2011 ENGINE

Engine Mechanical <3.0L Engine> - Outlander

GENERAL INFORMATION

The 6B31 (3.0 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.

GENERAL SPECIFICATIONS

ITEMS			SPECIFICATIONS
Type			V type, overhead camshaft
Number of cylinders			6
Bore mm (in)			87.6 (3.45)
Stroke mm (in)			82.9 (3.26)
Total displacement cm^3 (cu. in)			2,998 (182.9)
Compression ratio			10.5
Firing order			1-2-3-4-5-6
Valve timing	Intake valve	Opens (BTDC)	-1° < Low speed cam >
			18° < High speed cam >
		Closes (ABDC)	37° < Low speed cam >
			86° < High speed cam >
	Exhaust valve	Opens (BBDC)	55°
		Closes (ATDC)	20°
Lubrication system			Pressure feed, full-flow filtration
Oil pump type			Trochoid type

ENGINE DIAGNOSIS

ENGINE DIAGNOSIS CHART

SYMPTOMS	PROBABLE CAUSE	REMEDY
Compression is too low	Blown cylinder head gasket	Replace the gasket.
	Worn or damaged piston rings	Replace the rings.
	Worn piston or cylinder	Repair or replace the piston and/or the cylinder block.
	Worn or damaged valve seat	Repair or replace the valve and/or the seat ring
Drop in engine oil	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.
		Replace the gears and/or the

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

SERVICE SPECIFICATIONS

SERVICE SPECIFICATIONS

Item		Standard value	Limit
Power steering oil pump drive belt tension	Vibration frequency Hz	119 - 225	-
	Deflection (Reference) mm (in)	8.5 - 18.3 (0.33 - 0.72)	-
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		600 ± 100	-
Compression pressure (200 r/min) kPa (psi)		1,650 (239)	Minimum 1,150 (167)
Compression pressure difference of all cylinder kPa (psi)		-	98 (14)
Intake manifold vacuum at curb idle kPa (in Hg)		-	Minimum 60 (18)
Cylinder head bolt outside diameter mm (in)		-	0.1 (0.0039)
Auto-tensioner rod protrusion amount mm (in)		9.1 - 13.4 (0.36 - 0.52)	-

SEALANTS AND ADHESIVE

SEALANTS AND ADHESIVE SPECIFICATIONS

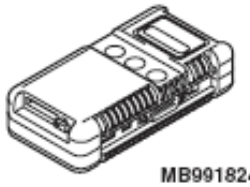
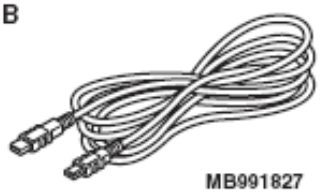
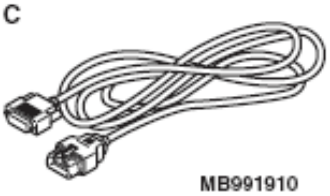
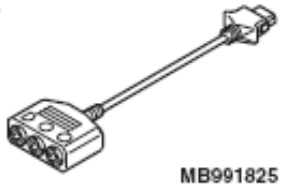
Item	Specified sealant and adhesive	Remark

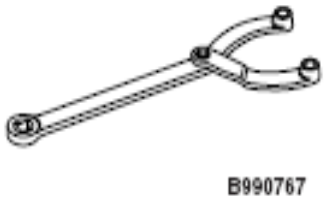
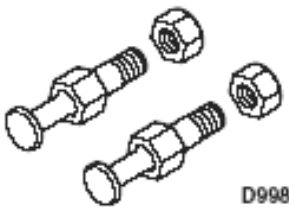
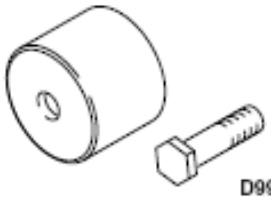
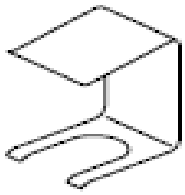
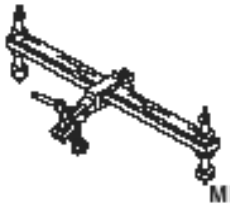
Engine oil pressure switch	ThreeBond 1141J, ThreeBond 1215, ThreeBond 1212D or equivalent	Semi-drying sealant
Engine upper oil pan	ThreeBond 1227D, ThreeBond 1217G (Mitsubishi Genuine Part No. 1000A923), LOCTITE 5970, LOCTITE 5900 or equivalent	Semi-drying sealant
Engine lower oil pan	ThreeBond 1227D, ThreeBond 1217G (Mitsubishi Genuine Part No. 1000A923), ThreeBond 1207F (Mitsubishi Genuine Part No. 1000A992), LOCTITE 5970, LOCTITE 5900 or equivalent	Semi-drying sealant
Drive plate bolt	ThreeBond 1324 or equivalent	Anaerobic adhesive

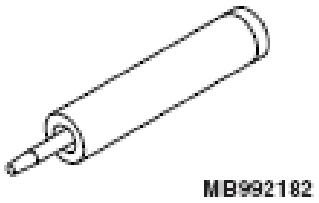
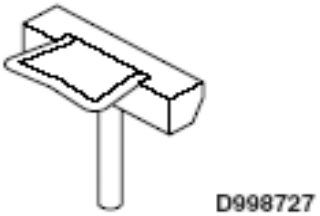
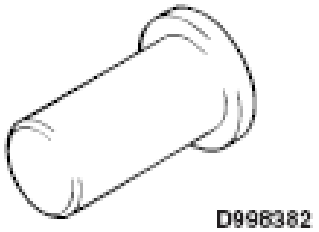
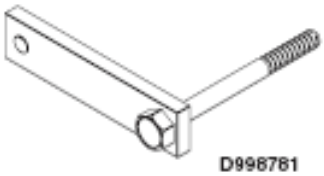
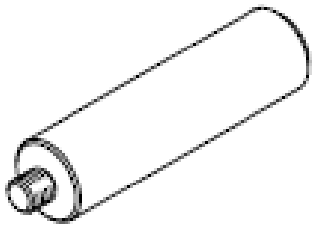
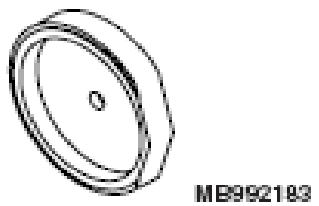
SPECIAL TOOLS

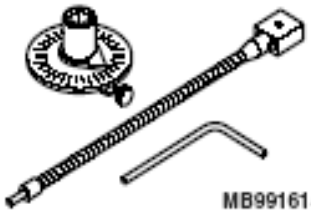
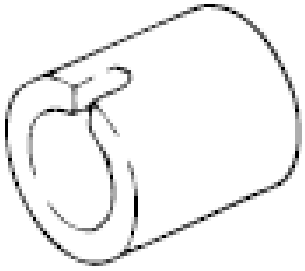
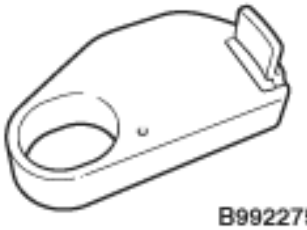
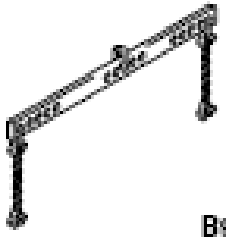
SPECIAL TOOLS

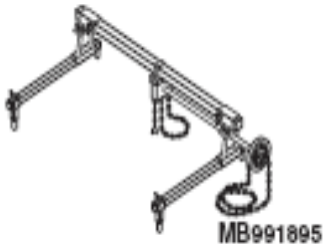
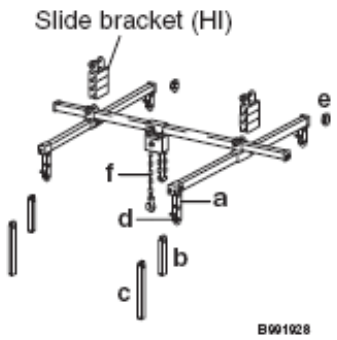
Tool	Tool number and name	Supersession	Application
	MB992080 Belt tension meter set a. MB9912081 Belt tension meter b. MB992082 Microphone assembly	Tool not available	Drive belt tension (frequency) measurement
	MB991958 Scan tool (M.U.T.-III sub assembly) a. MB991824 Vehicle communication interface (V.C.I.) b. MB991827 M.U.T.-III USB cable c. MB991910 M.U.T.-III main harness A (Vehicles with CAN communication system) d. MB991911 M.U.T.-III main harness B	MB991824-KIT **NOTE:** **MB991826 M.U.T.-III Trigger Harness is not**	**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.**

A  MB991824 B  MB991827 C  MB991910 D  MB991911 E  MB991914 F  MB991825 G  MB991826 MB991958	(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	**necessary when pushing V.C.I. ENTER key.**	• Ignition timing check • Curb idle speed check • Idle mixture check • Erasing the diagnostic trouble code
	MB990767 Front hub and flange yoke holder	MB990767-01	

 B990767			Holding the crankshaft pulley and camshaft sprocket
 D998719	MD998719 Pin	MIT308239	
 D998713	MD998713 Camshaft oil seal installer	MD998713-01	Press-in of the camshaft oil seal
 MD998777	MD998777 Camshaft oil seal installer adapter	-	Press-fitting the camshaft oil seal (left bank)
 D998443	MD998443 Auto-lash adjuster holder	MD998443-01	Holding the auto-lash adjuster
 MD998772	MD998772 Valve spring compressor	General service tool	Compressing valve spring
	MB992182 Valve stem seal installer	-	Valve stem seal installation

			
	MD998727 Oil pan FIPG cutter	MD998727-01	Engine lower oil pan removal
	MD998382 Crankshaft front oil seal installer	MD998382-01	Press-in of the crankshaft front oil seal
	MD998781 Flywheel stopper	General service tool	Securing the drive plate
	MB992075 Handle	-	Crankshaft rear oil seal installation
	MB992183 Crankshaft rear oil seal installer	-	
	MB991614 Angle gauge	-	Cylinder head bolt installation

 MB991614			
	MD998716 Crankshaft wrench	MD998716-01	Rotating the crankshaft when installing the timing belt
 B992275	MB992275 Drive belt installer	-	Power steering oil pump drive belt installation
 B992276	MB992276 Drive belt remover	-	Power steering oil pump drive belt removal
 MB992208	MB992208 Engine hanger plate A	General Service Tool	Supporting the engine assembly during removal and installation of the transaxle assembly
 B991454	MB991454 Engine hanger balancer	MZ203827-01	

	MB991895 Engine hanger	Tool not available	When the engine hanger is used: Supporting the engine assembly during removal and installation of the transaxle assembly **NOTE:** **Special tool MB991454 is a part of engine hanger attachment set MB991453.**
	MB991928 Engine hanger a. MB991929 Joint (50) x 2 b. MB991930 Joint (90) x 2 c. MB991931 Joint (140) x 2 d. MB991932 Foot (standard) x 4 e. MB991933 Foot (short) x 2 f. MB991934 Chain and hook assembly	Tool not available	

ON-VEHICLE SERVICE

GENERATOR DRIVE BELT TENSION CHECK

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

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

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

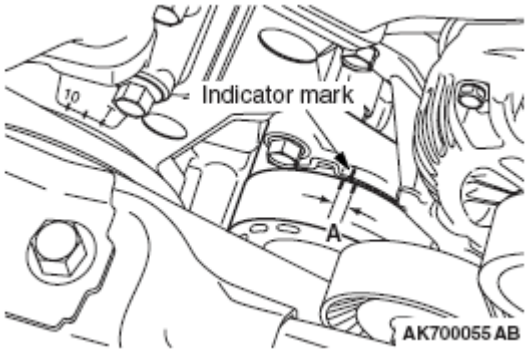


Fig. 1: Identifying Indicator Mark On Auto-Tensioner Is Within Marked Area A
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

AUTO-TENSIONER CHECK

OPERATION CHECK

1. Turn OFF the engine, then check to see that the drive belt is not protruding from the pulley width of the auto-tensioner.
2. Remove the drive belt. (Refer to **CRANKSHAFT PULLEY**).
3. Securely insert the spindle handle or ratchet handle with a 17 mm (11/16-inch) socket into the hexagonal boss of the auto tensioner. Turn the auto-tensioner slowly to the left and right to check and see that there is no binding or noise.
4. If there are any problems in the procedure 1 or 3, replace the auto-tensioner. (Refer to **<< A >> TIMING BELT AUTO-TENSIONER REMOVAL**).
5. Install the drive belt. (Refer to **CRANKSHAFT PULLEY**).

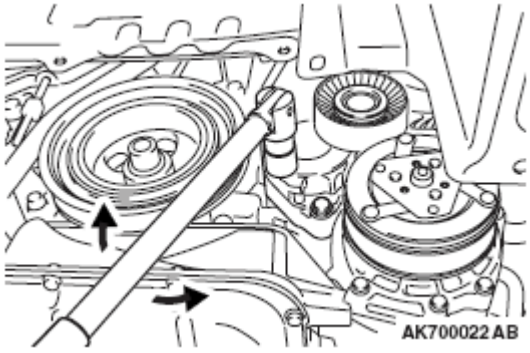


Fig. 2: Turning Auto-Tensioner To Left And Right To Check There Is No Binding Or Noise
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

POWER STEERING OIL PUMP DRIVE BELT TENSION CHECK

NOTE:

- **An elastic stretch-type belt is used for the power steering oil pump drive, therefore, the tension adjustment is not necessary.**

- **Perform the power steering oil pump drive belt tension check according to the following procedures.**

< WHEN THE VIBRATION FREQUENCY IS MEASURED: RECOMMENDATION >

Required Special Tools:

- MB992080: Belt Tension Meter Set
  - MB992081: Belt Tension Meter
  - MB992082: Microphone Assembly

CAUTION:
- **When measuring the vibration frequency, make sure that the engine is cold.**
- **Measure the vibration frequency after turning the crankshaft clockwise one turn or more.**

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 number key 1. Check to ensure that "No. 01" appears on the upper left of the display and that the following numeric values are displayed for individual items (M, W, and S):

   M 000.9 g/m

   W 010.0 mm/R

   S 0100 mm

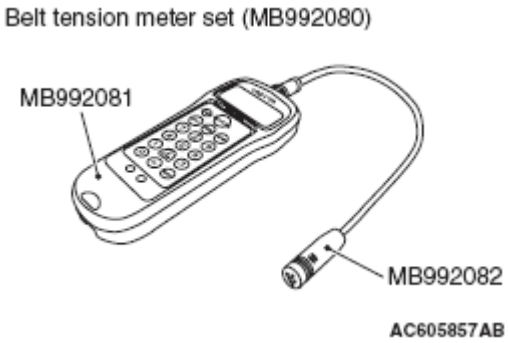


Fig. 3: Identifying Belt Tension Meter Set (MB992080)
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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 judgment of error.

< Setting procedure >

1. Press down the "MASS" button till the belt mass select display appears.
2. Press the "UP" or "DOWN" button to select "01 1.5GT 0.9" and press the "MEASURE" button to decide it.

   Check to ensure that "M 000.9 g/m" is displayed.

3. Press the "WIDTH" button to change to the belt width input display.
4. Press number keys 0, 1, 0, and 0 sequentially, and press the "SELECT" button to apply them. Check to ensure that "W 010.0 mm/R" appears on the display.
5. Press the "SPAN" button to change to the span length input display.
6. Press number keys 0, 1, 0, and 0 sequentially, and press the "SELECT" button to apply them. Check to ensure that "S 0100 mm" appears on the display.

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

CAUTION:
- **Do not 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 the special tool MB992080 to the middle of the power steering oil pump 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 power steering oil pump drive belt so that it is perpendicular to the power steering oil pump drive belt (within an angle of ± 15 degrees).
6. Press the "MEASURE" button.
7. Gently tap the middle of the power steering oil pump drive 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 power steering oil pump drive belt is within the standard value.

   Standard value: 119 - 225 Hz

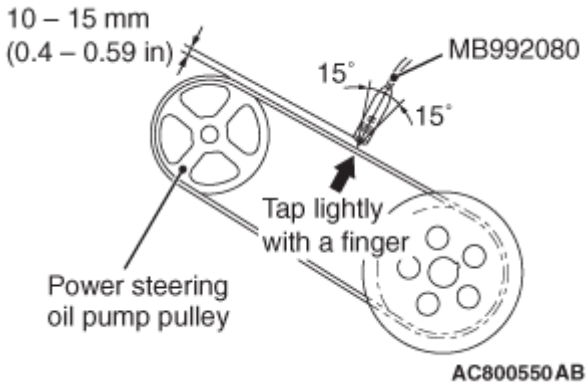


Fig. 4: Checking Tension Of Drive Belt Using Special Tool MB992080
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

NOTE: To take the measurement repeatedly, fillip the power steering oil pump drive belt again.

8. After the completion of the measurement, press and hold the "POWER" button to turn off the power supply.
9. If not within the standard value, replace the power steering oil pump drive belt (Refer to **CRANKSHAFT PULLEY**).

< WHEN THE DEFLECTION IS MEASURED >

CAUTION:
- **When measuring the flexure, make sure that the engine is cold.**
- **Measure the flexure after turning the crankshaft clockwise one turn or more.**

Apply approximately 100 N (22 pound) of force to the middle of the power steering oil pump 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 (Reference): 8.5 - 18.3 mm (0.33 - 0.72 inch)

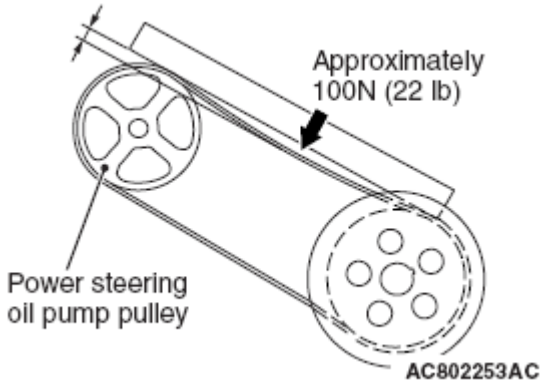


Fig. 5: Applying Approximately 100 N (22 Pound) Of Force To Middle Of Power Steering Oil Pump Drive Belt Between Pulleys (At Place Indicated By Arrow)
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

POWER STEERING OIL PUMP DRIVE BELT INSPECTION

1. Check the every part of power steering oil pump drive belt for damage including cracks or delamination in detail by a visual inspection or touching.
2. If there is the damage, replace the power steering oil drive belt with a new one.

VALVE CLEARANCE CHECK AND ADJUSTMENT

Refer to **GENERAL - MAINTENANCE SERVICE - INTAKE AND EXHAUST VALVE CLEARANCE (INSPECT AND ADJUST)**

ROCKER ARM PISTON OPERATION CHECK

1. Remove all of the ignition coils.
2. Remove the rocker cover.

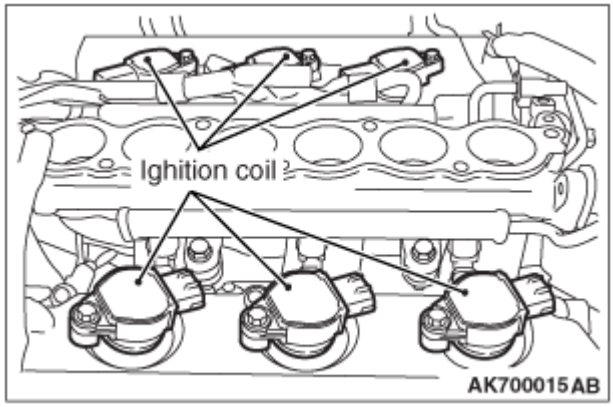


Fig. 6: Identifying Ignition Coils
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

3. Remove the engine oil control valve.
4. Remove the oil pipe.
5. Turn the crankshaft clockwise until the notch on the crankshaft pulley is lined up with the "T" mark on the lower cover of timing belt.

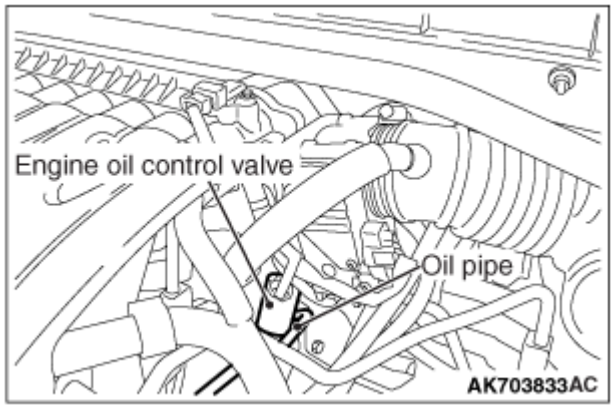


Fig. 7: Identifying Engine Oil Control Valve And Oil Pipe
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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

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

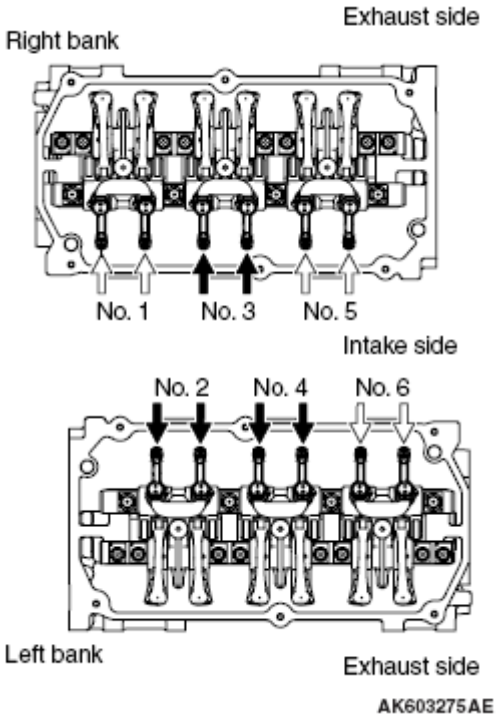


Fig. 8: Locating Rocker Arms
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

7. While putting your hands over the oil passage hole located at the back of the engine oil control valve installation hole in order to prevent air leakage, use an air blow gun to blow compressed air to the oil pipe installation hole at the right bank side. At that time, check that the rocker arm piston at the right bank side is operated.

NOTE: To surely perform the check, wrap the top of the air blow gun with a vinyl tape. Prevent compressed air leakage as much as possible. The pressure of 620 kPa (90 psi) or more is necessary for the compressed air.

8. Use the air blow gun to blow the compressed air to the oil pipe installation hole at the left bank side. At that time, check that the rocker arm piston at the left bank side is operated.

NOTE: To surely perform the check, wrap the top of the air blow gun with a vinyl tape. Prevent compressed air leakage as much as possible. The pressure of 620 kPa (90 psi) or more is necessary for the compressed air.

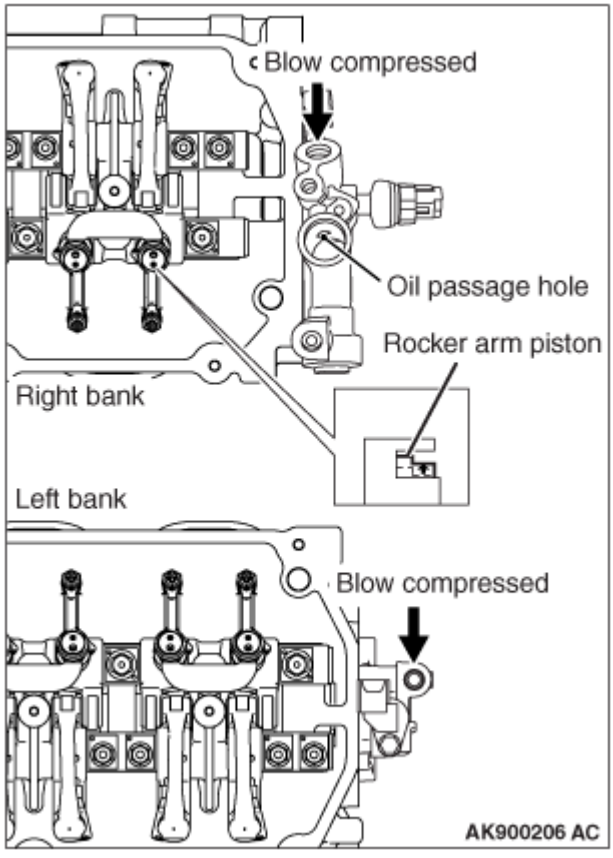


Fig. 9: Locating Oil Passage Hole
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

9. Turn the crankshaft clockwise until the notch on the crankshaft pulley is lined up with "T" mark on the lower cover of timing belt.
10. Confirm the rest of the rocker arm pistons under the procedure 7 - 8.
11. When the rocker arm piston does not operate, replace the rocker arm assy.
12. Install the oil pipe and the engine oil control valve. (Refer to **REMOVAL AND INSTALLATION** .)
13. Install the rocker cover.
14. Install all of the ignition coils.

IGNITION TIMING CHECK

Required Special Tool:

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

- MB991824: V.C.I.
- MB991827: M.U.T.-III USB Cable
- MB991910: M.U.T.-III Main Harness A

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

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

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

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

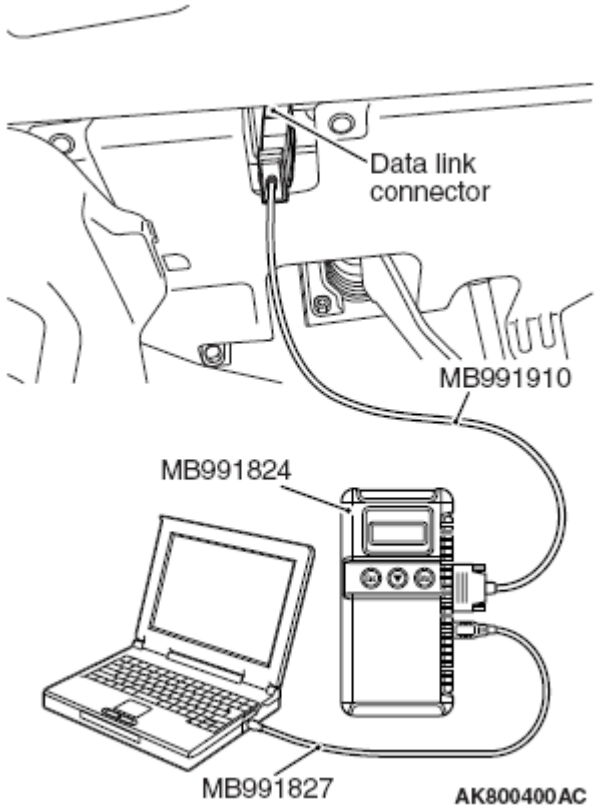


Fig. 10: Connecting Scan Tool MB991958 To Data Link Connector
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

3. Set the timing light to the power supply line (terminal No. 1) of the ignition coil No. 2.

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

4. Start the engine and run it at idle.
5. Check that the idle speed is approximately 600 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°

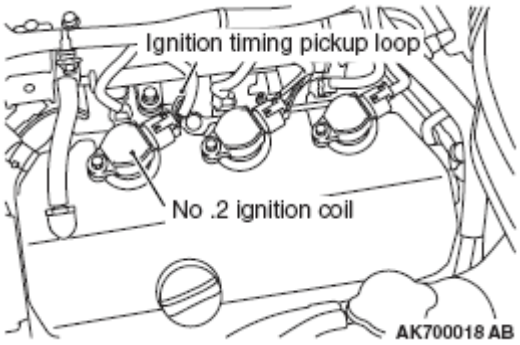


Fig. 11: Identifying Ignition Timing Pickup Loop And No.2 Ignition Coil
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

8. If the basic ignition timing is not within the standard value, refer to **SYMPTOM CHART** .

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

9. 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: The 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.

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.

12. Disconnect 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
   - Transmission: P range

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

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

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

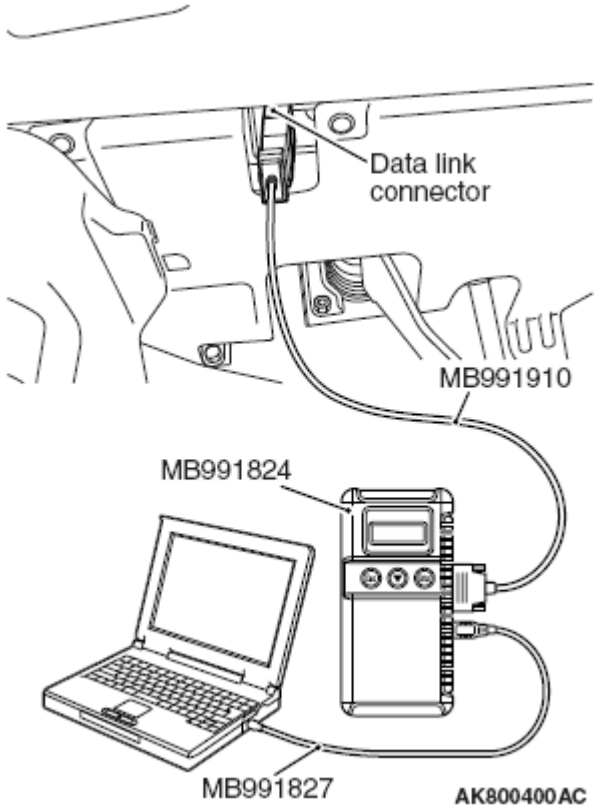


Fig. 12: Connecting Scan Tool MB991958 To Data Link Connector

Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

3. Set the timing light to the power supply line (terminal No. 1) of the ignition coil No. 2.

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

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

Standard value: Approximately 10° BTDC

NOTE: The 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.

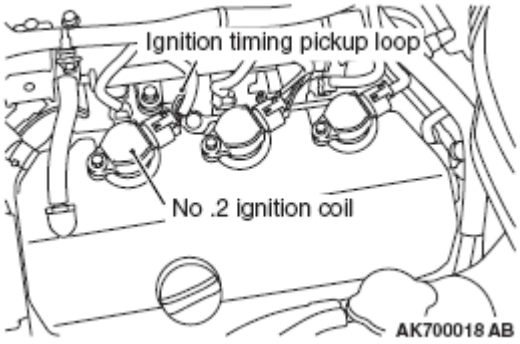


Fig. 13: Identifying Ignition Timing Pickup Loop And No.2 Ignition Coil
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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

Curb idle speed: 600 ± 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** .

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.

9. Disconnect scan tool MB991958 from the 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 the vehicle in the following condition:
    - Engine coolant temperature: 80 - 95°C (176 - 203°F)
    - Lights and all accessories: OFF
    - Transmission: P range

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

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

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

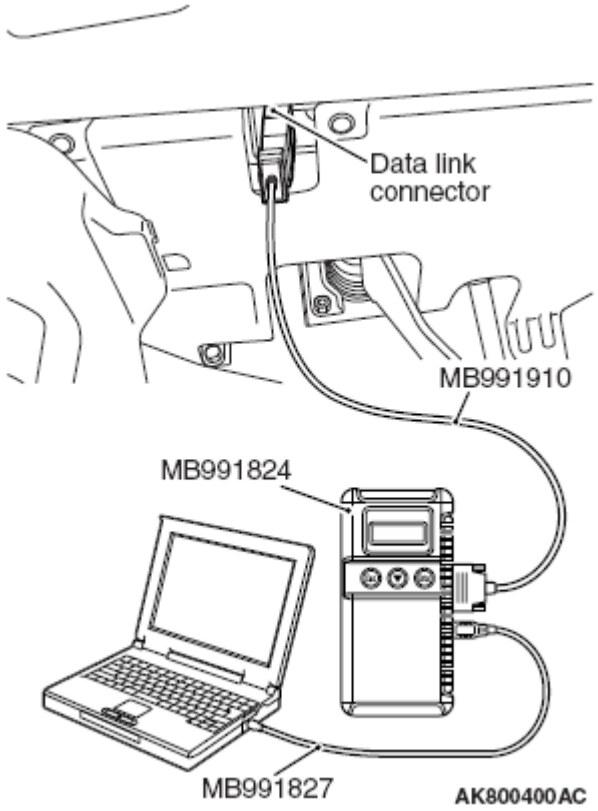


Fig. 14: Connecting Scan Tool MB991958 To Data Link Connector
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

3. Set the timing light to the power supply line (terminal No. 1) of the ignition coil No. 2.

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

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

Standard value: Approximately 10° BTDC

NOTE: The ignition timing fluctuates about ± 7°, even under normal operating condition.

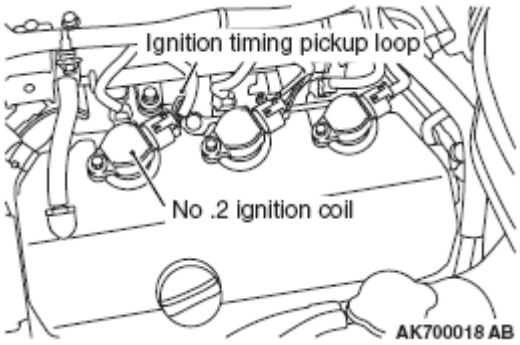


Fig. 15: Identifying Ignition Timing Pickup Loop And No.2 Ignition Coil
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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.

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

   Standard value:

   CO contents: 0.5% or less

   HC contents: 100 ppm or less

9. If the CO and HC contents do not remain inside the standard value, refer to **SYMPTOM CHART** .
10. Remove the CO, HC tester and timing light.

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.

11. Disconnect scan tool MB991958 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: On vehicles for Canada, the headlight, taillight, etc. remain lit even when the lighting switch is in "OFF" position but this is no problem for checks.

2. Remove all of the ignition coils and spark plugs.
3. Disconnect the injector connector.

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

4. Cover the spark plug hole with a shop towel etc., during cranking. After the engine has been cranked, check for foreign material adhering to the shop towel.

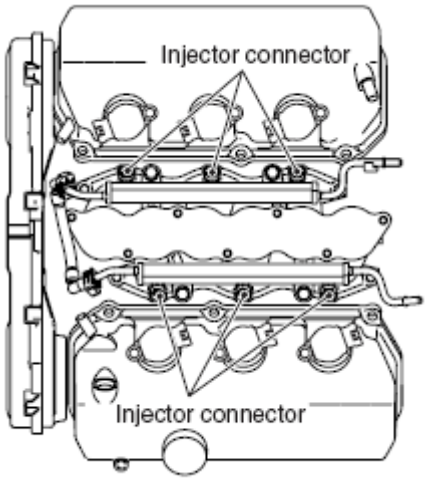


Fig. 16: Identifying Injector Connector
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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): 1,650 kPa (239 psi)

Minimum limit (at engine speed of 200 r/min): 1,150 kPa (167 psi)

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

   Limit: 98 kPa (14 psi)

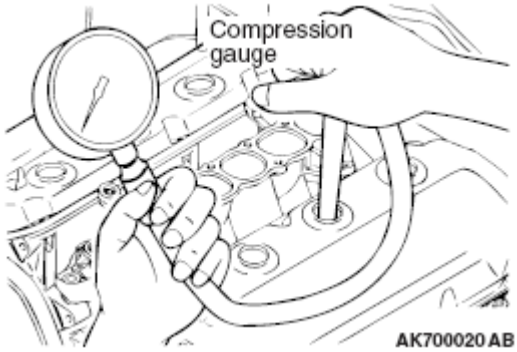


Fig. 17: Measuring Compression Pressure
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

8. If there is a cylinder with compression or a compression difference that is outside the limit, pour a small amount of engine oil through the spark plug hole, and repeat the operations in steps 5 to 7.
   1. If the compression increases after oil is added, the cause of the malfunction is a worn or damaged piston ring and/or cylinder inner surface.
   2. If the compression does not rise after oil is added, the cause is a burnt or defective valve seat, or pressure is leaking from the gasket.
9. Connect the injector 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 injector connector being disconnected.

12. Select "Mode $0A" from "Special Function" of Scan tool MB991958. Check whether the permanent-DTC (PDTC) is stored or not. If stored, clear the PDTC. (Refer to **DIAGNOSTIC FUNCTION**)

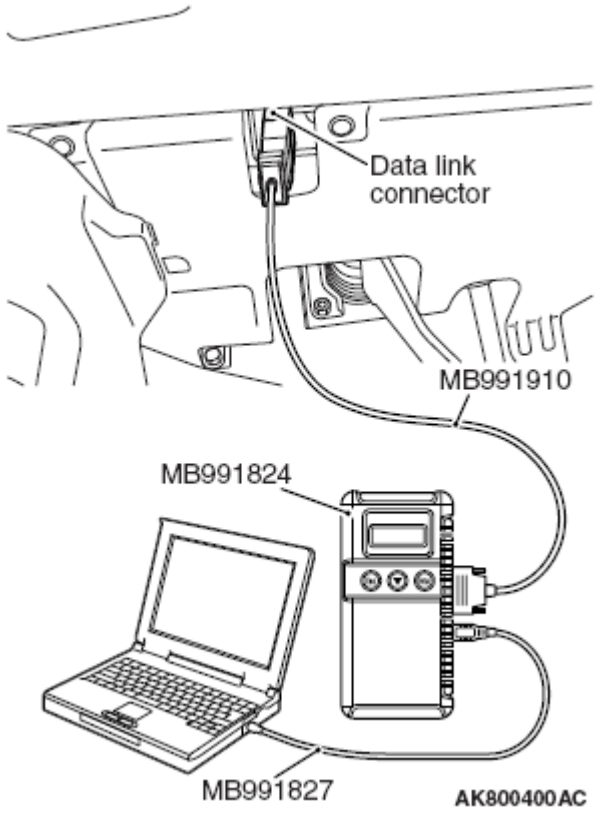


Fig. 18: Connecting Scan Tool MB991958 To Data Link Connector
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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: P range

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

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

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

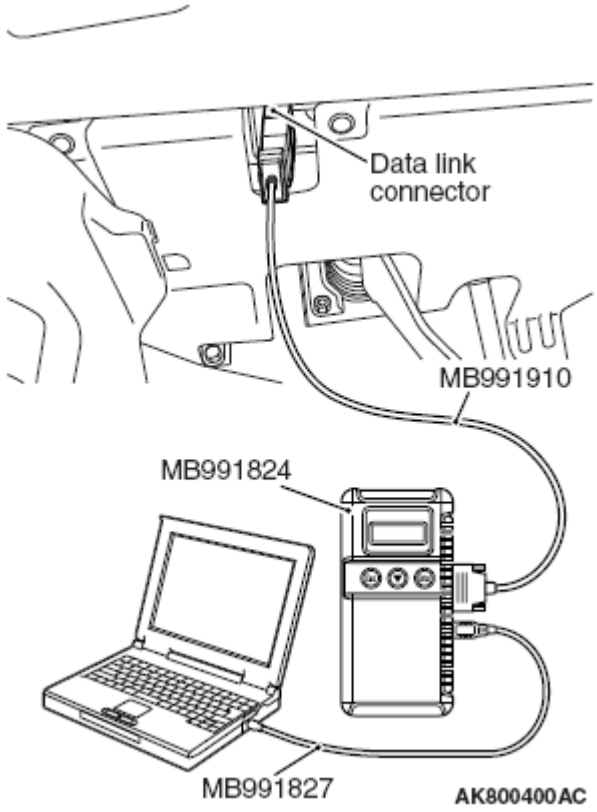


Fig. 19: Connecting Scan Tool MB991958 To Data Link Connector
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

3. Disconnect the ventilation hose from the positive crankcase ventilation (PCV) valve, and then connect a vacuum gauge to the ventilation hose. Plug the PCV valve.
4. Start the engine and check that idle speed is approximately 600 r/min.
5. Check the intake manifold vacuum.

Limit: Minimum 60 kPa (18 in Hg)

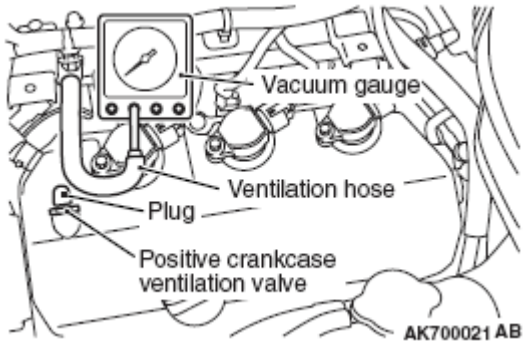


Fig. 20: Checking Intake Manifold Vacuum
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

6. Turn off the ignition switch.
7. Remove the vacuum gauge and then connect the ventilation hose to the PCV valve.

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.

8. Disconnect scan tool MB991958 from the data link connector.

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: The lash adjuster is installed in exhaust side only.

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 **LASH ADJUSTER 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 **LASH ADJUSTER INSPECTION**).

Bleeding lash adjuster system

NOTE: It can possibly be difficult to check the oil level within 30 seconds of the engine stopped because of the structure of oil level gauge. If it's difficult, the oil level must be checked later. The oil level always check at the one side of oil level gauge: at the rear side of the vehicle. The oil level cannot be checked at the another side because the engine oil adheres to all the surfaces.

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.

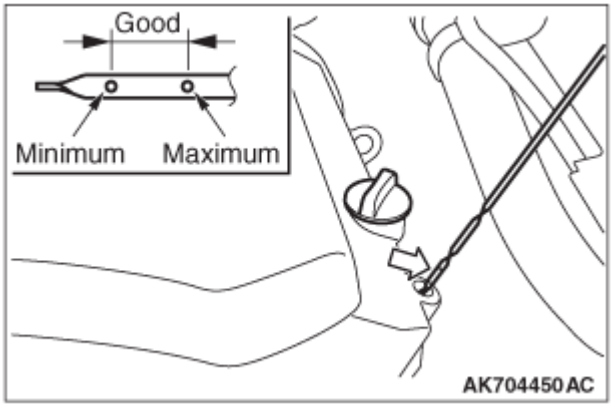


Fig. 21: Checking Engine Oil Level
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

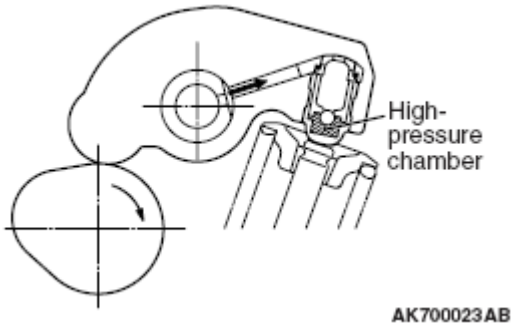


Fig. 22: Identifying High-Pressure Chamber
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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

2. Idle the engine for one to three minutes to warm it up.
3. Repeat the operation pattern, shown in left figure, at no load to check for abnormal noise. (Usually the abnormal noise is eliminated after repetition of the operation 10 to 30 times. If, however, no change is observed in the level of abnormal noise after repeating the operation more than 30 times, suspect that the

abnormal noise is due to some other factors.)

4. After elimination of abnormal noise, repeat the operation shown in left figure five more times.
5. Run the engine at idle for one to three minutes to make sure that the abnormal noise has been eliminated.

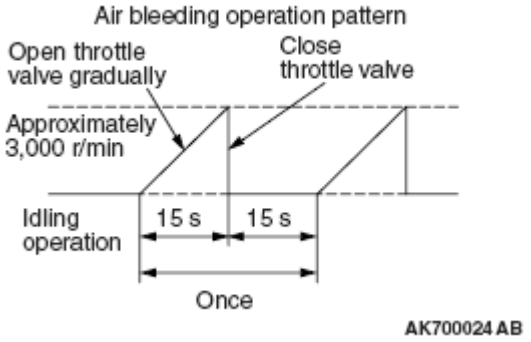
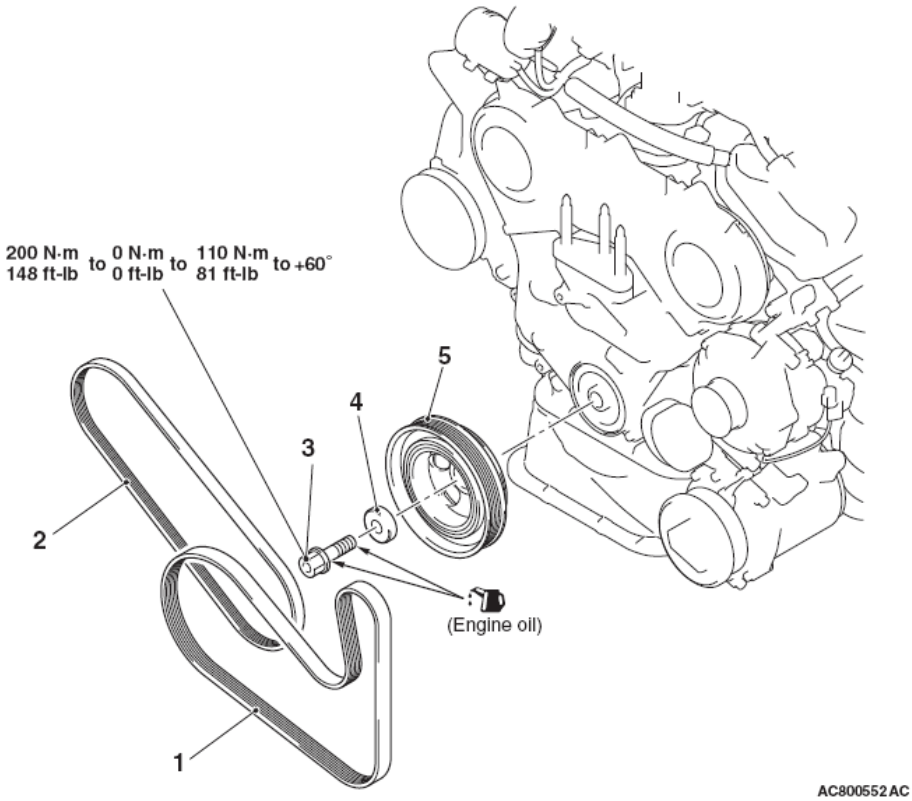


Fig. 23: Air Bleeding Operation Pattern Chart
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

CRANKSHAFT PULLEY

REMOVAL AND INSTALLATION

Pre-removal Operation	Post-installation Operation
• Engine Room Under Cover Front B and Engine Room Side Cover (RH) Removal	• Generator Drive Belt Tension Check • Power Steering Oil Pump Drive Belt Tension Check • Engine Room Under Cover Front B and Engine Room Side Cover (RH) Installation



Removal steps

<<A>>		1.	Generator drive belt	<<C>>	>>A<<	4. Crankshaft pulley washer
<<B>>	>>B<<	2.	Power steering oil pump drive belt	<<C>>	>>A<<	5. Crankshaft pulley
<<C>>	>>A<<	3.	Crankshaft pulley center bolt			

Fig. 24: Identifying Crankshaft Pulley Removal And Installation
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

Required Special Tools:

- MB990767: Front Hub and Flange Yoke Holder
- MD998719: Pin
- MB992275: Drive Belt Installer
- MB992276: Drive Belt Remover

REMOVAL SERVICE POINTS

<< A >> GENERATOR DRIVE BELT REMOVAL

CAUTION: When the generator drive belt is reused, draw an arrow indicating the

rotating direction on the back of the belt using chalk to install the same direction.

1. Turn the drive belt auto-tensioner to counterclockwise, and insert the L-shaped hexagon wrench to the auto-tensioner hole in order to fix the auto-tensioner.
2. Remove the generator drive belt.

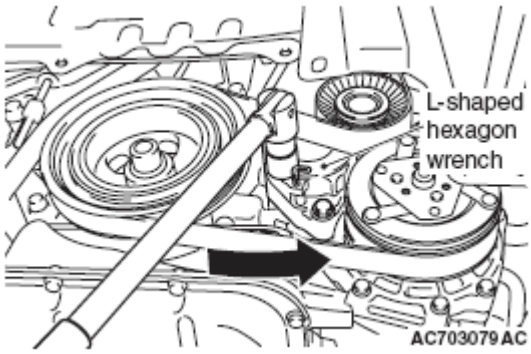


Fig. 25: Turning Drive Belt Auto-Tensioner To Counterclockwise
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

<< B >> POWER STEERING OIL PUMP DRIVE BELT REMOVAL

CAUTION:
- **To reuse the power steering oil pump drive belt, draw an arrow indicating the rotating direction on the back of the power steering oil pump drive belt using chalk to install the same direction.**
- **Hang the special tool MB992276 on the vehicle components (including front side members) using a cord and paper clip to prevent from falling.**

1. Set the special tool MB992276 as shown and hold it by a finger.

CAUTION: Be careful that the finger holding the special tool MB992276 is not pinched.

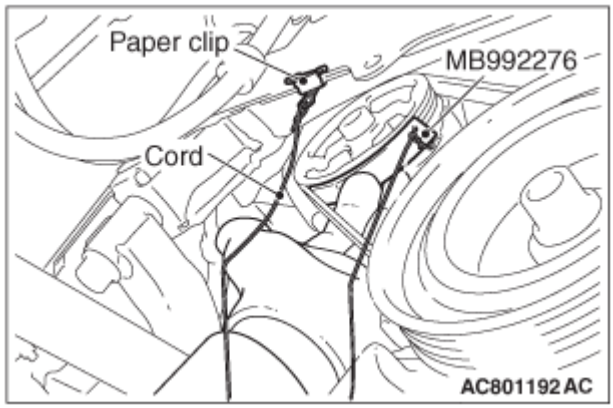


Fig. 26: Setting Special Tool MB992276
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

2. Slightly turn the crankshaft pulley clockwise until the special tool MB992276 is pinched and held between the oil pump assembly pulley and the power steering oil pump drive belt as shown.
3. If the special tool MB992276 is held, move the finger off.

CAUTION: If the power steering oil pump drive belt is detached, be careful that the special tool MB992276 is also detached and fallen.

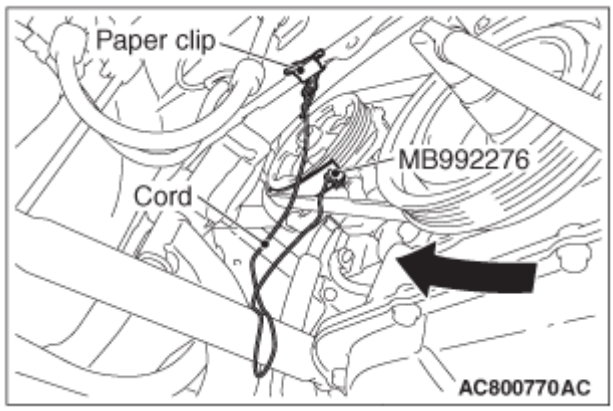


Fig. 27: Turning Crankshaft Pulley Clockwise Until Special Tool MB992276 Is Pinched And Held Between Oil Pump Assembly Pulley
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

4. Slowly turn the crankshaft pulley clockwise until the power steering oil pump drive belt goes aground on the special tool MB992276 and is detached.
5. Remove the special tool MB992276.

<< C >> CRANKSHAFT PULLEY CENTER BOLT/CRANKSHAFT PULLEY WASHER/CRANKSHAFT PULLEY REMOVAL

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

result.

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

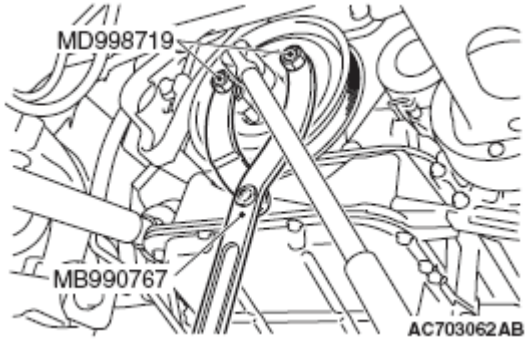


Fig. 28: Removing Crankshaft Pulley From Crankshaft Using Special Tools MB990767 And MD998719
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

CAUTION: Provide one punch mark on the head of the crankshaft pulley center bolt each time the bolt is removed. Replace the bolt that already has three punch marks. (The evidence of having been tightened three times)

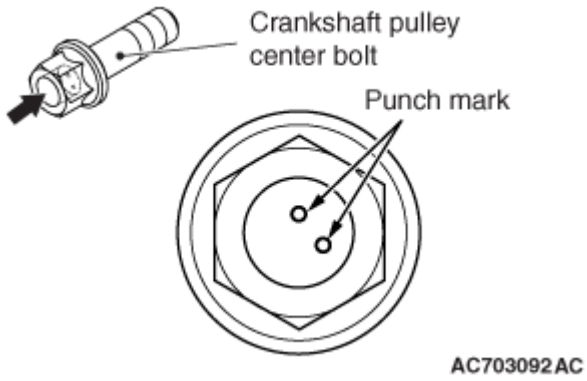


Fig. 29: Identifying Punch Mark On Head Of Crankshaft Pulley Center Bolt
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

INSTALLATION SERVICE POINTS

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

CAUTION: Before installing the crankshaft pulley center bolt, check the number of punch marks on its head. (The bolt is reusable if it is two or less.) If the bolt has three punch marks, replace it.

1. Clean the bolt hole in crankshaft pulley center bolt and crankshaft pulley's seating surface.
2. Degrease the cleaned seating surface of the front flange and crankshaft pulley.

3. Install the front flange and crankshaft pulley.
4. Apply oil to the threads of crankshaft pulley center bolt and the outer surface of crankshaft pulley washer.

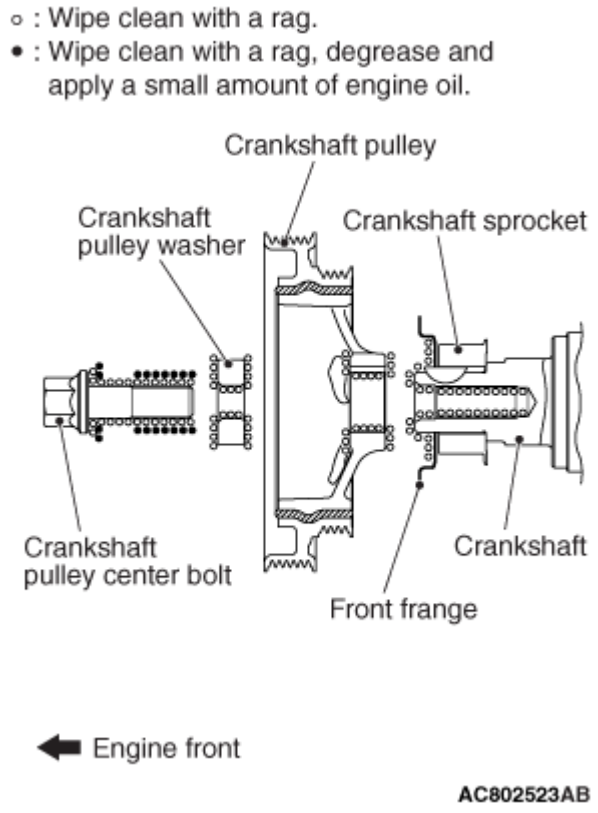


Fig. 30: Applying Oil To Threads Of Crankshaft Pulley Center Bolt And Outer Surface Of Crankshaft Pulley Washer
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

5. Use special tools MB990767 and MD998719 to hold the crankshaft pulley.
6. Tighten the crankshaft pulley center bolt to 200 N.m (148 ft-lb).
7. Loosen the crankshaft pulley center bolt fully.
8. Tighten the crankshaft pulley center bolt to 110 N.m (81 ft-lb).

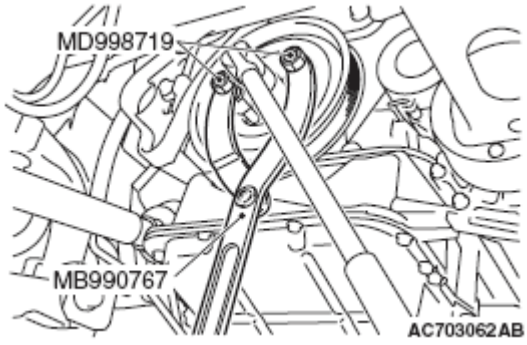


Fig. 31: Tightening Crankshaft Pulley Center Bolt
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

9. Make a paint mark on the crankshaft pulley center bolt.

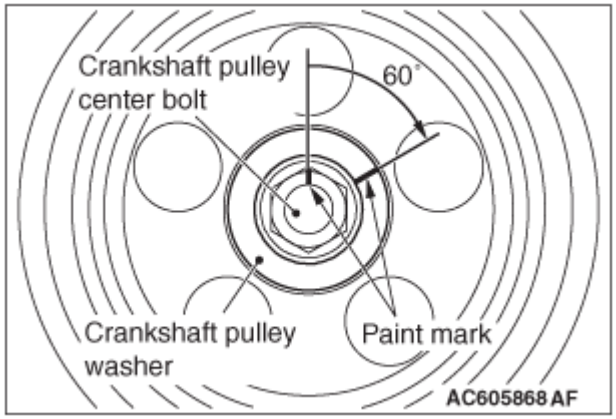


Fig. 32: Identifying Paint Mark On Crankshaft Pulley Center Bolt
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

CAUTION:
- **If the crankshaft pulley center bolt is turned less than 60 degrees, proper fastening performance may not be achieved. Be careful to tighten the crankshaft pulley center bolt exactly 60 degrees.**
- **If the crankshaft pulley center bolt is overtightened (exceeding 60 degrees), loosen the crankshaft pulley center bolt completely and then retighten it by repeating the tightening procedure from step 6.**

10. Make a paint mark on the crankshaft pulley center bolt end at a position 60 degrees from the paint mark made on the washer in the direction of tightening the crankshaft pulley center bolt.
11. Turn the crankshaft pulley center bolt another 60 degrees and make sure that the paint marks on the washer and crankshaft pulley center bolt are aligned.

>> B << POWER STEERING OIL PUMP DRIVE BELT INSTALLATION

CAUTION: Check that the belt is fitted in the notches of the notched pulley and the notches of crankshaft pulley securely.

1. Install the power steering oil pump drive belt in the crankshaft pulley.

CAUTION:
- **Hang the special tool MB992275 on the vehicle components (including front side members) using a cord and paper clip to prevent from falling.**

- **Be careful that the finger holding the special tool MB992275 is not pinched.**

2. Set the special tool MB992275 and power steering oil pump drive belt in the oil pump assembly pulley and hold it by a finger as shown.

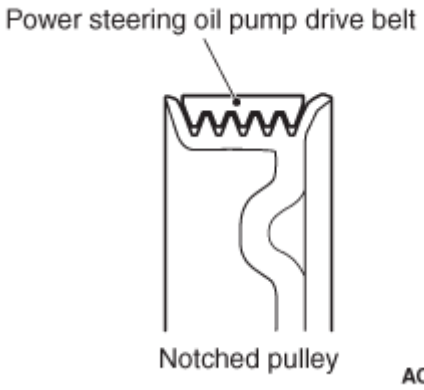


Fig. 33: Checking Belt Is Fitted In Notches Of Notched Pulley And Notches Of Crankshaft Pulley Securely
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

NOTE:

- **Check that the top surface of power steering oil pump drive belt goes aground on the special tool MB992275, and the power steering oil pump drive belt is fitted in the notched under the oil pump assembly pulley securely as shown.**

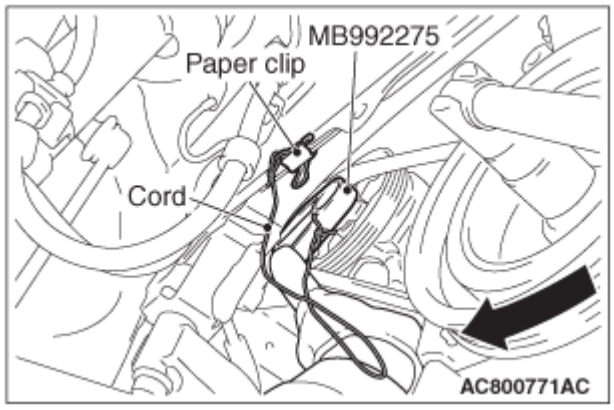


Fig. 34: Setting Special Tool MB992275 And Power Steering Oil Pump Drive Belt In Oil Pump Assembly Pulley
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

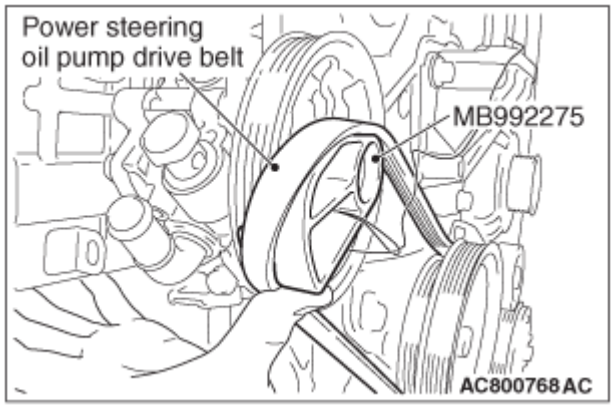


Fig. 35: Installing Power Steering Oil Pump Drive Belt Using Special Tool MB992275
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

- **Slightly turn the crankshaft pulley clockwise until the special tool MB992275 is pinched and held between the oil pump assembly pulley and the power steering oil pump drive belt as shown.**

3. If the special tool MB992275 is held, move the finger off.

CAUTION: If the power steering oil pump drive belt is installed, be careful that the special tool MB992275 is detached and fallen.

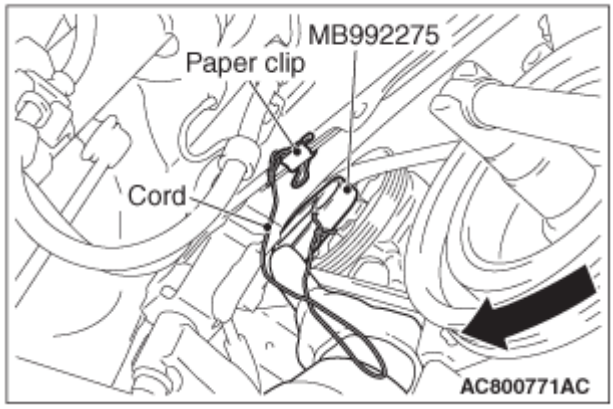


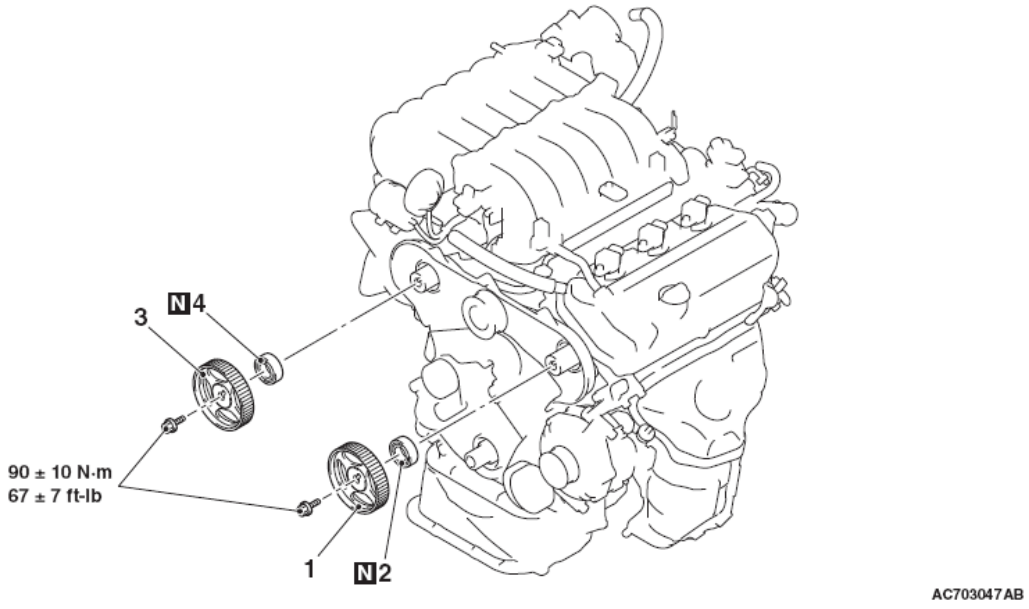
Fig. 36: Turning Crankshaft Pulley Clockwise
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

4. Slowly turn the crankshaft pulley clockwise and install the power steering oil pump drive belt.
5. Turn the crankshaft pulley until the special tool MB992275 is detached from the oil pump assembly and fallen, and then remove the special tool MB992275.
6. Turn the crankshaft pulley clockwise on several times and check that the power steering oil pump drive belt is installed in the oil pump assembly pulley and the crankshaft pulley securely.

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: Identifying Camshaft Oil Seal Removal And Installation With Torque Specifications
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

Required Special Tools:

- MB990767: Front Hub and Flange Yoke Holder
- MD998713: Camshaft Oil Seal Installer
- MD998719: Pin
- MD998777: Camshaft Oil Seal Installer Adapter

REMOVAL SERVICE POINTS

<< A >> CAMSHAFT SPROCKET REMOVAL

Use special tools MB990767 and MD998719 to remove the camshaft sprocket.

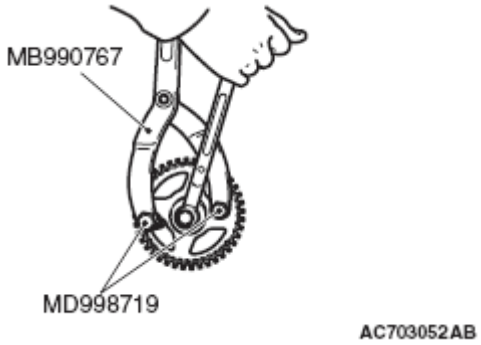


Fig. 38: Removing Camshaft Sprocket Using Special Tools MB990767 And MD998719
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

<< 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.

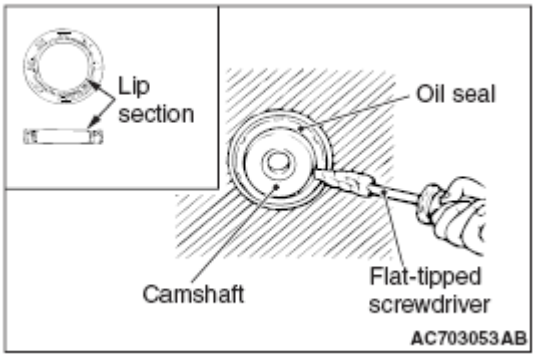


Fig. 39: Prying Out Camshaft Oil Seal
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

INSTALLATION SERVICE POINTS

>> A << CAMSHAFT OIL SEAL INSTALLATION

1. Apply engine oil to the camshaft oil seal lip.
2. Use special tools MD998713 and MD998777 to press-fit the camshaft oil seal.

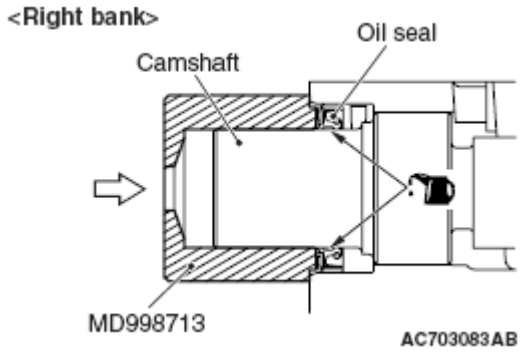


Fig. 40: Fitting Camshaft Oil Seal Using Special Tools MD998713 And MD998777 - Right Bank
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

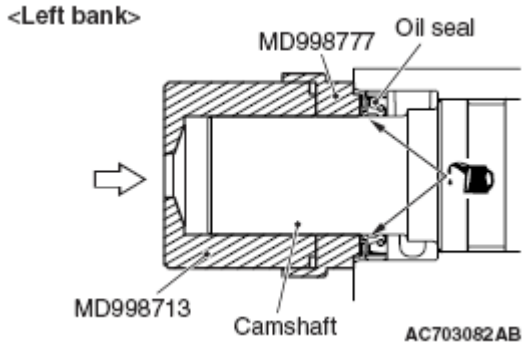


Fig. 41: Fitting Camshaft Oil Seal Using Special Tools MD998713 And MD998777 - Left Bank
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>> B << CAMSHAFT SPROCKET INSTALLATION

1. Use special tools MB990767 and MD998719 in the same way as during removal to hold the camshaft sprocket.
2. Tighten the camshaft sprocket mounting bolt to the specified torque.

   Tightening torque: 90 ± 10 N.m (67 ± 7 ft-lb)

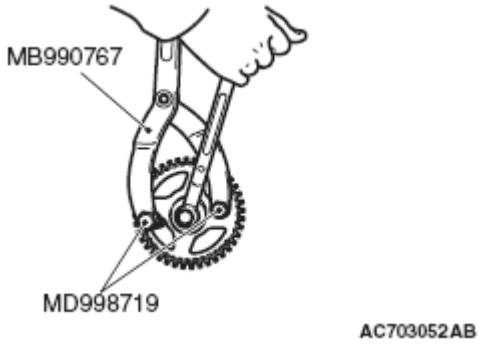


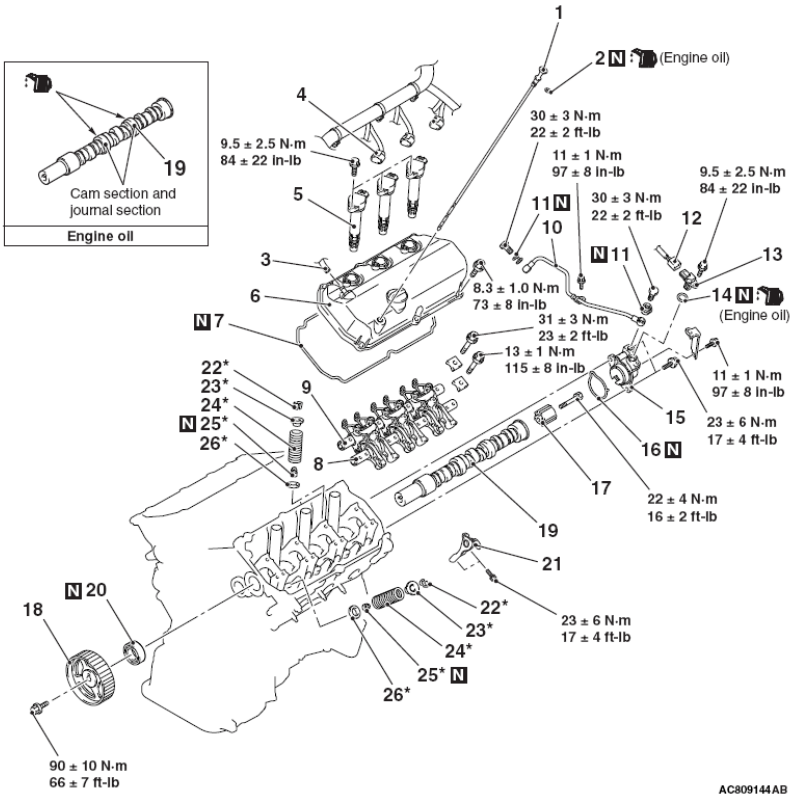
Fig. 42: Tightening Camshaft Sprocket Mounting Bolt To Specified Torque
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

CAMSHAFT AND VALVE STEM SEAL

REMOVAL AND INSTALLATION

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

< LEFT BANK >



Camshaft removal steps

- Engine cover
- Timing belt
- Thermostat housing

Camshaft removal steps

1. Engine oil dipstick
2. O-ring
3. PCV hose connection
4. Ignition coil connector
5. Ignition coil

>>E<< 6. Rocker cover

7. Rocker cover gasket

Camshaft removal steps

- Valve clearance check and adjustment (intake valve) <Installation only>.

<<A>> >>D<< 8. Rocker arm, shaft and lash adjuster assembly (exhaust side)

<<A>> >>D<< 9. Rocker arm and shaft assembly (intake side)

10. Oil pipe
11. Gasket
12. Camshaft position sensor connector
13. Camshaft position sensor
14. O-ring
15. Camshaft position sensor support
16. Camshaft position sensor support gasket
17. Camshaft position sensing cylinder

<<B>> >>G<< 18. Camshaft sprocket

19. Camshaft

<<C>> >>F<< 20. Camshaft oil seal

Valve stem seal removal steps

- Engine cover

1. Engine oil dipstick
2. O-ring
3. PCV hose connection
4. Ignition coil connector
5. Ignition coil

>>E<< 6. Rocker cover

7. Rocker cover gasket
- Valve clearance check and adjustment (intake valve) <Installation only>.

<<A>> >>D<< 8. Rocker arm, shaft and lash adjuster assembly (exhaust side)

<<A>> >>D<< 9. Rocker arm and shaft assembly (intake side)

- Spark plug

21. Engine hanger

<<D>> >>C<< 22. Valve spring retainer lock

23. Valve spring retainer

>>B<< 24. Valve spring

>>A<< 25. Valve stem seal

26. Valve spring seat

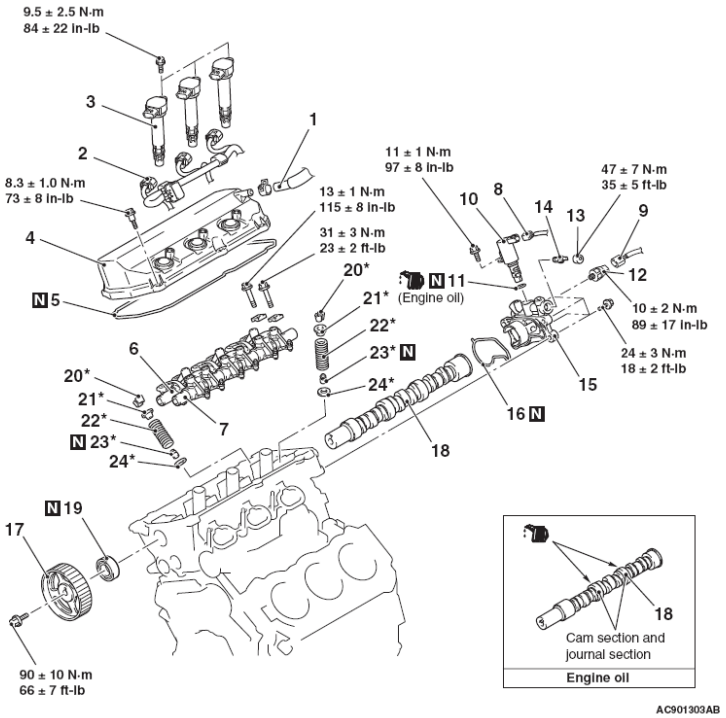
Fig. 43: Identifying Camshaft And Valve Stem Seal Removal/Installation With Torque Specifications - Left Bank

Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

Required Special Tools:

- MB990767: Front Hub and Flange Yoke Holder
- MB992182: Valve Stem Seal Installer
- MD998443: Auto-lash Adjuster Holder
- MD998713: Camshaft Oil Seal Installer
- MD998719: Pin
- MD998772: Valve Spring Compressor
- MD998777: Camshaft Oil Seal Installer Adapter

< RIGHT BANK >



Camshaft removal steps
- Intake manifold plenum
- Timing belt
- Thermostat housing

1. Breather hose connection
2. Ignition coil connector
3. Ignition coil
>>E<< 4. Rocker cover
5. Rocker cover gasket

Camshaft removal steps
- Valve clearance check and adjustment (intake valve) <Installation only>.

<<A>> >>D<< 6. Rocker arm, shaft and lash adjuster assembly (exhaust side)
<<A>> >>D<< 7. Rocker arm and shaft assembly (intake side)
8. Engine oil control valve connector
9. Engine oil pressure switch connector
>>I<< 10. Engine oil control valve
>>I<< 11. O-ring
>>H<< 12. Engine oil pressure switch
13. Plug
14. Engine oil control valve filter
15. Engine oil control valve housing
16. Engine oil control valve housing gasket
<<B>> >>G<< 17. Camshaft sprocket
- Engine control module
- Air cleaner bracket

18. Camshaft
<<C>> >>F<< 19. Camshaft oil seal

Valve stem seal removal steps
- Intake manifold plenum
- Timing belt

1. Breather hose connection
2. Ignition coil connector
3. Ignition coil
>>E<< 4. Rocker cover
5. Rocker cover gasket
- Valve clearance check and adjustment (intake valve) <Installation only>.

<<A>> >>D<< 6. Rocker arm, shaft and lash adjuster assembly (exhaust side)
<<A>> >>D<< 7. Rocker arm and shaft assembly (intake side)
- Spark plug

<<E>>
- Power steering oil pump

<<D>> >>C<< 20. Valve spring retainer lock
21. Valve spring retainer
>>B<< 22. Valve spring
>>A<< 23. Valve stem seal
24. Valve spring seat

Fig. 44: Identifying Camshaft And Valve Stem Seal Removal/Installation With Torque Specifications - Right Bank
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

Required Special Tools:

- MB990767: Front Hub and Flange Yoke Holder
- MB992182: Valve Stem Seal Installer
- MD998443: Auto-lash Adjuster Holder
- MD998713: Camshaft Oil Seal Installer
- MD998719: Pin
- MD998772: Valve Spring Compressor

REMOVAL SERVICE POINTS

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

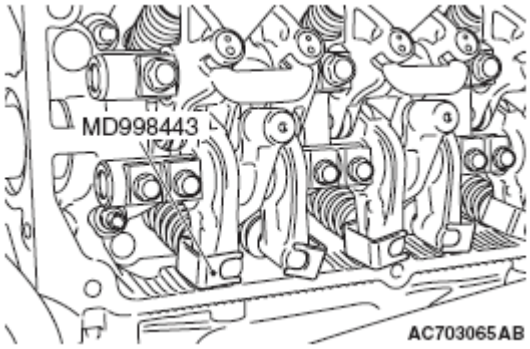


Fig. 45: Identifying Special Tool MD998443
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

<< B >> CAMSHAFT SPROCKET REMOVAL

Use special tools MB990767 and MD998719 to remove the camshaft sprocket.

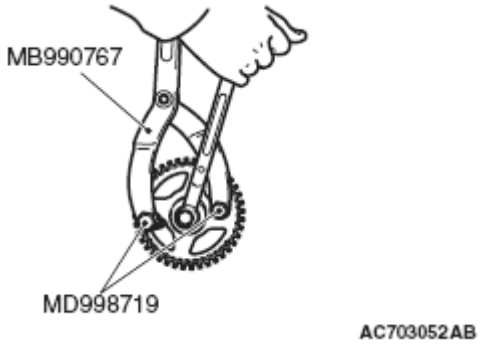


Fig. 46: Removing Camshaft Sprocket Using Special Tools MB990767 And MD998719
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

<< 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.

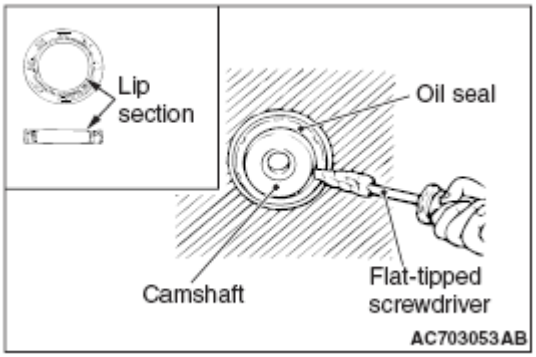


Fig. 47: Prying Out Camshaft Oil Seal
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

<< 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.

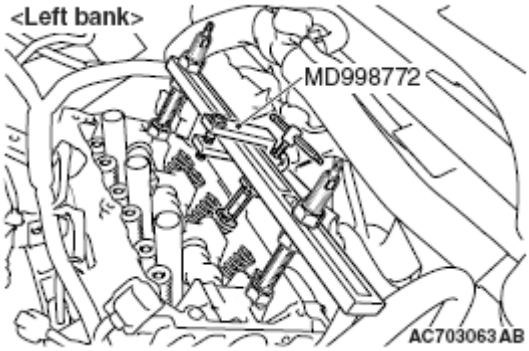


Fig. 48: Compressing Valve Spring Using Special Tool MD998772 - Left Bank
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

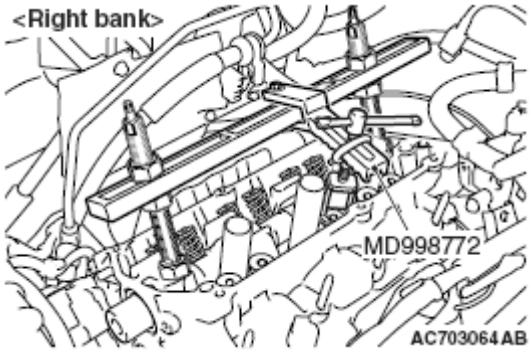


Fig. 49: Compressing Valve Spring Using Special Tool MD998772 - Right Bank
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

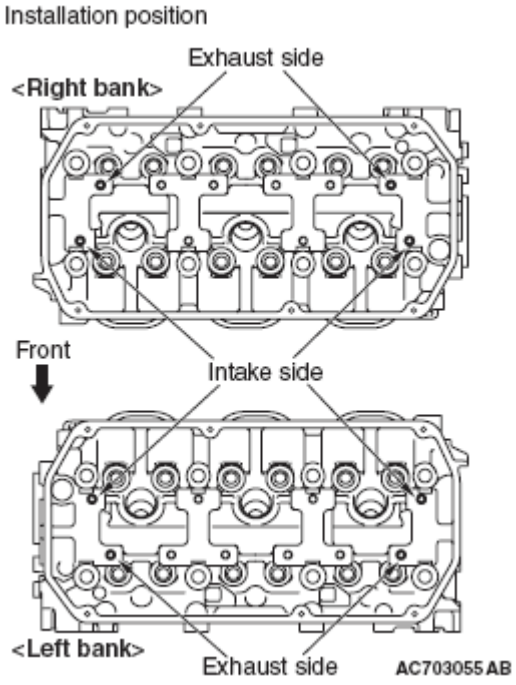


Fig. 50: Identifying Installation Position Of Special Tool MD998772 - Exhaust Side And Intake Side
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

NOTE: Installation position of special tool MD998772 is different between exhaust side and intake side.

<< E >> POWER STEERING OIL PUMP REMOVAL

1. With the hose installed, remove the power steering oil pump from the bracket.
2. Tie the removed power steering oil pump using a string at a position where it will not interfere with the removal and installation of valve stem seal.

INSTALLATION SERVICE POINTS

>> A << VALVE STEM SEAL INSTALLATION

CAUTION: Valve stem seal for intake valves and for exhaust valves are different. Be sure to install the correct ones.

- **Valve stem seal identification color.**

  Intake: GREY

  Exhaust: GREY GREEN

1. Apply an adequate and minimum amount of engine oil to the valve stem seal.

CAUTION:
- **Valve stem seals cannot be reused.**
- **Special tool must be used to install the valve stem seal. Improper installation could result in oil leaking past the valve guide.**

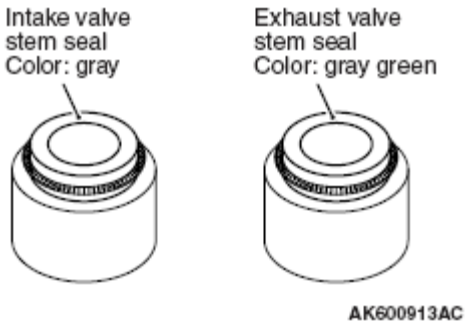


Fig. 51: Identifying Valve Stem Seals
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

2. Use special tool MB992182 to fill a new valve stem seal in the valve guide using the valve stem area as a

guide.

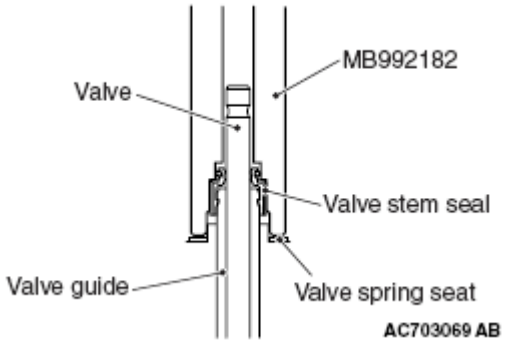


Fig. 52: Filling Valve Stem Seal In Valve Guide Using Valve Stem Area As Guide
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>> B << VALVE SPRING INSTALLATION

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

Identification color

Intake: White

Exhaust: Blue

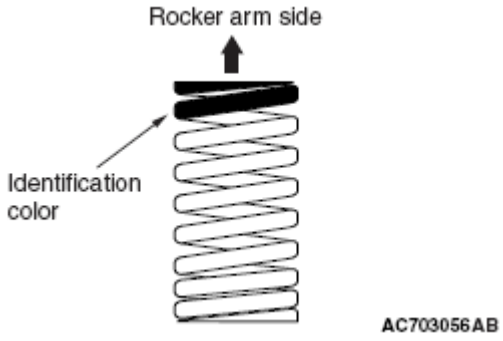


Fig. 53: Identifying Valve Spring End Identification Color
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>> C << VALVE SPRING RETAINER LOCK INSTALLATION

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

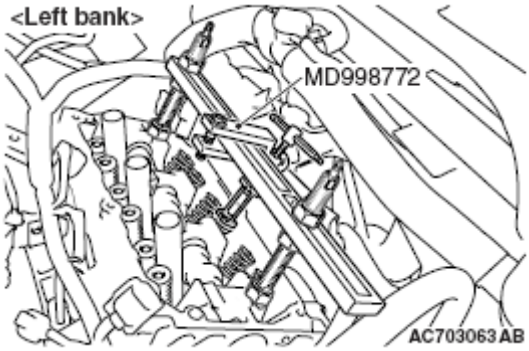


Fig. 54: Compressing Valve Spring Using Special Tool MD998772 - Left Bank
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

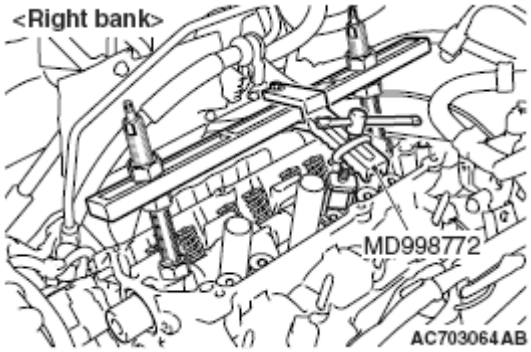


Fig. 55: Compressing Valve Spring Using Special Tool MD998772 - Right Bank
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>> D << ROCKER ARM AND SHAFT ASSEMBLY (INTAKE SIDE)/ROCKER ARM, SHAFT AND LASH ADJUSTER ASSEMBLY (EXHAUST SIDE) INSTALLATION

1. Install the intake side rocker arm and shaft assembly so that the f5.5 mm (0.22 inch) holes of rocker arm shaft face the cylinder head side.
2. Tighten the intake side rocker arm shaft mounting bolts to the specified torque.

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

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

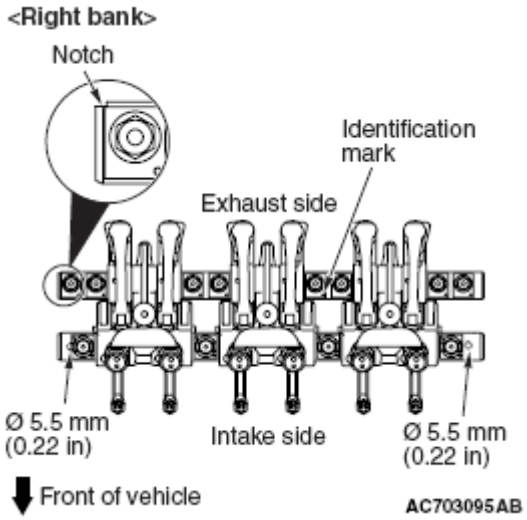


Fig. 56: Checking Identification Mark Of Exhaust Side Rocker Shaft Cap - Right Bank
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

Tightening torque: 13 ± 1 N.m (115 ± 8 in-lb)

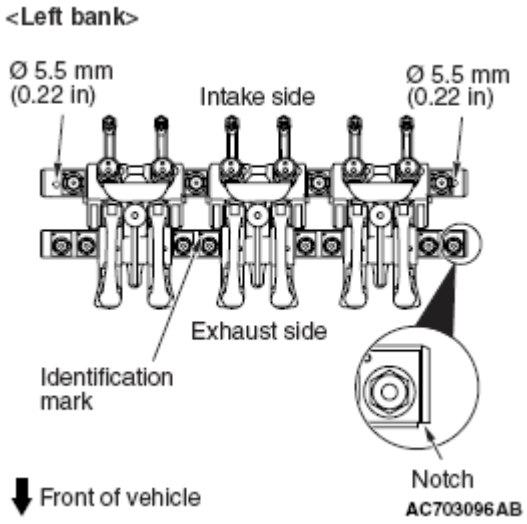


Fig. 57: Checking Identification Mark Of Exhaust Side Rocker Shaft Cap - Left Bank
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

6. Remove special tool MD998443.

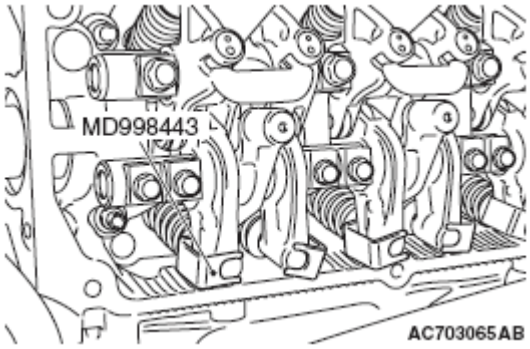


Fig. 58: Identifying Special Tool MD998443
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>> E << ROCKER COVER INSTALLATION

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

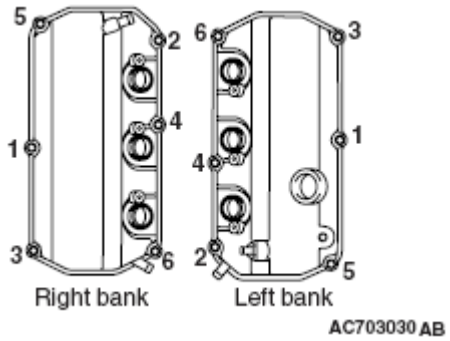


Fig. 59: Identifying Rocker Cover Bolts Tightening Sequence
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>> F << CAMSHAFT OIL SEAL INSTALLATION

1. Apply engine oil to the camshaft oil seal lip.
2. Use special tools MD998713 and MD998777 to press-fit the camshaft oil seal.

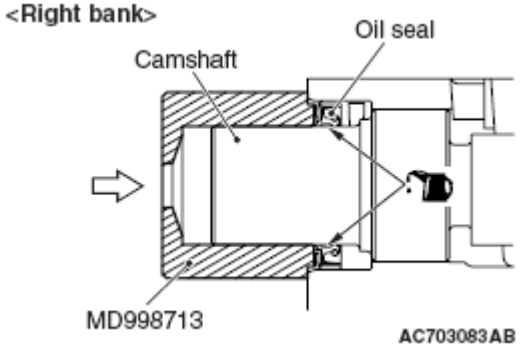


Fig. 60: Fitting Camshaft Oil Seal Using Special Tools MD998713 And MD998777 - Right Bank

Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

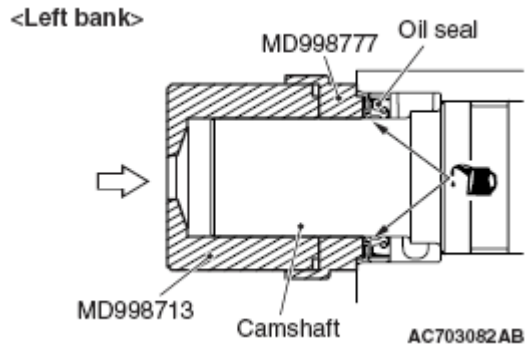


Fig. 61: Fitting Camshaft Oil Seal Using Special Tools MD998713 And MD998777 - Left Bank
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>> G << CAMSHAFT SPROCKET INSTALLATION

1. Use special tools MB990767 and MD998719 in the same way as during removal to hold the camshaft sprocket.
2. Tighten the camshaft sprocket mounting bolt to the specified torque.

Tightening torque: 90 ± 10 N.m (66 ± 7 ft-lb)

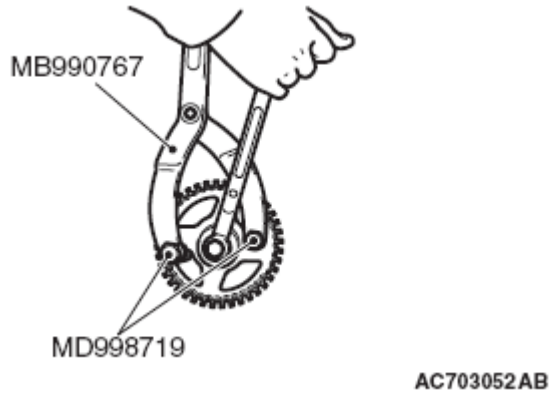


Fig. 62: Tightening Camshaft Sprocket Mounting Bolt
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>> H << ENGINE OIL PRESSURE SWITCH INSTALLATION

Apply the specified sealant to the thread of the engine oil pressure switch.

Specified sealant: ThreeBond 1141J or equivalent

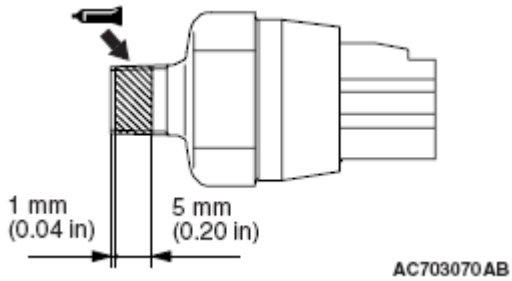


Fig. 63: Applying Specified Sealant To Thread Of Engine Oil Pressure Switch
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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

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

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

Tightening torque: 11 ± 1 N.m (97 ± 8 in-lb)

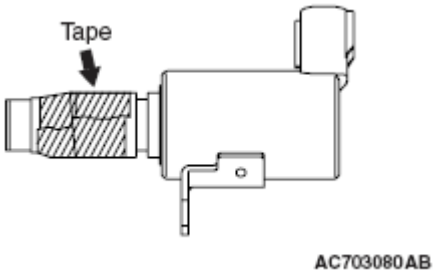
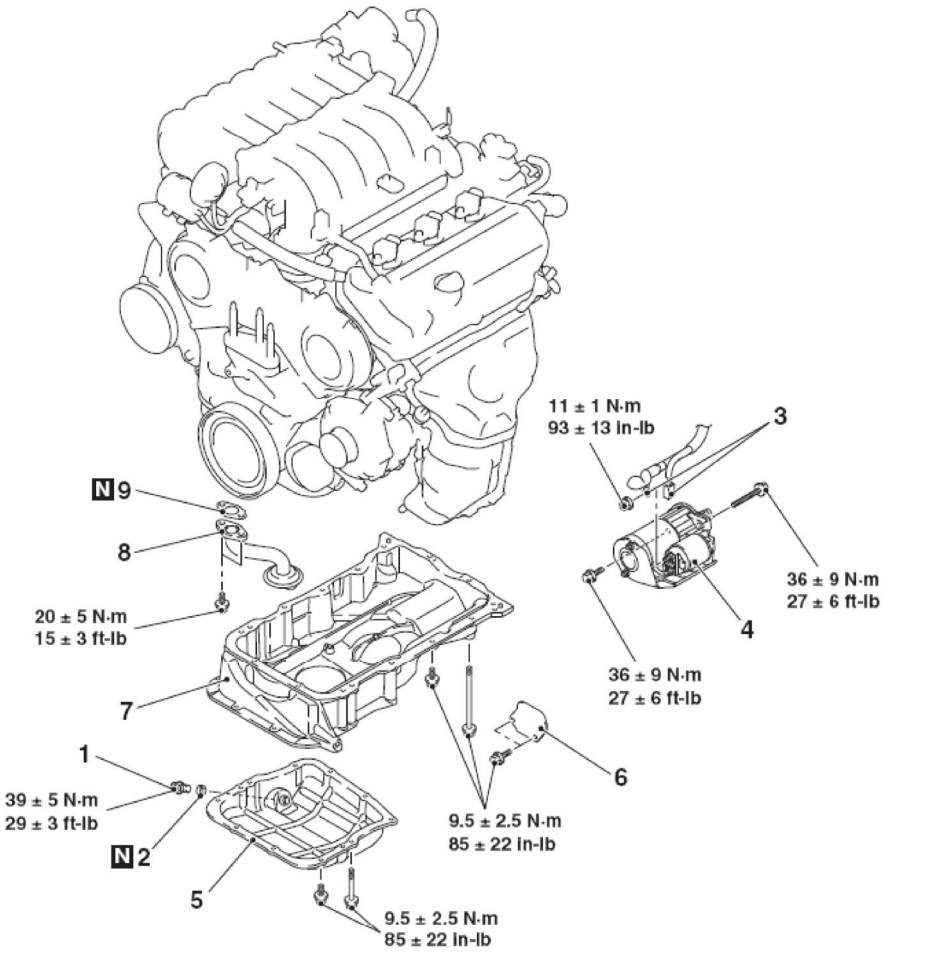


Fig. 64: Winding Sealing Tape Around Oil Passages Cut-Out Area Of Engine Oil Control Valve
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

OIL PAN AND OIL STRAINER

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Engine Room Under Cover Front Removal and Installation
- Engine Oil Draining and Refilling



Removal steps

1. Engine oil pan drain plug
>>C<< 2. Engine oil pan drain plug gasket
3. Starter connector and terminal connection
4. Starter assembly
<<A>> >>B<< 5. Engine lower oil pan
• Front exhaust pipe
>>A<< 6. Cover
<<B>>
• A/C compressor assembly
• A/C compressor bracket
<<C>> >>A<< 7. Engine upper oil pan
8. Oil strainer
9. Oil strainer gasket

Fig. 65: Identifying Oil Pan And Oil Strainer Removal/Installation With Torque Specifications
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

Required Special Tool:

MD998727: Oil Pan FIPG Cutter

REMOVAL SERVICE POINTS

<< A >> ENGINE LOWER OIL PAN REMOVAL

Insert the special tool MD998727 into the groove shown in the illustration. Strike and slide it and then cut the liquid gasket.

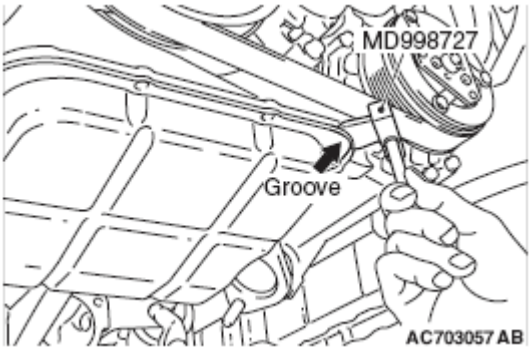


Fig. 66: Inserting Special Tool Md998727 Into Groove
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

<< B >> A/C COMPRESSOR ASSEMBLY REMOVAL

1. Remove the A/C compressor from the A/C 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 oil pan, and secure it with a cord or wire.

<< C >> ENGINE UPPER OIL PAN REMOVAL

1. Remove the engine upper oil pan mounting bolts.

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

2. Screw in the bolt (M10 x 1.5) into bolt hole A in the location shown. Then lift the upper oil pan and remove it.

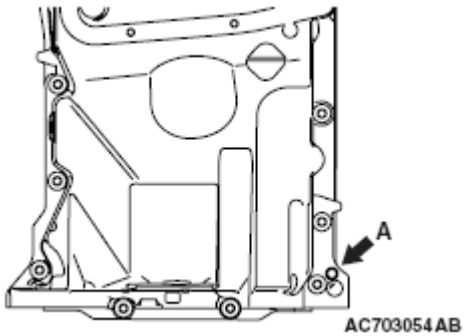


Fig. 67: Locating Upper Oil Pan Bolt Hole A
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

INSTALLATION SERVICE POINTS

>> A << ENGINE UPPER OIL PAN/COVER INSTALLATION

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

   Specified sealant: ThreeBond 1227D or equivalent

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

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

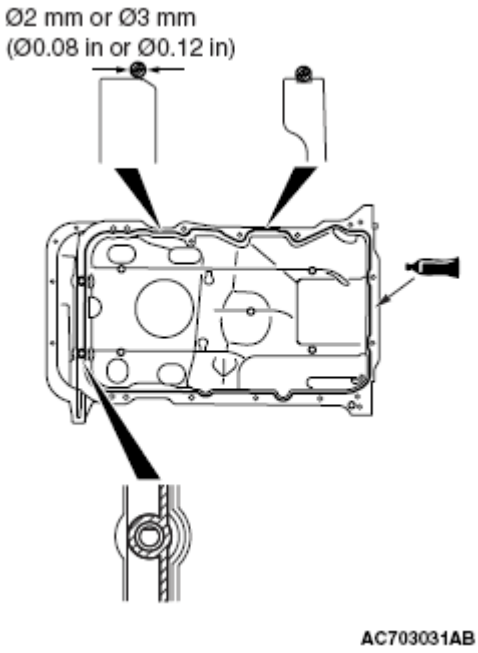


Fig. 68: Applying Bead Of Sealant To Cylinder Block Mating Surface Of Engine Oil Pan
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

4. Install the bolts to the engine upper oil pan and cover as shown, and tighten them to the specified torque.

   Tightening torque: 9.5 ± 2.5 N.m (85 ± 22 in-lb)

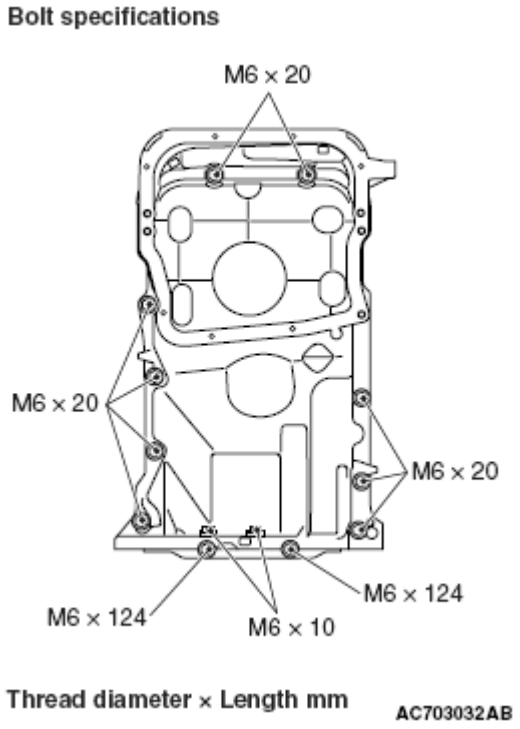


Fig. 69: Identifying Engine Upper Oil Pan And Cover Bolts Specifications
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>> B << ENGINE LOWER OIL PAN INSTALLATION

1. Remove sealant from the engine lower oil pan and engine upper oil pan.
2. Degrease the sealant-coated surface and the engine lower oil pan mating surface.
3. Apply a bead of the sealant to the mating surface of the engine lower oil pan as shown.

Specified sealant: ThreeBond 1227D or equivalent

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

4. Assemble the engine lower oil pan to the engine upper oil pan.

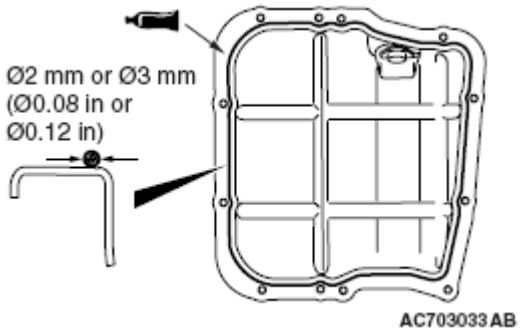


Fig. 70: Applying Bead Of Sealant To Mating Surface Of Engine Lower Oil Pan

Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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.

5. Install the bolts to the lower oil pan as shown, and tighten them to the specified torque.

Tightening torque: 9.5 ± 2.5 N.m (85 ± 22 in-lb)

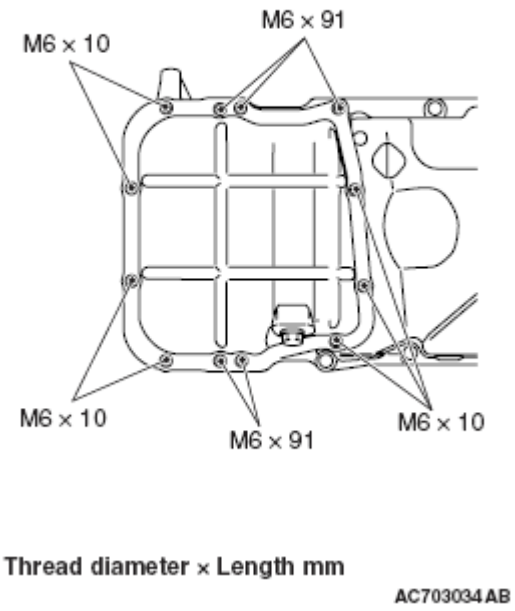


Fig. 71: Identifying Lower Oil Pan Bolts Specifications
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>> C << ENGINE OIL PAN DRAIN PLUG INSTALLATION

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

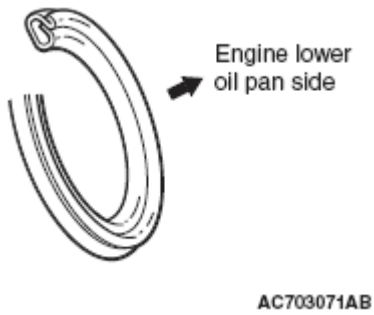


Fig. 72: Identifying Engine Oil Pan Drain Plug Gasket
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

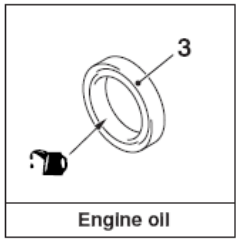
INSPECTION

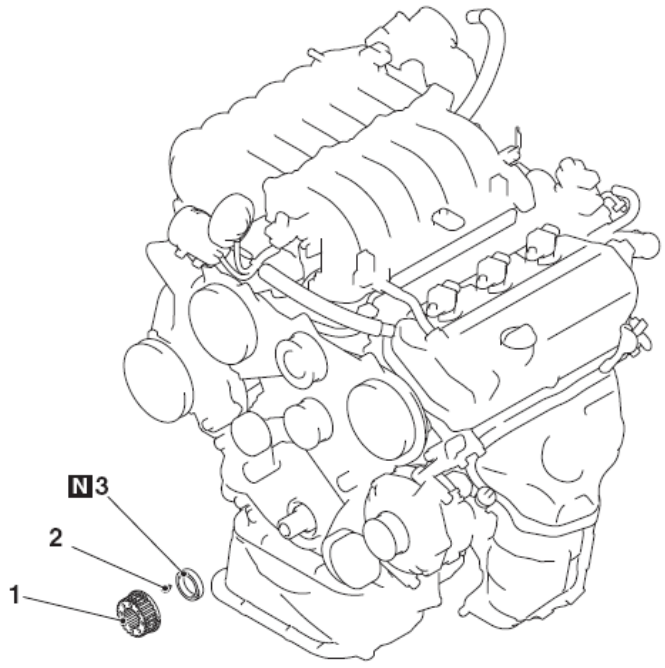
- Check the engine oil pan for cracks.
- Check the engine oil pan sealant-coated surface for damage and deformation.
- Check the oil strainer for cracked, clogged or damaged wire net and pipe.

CRANKSHAFT FRONT OIL SEAL

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Timing Belt Removal and Installation





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Removal steps
>>B<< 1. Crankshaft sprocket
2. Key
>>A<< 3. Crankshaft front oil seal

Fig. 73: Identifying Crankshaft Front Oil Seal Removal And Installation
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

Required Special Tool:

- MD998382: Crankshaft Front Oil Seal Installer

INSTALLATION SERVICE POINTS

>> A << CRANKSHAFT FRONT OIL SEAL INSTALLATION

1. Apply a small amount of engine oil to the oil seal lip and then insert the o-ring.
2. Using special tool MD998382, tap the oil seal into the front case.

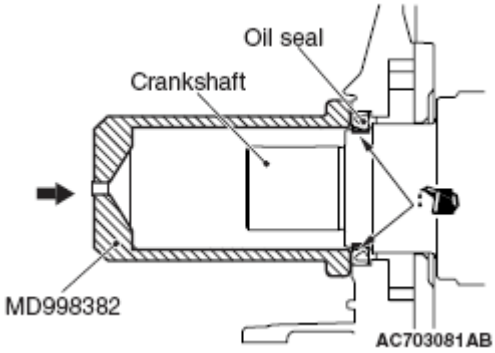


Fig. 74: Installing Oil Seal Into Front Case Using Special Tool MD998382
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>> B << CRANKSHAFT SPROCKET INSTALLATION

Clean the crankshaft and crankshaft sprocket, and mount them.

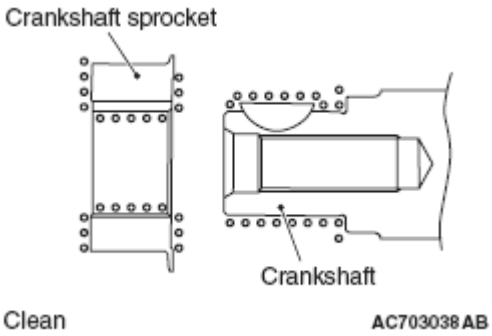


Fig. 75: Cleaning Crankshaft And Crankshaft Sprocket
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

CRANKSHAFT REAR OIL SEAL

REMOVAL AND INSTALLATION

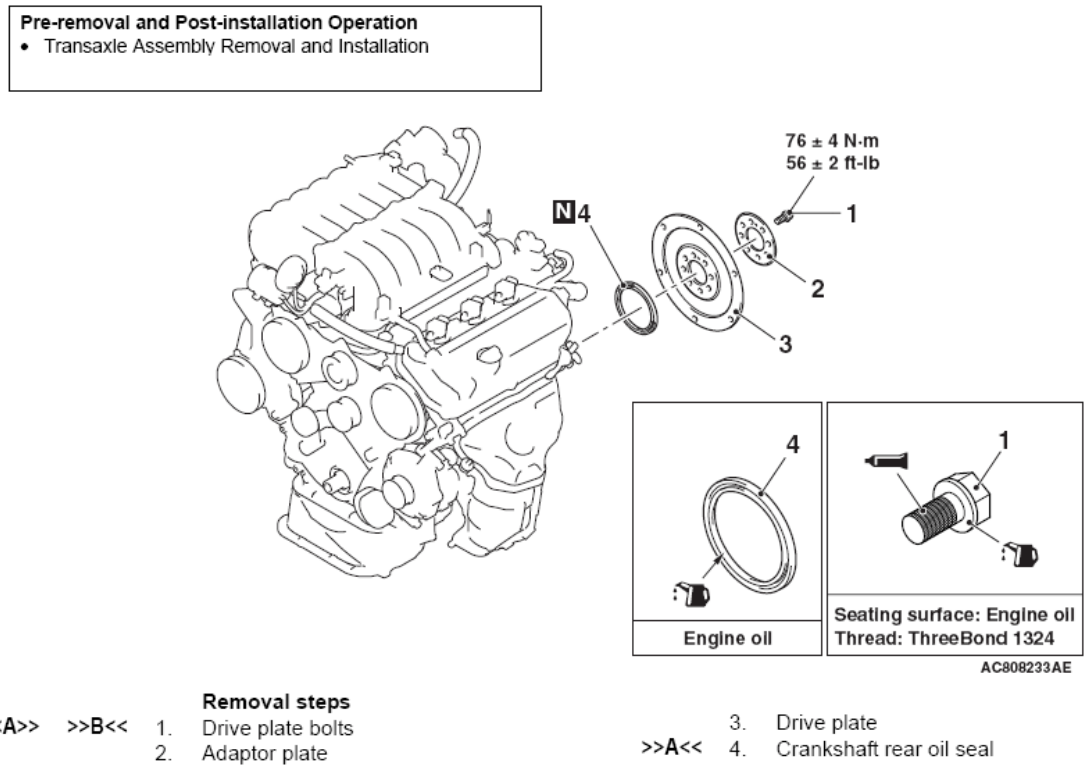


Fig. 76: Identifying Crankshaft Rear Oil Seal Removal And Installation With Torque Specifications
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

Required Special Tools:

- MB992075: Handle
- MB992183: 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.

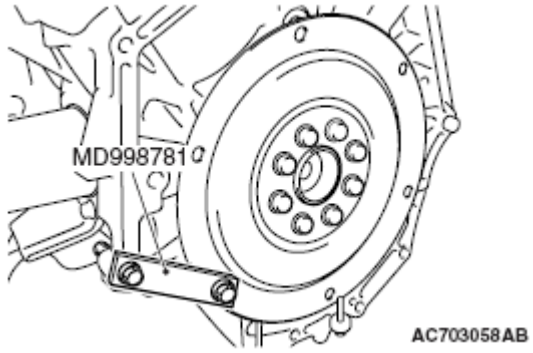


Fig. 77: Securing Drive Plate Using Special Tool MD998781
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

INSTALLATION SERVICE POINTS

>> A << CRANKSHAFT REAR OIL SEAL INSTALLATION

Use special tool MB992075 and MB992183, press-fit a new crankshaft rear oil seal into the oil seal case.

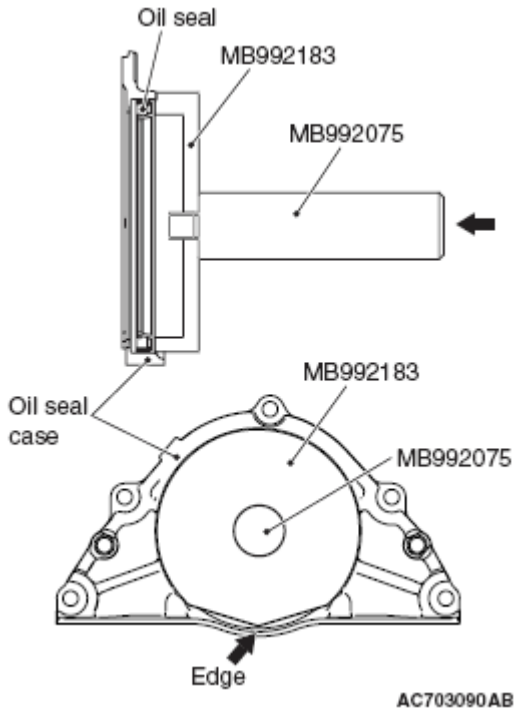


Fig. 78: Fitting Crankshaft Rear Oil Seal Into Oil Seal Case Using Special Tool MB992075 And MB992183
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>> B << DRIVE PLATE BOLTS INSTALLATION

1. Cleanly remove sealant, oil and dust on the drive plate bolt, the drive plate and the threaded portions of the crankshaft.
2. Apply oil to the drive plate and the seating surface of the drive plate bolt.
3. Apply oil to the threaded hole of the crankshaft
4. Apply sealant to the thread of the drive plate bolts.

   Specified sealant: ThreeBond 1324

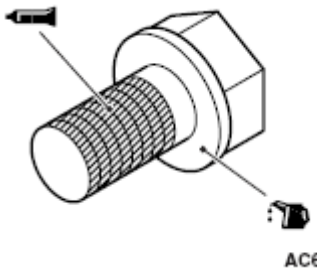


Fig. 79: Applying Sealant To Thread Of Drive Plate Bolts
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

5. Use special tool MD998781 to secure the drive plate in the same manner as removal.
6. Tighten the drive plate bolts to the specified torque.

Tightening torque: 76 ± 4 N.m (56 ± 2 ft-lb)

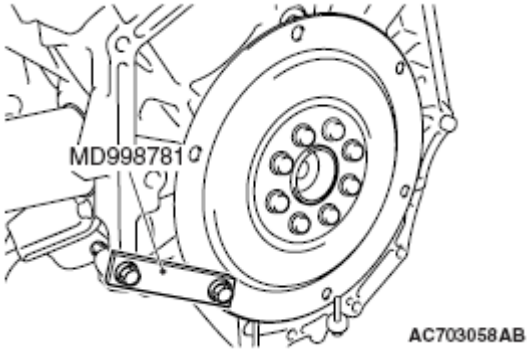
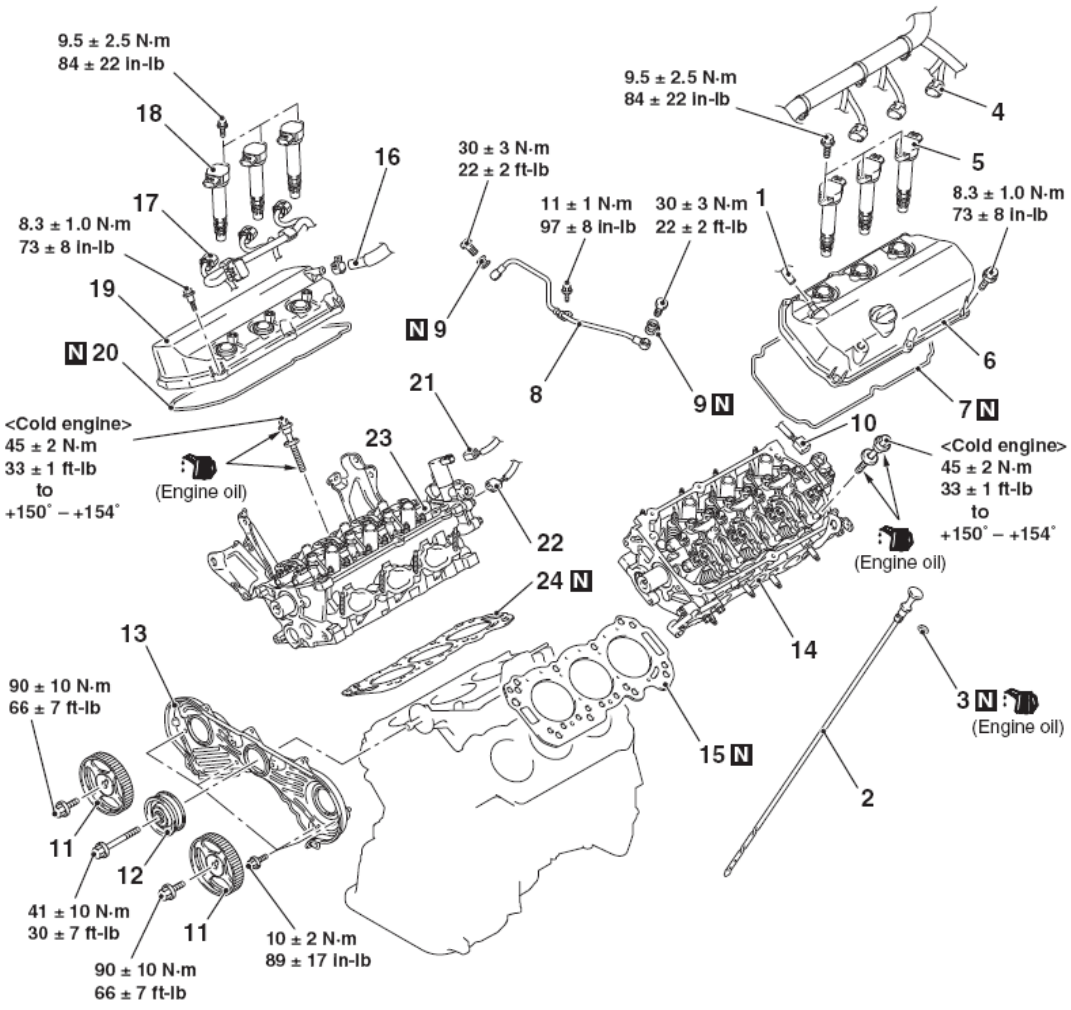


Fig. 80: Securing Drive Plate Using Special Tool MD998781
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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. Engine oil dipstick
3. O-ring
4. Ignition coil connector
5. Ignition coil
6. Rocker cover
7. Rocker cover gasket
8. Oil pipe
9. Gasket
10. Camshaft position sensor connector

<<A>> >>B<< 11. Camshaft sprocket

12. Idler pulley
13. Timing belt rear cover

<<B>> >>A<< 14. Left bank cylinder head assembly

>>A<< 15. Cylinder head gasket

16. Breather hose connection
17. Ignition coil connector
18. Ignition coil
19. Rocker cover
20. Rocker cover gasket
21. Engine oil control valve connector
22. Engine oil pressure switch connector

<<B>> >>A<< 23. Right bank cylinder head assembly

>>A<< 24. Cylinder head gasket

Fig. 81: Identifying Cylinder Head Gasket Removal And Installation With Torque Specifications
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

Required Special Tools:

- MB990767: Front Hub and Flange Yoke Holder
- MB991614: Angle Gauge
- MD998719: Pin

REMOVAL SERVICE POINTS

<< A >> CAMSHAFT SPROCKET REMOVAL

Use special tools MB990767 and MD998719 to remove the camshaft sprocket.

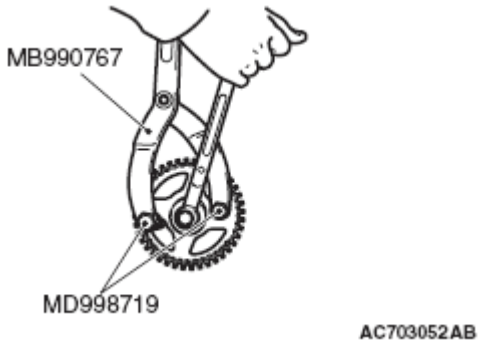


Fig. 82: Removing Camshaft Sprocket Using Special Tools MB990767 And MD998719
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

<< B >> CYLINDER HEAD ASSEMBLY REMOVAL

Loosen the bolts in two or three steps in the order of the numbers shown in the illustration, and remove them.

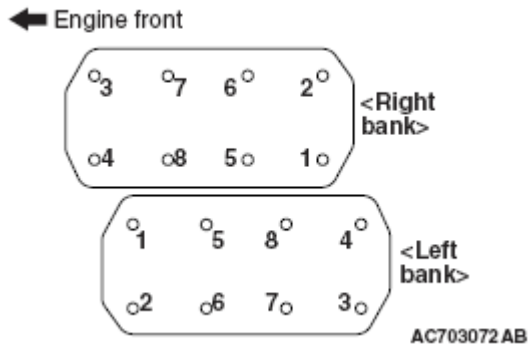


Fig. 83: Identifying Cylinder Head Assembly Bolts Loosening Sequence
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

INSTALLATION SERVICE POINTS

>> A << 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.
2. Check in the following procedure before reusing the cylinder head bolt.
    1. Measure the outside diameter "A".
    2. Measure the smallest outside diameter "B" within the range "X" shown in the illustration.
    3. If the difference of outside diameter of thread exceeds the limit, replace the cylinder head bolt.

    Limit: 0.1 mm (0.0039 inch)

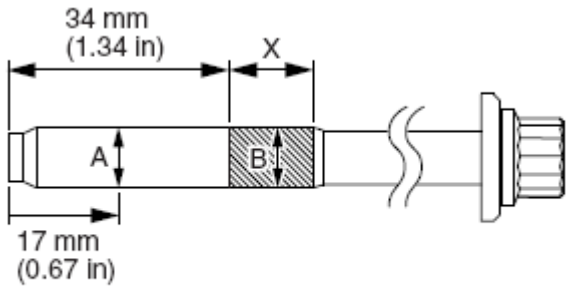


Fig. 84: Checking Cylinder Head Bolt Dimensions
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

3. Tighten the bolts to the specified torque in the order shown in the illustration. (in two or three cycles)

    Tightening torque: 45 ± 2 N.m (33 ± 1 ft-lb)

CAUTION:
- **If the bolt is turned less than 150 to 154 degrees, proper fastening performance may not be achieved. Be sure to turn the bolt exactly 150 to 154 degrees.**
- **If the bolt is overtightened, loosen the bolt completely and then retighten it by repeating the tightening procedure from step 1.**

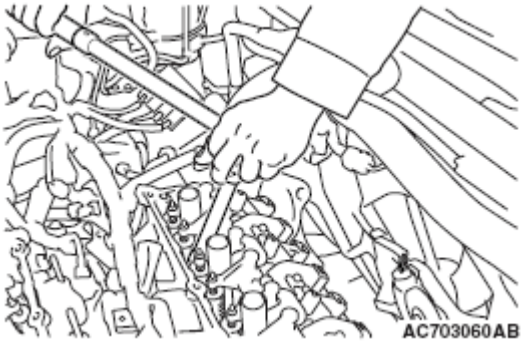


Fig. 85: Tightening Cylinder Head Bolts
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

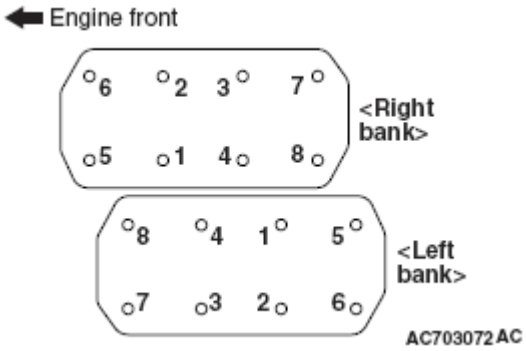


Fig. 86: Identifying Cylinder Head Bolts Loosening Sequence
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

4. Using special tool MB991614, tighten the cylinder head bolt another 150 to 154 degrees.

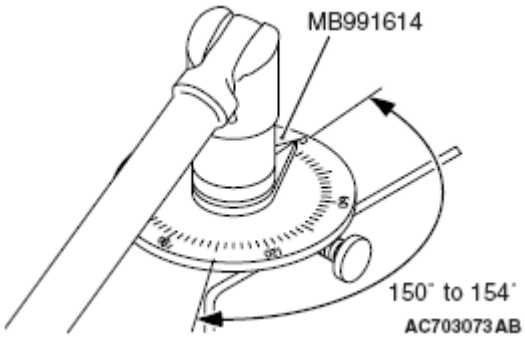


Fig. 87: Tightening Cylinder Head Bolt Another 150 To 154 Degrees Using Special Tool MB991614
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>> B << CAMSHAFT SPROCKET INSTALLATION

1. Use special tools MB990767 and MD998719 in the same way as during removal to hold the camshaft sprocket.
2. Tighten the camshaft sprocket mounting bolt to the specified torque.

Tightening torque: 90 ± 10 N.m (66 ± 7 ft-lb)

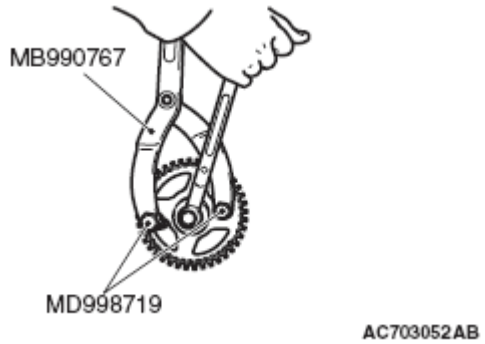
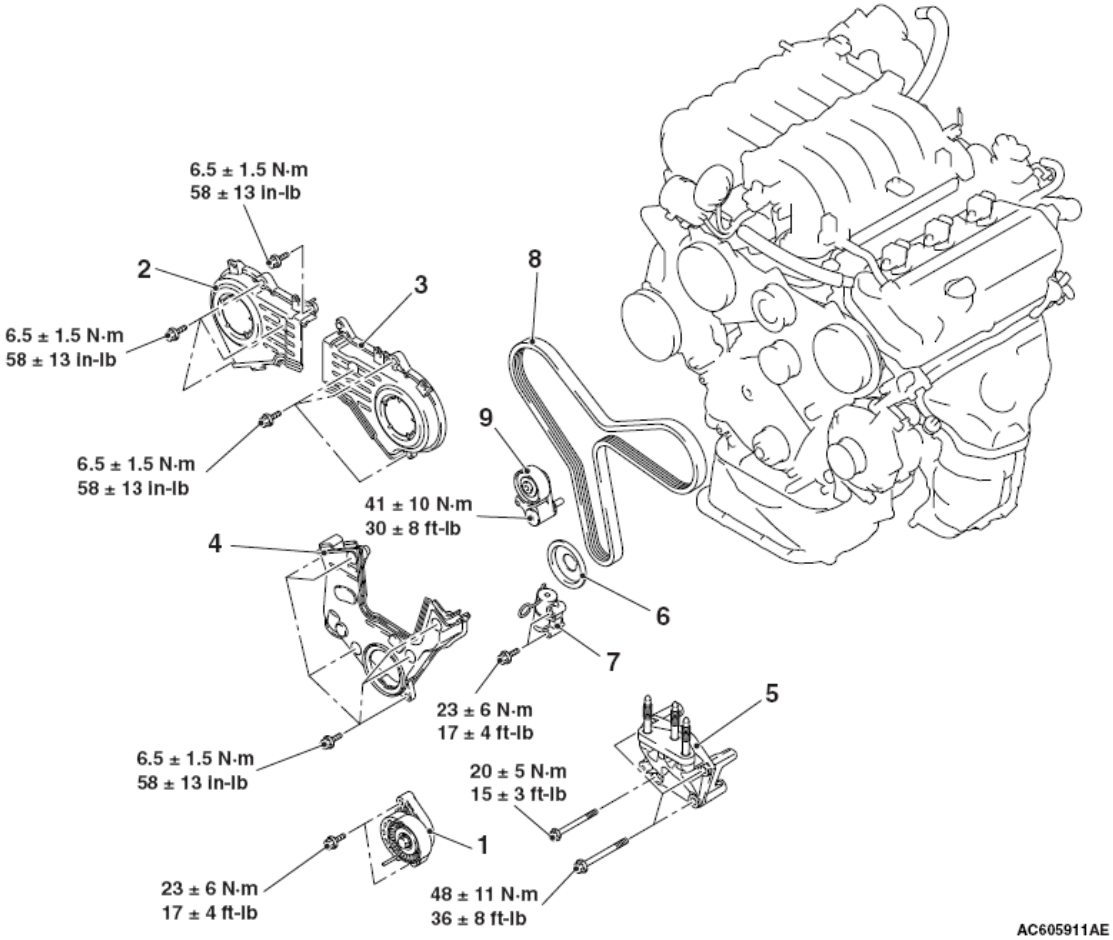


Fig. 88: Tightening Camshaft Sprocket Mounting Bolt
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

TIMING BELT

REMOVAL AND INSTALLATION

Pre-removal operation	Post-installation operation
• Engine Cover Removal • Engine Room Under Cover Front B and Engine Room Side Cover (RH) Removal • Crankshaft Pulley Removal	• Crankshaft Pulley Installation • Engine Room Under Cover Front B and Engine Room Side Cover (RH) Installation • Engine Cover Installation



Removal steps

1. Auto-tensioner
2. Timing belt front upper cover, right
3. Timing belt front upper cover, left
4. Timing belt lower cover
- Engine mounting bracket

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

5. Engine support bracket
6. Front flange
7. Timing belt auto-tensioner
8. Timing belt
9. Tensioner pulley assembly

Fig. 89: Identifying Timing Belt Removal And Installation With Torque Specifications
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

Required Special Tools:

- MB990767: Front Hub and Flange Yoke Holder
- MD998716: Crankshaft Wrench
- MD998719: Pin

REMOVAL SERVICE POINTS

<< A >> TIMING BELT AUTO-TENSIONER REMOVAL

CAUTION: Never turn the crankshaft counterclockwise.

1. Use special tool MD998716 to turn the crankshaft clockwise to align each timing mark and to set the No. 1 cylinder to compression top dead center.

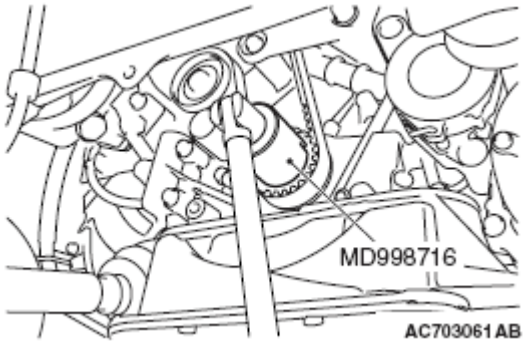


Fig. 90: Turning Crankshaft Clockwise Using Special Tool MD998716
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

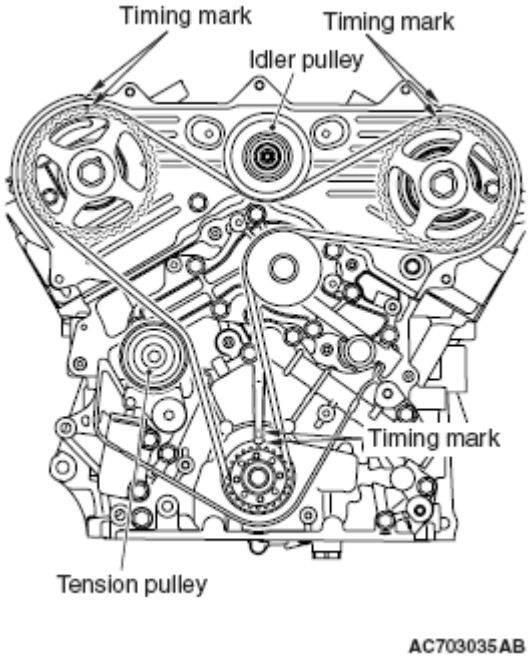


Fig. 91: Aligning Each Timing Mark And To Set No. 1 Cylinder To Compression Top Dead Center
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

2. Remove the upper mounting bolt of the timing belt auto-tensioner.

CAUTION: The timing belt auto-tensioner rotates centering on the flange bolt due to the rod thrust, so please make sure your finger is not trapped.

3. Loosen the lower mounting bolt of the timing belt auto-tensioner slowly and slide the timing belt auto-tensioner slightly. Remove the rod from the tensioner arm.
4. Remove the lower mounting bolt of the timing belt auto-tensioner.

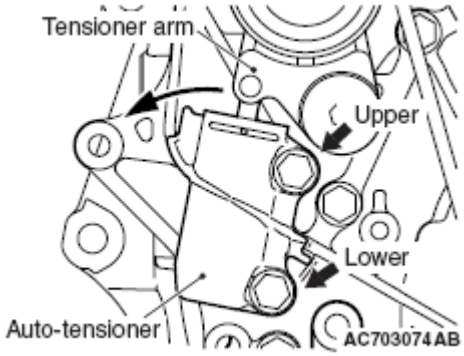


Fig. 92: Locating Timing Belt Auto-Tensioner Upper And Lower Mounting Bolts
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

<< B >> TIMING BELT REMOVAL

1. Check that the timing marks of each sprocket are aligned.
2. If the timing belt is to be reused, chalk an arrow on the flat side of the belt, indicating the clockwise direction.
3. Loosen the center bolt of the tensioner pulley, then remove the timing belt.

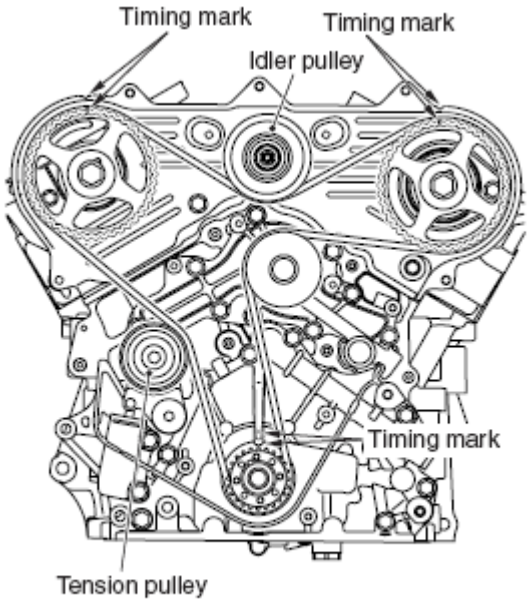


Fig. 93: Checking That Timing Marks Of Each Sprocket Are Aligned
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

INSTALLATION SERVICE POINT

>> A << TIMING BELT/TIMING BELT AUTO-TENSIONER INSTALLATION

CAUTION: Always bleed the timing belt auto-tensioner of air before installing the timing belt auto-tensioner (Refer to TIMING BELT AUTO-TENSIONER CHECK).

1. Insert the pin into the rod of the auto-tensioner under the following procedures.

CAUTION: Notable factors for inserting pin

- **Always use the vertical press and put the auto-tensioner vertically.**
- **Do not apply the load of 5,000 N (1,124 pound) or more to the rod.**
- **Do not press the rod beyond the dimension shown in the illustration.**

1. Put the auto-tensioner vertically to the vertical press not to be in the sideways direction.

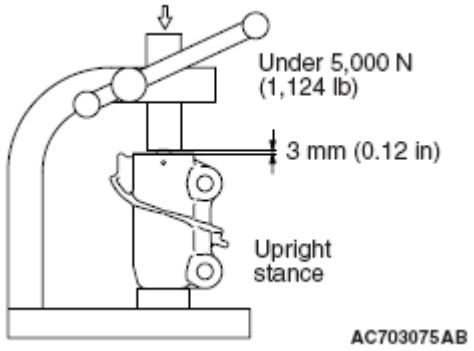


Fig. 94: Putting Auto-Tensioner Vertically To Vertical Press Not To Be In Sideways Direction
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

2. Slowly close the vice to force the rod in until the hole (A) of the rod is lined up with set hole (B) of the cylinder.
3. Insert a pin into the set holes.
4. Remove the timing belt auto-tensioner from the vice.

2. Install the timing belt auto-tensioner with the setting pin, and tighten the mounting bolts to the specified torque.

Tightening torque: 23 ± 6 N.m (17 ± 4 ft-lb)

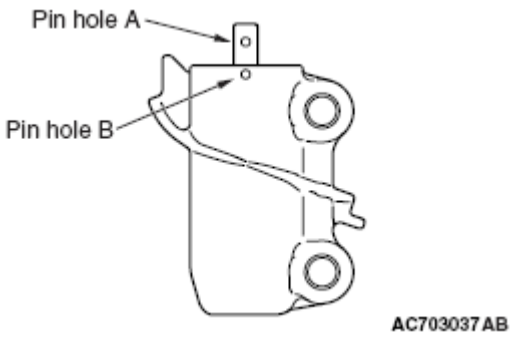


Fig. 95: Identifying Rod Hole Is Lined Up With Set Hole Of Cylinder
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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

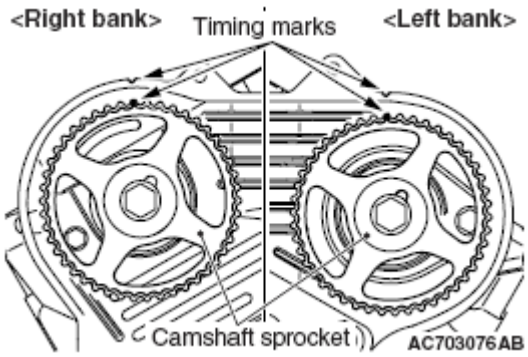


Fig. 96: Aligning Timing Marks On Camshaft Sprockets With Those On Timing Belt Rear Cover
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

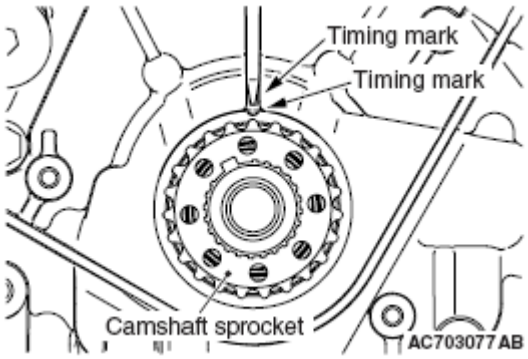


Fig. 97: Align Timing Mark On Crankshaft Sprocket With That On Engine Block
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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

4. 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. Water pump pulley
    3. Camshaft sprocket (Left bank)
    4. Idler pulley
    5. Camshaft sprocket (Right bank)
    6. Tensioner pulley
5. Apply the force to the camshaft sprocket (Right bank) counterclockwise until the tension side of timing belt is tight. Check all the timing marks again.
6. Remove the setting pin that has been inserted into the auto-tensioner.
7. Turn the crankshaft clockwise twice to align the timing marks.

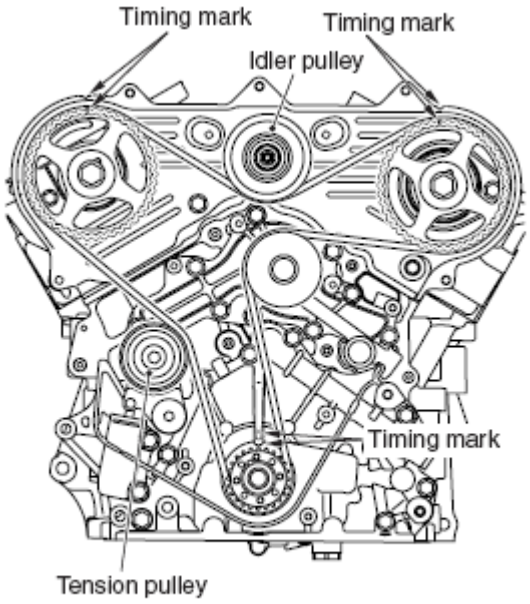


Fig. 98: Checking All Timing Marks
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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

   Standard value (A): 9.1 - 13.4 mm (0.36 - 0.52 inch)

9. If not, repeat the operation in steps 1 to 8 above.
10. Check again that the timing marks of the sprockets are aligned.

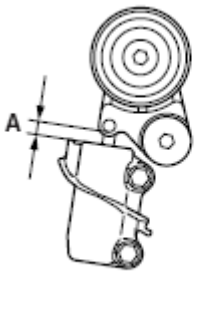


Fig. 99: Checking Auto-Tensioner Push Rod Extends Within Standard Value Range
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

INSPECTION

TIMING BELT 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.

AIR BLEEDING METHOD

CAUTION:
- **Always use the vertical press and put the auto-tensioner vertically.**
- **Do not apply the load of 5,000 N (1,124 pound) or more to the rod.**
- **Do not press the rod beyond Dimension "A" shown in the illustration.**

1. Set the auto-tensioner as shown in the illustration.
2. Press the rod slowly down to the lowest point "A" shown in the illustration.
3. Repeat the procedure 2 three times.
4. While the rod is projected at the point "B" shown in the illustration, push the rod with 100 - 200 N (22 - 44 pound). Check the enough stiffness. If the stiffness is not enough, replace the auto-tensioner.
5. Press down the rod slowly. Put the pin through the hole and secure it.

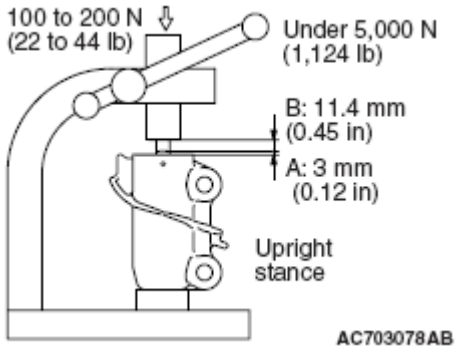


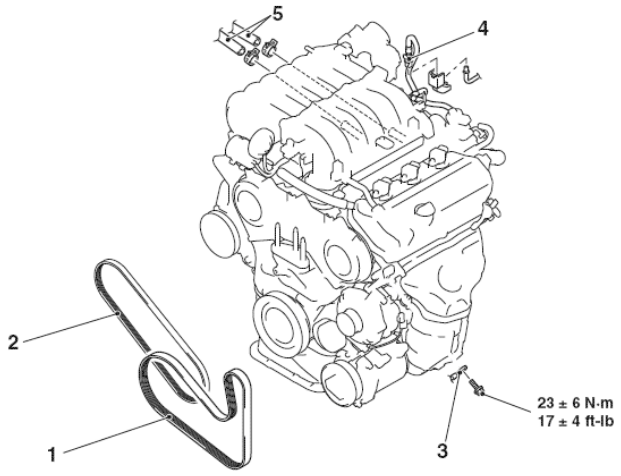
Fig. 100: Pressing Rod To Lowest Point A
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

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).**

Pre-removal Operation	Post-installation Operation
• Engine Room Under Cover Front and Engine Room Side Cover Removal	• Radiator Upper Hose and Radiator Lower Hose Installation
• Fuel Line Pressure Reduction	• Starter Installation
• Engine Coolant Draining	• Transfer Installation
• Engine Oil Draining	• Rear Roll Stopper Installation
• Transmission Fluid Draining	• Pressure Hose Assembly and Return Tube B Installation
• Transfer Oil Draining	• Propeller Shaft Installation
• Hood Removal • Engine Cover Removal	• Driveshaft Installation
• Air Cleaner Removal	• Strut Tower Bar Installation
• Engine Control Module (ECM) Removal	• Front Exhaust Pipe and Front Exhaust Pipe RH Installation
• Battery and Battery Tray Removal	• Battery and Battery Tray Installation
• Front Exhaust Pipe and Front Exhaust Pipe RH Removal	• Engine Control Module (ECM) Installation
• Strut Tower Bar Removal	• Air Cleaner Installation
• Driveshaft Removal	• Generator Drive Belt Tension Check • Power Steering Oil Pump Drive Belt Tension Check and Adjustment • Engine Oil Refilling
• Propeller Shaft Removal	• Transmission Fluid Refilling
• Pressure Hose Assembly and Return Tube B Removal	• Transfer Oil Refilling
• Rear Roll Stopper Removal	• Engine Coolant Refilling
• Transfer Removal	• Fuel Leak Check • Hood Installation • Engine Cover Installation
• Starter Removal	• Engine Room Under Cover Front and Engine Room Side Cover Installation
• Radiator Upper Hose and Radiator Lower Hose Removal	

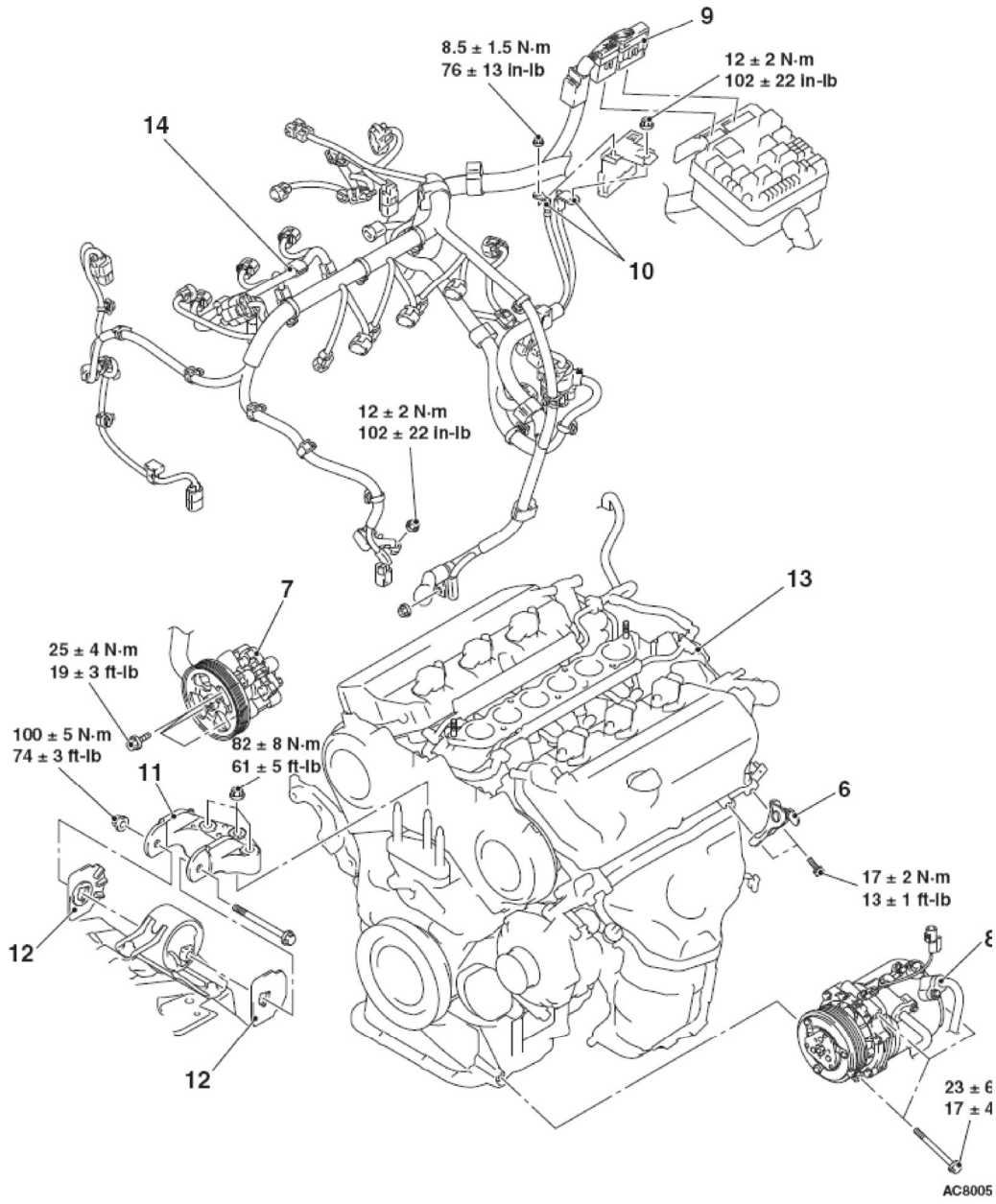


Removal steps

<<A>>		1. Generator drive belt
<<B>>	>>C<<	2. Power steering oil pump drive belt
		3. Grounding cable connection
<<C>>	>>B<<	4. Fuel high-pressure hose connection
		5. Heater hose connection

- Intake manifold plenum
- Right bank exhaust manifold

Fig. 101: Identifying Engine Assembly Removal And Installation With Torque Specifications (1 Of 2)
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.



Removal steps

6. Engine hanger
   - Transaxle assembly
7. <<D>> Power steering oil pump assembly
8. <<E>> A/C compressor assembly
9. Control wiring harness (rela side)
10. Control wiring harness (batt side)
11. <<F>> >>A<< Engine mounting bracket
12. >>A<< Engine mounting insulator stopper
13. <<G>> >>A<< Engine assembly
14. Control wiring harness

Fig. 102: Identifying Engine Assembly Removal And Installation With Torque Specifications (2 Of 2)
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

Required Special Tools:

- MB992275: Drive Belt Installer
- MB992276: Drive Belt Remover
- MB991454: Engine Hanger Balancer
- MB991895: Engine Hanger
- MB991928: Engine Hanger
- MB992208: Engine Hanger Plate A

REMOVAL SERVICE POINTS

<< A >> GENERATOR DRIVE BELT REMOVAL

CAUTION: When the generator drive belt is reused, draw an arrow indicating the rotating direction on the back of the belt using chalk to install the same direction.

1. Turn the drive belt auto-tensioner to counterclockwise, and insert the L-shaped hexagon wrench to the auto-tensioner hole in order to fix the auto-tensioner.
2. Remove the generator drive belt.

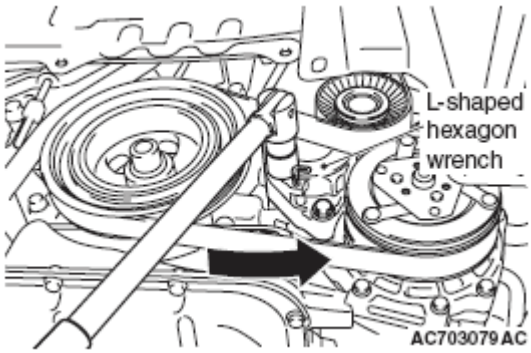


Fig. 103: Turning Drive Belt Auto-Tensioner To Counterclockwise
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

<< B >> POWER STEERING OIL PUMP DRIVE BELT REMOVAL

CAUTION:
- **To reuse the power steering oil pump drive belt, draw an arrow indicating the rotating direction on the back of the power steering oil pump drive belt using chalk to install the same direction.**
- **Hang the special tool MB992276 on the vehicle components (including front side members) using a cord and paper clip to prevent from falling.**

1. Set the special tool MB992276 as shown and hold it by a finger.

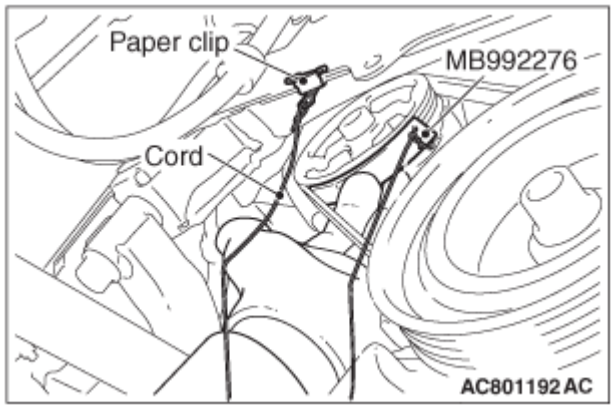


Fig. 104: Setting Special Tool MB992276
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

CAUTION: Be careful that the finger holding the special tool MB992276 is not pinched.

2. Slightly turn the crankshaft pulley clockwise until the special tool MB992276 is pinched and held between the oil pump assembly pulley and the power steering oil pump drive belt as shown.
3. If the special tool MB992276 is held, move the finger off.

CAUTION: If the power steering oil pump drive belt is detached, be careful that the special tool MB992276 is also detached and fallen.

4. Slowly turn the crankshaft pulley clockwise until the power steering oil pump drive belt goes aground on the special tool MB992276 and is detached.
5. Remove the special tool MB992276.

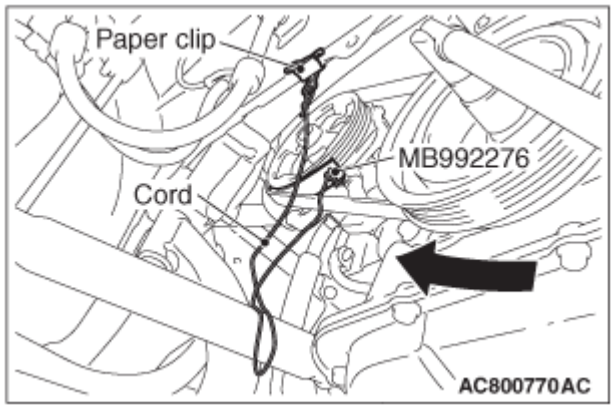


Fig. 105: Turning Crankshaft Pulley Clockwise Until Special Tool MB992276 Is Pinched
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

<< C >> FUEL HIGH-PRESSURE HOSE DISCONNECTION

1. Remove the stopper of the fuel high-pressure hose.

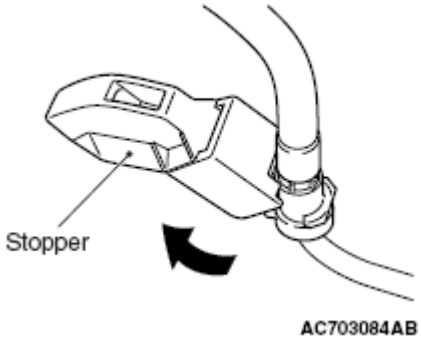


Fig. 106: Removing Stopper Of Fuel High-Pressure Hose
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

2. Raise the retainer of the fuel high-pressure hose and pull out the fuel high-pressure hose in the direction shown in the figure.

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

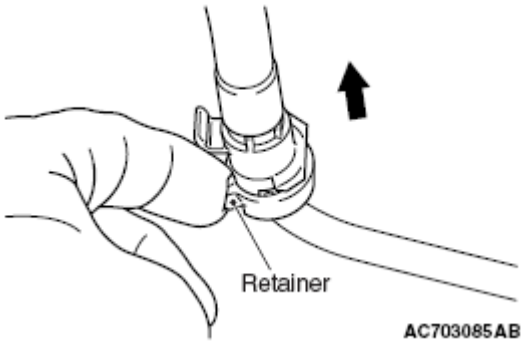


Fig. 107: Raising Retainer Of Fuel High-Pressure Hose
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

<< D >> POWER STEERING OIL PUMP ASSEMBLY 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 >> A/C COMPRESSOR ASSEMBLY REMOVAL

1. Remove the A/C compressor from the A/C 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.

<< F >> ENGINE MOUNTING BRACKET REMOVAL

1. Support the engine with a garage jack.
2. Engine hanger MB991895 is used
3. Remove special tool MB991895.

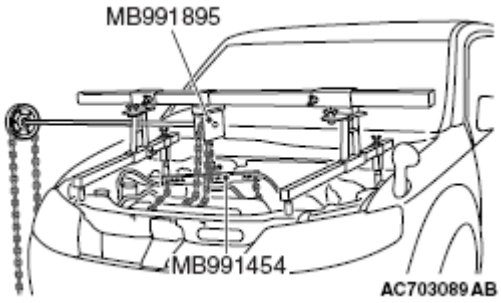


Fig. 108: Identifying Engine Hanger MB991895
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

4. Engine hanger MB991928 is used

   Remove special tool MB991928.

5. When removing the transaxle assembly, remove the special tool MB992208 (Right bank) that supported the engine assembly.

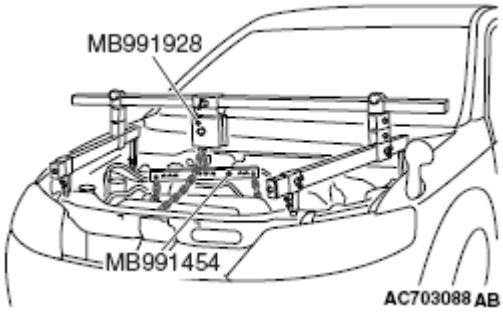


Fig. 109: Identifying Engine Hanger MB991928
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

6. Mount the special tool MB991454 to the engine right hanger and special tool MB992208 (Left bank), and support the engine assembly using the chain block or others.
7. Place a garage jack against the engine oil pan with a piece of wood in between so that the weight of the engine is no longer being applied to the engine mounting bracket.
8. Loosen the engine mount mounting nuts and bolt, and remove the engine mounting bracket.

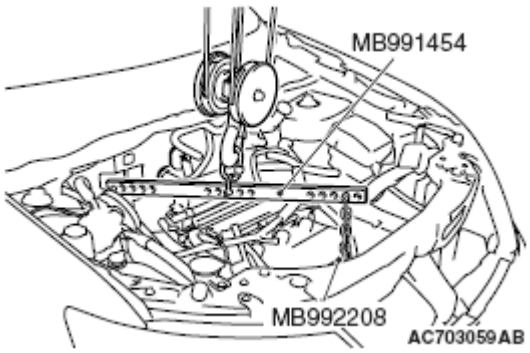


Fig. 110: Mounting Special Tool MB991454 To Engine Right Hanger And Special Tool MB992208 (Left Bank)
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

<< G >> 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/ENGINE MOUNTING INSULATOR STOPPER/ENGINE MOUNTING BRACKET INSTALLATION

1. Install the engine assembly, being careful not to pinch the cables, hoses or wiring harness connectors.
2. Support the engine assembly with a garage jack.

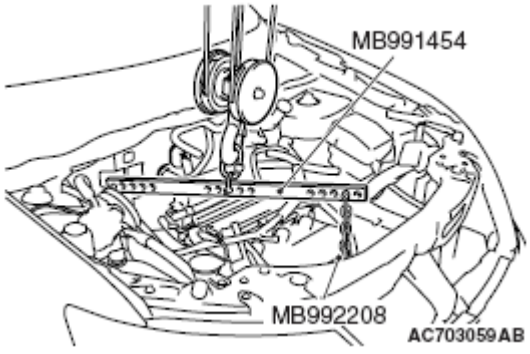


Fig. 111: Mounting Special Tool MB991454 To Engine Right Hanger And Special Tool MB992208 (Left Bank)
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

3. Mount the engine mounting insulator stopper to be positioned as shown in the figure, then mount the engine mounting bracket.

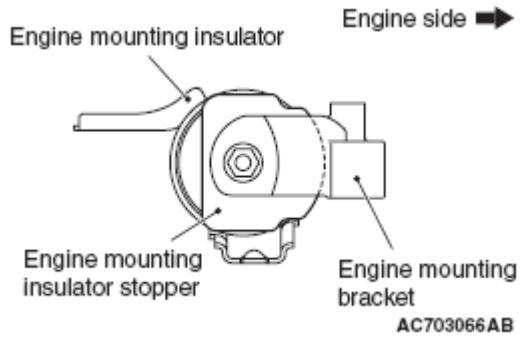


Fig. 112: Identifying Engine Mounting Insulator Stopper Position
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>> B << FUEL HIGH-PRESSURE HOSE CONNECTION

CAUTION: After connecting the fuel high-pressure hose, slightly pull it in the pull-out direction to check that it is installed firmly. In addition, check that there is approximately 1 mm (0.04 inch) play. After the check, install the stopper securely.

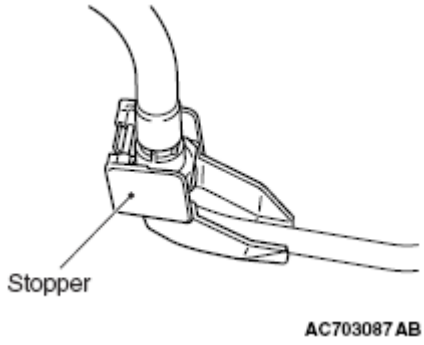


Fig. 113: Installing Stopper Securely
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

>> C << POWER STEERING OIL PUMP DRIVE BELT INSTALLATION

CAUTION: Check that the belt is fitted in the notches of the notched pulley and the notches of crankshaft pulley securely.

1. Install the power steering oil pump drive belt in the crankshaft pulley.

CAUTION:
- **Hang the special tool MB992275 on the vehicle components (including front side members) using a cord and paper clip to prevent from falling.**
- **Be careful that the finger holding the special tool MB992275 is not pinched.**

2. Set the special tool MB992275 and power steering oil pump drive belt in the oil pump assembly pulley and hold it by a finger as shown.

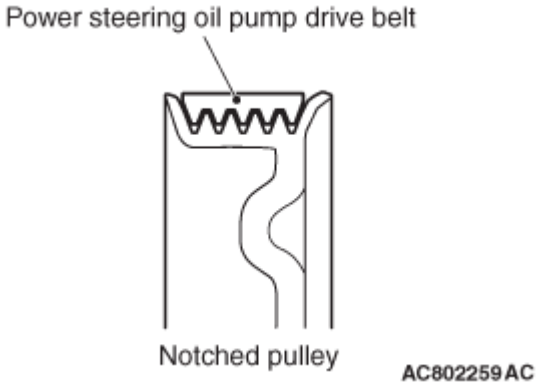


Fig. 114: Checking Belt Is Fitted In Notches Of Notched Pulley And Notches Of Crankshaft Pulley Securely
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

NOTE:

- **Check that the top surface of power steering oil pump drive belt goes aground on the special tool MB992275, and the power steering oil pump drive belt is fitted in the notched under the oil pump assembly pulley securely as shown.**

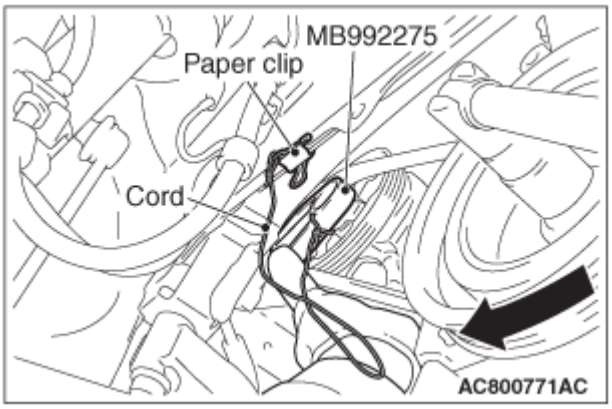


Fig. 115: Turning Crankshaft Pulley Clockwise
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

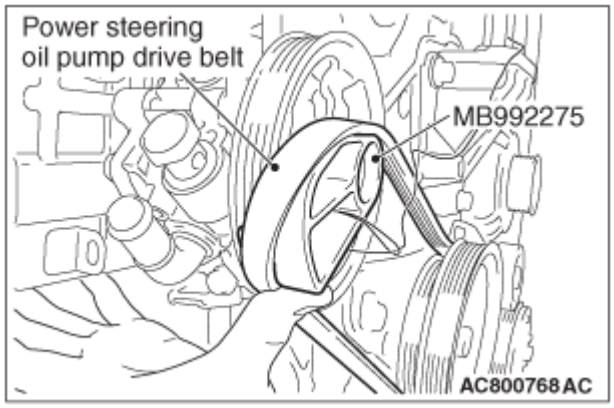


Fig. 116: Installing Power Steering Oil Pump Drive Belt Using Special Tool MB992275
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

- **Slightly turn the crankshaft pulley clockwise until the special tool MB992275 is pinched and held between the oil pump assembly pulley and the power steering oil pump drive belt as shown.**

3. If the special tool MB992275 is held, move the finger off.

CAUTION: If the power steering oil pump drive belt is installed, be careful that the special tool MB992275 is detached and fallen.

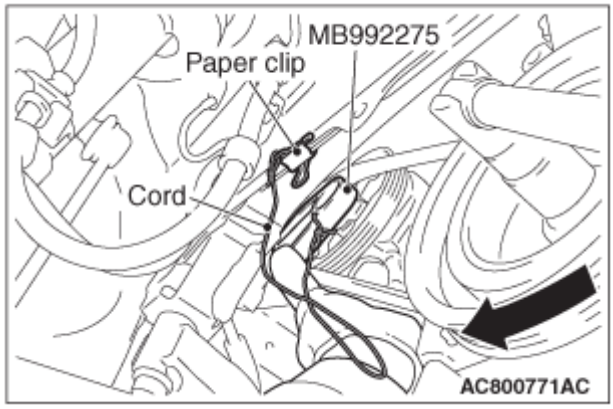


Fig. 117: Turning Crankshaft Pulley Clockwise
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

4. Slowly turn the crankshaft pulley clockwise and install the power steering oil pump drive belt.
5. Turn the crankshaft pulley until the special tool MB992275 is detached from the oil pump assembly and fallen, and then remove the special tool MB992275.
6. Turn the crankshaft pulley clockwise on several times and check that the power steering oil pump drive belt is installed in the oil pump assembly pulley and the crankshaft pulley securely.

