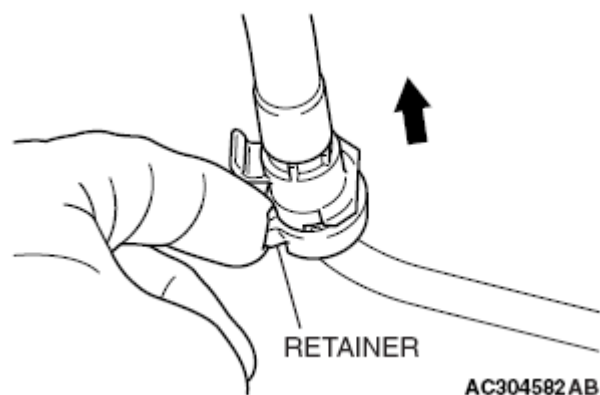


Fig. 27: Removing Fuel High-Pressure Hose Retainer

Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

<> EXHAUST MANIFOLD (RIGHT BANK) REMOVAL

Do not remove the center exhaust pipe, and pull out the exhaust manifold (right bank) between the crossmember

and cylinder block.

<<C>> RADIATOR REMOVAL

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

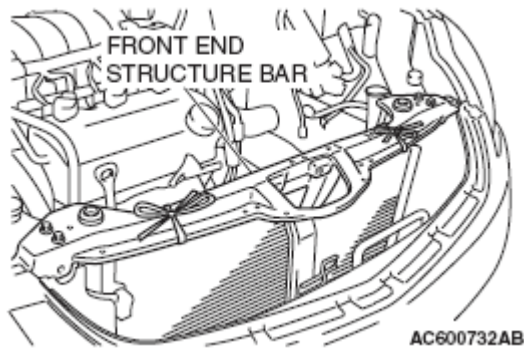


Fig. 28: Identifying Front End Structure Bar
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

<<D>> POWER STEERING OIL PUMP REMOVAL

1. Remove the power steering oil pump from the engine with the hose attached.
2. Place the removed power steering oil pump in a place where it will not interfere when removing and installing the engine assembly, and secure it with a cord or wire.

<<E>> ENGINE HANGER/ENGINE OIL DIPSTICK ASSEMBLY/THROTTLE BODY STAY/INTAKE MANIFOLD PLENUM STAY (REAR) REMOVAL

After removing the intake manifold plenum stay (rear), throttle body stay, engine oil dipstick assembly and engine hanger, set special tools MB992012 and MB992013 to each cylinder head.

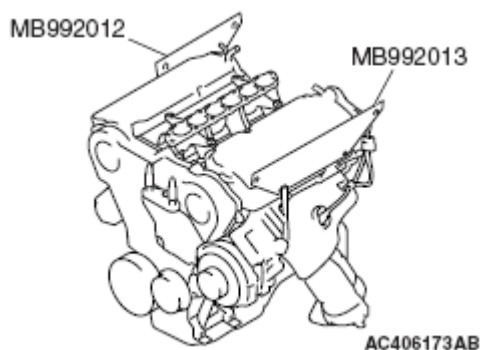


Fig. 29: Identifying Special Tools MB992012 And MB992013
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

<<F>> TRANSAXLE ASSEMBLY REMOVAL

Remove the transaxle assembly. (Refer to **REMOVAL AND INSTALLATION**).

<<G>> A/C COMPRESSOR ASSEMBLY REMOVAL

1. Remove the compressor from the compressor bracket with the hose still attached.
2. Place the removed A/C compressor where it will not interfere when removing and installing the engine assembly, and secure it with a cord or wire.

<<H>> ENGINE FRONT MOUNTING BRACKET REMOVAL

1. Support the engine with a garage jack.
2. < Engine hanger MB991895 is used>

Remove special tool MB991895.

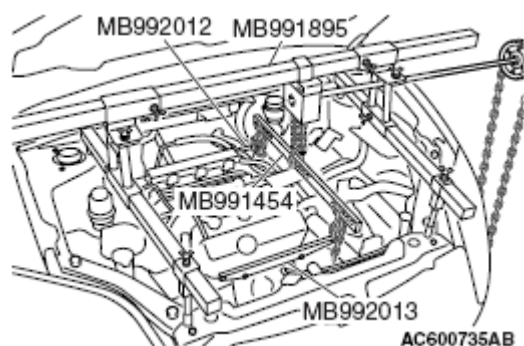


Fig. 30: Identifying Special Tool MB991895

Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

3. < Engine hanger MB991928 is used>

Remove special tool MB991928.

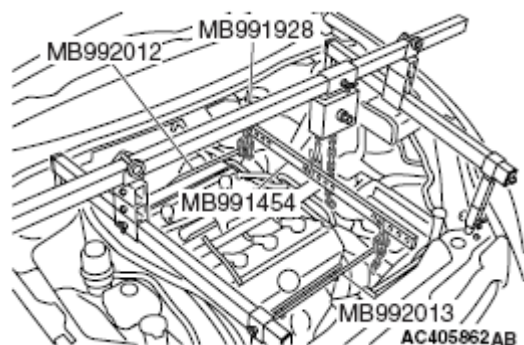


Fig. 31: Identifying Engine Hanger MB991928

Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

4. Remove special tool MB991454 and hook it again as shown in illustration. then, hold the engine

assembly with the chain block, etc.

5. Place a garage jack against the engine oil pan with a piece of wood in between so that the weight of the engine is no longer being applied to the engine mount.
6. Loosen the engine mount mounting nuts and bolts, and remove the engine mount.

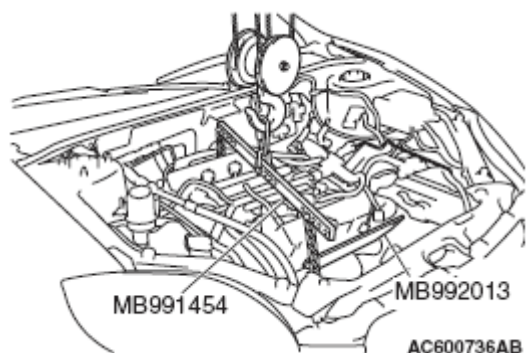


Fig. 32: Identifying Special Tool MB991454 And Hook
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

<<I>> ENGINE ASSEMBLY REMOVAL

After checking that all cables, hoses and wiring harness connectors and so on 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.

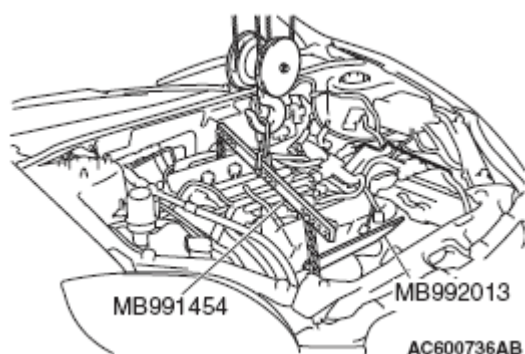


Fig. 33: Identifying Special Tool MB991454 And Hook
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>>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 mount while adjusting the position of the engine.

2. Support the engine assembly with a garage jack.
3. Remove the chain block.
4. < Engine hanger MB991895 is used>
 1. Set special tool MB991895 to the strut mounting nuts (A and B) and front end structure bar assembling bolts (C and D) as shown in illustration.

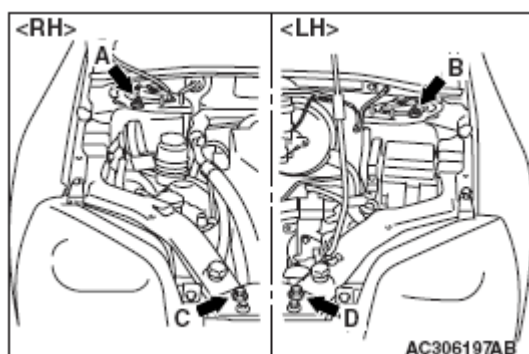


Fig. 34: Locating Strut Mounting Nuts

Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

2. Remove special tool MB991454 and hook it again as shown in illustration. Then, set special tool MB991454 to hold the engine assembly.

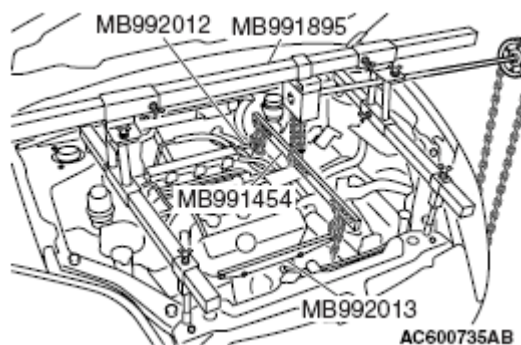


Fig. 35: Identifying Special Tool MB991895

Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

5. < Engine hanger MB991928 is used>
 1. Assemble special tool MB991928. (Set following parts to the base hanger.)
 - Slide bracket (HI)
 - Foot (standard) (MB991932)
 - Joint (140) (MB991931)

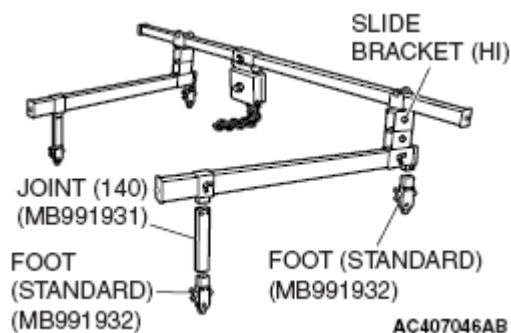


Fig. 36: Identifying Special Tool MB991928

Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

- Set special tool MB991928 to the strut mounting nuts (A and B) and front end structure bar assembling bolts (A and B) and (C and D) as shown in illustration.

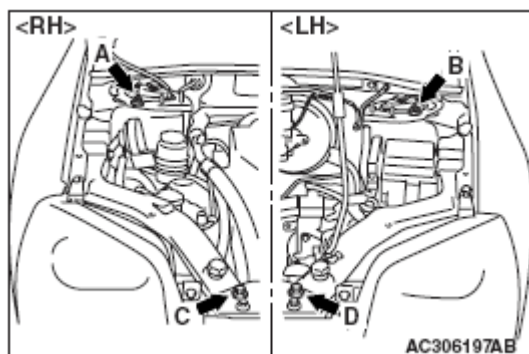


Fig. 37: Locating Strut Mounting Nuts

Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

- Remove special tool MB991454 and hook it again as shown in illustration. Then, set special tool MB991454 to hold the engine assembly.

NOTE: Adjust the engine hanger balance by sliding the slide bracket (Hi).

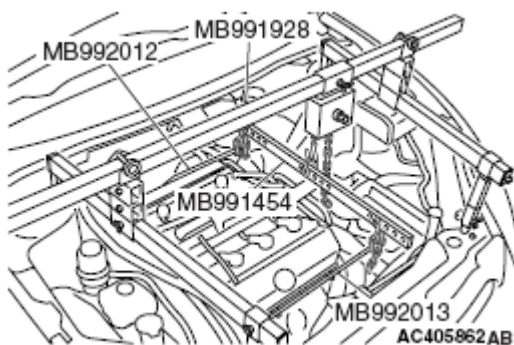


Fig. 38: Identifying Engine Hanger MB991928

Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>>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.

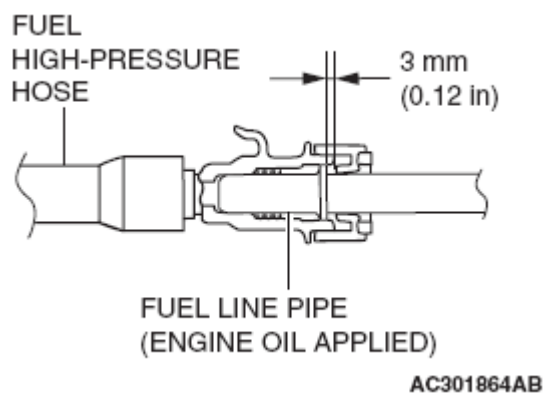


Fig. 39: Installing Fuel High-Pressure Hose
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

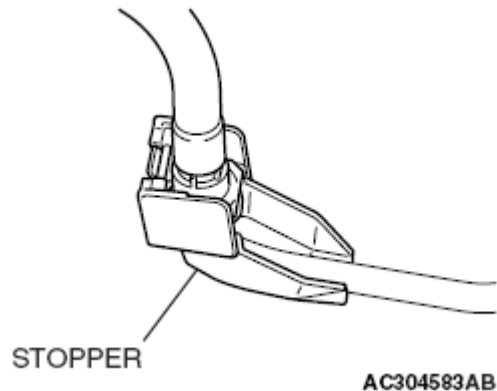


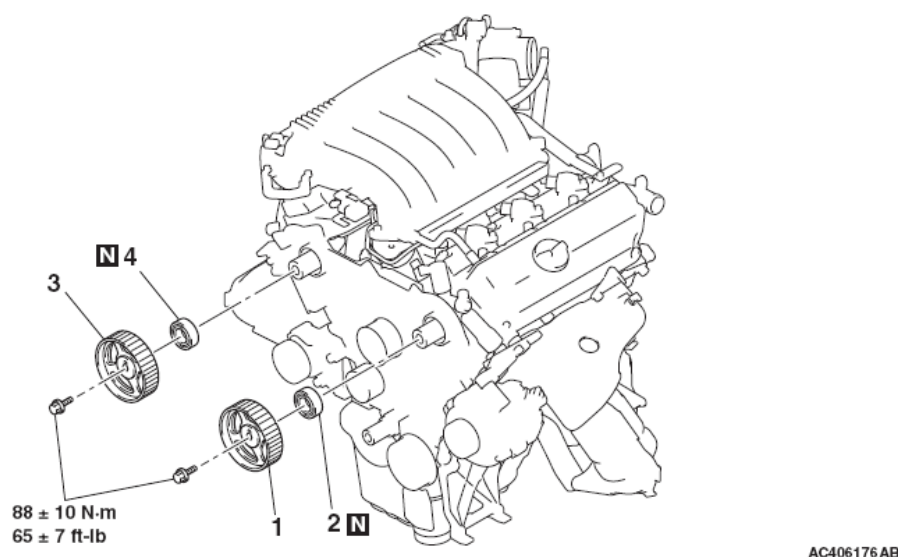
Fig. 40: Identifying Stopper
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

CAMSHAFT OIL SEAL

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation

- Timing Belt Removal and Installation



REMOVAL STEPS

- | | | | | | | | |
|-------|-------|----|-----------------------------|-------|-------|----|------------------------------|
| <<A>> | >>B<< | 1. | LEFT BANK CAMSHAFT SPROCKET | <<A>> | >>B<< | 3. | RIGHT BANK CAMSHAFT SPROCKET |
| <> | >>A<< | 2. | CAMSHAFT OIL SEAL | <> | >>A<< | 4. | CAMSHAFT OIL SEAL |

Fig. 41: Identifying Camshaft Oil Seal Components With Torque Specifications
 Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

Required Special Tools:

- MB990767: Front Hub and Flange Yoke Holder
- MD998713: Camshaft Oil Seal Installer
- MD998715: Crankshaft Pulley Holder Pin

REMOVAL SERVICE POINTS

<<A>> CAMSHAFT SPROCKET REMOVAL

Use special tools MD998715 and MB990767 to remove the camshaft sprocket.

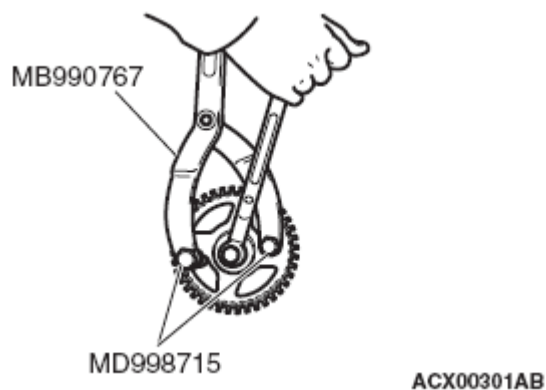


Fig. 42: Removing Camshaft Sprocket Bolt
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

<> CAMSHAFT OIL SEAL REMOVAL

1. Make a notch in the oil seal lip section with a knife, etc.

CAUTION: Be careful not to damage the camshaft and the cylinder head.

2. Cover the end of a flat-tipped screwdriver with a shop towel and insert into the notched section of the oil seal, and pry out the oil seal to remove it.

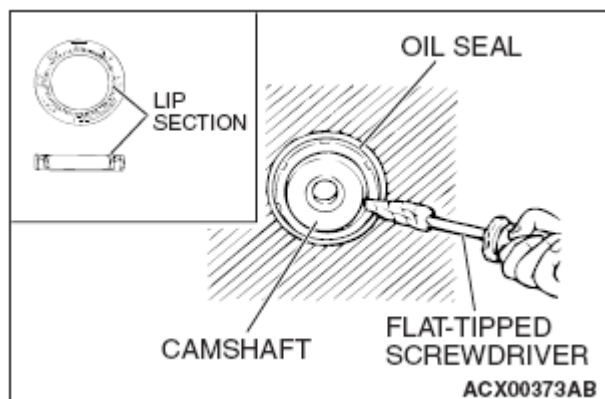


Fig. 43: Removing Oil Seal
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

INSTALLATION SERVICE POINTS

>>A << CAMSHAFT OIL SEAL INSTALLATION

1. Apply engine oil to the camshaft oil seal lip.
2. Use special tool MD998713 to press-fit the camshaft oil seal.

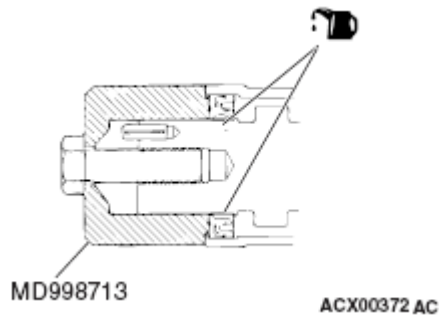


Fig. 44: Identifying Special Tool MD998713

Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>>B << CAMSHAFT SPROCKET INSTALLATION

1. Use special tools MD998715 and MB990767 in the same way as during removal to install the camshaft sprocket.
2. Tighten the camshaft sprocket mounting bolt to the specified torque.

Tightening torque: 88 ± 10 N.m (65 ± 7 ft-lb)

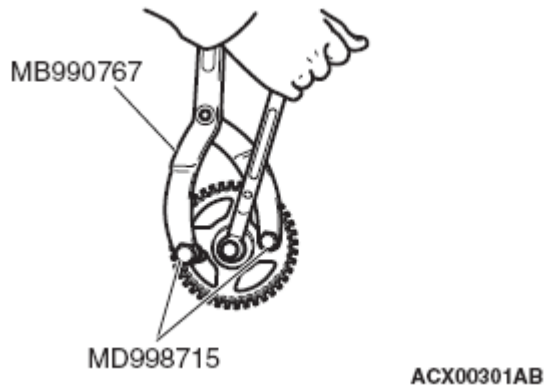


Fig. 45: Tightening Camshaft Sprocket Bolt

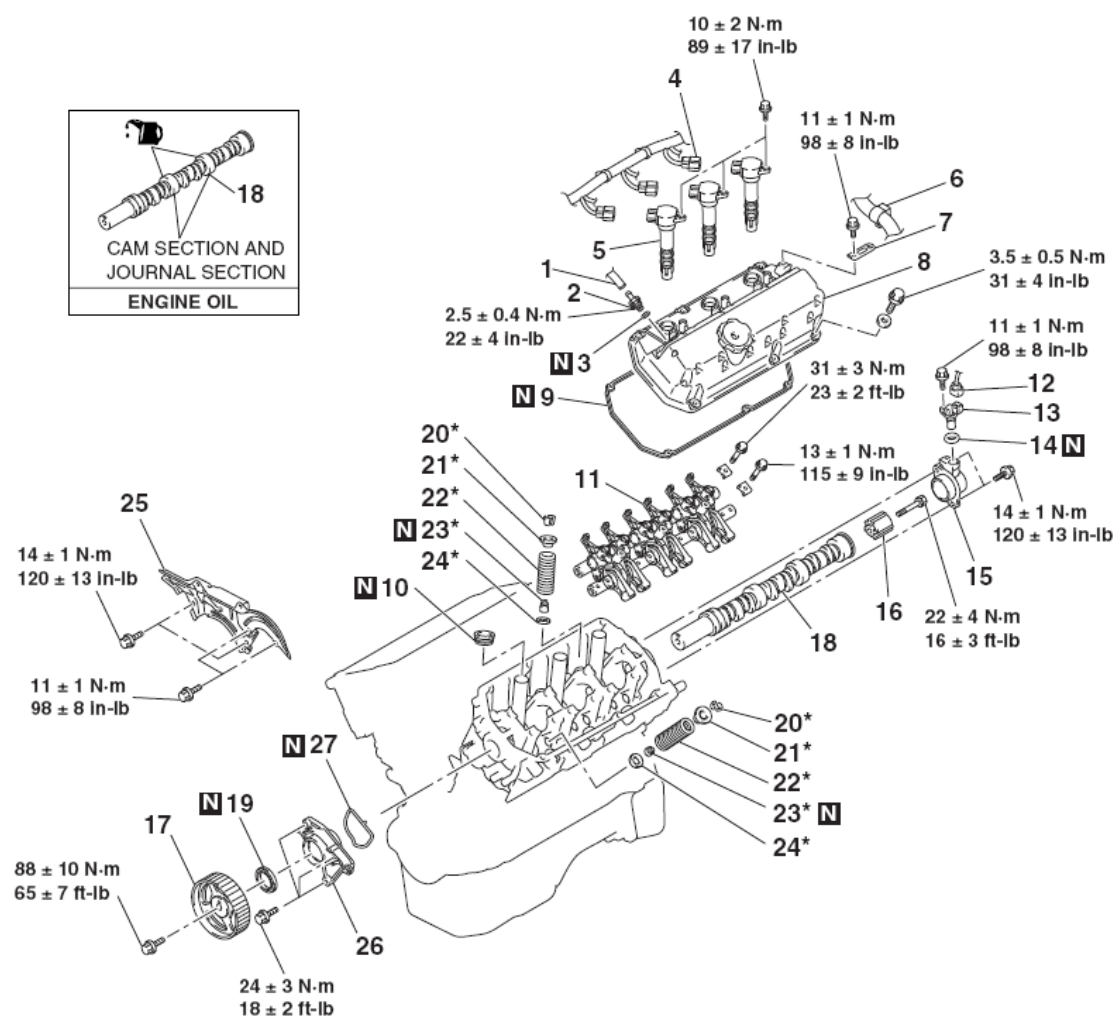
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

CAMSHAFT AND VALVE STEM SEAL

REMOVAL AND INSTALLATION

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

< LEFT BANK >



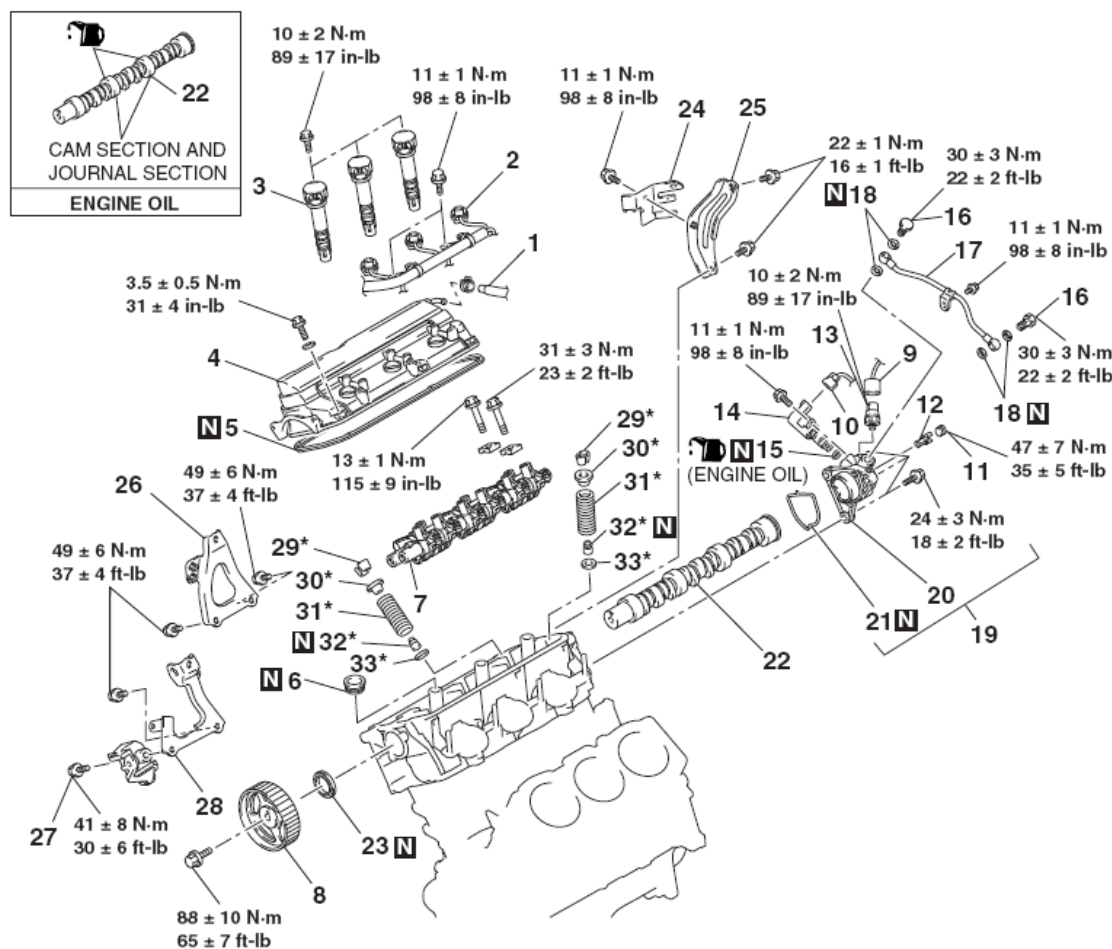
AC808324AB

Fig. 46: Identifying Camshaft And Valve Stem Seal Components With Torque Specifications - Left Bank
 Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

Required Special Tools:

- MB990767: Front Hub and Flange Yoke Holder
- MD998443: Auto-lash Adjuster Holder
- MD998713: Camshaft Oil Seal Installer
- MD998715: Crankshaft Pulley Holder Pin
- MD998772: Valve Spring Compressor
- MB991999: Valve Stem Seal Installer

< RIGHT BANK >



AC808325AB

Fig. 47: Identifying Camshaft And Valve Stem Seal Components With Torque Specifications - Right Bank (1 Of 2)

Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

- MD998772: Valve Spring Compressor
- MB991999: Valve Stem Seal Installer

REMOVAL SERVICE POINTS

<<A>> ROCKER ARM AND SHAFT ASSEMBLY REMOVAL

1. Install special tool MD998443 as shown in the illustration so that the lash adjusters will not fall out.

CAUTION: Never disassemble the rocker arm and shaft assembly.

2. Loosen the rocker arm and shaft assembly mounting bolt, and then remove the rocker arm and shaft assembly with the bolt still attached.

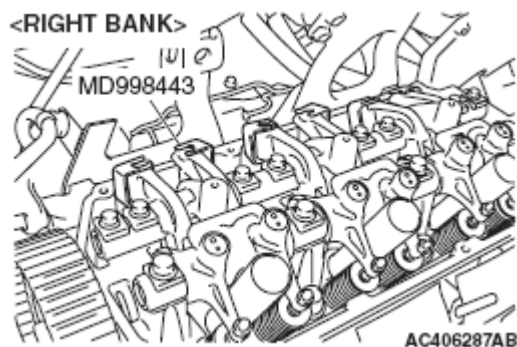


Fig. 49: Identifying Special Tool MD998443 - Right Bank
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

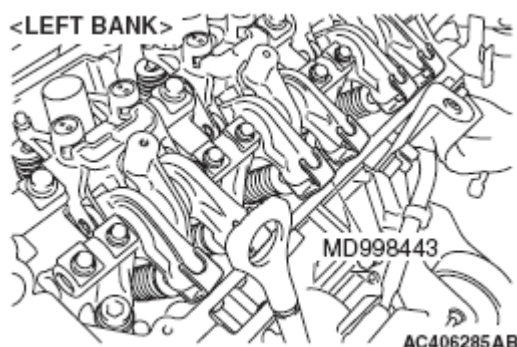


Fig. 50: Identifying Special Tool MD998443 - Left Bank
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

<> CAMSHAFT SPROCKET REMOVAL

Use special tools MD998715 and MB990767 to remove the camshaft sprocket.

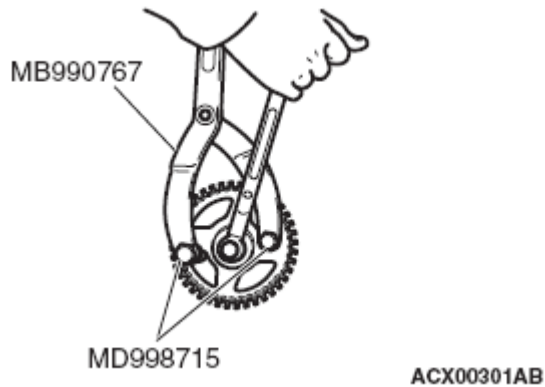


Fig. 51: Removing Camshaft Sprocket Bolt
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

<<C>> CAMSHAFT OIL SEAL REMOVAL

1. Make a notch in the oil seal lip section with a knife, etc.

CAUTION: Be careful not to damage the camshaft and the cylinder head.

2. Cover the end of a flat-tipped screwdriver with a shop towel and insert into the notched section of the oil seal, and pry out the oil seal to remove it.

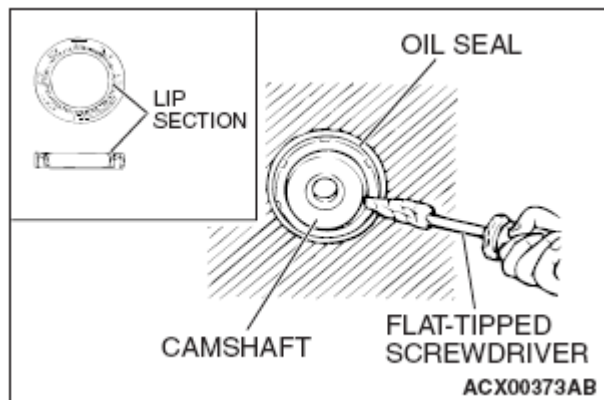


Fig. 52: Removing Oil Seal
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

<<D>> VALVE SPRING RETAINER LOCK 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 remove the valve spring retainer locks.

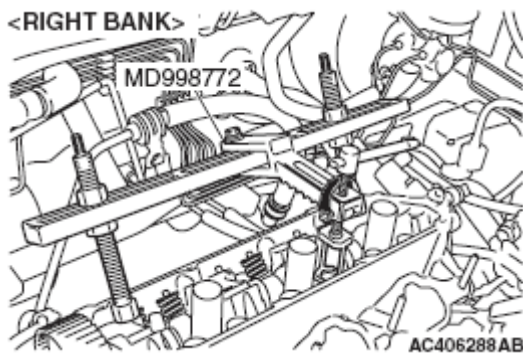


Fig. 53: Identifying Special Tool MD998772 - Right Bank
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

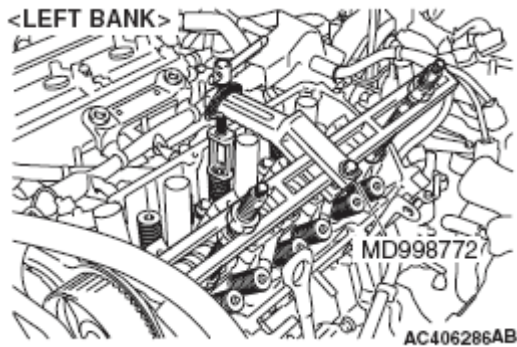


Fig. 54: Identifying Special Tool MD998772 - Left Bank
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

NOTE: Installation position of valve spring compressor special tool (MD998772) is different between exhaust side and intake side.

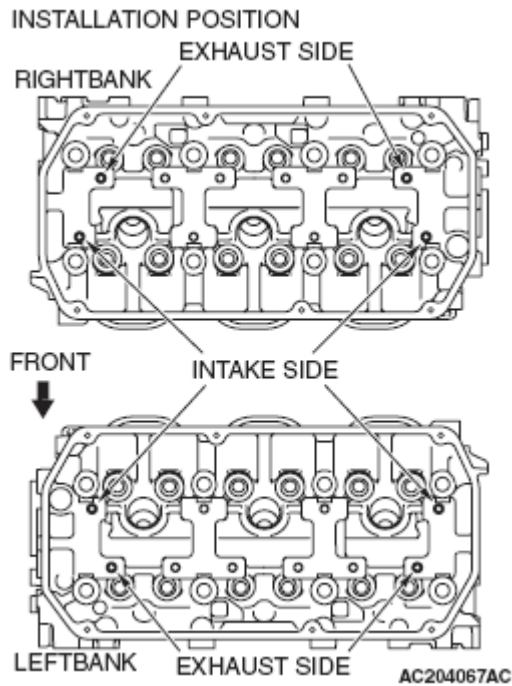


Fig. 55: Showing Installation Position Of Intake And Exhaust Cam
 Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

INSTALLATION SERVICE POINTS

>>A << CAMSHAFT OIL SEAL CASE GASKET/CAMSHAFT OIL SEAL CASE/OIL FEEDER CONTROL VALVE HOUSING GASKET/OIL FEEDER CONTROL VALVE HOUSING INSTALLATION

1. Install the camshaft oil seal case gasket and oil feeder control valve housing gasket as their protrusions are in the direction shown in illustration.

CAUTION:

- Be careful that any foreign materials does not get into the oil passages.
- Thoroughly confirm that there is not any foreign materials on the mating surfaces.

2. Install the camshaft oil seal case and oil feeder control valve housing to the cylinder head.
3. Tighten the mounting bolt to the specified torque.

Tightening torque: 24 ± 3 N.m (18 ± 2 ft-lb)

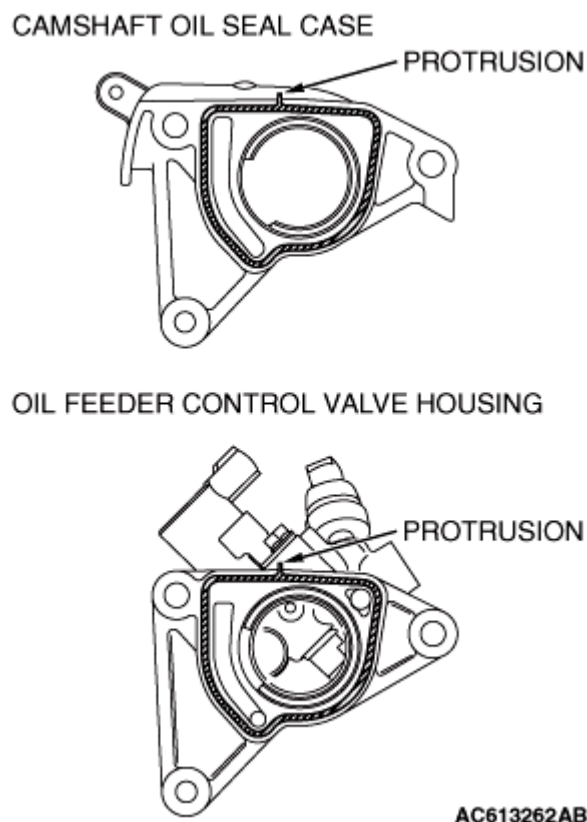


Fig. 56: Identifying Camshaft Oil Seal Case And Oil Feeder Control Valve Housing
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>>B << GASKET/OIL FEEDER CONTROL VALVE PIPE/EYE BOLT INSTALLATION

CAUTION: Install the oil feeder control valve pipe as follows so that the pipe is not deformed.

1. Install a gasket to one of oil feeder control valve pipes and tighten the eye bolt by hand.
2. Install a gasket to the other oil feeder control valve pipe and tighten the eye bolt to the specified torque.

Tightening torque: 30 ± 3 N.m (22 ± 2 ft-lb)

3. Tighten the eye bolt which is temporarily tightened by step 1 to the specified torque.

Tightening torque: 30 ± 3 N.m (22 ± 2 ft-lb)

4. Tighten the oil feeder control valve pipe mounting bolt to the specified torque.

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

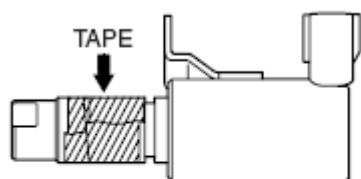
>>C << O-RING/ENGINE OIL CONTROL VALVE INSTALLATION

CAUTION:

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

1. Apply a small amount of engine oil to the O-ring and then install it to the 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)



AK303651AD

Fig. 57: Locating Tape

Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>>D << ENGINE OIL PRESSURE SWITCH INSTALLATION

1. Remove 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 in illustration.

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

NOTE: Install the engine oil pressure switch immediately after applying sealant.

CAUTION: After the installation, until a sufficient period of time (one hour or more) elapses, do not apply the engine oil or water to the sealant application area or start the engine.

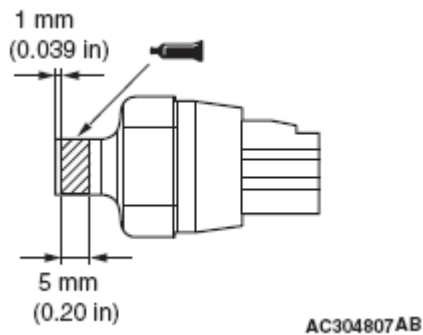


Fig. 58: Applying Sealant To Thread Of Engine Oil Pressure Switch
 Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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

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

>>E << VALVE STEM SEAL INSTALLATION

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

CAUTION:

- Valve stem seals cannot be reused.
- 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.

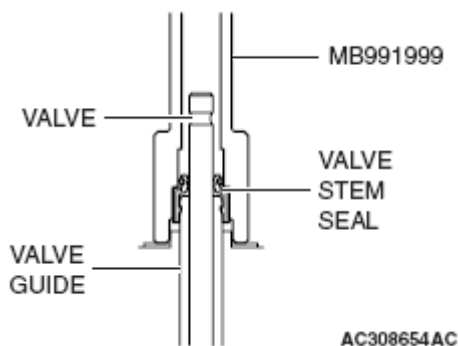


Fig. 59: Identifying Special Tool MB991999, Valve Stem Seal And Valve Guide
 Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>>F << VALVE SPRING INSTALLATION

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

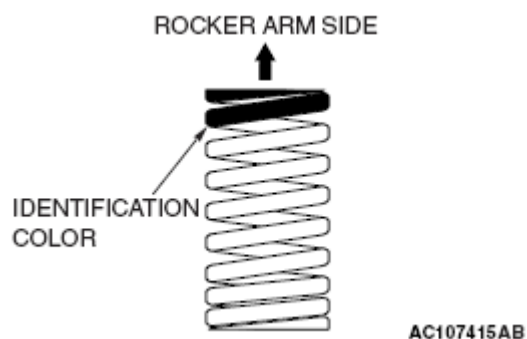


Fig. 60: Identifying Valve Spring With Identification Color
 Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>>G << VALVE SPRING RETAINER LOCK INSTALLATION

Use special tool MD998772 to compress the valve spring in the same manner as removal.

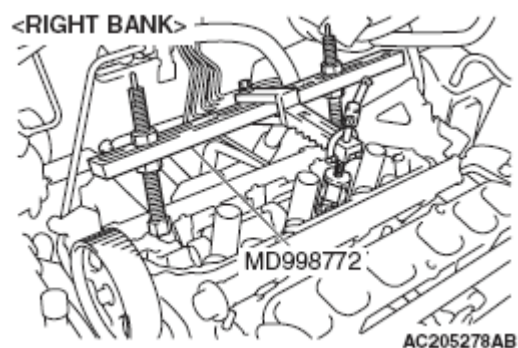


Fig. 61: Identifying Special Tool MD998772 - Right Bank
 Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

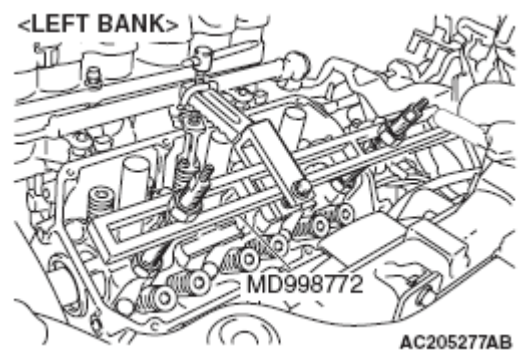


Fig. 62: Identifying Special Tool MD998772 - Left Bank
 Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>>H << ROCKER ARM AND SHAFT ASSEMBLY INSTALLATION

1. Install the intake side rocker arm and shaft assembly so that the f 6 mm (0.24 inch) and f 5.5 mm (0.22 inch) holes of rocker arm shaft face the cylinder head side.

2. Tighten the intake side rocker arm shaft mounting bolts to the specified torque.

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

3. Install the exhaust side rocker arm and shaft assembly so that the notch of rocker arm shaft is located as shown in the figure.
4. Check that the identification mark of exhaust side rocker shaft cap is located as shown in the figure.
5. Tighten the exhaust side rocker arm shaft mounting bolts to the specified torque.

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

<RIGHT BANK>

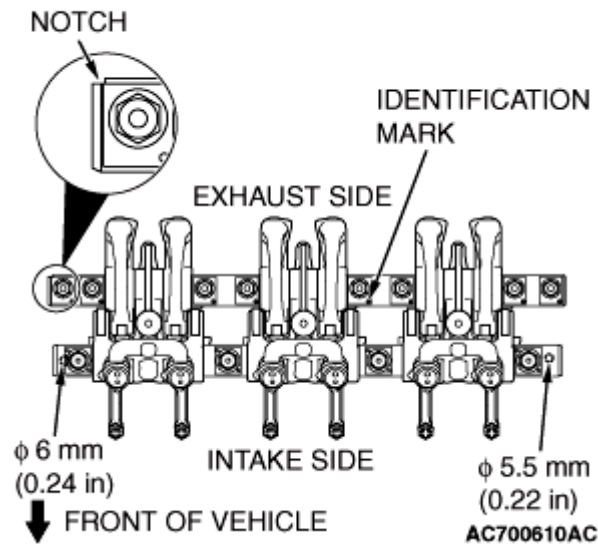


Fig. 63: Identifying Identification Mark Of Exhaust Side Rocker Shaft Cap - Right Bank
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

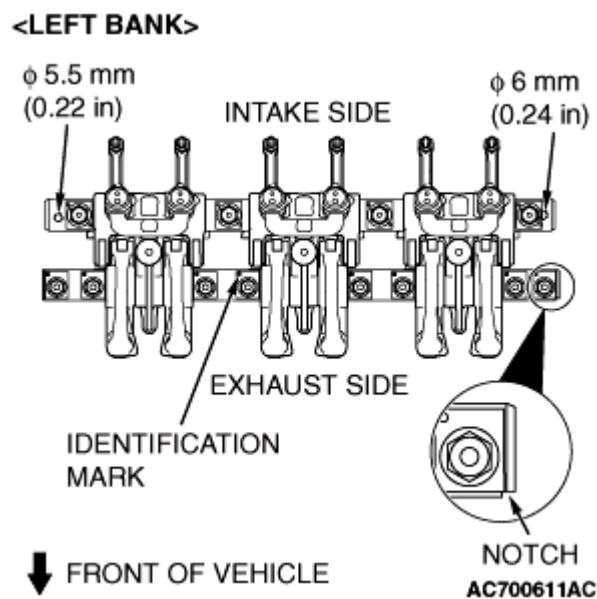


Fig. 64: Identifying Identification Mark Of Exhaust Side Rocker Shaft Cap - Left Bank
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

6. Remove special tool MD998443.

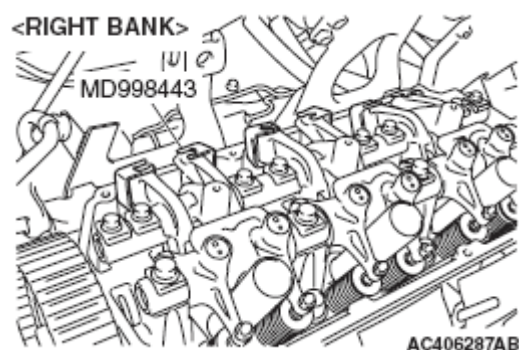


Fig. 65: Identifying Special Tool MD998443 - Right Bank
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

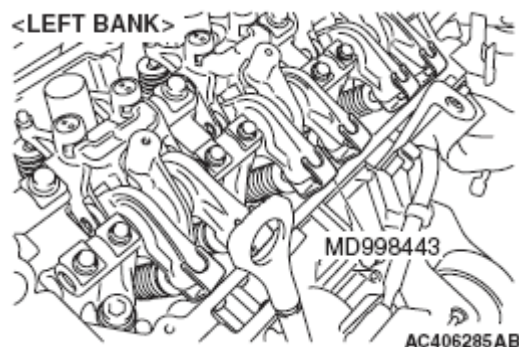


Fig. 66: Identifying Special Tool MD998443 - Left Bank

Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>>I << CAMSHAFT OIL SEAL INSTALLATION

1. Apply engine oil to the camshaft oil seal lip.
2. Use special tool MD998713 to press-fit the camshaft oil seal.

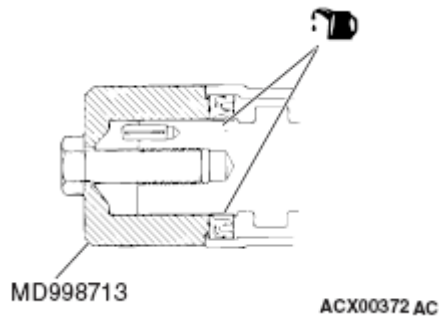


Fig. 67: Identifying Special Tool MD998713

Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>>J << CAMSHAFT SPROCKET INSTALLATION

1. Use special tools MD998715 and MB990767 in the same way as during removal to install the camshaft sprocket.
2. Tighten the camshaft sprocket mounting bolt to the specified torque.

Tightening torque: 88 ± 10 N.m (65 ± 7 ft-lb)

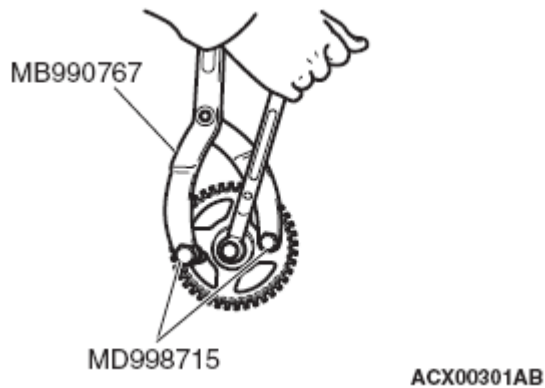


Fig. 68: Tightening Camshaft Sprocket Bolt

Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>>K << 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 immediately after applying sealant.

3. Install the camshaft position sensor support to the cylinder head.

CAUTION: After the installation, until a sufficient period of time (one hour or more) elapses, do not apply the engine oil or water to the sealant application area or start the engine.

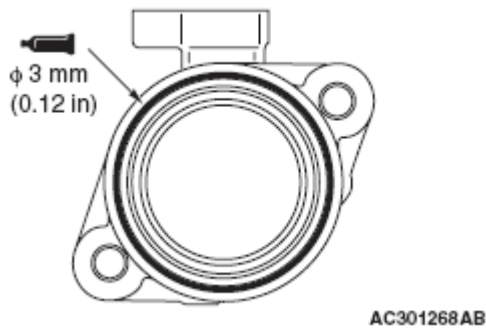


Fig. 69: Applying Sealant To Camshaft Position Sensor Support Flange
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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

Tightening torque: $14 \pm 1 \text{ N.m}$ ($120 \pm 13 \text{ in-lb}$)

OIL PAN AND OIL SCREEN

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation

- Under Cover Removal and Installation
- Engine Oil Draining and Refilling

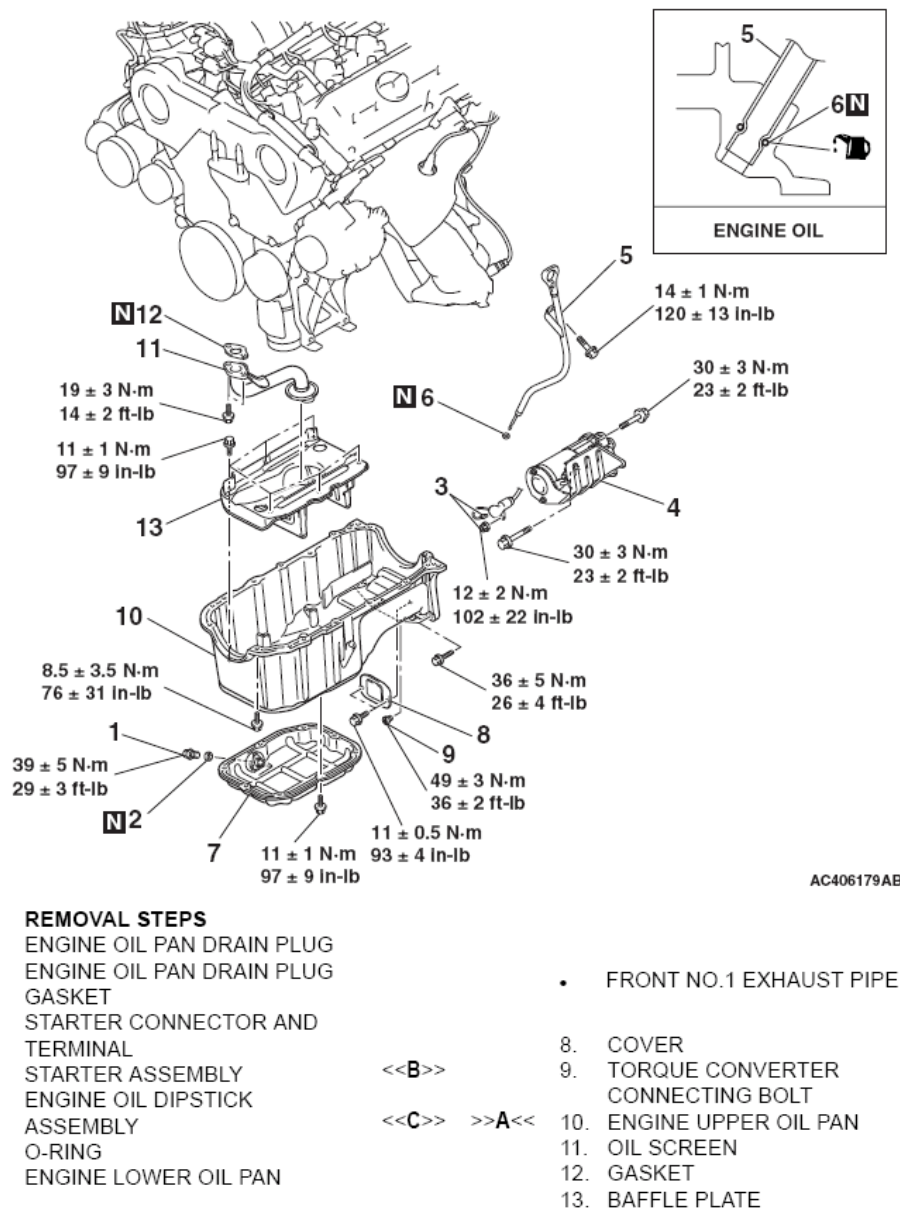


Fig. 70: Identifying Oil Pan And Oil Screen Components With Torque Specifications
 Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

REMOVAL SERVICE POINTS

<<A>> ENGINE LOWER OIL PAN REMOVAL

1. Remove the engine lower oil pan mounting bolts.

CAUTION: Do not use oil pan remover special tool (MD998727). The engine upper oil pan is made of aluminum and this tool will damage it.

2. Apply a piece of wood to the lower oil pan and strike it with a hammer to remove the engine lower oil pan.

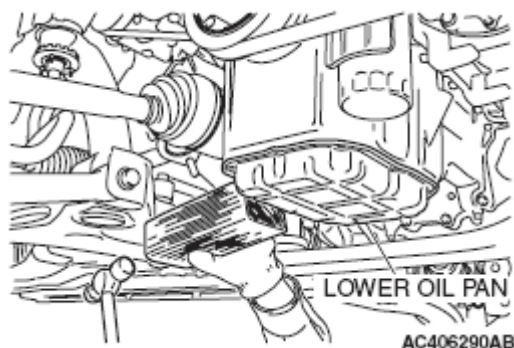


Fig. 71: Applying Piece Of Wood To Lower Oil Pan
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

<> TORQUE CONVERTER CONNECTING BOLT REMOVAL

Remove the one torque converter connecting bolt as shown in illustration.

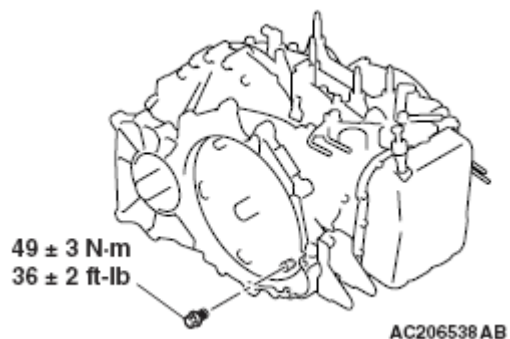


Fig. 72: Identifying Torque Converter Connecting Bolt With Torque Specifications
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

<<C>> ENGINE UPPER OIL PAN REMOVAL

1. Remove the engine upper oil pan mounting bolts.

CAUTION: Do not use oil pan remover special tool (MD998727). The engine upper oil pan is made of aluminum and this tool will damage it.

2. Screw in the bolt (M10) into bolt hole A in the location shown in illustration. Then lift the upper oil pan and remove it.

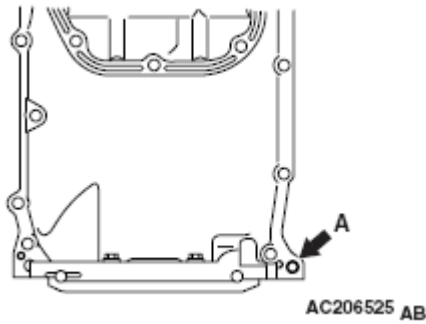


Fig. 73: Locating Bolt Hole

Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

INSTALLATION SERVICE POINTS

>>A << ENGINE UPPER OIL PAN INSTALLATION

1. Remove old sealant from the oil pan and cylinder block mating surfaces.
2. Degrease the sealant-coated surface and the engine mating surface.
3. Apply a bead of the sealant to the cylinder block mating surface of the engine upper oil pan as shown in illustration.

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

NOTE: Install the engine upper oil pan immediately after applying sealant.

4. Install the engine upper oil pan to the cylinder block.

CAUTION:

- The bolt holes for bolts 13 and 14 in the illustration are cut away on the transaxle side. Be careful not to insert these bolts at an angle.
- After the installation, until a sufficient period of time (one hour or more) elapses, do not apply the engine oil or water to the sealant application area or start the engine.

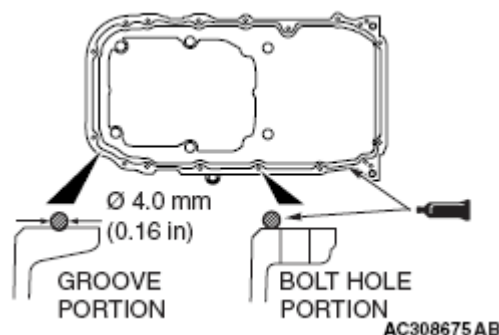
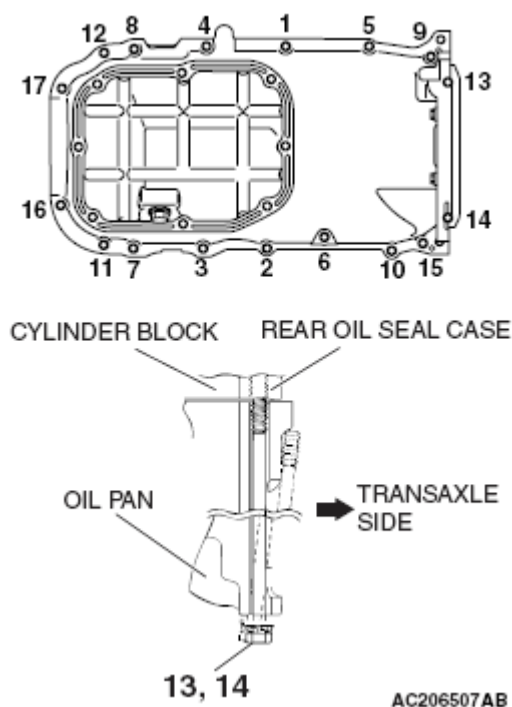


Fig. 74: Applying Bead Of Sealant To Cylinder Block Mating

Surface

Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

5. Tighten the bolts in the order shown in the illustration.

**Fig. 75: Identifying Oil Pan Bolts In Sequence**

Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>>B << ENGINE LOWER OIL PAN INSTALLATION

1. Remove old sealant from the engine lower oil pan and engine upper oil pan.
2. Apply a bead of the sealant to the mating surface of the engine lower oil pan as shown in illustration.

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

NOTE: Install the engine lower oil pan immediately after applying sealant.

3. Install the engine lower oil pan to the engine upper oil pan.

CAUTION: After the installation, until a sufficient period of time (one hour or more) elapses, do not apply the engine oil or water to the sealant application area or start the engine.

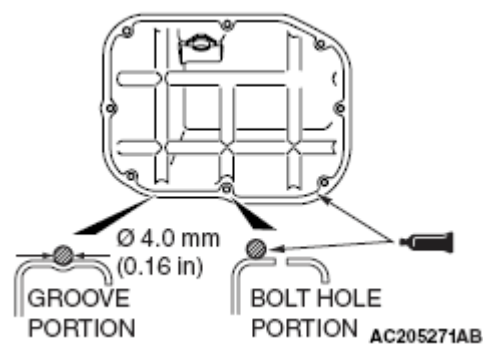


Fig. 76: Applying Bead Of Sealant To Mating Surface Of Engine Lower Oil Pan
 Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

4. Tighten the bolts in the order shown in the illustration.

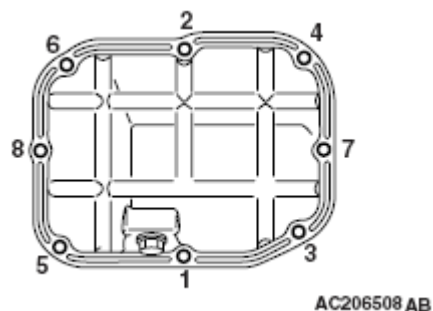


Fig. 77: Identifying Oil Pan Bolts In Sequence
 Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

INSPECTION

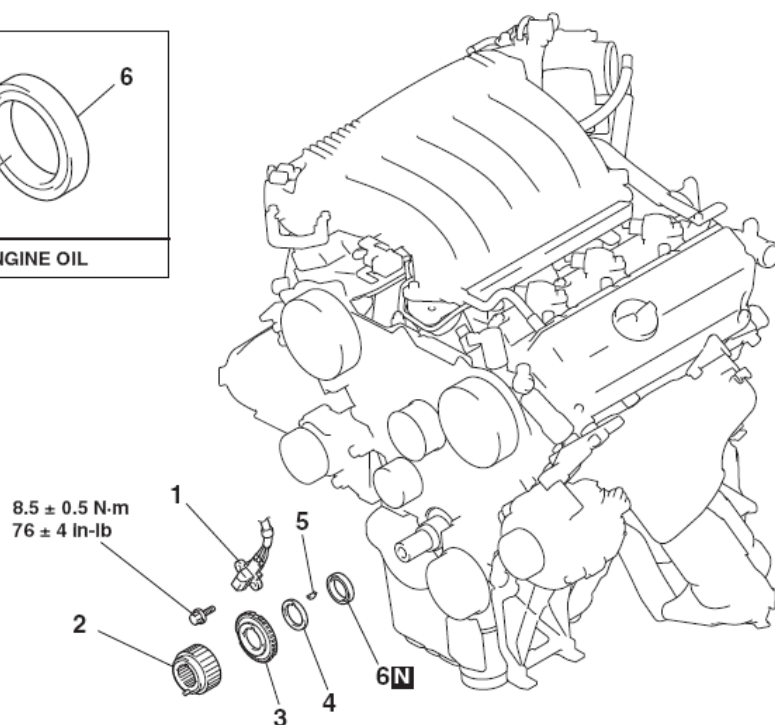
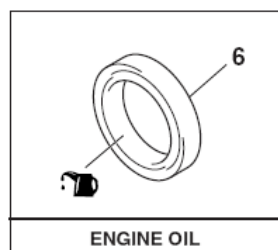
- Check the oil pan for cracks.
- Check the oil pan sealant-coated surface for damage and deformation.
- Check the oil screen for cracked, clogged or damaged wire net and pipe.

CRANKSHAFT OIL SEAL

REMOVAL AND INSTALLATION <FRONT OIL SEAL>

Pre-removal and Post-installation Operation

- Timing Belt Removal and Installation



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REMOVAL STEPS

- | | |
|-----------------------------------|------------------------------------|
| 1. CRANKSHAFT POSITION SENSOR | >>B<< 4. CRANKSHAFT SPACER |
| >>B<< 2. CRANKSHAFT SPROCKET | 5. KEY |
| >>B<< 3. CRANKSHAFT SENSING BLADE | >>A<< 6. CRANKSHAFT FRONT OIL SEAL |

Fig. 78: Identifying Crankshaft Oil Seal Components With Torque Specifications
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

Required Special Tool:

- MD998717: Crankshaft Front Oil Seal Installer

INSTALLATION SERVICE POINTS

>>A << CRANKSHAFT FRONT OIL SEAL INSTALLATION

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

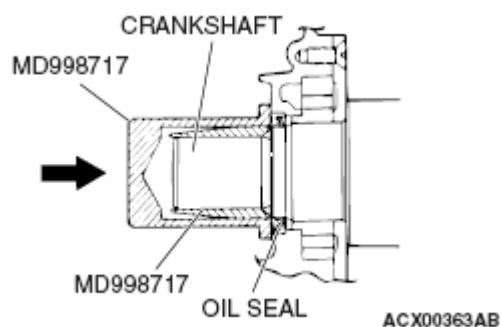


Fig. 79: Identifying Special Tool MD998717

Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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

To prevent the crankshaft pulley mounting bolt from loosening, degrease or clean the crankshaft, the crankshaft spacer, the crankshaft sensing blade and the crankshaft at the shown positions in illustration.

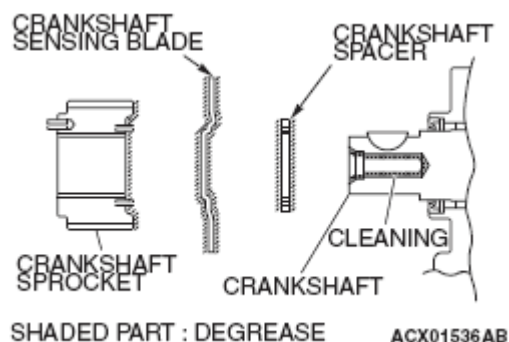
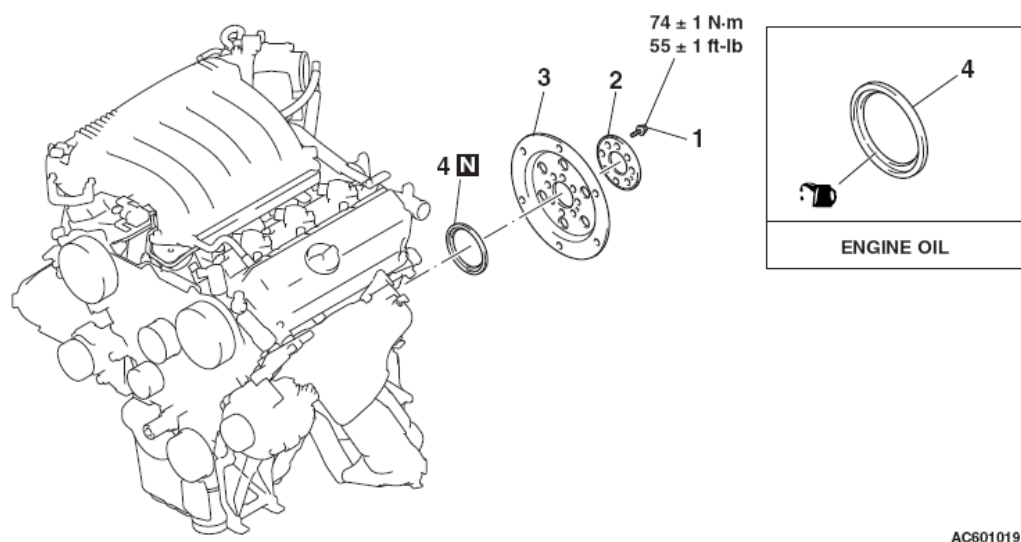


Fig. 80: Identifying Crankshaft Spacer, Crankshaft Sensing Blade And Crankshaft Sprocket
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

REMOVAL AND INSTALLATION <REAR OIL SEAL>

Pre-removal and Post-installation Operation

- Automatic Transaxle Assembly Removal and Installation



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- | | |
|----------------------|-----------------------------|
| REMOVAL STEPS | |
| <<A>> >>B<< | 1. DRIVE PLATE BOLTS |
| | 2. ADAPTOR PLATE |
| >>A<< | 3. DRIVE PLATE |
| | 4. CRANKSHAFT REAR OIL SEAL |

Fig. 81: Identifying Rear Oil Seal Components With Torque Specifications
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

Required Special Tools:

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

REMOVAL SERVICE POINT

<<A>> DRIVE PLATE BOLTS REMOVAL

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

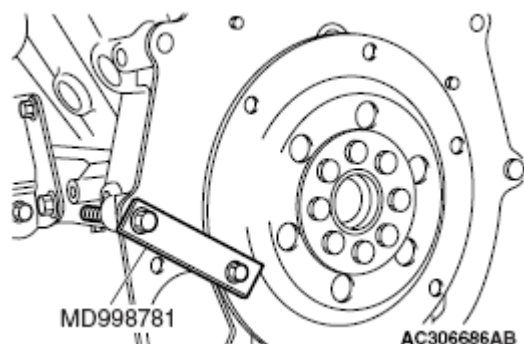


Fig. 82: Securing Drive Plate Using Special Tool MD998781
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

INSTALLATION SERVICE POINTS**>>A << CRANKSHAFT REAR OIL SEAL INSTALLATION**

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

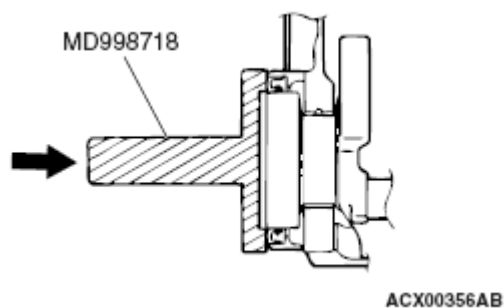


Fig. 83: Installing Oil Seal Using Special Tool MD998718
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>>B << DRIVE PLATE BOLTS INSTALLATION

Use special tool MD998781 in the same way as during removal to install the drive plate bolts.

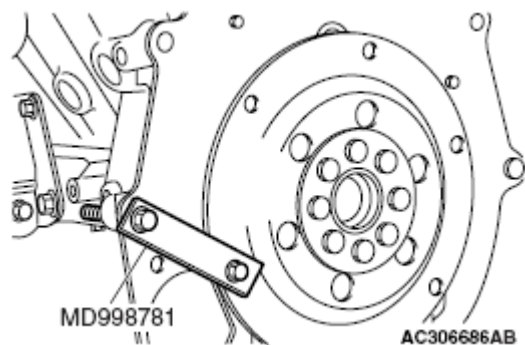
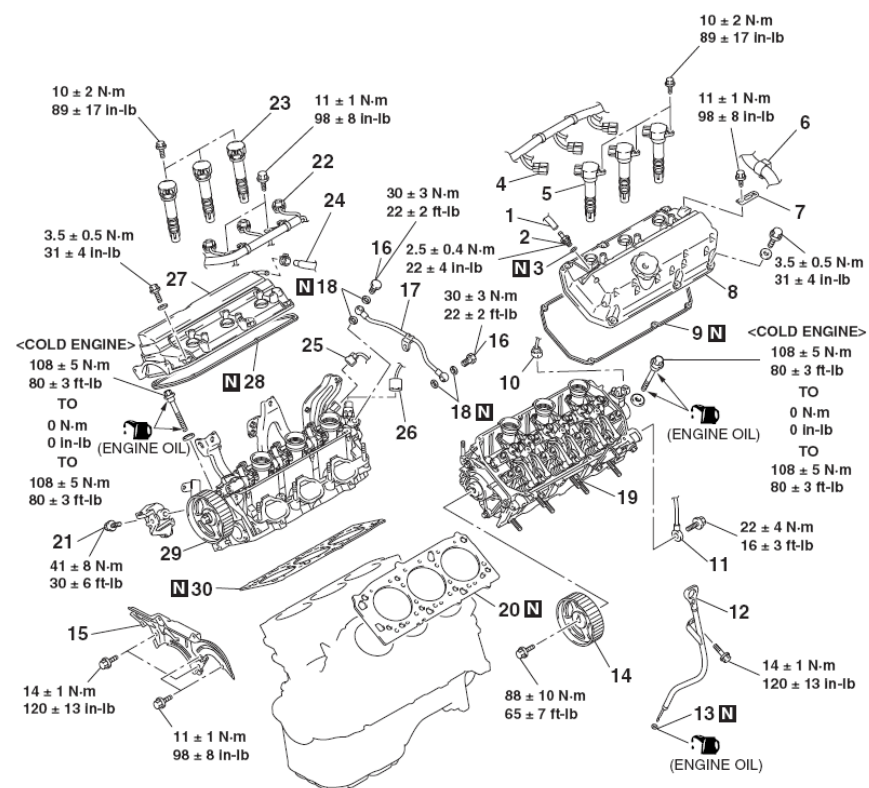


Fig. 84: Securing Drive Plate Using Special Tool MD998781
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

CYLINDER HEAD GASKET**REMOVAL AND INSTALLATION**

Pre-removal and Post-installation Operation

- Intake Manifold Removal and Installation
- Exhaust Manifold Removal and Installation
- Timing Belt Removal and Installation
- Thermostat Housing Removal and Installation
- Generator Removal and Installation



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REMOVAL STEPS

- | | |
|---|--|
| 1. PCV HOSE CONNECTION | <> >>B<< 19. LEFT BANK CYLINDER HEAD ASSEMBLY |
| 2. PCV VALVE | >>A<< 20. CYLINDER HEAD GASKET |
| 3. O-RING | • POWER STEERING OIL PUMP ASSEMBLY |
| 4. IGNITION COIL CONNECTOR | |
| 5. IGNITION COIL | |
| 6. ENGINE CONTROL WIRING HARNESS CLAMP | |
| 7. HARNESS BRACKET | |
| 8. ROCKER COVER | |
| 9. ROCKER COVER GASKET | |
| 10. CAMSHAFT POSITION SENSOR CONNECTOR | |
| 11. GROUNDING | |
| 12. ENGINE OIL DIPSTICK ASSEMBLY | |
| 13. O-RING | |
| <<A>> >>D<< 14. CAMSHAFT SPROCKET | |
| 15. TIMING BELT REAR CENTER COVER | |
| >>C<< 16. EYE BOLT | <> >>B<< 21. POWER STEERING OIL PUMP BRACKET BOLT |
| >>C<< 17. OIL FEEDER CONTROL VALVE PIPE | >>A<< 22. IGNITION COIL CONNECTOR |
| >>C<< 18. GASKET | >>A<< 23. IGNITION COIL |
| | >>A<< 24. BREATHER HOSE CONNECTION |
| | >>A<< 25. ENGINE OIL CONTROL VALVE CONNECTOR |
| | >>A<< 26. ENGINE OIL PRESSURE SWITCH CONNECTOR |
| | >>A<< 27. ROCKER COVER |
| | >>A<< 28. ROCKER COVER GASKET |
| | >>A<< 29. RIGHT BANK CYLINDER HEAD ASSEMBLY |
| | >>A<< 30. CYLINDER HEAD GASKET |

Fig. 85: Identifying Cylinder Head Gasket Components With Torque Specifications
 Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

Required Special Tools:

- MB990767: Front Hub and Flange Yoke Holder
- MD998051: Cylinder Head Bolt Wrench
- MD998715: Crankshaft Pulley Holder Pin

REMOVAL SERVICE POINTS**<<A>> CAMSHAFT SPROCKET REMOVAL**

Use special tools MD998715 and MB990767 to remove the camshaft sprocket.

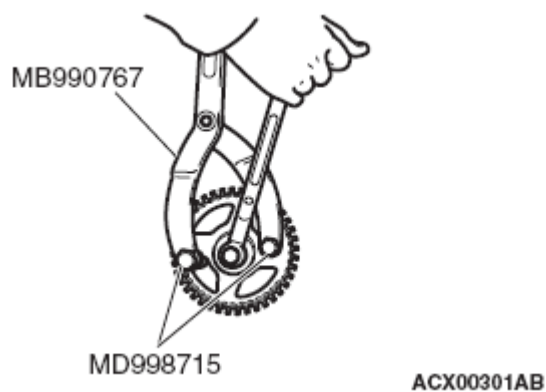


Fig. 86: Removing Camshaft Sprocket Bolt
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

<> CYLINDER HEAD ASSEMBLY REMOVAL

Use special tool MD998051 to loosen each bolt in two or three steps in the order shown in the illustration.

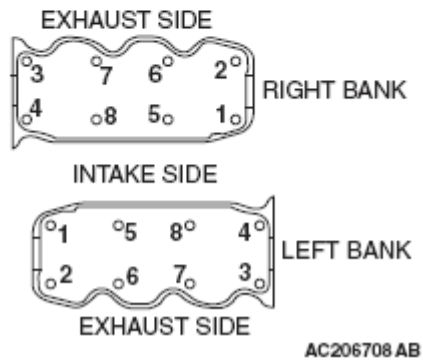
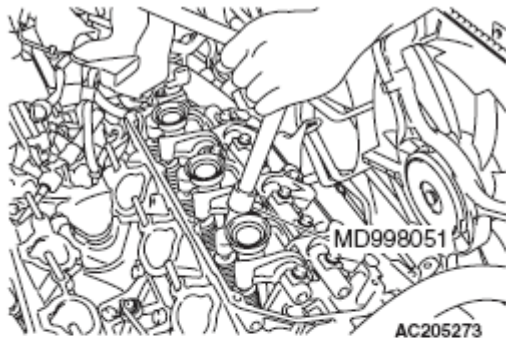


Fig. 87: Removing Cylinder Head Bolts Using Special Tool MD998051
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

INSTALLATION SERVICE POINTS

>>A << CYLINDER HEAD GASKET INSTALLATION

1. Degrease the cylinder head and cylinder block gasket mounting surfaces.
2. Make sure that the gasket has the proper identification mark for the engine.
3. Lay the cylinder head gasket on the cylinder block with the identification mark at the front top.

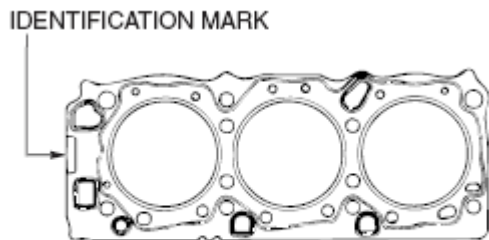


Fig. 88: Identifying Cylinder Head Gasket Identification Mark
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>>B << CYLINDER HEAD ASSEMBLY INSTALLATION

CAUTION: Be careful that no foreign material gets into the cylinder, coolant passages or oil passages. Engine damage may result.

1. Use a scraper to clean the gasket surface of the cylinder head assembly.

CAUTION: Install the head bolt washers with the beveled side facing upwards as shown in the illustration.

2. Using special tool MD998051 and a torque wrench, tighten the bolts to the specified torque in the order shown in the illustration. (in two or three cycles)

Tightening torque: 108 ± 5 N.m (80 ± 3 ft-lb) to 0 N.m (0 in-lb) to 108 ± 5 N.m (80 ± 3 ft-lb)

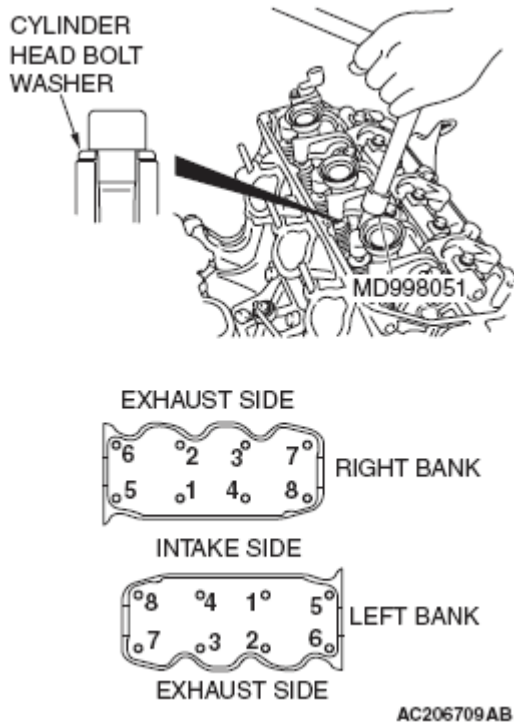


Fig. 89: Tightening Bolts Using Special Tool MD998051
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>>C << GASKET/OIL FEEDER CONTROL VALVE PIPE/EYE BOLT INSTALLATION

CAUTION: Install the oil feeder control valve pipe as follows so that the pipe is not deformed.

1. Install a gasket to one of oil feeder control valve pipes and tighten the eye bolt by hand.
2. Install a gasket to the other oil feeder control valve pipe and tighten the eye bolt to the specified torque.

Tightening torque: 30 ± 3 N.m (22 ± 2 ft-lb)

3. Tighten the eye bolt which is temporarily tightened by step 1 to the specified torque.

Tightening torque: 30 ± 3 N.m (22 ± 2 ft-lb)

>>D << CAMSHAFT SPROCKET INSTALLATION

1. Use special tools MD998715 and MB990767 in the same way as during removal to install the camshaft sprocket.
2. Tighten the camshaft sprocket mounting bolt to the specified torque.

Tightening torque: 88 ± 10 N.m (65 ± 7 ft-lb)

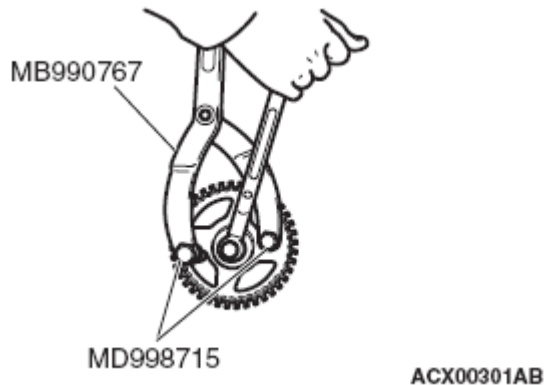


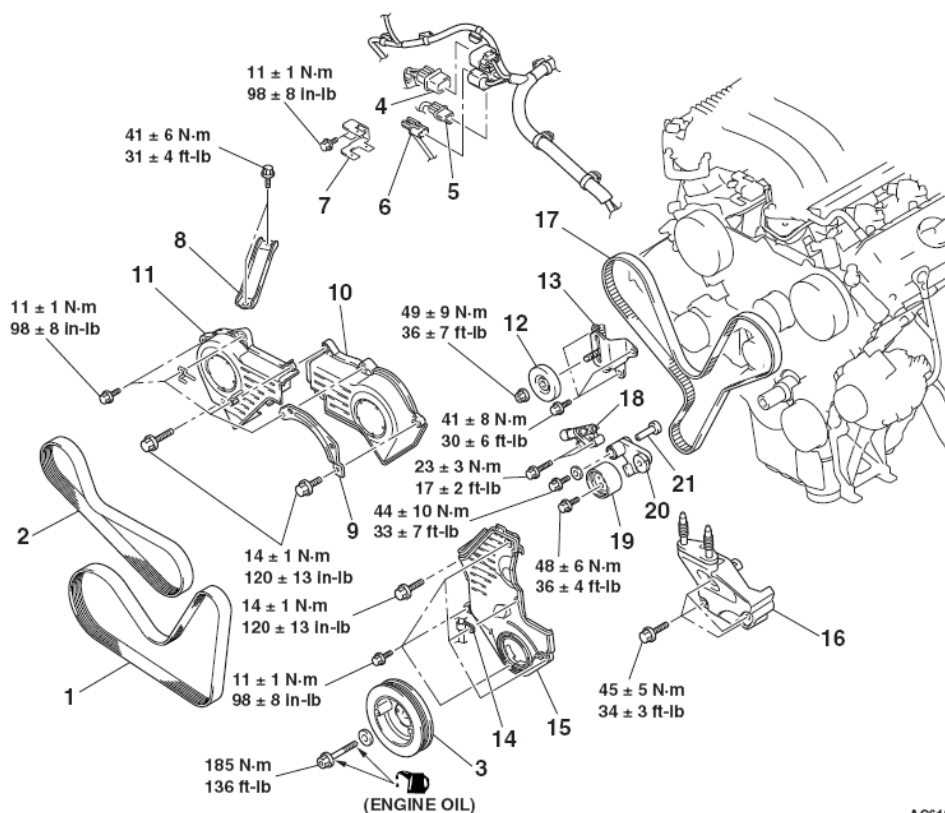
Fig. 90: Tightening Camshaft Sprocket Bolt
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

TIMING BELT

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation

- Engine Cover Removal and Installation (Refer to P.11E-22).
- Under Cover Removal and Installation (Refer to GROUP 51, Under Cover P.51-10).
- Side Under Cover Removal and Installation (Refer to GROUP 51, Under Cover P.51-10).



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REMOVAL STEPS

- GENERATOR DRIVE BELT
- POWER STEERING OIL PUMP DRIVE BELT
- CRANKSHAFT PULLEY
- CONTROL WIRING HARNESS AND INJECTOR WIRING HARNESS COMBINATION CONNECTOR
- KNOCK SENSOR CONNECTOR
- CRANKSHAFT POSITION SENSOR CONNECTOR
- CONNECTOR BRACKET
- ENGINE MOUNTING STAY
- CONNECTOR BRACKET
- TIMING BELT FRONT UPPER COVER, LEFT
- TIMING BELT FRONT UPPER COVER, RIGHT
- TENSIONER PULLEY
- TENSIONER BRACKET
- CRANKSHAFT POSITION SENSOR HARNESS CLAMP
- TIMING BELT LOWER COVER
- ENGINE FRONT MOUNTING BRACKET (REFER TO GROUP 32, ENGINE MOUNTING P.32-4).
- ENGINE SUPPORT BRACKET
- TIMING BELT *2
- TIMING BELT *1
- AUTO-TENSIONER *2
- AUTO-TENSIONER *1
- TENSIONER PULLEY
- TENSIONER ARM
- SHAFT

Fig. 91: Identifying Timing Belt Components With Torque Specifications
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

NOTE: *1 : In case that the amount of rod protrusion is 5 mm with the set pin inserted.

***2 : In case that the amount of rod protrusion is 1 mm with the set pin inserted.**

Required Special Tools:

- MB991800: Pulley Holder
- MB991802: Pin B
- MD998767: Tension Pulley Socket Wrench
- MD998769: Crankshaft Pulley Spacer

REMOVAL SERVICE POINTS

<<A>> CRANKSHAFT PULLEY REMOVAL

CAUTION: Use only the specified special tools, or a damaged pulley damper could result.

Use special tools MB991800 and MB991802 to remove the crankshaft pulley from the crankshaft.

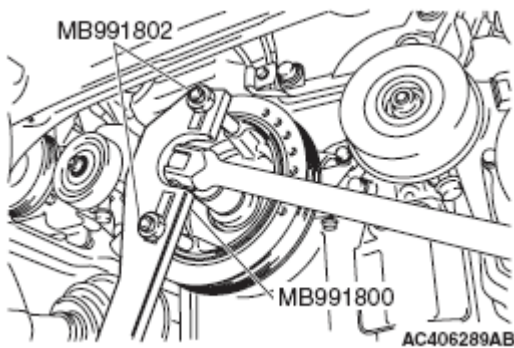


Fig. 92: Removing Crankshaft Pulley Bolt Using Special Tools MB991800 And MB991802
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

<> TIMING BELT REMOVAL

CAUTION: Never turn the crankshaft counterclockwise.

1. Turn the crankshaft clockwise to align each timing mark and to set the number 1 cylinder to compression top dead center.
2. If the timing belt is to be reused, chalk an arrow on the flat side of the belt, indicating the clockwise direction.
3. Loosen the center bolt of the tensioner pulley, then remove the timing belt.

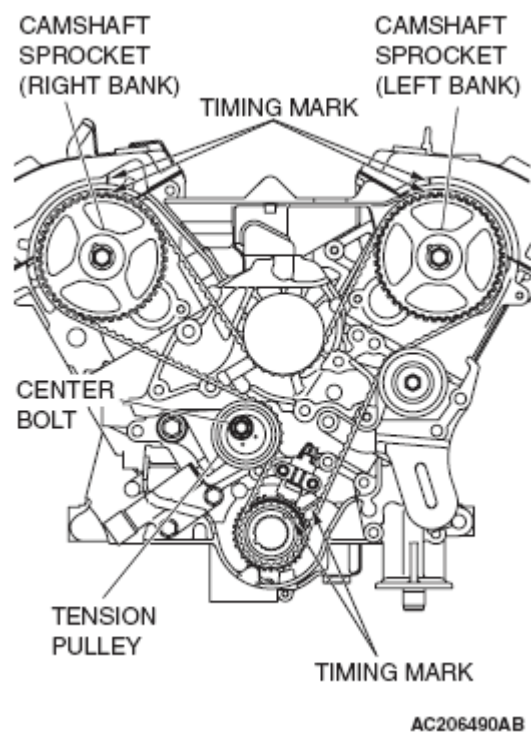


Fig. 93: Identifying Timing Marks On Timing Belt And Camshaft Sprock
 Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

INSTALLATION SERVICE POINTS

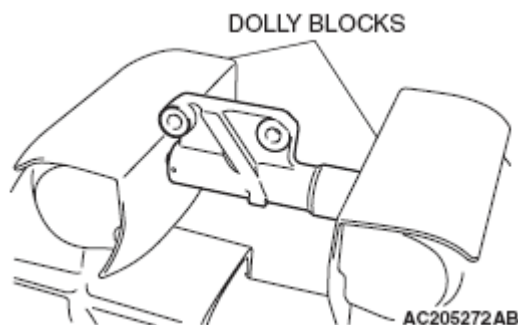
>>A << AUTO-TENSIONER INSTALLATION

< In case that the amount of rod protrusion is 5 mm with the set pin inserted.>

1. If the auto-tensioner rod remains fully extended, set according to the following procedure.

CAUTION: Place the auto-tensioner perpendicular to the jaws of the vice.

1. Place two dolly blocks in a vice as shown in the illustration, and then place the auto-tensioner in the vice.

**Fig. 94: Placing Dolly Blocks In Vice**

Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

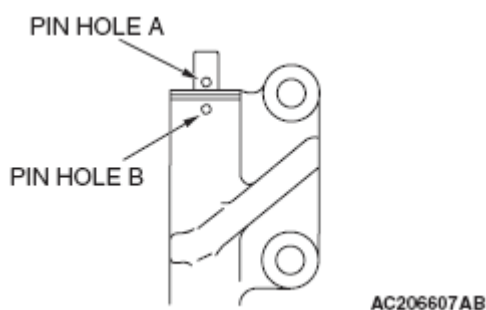
CAUTION: Never compress the pushrod too fast, or it may be damaged.

2. Slowly compress the pushrod of the auto-tensioner until pin hole A in the pushrod is aligned with pin hole B in the cylinder.
3. Insert the set pin into the pin holes once they are aligned.

NOTE: If replacing the auto-tensioner, the pin will already be inserted into the pin holes of the new part.

CAUTION: Do not remove the setting pin from the auto-tensioner.

4. Install the auto-tensioner to the engine.

**Fig. 95: Identifying Pin Hole A And B**

Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>>B << AUTO-TENSIONER INSTALLATION

< In case that the amount of rod protrusion is 1 mm with the set pin inserted.>

CAUTION: • If the lateral type press is used, the appropriate air bleeding is not

carried out. Always use longitudinal type press.

- To prevent damage to the auto tensioner, do not apply the load of 5,000N (1,124 lb) or more.
- To prevent damage to the auto tensioner, do not press the rod below the cylinder end plane.

1. Set the auto tensioner to the longitudinal type press as shown in the illustration.
2. Push in the rod little by little with the longitudinal type press until set hole A in the rod is aligned with hole B in the cylinder.

CAUTION: To prevent the air from being incorporated, keep the auto tensioner with its rod upward after the air bleeding.

3. Insert the set pin into the set holes. This auto-tensioner setting pin will be used during timing belt alignment.

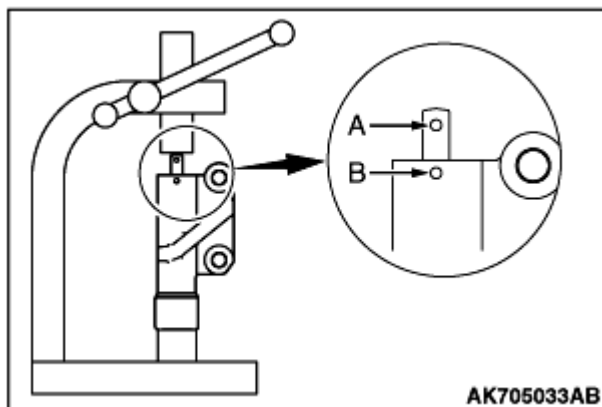


Fig. 96: Identifying Pin Hole A And B

Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>>C << TIMING BELT INSTALLATION

< In case that the amount of rod protrusion is 5 mm with the set pin inserted.>

1. Align the timing marks on the camshaft sprockets with those on the rocker cover and the timing mark on the crankshaft sprocket with that on the engine block as shown in the illustration.

CAUTION: The camshaft sprocket (right bank) can turn easily due to the spring force applied, so be careful not to get your fingers caught.

2. Install the timing belt by the following procedure so that there is no deflection in the timing belt between each sprocket and pulley.
 1. Crankshaft sprocket

2. Idler pulley
 3. Camshaft sprocket (Left bank)
 4. Water pump pulley
 5. Camshaft sprocket (Right bank)
 6. Tensioner pulley
3. Turn the camshaft sprocket (Right bank) counterclockwise until the tension side of the timing belt is firmly stretched. Check all the timing marks again.

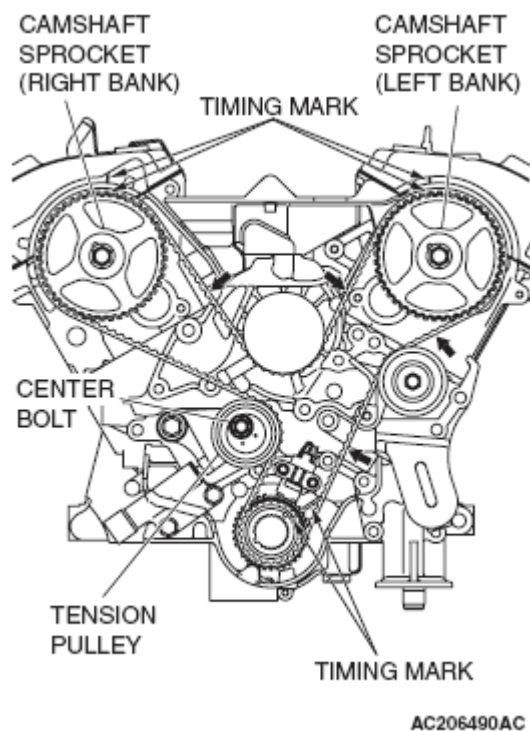


Fig. 97: Identifying Timing Marks On Timing Belt And Camshaft Sprock
 Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

4. Use special tool MD998767 to push the tensioner pulley into the timing belt, then temporarily tighten the center bolt.

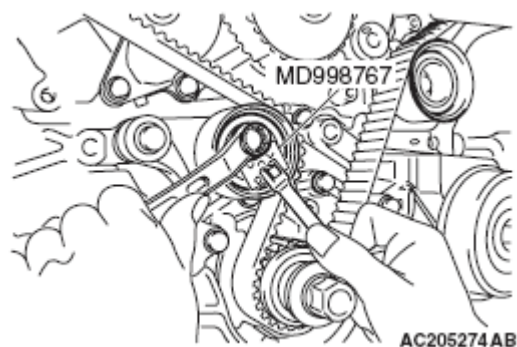
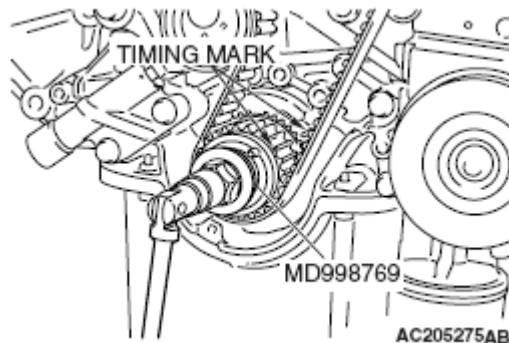


Fig. 98: Pushing Tensioner Pulley Into Timing Belt

Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

5. Use special tool MD998769 to turn the crankshaft 1/4 turn counterclockwise, then turn it again clockwise until the timing marks are aligned.

CAUTION: When tightening the center bolt, be careful that the tensioner pulley does not turn with the bolt.

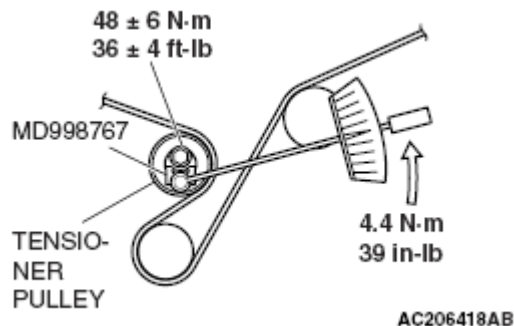
**Fig. 99: Turning Crankshaft 1/4 Counterclockwise**

Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

6. Loosen the center bolt of the tensioner pulley. Use special tool MD998767 and a torque wrench to apply the tension torque to the timing belt as shown in the illustration. Then tighten the center bolt to the specified torque.

Standard value: 4.4 N.m (39 in-lb) <Timing belt tension torque>

Tightening torque: 48 ± 6 N.m (36 ± 4 ft-lb)

**Fig. 100: Loosening Center Bolt Of Tensioner Pulley**

Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

7. Remove the set pin that has been inserted into the auto-tensioner.
8. Turn the crankshaft clockwise twice to align the timing marks.

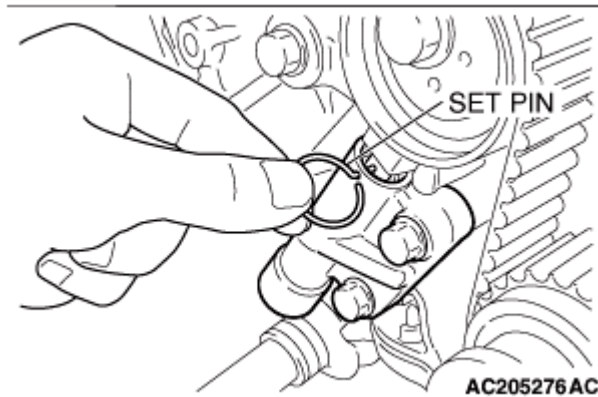


Fig. 101: Removing Set Pin

Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

9. Wait for at least five minutes, then check that the auto-tensioner pushrod extends within the standard value range.

Standard value (A): 4.8 - 6.0 mm (0.19 - 0.24 inch)

10. If not, repeat steps 1 through 8 above.
11. Check again that the timing marks of the sprockets are aligned.

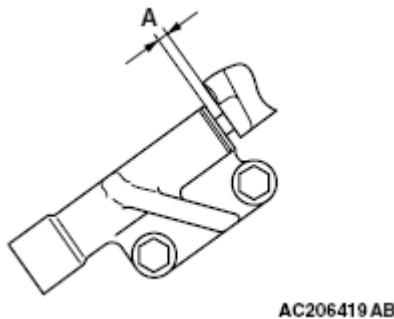


Fig. 102: Identifying Auto-Tensioner Pushrod Clearance

Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>>D << TIMING BELT INSTALLATION

< In case that the amount of rod protrusion is 1 mm with the set pin inserted.>

1. Align the timing marks on the camshaft sprockets with those on the rocker cover and the timing mark on the crankshaft sprocket with that on the engine block as shown in the illustration.

CAUTION: The camshaft sprocket (right bank) can turn easily due to the spring force applied, so be careful not to get your fingers caught.

2. Install the timing belt by the following procedure so that there is no deflection in the timing belt between

each sprocket and pulley.

1. Crankshaft sprocket
 2. Idler pulley
 3. Camshaft sprocket (Left bank)
 4. Water pump pulley
 5. Camshaft sprocket (Right bank)
 6. Tensioner pulley
3. Turn the camshaft sprocket (Right bank) counterclockwise until the tension side of the timing belt is firmly stretched. Check all the timing marks again.

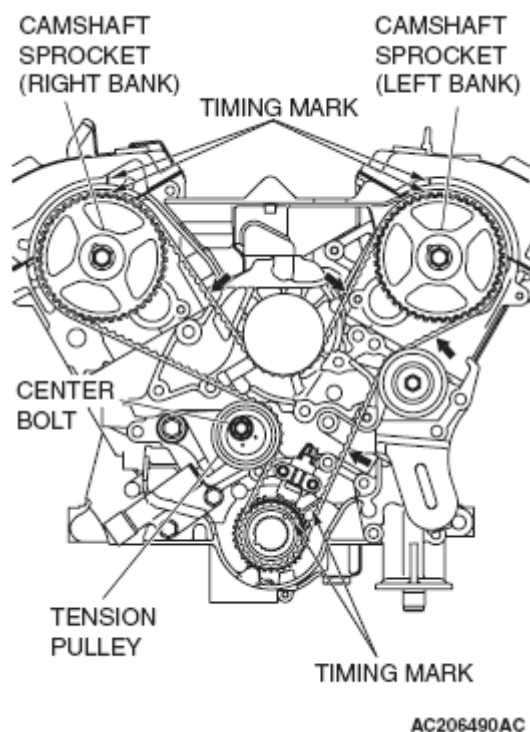


Fig. 103: Identifying Timing Marks On Timing Belt And Camshaft Sprocket
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

4. Insert the hexagon wrench having the width of 5 mm (0.20 inch) between the auto-tensioner and tensioner arm.

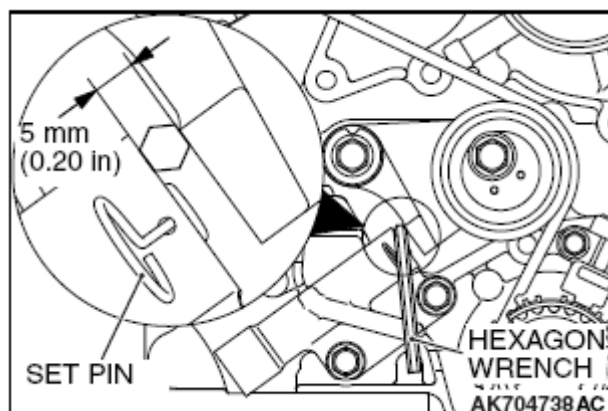


Fig. 104: Identifying Hexagon Wrench Between Auto-Tensioner And Tensioner Arm
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

5. Inserting the hexagon wrench, use special tool MD998767 to push the tensioner pulley into the timing belt, then temporarily tighten the center bolt.

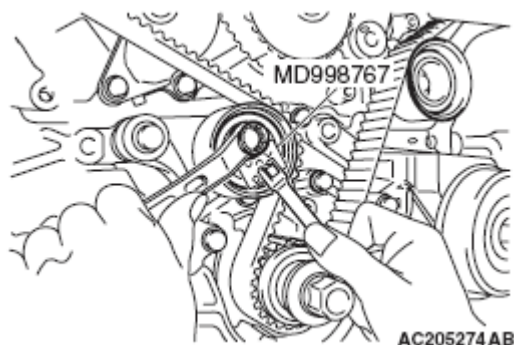


Fig. 105: Pushing Tensioner Pulley Into Timing Belt
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

6. Use special tool MD998769 to turn the crankshaft 1/4 turn counterclockwise, then turn it again clockwise until the timing marks are aligned.

CAUTION: When tightening the center bolt, be careful that the tensioner pulley does not turn with the bolt.

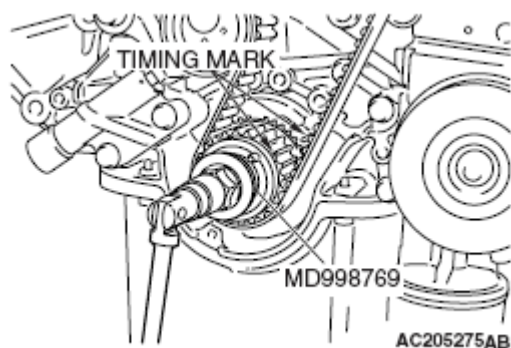


Fig. 106: Turning Crankshaft 1/4 Counterclockwise
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

7. Inserting the hexagon wrench, loosen the center bolt of the tensioner pulley. Use special tool MD998767 and a torque wrench to apply the tension torque to the timing belt as shown in the illustration. Then tighten the center bolt to the specified torque.

Standard value: 4.4 N.m (39 in-lb) <Timing belt tension torque>

Tightening torque: 48 ± 6 N.m (36 ± 4 ft-lb)



Fig. 107: Loosening Center Bolt Of Tensioner Pulley
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

CAUTION: If the hexagonal wrench is removed first, the timing belt would possibly become loose and come off the tooth.

8. Remove the set pin that has been inserted into the auto-tensioner.

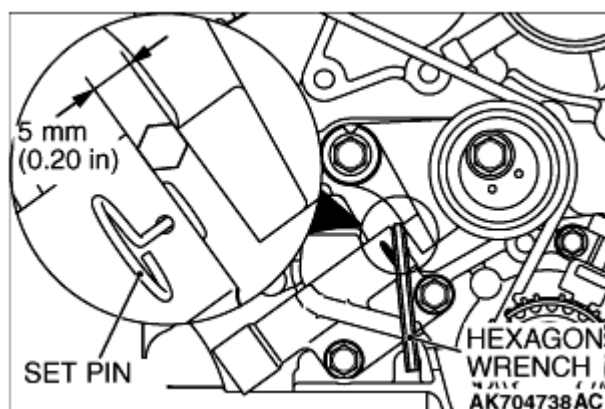


Fig. 108: Identifying Set Pin Into Auto-Tensioner
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

9. Pull out the hexagon wrench.
10. Turn the crankshaft clockwise twice to align the timing marks.

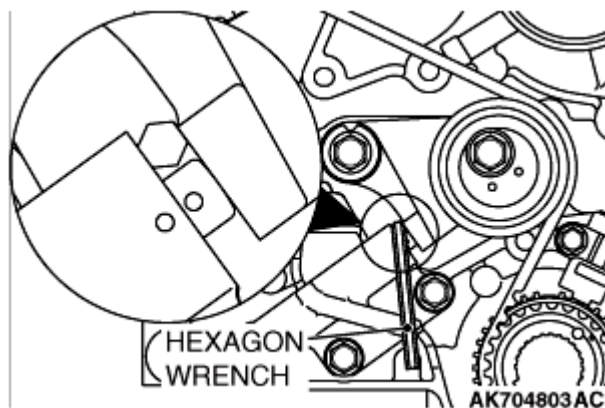
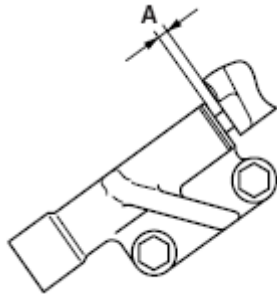


Fig. 109: Identifying Hexagon Wrench
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

11. Wait for at least five minutes, then check that the auto-tensioner pushrod extends within the standard value range.

Standard value (A): 4.8 - 6.0 mm (0.19 - 0.24 inch)

12. If not, repeat steps 1 through 10> above.
13. Check again that the timing marks of the sprockets are aligned.



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Fig. 110: Identifying Auto-Tensioner Pushrod Clearance
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>>E << CRANKSHAFT PULLEY INSTALLATION

Use special tools MB991800 and MB991802 to install the crankshaft pulley.

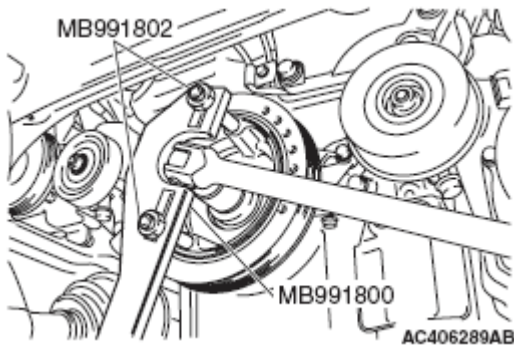


Fig. 111: Tightening Crankshaft Pulley Bolt Using Special Tools MB991800 And MB991802
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

INSPECTION

AUTO-TENSIONER CHECK

1. Check for oil leak from seal, and replace it if leak is detected.
2. Check for wear or damage at the top of the rod. Replace it, if required.
3. While holding the auto-tensioner with your hand, press the end of the pushrod against a metal surface (such as the cylinder block) with a force of 98 - 196 N (22 - 44 pounds) and measure how far the pushrod is pushed in.

Standard value: Within 1 mm (0.04 inch)

A: Length when no force is applied

B: Length when force is applied

A - B: Movement in

4. If the measured value is out of the standard value, replace the auto-tensioner.

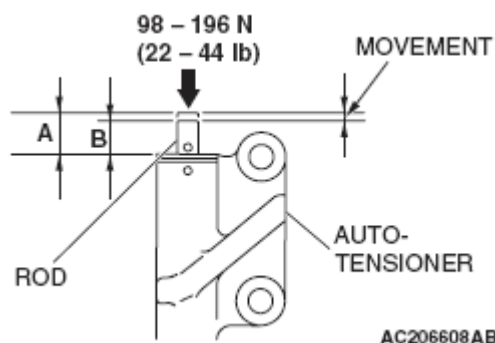


Fig. 112: Identifying Auto-Tensioner And Rod
 Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

AIR BLEEDING PROCEDURE OF AUTO-TENSIONER

< In case that the amount of rod protrusion is 1 mm with the set pin inserted.>

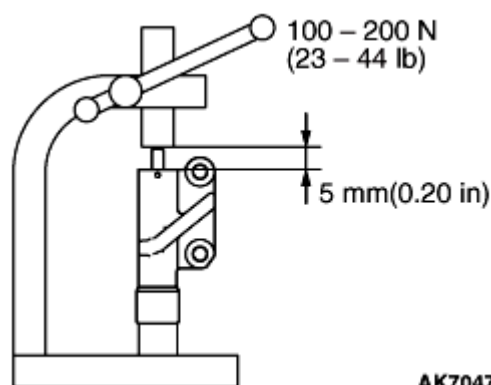
When the auto tensioner is not kept with its rod upward, or when the set pin having f 2 mm (0.08 inch) is pulled out before the installation to the engine, carry out the air bleeding as follows.

CAUTION:

- If the lateral type press is used, the appropriate air bleeding is not carried out. Always use longitudinal type press.
- To prevent damage to the auto tensioner, do not apply the load of 5,000N (1,124 lb) or more.
- To prevent damage to the auto tensioner, do not press the rod below the cylinder end plane.

1. Set the auto tensioner to the longitudinal type press as shown in the illustration.
2. Slowly press down the rod, two or three times, to the cylinder end plane.
3. When the rod protrusion has approximately 5 mm (0.20 inch), apply the load of 100 - 200N (23 - 44 lb). Check whether the auto tensioner has sufficient stiffness.
4. If the auto tensioner does not have sufficient stiffness, replace the auto tensioner.

CAUTION: To prevent the air from being incorporated, keep the auto tensioner with its rod upward after the air bleeding.



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Fig. 113: Identifying Auto-Tensioner Clearance
 Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

- Slowly pressing down the rod, insert the set pin having 2 mm (0.08 inch) through the hole to fix the auto tensioner.

SPECIFICATIONS

FASTENER TIGHTENING SPECIFICATIONS

FASTENER TIGHTENING SPECIFICATIONS

ITEM	SPECIFICATION
Camshaft and valve stem seal	
Camshaft oil seal case bolt	24 ± 3 N.m (18 ± 2 ft-lb)
Camshaft position sensing cylinder bolt	22 ± 4 N.m (16 ± 3 ft-lb)
Camshaft position sensor bolt	11 ± 1 N.m (98 ± 8 in-lb)
Camshaft position sensor support bolt	14 ± 1 N.m (120 ± 13 in-lb)
Camshaft sprocket bolt	88 ± 10 N.m (65 ± 7 ft-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)
Harness bracket bolt	11 ± 1 N.m (98 ± 8 in-lb)
Ignition coil bolt	10 ± 2 N.m (89 ± 17 in-lb)
Intake manifold plenum stay bolt	49 ± 6 N.m (37 ± 4 ft-lb)
Oil feeder control valve housing bolt	24 ± 3 N.m (18 ± 2 ft-lb)
Oil feeder control valve pipe bolt	11 ± 1 N.m (98 ± 8 in-lb)
Oil feeder control valve pipe eye bolt	30 ± 3 N.m (22 ± 2 ft-lb)
PCV valve	2.5 ± 0.4 N.m (22 ± 4 in-lb)
Power steering oil pump bracket connecting bolt	41 ± 8 N.m (30 ± 6 ft-lb)
Rocker cover bolt	3.5 ± 0.5 N.m (31 ± 4 in-lb)
Rocker shaft bolt (Intake side)	31 ± 3 N.m (23 ± 2 ft-lb)

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Rocker shaft bolt (Exhaust side)		13 ± 1 N.m (115 ± 9 in-lb)
Throttle body stay bolt		22 ± 1 N.m (16 ± 1 ft-lb)
Timing belt rear center cover bolt	M6	11 ± 1 N.m (98 ± 8 in-lb)
	M8	14 ± 1 N.m (120 ± 13 in-lb)
Camshaft oil seal		
Camshaft sprocket bolt		88 ± 10 N.m (65 ± 7 ft-lb)
Crankshaft oil seal		
A/T drive plate bolt		74 ± 1 N.m (55 ± 1 ft-lb)
Crankshaft position sensor bolt		8.5 ± 0.5 N.m (76 ± 4 in-lb)
Cylinder head gasket		
Camshaft sprocket bolt		88 ± 10 N.m (65 ± 7 ft-lb)
Cylinder head bolt <Cold engine>		108 ± 5 N.m (80 ± 3 ft-lb) to 0 N.m (0 in-lb) to 108 ± 5 N.m (80 ± 3 ft-lb)
Engine oil dipstick bolt		14 ± 1 N.m (120 ± 13 in-lb)
Grounding connecting bolt		22 ± 4 N.m (16 ± 3 ft-lb)
Harness bracket bolt		11 ± 1 N.m (98 ± 8 in-lb)
Ignition coil bolt		10 ± 2 N.m (89 ± 17 in-lb)
Oil feeder control valve pipe eye bolt		30 ± 3 N.m (22 ± 2 ft-lb)
PCV valve		2.5 ± 0.4 N.m (22 ± 4 in-lb)
Power steering oil pump bracket connecting bolt		41 ± 8 N.m (30 ± 6 ft-lb)
Rocker cover bolt		3.5 ± 0.5 N.m (31 ± 4 in-lb)
Timing belt rear center cover bolt	M6	11 ± 1 N.m (98 ± 8 in-lb)
	M8	14 ± 1 N.m (120 ± 13 in-lb)
Engine assembly		
Engine cover bolt		3.0 ± 0.5 N.m (27 ± 4 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)
Engine mounting stay bolt		41 ± 6 N.m (31 ± 4 ft-lb)
Engine hanger bolt		35 ± 6 N.m (26 ± 4 ft-lb)
Engine oil dipstick bolt		14 ± 1 N.m (120 ± 13 in-lb)
Grounding bolt and nut		9.0 ± 2.0 N.m (80 ± 17 in-lb)
Grounding cable bolt		9.0 ± 2.0 N.m (80 ± 17 in-lb)
Intake manifold plenum stay (rear) bolt	M8	22 ± 1 N.m (16 ± 1 ft-lb)
	M10	49 ± 6 N.m (37 ± 4 ft-lb)
Power steering oil pump bolt		46 ± 8 N.m (34 ± 6 ft-lb)
Power steering oil pump nut		42 ± 7 N.m (31 ± 5 ft-lb)
Power steering oil reservoir connecting nut		12 ± 2 N.m (102 ± 22 in-lb)
Power steering pressure hose clamp bracket bolt		12 ± 2 N.m (102 ± 22 in-lb)
Starter bolt		30 ± 3 N.m (23 ± 2 ft-lb)

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Starter terminal nut		12 ± 2 N.m (102 ± 22 in-lb)
Throttle body stay bolt		22 ± 1 N.m (16 ± 1 ft-lb)
Oil pan and oil screen		
Baffle plate bolt		11 ± 1 N.m (97 ± 9 in-lb)
Cover bolt		11 ± 0.5 N.m (93 ± 4 in-lb)
Engine oil dipstick bolt		14 ± 1 N.m (120 ± 13 in-lb)
Engine lower oil pan bolt		11 ± 1 N.m (97 ± 9 in-lb)
Engine oil pan drain plug		39 ± 5 N.m (29 ± 3 ft-lb)
Engine upper oil pan bolt		8.5 ± 3.5 N.m (76 ± 31 in-lb)
Engine upper oil pan to torque converter bolt		36 ± 5 N.m (26 ± 4 ft-lb)
Oil screen bolt		19 ± 3 N.m (14 ± 2 ft-lb)
Starter bolt		30 ± 3 N.m (23 ± 2 ft-lb)
Starter terminal nut		12 ± 2 N.m (102 ± 22 in-lb)
Torque converter connecting bolt		49 ± 3 N.m (36 ± 2 ft-lb)
Timing belt		
Auto-tensioner bolt		23 ± 3 N.m (17 ± 2 ft-lb)
Crankshaft pulley center bolt		185 N.m (136 ft-lb)
Engine mounting stay bolt		41 ± 6 N.m (31 ± 4 ft-lb)
Engine support bracket bolt		45 ± 5 N.m (34 ± 3 ft-lb)
Harness bracket bolt		11 ± 1 N.m (98 ± 8 in-lb)
Tensioner arm bolt		44 ± 10 N.m (33 ± 7 ft-lb)
Tensioner bracket bolt		41 ± 8 N.m (30 ± 6 ft-lb)
Tensioner pulley bolt		48 ± 6 N.m (36 ± 4 ft-lb)
Tensioner pulley nut		49 ± 9 N.m (36 ± 7 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)	M10	14 ± 1 N.m (120 ± 13 in-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)

SERVICE SPECIFICATIONS

SERVICE SPECIFICATIONS

ITEM		STANDARD VALUE	LIMIT
Generator drive belt tension (When checked)	Vibration frequency Hz	143 - 169	-
	Tension N (lb)	490 - 686 (110 - 154)	-
	Deflection (Reference) mm (in)	8.4 - 10.7 (0.33 - 0.42)	-
Generator drive belt tension (When	Vibration frequency Hz	150 - 163	-
	Tension N (lb)	539 - 637 (121 - 143)	-

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adjusted)	Deflection (Reference) mm (in)	8.9 - 10.1 (0.35 - 0.40)	-
Generator drive belt tension (When replaced)	Vibration frequency Hz	180 - 202	-
	Tension N (lb)	785 - 981 (176 - 221)	-
	Deflection (Reference) mm (in)	6.2 - 7.5 (0.24 - 0.30)	-
Power steering drive belt tension (When checked)	Vibration frequency Hz	124 - 160	-
	Tension N (lb)	294 - 490 (66 - 110)	-
	Deflection (Reference) mm (in)	12.3 - 16.2 (0.48 - 0.64)	-
Power steering drive belt tension (When adjusted)	Vibration frequency Hz	134 - 151	-
	Tension N (lb)	343 - 441 (77 - 99)	-
	Deflection (Reference) mm (in)	13.2 - 15.1 (0.52 - 0.59)	-
Power steering drive belt tension (When replaced)	Vibration frequency Hz	160 - 189	-
	Tension N (lb)	490 - 686 (110 - 154)	-
	Deflection (Reference) mm (in)	9.6 - 12.3 (0.38 - 0.48)	-
Intake valve clearance (at hot) mm (in)		0.20 (0.008)	-
Basic ignition timing at idle		5° BTDC ± 3°	-
Actual ignition timing at curb idle		Approximately 10° BTDC	-
CO contents %		0.5 or less	-
HC contents ppm		100 or less	-
Curb idle speed r/min		680 ± 100	-
Compression pressure (200 r/min) kPa (psi)		1,520 (220)	Minimum 1,110 (161)
Compression pressure difference of all cylinder kPa (psi)		-	98 (14)
Intake manifold vacuum at curb idle kPa (in Hg)		-	Minimum 60 (18)
Timing belt tension torque N.m (in-lb)		4.4 (39)	-
Auto tensioner rod protrusion amount mm (in)		4.8 - 6.0 (0.19 - 0.24)	-
Auto-tensioner pushrod movement mm (in)		Within 1.0 (0.04)	-

SEALANTS

SEALANTS SPECIFICATIONS

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