2011 ENGINE

Engine Mechanical - Endeavor

GENERAL DESCRIPTION

The 6G75 (3.8 L) 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			10.0
Firing order			1-2-3-4-5-6
Valve timing	Intake valve	Opens (BTDC)	5°
		Closes (ABDC)	55°
	Exhaust valve	Opens (BBDC)	51°
		Closes (ATDC)	17°
Lubrication system			Pressure feed, full-flow filtration
Oil pump type			Trochoid type

DIAGNOSIS

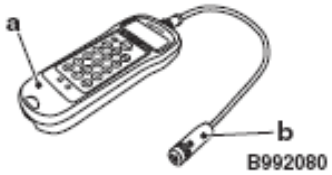
TROUBLE SYMPTOM CHART

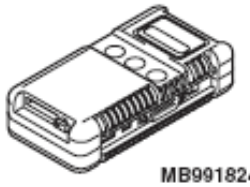
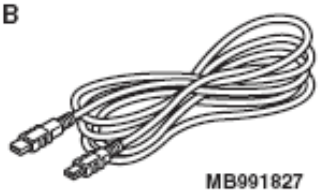
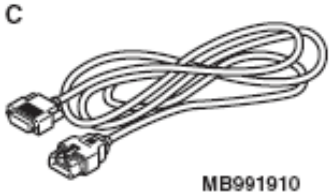
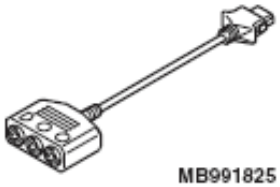
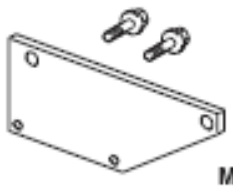
TROUBLE SYMPTOM	PROBABLE CAUSE	REMEDY
Compression is too low	Blown cylinder head gasket	Replace the gasket.
	Worn or damaged piston rings	Replace the rings.
	Worn piston or cylinder	Repair or replace the piston and/or the cylinder block.
	Worn or damaged valve seat	Repair or replace the valve and/or the seat ring.
Drop in engine oil pressure	Engine oil level is too low	Check the engine oil level.
	Malfunction of engine oil pressure switch	Replace the engine oil pressure switch.
	Clogged oil filter	Install a new filter.
	Worn oil pump gears or cover	Replace the gears and/or the cover.
		Change the engine oil to the

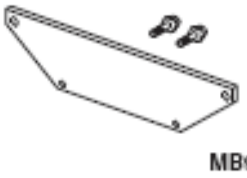
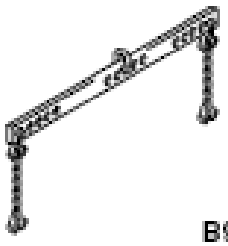
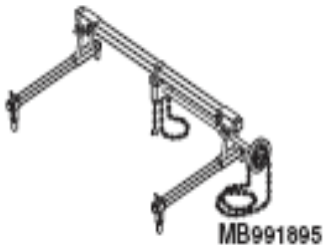
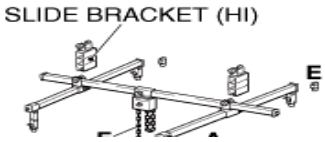
	Thin or diluted engine oil	correct viscosity.
	Stuck (opened) oil relief valve	Repair the relief valve.
	Excessive bearing clearance	Replace the bearings.
Engine oil pressure too high	Stuck (closed) oil relief valve	Repair the relief valve.
Noisy valves	Malfunction of lash adjuster (including entry of air into high pressure chamber)	Check the lash adjuster.
	Thin or diluted engine oil (low engine oil pressure)	Change the engine oil.
	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.

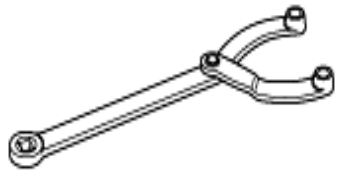
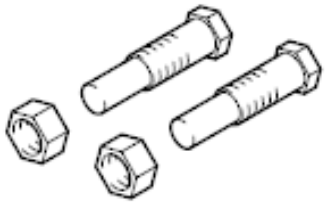
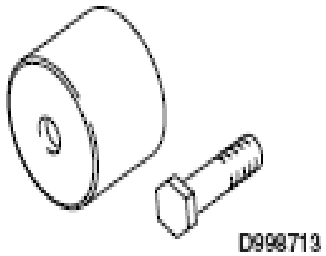
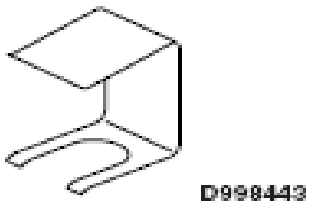
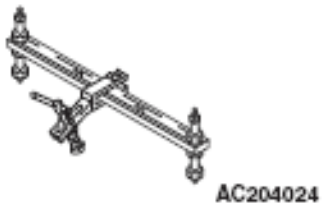
SPECIAL TOOLS

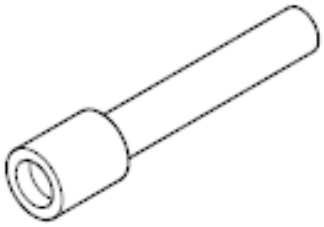
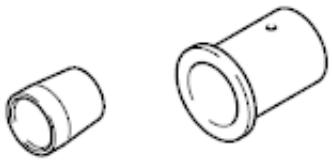
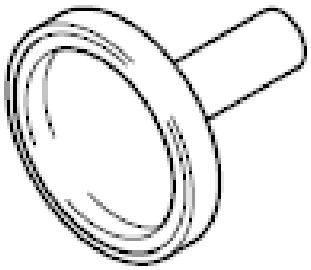
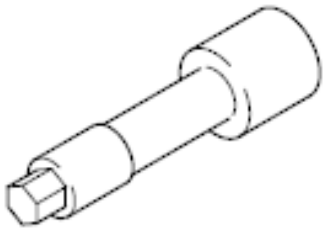
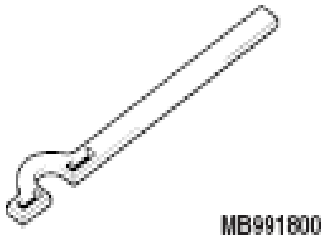
SPECIAL TOOLS REFERENCE

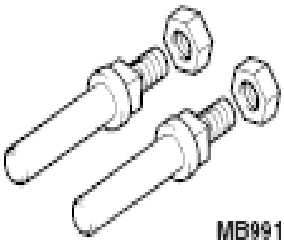
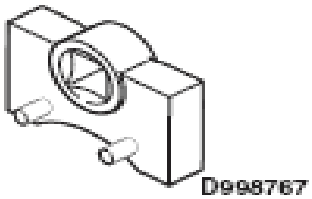
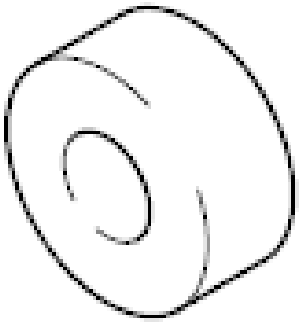
TOOL	TOOL NUMBER AND NAME	SUPERSESSION	APPLICATION
	MB992080 Belt tension meter set A. MB992081 Belt tension meter B. MB992082 Mic assembly	Tool not available	Drive belt tension check
	MB991958 Scan tool (M.U.T.-III sub assembly) A. MB991824 Vehicle communication interface (V.C.I.) B. MB991827 M.U.T.-III USB cable		

A  MB991824 B  MB991827 C  MB991910 D  MB991911 E  MB991914 F  MB991825 G  MB991826 MB991958	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	Supporting the engine

 MB992013	MB992013 Engine hanger plate B	General service tool	assembly
 B991454	MB991454 Engine hanger balancer	MZ203827-01	When the engine hanger is used: Supporting the engine assembly during removal and installation of the transaxle assembly **NOTE:** **Special tool MB991454 is a part of engine hanger attachment set MB991453.**
 MB991895	MB991895 Engine hanger	Tool not available	
 SLIDE BRACKET (HI) E	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 F. MB991934	Tool not available	

	Chain and hook assembly		
 B990767	MB990767 Front hub and flange yoke holder	MB990767-01	Holding the camshaft sprocket
	MD998715 Crankshaft pulley holder pin	MIT308239	
 D998713	MD998713 Camshaft oil seal installer	MD998713-01	Press-in of the camshaft oil seal
 B991559	MB991559 Camshaft oil seal adapter installer	MB991559-01	Press-fitting the camshaft oil seal (left bank side)
 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
	MD998717 Crankshaft front oil seal installer	MD998717-01	Press-in of the crankshaft front oil seal
	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 Pulley holder	MB991800-01	Holding the crankshaft pulley

	MB991802 Pin B	MB991802-01	
	MD998767 Tension pulley socket wrench	MD998752-01	Timing belt tension adjustment
	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 and that the following numeric values are displayed for individual items (M, W, and S):

   M 000.9 g/m

   W 010.0 mm/R

   S 0100 mm

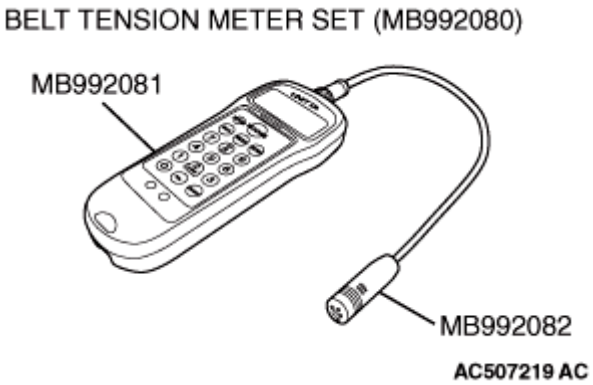


Fig. 1: Belt Tension Meter Set (MB992080)
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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

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

<Setting procedure>

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

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

CAUTION:
- **Do not 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), 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) with your finger as shown in the illustration, and measure that the vibration frequency of the belt is within the standard value.

Standard value:

STANDARD VALUE SPECIFICATION

Part No.	Vibration frequency Hz
MD368275	133 - 158
MN158101, MN187016	143 - 169

NOTE: **Because the frequency depends on the belt material, confirm Part No. shown on the reverse of the belt.**

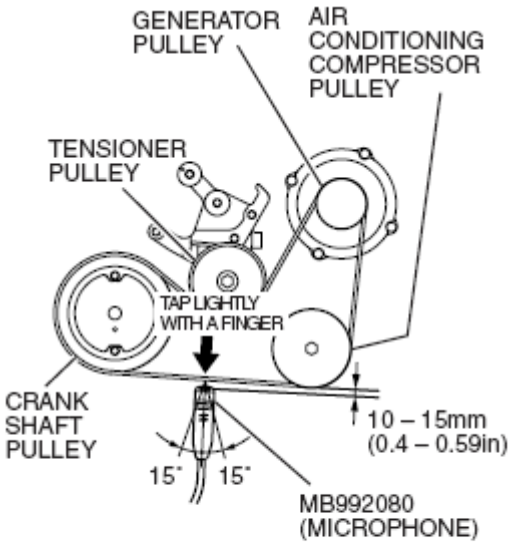


Fig. 2: Holding Special Tool MB992080 To Middle Of Drive Belt Between Pulleys
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

<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)

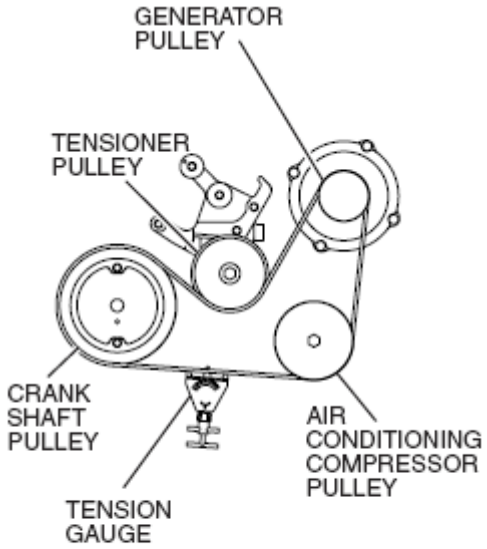


Fig. 3: Checking Belt Tension Within Standard Value
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

<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) and check that the amount of deflection in within the standard value.

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

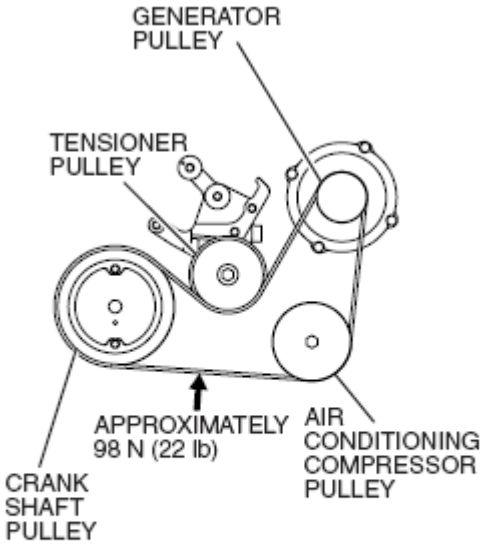


Fig. 4: Checking Belt Deflection
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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 defection amount to the standard value using the adjusting bolt.

Standard value:

ITEM SPECIFICATION

ITEM	Part No.	DURING ADJUSTMENT	DURING REPLACEMENT
Vibration frequency Hz	MD368275	140 - 152	168 - 188
	MN158101, MN187016	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)

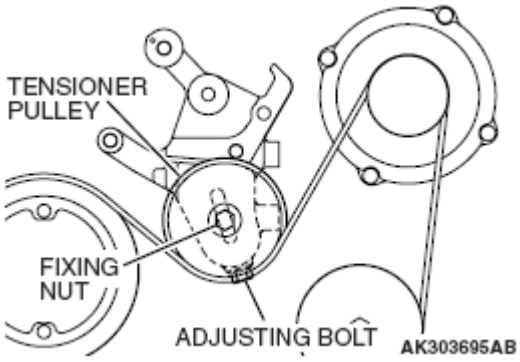


Fig. 5: Tightening Tension Pulley Fixing Nut
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

NOTE: Because the frequency depends on the belt material, confirm Part No. shown on the reverse of the belt.

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: Refer to generator drive belt tension check, for information regarding the vibration frequency measurement method using special tool MB992080.

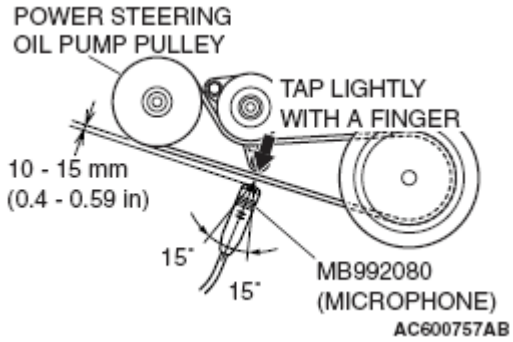


Fig. 6: Checking Power Steering Drive Belt Tension
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

<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)

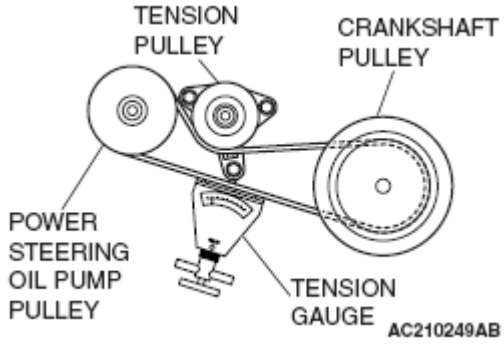


Fig. 7: Checking Belt Tension Within Standard Value
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

<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) and check that the amount of deflection is within the standard value.

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

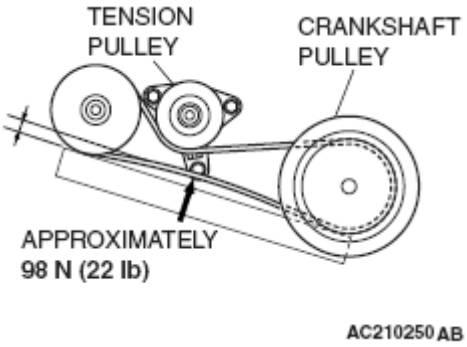


Fig. 8: Checking Belt Deflection
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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.

   Standard value:

   STANDARD VALUE SPECIFICATION

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)

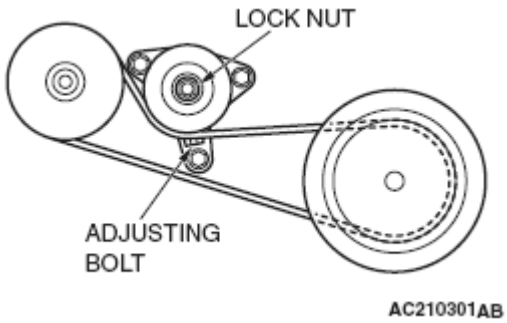


Fig. 9: Loosening Tensioner Pulley Lock Nut
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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 after turning the crankshaft one or more rotations clockwise.

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.

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: P range

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

   CAUTION: To prevent damage to scan tool MB991958, always turn the ignition switch to "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. 3) 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.

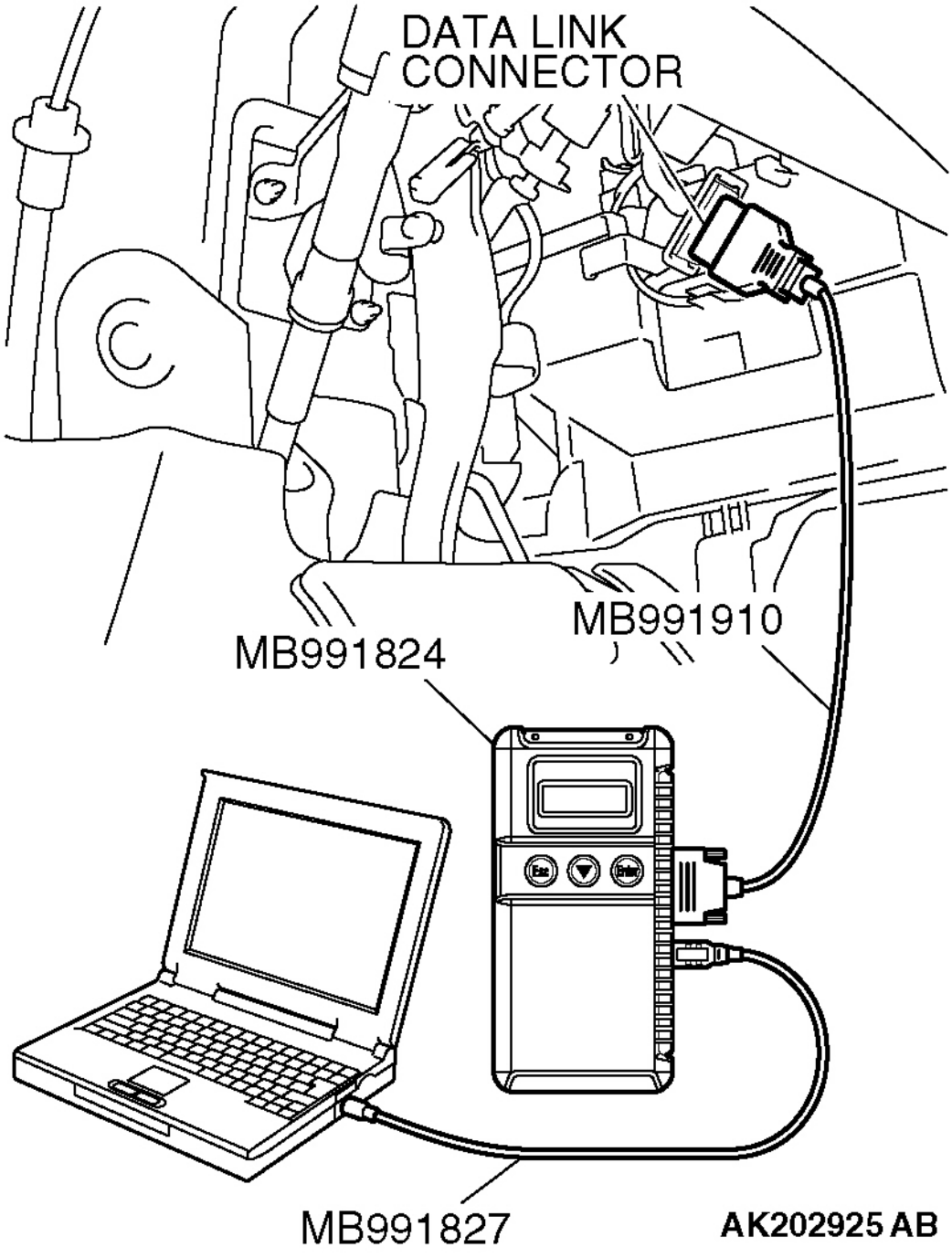


Fig. 10: Connecting Scan Tool To Data Link Connector
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

9. Cancel the setting mode of 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 ± 7°, 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 then disconnect the scan tool MB991958 from the data link connector.

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
    - Transaxle: P range

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

    CAUTION: To prevent damage to scan tool MB991958, always turn the ignition switch to "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. 3) of the ignition coil No. 4.

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

4. Start the engine.
5. Run the engine at idle for 2 minutes.
6. Check the actual ignition timing.

Standard value: Approximately 10° BTDC

NOTE: Ignition timing fluctuates about ±7°, 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.

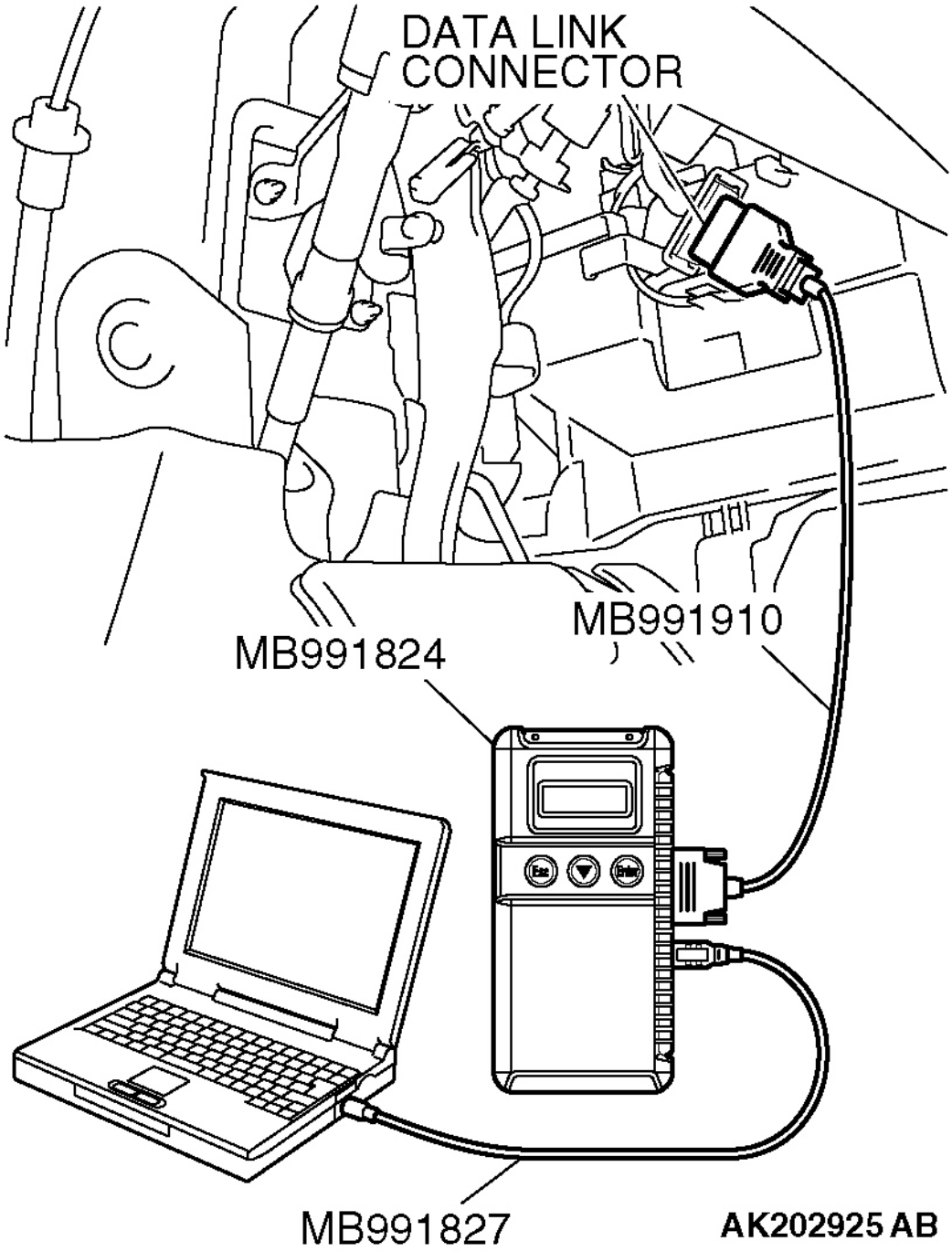


Fig. 11: Connecting Scan Tool To Data Link Connector
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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

Curb idle speed: 680 ± 100 r/min

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

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 then disconnect the scan tool MB991958 from data link connector.

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 vehicle in the following condition:
   - Engine coolant temperature: 80 - 95°C (176 - 203°F)
   - Lights and all accessories: OFF
   - Transaxle: P range

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

CAUTION: To prevent damage to scan tool MB991958, always turn the ignition switch to "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. 3) 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 increase the engine speed to 2,500 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 ± 7°, 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.

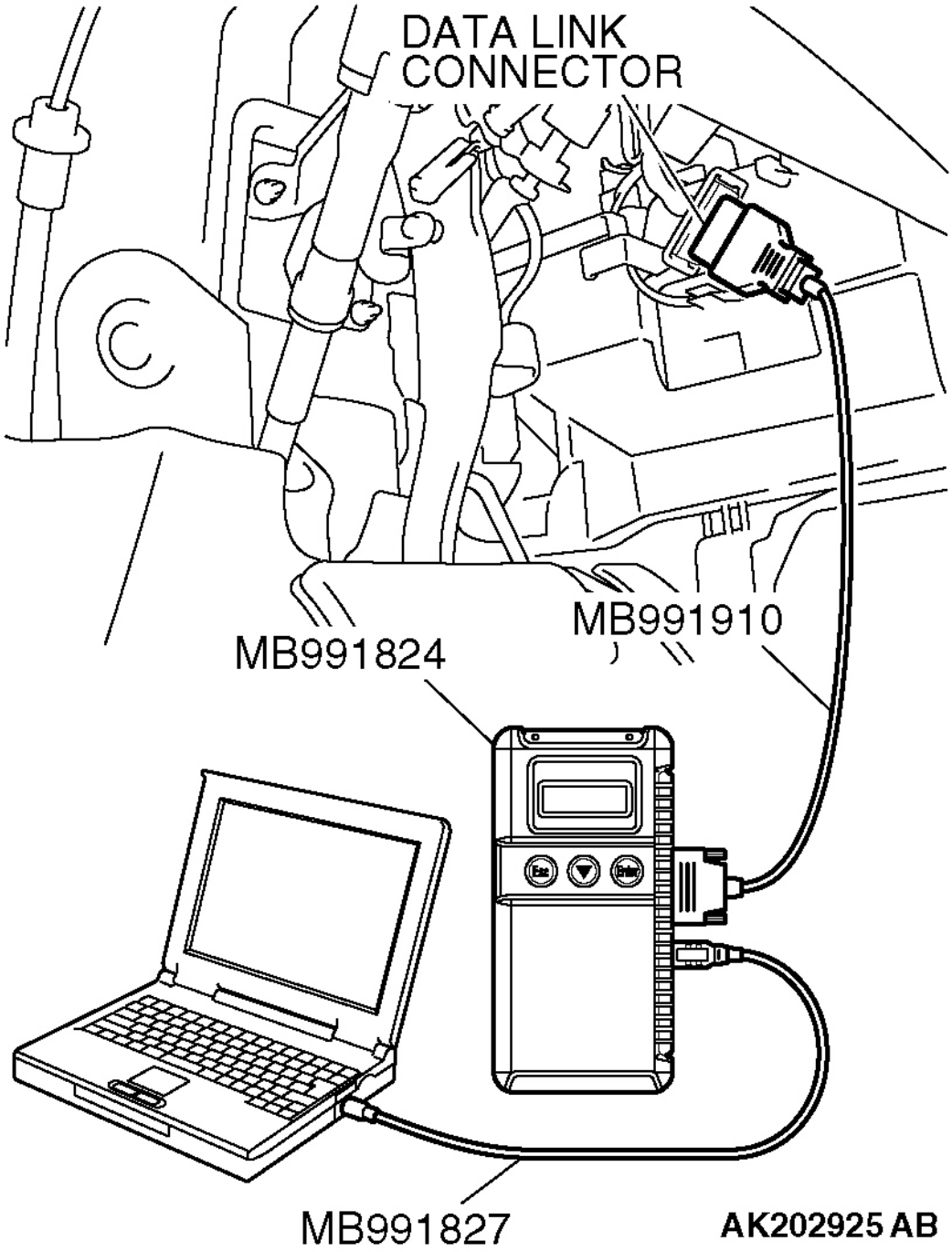


Fig. 12: Connecting Scan Tool To Data Link Connector
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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

8. If the CO and HC contents do not remain inside the standard value, refer to **SYMPTOM CHART** .
9. Remove the CO, HC tester and timing light.
10. Turn the ignition switch to the "LOCK" (OFF) position and then disconnect the scan tool MB 991958 from the data link connector.

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
   - Transaxle: P range

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

2. 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.

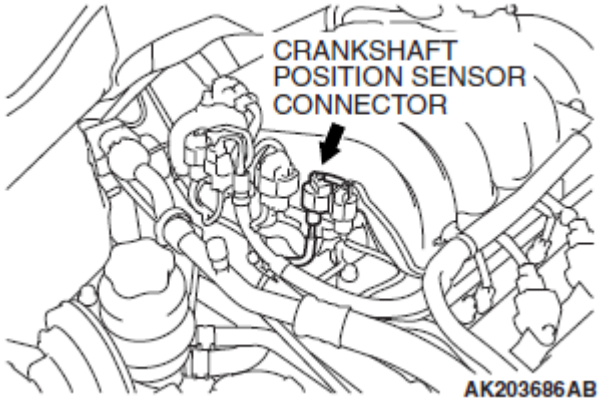


Fig. 13: Crankshaft Position Sensor Connector
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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): 1,548 kPa (225 psi)

   Minimum limit (at engine speed of 200 r/min): 1,117 kPa (162 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)

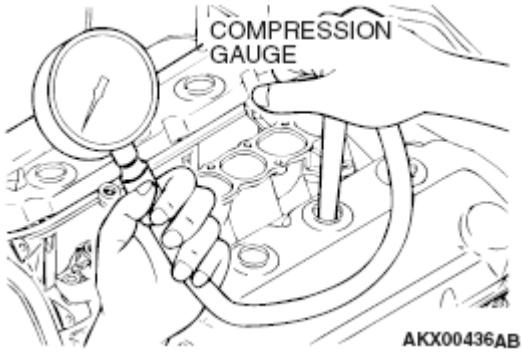


Fig. 14: Installing Compression Gauge To Spark Plug Hole
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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 6 to 8.
   1. If the compression increases after oil is added, the cause of the malfunction is a worn or damaged piston ring and/or cylinder inner surface.

2. If the compression does not rise after oil is added, the cause is a burnt or defective valve seat, or pressure is leaking from the gasket.

9. Connect the crankshaft position sensor connector.
10. Install the spark plugs and ignition coils.
11. Use the scan tool MB991958 to erase the diagnostic trouble codes.

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

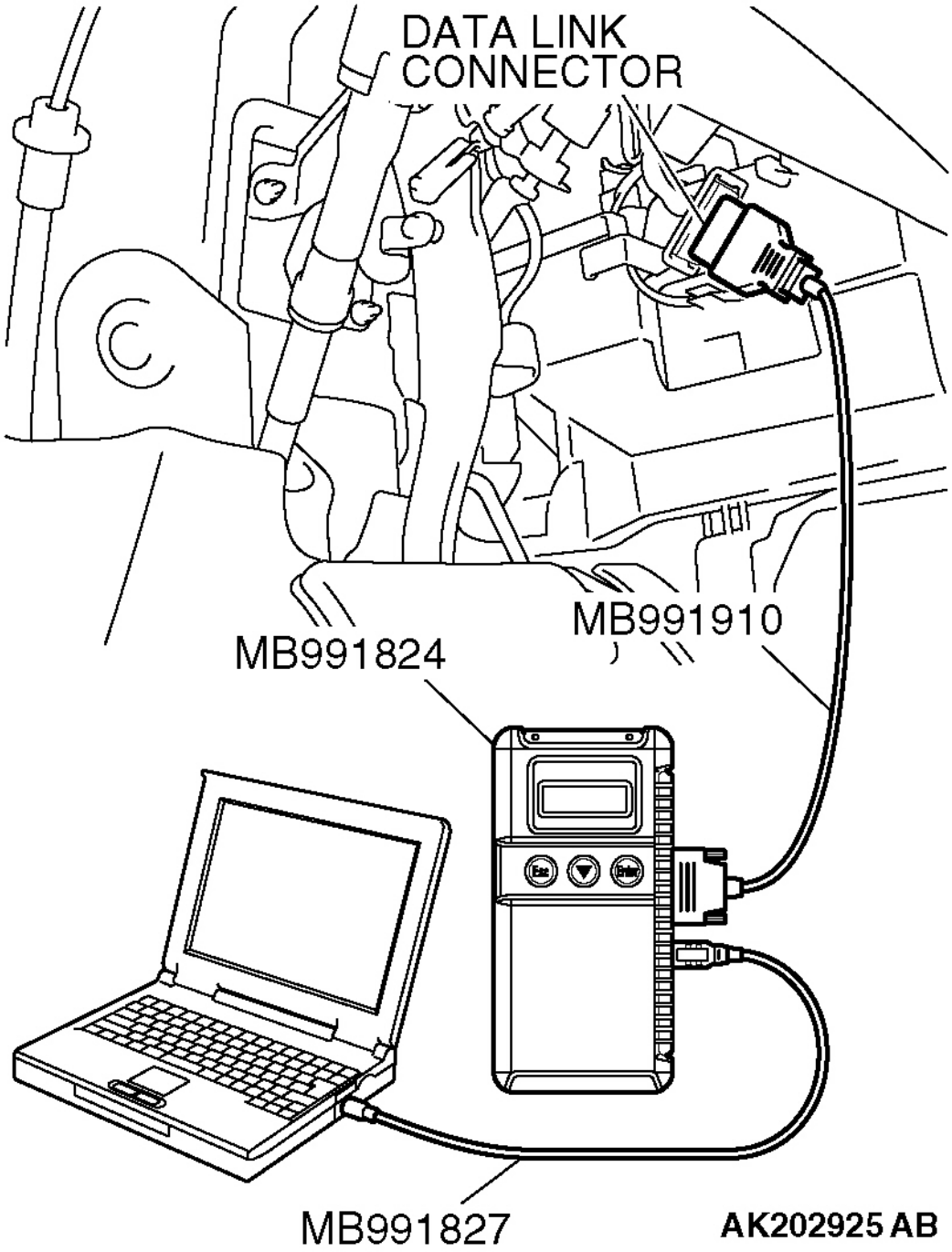


Fig. 15: Connecting Scan Tool To Data Link Connector
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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. Connect the scan tool MB991958 to the data link connector.

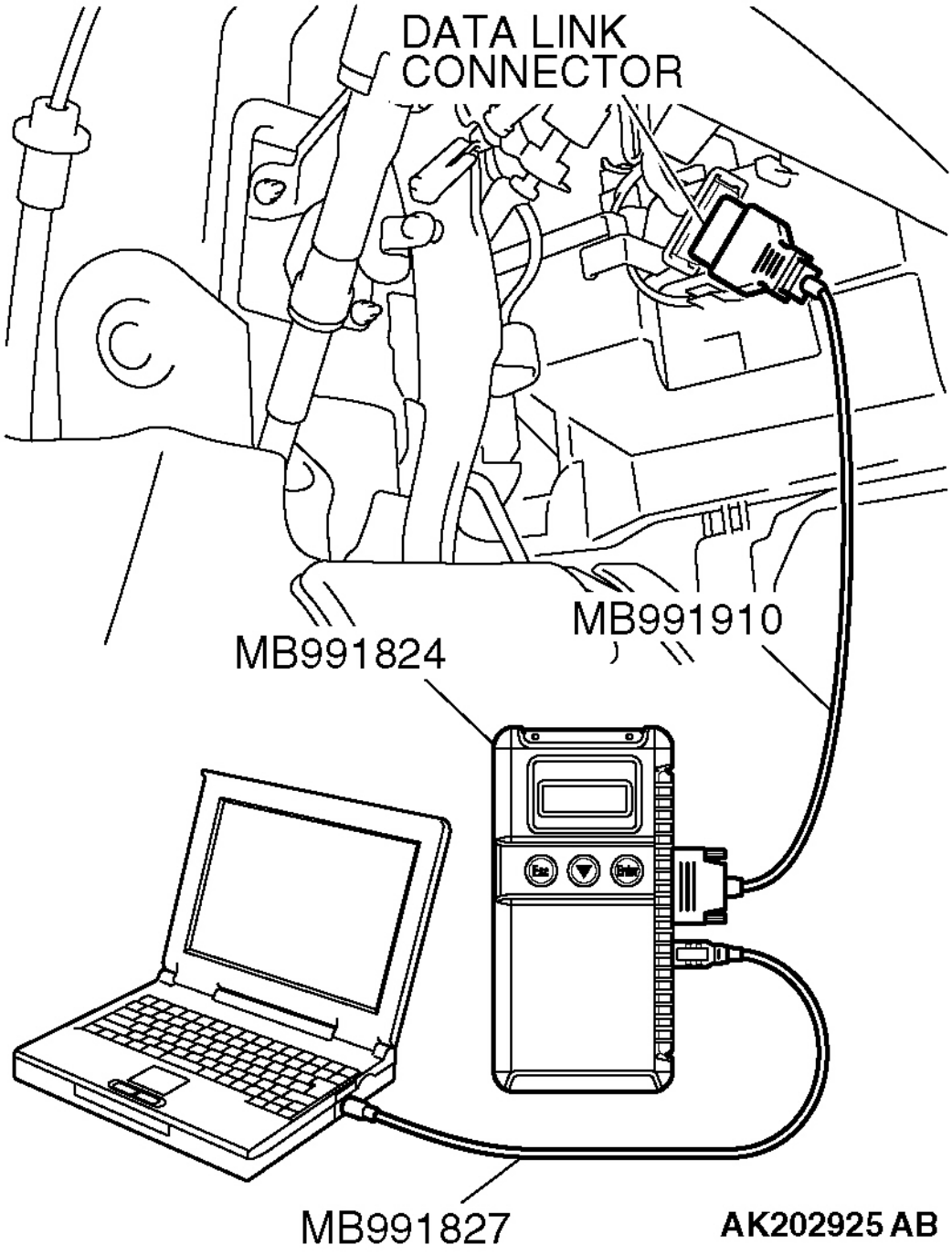


Fig. 16: Connecting Scan Tool To Data Link Connector
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

3. Disconnect the ventilation hose from the positive crankcase ventilation (PCV) valve, and then connect the

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.

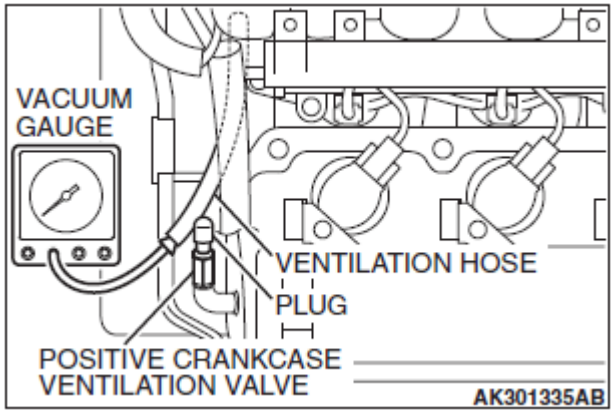


Fig. 17: Checking Manifold Vacuum
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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: 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.

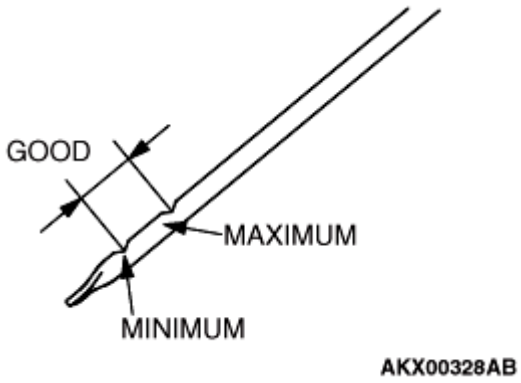


Fig. 18: Dipstick Oil Level
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

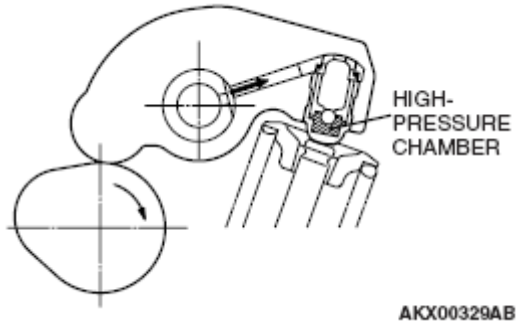


Fig. 19: High Pressure Chamber
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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 the illustration, 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 the illustration five more times.
5. Run the engine at idle for one to three minutes to make sure that the abnormal noise has been eliminated.

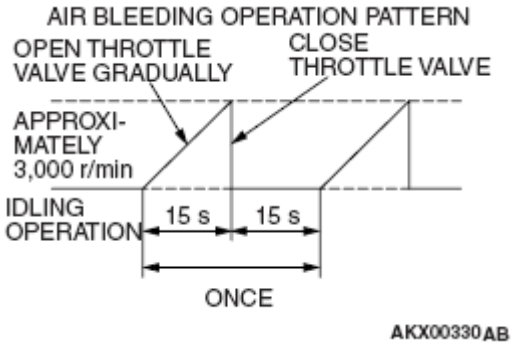


Fig. 20: Air Bleeding Operation Pattern
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

CYLINDER BLOCK HEATER UNIT CHECK

1. Remove the cylinder block heater cover. (Refer to **CYLINDER BLOCK HEATER UNIT**).
2. Disconnect cylinder block heater unit connector, and measure the resistance at cylinder block heater unit.

   Standard value: 19 - 30 ohms

3. If not within the standard value, replace the cylinder block heater unit. (Refer to **CYLINDER BLOCK HEATER UNIT**).

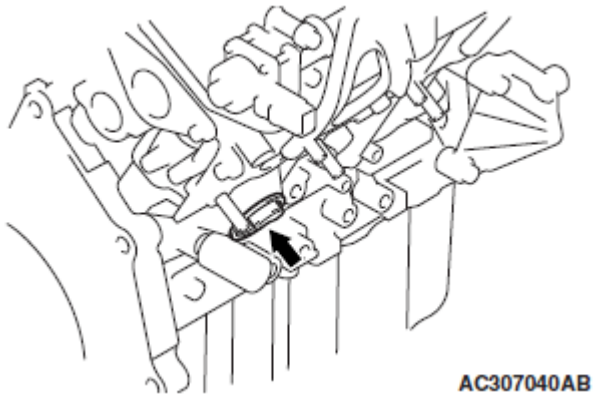


Fig. 21: Locating Cylinder Block Heater Unit Connector
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

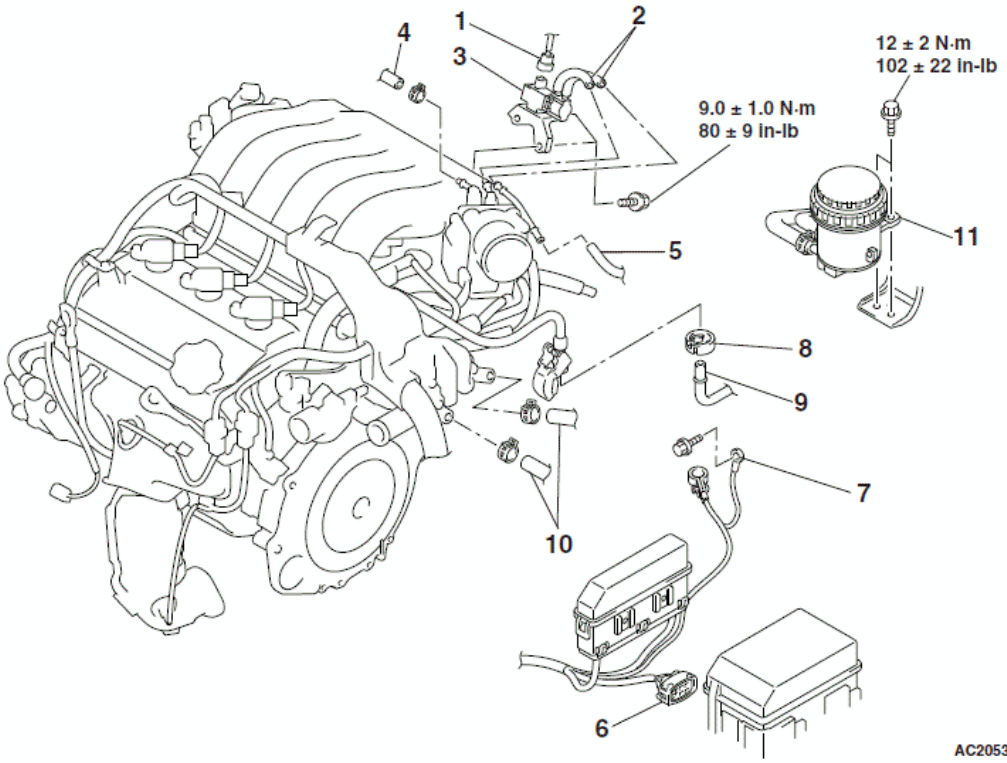
ENGINE ASSEMBLY

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.

Pre-removal Operation	Post-installation Operation
• Under Cover Removal and Installation	• Transaxle Assembly Installation
• Fuel Line Pressure Reduction	• Right Bank Exhaust Manifold Installation
• Engine Coolant Draining	• Radiator Assembly Installation
• Engine Oil Draining	• Radiator Grille Installation
• Hood Removal • Powertrain Control Module (PCM) Removal	• Battery and Battery Tray Installation • Air Cleaner Installation
• Air Cleaner Removal	• Powertrain Control Module (PCM) Installation
• Battery and Battery Tray Removal • Radiator Grille Removal	• Hood Installation • Drive Belt Tension Check • Engine Oil Refilling
• Radiator Assembly Removal	• Engine Coolant Refilling
• Right Bank Exhaust Manifold Removal	• Fuel Leak Check • Under Cover Removal and Installation
• Transaxle Assembly Removal	

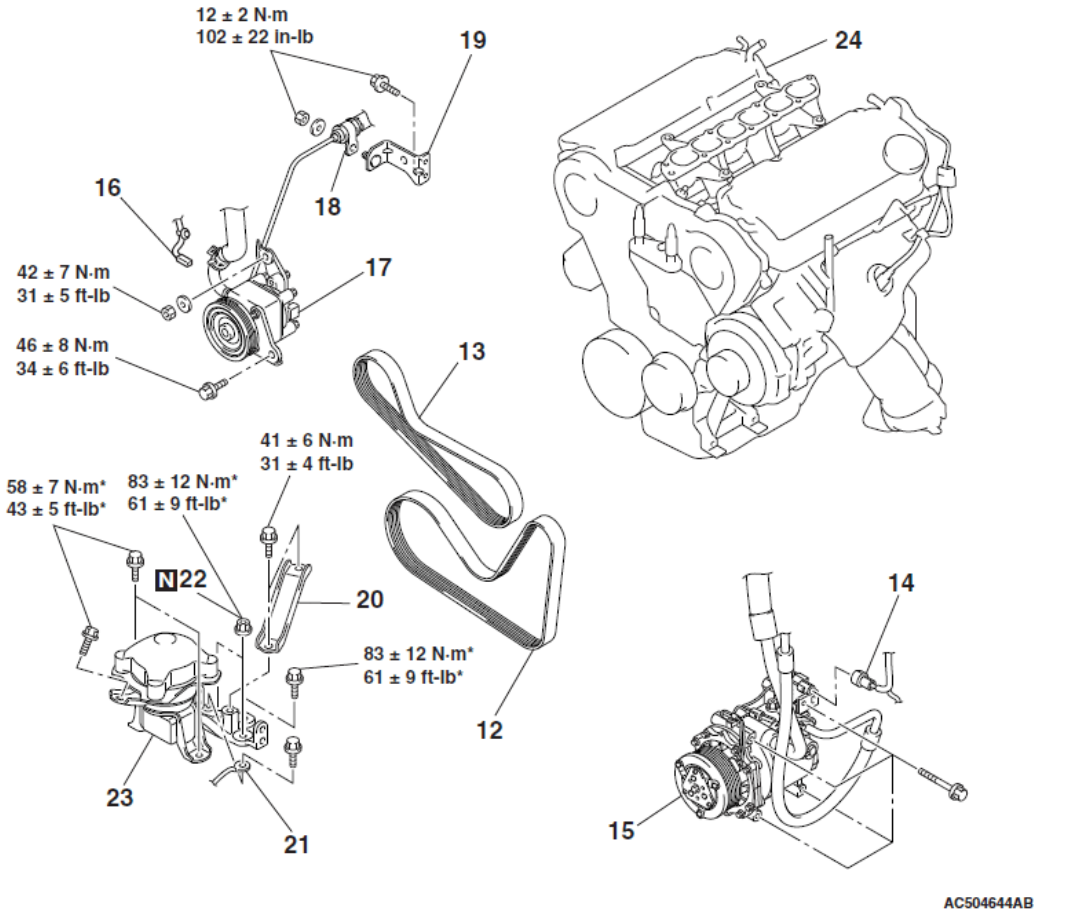


REMOVAL STEPS

1. EVAPORATIVE EMISSION PURGE SOLENOID CONNECTOR
2. PURGE HOSE
3. EVAPORATIVE EMISSION PURGE SOLENOID
4. VACUUM HOSE CONNECTION <<A>>
5. PURGE HOSE CONNECTION <<B>>
6. FRONT WIRING HARNESS AND CONTROL WIRING HARNESS COMBINATION CONNECTOR
7. GROUNDING
8. RETAINER
9. FUEL MAIN PIPE CONNECTION
10. HEATER HOSE CONNECTION
11. RESERVOIR ASSEMBLY

Fig. 22: Engine Components With Torque Specifications (1 Of 2)

Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.



12. GENERATOR DRIVE BELT
13. POWER STEERING OIL PUMP DRIVE BELT
14. A/C COMPRESSOR ASSEMBLY CONNECTOR
<<C>> 15. A/C COMPRESSOR ASSEMBLY
16. POWER STEERING PRESSURE SWITCH CONNECTOR
<<D>> 17. POWER STEERING OIL PUMP
18. POWER STEERING PRESSURE HOSE CLAMP
19. POWER STEERING PRESSURE HOSE CLAMP BRACKET
20. ENGINE MOUNT STAY
21. GROUNDING CABLE
22. SELF-LOCKING NUTS
<<E>> >>B<< 23. ENGINE MOUNT
<<F>> >>A<< 24. ENGINE ASSEMBLY

Fig. 23: Engine 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 MAIN PIPE DISCONNECTION

CAUTION: Do not bend the resin fuel high-pressure hose.

1. Remove the stopper.

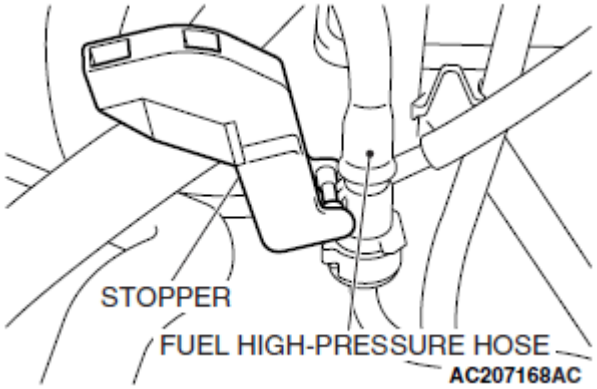


Fig. 24: Removing Fuel High-Pressure Hose And Stopper
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

2. Remove the fuel main pipe while the retainer is pulled up.

NOTE: If the retainer is removed, install it after removing the fuel main pipe.

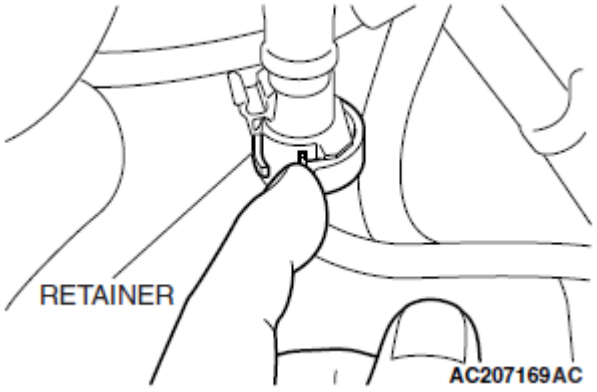


Fig. 25: Removing Fuel Main Pipe
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

<<B>> RESERVOIR ASSEMBLY REMOVAL

1. Remove the reservoir assembly from the body with the hose attached.
2. Place the removed reservoir assembly in a place where it will not be a hindrance when removing and

installing the engine assembly, and secure it with a cord or wire.

<<C>> 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 be a hindrance when removing and installing the engine assembly, and secure it with a cord or wire.

<<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 be a hindrance when removing and installing the engine assembly, and secure it with a cord or wire.

<<E>> ENGINE MOUNT REMOVAL

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

   Remove special tool MB991895.

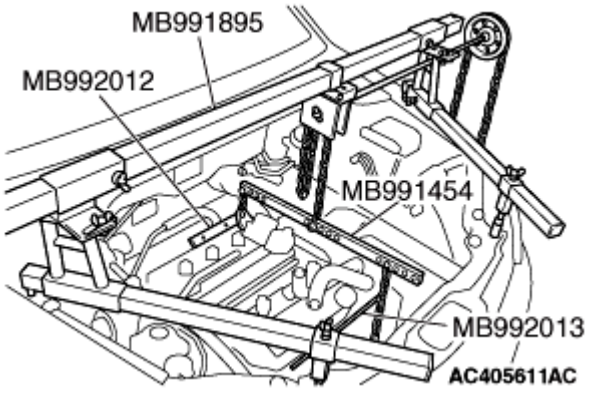


Fig. 26: Supporting Engine Using Special Tool MB991895
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

3. <Engine hanger MB991928 is used>

   Remove special tool MB991928.

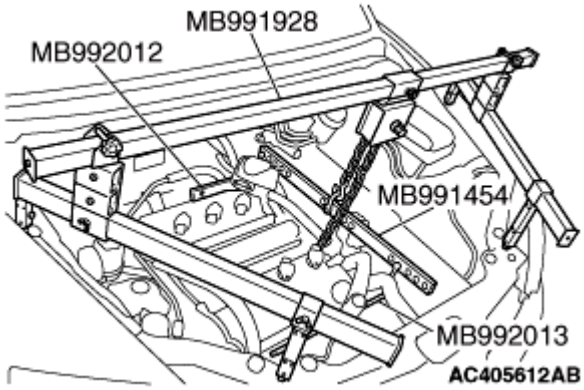


Fig. 27: Supporting Engine Using Special Tool MB991928
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

4. Remove special tool MB991454 and hook it again as shown in the 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 assembly is no longer being applied to the engine mount.
6. Loosen the engine mount mounting nuts and bolts, and remove the engine mount.

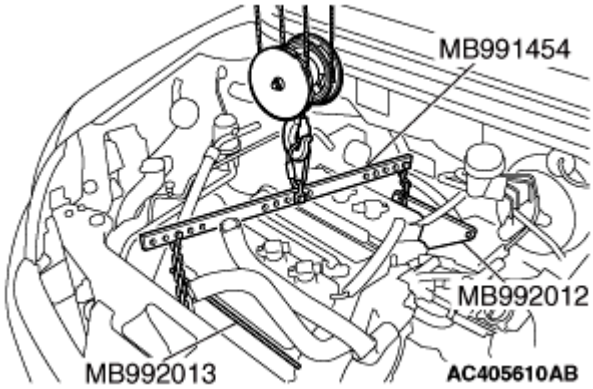


Fig. 28: Hooking Engine
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

<<F>> 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.

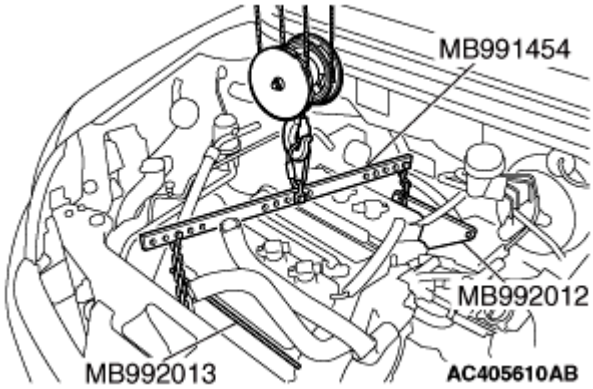


Fig. 29: Hooking Engine
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>>B<< ENGINE MOUNT 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 front fender assembling bolts (A and B) and (C and D) as shown in illustration.

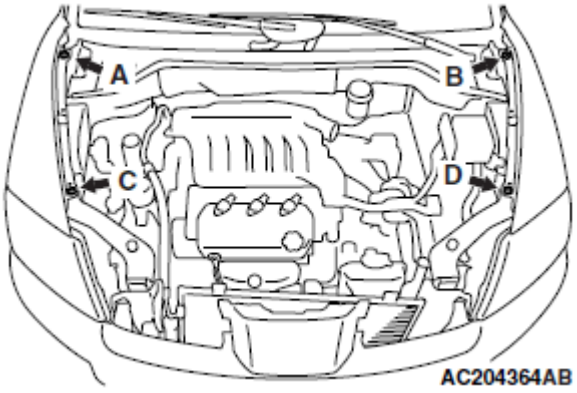


Fig. 30: Front Fender Assembling Bolts A, B, C And D
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

CAUTION: Place a thick shop towel as shown in the illustration so that special tool MB991454 does not damage the front deck panel.

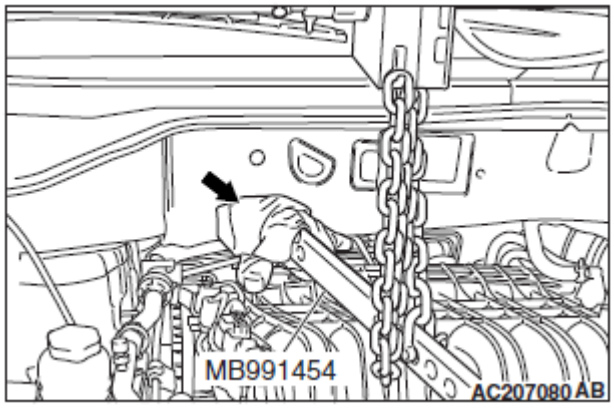


Fig. 31: Placing Thick Shop Towel On Special Tool MB991454
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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

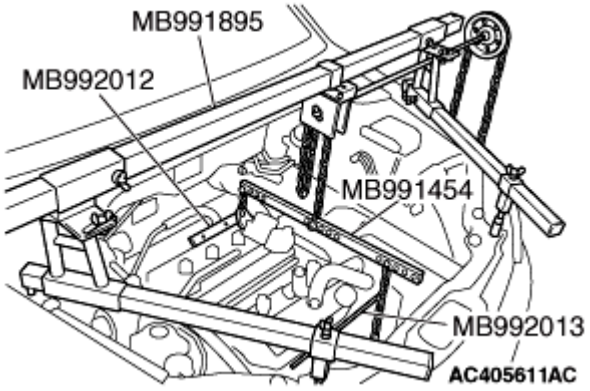


Fig. 32: Supporting Engine Using Special Tool MB991895
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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 (90) (MB991930)

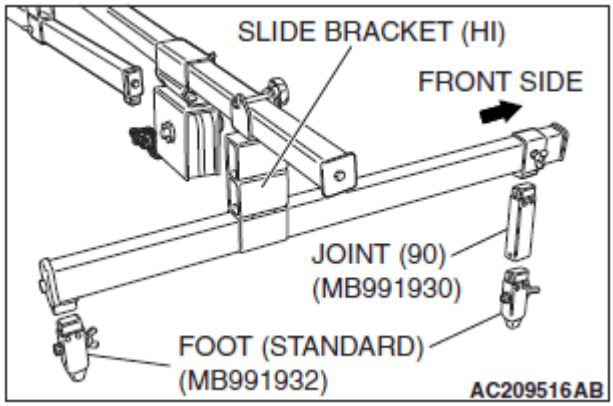


Fig. 33: Assembling Special Tool MB991928
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

2. Set special tool MB991928 to the front fender assembling bolts (A and B) and (C and D) as shown in the illustration.

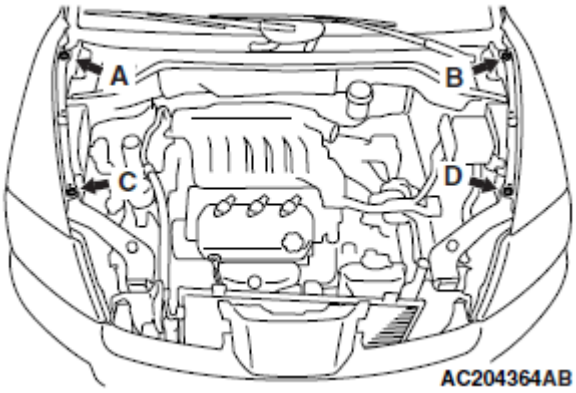


Fig. 34: Front Fender Assembling Bolts A, B, C And D
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

CAUTION: Place a thick shop towel as shown in the illustration so that special tool MB991454 does not damage the front deck panel.

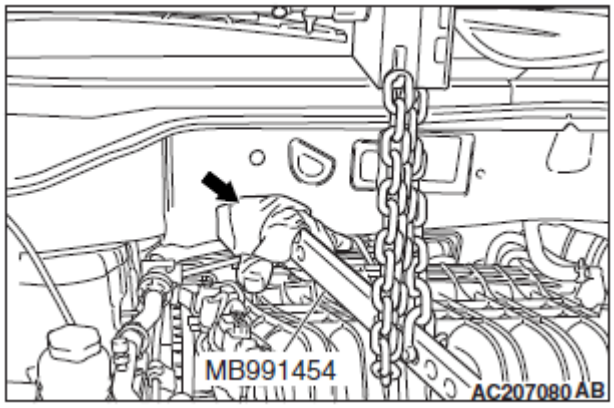


Fig. 35: Placing Thick Shop Towel On Special Tool MB991454
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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

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

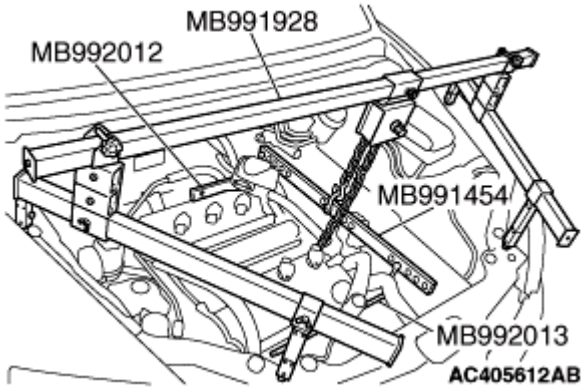
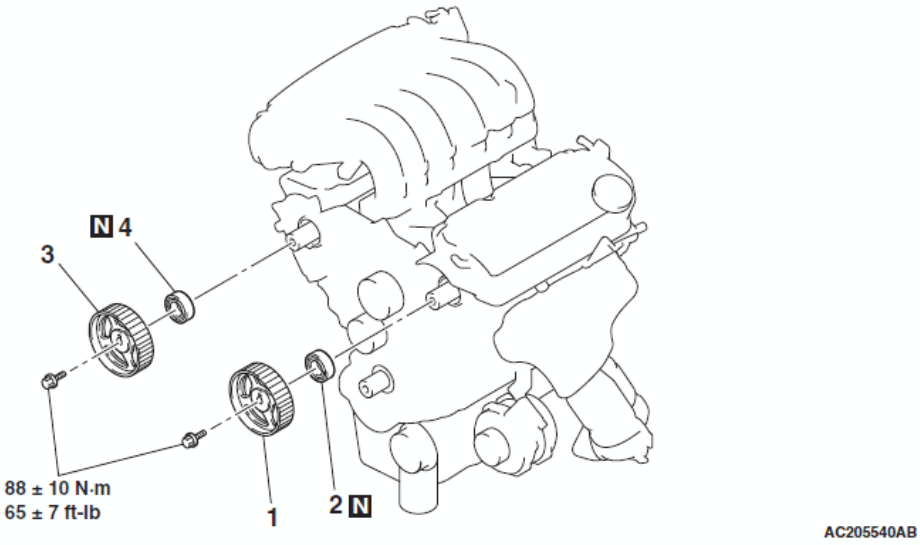


Fig. 36: Supporting Engine Using Special Tool MB991928
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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
<<B>>	>>A<<	2.	CAMSHAFT OIL SEAL	<<B>>	>>A<<	4.	CAMSHAFT OIL SEAL

Fig. 37: Camshaft Oil Seal Components With Torque Specification
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

Required Special Tools:

- MB990767: Front Hub and Flange Yoke Holder
- MB991559: Camshaft Oil Seal Adapter Installer
- 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.

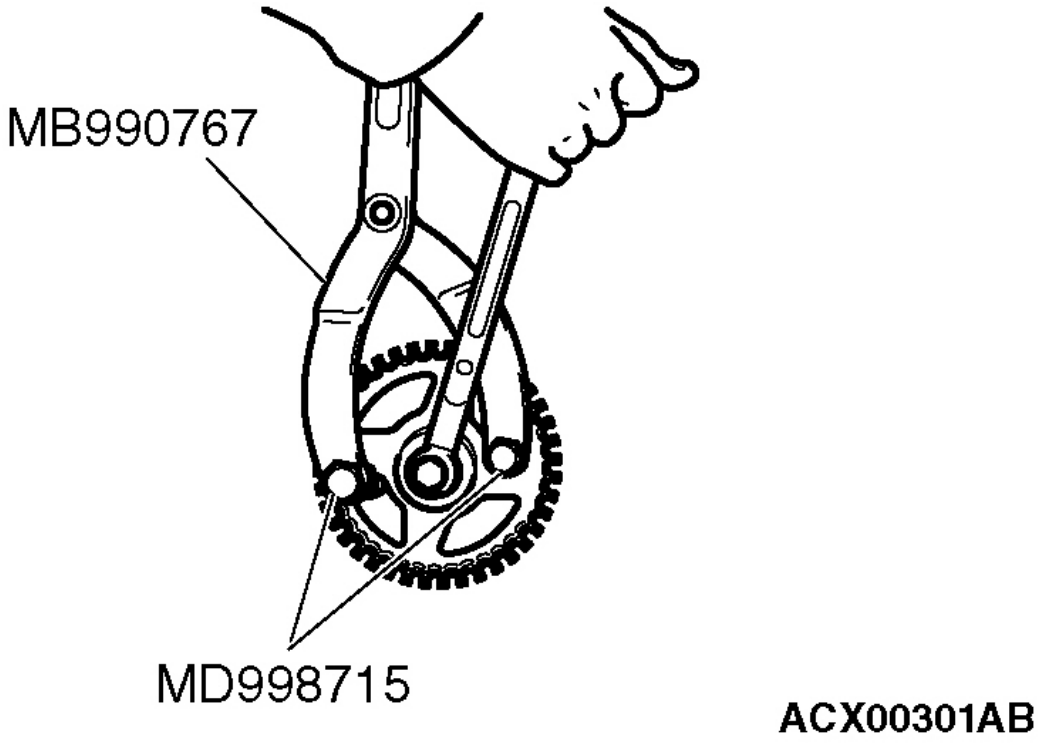


Fig. 38: Removing Camshaft Sprocket
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

<<B>> 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.

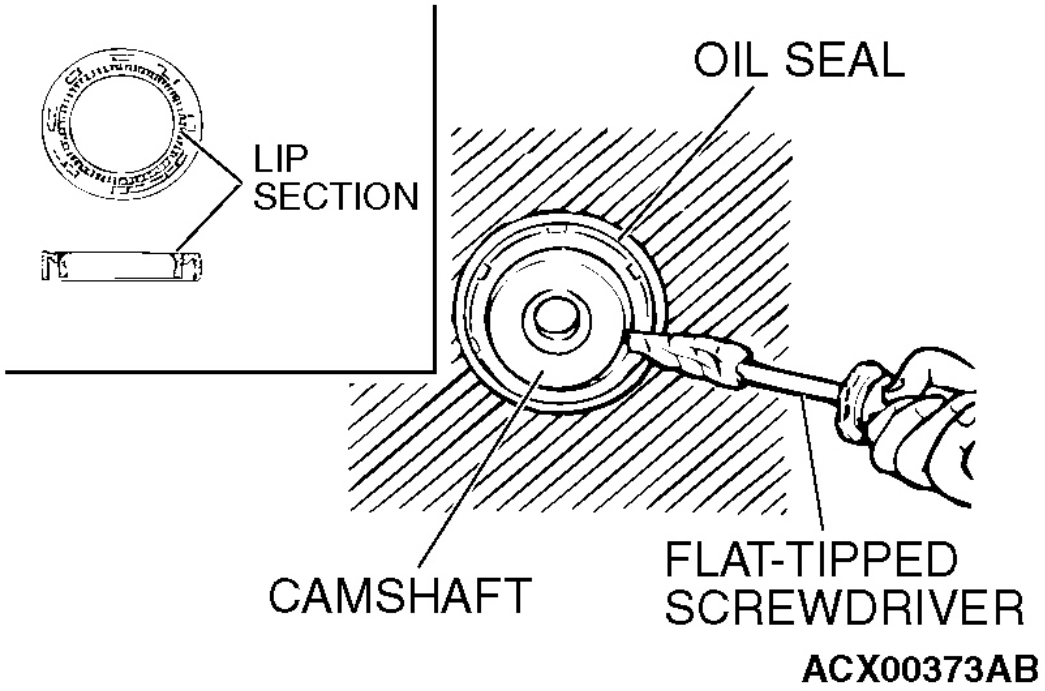


Fig. 39: Removing Oil Seal
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

INSTALLATION SERVICE POINTS

>>A<< CAMSHAFT OIL SEAL INSTALLATION

1. Apply engine oil to the camshaft oil seal lip.
2. Use special tools MD998713 and MB991559 to press-fit the camshaft oil seal.

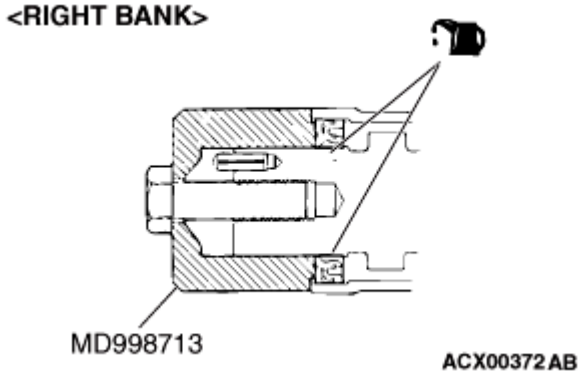


Fig. 40: Pressing-Fit Camshaft Oil Seal Using Special Tools MD998713 And MB991559 (Right Bank)

Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

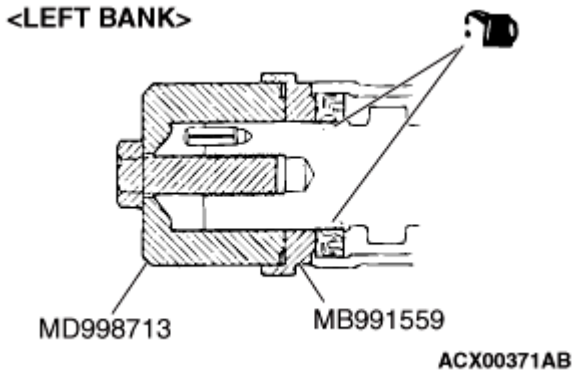


Fig. 41: Pressing-Fit Camshaft Oil Seal Using Special Tools MD998713 And MB991559 (Left Bank)
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>>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)

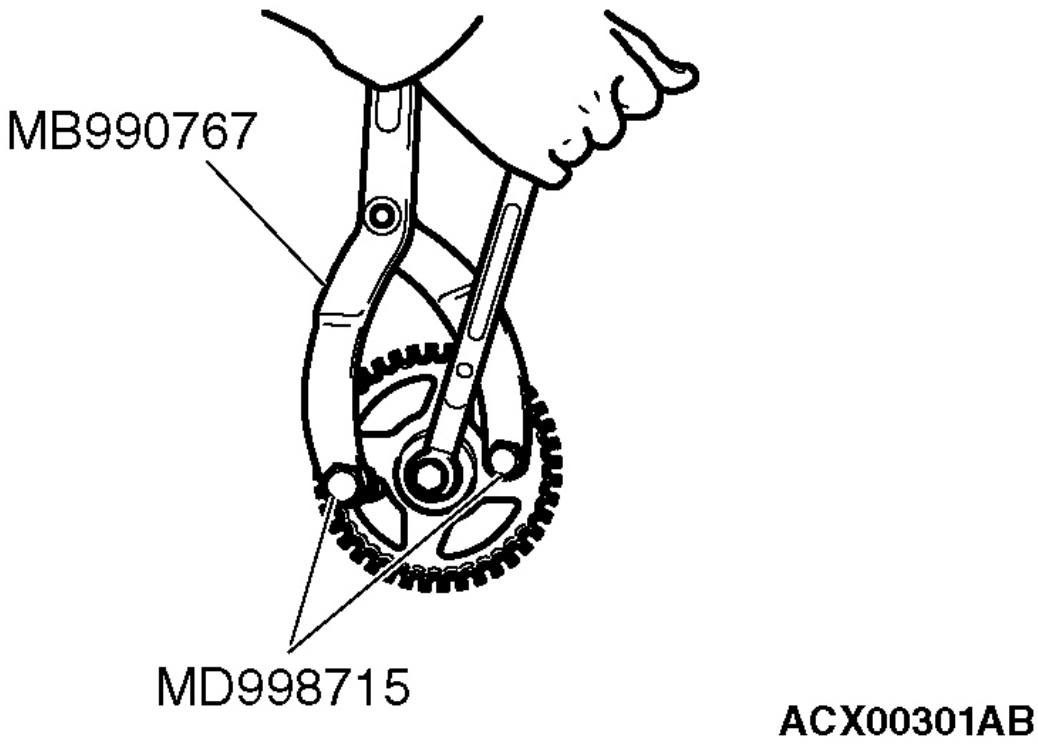


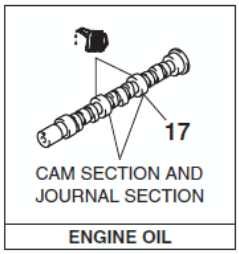
Fig. 42: Removing Camshaft Sprocket
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

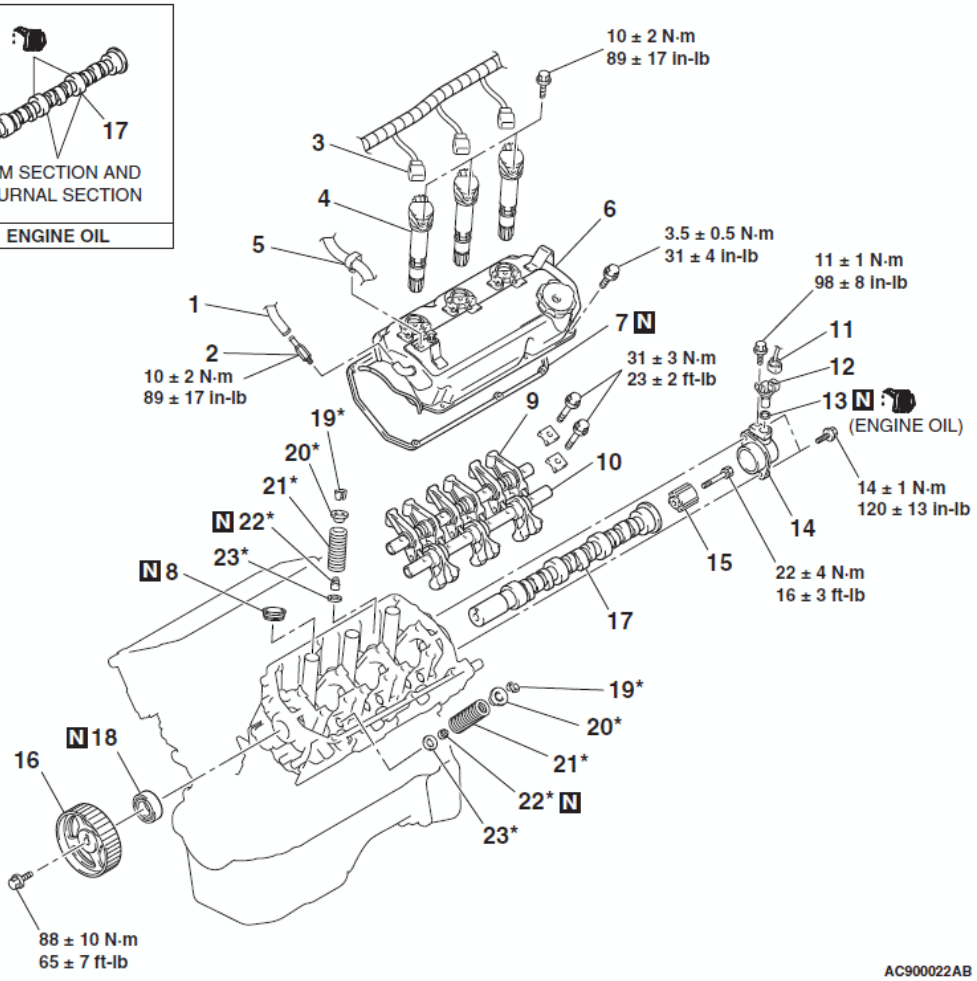
CAMSHAFT AND VALVE STEM SEAL

REMOVAL AND INSTALLATION

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

<LEFT BANK>





AC900022AB

CAMSHAFT REMOVAL STEPS

- TIMING BELT
- THERMOSTAT HOUSING

1. PCV HOSE CONNECTION
2. PCV VALVE
3. IGNITION COIL CONNECTOR
4. IGNITION COIL
5. ENGINE CONTROL WIRING HARNESS CLAMP
6. ROCKER COVER
7. ROCKER COVER GASKET
8. SPARK PLUG GUIDE OIL SEAL

<<A>> >>D<< 9. ROCKER ARM, SHAFT AND LASH ADJUSTER ASSEMBLY (INTAKE SIDE)

<<A>> >>D<< 10. ROCKER ARM, SHAFT AND LASH ADJUSTER ASSEMBLY (EXHAUST SIDE)

11. CAMSHAFT POSITION SENSOR CONNECTOR
12. CAMSHAFT POSITION SENSOR
13. O-RING

>>G<< 14. CAMSHAFT POSITION SENSOR SUPPORT

15. CAMSHAFT POSITION SENSING CYLINDER

<<B>> >>F<< 16. CAMSHAFT SPROCKET

VALVE STEM SEAL REMOVAL STEPS

1. PCV HOSE CONNECTION
2. PCV VALVE
3. IGNITION COIL CONNECTOR
4. IGNITION COIL
5. ENGINE CONTROL WIRING HARNESS CLAMP
6. ROCKER COVER
7. ROCKER COVER GASKET
8. SPARK PLUG GUIDE OIL SEAL

<<A>> >>D<< 9. ROCKER ARM, SHAFT AND LASH ADJUSTER ASSEMBLY (INTAKE SIDE)

<<A>> >>D<< 10. ROCKER ARM, SHAFT AND LASH ADJUSTER ASSEMBLY (EXHAUST SIDE)

<<D>> >>C<< 19. VALVE SPRING RETAINER LOCK
20. VALVE SPRING RETAINER

>>B<< 21. VALVE SPRING

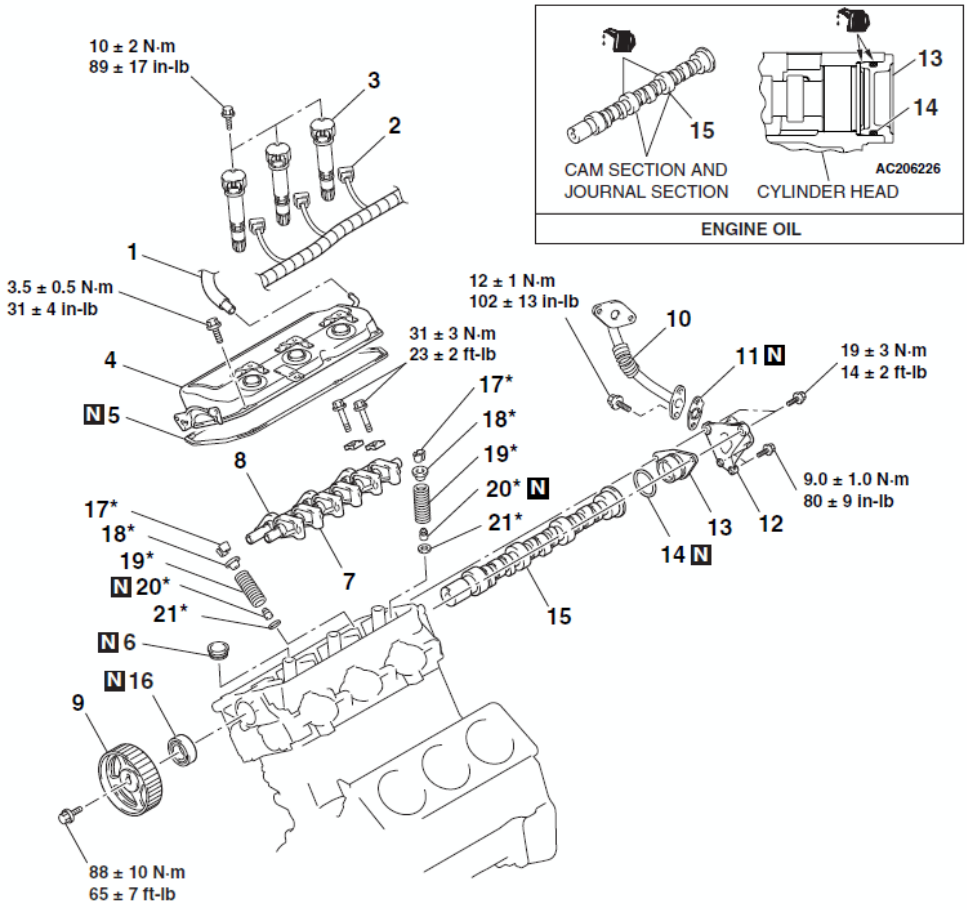
>>A<< 22. VALVE STEM SEAL
23. VALVE SPRING SEAT

Fig. 43: 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
- MB991559: Camshaft Oil Seal Adapter Installer
- MB991999: Valve Stem Seal Installer
- MD998443: Auto-lash Adjuster Holder
- MD998713: Camshaft Oil Seal Installer
- MD998715: Crankshaft Pulley Holder Pin
- MD998772: Valve Spring Compressor

<RIGHT BANK>



AC900023AB

CAMSHAFT REMOVAL STEPS

- INTAKE MANIFOLD PLENUM
- TIMING BELT
- THERMOSTAT HOUSING

1. BREATHER HOSE CONNECTION
2. IGNITION COIL CONNECTOR
3. IGNITION COIL
4. ROCKER COVER
5. ROCKER COVER GASKET
6. SPARK PLUG GUIDE OIL SEAL

<<A>> >>D<< 7. ROCKER ARM, SHAFT AND LASH ADJUSTER ASSEMBLY (INTAKE SIDE)

<<A>> >>D<< 8. ROCKER ARM, SHAFT AND LASH ADJUSTER ASSEMBLY (EXHAUST SIDE)

<<B>> >>F<< 9. CAMSHAFT SPROCKET

10. EGR PIPE B
11. GASKET
12. EGR VALVE SUPPORT
13. THRUST CASE
14. O-RING
15. CAMSHAFT

<<C>> >>E<< 16. CAMSHAFT OIL SEAL

VALVE STEM SEAL REMOVAL STEPS

- TIMING BELT FRONT UPPER COVER, RIGHT

1. BREATHER HOSE CONNECTION
2. IGNITION COIL CONNECTOR
3. IGNITION COIL
4. ROCKER COVER
5. ROCKER COVER GASKET
6. SPARK PLUG GUIDE OIL SEAL

<<A>> >>D<< 7. ROCKER ARM, SHAFT AND LASH ADJUSTER ASSEMBLY (INTAKE SIDE)

<<A>> >>D<< 8. ROCKER ARM, SHAFT AND LASH ADJUSTER ASSEMBLY (EXHAUST SIDE)

<<D>> >>C<< 17. VALVE SPRING RETAINER LOCK
18. VALVE SPRING RETAINER
>>B<< 19. VALVE SPRING
>>A<< 20. VALVE STEM SEAL
21. VALVE SPRING SEAT

Fig. 44: Camshaft And Valve Stem Seal Components With Torque Specifications (Right Bank)
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

Required Special Tools:

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

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.

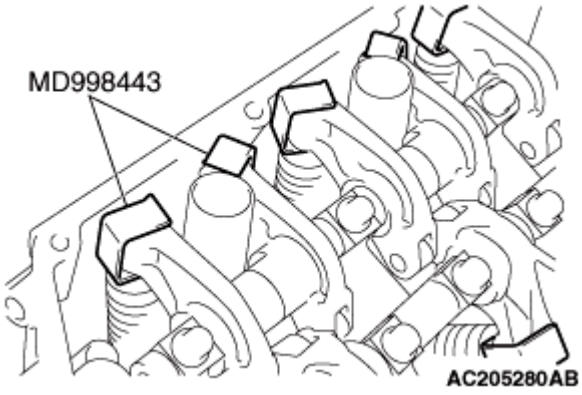


Fig. 45: Installing Special Tool MD998443 To Lash Adjuster
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

<<B>> CAMSHAFT SPROCKET REMOVAL

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

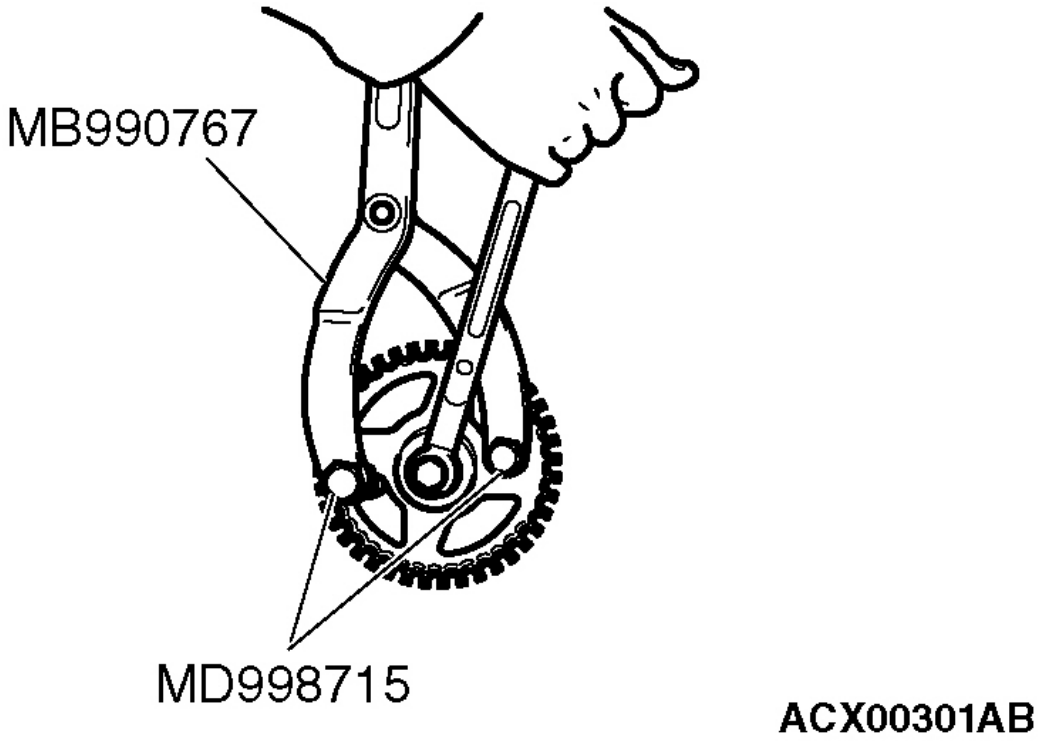


Fig. 46: Removing Camshaft Sprocket
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

<<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.

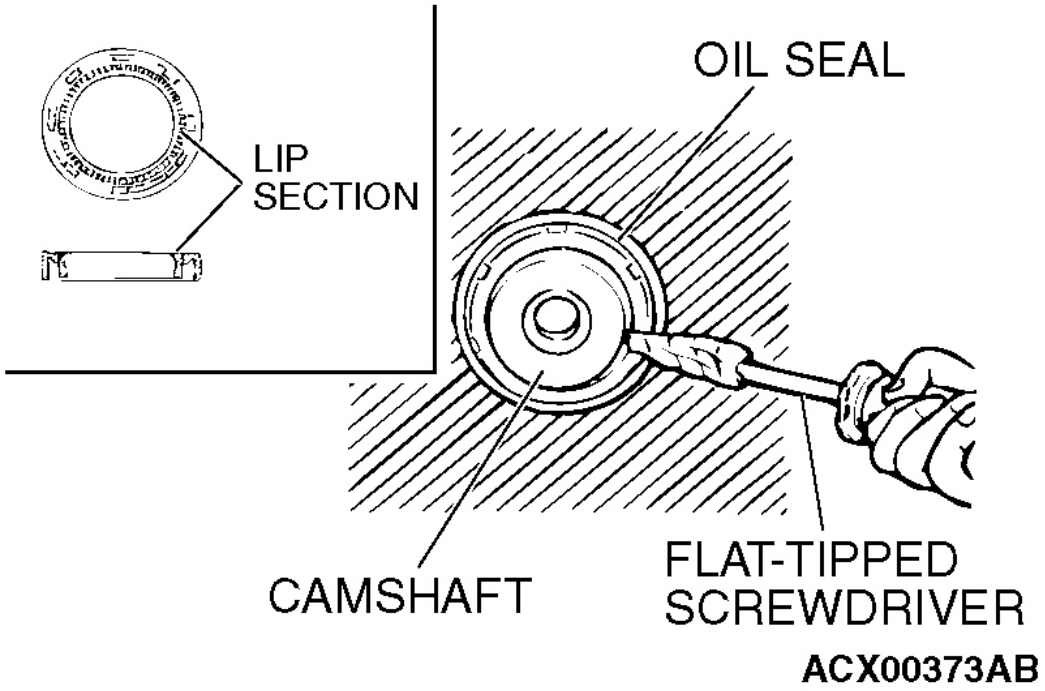


Fig. 47: Removing Oil Seal
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

<<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.

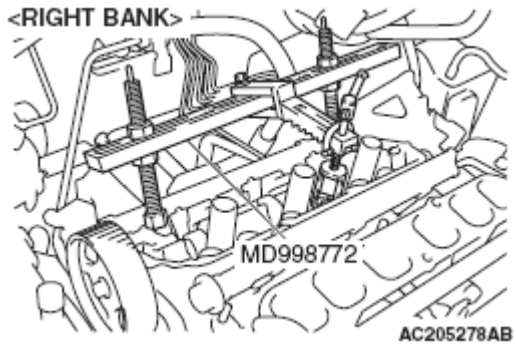


Fig. 48: Compressing Valve Spring Right Bank

Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

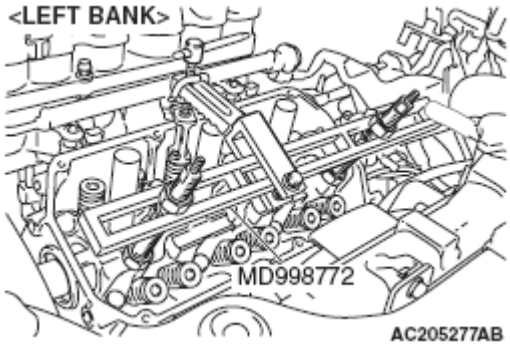


Fig. 49: Compressing Valve Spring Left Bank
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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

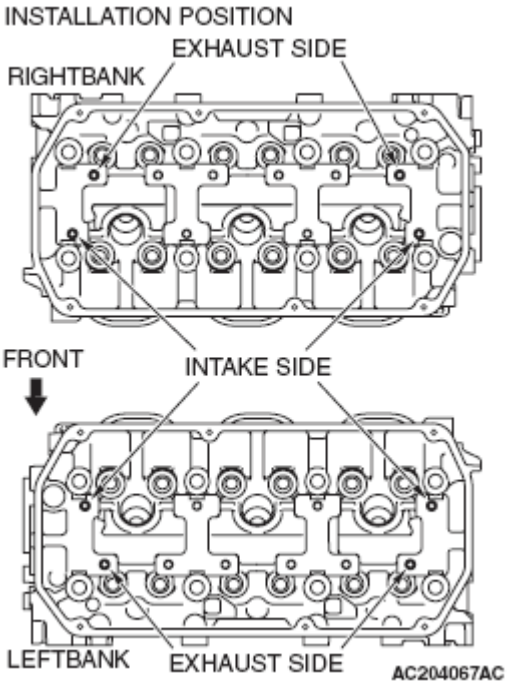


Fig. 50: Installing Position Of Valve Spring Compressor Special Tool (MD998772)
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

INSTALLATION SERVICE POINTS

>>A<< 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.

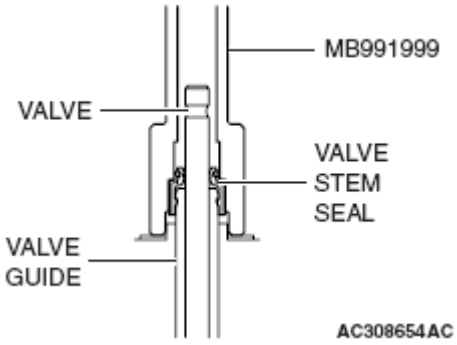


Fig. 51: Valve Stem Seal, Valve Guide And Valve
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>>B<< VALVE SPRING INSTALLATION

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

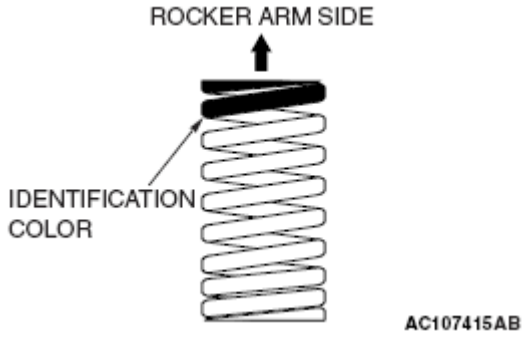


Fig. 52: Installing Valve Spring
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>>C<< VALVE SPRING RETAINER LOCK INSTALLATION

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

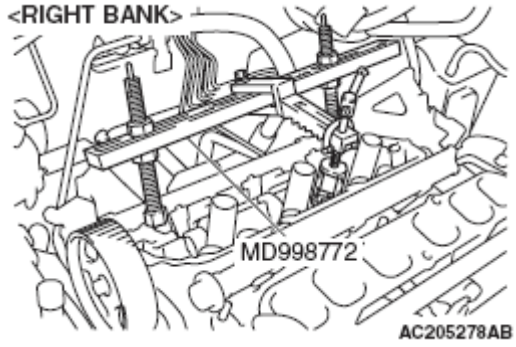


Fig. 53: Compressing Valve Spring Right Bank
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

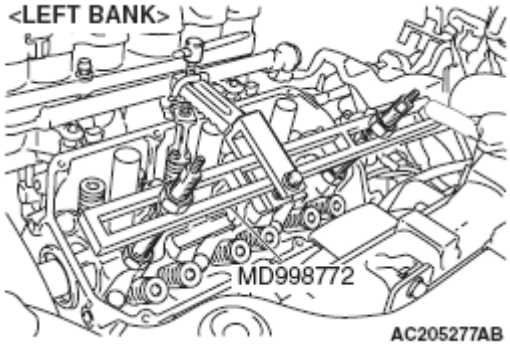


Fig. 54: Compressing Valve Spring Left Bank
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>>D<< ROCKER ARM AND SHAFT ASSEMBLY INSTALLATION

1. Install the rocker arm, shaft and lash adjuster assembly.
2. Tighten the mounting bolts to the specified torque.

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

3. Remove special tool MD998443.

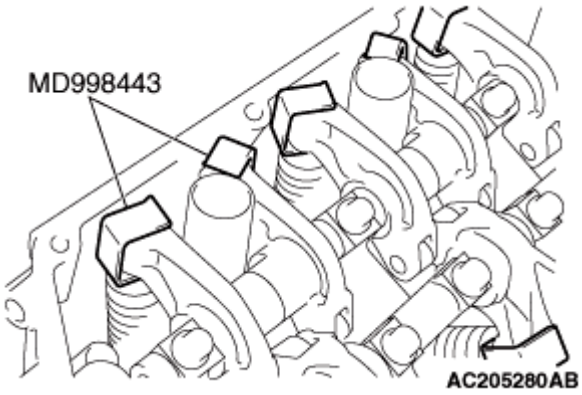


Fig. 55: Installing Special Tool MD998443
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

4. Check that notches in the each rocker shaft are facing the direction shown in the illustration.

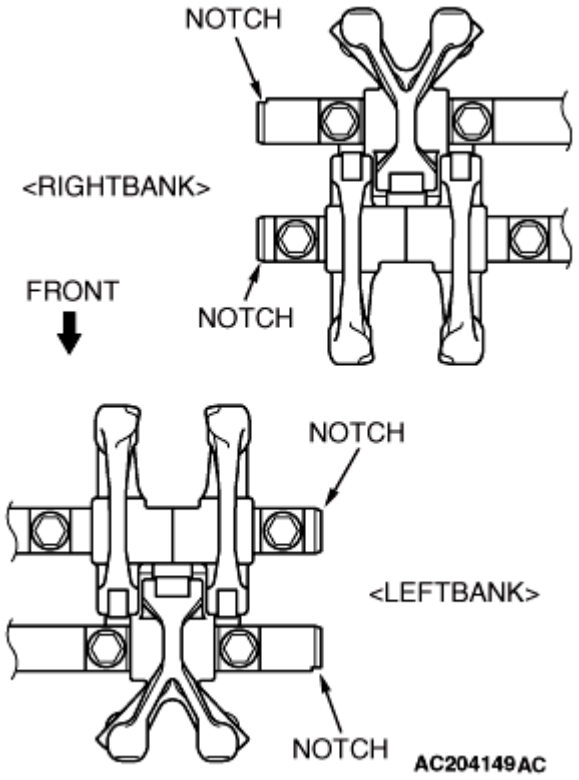


Fig. 56: Checking Notches
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>>E<< CAMSHAFT OIL SEAL INSTALLATION

1. Apply engine oil to the camshaft oil seal lip.
2. Use special tools MD998713 and MB991559 to press-fit the camshaft oil seal.

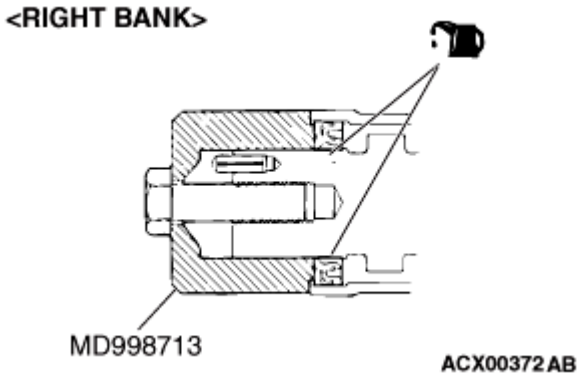


Fig. 57: Pressing-Fit Camshaft Oil Seal Using Special Tools MD998713 (Right Bank)

Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

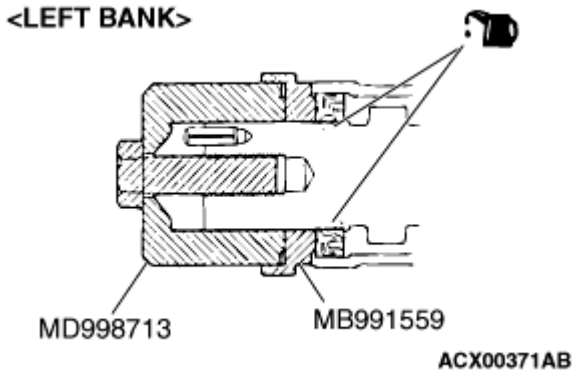


Fig. 58: Pressing-Fit Camshaft Oil Seal Using Special Tools MD998713 (Left Bank)
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>>F<< 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)

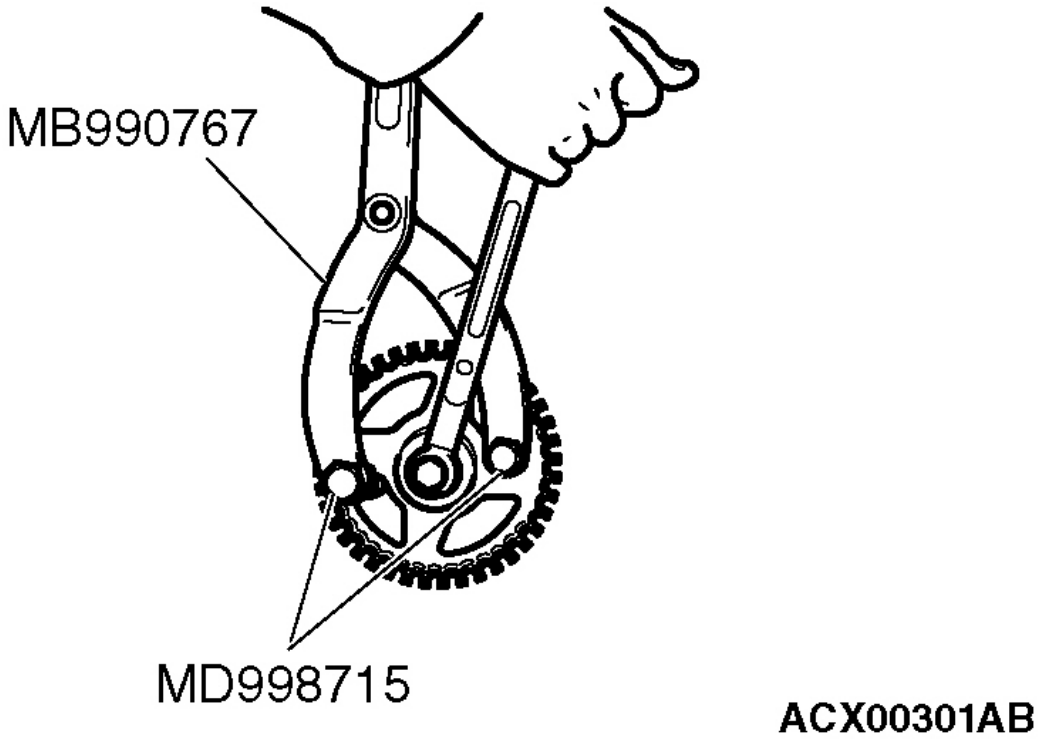


Fig. 59: Removing Camshaft Sprocket
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>>G<< 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.

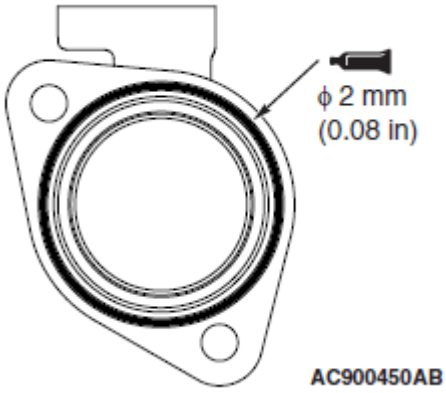


Fig. 60: Camshaft Position Sensor Support Flange Sealant Area
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

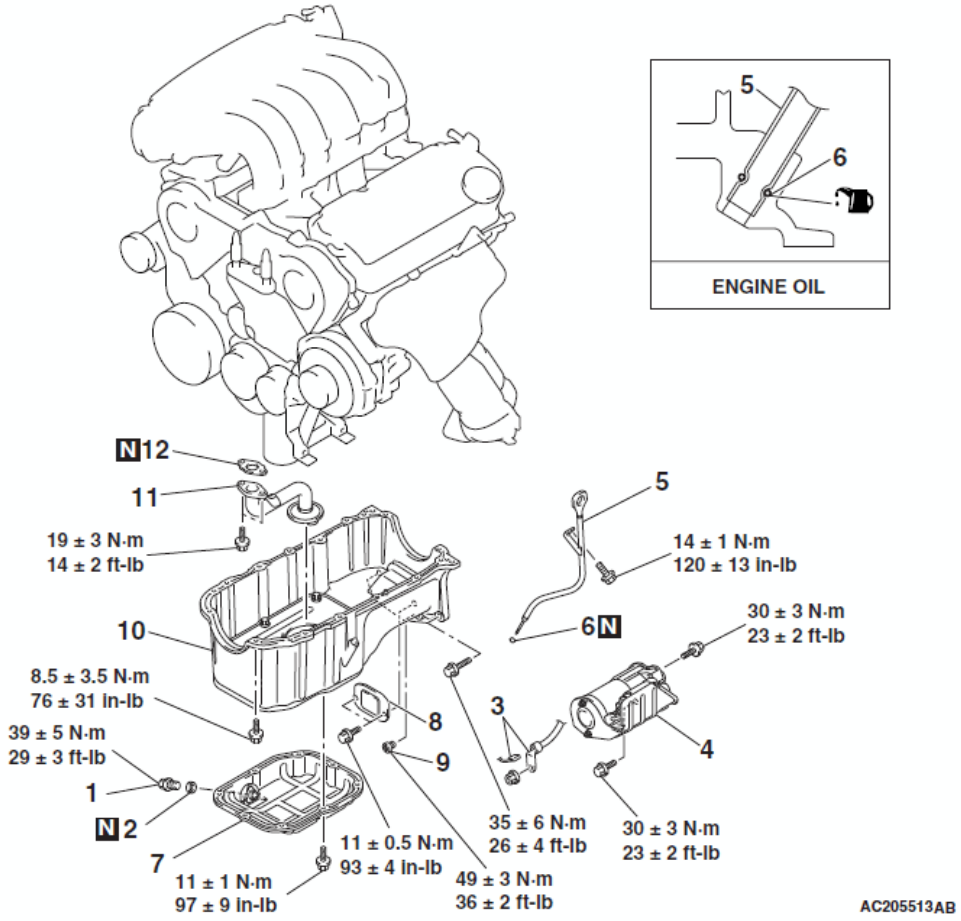
4. Tighten the camshaft position sensor support mounting bolts to the specified torque.

   Tightening torque: 14 ± 1 N.m (120 ± 13 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
- Front Exhaust Pipe Removal and Installation



REMOVAL STEPS

1. ENGINE OIL PAN DRAIN PLUG
2. ENGINE OIL PAN DRAIN PLUG GASKET
3. STARTER CONNECTOR
4. STARTER ASSEMBLY
5. ENGINE OIL DIPSTICK ASSEMBLY
6. O-RING
7. ENGINE LOWER OIL PAN
8. COVER
9. TORQUE CONVERTER CONNECTING BOLTS
10. ENGINE UPPER OIL PAN
11. OIL SCREEN
12. GASKET

<<A>> >>B<< <<B>> <<C>> >>A<<

Fig. 61: 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.

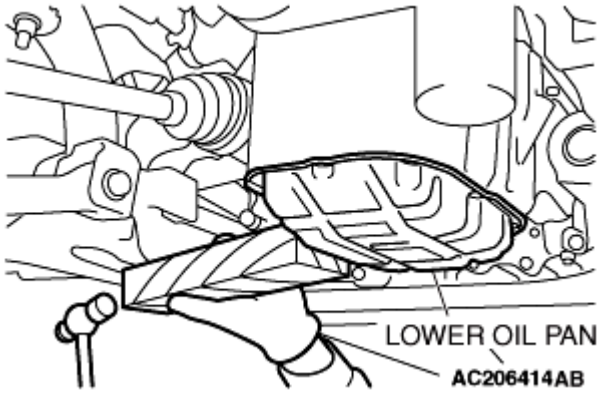


Fig. 62: Removing Engine Lower Oil Pan
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

<<B>> TORQUE CONVERTER CONNECTING BOLTS REMOVAL

Remove the two torque converter connecting bolts as shown in the illustration.

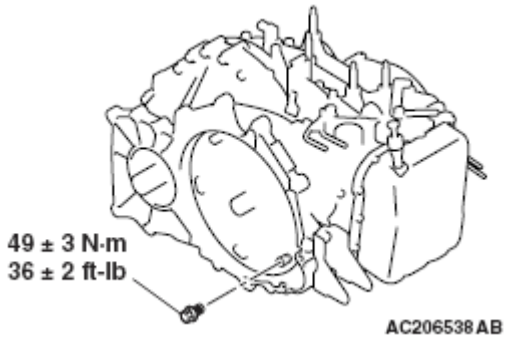


Fig. 63: Removing Torque Converter Connecting Bolt With Torque Specification
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

<<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 the illustration. Then lift the upper oil

pan and remove it.

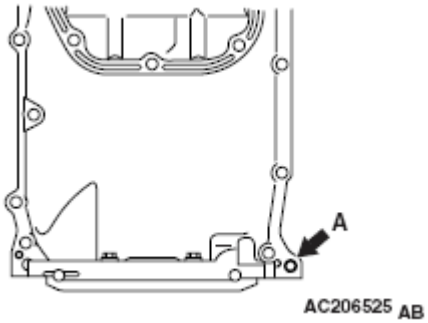


Fig. 64: Locating Bolt Hole
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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 oil pan as shown in the 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.**

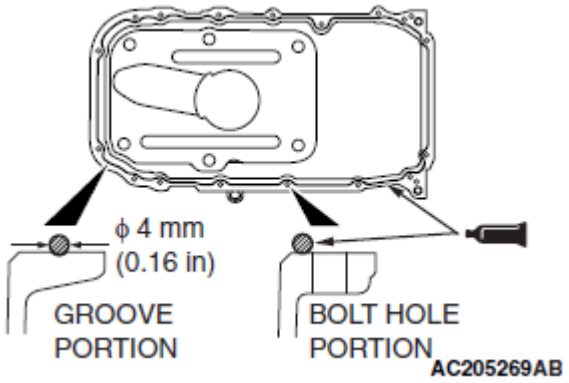


Fig. 65: Applying Bead Of Sealant To Cylinder Block Mating Surface Of Engine Oil Pan
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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

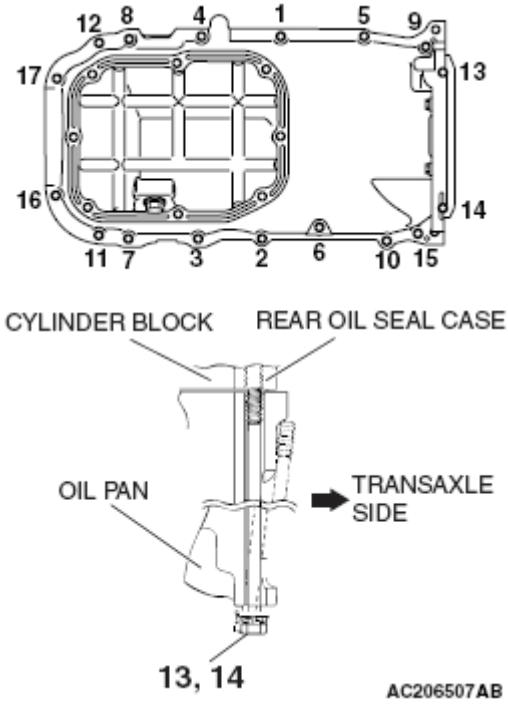


Fig. 66: Cylinder Block Bolts With Tighten Sequence
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>>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 the 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.

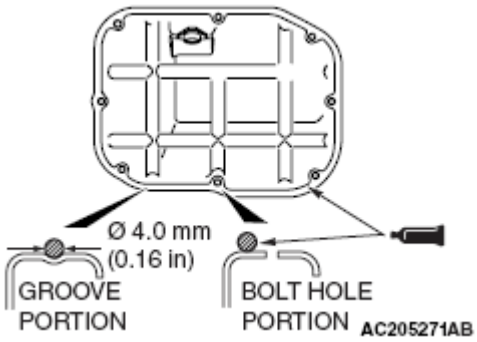


Fig. 67: Engine Lower Oil Pan Selant Applying Area
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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

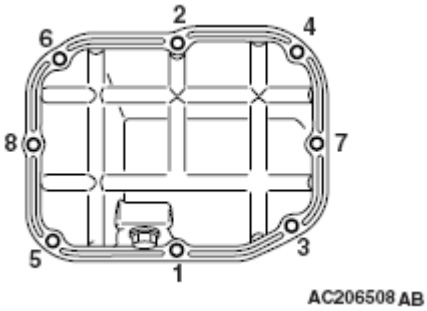


Fig. 68: Oil Pan Bolts With Tighten Sequence
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

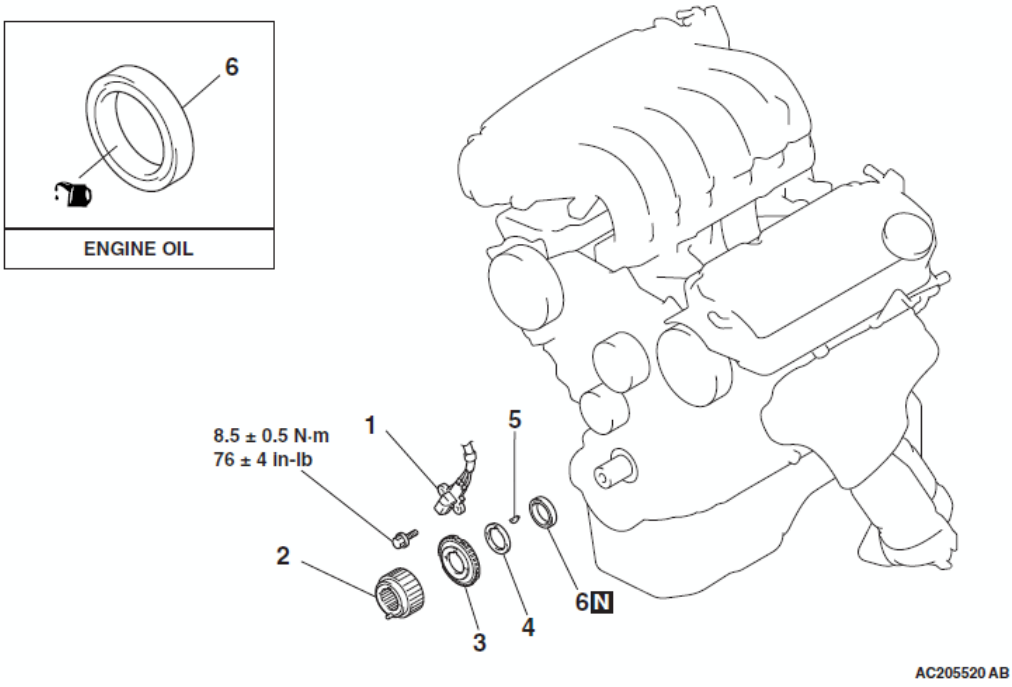
INSPECTION

- 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



REMOVAL STEPS

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

Fig. 69: Crankshaft Oil Seal Components With Torque Specification
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.
2. Using special tool MD998717, tap the oil seal into the front case.

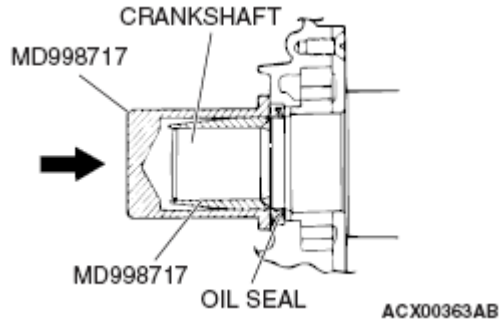


Fig. 70: Applying Small Amount Of Engine Oil To Oil Seal Lip
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>>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.

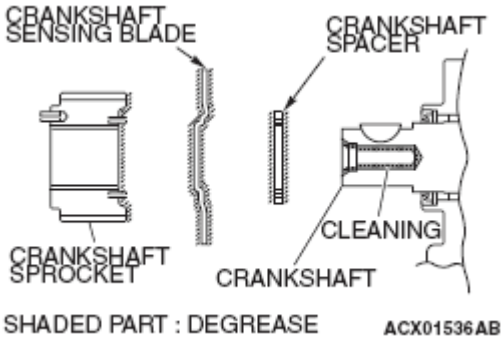
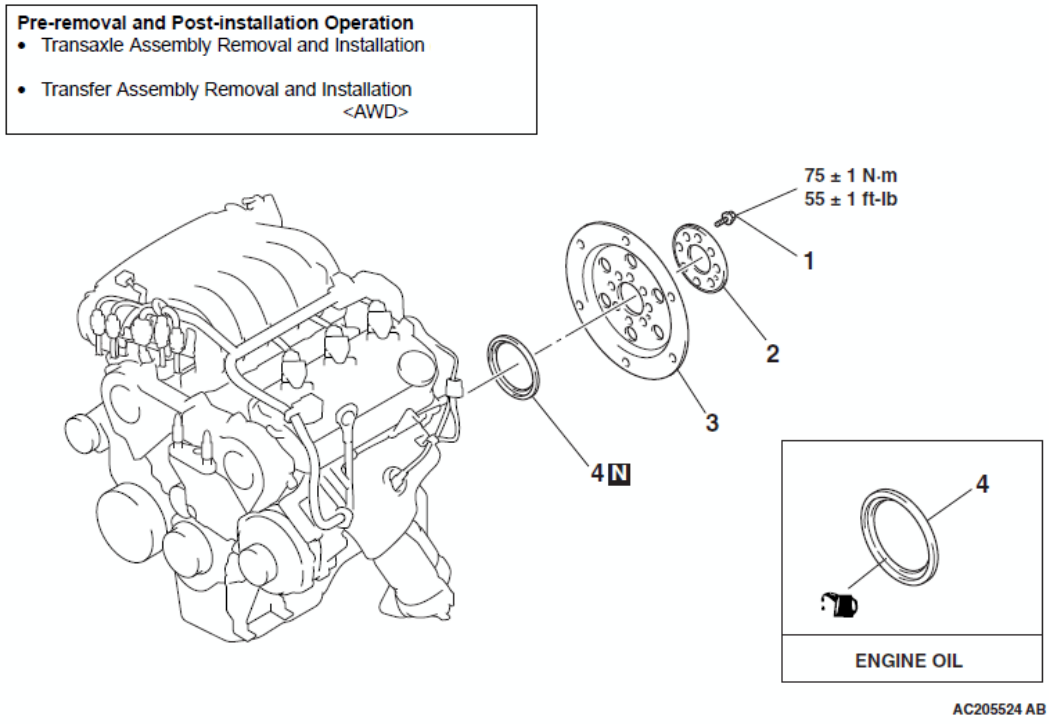


Fig. 71: Installing Crankshaft Spacer, Crankshaft Sensing Blade And Crankshaft Sprocket
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

REMOVAL AND INSTALLATION <REAR OIL SEAL>



REMOVAL STEPS

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

Fig. 72: Drive Plate, Crankshaft Rear Oil Seal, Adaptor Plate And Drive Plate Bolts
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.

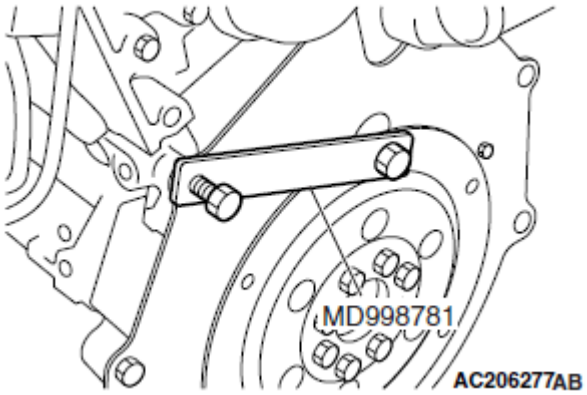


Fig. 73: Securing Drive Plate Using Special Tool MD998781
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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.

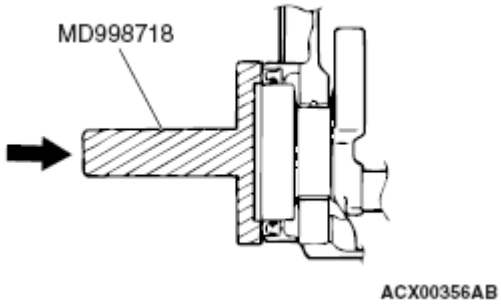


Fig. 74: Tapping Oil Seal Using Special Tool
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>>B<< DRIVE PLATE BOLTS INSTALLATION

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

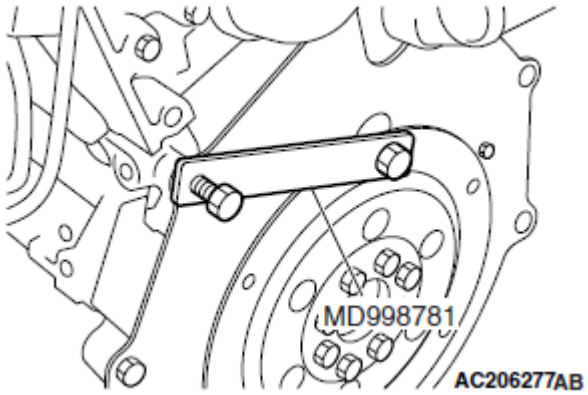
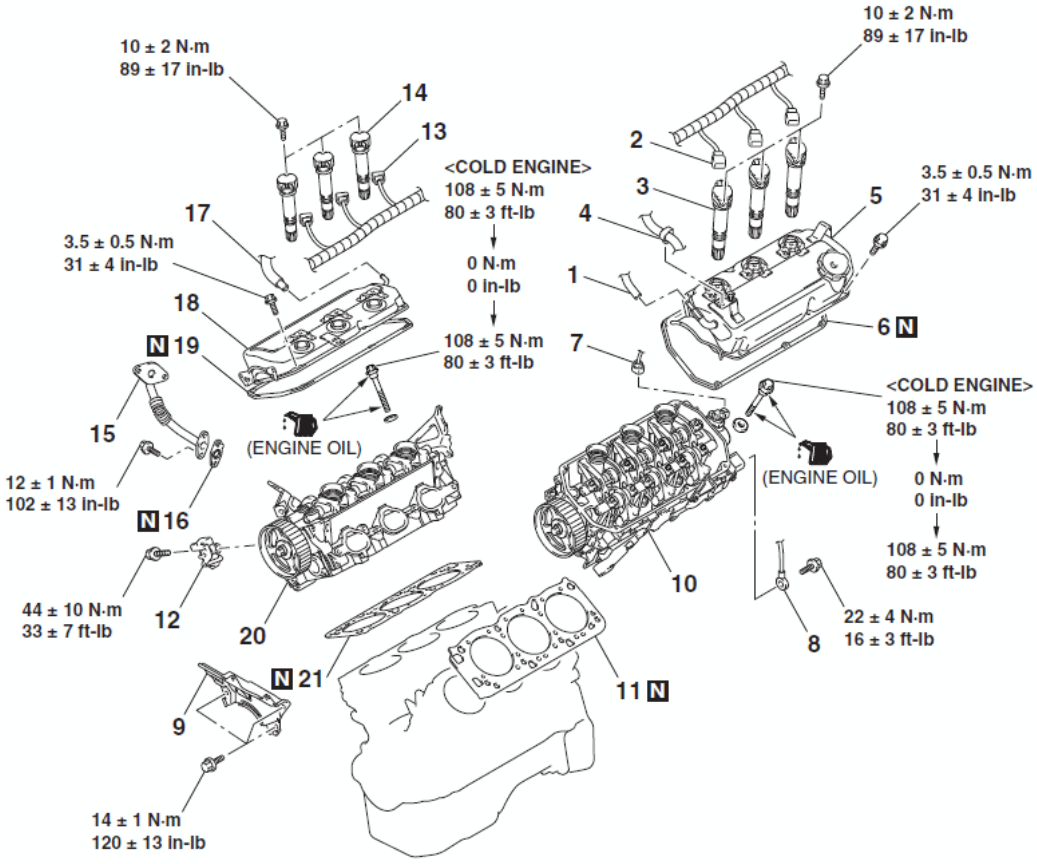


Fig. 75: Securing Drive Plate Using Special Tool MD998781
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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
2. IGNITION COIL CONNECTOR
3. IGNITION COIL
4. ENGINE CONTROL WIRING HARNESS CLAMP
5. ROCKER COVER
6. ROCKER COVER GASKET
7. CAMSHAFT POSITION SENSOR CONNECTOR
8. GROUNDING
9. TIMING BELT REAR CENTER COVER
10. <<A>> >>B<< LEFT BANK CYLINDER HEAD ASSEMBLY
11. CYLINDER HEAD GASKET
12. POWER STEERING OIL PUMP BRACKET ASSEMBLY
13. IGNITION COIL CONNECTOR
14. IGNITION COIL
15. EGR PIPE B
16. GASKET
17. BREATHER HOSE CONNECTION
18. ROCKER COVER
19. ROCKER COVER GASKET
20. <<A>> >>B<< RIGHT BANK CYLINDER HEAD ASSEMBLY
21. >>A<< CYLINDER HEAD GASKET

Fig. 76: Cylinder Head Components With Torque Specifications
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

Required Special Tool:

- MD998051: Cylinder Head Bolt Wrench

REMOVAL SERVICE POINT

<<A>> CYLINDER HEAD ASSEMBLY REMOVAL

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

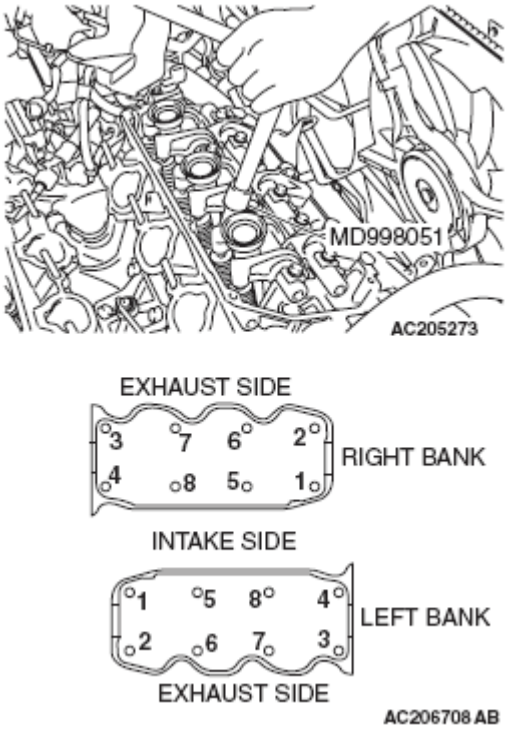


Fig. 77: Cylinder Head Assembly
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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.

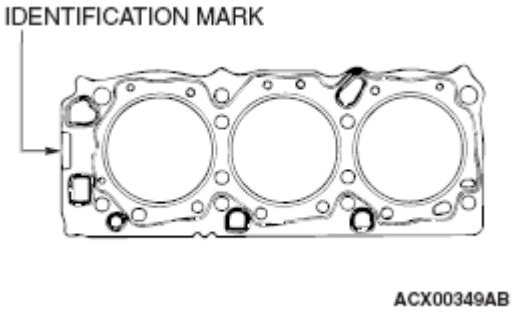


Fig. 78: Cylinder Head Gasket
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>>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) --> 0 N.m (0 in-lb) --> 108 ± 5 N.m (80 ± 3 ft-lb)

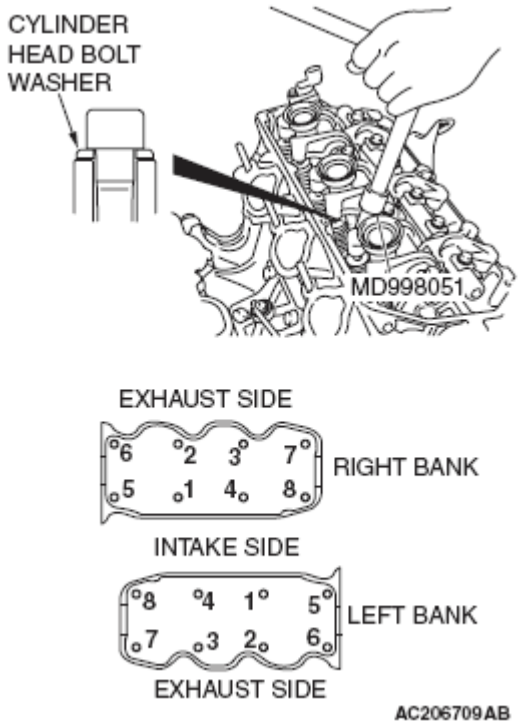
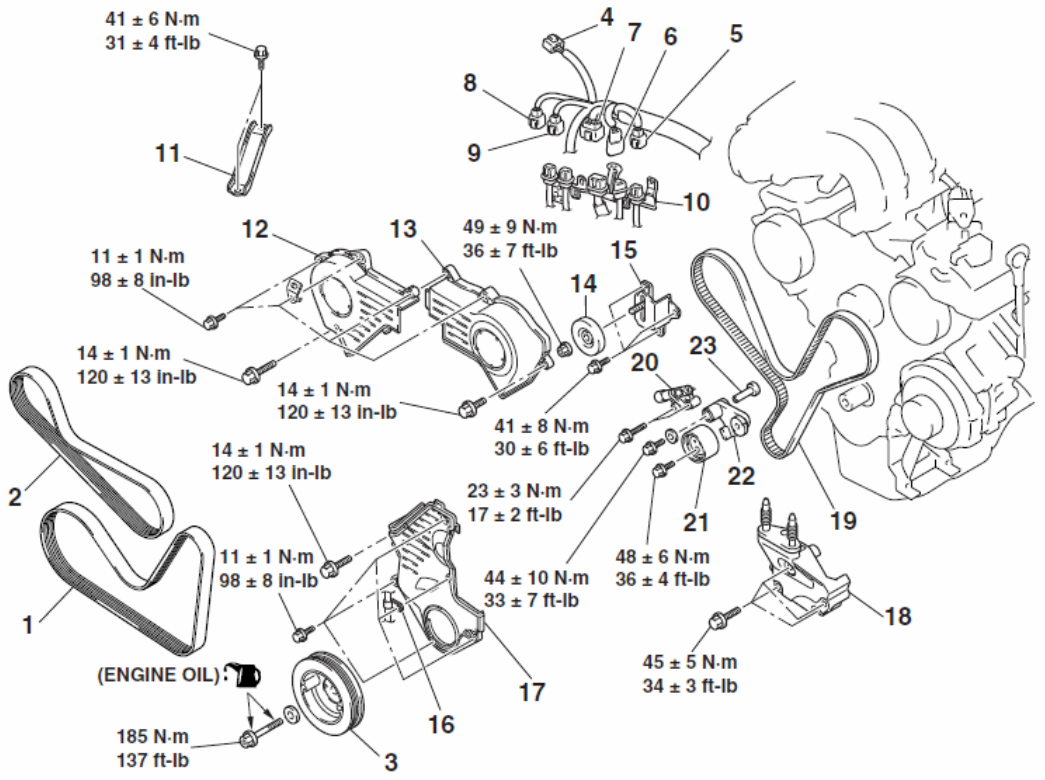


Fig. 79: Tightening Cylinder Head Bolts Using Special Tool
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

TIMING BELT

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Under Cover Removal and Installation
- Side Under Cover Removal and Installation



REMOVAL STEPS

1. GENERATOR DRIVE BELT
2. POWER STEERING OIL PUMP DRIVE BELT
<<A>> >>E<< 3. CRANKSHAFT PULLEY
4. MANIFOLD DIFFERENTIAL PRESSURE SENSOR CONNECTOR
5. KNOCK SENSOR CONNECTOR
6. CRANKSHAFT POSITION SENSOR CONNECTOR
7. CONTROL WIRING HARNESS AND INJECTOR WIRING HARNESS COMBINATION CONNECTOR
8. RIGHT BANK HEATED OXYGEN SENSOR (REAR) CONNECTOR
9. RIGHT BANK HEATED OXYGEN SENSOR (FRONT) CONNECTOR
10. CONNECTOR BRACKET
11. ENGINE MOUNT STAY
12. TIMING BELT FRONT UPPER COVER, RIGHT
13. TIMING BELT FRONT UPPER COVER, LEFT
14. TENSIONER PULLEY
15. TENSIONER BRACKET
16. CRANKSHAFT POSITION SENSOR HARNESS CLAMP
17. TIMING BELT LOWER COVER
- ENGINE MOUNT
18. ENGINE SUPPORT BRACKET
<<B>> >>D<< 19. TIMING BELT *2
<<B>> >>C<< 19. TIMING BELT *1
>>B<< 20. AUTO-TENSIONER *2
>>A<< 20. AUTO-TENSIONER *1
21. TENSIONER PULLEY
22. TENSIONER ARM
23. SHAFT

Fig. 80: Timing Belt Components With Torque Specification
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: Tensioner 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.

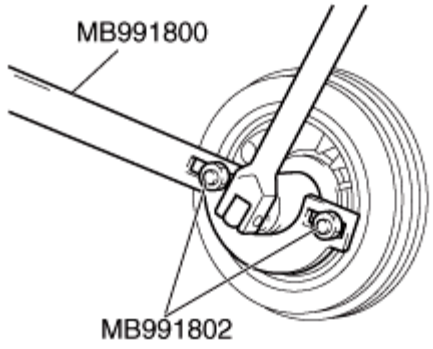


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Fig. 81: Removing Crankshaft Pulley Using Special Tools MB991800 And MB991802
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

<<B>> 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.

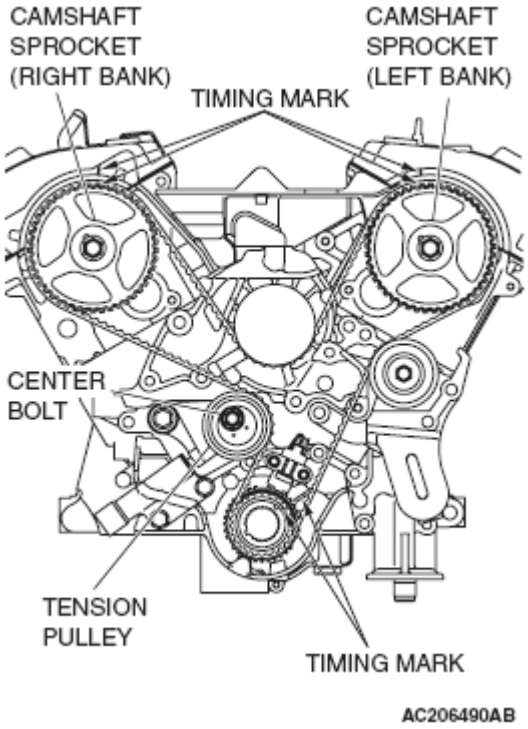

Fig. 82: Loosening Center Bolt Of Tensioner Pulley
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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.

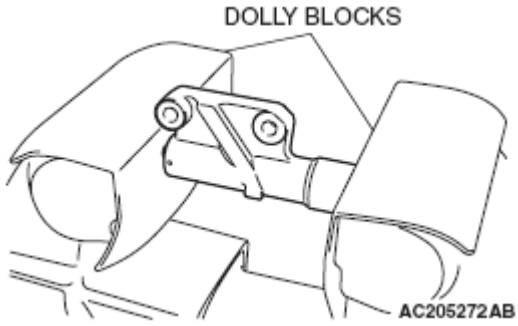

Fig. 83: Placing Dolly Blocks In Vice
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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.

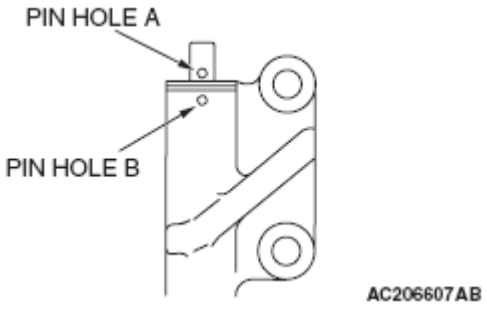

Fig. 84: Inserting Setting Pin Into Pin Holes
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>>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.

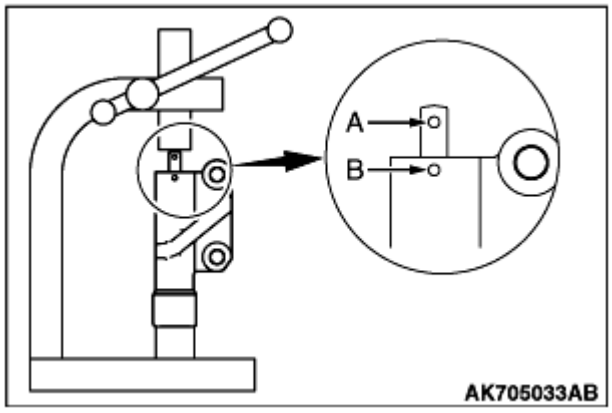

Fig. 85: Setting Auto Tensioner To Longitudinal Type
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>>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.

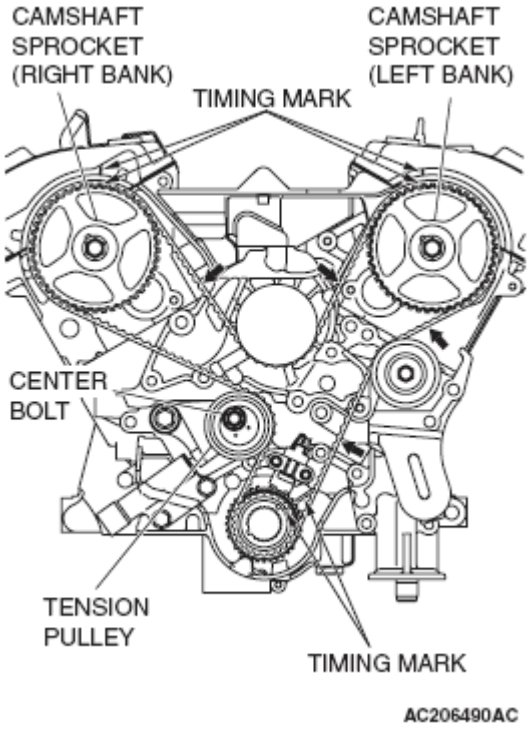

Fig. 86: Turning Camshaft Sprocket (Right Bank)
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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

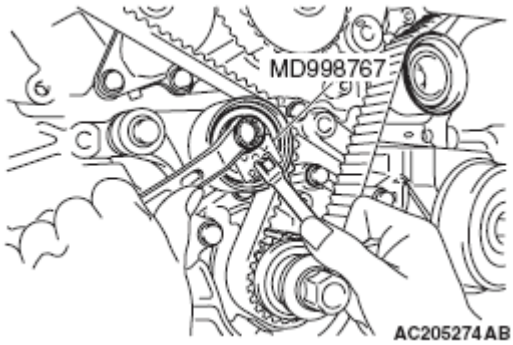

Fig. 87: Pushing Tensioner Pulley Into Timing Belt
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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.

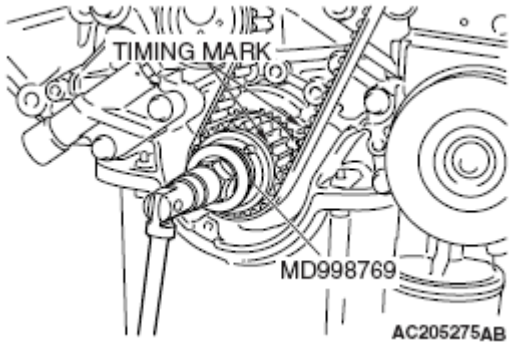

Fig. 88: Turning Crankshaft 1/4 Turn Counterclockwise
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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)

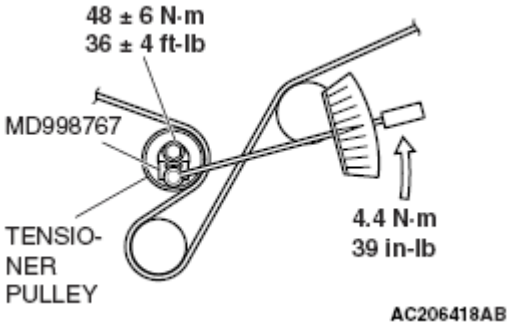

Fig. 89: Loosening Center Bolt Of Tensioner Pulley
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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

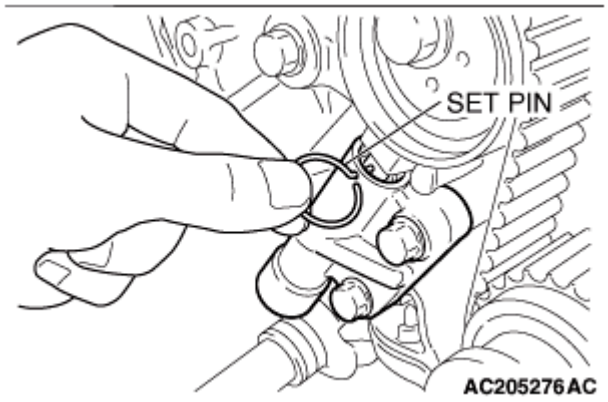

Fig. 90: Removing Set Pin
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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.

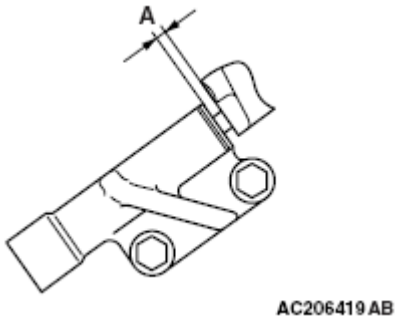

Fig. 91: Checking Timing Marks Of Sprockets
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>>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.

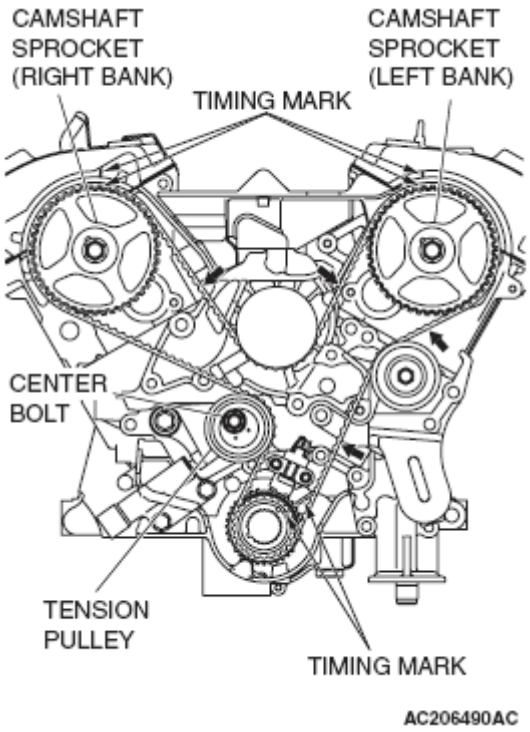

Fig. 92: Turning Camshaft Sprocket (Right Bank)
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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

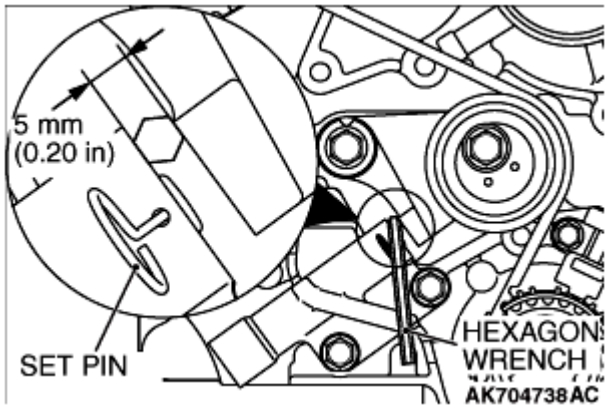

Fig. 93: Width Between Auto-Tensioner And Tensioner Arm
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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

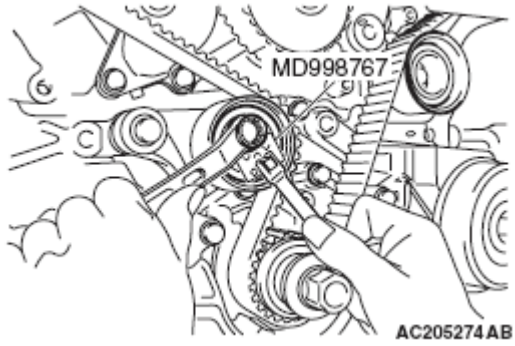

Fig. 94: Pushing Tensioner Pulley Into Timing Belt
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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.

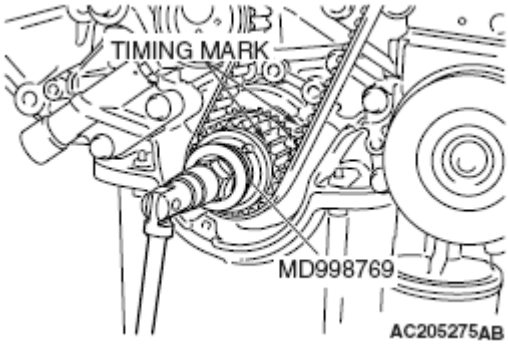

Fig. 95: Turning Crankshaft 1/4 Turn Counterclockwise
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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)

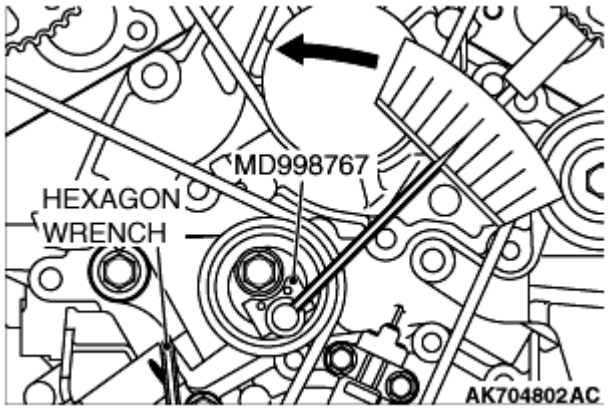

Fig. 96: Loosening Center Bolt Of Tensioner Pulley
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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.

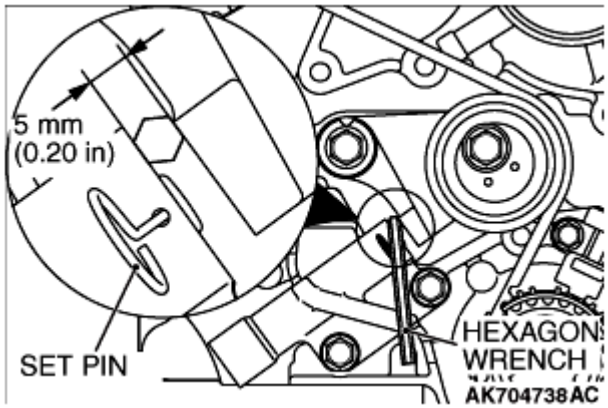

Fig. 97: Width Between Auto-Tensioner And Tensioner Arm
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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

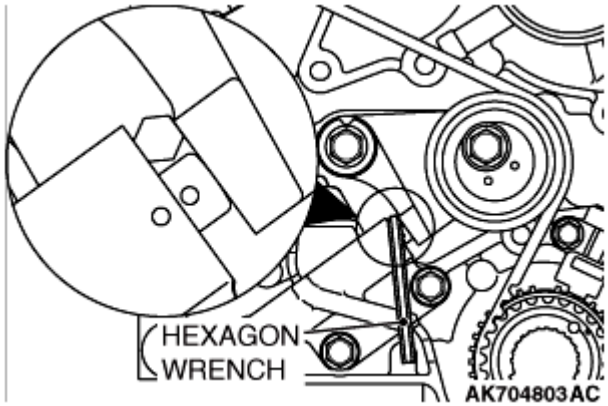

Fig. 98: Aligning Timing Marks
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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.

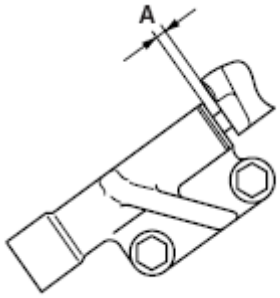

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Fig. 99: Checking Timing Marks Of Sprockets
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>>E<< CRANKSHAFT PULLEY INSTALLATION

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

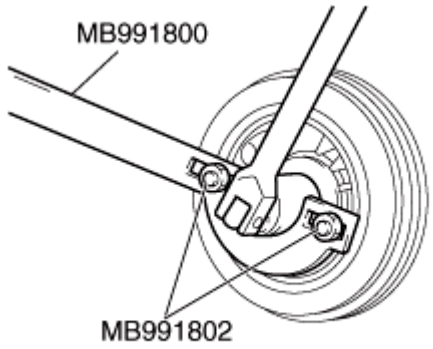

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Fig. 100: Removing Crankshaft Pulley Using Special Tools MB991800 And MB991802
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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.

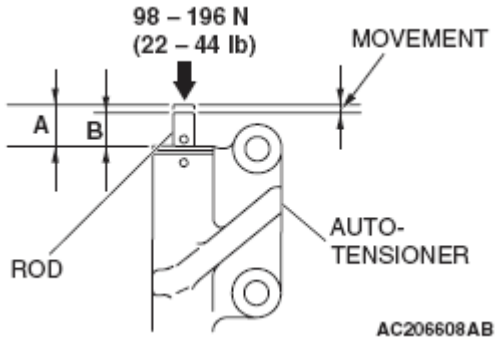


Fig. 101: Replacing Auto-Tensioner Adjuster
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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 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.

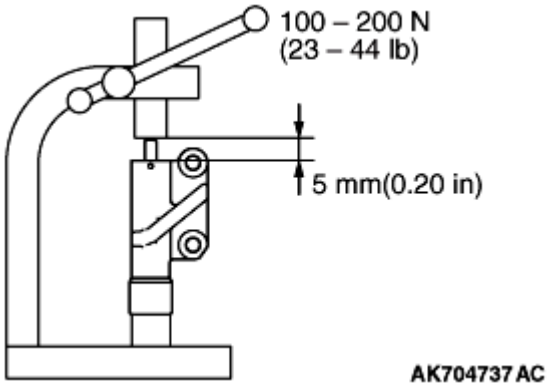


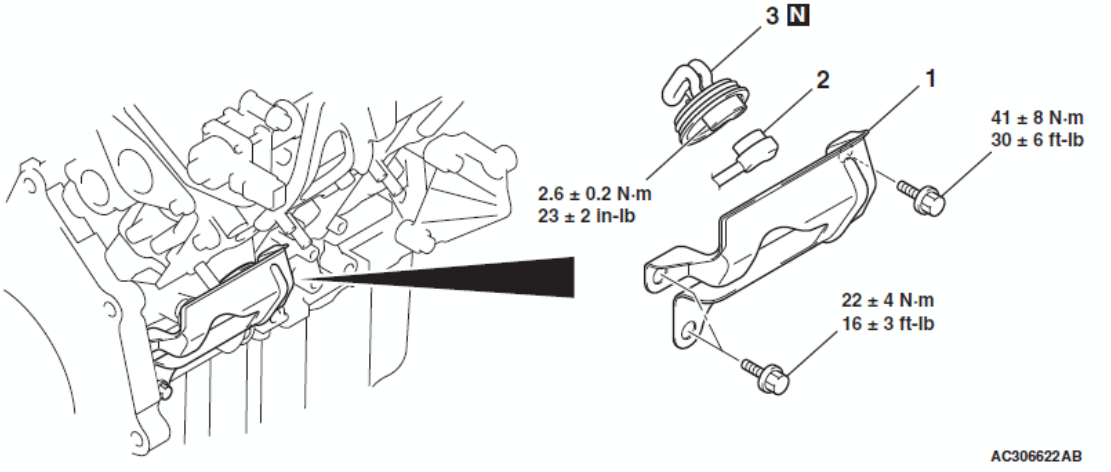
Fig. 102: Setting Auto Tensioner
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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

CYLINDER BLOCK HEATER UNIT

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
Transfer Assembly Removal and Installation



REMOVAL STEPS
1. CYLINDER BLOCK HEATER COVER
2. CYLINDER BLOCK HEATER UNIT CONNECTOR
<<A>> >>A<< 3. CYLINDER BLOCK HEATER UNIT

Fig. 103: Cylinder Block Heater Unit Components With Torque Specifications
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

REMOVAL SERVICE POINT

<<A>> CYLINDER BLOCK HEATER UNIT REMOVAL

Remove the cylinder block heater unit by using a flat-tipped screwdriver.

INSTALLATION SERVICE POINT

>>A<< CYLINDER BLOCK HEATER UNIT INSTALLATION

1. Install the cylinder block heater unit to the cylinder block within the range as shown.
2. Tighten the cylinder block heater unit mounting bolt to the specified torque.

   Tightening torque: 2.6 ± 0.2 N.m (23 ± 2 in-lb)

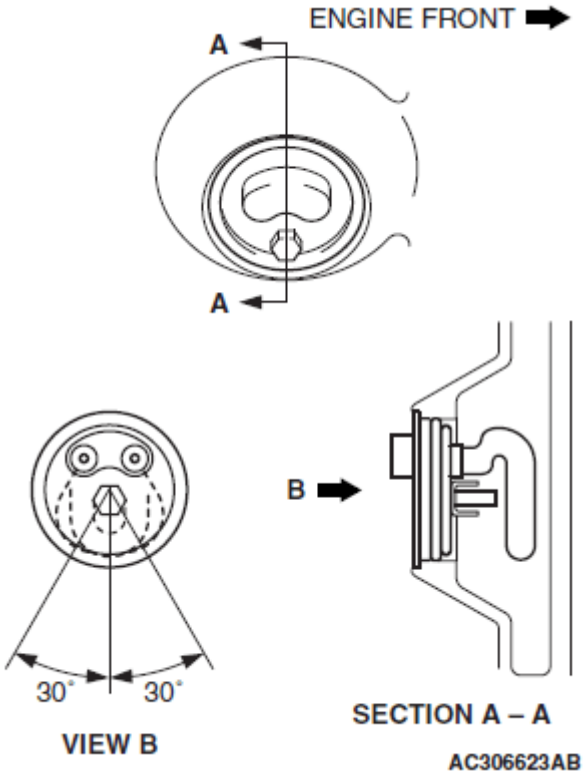


Fig. 104: Range For Installing Cylinder Block Heater Unit To Cylinder Block
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

SPECIFICATIONS

FASTENER TIGHTENING SPECIFICATIONS

ITEM SPECIFICATION

ITEM	SPECIFICATION
Engine assembly	
Engine mount assembly to engine bolt and nut	83 ± 12 N.m (61 ± 9 ft-lb)
Engine mount assembly to frame bolt	58 ± 7 N.m (43 ± 5 ft-lb)

Engine mounting stay bolt		41 ± 6 N.m (31 ± 4 ft-lb)
Evaporative emission purge solenoid bolt		9.0 ± 1.0 N.m (80 ± 9 in-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 pressure hose clamp nut		12 ± 2 N.m (102 ± 22 in-lb)
Power steering pressure hose clamp bracket bolt		12 ± 2 N.m (102 ± 22 in-lb)
Reservoir assembly bolt		12 ± 2 N.m (102 ± 22 in-lb)
Camshaft oil seal		
Camshaft sprocket bolt		88 ± 10 N.m (65 ± 7 ft-lb)
Camshaft and valve stem seal		
Camshaft position sensing cylinder bolt		22 ± 4 N.m (16 ± 3 ft-lb)
Camshaft position sensor support bolt		14 ± 1 N.m (120 ± 13 in-lb)
Camshaft position sensor bolt		11 ± 1 N.m (98 ± 8 in-lb)
Camshaft sprocket bolt		88 ± 10 N.m (65 ± 7 ft-lb)
EGR pipe B bolt		12 ± 1 N.m (102 ± 13 in-lb)
EGR valve support bolt	M6	9.0 ± 1.0 N.m (80 ± 9 in-lb)
	M8	19 ± 3 N.m (14 ± 2 ft-lb)
Ignition coil bolt		10 ± 2 N.m (89 ± 17 in-lb)
PCV valve		10 ± 2 N.m (89 ± 17 in-lb)
Rocker cover bolt		3.5 ± 0.5 N.m (31 ± 4 in-lb)
Rocker shaft bolt		31 ± 3 N.m (23 ± 2 ft-lb)
Oil pan and oil screen		
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		35 ± 6 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)
Torque converter connecting bolt		49 ± 3 N.m (36 ± 2 ft-lb)
Crankshaft oil seal		
A/T drive plate bolt		75 ± 1 N.m (55 ± 1 ft-lb)
Crankshaft position sensor bolt		8.5 ± 0.5 N.m (76 ± 4 in-lb)
Cylinder block heater unit		
Cylinder block heater unit		2.6 ± 0.2 N.m (23 ± 2 in-lb)
Cylinder block heater cover colt	M10	22 ± 4 N.m (16 ± 3 ft-lb)
	M12	41 ± 8 N.m (30 ± 6 ft-lb)
Cylinder head gasket		
Cylinder head bolt <Cold engine>		108 ± 5 N.m (80 ± 3 ft-lb) --> 0 N.m (0 in-lb) --> 108 ± 5

		N.m (80 ± 3 ft-lb)
EGR pipe B bolt		12 ± 1 N.m (102 ± 13 in-lb)
Grounding connecting bolt		22 ± 4 N.m (16 ± 3 ft-lb)
Ignition coil bolt		10 ± 2 N.m (89 ± 17 in-lb)
Power steering oil pump bracket connecting bolt		44 ± 10 N.m (33 ± 7 ft-lb)
Rocker cover bolt		3.5 ± 0.5 N.m (31 ± 4 in-lb)
Timing belt rear center cover bolt		14 ± 1 N.m (120 ± 13 in-lb)
Timing belt		
Auto-tensioner bolt		23 ± 3 N.m (17 ± 2 ft-lb)
Crankshaft pulley center bolt		185 N.m (137 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)
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

ITEM SPECIFICATION

ITEM		STANDARD VALUE	LIMIT
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)	-
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)	1,548 (225)	Minimum 1,117 (162)
Compression pressure difference of all cylinder kPa (psi)	-	98 (14)
Intake manifold vacuum at curb idle kPa (in Hg)	-	Minimum 60 (18)
Cylinder block heater unit internal resistance ohms	19 - 30	-
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 SPECIFICATION

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